

**Strain Investigation Feature No. 25 WPAT 22-inch ROW 15**  
Strain Investigation Study

Prepared by:



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Kirkland, WA 98033

Prepared for:

**Marathon Petroleum Company**



**Site Overview**

Strain Investigation Feature No. 25  
Pipeline System: Woodpat 22" Crude  
Pipeline Segment: Roxana - Patoka Woodpat 22"  
ROW 15

**Date of Desktop Review**

07/07/2021

**Date of Field Inspection**

06/15/2021

**Marathon Project ID No.**

141302

# SECTION 1 – Site Detail Information

## Strain Investigation

**Project Description:** Geomorphic Solutions, LLC, was contracted by Marathon to perform a strain investigation for strain feature No. 25 along the WPAT 22-inch pipeline near Edwardsville, IL (**Figure 1**). The WPAT pipeline flows west to east in the vicinity of strain Feature No. 25. Marathon provided information for this site and Geomorphic Solutions, LLC used these materials as a starting point to create a survey plan and a suite of GPS and electronic line finding equipment was deployed to the site.

**Desktop Investigation Summary:** The strain point provided by Marathon is located on the left/south bank of Cahokia Creek. The creek flows northeast to southwest and the pipeline runs parallel to the creek in the vicinity of the strain feature. There is minimal development on the left floodplain of Cahokia Creek and a bridge crosses the creek just upstream of the strain feature. No mining activity was located near this strain feature. No karst geology is identified at the strain feature. Historic and current aerial imagery indicates that the left bank of Cahokia Creek is prone to ongoing erosion and failures. Concrete matting has been installed on the left bank (first visible in imagery October, 2014) but appears to only cover only a portion of the top of bank. Ongoing bank erosion and failures are still notable after matting installation. NRCS soil mapping identifies the soils at the strain feature as somewhat poorly drained silt loam.

**Site Investigation Summary:** The 22-inch pipeline was buried within the right of way. In total, 16 depth of cover measurements were obtained. The minimum depth of cover was approximately 1.83-ft. Concrete matting was observed over the pipeline alignment but did not extend to the current top of bank location. The left bank was badly eroded with evidence of instability including recent failures, scarps, and cracking. This bank instability could be resulting in the observed pipeline bending. The data collected suggests that the pipeline is bending both horizontally and vertically in the direction of the bank failures here.

**Signal Application Notes:** Signal was applied to the pipeline with a TX-150 on ELF at a test station approximately 240-ft northeast of the strain feature and adjacent to Edwardsville Rd. Signal strength output was 2A and good signal was obtained at the strain feature, allowing successful detection of the pipeline across the entire surveyed profile. Measured depth of cover was not probe verified because the pipeline was beneath concrete matting.

### List of Figures:

**Figure 1:** Map showing location of strain Feature No. 25

Figures 2 and 3: Overviews of all survey data collected by Geomorphic Solutions, LLC.

Figure 4: Pipeline depth of cover survey in vicinity of strain feature

Figure 5: Map topographic data in vicinity of strain feature

Figure 6: Soil mapping in vicinity of strain feature

Figure 7: Map of Karst geology in vicinity of strain feature

Figure 8: Map of active/inactive mines in vicinity of strain feature

Figure 9: Contour map based on surveyed ground data

### **Strain Investigation Location:**

County and State: Madison, Illinois

Nearest City: Edwardsville, IL

Latitude/Longitude: [REDACTED]

Access to Strain Feature: Walk short distance along right of way from Edwardsville Rd

### **Pipeline Specific Data:**

Nominal Outside Diameter(s): 22-inch

Wall Thickness: 0.312

Pipe Grade: X46

Area: Wood River

Pipeline System(s): Woodpat 22" Crude

Pipeline Segment(s): Roxana - Patoka Woodpat 22"

ROW ID(s): 15

Pipeline Stationing(s): [REDACTED]

### **Pipeline Survey Personnel and Equipment:**

Personnel Conducting Survey:

Jeff Barry, Crew Lead/Supervisor

Megan Kenworthy, Systems Technician

Equipment:

Pipe Locating Equipment: TX-150 Transmitter and RD 8100 PDL Receiver

Transmitter Connection Utilized: Test station approximately 240-ft northeast of the strain feature and adjacent to Edwardsville Rd

Pipeline Probe Confirmation: N.A., pipeline beneath concrete matting

GPS Equipment: Topcon HiPer VR Base Station and Rover(s) with static GNSS RTK

Corrections

Survey Software Used: Magnet Field and Magnet Office

**Geodetic Settings:**

Horizontal Datum and Zone: NAD83 / BLM 16N

Geoid: NAVD88 - GEOID18

Units: US Survey ft

Projected Mapping Coordinates: NAD83 / BLM 16N

Benchmark / Control Point(s):

- (1) On screw near ground on guardrail near site, downstream left bank



## SECTION 2 – Executive Summary of Site Characteristics

### Presence of Abnormal Conditions:

**Exposed Pipe:** Yes  No

If Yes, Provide Details: N.A.

**Coating Damage:** Yes  No

If Yes, Provide Details: N.A.

**Pipeline Damage:** Yes  No

If Yes, Provide Details: N.A.

**Debris Threatening Pipeline:** Yes  No

If Yes, Provide Details: N.A.

**Prior Remediation Efforts:** Yes  No

If Yes, Provide Details: Concrete matting on portion of left bank



## SECTION 3 – Geohazard Classification and Recommendations

<b>Geohazard Type:</b>	Unstable bank of Cahokia Creek
<b>Description of Extent and Orientation to Pipeline:</b>	Cahokia Creek flows northeast to southwest and the pipeline parallels the creek approximately [REDACTED] from the current top of bank location.
<b>Pipeline Depth of Cover at Geohazard:</b>	1.83-ft to 4.75-ft
<b>Area Soil Type:</b>	Silt loam, somewhat poorly drained
<b>Severity Index 1-10 (10 Being Most Severe):</b>	7; proximity ongoing bank instability
<b>Additional Comments and Recommendations:</b>	<p>Concrete matting armors a portion of the left bank here but below the matting the bank is badly eroded with ongoing instability noted in aerial imagery and during the site visit. The data collected suggests that the pipeline is bending both horizontally and vertically in the direction of the bank failures here. This bank stability could be resulting in the observed pipeline bending.</p> <p>Recommend increased monitoring of bank stability and repeat depth of cover surveys. Consider additional armoring of left bank to decrease ongoing bank instability.</p>

## SECTION 4 – Site Photos



**Photo 1. At strain point looking southeast.**



**Photo 2. At strain point looking southwest.**





**Photo 3. At strain point looking northwest.**

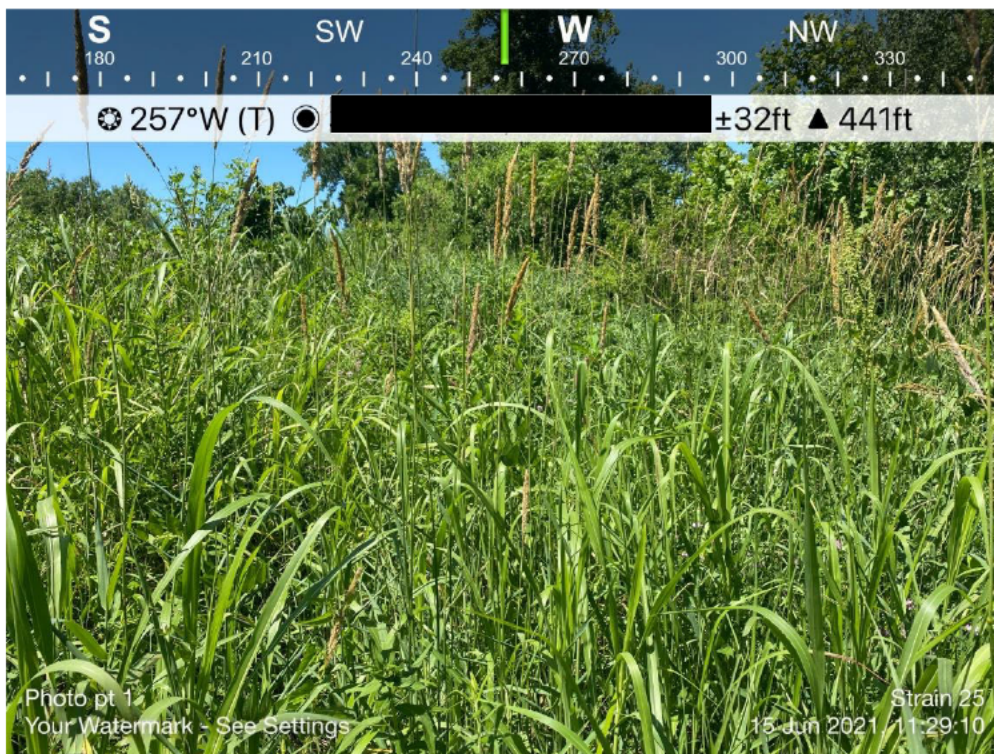


**Photo 4. At strain point looking northeast.**





**Photo 5. Photo location 1 looking toward strain point.**



**Photo 6. Photo location 1 looking away from strain point.**





**Photo 7. Photo location 1 looking toward Cahokia Creek.**

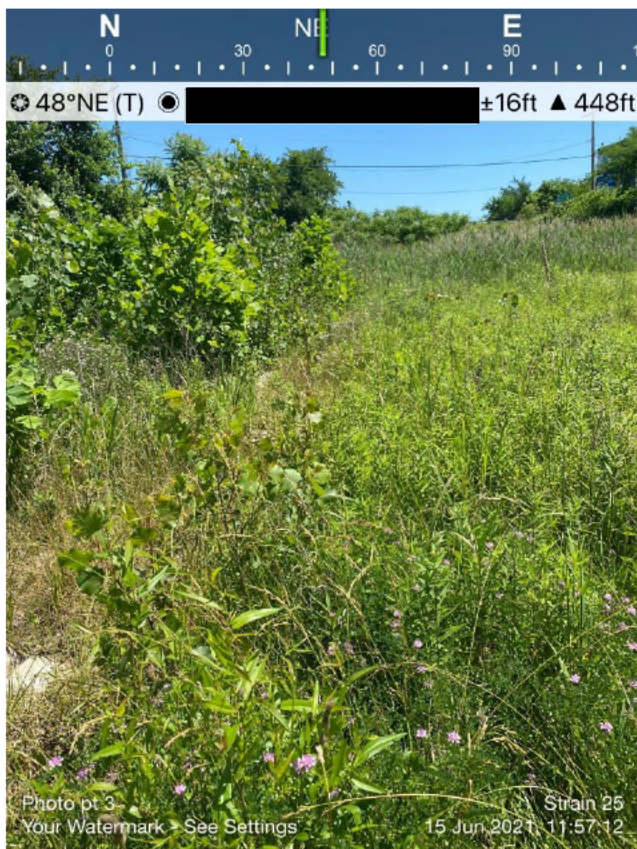


**Photo 8. Photo location 2 looking upstream and at slumping on left bank.**



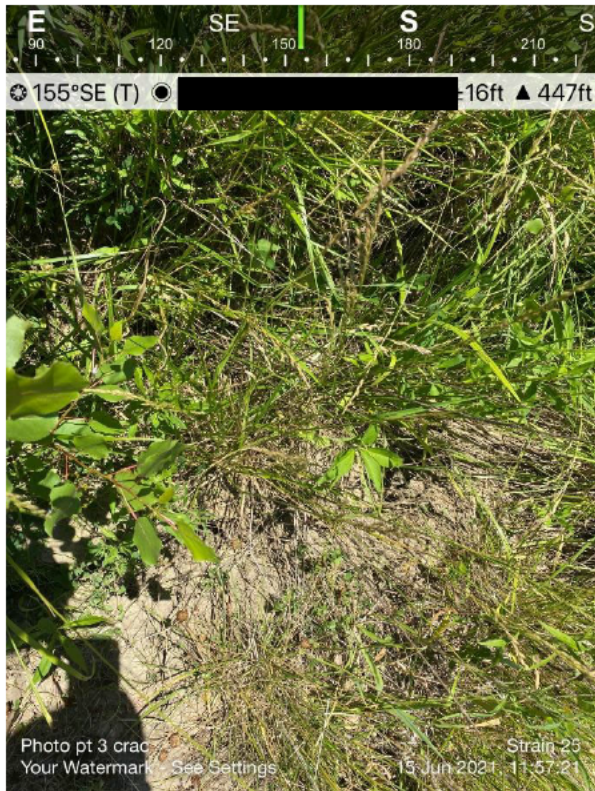


**Photo 9. Photo location 3 looking toward strain point.**



**Photo 10. Photo location 4 looking away from strain point.**





**Photo 11. Photo location 3 looking at cracking in bank.**



**Photo 12. Concrete matting over pipeline.**





**Photo 13. Scarp on left bank of Cahokia Creek.**



**Photo 14. Test station.**



Photo 15. Signal application.



# SECTION 5 – Survey Details

Pipeline Water Crossing: WPAT – Strain Feature No. 25 - ROW 15

## Geodetic Settings:

Horizontal Datum and Zone: NAD83 / BLM 16N (ftUS)

Geoid: NAVD88 - GEOID18

## Control Point Details

Point	Date Established	Easting (ft)	Northing (ft)	Elevation (ft)
Base/OPUS Control Point	6/15/2021	██████████	██████████	468.703
Control Point 1	6/15/2021	██████████	██████████	466.541



Base/OPUS Overview

Base/OPUS control point

<p><b>Control Point 1: Downstream left bank side of guard rail</b></p>	<p><b>Control Point 2: N.A.</b></p>

FILE: lga0615p.tps OP1623894012445

NGS OPUS-RS SOLUTION REPORT

=====

All computed coordinate accuracies are listed as 1-sigma RMS values.  
 For additional information: <https://www.ngs.noaa.gov/OPUS/about.jsp#accuracy>

USER: [REDACTED] DATE: June 17, 2021  
 RINEX FILE: lga0166p.21o TIME: 01:44:12 UTC

SOFTWARE: rsgps 1.38 RS93.prl 1.99.3 START: 2021/06/15 15:56:46  
 EPHEMERIS: igr21622.eph [rapid] STOP: 2021/06/15 17:10:54  
 NAV FILE: brdc1660.21n OBS USED: 5144 / 7968 : 65%  
 ANT NAME: TPSHIPER\_VR NONE QUALITY IND. 10.46/ 8.36  
 ARP HEIGHT: 1.490472 NORMALIZED RMS: 0.397

REF FRAME: NAD\_83(2011)(EPOCH:2010.0000) ITRF2014 (EPOCH:2021.45395)

X: [REDACTED] [REDACTED]  
 Y: [REDACTED] [REDACTED]  
 Z: [REDACTED] [REDACTED]

LAT: [REDACTED] [REDACTED] [REDACTED] [REDACTED]  
 E LON: [REDACTED] [REDACTED] [REDACTED] [REDACTED]  
 W LON: [REDACTED] [REDACTED] [REDACTED] [REDACTED]  
 EL HGT: 111.564(m) 0.016(m) 110.410(m) 0.016(m)  
 ORTHO HGT: 142.749(m) 0.024(m) [NAVD88 (Computed using GEOID18)]

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 16)	SPC (1202 IL W)
Northing (Y) [meters]	[REDACTED]	[REDACTED]
Easting (X) [meters]	[REDACTED]	[REDACTED]
Convergence [degrees]	[REDACTED]	[REDACTED]
Point Scale	1.00042084	0.99994463
Combined Factor	1.00040333	0.99992713

US NATIONAL GRID DESIGNATOR: [REDACTED]

BASE STATIONS USED			
PID	DESIGNATION	LATITUDE	LONGITUDE DISTANCE(m)
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

NEAREST NGS PUBLISHED CONTROL POINT  
 [REDACTED] [REDACTED] [REDACTED] [REDACTED]

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

## SECTION 6 – Inspection Results Figures





**Legend**

— Approximate Pipeline Alignment



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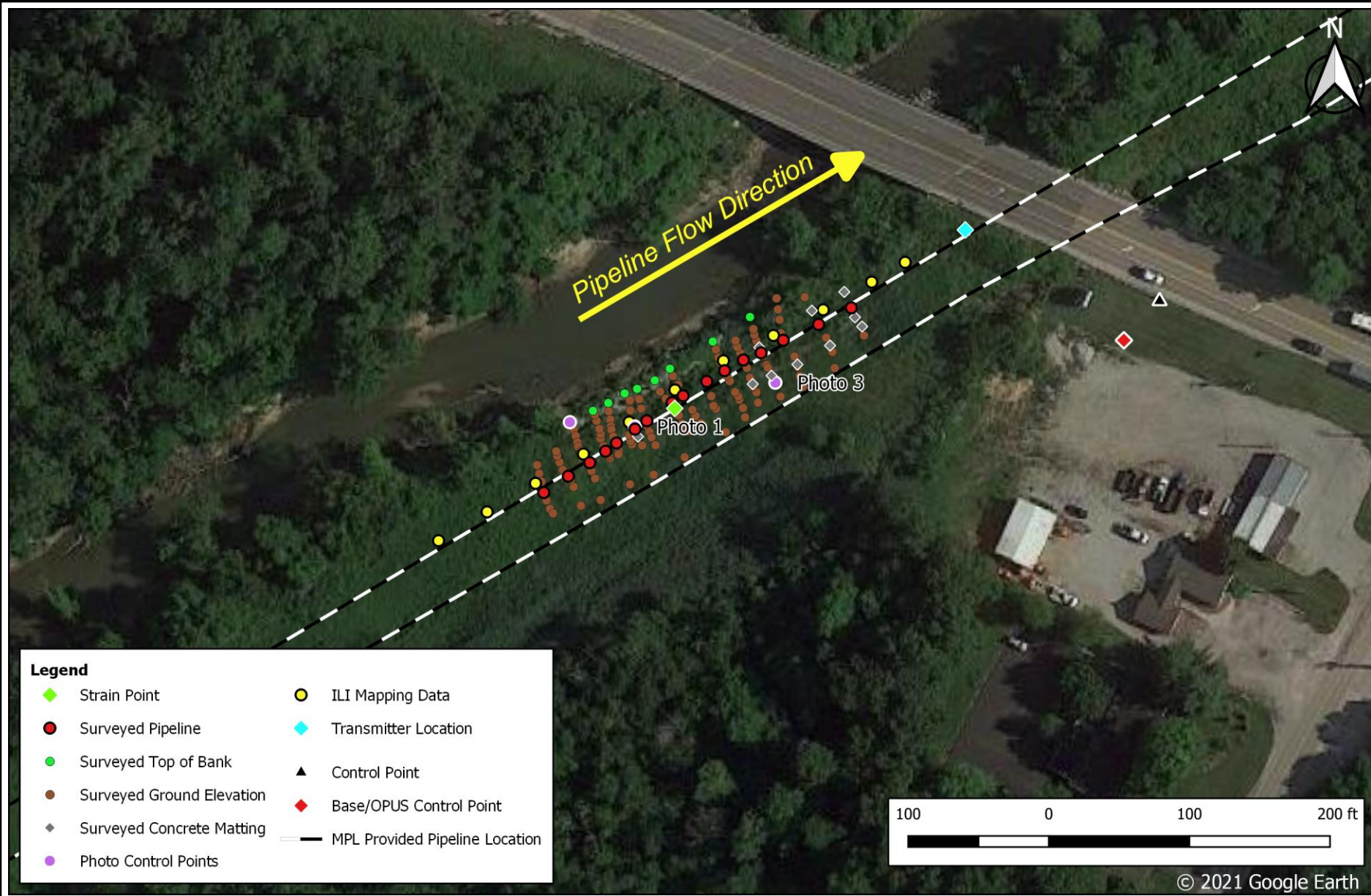
MARATHON PETROLEUM COMPANY, LP  
**SELECT MARATHON PETROLEUM  
COMPANY PIPELINE STRAIN  
INVESTIGATIONS**

**Overview Map of Strain  
Investigation Feature No. 25**



FIGURE  
**1**



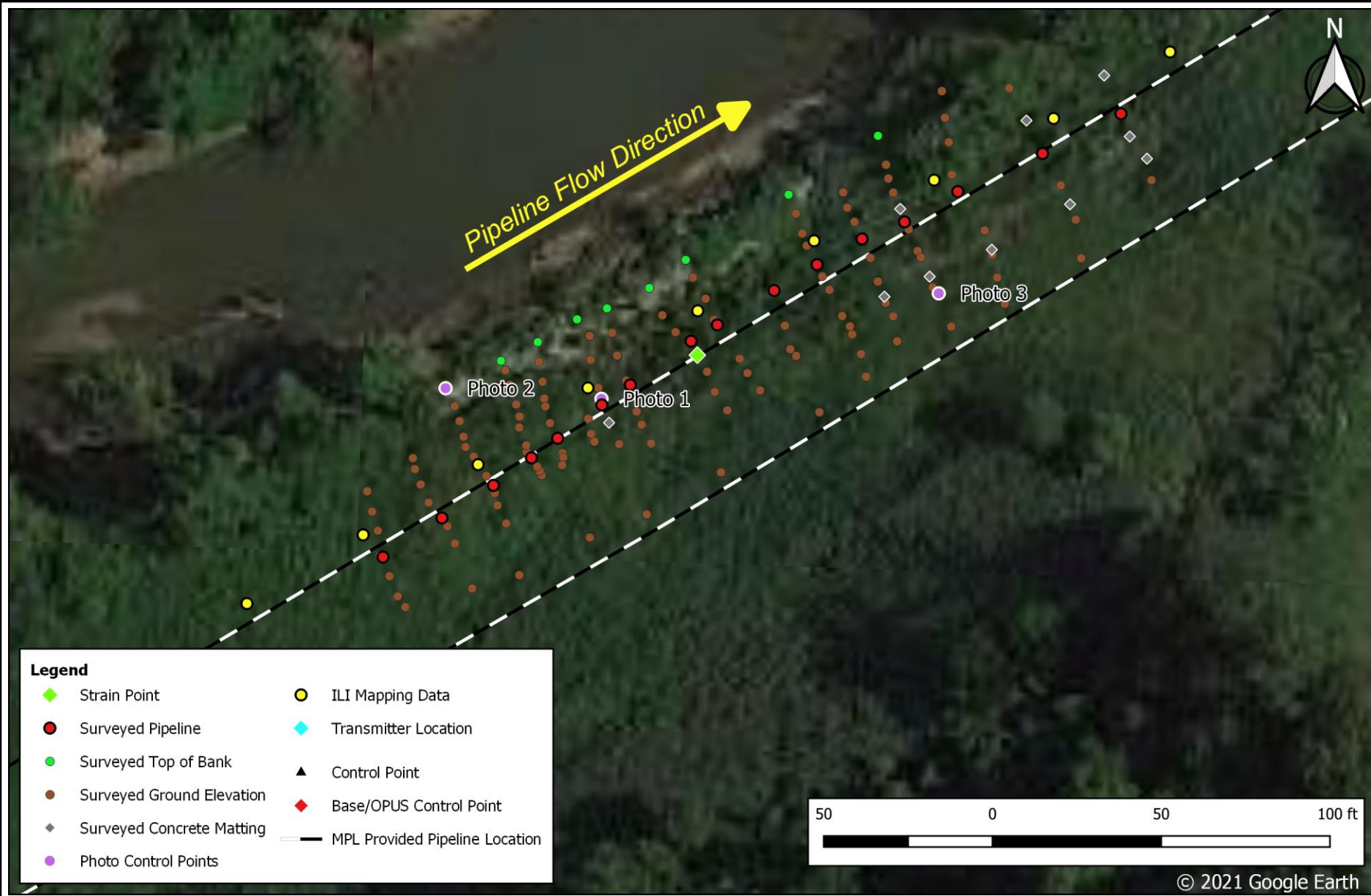


MARATHON PETROLEUM COMPANY, LP  
**SELECT MARATHON PETROLEUM  
 COMPANY PIPELINE STRAIN  
 INVESTIGATIONS**

**Overview Map of All Survey Data  
 Collected at Strain Investigation Feature  
 No. 25**



FIGURE  
**2**



**Legend**

<span style="color: green;">◆</span> Strain Point	<span style="color: yellow;">●</span> ILI Mapping Data
<span style="color: red;">●</span> Surveyed Pipeline	<span style="color: cyan;">◆</span> Transmitter Location
<span style="color: green;">●</span> Surveyed Top of Bank	<span style="color: black;">▲</span> Control Point
<span style="color: brown;">●</span> Surveyed Ground Elevation	<span style="color: red;">◆</span> Base/OPUS Control Point
<span style="color: grey;">◆</span> Surveyed Concrete Matting	<span style="color: black;">—</span> MPL Provided Pipeline Location
<span style="color: purple;">●</span> Photo Control Points	



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**SELECT MARATHON PETROLEUM  
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 INVESTIGATIONS**

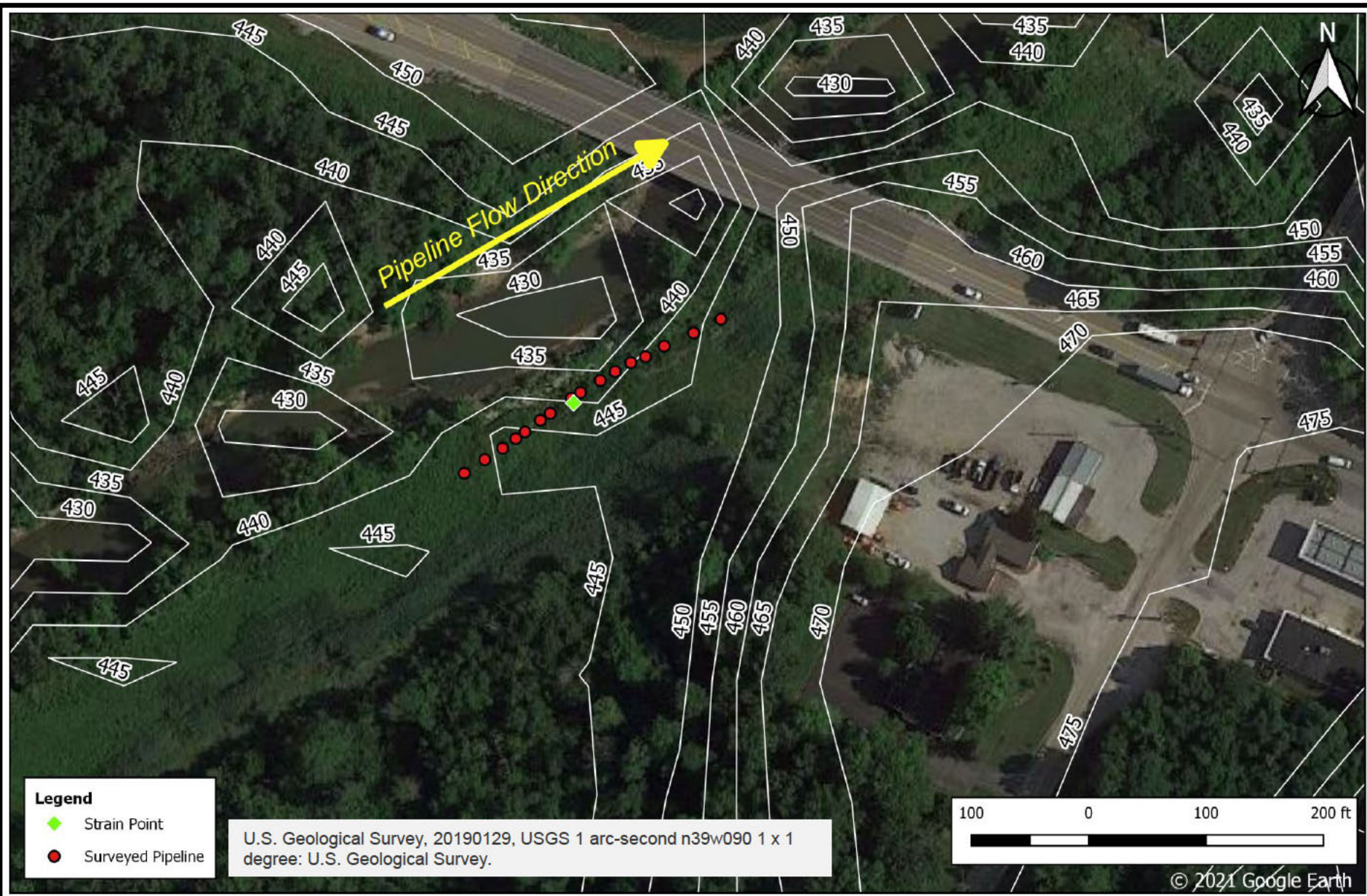
**Overview Map of All Survey Data  
 Collected at Strain Investigation Feature  
 No. 25**



FIGURE  
**3**







MARATHON PETROLEUM COMPANY, LP  
**SELECT MARATHON PETROLEUM  
 COMPANY PIPELINE STRAIN  
 INVESTIGATIONS**

**Overview Map of Publicly Available  
 Elevation Data at Strain Investigation  
 Feature No. 25; Elevation Data from USGS  
 National MAP**



FIGURE  
**5**



The Wakeland series consists of very deep, somewhat poorly drained soils that formed in silty alluvium. These soils are on flood plains and flood-plain steps. Slopes are from 0 to 2 percent. The mean annual temperature is about 12 degrees C (54 degrees F), and the mean annual precipitation is about 1067 mm (42 inches).

**TAXONOMIC CLASS:** Coarse-silty, mixed, superactive, nonacid, mesic Aeric Fluvaquents

**TYPICAL PEDON:** Wakeland silt loam on a nearly level slope in a cultivated field at an elevation of about 126 meters (413 feet) above MSL. (Colors are for moist soil unless otherwise specified.)

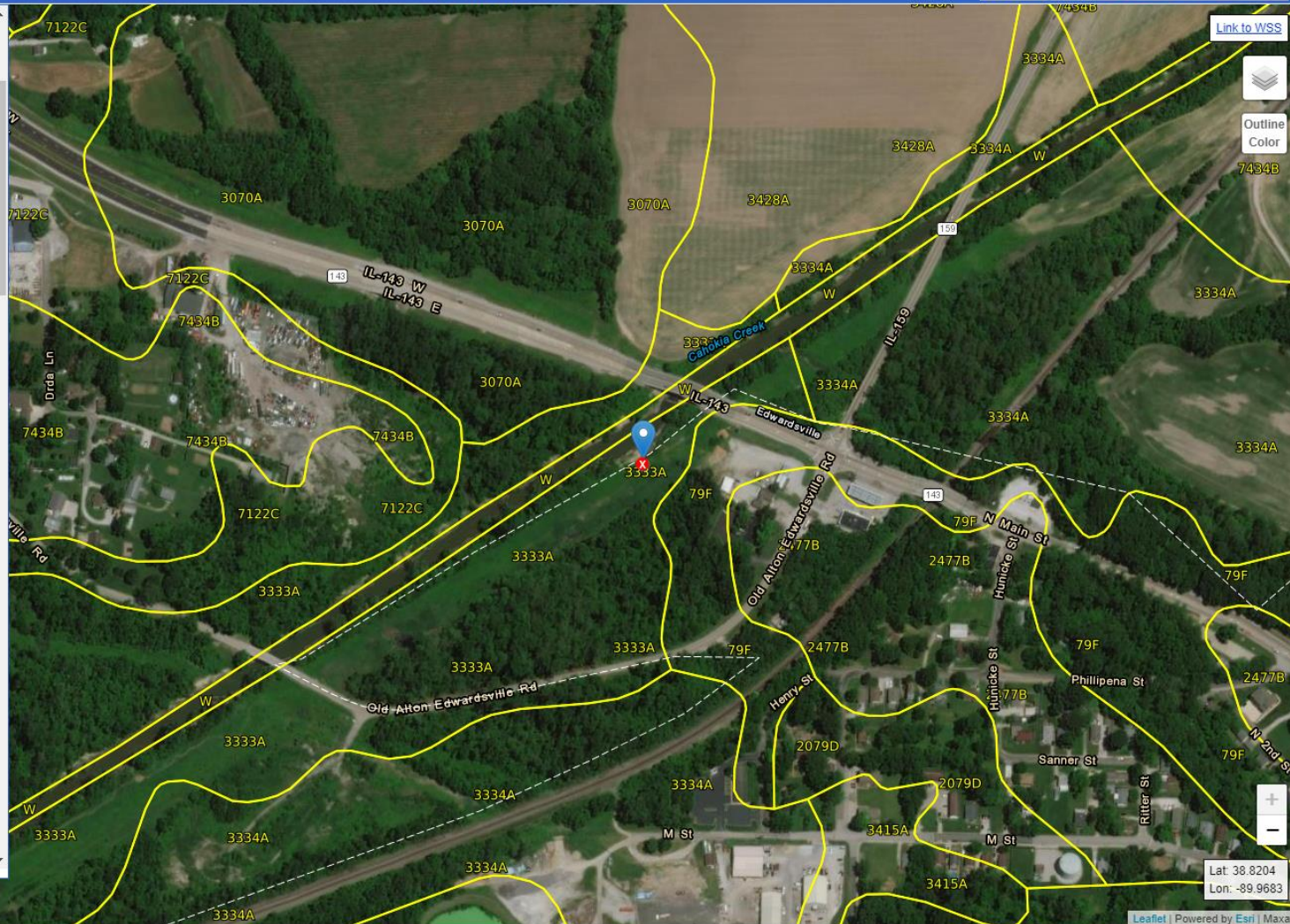
**Ap**--0 to 18 cm (0 to 7 inches); dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary. (15 to 30 cm or 6 to 12 inches thick)

**Cg1**--18 to 58 cm (7 to 23 inches); grayish brown (10YR 5/2) silt loam; weak medium granular structure; friable; common fine roots; many fine faint brown (10YR 5/3) masses of oxidized iron in the matrix; neutral; clear wavy boundary.

**Cg2**--58 to 74 cm (23 to 29 inches); grayish brown (10YR 5/2) silt loam; weak fine granular structure; friable; common fine roots; common medium distinct yellowish brown (10YR 5/4) masses of oxidized iron in the matrix; few fine faint gray (10YR 5/1) iron depletions in the matrix; neutral; gradual wavy boundary.

**Cg3**--74 to 152 cm (29 to 60 inches); grayish brown (10YR 5/2) silt loam; massive; friable; many medium prominent yellowish brown (10YR 5/6) masses of oxidized iron in the matrix; slightly acid.

**TYPE LOCATION:** Knox County, Indiana; 2,000 feet southwest of the east corner and then 1,000 feet northwest of the southeast boundary.



Link to WSS



Outline Color

7434B



Lat: 38.8204  
Lon: -89.9683

Leaflet | Powered by Esri | Maxar

MARATHON PETROLEUM COMPANY, LP  
**MARATHON PETROLEUM  
COMPANY PIPELINE STRAIN  
INVESTIGATIONS**

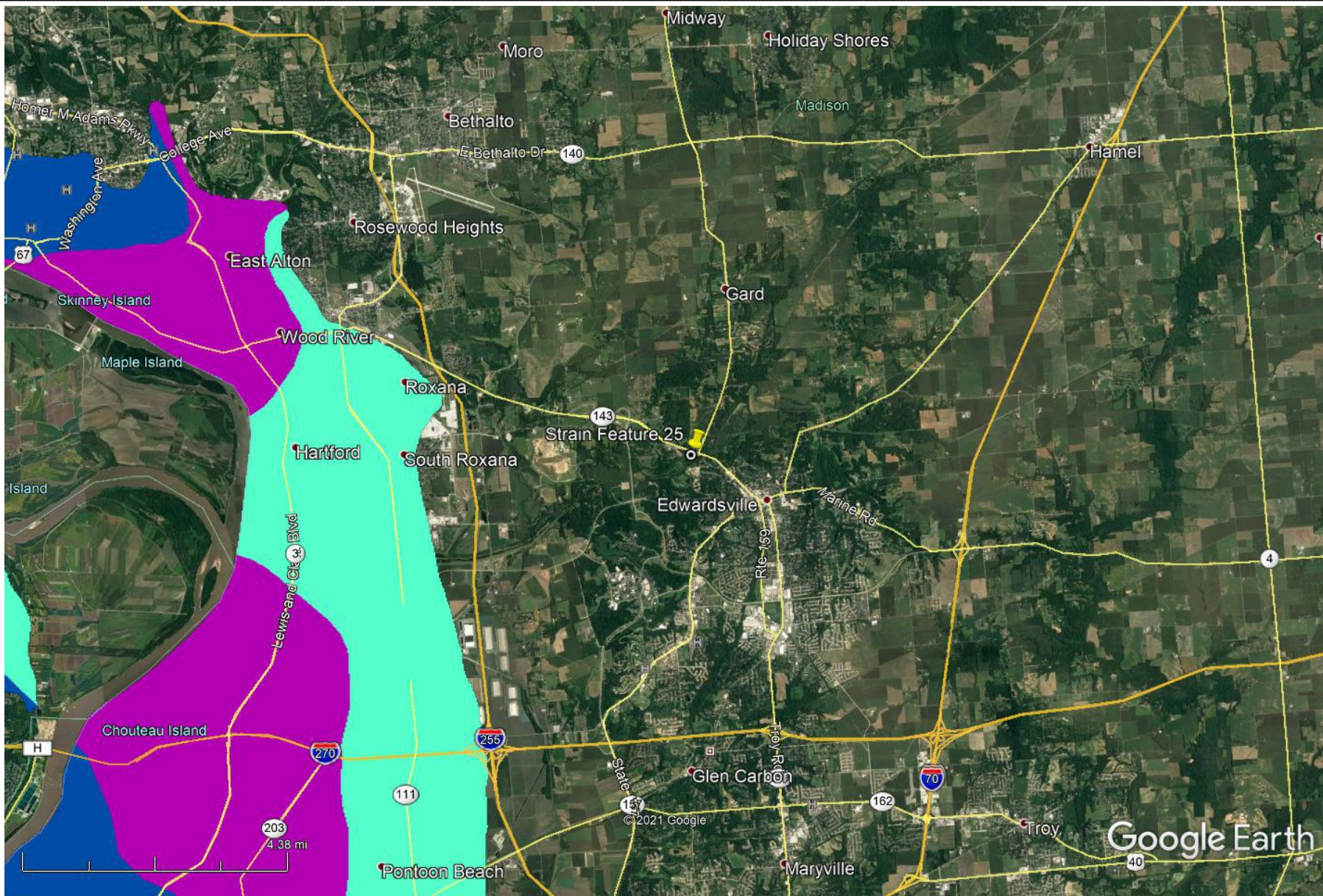
Overview Map of Soil Web Data in the  
Vicinity of the Strain Investigation Feature  
No. 25; Soil Data from NRCS Soil Web



FIGURE

6





MARATHON PETROLEUM COMPANY, LP  
**MARATHON PETROLEUM  
 COMPANY PIPELINE STRAIN  
 INVESTIGATIONS**

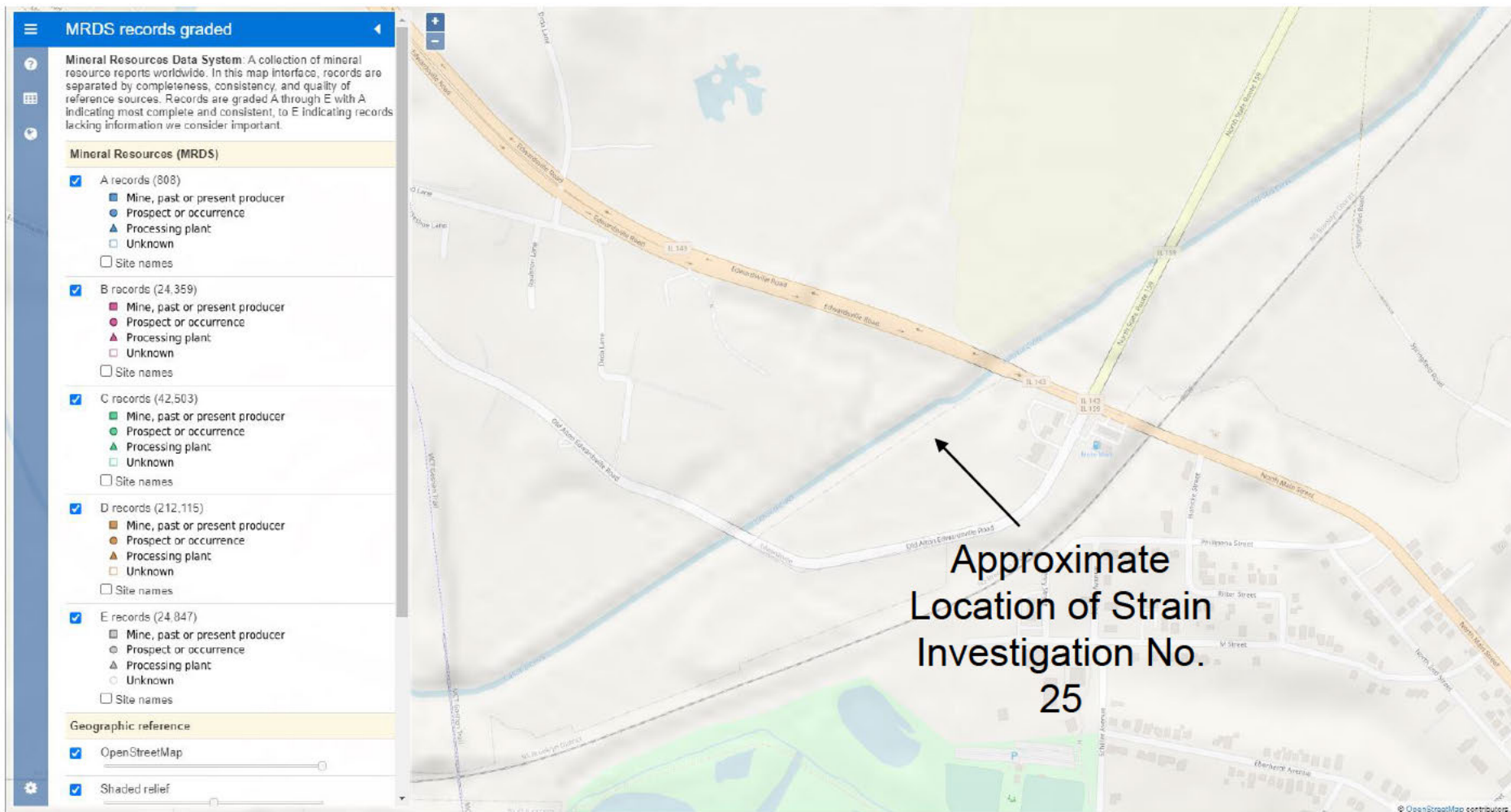
**Overview Map of Karst Geology in the  
 Vicinity of the Strain Investigation Feature  
 No. 25; U.S. Geological Survey Open-file  
 Report 2014-1156**



FIGURE

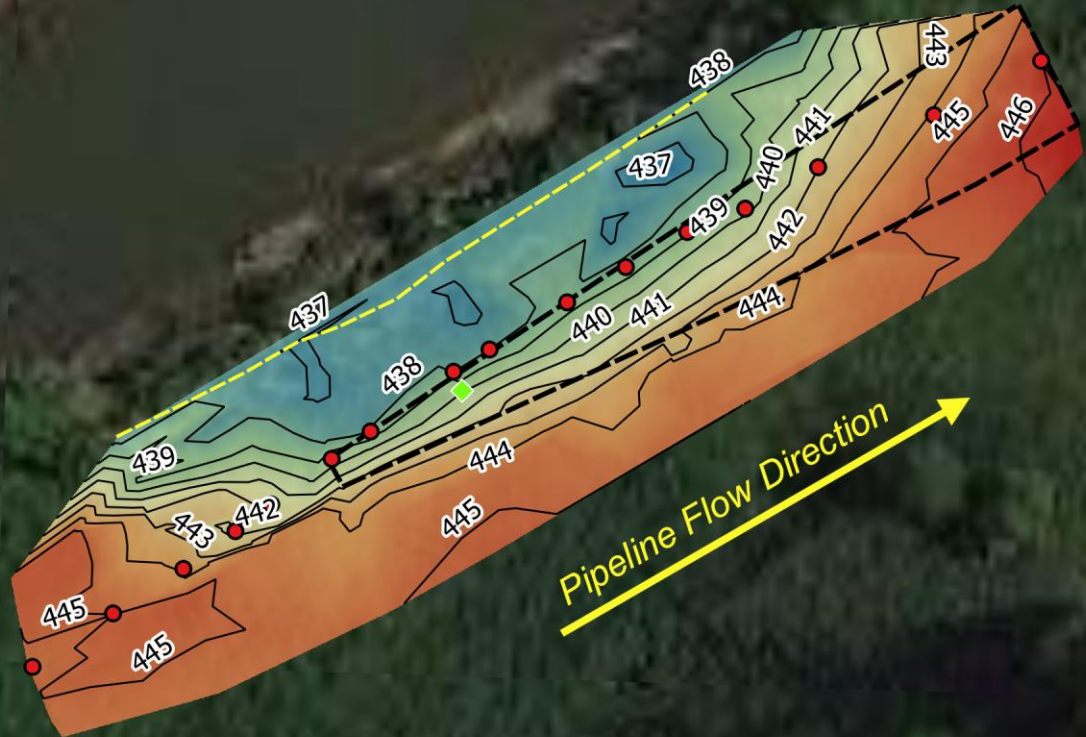
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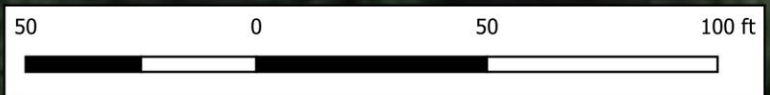




Creek Flow Direction



- Legend**
- ◆ Strain Point
  - Surveyed Pipeline
  - Top of Bank
  - - - Extent of Visible Concrete Matting
  - 1-ft Contours



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MARATHON PETROLEUM COMPANY, LP  
**SELECT MARATHON PETROLEUM  
COMPANY PIPELINE STRAIN  
INVESTIGATIONS**

**Contour Map Based on Surveyed Ground  
Elevations at Strain Investigation Feature  
No. 25**



FIGURE  
**9**