DRAINAGE DESIGN SUMMARY

County :	MARSHALL	Route :	Calvert City Road	Item # :			
UPN :		FPN :		Sta.:	0.703		
Latitude (dec deg):	37°01'34"	Longitude (dec deg):	88°22'15"				

EXISTING CONDITIONS

Downstream Channel Data			Drainage Area:	2.54	Sq Mi	Slope :	0.06%
Stream Name or Description:	Camp Creek						

Return Interval (years)	2	5	10	25	50	100	500
Discharge (cfs)	524	845	1090	1420	1690	1960	2670
Flow Depth ; Tailwater (ft)	3.08	3.70	4.11	4.63	5.01	5.36	6.19

Normal Pool El.	332.5	OHW Elev.		Bed Material:		D50 (mm)	
Drift:		Abrasion Level:		pH:		Resistivity:	Date Taken:
FEMA Flood Zone:	Yes	Zone Type:	AE	Flood Map No(s):	21157C0038E		

Existing Bridge or Culvert				Drainage Area:	2.54	Sq Mi
Size, Length, Type & Material:	60' 3-span precast channel beam bridge			Skew:	0	
Lt. Abut./Inlet:	30' LT (HEC Model)		Rt. Abut./Outlet:	30' RT (HEC Model)		
Inlet El.:		Outlet El.:		Slope:		Top/Grate El.:	
Low Road El.:	340.8	Low Beam El.:	339.05	Net Opening:	349 sq. ft.		

Return Interval (years)	2	5	10	25	50	100	500
Discharge (cfs)	524	845	1090	1420	1690	1960	2670
Headwater Elev.	335.24	335.85	336.25	336.69	336.98	337.31	339.06
Outlet Velocity (ft/s)	3.98	5.19	5.98	6.94	7.69	8.14	9.18

PROPOSED CONDITIONS

Downstream Channel Data			Drainage Area:	2.54	Sq Mi	Slope :	0.06%
Stream Name or Description:	Camp Creek						

Return Interval (years)	2	5	10	25	50	100	500
Discharge (cfs)	524	845	1090	1420	1690	1960	2670
Flow Depth ; Tailwater (ft)	3.08	3.69	4.11	4.62	4.99	5.34	6.17

Proposed Bridge or Culvert				Drainage Area:	2.54	Sq Mi
Size, Length, Type & Material:	40' single span 17" PPC Deck beam bridge			Skew:	0	
Lt. Abut./Inlet:	20' LT (HEC Model)		Rt. Abut./Outlet:	20' RT (HEC Model)		
Inlet El.:		Outlet El.:		Slope:		Top/Grate El.:	
Low Road El.:	340.8	Low Beam El.:	336.38	Net Opening:	289 sq ft		

Return Interval (years)	2	5	10	25	50	100	500
Discharge (cfs)	524	845	1090	1420	1690	1960	2670
Headwater Elev.	335.25	335.95	336.45	337.10	337.57	338.08	340.06
Outlet Velocity (ft/s)	4.51	6.19	7.29	8.32	9.24	9.60	7.39
Flow Over Road (cfs)	0.00	0.00	0.00	0.00	0.00	0.00	333.75

REMARKS and / or CONTROLS

A reduced bridge opening is not recommended for bridge replacement. Significant headwaters are produced, > 1', at the 100yr event which can cause potential flooding upstream. Channel velocites are increased over the existing condition which creates the potential for scour, resulting in damage the proposed structure.

RECORD HIGHWATER DATA

Source	1: FEMA Map	2:	3:
Elevation	342 +/- (100 yr)		
Date			
Location			

PROPOSED CHANNEL LINING / STREAM DISTURBANCE

Location	Class	Thickness	Depth	Length	Quantity	Quantity Below OHW (CY)
Upstream						
Downstream						

Total Length of Stream Disturbance (ft):

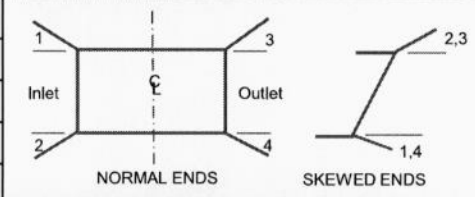
PROPOSED DIVERSION

Flooding	Return Interval (yrs)	Discharge (cfs)	Elevation
Design Storm			
Overtopping Storm			

Recommended Size and Type of Opening(s):

PROPOSED BOX CULVERT OR SPECIAL WING WALLS

Inlet/Lt. Abut. Skewed		Outlet/Rt. Abut. Skewed		
Location	1	2	3	4
30 Degree				
Skewed				
Special				



SCOUR

Analysis Method:	Froehlich	Flow Angle (deg):	0	D50 (mm)		D95 (mm)	
Contraction Scour (ft):		Local Abut. Scour (ft):		Total Abut. Scour (ft):	0.00		

Pier No.:												
Length (ft):												
Width (ft):												
* Type:												
Local Scour:												
Total Scour:												

* (1) Triangular Nose (2) Square Nose (3) Round Nose (4) Circular Cylinder (5) Group Cylinders

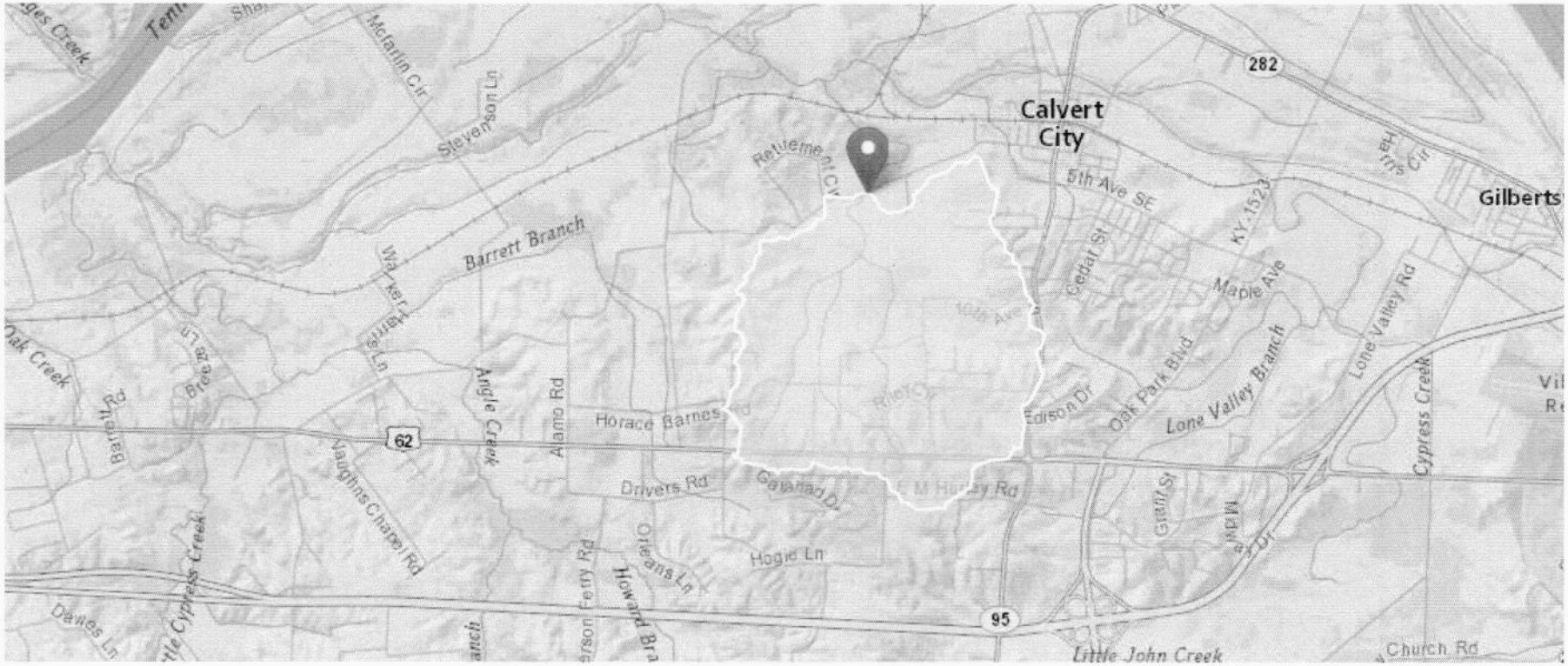
Potential for Aggradation/Degradation/Movement:

Other Factors Affecting Abut./Pier Location:

Scour Mitigation Measures:

StreamStats Report

Region ID: KY
Workspace ID: KY20180418154256523000
Clicked Point (Latitude, Longitude): 37.02623, -88.37065
Time: 2018-04-18 10:48:53 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	2.54	square miles
KYVARIND93	Mapped streamflow variability index as defined in WRIR 92-4173	0.7	dimensionless
KYVARIND10	Mapped streamflow-variability index as defined in SIR 2010-5217	0.711	dimensionless
LAT_OUT	Latitude of Basin Outlet	37.026214	degrees
ELEV	Mean Basin Elevation	383	feet
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	5.49	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0.66	percent

General Flow Statistics Parameters [Statewide Harmonic Mean Flow 92 4173]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.54	square miles	3.89	1607
KYVARIND93	KY Streamflow Variability Index 1993	0.7	dimensionless	0.4	1.35

General Flow Statistics Disclaimers [Statewide Harmonic Mean Flow 92 4173]

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

General Flow Statistics Flow Report [Statewide Harmonic Mean Flow 92 4173]

Statistic	Value	Unit
Harmonic Mean Streamflow	0.216	ft^3/s

General Flow Statistics Citations

Martin, G. R. and Ruhl, K. J.,1993, Regionalization of harmonic-mean streamflows in Kentucky: U.S. Geological Survey Water-Resources Investigations Report 92-4173, 47 p., 1 pl. (http://pubs.er.usgs.gov/publication/wri924173StreamStats_KY_20140226.mdb)

Peak-Flow Statistics Parameters [West Region 7]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.54	square miles	0.1	706

Peak-Flow Statistics Flow Report [West Region 7]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp	Equiv. Yrs.
2 Year Peak Flood	524	ft^3/s	47.2	1.4
5 Year Peak Flood	845	ft^3/s	46	2.1
10 Year Peak Flood	1090	ft^3/s	45.6	3
25 Year Peak Flood	1420	ft^3/s	45.8	4.1
50 Year Peak Flood	1690	ft^3/s	46.2	5
100 Year Peak Flood	1960	ft^3/s	46.8	5.8
200 Year Peak Flood	2260	ft^3/s	47.7	6.6
500 Year Peak Flood	2670	ft^3/s	49.1	7.5

Peak-Flow Statistics Citations

Hodgkins, G.A. and Martin, G.R.,2003, Estimating the Magnitude of Peak Flows for Streams in Kentucky for Selected Recurrence Intervals: U.S. Geological Survey Water-Resources Investigations Report 03-4180, 69 p. (http://water.usgs.gov/pubs/wri/wri034180/)

Probability Statistics Parameters [Statewide ZeroProbability 2010 5217]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.54	square miles	0.04	1984
KYVARIND10	KY Streamflow Variability Index 2010	0.711	dimensionless	0.45	1.35

Probability Statistics Flow Report [Statewide ZeroProbability 2010 5217]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PC
Probability zero flow 7 day 2 year	0.486	dim	94
Probability zero flow 7 day 10 year	0.174	dim	88
Probability zero flow 7 day 20 year	0.106	dim	94
Probability zero flow 30day 2 year	0.385	dim	98
Probability zero flow 30 day 5 year	0.185	dim	94

Probability Statistics Citations

Martin, G.R., and Arihood, L.D.,2010, Methods for estimating selected low-flow frequency statistics for unregulated streams in Kentucky: U.S. Geological Survey Scientific Investigations Report 2010-5217, 83 p. (http://pubs.usgs.gov/sir/2010/5217/)

Low-Flow Statistics Parameters [Low Flow Region 1 2010 5217]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.54	square miles	0.65	1976
KYVARIND10	KY Streamflow Variability Index 2010	0.711	dimensionless	0.46	1.35

Low-Flow Statistics Flow Report [Low Flow Region 1 2010 5217]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
7 Day 2 Year Low Flow	0.0714	ft^3/s	157
7 Day 10 Year Low Flow	0.0512	ft^3/s	208
7 Day 20 Year Low Flow	0.0479	ft^3/s	226
30 Day 2 Year Low Flow	0.122	ft^3/s	108
30 Day 5 Year Low Flow	0.0554	ft^3/s	161

Low-Flow Statistics Citations

Martin, G.R., and Arihood, L.D.,2010, Methods for estimating selected low-flow frequency statistics for unregulated streams in Kentucky: U.S. Geological Survey Scientific Investigations Report 2010-5217, 83 p. (http://pubs.usgs.gov/sir/2010/5217/)

Annual Flow Statistics Parameters [Statewide Mean Annual Flow 02 4206]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.54	square miles	0.67	2762
LAT_OUT	Latitude of Basin Outlet	37.026214	degrees	36.341	39.14
ELEV	Mean Basin Elevation	383	feet	391	2414

Annual Flow Statistics Disclaimers [Statewide Mean Annual Flow 02 4206]

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

Annual Flow Statistics Flow Report [Statewide Mean Annual Flow 02 4206]

Statistic	Value	Unit

Statistic	Value	Unit
Mean Annual Flow	3.13	ft^3/s

Annual Flow Statistics Citations

Martin, G.R.,2002, Estimating Mean Annual Streamflow of Rural Streams in Kentucky: U.S. Geological Survey Water-Resources Investigations Report 02-4206, 35 p. (http://pubs.er.usgs.gov/publication/wri024206)

sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

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

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

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

The **projection** used in the preparation of this map was Kentucky State Plane coordinate system (FIPSZONE 1600). The horizontal datum was NAD83, GRS80 spheroid. Differences in datum, spheroid or projection used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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

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

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

Base map information was derived from multiple sources. Digital orthophotography shown on this FIRM is provided by Kentucky Division of Geographic Information (KY DGI). These images were originally produced by Photo Science, Inc. in 2009 as 10,000ft x 10,000ft tiles with 2-foot pixel resolution and projected to State Plane Kentucky Single Zone with a NAD83 datum. The images have been combined as a mosaic to provide seamless coverage. Road centerlines obtained in 2005 and political boundary files dated 2009 were provided by the Kentucky Geographic Network. Stream centerlines were downloaded from the National Hydrography Dataset provided by the U.S. Geological Survey. Users of this FIRM should be aware that minor adjustments may have been made to specific base map features.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

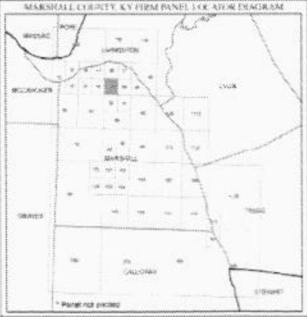
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

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

Contact the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA MAP** (1-877-336-2627) for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Information eXchange may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov/.

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

MARSHALL COUNTY, KY FIRM PANEL LOCATOR DIAGRAM



Kentucky

In cooperation with the Federal Emergency Management Agency (FEMA) and local communities in Kentucky, this Flood Insurance Rate Map was developed by the Kentucky Division of Water in a digital statewide format to assist communities in their efforts to minimize the loss of property and life through effectively managing development in flood-prone areas. The State of Kentucky has implemented a long term approach to floodplain management to reduce the

ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH
ZONE AO
ZONE AR
ZONE A99
ZONE V
ZONE VE

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X

OTHER AREAS

ZONE X
ZONE D

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

MAP SCALE 1" = 500'

250	0	500	1000 FEET

150	0	150	300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0038E

FIRM
FLOOD INSURANCE RATE MAP

MARSHALL COUNTY, KENTUCKY
AND INCORPORATED AREAS

PANEL 38 OF 325
(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

EFFECTIVE DATE
JUNE 2, 2011

MAP NUMBER
21157C0038E

National Flood Hazard Layer FIRMette

FEMA

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth
- Regulatory Floodway *Zone AE, AO, AH, VE, AR*

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

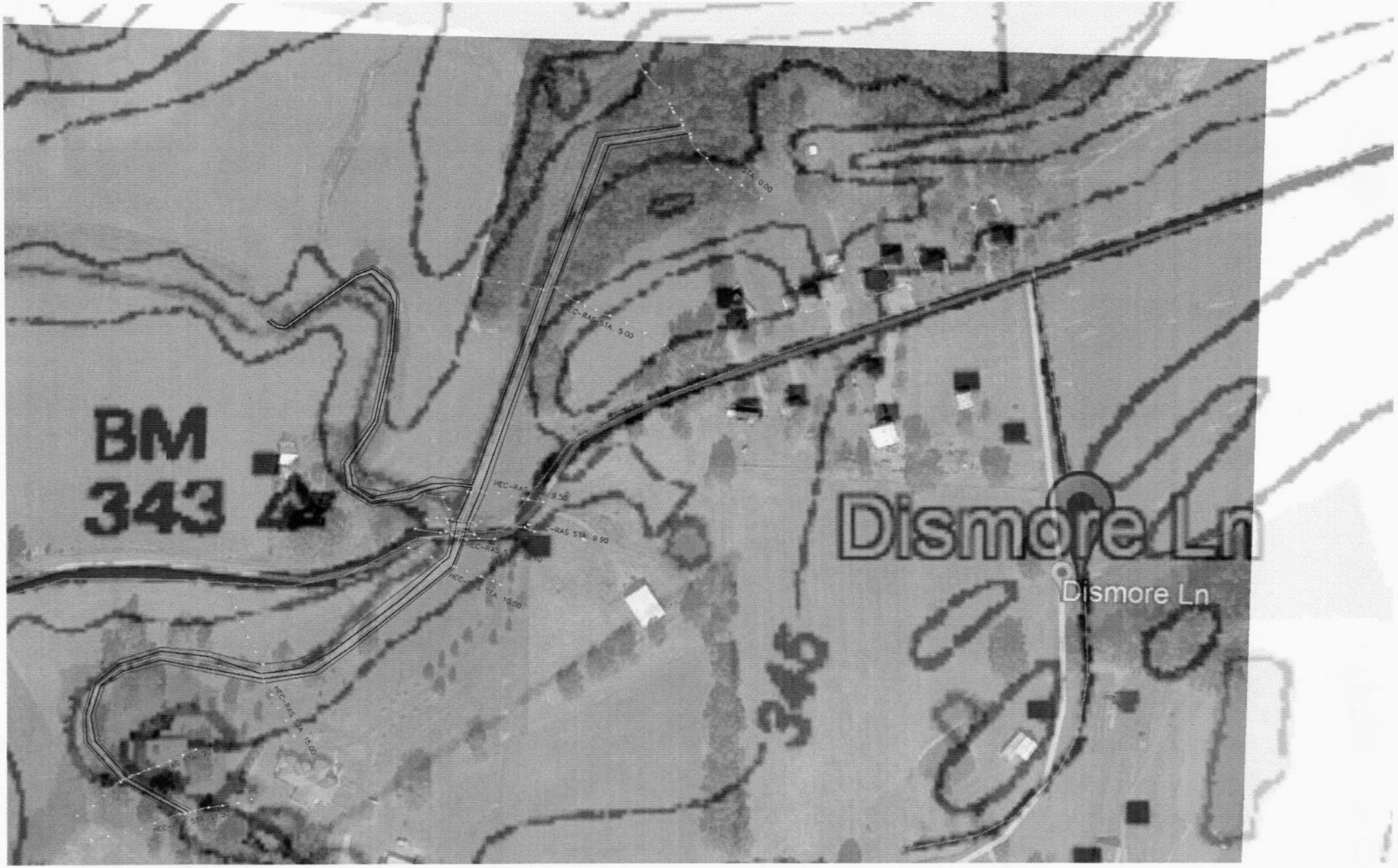
MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The base map shown complies with FEMA's base map accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/20/2018 at 4:21:09 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: base map imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.


BM
343
345
Dismore Ln
Dismore Ln