U.S. Department of Transportation
Pipeline and Hazardous Materials Safety Administration

Natural Gas Distribution Infrastructure Safety and Modernization Grant Program
City Utilities of Springfield, MO
Tier 2 Site Specific Environmental Assessment
NGDISM-FY22-EA-2023-09

PHMSA Approval:

SHELBY MATTHEW FULLER

Digitally signed by SHELBY MATTHEW FULLER
Date: 2024.01.16 10:52:32 -06'00'

PHMSA Office of Planning and Analytics
Environmental Policy and Justice Division
Matt Fuller
Matt.Fuller@dot.gov

City Utilities of Springfield
Casey Haynes
Casey.haynes@cityutilities.net

Overview:

The purpose of this Tier 2 Site Specific Environmental Assessment (Tier 2) is to: (1) document the proposed action (the Project) and the need for the action; (2) identify existing conditions; (3) assess the social, economic, and environmental effects using appropriate tools and agency coordination to comply with local, state, and federal environmental laws, regulations, and ordinances; (4) document applicable mitigation commitments that would avoid, minimize, or mitigate potential effects; and (5) seek comments from the public. This Tier 2 analysis informs the Pipeline and Hazardous Materials Safety Administration's (PHMSA) assessment as to whether the Project is consistent with the impacts described in the Tier 1 Nationwide Environmental Assessment for the Natural Gas Distribution Infrastructure Safety and Modernization Grant Program.[1]

As part of this Tier 2, PHMSA is soliciting public comments through a public comment period. This Tier 2 is available on PHMSA's website where comments can be submitted to the contact noted below. PHMSA will accept public comments for 30 days on this Tier 2. PHMSA will consider comments received and incorporate them in the decision-making process. Consultation with appropriate agencies on related processes, regulations, and permits is ongoing. Please submit all comments to: PHMSABILGrantNEPAComments@dot.gov and reference NGDISM-FY22-EA-2023-09 in your response.

At the conclusion of the EA process, PHMSA will either issue a "Finding of No Significant Impact," further supplement this EA with additional analysis, mitigation measures, or prepare an Environmental Impact Statement.

I. Project Description/Proposed Action

Project Title	City Utilities of Springfield
Project Location	Springfield, Greene County, Missouri

Project Description/Proposed Action:

City Utilities of Springfield (City Utilities) currently has approximately 500 miles of "Aldyl A" polyethylene (PE) gas pipeline in their system. This project would replace 14 miles, approximately 74,000 linear feet (LF) of the vintage PE pipe and the approximately 1,150 vintage PE gas services and meter sets associated with those gas mains. The vintage PE gas pipelines, installed between 1968 and 1999, range in size from 1 ¼ inches to 6 inches in diameter and the gas service lines range in size from ¾ inch to 2 inches in diameter. There is approximately 36 inches of fill covering the existing pipelines. The exact alignment of the proposed replacement pipeline is unknown at this time. City Utilities plans to locate the replacement pipe within vegetated areas outside of the roadway to minimize required restoration of paved areas. However, it is anticipated that roadway, sidewalk, or other paved areas would be disturbed for a portion of the work, depending on the location of the existing utilities within the right-of-way (ROW). A typical trench for gas only installation would be a minimum of 42 inches deep, plus the pipe diameter, to the bottom of the trench. Where a water main would be located under the gas pipeline, a typical joint trench, including the water

[1] https://www.federalregister.gov/documents/2022/11/09/2022-24378/pipeline-safety-notice-of-availability-of-the-tier-1-nationwide-environmental-assessment-for-the

main, would be a minimum of 60 inches deep, plus the diameter of the water main. Trenches could extend below these minimum depths, where required, due to existing utility conflicts or other obstructions.

Construction methods to replace pipeline would include insertion, horizontal direction drilling or boring (HDD), and cut and cover (trenching) methods. The Tier 1 EA described that the majority of site-specific projects would utilize the insertion method of pipe replacement. As described in this document, City Utilities would also utilize open trench and HDD methods, which generally involve greater soil disturbance and the use of heavy equipment, when compared to just using the insertion method. Trenching methods would normally be used where the area for pipeline installation is adjacent to the roadway in otherwise unoccupied space where other utilities, obstructions, or environmentally sensitive areas are not likely to be present. Directional drilling methods would be utilized to work around other assets (such as storm sewer), avoid tree root zone areas, and under paved areas to avoid costly pavement replacement. Additionally, City Utilities could bore in areas where HDD would cause less disturbances and would be more efficient. Insertion installation methods would primarily be used on gas service replacements. If the existing gas service is at sufficient depth and large enough in diameter, a new pipeline could be inserted with a smaller diameter pipe in lieu of trenching or direction drilling. Prior to inserting the new pipe, the existing service would be taken out of service and purged before inserting the new pipe. The insertion process is generally the more efficient, economical, and customer convenient method of service replacement. The type of installation method used for pipeline replacement would be determined after final design when all utilities are identified and the safest, most economical, and environmentally friendly method is determined, based on the assets identified in the specific project areas. No new ROW or easement would be needed to replace the 74,000 linear feet of pipe.

The project has been divided into five segments. A depiction of the project areas included in each segment can be found in Appendix A, Project Maps.

Segment A - North-central Springfield residential area.
Segment B - North-central Springfield residential area.
Segment C - North-central Springfield residential area.
Segment E1/E2 - West-central Springfield residential area.
Segment H- South-central Springfield residential area.

City Utilities would abandon the existing pipes in place after utility services have been moved to the new pipeline. Abandonment of the existing pipeline (versus excavation and removal) would minimize ground disturbance and facilitate the replacement process in a more efficient manner. PHMSA has specific requirements for gas and hazardous liquid pipeline abandonment, found in 49 CRF 192.727 and 195.402(c)(10). These requirements include disconnecting pipelines from all sources and supplies of gas, purging all combustibles and sealing the facilities left in place. By complying with PHMSA requirements for purging and sealing abandoned pipelines, City Utilities would ensure that the abandoned pipelines pose no risk to safety in their abandoned state.

No Action:

The No Action alternative, as required under NEPA, serves as a baseline, and is used to compare impacts resulting from the Proposed Action. Under the No Action alternative, PHMSA would not fund this pipeline replacement project. Additionally, PHMSA would not be able to reduce the inventory of methane leaks and reduce safety risks by replacing pipe prone to leakage. Under this alternative, City Utilities would continue to

use leak prone pipeline material and conduct repairs or replacements in the future using non-federal sources of funding, and potentially on an emergency basis, when a pipeline fails. Impacts and benefits associated with replacing the leak prone pipeline within the City of Springfield, with updated material would not be seen in the near term. The safety risks and methane leaks would persist. The replacement pipeline activities would either not be taken or they would be undertaken at a later, uncertain date. Even if pipe replacement were to happen at some point in the future, environmental mitigation measures during such a replacement would be unknown. Furthermore, existing economic losses, and increased risk associated with prolonged gas leaks would continue.

Need for the Project:

This project would replace 14 miles, approximately 74,000 LF of existing vintage PE pipe and approximately 1,150 vintage PE gas services and meter sets installed between 1968 and 1999. City Utilities would replace the leak-prone materials with new, polyethylene piping. The overall needs addressed by this project would include: (1) improving upon the safe delivery of energy by reducing incidents, as well as methane leaks; (2) avoiding economic losses caused by pipeline failures; and (3) protecting the environment and reducing climate impacts by remediating aged and failing pipelines and pipe prone to leakage.

Description of the Environmental Setting of the Project Area:

The affected environment includes residential and commercial areas of the City of Springfield, Greene County, Missouri, with the majority of the work occurring within residential areas. The existing ROW is anticipated to contain other utilities including gas, water, electric, storm and sanitary sewers, and underground communications. Existing utilities would be located as part of the design process. Current ROW varies and ranges from approximately 40 feet to 80 feet wide throughout the project area.

II. Resource Review

Air Quality and Greenhouse Gases (GHG)	
Question	**Information and Justification**
Is the project located in an area designated by the EPA as non-attainment or maintenance status for one or more of the National Ambient Air Quality Standards (NAAQS)?	No, based on a review of the EPA Greenbook.[2]
Will the construction activities produce emissions that exceed de minimis thresholds (tons per year) described in the initial Tier 2 EA worksheet?	No
Will mitigation measures be used to capture blowdown[3]?	No
Does the system have the capability to reduce pressure on the segments to be replaced? If yes, what is the lowest PSI your system can reach prior to venting?	No

[2] https://www.epa.gov/green-book/green-book-national-area-and-county-level-multi-pollutant-information

[3] Blowdown refers to the venting of natural gas in current facilities, in order to begin rehabilitation, repair, or replacement activities.

Will City Utilities commit to reducing pressure to this PSI prior to venting? Please calculate venting emissions based on this commitment, and provide comparison figure of venting emissions volume without pressure reduction/drawdown using calculation methods identified in the initial Tier 2 EA worksheet.	The existing system in the project area operates at various pressures ranging from 2.4 pounds per square inch (PSI) to 60 PSI. Based on the size of the existing pipes, it is estimated that a total of 14.8 thousand cubic feet (MCF) of methane would be vented during construction.
Estimate the current leak rate per mile based on the type of pipeline material. Based on mileage of replacement and new pipeline material, estimate the total reduction of methane.	The existing leak rate is estimated at 1,632 kg/year. Replacement would result in a leak rate of approximately 397 kg/year or a reduction of approximately 24,244 kg over a 20-year timeframe.

Conclusion:

The project area is located within the City of Springfield in Greene County, Missouri which is designated by the EPA as in attainment for all National Ambient Air Quality Standards (NAAQS). The existing pipelines within the project area consist of vintage PE gas pipelines, which range in size from ¾ inch to 6 inches in diameter**.**

No Action:

Under the No Action alternative, existing and planned pipeline activities, including construction and maintenance activities, would continue unchanged. The project proponent would continue to use the existing vintage PE leak prone pipes. The total methane emissions for the pipelines within the project area were extrapolated over 20 years to represent the continuation of methane release under the No Action alternative. Under the No Action alternative, PHMSA estimates that 1,632 kg of methane would be released each year from the existing pipelines within the project area. This amounts to 32,641 kg of methane over a 20-year time frame. See Appendix B, Methane Calculations, for estimated methane leak rate calculations.

Proposed Action:

The Proposed Action alternative consists of replacing 14 miles, approximately 74,000 LF of the vintage plastic pipe and approximately 1,150 vintage plastic gas services and meter sets associated with those gas mains. The associated construction activities would result in minor air quality impacts, including the intentional venting of methane contained in the existing pipelines prior to replacement. Pipeline blowdowns are typically necessary to ensure that construction and maintenance work can be conducted safely on depressurized natural gas facilities and pipelines. Venting methane is required when service is switched from the existing lines to the newly installed lines, but the volume of vented gas can depend on the ability to reduce pressure on the pipe segment or other mitigative actions. Therefore, some methane would be vented into the atmosphere during construction. Based on various pressures ranging from 2.4 PSI to 60 PSI and an average inside pipe diameter ranging from 1.328 inches to 5.473 inches, PHMSA estimates 14.8 MCF of methane (or 460.5 kg) would be vented into the atmosphere during construction.

As described in the Tier 1 EA, methane leaks from natural gas distribution pipelines increase with age and are considerably higher for cast iron and steel pipelines, as compared with new PE pipeline. Replacing leak prone pipe with newer, more durable materials would reduce leaks and methane emissions. Based on the current leak rate of the existing pipe within the project area, this project would reduce overall emissions by approximately 775 kg in the first year (when considering the methane that would be released from blowdown that would occur during construction) and would reduce approximately 1,235 kg of methane per

year thereafter. This amounts to a total reduction of approximately 24,244 kg of methane emissions over a 20-year timeframe, post construction. See Appendix B, Methane Calculations, for the methane reduction calculations. Therefore, it is PHMSA's assessment that the proposed project would provide a net benefit to air quality from the overall reduction of greenhouse gas emissions and that there are no indirect or cumulative impacts that would result from the Proposed Action.

Mitigation Measures:

The City Utilities of Springfield shall implement the following mitigation measures:

- Efficient use of on-road and non-road vehicles, by minimizing speeds and vehicles.
- Minimizing excavation to the greatest extent practical.
- Use of cleaner, newer, non-road equipment as practicable.
- Minimizing all vehicle idling and at minimum, conforming with local idling regulations.
- Ensuring that all vehicles and equipment are in proper operating condition.
- On-road and non-road engines must meet EPA exhaust emission standards (40 CFR Parts 85, 86, and 89).
- Covering open-bodied trucks while transporting materials.
- Watering, or use of other approved dust suppressants, at construction sites and on unpaved roadways, as necessary.
- Minimizing the area of soil disturbance to those necessary for construction.
- Minimizing construction site traffic by the use of offsite parking and shuttle buses, as necessary.

Water Resources	
Question	**Information and Justification**
Are there water resources within the project area, such as wetlands, streams, rivers, or floodplains? If so, would the project temporarily or permanently impact wetlands or waterways?	Yes, according to the U.S. Fish and Wildlife Service's (USFWS) National Wetland Inventory (NWI), and Federal Emergency Management Agency (FEMA) National Flood Hazard Layer FIRMette maps.
Under the Clean Water Act, is a Section 401 State certification potentially required? If yes, describe anticipated permit and how project proponent will ensure permit compliance.	No, all work around water resources would employ directional bore methods and no impact to water resources would occur.
Under the Clean Water Act, is a USACE Section 404 Permit required for the discharge of dredge and fill material? If yes, describe anticipated permit and how project proponent will ensure permit compliance.	No, all work around water resources would employ directional bore methods and no impact to waters would occur.
Under the Clean Water Act, is an EPA or State Section 402 permit required for the discharge of pollutants into the waters of the United States? Is a Stormwater Pollution Prevention Plan (SWPPP) required?	No. While the Project would disturb, cumulatively, more the 1 linear acre, according to 10 CSR 20-6.200 Storm Water Regulations, linear, strip, or ribbon construction or maintenance operations with trenches less than 24 inches are exempt from land disturbance permitting. City Utilities would evaluate construction activities and reassess the need for a

	land disturbance permit if wider trenching or other unforeseen construction methods become necessary. City Utilities maintains Sedimentation and Erosion Control Plans in their 600 series Gas and Water Construction Standards.
Will work activities take place within a FEMA designated floodplain? If so, describe any permanent or temporary impacts and the required coordination efforts with state or local floodplain regulatory agencies.	Yes. Roughly 12,000 square feet (sf) of project area is within flood zone AE. Work activities would not affect the flood-holding capacity of the 100-year floodplain or cause any adverse impacts to the special flood hazard areas. There would be temporary impacts from trenching; however, all areas would be restored to pre-construction contours and conditions and there would be no permanent impacts. To ensure compliance with local floodplain ordinances, City Utilities has indicated their intent to coordinate with the City of Springfield's floodplain administrator to inquire and obtain all necessary permits, prior to beginning work.
Will the proposed project activities potentially occur within a coastal zone[4] or affect any coastal use or natural resource of the coastal zone, requiring a Consistency Determination and Certification?	No

Conclusion:

PHMSA reviewed NWI maps to assist in identifying aquatic features including wetlands, streams, and other water resources in or near the project area. Based on a review of the NWI maps, Natural Resources Conservation Service's (NRCS) soils maps, topographic maps, and information provided by City Utilities, PHMSA identified water resources in the project area. West Fork Doling Branch is located in the northern portion of the project area and crosses Robertson Avenue, Boonville Avenue, and Campbell Avenue. The tributary has been previously impacted in and near the project area and incorporated into the city's stormwater system. The tributary is piped under Kearney Street and for the remainder of where it continues upstream. A map depicting the location of the city's stormwater system in this area is included in Appendix C, Water Resources. Google earth photographs and site reconnaissance conducted by City Utilities confirm that there is no surface water tributary in this location. No open channel streams, wetlands or other surface aquatic resources were identified in the project area.

PHMSA also reviewed FEMA's National Flood Hazard Layer to identify any Special Flood Hazard Areas potentially impacted by the project. The FIRMette map indicates the project is located in areas designated as Zone X, and AE. Areas designated as Zone X are outside of any designated special flood hazard areas. Areas designated as Zone AE correspond to the one percent annual chance of flooding (100-year floodplain). Approximately 12,000 sf of project area, located along Mount Vernon and Lexington Avenue, is within flood zone AE. See Appendix C, Water Resources.

[4] The term "coastal zone" means the coastal waters (including the lands therein and thereunder) and the adjacent shorelands (including the waters therein and thereunder), strongly influenced by each other and in proximity to the shorelines of the several coastal states, and includes islands, transitional and intertidal areas, salt marshes, wetlands, and beaches.)

No Action:

Under the No Action alternative, the existing pipeline would remain in the current location and normal maintenance activities would continue. No impacts to open water resources would occur; however, any maintenance work conducted in FEMA designated special flood hazard areas may require coordination with the City of Springfield.

Proposed Action:

According to NWI maps, West Fork Doling Branch is the only tributary identified in the project area. There are no other tributaries or wetlands, based on a review of available information. This tributary has been previously impacted and is piped in the project area. In the three areas where the Project crosses this piped tributary, the natural gas pipeline would be installed by horizontal directionally drilling (HDD) under the box culverts or concrete stormwater pipes and therefore, there would be no impacts to the existing stormwater system. HDD methods provide a way to avoid impacting sensitive areas, such as wetlands or streams, by boring relatively shallow arcs along a specific path underground using a surface drill rig. Directional boring begins with excavating pits where the pipe would enter and go underground and exit where the pipe would then come back to the surface to tie into existing pipelines. The pits collect the drilling fluids that are pumped to the cutting head or the drill to create and lubricate the passage of the new pipe. The fluids in the pits can then be collected and disposed of or reclaimed. While there is only one named tributary identified in the project area, there is the potential for sediment to be transported during land disturbance activities, specifically during open trenching activities that expose soils. Sediment can be transported to downstream waters through the stormwater system. Additionally, pits used during HDD introduces the potential for drilling fluids to migrate to other areas. However, land disturbance mitigation and protection measures would be utilized throughout this project. City Utilities utilizes Appendix 10, Sedimentation and Erosion Control Standards from their 600 series Gas and Water Construction Standards (included in Appendix C, Water Resources). These standards identify best management practices (BMPs) used to minimize and prevent soil, sediment, and other pollutants from entering into local storm water sewers and waterways.

A small portion of the pipeline placement work located along Mount Vernon and Lexington Avenue would be conducted within a Zone AE special flood hazard area. The National Flood Insurance Program (NFIP) requires a permit before new construction or development begins within any special flood hazard area to ensure that project development meets the requirements of the NFIP program and the local community's floodplain management ordinances. The proposed pipeline replacement is not considered new construction or development as pipes would be installed in existing, previously impacted ROW and all areas would be restored to their existing contours and condition. These activities would not affect the flood-holding capacity of the 100-year floodplain or cause any adverse impacts to the special flood hazard areas. There would be temporary impacts from trenching; however, all areas would be restored to pre-construction contours and conditions and there would be no permanent impacts. To ensure compliance with local floodplain ordinances, City Utilities has indicated their intent to coordinate with the City of Springfield's floodplain administrator to inquire and obtain all necessary permits, prior to beginning work.

The existing pipelines would be abandoned in place and therefore where the existing pipelines crosses the piped portion of West Fork Doling Branch and where pipeline is located within Special Flood Hazard Areas, no disturbances would occur. Therefore, with City Utilities directional boring under the one identified tributary in the project area along with their commitment to utilizing BMPs and restoring all areas to pre-construction contours and conditions, PHMSA's assessment is that there are no permanent impacts to water resources, as a result of the proposed action. The pipeline placement and abandonment of the

existing pipeline is not anticipated to cause any reasonably foreseeable indirect effects or cumulative effects to water resources. Therefore, it is PHMSA's assessment that there would be no adverse impacts to water resources.

Mitigation Measures:

City Utilities of Springfield shall avoid staging in wetlands or floodplains and all preconstruction contours shall be restored with natural areas reseeded or repaved as soon as practical. BMPs shall be used during construction to control sediment and erosion and prevent pollutants from entering adjacent waterways.

City Utilities of Springfield shall coordinate with the City of Springfield's floodplain administrator to obtain any necessary permits for conducting work in special flood hazard areas, prior to the commencement of work.

Groundwater and Hazardous Materials/Waste	
Question	**Information and Justification**
Does the project have potential to encounter and impact groundwater? If yes, describe potential impacts from construction activities.	Yes. The project could potentially impact groundwater from sources such as leaks of fuel or fluids from construction equipment and sediment from ground disturbance activities.
Will the project require boring or directional drilling that may require pits containing mud and inadvertent return fluids? If yes, describe measures that will be taken during construction activities to prevent impacts to groundwater resources.	Yes. Directional drilling would be utilized in areas where trenching is not possible. All construction activities would be conducting in conformance with all federal, state and local laws, regulations and ordinances for the protection of the environment, all drilling mud would be retained and reclaimed, and drilling mud used shall not be harmful to the environment and shall comply with all applicable regulations.
Will the project potentially involve a site(s) contaminated by hazardous waste? Is there any indication that the pipeline was ever used to convey coal gas? If yes, PHMSA will work with the project proponent for required studies.	Yes. The Missouri Department of Natural Resources (MDNR) database[5] and EPA's NEPAssist website identified hazardous waste sites in the project area.
Does the project have the potential to encounter or disturb lead pipes or asbestos?	Yes, there are legacy ACM gas mains (asphaltic coating over steel) in this area. Asbestos, concrete, and lead water pipes may also be encountered/exposed but would not be disturbed as part of this project.

Conclusion

PHMSA reviewed EPA's NEPAssist website[6], and the information submitted by City Utilities from MDNR to identify any brownfields properties, hazardous waste sites, or superfund sites in the project area (See Appendix D, Hazardous Materials). In Segment A, one hazardous waste site, Atlantic Geo Cleaners and two brownfields' sites were identified within in the project footprint, Union Pacific-South Yard (lead, petroleum products, other metals and VOCs) and 649 W High Street (arsenic, lead, petroleum and other metals). In

[5] https://apps5.mo.gov/ESTARTMAP/map/init_map.action
[6] https://nepassisttool.epa.gov/nepassist/nepamap.aspx

Segment B, one hazardous waste site, Bathroom Magic of the Ozarks, Inc., and one brownfields site, Fegan, were identified. It is noted that EPA's facilities report for Feagan assessment, states *the Phase I ESA did not identify evidence of recognized environmental conditions for the subject property, and no further assessments were required*[7]. A review of NEPA Assist for Segment C and Segment H did not reveal any potentially hazardous materials/ waste sites. A review of Segment E identified one brownfields site, 1621 West College and 1620 West Olive Street Site (potentially petroleum) and two hazardous waste sites on West Mt. Vernon Street, Bio Kinetic Clinic Applications, and the City of Springfield. Additionally, City Utilities has indicated that there are legacy ACM gas mains (asphaltic coating over steel), asbestos, and concrete pipes in the project area, and there is the potential to encounter lead water pipes as well; however, none are known.

To assist in determining the potential for encountering groundwater during construction, PHMSA obtained a custom soil report for the project area from the NRCS's web soil survey which indicates that the project area is comprised of various soils ranging from somewhat poorly drained soils, where the depth to the water table is estimated to be found between 12 inches and 21 inches, to well drained soils where the depth to the water table is estimated to be found at depths greater than 80 inches.

No Action:

Under the No Action alternative, the vintage plastic pipes would remain in their current location and ongoing and routine maintenance activities would occur. Pipes would be replaced under failed circumstances. While there are no adverse impacts to groundwater anticipated by the No Action alternative, increased methane emissions are likely to occur if the leak prone pipes remain (EPA, PRO Fact Sheet No. 402[8]) and the risk of failure is higher among these types of pipes. Therefore, under the no action alternative, PHMSA anticipates an increased risk for the release of methane, both as leaks and during a pipeline failure, which could then result in ground disturbances from construction activities, potentially impacting groundwater.

Proposed Action:

Under the Proposed Action Alternative, City Utilities would replace approximately 14 miles of existing pipelines within the existing ROW for the project area. The exact alignment of the replacement pipeline within the ROW is unknown at this time; however, City Utilities normally locates natural gas pipe within vegetated areas outside of the roadway to minimize required restoration of paved areas. A typical trench for gas only installation would be at a minimum depth of 42 inches, plus the pipe diameter, to the bottom of the trench. Where a water main would be located under the gas pipeline, a typical joint trench, including the water main, would be a minimum of 60 inches deep, plus the diameter of the water main. Trenches could extend below these minimum depths, where required, due to existing utility conflicts or other obstructions. City Utilities would use directional drilling methods to work around other assets (such as storm sewer), avoid tree root zone areas, and under paved areas to avoid costly pavement replacement. Additional areas may be bored when HDD methods would be more efficient and cause less disturbances. When open trenching methods are used in areas where the depth to water table is located within the excavated depths, groundwater may be encountered. As described above, in somewhat poorly drained soils and moderately well drained soils, the water table could be encountered if the pipeline is installed by open trenching in these areas. Should groundwater be intercepted by construction activities, dewatering may be required during construction. In these cases, groundwater would be kept to just below the work area so that the

[7] https://ordspub.epa.gov/ords/cimc/f?p=CIMC:31::::Y,31,0:P31_ID:97042

[8] Insert Gas Main Flexible Liners at https://www.epa.gov/sites/default/files/2016-06/documents/insertgasmainflexibleliners.pdf#:~:text=Methane%20emissions%20reductions%20come%20from%20lower%20leakage%20rates,pipe%20and%20external%20corrosion%20in%20unprotected%20steel%20piping.

proposed work to be completed would not be compromised. BMPs would be utilized at all times. A mitigative measure would be added to the project requiring City Utilities to utilize a Stormwater Pollution Prevention Plan which would identify appropriate construction and restoration activities to minimize the potential impacts to groundwater. If insertion methods are used to install pipelines, there would be no potential impacts to groundwater.

The installation of gas lines within the project area would occur in areas identified as containing potentially hazardous materials. Therefore, it is possible that hazardous materials and/or waste may be encountered during the replacement of the natural gas pipelines. Additionally, there is the possibility of encountering asbestos containing materials. City Utilities would ensure construction crews are vigilant and observe soils and groundwater for any visual or olfactory evidence of contamination. If, during construction activities, potential environmental liabilities are encountered (i.e., stained soils, sheen on groundwater, petroleum odors in soil and groundwater, etc.), City Utilities has committed to cease all activities in the area immediately and contact City Utilities' Environmental Affairs personnel to do further site investigation. Potentially impacted soils or water would be separated and analyzed to determine proper disposal. To ensure compliance with this commitment and identify proper protocol that would ensure there is no migration of contaminants (if encountered), PHMSA will include a mitigative measure requiring City Utilities to develop a Soil Management Plan which will identify proper protocol and pertinent personnel, should potentially hazardous material be encountered. If insertion methods are used to install pipelines, there would be no potential impacts to hazardous materials, assuming that the entrance and exit points are located outside any area identified to potentially contain hazardous materials.

Therefore, while PHMSA has identified known and potentially hazardous materials/waste sites, mitigation measures have been included to prevent adverse environmental impacts resulting from the inadvertent discovery of potentially hazardous materials during construction. With the inclusion of mitigative measures to assist in the prevention of potential impacts, PHMSA's assessment is that there would be no adverse impacts to groundwater associated with the project and there will be no indirect or cumulative effects to groundwater or hazardous materials.

Mitigation Measures:

City Utilities of Springfield shall utilize a Stormwater Pollution Prevention Plan which will identify appropriate construction and restoration activities to minimize the potential impacts to groundwater. All impacted areas would be restored to pre-construction conditions.

Prior to the commencement of work, City Utilities of Springfield shall develop a Soil Management Plan to address the likelihood and procedures for encountering unsuitable or contaminated soils. This plan should include soil screening requirements, the oversight or monitoring of soil moving activities, contingency plans for the handling, removing, temporarily storing, characterizing, disposing of contaminated or unsuitable materials, and measures for containing, treating, and disposing of stormwater that may contact exposed soils. The Soil Management Plan shall also include a list of appropriate response agencies, regulatory agencies, project managers, etc. and shall also outline the proper protocol for notifying the appropriate parties to ensure that any potential situation is handled appropriately.

City Utilities of Springfield will ensure that there is no boring/drilling, staging or laydown areas within EPA superfund sites or areas containing known hazardous waste.

In the event of a release of hazardous materials/waste into the environment during construction, City Utilities of Springfield shall notify the appropriate emergency response agencies, potentially impacted residents, and regulatory agencies.

Soils	
Will all bare soils be stabilized using methods identified in the initial Tier 2 EA worksheet? Will additional measures be required?	Yes, the contractor would utilize erosion and sediment control measures.
Will the project require unique impacts related to soils?	No

Conclusion:

PHMSA obtained a custom soil report (see Appendix E, Soils) for the various segments in the project area from NRCS's web soil survey. Segment A and B are comprised of Viraton Silt loam with areas of Goss gravely silt loam, Wilderness gravely silt loam and Goss-Wilderness complex. Goss gravely silt loam is a well-drained soil type with a depth to water table found at depths greater than 80 inches. Viraton is moderately well drained with a depth to water table between 15 to 30 inches. Wilderness gravely silt loam is moderately well drained with the water table found between 12 to 24 inches. Goss-Wilderness complex is well drained/moderately well drained with a depth to water table from 10 inches to over 80 inches.

Segment C is comprised of Creldon silt loam, Grandgulf silt loam, and Splitlimb silt loam soils. Creldon silt loam is a moderately well drained soil with a depth to water table found between 18 and 36 inches. Grandgulf silt loam is also a moderately well drained soil with the water table found between 18 and 36 inched. Splitlimb silt loam is somewhat poorly drained with the water table normally found between 12 and 21 inches.

Segment E is comprised of Hepler silt loam, Winnipeg silt loam, Viraton Silt loam and Goss gravely silt loam. Hepler silt loam is a somewhat poorly drained soil where the depth to the water table is found between 12 and 36 inches. Winnipeg silt loam is a well-drained soil where the water table is found at depths greater than 80 inches.

Segment H contains Creldon silt loam which is a moderately well drained soil with a depth to water table found between 18 and 36 inches.

It is noted that the project area is an urbanized area where ground disturbance activities have already occurred and there are very few areas, if any, that remain in a natural state. Therefore, while the soils report provides valuable information, the soils in the project area have been disturbed and likely contain some degree of fill material brought in as a suitable base for construction.

No Action:

Under the No Action alternative, the vintage PE pipelines would remain in their current location and soils would remain in their current state and condition. Normal maintenance activities would occur, and pipes would be replaced under failed circumstances. Some soil disturbance would occur during emergency repairs and the affected areas would be restored upon completion. Under either scenario, no adverse impacts to soils would be anticipated under the No Action alternative.

Proposed Action:

This project would replace 14 miles, approximately 74,000 LF of the vintage PE pipe and approximately 1,150 vintage plastic gas services and meter sets associated with the gas mains. All work would be contained

within the existing ROW. A typical trench for pipeline installation would range from 42 inches, plus the pipe diameter, to a minimum of 60 inches deep, plus the diameter of the water main, when natural gas pipeline and water mains are placed in the same trench. Trenches could extend below these minimum depths, where required, due to existing utility conflicts or other obstructions. All disturbed areas would be re-seeded or paved (as appropriate) and restored to pre-existing conditions. When directional drilling methods are utilized, there would be minimal soil disturbance, mainly at the entrance and exit pits. Best management practices would be employed during construction and all disturbed areas would also be restored to pre-construction contours and conditions. Where insertion methods would be employed to install pipeline, there would be no impact to soils. Therefore, PHMSA's assessment is that there would be no adverse impact to soils resulting from the Proposed Action alternative and that there are no indirect or cumulative impacts anticipated as the City Utilities would restore all areas to pre-construction conditions.

Mitigation Measures:

City Utilities of Springfield shall utilize best management practices, as appropriate, to control sediment and erosion during construction which may include silt fencing, check dams, and promptly covering all bare areas. All impacted areas shall be restored to pre-construction conditions.

Biological Resources	
Question	**Information and Justification**
Based on review of IPaC and NOAA Fisheries database, are there any federally threatened or endangered species and/or critical habitat potentially occurring within the geographic range of the project area?[9] If no, no further analysis is required.	Yes, based on review of the USFWS's Information for Planning and Consultation (IPaC) and National Oceanic and Atmospheric Administration (NOAA) Fisheries website. Additionally, Missouri state resources were inventoried to identify potential state listed species.[10]
Will the project impact any areas in or adjacent to habitat for Federally listed threatened or endangered species or their critical habitat? If no, provide justification and avoidance measures. If yes, PHMSA will work with the project proponent to conduct necessary consultation with resource agencies.	No. There is no habitat conducive for the identified species.

Conclusion:

PHMSA requested a species list through the USFWS's IPaC website. See Appendix F, Biological Resources for a list of protected species. The following were identified as potentially occurring within the geographic area:

Indiana Bat (mammal) *Myotis sodalis* -Endangered
Northern Long-eared Bat (mammal) *Myotis septentrionalis*- Endangered
Tricolored Bat (mammal) *Perimyotis subflavus*- Proposed Endangered
Gray Bat (mammal) *Myotis grisescens*- Endangered
Niangua Darter (fish) *Etheostoma nianguae*- Threatened

[9] https://ipac.ecosphere.fws.gov/ and https://www.fisheries.noaa.gov/species-directory/threatened-endangered
[10] Missouri Natural Heritage Program | Missouri Department of Conservation (mo.gov)

Ozark Cavefish (fish) *Amblyopsis rosae* Threatened
Monarch Butterfly (insect) *Danaus plexippus* -Candidate

The Indiana bat is a small, insectivorous, migratory bat that hibernates in groups in large caves and mines in the winter. They have chestnut brown to dark grey fur and their small ears and wing membranes have a dull appearance that mimics the flat appearance of their fur. In the summer, Indiana bats roost under the loose bark of dead or dying trees which are often found within open canopy or gaps within forested areas or along riparian areas or fence lines. They roost in these semi-open areas and can be found in the eastern half of the United States.[11]

Northern long-eared bat is a wide-ranging, federally threatened bat species, found in 37 states and eight provinces in North America.[12] The species typically overwinters in caves or mines and spends the remainder of the year in forested habitats. As its name suggests, the northern long-eared bat is distinguished by its long ears, particularly as compared to other bats in the genus *Myotis*.

The tricolored bat is a small insectivorous bat that typically overwinters in caves, abandoned mines and tunnels, and road-associated culverts (southern portion of the range) and spends the rest of the year in forested habitats, typically roosting among live and dead leaf clusters. The tricolored bat is one of the smallest bats native to North America and is found across the eastern and central United States and portions of southern Canada, Mexico and Central America. The tricolored bat is distinguished by its unique tricolored fur that appears dark at the base, lighter in the middle and dark at the tip.[13]

The gray bat has glossy light brown to brown fur and ears that are longer than any other *Myotis* species. They can be found in limestone areas marked by caves, sinkholes and springs in the southeastern and Midwestern U.S. Unlike other protected bats that roost in high places, out of reach to normal human activities, gray bats roost on the ceilings of caves and rear young in places where humans can disturb them with their presence through physical touch, noise and artificial lighting. [14]

The Niangua darter is a large but slender fish and is the only darter found in Missouri that has 2 small black spots located on the tail fin. The Niangua darter is found in Missouri in the Niangua and Little Niangua Rivers where they inhabit clear Ozark creeks and small rivers. They can often be found in moving waters with shallow pools and silt-free, gravelly bottom creeks.[15]

Ozark cavefish are small fish that appear pink and white due to a lack of pigment, revealing their inner organs. These blind fish normally lack eyes and have a flattened head with a slightly protruding lower jaw. Cavefish live most or all of their lives in total darkness in cave streams with a gravel bottom. [16]

The monarch butterfly is known for its large size, its orange and black wings, and its long annual migrations. They have two sets of wings and a wingspan of three to four inches (7 to 10 centimeters). Their wings are a deep orange with black borders and veins, and white spots along the edges. The underside of the wings is pale orange. Monarch butterflies are found wherever suitable feeding, breeding, and overwintering habitat exists. As caterpillars, monarchs feed exclusively on the leaves of milkweed. As adults, monarchs feed on

[11] Indiana Bat (Myotis sodalis) | U.S. Fish & Wildlife Service (fws.gov)
[12] https://ecos.fws.gov/ecp/species/9045
[13] Tricolored Bat (Perimyotis subflavus) | U.S. Fish & Wildlife Service (fws.gov)
[14] https://www.fws.gov/species/gray-bat-myotis-grisescens
[15] https://mdc.mo.gov/discover-nature/field-guide/niangua-darter
[16] https://www.fws.gov/species/ozark-cavefish-amblyopsis-rosae

nectar from a wide range of blooming native plants but can only lay eggs on milkweed plants. [17]

The habitat needed for the protected bat species above consists of either caves and mines for hibernating or forested areas for foraging and roosting, of which neither exists in the project areas. Additionally, no open waters exist in the project area for the fish species.

Missouri's Department of Conservation's Natural Heritage Program website was reviewed to assist in identifying potential species protected by the State of Missouri. A list of state protected species can be found in Appendix F, Biological Resources.

No Action:

Under the No Action alternative, existing conditions would remain, and normal maintenance activities would occur. The project area is in an urbanized environment and therefore has very limited biological resources present. Additionally, the project area does not contain suitable habitat for listed species and therefore no impacts to biological resources would occur under the No Action alternative.

Proposed Action:

The project area is located in an urban environment where the areas of disturbance are within existing transportation corridors and along roadsides. Because these areas are within current ROW that has been previously impacted (i.e., pipeline laid in the ground in close proximity to the location where new pipes would be laid and subsequently paved), the immediate project area has very limited biological resources present and does not contain suitable habitat for either federal or state listed species. As a result, PHMSA's assessment is that the project is unlikely to have any detrimental effects to federally- listed species or critical habitat, and that the project would have no effect to Indiana bat, Northern long-eared bat, gray bat, Niangua darter or Ozark cavefish. Under Section 7(a)(4) of the Endangered Species Act (ESA), Federal agencies must confer with the USFWS if their action will jeopardize the continued existence of a proposed species. As a candidate species, the monarch butterfly receives no statutory protection under the ESA. The tricolored bat is proposed for listing and the project is unlikely to jeopardize this species' existence. PHMSA's assessment is that the project would have no adverse impacts to state listed species or other biological resources and that there are no indirect or cumulative impacts anticipated as no impacts to habitat or species would occur.

Mitigation Measures:

No mitigative measures are required.

Cultural Resources	
Question	**Information and Justification**
Does the project include any ground disturbing activities, modifications to buildings or structures, or construction or installation of any new aboveground components?	Yes.
Is the project located within a previously identified local, state, or National Register historic district or adjacent to any locally or nationally recognized	No. A review of the National Register did not identify any historic districts or locally or nationally recognized historical properties.

[17] https://www.fws.gov/species/monarch-danaus-plexippus

historic properties? This information can be gathered from the local government and/or State Historic Preservation Office.[18]	
Does the project or any part of the project take place on tribal lands or land where a tribal cultural interest may exist?[19]	No.
Are there any nearby properties or resources that either appear to be or are documented to have been constructed more than 45 years ago?[20] Does there appear to be a group of properties of similar age, design, or method of construction? Any designed landscapes such as a park or cemetery? Please provide photographs to show the context of the project area and adjacent properties.	Yes. All of the segments are in areas of the city with older construction. Many of the properties were constructed more than 45 years ago. The project would not impact homes or designed landscapes.
Has the entire area and depth of construction for the project been previously disturbed by the original installation or other activities? If so, provide any documentation of prior ground disturbances.	Yes. The pipes that would be replaced are all located within existing right of ways and easements that have been previously disturbed.
Will project implementation require removal or disturbance of any stone or brick sidewalk, roadway, or landscape materials or other old or unique features? Please provide photos of the project area that include the roadway and sidewalk materials in the project and staging areas.	Yes. Brick Corridor would be disturbed. The City of Springfield has a brick sidewalk maintenance program to preserve these features.

Conclusion:

PHMSA must consider the impact of projects for which they provide funding on historic and archeological properties[21] in accordance with Section 106 of the National Historic Preservation Act (Section 106). Pursuant to 36 CFR 800.4(a)(1), the Area of Potential Effects (APE) is defined as the geographic area(s) within which the Undertaking may directly or indirectly affect historic resources. Based on the proposed scope of work, PHMSA has delineated the APE for this project to encompass the existing ROW, which includes the limits of disturbance, staging areas, and the limits of any potential vibration effects. See Appendix G, Cultural Resources, for the APE.

No Action:

Under the No Action alternative, existing conditions would remain, and normal maintenance activities would occur. These activities could result in ground disturbance that might affect historic resources. However, no

[18] Many SHPOs have an online system at https://www.nps.gov/subjects/nationalregister/state-historic-preservation-offices.htm that can tell you previously identified historic properties in your project area. The National Register list at https://www.nps.gov/subjects/nationalregister/database-research.htm can also be accessed online.

[19] The SHPO may have information on areas of tribal interest, or a good source is the HUD TDAT website at https://egis.hud.gov/TDAT/.

[20] Local tax and property records or historic maps may indicate dates of construction.

[21] Historic property means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (National Register) maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria.

federal funding would be applied and therefore Section 106 would not be required.

Proposed Action:

PHMSA staff identified properties based on available information on previously identified historic properties in the APE, including the National Register of Historic Places (NRHP) database and data received from the Missouri Division of Historical Resources. PHMSA staff also conducted research to determine if there are any previously unidentified properties within the APE that are 45 years of age or older and may be eligible for the NRHP. PHMSA has determined that there are two historic properties as defined in 36 CFR 800.16(l) within the APE: site 23GR325 and site 23GR297. Most of the project work will be limited to the existing ROW, except in areas where work within vegetated areas outside of the ROW is needed, in which case the insertion method will be utilized. No work is occurring near sites 23GR325 and 23GR297; they will be completely avoided. Work is expected to mainly take place under paved surfaces, and no character-defining historic materials or features will be removed or disturbed because of the Undertaking. See Appendix G, Cultural Resources for additional information about the APE and the properties identified.

Project work is limited to the replacement of existing pipelines in areas that demonstrate a low probability for intact significant archaeological resources and areas where the probability is higher will be avoided completely. The Undertaking will not result in lasting physical, visual, or audible effects to NRHP-listed historic properties. The Undertaking also does not include land acquisition, nor would it limit access to or change the use of any of the historic properties identified above.

The exact staging areas for the Undertaking are currently unknown. Therefore, a mitigative measure will be included suggesting that staging should be confined to paved areas; if staging cannot be confined to paved areas, geotextile fabric or other similar protective measures (such as pressure distributing mats) must be laid in any affected unpaved area to minimize ground disturbance, prevent soil compaction, and protect archaeological features and artifacts. In accordance with 36 CFR Part 800.5, PHMSA's assessment is that the Undertaking would have No Adverse Effect on historic properties.

A letter was sent on January 4, to the Missouri State Historic Preservation Office (SHPO), federally recognized tribes with a potential interest in the project area, and all consulting parties outlining the Section 106 process, including a description of the undertaking, delineation and justification of the APE, identification of historic properties and an evaluation and proposed finding of no adverse effects. PHMSA has requested comments on the Section 106 process, identification of historic properties, and proposed finding within 30 days of receipt of the letter. See Appendix E, Cultural Resources, for additional information.

Mitigation Measures:

If, during project implementation, a previously undiscovered archeological or cultural resource that is or could reasonably be a historic property is encountered or a previously known historic property will be affected in an unanticipated manner, all project activities in the vicinity of the discovery will cease and City Utilities of Springfield will immediately notify PHMSA. This may include discovery of cultural features (e.g., foundations, water wells, trash pits, etc.) and/or artifacts (e.g., pottery, stone tools and flakes, animal bones, etc.) or damage to a historic property that was not anticipated. PHMSA will notify the State Historic Preservation Office and participating federally recognized tribes and conduct consultation as appropriate in accordance with 36 CFR § 800.13. Construction in the area of the discovery must not resume until PHMSA provides further direction.

In the event that unmarked human remains are encountered during permitted activities, all work shall halt and City Utilities of Springfield shall immediately contact PHMSA as well as the proper authorities in

accordance with applicable state statutes to determine if the discovery is subject to a criminal investigation, of Native American origin, or associated with a potential archaeological resource. At all times human remains must be treated with the utmost dignity and respect. Human remains and associated artifacts will be left in place and not disturbed. No skeletal remains or materials associated with the remains will be photographed, collected, or removed until PHMSA has conducted the appropriate consultation and developed a plan of action. Project activities shall not resume until PHMSA provides further direction.

All work, material, equipment, and staging to remain within the road's existing right of way or utility easement or other staging areas as identified in the environmental documentation. If the scope of work changes in any way that may alter the effects to historic properties as described herein, the grant recipient must notify PHMSA, and consultation may be reopened under Section 106.

Staging areas for the Undertaking are currently unknown. Staging should be confined to paved areas; if staging cannot be confined to paved areas, geotextile fabric or other similar protective measures (such as pressure distributing mats) must be laid in any affected unpaved area to minimize ground disturbance, prevent soil compaction, and protect archaeological features and artifacts.

Section 4(f)	
Question	**Information and Justification**
Are there Section 4(f) properties within or immediately adjacent to the project area? If yes, provide a list of properties or as an attachment.	Yes. Lafayette Park, L.A. Wise Park and Zagonyi Park.
Will any construction activities occur within the property boundaries of a Section 4(f) property? If so, please detail these activities and indicate if these are temporary or permanent uses of the Section 4(f) property. Further coordination with PHMSA is required for all projects that might impact a Section 4(f) property.	All construction activities would be within existing ROW and easements. The project would not disturb any 4(f) properties.

Conclusion:

Section 4(f) of the US Department of Transportation (USDOT) Act of 1966 as amended (Section 4(f)) (49 U.S.C. § 303(c)); is a federal law that applies to transportation projects that require funding or other approvals by the USDOT. Section 4(f) prohibits the Secretary of Transportation from approving any program or project which requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance, or any land from an historic site of national, state, or local significance unless:

- There is no feasible and prudent alternative to the use of the land;
- The program or project includes all possible planning to minimize harm to such park, recreational area, wildlife and waterfowl refuge, or historic site, resulting from such use.

PHMSA conducted a review of properties that are located within the Project Area to identify properties that may possibly qualify as Section 4(f). Lafayette Park, L.A. Wise Park, Zagonyi Park, as well as Bissett, Reed and Bowerman School Playgrounds, were all identified within the project area as potential 4(f) properties. The three school playgrounds are not open to the public and would therefore not be considered Section 4(f)

properties. Lafayette Park, L.A. Wise Park, and Zagonyi Park are all owned by the City of Springfield and are open to the public for recreation.

No Action:

Under the No Action alternative, there would be no change to existing pipeline infrastructure pursuant to federal funding provided by the Program. Therefore, there would be no use of Section 4(f) property under the No Action alternative.

Proposed Action:

Under the Proposed Action alternative, there would be no impact on L.A. Wise Park or Zagonyi Park as access to the parks would remain open and unencumbered and there would be no land disturbances to these parks. Additionally, no staging, laydown or any disturbance would be allowed within these parks and City Utilities would require contractors to refrain from any use, including any staging/laydown activities within L.A. Wise, and Zagonyi Park. There would be some ground disturbance activities along the access road to Lafayette Park in order to replace the pipeline in this area; however, all work would be within the existing ROW and access to the park would remain open and unencumbered. PHMSA would include mitigative measures to emphasize City Utilities' commitments to prohibit laydown and staging with the parks and to ensure access remains unencumbered. Therefore, under the Proposed Action alternative, PHMSA's assessment is that there would be no use of Section 4(f) resources.

Mitigation Measures:

City Utilities of Springfield shall ensure that full public access to, and use of L.A. Wise Park, Lafayette Park and Zagonyi Park is maintained during construction.

City Utilities of Springfield shall prohibit laydown and staging activities with L.A. Wise Park, and Zagonyi Park during construction.

Land Use and Transportation	
Question	**Information and Justification**
Will the full extent of the project boundaries remain within the existing right-of-way or easements? If no, please describe any right-of-way acquisitions or additional easements needed.	Yes
Will the project result in detours, transportation restrictions, or other impacts to normal traffic flow or to existing transportation facilities during construction? Will there be any permanent change to existing transportation facilities? If so, what are the changes, and how would the changes affect the public?	Yes, temporary traffic impacts may consist of traffic congestion and minor disruptions to street parking. The project would not result in a permanent change to existing transportation facilities.
Will the project interrupt or impede emergency response services from fire, police, ambulance or any other emergency or safety response providers?	No

If so, describe any coordination that will occur with emergency response providers?	

Conclusion:

The project is located in the City of Springfield, consisting of residential areas.

No Action:

Under the No Action alternative, vintage PE would remain in their current location and no changes to land use would occur. Normal maintenance activities would occur, and pipes would be replaced under failed circumstances.

Proposed Action:

City Utilities is proposing to replace pipeline infrastructure within the existing ROW and would not include adding pipeline to serve new areas. Construction activities would typically span only a few blocks at a time, with restoration occurring as the work advances and construction would then move to another area identified for pipeline replacement. City Utilities anticipates confining work to one side of the road in the ROW and streets would remain open to local traffic but closed to through traffic. Where detours are required to avoid active work areas, traffic would be rerouted in a manner that minimizes length of detour and impact to vehicle traffic. Detours for a particular section of road would likely last for less than one month. Therefore, during construction, there may be short-term impacts to adjacent residences as traffic would be routed to avoid construction areas for the safety of contractors and residents. Other potential impacts include an increase in noise, dust, and transportation accessibility, as a result of construction and construction staging. Local and state regulations guide the transport of machinery, equipment, and automobiles around the construction areas. Temporary traffic impacts on the local road network and adjacent pedestrian routes would be minimal and temporary. Consideration of emergency response vehicles, travel restrictions, and other impacts to local transportation are anticipated to be temporary and would only last for the duration of construction. Minor disruptions to on-street parking may occur, but access to existing residences would not be restricted.

City Utilities would coordinate with the appropriate local and state agencies regarding interruptions to traffic and detours and notify emergency services of the scheduled work and traffic implications. Normal traffic flow would be maintained to the maximum extent possible, and City Utilities would notify any potentially impacted residents and businesses of traffic disruptions. Therefore, because the work consists of the replacement of existing pipeline, would not convert any new areas into a different use and impacts would only occur during construction, PHMSA's assessment is that there would be no permanent impact to land use.

PHMSA considered the cumulative effects of this action with ongoing and planned transportation related construction projects that could cumulatively impact land use and transportation. Like many municipalities, various maintenance and improvement projects could occur within or near the project area. All municipalities and businesses must abide by the same requirements and coordinate with state and local agencies on any disruptions to normal traffic patterns. Through this coordination, the overall cumulative effects of other potential projects occurring would be minimized by planning and scheduling efforts with the responsible agency's oversight. Land use changes are not anticipated as the projects are occurring in an urbanized area that is built out and therefore would not change the existing use.

Mitigation Measures:

City Utilities of Springfield shall maintain traffic flows to the extent possible and use traffic control measures to assist traffic negotiating through construction areas, as needed.

City Utilities of Springfield shall coordinate with state and local agencies regarding detours and/or routing adjustments during construction and will notify emergency services and any potentially impacted residents and/or business owners.

Noise and Vibration	
Question	**Information and Justification**
Will the project construction occur for longer than a month at a single project location?	No. City Utilities does not expect to work in one area longer than one month; however, there could be cases where unexpected issues arise, where work may take longer.
Will the project location be in proximity (less than 50-ft.) to noise sensitive receivers (residences, schools, houses of worship, etc.)? If so, what measures will be taken to reduce noise and vibration impacts to sensitive receptors?	Yes, the project would adhere to state and local noise regulations, limit construction activities to normal weekday business hours, and make sure equipment mufflers have proper maintenance.
Will the project require high-noise and vibration inducing construction methods? If so, please specify.	Backhoes, backhoe breakers, hot saws, concrete saws, jackhammers (rare), and drill machines, directional drills and trenching equipment would be used.
Will the project comply with state and local ordinances? If so, identify applicable ordinances and limitations on noise/vibration times or sound levels.	Yes, City of Springfield Municipal Code. Specific sections that apply are Chapter 36, Article III, Division 6, Section 36-485 & Chapter 78, Article IV, Division 2, Section 78-113. Construction related noise is restricted to the hours of 7am-11pm in the first case, and between 7am until 1-half hour before sunset in the 2nd case with exceptions.
Will construction activities require large bulldozers, hoe ram, or other vibratory equipment within 20 feet of a structure?	No, large vibratory equipment would not be utilized.

Conclusion:

The project is located in the City of Springfield where the ambient noise in the project area consists of a combination of environmental noise from road traffic, construction, industry, the built environment, population density and other sources. There are several sensitive noise receptors (i.e., residences, schools, etc.) located adjacent to the streets where work would occur.

No Action:

Under the No Action, the project would not move forward and the pipelines along the designated streets in the project area would not be replaced at this time, and likely would not be replaced all at once. Current vintage pipelines would likely be repaired or replaced under emergency conditions. If replacement or repairs occur under emergency conditions, noise from construction equipment would add to that of the current ambient noise and would be of a shorter duration.

Proposed Action:

Excavators, dump trucks, skid steers, rollers, pavers, and other similar construction equipment would be used to excavate a trench, lay pipe, compact soils and re-pave the affected areas. Pipeline may be installed in some areas via directional bore methods where drill rigs, excavators, reamers, and similar equipment would be used to install pipeline by horizontal directional drilling. City Utilities would adhere to the City of Springfield's Municipal Code related to noise. Specific sections that apply to the project include Chapter 36, Article III, Division 6, Section 36-485, and Chapter 78, Article IV, Division 2, Section 78-113. Construction-related noise is restricted to the hours of 7am to 11pm in the first case, and between 7am until 1-half hour before sunset in the 2nd case, with exceptions. While there would be a temporary increase in noise due to construction equipment, PHMSA's assessment is that these impacts would be minor and temporary. PHMSA considered the cumulative effects of this action with ongoing and planned transportation related construction projects that could cumulatively have an impact on the noise and vibration impacts within the City of Springfield. Rural areas often have paving, drainage improvement, and other construction or maintenance projects on going which could occur within or near the project area which would contribute to increased noise. These construction and maintenance projects could occur at the same time as the Proposed Action alternative and would contribute to an increase in cumulative noise effects during construction. However, PHMSA's assessment is that adhering to state and local noise ordinances would ensure the project does not cause cumulatively more than minor adverse noise or vibration impacts.

Mitigation Measures:

City Utilities of Springfield shall adhere to the City of Springfield's noise ordinances, Municipal Code Chapter 36, Article III, Division 6, Section 36-485, and Chapter 78, Article IV, Division 2, Section 78-113.

Environmental Justice	
Question	**Information and Justification**
Using the EPA EJScreen or census data[22], is the project located in an area of minority and/or low-income individuals as defined by USDOT Order 5610.2(c)? If so, provide demographic data for minority and/or low-income individuals within ½ mile from the project area as a percentage of the total population.	Based on review of socioeconomic data using the EPAs EJScreen, the population residing within the general project area for the City of Springfield contains 46 percent low income and 16 percent minority populations.
Will the project displace existing residents or workers from their homes and communities? If so, what is the expected duration?	No

[22] https://www.census.gov/quickfacts/fact/table/US/PST045222

Will the project require service disruptions to homes and communities? If so, what is the expected communication and outreach plan to the residents and the duration of the outages?	Minor service disruptions may be required to connect businesses and residents to the new pipeline. These disruptions would be of short duration, lasting 1 to 4 hours.
Are there populations with Limited English Proficiency located in the project area? If so, what measures will be taken to provide communications in other languages?	Yes, this area has 1 percent limited English-speaking households. City Utilities would post communications in the languages of the area as well as in letter form once the language is identified.

Conclusion:

Executive Order (E.O.) 14096—"Revitalizing Our Nation's Commitment to Environmental Justice for All" was enacted on April 21, 2023. E.O. 14096 on environmental justice does not rescind E.O. 12898 – "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," which has been in effect since February 11, 1994, and is currently implemented through DOT Order 5610.2C. This implementation would continue until further guidance is provided regarding the implementation of the new E.O. 14096 on environmental justice.

PHMSA reviewed socioeconomic data using the EPA's EJScreen and found that the population residing within the City of Springfield, encompassing areas of the project, contains 46 percent low income and 16 percent minority populations. The percentage of these populations is above the Greene County average of 36 percent low income and 14 percent minority populations. See Appendix H, Environmental Justice, for socioeconomic data for the City, County, and all individual segments of the project area.

No Action:

Under the No Action alternative, existing and planned pipeline activities, including construction and maintenance activities, would continue unchanged. City Utilities would continue to use leak prone pipe material that could lead to safety incidents and service disruptions. Additionally, if a pipeline segment is not repaired or replaced prior to failure, it is likely to be associated with even more emissions under the No Action alternative. Thus, emissions benefits to the community associated with repairing or replacing existing pipelines with updated material would not be achieved and the incident risks and leaks would remain. There may be some degree of air pollution associated with construction activities for maintenance and repairs of existing pipelines under the No Action alternative, either through planned repair or replacement efforts or unplanned, emergency repairs or replacements.

Proposed Action:

Construction activities would result in minor temporary air quality impacts, including the intentional venting of existing distribution lines prior to replacement. Minor disruptions to services would occur during construction activities. City Utilities, or their contractors would make personal contact with affected residents and inform them of anticipated outages. If residents are not home, door hangers would be left providing the requisite notification. City Utilities would also send out advanced notification of service disruptions and the anticipated construction schedule using advertisements/mailers and would hold ADA accessible public meetings. The average duration for service is anticipated to last 1 to 4 hours. City Utilities personnel, or their contractors would relight pilot lights for residents, assuming the resident is home. To communicate with limited English speakers, City Utilities would include contact information, in both English

and Spanish, on advertisements/mailings that translation services would be available upon request. If City Utilities inspectors or contractors encounter an individual who does not speak English, they would provide them with an "I speak" card that would allow them to identify their spoken language. Inspectors or contractors would provide this information to City Utilities' communication team so they can follow up and provide information in their language.

The Proposed Action alternative would result in an overall reduction in GHG emissions. Noise impacts associated with construction are anticipated to be minor. Traffic impacts would be temporary and only minor disruptions or delays would occur. While there would be minor temporary impacts during construction, the removal of leak prone pipe from the natural gas system would permanently reduce leaks and lower the potential for incidents, resulting in an increase in pipeline safety across the system, while also improving operation and reliability of the overall gas utility system. Therefore, consistent with Executive Order 12898 and DOT Order 5610.2(c), PHMSA's assessment is that the project would not result in disproportionately high and adverse effects on minority or low-income populations, or other underserved and disadvantaged communities. PHMSA's assessment concluded that the project would have an overall beneficial effect on environmental justice populations and would not result in indirect or cumulative impacts.

Mitigation Measures:

City Utilities of Springfield shall provide advanced notification of service disruptions and construction schedule to all affected parties including residents and businesses adjacent to the project area.

Safety	
Question	**Information and Justification**
Has a risk profile been developed to describe the condition of the current infrastructure and potential safety concerns?	Yes, as described in the Distribution Integrity Management Program (DIMP).
Has a public awareness program been developed and implemented that follows the guidance provided by the American Petroleum Institute (API) Recommended Practice (RP) 1162?	Yes. City Utilities has developed and maintains its Natural Gas Public Awareness Plan in accordance with 49 CFR 192.616 which is commensurate with API Recommended Practice 1162.
Does the project area include pipes prone to leakage?	Yes. The pipe being replaced in this project is "Aldyl A" polyethylene which falls under the PHMSA category of Legacy Plastic. This pipe is known to have slow crack growth failures causing leaks.
Will construction safety methods and procedures to protect human health and prevent/minimize hazardous materials releases during construction, including personal protection, workplace monitoring and site-specific health and safety plans, be utilized? If yes, document measures and reference appropriate safety plans.	Yes. All construction work performed on the project by City Utilities' employees will be in accordance with City Utilities' Natural Gas Distribution Safety Manual and Operator Qualification Plan. Contractors awarded construction projects will be required to comply with an approved Operator Qualification plan and, at a minimum, all applicable OSHA safety standards.
Has an assessment of the project been performed to	While no formal assessment has been performed for

analyze the risk and benefits of implementation?	this project, City Utilities has on-going infrastructure replacement programs of this nature to address aging and higher-risk infrastructure. This project replaces Aldyl A pipe which falls into 10 of the top 13 DIMP risk in the system.

Conclusion:

The proposed project would replace historic Aldyl A, PE pipes. Pipelines that are known to leak based on the material include cast iron, bare steel, wrought iron, and historic plastics with known issues (PIPES Act of 2020). PHMSA establishes safety regulations for all pipelines (49 CFR Parts 190-199). In 2011, following major natural gas pipeline incidents, DOT and PHMSA issued a Call to Action to accelerate the repair, rehabilitation, and replacement of the highest-risk pipeline infrastructure. Among other factors, pipeline age and material are significant risk indicators. Pipelines constructed of cast and wrought iron, as well as bare steel, are among the pipelines that pose the highest risk. PHMSA continues to encourage vintage pipeline repair or replacement to increase the safety of these segments of the gas distribution systems. Pipeline incidents can result in death, injury, property damage, and environmental damage.

City Utilities utilizes its Distribution Integrity Management Plan (DIMP) to enhance safety and identify risks in the natural gas distribution system. The program consists of different elements such as knowledge-gathering, threat identification, and assessing and ranking risk. City Utilities DIMP lists excavation damage and vintage plastic pipe failure risks as 10 of the top 13 DIMP risks. Often, vintage plastic cannot be properly located due to the lack of properly working tracer wire.

No Action:

Under the No Action alternative, the vintage plastic pipes would remain in their current location, state, and condition. Normal maintenance activities would occur, and pipes would be replaced under failed circumstances. Safety risks resulting from existing leak prone pipes remaining in place would persist until the existing leak-prone pipes are replaced.

Proposed Action:

The proposed project is necessary to replace leak prone pipes. This replacement is in alignment with City Utilities DIMP plan, increasing the overall safety of the community. The project would reduce the risk profile of existing pipeline systems prone to methane leakage and would also benefit disadvantaged rural and urban communities with the safe provision of natural gas. The project responds to the need to address the potentially unsafe condition of the natural gas distribution system of pipelines. The repair, rehabilitation, or replacement of pipelines would be constructed in accordance with industry best practices and would comply with all local, state, and federal regulations, including those for safety.

The abandonment of the existing pipeline would be conducted in accordance with PHMSA requirements found in 49 CRF 192.727 and 195.402(c)(10). These requirements include disconnecting pipelines from all sources and supplies of gas, purging all combustibles and sealing the facilities left in place. These requirements for purging and sealing abandoned pipelines would ensure that the abandoned pipelines are properly purged and cleaned and pose no risk to safety in their abandoned state. Therefore, PHMSA's assessment is that this replacement project would improve the overall safety of City Utilities' infrastructure.

Mitigation Measures:

City Utilities of Springfield shall ensure their DIMP procedures are updated as necessary, the work is constructed in accordance with industry best practices and the project will comply with all local, state, and federal regulations, including those for safety.

City Utilities of Springfield shall use standard construction safety methods and procedures; and conduct regular safety audits of crews performing work in the field and subsequent follow-up reporting and/or training, as required.

III. Public Involvement

On November 9, 2022, PHMSA published a Federal Register notice (87 FR 67748) with a 30-day comment period soliciting comments on the "Tier 1 Nationwide Environmental Assessment for the Natural Gas Distribution Infrastructure Safety and Modernization Grant Program." During the 30-day comment period, PHMSA received one comment letter from the APGA on various aspects of the program and air quality related analysis in the EA on December 9, 2022. This APGA letter is available for public review at the Docket No: PHMSA-2022-0123.[23] PHMSA reviewed the comment letter and determined the comments were not substantial and did not warrant further analysis. One comment provided by the APGA indicated that the majority of construction methods used for pipe replacements would be replacement by open trenching and that some may want to abandon the existing pipe rather than removing it for replacement. Any departures from methods described in the Tier 1 EA will require additional documentation from the project proponent, as reflected in this Tier 2.

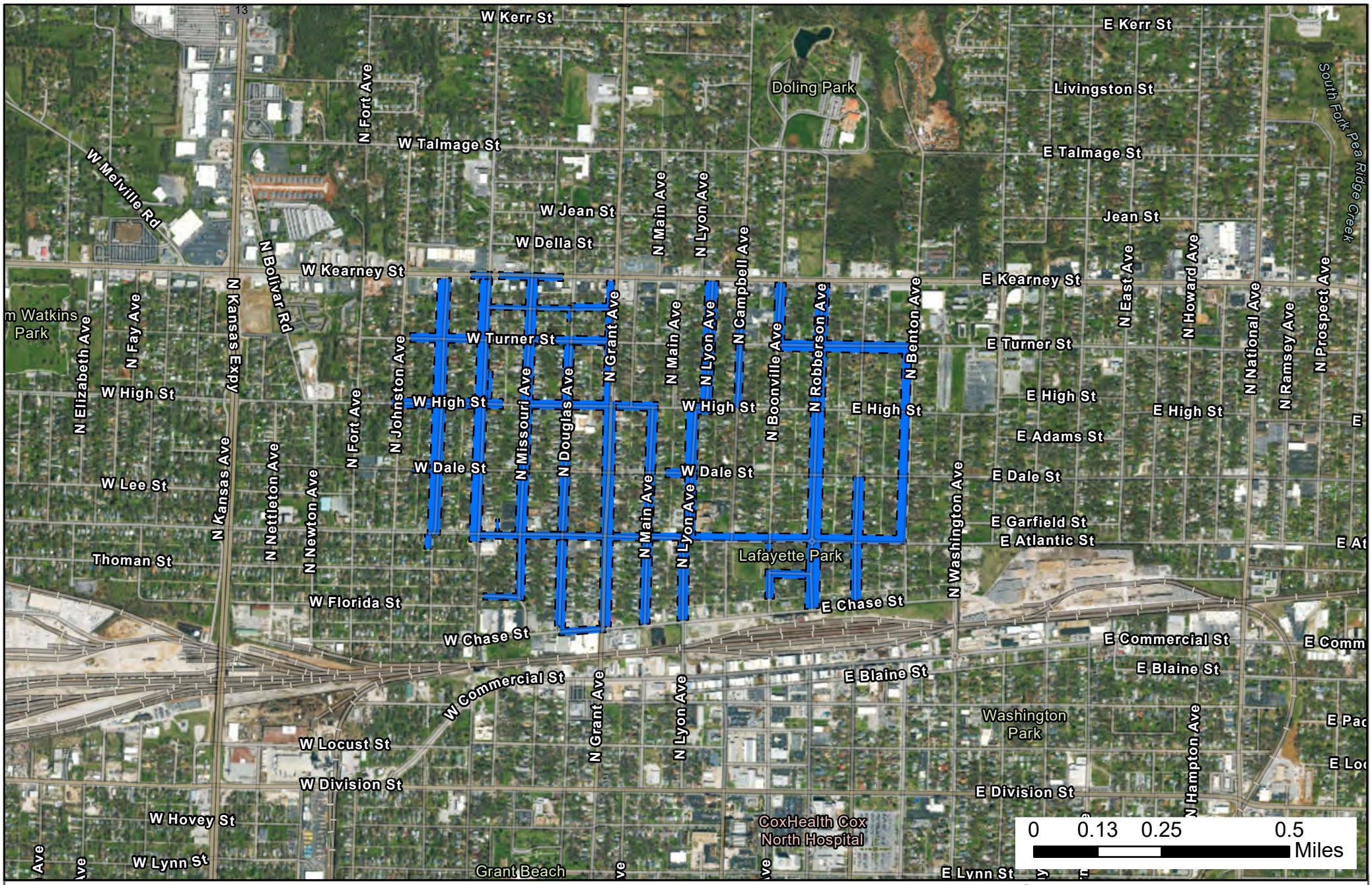
As part of this Tier 2 EA, PHMSA is soliciting public comments through a public comment period. This Tier 2 EA is available on PHMSA's website where comments can be submitted to the contact noted below. PHMSA will accept public comments for 30 days on this Tier 2 EA. PHMSA will consider comments received and incorporate them in the decision-making process. Consultation with appropriate agencies on related processes, regulations, and permits is ongoing. Please submit all comments to: PHMSABILgrantNEPAcomments@dot.gov and reference NGDISM-FY22-EA-2023-09 in your response.

[23] https://www.regulations.gov/document/PHMSA-2022-0123-0002/comment

Appendix A

Project Maps

Project Map



Name: Springfield, MO Segment A Gas Line Replacement
Scale: 15,000
Pipeline to be Replaced

N

State of Missouri, Maxar, Esri Community Maps Contributors, Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

Project Map

Name: Springfield, MO Segment B Gas Line Replacement
Scale: 3,000
Pipeline to be Replaced

N

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Project Map

Name: Springfield, MO Segment C Gas Line Replacement
Scale: 5,500
Pipeline to be Replaced

N

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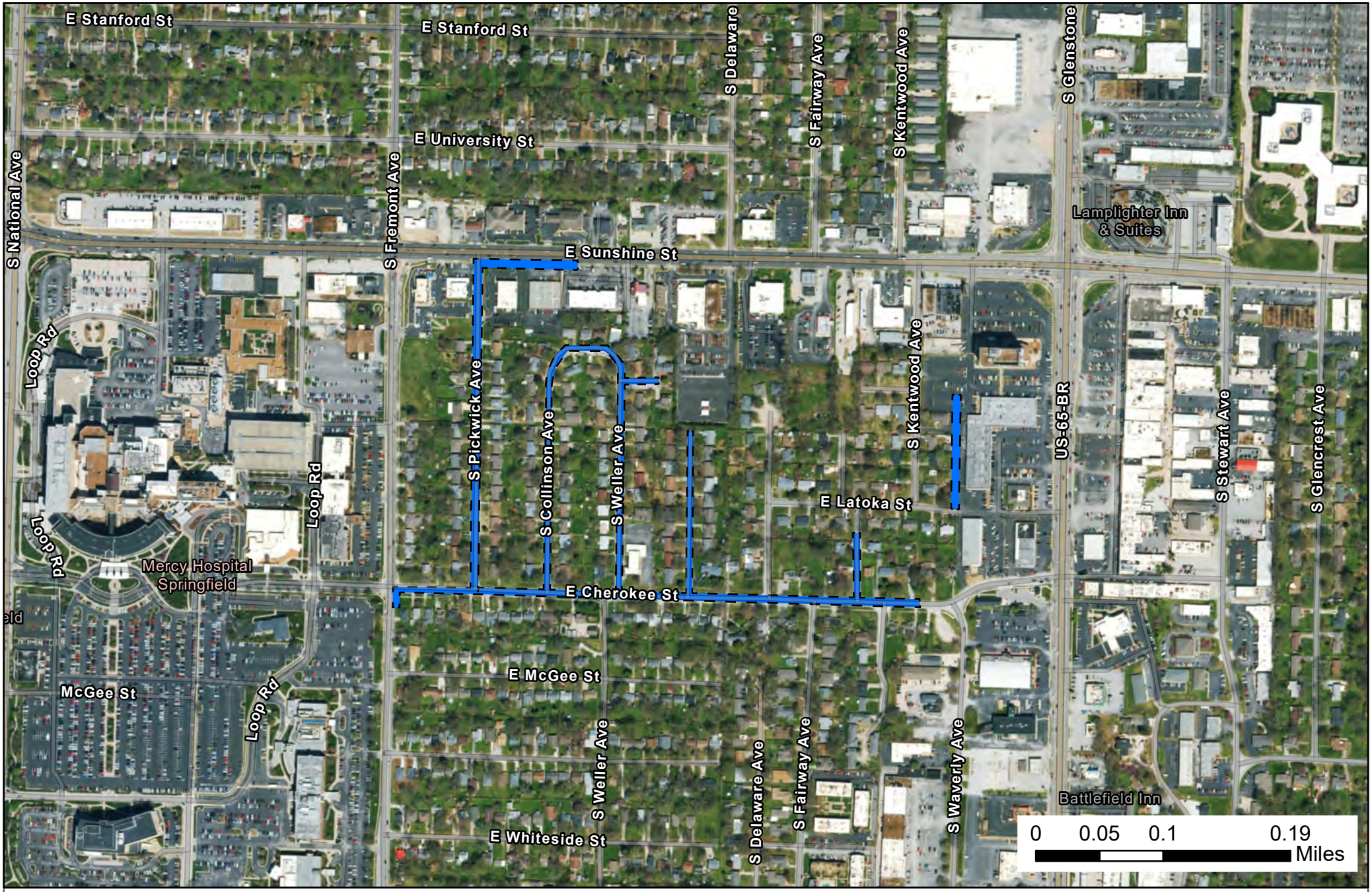
Project Map

Name: Springfield, MO Segment E Gas Line Replacement
Scale: 10,000
Pipeline to be Replaced

N

State of Missouri, Maxar, Esri Community Maps Contributors, Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

Project Map



Name: Springfield, MO Segment H Gas Line Replacement
Scale: 6,000
Pipeline to be Replaced

N

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Appendix B

Methane Calculations

Table 1. Average methane emission factors for natural gas pipelines (adapted from EPA GHG Inventory, Annex 3.6, Table 3.6-2)

Pipeline Material	Pre-1990 Installation (kg/mile)	1990-2020 Installation (kg/mile)	Average Rate (kg/mile/year)
Cast Iron	4,597.40	1,157.30	2,877.35
Unprotected steel	2,122.30	861.3	1,491.80
Protected steel	59.1	96.7	77.90
Plastic	190.9	28.8	109.85

Table 2. No Action Leak Rate

Pipeline Material Type & Segment	Average Rate (kg/mile/year)	Miles	Current Methane Leak Rate (kg/year)
Plastic, Segment A	**109.85**	**8.34**	**916**
Plastic, Segment B	**190.90**	**0.72**	**137**
Plastic, Segment C	**190.9**	**0.74**	**141**
Plastic, Segment E1/E2	**109.85**	**2.7**	**297**
Plastic, Segment H	**109.85**	**1.28**	**141**
Total Annual Methane Leak Rate			**1632**
20-year Methane Emissions			**32641**

Table 3. Proposed Action Leak Rate

Pipeline Material Type	Average Rate (kg/mile/year)	Miles	New Methane Leak Rate (kg/year)
Plastic	**28.8**	**13.78**	**397**
Year 1 Methane Reduction			**775**
Annual Methane Reduction			**1235**
20-year Methane Reduction			**24244**

Equation 1 was used to estimate blowdown emissions in MCF, assuming a pipeline diameter (d) and pressure (P) described in Table 3.

$$E_{blowdown} = V \times \frac{P_{pipe} + P_{atm}}{P_{atm}} \qquad (1)$$

Where the pipeline volume (V) is calculated by multiplying the cross-sectional area of the pipe by the length of pipeline (L):

$$V = \pi \times \frac{d^2}{4} \times L \qquad (2)$$

Table 4 Proposed Action - Methane Blowdown

Segment A							Total	
Inside Diameter = inches	1.328	1.943	2.892	3.718	5.473	1.943		
Blowdown Pressure (psi)	2.8	2.8	2.8	2.8	2.8	60		
Length of Blowdown = feet	1257	20079	7064	12871	2257	489		
Blowdown MCF	0.014	0.492	0.383	1.155	0.439	0.051	**2.5**	**MCF**
Blowdown kg/yr							**77.8**	kg/yr

Segment B					Total	
Inside Diameter = inches	1.328	1.943	2.892	3.718		
Blowdown Pressure (psi)	2.4	2.4	2.4	2.4		
Length of Blowdown = feet	158	2511	505	642		
Blowdown MCF	0.0018	0.0601	0.0268	0.0563	**0.1**	**MCF**
Blowdown kg/yr					**4.5**	kg/yr

Segment C				Total	
Inside Diameter = inches	1.943				
Blowdown Pressure (psi)	28				
Length of Blowdown = feet	3930				
Blowdown MCF	0.2	0.0	0	**0.2**	**MCF**
Blowdown kg/yr				**7.2**	kg/yr

Segments E1/ E2	Segment E1	Segment E1	Segment E1	Segment E1	Segment E2	Segment E2	Total	
Inside Diameter = inches	1.943	2.892	3.718	3.718	1.943	3.718		
Blowdown Pressure (psi)	2.5	2.5	2.5	60	2.5	2.5		
Length of Blowdown = feet	5761	1115	977	28880	3156	510		
Blowdown MCF	0.1388	0.0595	0.0862	11.0468	0.0760	0.0450	**11.5**	**MCF**
Blowdown kg/yr							**351.7**	kg/yr

Segment H					Total	
Inside Diameter = inches	1.328	1.943	2.892	3.718		
Blowdown Pressure (psi)	28	28	28	28		
Length of Blowdown = feet	102	4586	1197	892		
Blowdown MCF	0.0028	0.2739		0.1951	**0.5**	**MCF**
Blowdown kg/yr					**19.4**	kg/yr

Appendix C

Water Resources

Site A

N
W E
S

Legend

- Brownfield/Voluntary Clean-up Program
- Missouri Historic Districts and Sites
- Brick Sidewalk
- Brick Sidewalk Preservation Corridor
- FEMA 2010 Flood Zone
- 0.2% Chance Annual Flood
- Un-Numbered A Zone, 1% Chance Annual Flood
- AE-1% Chance Annual Flood
- Wetlands
- National Register of Historic Places District
- Regulator Station
- *Approximate Main Location
- Schools
- Parks
- CS Feeder
- CSHP
- CSIP
- CSLP
- CSTP
- PLHP
- PLIP
- PLLP

*Associated service lines and meters not depicted for clarity

0 200 400 800 1,200 1,600 Feet

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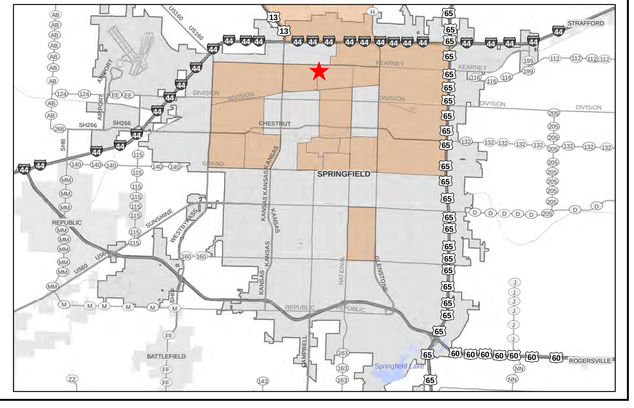
Date: August 2023
City Utilities of Springfield
Natural Gas & Water Engineering
Data Sources: ESRI, City of Springfield,
City Utilities, MO DNR & MSDIS



Site B

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0 60 120 240 360 480 Feet

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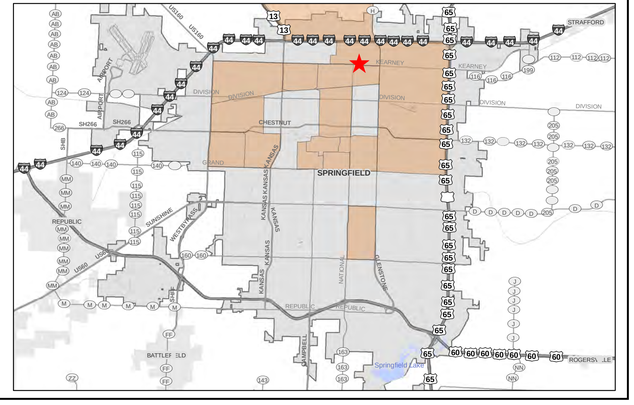
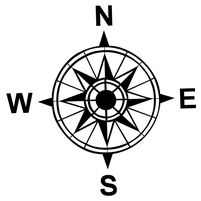


Site C



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0 70 140 280 420 560 Feet

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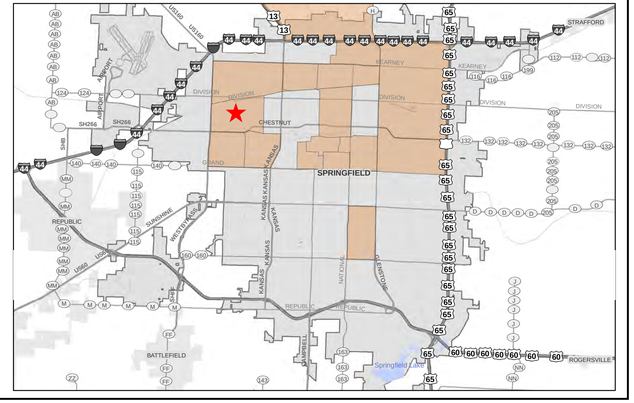
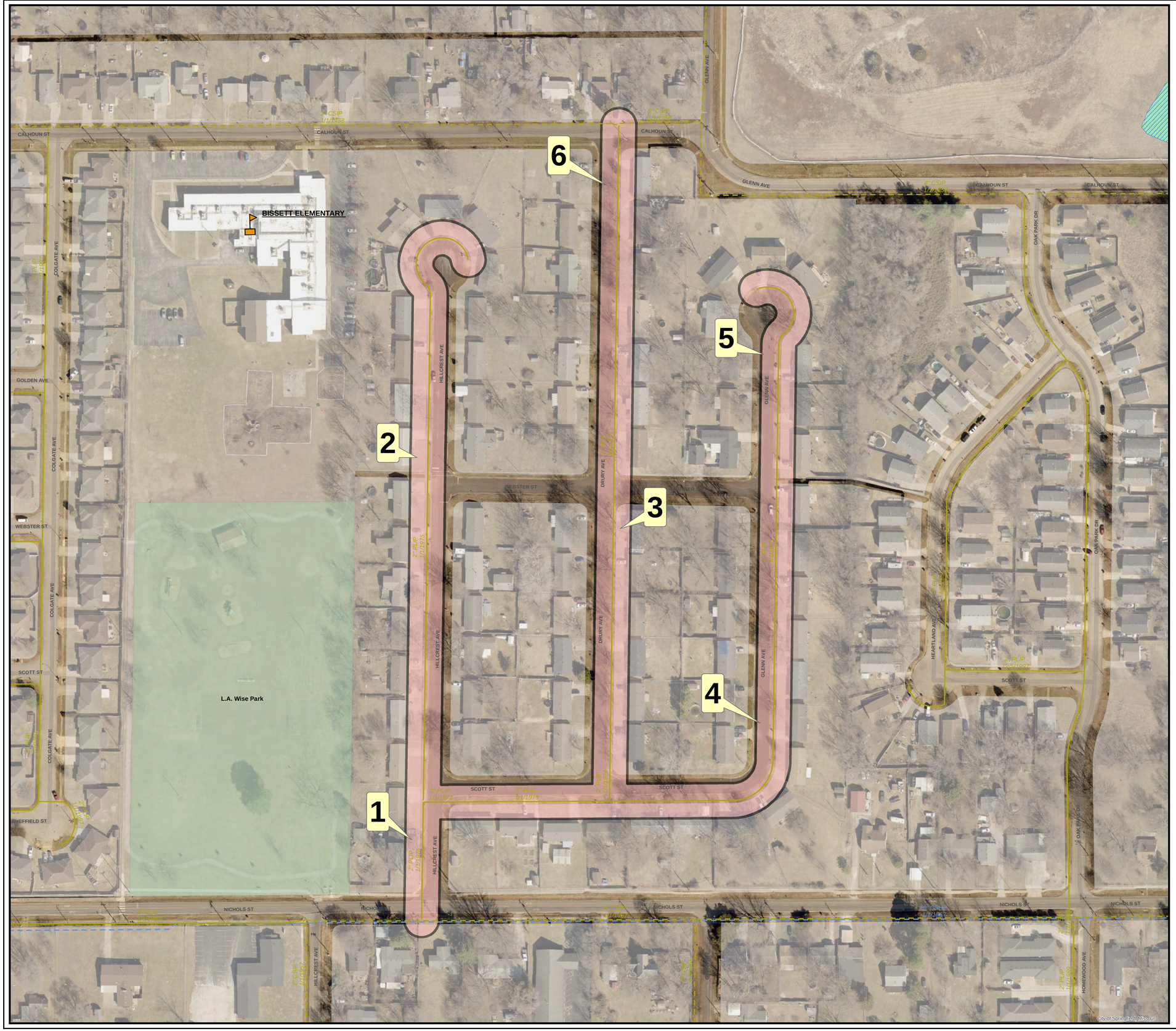
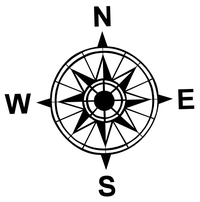




Site E



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0 150 300 600 900 1,200 Feet

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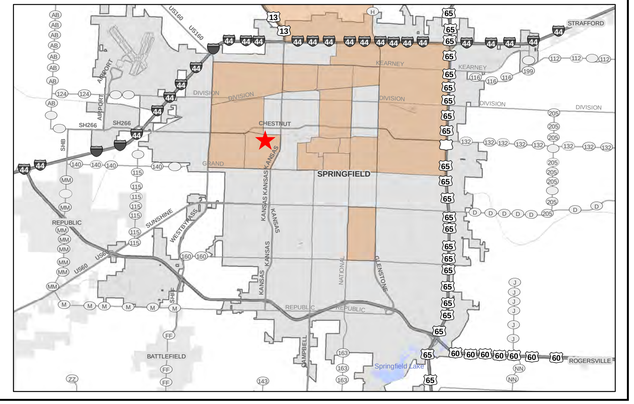


STUDY ALTERNATIVE CENTER

Rock Fountain Court Historic District

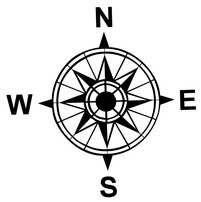
Zagonyi Park

E1

E2

1 2 3 4 5 6 7 8

Site H



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0 100 200 400 600 800 Feet

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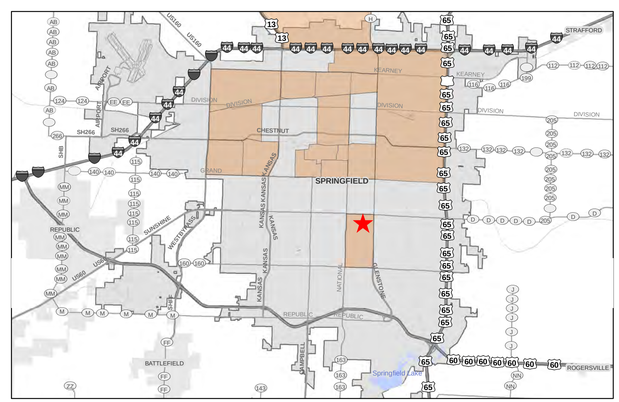


Appendix 10

Series 600

Erosion and Sediment Control

Sediment and Erosion Control Standards

General

All construction work performed in the United States, no matter how large or how small, must be performed in a way that minimizes the amount of soil, sediment and other pollutants introduced into local storm water sewers and waterways. This is required by the Environmental Protection Agency's Clean Water Act. Local government agencies, such as the City of Springfield, and Greene County, have jurisdiction on enforcing these regulations, as does the Missouri Department of Natural Resources and the Army Corps of Engineers. All work performed by or for City Utilities of Springfield must comply with these regulations.

There are many tools and construction methods used to prevent pollution caused by construction runoff, which are commonly known as Best Management Practices, or BMP's. The Construction Standards included in this Section are intended to provide instruction on how to use the most common BMP's currently available. However, it is the employee or contractor's responsibility to ensure these BMP's are effective. If the BMP's in place are not effectively preventing soil runoff pollution, you are responsible for developing a plan that is effective. The City of Springfield has developed a more comprehensive booklet of BMP's, which should be referenced if the common methods described in these Standards are not entirely effective on your project.

Large construction projects, effecting more than 1 acre, require a Storm Water Pollution Prevention Plan , or SWPPP. This is required to obtain a land disturbance permit from the City or County. Engineers and Designers are encouraged to incorporate these Standards as part of their SWPPP. Similarly, on smaller construction projects effecting less than 1 acre of land, these same BMP's must be utilized to prevent erosion and sediment pollution to the storm water sewers and waterways in the area.

Erosion control measures will be both temporary and permanent in nature. Temporary controls will include such items as compost filter socks, silt fencing, mulching, and ditch checks. Permanent controls will consist of rip-rap placement and reestablishing permanent cover (asphalt, gravel, vegetation). It should be noted that the BMPs standards should be used for the appropriate situations as determined by the project engineer on permitted projects, or by the personnel overseeing the construction activities for non-permitted projects. BMPs installed shall be maintained and monitored throughout construction and until ground cover has been reestablished.

Stormwater runoff from or over disturbed areas consists of both sheet flow and concentrated flow. A great deal of storm water runoff will be in the form of sheet flow, therefore, many of the erosion control practices will be employed to control erosion of this type. Concentrated flow may occur within small intermittent drainage paths located along the right-of-ways or along drainage ditches parallel to roadways.

Natural vegetation can act as an effective filter media to remove silt from surface runoff. The use of natural vegetation is the most cost effective means of sediment control and generally results in the least overall disturbance to the land. This technique should be applied wherever appropriate given site conditions. Sediment barriers will be required in areas where natural vegetation alone is inadequate to minimize sediment transport from the area of disturbance..

Throughout the course construction activity, roadways, parking lots and other hard surfaces should be cleaned of spilled or tracked soil and gravel on at least a daily basis. Cleaning will consist of scraping with backhoe bucket followed by sweeping. It is the responsibility of the construction supervisor to determine if the services of the City street sweeper are required to clean roadways.

All disturbed areas should be restored as soon as practicable to minimize erosion and sediment transport. All aspects of the construction should proceed to completion in an efficient and timely fashion. This will also be of economic benefit to the City Utilities.

Planning and Selection of BMPs

Proper planning will help to identify potential erosion problems before they occur. The project engineer and/or construction supervision shall be responsible for surveying the entire project site prior to work commencing in order to select the appropriate BMPs given site conditions.. The phasing of the work shall be considered in this planning phase to ensure BMP's are installed at the appropriate time and locations corresponding with the construction activity.

Some key items to consider while planning the erosion and sediment controls for the project are as follows:

- Asses direction and grade of all slopes to evaluate the natural drainage of the site
- Identify areas where sheet flow or concentrated flow will occur
- Note location, type and number of storm water inlets
- Recognize all streams, creeks, dry-creeks, rivers, ponds, and lakes near the site
- Note previously eroded areas, steep slopes, or bare areas that will be susceptible to erosion
- Select appropriate measures that will minimize sediment from leaving the jobsite or reaching the watershed system.
- Revaluate measures periodically and maintain them to ensure they are functioning as expected

Installation of BMPs

Utilizing the BMP standards in this section, construct the BMPs necessary to minimize erosion for the utility construction project. The materials to be used in constructing BMP's are available from City Utilities storeroom (see appendix A), or through a blanket contract with Eroco 417-831-6030 (see appendix B). Materials not on hand may also be purchased from local vendors as necessary.

Maintaining BMPs

Inspecting and maintaining the construction site and the BMPs installed are vital to the performance of all erosion and sediment control measures. If a particular BMP is not functioning as desired it is the responsibility of construction supervision to make necessary changes. BMPs such as curb inlet protection, silt fences, etc. will need sediment cleaned periodically from them to ensure they continue to function as they should.

Accumulated silt will be removed when it reaches a depth of ½ the height of silt socks or curb inlet protection. Accumulated silt will be removed from behind silt fences when it accumulates to a depth of six inches. The silt will be removed and disposed of on the job site in a manner that will not contribute to additional siltation.

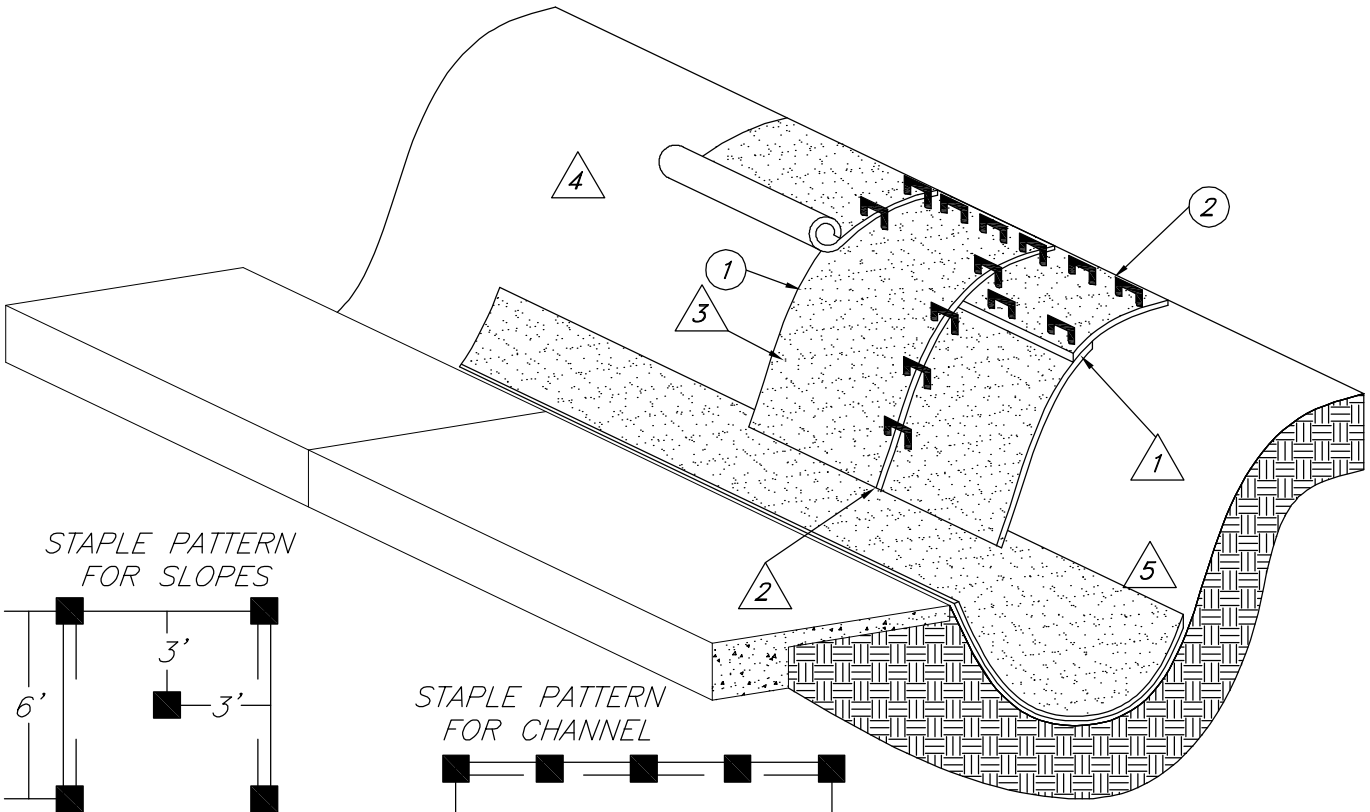
After rain falls of ½" or greater, the construction site should be inspected to ensure BMP's functioned properly and to determine if additional sediment or erosion control practices are needed.

When soil disturbing activities cease in an area for more than 14 days, the disturbed areas shall be protected from erosion by stabilizing the area with mulch, or other similarly effective erosion control BMPs. If the slope of the area is greater than 3:1 the disturbed areas shall be protected from erosion by stabilizing the area with mulch or other similarly effective erosion control BMPs if activities cease from more than seven days.

Removal of BMPs

Temporary BMPs shall be removed from the construction site once non-erodible permanent cover has been installed and/or established. This will typically be through seeding, mulching, sodding, paving, etc.

EROSION CONTROL MATTING



MATERIAL LIST

	QTY	DESCRIPTION	STOCK NO.		QTY	DESCRIPTION	STOCK NO.
1	1	EROSION CONTROL MATTING	02505722				
2	1	STAPLES	00211495				

GENERAL NOTES

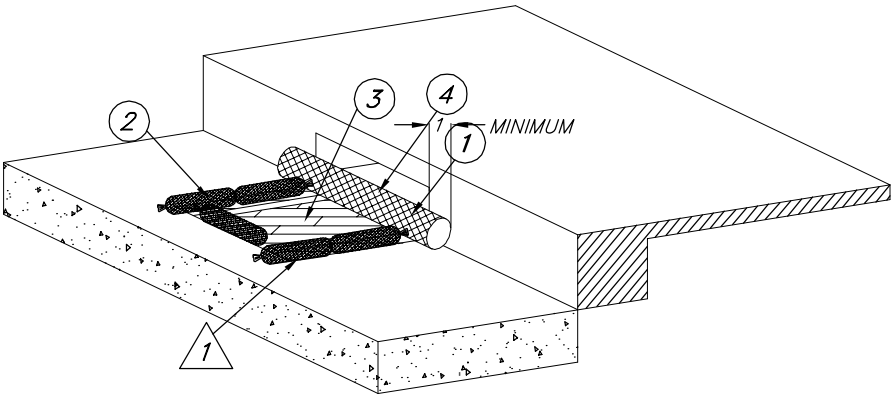
1. IF MORE THAN ONE BLANKET IS NEEDED FOR A RUN THEN OVERLAP ADJOINING ENDS A MINIMUM OF 4" SHINGLE STYLE. STAPLE OVERLAP AREAS WITH STAGGERED PATTERN.
2. OVERLAP EDGES OR ENDS OF BLANKET A MINIMUM OF 2" WITH CONNECTING BLANKETS
3. EROSION CONTROL MATTING TO BE USED ON AREAS OF CONCENTRATED FLOW, ALL SLOPES 3:1 OR STEEPER OR ON LESSER SLOPES WHEN DEEMED NECESSARY. MATTING SHALL ALSO BE USED TO PROTECT AREAS BEING RESTORED OUTSIDE OF NORMAL GROWING SEASON.
4. INSTALL ALL MATTING IMMEDIATELY AFTER THE AREA HAS BEEN FINAL GRADED, SEEDED AND FERTILIZED.
5. ORIENT MATTING PARALLEL WITH CHANNEL FOR HEAVY FLOW ALONG CHANNEL.
6. STAPLE PATTERN SHOWN IS APPLICABLE UP TO 3:1 ANYTHING STEEPER REFER TO MANUFACTURERS SPECS.
7. REFER TO OTHER STANDARDS TO MINIMIZE FLOW.

CONSTRUCTION STANDARD
CITY UTILITIES OF
SPRINGFIELD, MISSOURI

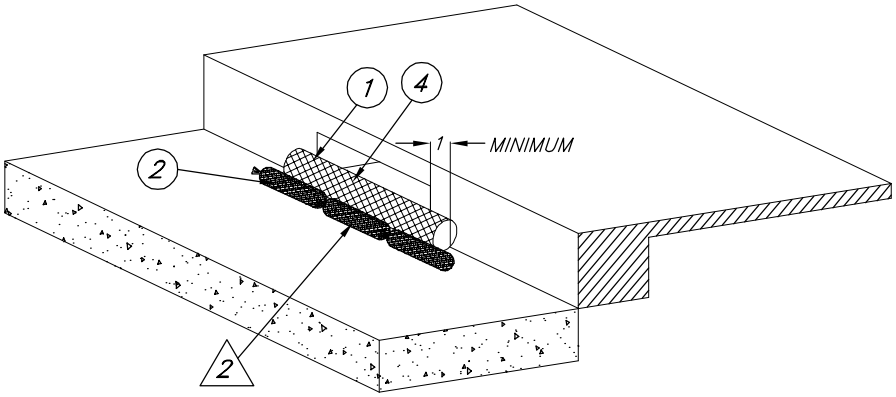
INSTALLATION OF
EROSION CONTROL MATTING

LATEST REV. DATE	STANDARD NO.	PAGE:
03/14/2013	ES–610	

CURB INLET WITH GRATE



CURB INLET WITHOUT GRATE



MATERIAL LIST

	QTY	DESCRIPTION	STOCK NO.		QTY	DESCRIPTION	STOCK NO.
1	1	GUTTER BUDDY 9"	02505721				
2		SAND BAG	02525723				
3	1	GEOTEXTILE FABRIC	02505720				
4	1	SILT SOCK 9"	02505689				

GENERAL NOTES

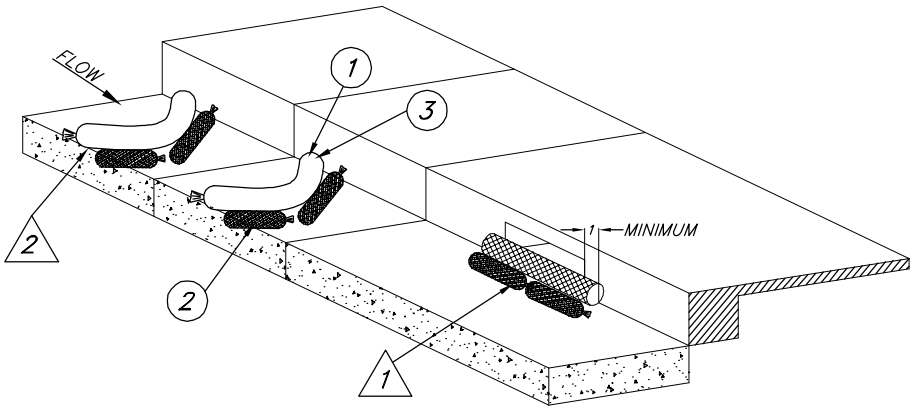
1. PLACE SAND BAGS AROUND EDGE OF FABRIC TO HOLD IN PLACE. IF GEOTEXTILE FABRIC IS NOT USED SAND BAGS OR ADDITIONAL GUTTER BUDDY SHALL BE USED TO PROTECT GRATE FROM SEDIMENT.
2. PLACE SAND BAGS IN FRONT OF SILT SOCK TO HOLD IN PLACE WHEN USED IN LIEU OF GUTTER BUDDY.
3. SAND BAGS WILL BE OMITTED IF NOT APPLICABLE. WRAP FABRIC UNDER GRATE TO HOLD IN PLACE IN LIEU OF USING SAND BAGS.
4. INLET PROTECTION SHALL BE REQUIRED DOWN HILL FROM WORK ZONES MULTIPLE INLETS NEED TO BE PROTECTED.

CONSTRUCTION STANDARD
CITY UTILITIES OF
SPRINGFIELD, MISSOURI

CURB INLET PROTECTION

LATEST REV. DATE	STANDARD NO.	PAGE:
03/14/2013	ES-620	

GUTTER CHECKS



MATERIAL LIST

	QTY	DESCRIPTION	STOCK NO.		QTY	DESCRIPTION	STOCK NO.
1	1	GUTTER BUDDY 9"	02505721				
2		SAND BAG	02525723				
3	1	SILT SOCK 9"	02505689				

GENERAL NOTES

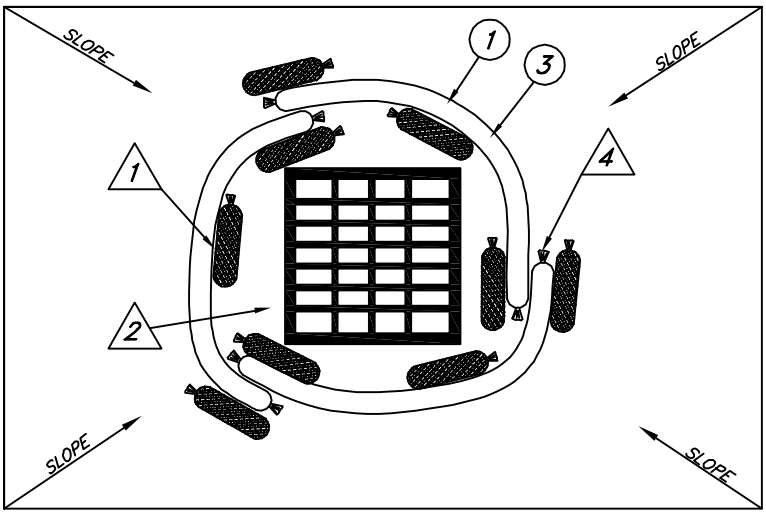
1. SEE ES-620 FOR CURB INLET PROTECTION.
2. INSTALL GUTTER CHECKS USING GUTTER BUDDY OR SILT SOCK AND SAND BAGS UPSTREAM OF INLETS TO ALLOW ADDITIONAL AREAS FOR SEDIMENT TO BE DEPOSITED PRIOR TO REACHING INLETS. THIS SHOULD BE DONE FOR FLOWS WITH HIGH SEDIMENT LOADING SUCH AS MAIN BREAKS AND TRENCH DEWATERING. DO NOT INSTALL INTO TRAFFIC LANES WHERE LANES ARE OPEN TO VEHICLES.
3. SAND BAGS OR COURSE GRANULAR MATERIAL MAY ALSO BE USED IN A U-SHAPE FOR GUTTER CHECKS.

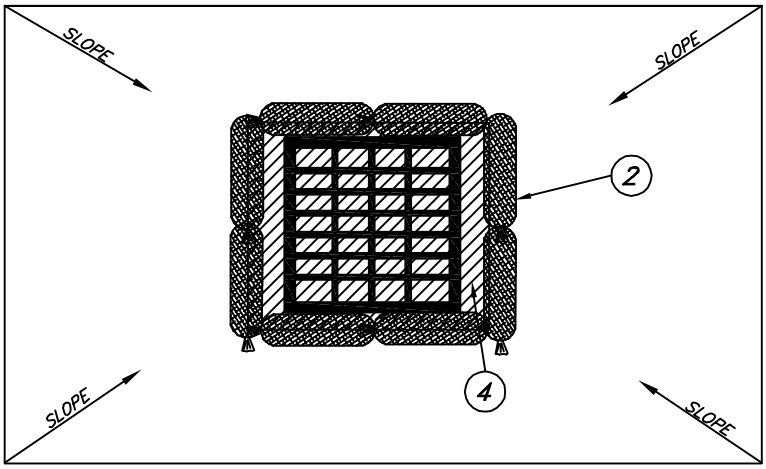
CONSTRUCTION STANDARD
CITY UTILITIES OF
SPRINGFIELD, MISSOURI

INSTALLATION OF
GUTTER CHECKS FOR
SEDIMENT CONTROL

LATEST REV. DATE	STANDARD NO.	PAGE:
03/14/2013	ES-630	

AREA INLET





MATERIAL LIST

	QTY	DESCRIPTION	STOCK NO.		QTY	DESCRIPTION	STOCK NO.
1	1	GUTTER BUDDY 9"	02505721				
2		SAND BAG	02505723				
3	1	SILT SOCK 9"	02505689				
4	1	GEOTEXTILE FABRIC	02505720				

GENERAL NOTES

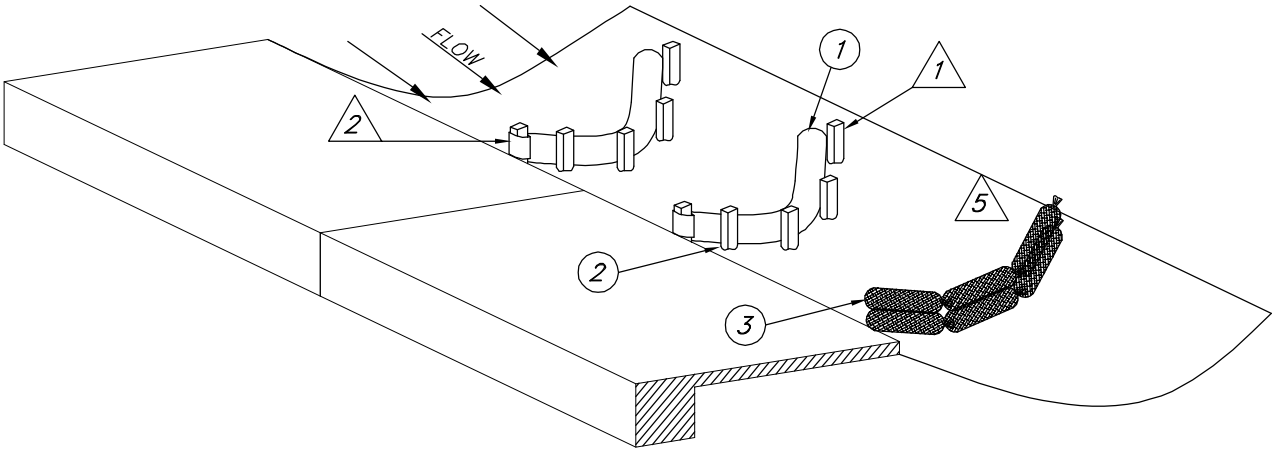
1. WHEN HEAVY SEDIMENT LOADING IS EXPECTED GUTTER BUDDY, SILT SOCK OR SAND BAG PERIMETER RING SHALL BE USED TO PREVENT OVERLOADING THE GEOTEXTILE FABRIC.
2. INSTALL GEOTEXTILE FABRIC OVER AREA INLET TO KEEP SEDIMENT OUT OF INLET BOX.
3. WHEN HEAVY SEDIMENT LOADING IS NOT EXPECTED GEOTEXTILE FABRIC ALONE MAY BE USED TO PROTECT THE INLET.
4. OVERLAP SILT SOCK OR GUTTER BUDDY ENDS TO PREVENT SEDIMENT FROM BYPASSING.
5. GEOTEXTILE FABRIC SHALL BE SECURED WITH SAND BAGS OR STAKES.

CONSTRUCTION STANDARD
CITY UTILITIES OF
SPRINGFIELD, MISSOURI

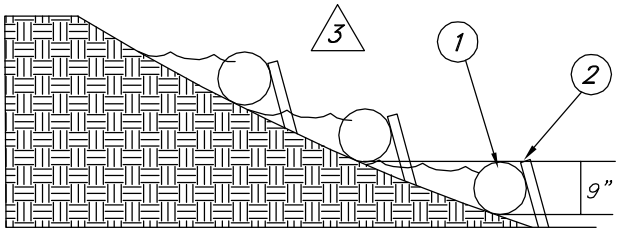
AREA INLET FOR SEDIMENT CONTROL

LATEST REV. DATE	STANDARD NO.	PAGE:
11/05/2014	ES-631	

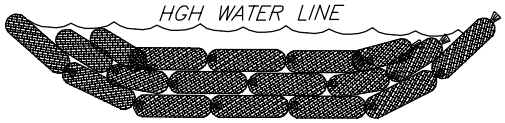
DITCH CHECKS



DITCH CHECK FOR SILT SOCK



DITCH CROSS SECTION OF SAND BAGS



MATERIAL LIST

	QTY	DESCRIPTION	STOCK NO.		QTY	DESCRIPTION	STOCK NO.
1	1	SILT SOCK	02505689				
2	1	STAKES	00111190				
3		SAND BAGS	02525723				

GENERAL NOTES

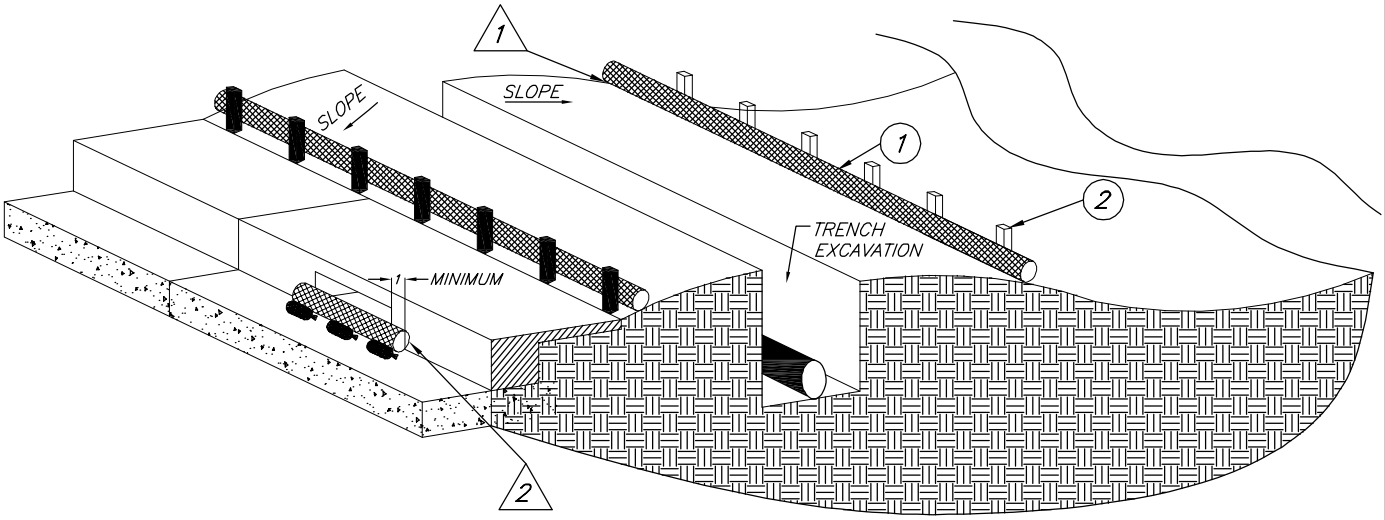
1. PLACE SERIES OF SILT SOCKS WITH STAKES TO KEEP IN PLACE. SAND BAGS MAY ALSO BE USED IN LIEU OF SILT SOCK.
2. EXCESS SOCK MATERIAL TO BE DRAWN IN AND TIED OFF TO STAKE AT BOTH ENDS.
3. DEPENDING ON SLOPE PLACE SILT SOCK ACCORDINGLY TO ALLOW FOR PROPER PONDING OF WATER. EACH DITCH CHECK SHOULD BACK UP WATER TO THE BOTTOM OF THE UPHILL CHECK.
4. DITCH CHECKS SHALL BE USED DOWNHILL FROM WORK ZONES TO PREVENT SEDIMENT TRANSPORT BY REDUCING THE VELOCITY. THEY MAY ALSO BE USED UPSTREAM TO REDUCE VELOCITIES.
5. EXTEND DITCH CHECKS UP SIDES OF CHANNEL ABOVE HIGH WATER MARK.

CONSTRUCTION STANDARD
CITY UTILITIES OF
SPRINGFIELD, MISSOURI

DITCH CHECKS
FOR SEDIMENT AND
EROSION CONTROL

LATEST REV. DATE	STANDARD NO.	PAGE:
03/14/2013	ES-640	

PERIMETER FLOW FROM JOBSITE



MATERIAL LIST

	QTY	DESCRIPTION	STOCK NO.		QTY	DESCRIPTION	STOCK NO.
1	1	SILT SOCK 9"	02505689				
2	1	STAKES	00111190				

GENERAL NOTES

1	INSTALL SILT SOCK WITH STAKES TO PREVENT SEDIMENT TRANSPORT DOWN SLOPE FROM EXCAVATION AREAS TO PROTECT DRAINAGE DITCHES, STREAMS, BODIES OF WATER, DRAINAGE STRUCTURE, STREETS, CURB AND GUTTER, ETC.
2	REFER TO STANDARD ES-620 FOR CURB INLET PROTECTION.

CONSTRUCTION STANDARD
CITY UTILITIES OF
SPRINGFIELD, MISSOURI

PERMITER FLOW FROM
JOBSITE FOR
RUN-OFF CONTROL

LATEST REV. DATE	STANDARD NO.	PAGE:
03/14/2013	ES-650	

Appendix D

Hazardous Materials

Segment A

October 30, 2023

- Brownfields (ACRES)
- Brownfields (ACRES)
- Hazardous Waste (RCRAInfo)
- Hazardous Waste (RCRAInfo)
- segment_a

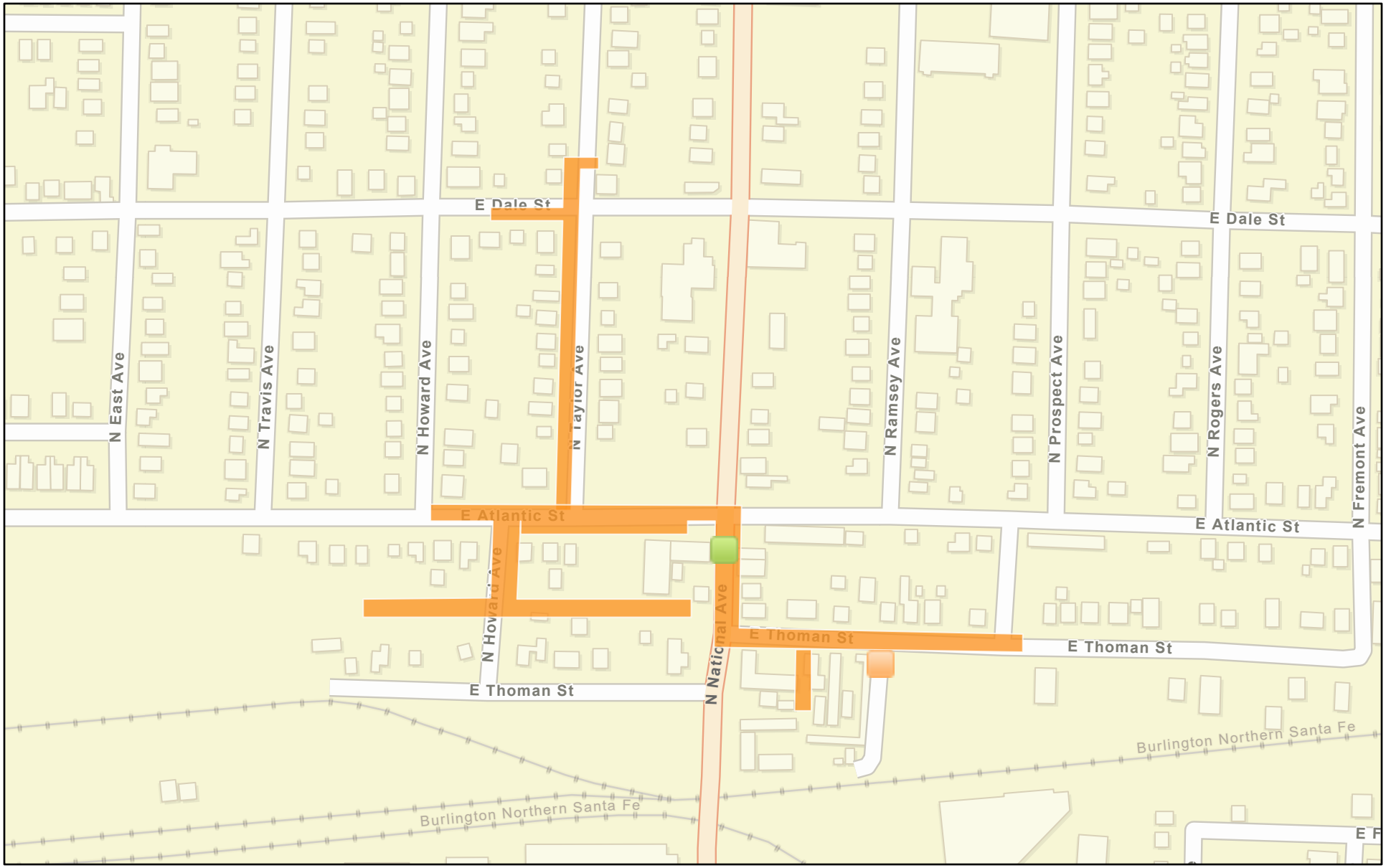
1:18,056

0 0.13 0.25 0.5 mi

0 0.17 0.35 0.7 km

Esri Community Maps Contributors, Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA,

Segment B



October 30, 2023

Brownfields (ACRES)

Hazardous Waste (RCRAInfo)

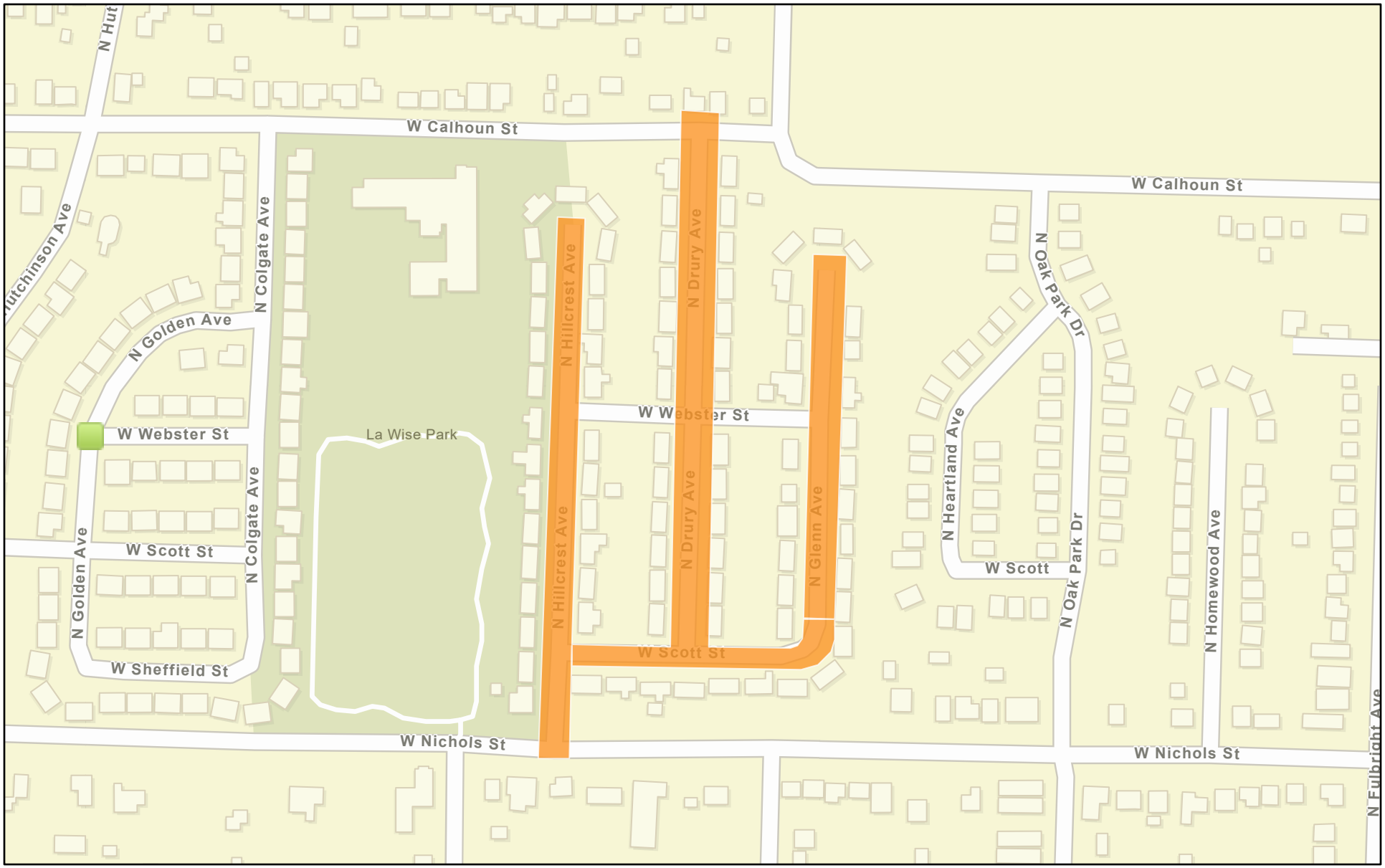
segment_b

1:4,514

0 0.03 0.06 0.12 mi

0 0.05 0.1 0.2 km

Segment C



October 30, 2023

Hazardous Waste (RCRAInfo)

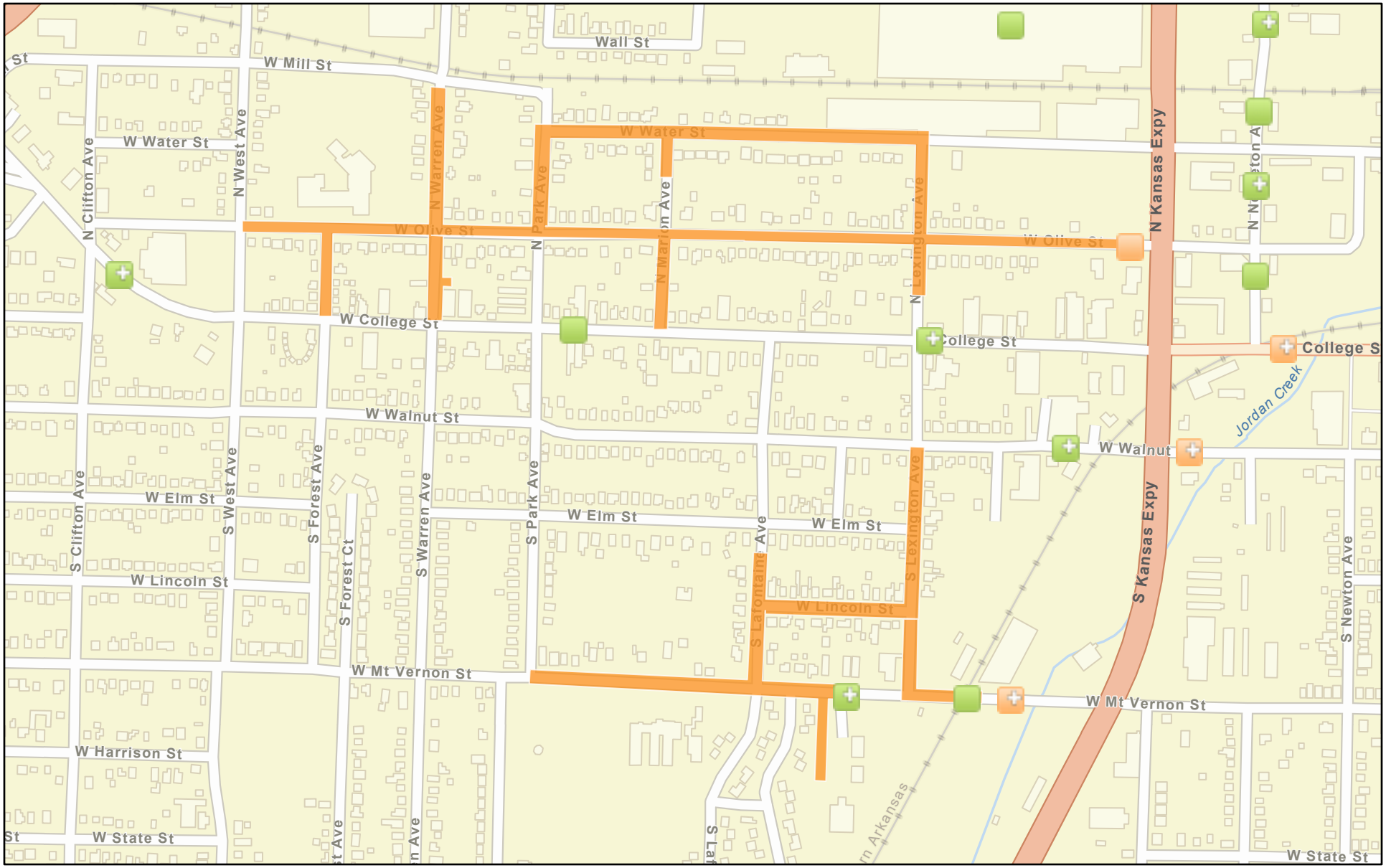
segment_c

1:4,514

0 0.03 0.06 0.12 mi

0 0.05 0.1 0.2 km

Segment E



October 30, 2023

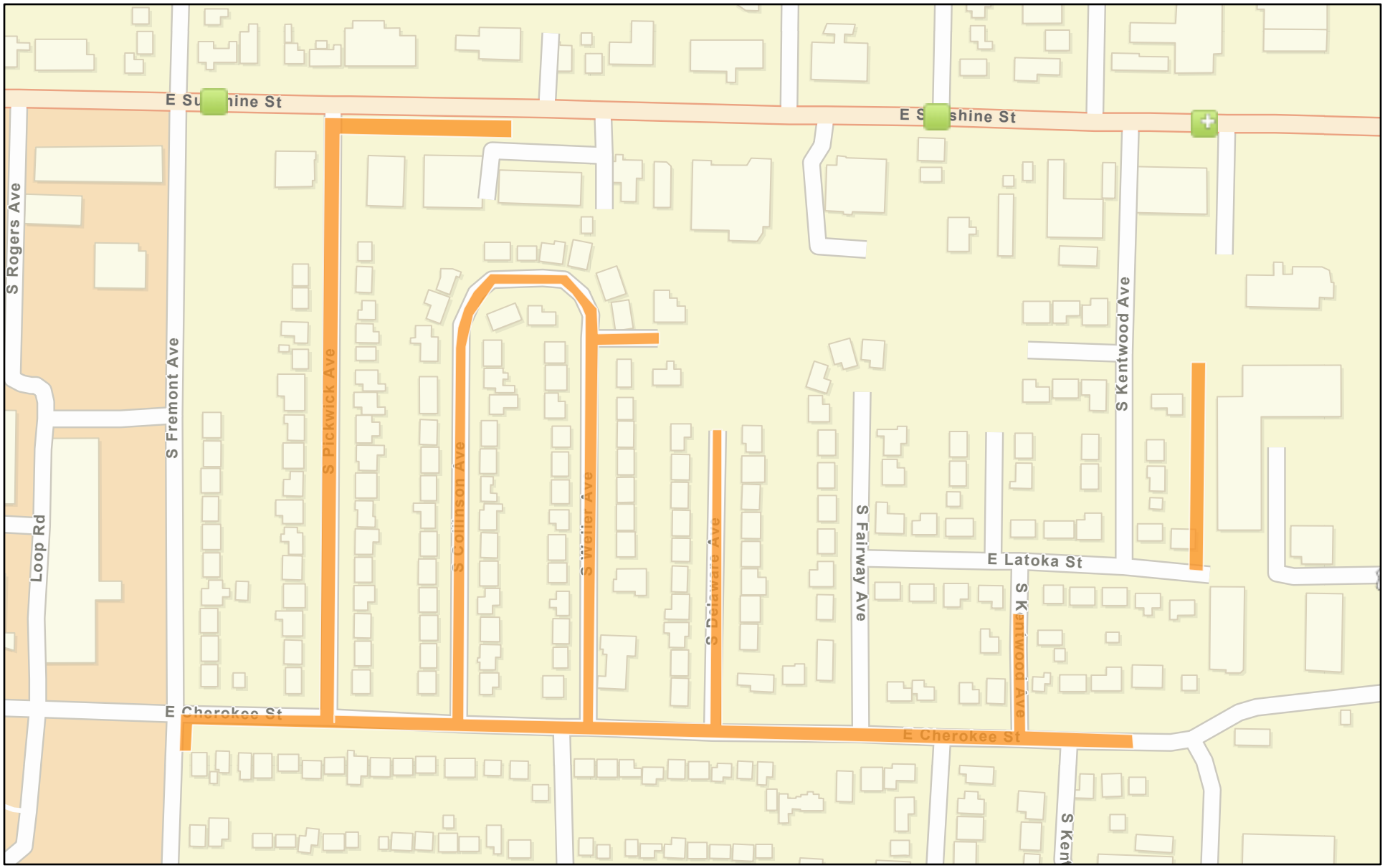
1:9,028

0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

- Brownfields (ACRES)
- Brownfields (ACRES)
- Hazardous Waste (RCRAInfo)
- Hazardous Waste (RCRAInfo)
- segment_e

Segment H



October 30, 2023

Hazardous Waste (RCRAInfo)

segment_h

Hazardous Waste (RCRAInfo)

1:4,514

0 0.03 0.06 0.12 mi

0 0.05 0.1 0.2 km

Appendix 12 - MDNR E-Start Hazard Sites

Segment A - Hazardous Sites

Site Name	Address	City	Status	Site Owner	Facility Id	Clean Up Summary	Facility Type	Closure Guide
WADE'S 66	658 W Kearney	SGF	Facility Closed Prior to Implementation of 2004 Tanks RBCA	DNR	ST0018724	A petroleum or hazardous substance storage tank closure or regulated release was addressed prior to the adoption of the 2004 Missouri Risk-Based Corrective Action Guidance for Petroleum Storage Tanks. An evaluation found that no further action was warranted based on the tank closure or corrective action process in use at the time. Please review the Department of Natural Resources site file for more information.	Former Underground Storage Tank Facilities	1992 CGD
VILLAGE GLASS	1000 W Kearney	SGF	Facility Closed Prior to Implementation of 2004 Tanks RBCA	DNR	ST0020739		Former Underground Storage Tank Facilities	1996 CGD
WHITE OAK #61	650 W Kearney	SGF	Operating UST Facilities with No Known Release	DNR	ST0007774	An operating UST facility as defined by Section 319.100 RSMo is located at this location. The Department of Natural Resources is not aware of a release from this facility.	All Operating Underground Storage Tank Facilities	null
PECKS SERVICE & TRAILER RENTAL	400 W Kearney	SGF	No Further Action Letter Issued with Restriction	DNR	ST0007545	A petroleum or hazardous substance storage tank closure or regulated release was addressed under the Missouri Risk-Based Corrective Action Guidance for Petroleum Storage Tanks. Evaluation of environmental media found that concentrations of any remaining contaminants, if present, do not pose an unacceptable risk to human health or the environment provided that Activity & Use Limitations applied to this property remain in place. Please review the Department of Natural Resources site file for more information.	Former Underground Storage Tank Facilities	2004 MRBCA
AMERICAN LINEN SUPPLY CO	907 W Chase ST	SGF	Facility Closed Prior to Implementation of 2004 Tanks RBCA	DNR	ST0006471	A petroleum or hazardous substance storage tank closure or regulated release was addressed prior to the adoption of the 2004 Missouri Risk-Based Corrective Action Guidance for Petroleum Storage Tanks. An evaluation found that no further action was warranted based on the tank closure or corrective action process in use at the time. Please review the Department of Natural Resources site file for more information.	Former Underground Storage Tank Facilities	Other
BURLINGTON NORTHERN RAILROAD	210 W Case	SGF	Facility Closed Prior to Implementation of 2004 Tanks RBCA	DNR	ST0008641		Former Underground Storage Tank Facilities	1996 CGD

Appendix 12 - MDNR E-Start Hazard Sites

ROOKS SERVICE STATION	1846 N Grant	SGF	No Further Action Letter Issued with Restriction	DNR	ST0006605	A petroleum or hazardous substance storage tank closure or regulated release was addressed under the Missouri Risk-Based Corrective Action Guidance for Petroleum Storage Tanks. Evaluation of environmental media found that concentrations of any remaining contaminants, if present, do not pose an unacceptable risk to human health or the environment provided that Activity & Use Limitations applied to this property remain in place. Please review the Department of Natural Resources site file for more information.	All Operating Underground Storage Tank Facilities	2013 MRBCA
FINA STATION #10 - SOLD	Grant and Chase	SGF	Facility Closed Prior to Implementation of 2004 Tanks RBCA	DNR	ST0013512	A petroleum or hazardous substance storage tank closure or regulated release was addressed prior to the adoption of the 2004 Missouri Risk-Based Corrective Action Guidance for Petroleum Storage Tanks. An evaluation found that no further action was warranted based on the tank closure or corrective action process in use at the time. Please review the Department of Natural Resources site file for more information.	Former Underground Storage Tank Facilities	No Data
Ozark Circuits	933 W Chase St	SGF	Environmental Notice	DNR		The Ozark Circuits Site is the location of a former circuit board manufacturer, Ozark Circuits, Inc., which included electroplating and an on-site waste water treatment system in its operations. The business filed for bankruptcy in 2011 and abandoned over 100 containers of waste. The Missouri Department of Natural Resources (Department) Compliance and Enforcement Unit referred the site to the Departments Superfund Section on May 31, 2013. From July 2013 through October 2013, EPA conducted time-critical removal activities at the site which included the removal of wastes abandoned in drums, vats, trenches and the waste water treatment system. After which, analyses of surface soil, subsurface soil, and groundwater samples collected from the site in November 2013 document a release of metals to the environmental media, particularly beneath the trench in the plating area of the building.		

Appendix 12 - MDNR E-Start Hazard Sites

Segment B - Hazardous Sites

Site Name	Address	City	Status	Site Owner	Facility Id	Clean Up Summary	Facility Type	Closure Guide
BURLINGTON NORTHERN SANTA FE	Washinto n and Chase St	SGF	Facility Closed Prior to Implementation of 2004 Tanks RBCA	DNR	ST5800906	A petroleum or hazardous substance storage tank closure or regulated release was addressed prior to the adoption of the 2004 Missouri Risk-Based Corrective Action Guidance for Petroleum Storage Tanks. An evaluation found that no further action was warranted based on the tank closure or corrective action process in use at the time. Please review the Department of Natural Resources site file for more information.	Other Known Petroleum Facilities	1996 CGD

Segment C - Hazardous Sites

None-known

Segment E1 - Hazardous Sites

Site Name	Address	City	Status	Site Owner	Facility Id	Clean Up Summary	Facility Type	Closure Guide
PAUL MUELLER COMPANY	1734 W Water St	SGF	Facility Closed Prior to Implementation of 2004 Tanks RBCA	DNR	ST0003546	A petroleum or hazardous substance storage tank closure or regulated release was addressed prior to the adoption of the 2004 Missouri Risk-Based Corrective Action Guidance for Petroleum Storage Tanks. An evaluation found that no further action was warranted based on the tank closure or corrective action process in use at the time. Please review the Department of Natural Resources site file for more information.	Former Underground Storage Tank Facilities	Other

Segment E2 - Hazardous Sites

None-known

Segment H - Hazardous Sites

Site Name	Address	City	Status	Site Owner	Facility Id	Clean Up Summary	Facility Type	Closure Guide
ATON CONSTRUCTION CO, INC	1571 E Cherokee	SGF	Facility Closed Prior to Implementation of 2004 Tanks RBCA	DNR	ST0006586	A petroleum or hazardous substance storage tank closure or regulated release was addressed prior to the adoption of the 2004 Missouri Risk-Based Corrective Action Guidance for Petroleum Storage Tanks. An evaluation found that no further action was warranted based on the tank closure or corrective action process in use at the time. Please review the Department of Natural Resources site file for more information.	Former Underground Storage Tank Facilities	Other

Appendix E

Soils

United States Department of Agriculture

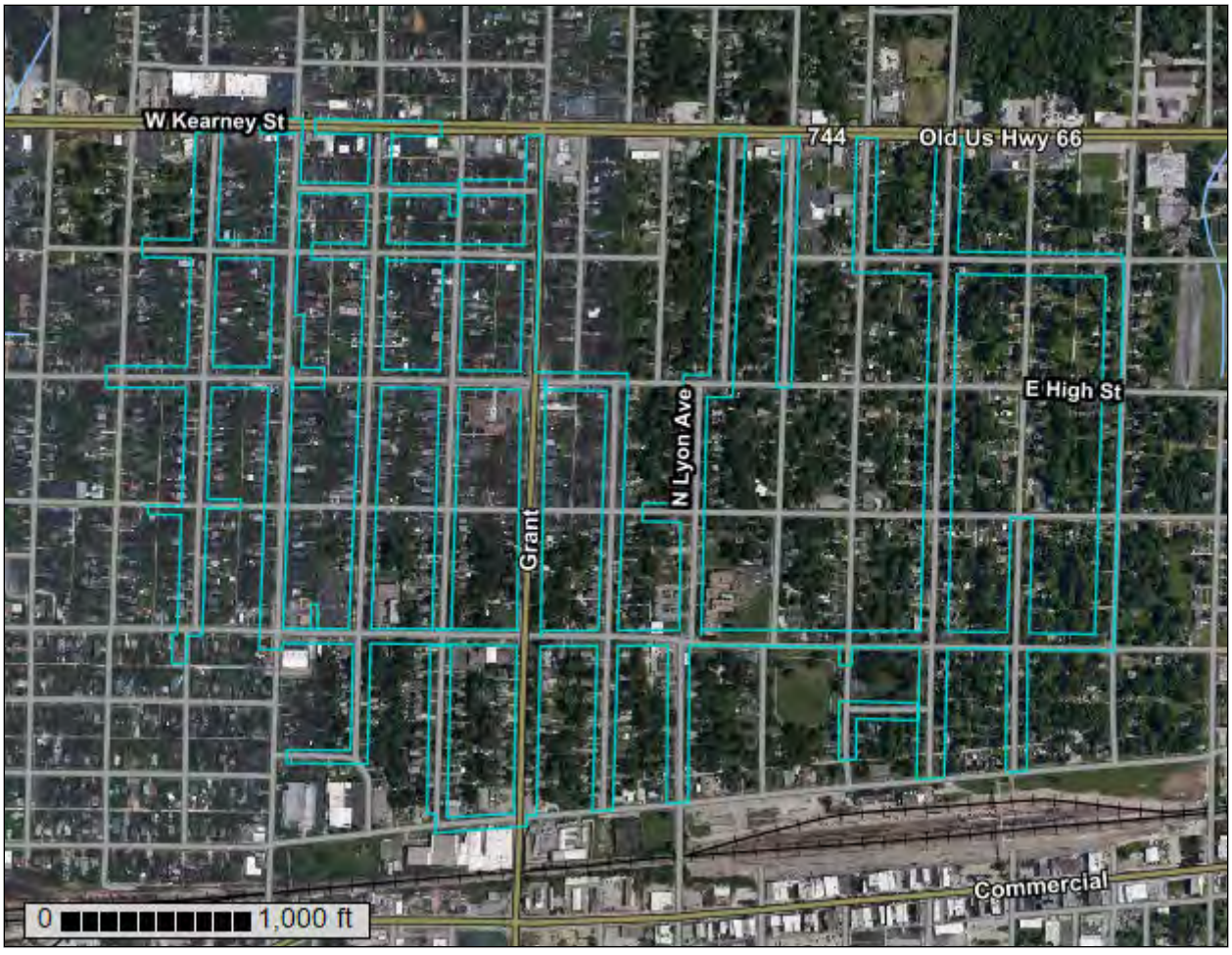
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Greene County, Missouri

Segment A



October 13, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Greene County, Missouri
Survey Area Data: Version 29, Aug 22, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 17, 2019—Apr 1, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
70009	Goss gravelly silt loam, 8 to 15 percent slopes	15.1	14.3%
73008	Viraton silt loam, 2 to 5 percent slopes	65.1	61.8%
73010	Wilderness gravelly silt loam, 3 to 8 percent slopes	4.3	4.1%
73450	Goss-Wilderness complex, 3 to 8 percent slopes	20.8	19.8%
Totals for Area of Interest		**105.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Greene County, Missouri

70009—Goss gravelly silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2qpbk
Elevation: 800 to 1,200 feet
Mean annual precipitation: 41 to 45 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 194 to 221 days
Farmland classification: Not prime farmland

Map Unit Composition

Goss and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Goss

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Slope alluvium over residuum weathered from limestone

Typical profile

A - 0 to 6 inches: gravelly silt loam
E - 6 to 19 inches: extremely gravelly silt loam
2Bt1 - 19 to 60 inches: very gravelly silty clay loam
2Bt2 - 60 to 79 inches: gravelly clay

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F116BY003MO - Chert Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Lowassie

Percent of map unit: 5 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

Alred

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116AY011MO - Chert Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Rueter

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116AY002MO - Chert Protected Backslope Forest, F116AY062MO - Chert Exposed Backslope Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Peridge

Percent of map unit: 2 percent
Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F116AY008MO - Loamy Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

73008—Viraton silt loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2qpf6
Elevation: 800 to 1,500 feet
Mean annual precipitation: 39 to 49 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 172 to 232 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Viraton and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Viraton

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess over pedisediment over residuum weathered from limestone

Typical profile

Ap - 0 to 6 inches: silt loam
Bt1 - 6 to 21 inches: silt loam
2Btx - 21 to 30 inches: very gravelly silty clay loam
3Bt2 - 30 to 79 inches: gravelly clay

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 18 to 33 inches to fragipan
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 15 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: F116AY004MO - Fragipan Upland Woodland

Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Bado
Percent of map unit: 3 percent
Landform: Depressions
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F116AY066MO - Fragipan Upland Flatwoods
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

Lowassie
Percent of map unit: 2 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

73010—Wilderness gravelly silt loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: 2vxwj
Elevation: 900 to 1,200 feet
Mean annual precipitation: 39 to 49 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 172 to 232 days
Farmland classification: Not prime farmland

Map Unit Composition
Wilderness and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wilderness

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex

Parent material: Slope alluvium over pedisediment over residuum weathered from dolomite

Typical profile

A - 0 to 6 inches: gravelly silt loam
E - 6 to 11 inches: gravelly silt loam
Bt1 - 11 to 25 inches: extremely gravelly silt loam
2Btx - 25 to 32 inches: very gravelly silt loam
3Bt2 - 32 to 79 inches: gravelly clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 15 to 29 inches to fragipan
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F116AY012MO - Low-Base Chert Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Viraton

Percent of map unit: 3 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116AY004MO - Fragipan Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Lowassie

Percent of map unit: 2 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

73450—Goss-Wilderness complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2qpyf
Elevation: 800 to 1,620 feet
Mean annual precipitation: 39 to 49 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 172 to 232 days
Farmland classification: Not prime farmland

Map Unit Composition

Goss and similar soils: 50 percent
Wilderness and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Goss

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Slope alluvium over residuum weathered from dolomite

Typical profile

A - 0 to 8 inches: gravelly silt loam
2Bt1 - 8 to 20 inches: very gravelly silty clay loam
2Bt2 - 20 to 79 inches: very gravelly clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F116AY011MO - Chert Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)

Hydric soil rating: No

Description of Wilderness

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Slope alluvium over pedisediment over residuum weathered from limestone

Typical profile

A - 0 to 8 inches: gravelly silt loam
Bt1 - 8 to 18 inches: very gravelly silty clay loam
2Btx - 18 to 40 inches: extremely gravelly silty clay loam
3Bt2 - 40 to 79 inches: very gravelly clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 14 to 22 inches to fragipan
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 10 to 14 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: D
Ecological site: F116AY012MO - Low-Base Chert Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Lowassie

Percent of map unit: 5 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

Viraton

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit

Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116AY004MO - Fragipan Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

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United States Department of Agriculture

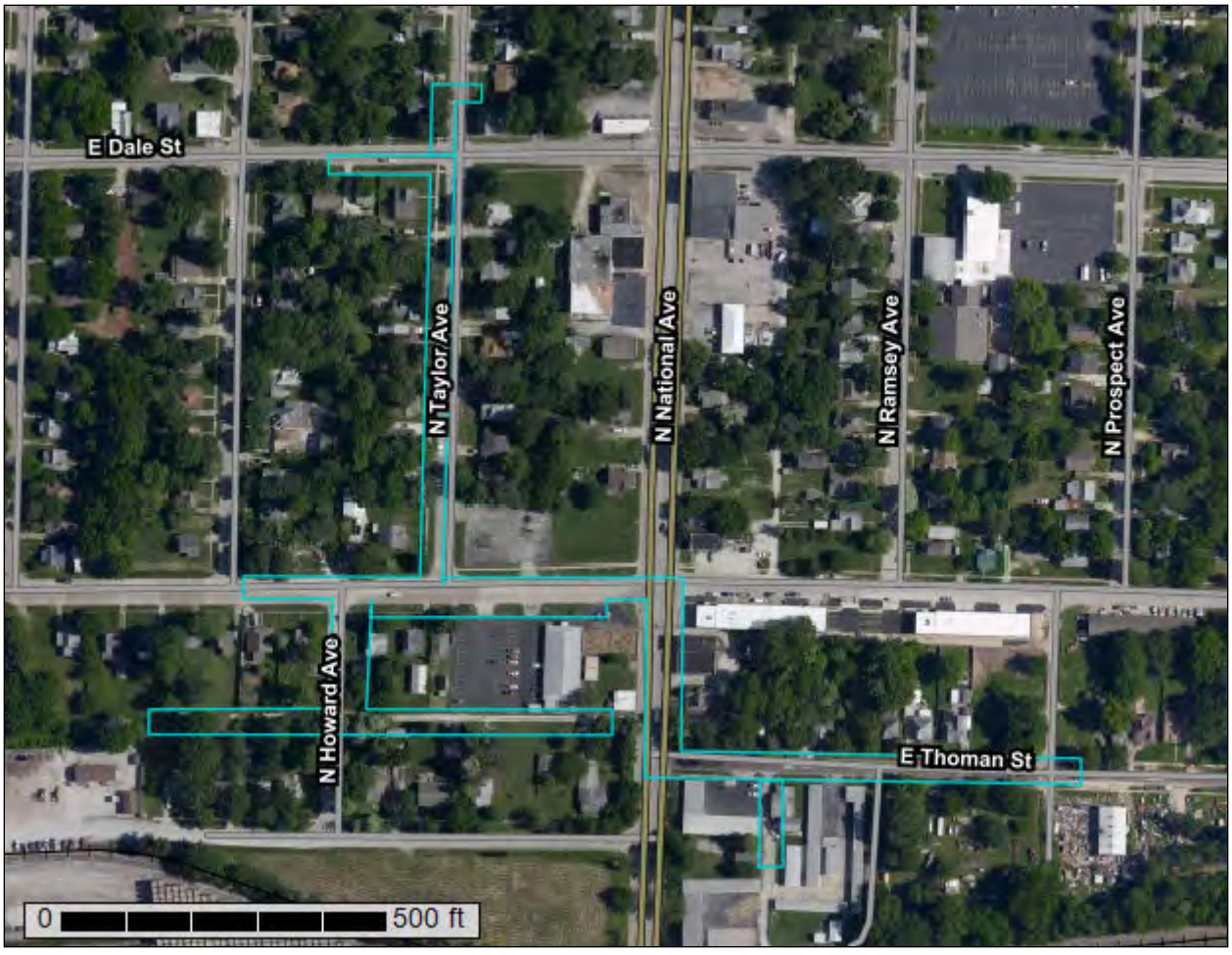
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Greene County, Missouri

Segment B



October 12, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

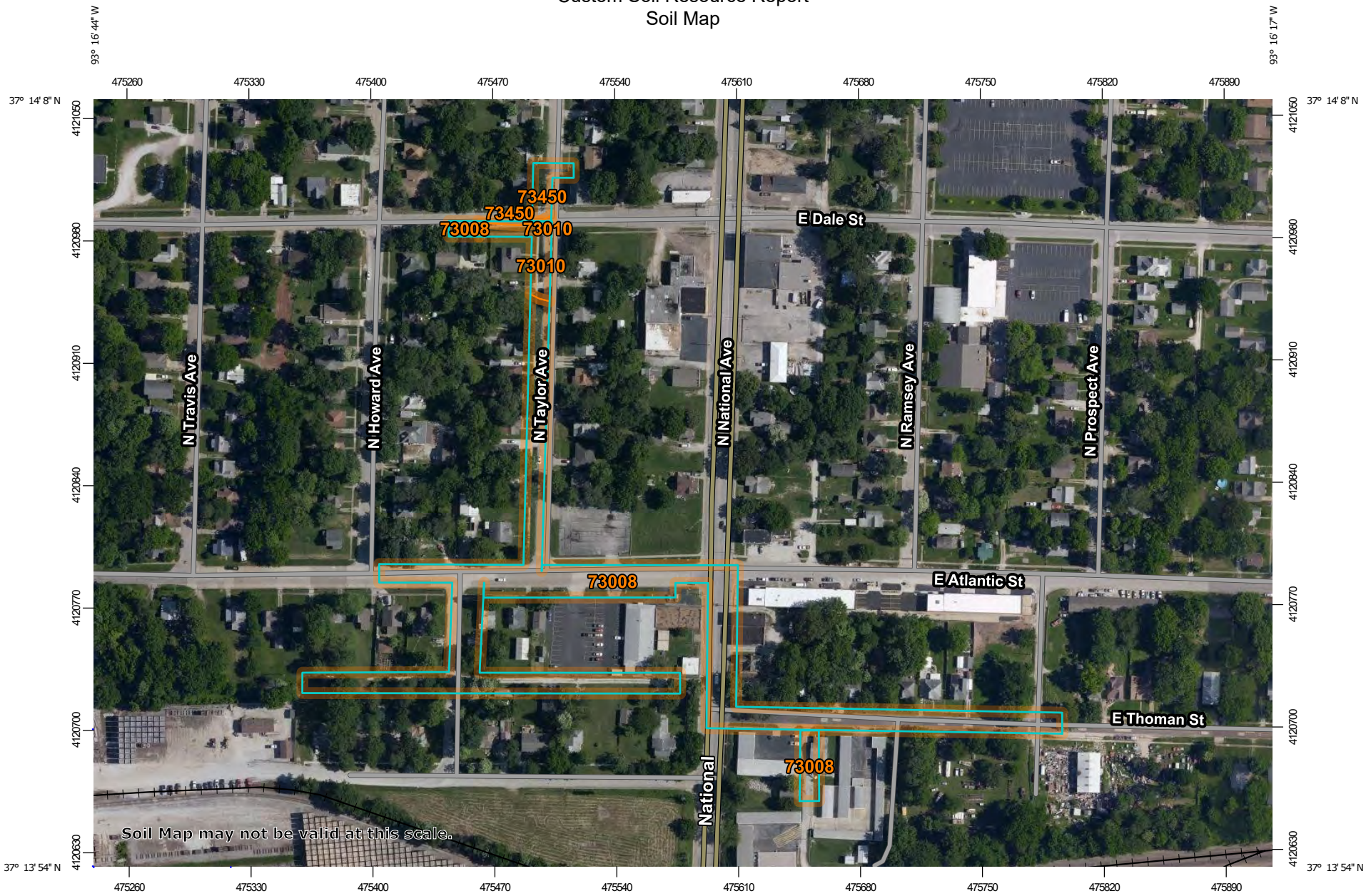
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.



Map Scale: 1:3,100 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Greene County, Missouri
Survey Area Data: Version 29, Aug 22, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 17, 2019—Aug 12, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
73008	Viraton silt loam, 2 to 5 percent slopes	3.1	91.0%
73010	Wilderness gravelly silt loam, 3 to 8 percent slopes	0.2	5.2%
73450	Goss-Wilderness complex, 3 to 8 percent slopes	0.1	3.8%
Totals for Area of Interest		**3.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Greene County, Missouri

73008—Viraton silt loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2qpf6
Elevation: 800 to 1,500 feet
Mean annual precipitation: 39 to 49 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 172 to 232 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Viraton and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Viraton

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess over pedisediment over residuum weathered from limestone

Typical profile

Ap - 0 to 6 inches: silt loam
Bt1 - 6 to 21 inches: silt loam
2Btx - 21 to 30 inches: very gravelly silty clay loam
3Bt2 - 30 to 79 inches: gravelly clay

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 18 to 33 inches to fragipan
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 15 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: F116AY004MO - Fragipan Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Bado

Percent of map unit: 3 percent
Landform: Depressions
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F116AY066MO - Fragipan Upland Flatwoods
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

Lowassie

Percent of map unit: 2 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

73010—Wilderness gravelly silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2vxwj
Elevation: 900 to 1,200 feet
Mean annual precipitation: 39 to 49 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 172 to 232 days
Farmland classification: Not prime farmland

Map Unit Composition

Wilderness and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wilderness

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Slope alluvium over pedisediment over residuum weathered from dolomite

Typical profile

A - 0 to 6 inches: gravelly silt loam
E - 6 to 11 inches: gravelly silt loam
Bt1 - 11 to 25 inches: extremely gravelly silt loam
2Btx - 25 to 32 inches: very gravelly silt loam
3Bt2 - 32 to 79 inches: gravelly clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 15 to 29 inches to fragipan
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F116AY012MO - Low-Base Chert Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Viraton

Percent of map unit: 3 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116AY004MO - Fragipan Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Lowassie

Percent of map unit: 2 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

73450—Goss-Wilderness complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2qpyf
Elevation: 800 to 1,620 feet
Mean annual precipitation: 39 to 49 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 172 to 232 days
Farmland classification: Not prime farmland

Map Unit Composition

Goss and similar soils: 50 percent
Wilderness and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Goss

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Slope alluvium over residuum weathered from dolomite

Typical profile

A - 0 to 8 inches: gravelly silt loam
2Bt1 - 8 to 20 inches: very gravelly silty clay loam
2Bt2 - 20 to 79 inches: very gravelly clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F116AY011MO - Chert Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)

Hydric soil rating: No

Description of Wilderness

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Slope alluvium over pedisediment over residuum weathered from limestone

Typical profile

A - 0 to 8 inches: gravelly silt loam
Bt1 - 8 to 18 inches: very gravelly silty clay loam
2Btx - 18 to 40 inches: extremely gravelly silty clay loam
3Bt2 - 40 to 79 inches: very gravelly clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 14 to 22 inches to fragipan
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 10 to 14 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: D
Ecological site: F116AY012MO - Low-Base Chert Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Lowassie

Percent of map unit: 5 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

Viraton

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit

Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116AY004MO - Fragipan Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

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United States Department of Agriculture

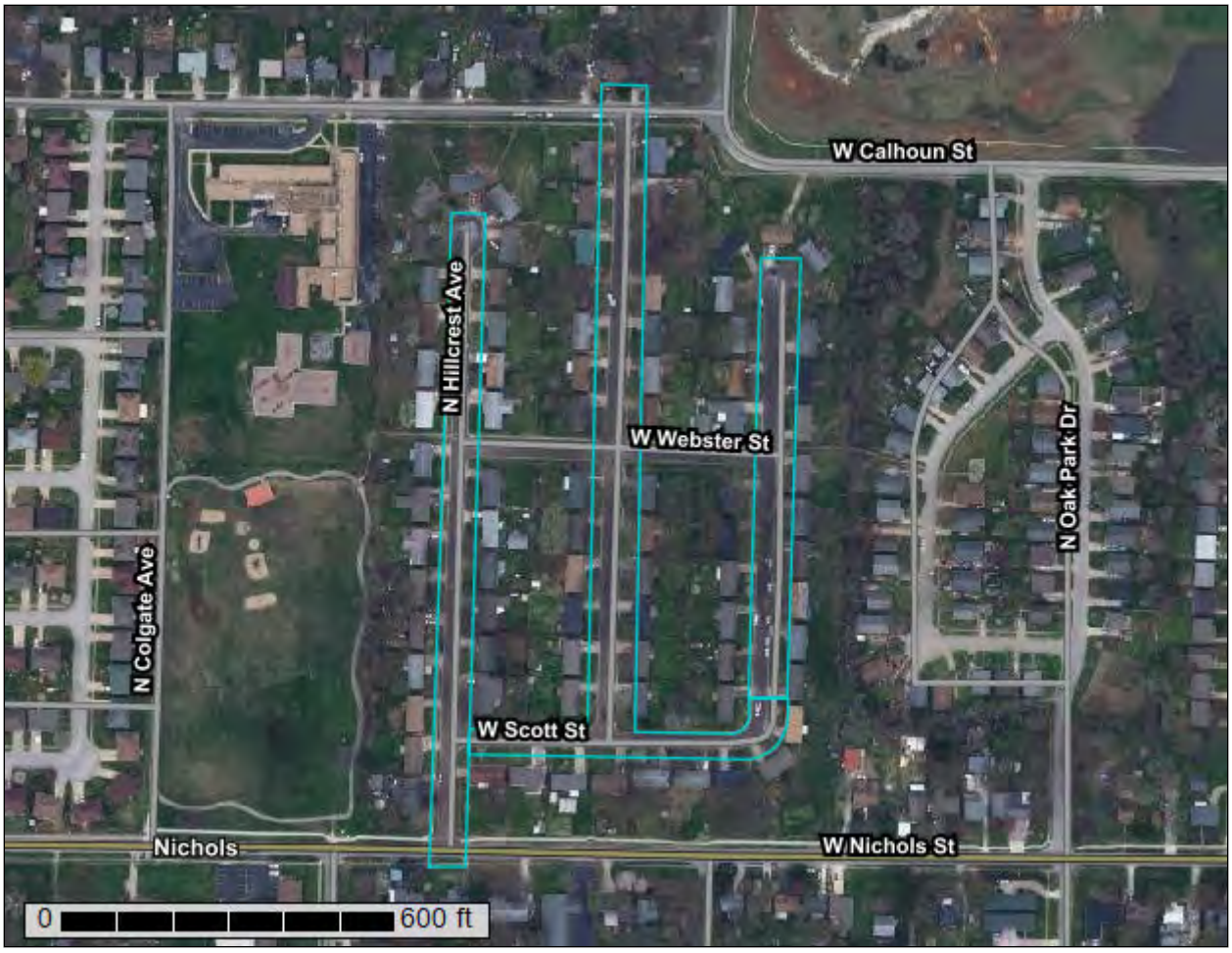
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Greene County, Missouri

Segment C



October 18, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

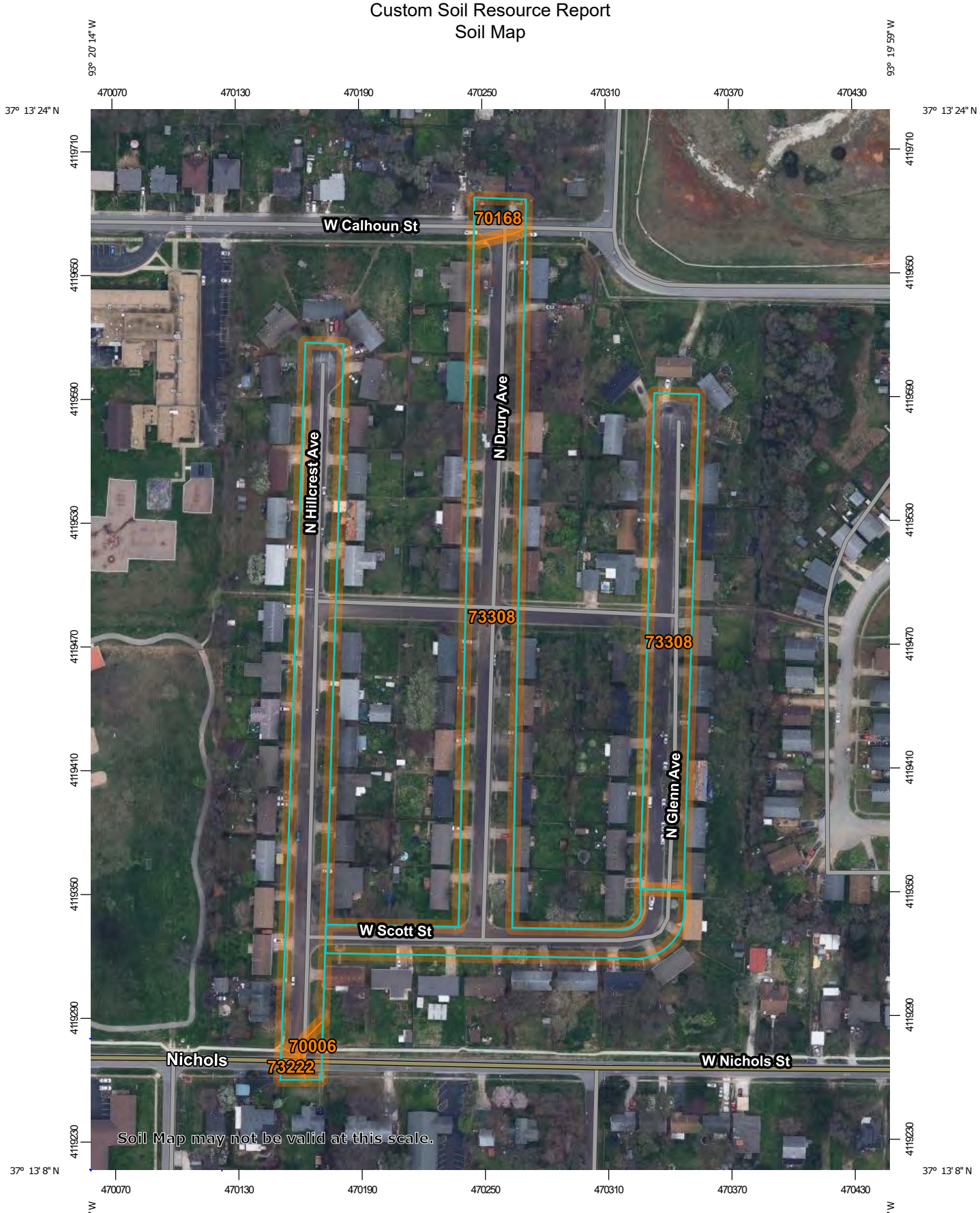
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:2,510 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Greene County, Missouri
Survey Area Data: Version 29, Aug 22, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 30, 2020—Apr 1, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
70006	Creldon silt loam, 1 to 3 percent slopes	0.1	1.0%
70168	Creldon silt loam, karst, 1 to 3 percent slopes	0.1	1.9%
73222	Splitlimb silt loam, frequently ponded, 0 to 3 percent slopes	0.0	0.6%
73308	Grandgulf silt loam, 1 to 3 percent slopes, rarely ponded	5.7	96.5%
Totals for Area of Interest		**5.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Greene County, Missouri

70006—Creldon silt loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2qpbg
Elevation: 800 to 1,500 feet
Mean annual precipitation: 41 to 45 inches
Mean annual air temperature: 55 to 57 degrees F
Frost-free period: 194 to 221 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Creldon and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Creldon

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess over pedisediment over residuum weathered from limestone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt1 - 10 to 16 inches: silty clay loam
Bt2 - 16 to 24 inches: silty clay loam
2Btx1 - 24 to 42 inches: gravelly silt loam
2Btx2 - 42 to 51 inches: extremely cobbly silt loam
3Bt3 - 51 to 79 inches: clay

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: 20 to 35 inches to fragipan
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R116BY021MO - Chert Upland Prairie
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)

Hydric soil rating: No

Minor Components

Keeno

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R116BY021MO - Chert Upland Prairie
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

Sacville

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY005MO - Wet Footslope Savanna
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: Yes

Lowassie

Percent of map unit: 2 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

70168—Creldon silt loam, karst, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 20hn5
Elevation: 900 to 1,500 feet
Mean annual precipitation: 41 to 45 inches
Mean annual air temperature: 55 to 57 degrees F
Frost-free period: 194 to 221 days
Farmland classification: Not prime farmland

Map Unit Composition

Creldon and similar soils: 95 percent
Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Creldon

Setting

Landform: Interfluves, sinkholes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess over pedisediment over residuum weathered from limestone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt1 - 10 to 16 inches: silty clay loam
Bt2 - 16 to 24 inches: silty clay loam
2Btx1 - 24 to 42 inches: gravelly silt loam
2Btx2 - 42 to 51 inches: extremely cobbly silt loam
3Bt3 - 51 to 60 inches: clay

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: 20 to 35 inches to fragipan
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R116BY021MO - Chert Upland Prairie
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

Minor Components

Keeno

Percent of map unit: 3 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R116BY021MO - Chert Upland Prairie
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

Lowassie

Percent of map unit: 2 percent

Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

73222—Splitlimb silt loam, frequently ponded, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2q2f2
Elevation: 300 to 1,500 feet
Mean annual precipitation: 39 to 49 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 172 to 232 days
Farmland classification: Not prime farmland

Map Unit Composition

Splitlimb and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Splitlimb

Setting

Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loess over slope alluvium

Typical profile

Ap - 0 to 10 inches: silt loam
Bt1 - 10 to 20 inches: silt loam
Bt2 - 20 to 29 inches: silt loam
2Bt3 - 29 to 79 inches: silty clay loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 12 to 21 inches
Frequency of flooding: None
Frequency of ponding: Frequent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Grandgulf

Percent of map unit: 3 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116BY018MO - Loamy Sinkhole Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Lowassie

Percent of map unit: 2 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

73308—Grandgulf silt loam, 1 to 3 percent slopes, rarely ponded

Map Unit Setting

National map unit symbol: 2qpxm
Elevation: 300 to 1,500 feet
Mean annual precipitation: 39 to 49 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 172 to 232 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Grandgulf and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Grandgulf

Setting

Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Slope alluvium

Typical profile

Ap - 0 to 10 inches: silt loam
Bt1 - 10 to 48 inches: silt loam
Bt2 - 48 to 79 inches: silt loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: Rare
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 13.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: F116BY018MO - Loamy Sinkhole Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Taterhill

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116AY031MO - Dry Footslope Forest
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Splitlimb

Percent of map unit: 3 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Concave
Across-slope shape: Concave

Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Lowassie

Percent of map unit: 2 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

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United States Department of Agriculture

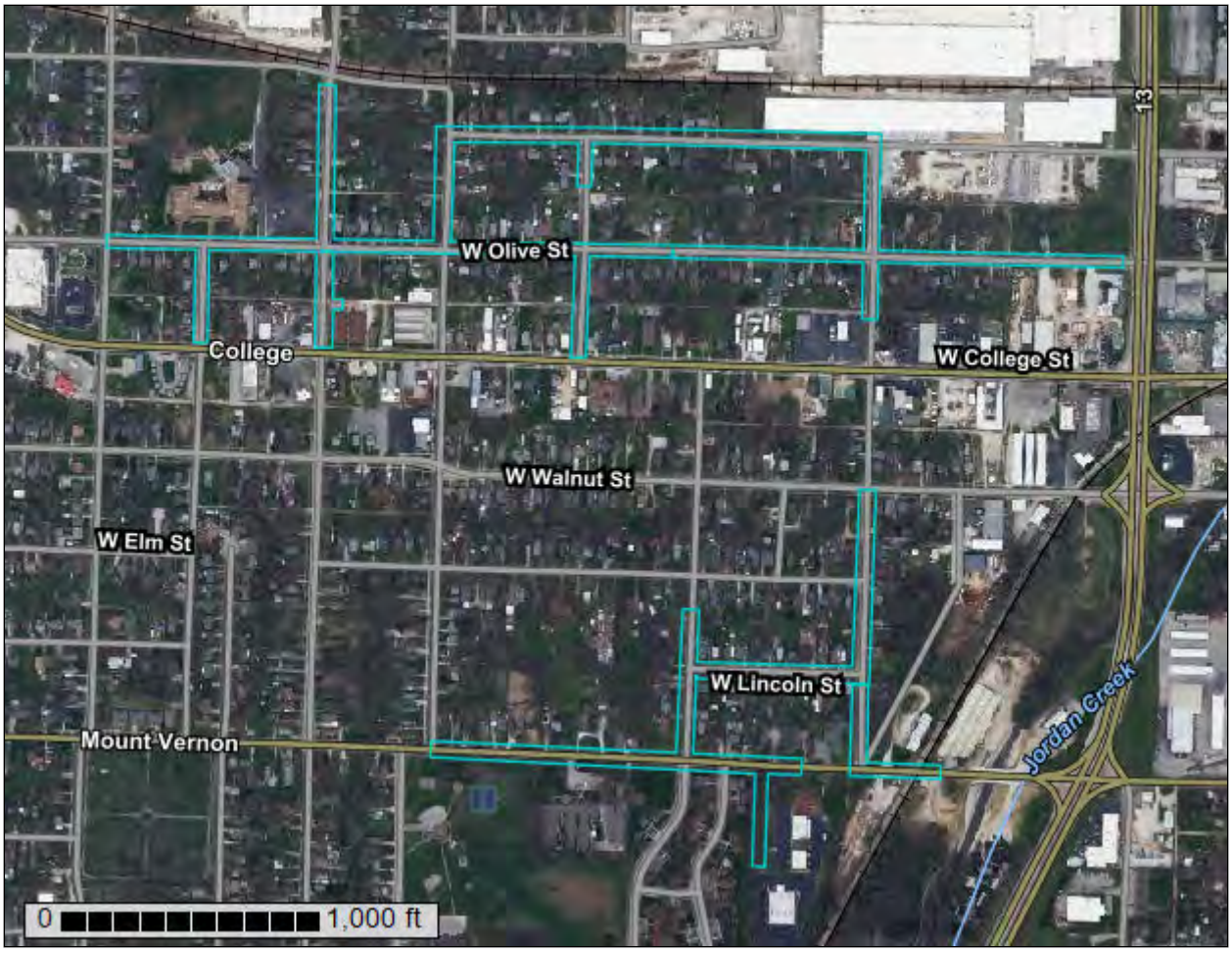
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Greene County, Missouri

Segment E



October 18, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Greene County, Missouri
Survey Area Data: Version 29, Aug 22, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 30, 2020—Apr 1, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
46002	Hepler silt loam, 0 to 2 percent slopes, occasionally flooded	0.3	1.5%
70009	Goss gravelly silt loam, 8 to 15 percent slopes	0.7	4.0%
73008	Viraton silt loam, 2 to 5 percent slopes	9.0	52.9%
73051	Winnipeg silt loam, 2 to 5 percent slopes	7.1	41.5%
Totals for Area of Interest		**17.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Greene County, Missouri

46002—Hepler silt loam, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 2w21x
Elevation: 820 to 1,070 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 54 to 61 degrees F
Frost-free period: 185 to 237 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Hepler and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hepler

Setting

Landform: Flood-plain steps
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium

Typical profile

Ap - 0 to 9 inches: silt loam
E - 9 to 25 inches: silt loam
Btg1 - 25 to 29 inches: silty clay loam
Btg2 - 29 to 40 inches: silty clay loam
BC - 40 to 79 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Ecological site: R112XY122OK - Wet Terrace
Hydric soil rating: No

Minor Components

Verdigris

Percent of map unit: 5 percent

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R112XY125KS - Loamy Floodplain
Hydric soil rating: No

Mason

Percent of map unit: 3 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R112XY123KS - Loamy Terrace
Hydric soil rating: No

Osage

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R112XY124KS - Wet Floodplain
Hydric soil rating: Yes

70009—Goss gravelly silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2qpbk
Elevation: 800 to 1,200 feet
Mean annual precipitation: 41 to 45 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 194 to 221 days
Farmland classification: Not prime farmland

Map Unit Composition

Goss and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Goss

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Slope alluvium over residuum weathered from limestone

Typical profile

A - 0 to 6 inches: gravelly silt loam
E - 6 to 19 inches: extremely gravelly silt loam
2Bt1 - 19 to 60 inches: very gravelly silty clay loam
2Bt2 - 60 to 79 inches: gravelly clay

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F116BY003MO - Chert Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Lowassie

Percent of map unit: 5 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

Alred

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116AY011MO - Chert Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Rueter

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope

Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116AY002MO - Chert Protected Backslope Forest, F116AY062MO - Chert Exposed Backslope Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Peridge

Percent of map unit: 2 percent
Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F116AY008MO - Loamy Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

73008—Viraton silt loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2qpf6
Elevation: 800 to 1,500 feet
Mean annual precipitation: 39 to 49 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 172 to 232 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Viraton and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Viraton

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess over pedisediment over residuum weathered from limestone

Typical profile

Ap - 0 to 6 inches: silt loam
Bt1 - 6 to 21 inches: silt loam
2Btx - 21 to 30 inches: very gravelly silty clay loam
3Bt2 - 30 to 79 inches: gravelly clay

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 18 to 33 inches to fragipan
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 15 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: F116AY004MO - Fragipan Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Bado

Percent of map unit: 3 percent
Landform: Depressions
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F116AY066MO - Fragipan Upland Flatwoods
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

Lowassie

Percent of map unit: 2 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

73051—Winnipeg silt loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2qpg8
Elevation: 790 to 1,500 feet
Mean annual precipitation: 39 to 49 inches

Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 172 to 232 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Winnipeg and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Winnipeg

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Silty slope alluvium over gravelly slope alluvium

Typical profile

Ap - 0 to 6 inches: silt loam
Bt1 - 6 to 16 inches: silt loam
Bt2 - 16 to 44 inches: silty clay loam
2Bt3 - 44 to 79 inches: gravelly silty clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F116AY032MO - Loamy Footslope Forest
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Viraton

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116AY004MO - Fragipan Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)

Hydric soil rating: No

Pomme

Percent of map unit: 5 percent
Landform: Strath terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F116AY032MO - Loamy Footslope Forest
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Splitlimb

Percent of map unit: 5 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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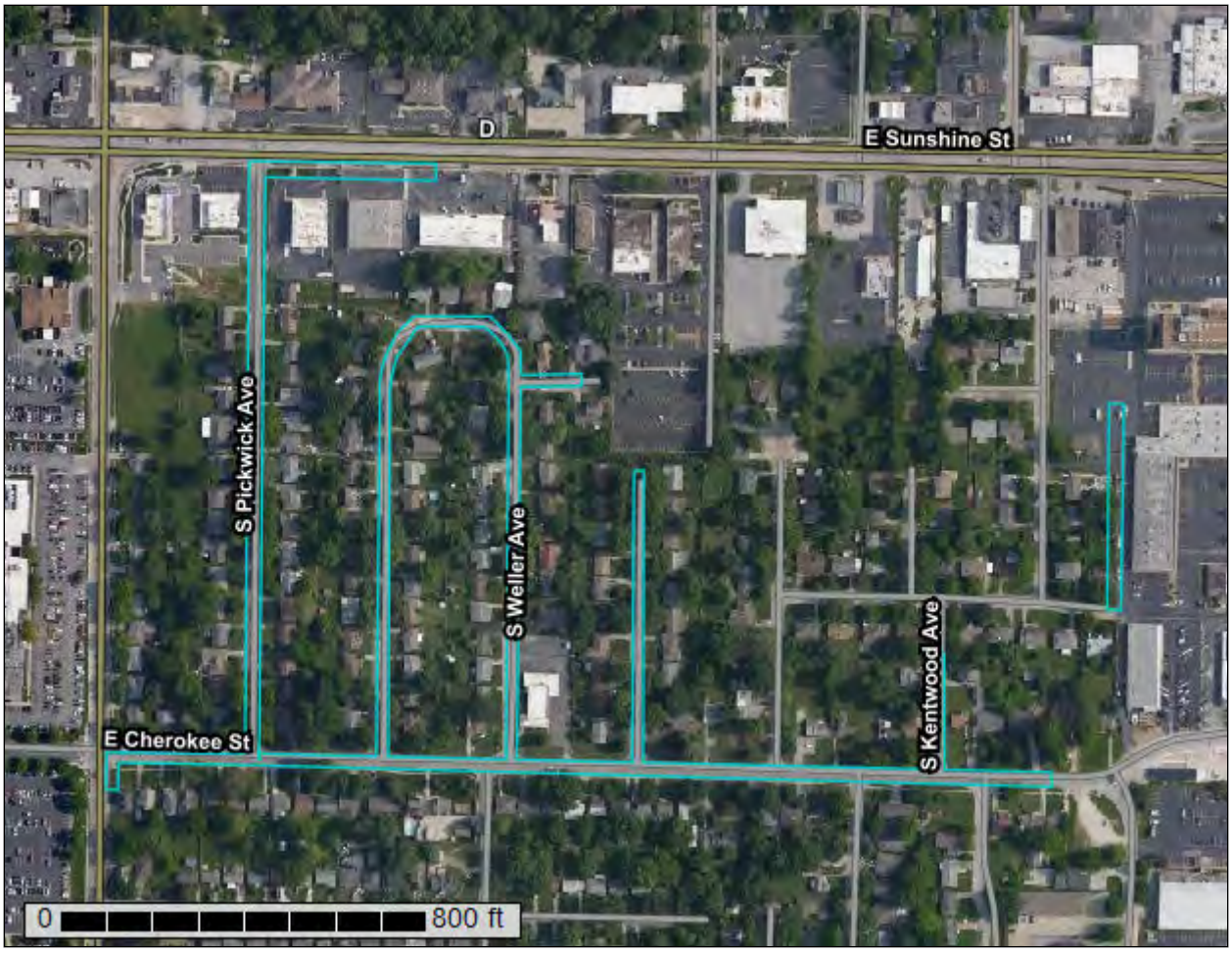
Custom Soil Resource Report for Greene County, Missouri

Segment H



October 18, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:3,740 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 50, 100, 200, 300

Feet: 0, 150, 300, 600, 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Greene County, Missouri
Survey Area Data: Version 29, Aug 22, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 17, 2019—Aug 12, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
70006	Creldon silt loam, 1 to 3 percent slopes	4.8	100.0%
Totals for Area of Interest		**4.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Greene County, Missouri

70006—Creldon silt loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2qpbg
Elevation: 800 to 1,500 feet
Mean annual precipitation: 41 to 45 inches
Mean annual air temperature: 55 to 57 degrees F
Frost-free period: 194 to 221 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Creldon and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Creldon

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess over pedisediment over residuum weathered from limestone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt1 - 10 to 16 inches: silty clay loam
Bt2 - 16 to 24 inches: silty clay loam
2Btx1 - 24 to 42 inches: gravelly silt loam
2Btx2 - 42 to 51 inches: extremely cobbly silt loam
3Bt3 - 51 to 79 inches: clay

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: 20 to 35 inches to fragipan
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R116BY021MO - Chert Upland Prairie
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)

Hydric soil rating: No

Minor Components

Keeno

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R116BY021MO - Chert Upland Prairie
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

Sacville

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY005MO - Wet Footslope Savanna
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: Yes

Lowassie

Percent of map unit: 2 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

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Appendix G

Cultural Resources

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF STATE PARKS

STATE HISTORIC PRESERVATION OFFICE REVIEW AND COMPLIANCE INFORMATION FORM (PAGE 1 OF 3)

FOR SHPO USE ONLY	
SHPO PROJECT NUMBER	SHPO LOG NUMBER

Have you ever served on active duty in the Armed Forces of the United States and separated from such service under conditions other than dishonorable? ❑ YES ❑ NO

Submit one application for each project for which comment is requested. Consult the *Instructions for Completion of the Review and Compliance Information Form* when completing this application. Submission of a completed Review and Compliance Information Form with adequate information and attachments constitutes a request for review pursuant to Section 106 or 110 of the National Historic Preservation Act of 1966 (as amended). We reserve the right to request more information. **Please refer to the CHECKLIST on Page 3 to ensure that all basic information relevant to the project has been included.** For further information, refer to our website at *http://mostateparks.com/shpo* and follow the links to Section 106 Review.

NOTE: Section 106 regulations provide for a 30-day response time by the Missouri State Historic Preservation Office from the date of receipt.

I. REVIEW TYPE

■ Section 106 ❑ Section 110 ❑ Courtesy Review

II. SUBMISSION TYPE

■ New Submission ❑ Existing Project (Provide Existing Project Number)

Does this submission include a cultural resource investigation report? ❑ YES ■ NO
(If yes, you must include a *Cultural Resource Investigation Report Form*)

Does this submission include architectural plans and/or construction documents (If yes, include them in your submission)? ❑ YES ■ NO

Is this submission related to a programmatic agreement (PA) or memorandum of agreement (MOA)? ❑ YES ■ NO

If yes, provide PA or MOA Draft number _____or MOA or PA Mitigation Stipulation number _____

III. PROJECT INFORMATION

PROJECT NAME (include any agency assigned project numbers and please do not include applicants' names)
PHMSA Pipeline Replacement Project in the City of Springfield, Greene County, Missouri

PROJECT DESCRIPTION (additional information may be provided in separate sheets)
The Undertaking will replace 14 miles, approximately 74,000 linear feet (LF) of the legacy PE pipe and approximately 1,150 LF legacy PE gas services and meter sets associated with those gas mains. Cut and cover (trenching) and directional drilling will be utilized to work around other infrastructure such as storm sewer, to avoid tree root areas, and under paved areas to avoid costly pavement replacement. See consultation letter.

IV. PROJECT LOCATION

STREET ADDRESS
Various, see consultation letter.

CITY	STATE	ZIP
Springfield	MO	65800

COUNTY	LATITUDE/LONGITUDE	SECTION	TOWNSHIP	RANGE
Greene	Various	5th Principal Mer	Various	Various

V. PROJECT CONTACT INFORMATION

PROJECT CONTACT NAME	PROJECT CONTACT ORGANIZATION
Kathering Giraldo	U.S Department of Transportation
PROJECT CONTACT EMAIL	PHONE (EXT.)
k.giraldo@dot.gov	857-320-1359

STREET ADDRESS
220 Binney Street

CITY	STATE	ZIP
Cambridge	MA	02142

VI. FEDERAL INVOLVEMENT

Does this project involve approval, funding, permit, or license from a federal agency or involve federal land or property? ■ YES (Please complete this section) ❑ NO (Skip to next section)

FEDERAL AGENCY	FEDERAL PROGRAM, FUNDING, OR PERMIT TYPE
CHOOSE ONE	Natural Gas Distribution Infrastructure Safety a

FEDERAL AGENCY CONTACT PERSON	EMAIL	PHONE
Kathering Giraldo	k.giraldo@dot.gov	(857) 320-1359

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF STATE PARKS

STATE HISTORIC PRESERVATION OFFICE REVIEW AND COMPLIANCE INFORMATION FORM (PAGE 2 OF 3)

VII. CONTACTS FOR CC (please indicate all individuals to Cc for SHPO response letter)

CONTACT NAME	ORGANIZATION	EMAIL
CONTACT NAME	ORGANIZATION	EMAIL
CONTACT NAME	ORGANIZATION	EMAIL

VIII. IDENTIFICATION OF HISTORIC PROPERTIES: ARCHAEOLOGY

Does this project involve ground-disturbing activity (including staging and borrow areas)? ■ YES (Please complete this section) ❑ NO ❑ WILL SUBMIT LATER

DESCRIBE THE NATURE OF GROUND-DISTURBING ACTIVITY, INCLUDING BUT NOT LIMITED TO DEPTH, WIDTH, AND LENGTH

The replacement gas lines will be installed at a depth of 42 in. plus pipe diameter below grade. Gas services will be replaced by insertion method so the only disturbance will be entrance and exit holes. See consultation letter.

DESCRIBE THE PREVIOUS AND CURRENT LAND USE, CONDITIONS, AND DISTURBANCES

Urban land with considerable development for residential and commercial purposes.

Will the project require fill material? ❑ YES (If yes, indicate borrow areas on project area map) ■ NO

Are you aware of archaeological sites on or adjacent to the project area? ■ YES (If yes, indicate all archaeological sites on project area map) ❑ NO

IX. IDENTIFICATION OF HISTORIC PROPERTIES: BUILDINGS AND STRUCTURES

Does the project area or APE include buildings, structures, objects, or designed landscape features (such as parks or cemeteries)? ❑ YES (Please complete this section and provide a map showing resource locations) ■ NO (Skip to next section)

ADDRESS AND RESOURCE NAME OR NUMBER	DATE OF CONSTRUCTION	DATES OF ADDITIONS

If there are more resources include a separate page identifying this information.

Is the project area or APE within or adjacent to a property or district that is listed in or eligible for listing in the National Register of Historic Places? ❑ YES _____ ■ NO ❑ UNKNOWN

X. DETERMINATION OF EFFECT

❑ No Historic Properties Affected

❑ Historic Properties Will Be Affected and the Project Will (Check One):

■ Have **NO ADVERSE EFFECT** on Historic Properties within the area of potential effects (APE).

❑ Have an **ADVERSE EFFECT** on One or More Historic Properties in the APE and the Federal Agency, or Federally Authorized Representative, will Consult with the SHPO and Other Parties to Resolve the Adverse Effect Under CFR 800.6.

BASIS FOR DETERMINATION OF EFFECT

Project work is limited to the replacement of existing pipelines in areas that demonstrate a low probability for intact significant archaeological resources and areas where the probability is higher will be avoided completely. The Undertaking will not result in lasting physical, visual, or audible effects to NRHP-listed historic properties.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF STATE PARKS

STATE HISTORIC PRESERVATION OFFICE
REVIEW AND COMPLIANCE INFORMATION FORM (PAGE 3 OF 3)

XI. ADDITIONAL REQUIREMENTS

Map Requirements: Attach a map depicting the project area, and, if necessary, a large scale project map. If project involves ground disturbance, the project footprint must be clearly delineated on the map. Please do not send an individual map with each structure or site. While a topographic map is preferred, other styles of maps are acceptable.

Photography requirements: Recent photographs of the complete exterior elevations of the building(s). **Good quality photographs are important for expeditious project review.** Our office does not accept images from online image servers (e.g., Google Earth or Maps) due to the time elapsed between the image capture and the project date. Photographs of neighboring or nearby buildings should also be submitted. All photographs should be labeled and keyed to a map of the project area. Images should be at a minimum of 300 pixels per inch or 1200 x 1800 pixels. Please provide clear recent photographs to aid in the assessment of effects for this project.

CHECKLIST: DID YOU PROVIDE THE FOLLOWING INFORMATION?

- ■ Project area map (per project, not structure)
- ■ Thorough project description detailing all aspects of project
- ■ Photographs of all structures and overview photographs for archaeology (Note: all photographs should be labeled and keyed to one map of the project area)
- ❑ Other supporting documents (if necessary to explain the document)
- ❑ For new construction, rehabilitations, etc., attach work write-ups, plans, drawings, etc.
- ❑ Dates of construction of structures in project area

Return this form and attachments to: MOSection106@dnr.mo.gov with the following subject heading format: "Review Request – (SHPO Project Number (if previously assigned), Project Title and/or Address)." Please note that our system cannot receive emails exceeding 10 MB in size. If your submission contains large files, you may provide this information to our office via a large-file transfer service such as your organization's FTP system, Dropbox, Google Drive, etc. If your organization does not have access to a large-file transfer service you may request that SHPO sends you an FTP upload request from the State of Missouri system by checking the box below:

❑ APPLICANT IS REQUESTING AN FTP UPLOAD LINK BE SENT TO THE FOLLOWING EMAIL ADDRESS

FOR SHPO USE ONLY

REVIEWER 1 NAME	DATE
REVIEWER 2 NAME	DATE
SURVEY ACREAGE	
NUMBER OF ELIGIBLE PROPERTIES	
NUMBER OF NOT ELIGIBLE PROPERTIES	

ARCHAEOLOGY REVIEW DETERMINATION

❑ NHPA	❑ More Info	❑ Survey	❑ PA	❑ Other:
❑ NAE	❑ NRN	❑ Monitor	❑ ATF	
❑ AE	❑ Email	❑ MOA	❑ Continue to Consult	

ARCHITECTURE REVIEW DETERMINATION:

❑ NHPA	❑ More Info	❑ Survey	❑ PA	❑ Other:
❑ NAE	❑ NRN	❑ Monitor	❑ ATF	
❑ AE	❑ Email	❑ MOA	❑ Continue to Consult	

STAFF COMMENTS

U.S. Department
of Transportation
Pipeline and Hazardous Materials Safety Administration

1200 New Jersey Avenue, SE
Washington, DC 20590

January 4, 2024

Dr. Toni M. Prawl
Deputy
State Historic Preservation Office
P.O. Box 176
Jefferson City, MO 65102

Section 106 Consultation: PHMSA Pipeline Replacement Project in the City of Springfield, Greene County, Missouri
Grant Recipient: City Utilities of Springfield (CUS)
Project Location: City of Springfield, Greene County, Missouri

Dear Dr. Prawl:

The Pipeline and Hazardous Materials Safety Administration (PHMSA) provides funds authorized under the Natural Gas Distribution Infrastructure Safety and Modernization Grant Program. PHMSA proposes to provide funds to the City Utilities of Springfield (Grant Recipient) for the replacement of pipeline (Undertaking). PHMSA is initiating consultation for the above referenced Undertaking in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and the associated implementing regulations, 36 CFR Part 800 (Section 106).

Project Description/Background

The Grant Recipient currently has approximately 500 miles of polyethylene (PE) gas pipeline in their system. The legacy PE gas pipelines were installed between 1968 and 1999. The materials for much of the existing infrastructure of this project need to be replaced to maintain their safe operation because they are leak prone pipelines.

The Undertaking will replace 14 miles, approximately 74,000 linear feet (LF) of the legacy PE pipe and approximately 1,150 LF legacy PE gas services and meter sets associated with those gas mains. Cut and cover (trenching) and directional drilling will be utilized to work around other infrastructure such as storm sewer, to avoid tree root areas, and under paved areas to avoid costly pavement replacement. Additionally, the Grant Recipient may bore in areas where horizontal directional drilling will cause less disturbances and will be more efficient. Insertion installation methods will primarily be used on gas service replacements.

The Undertaking is divided into five segments:

Segment A - North-central Springfield residential area.
Segment B - North-central Springfield residential area.
Segment C - North-central Springfield residential area.
Segment E1/E2 - West-central Springfield residential area.
Segment H- South-central Springfield residential area.

Work will take place within the existing right-of-way (ROW). However, gas services may be located within vegetated areas outside of the ROW, in which case the insertion method will be utilized, as determined by the openness of the available corridor within the ROW. The staging areas for the project have not been identified. Project location maps are enclosed in **Attachment A**. Photographs showing the overall character of the project areas are included in **Attachment B**.

The existing pipelines being replaced are between 1 ¼ to 6 inches in diameter and the gas service lines range in size from ¾ to 2 inches in diameter and will be replaced with equivalent or smaller diameters. While the pipe alignment has not been determined, the side of road will be determined by the clearest available alignment within the corridor. Gas services will be replaced by insertion method. The existing pipelines will be abandoned in place. Abandonment of the existing pipeline (versus excavation and removal) will minimize ground disturbance and facilitate the replacement process in a more efficient manner. The replacement gas lines will be installed at a depth of 42 in. plus pipe diameter below grade unless another utility is crossed.

Area of Potential Effects (APE)

Pursuant to 36 CFR 800.4(a)(1), the Area of Potential Effects (APE) is defined as the geographic area(s) within which the Undertaking may directly or indirectly affect historic resources. Due to the scale and nature of the Undertaking, PHMSA has delineated the APE for this Undertaking to encompass the existing ROW and the adjacent parcels, which include the limits of disturbance, staging and access areas, and the limits of any potential vibration effects. The adjacent parcels are included in the APE because gas service lines will be connected to houses along the main pipeline. The APE extends to the depth of proposed ground disturbance of up to 42 in. plus pipe diameter below grade. The Undertaking does not have the potential to cause visual or audible effects after the completion of construction. The existing ROW encompasses various roads, signage, sidewalks, and grassy areas throughout the City of Springfield, Missouri. The APE is shown on the maps in **Attachment A**.

Identification and Evaluation

To identify historic properties in the APE, U.S. Department of Transportation (U.S. DOT) staff who meet the Secretary of the Interior's (SOI) Professional Qualification Standards reviewed available information on previously identified historic properties in the APE, including the National Register of Historic Places (NRHP) database, data gathered from the Missouri Department of Natural Resources, historic topographic maps and historic aerial photographs. U.S. DOT staff also conducted research to determine if there are any previously unidentified properties within the APE that are 45 years of age or older and may be eligible for the NRHP.

Historic Architecture

There are no NRHP-listed above-ground resources within the APE. There are also no above-ground resources that have been previously determined eligible within the APE. Due to the scale and nature of the Undertaking, which is limited to the replacement of gas main pipelines within existing ROW and insertion of services in most areas, the identification effort for previously unidentified above-ground historic properties focused on identifying properties that are susceptible to the vibration effects of pipeline replacement and could experience diminished integrity as a result of the Undertaking. A review of the APE found no additional above-ground resources that have the potential to be affected by the Undertaking.

Archaeology

Missouri's archeological site file database, Missouri Department of Natural Resources Archaeology Viewer, was examined to identify the presence of previously recorded archeological sites and previously conducted archeological surveys within the APE. Per Missouri state standards and guidelines, a one-mile search radius was also examined for previously recorded archeological sites and surveys (Table 1). Within

one mile of the APE, 52 archeological surveys have been conducted and 10 archeological sites that are listed, or may be eligible for listing in, the NRHP have been recorded.

Table 1. Previously Recorded Archeological Sites within One Mile of the APE

Archeological Site	Site Type	NRHP Eligibility	Distance from APE
23GR63	Precontact habitation	Unknown	1,750 feet
23GR297	**Precontact lithic scatter, historic musket ball**	**Unknown**	**Within APE**
23GR325	**Precontact habitation**	**Unknown**	**Within APE**
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23GR429	Precontact lithic scatter	Unknown	3,500 feet
23GR430	Precontact lithic scatter	Unknown	3,800 feet
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23GR433	Historic (unknown type)	Unknown	4,900 feet
23GR1000	Historic artifact scatter	Eligible	3,600 feet
23GR2025	Precontact lithic scatter and historic artifact scatter	Unknown	2,400 feet

***Bold entries note sites within the APE**

Three of the 52 previous surveys were identified as intersecting the APE. In 1978, the SMSU Center for Archaeological Research conducted a survey for the Federal Housing Authority. The survey intersects Segment E of the APE. In 2016, a survey was conducted by K & K Environmental, LLC for a communication tower. This survey intersects Segment A. In 2020, a survey was conducted for resurfacing and ADA improvements to roadways for the Federal Highway Administration. This survey intersects Segments B and H of the APE. Two previously recorded archeological sites (23GR297 and 23GR325) are within the APE. Both sites are located at Segment E of the APE. Site 23GR297 was recorded as a precontact lithic scatter and musket ball. The NRHP eligibility of the site is unknown and the Missouri site file database notes that the location may not be accurate. Site 23GR325 was recorded as a precontact lithic tool. The NRHP eligibility of the site is also unknown.

Project work in Segment A near archaeological site 23GR297 includes renewal of a gas main within the ROW along W Mount Vernon Street. Gas services will be inserted on the north side of Mt Vernon Street, completely avoiding site 23GR297, which is located north of the work being done in this area. Furthermore, notes will be added to the design plans to require renewal of the services at 2115-2145 W Mt Vernon Street via insertion. There is no work taking place within S Park Avenue or W Elm Street, which are adjacent to site 23GR297.

Project work in Segment E near archaeological site 23GR325 includes renewal of a gas main within the ROW of W Mount Vernon Street and on private property south of Mt Vernon Street to serve 1816, 1820, and 1820-A W Mount Vernon Street. Renewal of these sections of main will be contained within existing ROW and within existing utility easement, with no gas service replacements and thus no disturbance outside of the road. There is no work occurring within S Lafontaine Avenue or S Wabash Avenue adjacent to site 23GR325.

An examination of Web Soil Survey data within the APE reveals ten soil classes (Table 2). Well drained and moderately well drained soils can be indicative of human habitation during both the pre-contact and historic periods. Well drained soils within the APE include Goss, Winnipeg, Grandgulf, and Goss-Wilderness types. Typically slopes greater than 15 percent are not suitable for human occupation, and soil types within the APE are all at or below 15 percent slope. The composition of soils within the APE indicates suitable conditions for human habitation in both the pre-contact and historic periods. Proximity to major

waterways generally indicates a suitable environment for both precontact and historic human activity. Topographic maps indicate that the APE is located close to Jordan Creek, which connects to the James River 11 miles south of Springfield, Missouri.

Table 2. Soil Types within the APE

Map Unit Name	Drainage Class	Slope	Percent of APE
Hepler silt loam, occasionally flooded	Somewhat poorly drained	0-2 %	2.40%
Creldon silt loam	Moderately well drained	1-3 %	10.50%
Goss gravelly silt loam	Well drained	8-15 %	10.30%
Creldon silt loam, karst	Moderately well drained	1-3 %	0.00%
Viraton silt loam	Moderately well drained	2-5 %	51.50%
Wilderness gravelly silt loam	Moderately well drained	3-8 %	3.70%
Winnipeg silt loam	Well drained	2-5 %	8.20%
Splitlimb silt loam, frequently ponded	Somewhat poorly drained	0-3 %	0.00%
Grandgulf silt loam, rarely ponded	Well drained	1-3 %	3.40%
Goss-Wilderness complex	Well drained	3-8 %	9.90%

Historic topographic maps from 1884, 1935, and 1960 and historic aerial photographs from 1959 were examined for archeological resource potential within the APE. The presence of structures on historic maps and aerial photography may indicate the likelihood of historic period archeological deposits associated with the occupation of structures within the APE. Historic maps and aerial photography may also illustrate land use of the APE historically. The APE is comprised of the urban, historic town center of Springfield. A topographic map from 1884 shows Segment A and B as located within a dense cluster of streets in what was then the epicenter of Springfield. The 1935 topographic map shows considerable development in contrast to the 1884 map, with all five segments located in urban areas. Additionally, the 1960 topographic map shows greater development and additional details such as two churches and two schools within Segment A of the APE, one church at Segment B, one school at Segment C, one school at Segment E, and a school and church at Segment H. Historic aerial imagery shows the APE as largely developed for residential and commercial purposes. Historic topographic maps and the Find a Grave online database were also examined to identify any known historic cemeteries within the APE. No known cemeteries were encountered.

Background research revealed 10 archeological sites and 52 surveys within a mile of the APE. Within the APE, two archeological sites and three surveys were identified. Examination of soils within the APE indicates suitable conditions for human habitation, and a review of historic maps and photographs reveal the APE has been heavily developed with residential and commercial areas, as well as churches and municipal buildings. While these factors may indicate the presence of potential archeological deposits, it is unlikely that archeological deposits would contain the subsurface integrity needed for NRHP consideration due to the heavily modified nature of the APE.

Determination of Effect

Based on the aforementioned identification and evaluation, PHMSA has determined that there are two historic properties as defined in 36 CFR 800.16(l) within the APE: site 23GR325 and site 23GR297.

Most of the project work will be limited to the existing ROW, except in areas where work within vegetated areas outside of the ROW is needed, in which case the insertion method will be utilized. No work is occurring near sites 23GR325 and 23GR297; they will be completely avoided. Work is expected to mainly take place under paved surfaces, and no character-defining historic materials or features will be removed or disturbed because of the Undertaking.

Project work is limited to the replacement of existing pipelines in areas that demonstrate a low probability for intact significant archaeological resources and areas where the probability is higher will be avoided completely. The Undertaking will not result in lasting physical, visual, or audible effects to NRHP-listed historic properties. The Undertaking also does not include land acquisition, nor would it limit access to or change the use of any of the historic properties identified above.

While the exact staging areas for the Undertaking are currently unknown, staging should be confined to paved areas; if staging cannot be confined to paved areas, geotextile fabric or other similar protective measures (such as pressure distributing mats) must be laid in any affected unpaved area to minimize ground disturbance, prevent soil compaction, and protect archaeological features and artifacts.

In accordance with 36 CFR Part 800.5, PHMSA has determined the Undertaking will have No Adverse Effect on historic properties.

Consulting Party Outreach

PHMSA identified parties that may be interested in the Project and its effects on historic properties. PHMSA invites the individuals/organizations copied on this letter to participate as Section 106 consulting parties. Invited parties should indicate their willingness to participate as a consulting party and provide comments on the enclosed form (**Attachment C**) within 30 calendar days from the date on this letter. Note that a non-response is considered to be a declination to participate; however, interested parties can request to join consultation at any time in the process. If any invited party expresses concern about the Project's potential effects to historic properties, PHMSA will consult with the party to resolve those concerns prior to project implementation.

PHMSA will also invite the following federally recognized tribes to participate in consultation by separate letter:

- Apache Tribe of Oklahoma
- Cherokee Nation
- Delaware Nation, Oklahoma
- Delaware Tribe of Indians
- Osage Nation
- Seneca-Cayuga Nation

Request for Section 106 Concurrence

Based on the information presented above, PHMSA has determined that the Undertaking will result in No Adverse Effect to properties that are either in, or eligible for inclusion in, the NRHP. PHMSA is submitting this Undertaking to your office for your review and comment. PHMSA requests your concurrence with this determination of effect within 30 calendar days of the date of this letter. Should you need additional information please contact Kat Giraldo, Section 106 specialist, at PHMSASection106@dot.gov or 857-320-1359.

Sincerely,

Matt Fuller
Senior Environmental Protection Specialist

MF/kg

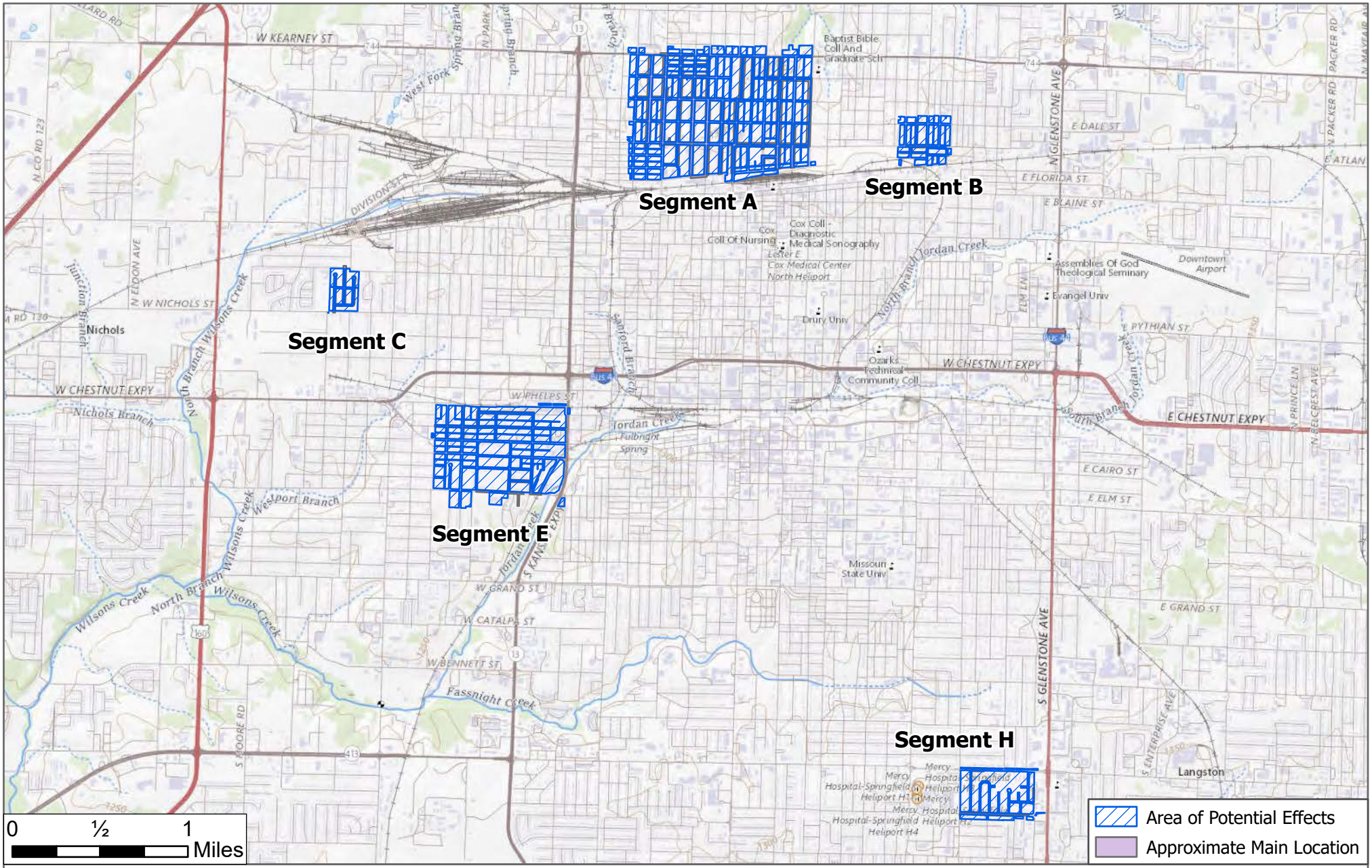
cc: Elizabeth Williams, Environmental Protection Specialist, USDOT Volpe Center
Susan Anderson, PHMSA Grant Specialist
Casey Haynes, City Utilities of Springfield
Greene County Historical Society

Enclosures:
Attachment A: Project Location and APE Maps
Attachment B: Project Area Photographs
Attachment C: Consulting Party Response Form

ATTACHMENT A

Project Location and APE Maps

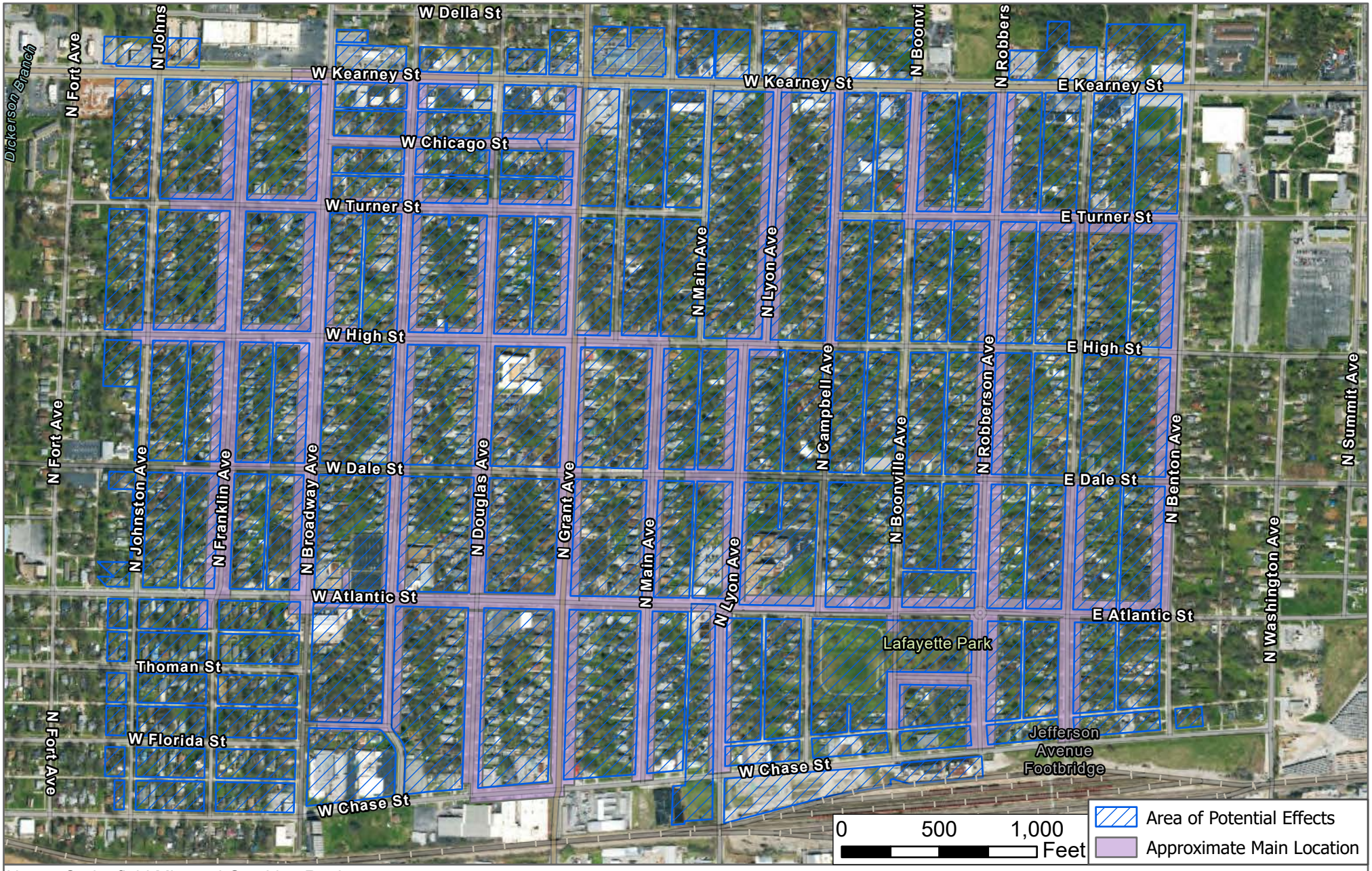
Area of Potential Effects Map



Name: Springfield Missouri Gas Line Replacement
Scale: 47,000
Total Acreage: 672
USGS Basemap: Palmyra
Springfield, MO, Greene County

Service Layer Credits: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed April, 2023.

Area of Potential Effects Map

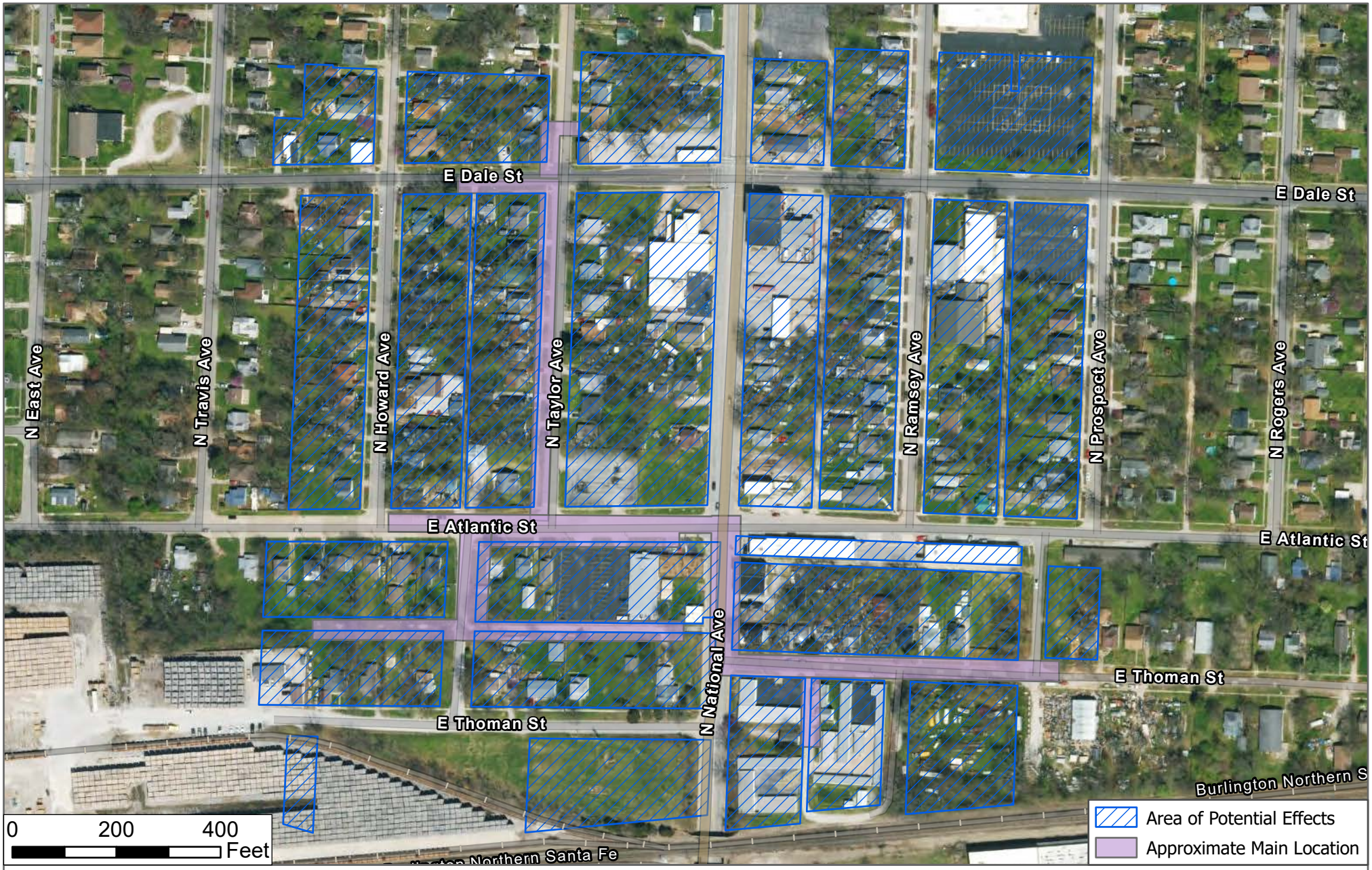


Name: Springfield Missouri Gas Line Replacement
Scale: 8,000
Total Acreage: 672
Springfield, MO, Greene County
Segment A

N

Service Layer Credits: Esri Community Maps Contributors, County of Greene, Missouri Dept. of Conservation, Missouri DNR, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, State of Missouri, Maxar

Area of Potential Effects Map



Name: Springfield Missouri Gas Line Replacement
Scale: 3,000
Total Acreage: 672
Springfield, MO, Greene County
Segment B

N

Service Layer Credits: Esri Community Maps Contributors, County of Greene, Missouri Dept. of Conservation, Missouri DNR, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, State of Missouri, Maxar, Microsoft

Area of Potential Effects Map

Name: Springfield Missouri Gas Line Replacement
Scale: 3,000
Total Acreage: 672
Springfield, MO, Greene County
Segment C

N

Service Layer Credits: Esri Community Maps Contributors, County of Greene, Missouri Dept. of Conservation, Missouri DNR, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, State of Missouri, Maxar, Microsoft

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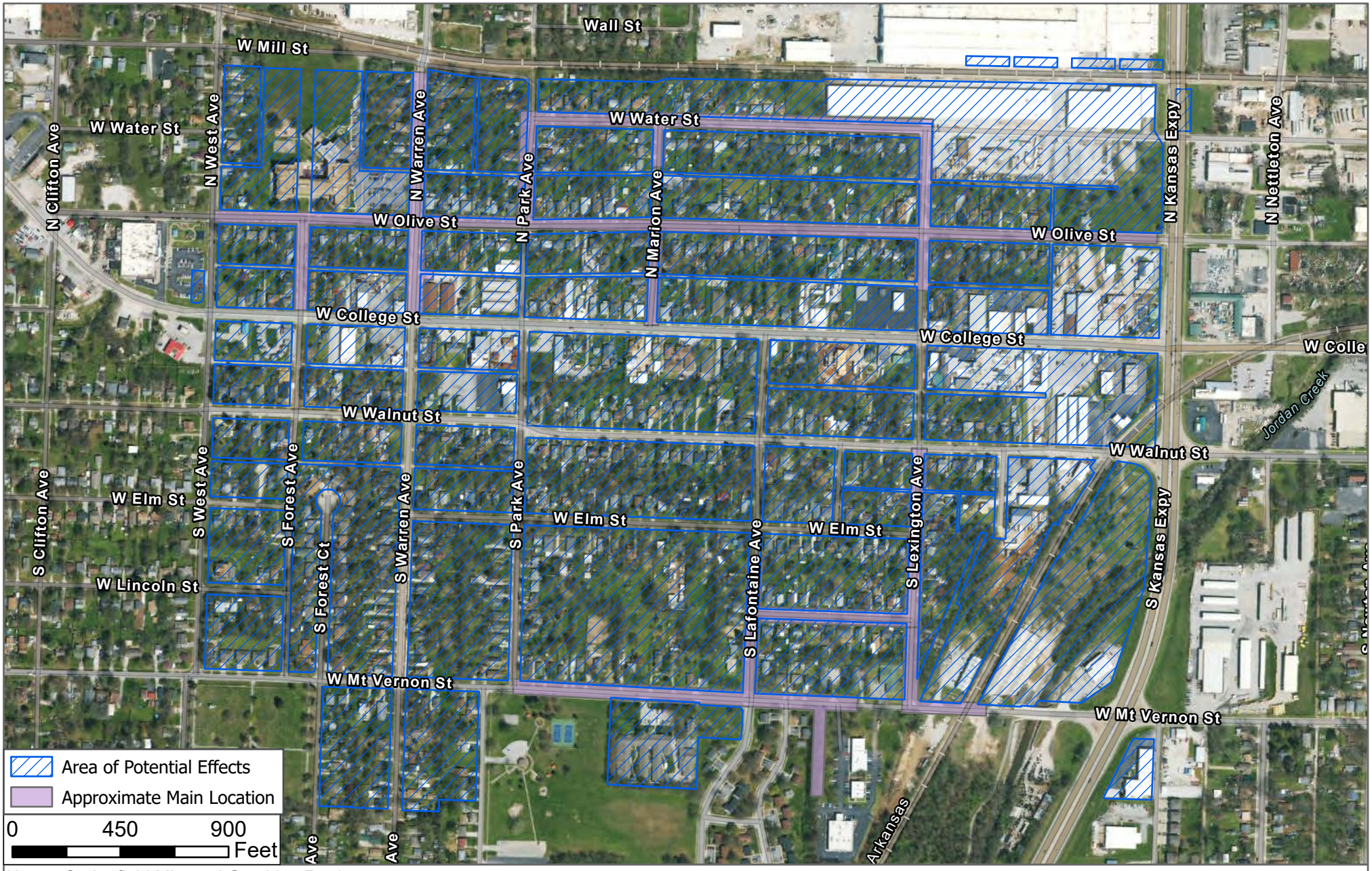

Name: Springfield Missouri Gas Line Replacement
Scale: 6,500
Total Acreage: 672
Springfield, MO, Greene County
Segment E

N

Service Layer Credits: Esri Community Maps Contributors, County of Greene, Missouri Dept. of Conservation, Missouri DNR, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, State of Missouri, Maxar

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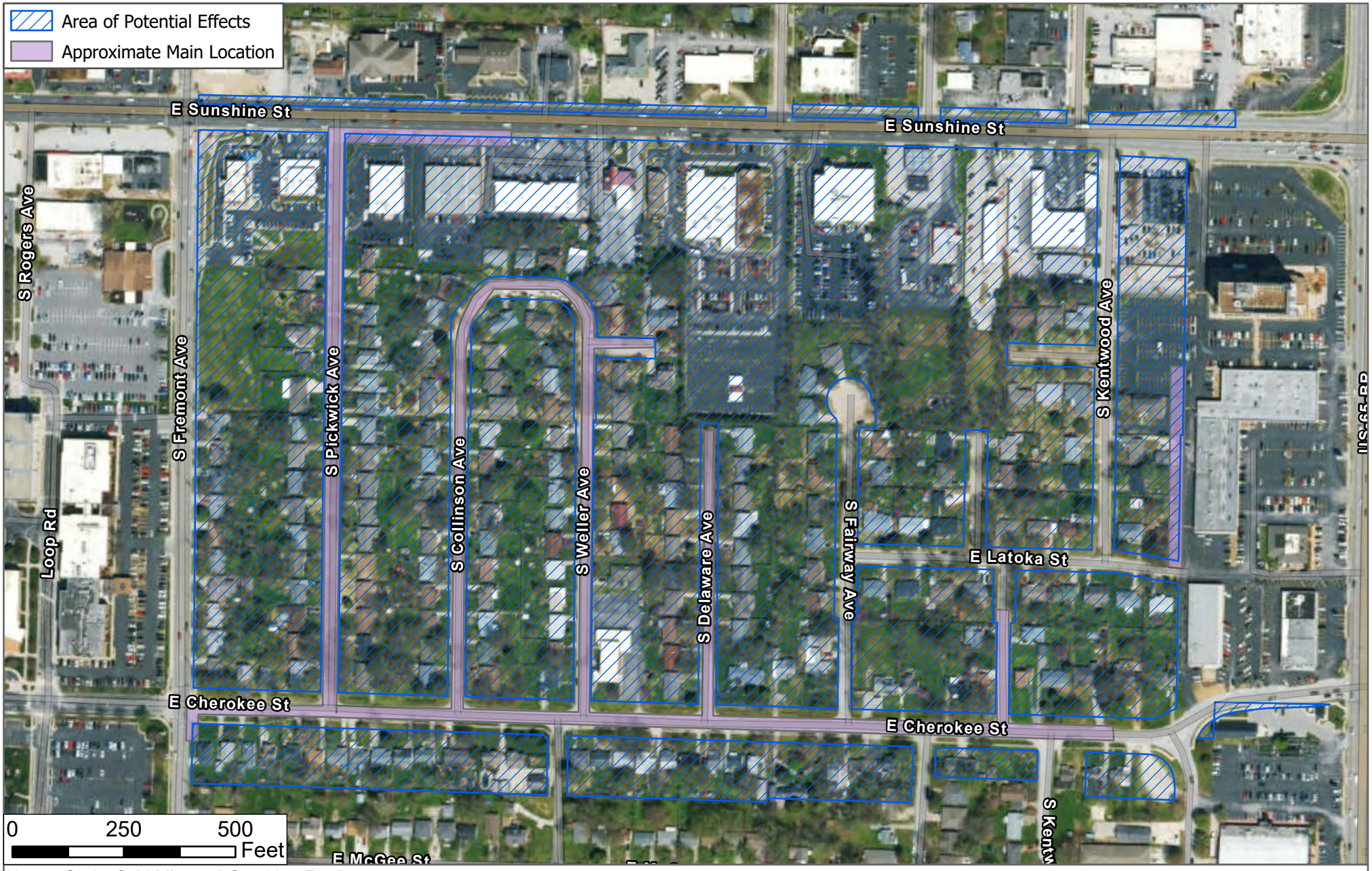

Name: Springfield Missouri Gas Line Replacement
Scale: 3,500
Total Acreage: 672
Springfield, MO, Greene County
Segment H

N

Service Layer Credits: Esri Community Maps Contributors, County of Greene, Missouri Dept. of Conservation, Missouri DNR, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, State of Missouri, Maxar

ATTACHMENT B

Project Area Photographs

Segment A - 1

Segment A - 2

Segment A - 3

Segment A - 4

Segment A - 5

Segment A - 6

Segment A - 7

Segment A - 8

Segment A - 9

Segment A - 10

Segment A - 11

Segment A - 12

Segment A - 13

Segment A - 14

Segment A - 15

Segment A - 16

Segment B - 1

Segment B - 2

Segment B - 3

Segment B - 4

Segment B - 5

Segment B - 6


Segment C – 1

Segment C – 2

Segment C – 3

Segment C – 4

Segment C – 5

Segment C – 6

Segment E1 - 1

Segment E1 - 2

Segment E1 - 3

Segment E1 - 4

Segment E1 - 5

Segment E1 - 6

Segment E1 - 7

Segment E1 – 8

Segment E2 - 1

Segment E2 - 2

Segment E2 - 3

Segment E2 - 4

Segment E2 - 5

Segment H - 1

Segment H - 2

Segment H - 3

Segment H - 4

Segment H - 5

Segment H - 6

Segment H - 7

ATTACHMENT C

Consulting Party Response Form

Section 106 Consulting Party Response Form

Pipeline and Hazardous Materials Safety Administration (PHMSA)

Natural Gas Distribution Infrastructure Safety and Modernization Grant Program

Project Name/Location:

Date: _____

Organization: _____

Name: _____

Affiliation: _____

Address: _____

_____

_____

Phone Number: _____

E-mail: _____

Please check one of the following:

○ **Yes,** I, or my organization, would like to participate in consultation on the project's potential effects to historic properties. I, or my organization, has a legal or economic relation to the project or affected properties or have a concern with the project's effects on historic properties.

○ **No,** I, or my organization, do(es) not wish to participate as a consulting party for the project.

Do you know of any other potential consulting parties that should be contacted? If so, please list the name, email, or other contact information below.

_____

_____

_____

Comments: _____

_____

_____

_____

Please return by:

Please return to: Kathering Giraldo
USDOT Volpe Center
220 Binney Street
Cambridge, MA 02142
E-mail: PHMSASection106@dot.gov

U.S. Department
of Transportation
**Pipeline and Hazardous
Materials Safety
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

December 29, 2023

Wamblee Smith
Acting Environmental Director
Apache Tribe of Oklahoma
PO Box 1330
Anadarko, OK 73005

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Project Location: City of Springfield, Greene County, Missouri

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Creldon silt loam, karst	Moderately well drained	1-3 %	0.00%
Viraton silt loam	Moderately well drained	2-5 %	51.50%
Wilderness gravelly silt loam	Moderately well drained	3-8 %	3.70%
Winnipeg silt loam	Well drained	2-5 %	8.20%
Splitlimb silt loam, frequently ponded	Somewhat poorly drained	0-3 %	0.00%
Grandgulf silt loam, rarely ponded	Well drained	1-3 %	3.40%
Goss-Wilderness complex	Well drained	3-8 %	9.90%

Historic topographic maps from 1884, 1935, and 1960 and historic aerial photographs from 1959 were examined for archeological resource potential within the APE. The presence of structures on historic maps and aerial photography may indicate the likelihood of historic period archeological deposits associated with the occupation of structures within the APE. Historic maps and aerial photography may also illustrate land use of the APE historically. The APE is comprised of the urban, historic town center of Springfield. A topographic map from 1884 shows Segment A and B as located within a dense cluster of streets in what was then the epicenter of Springfield. The 1935 topographic map shows considerable development in contrast to the 1884 map, with all five segments located in urban areas. Additionally, the 1960 topographic map shows greater development and additional details such as two churches and two schools within Segment A of the APE, one church at Segment B, one school at Segment C, one school at Segment E, and a school and church at Segment H. Historic aerial imagery shows the APE as largely developed for residential and commercial purposes. Historic topographic maps and the Find a Grave online database were also examined to identify any known historic cemeteries within the APE. No known cemeteries were encountered.

Background research revealed 10 archeological sites and 52 surveys within a mile of the APE. Within the APE, two archeological sites and three surveys were identified. Examination of soils within the APE indicates suitable conditions for human habitation, and a review of historic maps and photographs reveal the APE has been heavily developed with residential and commercial areas, as well as churches and municipal buildings. While these factors may indicate the presence of potential archeological deposits, it is unlikely that archeological deposits would contain the subsurface integrity needed for NRHP consideration due to the heavily modified nature of the APE.

Determination of Effect

Based on the aforementioned identification and evaluation, PHMSA has determined that there are two historic properties as defined in 36 CFR 800.16(l) within the APE: site 23GR325 and site 23GR297.

Most of the project work will be limited to the existing ROW, except in areas where work within vegetated areas outside of the ROW is needed, in which case the insertion method will be utilized. No work is occurring near sites 23GR325 and 23GR297; they will be completely avoided. Work is expected to mainly take place under paved surfaces, and no character-defining historic materials or features will be removed or disturbed because of the Undertaking.

Project work is limited to the replacement of existing pipelines in areas that demonstrate a low probability for intact significant archaeological resources and areas where the probability is higher will be avoided completely. The Undertaking will not result in lasting physical, visual, or audible effects to NRHP-listed historic properties. The Undertaking also does not include land acquisition, nor would it limit access to or change the use of any of the historic properties identified above.

While the exact staging areas for the Undertaking are currently unknown, staging should be confined to paved areas; if staging cannot be confined to paved areas, geotextile fabric or other similar protective measures (such as pressure distributing mats) must be laid in any affected unpaved area to minimize ground disturbance, prevent soil compaction, and protect archaeological features and artifacts.

In accordance with 36 CFR Part 800.5, PHMSA has determined the Undertaking will have No Adverse Effect on historic properties.

Request for Section 106 Concurrence

PHMSA requests that you provide any information you have regarding historic properties of religious or cultural significance to your Tribe/Nation that may be present in the APE and affected by the Undertaking. If your Tribe/Nation is unaware of any historic properties beyond what we have identified to date, PHMSA is notifying your Tribe/Nation of our intention to make a No Adverse Effect to Historic Properties finding. Please notify us within 30 days from the date of receipt of this letter if you have any concerns about the project's effects to historic properties. Should you need additional information please contact Kat Giraldo, Section 106 specialist, at PHMSASection106@dot.gov or 857-320-1359.

Sincerely,

Matt Fuller
Senior Environmental Protection Specialist

MF/kg

cc: Elizabeth Williams, Environmental Protection Specialist, USDOT Volpe Center
Susan Anderson, PHMSA Grant Specialist

Enclosures:
Attachment A: Project Location and APE Maps
Attachment B: Project Area Photographs

U.S. Department
of Transportation
**Pipeline and Hazardous
Materials Safety
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

December 29, 2023

Elizabeth Toombs
Tribal Historic Preservation Officer
Cherokee Nation
PO Box 948
Tahlequah, OK 74465

Section 106 Consultation: PHMSA Pipeline Replacement Project in the City of Springfield, Greene County, Missouri
Grant Recipient: City Utilities of Springfield (CUS)
Project Location: City of Springfield, Greene County, Missouri

Dear Tribal Historic Preservation Officer Toombs:

The Pipeline and Hazardous Materials Safety Administration (PHMSA) provides funds authorized under the Natural Gas Distribution Infrastructure Safety and Modernization Grant Program. PHMSA proposes to provide funds to the City Utilities of Springfield (Grant Recipient) for the replacement of pipeline (Undertaking). PHMSA is initiating consultation for the above referenced Undertaking in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and the associated implementing regulations, 36 CFR Part 800 (Section 106). The purpose of this letter is to initiate Section 106 consultation for the Undertaking to determine if there are historic properties of cultural or religious significance to your Tribe/Nation that may be affected by the Undertaking, to determine if you want to be a consulting party, and to notify your Tribe/Nation of PHMSA's intention to make a finding of No Adverse Effect to Historic Properties. PHMSA is also available for Government-to-Government consultation on this Program.

Project Description/Background

The Grant Recipient currently has approximately 500 miles of polyethylene (PE) gas pipeline in their system. The legacy PE gas pipelines were installed between 1968 and 1999. The materials for much of the existing infrastructure of this project need to be replaced to maintain their safe operation because they are leak prone pipelines.

The Undertaking will replace 14 miles, approximately 74,000 linear feet (LF) of the legacy PE pipe and approximately 1,150 LF legacy PE gas services and meter sets associated with those gas mains. Cut and cover (trenching) and directional drilling will be utilized to work around other infrastructure such as storm sewer, to avoid tree root areas, and under paved areas to avoid costly pavement replacement. Additionally, the Grant Recipient may bore in areas where horizontal directional drilling will cause less disturbances and will be more efficient. Insertion installation methods will primarily be used on gas service replacements.

The Undertaking is divided into five segments:

Segment A - North-central Springfield residential area.

Segment B - North-central Springfield residential area.
Segment C - North-central Springfield residential area.
Segment E1/E2 - West-central Springfield residential area.
Segment H- South-central Springfield residential area.

Work will take place within the existing right-of-way (ROW). However, gas services may be located within vegetated areas outside of the ROW, in which case the insertion method will be utilized, as determined by the openness of the available corridor within the ROW. The staging areas for the project have not been identified. Project location maps are enclosed in **Attachment A**. Photographs showing the overall character of the project areas are included in **Attachment B**.

The existing pipelines being replaced are between 1 ¼ to 6 inches in diameter and the gas service lines range in size from ¾ to 2 inches in diameter and will be replaced with equivalent or smaller diameters. While the pipe alignment has not been determined, the side of road will be determined by the clearest available alignment within the corridor. Gas services will be replaced by insertion method. The existing pipelines will be abandoned in place. Abandonment of the existing pipeline (versus excavation and removal) will minimize ground disturbance and facilitate the replacement process in a more efficient manner. The replacement gas lines will be installed at a depth of 42 in. plus pipe diameter below grade unless another utility is crossed.

Area of Potential Effects (APE)

Pursuant to 36 CFR 800.4(a)(1), the Area of Potential Effects (APE) is defined as the geographic area(s) within which the Undertaking may directly or indirectly affect historic resources. Due to the scale and nature of the Undertaking, PHMSA has delineated the APE for this Undertaking to encompass the existing ROW and the adjacent parcels, which include the limits of disturbance, staging and access areas, and the limits of any potential vibration effects. The adjacent parcels are included in the APE because gas service lines will be connected to houses along the main pipeline. The APE extends to the depth of proposed ground disturbance of up to 42 in. plus pipe diameter below grade. The Undertaking does not have the potential to cause visual or audible effects after the completion of construction. The existing ROW encompasses various roads, signage, sidewalks, and grassy areas throughout the City of Springfield, Missouri. The APE is shown on the maps in **Attachment A**.

Identification and Evaluation

To identify historic properties in the APE, U.S. Department of Transportation (U.S. DOT) staff who meet the Secretary of the Interior's (SOI) Professional Qualification Standards reviewed available information on previously identified historic properties in the APE, including the National Register of Historic Places (NRHP) database, data gathered from the Missouri Department of Natural Resources, historic topographic maps and historic aerial photographs. U.S. DOT staff also conducted research to determine if there are any previously unidentified properties within the APE that are 45 years of age or older and may be eligible for the NRHP.

Historic Architecture

There are no NRHP-listed above-ground resources within the APE. There are also no above-ground resources that have been previously determined eligible within the APE. Due to the scale and nature of the Undertaking, which is limited to the replacement of gas main pipelines within existing ROW and insertion of services in most areas, the identification effort for previously unidentified above-ground historic properties focused on identifying properties that are susceptible to the vibration effects of pipeline replacement and could experience diminished integrity as a result of the Undertaking. A review of the APE found no additional above-ground resources that have the potential to be affected by the Undertaking.

Archaeology

Missouri's archeological site file database, Missouri Department of Natural Resources Archaeology Viewer, was examined to identify the presence of previously recorded archeological sites and previously conducted archeological surveys within the APE. Per Missouri state standards and guidelines, a one-mile search radius was also examined for previously recorded archeological sites and surveys (Table 1). Within one mile of the APE, 52 archeological surveys have been conducted and 10 archeological sites that are listed, or may be eligible for listing in, the NRHP have been recorded.

Table 1. Previously Recorded Archeological Sites within One Mile of the APE

Archeological Site	Site Type	NRHP Eligibility	Distance from APE
23GR63	Precontact habitation	Unknown	1,750 feet
23GR297	**Precontact lithic scatter, historic musket ball**	**Unknown**	**Within APE**
23GR325	**Precontact habitation**	**Unknown**	**Within APE**
23GR428	Precontact lithic scatter	Unknown	3,600 feet
23GR429	Precontact lithic scatter	Unknown	3,500 feet
23GR430	Precontact lithic scatter	Unknown	3,800 feet
23GR432	Precontact lithic scatter	Unknown	4,700 feet
23GR433	Historic (unknown type)	Unknown	4,900 feet
23GR1000	Historic artifact scatter	Eligible	3,600 feet
23GR2025	Precontact lithic scatter and historic artifact scatter	Unknown	2,400 feet

***Bold entries note sites within the APE**

Three of the 52 previous surveys were identified as intersecting the APE. In 1978, the SMSU Center for Archaeological Research conducted a survey for the Federal Housing Authority. The survey intersects Segment E of the APE. In 2016, a survey was conducted by K & K Environmental, LLC for a communication tower. This survey intersects Segment A. In 2020, a survey was conducted for resurfacing and ADA improvements to roadways for the Federal Highway Administration. This survey intersects Segments B and H of the APE. Two previously recorded archeological sites (23GR297 and 23GR325) are within the APE. Both sites are located at Segment E of the APE. Site 23GR297 was recorded as a precontact lithic scatter and musket ball. The NRHP eligibility of the site is unknown and the Missouri site file database notes that the location may not be accurate. Site 23GR325 was recorded as a precontact lithic tool. The NRHP eligibility of the site is also unknown.

Project work in Segment A near archaeological site 23GR297 includes renewal of a gas main within the ROW along W Mount Vernon Street. Gas services will be inserted on the north side of Mt Vernon Street, completely avoiding site 23GR297, which is located north of the work being done in this area. Furthermore, notes will be added to the design plans to require renewal of the services at 2115-2145 W Mt Vernon Street via insertion. There is no work taking place within S Park Avenue or W Elm Street, which are adjacent to site 23GR297.

Project work in Segment E near archaeological site 23GR325 includes renewal of a gas main within the ROW of W Mount Vernon Street and on private property south of Mt Vernon Street to serve 1816, 1820, and 1820-A W Mount Vernon Street. Renewal of these sections of main will be contained within existing ROW and within existing utility easement, with no gas service replacements and thus no disturbance outside of the road. There is no work occurring within S Lafontaine Avenue or S Wabash Avenue adjacent to site 23GR325.

An examination of Web Soil Survey data within the APE reveals ten soil classes (Table 2). Well drained and moderately well drained soils can be indicative of human habitation during both the pre-contact and historic periods. Well drained soils within the APE include Goss, Winnipeg, Grandgulf, and Goss-Wilderness types. Typically slopes greater than 15 percent are not suitable for human occupation, and soil types within the APE are all at or below 15 percent slope. The composition of soils within the APE indicates suitable conditions for human habitation in both the pre-contact and historic periods. Proximity to major waterways generally indicates a suitable environment for both precontact and historic human activity. Topographic maps indicate that the APE is located close to Jordan Creek, which connects to the James River 11 miles south of Springfield, Missouri.

Table 2. Soil Types within the APE

Map Unit Name	Drainage Class	Slope	Percent of APE
Hepler silt loam, occasionally flooded	Somewhat poorly drained	0-2 %	2.40%
Creldon silt loam	Moderately well drained	1-3 %	10.50%
Goss gravelly silt loam	Well drained	8-15 %	10.30%
Creldon silt loam, karst	Moderately well drained	1-3 %	0.00%
Viraton silt loam	Moderately well drained	2-5 %	51.50%
Wilderness gravelly silt loam	Moderately well drained	3-8 %	3.70%
Winnipeg silt loam	Well drained	2-5 %	8.20%
Splitlimb silt loam, frequently ponded	Somewhat poorly drained	0-3 %	0.00%
Grandgulf silt loam, rarely ponded	Well drained	1-3 %	3.40%
Goss-Wilderness complex	Well drained	3-8 %	9.90%

Historic topographic maps from 1884, 1935, and 1960 and historic aerial photographs from 1959 were examined for archeological resource potential within the APE. The presence of structures on historic maps and aerial photography may indicate the likelihood of historic period archeological deposits associated with the occupation of structures within the APE. Historic maps and aerial photography may also illustrate land use of the APE historically. The APE is comprised of the urban, historic town center of Springfield. A topographic map from 1884 shows Segment A and B as located within a dense cluster of streets in what was then the epicenter of Springfield. The 1935 topographic map shows considerable development in contrast to the 1884 map, with all five segments located in urban areas. Additionally, the 1960 topographic map shows greater development and additional details such as two churches and two schools within Segment A of the APE, one church at Segment B, one school at Segment C, one school at Segment E, and a school and church at Segment H. Historic aerial imagery shows the APE as largely developed for residential and commercial purposes. Historic topographic maps and the Find a Grave online database were also examined to identify any known historic cemeteries within the APE. No known cemeteries were encountered.

Background research revealed 10 archeological sites and 52 surveys within a mile of the APE. Within the APE, two archeological sites and three surveys were identified. Examination of soils within the APE indicates suitable conditions for human habitation, and a review of historic maps and photographs reveal the APE has been heavily developed with residential and commercial areas, as well as churches and municipal buildings. While these factors may indicate the presence of potential archeological deposits, it is unlikely that archeological deposits would contain the subsurface integrity needed for NRHP consideration due to the heavily modified nature of the APE.

Determination of Effect

Based on the aforementioned identification and evaluation, PHMSA has determined that there are two historic properties as defined in 36 CFR 800.16(l) within the APE: site 23GR325 and site 23GR297.

Most of the project work will be limited to the existing ROW, except in areas where work within vegetated areas outside of the ROW is needed, in which case the insertion method will be utilized. No work is occurring near sites 23GR325 and 23GR297; they will be completely avoided. Work is expected to mainly take place under paved surfaces, and no character-defining historic materials or features will be removed or disturbed because of the Undertaking.

Project work is limited to the replacement of existing pipelines in areas that demonstrate a low probability for intact significant archaeological resources and areas where the probability is higher will be avoided completely. The Undertaking will not result in lasting physical, visual, or audible effects to NRHP-listed historic properties. The Undertaking also does not include land acquisition, nor would it limit access to or change the use of any of the historic properties identified above.

While the exact staging areas for the Undertaking are currently unknown, staging should be confined to paved areas; if staging cannot be confined to paved areas, geotextile fabric or other similar protective measures (such as pressure distributing mats) must be laid in any affected unpaved area to minimize ground disturbance, prevent soil compaction, and protect archaeological features and artifacts.

In accordance with 36 CFR Part 800.5, PHMSA has determined the Undertaking will have No Adverse Effect on historic properties.

Request for Section 106 Concurrence

PHMSA requests that you provide any information you have regarding historic properties of religious or cultural significance to your Tribe/Nation that may be present in the APE and affected by the Undertaking. If your Tribe/Nation is unaware of any historic properties beyond what we have identified to date, PHMSA is notifying your Tribe/Nation of our intention to make a No Adverse Effect to Historic Properties finding. Please notify us within 30 days from the date of receipt of this letter if you have any concerns about the project's effects to historic properties. Should you need additional information please contact Kat Giraldo, Section 106 specialist, at PHMSASection106@dot.gov or 857-320-1359.

Sincerely,

Matt Fuller
Senior Environmental Protection Specialist

MF/kg

cc: Elizabeth Williams, Environmental Protection Specialist, USDOT Volpe Center
Susan Anderson, PHMSA Grant Specialist

Enclosures:
Attachment A: Project Location and APE Maps
Attachment B: Project Area Photographs

U.S. Department
of Transportation
**Pipeline and Hazardous
Materials Safety
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

December 29, 2023

Deborah Dotson
President
Delaware Nation
31064 State Highway 281, Building 100
Anadarko, OK – 73005

Section 106 Consultation: PHMSA Pipeline Replacement Project in the City of Springfield, Greene County, Missouri
Grant Recipient: City Utilities of Springfield (CUS)
Project Location: City of Springfield, Greene County, Missouri

Dear President Dotson:

The Pipeline and Hazardous Materials Safety Administration (PHMSA) provides funds authorized under the Natural Gas Distribution Infrastructure Safety and Modernization Grant Program. PHMSA proposes to provide funds to the City Utilities of Springfield (Grant Recipient) for the replacement of pipeline (Undertaking). PHMSA is initiating consultation for the above referenced Undertaking in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and the associated implementing regulations, 36 CFR Part 800 (Section 106). The purpose of this letter is to initiate Section 106 consultation for the Undertaking to determine if there are historic properties of cultural or religious significance to your Tribe/Nation that may be affected by the Undertaking, to determine if you want to be a consulting party, and to notify your Tribe/Nation of PHMSA's intention to make a finding of No Adverse Effect to Historic Properties. PHMSA is also available for Government-to-Government consultation on this Program.

Project Description/Background

The Grant Recipient currently has approximately 500 miles of polyethylene (PE) gas pipeline in their system. The legacy PE gas pipelines were installed between 1968 and 1999. The materials for much of the existing infrastructure of this project need to be replaced to maintain their safe operation because they are leak prone pipelines.

The Undertaking will replace 14 miles, approximately 74,000 linear feet (LF) of the legacy PE pipe and approximately 1,150 LF legacy PE gas services and meter sets associated with those gas mains. Cut and cover (trenching) and directional drilling will be utilized to work around other infrastructure such as storm sewer, to avoid tree root areas, and under paved areas to avoid costly pavement replacement. Additionally, the Grant Recipient may bore in areas where horizontal directional drilling will cause less disturbances and will be more efficient. Insertion installation methods will primarily be used on gas service replacements.

The Undertaking is divided into five segments:

Segment A - North-central Springfield residential area.

Segment B - North-central Springfield residential area.
Segment C - North-central Springfield residential area.
Segment E1/E2 - West-central Springfield residential area.
Segment H- South-central Springfield residential area.

Work will take place within the existing right-of-way (ROW). However, gas services may be located within vegetated areas outside of the ROW, in which case the insertion method will be utilized, as determined by the openness of the available corridor within the ROW. The staging areas for the project have not been identified. Project location maps are enclosed in **Attachment A**. Photographs showing the overall character of the project areas are included in **Attachment B**.

The existing pipelines being replaced are between 1 ¼ to 6 inches in diameter and the gas service lines range in size from ¾ to 2 inches in diameter and will be replaced with equivalent or smaller diameters. While the pipe alignment has not been determined, the side of road will be determined by the clearest available alignment within the corridor. Gas services will be replaced by insertion method. The existing pipelines will be abandoned in place. Abandonment of the existing pipeline (versus excavation and removal) will minimize ground disturbance and facilitate the replacement process in a more efficient manner. The replacement gas lines will be installed at a depth of 42 in. plus pipe diameter below grade unless another utility is crossed.

Area of Potential Effects (APE)

Pursuant to 36 CFR 800.4(a)(1), the Area of Potential Effects (APE) is defined as the geographic area(s) within which the Undertaking may directly or indirectly affect historic resources. Due to the scale and nature of the Undertaking, PHMSA has delineated the APE for this Undertaking to encompass the existing ROW and the adjacent parcels, which include the limits of disturbance, staging and access areas, and the limits of any potential vibration effects. The adjacent parcels are included in the APE because gas service lines will be connected to houses along the main pipeline. The APE extends to the depth of proposed ground disturbance of up to 42 in. plus pipe diameter below grade. The Undertaking does not have the potential to cause visual or audible effects after the completion of construction. The existing ROW encompasses various roads, signage, sidewalks, and grassy areas throughout the City of Springfield, Missouri. The APE is shown on the maps in **Attachment A**.

Identification and Evaluation

To identify historic properties in the APE, U.S. Department of Transportation (U.S. DOT) staff who meet the Secretary of the Interior's (SOI) Professional Qualification Standards reviewed available information on previously identified historic properties in the APE, including the National Register of Historic Places (NRHP) database, data gathered from the Missouri Department of Natural Resources, historic topographic maps and historic aerial photographs. U.S. DOT staff also conducted research to determine if there are any previously unidentified properties within the APE that are 45 years of age or older and may be eligible for the NRHP.

Historic Architecture

There are no NRHP-listed above-ground resources within the APE. There are also no above-ground resources that have been previously determined eligible within the APE. Due to the scale and nature of the Undertaking, which is limited to the replacement of gas main pipelines within existing ROW and insertion of services in most areas, the identification effort for previously unidentified above-ground historic properties focused on identifying properties that are susceptible to the vibration effects of pipeline replacement and could experience diminished integrity as a result of the Undertaking. A review of the APE found no additional above-ground resources that have the potential to be affected by the Undertaking.

Archaeology

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***Bold entries note sites within the APE**

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Project work in Segment A near archaeological site 23GR297 includes renewal of a gas main within the ROW along W Mount Vernon Street. Gas services will be inserted on the north side of Mt Vernon Street, completely avoiding site 23GR297, which is located north of the work being done in this area. Furthermore, notes will be added to the design plans to require renewal of the services at 2115-2145 W Mt Vernon Street via insertion. There is no work taking place within S Park Avenue or W Elm Street, which are adjacent to site 23GR297.

Project work in Segment E near archaeological site 23GR325 includes renewal of a gas main within the ROW of W Mount Vernon Street and on private property south of Mt Vernon Street to serve 1816, 1820, and 1820-A W Mount Vernon Street. Renewal of these sections of main will be contained within existing ROW and within existing utility easement, with no gas service replacements and thus no disturbance outside of the road. There is no work occurring within S Lafontaine Avenue or S Wabash Avenue adjacent to site 23GR325.

An examination of Web Soil Survey data within the APE reveals ten soil classes (Table 2). Well drained and moderately well drained soils can be indicative of human habitation during both the pre-contact and historic periods. Well drained soils within the APE include Goss, Winnipeg, Grandgulf, and Goss-Wilderness types. Typically slopes greater than 15 percent are not suitable for human occupation, and soil types within the APE are all at or below 15 percent slope. The composition of soils within the APE indicates suitable conditions for human habitation in both the pre-contact and historic periods. Proximity to major waterways generally indicates a suitable environment for both precontact and historic human activity. Topographic maps indicate that the APE is located close to Jordan Creek, which connects to the James River 11 miles south of Springfield, Missouri.

Table 2. Soil Types within the APE

Map Unit Name	Drainage Class	Slope	Percent of APE
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Determination of Effect

Based on the aforementioned identification and evaluation, PHMSA has determined that there are two historic properties as defined in 36 CFR 800.16(l) within the APE: site 23GR325 and site 23GR297.

Most of the project work will be limited to the existing ROW, except in areas where work within vegetated areas outside of the ROW is needed, in which case the insertion method will be utilized. No work is occurring near sites 23GR325 and 23GR297; they will be completely avoided. Work is expected to mainly take place under paved surfaces, and no character-defining historic materials or features will be removed or disturbed because of the Undertaking.

Project work is limited to the replacement of existing pipelines in areas that demonstrate a low probability for intact significant archaeological resources and areas where the probability is higher will be avoided completely. The Undertaking will not result in lasting physical, visual, or audible effects to NRHP-listed historic properties. The Undertaking also does not include land acquisition, nor would it limit access to or change the use of any of the historic properties identified above.

While the exact staging areas for the Undertaking are currently unknown, staging should be confined to paved areas; if staging cannot be confined to paved areas, geotextile fabric or other similar protective measures (such as pressure distributing mats) must be laid in any affected unpaved area to minimize ground disturbance, prevent soil compaction, and protect archaeological features and artifacts.

In accordance with 36 CFR Part 800.5, PHMSA has determined the Undertaking will have No Adverse Effect on historic properties.

Request for Section 106 Concurrence

PHMSA requests that you provide any information you have regarding historic properties of religious or cultural significance to your Tribe/Nation that may be present in the APE and affected by the Undertaking. If your Tribe/Nation is unaware of any historic properties beyond what we have identified to date, PHMSA is notifying your Tribe/Nation of our intention to make a No Adverse Effect to Historic Properties finding. Please notify us within 30 days from the date of receipt of this letter if you have any concerns about the project's effects to historic properties. Should you need additional information please contact Kat Giraldo, Section 106 specialist, at PHMSASection106@dot.gov or 857-320-1359.

Sincerely,

Matt Fuller
Senior Environmental Protection Specialist

MF/kg

cc: Elizabeth Williams, Environmental Protection Specialist, USDOT Volpe Center
Susan Anderson, PHMSA Grant Specialist
Katelyn Lucas, Tribal Historic Preservation Officer

Enclosures:
Attachment A: Project Location and APE Maps
Attachment B: Project Area Photographs

U.S. Department
of Transportation
**Pipeline and Hazardous
Materials Safety
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

December 29, 2023

Brad Killscrow
Chief
Delaware Tribe of Indians
5100 Tuxedo Blvd.
Bartlesville, OK 74006-2838

Section 106 Consultation: PHMSA Pipeline Replacement Project in the City of Springfield, Greene County, Missouri
Grant Recipient: City Utilities of Springfield (CUS)
Project Location: City of Springfield, Greene County, Missouri

Dear Chief Killscrow:

The Pipeline and Hazardous Materials Safety Administration (PHMSA) provides funds authorized under the Natural Gas Distribution Infrastructure Safety and Modernization Grant Program. PHMSA proposes to provide funds to the City Utilities of Springfield (Grant Recipient) for the replacement of pipeline (Undertaking). PHMSA is initiating consultation for the above referenced Undertaking in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and the associated implementing regulations, 36 CFR Part 800 (Section 106). The purpose of this letter is to initiate Section 106 consultation for the Undertaking to determine if there are historic properties of cultural or religious significance to your Tribe/Nation that may be affected by the Undertaking, to determine if you want to be a consulting party, and to notify your Tribe/Nation of PHMSA's intention to make a finding of No Adverse Effect to Historic Properties. PHMSA is also available for Government-to-Government consultation on this Program.

Project Description/Background

The Grant Recipient currently has approximately 500 miles of polyethylene (PE) gas pipeline in their system. The legacy PE gas pipelines were installed between 1968 and 1999. The materials for much of the existing infrastructure of this project need to be replaced to maintain their safe operation because they are leak prone pipelines.

The Undertaking will replace 14 miles, approximately 74,000 linear feet (LF) of the legacy PE pipe and approximately 1,150 LF legacy PE gas services and meter sets associated with those gas mains. Cut and cover (trenching) and directional drilling will be utilized to work around other infrastructure such as storm sewer, to avoid tree root areas, and under paved areas to avoid costly pavement replacement. Additionally, the Grant Recipient may bore in areas where horizontal directional drilling will cause less disturbances and will be more efficient. Insertion installation methods will primarily be used on gas service replacements.

The Undertaking is divided into five segments:

Segment A - North-central Springfield residential area.

Segment B - North-central Springfield residential area.
Segment C - North-central Springfield residential area.
Segment E1/E2 - West-central Springfield residential area.
Segment H- South-central Springfield residential area.

Work will take place within the existing right-of-way (ROW). However, gas services may be located within vegetated areas outside of the ROW, in which case the insertion method will be utilized, as determined by the openness of the available corridor within the ROW. The staging areas for the project have not been identified. Project location maps are enclosed in **Attachment A**. Photographs showing the overall character of the project areas are included in **Attachment B**.

The existing pipelines being replaced are between 1 ¼ to 6 inches in diameter and the gas service lines range in size from ¾ to 2 inches in diameter and will be replaced with equivalent or smaller diameters. While the pipe alignment has not been determined, the side of road will be determined by the clearest available alignment within the corridor. Gas services will be replaced by insertion method. The existing pipelines will be abandoned in place. Abandonment of the existing pipeline (versus excavation and removal) will minimize ground disturbance and facilitate the replacement process in a more efficient manner. The replacement gas lines will be installed at a depth of 42 in. plus pipe diameter below grade unless another utility is crossed.

Area of Potential Effects (APE)

Pursuant to 36 CFR 800.4(a)(1), the Area of Potential Effects (APE) is defined as the geographic area(s) within which the Undertaking may directly or indirectly affect historic resources. Due to the scale and nature of the Undertaking, PHMSA has delineated the APE for this Undertaking to encompass the existing ROW and the adjacent parcels, which include the limits of disturbance, staging and access areas, and the limits of any potential vibration effects. The adjacent parcels are included in the APE because gas service lines will be connected to houses along the main pipeline. The APE extends to the depth of proposed ground disturbance of up to 42 in. plus pipe diameter below grade. The Undertaking does not have the potential to cause visual or audible effects after the completion of construction. The existing ROW encompasses various roads, signage, sidewalks, and grassy areas throughout the City of Springfield, Missouri. The APE is shown on the maps in **Attachment A**.

Identification and Evaluation

To identify historic properties in the APE, U.S. Department of Transportation (U.S. DOT) staff who meet the Secretary of the Interior's (SOI) Professional Qualification Standards reviewed available information on previously identified historic properties in the APE, including the National Register of Historic Places (NRHP) database, data gathered from the Missouri Department of Natural Resources, historic topographic maps and historic aerial photographs. U.S. DOT staff also conducted research to determine if there are any previously unidentified properties within the APE that are 45 years of age or older and may be eligible for the NRHP.

Historic Architecture

There are no NRHP-listed above-ground resources within the APE. There are also no above-ground resources that have been previously determined eligible within the APE. Due to the scale and nature of the Undertaking, which is limited to the replacement of gas main pipelines within existing ROW and insertion of services in most areas, the identification effort for previously unidentified above-ground historic properties focused on identifying properties that are susceptible to the vibration effects of pipeline replacement and could experience diminished integrity as a result of the Undertaking. A review of the APE found no additional above-ground resources that have the potential to be affected by the Undertaking.

Archaeology

Missouri's archeological site file database, Missouri Department of Natural Resources Archaeology Viewer, was examined to identify the presence of previously recorded archeological sites and previously conducted archeological surveys within the APE. Per Missouri state standards and guidelines, a one-mile search radius was also examined for previously recorded archeological sites and surveys (Table 1). Within one mile of the APE, 52 archeological surveys have been conducted and 10 archeological sites that are listed, or may be eligible for listing in, the NRHP have been recorded.

Table 1. Previously Recorded Archeological Sites within One Mile of the APE

Archeological Site	Site Type	NRHP Eligibility	Distance from APE
23GR63	Precontact habitation	Unknown	1,750 feet
23GR297	**Precontact lithic scatter, historic musket ball**	**Unknown**	**Within APE**
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23GR428	Precontact lithic scatter	Unknown	3,600 feet
23GR429	Precontact lithic scatter	Unknown	3,500 feet
23GR430	Precontact lithic scatter	Unknown	3,800 feet
23GR432	Precontact lithic scatter	Unknown	4,700 feet
23GR433	Historic (unknown type)	Unknown	4,900 feet
23GR1000	Historic artifact scatter	Eligible	3,600 feet
23GR2025	Precontact lithic scatter and historic artifact scatter	Unknown	2,400 feet

***Bold entries note sites within the APE**

Three of the 52 previous surveys were identified as intersecting the APE. In 1978, the SMSU Center for Archaeological Research conducted a survey for the Federal Housing Authority. The survey intersects Segment E of the APE. In 2016, a survey was conducted by K & K Environmental, LLC for a communication tower. This survey intersects Segment A. In 2020, a survey was conducted for resurfacing and ADA improvements to roadways for the Federal Highway Administration. This survey intersects Segments B and H of the APE. Two previously recorded archeological sites (23GR297 and 23GR325) are within the APE. Both sites are located at Segment E of the APE. Site 23GR297 was recorded as a precontact lithic scatter and musket ball. The NRHP eligibility of the site is unknown and the Missouri site file database notes that the location may not be accurate. Site 23GR325 was recorded as a precontact lithic tool. The NRHP eligibility of the site is also unknown.

Project work in Segment A near archaeological site 23GR297 includes renewal of a gas main within the ROW along W Mount Vernon Street. Gas services will be inserted on the north side of Mt Vernon Street, completely avoiding site 23GR297, which is located north of the work being done in this area. Furthermore, notes will be added to the design plans to require renewal of the services at 2115-2145 W Mt Vernon Street via insertion. There is no work taking place within S Park Avenue or W Elm Street, which are adjacent to site 23GR297.

Project work in Segment E near archaeological site 23GR325 includes renewal of a gas main within the ROW of W Mount Vernon Street and on private property south of Mt Vernon Street to serve 1816, 1820, and 1820-A W Mount Vernon Street. Renewal of these sections of main will be contained within existing ROW and within existing utility easement, with no gas service replacements and thus no disturbance outside of the road. There is no work occurring within S Lafontaine Avenue or S Wabash Avenue adjacent to site 23GR325.

An examination of Web Soil Survey data within the APE reveals ten soil classes (Table 2). Well drained and moderately well drained soils can be indicative of human habitation during both the pre-contact and historic periods. Well drained soils within the APE include Goss, Winnipeg, Grandgulf, and Goss-Wilderness types. Typically slopes greater than 15 percent are not suitable for human occupation, and soil types within the APE are all at or below 15 percent slope. The composition of soils within the APE indicates suitable conditions for human habitation in both the pre-contact and historic periods. Proximity to major waterways generally indicates a suitable environment for both precontact and historic human activity. Topographic maps indicate that the APE is located close to Jordan Creek, which connects to the James River 11 miles south of Springfield, Missouri.

Table 2. Soil Types within the APE

Map Unit Name	Drainage Class	Slope	Percent of APE
Hepler silt loam, occasionally flooded	Somewhat poorly drained	0-2 %	2.40%
Creldon silt loam	Moderately well drained	1-3 %	10.50%
Goss gravelly silt loam	Well drained	8-15 %	10.30%
Creldon silt loam, karst	Moderately well drained	1-3 %	0.00%
Viraton silt loam	Moderately well drained	2-5 %	51.50%
Wilderness gravelly silt loam	Moderately well drained	3-8 %	3.70%
Winnipeg silt loam	Well drained	2-5 %	8.20%
Splitlimb silt loam, frequently ponded	Somewhat poorly drained	0-3 %	0.00%
Grandgulf silt loam, rarely ponded	Well drained	1-3 %	3.40%
Goss-Wilderness complex	Well drained	3-8 %	9.90%

Historic topographic maps from 1884, 1935, and 1960 and historic aerial photographs from 1959 were examined for archeological resource potential within the APE. The presence of structures on historic maps and aerial photography may indicate the likelihood of historic period archeological deposits associated with the occupation of structures within the APE. Historic maps and aerial photography may also illustrate land use of the APE historically. The APE is comprised of the urban, historic town center of Springfield. A topographic map from 1884 shows Segment A and B as located within a dense cluster of streets in what was then the epicenter of Springfield. The 1935 topographic map shows considerable development in contrast to the 1884 map, with all five segments located in urban areas. Additionally, the 1960 topographic map shows greater development and additional details such as two churches and two schools within Segment A of the APE, one church at Segment B, one school at Segment C, one school at Segment E, and a school and church at Segment H. Historic aerial imagery shows the APE as largely developed for residential and commercial purposes. Historic topographic maps and the Find a Grave online database were also examined to identify any known historic cemeteries within the APE. No known cemeteries were encountered.

Background research revealed 10 archeological sites and 52 surveys within a mile of the APE. Within the APE, two archeological sites and three surveys were identified. Examination of soils within the APE indicates suitable conditions for human habitation, and a review of historic maps and photographs reveal the APE has been heavily developed with residential and commercial areas, as well as churches and municipal buildings. While these factors may indicate the presence of potential archeological deposits, it is unlikely that archeological deposits would contain the subsurface integrity needed for NRHP consideration due to the heavily modified nature of the APE.

Determination of Effect

Based on the aforementioned identification and evaluation, PHMSA has determined that there are two historic properties as defined in 36 CFR 800.16(l) within the APE: site 23GR325 and site 23GR297.

Most of the project work will be limited to the existing ROW, except in areas where work within vegetated areas outside of the ROW is needed, in which case the insertion method will be utilized. No work is occurring near sites 23GR325 and 23GR297; they will be completely avoided. Work is expected to mainly take place under paved surfaces, and no character-defining historic materials or features will be removed or disturbed because of the Undertaking.

Project work is limited to the replacement of existing pipelines in areas that demonstrate a low probability for intact significant archaeological resources and areas where the probability is higher will be avoided completely. The Undertaking will not result in lasting physical, visual, or audible effects to NRHP-listed historic properties. The Undertaking also does not include land acquisition, nor would it limit access to or change the use of any of the historic properties identified above.

While the exact staging areas for the Undertaking are currently unknown, staging should be confined to paved areas; if staging cannot be confined to paved areas, geotextile fabric or other similar protective measures (such as pressure distributing mats) must be laid in any affected unpaved area to minimize ground disturbance, prevent soil compaction, and protect archaeological features and artifacts.

In accordance with 36 CFR Part 800.5, PHMSA has determined the Undertaking will have No Adverse Effect on historic properties.

Request for Section 106 Concurrence

PHMSA requests that you provide any information you have regarding historic properties of religious or cultural significance to your Tribe/Nation that may be present in the APE and affected by the Undertaking. If your Tribe/Nation is unaware of any historic properties beyond what we have identified to date, PHMSA is notifying your Tribe/Nation of our intention to make a No Adverse Effect to Historic Properties finding. Please notify us within 30 days from the date of receipt of this letter if you have any concerns about the project's effects to historic properties. Should you need additional information please contact Kat Giraldo, Section 106 specialist, at PHMSASection106@dot.gov or 857-320-1359.

Sincerely,

Matt Fuller
Senior Environmental Protection Specialist

MF/kg

cc: Elizabeth Williams, Environmental Protection Specialist, USDOT Volpe Center
Susan Anderson, PHMSA Grant Specialist
Larry Heady, Tribal Historic Preservation Officer

Enclosures:
Attachment A: Project Location and APE Maps
Attachment B: Project Area Photographs

U.S. Department
of Transportation
**Pipeline and Hazardous
Materials Safety
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

December 29, 2023

Dr. Andrea A. Hunter
Director
Osage Nation
627 Grandview Avenue
Pawhuska, OK 74056

Section 106 Consultation: PHMSA Pipeline Replacement Project in the City of Springfield, Greene County, Missouri
Grant Recipient: City Utilities of Springfield (CUS)
Project Location: City of Springfield, Greene County, Missouri

Dear Dr. Hunter:

The Pipeline and Hazardous Materials Safety Administration (PHMSA) provides funds authorized under the Natural Gas Distribution Infrastructure Safety and Modernization Grant Program. PHMSA proposes to provide funds to the City Utilities of Springfield (Grant Recipient) for the replacement of pipeline (Undertaking). PHMSA is initiating consultation for the above referenced Undertaking in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and the associated implementing regulations, 36 CFR Part 800 (Section 106). The purpose of this letter is to initiate Section 106 consultation for the Undertaking to determine if there are historic properties of cultural or religious significance to your Tribe/Nation that may be affected by the Undertaking, to determine if you want to be a consulting party, and to notify your Tribe/Nation of PHMSA's intention to make a finding of No Adverse Effect to Historic Properties. PHMSA is also available for Government-to-Government consultation on this Program.

Project Description/Background

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The Undertaking will replace 14 miles, approximately 74,000 linear feet (LF) of the legacy PE pipe and approximately 1,150 LF legacy PE gas services and meter sets associated with those gas mains. Cut and cover (trenching) and directional drilling will be utilized to work around other infrastructure such as storm sewer, to avoid tree root areas, and under paved areas to avoid costly pavement replacement. Additionally, the Grant Recipient may bore in areas where horizontal directional drilling will cause less disturbances and will be more efficient. Insertion installation methods will primarily be used on gas service replacements.

The Undertaking is divided into five segments:

Segment A - North-central Springfield residential area.

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Segment H- South-central Springfield residential area.

Work will take place within the existing right-of-way (ROW). However, gas services may be located within vegetated areas outside of the ROW, in which case the insertion method will be utilized, as determined by the openness of the available corridor within the ROW. The staging areas for the project have not been identified. Project location maps are enclosed in **Attachment A**. Photographs showing the overall character of the project areas are included in **Attachment B**.

The existing pipelines being replaced are between 1 ¼ to 6 inches in diameter and the gas service lines range in size from ¾ to 2 inches in diameter and will be replaced with equivalent or smaller diameters. While the pipe alignment has not been determined, the side of road will be determined by the clearest available alignment within the corridor. Gas services will be replaced by insertion method. The existing pipelines will be abandoned in place. Abandonment of the existing pipeline (versus excavation and removal) will minimize ground disturbance and facilitate the replacement process in a more efficient manner. The replacement gas lines will be installed at a depth of 42 in. plus pipe diameter below grade unless another utility is crossed.

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Identification and Evaluation

To identify historic properties in the APE, U.S. Department of Transportation (U.S. DOT) staff who meet the Secretary of the Interior's (SOI) Professional Qualification Standards reviewed available information on previously identified historic properties in the APE, including the National Register of Historic Places (NRHP) database, data gathered from the Missouri Department of Natural Resources, historic topographic maps and historic aerial photographs. U.S. DOT staff also conducted research to determine if there are any previously unidentified properties within the APE that are 45 years of age or older and may be eligible for the NRHP.

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Project work in Segment A near archaeological site 23GR297 includes renewal of a gas main within the ROW along W Mount Vernon Street. Gas services will be inserted on the north side of Mt Vernon Street, completely avoiding site 23GR297, which is located north of the work being done in this area. Furthermore, notes will be added to the design plans to require renewal of the services at 2115-2145 W Mt Vernon Street via insertion. There is no work taking place within S Park Avenue or W Elm Street, which are adjacent to site 23GR297.

Project work in Segment E near archaeological site 23GR325 includes renewal of a gas main within the ROW of W Mount Vernon Street and on private property south of Mt Vernon Street to serve 1816, 1820, and 1820-A W Mount Vernon Street. Renewal of these sections of main will be contained within existing ROW and within existing utility easement, with no gas service replacements and thus no disturbance outside of the road. There is no work occurring within S Lafontaine Avenue or S Wabash Avenue adjacent to site 23GR325.

An examination of Web Soil Survey data within the APE reveals ten soil classes (Table 2). Well drained and moderately well drained soils can be indicative of human habitation during both the pre-contact and historic periods. Well drained soils within the APE include Goss, Winnipeg, Grandgulf, and Goss-Wilderness types. Typically slopes greater than 15 percent are not suitable for human occupation, and soil types within the APE are all at or below 15 percent slope. The composition of soils within the APE indicates suitable conditions for human habitation in both the pre-contact and historic periods. Proximity to major waterways generally indicates a suitable environment for both precontact and historic human activity. Topographic maps indicate that the APE is located close to Jordan Creek, which connects to the James River 11 miles south of Springfield, Missouri.

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Sincerely,

Matt Fuller
Senior Environmental Protection Specialist

MF/kg

cc: Elizabeth Williams, Environmental Protection Specialist, USDOT Volpe Center
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Enclosures:
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Attachment B: Project Area Photographs

U.S. Department
of Transportation
**Pipeline and Hazardous
Materials Safety
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

December 29, 2023

Charles Diebold
Chief
Seneca-Cayuga Nation
23701 South 655 Road
Grove, OK – 74344

Section 106 Consultation: PHMSA Pipeline Replacement Project in the City of Springfield, Greene County, Missouri
Grant Recipient: City Utilities of Springfield (CUS)
Project Location: City of Springfield, Greene County, Missouri

Dear Chief Diebold:

The Pipeline and Hazardous Materials Safety Administration (PHMSA) provides funds authorized under the Natural Gas Distribution Infrastructure Safety and Modernization Grant Program. PHMSA proposes to provide funds to the City Utilities of Springfield (Grant Recipient) for the replacement of pipeline (Undertaking). PHMSA is initiating consultation for the above referenced Undertaking in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and the associated implementing regulations, 36 CFR Part 800 (Section 106). The purpose of this letter is to initiate Section 106 consultation for the Undertaking to determine if there are historic properties of cultural or religious significance to your Tribe/Nation that may be affected by the Undertaking, to determine if you want to be a consulting party, and to notify your Tribe/Nation of PHMSA's intention to make a finding of No Adverse Effect to Historic Properties. PHMSA is also available for Government-to-Government consultation on this Program.

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The Undertaking is divided into five segments:

Segment A - North-central Springfield residential area.

Segment B - North-central Springfield residential area.
Segment C - North-central Springfield residential area.
Segment E1/E2 - West-central Springfield residential area.
Segment H- South-central Springfield residential area.

Work will take place within the existing right-of-way (ROW). However, gas services may be located within vegetated areas outside of the ROW, in which case the insertion method will be utilized, as determined by the openness of the available corridor within the ROW. The staging areas for the project have not been identified. Project location maps are enclosed in **Attachment A**. Photographs showing the overall character of the project areas are included in **Attachment B**.

The existing pipelines being replaced are between 1 ¼ to 6 inches in diameter and the gas service lines range in size from ¾ to 2 inches in diameter and will be replaced with equivalent or smaller diameters. While the pipe alignment has not been determined, the side of road will be determined by the clearest available alignment within the corridor. Gas services will be replaced by insertion method. The existing pipelines will be abandoned in place. Abandonment of the existing pipeline (versus excavation and removal) will minimize ground disturbance and facilitate the replacement process in a more efficient manner. The replacement gas lines will be installed at a depth of 42 in. plus pipe diameter below grade unless another utility is crossed.

Area of Potential Effects (APE)

Pursuant to 36 CFR 800.4(a)(1), the Area of Potential Effects (APE) is defined as the geographic area(s) within which the Undertaking may directly or indirectly affect historic resources. Due to the scale and nature of the Undertaking, PHMSA has delineated the APE for this Undertaking to encompass the existing ROW and the adjacent parcels, which include the limits of disturbance, staging and access areas, and the limits of any potential vibration effects. The adjacent parcels are included in the APE because gas service lines will be connected to houses along the main pipeline. The APE extends to the depth of proposed ground disturbance of up to 42 in. plus pipe diameter below grade. The Undertaking does not have the potential to cause visual or audible effects after the completion of construction. The existing ROW encompasses various roads, signage, sidewalks, and grassy areas throughout the City of Springfield, Missouri. The APE is shown on the maps in **Attachment A**.

Identification and Evaluation

To identify historic properties in the APE, U.S. Department of Transportation (U.S. DOT) staff who meet the Secretary of the Interior's (SOI) Professional Qualification Standards reviewed available information on previously identified historic properties in the APE, including the National Register of Historic Places (NRHP) database, data gathered from the Missouri Department of Natural Resources, historic topographic maps and historic aerial photographs. U.S. DOT staff also conducted research to determine if there are any previously unidentified properties within the APE that are 45 years of age or older and may be eligible for the NRHP.

Historic Architecture

There are no NRHP-listed above-ground resources within the APE. There are also no above-ground resources that have been previously determined eligible within the APE. Due to the scale and nature of the Undertaking, which is limited to the replacement of gas main pipelines within existing ROW and insertion of services in most areas, the identification effort for previously unidentified above-ground historic properties focused on identifying properties that are susceptible to the vibration effects of pipeline replacement and could experience diminished integrity as a result of the Undertaking. A review of the APE found no additional above-ground resources that have the potential to be affected by the Undertaking.

Archaeology

Missouri's archeological site file database, Missouri Department of Natural Resources Archaeology Viewer, was examined to identify the presence of previously recorded archeological sites and previously conducted archeological surveys within the APE. Per Missouri state standards and guidelines, a one-mile search radius was also examined for previously recorded archeological sites and surveys (Table 1). Within one mile of the APE, 52 archeological surveys have been conducted and 10 archeological sites that are listed, or may be eligible for listing in, the NRHP have been recorded.

Table 1. Previously Recorded Archeological Sites within One Mile of the APE

Archeological Site	Site Type	NRHP Eligibility	Distance from APE
23GR63	Precontact habitation	Unknown	1,750 feet
23GR297	**Precontact lithic scatter, historic musket ball**	**Unknown**	**Within APE**
23GR325	**Precontact habitation**	**Unknown**	**Within APE**
23GR428	Precontact lithic scatter	Unknown	3,600 feet
23GR429	Precontact lithic scatter	Unknown	3,500 feet
23GR430	Precontact lithic scatter	Unknown	3,800 feet
23GR432	Precontact lithic scatter	Unknown	4,700 feet
23GR433	Historic (unknown type)	Unknown	4,900 feet
23GR1000	Historic artifact scatter	Eligible	3,600 feet
23GR2025	Precontact lithic scatter and historic artifact scatter	Unknown	2,400 feet

***Bold entries note sites within the APE**

Three of the 52 previous surveys were identified as intersecting the APE. In 1978, the SMSU Center for Archaeological Research conducted a survey for the Federal Housing Authority. The survey intersects Segment E of the APE. In 2016, a survey was conducted by K & K Environmental, LLC for a communication tower. This survey intersects Segment A. In 2020, a survey was conducted for resurfacing and ADA improvements to roadways for the Federal Highway Administration. This survey intersects Segments B and H of the APE. Two previously recorded archeological sites (23GR297 and 23GR325) are within the APE. Both sites are located at Segment E of the APE. Site 23GR297 was recorded as a precontact lithic scatter and musket ball. The NRHP eligibility of the site is unknown and the Missouri site file database notes that the location may not be accurate. Site 23GR325 was recorded as a precontact lithic tool. The NRHP eligibility of the site is also unknown.

Project work in Segment A near archaeological site 23GR297 includes renewal of a gas main within the ROW along W Mount Vernon Street. Gas services will be inserted on the north side of Mt Vernon Street, completely avoiding site 23GR297, which is located north of the work being done in this area. Furthermore, notes will be added to the design plans to require renewal of the services at 2115-2145 W Mt Vernon Street via insertion. There is no work taking place within S Park Avenue or W Elm Street, which are adjacent to site 23GR297.

Project work in Segment E near archaeological site 23GR325 includes renewal of a gas main within the ROW of W Mount Vernon Street and on private property south of Mt Vernon Street to serve 1816, 1820, and 1820-A W Mount Vernon Street. Renewal of these sections of main will be contained within existing ROW and within existing utility easement, with no gas service replacements and thus no disturbance outside of the road. There is no work occurring within S Lafontaine Avenue or S Wabash Avenue adjacent to site 23GR325.

An examination of Web Soil Survey data within the APE reveals ten soil classes (Table 2). Well drained and moderately well drained soils can be indicative of human habitation during both the pre-contact and historic periods. Well drained soils within the APE include Goss, Winnipeg, Grandgulf, and Goss-Wilderness types. Typically slopes greater than 15 percent are not suitable for human occupation, and soil types within the APE are all at or below 15 percent slope. The composition of soils within the APE indicates suitable conditions for human habitation in both the pre-contact and historic periods. Proximity to major waterways generally indicates a suitable environment for both precontact and historic human activity. Topographic maps indicate that the APE is located close to Jordan Creek, which connects to the James River 11 miles south of Springfield, Missouri.

Table 2. Soil Types within the APE

Map Unit Name	Drainage Class	Slope	Percent of APE
Hepler silt loam, occasionally flooded	Somewhat poorly drained	0-2 %	2.40%
Creldon silt loam	Moderately well drained	1-3 %	10.50%
Goss gravelly silt loam	Well drained	8-15 %	10.30%
Creldon silt loam, karst	Moderately well drained	1-3 %	0.00%
Viraton silt loam	Moderately well drained	2-5 %	51.50%
Wilderness gravelly silt loam	Moderately well drained	3-8 %	3.70%
Winnipeg silt loam	Well drained	2-5 %	8.20%
Splitlimb silt loam, frequently ponded	Somewhat poorly drained	0-3 %	0.00%
Grandgulf silt loam, rarely ponded	Well drained	1-3 %	3.40%
Goss-Wilderness complex	Well drained	3-8 %	9.90%

Historic topographic maps from 1884, 1935, and 1960 and historic aerial photographs from 1959 were examined for archeological resource potential within the APE. The presence of structures on historic maps and aerial photography may indicate the likelihood of historic period archeological deposits associated with the occupation of structures within the APE. Historic maps and aerial photography may also illustrate land use of the APE historically. The APE is comprised of the urban, historic town center of Springfield. A topographic map from 1884 shows Segment A and B as located within a dense cluster of streets in what was then the epicenter of Springfield. The 1935 topographic map shows considerable development in contrast to the 1884 map, with all five segments located in urban areas. Additionally, the 1960 topographic map shows greater development and additional details such as two churches and two schools within Segment A of the APE, one church at Segment B, one school at Segment C, one school at Segment E, and a school and church at Segment H. Historic aerial imagery shows the APE as largely developed for residential and commercial purposes. Historic topographic maps and the Find a Grave online database were also examined to identify any known historic cemeteries within the APE. No known cemeteries were encountered.

Background research revealed 10 archeological sites and 52 surveys within a mile of the APE. Within the APE, two archeological sites and three surveys were identified. Examination of soils within the APE indicates suitable conditions for human habitation, and a review of historic maps and photographs reveal the APE has been heavily developed with residential and commercial areas, as well as churches and municipal buildings. While these factors may indicate the presence of potential archeological deposits, it is unlikely that archeological deposits would contain the subsurface integrity needed for NRHP consideration due to the heavily modified nature of the APE.

Determination of Effect

Based on the aforementioned identification and evaluation, PHMSA has determined that there are two historic properties as defined in 36 CFR 800.16(l) within the APE: site 23GR325 and site 23GR297.

Most of the project work will be limited to the existing ROW, except in areas where work within vegetated areas outside of the ROW is needed, in which case the insertion method will be utilized. No work is occurring near sites 23GR325 and 23GR297; they will be completely avoided. Work is expected to mainly take place under paved surfaces, and no character-defining historic materials or features will be removed or disturbed because of the Undertaking.

Project work is limited to the replacement of existing pipelines in areas that demonstrate a low probability for intact significant archaeological resources and areas where the probability is higher will be avoided completely. The Undertaking will not result in lasting physical, visual, or audible effects to NRHP-listed historic properties. The Undertaking also does not include land acquisition, nor would it limit access to or change the use of any of the historic properties identified above.

While the exact staging areas for the Undertaking are currently unknown, staging should be confined to paved areas; if staging cannot be confined to paved areas, geotextile fabric or other similar protective measures (such as pressure distributing mats) must be laid in any affected unpaved area to minimize ground disturbance, prevent soil compaction, and protect archaeological features and artifacts.

In accordance with 36 CFR Part 800.5, PHMSA has determined the Undertaking will have No Adverse Effect on historic properties.

Request for Section 106 Concurrence

PHMSA requests that you provide any information you have regarding historic properties of religious or cultural significance to your Tribe/Nation that may be present in the APE and affected by the Undertaking. If your Tribe/Nation is unaware of any historic properties beyond what we have identified to date, PHMSA is notifying your Tribe/Nation of our intention to make a No Adverse Effect to Historic Properties finding. Please notify us within 30 days from the date of receipt of this letter if you have any concerns about the project's effects to historic properties. Should you need additional information please contact Kat Giraldo, Section 106 specialist, at PHMSASection106@dot.gov or 857-320-1359.

Sincerely,

Matt Fuller
Senior Environmental Protection Specialist

MF/kg

cc: Elizabeth Williams, Environmental Protection Specialist, USDOT Volpe Center
Susan Anderson, PHMSA Grant Specialist
William Tarrant, Tribal Historic Preservation Officer

Enclosures:
Attachment A: Project Location and APE Maps
Attachment B: Project Area Photographs

Appendix H

Environmental

Justice

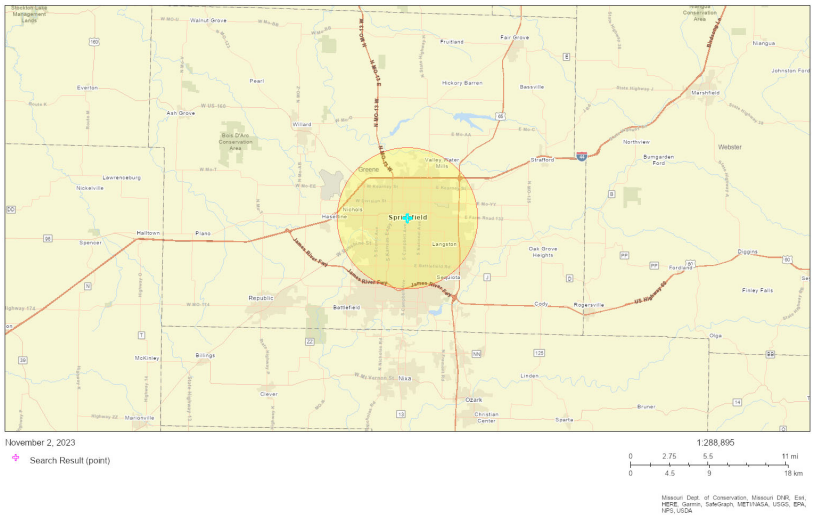
EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Springfield, MO

5 miles Ring Centered at 37.209004,-93.291779
Population: 172,859
Area in square miles: 78.53

A3 Landscape



LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	94%
Spanish	3%
Total Non-English	6%

COMMUNITY INFORMATION

- Low income: 46 percent
- People of color: 16 percent
- Less than high school education: 9 percent
- Limited English households: 1 percent
- Unemployment: 5 percent
- Persons with disabilities: 18 percent
- Male: 49 percent
- Female: 51 percent
- 71 years — Average life expectancy
- $27,469 — Per capita income
- Number of households: 79,099
- Owner occupied: 45 percent

BREAKDOWN BY RACE

- White: 84%
- Black: 4%
- American Indian: 0%
- Asian: 2%
- Hawaiian/Pacific Islander: 0%
- Other race: 0%
- Two or more races: 5%
- Hispanic: 5%

BREAKDOWN BY AGE

From Ages 1 to 4	6%
From Ages 1 to 18	18%
From Ages 18 and up	82%
From Ages 65 and up	15%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	38%
Speak Other Indo-European Languages	13%
Speak Asian-Pacific Island Languages	44%
Speak Other Languages	5%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

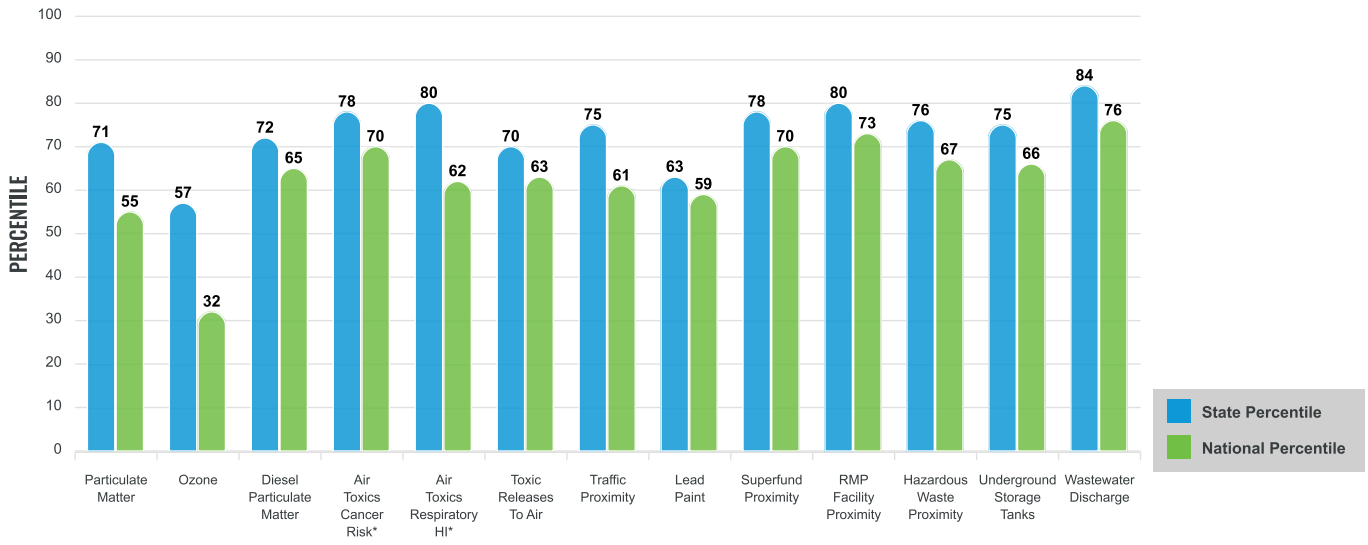
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

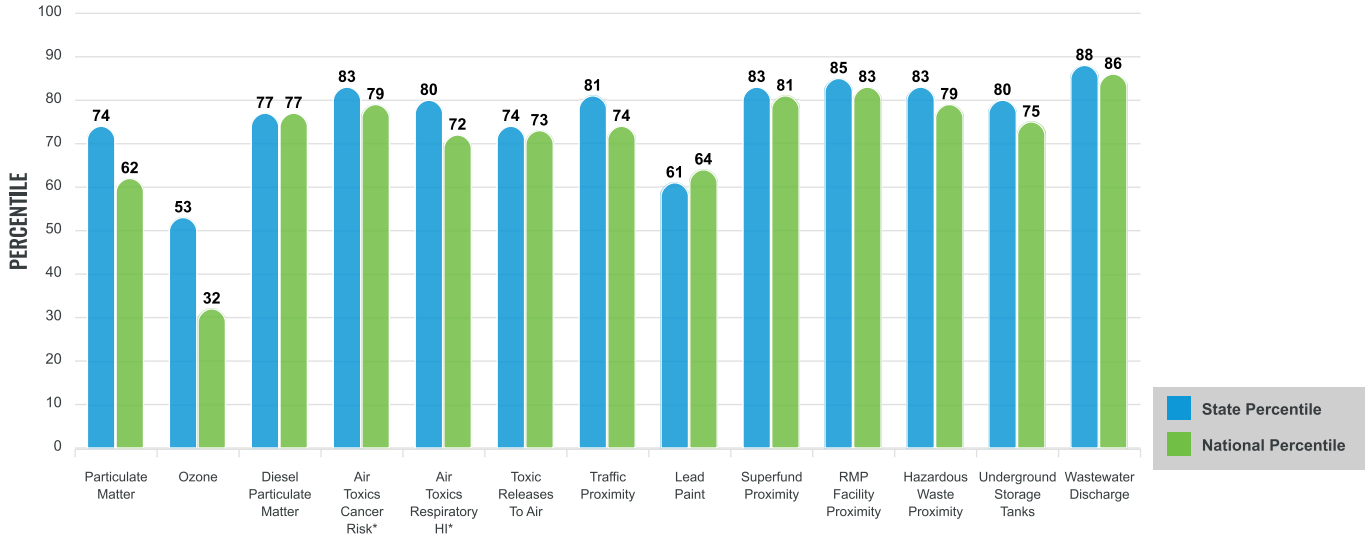
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 5 miles Ring Centered at 37.209004,-93.291779

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	8.02	8.05	55	8.08	45
Ozone (ppb)	57.4	59.9	34	61.6	20
Diesel Particulate Matter (µg/m^3)	0.278	0.268	58	0.261	64
Air Toxics Cancer Risk* (lifetime risk per million)	30	25	0	25	5
Air Toxics Respiratory HI*	0.33	0.31	14	0.31	31
Toxic Releases to Air	1,300	4,500	66	4,600	64
Traffic Proximity (daily traffic count/distance to road)	150	110	77	210	67
Lead Paint (% Pre-1960 Housing)	0.26	0.31	54	0.3	55
Superfund Proximity (site count/km distance)	0.14	0.097	80	0.13	76
RMP Facility Proximity (facility count/km distance)	0.91	0.45	85	0.43	86
Hazardous Waste Proximity (facility count/km distance)	1.9	1.3	76	1.9	72
Underground Storage Tanks (count/km^2)	3.8	2	81	3.9	71
Wastewater Discharge (toxicity-weighted concentration/m distance)	1.5	0.49	96	22	92
SOCIOECONOMIC INDICATORS					
Demographic Index	31%	28%	67	35%	53
Supplemental Demographic Index	17%	14%	69	14%	68
People of Color	16%	23%	57	39%	33
Low Income	46%	33%	73	31%	76
Unemployment Rate	5%	5%	66	6%	58
Limited English Speaking Households	1%	1%	81	5%	58
Less Than High School Education	9%	10%	55	12%	53
Under Age 5	6%	6%	55	6%	58
Over Age 64	15%	18%	44	17%	48
Low Life Expectancy	20%	21%	38	20%	53

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund	1
Hazardous Waste, Treatment, Storage, and Disposal Facilities	15
Water Dischargers	983
Air Pollution	183
Brownfields	208
Toxic Release Inventory	61

Other community features within defined area:

Schools	53
Hospitals	10
Places of Worship	2

Other environmental data:

Air Non-attainment	No
Impaired Waters	Yes

Selected location contains American Indian Reservation Lands*	No
Selected location contains a "Justice40 (CEJST)" disadvantaged community	Yes
Selected location contains an EPA IRA disadvantaged community	Yes

Report for 5 miles Ring Centered at 37.209004,-93.291779

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	20%	21%	38	20%	53
Heart Disease	6.6	6.9	40	6.1	60
Asthma	10.2	9.9	71	10	61
Cancer	6	6.6	28	6.1	43
Persons with Disabilities	16.8%	15.1%	65	13.4%	74

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	4%	8%	29	12%	34
Wildfire Risk	0%	5%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	22%	16%	72	14%	77
Lack of Health Insurance	14%	10%	76	9%	82
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Footnotes

Report for 5 miles Ring Centered at 37.209004,-93.291779

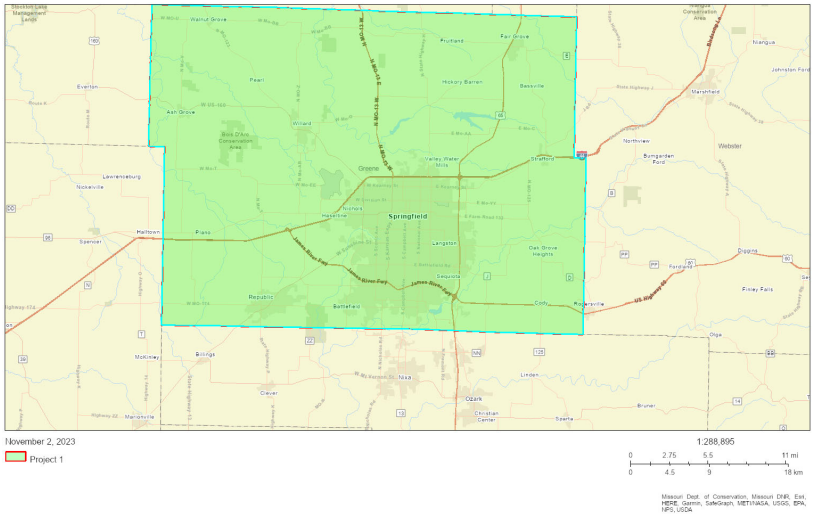
EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Greene County, MO

County: Greene
Population: 296,875
Area in square miles: 677.88

A3 Landscape



LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	95%
Spanish	2%
Total Non-English	5%

COMMUNITY INFORMATION

Low income: 36 percent

People of color: 14 percent

Less than high school education: 7 percent

Limited English households: 1 percent

Unemployment: 4 percent

Persons with disabilities: 15 percent

Male: 49 percent

Female: 51 percent

78 years
Average life expectancy

$30,477
Per capita income

Number of households: 129,367

Owner occupied: 57 percent

BREAKDOWN BY RACE

White: 86%

Black: 3%

American Indian: 0%

Asian: 2%

Hawaiian/Pacific Islander: 0%

Other race: 0%

Two or more races: 4%

Hispanic: 4%

BREAKDOWN BY AGE

From Ages 1 to 4	6%
From Ages 1 to 18	21%
From Ages 18 and up	79%
From Ages 65 and up	16%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	46%
Speak Other Indo-European Languages	12%
Speak Asian-Pacific Island Languages	39%
Speak Other Languages	3%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

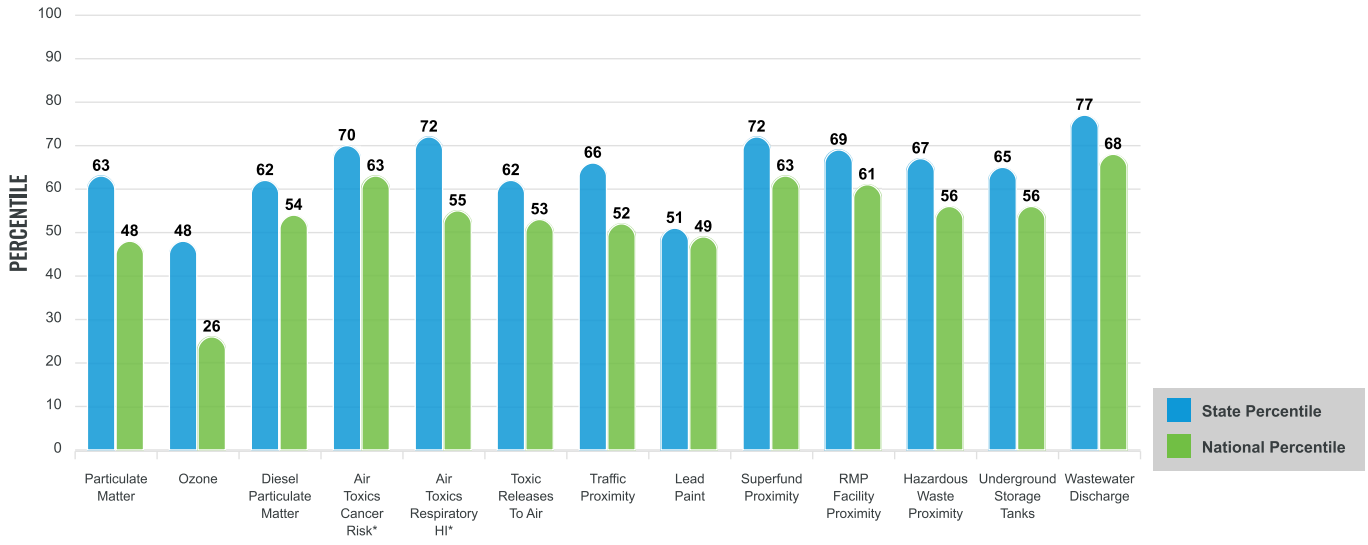
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

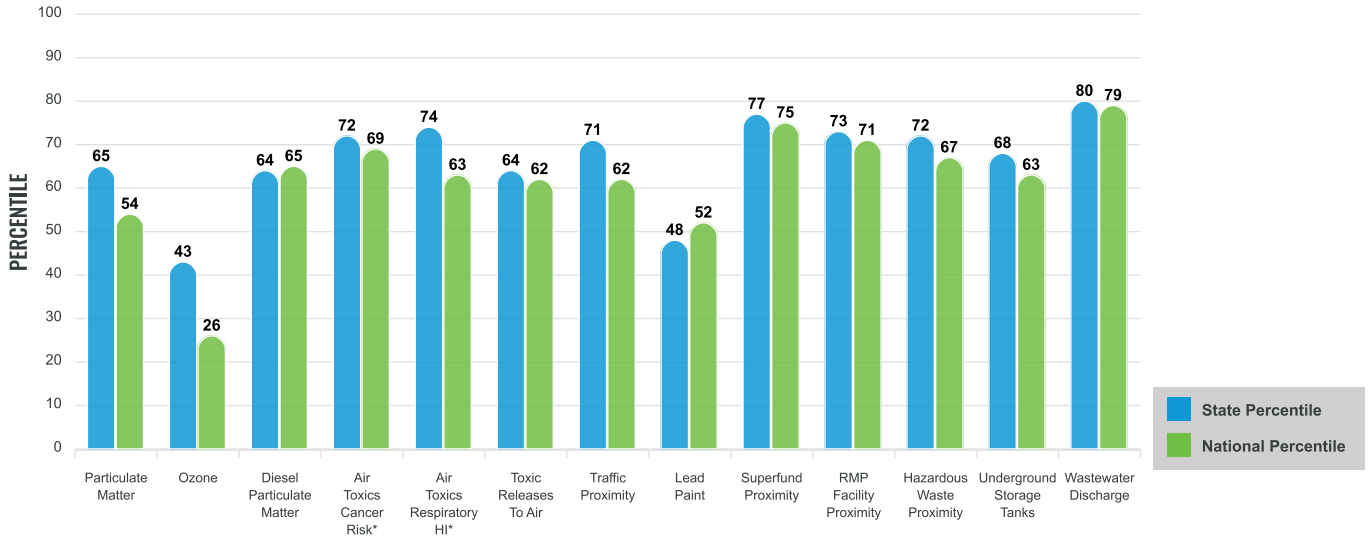
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	7.97	8.05	52	8.08	44
Ozone (ppb)	57.4	59.9	32	61.6	20
Diesel Particulate Matter (µg/m^3)	0.228	0.268	50	0.261	52
Air Toxics Cancer Risk* (lifetime risk per million)	28	25	0	25	5
Air Toxics Respiratory HI*	0.32	0.31	14	0.31	31
Toxic Releases to Air	1,000	4,500	60	4,600	60
Traffic Proximity (daily traffic count/distance to road)	110	110	70	210	59
Lead Paint (% Pre-1960 Housing)	0.2	0.31	45	0.3	48
Superfund Proximity (site count/km distance)	0.16	0.097	84	0.13	80
RMP Facility Proximity (facility count/km distance)	0.6	0.45	76	0.43	79
Hazardous Waste Proximity (facility count/km distance)	1.2	1.3	66	1.9	65
Underground Storage Tanks (count/km^2)	2.4	2	73	3.9	62
Wastewater Discharge (toxicity-weighted concentration/m distance)	1	0.49	94	22	91
SOCIOECONOMIC INDICATORS					
Demographic Index	25%	28%	55	35%	43
Supplemental Demographic Index	14%	14%	55	14%	56
People of Color	14%	23%	51	39%	28
Low Income	36%	33%	59	31%	64
Unemployment Rate	4%	5%	60	6%	51
Limited English Speaking Households	1%	1%	81	5%	58
Less Than High School Education	7%	10%	47	12%	46
Under Age 5	6%	6%	56	6%	59
Over Age 64	16%	18%	50	17%	53
Low Life Expectancy	19%	21%	30	20%	46

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund	3
Hazardous Waste, Treatment, Storage, and Disposal Facilities	18
Water Dischargers	1918
Air Pollution	225
Brownfields	213
Toxic Release Inventory	77

Other community features within defined area:

Schools	94
Hospitals	10
Places of Worship	61

Other environmental data:

Air Non-attainment	No
Impaired Waters	Yes

Selected location contains American Indian Reservation Lands*	No
Selected location contains a "Justice40 (CEJST)" disadvantaged community	Yes
Selected location contains an EPA IRA disadvantaged community	Yes

Report for County: Greene

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	19%	21%	30	20%	46
Heart Disease	6.3	6.9	36	6.1	56
Asthma	9.7	9.9	50	10	46
Cancer	6.3	6.6	39	6.1	52
Persons with Disabilities	14.7%	15.1%	51	13.4%	63

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	4%	8%	33	12%	38
Wildfire Risk	1%	5%	87	14%	78

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	19%	16%	65	14%	72
Lack of Health Insurance	12%	10%	62	9%	74
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Footnotes

Report for County: Greene

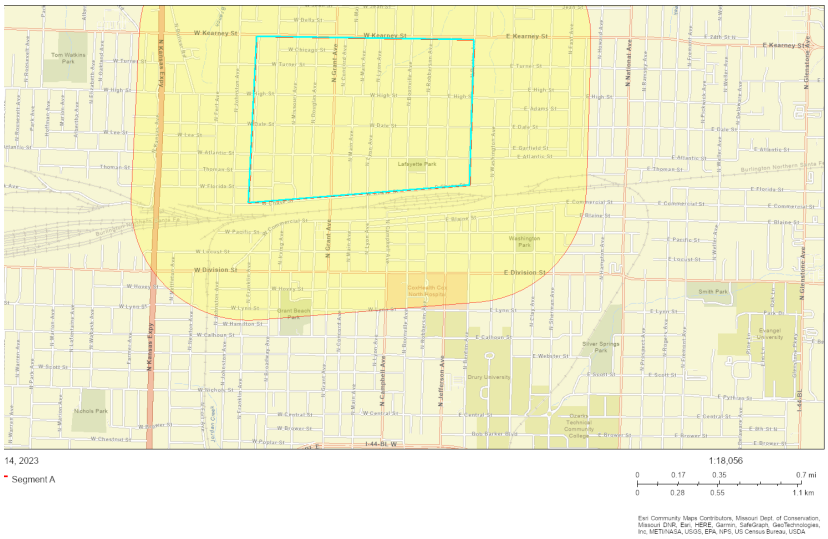
Segment - A

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Springfield, MO

0.5 miles Ring around the Corridor
Population: 10,049
Area in square miles: 3.00



LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	95%
Spanish	3%
Other and Unspecified	1%
Total Non-English	5%

COMMUNITY INFORMATION

- Low income: 56 percent
- People of color: 14 percent
- Less than high school education: 11 percent
- Limited English households: 1 percent
- Unemployment: 9 percent
- Persons with disabilities: 20 percent
- Male: 54 percent
- Female: 46 percent
- 59 years — Average life expectancy
- $17,625 — Per capita income
- Number of households: 4,246
- Owner occupied: 49 percent

BREAKDOWN BY RACE

- White: 87%
- Black: 4%
- Asian: 0%
- Hispanic: 5%
- American Indian: 1%
- Hawaiian/Paci c Islander: 0%
- Other race: 2%
- Two or more races: 6%

BREAKDOWN BY AGE

From Ages 1 to 4	5%
From Ages 1 to 18	21%
From Ages 18 and up	79%
From Ages 65 and up	10%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	66%
Speak Other Indo-European Languages	4%
Speak Asian-Pacific Island Languages	0%
Speak Other Languages	30%

Notes: Numbers may not sum to totals due to rounding. Hispanic popultion can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

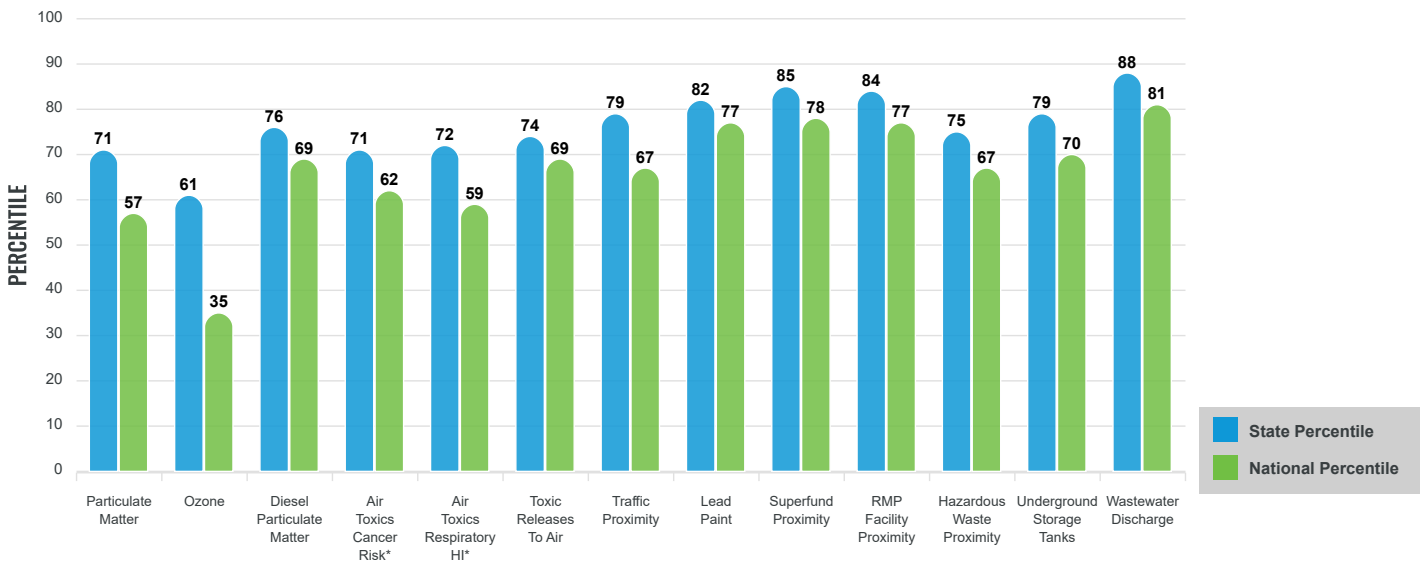
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

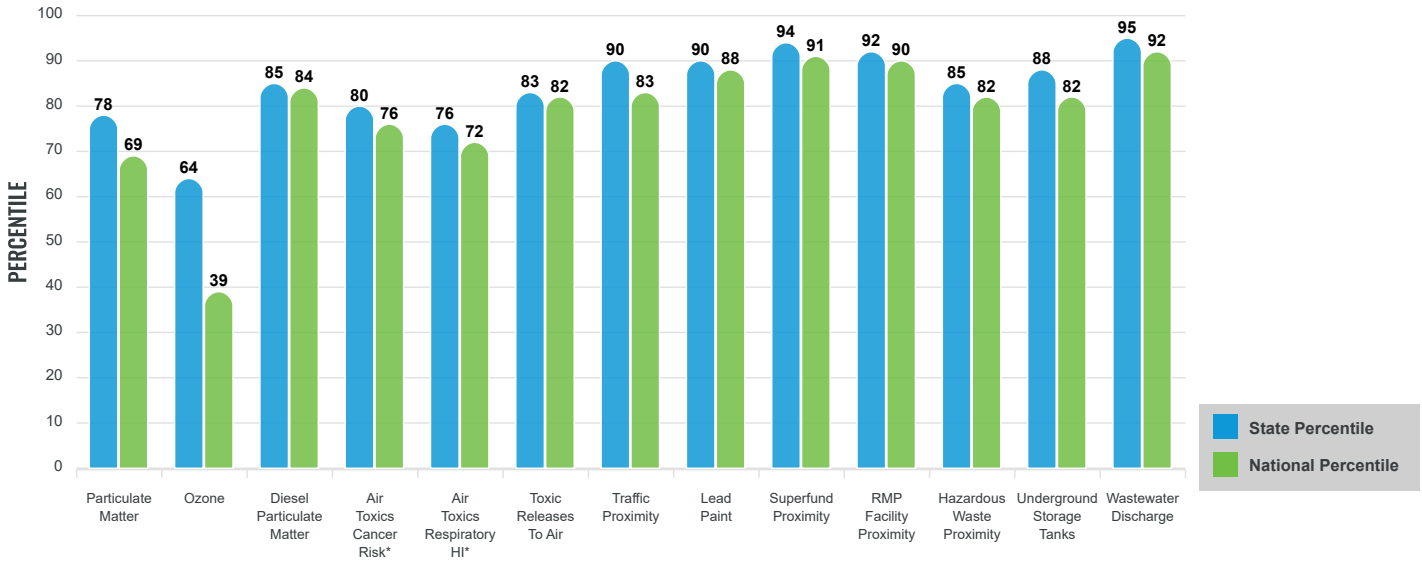
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 0.5 miles Ring around the Corridor

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	7.95	8.05	51	8.08	43
Ozone (ppb)	57.5	59.9	35	61.6	20
Diesel Particulate Matter (µg/m^3)	0.299	0.268	61	0.261	68
Air Toxics Cancer Risk* (lifetime risk per million)	30	29	14	28	35
Air Toxics Respiratory HI*	0.31	0.31	14	0.31	31
Toxic Releases to Air	1,200	4,500	64	4,600	62
Traffic Proximity (daily traffic count/distance to road)	170	110	80	210	70
Lead Paint (% Pre-1960 Housing)	0.61	0.31	81	0.3	81
Superfund Proximity (site count/km distance)	0.23	0.097	92	0.13	87
RMP Facility Proximity (facility count/km distance)	1.2	0.45	91	0.43	91
Hazardous Waste Proximity (facility count/km distance)	1.2	1.3	65	1.9	64
Underground Storage Tanks (count/km^2)	3.8	2	82	3.9	72
Wastewater Discharge (toxicity-weighted concentration/m distance)	2.7	0.49	97	22	94
SOCIOECONOMIC INDICATORS					
Demographic Index	35%	28%	73	35%	58
Supplemental Demographic Index	20%	14%	83	14%	79
People of Color	14%	23%	53	39%	30
Low Income	56%	33%	84	31%	85
Unemployment Rate	9%	5%	83	6%	78
Limited English Speaking Households	1%	1%	81	5%	58
Less Than High School Education	11%	10%	65	12%	62
Under Age 5	5%	6%	53	6%	56
Over Age 64	10%	18%	22	17%	27
Low Life Expectancy	23%	21%	67	20%	78

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund 0
Hazardous Waste, Treatment, Storage, and Disposal Facilities 0
Water Dischargers 24
Air Pollution 12
Brownfields 19
Toxic Release Inventory 3

Other community features within defined area:

Schools 5
Hospitals 1
Places of Worship 0

Other environmental data:

Air Non-attainment ..... No
Impaired Waters ..... No

Selected location contains American Indian Reservation Lands* ..... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community ..... Yes
Selected location contains an EPA IRA disadvantaged community ..... Yes

Report for 0.5 miles Ring around the Corridor

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	23%	21%	67	20%	78
Heart Disease	6.6	6.9	42	6.1	62
Asthma	10.9	9.9	83	10	75
Cancer	5.2	6.6	15	6.1	29
Persons with Disabilities	18.7%	15.1%	75	13.4%	82

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	4%	8%	29	12%	34
Wildfire Risk	0%	5%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	25%	16%	78	14%	82
Lack of Health Insurance	18%	10%	88	9%	89
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Footnotes

Report for 0.5 miles Ring around the Corridor

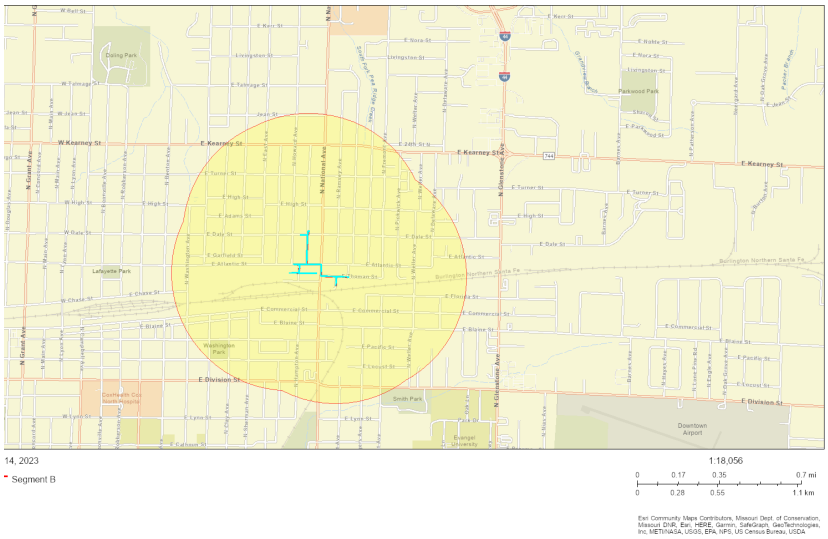
Segment - B

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Springfield, MO

0.5 miles Ring around the Corridor
Population: 5,024
Area in square miles: 1.19



LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	95%
Spanish	3%
French, Haitian, or Cajun	1%
Other and Unspecified	1%
Total Non-English	5%

COMMUNITY INFORMATION

- Low income: 59 percent
- People of color: 21 percent
- Less than high school education: 15 percent
- Limited English households: 4 percent
- Unemployment: 3 percent
- Persons with disabilities: 19 percent
- Male: 54 percent
- Female: 46 percent
- 54 years — Average life expectancy
- $17,462 — Per capita income
- Number of households: 1,954
- Owner occupied: 36 percent

BREAKDOWN BY RACE

- White: 81%
- Black: 7%
- Asian: 0%
- Hispanic: 7%
- American Indian: 0%
- Hawaiian/Paci c Islander: 0%
- Other race: 1%
- Two or more races: 9%

BREAKDOWN BY AGE

From Ages 1 to 4	6%
From Ages 1 to 18	19%
From Ages 18 and up	81%
From Ages 65 and up	10%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	85%
Speak Other Indo-European Languages	15%
Speak Asian-Pacific Island Languages	0%
Speak Other Languages	0%

Notes: Numbers may not sum to totals due to rounding. Hispanic popultion can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

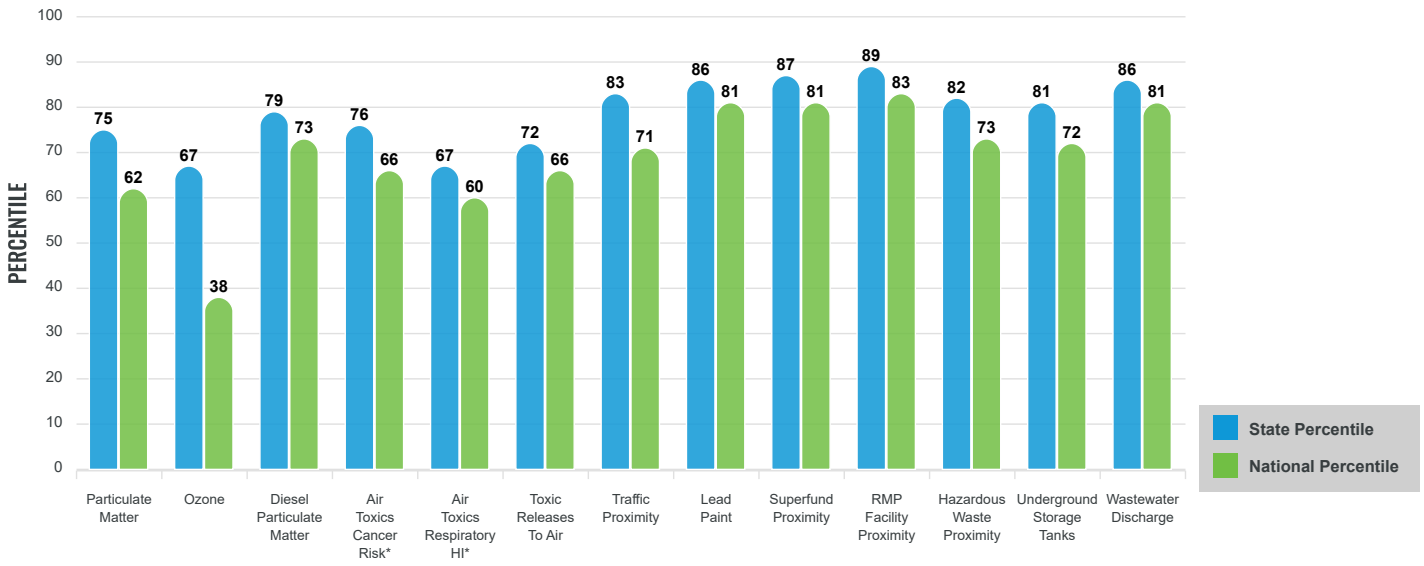
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

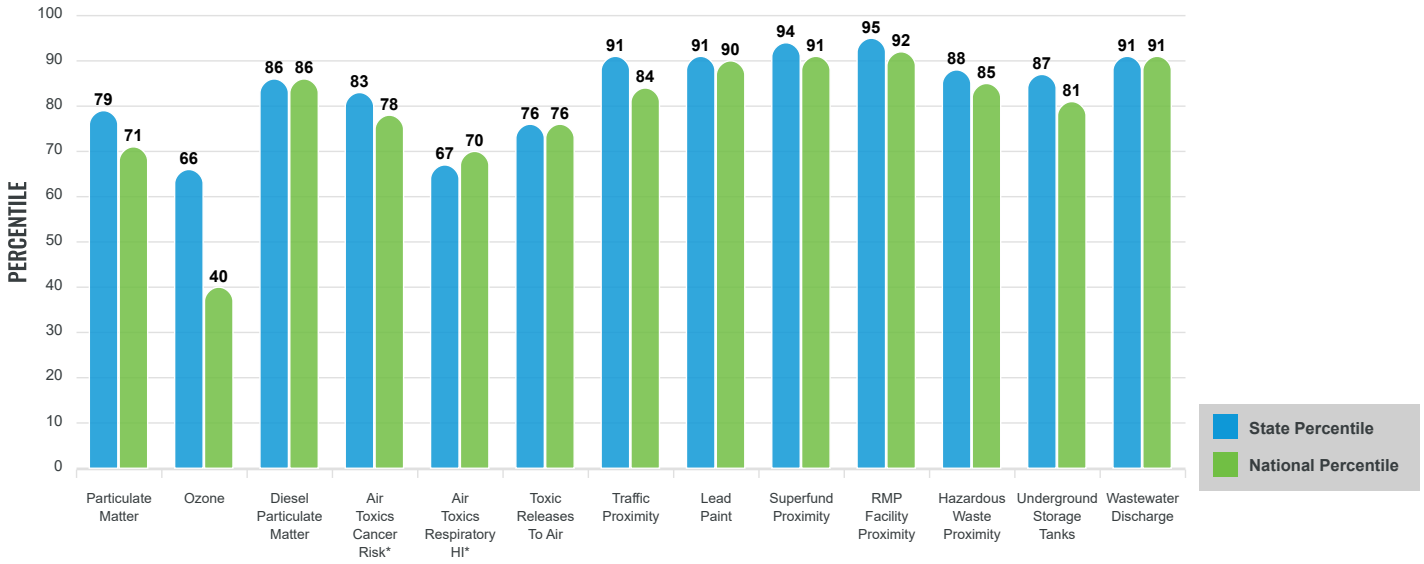
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 0.5 miles Ring around the Corridor

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	7.94	8.05	50	8.08	43
Ozone (ppb)	57.5	59.9	36	61.6	20
Diesel Particulate Matter (µg/m^3)	0.301	0.268	62	0.261	68
Air Toxics Cancer Risk* (lifetime risk per million)	30	29	14	28	35
Air Toxics Respiratory HI*	0.3	0.31	14	0.31	31
Toxic Releases to Air	590	4,500	47	4,600	49
Traffic Proximity (daily traffic count/distance to road)	160	110	78	210	68
Lead Paint (% Pre-1960 Housing)	0.62	0.31	82	0.3	81
Superfund Proximity (site count/km distance)	0.18	0.097	88	0.13	83
RMP Facility Proximity (facility count/km distance)	2	0.45	96	0.43	96
Hazardous Waste Proximity (facility count/km distance)	1.6	1.3	72	1.9	69
Underground Storage Tanks (count/km^2)	2.8	2	75	3.9	65
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.33	0.49	87	22	88
SOCIOECONOMIC INDICATORS					
Demographic Index	40%	28%	79	35%	64
Supplemental Demographic Index	21%	14%	86	14%	81
People of Color	21%	23%	65	39%	40
Low Income	59%	33%	87	31%	88
Unemployment Rate	3%	5%	54	6%	46
Limited English Speaking Households	4%	1%	90	5%	71
Less Than High School Education	15%	10%	77	12%	72
Under Age 5	6%	6%	58	6%	60
Over Age 64	10%	18%	20	17%	25
Low Life Expectancy	22%	21%	64	20%	76

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund 0
Hazardous Waste, Treatment, Storage, and Disposal Facilities 0
Water Dischargers 19
Air Pollution 5
Brownfields 5
Toxic Release Inventory 3

Other community features within defined area:

Schools 4
Hospitals 0
Places of Worship 0

Other environmental data:

Air Non-attainment ..... No
Impaired Waters ..... No

Selected location contains American Indian Reservation Lands* ..... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community ..... Yes
Selected location contains an EPA IRA disadvantaged community ..... Yes

Report for 0.5 miles Ring around the Corridor

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	22%	21%	64	20%	76
Heart Disease	6	6.9	28	6.1	48
Asthma	11.2	9.9	88	10	82
Cancer	4.5	6.6	7	6.1	16
Persons with Disabilities	19.8%	15.1%	79	13.4%	85

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	2%	8%	15	12%	22
Wildfire Risk	0%	5%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	21%	16%	70	14%	76
Lack of Health Insurance	19%	10%	89	9%	90
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	No	N/A	N/A	N/A	N/A

Footnotes

Report for 0.5 miles Ring around the Corridor

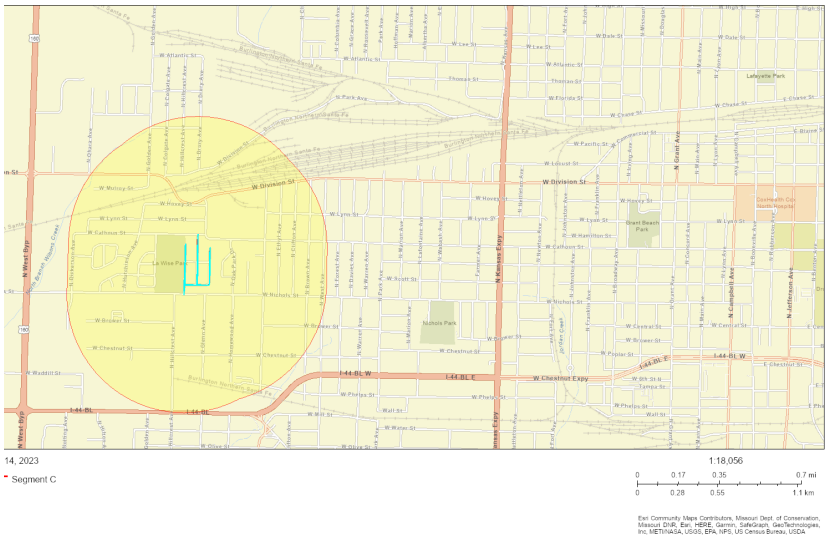
Segment - C

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Springfield, MO

0.5 miles Ring around the Corridor
Population: 2,754
Area in square miles: 1.13



LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	94%
Spanish	4%
Other Indo-European	1%
Other and Unspecified	1%
Total Non-English	6%

COMMUNITY INFORMATION

- Low income: 59 percent
- People of color: 25 percent
- Less than high school education: 18 percent
- Limited English households: 0 percent
- Unemployment: 8 percent
- Persons with disabilities: 24 percent
- Male: 47 percent
- Female: 53 percent
- 72 years — Average life expectancy
- $18,396 — Per capita income
- Number of households: 1,182
- Owner occupied: 50 percent

BREAKDOWN BY RACE

- White: 82%
- Black: 7%
- Asian: 0%
- Hispanic: 9%
- American Indian: 1%
- Hawaiian/Paci c Islander: 0%
- Other race: 0%
- Two or more races: 9%

BREAKDOWN BY AGE

From Ages 1 to 4	8%
From Ages 1 to 18	26%
From Ages 18 and up	74%
From Ages 65 and up	12%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	0%
Speak Other Indo-European Languages	0%
Speak Asian-Pacific Island Languages	0%
Speak Other Languages	0%

Notes: Numbers may not sum to totals due to rounding. Hispanic popultion can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

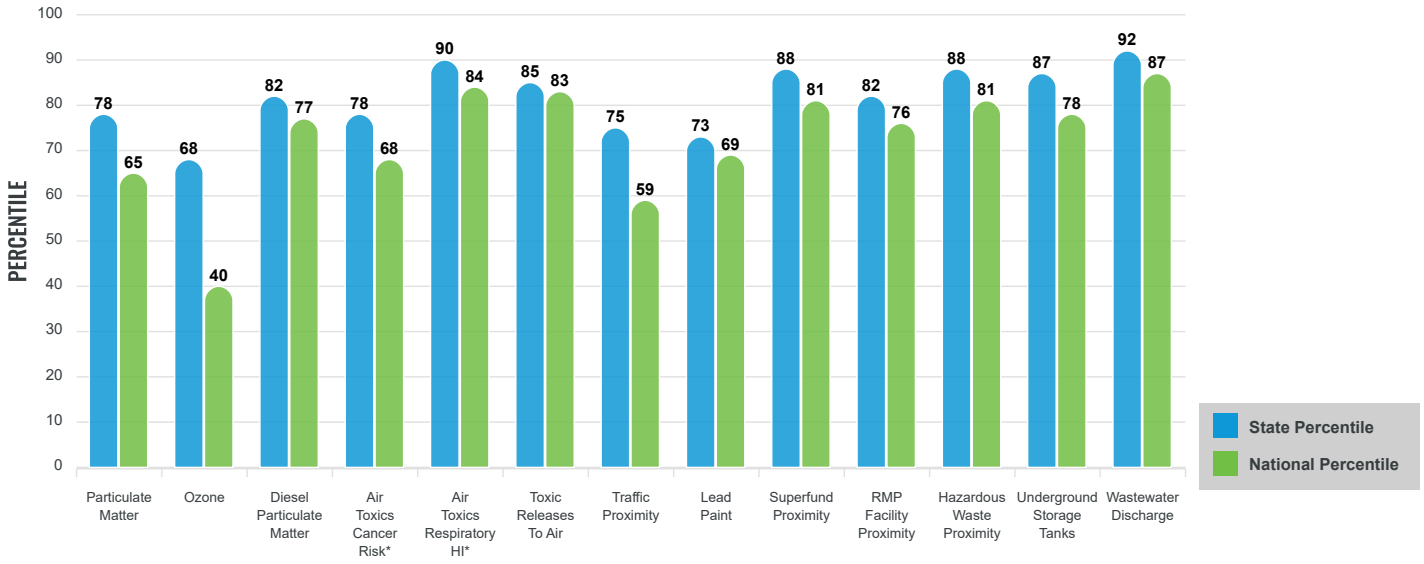
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

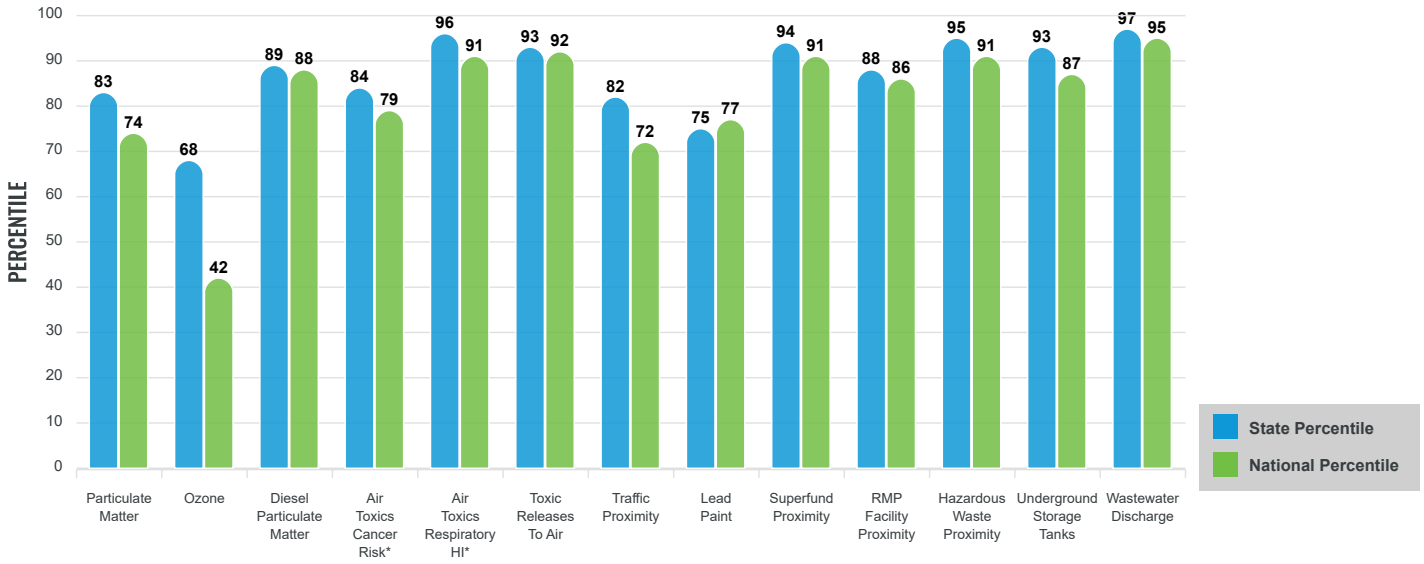
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 0.5 miles Ring around the Corridor

www.epa.gov/ejscreen

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	8	8.05	54	8.08	44
Ozone (ppb)	57.5	59.9	35	61.6	20
Diesel Particulate Matter (µg/m^3)	0.328	0.268	66	0.261	73
Air Toxics Cancer Risk* (lifetime risk per million)	30	29	14	28	35
Air Toxics Respiratory HI*	0.4	0.31	76	0.31	70
Toxic Releases to Air	4,000	4,500	79	4,600	83
Traffic Proximity (daily traffic count/distance to road)	71	110	58	210	48
Lead Paint (% Pre-1960 Housing)	0.24	0.31	51	0.3	52
Superfund Proximity (site count/km distance)	0.16	0.097	85	0.13	81
RMP Facility Proximity (facility count/km distance)	0.39	0.45	68	0.43	72
Hazardous Waste Proximity (facility count/km distance)	3.8	1.3	89	1.9	85
Underground Storage Tanks (count/km^2)	5.4	2	88	3.9	78
Wastewater Discharge (toxicity-weighted concentration/m distance)	10	0.49	99	22	97
SOCIOECONOMIC INDICATORS					
Demographic Index	42%	28%	81	35%	66
Supplemental Demographic Index	22%	14%	88	14%	83
People of Color	25%	23%	70	39%	44
Low Income	59%	33%	87	31%	88
Unemployment Rate	8%	5%	82	6%	76
Limited English Speaking Households	0%	1%	0	5%	0
Less Than High School Education	18%	10%	82	12%	77
Under Age 5	8%	6%	72	6%	74
Over Age 64	12%	18%	28	17%	33
Low Life Expectancy	25%	21%	88	20%	92

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund 0
Hazardous Waste, Treatment, Storage, and Disposal Facilities 1
Water Dischargers 13
Air Pollution 5
Brownfields 2
Toxic Release Inventory 2

Other community features within defined area:

Schools 2
Hospitals 0
Places of Worship 0

Other environmental data:

Air Non-attainment ..... No
Impaired Waters ..... Yes

Selected location contains American Indian Reservation Lands* ..... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community ..... Yes
Selected location contains an EPA IRA disadvantaged community ..... Yes

Report for 0.5 miles Ring around the Corridor

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	25%	21%	88	20%	92
Heart Disease	7.5	6.9	64	6.1	77
Asthma	11.3	9.9	88	10	84
Cancer	5.4	6.6	18	6.1	33
Persons with Disabilities	21.8%	15.1%	86	13.4%	90

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	5%	8%	39	12%	42
Wildfire Risk	0%	5%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	20%	16%	67	14%	74
Lack of Health Insurance	20%	10%	93	9%	92
Housing Burden	No	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Footnotes

Report for 0.5 miles Ring around the Corridor

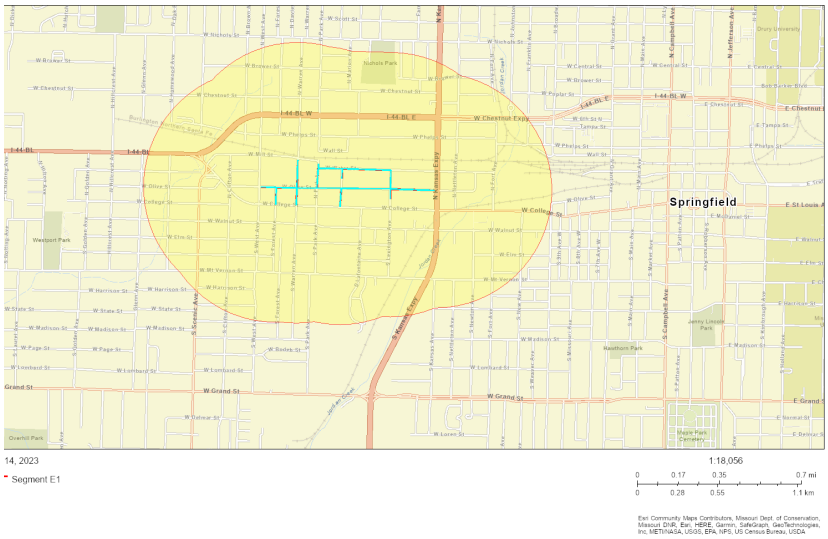
Segment - E1

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Springfield, MO

0.5 miles Ring around the Corridor
Population: 5,298
Area in square miles: 1.67



LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	97%
Spanish	3%
Total Non-English	3%

COMMUNITY INFORMATION

- Low income: 63 percent
- People of color: 15 percent
- Less than high school education: 18 percent
- Limited English households: 0 percent
- Unemployment: 8 percent
- Persons with disabilities: 23 percent
- Male: 49 percent
- Female: 51 percent
- 70 years — Average life expectancy
- $15,504 — Per capita income
- Number of households: 2,529
- Owner occupied: 38 percent

BREAKDOWN BY RACE

- White: 88%
- Black: 2%
- Asian: 0%
- Hispanic: 4%
- American Indian: 3%
- Hawaiian/Pacific Islander: 0%
- Other race: 0%
- Two or more races: 6%

BREAKDOWN BY AGE

From Ages 1 to 4	5%
From Ages 1 to 18	21%
From Ages 18 and up	79%
From Ages 65 and up	12%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	60%
Speak Other Indo-European Languages	40%
Speak Asian-Pacific Island Languages	0%
Speak Other Languages	0%

Notes: Numbers may not sum to totals due to rounding. Hispanic popultion can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

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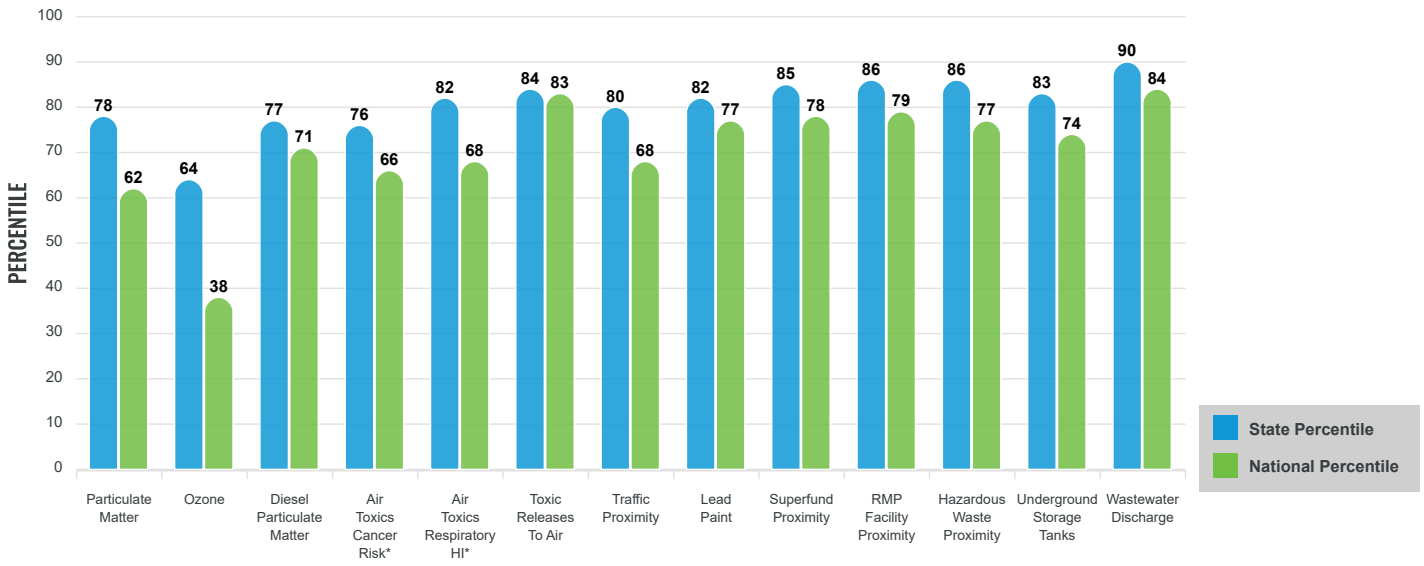
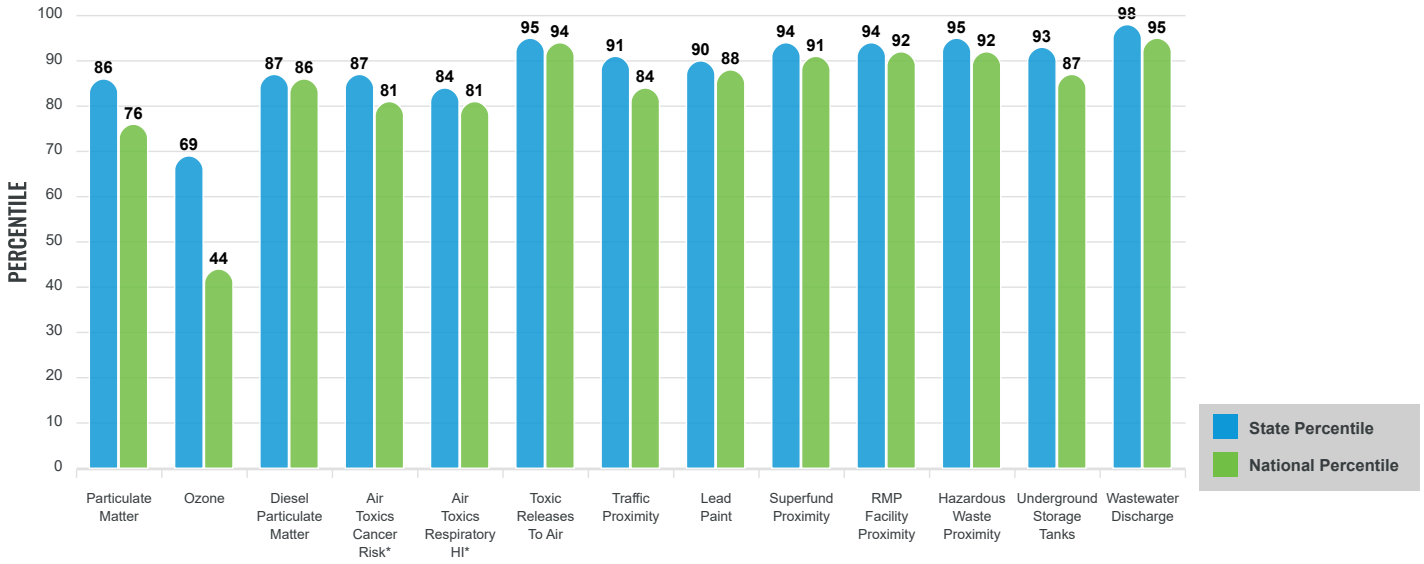
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 0.5 miles Ring around the Corridor

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	8.02	8.05	57	8.08	45
Ozone (ppb)	57.4	59.9	33	61.6	20
Diesel Particulate Matter (µg/m^3)	0.276	0.268	58	0.261	63
Air Toxics Cancer Risk* (lifetime risk per million)	30	29	14	28	35
Air Toxics Respiratory HI*	0.33	0.31	14	0.31	31
Toxic Releases to Air	11,000	4,500	88	4,600	93
Traffic Proximity (daily traffic count/distance to road)	150	110	77	210	67
Lead Paint (% Pre-1960 Housing)	0.46	0.31	72	0.3	71
Superfund Proximity (site count/km distance)	0.14	0.097	80	0.13	77
RMP Facility Proximity (facility count/km distance)	0.84	0.45	83	0.43	85
Hazardous Waste Proximity (facility count/km distance)	3	1.3	84	1.9	81
Underground Storage Tanks (count/km^2)	3.8	2	82	3.9	72
Wastewater Discharge (toxicity-weighted concentration/m distance)	2.2	0.49	97	22	93
SOCIOECONOMIC INDICATORS					
Demographic Index	39%	28%	78	35%	63
Supplemental Demographic Index	23%	14%	91	14%	86
People of Color	15%	23%	55	39%	31
Low Income	63%	33%	90	31%	90
Unemployment Rate	8%	5%	81	6%	75
Limited English Speaking Households	0%	1%	79	5%	57
Less Than High School Education	18%	10%	83	12%	78
Under Age 5	5%	6%	43	6%	47
Over Age 64	12%	18%	30	17%	35
Low Life Expectancy	27%	21%	93	20%	96

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund 0
Hazardous Waste, Treatment, Storage, and Disposal Facilities 1
Water Dischargers 22
Air Pollution 11
Brownfields 22
Toxic Release Inventory 1

Other community features within defined area:

Schools 1
Hospitals 0
Places of Worship 0

Other environmental data:

Air Non-attainment ..... No
Impaired Waters ..... Yes

Selected location contains American Indian Reservation Lands* ..... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community ..... Yes
Selected location contains an EPA IRA disadvantaged community ..... Yes

Report for 0.5 miles Ring around the Corridor

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	27%	21%	93	20%	96
Heart Disease	8.6	6.9	80	6.1	89
Asthma	11.6	9.9	90	10	87
Cancer	5.9	6.6	28	6.1	43
Persons with Disabilities	22.9%	15.1%	89	13.4%	92

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	5%	8%	39	12%	42
Wildfire Risk	0%	5%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	28%	16%	83	14%	86
Lack of Health Insurance	18%	10%	88	9%	89
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Footnotes

Report for 0.5 miles Ring around the Corridor

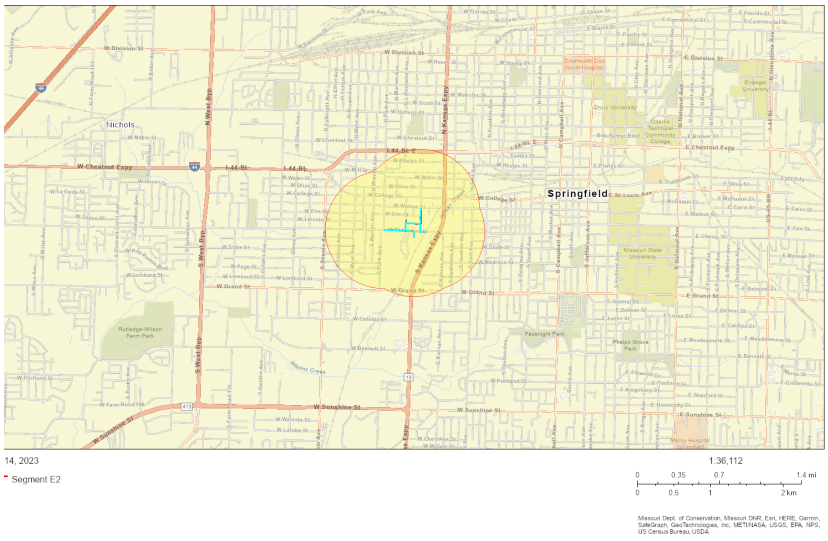
Segment - E2

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Springfield, MO

0.5 miles Ring around the Corridor
Population: 4,559
Area in square miles: 1.30



LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	96%
Spanish	4%
Total Non-English	4%

COMMUNITY INFORMATION

- Low income: 65 percent
- People of color: 18 percent
- Less than high school education: 19 percent
- Limited English households: 0 percent
- Unemployment: 9 percent
- Persons with disabilities: 22 percent
- Male: 49 percent
- Female: 51 percent
- 71 years — Average life expectancy
- $15,762 — Per capita income
- Number of households: 2,086
- Owner occupied: 36 percent

BREAKDOWN BY RACE

- White: 88%
- Black: 3%
- Asian: 0%
- Hispanic: 6%
- American Indian: 2%
- Hawaiian/Pacific Islander: 0%
- Other race: 1%
- Two or more races: 6%

BREAKDOWN BY AGE

From Ages 1 to 4	5%
From Ages 1 to 18	22%
From Ages 18 and up	78%
From Ages 65 and up	13%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	66%
Speak Other Indo-European Languages	34%
Speak Asian-Pacific Island Languages	0%
Speak Other Languages	0%

Notes: Numbers may not sum to totals due to rounding. Hispanic popultion can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

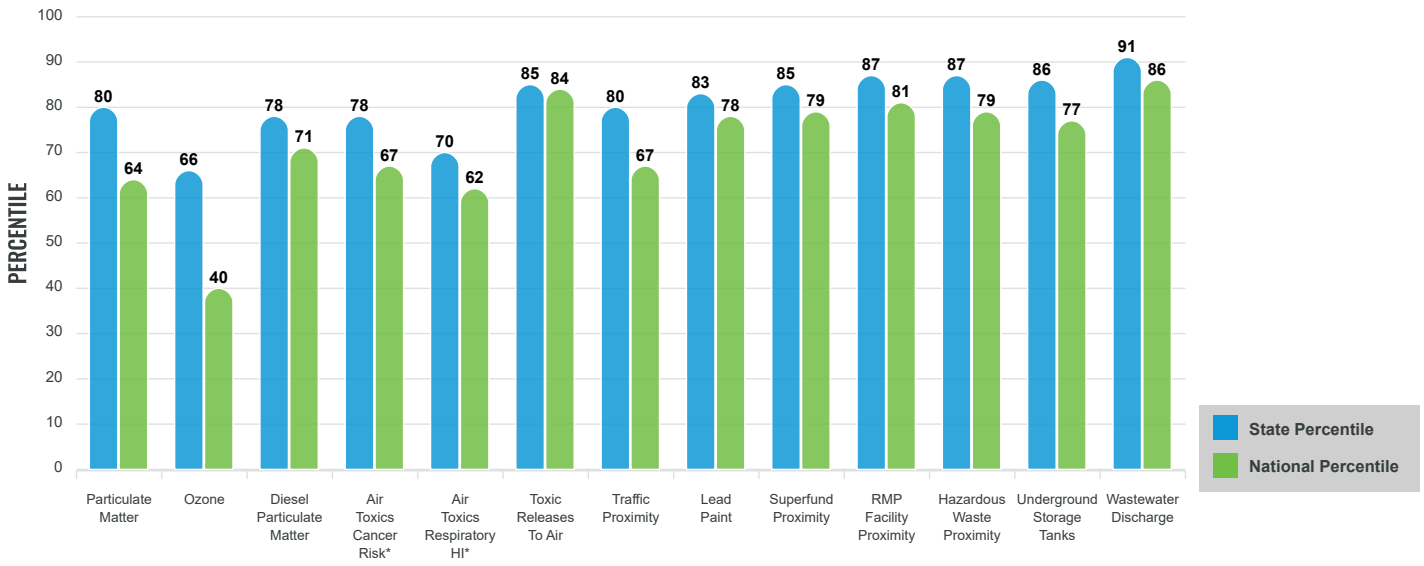
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

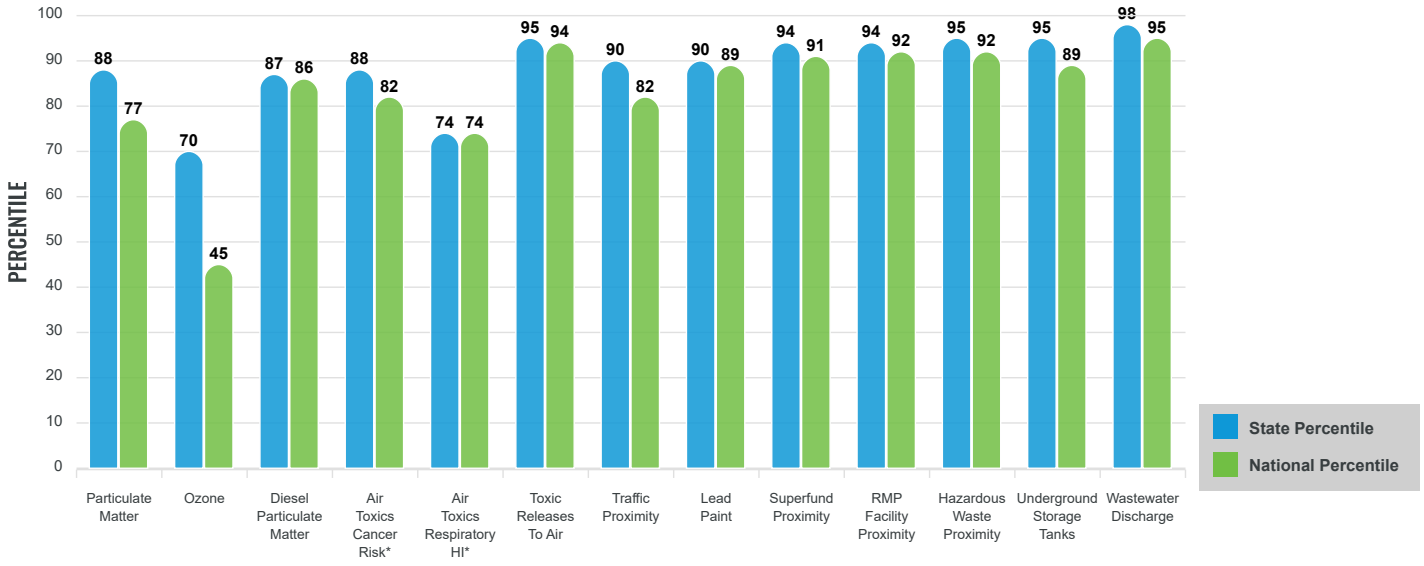
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 0.5 miles Ring around the Corridor

www.epa.gov/ejscreen

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	8.03	8.05	58	8.08	45
Ozone (ppb)	57.4	59.9	33	61.6	20
Diesel Particulate Matter (µg/m^3)	0.26	0.268	55	0.261	60
Air Toxics Cancer Risk* (lifetime risk per million)	30	29	14	28	35
Air Toxics Respiratory HI*	0.3	0.31	14	0.31	31
Toxic Releases to Air	7,900	4,500	85	4,600	91
Traffic Proximity (daily traffic count/distance to road)	100	110	68	210	58
Lead Paint (% Pre-1960 Housing)	0.45	0.31	71	0.3	70
Superfund Proximity (site count/km distance)	0.13	0.097	77	0.13	75
RMP Facility Proximity (facility count/km distance)	0.83	0.45	83	0.43	85
Hazardous Waste Proximity (facility count/km distance)	2.9	1.3	83	1.9	80
Underground Storage Tanks (count/km^2)	4.6	2	85	3.9	76
Wastewater Discharge (toxicity-weighted concentration/m distance)	1.7	0.49	96	22	93
SOCIOECONOMIC INDICATORS					
Demographic Index	42%	28%	81	35%	66
Supplemental Demographic Index	24%	14%	92	14%	87
People of Color	18%	23%	60	39%	35
Low Income	65%	33%	92	31%	91
Unemployment Rate	9%	5%	83	6%	78
Limited English Speaking Households	0%	1%	79	5%	57
Less Than High School Education	19%	10%	85	12%	79
Under Age 5	5%	6%	50	6%	53
Over Age 64	13%	18%	36	17%	40
Low Life Expectancy	27%	21%	92	20%	95

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund 0
Hazardous Waste, Treatment, Storage, and Disposal Facilities 1
Water Dischargers 17
Air Pollution 6
Brownfields 18
Toxic Release Inventory 1

Other community features within defined area:

Schools 2
Hospitals 0
Places of Worship 0

Other environmental data:

Air Non-attainment ..... No
Impaired Waters ..... Yes

Selected location contains American Indian Reservation Lands* ..... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community ..... Yes
Selected location contains an EPA IRA disadvantaged community ..... Yes

Report for 0.5 miles Ring around the Corridor

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	27%	21%	92	20%	95
Heart Disease	9.1	6.9	87	6.1	93
Asthma	11.8	9.9	91	10	89
Cancer	6.1	6.6	31	6.1	45
Persons with Disabilities	22.5%	15.1%	89	13.4%	91

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	3%	8%	25	12%	31
Wildfire Risk	0%	5%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	32%	16%	89	14%	90
Lack of Health Insurance	17%	10%	87	9%	89
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Footnotes

Report for 0.5 miles Ring around the Corridor

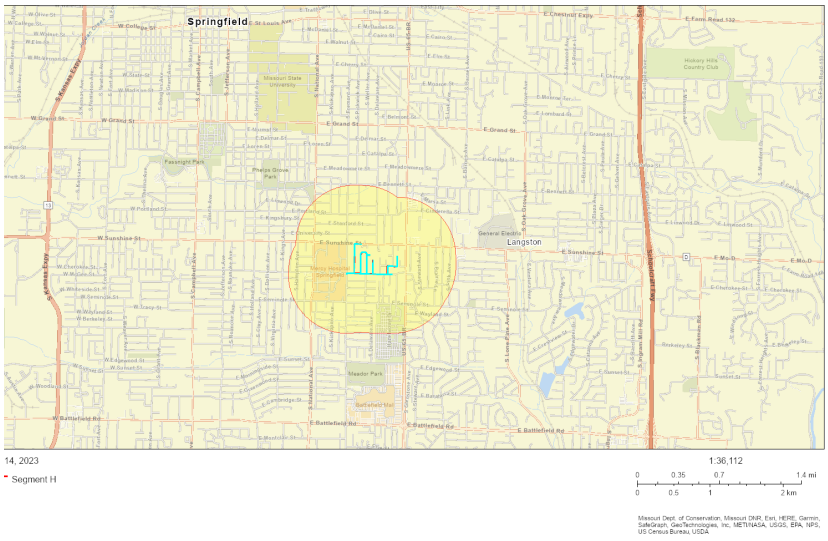
Segment - H

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Springfield, MO

0.5 miles Ring around the Corridor
Population: 3,848
Area in square miles: 1.47



LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	95%
Spanish	3%
Other Indo-European	1%
Total Non-English	5%

COMMUNITY INFORMATION

- Low income: 35 percent
- People of color: 11 percent
- Less than high school education: 4 percent
- Limited English households: 0 percent
- Unemployment: 2 percent
- Persons with disabilities: 18 percent
- Male: 47 percent
- Female: 53 percent
- 72 years — Average life expectancy
- $38,443 — Per capita income
- Number of households: 1,997
- Owner occupied: 48 percent

BREAKDOWN BY RACE

- White: 92%
- Black: 4%
- Asian: 1%
- Hispanic: 4%
- American Indian: 0%
- Hawaiian/Pacific Islander: 0%
- Other race: 0%
- Two or more races: 3%

BREAKDOWN BY AGE

From Ages 1 to 4	7%
From Ages 1 to 18	17%
From Ages 18 and up	83%
From Ages 65 and up	17%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	0%
Speak Other Indo-European Languages	0%
Speak Asian-Pacific Island Languages	0%
Speak Other Languages	0%

Notes: Numbers may not sum to totals due to rounding. Hispanic popultion can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

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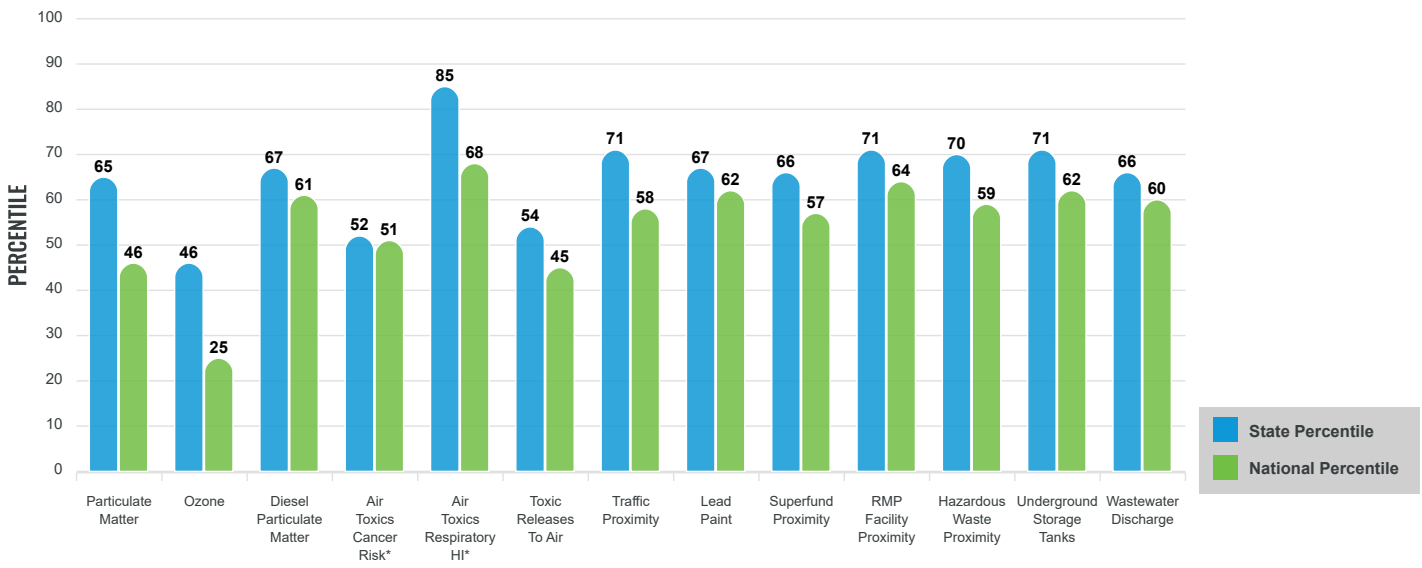
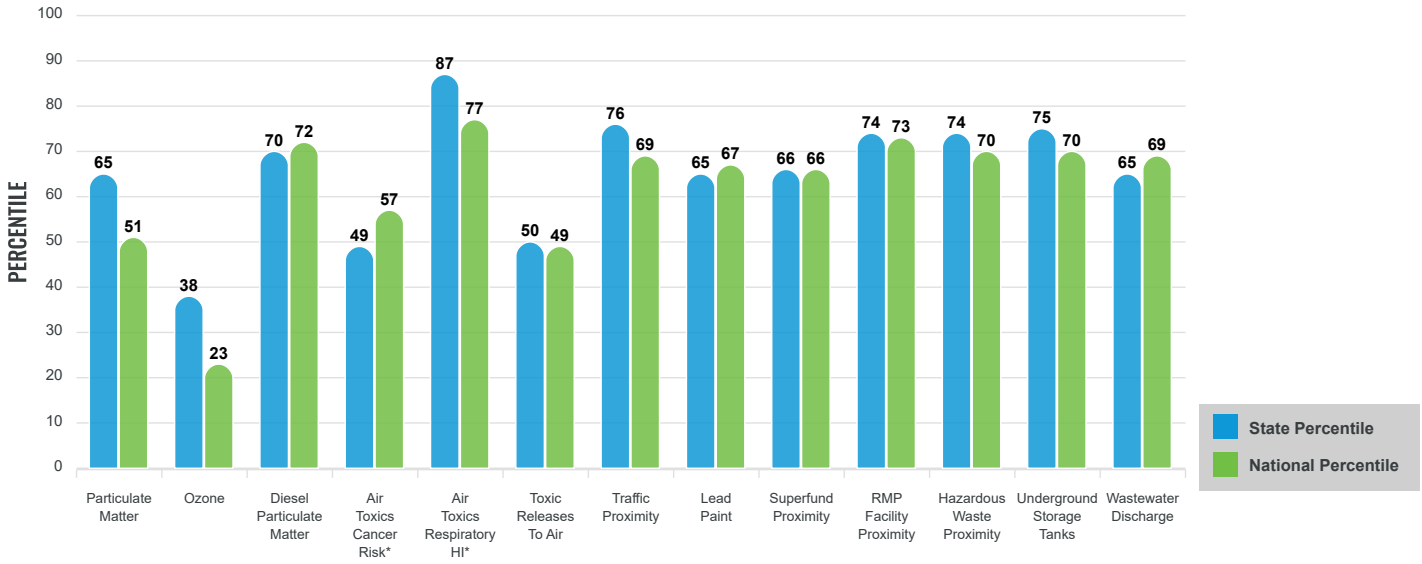
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 0.5 miles Ring around the Corridor

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	8.08	8.05	61	8.08	46
Ozone (ppb)	57.4	59.9	35	61.6	20
Diesel Particulate Matter (µg/m^3)	0.344	0.268	67	0.261	76
Air Toxics Cancer Risk* (lifetime risk per million)	30	29	14	28	35
Air Toxics Respiratory HI*	0.4	0.31	76	0.31	70
Toxic Releases to Air	450	4,500	43	4,600	45
Traffic Proximity (daily traffic count/distance to road)	240	110	87	210	78
Lead Paint (% Pre-1960 Housing)	0.56	0.31	79	0.3	77
Superfund Proximity (site count/km distance)	0.09	0.097	61	0.13	63
RMP Facility Proximity (facility count/km distance)	0.91	0.45	85	0.43	87
Hazardous Waste Proximity (facility count/km distance)	2.3	1.3	80	1.9	76
Underground Storage Tanks (count/km^2)	6	2	90	3.9	80
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.097	0.49	78	22	82
SOCIOECONOMIC INDICATORS					
Demographic Index	23%	28%	49	35%	38
Supplemental Demographic Index	12%	14%	43	14%	47
People of Color	11%	23%	45	39%	25
Low Income	35%	33%	56	31%	62
Unemployment Rate	2%	5%	40	6%	32
Limited English Speaking Households	0%	1%	0	5%	0
Less Than High School Education	4%	10%	30	12%	31
Under Age 5	7%	6%	67	6%	69
Over Age 64	17%	18%	51	17%	55
Low Life Expectancy	19%	21%	32	20%	48

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund 0
Hazardous Waste, Treatment, Storage, and Disposal Facilities 1
Water Dischargers 13
Air Pollution 9
Brownfields 0
Toxic Release Inventory 0

Other community features within defined area:

Schools 2
Hospitals 1
Places of Worship 0

Other environmental data:

Air Non-attainment ..... No
Impaired Waters ..... Yes

Selected location contains American Indian Reservation Lands* ..... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community ..... Yes
Selected location contains an EPA IRA disadvantaged community ..... Yes

Report for 0.5 miles Ring around the Corridor

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	19%	21%	32	20%	48
Heart Disease	7.1	6.9	54	6.1	71
Asthma	9.6	9.9	44	10	43
Cancer	7.1	6.6	61	6.1	69
Persons with Disabilities	15.7%	15.1%	57	13.4%	69

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	2%	8%	19	12%	26
Wildfire Risk	0%	5%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	18%	16%	61	14%	69
Lack of Health Insurance	11%	10%	62	9%	74
Housing Burden	No	N/A	N/A	N/A	N/A
Transportation Access	No	N/A	N/A	N/A	N/A
Food Desert	No	N/A	N/A	N/A	N/A

Footnotes

Report for 0.5 miles Ring around the Corridor