QUALITY ASSURANCE PROJECT PLAN FOR REMOVAL ACTION SUPPORT

VIBURNUM TREND LEAD HAUL ROADS SITE OU2, VIBURNUM, MISSOURI

Superfund Technical Assessment and Response Team (START) 5
Contract No. 68HE0719D0001, Task Order No. 21F0053

Prepared For:

U.S. Environmental Protection Agency
Region 7
Superfund Division
11201 Renner Boulevard
Lenexa, Kansas 66219

March 29, 2021

Prepared By:

Tetra Tech, Inc.
415 Oak Street
Kansas City, Missouri 64106
(816) 412-1741

APPROVED BY:

Clayton Hayes, START Project Manager — 03/30/2021 Date

Ted Faile, PG, CHMM, START Program Manager — 03/30/2021 Date

Heather Wood, START Quality Assurance Manager — 3/30/2021 Date

Kirk Mammoliti, EPA Project Manager — Date

DIANE HARRIS
Digitally signed by DIANE HARRIS
Date: 2021.04.02 13:55:36 -05'00'

Diane Harris, EPA Quality Assurance Manager — 04/02/2021 Date
approved with condition

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APPENDICES

TABLES

1.0 PROJECT MANAGEMENT

The following sections address the major aspects of project management.

1.1 DISTRIBUTION LIST

Region 7 EPA	Kirk Mammoliti, Project Manager Diane Harris, Quality Assurance Manager
Region 7 START	Clayton Hayes, Project Manager Ted Faile, Program Manager Heather Wood, Quality Assurance Manager

1.2 PROJECT, TASK ORGANIZATION, AND SCOPE OF WORK

Under Superfund Technical Assessment and Response Team (START) 5 Contract Number 68HE0719D0001, Task Order Number 21F0053, the U.S. Environmental Protection Agency (EPA) Region 7 Superfund Division tasked Tetra Tech, Inc. (Tetra Tech) to assist with time-critical removal action (RA) activities at the Viburnum Trend Lead Haul Roads (VTLHR) OU2 site (the site) in Viburnum, Missouri. Clayton Hayes of Tetra Tech will serve as the Superfund Technical Assessment and Response Team (START) Project Manager. He will be responsible for ensuring that sampling of environmental media proceeds as described in this Quality Assurance Project Plan (QAPP), and for providing periodic updates to the client concerning the status of the project, as needed. Kirk Mammoliti will be the EPA Project Manager for this activity.

For this project, Tetra Tech START will (1) assist EPA in obtaining access to properties for sampling and soil removal activities, (2) acquire appropriate sampling and monitoring equipment, (3) collect samples of environmental media, (4) conduct field screening, (5) document property conditions and attainment of the removal action level (RAL), and (6) coordinate laboratory analyses. The Tetra Tech START Quality Assurance (QA) Manager will provide technical assistance, as needed, to ensure that necessary QA issues are adequately addressed.

Although Tetra Tech START will attempt to adhere to this QAPP as much as possible, the proposed activities may be altered in the field if warranted by site-specific conditions and unforeseen hindrances that prevent implementation of any aspect of this QAPP in a feasible manner. Tetra Tech START will record such deviations in the site logbook, as necessary. The START Project Manager will ensure this QAPP will be available to the field team at all times during sampling activities to serve as a key reference for the proposed activities described herein.

1.3 PROBLEM DEFINITION, BACKGROUND, AND SITE DESCRIPTION

Tetra Tech START prepared this QAPP to address imminent concerns that could impact human health and the environment at the site, where soil contaminated with lead had been identified during previous sampling activities. The site is in the City of Viburnum, Crawford, Iron, and Washington Counties, Missouri (see Figure 1 in Appendix A) with the overall site expanding into Reynolds, and Dent Counties, in Missouri. The Viburnum Trend is commonly known as the New Lead Belt, which began producing lead in 1959 around Viburnum, Missouri, and continues production to this day.

The Doe Run Resources Corporation – Viburnum Division (formerly St. Joe Minerals Corp –Viburnum) is in and near the City of Viburnum, Missouri, at the northern end of the Viburnum Trend Lead Mining District. The Viburnum Division includes four mines where ore was brought to the surface: Viburnum Mine 27 in Crawford County, Viburnum Mine 29 in Washington County, Viburnum Mine 28 in Iron County, and Casteel Mine in Iron County. Transport of the mined ore previously occurred over haul roads to the Viburnum Central Mill at Viburnum Mine 28 (currently inactive) in Iron County. From the Viburnum Central Mill, the processed lead (called lead concentrate) was hauled to various smelters or shipped overseas. Currently, only Viburnum Mine 29 and the Casteel Mine are operating. Viburnum Mine 27 was closed in 1983; Viburnum Mine 28 was closed in 2004. Ore from the Viburnum Mine 29 now is now brought to the Viburnum Central Mill Complex where it is crushed and then hauled over public roadways, primarily to the Buick Mill, for concentrating. The lead ore from the Casteel Mine is also hauled over public roadways to other mine ore concentrators within the Viburnum Trend Mining District for further processing. In addition to the mines and mills are two large tailings piles created from processing of ore at the Viburnum Central Mill Complex (EPA 2020).

During construction development and early operation of these mines, use of lead-contaminated materials such as tailings and/or “poor rock” for construction materials was not uncommon in the City of Viburnum, established by the St. Joe Minerals Corporation to support mining operations. "Poor rock" is a term used to describe low grade ore removed during mine development but not purposely mined or concentrated. Poor rock commonly contains higher than one percent lead (10,000 parts per million [ppm]). In addition to the mine waste scenario, the Central Mill in Viburnum was a likely source of air pollution and lead fallout from hauling, crushing, and processing of ore and/or concentrate, particularly prior to requirements to reduce air emissions (EPA 2020).

The site boundary is defined to include any residence or child high use area (CHUA) within or adjacent to the City of Viburnum, Missouri (see Figure 2 in Appendix A) (EPA 2020). The site boundary includes a

proposed sampling area, adjacent to and within 200 feet of either edge of the haul roads, within 1,000 feet of the head frames of the Viburnum 27, 29, and Castell mines, and within 1,000 feet from the edge of all Doe Run and St. Joe Minerals – Viburnum mine waste disposal areas (e.g., tailings piles) (see Figure 2 in Appendix A) (EPA 2020). Lead concentrations above health-based risk levels have been found in residential yards, as well as on properties defined as CHUA. Approximately 150 residential properties or CHUAs at the site have been identified as containing soils with lead concentrations above the health-based risk level of 400 parts per million (ppm).

As a result of mining-related activities in and around the City of Viburnum, Missouri, lead and lead compounds have been released into the environment in quantities sufficient to present an imminent and substantial danger to public health and welfare. Lead and lead compounds are hazardous substances, as defined by Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and are listed as hazardous substances in 40 *Code of Federal Regulations* (CFR) § 302.4.

In September 2005, EPA issued an Administrative Order of Consent (AOC) to Doe Run Resources Corporation, Teck Cominco American Incorporated, Cyprus Amax Minerals Company, Homestake Lead Company of Missouri, and DII Industries, LLC (Respondents) to conduct a removal Preliminary Assessment/Site Inspection (PA/SI). The primary objective of the PA/SI was to identify lead-contaminated properties in and around the City of Viburnum, Missouri (EPA 2020).

In July 2006, the Respondents submitted the PA/SI report to EPA that detailed results of the sampling investigation. Out of an estimated 315 homes, the Respondents had sampled 304 residential or CHUA properties. Lead levels in soil exceeded EPA's residential screening level (RSL) of 400 ppm at 222 properties (73 percent). Concentrations above the RSL ranged from 400 to 38,000 ppm. At least 64 of the properties had soils containing lead at concentrations exceeding 1,200 ppm, thus necessitating a time-critical removal action that EPA mandated at those properties in May 2007 with issuance of an AOC (CERCLA-07-2007-0013) to the Respondents (EPA 2020).

Moreover, sampling by various parties had identified approximately 150 residences or CHUAs with lead concentrations below 1,200 ppm but exceeding 400 ppm. Soils exceeding time-critical action levels (1,200 ppm) subsequently were addressed. However, residential and CHUA soils exceeding the non-time critical action level (400 ppm) remained at the site.

On April 8, 2010, the Respondents submitted an Engineering Evaluation / Cost Analysis Report describing alternatives to address residential properties and CHUAs along the Viburnum Trend Lead Haul Roads.

On April 11, 2013, the Respondents submitted a Property Location Report to EPA that identified all residential properties and CHUAs along the Haul Roads that would be subject to this RA. This report identified approximately 350 residential properties or CHUAs that would have to be sampled to determine if lead concentrations existed above 400 ppm.

On June 3, 2016, the Respondents and EPA entered into an Administrative Settlement Agreement (ASA) and Order on Consent for a Non-Time Critical Removal Action at the site to remove soil at the remaining properties with lead concentrations exceeding 400 ppm, and to sample (with possible soil removal) at the approximately 350 additional properties identified in the Property Location Report.

On September 2, 2020, EPA tasked Tetra Tech START to assist EPA in gaining access to and sampling residential properties within Viburnum, Missouri to determine extent of lead contamination. Residential properties targeted during this sampling event either had known contamination based on prior sampling or had not been previously sampled. Field activities commenced in October 2020 and concluded in December 2020. This current RA will focus on the properties sampled during the 2020 removal assessment that were found to contain lead levels in soil >400 ppm. These properties can be found on Figure 3 in Appendix A.

1.4 PROJECT AND TASK DESCRIPTION

Activities described in this QAPP will address the following:

- Delineations of extent of lead-contaminated soil at previously unscreened residential properties
- Determination of post-excavation concentrations of lead in site soils to assess whether RALs will have been achieved
- Determination of appropriate disposal options for excavated soils
- Assessment of potential sources of backfill soil.

The following is a preliminary schedule of activities for the planned RA:

- April 2021 – Begin site walks and collect pre-excavation documentation.
- April 2021 – Begin excavation at highest-priority properties. Excavations will continue until completed (anticipated by August 2021).

- Spring/Summer 2021 – Sample additional residential properties for lead contamination, as property owners grant access.

The following sections of this QAPP describe aspects of the project.

1.5 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The QA objective for this project is to provide valid data of known and documented quality. Specific data quality objectives are discussed in terms of accuracy, precision, completeness, representativeness, and comparability.

For this project, accuracy is defined as the ratio, expressed as a percentage, of a measured value to a true or reference value. The analytical component of accuracy will be expressed as percent recovery, based on analyses of laboratory-prepared spike samples and performance evaluation audit samples. Accuracy of field screening measurements will be measured by routine assessment of field standards and by comparisons of screening data to laboratory results from split samples, as described in Section 2.5 of this QAPP.

Precision for this project is defined as a measure of agreement among individual measurements of laboratory-prepared duplicate samples. Because total method precision will not be determined for this project, no collocated samples will be collected.

Data completeness will be expressed as the percentage of acquired data considered valid. A completeness goal of 100 percent will be applied to this project; however, if that goal is not met, site decisions may still occur based on the remaining data. No critical samples have been identified for the project.

Representativeness of collected samples is facilitated by establishing and following criteria and procedures identified in this QAPP. Data comparability is achieved by requiring that all data generated for the project be reported in common units. Table 1 lists the various types of data to be obtained, and reporting units.

TABLE 1

SPECIFIC DATA REPORTING UNITS

Parameter	Unit
Metals in soil via x-ray fluorescence (XRF)	Parts per million (ppm)
Metals in soil via laboratory analysis	Milligrams per kilogram (for total concentrations); milligrams per liter (for toxicity characteristic leaching procedure data)
Time	Military time (00:01 - 24:00)

1.6 SPECIAL TRAINING REQUIREMENTS AND CERTIFICATION

All site personnel will be required to have completed a basic 40-hour health and safety (Hazardous Waste Operations and Emergency Response) training course and annual refreshers. Familiarization with x-ray fluorescence (XRF) instruments and operating procedures also will be necessary for the Tetra Tech START team. The EPA Regional Laboratory is ISO-accredited for the analytes, methods, and matrices applicable to this project.

1.7 DOCUMENTATION AND RECORDS

Tetra Tech START personnel will maintain a field logbook to record all pertinent activities associated with the sampling events. Appropriate documentation pertaining to photographs taken by Tetra Tech START also will be recorded by use of Survey123 photo log. Tetra Tech START will record video of all residential areas prior to any excavation and after completion of backfilling. Information pertaining to all samples collected for laboratory analysis during this event (such as sampling dates and times, locations, and so on) will be recorded on sample field sheets generated by EPA. Each sample will have a unique identification number provided by EPA. Tetra Tech START will affix to sample containers EPA-generated labels that indicate the following in indelible ink:

- Sample numbers
- Dates collected
- Requested analyses
- Property identification (ID) (provided by EPA)
- Sampling cell
- Depth below ground surface (bgs)
- Method of collection.

All sampled portions of the yard will be indicated by the following:

- Cell 1 = C1
- Cell 2 = C2
- Cell 3 = C3
- Cell 4 = C4
- Drip Zone = DZ
- Driveway = DW
- Landscaping = LS
- Garden = G
- Gravel Area = GA
- Road Easement = RE
- Alley Easement = AE.

Depths bgs of sample collection will be indicated as follows:

- Surface = SF
- 12 inches bgs = 1.0
- 24 inches bgs = 2.0.

Method of collection will be indicated by the following:

- Composite = CP
- Confirmation = CFN.

The following example is a composite (CP) sample identification number collected within Cell 1 (C1) at 12 inches bgs at property 1220: 1220-C1-1.0-CP.

A chain-of-custody (COC) form will accompany each sample. The COC will include project name and number, names of the field sampling personnel, sample number, date and time of sample collection, whether the sample is a composite or a grab sample, sample location, number of containers per sample, analytes, and comments. The COC will document date, time, and signatures of persons relinquishing and receiving custody of the samples. Tetra Tech START personnel will deliver or ship samples to the EPA Region 7 laboratory for analysis whenever a significant number has been collected. All samples will be submitted to the laboratory within required holding times.

Prior to field activities, Tetra Tech START will prepare a health and safety plan (HASP) addressing site-specific hazards. All field personnel will review and sign the HASP prior to field work, indicating that they understand the plan and its requirements. Copies of the plan will be available to all personnel throughout sampling activities.

2.0 MEASUREMENT AND DATA ACQUISITION

The following sections address methodological and instrumental aspects of anticipated activities in the field and at the laboratory.

2.1 SAMPLING PROCESS DESIGN

The sampling design proposed in the following subsections has been selected to fully delineate extent of soil contamination at the site, determine whether RALs will have been achieved, and determine appropriate disposal options for excavated soils.

2.1.1 Soil Screening Activities

During the RA, screening of additional residential properties within the study area will occur following acquisition of access permission from property owners. The proposed sampling scheme for this project will be judgmental (based on the layout of each property) in accordance with EPA Region 7 Standard Operating Procedure (SOP) 4230.19 and the *Superfund Lead-Contaminated Residential Sites Handbook* (EPA 2003). During the screening process, at least four cells will be established across each property. These cells will radiate out 100 feet from the drip zone around the home or until the property line is reached, whichever is less. Maximum size of each cell will be 100 by 100 feet; however, the actual size will be established in the field based on site features. Additional areas or cells to be screened include the following: the drip zone; right-of-way/easements; fine-grained material if used for driveways, sidewalks, or under carports; vegetable gardens; and children's play areas that are at least 25 by 25 feet.
A composite sample consisting of five aliquots, collected within 0 to 1 inch bgs and spaced approximately equally, will be collected in each cell and placed in a labeled, sealed plastic bag.

All samples will be transported to a sample preparation facility and placed in pans. The samples will be allowed to completely air dry. Once dried, the samples will be homogenized, passed through a number 10 sieve (2-millimeter), and screened for lead by use of an XRF spectrometer as described in SW-846 Method 6200. Three XRF results will be recorded for each sample. The average of the three readings will be calculated and recorded on the Property Screening Form. At least 10 percent of the screened soil samples will be submitted to the EPA Region 7 laboratory for confirmation analysis for lead. XRF readings are generally considered valid screening level data if a comparison between the XRF values and the corresponding laboratory results yields a regression coefficient (r^2) of at least 0.7 (EPA 2007).

2.1.2 Post-Excavation Screening Activities

EPA has established an RAL for lead in soil of 400 mg/kg for the site. EPA will conduct removal activities at residential properties only after receipt of written consent from property owners.

EPA will initiate excavation in all areas where lead concentrations equal or exceed 400 mg/kg. Initial removal activities in each contaminated cell will involve excavation of approximately 6 inches of soil from the surface layer. This will proceed by use of excavating machinery such as skid loaders, dozers, excavators, backhoes, and hand tools. Tetra Tech START will then take in-situ XRF readings within the excavated area. If soils at 6 inches bgs exceed 400 mg/kg, additional soil will be excavated. If XRF readings are consistently below 400 mg/kg at depths less than 12 inches, or are below 1,200 mg/kg at 12 inches bgs, excavation will be considered complete for that cell. If readings exceed 1,200 mg/kg for lead at depth of 12 inches, excavation may continue until concentrations fall below this level. If lead concentration below a 24-inch excavation depth remains at or above 1,200 mg/kg, EPA may choose to halt further excavation and place a warning barrier at that depth.

Garden soils containing lead at concentrations equaling or exceeding 400 mg/kg (based on XRF results from discrete samples) will be excavated to a minimum depth of 24 inches. If soils at 24 inches bgs exceed 1,200 mg/kg, excavation will continue in 6- to 12-inch lifts until lead concentrations fall below 1,200 mg/kg or EPA decides to cease excavation and place a warning barrier at the final excavated depth.

When the final depth of excavation is reached within a cell, Tetra Tech START will collect a composite sample of five randomly spaced aliquots from the base of the final excavation level to 6 inches below the final excavation base level, and screen it for lead using an XRF unit. These samples will be collected by use of a slide hammer with a soil collection tube containing disposable, plastic sample liners. Tetra Tech START may use alternative sampling equipment (e.g., hand-held bucket auger) with EPA's approval. These samples will be prepared/sieved as previously described for pre-excavation samples. The average of three XRF readings of each composite sample will be calculated and recorded on the appropriate Property Screening Form. Samples from 10 percent of the screened cells will be submitted to the EPA Region 7 laboratory for analysis for lead.

After removal of soils from the affected areas and placement of warning barriers where required, the excavated areas will be backfilled with clean soil. Clean backfill will consist of soils with lead concentrations below 100 mg/kg, and other hazardous substances, pollutants, or contaminants below residential soil screening levels, as determined by EPA. To ensure borrow source material (backfill) is not contaminated, Tetra Tech START will collect grab samples from potential borrow source areas.

Grab samples will be collected from the backfill sources at an interval of 1,000 cubic yards of soil and/or 1,000 cubic yards of gravel to provide analytical data that is quantitatively representative. At each borrow source area, Tetra Tech START will utilize a shovel to expose a 1-foot excavation, followed by collection of a grab sample from the entire depth by use of a hand trowel. All samples of potential backfill will be submitted to the EPA Region 7 laboratory for laboratory analysis for VOCs, SVOCs, pesticides/herbicides, and RCRA 8 metals. The selected analyses will allow for detection limits that are below EPA Regional Screening Levels (RSLs).

Tetra Tech START will place all soil samples for total lead analysis into 8-ounce glass jars or other laboratory-specified containers, and deliver these to the EPA Region 7 laboratory with proper COC forms included.

2.1.3 Stockpiled Soil Sampling

EPA's removal contractor will transport excavated soils to a repository and place those soils in stockpiles. EPA anticipates the volume of each staged pile as no greater than approximately 500 cubic yards (yd^3). Tetra Tech START will collect a composite sample from each stockpile using a disposable stainless steel spoon or trowel, per EPA SOP 4231.2017. The composite sample will consist of 10 aliquots collected at equally spaced locations around the pile. The number of aliquots collected for each composite sample will vary depending on size of the stockpile; approximately one aliquot of material will be collected for every 40 tons of material. For a 500 yd^3 pile, which would contain approximately 400 tons of material (assuming 1.3 tons per yd^3), a 10-aliquot composite sample would be collected. Each sample will be submitted for laboratory toxicity characteristic leaching procedure (TCLP) analysis for lead via EPA Region 7 SOPs 3171.01 (or equivalent methods). Samples will be analyzed at either the EPA Region 7 laboratory or a START-contracted laboratory.

If the TCLP lead result is below 5 milligrams per liter (mg/L) for lead, Tetra Tech START will inform EPA and the removal contractor, who will proceed to spread the stockpiled soil throughout the repository area. If a TCLP lead result equals or exceeds 5 mg/L for lead, EPA's removal contractor will treat the soil with a stabilizing agent (e.g., Free Flow 100®). Afterwards, Tetra Tech START will resample the pile for TCLP analysis. Re-treatment of the stockpile will continue until TCLP levels are below regulatory limits.

A summary of samples anticipated during this project is in Table 2 below. Actual number of samples will depend on field screening results and the amount of soil excavated during the RA. Initiation of removal activities is expected in early April 2021.

TABLE 2

ANTICIPATED SOIL SAMPLE SUMMARY

Number of Samples		Laboratory Analyses
Field Screening	**Laboratory**	
100	10	Total lead
N/A	20	TCLP lead

Notes:

See Section 2.4 for details pertaining to laboratory analyses.

N/A Not applicable
TCLP Toxicity characteristic leaching procedure

2.2 SAMPLING METHODS REQUIREMENTS

Table 3 lists EPA Region 7 SOPs to be followed during sample collection. SOPs for sampling soil are included for the various activities that may occur during the RA.

TABLE 3

SUMMARY OF SOIL SAMPLING

Sample Description	EPA Region 7 SOPs
On-site soil & backfill soil	4231.1707, 4231.2012, 4231.2017, 4220.03, 4230.19

Notes:

EPA U.S. Environmental Protection Agency
SOP Standard Operating Procedure

Tetra Tech START will address disposal of investigation-derived waste (IDW) and procedures for equipment and personal decontamination in a separate, site-specific HASP. Most IDW will consist of disposable sampling supplies (gloves, paper towels, etc.) that Tetra Tech START will dispose of as uncontaminated debris. If any corrective actions need to be implemented in the field, the START Project Manager will make that determination.

2.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Sample containers, preservatives, and holding times will comply with procedures defined in EPA Region 7 SOP 2420.06. COC procedures will conform to EPA Region 7 SOP 2420.04. The EPA Region 7 laboratory will accept samples in accordance with EPA Region 7 SOP 2420.01.

Tetra Tech START will complete necessary paperwork for all samples, including COC records that will accompany sample coolers until delivery to the laboratory. If shipment of samples via commercial service becomes necessary, each cooler lid will be securely taped shut, and two custody seals will be signed, dated, and placed across the lid opening. Samples will be submitted to the laboratory in a time-efficient manner to ensure no exceedances of applicable holding times.

2.4 ANALYTICAL METHODS REQUIREMENTS

The EPA Region 7 laboratory will analyze the samples according to the EPA SOPs listed in Table 4. Detection limits typical for those methods are expected to be adequate for this activity. The requested analyses have been selected based on past sampling data and historical information regarding the site. Standard laboratory turnaround times will be sufficient for the QC samples. The samples for backfill soil and TCLP analysis must be expedited due to logistical constraints at the site.

TABLE 4

ANALYTICAL METHODS FOR SOIL SAMPLES

Analytical Parameter	EPA Method or Region 7 SOP
VOCs, SVOCs, Pesticides/Herbicides, RCRA Metals	SOPs 3122.03, 3230.02, 3230.15, and 3240.02
Total concentrations – Lead	Method 6200 (XRF screening), SOP 3122.03
Toxicity characteristic leaching procedure – Lead	SOP 3171.01

Notes:

EPA U.S. Environmental Protection Agency
SOP Standard Operating Procedure
XRF X-ray fluorescence

2.5 QUALITY CONTROL REQUIREMENTS

Because dedicated supplies will be used for all soil samples (plastic bags, sampling gloves, stainless-steel spoons, plastic slide hammer liners, paper pans, etc.), no quality control (QC) samples will be required to assess potential for cross-contamination. Analytical error (precision and accuracy) will be assessed via analysis of laboratory-prepared duplicates and spike samples. This, along with other laboratory QC elements, will accord with EPA SOPs.

To satisfy QC evaluation criteria for XRF data, Tetra Tech START will compare XRF screening data to laboratory confirmation results. The mean of three XRF readings taken for each confirmation sample will be compared statistically to the laboratory result from that sample. For XRF data from an instrument to be considered quantitatively valid, the r^2 value between the XRF data from that instrument and laboratory

confirmation results should exceed 0.7 (EPA 2007). Tetra Tech START also will check XRF instruments against known standards each day to assess analytical drift.

Every measurement by an XRF spectrometer has an uncertainty range consistent with a 95 percent confidence interval. In general, precision and accuracy increase with increasing sample run time. For samples yielding very high (greater than 1,000 mg/kg) or very low (less than 300 mg/kg) lead concentrations, sample run time must be long enough to obtain readings within 30 percent of actual concentrations. For samples with lead levels between 300 and 1,000 mg/kg, sample run times should be long enough to obtain measurements within 20 percent of actual concentrations. Tetra Tech START will screen soil samples using the XRF unit for a minimum of 30 nominal seconds.

2.6 INSTRUMENT, EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Prior to deployment for field activities, Tetra Tech START personnel will test, inspect, and maintain all sampling equipment and supplies, along with field screening instrumentation. Testing, inspection, and maintenance of analytical instrumentation will accord with EPA SOPs and recommendations from instrument manufacturers.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

Calibration of the field screening and laboratory analytical instrumentation will conform to the referenced SOPs and manufacturers' recommendations. Calibration checks of XRF analyzers will be noted in the field logbook.

2.8 INSPECTION AND ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

All sample containers will meet EPA criteria for cleaning procedures required for low-level chemical analysis. Sample containers will have Level II certifications provided by the manufacturer in accordance with pre-cleaning criteria established by EPA in *Specifications and Guidelines for Obtaining Contaminant-Free Sample Containers*. The START Project Manager will ensure certificates of cleanliness are maintained in the project file.

2.9 DATA ACQUISITION REQUIREMENTS

Tetra Tech START has compiled previous data and information pertaining to the site (including other analytical data, reports, photographs, and maps referenced in this QAPP) from various sources. Some of those data have not been verified; however, that unverified information will not be used for decision making purposes without verification of its authenticity.

2.10 DATA MANAGEMENT

All laboratory data acquired during this activity will be managed in accordance with EPA Region 7 SOP 2410.01. All data management procedures for the project are addressed in Appendix B.

3.0 ASSESSMENT AND OVERSIGHT

The following sections address assessments and response actions, and reports to management.

3.1 ASSESSMENTS AND RESPONSE ACTIONS

Assessment and response actions pertaining to analytical and field phases of the project are addressed in EPA Region 7 SOPs 2430.06 and 2430.12. Corrective action will be taken at the discretion of the EPA Project Manager whenever problems appear that could adversely affect data quality or resulting decisions affecting future response actions pertaining to the site.

3.2 REPORTS TO MANAGEMENT

Tetra Tech START will prepare a formal report within 90 days of completion of the project describing sampling techniques, locations, and problems encountered (with resolutions to those problems); interpretation of analytical results following completion of field activities described herein; and validation of laboratory data. Laboratory data from soil will be compared to all applicable or relevant and appropriate requirements, including RALs established for the site, to determine whether further response is warranted.

4.0 DATA VALIDATION AND USABILITY

The following sections discuss aspects of data review, verification, and validation.

4.1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

A qualified laboratory analyst and the EPA laboratory's section manager will perform data review and verification in accordance with EPA Region 7 SOPs 2430.12 and 2410.10. If a START-contracted laboratory is used, the contracted laboratory will validate the analytical data package internally in accordance with the laboratory's established SOPs. A Tetra Tech chemist will conduct an external verification and validation of the laboratory data package by applying a method consistent with a Stage 2A validation, as described in the EPA Contract Laboratory Program (CLP) *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (EPA 2009). A Stage 2A validation includes verification and validation based on a completeness and compliance check of sample receipt conditions and sample-related and instrument-related QC results. The EPA Project Manager will be responsible for overall validation and final approval of the data, in accordance with the projected use of the results.

4.2 VALIDATION AND VERIFICATION METHODS

Validation of the data will accord with the EPA laboratory's established SOPs, including EPA Region 7 SOPs 2430.12 and 2410.10. Laboratory personnel will perform QC spot checks, as needed. The EPA Project Manager will inspect the data to provide a final review. The EPA Project Manager will also compare sample descriptions with field sheets for consistency, and will ensure appropriate documentation of any anomalies in the data occurs.

4.3 RECONCILIATION WITH USER REQUIREMENTS

If data quality indicators do not meet the project's requirements as outlined in this QAPP, the data may be discarded, and re-sampling or re-analysis may be required.

5.0 REFERENCES

U.S. Environmental Protection Agency (EPA). 2003. *Superfund Lead-Contaminated Residential Sites Handbook*. August.

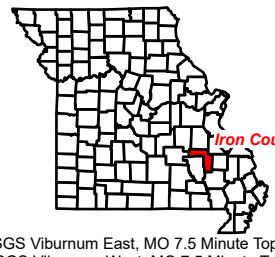
EPA. 2007. *Standard Operating Procedure for the Portable XRF Analyzer*. SW-846 Method 6200. February.

EPA. 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. EPA 540-R-08-005. January.

EPA. 2020. Engineering Evaluation/Cost Analysis Approval for Viburnum Trend Lead Haul Road OU02 – St. Joe Minerals. March.

APPENDIX A

FIGURES



Source: USGS Viburnum East, MO 7.5 Minute Topo Quad, 1999
USGS Viburnum West, MO 7.5 Minute Topo Quad, 1999

N

0 1,000 2,000

Feet

Viburnum Trend Lead Haul Roads OU02 Site
Viburnum, Missouri

Figure 1
Site Location Map

TETRA TECH

Date: 3/24/2021 Drawn By: Clayton Hayes Project No.: 103X903021F0053.000

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Holiday Lake
Highway Y
Courtois
Mine 27
Mine 29
Crawford County
Washington County
Iron County
N Highway Y
Viburnum Golf & Country Club
49
Viburnum
Mark Twain National Forest
Highway 49
Casteel Mine
Bixby
Highway 32
32

Legend

- Mine shaft location
- Haul road
- County line
- Site boundary
- Tailings pile
- Viburnum city limit

Source: The source of the image is ESRI, used by the EPA with ESRI's permission.

N

0 1,600 3,200

Feet

Viburnum Trend Lead Haul Roads OU02 Site
Viburnum, Missouri

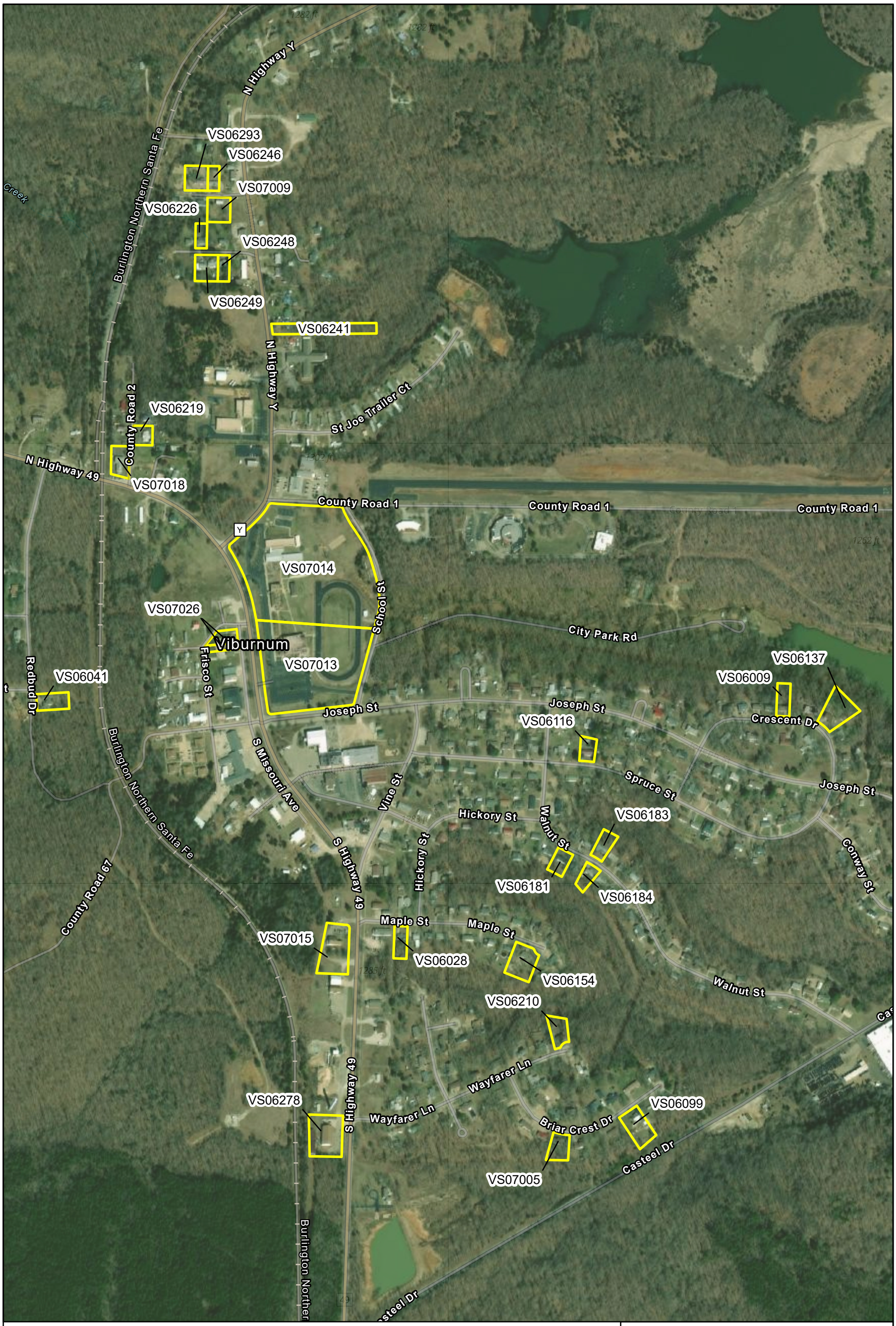
Figure 2

Site Layout Map

TETRA TECH

Date: 3/24/2021 Drawn By: Clayton Hayes Project No.: 103X903021F0053.000

X:\G\903\20\F0075\000\Projects\mxd\St Joes Overview\St Joes Overview.aprx



Legend

2021 time critical removal property

N

0 350 700

Feet

Source: The source of the image is ESRI, used by the EPA with ESRI's permission.

Viburnum Trend Lead Haul Roads OU02 Site
Viburnum, Missouri

Figure 3

Time Critical Removal Properties Map

TETRA TECH

Date: 3/24/2021 Drawn By: Clayton Hayes Project No.: 103X903021F0053.000

X:\G\9030\20F0075000\Projects\mxd\St Joes Overview\St Joes Overview.aprx

APPENDIX B

ACCESS AGREEMENT FORMS

	U.S. Environmental Protection Agency	Viburnum Trend Haul Roads Site
	Region VII 11201 Renner Rd Lenexa, KS 66219	Access Agreement to Perform Soil Sampling

PROPERTY ACCESS (To be completed by property owner)

The U.S. Environmental Protection Agency (EPA) is attempting to complete sampling of all residential properties that have not been previously sampled at the Viburnum Trend Haul Roads Superfund Site for residential soils cleanup. Soil sampling and analyses will determine the levels of lead in the surface soils. Permission to perform soil sampling must be obtained from the property owner. Your cooperation is requested to grant EPA and its contractors access to your property. You will be provided all results of sampling. For further information and questions, please contact Kirk Mammoliti, EPA On-Scene Coordinator at (913) 551-7902 or the Community Involvement Coordinator for the Site at 1-800-223-0425.

Printed Name of Property Owner Granting Access: _____
(Property Owner's Printed Name)

_____ _____
(Property Owner's Signature) *(Date)*

NOTE: This access agreement will be operable until completion of all response actions at this property. Sampling will not typically be scheduled in advance, but results of all sample analyses will be communicated to property owners. Some delay in sampling can be expected following reception of the access agreement by EPA.

PROPERTY INFORMATION
(To be completed by residential and/or property owner – Please Print)

Property Address: _____
(CITY) (STATE) (ZIP)

County Where Property is Located: _____

Property Owner's Name: _____

Resident's Name (If not Owner): _____

Owner's Mailing Address: _____

Owner's Telephone Number - Home: _____ Alternate: _____

Is there a residential home on the property? ____ Yes ____ No

Are there children under 7 years old living at this property? _____Yes _____No____N/A _____Unknown

How long have you owned the property? _____

Has this property ever been identified under a different address? ___yes ____no (If yes, provide below)

Comments: _____

_____

_____

_____

***SEE TERMS AND CONDITIONS REGARDING AUTHORITY FOR ENVIRONMENTAL RESPONSE ACTIONS ON REVERSE SIDE**

TERMS AND CONDITIONS

The activities to be implemented by EPA under this agreement are pursuant to Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 *United States Code* (U.S.C.) 9604. EPA's right of access to the property in Section 104(e) of CERCLA, 42 U.S.C. 9604(e) provides entry for "determining the need for response, or choosing or taking any response action under this title, or otherwise enforcing the provisions of this title."

RIGHT OF ENTRY TO PREMISES: Grantor (the property owner), consents to and authorizes EPA, its authorized representatives, and Missouri Department of Natural Resources (MDNR), collectively the Grantee, to enter and perform certain environmental response activities upon the premises described on the front side of this form and in the site sketch.

ENVIRONMENTAL RESPONSE ACTIONS: The environmental response actions to be performed on the property may include the following activities:

a. Obtaining environmental samples from the property
b. Conducting a pre-excavation site walk
c. Locating equipment and machinery on-site in preparation for and in the course of the remedial action or cleanup and restoration
d. Backfilling with replacement material and revegetating
e. Any other response actions necessary.

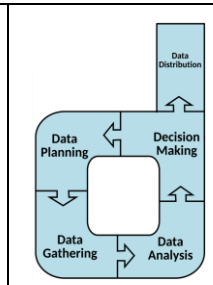
SAMPLING ACTIVITIES: Grantee agrees to provide Grantor with the results of any and all sampling and/or analyses conducted during Grantee's response activities on the properties. In accordance with Section 104(e)(7) of CERCLA, I consent to EPA releasing to the public all analytical results of any samples that EPA collects on my property, as identified by the property address. RESTORATION OF PROPERTY: The Grantee agrees that said property will be restored as nearly as possible to its original state and condition as found immediately preceding the beginning of activities authorized by this Agreement following completion of the activities.

AGREEMENT NOT TO INTERFERE: The Grantor agrees not to interfere or tamper with any of the activities or work done, or the equipment used to perform the activities, or to undertake any actions regarding the use of said property which would endanger the health or welfare of the Grantees or the environment, or to allow others to use the property in such a manner, during the term of this Agreement.

LIABILITY: I understand that EPA requires its contractors to maintain comprehensive vehicle liability insurance, and comprehensive general liability insurance for bodily injury, death, and loss or damage to property or third persons arising from their activities. I also understand that EPA's liability for damages to the property or injuries to persons which result from or are caused by its activities on the property shall be to the extent permitted by the Federal Tort Claims Act (28 U.S.C. §§ 1346(b), 2671 - 2680) and the Federal Employee's Compensation Act (5 U.S.C. §§ 8101 - 8151).

APPENDIX C

SITE-SPECIFIC DATA MANAGEMENT PLAN



EPA Site-Specific Data Management Plan			
Site Name:	Viburnum Trend Haul Roads OU2 Removal Action	**Site ID:**	A7J5
Author:	Clayton Hayes	**Affiliation:**	EPA Region 7
Date Initiated:	3/26/2021	**Last Updated:**	

This site-specific data management plan (SSDMP) is intended to provide guidance for acquisition, storage, analysis, and distribution of data. Data acquisition and management practices identified in this plan are designed to ensure data integrity and consistency throughout the project. The SSDMP does not encompass all data management, and implementation of it should occur in conjunction with application of the Region 7 Regional Data Management Plan. Updates to this document are anticipated as data management practices change; therefore, revisions to this plan may well occur during a project.

Data Planning

Data Quality Objective	Data Stream(s)
Determine if lead is present at levels that pose a threat to human health and the environment / warrant removal activities	Sampling Data
Collect site-specific property information	Electronic Documents/Files

Data Planning – Site Contact List

Name (Affiliation)	Role	Email	Phone Number
Kirk Mammoliti	On-scene Coordinator (OSC)	Mammoliti.Kirk@epa.gov	913-551-7902
Clayton Hayes	Data Manager	Clayton.hayes@tetratech.com	816-412-1933
Clayton Hayes	Superfund Technical Assessment and Response Team (START) Project Manager (PM)	Clayton.hayes@tetratech.com	816-412-1933
Clayton Hayes	START Geographic Information System (GIS) Team Contact	Clayton.hayes@tetratech.com	816-412-1933
Emily Fisher	Residential Lead Database Manager	Emily.Fisher@tetratech.com	816-412-1755

Data Gathering – Collection

Data Stream	Collection Tool	Specifications	Instructions	Repository
Images	Camera/Iphone	Photographer, Lat/Long, date, time	Collect using R7 Photo Log in Survey123	GeoPlatform/START folders
Documents / Files	Mobile Data Form	Access Agreement and Residential Screening	Collect using Survey123	ER Cloud/START folders
Contacts	Response.EPA.gov	Name, Affiliation	Enter contacts in response.epa.gov site page contacts list	Response.epa.gov
Monitoring Data	XRF Data Logger/Mobile Data Form	XRF Screening Survey	Transfer XRF data to repository	Oracle/Residential Lead Database
Sampling Data	Mobile Data Form	SampleID, LocationID, Latitude, Longitude, Date, Time, Depth, Depth Units, Sampler, Comments	Transfer laboratory data into Oracle / Res lead	Scribe / Superfund Enterprise Management System (SEMS)
Analytical Data	Field Sheets/Mobile Data Form	Property ID, Address, SampleID, Result, Result Qualifier, Result Units, Analytical Method, Analyte	Transfer laboratory data into Oracle / Res lead	Oracle/ Residential Lead Database
Spatial Data	GIS	Latitude, Longitude, Datum, Horizontal Accuracy, Collection Format (GPS, Interpolated, Surveyed, etc.)	Collection using Collector and modification using GeoPlatfrom or ER Cloud	ER Cloud / SEMS

Data Gathering – Quality Assurance (QA) /Quality Control (QC)

Data Stream	QA/QC Method	Frequency	Responsibility
Data Collection Instrumentation	Calibration	Per recommended instrumentation requirement (minimum)	OSC/Data Manager/START PM
Images	Technical/Editorial Review	Prior to storage deposit	OSC/Data Manager/START PM
Documents / Files	Technical/Editorial Review	Prior to storage deposit	START PM
Contacts	Technical/Editorial Review	Daily	OSC
Monitoring Data	Technical Review	Prior to storage deposit	START PM/Data Manager
Sampling Data	Technical Review	Prior to storage deposit	START PM/Data Manager
Analytical Data	Data validation review of contract lab data	Prior to storage deposit	START
Analytical Data	Technical Review	Prior to storage deposit	Data Manager
Spatial Data	Technical Review	Prior to storage deposit	START GIS Team

Data Gathering – Storage

Repository	Instructions	Frequency	Responsibility	Access Details
START folders	Document folders maintained by START	Create at initiation of project – planning phase	START PM	START accessed
Residential Lead Database	Residential Lead Database project created at direction of OSC and Data Manager	At beginning of project – prior to data collection	Data Manager	Residential Lead Database Project No.
ER Cloud	Store operational data on the ER Cloud in accordance with EPA requirements	Throughout response	Data Manager	Emergency Response (ER) Cloud secured access
SEMS	Archive project-related documents in accordance with EPA requirements	At conclusion of project	EPA R7	https://www.epa.gov/enviro/sems-search

Data Analysis – Decision Making

Analysis Task	Method	Data Storage Source	Frequency	Responsibility	Deliverable
Sample results evaluation	Web Viewer / Database evaluation	Oracle / Res lead	As directed by OSC	OSC/START PM	Map / Interactive Web Viewer
Site-specific information evaluation	Web Viewer/ Database evaluation	Oracle / Res lead	As directed by OSC	OSC/START PM	Map / Interactive Web Viewer

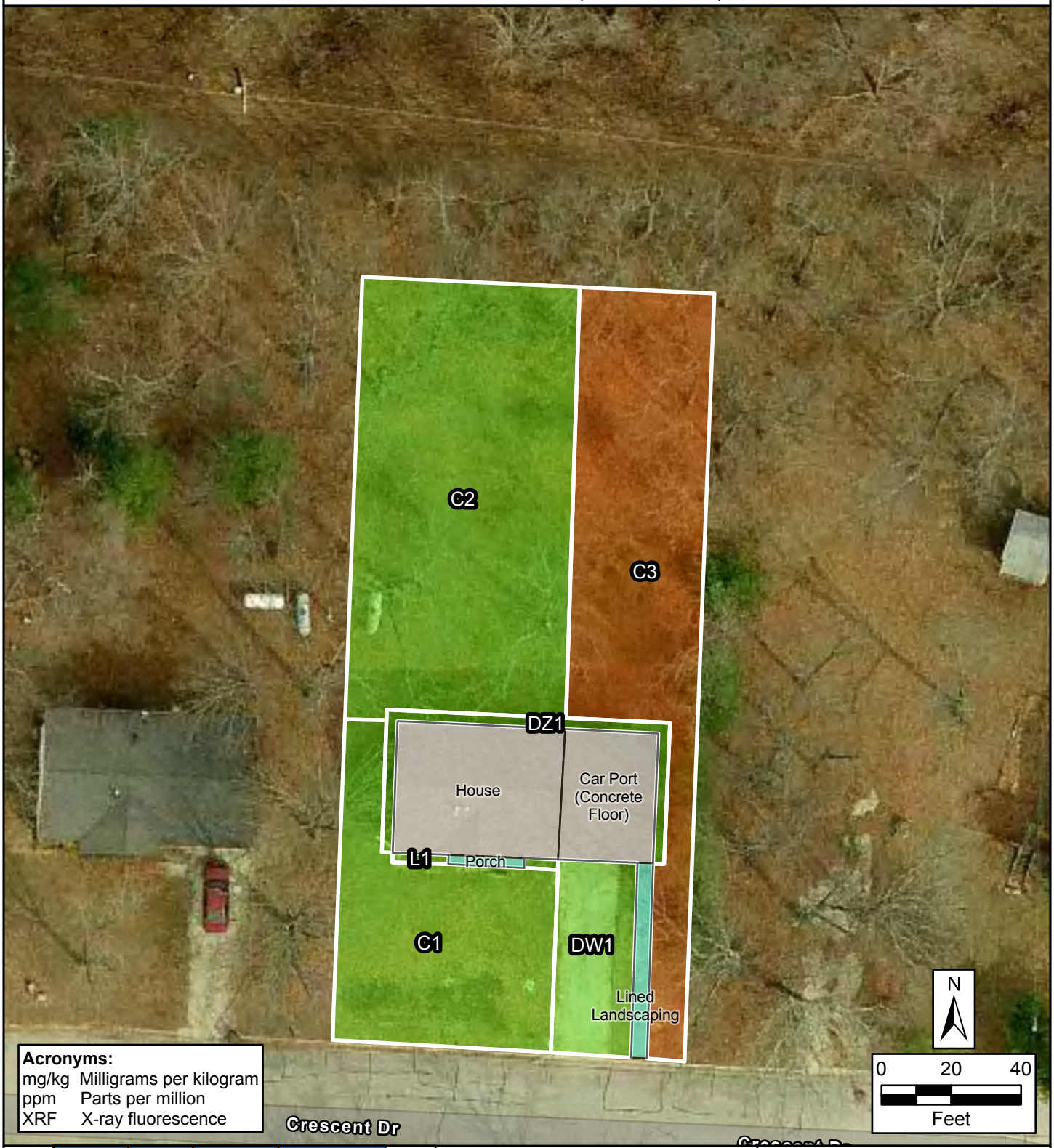
Data Distribution

Deliverable	Audience	Review	Approve	Release Method
Progress Report	EPA	START PM / OSC	OSC	Email / Response.EPA.gov
Final Report	EPA / State / public	OSC	OSC	Response.EPA.gov / FOIA request

APPENDIX D

PROPERTY MAPS

Property ID: VS06009
Owner: GRAHMAN, JAMES K
Address: 14 CRESCENT ST, VIBURNUM, MO



Acronyms:
mg/kg Milligrams per kilogram
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	282	ppm	Average XRF
C2	243	ppm	Average XRF
C3	539	ppm	Average XRF
DW1	284	ppm	Average XRF
DZ1	223	ppm	Average XRF
L1	116	ppm	Average XRF
DZ1	238	mg/kg	Metals in Solids by ICP-AES

Legend

Property feature	Property XRF/sample result
Building	< 400 ppm or mg/kg
Other	≥ 400 ppm or mg/kg

Source: MSDIS, Iron County 6-inch imagery service, 2011

St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06009
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06028
Owner: DISABLED CITIZENS ALLIANCE FOR INDEPENDENCE FOUNDATION, INC
Address: 3 MAPLE ST, VIBURNUM, MO

Acronyms:
mg/kg Milligrams per kilogram
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	142	ppm	Average XRF
C2	288	ppm	Average XRF
C3	222	ppm	Average XRF
C4	157	ppm	Average XRF
C5	113	ppm	Average XRF
DZ1	356	ppm	Average XRF
GA1	1015	ppm	Average XRF
L1	213	ppm	Average XRF
DZ1	419	mg/kg	Metals in Solids by ICP-AES

Legend
Fence
Property feature
Building
Driveway
Walkway
Other
Property XRF/sample result
< 400 ppm or mg/kg
≥ 400 ppm or mg/kg

Source: MSDIS, Iron County 6-inch imagery service, 2011

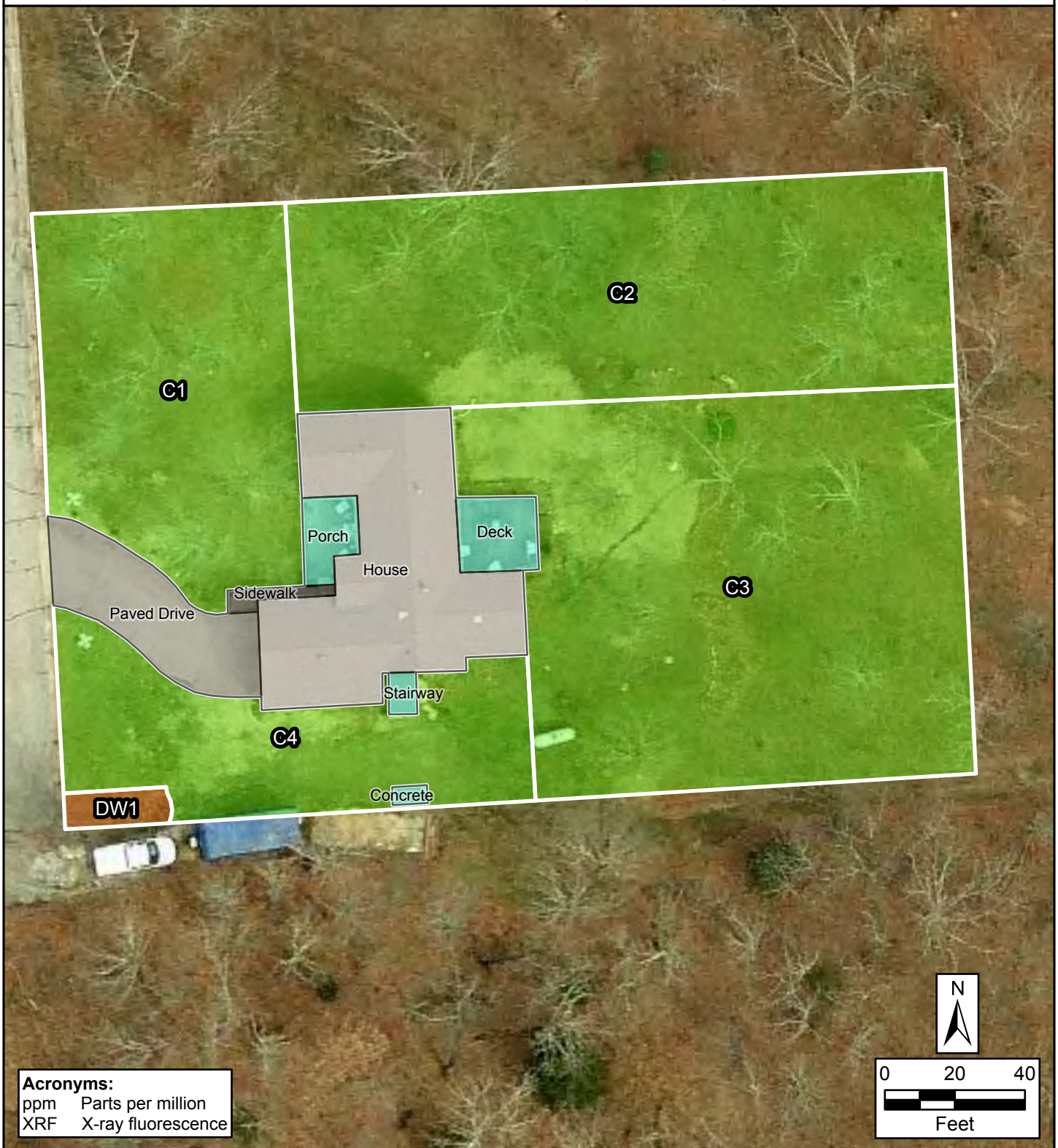
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06028
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06041
Owner: WEBB, CHRISTINA
Address: 25 REDBUD LN, VIBURNUM, MO



Acronyms:
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	122	ppm	Average XRF
C2	143	ppm	Average XRF
C3	154	ppm	Average XRF
C4	156	ppm	Average XRF
DW1	668	ppm	Average XRF

Legend

Property feature	Property XRF screening result
Building	< 400 ppm
Driveway	≥ 400 ppm
Walkway	
Other	

Source: MSDIS, Iron County 6-inch imagery service, 2011

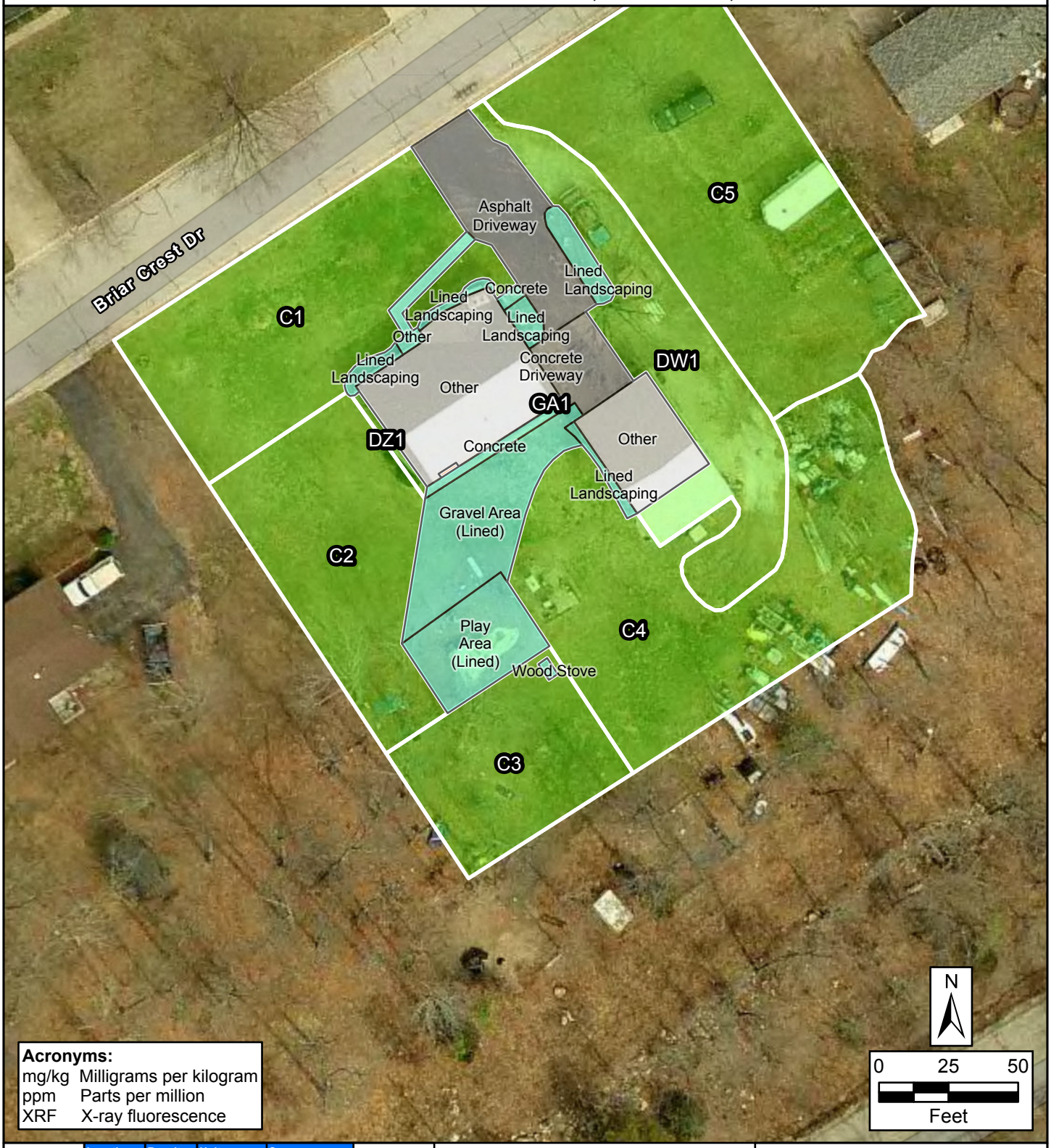
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06041
Pre-Excavation Screening Form

TETRA TECH

Date: 1/28/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06099
Owner: LA RUE, TERRY O & TOREEN L
Address: 21 BRIARCREST DR, VIBURNUM, MO



Acronyms:

mg/kg	Milligrams per kilogram
ppm	Parts per million
XRF	X-ray fluorescence

Location:	Result:	Units:	Source:
C1	225	ppm	Average XRF
C2	180	ppm	Average XRF
C3	306	ppm	Average XRF
C4	371	ppm	Average XRF
C5	165	ppm	Average XRF
DW1	152	ppm	Average XRF
DZ1	141	ppm	Average XRF
GA1	1432	ppm	Average XRF
DZ1	154	mg/kg	Metals in Solids by ICP-AES

Legend

Property feature	Property XRF/sample result
Building	< 400 ppm or mg/kg
Driveway	≥ 400 ppm or mg/kg
Other	

Source: MSDIS, Iron County 6-inch imagery service, 2011

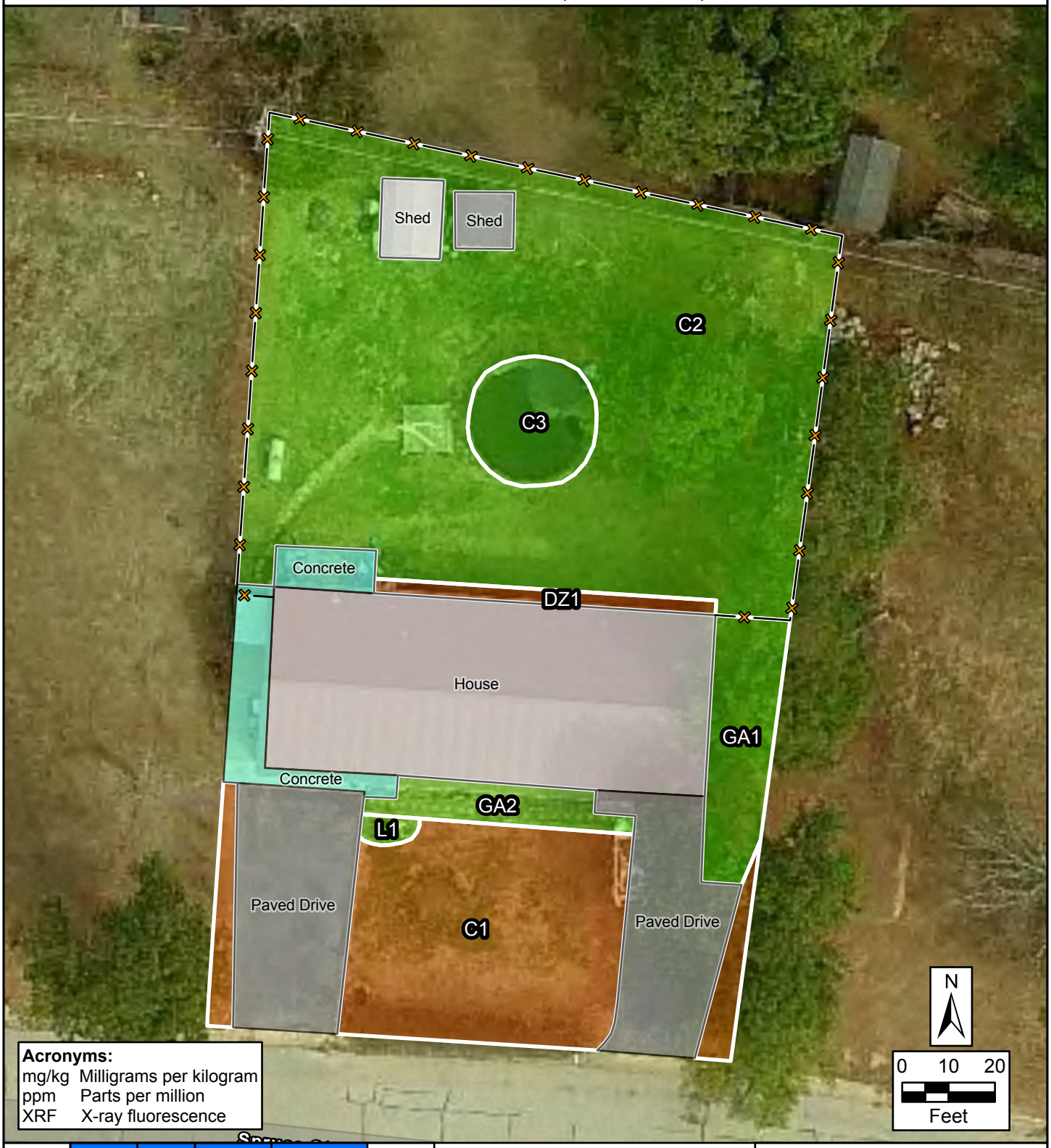
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06099
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06116
Owner: KELLY, PATRICK D & TAMMY K
Address: 30 SPRUCE ST, VIBURNUM, MO



Acronyms:
mg/kg Milligrams per kilogram
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	416	ppm	Average XRF
C2	114	ppm	Average XRF
C3	37	ppm	Average XRF
DZ1	1774	ppm	Average XRF
GA1	104	ppm	Average XRF
GA2	162	ppm	Average XRF
L1	147	ppm	Average XRF
LS1	180	mg/kg	Metals in Solids by ICP-AES

Legend
Fence
Property feature
Building
Driveway
Other
Property XRF/sample result
< 400 ppm or mg/kg
≥ 400 ppm or mg/kg

Source: MSDIS, Iron County 6-inch imagery service, 2011

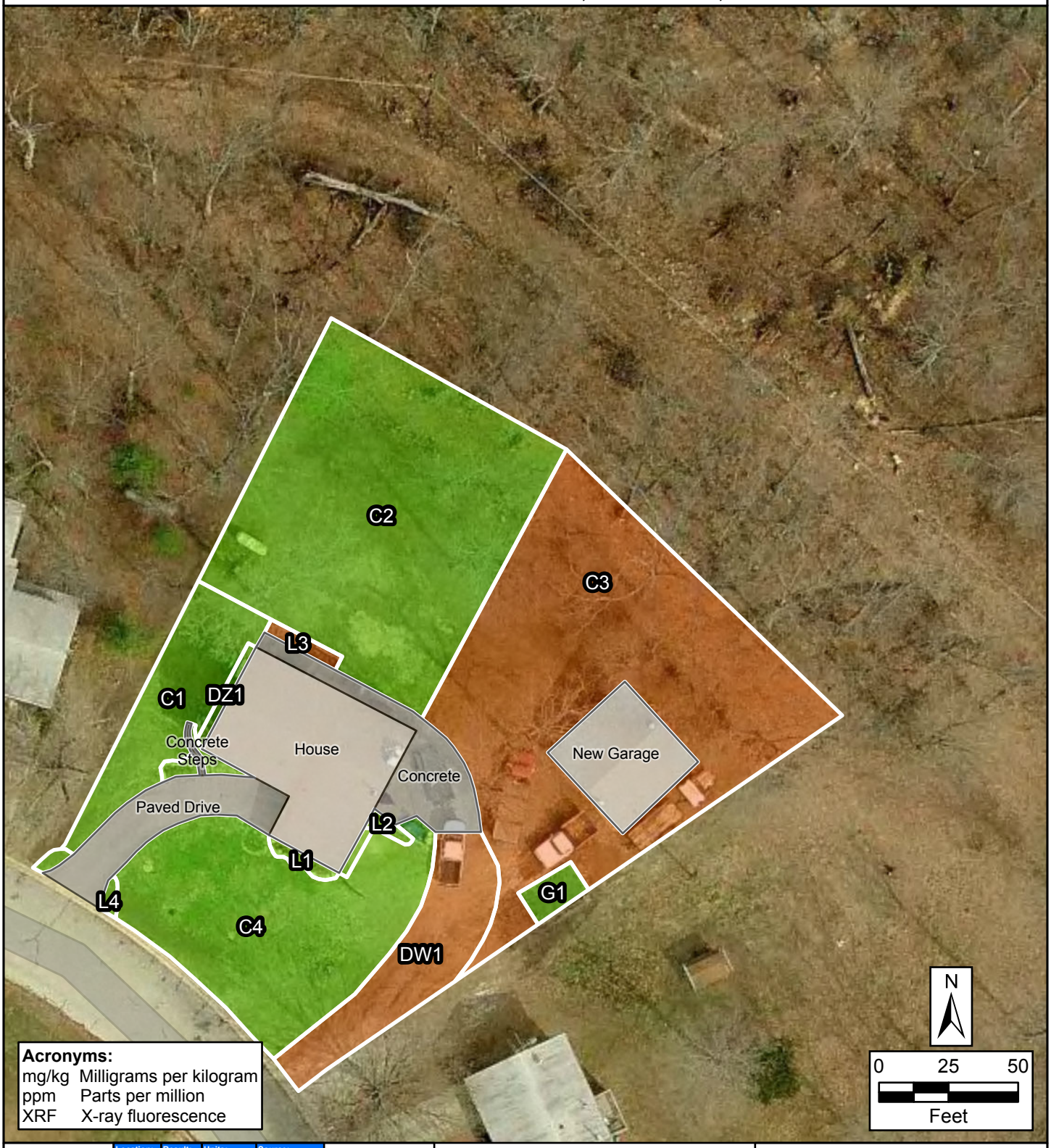
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06116
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06137
Owner: GRAHAM, JAMES K
Address: 20 CRESCENT DR, VIBURNUM, MO



Acronyms:
mg/kg Milligrams per kilogram
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	256	ppm	Average XRF
C2	280	ppm	Average XRF
C3	565	ppm	Average XRF
C4	263	ppm	Average XRF
DW1	4045	ppm	Average XRF
DZ1	342	ppm	Average XRF
G1	204	ppm	Average XRF
L1	193	ppm	Average XRF
L2	108	ppm	Average XRF
L3	402	ppm	Average XRF
L4	384	ppm	Average XRF
C2	339	mg/kg	Metals in Solids by ICP-AES

Legend

Property feature	Property XRF/sample result
Building	< 400 ppm or mg/kg
Driveway	≥ 400 ppm or mg/kg
Walkway	

Source: MSDIS, Iron County 6-inch imagery service, 2011

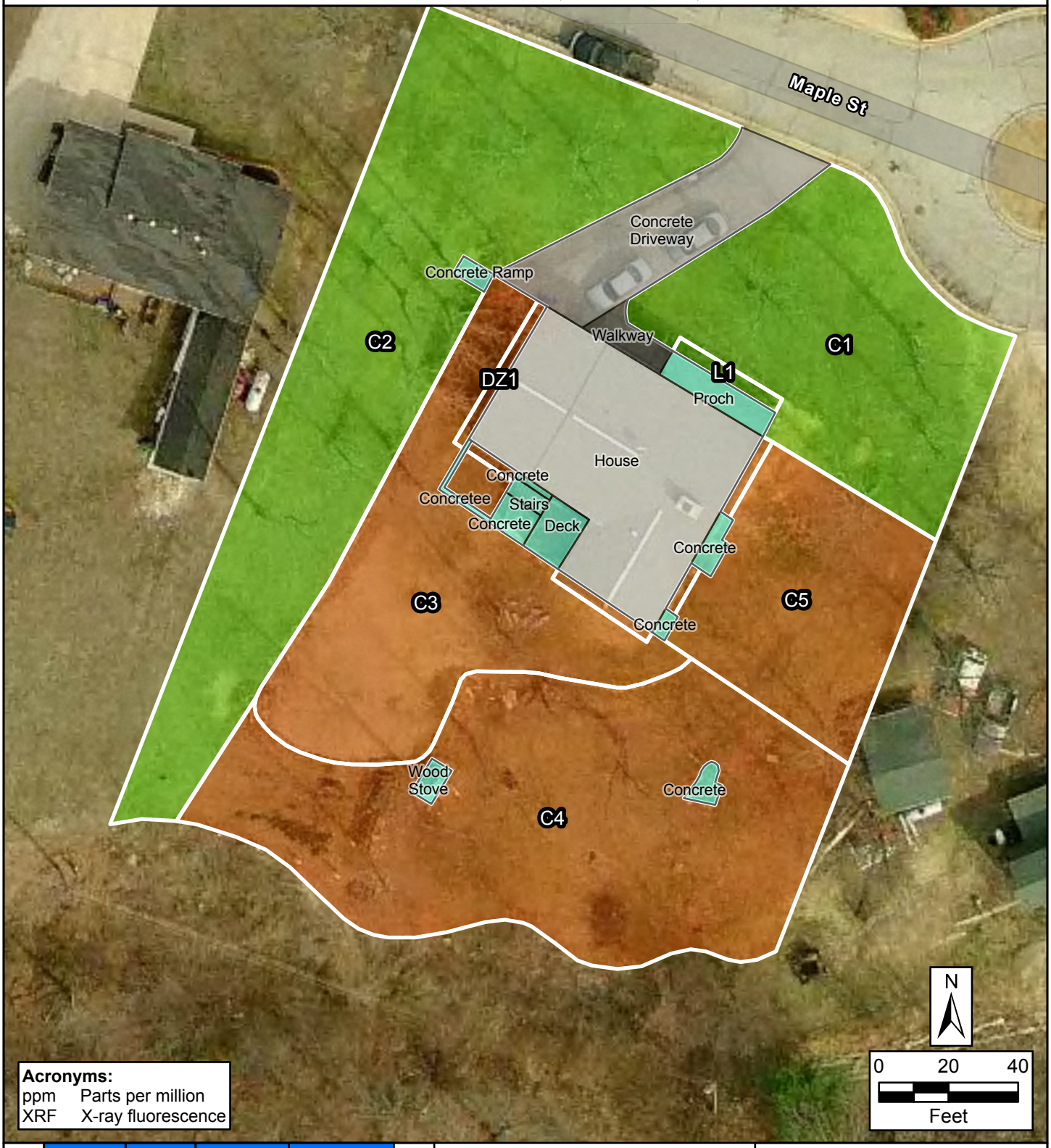
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06137
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06154
Owner: CHANDLER, TRENTON D & BRITTANY L
Address: 23 MAPLE ST, VIBURNUM, MO



Acronyms:
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	285	ppm	Average XRF
C2	267	ppm	Average XRF
C3	669	ppm	Average XRF
C4	414	ppm	Average XRF
C5	410	ppm	Average XRF
DZ1	1040	ppm	Average XRF
L1	121	ppm	Average XRF

Legend

Property feature	Property XRF screening result
Building	< 400 ppm
Driveway	≥ 400 ppm
Walkway	
Other	

Source: MSDIS, Iron County 6-inch imagery service, 2011

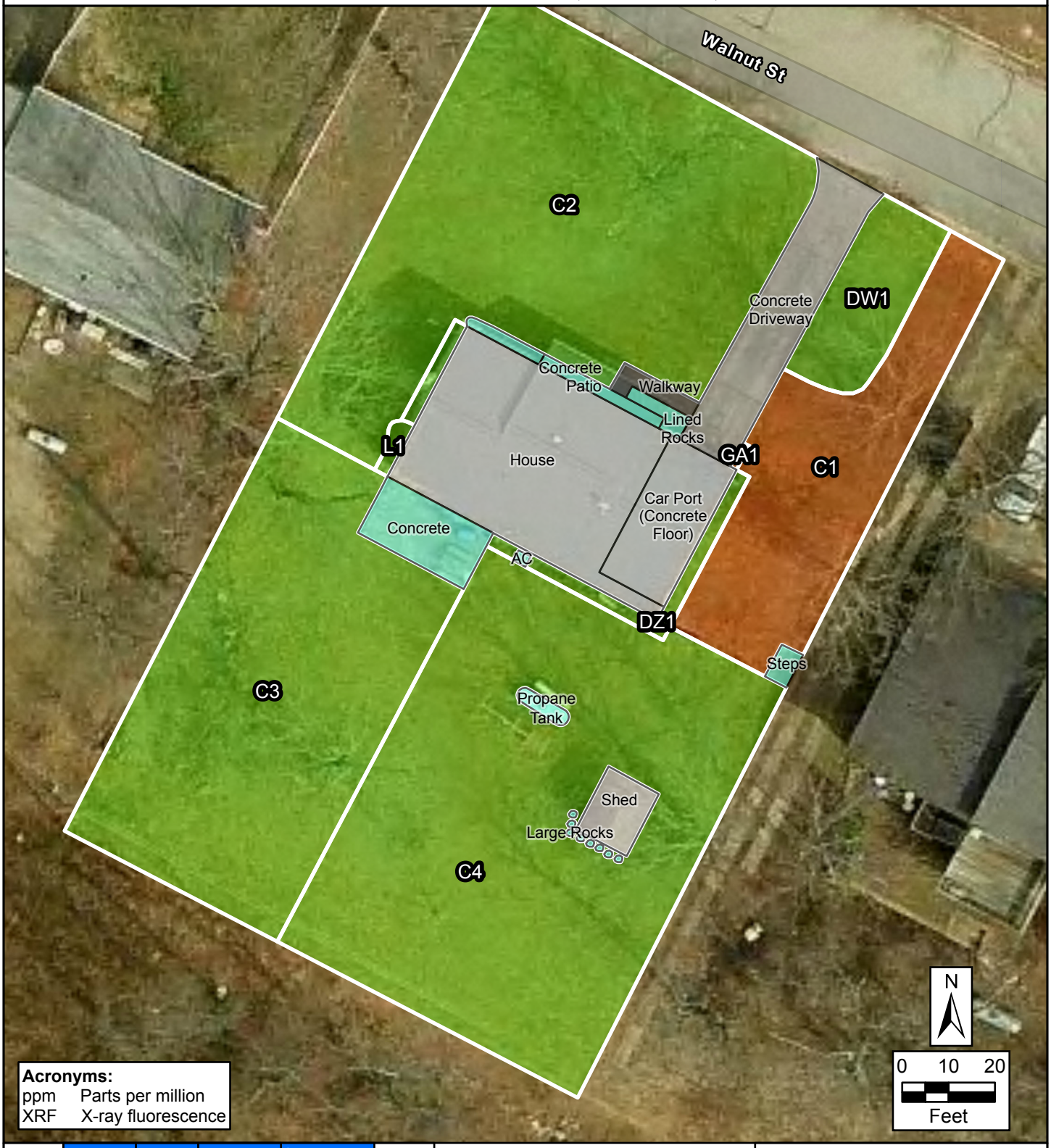
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06154
Pre-Excavation Screening Form

TETRA TECH

Date: 1/28/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06181
Owner: JACKSON, TAMMY
Address: 37 WALNUT ST, VIBURNUM, MO



Acronyms:
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	1495	ppm	Average XRF
C2	251	ppm	Average XRF
C3	253	ppm	Average XRF
C4	225	ppm	Average XRF
DW1	219	ppm	Average XRF
DZ1	188	ppm	Average XRF
GA1	458	ppm	Average XRF
L1	153	ppm	Average XRF

Legend

Property feature	Property XRF screening result
Building	< 400 ppm
Driveway	≥ 400 ppm
Walkway	
Other	

Source: MSDIS, Iron County 6-inch imagery service, 2011

St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06181
Pre-Excavation Screening Form

TETRA TECH

Date: 1/28/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06183
Owner: MOWERY, MICHELE L
Address: 40 WALNUT ST, VIBURNUM, MO

Acronyms:
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	302	ppm	Average XRF
C2	305	ppm	Average XRF
C3	465	ppm	Average XRF
C4	380	ppm	Average XRF
DZ1	404	ppm	Average XRF
L1	443	ppm	Average XRF

Legend
Fence
Property feature
Building
Driveway
Walkway
Other
Property XRF screening result
< 400 ppm
≥ 400 ppm

Source: MSDIS, Iron County 6-inch imagery service, 2011

St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06183
Pre-Excavation Screening Form

TETRA TECH

Date: 1/28/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06184
Owner: DISABLED CITIZENS ALLIANCE FOR INDEPENDENCE FOUNDATIO
Address: 41 WALNUT ST, VIBURNUM, MO

Acronyms:
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	271	ppm	Average XRF
C2	518	ppm	Average XRF
C3	331	ppm	Average XRF
C4	259	ppm	Average XRF
DZ1	187	ppm	Average XRF

Legend
Fence
Property feature
Building
Driveway
Walkway
Other
Property XRF screening result
< 400 ppm
≥ 400 ppm

Source: MSDIS, Iron County 6-inch imagery service, 2011

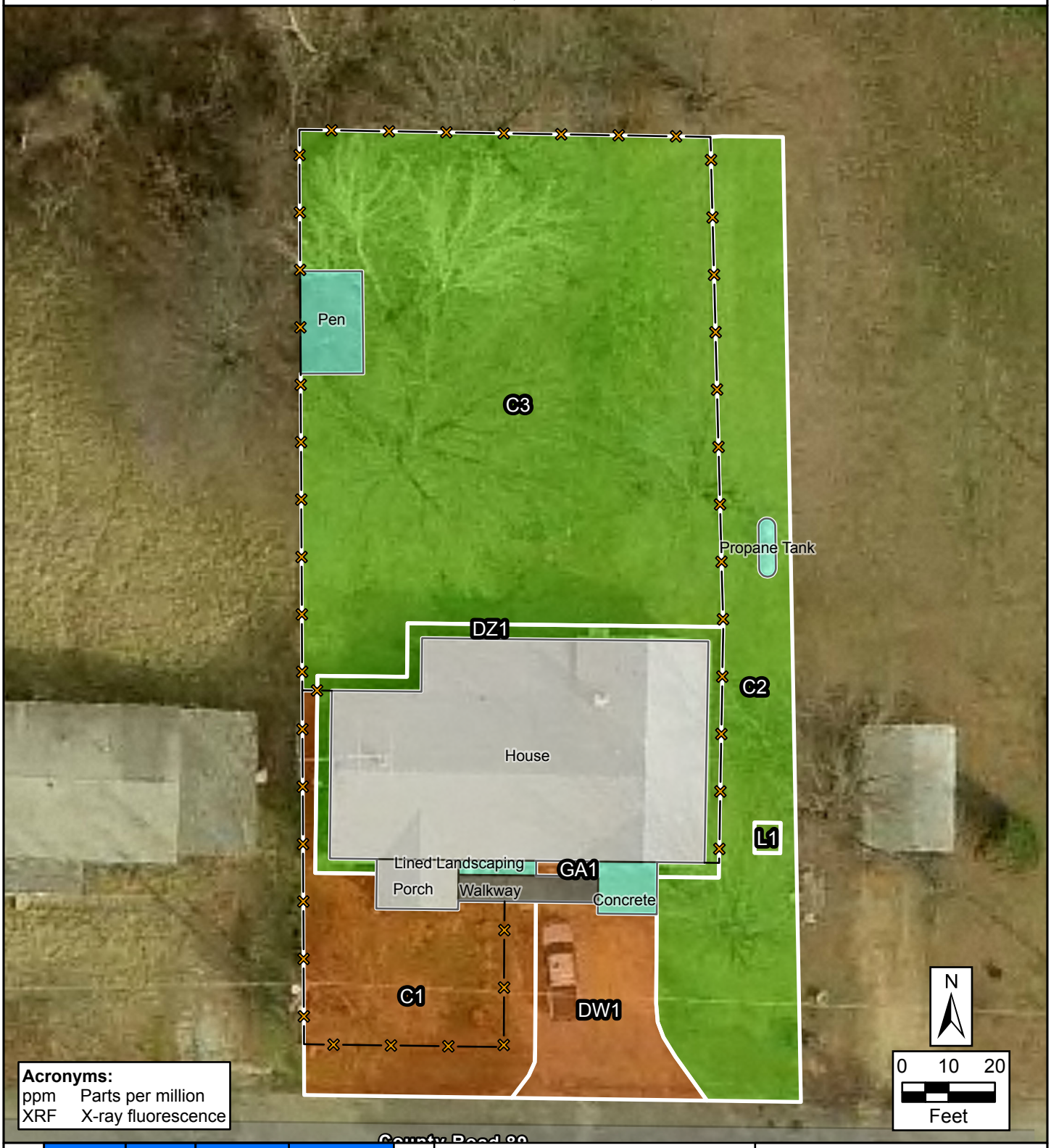
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06184
Pre-Excavation Screening Form

TETRA TECH

Date: 1/28/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06226
Owner: CONAWAY, JEARL D & LINDA S
Address: 58 CR 89, VIBURNUM, MO



Acronyms:
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	400	ppm	Average XRF
C2	181	ppm	Average XRF
C3	93	ppm	Average XRF
DW1	1175	ppm	Average XRF
DZ1	187	ppm	Average XRF
GA1	3322	ppm	Average XRF
L1	174	ppm	Average XRF

Legend
Fence
Property feature
Building
Walkway
Other
Property XRF screening result
< 400 ppm
≥ 400 ppm

Source: MSDIS, Iron County 6-inch imagery service, 2011

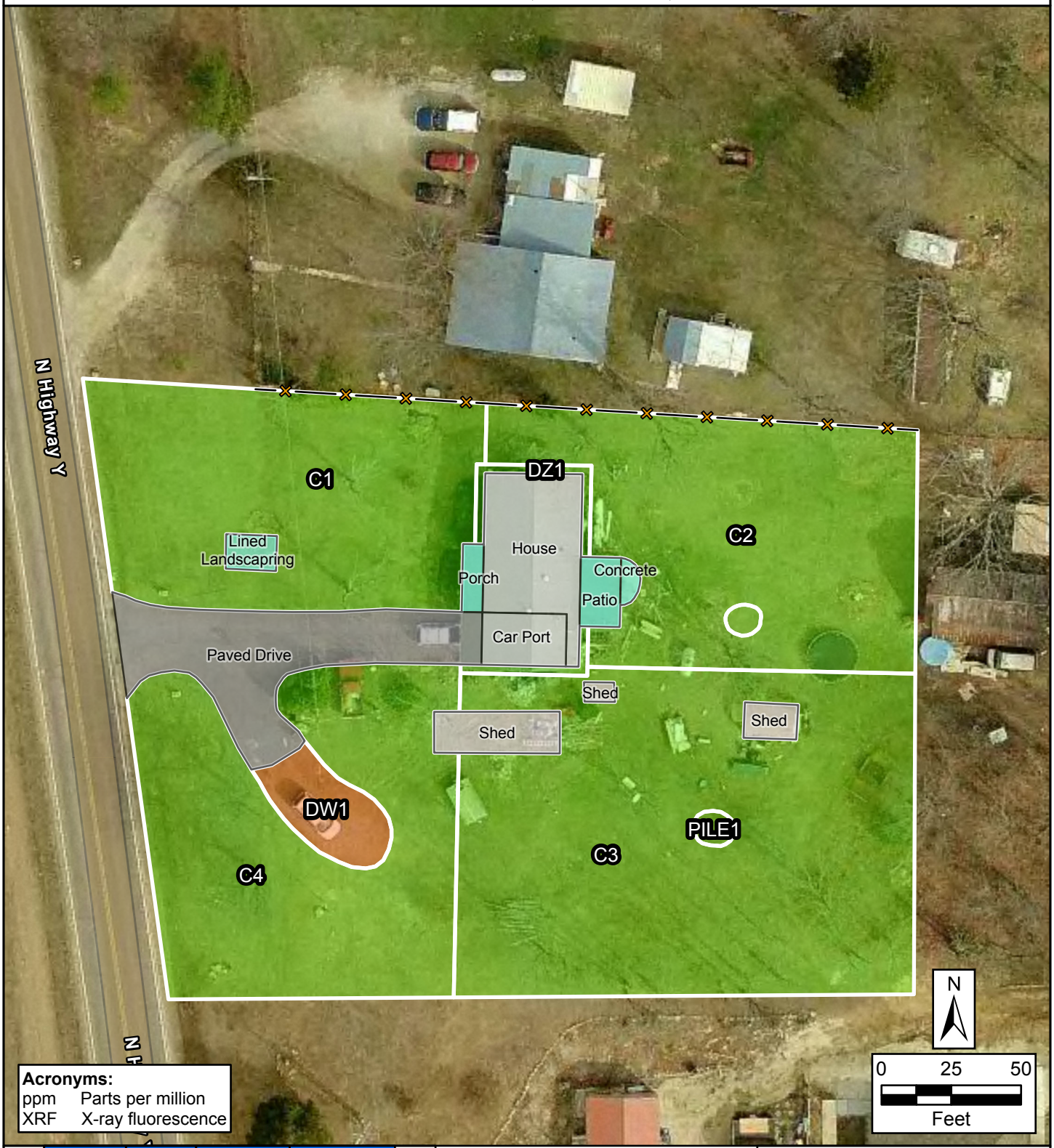
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06226
Pre-Excavation Screening Form

TETRA TECH

Date: 1/28/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06241
Owner: BOURBON, RONALD E JR & LORETTA M
Address: 4 N HWY Y, VIBURNUM, MO



Acronyms:
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	357	ppm	Average XRF
C2	111	ppm	Average XRF
C3	93	ppm	Average XRF
C4	170	ppm	Average XRF
DW1	2238	ppm	Average XRF
DZ1	308	ppm	Average XRF
PILE1	48	ppm	Average XRF

Legend
Fence
Property feature
Building
Driveway
Other
Property XRF screening result
< 400 ppm
≥ 400 ppm

Source: MSDIS, Iron County 6-inch imagery service, 2011

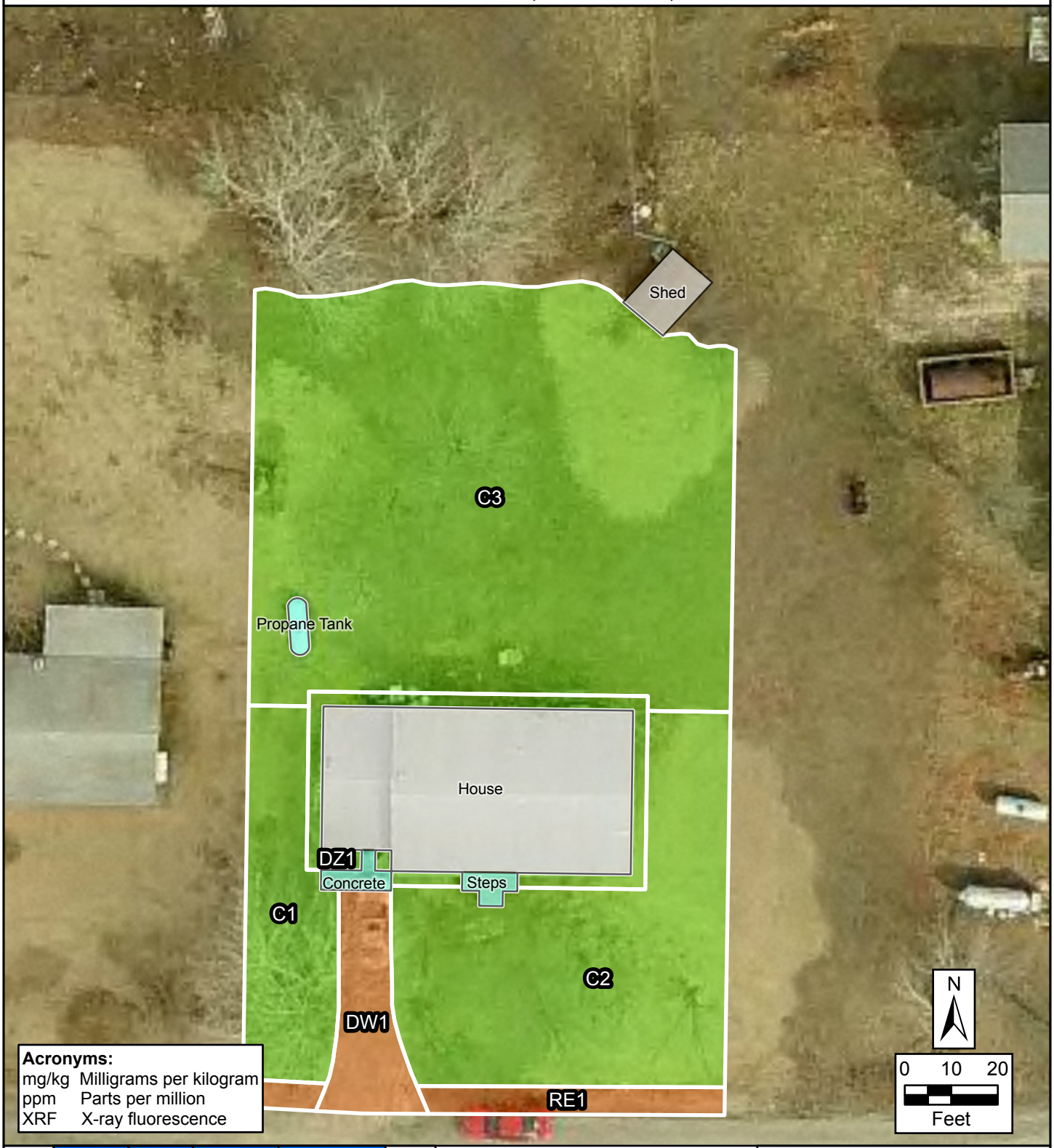
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06241
Pre-Excavation Screening Form

TETRA TECH

Date: 1/28/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06246
Owner: JENNINGS, LESA J
Address: 43 CR 88, VIBURNUM, MO



Acronyms:
mg/kg Milligrams per kilogram
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	244	ppm	Average XRF
C2	174	ppm	Average XRF
C3	141	ppm	Average XRF
DW1	651	ppm	Average XRF
RE1	1308	ppm	Average XRF
DZ1	337	ppm	Average XRF
DZ1	396	mg/kg	Metals in Solids by ICP-AES

Legend

Property feature	Property XRF/sample result
Building	< 400 ppm or mg/kg
Other	≥ 400 ppm or mg/kg

Source: MSDIS, Iron County 6-inch imagery service, 2011

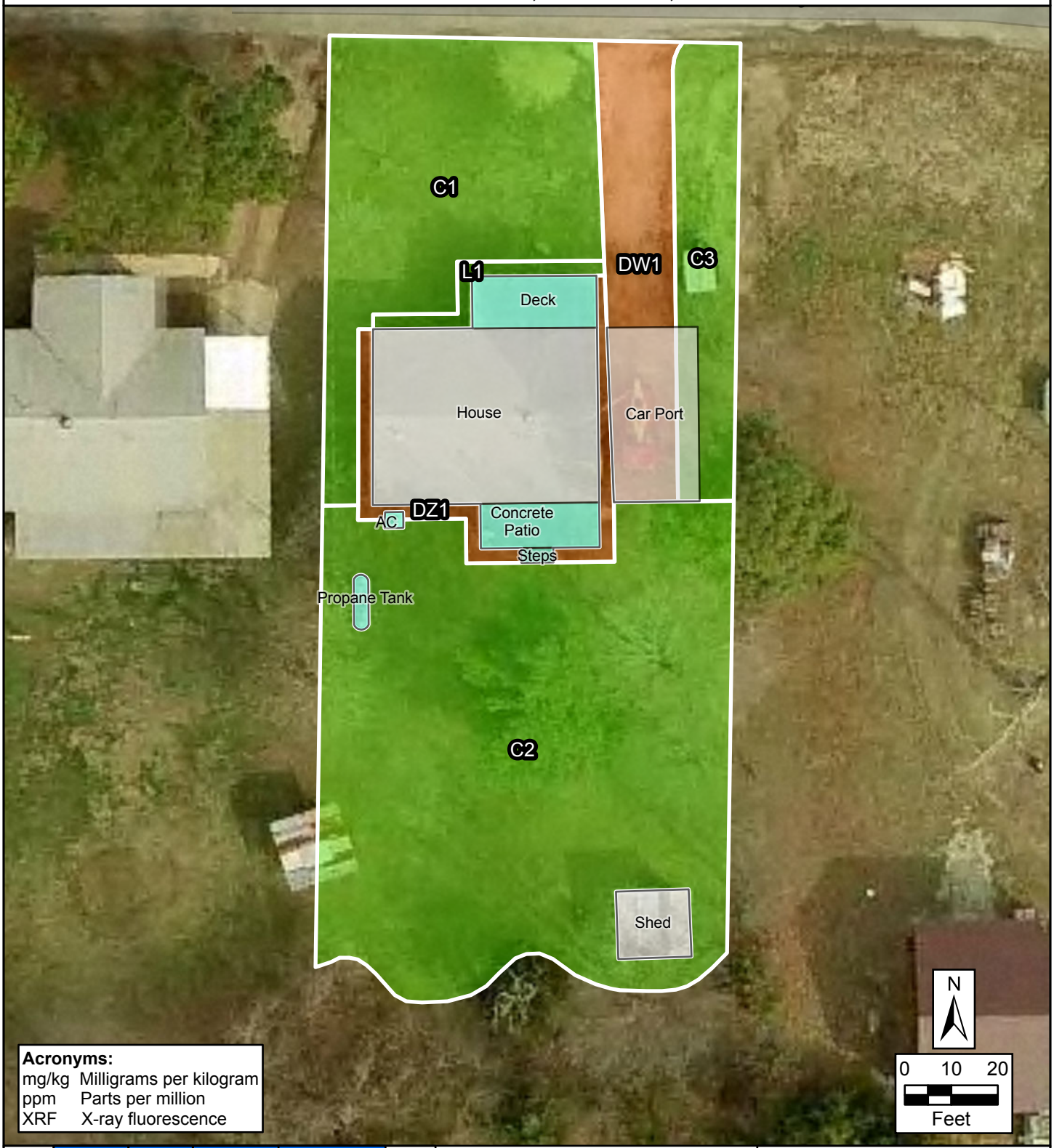
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06246
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06248
Owner: CONAWAY, JEARL D & LINDA S
Address: 31 CR 89, VIBURNUM, MO



Acronyms:
mg/kg Milligrams per kilogram
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	210	ppm	Average XRF
C2	168	ppm	Average XRF
C3	189	ppm	Average XRF
DW1	4474	ppm	Average XRF
DZ1	947	ppm	Average XRF
L1	125	ppm	Average XRF
C3	207	mg/kg	Metals in Solids by ICP-AES

Legend
Property feature
Building
Other
Property XRF/sample result
< 400 ppm or mg/kg
≥ 400 ppm or mg/kg

Source: MSDIS, Iron County 6-inch imagery service, 2011

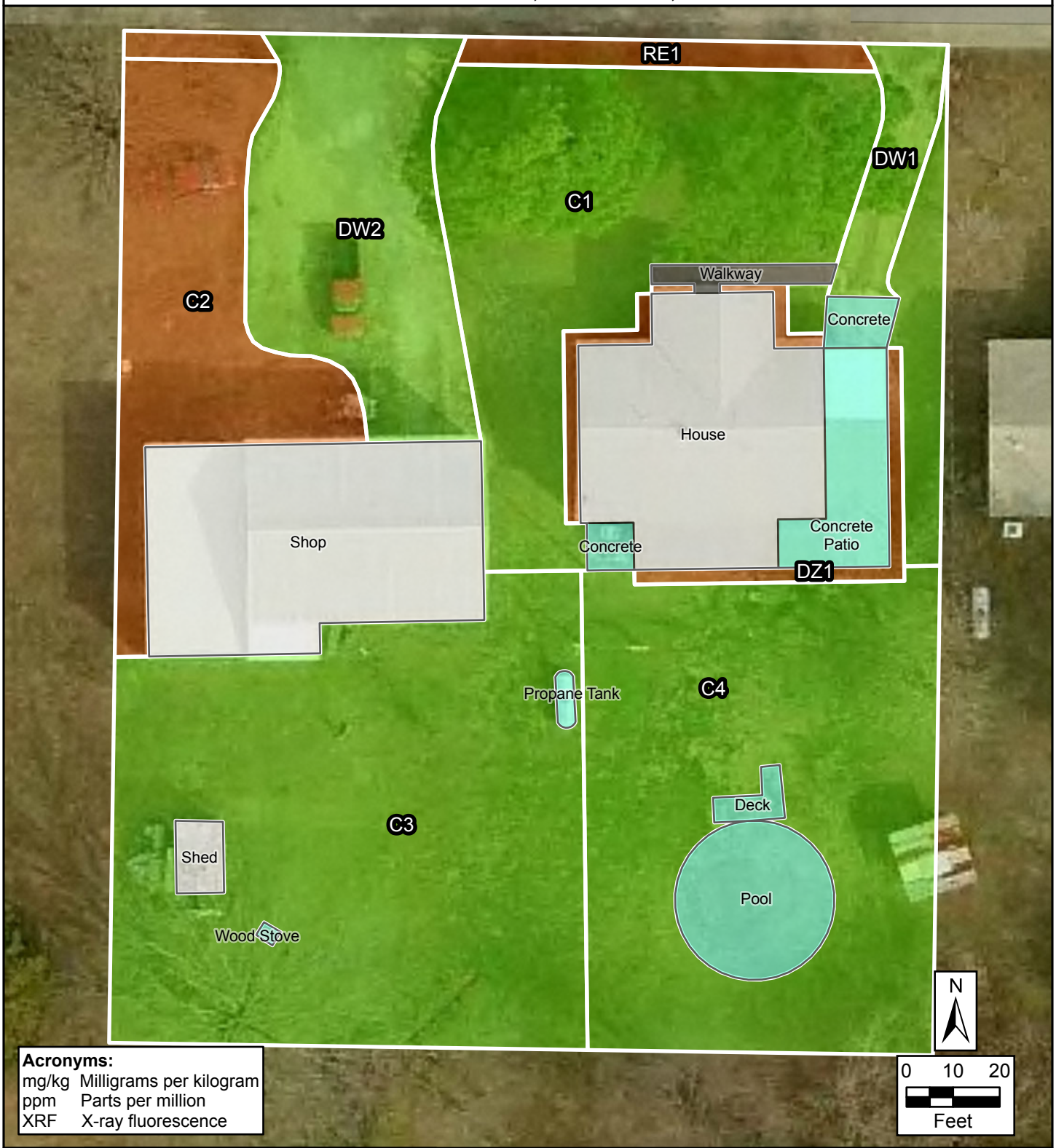
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06248
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06249
Owner: CONAWAY, JEARL D & LINDA S
Address: 45 CR 89, VIBURNUM, MO



Acronyms:

mg/kg	Milligrams per kilogram
ppm	Parts per million
XRF	X-ray fluorescence

Location:	Result:	Units:	Source:
C4	104	mg/kg	Metals in Solids by ICP-AES
C1	188	ppm	Average XRF
C2	8737	ppm	Average XRF
C3	171	ppm	Average XRF
C4	96	ppm	Average XRF
DW1	205	ppm	Average XRF
DW2	316	ppm	Average XRF
DZ1	417	ppm	Average XRF
RE1	808	ppm	Average XRF

Legend

Property feature	Property XRF/sample result
Building	< 400 ppm or mg/kg
Walkway	≥ 400 ppm or mg/kg
Other	

Source: MSDIS, Iron County 6-inch imagery service, 2011

St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06249
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06278
Owner: MILES, THOMAS W SHARON
Address: 116 S HWY 49, VIBURNUM, MO

Acronyms:
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	2678	ppm	Average XRF
C2	137	ppm	Average XRF
C3	157	ppm	Average XRF
C4	261	ppm	Average XRF
C5	1494	ppm	Average XRF
DW1	436	ppm	Average XRF
DZ1	248	ppm	Average XRF
GA1	1277	ppm	Average XRF
L1	91	ppm	Average XRF

Legend

Property feature	Property XRF screening result
Building	< 400 ppm
Driveway	≥ 400 ppm
Walkway	
Other	

Source: MSDIS, Iron County 6-inch imagery service, 2011

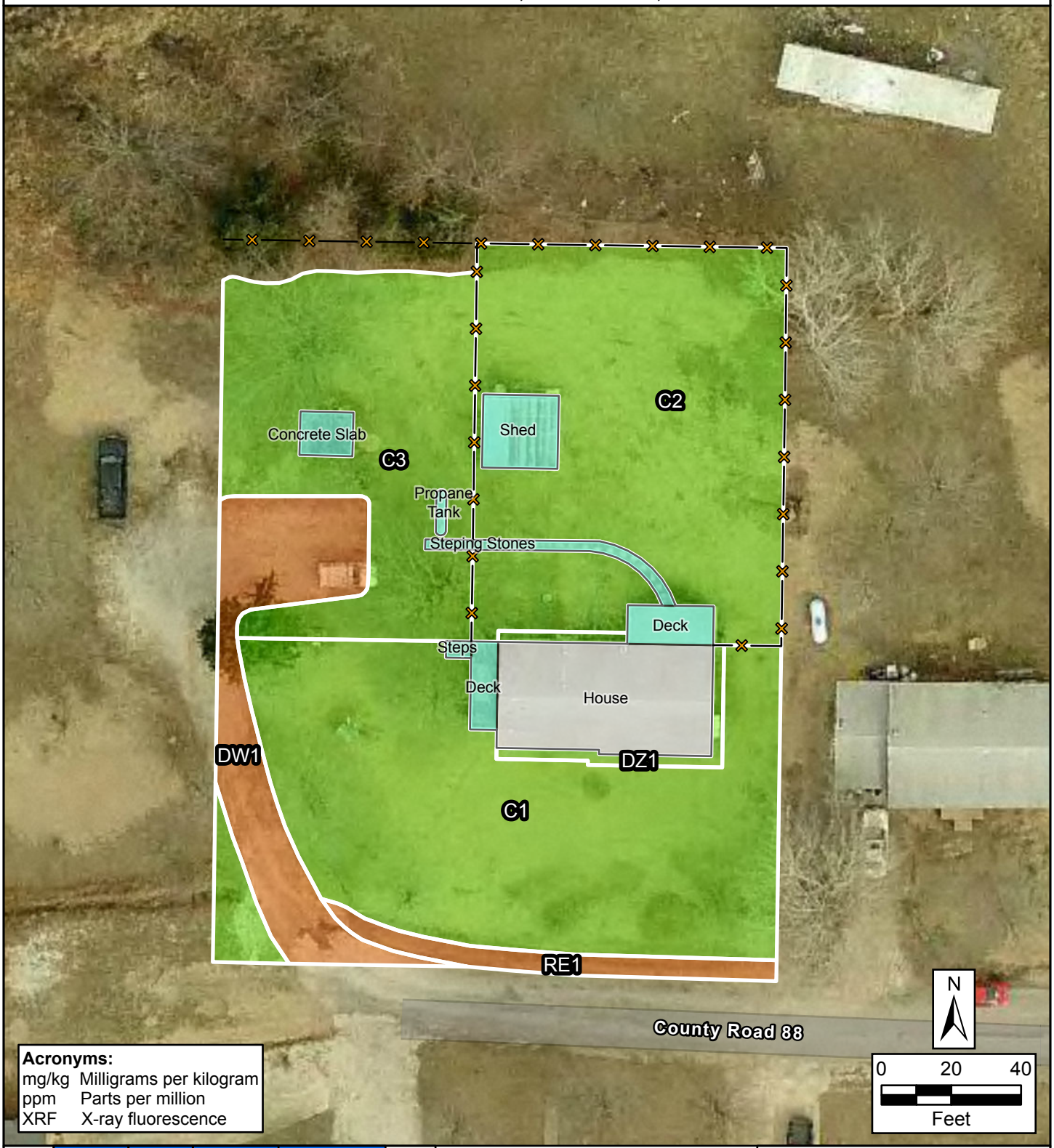
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06278
Pre-Excavation Screening Form

TETRA TECH

Date: 1/28/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS06293
Owner: MINER, NANCY J
Address: CR 88, VIBURNUM, MO



Acronyms:
mg/kg Milligrams per kilogram
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	145	ppm	Average XRF
C2	90	ppm	Average XRF
C3	351	ppm	Average XRF
DW1	1209	ppm	Average XRF
DZ1	163	ppm	Average XRF
RE1	831	ppm	Average XRF
DZ1	161	mg/kg	Metals in Solids by ICP-AES

Legend
Fence
Property feature
Building
Other
Property XRF/sample result
< 400 ppm or mg/kg
≥ 400 ppm or mg/kg

Source: MSDIS, Iron County 6-inch imagery service, 2011

St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS06293
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS07005
Owner: BROOKS, TIMOTHY W & SUMMER
Address: 9 BRIARCREST DR, VIBURNUM, MO

Acronyms:

mg/kg	Milligrams per kilogram
ppm	Parts per million
XRF	X-ray fluorescence

Location:	Result:	Units:	Source:
C1	146	ppm	Average XRF
C2	200	ppm	Average XRF
C3	130	ppm	Average XRF
C4	96	ppm	Average XRF
DZ1	132	ppm	Average XRF
G1	21	ppm	Average XRF
GA1	1037	ppm	Average XRF
L1	100	ppm	Average XRF
GA1	1220	mg/kg	Metals in Solids by ICP-AES

Legend

Property feature	Property XRF/sample result
Building	< 400 ppm or mg/kg
Driveway	≥ 400 ppm or mg/kg
Walkway	
Other	

Source: MSDIS, Iron County 6-inch imagery service, 2011

St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS07005
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS07009
Owner: FRIENDLY COMMUNITY, LLC
Address: 28 CR 88, VIBURNUM, MO

Acronyms:
mg/kg Milligrams per kilogram
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
DZ1	310	mg/kg	Metals in Solids by ICP-AES
C1	488	ppm	Average XRF
C2	266	ppm	Average XRF
C3	188	ppm	Average XRF
C4	206	ppm	Average XRF
DZ1	314	ppm	Average XRF
G1	103	ppm	Average XRF
GA1	1141	ppm	Average XRF

Legend

Property feature	Property XRF/sample result
Building	< 400 ppm or mg/kg
Other	≥ 400 ppm or mg/kg

Source: MSDIS, Iron County 6-inch imagery service, 2011

St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS07009
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS07013 & VS07014
Owner: VIBURNUM C4 SCHOOL DISTRICT
Address: 35 N HWY 49, VIBURNUM, MO

Property ID:	Location:	Result:	Units:	Source:	Property ID:	Location:	Result:	Units:	Source:	Property ID:	Location:	Result:	Units:	Source:	Property ID:	Location:	Result:	Units:	Source:	Property ID:	Location:	Result:	Units:	Source:
VS07013	C1	132	ppm	Average XRF	VS07013	C16	1633	ppm	Average XRF	VS07014	C6	105	ppm	Average XRF	VS07014	C21	51	ppm	Average XRF	VS07014	C36	311	ppm	Average XRF
VS07013	C2	153	ppm	Average XRF	VS07013	C17	182	ppm	Average XRF	VS07014	C7	104	ppm	Average XRF	VS07014	C22	90	ppm	Average XRF	VS07014	C37	280	ppm	Average XRF
VS07013	C3	180	ppm	Average XRF	VS07013	C18	359	ppm	Average XRF	VS07014	C8	45	ppm	Average XRF	VS07014	C23	1820	ppm	Average XRF	VS07014	C38	128	ppm	Average XRF
VS07013	C4	153	ppm	Average XRF	VS07013	C19	113	ppm	Average XRF	VS07014	C9	134	ppm	Average XRF	VS07014	C24	77	ppm	Average XRF	VS07014	C39	35	ppm	Average XRF
VS07013	C5	196	ppm	Average XRF	VS07013	C20	171	ppm	Average XRF	VS07014	C10	73	ppm	Average XRF	VS07014	C25	95	ppm	Average XRF	VS07014	DW1	773	ppm	Average XRF
VS07013	C6	136	ppm	Average XRF	VS07013	C21	200	ppm	Average XRF	VS07014	C11	102	ppm	Average XRF	VS07014	C26	179	ppm	Average XRF	VS07014	DW2	243	ppm	Average XRF
VS07013	C7	137	ppm	Average XRF	VS07013	C22	212	ppm	Average XRF	VS07014	C12	417	ppm	Average XRF	VS07014	C27	1528	ppm	Average XRF	VS07014	PA1	84	ppm	Average XRF
VS07013	C8	179	ppm	Average XRF	VS07013	C23	269	ppm	Average XRF	VS07014	C13	263	ppm	Average XRF	VS07014	C28	470	ppm	Average XRF	VS07014	PA2	20	ppm	Average XRF
VS07013	C9	138	ppm	Average XRF	VS07013	PILE1	43	ppm	Average XRF	VS07014	C14	113	ppm	Average XRF	VS07014	C29	1185	ppm	Average XRF	VS07014	PILE1	23	ppm	Average XRF
VS07013	C10	356	ppm	Average XRF	VS07013	DZ1	403	ppm	Average XRF	VS07014	C15	122	ppm	Average XRF	VS07014	C30	266	ppm	Average XRF	VS07014	DZ1	190	ppm	Average XRF
VS07013	C11	1364	ppm	Average XRF	VS07014	C1	126	ppm	Average XRF	VS07014	C16	105	ppm	Average XRF	VS07014	C31	351	ppm	Average XRF	VS07014	DZ2	52	ppm	Average XRF
VS07013	C12	907	ppm	Average XRF	VS07014	C2	128	ppm	Average XRF	VS07014	C17	139	ppm	Average XRF	VS07014	C32	224	ppm	Average XRF	VS07014	DZ3	127	ppm	Average XRF
VS07013	C13	757	ppm	Average XRF	VS07014	C3	94	ppm	Average XRF	VS07014	C18	171	ppm	Average XRF	VS07014	C33	128	ppm	Average XRF	VS07014	DZ4	113	ppm	Average XRF
VS07013	C14	1925	ppm	Average XRF	VS07014	C4	105	ppm	Average XRF	VS07014	C19	128	ppm	Average XRF	VS07014	C34	296	ppm	Average XRF	VS07014	DW1	931	mg/kg	Metals in Solids
VS07013	C15	642	ppm	Average XRF	VS07014	C5	123	ppm	Average XRF	VS07014	C20	41	ppm	Average XRF	VS07014	C35	51	ppm	Average XRF	VS07013	C18	360	mg/kg	Metals in Solids

Legend

Property feature
- Building
- Other

Property XRF/sample result
- < 400 ppm or mg/kg
- ≥ 400 ppm or mg/kg

Acronyms:
mg/kg Milligrams per kilogram
ppm Parts per million
XRF X-ray fluorescence

N

0 60 120
Feet

Source: MSDIS, Iron County 6-inch imagery service, 2011

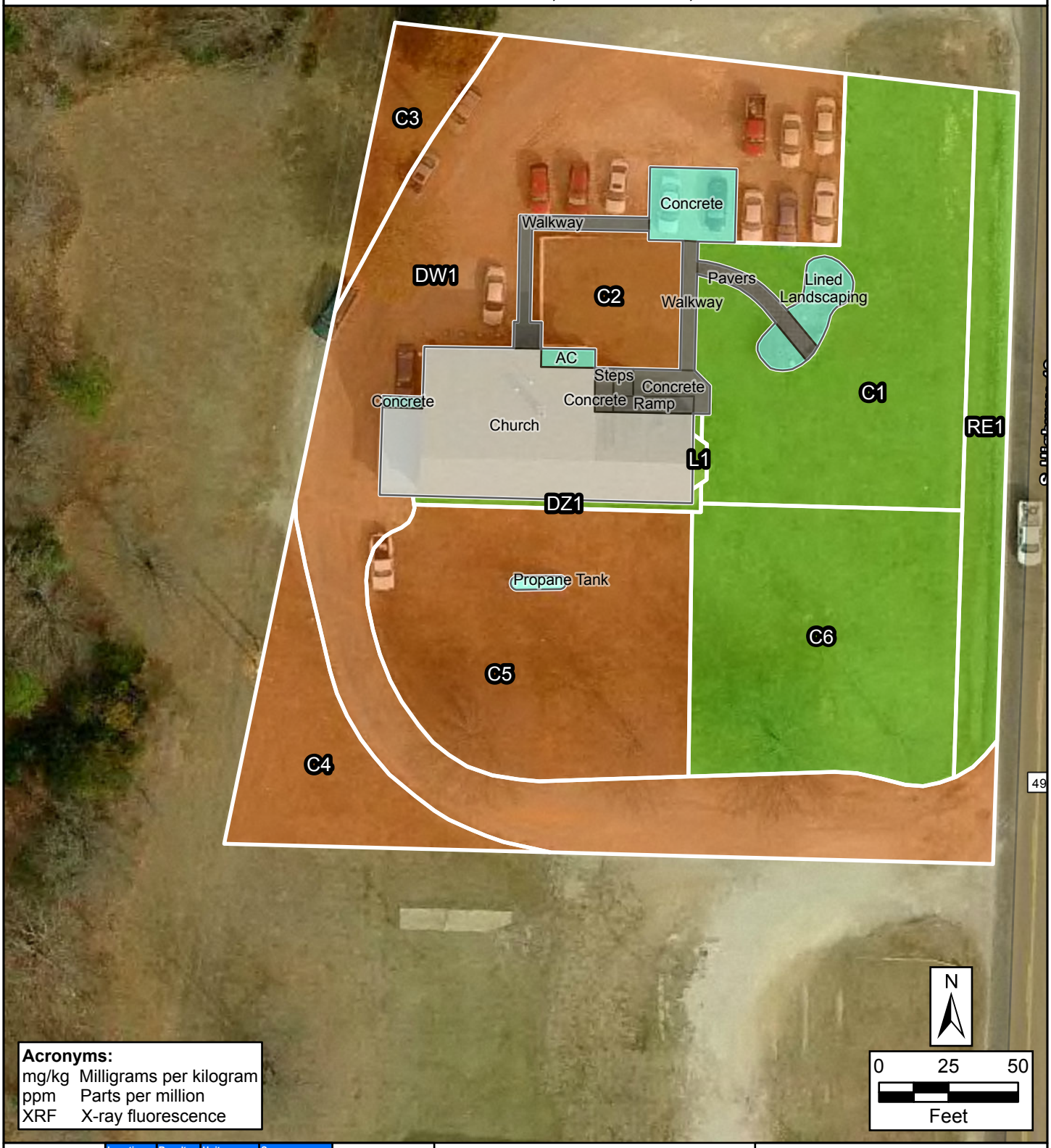
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS07013 & VS07014
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS07015
Owner: EMMANUEL UNITED METHODIST CHURCH
Address: 70 S HWY 49, VIBURNUM, MO



Acronyms:
mg/kg Milligrams per kilogram
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	192	ppm	Average XRF
C2	635	ppm	Average XRF
C3	6640	ppm	Average XRF
C4	360	ppm	Average XRF
C5	730	ppm	Average XRF
C6	180	ppm	Average XRF
DW1	13200	ppm	Average XRF
DZ1	261	ppm	Average XRF
L1	42	ppm	Average XRF
RE1	270	ppm	Average XRF
C4	424	mg/kg	Metals in Solids by ICP-AES

Legend

Property feature	Property XRF/sample result
Building	< 400 ppm or mg/kg
Walkway	≥ 400 ppm or mg/kg
Other	

Source: MSDIS, Iron County 6-inch imagery service, 2011

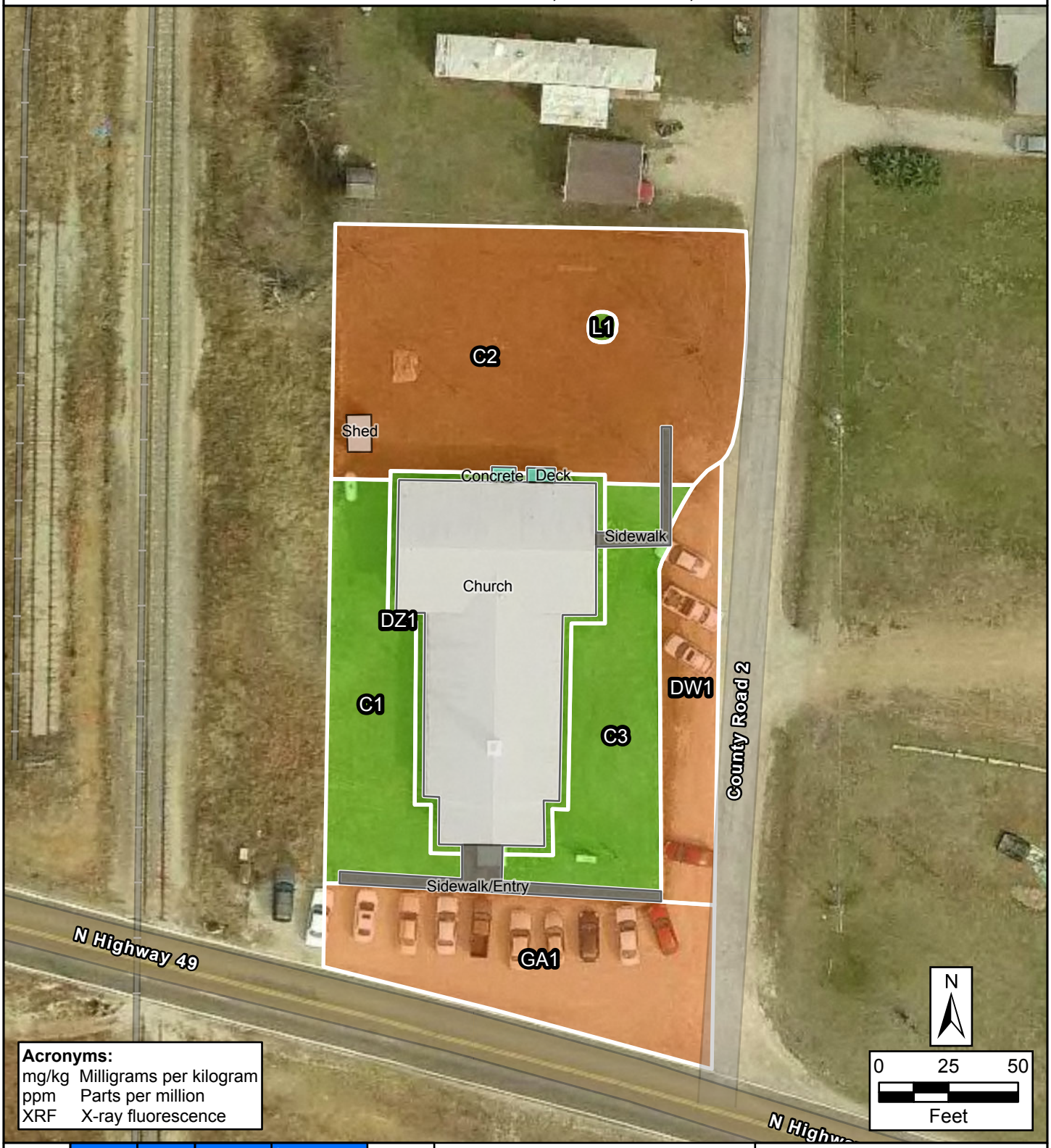
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS07015
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS07018
Owner: VIBURNUM FREEWILL BAPTIST CHURCH
Address: 49 N HWY 49, VIBURNUM, MO



Acronyms:
mg/kg Milligrams per kilogram
ppm Parts per million
XRF X-ray fluorescence

Location:	Result:	Units:	Source:
C1	308	ppm	Average XRF
C2	479	ppm	Average XRF
C3	249	ppm	Average XRF
DW1	3868	ppm	Average XRF
DZ1	260	mg/kg	Metals in Solids by ICP-AES
DZ1	222	ppm	Average XRF
GA1	3467	ppm	Average XRF
L1	384	ppm	Average XRF

Legend

Property feature	Property XRF/sample result
Building	< 400 ppm or mg/kg
Walkway	≥ 400 ppm or mg/kg
Other	

Source: MSDIS, Iron County 6-inch imagery service, 2011

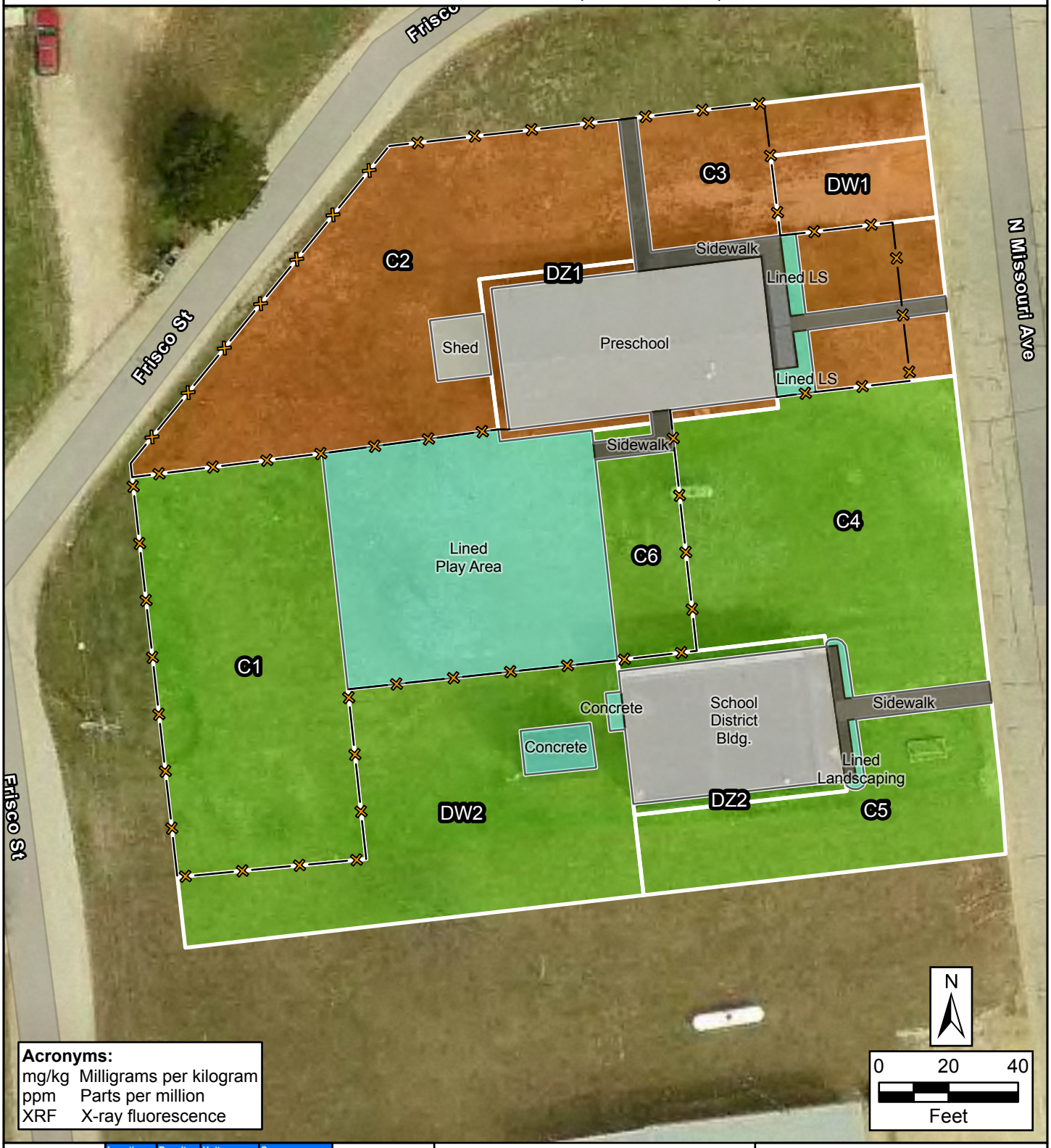
St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS07018
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075

Property ID: VS07025
Owner: IRON COUNTY C-4 SCHOOL DISTRICT
Address: 24 MISSOURI AVE, VIBURNUM, MO



Acronyms:

mg/kg	Milligrams per kilogram
ppm	Parts per million
XRF	X-ray fluorescence

Location:	Result:	Units:	Source:
C5	177	mg/kg	Metals in Solids by ICP-AES
C1	152	ppm	Average XRF
C2	786	ppm	Average XRF
C3	1193	ppm	Average XRF
C4	303	ppm	Average XRF
C5	166	ppm	Average XRF
C6	130	ppm	Average XRF
DW1	4592	ppm	Average XRF
DW2	18	ppm	Average XRF
DZ1	2068	ppm	Average XRF
DZ2	300	ppm	Average XRF

Legend

Fence

Property feature
- Building
- Walkway
- Other

Property XRF/sample result
- < 400 ppm or mg/kg
- ≥ 400 ppm or mg/kg

Source: MSDIS, Iron County 6-inch imagery service, 2011

St. Joe Minerals - Viburnum
Viburnum, Missouri

Property ID: VS07025
Pre-Excavation Screening Form

TETRA TECH

Date: 3/17/2021 Drawn By: Clayton Hayes Project No: X9030.20F.0075