

Bridge M1528 Inspection Report



Latitude:33.22922, Longitude:-91.79747

Route:82 Section:08 Log:24.36

Arnold Road ID:2x82x8xA, Arnold Log mile:24.11

District 02, 3 - Ashley County

Owner: 1 - State Highway Agency

Inspection Direction: 2 - S to N

Bridge Posting Information

41 - Structure Open/Posted/Closed: A - Open, no restriction

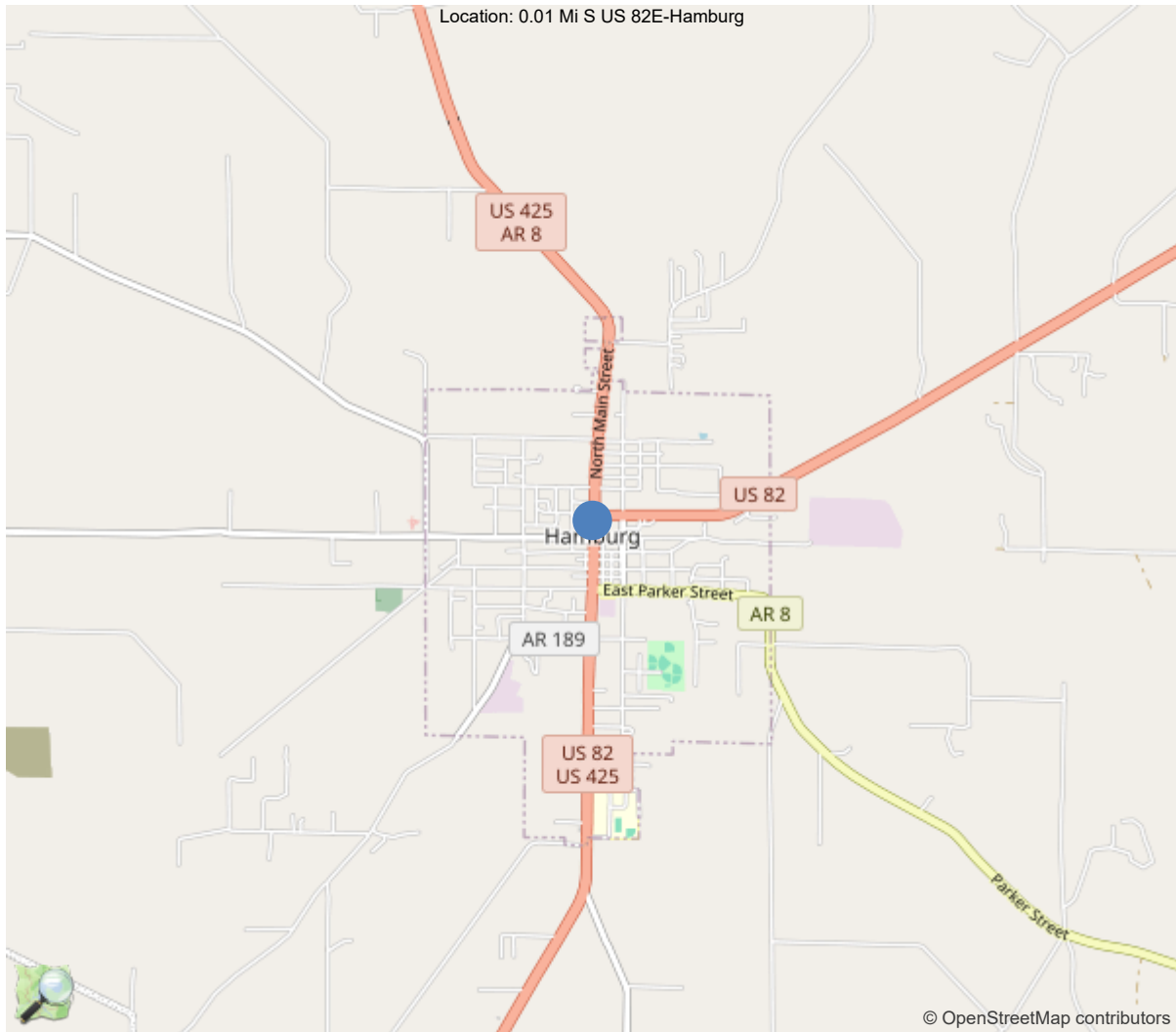
70 - Bridge Posting: 5 - Equal to or above legal loads

Legal Load	Calculated Capacity	Beginning of Bridge Sign Current Value	End of Bridge Sign Current Value
Code 4 (22 Tons)	31		
Code 9 (31 Tons)	39		
Code 5 (40 Tons)	54		

If calculated capacity is less than the Legal Load Listed, the Bridge Legally Requires Posting Signs to be installed by the Bridge Owner.



30"x36" AR



33.22922, -91.79747



Asset #M1528(POA Scour Assessment Evaluation)

US 82-08 LM 24.36 over Weaver Creek-Ashley Co

Location: 0.01 Mi S US 82E-Hamburg

Team Lead: Nicholas Holmgren Inspection Date: 06/10/2025

National Bridge Inventory Data Sheet

IDENTIFICATION	
(1) State Names	5 - Arkansas
(8) Structure Number	M1528
(5) Inventory Route	1
(2) Highway Agency District	02 - District 02
(3) County Code	3 - Ashley County
(4) Place Code	29500
(6) Features Intersected	Weaver Creek-Ashley Co
(7) Facility Carried	US 82-08 LM 24.36
(9) Location	0.01 Mi S US 82E-Hamburg
(11) Mile Point	24.36 mi
(12) Base Highway Network	Yes
(13) LRS Inventory Rte & Subrte	0000082080
(16) Latitude	33.2292187027565
(17) Longitude	-91.7974704957009
(98) Border Bridge State Code	
(99) Border Bridge Structure No.	
STRUCTURE TYPE AND MATERIAL	
(43) Main Structure Type	119
Material	1 - Concrete
Type	19 - Culvert
(44) Approach Structure Type	00
Material	0 - Other
Type	0 - Other
(45) No. of Spans in Main Unit	2
(46) No. of Approach Spans	0
(107) Deck Structure Type	N - Not applicable
(108) Wearing Surface/Protective System	
Type of Wearing Surface	N - Not applicable (applies only to stru
Type of Membrane	N - Not applicable (applies only to stru
Type of Deck Protection	N - Not applicable (applies only to stru
AGE AND SERVICE	
(27) Year Built	1930
(106) Year Reconstructed	1950
(42) Type of Service	15
On	1 - Highway
Under	5 - Waterway
(28) Lane	
On	5
Under	0
(29) Average Daily Traffic	7300
(30) Year of ADT	2018
(109) Truck ADT	1 %
(19) Bypass, Detour Length	25 mi
GEOMETRIC DATA	
(48) Length of Maximum Span	10 ft
(49) Structure Length	22 ft
(50) Curb or Sidewalk Width	
Left	0 ft
Right	0 ft
(51) Bridge Roadway Width Curb to Curb	0 ft
(52) Deck Width Out to Out	0 ft
(32) Approach Roadway Width (W/Shoulders)	56.1 ft
(33) Bridge Median	0 - No median
(34) Skew	0 Deg
(35) Structure Flared	0 - No flare
(10) Inventory Route Min Vert Clear	99.99 ft
(47) Inventory Route Total Horiz Clear	99.9 ft
(53) Min Vert Clear Over Bridge Rdwy	99.99 ft
(54) Min Vert Underclear	0 ft
Ref:	
(55) Min Lat Underclear RT	99.9 ft
Ref:	
(56) Min Lat Underclear LT	0 ft
NAVIGATION DATA	
(38) Navigation Control	0 - No navigation control on w
(111) Pier Protection	5 - None present but re-evalua
(39) Navigation Vertical Clearance	0 ft
(116) Vert-Lift Bridge Nav Min Vert Clear	0 ft
(40) Navigation Horizontal Clearance	0 ft

CLASSIFICATION	
(112) NBIS Bridge Length	Y
(104) Highway System	1
(26) Functional Class	2 - Rural Principal Arterial -
(100) Defense Highway	0 - The inventory route is not
(101) Parallel Structure	N - No parallel structure exists
(102) Direction of Traffic	2 - way traffic
(103) Temporary Structure	
(105) Federal Lands Highways	0 - N/A
(110) Designated National Network	1 - The inventory route is par
(20) Toll	3 - On free road. The structu
(21) Maintain	1 - State Highway Agency
(22) Owner	1 - State Highway Agency
(37) Historical Significance	5 - Bridge is not eligible for
CONDITION	
(58) Deck	N
(59) Superstructure	N
(60) Substructure	N
(61) Channel & Channel Protection	7
(62) Culverts	6
LOAD RATING AND POSTING	
(31) Design Load	2 - M 13.5 / H 15
(63) Operating Rating Method	1
(64) Operating Rating	
Type	1 - Load Factor(LF)
Rating	44
(65) Inventory Rating Method	1 - Load Factor(LF)
(66) Inventory Rating	
Type	
Rating	26
(70) Bridge Posting	5 - Equal to or above legal loads
(41) Structure Open/Posted/Closed	A - Open, no restriction
APPRAISAL	
(67) Structural Evaluation	
(68) Deck Geometry	N
(69) Clearances, Vertical/Horizontal	N
(71) Waterway Adequacy	8
(72) Approach Roadway Alignment	8
(36A) Bridge Railings	0 - Inspected feature does not meet
(36B) Transitions	0 - Inspected feature does not meet
(36C) Approach Guardrail	0 - Inspected feature does not meet
(36D) Approach Guardrail Ends	0 - Inspected feature does not meet
(113) Scour Critical Bridges	4 - Bridge foundations determined t
PROPOSED IMPROVEMENTS	
(75) Type of Work	
(76) Length of Structure Improvement	0 ft
(94) Bridge Improvement Cost	\$ 0
(95) Roadway Improvement Cost	\$ 0
(96) Total Project Cost	\$ 0
(97) Year of Improvement Cost Estimate	
(114) Future ADT	9943
(115) Year of Future ADT	2027

INSPECTIONS *			
(90) Inspection Date			05/05/2025
(91) Frequency			24
(92) Critical Feature Inspection	Done	Freq. (Mon)	Date
A: Fracture Critical Detail	No		
B: Underwater Inspection	No		
C: Other Special Inspection	No		
* The inspection date and frequency information in this box contains the current NBI date and frequency information. Please refer to the report header for the date this inspection was conducted.			

Team Lead: Nicholas Holmgren, Inspection Date: 06/10/2025

Specifications for National Bridge Inventory Sheets

IDENTIFICATION	
B.ID.01 Bridge Number	M1528
B.ID.02 Bridge Name	
B.ID.03 Previous Bridge No.	
B.W.01 Year Built	1930

LOCATION	
B.L.01 State Code	5 - Arkansas
B.L.02 County Code	3 - Ashley County
B.L.03 Place Code	29500 - Hamburg
B.L.04 Highway Agency District	02 - District 02
B.L.05 Latitude	33.2292187027565
B.L.06 Longitude	-91.7974704957009
B.L.07 Border Bridge Number	
B.L.08 Border Bridge State or Country Code	
B.L.09 Border Bridge Insp. Resp.	
B.L.10 Border Bridge Designated Lead State	
B.L.11 Bridge Location	0.01 Mi S US 82E-Hamburg
B.L.12 Metropolitan Planning Organization	

CLASSIFICATION	
B.CL.01 Owner	S01 - State transportation departme
B.CL.02 Maint. Responsibility	S01 - State transportation departme
B.CL.03 Federal or Tribal Land Access	N - Not Applicable
B.CL.04 Historic Significance	N - Bridge is not eligible for the
B.CL.05 Toll	N - Bridge does not carry a toll ro
B.CL.06 Emergency Evacuation Designation	

ROADSIDE HARDWARE	
B.RH.01A Bridge Railing Type	
B.RH.01B Bridge Railing Year (YY)	
B.RH.01C Bridge Railing Test Level	
B.RH.02A Transition Type	
B.RH.02B Transition Year (YY)	
B.RH.02C Transition Test Level	

BRIDGE GEOMETRY	
B.G.01 NBIS Bridge Length	20.8
B.G.02 Total Bridge Length	22
B.G.03 Max Span Length	9.8
B.G.04 Min Span Length	10
B.G.05 Bridge Width Out-to-Out	
B.G.06 Bridge Width Curb-to-Curb	0
B.G.07 Left Curb or Sidewalk Width	0
B.G.08 Right Curb or Sidewalk Width	0
B.G.09 Approach Roadway Width	56.1

B.G.10 Bridge Median	0 - No median
B.G.11 Skew	0
B.G.12 Curved Bridge	N - Not curved
B.G.13 Max Bridge Height	5
B.G.14 Sidehill Bridge	N - Not a sidehill bridge
B.G.15 Irregular Deck Area	
B.G.16 Calculated Deck Area	

LOADS AND LOAD RATING	
B.LR.01 Design Load	H15 - H-15
B.LR.02 Design Method	
B.LR.03 Load Rating Date	
B.LR.04 Load Rating Method	LFR - Load Factor Rating
B.LR.05 Inventory Load Rating Factor	0.72
B.LR.06 Operating Load Rating Factor	1.22
B.LR.07 Controlling Legal Load Rating Factor	
B.LR.08 Routine Permit Loads	

INSPECTION REQUIREMENTS	
B.IR.01 NSTM Inspection Required	N - NSTM inspection not required.
B.IR.02 Fatigue Details	
B.IR.03 UW Inspection Required	N - Underwater inspection not requi
B.IR.04 Complex Feature	N - Bridge does not have complex fe

COMPONENT CONDITION RATINGS	
B.C.01 Deck Condition Rating	N - NOT APPLICABLE - Component
B.C.02 Superstructure Condition	N - NOT APPLICABLE - Component
B.C.03 Substructure Condition	N - NOT APPLICABLE - Component
B.C.04 Culvert Condition	6 - SATISFACTORY - Widespread
B.C.05 Bridge Railing Condition	N - NOT APPLICABLE - Component
B.C.06 Bridge Railing Transitions Condition	N - NOT APPLICABLE - Component
B.C.07 Bridge Bearings Cond.	N - NOT APPLICABLE - Component
B.C.08 Bridge Joints Condition	N - NOT APPLICABLE - Bridge do
B.C.09 Channel Condition Rating	7 - GOOD - Some minor defects.
B.C.10 Channel Protection Condition	N - NOT APPLICABLE - Bridge do
B.C.11 Scour Condition Rating	7 - Some minor scour.
B.C.12 Bridge Condition Classification	F - Fair
B.C.13 Lowest Condition Rating	6 - SATISFACTORY - Widespread
B.C.14 NSTM Insp. Condition	
B.C.15 UW Inspection Condition	

APPRAISAL	
B.AP.01 Approach Roadway Alignment	G - Good
B.AP.02 Overtopping Likelihood	1 - Remote - once every 100 years o
B.AP.03 Scour Vulnerability	B - Scour appraisal completed. Brid
B.AP.04 Scour Plan of Action	0 - A scour POA is not required.
B.AP.05 Seismic Vulnerability	0 - Seismic evaluation not complete



Team Lead: Nicholas Holmgren, Inspection Date: 06/10/2025

SPAN SETS

C1			
B.SP.02 # of Spans	2	B.SP.08 Deck Interaction	
B.SP.03 # of Beam Lines	1	B.SP.09 Deck Material and Type	0 - None
B.SP.04 Span Material	C01 - Reinforced concrete - ca	B.SP.10 Wearing Surface	
B.SP.05 Span Continuity	7 - Buried	B.SP.11 Deck Protective System	
B.SP.06 Span Type	F02 - Frame - four-sided	B.SP.12 Deck Reinforcing Protective System	
B.SP.07 Span Protective System	0 - None	B.SP.13 Deck Stay-In-Place Forms	

HIGHWAY FEATURES

H1			
B.F.02 Feature Location	C - Carried on bridge	B.H.09 Annual ADT	7300
B.F.03 Feature Name	US 82-08 LM 24.36	B.H.10 Annual ADTT	73
B.H.01 Functional Classification	3 - Principal Arterial - Other	B.H.11 Year of Annual ADT	2018
B.H.02 Urban Code	99999	B.H.12 Highway Max Usable Vertical Clearance	99.9
B.H.03 NHS Designation	Y - NHS	B.H.13 Highway Min Vertical Clearance	99.9
B.H.04 National Highway Freight Network	1-T - TEMP - NHFN - 1 or 2 or	B.H.14 Highway Min Horizontal Clearance, Left	
B.H.05 STRAHNET Designation	N - Not a STRAHNET route	B.H.15 Highway Min Horizontal Clearance, Right	
B.H.06 LRS Route ID	82080	B.H.16 Highway Max Usable Surface Width	99.9
B.H.07 LRS Mile Point	24.36	B.H.17 Bypass Detour Length	25
B.H.08 Lanes On Highway	5	B.H.18 Crossing Bridge Number	

HIGHWAY ROUTES

Highway Parent	B.RT.01 Route Designation	B.RT.02 Route Number	B.RT.03 Route Direction	B.RT.04 Route Type	B.RT.05 Service Type
H1	1	82	2-T - TEMP - Two-way traffic - NS or EW	2 - U.S. route	1 - Mainline

WATERWAY FEATURES

W1			
B.F.02 Feature Location	B - Below bridge	B.N.03 Movable Bridge Max Navigation Vertical Clearance	
B.F.03 Feature Name	Weaver Creek	B.N.04 Navigation Channel Width	
B.N.01 Navigable Waterway	N - Not navigable waters	B.N.05 Navigation Channel Min Horizontal Clearance	
B.N.02 Navigation Min Vertical Clearance		B.N.06 Substructure Navigation Protection	

POSTING STATUS DATA

B.PS.01 Load Posting Status	B.PS.02 Posting Status Change Date
PO - Permanent and Open	

LOAD EVALUATION AND POSTING

B.EP.01 Legal Load Configuration	B.EP.02 Legal Load Rating Factor	B.EP.03 Posting Type	B.EP.04 Posting Value
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Asset #M1528(POA Scour Assessment Evaluation)

US 82-08 LM 24.36 over Weaver Creek-Ashley Co

Location: 0.01 Mi S US 82E-Hamburg

Team Lead: Nicholas Holmgren **Inspection Date:** 06/10/2025

Inspection Notes

General Observation

Bridge is logged from south to north.
Beginning of structure toward SH 8, South End.

Inspection of this structure can be performed by foot.
Normal water level requires use of waders.

11 - Milepoint (24.36)

Updated LM from 24.18 to 24.36 per Str Ln from TS dated 4/09. DRB, 6/24/09

61 - Channel/Channel Protection (7 - Bank protection is in need of minor repairs. River control devices and embankment protection have a little minor damage. Banks and/or channel have minor amounts of drift.)

Channel is in good condition with minor debris build up.

62 - Culverts (6 - Deterioration or initial disintegration, minor chloride contamination, cracking with some leaching, or spalls on concrete or masonry walls and slabs. Local minor scouring at curtain walls, wingwalls or pipes. Metal culverts have a smooth curvature, non-symmetrical shape, significant corrosion or moderate pitting.)

Culverts are in satisfactory condition with delamination, cracking, abrasion/wear, and scour.

A-B.C.11 - B.C.11 Scour Condition Rating (New NBIS) (7 - Some minor scour.)

Scour condition is good with minor erosion at inlet and outlet ends of box.

ELEMENTS	DESCRIPTION	UNITS	TOTAL	CS1	CS2	CS3	CS4
241	Reinforced Concrete Culvert	LF	124	0	123	1	0
1080	Delamination/Spall/Patched Area	LF	1	0	0	1	0
1130	Cracking (RC and Other)	LF	5	0	5	0	0
1190	Abrasion/Wear (PSC/RC)	LF	114	0	114	0	0
6000	Scour	LF	4	0	4	0	0
(241) Box culvert: 2 barrels (10' wide x 5' tall) @ 62' each = 124 LF total.							
Small vertical cracks in walls of both barrels. 5 LF CS2 Cracking							
Minor abrasion on bottom slab both barrels. 114 LF CS2 Abrasion/Wear							
Barrel 1: Right side, small spall in top slab. 1 LF CS3 Spall							
Channel - Barrels 1 & 2: Toe wall exposed on both sides (no undermining). 4 LF CS2 Scour							

Inspection Photos and Notes



Elevation - Right side view



Roadway view



Channel - Left side view



Channel - Right side view

Maintenance Needs

Date Reported: 04/19/2023

Priority: C - Important

Type of Work: Repair (General)

Status: Assigned

Component: Culverts

Deficiency Description

Roadway slope - Barrel 1 left: Significant erosion with vertical drop.

Remarks

Bent 1 left has side slope erosion.



Bent 1 left side slope erosion.



Bent 1 left side slope erosion.



Bent 1 left has slope erosion.



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US 82-08 LM 24.36 over Weaver Creek-Ashley Co

Location: 0.01 Mi S US 82E-Hamburg

Team Lead: Nicholas Holmgren **Inspection Date:** 06/10/2025

Routine Maintenance

Check Box Maintenance Items

Type of Maintenance	Is Recommended?
A-54 - Sealable Deck Cracks	No
A-55 - Deck Washing Needed	No
A-56 - Joint Cleaning/Flushing Needed	No
A-57 - Beam End and Bearing Paint Needed	No
A-58 - Cap Cleaning/Flushing Needed	No
A-59 - Joint Repair Needed	No
A-60 - Full Beam Painting Needed	No
A-61 - Polymer Overlay Advised	No
A-62 - Hydro and LMC Advised	No
A-63 - Missing/Incorrect Log Mile Signage	No
A-64 - Vegetation Removal Requested	No
A-65 - Clogged deck drains?	
A-66 - Approach minor pothole/leveling needed	

A-54 - Sealable Deck Cracks (No)

A-55 - Deck Washing Needed (No)

A-56 - Joint Cleaning/Flushing Needed (No)



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A-57 - Girder End and Bearing Painting Needed (No)

A-58 - Cap Cleaning/Flushing Needed (No)

A-59 - Joint Repair Needed (No)

A-60 - Full Girder Painting Needed (No)

A-61 - Polymer Overlay Advised (No)

A-62 - Hydro and LMC Advised (No)

A-63 - Missing/Incorrect Log Mile Signage (No)

A-64 - Vegetation Removal Requested (No)

A-65 - Clogged deck drains?



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A-66 - Approach minor pothole/leveling needed



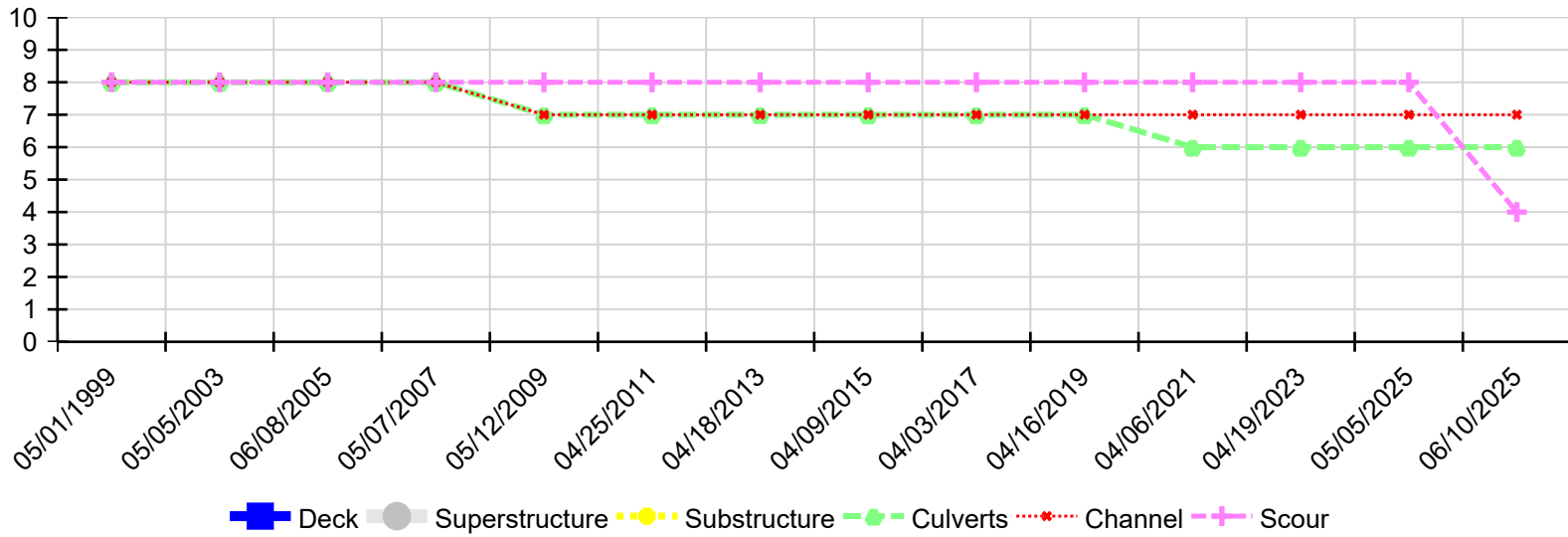
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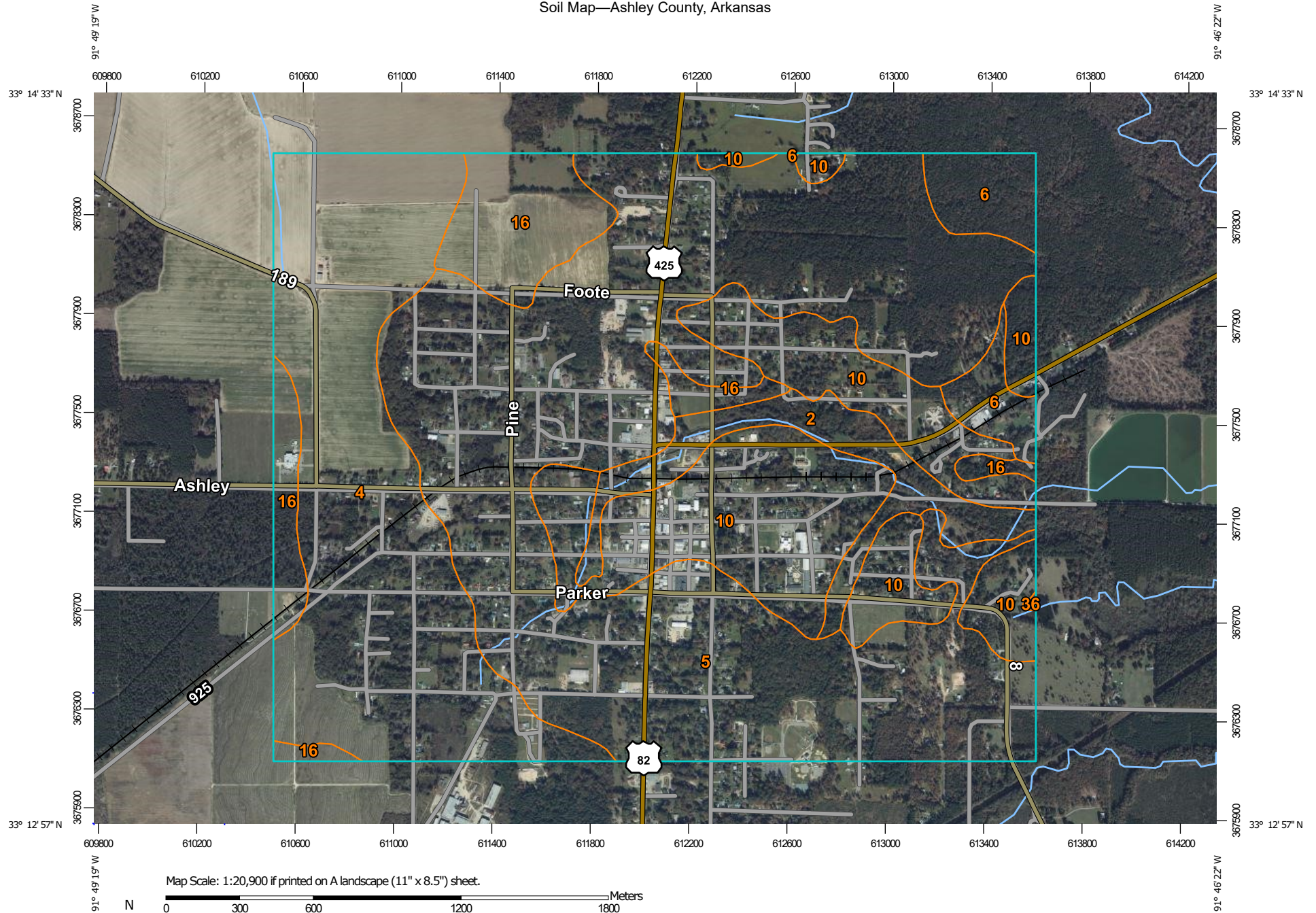
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Condition History

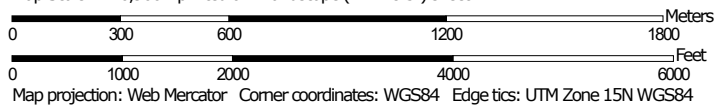


Inspection Date	Deck	Superstructure	Substructure	Culverts	Channel	Scour
06/10/2025	N	N	N	6	7	4
05/05/2025	N	N	N	6	7	8
04/19/2023	N	N	N	6	7	8
04/06/2021	N	N	N	6	7	8
04/16/2019	N	N	N	7	7	8
04/03/2017	N	N	N	7	7	8
04/09/2015	N	N	N	7	7	8
04/18/2013	N	N	N	7	7	8
04/25/2011	N	N	N	7	7	8
05/12/2009	N	N	N	7	7	8
05/07/2007	N	N	N	8	8	8
06/08/2005	N	N	N	8	8	8
05/05/2003	N	N	N	8	8	8
05/01/1999	N	N	N	8	8	8

Soil Map—Ashley County, Arkansas



Map Scale: 1:20,900 if printed on A landscape (11" x 8.5") sheet.



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

3/4/2025
Page 1 of 3


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 1:20,000.

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: Ashley County, Arkansas

Survey Area Data: Version 26, Sep 9, 2024

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

Date(s) aerial images were photographed: Sep 29, 2020—Nov 17, 2020

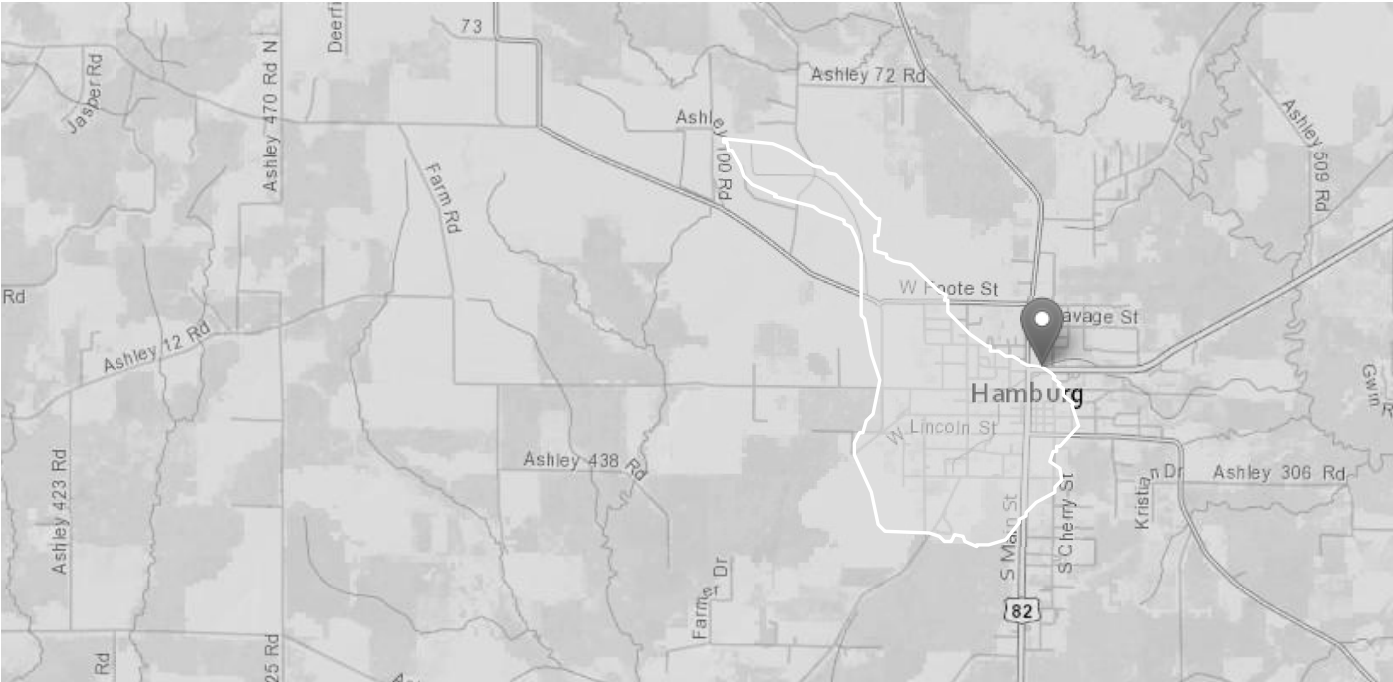
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2	Arkabutla silt loam, 0 to 1 percent slopes, frequently flooded	85.2	4.5%
4	Calhoun silt loam, 0 to 1 percent slopes	402.9	21.3%
5	Calloway silt loam, 0 to 1 percent slopes	872.3	46.1%
6	Calloway silt loam, 1 to 3 percent slopes	61.7	3.3%
10	Grenada silt loam, 1 to 3 percent slopes	342.3	18.1%
16	Henry silt loam, 0 to 1 percent slopes	127.6	6.7%
36	Water	0.6	0.0%
Totals for Area of Interest		1,892.7	100.0%

StreamStats Report

Region ID: AR
Workspace ID: AR20250304132047277000
Clicked Point (Latitude, Longitude): 33.22986, -91.79609
Time: 2025-03-04 07:21:15 -0600



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
ALVM	Percentage of the basin covered by Quaternary alluvial deposits from Reed & Bush (2005)	100	percent
BFI	Proportion of mean annual flow that is from ground water (base flow)	0.31	dimensionless
BSHAPELFP	Basin Shape Factor computed as the square of the longest flow path divided by drainage area	5.011	dimensionless
CSL1085ADJ	Adjusted 10-85 slope in feet per mile	10.338	feet per mi
CSL1085LFP	Change in elevation divided by length between points 10 and 85 percent of distance along the longest flow path to the basin divide, LFP from 2D grid	9.37	feet per mi
CSL1085RAW	Unadjusted 10-85 stream slope method in feet per mile.	9.37	feet per mi
CSLBlue	Change in elevation of the longest blue-line stream (not extended to the boundary) divided by stream length	7.03	feet per mi
DRNAREA	Area that drains to a point on a stream	1.62	square miles
ELEV	Mean Basin Elevation	175	feet

Parameter Code	Parameter Description	Value	Unit
HIGHREG	HIGHREG	1719	dimensionless
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	67.3	percent
LC11DVOPN	Percentage of developed open area from NLCD 2011 class 21	8.84	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	24	percent
LC11PAST	Percentage of area of pasture area from NLCD 2011 class 81	5.86	percent
LFPLENGTH	Length of longest flow path	2.847	miles
LOWREG	Low Flow Region Number	1439	dimensionless
MARAVPRE	Mean March Precipitation	5.51	inches
NOVAVPRE	Mean November Precipitation	5.08	inches
ORDOMISS	Percent Surficial Geology as Ordovician and Mississippian Rocks	0	percent
PRECIP	Mean Annual Precipitation	56.3	inches
PREMARAPR	Precipitation March-April basin average, mean monthly as defined in SIR 2008-5065	11.2	inches
PRENOVDEC	Precipitation November-December basin average, mean monthly as defined in SIR 2008-5065	10.6	inches
PRNOVAPR00	Precipitation November-April basin average, mean seasonal from PRISM 1971-2000	31.9	inches
PRNOVAPR90	Precipitation November-April basin average, mean seasonal from PRISM 1961-1990	30.7	inches
PZNSSREGNO	Zeroflow Region Number	1446	dimensionless
SOILINDEX	Mean STATSGO Hydrologic Soils Index (from PL. 2 WRIR 03-4107 for WY)	3	dimensionless
TAU_ANN_G	Tau, Average annual base-flow recession time constant as defined in SIR 2008-5065	10	days
TAU_SPR_G	Tau, Average base-flow recession time constant for March through April as defined in SIR 2008-5065, estimated from a grid	8	days
TAU_WIN_G	Tau, Average base-flow recession time constant for November through December as defined in SIR 2008-5065, estimated from a grid	10	days
TRUN0711	Mean annual dry season total runoff, July through November	3.54	inches
UPZ	Percentage of the basin covered by upper Paleozoic strata from Reed & Bush (2005)	0	percent

➤ Peak-Flow Statistics

Peak-Flow Statistics Parameters [Peak Region D 2016 5081]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
BSHAPELFP	Basin Shape Factor, Longest flow path method	5.011	dimensionless	3.12	76
CSLBlue	Stream Slope Blue Line Method	7.03	feet per mi	0.36	31.8
DRNAREA	Drainage Area	1.62	square miles	0.15	1620

Peak-Flow Statistics Flow Report [Peak Region D 2016 5081]

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, SE: Standard Error, PC: Percent Correct, RMSE: Root Mean Squared Error, PseudoR²: Pseudo R Squared (other -- see report)

Statistic	Value	Unit	PIL	PIU	ASEp
50-percent AEP flood	200	ft ³ /s	117	342	33
20-percent AEP flood	319	ft ³ /s	186	546	31
10-percent AEP flood	405	ft ³ /s	223	736	33
4-percent AEP flood	522	ft ³ /s	265	1030	37
2-percent AEP flood	613	ft ³ /s	293	1280	41
1-percent AEP flood	707	ft ³ /s	320	1560	45
0.2-percent AEP flood	940	ft ³ /s	374	2360	56

Peak-Flow Statistics Citations

Wagner, D.M., Krieger, J.D., and Veilleux, A.G., 2016, Methods for estimating annual exceedance probability discharges for streams in Arkansas, based on data through water year 2013: U.S. Geological Survey Scientific Investigations Report 2016–5081, 136 p. (<http://dx.doi.org/10.3133/sir20165081>)

➤ Low-Flow Statistics

Low-Flow Statistics Parameters [Low Flow Region 2 2008 5065]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.62	square miles	4.7	932
LOWREG	Low Flow Region Number	1439	dimensionless		
PRECIP	Mean Annual Precipitation	56.3	inches	44.5	61.9
TAU_ANN_G	Tau Annual from Grid	10	days	5.5	26.7

Low-Flow Statistics Disclaimers [Low Flow Region 2 2008 5065]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Low-Flow Statistics Flow Report [Low Flow Region 2 2008 5065]

Statistic	Value	Unit
7 Day 2 Year Low Flow	0.00339	ft ³ /s
7 Day 10 Year Low Flow	0.00604	ft ³ /s

Low-Flow Statistics Citations

Funkhouser, J.E., Eng, Ken, and Moix, M.W.,2008, Low-Flow Characteristics and Regionalization of Low Flow Characteristics for Selected Streams in Arkansas: U. S. Geological Survey Scientific Investigations Report 2008-5065, 161 p. (<http://pubs.usgs.gov/sir/2008/5065/pdf/SIR2008-5065.pdf>)

Monthly Flow Statistics

Monthly Flow Statistics Parameters [Low Flow Region 2 2008 5065]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.62	square miles	4.7	932
LOWREG	Low Flow Region Number	1439	dimensionless		
MARAVPRE	Mean March Precipitation	5.51	inches	4.1	6.6
NOVAVPRE	Mean November Precipitation	5.08	inches	4.3	5.6
ORDOMISS	Percent SurficialGeology Ordo and Miss	0	percent	0	100
PRNOVAPR90	Basin Ave Rainfall Nov Apr PRISM 1990	30.7	inches	8.3	31.1
TAU_ANN_G	Tau Annual from Grid	10	days	5.5	26.7
TAU_WIN_G	Tau Nov Dec from Grid	10	days	6.5	12.3

Monthly Flow Statistics Parameters [Dry Season Mean Monthly Flow 2015 5031]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.62	square miles	4.1	7350
TRUN0711	Dry Season Total Runoff	3.54	inches	3.6	5.6

Monthly Flow Statistics Disclaimers [Dry Season Mean Monthly Flow 2015 5031]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Monthly Flow Statistics Flow Report [Dry Season Mean Monthly Flow 2015 5031]

Statistic	Value	Unit
July Mean Flow	0.384	ft ³ /s
August Mean Flow	0.156	ft ³ /s
September Mean Flow	0.415	ft ³ /s
October Mean Flow	0.81	ft ³ /s

Statistic	Value	Unit
November Mean Flow	2.34	ft ³ /s

Monthly Flow Statistics Disclaimers [Low Flow Region 2 2008 5065]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Monthly Flow Statistics Flow Report [Low Flow Region 2 2008 5065]

Statistic	Value	Unit
Nov 7 Day 10 Year Low Flow	0.0148	ft ³ /s
Dec 7 Day 10 Year Low Flow	0.0214	ft ³ /s
Jan 7 Day 10 Year Low Flow	0.0269	ft ³ /s
Feb 7 Day 10 Year Low Flow	0.147	ft ³ /s
Mar 7 Day 10 Year Low Flow	0.151	ft ³ /s
Apr 7 Day 10 Year Low Flow	0.0894	ft ³ /s

Monthly Flow Statistics Flow Report [Area-Averaged]

Statistic	Value	Unit
July Mean Flow	0.384	ft ³ /s
August Mean Flow	0.156	ft ³ /s
September Mean Flow	0.415	ft ³ /s
October Mean Flow	0.81	ft ³ /s
November Mean Flow	2.34	ft ³ /s
Nov 7 Day 10 Year Low Flow	0.0148	ft ³ /s
Dec 7 Day 10 Year Low Flow	0.0214	ft ³ /s
Jan 7 Day 10 Year Low Flow	0.0269	ft ³ /s
Feb 7 Day 10 Year Low Flow	0.147	ft ³ /s
Mar 7 Day 10 Year Low Flow	0.151	ft ³ /s
Apr 7 Day 10 Year Low Flow	0.0894	ft ³ /s

Monthly Flow Statistics Citations

Funkhouser, J.E., Eng, Ken, and Moix, M.W.,2008, Low-Flow Characteristics and Regionalization of Low Flow Characteristics for Selected Streams in Arkansas: U. S. Geological Survey Scientific Investigations Report 2008-5065, 161 p. (<http://pubs.usgs.gov/sir/2008/5065/pdf/SIR2008-5065.pdf>)

Breaker, B.K.,2015, Dry season mean monthly flow and harmonic mean flow regression equations for selected ungaged basins in Arkansas: U.S. Geological Survey Scientific Investigations Report 2015-5031, 25 p. (<http://pubs.usgs.gov/sir/2015/5031/>)

➤ Seasonal Flow Statistics

Seasonal Flow Statistics Parameters [Low Flow Region 2 2008 5065]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.62	square miles	4.7	932
LOWREG	Low Flow Region Number	1439	dimensionless		
ORDOMISS	Percent SurficialGeology Ordo and Miss	0	percent	0	100
PRENOVDEC	Basin Ave Rainfall Nov Dec	10.6	inches	7.6	10.9
PRNOVAPR90	Basin Ave Rainfall Nov Apr PRISM 1990	30.7	inches	8.3	31.1
TAU_SPR_G	Tau Mar Apr from Grid	8	days	4.5	25.2

Seasonal Flow Statistics Disclaimers [Low Flow Region 2 2008 5065]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Seasonal Flow Statistics Flow Report [Low Flow Region 2 2008 5065]

Statistic	Value	Unit
Nov to Apr 7 Day 10 Year Low Flow	0.0107	ft ³ /s
Nov to Dec 7 day 10 Year Low Flow	0.0108	ft ³ /s
Jan to Feb 7 Day 10 Year Low Flow	0.65	ft ³ /s
Mar to Apr 7 Day 10 Year Low Flow	0.0729	ft ³ /s

Seasonal Flow Statistics Citations

Funkhouser, J.E., Eng, Ken, and Moix, M.W.,2008, Low-Flow Characteristics and Regionalization of Low Flow Characteristics for Selected Streams in Arkansas: U. S. Geological Survey Scientific Investigations Report 2008-5065, 161 p. (<http://pubs.usgs.gov/sir/2008/5065/pdf/SIR2008-5065.pdf>)

➤ General Flow Statistics

General Flow Statistics Parameters [Harmonic Mean Flow Region 2 2015 5031]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
BFI	Base Flow Index	0.31	dimensionless	0.1	0.4
DRNAREA	Drainage Area	1.62	square miles	4.1	2090
ORDOMISS	Percent SurficialGeology Ordo and Miss	0	percent	0	100

General Flow Statistics Disclaimers [Harmonic Mean Flow Region 2 2015 5031]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

General Flow Statistics Flow Report [Harmonic Mean Flow Region 2 2015 5031]

Statistic	Value	Unit
Harmonic Mean Streamflow adjusted for proportion of zero flow days	0.0279	ft ³ /s

General Flow Statistics Citations

Breaker, B.K.,2015, Dry season mean monthly flow and harmonic mean flow regression equations for selected ungaged basins in Arkansas: U.S. Geological Survey Scientific Investigations Report 2015–5031, 25 p.
(<http://pubs.usgs.gov/sir/2015/5031/>)

➤ Bankfull Statistics

Bankfull Statistics Parameters [Atlantic Plain D Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.62	square miles	0.30888	1086.8715

Bankfull Statistics Parameters [USA Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.62	square miles	0.07722	59927.7393

Bankfull Statistics Flow Report [Atlantic Plain D Bieger 2015]

Statistic	Value	Unit
Bieger_D_channel_width	12.3	ft
Bieger_D_channel_depth	1.25	ft
Bieger_D_channel_cross_sectional_area	14.8	ft ²

Bankfull Statistics Flow Report [USA Bieger 2015]

Statistic	Value	Unit
Bieger_USA_channel_width	14.7	ft
Bieger_USA_channel_depth	1.34	ft
Bieger_USA_channel_cross_sectional_area	22.2	ft ²

Bankfull Statistics Flow Report [Area-Averaged]

Statistic	Value	Unit
Bieger_D_channel_width	12.3	ft
Bieger_D_channel_depth	1.25	ft
Bieger_D_channel_cross_sectional_area	14.8	ft ²
Bieger_USA_channel_width	14.7	ft
Bieger_USA_channel_depth	1.34	ft

Statistic	Value	Unit
Bieger_USA_channel_cross_sectional_area	22.2	ft^2

Bankfull Statistics Citations

Bieger, Katrin; Rathjens, Hendrik; Allen, Peter M.; and Arnold, Jeffrey G., 2015, Development and Evaluation of Bankfull Hydraulic Geometry Relationships for the Physiographic Regions of the United States, Publications from USDA-ARS / UNL Faculty, 17p. (https://digitalcommons.unl.edu/usdaarsfacpub/1515?utm_source=digitalcommons.unl.edu%2Fusdaarsfacpub%2F1515&utm_medium=PDF&utm_campaign=PDFCoverPa)

➤ Probability Statistics

Probability Statistics Parameters [Pzero Flow Region 2 2008 5065]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.62	square miles	4.7	932
PZNSSREGNO	Prob zero flow region number	1446	dimensionless		
TAU_ANN_G	Tau Annual from Grid	10	days	5.5	26.7

Probability Statistics Disclaimers [Pzero Flow Region 2 2008 5065]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Probability Statistics Flow Report [Pzero Flow Region 2 2008 5065]

Statistic	Value	Unit
Probability zero flow 7Day	0.119	dim
Probability zero flow 7 day Nov to Apr	0.17	dim
Probability zero flow 7 day Nov to Dec	0.279	dim
Probability zero flow 7 day Nov	0.299	dim

Probability Statistics Citations

Funkhouser, J.E., Eng, Ken, and Moix, M.W., 2008, Low-Flow Characteristics and Regionalization of Low Flow Characteristics for Selected Streams in Arkansas: U. S. Geological Survey Scientific Investigations Report 2008-5065, 161 p. (<http://pubs.usgs.gov/sir/2008/5065/pdf/SIR2008-5065.pdf>)

➤ Maximum Probable Flood Statistics

Maximum Probable Flood Statistics Parameters [84.0 Percent (1.36 square miles) Crippen Bue Region 3]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.62	square miles	0.1	10000

Maximum Probable Flood Statistics Parameters [16.0 Percent (0.255 square miles) Crippen Bue Region 10]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.62	square miles	0.1	1000

Maximum Probable Flood Statistics Flow Report [84.0 Percent (1.36 square miles) Crippen Bue Region 3]

Statistic	Value	Unit
Maximum Flood Crippen Bue Regional	6830	ft^3/s

Maximum Probable Flood Statistics Flow Report [16.0 Percent (0.255 square miles) Crippen Bue Region 10]

Statistic	Value	Unit
Maximum Flood Crippen Bue Regional	8640	ft^3/s

Maximum Probable Flood Statistics Flow Report [Area-Averaged]

Statistic	Value	Unit
Maximum Flood Crippen Bue Regional	7120	ft^3/s

Maximum Probable Flood Statistics Citations

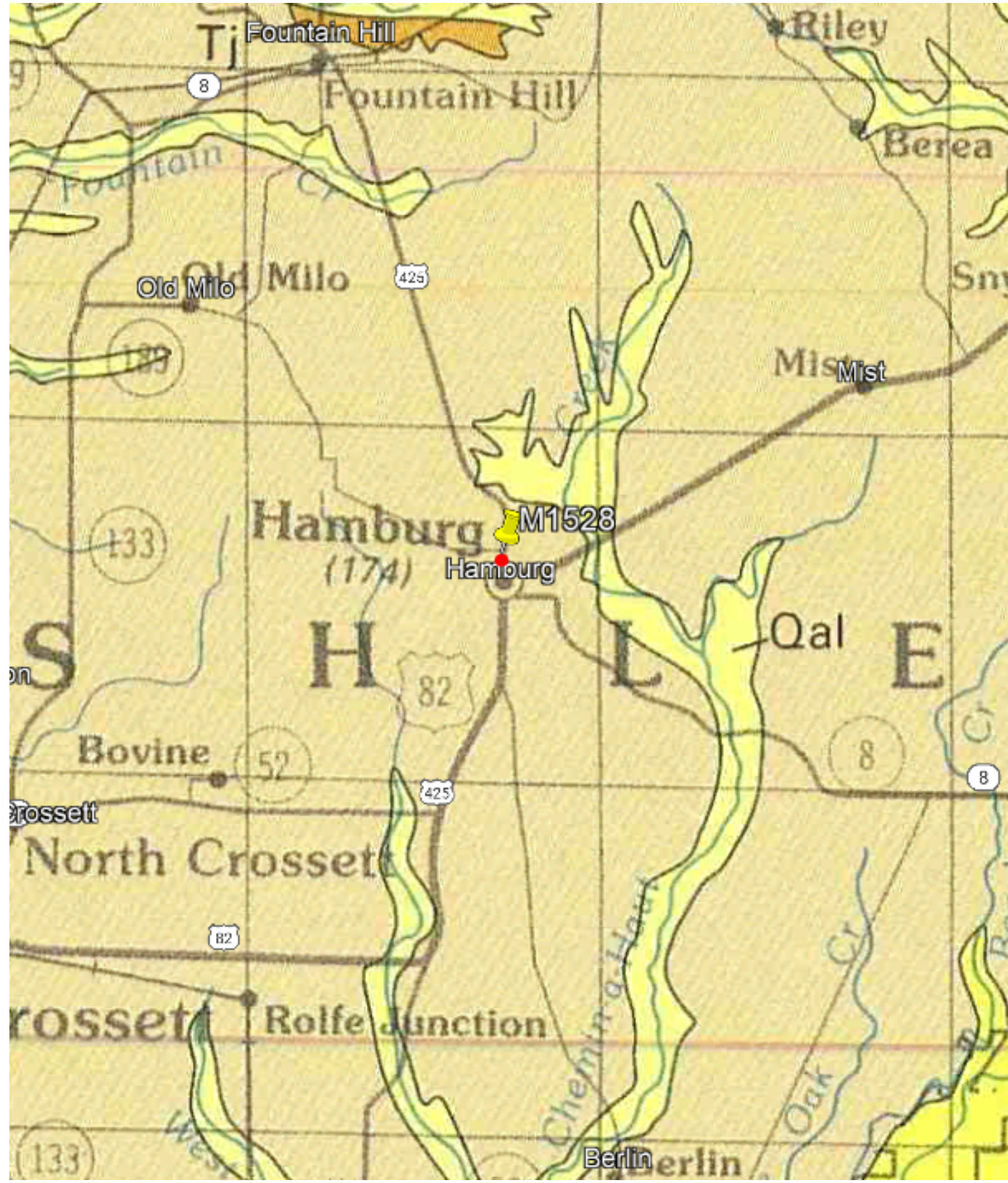
Crippen, J.R. and Bue, Conrad D.1977, Maximum Floodflows in the Conterminous United States, Geological Survey Water-Supply Paper 1887, 52p. (<https://pubs.usgs.gov/wsp/1887/report.pdf>)

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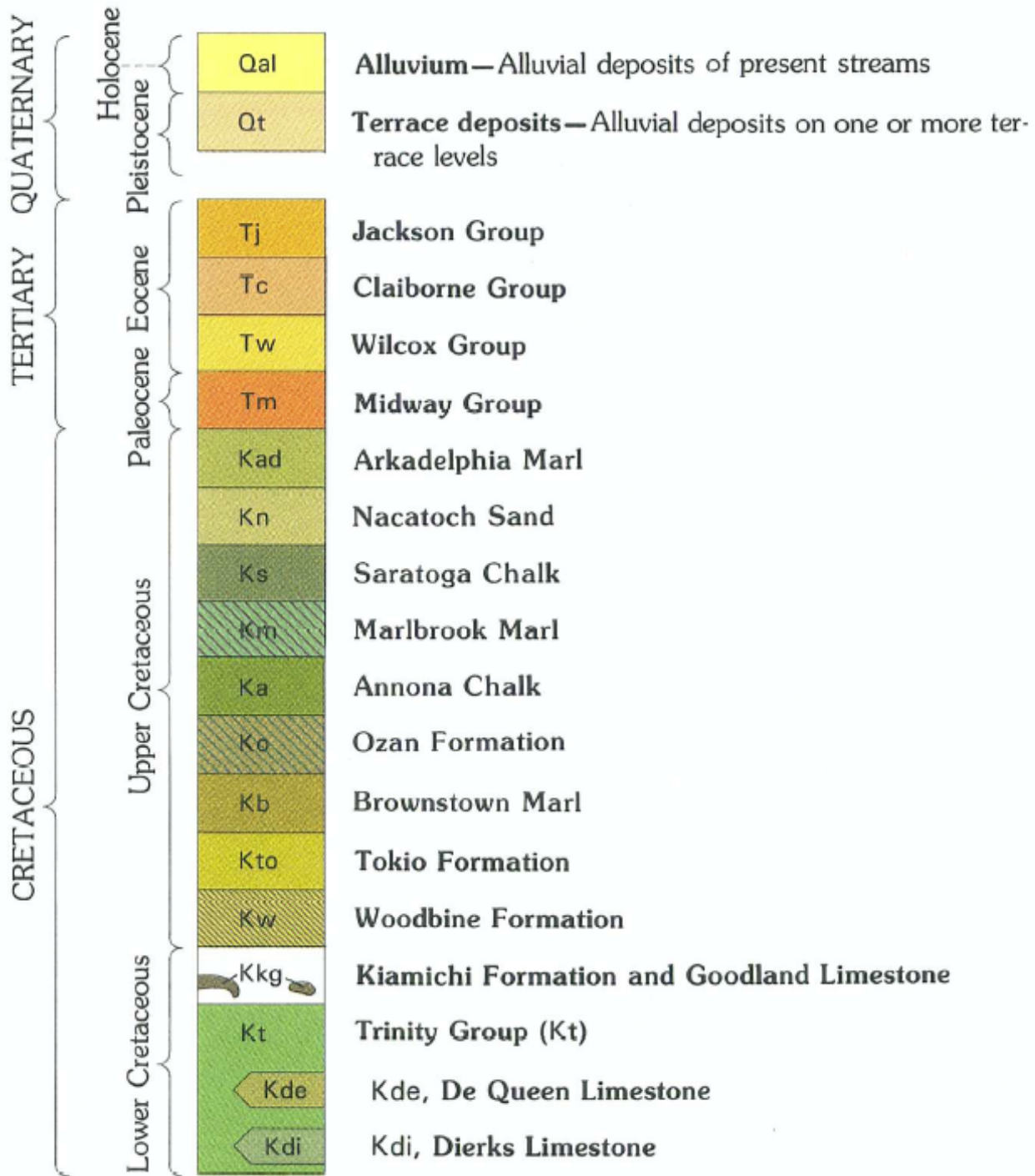
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Application Version: 4.28.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1



GULF COASTAL PLAIN



MISSISSIPPI EMBAYMENT AND GULF COASTAL PLAIN

Eastern and southern Arkansas are underlain by Cretaceous age through recent sedimentary deposits with small areas of Cretaceous age igneous intrusions. The Cretaceous sedimentary deposits crop out in southwestern Arkansas and represent shallow, marginal, and often restricted marine environments. Southern Arkansas is dominated by Tertiary age marginal marine and coastal plain continental deposits with a veneer of Quaternary terrace and alluvial deposits. Eastern and northeastern Arkansas is dominated by Quaternary age terrace and alluvial deposits with minor exposures of Tertiary age materials. At least three terrace levels are recognized in the region. The Mississippi Embayment manifests a north-south linear erosional remnant called Crowley's Ridge which is generally capped by Quaternary age loess and preserves minor exposures of Tertiary age deposits along its margins. Topographically the entire area ranges from low hills to essentially flat.

TRINITY GROUP/FORMATION

Age: Early Cretaceous Period, Comanchian Series

Distribution: Gulf Coastal Plain in southwest Arkansas. Parts of Little River, Sevier, Howard, Hempstead, Pike, Clark, and Nevada counties; Texas, Louisiana, Oklahoma.

Geology: The Trinity Group is comprised of sand, gravel, clay, limestone, and evaporite deposits. Gypsum is mined commercially from this unit. Prominent members of the Trinity include the Pike Gravel, the Dierks Limestone, and the DeQueen Limestone. The Pike Gravel, the basal member of the Trinity Group, is a bedded, 0 to 100 foot thick, pale yellow to medium orange gravel deposit. The Dierks Limestone is a 0 to 70 foot thick, interbedded, greenish calcareous clay and gray fossiliferous limestone found in the lower part of the Trinity. The DeQueen Limestone is found in the middle part of the Trinity sequence and is composed of interbedded green and gray calcareous clay, limestone, gypsum and celestite 0 to 100 feet thick. The limestones are thin bedded and sandy for the most part, but crystalline and fossiliferous intervals are present. The DeQueen is also noted for a dinosaur track-way site found in a quarry near Nashville in Howard County. The upper part of the Trinity is mostly fine-grained, cross-bedded sand, usually weathered reddish. Marginal marine fossils are noted from the Trinity and carbonized logs are found between the Dierks and DeQueen. The base of the Trinity rests unconformably on a surface of upturned and eroded Paleozoic rocks. The Trinity Group may be as much as 1000 feet thick although it is usually much thinner.

Original Reference: R. T. Hill, 1888, Science, v. 11, p. 21

Type locality: Named for exposures on the Trinity River of Texas.

GOODLAND LIMESTONE/FORMATION

Age: Early Cretaceous Period, Comanchian Series

Distribution: Limited exposure along Little River north of Cerrogordo, Little River County, Arkansas, Gulf Coastal Plain; Oklahoma and Texas

Geology: The Goodland Limestone is a medium to thick bedded, hard, sandy, light gray limestone with minor thin bedded calcareous sandstone. Poorly preserved fossils are common. The lower contact is not exposed in Arkansas. The maximum exposed thickness of the Goodland is 35 feet; however, the entire unit may reach 50 feet.

Original reference: R. T. Hill, 1891, Geological Society American Bulletin v. 2, p. 504-514.

Type locality: Named for Goodland, Choctaw County, Oklahoma. (Old Goodland is present site of Good Switch on railroad, 3 miles south of Hugo, OK.)

KIAMICHI FORMATION

Age: Early Cretaceous Period, Comanchian Series

Distribution: Very limited exposure in Little River County, Arkansas Gulf Coastal Plain; Oklahoma, Texas.

Geology: The Kiamichi Formation is composed of closely packed oyster shells in a matrix of dense, hard, gray-green marl interbedded with softer gray and green marls. Discontinuous beds and lenses of fossiliferous limestone are found in some outcrops. Almost all fossils associated with this unit are assigned to *Gryphaea navia*. The conformability of the lower contact has not been reported in Arkansas. A maximum of 20 feet of Kiamichi is reported.

Original reference: R. T. Hill, 1891, Geological Society of America Bulletin, v. 2, p. 504-515.

Type locality: Named for historic plains of Kiamichi River near Fort Towson, Choctaw County, Oklahoma.

WOODBINE FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas, parts of Pike, Howard, and Sevier Counties; Texas, Oklahoma, Louisiana

Geology: The Woodbine is composed of bedded gravel, sand, bedded clay, and water-lain volcanic tuff and ash. The basal part of this unit is gravel of variable thickness and maybe cemented by iron oxides to form a conglomerate. The overlying water-lain volcanic tuffs are sandy and cross-bedded. These sediments are blue-green when fresh and deep red waxy clay when weathered. Rare leaf fossils are noted from some clays of the Woodbine. The formation was deposited upon an

unconformable surface separating the Early and Late Cretaceous. The Woodbine Formation is 0-350 feet thick.

Original reference: R. T. Hill, 1901, U. S. Geological Survey 21st Annual Report, pt. 7, p. 293.

Type locality: Named for exposures at Woodbine, Cooke County, Texas.

TOKIO FORMATION

Age: Late Cretaceous, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas. Parts of Clark, Pike, Hempstead, Howard, Sevier and Little River Counties; Oklahoma

Geology: The Tokio Formation is composed of a basal gravel overlain by coarse sand interbedded with light to dark colored clays. Some beds of calcareous or ferruginous sandstone occur in the sequence. The basal unit of bedded gravel is variable in thickness, ranging from 1 to 25 feet. This gravel may be cemented by iron oxides in places to form a conglomerate. The sands tend to be brown to gray and are generally cross-bedded. The dark gray clay is pyritic and contains plant imprints. Kaolin beds are found in the Tokio in Pike County. Fossils from the Tokio include bivalves, gastropods, plant material, and a few vertebrate remains. The lower contact of the Tokio is unconformable: the Tokio rests on the Woodbine Formation in Little River County and successively older units eastward. The Tokio's thickness reaches 300 feet in Howard County, but it thins to the east.

Original reference: H. D. Miser and A. H. Purdue, 1918, U. S. Geological Survey Bulletin 690, p. 19-24.

Type locality: Named for exposure in the vicinity of Tokio, Hempstead County, Arkansas.

BROWNSTOWN MARL/FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas. Parts of Clark, Pike, Hempstead, Howard, Sevier and Little River Counties; Texas, Oklahoma, (Louisiana?).

Geology: The Brownstown Marl is composed of clay marls, thin sometimes sandy limestones, sandy marls, and some fine-grained sands. Glauconite and some phosphatic material may be found associated with the various lithologies. The color is quite variable depending on the degree of weathering, iron content, and other factors yielding tan, brown, blue, green, red, yellow, gray, or any combination and shade of these colors. Near the base of the unit beds of thin hard limestone exists which contains poorly preserved fossils. The marls in the formation are often highly fossiliferous. The most common fossils are oysters and other bivalves, some cephalopods, and occasional echinoderms, fish material, and annelids. The Brownstown rests unconformably on underlying formations. The

Brownstown is about 250 feet thick in Howard County but thins both east and west of there.

Original reference: R. T. Hill, 1888, Arkansas Geological Survey Annual Report 1888, v. 2, p. 72, 86-87, 188; 1894, Geological Society of America Bulletin, v. 5, p. 302.

Type locality: Named after Brownstown, Sevier County, Arkansas.

OZAN FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain, parts of Clark, Pike, Hempstead, Howard, Sevier and Little River Counties; Oklahoma.

Geology: The Ozan Formation consists of tan, sandy, micaceous marl with a basal lentil of sandy marl and marly sand. The basal lentil, known as the Buckrange Sand, is highly glauconitic and contains shark teeth and phosphatic nodules. Another glauconitic interval is sometimes found about fifty five feet above the base of the Ozan. Near the top of the formation, the marls tend to become more chalky. An occasional bed of hard limestone has been noted in some outcrops near the top of the unit. Some of the Ozan marls are highly fossiliferous, commonly containing bivalves (mostly oysters), cephalopods, gastropods, echinoderms, corals, crustaceans, fish material and annelids. The Ozan Formation lies unconformably upon the Brownstown Marl. The Ozan ranges from 150 to 250 feet thick.

Original reference: C. H. Dane, 1926, U. S. Geological Survey Press Bulletin 8823, September 10, 1926

Type locality: Named for exposures along the middle fork of Ozan Creek and for the town of Ozan, Hempstead County, Arkansas.

ANNONA CHALK/FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas. Parts of Hempstead, Howard and Little River Counties; Texas, Louisiana, Oklahoma.

Geology: The Annona Chalk is a hard, thick bedded to massive, slightly fossiliferous chalk. It weathers white, but is blue-gray when freshly exposed. The unit is commercially mined for cement. Fossils in the Annona include coelenterates, echinoderms, annelids, bivalves, gastropods, cephalopods, and some vertebrate traces. The Annona rests conformably upon the Ozan Formation. The unit is 0 to 100 feet thick.

Original reference: R. T. Hill, 1894, Geological Society of America Bulletin, v. 5, p. 308.

Type locality: Named for outcrops about 2 miles northwest of Annona, Red River County, Texas.

MARLBROOK MARL/FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas. Parts of Clark, Hempstead, Howard, and Little River Counties; Texas, Louisiana.

Geology: The Marlbrook Marl is a uniform chalky marl that is blue-gray when freshly exposed, and white to light brown when weathered. This unit is moderately fossiliferous in its upper part in contrast to the lower part where fossils are few. Common fossils include *Exogyra*, *Gryphaea*, and *Ostrea* oyster species and reptile remains. The lower contact of the Marlbrook is thought to be conformable. The Marlbrook is 50 to 220 feet thick.

Original reference: R. T. Hill, 1888, Arkansas Geological Survey Annual Report 1888, v. 2, p. 72, 84-86, 188.

Type locality: Typically exposed about 1 mile north of Saratoga, on road to Mineral Springs, Howard County, AR. Also exposed along Marlbrook Creek in T. 10 S., R. 24 W., Hempstead County, AR.

SARATOGA CHALK/FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas. Parts of Clark, Hempstead, and Howard Counties; Louisiana, Texas.

Geology: The Saratoga Chalk is fossiliferous, hard, sandy, somewhat glauconitic chalk with some beds of marly chalk and chalky sand. It weathers white, light gray and light brown, and is blue-gray when freshly exposed. The common fossils found in the unit include sponges, bryozoa, echinodermata, annelids, bivalves, gastropods, cephalopods, crustaceans, and fish teeth. This unit displays an unconformity at its base, which represents a distinct faunal and lithologic break. The Saratoga is 20 to 70 feet thick.

Original reference: J. C. Branner, 1898, American Institute of Mining Engineers Transactions, v. 27, p. 52-59.

Type locality: Named for typical exposures north and east of Saratoga, Hempstead & Howard Counties, AR.

NACATOCH SAND/FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas, parts of Clark, Nevada, and Hempstead Counties; Louisiana, Texas.

Geology: The Nacatoch Sand is composed of cross-bedded, yellowish and gray fine quartz sand; hard, fossiliferous sandy limestone; coarse, highly glauconitic sand; fine-grained, argillaceous blue-black sand; bedded light-gray clay and marl. The

sands in the Nacatoch are generally unconsolidated. At the base of the unit hard, fossiliferous limestones and marl are found. Near the middle of the unit a coarse, highly glauconitic lens can be observed. On outcrop, this lens appears almost black in places and maybe 60 feet thick but averages closer to 30 feet thick. Thin bedded gray clay is found interbedded with fine sands close to the top of the unit. Fossils found in the Nacatoch include corals, echinoderms, bryozoa, annelids, bivalves, gastropods, cephalopods, crab remains, and some shark teeth. The Nacatoch Sand appears to have an unconformity at its base. The unit is 150 to 400 feet thick.

Original reference: A. C. Veatch, 1905, Louisiana Geological Survey Bulletin 1, p. 84-88; *and* 1905, U. S. Geological Survey Water-Supply Paper 114, p. 180-183.

Type locality: Typically exposed at Nacatoch Bluff on the Little Missouri River, Clark County, AR.

ARKADELPHIA MARL/FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas, parts of Clark, Nevada, and Hempstead Counties; Louisiana, Texas.

Geology: The Arkadelphia Marl is mostly a dark gray to black marl or marly clay with some limy, gray sandstone, gray sandy clay, sandy limestone, concretionary limestone, and white to light brown impure chalk. The sandy marls and limestones are found at or near the base of the unit, while the impure chinks are found closer to the top. (The strata that Hill first applied the name "Arkadelphia" to are no longer considered a part of this unit.) The fossil fauna includes corals, bivalves, gastropods, cephalopods, shark teeth, and various microfossils. The Arkadelphia rest with slight unconformably upon the Nacatoch Sand. The unit is 120 to 160 feet thick.

Original reference: R. T. Hill, 1888, Arkansas Geological Survey Annual Report 1888, v. 2, p. 53-56, 188.

Type locality: Typical exposures of the Arkadelphia (in its modern sense) can be found 5 to 7 miles north and northwest of Hope, between Interstate 30 and Prescott along Arkansas Highway 19, and in the Oakhaven area.

MIDWAY GROUP

Age: Tertiary Period, Paleocene Epoch

Distribution: central to southwestern Arkansas, in a band of exposure from Cabot to Texarkana; Texas to Georgia, Illinois, Kentucky, Missouri, and Tennessee.

Geology: The Midway sequence exposed at the surface in Arkansas represents a marginal marine depositional environment. The lithologies noted include calcareous shale, arenaceous limestone, calcareous glauconitic sandstone, conglomerate, and light to very dark bluish-gray clay shale. The Midway interval is not normally divided into

formations in Arkansas; however, various workers have indicated that it is possible to divide the unit into two formations: the lower Clayton Formation and the upper Porters Creek Formation. The Clayton contains most of the calcareous and sandy lithologies whereas the Porters Creek is chiefly composed of shales and silty shales. The fossils of the Midway interval includes a rich fauna that includes bivalves, gastropods, foraminifera, and ostracods with bryozoa, brachiopods, echinoids, crabs, fish, and crocodile teeth fossils also found. The lower boundary of the Midway is unconformable. The thickness ranges from a feather edge to as much as 130 feet on the outcrop; in the subsurface the unit is usually much thicker.

Original reference: G. D. Harris, 1894, American Journal Science, 3d, v. 47, p. 303-304; and, 1896, American Paleontology Bulletin, v. 1, n. 4, p. 10-38.

Type locality: Named for exposures at Midway Landing and plantation on west side of Alabama River (about 5 miles below Prairie Bluff) in Wilcox Co., Alabama.

WILCOX GROUP

Age: Tertiary Period, Eocene Epoch

Distribution: central to southwestern Arkansas, in a wide band of exposure from Cabot to Texarkana, along the west side of Crowley's Ridge north of Jonesboro; Texas to Georgia, Illinois, Kentucky, Missouri, and Tennessee.

Geology: The Wilcox is a thick series of non-marine sands, silty sands, clays, and gravels with some thick deposits of lignite. In central Arkansas bauxite is found at the base of the Wilcox near Cretaceous age syenite knobs that were positive topographic features during Wilcox time. The sands are generally fine to very-fine grained and light gray in color when fresh. The clays are light gray or brown in color and often sandy or silty. Frequently, either lithology will be dark brown to black when enough carbonaceous material is included. The lignites occur throughout the sequence, controlled by depositional environment rather than stratigraphic position. Some workers divide the Wilcox of Arkansas into three formations: the Berger, the Saline, and the Detonti. Plant fossils and trace fossils, associated with the lignites and lignitic clays, are the most commonly found biologic indicators. The lower contact of the Wilcox is unconformable and unconformities occur within the sequence. The thickness of the Wilcox ranges from a feather edge to as much as 1025 feet with 850 feet often reported as average.

Original reference: A F. Crider and L. C. Johnson, 1906, U. S. Geological Survey Water-Supply Paper 159, p. 5, 9; A. F. Crider, 1906, U. S. Geological Survey Bulletin 283.

Type locality: Named for extensive development in Wilcox County, Alabama

CLAIBORNE GROUP

Age: Tertiary Period, Eocene Epoch

Distribution: West Gulf Coastal Plain of southern Arkansas and Crowley's Ridge in eastern Arkansas; Gulf Coastal Plain from Georgia to southern Texas.

Geology: The Claiborne is chiefly non-marine in origin but does contain some marine intervals. The unit is composed of medium to very-fine sands, silts, and silty clays. The sands tend to be light- to dark-gray, white, brown, or red depending on the degree of weathering. The silts and clays are light to dark gray and sometimes variegated. Intervals enriched in carbonaceous material are dark brown to black. The silts are usually clayey and the clays are normally silty or sandy. Lignite beds are found in this interval and seem to be environmentally rather than stratigraphically controlled. In the subsurface the Claiborne Group has been divided into the Carrizo Sand, Cane River Formation, Sparta Sand, Cook Mountain Formation, and Cockfield Formation. Fossils include fish and reptile bones and teeth, leaf impressions and lignitic wood, and trace fossils. The lower contact of the Claiborne is poorly known but considered unconformable. The thickness of the Claiborne ranges from a thin edge to as much as 1500 feet.

Original reference: T. A. Conrad, 1847, Philadelphia Academy of Natural Science Proceedings, v. 3, p. 280-282

Type locality: Named for exposures at Claiborne Bluff and Claiborne Landing, on the Alabama River, in Monroe County, Alabama.

JACKSON GROUP

Age: Tertiary Period, Eocene Epoch (upper)

Distribution: Southeast Arkansas and southern Crowley's Ridge in eastern Arkansas; Gulf Coastal Plain from Georgia to southern Texas.

Geology: The Jackson is divided into two distinct units in Arkansas: a lower marine unit called the White Bluff Formation and an overlying non-marine unit called the Redfield Formation. The blue gray to off white White Bluff has three dominate facies: an argillaceous sand containing glauconite and rich in molluscan fossils, a calcareous glauconitic clay with common invertebrate fossils, and a blocky clay with some silt and a trace of sand and invertebrate (mostly molluscan) molds. The Redfield is typically a sequence of light gray, thinly laminated silts, silty clays, and silty sands. Crossbedded sands and minor lignite beds have been noted in the Redfield and plant remains are generally abundant. A minor disconformity is thought to exist at the base of the Jackson sequence. The thickness of the Jackson may be as much as 300 feet but no outcrop areas exhibits the entire Arkansas section.

Original reference: T. A. Conrad, 1856, Philadelphia Academy of Natural Science Proceedings, v. 7, p. 257-258; E. W. Hilgard, 1860, Rept. Geology and Agriculture Mississippi, p. 128-135.

Type locality: Named for exposures at Jackson, MS, along the Pearl River and Moodys Branch.

SAND AND GRAVEL

Age: Quaternary Period, Pleistocene Epoch (Late Tertiary, Pliocene Epoch?)

Distribution: Crowley's Ridge in eastern Arkansas

Geology: Sands and gravels found on Crowley's Ridge underlying loess deposits. This interval has not been assigned to specific stratigraphic unit nor studied in detail.

LOESS

Age: Quaternary Period, Pleistocene Epoch

Distribution: Crowley's Ridge in eastern Arkansas

Geology: Although loess undoubtedly occurs in other places, only on the middle and southern portions of Crowley's Ridge is it specifically mapped. It consists of tan, brown, reddish brown calcareous silt in thin to massive beds. Many workers recognize three loesses: an upper thick loess, a middle thin loess, and a lower thick loess. The loess will often hold a high vertical slope. Calcareous concretions are regularly found in the unit. Fossils of pulmonate gastropods are fairly common with fresh water mollusks and proboscidean bones occasionally found. The lower contact of the loess is unconformable. The thickness increases from north to south reaching as much as 140 feet of loess, although 40 to 60 feet is more common at the southern end of Crowley's Ridge.

SILT AND SAND

Age: Quaternary Period, Pleistocene Epoch

Distribution: Crowley's Ridge in eastern Arkansas

Geology: The northern portion of Crowley's Ridge is capped by a interval of unconsolidated silt and sand with lenses of clay and gravel. This unit has never been studied in Arkansas.

DUNE SAND

Age: Quaternary Period, Pleistocene Epoch

Distribution: Mississippi River Embayment in eastern Arkansas

Geology: The sand dunes generally consist of homogeneous, massive, well-sorted, tan or buff to grayish or reddish brown, fine sands. Cross-stratification and bedding features seem to be lacking in the interval apparently due to extensive weathering and biogenic reworking. It is thought that these sands were derived from glacial outwash originally deposited along major drainages during the initial stages of interglacial times. The dunes are best developed on the east side of the White, Current, and Black rivers. The sand of these dunes is observed to fine with distance from these rivers. The dunes are present on all terrace levels but not on

present day alluvium. No significant fossils have been found associated with these sands. The lower contact seems to be unconformable in most places.

TERRACE DEPOSITS

Age: Quaternary Period, Pleistocene Epoch

Distribution: eastern and southern Arkansas, Mississippi River Embayment, West Gulf Coastal Plain

Geology: The terrace deposits include a complex sequence of unconsolidated gravels, sandy gravels, sands, silty sands, silts, clayey silts, and clays. The individual deposits are often lenticular and discontinuous. At least three terrace levels are recognized with the lowest being the youngest. Fossils are rare. The lower contact is unconformable. The thickness is variable.

ALLUVIUM

Age: Quaternary Period, Holocene Epoch

Distribution: state wide

Geology: The deposits indicated by this notation are alluvial deposits of present streams. Sediments will include gravels, sands, silts, clays and mixtures of any and all of these. The partition of this unit from other Holocene alluvial deposits was based more on geomorphic considerations than lithic or age considerations. Fossils are rare and modern. The lower contact is unconformable. The thickness is variable.

ALLUVIUM (STREAM OVERBANK)

Age: Quaternary Period, Holocene Epoch

Distribution: eastern Arkansas, Mississippi River Embayment

Geology: The deposits indicated by this notation are alluvial deposits of small streams, the overbank deposits of major streams, or older meander belt deposits of major streams. The partition of this unit from other Holocene alluvial deposits was based more on geomorphic considerations than lithic or age considerations. Fossils are rare. The lower contact is unconformable. The thickness is variable.

ALLUVIUM (CHANNEL MEANDER)

Age: Quaternary Period, Holocene Epoch

Distribution: eastern Arkansas, Mississippi River Embayment

Geology: This unit represents the more recent channel meanders and current flood plain deposits of significant streams. Channel meander scars are distinct in this unit. The partition of this unit from other Holocene alluvial deposits was based more on geomorphic considerations than lithic or age considerations. Fossils are rare. The lower contact is unconformable. The thickness is variable.

Every bridge over a waterway carrying public vehicular traffic on the structure with more than 20-ft clear span requires a Scour Appraisal. Pipe culverts and 4-sided boxes will be assessed using the Culvert Scour Assessment Worksheet in Appendix B. Documentation must be done in InspectX, ARDOT's bridge inventory and appraisal data collection system, starting April 01, 2024. Directions are provided in this document.

Scour Appraisal

Scour Appraisals are the risk-based and data-driven determination of a bridge's vulnerability to scour, resulting from the least stable result of scour that is either observed, or estimated through a scour evaluation or a scour assessment. Both field observed scour and office estimated scour must be performed to determine the least stable result. Observed scour results are recorded by inspectors in the inspection report(s). Estimated scour results are recorded by engineering staff on the Scour Appraisal form in InspectX. The terms can best be organized in an outline:

1. Observed Scour **AND**
2. Estimated Scour (which will consist of)
 - a. Scour Evaluations **OR**
 - b. Scour Assessment: All assessments performed will consist of three levels:
 - i. Level A– Stability Screening
Answer all 5 Questions. If all questions are answered “No”, then the Assessment is complete and Specification for the National Bridge Inventory (SNBI) (B.AP.03) Scour Vulnerability code will be assigned accordingly. If any answer is “Yes”, then continue to Level B.
 - ii. Level B – Susceptibility Screening
Answer all 18 Questions. Each answer has a point total. Total points determine a triage-range of three (3) options. If the point total is low or high, then assign the (B.AP.03) Scour Vulnerability code will be assigned accordingly. If the point total is in the middle-range, or inconclusive, then continue to Level C.
 - iii. Level C – Vulnerability Screening
Answer questions progressively in three groups (three (3), eight (8) or eleven (11) questions). Based on the results the appropriate (B.AP.03) Scour Vulnerability code will be assigned.

Observed Scour

Bridge Inspection Team Leaders perform Routine Inspections. All portions of a bridge substructure (Figure 1 and 2) and the surrounding channel to the mudline at low water accessible by wading or probing (Figure 3) are within the scope of each scheduled Routine Inspection. When wading or probing are not safe or feasible during each Routine Inspection then probing from a boat (Figure 4) or snooper bucket are acceptable alternatives when the inspection reaches to the mudline of all substructure units and can adequately determine in-service conditions. When probing and wading is unsafe nor feasible then underwater diving techniques are typically required. Underwater Inspection must not exceed the intervals specified in the ARDOT Bridge Inspection Manual. Channel cross-sections should be taken periodically and compared to original ground line. This provides indications of the presence of contraction scour, lateral stream migration, and long-term degradation.



Figure 1 Undermining of the abutment exposing piles.



Figure 2 Exposed footing with undermining.



Figure 3 Wading and Probing.



Figure 4 Probing from a boat.

Scour Evaluation

Scour Evaluations are performed by a bridge, geotechnical, and/or hydraulic engineer. The purpose of an evaluation is to calculate the depth of potential scour so the foundation can be designed with sufficient depth, stability, and capacity. Hydraulic calculations are commonly performed during early design-stages for new-construction or rehabilitation bridge projects. Scour evaluations are also performed for high-risk in-service bridges (at a minimum) where calculations are not documented. These evaluations provide theoretical scour depths that are compared to in-place foundation depths to determine the bridge's vulnerability to scour, i.e. to determine if the existing bridge scour critical. Refer to the latest ARDOT Bridge Design Guidelines for the scour evaluation and design procedures. The Scour Evaluation results (report with calculations explaining how the structure's vulnerability to scour was determined) must be documented in the POA Scour Assessment/Evaluation Inspection within InspectX after construction of the bridge or after completion of scour evaluation of an existing bridge.

After documenting the Scour Evaluation results, the evaluating engineer must code SNBI B.AP.03 (Scour Vulnerability) as described in the SNBI. When a documented evaluation exists then the Scour Appraisal is complete. If there are no bridge-threatening observed scour defects that demonstrate that the bridge is vulnerable to estimated scour depths, then the evaluating engineer may code SNBI B.AP.03 (Scour Vulnerability) based on the results of the scour evaluation and the descriptions provided. When a stand-alone scour evaluation is performed on an existing bridge (that is missing a documented scour evaluation), if the results show a bridge is vulnerable to scour, a Plan of Action is required.

Table 1 SNBI (B.AP.03) Scour Vulnerability Code

Code	Scour Appraisal	Description
A	A – Scour appraisal completed.	Bridge determined to be stable for scour.
B	B – Scour appraisal completed.	Bridge determined to be stable for scour, dependent upon designed, and functioning countermeasures. <ul style="list-style-type: none"> • <i>Use code B when designed, installed, and functioning countermeasures are used to address potential scour and to maintain bridge stability for new or existing bridges, or bridges with unknown foundations.</i> • <i>Use code B when the Scour Appraisal Team determines that the in-place, non-designed countermeasures are fully functioning and are appropriate to mitigate the risk of scour.</i>

C	C – Scour Appraisal completed.	Bridge could become unstable for scour. Temporary (not designed) countermeasures installed to mitigate scour. Bridge is scour critical. Follow POA Requirement. <ul style="list-style-type: none"> Use code C for bridges that could become unstable for the potential scour, and temporary countermeasures are installed that were not designed.
D	D – Scour Appraisal completed.	Bridge is, or may become, unstable for scour. Bridge is scour critical. Follow POA Requirement.
O	O – Scour appraisal has not been completed.	
E	E – Scour appraisal has not been completed.	Temporary (not designed) countermeasures installed to mitigate scour.
U	U – Scour appraisal has not been completed.	Due to unknown foundations.

Scour Assessment

A Scour Assessment is the determination of a bridge's vulnerability to scour which considers stream stability and scour potential as described in HEC 20 *Stream Stability at Highway Structures 4th Edition* and other scour-related data sources. Based on risk, a Scour Evaluation is required for high-risk structures. All remaining non-high-risk structures over water will have a Scour Assessment. There are three levels of an Assessment. Each Assessment Level is a progressive screening process that affectively documents the scour and directs the assessor in coding the appraisal field (B.AP.03) Scour Vulnerability Code. Legacy Assessments will be accepted; however, it is recommended that the new progressive screening process is completed. The following information is required when completing all types of Assessments in InspectX:

- Scour Assessment Level(s) Performed
 - Level A
 - Level B (Includes Level A)
 - Level C (Includes Level A and B)
 - Other, Documented File or Checklist on File
- Scour Assessment Date
- Countermeasure Type – Countermeasures are material, devices, or structures designed to prevent, slow, or stop the occurrence of scour. Select the most appropriate answer. Refer to HEC 23 – *Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance 4th Edition*, for determining the nature of the countermeasures.
 - Designed, installed, and functioning countermeasures are used to address potential scour and to maintain bridge stability for new or existing bridges, or bridges with unknown foundations.

- B. Scour Appraisal Team determines that the in-place, non-designed countermeasures are fully functioning and are appropriate to mitigate the risk of scour.
- C. Temporary countermeasures are installed that were not designed. Bridge could become unstable for scour.
- D. None.



Figure 5 Bridge with non-scour-resistant rock.

References

- Specifications for the National Bridge Inventory (https://www.fhwa.dot.gov/bridge/snbi/snbi_march_2022_publication.pdf)
- Scour-Hydraulics – Bridges & Structures – Federal Highway Administration (<https://www.fhwa.dot.gov/engineering/hydraulics/scourtech/>)
- ARDOT Bridge Design Guidelines (<https://www.ardot.gov/wp-content/uploads/2020/11/Bridge-Division-Guidelines.pdf>)
- ARDOT Bridge Inspection Manual (https://www.ardot.gov/wp-content/uploads/2022/05/ARDOT_BIM_20220507.pdf)

APPENDIX B

Item 113 - Scour Critical Box or Pipe Culverts

Bridge No. M1528 Date: 3/4/2025 County: Ashley

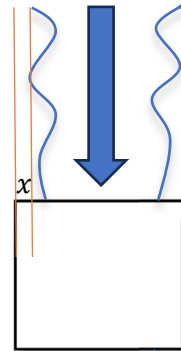
Assessed By: Nick Holmgren Checked By: Victoria Elliott

Code Description

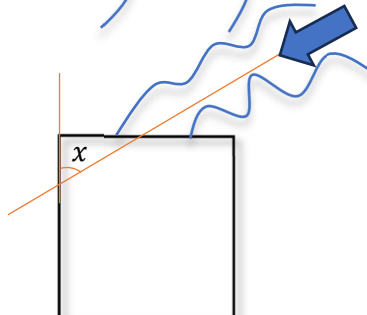
- ☐ **8** Well aligned with channel, hydraulically sized.
- ☐ **5** Not well aligned with channel and no major scour history, or not hydraulically sized/designed.
- ☒ **4** Culvert is in stable condition: Settlement and / or undermining of culvert not endangering the roadway.
- ☐ **3** Culvert is scour critical: extensive settlement and / or undermining under roadway, endangering the roadway.

Examples:

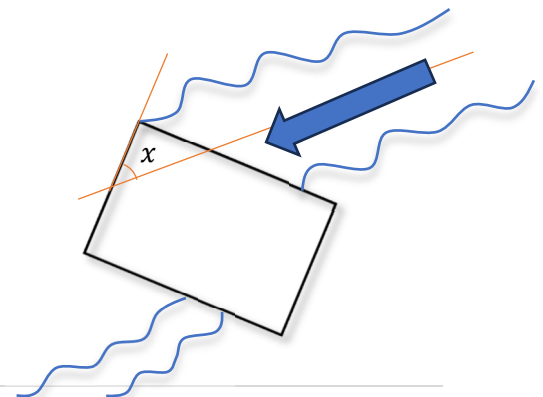
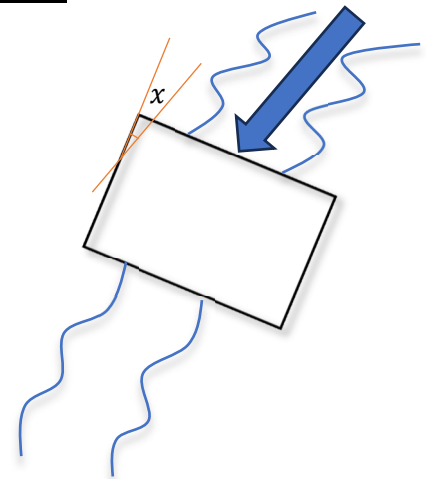
A: Rated number 8
Channel is well aligned.
 $0^\circ \leq x \leq 30^\circ$



B: Rated number 5
Channel is not well aligned.
 $x > 30^\circ$



Culvert Scour Description



Note: If the culvert's stability isn't compromised, flow alignment may not be a consideration; Severity of observed scour conditions should be reflected in '4' and '3' to describe where variance from '8' are appropriate (as well as B.C.04).

Item B.AP.03 – Box or Pipe Culvert Scour Vulnerability

Code Description

- ☐ **0** Channel/Scour appraisal has not been completed.
- ☐ **A** Well aligned with channel, hydraulically sized and no major scour history, Or culvert is not well aligned with channel, not hydraulically sized, but is determined to be stable with no major scour history.
- ☒ **B** Culvert is stable with countermeasures.

*From SNBI Commentary for Scour Vulnerability:

Use code B when designed, installed, and functioning countermeasures are used to address potential scour and to maintain bridge stability for new or existing bridges, or bridges with unknown foundations. Use code B when the scour appraisal team determines that the in-place, non-designed countermeasures are fully functioning and are appropriate to mitigate the risk of scour.

- ☐ **C** Culvert is scour critical; Use code C for bridges that could become unstable for the potential scour, and temporary countermeasures are installed that were not designed.
- ☐ **D** Culvert is scour critical; Culvert is or may become unstable for scour.
- ☐ **E** Scour appraisal has not been completed. Temporary (not designed) countermeasure installed to mitigate scour.
- ☐ **U** Scour appraisal has not been completed due to unknown foundations.