

Planning for Extreme Flooding Events – What Stormwater Managers Should Know

October 19, 2016

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History of Recent Events

We want to start our presentation today with some discussion about “Extreme Events”??

So, what contributes to an “Extreme Event”??



One measure could be in the quantity of
rain....

Maybe as a 100-year storm??



But wait....

That is *too* complicated!!!

“At least we won’t see another storm like that during *our* lifetime....” or

“That only happens every 100 years, right?”


Why don't we call it....

“A 1% Chance Storm”....

Now, that's easier for the average person to understand.... Right??

By show of hands, who would like to stand up and define that in terms that the average person can understand??

I didn't think so.....



Another way might be to refer to it in terms
of Billions of \$\$'s of Damage

Billion-Dollar Disasters

U.S. 2016 Billion-Dollar Weather and Climate Disasters



This map denotes the approximate location for each of the 12 billion-dollar weather and climate disasters that have impacted the United States between January 1 and September 30, 2016.

History of Recent Events

Following the extreme flood events that occurred in South Carolina last fall, we were contacted by the City of Columbia, and by Richland County to discuss flood recovery.

An article in “The State” cited the concern that “there has been a 1000-yr event somewhere in the US every year since 2010”....

* The events that were cited, counting backwards from the SC Event, were as follows:

- * South Carolina, October 2015
- * Pensacola, April 2014
- * Colorado Front Range, September 2013
- * Hurricane Sandy, 2012
- * Hurricane Irene and West Tennessee (MS River) , 2011
- * Nashville, May 2010
- * Atlanta, 2009 and Cedar Rapids, 2008

And don't forget, Cedar Rapids just experienced another significant event around the end of September....



But the reality is, that extreme weather events are occurring all over the place, sometimes multiple times per month....

Rain Bomb!!!



... or “Wet Microburst”

- * A thunderstorm runs into a dry patch of air that sucks some moisture away...
- * The air underneath the storm cloud cools, making it more dense than the air around it....
- * The cooler air begins to drop into even warmer air and then accelerates...
- * When the faucet really flips on, air can blast out of the sky at more than 115 miles per hour....
- * It deflects off the ground and pushes winds outward, at or near tornado strength....

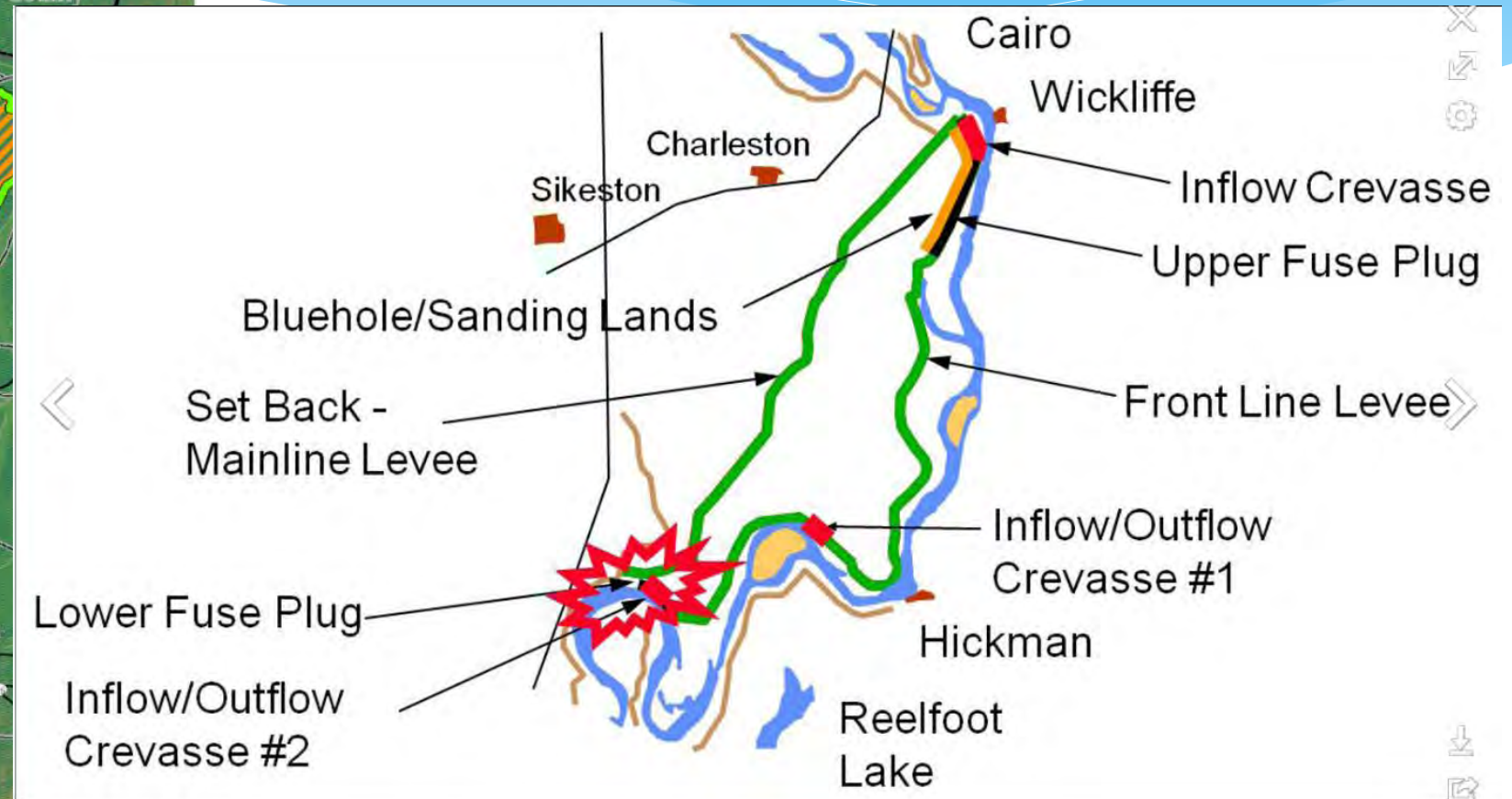
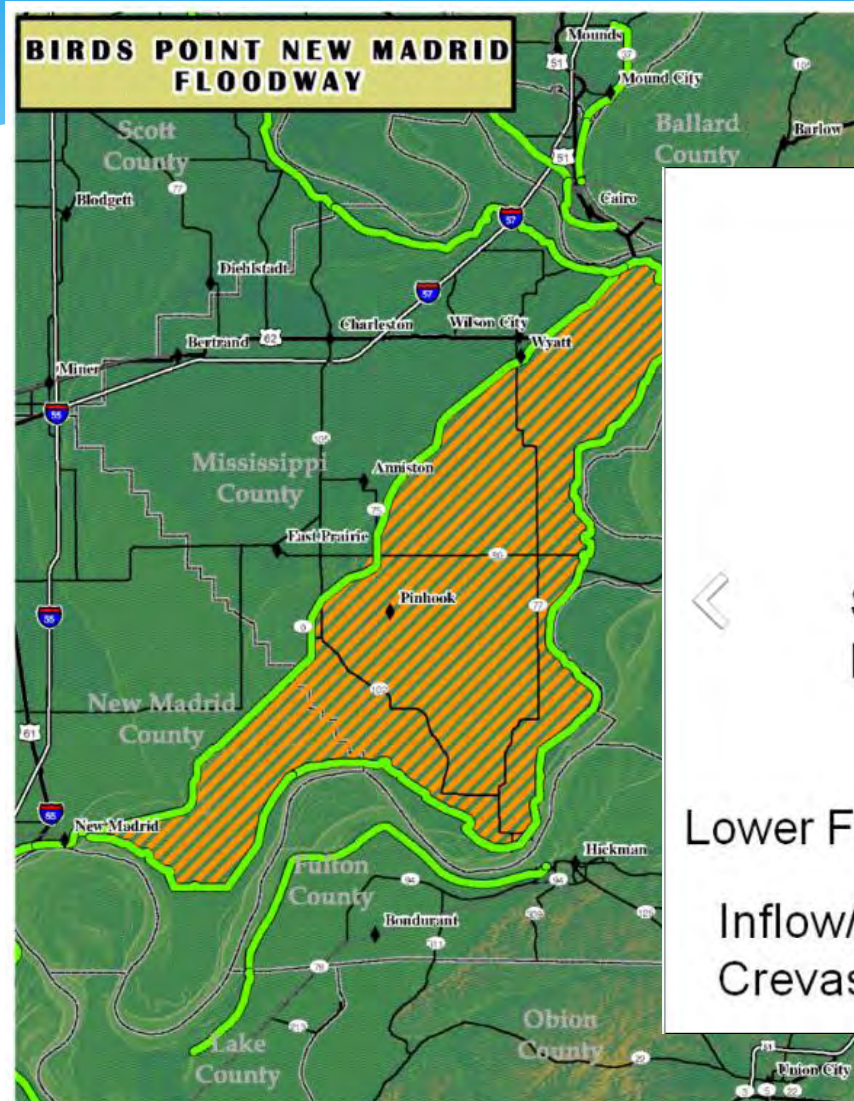
Local Microburst Events

- * Madison TN
- * Vanderbilt University – Centennial Park
- * Cool Springs Galleria Mall
- * Thompson Station TN

So, just since March of this year.....

- * Texas and North Louisiana – March 8
- * Houston TX – April 18
- * Palestine TX – April 30
- * Brenham TX – May 26
- * Oklahoma – June 16
- * Greenbrier WVA – June 23
- * Las Vegas – June 30
- * Ellicott City MD – July 30
- * Louisiana – August 16
- * San Antonio – August 20
- * Hurricane Matthew

Birds Point – New Madrid Floodway



But what is causing....

....this rash of new, extreme rain events all over the country and the world??

In simple terms, the slight increase of global temperatures causes an increase in the concentration of moisture in the atmosphere....the National Weather Service talks about “Precipitable Water” in the atmosphere....

And in Ellicott City MD, ... “The meteorological cause of Ellicott City's epic flood was complex, a mixture of high humidity, unstable air, southerly wind flow, a nearby warm front and other factors as noted by *The Washington Post's Capital Weather Gang.*”

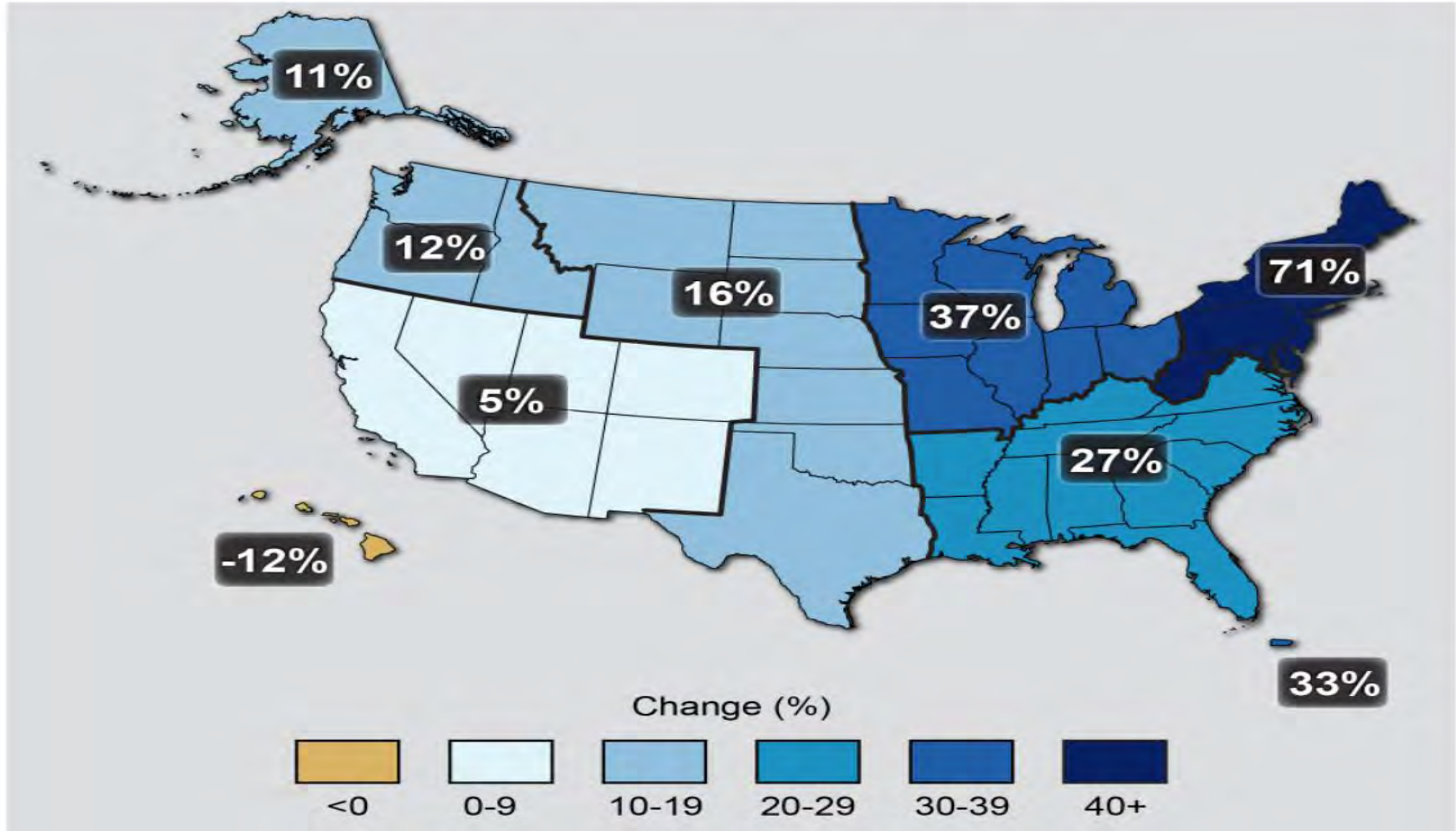
From the National Climate Assessment....

Heavy Downpours Increasing

Heavy downpours are increasing nationally, especially over the last three to five decades, with the largest increases in the Midwest and Northeast. Increases in extreme precipitation are projected for all U.S. regions.

[Explore extreme precipitation.](#)

Observed Change in Very Heavy Precipitation



Which leads us to....

... Be prepared for extreme weather events at all times – never assume that it can't/won't happen this year!!

... Acknowledge that we are much more susceptible to similar events at any time.

... Be deliberate about our efforts to plan for and complete effective mitigation throughout all areas at risk in our communities...



Questions??

Planning for Extreme Flooding Events – What to do When the Water Goes Down

SESWA

Birmingham AL

October 19, 2016

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It can happen to anyone!!

The likely initial reaction will be one of shock....and early on, it may seem that there is no end to the damage....

The Stafford Act

The Robert T. Stafford Disaster Relief and
Emergency Assistance Act, 42 U.S.C. §§ 5121-
5207

"All requests for a declaration by the President that a major disaster exists shall be made by the Governor of the affected State."

Damage Assessments

Assessments of damaged infrastructure must be completed quickly, in order to funnel information to the Mayor of your city or community, and to forward that information to the Governors Office, in order to request a Presidentially Declared Disaster.

USACE Disaster Life Cycle

- Response
- Recovery
- Mitigation
- Preparation/Training



FEMA's Disaster Management Cycles:

- * Mitigation
- * Preparedness
- * Response
- * Recovery

Mitigation

- * Preventing future emergencies or minimizing their effects
- * Includes activities that prevent an emergency, reduce the chance of an emergency happening, or reduce the damaging effects of unavoidable emergencies
- * Mitigation activities take place both before and after emergencies

Preparedness

- * Preparing to handle an emergency
 - * Includes plans or preparations made to save lives
 - * Evacuation plans and stocking food are examples of preparedness
 - * Preparedness takes place before an emergency takes place

Response

- * Responding safely to an emergency
 - * Includes actions taken to save lives and prevent further property damage
 - * Seeking shelter from a tornado is a response activity
 - * Response Activities take place during an emergency

Recovery

- * Recovering from an emergency
 - * Includes actions taken to return to a normal or an even safer situation following an emergency
 - * Recovery includes getting financial assistance to help pay for the repairs
 - * Recovery activities take place after an emergency

Assessment of Damage to Critical Infrastructure

- * Weeks of driving and walking roadways and drainage ways to identify damaged and destroyed infrastructure
- * Includes assessment of damaged commercial and residential properties
- * May include capturing high water marks while marks are still easily identifiable

K.R. Harrington Water Treatment Plant

Inundated with flood waters for 3 days

Recovery

- * Days out of service: 28
- * Controlled shut down
- * Volunteer fire crews assisted with clean up
- * Online with 30% capacity June 1
- * 95% capacity Aug. 31



K.R. Harrington Water Treatment Plant

Flood related expenditures: \$14.2 million

Total anticipated recovery = 78%
\$10.3 million

Flood mitigation submitted to FEMA
\$18.6 million

FEMA approved \$8.8 million

FEMA appeal \$4.5 million
(\$0.01 million approved)

Insurance \$1.5 million
(anticipated)

- * Elevation of Generator Bldg./Hot House
- * Raw Water Pumping Station and Solids Building
 - * Elevation of electrical and susceptible equipment.
 - * Installation of submersible components.
- * Elevation of Chemical feed system and flood proofing of components

Dry Creek Waste Water Treatment Plant

Most devastated facility; Inundated for 7 days.



Recovery

- * Days out of service: 50
- * 10 MGD 9 days after flooding; critical components not functioning
- * Facility operated manually
- * 90% in August

Dry Creek Waste Water Treatment Plant

Total flood expenditures: \$19.6 million

Total anticipated recovery = 74%
\$13 million

FEMA approved \$10.9 million

FEMA appeal \$13.0 million
(\$0.01 million approved)

Insurance \$2.1 million
(anticipated)

Flood mitigation submitted to FEMA \$9.3 million

- * Construction of a perimeter flood wall around the facility



Biosolids facility

Flooded 3 feet above 100 year flood level

Recovery

- * Days out of service: 30
- * Temporary sludge disposal equipment utilized
 - * 2 mobile belt presses used
 - * Converted 2 aerator basins into aerobic digesters
- * Full operation October 2010



Biosolids Facility

Total flood expenditures: \$9.4 million

Total anticipated recovery = 77%
\$6.1 million

Flood mitigation submitted to FEMA \$5.2 million

FEMA approved \$4.7 million

FEMA appeal \$2.1 million

No anticipated insurance proceeds

- * Modifications to the digesters
- * General flood proofing
- * Elevation of Effluent Pumping Station
- * Construction of a perimeter flood wall around the facility

Other Facilities

- * Central Wastewater Treatment Plant experienced minor processing interruptions
- * Whites Creek Wastewater Treatment Plant had one secondary clarifier damaged; did not affect plant capacity.
- * Omohundro Water Treatment Plant provided majority of water for Metro customers



Other Facilities

Total flood related expenditures: \$5.9 million

Total anticipated recovery = 85%
\$5 million

FEMA approved	\$4.2 million
FEMA appeal	\$0.03 million
Insurance (anticipated)	\$0.8 million

Flood mitigation submitted to FEMA \$5.5 million

Omohundro Water Treatment Plant

- * Intake mitigation
- * General flood proofing
- * Additional access road

Distribution and Collection System

Total flood related expenditures: \$24.5 million

Richland Creek Sewer compromised \$2.5 million

Water/sewer line/manhole repairs,
debris removal \$18.1 million

3 water pump stations and
28 sewer pump stations \$7.4million

3 reservoirs damaged \$1.6million



Distribution and Collection System

Total anticipated recovery = 89%
\$29.6 million

Flood mitigation submitted to FEMA \$3.4 million

FEMA approved \$10.5 million

FEMA appeal \$1.9 million

Insurance (anticipated) \$15.7 million

- * Elevation of electrical equipment
- * Installation of wet pit submersible pumps at several pump stations

Stormwater

100+ sites damaged

- * Field assessment to determine & document infrastructure damage at 5,200 locations

Recovery

- * Rec



Stormwater

Total flood related expenditures \$2.0 million

Total anticipated recovery = 32%
\$2.58 million 32%

Flood mitigation submitted to FEMA \$0.3 million

* Various mitigation measures

FEMA approved \$1.3 million

FEMA appeal \$0.4 million

Insurance
(anticipated) \$0.8 million



Metro Center Stormwater Pump Station

Total flood related expenditures: \$6.0 million



Mitigation

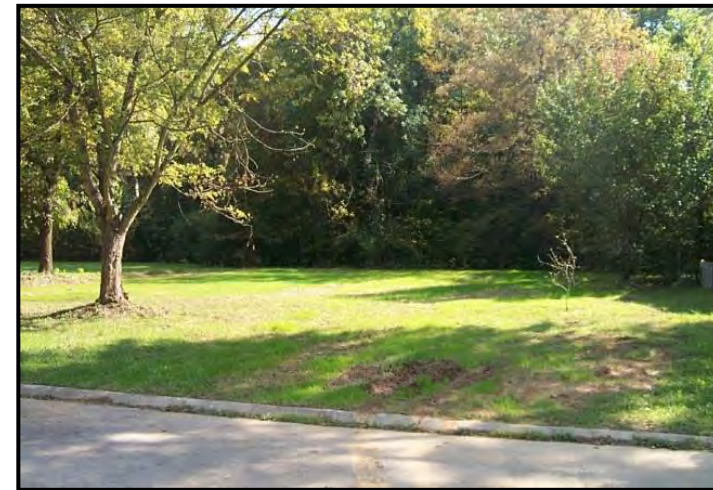
- Rehabilitation of existing pumping station
- New power distribution system
- Additional electrical/ pump building

Hazard Mitigation Buyout Program

Total Flood related expenditures:

Mitigation

- * Cost shared - 75% Federal, 12.5% State, 12.5% Local
- * 227 homes purchased since May 2010
- * 35 pending FEMA approval



Flood Recovery Finances

Expenditures \$70,981,196

Summary

Proceeds \$57,892,182

(excluding mitigation)

Net 82% \$22,089,014

FEMA & Insurance

Approved \$37,792,182

Appealed \$21,402,748

Mitigation \$43,013,266

(submitted for consideration)

Insurance \$20,100,000

(anticipated)

Permitting for Reconstruction

- * Triage: Quickly assess the properties that can proceed, while beginning discussions with property owners that are potentially Substantially Damaged.
- * If out of the floodplain, approve permit to begin reconstruction
- * If the structure meets floodplain ordinance requirements, approve permit to begin reconstruction (freeboard, flood vents)
- * If the structure is clearly less than about 40% damaged, approve permit to begin reconstruction.

Links to Substantial Damage Information:

- * FEMA 213, Answers to Questions About Substantially Damaged Buildings (1991) <http://www.fema.gov/library/viewRecord.do?id=1636>
- * FEMA P-758, Substantial Improvement/Substantial Damage Desk Reference (2010)
<http://www.fema.gov/library/viewrecord.do?id=4160>
- * FEMA P-784 CD, Substantial Damage Estimator (SDE) (2013)
<http://www.fema.gov/media-library/assets/documents/18692?id=4166>
- * USACE Generic Depth Damage Relationships
<https://planning.usace.army.mil/toolbox/library/EGMs/egm04-01.pdf>

Nashville SAFE and Nashville NERVE

During the course of months and years following the catastrophic flood that occurred during May 1 & 2, 2010, we worked to develop a flood forecasting tool (SAFE) and a citizens notification program (NERVE).