

**Lynnwood Branch and
Cartwright Creek**

**Conceptual Flood Mitigation Master Plan
and
Hydrologic and Hydraulic Study**

Williamson County, TN

Prepared By:



AMEC Earth and Environmental, Inc.
3800 Ezell Road, Suite 100
Nashville, TN 37211

July 2011

TABLE OF CONTENTS

Section 1: Introduction

Project Description.....	1
--------------------------	---

Section 2: Watershed Description

Watershed Location and Drainage Area	2
Topography	2
Soils.....	2
Land Use	2

Section 3: Hydrology Documentation

Basin Boundary Delineation.....	4
Land Use	4
Soils.....	5
Curve Number Calculations.....	5
Time of Concentration Calculations	7
Precipitation	9
Channel Routing	9
Model Calibration	9
Hydrologic Model Results	9

Section 4: Hydraulics Documentation

Topographic Data.....	17
Cross Section Development.....	17
Parameter Estimation	17
Model Results	18
Floodway Development.....	20

Section 5: Alternative Analysis

Lynnwood Branch Alternatives	22
Cartwright Creek Alternatives	24

Section 6: Alternative Analysis

Section 7: References

Appendix A. Floodplain and Floodway Maps

Appendix B. Flood Profiles

List of Tables

No.	Description	Page
3-1	Distribution of Land Use in Lynnwood Branch and Cartwright Creek Watersheds	4
3-2	Curve Number Lookup Table	6
3-3	Hydrologic Parameters Summary for Lynnwood Branch Basin	7
3-4	Hydrologic Parameters Summary for Cartwright Creek Basin	8
3-5	Williamson County, TN, Frequency Rainfall Depths.....	9
3-6	Lynnwood Branch Flow Comparisons	10
3-7	Cartwright Creek Flow Comparisons	10
4-1	Lynnwood Branch Hydraulic Model Results	18
4-2	Cartwright Creek Hydraulic Model Results	19
4-3	Lynnwood Branch Floodway Results.....	20
4-4	Cartwright Creek Floodway Results.....	21
5-1	Lynnwood Branch Alternative Analysis Results.....	23
5-2	Cartwright Creek Alternative Analysis Results.....	25

List of Maps

No.	Description	Page
2-1	Location Map	3
3-1	Lynnwood Branch Sub-Basin Boundaries.....	11
3-2	Cartwright Creek Sub-Basin Boundaries.....	12
3-3	Lynnwood Branch Land Use Delineations	13
3-4	Cartwright Creek Land Use Delineations	14
3-5	Lynnwood Branch Soil Group Delineations.....	15
3-6	Cartwright Creek Soil Group Delineations.....	16

SECTION 1

INTRODUCTION

Project Description

Williamson County contracted AMEC Earth & Environmental to develop a concept level floodplain mitigation master plan. This included the development of hydrologic and hydraulic computer models and FEMA floodplain and floodway mapping to replace and extend existing studies on Cartwright Creek and Lynnwood Branch. Conceptual flood mitigation alternatives were analyzed in each basin for areas with high flooding potential. Lynnwood Branch was studied from approximately 3500 feet upstream of Berry's Chapel Road to its confluence with the Harpeth River. Cartwright Creek was studied from approximately 300 feet downstream of the Log Cabin Trail bridge crossing to its confluence with the Harpeth River. This project includes areas of both streams that were previously Zone A non-detailed study areas and also a floodway analysis/development for Cartwright Creek which previously had no such analysis.

Alternatives for potential flood reductions were analyzed for both streams and ranked based on the effectiveness of each scenario. The main factor in the ranking was the overall number of homes removed from the 100-year floodplain.

The project includes production of a Letter of Map Revision (LOMR) application request package for Lynnwood Branch and Cartwright Creek to be submitted to FEMA for review and (presumed) approval. The following report is a summary of all engineering work related to this project.

SECTION 2

WATERSHED DESCRIPTION

Watershed Location and Drainage Area

The Lynnwood Branch and Cartwright Creek watersheds lie adjacent to each other in North Central Williamson County, Tennessee (See Map 2-1). Both areas drain to the West with their respective streams flowing into the Harpeth River. The Cartwright Creek basin drains 5.3 square miles while the Lynnwood Branch basin drains 4.7 square miles.

Topography

Due to the proximity of the two basins, topographic conditions are similar. The eastern and more upstream sub-basins of the study areas are steeper and wooded. As you move west toward the Harpeth River and its floodplain, topography flattens and an increase in development is present. The highest point of elevation in both watersheds is approximately 1140 feet while the lowest point at the confluence of Cartwright Creek and the Harpeth River is approximately 560 feet.

Soils

Soils information was downloaded from the Soil Survey Geographic (SSURGO) databases, provided by the Natural Resources Conservation Service. Soils throughout both Cartwright Creek and Lynnwood Branch Watersheds can be generally classified as Group B and C (moderate runoff potential). A small amount of group D (high runoff potential) is present in the upper parts of the watersheds. There are no group A soils (sandy) in the study area.

Land Use

Land use in both study areas is similar with the exception of the Cartwright Creek basin having a small amount of commercial development in the lower reaches along Hillsboro Road. The upper parts of the watersheds are mostly wooded with a small amount of residential development. Further downstream towards the Harpeth River the watersheds flatten out and an increase in dense residential development occurs, especially in the Lynnwood Branch basin.



MAP 2-1 LOCATION MAP

SECTION 3

HYDROLOGY DOCUMENTATION

Frequency discharges for the Lynnwood Branch and Cartwright Creek watersheds were calculated using the U.S. Army Corps of Engineers hydrologic computer model, HEC-HMS version 3.0.1. Discharges were compared to flows computed by the USACE and the existing FIS flows. The following sections describe the methods used to acquire the required input data for the development of the HEC-HMS model.

Basin Boundary Delineation

Internal sub-basin boundaries were delineated based upon hydrologic features within the watershed, both natural and man-made. Topographic data in the form of 5' contours for the Cartwright Creek Basin and 2' contours for the Lynnwood Branch Basin were provided by Williamson County. Basins were delineated with an average size of 200 acres per sub-basin. Delineation was performed using automated methods within GIS then refined manually. The area of each sub-basin was calculated, in square miles, and is listed in Tables 3-6 and 3-7. Map 3-1 and 3-2 give a visual representation of basin boundaries, and can be found at the end of this section.

Land Use Determination

Land use coverage was developed using parcel data and aerial photography provided by Williamson County. Parcel data was modified within GIS to represent differences in land use using 14 different land use codes as presented later in this section. Land use was verified with field visits. Map 3-3 and 3-4 depict land use boundaries over aerial photos and can be found at the end of this section.

Table 3-1 - Distribution of Land Use in Lynnwood Branch and Cartwright Creek Watersheds

Land Use Description	Percentage of Total Area	
	Cartwright Creek	Lynnwood Branch
Residential (High Density)	0.8%	4.2%
Residential (Medium Density)	5.9%	12.6%
Residential (Low Density)	18.1%	8.5%
Commercial	0.5%	0.0%
Industrial	3.1%	0.8%
Disturbed/Transitional	0.0%	0.1%
Open Land (Fair)	3.8%	0.0%
Open Land (Good)	5.1%	22.7%
Meadow	1.7%	0.0%
Woods (Thick Cover)	51.5%	38.7%
Woods (Thin Cover)	4.8%	4.8%
Impervious	4.1%	7.0%
Water	0.5%	0.0%
Total Area (square miles)	5.32	4.72

Soils

Soils information was downloaded from the Soil Survey Geographic (SSURGO) databases, provided by the Natural Resources Conservation Service (NRCS). The NRCS classifies soils into four Hydrologic Soil Groups based on tendency to infiltrate water. Group A soils have the greatest infiltration capacity while Group D soils have the least. Soils throughout the watershed can be generally classified as Group B and C soils (moderate runoff potential), though there are patches of soil that are classified as Group D (high runoff potential). The soils data for this watershed was compiled in a GIS file, with polygons representing each soil type. Map 3-5 and 3-6 depict the soil group boundaries, and can be found at the end of this section.

Curve Number Calculations

Curve numbers for the sub-basins were generated using a GIS model. The model overlays the polygon files for soils, land use, and drainage basins in order to create a new file demarcating a separate mini-polygon for each soil-land use-basin combination. Each unique mini-polygon was assigned a separate curve number based upon its soil-land use-basin combination, with assumed AMC II soil moisture conditions. Table 3-2 summarizes the land use – soil type – curve number relationships. A curve number was determined for each sub-basin by generating an area-weighted average from all the mini-polygons that lie within the basin boundary. Tables 3-3 and 3-4 provides a summary of the results of the curve number calculations.

Table 3-2 - Curve Number Lookup Table

Land Use Code	Description	Curve Number by Hydrologic Soil Group				Typical Land Uses
		A	B	C	D	
1	Residential (High Density)	77	85	90	92	Multi-Family, Apartments, Condos, Row Houses, Trailer Parks
2	Residential (Medium Density)	57	72	81	86	Single-Family, Lot Size 1/4 to 1 Acre
3	Residential (Low Density)	48	66	78	83	Single-Family, Lot Size 1 acre and Greater
4	Commercial	89	92	94	95	Strip Commercial, Shopping Centers, Convenience Stores
5	Industrial	81	88	91	93	Light Industrial, Schools, Prisons, Treatment Plants
6	Disturbed/Transitional	76	85	89	91	Gravel Parking, Quarries, Gravel Pits, Land Under Development
7	Agricultural	67	77	83	87	Cultivated Land, Row Crops, Broadcast Legumes
8	Open Land - Fair	49	69	79	84	Grazed Pasture
9	Open Land - Good	39	61	74	80	Urban Green Space, Parks, Golf Courses, Cemeteries
10	Meadow	30	58	71	78	Hay Fields, Tall Grass, Ungrazed Pasture
11	Woods (Thick Cover)	30	55	70	77	Forest Litter and Brush adequately Cover Soil
12	Woods (Thin Cover)	43	65	76	82	Light Woods, Woods-Grass Combination, Tree Farm, Orchards
13	Impervious	98	98	98	98	Paved Parking, Shopping Malls, Major Roadways, Paved Ditches
14	Water	100	100	100	100	Water Bodies, Lakes, Ponds, Wetlands

Time of Concentration Calculations

Times of concentration (T_c) were calculated using the lag method as described in Technical Release #55 by the NRCS, whereas flow along the path from the most distant point to the outlet was subdivided into sections according to the type of flow: overland, shallow concentrated, pipe, and channel. Flow paths in question were field verified. Travel times were calculated for each of these sections, and summed into T_c . Tables 3-3 and 3-4 provide a summary of parameters used for the hydrologic modeling for Lynnwood Branch and Cartwright Creek.

Table 3-3 - Hydrologic Parameters Summary for Lynnwood Branch Basin

Lynnwood Branch Basin				
Basin Name	Basin ID	Area (acres)	Curve Number	Time of Concentration (minutes)
Above Brookside	1	145	71	24
Beechs Tavern	2	152	67	35
Below Smith	3	226	69	26
Brookside	4	152	75	16
Farmington	5	151	78	41
Fieldstone	6	182	83	33
Glen Haven	7	76	66	25
Hartland	8	152	70	31
Legends1	9	61	78	27
Legends2	10	70	76	28
Lower Berrys	11	198	72	30
Lower Brookside	12	128	80	32
Lower Fieldstone	13	156	76	31
Smith	14	144	70	26
Upper Berrys	15	155	66	28
Upper Hartland	16	185	63	26
Upper Lake Valley	17	79	72	28
Upper Lynnwood	18	189	65	32
Upper Meadowgreen	19	138	75	27
Walesworth	20	114	85	13
Walnut Grove	21	72	83	22
Legends3	22	70	77	32
Upper Legends3	23	31	80	27

Table 3-4 - Hydrologic Parameters Summary for Cartwright Creek Basin

Cartwright Creek Basin				
Basin Name	Basin ID	Area (acres)	Curve Number	Time of Concentration (minutes)
Upper Hunterwood	1	137	68	29
Lower HBRO	6	115	79	43
Upper HBRO	7	165	72	28
Featherstone	13	114	73	32
Lower Cartwright Creek	15	198	74	49
Blue Springs	17	141	77	28
Battlewood	18	88	78	21
Manley Basin	19	255	74	44
Lower Hunterwood	21	145	79	44
Upper Cartwright Creek	22	59	85	42
Upper Berrys	23	147	65	20
Hidden Valley	24	144	68	33
Hidden Hollow	25	169	73	33
Mid Hidden Valley	26	77	70	30
Upper HV	27	117	75	30
Lower HV	28	171	69	25
Upper General JB	29	182	66	46
Upper Bobby	30	186	72	41
Bobby	31	189	73	31
E Manley	33	180	74	37
Beech Creek	34	139	72	28
Gen JB Hood	36	109	76	30
Overlook	37	65	75	31
Harpeth Hills	39	113	78	39

Precipitation

Rainfall depths were taken from NOAA Atlas-14. Table 3-5 presents the 2-, 10-, 50-, 100-, and 500-year frequency rainfall depths, for the 24 hour duration, used to develop the SCS Type II storm for hydrologic modeling in the Cartwright Creek and Lynnwood Branch watersheds.

Table 3-5 – Williamson County, TN, Frequency Rainfall Depths

FREQUENCY (YEARS)	24 HR RAINFALL DEPTH
2	3.68
10	5.12
25	6.02
50	6.75
100	7.50
500	9.38

Channel Routing

The commonly used Muskingum-Cunge method of channel routing was used for all reaches in both watersheds due to its applicability in a varied range of channel and hydrograph conditions. Reach lengths were calculated using GIS and aerial photography. Slopes were determined from available survey and contour data. Channel roughness factors (Manning's n values) were estimated from aerial photographs and field visits.

To capture channel geometry in the model, cross section parameters necessary to develop 8-point cross sections were determined using two methods. First, field survey data collected for hydraulic modeling were used for those reaches where appropriate. Second, where field survey data were not available, a trapezoidal channel shape was used, and the remaining section geometry estimated from available topographic data.

Model Calibration

Since no USGS gauges exist on either of the creeks, calibration targets were limited to previous studies and similar watershed comparisons containing gauges. The predicted discharges match fairly well with the existing studies and similar watersheds. Differences may be attributed to better topography, increased resolution of aerials used to determine land use, and more detailed parameter development for the models.

Hydrologic Model Results

The hydrologic models of Lynnwood Branch and Cartwright Creek watersheds provide peak discharge estimates at numerous locations in the watershed. Tables 3-6 and 3-7 show a comparison of the hydrologic modeling results for various flood frequencies for both watersheds.

Table 3-6 – Lynnwood Branch Flow Comparisons

Location	FIS Drain. Area (sq.mi.)	AMEC Drain. Area (sq.mi.)	Peak Discharge (cfs)							
			Existing FIS Q10	Revised Q10	Existing FIS Q50	Revised Q50	Existing FIS Q100	Revised Q100	Existing FIS Q500	Revised Q500
At Confluence with Harpeth River	5.38	4.73	1950	2090	2900	3327	3350	3940	4350	5787
At Approximately .574 Mile (Appox. 500' upstream of Meadowgreen Drive)	4.12	3.91	1780	1761	2650	2898	3060	3437	4000	5160
At Approximately .831 Mile (At Hillsboro Road)	3.64	3.7	1560	1669	2330	2772	2700	3292	3540	5009
At Approximately 1.361 Mile (Appox. 1200' downstream of S. Berry's Chapel Rd)	3.27	3.23	1380	1498	2070	2504	2400	2985	3160	4408
At Approximately 577 Mile (Appox. +00' upstream of S. Berry's Chapel Rd)	2.24	2.01	840	948	1270	1596	1470	1894	1950	2731

Table 3-7 – Cartwright Creek Flow Comparisons

Location	FIS Drain. Area (sq.mi.)	AMEC Drain. Area (sq.mi.)	Peak Discharge (cfs)							
			Exist FIS Q10	Revised Q10	Exist FIS Q50	Revised Q50	Exist FIS Q100	Revised Q100	Existing FIS Q500	Revised Q500
At Confluence with Harpeth River	5.38	5.31	2148	3274	3284	4912	3793	5694	5200	7759
Just Downstream of confluence with Sweeny Hollow	4.45	4.78	1952	3067	3005	4588	3458	5255	4800	7269
Just Downstream of confluence with Fulton Branch	2.58	2.37	1359	1582	2141	2334	2414	2706	3400	3662
Just Upstream of Beech Road	1.25	1.29	781	860	1257	1279	1396	1486	1950	2028

MAP 3-1

Lynnwood Branch Drainage Basin

- Stream
- SubBasin
- Major Street

SubBasin ID	SubBasin Name
1	Above Brookside
2	Beechs Tavern
3	Below Smith
4	Brookside
5	Farmington
6	Fieldstone
7	Glen Haven
8	Hartland
9	Legends1
10	Legends2
11	Lower Berrys
12	Lower Brookside
13	Lower Fieldstone
14	Smith
15	Upper Berrys
16	Upper Hartland
17	Upper Lake Valley
18	Upper Lynnwood
19	Upper Meadowgreen
20	Walesworth
21	Walnut Grove
22	Legends3
23	Upper Legends3

Map Scale 1:17,000

0 1,000 2,000 FEET



0 0.25 0.5 MILES



MAP 3-2

Cartwright Creek Drainage Basin

- Stream
- SubBasin
- Major Street

SubBasin ID	SubBasin Name
1	Upper Hunterwood
6	Lower HBRO
7	Upper HBRO
13	Featherstone
15	Lower Cartwright Creek
17	Blue Springs
18	Battlewood
19	Manley Basin
21	Lower Hunterwood
22	Upper Cartwright Creek
23	Upper Berrys
24	Hidden Valley
25	Hidden Hollow
26	Mid Hidden Valley
27	Upper HV
28	Lower HV
29	Upper General JB
30	Upper Bobby
31	Bobby
33	East Manley
34	Beech Creek
36	General JB Hood
37	Overlook
39	Harpeth Hills

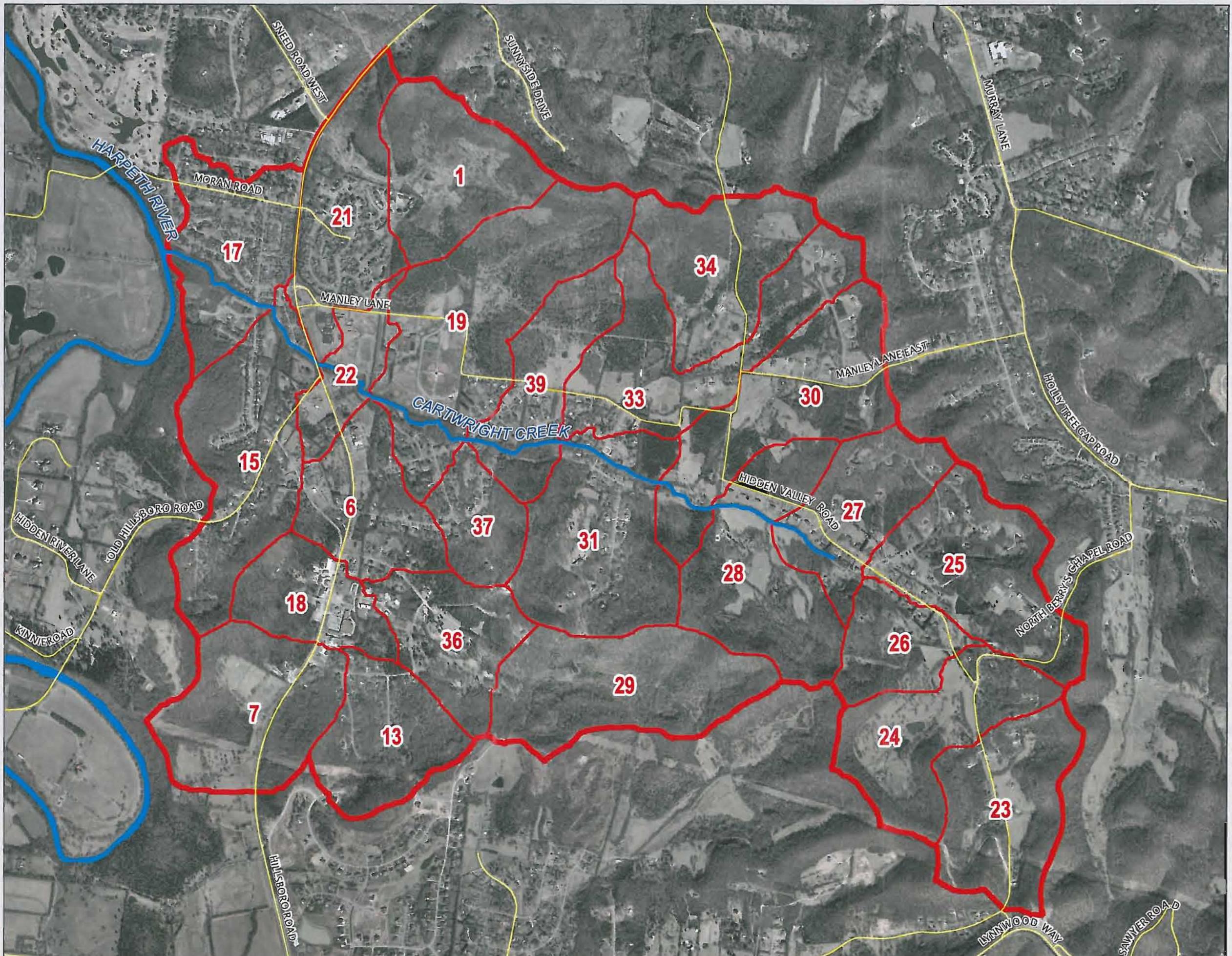
Map Scale 1:19,000

0 1,000 2,000 FEET

0 0.25 0.5 MILES



amec



MAP 3-3

Lynnwood Branch Drainage Basin Land Use

	Stream
	SubBasin
	SubBasin ID
8	Major Street
	Land Use Code
	Land Use Description
1	Residential (High Density)
2	Residential (Medium Density)
3	Residential (Low Density)
4	Commercial
5	Industrial
6	Disturbed/Transitional
8	Open Land - Fair
9	Open Land - Good
10	Meadow
11	Woods (Thick Cover)
12	Woods (Thin Cover)
13	Impervious
14	Water

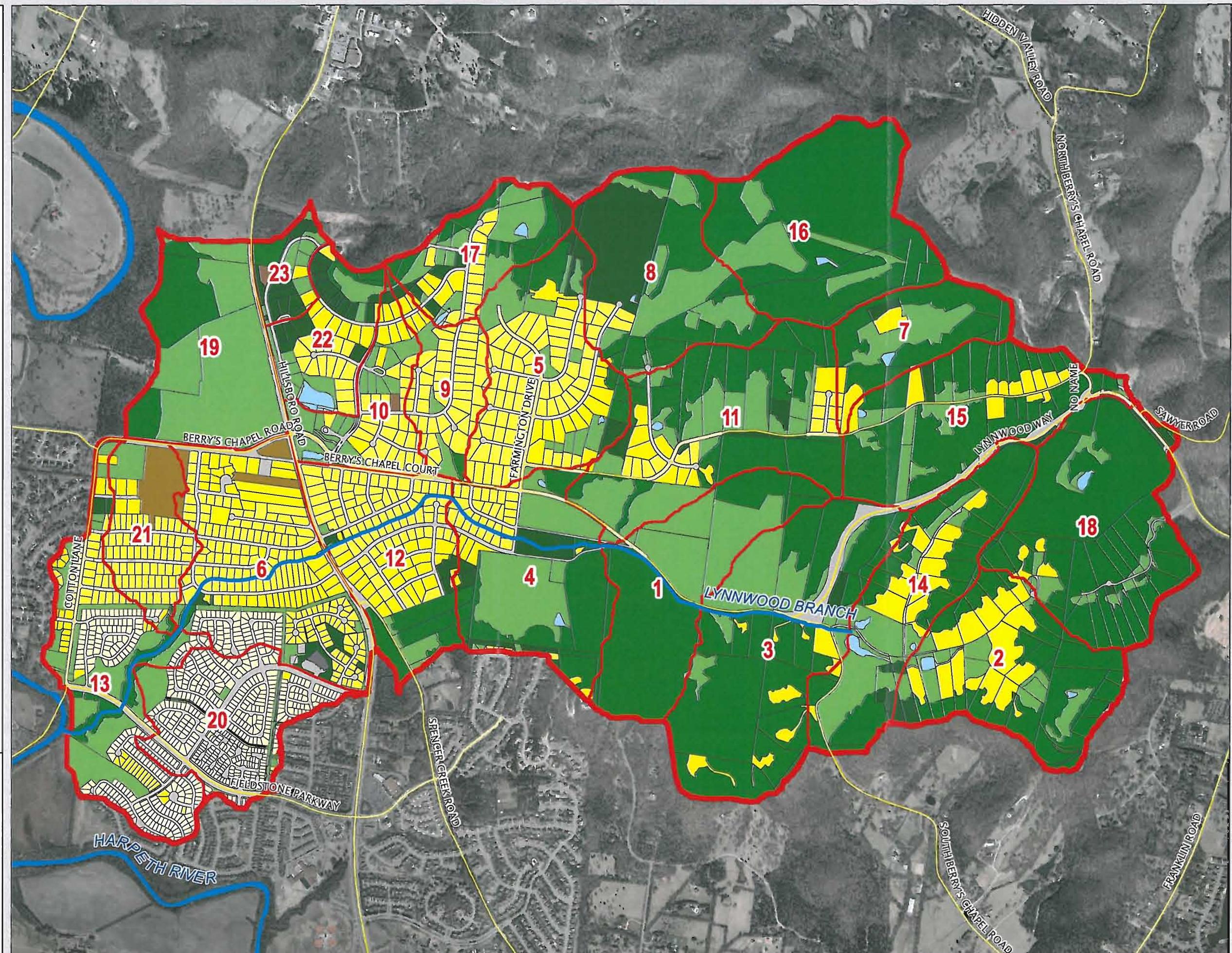
Map Scale 1:17,000

0 1,000 2,000 FEET

0 0.25 0.5 MILES



amec



MAP 3-5

Lynnwood Branch Drainage Basin Soils

- Stream
- SubBasin
- SubBasin ID
- Major Street

Hydrologic Soil Group

- B
- C
- D
- E

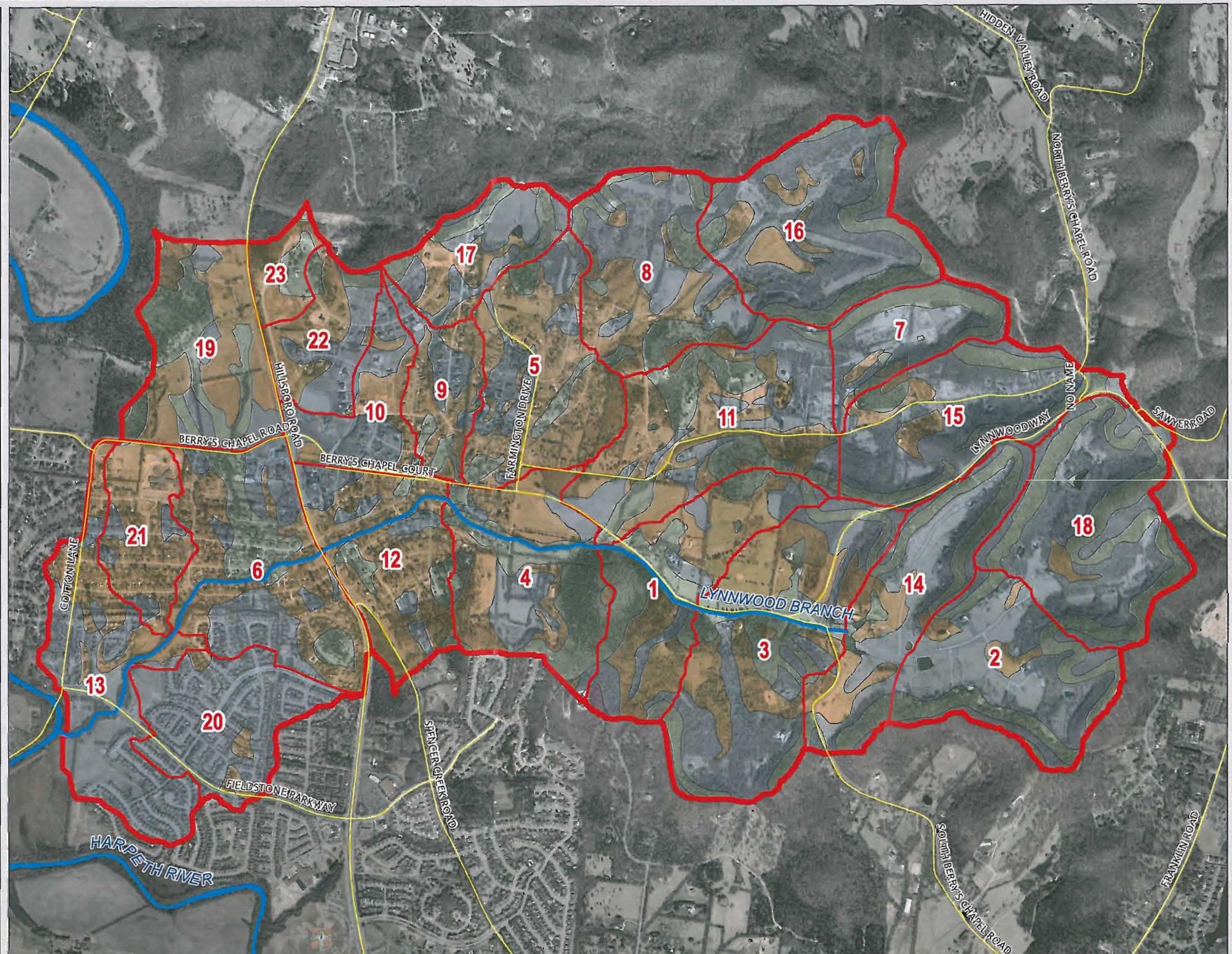
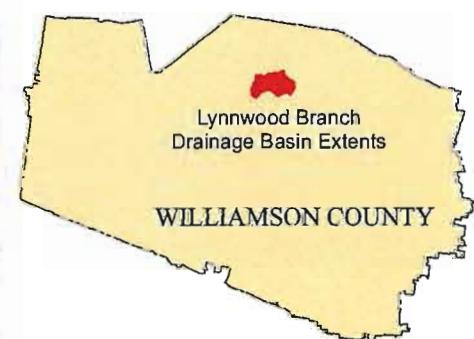
Map Scale 1:17,000

0 1,000 2,000 FEET

0 0.25 0.5 MILES



amec



MAP 3-6

Cartwright Creek Drainage Basin Soils

- Stream
- SubBasin
- SubBasin ID
- Major Street

Hydrologic Soil Group

Map Scale 1:19,000

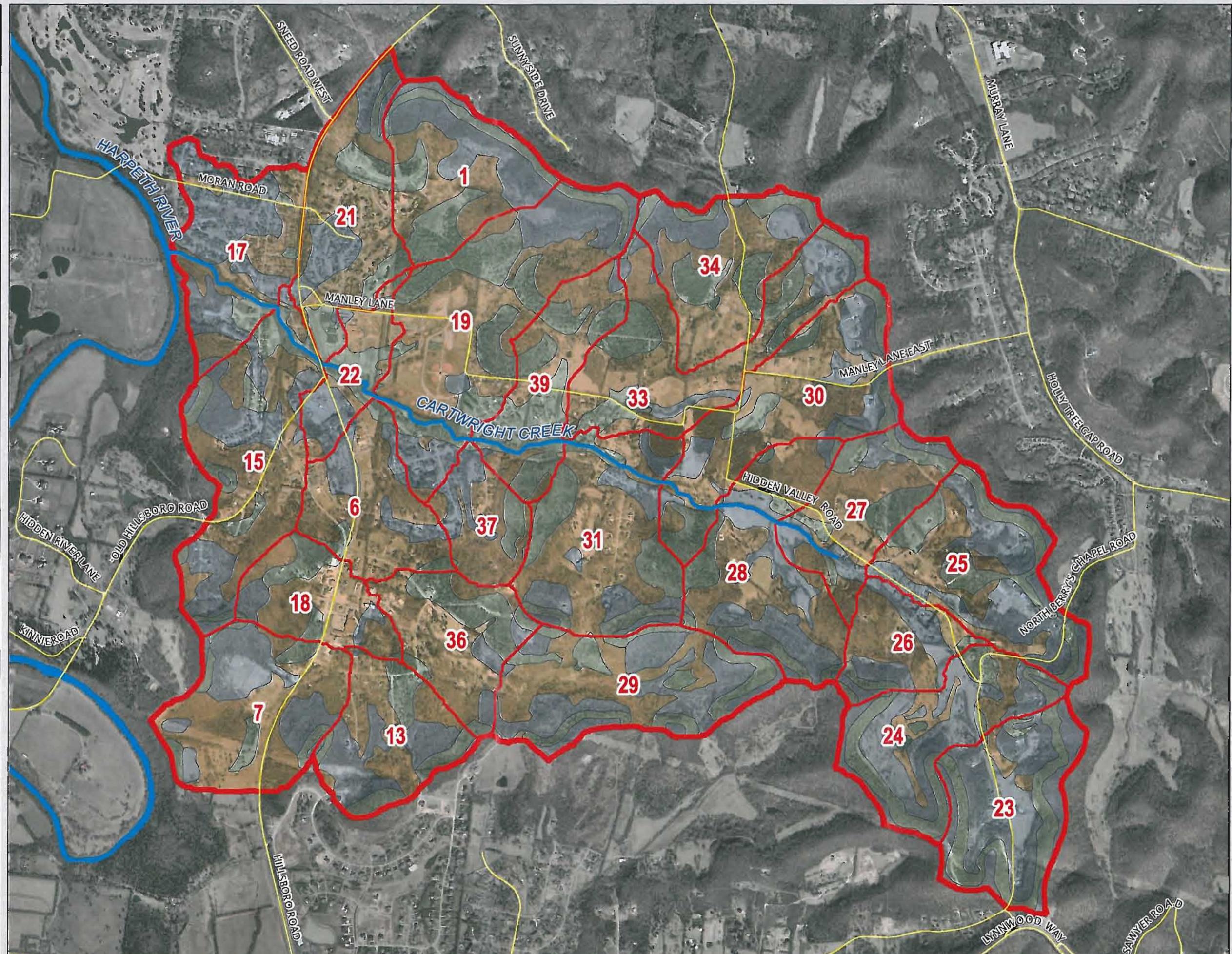
0 1,000 2,000

A scale bar with two markings. The first marking is at 0.25 miles, and the second marking is at 0.5 miles. The text 'FEET' is at the top right, and 'MILES' is at the bottom right.

S



amec



SECTION 4

HYDRAULICS DOCUMENTATION

A detailed hydraulic analysis was performed on Cartwright Creek and Lynnwood Branch. Lynnwood Branch was studied from approximately 3500 feet upstream of Berry's Chapel Road to its confluence with the Harpeth River. Cartwright Creek was restudied from approximately 300 feet downstream of the Log Cabin Trail bridge crossing to its confluence with the Harpeth River. The analyses were performed using the hydraulic model HEC-RAS version 3.1.3. The hydraulic model was developed using available information including topographic data, channel and overbank surveys, and hydraulic structure survey. The development of geometric data and hydraulic parameters is discussed in the following sections.

Topographic Data

Digital topographic contour maps with a 5-foot interval for Cartwright Creek, 2-foot for Lynnwood Branch were provided by Williamson County. The contour data references the National Geodetic Vertical Datum of 1988 (NGVD88). The NGVD88 is the most accurate vertical datum, and is compatible with modern surveying and mapping technologies. These contour maps were used to produce a digital elevation model (DEM) of the study area. The digital elevation model was then used for the development of hydraulic cross-sections and floodplain mapping.

Cross Section Development

Model cross-section locations were chosen based upon changes in topography and stream confluences. Station and elevation data for the model cross-sections were then digitally cut from the topographic data, and cross-sections numbered according to their distance (in feet) upstream from their confluence with the Harpeth River. A detailed field survey was performed at each stream crossings. Survey data for each cross-section was then integrated into the model cross-sections using Microsoft Excel.

Parameter Estimation

Additional parameters developed for the HEC-RAS model include downstream reach lengths, roughness coefficients, main channel bank stations, and contraction and expansion coefficients. Downstream reach lengths were calculated using an automated routine that measures the length between two cross-sections in the right and left overbanks, as well as the length along the channel centerline. This routine accounts for meander in the stream and changes in the relative size of the floodplain. Coefficients for channel and overbank roughness were estimated based upon cross-section photographs taken during the field survey and supplemented by aerial photographs. Contraction and expansion were set at 0.1 and 0.3, respectively for normal channel conditions and 0.3 and 0.5 at the two bridges. Roughness parameter values for each cross-section were estimated based on visual observation, aerial photography, and contour information. Generally, overbank roughness Manning's n values ranged from 0.07 to 0.12. Channel roughness ranged from 0.03 to 0.06.

Model Results

Existing conditions HEC-RAS results at each cross section are provided in Tables 4-1 and 4-2.

Table 4-1 – Lynnwood Branch Hydraulic Model Results

River Station	Water Surface Elevation (ft)					
	2 yr	10 yr	25 yr	50 yr	100 yr	500 yr
12696	686.80	687.54	687.87	688.13	688.28	688.57
12056	678.49	679.11	679.50	679.80	680.25	681.16
11539	673.86	675.38	676.01	676.31	676.64	677.24
11018	669.86	670.98	671.70	672.32	672.62	673.52
10351	663.10	665.04	665.68	665.92	666.32	666.85
9557	656.26	656.92	657.51	658.17	658.44	659.30
9270	651.96	654.46	655.86	656.92	657.57	657.95
9196	651.72	653.33	654.05	654.28	654.61	655.36
8950	650.16	651.97	652.75	653.20	653.61	654.65
8518	647.67	649.70	650.52	651.06	651.54	652.71
7884	643.22	644.79	645.42	645.86	646.26	647.20
7334	638.94	640.59	641.13	641.49	641.81	642.67
6694	634.28	636.17	637.01	637.55	638.06	639.56
6087	629.05	630.59	631.46	632.17	632.85	635.26
5877	628.67	630.47	631.46	632.21	632.91	635.37
5695	628.56	630.12	630.89	631.43	631.90	633.23
5478	627.90	629.26	629.91	630.33	630.64	631.47
5031	624.08	625.47	626.06	626.48	626.92	628.17
4306	618.75	619.90	620.55	621.06	621.34	621.96
3758	615.36	616.65	617.29	617.77	619.29	620.76
3618	614.98	616.38	617.00	617.46	619.01	620.75
3529	613.57	614.85	615.40	615.80	616.07	617.19
3312	611.51	612.94	613.57	614.02	614.54	615.22
2891	608.57	610.13	610.82	611.33	611.53	613.77
2414	606.62	607.86	608.29	608.61	610.01	613.37
1768	601.43	603.63	605.17	606.98	609.59	613.21
1291	599.71	602.69	604.42	606.44	609.14	612.69
1118	598.26	600.35	601.59	602.70	603.75	606.90
810	596.84	599.30	600.63	601.83	602.96	606.04
251	593.78	596.37	597.66	598.77	599.80	602.50

Table 4-2 – Cartwright Creek Hydraulic Model Results

River Station	Water Surface Elevation (ft)					
	2 yr	10 yr	25 yr	50 yr	100 yr	500 yr
14223	668.29	669.19	669.65	670.01	670.34	671.10
13662	662.20	662.95	663.33	663.65	663.93	664.57
13099	652.77	653.95	654.47	654.87	655.22	655.95
12567	649.63	650.78	651.23	651.56	651.85	652.45
12020	644.37	645.45	646.06	646.54	646.96	647.79
11199	637.46	638.18	638.61	638.83	639.30	640.12
10304	629.87	631.61	632.20	632.79	632.89	633.60
9658	624.17	624.61	624.78	624.88	625.72	626.27
9545	623.89	624.51	624.72	624.90	625.03	625.35
9455	622.12	622.36	622.56	622.76	622.97	623.40
9246	620.30	620.69	620.88	621.05	621.20	621.62
8823	616.45	616.84	616.97	617.09	617.35	617.86
7863	609.79	611.12	611.75	612.21	612.51	613.27
7312	605.73	607.15	607.51	607.74	608.26	609.00
7123	605.45	607.29	607.76	608.07	608.41	609.02
7056	605.07	606.86	607.59	607.99	608.35	609.00
6934	604.16	605.59	606.27	606.55	606.91	607.53
6430	600.97	601.59	601.78	602.11	602.40	603.00
5711	596.21	596.99	597.48	597.70	597.93	598.49
4812	591.84	592.66	592.88	593.33	593.77	594.69
3942	588.61	590.00	591.20	592.19	592.65	593.43
3667	588.17	589.53	590.85	592.07	592.52	593.27
3444	586.48	588.50	589.04	589.61	590.20	591.35
3199	584.19	584.57	585.92	586.43	586.84	587.92
2662	581.21	583.03	584.57	585.06	585.66	588.03
2151	579.69	582.02	583.89	584.27	584.80	587.35
2075	579.57	581.84	583.68	583.99	584.46	586.95
1895	577.15	579.24	580.13	580.62	581.03	582.78
1623	574.12	574.79	575.48	576.09	576.61	577.73
581	568.68	570.94	572.30	573.25	573.92	575.24
132	565.90	568.21	569.50	570.37	571.00	572.20

Floodway Development

The existing conditions 100-year floodway profile was computed. The initial floodway analysis was performed using HEC RAS Method 4, or the equal conveyance reduction method, with a target of 1.00 feet of surcharge at all cross-sections. In locations where the Method 4 analysis did not produce a suitable floodway, Method 1, which defines explicit encroachment stations, was used to determine appropriate floodway limits. The results of the floodway analysis are provided in Table 4-3 and 4-4.

Table 4-3 – Lynnwood Branch Floodway Results

River Station	Water Surface Elevation (ft)		Floodway			
	100yr (Natural)	Encroachment (floodway)	Surcharge (ft)	Width (ft)	Velocity (ft/s)	Area (ft ²)
12696	688.28	688.94	0.66	55	6.1	163
12056	680.25	680.54	0.29	50	7.4	135
11539	676.64	677.64	1.00	47	4.1	245
11018	672.62	673.26	0.63	58	6.3	302
10351	666.32	666.39	0.07	70	6.4	295
9557	658.44	658.91	0.47	80	6.2	304
9270	657.57	657.99	0.43	85	4.1	462
9196	654.61	655.52	0.91	85	5.4	353
8950	653.61	654.57	0.96	95	4.3	441
8518	651.54	652.15	0.62	74	6.4	467
7884	646.26	647.01	0.75	105	6.4	466
7334	641.81	642.79	0.98	105	5.5	543
6694	638.06	638.30	0.25	135	5.3	623
6087	632.85	633.23	0.37	80	8.2	404
5877	632.91	633.24	0.33	94	4.7	694
5695	631.90	632.45	0.55	90	5.2	636
5478	630.64	631.64	1.00	109	5.0	656
5031	626.92	627.82	0.89	120	5.6	592
4306	621.34	621.38	0.03	140	6.0	573
3758	619.29	619.29	0.00	155	4.5	766
3618	619.01	619.01	0.01	133	4.2	825
3529	616.07	617.03	0.96	105	5.5	621
3312	614.54	614.72	0.18	145	6.1	566
2891	611.53	612.27	0.74	160	5.6	662
2414	610.01	610.48	0.47	128	5.4	698
1768	609.59	609.64	0.05	167	2.9	1297
1291	609.14	609.30	0.16	80	3.6	1038
1118	603.75	603.91	0.16	80	5.5	678
810	602.96	603.19	0.23	90	5.6	663
251	599.80	599.97	0.17	31	11.4	347

Table 4-4 – Cartwright Creek Floodway Results

River Station	Water Surface Elevation (ft)		Floodway			
	100yr (Natural)	Encroachment (floodway)	Surcharge (ft)	Width (ft)	Velocity (ft/s)	Area (ft ²)
14223	670.34	670.4	0.06	43	6.5	186
13662	663.93	663.9	0.00	79	6.5	185
13099	655.22	655.4	0.19	34	8.1	148
12567	651.85	651.9	0.02	120	4.8	314
12020	646.96	647.0	0.01	120	5.6	266
11199	639.32	640.1	0.81	132	2.7	643
10304	632.88	632.9	0.00	60	8.6	241
9658	625.71	626.0	0.30	125	5.2	396
9545	625.03	625.8	0.80	209	2.8	752
9455	622.97	623.9	0.97	210	2.6	796
9246	621.20	622.2	0.98	130	5.2	402
8823	617.35	618.1	0.79	166	3.8	551
7863	612.51	613.0	0.49	250	3.2	906
7312	608.26	609.2	0.96	53	9.0	325
7123	608.41	609.3	0.85	125	3.6	813
7056	608.35	608.8	0.43	120	3.7	788
6934	606.91	607.0	0.09	95	8.3	351
6430	602.40	603.2	0.83	130	5.6	525
5711	597.93	598.2	0.22	300	3.6	939
4812	593.77	594.7	0.96	260	2.7	1234
3942	592.65	593.4	0.79	310	2.4	2086
3667	592.52	592.8	0.23	163	3.9	1257
3444	590.20	590.6	0.36	130	5.5	896
3199	586.84	586.9	0.03	192	6.9	716
2662	585.66	585.7	0.02	290	2.9	1728
2151	584.80	584.8	0.01	215	3.0	1624
2075	584.46	584.5	0.00	138	4.3	1153
1895	581.03	581.3	0.24	90	7.9	622
1623	576.61	576.6	0.02	125	11.1	444
581	573.92	574.4	0.45	250	3.1	1812
132	571.00	571.3	0.32	56	11.4	501

SECTION 5

ALTERNATIVE ANALYSIS

Three types of alternatives to alleviate potential flooding were modeled for both Lynnwood Branch and Cartwright Creek. These alternatives included:

- Channel Improvements
- Structure Upsizing
- Detention
- Home Buyout

Alternatives for both creeks were located in areas that would provide the highest benefit and could be constructed with the least amount of demolition. For alternatives that potentially might remove homes from the floodplain, a benefit-cost analysis was performed.

Lynnwood Branch Alternatives

Alternative A

Alternative A consists of channel improvements from Hillsboro Road Upstream to Berry's Chapel Road (XS's 5877-8950). This alternative would involve the excavation of approximately 25 feet of material into and along one of the streambanks, thus forming a high flow channel with a low Manning's n value. This high flow channel would provide a significantly higher conveyance area which should lower the predicted water surface elevations (WSELS) in this area and upstream. The maximum reduction in the 100-year flood elevation is 2.2 feet. In order to place this alternative, two structures would be required to be removed at XS 7884 and XS 6087. The implementation of this alternative would potentially remove up to 17 homes from the 100-year floodplain. The full results of this alternative are presented in Table 5-1.

Benefit Cost Analysis:

A benefit cost analysis was performed on the 17 properties located within the Alternative A project area that would be removed from the floodplain as a result of implementation. The benefit cost ratios for these structures vary from 0.01 to 5.73. All but one home has a benefit cost ratio of 0.51 or less. The project benefit cost ratio is 0.46. This project alternative does not have a benefit cost ratio greater than 1.00 and thus is not a viable project alternative.

One home within this reach, 1116 Brookside Drive, has a benefit cost ratio of 5.73 for this alternative and a benefit cost ratio of 9.10 for existing conditions and could be a possible candidate for a future home buyout program.

Alternative B

Alternative B is the addition of a box culvert to the right of the existing Hillsboro Road box culverts. This additional box culvert would result in the lowering of the WSEL in the area of the crossing and upstream with a maximum reduction of 0.7 feet for the 100-year flood elevation. This alternative would result in the removal of one home from the floodplain. The results of this alternative are presented in Table 5-1.

Benefit Cost Analysis:

A benefit cost analysis was performed on 1 property located within the project area. The benefit cost ratio for this property is 0.01. This project alternative does not have a benefit cost ratio greater than 1.00 and thus is not a viable project alternative.

Alternative C

Alternative C consists of channel improvements from XS 3758 upstream to Hillsboro Road. The same procedure of creating a high flow channel as used in Alternative A was used for this alternative. A maximum water surface elevation reduction of 1.5 feet was achieved with this alternative. This alternative would result in the removal of two homes from the floodplain. The results of this alternative are presented in Table 5-1.

Benefit Cost Analysis:

A benefit cost analysis was performed on 13 properties located within the project area. The benefit cost ratios for these structures vary from 0.00 to 2.04. All but one home have a benefit cost ratio of 0.41 or less. The project benefit cost ratio is 0.28. This project alternative does not have a benefit cost ratio greater than 1.00 and thus is not a viable project alternative.

231 Derby Lane has a benefit cost ratio of 2.04 for this alternative and a benefit cost ratio of 1.89 for existing conditions and could be a possible candidate for a future home buyout program.

Alternative D

Regional detention was considered as the final structural alternative. This alternative would potentially decrease downstream flows and WSELs, whereas the previous alternatives focused on lowering the WSELs upstream of the alternatives with no impact on flows. The location chosen for regional detention had to be in an area where an impoundment would have the least effect on adjacent homeowners and on property acceptable for this type of alternative. A detention pond was chosen to be added just upstream of Berry's Chapel Road. The pond would maintain a low flow channel and add detention for larger storm events. Flows were updated in the RAS model. Data for the detention is located in the HMS model and in the accompanying spreadsheet. The results of this alternative show a maximum reduction of 2.7 feet and the removal of up to 11 homes from the floodplain. The full results are presented in Table 5-1.

Benefit Cost Analysis:

A benefit cost analysis was performed on the 14 properties located within the project area. The benefit cost ratios for these structures vary from 0.01 to 28.18. All but one home have a benefit cost ratio of 0.48 or less. The project benefit cost ratio of all properties in the project area is 2.25. If 1116 Brookside Drive is excluded from the project, then the benefit cost ratio is reduced to 0.24. The project alternative with 1116 Brookside Drive excluded does not have a benefit cost ratio greater than 1.00 and thus is not a viable project alternative. 1116 Brookside Drive has a benefit cost ratio for this alternative of 28.18 and a benefit cost ratio of 9.10 for existing conditions and could be a possible candidate for a future home buyout program.

Alternative E

Home buyout alone was also considered as a viable alternative. Only two homes scored a BC Ratio greater than 1.0. 1116 Brookside Drive scored a BC Ratio of 9.1 while 231 Derby Lane scored 1.89.

Table 5-1 – Lynnwood Branch Alternative Analysis Results

Base Condition		Alternative A		Alternative B		Alternative C		Alternative D	
River Sta	W.S. Elev	W.S. Elev	Delta WS						
12696	688.28	688.28	0	688.28	0	688.28	0	688.28	0
12056	680.25	680.25	0	680.25	0	680.25	0	680.25	0
11539	676.64	676.64	0	676.64	0	676.64	0	676.40	-0.24
11018	672.62	672.62	0	672.62	0	672.62	0	672.04	-0.58
10351	666.32	666.32	0	666.32	0	666.32	0	665.83	-0.49
9557	658.44	658.44	0	658.44	0	658.44	0	657.84	-0.6
9270	657.57	657.56	-0.01	657.57	0	657.57	0	656.44	-1.13
9196	654.61	653.57	-1.04	654.61	0	654.61	0	654.32	-0.29
8950	653.61	652.15	-1.46	653.62	0.01	653.62	0.01	653.10	-0.51
8518	651.54	650.05	-1.49	651.50	-0.04	651.50	-0.04	651.00	-0.54
7884	646.26	644.59	-1.67	646.33	0.07	646.33	0.07	645.8	-0.46
7334	641.81	641.32	-0.49	641.73	-0.08	641.73	-0.08	641.45	-0.36
6694	638.06	635.82	-2.24	638.16	0.1	638.16	0.1	637.53	-0.53
6087	632.85	633.12	0.27	632.52	-0.33	632.52	-0.33	632.14	-0.71
5877	632.91	633.00	0.09	632.23	-0.68	632.13	-0.78	632.17	-0.74
5695	631.90	631.90	0	631.80	-0.1	630.59	-1.31	631.40	-0.5
5478	630.64	630.64	0	630.64	0	629.53	-1.11	630.31	-0.33
5031	626.92	626.92	0	626.92	0	626.15	-0.77	626.46	-0.46
4306	621.34	621.34	0	621.34	0	620.70	-0.64	621.04	-0.3
3758	619.29	619.29	0	619.29	0	617.77	-1.52	617.76	-1.53
3618	619.01	619.01	0	619.01	0	617.41	-1.6	617.44	-1.57
3529	616.07	616.07	0	616.07	0	616.07	0	615.79	-0.28
3312	614.54	614.54	0	614.54	0	614.54	0	614.01	-0.53
2891	611.53	611.53	0	611.53	0	611.53	0	611.32	-0.21
2414	610.01	610.01	0	610.01	0	610.01	0	608.60	-1.41
1768	609.59	609.59	0	609.59	0	609.59	0	606.95	-2.64
1291	609.14	609.14	0	609.14	0	609.14	0	606.40	-2.74
1118	603.75	603.75	0	603.75	0	603.75	0	602.69	-1.06
810	602.96	602.96	0	602.96	0	602.96	0	601.84	-1.12
251	599.80	599.80	0	599.80	0	599.80	0	598.78	-1.02
Structures Removed		17		1		2		11	

*Note: removed structures based on flooded area not change in WS Elevation at structure.

Lynnwood Branch Alternative Summary

Structures at the roadways did not appear to be the limiting factor in conveyance through the area. Improving channel conveyance most significantly reduced the water surface elevation in the Reach especially in the area upstream of Hillsboro Road. Detention (Alt. D) resulted in reductions in the 100-year flood elevation throughout the study reach.

Cartwright Creek Alternatives

Alternative A

This alternative included channel improvement from Hillsboro Road upstream to Harpeth Hills Drive (XS's 3667-7312). The channel was widened through this area by laying back the right channel bank to a 3:1 slope and widening by an average of 25 feet. Manning's values were reduced in the channel to 0.04, representing a more maintained channel. 100-year water surface elevations were lowered up to 2 feet and two houses (between cross-sections 6934 and 7055) were removed from the floodplain.

Benefit Cost Analysis:

A benefit cost analysis was performed on 3 properties located within the project area. 304, 306, and 309 Harpeth Hills Drive. The benefit cost ratios for these structures are 0.05, 0.01 and 0.00 respectively, giving a project benefit cost ratio of 0.02. This project alternative does not have a benefit cost ratio greater than 1.00 and thus is not a viable project alternative.

Alternative B

The bridge opening at Hillsboro Road was widened from 90' to 156'. Minimal change in 100-year water surface elevations resulted.

Benefit Cost Analysis:

No significant changes to the 100-year water surface elevations, thus no significant benefits to offset the costs of this alternative. This is not a viable project alternative.

Alternative C

A regional detention was added just upstream of the eastern terminus of Bobby Drive. Flows were updated in the RAS model. Data for the detention is located in the HMS model and in the accompanying spreadsheet. 100-year water surface elevations changed up to nearly 1 foot, and one house (at Cross Section 9657) was removed from the floodplain

Benefit Cost Analysis:

No significant damages would be avoided by implementation of this alternative, thus no significant benefits to offset the costs of this alternative. This is not a viable project alternative.

Alternative D

Home buyout was also considered as an alternative for Cartwright Creek. No homes were considered viable alternatives due to the low computed BC Ratios.

Cartwright Creek Alternative Summary

Structures at the roadways did not appear to be the limiting factor in conveyance through the area. Improving channel conveyance between Hillsboro Road and Harpeth Hills Drive most significantly reduces the water surface elevation in the Reach.

Table 5-2 – Cartwright Creek Alternative Analysis Results

Base Condition		Alternative A		Alternative B		Alternative C	
River Sta	W.S. Elev	W.S. Elev	Delta WS	W.S. Elev	Delta WS	W.S. Elev	Delta WS
14223	670.34	670.33	-0.01	670.33	-0.01	670.33	-0.01
13662	663.93	663.93	0	663.93	0	663.93	0
13099	655.22	655.22	0	655.22	0	655.21	-0.01
12567	651.85	651.85	0	651.85	0	651.85	0
12020	646.96	646.96	0	646.96	0	646.96	0
11199	639.32	639.32	0	639.32	0	639.00	-0.32
10304	632.88	632.88	0	632.88	0	632.58	-0.3
9658	625.71	625.71	0	625.71	0	624.85	-0.86
9545	625.03	625.05	0.02	625.01	-0.02	624.81	-0.22
9455	622.97	623.01	0.04	622.96	-0.01	622.69	-0.28
9246	621.20	621.13	-0.07	621.21	0.01	620.94	-0.26
8823	617.35	618.06	0.71	617.34	-0.01	617.04	-0.31
7863	612.51	611.53	-0.98	612.51	0	611.96	-0.55
7312	608.26	607.63	-0.63	608.26	0	607.62	-0.64
7123	608.41	607.55	-0.86	608.41	0	607.90	-0.51
7056	608.35	606.24	-2.11	608.35	0	607.77	-0.58
6934	606.91	604.95	-1.96	606.91	0	606.37	-0.54
6430	602.40	601.50	-0.9	602.36	-0.04	601.95	-0.45
5711	597.93	597.18	-0.75	597.97	0.04	597.58	-0.35
4812	593.77	593.06	-0.71	593.68	-0.09	593.12	-0.65
3942	592.65	592.36	-0.29	592.25	-0.4	591.94	-0.71
3667	592.52	592.27	-0.25	592.09	-0.43	591.64	-0.88
3444	590.20	590.20	0	590.20	0	589.38	-0.82
3199	586.84	586.84	0	586.84	0	586.22	-0.62
2662	585.66	585.66	0	585.66	0	584.85	-0.81
2151	584.80	584.80	0	584.80	0	584.09	-0.71
2075	584.46	584.46	0	584.46	0	583.85	-0.61
1895	581.03	581.03	0	581.03	0	580.45	-0.58
1623	576.61	576.60	-0.01	576.60	-0.01	575.83	-0.78
581	573.92	573.92	0	573.92	0	573.14	-0.78
132	571.00	571.00	0	571.00	0	570.26	-0.74
Structures Removed		2		0		1	

SECTION 6 RECOMMENDATIONS

The recommendations in this section are based on the modeling results for both watersheds, as well as the alternative analysis of potential solutions to existing flooding problems. The recommended alternatives were based on modeled conditions only. No detailed survey or property search was conducted on the land that would be required to acquire to implement the alternatives.

Regional detention is not recommended for either stream, due to the development on both stream banks and the limited effectiveness of the detention on lowering the 100-year water surface elevations (WSELS). There would be moderate benefits of detention in Lynnwood Branch, but in-stream detention would be difficult to permit and very costly to implement. Localized detention of the 100-year event would be recommended for all new developments upstream of Berry's Chapel Road in the Lynnwood Branch Watershed and Jefferson Davis Drive in the Cartwright Creek Basin. For any development downstream of these crossings, an analysis of the cumulative effects of detention on the hydrograph for the creek would need to be conducted. In these areas, the effect of detention may cause the flooding along the channel to actually increase due to changes in the natural runoff timing of the watershed.

The recommended alternative for Lynnwood Branch is the removal of two homes. One home is at 1116 Brookside Drive and the other is at 231 Derby Lane. The benefit-cost ratio of 1116 Brookside Drive for existing conditions is 9.10 based on an FFE elevation of 635.3 feet, a streambed elevation of 627.98, and a 100-year flood elevation of 639.64. The benefit-cost ratio of 231 Derby Lane for existing conditions is 1.89 based on a FFE elevation of 618.3 feet, a streambed elevation of 614.15, and a 100-year flood elevation of 621.14.

None of the structural alternatives had a BC Ratio above 1.0 which would warrant implementation.

None of the alternatives in the Cartwright Creek Basin proved to be effective in removing a significant number of homes from the 100-year floodplain for the Basin. This creek is defined by several crossings which more closely dictate flows and WSELS than the adjacent Lynnwood Branch. The best alternative for Cartwright Creek would be in localized detention and over-detention above what would be required by the Storm Water Regulations for Williamson County. This detention would provide the most benefit in the upper third of the watershed. This localized detention would help lower the peak discharge on the creek and should lower flood elevations.

SECTION 7

REFERENCES

Interagency Advisory Committee on Water Data, Bulletin #17B of the Hydrology Subcommittee. "Guidelines for Determining Flood Flow Frequency". March 1982.

Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic database for Williamson County, Tennessee. [Online WWW]. Available URL: "<http://SoilDataMart.nrcs.usda.gov/>" [17 April 2006]

SCS Technical Release 55, Urban Hydrology for Small Watersheds, Second Edition, June 1986.

U.S. Department of Defense, Corps of Engineers, The Hydrologic Engineering Center (HEC). "HEC-RAS River Analysis System, User's Manual". November 2002.

U.S. Department of Defense, Corps of Engineers, The Hydrologic Engineering Center (HEC). "Hydrologic Modeling System HEC-HMS, User's Manual". April 2006.

NOTES TO USERS

MAPPING NOTES

Digital orthophotography shown on this Panel is from the National Agricultural Imagery Program (NAIP), 2010. They were originally produced by the USDA-FSA Aerial Photography Field Office and published with 1 meter resolution, UTM NAD83, in 3.75 min quarter quad (QQ) tiles.

The coordinate system used in the preparation of this map is Tennessee State Plane FIPS 4100, Lambert Conformal Conic Projection. Horizontal datum is NAD 83, GRS80 spheroid. Vertical Datum of 1988.

Map page size is Arch D (24" x 36"). Accuracy of the map scales for varying paper sizes is valid only if printed at this page size.

MODELING NOTES

Hydraulic model for both study reaches simulated existing conditions in the U.S. Army Corps of Engineer's hydraulic model HEC-RAS. Modeling is consistent with current FEMA specifications in regard to coefficients, modeling methods, and cross section data.

LEGEND

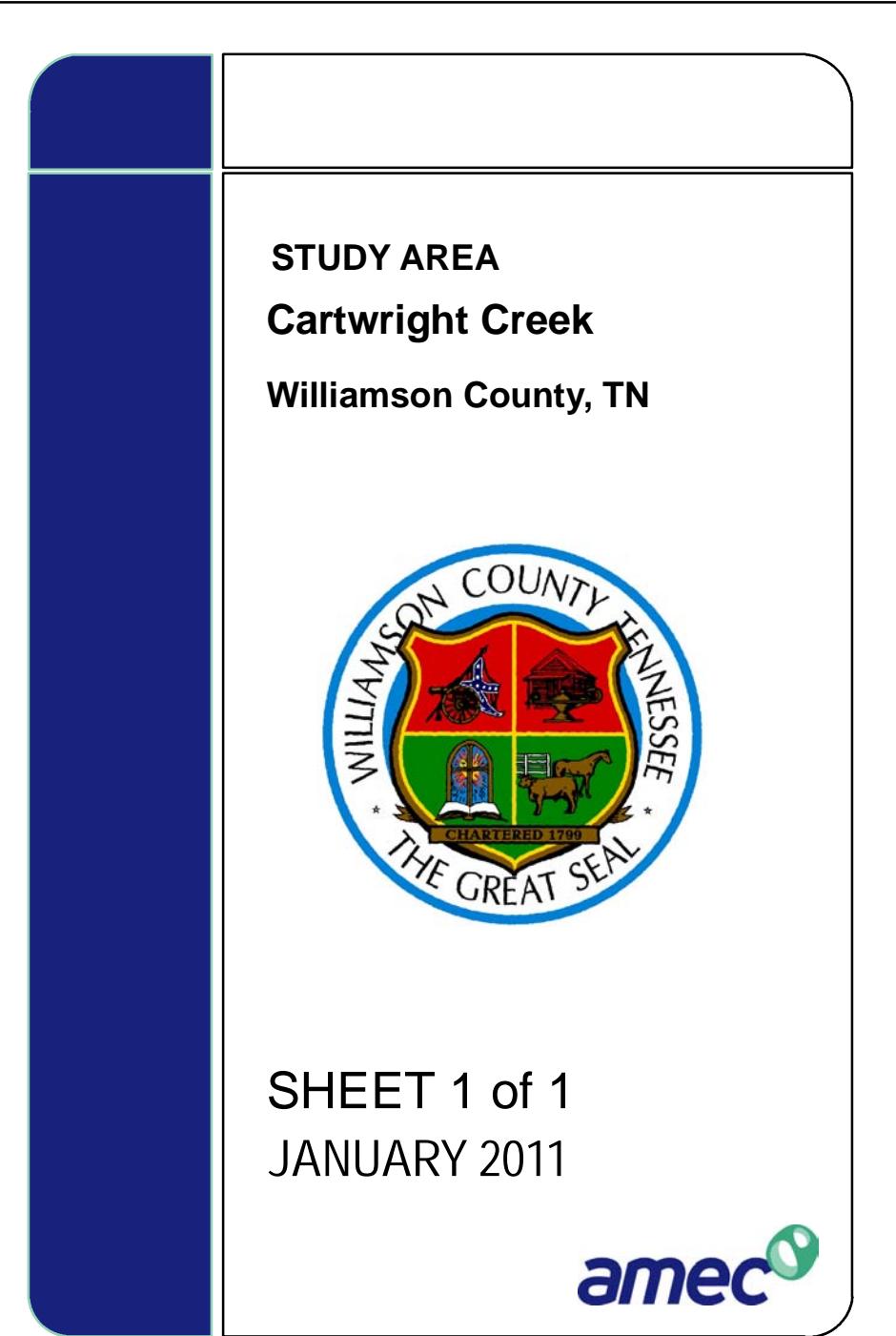
Cross Sections	Political Boundaries
1623 Cross Section Station	Stream
Existing Floodplains	Revised Floodplains
AE / Floodway	Floodway
Zone A	100 Year Floodplain
Zone AE	500 Year Floodplain

42°76'00"E Universal Transverse Mercator (UTM) coordinate, 1000 Meter Intervals
30°85'22"E State Plane coordinate, 1000 Foot Intervals
87°07'45" 32°22'30" Geographic coordinates referenced to North American Datum of 1983 (NAD 83)

0 455 910 1,820 Feet
1:6,000 1 inch = 500 feet

DISCLAIMER

This map has been compiled using the best information available and is believed to be accurate; however, its preparation required many assumptions. Actual conditions during a failure may vary from those assumed, so the accuracy cannot be guaranteed. The limits of flooding shown and the temporal data should only be used as a guideline for emergency planning and response actions. Actual areas inundated will depend on specific flooding and failure conditions and may differ from the areas shown on the maps.





Federal Emergency Management Agency
Washington, D.C. 20472

**LETTER OF MAP REVISION
DETERMINATION DOCUMENT**

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST	
COMMUNITY	Williamson County Tennessee (Unincorporated Areas)	NO PROJECT	FLOODWAY HYDRAULIC ANALYSIS HYDROLOGIC ANALYSIS NEW TOPOGRAPHIC DATA	
	COMMUNITY NO.: 470204			
IDENTIFIER	Cartwright Creek Restudy	APPROXIMATE LATITUDE & LONGITUDE: 36.005, -86.881 SOURCE: USGS QUADRANGLE DATUM: NAD 83		
ANNOTATED MAPPING ENCLOSURES		ANNOTATED STUDY ENCLOSURES		
TYPE: FIRM*	NO.: 47187C0088F	DATE: September 29, 2006	DATE OF EFFECTIVE FLOOD INSURANCE STUDY REPORT: September 29, 2006	
TYPE: FIRM*	NO.: 47187C0205F	DATE: September 29, 2006	PROFILES: 14P, 15P, AND 16P	
TYPE: FIRM*	NO.: 47187C0070F	DATE: September 29, 2006	FLOODWAY DATA TABLE: 7 SUMMARY OF DISCHARGES TABLE: 5	

Enclosures reflect changes to flooding sources affected by this revision.

* FIRM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES)

See Page 2 for Additional Flooding Sources

Cartwright Creek - from the confluence with Harpeth River to approximately 2,250 feet upstream of Beech Creek Road

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Cartwright Creek	Zone AE	Zone AE	YES	YES
	Zone A	Zone AE	YES	YES
	Zone X (shaded)	Zone X (shaded)	YES	YES
	No Floodway	Floodway	YES	NONE

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at <http://www.fema.gov/nfip>.

Beth A. Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration



Federal Emergency Management Agency
Washington, D.C. 20472

**LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)**

OTHER FLOODING SOURCES AFFECTED BY THIS REVISION

FLOODING SOURCE(S) & REVISED REACH(ES)

Cartwright Creek - from the confluence with Harpeth River to approximately 2,250 feet upstream of Beech Creek Road

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Cartwright Creek	No BFEs* BFES	BFEs BFES	YES YES	NONE YES

* BFEs - Base Flood Elevations

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional information about the NFIP is available on our website at <http://www.fema.gov/nfip>.

Beth A. Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

125360 PT202.02.BKR.11044928P.H17 102-I-A-C



Federal Emergency Management Agency
Washington, D.C. 20472

**LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)**

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

COMMUNITY REMINDERS

We based this determination on the base (1-percent-annual-chance) flood discharges computed in the submitted hydrologic model. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at <http://www.fema.gov/nfip>.

Beth A. Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration



Federal Emergency Management Agency
Washington, D.C. 20472

**LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)**

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Mr. Brad Loar
Director, Mitigation Division
Federal Emergency Management Agency, Region IV
Koger Center - Rutgers Building, 3003 Chamblee Tucker Road
Atlanta, GA 30341
(770) 220-5400

STATUS OF THE COMMUNITY NFIP MAPS

We are preparing a revised FIRM and FIS report for Williamson County in our countywide format; therefore, we will not physically revise and republish the FIRM and FIS report for your community to incorporate the modifications made by this LOMR at this time. Preliminary copies of the countywide FIRM and FIS report, which will present information from the effective FIRMs and FIS reports for your community and other incorporated communities in Williamson County, will be distributed for review in approximately one year. We will not be able to incorporate the modifications made by this LOMR into the preliminary countywide FIRM before it is distributed. However, the modifications made by this LOMR will be included when the countywide FIRM and FIS report becomes effective.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at <http://www.fema.gov/nfip>.

Beth A. Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration



Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below and through FEMA's Flood Hazard Mapping website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp.

LOCAL NEWSPAPER Name: *The Tennessean*
 Dates: March 2, 2012 and March 9, 2012

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised flood hazard determination information presented in this LOMR may be changed.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional information about the NFIP is available on our website at <http://www.fema.gov/nfip>.

A handwritten signature in black ink that appears to read "Beth A. Norton".

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

125360 PT202.02.BKR.11044928P.H17 102-I-A-C

REVISED TO
REFLECT LOMR
EFFECTIVE: July 9, 2012

Table 5. Summary of Discharges - continued
Detail Study Streams

Flooding Source and Location	Drainage Area (sq. mi.)	Peak Discharges (Cubic Feet per Second)				
		10-Percent- Annual-Chance	2-Percent- Annual-Chance	1-Percent- Annual-Chance	0.2-Percent- Annual-Chance	
CARTWRIGHT CREEK						
At the confluence with						
Harpeth River	5.31	3,270	4,910	5,690	7,760	
Just upstream of Hillsboro Road	4.34	2,860	4,260	4,930	6,690	
Just downstream of Beech Road	1.30	860	1,280	1,490	2,030	
Approximately 0.1 mile downstream of Log Cabin Trail	1.02	700	1,040	1,200	1,630	
DRYBRANCH						
At the confluence with						
Spencer Creek	2.26	*	2,105	*	REVISED DATA	
EAST FORK CREEK						
At river mile 0.3	8.71	2,300	3,600	4,200	5,600	
At river mile 2.15	7.14	2,000	3,150	3,650	4,900	
At river mile 3.04	4.30	1,400	2,200	2,550	3,450	
At river mile 4.86	2.10	850	1,350	1,550	2,100	
FIVEMILE CREEK						
At confluence with Harpeth River	9.65	3,470	5,240	5,800	7,880	
Just downstream of confluence of Goose Creek	7.51	2,880	4,340	4,800	6,530	
Approximately 0.5 mile upstream of Goose Creek Bypass	4.90	2,100	3,170	3,510	4,780	
GRASSY BRANCH						
Approximately 0.6 mile upstream of Duplex Road	2.15	1,120	1,700	1,880	2,570	
HARPETH RIVER						
At confluence with						
Little Harpeth River	361.0	18,300	27,200	33,000	43,000	
Just 0.27 mile downstream of U.S. Route 431	194.0	14,500	21,500	25,000	33,500	
At confluence of Mayes Creek	145.0	11,600	17,200	20,000	26,800	
At confluence of Arrington Creek	106.0	9,200	13,600	15,800	21,200	

* Data not available

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY ELEVATION (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
CARTWRIGHT CREEK					584.0 ¹	580.2 ²	580.2 ²	0.0
A	1,890	86	524	9.4	584.0 ¹	590.2	590.6	0.4
B	3,440	130	896	5.5	590.2	593.8	594.7	0.9
C	4,810	260	1234	2.7	593.8	597.9	598.2	0.3
D	5,710	300	939	3.6	597.9	608.3	609.2	0.9
E	7,310	53	325	8.9	608.3	617.3	618.1	0.8
F	8,820	166	551	3.8	617.3	625.7	626.0	0.3
G	9,660	125	397	5.2	625.7	639.3	640.2	0.9
H	11,200	132	655	2.7	639.3	650.0	650.0	0.0
I	12,090	130	845	1.8	650.0	656.3	656.4	0.1
J	13,100	35	182	6.6	656.3	670.3	670.4	0.1
K	14,220	43	186	6.5				

¹ Feet above confluence with Harpeth River

² Elevation computed without consideration of backwater effects from Harpeth River

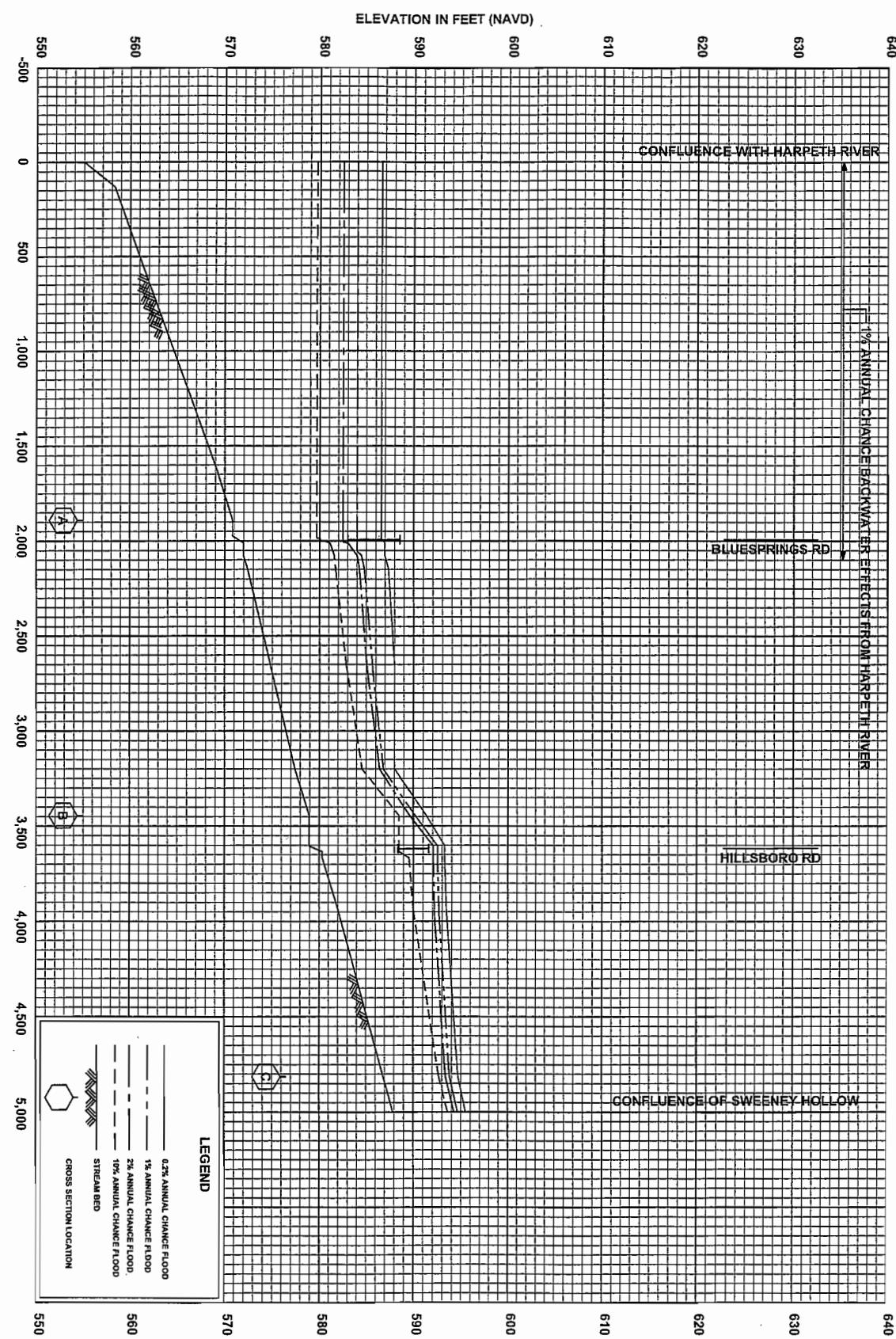
TABLE 7

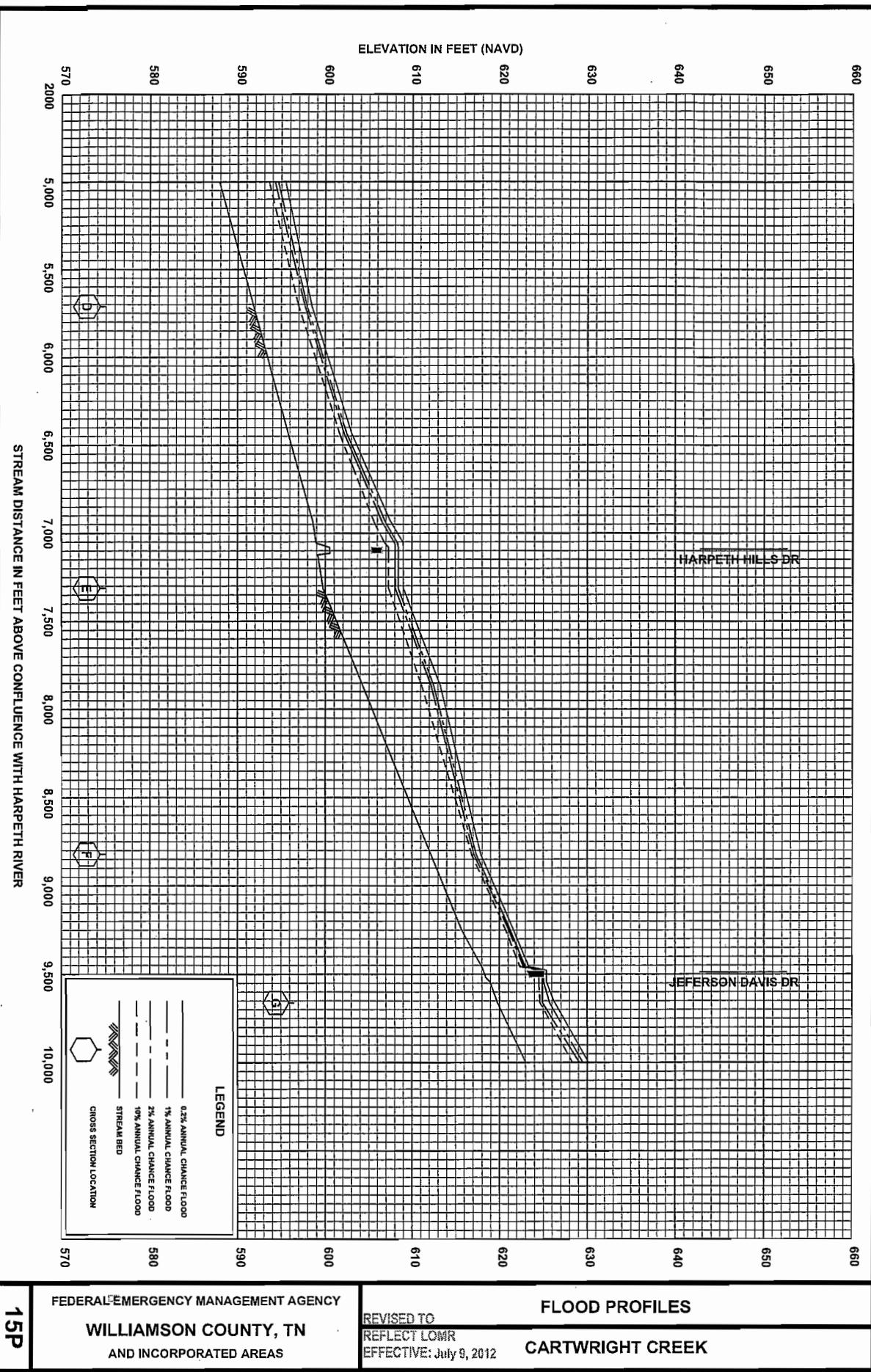
REVISED TO
REFLECT LOMR
EFFECTIVE: July 9, 2012

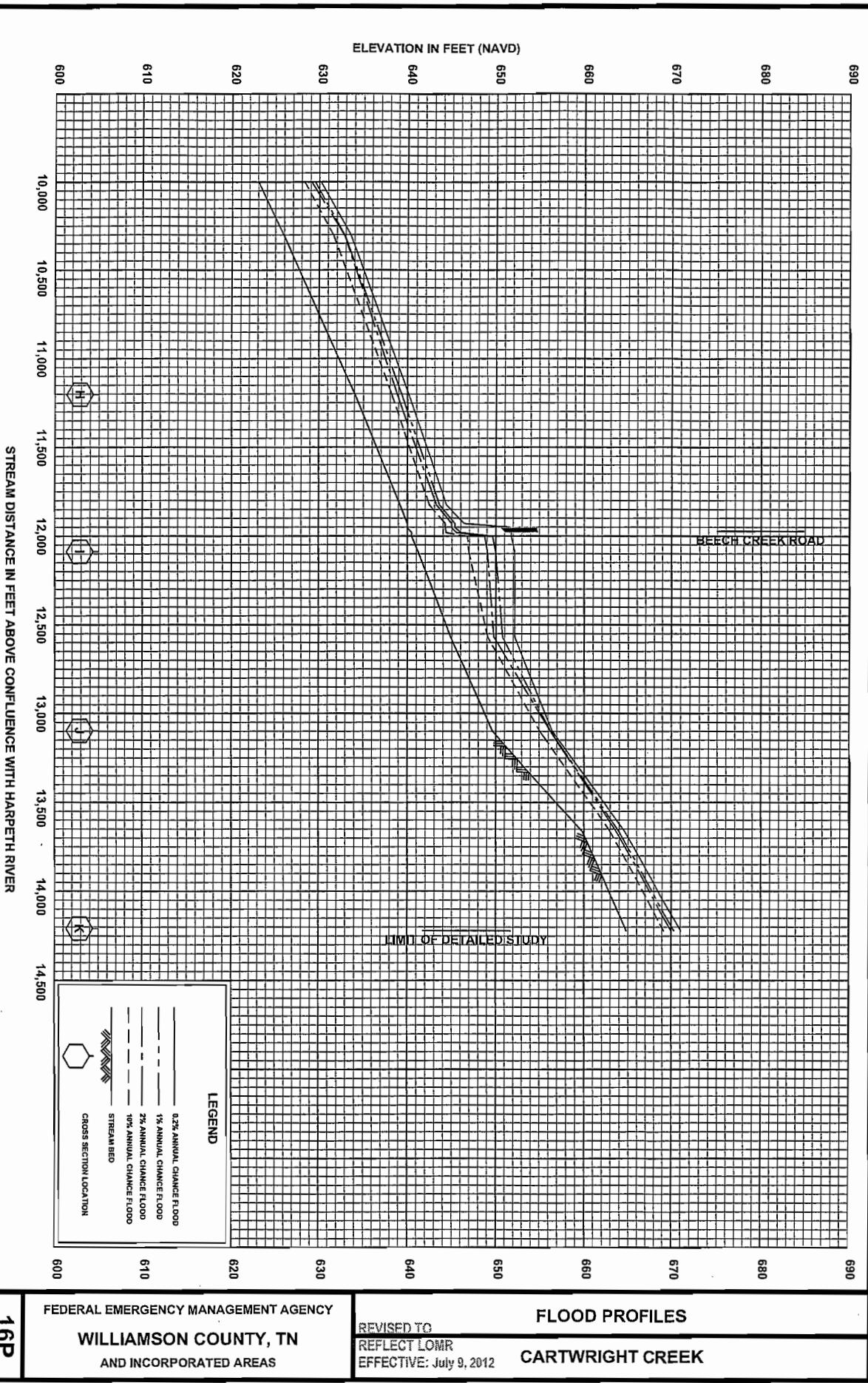
FLOODWAY DATA

WILLIAMSON COUNTY, TN
(AND INCORPORATED AREAS)

CARTWRIGHT CREEK





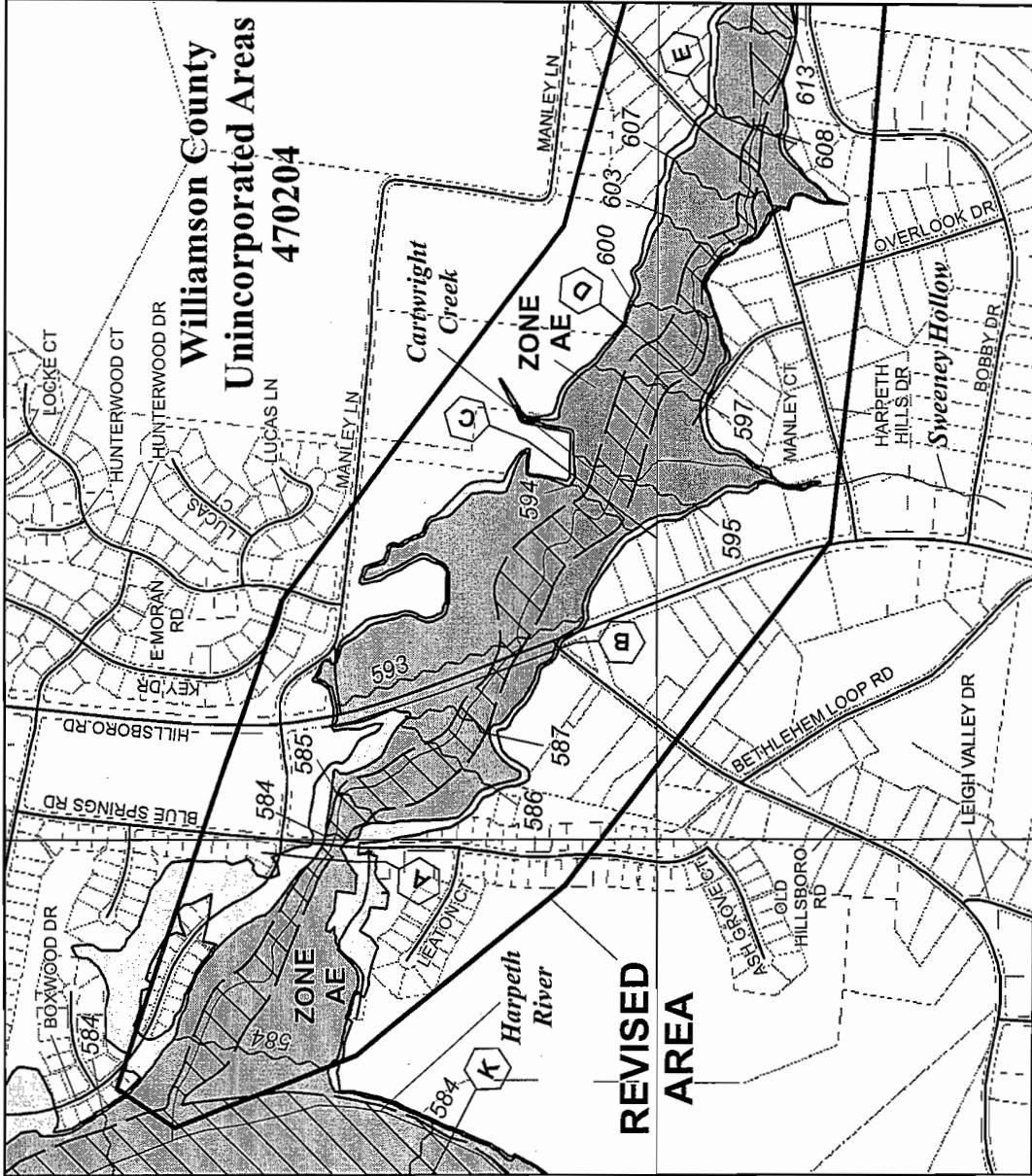


JOINS PANEL 0088

610

3600
8652230.0"

**Williamson County
Unincorporated Areas
470204**



JOINS PANEL 0182

1705000 FT T

Legend

- 1% annual chance
(100-Year) Floodplain
- 1% annual chance
(100-Year) Floodway
- 0.2% annual chance
(500-Year) Floodplain



MAP SCALE 1" = 1000'



PANEL 0070F

**FIRM
FLOOD INSURANCE RATE MAP**

**WILLIAMSON COUNTY,
TENNESSEE
AND INCORPORATED AREAS**

PANEL 70 OF 485

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY

NUMBER **PANEL SUFFIX**
WILLIAMSON COUNTY 470204 0070 F

**REVISED TO
REFLECT LOMR
EFFECTIVE: July 9, 2012**

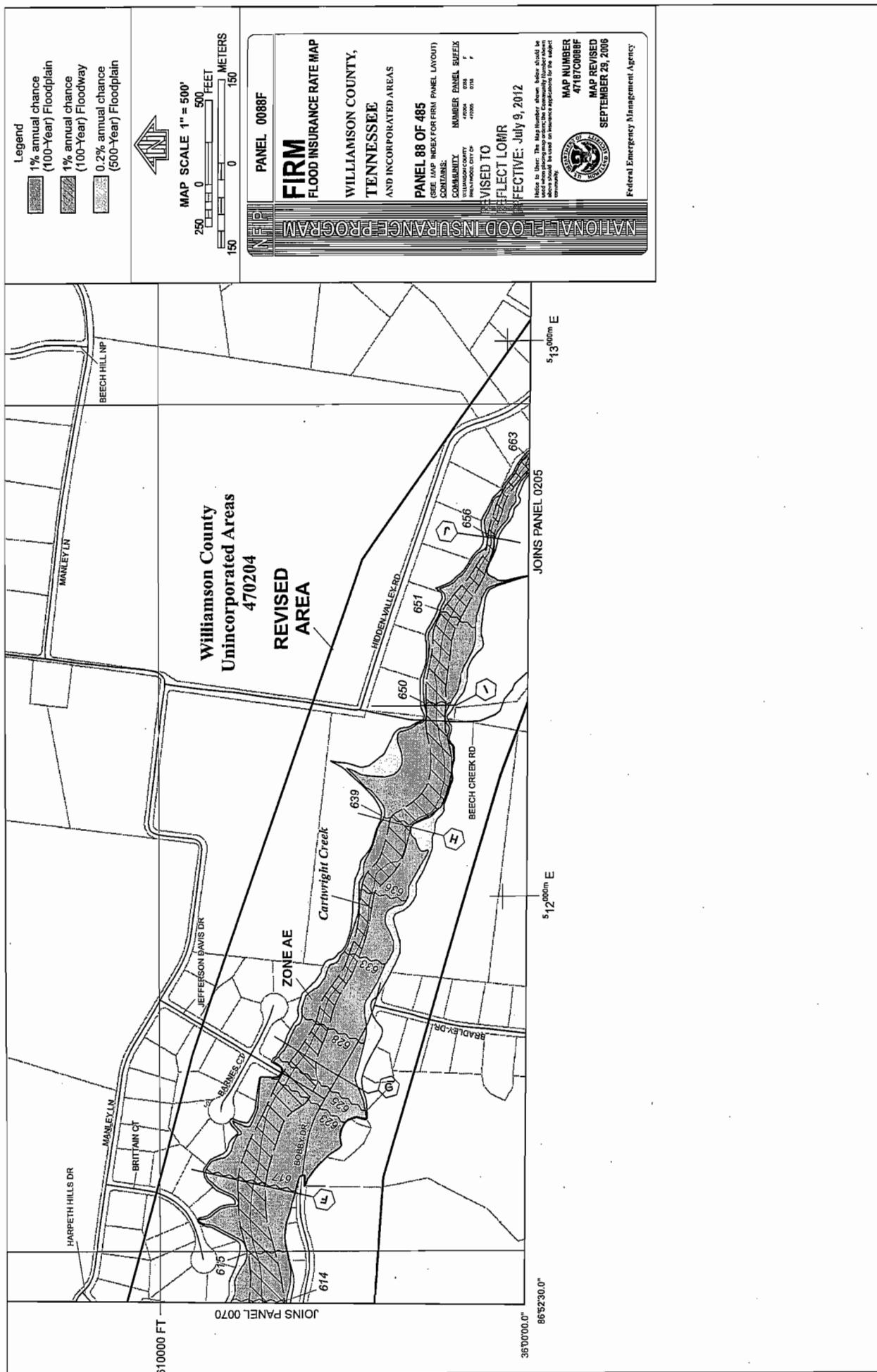
Notice to User: The Map Number, shown below, should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

**MAP NUMBER
47187C0070F
MAP REVISED
SEPTEMBER 29, 2006**



Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM





Legend

MAP SCALE 1" = 1000'

A scale bar with markings for 300, 0, 500, and 1000 feet. The markings are as follows:

- 0: Located at the center of the scale bar.
- 500: Located on the left side of the scale bar.
- 1000: Located at the top of the scale bar.
- 300: Located on the right side of the scale bar.

FIRM
FLOOD INSURANCE RATE MAP
WILLIAMSON COUNTY,
TENNESSEE
AND INCORPORATED AREAS

PANEL 205 OF 485

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)			
CONTAINS:	NUMBER	PANEL	SUFFIX
COMMUNITY	470204	0205	F
WILLIAMSON COUNTY	470205	0205	F
BRENTWOOD, CITY OF	470206	0205	F
FRANKLIN, CITY OF			

REVISED TO REFLECT LOMR EFFECTIVE: 1/1/

NOTICE TO USERS: THE WASHINGTON STATE

MAP NUMBER
DEPARTMENT
ROUTE TO USER: The Map Number shown below should be used when placing map orders; the Community Numbers shown above should be used on insurance applications for the subject community.

47187C0205F
MAP REVISED
SEPTEMBER 29, 2006

Federal Emergency Management Agency

**Williamson County
-Unincorporated Areas**

A detailed map of a residential area. A street is labeled "N BERRY'S CHAPEL RD". The map shows property boundaries as dashed lines, a river flowing through the center, and several cross streets marked with dashed lines and crosses. A north arrow is located in the lower-left quadrant.



NOTES TO USERS

MAPPING NOTES

Digital orthophotography shown on this Panel is from the National Agricultural Imagery Program (NAIP), 2010. They were originally produced by the USDA-FSA Aerial Photography Field Office and published with 1 meter resolution, UTM NAD83, in 3.75 min quarter quad (QQ) tiles.

The coordinate system used in the preparation of this map is Tennessee State Plane FIPS 4100, Lambert Conformal Conic Projection. Horizontal datum is NAD 83, GRS80 spheroid. Vertical Datum of 1988.

Map page size is Arch D (24" x 36"). Accuracy of the map scales for varying paper sizes is valid only if printed at this page size.

MODELING NOTES

Hydraulic model for both study reaches simulated existing conditions in the U.S. Army Corps of Engineer's hydraulic model HEC-RAS. Modeling is consistent with current FEMA specifications in regard to coefficients, modeling methods, and cross section data.

LEGEND

Legend for the Floodplain Map:

- Cross Sections:** Represented by a black line.
- Political Boundaries:** Represented by a thick black line.
- 1623 Cross Section Station:** Represented by a grey rectangle.
- Existing Floodplains:** Represented by a grey rectangle.
- Revised Floodplains:** Represented by a grey rectangle.
- AE / Floodway:** Represented by a grey rectangle.
- Zone A:** Represented by a grey rectangle.
- Zone AE:** Represented by a grey rectangle.
- Stream:** Represented by a blue line.
- Floodway:** Represented by a yellow line.
- 100 Year Floodplain:** Represented by an orange rectangle.
- 500 Year Floodplain:** Represented by a red rectangle.

42° 76^{000m.}E Universal Transverse Mercator (UTM) coordinate, 1000 Meter Intervals
20° 85^{228f.}E State Plane coordinate, 1000 Foot Intervals
87°07'45" Geographic coordinates referenced to North American Datum of 1983 (NAD 83)

32°22'30"

0 362.5 725 1,450 Feet

1:4,800 1 inch = 400 feet

N



STUDY AREA

Lynnwood Branch

Williamson County, TN



SHEET 1 of 1

JANUARY 2011



Federal Emergency Management Agency
Washington, D.C. 20472

**LETTER OF MAP REVISION
DETERMINATION DOCUMENT**

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST	
COMMUNITY	Williamson County Tennessee (Unincorporated Areas)	UPDATE	HYDRAULIC ANALYSIS HYDROLOGIC ANALYSIS NEW TOPOGRAPHIC DATA FLOODWAY	
	COMMUNITY NO.: 470204			
IDENTIFIER	Lynnwood Branch Restudy	APPROXIMATE LATITUDE & LONGITUDE: 35.975, -86.887 SOURCE: USGS QUADRANGLE DATUM: NAD 83		
ANNOTATED MAPPING ENCLOSURES		ANNOTATED STUDY ENCLOSURES		
TYPE: FIRM*	NO.: 47187C0182F	DATE: September 29, 2006	DATE OF EFFECTIVE FLOOD INSURANCE STUDY REPORT: September 29, 2006	
TYPE: FIRM*	NO.: 47187C0205F	DATE: September 29, 2006	PROFILE(S): 59P and 60P FLOODWAY DATA TABLE: 7 SUMMARY OF DISCHARGES TABLE: 5	

Enclosures reflect changes to flooding sources affected by this revision.

* FIRM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES)

Lynnwood Branch - from approximately 490 feet downstream of Meadowgreen Road to approximately 3,470 feet upstream of South Berry's Chapel Road

SUMMARY OF REVISIONS		See Page 2 for Additional Revisions	
Flooding Source	Effective Flooding	Revised Flooding	Increases
Lynnwood Branch	Zone AE	Zone AE	YES
	Zone A	Zone AE	YES
	BFEs*	BFEs	YES
	Floodway	Floodway	YES

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at <http://www.fema.gov/business/nfip>.

Beth A. Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration



Federal Emergency Management Agency
Washington, D.C. 20472

**LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)**

OTHER FLOODING SOURCES AFFECTED BY THIS REVISION

FLOODING SOURCE(S) & REVISED REACH(ES)

Lynnwood Branch - from approximately 490 feet downstream of Meadowgreen Road to approximately 3,470 feet upstream of South Berry's Chapel Road

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Lynnwood Branch	No Floodway	Floodway	YES	NONE
	Zone X (unshaded)	Zone AE	YES	NONE
	No BFEs*	BFEs	YES	YES

* BFEs - Base Flood Elevations

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at <http://www.fema.gov/business/nfip>.

Beth A. Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration



Federal Emergency Management Agency
Washington, D.C. 20472

**LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)**

OTHER COMMUNITIES AFFECTED BY THIS REVISION

CID Number: 470206 **Name:** City of Franklin, Tennessee

AFFECTED MAP PANELS	AFFECTED PORTIONS OF THE FLOOD INSURANCE STUDY REPORT
TYPE: FIRM* NO.: 47187C0182F DATE: September 29, 2006	DATE OF EFFECTIVE FLOOD INSURANCE STUDY REPORT: September 29, 2006 PROFILE(S): 59P SUMMARY OF DISCHARGES TABLE: 5

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional information about the NFIP is available on our website at <http://www.fema.gov/business/nfip>.

Beth A. Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration



Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

COMMUNITY REMINDERS

We based this determination on the 1-percent-annual-chance discharges computed in the submitted hydrologic model. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at <http://www.fema.gov/business/nfip>.

Beth A. Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration



Federal Emergency Management Agency Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Mr. Brad Loar
Director, Mitigation Division
Federal Emergency Management Agency, Region IV
Koger Center - Rutgers Building, 3003 Chamblee Tucker Road
Atlanta, GA 30341
(770) 220-5400

STATUS OF THE COMMUNITY NFIP MAPS

We are preparing a revised FIRM and FIS report for Williamson County in our countywide format; therefore, we will not physically revise and republish the FIRM and FIS report for your community to incorporate the modifications made by this LOMR at this time. Preliminary copies of the countywide FIRM and FIS report, which will present information from the effective FIRM and FIS report for your community and the incorporated communities in Williamson County, will be distributed for review in approximately 7 months. We will incorporate the modifications made by this LOMR into the Preliminary FIRM before it is distributed, and the modifications will be included when the FIRM becomes effective.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional information about the NFIP is available on our website at <http://www.fema.gov/business/nfip>.

A handwritten signature in black ink that appears to read "Beth A. Norton".

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration



Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below and through FEMA's Flood Hazard Mapping website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp.

LOCAL NEWSPAPER Name: *The Tennessean's Williamson A.M.*
 Dates: September 28, 2012 and October 5, 2012

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised flood hazard determination information presented in this LOMR may be changed.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at <http://www.fema.gov/business/nfip>.

A handwritten signature in black ink that reads "Beth A. Norton".

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Table 5. Summary of Discharges - continued

Detail Study Streams

<u>Flooding Source and Location</u>	Drainage Area (sq. mi)	Peak Discharges (Cubic Feet per Second)			
		<u>10-Percent- Annual-Chance</u>	<u>2-Percent- Annual-Chance</u>	<u>1-Percent- Annual-Chance</u>	<u>0.2-Percent- Annual-Chance</u>
LIBERTY CREAK					
At mile 87.4 of Harpeth River	0.60	450	675	780	1,000
LITTLE EAST FORK					
At mouth	4.25	1,324	2,089	2,450	3,933
At approximately 2.32 miles	2.32	856	1,354	1,589	2,698
At approximately 2.66 miles	1.17	519	824	968	1,722
LITTLE HARPETH RIVER					
At confluence with Harpeth River	46.70	10,500	16,800	18,800	24,000
Approximately 0.6 mile upstream of U.S. Route 431	27.40	6,980	11,100	12,500	16,100
LYNNWOOD BRANCH					
At confluence with Harpeth River	4.73	2,090	3,327	3,940	5,785
At approximately 0.831 mile	3.92	1,761	2,898	3,437	5,160
At approximately 1.577 miles	3.23	1,498	2,504	2,985	4,408
At approximately 2.144 miles	2.01	948	1,596	1,894	2,731
MCCUTCHEON CREEK					
400 feet downstream of private drive	3.05	1,460	2,210	2,440	3,340
MILL CREEK					
Just upstream of confluence of Owl Creek	21.90	8,823	14,037	16,437	24,293
At river mile 22.49	12.18	5,850	9,200	10,750	15,850
At river mile 23.72	11.31	5,500	8,750	10,250	15,050
At river mile 24.14	6.21	3,150	4,950	5,800	8,500
OWL CREEK					
At confluence with Mill Creek	13.01	4,050	6,100	7,000	9,150
At river mile 1.90	8.99	3,150	4,750	5,450	7,150
At river Mile 2.53	4.72	2,050	3,100	3,550	4,650
At river mile 4.39	3.22	1,600	2,400	2,750	3,600
RUTHERFORD CREEK	*	*	*	*	*

* Data not available

REVISED TO
REFLECT LOMR
EFFECTIVE: February 4, 2013

FLOODING SOURCE	FLOODWAY					BASE FLOOD WATER SURFACE ELEVATION		
	CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)
LYNWOOD BRANCH					REVISED AREA 			
A	0.671 ¹	105	612	5.6	616.1	616.1	617.0	0.9
B	0.957 ¹	120	593	5.6	626.9	626.9	627.8	0.9
C	1.117 ¹	94	694	4.7	632.9	632.9	633.2	0.3
D	1.273 ¹	135	623	5.3	638.0	638.0	638.3	0.3
E	1.499 ¹	105	466	6.4	646.3	646.3	647.0	0.7
F	1.619 ¹	74	467	6.4	651.5	651.5	652.2	0.7
G	2.095 ¹	58	304	6.2	672.6	672.6	673.3	0.7
McCUTCHEON CREEK								
A	19,490 ²	100	776	3.3	714.6	714.6	715.1	0.5
B	21,135 ²	160	562	4.0	718.8	718.8	719.6	0.8
C	22,375 ²	160	447	4.2	724.5	724.5	725.4	0.9
D	24,125 ²	80	382	4.0	732.0	732.0	732.9	0.9
E	25,205 ²	55	237	5.4	736.6	736.6	736.9	0.3
F	26,335 ²	45	199	5.1	742.7	742.7	743.3	0.6
MILL CREEK								
A	21.00 ³	495	3,421	4.8	557.2	557.2	557.8	0.6
B	21.11 ³	471	3,914	4.2	558.9	558.9	559.2	0.3
C	21.21 ³	560	3,282	5.0	559.3	559.3	560.2	0.9
D	21.34 ³	500	4,573	3.6	561.8	561.8	560.2	0.4

¹ Miles above mouth

² Feet above mouth

³ Miles above confluence with Harpeth River

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY
WILLIAMSON COUNTY, TN
AND INCORPORATED AREAS

REvised to
REFLECT LOMR
EFFECTIVE: February 4, 2013
FLOODWAY DATA
LYNNWOOD BRANCH - McCUTCHEON CREEK -
MILL CREEK

REvised to

REFLECT LOMR
EFFECTIVE: February 4, 2013

