ONSITE
FLOOD STUDY REPORT
Millcreek BESS
Lincoln County, MO

PREPARED FOR

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Attachment C

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EXECUTIVE SUMMARY

Ameren is proposing to construct Millcreek BESS development, which encompasses approximately 40 acres of mainly agricultural land located in Lincoln County, Missouri. The site is bounded by Highway 61 to the east, Millcreek Church Road to the west, and Mill Creek to the south. The location of the proposed development is shown below in Figure 1.

*Figure 1: Millcreek B**ESS** Project Location*

The purpose of this drainage study is to provide the results of the onsite and offsite drainage analysis and to estimate the 100-year inundation depths at the Millcreek BESS site under existing conditions. This report describes the methodology used to perform this analysis and determine existing drainage patterns.

Drainage patterns were determined from a two-dimensional (2-D) hydrologic and hydraulic analysis using the U.S. Army Corp of Engineers' Hydrologic Center River Analysis System (HEC-RAS) version 6.6.

Expected flooding for the 100-year, 24-hour storm event was modeled for the Millcreek BESS site. Flooding depths were calculated for existing terrain conditions in the project area. Results from the model show that a majority of the onsite areas experience water depths of less than 1 foot and select onsite areas reach up to two feet in depth. Areas that experience depths near two feet are generally confined to channelized flow. The model setup and results can be viewed in the exhibits in the Appendix A.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Kimley-Horn was retained by Ameren to conduct a hydrologic and hydraulic analysis for the proposed Millcreek BESS Site. The project area is located in Lincoln County, MO, about 1.5 miles east of Whiteside, MO (**Figure 1**). The proposed development is located between Highway 61 to the east, Millcreek Church Road to the west, and Mill Creek to the south. The purpose of this report is to provide the results of the onsite and offsite drainage analysis for existing conditions.

1.2 SITE DESCRIPTION

The project site is approximately 40 acres located in Lincoln County, MO. The site is primarily agricultural land. From the NRCS (Natural Resources Conservation Service) Web Soil Survey database (**Figure 6**), the majority of onsite soils are hydrologic soil group C and D.

Onsite and offsite site topography is shown in (**Figure 2)** with 10-ft and 20-ft contours developed from publicly available Digital Elevation Model (DEM) data and surveyed topography data. Elevations range from approximately 494 to 930 feet for the model area.

The site is shown on FEMA Flood Insurance Rate Map (FIRM) Panel 29113C0090D (**Figure 7**), dated September 29, 2010. The site is mapped as FEMA Special Flood Hazard Area (SFHA) Zone X, which indicates areas of minimal flood risk. Further downstream, there is a FEMA SFHA Zone A present, associated with Mill Creek. Zone A SFHAs indicate areas where FEMA has identified a flood risk in the 100-year floodplain, but Base Flood Elevations (BFEs) have not been developed.

2 ENGINEERING METHODOLOGY

Existing onsite and offsite drainage patterns were determined by a two-dimensional (2-D) hydrologic and hydraulic analysis (**Figure 3**). The 2-D analysis boundary extends beyond the project site to capture both onsite and offsite runoff that impacts flood patterns on the site. Boundary conditions were set along the sides of the 2-D analysis boundary where runoff enters and exits the analysis. Publicly available LiDAR data with 1-meter grid cell size was obtained from the USGS National Map and was used as the base terrain for the 2-D analysis. Site specific topographic survey was obtained and incorporated into the public LiDAR to perform the subsequent drainage analysis.

2.1 MODEL SELECTION

To model the runoff and drainage patterns during a 100-year rainfall event, a 2-D hydrodynamic model was used. Specifically, the U.S Army Corp of Engineers' Hydrologic Center River Analysis System (HEC-RAS) version 6.6 was used to perform the 2-D analysis.

Runoff was estimated based on a direct rainfall method wherein the model applies the 100-year rainfall directly to the 2-D grid mesh. The model then simulates rainfall transformation to runoff and routes the runoff across a 2-D grid.

2.2 HYDROLOGIC ANALYSIS

2.2.1 ONSITE HYDROLOGY

Hydrology was simulated as rainfall runoff on the 2-D grid. To account for infiltration, the SCS Curve Number (CN) loss method was utilized. The base land cover layer was sourced from the National Land Cover Dataset (NLCD). Important hydraulic features like roadways and streams were delineated and refined based on aerial photography, elevation data, and inundation depth results. **Table 1** below lists the Manning's "n" values for friction losses used in the 2-D model.

Land Use Classification	Manning's n-Value
Straight Row Crops – Poor Condition	0.060
Woods, Good Condition	0.150
¼ Acre Residential	0.090
Open Space, Good Condition	0.060
Emergent Herbaceous Wetland	0.050
Pasture, Good Condition	0.080
Open Water	0.020
Woods-Grass Combination – Good Condition	0.050
Streets – Curb & Gutter	0.020
Dirt Roads	0.020
River and Immediate Overbank	0.045

Table 1: Land Use Parameters and Manning's n-Values

Soil data was obtained from NRCS and classified by Hydrologic Soil Group (HSG) (**Figure 6**). Most onsite soils are HSG Class C and D and therefore display moderate to low infiltration rates and slow rates of water transmission.

2.2.2 PRECIPITATION

The precipitation model used in this analysis was based on a frequency storm with a rainfall duration of 24 hours. The 100-year (1% annual chance), 24-hour rainfall frequency event was analyzed for this study. A rainfall depth of 6.74 inches was selected based on NOAA Atlas 14 Precipitation Frequency Data Server (PFDS). A hyetograph was developed for the rainfall distribution using the MSE Type 4 rainfall distribution curve. The resulting hyetograph was applied to the HEC-RAS hydrologic model as a precipitation gage. This model was used to generate an excess precipitation time series for the 2-D model area.

Precipitation excess, the accumulated rainfall that exceeds the initial abstraction and infiltration, was calculated using HEC-RAS 6.6. HEC-RAS calculates an infiltration layer based on a land cover layer

and soils layer input by the user. The infiltration layer results in a weighted curve number value, initial abstraction value, and minimum infiltration rate value for every spatial location within the 2-D model mesh. As rainfall is applied to the 2-D model area, the amount of excess rainfall, or rainfall that results in runoff, is calculated across the entire 2-D model domain. The total excess rainfall was 4.31 inches. Precipitation quantities are summarized in **Table 2**.

Precipitation Type	Quantity (in)
Rainfall Depth	6.74
Excess Depth	4.31

Table 2: Precipitation Type and Associated Quantities

2.3 Hydraulic Analysis

The study area was modeled using the 2-D option in HEC-RAS. For the existing conditions analysis, the terrain surface was built from a combination of publicly available LiDAR and surveyed topography.

A computational grid was created for the surface to develop a group of rating tables for the stage storage volume in each computational grid cell. HEC-RAS also cuts cross sections at each cell face of the computational grid to simulate flow more accurately between cells. The entire onsite area has been included in the 2-D model surface. The computational grid outside of the project area was developed with a 100-foot maximum cell size. A refinement region was added around the project site to increase computation detail. The maximum cell size in the refinement region is 50 feet.

The computational grid mesh was further refined by adding breaklines to subdivide cells along important hydraulic features such as culverts, channels, roads, and berms (**Figure 4**). The minimum and maximum computation grid size associated with breaklines is 10 ft and 15 ft, respectively. Existing culverts in the ALTA survey were provided by the client, with critical hydraulic structures included in the model as SA/2D connections. Other culverts were modeled as modifications of the terrain in order to simulate flow from the upstream side of a weir to the downstream side. A total of 9 culverts and 65 terrain modifications were included in the model.

Outflow boundary conditions were defined at the limits of the 2-D model area. The model has six outflows spread around its entire perimeter. One of these outflow areas ties into a FEMA Zone AE, and has a known BFE of 519 ft. This boundary condition utilizes a Stage Hydrograph method to model outflow. The stage hydrograph was created by beginning at the ground elevation, then set to have the water surface elevation gradually rise until it reached the BFE slightly before the peak rainfall volume was applied to the model. For the remaining five boundary conditions, corresponding BFE's were not available, therefore boundary conditions were set to calculate the normal depth based on the slope of the terrain in their respective areas. Slopes used in these boundary conditions range from 0.005 ft/ft to 0.01 ft/ft.

2.4 Inundation Depth Calculation Summary

Predicted flooding depths for site conditions were calculated based on the 2-D modeling simulation and were mapped within the study area. **Figure 5** shows the inundation depths for existing conditions. The mapping reflects depths that are expected to equal or exceed 0.25 feet. Shallower depths were removed from the mapping as is typically done for models based on the direct rainfall method, as this method produces depth in every grid cell of the mesh, requiring filtering of the results based on depths.

Within the project site, the majority of ponding remains close to the tributary channels. A majority of the ponding on the site is less than 1.0 foot; however, flood depths within channelized areas can close to 2.0 feet. Areas near Mill Creek show can reach deeper depths, with the intersection of Mill Creek and Millcreek Church Road reaching depths higher than 7 feet to the west of the project site.

Appendix A – Figures

FIGURE 1:
SITE LOCATION MAP

MILLCREEK BESS
FACILITY

LINCOLN COUNTY, MISSOURI

Legend

Limits of Disturbance

N

0 500 1,000
Feet

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FIGURE 2:
ON-SITE TOPOGRAPHIC WORK MAP

MILLCREEK BESS FACILITY

LINCOLN COUNTY, MISSOURI

Legend

- 2-D Model Area
- Limits of Disturbance
- Onsite Contours (5-ft)
- Offsite Contours (20-ft)

N

0 3,700 7,400 Feet

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FIGURE 2:
ON-SITE TOPOGRAPHIC WORK MAP

MILLCREEK BESS FACILITY

LINCOLN COUNTY, MISSOURI

Legend

- 2-D Model Area
- Limits of Disturbance
- Onsite Contours (5-ft)
- Offsite Contours (20-ft)

N

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0 255 510 Feet

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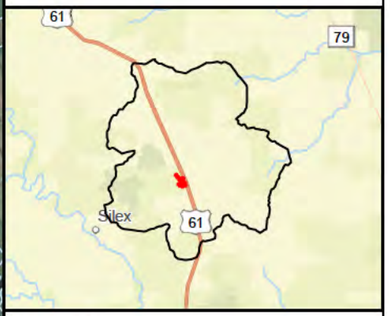
FIGURE 3:
DRAINAGE AREA MAP

MILLCREEK BESS
FACILITY

LINCOLN COUNTY, MISSOURI



Legend

- 2-D Model Area
- Limits of Disturbance
- HUC-12 Hydrologic Unit: Subwatershed
- Flowlines

N

0 4,500 9,000 Feet

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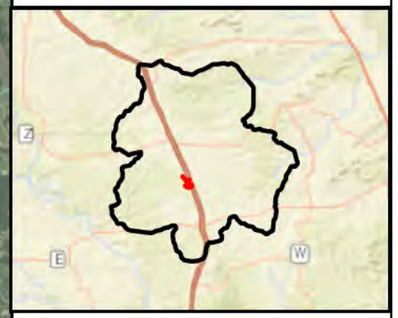
FIGURE 4:
HEC-RAS STUDY MAP

MILLCREEK
BESS FACILITY

LINCOLN COUNTY, MISSOURI



Legend

- 2-D Model Area
- Limits of Disturbance
- Refinement Region
- 2-D Mesh Grid
- Breaklines
- Boundary Conditions
- Culverts
- Terrain Modifications

N

Page 1 of 2

0 3,450 6,900 Feet

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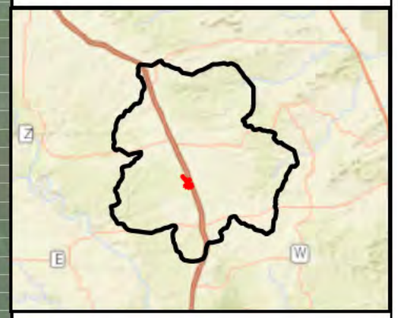
FIGURE 4:
HEC-RAS STUDY MAP

MILLCREEK
BESS FACILITY

LINCOLN COUNTY, MISSOURI



Legend

- 2-D Model Area
- Limits of Disturbance
- Refinement Region
- 2-D Mesh Grid
- Breaklines
- Boundary Conditions
- Culverts
- Terrain Modifications

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0 240 480 Feet

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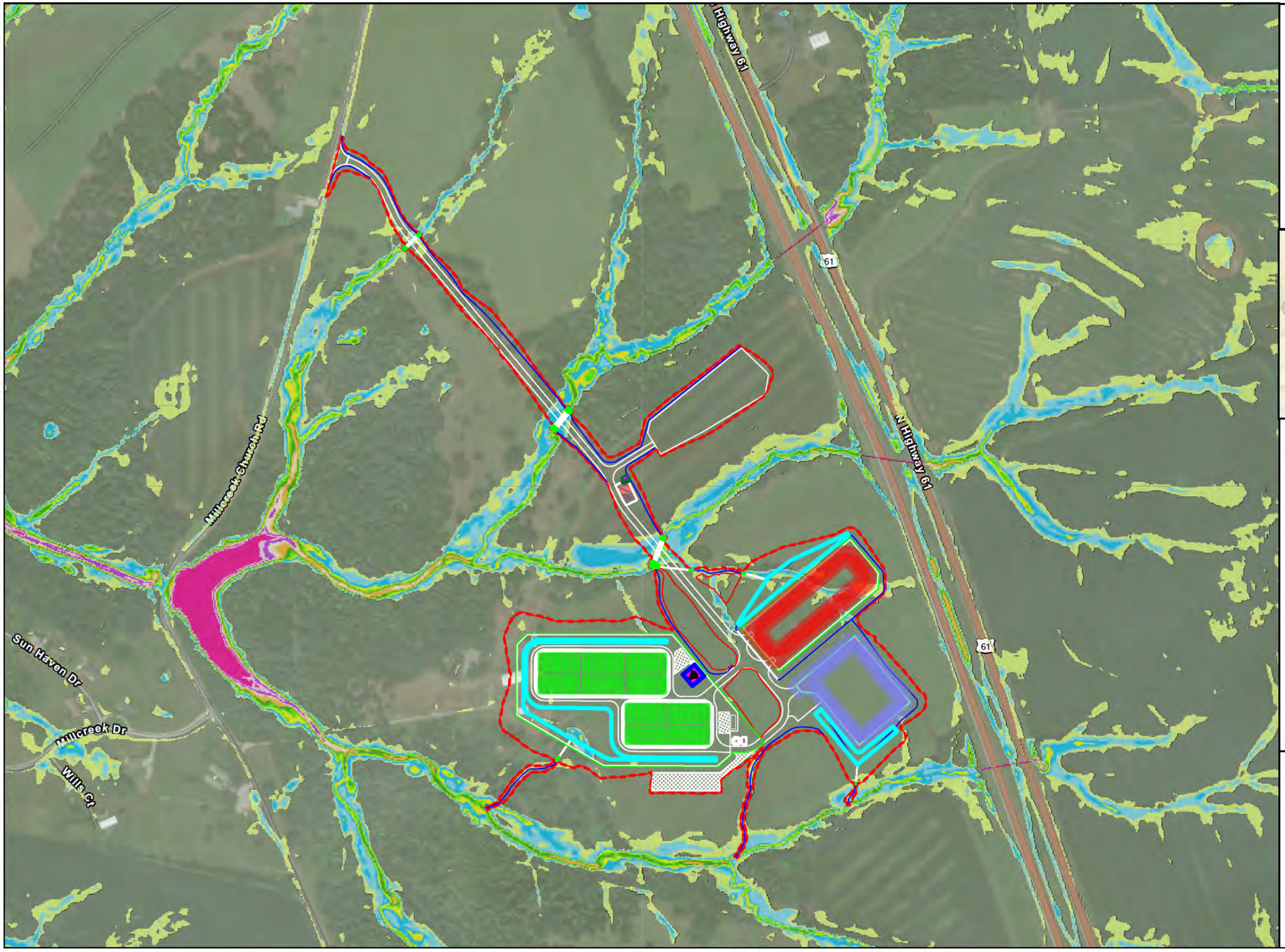
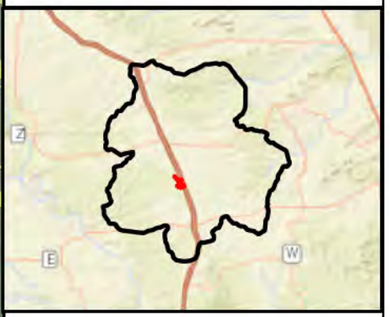


FIGURE 5:
100-YEAR DEPTH MAP
EXISTING CONDITION

MILLCREEK
BESS FACILITY

LINCOLN COUNTY, MISSOURI



Legend

- Limits of Disturbance
- 2-D Model Area

Inundation Depth (ft)

- 0.25 - 0.49
- 0.49 - 0.99
- 0.99 - 1.49
- 1.49 - 1.99
- 1.99 - 2.49
- 2.49 - 2.99
- 2.99 - 3.99
- 3.99 - 4.99
- 4.99 - 5.99
- 5.99 - 6.99
- Above 7

N

0 375 750 Feet

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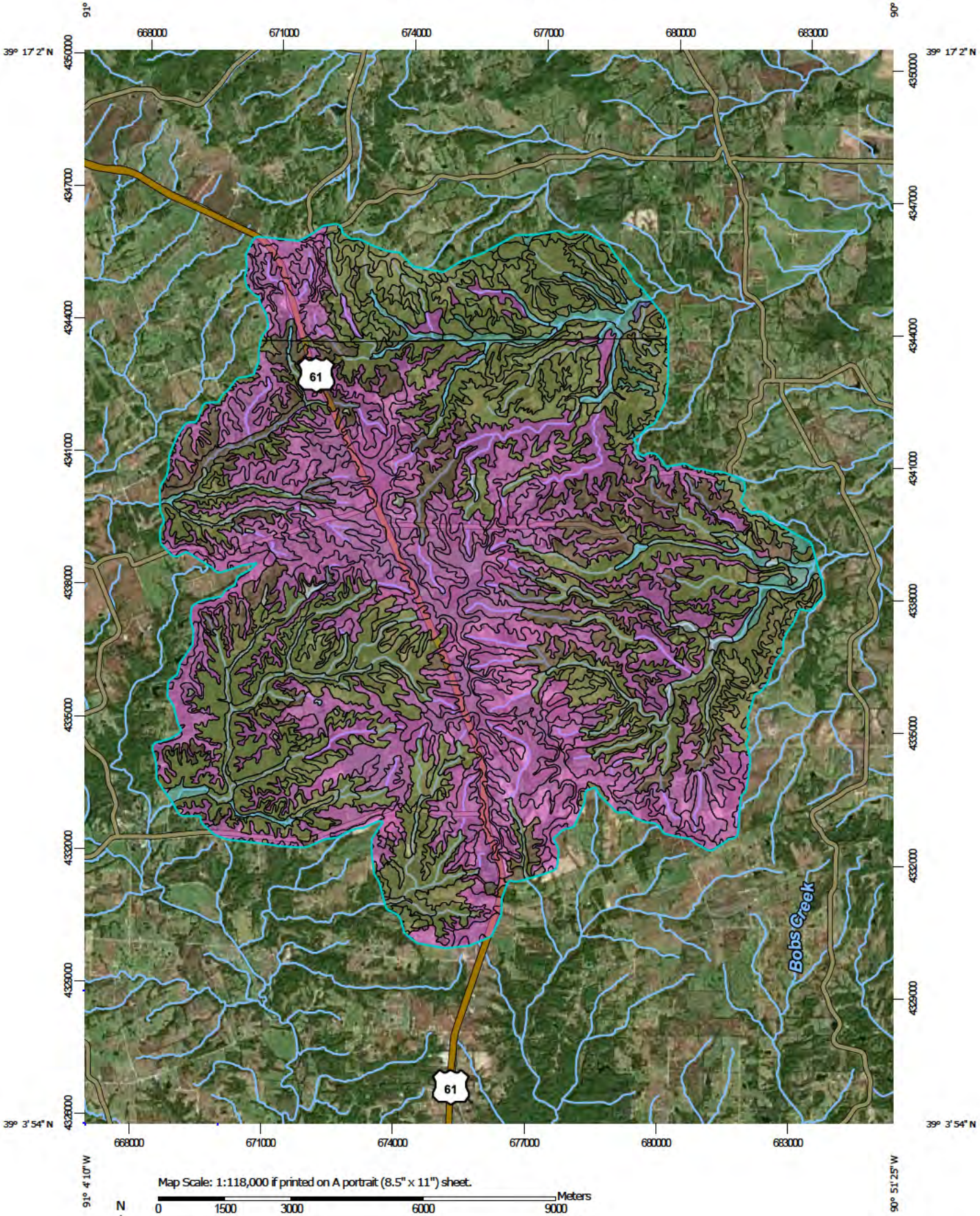
Hydrologic Soil Group—Lincoln County, Missouri, and Pike County, Missouri
(MillCreek_2DMA_buffer_WebMercator)



MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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.

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: Lincoln County, Missouri
Survey Area Data: Version 29, Sep 2, 2025

Soil Survey Area: Pike County, Missouri
Survey Area Data: Version 28, Sep 2, 2025

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Apr 8, 2020—Aug 30, 2022

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
30066	Gorin silt loam, 2 to 5 percent slopes	C	20.9	0.1%
30068	Gorin silt loam, 5 to 9 percent slopes, eroded	C	26.6	0.1%
34018	Moniteau silt loam, 0 to 3 percent slopes, rarely flooded	C/D	202.4	0.5%
36020	Kennebec silt loam, 0 to 2 percent slopes, occasionally flooded	C	126.9	0.3%
50008	Keswick silt loam, 5 to 9 percent slopes, eroded	D	5,915.5	14.3%
50009	Keswick silt loam, 9 to 14 percent slopes, eroded	C/D	3,724.3	9.0%
50058	Mexico silt loam, 0 to 2 percent slopes	D	1,412.1	3.4%
50059	Mexico silt loam, 1 to 4 percent slopes, eroded	D	2,950.6	7.1%
60003	Menfro silt loam, 9 to 14 percent slopes, eroded	B	199.5	0.5%
60015	Goss gravelly silt loam, 9 to 14 percent slopes, eroded	C	7.3	0.0%
60028	Weller silt loam, 5 to 9 percent slopes, eroded	D	0.5	0.0%
60031	Winfield silt loam, 9 to 14 percent slopes, eroded	C	1.8	0.0%
60066	Brevator loam, 14 to 30 percent slopes	C	1,632.8	3.9%
60072	Bucklick silty clay loam, 14 to 20 percent slopes, eroded	C	455.1	1.1%
60073	Bucklick silty clay loam, 5 to 9 percent slopes, eroded	C	756.7	1.8%
60074	Bucklick silty clay loam, 9 to 14 percent slopes, eroded	C	1,413.3	3.4%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
60081	Crider silt loam, 14 to 20 percent slopes	C	373.6	0.9%
60084	Crider silt loam, 5 to 9 percent slopes, eroded	C	922.4	2.2%
60086	Crider silt loam, 9 to 14 percent slopes, eroded	C	1,245.2	3.0%
60103	Gasconade-Rock outcrop complex, 9 to 70 percent slopes, very stony	D	1,426.1	3.4%
60112	Goss very gravelly silt loam, 14 to 45 percent slopes	C	97.0	0.2%
60120	Goss-Gasconade-Brussels complex, 9 to 70 percent slopes, very stony	C	4,534.5	10.9%
60126	Hatton silt loam, 2 to 5 percent slopes	D	3,630.2	8.8%
60129	Hatton silt loam, 5 to 9 percent slopes	D	2,821.2	6.8%
60165	Menfro silt loam, 2 to 5 percent slopes	C	236.8	0.6%
60168	Menfro silt loam, 5 to 9 percent slopes, eroded	C	787.4	1.9%
60244	Winfield silt loam, 5 to 10 percent slopes, eroded	C	8.4	0.0%
64040	Weller silt loam, terraces, 2 to 5 percent slopes	D	69.2	0.2%
66001	Dameron silt loam, 0 to 2 percent slopes, frequently flooded	C	286.0	0.7%
66014	Haymond silt loam, 0 to 3 percent slopes, frequently flooded	B	331.1	0.8%
66077	Dameron silt loam, 0 to 3 percent slopes, occasionally flooded	C	34.8	0.1%
66116	Haymond silt loam, 0 to 2 percent slopes, occasionally flooded	B	92.7	0.2%
66135	Dameron silt loam, 1 to 4 percent slopes, occasionally flooded	C	586.1	1.4%

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Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
67012	Cedargap silt loam, 1 to 3 percent slopes, frequently flooded, cool	B	105.6	0.3%
67035	Haymond silt loam, 1 to 3 percent slopes, frequently flooded	B	31.5	0.1%
67521	Cedargap silt loam, 0 to 3 percent slopes, frequently flooded, cool	B	46.0	0.1%
99000	Pits, quarry		3.0	0.0%
99001	Water		199.6	0.5%
Subtotals for Soil Survey Area			**36,714.4**	**88.5%**
Totals for Area of Interest			**41,487.2**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
30066	Gorin silt loam, 2 to 5 percent slopes	C	89.3	0.2%
30068	Gorin silt loam, 5 to 9 percent slopes, eroded	C	108.8	0.3%
50008	Keswick silt loam, 5 to 9 percent slopes, eroded	D	274.9	0.7%
50009	Keswick silt loam, 9 to 14 percent slopes, eroded	C/D	88.6	0.2%
50012	Putnam silt loam, 0 to 1 percent slopes	D	8.8	0.0%
50018	Armstrong loam, 3 to 7 percent slopes, eroded	D	122.3	0.3%
50020	Calwoods silt loam, 2 to 5 percent slopes	D	12.2	0.0%
50058	Mexico silt loam, 0 to 2 percent slopes	D	147.9	0.4%
50059	Mexico silt loam, 1 to 4 percent slopes, eroded	D	356.6	0.9%
60003	Menfro silt loam, 9 to 14 percent slopes, eroded	B	12.6	0.0%
60008	Menfro silt loam, 20 to 45 percent slopes	C	20.2	0.0%
60015	Goss gravelly silt loam, 9 to 14 percent slopes, eroded	C	452.8	1.1%

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Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
60031	Winfield silt loam, 9 to 14 percent slopes, eroded	C	457.1	1.1%
60055	Winfield silt loam, 2 to 5 percent slopes	C	111.4	0.3%
60066	Brevator loam, 14 to 30 percent slopes	C	2.8	0.0%
60070	Bucklick silt loam, 9 to 14 percent slopes	C	217.8	0.5%
60081	Crider silt loam, 14 to 20 percent slopes	C	29.6	0.1%
60084	Crider silt loam, 5 to 9 percent slopes, eroded	C	3.2	0.0%
60086	Crider silt loam, 9 to 14 percent slopes, eroded	C	14.0	0.0%
60112	Goss very gravelly silt loam, 14 to 45 percent slopes	C	571.9	1.4%
60120	Goss-Gasconade-Brussels complex, 9 to 70 percent slopes, very stony	C	54.7	0.1%
60165	Menfro silt loam, 2 to 5 percent slopes	C	66.0	0.2%
60168	Menfro silt loam, 5 to 9 percent slopes, eroded	C	12.8	0.0%
60193	Minnith silt loam, 5 to 9 percent slopes, eroded	C	106.6	0.3%
60212	Ranacker flaggy silty clay loam, 9 to 14 percent slopes	D	49.6	0.1%
60229	Vanmeter silty clay loam, 14 to 35 percent slopes, eroded	D	137.0	0.3%
60234	Weller silt loam, 2 to 5 percent slopes	D	0.1	0.0%
60244	Winfield silt loam, 5 to 10 percent slopes, eroded	C	778.3	1.9%
64040	Weller silt loam, terraces, 2 to 5 percent slopes	D	14.2	0.0%
66014	Haymond silt loam, 0 to 3 percent slopes, frequently flooded	B	28.3	0.1%

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Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
66078	Dameron, occasionally flooded-Cedargap, frequently flooded complex, 0 to 3 percent slopes	B	173.5	0.4%
66107	Tice silt loam, 0 to 2 percent slopes, occasionally flooded	B/D	18.5	0.0%
67012	Cedargap silt loam, 1 to 3 percent slopes, frequently flooded, cool	B	85.1	0.2%
67013	Cedargap-Dameron complex, 1 to 3 percent slopes, frequently flooded	B	75.4	0.2%
67521	Cedargap silt loam, 0 to 3 percent slopes, frequently flooded, cool	B	69.6	0.2%
Subtotals for Soil Survey Area			**4,772.8**	**11.5%**
Totals for Area of Interest			**41,487.2**	**100.0%**

Attachment C

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations (BFEs) shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Missouri East State Plane Coordinate System. The **horizontal datum** was NAD83. Differences in datum, spheroid, projection or state plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was derived from U.S. Geological Survey Digital Orthophoto Quadrangles (DOQs) produced at a scale of 1:12,000 from photography dated 1996 or later.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report*, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip/.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the profile baseline, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Areas to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- A–A — Cross section line
- 23–23 — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4275000mE — 1000-meter Universal Transverse Mercator grid ticks, zone 15
- 6000000 FT — 5000-foot grid values: Missouri State Plane coordinate system, East Zone (FIPSZONE 2401), Transverse Mercator projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
September 29, 2010

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 500 1,000 1,500 2,000 FEET
300 0 300 600 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0090D

FIRM

FLOOD INSURANCE RATE MAP

LINCOLN COUNTY, MISSOURI

AND INCORPORATED AREAS

PANEL 90 OF 480

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LINCOLN COUNTY	290869	0090	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
29113C0090D

EFFECTIVE DATE
SEPTEMBER 29, 2010

Federal Emergency Management Agency

Attachment C