

**Data Control Points Used to Construct the
Surficial Geology Map (M-125) of
Morris County, Kansas**

Robert S. Sawin and Ronald R. West

**KGS OPEN-FILE
REPORT 2016-2**
(revised 27 July 2022)

**KANSAS GEOLOGICAL SURVEY
1930 Constant Ave. - Campus West
Lawrence, Kansas 66047-3724
Telephone: (785) 864-3965**

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Introduction

This report is a supplemental reference to the Surficial Geology of Morris County, Kansas, map (M-125) (Sawin and West, 2016) and is a synthesis of the data control points and field notes used to construct the map.

The bedrock geology of Morris County was mapped in the field on U.S. Geological Survey topographic quadrangle maps at a scale of 1:24,000 (fig.1). Data control points used in mapping the bedrock geology are organized by quadrangle in this report. The locations of these control points are plotted on copies of the field maps in previous Kansas Geological Survey (KGS) open-file reports for Morris County (West and Sawin, 2008; Sawin and West, 2009; Sawin and West, 2010; Sawin and West, 2011; Sawin and West, 2012). The data control points in this report may be different from those reported in earlier open-file reports and therefore supersede those reports.

The stratigraphic names used herein are from Zeller (1968). Included in map M-125 is a stratigraphic rock column that depicts the vertical sequence, thickness, and lithologies of the geologic units. A short, generalized description of each geologic unit is also included. A west-east cross section shows the vertical relationship of the rock units.

Numbering System

Data control points for Morris County are identified by the following letter prefixes. Sites may be identified by one or more of these designations.

- (1) Numbers preceded by the letter **M** refer to Morris County, Kansas, measured sections on file at the Kansas Geological Survey. These files are arranged by township and range; the numbers assigned herein are arbitrary but do begin with the first measured section in the file and proceed sequentially to the last section;
- (2) Numbers preceded by the letters **MMW** refer to measured sections in Mudge et al., 1958;
- (3) Numbers preceded by the letters **MTB** refer to measured section in Mazzullo et al., 1997.
- (4) Numbers preceded by the letters **MR** are sites examined and recorded by Sawin and West specifically for this mapping project.

Photo Scale

Red and white markings on staff used for scale in the photos are decimeters.

MORRIS COUNTY, KANSAS

INDEX TO 1:24,000-SCALE MAPS

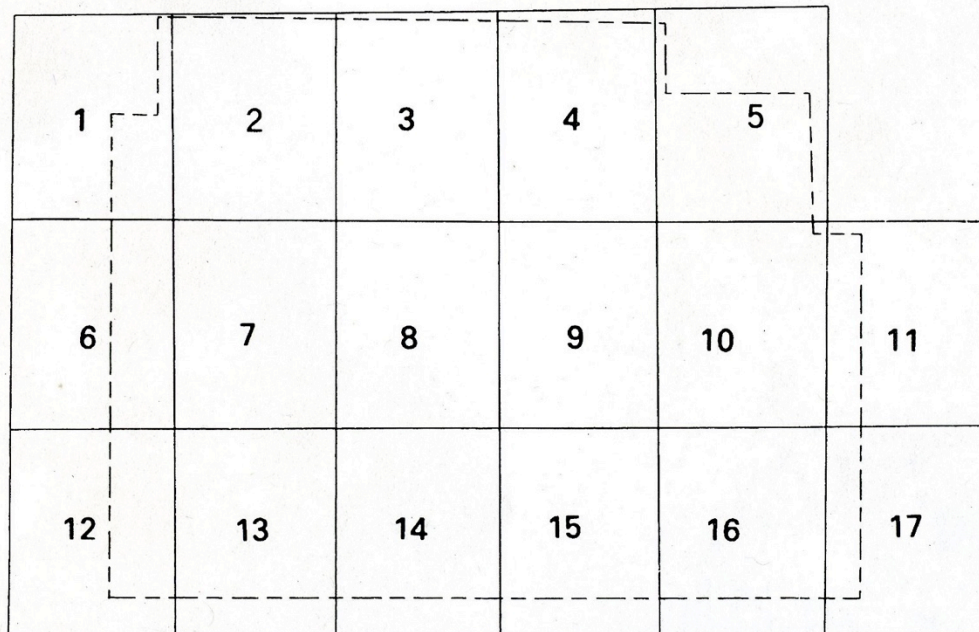


Figure 1. USGS 7.5-minute 1:24,000-scale quadrangles for Morris County, Kansas.

Quadrangle	page	Quadrangle	page
1 Woodbine	6	10 Council Grove	143
2 Skiddy	12	11 Bushong	167
3 White City	34	12 Lost Springs	174
4 Dwight	47	13 Burdick	181
5 Alta Vista	61	14 Diamond Springs	194
6 Herington	67	15 Wilsey SE	209
7 Delavan	78	16 Lake Kahola	225
8 Wilsey	96	17 Americus	239
9 Council Grove Lake	126		

Stratigraphic Column 3

References 5

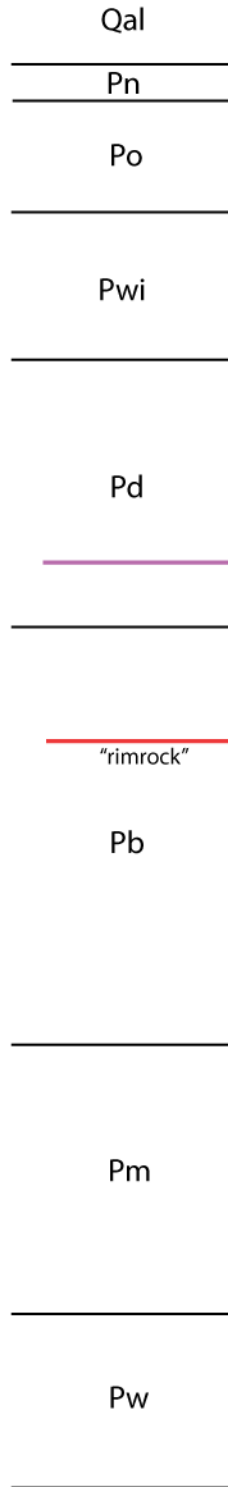
Appendix A. Global Positioning System (GPS) Coordinates 246

Copies of the field maps are open-filed at the Kansas Geological Survey, Lawrence, Kansas.

The map symbols (Qal, Pn, Po, etc.) shown on the stratigraphic column (below) were those used in the preliminary reports and may be different from those that appear on the published map. The purple contact line represents the base of the Towanda Limestone Member and the red line is the base of the rimrock marker bed within the Fort Riley Limestone Member.

System	Series	Group	Formations	Members
			QUATERNARY	Alluvium and Terraces
PERMIAN	WOLFCAMPIAN	CHASE GROUP	Nolan Ls	Krider ls
			Odell Sh	
			Winfield Ls	Cresswell ls
				Grant sh
				Stovall ls
			Doyle Sh	Gage sh
				Towanda ls
				Holmesville sh
				Barneston Ls
			Oketo sh	
			Florence ls	
			Matfield Sh	Blue Springs sh
				Kinney ls
				Wymore sh
			Wreford Ls	Schroyer ls
				Havensville sh
				Threemile ls
	Speiser Sh			

Mapped Contacts

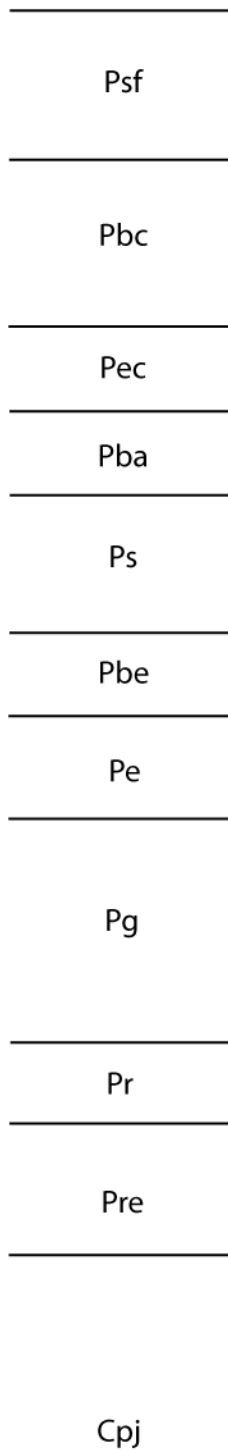


(not to scale)

System	Series	Group	Formations	Members
PERMIAN	Wolfcampian	Council Grove	Speiser Sh	
			Funston Ls	
			Blue Rapids Sh	
			Crouse Ls	
			Easily Creek Sh	
			Bader Ls	Middleburg ls
				Hooser sh
				Eiss ls
			Stearns Sh	
			Beattie Ls	Morrill ls
				Florena sh
				Cottonwood ls
			Eskridge Sh	
			Grenola Ls	Neva ls
				Salem Point sh
				Burr ls
				Legion sh
Sallyards ls				
Roca Sh				
Red Eagle Ls	Howe ls			
	Bennett sh			
	Glenrock ls			
Johnson Sh				

(not to scale)

Mapped Contacts



References

- Mazzullo, S. J., Teal, C. S., and Burtnett, C. A., 1997, Outcrop stratigraphy and depositional facies of the Chase Group (Permian, Wolfcampian) in Kansas and southeastern Nebraska: Kansas Geological Survey, Technical Series, no. 6, 210 p.
- Mudge, M. R., Matthews, C. W., and Wells, J. D., 1958, Geology and construction-material resources of Morris County, Kansas: U.S. Geological Survey, Bulletin 1060-A, 61 p., 2 plates.
- Pecchioni, L. L., 1981, Depositional environment of the Eskridge Shale (Lower Permian), M.S. thesis, Kansas State University, 171 p.
- Sawin, R. S., and West, R. R., 2009, Field geology maps, Morris County, Kansas (1:24,000 quadrangles—Bushong, Council Grove, and Council Grove Lake Quadrangles): Kansas Geological Survey, Open-File Report 2009-14, 44 p., 3 maps.
- Sawin, R. S., and West, R. R., 2010, Field geology maps, Morris County, Kansas (1:24,000 quadrangles—Delavan, Herington, and Wilsey Quadrangles): Kansas Geological Survey, Open-File Report 2010-5, 40 p., 1 sheet.
- Sawin, R. S., and West, R. R., 2011, Field geology maps, Morris County, Kansas; preliminary field geology maps for Burdick, Diamond Springs, and Lost Springs 1:24,000-scale quadrangles: Kansas Geological Survey, Open-File Report 2011-9, 35 p., 1 sheet.
- Sawin, R. S., and West, R. R., 2012, Field geology maps, Morris County, Kansas; preliminary field geology maps for Americus, Lake Kahola, and Wilsey SE 1:24,000-scale quadrangles: Kansas Geological Survey, Open-File Report 2012-5, 39 p., 1 sheet.
- Sawin, R. S., and West, R. R., 2016, Surficial geology of Morris County, Kansas: Kansas Geological Survey, Map M-125, scale 1:50,000.
- West, R. R., and Sawin, R. S., 2008, Field geology maps, Morris County, Kansas (1:24,000 quadrangles—Alta Vista, Dwight, Skiddy, White City, and Woodbine Quadrangles): Kansas Geological Survey, Open-File Report 2008-08, 44 p., 5 maps.
- Zeller, D. E., ed., [1968] 2009, Classification of rocks in Kansas, revised by Kansas Geological Survey Stratigraphic Nomenclature Committee; *in*, The Stratigraphic Succession in Kansas: Kansas Geological Survey, Bulletin 189, 81 p., chart.

WOODBINE QUADRANGLE – MORRIS COUNTY

Field work was conducted January–May 2008.

MMW-8 = Winfield Limestone (Grant and Cresswell) in roadcut exposure in SE SE sec. 31, T. 14 S., R. 5 E., Morris County, Kansas

MR-84 = Near top of Winfield Limestone at 1,340 ft in field east of section line road and in stream bank just north of this site; one photo; near center of west line SW sec. 28, T. 14 S., R. 5 E., Morris County, Kansas.



MR-85 = Nolans (Krider) Limestone at 1,395 ft in field just north of paved road; one photo; near center of south line SW SE sec. 28, T. 14 S., R. 5 E., Morris County, Kansas.



MR-86 = Base of Winfield (Stovall) Limestone at 1,315 ft and overlying members of Winfield Limestone in ditches on both sides of Kansas Highway 209; two photos of exposure on south side of highway; approximately 200 ft west of center of north line NE NW sec. 31, T. 14 S., R. 5 E., Morris County, Kansas.



MR-87 = Winfield (Stovall) Limestone at 1,295 ft in road and ditches, poorly exposed; one photo; approximately 100 ft west of center of north line sec. 30, T. 14 S., R. 5 E., Morris County, Kansas.



MR-88 = Winfield (Stovall) Limestone at 1,315 ft in roadcut at road intersection; two photos, one of Stovall and a longer view looking northeast; just west of center of east line sec. 30, T. 14 S., R. 5 E., Morris County, Kansas.



MR-89 = Near top of Winfield Limestone at 1,335 ft in road; one photo of exposure on north side of road; near center of north line NE NW NW sec. 21, T. 14 S., R. 5 E., Morris County, Kansas.



MR-90 = Winfield (Stovall) Limestone at 1,310 ft in road and on west side of road; one photo; center of west line SW sec. 16, T. 14 S., R. 5 E., Morris County, Kansas.



MR-91 = Winfield (Stovall) Limestone at 1,309 ft in roadcuts on northwest side of U.S. Highway 77; two photos; south of center of north line SE NE NW sec. 29, T. 14 S., R. 5 E., Morris County, Kansas.



MR-92 = Top of Winfield Limestone at 1,331 ft in roadcut on southeast side of U.S. Highway 77; two photos; near center of north line SE SW NW sec. 29, T. 14 S., R. 5 E., Morris County, Kansas.



MR-93 = Winfield (Stovall) Limestone at 1,315 ft in roadcut on east side of U.S. Highway 77; two photos; near southwest corner sec. 7, T. 15 S., R. 5 E., Morris County, Kansas.



MR-94 = Winfield (Stovall) Limestone at 1,319 ft in drainage on west side of road; one photo; near center of NE NE NE sec. 18, T. 15 S., R. 5 E., Morris County, Kansas.



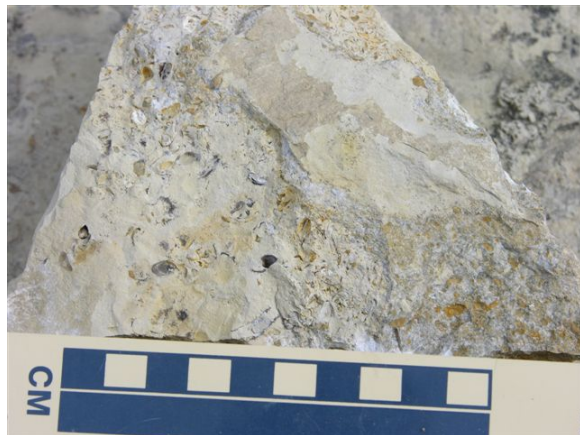
MR-95 = Winfield (Stovall) Limestone at 1,320 ft in drainage on west side of road; one photo; approximately 150 ft south of center of east line NE sec. 6, T. 15 S., R. 5 E., Morris County, Kansas.



MR-96 = Winfield (Stovall) Limestone at 1,318 ft in drainage on east side of road; one photo; near center of west line NW SW sec. 32, T. 14 S., R. 5 E., Morris County, Kansas.



MR-97 = Nolans Limestone, base of Krider at 1,390 ft, Paddock, and lower beds of Herington exposed in road and ditch on south side of road, small bivalves in Krider and small calcite lined geodes in Herington; two photos; near center of north line NE NE NE sec. 5, T. 15 S., R. 5 E., Morris County, Kansas.



SKIDDY QUADRANGLE – MORRIS COUNTY

Field work was conducted January–May 2008.

M-1 = Sequence from Doyle Shale, Towanda Limestone Member to Winfield Limestone, Cresswell Limestone Member; near center of west line NW SW sec. 25, T. 14 S., R. 5 E., Morris County, Kansas; measured and described by M. K. Elias in 1935.

M-2 = Sequence from Doyle Shale, Towanda Limestone Member to Winfield Limestone, Cresswell Limestone Member; near center of south line SE SW sec. 25, T. 14 S., R. 5 E., Morris County, Kansas; measured and described by M. K. Elias in 1935.

MMW-10 = Roadcut exposure of Doyle Shale, Gage Shale Member; SW SW sec. 25, T. 14 S., R. 5 E., Morris County, Kansas.

MMW-11 = Roadcut exposure of Doyle Shale, Holmesville Shale Member, and Towanda Limestone Member; SW NW sec. 6, T. 14 S., R. 6 E., Morris County, Kansas. Same as MTB-101.

MMW-12 = Roadcut exposure of Barneston Limestone, Oketo Shale Member, and Fort Riley Limestone Member; NE NE sec. 5, T. 14 S., R. 6 E., Morris County, Kansas.

MMW-13 = Roadcut exposure of Barneston Limestone, Oketo Shale Member, and Fort Riley Limestone Member; NE NE sec. 8, T. 14 S., R. 6 E., Morris County, Kansas.

MTB-101 = Doyle Shale, lower part of Towanda Limestone Member and upper part of Holmesville Shale Member; roadcut just southwest of Skiddy, Kansas; SW NW sec. 6, T. 14 S., R. 6 E., Morris County, Kansas. Same as MMW-11.

MR-47 = Winfield (Cresswell) Limestone (conglomeratic) at 1,412 ft in ditch and field west of road; two photos, one of vertical surface and one of horizontal surface; approximately 200 ft north of center of east line sec. 21, T. 14 S., R. 6 E., Morris County, Kansas.



MR-48 = Base of Towanda Limestone Member (Doyle Shale) at 1,371 ft in road and ditch on west side of road; one photo; just north of center of east line SE SE sec. 16, T. 14 S., R. 6 E., Morris County, Kansas.



MR-49 = Base of Towanda Limestone Member (Doyle Shale) at 1,360 ft in road and ditch on west side of road, good exposure of upper Holmesville and lower Towanda; one photo; approximately 100 ft north of center of east line SE NE sec. 16, T. 14 S. R. 6 E., Morris County, Kansas.



MR-50 = Base of Towanda Limestone Member (Doyle Shale) at 1,360 ft in road and ditch on west side of road; one photo; about 100 ft south of northeast corner sec. 9, T. 14 S., R. 6 E., Morris County, Kansas.



MR-51 = rimrock (lower) of Fort Riley Limestone Member at 1,310 ft on south side of road; one photo; center of north line NE NW sec. 9, T. 14 S., R. 6 E., Morris County, Kansas.



MR-52 = Base of Barneston (Florence) Limestone at 1,260 ft in south bank of Ralls Creek on south side of road with Blue Springs below and Oketo and Fort Riley rimrock (lower) above; two photos; approximately 200 ft east of southwest corner sec. 4, T. 14 S., R. 6 E., Morris County, Kansas. Compare with MTB-99B.



MR-53 = Near base of Towanda Limestone Member of Doyle Shale at 1,349 ft in ditches on both sides of paved road with best exposure on east side; one photo near base on east side of road; near center of west line SW SW NW sec. 9, T. 14 S., R. 6 E., Morris County, Kansas.



MR-54 = Winfield (Stovall) Limestone at 1,424 ft in ditch on north side of paved road; one photo; southeast corner sec. 28, T. 14 S., R. 6 E., Morris County, Kansas.



MR-55 = Base of Towanda Limestone Member at 1,347 ft with upper beds of Holmesville Shale Member (Doyle Shale) below in road and ditch, thin bedded, platy limestone in the greenish gray and reddish mudrocks of the upper Holmesville; one photo; near center of south line SW SW sec. 20, T. 14 S., R. 6 E., Morris County, Kansas.



MR-56 = Base of Towanda Limestone Member of Doyle Shale at 1,350 ft in road north of an active quarry; one photo of exposure and two of the quarry pit taken from the road; approximately 100 ft west of center of south line sec. 20, T. 14 S., R. 6 E., Morris County, Kansas.



MR-57 = Winfield (Stovall) Limestone at 1,388 ft in ditch on north side of road; two photos; near center of south line SE SE SW sec. 30, T. 14 S., R. 6 E., Morris County, Kansas.



MR-58 = Winfield (Stovall) Limestone at 1,385 ft in ditch on west side of road, poor exposure; one photo; near center of east line NE sec. 25, T. 14 S., R. 5 E., Morris County, Kansas.



MR-59 = Base of Towanda Limestone Member of Doyle Shale at 1,350 ft on both sides of road, good exposure of limestone in road just west of stream; five photos of roadcut exposure, one of the stream bed (dark gray to black mudrocks in upper Fort Riley) on north side of road, and two of the spring in the upper Fort Riley on south side of road; near center of east half NE sec. 30, T. 14 S., R. 6 E., Morris County, Kansas.



MR-59 (continued)



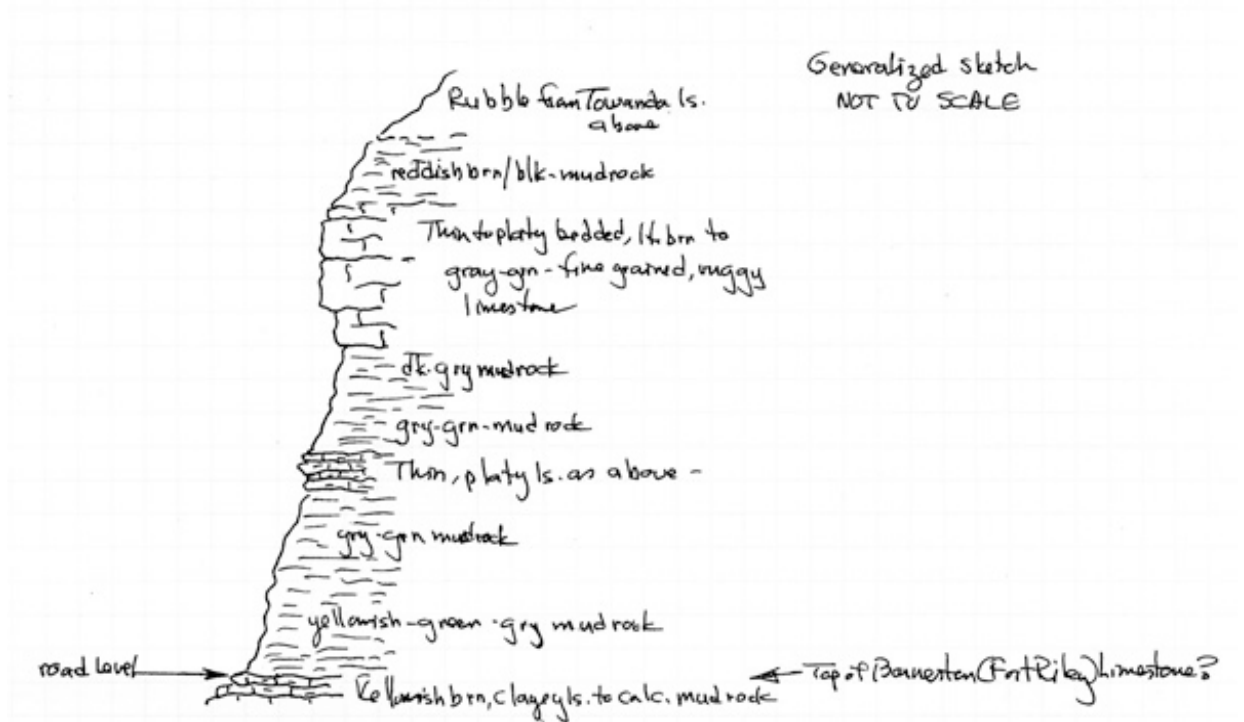
MR-60 = Base of Towanda Limestone Member of Doyle Shale at 1,327 ft on east side of road; one photo; near center of west line SW NW SW sec. 18, T. 14 S., R. 6 E., Morris County, Kansas.



MR-61 = Top of Barneston (Fort Riley) Limestone at 1,310 ft with Doyle Shale (Holmesville and Towanda) above, thickness from top of rimrock to top of Fort Riley is 25.5 ft (hand leveled); one photo of exposure on east side of road; see graphic sketch; near center of west line NW SW SW sec. 7, T. 14 S., R. 6 E., Morris County, Kansas.



MR-61 - MORRIS CO. KS. - Skiddy Quad.



MR-62 = Fort Riley rimrock (lower) at 1,290 ft in roadcut exposures on both sides of Skiddy Road; one photo; near center of west line NW NW sec. 5, T. 14 S., R. 6 E., Morris County, Kansas.



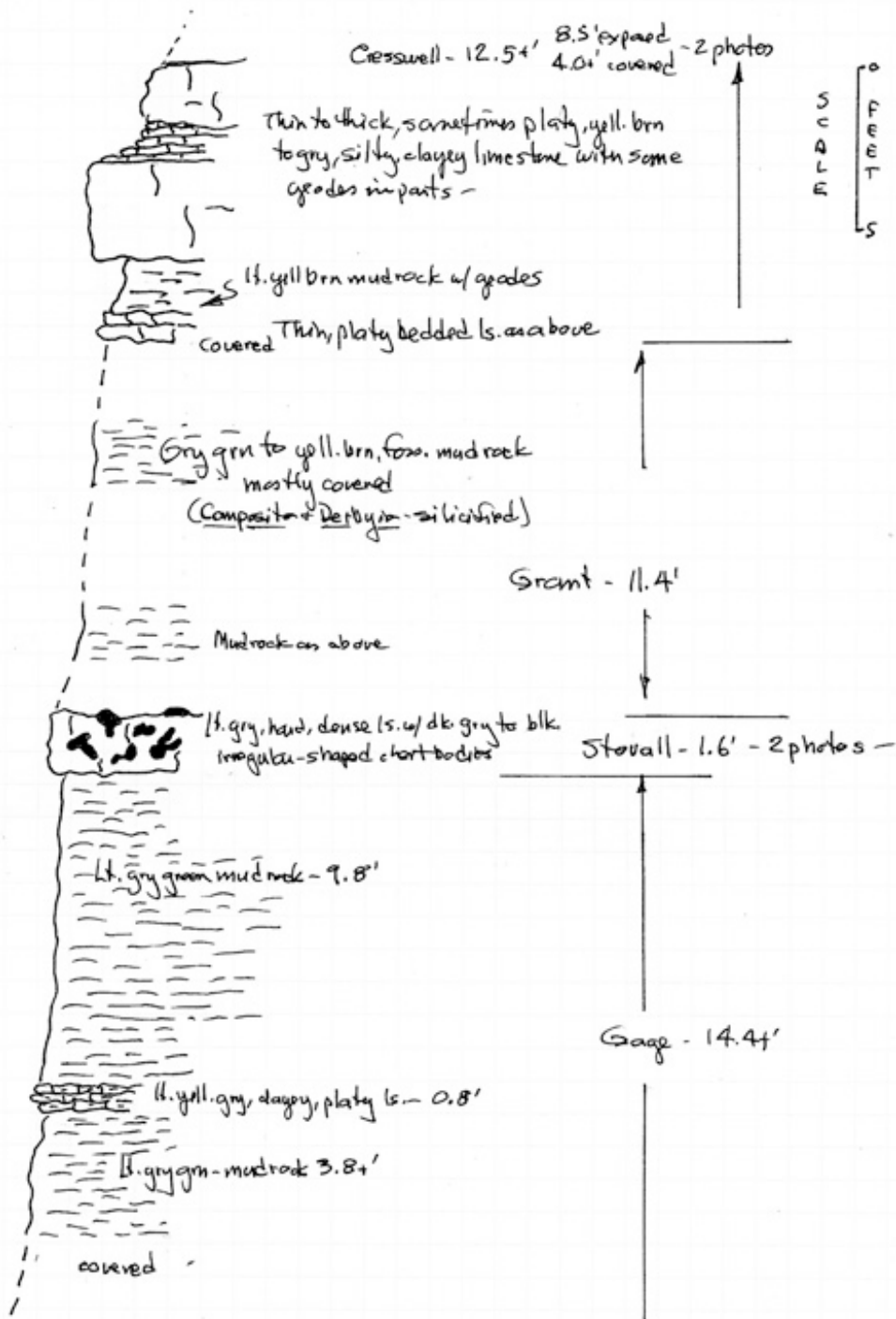
MR-63 = Base of Towanda Limestone Member of Doyle Shale at 1,321 ft in road; one photo; near center of west line NW sec. 13, T. 14 S., R. 5 E., Morris County, Kansas.



MR-64 = sequence from Gage Shale Member (Doyle Shale) into the Winfield (Cresswell) Limestone in roadcut on north side of road with Stovall at 1,380 ft; four photos (two of Stovall and two of Cresswell); section measured (hand level) and briefly described; see graphic sketch; from near center of south line SW SE to center of south line SW SE sec. 25, T. 14 S., R. 5 E., Morris County, Kansas.



MR. 64 MORRIS CO. KS. - Skiddy Quad.



MR-65 = Base of Towanda Limestone Member (Doyle Shale) at 1,315 ft in road on north side of road; one photo; 100 ft west of center of south line SW sec. 24, T. 14 S., R. 5 E., Morris County, Kansas.



MR-66 = Winfield (Stovall) Limestone at 1,345 ft in ditch on east side of road; one photo; center of west line NW SW NW sec. 23, T. 14 S., R. 5 E., Morris County, Kansas.



MR-67 = Winfield (Stovall) Limestone at 1,355 ft in road; one photo; approximately 250 ft south of center of west line sec. 26, T. 14 S., R. 5 E., Morris County, Kansas.



MR-68 = Winfield (Stovall) Limestone at 1,350 ft in road and cut bank at road intersection; two photos; center of west line SW SW sec. 26, T. 14 S., R. 5 E., Morris County, Kansas.



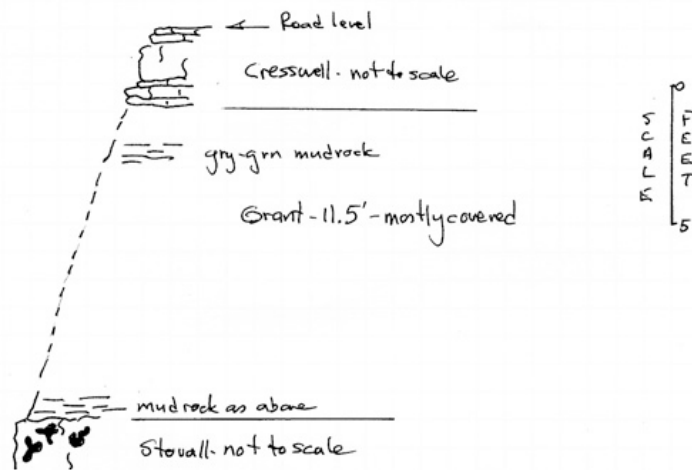
MR-69 = Winfield (Cresswell) Limestone, chert nodules, and geodes (chert nodules originally were geodes and geodes were anhydrite/gypsum nodules) at 1,390 ft in roadcut on west side of road; two photos; near center of east line NE SE sec. 35, T. 14 S., R. 5 E., Morris County, Kansas.



MR-70 = Winfield (Stovall) Limestone at 1,379 ft in ditch on north side of road with partially covered Grant (1.5 ft) and lower beds of Cresswell above; four photos, one of Stovall, one of complete sequence, and two of *Aviculopinna* sp. bivalves/burrows in lower Cresswell; see graphic sketch; approximately 100 ft east of center of south line SE SE sec. 35, T. 14 S., R. 5 E., Morris County, Kansas.



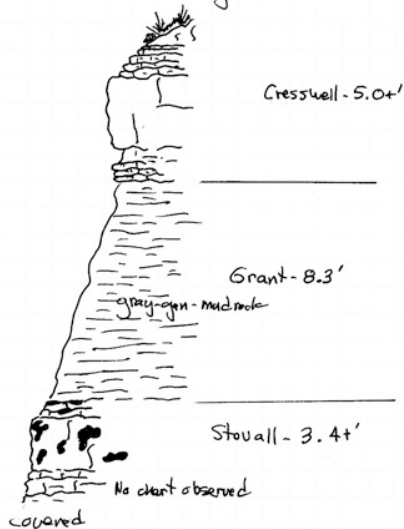
MR-70 - MORRIS CO. KS - Skiddy Quad



MR-71 = Winfield Limestone (Stovall at 1,345 ft, Grant, and lower beds of Cresswell) on both sides of road and also on the east side of the road intersection; three photos; sequence measured (hand level) and briefly described, see graphic sketch; at road intersection in southeast corner sec. 33 and southwest corner sec. 34, T. 14 S., R. 5 E., and northeast corner sec. 4 and northwest corner sec. 3, T. 15 S., R. 5 E., Morris County, Kansas.



MR-71 - MORRIS CO. KS. Skiddy Quad.



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MR-72 = Top of Stovall Limestone Member of Winfield Limestone at 1,360 ft on east side of road with Doyle (Gage) Shale below and Grant and Cresswell (Winfield Limestone) above; one photo; near center of NW NE NE sec. 3, T. 15 S., R. 5 E., Morris County, Kansas.



MR-73 = Winfield (Stovall) Limestone at 1,370 ft in road and fields on both sides of road and in a pond bank west of road; two photos; near center of east line SE SE NE sec. 2, T. 15 S., R. 5 E., Morris County, Kansas.



MR-74 = Winfield Limestone (Stovall at 1,375 ft, Grant, and Cresswell) on both sides of road; one photo; near center of east line NE SE NE sec. 11, T. 15 S., R. 5 E., Morris County, Kansas.



MR-75 = Winfield Limestone (Stovall at 1,388 ft and Grant) in road and ditches on both sides of road; one photo; approximately 100 ft east of center of north line sec. 1, T. 15 S., R. 5 E., Morris County, Kansas.



MR-76 = Winfield (Stovall) Limestone at 1,398 ft in ditches on both sides of paved road; one photo of exposure on south side; just west of center of north line NW NE NW sec. 32, T. 14 S., R. 6 E., Morris County, Kansas.



MR-77 = Winfield (Stovall) Limestone exposed at 1,402 ft in ditch on south side of road, lower beds with in situ *Aviculopinna* sp. and lacking chert, very similar to the limestone beds in the lower Cresswell; one photo; approximately 400 ft east of northwest corner sec. 5, T. 15 S., R. 6 E., Morris County, Kansas.



NOTE: When well exposed, three distinct lithologies constitute the Stovall and these are, in ascending order: (1) thin beds of light brown to brownish orange clayey limestone with bivalve burrows and sometimes in situ *Aviculopinna* sp., (2) a medium bed of hard, dense, light to medium gray limestone with dark gray to black, highly irregularly shaped chert bodies suggestive of burrow fillings, and (3) thin to platy bedded light brown to brownish orange clayey limestone often with chert nodules (3 to 5 cm in size). The commonly seen and readily identified unit is the hard, dense, medium limestone with irregularly shaped chert bodies. If this characteristic chert bed of the Stovall is absent, these lower beds of the Stovall could easily be mistaken for limestone beds in the lower Cresswell.

MR-78 = Same as MR-77 with Stovall at 1,412 ft but on the north side of road; one photo; near center of south line SE SW sec. 32, T. 14 S., R. 6 E., Morris County, Kansas.



MR-79 = Chert from Stovall in ditch at 1,412 ft on south side of road suggestive of in-place Stovall; one photo; approximately 100 ft west of center of north line NE NE sec. 5, T. 15 S., R. 6 E., Morris County, Kansas.



MR-80 = Winfield (Stovall) Limestone at 1,420 ft in road and road bank on south side of road; two photos; near center of north line NW NW NE sec. 4, T. 15 S., R. 6 E., Morris County, Kansas.



MR-81 = Winfield (Stovall) Limestone at 1,418 ft in ditch on east side of road; one photo; center of west line NW SW sec. 4, T. 15 S., R. 6 E., Morris County, Kansas.



MR-82 = Base of Cresswell at 1,390 ft with Grant below in ditch on north side of road, thin bed of chert above lower medium bed of limestone in Cresswell with geodes in lower Cresswell and upper Grant; one photo; approximately 200 ft east of northeast corner sec. 7, T. 15 S., R. 6 E., Morris County, Kansas.



MR-83 = Stovall with Grant above in field and drainage west of road, Stovall is at an elevation of about 1,380 ft; one photo; near center of NE SE SE sec. 1, T. 15 S., R. 6 E., Morris County, Kansas.



MR-108 = Winfield (Stovall) Limestone at 1,442 ft in road; one photo; about 300 ft east of the southwest corner sec. 10, T. 15 S., R. 6 E., Morris County, Kansas.



MR-109 = Base of Cresswell Limestone Member (Winfield Limestone) at 1,431 ft in ditch on north side of road; limestone with some small geodes is earthy and heavily stained by iron oxides, small walnut-sized geodes are abundant in the mudrock (Grant shale) below the Cresswell; one photo; approximately 1,700 ft west of southeast corner sec. 9, T. 15 S., R. 6 E., Morris County, Kansas.



WHITE CITY QUADRANGLE – MORRIS COUNTY

Field work was conducted January–May 2008.

M-3 = Quarry in Barneston (Fort Riley) Limestone, 17.5 ft of limestone measured and described by W. Ives, 12 August 1953 in northwest corner sec. 32, T. 14 S., R. 7 E., Morris County, Kansas; now overgrown. Same as MR-35.

MR-27 = Fort Riley rimrock at 1,431 ft in road and field on west side of road; one photo; center north line NE sec. 9, T. 15 S., R. 7 E., Morris County, Kansas.



MR-28 = Base of the Barneston (Florence) Limestone at 1,440 ft in ditches; one photo of south side of road; near center of south line SW SE SE sec. 34, T. 14 S., R. 7 E., Morris County, Kansas.



MR-29 = Fort Riley rimrock at 1,419 ft in road and field on east side of road; one photo; approximately center of west line NW NE sec. 17, T. 15 S., R. 7 E., Morris County, Kansas.



MR-30 = Fort Riley rimrock at 1,395 ft in road and field on west side of road; one photo; approximately 200 ft west of southeast corner sec. 12, T. 15 S., R. 6 E., Morris County, Kansas.



MR-31 = Upper Fort Riley in roadcut on east side of road; thin-bedded, platy upper Fort Riley in ditch on west side of road; two photos; Fort Riley in south bank of Neosho River approximately 150 ft north of center of west line sec. 12, T. 15 S., R. 6 E., Morris County, Kansas.



MR-32 = Fort Riley rimrock at 1,390 ft in ditches on both sides of highway; one photo of north side of road; center of north line NW NW sec. 7, T. 15 S., R. 7 E., Morris County, Kansas.



MR-33 = Fort Riley rimrock at 1,390 ft in ditches on both sides of highway; one photo; approximately 400 ft north of southwest corner sec. 5, T. 15 S., R. 7 E., Morris County, Kansas.



MR-34 = Fort Riley rimrock at 1,410 ft in ditch on south side of road; one photo; approximately 150 ft west of northeast corner sec. 5, T. 15 S., R. 7 E., Morris County, Kansas.



MR-35 = Upper or “second rimrock” in Fort Riley at 1,430 ft in ditches and fields on both sides of Kansas Highway 4. Fort Riley rimrock in quarry south of highway at 1,410 ft; one photo of exposure on north side of highway; approximately 400 ft east of southwest corner sec. 29, T. 14 S., R. 7 E., Morris County, Kansas. Same as M-3.



MR-36 = Fort Riley rimrock at 1,435 ft in ditches and fields on both sides of Kansas Highway 4; one photo of exposure on east side of highway; approximately 250 ft south of center of east line sec. 27, T. 14 S., R. 7 E., Morris County, Kansas.



MR-37 = Base of Barneston (Florence) Limestone at 1,390 ft in west bank of Lairds Creek on south side of road; two photos; center of north line sec. 27, T. 14 S., R. 7 E., Morris County, Kansas.



MR-38 = Fort Riley rimrock at 1,440 ft in field on east side of road; one photo; approximately 1,000 ft south of center of west line sec. 23, T. 14 S., R. 7 E., Morris County, Kansas.



MR-39 = Doyle (Towanda) Shale at 1,435 ft on both sides of road; two photos; approximately 800 ft south of northeast corner sec. 5, T. 14 S., R. 7 E., Morris County, Kansas.



MR-40 = Very good exposure of the Fort Riley rimrock at 1,382 ft in south bank of Davis Creek on west side of road, 27.5 ft of Fort Riley based on hand leveling from the base of the “lower rimrock” to the top of the exposure approximately 1/8 mi south along west side of road, “upper rimrock” 10 to 12 ft above “lower rimrock”; three photos (first two are of “lower rimrock” and third one is of “upper rimrock”); near center of east line SE SE sec. 5, T. 14 S., R. 7 E., Morris County, Kansas.



MR-41 = Fort Riley rimrock at 1,379 ft on south side of road in drainage of north flowing stream; one photo; center of north line NE NW sec. 8, T. 14 S., R. 7 E., Morris County, Kansas.



MR-42 = Winfield (Stovall) Limestone at 1,483 ft in ditch on east side of road; two photos; approximately 200 ft south of center of west line sec. 17, T. 14 S., R. 7 E., Morris County, Kansas.



MR-42A = Excellent exposure of Fort Riley rimrock at 1,430 ft in what appears to be an old quarry on the west side of road; one photo; approximately 200 ft west of center of east line NE SE sec. 21, T. 14 S., R. 7 E., Morris County, Kansas.



MR-43 = Ditch exposure of Doyle Shale (Towanda Limestone Member) with base of Towanda at 1,401 ft; one photo; center of west line NW sec. 6, T. 14 S., R. 7 E., Morris County, Kansas.



MR-44 = Near base of Towanda Limestone Member (Doyle Shale) at 1,368 ft in road; one photo; approximately 400 ft west of center of north line NE sec. 3, T. 14 S., R. 6 E., Morris County, Kansas.



MR-45 = Fort Riley rimrock at 1,323 ft in west bank of Thomas Creek on north side of road; one photo; near center of south line SE SE sec. 34, T. 13 S., R. 6 E., Geary County, Kansas.



MR-46 = Doyle Shale with upper beds of Holmesville Shale Member and base of Towanda at 1,365 ft on east side of road; two photos; near center of west line SW NW NW sec. 2, T. 14 S., R. 6 E., Morris County, Kansas.



MR-46A = Doyle Shale with base of Towanda Limestone Member at 1,386 ft and Holmesville Shale Member exposed below in ditch on north side of road, 9.6 ft of Towanda exposed (hand leveled); one photo; near center of south line SW sec. 11, T. 14 S., R. 6 E., Morris County, Kansas.



MR-110 = Top of Barneston Limestone (Fort Riley) at 1,414 ft in ditch on east side of road; one photo; about 100 ft south of northwest corner sec. 1, T. 15 S., R. 6 E., Morris County, Kansas.



MR-111 = Winfield Limestone (Stovall) at 1,473 ft in road; one photo; center west line NW sec. 20, T. 14 S., R. 7 E., Morris County, Kansas.



MR-112 = Winfield Limestone (Cresswell) at 1,498 ft., no contacts; one photo; center north line NW NE NW sec. 20, T. 14 S., R. 7 E., Morris County, Kansas.



MR-113 = Covered base of Towanda Limestone Member (Doyle Shale) estimated in road at 1,435 ft; no photo; center north line NW NE sec. 17, T. 14 S., R. 7 E., Morris County, Kansas.

NO PHOTO

MR-114 = Poorly exposed beds of upper Fort Riley limestone in drainage on north side of road at 1,430 ft; one photo; center south line SE sec. 16, T. 14 S., R. 7 E., Morris County, Kansas.



MR-115 = Fort Riley rimrock in road at 1,425 ft; one photo; center east line SE NE NE sec. 21, T. 14 S., R. 7 E., Morris County, Kansas.



DWIGHT QUADRANGLE – MORRIS COUNTY

Field work was conducted January–May 2008.

MR-9 = Fort Riley rimrock at 1,414 ft in road and fields and ditches on both sides of road; one photo; near center SW sec. 32, T. 14 S., R. 8 E., Morris County, Kansas.



MR-10 = Base of approximately 10 ft of Barneston (Florence) Limestone at 1,421 ft on both sides of road with greenish-gray mudrock (Blue Springs) below; one photo; approximately 1,000 ft west of southeast corner sec. 30, T. 14 S., R. 8 E., Morris County, Kansas.



MR-11 = Fort Riley rimrock at 1,430 ft on both sides of road; one photo; approximately 500 ft south of center of east line sec. 26, T. 14 S., R. 7 E., Morris County, Kansas.



MR-12 = Fort Riley rimrock at 1,449 ft on both sides of road; one photo; near center of east line NE sec. 23, T. 14 S., R. 7 E., Morris County, Kansas.



MR-13 = Covered base of Barneston (Florence) Limestone estimated at 1,457 ft in hillside on south side of road with greenish-gray mudrock in creek bed on north side of road; one photo; near center of north line NW NE SW sec. 3, T. 14 S., R. 8 E., Morris County, Kansas.



MR-14 = Base of Barneston (Florence) Limestone at 1,439 ft with Blue Springs in road and creek bed on south side of road; one photo; approximately 2,500 ft west of northeast corner sec. 19, T. 14 S., R. 8 E., Morris County, Kansas.



MR-15 = Base of Barneston (Florence) Limestone at 1,470 ft and Blue Springs exposed in road and in creek bank on south side of road; one photo; approximately 700 ft west of southeast corner sec. 18, T. 14 S., R. 8 E., Morris County, Kansas.



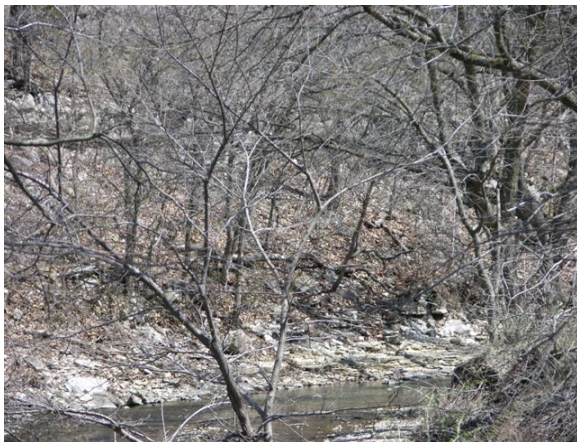
MR-16 = Top of Wreford (Schroyer) Limestone at 1,364 ft in ditch at northwest corner on road intersection; one photo; southeast corner sec. 2, T. 15 S., R. 7 E., Morris County, Kansas.



MR-17 = Base of Barneston (Florence) Limestone at 1,439 ft with greenish-gray mudrock below in ditch on west side of road; one photo; near center of east line SE NE NE sec. 1, T. 15 S., R. 7 E., Morris County, Kansas.



MR-18 = Base of Wreford (Threemile) Limestone at 1,315 ft with upper beds of the Speiser Shale in stream bank on the east side of the stream bridge; one photo; approximately 200 ft east of northwest corner sec. 18, T. 15 S., R. 8 E., Morris County, Kansas.



MR-19 = Top of Wreford (Schroyer, with good grainstone at top) Limestone at 1,362 ft in ditches on both sides of road; 19.5 ft of Wreford exposed (hand leveled, 13.5+ ft = Schroyer, 4.0 ft = Havensville, 2.0+ ft = Threemile); two photos (second photo looking northeast across field); near center of east line SE NE SE sec. 12, T. 15 S., R. 7 E., Morris County, Kansas.



MR-20 = Fort Riley rimrock at 1,370 ft in ditches on both sides of road and around pond in a field north of road; one photo; approximately 200 ft west of center south line SW SW sec. 5, T. 15 S., R. 8 E., Morris County, Kansas.



MR-21 = Fort Riley rimrock at 1,377 ft in ditches on both sides of road and in a field south of road; one photo; near center of north line NW sec. 9, T. 15 S., R. 8 E., Morris County, Kansas.



MR-22 = Base of Barneston (Florence) Limestone at 1,338 ft in east stream bank south of road; two photos; northeast corner sec. 9, T. 15 S., R. 8 E., Morris County, Kansas.



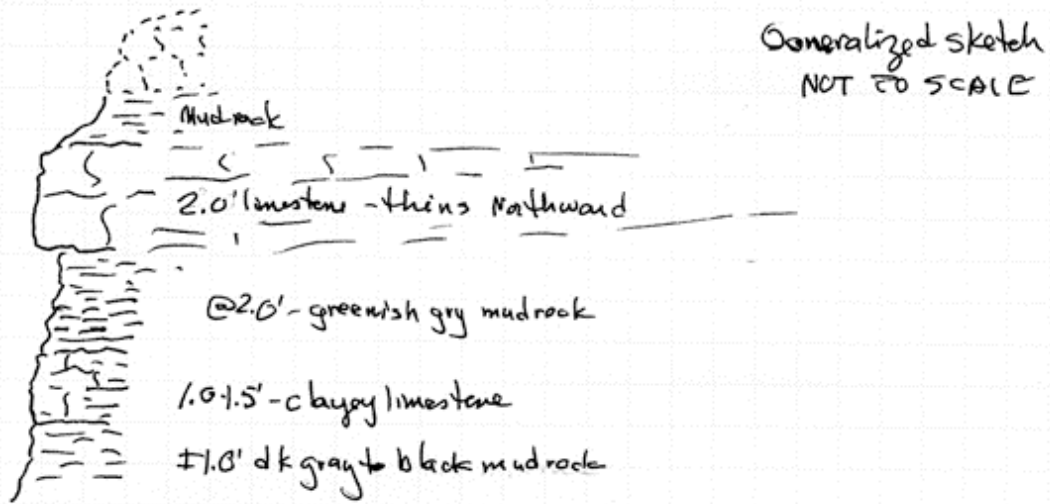
MR-23 = Base of Barneston (Florence) Limestone at 1,350 ft in road on north side of road; one photo; near center of south line SE SE SW sec. 10, T. 15 S., R. 8 E., Morris County, Kansas.



MR-24 = Top of the Wreford (Schroyer) Limestone at 1,335 ft in drainage on west side of road; first photo on west side of road, second photo and sketch of creek bank just east of road; near center of south line NE NE sec. 18, T. 15 S., R. 8 E., Morris County, Kansas.



MR-24 - MORRIS CO. KS. - Dwight Quad.



MR-25 = Base of Barneston (Florence) Limestone at 1,405 ft in ditch on south side of road; one photo; approximately 1,900 ft west of southeast corner sec. 7, T. 15 S., R. 8 E., Morris County, Kansas.



MR-26 = Base of Barneston (Florence) Limestone at 1,445 ft in ditch on west side of road; one photo; near center sec. 31, T. 14 S., R. 8 E., Morris County, Kansas.



MR-98 = Base of Barneston (Florence) Limestone at 1,379 ft in ditch on north side of road; one photo; about 200 ft east of center of south line SE SW sec. 8, T. 15 S., R. 8 E., Morris County, Kansas.



MR-99 = Base of Barneston (Florence) Limestone at 1,400 ft in east ditch; one photo; about 3,200 ft east and 850 ft south of northwest corner sec. 18, T. 15 S., R. 8 E., Morris County, Kansas.



MR-100 = Base of Barneston (Florence) Limestone at 1,419 ft in ditch on south side of road; one photo; about 2,100 ft east of northwest corner sec. 7, T. 15 S., R. 8 E., Morris County, Kansas.



MR-101 = Base of Barneston (Florence) Limestone at 1,430 ft in ditch on north side of road; one photo; about 4,000 ft west of southeast corner sec. 31, T. 14 S., R. 8 E., Morris County, Kansas.



MR-102 = Base of Barneston (Florence) Limestone at 1,412 ft in ditch on north side of road; one photo; about 2,200 ft west of southeast corner sec. 31, T. 14 S., R. 8 E., Morris County, Kansas.



MR-103 = Base of Barneston (Florence) Limestone at 1,410 ft in ditch on west side of road; one photo; about 1,200 ft west and 200 ft north of southeast corner sec. 31, T. 14 S., R. 8 E., Morris County, Kansas.



MR-104 = Fort Riley rimrock at 1,424 ft in road and ditch on east side of road; one photo; near center south-half NW sec. 32, T. 14 S., R. 8 E., Morris County, Kansas.



MR-105 = Estimated base of Barneston (Florence) Limestone at 1,420 ft in ditch on north side of road; one photo; center south line SW SW sec. 29, T. 14 S., R. 8 E., Morris County, Kansas.



MR-106 = Base of Barneston (Florence) Limestone at 1,395 ft along south side of drainage in a pasture south of the road; one photo; about 2,700 ft west and 1,000 ft south of northeast corner sec. 6, T. 15 S., R. 8 E., Morris County, Kansas.



MR-107 = Limestone in the Barneston (Fort Riley) Limestone at 1,392 ft with an east to southeast dip in drainage in field on south side of road; two photos; about 2,600 ft east of southwest corner sec. 6, T. 15 S., R. 8 E., Morris County, Kansas.



ALTA VISTA QUADRANGLE – MORRIS COUNTY

Field work was conducted January–May 2008.

MMW-16 = Matfield Shale (Blue Springs Shale Member, Kinney Limestone Member, and Wymore Shale Member) exposed in a roadcut and streambank in SE SE sec. 31, T. 14 S., R. 9 E., Morris County, Kansas. Same as MR-6.

MTB-98 = Barneston (Florence) Limestone and Matfield (Blue Springs Shale Member, Kinney Limestone Member, and Wymore Shale Member) Shale in roadcut and along Middle Branch of Munkers Creek in SE sec. 31 and SW sec. 32, T. 14 S., R. 9 E., Morris County, Kansas. Same as MR-6.

MR-1 = Fort Riley rimrock at 1,412 ft in road and on south side of road; one photo; approximately 100 ft west of center north line NE NW sec. 19, T. 14 S., R. 9 E., Morris County, Kansas.



MR-2 = Base of Barneston (Florence) Limestone at 1,365 ft in south bank of stream on west side of road; one photo; near center of east line NE SE sec. 26, T. 14 S., R. 8 E., Morris County, Kansas.



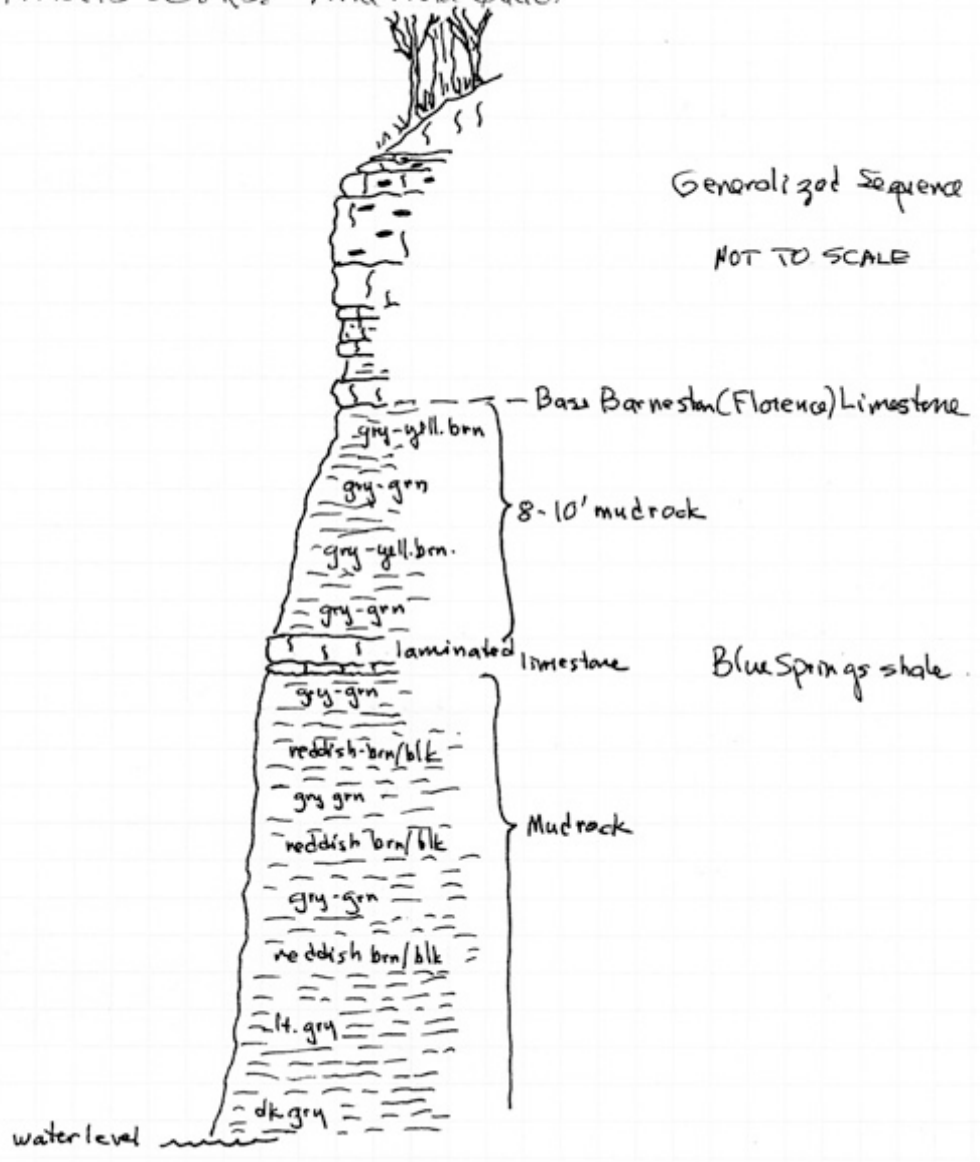
MR-3 = Fort Riley rimrock at 1,409 ft in old quarry on east side of road and in the road; one photo; southwest corner sec. 25, T. 14 S., R. 8 E., Morris County, Kansas.



MR-4 = Base of Barneston (Florence) Limestone at 1,388 ft with Blue Springs Shale Member below in south bank of Middle Branch of Munkers Creek on the south side of road; one photo and generalized sketch of exposed sequence; just west of northeast corner sec. 29, T. 14 S., R. 9 E., Morris County, Kansas.



MR-4 - MORRIS CO. KS. - Alta Vista Quad.



Generalized Sequence
NOT TO SCALE

MR-5 = Base of Barneston (Florence) Limestone at 1,435 ft in roadcut exposures on east side of road with reddish and greenish gray mudrocks in road below Florence; one photo; center of east line SE NE sec. 34, T. 14 S., R. 9 E., Morris County, Kansas.

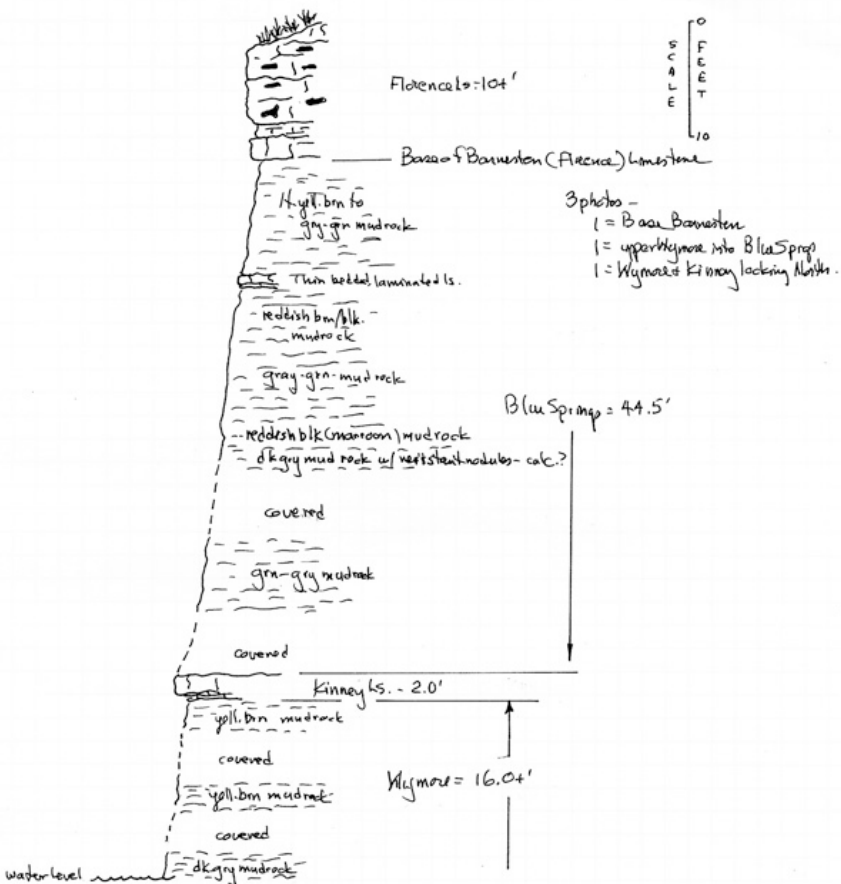


MR-6 = Base of Barneston (Florence) Limestone at 1,390 ft in roadcut exposure north side of road with the Blue Springs, Kinney (at 1,345 ft), and Wymore exposed below in ditch draining in the Middle Branch of Munkers Creek; three photos and generalized sketch of exposed sequence; northeast corner sec. 6, T. 15 S., R. 9 E., Morris County, Kansas. NOTE – Same as Mudge, et al., 1958, sec. 16, and Mazzullo, et al., 1997, sec. 98.





MR-6- MORRIS CO. KS. - Alta Vista Quad.



MR-7 = Fort Riley rimrock at 1,440 ft on north side of road; one photo; center of south line SE SW sec. 35, T. 14 S., R. 8 E., Morris County, Kansas.



MR-8 = Covered base of Barneston (Florence) Limestone estimated at 1,410 ft in ditch on west side of road; one photo; approximately 250 ft north of center of east line NE sec. 8, T. 15 S., R. 9 E., Morris County, Kansas.



HERINGTON QUADRANGLE – MORRIS COUNTY

Field work was conducted February–April 2010.

M-6 = Nolans (Herington) Limestone; northwest corner sec. 20, T. 16 S., R. 5 E., Morris County, Kansas; measured and described by M. K. and M. M. Elias in 1935; see MR-286.

M-7 = Nolans (Herington) Limestone; just northwest of center NW NW sec. 20, T. 16 S., R. 5 E., Morris County, Kansas; measured and described by M. K. and M. M. Elias in 1935; possibly the same as M-6; see MR-286.

M-8 = Nolans Limestone; near center of east line NE sec. 30, T. 16 S., R. 5 E., Morris County, Kansas; measured and described by M. K. and M. M. Elias in 1935.

MMW-5 = Nolans Limestone in railway cut; NW NW sec. 31, T. 15 S., R. 5 E., Morris County, Kansas; see MR-275.

MMW-6 = Nolans (Krider) Limestone and Odell Shale in stream bank; NW NW sec. 29, T. 16 S., R. 5 E., Morris County, Kansas.

MR-266 = Nolans (base of Herington) Limestone at 1,437 ft in field north of road; one photo; near center of south line SW SE SE sec. 16, T. 16 S., R. 5 E., Morris County, Kansas.



MR-269 = Nolans (base of Herington with Paddock below) Limestone at 1,420 ft in roadcut on north side of Kansas Highway 4; three photos (third one is approximately 750 ft west of MR-269); near center of south line SE sec. 28, T. 15 S., R. 5 E., Morris County, Kansas.



MR-270 = Nolans (base of Krider to lower beds of Herington with approximately 5 ft of Paddock in between) Limestone, base of Nolans (Krider) Limestone in road at 1,395 ft; two photos, one of Nolans Limestone and one of base of Krider; near center of south line SE SE SE sec. 20, T. 15 S., R. 5 E., Morris County, Kansas.



MR-271 = Base of Nolans (Herington) Limestone at 1,398 ft in road; one photo; near center of north line sec. 19, T. 15 S., R. 5 E., Morris County, Kansas.



MR-272 = Base of Nolans (Krider) Limestone at 1,385 ft in road; one photo; near center of east line NE NE SE sec. 19, T. 15 S., R. 5 E., Morris County, Kansas.



MR-273 = Base of the Nolans (Krider) Limestone in a roadcut on the east side of U.S. Highway 77 at 1,375 ft; one photo; center of west line NW NW sec. 19, T. 15 S., R. 5 E., Morris County, Kansas.



MR-274 = Top of Winfield (Cresswell, finely laminated, non-fossiliferous) Limestone in roadcuts on both sides of U.S. Highway 77 at 1,340 ft; one photo of exposure on east side of highway; northwest corner sec. 30, T. 15 S., R. 5 E., Morris County, Kansas.



MR-275 = Base of the Nolans (Kridler) Limestone on the north side of a Chicago, Rock Island, and Pacific railroad cut at 1,370 ft; one photo; approximately 300 ft west of center NW NW sec. 31, T. 15 S., R. 5 E., Morris County, Kansas ; see MMW-5.



MR-276 = Exposure near top of Winfield (Cresswell) Limestone in roadcut on east side of U.S. Highway 77 at 1,344 ft; one photo; approximately 300 ft south and 100 ft east of northwest corner sec. 6, T. 16 S., R. 5 E., Morris County, Kansas.



MR-277 = Base of the Nolans (Herington) Limestone in roadcut on north side of Kansas Highway 4 at 1,380 ft; one photo; approximately 350 ft west of center of south line sec. 31, T. 15 S., R. 5 E., Morris County, Kansas.



MR-278 = Base of the Nolans (Herington) Limestone in roadcuts on both sides of U.S. Highway 77 at 1,383 ft; one photo of exposure on east side of highway; near center of west line NW SW sec. 6, T. 16 S., R. 5 E., Morris County, Kansas.



MR-279 = Nolans (base of Herington) Limestone in roadcuts on both sides of U.S. Highway 77 at 1,380 ft; one photo of exposure on east side of highway; near center west line SW NW sec. 7, T. 16 S., R. 5 E., Morris County, Kansas.



MR-280 = Nolans (near base of Herington) Limestone in road and field south of road at 1,390 ft; one photo, south side of road; center of north line NW NE sec. 7, T. 16 S., R. 5 E., Morris County, Kansas.



MR-281 = Base of the Nolans (Herington) Limestone in roadcut on east side of road at 1,406 ft; one photo; near center of west line NW sec. 4, T. 16 S., R. 5 E., Morris County, Kansas.



MR-283 = Wellington (Hollenberg) in road and field west of road at 1,465 ft; one photo; approximately 200 ft north of center of east line sec. 20, T. 16 S., R. 5 E., Morris County, Kansas.



MR-285 = Wellington (Hollenberg) in road at 1,468 ft; one photo; near center of north line NE NW NW sec. 20, T. 16 S., R. 5 E., Morris County, Kansas.



MR-286 = Nolans (base of Herington) Limestone in road and roadcut on east side of road at 1,430 ft; one photo; approximately 300 ft south of center of west line, sec. 20, T. 16 S., R. 5 E., Morris County, Kansas; area of M-6 and M-7.



MR-287 = Nolans (base of Herington) Limestone in road and field east of road at 1,417 ft with a thin Paddock and the Krider mostly covered with one or two thin to platy beds of earthy limestone in the upper Odell Shale above maroon mudrocks of Odell Shale exposed in the road; one photo; approximately 300 ft south of center of west line SW sec. 20, T. 16 S., R. 5 E., Morris County, Kansas.



MR-288 = Wellington (base of Hollenberg) in road at 1,460 ft; one photo; approximately 200 ft south of west line NW SW sec. 29, T. 16 S., R. 5 E., Morris County, Kansas.



MR-289 = Base of Nolans (Krider) Limestone on both sides of road at 1,410 ft with maroon mudrock of Odell Shale below in road; approximately 7.5 ft of Paddock (covered) above approximately 3.7 ft of Krider (two thin dolomitic limestones with a thin mudrock between); four photos: 1 – base of Krider with Odell Shale below, 2 – top of the thin lower limestone in the Krider, 3 – interval from the top of the thin lower limestone in the Krider to the top of the thin upper limestone in the Krider, and 4 – thin upper limestone in the Krider; near center of west line SW SW sec. 20, T. 16 S., R. 5 E., Morris County, Kansas.



MR-290 = Base of Nolans (Krider) Limestone in field on west side of road at 1,395 ft (hand leveled to the base of the lower beds in the Herington); one photo; approximately 300 ft south of center of east line NE NE sec. 30, T. 16 S., R. 5 E., Morris County, Kansas.



MR-295 = Nolans (base of Herington) Limestone on the north side of a Chicago, Rock Island, and Pacific railroad cut at 1,390 ft; one photo; approximately 200 ft north of southeast corner sec. 30, T. 15 S., R. 5 E., Morris County, Kansas.



DELAVAN QUADRANGLE – MORRIS COUNTY

Field work was conducted February–April 2010.

MR-236 = Winfield Limestone (base of Cresswell) at 1,489 ft exposed in ditches on both sides of road, hand leveled 4.5 ft of limestone and 9.0 ft of Grant; one photo; approximately 200 ft east of center of south line SW SW sec. 22, T. 16 S., R. 6 E., Morris County, Kansas.



MR-237 = Winfield Limestone (Stovall) at 1,480 ft exposed in ditch on north side of road; one photo; near center of south line SW sec. 22, T. 16 S., R. 6 E., Morris County, Kansas.



MR-238 = Winfield Limestone (base of Cresswell) at 1,475 ft exposed in both ditches; one photo; near center of south line SE SW SE sec. 21, T. 16 S., R. 6 E., Morris County, Kansas.



MR-239 = Winfield Limestone (Stovall) at 1,457 ft exposed in ditch on south side of road; one photo; near center of north line NE NW sec. 28, T. 16 S., R. 6 E., Morris County, Kansas.



MR-240 = Winfield Limestone (Stovall) at 1,457 ft exposed in ditch on north side of road; one photo; about 200 ft east of south line SE SE sec. 20, T. 16 S., R. 6 E., Morris County, Kansas.



MR-243 = Nolans (near base of Herington) Limestone at 1,455 ft in trench silo on east side of road; two photos; approximately 200 ft south of northwest corner sec. 19, T. 15 S., R. 6 E., Morris County, Kansas.



MR-244 = Winfield (near top of Cresswell) Limestone at 1,405 ft in road, ditches, and old quarry north of road (see Mudge et al., 1958, p. 24, Table 1, limestone 9); limestone echinoid skeletal debris and bivalves (especially burrows) and what appear to be *Thalassinoides*; three photos; near center of south line SE SW sec. 26, T. 15 S., R. 5 E., Morris County, Kansas.



MR-245 = Good exposure of Winfield (near top of Cresswell) Limestone at 1,380 ft in roadcut on east side of road; one photo; approximately 500 ft south on northwest corner sec. 22, T. 15 S., R. 5 E., Morris County, Kansas.



MR-246 = Winfield (near top of Cresswell) Limestone at 1,395 ft in ditch on west side of road; in situ *Wilkingia* sp. and small geodes; two photos; approximately 200 ft north of west line NW SW sec. 35, T. 15 S., R. 5 E., Morris County, Kansas.



MR-247 = Nolans (near base of Herington) Limestone at 1,435 ft in roadcut on east side of road; center west line NW SW sec. 35, T. 15 S., R. 5 E., Morris County, Kansas.



MR-248 = Nolans (near base of Herington) Limestone at 1,447 ft in road and ditches on both sides of road; one photo of exposure on east side of road; near center west line NW SW NW sec. 2, T. 16 S., R. 5 E., Morris County, Kansas.



MR-249 = Winfield (Stovall) Limestone at 1,481 ft in road and ditch on south side of road; one photo near center of south line SE SE SW sec. 3, T. 16 S., R. 6 E., Morris County, Kansas.



MR-250 = Nolans (Herington) Limestone at 1,498 ft in road and road ditch on west side of road; one photo; about 300 ft east of center of south line SE sec. 18, T. 16 S., R. 6 E., Morris County, Kansas.



MR-251 = Winfield (Cresswell, near top) Limestone at 1,434 ft in road, near MMW-7; one photo of south side of road and abandoned quarry (MMW-7); near center of north line NE NE sec. 12, T. 16 S., R. 5 E., Morris County, Kansas.



MR-252 = Nolans (Herington) Limestone at 1,470 ft in road ditch on west side of road; one photo; near center of east line SE NE NE sec. 1, T. 16 S., R. 5 E., Morris County, Kansas.



MR-253 = Nolans (base of Herington) Limestone at 1,480 ft in road ditch on east side of road; two photos (geodes in limestone and base of limestone); near center of west line sec. 6, T. 16 S., R. 6 E., Morris County, Kansas.



MR-254 = Base of Nolans (Herington) Limestone at 1,476 ft in road and road ditch on west side of road; one photo; near center of east line SE NE NE sec. 36, T. 15 S., R. 5 E., Morris County, Kansas.



MR-255 = Base of Nolans (Herington) Limestone at 1,470 ft in road and field on west side of road; one photo; near center of east line SE SE sec. 25, T. 15 S., R. 5 E., Morris County, Kansas.



MR-256 = Base of Nolans (Herington) Limestone with Odell Shale below at 1,467 ft in road ditch on both sides of road; three photos (one on each side of road and one of limestone slab with geodes); near center of east line SE NE NE sec. 25, T. 15 S., R. 5 E., Morris County, Kansas.



MR-257 = Nolans (Herington) Limestone at 1,453 ft in road; one photo; near center of east line SE SE sec. 24, T. 15 S., R. 5 E., Morris County, Kansas.



MR-258 = Winfield (Cresswell, near top) Limestone at 1,418 ft in road; one photo; approximately 200 ft north of center of east line SE NE sec. 13, T. 15 S., R. 5 E., Morris County, Kansas.



MR-259 = Nolans (Herington) Limestone at 1,449 ft in road; one photo; near center of east line sec. 26, T. 15 S., R. 5 E., Morris County, Kansas.



MR-260 = Nolans (Herington) Limestone at 1,443 ft in road; one photo; near center of east line SE NE SE sec. 23, T. 15 S., R. 5 E., Morris County, Kansas.



MR-261 = Base of Nolans (Herington) Limestone at 1,448 ft in old trench silo on north side of road; one photo; approximately 400 ft east and 100 ft north of southwest corner sec. 36, T. 15 S., R. 5 E., Morris County, Kansas.



MR-262 = Base of Nolans (Herington) Limestone at 1,493 ft in road and in road ditch on south side of road; one photo; approximately 200 ft east of center of south line SE sec. 18, T. 16 S., R. 6 E., Morris County, Kansas.



MR-263 = Base of Nolans (Krider) Limestone at 1,469 ft in ditch on west side of road; one photo; approximately 200 ft south of center SE sec. 27, T. 16 S., R. 5 E., Morris County, Kansas.



MR-267 = Nolans (Herington, base estimated at 1,435 ft) Limestone at 1,440 ft on north side of an old railroad cut; one photo; near center of NW sec. 15, T. 16 S., R. 5 E., Morris County, Kansas.



MR-268 = Base of Nolans (Herington) Limestone at 1,441 ft in roadcut on north side of road; one photo; near center of south line SE SW sec. 10, T. 16 S., R. 5 E., Morris County, Kansas.



MR-282 = Nolans (Herington) Limestone in road at 1,433 ft; one photo; near center of west line NW sec. 10, T. 16 S., R. 5 E., Morris County, Kansas.



MR-292 = Nolans (Herington) Limestone in road and road ditch on south side of road at 1,472 ft; two photos, one on each side of road; approximately 200 ft west of center of north line sec. 23, T. 16 S., R. 5 E., Morris County, Kansas.



MR-293 = Nolans (base of Herington) Limestone in road and ditch on south side of road at 1,465 ft; one photo; near center of north line NW NE NE sec. 26, T. 16 S., R. 5 E., Morris County, Kansas.



MR-294 = Wellington (Hollenberg) Formation in the road at 1,490 ft; one photo; center of south line SW sec. 22, T. 16 S., R. 5 E., Morris County, Kansas.



MR-297 = Nolans (from the base of the Krider through 5 ft of Paddock to the lower beds of the Herington) Limestone, base of the Nolans (Krider) Limestone at 1,433 ft; Krider is two thin, platy, poorly exposed limestone beds like at MR-270; one photo; approximately 400 ft west of southeast corner sec. 22, T. 15 S., R. 5 E., Morris County, Kansas.



MR-298 = Exposure (very poor) of Nolans (Herington) Limestone in road at 1,477 ft; one photo; near center of west line SW NW NW sec. 20, T. 15 S., R. 6 E., Morris County, Kansas.



MR-299 = Winfield (Cresswell) Limestone in road at 1,389 ft, good exposure of lower beds of Cresswell; one photo; near center of south line SW sec. 34, T. 15 S., R. 5 E., Morris County, Kansas.



MR-300 = Base of Nolans (Krider) Limestone in road at 1,330 ft; 12 ft of Paddock to base of the Herington; one photo; center of south line SW SE SW sec. 3, T. 16 S., R. 5 E., Morris County, Kansas.



MR-301 = Nolans (Herington) Limestone in road at 1,458 ft; one photo; near center of south line SE SE sec. 2, T. 16 S., R. 5 E., Morris County, Kansas.



MR-302 = Nolans (Herington) Limestone in road at 1,460 ft; one photo; near center of south line SW sec. 1, T. 16 S., R. 5 E., Morris County, Kansas.



MR-303 = Nolans (base of Herington) Limestone in road ditch on south side of road at 1,466 ft; one photo; near center of south line SW SE SE sec. 11, T. 16 S., R. 5 E., Morris County, Kansas.



MR-304 = Nolans (Herington) Limestone in road ditch on south side of road at 1,470 ft; one photo; near center of south line SW SW SE sec. 12, T. 16 S., R. 5 E., Morris County, Kansas.



MR-310 = Winfield Limestone (Stovall) at 1,450 ft exposed in road and ditch on south side of road; one photo; near center of the north line NE NE sec. 28, T. 15 S., R. 6 E., Morris County, Kansas.



WILSEY QUADRANGLE – MORRIS COUNTY

Field work was conducted February–April 2010.

M-9 = Barneston Limestone (Fort Riley) exposed in a recently open quarry (now abandoned); southeast corner sec. 29, T. 16 S., R. 7 E., Morris County, Kansas; measured and described by W. Ives, 12 August 1953.

MMW-18 = Wreford Limestone (Threemile) into the Matfield Shale (Wymore) in roadcut of the east side of road in SW SW sec. 15, T. 15 S., R. 7 E., Morris County, Kansas.

MMW-22 = Wreford Limestone (Threemile) exposure in road ditch and south bank of Neosho River on east side of road (at 1,340 ft); SW NW sec. 15, T. 15 S., R. 7 E., Morris County, Kansas.

MTB-99A = Barneston (Florence) Limestone in roadcuts on U.S. Highway 56 west of Council Grove, in SW sec. 15 and NW sec. 22, T. 16 S., R. 7 E., Morris County, Kansas.

MR-177 = Matfield Shale (Kinney Limestone Member) at 1,450 ft in road and ditches on both sides of road; one photo; about 350 ft west of center of north line sec. 11, T. 16 S., R. 7 E., Morris County, Kansas.



MR-186 = Base of Barneston Limestone (Florence) at 1,500 ft in road and roadcut on east side of road; one photo; near center of west line NW SW sec. 11, T. 16 S., R. 7 E., Morris County, Kansas.



MR-211 = Base of Barneston Limestone (Florence) at 1,410 ft in road ditch and exposure on east side of road; one photo; center of west line SW NW NW sec. 22, T. 15 S., R. 7 E., Morris County, Kansas.



MR-212 = Top of Wreford Limestone (Schroyer) at 1,360 ft in exposure on west side of road near MMW-18; one photo; near center of east line SE SE SE sec. 16, T. 15 S., R. 7 E., Morris County, Kansas.



MR-213 = Exposure of atypical Wreford Limestone (Threemile) at 1,340 ft on east side of road south of Crooked Creek; limestone is a very light gray to white sub-lithographic carbonate that appears to have been burrowed and contains very little chert; two photos; near center of west line NW SW SW sec. 15, T. 15 S., R. 7 E., Morris County, Kansas.



MR-214 = Base of Barneston Limestone (Florence) at 1,500 ft in roadcut on south side of U.S. Highway 56; one photo; near center of north line NW NW NE sec. 22, T. 16 S., R. 7 E., Morris County, Kansas.



MR-215 = Barneston Limestone (Fort Riley) at 1,480 ft in road, ditches, and pond bank on north side of road; one photo; east of center of south line SE SE sec. 4, T. 16 S., R. 7 E., Morris County, Kansas.



MR-217 = Base of Barneston Limestone (Florence) at 1,465 ft in road ditch on west side of road; one photo; near center of east line SE NE sec. 21, T. 16 S., R. 7 E., Morris County, Kansas.



MR-218 = Base of Barneston Limestone (Florence) at 1,485 ft in road ditch on west side of road; one photo; near center of east line NE SE SE sec. 22, T. 16 S., R. 7 E., Morris County, Kansas.



MR-220 = Barneston Limestone (Fort Riley rimrock) at 1,470 ft exposed in road and fields on both sides of road; one photo of exposure on east side of road; near center of west line SW NW NW sec. 5, T. 16 S., R. 7 E., Morris County, Kansas.



MR-221 = Base of Barneston Limestone (Florence) at 1,430 ft in excellent roadcut on west side of road; one photo; near center of south line SW SE SW sec. 28, T. 15 S., R. 7 E., Morris County, Kansas.



MR-222 = Base of Barneston Limestone (Florence) at 1,450 ft in road ditch on north side of road; one photo; center of south line SW SE SW sec. 23, T. 16 S., R. 7 E., Morris County, Kansas.



MR-223 = Barneston Limestone (Florence) at 1,435 ft in gully on west side of road; two photos; about 150 ft west of center of east line NE NE SE sec. 27, T. 16 S., R. 7 E., Morris County, Kansas.



MR-224 = Barneston Limestone (Fort Riley rimrock) at 1,432 ft exposed in pasture/feedlot on east side of road; two photos; center of west line SW NW SW sec. 26, T. 16 S., R. 7 E., Morris County, Kansas.



MR-225 = Base of Barneston Limestone (Florence) estimated at 1,425 ft (covered) in bluff on south side of Elm Creek; one photo; near center NW SE SE sec. 27, T. 16 S., R. 7 E., Morris County, Kansas.



MR-226 = Barneston Limestone (Florence) at 1,409 ft in bank on north side of Elm Creek, west side of road; two photos; just west of center of east line SE SE sec. 27, T. 16 S., R. 7 E., Morris County, Kansas.



MR-227 = Barneston Limestone (Fort Riley rimrock) at 1,448 ft on both sides of road; one photo of exposure on south side of road; near center of south line SW SE SW sec. 31, T. 15 S., R. 7 E., Morris County, Kansas.



MR-228 = Barneston Limestone (Fort Riley rimrock) at 1,420 ft exposed in field west of road; one photo; approximately 150 ft south of center of east line SE NE sec. 36, T. 15 S., R. 6 E., Morris County, Kansas.



MR-229 = Barneston Limestone (Fort Riley rimrock) at 1,425 ft exposed on both sides of road; one photo west side of road; center of east line SE NE NE sec. 36, T. 15 S., R. 6 E., Morris County, Kansas.



MR-230 = Base of Barneston Limestone (Florence) at 1,390 ft in west bank of Haun Creek on north side; two photos; near center SW SE SW sec. 30, T. 15 S., R. 7 E., Morris County, Kansas.



MR-231 = Barneston Limestone (Fort Riley) at 1,450 ft exposed in field north of road; one photo; center south line SW SE sec. 30, T. 15 S., R. 7 E., Morris County, Kansas.



MR-232 = Barneston Limestone (Fort Riley rimrock) at 1,415 ft exposed in road and fields on both sides of road with Oketo below along stream bank north of road; one photo; center of south line SW sec. 19, T. 15 S., R. 7 E., Morris County, Kansas.



MR-233 = Barneston Limestone (Fort Riley rimrock) at 1,420 ft in fields on both sides of road; one photo of west side of road; near center of sec. 19, T. 15 S., R. 7 E., Morris County, Kansas.



MR-234 = Doyle (Towanda) Shale at 1,459 ft in ditches on both sides of road; one photo of exposure on south side of road; near center SE SE SE sec. 12, T. 16 S., R. 6 E., Morris County, Kansas.



MR-235 = Winfield Limestone (Stovall) at 1,501 ft in road ditch on east side of road; two photos; approximately 200 ft north of center of west line SW NW sec. 24, T. 15 S., R. 6 E., Morris County, Kansas.



MR-241 = Doyle (Towanda) Shale at 1,422 ft in road; one photo; near center south line sec. 14, T. 15 S., R. 6 E., Morris County, Kansas.



MR-242 = Doyle (near base of Towanda) Shale at 1,434 ft in road ditch on north side of road; one photo; near center south line SW SW sec. 24, T. 15 S., R. 6 E., Morris County, Kansas.



MR-305 = Barneston Limestone (Fort Riley rimrock) at 1,490 ft in pasture on south side of road; one photo; near northeast corner of NE NE sec. 16, T. 16 S., R. 7 E., Morris County, Kansas.



MR-306 = Barneston Limestone (Fort Riley rimrock) at 1,430 ft exposed in stream bank on both sides of bridge; base about 2 ft above water level; upper Fort Riley partially exposed in road and road ditches to east (platy limestone above rimrock with mudrock and massive layers evident within mostly covered interval); one photo; near northeast corner of NE NW sec. 7, T. 16 S., R. 7 E., Morris County, Kansas.



MR-307 = Barneston Limestone (upper part of Fort Riley) at 1,458 ft exposed in road ditch and pond spillway on south side of road; massive, blocky layer approximately 0.8 ft thick with vugs and high skeletal content and crystalline calcite, platy limestone above in spillway and silty limestone below massive limestone; two photos; near northeast corner of NE NE sec. 7, T. 16 S., R. 7 E., Morris County, Kansas.



MR-308 = Winfield Limestone (Cresswell) at 1,482 ft exposed in road ditch on west side of road; abundant large calcite geodes; two photos; near center of east line sec. 17, T. 16 S., R. 7 E., Morris County, Kansas.



MR-309 = Winfield Limestone (Stovall) at 1,535 ft exposed in road ditch in southwest corner of intersection; one photo; northeast corner of sec. 26, T. 16 S., R. 6 E., Morris County, Kansas.



MR-382 = Kansas Department of Transportation Core **CH-1** on U.S. Highway 56 right-of-way, north side of highway, west of county road; Winfield Limestone (Cresswell) near the surface at 1,494 ft; one photo; SE SE SE sec. 18, T. 16 S., R. 7 E., Morris County, Kansas.



KANSAS DEPARTMENT OF TRANSPORTATION



RTE./CO.	56-Morris	SOUNDING NO.	CH-1	SHEET 1 of 2
		PROJ. NO.	xxxx	BRIDGE NO.
SITE NAME	US-56, KGS Core Holes			
GEOLOGIST	K. Halverson, G.A.	SCALE	1 inch = 5.0 feet	DATE
				November 14, 2011
DRILLER	J. Burns	RIG TYPE	CME 55	TOP HOLE ELEV.
				1500.0
GW ELEV.	N/A	TOTAL DEPTH	18.6	M/B ELEV.
				1494.2

Bit Type	GEOLOGIC NAME	STRATIGRAPHIC COLUMN	DEPTH	ELEVATION	CLASSIFICATION OF MATERIALS DESCRIPTION AND REMARKS	UNCONFINED COMPRESSION (TSF)	ELASTIC MODULUS (PSF)	N60 COUNT (SPT)	ELEVATION
NQ2 Diamond	Cresswell Limestone Mbr.		5.8	1494.2	Limestone, gray to brownish gray, porous, calcite on pores, very closely fractured, weathered, hard to very hard				
			6.9	1493.1	Shale, limy, tan, very closely fractured, hard, sandy				
			8.6	1491.4	Shale, tan, sandy, very closely fractured, poor bedding structure, occasional geode, @ 12.8 became porous				
			13.6	1486.4	Cresswell calcite filled vugs, small geodes, tan buff colored				
			18.6	1481.4	T.D. = 18.6				

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KANSAS DEPARTMENT OF TRANSPORTATION

RTE./CO.	56-Morris	SOUNDING NO.	CH-1	SHEET 2 of 2
		PROJ. NO.	xxxx	BRIDGE NO.
SITE NAME	US-56, KGS Core Holes			

Bit Type	GEOLOGIC NAME	STRATIGRAPHIC COLUMN	DEPTH	ELEVATION	CLASSIFICATION OF MATERIALS DESCRIPTION AND REMARKS	UNCONFINED COMPRESSION (TSF)	ELASTIC MODULUS (PSF)	N60 COUNT (SPT)	ELEVATION																																		
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Total	18.6	1481.4	12.6	11.0	87	53%																																					

BOREHOLE REPORT - KANSAS DOT.GDT - 1/4/12 08:22 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINT\PROJECTS\56_KGS BORINGS.GPJ

MR-383 = Kansas Department of Transportation Core **CH-2** on U.S. Highway 56 right-of-way, north side of highway; Doyle Shale (Holmesville) near the surface at 1,512 ft; one photo; SE SE SW sec. 17, T. 16 S., R. 7 E., Morris County, Kansas.



KANSAS DEPARTMENT OF TRANSPORTATION



RTE./CO.	56-Morris	SOUNDING NO.	CH-2	SHEET 1 of 2	
		PROJ. NO.	xxxx	BRIDGE NO.	
SITE NAME	US-56, KGS Core Holes				
GEOLOGIST	K. Halverson, G.A.	SCALE	1 inch = 5.0 feet	DATE	November 14, 2011
DRILLER	J. Burns	RIG TYPE	CME 55	TOP HOLE ELEV.	1521.0
GW ELEV.	N/A	TOTAL DEPTH	27.8	M/B ELEV.	1511.9

Bit Type	GEOLOGIC NAME	STRATIGRAPHIC COLUMN	DEPTH	ELEVATION	CLASSIFICATION OF MATERIALS DESCRIPTION AND REMARKS	UNCONFINED COMPRESSION (TSF)	ELASTIC MODULUS (PSF)	N60 COUNT (SPT)	ELEVATION
BOREHOLE REPORT - KANSAS DOT.GDT - 1/4/12 08:22 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINT\PROJECTS\US 56, KGS BORINGS.GPJ 8" Hollow Augers N02 Diamond	Soil Mantle		1520	1521.0	Silty Clay, brown to reddish brown, soft to firm, moist				
			1515						
	Holmesville Shale Mbr.		9.1	1511.9	Shale, olive green, weathered, hard to medium hard,				
	Fort Riley Limestone Mbr.		12.6	1508.4	Limestone, gray, very hard				
			13.3	1507.7	Limestone, gray, weathered, very closely fractured, very hard, occasional verticle fracture, clay infill in fractures, porus				
			14.6	1506.4	Shale, tan to olive green, limy, very closely fractured, weathered, hard				
			14.8	1506.2					
			15.9	1505.1	Graded to sandy Shale, tan, very closely fractured, weathered, hard				
			17.9	1503.1	Shale, greenish gray with thin zones of maroon, very closely fractured, hard, non-weathered, @ 17.0 occasional verticle fracture, clayey				
			18.0	1503.1	Limestone, brownish gray, very closely to closely fractured, clay infilling in fractures, very hard, occasional solution voids @ 18.0-18.8 and @21.1-22.3, shaly, possible chert or secondary phosphate infill in fractures				
			23.0	1498.0					
			23.4	1497.6	Shale, light gray, medium hard, very closely fractured, weathered				
			23.4	1497.6	Limestone, brownish gray, weathered, very closely fractured, clay infill in fractures, hard, slightly porus(solution derived)				
	27.8	1493.2	T.D. = 27.8						



KANSAS DEPARTMENT OF TRANSPORTATION

RTE./CO.	56-Morris	SOUNDING NO.	CH-2
		PROJ. NO.	xxxx
SITE NAME		US-56, KGS Core Holes	
		SHEET 2 of 2	
		BRIDGE NO.	

Bit Type	GEOLOGIC NAME	STRATIGRAPHIC COLUMN	DEPTH	ELEVATION	CLASSIFICATION OF MATERIALS DESCRIPTION AND REMARKS	UNCONFINED COMPRESSION (TSF)	ELASTIC MODULUS (PSF)	N60 COUNT (SPT)	ELEVATION																																									
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Core	Depth	Elev.	Cut	Rec	Rec %	RQD																																												
1	13.3	1507.7	2.6	2.4	92	0%																																												
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4	22.8	1498.2	5.0	1.7	34	0%																																												
Total	27.8	1493.2	14.5	10.9	75	18%																																												

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MR-384 = Kansas Department of Transportation Core **CH-3** on U.S. Highway 56 right-of-way, north side of highway; Doyle Shale (Holmesville) near the surface at 1,517 ft; one photo; SW SE SW sec. 17, T. 16 S., R. 7 E., Morris County, Kansas.



KANSAS DEPARTMENT OF TRANSPORTATION



RTE./CO.	56-Morris	SOUNDING NO.	CH-3	SHEET 1 of 2	
		PROJ. NO.	xxxx	BRIDGE NO.	
SITE NAME	US-56, KGS Core Holes				
GEOLOGIST	K. Halverson, G.A.	SCALE	1 inch = 5.0 feet	DATE	November 14, 2011
DRILLER	J. Burns	RIG TYPE	CME 55	TOP HOLE ELEV.	1523.0
GW ELEV.	N/A	TOTAL DEPTH	18.6	M/B ELEV.	1516.5

Bit Type	GEOLOGIC NAME	STRATIGRAPHIC COLUMN	DEPTH	ELEVATION	CLASSIFICATION OF MATERIALS DESCRIPTION AND REMARKS	UNCONFINED COMPRESSION (TSF)	ELASTIC MODULUS (PSF)	N60 COUNT (SPT)	ELEVATION
8" Hollow Augers	Soil Mantle			1523.0	Silty Clay, brown, moist, firm				
			6.5	1516.5	Shale, olive green to brown, sandy, hard to medium hard				
NO2 Diamond	Holmesville Shale Mbr.		1	1513.0	Shale, olive green, very closely to closely fractured, non-weathered, sandy, clay infill in fractures				
			2	1510					
			13.2 13.6	1509.8 1509.4	Shale became tan to olive green, sandy, slightly weathered, hard to medium hard, very closely fractured, limy				
Fort Riley Limestone Mbr.			3	1507.4	Limestone, gray, very hard, well cemented, very closely fractured, non-weathered, shaly, @ 14.3 became slightly porous (solution derived)				
				1504.4	Shale, limy, greenish gray to olive green, slightly weathered, very closely fractured, hard, clay infill in fractures				
			18.6	1504.4	T.D. = 18.6				

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KANSAS DEPARTMENT OF TRANSPORTATION

RTE./CO.	56-Morris	SOUNDING NO.	CH-3
		PROJ. NO.	xxxx
SITE NAME		US-56, KGS Core Holes	
		SHEET 2 of 2	
		BRIDGE NO.	

Bit Type	GEOLOGIC NAME	STRATIGRAPHIC COLUMN	DEPTH	ELEVATION	CLASSIFICATION OF MATERIALS DESCRIPTION AND REMARKS	UNCONFINED COMPRESSION (TSF)	ELASTIC MODULUS (PSF)	N60 COUNT (SPT)	ELEVATION																																		
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MR-385 = Kansas Department of Transportation Core **CH-4** on U.S. Highway 56 right-of-way, north side of highway; Barneston Limestone (Fort Riley) near the surface at 1,503 ft; one photo; SE SW SW sec. 17, T. 16 S., R. 7 E., Morris County, Kansas.



KANSAS DEPARTMENT OF TRANSPORTATION



RTE./CO.	56-Morris	SOUNDING NO.	CH-4	SHEET 1 of 2
		PROJ. NO.	xxxx	BRIDGE NO.
SITE NAME	US-56, KGS Core Holes			
GEOLOGIST	K. Halverson, G.A.	SCALE	1 inch = 5.0 feet	DATE
				November 15, 2011
DRILLER	J. Burns	RIG TYPE	CME 55	TOP HOLE ELEV.
				1514.0
GW ELEV.	N/A	TOTAL DEPTH	18.0	M/B ELEV.
				1503.2

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Bit Type	GEOLOGIC NAME	STRATIGRAPHIC COLUMN	DEPTH	ELEVATION	CLASSIFICATION OF MATERIALS DESCRIPTION AND REMARKS	UNCONFINED COMPRESSION (TSF)	ELASTIC MODULUS (PSF)	N60 COUNT (SPT)	ELEVATION
8" Hollow Augers	Soil Mantle		7.5	1514.0	Silty Clay, dark brown, moist, firm to soft				
			8.0	1506.5		Limestone boulder (Float), very hard			
NO2 Diamond	Fort Riley Limestone Mbr.		10.8	1506.0	Silty Clay, brown moist, firm				
			11.0	1503.2	Shale, weathered, olive green, hard to medium hard				
			11.2	1503.0	Limestone, very hard, non-weathered				
			13.4	1502.8	Limestone, shaly, slightly weathered, very closely fractured, clay infill in fractures, gray to brownish gray, slightly porous				
			17.8	1500.6	Limestone, gray, weathered, very closely fractured, clay infill in fractures, very shaly, solution pores abundant @14-17.8				
			18.0	1496.2	Shale, tan, sandy, medium hard				
				1496	T.D. = 18				



KANSAS DEPARTMENT OF TRANSPORTATION

RTE./CO.	56-Morris	SOUNDING NO.	CH-4
		PROJ. NO.	xxxx
SITE NAME		US-56, KGS Core Holes	
		SHEET 2 of 2	
		BRIDGE NO.	

Bit Type	GEOLOGIC NAME	STRATIGRAPHIC COLUMN	DEPTH	ELEVATION	CLASSIFICATION OF MATERIALS DESCRIPTION AND REMARKS	UNCONFINED COMPRESSION (TSF)	ELASTIC MODULUS (PSF)	N60 COUNT (SPT)	ELEVATION																											
					<table border="1" style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th>Core</th> <th>Depth</th> <th>Elev.</th> <th>Cut</th> <th>Rec</th> <th>Rec %</th> <th>RQD</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>11.2</td> <td>1502.8</td> <td>2.2</td> <td>1.0</td> <td>45</td> <td>0%</td> </tr> <tr> <td>2</td> <td>13.4</td> <td>1500.6</td> <td>4.6</td> <td>2.6</td> <td>57</td> <td>15%</td> </tr> <tr> <td>Total</td> <td>18</td> <td>1496.0</td> <td>6.8</td> <td>3.6</td> <td>53</td> <td>10%</td> </tr> </tbody> </table>	Core	Depth	Elev.	Cut	Rec	Rec %	RQD	1	11.2	1502.8	2.2	1.0	45	0%	2	13.4	1500.6	4.6	2.6	57	15%	Total	18	1496.0	6.8	3.6	53	10%			
Core	Depth	Elev.	Cut	Rec	Rec %	RQD																														
1	11.2	1502.8	2.2	1.0	45	0%																														
2	13.4	1500.6	4.6	2.6	57	15%																														
Total	18	1496.0	6.8	3.6	53	10%																														

BOREHOLE REPORT - KANSAS DOT.GDT - 1/4/12 08:22 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINT\PROJECTS\US 56, KGS BORINGS.GPJ

MR-386 = Kansas Department of Transportation Core **CH-5** on U.S. Highway 56 right-of-way, north side of highway; Odell Shale near the surface at 1,505 ft; one photo; SW SW SW sec. 17, T. 16 S., R. 7 E., Morris County, Kansas.



KANSAS DEPARTMENT OF TRANSPORTATION



RTE./CO.	56-Morris	SOUNDING NO.	CH-5	SHEET 1 of 2
		PROJ. NO.	xxxx	BRIDGE NO.
SITE NAME	US-56, KGS Core Holes			
GEOLOGIST	K. Halverson, G.A.	SCALE	1 inch = 5.0 feet	DATE
DRILLER	J. Burns	RIG TYPE	CME 55	TOP HOLE ELEV.
GW ELEV.	N/A	TOTAL DEPTH	23.0	M/B ELEV.
				1511.0
				1504.5

	Bit Type	GEOLOGIC NAME	STRATIGRAPHIC COLUMN	DEPTH	ELEVATION	CLASSIFICATION OF MATERIALS DESCRIPTION AND REMARKS	UNCONFINED COMPRESSION (TSF)	ELASTIC MODULUS (PSF)	N60 COUNT (SPT)	ELEVATION
BOREHOLE REPORT - KANSAS DOT GDT - 1/4/12 08:22 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\PROJECTS\US 56 KGS BORINGS.GPJ	NQ2 Diamond	8" Hollow Augers	Soil Mantle		1510	Silty Clay, brown, moist, firm to soft				
			Odell Shale	6.5	1504.5	Shale, weathered, dark green, medium hard, poor structure				
			Odell Shale	9.8	1501.2	Shale, weathered, tan, sandy, medium hard to hard				
			Odell Shale	10.5	1500.5	Limestone, very hard, non-weathered				
			Odell Shale	11.0	1500.0	Limestone, gray to brownish gray, shaly, slightly weathered, very closely fractured, porous (solution derived), clay infill in fractures, hard				
			Cresswell Limestone Mbr.	13.8	1497.2	Limestone, weathered, brownish gray, very closely fractured, calcite geodes in pores, hard to very hard, caly infill in fractures, @15.6-16.2 Shale seam, weathered, tan, sandy, poor structure, medium hard, limy				
			Cresswell Limestone Mbr.	18.8	1492.2	Shale, tan, limy, very closely fractured, calcite geode nodules, hard, sandy,				
			Cresswell Limestone Mbr.	19.5	1491.5	Limestone, slightly porous, gray, very hard, very closely fractured, non-weathered				
			Cresswell Limestone Mbr.	23.0	1488	T.D. = 23				



KANSAS DEPARTMENT OF TRANSPORTATION

RTE./CO.	56-Morris	SOUNDING NO.	CH-5
		PROJ. NO.	xxxx
SHEET 2 of 2		BRIDGE NO.	
SITE NAME: US-56, KGS Core Holes			

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Bit Type	GEOLOGIC NAME	STRATIGRAPHIC COLUMN	DEPTH	ELEVATION	CLASSIFICATION OF MATERIALS DESCRIPTION AND REMARKS	UNCONFINED COMPRESSION (TSF)	ELASTIC MODULUS (PSF)	N60 COUNT (SPT)	ELEVATION																																		
					<table border="1" style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th>Core</th> <th>Depth</th> <th>Elev.</th> <th>Cut</th> <th>Rec</th> <th>Rec %</th> <th>RQD</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>11.0</td> <td>1500.0</td> <td>2.8</td> <td>1.9</td> <td>68</td> <td>0%</td> </tr> <tr> <td>2</td> <td>13.8</td> <td>1497.2</td> <td>5.0</td> <td>3.0</td> <td>60</td> <td>18%</td> </tr> <tr> <td>3</td> <td>18.8</td> <td>1492.2</td> <td>4.2</td> <td>2.0</td> <td>48</td> <td>0%</td> </tr> <tr> <td>Total</td> <td>23</td> <td>1488.0</td> <td>12.0</td> <td>6.9</td> <td>57</td> <td>7%</td> </tr> </tbody> </table>	Core	Depth	Elev.	Cut	Rec	Rec %	RQD	1	11.0	1500.0	2.8	1.9	68	0%	2	13.8	1497.2	5.0	3.0	60	18%	3	18.8	1492.2	4.2	2.0	48	0%	Total	23	1488.0	12.0	6.9	57	7%			
Core	Depth	Elev.	Cut	Rec	Rec %	RQD																																					
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2	13.8	1497.2	5.0	3.0	60	18%																																					
3	18.8	1492.2	4.2	2.0	48	0%																																					
Total	23	1488.0	12.0	6.9	57	7%																																					

MR-387 = Spring in pasture approximately 500 ft east of road; two photos; NW NW SW sec. 17, T. 16 S., R. 7 E., Morris County, Kansas.



COUNCIL GROVE LAKE QUADRANGLE – MORRIS COUNTY

Field work was conducted February–May 2009.

MR-172 = Fort Riley rimrock at 1,402 ft in roadcuts on both sides of U.S. Highway 56 west of Council Grove, Kansas; two photos, scale in exposure on south side, no scale in exposure on north side; approximately 100 ft east of northwest corner sec. 20, T. 16 S., R. 8 E., Morris County, Kansas.



MR-173 = Base of Barneston Limestone (Florence) at 1,372 ft in roadcut on north side of U.S. Highway 56 west of Council Grove, Kansas; one photo; near southeast corner sec. 17, T. 16 S., R. 8 E., Morris County, Kansas.



MR-176 = Fort Riley rimrock at 1,393 ft in road and fields on both sides of road; one photo; approximately 400 ft west of northeast corner sec. 25, T. 16 S., R. 7 E., Morris County, Kansas.



MR-178 = Fort Riley rimrock at 1,461 ft in road and field east of road; one photo; approximately 100 ft south of center of west line NW sec. 13, T. 16 S., R. 7 E., Morris County, Kansas.



MR-179 = Fort Riley rimrock at 1,385 ft in road and fields on both sides of road; one photo; approximately 100 ft east of northwest corner sec. 18, T. 16 S., R. 8 E., Morris County, Kansas.



MR-180 = Fort Riley rimrock at 1,385 ft in roadcut on west side of road with Oketo and Fort Riley exposed on the east side of road; four photos: 1 – thin limestone in the Oketo, 2 – from the upper part of the Florence to the thin limestone in the Oketo, 3 – the upper Oketo and lower Fort Riley, 4 – the Fort Riley rimrock; approximately 4,100 ft east and 1,100 ft north of southwest corner sec. 7, T. 16 S., R. 8 E., Morris County, Kansas.



MR-181 = Fort Riley rimrock at 1,385 ft in road and fields on both sides of road; one photo of the good exposure on the east side of road; approximately 4,100 ft east and 2,200 ft north of southwest corner sec. 6, T. 16 S., R. 8 E., Morris County, Kansas.



MR-182 = Base of Barneston Limestone (Florence) at 1,440 ft in road and roadcut on east side of road; one photo; approximately 400 ft north of southwest corner sec. 31, T. 15 S., R. 7 E., Morris County, Kansas.



MR-183 = Base of Schroyer Limestone Member, Wreford Limestone at 1,380 ft with greenish gray mudrock below in road ditch on east side of road; bedded chert here is unlike the more nodular chert in the Florence; one photo; approximately 1,650 ft south of northwest corner sec. 31, T. 15 S., R. 8 E., Morris County, Kansas.



MR-184 = Base of Wreford Limestone (Threemile) at 1,340 ft on east side of road with upper Speiser Shale; including the thin limestone in the Speiser; lower Speiser Shale is covered; an excellent exposure; two photos; approximately 500 ft north of southeast corner sec. 25, T. 15 S., R. 7 E., Morris County, Kansas.



MR-185 – Excellent exposure of Funston Limestone at 1,310 ft with Blue Rapids Shale below in south facing bank of Gilmore Creek; two photos; approximately 800 ft north and 200 ft west of southwest corner sec. 30, T. 15 S., R. 7 E., Morris County, Kansas.



MR-187 (near MMW-15) = Kinney Limestone Member at 1,311 ft in drainage below spillway of City Reservoir with Blue Springs (variegated mudrocks) above and the Wymore (variegated mudrocks) below approximately 200 yards downstream below the Kinney; one photo; about 300 ft east and 200 ft north of center NW NW sec. 8, T. 16 S., R. 8 E., Morris County, Kansas.



MR-188 = Fort Riley rimrock at 1,407 ft in road and fields on both sides of road; one photo; approximately 3,000 ft north and 2,500 ft west of southwest corner sec. 18, T. 16 S., R. 8 E., Morris County, Kansas.



MR-191 = Top of Wreford Limestone (Schroyer) at 1,300 ft exposed along west side of Council Grove Lake near picnic site 35 in the Canning Creek Cove area; one photo; near center of south line NE NW sec. 4, T. 16 S., R. 8 E., Morris County, Kansas.



MR-192 = Top of Wreford Limestone (Schroyer) at 1,298 ft exposed on the north side of an old, grassy roadcut in the Marina Area of Council Grove Lake; one photo; approximately 350 ft west of southeast corner sec. 4, T. 16 S., R. 8 E., Morris County, Kansas.



MR-193 = Rubble (chert) covered base of Barneston Limestone (Florence) with Blue Springs below estimated at 1,340 ft exposed in a roadcut on the east side of Parkerville Road; one photo; approximately 2,300 ft west and 2,400 ft north of southeast corner sec. 31, T. 15 S., R. 8 E., Morris County, Kansas.



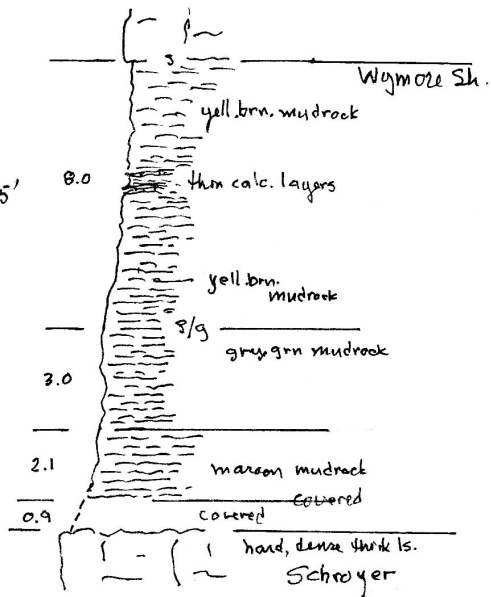
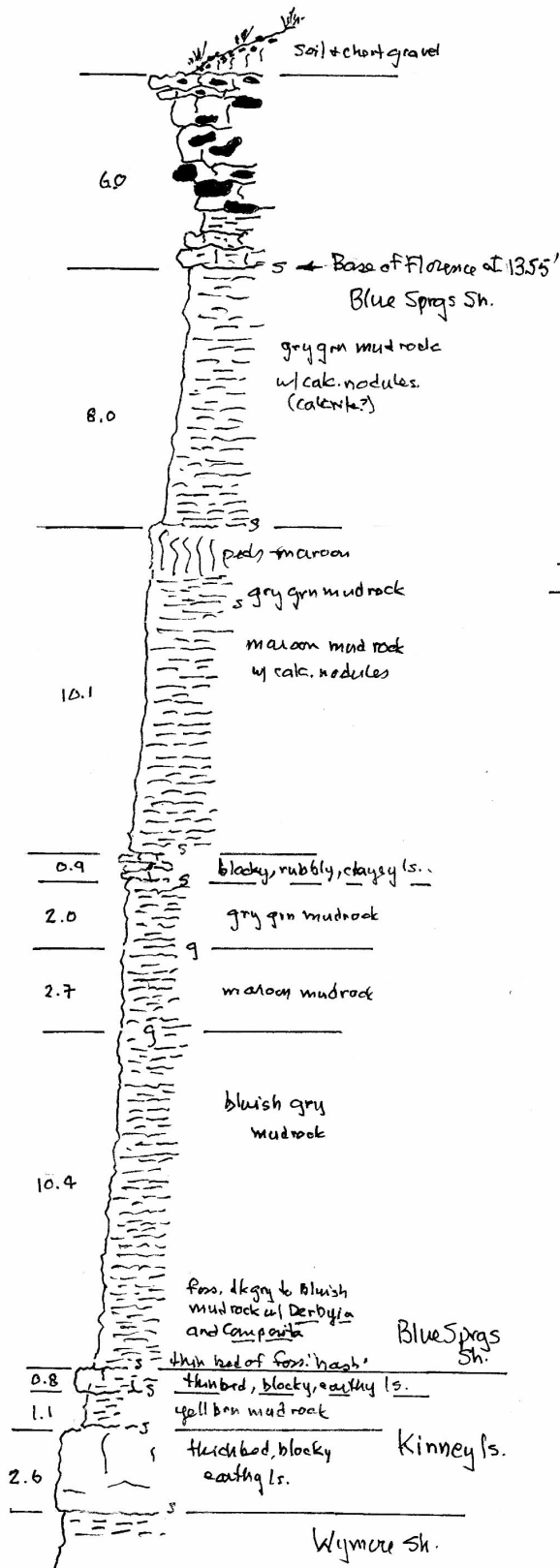
MR-194 = Kinney Limestone Member at 1,320 ft exposed in field and road ditch on southwest side of Parkerville Road; slabs of thick limestone as large as an automobile have been displaced down slope along the northwest bank of small stream on the southwest side of road; one photo; approximately 3,000 ft west and 3,600 ft north of southeast corner sec. 31, T. 15 S., R. 8 E., Morris County, Kansas.



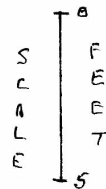
MR-195 = Sequence from the Wreford Limestone (Schroyer) to the Barneston Limestone (Florence) exposed on both sides of Parkerville Road just south of where the road crosses Gilmore Creek; base of the Barneston Limestone (Florence) at 1,355 ft; two photos, one of upper Blue Springs and lower Florence and one of the Kinney; approximately 2,440 ft west and 500 ft north of southeast corner sec. 31, T. 15 S., R. 8 E., Morris County, Kansas. – see graphic section.



SITE MR-195 - COUNCIL GROVE LAKE QUAD. ~ MORRIS CO., KANSAS



s = sharp contact
g = gradational contact



Roadcut exposures on both sides of Parkerville Road; Schroyer to Florence on west side, Wymore to Florence on east side.

MR-196 = MMW-23 = Base of Wreford Limestone (Threemile) with Speiser Shale below at 1,280 ft exposed in north facing bank of Gilmore Creek on the north side of Parkerville Road; two photos; approximately 5,100 ft west and 1,200 ft north of southeast corner sec. 31, T. 15 S., R. 8 E., Morris County, Kansas.



MR-197 = Top of Wreford Limestone (Schroyer) at 1,290 ft in south facing gully at White Memorial Camp; one photo; near center of NE SW SW sec. 34, T. 15 S., R. 8 E., Morris County, Kansas.



MR-198 = Base of Barneston Limestone (Florence) at 1,388 ft in roadcut and hillside on east side of road with gray green mudrock below and reddish mudrock in road; one photo; approximately 500 ft north of southeast corner sec. 17, T. 15 S., R. 8 E., Morris County, Kansas.



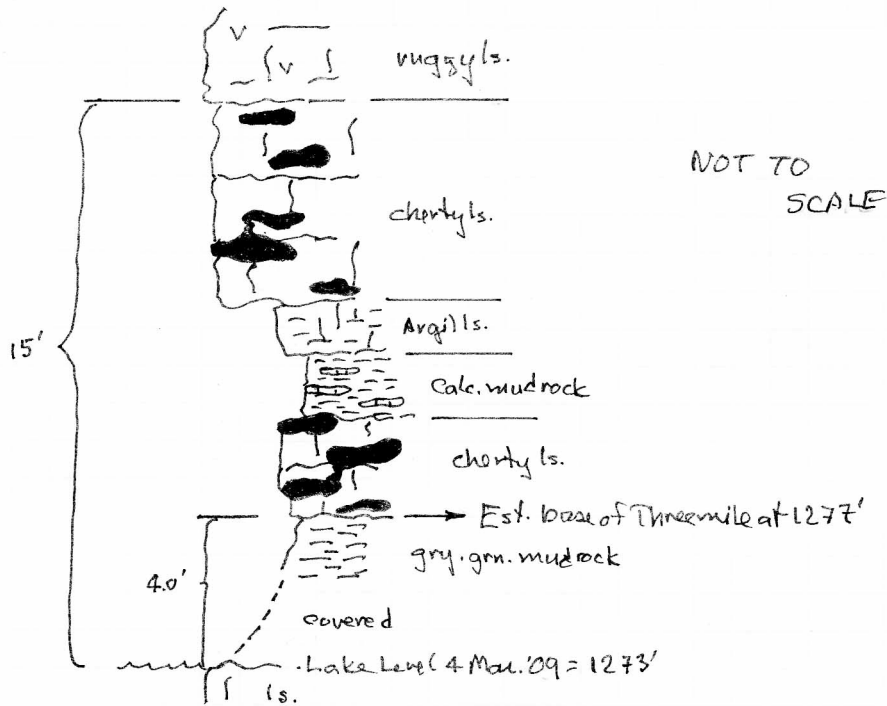
MR-199 = Base of Wreford Limestone (Threemile) at 1,305 ft in road ditch on north side of road; one photo; near center of south line SE NW sec. 20, T. 15 S., R. 8 E., Morris County, Kansas.



MR-200 = Estimated base of Wreford Limestone (Threemile) at 1,277 ft in north facing exposure along the south side of Council Grove Lake just east of the boat ramp; vertical distance from water level (1,273 ft) to the base of thick, massive, vuggy bed of Threemile is 15 ft; two photos, one of the gray green mudrock in the Speiser Shale and one of lower beds of Threemile including the mudrock interval above the basal beds; approximately 200 ft north of center of north half sec. 10, T. 16 S., R. 8 E., Morris County, Kansas.— see graphic section.



SITE MR-200 - COUNCIL GROVE LAKE QUAD. ~ MORRIS CO., KANSAS



MR-202 = Towanda in roadcuts on both side of U.S. Highway 56 west of Council Grove, Kansas; from Kansas Department of Transportation profile the base of the Towanda is at 1,430 ft; one photo of exposure on north side of highway; near center of south line SW SE sec. 13, T. 16 S., R. 7 E., Morris County, Kansas.



MR-203 = Base of Barneston Limestone (Florence) at 1,475 ft in roadcuts on both sides of U.S. Highway 56 west of Council Grove, Kansas; apparent dip of limestone beds is approximately 6° east; three photos, two of the exposure on south side of highway and one of exposure on north side; near center of south line SE SW SW sec. 14, T. 16 S., R. 7 E., Morris County, Kansas.



MR-204 = Fort Riley rimrock at 1,430 ft in road and road ditch on the west side of road; one photo; near center of east line sec. 1, T. 16 S., R. 7 E., Morris County, Kansas.



MR-205 = Near base of the Barneston Limestone (Florence) at 1,425 ft in road ditch on west side of road; spring from the base of the Barneston on east side of road; two photos, one of exposure and one of spring; near center of east line NE NE sec. 1, T. 16 S., R. 8 E., Morris County, Kansas.



MR-206 = Top of Wreford Limestone (Schroyer) at 1,337 ft in ditch on west side of road; one photo; about 1,100 ft south of center of north line sec. 30, T. 15 S., R. 8 E., Morris County, Kansas.



MR-207 = Base of Wreford Limestone (Threemile) at 1,360 ft in road ditch on south side of road; one photo; near center of north line NW NW NE sec. 36, T. 15 S., R. 7 E., Morris County, Kansas.



MR-208 = Top of Wreford Limestone (Schroyer) at 1,392 ft in road ditch on north side of road; one photo; near center of south line SW SE SE sec. 26, T. 15 S., R. 7 E., Morris County, Kansas.



MR-209 = Base of Barneston Limestone (Florence) at 1,460 ft on southeast side of road; one photo; approximately 300 ft south and 200 ft east of center SE SW sec. 26, T. 15 S., R. 7 E., Morris County, Kansas.



MR-210 = Base of Wreford Limestone (Threemile) at 1,320 ft in road ditch on east side of road; one photo; near center of west line SW SW sec. 18, T. 15 S., R. 8 E., Morris County, Kansas.



COUNCIL GROVE QUADRANGLE – MORRIS COUNTY

Field work was conducted February–May 2009.

MR-116 = MMW-17 = Top of Wreford Limestone (Schroyer) at 1,308 ft in roadcut on west side of Kansas Highway 177 north of Council Grove, Kansas; also exposed on east side of highway; two photos; near center of north line SE SW SW sec. 23, T. 15 S., R. 8 E., Morris County, Kansas.



MR-117 = Kinney (Matfield Shale) at 1,338 ft in hillside on south side of road; one photo; near center of the north line NW NE sec. 23, T. 15 S., R. 8 E., Morris County, Kansas.



MR-118 = Top of Wreford Limestone (Schroyer) at 1,300 ft in drainage on south side of road; one photo; approximately 100 ft east of center of west line SE NW NE sec. 23, T. 15 S., R. 8 E., Morris County, Kansas.



MR-119 = MMW-19 = Top of Wreford Limestone (Schroyer) at 1,303 ft in roadcut on west side of Kansas Highway 177 north of Council Grove, Kansas; one photo; also exposed on east side of highway; near old road where MMW-19 was measured and described; near center of east line SW NW sec. 35, T. 15 S., R. 8 E., Morris County, Kansas.



MR-120 = Top of Wreford Limestone (Schroyer) at 1,321 ft in roadcut on east side of Kansas Highway 177 north of Council Grove, Kansas; one photo; near MMW-21; near center SW SE sec. 2, T. 16 S., R. 8 E., Morris County, Kansas.



MR-121 = Base of Barneston Limestone (Florence) at 1,380 ft in hillside on east side of road; one photo; near center of south line SW sec. 29, T. 15 S., R. 9 E., Morris County, Kansas.



MR-122 = Top of Wreford Limestone (Schroyer) at 1,335 ft in road and field north of road; one photo; near center of south line SE SW SE sec. 1, T. 16 S., R. 8 E., Morris County, Kansas.



MR-123 = Covered base of Barneston Limestone (Florence) estimated at 1,445 ft in road ditch on north side of road; underlying mudrock of Blue Springs in place; one photo; center south line SW SE sec. 21, T. 15 S., R. 9 E., Morris County, Kansas.



MR-124 = Top of Wreford Limestone (Schroyer) at 1,360 ft in ditch on east side of road; one photo; about 200 ft south of center of west line SW NW sec. 10, T. 16 S., R. 9 E., Morris County, Kansas.



MR-125 = Base of Barneston Limestone (Florence) at 1,420 ft in roadcut on north side of road; one photo; approximately 350 ft east of southwest corner sec. 4, T. 16 S., R. 9 E., Morris County, Kansas.



MR-126 = Top of Wreford Limestone (Schroyer) at 1,361 ft in road ditch on east side of road; one photo; about 200 ft south of center of west line SW sec. 4, T. 16 S., R. 9 E., Morris County, Kansas.



MR-127 = Kinney Limestone Member (Matfield Shale) at 1,405 ft in roadcut with a good exposure of Blue Springs above on east side of road; one photo; near center of west line SW SW sec. 4, T. 16 S., R. 9 E., Morris County, Kansas.



MR-128 = Base of Wreford Limestone (Threemile) at 1,330 ft in roadcut on north side of U.S. Highway 56; top of Threemile and lower beds of Havensville exposed on both sides of road just north of intersection with U.S. Highway 56 east of Council Grove, Kansas; four photos: one of base of Wreford Limestone, two of Threemile (one on west and one on east side of road), and one of upper Threemile and lower Havensville on east side of road; southwest corner sec. 9, T. 16 S., R. 9 E., Morris County, Kansas.



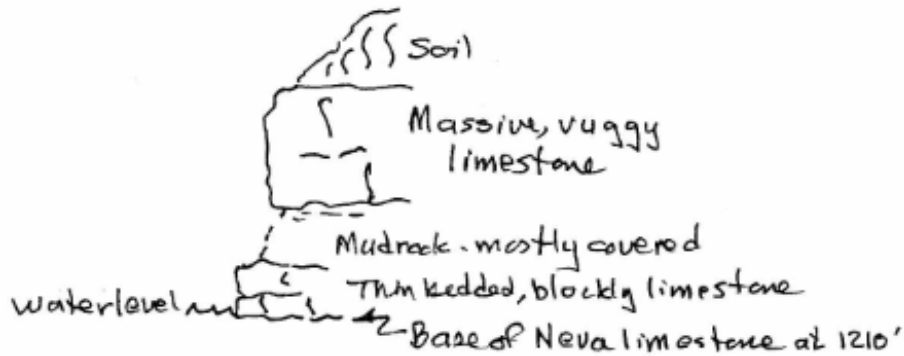
MR-129 = Top of Wreford Limestone (Schroyer, grainstone with oomoldic porosity) at 1,395 ft in road and field to west; one photo; center east line SE SE sec. 34, T. 15 S., R. 9 E., Morris County, Kansas.



MR-144 = Limestone in the Grenola Limestone (Neva) at 1,210 ft exposed in the northeast facing stream bank on the southwest side of road; the conspicuous bed is massive and vuggy overlying a covered interval assumed to be mudrock with two thin beds of limestone below at water level; three photos, third one is of limestone beds at water level; approximately 200 ft east of center of south line SW NE sec. 16, T. 16 S., R. 9 E., Morris County, Kansas. – see graphic section.



SITE MR-144 - COUNCIL GROVE QUAD. - MORRIS CO., KANSAS

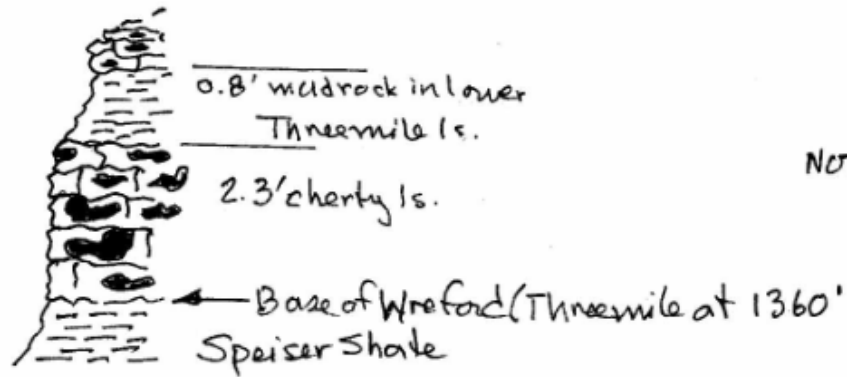


NOT TO SCALE

MR-147 = Base of Wreford Limestone (Threemile) at 1,360 ft in roadcut on the north side of U.S. Highway 56 east of Council Grove, Kansas, with Speiser Shale well exposed below; three photos; center of south line SW sec. 11, T. 16 S., R. 9 E., Morris County, Kansas. – see graphic section.



SITE MR-147- COUNCIL GROVE QUAD, - MORRIS CO., KANSAS



NOT TO SCALE

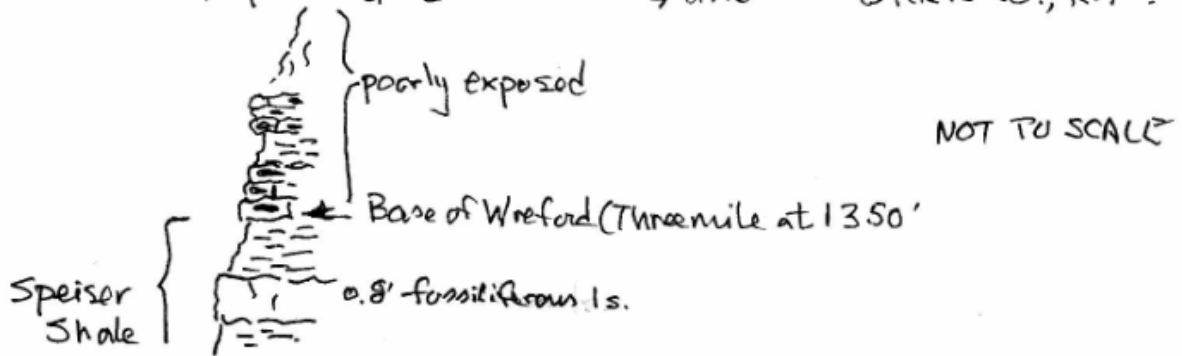
MR-148 = Funston Limestone at 1,335 ft in road and road ditches on both sides of road; one photo; center of west line SW SW NW sec. 14, T. 16 S., R. 9 E., Morris County, Kansas.



MR-149 = Base of Wreford Limestone (Threemile) at 1,350 ft in roadcut on east side of road with 0.8 ft of fossiliferous limestone in the upper Speiser Shale; two photos: one of base of Wreford Limestone and one of fossiliferous limestone in Speiser Shale; center of west line sec. 14, T. 16 S., R. 9 E., Morris County, Kansas. – see graphic section.



SITE MR-149 - COUNCIL GROVE QUAD. - MORRIS CO., KANSAS



MR-150 = Base of Wreford Limestone (Threemile) at 1,350 ft in roadcut on east side of road with fossiliferous limestone in Speiser Shale as at MR-149; one photo; near center of west line SW SW sec. 14, T. 16 S., R. 9 E., Morris County, Kansas.



MR-151 = Crouse Limestone at 1,309 ft in road and ditches on both sides of road; one photo with mudrock and limestone of upper Easley Creek Shale below; center of west line SW NW NW sec. 23, T. 16 S., R. 9 E., Morris County, Kansas.



MR-152 = Crouse Limestone at 1,309 ft in road; similar to limestone at MR-151; one photo near covered base; near center of west line SW NW sec. 26, T. 16 S., R. 9 E., Morris County, Kansas.



MR-153 = Top of the Eiss Limestone Member (Bader Limestone) at 1,279 ft in roadcut on west side of road; two photos: 1 general view and a close-up of recrystallized bellerophontid gastropods in limestone; center of east line NE NE sec. 27, T. 16 S., R. 9 E., Morris County, Kansas.



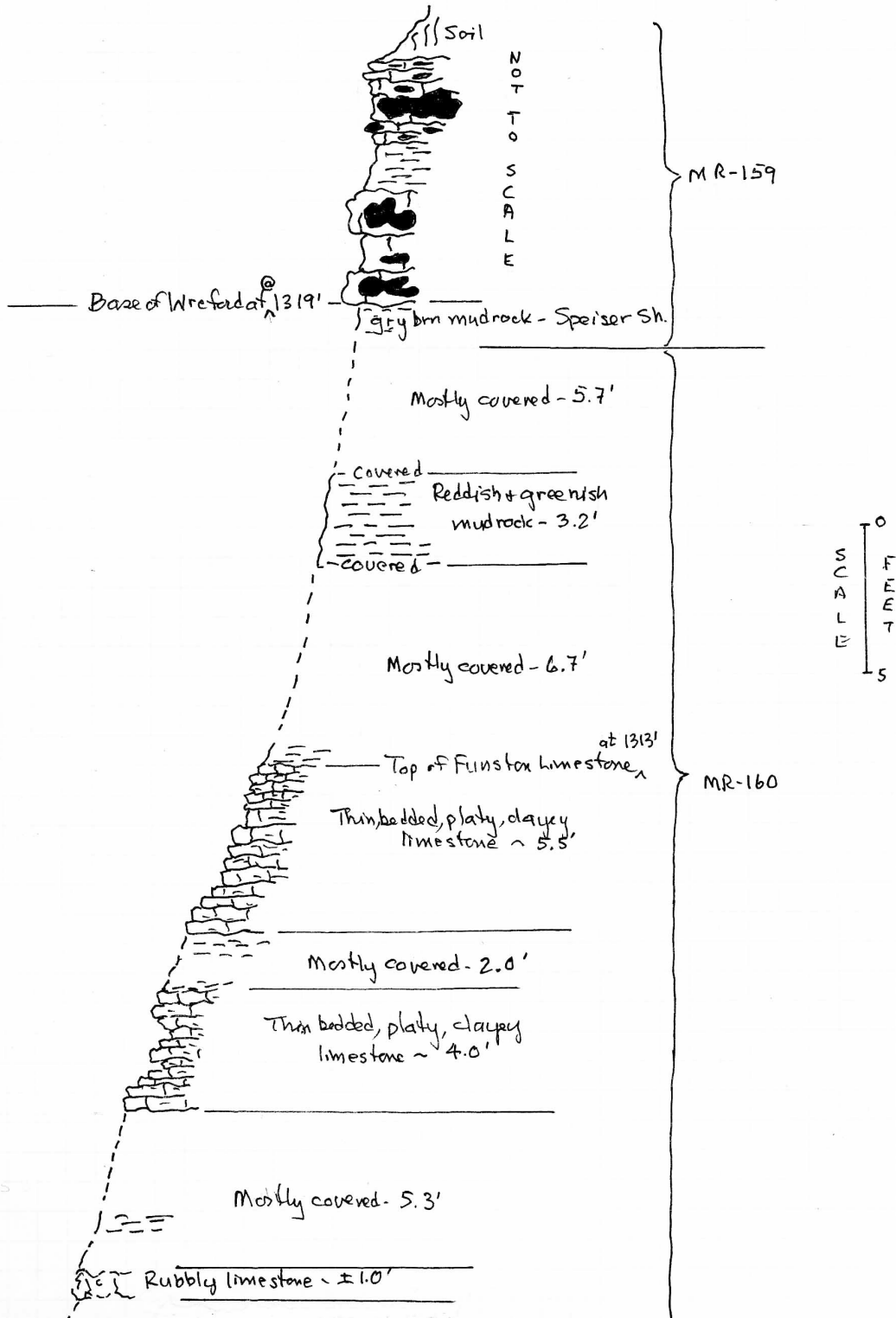
MR-158 = Base of Wreford Limestone (Threemile) at 1,321 ft in roadcut on east side of road with upper Speiser Shale exposed below; one photo; near center of west line SW SW NE sec. 20, T. 16 S., R. 9 E., Morris County, Kansas.



MR-159 = Base of Wreford Limestone (Threemile) at 1,319 ft in roadcut on south side of road with lower Speiser Shale exposed below; upper Speiser Shale covered by chert rubble from Threemile; one photo; near center of north line NW NW SW sec. 20, T. 16 S., R. 9 E., Morris County, Kansas. – see graphic section.



SITES MR-159 + 160 - COUNCIL GROVE QUAD. - MORRIS CO., KANSAS



MR-160 = Base of Funston Limestone at 1,295 ft in ditch on south side of road; four photos from the base to the top of the Funston Limestone; near center of west line NW NW SW sec. 20, T. 16 S., R. 9 E., Morris County, Kansas. – see graphic section in MR-159.



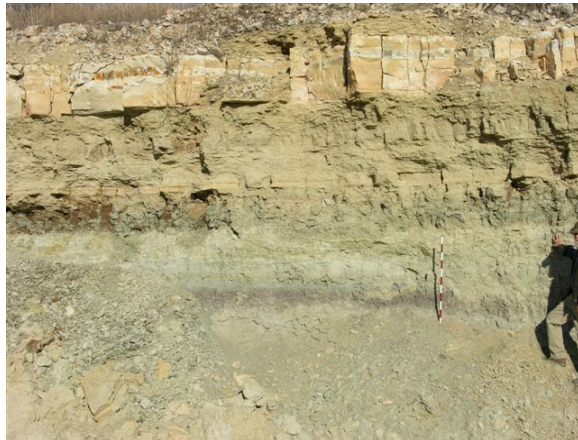
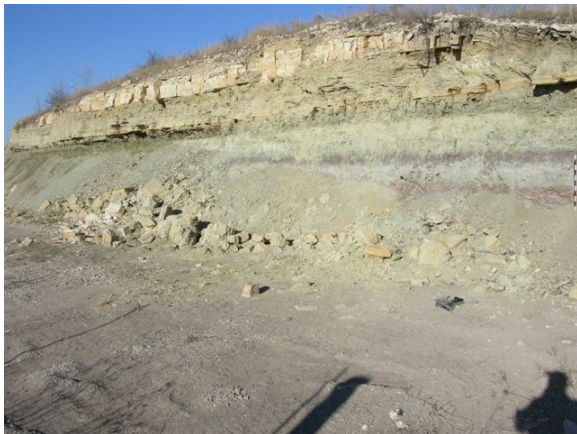
MR-161 = Crouse Limestone (1.5 ft) at 1,267 ft in ditch on south side of road with 3 to 4 ft of yellowish green mudrock below; one photo; approximately 100 ft east of center NE SE sec. 19, T. 16 S., R. 9 E., Morris County, Kansas.



MR-162 = Base of Wreford Limestone (Threemile) at 1,328 ft in ditch on east side of road; one photo; near center of west line NW SW NW sec. 16, T. 16 S., R. 9 E., Morris County, Kansas.



MR-163 = Base of Wreford Limestone (Threemile) at 1,315 ft in west facing exposure with complete (15.7 ft) Speiser Shale below at the Morris County Transfer Station east of Council Grove, Kansas, just north of U.S. Highway 56; two photos; approximately 100 ft north and 200 ft west of center of east line SE SE sec. 7, T. 16 S., R. 9 E., Morris County, Kansas.



MR-164 = Top of 5.5 ft of Funston Limestone at 1,300 ft in north facing exposure; continuation of exposure at MR-163; one photo; approximately 200 ft north of MR-163 in SE SE sec. 7, T. 16 S., R. 9 E., Morris County, Kansas.



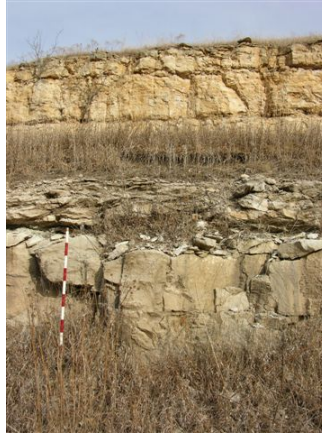
MR-165 = Base of Wreford Limestone (Threemile) at 1,340 ft in roadcut on north side of U.S. Highway 56 east of Council Grove, Kansas; one photo; center of south line SE SW SE sec. 9, T. 16 S., R. 9 E., Morris County, Kansas.



MR-166 = Base of Wreford Limestone (Threemile) at 1,320 ft in roadcut on south side of U.S. Highway 56 east of Council Grove, Kansas; three photos: two of the exposure and one of bedding plane with gypsum crystal molds; approximately 150 ft east of northeast corner sec. 18, T. 16 S., R. 9 E., Morris County, Kansas.

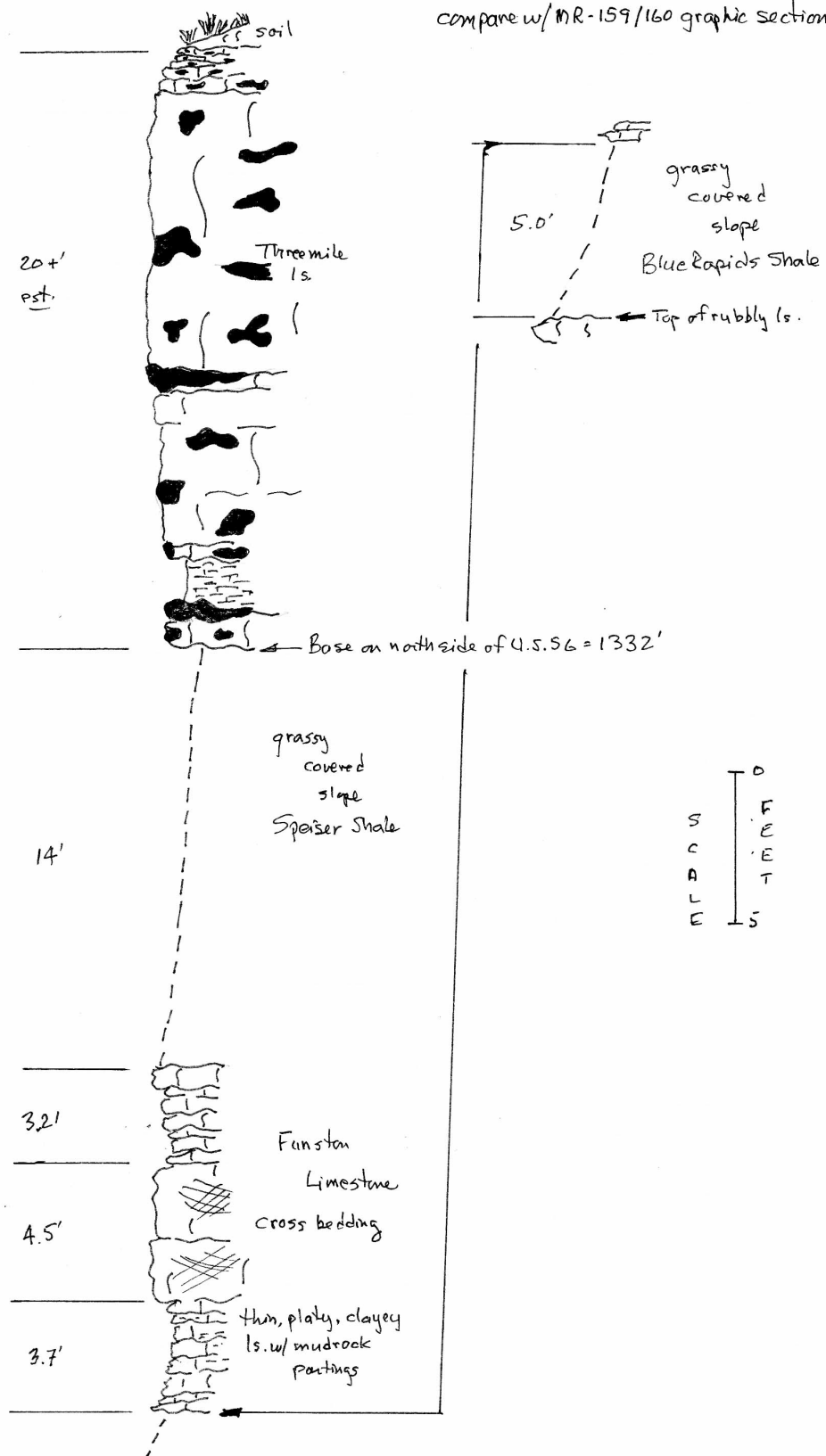


MR-167 (near MMW-25) = Base of Wreford Limestone (Threemile) at 1,315 ft in roadcut on north side of U.S. Highway 56 at east edge of Council Grove, Kansas; sequence from Blue Rapids into Threemile exposed on both sides of U.S. Highway 56; five photos: three of the exposure on north side and two of the Funston Limestone exposed on the south side; approximately 100 ft south of center of the west half NE sec. 13, T. 16 S., R. 9 E., Morris County, Kansas. – see graphic section

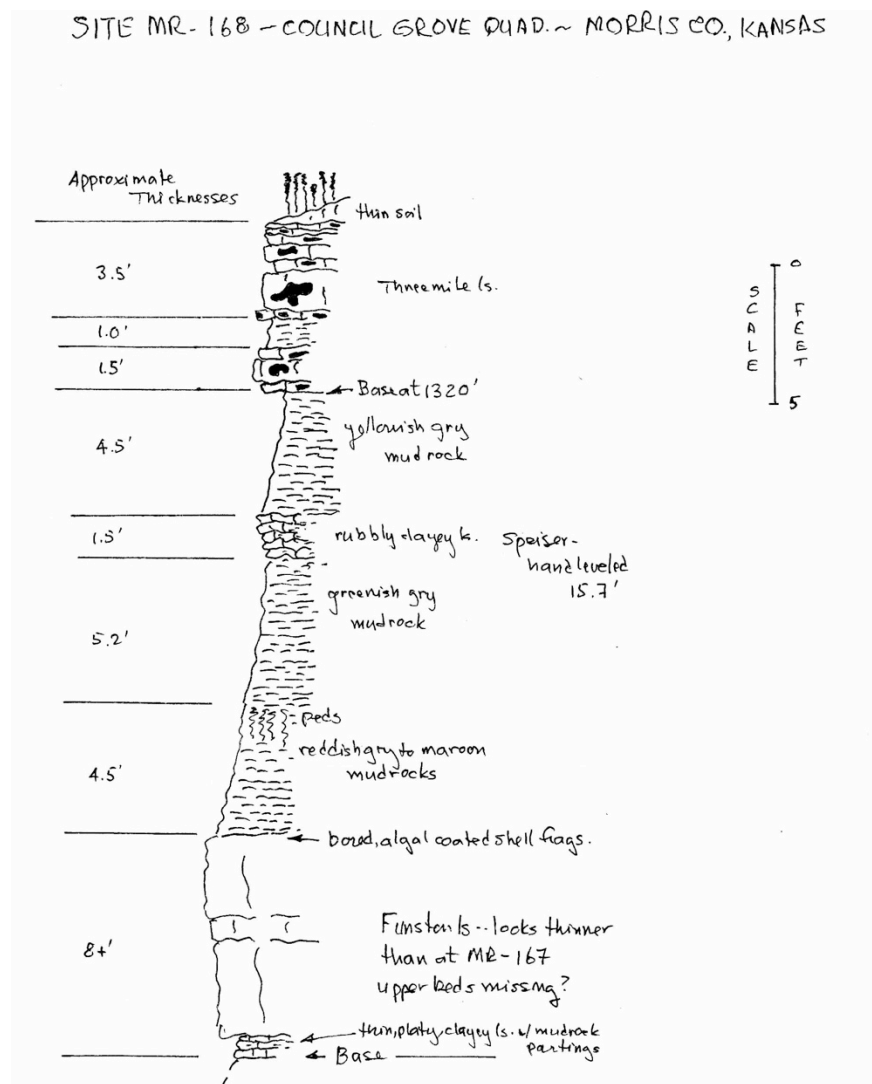


SITE MR-167 ~ COUNCIL GROVE QUAD. ~ MORRIS CO., KANSAS

compare w/ MR-159/160 graphic section



MR-168 (near MMW-24) = Base of Wreford Limestone (Threemile) at 1,295 ft in roadcut on east side of Kansas Highway 177/57 south of Council Grove, Kansas, with 15.7 ft of Speiser Shale below and Funston Limestone on west side of highway; two photos; near center NW SW SE sec. 23, T. 16 S., R. 8 E., Morris County, Kansas. - see graphic section.



MR-169 = Base of Funston Limestone at 1,280 ft in ditch on west side of road; one photo; approximately 100 ft east of center NW NE sec. 23, T. 16 S., R. 8 E., Morris County, Kansas.



MR-170 = Base of Wreford Limestone (Threemile) at 1,310 ft in ditch on west side of road with Speiser Shale below; limestone in upper Speiser Shale is thicker here and weathers into thin sheets; one photo; approximately 200 ft north of center of west half NE sec. 23, T. 16 S., R. 8 E., Morris County, Kansas.



Note: Sections MMW-20, 24, and 26 are located between MR-168 and MR-170.

MR-171 (near MMW-27) = Top of Crouse Limestone at 1,250 ft in roadcut on both sides of Kansas Highway 177/57 south of Council Grove, Kansas; one photo of exposure on west side of highway; near center of NE NW NE sec. 23, T. 16 S., R. 8 E., Morris County, Kansas.



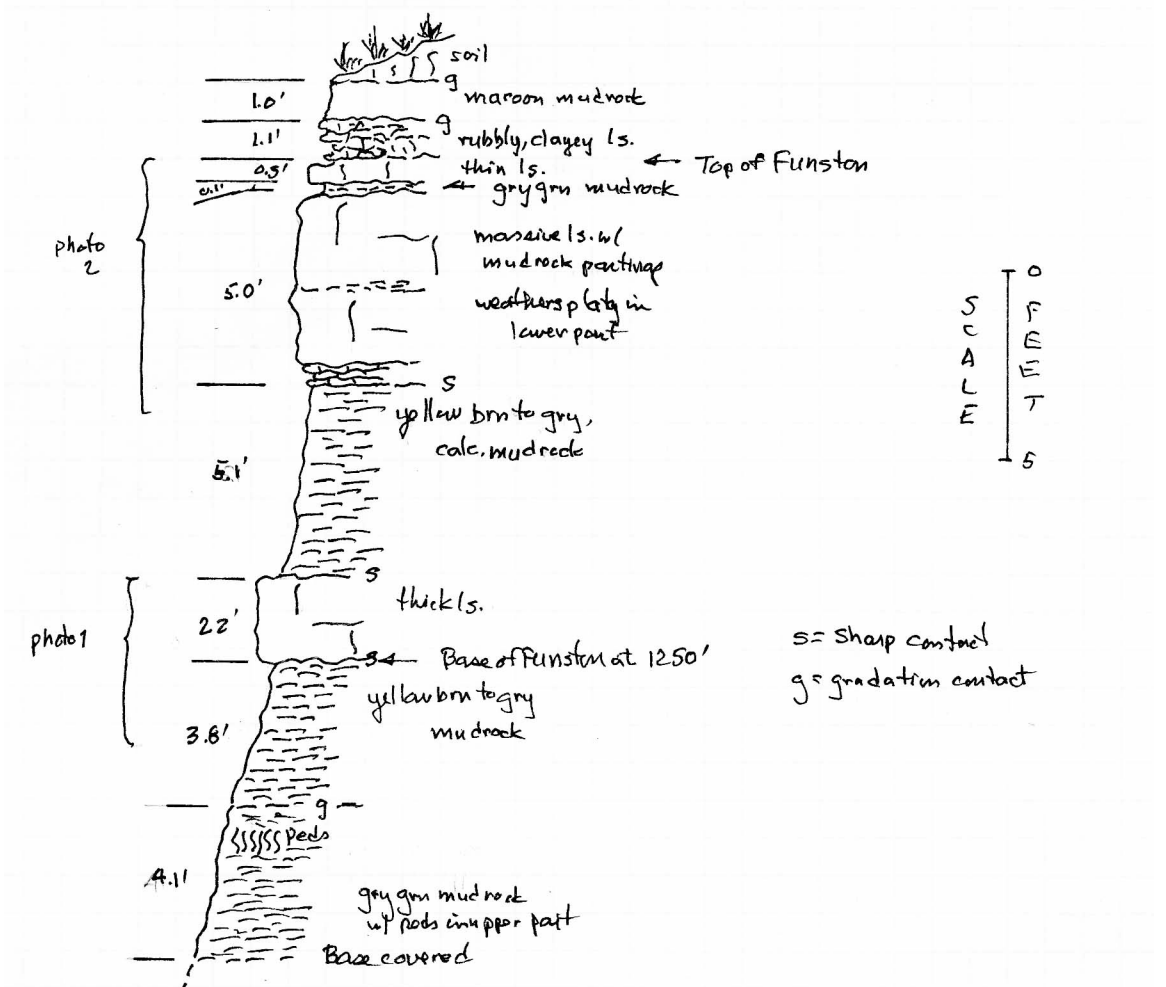
MR-189 = Exposure of thin bedded to platy, dark gray to bluish, fossiliferous, calcareous mudrock in the bed of the Neosho River just north of U.S. Highway 56 bridge in Council Grove, Kansas; one photo looking northeast from the southwest side of the river; near center NE SW NE sec. 14, T. 16 S., R. 8 E., Morris County, Kansas.



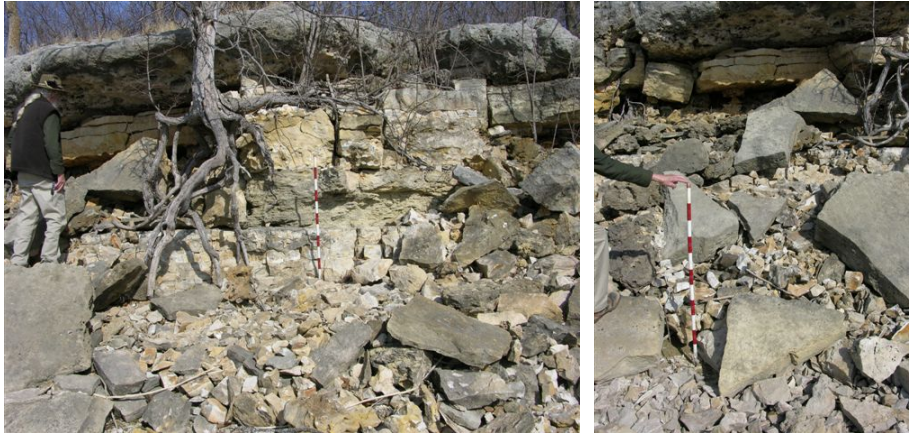
MR-190 = Base of Funston Limestone at 1,250 ft exposed in roadcuts on both sides of Huffaker Street in Council Grove, Kansas; two photos: one of the base and one of the upper limestone bed(s); approximately 200 ft east and 250 ft north of southwest corner NW NE NW sec. 14, T. 16 S., R. 8 E., Morris County, Kansas. – see graphic section.



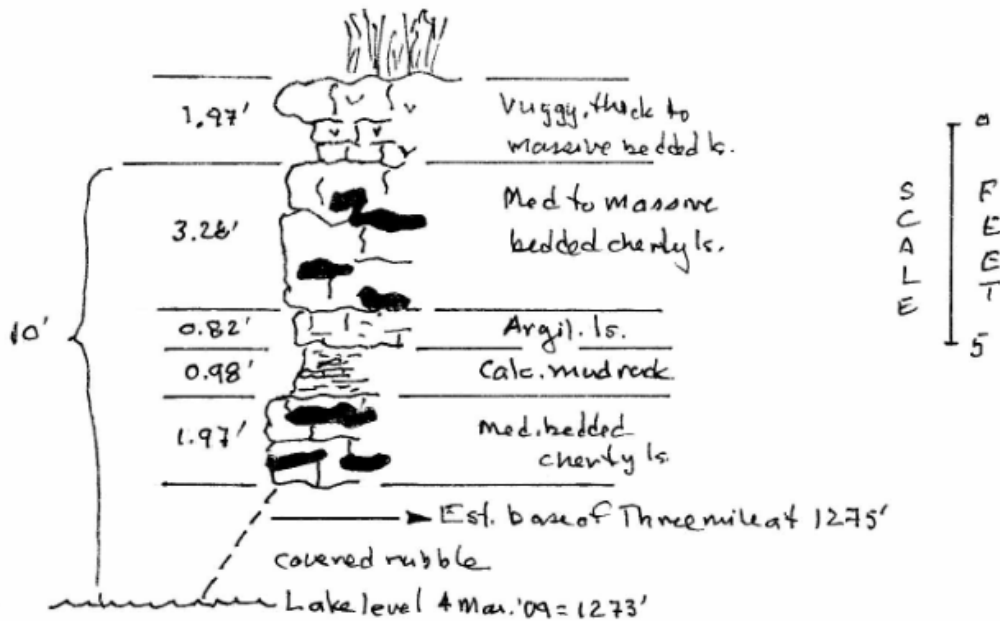
SITE-190- COUNCIL GROVE QUAD. ~ MORRIS CO., KANSAS



MR-201 = Estimated base of Wreford Limestone (Threemile) at 1,275 ft in west facing exposure along the east side of Council Grove Lake just east of the dam; vertical distance from water level (1,273 ft) to the base of thick massive vuggy bed of Threemile is 10 ft; two photos; near center SW NE SW sec. 2, T. 16 S., R. 8 E., Morris County, Kansas. – see graphic section.



SITE MR-201 ~ COUNCIL GROVE QUAD. ~ MORRIS CO., KANSAS



BUSHONG QUADRANGLE – MORRIS COUNTY

Field work was conducted February–May 2009.

MR-130 = Base of Wreford Limestone (Threemile) inferred at 1,360 ft in roadcut on east side of road with mudrock in south creek bank on west side of road; two photos; approximately 200 ft south of center of west line SW sec. 24, T. 15 S., R. 9 E., Morris County, Kansas.



MR-131 = Funston Limestone (no contacts) in field west of road on Morris-Lyon county line at 1,330 ft; two photos; near center of east line sec. 25, T. 15 S., R. 9 E., Morris County, Kansas.



MR-132 = Base of Crouse Limestone at 1,295 ft in road and in ditches on both sides of road; Easley Creek Shale with 1 foot of limestone is exposed below in ditch on east side of road and a gray green to reddish mudrock is exposed in a pasture on the west side of road below the 1 ft limestone; two photos; approximately 250 ft south of center of west line NW NW sec. 12, T. 16 S., R. 9 E., Morris County, Kansas.



MR-133 = Funston Limestone at 1,340 ft in road and fields on both sides of road with reddish mudrock of Speiser Shale above in road; one photo; approximately 400 ft north of southwest corner sec. 1, T. 16 S., R. 9 E., Morris County, Kansas.



MR-134 = Base of Wreford Limestone (Threemile) at 1,348 ft in road; one photo; near center of west line NW sec. 1, T. 16 S., R. 9 E., Morris County, Kansas.



MR-135 = Crouse Limestone at 1,290 ft in hillside on south side of road; one photo; near northwest corner sec. 1, T. 16 S., R. 9 E., Morris County, Kansas.



MR-136 = Base of 5.5 ft of Funston Limestone at 1,322 ft in road and on both sides of road; one photo; approximately 100 ft south of northwest corner sec. 1, T. 16 S., R. 9 E., Morris County, Kansas.



MR-137 = Base of Wreford Limestone (Threemile) at 1,353 ft in roadcut on west side of road with greenish gray mudrock of Speiser Shale below; one photo; near center of east line NE NE NE sec. 2, T. 16 S., R. 9 E., Morris County, Kansas. Note: There is 22.0 ft of Speiser Shale between the Funston Limestone at MR-136 and the base of the Wreford Limestone (Threemile) at MR-137.



MR-138 = At 1,354 ft in a ditch on the south side of the road is 0.5 ft of mudrock that looks like the mudrock unit in the lower part of the Threemile; two photos; approximately 800 ft east of northwest corner sec. 11, T. 16 S., R. 9 E., Morris County, Kansas.



MR-139 = Top of Bader Limestone (Middleburg) at 1,282 ft in roadcut on east side of road; lower limestone bed is separated from the thin and platy upper bed by a mudrock unit; one photo; near center of west line NW NW sec. 18, T. 16 S., R. 10 E., Morris County, Kansas.



MR-140 = Top of Crouse Limestone at 1,310 ft in roadcut on west side of road; upper beds of the Crouse Limestone are thick to massive but weather into thin plates; a spring occurs at the base of these upper beds; one photo; near center of east line of SE NE sec. 13, T. 16 S., R. 9 E., Morris County, Kansas.



MR-141 = Base of Beattie Limestone (Cottonwood) at 1,230 ft in east bank of Rock Creek on south side of road; one photo; near center of north line NE sec. 24, T. 16 S., R. 9 E., Morris County, Kansas.



MR-142 = Top of Easley Creek Shale “limestone” at 1,290 ft in roadcut on both sides of road; one photo of exposure on north side of road; approximately 200 ft west of center of north line NE NE sec. 24, T. 16 S., R. 9 E., Morris County, Kansas.



MR-143 = Top of Bader Limestone (Middleburg) at 1,293 ft in ditch on east side of road; tombstone-like topography suggests Middleburg; Easley Creek Shale above Middleburg with lower beds of Crouse Limestone forming a bench above the Easley Creek Shale; one photo; near center of east line SW SW SW sec. 12, T. 16 S., R. 9 E., Morris County, Kansas.



LOST SPRINGS QUADRANGLE – MORRIS COUNTY

Field work was conducted February–April 2011.

MMW-3 = Wellington Formation including the Hollenberg in roadcut in NE NW sec. 5, T. 17 S., R. 5 E., Morris County, Kansas.

MMW-4 = Nolans Limestone and Odell Shale in roadcut in NW NE sec. 31, T. 16 S., R. 5 E., Morris County, Kansas.

MR-284 = Wellington (Hollenberg) Formation in ditch on north side of road at 1,472 ft; one photo; approximately 500 ft east of southwest corner sec. 28, T. 16 S., R. 5 E., Morris County, Kansas.



MR-291 = Wellington (Hollenberg) Formation in road at 1,472 ft; one photo; approximately 200 ft east of center of north line sec. 32, T. 16 S., R. 5 E., Morris County, Kansas.



MR-311 = Base of the Herington in road and roadcut on north side of road at 1,415 ft; 1 photo; approximately 250 ft east of southwest corner sec. 30, T. 16 S., R. 5 E., Morris County, Kansas.



MR-312 = Base of the Herington in road, ditch, and field north of road at 1,420 ft, with Paddock below as described by MMW at their section 4, thin limestone in the Paddock exposed in road and also what is probably the Krider; one photo; approximately 300 ft west of center of north line sec. 31, T. 16 S., R. 5 E., Morris County, Kansas. This site is approximately 1,200 ft due west of MMW-4.



MR-313 = Wellington (Hollenberg) Formation in road (caps the hill) with estimated base at 1,460 ft; one photo; about 650 ft south of northeast corner sec. 31, T. 16 S., R. 5 E., Morris County, Kansas.



MR-314 = Wellington (Hollenberg) Formation near top of hill on the east side of road at 1,450 ft with gray green mudrock below; two photos; approximately 300 ft east of center of west line NW SW sec. 32, T. 16 S., R. 5 E., Morris County, Kansas.



MR-315 = MMW-3 = Wellington (Hollenberg) Formation in road and roadcut on north side of road at 1,470 ft; gray green mudrock below Hollenberg exposed in trench silo on north side of road; two photos (one of road and one of trench silo); approximately 150 ft east of center of north line NW sec. 5, T. 17 S., R. 5 E., Morris County, Kansas.



MR-316 = Wellington (Hollenberg) Formation in roadcut on east side of road with base at 1,485 ft; one photo; approximately 1,700 ft north of southwest corner sec. 5, T. 17 S., R. 5 E., Morris County, Kansas.



MR-317 = Wellington (Hollenberg) Formation in road and pond bank on east of road with base at 1,470 ft; one photo; center of west line NW SW NW sec. 20, T. 17 S., R. 5 E., Morris County, Kansas.



MR-318 = Wellington (Hollenberg) Formation in road at 1,477 ft; one photo; approximately 150 ft south of northeast corner sec. 30, T. 17 S., R. 5 E., Morris County, Kansas.



MR-319 = Wellington (Hollenberg) Formation in road at 1,468 ft; one photo; approximately 150 ft south of northwest corner sec. 31, T. 17 S., R. 5 E., Morris County, Kansas.



MR-320 = Wellington (Hollenberg) Formation in road and ditch on north side of road with the top of Hollenberg near 1,450 ft; one photo; near center of south line SE sec. 4, T. 17 S., R. 5 E., Morris County, Kansas.



MR-321 = Wellington (Hollenberg) Formation in road and ditch on south side of road at 1,490 ft just east of Cedar Creek, no contacts; one photo; near center of north line NW NE sec. 18, T. 17 S., R. 5 E., Morris County, Kansas.



MR-327 = Wellington (Hollenberg) Formation in road with yellowish brown mudrock in ditch on north side of road at 1,490 ft; one photo; near center of south line SW SW SE sec. 20, T. 17 S., R. 5 E., Morris County, Kansas.



MR-328 = Wellington (Hollenberg) Formation in road and ditch on north side of road at 1,481 ft; one photo; about 150 ft east of center of south line SW SW sec. 33, T. 17 S., R. 5 E., Morris County, Kansas.



MR-329 = Base of the Herington in road at 1,470 ft with Paddock below in ditch on north side of road; one photo; approximately 150 ft west of center of south line sec. 33, T. 17 S., R. 5 E., Morris County, Kansas.



BURDICK QUADRANGLE – MORRIS COUNTY

Field work was conducted February–April 2011.

M-25 = Hillside exposure of Barneston (Fort Riley) Limestone that has been quarried; just north of center of NW NW sec. 20, T. 17 S., R. 6 E., Morris County, Kansas; measured and described by W. Ives, 12 August 1953.

MMW-9 = Winfield (Grant and Stovall) Limestone in stream bank in SE SE sec. 14, T. 17 S., R. 5 E., Morris County, Kansas.

MMW–limestone 28, page 26 = Exposures in old quarry of Barneston Limestone with 10 ft of Florence reported; near center of SE sec. 17, T. 17 S., R. 6 E., Morris County, Kansas.

MR-264 = Nolans (top of lower limestone in Herington) Limestone at 1,470 ft in road; one photo; approximately 200 ft east of center of north line sec. 35, T. 16 S., R. 5 E., Morris County, Kansas.



MR-265 = Nolans (upper limestone in Herington) Limestone at 1,470 ft in road; one photo; approximately 200 ft east of center of north line SE sec. 34, T. 16 S., R. 5 E., Morris County, Kansas.



MR-322 = Winfield (Cresswell) Limestone in road and field south of road at 1,470 ft, with chert float (Stovall) at 1,455 ft in ditches on both sides of road; one photo; approximately 300 ft east of center of north line NE NW sec. 25, T. 17 S., R. 5 E., Morris County, Kansas.



MR-323 = Winfield (Cresswell) Limestone in road at 1,450 ft; one photo; approximately 150 ft west of center of north line NW NW sec. 25, T. 17 S., R. 5 E., Morris County, Kansas.



MR-324 = Winfield (Cresswell) Limestone in road and roadcut on north side of road at 1,440 ft, just west of MMW section 9 north of Burdick, Kansas; two photos; approximately 200 ft east of center of south line SE sec. 14, T. 17 S., R. 5 E., Morris County, Kansas.



MR-325 = Winfield (Cresswell) Limestone in road with float in fields on both sides of road at 1,432 ft, approximately 0.1 mi south of Camp Creek; one photo; near center of east line NE SE SE sec. 11, T. 17 S., R. 5 E., Morris County, Kansas.



MR-326 = Winfield (Stovall to lower beds of Cresswell) Limestone in roadcut on west side of road, Stovall exposed in road and ditch on west side of road with base at 1,430 ft, 12 ft (hand leveled) of Grant and the lower cherty beds of Cresswell in roadcut on west side of road approximately 250 ft south of Sixmile Creek; two photos; near center of east line NE SE SE sec. 2, T. 17 S., R. 5 E., Morris County, Kansas.



MR-330 = Base of the Herington (fossiliferous – bivalves and gastropods) in road at 1,480 ft with Paddock below on east side of road; one photo; near west line sec. 34, T. 17 S., R. 5 E., Morris County, Kansas.



MR-331 = Base of Cresswell in ditch and drainage east of road at 1,420 ft just north of Camp Creek; two photos; about 350 ft south of west line sec. 11, T. 17 S., R. 5 E., Morris County, Kansas.



MR-332 = Exposure near the base of the Towanda in road at 1,430 ft with yellowish brown mudrock below; one photo; near center of north line sec. 31, T. 17 S., R. 6 E., Morris County, Kansas.



MR-333 = Base of the Herington on south side of road at 1,463 ft with grayish green mudrock below; one photo; near center of north line NW sec. 22, T. 17 S., R. 5 E., Morris County, Kansas.



MR-334 = Base of the Herington in road and ditch on east side of road at 1,470 ft with yellowish, gray-green mudrock below; one photo; approximately 150 ft north of west line SW SW sec. 10, T. 17 S., R. 5 E., Morris County, Kansas.



MR-335 = Base of the Herington in road and roadcuts on both sides of road at 1,450 ft (best exposure on west side of road), with yellowish, gray-green mudrock (Paddock) below; one photo; approximately 300 ft south of northwest corner sec. 10, T. 17 S., R. 5 E., Morris County, Kansas.



MR-336 = Base of the Herington in road at 1,450 ft; one photo; near center of west line sec. 34, T. 16 S., R. 5 E., Morris County, Kansas.



MR-337 = Base of Winfield (Stovall) Limestone in road and ditch on south side of road at 1,441 ft, with gray green mudrock (Gage) below; loose chert is abundant; one photo; approximately 100 ft east of center of north line NE NW sec. 6, T. 17 S., R. 6 E., Morris County, Kansas.



MR-338 = Doyle (Towanda) Shale in east bank of Threemile Creek on east side of road at 1,393 ft with mudrock of lower Gage well exposed above; one photo; just north of center of west line NW SW sec. 5, T. 17 S., R. 6 E., Morris County, Kansas.



MR-339 = Unidentified limestone (Towanda?) in road and ditch on east side of road at 1,395 ft; one photo; near center of west line SW SW sec. 8, T. 17 S., R. 6 E., Morris County, Kansas.



MR-340 = Exposure of 11.0 ft of light brown limestone with crystalline lined vugs and fractures, probably upper Fort Riley, in road and roadcut on south side of road at 1,395 ft; one photo; approximately 300 ft west of center of north line NW sec. 17, T. 17 S., R. 6 E., Morris County, Kansas.



MR-341 = Barneston (Fort Riley rimrock) Limestone in road and field south of road at 1,382 ft, approximately 400 ft west of Threemile Creek; one photo; near center of north line NE sec. 17, T. 17 S., R. 6 E., Morris County, Kansas.



MR-342 = Barneston (Fort Riley rimrock) Limestone in road and field east of road at 1,380 ft, approximately 600 ft south of Sixmile Creek; approximately 800 ft south of center sec. 17, T. 17 S., R. 6 E., Morris County, Kansas.



MR-343 = Winfield (Stovall) Limestone in trench silo on south side of road at 1,470 ft, abundant Stovall chert in road; two photos; approximately 200 ft east of center of north line NW sec. 30, T. 17 S., R. 6 E., Morris County, Kansas.



MR-344 = Barneston (Fort Riley rimrock) Limestone in road at 1,390 ft; one photo; approximately 800 ft north of center of south line sec. 17, T. 17 S., R. 6 E., Morris County, Kansas.



MR-345 = Matfield (Kinney) Shale in northeast bank of Sixmile Creek southeast of road at 1,340 ft; two photos; approximately 100 ft south and 150 ft west of center of east line SW sec. 17, T. 17 S., R. 6 E., Morris County, Kansas.



MR-371 = Matfield (Kinney with upper Wymore below) Shale with base of Kinney at 1,340 ft in creek bank on west side of Mile-and-a-Half Creek on Kassebaum farm; one photo; approximately 300 ft south and 100 ft west of center of north line NW sec. 16, T. 17 S., R. 6 E., Morris County, Kansas.



MR-372 = Exposure near the base of the Barneston (Florence) Limestone at 1,360 ft in south facing hillside along Mile-and-a-Half Creek on Kassebaum farm; one photo; near center of SW SE SW sec. 9, T. 17 S., R. 6 E., Morris County, Kansas.



MR-373 = Top of Towanda at 1,445 ft along southeast face of old quarry; one photo; near center of west half NE NE sec. 30, T. 17 S., R. 6 E., Morris County, Kansas.



MR-374 = Barneston (Fort Riley rimrock) Limestone with base of rimrock at 1,420 ft in road and fields on both sides of road; one photo; near center of north line NW NE NE sec. 32, T. 17 S., R. 6 E., Morris County, Kansas.



DIAMOND SPRINGS QUADRANGLE – MORRIS COUNTY

Field work was conducted February–April 2011.

M-24a = M-24b = Beattie (Florena) Limestone northwest of Highway 897 and 500 and roadcut 0.5 mi south on east side of highway; center SE SE sec. 1, T. 17 S., R. 6 E., Morris County, Kansas; measured and described by M. K. Elias in 1935.

M-27 = Exposure from Crouse Limestone to Wreford Limestone; near center sec. 7, T. 17 S., R. 7 E., Morris County, Kansas; measured and described by M. K. Elias in 1935 as an “algae exposure.”

MR-216 = Barneston Limestone (Fort Riley rimrock) at 1,470 ft exposed in road, ditch, and pond bank on north side of road; one photo; near center of south line SE SE SE sec. 29, T. 16 S., R. 7 E., Morris County, Kansas.



MR-219 = Barneston Limestone (Fort Riley rimrock) at 1,430 ft exposed in road and fields on both sides of road; one photo; near center of west line SW SW SW sec. 26, T. 16 S., R. 7 E., Morris County, Kansas.



MR-346 = Matfield (top of Kinney) Shale in roadcut on west side of road at 1,385 ft; one photo; about 350 ft south of center of north line NW NW sec. 14, T. 17 S., R. 6 E., Morris County, Kansas.



MR-347 = Barneston (estimated base of Florence) Limestone in road and ditch on east side of road at 1,420 ft; one photo; near center of west line NW SW sec. 11, T. 17 S., R. 6 E., Morris County, Kansas.



MR-348 = Barneston (base of Fort Riley) Limestone in road at 1,458 ft with Oketo Shale Member in ditches on both sides of road; one photo; approximately 150 ft south of west line NW NW sec. 11, T. 17 S., R. 6 E., Morris County, Kansas.



MR-349 = Doyle (Towanda) Shale in road and ditch on north side of road at 1,515 ft, limestone is platy to thin bedded, yellowish brown, “rotten looking,” appears conglomeratic/brecciated; one photo; center of north line NE NE sec. 36, T. 16 S., R. 6 E., Morris County, Kansas.



MR-350 = Well exposed Barneston (Fort Riley rimrock) Limestone in ditch and drainage on west side of road at 1,520 ft; one photo; near center of east line NE SE SE sec. 6, T. 17 S., R. 7 E., Morris County, Kansas.



MR-351 = Barneston (base of Florence) Limestone in stream bank northwest of road at 1,480 ft, same as sections M-24a and M-24b; one photo; approximately 200 ft west of center of east line NE SE SE sec. 1, T. 17 S., R. 6 E., Morris County, Kansas.



MR-352 = Barneston (estimated base of Florence) Limestone in stream cut on east side of road at 1,470 ft; one photo; near center of west line NW SW NW sec. 7, T. 17 S., R. 7 E., Morris County, Kansas.



MR-353 = Barneston (base of Florence) Limestone in roadcut on northwest side of road at 1,455 ft; one photo; just west of center of south line NE NW SW sec. 13, T. 17 S., R. 6 E., Morris County, Kansas.



MR-354 = Wreford (near top of Schroyer) Limestone in roadcuts on both sides of road at 1,355 ft; one photo; near center of south line sec. 14, T. 17 S., R. 6 E., Morris County, Kansas.

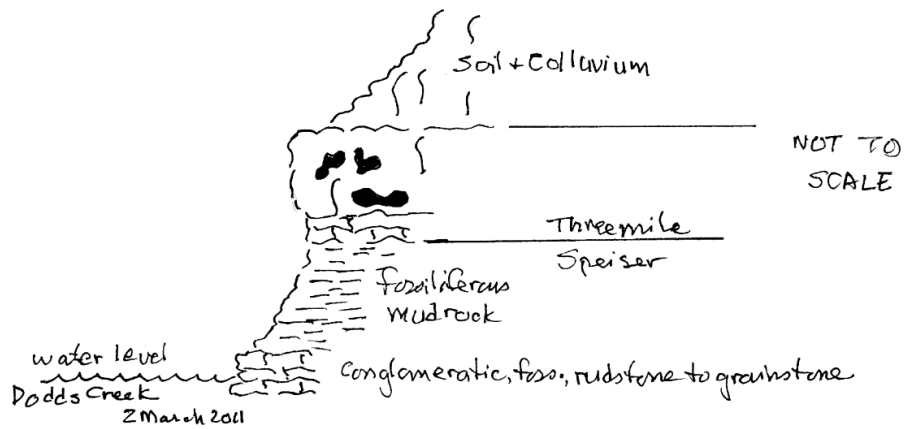


MR-355 = Wreford (base of Threemile) Limestone in west bank of Dodds Creek at 1,335 ft with fossiliferous mudrocks and limestones of upper Speiser Shale below in east bank; five photos (one from the bridge, one of contact, and three of the chert bed); near center of south line SE SE SW sec. 14, T. 17 S., R. 6 E., Morris County, Kansas. – see graphic section.





SITE MR-355 - DIAMOND SPRINGS QUAD. - MORRIS CO., KANSAS



MR-356 = Base of Funston Limestone in the southeast bank of Silver Creek at 1,320 ft; one photo; near center of west line NE NE sec. 26, T. 17 S., R. 6 E., Morris County, Kansas.



MR-357 = Base of Funston Limestone in west bank of Silver Creek at 1,320 ft; one photo; near center of south line SE SE sec. 23, T. 17 S., R. 6 E., Morris County, Kansas.



MR-358 = Barneston (Fort Riley rimrock) Limestone in road and ditch on east side of road and field on west side of road at 1,505 ft; one photo; near center of west line SW NW SW sec. 8, T. 17 S., R. 7 E., Morris County, Kansas.



MR-359 = Barneston (Fort Riley rimrock) Limestone in road at 1,493 ft; one photo; near center of east line SE NE NE sec. 18, T. 17 S., R. 7 E., Morris County, Kansas.



MR-360 = Barneston (Fort Riley rimrock) Limestone in road and ditch on east side of road at 1,475 ft; one photo; near center of east line NE NE sec. 5, T. 17 S., R. 7 E., Morris County, Kansas.



MR-361 = Wreford (base of Threemile) Limestone in roadcut on west side of road at 1,330 ft with upper Speiser Shale (fossiliferous mudrock above a conglomeratic limestone with a greenish gray mudrock below a 1.0 ft thick limestone) below; one photo; center of south line sec. 26, T. 17 S., R. 6 E., Morris County, Kansas.



MR-362 = Funston Limestone in roadcut on west side of road at 1,317 ft; one photo; approximately 100 ft north of center of south line SW SW SW sec. 36, T. 17 S., R. 6 E., Morris County, Kansas.



MR-363 = Wreford (base of Threemile) Limestone in roadcut on west side of road at 1,345 ft with upper Speiser Shale (fossiliferous mudrock above a conglomeratic limestone with a greenish gray mudrock below a 1.0 ft thick limestone) below; two photos; near center north half sec. 36, T. 17 S., R. 6 E., Morris County, Kansas.



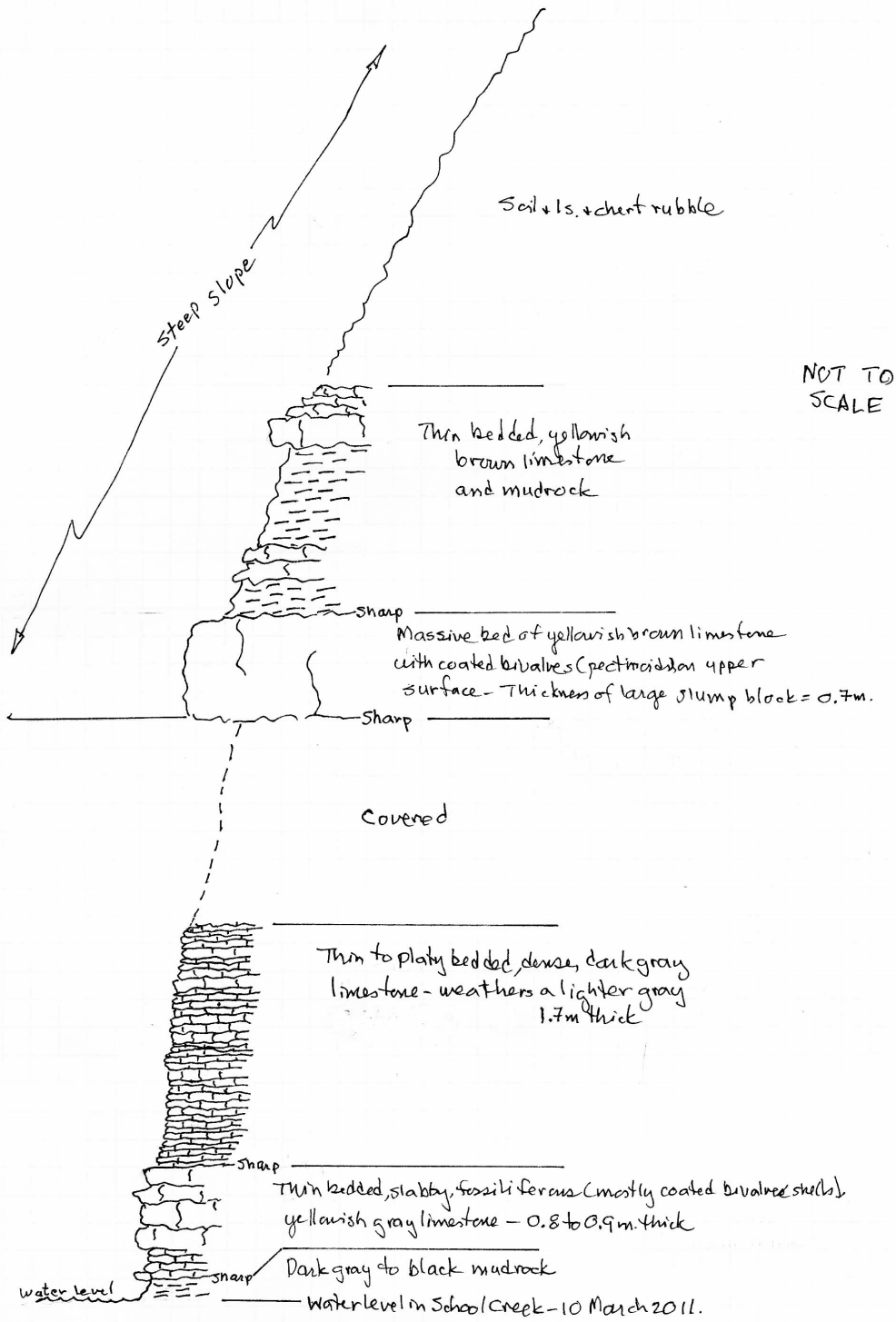
MR-364 = Wreford (top of Schroyer) Limestone in road and ditch on west side of road at 1,403 ft; one photo; near center south half sec. 25, T. 17 S., R. 6 E., Morris County, Kansas.



MR-365 = Exposure of sequence from Easley Creek through Funston Limestone on west facing bank of School Creek on Senne ranch with base of Crouse Limestone at 1,325 ft; three photos; near center south line SE NE sec. 25, T. 17 S., R. 6 E., Morris County, Kansas. – see graphic section.



SITE-MR-365-DIAMOND SPRINGS QUAD. - MORRIS CO., KANSAS



MR-366 = Wreford (base of Threemile) Limestone in road and in ditch on north side of road at 1,405 ft with upper Speiser Shale (fossiliferous mudrock above a conglomeratic limestone with a greenish gray mudrock below a 1.0 ft thick limestone) below; one photo; near center south line SW sec. 24, T. 17 S., R. 6 E., Morris County, Kansas.



MR-367 = Barneston (Fort Riley rimrock) Limestone in road at 1,412 ft; one photo; center north line NE NE sec. 35, T. 16 S., R. 7 E., Morris County, Kansas.



MR-368 = Barneston (Fort Riley rimrock) Limestone in drainage in field on east side of road at 1,419 ft; one photo; near center SW NW sec. 35, T. 16 S., R. 7 E., Morris County, Kansas.



MR-369 = Barneston (Fort Riley rimrock) Limestone in road at 1,480 ft; one photo; approximately 200 ft west of center of north line NE sec. 33, T. 16 S., R. 7 E., Morris County, Kansas.



MR-375 = Exposure near base of Barneston (Florence) Limestone at 1,420 ft in road; one photo; near center of north line NE NE sec. 34, T. 17 S., R. 6 E., Morris County, Kansas.



WILSEY SE QUADRANGLE – MORRIS COUNTY

Field work was conducted January–April 2012.

M-10a = M-10b = Barneston Limestone in Missouri and Pacific railroad quarry, 1/8 mi south of Nelonick siding; center NE sec. 36, T. 16 S., R. 7 E., Morris County, Kansas; measured and described by M. K. Elias, 14 June 1935.

M-26 = Unnamed limestones and mudrocks (appear to be Fort Riley and Oketo) along north-south and east-west ditches; center SW SE sec. 12, T. 17 S., R. 7 E., Morris County, Kansas; measured and described by H. G. O'Connor, date unknown.

M-28 = Exposure from Barneston (Florence) Limestone to Doyle Shale; near center of east line NE SE sec. 24, T. 17 S., R. 7 E., Morris County, Kansas; author and date unknown.

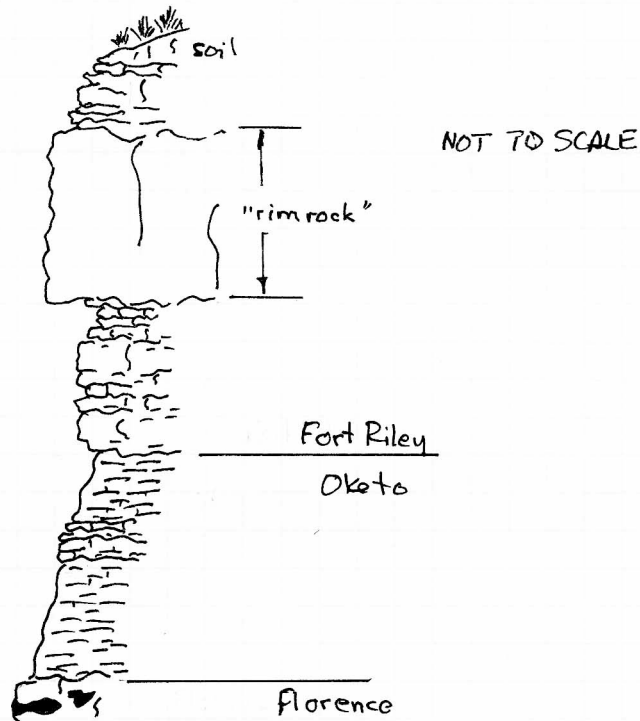
MR-174 (near MMW section 14, M-10a and M-10b) = Barneston (Fort Riley rimrock) Limestone in road and roadcut on west side of road at 1,379 ft; one photo; near center of east line SE NE sec. 36, T. 16 S., R. 7 E., Morris County, Kansas.



MR-175 = Barneston Limestone, sequence from the top of the Florence Limestone Member to the rimrock in the Fort Riley Limestone Member in ditch and roadcut on the north side of the road with the rimrock at 1,385 ft; three photos: upper left photo is of the sequence from the Florence through the Oketo and lower Fort Riley, upper right photo is of the upper part of the Oketo including a thin limestone and the lower part of the Fort Riley including the rimrock, and lower left photo is of the Fort Riley rimrock; just north and west of the center of south line SE SW sec. 25, T. 16 S., R. 7 E., Morris County, Kansas. – see graphic section.



SITE MR-175- WILSEY SE QUAD. ~ MORRIS CO., KANSAS



MR-370 = Barneston (Fort Riley rimrock) Limestone in roadcut on north side of road and along east bank of Fourmile Creek at 1,387 ft; one photo; just northwest of center of south line sec. 2, T. 17 S., R. 7 E., Morris County, Kansas.



MR-376 = Barneston (top of Florence) Limestone at 1,427 ft in a hillside gully; two photos; approximately 200 ft north of center of south half NW sec. 24, T. 17 S., R. 7 E., Morris County, Kansas.



MR-377 = Barneston (base of Florence) Limestone at 1,410 ft in a hillside; three photos; center of west half NW sec. 24, T. 17 S., R. 7 E., Morris County, Kansas.



MR-378 = Barneston (Fort Riley rimrock) Limestone at 1,419 ft in a hillside; one photo; approximately 300 ft east of center of NW sec. 24, T. 17 S., R. 7 E., Morris County, Kansas.



MR-379 = Barneston (Fort Riley rimrock) Limestone at 1,423 ft in a hillside; one photo; approximately 300 ft west of center of north half NW sec. 24, T. 17 S., R. 7 E., Morris County, Kansas.



MR-388 = Barneston (Fort Riley rimrock) Limestone at 1,397 ft in road; one photo; approximately 3,700 ft west of southwest corner sec. 31, T. 16 S., R. 8 E., Morris County, Kansas.



MR-389 = Matfield (Kinney) Shale at 1,356 ft in ditch on north side of road; one photo; approximately 150 ft west of southeast corner sec. 32, T. 16 S., R. 8 E., Morris County, Kansas.



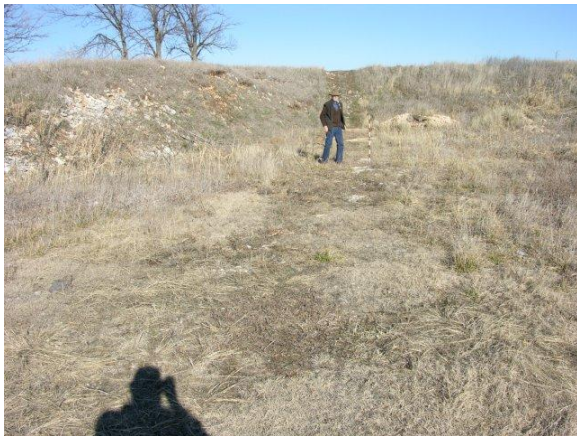
MR-390 = Wreford (top of Schroyer) Limestone at 1,320 ft in ditch on east side of road; one photo; center south line SE sec. 27, T. 16 S., R. 8 E., Morris County, Kansas.



MR-391 = Matfield (Kinney) Shale at 1,335 ft in road; one photo; approximately 250 ft south of center of north line NE sec. 34, T. 16 S., R. 8 E., Morris County, Kansas. The interval between the top of the Wreford at MR-390 and the Kinney at MR-391 is 11.5 ft.



MR-392 = Wreford (top of Threemile) Limestone at 1,315 ft in an old excavation on the east side of road; one photo; near center of south line SE sec. 34, T. 16 S., R. 8 E., Morris County, Kansas.



MR-393 = Wreford (top of Schroyer) Limestone at 1,317 ft in ditch on east side of road; two photos (one of exposure in road and one of a stream bank exposure along the southwest bank of a tributary of Fourmile Creek); just south of center of NW sec. 8, T. 17 S., R. 8 E., Morris County, Kansas.



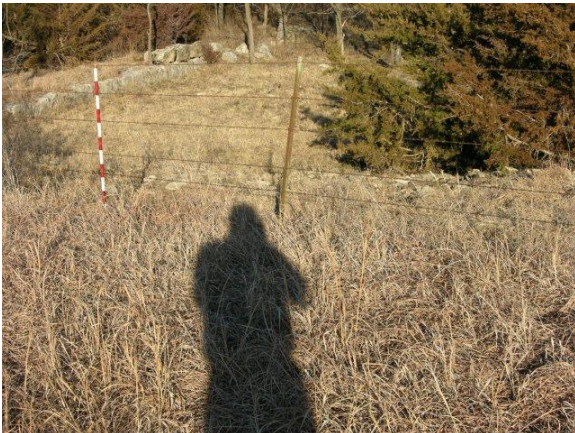
MR-394 = Barneston (Fort Riley rimrock) Limestone at 1,391 ft in road and field north of road; one photo; center south line NE NW sec. 1, T. 17 S., R. 7 E., Morris County, Kansas.



MR-395 = Barneston (Fort Riley rimrock) Limestone at 1,390 ft in road and ditch west of road with fossiliferous Oketo exposed below; one photo; approximately 300 ft north of center of east line sec. 11, T. 17 S., R. 7 E., Morris County, Kansas.



MR-396 = Barneston (Fort Riley rimrock) Limestone at 1,400 ft in old quarry on east side of road with fossiliferous Oketo exposed below in ditch on west side of road; one photo; approximately 300 ft south of northwest corner sec. 13, T. 17 S., R. 7 E., Morris County, Kansas.



MR-397 = Wreford (top of Schroyer) Limestone at 1,493 ft on both sides of road and in southwest-facing bank of stream on south side of road; two photos; along south line SE SE SE sec. 23, T. 17 S., R. 7 E., Morris County, Kansas.



MR-398 = Barneston (Fort Riley rimrock) Limestone at 1,385 ft in road and fields on both sides of road north of Fourmile Creek; one photo; near center of east line SE sec. 12, T. 17 S., R. 7 E., Morris County, Kansas.



MR-399 = Barneston (Fort Riley rimrock) Limestone at 1,409 ft in road and field north of road; one photo; about 100 ft west of center of south line SE sec. 13, T. 17 S., R. 7 E., Morris County, Kansas.



MR-400 = Barneston (Fort Riley rimrock) Limestone at 1,398 ft in drainage on east side of road, near M-28; one photo; approximately 150 ft north of center of east line NE SE sec. 24, T. 17 S., R. 7 E., Morris County, Kansas.



MR-401 = Sinkhole on west side of road; one photo; near southeast corner SE SE SE sec. 24, T. 17 S., R. 7 E., Morris County, Kansas.



MR-402 = Barneston (upper Fort Riley) Limestone at 1,430 ft in road and field north of road; two photos; approximately 0.75 mi east of southwest corner sec. 19, T. 17 S., R. 8 E., Morris County, Kansas.



MR-403 = Barneston (Fort Riley rimrock) Limestone at 1,405 ft on east side of road; one photo; about 0.8 mi east and 0.5 mi south of northwest corner sec. 30, T. 17 S., R. 8 E., Morris County, Kansas.



MR-404 = Barneston (Fort Riley “upper rimrock”) Limestone at 1,419 ft on north side of road; one photo; near center of south line SW sec. 30, T. 17 S., R. 8 E., Morris County, Kansas.



MR-405 = Barneston (Fort Riley rimrock) Limestone at 1,440 ft in drainage in field west of road; one photo; near center NE SE SE sec. 29, T. 17 S., R. 8 E., Morris County, Kansas.



MR-406 = Barneston (Fort Riley rimrock) Limestone at 1,440 ft in road and ditch on west side of road; one photo; near center of west line NW NW sec. 28, T. 17 S., R. 8 E., Morris County, Kansas.



MR-407 = Barneston (Fort Riley rimrock) Limestone at 1,435 ft in road and fields on both sides of road; one photo; near center of south line SE SW sec. 21, T. 17 S., R. 8 E., Morris County, Kansas.



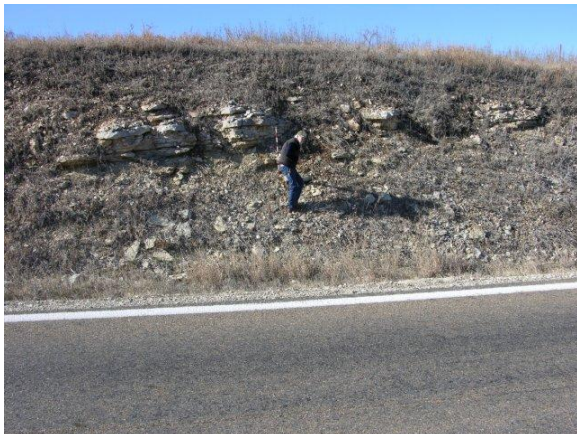
MR-408 = Barneston (Fort Riley rimrock) Limestone at 1,462 ft in road, west ditch, and field east of road; one photo; near center of west line SW SW NW sec. 34, T. 17 S., R. 8 E., Morris County, Kansas.



MR-409 = Barneston (Fort Riley rimrock) Limestone at 1,469 ft in road; one photo; near center of north line NW NE NE sec. 34, T. 17 S., R. 8 E., Morris County, Kansas.



MR-410 = Base of Barneston (Florence) Limestone at 1,415 ft in roadcuts on both sides of Kansas Highway 177; one photo; approximately 200 ft east of center SE SE sec. 16, T. 17 S., R. 8 E., Morris County, Kansas.



MR-411 = Top of Wreford (Schroyer) Limestone at 1,354 ft in ditch on west side of road; one photo; near center of east line NE NE sec. 16, T. 17 S., R. 8 E., Morris County, Kansas.



MR-412 = Top of Wreford (Schroyer) Limestone at 1,348 ft in roadcuts on both sides of Kansas Highway 177; one photo; near center SW NE sec. 10, T. 17 S., R. 8 E., Morris County, Kansas. The Schroyer here is a thick bedded, vuggy, sucrosic limestone with nodules of calcium sulfate and chert.



MR-413 = Funston Limestone at 1,265 ft in southeast bank of Spring Creek with a gray-green mudrock below at water level; two photos; approximately 150 ft south of center of north line NW sec. 10, T. 17 S., R. 8 E., Morris County, Kansas.



MR-418 = Base of Wreford (Threemile) Limestone at 1,310 ft in roadcuts on both sides of Kansas Highway 177; one photo of exposure on east side; near center of east line SE SE SE sec. 3, T. 17 S., R. 8 E., Morris County, Kansas.



LAKE KAHOLA QUADRANGLE – MORRIS COUNTY

Field work was conducted January–April 2012.

M-20 = Beattie (Cottonwood) Limestone in old quarry; near southeast corner sec. 33, T. 16 S., R. 9 E., Morris County, Kansas; measured and described by W. Ives, 12 August 1953. See MR-422.

M-21 = Unnamed limestone and mudrock sequence in railroad cut; northwest corner sec. 33, T. 16 S., R. 9 E., Morris County, Kansas; measured and described by M. K. Elias in 1935.

M-30 = Exposure from below the Red Eagle (Howe) Limestone to the Grenola (Neva) Limestone; near center of SW SW sec. 26, T. 17 S., R. 9 E., Morris County, Kansas; measured and described by M. K. Elias in 1935. Section was not found.

M-31 = MR-453 = Exposure from the Grenola (Neva) Limestone to the Beattie (Cottonwood) Limestone at Lake Kahola; near center north line SE SE sec. 34, T. 17 S., R. 9 E., Morris County, Kansas; measured and described by J. M. Jewett and H. G. O'Connor, 17 July 1947.

MR-145 = Base of Beattie Limestone (Cottonwood) at 1,258 ft on hillside north of road; two photos; near center SW SW SE sec. 26, T. 16 S., R. 9 E., Morris County, Kansas.



MR-154 = Crouse Limestone at 1,300 ft in road and on both sides of road; two photos; near center of north line NW NE NE sec. 34, T. 16 S., R. 9 E., Morris County, Kansas.



MR-155 = Crouse Limestone at 1,289 ft in road and on both sides of road like that seen in MR-154; vertical parts of fence posts are Cottonwood; one photo; near center of north line NW NE NW sec. 34, T. 16 S., R. 9 E., Morris County, Kansas.



MR-156 = Base of Crouse Limestone at 1,310 ft in road and both sides of road, like the limestone exposed at MR-154 and MR-155; three photos, two of north side of road and one of south side; approximately 100 ft west of northeast corner sec. 33, T. 16 S., R. 9 E., Morris County, Kansas.



MR-157 = Base of Bader Limestone (Eiss) at 1,270 ft in road and ditches on both sides of road, measured 11 ft of Eiss; two photos, one of the base and one of the thick upper Eiss on the south side of road; center north line NE NE sec. 33, T. 16 S., R. 9 E., Morris County, Kansas.



MR-414 = Base of Wreford (Threemile) Limestone at 1,320 ft in ditch on north side of road; one photo; approximately 100 ft east of center south line SE SW sec. 11, T. 17 S., R. 8 E., Morris County, Kansas.



MR-415 = Upper Funston Limestone at 1,290 ft on south side of road in west-facing bank of Wolf Creek; thin, platy bedded limestone above a medium to thick limestone bed; two photos; approximately 100 ft west of center south line SE SW sec. 11, T. 17 S., R. 8 E., Morris County, Kansas.



MR-416 = Wreford (Schroyer) Limestone, near the top at 1,373 ft in road and fields on both sides of road; one photo; approximately 100 ft west of southeast corner sec. 14, T. 17 S., R. 8 E., Morris County, Kansas.



MR-417 = Base of Barneston (Florence) Limestone at 1,415 ft in hillside on east side of road; one photo; near center of NE SW NW sec. 26, T. 17 S., R. 8 E., Morris County, Kansas.



MR-419 = Limestone in Easley Creek Shale at 1,250 ft in bluff on south side of road along Fourmile Creek; one photo; just south of center of north line NW SE SW sec. 31, T. 16 S., R. 9 E., Morris County, Kansas.



MR-420 = Funston Limestone at 1,263 ft in ditch on north side of road; a moldic, ostracodal limestone; one photo; near southwest corner SE NE SE sec. 35, T. 16 S., R. 8 E., Morris County, Kansas.



MR-421 = Beattie (Cottonwood) Limestone at 1,243 ft in ditch on both sides of road (area of M-20); one photo; approximately 200 ft south of center of west line SW SW sec. 34, T. 16 S., R. 9 E., Morris County, Kansas.



MR-422 (near M-20) = Beattie (top of Cottonwood) Limestone at 1,240 ft in drainage on south side of road; one photo; approximately 450 ft west of center of south line sec. 34, T. 16 S., R. 9 E., Morris County, Kansas.



MR-423 = Base of Beattie (Cottonwood) Limestone at 1,240 ft in roadcut on north side of road; one photo; approximately 100 ft south of center of north line NE NW NW sec. 2, T. 17 S., R. 9 E., Morris County, Kansas.



MR-424 = Eskridge Shale and Beattie (base of Cottonwood) Limestone at 1,215 ft in roadcut and hillside on west side of road; one photo; approximately 200 ft north of center north half sec. 9, T. 17 S., R. 9 E., Morris County, Kansas.



MR-425 = Beattie (top of Cottonwood) Limestone at 1,249 ft in road and fields on both sides of road; one photo; near center of east line NE NE NE sec. 16, T. 17 S., R. 9 E., Morris County, Kansas.



MR-426 = South dipping Beattie (top of Cottonwood) Limestone at 1,246 ft in road and fields on both sides of road; one photo; about 1,200 ft south northeast corner sec. 16, T. 17 S., R. 9 E., Morris County, Kansas.



MR-427 = Beattie (top of Cottonwood) Limestone at 1,242 ft in road and fields on both sides of road; one photo; about 1,600 ft south of northeast corner sec. 16, T. 17 S., R. 9 E., Morris County, Kansas.



MR-428 = Beattie (top of Cottonwood) Limestone at 1,244 ft in road and fields on both sides of road; one photo; center south line SE NW sec. 15, T. 17 S., R. 9 E., Morris County, Kansas.



MR-429 = Grenola (top of Neva) Limestone at 1,206 ft in road and fields on both sides of road; one photo; near center sec. 15, T. 17 S., R. 9 E., Morris County, Kansas.



MR-430 = Base of Crouse Limestone at 1,317 ft in roadcuts on both sides of road; two photos; center east line NE SE sec. 16, T. 17 S., R. 9 E., Morris County, Kansas.



MR-431 = Base of Crouse Limestone at 1,321 ft in ditch on east side of road; one photo; southwest corner sec. 15, T. 17 S., R. 9 E., Morris County, Kansas.



MR-432 = Funston Limestone at 1,365 ft in road and fields on both sides of road; one photo; near center east line NE NE sec. 21, T. 17 S., R. 9 E., Morris County, Kansas.



MR-433 = Wreford (base of Threemile) Limestone at 1,388 ft in roadcuts on both sides of road; one photo; about 800 ft south of northeast corner sec. 21, T. 17 S., R. 9 E., Morris County, Kansas.



MR-434 = Beattie (top of Cottonwood) Limestone at 1,265 ft in road and fields on both sides of road; one photo; near center of south line SW SW SW sec. 23, T. 17 S., R. 9 E., Morris County, Kansas.



MR-435 = Beattie (top of Cottonwood) Limestone at 1,262 ft in ditch on east side of road; one photo; about 400 ft south of northeast corner sec. 28, T. 17 S., R. 9 E., Morris County, Kansas.



MR-436 = Base of Crouse Limestone at 1,331 ft in road; one photo; near center of south line SW SW sec. 28, T. 17 S., R. 9 E., Morris County, Kansas.



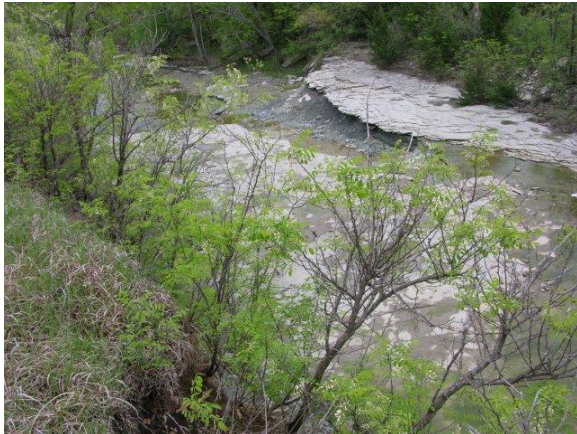
MR-437 = Wreford (estimated base of Threemile) Limestone at 1,390 ft in road; one photo; approximately 800 ft west of southeast corner sec. 29, T. 17 S., R. 9 E., Morris County, Kansas.



MR-438 = Wreford (top of Schroyer) Limestone at 1,378 ft in drainage on south side of road; one photo; approximately 200 ft east of center north line sec. 2, T. 16 S., R. 8 E., Morris County, Kansas.



MR-453 = M-31 = Beattie (base of Cottonwood) Limestone at 1,265 ft in spillway at Lake Kahola; five photos; about 200 ft north and 200 ft west of center of south line NE sec. 33, T. 17 S., R. 9 E., Morris County, Kansas. See also the Lake Kahola measured section in Pecchioni (1981).



MR-454 = Bader (top of Middleburg) Limestone at 1,280 ft in ditch on southwest side of road; one photo; about 100 ft south of center of north line SW sec. 32, T. 17 S., R. 9 E., Morris County, Kansas.



MR-455 = Crouse Limestone at 1,312 ft in roadcut and field on west side of road; one photo; approximately 200 ft east of center of south line SW sec. 32, T. 17 S., R. 9 E., Morris County, Kansas.



MR-456 = Wreford (base of Threemile) Limestone at 1,350 ft in roadcut on north side of road; one photo; about 100 ft north of southwest corner sec. 31, T. 17 S., R. 9 E., Morris County, Kansas.



AMERICUS QUADRANGLE – MORRIS COUNTY

Field work was conducted January–April 2012.

M-22 = Exposure from the Beattie (Cottonwood) Limestone to Bader (Eiss) Limestone in Missouri Pacific Railroad cut in NE NW sec. 36 to SE NW sec. 36, T. 16 S., R. 9 E., Morris County, Kansas; measured and described by H. G. O'Connor, 7 July 1950. Section was not found.

M-23 = Beattie (Cottonwood) Limestone in railroad cut in sec. 36, T. 16 S., R. 9 E., Morris County, Kansas; measured and described as Location 10 by Imbrie and Laporte, 1 March 1959. Section was not found.

M-29 = MR-445, 446, and 447 = Unnamed sequence of limestones and mudrocks exposed in southeast corner sec. 23, T. 17 S., R. 9 E., Morris County, Kansas; measured and described by M. K. Elias in 1935.

M-32 = MR-440 = Exposure from the Red Eagle (Glenrock) Limestone to the Grenola (Burr) Limestone; near center of east line (and extending north downhill) SE sec. 36, T. 17 S., R. 9 E., Morris County, Kansas; measured and described by J. M. Jewett, 18 July 1947.

MR-146 = Beattie Limestone (Cottonwood) at 1,247 ft on a hillside in field south of the road; two photos; approximately 200 ft south of center of north line NE NW sec. 1, T. 17 S., R. 9 E., Morris County, Kansas.



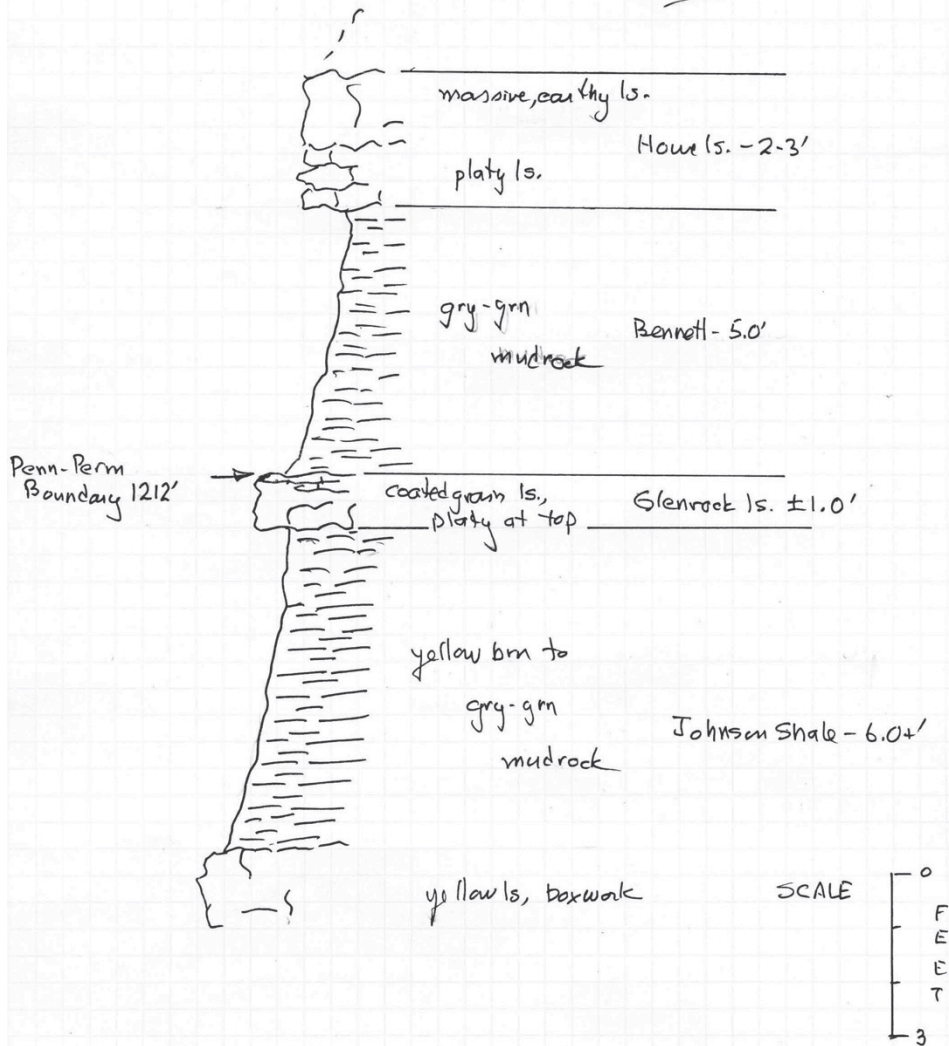
MR-439 = Beattie Limestone (Cottonwood) at 1,280 ft in field on west side of road; two photos; near center of south line SE SE SE sec. 36, T. 17 S., R. 9 E. Morris County, Kansas.



MR-440 = M-32 = Red Eagle (top of Glenrock) Limestone at 1,212 ft in ditch on west side of road; one photo; approximately 250 ft south of center of east line sec. 36, T. 17 S., R. 9 E., Morris County, Kansas. – see graphic section.



MORRIS CO. MEASURED SEC. 440 = M-32
 AMERICUS QUAD.



MR-441 = Beattie Limestone (Cottonwood) at 1,298 ft in ditch on south side of road; one photo; near center of north line NW NW NW sec. 1, T. 18 S., R. 9 E., Morris County, Kansas.



MR-442 = Grenola (Burr) Limestone at 1,248 ft in road and ditch on east side of road; one photo; near center of west line SW NE SW sec. 36, T. 17 S., R. 9 E., Morris County, Kansas.



MR-443 = Grenola (Neva) Limestone at 1,261 ft in road; one photo; northwest corner NE SW sec. 36, T. 17 S., R. 9 E., Morris County, Kansas.



MR-444 = MMW section 39 = Limestone in Roca Shale at 1,227 ft in road and east ditch; two photos; about 150 ft north of center of east line NE SW sec. 36, T. 17 S., R. 9 E., Morris County, Kansas.



MR-445 = M-29 in part = Grenola (base of Neva) Limestone at 1,235 ft in roadcut on west side of road; one photo; near southeast corner sec. 23, T. 17 S., R. 9 E., Morris County, Kansas.



MR-446 = M-29 in part = Grenola (base of Burr) Limestone at 1,215 ft in roadcut on west side of road; one photo; about 200 ft south of center of west line SW sec. 24, T. 17 S., R. 9 E., Morris County, Kansas.



MR-447 = M-29 in part = Grenola (base of Sallyards) Limestone at 1,209 ft in roadcut on west side of road; one photo; center of west line SW sec. 24, T. 17 S., R. 9 E., Morris County, Kansas.



MR-448 = Grenola (base of Neva) Limestone at 1,233 ft in roadcut on north side of road; one photo; about 400 ft west of center of south line SE sec. 12, T. 17 S., R. 9 E., Morris County, Kansas.



MR-449 = Beattie Limestone (Cottonwood) at 1,290 ft in hillside near Dunlap Cemetery; one photo; approximately 450 ft west and 300 ft south of northeast corner sec. 13, T. 17 S., R. 9 E., Morris County, Kansas.



MR-450 = Beattie Limestone (Cottonwood) at 1,285 ft in road, ditches, and fields on both sides of road; one photo; about 200 ft south of center of east line SE NE sec. 12, T. 17 S., R. 9 E., Morris County, Kansas.



MR-451 = Beattie Limestone (base of Cottonwood) at 1,260 ft in road and fields on both sides of road; one photo; near center of west line SW SE sec. 1, T. 17 S., R. 9 E., Morris County, Kansas.



MR-452 = Grenola (top of Neva) Limestone at 1,220 ft in ditch and field on west side of road; one photo; near center of east line NW sec. 1, T. 17 S., R. 9 E., Morris County, Kansas.



Appendix A. GPS Coordinates

Control Point	Latitude	Longitude
MR-1	38.82591503500	-96.45803263400
MR-2	38.80240358100	-96.48296851000
MR-3	38.79770282200	-96.48248665400
MR-4	38.81103332200	-96.42787053300
MR-5	38.79149569400	-96.39018283400
MR-6	38.78234104100	-96.44533158100
MR-7	38.78273843100	-96.49480175000
MR-8	38.76538181900	-96.42690347200
MR-9	38.78735698900	-96.55234338500
MR-10	38.79743461500	-96.56188461100
MR-11	38.80326646200	-96.61303604400
MR-12	38.82306300200	-96.61307850100
MR-13	38.86237340900	-96.51404206800
MR-14	38.82646716800	-96.56609070400
MR-15	38.82659685300	-96.56008758000
MR-16	38.76853935500	-96.61286368700
MR-17	38.77989052100	-96.59436173500
MR-18	38.75378770500	-96.59330784800
MR-19	38.75974606400	-96.59416447000
MR-20	38.76814915900	-96.55560604100
MR-21	38.76797167100	-96.53459828900
MR-22	38.76798671000	-96.52036325700
MR-23	38.75376152500	-96.51153645000
MR-24	38.75153770000	-96.55742458600
MR-25	38.75360079600	-96.56396426300
MR-26	38.79037147200	-96.57553681000
MR-27	38.76758291600	-96.65538720400
MR-28	38.78302175800	-96.63474795000
MR-29	38.75263608800	-96.67737580900
MR-30	38.75415816000	-96.70551696100
MR-31	38.76180329100	-96.72326204800
MR-32	38.76860949100	-96.70210416200
MR-33	38.76994306500	-96.68680875600
MR-34	38.78307967700	-96.66900351700
MR-35	38.79777234000	-96.68539974100
MR-36	38.80438485800	-96.64995452400
MR-37	38.81218728800	-96.64032665900
MR-38	38.81650957800	-96.63145624200
MR-39	38.86827525900	-96.66821907400
MR-40	38.86460534000	-96.66825692200
MR-41	38.85565509200	-96.67987670500
MR-42	38.83345455400	-96.68637547500
MR-42a	38.81748984900	-96.65051824600
MR-43	38.86631409700	-96.70487584000
MR-44	38.87002145700	-96.74772211300
MR-45	38.87017301300	-96.74497320900

MR-46	38.86641086000	-96.74230910300
MR-46a	38.84096388600	-96.73701144900
MR-47	38.81951393100	-96.76057186600
MR-48	38.82877492800	-96.76055559900
MR-49	38.83583938000	-96.76046879100
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MR-430	38.56998889800	-96.40913704700
MR-431	38.56514430800	-96.40904441500
MR-432	38.56325022000	-96.40900817400
MR-433	38.56283033500	-96.40902583300
MR-434	38.55070658900	-96.38904518200
MR-435	38.54967208700	-96.40901906600
MR-436	38.53616576600	-96.42512149000
MR-437	38.53620303000	-96.43085348800
MR-438	38.52155654400	-96.49089579200
MR-439	38.52178096400	-96.35527424900
MR-440	38.52812277600	-96.35380607200
MR-441	38.52174749300	-96.37121260400
MR-442	38.52607173900	-96.36766349200
MR-443	38.52542474100	-96.36778746200
MR-444	38.52749091600	-96.36765191000

MR-445	38.55111396100	-96.37218057700
MR-446	38.55337199800	-96.37197796900
MR-447	38.55399675200	-96.37183722800
MR-448	38.57996129100	-96.35973117600
MR-449	38.57879184200	-96.35593984700
MR-450	38.58754348700	-96.35341297100
MR-451	38.59639332100	-96.36259240700
MR-452	38.60530720400	-96.36278887500
MR-453	38.52939505100	-96.41448285300
MR-454	38.52463485100	-96.43907391700
MR-455	38.52166358800	-96.44091048700
MR-456	38.52171779200	-96.46476052700
MR-457	38.76380929600	-96.56282332100
MR-458	38.76472301200	-96.56288379000
MR-459	38.76233561700	-96.56527609400
MR-460	38.76342502400	-96.57912186400
MR-461	38.76676655800	-96.57161666600
MR-462	38.75268210500	-96.57639157600
MR-463	38.74779951300	-96.58449802400
MR-464	38.74843470400	-96.58696821800
MR-465	38.75386039000	-96.58214524600
MR-466	38.74336603200	-96.58421287500