2.0 RISK ASSESSMENT

2.2.4 Epidemic

This profile primarily examines two types of public health emergencies, each corresponding to a level of disease presence (defined below): epidemic and pandemic.				
Vulnerability  	Period of Occurrence:	At any time	Hazard Index Ranking:	Medium
	Warning Time:	More than 24 hours	State Risk Ranking:	Not Ranked
	Probability:	Likely	Severity:	Critical
	Type of Hazard:	Natural	Disaster Declarations:	None

Hazard Overview

In 2016, pandemic and infectious diseases accounted for three of the top ten causes of death worldwide. Microorganisms such as bacteria, viruses, fungi, or parasites, cause these diseases and pass directly or indirectly from one person to another (Baylor College of Medicine, n.d.). Humans can also become infected from an infected animal that harbors a pathogenic organism.

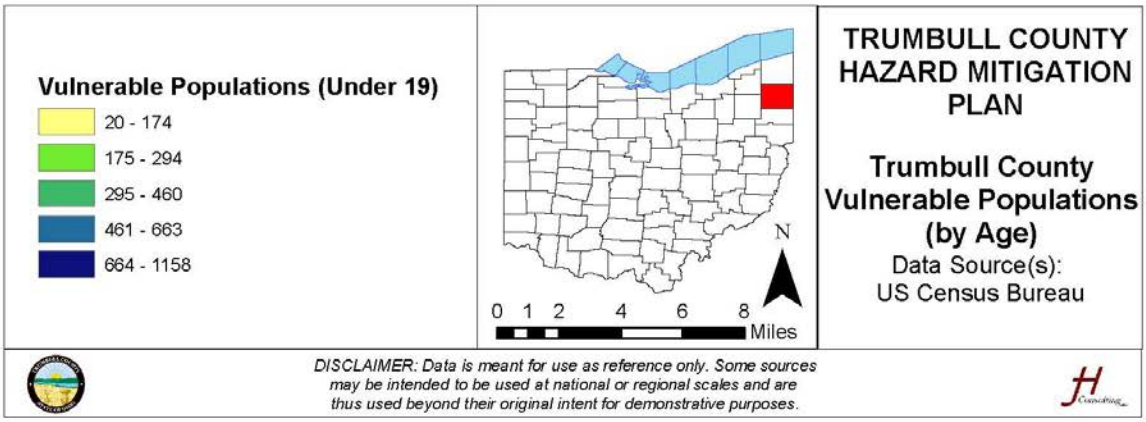
Location and Extent

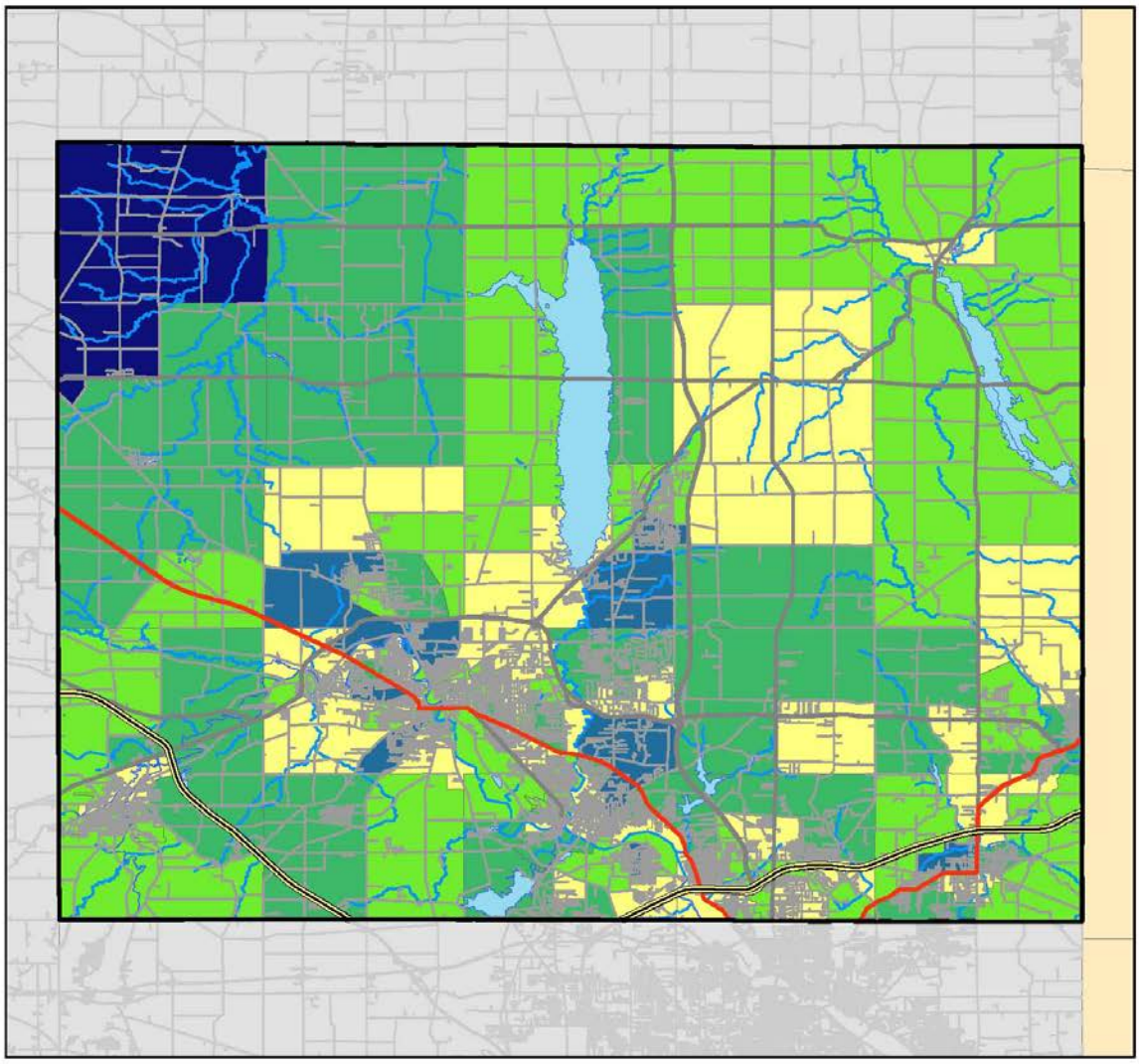
According to the Center for Disease Control and Prevention (CDC), there are three widely accepted "levels" of disease presence.

- ***Endemic*** refers to the baseline level of a particular disease in a population or area. This level is not necessarily the desired level, but the observed level.
- ***Epidemic*** refers to an increase in the number of cases of a disease above the usual level in that population or area. Epidemics may result from an increase of the disease's virulence, presence of a disease in a new outbreak, enhanced disease transmission, increased susceptibility among exposed persons, or increased exposure to the disease-causing agent. Note that, while the term "epidemic" originally only included infectious diseases, some non-infectious health conditions (such as obesity and the opioid misuse) have reached epidemic status in the United States.
- ***Pandemic*** refers to an epidemic that has spread over several countries or continents,

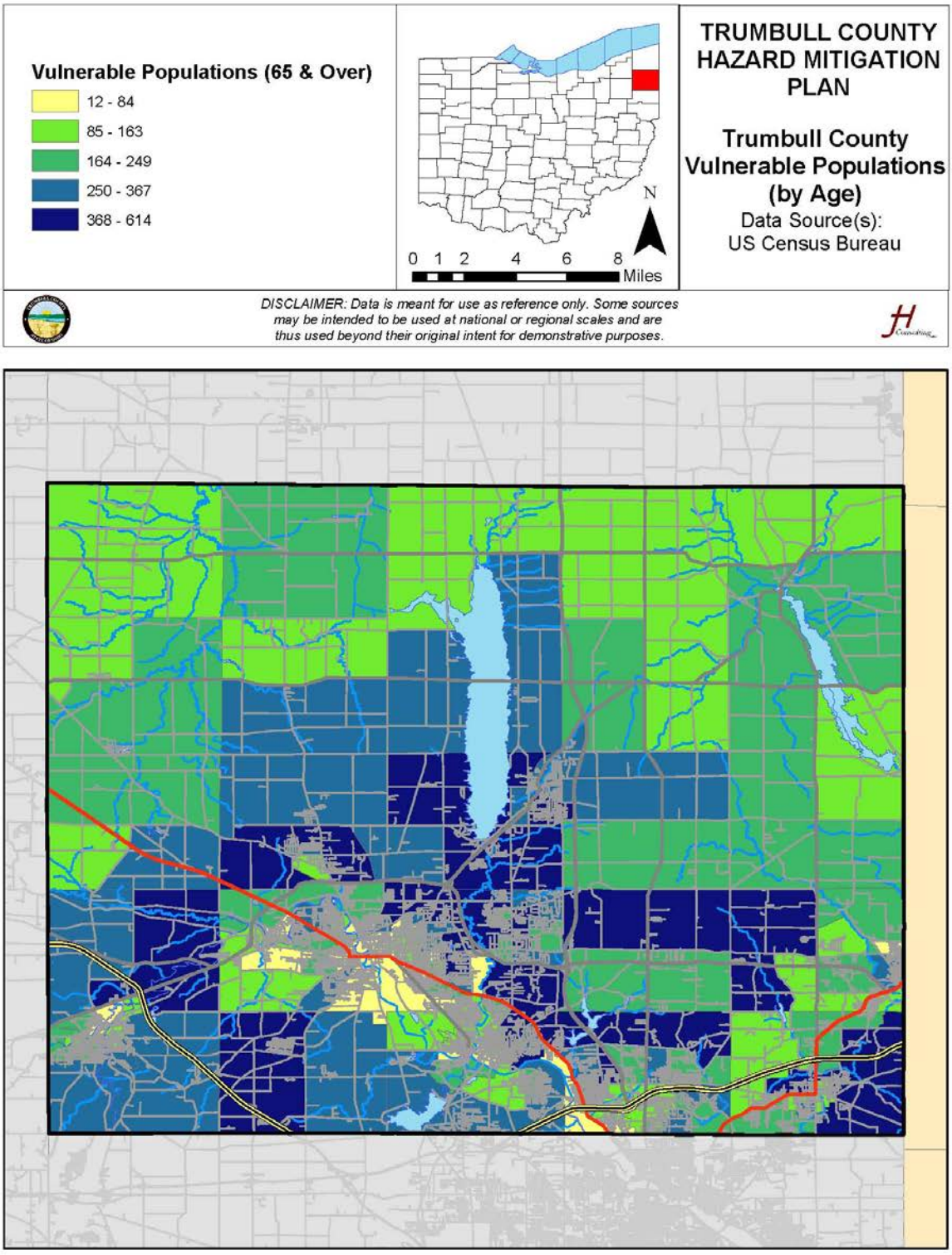
typically affecting a large number of people.

An epidemic or pandemic would affect all areas of Trumbull County, but certain sub-sections of the population would be more affected than others. Those most vulnerable are children, the elderly, and individuals with chronic illnesses. The following map shows the Census block groups with the highest concentrations of those aged 19 and under.


Vulnerable Populations (Under 19)
20 - 174
175 - 294
295 - 460
461 - 663
664 - 1158
N
0 1 2 4 6 8
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
Trumbull County Vulnerable Populations (by Age)
Data Source(s):
US Census Bureau
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.



The following map shows the Census block groups with the highest concentrations of those aged "over 65."



Impacts and Vulnerability

The extent of illness caused by a communicable or infectious disease depends on both the person infected and the pathogen infecting them. For example, the influenza virus usually circulates from November to March and affects up to 20% of Americans. Unlike seasonal influenza, pandemic strains of the flu virus are easily circulated and affect healthy individuals.

SEASONAL FLU	FLU PANDEMIC
Outbreaks occur every year, usually in winter.	This occurs only rarely (only four times since 1918).
Caused by influenza viruses that are similar to those already affecting people.	Caused by a new influenza virus that people have not been exposed to before.
Healthy adults usually not at risk for serious complications.	Healthy adults may be at increased risk for serious complications.
Hospitals and healthcare providers can usually meet public needs.	Hospitals and healthcare providers may be overwhelmed and difficult to access.
The vaccine is available at beginning of flu season.	A vaccine would probably not be available in the early stages of a pandemic.
It causes an average of 36,000 deaths each year in the United States.	The number of deaths could be significantly higher. In the 1918 pandemic, approximately 675,000 people died in the United States.
Generally does not have a severe impact on daily life.	May have a severe impact on daily life, including widespread restrictions on travel, closings of schools and businesses, and cancellation of public events.

Pandemics are further exacerbated by the fact that healthcare resources can become scarce during an event. An increased number of cases and a reduced number of caregivers can overload jurisdictions or healthcare systems. Furthermore, preventative measures, such as vaccinations or prophylactic medication, may be in short supply or unavailable.

Fortunately, there are vaccines for several communicable diseases. The State of Ohio does not provide vaccination reports at the county level, but does provide information concerning vaccinations of children between 19 and 35 months in age.

OHIO VACCINATION RATES 2010-2017									
Vaccine	*Dose*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
DTP/DTaP	4+	84.3%	85.2%	83.3%	75.8%	85.1%	80.9%	78.6%	81.1%
Polio	3+	94.9%	94.7%	92.5%	90.4%	94.6%	91.8%	86.6%	88.2%
MMR	1+	93.6%	93.3%	90.3%	86.0%	95.6%	88.1%	87.4%	88.3%
Hib	3+	92.2%	96.6%	91.2%	90.3%	92.9%	78.6%	79.0%	76.7%
Hepatitus B	3+	94.8%	95.8%	89.4%	87.4%	92.3%	92.3%	88.0%	89.5%
Varicella (Chickenox)	1+	89.7%	93.4%	90.8%	85.4%	92.9%	86.2%	85.5%	85.5%
PCV7 or PCV13	4+	81.8%	83.8%	83.8%	71.6%	83.3%	79.1%	81.0%	78.8%
Series	*–*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
4•3•1•3•3•1	–	76.0%	80.6%	72.1%	69.7%	73.6%	–	–	–
4•3•1•3•3•1:4	–	73.8%	74.7%	66.8%	61.7%	68.1%	68.1%	68.0%	66.4%

Vaccination rates in infants and toddlers in Ohio have fluctuated since 2010, but has consistently remained in the upper 50th percentile. However, it typically requires vaccination rates above 85% to provide sufficient community (i.e., herd) immunity to those who are not vaccinated.

Past Mitigation Efforts: Epidemic

- The Trumbull County General Health District has taken many steps to ensure a base level of preparedness for epidemic and pandemic conditions. Initiatives surrounding general preparedness for Avian flu (beginning in 2006), and most recently for H1N1 (swine flu) have led other local governments to create and adopt business continuity plans.
- Health departments also administered approximately 16,000 H1N1 vaccinations in 2010, and has identified two points of dispensing sites (PODs).
- Health departments continually conduct disease surveillance, and maintains an adequate supply of vaccinations.
- Health departments have also developed the following plans in a continuing effort to remain prepared for epidemic outbreaks: pandemic preparedness plan, bioterrorism plan, and epi plan.
- At the time this plan was submitted to the Ohio Emergency Management Agency for approval, local authorities were participating in the response to the COVID-19 pandemic.

Historical Occurrences

Four pandemic influenza events have occurred in the last century. The 1918 Spanish Influenza outbreak remains the worst-case pandemic on record, with the number of deaths dramatically decreasing with each event.

PREVIOUS WORLDWIDE PANDEMIC EVENTS		
Date	*Pandemic Name/Subtype*	*Worldwide Deaths*
1918-1920	Spanish Flu / H1N1	50 million
1957-1958	Asian Flu / H2N2	1-3 million
1968-1969	Hong Kong Flu / H3N2	1 million
2009-2010	Swine Flu / A/H1N1	25,174

H1N1 Epidemic of 2009

The most recent pandemic influenza event was the H1N1 (swine flu) epidemic in 2009. The CDC monitored the spread of the disease on a near-daily basis. The H1N1 flu was relatively mild for most people, but the virus spread with unprecedented speed; more than 700 schools in the United States closed, and many hospitals quarantined infected individuals. H1N1 was almost entirely responsible for total anomalies resolved as health events for 2009 (70%) in Trumbull county.

The ODH keeps records of certain notifiable diseases reported within the state. The following table presents reported cases of select notifiable diseases for Trumbull County from 1997 to 2019.

COMMUNICABLE DISEASES, TRUMBULL COUNTY 1997-2019																							
Disease	*'97*	*'98*	*'99*	*'00*	*'01*	*'02*	*'03*	*'04*	*'05*	*'06*	*'07*	*'08*	*'09*	*'10*	*'11*	*'12*	*'13*	*'14*	*'15*	*'16*	*'17*	*'18*	*'19*
AIDS	4	4	7	6	1	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Anaplasma phagocytophilum	–	–	–	–	–	–	–	–	–	–	–	1	–	0	–	1	0	0	0	0	0	0	0
Botulism, foodborn	0	0	0	2	–	–	–	0	–	–	0	0	0	0	0	0	–	0	0	–	–	–	–
Botulism, infant	–	–	0	0	0	1	0	0	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Campylobacteriosis	15	14	15	21	17	18	18	26	23	10	21	15	20	20	11	15	11	12	15	13	16	12	16
Carbapenemase-Producing Carbapenem-Resistant Enterobacteriaceae (CP-CRE)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	25	14
Chlamydia, total	171	233	311	267	303	351	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Coccidioidomycosis	–	–	–	–	–	–	–	–	–	–	1	0	0	0	1	0	0	0	0	1	0	0	0
Creutzfeldt-Jakob Diseas (CJD)	–	–	0	0	0	1	0	0	0	0	0	0	–	0	0	0	0	1	1	0	0	0	0
Cryptosporidiosis	1	0	0	0	1	0	7	21	9	11	8	8	27	24	26	18	17	6	6	11	4	12	8
Cytomegalovirus (CMV), congenital	0	1	0	1	0	0	0	0	0	2	0	0	0	0	0	0	1	–	–	–	–	–	–
Dengue	0	0	–	0	–	0	0	0	0	0	0	0	1	–	0	0	0	0	0	0	0	1	0
E. Coli O157:H7	0	0	2	0	1	0	0	2	1	1	1	2	0	0	0	1	0	0	0	0	0	0	2
E. Coli Shiga toxin producing (not O157:H7)	–	–	–	0	0	0	0	0	2	0	0	0	0	2	1	0	2	0	3	0	0	0	0
E. Coli Shiga toxin producing, serotype unknown)	–	–	–	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5	0
Ehrlichiosis, Ehrlichia chaffeensis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0	0	0	0	0
Encephalitis, La Crosse	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0
Encephalitis, other viral	1	0	0	1	1	–	–	0	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Encephalitis, post infection	1	0	0	0	0	0	0	1	0	0	0	0	–	–	–	–	–	–	–	–	–	–	–

COMMUNICABLE DISEASES, TRUMBULL COUNTY 1997-2019																							
Disease	*'97*	*'98*	*'99*	*'00*	*'01*	*'02*	*'03*	*'04*	*'05*	*'06*	*'07*	*'08*	*'09*	*'10*	*'11*	*'12*	*'13*	*'14*	*'15*	*'16*	*'17*	*'18*	*'19*
Encephalitis, primary	–	–	–	0	0	0	0	1	0	0	0	1	–	–	–	–	–	–	–	–	–	–	–
Encephalitis, West Nile	–	–	–	0	0	2	3	0	0	0	0	–	0	0	2	1	1	0	1	0	0	4	–
Giardiasis	10	17	12	9	5	12	12	7	8	15	10	9	7	5	11	14	6	6	4	0	6	2	0
Gonorrhea, total	143	122	151	185	233	188	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
H. Influenza, invasive disease	1	0	0	1	1	0	3	2	2	6	4	3	2	3	4	3	4	1	6	3	4	2	8
Hemolytic Uremic Syndrome (HUS)	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	–
Hepatitis A	3	3	11	1	2	11	2	0	3	0	0	1	0	0	0	0	3	0	1	0	0	18	7
Hepatitis B (including acute & chronic)	1	0	3	0	4	5	10	15	16	12	58	28	16	21	1	9	5	0	57	44	–	–	–
Hepatitis, Non A-Non B (includes Hepatitis C, past & present)	1	0	0	0	0	0	70	84	137	106	182	123	116	72	0	0	2	276	320	485	–	–	–
Herpes, congenital	0	0	0	1	0	0	0	0	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–
HIV	–	–	3	7	6	6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Influenza-associated hospitalization	–	–	–	–	–	–	–	–	–	–	–	–	33	6	23	40	67	68	56	89	306	349	109
Influenza A virus, novel human infection	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	0	0	0	0	0	–	–	–
Kawasaki Disease	0	0	3	2	0	0	0	1	1	2	0	0	–	–	–	–	–	–	–	–	–	–	–
Legionnaires' Disease	4	1	0	0	1	0	0	1	0	6	6	3	0	4	7	5	8	5	8	9	9	17	9
Listeriosis	1	0	2	2	1	2	3	2	0	1	1	1	0	1	1	0	0	0	0	0	1	0	0
Lyme Disease	2	1	2	1	3	2	1	6	2	2	1	2	1	3	0	0	2	1	3	1	7	6	5
Malaria	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meningitis, aseptic	16	5	2	6	6	12	6	2	42	6	7	6	10	12	31	8	6	7	3	6	5	7	5
Meningitis, other bacterial	0	0	0	0	1	1	2	1	1	1	0	0	1	1	12	6	1	2	0	2	2	0	1

COMMUNICABLE DISEASES, TRUMBULL COUNTY 1997-2019																							
Disease	*'97*	*'98*	*'99*	*'00*	*'01*	*'02*	*'03*	*'04*	*'05*	*'06*	*'07*	*'08*	*'09*	*'10*	*'11*	*'12*	*'13*	*'14*	*'15*	*'16*	*'17*	*'18*	*'19*
Meningitis, Streptococcal (Group B)	–	–	1	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Meningococcal Disease	1	1	0	1	0	0	1	1	2	2	0	1	0	0	1	0	1	0	0	1	1	0	0
Mumps	1	1	1	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Outbreaks, foodborne	1	4	3	2	0	1	1	1	0	2	0	0	0	1	1	2	1	2	0	0	1	1	–
Outbreaks, healthcare-associated	–	–	–	–	–	–	–	–	–	–	–	–	1	0	0	0	0	2	0	0	0	0	–
Outbreaks, Institutional	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0	–
Outbreaks, unspecified	–	–	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	–
Outbreaks, waterborne	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	–
Pertussis	1	0	0	5	2	5	0	3	2	1	0	12	28	15	20	12	2	16	6	1	9	8	1
Psittacosis	0	9	0	0	–	–	–	–	–	0	–	–	–	0	–	–	–	–	–	–	–	–	–
Rabies, animal	11	0	5	2	1	0	2	0	1	0	0	3	0	1	1	1	8	2	3	2	0	1	–
Rheumatic fever	0	18	0	–	0	0	0	0	0	–	0	0	–	–	–	–	–	–	–	–	–	–	–
Rocky Mountain Spotted Fever (RMSF)	0	17	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmonellosis	16	0	26	20	26	24	21	14	18	18	21	19	17	20	15	18	12	18	19	22	16	15	13
Shigellosis	41	1	3	2	0	1	0	0	1	0	0	13	17	0	0	0	4	2	18	9	0	0	1
Staphococcal skin infections	–	–	–	–	–	–	–	–	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Streptococcal disease, invasive, (Group A)	4	0	3	4	2	4	6	5	1	6	6	6	4	4	2	8	0	5	3	9	17	5	10
Streptococcal disease in newborn, (Group B)	2	0	0	1	0	1	0	1	2	1	0	1	1	0	2	2	2	1	0	0	0	2	0
Streptococcal Toxic Shock Syndrome (STSS)	1	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

COMMUNICABLE DISEASES, TRUMBULL COUNTY 1997-2019																							
Disease	*'97*	*'98*	*'99*	*'00*	*'01*	*'02*	*'03*	*'04*	*'05*	*'06*	*'07*	*'08*	*'09*	*'10*	*'11*	*'12*	*'13*	*'14*	*'15*	*'16*	*'17*	*'18*	*'19*
Streptococcus Pneumoniae, Invasive Disease (ISP)	–	–	–	37	23	33	26	24	23	22	34	38	34	29	25	27	19	23	20	26	21	23	15
Syphylis, primary and secondary	1	0	0	0	1	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Syphylis, all other stages	–	–	0	0	0	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Toxic Shock Syndrome (TSS), Staphylococcal	0	0	0	0	0	1	0	0	0	1	0	0	0	0	–	0	0	0	0	0	0	0	0
Tuberculosis	5	0	2	9	6	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Typhoid Fever	0	4	0	0	0	0	0	0	0	0	0	0	0	0	–	0	0	0	0	1	0	0	–
Vancomycin-Resistant Enterococcal Disease (VRE)	–	–	–	71	58	71	28	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Varicella zoster virus (Chickenpox)	–	–	32	9	0	87	39	1	6	428	82	58	81	38	25	19	20	5	4	4	12	6	3
Vibriosis	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yersiniosis	0	0	0	0	0	1	2	0	0	0	0	2	0	1	0	0	1	0	0	1	2	1	1
TOTALS	460	465	600	676	709	850	264	224	304	663	443	356	421	285	225	210	207	462	557	741	440	522	229

In the table above, planners omitted diseases that either had zero or no reported cases from the beginning of the reported years. Diseases not reported in Trumbull County (but reportable elsewhere) appear in the table below.

REPORTABLE DISEASES NOT REPORTED IN TRUMBULL COUNTY	
Disease	*Cause*
Amebiasis	Disease contracted by ingesting contaminated food or water. Caused by the parasite *Entamoeba histolytica.*
Brucellosis	Disease contracted by ingesting unpasteruized milk or undercooked meat from and infected animal.
Cyclosporiasis	Intestinal illness contracted by ingesting contaminated food or water. Caused by *Cyclospora cayetansis.*
Ehrlichiosis, Human Granulocytic (HGE)	Former name of Anaplasmosis.
Ehrlichiosis, Human Monocytic (HME)	Former name of Anaplasmosis.
Hepatitis B, perinatal	Hepatitus B that is passed from mother to infant.
Leprosy (Hansen's Disease)	Disease caused by *Myobaterium leprae* that can result in nerve damage, crippling of the hands and feet, paralysis, and blindness.
Leptospirosis	Disease caused by the bacteria *Leptospira* that can result in kidney damage, meningitis, liver failure, respiratory distress, and death.
Measles, imported	Measles contracted outside of the United States.
Measles, indigenous	Measles contracted within the United States.
Q Fever	Disease caused by the bacteria Coxiella burnetii that can be transmitted by contact with animal waste.
Reye Syndrome	Cause is unknown, but is symptoms often begin shortly after a viral infection. Suriviors are often left with brain damage.
Scabies	Infestation of human skin by the human itch mite (*Sarcoptes scabiee)* and is spread by skin contact.
Syphylis, congenital	Sexually transmitted disease that can be passed from mother to infant in utero.
Tetanus	Infection caused by the bacteria *Clostridium tetani* that causes "lockjaw."
Toxoplasmosis, congenital	Disease caused by ingesting food contaminated by the parasite *Toxoplasma*; passed from mother to infant in utero.
Trichinosis	Disease caused by ingesting raw or undercooked meat infected with the parasite *Trichinella.*
Tularemia	Disease caused by contact with animals or water infected by *Francisella tularensis.*
Typhus, murine	Disease caused by the bacteria *Rickettsia typhi* and is spread by fleas.
Vibrio Parahaemolyticus infection	*Vibrio* illness caused by ingesting shellfish and other seafood infected *V. parahaemolyticus*.
Vibrio Vulnificus infection	*Vibrio* illness caused by an open wound coming into contact with shellfish or water infected *V. Vulnificus*. Severe infections can lead to necrotizing faciitis.

Loss and Damages

Major concerns during a public health emergency include the ability of local healthcare providers to give medical attention to everyone who becomes ill, and the ability to identify the source of illness in the population. Cascading effects of public health emergencies can include:

- illness or death,

- civil disturbance,
- distrust of government,
- poor water quality, and
- temporary loss of income.

Of the diseases experienced in Trumbull County, there are vaccines for chickenpox, pertussis, and Hepatitis B. Because most children in Trumbull County received vaccinations, the number of cases of these diseases should not significantly increase.

Vulnerability Assessment

This section summarizes the vulnerability to Trumbull County from the epidemic hazard. Trumbull County conducted an online survey for the public to share its thoughts on hazard vulnerabilities. The following table presents the results of that survey regarding epidemics.

PUBLIC SENTIMENT, EPIDEMIC – TRUMBULL COUNTY					
Hazard	*Level of Concern*				*Total Responses*
	Not at All	*Somewhat*	*Concerned*	*Very*	
Epidemic	40 (11.56%)	126 (36.42%)	126 (36.42%)	54 (15.61%)	346
In the past ten years, do you remember this hazard occurring in your community?				22 (6.38%)	345
Have you noticed an increase in the occurrences or intensity of this hazard?				21 (6.33%)	332
Have you noticed a decrease in the occurrences or intensity of this hazard?				29 (9.24%)	314

The following table assigns point totals based on the research presented in this profile for each category that appears in Ohio EMA's SHARPP tool.

EPIDEMIC VULNERABILITY SUMMARY			
Category	*Points*	*Description*	*Notes*
Frequency	5	Excessive	Trumbull County can expect a seasonal outbreak of infectious disease every year. Significantly, though, even when considering the 2020 COVID-19 pandemic, large-scale disaster situations would likely occur 0.05 times per year.
Response	3	One week	Pandemic responses, like the H1N1 response and the on-going COVID-19 response, far exceed one month in duration; however, the response to other outbreaks occurs more quickly. Planners thus selected the median option for this category.
Onset	1	Over 24 hours	While one person can become ill in less than a day, the onset of a pandemic is slow and takes place over weeks or months.
Magnitude	1	Less than 10% of land area affected	An epidemic would affect less than 10% of land area in Trumbull County. Its impacts are limited to human health.
Business	3	At least two weeks	For this category, planners again averaged potential impacts. A "normal" outbreak would not likely impact business operations. However, a pandemic response (e.g., COVID-19) would disrupt business operations for 30 or more days.
Human	2	Some injuries	Though many people may become ill, most recover from communicable diseases.
Property	1	Less than 10% of property affected	Epidemic events primarily affect human health, not property.
Total	16	Medium	

2.0 RISK ASSESSMENT

2.2.5 Flooding

A flood is a general or temporary condition of partial or complete inundation of normally dry land areas or the rapid accumulation of runoff surface waters from any source. A flash flood is a sudden local flood, typically due to heavy rain.				
Vulnerability  HIGHEST HIGH MEDIUM LOW LOWEST	Period of Occurrence:	At any time, typically after prolonged periods of precipitation	Hazard Index Ranking:	High
	Warning Time:	12-24 hours	State Risk Ranking:	4 – High
	Probability:	Highly likely	Severity:	Critical
	Type of Hazard:	Natural	Disaster Declarations:	DR 870 (1990) DR 951 (1992) DR 1484 (2003) DR 1556 (2004)

Hazard Overview

Floods are the most prevalent hazard in the United States. Each year, floods cause more property damage in the U.S. than any other type of natural disaster, killing an average of 150 people a year. According to NOAA, some of the possible causes for flooding include the following.

- **Excessive Rainfall:** This is the most common cause of flooding. Water accumulates quicker than the soil can absorb, resulting in flooding.
- **Snowmelt**: It occurs when the primary source of water involved is melting snow. Unlike rainfall that can reach the soil almost immediately, the snowpack can store the water for an extended amount of time until temperatures rise above freezing, and the snow melts.
- **Ice or Debris Jams**: Common during the winter and spring along rivers, streams, and creeks. As ice or debris moves downstream, it may get caught on obstructions to the water flow. When this occurs, water can be held back, causing upstream flooding. When the jam finally breaks, flash flooding can occur downstream.
- **Dam Breaks or Levee Failure**: Dams can overtop, have excessive seepage, or have a structural failure. For more information, see Section 2.2.1 Dam and Levee Failure.

Location and Extent

Floods are described by their horizontal extents, the depth of the floodwaters, and the probability of occurrence. Unfortunately, meteorological officials historically have expressed the likelihood of occurrence in terms such as a “100-year flood”, which the general public logically

assumes means a flood that happens once in 100 years. The probability of occurrence is interpreted best as a percent chance of occurring. So, a 100-year flood is that flood level that has a 1% chance of occurring in any given year. The 100 year, or 1% flood, is often a function of risk planning. Smaller floods are more likely to occur; thus, a 10-year flood has a 10% chance of occurring in any given year.

When structures experience more than one flooding event, they can become "repetitive loss" or "severe repetitive loss" properties. The Flood Mitigation Assistance (FMA) grant and the National Flood Insurance Program (NFIP) define repetitive loss and severe repetitive loss slightly differently. The table below outlines both definitions.

REPETITIVE LOSS AND SEVERE REPETITIVE LOSS DEFINITIONS		
Program	*Repetitive Loss*	*Severe Repetitive Loss*
Flood Mitigation Assistance (FMA) Grant	*A repetitive loss (RL) property is a structure covered by a contract for flood insurance made available under the NFIP that:* Has incurred flood-related damage on 2 occasions, in which the cost of the repair, on the average, equaled or exceeded 25% of the market value of the time of each such flood event; At the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.	(a) Is covered under a contract for flood insurance made available under the NFIP; and (b) Has incurred flood-related damage i. For which 4 or more separate claims payments (includes building and contents) have been made under flood insurance coverage with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claim's payments exceeding $20,000, or ii. For which at least 2 separate claims payments (includes only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.
National Flood Insurance Program (NFIP)	A repetitive loss (RL) property is any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period since 1978.	A single-family property (consisting of one to four residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which four or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding $5,000 and with cumulative amount of such claims payments exceeding $20,000; or for which at least two separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

The following table outlines NFIP policies in force throughout Trumbull County.

NFIP POLICIES IN FORCE, TRUMBULL COUNTY			
Community Name (Number)	*Policies in Force*	*Total Coverage ($)*	*Total Written Premium + FPF ($)*
Cortland City (390823)	8	$2,730,000	$3,365
Girard City (390536)	10	$3,301,000	$31,075
Hubbard City (390537)	11	$1,625,800	$5,788
Lordstown Village (390812)	2	$427,000	$1,470
Newton Falls Village (390539)	6	$1,801,000	$3,690
Niles City (390540)	95	$16,557,800	$97,210
Trumbull County (390535)	233	$39,308,300	$204,102
Warren City (390541)	55	$12,684,400	$94,926

There are 40 repetitive loss properties in Trumbull County, with 105 combined losses. There are no severe repetitive loss properties in the county.

REPETITIVE LOSS PROPERTIES, TRUMBULL COUNTY							
Community Name (Jurisdiction)	*Community Number*	*Occupancy*	*Zone*	*Building Payments*	*Contents Payments*	*Total Paid*	*Average Payment*
Trumbull County (Warren Twp.)	390535	Single Family	B	$69,041.45	$0.00	$69,041.45	$13,808.29
Trumbull County (Liberty Twp.)	390535	Single Family	X	$79,982.22	$29,440.85	$109,423.07	$18,237.18
Warren, City of	390541	Single Family	A	$65,060.25	$16,158.62	$81,218.87	$16,243.77
Girard, City of	390536	Single Family	AE	$25,489.72	$979.04	$26,468.76	$6,617.19
Hubbard, City of	390537	2-4 Family	C	$24,684.51	$0.00	$24,684.51	$8,228.17
Trumbull County (Braceville Twp.)	390535	Single Family	A	$28,898.45	$0.00	$28,898.45	$14,449.23
Trumbull County (Warren Twp.)	390535	Single Family	B	$28,448.83	$4,196.15	$32,644.98	$16,322.49
Trumbull County (Braceville Twp.)	390535	Single Family	A	$4,143.36	$0.00	$4,143.36	$2,071.68
Trumbull County (Girard Twp.)	390535	Single Family	X	$31,695.48	$723.75	$32,419.23	$16,209.62
Trumbull County (Braceville Twp.)	390535	Single Family	A	$47,722.39	$22,254.60	$69,976.99	$34,988.5
Trumbull County (Warren Twp.)	390535	Single Family	A06	$30,478.24	$0.00	$30,478.24	$15,239.12
Trumbull County (Warren Twp.)	390535	Single Family	A	$3,917.65	$1,372.02	$5,289.67	$1,763.22
Trumbull County (Champion Twp.)	390535	Other Resident	X	$90,991.14	$0.00	$90,991.14	$45,495.57
Trumbull County (Farmington Twp.)	390535	Single Family	X	$40,427.75	$35,656.97	$76,084.72	$38,042.36

REPETITIVE LOSS PROPERTIES, TRUMBULL COUNTY							
Community Name (Jurisdiction)	*Community Number*	*Occupancy*	*Zone*	*Building Payments*	*Contents Payments*	*Total Paid*	*Average Payment*
Trumbull County (Girard Twp.)	390535	2-4 Family	C	$6,747.96	$600.51	$7,348.47	$3,674.24
Trumbull County (Warren Twp.)	390535	Single Family	X	$37,850.35	$24,118.23	$61,968.58	$30,984.29
Trumbull County (Warren Twp.)	390535	Single Family	AE	$78,288.12	$0.00	$78,288.12	$39,144.06
Trumbull County (Warren Twp.)	390535	Single Family	A06	$28,659.19	$8,773.92	$37,433.11	$18,716.56
Trumbull County (Warren Twp.)	390535	Single Family	AE	$20,048.68	$0.00	$20,048.68	$10,024.34
Trumbull County (Warren Twp.)	390535	Single Family	A02	$12,557.96	$1,298.01	$13,855.97	$6,927.99
Trumbull County (Warren Twp.)	390535	Single Family	AE	$5,195.61	$0.00	$5,195.61	$2,597.81
Trumbull County (Warren Twp.)	390535	Single Family	X	$40,265.46	$0.00	$40,265.46	$8,053.09
Trumbull County (Warren Twp.)	390535	Single Family	A06	$3,033.75	$3,446.32	$6,480.07	$3,240.04
Trumbull County (Warren Twp.)	390535	Single Family	A	$111,383.29	$2,554.72	$113,938.01	$37,979.34
Trumbull County (Hubbard Twp.)	390535	Other-Nonresident	AE	$49,300.00	$110,800.00	$160,100.00	$8,0050
Trumbull County (Howard Twp.)	390535	Other-Nonresident	C	$140,894.42	$36,493.39	$177,387.81	$59,129.27
Trumbull County (Warren Twp.)	390535	Single Family	A06	$22,241.35	$0.00	$22,241.35	$11,120.68
Trumbull County (Warren Twp.)	390535	Single Family	A06	$5,381.82	$0.00	$5,381.82	$2,690.91
Trumbull County (Liberty Twp.)	390535	2-4 Family	B	$25,375.92	$0.00	$25,375.92	$8,458.64
Trumbull County (Brookfield Twp.)	390535	Other-Nonresident	C	$0.00	$58,392.12	$58,392.12	$29,196.06
Trumbull County (Warren Twp.)	390535	Single Family	A06	$63,500.00	$0.00	$63,500.00	$3,1750
Trumbull County (Brookfield Twp.)	390535	Single Family	C	$20,391.70	$0.00	$20,391.70	$5,097.93
Warren, City of	390541	Single Family	AE	$32,815.14	$0.00	$32,815.14	$10,938.38
Warren, City of	390541	Single Family	X	$21,432.27	$11,710.07	$33,142.34	$16,571.17
Warren, City of	390541	Single Family	A	$31,853.33	$0.00	$31,853.33	$15,926.67
Warren, City of	390541	Single Family	B	$66,093.61	$721.22	$66,814.83	$13,362.97
Warren, City of	390541	Single Family	X	$44,371.83	$6,924.25	$51,296.08	$17,098.69
Warren, City of	390541	Other-Nonresident	X	$6,752.38	$0.00	$6,752.38	$3,376.19
Warren, City of	390541	Single Family	A	$10,939.01	$0.00	$10,939.01	$5,469.51

REPETITIVE LOSS PROPERTIES, TRUMBULL COUNTY							
Community Name (Jurisdiction)	*Community Number*	*Occupancy*	*Zone*	*Building Payments*	*Contents Payments*	*Total Paid*	*Average Payment*
Warren, City of	390541	Other-Nonresident	A06	$3,808.14	$0.00	$3,808.14	$1,904.07

Impacts and Vulnerability

Impacts from flooding can be primary or secondary. Primary effects are those that occur due to contact with water. Secondary effects occur because of flooding, such as disruption of services and changes in the position of river channels.

EFFECTS OF FLOODING	
Type	*Description*
Primary Impacts	• With higher velocities, streams are able to transport larger particles as suspended load. Such large particles include not only rocks and sediment, but, during a flood, could include such large objects as automobiles, houses, and bridges. • Massive amounts of erosion can be accomplished by floodwaters. Such erosion can undermine bridge structures, levees, and buildings causing their collapse. • Water entering human-built structures cause water damage. Even with minor flooding of homes, furniture is ruined, floors and walls are damaged, and anything that comes in contact with the water is likely to be damaged or lost. Flooding of automobiles usually results in damage that cannot easily be repaired. • The high velocity of floodwaters allows the water to carry more sediment as suspended load. When the floodwaters retreat, velocity is generally much lower and sediment is deposited. After retreat of the floodwaters, everything is usually covered with a thick layer of stream deposited mud, including the interior of buildings. • Flooding of farmland usually results in crop loss. Livestock, pets, and other animals are often carried away and drown. • Humans that get caught in the high-velocity floodwaters are often drowned by the water. • Floodwaters can concentrate garbage, debris, and toxic pollutants that can cause the secondary effects of health hazards.
Secondary Impacts	Disruption of services - • Drinking water supplies may become polluted, especially if sewerage treatment plants are flooded. This may result in disease and other health effects, especially in underdeveloped countries. • Gas and electrical service may be disrupted. • Transportation systems may be disrupted, resulting in shortages of food and clean-up supplies. In underdeveloped countries, food shortages often lead to starvation.
Long-Term (Tertiary) Impacts	• Location of river channels may change as the result of flooding, new channels develop, leaving the old channels dry. • Sediment deposited by flooding may destroy farmland (although silt deposited by floodwaters could also help to increase agricultural productivity). • Jobs may be lost due to the disruption of services, destruction of business, etc. (although jobs may be gained in the construction industry to help rebuild or repair flood damage). • Insurance rates may increase. • Corruption may result from misuse of relief funds. • Destruction of wildlife habitat.

Past Mitigation Efforts: Flooding

- Require applications for floodplain development permits for all development activities located within, or in contact with, an identified special flood hazard area. Such application shall be made by the owner of the property or his/her authorized agent, prior to the actual commencement of such construction. Where it is unclear whether a development site is in a special flood hazard area, the Floodplain Administrator may require an application for a floodplain development permit to determine the development's location. It shall be unlawful for any person to begin construction or other development activity, including but not limited to, filling; grading; construction; alteration, remodeling, or expanding any structure; or alteration of any watercourse wholly within, partially within or in contact with any identified special flood hazard area, until a floodplain development permit is obtained.
- Conducted buyouts or property acquisition and relocation projects in several areas, and have conducted flood elevation adjustments to several facilities.
- Several jurisdictions have designated an "NFIP Coordinator". The NFIP Coordinator maintains the jurisdiction's floodplain ordinance and ensures that development is compliant with that ordinance (and, consequently, the NFIP).
- Worked with FEMA and the Ohio Emergency Management Agency (OEMA) on the Map Modernization Program to improve FIRMs (i.e., flood insurance study [FIS] dated June 2010).
- Working with the municipalities to update all outdated floodplain ordinances.
- Floodplain information now appears on zoning maps.
- Collecting updated information of the number and location of all repetitive loss properties throughout the county and the municipalities.
- Identifying owners of repetitive loss properties who are interested in participating in future property acquisition and relocation projects.
- The distribution of letters to all property owners in the county regarding potential flood hazards as required for participation in the Community Rating System (CRS).
- The development and distribution of public awareness materials concerning flood hazard risks, and updating the county's website to provide hazard related information that is easily accessible.
- Miscellaneous culvert and bridge projects designed to more efficiently move stormwater and keep it from pooling.

Historical Occurrences

There have been 29 floods and 33 flash floods in Trumbull County since 1996, for an average of 1.3 floods and 1.4 flash floods per year. These events have caused a combined $89.42 million in damage. The following table outlines the instances of flooding.

HISTORICAL OCCURRENCES – FLOOD (Source: NCEI Storm Events Database)						
Location	*Date*	*Type*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
Trumbull (Zone)	3/20/1996	Flood	0	0	0.00K	0.00K
Trumbull (Zone)	5/11/1996	Flood	0	0	55.00K	0.00K
Trumbull (Zone)	5/11/1996	Flood	0	0	0.00K	0.00K
Trumbull (Zone)	12/12/1996	Flood	0	0	0.00K	0.00K
Trumbull (Zone)	6/2/1997	Flood	0	0	0.00K	0.00K
Trumbull (Zone)	1/9/1998	Flood	0	0	0.00K	0.00K
Trumbull (Zone)	4/17/1998	Flood	0	0	0.00K	0.00K
Trumbull (Zone)	1/24/1999	Flood	0	0	0.00K	0.00K
Trumbull (Zone)	4/8/2000	Flood	0	0	0.00K	0.00K
Trumbull (Zone)	7/19/2001	Flood	0	0	50.00K	0.00K
Trumbull (Zone)	6/12/2003	Flood	0	0	300.00K	0.00K
Trumbull (Zone)	6/13/2003	Flood	0	0	50.00K	0.00K
Trumbull (Zone)	7/21/2003	Flood	0	0	32.000M	0.00K
Trumbull (Zone)	7/23/2003	Flood	0	0	100.00K	0.00K
Trumbull (Zone)	8/6/2003	Flood	0	0	100.00K	0.00K
Trumbull (Zone)	9/9/2004	Flood	0	0	250.00K	0.00K
Trumbull (Zone)	9/17/2004	Flood	0	0	325.00K	0.00K
Trumbull (Zone)	1/1/2005	Flood	0	0	425.00K	0.00K
Trumbull (Zone)	8/30/2005	Flood	0	0	100.00K	0.00K
Phalanx	2/28/2011	Flood	0	0	600.00K	0.00K
Leavittsburg	5/12/2011	Flood	0	0	0.00K	0.00K
Sodom	5/25/2011	Flood	0	0	0.00K	0.00K
McDonald	5/27/2011	Flood	0	0	0.00K	0.00K
Albion	9/10/2011	Flood	0	0	20.00K	0.00K
Mineral Ridge	6/30/2015	Flood	0	0	80.00K	0.00K
Niles	1/12/2017	Flood	0	0	0.00K	0.00K
Leavittsburg	4/16/2018	Flood	0	0	30.00K	0.00K
Braceville	1/24/2019	Flood	0	0	0.00K	0.00K
Five Points	6/1/2019	Flood	0	0	0.00K	0.00K
		TOTALS	0	0	34.485M	0.00K

HISTORICAL OCCURRENCES – FLASH FLOOD (Source: NCEI Storm Events Database)						
Location	*Date*	*Type*	*Deaths*	Injuries	*Property Damage*	*Crop Damage*
County Wide	4/23/1996	Flash Flood	0	0	0.00K	0.00K
Southern Half	5/11/1996	Flash Flood	0	0	10.00K	0.00K
County Wide	6/7/1996	Flash Flood	0	0	0.00K	0.00K
Liberty Township	6/24/1996	Flash Flood	0	0	0.00K	0.00K
County Wide	7/16/1996	Flash Flood	0	0	0.00K	0.00K
Warren	8/23/1996	Flash Flood	0	0	0.00K	0.00K

HISTORICAL OCCURRENCES – FLASH FLOOD (Source: NCEI Storm Events Database)						
Location	*Date*	*Type*	*Deaths*	Injuries	*Property Damage*	*Crop Damage*
County Wide	12/11/1996	Flash Flood	0	0	5.00K	0.00K
Kinsman	6/12/1997	Flash Flood	0	0	0.00K	0.00K
Brookfield	9/10/1997	Flash Flood	0	0	0.00K	0.00K
County Wide	1/7/1998	Flash Flood	0	0	0.00K	0.00K
Niles	4/16/1998	Flash Flood	0	0	0.00K	0.00K
County Wide	1/23/1999	Flash Flood	0	0	0.00K	0.00K
County Wide	7/28/1999	Flash Flood	0	0	50.00K	0.00K
County Wide	7/21/2003	Flash Flood	1	0	12.000M	0.00K
County Wide	7/21/2003	Flash Flood	0	0	25.000M	0.00K
County Wide	7/22/2003	Flash Flood	0	0	500.00K	0.00K
South Portion	7/27/2003	Flash Flood	0	0	6.000M	0.00K
County Wide	8/29/2003	Flash Flood	0	0	250.00K	0.00K
County Wide	9/8/2004	Flash Flood	0	0	4.200M	0.00K
Green Center	9/8/2007	Flash Flood	0	0	25.00K	0.00K
Oakfield	5/13/2011	Flash Flood	0	0	20.00K	0.00K
Braceville	5/14/2011	Flash Flood	0	0	0.00K	0.00K
North Bloomfield	5/14/2011	Flash Flood	0	0	10.00K	0.00K
Newton Falls	7/10/2013	Flash Flood	0	0	200.00K	0.00K
Newton Falls	8/8/2013	Flash Flood	0	0	2.500M	0.00K
Kinsman	7/27/2014	Flash Flood	0	0	60.00K	0.00K
Girard	8/2/2014	Flash Flood	0	0	30.00K	0.00K
Cortland	8/2/2014	Flash Flood	0	0	15.00K	0.00K
Champion	6/14/2015	Flash Flood	0	0	180.00K	0.00K
McKinley Heights	9/3/2018	Flash Flood	0	0	5.00K	0.00K
Lockwood	6/5/2019	Flash Flood	0	0	125.00K	0.00K
Kinsman	7/20/2019	Flash Flood	0	0	3.000M	0.00K
Barclay	7/20/2019	Flash Flood	0	0	750.00K	0.00K
		TOTALS	0	0	54.935M	0.00K

July 21, 2003, Flood and Flash Flood

Heavy rain caused the Mahoning River to flood. At its height, the river crested to 17.16 feet at Leavittsburg. Three cities, Leavittsburg, Niles, and Warren, were all evacuated and sustained extensive damage. In total, 753 homes were damaged by the floodwaters, with 90 homes being destroyed or declared uninhabitable. A further 1,400 homes sustained basement flooding, and dozens of roads, culverts, and driveways were damaged. Damage to roads, government or public buildings, parks, and recreational areas reached $4 million.

In the southeast area of Trumbull County, over seven inches of rain fell within a few hours. Floodwaters up to five feet deep were reported in Brookfield, and evacuations were ordered for both Brookfield and portions of Hubbard. The Trumbull County 911 Center in Howland was evacuated around 9:00 p.m. after floodwaters collapsed a basement wall.

July 20, 2019, Flash Flood

A cold front originating in the Great Lakes caused storms to drop five to six inches of rain on Kinsman Lake. Runoff overwhelmed an earthen dam that eventually eroded and failed. Downstream, agricultural fields sustained significant erosion, a basement wall collapsed, and a bridge washed out, leaving 55 people in 21 homes stranded. Damages reached $3 million.

Loss and Damages

Floods have caused $34.5 million in damages in Trumbull County since 1996, and flash floods have generated an additional $54.9 million in damages in that same time. These figures give a combined loss per year of $3.9 million per year or $1.4 million per event. Further, FEMA can estimate losses from flood to buildings in Trumbull County through the HAZUS-MH program. The program calculates the expected losses to buildings from a 100-year flood event. The following tables outline the expected building damages by occupancy and type and the building-related economic losses. The following table describes the expected damages by occupancy.

EXPECTED BUILDING DAMAGE BY OCCUPANCY												
Occupancy	*1-10*		*11-20*		*21-30*		*31-40*		*41-50*		*Substantially*	
	Ct.	*%*	*Ct.*	*%*	*Ct.*	*%*	*Ct.*	*%*	*Ct.*	*%*	*Ct.*	*%*
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	2	14	9	64	2	14	0	0	0	0	1	7
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	1	100	0	0	0	0	0	0	0	0	0	0
Industrial	3	18	11	65	3	18	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	139	20	277	40	141	20	64	9	38	5	40	6
TOTAL	145		297		146		64		38		41	

EXPECTED BUILDING DAMAGE BY BUILDING TYPE												
Building Type	*1-10*		*11-20*		*21-30*		*31-40*		*41-50*		*Substantially*	
	Ct.	*%*	*Ct.*	*%*	*Ct.*	*%*	*Ct.*	*%*	*Ct.*	*%*	*Ct.*	*%*
Concrete	1	17	4	67	1	17	0	0	0	0	0	0
Manufactured Housing	0	0	3	14	1	5	0	0	3	14	14	67
Masonry	16	19	42	49	18	21	6	7	4	5	0	0
Steel	3	18	11	65	3	18	0	0	0	0	0	0
Wood	124	21	237	40	123	21	58	10	31	5	26	4

Building-related losses include the building itself, its contents, the inventory, income, relocation costs, rental income losses, and lost wages.

BUILDING-RELATED ECONOMIC LOSS ESTIMATES (MILLIONS OF DOLLARS)						
Category	*Area*	*Residential*	*Commercial*	*Industrial*	*Others*	*Total*
Building Loss	Building	85.23	26.95	33.34	5.36	150.89
	Content	44.32	81.26	88.70	25.27	239.54
	Inventory	0.00	2.01	13.89	0.09	16.00
	Subtotal	129.55	110.22	135.94	30.72	406.42
Business Interruption	Income	3.14	46.59	5.17	9.00	63.90
	Relocation	25.69	14.24	3.65	4.48	48.07
	Rental Income	11.25	9.98	0.96	0.60	22.78
	Wage	7.43	65.34	4.32	48.58	125.67
	Subtotal	47.51	136.15	14.10	62.66	260.42
TOTAL		177.06	246.37	150.03	93.38	666.84

The Ohio EMA coordinated with the U.S. Army Corps of Engineers' Silver Jackets program to complete Level 2 HAZUS analyses for various counties in Ohio, including Trumbull. The Level 2 analysis presents a list of the structures that could suffer losses during a flood event (and displays them on a structure-by-structure basis). The following table is a summary of the Level 2 analysis.

HAZUS LEVEL 2 SUMMARIES, TRUMBULL COUNTY (Source: OEMA)							
Occupancy	*Total Cost*	*25-yr. Flood Building Loss*	*25-yr. Flood Contents Loss*	*25-yr. Flood Inventory Loss*	*100-yr. Flood Building Loss*	*100-yr. Flood Contents Loss*	*100-yr. Flood Inventory Loss*
AGR1	$14,680,700	$820,489.50	$2,509,832	$3,098,940	$820,489.50	$2,509,832	$3,098,940
COM1	$2,514,300	$234,262.40	$669,783.20	$739,604.30	$231,899.70	$669,783.20	$739,604.30
COM2	$1,249,300	$42,434.54	$152,456.80	$184,609.70	$42,434.54	$152,456.80	$184,609.70
COM3	$8,465,600	$1,003,451	$4,330,165	$0	$1,003,451	$4,330,165	$0
COM4	$3,344,300	$381,669	$533,591.80	$0	$381,669	$533,591.80	$0
COM6	$1,111,100	$180,964.20	$307,623.10	$0	$180,964.20	$307,623	$0
COM8	$3,273,900	$244,483	$925,307.30	$0	$244,483	$925,307.30	$0
COM10	$83,600	$918.34	$1,683.61	$0	$918.34	$1,683.61	$0
GOV1	$80,035,700	$4,109,702	$22,692,790	$0	$4,109,702	$22,692,790	$0
IND1	$2,890,500	$695,891.50	$1,794,501	$1,274,711	$695,891.50	$1,794,501	$1,274,711
IND2	$7,549,600	$1,624,252	$4,128,721	$3,187,555	$1,624,252	$4,128,721	$3,187,555
IND3	$561,900	$118,205.70	$424,584.10	$322,275	$118,205.70	$424,584.10	$322,275
IND6	$746,800	$360,572	$458,609.70	$498,214.50	$360,572	$458,609.70	$498,214.50
REL1	$1,024,400	$76,335.41	$542,232.70	$0	$76,335.41	$542,232.70	$0
RES1	$56,455,400	$11,682,818	$5,512,850	$0	$11,682,818	$5,512,850	$0
RES2	$7,301,500	$477,776.50	$169,413.50	$0	$477,776.50	$169,413.50	$0
RES3A	$1,202,000	$114,395	$79,455.55	$0	$114,395	$79,445.55	$0
RES3C	$297,700	$22,711.89	$16,990.72	$0	$22,711.89	$16,990.72	$0
RES3E	$2,681,500	$653,767.50	$378,978.60	$0	$653,767.50	$378,978,60	$0
RES3F	$234,500	$34,032.98	$18,782.87	$0	$34,032.98	$18,782.87	$0

To complete the SHARPP vulnerability assessment, the Ohio EMA's "loss estimate workbook for HAZUS results" provided the figures included in the following table.

FLOODING EXPOSURE ESTIMATE – SHARPP DATA ENTRY		
Structure Type	*Number*	*Loss Estimate*
Residential	4,405	$2,408,788,000
Non-Residential	1,820	$998,822,000
Critical Facilities	332	$185,645,000
TOTALS	6,556	$3,593,245,000

Another means of calculating flood losses is via the NFIP records of claims paid. The following table shows the total amount of claims paid in each municipality, according to the NFIP Consumer Insurance Service (CIS).

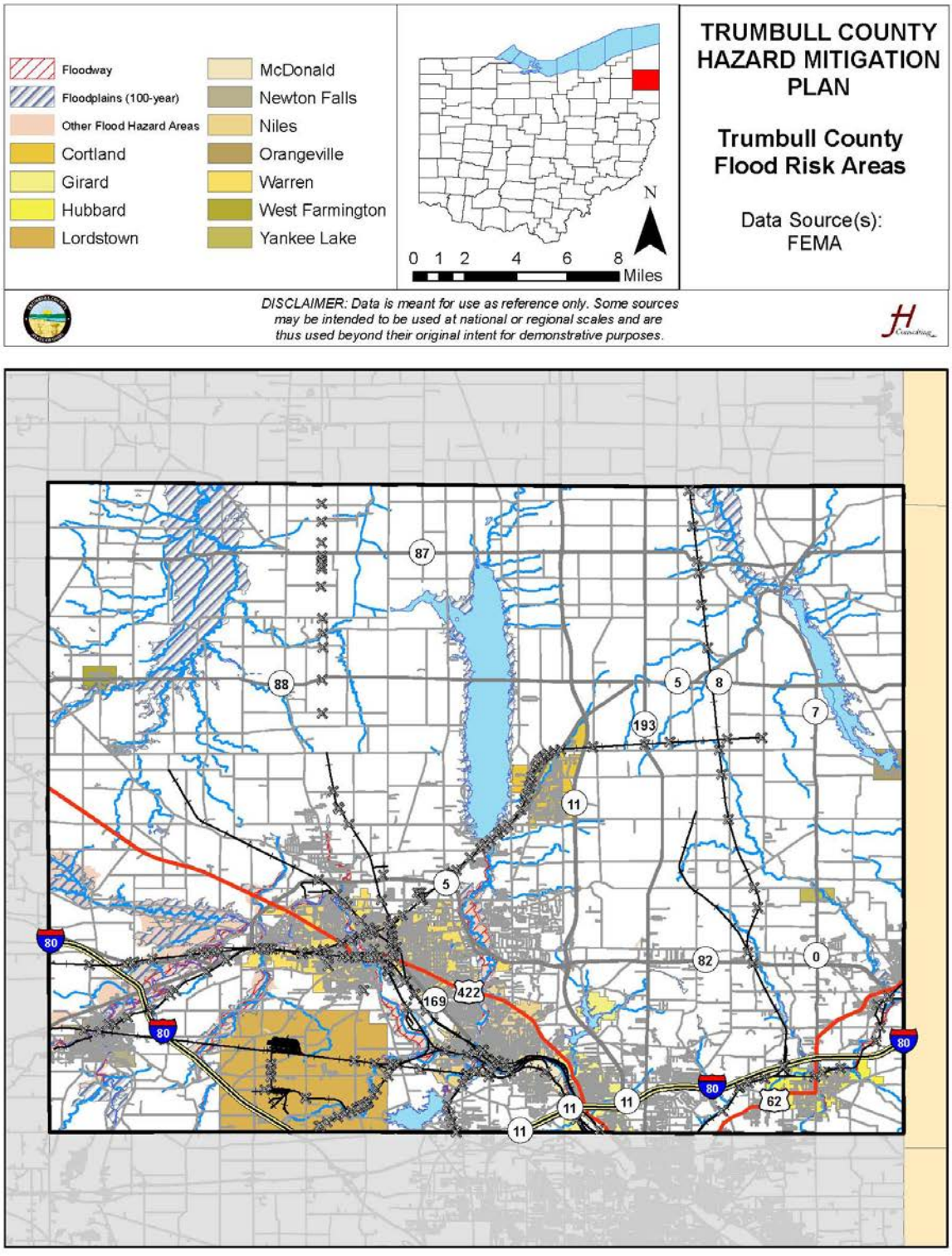
FLOODING CLAIMS PAID, TRUMBULL COUNTY		
Community	*Participation Status*	*Total Amount of Paid Claims*
Cortland City	Participating	$0
Girard City	Participating	$37,420
Hubbard City	Participating	$56,453
Lordstown Village	Participating	$0
McDonald Village	Participating	$2,994
Newton Falls Village	Participating	$8,618
Niles City	Participating	$112,022
Trumbull County	Participating	$2,671,831
Unknown	N/A	$25,798
Warren City	Participating	$557,646
Youngstown City (the portion in Trumbull Co.)	Participating	$11,955

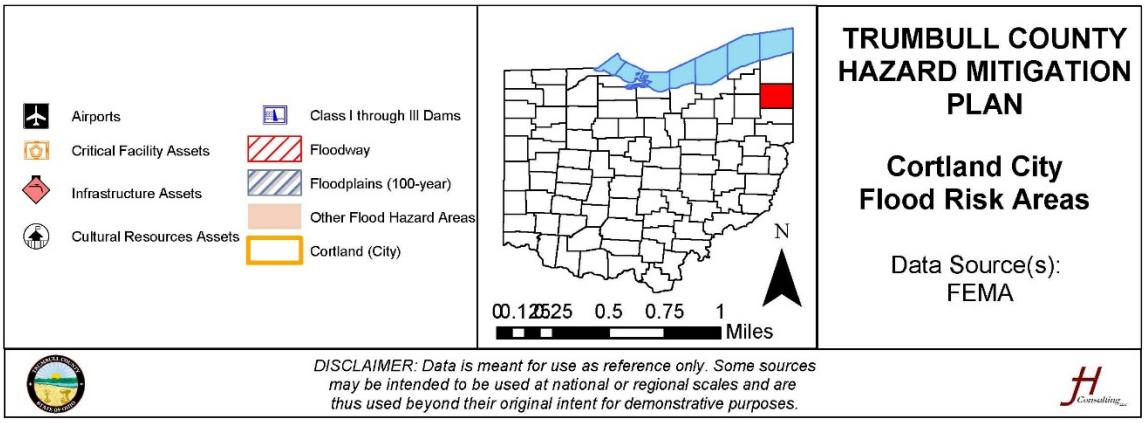
Vulnerability Assessment

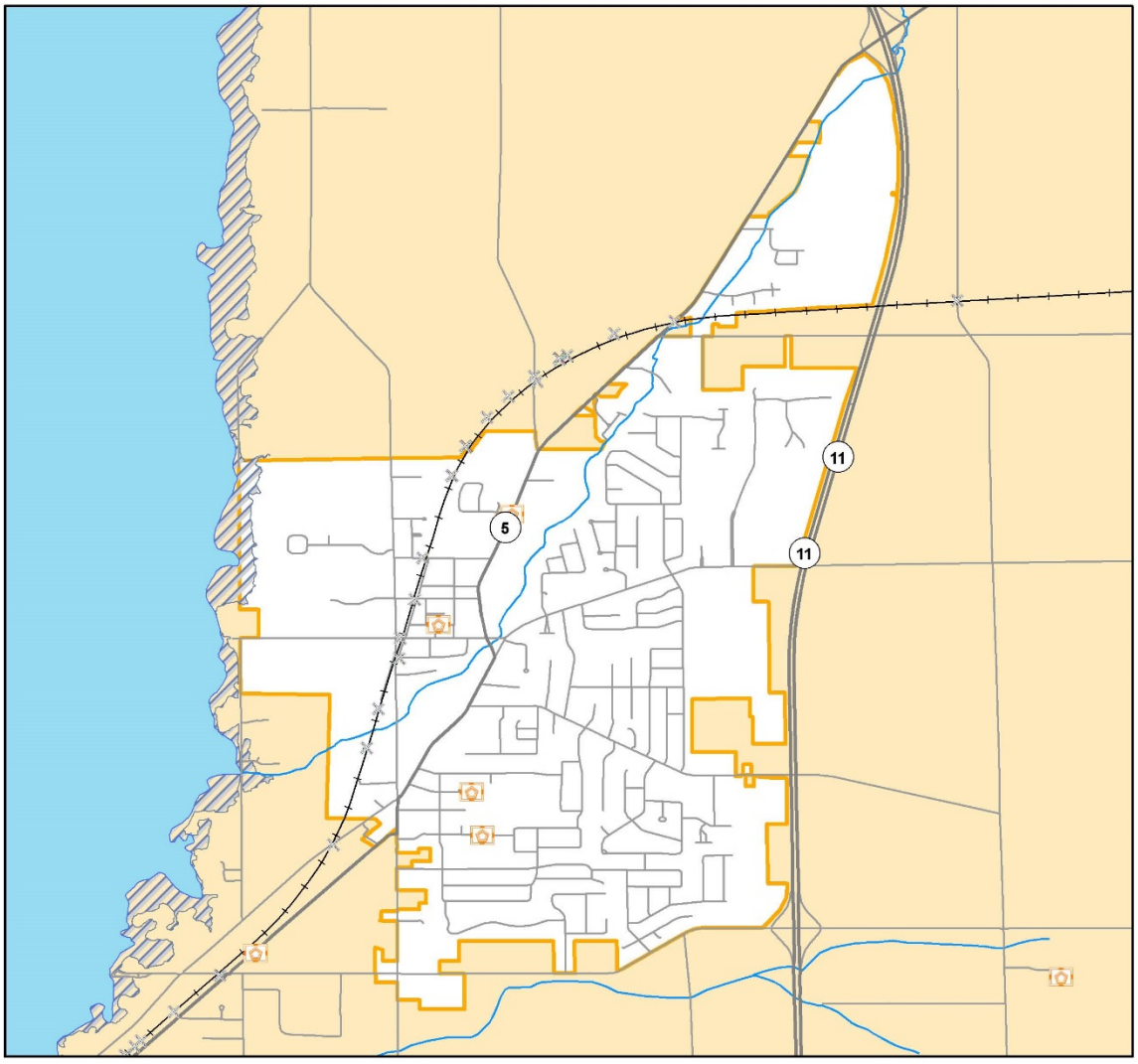
This section summarizes the vulnerability to Trumbull County from flooding. Trumbull County conducted an online survey for the public to share its thoughts on hazard vulnerabilities. The following table presents the results of that survey regarding flooding.

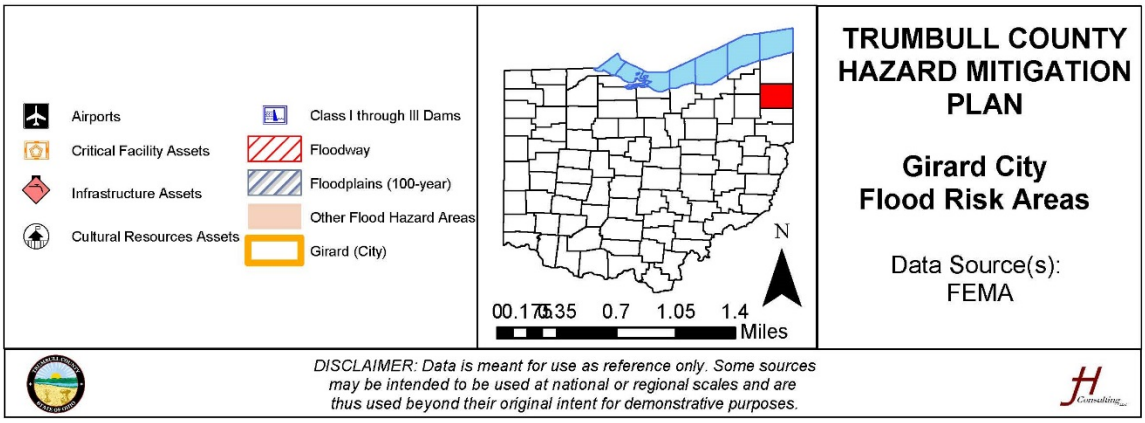
PUBLIC SENTIMENT, FLOODING – TRUMBULL COUNTY					
	Level of Concern				
Hazard	*Not at All*	*Somewhat*	*Concerned*	*Very*	*Total Responses*
Flooding	71 (20.52%)	128 (36.99%)	99 (28.61%)	48 (13.87%)	346
In the past ten years, do you remember this hazard occurring in your community?				228 (66.09%)	345
Have you noticed an increase in the occurrences or intensity of this hazard?				152 (45.78%)	332
Have you noticed a decrease in the occurrences or intensity of this hazard?				8 (2.55%)	314

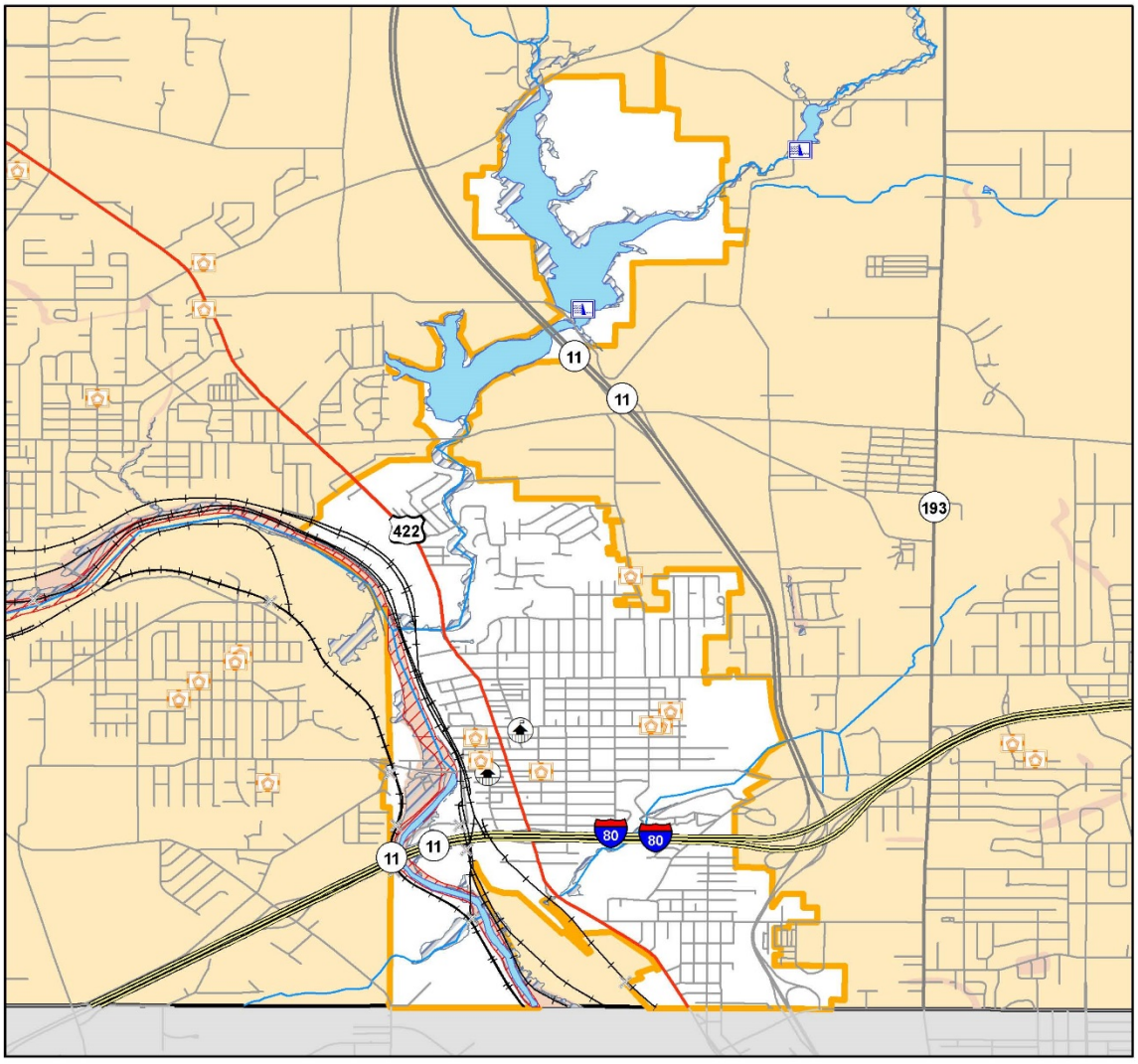
The map images graphically depict potential risk areas in Trumbull County. The first image is countywide; the remaining images are by city and village and show both the 100-year floodplain and community assets.

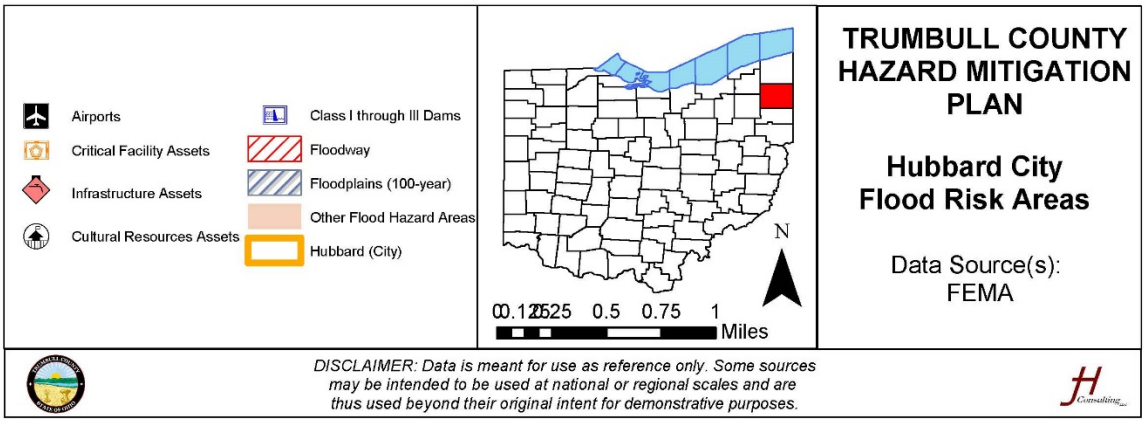

Floodway
Floodplains (100-year)
Other Flood Hazard Areas
Cortland
Girard
Hubbard
Lordstown
McDonald
Newton Falls
Niles
Orangeville
Warren
West Farmington
Yankee Lake
N
0 1 2 4 6 8
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
Trumbull County Flood Risk Areas
Data Source(s): FEMA
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.
87
88
5
8
7
193
11
5
80
82
0
169
422
80
80
11
11
11
62

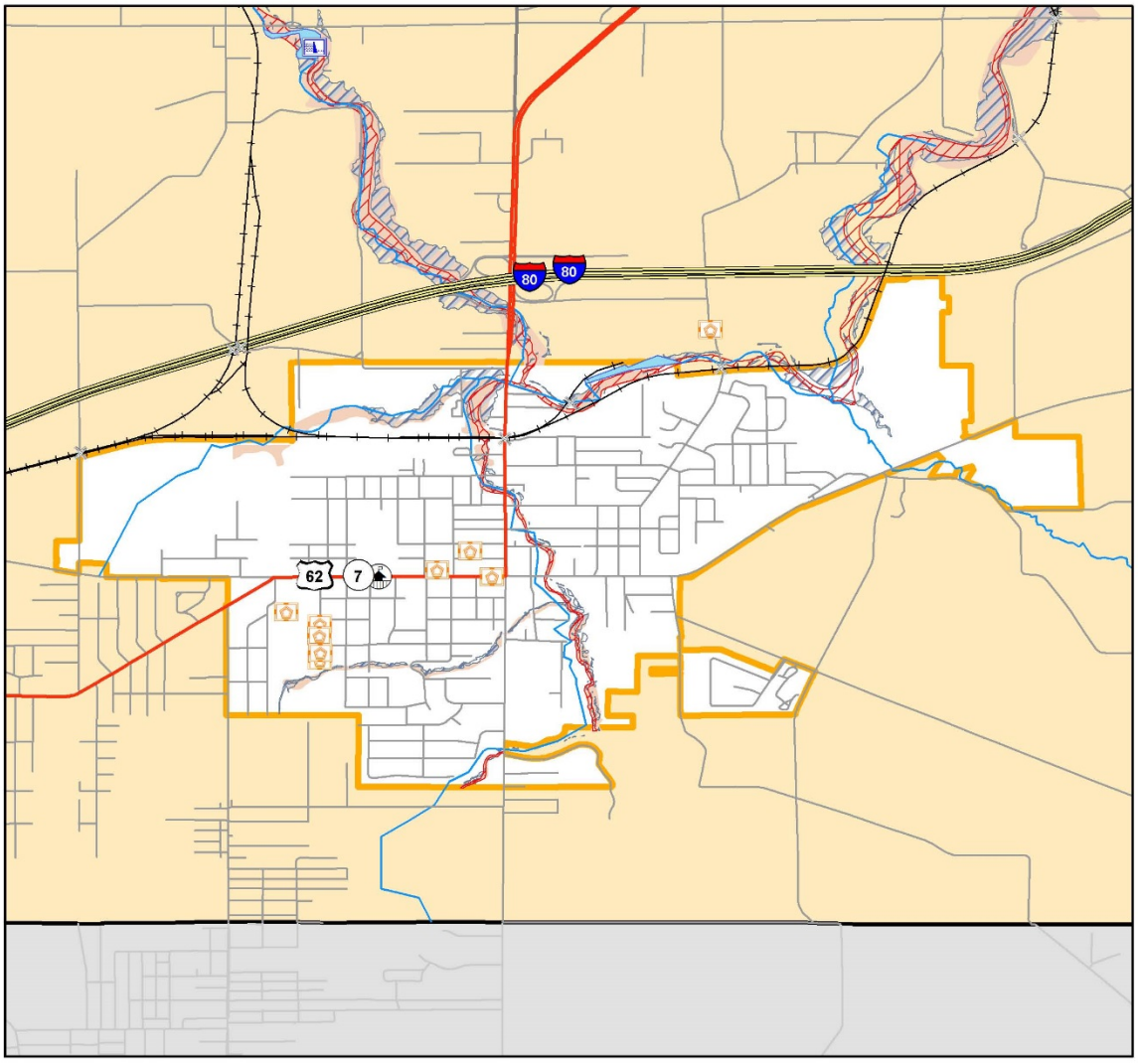

Airports
Critical Facility Assets
Infrastructure Assets
Cultural Resources Assets
Class I through III Dams
Floodway
Floodplains (100-year)
Other Flood Hazard Areas
Cortland (City)
N
0 0.125 0.25 0.5 0.75 1
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
Cortland City Flood Risk Areas
Data Source(s): FEMA
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

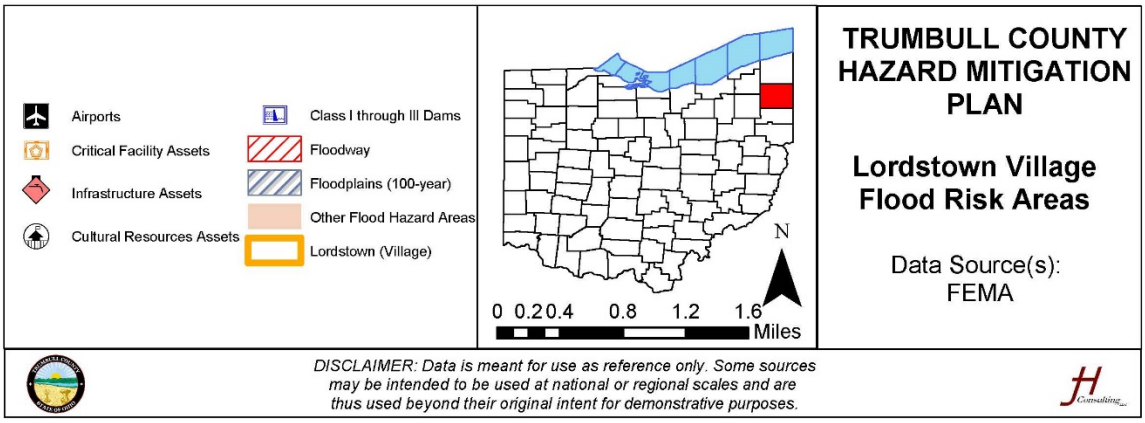

5
11
11

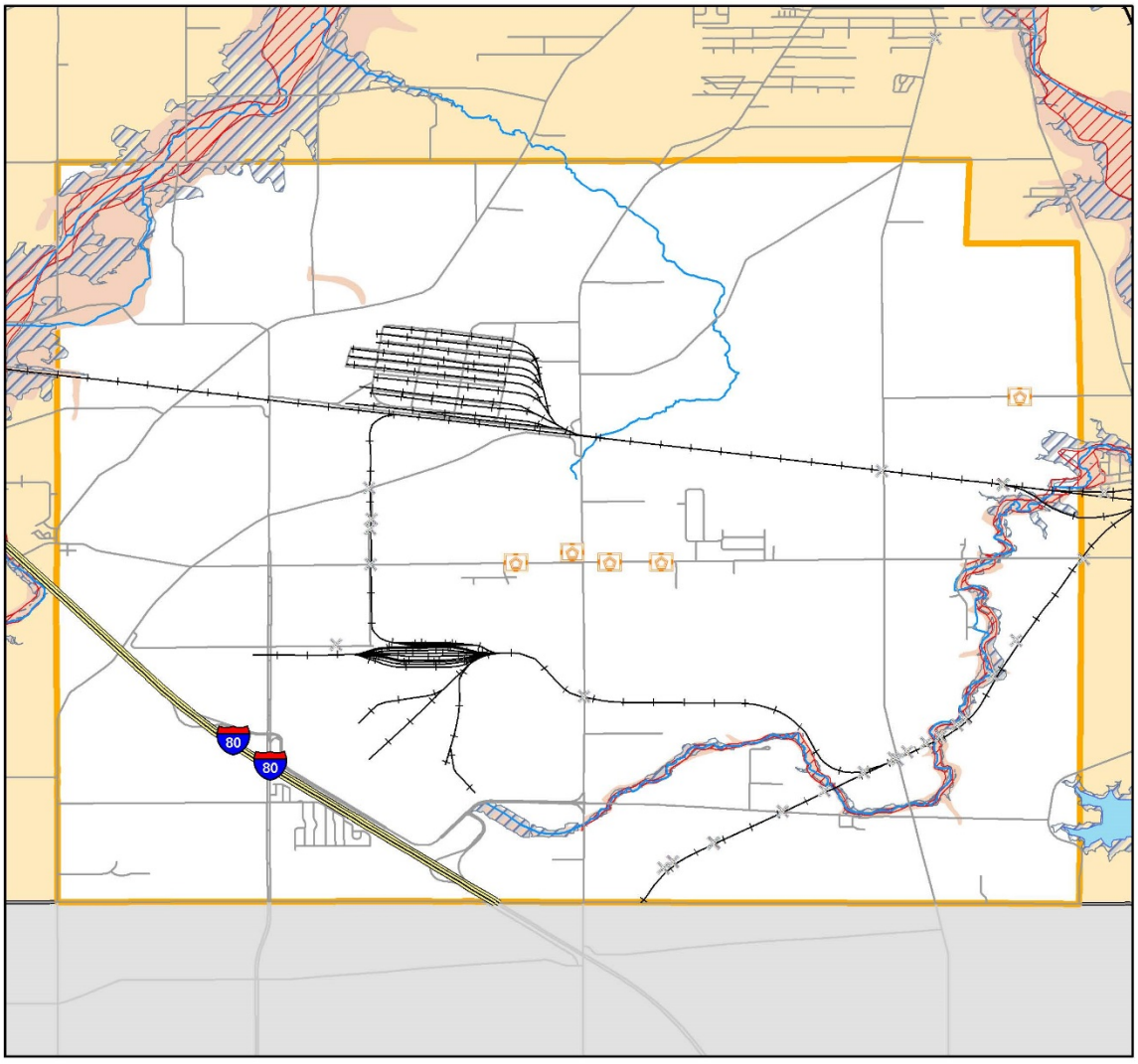

Airports
Critical Facility Assets
Infrastructure Assets
Cultural Resources Assets
Class I through III Dams
Floodway
Floodplains (100-year)
Other Flood Hazard Areas
Girard (City)
N
0 0.175 0.35 0.7 1.05 1.4
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
Girard City Flood Risk Areas
Data Source(s): FEMA
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

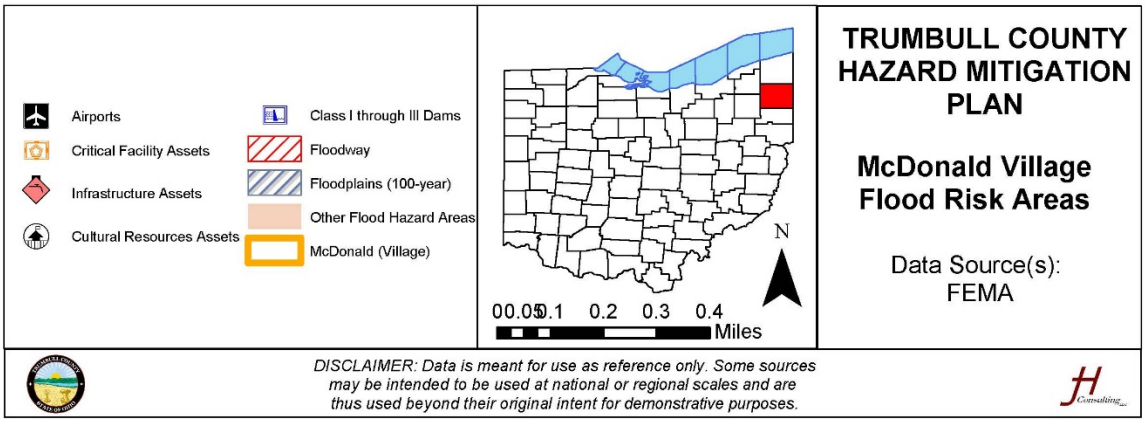

11
11
422
193
80
80
11
11

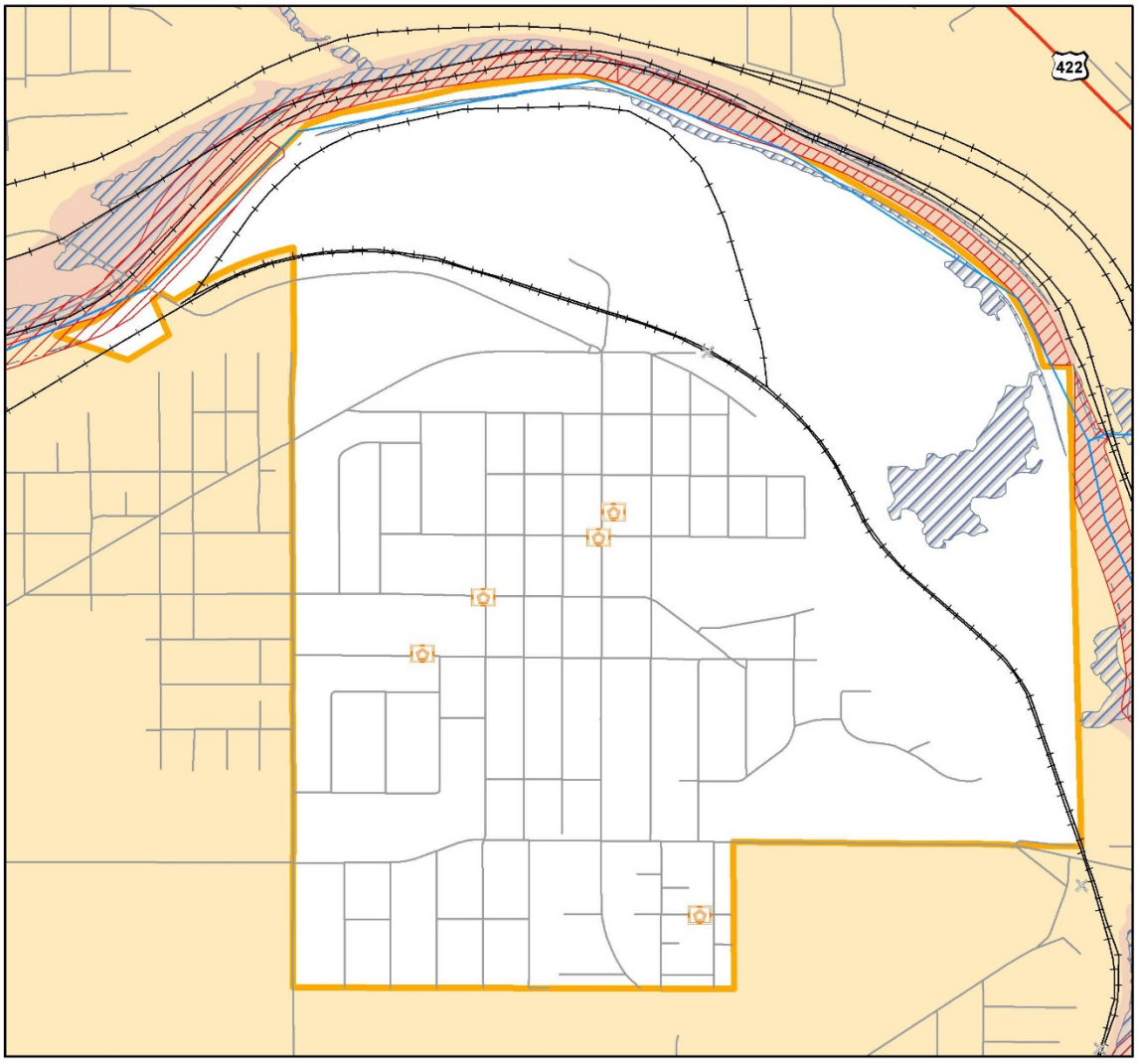

Airports
Critical Facility Assets
Infrastructure Assets
Cultural Resources Assets
Class I through III Dams
Floodway
Floodplains (100-year)
Other Flood Hazard Areas
Hubbard (City)
N
0 0.125 0.25 0.5 0.75 1
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
Hubbard City Flood Risk Areas
Data Source(s): FEMA
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

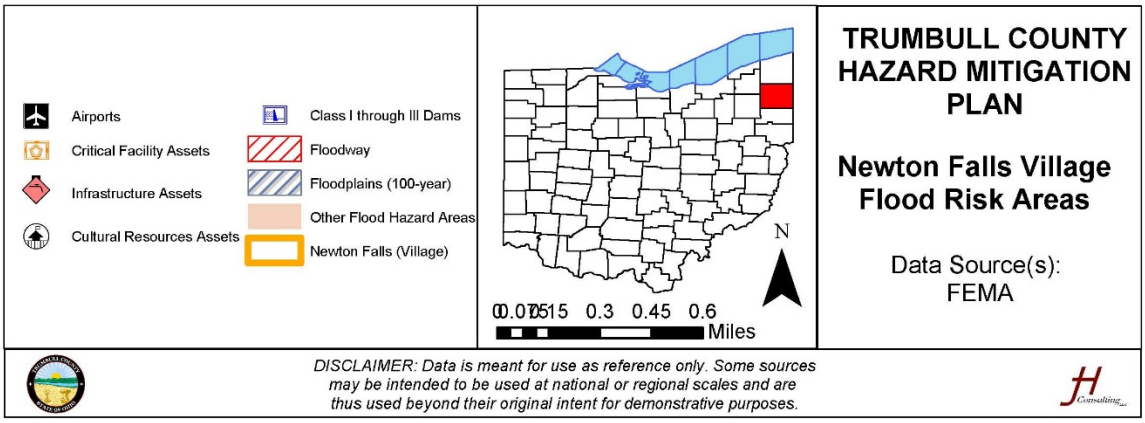

80
80
62
7

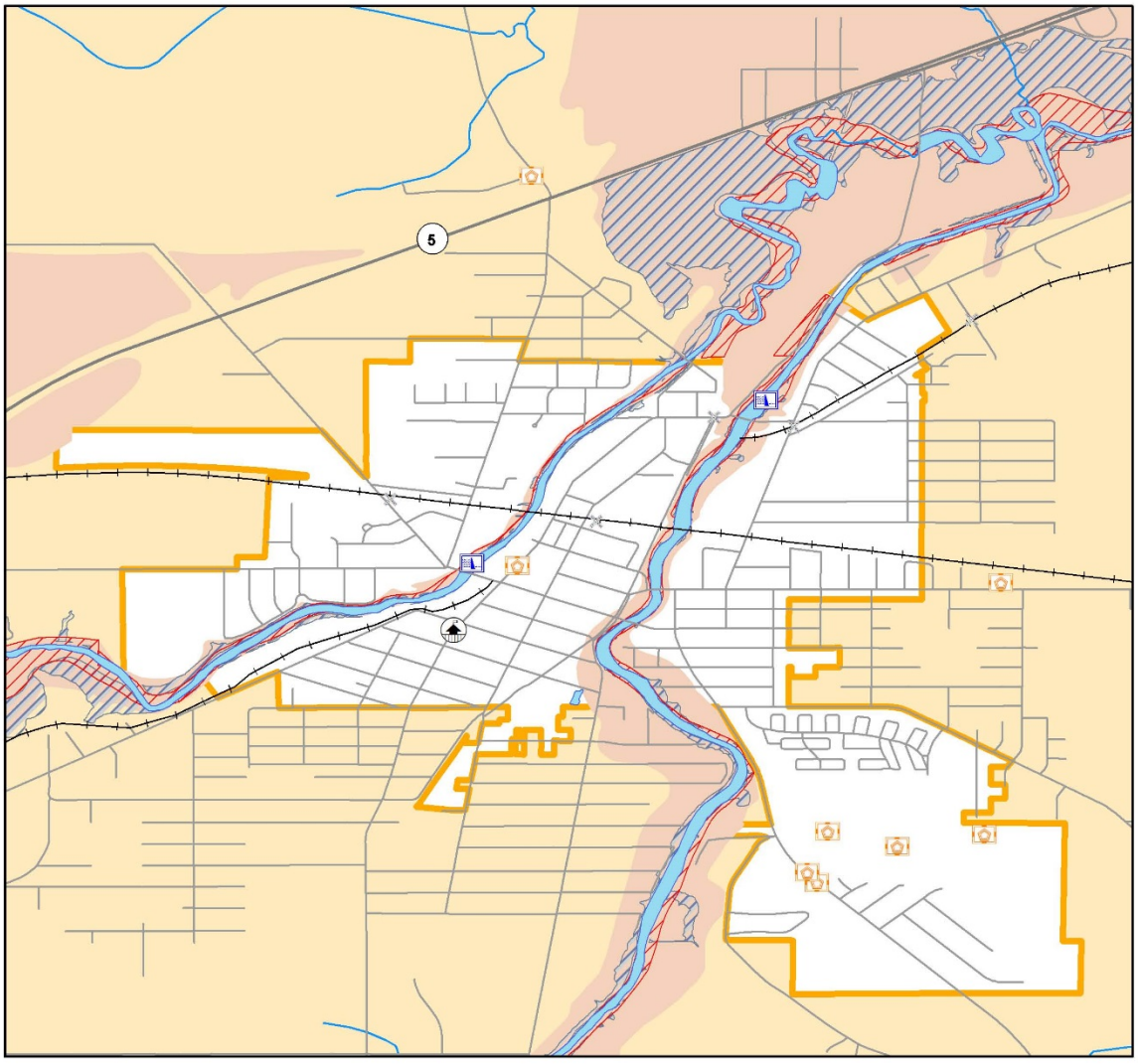

Airports
Critical Facility Assets
Infrastructure Assets
Cultural Resources Assets
Class I through III Dams
Floodway
Floodplains (100-year)
Other Flood Hazard Areas
Lordstown (Village)
N
0 0.20.4 0.8 1.2 1.6
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
Lordstown Village Flood Risk Areas
Data Source(s):
FEMA
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

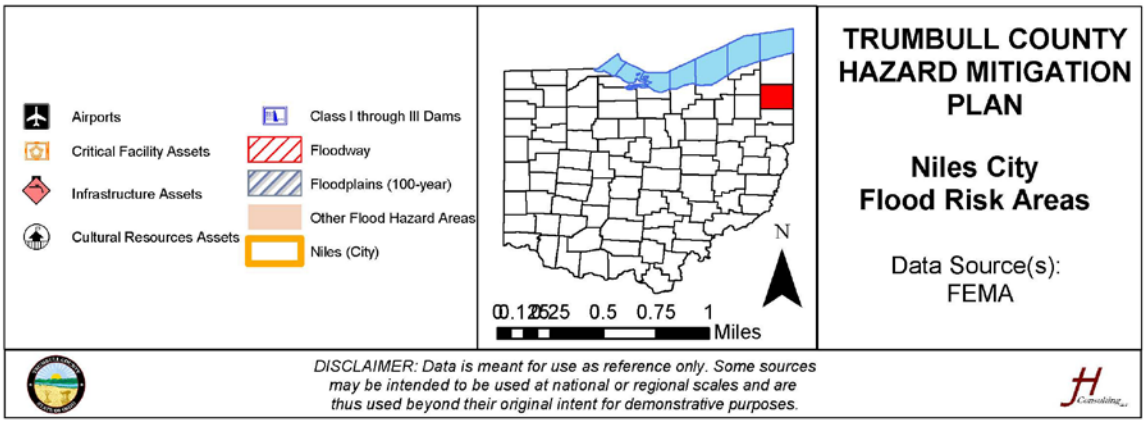

80
80

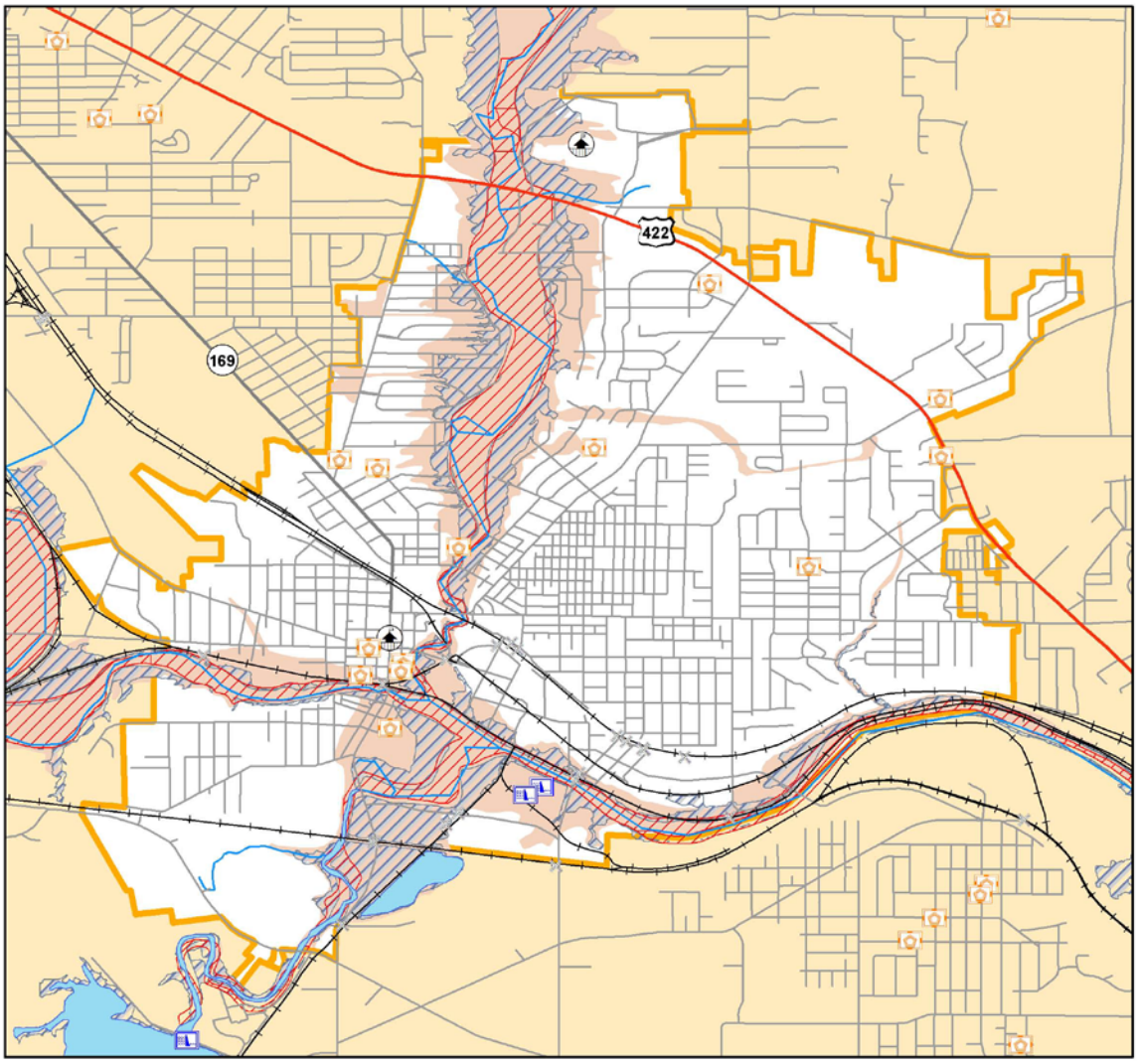

Airports
Critical Facility Assets
Infrastructure Assets
Cultural Resources Assets
Class I through III Dams
Floodway
Floodplains (100-year)
Other Flood Hazard Areas
McDonald (Village)
N
0 0.05 0.1 0.2 0.3 0.4
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
McDonald Village Flood Risk Areas
Data Source(s): FEMA
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

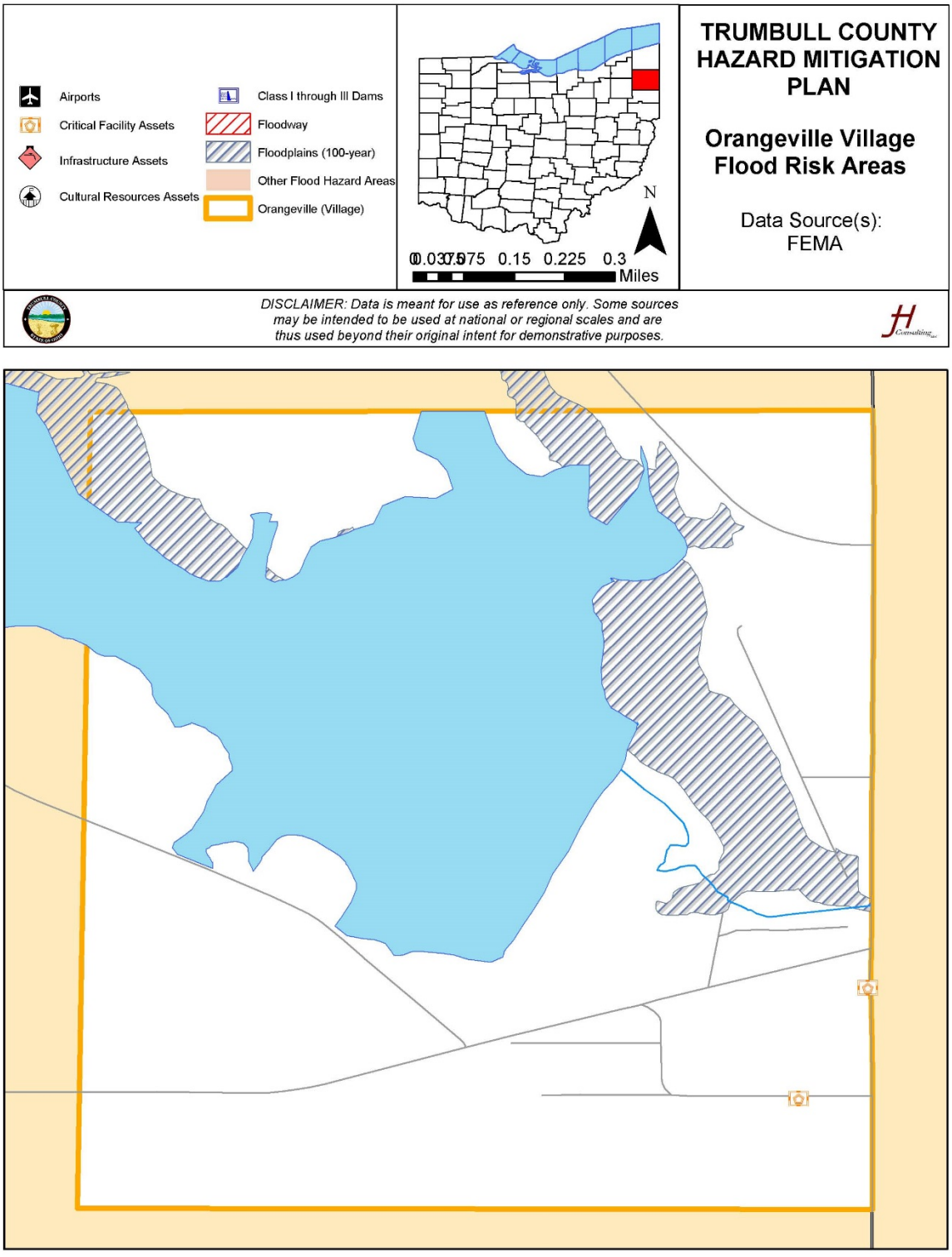

422

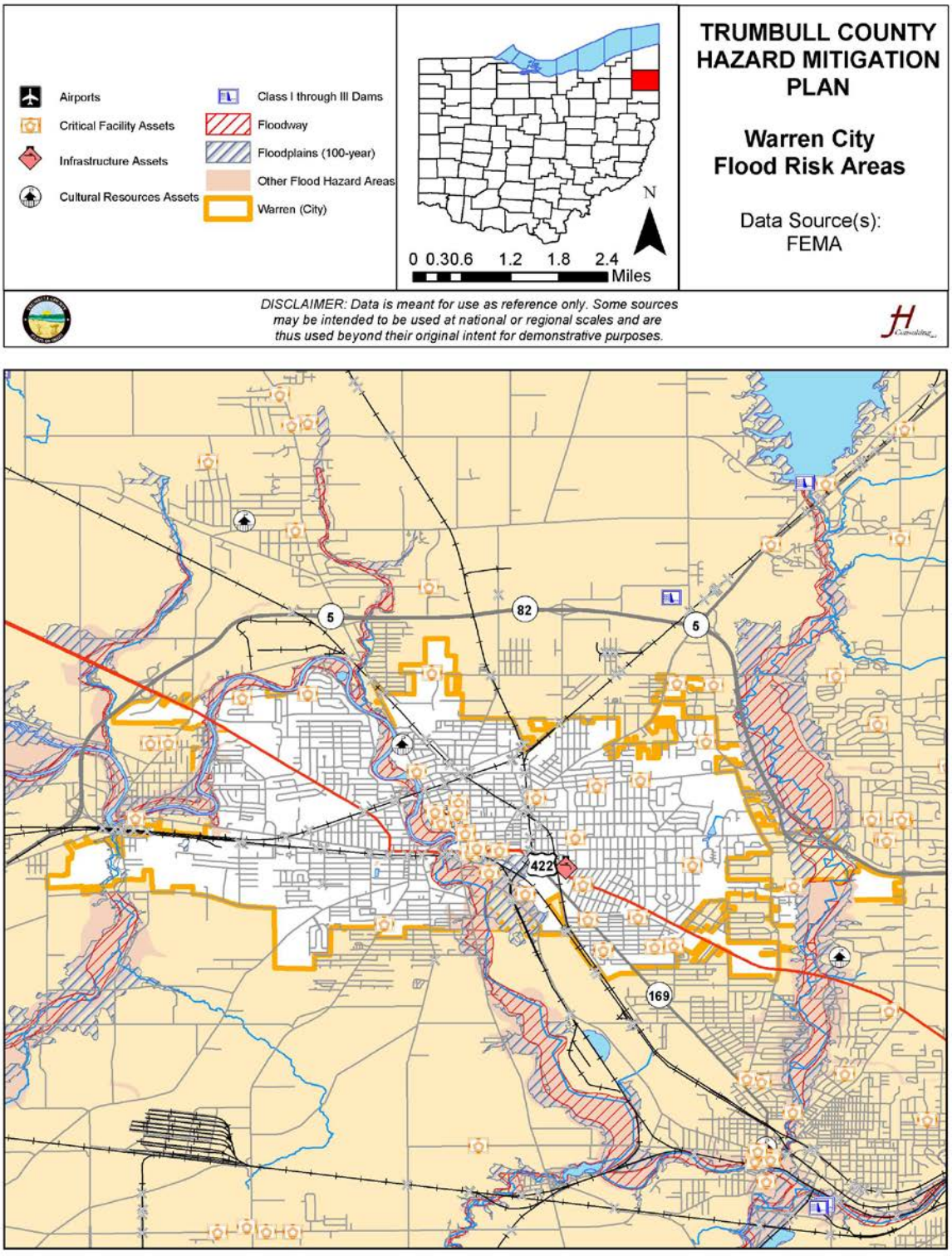

Airports
Critical Facility Assets
Infrastructure Assets
Cultural Resources Assets
Class I through III Dams
Floodway
Floodplains (100-year)
Other Flood Hazard Areas
Newton Falls (Village)
N
0 0.075 0.15 0.3 0.45 0.6
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
Newton Falls Village Flood Risk Areas
Data Source(s): FEMA
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

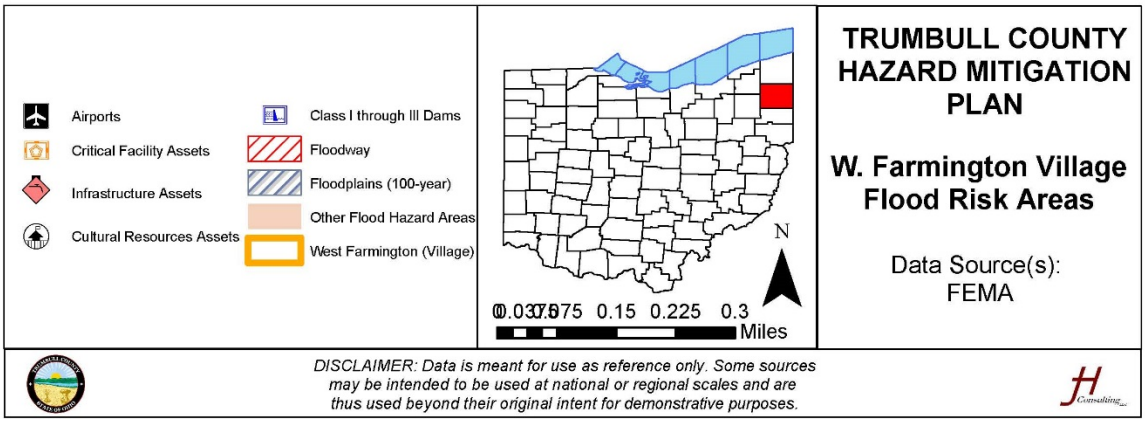

5

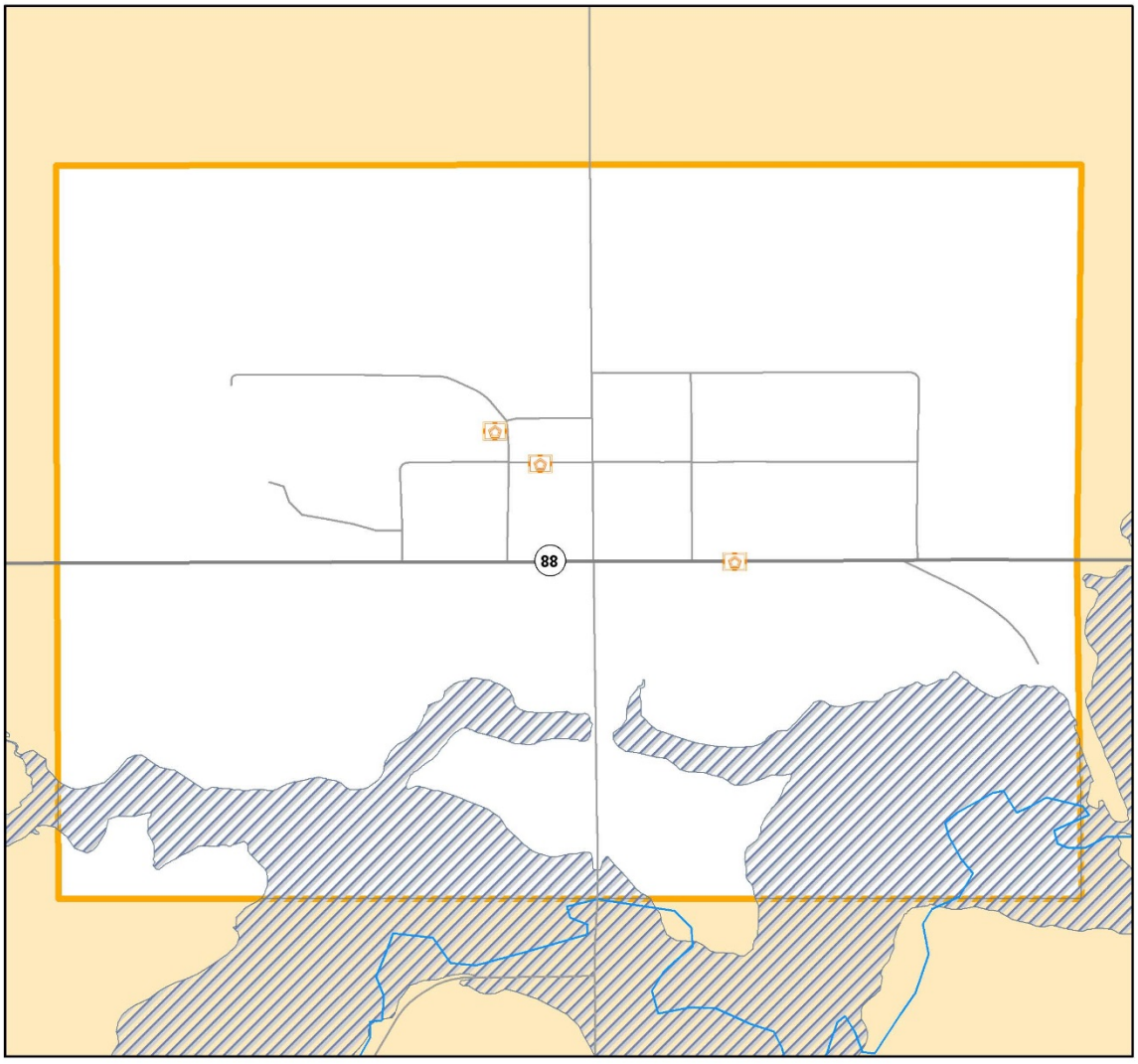

Airports
Critical Facility Assets
Infrastructure Assets
Cultural Resources Assets
Class I through III Dams
Floodway
Floodplains (100-year)
Other Flood Hazard Areas
Niles (City)
N
0 0.125 0.25 0.5 0.75 1
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
Niles City
Flood Risk Areas
Data Source(s):
FEMA
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

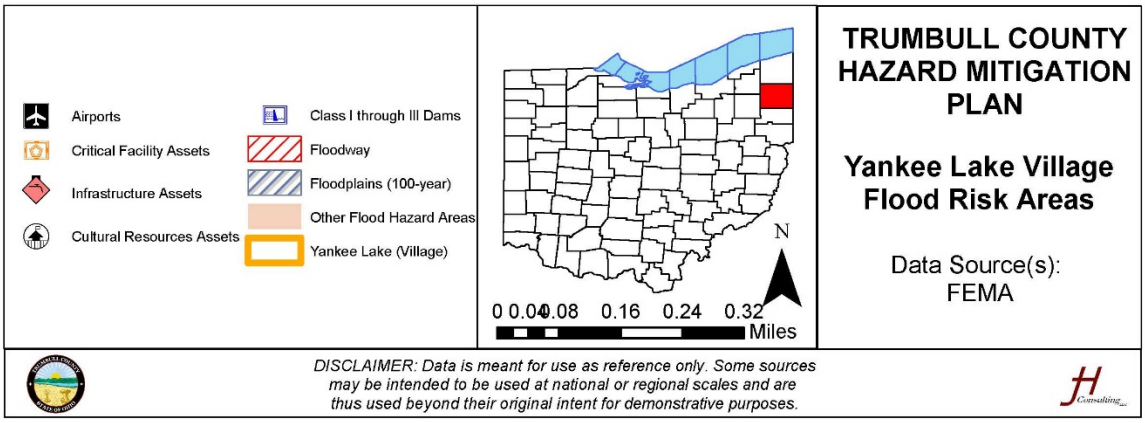

422
169

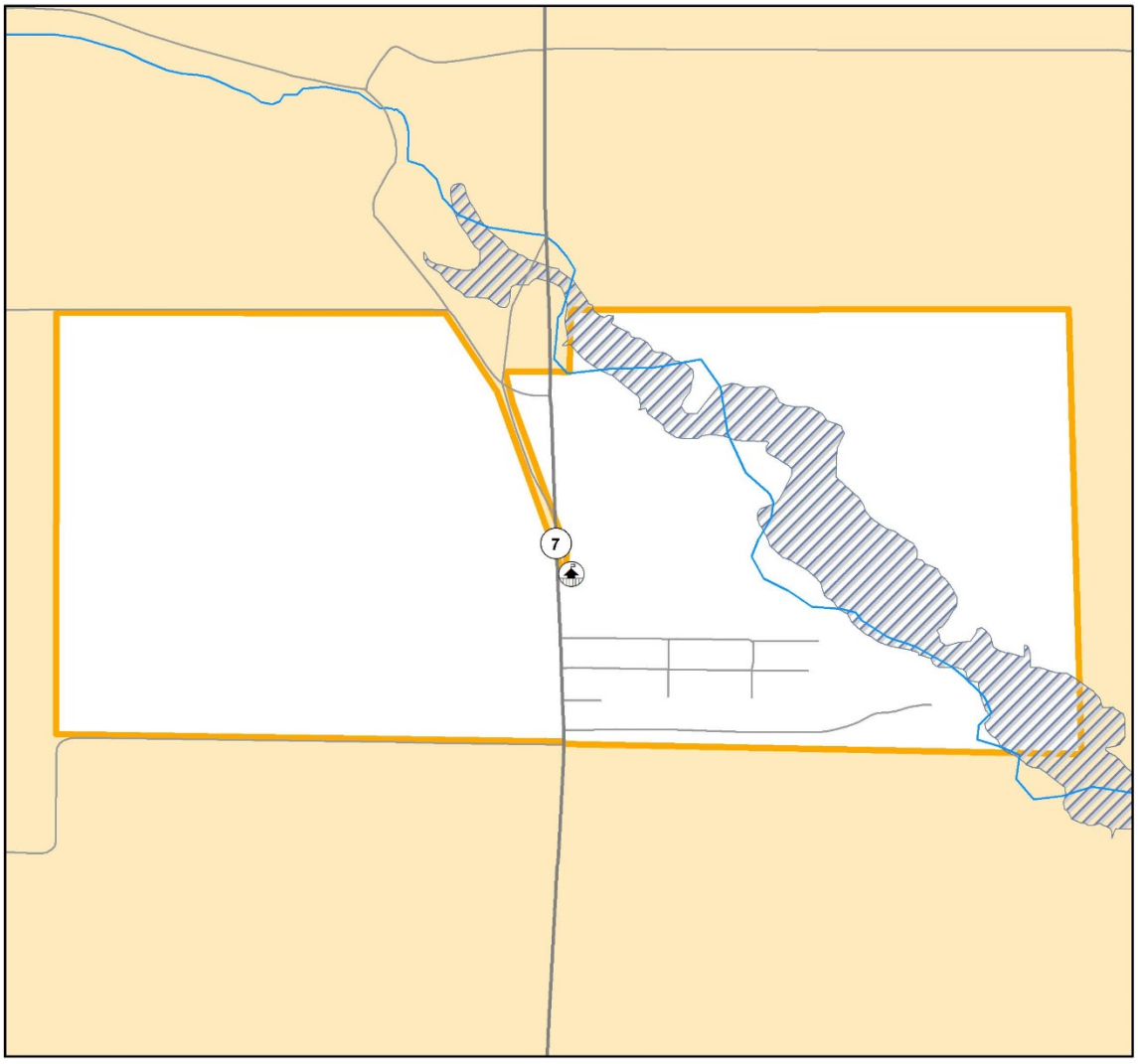

Airports
Critical Facility Assets
Infrastructure Assets
Cultural Resources Assets
Class I through III Dams
Floodway
Floodplains (100-year)
Other Flood Hazard Areas
Orangeville (Village)
N
0 0.0375 0.075 0.15 0.225 0.3
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
Orangeville Village Flood Risk Areas
Data Source(s): FEMA
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.


Airports
Critical Facility Assets
Infrastructure Assets
Cultural Resources Assets
Class I through III Dams
Floodway
Floodplains (100-year)
Other Flood Hazard Areas
Warren (City)
N
0 0.30.6 1.2 1.8 2.4
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
Warren City Flood Risk Areas
Data Source(s): FEMA
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.
5
82
5
422
169


Airports
Critical Facility Assets
Infrastructure Assets
Cultural Resources Assets
Class I through III Dams
Floodway
Floodplains (100-year)
Other Flood Hazard Areas
West Farmington (Village)
N
0 0.0375 0.075 0.15 0.225 0.3
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
W. Farmington Village Flood Risk Areas
Data Source(s):
FEMA
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.


88


Airports
Critical Facility Assets
Infrastructure Assets
Cultural Resources Assets
Class I through III Dams
Floodway
Floodplains (100-year)
Other Flood Hazard Areas
Yankee Lake (Village)
N
0 0.04 0.08 0.16 0.24 0.32
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
Yankee Lake Village Flood Risk Areas
Data Source(s): FEMA
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.


7

The following table identifies the assets located in flood risk areas. Those listed in red (i.e., floodway) and orange (i.e., 100-year floodplain) are in higher risk areas.

ASSET	ADDRESS	CITY	ASSET TYPE		
			Infrastructure	*Critical Facilities*	*Cultural Resources*
Niles McKinley High School	616 Dragon Drive	Niles		X	
Transportation	600 Roanoke SE	Warren		X	
Niles City BOE	102 Water Street	Niles		X	
Niles Middle School	411 Brown Street	Niles		X	
Braceville Twp. FD	582 Braceville Robinson Road	Newton Falls		X	
Delphi Corp.	745 Pine Avenue SE	Warren		X	

The following table assigns point totals based on the research presented in this profile for each category that appears in Ohio EMA's SHARPP tool.

FLOODING VULNERABILITY SUMMARY			
Category	*Points*	*Description*	*Notes*
Frequency	5	Excessive	Based on historical data, there have been 62 flood-related incidents in 24 years, for an average of 2.7 per year.
Response	4	One month	The recovery to large-scale floods can take several weeks.
Onset	2	12-24 Hours	The NWS typically issues flood watches and warnings within 12-24 hours of anticipated conditions.
Magnitude	5	N/A	Although flooding is a localized event, it can have devastating effects on the communities it reaches.
Business	2	One week	The HAZUS-MH analysis indicates that several commercial/industrial structures are vulnerable to flooding conditions; as such, the general economy of the county could feel impacts for up to one week.
Human	2	Low (some injuries)	There have not been any recorded injuries or deaths associated with floods in Trumbull County. However, flooding is capable of producing injury.
Property	1	Less than 10%	Historical data indicates that the average property damage per event is $1.4 million, which is less than 10% of potentially-impacted property in the county.
Total	21	High	

2.0 RISK ASSESSMENT

2.2.6 Hailstorm

Severe hail is often a product of severe storms, producing hailstones of one inch in diameter or larger.				
Vulnerability  HIGHEST HIGH MEDIUM LOW LOWEST	Period of Occurrence:	At any time, typically during the summer months	Hazard Index Ranking:	Low
	Warning Time:	12-24 hours	State Risk Ranking:	4-High
	Probability:	Likely	Severity:	Limited
	Type of Hazard:	Natural	Disaster Declarations:	None

Hazard Overview

Hail is a form of precipitation that occurs when updrafts from a thunderstorm carry raindrops upward into colder temperatures. The drops of water freeze together in the cold upper regions of the thunderstorm clouds. Hailstones grow by colliding with super-cooled water droplets. When a hailstone is heavy enough, or the updraft weakens, the hailstone falls to the ground.

The TORRO Hailstorm Intensity Scale (Voss Law Firm, n.d.) measures hail, H0-H10, based on diameter. The TORRO scale and reference objects appear in the table below.

TORRO HAILSTORM INTENSITY SCALE			
TORRO Intensity	*Intensity Category*	*Diameter (mm)*	*Reference Object*
H0	Hard Hail	5	Pea
H1	Potentially Damaging	5-15	Mothball
H2	Significant	10-20	Marble, Grape
H3	Severe	20-30	Walnut
H4	Severe	25-40	Pigeon's egg > Squash ball
H5	Destructive	30-50	Golf ball > Pullet's egg
H6	Destructive	40-60	Hen's egg
H7	Destructive	50-75	Tennis ball > Cricket ball
H8	Destructive	60-90	Large orange > Softball
H9	Super Hailstorms	75-100	Grapefruit
H10	Super Hailstorms	>100	Melon

Location and Extent

Hail can affect all areas of the county. These events can last up to hours and can range in size from a few acres to an area of 10 miles wide by 100 miles long.

Impacts and Vulnerability

The impacts of hail include injury and even death. Hail can damage vegetation and infrastructure. Most hail damage affects vehicles and structures. The table below outlines the typical impacts of a hailstorm.

Intensity (TORRO Scale)	Typical Damage Impacts
H0	No Damage
H1	Slight damage to plants, crops
H2	Significant damage to fruit, crops, vegetation
H3	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Widespread glass damage, vehicle bodywork damage
H5	The wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Bodywork of grounded aircraft dented, brick walls pitted
H7	Severe roof damage, risk of serious injuries
H8	Severe damage to aircraft bodywork
H9	Extensive structural damage. Risk of severe or fatal injuries to persons caught in the open
H10	Extensive structural damage. Risk of severe or fatal injuries to persons caught in the open

Past Mitigation Efforts: Hailstorm

- Develop and distribute public awareness materials concerning hailstorms.
- Utilize local media for the distribution and publication of hazard information.
- Conduct National Weather Service Storm Spotter classes.

Historical Occurrences

Trumbull County has experienced 63 severe hail events on 39 days since 1975. This rate is an average of 1.4 severe hailstorms per year. These events appear in the table below.

HISTORICAL OCCURRENCES, HAIL > 1 IN. (Source: NCEI Storm Events Database)							
Location	*Date*	*Magnitude (in.)*	*Report Source*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
Trumbull County	7/24/1975	1	N/A	0	0	$0.00	$0.00
Trumbull County	5/6/1986	1	N/A	0	0	$0.00	$0.00

HISTORICAL OCCURRENCES, HAIL > 1 IN. (Source: NCEI Storm Events Database)							
Location	*Date*	*Magnitude (in.)*	*Report Source*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
Trumbull County	8/1/1986	1	N/A	0	0	$0.00	$0.00
Trumbull County	5/15/1988	1	N/A	0	0	$0.00	$0.00
Trumbull County	8/28/1990	1	N/A	0	0	$0.00	$0.00
Countywide	6/21/1995	1	N/A	0	0	$5,000.00	$0.00
Countywide	7/15/1995	1.75	N/A	0	0	$0.00	$0.00
East Half	5/1/1996	1.75	N/A	0	0	$100,000.00	$0.00
NorthWest Portion	8/15/1996	1	N/A	0	0	$0.00	$0.00
Farmington	6/2/1998	1	Trained Spotter	0	0	$0.00	$0.00
Girard	6/2/1998	1	Trained Spotter	0	0	$0.00	$0.00
Southington	4/15/2002	1	Trained Spotter	0	0	$10,000.00	$0.00
Braceville	4/15/2002	1.75	Trained Spotter	0	0	$50,000.00	$0.00
Warren	4/15/2002	1	Trained Spotter	0	0	$15,000.00	$0.00
Niles	4/15/2002	1	Trained Spotter	0	0	$25,000.00	$0.00
Vienna	8/22/2002	1	Newspaper	0	0	$5,000.00	$0.00
Hubbard	8/4/2003	1.75	Trained Spotter	0	0	$20,000.00	$0.00
Hubbard	6/24/2004	1	Trained Spotter	0	0	$0.00	$0.00
Bristolville	7/14/2004	1	Trained Spotter	0	0	$0.00	$0.00
Newton Falls	5/1/2007	1	Trained Spotter	0	0	$0.00	$0.00
Lordstown	6/21/2008	1	Trained Spotter	0	0	$0.00	$0.00
Bristolville	7/22/2008	1.75	Trained Spotter	0	0	$150,000.00	$0.00
Greene Center	7/22/2008	1.75	Fire Department/ Rescue	0	0	$150,000.00	$0.00
Cortland	8/7/2008	1	Public	0	0	$0.00	$0.00
Bristolville	8/7/2008	1	Public	0	0	$0.00	$0.00
Bristolville	5/7/2010	1	Trained Spotter	0	0	$0.00	$0.00
West Farmington	5/7/2010	1	Trained Spotter	0	0	$0.00	$0.00
Bristolville	5/7/2010	1	Trained Spotter	0	0	$0.00	$0.00

HISTORICAL OCCURRENCES, HAIL > 1 IN. (Source: NCEI Storm Events Database)							
Location	*Date*	*Magnitude (in.)*	*Report Source*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
Hubbard	5/7/2010	1	Law Enforcement	0	0	$0.00	$0.00
Leavittsburg	9/7/2010	1.5	Law Enforcement	0	0	$10,000.00	$0.00
Warren	5/12/2011	1	Storm Chaser	0	0	$10,000.00	$0.00
Warren	5/12/2011	1	Public	0	0	$5,000.00	$0.00
Vienna	5/23/2011	1.75	Trained Spotter	0	0	$50,000.00	$0.00
Youngstown Municipal	5/23/2011	1	ASOS	0	0	$0.00	$0.00
Warren	5/25/2011	1.75	Public	0	0	$100,000.00	$0.00
Newton Falls	6/7/2011	1	Public	0	0	$0.00	$0.00
Burghill	6/16/2011	2	Public	0	0	$100,000.00	$0.00
Newton Falls	8/19/2011	1	Public	0	0	$0.00	$0.00
Braceville	9/13/2011	1	Law Enforcement	0	0	$0.00	$0.00
Braceville	9/13/2011	1	Trained Spotter	0	0	$0.00	$0.00
Newton Falls	11/14/2011	1	Public	0	0	$0.00	$0.00
Warren	11/14/2011	1	Public	0	0	$0.00	$0.00
Mineral Ridge	11/14/2011	1	Storm Chaser	0	0	$0.00	$0.00
Hubbard	11/14/2011	1	Public	0	0	$0.00	$0.00
Cortland	5/7/2012	1	Public	0	0	$0.00	$0.00
Vienna	5/7/2012	1	Trained Spotter	0	0	$0.00	$0.00
Hubbard	5/7/2012	1.25	Public	0	0	$15,000.00	$0.00
Bristolville	5/29/2012	1	Public	0	0	$0.00	$0.00
Bristolville	5/29/2012	1	Trained Spotter	0	0	$0.00	$0.00
Mecca	5/29/2012	1	Law Enforcement	0	0	$0.00	$0.00
Niles	5/29/2012	1.25	Public	0	0	$5,000.00	$0.00
Vienna	5/29/2012	1	Public	0	0	$0.00	$0.00
Cortland	7/3/2012	1	Public	0	0	$0.00	$0.00
Farmdale	7/4/2012	1	Trained Spotter	0	0	$0.00	$0.00
Howland Corners	7/4/2012	1	Law Enforcement	0	0	$0.00	$0.00
Mecca	6/16/2013	1	Broadcast Media	0	0	$0.00	$0.00
Kinsman	5/21/2014	1.5	Broadcast Media	0	0	$5,000.00	$0.00
Niles	8/21/2017	1	Public	0	0	$0.00	$0.00

HISTORICAL OCCURRENCES, HAIL > 1 IN. (Source: NCEI Storm Events Database)							
Location	*Date*	*Magnitude (in.)*	*Report Source*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
Fowler	7/26/2018	1	Social Media	0	0	$0.00	$0.00
Kinsman	6/1/2019	1	Broadcast Media	0	0	$0.00	$0.00
Lockwood	6/1/2019	1	Trained Spotter	0	0	$0.00	$0.00
Kinsman	8/17/2019	1	Trained Spotter	0	0	$0.00	$0.00
Barclay	8/17/2019	1.25	Trained Spotter	0	0	$0.00	$0.00
			TOTALS	0	0	$830,000	$0.00

Loss and Damages

Hailstorms have caused significant damage in Ohio, with $187,455,392 in costs over the past ten years, or approximately $18 million per year. Trumbull County's annual damage from hail is roughly $18,863.64, or $10.70 per person, per year. Trumbull County's average annual per capita loss from hail is significantly higher than that of Ohio's Region 3, which is $1.37 per person per year.

For SHARPP data entry, planners utilized the historical worst-case scenario loss of $150,000. Planners considered the entire building stock as exposed and used the worst-case scenario Trumbull County event as the representative historical occurrence for completion of the following table.

SEVERE THUNDERSTORMS AND HAIL LOSS ESTIMATE – SHARPP DATA ENTRY		
Structure Type	*Number*	*Loss Estimate*
Residential	1	$108,800
Non-residential	1	$35,500
Critical Facility	1	$5,700
TOTALS	3	$150,000

Vulnerability Assessment

This section summarizes the vulnerability to Trumbull County from hail. Trumbull County conducted an online survey for the public to share its thoughts on hazard vulnerabilities. The following table presents the results of that survey regarding hail. For the following table, data includes both severe thunderstorms and hail, as those hazards appeared combined in the survey.

PUBLIC SENTIMENT, HAIL – TRUMBULL COUNTY					
Hazard	*Level of Concern*				*Total Responses*
	Not at All	*Somewhat*	*Concerned*	*Very*	
Hail	43 (12.46%)	117 (33.91%)	116 (33.62%)	69 (20.00%)	346
In the past ten years, do you remember this hazard occurring in your community?				162 (46.96%)	345
Have you noticed an increase in the occurrences or intensity of this hazard?				32 (9.64%)	332
Have you noticed a decrease in the occurrences or intensity of this hazard?				9 (2.87%)	314

The following table assigns point totals based on the research presented in this profile for each category that appears in Ohio EMA's SHARPP tool.

HAIL VULNERABILITY SUMMARY			
Category	*Points*	*Description*	*Notes*
Frequency	5	Excessive	There has been an average of 3.7 occurrences of hail every year since 1974, but less than half of all events result in hail 1 inch or more in diameter.
Response	1	Less than half a day	Responses will be minimal, and most damage will be repaired in one week or less.
Onset	2	12-24 hours	Thunderstorms that could produce hail can be predicted up to 24 hours in advance.
Magnitude	4	More than 50% of land area affected	Hail could affect more than half of the county's land area within a single event; however, damage would be minimal.
Business	1	Less than 24 hours	Businesses would not typically close for a thunderstorm or hailstorm. Damages from a significant storm may cause a short (less than 24 hour) disruption of services.
Human	1	Minor	There are no reported injuries or deaths due to hail greater than 1 inch in diameter in the past. While injury and death are possible, it is unlikely that thunderstorms or hailstorms would cause significant human injuries.
Property	1	Less than 10%	Hailstorms are localized events and would not cause significant property damage.
Total	15	Low	

2.0 RISK ASSESSMENT

2.2.7 Infestation

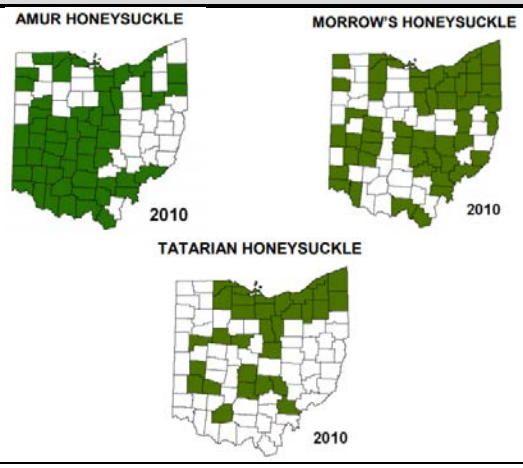
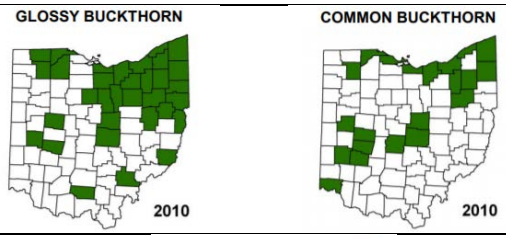
Species that are both non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health are considered invasive. An infestation is to swarm or overcome in an intrusive manner.				
Vulnerability  HIGHEST HIGH MEDIUM LOW LOWEST	Period of Occurrence:	Invasive species can occur at any time	Hazard Index Ranking:	Medium
	Warning Time:	None	State Risk Ranking:	8
	Probability:	Likely	Severity:	Non-critical
	Type of Hazard:	Natural	Disaster Declarations:	N/A

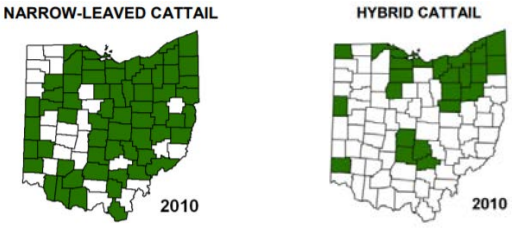
Hazard Overview

The National Invasive Species Council defines invasive species as "both non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health" (ODNR, 2020). Human actions are the primary cause of invasive species transfer. There are four main types of invasive species: aquatic species, plants, animals, and microbes (USDA, n.d.). An invasive species can be any living organism, amphibian, plant, insect, fish, fungus, bacteria, and seed or egg (National Wildlife Federation, n.d.). Ohio has a large number of invasive plants and animals. A description of each type of invasive organism, as well as control measures, appears below.

Invasive Terrestrial Plants

Invasive terrestrial plants are those that displace or crowd native plant species, impact wildlife, which relies on native plant communities for food, shelter and breeding habitat, and for monoculture plant communities, which reduces biological diversity.

INVASIVE PLANT SPECIES, ODNR	
Common Name	*Distribution*
Honeysuckles: Amur, Morrow's and Tatarian bush honeysuckles are upright, deciduous shrubs that range from 6 to 15 feet in height at maturity. These honeysuckles fruit prolifically and are highly attractive to birds, which widely disseminate seeds across the landscape. Deer also disperse seeds. Cut stems will resprout vigorously. These shrubs shade native vegetation since they leaf out earlier in the spring and drop their leaves later in the fall than native plants. It has been documented that birds nesting in honeysuckle suffer greater nest predation than those nesting in native shrubs.	
Japanese Honeysuckle: Japanese honeysuckle is a vine with entire (sometimes lobed), oval-oblong, opposite leaves from 1 ½ -3 inches long. In Ohio, the plants are semi-evergreen with leaves persisting into late winter or early spring. Japanese honeysuckle thrives in disturbed areas such as roadsides, fencerows, forest edges, and forest gaps. Areas of special concern are woodland edges, early successional forests, and riparian corridors. Although preferring sunny areas, both are shade tolerant and can live in marginal habitats until favorable conditions arise.	
Common and Glossy Buckthorns: Glossy and common buckthorns are woody shrubs or small trees that can attain a height of 20 feet. Glossy and common buckthorns tend to form dense, even-aged thickets (of seedlings, saplings, or sprouts), crowding and shading out native shrubs and herbs, often completely displacing them.	
Garlic Mustard: Garlic mustard is a biennial herb that emits a garlic-like odor from crushed leaves Garlic mustard prefers some shade in mesic upland and floodplain forests, savannas, pastures, lawns, and along fencerows and roadsides. It invades forest edges and progresses into the interior along streams and trails.	
Purple Loosestrife: Purple loosestrife is an erect perennial with opposite or whorled leaves. The thick taproot supports thirty to fifty stems that can attain a height of 3-6 feet. Purple loosestrife thrives in wetlands, including marshes, fens, wet meadows, stream and river banks, lake shores and ditches. It can also survive in drier conditions.	

Common Reed Grass (Phragmites): Common reed grass is a tall, perennial wetland grass, 5-10 feet in height. Both native and introduced Phragmites are found in the state. The introduced Phragmites forms a dense network of rhizomes with deep roots. Common reed grass is found in brackish and freshwater marshes, river edges, shores of lakes and ponds, roadsides, fens, swamps, wet meadows, and disturbed moist/wet areas.	
Reed Canary Grass: Reed canary grass is a large, coarse grass that attains a height of 2 to 7 feet. The erect, hairless stem supports rough-textured, tapering leaves of 3 ½ to 10 inches long and 1/4 to 3/4 inch wide. Reed canary grass grows best on fertile, moist organic soils in full sun. It can grow in standing water by producing special roots along the submersed portion of the stem. It also grows on dry soils in upland sites and under partial shade.	
Autumn-Olive: Autumn-olive and are deciduous shrubs or small trees that grow to a height of 30 feet. Autumn-olive has nitrogen-fixing root nodules, which allow them to adapt to many poor soil types including bare mineral substrates. Autumn-olive is found throughout Ohio, occurring in various open to semi-shaded habitats including old fields, grasslands, barrens, woodlands, savannahs, alvars (limestone prairies), roadsides, reclaimed strip-mined areas, and open disturbed sites.	
Mulitflora Rose: Multiflora rose is a thorny shrub with arching stems (canes). The compound leaves are divided into 5-11 sharply-toothed leaflets. Multiflora rose prefers sunny to semi-shaded habitats with well-drained soils, but can tolerate a wide range of habitats including mesic upland and flood plain woods, forest edges, old fields, savannas, prairies, fens, roadsides, fencerows and lawns.	
Narrow-leaved and Hybrid Cattail: Narrow-leaved cattail is an introduced species which hybridizes with the native common cattail (*T. latifolia*). Cattails can be found in damp soil or shallow water where sufficient nutrients are available. They are commonly found along expressways, in artificial ditches and shallow ponds, at the edges of calm waters, in consistently damp patches of rural and suburban yards, in marshes as well as brackish and polluted waters to a depth nearing 3 feet. These taxa also invade fens, wet meadows, wet prairies, and beach swales.	
Moneywort: Also called pennywort and creeping jenny, moneywort is a member of the primrose family that was once used as an ornamental form of ground cover. It grows close to the ground and forms a thick mat up to two feet long and up to four inches tall. Moneywort spreads rapidly by creeping stems and dispersing seeds. Seeds can be spread by floodwaters or human activity.	

Of the top ten invasive plant species listed by ODNR, nine appear in Trumbull County. Invasive plants can spread in numerous ways. Three methods of control (mechanical, chemical, and biological) can help abate the spread of these plants, but some methods work better than others.

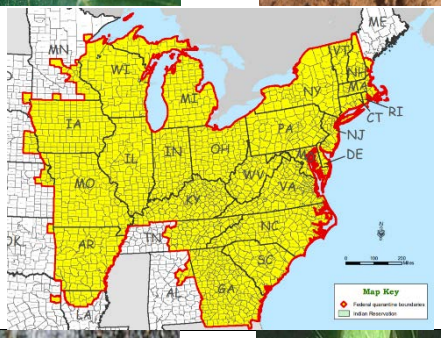
- ***Mechanical control methods*** involve cutting, digging, burning, or otherwise physically removing the plant. Mechanical control methods are labor-intensive and ultimately unsuccessful at eradicating invasive plants long-term.
- ***Chemical control methods*** involve herbicides that target specific plant species while protecting native species. Some herbicides are non-selective and have the ability to kill or contaminate the surrounding ecosystem.
- ***Biological control methods*** involve introducing natural enemies that destroy the invasive plant species. Care is necessary so that the introduced species does not itself become a problem for the area in which they are introduced.

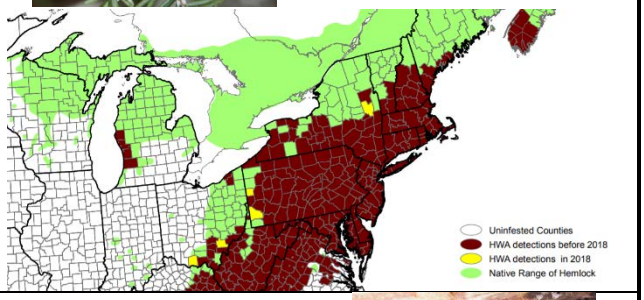
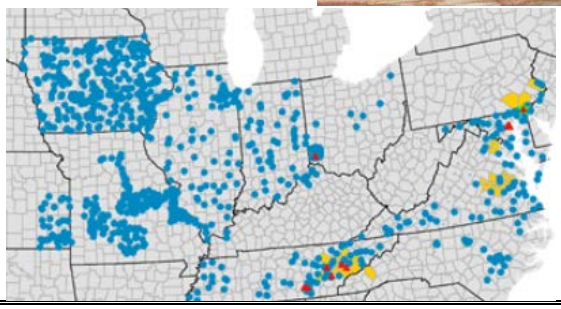
Invasive Terrestrial Wildlife

Invasive terrestrial wildlife are animals or other organisms that evolved to live on land rather than aquatic habitats; these organisms cause damage to important habitat that other wildlife depends on. In Ohio, the primary invasive terrestrial animal is the feral hog. Originally introduced to the United States in 1539, these animals were once domestic pigs that escaped, bred with Eurasian wild boars, and are now present in 35 states. These animals can weigh up to 200 pounds and cause significant damage to crops and property. Litter size varies depending on the lineage of the pig, with descendants of domestic breeds producing up to ten piglets whereas descendants of Eurasian boars produce on average four to five piglets. Each lineage can have up to two litters per year under ideal conditions. Typical control methods for feral hogs include open-season hunting, poisons, or trapping.

Invasive Insects and Diseases

Invasive insects and diseases are other tiny organisms that can cause a great deal of damage to plant, forest, and wildlife health. Non-native insects, fungus and microbes can cause significant damage to forests and other wildlife. The spread of these organisms, such as the emerald ash borer, can be controlled by taking care not transporting firewood long distances. Below are the most prominent invasive species of insects and diseases in Ohio.

INVASIVE INSECTS AND DISEASES, ODNR	
Common Name	*Description*
Asian Longhorned Beetle: The Asian Longhorned Beetle (ALB) is native to Japan, Korea, and southern China. Experts believe that the beetle "hitchhiked" to the U.S. during the early 1990s in solid wood packing or crating materials on a cargo ship arriving from China. When the eggs hatch, the beetle grubs bore into hardwood trees. Once they mature, they chew exit holes in branches and trunks. The larvae eventually burrow deep enough to damage the living portion of the trunk, ultimately killing the tree. In Ohio, the Asian Longhorn Beetle is quarantined to Clermont County and firewood cannot be transported from the area.	  
Emerald Ash Borer: The Emerald Ash Borer is a small, wood-boring beetle native to Asia. These beetles affect all species of ash tree by eating the living portion of the tree directly underneath the bark. Adult beetles are dark metallic green and up to half and inch long. Larvae are about an inch long and carve S-shaped tunnels while feeding, which kills the tree. The Emerald Ash Borer has spread across much of the East Coast. As of September 8, 2010, all of Ohio has been quarantined.	  
Gypsy Moth: The gypsy moth, native to Europe, Asia, and North Africa, was established in North America in 1869 when they were brought to Massachusetts in an unsuccessful attempt to cross breed them with silk worms. Caterpillars are dark gray or brown and grow to about 2.5 inches long. Adult male moths are gray-brown while female moths are whitish with brown markings. Caterpillars feed on the leaves of trees and cause mass defoliation. The gypsy moth has an expansive quarantine zone that encompasses much of Ohio.	  

INVASIVE INSECTS AND DISEASES, ODNR	
Common Name	*Description*
Hemlock Woolly Adelgid: The hemlock woolly adelgid (HWA) is a small, aphid-like insect that feeds on stored nutrients in young hemlock branches. Young adelgids cover themselves with a white substance until they mature into adults. Adults are black and all females that can lay up to 300 eggs twice a year. Juveniles attach themselves to the tree in one spot for and feed continuously for the rest of their lives, disrupting the flow of nutrients to the rest of the branch. This eventually kills the tree.	  
Walnut Twig Beetle: The walnut twig beetle are very small insects, about the size of a flea, which act as a vector a fungus that causes Thousand Cankers Disease in walnut trees. The fungus grows around the pupal chambers of walnut twig beetle larvae. The fungus causes openings, called cankers, in the living tissue of the walnut tree that can be over two inches in length. As the tree dies, more beetles are attracted to it and more cankers are formed. Repeated attacks ultimately kill the tree. The fungus has been confirmed in Butler County, and the Ohio Department of Agriculture is monitoring Butler, Hamilton, and Warren counties. Transportation of firewood helps the beetle and fungus spread to new areas.	  

Aquatic Invasive Species

Aquatic invasive species are plants and animals living in and degrading the quality of waterways. In many cases, the spread of these organisms can be abated by taking care to wash recreational water equipment before transportation. Additionally, residents should avoid the release of plants and animals from personal aquariums.

AQUATIC INVASIVE SPECIES, PLANTS, ODNR	
Common Name	*Description*
Brittle Naiad: Also called brittle waternymph, brittle naiad is a submerged aquatic herb native to Europe. Brittle naiad prefers to grow in calm waters, but may be found in streams and rivers. Brittle naiad spreads both by seeds and fragmentation. Fragments may cling to boats, jet skis, and fishing gear. Seeds may also be carried by waterfowl.	 
Eurasian Watermilfoil: A feathery submerged aquatic plant that was sold as an aquarium plant. It forms thick mats that cause harm to shallow areas to lakes and rivers. The plant is very hardy and can survive a wide range of temperatures, still or flowing water, and even under ice. Eurasian Watermilfoil reproduces by fragmentation. Pieces break off and float to new locations or are transported by boats, trailers, and fishing gear.	 
Fanwort: A submerged freshwater plant that is persistent, aggressive, and competitive with the potential to take over waterways. It is very resilient and grows in slow-moving waters. Fanwort can overwinter in frozen lakes. Fanwort is fragile and fragments easily. Fragments float to new locations and take root, growing into new plants. It is believed that Fanwort has spread through the intentional and unintentional release of aquarium plants.	 

AQUATIC INVASIVE SPECIES, INVERTEBRATES, ODNR		
Common Name	*Description*	
Asian Clam: Also called the Asiatic clam, pygmy clam, or gold clam, the Asian clam is a small freshwater clam that rarely grow more than an inch in diameter. The shell is typically yellowish green to brown. The clams can be found in streams, rivers, ponds, lakes, and canals, but prefer running waters with a sand or gravel bed. It is capable of self-fertilization and can release up to thousands of young a day that are then spread by currents and human activity The Asian clam was originally introduced to the west coast of the US, but has spread to the eastern US. They attach themselves to boating, fishing, and scuba diving equipment and their young can be transferred by buckets or live wells.		

AQUATIC INVASIVE SPECIES, INVERTEBRATES, ODNR		
Common Name	*Description*	
Mystery Snails: Large freshwater snails commonly sold for freshwater aquariums and garden ponds. They can outcompete native snails in their habitat. Mystery snails tend to live in lakes, marshes, rivers, ponds and slower portions of rivers. Due to its popularity, the mystery snail has spread across the United States. The snail can continue to spread by recreational water activities, water holds on boats, and bait buckets,		
Red Swamp Crayfish: A large and aggressive crayfish native to northern Mexico, Florida, and southern Illinois. They are dark red and typically range from two to five inches long. They can live in a wide variety of environments including those with low oxygen levels, extreme temperatures, pollution, and areas with fluctuating water levels. Red swamp crayfish prefer to live in slow-moving waters, ponds, and marshes where there is plentiful organic debris. The popularity of red swamp crayfish as aquarium animals and a food source have caused the animal to easily spread to new areas. They are also capable of traveling long distances over land at night or during wet weather.		
Rusty Crayfish: A large, aggressive crayfish that outcompetes native species. They are typically three to five inches long and are usually grayish green or reddish brown in color. Rusty crayfish are pollution tolerant and prefer areas with adequate cover. They can survive in lakes, ponds, and streams. Rusty crayfish are used as fishing bait and can be accidentally introduced to new areas. They are capable of hybridization and it is not necessary to have both a male and female rusty crayfish in the same area to begin new invasions.		

AQUATIC INVASIVE SPECIES, INVERTEBRATES, ODNR		
Common Name	*Description*	
Zebra Mussel: Small freshwater mollusks that attach to hard surfaces including other mussels and crayfish. They can be found in lakes, rivers, reservoirs, ponds, and quarries. Zebra mussels require environments rich in calcium to aid in shell production and waters above 50°F to reproduce. Young zebra mussels float for up to five weeks before settling. The control and removal of zebra mussels costs billions of dollars. They have quickly spread across North America and have become one of the most intrusive, prolific, and costly aquatic alien species. Once established in open-water environments, they are virtually impossible to eradicate.		

AQUATIC INVASIVE SPECIES, FISH, ODNR		
Common Name	*Description*	
Common Carp: The common carp is the largest member of the minnow family. It can live up to 50 years and has a voracious appetite. They can grow up to 22 inches long and weigh up to ten pounds, but some can reach 48 inches long and weigh 40 pounds or more. They tend to live in lakes, ponds, and calmer rivers. Common carp can spread through connected bodies of water once they've been established in a waterway. Juvenile carp are used as bait and can be released by anglers or escape into new territories.		
Goldfish: Goldfish are a freshwater species of carp that was originally introduced to North America as an ornamental fish in the 1600s. They can grow up to 23 inches long and weigh almost seven pounds, but are typically up to eight inches long and weigh less than a pound. Goldfish prefer muddy water with thick vegetation, but are tolerant to pollution, fluctuating temperatures, and otherwise murky waters. Goldfish are intentionally introduced to lakes, ponds, and fountains as ornamental fish. They are also popular pets and are used as bait. Sometimes these animals are released by owners or anglers without them realizing the potential environmental impact.		

AQUATIC INVASIVE SPECIES, FISH, ODNR		
Common Name	*Description*	
Grass Carp: The grass carp, or white amur, was originally introduced into the ecosystem to control aquatic weed growth. However, these fish voraciously feed on different animals and other plant life. They typically vary between 65-80 pounds. They prefer to live in shallow waters of lakes, ponds, and backwaters. Grass carp are intentionally stocked in private ponds to control aquatic vegetation, but only sterilized triploid grass carp can be stocked or owned within Ohio. If they are released or escape into other waterways, they can easily spread into tributaries, waterways, river systems, canals, and dams.		

Impacts and Vulnerability

Invasive species can harm wildlife in several different ways. When a species enters an ecosystem, it can breed or spread quickly and take over an area if it has no natural predators. Native species may not be able to defend their habitats from the invasive species. Native species may also become prey or have to compete for food. Invasive species can carry disease, prevent native species from reproducing or kill native species offspring (National Wildlife Federation, 2018).

There are also indirect results of an alien species moving into a new habitat. Invasive species can change the food web in an ecosystem by destroying or replacing native food sources. Though a new species may become an optional food source, it may not produce enough to supply the wildlife around it. Some species can completely reconstruct an ecosystem; aggressive plant species can take over ecosystems and replace every plant with a form of itself (National Wildlife Federation, 2018).

Though the tables above list invasive species that directly impact Trumbull County, many surrounding counties harbor many different animals and plants that could eventually inhabit the area. Feral hogs have been confirmed Ashtabula County and many other plants, fish, and invertebrates are confirmed in all counties bordering Trumbull County.

Past Mitigation Efforts: Infestation

- The Ohio Division of Forestry disseminated public information encouraging Ohio residents to not move firewood, in an effort to slow the spread of the emerald ash borer.

- Research is also studying controlling and stemming the spread of the ash borer through insecticides and other treatments, including the introduction of predators, such as a wasp native to China.
- The Ohio Division of Forestry has also strategically placed pheromone traps throughout Trumbull County, in an effort to reduce the European strain of gypsy moth population.

Historical Occurrences

Most invasive species have been introduced due to human intervention, whether intentionally or accidentally. In almost all cases, once an invasive species is introduced they are a continuous issue due to the difficulty in not only eliminating, but also eradicating them from the area.

Loss and Damages

Invasive species can put human health and economies at risk. These organisms can threaten the livelihoods of people who depend on agriculture for financial stability by destroying crops and decreasing the availability of water. The cost of repairing damages or controlling populations can drain budgets whereas the cost of lost crops can harm farmers.

Vulnerability Assessment

This section summarizes the vulnerability to Trumbull County from infestation. The following table assigns point totals based on the research presented in this profile for each category that appears in Ohio EMA's SHARPP tool.

INFESTATION VULNERABILITY SUMMARY			
Category	*Points*	*Description*	*Notes*
Frequency	5	Excessive	There are 31 known species of invasive organisms in Trumbull County. Once introduced, invasive species are difficult to remove.
Response	5	More than one month	Invasive species do not generally warrant a traditional emergency response; however, the response measures put into place are long term.
Onset	1	Over 24 hours	Once introduced to a new area, invasive species need time to establish an infestation.
Magnitude	2	Limited (10-25% of land area affected)	The most notable invasive species in Trumbull County, the EAB, has affected ash trees. Loss of these trees has caused destabilization of streambanks.
Business	1	Less than 24 hours	Typically, the economy would not be interrupted by an invasive species.
Human	1	Minimum (minor injuries)	Invasive species does not pose a direct threat to human health at this time.
Property	1	Less than 10% of property affected	Invasive species in Trumbull County would not affect significant amounts of property. Losses and damages are primarily limited to land area and the environment.
Total	16	Medium	

2.0 RISK ASSESSMENT

2.2.8 Geologic Hazards

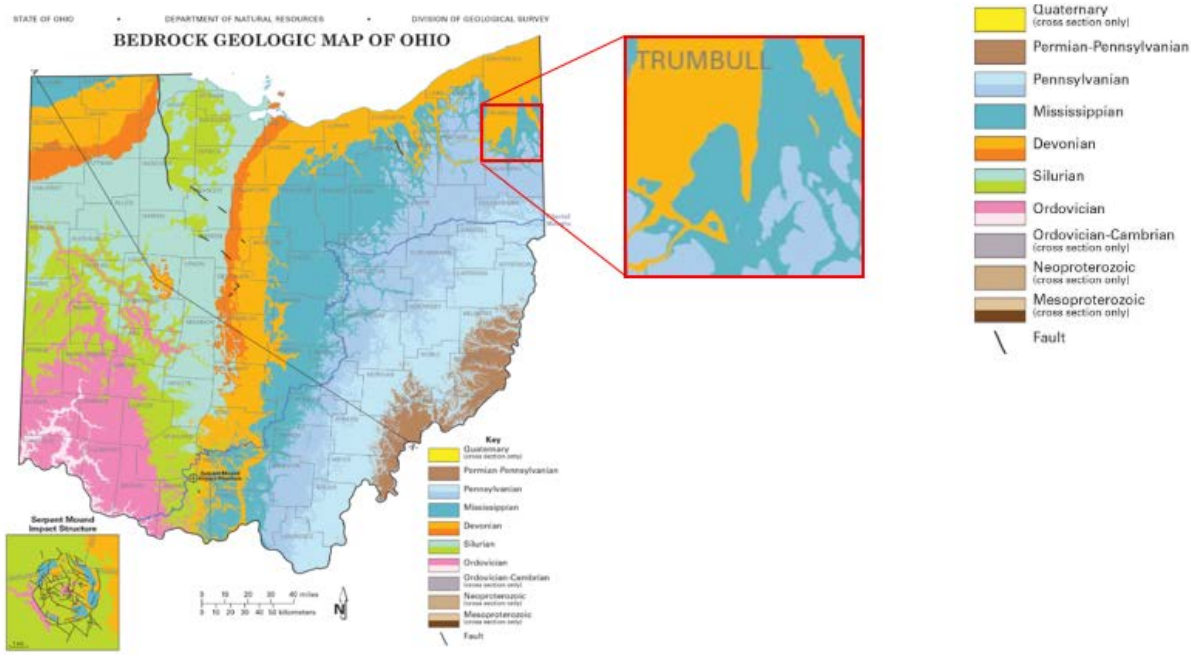
A geologic hazard is one of several types of adverse geologic conditions capable of causing damage or loss of property and life that consist of sudden and slow phenomena.				
Vulnerability  HIGHEST HIGH MEDIUM LOW LOWEST	Period of Occurrence:	At any time	Hazard Index Ranking:	Lowest
	Warning Time:	Weeks to minutes	State Risk Ranking:	4
	Probability:	Remote	Severity:	Critical
	Type of Hazard:	Natural and human-caused	Disaster Declarations:	None

Hazard Overview

Land subsidence is a general term for a variety of collapses in the earth's surface. Some can be rapid, occurring in seconds, whereas others may take hours, weeks, or even longer to develop. Subsidence, in the context of underground mining, is the lowering of the Earth's surface due to collapse of bedrock and unconsolidated materials (i.e., sand, gravel, silt, and clay) into underground mined areas.

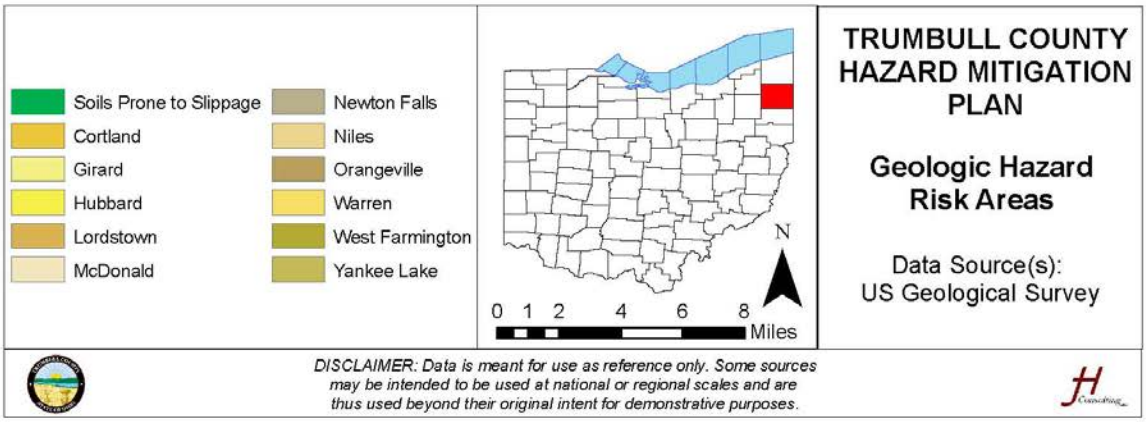
There are two types of subsidence: (1) pit, also called sinkhole or pothole, and (2) sag or through. (The term "sinkhole" more properly refers to solution collapse features in limestone). Pit subsidence is an abrupt sinking of the surface resulting in a circular, steep-sided, craterlike feature that has an inward drainage pattern. It is often associated with the roof collapse of mines that have total overburden (overlying unconsolidated material and rock) of less than 165 feet, weak roof rock of shale or mudstone, and a ratio of unconsolidated-material thickness to rock thickness of less than 1:2. Sag subsidence is a gentle, gradual settling of the surface. It is associated with pillar crushing or pillar punching in deeper mines (overburden of more than 75 feet). Sag subsidence features may fill with water if the surface of the subsidence intersects the water table.

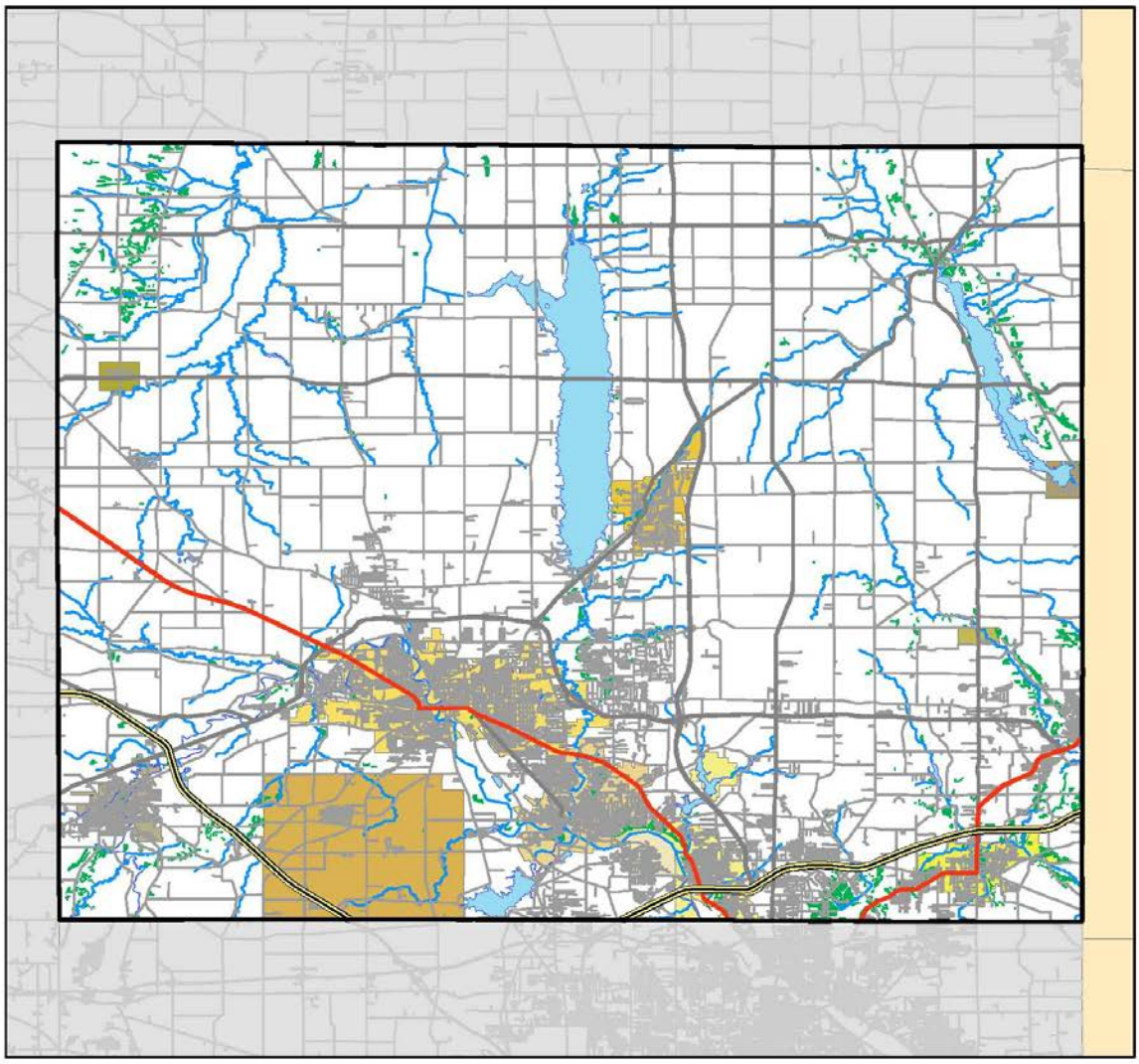
The State of Ohio has a variety of bedrock types; in Trumbull County, the most predominant is the Devonian and Mississippian, with some Pennsylvanian (as seen in the map below). Devonian bedrock consists of shale, sandstone, and limestone. Pennsylvanian bedrock consists of sedimentary rocks, mainly shale, sandstone, siltstone, mudstone, limestone, and some coal. The Mississippian is similar and also contains conglomerate.



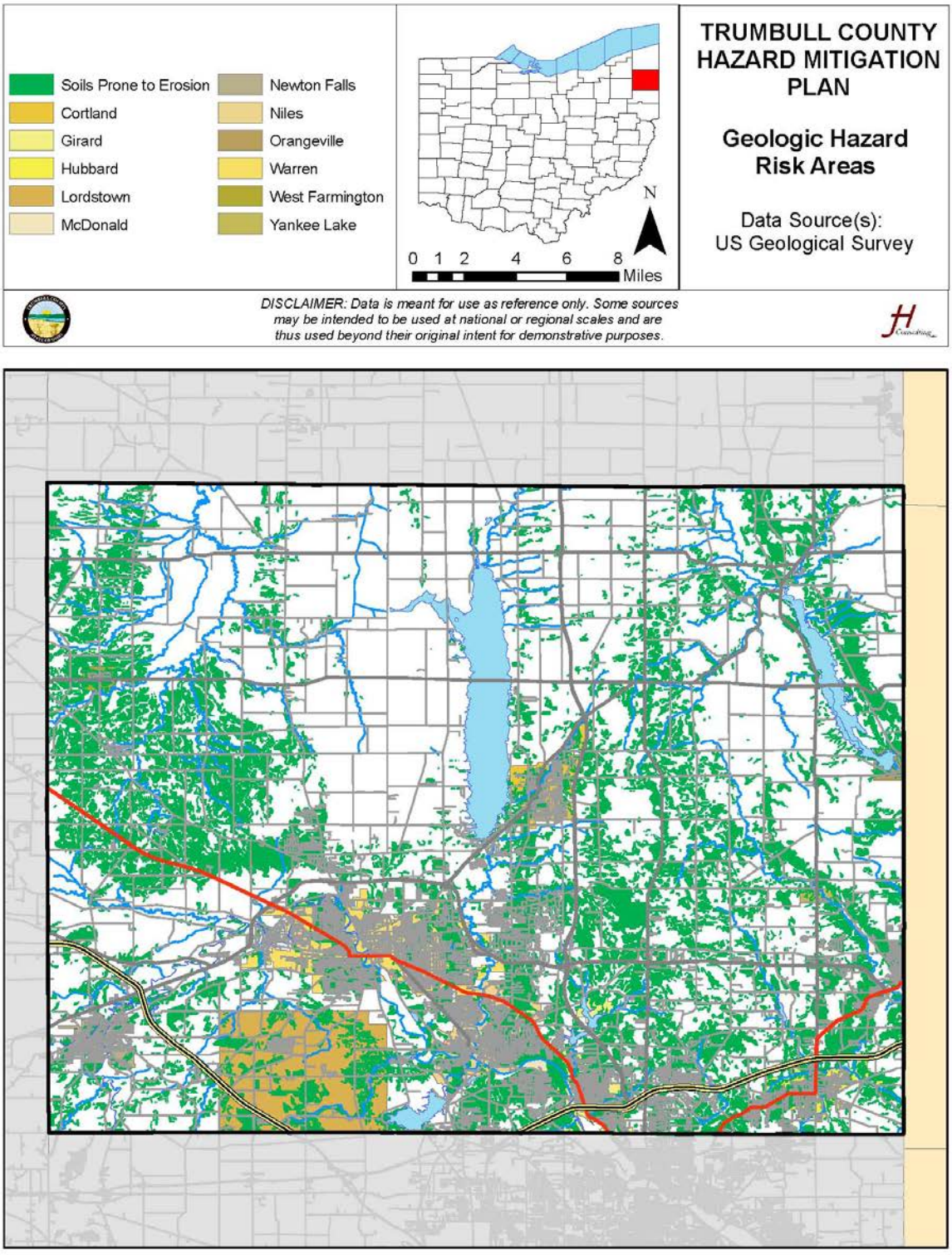
Location and Extent

Due to the lack of steep slopes and lack of failure-prone geologic units, traditional landslides are almost non-existent in most of Ohio. As shown in the map below, there are few soil types (USGS, 1992) prone to slippage. Most of these areas are in the northwestern and southeastern corners of the county.


Soils Prone to Slippage
Cortland
Girard
Hubbard
Lordstown
McDonald
Newton Falls
Niles
Orangeville
Warren
West Farmington
Yankee Lake
N
0 1 2 4 6 8
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
Geologic Hazard Risk Areas
Data Source(s):
US Geological Survey
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.



Other types of geologic hazards affect the state, though. Mine subsidence can strike with little or no warning and can result in very costly damage. However, unlike earthquakes, mine subsidence effects very few people but does have the ability to affect many lives and business if the ground was to subside in the middle of a town or on major roadways. Repairs for such events can take months and cost millions of dollars (ODNR, 1995). With potential damages to the foundations of structures, underground utilities, and the possible impact on human life, mine subsidence can be devastating (OEMA, 2019). The following image presents soil types that are prone to erosion, as per the county's latest soil survey (USGS, 1992).


Soils Prone to Erosion
Cortland
Girard
Hubbard
Lordstown
McDonald
Newton Falls
Niles
Orangeville
Warren
West Farmington
Yankee Lake
N
0 1 2 4 6 8
Miles
TRUMBULL COUNTY HAZARD MITIGATION PLAN
Geologic Hazard Risk Areas
Data Source(s):
US Geological Survey
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

Abandoned underground mines are in 41 of the 88 counties in Ohio. In 2004, the ODNR Division of Geological Survey partnered with the Ohio Mine Subsidence Insurance Underwriting Association and the ODF Division of Mineral Resources Management and created a website for property owners, developers, and transportation officials to determine the locations of mines underneath of their properties. The resultant map was to improve public access to abandoned underground mine records. Along with the area of the mines, the information includes the hazard potential, the commodity mined, past operator, and any records of roofs collapsing (ODNR, 2010).

The image below displays all mapped mines in Trumbull County. There are many abandoned mines in the southeastern portion of Ohio existing in Weathersfield, Liberty, Hubbard, Vienna, and Brookfield counties. The bounds of these abandoned mines are largely unknown. Most surface mines located in Trumbull County are in northern Mesopotamia (ODNR, 2018).

Impacts and Vulnerability

Land subsidence causes many problems including changes in elevation and slope of streams, canals, and drains; damage to bridges, roads, railroads, electric power lines, storm drains, sanitary sewers, canals, and levees; damage to private and public buildings; failure of well casings from forces generated by compaction of fine-grained materials in aquifer systems. Safety

problems for residents caused by sinkholes and subsidence initiated by abandoned underground mines are a growing concern.

Mine subsidence, like an earthquake, is a geologic hazard that can strike with little or no warning and can result in catastrophic and costly damages. Unlike an earthquake, mine subsidence normally only affects few people. However, if a mine collapses under an interstate highway, several lives and industries are subjected to potential damage. Mine subsidence can also cause foundation damage to buildings, disrupt underground utilities, and be a potential risk to human life.

Past Mitigation Efforts: Geologic Hazards

- Local officials have reviewed existing regulations, comprehensive plans, and capital improvement plans to ensure adequacy in reducing the amount of future development in areas identified as prone to land and mine subsidence.
- The ODNR developed GIS-based online mapping which illustrates the undermined areas in Trumbull County.

Historical Occurrences

In October of 2018, officials noted two sinkholes along Saddlebrook Lane in Bazetta Township (DiPaulo, 2019). The sinkholes were a result of a collapsed metal sewer line and affected 40 of the 64 properties in the area. The sewer lines were part of a drainage district constructed in 2001.

On December 3, 2018, motorists traveling on Mahoning Avenue in Warren reported a sinkhole. At the surface, the sinkhole was 30 inches wide, but the hole was actually eight feet deep and between ten and 12-feet wide. A collapsed clay pipe combined with stormwater runoff were determined to be the cause (Shiller, 2019).

Abandoned mines have been problematic for the Mineral Ridge area in Trumbull County. Between 1997 and 2008, subsidence crews visited the area four times to fill voids with rock and cement. Tracing the extent of these mines has been difficult due to the lack of accurate maps of the mine shafts. During the Depression, people would remove coal from abandoned shafts to heat their homes. Additionally, Ohio did not require companies to file maps of their mines until 1874. A loophole existed in the rule which stated that if a mine employed less than ten people, it did not have to share information to inspectors (The Columbus Dispatch, 2008).

Loss and Damages

According to the *State of Ohio's Enhanced Hazard Mitigation Plan* (OEMA, 2019), abandoned mine liability insurance is mandatory in Trumbull County. This insurance covers the lesser of $300,000 or the amount of insurance coverage for the building.

The state's mitigation plan also notes that Trumbull County is in ODOT Region 3, which contains the most area that is susceptible to landslide. Despite this, Trumbull is the third-lowest county for potential monetary impact due to landslides. There are eight total exposed critical facilities and no facilities in high incidence areas (OEMA, 2019). The total replacement value of those facilities equals $1,052,544.

To complete the SHARPP vulnerability assessment, the Ohio EMA's "loss estimate workbook for HAZUS results" provided the figures included in the following table.

GEOLOGICAL HAZARDS EXPOSURE ESTIMATE – SHARPP DATA ENTRY		
Structure Type	*Number*	*Loss Estimate*
Residential	2	$763,300
Non-Residential	1	$249,300
Critical Facilities	1	$39,900
TOTALS	4	$1,052,500

Vulnerability Assessment

This section summarizes the vulnerability to Trumbull County from geological hazards. The following table identifies the assets located in geologic hazard risk areas.

ASSET	ADDRESS	CITY	ASSET TYPE		
			Infrastructure	*Critical Facilities*	*Cultural Resources*
Animal Welfare League Shelter Admin.	545 Brunsetter Road SW	Warren		X	
Baker/Currie Elementary	4095 Sheridan Drive	Vienna		X	
Bazetta Twp.	3372 State Route 5 NE	Cortland		X	
Bazetta Twp. FD	300 Warren Meadville Road	Cortland		X	
Bazetta Twp. PD	2671 McCleary Jacoby Road	Cortland		X	
Braceville Twp. FD	582 Braceville Robinson Road	Newton Falls		X	
Brookfield Twp.	6844 Strimbu Drive	Brookfield		X	
Brookfield Twp. PD	6844 Strimbu Drive	Brookfield		X	

ASSET	ADDRESS	CITY	ASSET TYPE		
			Infrastructure	*Critical Facilities*	*Cultural Resources*
Champion Elementary	5759 Mahoning Avenue NW	Warren		X	
Champion High School	5976 Mahoning Avenue NW	Warren		X	
Champion Local BOE	5976 Mahoning Avenue, Suite B	Warren		X	
Champion Local Schools	5759 Mahoning Avenue NW	Warren		X	
Champion Middle School	5435 Kuszmaul NW	Warren		X	
Champion Twp.	149 Center Street E	Warren		X	
Champion Twp. FD	139 Champion Avenue	Warren		X	
Champion Twp. PD	149 Center Street E	Warren		X	
City of Hubbard	220 West Liberty Street	Hubbard		X	
Clarence Darrow Octagon House	8405 Main Street	Kinsman			X
Clearview Lantern Suites	596 Champion Avenue W	Warren			X
Community Health Care at the Ridge	3379 Main Street	Mineral Ridge		X	
Cortland City FD	194 Lattin Street	Cortland		X	
Cortland City PD	400 North High Street	Cortland		X	
Cortland Health Care Ctr.	369 North High Street	Cortland		X	
Currie Elementary	3306 Ridge Road NE	Cortland		X	
E.J. Blott Elementary/Guy Middle	4003 Shady Road	Youngstown		X	
Farmington Twp.	251 4th Street	West Farmington		X	
Farmington Twp. FD	151 College Street	West Farmington		X	
Forum Hillside Rehab. Hospital	8747 Squires Lane NE	Warren		X	
Fowler Twp.	4562 Wilson Sharpsville Road	Cortland		X	
Fowler Twp. VFD	3386 Youngstown-Kingsville Road	Fowler		X	
Gillette Nursing Home	3310 Elm Road	Warren		X	
Girard City BOE	704 East Propect Street	Girard		X	
Girard City FD	105 E. Liberty Street	Girard		X	
Girard FD	105 East Liberty Street	Girard		X	

ASSET	ADDRESS	CITY	ASSET TYPE		
			Infrastructure	*Critical Facilities*	*Cultural Resources*
Girard High School	1244 Shannon Road	Girard		X	
Girard Intermediate	702 East Prospect Street	Girard		X	
Girard Junior High	1244 Shannon Road	Girard		X	
Girard Library	105 East Prospect Street	Girard			X
Grace Woods Village	730 Youngstown Road	Niles		X	
Guy Middle School	4115 Shady Road	Youngstown		X	
H.C. Mines Elementary	850 Howland-Wilson Road NE	Warren		X	
Horizon Village Nursing & Rehab. Ctr.	2473 North Road NE	Warren		X	
Howland Glen Primary	8000 Bridle Lane	Warren		X	
Howland Local Schools	8200 South Street SE	Warren		X	
Howland Local Schools	850 Howland-Wilson Road	Warren		X	
Howland Middle School	8100 South Street SE	Warren		X	
Howland Springs Primary	9500 Howland Springs Road	Warren		X	
Howland Twp.	205 Niles Cortland Road NE	Warren		X	
Howland Twp. FD, #30, #31, #32	169 Niles Cortland Road	Warren		X	
Howland Twp. PD	169 Niles Cortland NE	Warren		X	
Hubbard Elementary	150 Hall Avenue	Hubbard		X	
Hubbard Exempted Village BOE	108 Orchard Avenue	Hubbard		X	
Hubbard Exempted Village Schools	150 Hall Avenue	Hubbard		X	
Hubbard Exempted Village Schools	341 Hall Avenue	Hubbard		X	
Hubbard Exempted Village Schools	351 Hall Avenue	Hubbard		X	
Hubbard High School	350 Hall Avenue	Hubbard		X	
Hubbard Middle School	250 Hall Avenue	Hubbard		X	
Hubbard Public Library	436 West Liberty Street	Hubbard			X
Hubbard Twp.	2600 Elmwood Drive	Hubbard		X	
Jefferson K-8	1543 Tod Avenue SW	Warren		X	
John F. Kennedy Lower Campus	3000 Reeves Road	Warren		X	

ASSET	ADDRESS	CITY	ASSET TYPE		
			Infrastructure	*Critical Facilities*	*Cultural Resources*
Kinsman Public Library	6420 Church Street	Kinsman			X
Kinsman Twp.	6346 State Route 87	Kinsman		X	
Kinsman Twp. VFD	8450 Ridge Road	Kinsman		X	
Lakeview High School	300 Hillman Drive	Cortland		X	
Lakeview Local BOE	300 Hillman Drive	Cortland		X	
Liberty High School	1 Leopard Way	Youngstown		X	
Liberty Local Schools	4115 Shady Road	Youngstown		X	
Liberty Twp. FD	4001 Logan Way	Youngstown		X	
Lincoln K-8	2253 Atlantic Avenue NE	Warren		X	
Lincoln K-8	3465 Tod Avenue NW	Warren		X	
Lincoln/Jefferson	2253 Atlantic Avenue NE	Warren		X	
Lincoln/Willard	2253 Atlantic Avenue NE	Warren		X	
Lordstown Elementary	1776 Salt Springs Road	Warren		X	
Lordstown High School	1824 Salt Springs Road	Warren		X	
Lordstown Local Schools	1824 Salt Springs Road	Warren		X	
Mathews High School	4429 Warren-Sharon Road	Vienna		X	
Mathews Local BOE	4429 Warren-Sharon Road	Vienna		X	
Mathews Local Schools	4096 Cadwallader-Sonk Road	Cortland		X	
McDonald Elementary	410 W. 7th Street	McDonald		X	
McDonald High School	600 Iowa Avenue	McDonald		X	
McDonald Local Schools	410 West 7th Street	McDonald		X	
McDonald Local Schools	600 Iowa Avenue	McDonald		X	
McDonald PO	500 Ohio Avenue	McDonald		X	
McDonald Village FD	451 Ohio Avenue	McDonald		X	
McDonald Village PD	218 Adam Street	McDonald		X	
McGuffey K-8	3465 Tod Avenue NW	Warren		X	
McGuffey/Willard	2253 Atlantic Avenue NE	Warren		X	
Med Star EMS & Transport	1600 Youngstown Road SE	Warren		X	
Mesopotamia Twp. VFD	8800 State Route 534	Mesopotamia		X	
Mespo Elementary	4466 Kinsman Road	Mesopotamia		X	

ASSET	ADDRESS	CITY	ASSET TYPE		
			Infrastructure	*Critical Facilities*	*Cultural Resources*
Newton Falls Jr./Sr. High	905 Milton Boulevard	Newton Falls		X	
Niles City BOE	309 Rhodes Avenue	Niles		X	
Niles Middle School	309 North Rhodes Avenue	Niles		X	
Niles Middle School	411 Brown Street	Niles		X	
O'Brien Memorial Nursing Home	563 Brookfield Avenue SE	Masury		X	
Orangeville Village VFD	8276 High Street	Orangeville		X	
Prospect Elementary	700 East Prospect Street	Girard		X	
Ridgecrest Care Ctr.	1926 Ridge Avenue SE	Warren		X	
Roosevelt Elementary	410 West 7th Street	McDonald		X	
Seaborn Elementary	3800 Niles-Carver Road	Mineral Ridge		X	
Shepherd of the Valley Lutheran Retirement Ser.	4100 North River Road	Howland		X	
St. Joseph Health Ctr.	667 Eastland Avenue SE	Warren		X	
TCTC	528 Educational Highway	Warren		X	
Trumbull Memorial Hospital	1350 East Market Street	Warren		X	
Vernon Twp.	6160 State Route 7	Kinsman		X	
Village of McDonald	451 Ohio Avenue	McDonald		X	
Village of West Farmington	251 Fourth Street	West Farmington		X	
Warren FD Northeast Station	1600 Atlantic Avenue	Warren		X	
Weathersfield Twp.	1451 Prospect Street	Mineral Ridge		X	
Weathersfield Twp. FD	1451 Prospect Street	Mineral Ridge		X	
Weathersfield Twp. PD	1451 Prospect Street	Mineral Ridge		X	
West Farmington PD	251 Fourth Street	West Farmington		X	
West Farmington PO	226 East Main Street	West Farmington		X	
Youngstown Air Reserve Station	3976 King Graves Road	Vienna		X	
Youngstown-Warren Regional Airport	1453 Youngstown-Kingsville Road	Vienna		X	

The following table assigns point totals based on the research presented in this profile for each category that appears in Ohio EMA's SHARPP tool.

GEOLOGICAL HAZARDS VULNERABILITY SUMMARY			
Category	*Points*	*Description*	*Notes*
Frequency	2	Low	Sinkholes are more common that landslides in Trumbull County, but both are rare.
Response	1	Less than half a day	Sinkholes typically do not require a traditional emergency response; though repairs can take time, detours and other measures allow for continuity of operations in affected areas.
Onset	1	Over 24 hours	Areas of subsidence and sinkhole can develop slowly, over the course of weeks. Other times, sinkholes can open with no warning.
Magnitude	2	10-25% of land area affected	Sinkholes and landslides have traditionally been confined to small sites; mine subsidence has also been single-site occurrences (though clusters of subsidence may occur).
Business	1	Less than 24 hours	Sinkholes typically do not impact the county's economic activity.
Human	1	Minimum with minor injuries	Sinkholes and subsidence do not usually cause human impacts. Damages are related primarily to land and property.
Property	1	Less than 10% damaged	Sinkholes and subsidence affect small areas and do not affect more than 10% of property in the county.
Total	9	Lowest	