3.3 Risk Assessment

All sections of the risk assessment were developed utilizing the best available data in the Lincoln Trail Region. Lincoln Trail staff used GIS resources to assess the physical impact that specific natural hazard events have on the region. When GIS information was not available or applicable, research data and local historic records, such as those obtained from regional emergency management offices, the media, insurance records, and the knowledge of local officials and residents, were used. Research sources include, but are not limited to the following:

- The National Oceanic and Atmospheric Administration (NOAA)
- The Kentucky Energy and Environment Cabinet
- US Geological Survey (USGS)
- National Severe Storms Laboratory
- FEMA
- Kentucky Office of Emergency Management
- Kentucky Geological Survey
- National Center for Environmental Information (NCEI)

Table 3.3.1 - Hazard Maps by Jurisdiction

Jurisdiction			***MAP TYPE***			
	FLOODING	*TORNADO*	*LANDSLIDE*	*KARST*	*EARTHQUAKE*	*RISK*
Breckinridge	Y	Y	Y	Y	Y	Y
Cloverport	Y	Y	Y	Y	NA	Y
Hardinsburg	Y	Y	Y	Y	NA	Y
Irvington	NA	NA	NA	Y	NA	Y
Grayson	Y	Y	Y	Y	Y	Y
Caneyville	Y	Y	Y	NA	NA	Y
Clarkson	Y	Y	NA	Y	NA	Y
Leitchfield	Y	Y	Y	Y	NA	Y
Hardin	Y	Y	Y	Y	Y	Y
Elizabethtown	Y	Y	Y	Y	NA	Y
Radcliff	Y	Y	Y	Y	NA	Y
Sonora	Y	NA	NA	Y	NA	Y
Upton	NA	NA	NA	Y	NA	Y
Vine Grove	Y	Y	Y	Y	NA	Y
West Point	Y	NA	Y	Y	NA	Y
Larue	Y	Y	Y	Y	Y	Y
Hodgenville	Y	Y	Y	Y	NA	Y
Marion	Y	Y	Y	Y	Y	Y
Bradfordsville	Y	Y	Y	NA	NA	Y
Lebanon	Y	Y	Y	Y	NA	Y
Loretto	NA	NA	Y	Y	NA	Y
Raywick	Y	NA	Y	NA	NA	Y
Meade	Y	Y	Y	Y	Y	Y
Brandenburg	Y	Y	Y	Y	NA	Y

Ekron	NA	NA	NA	Y	NA	Y
Muldraugh	NA	NA	NA	Y	NA	Y
Nelson	Y	Y	Y	Y	Y	Y
Bardstown	Y	Y	Y	Y	NA	Y
Bloomfield	Y	NA	Y	NA	NA	Y
Fairfield	NA	NA	NA	NA	NA	Y
New Haven	Y	Y	Y	NA	NA	Y
Washington	Y	Y	Y	Y	Y	Y
Mackville	NA	NA	Y	NA	NA	Y
Springfield	Y	Y	NA	NA	NA	Y
Willisburg	NA	Y	Y	NA	NA	Y

Y = Map Available
NA = Not Applicable

3.3.1 Identifying Hazards

The Lincoln Trail Region encompasses an area of 3,342 square miles and is vulnerable to several natural hazard events. The events outlined in Table 3.3.1.1 have a 100% chance of occurring in any given year within this region and cost the area an average of $223,758 per event. Due to the size of the region, events may be more prevalent in one portion of the area than in others. This phenomenon makes it imperative to include as many research sources as possible, and to look at mitigation strategies appropriate for every jurisdiction within the region. The events listed below were identified using information from local emergency management offices and review of local past disasters in addition to those listed.

Table 3.3.1.1 Lincoln Trail Region Significant Hazard Events

Hazard	How Identified	Reason Identified
Thunderstorm-Wind Total Cost- $74,457,996.00 Number of Events- 2016 60-64 Years	Media Coverage Insurance Records National Center for Environmental Information (NCEI)	Historic Regional Significance (Affects all Jurisdictions)
Floods Total Cost-$132,991,112.0 Number of Events- 510 54 years	Public Input Insurance Records FIRM/DFIRM Maps SHELDUS National Center for Environmental Information (NCEI)	Historic Regional Significance (Affects all Jurisdictions) Presence of Waterways Presence of Flood Prone Area

Hail Total Cost-$130,364,632.0 Number of Events - 630 48-60 years	Media Coverage Insurance Records SHELDUS National Center for Environmental Information (NCEI)	Historic Regional Significance (Affects all Jurisdictions)
Lightning Total Cost-$3,765,207.00 Number of Events- 267 60-61 -years	Media Coverage Insurance Records SHELDUS National Center for Environmental Information (NCEI)	Historic Regional Significance (Affects all Jurisdictions
Snow & Ice Total Cost-$16,342,589.00 Number of Events-372 48-60-years	Community Input Media Coverage National Center for Environmental Information (NCEI)	Historic Regional Significance (Affects all Jurisdictions
Tornado Total Cost-$93,649,450.00 Number of Events-123 61-69 -years	Public Input Insurance Records FEMA Data Wind Zone Maps SHELDUS National Center for Environmental Information (NCEI)	High Wind Risk Area Historic Regional Significance (Affects all Jurisdictions)
Earthquake Total Cost-NA Number of Events- 6 241-years	National Center for Environmental Information (NCEI) Media Coverage	Media Coverage NCEI
Total Number of Events-3924		

Table 3.3.1.2 profiles natural hazards that can affect this region, but which historically, have not posed a significant risk to the area. Most of these hazards do not pose a significant threat to this region but cannot be overlooked. Most have either no reports of past occurrence and/or an adverse impact on local communities.

Table 3.3.1.2 Lincoln Trail Region Hazard Events with Negligible Risk		
Hazard	**How Identified**	**Reason Identified**
Landslides (Road slides)	Local Input Hazard Areas Identified by KY Geological Survey	Topographic Maps Show Significant Potential Regional Impact
Karst/Sinkhole & Subsidence Topography	USGS & KGS Topographic Maps Local Input	Topographic Maps Indicate High Risk of Development
Drought & Heat	KY Mesonet Data Local Input National Center for Environmental Information (NCEI)	Rural Area with Potential for Economic Impact
Wildfires	Public Input National Center for Environmental Information (NCEI)	Area Prone to Grass/Brush Fires
Earthquakes	Historic Data Media Coverage USGS & KGS	Peak Ground Acceleration Maps (PGA Maps)
Dam Safety	KY Energy & Environment Cabinet	No Significant Historic Data
Tsunamis	Historic Data	No Historic Data
Hurricanes	Media Coverage National Center for Environmental Information (NCEI)	Little Historic Data

3.3.2 Profiling Hazard Events

This section provides a profile of each hazard identified in the Lincoln Trail Region. This part of the Lincoln Trail Regional Hazard Mitigation Plan provides the following information based on the best data available:

1. A description of each hazard identified within the planning area and the impact that each hazard has on the area.
2. The historical background of each identified hazard in the planning area and the probability of it occurring again.
3. Maps indicating the locations and areas within the region impacted by Hazard events.

Lincoln Trail staff used GIS resources to assess the physical and economic impact of certain natural disasters on the region. In situations where GIS data was not available, state websites and local records were used to give plan reviewers a more comprehensive understanding of past hazard events. Local records included county emergency management records, media, local officials, community members and the historical knowledge of subcommittee members.

Credible websites accessed and cited throughout the plan include the Kentucky State Climatology Center, the Spatial Hazard Events and Losses Database for the United States (SHELDUS), the National Center for Environmental Information (NCEI), FEMA's Hazard Mapping website, the Kentucky Geological Survey (KGS), the United States Geologic Survey (USGS), and Kentucky MESONET centers. In addition, leaders from regional educational institutions, business, emergency management, and first response agencies were contacted and involved with the planning process per 44 CFR §201.6(b)(2).

In the past, subcommittees reviewed the best available data gathered, several gaps were identified. To project a more accurate and comprehensive record of past hazard events, researching public input and local records played a significant role in augmenting the data. The consensus of subcommittee reviewers is that some local data is not being forwarded to all interested parties. In particular, property damage estimates are not accurately calculated. To bridge this void, local and regional insurance estimates were gathered from providers in the region and incorporated into the plan.

One goal of the Lincoln Trail Regional Mitigation Committee is to capture new data with every update, that will be useful in preparing future proposals and in developing local environmental and economic plans. All information in this regional plan is dated and should be easily discernable from the original data. The plan should guide community development, improve regional resiliency and preparedness, and enhance quality of life throughout the Lincoln Trail Region.

Review: The Lincoln Trail Region has a documented history of several different types of Hazards with various impacts. The impact of these hazards is measured by both the frequency of occurrence and by the cost of the event; both economic and social. This section is focused on the types and frequency of hazards in the Lincoln Trail Region. The costs of events will be addressed in section 3.3.4 and will focus on the potential losses that may be incurred with a future event. The following tables provide an analytical review of documented hazard events in the Lincoln Trail Region. For planning purposes, the historic frequencies will be used in subsequent vulnerability analysis. The tables are presented for each county including incorporated and unincorporated areas and for the region as a whole.

Table 3.3.2.1 - Summary of Hazard Events and Cost by County

BRECKINRIDGE

Hazard	Number of Events in Historic Record	Number of Years in Historic Record	Number of Events in Past 10 Years	Number of Events in Past 20 Years	Number of Events in Past 50 Years	Historic Recurrence Interval (years)	Historic Frequency % chance/year	Past 10 Year Record Frequency Per Year	Past 20 Year Record Frequency Per Year	Past 50 Year Record Frequency Per Year
Thunderstorm Wind	265	60.5	112	154	222	0.23	438.02%	11.2	7.7	4.44
Floods	60	54.5	20	38	58	0.91	110.09%	2	1.9	1.16
Hail	86	58.5	45	61	73	0.68	147.01%	4.5	3.05	1.46
Lightning	26	60.5	1	1	9	2.33	42.98%	0.1	0.05	0.18
Snow & Ice	48	61.5	22	34	43	1.28	78.05%	2.2	1.7	0.86
Tornado	17	61.5	8	11	14	3.62	27.64%	0.8	0.55	0.28
Earthquake	0	241	0	0	0	0	0.00%	0	0	0

Hazard	Total Cost	Number Events	Number Years	Total Loss of Life	Total Injuries	Average Cost Per Year	Average Cost Per Event	Average Loss of Life Per Year	Average Loss of Life Per Event	Average Injuries Per Year	Average Injuries Per Event
Thunderstorm Wind	$1,761,803	265	60.5	0.25	4.21	$29,121	$6,648	0.00	0.00	0.07	0.02
Floods	$7,811,684	60	54.5	2.09	0.11	$143,334	$130,195	0.04	0.03	0.00	0.00
Hail	$4,925,750	86	58.5	0.01	0.52	$84,201	$57,276	0.00	0.00	0.01	0.01
Lightning	$489,925	26	60.5	0.04	0.36	$8,098	$18,843	0.00	0.00	0.01	0.01
Snow & Ice	$1,411,082	48	61.5	0.31	1.83	$22,944	$29,398	0.01	0.01	0.03	0.04
Tornado	$5,285,260	17	61.5	1.09	20.00	$85,939	$310,898	0.02	0.06	0.33	1.18
Earthquake	0	0	241	0	0	0	0	0	0	0	0

GRAYSON

Hazard	Number of Events in Historic Record	Number of Years in Historic Record	Number of Events in Past 10 Years	Number of Events in Past 20 Years	Number of Events in Past 50 Years	Historic Recurrence Interval (years)	Historic Frequency % chance/year	Past 10 Year Record Frequency Per Year	Past 20 Year Record Frequency Per Year	Past 50 Year Record Frequency Per Year
Thunderstorm Wind	224	62.5	69	106	178	0.28	358.40%	6.9	5.3	3.56
Floods	56	54.5	22	36	55	0.97	102.75%	2.2	1.8	1.1
Hail	87	57.5	37	57	75	0.66	151.30%	3.7	2.85	1.5
Lightning	32	60.5	2	2	12	1.89	52.89%	0.2	0.1	0.24
Snow & Ice	51	61.5	24	30	47	1.21	82.93%	2.4	1.5	0.94
Tornado	16	62.5	6	7	5	3.91	25.60%	0.6	0.35	0.1
Earthquake	0	241	0	0	0	0	0.00%	0	0	0

Hazard	Total Cost	Number Events	Number Years	Total Loss of Life	Total Injuries	Average Cost Per Year	Average Cost Per Event	Average Loss of Life Per Year	Average Loss of Life Per Event	Average Injuries Per Year	Average Injuries Per Event
Thunderstorm Wind	$1,740,288	224	62.5	0.25	6.62	$27,845	$7,769	0.00	0.00	0.11	0.03
Floods	$8,490,065	56	54.5	0.04	0.11	$155,781	$151,608	0.00	0.00	0.00	0.00
Hail	$2,438,935	87	57.5	0.01	0.5	$42,416	$28,034	0.00	0.00	0.01	0.01
Lightning	$423,574	32	60.5	0.04	4.36	$7,001	$13,237	0.00	0.00	0.07	0.14
Snow & Ice	$1,981,398	51	61.5	0.29	3.41	$32,218	$38,851	0.00	0.01	0.06	0.07
Tornado	$56,783,213	16	62.5	3.00	23.09	$908,531	$3,548,951	0.05	0.19	0.37	1.44
Earthquake	0	0	241	0	0	0	0	0	0	0	0

HARDIN

Hazard	Number of Events in Historic Record	Number of Years in Historic Record	Number of Events in Past 10 Years	Number of Events in Past 20 Years	Number of Events in Past 50 Years	Historic Recurrence Interval (years)	Historic Frequency % chance/year	Past 10 Year Record Frequency Per Year	Past 20 Year Record Frequency Per Year	Past 50 Year Record Frequency Per Year
Thunderstorm Wind	366	64.5	136	205	309	0.18	567.44%	13.6	10.25	6.18
Floods	88	54.5	42	63	86	0.62	161.47%	4.2	3.15	1.72
Hail	113	58.5	51	72	96	0.52	193.16%	5.1	3.6	1.92
Lightning	34	60.5	2	3	13	1.78	56.20%	0.2	0.15	0.26
Snow & Ice	56	61.5	28	34	52	1.10	91.06%	2.8	1.7	1.04
Tornado	26	61.5	10	13	19	2.37	42.28%	1	0.65	0.38
Earthquake	1	241	0	0	1	241	0.00%	0	0	0.02

Hazard	Total Cost	Number Events	Number Years	Total Loss of Life	Total Injuries	Average Cost Per Year	Average Cost Per Event	Average Loss of Life Per Year	Average Loss of Life Per Event	Average Injuries Per Year	Average Injuries Per Event
Thunderstorm Wind	$65,915,949	366	64.5	4.45	133.17	$1,021,953	$180,098	0.07	0.01	2.06	0.36
Floods	49261888.78	88	54.5	2.17	0.11	$903,888	$559,794	0.04	0.02	0.00	0.00
Hail	$26,768,252	113	58.5	0.01	0.52	$457,577	$236,887	0.00	0.00	0.01	0.00
Lightning	$869,962	34	60.5	1.11	2.36	$14,380	$25,587	0.02	0.03	0.04	0.07
Snow & Ice	$2,792,155	56	61.5	1.29	4.47	$45,401	$49,860	0.02	0.02	0.07	0.08
Tornado	$16,643,723	26	61.5	2.00	73.09	$270,630	$640,143	0.03	0.08	1.19	2.81
Earthquake	0	1	241	No Information Available							

LARUE

Hazard	Number of Events in Historic Record	Number of Years in Historic Record	Number of Events in Past 10 Years	Number of Events in Past 20 Years	Number of Events in Past 50 Years	Historic Recurrence Interval (years)	Historic Frequency % chance/year	Past 10 Year Record Frequency Per Year	Past 20 Year Record Frequency Per Year	Past 50 Year Record Frequency Per Year
Thunderstorm Wind	217	60.5	60	88	160	0.28	358.68%	6	4.4	3.2
Floods	47	54.5	18	25	45	1.16	86.24%	1.8	1.25	0.9
Hail	66	65.5	27	30	42	0.99	100.76%	2.7	1.5	0.84
Lightning	33	60.5	0	0	8	1.83	54.55%	0	0	0.16
Snow & Ice	46	61.5	20	25	42	1.34	74.80%	2	1.25	0.84
Tornado	12	69.5	5	7	7	5.79	17.27%	0.5	0.35	0.14
Earthquake	1	241	0	0	1	241	0.00%	0	0	0.02

Hazard	Total Cost	Number Events	Number Years	Total Loss of Life	Total Injuries	Average Cost Per Year	Average Cost Per Event	Average Loss of Life Per Year	Average Loss of Life Per Event	Average Injuries Per Year	Average Injuries Per Event
Thunderstorm Wind	$1,869,787	217	60.5	1.32	11.6	$30,906	$8,617	0.02	0.01	0.19	0.05
Floods	$8,067,971	47	54.5	0.17	0.11	$148,036	$171,659	0.00	0.00	0.00	0.00
Hail	$1,969,355	66	65.5	0.06	0.56	$30,066	$29,839	0.00	0.00	0.01	0.01
Lightning	$61,022	33	60.5	0	0	$1,009	$1,849	0.00	0.00	0.00	0.00
Snow & Ice	$1,050,662	46	61.5	0.29	3.36	$17,084	$22,840	0.00	0.01	0.05	0.07
Tornado	$5,210,111	12	69.5	0.00	19.12	$74,966	$434,176	0.00	0.00	0.28	1.59
Earthquake	0	1	241	No Information Available							

MARION

Hazard	Number of Events in Historic Record	Number of Years in Historic Record	Number of Events in Past 10 Years	Number of Events in Past 20 Years	Number of Events in Past 50 Years	Historic Recurrence Interval (years)	Historic Frequency % chance/year	Past 10 Year Record Frequency Per Year	Past 20 Year Record Frequency Per Year	Past 50 Year Record Frequency Per Year
Thunderstorm Wind	214	60.5	56	89	156	0.28	353.72%	5.6	4.45	3.12
Floods	58	54.5	23	33	56	0.94	106.42%	2.3	1.65	1.12
Hail	64	60.5	18	24	37	0.95	105.79%	1.8	1.2	0.74
Lightning	36	61.5	1	1	8	1.71	58.54%	0.1	0.05	0.16
Snow & Ice	39	61.5	14	18	35	1.58	63.41%	1.4	0.9	0.7
Tornado	13	61.5	4	6	5	4.73	21.14%	0.4	0.3	0.1
Earthquake	0	241	0	0	0	0	0.00%	0	0	0

Hazard	Total Cost	Number Events	Number Years	Total Loss of Life	Total Injuries	Average Cost Per Year	Average Cost Per Event	Average Loss of Life Per Year	Average Loss of Life Per Event	Average Injuries Per Year	Average Injuries Per Event
Thunderstorm Wind	$1,547,735	214	60.5	0.24	1.63	$25,582	$7,232	0.00	0.00	0.03	0.01
Floods	$9,800,835	58	54.5	0.31	2.54	$179,832	$168,980	0.01	0.01	0.05	0.04
Hail	$35,497,179	64	60.5	0.06	2.56	$586,730	$554,643	0.00	0.00	0.04	0.04
Lightning	$404,253	36	61.5	0.14	0.39	$6,573	$11,229	0.00	0.00	0.01	0.01
Snow & Ice	$2,681,555	39	61.5	0.29	3.36	$43,603	$68,758	0.00	0.01	0.05	0.09
Tornado	$920,833	13	61.5	0.00	4.15	$14,973	$70,833	0.00	0.00	0.07	0.32
Earthquake	0	0	241	0	0	0	0	0	0	0	0

MEADE

Hazard	Number of Events in Historic Record	Number of Years in Historic Record	Number of Events in Past 10 Years	Number of Events in Past 20 Years	Number of Events in Past 50 Years	Historic Recurrence Interval (years)	Historic Frequency % chance/year	Past 10 Year Record Frequency Per Year	Past 20 Year Record Frequency Per Year	Past 50 Year Record Frequency Per Year
Thunderstorm Wind	234	61.5	72	110	222	0.26	380.49%	7.2	5.5	4.44
Floods	47	54.5	13	24	45	1.16	86.24%	1.3	1.2	0.9
Hail	74	66.5	26	46	56	0.90	111.28%	2.6	2.3	1.12
Lightning	28	60.5	0	0	11	2.16	46.28%	0	0	0.22
Snow & Ice	49	61.5	24	28	45	1.26	79.67%	2.4	1.4	0.9
Tornado	14	61.5	7	9	10	4.39	22.76%	0.7	0.45	0.2
Earthquake	4	241	0	1	4	60.25	0.02%	0	0.05	0.08

Hazard	Total Cost	Number Events	Number Years	Total Loss of Life	Total Injuries	Average Cost Per Year	Average Cost Per Event	Average Loss of Life Per Year	Average Loss of Life Per Event	Average Injuries Per Year	Average Injuries Per Event
Thunderstorm Wind	$1,959,733	234	61.5	3.45	46.26	$31,866	$8,375	0.06	0.01	0.75	0.20
Floods	$7,284,005	47	54.5	1.14	0.11	$133,651	$154,979	0.02	0.02	0.00	0.00
Hail	$25,032,572	74	66.5	0.01	2.52	$376,430	$338,278	0.00	0.00	0.04	0.03
Lightning	$129,715	28	60.5	0	0	$2,144	$4,633	0.00	0.00	0.00	0.00
Snow & Ice	$1,420,840	49	61.5	0.29	1.81	$23,103	$28,997	0.00	0.01	0.03	0.04
Tornado	$6,342,324	14	61.5	31.00	268.07	$103,127	$453,023	0.50	2.21	4.36	19.15
Earthquake		4	241	No Information Available							

NELSON

Hazard	Number of Events in Historic Record	Number of Years in Historic Record	Number of Events in Past 10 Years	Number of Events in Past 20 Years	Number of Events in Past 50 Years	Historic Recurrence Interval (years)	Historic Frequency % chance/year	Past 10 Year Record Frequency Per Year	Past 20 Year Record Frequency Per Year	Past 50 Year Record Frequency Per Year
Thunderstorm Wind	296	60.5	91	97	216	0.20	489.26%	9.1	4.85	4.32
Floods	104	54.5	45	78	102	0.52	190.83%	4.5	3.9	2.04
Hail	85	60.5	36	53	61	0.71	140.50%	3.6	2.65	1.22
Lightning	42	61.5	2	6	16	1.46	68.29%	0.2	0.3	0.32
Snow & Ice	50	61.5	22	27	46	1.23	81.30%	2.2	1.35	0.92
Tornado	14	61.5	3	4	9	4.39	22.76%	0.3	0.2	0.18
Earthquake	0	241	0	0	0	0	0.00%	0	0	0

Hazard	Total Cost	Number Events	Number Years	Total Loss of Life	Total Injuries	Average Cost Per Year	Average Cost Per Event	Average Loss of Life Per Year	Average Loss of Life Per Event	Average Injuries Per Year	Average Injuries Per Event
Thunderstorm Wind	$1,794,130	294	60.5	0.3	12.58	$29,655	$6,102	0.00	0.00	0.21	0.04
Floods	35033005.07	104	54.5	3.17	2.11	$642,807	$336,856	0.06	0.03	0.04	0.02
Hail	22857556	85	60.5	0.06	1.56	$377,811	$268,912	0.00	0.00	0.03	0.02
Lightning	$932,717	42	61.5	2.12	2.34	$15,166	$22,208	0.03	0.05	0.04	0.06
Snow & Ice	$2,307,155	50	61.5	1.29	3.47	$37,515	$46,143	0.02	0.03	0.06	0.07
Tornado	$2,233,978	14	61.5	1.00	28.15	$36,325	$159,570	0.02	0.07	0.46	2.01
Earthquake	0	0	241	0	0	0	0	0	0	0	0

WASHINGTON

Hazard	Number of Events in Historic Record	Number of Years in Historic Record	Number of Events in Past 10 Years	Number of Events in Past 20 Years	Number of Events in Past 50 Years	Historic Recurrence Interval (years)	Historic Frequency % chance/year	Past 10 Year Record Frequency Per Year	Past 20 Year Record Frequency Per Year	Past 50 Year Record Frequency Per Year
Thunderstorm Wind	200	60.5	50	77	142	0.30	330.58%	5	3.85	2.84
Floods	50	54.5	15	23	48	1.09	91.74%	1.5	1.15	0.96
Hail	55	60.5	16	22	30	1.10	90.91%	1.6	1.1	0.6
Lightning	36	61.5	0	0	9	1.71	58.54%	0	0	0.18
Snow & Ice	49	61.5	17	21	41	1.26	79.67%	1.7	1.05	0.82
Tornado	11	61.5	5	7	4	5.59	17.89%	0.5	0.35	0.08
Earthquake	0	241	0	0	0	0	0.00%	0	0	0

Hazard	Total Cost	Number Events	Number Years	Total Loss of Life	Total Injuries	Average Cost Per Year	Average Cost Per Event	Average Loss of Life Per Year	Average Loss of Life Per Event	Average Injuries Per Year	Average Injuries Per Event
Thunderstorm Wind	$1,668,572	200	60.5	0.22	3.58	$27,580	$8,343	0.00	0.00	0.06	0.02
Floods	$9,124,658	50	54.5	1.17	1.11	$167,425	$182,493	0.02	0.02	0.02	0.02
Hail	$11,037,640	55	60.5	0.06	3.56	$182,440	$200,684	0.00	0.00	0.06	0.06
Lightning	$223,179	36	61.5	0.12	0.34	$3,629	$6,199	0.00	0.00	0.01	0.01
Snow & Ice	$2,697,743	49	61.5	0.37	3.48	$43,866	$55,056	0.01	0.01	0.06	0.07
Tornado	$1,840,007	11	61.5	0.00	5.15	$29,919	$167,273	0.00	0.00	0.08	0.47
Earthquake	0	0	241	0	0	0	0	0	0	0	0

LINCOLN TRAIL REGION

Hazard	Number of Events in Historic Record	Number of Years in Historic Record	Number of Events in Past 10 Years	Number of Events in Past 20 Years	Number of Events in Past 50 Years	Historic Recurrence Interval (years)	Historic Frequency % chance/year	Past 10 Year Record Frequency Per Year	Past 20 Year Record Frequency Per Year	Past 50 Year Record Frequency Per Year
Thunderstorm Wind	2016	64.5	646	926	1605	0.03	113.08%	64.6	46.3	32.1
Floods	510	54.5	198	320	495	0.11	31.14%	19.8	16	9.9
Hail	630	65.5	256	365	470	0.10	38.30%	25.6	18.25	9.4
Lightning	267	61.5	8	13	86	0.23	37.75%	0.8	0.65	1.72
Snow & Ice	388	61.5	171	217	351	0.158505	78.86%	17.1	10.85	7.02
Tornado	123	63	48	64	73	0.51	6.46%	4.8	3.2	1.46
Earthquake	6	241	0	1	6	40.3	0.02%	0	0.05	0.12

Hazard	Total Cost	Number Events	Number Years	Total Loss of Life	Total Injuries	Average Cost Per Year	Average Cost Per Event	Average Loss of Life Per Year	Average Loss of Life Per Event	Average Injuries Per Year	Average Injuries Per Event
Thunderstorm Wind	$78,257,999	2014	64.5	10.48	219.65	$1,213,302	$38,857	0.16	0.01	3.41	0.11
Floods	$134,874,112	510	54.5	10.26	6.31	$2,474,754	$264,459	0.19	0.02	0.12	0.01
Hail	$130,527,238	630	66.5	0.28	12.3	$1,962,816	$207,186	0.00	0.00	0.18	0.02
Lightning	$4,265,847	276	60.5	5.57	13.15	$70,510	$15,456	0.09	0.02	0.22	0.05
Snow & Ice	$16,342,589	388	61.5	4.42	25.19	$265,733	$42,120	0.07	0.01	0.41	0.06
Tornado	$95,259,449	123	63	38.09	440.82	$1,521,109	$774,467	0.61	0.31	7.04	3.58
Earthquake		6	241	No Information Available							

NOTE: The historic frequency of a hazard event over a given period of time determines the historic recurrence interval. For example: If there have been 10 Thunderstorm events in the County in the past 5 years, statistically, that would average two events a year. Realize that from a statistical standpoint, there are several variables to consider. 1) Accurate hazard history data and collection are crucial to an accurate recurrence interval and frequency. 2) Data collection and accuracy has been much better in the past 20 years (NCDC & NEIC weather records). 3) It is important to include all significant recorded hazard events that will include periodic updates to this table.

The values in the preceding tables should be considered low. More events have occurred than are documented by the sources used in these tables.

1. Compilation of SHELDUS, NCDC & NEIC, SHELDUS Data Base, Hazard Research Lab, University of South Carolina, 2009. Dates 1960-2009. National Climate Data Center (NCDC), NOAA & National Weather Service, various ranges 1950-2009. National Environmental Information Center (NEIC) July 1, 2009 - June 30, 2015.

2. USGS & National Earthquake Information Center (NEIC) Databases, "USGS/NEIC 1973-Sept. 9, 2015" & "Eastern, Central and Mountain States of U.S., 1534 - 1986".

3. Includes cumulative reports of claims filed from various insurance providers.

4. Consolidated based on review of repeated events in individual counties.

3.3.2.1 Flooding

I. Background

Definition: "An overflow of water onto lands that are used or usable by man and not normally covered by water. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river, stream, lake, or ocean." (Water Science Glossary of Terms; http://ga.water.usgs.gov/edu/dictionary.html)

A **Flood,** as defined by the National Flood Insurance Program (NFIP) is: "A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties (at least one of which is your property) from:

- Overflow of inland or tidal waters,
- Unusual and rapid accumulation or runoff of surface waters from any source, or
- A mudflow

Or it can be a collapse or subsidence of land along the shore of a lake or similar body of water because of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood."

Description

A flood is a natural event around rivers and streams. Excessive water from snowmelt, rainfall, or a storm surge accumulates and overflows onto the banks and adjacent floodplains. **Floodplains** are lowlands, adjacent to rivers, lakes, and oceans that are subject to recurring floods. Over nine million U.S. households are in floodplains.

Flooding is caused in a variety of ways. Winter or spring rains, coupled with melting snows, can fill river basins too quickly. Torrential rains from decaying hurricanes or other tropical systems can also produce river flooding.

During the 20^{th} century, flooding was the leading cause of property damage and loss of life of all natural disasters in the United States. Most U.S. communities have experienced some kind of flooding due to spring rains, heavy thunderstorms, or winter snow thaws. Floods can be either slow or fast rising, but generally develop over a period of days. Hundreds of floods occur each year, making it one of the most common hazards in all U.S. states.

In most years, 75% of all Federal disaster declarations involve flooding either in part or exclusively. Flooding claims an average of 140 lives per year and is responsible for more annual property damage than any other type of weather hazard according to the National Severe Storms Laboratory.

Factors that determine flooding severity and/or exacerbate the effects of floods:

- Rainfall Intensity and Duration
- Large amounts of rain over a short time can result in Flash Flooding
- Small amounts of rain can cause flooding where soil is saturated
- Small amounts of rain can cause flooding if concentrated in an area of impermeable surfaces

- Topography and Ground Cover
- Water runoff is greater in areas of steep slopes and little vegetation
- Development without adequate elevation or Flood Proofing
- Storm Sewer or Sinkhole backup
- Debris or Obstructions

The frequency of flooding depends on the climate, soil, and channel slope. In regions without prolonged periods of below-freezing temperatures, floods usually occur in the season with the highest precipitation.

Types of Flooding:
While floods can be the result of numerous naturally occurring and manmade factors, all floods can be defined as the accumulation of too much water, in too little time, within a specific area. Types of floods include regional, river or riverine, flashfloods, urban, ice-jam, storm surge, dam or levee failure, and debris, landslide, and mudflow.

Regional Flooding
Seasonal, regional flooding can occur when winter or spring rains, coupled with melting snow, fill river basins with too much water too quickly. Frozen ground further reduces water infiltration into the soil and causes runoff. Extended wet periods, at any time during the year, can result in saturated soils and exacerbates runoff into streams and rivers until their water containment capabilities are exceeded.

River or Riverine Floods
River/riverine flooding occurs when a high volume of water from a river or similar body of water occurs over a period too long to be considered a flash flood.

The spillway at Rough River Lake April 27 2011 Falls of Rough, Ky. - Heavy rains in the area caused Rough River Lake to reach a record pool causing water to run into the spillway for the first time since the dam became operational in 1961. *Image: US Army Corps of Engineers photo by Mike Lush*

Flash Floods
Flash floods are the result of quickly rising waters that occur as the result of heavy rains over the period of a few hours or less. Flash flooding can occur within several seconds to several hours, and with little warning. Flash floods are deadly because they produce rapid increases in water volume that often has swift velocities.

Several factors can contribute to flash flooding including rainfall intensity, rainfall duration, surface conditions, topography, and the slope of the receiving basin. Urban areas are more susceptible to flash flooding since a great percentage of the surface area is composed of impervious surfaces such as roads, roofs and parking lots causing rapid runoff of water. They can also be caused by ice jams on rivers in conjunction with a winter or spring thaw, or even a dam break. Flash flooding is characterized by the rapid and constant influx of water that caused a treacherous overflow with volume and velocity sufficient to sweep vehicles away, roll boulders onto roadways, uproot trees, level buildings, and sweep bridges off their piers.

Urban Flooding

As land is developed from fields and woodlands into roads, parking lots and built environments, it loses its ability to absorb rainfall. Urbanization of a watershed changes the hydrologic systems of a basin. Heavy rainfall collects and flows faster on impervious surfaces such as asphalt and concrete. Water falls from the clouds and moves along the surface and into streams at a much faster rate in urban areas. Adding a built environment into hydrologic systems can result in floodwaters rising very quickly and moving extremely swiftly. During periods of urban flooding, streets can become rapidly moving rivers and basements can fill with water. Often, storm drains become clogged with debris causing additional, localized flooding.

Most People are Unaware that:

- Over half of deaths due to flooding occur in vehicles. Most happen when drivers try to navigate through floodwaters. The next highest is due to walking into or near flood waters. (NWS)
- Just 6 inches of rapidly moving floodwater can knock a person down. (NWS)
- It only takes 2 feet of water to float a large vehicle. (NWS)
- One-third of all flooded roads and bridges are so damaged by water, that any vehicle trying to cross stands only a 50% chance of making it to the other side.
- 95% of people killed by a flash flood try to outrun rapidly moving water rather than seeking higher grounds.

Ice-Jam Floods

Ice-jam floods can occur when rivers become totally or partially frozen. A rise in stream stage will break up a totally frozen river and create ice flows that can pile up on channel obstructions such as shallow riffles, log jams, or bridge piers. The jammed ice creates a dam across the channel that water and ice cannot breach. The mixture can then rise rapidly and overflow the channel banks. Flooding then moves downstream when the ice dam fails, and the water stored behind the dam is released. At this juncture, the flood takes on the characteristics of a flash flood, with the added danger of ice flows gaining velocity. Such flooding can seriously damage structures in its path.

Storm-Surge Floods

Storm-surge flooding occurs when water is pushed up onto otherwise dry land by onshore winds. Friction between the water and the moving air creates drag that, depending on the distance of the water (fetch) and the velocity of the wind, can pile water up to depths greater than twenty feet. Intense, low-pressure systems and hurricanes can create storm-surge flooding. Storm surge is unquestionably the most dangerous part of a hurricane when pounding waves create very hazardous flood currents.

Dam and Levee Failure floods
Dam failures are potentially the worst flood events. Dam failure is usually the result of neglect, poor design, or structure damage caused by a major event such as an earthquake. When a dam fails, an immense volume of water is sent speeding downstream, destroying everything in its path. Dams and levees are designed and built for flood protection and are usually engineered to withstand a flood with a calculated risk of occurrence. For example, a dam or levee may be designed to contain a flood at one location on a stream that has a certain probability of occurring in any given year. If a larger flood occurs, that structure will be overtopped. If a dam or levee is overtopped, it could result in the structure being washed out and the water behind it becomes a flash flood. A failed dam or levee can create a flood that is catastrophic to life and property due to the tremendous energy of the water that is released.

Debris and Landslide Floods
Debris and landslide flooding occurs when the accumulation of debris, mud, rocks, and logs in a channel form a temporary dam. Flooding occurs upstream as water becomes trapped behind the temporary dam and quickly becomes a flash flood as water breaches the dam and rapidly washes away. Landslides can also create large waves on lakes or embayments that can be deadly.

Most loss of life occurs when people are swept away by flood currents, while most property damage results from inundation by sediment-laden water. Floodwaters have the potential to be an extremely destructive force. Lateral forces can demolish buildings while erosion can undermine bridge foundations and footings that can lead to collapse of structures.

Flood Facts
- Omitting heat related fatalities, more deaths occur due to flooding than any other hazard and most flood related deaths are due to flash floods. The national, 30-year average for flood related deaths in the U.S. is 88 according to the National Weather Service (NWS).
- Fifty percent of all flash-flood fatalities are vehicle related.
- Most homeowner insurance policies do not cover floodwater damage – Just one inch of water in an average sized home can cause more than $25,000 in damage.
- Estimated property damage in the U.S. in 2019 was $3.75 billion according to the National Weather Service.

Common Terms:

100-Year Flood Plain: An area with a 1% chance of flooding in any given year. This is also known as the Base Flood level.

500-Year Flood Plain: An area with a 0.2% chance of flooding in any given year.

Base Flood: A flood that has a 1% chance of being equaled or exceeded in any given year. In this respect, it is also the regulatory standard for the "100-yeard flood." The base flood is the national standard used by the National Flood Insurance Program (NFIP) and all federal agencies for the purpose of requiring the purchase of flood insurance and the regulation of new development. Base Flood Elevations (BFEs) are usually shown on Flood Insurance Rate Maps (FIRMs)(DFIRMs).

Floodplain: A floodplain is an area of land adjacent to a river, stream, lake, estuary, or other body of water that is subject to flooding. This area of land, if left undisturbed, serves the purpose of storing excess floodwater. A floodplain has two sections, the floodway, and the flood fringe.

Floodway: The NFIP defines floodway as "the channel of a river or other watercourse and adjacent land areas that must be reserved, in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot." The floodway carries the majority of floodwater downstream and is usually the area where water velocity and force are the greatest. NFIP regulations require the floodway be kept open and free from any development or construction that would obstruct or divert floodwaters onto other properties. Floodways are not mapped for all rivers and streams but are generally mapped in developed areas.

Flood Fringe: The flood fringe is the area of a floodplain outside of the floodway. The land area outside of a floodway is subject to inundation by regular flooding.

Annual Flooding: Annual flooding occurs far more frequently than indicated by the term "100-year flood." Over time, a structure located within a 100-year floodplain is at a much greater risk than indicated by the time frame of 100-year.

History of Flooding in Kentucky

As of June 2021, Kentucky has declared 72 major disasters since 1953 according to FEMA's website. Of Kentucky's 72 major disaster declarations, most were due to flooding or included flooding. Flooding in Kentucky occurs almost every year, and it is not unusual for several flooding events to occur in any given year.

An Overview of Kentucky Water and Water Events
13 = Number of Major Basins in Kentucky Approximately 49 = Average Rainfall Maximum Rainfall occurs in Winter and Spring Minimum Rainfall occurs in Late Summer and Fall More than 90,000 = Miles of Rivers and Streams in the Commonwealth 637,000 = Acres of Wetlands 45 = Number of major lakes, including reservoirs, with 29 dams 50 feet tall or higher.

Significant Kentucky floods, resulting in declarations, occurred in 1973, 1975, 1977, 1978, 1982, 1984, three in 1989, 1991, 1997, 1998, 2000, 2001, 2002, 2003, 2004, 2007, 2008, 2009, 2010, 2011, 2012, 2014, 2015, 2016, 2018, 2019, 2020, 2021. The flooding in 1997 involved disaster declarations in 101, Kentucky Counties. The two types of flooding most common in Kentucky are *flash floods* and *river basin* or riverine floods.

Flash Flooding: Resulting from excessive rainfall in a short amount of time, flash flooding occurs in the entire state, but is more common in Eastern Kentucky due to the region's mountainous terrain, narrow gorges, and numerous streams and riverbeds. Flash floods can occur at any time of the year but are more prevalent during the spring and summer months.

River Basin Flooding: River basin flooding is common along Kentucky's major streams such as the Kentucky, Green, Licking, Ohio and Mississippi Rivers. It is most likely to occur during late winter and early spring and seriously affects the major Kentucky cities of Frankfort, Louisville, Owensboro, and Paducah. Every two to three years, serious flooding occurs along one or more of Kentucky's major streams and it is not uncommon for flooding to occur several years in succession.

Aerial photo of Rough River Lake 29 April 2011. On April 30 Rough River Lake pool is recoreded at 524.7ft, a new record. *Image: US Army Corps of Engineers*

II. Profile

The Lincoln Trail Area Development District is bordered on the north in part by the Ohio River. Numerous rivers and streams crisscross the region including Rough River, Nolin River, Beech Fork, Rolling Fork, Chaplin River, Salt River, Clover Creek, Sinking Creek and Otter Creek. These waterways and their tributaries drain an immediate area of 4,600 square miles. Since the Lincoln Trail Region consists of only 3,342 square miles, the potential for flooding is obvious.

Historically, flooding has occurred on all these waterways. Ohio River flooding in the towns of West Point, Brandenburg, and Cloverport has resulted in tremendous property damage and loss of life. Localized flooding resulting in property damage and loss of life has also occurred on most other major streams within the region and has affected the communities of Fredericktown, Bradfordsville and New Haven.

Bradfordsville: South Rolling Fork flooding KY 49, March 2015. *Photo Courtesy: David Edelen.*

Several flood controls projects have been completed within the region, over the years. Most have been construction projects initiated by the U.S. Corps of Engineers and USDA on the Ohio, Rough and Nolin River systems and their tributaries. Local projects have also been completed to deal with storm water runoff and bank erosion issues.

Based on FEMA DFIRM data from 2007 – 2012, 6.23 square miles of land or 0.2% of the Lincoln Trail Region lies in a 500-year floodplain and 256.68 square miles of land or 7.6% of the area lies within a 100-year floodplain. Since approval of the original plan in 2005 all of the eight Lincoln Trail counties have gone through the map modernization program of the floodplains.

DFIRM versions

Breckinridge (8/4/2008)	Grayson (9/19/2012)	Hardin (8/16/2007)
LaRue (1/16/2009)	Marion (1/6/2010)	Meade (7/18/2011)
Nelson (5/24/2011)	Washington (2/17/2010)	

Overview of the Kentucky Floodplain Management Program	
Number of Kentucky communities that Participate in the National Flood Insurance Program	116 out of 120 counties 245 cities out of 422
Number of Lincoln Trail communities that Participate in the National Flood Insurance Program	8 out of 8 counties 20 out of 27 cities
Presidential flood declarations between 2005 And April of 2021	22
Presidential flood declaration between 1970 and 2021	34

Source: FEMA.gov and the Kentucky Office of Emergency Management

Table 3.3.2.1.1 lists historical flood claims and their associated cost in each jurisdiction in the Lincoln Trail area because of flooding events. It should be noted that the claims reported to the National Flood Insurance Program (NFIP) may not be the only assistance available to property owners. Flood assistance is also available from FEMA and other state or federal agencies because of a disaster declaration.

Table 3.3.2.1.1

Jurisdiction	Flood Claims	Total Payments
Breckinridge County	3	$131,776
City of Cloverport	17	$133,279
City of Hardinsburg	2	$30,036
City of Irvington	4	$27,373
Grayson County	1	$0
City of Caneyville		$0
Hardin County	92	$1,730,681
City of Elizabethtown	62	$370,001
City of Radcliff	17	$334,542
City of Vine Grove	5	$28,105
City of West Point	207	$3,401,326
LaRue County	21	$201,813
Marion County	6	$100,125
City of Bradfordsville	1	$32,000
City of Lebanon	3	$14,157
Meade County	6	$34,561
City of Brandenburg	4	$169,035

Nelson County City of Bardstown City of Bloomfield City of New Haven	56 7 3 26	$1,427,188 $90,663 $1,883 $705,102
Washington County City of Springfield City of Williamsburg	20 8 1	$467,554 $140,790 $53,994
Policy and Loss Data by Geography (HUDEX)		

The National Flood Insurance Program (NFIP) defines a repetitive loss (RL) as any insurable building for which two or more claims of $1,000.00 were paid by the NFIP within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by NFIP. Currently, there are over 122,000 RL properties nationwide. The National Flood Insurance Reform Act of 2004 recognized repetitive loss as a significant problem. The Act also defined severe repetitive loss (SRL) as "a single family property consisting of 1 to 4 residences that is covered under flood insurance by the NFIP and has incurred flood related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding $5,000.00 and with the cumulative amount of such claims payments exceeding $20,000.00; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property." Currently, there are approximately 6,000 properties nationwide, meeting the definition of SRL.

Table 3.3.2.1.2	
Flood or Flash Flood Related Disaster Declarations in the Lincoln Trail Region	
Declaration Date and Number	**LTADD Counties included in the Declaration**
3-3-15 #4218	Larue and Washington Counties (Public Assistance)
2-21-18 #4361	Hardin and Washington Counties (Public Assistance)
2-6-19 #4428	Marion and Washington Counties (Public Assistance)
2-8-21 #4592	Marion and Nelson Counties (Public Assistance)
2-27-21 #4595	Marion County (Public Assistance)
Source: https://www.fema.gov/disaster/declarations	

In 1973 Congress made the purchase of Flood Insurance mandatory for many properties. Lending institutions could not increase, extend, or renew funds secured by real estate located in a flood hazard area, unless the property was covered under the NFIP.

Participation: The Lincoln Trail currently has all 8 counties and 20 of 27 cities with NFIP policies. The region has seen steady gains in policies. In 2005 only 7 counties and 16 cities had policies. In

2010 all 8 counties and 17 cities had policies and in 2015 all 8 counties and 18 cities had policies. Through conversations with local insurance providers and floodplain managers it was determined the increase is a result of new flood mapping in some areas and increased emphasis on the National Flood Insurance Program.

Non-participation: Jurisdictions not actively participating in the NFIP have deemed it unnecessary to do so, due to the absence of identified flood prone areas within their boundaries. These include: Sonora, which only has an edge of their corporate boundary in a mapped flood plain, no structures within the floodplain and no history of loss.

- Upton, which has no flood plains in mapped section. LaRue County section has not been mapped. It has no streams and no history of loss.
- Loretto, which sits on a ridge and has no flood plain, and no history of loss.
- Ekron, Has no flood plain, no streams and no history of loss.
- Muldraugh, which sits on a ridge and has no steams, no flood plain, and no history of loss.
- Mackville, which sits on a ridge, has no flood plain, and no history of loss.
- Willisburg, which sits on a ridge, has no flood plain, and no history of loss.

The above information is illustrated in the Table 3.3.2.1.3 along with the subsequent maps included in this plan.

Table 3.3.2.1.3 - NFIP and Mapping Summary

Jurisdiction	Affected by 100/500 Year Floodplain	Flood area mapped by FEMA	Map Status Date	NFIP Participant	Total # of Active Policies as of 2004	Total # of Active Policies as of 2009	Total # of Active policies as of 6/30/2015	Total # of Active Policies as of 5/31/2021	Total Written Premium in Force 5/31/2021
Breckinridge Co.	**Yes**	**Yes**	**8/4/08**	**Yes**	**8**	**19**	**30**	**9**	**$8,971**
Cloverport	Yes	Yes		Yes	13	19	12	8	$15,796
Hardinsburg	Yes	Yes		Yes	0	0	1	1	$321
Irvington	No	Yes		Yes	3	1	1	0	
Grayson Co.	**Yes**	**Yes**	**9/19/12**	**Yes**	**2**	**14**	**15**	**19**	**$11,242**
Caneyville	Yes	Yes		Yes	1	1	3	1	$4,118
Clarkson	Yes	Yes		No	0	0	0	0	
Leitchfield	Yes	Yes		Yes	1	0	0	0	
Hardin Co.	**Yes**	**Yes**	**8/16/07**	**Yes**	**46**	**97**	**154**	**90**	**$66,776**
Elizabethtown	Yes	Yes		Yes	30	113	161	122	$142,212
Radcliff	Yes	Yes		Yes	21	29	30	13	$5,502
Sonora	Yes	Yes		No	0	0	0	0	
Upton	No	Partial		No	0	0	0	0	
Vine Grove	Yes	Yes		Yes	7	16	29	26	$24,092
West Point	Yes	Yes		Yes	176	159	145	104	$125,983
LaRue Co.	**Yes**	**Yes**	**1/16/10**	**Yes**	**12**	**13**	**13**	**14**	**$16,934**
Hodgenville	Yes	Yes		Yes	2	9	4	4	$5,350
Marion Co.	**Yes**	**Yes**	**1/6/10**	**Yes**	**6**	**10**	**19**	**25**	**$19,186**
Bradfordsville	Yes	Yes		Yes	1	2	4	4	$4,144
Lebanon	Yes	Yes		Yes	2	2	6	9	$5,365
Loretto	No	Yes		No	0	0	0	0	
Raywick	Yes	Yes		Yes	0	0	0	0	
Meade Co.	**Yes**	**Yes**	**7/18/11**	**Yes**	**8**	**12**	**20**	**21**	**$11,340**
Brandenburg	Yes	Yes		Yes	1	2	3	2	$699
Ekron	No	Yes		No	7	0	0	0	
Muldraugh	No	Yes		No	0	0	0	0	
Nelson Co.	**Yes**	**Yes**	**5/24/11**	**Yes**	**47**	**38**	**31**	**25**	**$27,123**
Bardstown	Yes	Yes		Yes	6	5	5	6	$5,747
Bloomfield	Yes	Yes		Yes	7	12	21	15	$26,783
Fairfield	No	Yes		Yes	0	0	0	0	
New Haven	Yes	Yes		Yes	21	19	25	18	
Washington Co.	**Yes**	**Yes**	**2/17/10**	**Yes**	**10**	**9**	**15**	**14**	**$11,349**
Mackville	No	Yes		No	0	0	0	0	
Springfield	Yes	Yes		Yes	7	4	9	5	$37,462
Willisburg	No	Yes		No	0	0	0	0	

Original Source: http://www.fema.gov/nfip/10110309.html
Source of 2009 Update: http://bsa.nfipstat.com/reports/1040.html & http://bsa.nfipstat.com/reports/1011.html
Source of 2015 Update: http://bsa.nfipstat.fema.gov/reports/reports.html
Source of 2021 Update: https://nfipservices.floodsmart.gov/reports-flood-insurance-data

Table 3.3.2.1.4 - Claims Summary

Jurisdction	Total # Claims 1978-2004	Total # Claims 2004-2009	Total # Claims 2010-2015	Total # Claims Since 2015	Total Claim	Total Payments	Payments Prior to 2016	Change Since 2015
Breckinridge Co.	**0**	**0**	**4**	**0**	**4**	**$131,776**	**$131,776**	**$0**
Cloverport	11	2	5	2	20	$133,279	$87,994	$45,285
Hardinsburg	0	0	0	2	2	$30,036	$0	$30,036
Irvington	2	2	0	0	4	$27,373	$27,373	$0
Grayson Co.	**0**	**0**	**2**	**0**	**2**	**$0**	**$0**	**$0**
Caneyville	1	0	0	1	2	$0	$0	$0
Clarkson	0	0	0	0	0	$0	$0	$0
Leitchfield	0	0	0	0	0	$0	$0	$0
Hardin Co.	**44**	**23**	**39**	**6**	**112**	**$1,730,681**	**$1,662,464**	**$68,217**
Elizabethtown	18	27	22	12	79	$370,001	$305,618	$64,383
Radcliff	3	7	10	1	21	$334,542	$309,225	$25,317
Sonora	0	0	0	0	0	$0	$0	$0
Upton	0	0	0	0	0	$0	$0	$0
Vine Grove	0	2	0	3	5	$28,105	$23,071	$5,034
West Point	145	2	39	36	222	$3,401,326	$2,302,270	$1,099,056
LaRue Co.	**17**	**0**	**5**	**0**	**22**	**$203,045**	**$203,045**	**$0**
Hodgenville	0	0	0	0	0	$0	$0	$0
Marion Co.	**3**	**0**	**5**	**0**	**8**	**$100,125**	**$100,125**	**$0**
Bradfordsville	0	0	1	0	1	$32,000	$32,000	$0
Lebanon	5	0	0	0	5	$14,157	$14,157	$0
Loretto	0	0	0	0	0	$0	$0	$0
Raywick	0	0	0	0	0	$0	$0	$0
Meade Co.	**0**	**3**	**3**	**2**	**8**	**$34,561**	**$30,702**	**$3,859**
Brandenburg	3	0	0	1	4	$169,035	$161,330	$7,705
Ekron	0	0	0	0	0	$0	$0	$0
Muldraugh	0	0	0	0	0	$0	$0	$0
Nelson Co.	**39**	**0**	**20**	**3**	**62**	**$1,427,188**	**$1,350,576**	**$76,612**
Bardstown	4	0	3	0	7	$90,663	$90,663	$0
Bloomfield	2	0	0	1	3	$1,883	$1,883	$0
Fairfield	0	0	0	0	0	$0	$0	$0
New Haven	15	0	11	3	29	$705,102	$472,457	$232,645
Washington Co.	**3**	**1**	**8**	**9**	**21**	**$467,554**	**$396,666**	**$70,888**
Mackville	0	0	0	0	0	$0	$0	$0
Springfield	2	0	4	0	6	$172,515	$172,515	$0
Willisburg	0	0	0	1	1	$53,994	$0	$53,994

Original Source: http://www.fema.gov/nfip/10110309.html
Source of 2009 Update: http://bsa.nfipstat.com/reports/1040.html & http://bsa.nfipstat.com/reports/1011.html
Source of 2015 Update: http://bsa.nfipstat.fema.gov/reports/reports.html
Source of 2020 Update: Policy and Loss Data by Geography (HUDEX)

III. Analysis

To identify flooding as a threat to the Lincoln Trail Region, the types of floods and their causes were analyzed; areas of vulnerability were determined; historical data was researched; and maps were created to identify the vulnerable areas. The Sources for this information include FEMA, the National Center for Environmental Information (NCEI), the Kentucky Climatic Data Center, the National Weather Service (NWS), the National Flood Insurance Program, and the Atlas of Kentucky.

One date that will stand out in the history of the Lincoln Trail Region, is March 1997. Ninety-two counties in Kentucky and 14 counties in southern Indiana were declared disaster areas. Tens of thousands of people were evacuated from their homes, with total damage across the region estimated at $400,000,000. In the small city of West Point in Hardin County, it was estimated that 85% of the city was under water leaving residents devastated and property destroyed.

The following tables outline the history of flooding events that have been recorded in each county/jurisdiction within the Lincoln Trail region since 1967. The impact, of these flooding events, is documented by the number of lives lost, individual injuries reported, and the estimated cost of property and crop damage. This information was reported to the Spatial Hazard Events and Losses Databases for the United States (SHELDUS) and later the National Climate Data Center (NCDC) and was subsequently rolled into the National Centers for Environmental Information (NCEI) database. For the original, plan data was only available through 2003. The 2010 update provided data thru 30 June 2009. The 2015 update included events for the period 1 July 2009 through 30 June 2015. This update includes events from 1 July 2015 to May of 2021. The summary tables, 3.3.2.1.5 & 3.3.2.1.6 show data for the entire period covered by the various sources. Note that there are many variations in recording the locations of the events over time. In the past this was typically done at a county level. More recently, nearest place names have been used. Because of this, the records in the summation tables that pertain to individual incorporated areas should not be considered all encompassing.

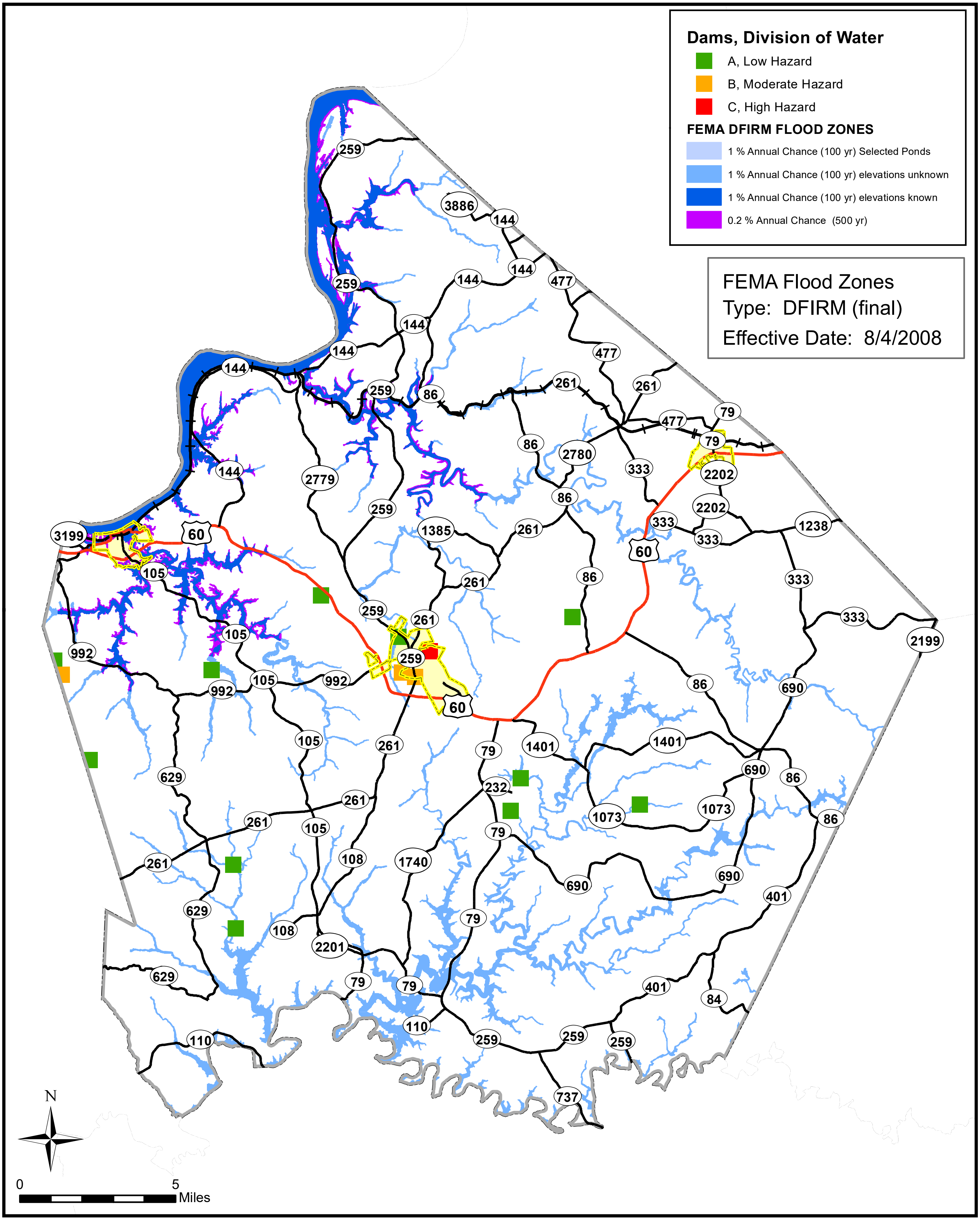
Table 3.3.2.1.5 - County Specific Data – Flooding, *Source: NCEI*

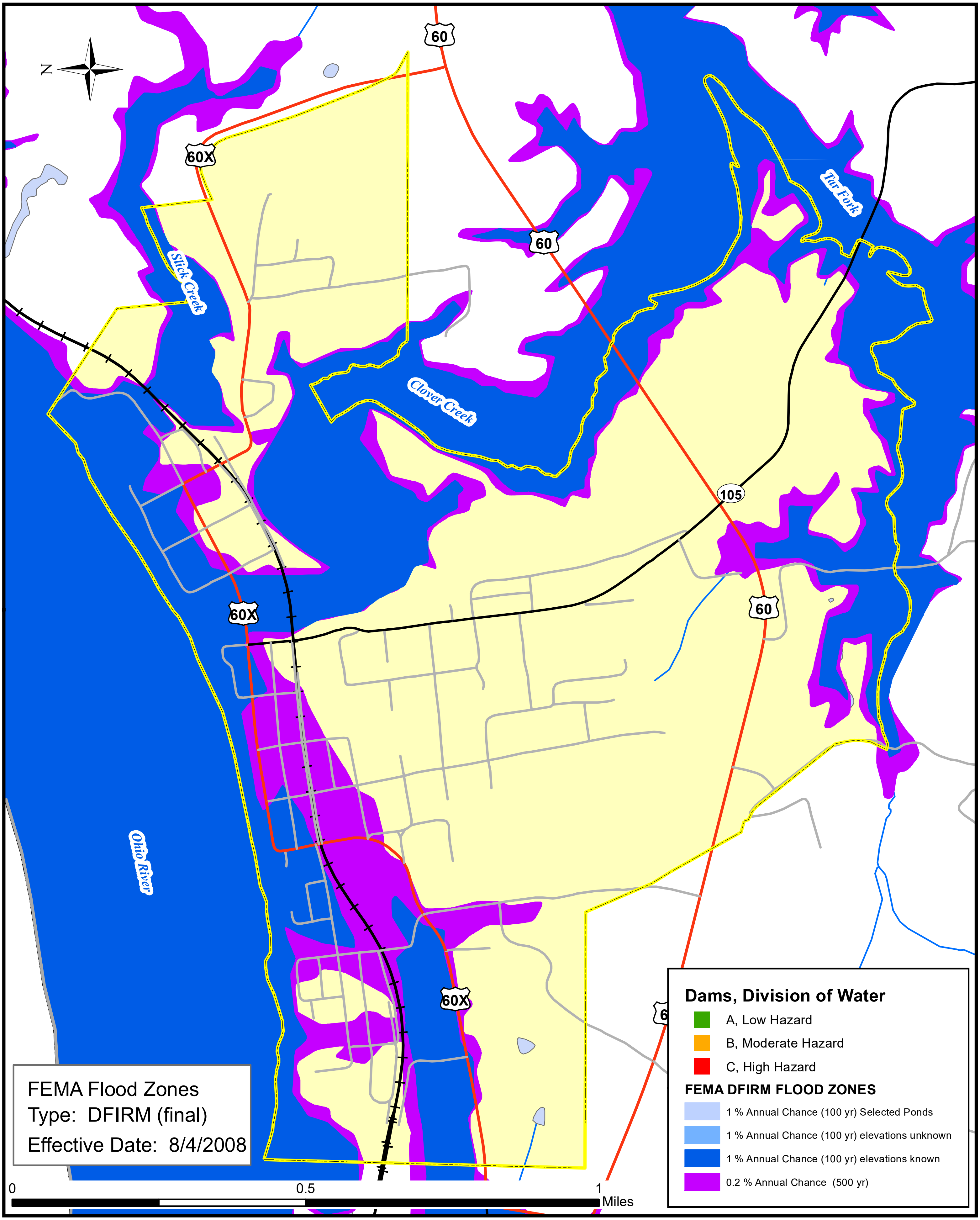
BRECKINRIDGE
60 Flood/Flash Flood event(s) were recorded between 1967 and 5/15/2021 by SHELDUS and the NCDC.

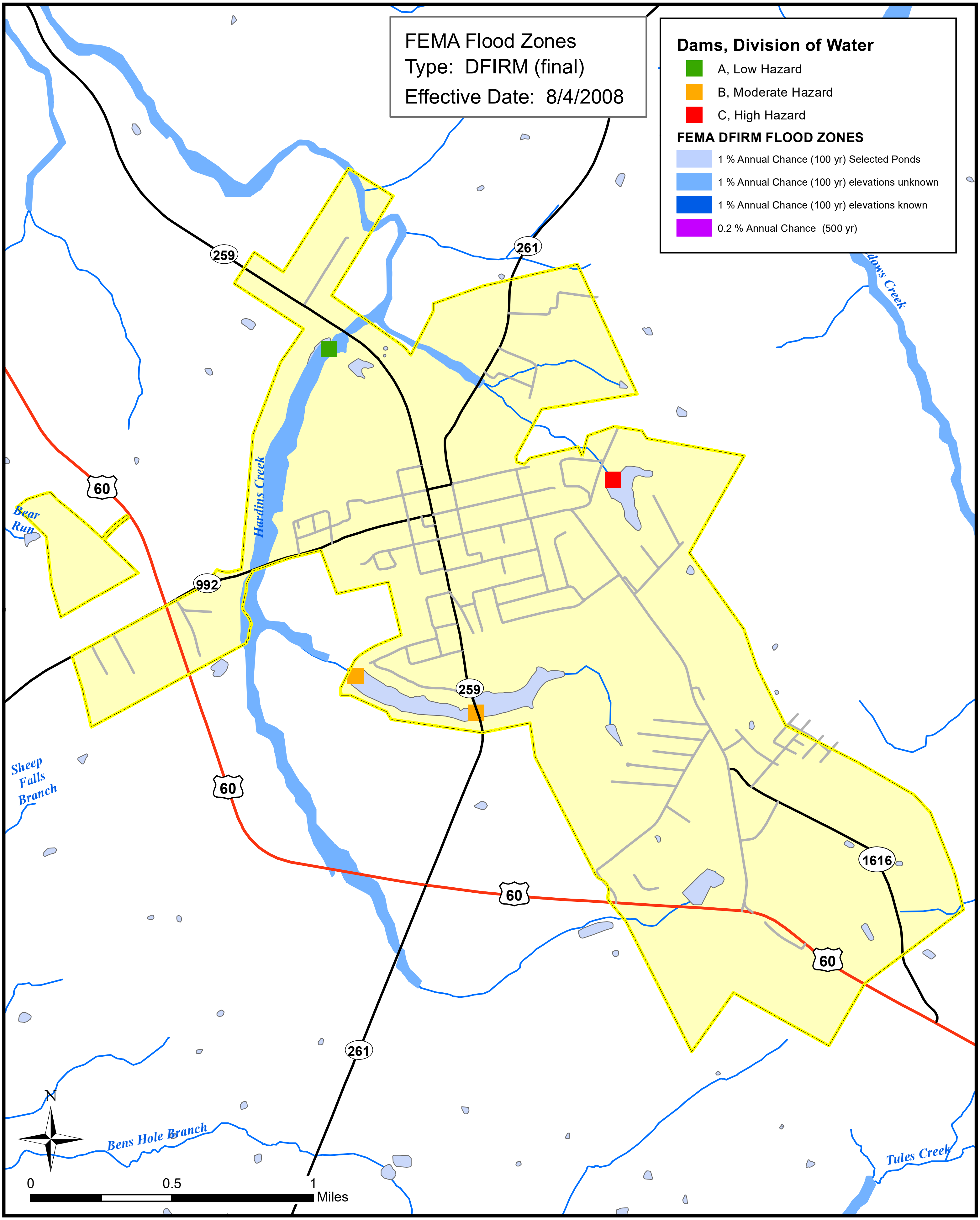
There have been 7 Flood/Flash Flood events recorded from 7/1/2015 through 5/15/2021 in NCEI.

LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE ($)	CROP DAMAGE ($)
HARDINSBURG ARPT	7/3/15	0	0	0	0
BRECKINRIDGE CO.	2/23/18	0	0	0	0
BRECKINRIDGE CO.	2/23/18	0	0	0	0
CLOVERPORT	2/23/18	0	0	0	0
HARDINSBURG ARPT	2/25/18	0	0	0	0
BRECKINRIDGE CO.	11/1/18	0	0	0	0
BRECKINRIDGE CO.	11/30/19	0	0	10000	0

BRECKINRIDGE COUNTY
FLOODING




N
60
60X
60
Slick Creek
Tar Fork
Clover Creek
105
60X
60
Ohio River
60X
FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 8/4/2008
0
0.5
1
Miles
Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)


FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 8/4/2008
Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
259
261
60
992
1616
Hardins Creek
Bear Run
Sheep Falls Branch
Bens Hole Branch
Tules Creek
N
0
0.5
1
Miles

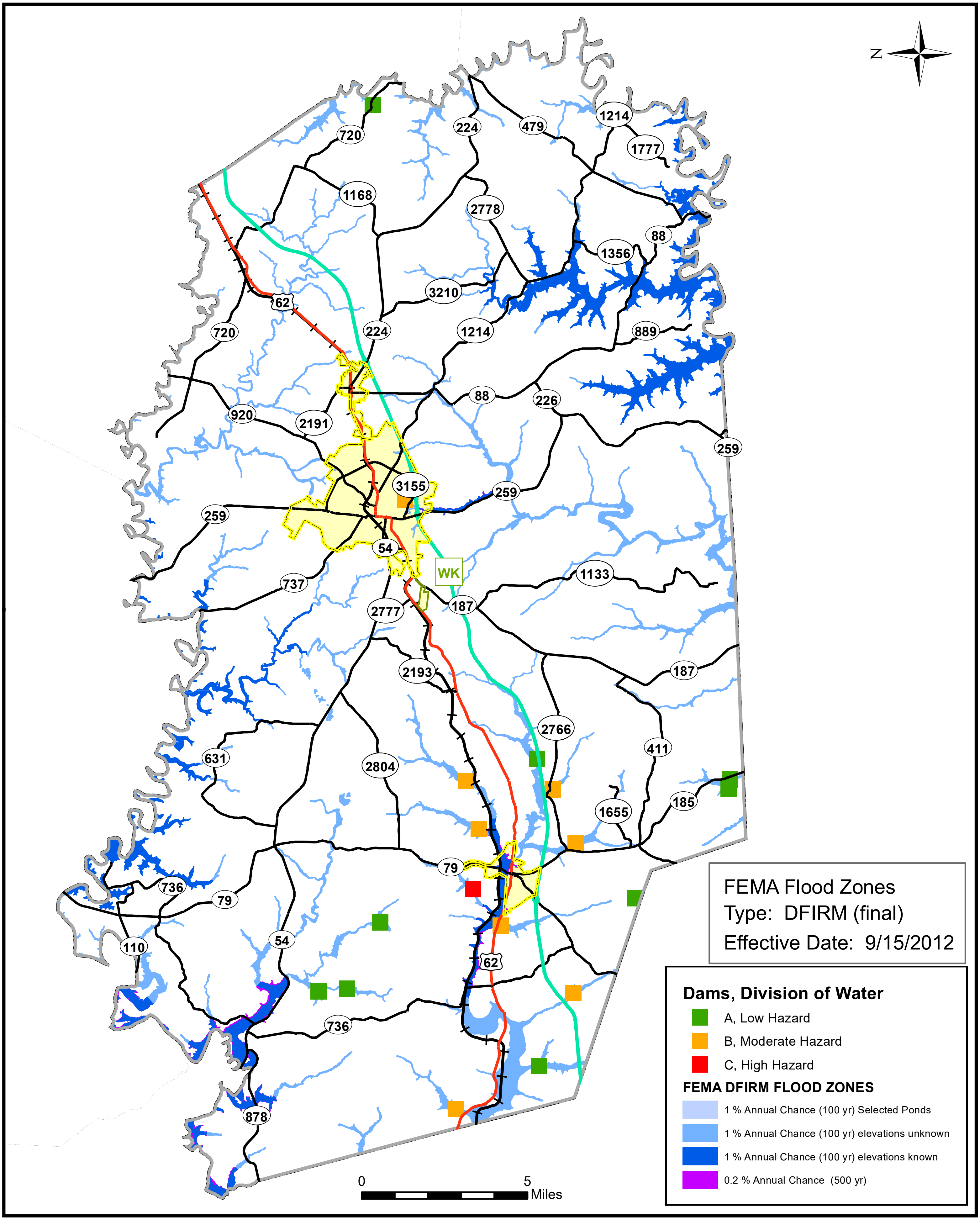
GRAYSON

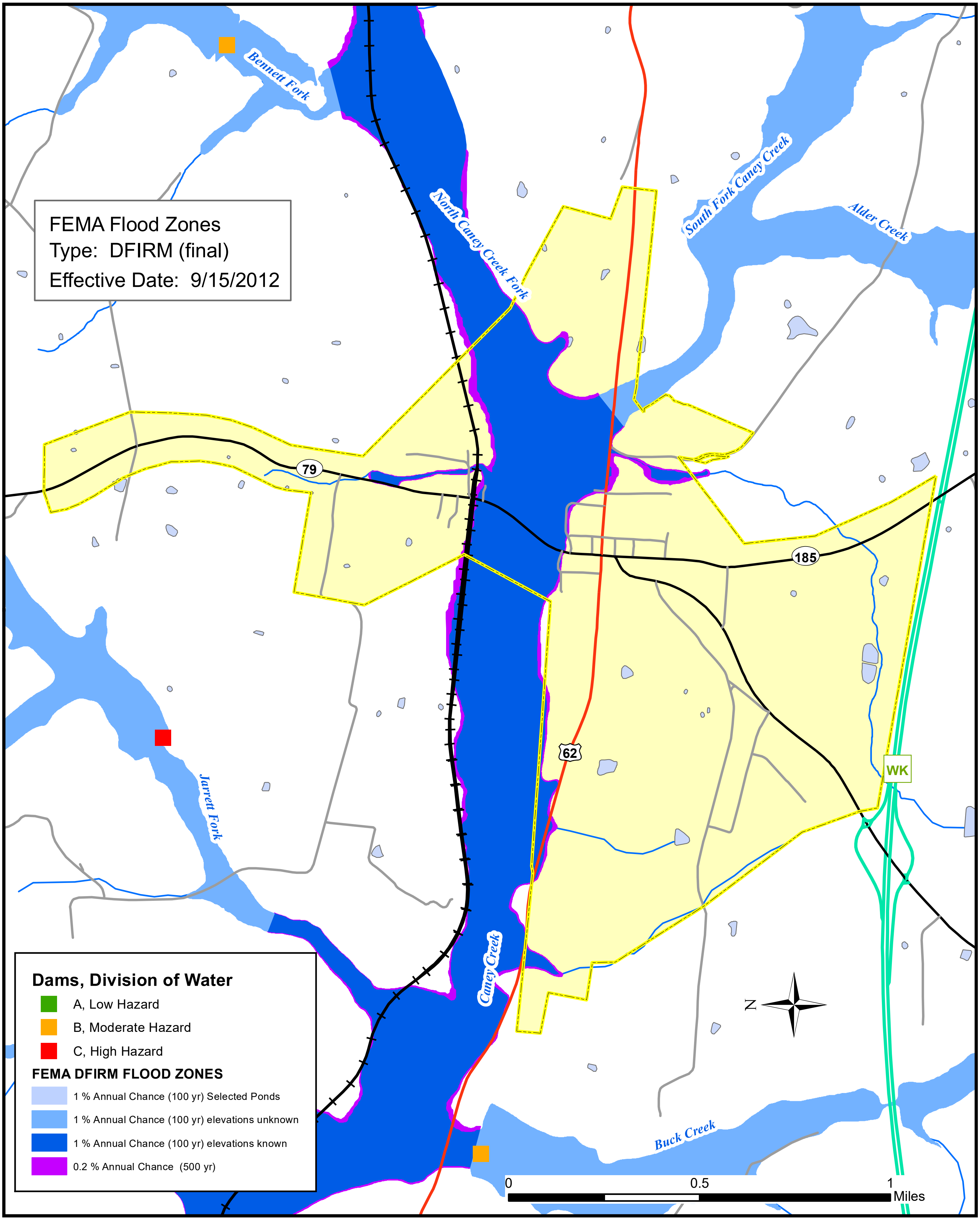
56 Flood/Flash Flood event(s) were recorded between 1967 and 5/15/2021 by SHELDUS and the NCDC.

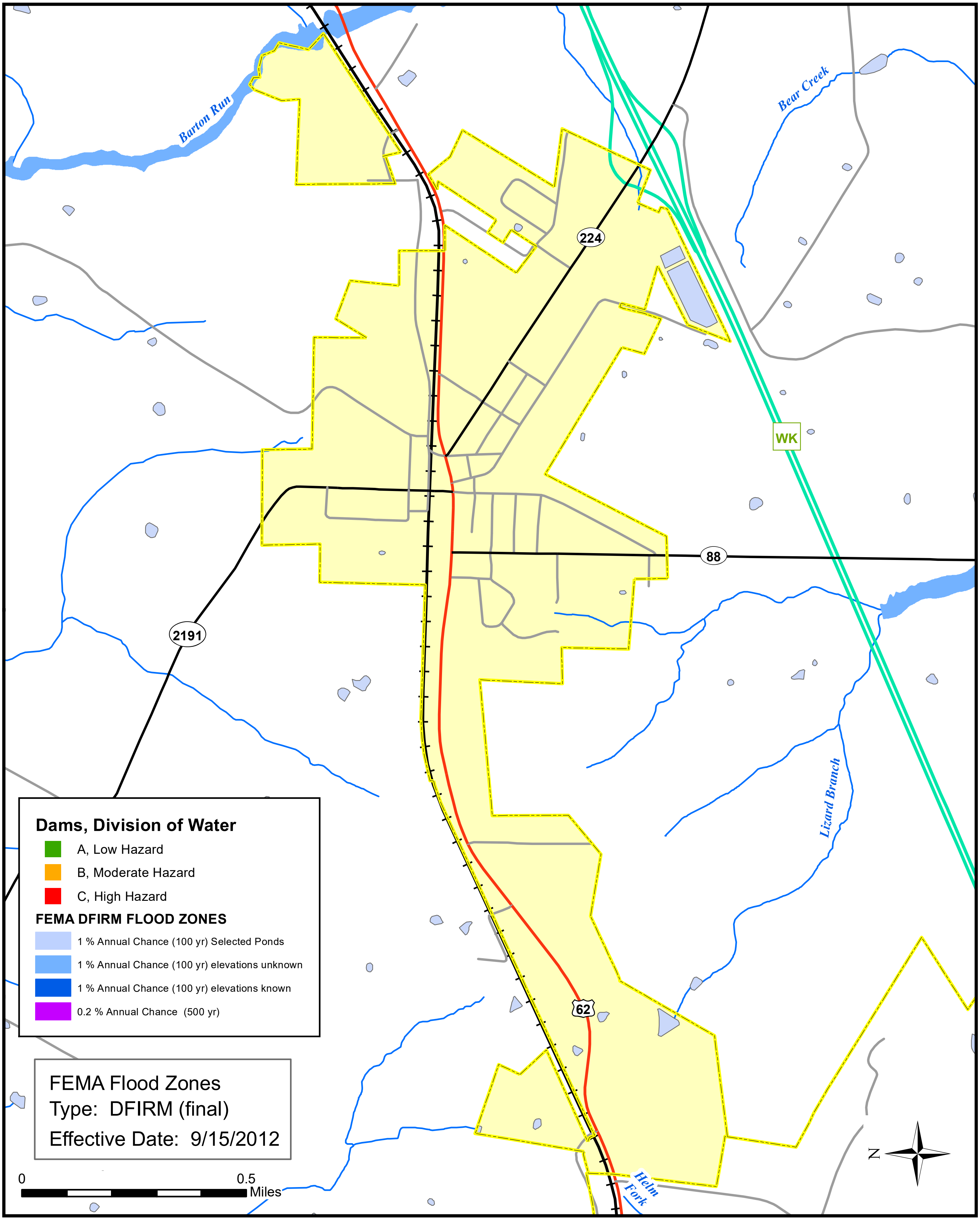
There have been 10 Flood/Flash Flood events recorded from 7/1/2015 through 5/15/2021 in NCEI.

LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE ($)	CROP DAMAGE ($)
CLARKSON	4/27/16	0	0	0	0
CANEYVILLE	2/22/18	0	0	250000	0
GRAYSON CO.	2/23/19	0	0	0	0
GRAYSON CO.	11/30/19	0	0	10000	0
CLARKSON	3/28/20	0	0	0	0
GRAYSON CO.	6/28/20	0	0	0	0
GRAYSON CO.	6/28/20	0	0	30000	0
GRAYSON CO.	6/28/20	0	0	15000	0
GRAYSON CO.	6/28/20	0	0	0	0
CLARKSON	7/5/20	0	0	0	0

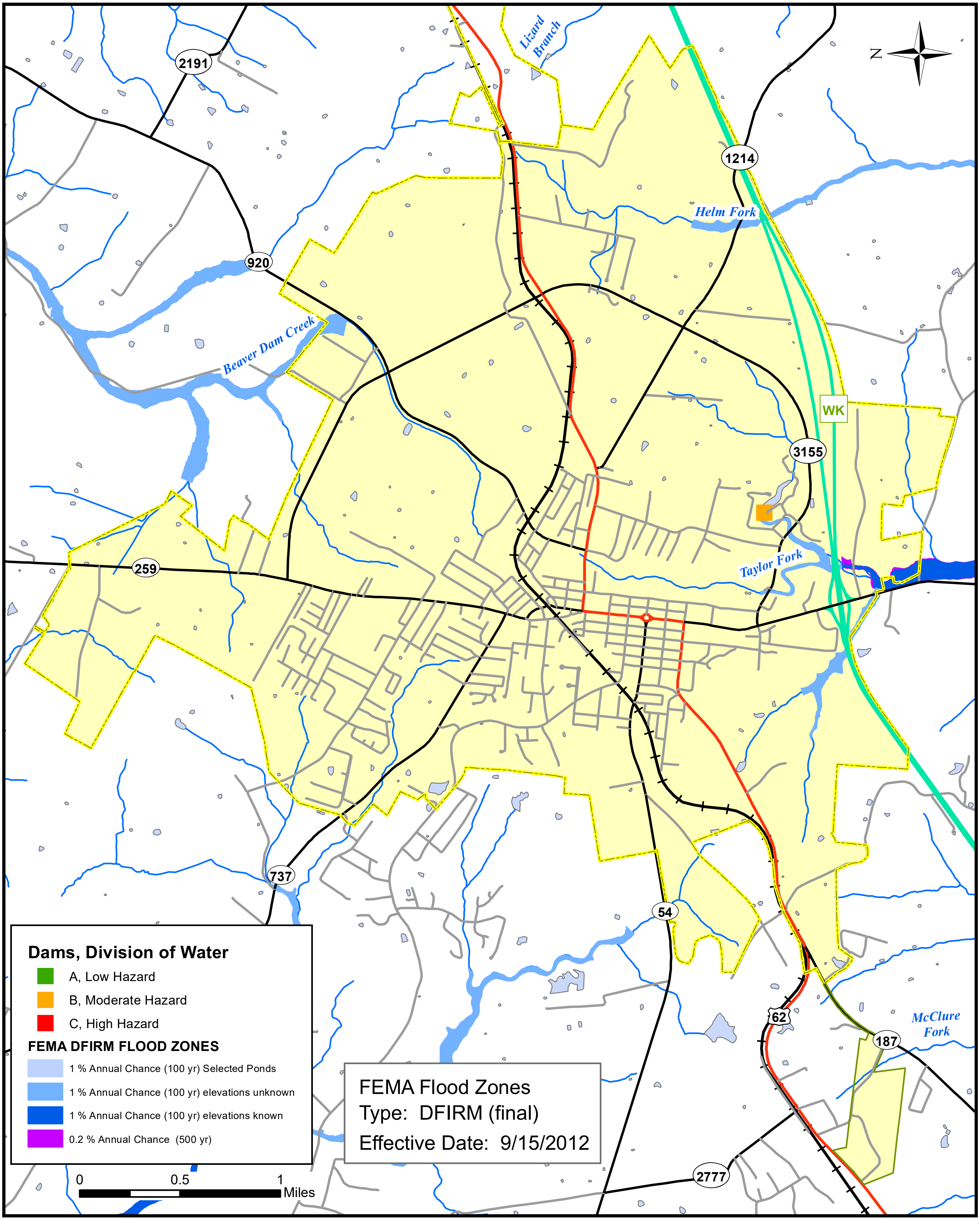
Road Washout in Grayson County, May 8, 2009, and a flooded cornfield, Grayson County June 2009. *LTADD Archives.*


FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 9/15/2012
Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
0
5
Miles
N
WK
720
224
479
1214
1777
1168
2778
88
1356
3210
62
720
224
1214
889
88
226
920
2191
259
3155
259
259
54
737
1133
2777
187
2193
187
2766
411
631
2804
1655
185
79
736
79
110
54
62
736
878


FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 9/15/2012
Bennett Fork
North Caney Creek Fork
South Fork Caney Creek
Alder Creek
79
185
62
WK
Jarrett Fork
Caney Creek
Buck Creek
N
0
0.5
1
Miles
Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)


Barton Run
Bear Creek
Lizard Branch
Helm Fork
224
88
2191
62
WK
Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 9/15/2012
0
0.5
Miles
N

LEITCHFIELD FLOODING



HARDIN

88 Flood/Flash Flood event(s) were recorded between 1967 and 5/15/2021 by SHELDUS and the NCDC.

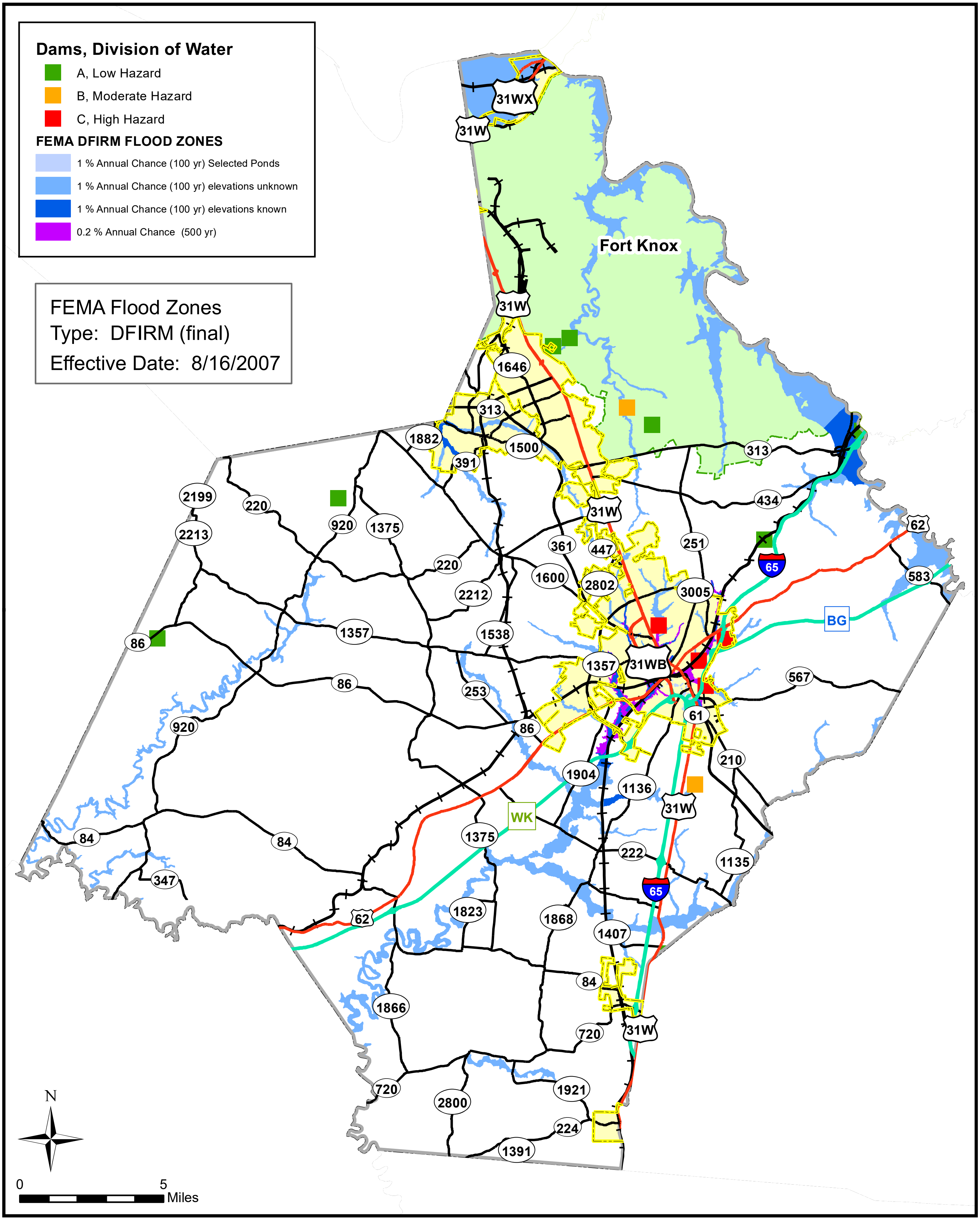
There have been 19 Flood/Flash Flood events recorded from 7/1/2015 through 5/15/2021 in NCEI.

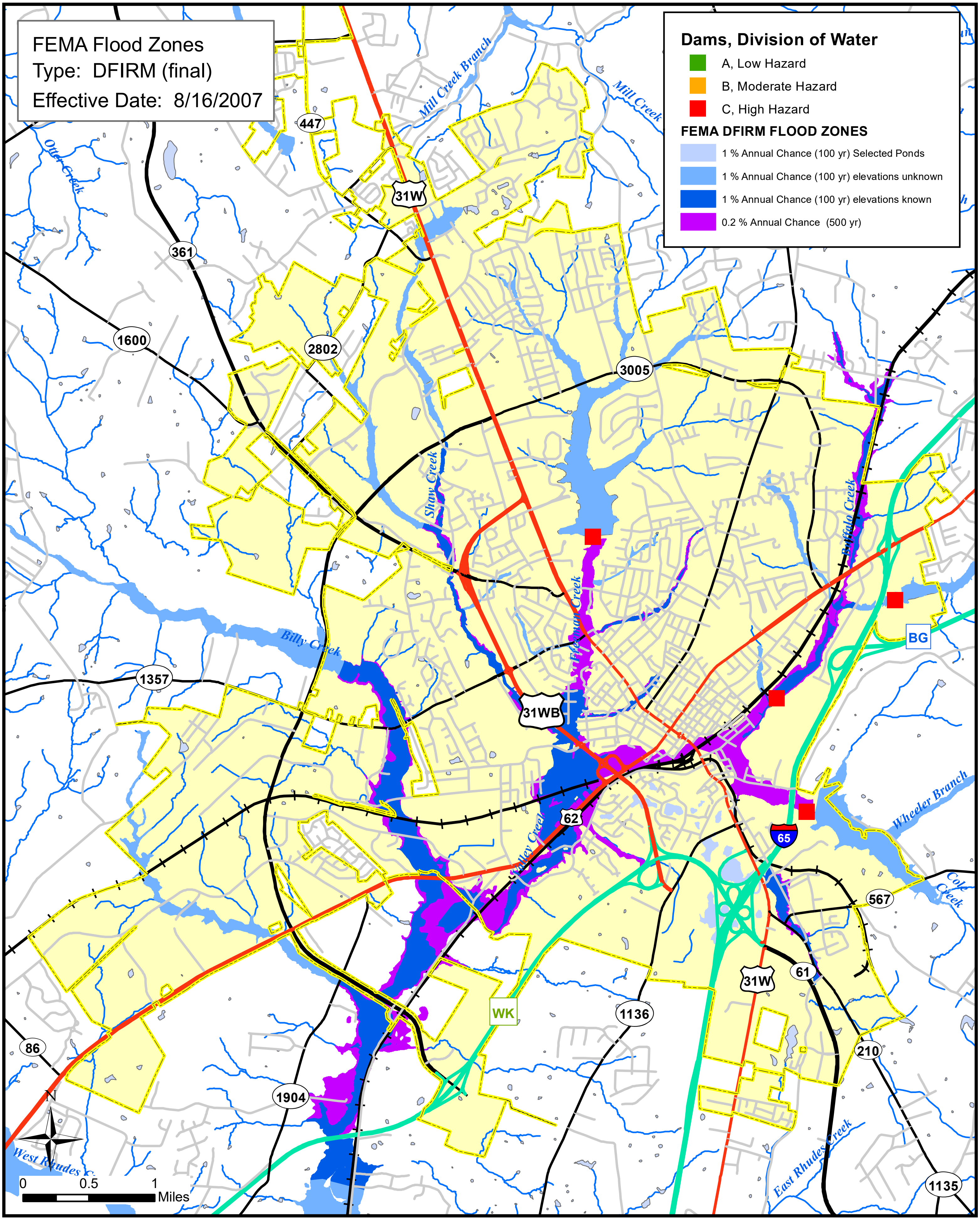
LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE ($)	CROP DAMAGE ($)
ELIZABETH TOWN	5/10/16	0	0	0	0
ELIZABETH TOWN ARPT	7/22/16	0	0	0	0
HARDIN CO.	6/23/17	0	0	0	0
HARDIN CO.	6/23/17	0	0	0	0
HARDIN CO.	6/23/17	0	0	0	0
HARDIN CO.	6/23/17	0	0	0	0
WEST POINT	2/22/18	0	0	1250000	0
HARDIN CO.	2/24/18	0	0	0	0
HARDIN CO.	2/25/18	0	0	0	0
ELIZABETH TOWN	6/25/18	0	0	0	0
HARDIN CO.	6/25/18	0	0	0	0
HARDIN CO.	6/26/18	0	0	0	0
VINE GROVE	11/30/19	0	0	0	0
ELIZABETH TOWN ARPT	11/30/19	0	0	0	0
HARDIN CO.	11/30/19	0	0	0	0
HARDIN CO.	11/30/19	0	0	15000	0
HARDIN CO.	3/12/20	0	0	3000	0
ELIZABETH TOWN ARPT	7/20/20	0	0	100000	0
HARDIN CO.	8/14/20	0	0	0	0

Flood damage in Vine Grove parks, Spring 2008. *Photos courtesy of City of Vine Grove.*

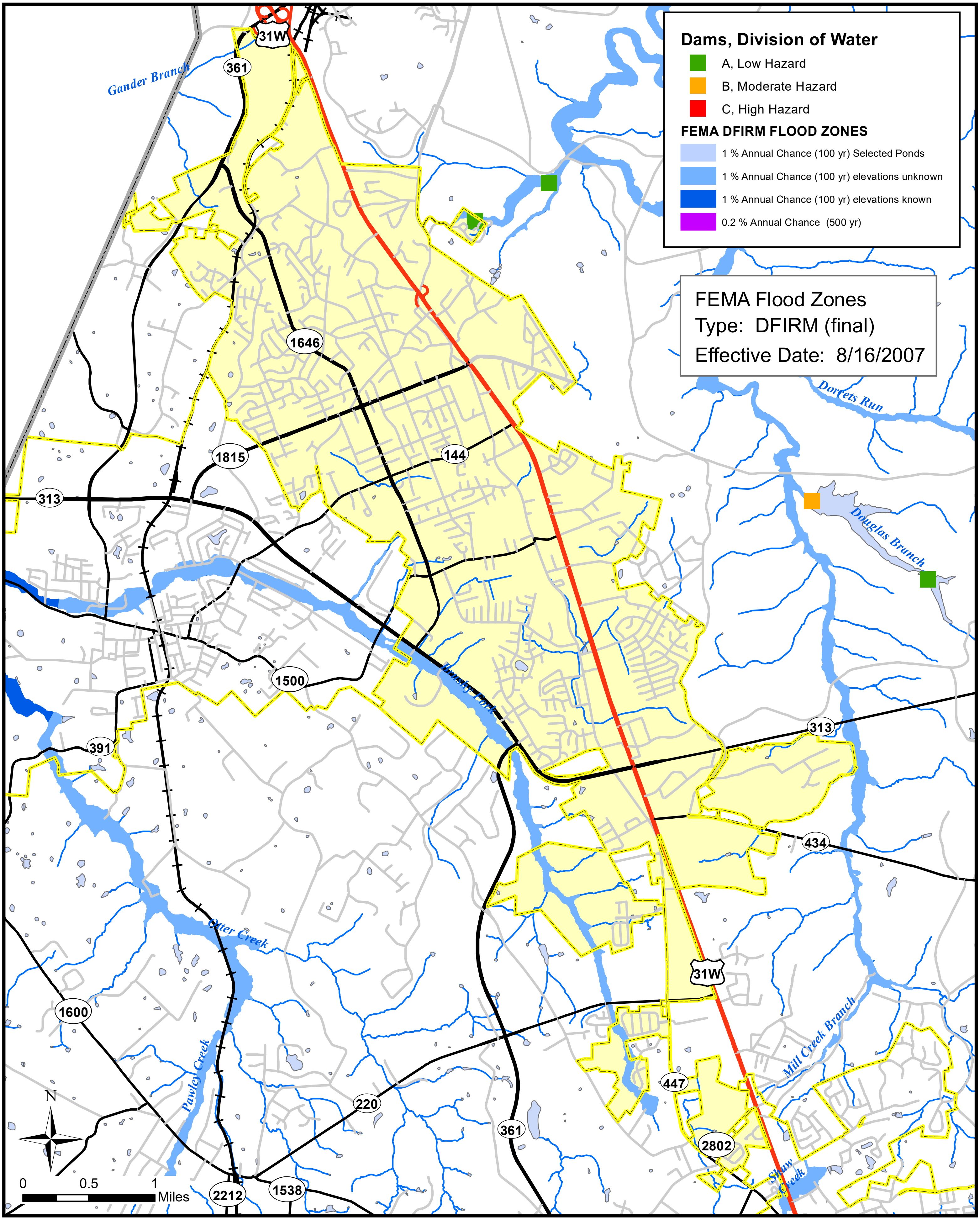
2011 Flooding in Vine Grove - Zoom of previous photo. *Photo courtesy of the City of Vine Grove*

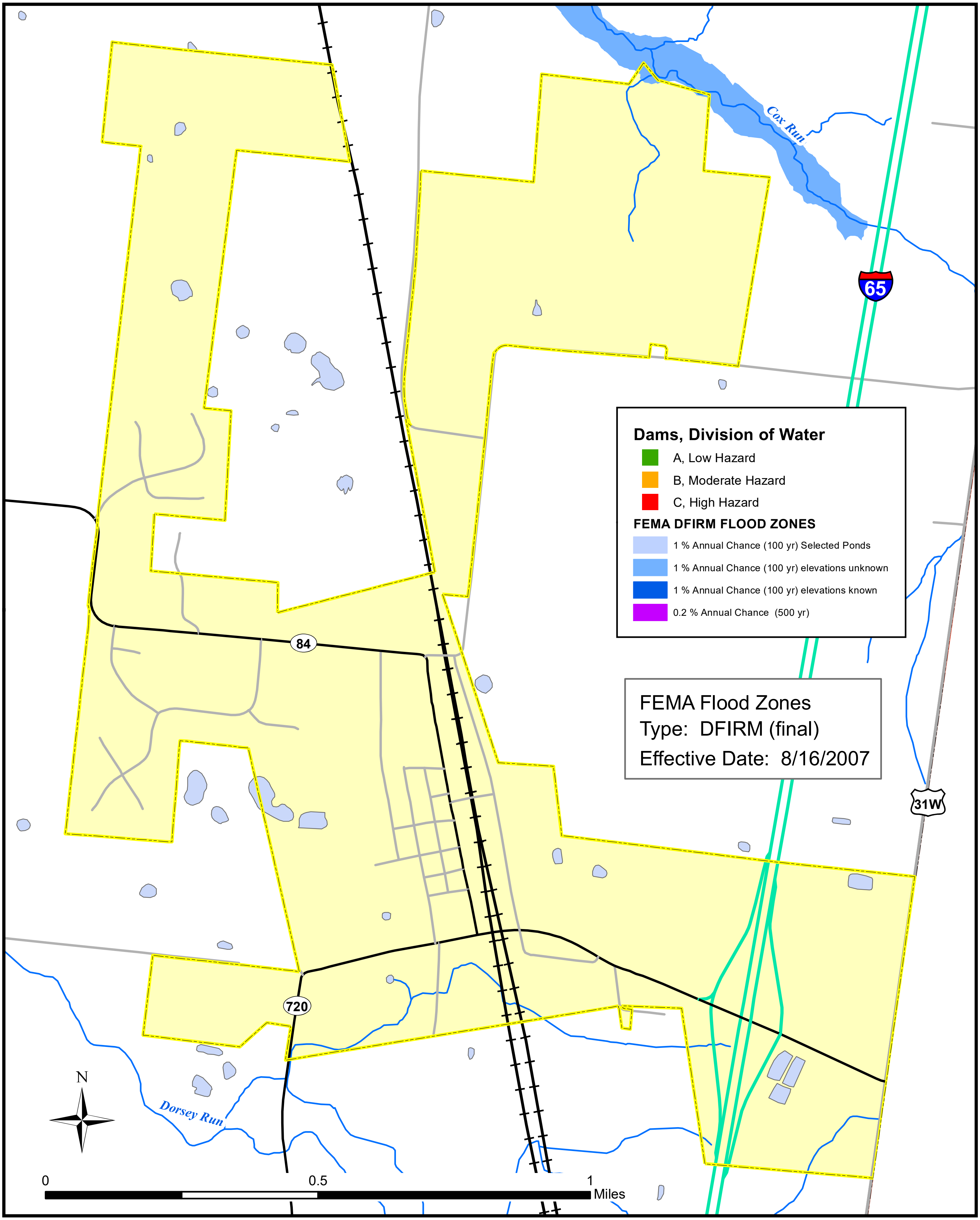
Flooded homes in West Point in March 2021. *Source: The News Enterprise*

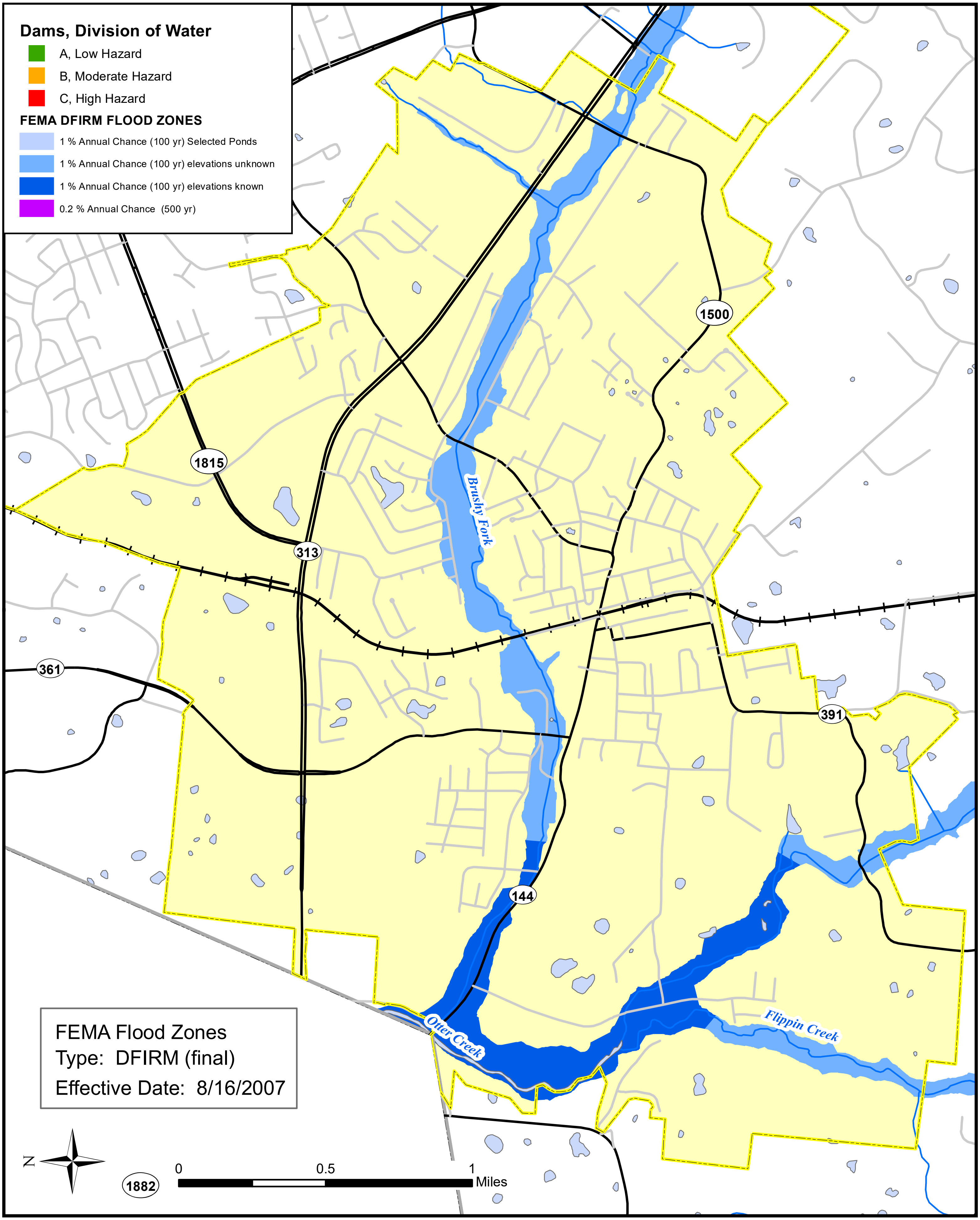

Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 8/16/2007
Fort Knox
31WX
31W
1646
313
1882
1500
391
434
2199
220
920
1375
2213
361
447
251
62
65
583
1600
2802
3005
2212
BG
86
1357
1538
31WB
567
253
61
210
1904
1136
WK
84
1375
222
1135
347
62
1823
1868
1407
1866
720
2800
1921
224
1391
N
0
5
Miles

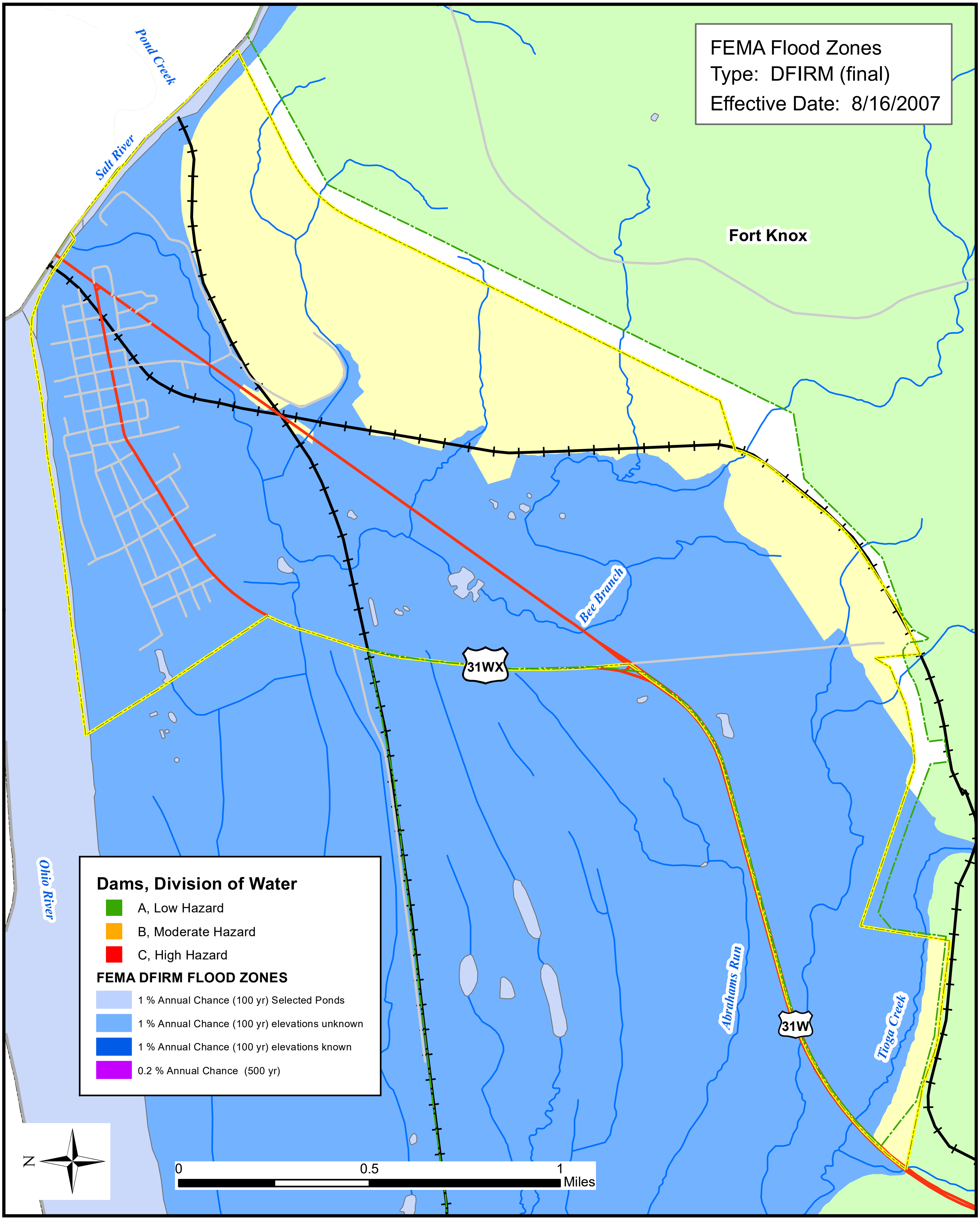

FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 8/16/2007
Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
Mill Creek Branch
Mill Creek
Otter Creek
Shaw Creek
Billy Creek
Buffalo Creek
Wheeler Branch
Cole Creek
East Rhudes Creek
West Rhudes Creek
447
31W
361
1600
2802
3005
1357
31WB
62
65
567
61
1136
210
86
1904
1135
BG
WK
N
0
0.5
1
Miles

RADCLIFF
FLOODING




Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 8/16/2007
Cox Run
Dorsey Run
65
31W
84
720
N
0
0.5
1
Miles


Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
Brushy Fork
Otter Creek
Flippin Creek
1500
1815
313
361
391
144
1882
FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 8/16/2007
N
0
0.5
1
Miles


FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 8/16/2007
Fort Knox
Pond Creek
Salt River
Bee Branch
31WX
Ohio River
Abrahams Run
31W
Tioga Creek
Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
N
0
0.5
1
Miles

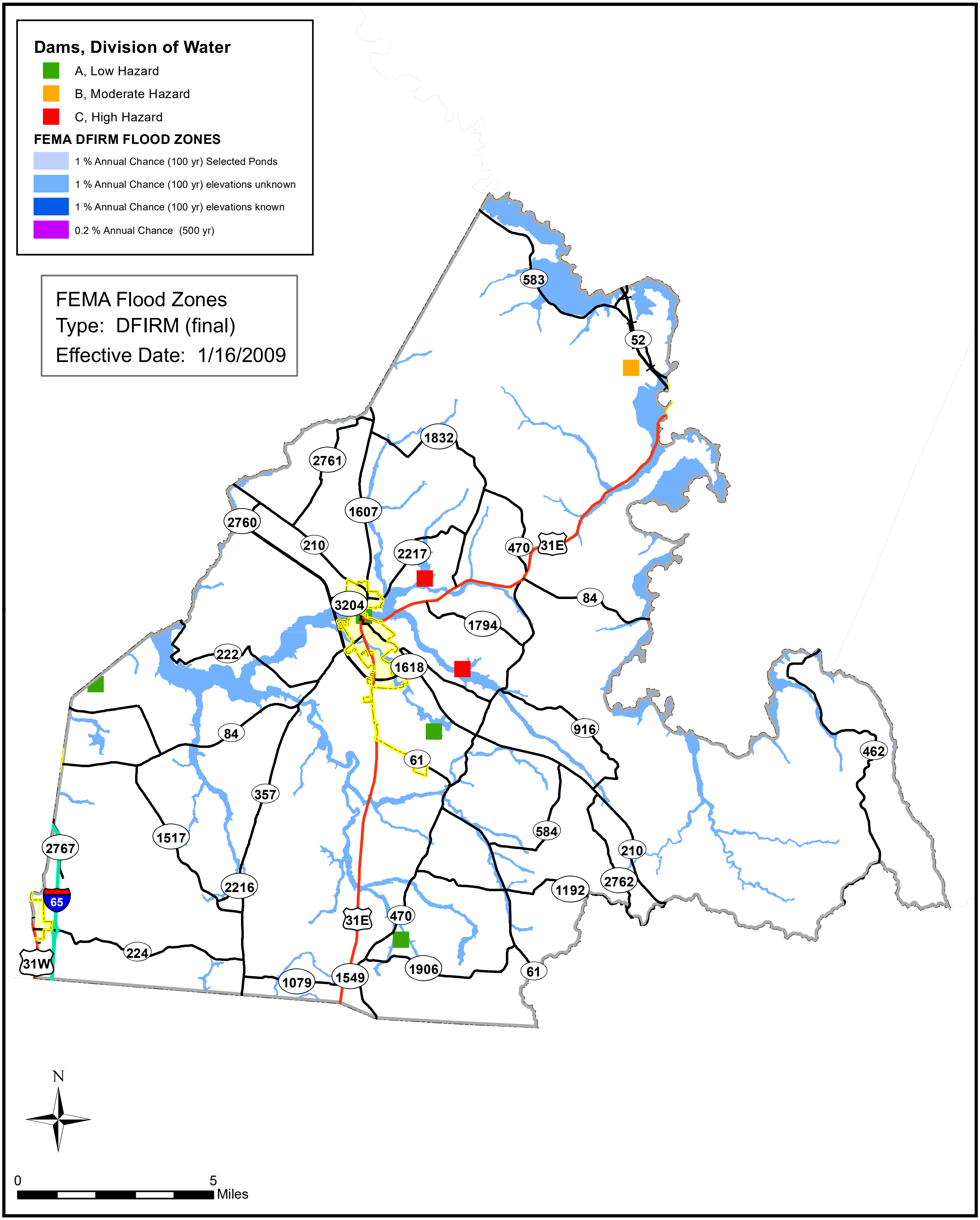
LARUE
47 Flood/Flash Flood event(s) were recorded between 1967 and 5/15/2021 by SHELDUS and the NCDC.

There have been 10 Flood/Flash Flood events recorded from 7/1/2015 through 5/15/2021 in NCEI.

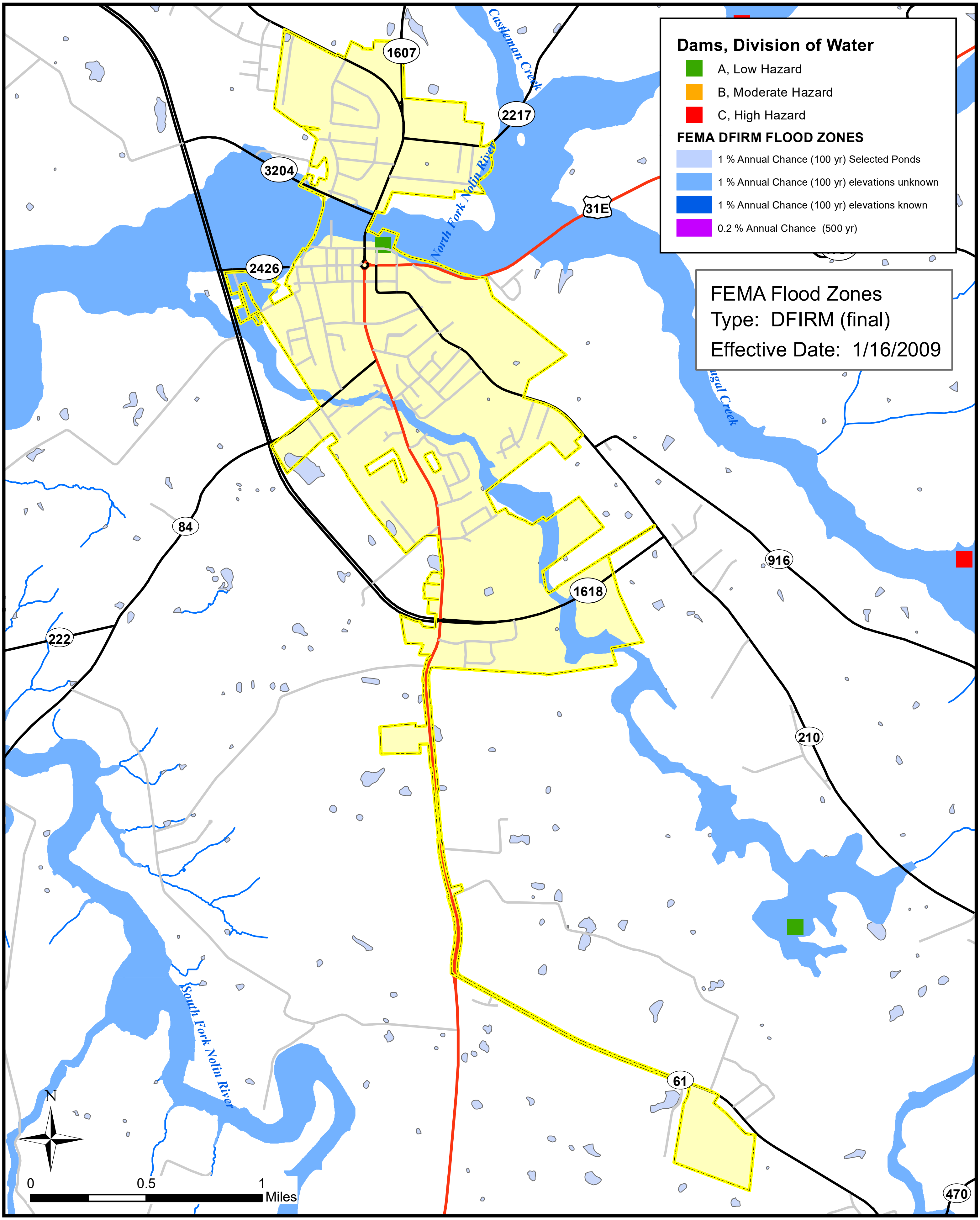
LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE ($)	CROP DAMAGE ($)
HODGENVILLE	7/3/15	0	0	0	0
HODGENVILLE	7/3/15	0	0	0	0
LARUE CO.	8/5/15	0	0	0	0
LARUE CO.	2/23/19	0	0	0	0
LARUE CO.	2/24/19	0	0	0	0
LARUE CO.	7/5/20	0	0	0	0
LARUE CO.	7/17/20	0	0	0	0
LARUE CO.	7/17/20	0	0	0	0
LARUE CO.	7/17/20	0	0	0	0
LARUE CO.	7/17/20	0	0	0	0

Flooding in Hodgenville. *Photo courtesy of City of Hodgenville.*


Flooded Park in Hodgenville in 2018. *Source: Herald News*


Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 1/16/2009
583
52
1832
2761
1607
2760
210
2217
470
31E
84
3204
1794
222
1618
916
84
61
462
357
584
1517
2767
210
2216
1192
2762
65
31E
470
224
31W
1906
61
1079
1549
N
0
5
Miles

HODGENVILLE
FLOODING



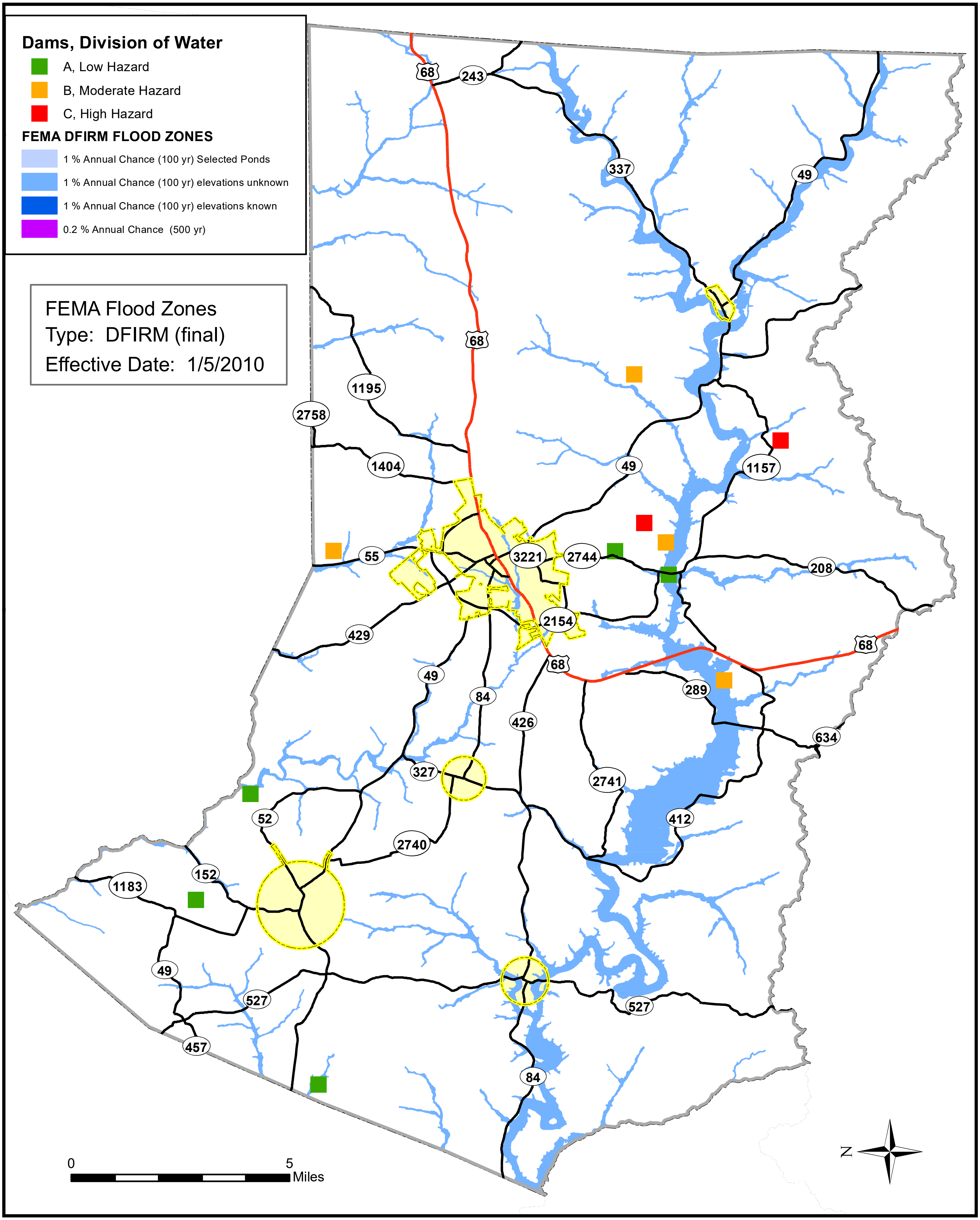
MARION
58 Flood/Flash Flood event(s) were recorded between 1967 and 5/15/2021 by SHELDUS and the NCDC.

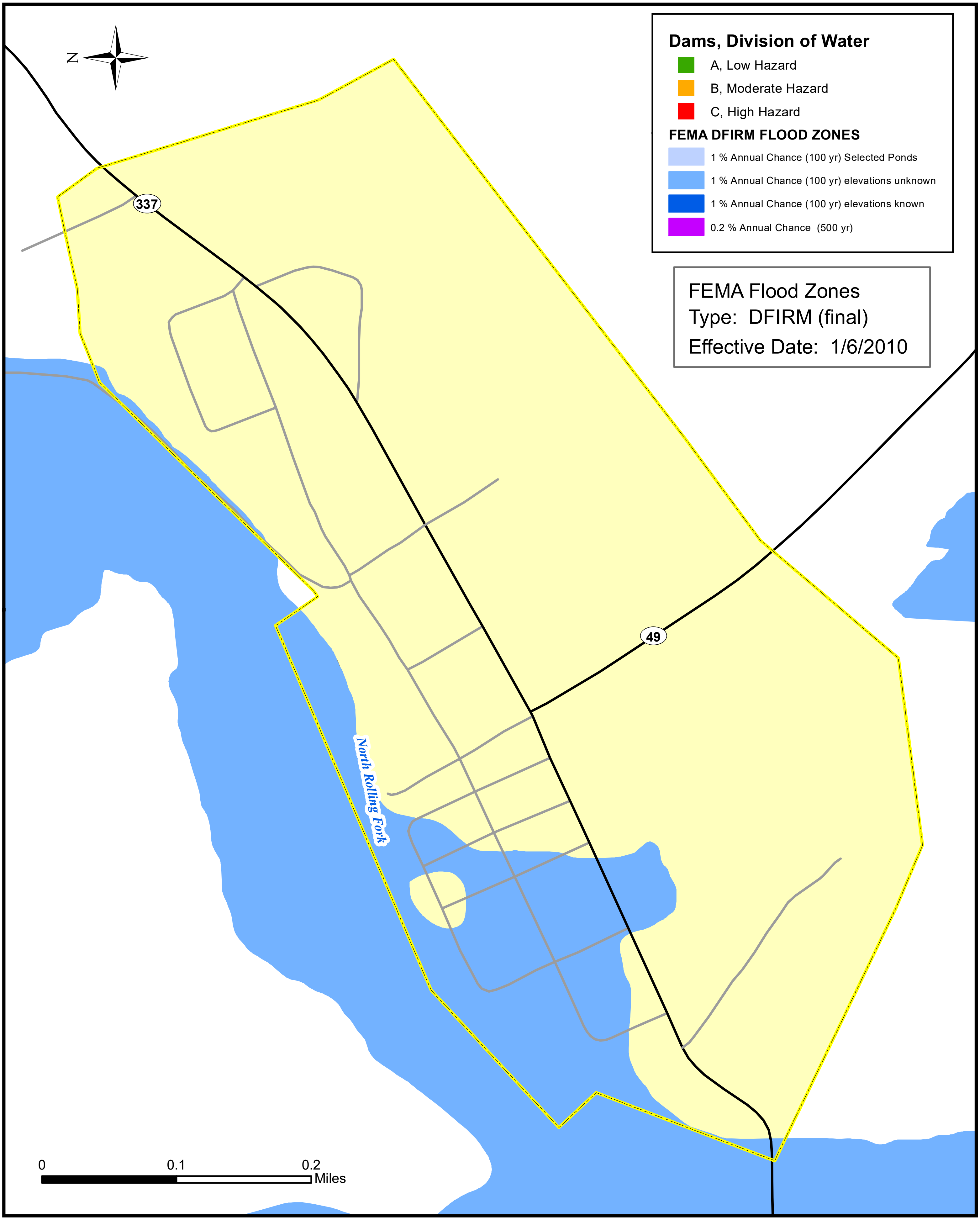
There have been 14 Flood/Flash Flood events recorded from 7/1/2015 through 5/15/2021 in NCEI.

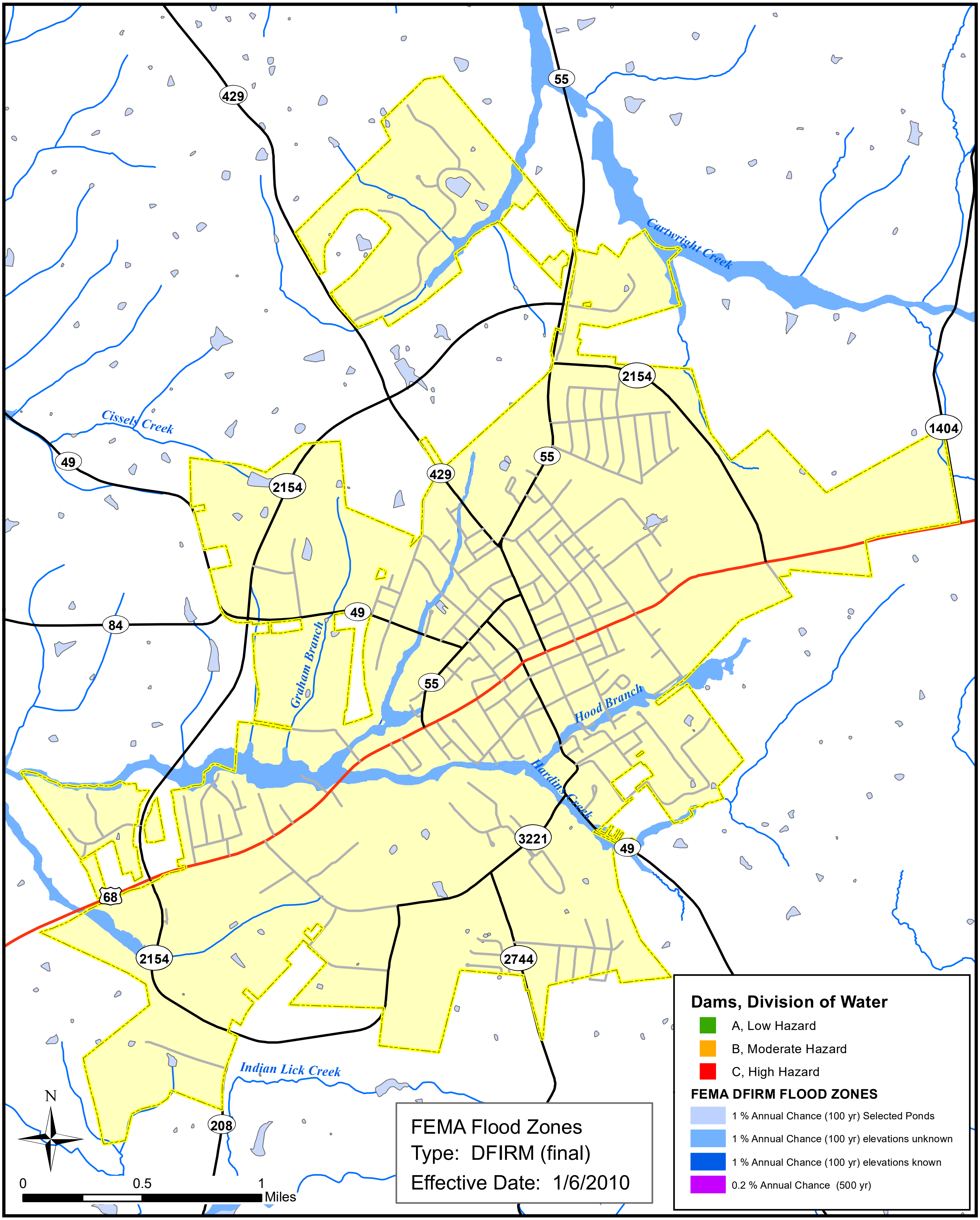
LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE ($)	CROP DAMAGE ($)
MARION CO.	7/19/15	0	0	0	0
BRADFORDSVILLE	12/25/15	0	0	0	0
MARION CO.	5/31/18	0	0	0	0
LEBANON	5/31/18	0	0	0	0
LEBANON	5/31/18	0	0	0	0
LEBANON	5/31/18	0	0	0	0
MARION CO.	6/26/18	0	0	0	0
MARION CO.	6/26/18	0	0	0	0
MARION CO.	6/26/18	0	0	0	0
MARION CO.	11/30/19	0	0	0	0
BRADFORDSVILLE	6/29/20	0	0	0	0
BRADFORDSVILLE	6/29/20	0	0	0	0
MARION CO.	6/29/20	0	0	50000	0
MARION CO.	6/29/20	0	0	10000	0

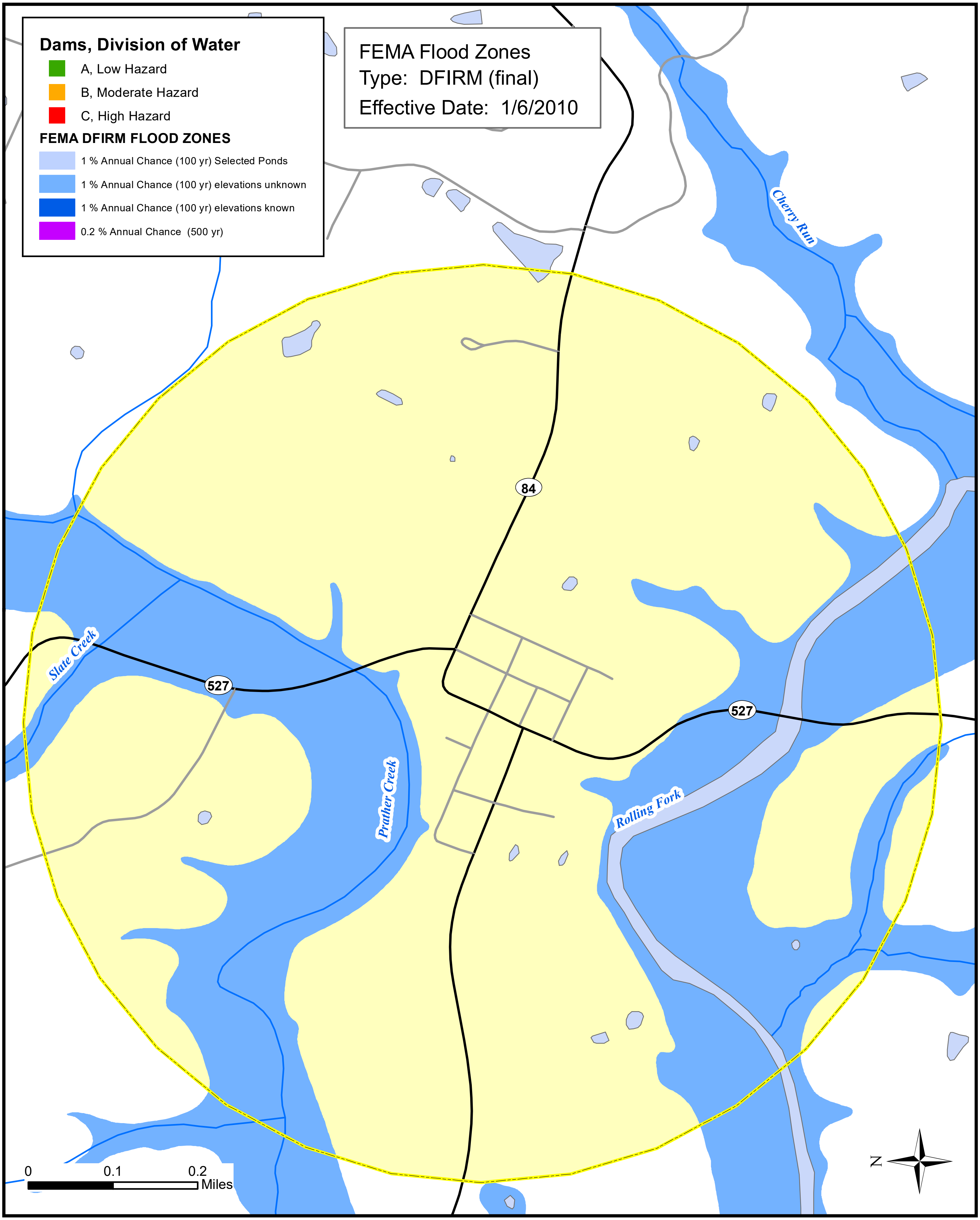
Bradfordsville, North Rolling Fork Flooding, March 2015, *Photo: David Edelen.*


Drone photograph of flooded fields in Marion County in March 2021. *Source: The Lebanon Enterprise.*


Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 1/5/2010
68
243
337
49
1195
2758
1404
1157
55
3221
2744
208
429
2154
68
49
84
289
426
634
327
2741
412
52
2740
152
1183
49
527
527
457
84
0
5
Miles
N


Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 1/6/2010
N
337
49
North Rolling Fork
0
0.1
0.2
Miles

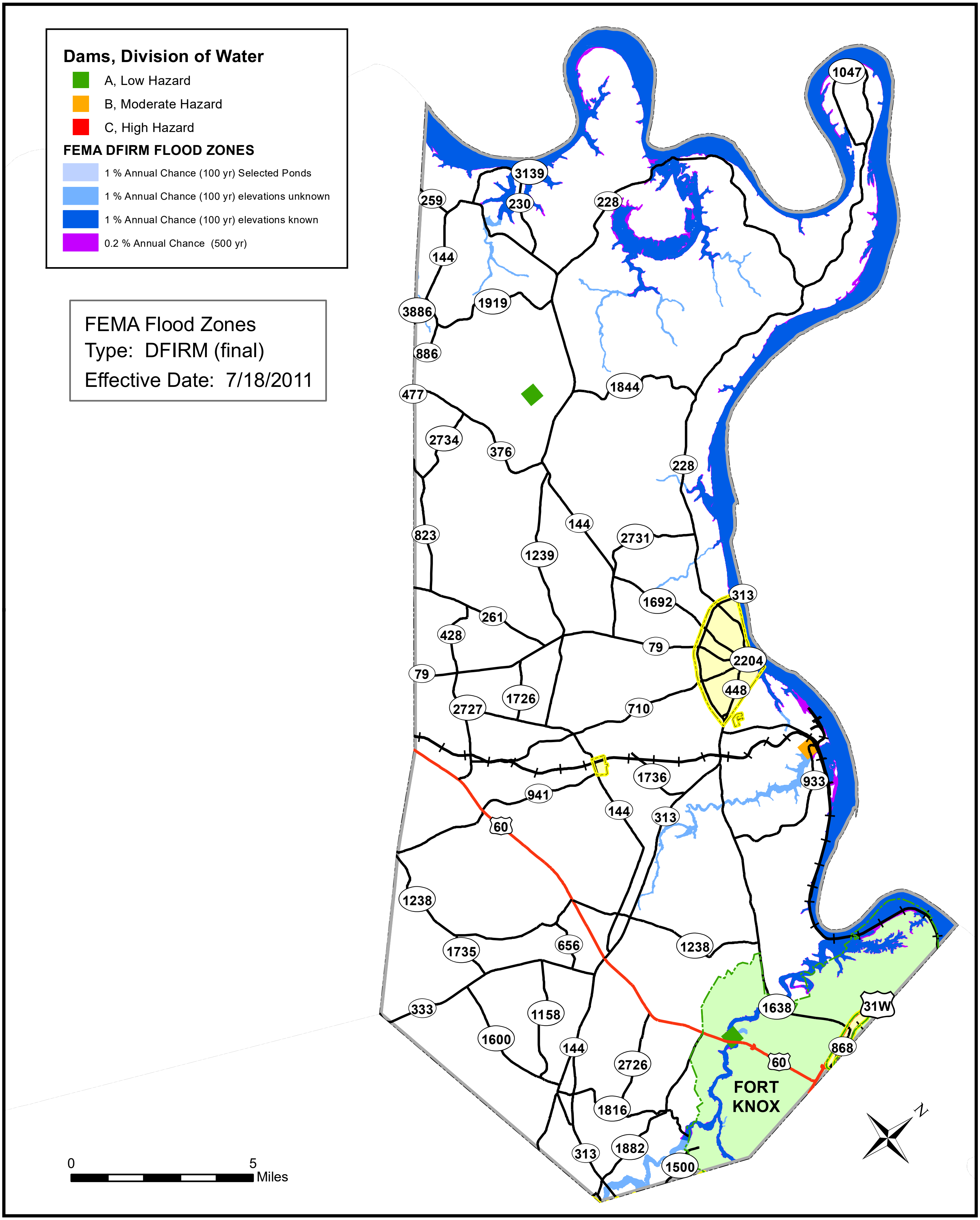

Cartwright Creek
Cissels Creek
Graham Branch
Hood Branch
Hardins Creek
Indian Lick Creek
429
55
2154
1404
49
84
68
3221
2744
208
N
0
0.5
1
Miles
FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 1/6/2010
Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)

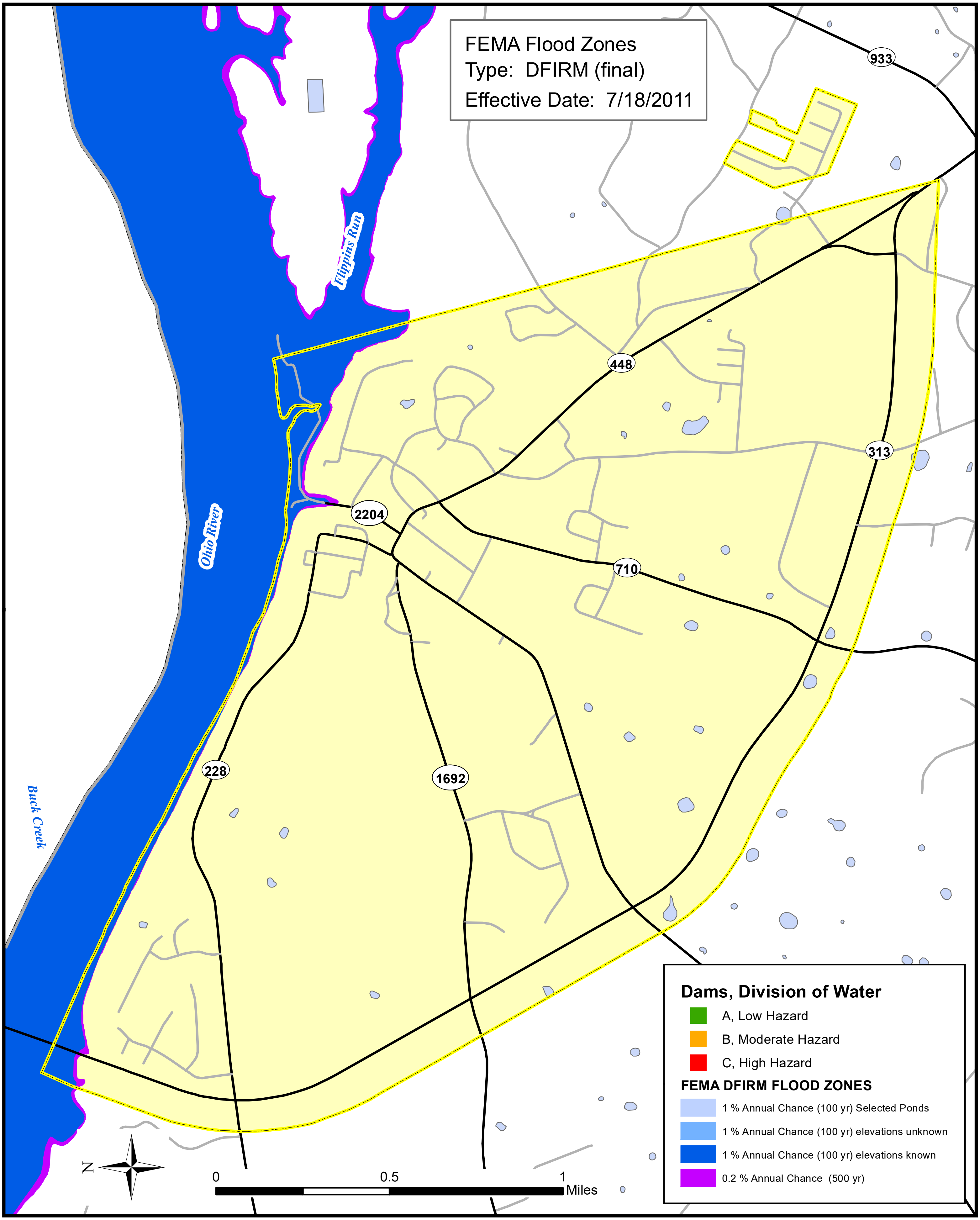

Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 1/6/2010
Cherry Run
84
Slate Creek
527
527
Prather Creek
Rolling Fork
0
0.1
0.2
Miles
N

MEADE
47 Flood/Flash Flood event(s) were recorded between 1967 and 5/15/2021 by SHELDUS and the NCDC.

There have been 5 Flood/Flash Flood events recorded from 7/1/2015 through 5/15/2021 in NCEI.

LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE ($)	CROP DAMAGE ($)
MULDRAUGH	2/23/18	0	0	0	0
MEADE CO.	2/23/18	0	0	0	0
MEADE CO.	2/25/18	0	0	0	0
MEADE CO.	2/20/19	0	0	0	0
MEADE CO.	11/30/19	0	0	0	0


Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 7/18/2011
1047
3139
259
230
228
144
1919
3886
886
1844
477
2734
376
228
144
823
2731
1239
313
1692
261
428
79
2204
79
448
1726
2727
710
1736
933
941
144
313
60
1238
1238
656
1735
1638
31W
333
1158
1600
144
868
2726
60
FORT KNOX
1816
313
1882
1500
N
0
5
Miles


FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 7/18/2011
Flippins Run
Ohio River
Buck Creek
933
448
313
2204
710
228
1692
N
0
0.5
1
Miles
Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)

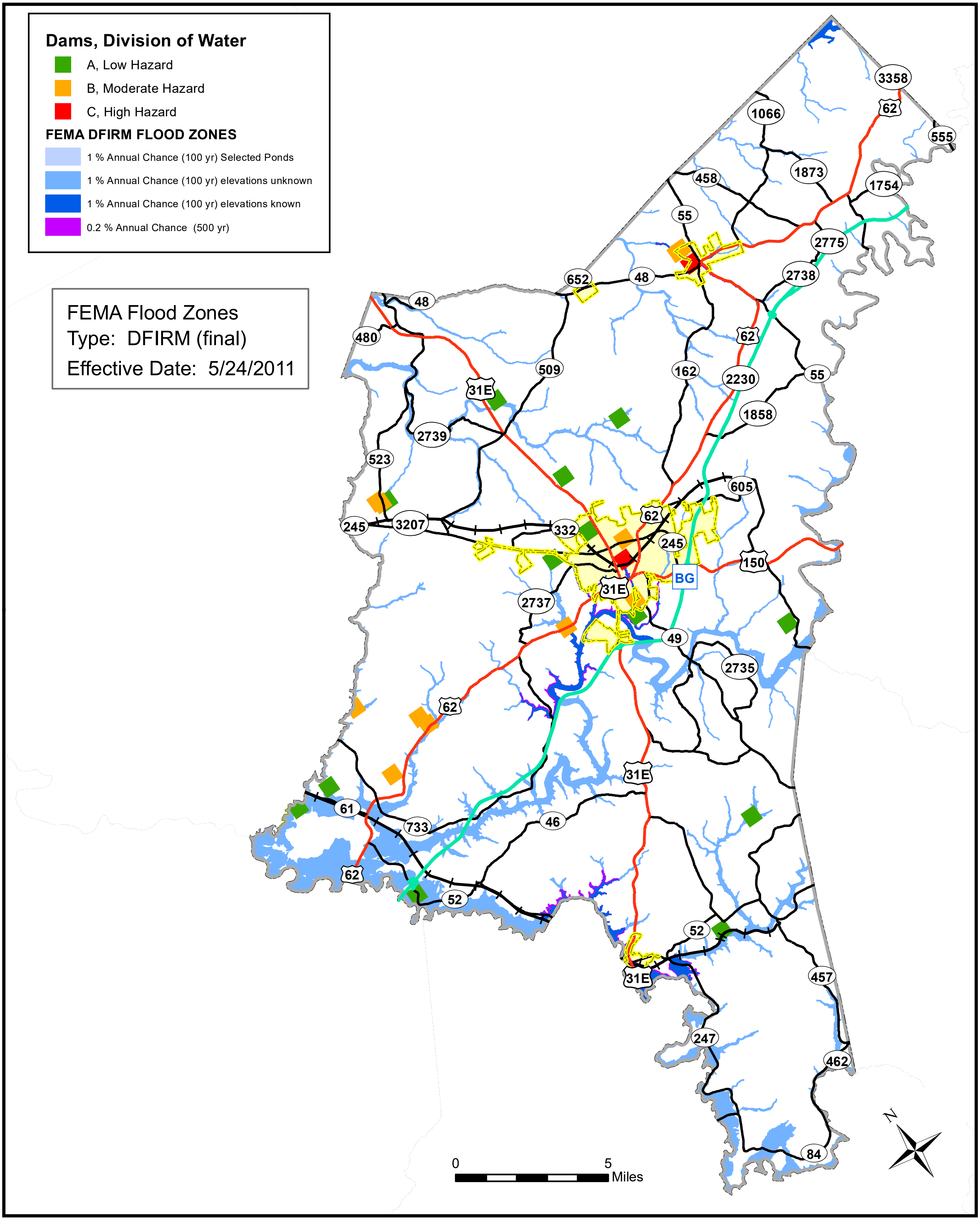
NELSON

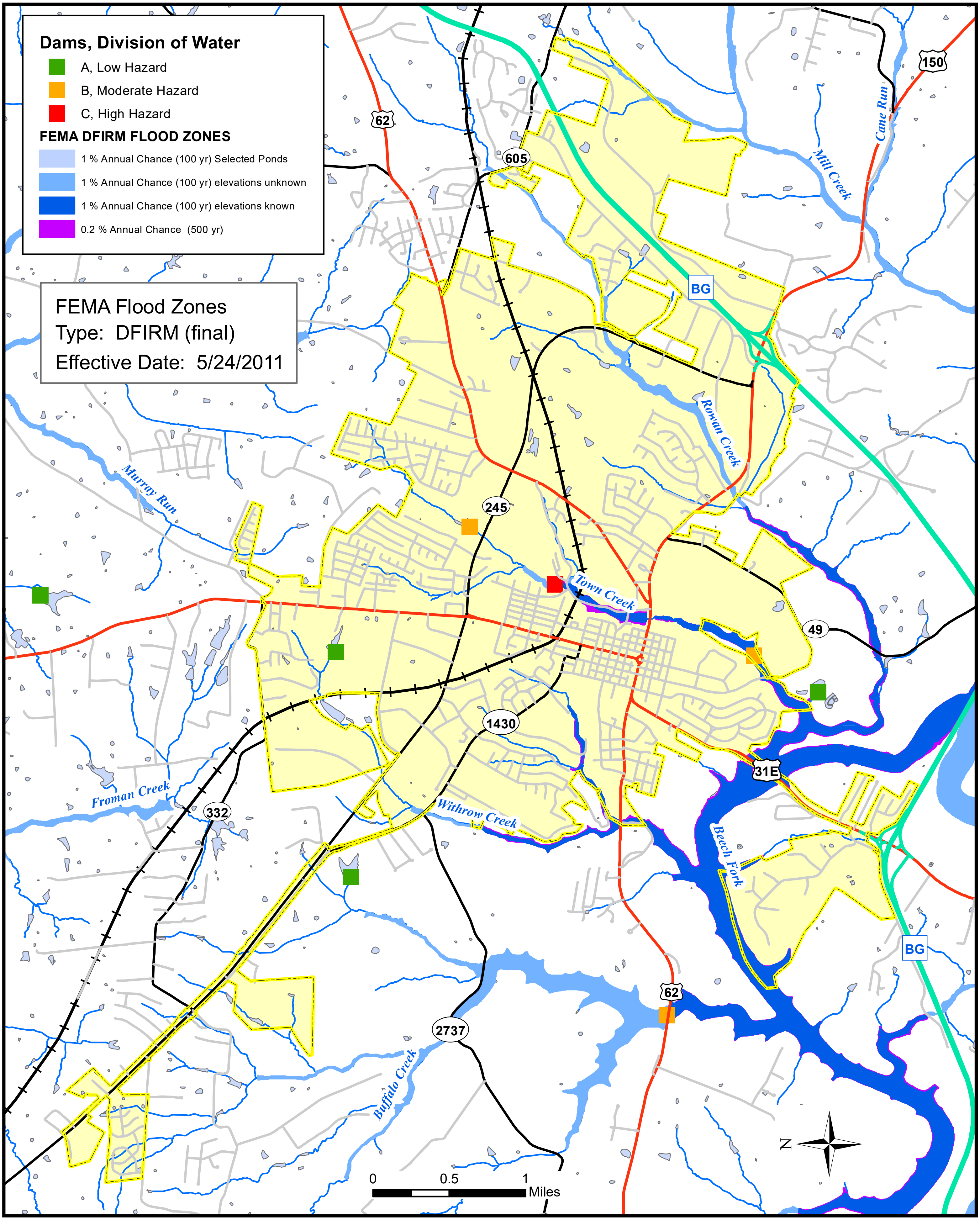
104 Flood/Flash Flood event(s) were recorded between 1967 and 5/15/2021 by SHELDUS and the NCDC.

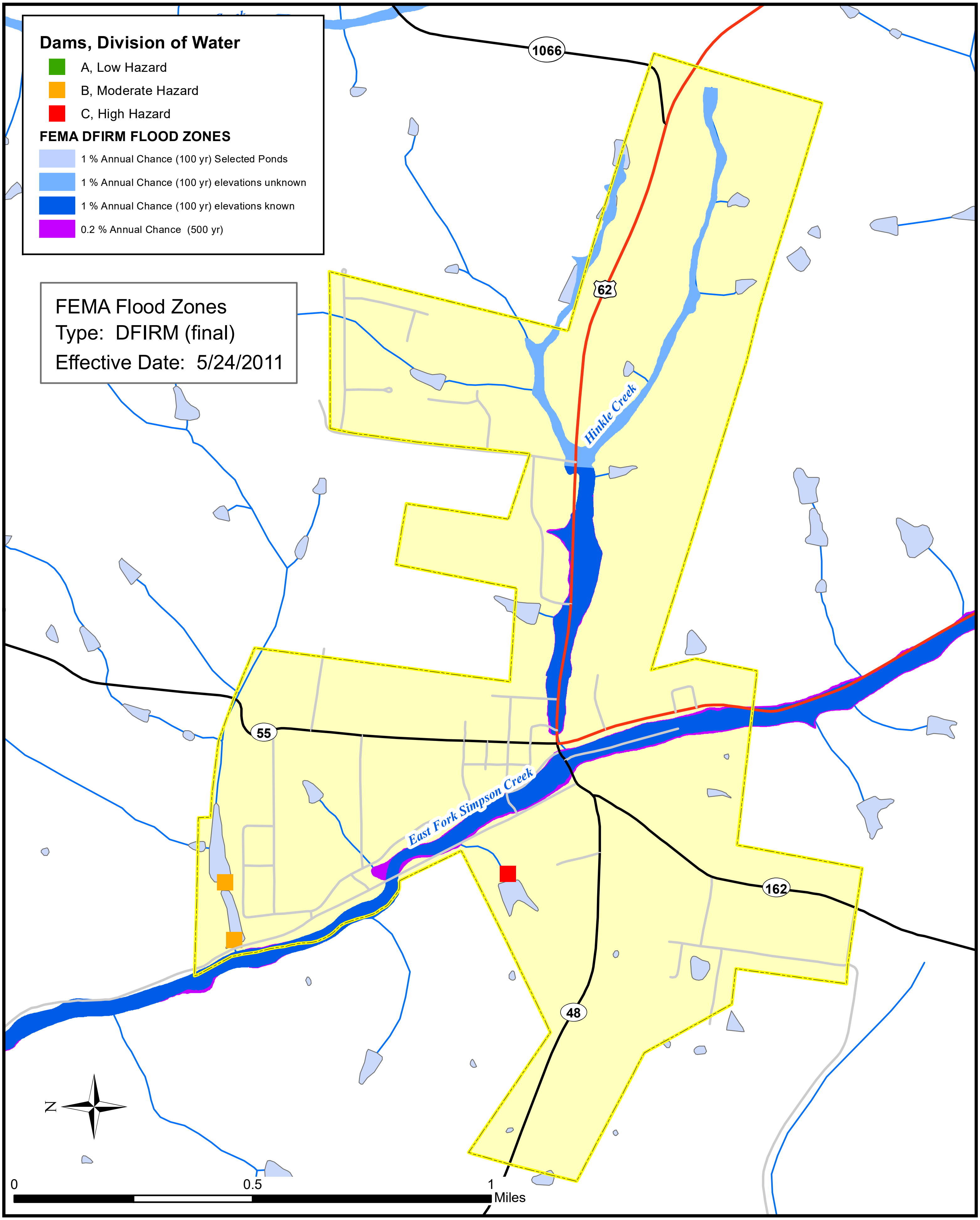
There have been 11 Flood/Flash Flood events recorded from 7/1/2015 through 5/15/2021 in NCEI.

LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE ($)	CROP DAMAGE ($)
BLOOMFIELD	7/14/15	0	0	0	0
NELSON CO.	7/14/15	0	0	0	0
NELSON CO.	12/24/15	0	0	0	0
NELSON CO.	2/3/16	0	0	0	0
BLOOMFIELD	6/18/17	0	0	0	0
NELSON CO.	6/23/17	0	0	0	0
NELSON CO.	6/23/17	0	0	0	0
NELSON CO.	2/22/18	0	0	0	0
NELSON CO.	2/25/18	0	0	0	0
BARDSTOWN	6/29/20	0	0	0	0
NELSON CO.	6/29/20	0	0	0	0

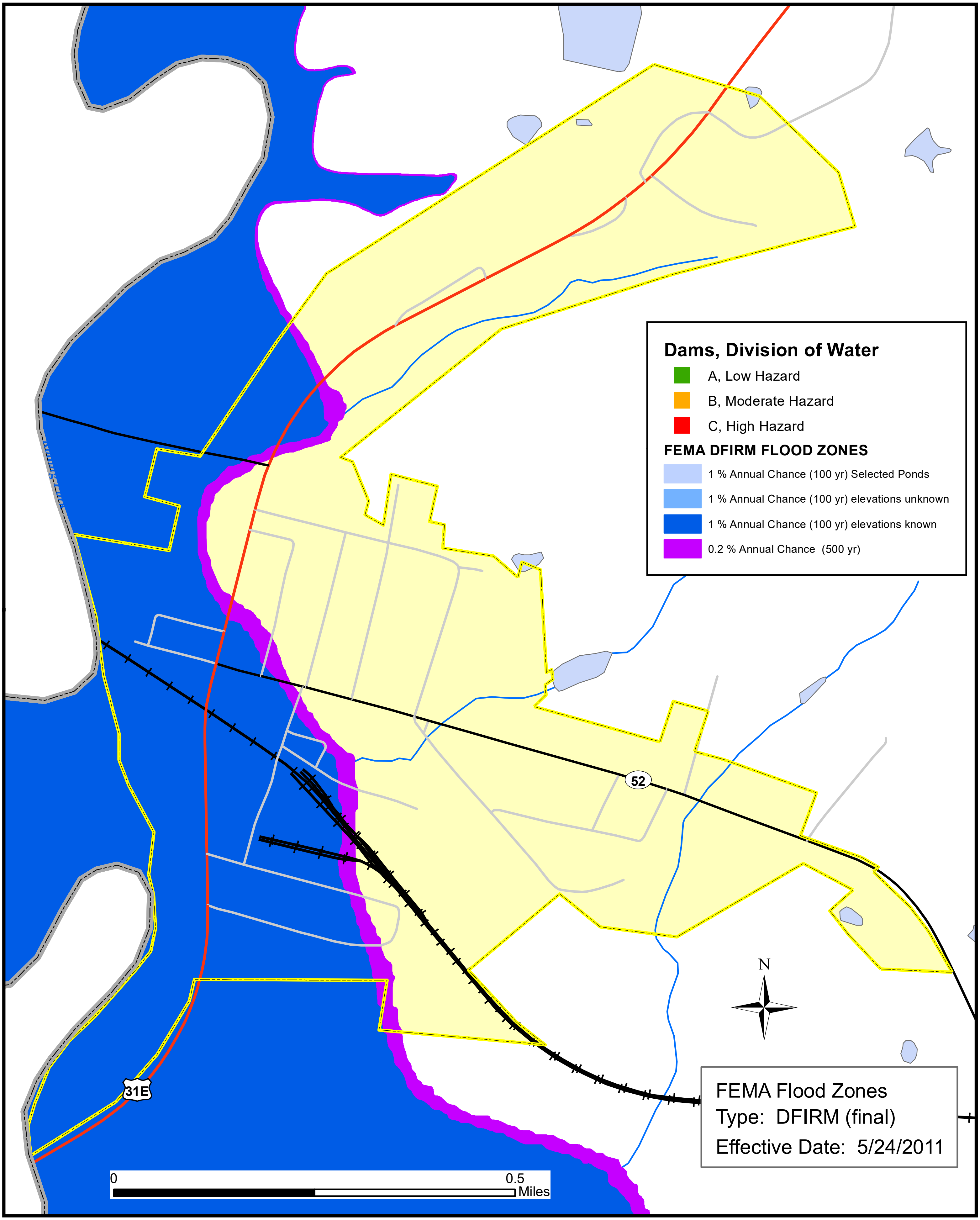
New Haven flood in March 2021. *Source Wave 3 News*


Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 5/24/2011
3358
62
1066
555
1873
458
1754
55
2775
2738
652
48
480
62
509
162
2230
55
31E
1858
2739
523
605
62
245
3207
332
245
150
BG
31E
2737
49
2735
62
31E
61
733
46
62
52
52
457
31E
247
462
84
0
5
Miles
N


Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 5/24/2011
Murray Run
Froman Creek
Withrow Creek
Town Creek
Rowan Creek
Mill Creek
Cane Run
Beech Fork
Buffalo Creek
62
605
150
BG
245
49
1430
31E
332
2737
0
0.5
1
Miles
N


Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)
FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 5/24/2011
1066
62
Hinkle Creek
55
East Fork Simpson Creek
162
48
N
0
0.5
1
Miles

NEW HAVEN
FLOODING



WASHINGTON

50 Flood/Flash Flood event(s) were recorded between 1967 and 5/15/2021 by SHELDUS and the NCDC.

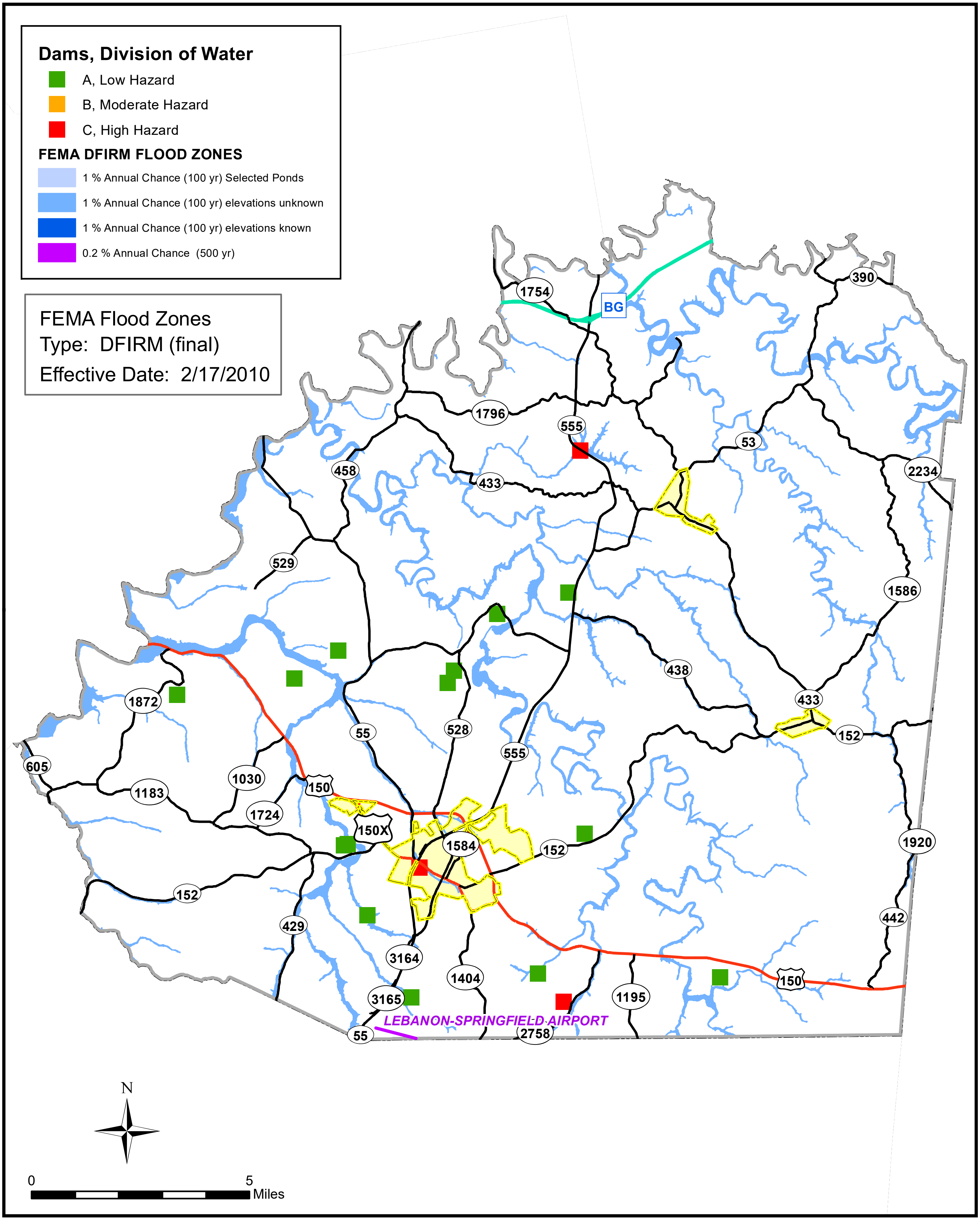
There have been 11 Flood/Flash Flood events recorded from 7/1/2015 through 5/15/2021 in NCEI.

LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE ($)	CROP DAMAGE ($)
WASHINGTON CO.	2/22/18	0	0	0	0
WASHINGTON CO.	5/31/18	0	0	0	0
WASHINGTON CO.	6/26/18	0	0	0	0
WASHINGTON CO.	11/30/19	0	0	0	0
SPRINGFIELD	6/29/20	0	0	0	0
WILLISBURG	6/29/20	0	0	0	0
WASHINGTON CO.	6/29/20	0	0	60000	0
WASHINGTON CO.	6/29/20	0	0	0	0
WILLISBURG	6/29/20	0	0	0	0
WILLISBURG	6/29/20	1	1	30000	0
WILLISBURG	6/29/20	0	0	50000	0

Barn under water, Washington Co. April 2008. *LTADD Archives*.

County road under water near Frederickstown, Washington Co. April 2008. *LTADD Archives*.

WASHINGTON COUNTY
FLOODING



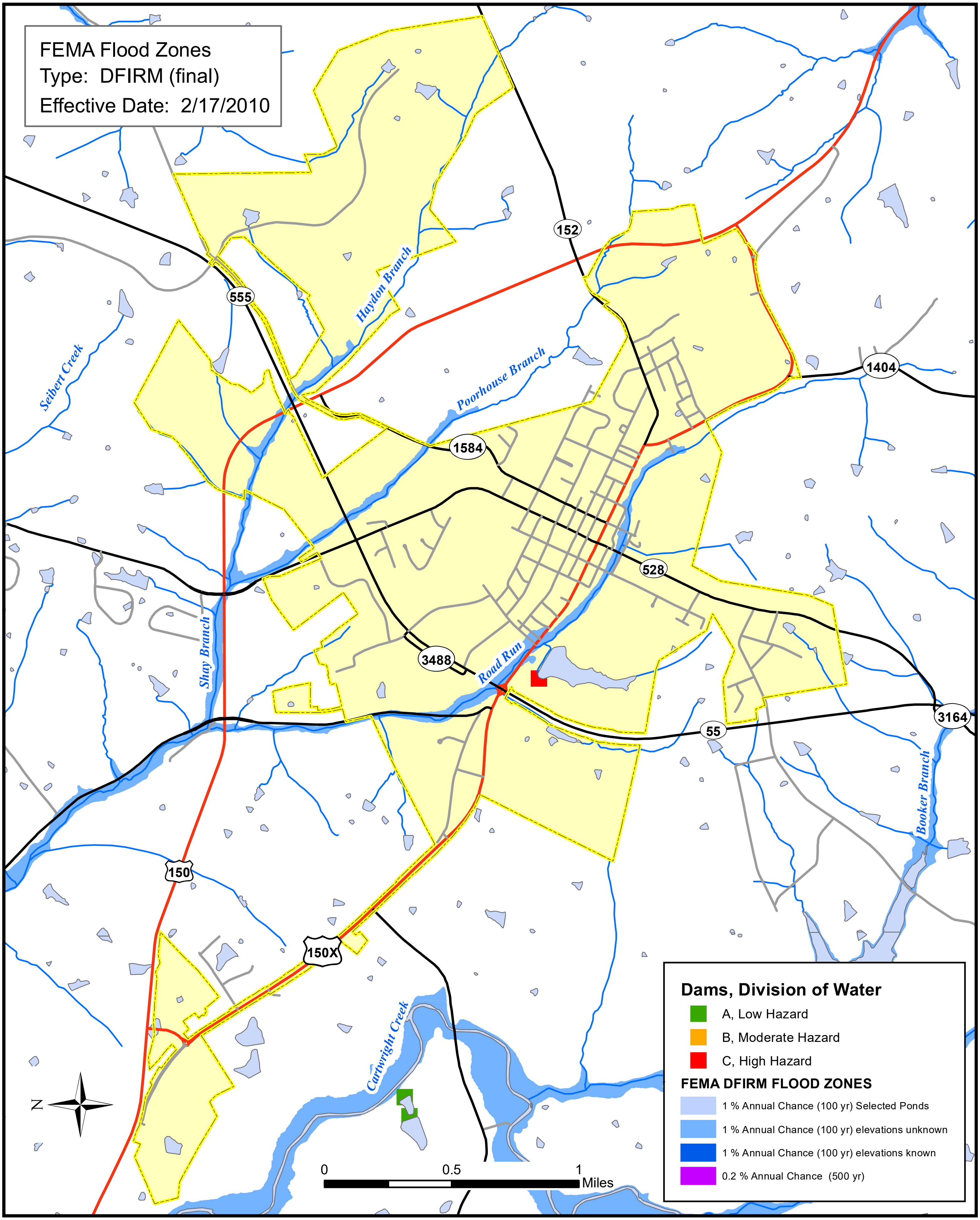

FEMA Flood Zones
Type: DFIRM (final)
Effective Date: 2/17/2010
Haydon Branch
Seibert Creek
Poorhouse Branch
Shay Branch
Road Run
Booker Branch
Cartwright Creek
152
555
1404
1584
528
3488
55
3164
150
150X
N
0
0.5
1
Miles
Dams, Division of Water
A, Low Hazard
B, Moderate Hazard
C, High Hazard
FEMA DFIRM FLOOD ZONES
1 % Annual Chance (100 yr) Selected Ponds
1 % Annual Chance (100 yr) elevations unknown
1 % Annual Chance (100 yr) elevations known
0.2 % Annual Chance (500 yr)

Table 3.3.2.1.6 - Summary of Flooding Data, Costs

FLOODS	Total Cost	Number Events	Number Years	Total Loss of Life	Total Injuries	Average Cost Per Year	Average Cost Per Event	Average Loss of Life Per Year	Average Loss of Life Per Event	Average Injuries Per Year	Average Injuries Per Event
BRECKINRIDGE	$7,811,684	60	54.5	2.09	0.11	$143,334	$130,195	0.04	0.03	0.00	0.00
Cloverport	$0	2	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Hardinsburg	$0	3	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Irvington	$10,000	4	54.5	1	0	$183	$2,500	0.02	0.25	0.00	0.00
GRAYSON	$8,490,065	56	54.5	0.04	0.11	$155,781	$151,608	0.00	0.00	0.00	0.00
Caneyville	$250,000	2	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Clarkson	$0	4	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Leitchfield	$0	5	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
HARDIN	$49,261,889	88	54.5	2.17	0.11	$903,888	$559,794	0.04	0.02	0.00	0.00
Elizabethtown	$5,230,000	16	54.5	0	0	$95,963	$326,875	0.00	0.00	0.00	0.00
Radcliff	$0	1	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Sonora	$0	1	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Upton	$0	0	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Vine Grove	$250,000	4	54.5	0	0	$4,587	$62,500	0.00	0.00	0.00	0.00
West Point	$1,250,000	1	54.5	0	0	$22,936	$0	0.00	0.00	0.00	0.00
LARUE	$8,067,971	47	54.5	0.17	0.11	$148,036	$171,659	0.00	0.00	0.00	0.00
Hodgenville	$0	4	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
MARION	$9,800,835	58	54.5	0.31	2.54	$179,832	$168,980	0.01	0.01	0.05	0.04
Bradfordsville	$0	3	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Lebanon	$75,000	9	54.5	0	0	$1,376	$8,333	0.00	0.00	0.00	0.00
Loretto	$0	1	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Raywick	$2,000	1	54.5	0	0	$37	$0	0.00	0.00	0.00	0.00
MEADE	$7,284,005	47	54.5	1.14	0.11	$133,651	$154,979	0.02	0.02	0.00	0.00
Brandenburg	$0	5	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Ekron	$0	0	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Muldraugh	$0	1	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
NELSON	$35,033,005	104	54.5	3.17	2.11	$642,807	$336,856	0.06	0.03	0.04	0.02
Bardstown	$2,000	5	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Bloomfield	$0	2	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Fairfield	$0	0	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
New Haven	$0	2	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
WASHINGTON	$9,124,658	50	54.5	1.17	1.11	$167,425	$182,493	0.02	0.02	0.02	0.02
Mackville	$0	0	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Springfield	$75,000	4	54.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Willisburg	$80,000	4	54.5	1	1	$0	$0	0.02	0.00	0.02	0.00
LTADD	$134,874,112	510	54.5	10.26	6.31	$2,474,754	$264,459	0.19	0.02	0.12	0.01

NOTE: The historic frequency of a hazard event over a given period of time determines the historic recurrence interval. For example: If there have been 10 Thunderstorm events in the County in the past 5 years, statistically you could expect that there will be 2 events a year.

Realize that from a statistical standpoint, there are several variables to consider. 1) Accurate hazard history data and collection are crucial to an accurate recurrence interval and frequency. 2) Data collection and accuracy has been much better in the past 10-20 years (NCDC weather records). 3) It is important to include all significant recorded hazard events which will include periodic updates to this table.

By updating and reviewing this table over time, it may be possible to see if certain types of hazard events are increasing in the past 10-20 years.

These values should be considered low. More events that have occurred than are documented by the sources used in this table.

All data is compiled at the county level due to extremely limited city specific data, therefore all data and analysis represents incorporated and unincorporated areas inclusively.

Compilation of SHELDUS, NCDC & NCEI. 1967- June 30, 2021.

Table 3.3.2.1.6 - Summary of Flooding Data, Events

FLOODS	Number of Events in Historic Record	Number of Years in Historic Record	Number of Events in Past 10 Years	Number of Events in Past 20 Years	Number of Events in Past 50 Years	Historic Recurrence Interval (years)	Historic Frequency % chance/year	Past 10 Year Record Frequency Per Year	Past 20 Year Record Frequency Per Year	Past 50 Year Record Frequency Per Year
BRECKINRIDGE	60	54.5	20	38	58	0.91	110.09%	2	1.9	1.16
Cloverport	2	54.5	2	2	2	27.25	3.67%	0.2	0.1	0.04
Hardinsburg	3	54.5	2	3	3	18.17	5.50%	0.2	0.15	0.06
Irvington	4	54.5	2	3	4	13.63	7.34%	0.2	0.15	0.08
GRAYSON	56	54.5	22	36	55	0.97	102.75%	2.2	1.8	1.1
Caneyville	2	54.5	2	2	2	27.25	3.67%	0.2	0.1	0.04
Clarkson	4	54.5	4	4	4	13.63	7.34%	0.4	0.2	0.08
Leitchfield	5	54.5	2	5	5	10.90	9.17%	0.2	0.25	0.1
HARDIN	88	54.5	42	63	86	0.62	161.47%	4.2	3.15	1.72
Elizabethtown	16	54.5	10	14	15	3.41	29.36%	1	0.7	0.3
Radcliff	1	54.5	0	1	1	54.50	1.83%	0	0.05	0.02
Sonora	1	54.5	1	1	1	54.50	1.83%	0.1	0.05	0.02
Upton	0	54.5	0	0	0	0.00	0.00%	0	0	0
Vine Grove	4	54.5	3	4	4	13.63	7.34%	0.3	0.2	0.08
West Point	1	54.5	1	1	1	54.50	1.83%	0.1	0.05	0.02
LARUE	47	54.5	18	25	45	1.16	86.24%	1.8	1.25	0.9
Hodgenville	4	54.5	4	4	4	13.63	7.34%	0.4	0.2	0.08
MARION	58	54.5	23	33	56	0.94	106.42%	2.3	1.65	1.12
Bradfordsville	3	54.5	3	3	3	18.17	5.50%	0.3	0.15	0.06
Lebanon	9	54.5	7	9	9	6.06	16.51%	0.7	0.45	0.18
Loretto	1	54.5	0	1	1	54.50	1.83%	0	0.05	0.02
Raywick	1	54.5	1	1	1	54.50	1.83%	0.1	0.05	0.02
MEADE	47	54.5	13	24	45	1.16	86.24%	1.3	1.2	0.9
Brandenburg	5	54.5	2	4	5	10.90	9.17%	0.2	0.2	0.1
Ekron	0	54.5	0	0	0	0.00	0.00%	0	0	0
Muldraugh	1	54.5	1	1	1	54.50	1.83%	0.1	0.05	0.02
NELSON	104	54.5	45	78	102	0.52	190.83%	4.5	3.9	2.04
Bardstown	5	54.5	2	4	5	10.90	9.17%	0.2	0.2	0.1
Bloomfield	2	54.5	2	2	2	27.25	3.67%	0.2	0.1	0.04
Fairfield	0	54.5	0	0	0	0.00	0.00%	0	0	0
New Haven	2	54.5	1	2	2	27.25	3.67%	0.1	0.1	0.04
WASHINGTON	50	54.5	15	23	48	1.09	91.74%	1.5	1.15	0.96
Mackville	0	54.5	0	0	0	0.00	0.00%	0	0	0
Springfield	4	54.5	3	4	4	13.63	7.34%	0.3	0.2	0.08
Willisburg	4	54.5	4	4	4	13.63	7.34%	0.4	0.2	0.08
LTADD	510	54.5	198	320	495	0.11	935.78%	19.8	16	9.9

NOTE: The historic frequency of a hazard event over a given period of time determines the historic recurrence interval. For example: If there have been 10 Thunderstorm events in the County in the past 5 years, statistically you could expect that there will be 2 events a year.

Realize that from a statistical standpoint, there are several variables to consider. 1) Accurate hazard history data and collection are crucial to an accurate recurrence interval and frequency. 2) Data collection and accuracy has been much better in the past 10-20 years (NCDC weather records). 3) It is important to include all significant recorded hazard events which will include periodic updates to this table.

By updating and reviewing this table over time, it may be possible to see if certain types of hazard events are increasing in the past 10-20 years.

These values should be considered low. More events that have occurred than are documented by the sources used in this table.

All data is compiled at the county level due to extremely limited city specific data, therefore all data and analysis represents incorporated and unincorporated areas inclusively.

Compilation of SHELDUS, NCDC & NCEI. 1967- June 30, 2021.

Extent

The extent of flooding in the Lincoln Trail eight-county region is difficult to document. However, on April 30, 2011, the pool at Rough River Lake in Grayson County was recorded at a depth of 524.7 feet, a new record. Grayson County received FEMA assistance in funding two bridge elevation projects under DR-1818-0027 and DR-1818-0153 on Lake Shore Road and on Bloomington Church Road. Widespread flooding in these areas would reach a depth of up to 24 inches and closed these roads for days. Another bridge elevation project was funded in the City of Leitchfield in Grayson County, under DR-1818-0063. Floodwaters reaching depths of twelve to twenty-four inches closed a road there.

In April of 2011, Ohio River flooding affected the City of West Point in Hardin County. On 4/26/2011, the river crested at 61.8 feet, about 6.8 feet above flood stage.

The Rolling Fork River meanders through Hardin County and becomes the boundary between Hardin and Nelson County. The flood stage of the Rolling Fork is thirty-five feet, moderate flooding occurs at forty-two feet with major flooding occurring at forty-five feet. The Rolling Fork often floods rural areas of Hardin County as well as the Boston and New Haven regions of Nelson County. The Chart below documents crest stage levels of the Rolling Fork.

Table 3.3.2.1.7 - Recent Crests of the Rolling Fork River (Flood Stage = 35')

Date	Depth in Feet
3/3/21	46.24 Feet
7/1/20	38.15 Feet
2/14/20	36.63 Feet
12/19/19	39.19 Feet
12/3/19	36.30 Feet
2/26/19	40.61 Feet
2/22/19	37.32 Feet
2/14/19	40.70 Feet
11/8/18	35.83 Feet
3/26/18	36.63 Feet

Source: NOAA - Advanced Hydrologic Prediction Service

3.3.2.2 Tornados

I. Background

According to the National Severe Storms Laboratory (NSSL) of the National Oceanic and Atmospheric Administration (NOAA) a tornado is "a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground. Because wind is invisible, it is hard to see a tornado unless it forms a condensation funnel made up of water droplets, dust, and debris. Tornados are the most violent of all atmospheric storms."

Attributes: About 1,000 tornados hit the United States annually. Historical data pertaining to tornados only date back to 1950 and methodology for spotting and reporting tornados has greatly evolved over the last few decades.

Tornado season in the U.S. usually refers to the time of year when tornados are most likely to occur. For the southern plains, it occurs during May and into early June. On the Gulf Coast, it is earlier in the spring. In the northern plains and upper Midwest, tornado season is in June or July. However, a tornado can occur at any time during the year and can happen at any time of day or night. Most tornados occur between 4 and 9 p.m.

The most destructive and deadly tornados are spawned from supercells with a well-defined radar circulation called a mesocyclone. Supercells can also produce damaging hail, severe non-tornadic winds, frequent lightning, and flash floods.

Analysis of damage caused by the storm, is a common and practical method for determining the strength of a tornado. From the extent of damage, an estimated wind speed can be determined. The "Enhanced Fujita Scale" was implemented by the National Weather Service in 2007 to rate tornados in a consistent and accurate manner. The EF-Scale accounts for more variables than the original Fujita Scale (F-Scale) when determining wind speed rating to a tornado by incorporating 28 damage indicators such as building type, structures, and trees. For each damage indicator, there are 8 degrees of damage ranging from the beginning of visible damage to complete destruction of the damage indicator. The original F-scale did not take degrees of damage into account. The historic F-Scale database will not change. A tornado rated F5 years ago is still an F5, but wind speed may have been slightly less than previously estimated.

A comparison between the Fujita Scale and the Enhanced Fujita Scale is shown below. The Enhanced Fujita Scale is a set of wind estimates (not measurements) based on damage evaluations. According to the National Oceanic and Atmospheric Administration the Enhance Fujita Scale "uses three-second gusts estimated at the point of damage based on a judgment of 8 levels of damage to 28 indicators." These 28 indicators are based on the structure type, ranging from manufactured housing to institutional buildings, and from trees to light poles. It is important to note that a 3 second gust is not the same speed of wind observed in standard surface wind. Measurements are taken by weather stations located in open exposures and using a directly measured, "one minute mile" speed.

Table 3.3.2.2.1 - Fujita/Enhanced Fujita Scale						
FUJITA SCALE			**DERIVED EF SCALE**		**OPERATIONAL EF SCALE**	
F Number	**Fastest ¼ mile (mph)**	**3 Second Gust (mph)**	**EF Number**	**3 Second Gust (mph)**	**EF Number**	**3 Second Gust (mph)**
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200
Source: NOAA						

Tornado - February 29, 2012, Near LaRue County High School in Hodgenville
Photo Tara Wooden

Tornado Facts and Effects

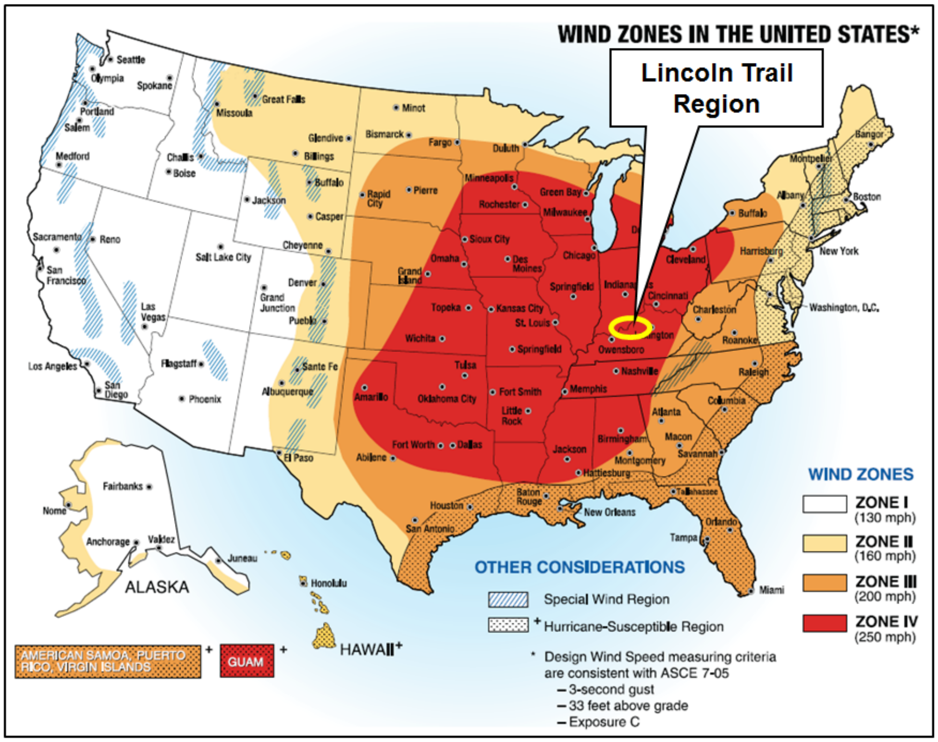
- Tornadoes can last from several seconds to more than an hour.
- A tornado is considered “significant” if it is rated EF2 or greater on the Enhanced Scale or at least F2 on the old F-Scale.
- Hurricanes and tropical storms can spawn tornados.

- Tornados are forecast when the development of temperature and wind flow patterns in the atmosphere can cause enough moisture, instability, life, and wind shear for the formation of tornadic thunderstorms. These are the four main factors for the formation of tornados.
- Tornado damage occurs as the result of exposure to extreme winds or the impact of flying debris. Another hazard exists when hazardous materials are released by tornados such as natural gas, medical waste, gasoline, and other dangerous chemicals or sewage. Winds can topple trees and power lines resulting in long-term power outages.
- Wind associated with tornados can loft debris several miles into the air and carry it for long distances. Small items and paper can be carried over 100 miles away.
- Tornados vary in size with the widest ground width measured at about 4.3 miles. Wind speed also varies. The greatest ground-level speeds have never been measured, but on May 3, 1999, 302 mph winds were recorded near Bridge Creek, OK.
- April is the month with the greatest number of tornado outbreaks. In April 2011, the NOAA Storm Prediction Center data shows 817 tornados occurred.
- The tornados with the greatest death toll occurred on March 18, 1925, when 695 people were killed when tornados raced across Missouri, Illinois and Indiana producing F5 damage. On April 3, 1974, the main day of a two-day "Super Outbreak," tornados killed 310 people. During that outbreak, seven F5 tornados occurred in one day. The Dixie outbreak of April 27, 2011, killed about 316 people.
- Approximately 1,000 tornados occur in the United States each year. On average, 60 people are killed annually because of tornados, most from flying or falling debris. Since records have been kept, the greatest number of deaths from tornados occurred in 2011 when 550 people died in 15 states.
- Funnel clouds have rotation, but do not touch the ground. Only a true tornado has ground contact.
- The size or shape of a tornado does not have anything to do with its strength.

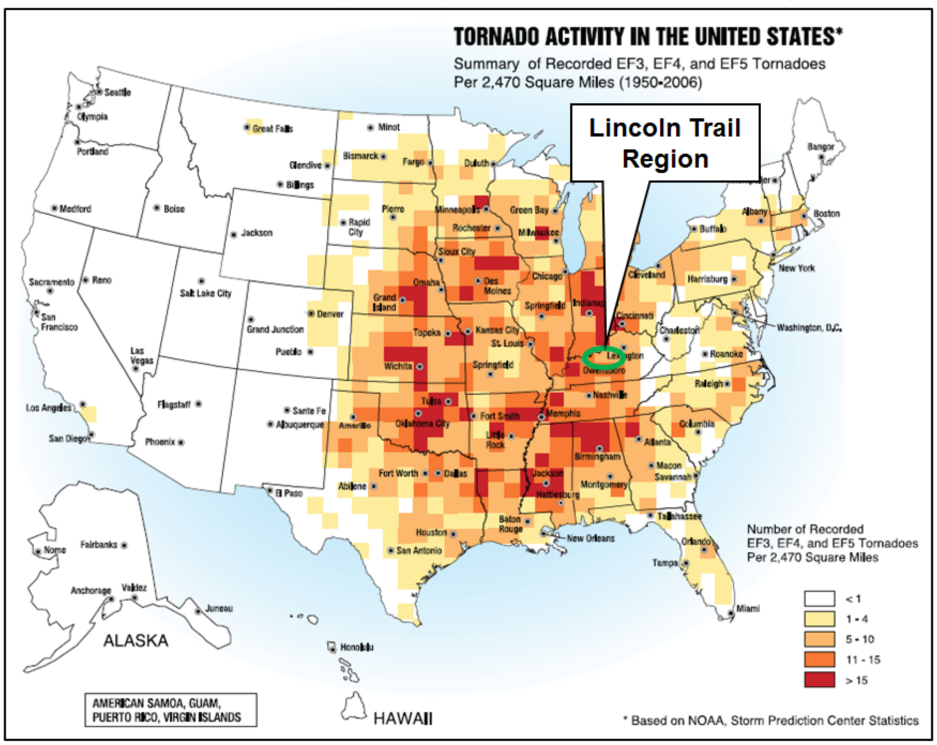
II. Profile

Kentucky is located in Wind Zone IV, the most severe wind zone in the United States. The states most vulnerable to tornado activity are located within this wind zone.

The risk associated with tornados in Kentucky is illustrated in Chart 3.3.2.2.1. Of the 1214 tornados reported throughout the State between 1950 and 2021, each of the counties within the Lincoln Trail Region experienced at least 11.



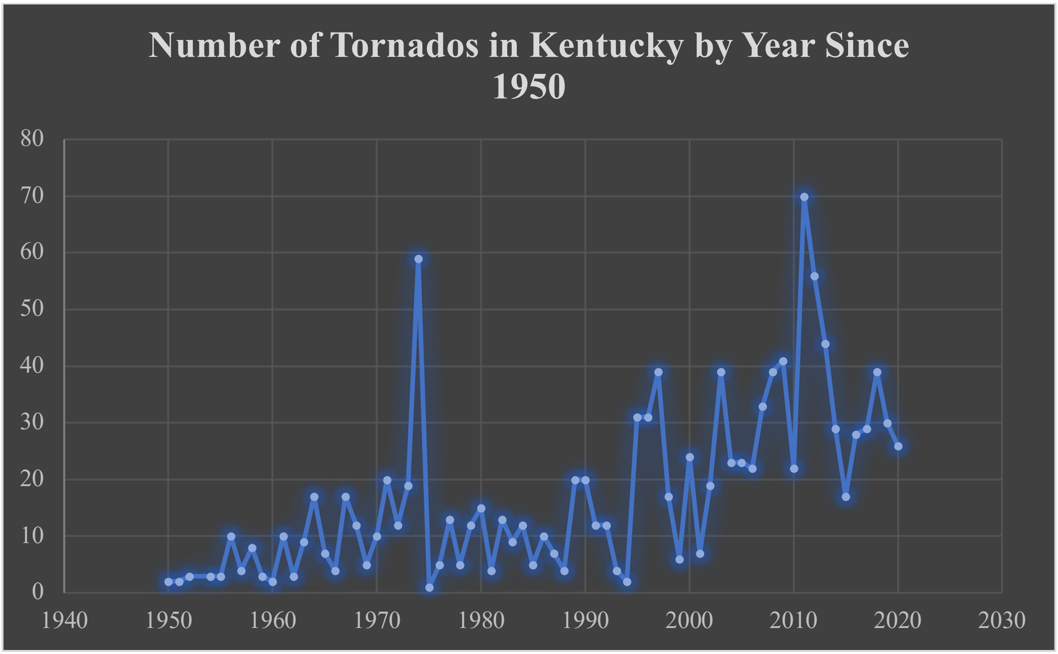
Source: FEMA, *Taking Shelter from the Storm*, 3rd Edition, Fig 1-4.



Source: FEMA, *Taking Shelter from the Storm*, 3rd Edition, Fig 1-2.

Kentucky averaged over 30 tornados annually from 2016-2020. Of the 149 people killed in Kentucky due to tornados, 38 were killed in the Lincoln Trail Region. Tornado data has only been collected since 1950 and the history of tornado events in the Lincoln Trail Region dates from 1950 through 2021. Clearly, the Lincoln Trail Region is at risk for tornado activity.

Chart 3.3.2.2.1



Source: https://data.courier-journal.com/tornado-archive/

Table 3.3.2.2.2 – Tornado Activity

Tornado Activity in Kentucky and the 8-County Lincoln Trail Region Between 1950 and 2021							
Jurisdiction	Dates Yr.,Month,Day	Tornados	Fatalities	Injuries	Highest Injuries	Longest Path	Widest Path
Kentucky	1950/11/20 – 2021/5/14	1214	149 People	3,066 People	350 People	84.99 Miles	3,000 Yards
Breckinridge Co.	1960/06/28 – 2016/0/10	17	1 People	20 People	13 People	32.3 Miles	440 Yards
Grayson Co.	1959/01/21 – 2018/04/3	16	3 People	26 People	16 People	58 Miles	880 Yards
Hardin Co.	1960/06/28 – 2018/31/10	26	2 People	73 People	57 People	37.9 Miles	440 Yards
LaRue Co.	1952/03/22 – 2017/06/23	12	0 People	19 People	18 People	6.65 Miles	1200 Yards
Marion Co.	1960/06/26 – 2018/11/05	13	0 People	4 People	2 People	6.65 Miles	1200 Yards
Meade Co.	1960/06/28 – 2017/11/18	14	31 People	268 People	257 People	32.3 Miles	440 Yards
Nelson Co.	1960/06/28 – 2020/04/06	14	1 People	28 People	24 People	37.9 Miles	1500 Yards
Washington Co.	1960/06/28 – 2020/04/06	11	0 People	5 People	4 People	46.6 Miles	800 Yards
Source: Storm Prediction Center, Historical Tornado Data File (NOAA)							

III. Analysis

To analyze tornados as a hazard threat to the Lincoln Trail Region historical data was researched. The sources of this information include the National Weather Service, National Climatic Data Center, Kentucky Climatic Data Center, ESRI, FEMA, Kentucky Emergency Management Area III, and LTADD GIS.

The following map and tables illustrate a number of the documented tornadic events that have occurred in the Lincoln Trail Region. Note that the general paths are consistent with tornados in this region of the United States. They do affect a widespread region and are not affected in general by geography.

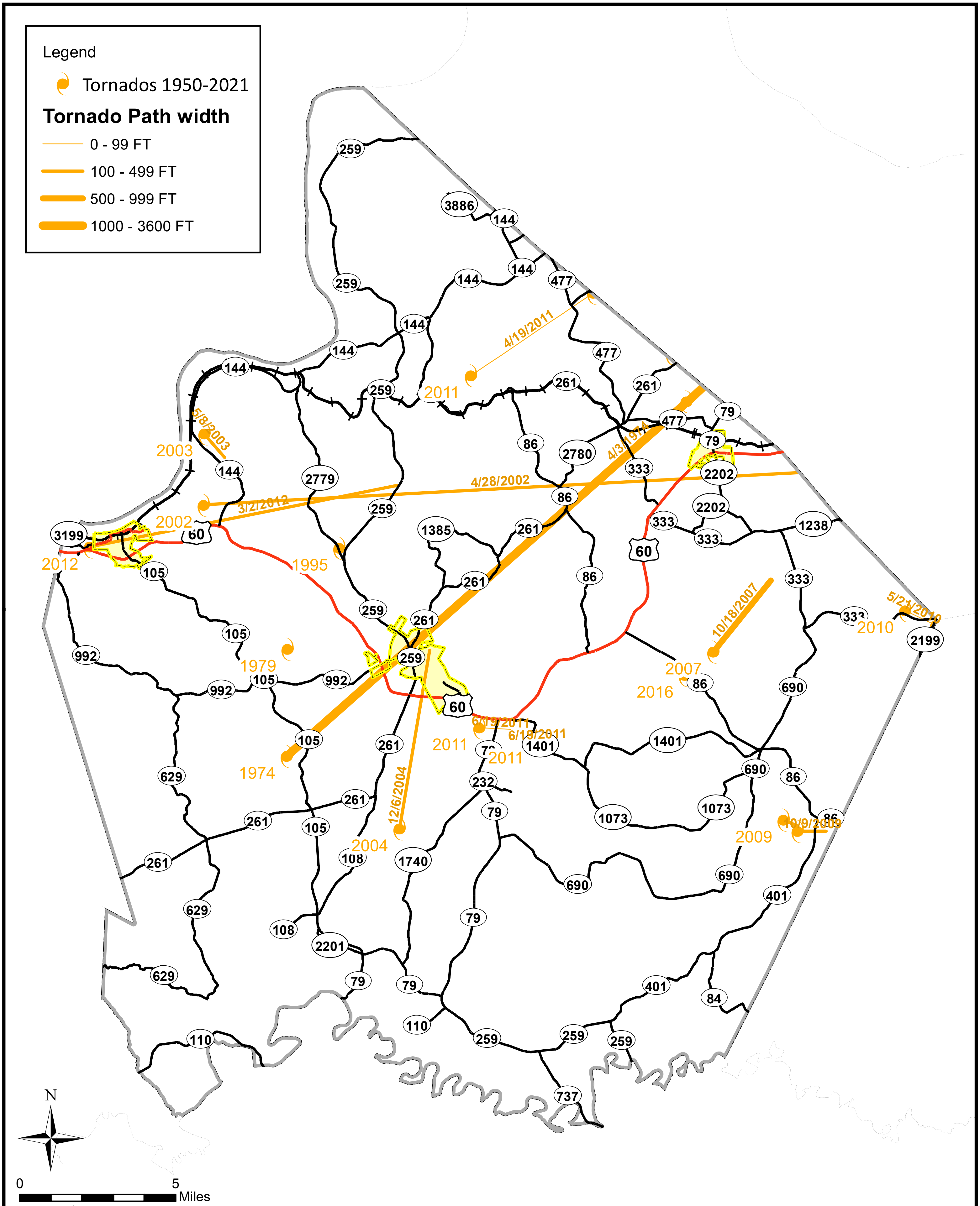
The level of impact is evidenced through the number of lives lost or individual injuries reported, as well as the estimated property and crop damage based on information reported to the National Climate Data Center. This information was subsequently rolled into the data from the National Centers for Environmental Information (NCEI). Data for the original plan was only available through 2003. The 2010 update provided data thru 30 June 2009. The 2015 update provided data from 1 July 2009 through 30 June 2015. This update shows only individual events for the period 1 July 2015 through 14 May 2021. The summary tables show data for the entire periods covered by the various sources. Note that there are many variations in recording the locations of the events over time. In the past, this was typically done at a county level. More recently, nearest place names have been used. Because of this, the records in the summation tables regarding the individual incorporated areas should not be considered all encompassing.

Throughout the following tables, April 3, 1974, will stand out and is probably the most significant day to remember in our region, if not the state, as it pertains to natural hazards and the devastating effects, they can have on us all. In what is labeled the worst tornado outbreak in U.S. history, 148 twisters touched down in 13 states, killing 330 people and injuring 5,484. Between the hours of 3:40pm and midnight 26 of those tornados touched down in Kentucky and affected 39 of our 120 counties, killing 77 people and injuring 1,377. Closer to home, within the Lincoln Trail Region a total of 36 of our residents were killed and 353 were injured. The tornado causing the most destruction hit Meade County and had an intensity rating of F5 on the Fujita scale and a path 550 yards wide.

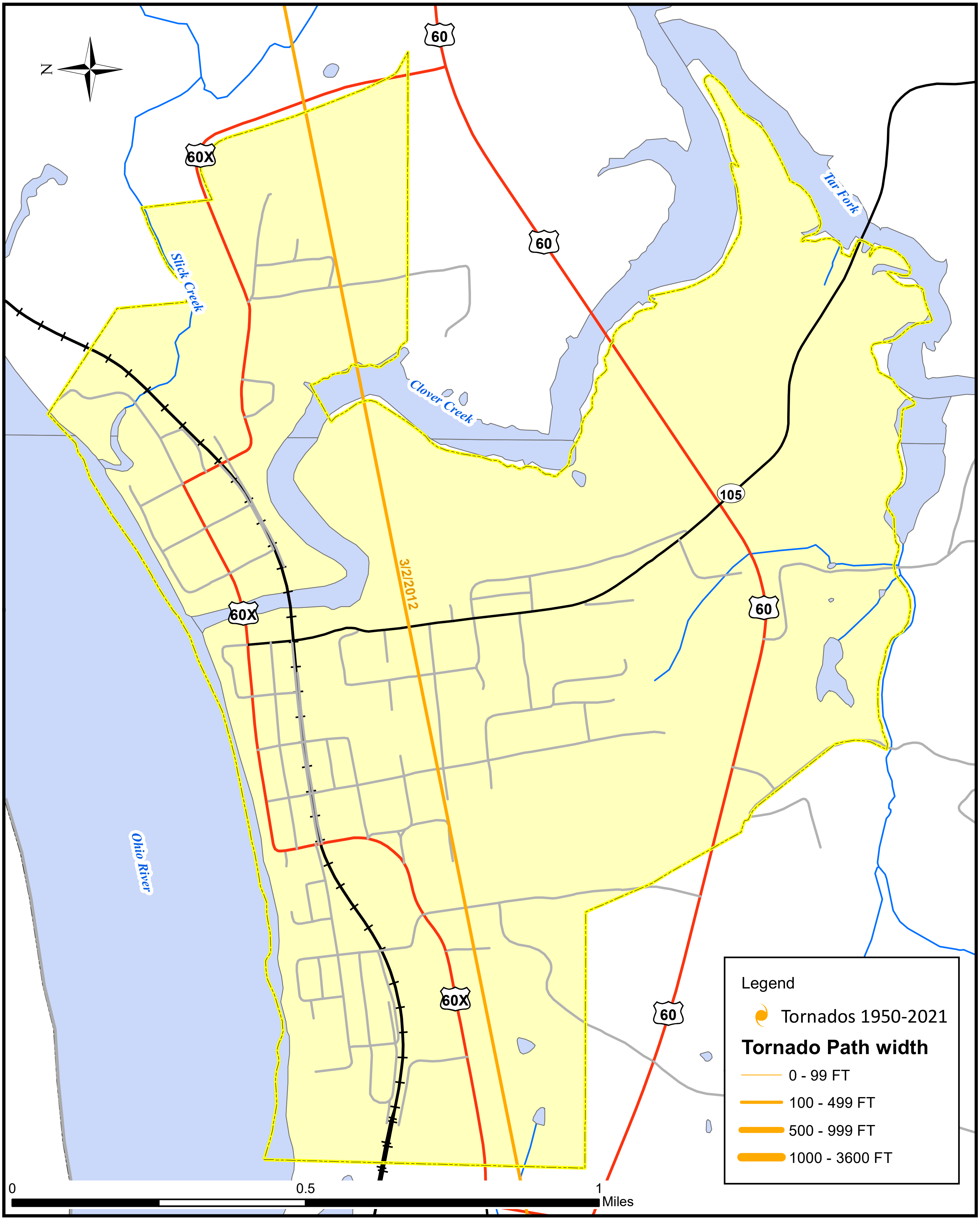
Table 3.3.2.2.3 - County Specific Data – Tornados, *Source: NCEI*

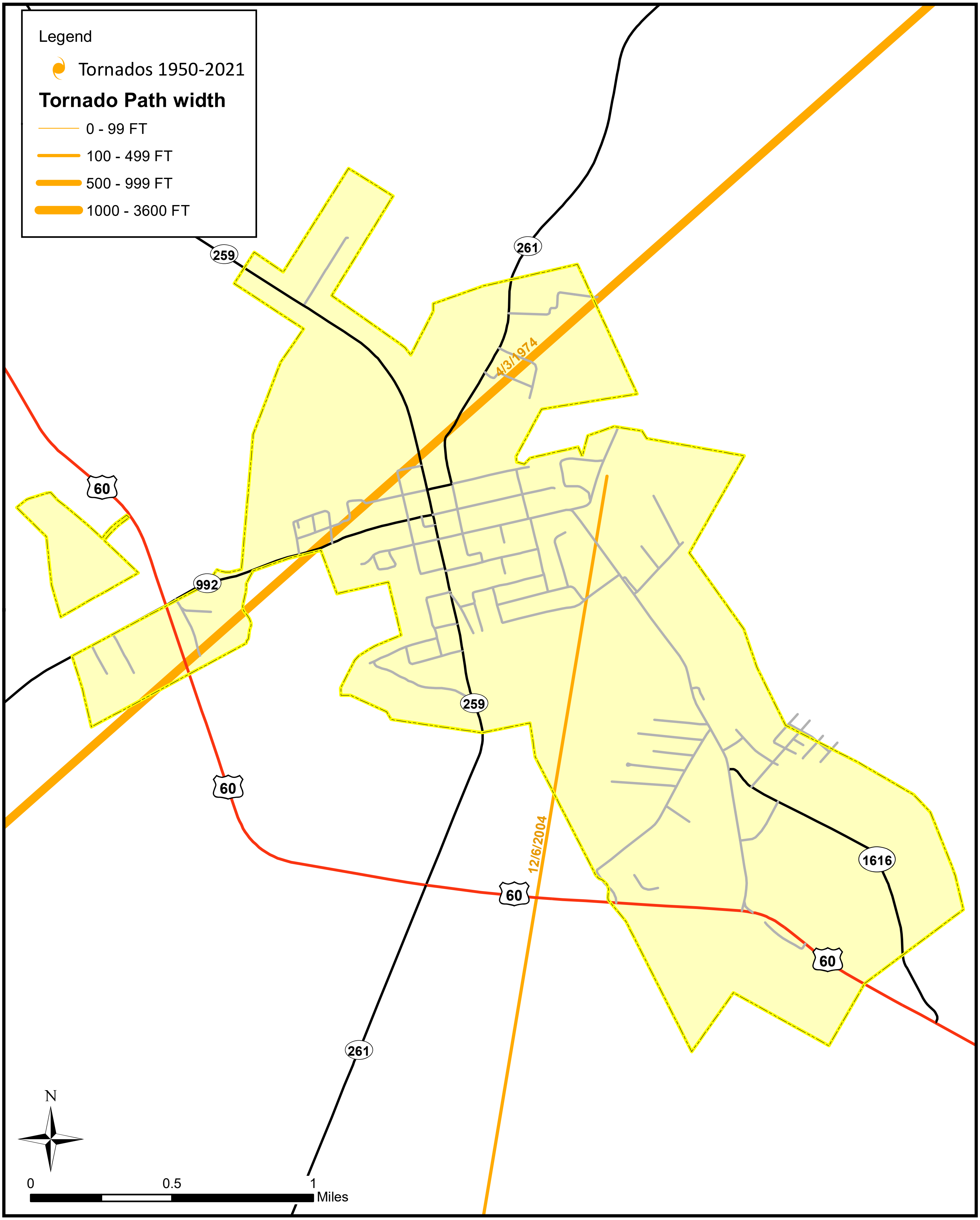
BRECKINRIDGE

LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE	CROP DAMAGE	F SCALE
GRAYSVILLE	5/10/16	0	0	100000	0	EF1


Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
N
0
5
Miles
4/19/2011
2011
5/8/2003
2003
4/3/1974
4/28/2002
3/2/2012
2002
2012
1995
1979
1974
10/18/2007
2007
2016
5/21/2010
2010
6/19/2011
2011
12/6/2004
2004
2009

CLOVERPORT
TORNADO

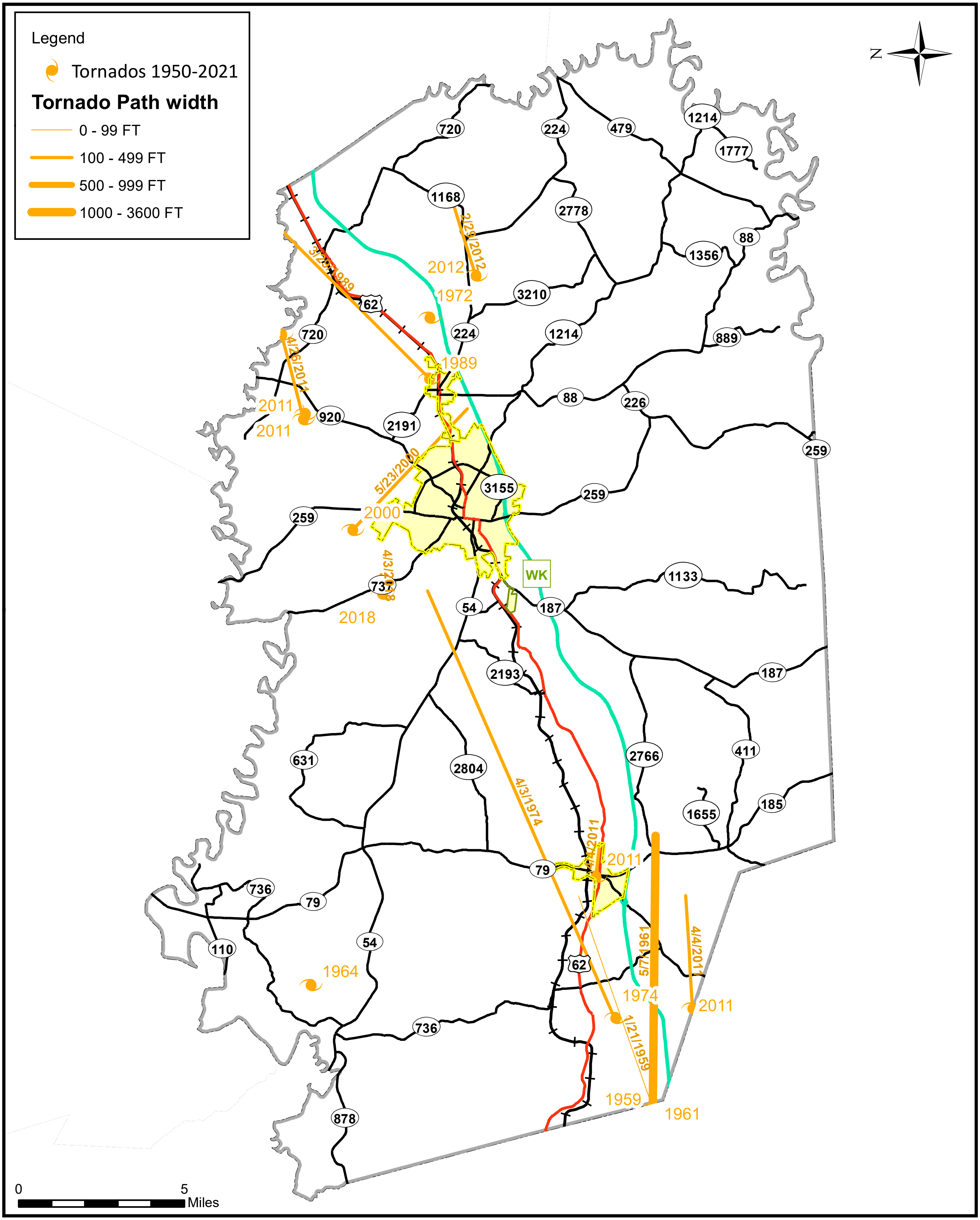


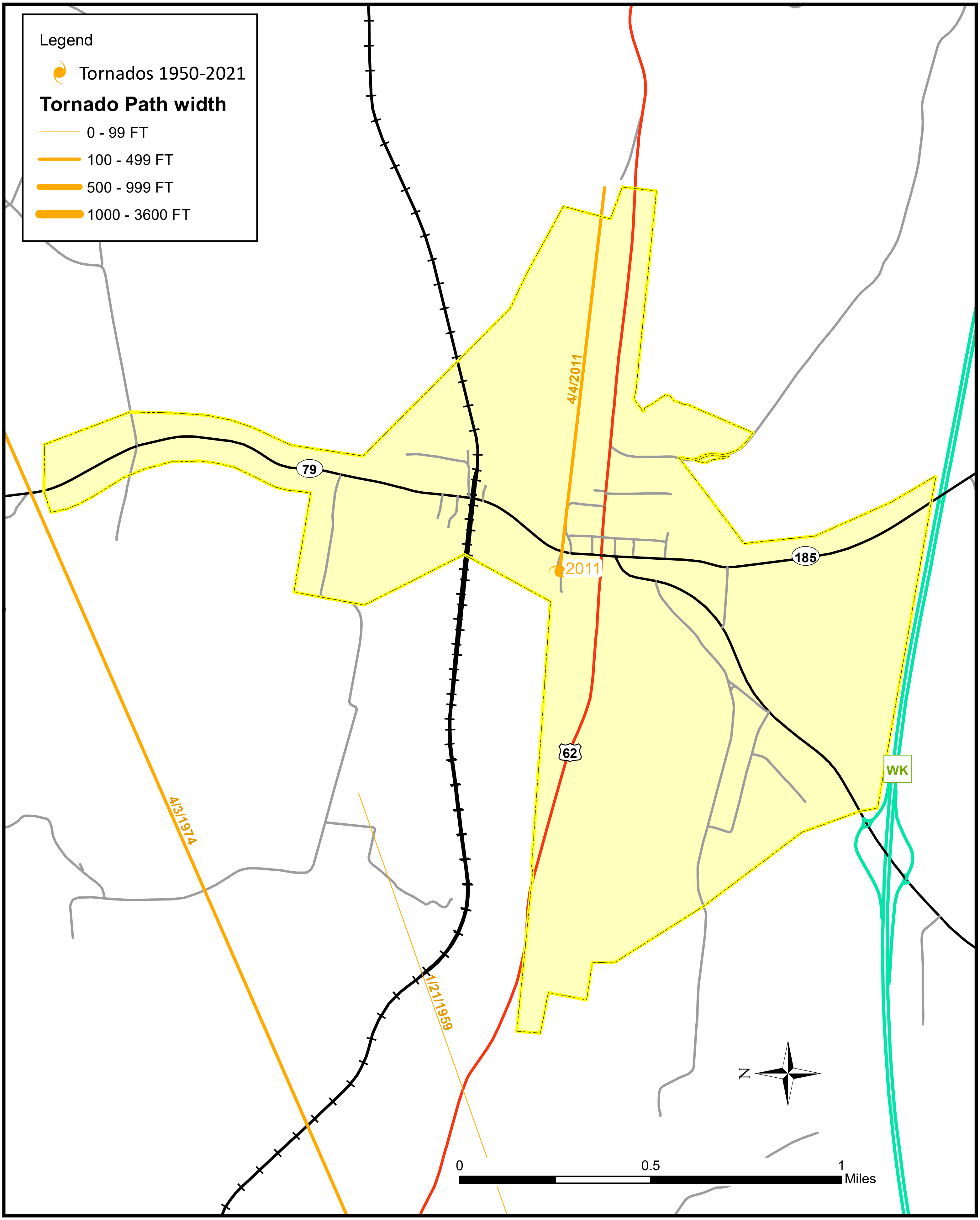

Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
259
261
4/3/1974
60
992
1616
12/6/2004
N
0
0.5
1
Miles

GRAYSON

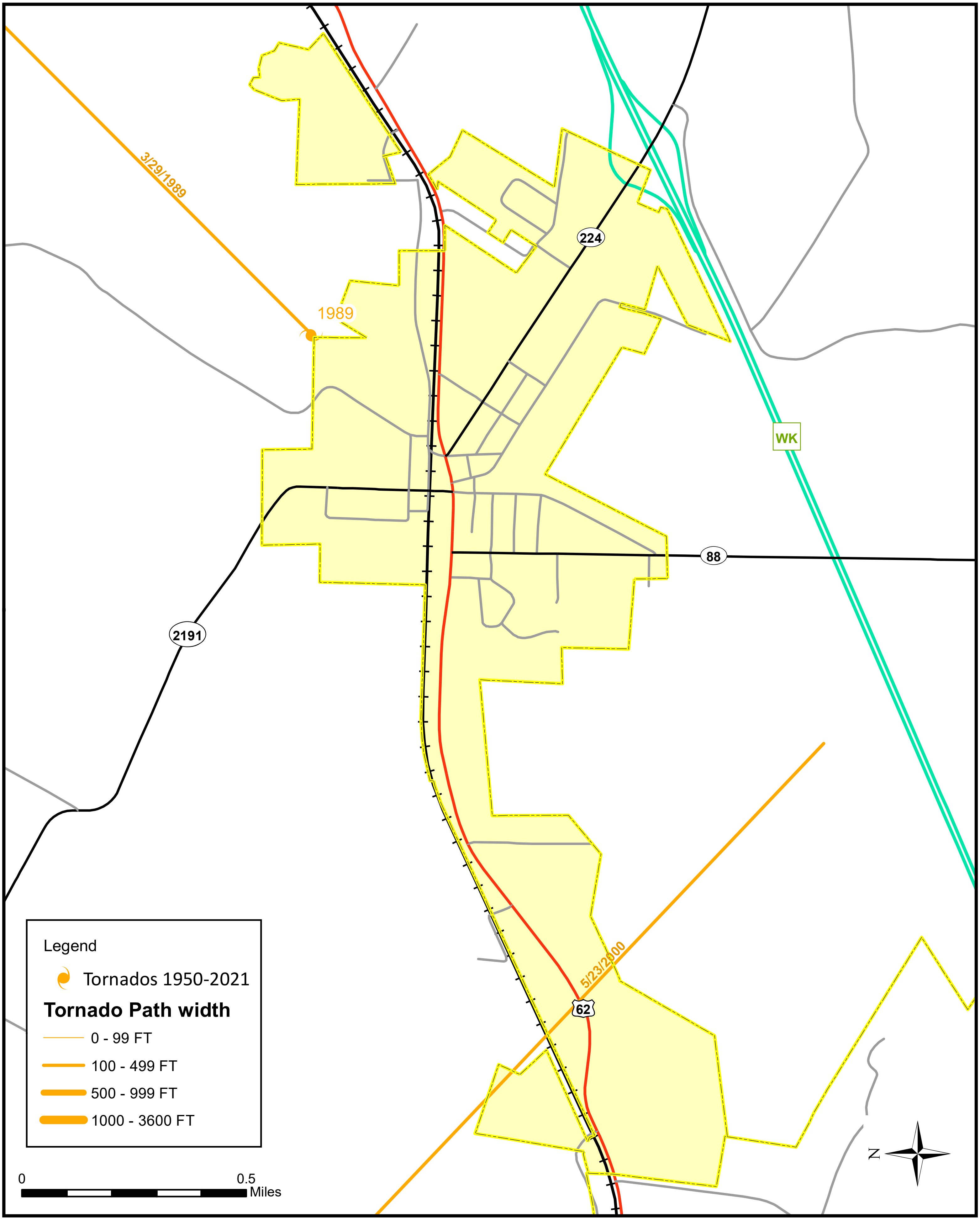
LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE	CROP DAMAGE	F SCALE
LILAC	4/3/18	0	0	300000	0	EF1

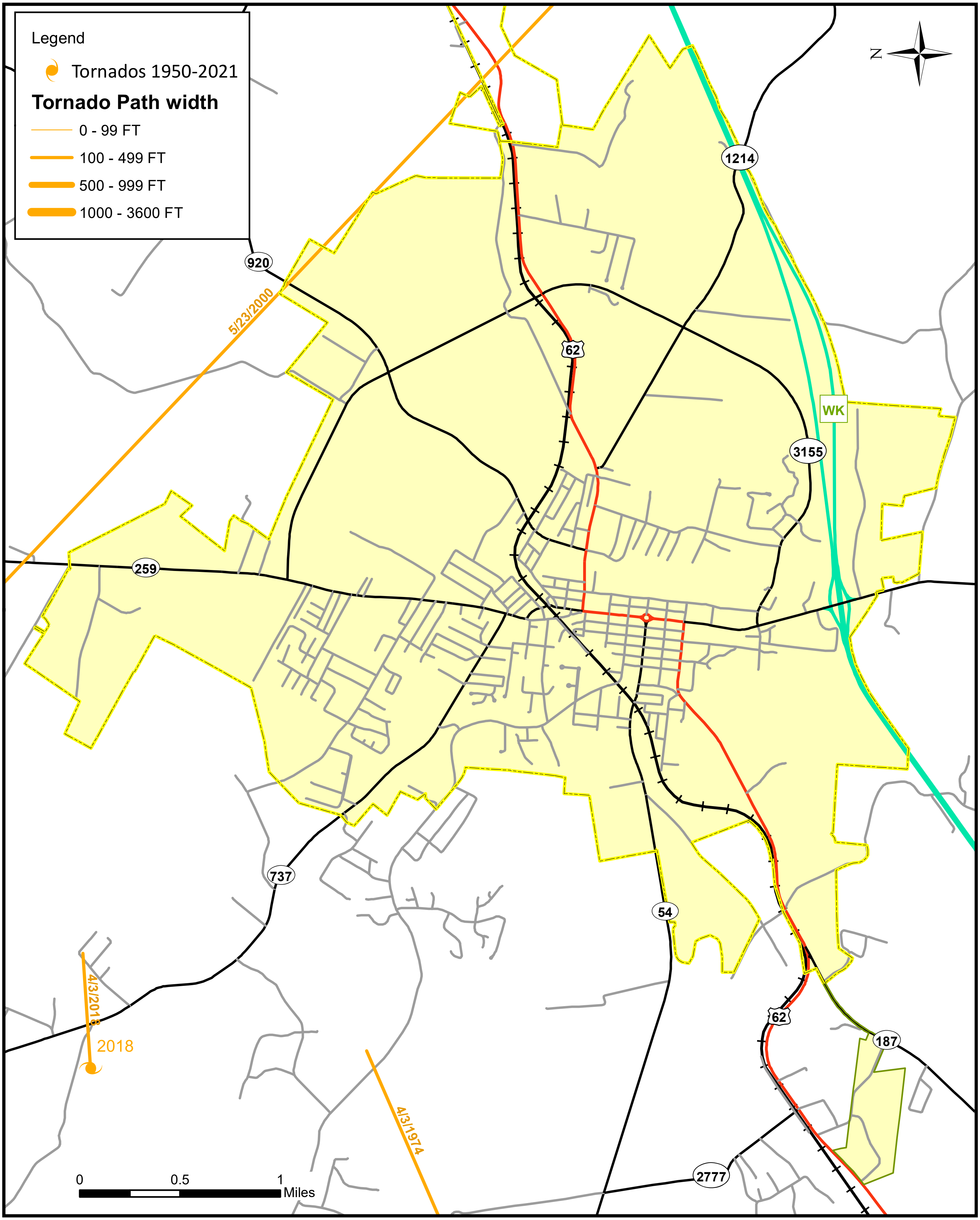
Cleanup in Grayson County after a residential garage was destroyed by a tornado in March 2021. *Source: National Weather Service Louisville*


Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
N
3/27/1989
2/29/2012
2012
1972
1989
4/26/2011
2011
2011
5/23/2000
2000
4/3/2018
2018
4/3/1974
2011
2011
5/7/1961
4/4/2011
1974
2011
1964
1/21/1959
1959
1961
WK
720
224
479
1214
1777
1168
2778
88
1356
3210
62
224
1214
889
720
88
226
920
2191
259
3155
259
259
737
1133
54
187
2193
187
631
2804
2766
411
1655
185
79
736
79
110
54
62
736
878
0
5
Miles


Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
4/4/2011
2011
79
185
62
WK
4/3/1974
1/21/1959
N
0
0.5
1
Miles

CLARKSON
TORNADO

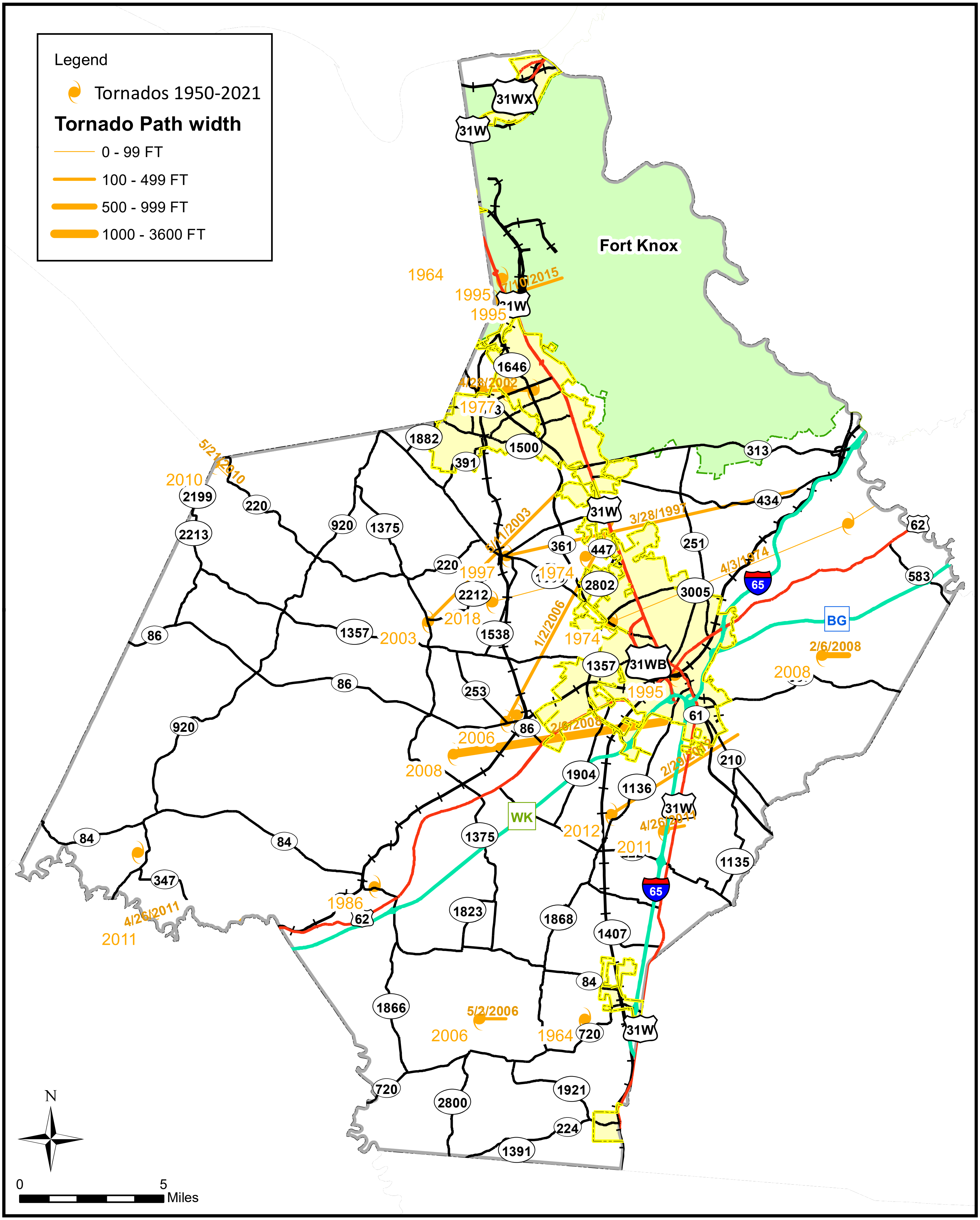


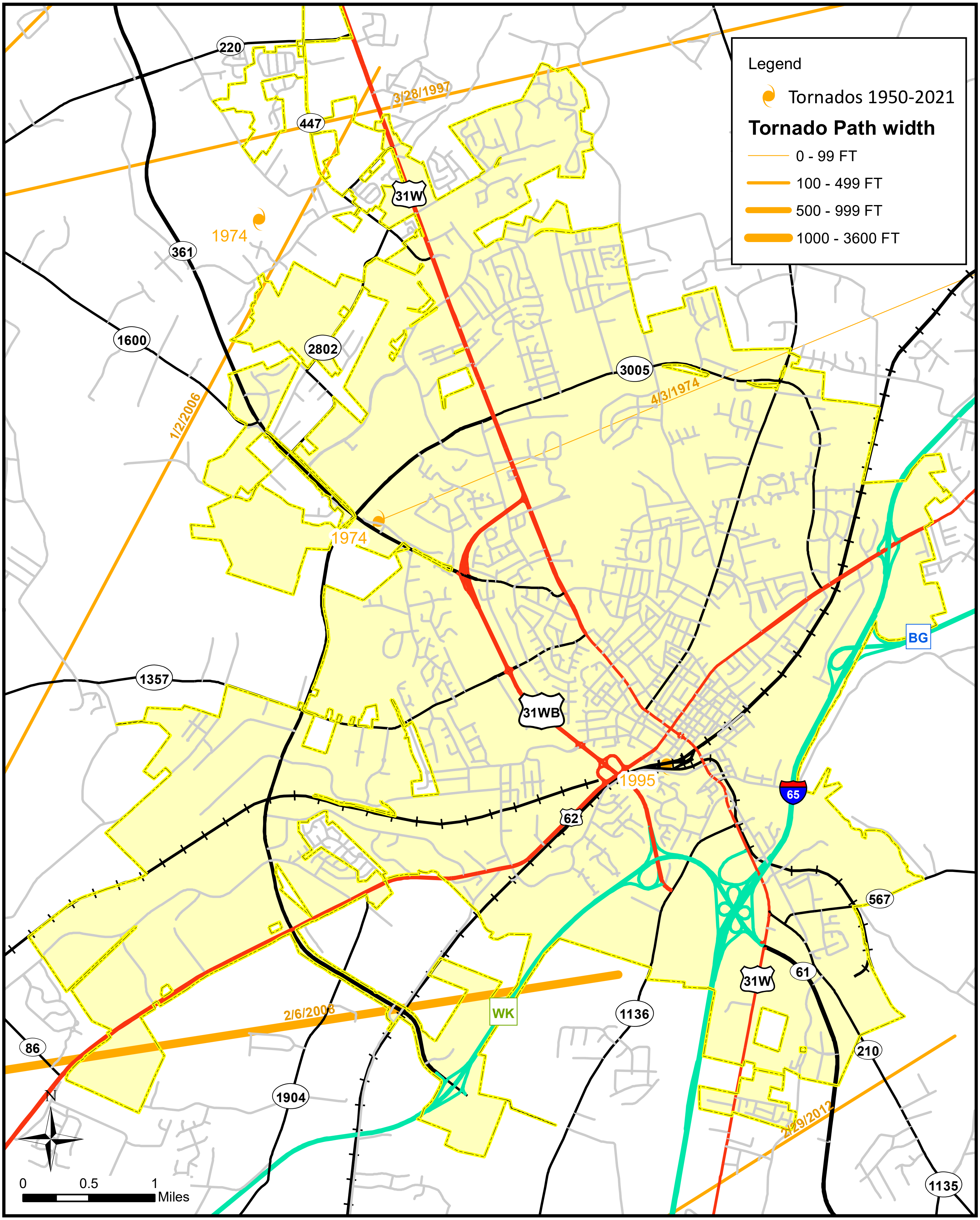

Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
N
5/23/2000
4/3/2018
2018
4/3/1974
920
1214
62
259
3155
WK
737
54
187
2777
0
0.5
1
Miles

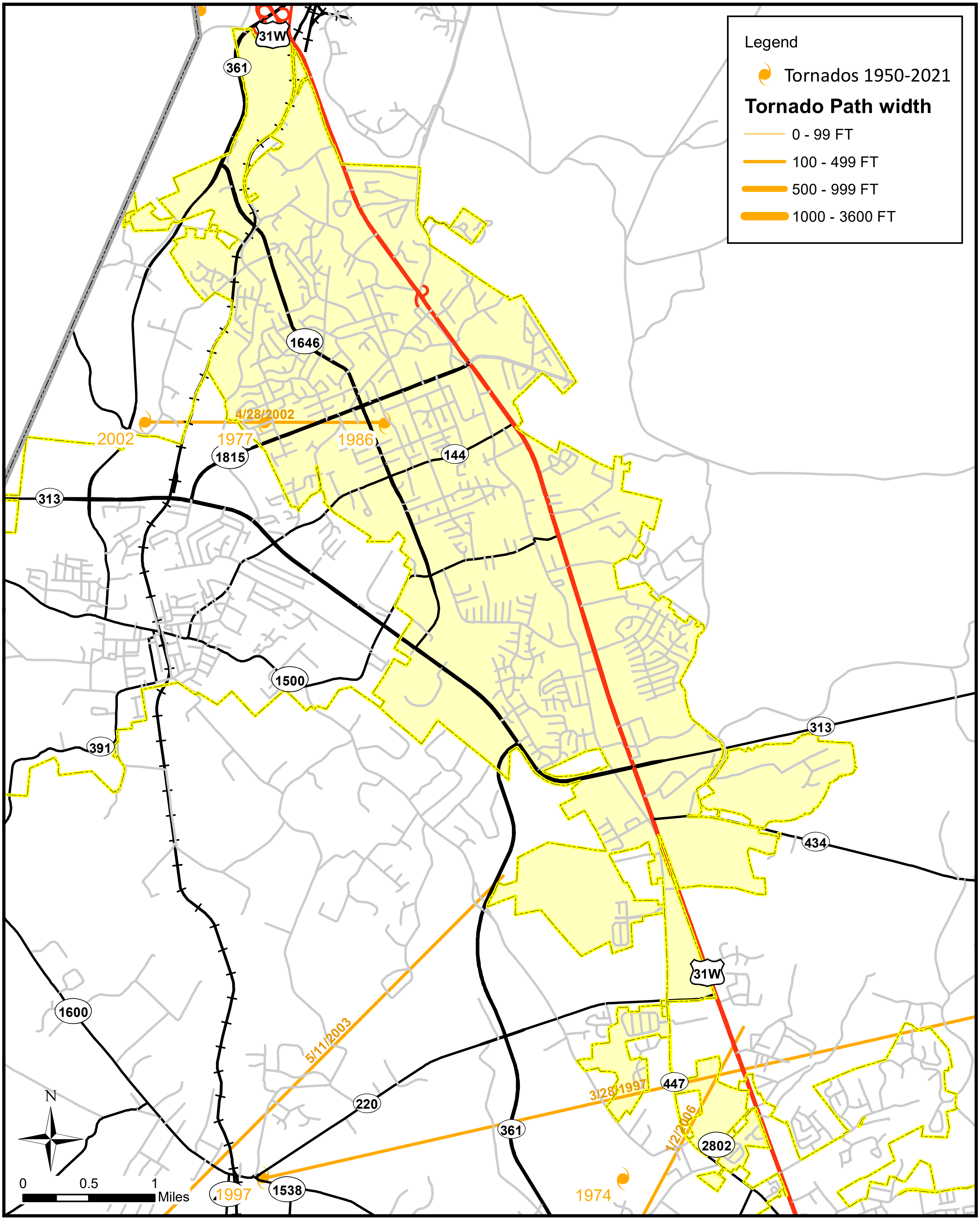
HARDIN

LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE	CROP DAMAGE	F SCALE
PRICHARD PLACE	7/10/15	0	0	25000	0	EF0
KRAFT	10/31/18	0	0	500000	0	EF1

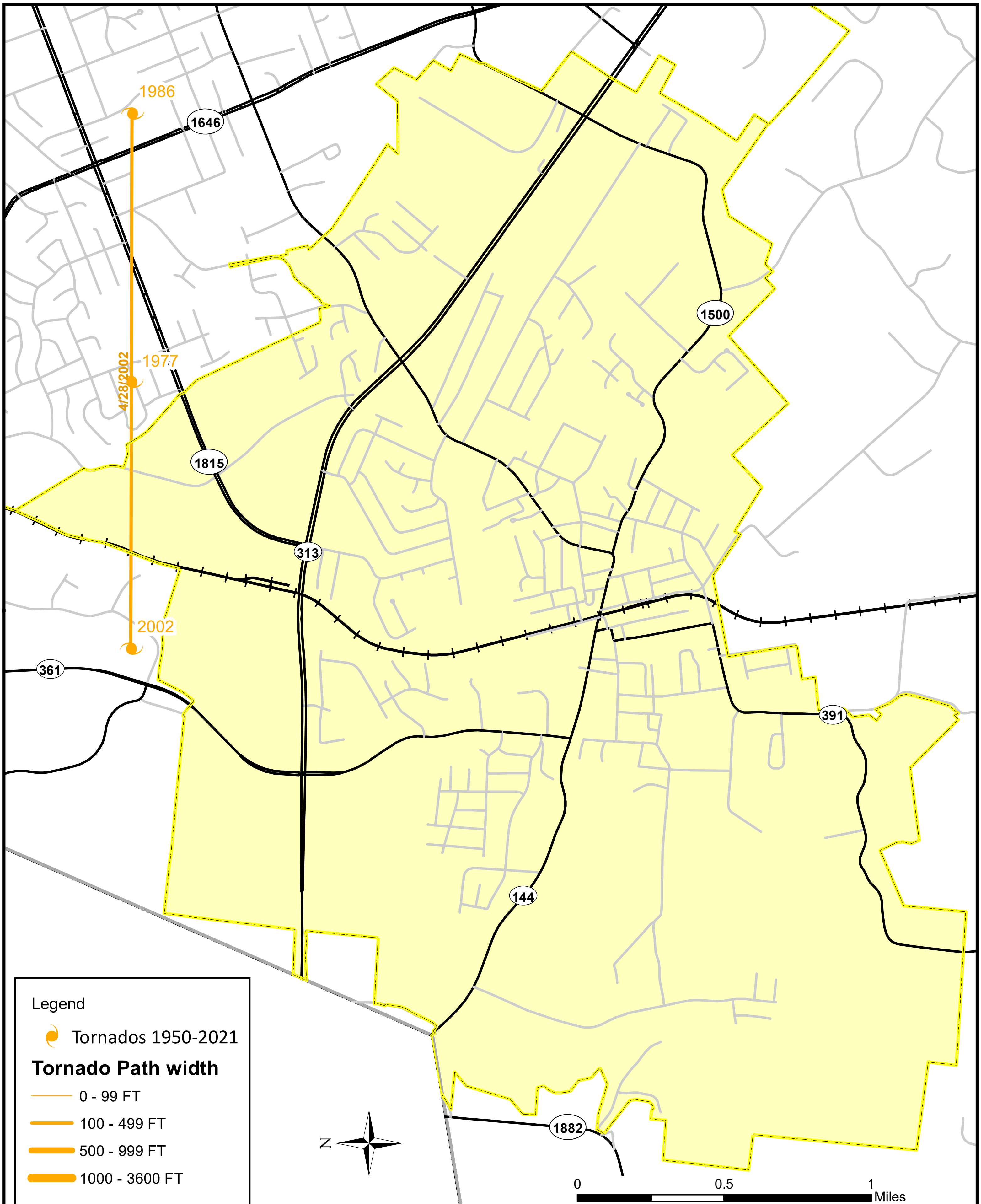
Building debris from an October 2018 tornado in Hardin County. *Source: The News Enterprise*


Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
Fort Knox
N
0
5
Miles


Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
220
447
31W
3/28/1997
1974
361
1600
2802
3005
4/3/1974
1/2/2006
1974
1357
31WB
1995
62
65
BG
567
61
31W
WK
2/6/2008
1136
210
86
1904
2/29/2012
1135
N
0
0.5
1
Miles


Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
31W
361
1646
1815
144
313
1500
391
434
1600
220
447
2802
1538
4/28/2002
2002
1977
1986
5/11/2003
3/28/1997
1/2/2006
1997
1974
N
0
0.5
1
Miles

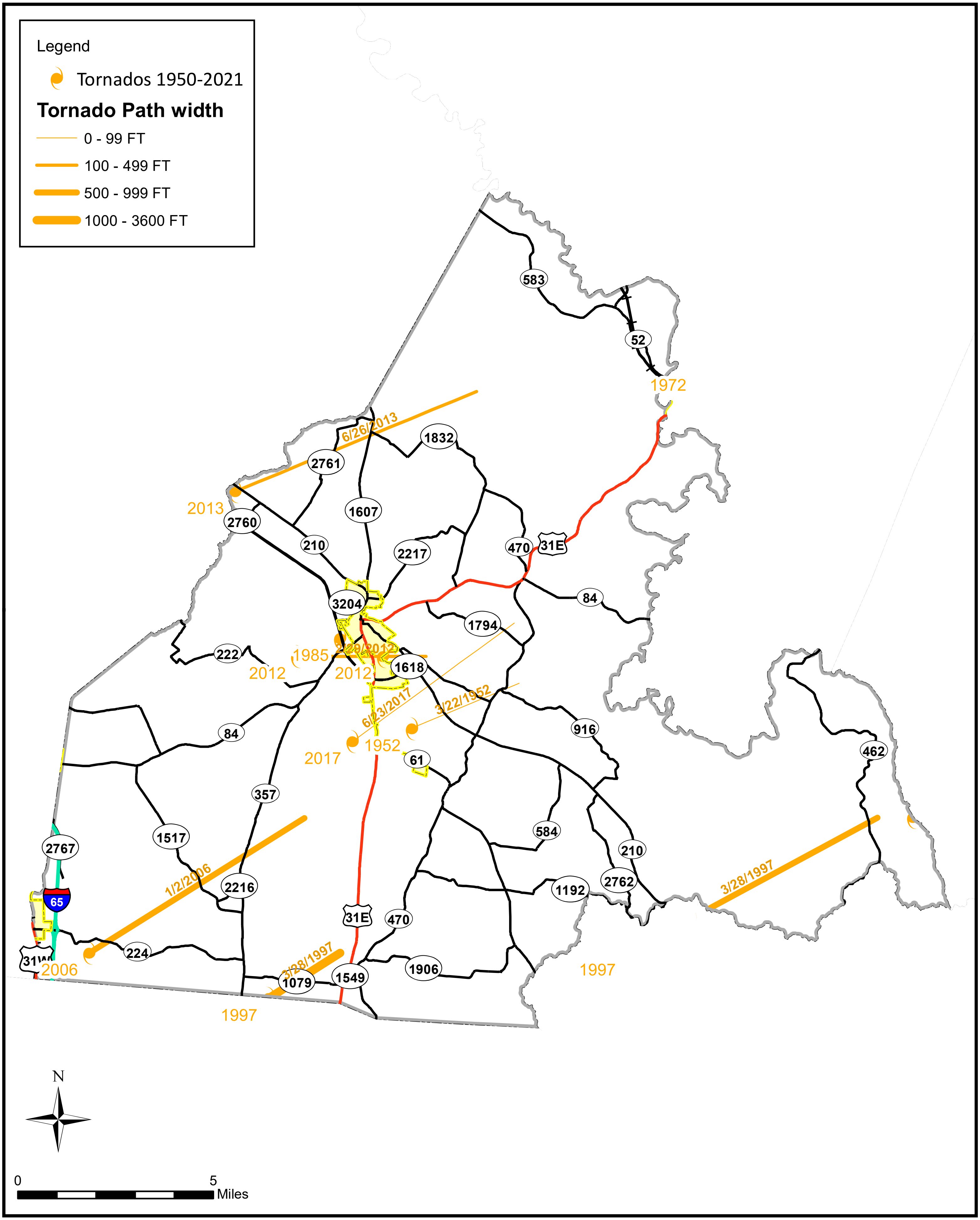
VINE GROVE
TORNADO



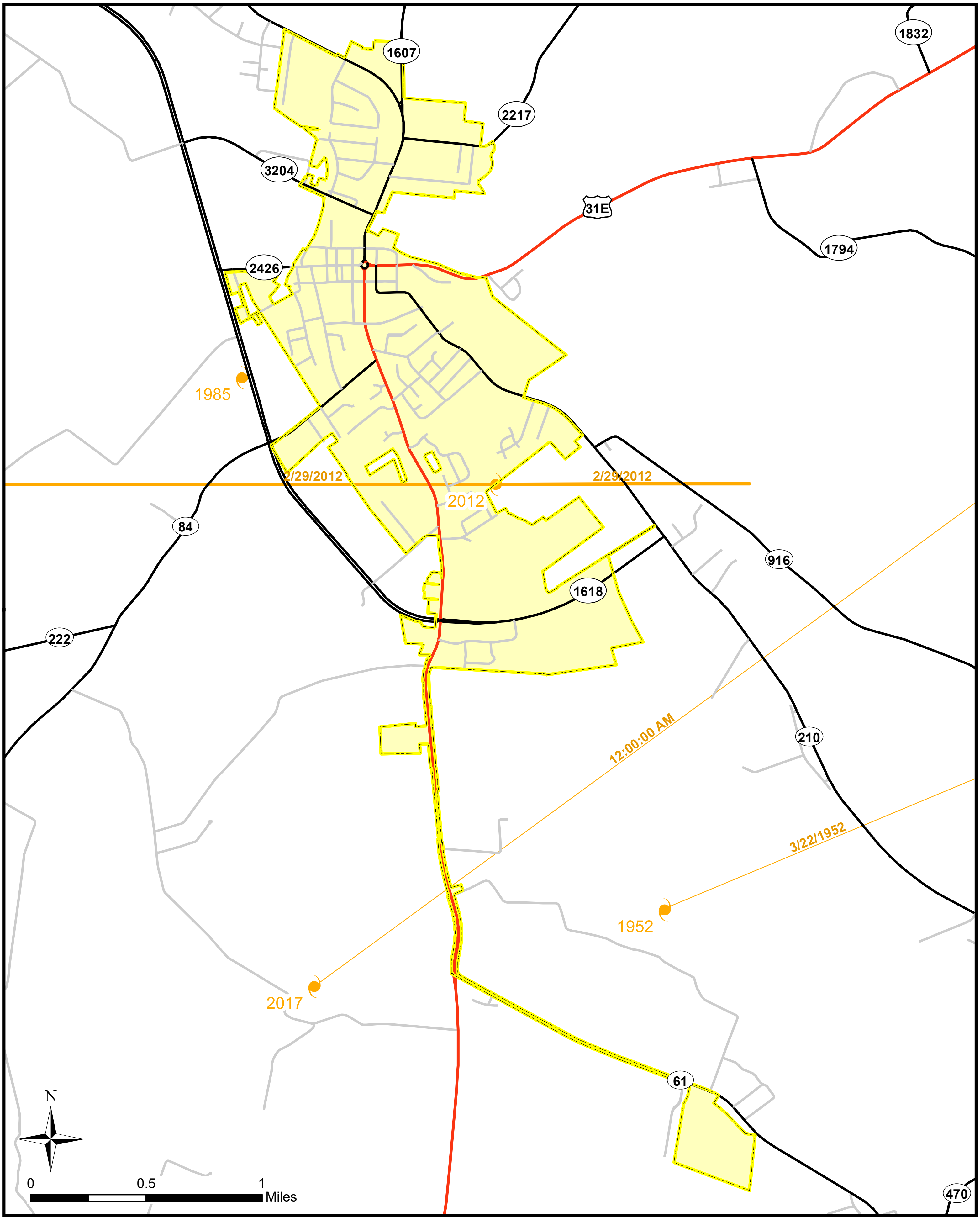
LARUE

LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE	CROP DAMAGE	F SCALE
MATHERS MILL	6/23/17	0	0	100000	0	EF1

Property damage in LaRue County from March 2021 tornado. *Source: Wave 3 News*


Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
583
52
1972
6/26/2013
1832
2761
2013
1607
2760
210
2217
470
31E
84
3204
1794
222
1985
2/29/2012
2012
2012
1618
6/23/2017
3/22/1952
916
84
2017
1952
61
462
357
1517
2767
584
210
1/2/2006
2216
2762
1192
3/28/1997
65
31E
470
224
31W
2006
1906
3/28/1997
1079
1549
1997
1997
N
0
5
Miles

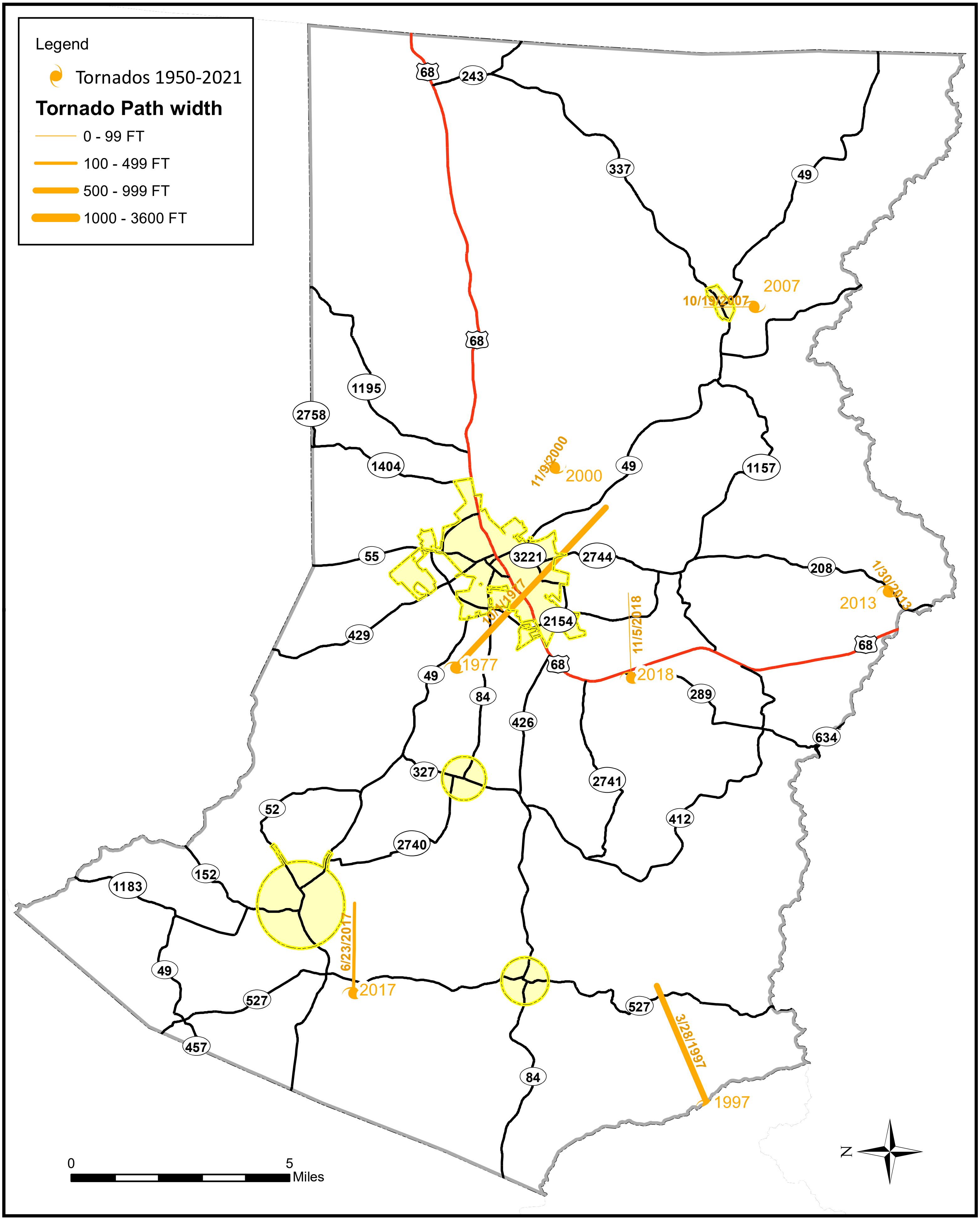
HODGENVILLE
TORNADO

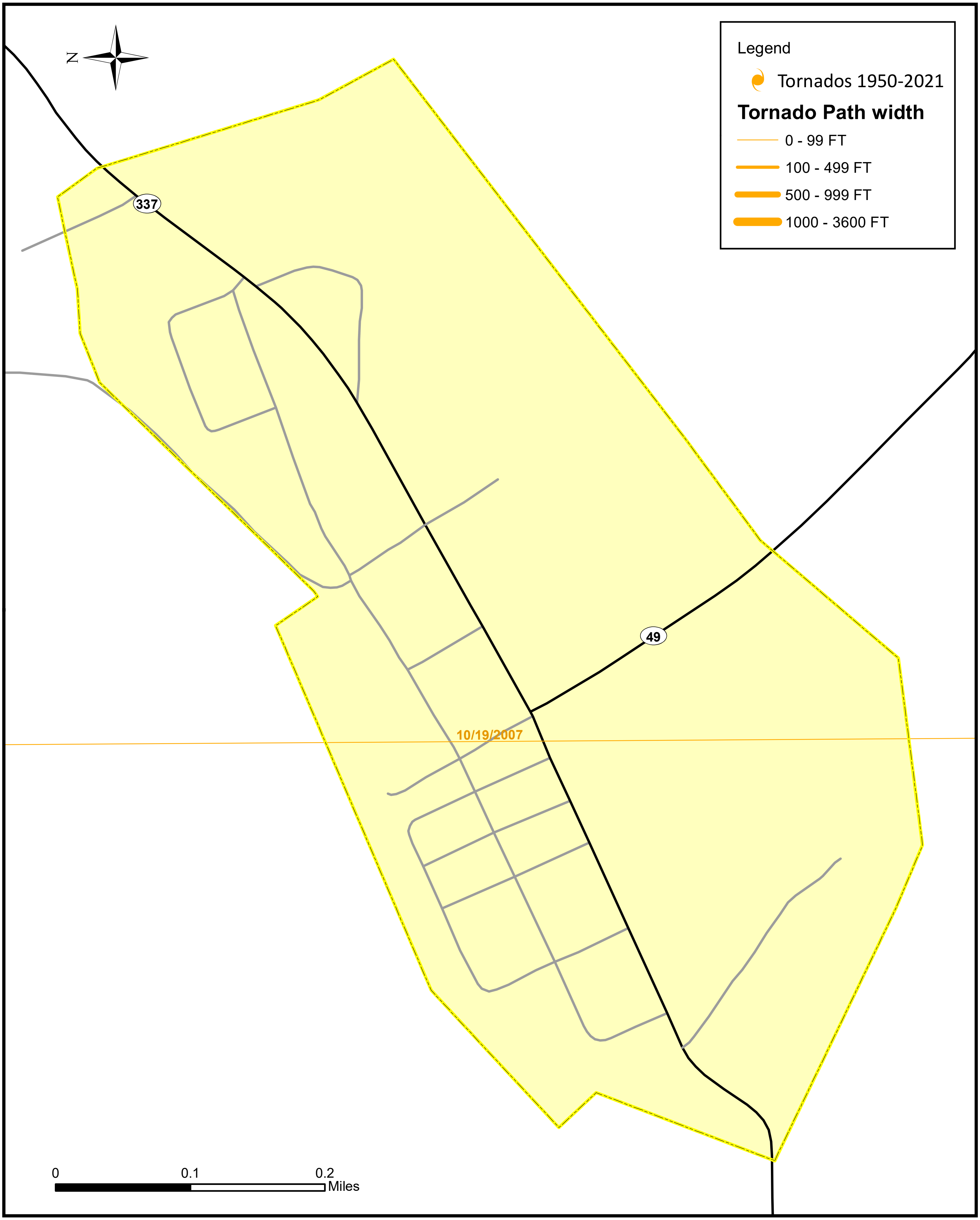


MARION

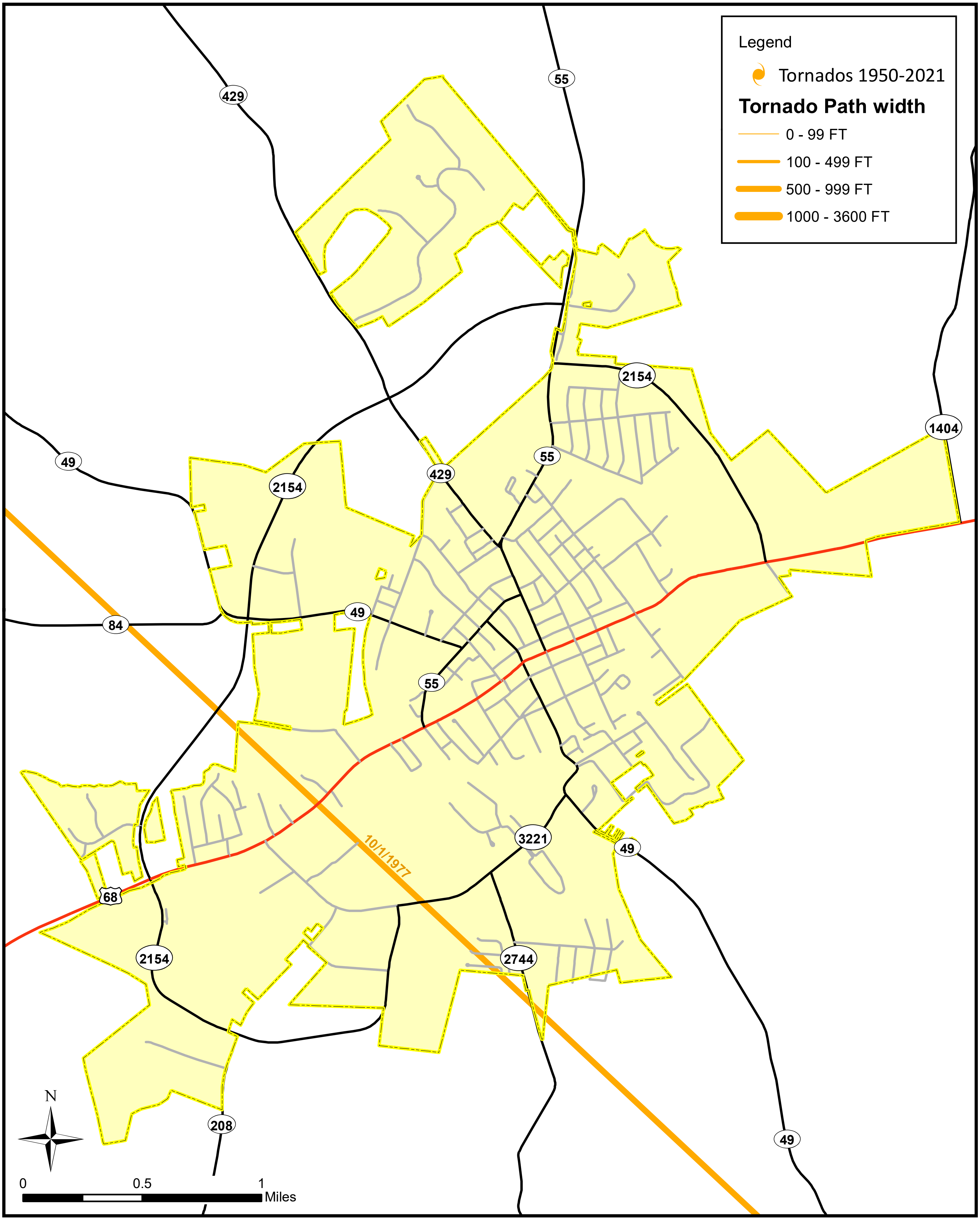
LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE	CROP DAMAGE	F SCALE
ST FRANCIS	6/23/17	0	0	150000	0	EF1
BELLTOWN	11/5/18	0	0	35000	0	EF0

Structure damage at the Lebanon-Springfield Airport due to strong winds and damage to trees at a residential property due to a June 2017 tornado. *Source: The Lebanon Enterprise*


Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
10/19/2007
2007
11/9/2000
2000
10/1/1977
1977
11/5/2018
2018
1/30/2013
2013
6/23/2017
2017
3/28/1997
1997
68
243
337
49
1195
2758
1404
1157
55
3221
2744
208
429
2154
84
426
289
634
327
2741
52
412
2740
152
1183
527
457
0
5
Miles
N

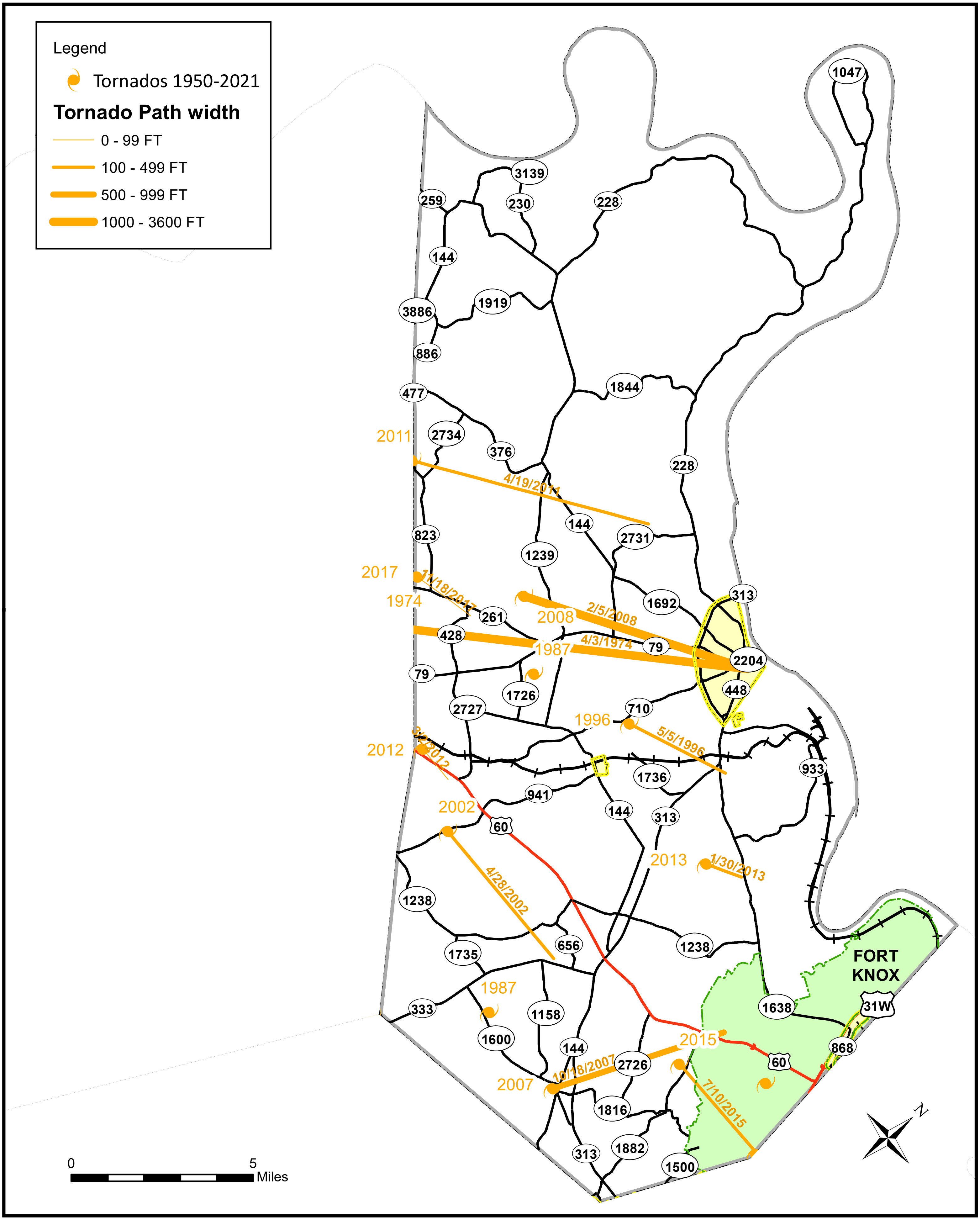

N
Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
337
49
10/19/2007
0
0.1
0.2
Miles

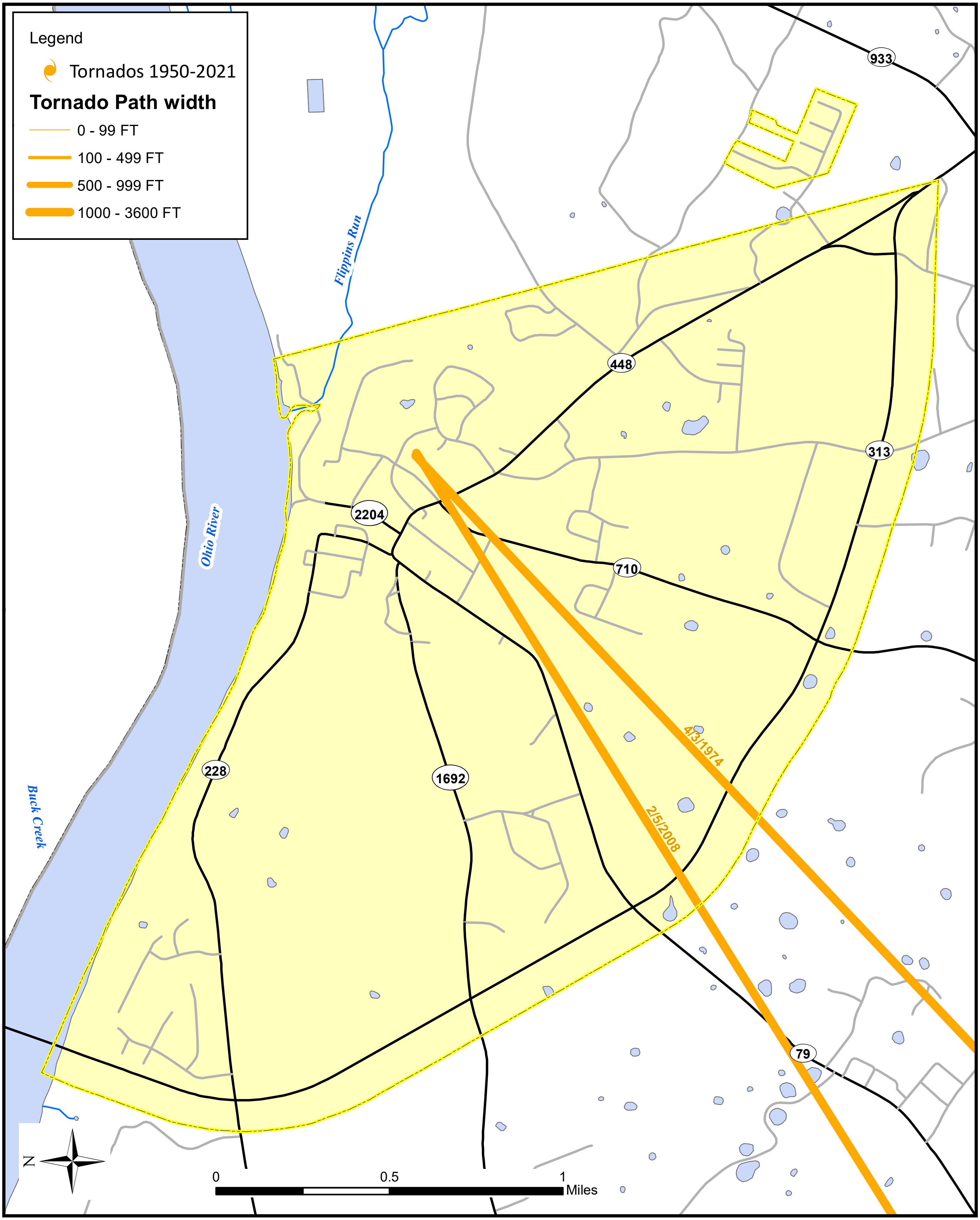
LEBANON
TORNADO



MEADE

LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE	CROP DAMAGE	F SCALE
COBURG	7/10/15	0	0	0	0	EF0
HAYSVILLE	11/18/17	0	1	200000	0	EF1

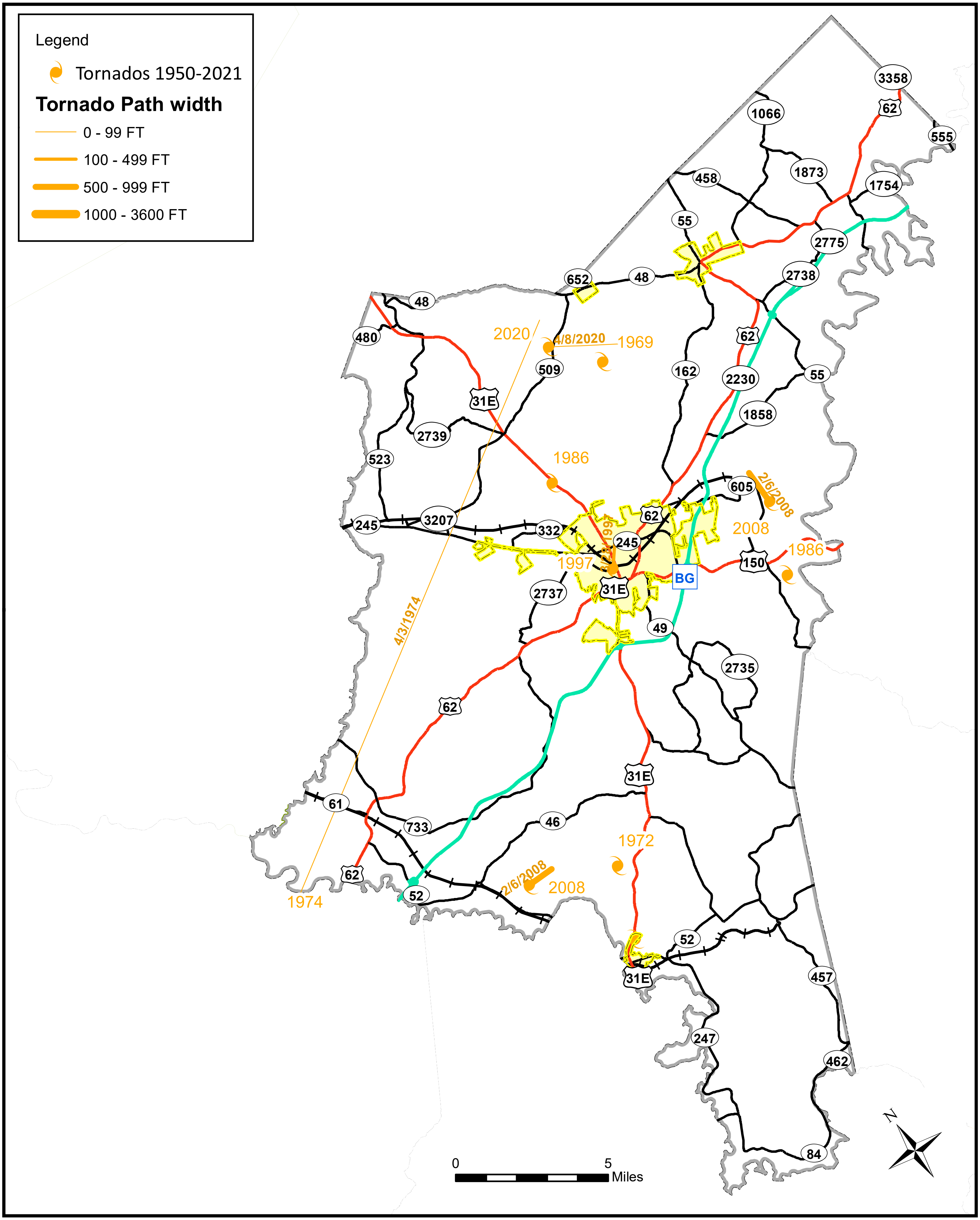

Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
2011
4/19/2011
2017
11/18/2017
1974
4/3/1974
2008
2/5/2008
1987
1996
5/5/1996
2012
3/2/2012
2002
4/28/2002
2013
1/30/2013
2015
7/10/2015
2007
10/18/2007
FORT KNOX
0
5
Miles
N

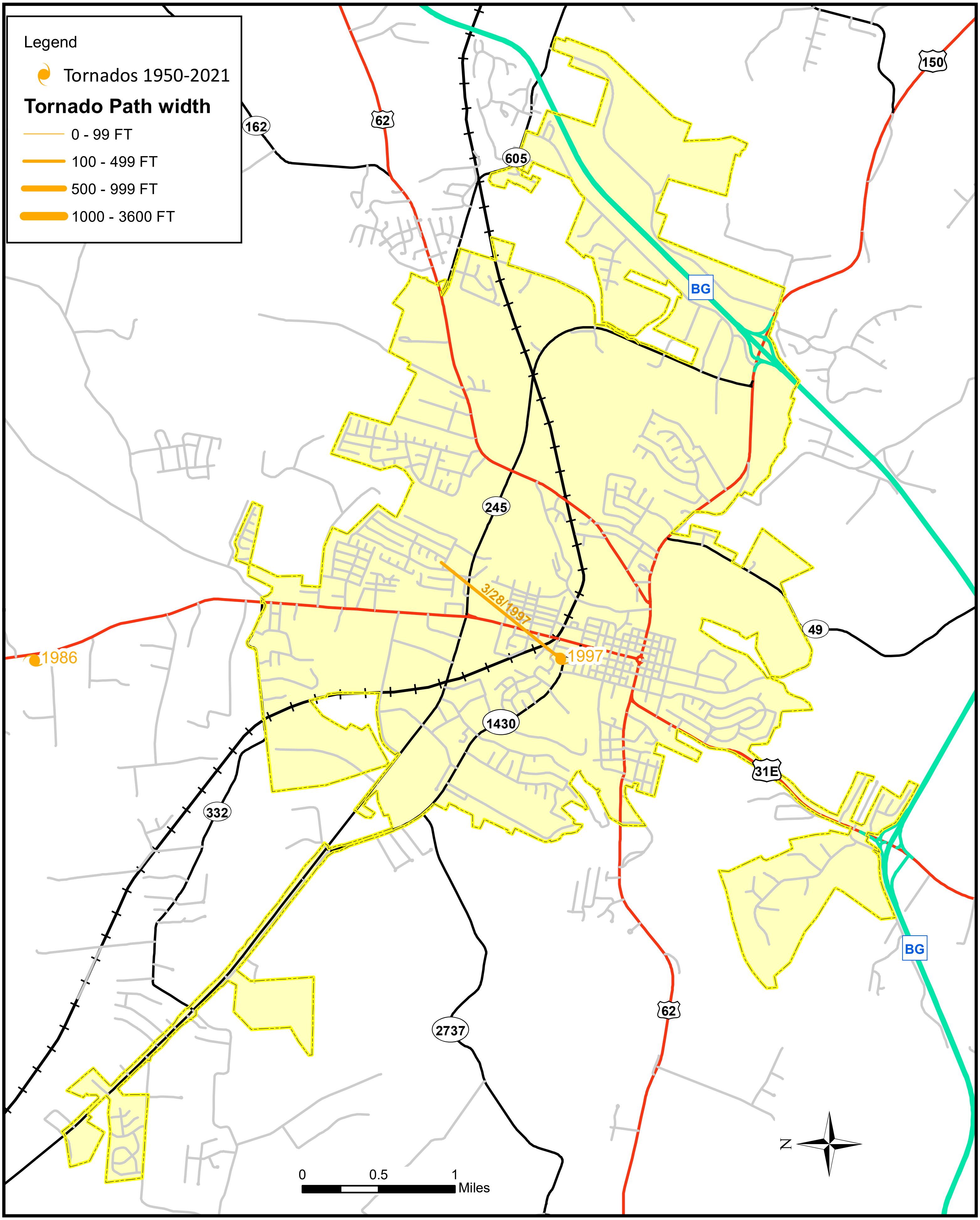

Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
Flippins Run
Ohio River
Buck Creek
933
448
313
2204
710
228
1692
79
4/3/1974
2/5/2008
N
0
0.5
1
Miles

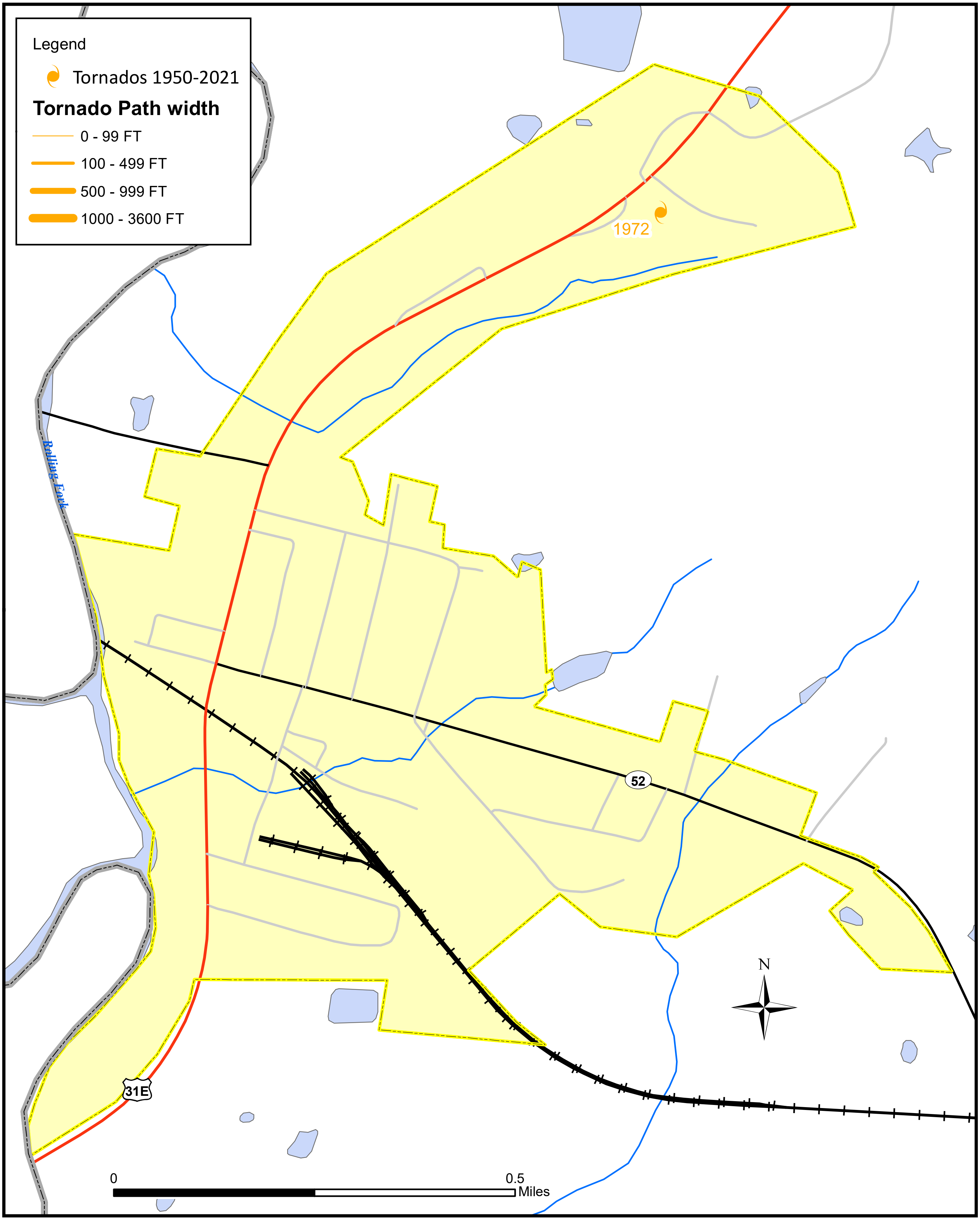
NELSON

LOCATION	DATE	DEATHS DIRECT	INJURIES DIRECT	PROPERTY DAMAGE	CROP DAMAGE	F SCALE
FAIRFIELD	4/8/20	0	0	200000	0	EF1

Damage from a Nelson County barn from an April 2020 tornado. *Source Nelson County Gazette.*

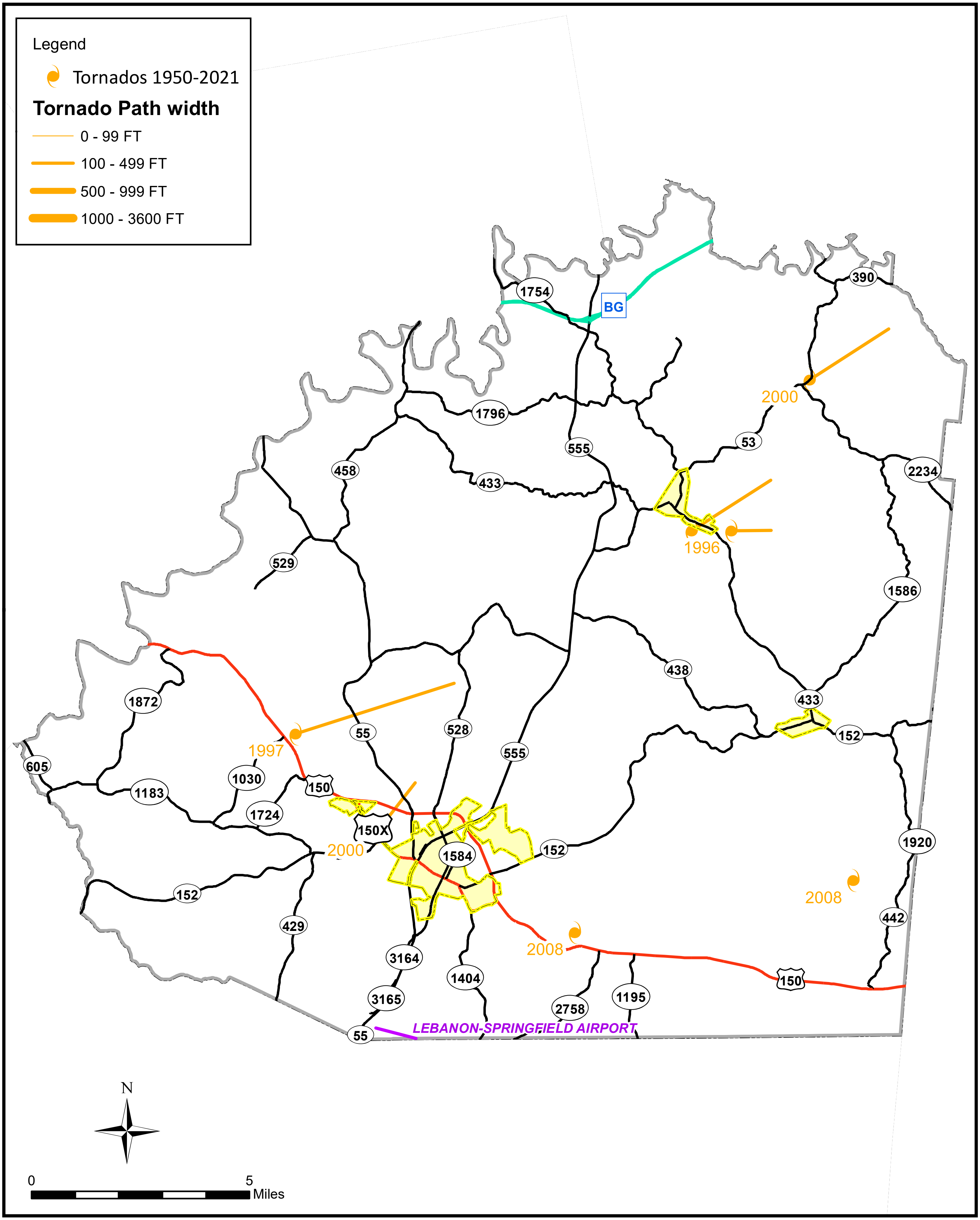

Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
2020
4/8/2020
1969
1986
2008
2/6/2008
1986
1997
4/3/1974
1974
1972
2/6/2008
2008
BG
0
5
Miles

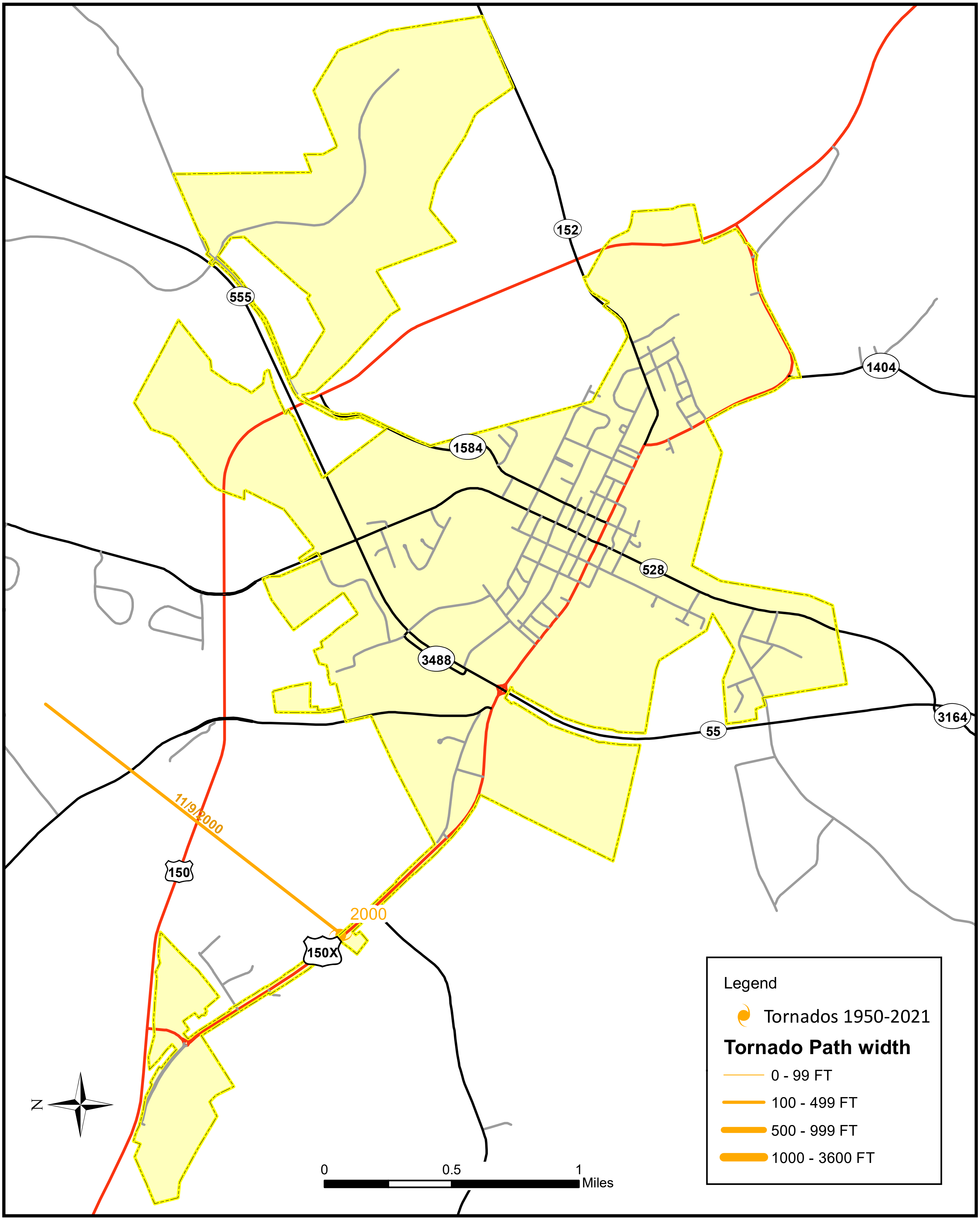

Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
162
62
605
150
BG
245
49
1430
31E
332
2737
62
BG
3/28/1997
1997
1986
0
0.5
1
Miles
N


Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
1972
Rolling Fork
52
31E
N
0
0.5
Miles

WASHINGTON – No new events recorded from 1 July 2015 to May 14, 2021

WASHINGTON COUNTY
TORNADOS




152
555
1404
1584
528
3488
3164
55
11/9/2000
150
2000
150X
Legend
Tornados 1950-2021
Tornado Path width
0 - 99 FT
100 - 499 FT
500 - 999 FT
1000 - 3600 FT
N
0
0.5
1
Miles

WILLISBURG
TORNADO

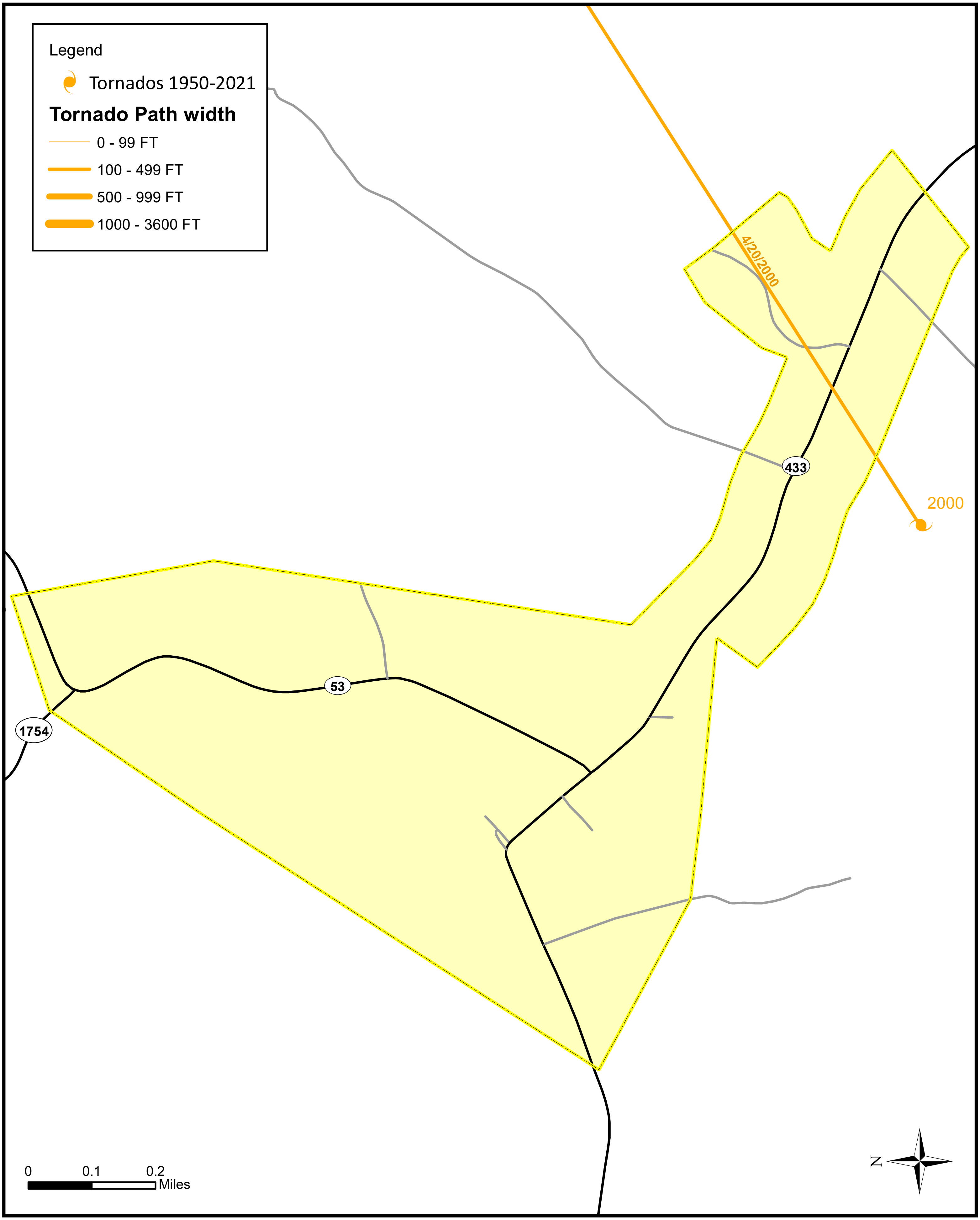


Table 3.3.2.2.4 - Summary of Tornado Data, Costs

TORNADOS	Total Cost	Number Events	Number Years	Total Loss of Life	Total Injuries	Average Cost Per Year	Average Cost Per Event	Average Loss of Life Per Year	Average Loss of Life Per Event	Average Injuries Per Year	Average Injuries Per Event
BRECKINRIDGE	$5,285,260	17	61.5	1.09	20.00	$85,939	$310,898	0.02	0.06	0.33	1.18
Cloverport	$900,000	2	61.5	1.00	7.00	$14,634	$450,000	0.02	0.50	0.11	3.50
Hardinsburg	$100,000	2	61.5	0.00	0.00	$1,626	$50,000	0.00	0.00	0.00	0.00
Irvington	$0	0	61.5	0.00	0.00	$0	na	0.00	na	0.00	na
GRAYSON	$56,783,213	16	62.5	3.00	23.09	$908,531	$3,548,951	0.05	0.19	0.37	1.44
Caneyville	$0	1	62.5	0.00	0.00	$0	na	0.00	na	0.00	na
Clarkson	$0	0	62.5	0.00	0.00	$0	na	0.00	na	0.00	na
Leitchfield	$50,000,000	1	62.5	0.00	16.00	$800,000	$50,000,000	0.00	0.00	0.26	16.00
HARDIN	$16,643,723	26	61.5	2.00	73.09	$270,630	$640,143	0.03	0.08	1.19	2.81
Elizabethtown	$0	0	61.5	0.00	0.00	$0	na	0.00	na	0.00	na
Radcliff	$650,000	2	61.5	0.00	0.00	$10,569	$325,000	0.00	0.00	0.00	0.00
Sonora	$0	0	61.5	0.00	0.00	$0	na	0.00	na	0.00	na
Upton	$0	0	61.5	0.00	0.00	$0	na	0.00	na	0.00	na
Vine Grove	$0	0	61.5	0.00	0.00	$0	na	0.00	na	0.00	na
West Point	$0	0	61.5	0.00	0.00	$0	na	0.00	na	0.00	na
LARUE	$5,210,111	12	69.5	0.00	19.12	$74,966	$434,176	0.00	0.00	0.28	1.59
Hodgenville	$220,000	2	69.5	0.00	0.00	$3,165	na	0.00	na	0.00	na
MARION	$920,833	13	61.5	0.00	4.15	$14,973	$70,833	0.00	0.00	0.07	0.32
Bradfordsville	$100,000	1	61.5	0.00	0.00	$1,626	$100,000	0.00	0.00	0.00	0.00
Lebanon	$100,000	1	61.5	0.00	0.00	$1,626	$100,000	0.00	0.00	0.00	0.00
Loretto	$0	0	61.5	0.00	0.00	$0	na	0.00	na	0.00	na
Raywick	$0	0	61.5	0.00	0.00	$0	na	0.00	na	0.00	na
MEADE	$6,342,324	14	61.5	31.00	268.07	$103,127	$453,023	0.50	2.21	4.36	19.15
Brandenburg	$0	0	61.5	0.00	0.00	$0	na	0.00	na	0.00	na
Ekron	$500,000	1	61.5	0.00	10.00	$8,130	$500,000	0.00	0.00	0.16	10.00
Muldraugh	$0	0	61.5	0.00	0.00	$0	na	0.00	na	0.00	na
NELSON	$2,233,978	14	61.5	1.00	28.15	$36,325	$159,570	0.02	0.07	0.46	2.01
Bardstown	$50,000	1	61.5	0.00	0.00	$813	$50,000	0.00	0.00	0.00	0.00
Bloomfield	$0	0	61.5	0.00	0.00	$0	na	0.00	na	0.00	na
Fairfield	$200,000	1	61.5	0.00	0.00	$3,252	na	0.00	na	0.00	na
New Haven	$0	0	61.5	0.00	0.00	$0	na	0.00	na	0.00	na
WASHINGTON	$1,840,007	11	61.5	0.00	5.15	$29,919	$167,273	0.00	0.00	0.08	0.47
Mackville	$0	0	61.5	0.00	0.00	$0	na	0.00	na	0.00	na
Springfield	$15,000	1	61.5	0.00	0.00	$244	$15,000	0.00	0.00	0.00	0.00
Willisburg	$70,000	2	60.5	0.00	4.00	$1,157	$35,000	0.00	0.00	0.07	2.00
LTADD	$95,259,449	123	63	38.09	440.82	$1,521,109	$774,467	0.61	0.31	7.04	3.58

NOTE: The historic frequency of a hazard event over a given period of time determines the historic recurrence interval. For example: If there have been 10 Thunderstorm events in the County in the past 5 years, statistically you could expect that there will be 2 events a year.

Realize that from a statistical standpoint, there are several variables to consider. 1) Accurate hazard history data and collection are crucial to an accurate recurrence interval and frequency. 2) Data collection and accuracy has been much better in the past 10-20 years (NCDC weather records). 3) It is important to include all significant recorded hazard events which will include periodic updates to this table.

By updating and reviewing this table over time, it may be possible to see if certain types of hazard events are increasing in the past 10-20 years.

These values should be considered low. More events that have occurred than are documented by the sources used in this table.

All data is compiled at the county level due to extremely limited city specific data, therefore all data and analysis represents incorporated and unincorporated areas inclusively.

Compilation of SHELDUS, NCDC & NCEI. 1967- June 30, 2015.

Table 3.3.2.2.5 - Summary of Tornado Data, Events

TORNADOS	Number of Events in Historic Record	Number of Years in Historic Record	Number of Events in Past 10 Years	Number of Events in Past 20 Years	Number of Events in Past 50 Years	Historic Recurrence Interval (years)	Historic Frequency % chance/year	Past 10 Year Record Frequency Per Year	Past 20 Year Record Frequency Per Year	Past 50 Year Record Frequency Per Year
BRECKINRIDGE	17	61.5	8	11	14	3.62	27.64%	0.8	0.55	0.28
Cloverport	2	61.5	1	2	2	30.75	3.25%	0.1	0.1	0.04
Hardinsburg	2	61.5	1	2	2	30.75	3.25%	0.1	0.1	0.04
Irvington	0	61.5	0	0	0	0.00	0.00%	0	0	0
GRAYSON	16	62.5	6	7	5	3.91	25.60%	0.6	0.35	0.1
Caneyville	1	62.5	1	1	1	62.50	1.60%	0.1	0.05	0.02
Clarkson	0	62.5	0	0	0	0.00	0.00%	0	0	0
Leitchfield	1	62.5	0	1	1	62.50	1.60%	0	0.05	0.02
HARDIN	26	61.5	10	13	19	2.37	42.28%	1	0.65	0.38
Elizabethtown	0	61.5	0	0	0	0.00	0.00%	0	0	0
Radcliff	2	61.5	0	1	2	30.75	3.25%	0	0.05	0.04
Sonora	0	61.5	0	0	0	0.00	0.00%	0	0	0
Upton	0	61.5	0	0	0	0.00	0.00%	0	0	0
Vine Grove	0	61.5	0	0	0	0.00	0.00%	0	0	0
West Point	0	61.5	0	0	0	0.00	0.00%	0	0	0
LARUE	12	69.5	5	7	7	5.79	17.27%	0.5	0.35	0.14
Hodgenville	2	69.5	0	0	0	34.75	2.88%	0	0	0
MARION	13	61.5	4	6	5	4.73	21.14%	0.4	0.3	0.1
Bradfordsville	1	61.5	1	1	1	61.50	1.63%	0.1	0.05	0.02
Lebanon	1	61.5	0	1	1	61.50	1.63%	0	0.05	0.02
Loretto	0	61.5	0	0	0	0.00	0.00%	0	0	0
Raywick	0	61.5	0	0	0	0.00	0.00%	0	0	0
MEADE	14	61.5	7	9	10	4.39	22.76%	0.7	0.45	0.2
Brandenburg	0	61.5	0	0	0	0.00	0.00%	0	0	0
Ekron	1	61.5	0	1	1	61.50	1.63%	0	0.05	0.02
Muldraugh	0	61.5	0	0	0	0.00	0.00%	0	0	0
NELSON	14	61.5	3	4	9	4.39	22.76%	0.3	0.2	0.18
Bardstown	1	61.5	0	1	1	61.50	1.63%	0	0.05	0.02
Bloomfield	0	61.5	0	0	0	0.00	0.00%	0	0	0
Fairfield	1	61.5	1	1	1	61.50	1.63%	0.1	0.05	0.02
New Haven	0	61.5	0	0	0	0.00	0.00%	0	0	0
WASHINGTON	11	61.5	5	7	4	5.59	17.89%	0.5	0.35	0.08
Mackville	0	61.5	0	0	0	0.00	0.00%	0	0	0
Springfield	1	61.5	0	1	1	61.50	1.63%	0	0.05	0.02
Willisburg	2	61.5	1	2	2	30.75	3.25%	0.1	0.1	0.04
LTADD	123	63	48	64	73	0.51	196.41%	4.8	3.2	1.46

NOTE: The historic frequency of a hazard event over a given period of time determines the historic recurrence interval. For example: If there have been 10 Thunderstorm events in the County in the past 5 years, statistically you could expect that there will be 2 events a year.

Realize that from a statistical standpoint, there are several variables to consider. 1) Accurate hazard history data and collection are crucial to an accurate recurrence interval and frequency. 2) Data collection and accuracy has been much better in the past 10-20 years (NCDC weather records). 3) It is important to include all significant recorded hazard events which will include periodic updates to this table.

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Compilation of SHELDUS, NCDC & NCEI. 1967- June 30, 2015.

3.3.2.3 <u>Severe Thunderstorms</u>

I. Background

Definition: Thunderstorm. The National Oceanic and Atmospheric Administration (NOAA) defines a thunderstorm as "a rain shower during which you hear thunder. Since thunder comes from lightning, all thunderstorms have lightning."

Severe Thunderstorm: NOAA classifies a thunderstorm as severe "when it contains one or more of the following: hail one inch or greater, winds gusting in excess of 50 knots (57.5 mph), or a tornado."

Cause and Types of Thunderstorms

Three basic ingredients are necessary for a thunderstorm to form: moisture, rising unstable air (air that keeps rising when given a nudge), and a lifting mechanism to provide the "nudge." Lifts can form from fronts, sea breezes or mountains. Upward moving air is an updraft. Cooler air tends to sink and produces downdraft winds. Downdraft winds can result in one of four different storms: single cell, multicell cluster, multicell line, or supercell.

When sun heats the surface of the earth, it warms the air above the ground. If this warm air is forced to rise because of "bumping" into cooler or damper air, it will continue to rise for as long as it weighs less and remains warmer than the air around it. As the air rises, it transfers heat from the earth's surface to the upper levels of the atmosphere; a process known as convection. The water vapor in the air begins to cool, releases heat, condenses and forms a cloud. This cloud gradually grows upward into areas where the temperature is below freezing. These Cumulonimbus clouds are also known as "thunderhead" clouds and produce lightning.

As a storm rises into freezing air, ice particles can form and grow by condensing vapor and collecting smaller liquid drops that haven't yet frozen (a state called "supercooled"). When two ice particles collide, they usually bounce off each other, but one particle can rip off a little bit of ice from another and grab some electric charge. When lots of these collisions build up big areas of electric charges, it causes a bolt of lightning and creates sound waves that are heard as thunder.

Thunderstorms can occur year-round and at all hours and happen in every US state. However, they are most likely to occur in the spring and summer months and during the afternoon and evening hours. It is estimated that approximately 1,800 thunderstorms occur across our planet every day. About 100,000 thunderstorms occur in the U.S. each year.

A typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. All thunderstorms produce lightning and are dangerous. Lightning kills between 75 to 100 people annually. Lightning can also cause fires. In addition, thunderstorms can cause flash floods that kill more people each year than hurricanes, tornadoes, or lightning. Severe thunderstorms can produce hail up to the size of softballs that damages cars and property, and kills livestock caught out in the open. Strong, straight-line winds associated with thunderstorms knock down trees, power lines and mobile homes. Severe thunderstorms can spawn tornadoes with winds up to 300 mph that can destroy well-built man-made structures.

Shelf Cloud

A shelf cloud is a low, horizontal wedge-shaped cloud associated with a thunderstorm gust front or, occasionally, with a cold front. Shelf clouds can be attached to the front side of lines of storms or even a single storm. Usually, there isn't any persistent rotation on a vertical axis within shelf clouds or within individual cloud fragments that extend down from the shelf cloud. Shelf clouds often resemble snowplows, big waves or tsunamis and can look very threatening.

Meade County Thunderstorm, 10/27/2009, *Source: Meade County Emergency Management Office.*

Single Cell or Pulse Storm

A pulse storm is short-lived and usually lasts 30 to 60 minutes. Pulse storms are common in summer and are usually not severe. Pulse storms may produce heavy rain, thunder, lightning, and possible hail and gusty winds. Brief severe weather is possible during a pulse storm in the form of a microburst. These storms are moderately dangerous to the public and moderately to highly dangerous to aviation.

Multicell Cluster

A multicell cluster is a group of severe or non-severe cells in various stages of development. The most common of thunderstorms, mature thunderstorms are located near the center of the cluster, while dissipating thunderstorms exist on their downwind side. Each cluster may only last 20 minutes, but the storm itself may persist for hours. Multicell cluster storms are stronger than single cell storms, but much weaker than a supercell storm. A multicell cluster can produce moderate-sized hail, flash flooding, and weak tornados.

Multicell Line

A multicell line, also known as squall line, is an elongated line of severe thunderstorms that can form along and/or ahead of a cold front. It has the potential to produce heavy precipitation, hail, frequent lightning, strong straight-line winds, and possibly tornados and waterspouts. Severe weather in the form of strong straight-line winds can be expected in areas of the squall line where the line itself is in the shape of a bow echo and within that portion of the line that bows out the most. Tornados can be found along waves within the line echo wave pattern, or LEWP, where mesoscale low-pressure areas are present.

Supercells

Supercell storms are large, usually severe storms that form in an environment where wind speed or wind direction varies with height (an area of "wind shear"), and they have separate downdrafts and updrafts with a strong, rotating updraft ("mesocyclone"). A supercell storm can be 15 miles wide. Research shows that at least 90% of supercell storms cause severe weather. Sometimes these storms produce F3 or higher tornados, extremely large hail (4 inches in diameter), straight-line winds in excess of 80 mph and flash floods. Supercell storms are the most powerful type of thunderstorm and a danger to the public and aviation.

Visible Warning Signs of Thunderstorms

- Dark, towering, threatening clouds
- Distant lightning and thunder

General Facts

- The National Weather Service estimates that there approximately 1,800 thunderstorms daily, on our planet
- There are about 100,000 thunderstorms annually in the U.S. and about 10% of those are severe
- All thunderstorms are dangerous and produce lightning
- Lightning can reach a temperature of 53,540 degrees Fahrenheit; the surface of sun reaches 10,340 degrees Fahrenheit

Dangers Associated with Thunderstorms

- Cloud to ground lightning
- Hail
- Tornados and Waterspouts
- Flash Floods
- Downbursts (Downburst winds are generally very powerful and are often mistaken for wind speeds produced by tornados. These winds can destroy unstable or weakly constructed infrastructures, damaging agricultural crops, displacing automobiles, and crashing aircraft engaged in takeoff or landing.

Damaging Winds

According to the National Severe Storms Laboratory, severe and damaging winds can be produced by any type of thunderstorm, even one that is dying. There are several types of damaging wind as outlined below:

Straight-line wind is the term used to define any wind associated with a thunderstorm that is not a result of rotation and tornadic winds.

A **downdraft** is a small-scale column of air that rapidly sinks toward the ground.

A **downburst** is the result of a strong downdraft with horizontal dimensions larger than 2.5 miles that results in an outward burst of damaging wind on or near the ground. A downburst may begin as a microburst and spread out over a larger area. It can produce damage like a strong tornado.

A **microburst** is a small, concentrated downburst that produces an outward burst of damaging wind at the surface. They are usually small and last only 5 to 10 minutes, with wind speeds up to 168 mph.

The leading edge of rain-cooled air that clashes with warmer thunderstorm inflow is called a **gust front.** Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. At times, these winds push up air above them and form a shelf cloud or detached roll cloud.

A **derecho** is a widespread, long-lived windstorm associated with a band of rapidly moving showers or thunderstorms. It consists of numerous microbursts, downbursts, and clusters of downbursts. A derecho includes winds of at least 58 mph or greater and a swath of damage that extends more than 240 miles, by definition.

A wall of dust that is pushed out along the ground from a thunderstorm downdraft at high speeds is called a **haboob**.

Table 3.3.2.3.1 - International Tornado Intensity Scale (TORRO)

Tornado Intensity	Description of Tornado and Windspeeds
T0	Light Tornado 17 – 24 m s-1 (39 – 54 mi h-1)
T1	Mild Tornado 25 – 32 m s-1 (55 – 72 mi h-1)
T2	Moderate Tornado 33 – 41 m s-2 (73 – 92 mi h-1)
T3	Strong Tornado 42 – 51 m s-1 (93 – 114 mi h-1)
T4	Severe Tornado 52 – 61 m s-1 (115 – 136 mi h-1)
T5	Intense Tornado

	62 – 72 m s-1 (127 – 160 mi h-1)
T6	Moderately Devastating Tornado 73 – 83 m s-1 (161 – 186 mi h-1)
T7	Strongly Devastating Tornado 84 – 95 m s-1 (187 – 212 mi h-1)
T8	Severely Devastating Tornado 96 – 107 m s-1 (213 – 240 mi h-1)
T9	Intensely Devastating Tornado 108 – 120 mi s-1 (241 – 269 mi h-1)
T10	Super Tornado 121 – 134 m s-1 (270 – 299 mi h-1)
Source: The Tornado and Storm Research Organization	

II. Analysis

To analyze severe thunderstorms as a threat to the Lincoln Trail Region, the generalized threat of thunderstorms was identified by reviewing historical data on wind and hail events.
The following tables outline the mean number of days precipitation and thunderstorms occur in an average year and the history of thunderstorms that have been recorded in a given county/jurisdiction within the Lincoln Trail region since 1960. The level of impact is evidenced through the number of lives lost or individual injuries recorded, as well as the estimated cost of property and crop damage based on information reported to the National Climate Data Center which was subsequently rolled into the National Centers for Environmental Information (NCEI). For the original plan, data was only available through 2003. The 2010 update provided data thru 30 June 2009. The 2015 update provided data from, 1 July 2009 to 30 June 2015. This update shows only individual events for the period 1 July 2015 through 14 May 2021. The summary tables show data for the entire period as reported by various sources. Note that there are many variations in recording the locations of the events over time. In the past this was typically done at a county level. More recently they have used nearest place names. Because of this, the records in the summation tables that pertain to individual incorporated areas, should not be considered all encompassing.

Table 3.3.2.3.2 - County Specific Data – Severe Thunderstorms, *Source: NCEI*

Breckinridge

Location	Date	Deaths Direct	Injuries Direct	Property Damage	Crop Damage
Mystic	6/25/15	0	0	10000	0
Locust Hill	7/10/15	0	0	0	0
Buras	7/10/15	0	0	0	0
Sample	7/20/15	0	0	0	0
McQuady	12/23/15	0	0	0	0
Hardinsburg Arpt	3/31/16	0	0	15000	0
Harned	3/31/16	0	2	30000	0
N/A	4/2/16	0	0	5000	0
Cloverport	4/27/16	0	0	5000	0
Harned	4/27/16	0	0	0	0
Custer	5/1/16	0	0	0	0
Hardinsburg Arpt	5/10/16	0	0	0	0
Harned	5/10/16	0	0	6000	0
Harned	5/10/16	0	0	0	0
Harned	5/10/16	0	0	10000	0
Custer	5/10/16	0	0	0	0
Graysville	5/10/16	0	0	100000	0
Hardinsburg Arpt	5/10/16	0	0	0	0
Hardinsburg Arpt	5/10/16	0	0	0	0
Axtel	7/3/16	0	0	20000	0
Constantine	7/3/16	0	0	5000	0
Irvington	3/1/17	0	0	30000	0
Hardinsburg Arpt	4/5/17	0	0	0	0
Harned	4/5/17	0	0	0	0
Dugan	4/5/17	0	0	0	0
Hardinsburg	4/5/17	0	0	0	0
Irvington	4/5/17	0	0	20000	0
Hardinsburg Arpt	4/3/18	0	0	0	0
Garfield	4/3/18	0	0	15000	0
Cloverport	5/27/18	0	0	50000	0
Hardinsburg	6/10/18	0	0	0	0
Mystic	6/26/18	0	0	0	0
Cloverport	6/26/18	0	0	0	0
Madrid	6/26/18	0	0	15000	0

Mc Daniels	6/26/18	0	0	0	0
Harned	6/26/18	0	0	20000	0
Harned	6/26/18	0	0	50000	0
Bewleyville	6/26/18	0	0	0	0
Buras	6/26/18	0	0	0	0
Mc Daniels	7/20/18	0	0	0	0
Vanzant	8/15/18	0	0	3000	0
McQuady	8/15/18	0	0	40000	0
Tar Fork	8/15/18	0	0	1000	0
Raymond	8/15/18	0	0	15000	0
Cloverport	12/31/18	0	0	0	0
Stephensport	12/31/18	0	0	0	0
McQuady	6/5/19	0	0	0	0
Hardinsburg Arpt	6/5/19	0	0	15000	0
Mc Daniels	6/5/19	0	0	0	0
Garfield	6/21/19	0	0	20000	0
Stephensport	6/30/19	0	0	0	0
Cloverport	6/30/19	0	0	30000	0
Cloverport	6/30/19	0	0	0	0
Cloverport	6/30/19	0	0	0	0
McQuady	6/30/19	0	0	0	0
Mattingly	8/20/19	0	0	0	0
Raymond	1/11/20	0	0	0	0
Hardinsburg Arpt	1/11/20	0	0	0	0
Hardinsburg	3/28/20	0	0	20000	0

Grayson

Location	Date	Deaths Direct	Injuries Direct	Property Damage	Crop Damage
Clarkson	6/18/15	0	0	0	0
Leitchfield	6/26/15	0	0	50000	0
Leitchfield	7/14/15	0	0	0	0
Caneyville	8/19/15	0	0	0	0
Short Creek	12/23/15	0	0	0	0
Short Creek	12/23/15	0	0	0	0
Leitchfield	12/23/15	0	0	0	0
Wax	12/23/15	0	0	0	0
N/A	4/2/16	0	0	0	0
Leitchfield	4/27/16	0	0	0	0

Short Creek	5/11/16	0	0	0	0
Spring Lick	5/26/16	0	0	0	0
Fentress Mc Mahon	6/23/16	0	0	0	0
Big Clifty	6/23/16	0	0	0	0
Big Clifty	7/7/16	0	0	0	0
Leitchfield	3/1/17	0	0	0	0
Black Rock	3/27/17	0	0	0	0
Meredith	5/20/17	0	0	0	0
Lilac	4/3/18	0	0	25000	0
Lilac	4/3/18	0	0	300000	0
Lilac	4/3/18	0	0	75000	0
Leitchfield	4/3/18	0	0	0	0
Skaggstown	4/3/18	0	0	75000	0
Big Clifty	7/20/18	0	0	0	0
Black Rock	6/30/19	0	0	0	0
Clarkson	7/2/19	0	0	0	0
Clarkson	7/2/19	0	0	0	0
Leitchfield	7/5/20	0	0	0	0
Church	6/21/21	0	0	0	0

Hardin

Location	Date	Deaths Direct	Injuries Direct	Property Damage	Crop Damage
Glendale	6/19/15	0	0	5000	0
Elizabeth Town	6/19/15	0	0	0	0
Gaithers	6/26/15	0	0	2000	0
Rineyville	6/26/15	0	0	0	0
Rineyville	7/7/15	0	0	10000	0
Prichard Place	7/10/15	0	0	25000	0
Rineyville	12/23/15	0	0	0	0
Sonora	12/23/15	0	0	0	0
Vine Grove	3/27/16	0	0	10000	0
Rineyville	3/27/16	0	0	50000	0
Rogersville	3/31/16	0	0	0	0
N/A	4/2/16	0	0	10000	0
Crest	5/7/16	0	0	0	0
Vertrees	5/10/16	0	0	0	0
Perryville	5/10/16	0	0	0	0
Perryville	5/10/16	0	0	0	0

North Four Corners	5/10/16	0	0	0	0
Vine Grove	5/10/16	0	0	0	0
Long View	5/10/16	0	0	0	0
Vertrees	5/10/16	0	0	0	0
Rogersville	5/10/16	0	0	0	0
Vine Grove	5/10/16	0	0	0	0
Cecilia	5/10/16	0	0	0	0
Elizabeth Town	5/10/16	0	0	0	0
Colesburg	5/10/16	0	0	0	0
Kraft	5/11/16	0	0	0	0
Cecilia	7/6/16	0	0	15000	0
Elizabeth Town	7/6/16	0	0	0	0
Martin Box	7/6/16	0	0	0	0
Eastview	7/7/16	0	0	0	0
(Ftk)Godman Aaf Ft K	7/7/16	0	0	0	0
Vine Grove Jct	7/14/16	0	0	0	0
Elizabeth Town	9/10/16	0	0	8000	0
Perryville	10/20/16	0	0	50000	0
Perryville	10/20/16	0	0	0	0
Rineyville	10/20/16	0	0	0	0
Elizabeth Town	3/1/17	0	0	0	0
Vine Grove	3/1/17	0	0	50000	0
Rineyville	3/27/17	0	0	0	0
Rogersville	3/27/17	0	0	0	0
Long View	3/27/17	0	0	0	0
Howe Vly	3/27/17	0	0	0	0
Gaithers	3/30/17	0	0	0	0
Martin Box	3/30/17	0	0	0	0
Martin Box	4/5/17	0	0	0	0
Elizabeth Town	4/5/17	0	0	0	0
Elizabeth Town	4/5/17	0	0	25000	0
Elizabeth Town	4/5/17	0	0	25000	0
Elizabeth Town	4/5/17	0	0	15000	0
Vine Grove	4/3/18	0	0	0	0
Vine Grove	4/3/18	0	0	0	0
Nolin	4/3/18	0	1	20000	0
Nolin	4/3/18	0	0	50000	0
Glendale Jct	4/3/18	0	0	75000	0
Glendale	4/3/18	0	0	25000	0

Sonora	4/3/18	0	0	75000	0
Eastview	4/3/18	0	0	20000	0
Vine Grove	6/9/18	0	0	0	0
Colesburg	6/12/18	0	0	0	0
Colesburg	6/12/18	0	0	0	0
Martin Box	6/26/18	0	0	100000	0
Cecilia	6/26/18	0	0	0	0
Kraft	10/31/18	0	0	500000	0
Vertrees	6/21/19	0	0	15000	0
Gaithers	8/20/19	0	0	0	0
(Ftk)Godman Aaf Ft K	4/8/20	0	0	0	0
Sonora	6/11/21	0	0	0	0

Larue

Location	Date	Deaths Direct	Injuries Direct	Property Damage	Crop Damage
Tanner	6/18/15	0	0	0	0
Mt Sherman	6/26/15	0	0	0	0
Hodgenville	7/10/15	0	0	0	0
Hodgenville	7/10/15	0	0	0	0
Hodgenville	7/13/15	0	0	0	0
Hodgenville	12/23/15	0	0	0	0
Hodgenville	12/23/15	0	0	0	0
N/A	4/2/16	0	0	5000	0
Attilla	5/10/16	0	0	0	0
Upton	5/10/16	0	0	0	0
Upton	5/26/16	0	0	0	0
Magnolia	7/7/16	0	0	0	0
Upton	3/1/17	0	0	25000	0
Hodgenville	4/30/17	0	0	0	0
Mathers Mill	6/23/17	0	0	100000	0
Mathers Mill	4/3/18	0	0	200000	0
Hodgenville	4/3/18	0	0	0	0
White City	4/3/18	0	0	25000	0
Buffalo	4/3/18	0	0	0	0
Mathers Mill	3/28/20	0	0	5000	0
Buffalo	7/5/20	0	0	0	0
Hodgenville	7/5/20	0	0	0	0
Hodgenville	7/5/20	0	0	0	0

Tonieville	7/5/20	0	0	0	0

Marion

Location	Date	Deaths Direct	Injuries Direct	Property Damage	Crop Damage
Penicks	6/26/15	0	0	0	0
Lebanon	6/26/15	0	0	0	0
Raywick	7/13/15	0	0	0	0
Lebanon	7/14/15	0	0	0	0
Lebanon	7/14/15	0	0	0	0
Belltown	7/19/15	0	0	0	0
N/A	4/2/16	0	0	5000	0
Jessietown	5/10/16	0	0	0	0
Lebanon	6/23/16	0	0	0	0
Jessietown	6/23/16	0	0	0	0
Gravel Switch	10/20/16	0	0	0	0
Calvary	3/1/17	0	0	50000	0
Lebanon	4/5/17	0	0	0	0
St Francis	6/23/17	0	0	150000	0
Nurkes Spg	6/23/17	0	0	15000	0
Loretto	6/23/17	0	0	0	0
Loretto	6/23/17	0	0	0	0
Lebanon	6/23/17	0	0	0	0
Bradfordsville	6/23/17	0	0	10000	0
Loretto	4/3/18	0	0	10000	0
Bradfordsville	4/3/18	0	0	20000	0
Loretto	5/31/18	0	0	0	0
Lebanon	5/31/18	0	0	0	0
Penicks	5/31/18	0	0	0	0
Lebanon	6/12/18	0	0	5000	0
Belltown	6/26/18	0	0	0	0
Salleetown	6/26/18	0	0	0	0
Loretto	7/20/18	0	0	0	0
Lebanon	7/20/18	0	0	0	0
Penicks	7/20/18	0	0	0	0
Lebanon	8/7/18	0	0	0	0
Belltown	11/5/18	0	0	35000	0
Bradfordsville	6/29/20	0	0	0	0
St Mary	7/12/20	0	0	0	0

Meade

Location	Date	Deaths Direct	Injuries Direct	Property Damage	Crop Damage
Garrett	6/21/15	0	0	3000	0
Garrett	6/21/15	0	0	10000	0
Battletown	6/26/15	0	0	0	0
Flaherty	6/26/15	0	0	0	0
Flaherty	6/26/15	0	0	1000	0
Rock Haven	6/26/15	0	0	1000	0
Muldraugh	6/26/15	0	0	0	0
Coburg	7/10/15	0	0	0	0
Rhodelia	12/23/15	0	0	0	0
Battletown	12/23/15	0	0	0	0
N/A	4/2/16	0	0	0	0
Brandenburg	4/27/16	0	0	5000	0
Ekron	5/10/16	0	0	0	0
Wolf Creek	4/5/17	0	0	0	0
Haysville	11/18/17	0	1	200000	0
Guston	11/18/17	0	0	20000	0
Rock Haven	5/31/18	0	0	0	0
Sirocco	6/11/18	0	0	0	0
Andyville	7/20/18	0	0	0	0
Midway	7/20/18	0	0	0	0
Brandenburg Station	7/20/18	0	0	15000	0
Andyville	9/8/18	0	0	15000	0
Payneville	12/31/18	0	0	0	0
Ekron	5/1/19	0	0	10000	0
Brandenburg	6/30/19	0	0	0	0
Concordia	4/8/20	0	0	0	0

Nelson

Location	Date	Deaths Direct	Injuries Direct	Property Damage	Crop Damage
Culvertown	6/26/15	0	0	0	0
Coxs Creek	7/7/15	0	0	0	0
Bardstown	7/7/15	0	0	100000	0
Bourbon Spgs	7/10/15	0	0	30000	0
Boston	7/14/15	0	0	0	0

Fairfield	12/23/15	0	0	0	0
N/A	4/2/16	0	0	0	0
Boston	5/10/16	0	0	0	0
Samuels	5/10/16	0	0	0	0
Samuels	5/10/16	0	0	0	0
Bardstown	5/11/16	0	0	0	0
Bourbon Spgs	6/23/16	0	0	0	0
Bardstown	6/23/16	0	0	0	0
Bardstown	7/7/16	0	0	0	0
Fairfield	7/28/16	0	0	0	0
Coxs Creek	3/1/17	0	0	40000	0
Bardstown	3/1/17	0	0	0	0
Bloomfield	3/1/17	0	0	0	0
Coxs Creek	3/27/17	0	0	0	0
Fairfield	3/27/17	0	0	0	0
Coxs Creek	3/27/17	0	0	0	0
Boston	4/5/17	0	0	0	0
Boston	4/5/17	0	0	0	0
Bardstown	4/5/17	0	0	0	0
Fairfield	4/5/17	0	0	0	0
Bloomfield	4/5/17	0	0	0	0
Fairfield	4/5/17	0	0	0	0
Bardstown	4/30/17	0	0	0	0
Bloomfield	6/18/17	0	0	0	0
Balltown	6/23/17	0	0	0	0
Culvertown	6/23/17	0	0	0	0
Howardstown	4/3/18	0	0	0	0
Howardstown	4/3/18	0	0	0	0
Bloomfield	5/31/18	0	0	0	0
Bloomfield	6/11/18	0	0	0	0
Boston	6/12/18	0	0	5000	0
Early Times	6/26/18	0	0	15000	0
Bourbon Spgs	7/5/18	0	0	0	0
Bloomfield	7/5/18	0	0	0	0
Lenore	7/20/18	0	0	0	0
Coxs Creek	7/20/18	0	0	0	0
Chaplin	7/20/18	0	0	0	0
East Bardstown	7/20/18	0	0	0	0
Boston	10/31/18	0	0	0	0

Nazareth	10/31/18	0	0	0	0
Fairfield	4/8/20	0	0	200000	0
Bloomfield	6/21/2	0	0	0	0

Washington

Location	Date	Deaths Direct	Injuries Direct	Property Damage	Crop Damage
	4/2/16	0	0	5000	0
St Catherine	5/10/16	0	0	0	0
Willisburg	5/10/16	0	0	0	0
Mackville	5/10/16	0	0	50000	0
Springfield	5/11/16	0	0	0	0
St Catherine	6/23/16	0	0	0	0
Fredricktown	6/23/16	0	0	0	0
Willisburg	7/8/16	0	0	0	0
Willisburg	3/27/17	0	0	75000	0
Willisburg	3/27/17	0	0	15000	0
Maud	4/29/17	0	0	0	0
Pulliam	4/30/17	0	0	0	0
Springfield	5/11/17	0	0	50000	0
St Catherine	6/23/17	0	0	0	0
Brush Grove	6/11/18	0	0	0	0
Cardwell	6/11/18	0	0	0	0
Mooresville	6/11/18	0	0	0	0
Kirkland	6/11/18	0	0	0	0
Battle	6/11/18	0	0	0	0
Cardwell	6/11/18	0	0	0	0
Mooresville	6/11/18	0	0	0	0
Polin	6/11/18	0	0	0	0
Battle	6/11/18	0	0	0	0
Kirkland	6/11/18	0	0	0	0
Pulliam	7/5/18	0	0	0	0
St Catherine	7/20/18	0	0	0	0
St Catherine	7/20/18	0	0	0	0
Cardwell	3/14/19	0	0	20000	0
Pulliam	4/8/20	0	0	0	0
St Catherine	7/12/20	0	0	0	0
Pleasant Grove	7/12/20	0	0	0	0
Willisburg	7/20/20	0	0	0	0

Table 3.3.2.3.3 - Summary of Thunderstorm/Winds Data, Costs

THUNDERSTORMS WINDS	Total Cost	Number Events	Number Years	Total Loss of Life	Total Injuries	Average Cost Per Year	Average Cost Per Event	Average Loss of Life Per Year	Average Loss of Life Per Event	Average Injuries Per Year	Average Injuries Per Event
BRECKINRIDGE	$1,761,803	265	60.5	0.25	4.21	$29,121	$6,648	0.00	0.00	0.07	0.02
Cloverport	$90,000	16	60.5	0	0	$1,488	$5,625	0.00	0.00	0.00	0.00
Hardinsburg	$155,000	35	60.5	0	0	$2,562	$4,429	0.00	0.00	0.00	0.00
Irvington	$105,000	7	60.5	0	0	$1,736	$15,000	0.00	0.00	0.00	0.00
GRAYSON	$1,740,288	225	62.5	0.25	6.62	$27,845	$7,735	0.00	0.00	0.11	0.03
Caneyville	$0	21	62.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Clarkson	$0	9	62.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Leitchfield	$202,000	27	62.5	0	0	$3,232	$7,481	0.00	0.00	0.00	0.00
HARDIN	$65,915,949	367	64.5	4.45	133.17	$1,021,953	$179,607	0.07	0.01	2.06	0.36
Elizabethtown	$153,000	44	64.5	0	0	$2,372	$3,477	0.00	0.00	0.00	0.00
Radcliff	$5,050,000	13	64.5	0	46	$78,295	$388,462	0.00	0.00	0.71	3.54
Sonora	$76,000	11	64.5	0	0	$1,178	$6,909	0.00	0.00	0.00	0.00
Upton	$0	1	64.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Vine Grove	$50,080,000	16	64.5	0	0	$776,434	$3,130,000	0.00	0.00	0.00	0.00
West Point	$0	4	64.5	0	0	$0	$0	0.00	0.00	0.00	0.00
LARUE	$1,869,787	217	60.5	1.32	11.6	$30,906	$8,617	0.02	0.01	0.19	0.05
Hodgenville	$150,000	29	60.5	0	0	$2,479	$5,172	0.00	0.00	0.00	0.00
MARION	$1,547,735	214	60.5	0.24	1.63	$25,582	$7,232	0.00	0.00	0.03	0.01
Bradfordsville	$30,000	4	60.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Lebanon	$175,000	35	60.5	0	0	$2,893	$5,000	0.00	0.00	0.00	0.00
Loretto	$20,000	9	60.5	0	0	$331	$2,222	0.00	0.00	0.00	0.00
Raywick	$0	3	60.5	0	0	$0	$0	0.00	0.00	0.00	0.00
MEADE	$1,959,733	234	61.5	3.45	46.26	$31,866	$8,375	0.06	0.01	0.75	0.20
Brandenburg	$77,000	25	61.5	0	0	$1,252	$3,080	0.00	0.00	0.00	0.00
Ekron	$10,000	6	61.5	0	0	$163	$1,667	0.00	0.00	0.00	0.00
Muldraugh	$10,000	5	61.5	0	0	$163	$2,000	0.00	0.00	0.00	0.00
NELSON	$1,794,130	295	60.5	0.3	12.58	$29,655	$6,082	0.00	0.00	0.21	0.04
Bardstown	$155,000	47	60.5	0	0	$2,562	$3,298	0.00	0.00	0.00	0.00
Bloomfield	$0	10	60.5	0	0	$0	$0	0.00	0.00	0.00	0.00
Fairfield	$200,000	7	60.5	0	0	$3,306	$0	0.00	0.00	0.00	0.00
New Haven	$50,000	3	60.5	0	0	$826	$16,667	0.00	0.00	0.00	0.00
WASHINGTON	$1,668,572	200	60.5	0.22	3.58	$27,580	$8,343	0.00	0.00	0.06	0.02
Mackville	$225,000	5	60.5	0	0	$3,719	$45,000	0.00	0.00	0.00	0.00
Springfield	$120,000	18	60.5	0	0	$1,983	$6,667	0.00	0.00	0.00	0.00
Willisburg	$91,000	12	60.5	0	0	$1,504	$7,583	0.00	0.00	0.00	0.00
LTADD	$78,257,999	2017	64.5	10.48	219.65	$1,213,302	$38,799	0.16	0.01	3.41	0.11

NOTE: The historic frequency of a hazard event over a given period of time determines the historic recurrence interval. For example: If there have been 10 Thunderstorm events in the County in the past 5 years, statistically you could expect that there will be 2 events a year.

Realize that from a statistical standpoint, there are several variables to consider. 1) Accurate hazard history data and collection are crucial to an accurate recurrence interval and frequency. 2) Data collection and accuracy has been much better in the past 10-20 years (NCDC weather records). 3) It is important to include all significant recorded hazard events which will include periodic updates to this table.

By updating and reviewing this table over time, it may be possible to see if certain types of hazard events are increasing in the past 10-20 years.

These values should be considered low. More events that have occurred than are documented by the sources used in this table.

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Compilation of SHELDUS, NCDC & NCEI. 1967- June 30, 2015.

Table 3.3.2.3.4 - Summary of Thunderstorm/Winds Data, Events

THUNDERSTORMS WINDS	Number of Events in Historic Record	Number of Years in Historic Record	Number of Events in Past 10 Years	Number of Events in Past 20 Years	Number of Events in Past 50 Years	Historic Recurrence Interval (years)	Historic Frequency % chance/year	Past 10 Year Record Frequency Per Year	Past 20 Year Record Frequency Per Year	Past 50 Year Record Frequency Per Year
BRECKINRIDGE	265	60.5	112	154	222	0.23	438.02%	11.2	7.7	4.44
Cloverport	16	60.5	8	10	10	3.78	26.45%	0.8	0.5	0.2
Hardinsburg	35	60.5	9	21	24	1.73	57.85%	0.9	1.05	0.48
Irvington	7	60.5	3	4	5	8.64	11.57%	0.3	0.2	0.1
GRAYSON	225	62.5	70	107	179	0.28	360.00%	7	5.35	3.58
Caneyville	21	62.5	13	21	21	2.98	33.60%	1.3	1.05	0.42
Clarkson	9	62.5	7	9	9	6.94	14.40%	0.7	0.45	0.18
Leitchfield	27	62.5	12	26	27	2.31	43.20%	1.2	1.3	0.54
HARDIN	367	64.5	137	206	310	0.18	568.99%	13.7	10.3	6.2
Elizabethtown	44	64.5	27	44	44	1.47	68.22%	2.7	2.2	0.88
Radcliff	13	64.5	3	12	13	4.96	20.16%	0.3	0.6	0.26
Sonora	11	64.5	6	10	10	5.86	17.05%	0.6	0.5	0.2
Upton	1	64.5	0	1	1	64.50	1.55%	0	0.05	0.02
Vine Grove	16	64.5	10	15	16	4.03	24.81%	1	0.75	0.32
West Point	4	64.5	3	4	4	16.13	6.20%	0.3	0.2	0.08
LARUE	217	60.5	60	88	160	0.28	358.68%	6	4.4	3.2
Hodgenville	29	60.5	18	29	29	2.09	47.93%	1.8	1.45	0.58
MARION	214	60.5	56	89	156	0.28	353.72%	5.6	4.45	3.12
Bradfordsville	4	60.5	4	4	4	15.13	6.61%	0.4	0.2	0.08
Lebanon	35	60.5	20	34	35	1.73	57.85%	2	1.7	0.7
Loretto	9	60.5	9	9	9	6.72	14.88%	0.9	0.45	0.18
Raywick	3	60.5	2	3	3	20.17	4.96%	0.2	0.15	0.06
MEADE	234	61.5	72	110	222	0.26	380.49%	7.2	5.5	4.44
Brandenburg	25	61.5	16	25	25	2.46	40.65%	1.6	1.25	0.5
Ekron	6	61.5	6	6	6	10.25	9.76%	0.6	0.3	0.12
Muldraugh	5	61.5	3	5	5	12.30	8.13%	0.3	0.25	0.1
NELSON	295	60.5	90	96	214	0.21	487.60%	9	4.8	4.28
Bardstown	47	60.5	24	46	47	1.29	77.69%	2.4	2.3	0.94
Bloomfield	10	60.5	9	9	9	6.05	16.53%	0.9	0.45	0.18
Fairfield	7	60.5	7	7	7	8.64	11.57%	0.7	0.35	0.14
New Haven	3	60.5	0	2	3	20.17	4.96%	0	0.1	0.06
WASHINGTON	200	60.5	50	77	142	0.30	330.58%	5	3.85	2.84
Mackville	5	60.5	3	5	5	12.10	8.26%	0.3	0.25	0.1
Springfield	18	60.5	7	17	17	3.36	29.75%	0.7	0.85	0.34
Willisburg	12	60.5	8	12	12	5.04	19.83%	0.8	0.6	0.24
LTADD	2017	64.5	647	927	1605	0.03	113.21%	64.7	46.35	32.1

NOTE: The historic frequency of a hazard event over a given period of time determines the historic recurrence interval. For example: If there have been 10 Thunderstorm events in the County in the past 5 years, statistically you could expect that there will be 2 events a year.

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