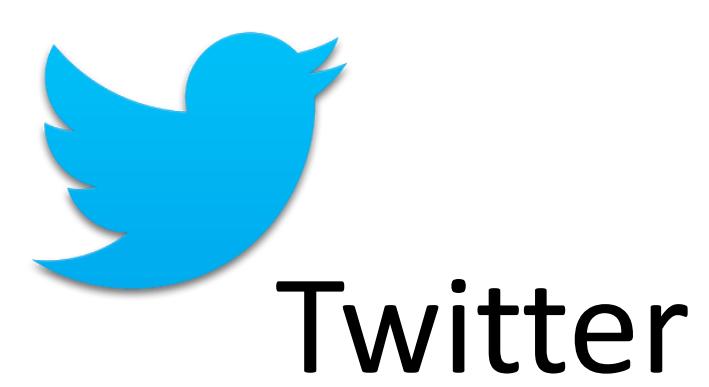
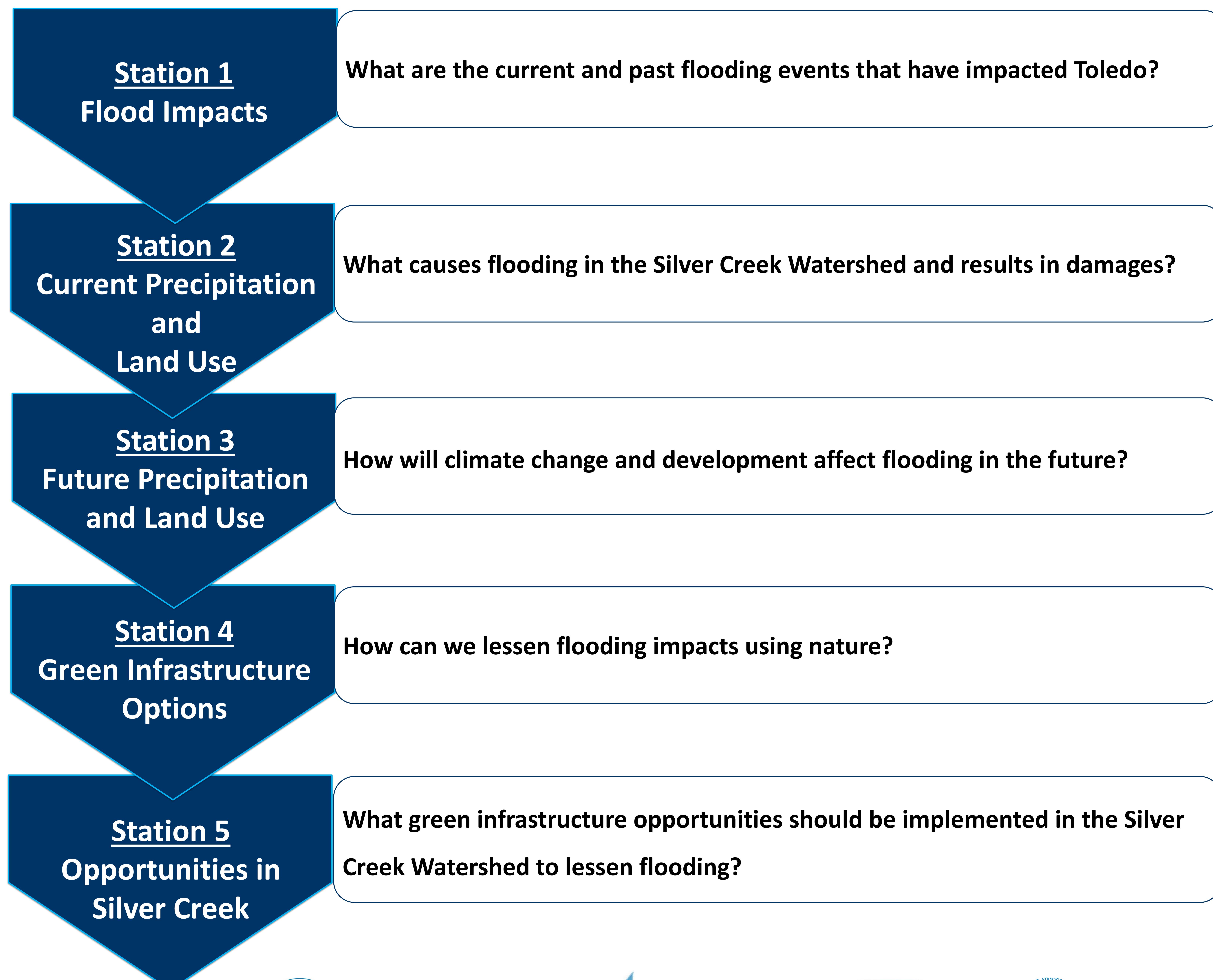


USING NATURE TO REDUCE FLOOD IMPACTS IN SILVER CREEK



The study of Toledo, Ohio, assessed the economic benefits of green infrastructure as a method for reducing flood impacts in the Silver Creek Watershed. Visit the different stations to learn about current and past flooding events that have impacted Toledo, how current precipitation and land use can create runoff during flood events and cause damages, how flooding and associated damages might increase in the future due to climate change, and how green infrastructure can be used to lessen those impacts. We also want to hear about the types of green infrastructure you would like to see in the Silver Creek Watershed to reduce flooding impacts as well as what you can do on your own property.

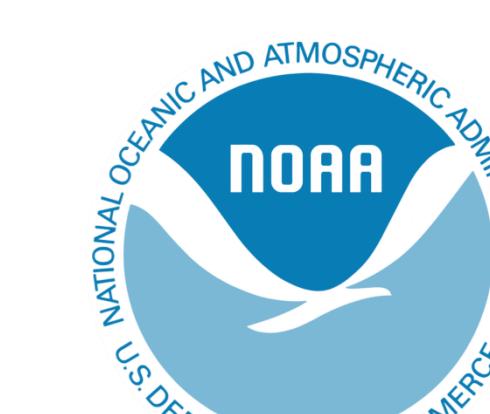
Stations:



Project Sponsors



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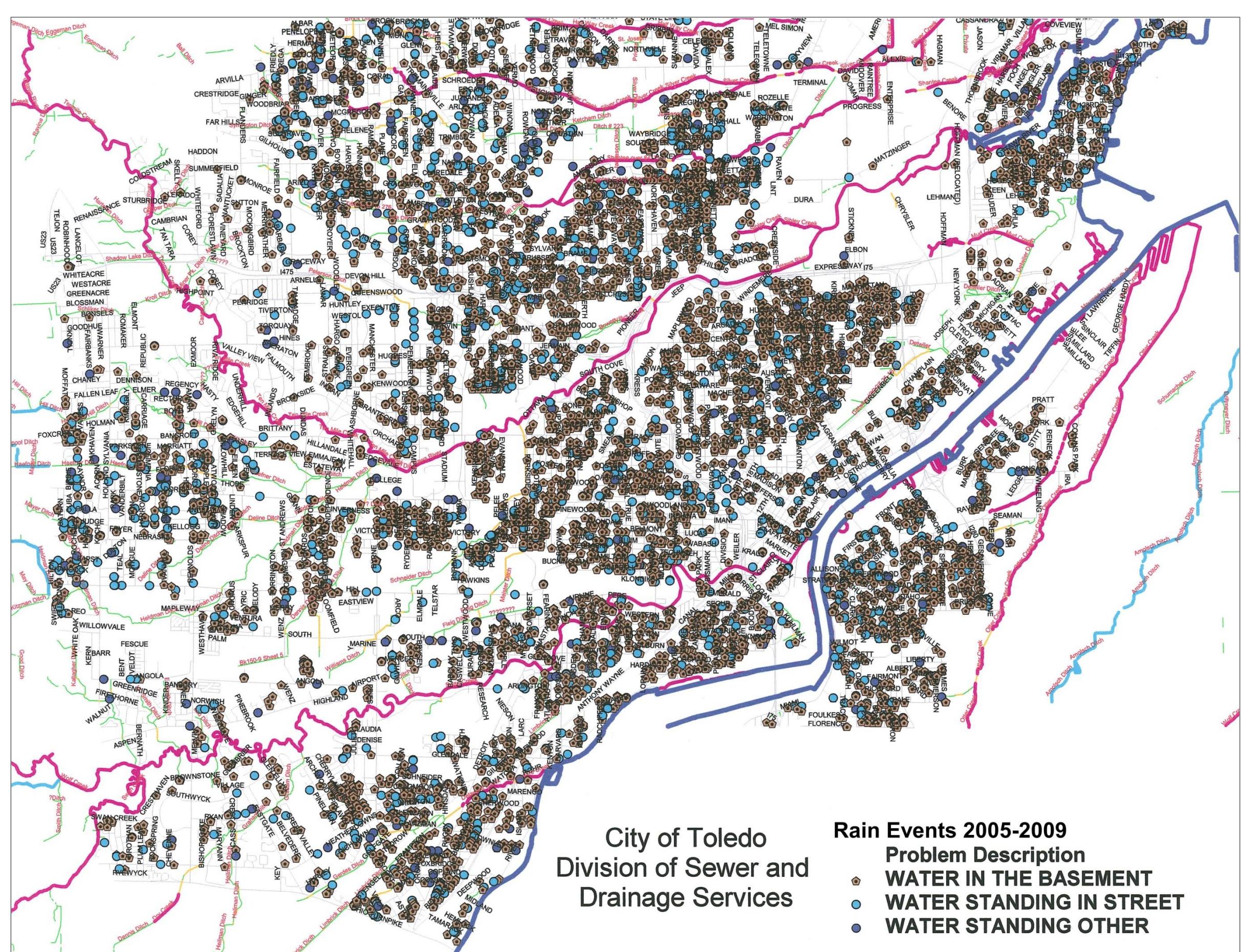


Station 1

HEAVY RAINS = FLOODING

TOLEDO FLOODS

Toledo's Chronic Urban Flooding

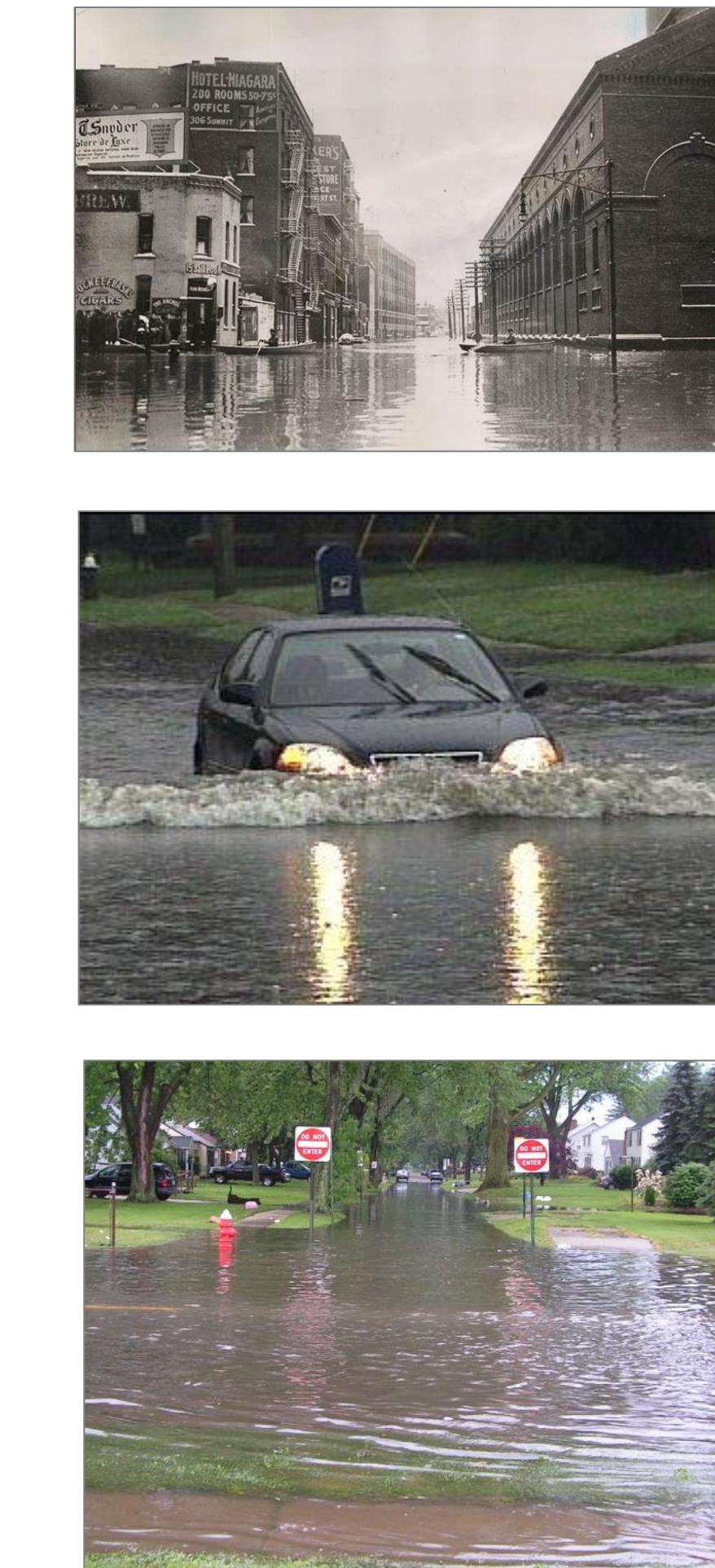


Flood reports from 2007 through 2012

Toledo's More Memorable Floods

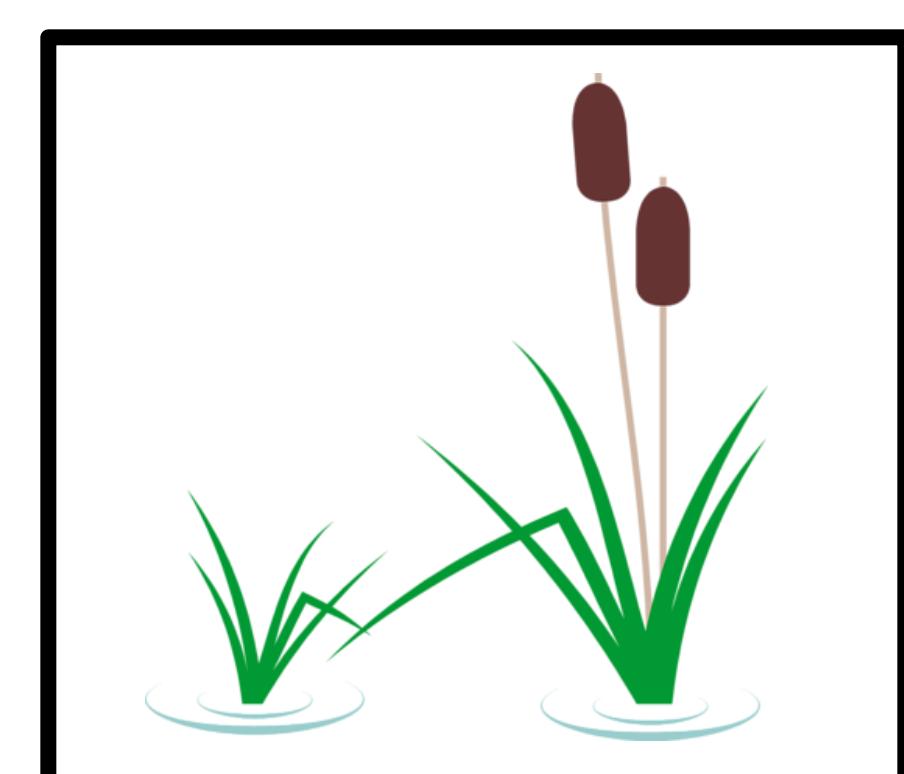
- 1913: 6-8 inches
- 1969: 10-14 inches of rain
- 2006: 5-7 inches of rain.
 - 3 floods in 3 weeks!

When's the
next one?



WHY IT FLOODS

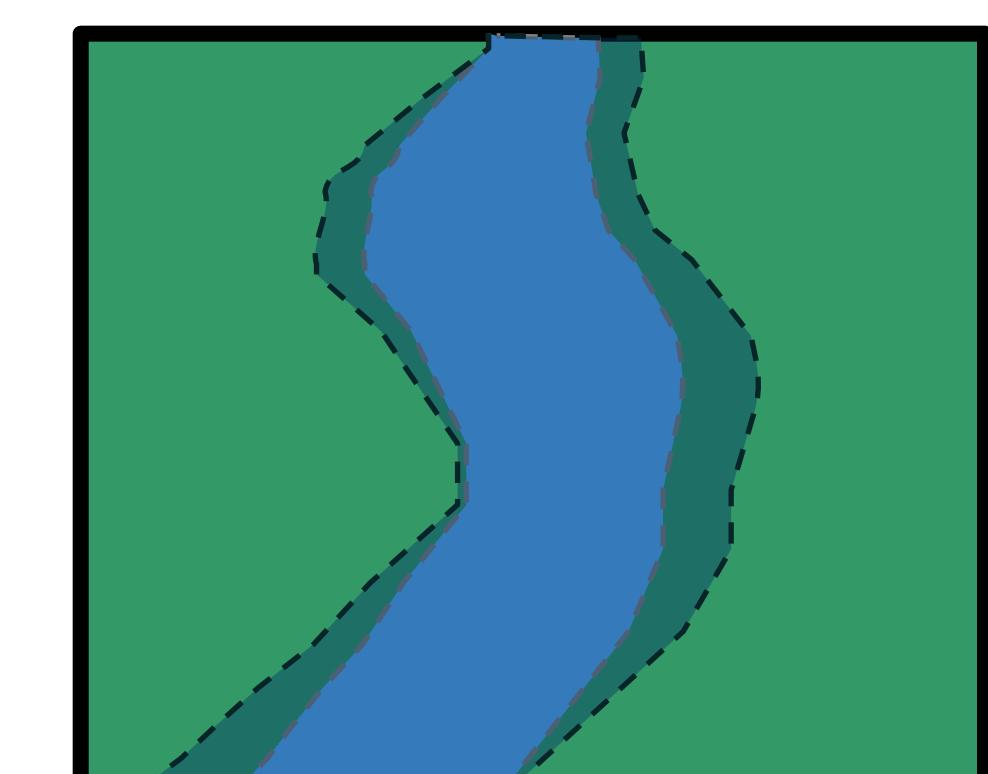
Toledo –
Once the Great
Black Swamp



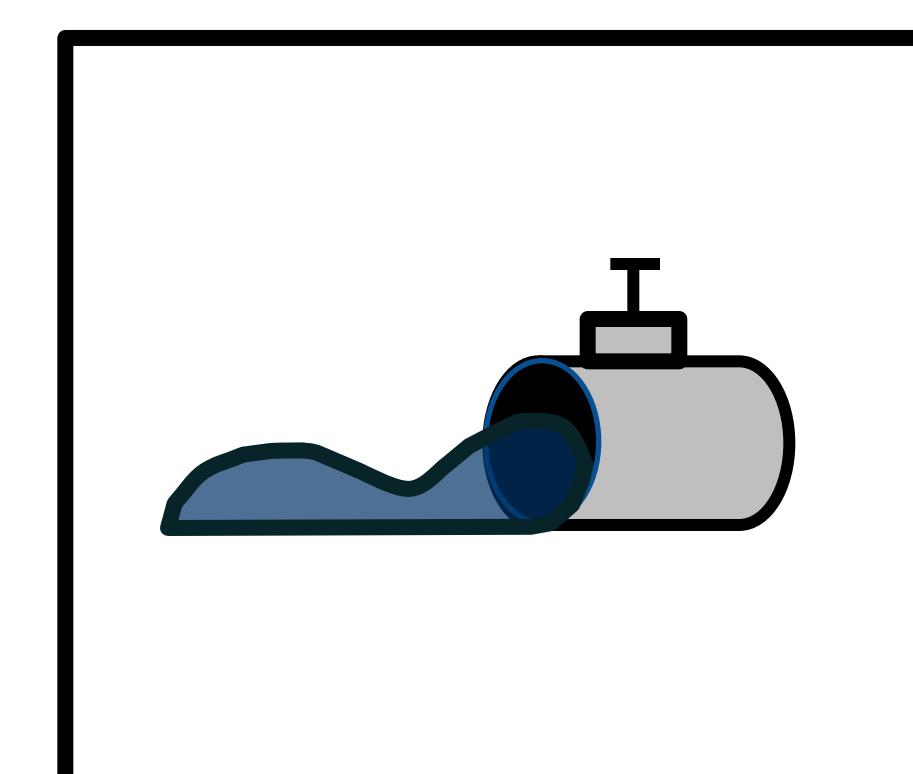
Swampy, flat
land does not
drain well



Lots of paved
surfaces



Creek reaches
peak fullness



Too much
water, too fast
for stormwater
pipes

BIG STORMS: WHAT ARE THE CHANCES?



Our project is identifying the impacts from a big storm known as a “100-year” storm. This storm has a 1% chance of occurring every year. Extreme events such as the 100-year storm do not happen very often, but when they do, they cause major damages.

Station 2

HEAVY RAIN + PAVED AREAS = DAMAGES

HEAVY RAIN

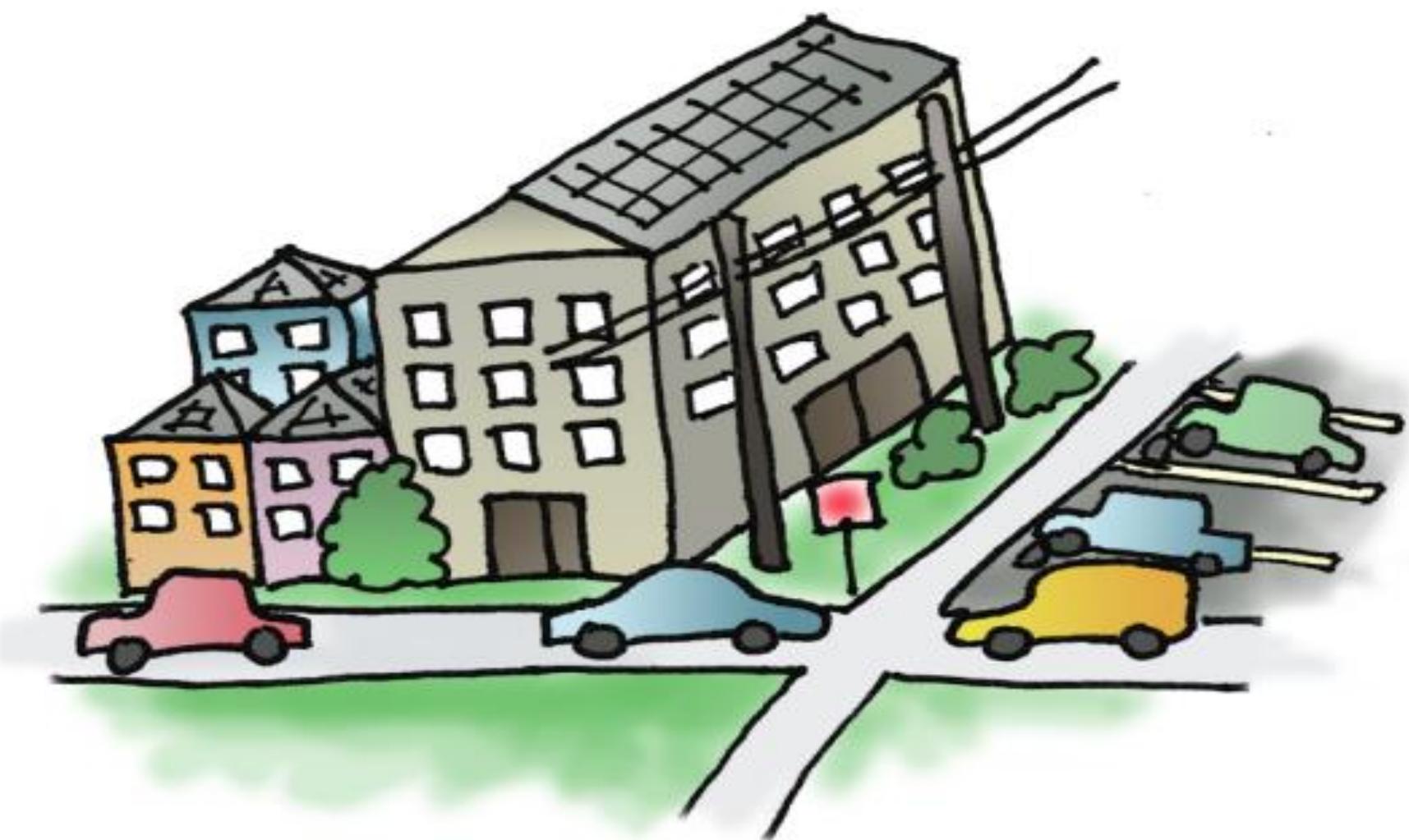


Average 5* or more inches in 24 hours (for 100-year storm).

Toledo has traditionally had bigger storms in the summer months of June through August.

* Source: NOAA Precipitation Frequency Data for Toledo

PARKING LOTS, ROOFS, STREETS

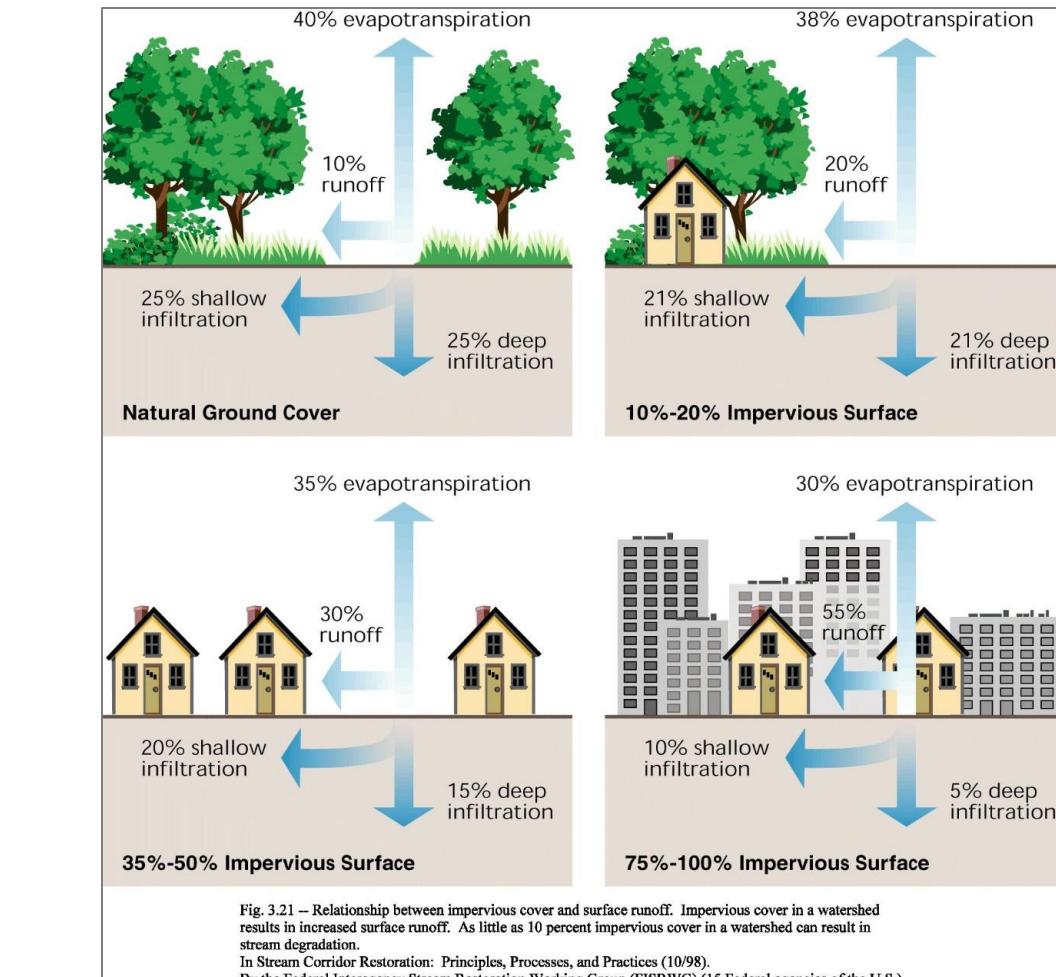


9,370 acres or 92% of the watershed is covered in paved materials.

This is a problem because rooftops and streets do not absorb rainwater which runs off into nearby streams, ditches, and storm drains. If there is too much water too fast, then these systems become overwhelmed and flooding happens.



Keep your storm ditches clean and open to reduce flooding potential. Those storm ditches help water flow to the larger stormwater system and take water out of your neighborhood.



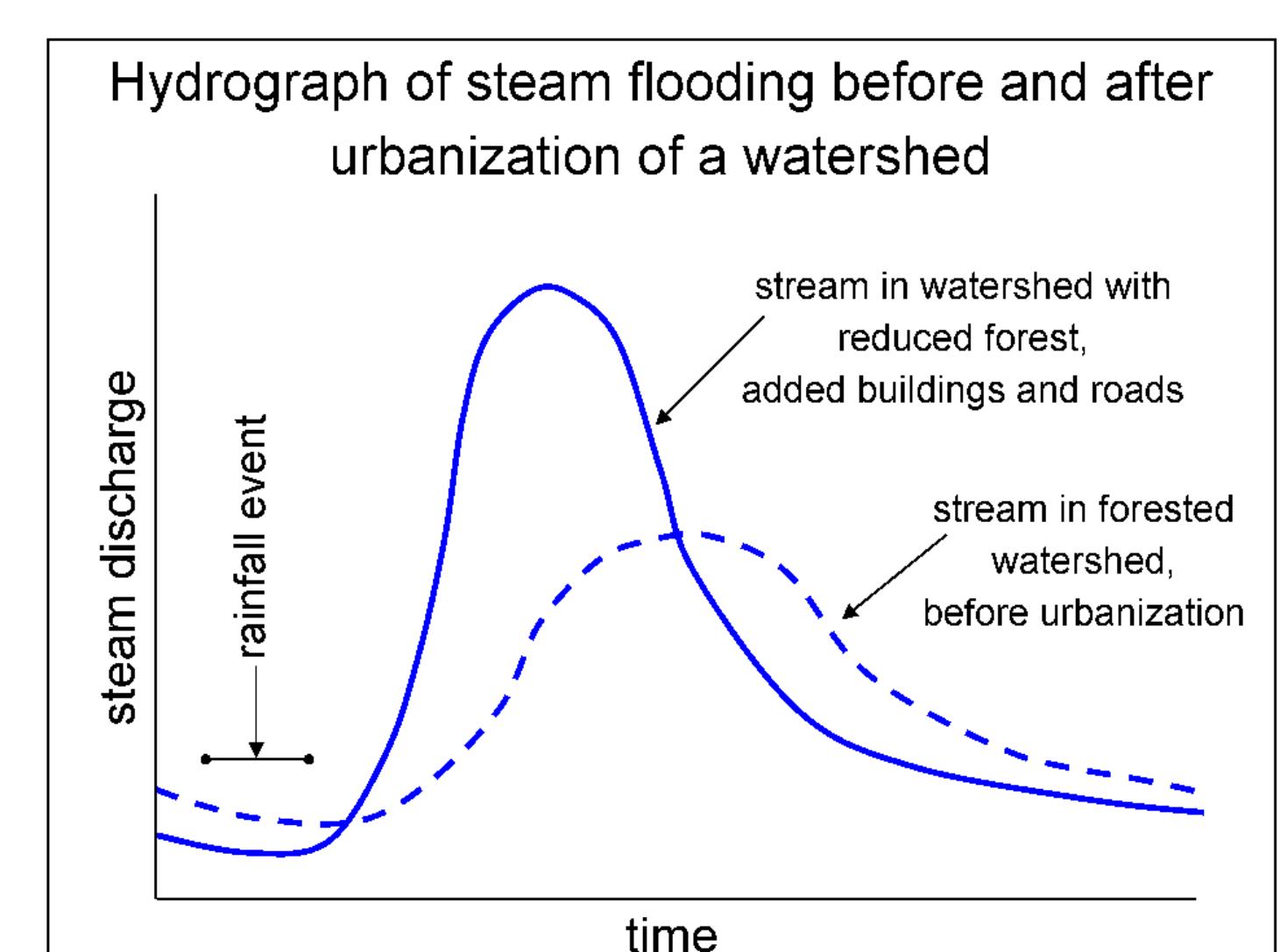
FLOODING HAPPENS



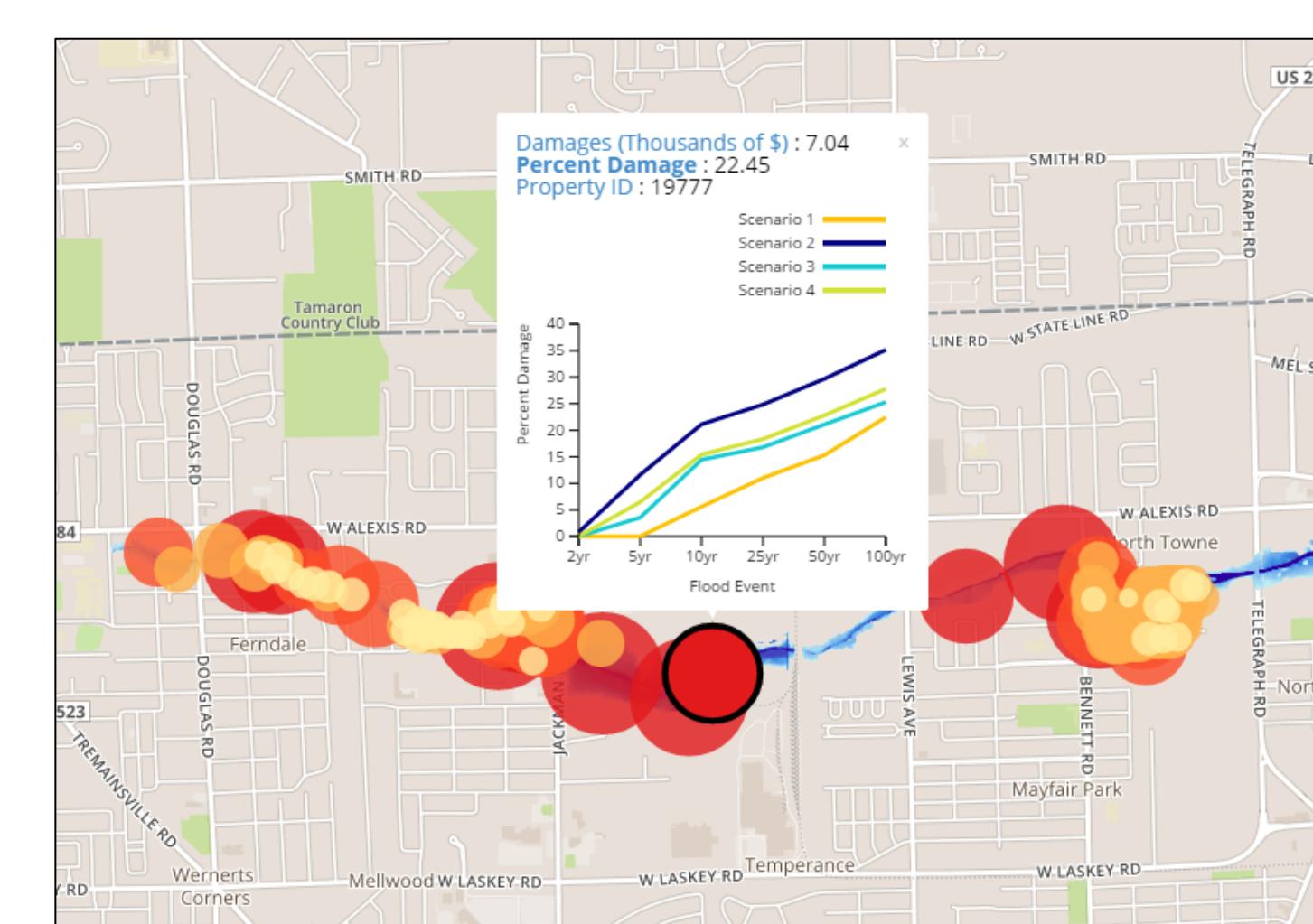
This information will help us identify when flooding could occur:

- Amount of rain from the 100-year storm
- Information about what is on the land

These two pieces of information give us the peak discharge estimate, which is the maximum amount of water moving through Silver Creek at a certain time and location.



IMPACTS



In our current flood scenario, a 100-year flood could damage about 20% of the structure on this property.

station

3

FUTURE CLIMATE CHANGE

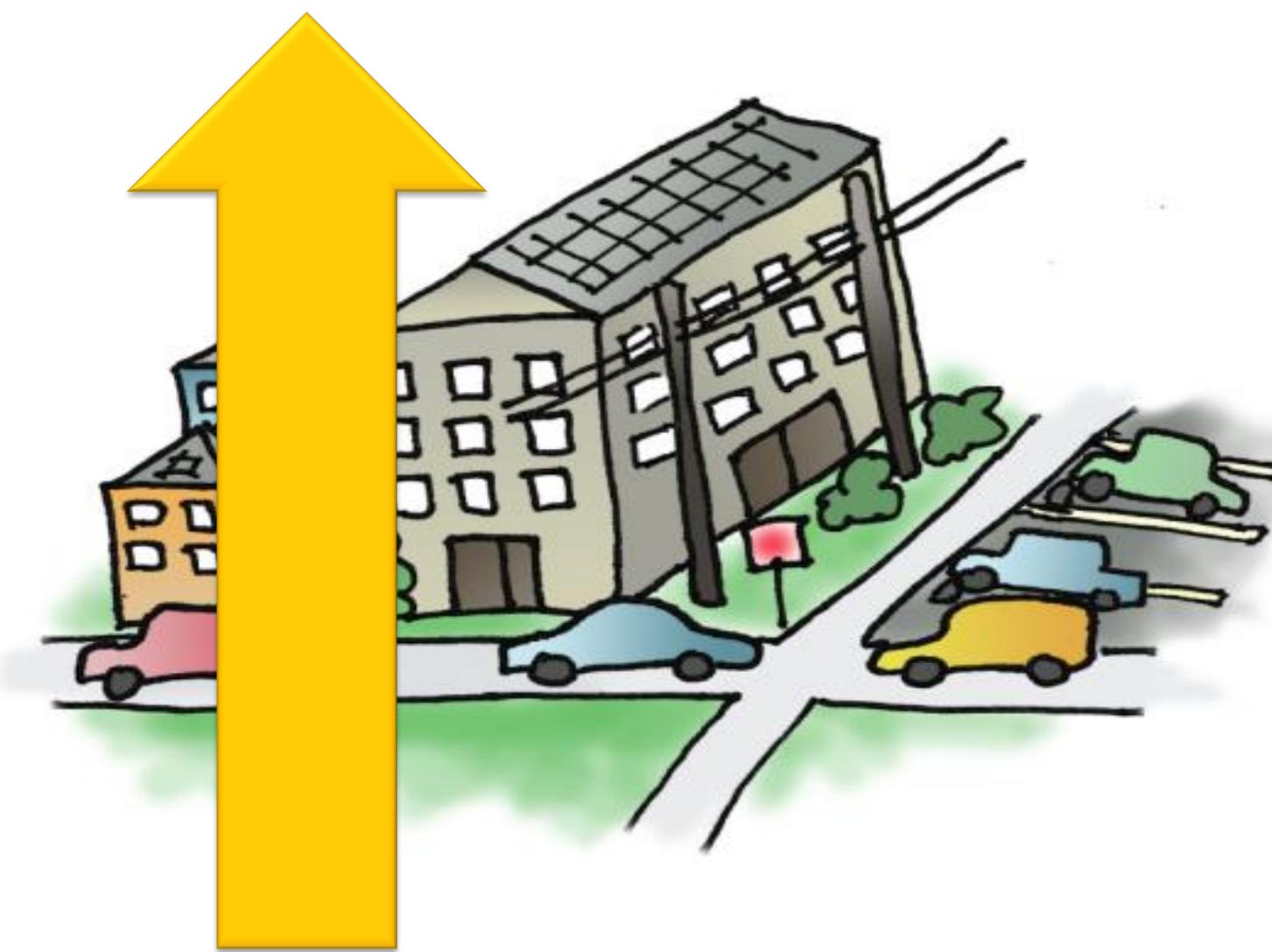
↑ HEAVY RAIN + ↑ PAVED AREAS = ↑ DAMAGES

MORE HEAVY RAIN

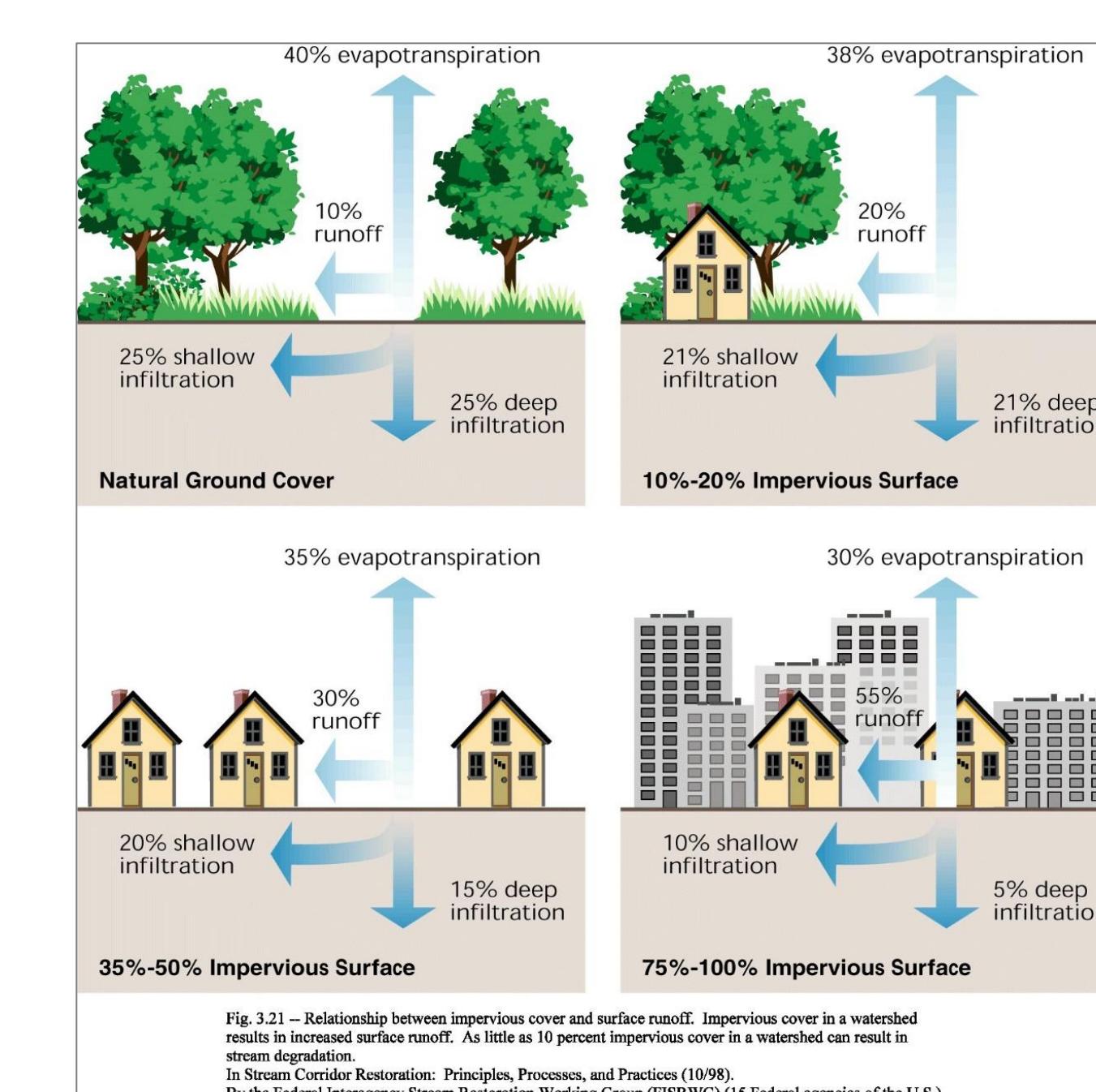


Big storms and flooding have increased over the last century and are expected to further increase. Climate models are projecting an increase in big storm events. Our project looked at heavy rain in the year 2035. The climate data from our study show a projected 0.58 % increase in the frequency of 100-year storms.

MORE PARKING LOTS, ROOFS, STREETS



The Silver Creek Watershed is about already 92% covered by paved surfaces, so there is not much room for more development. However, there is a major need for more floodwater storage.

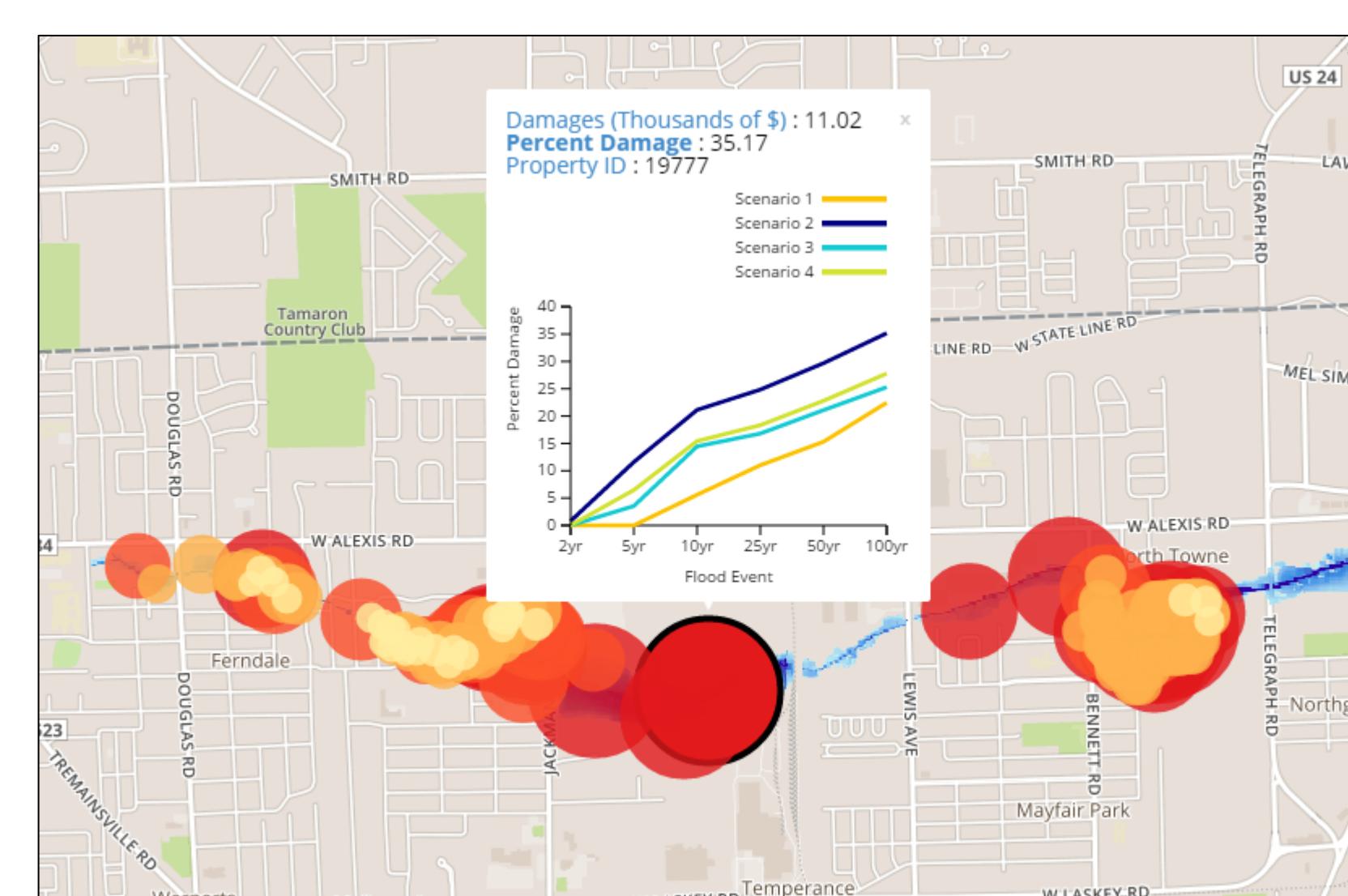


FLOODING HAPPENS MORE OFTEN



In the future, with the climate changing, the chances of a damaging peak discharge from the 100-year storm event could go from a 1% annual chance to a 1.45% annual chance. The community's chances of a damaging storm increase, making impacts more likely to happen.

GREATER IMPACTS



In our future flood scenario, a 100-year flood could damage 35% of the structures on this property, compared to 20% in the current flood scenario.

Station 4

INCREASED GREEN INFRASTRUCTURE = DECREASED FLOODING

CREATE NEW NATURAL AREAS TO ABSORB FLOOD WATERS

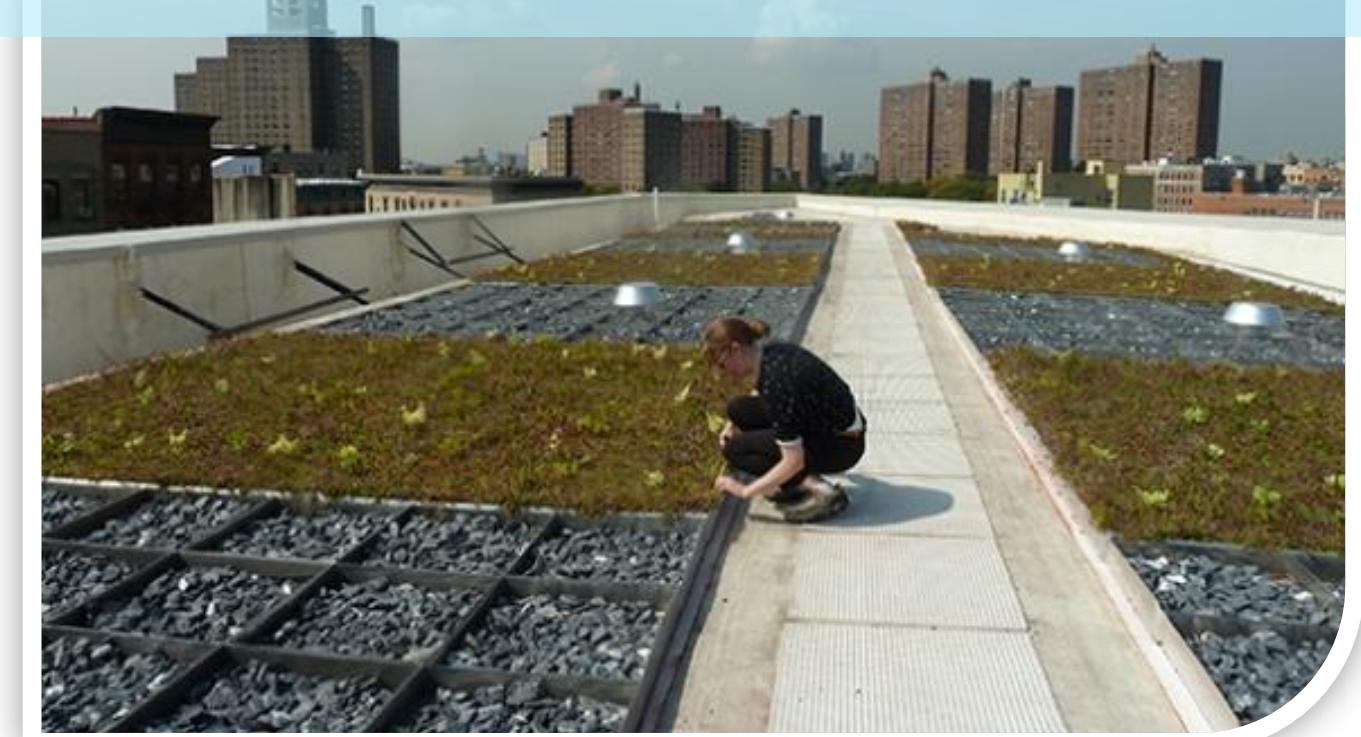
Benefits:

- ❖ Reduces peak discharges
- ❖ Captures and reduces a variety of pollutants like sediment, nutrients, and bacteria
- ❖ Reduces temperature
- ❖ Reduces runoff quantity during storm events
- ❖ Can be designed for public access and enjoyment
- ❖ Improves water quality

Rain Barrels and Cisterns



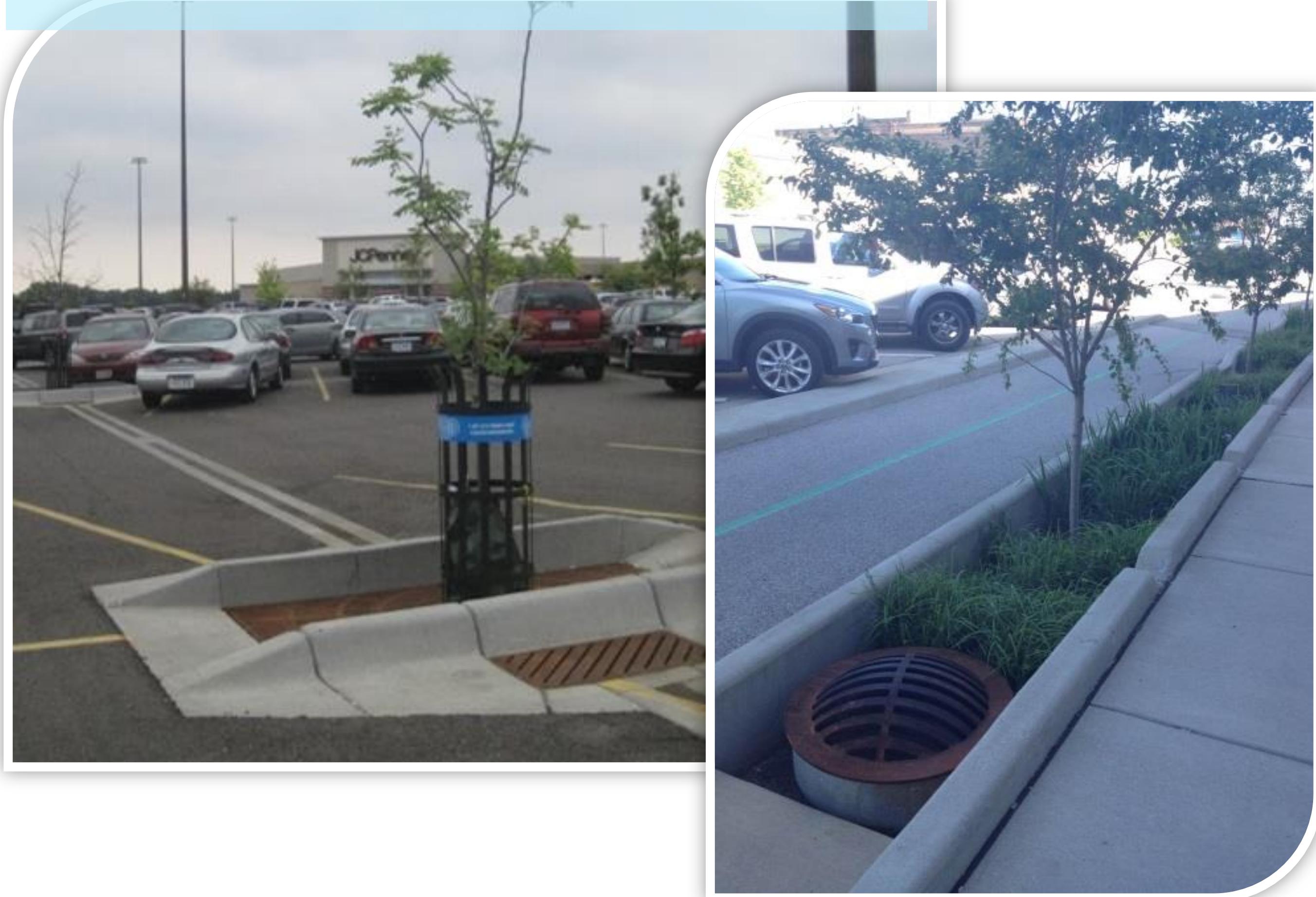
Green and Blue Roofs



Underground Storage



Stormwater Tree Trenches



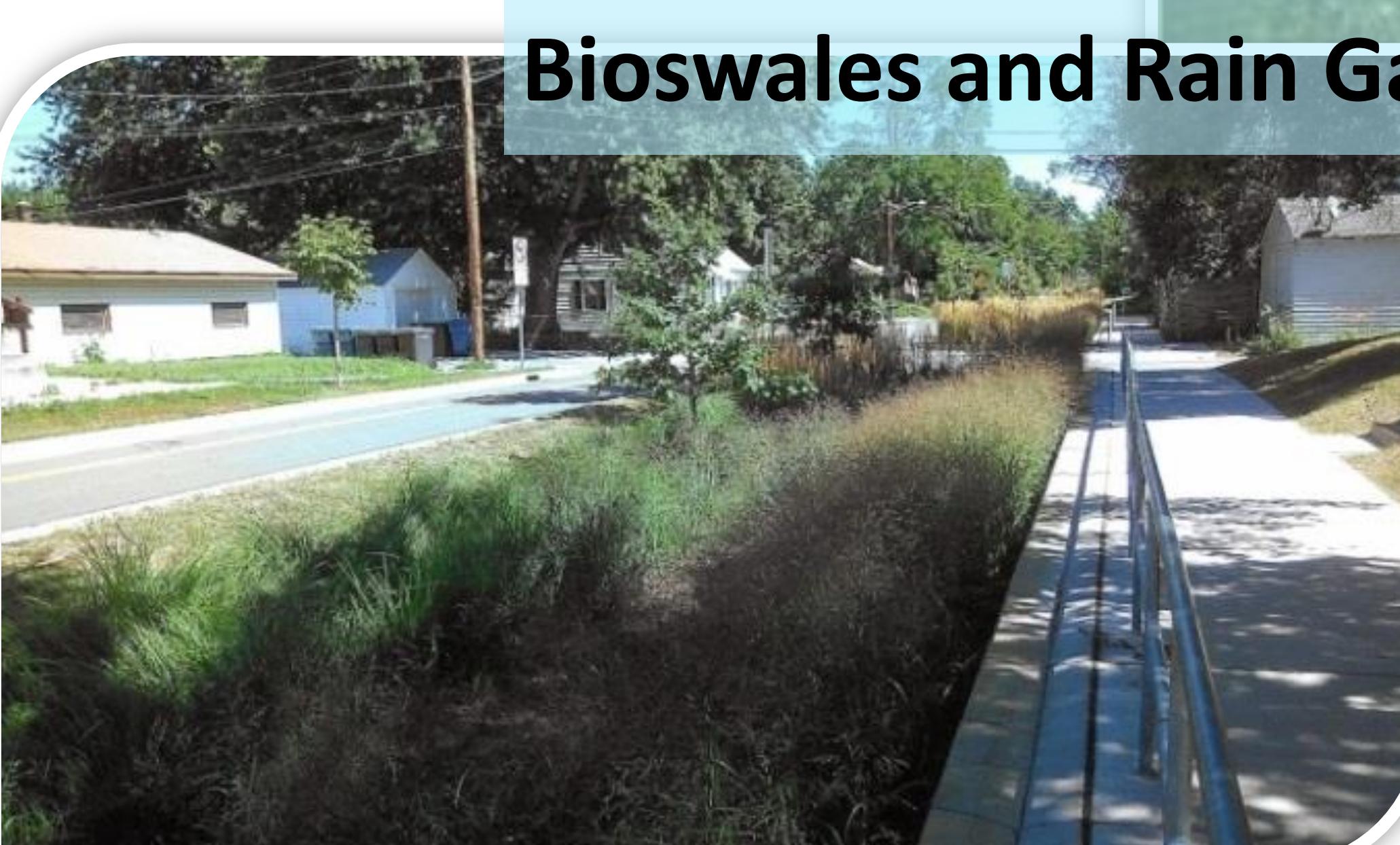
Permeable Pavement



Trees



Bioswales and Rain Gardens



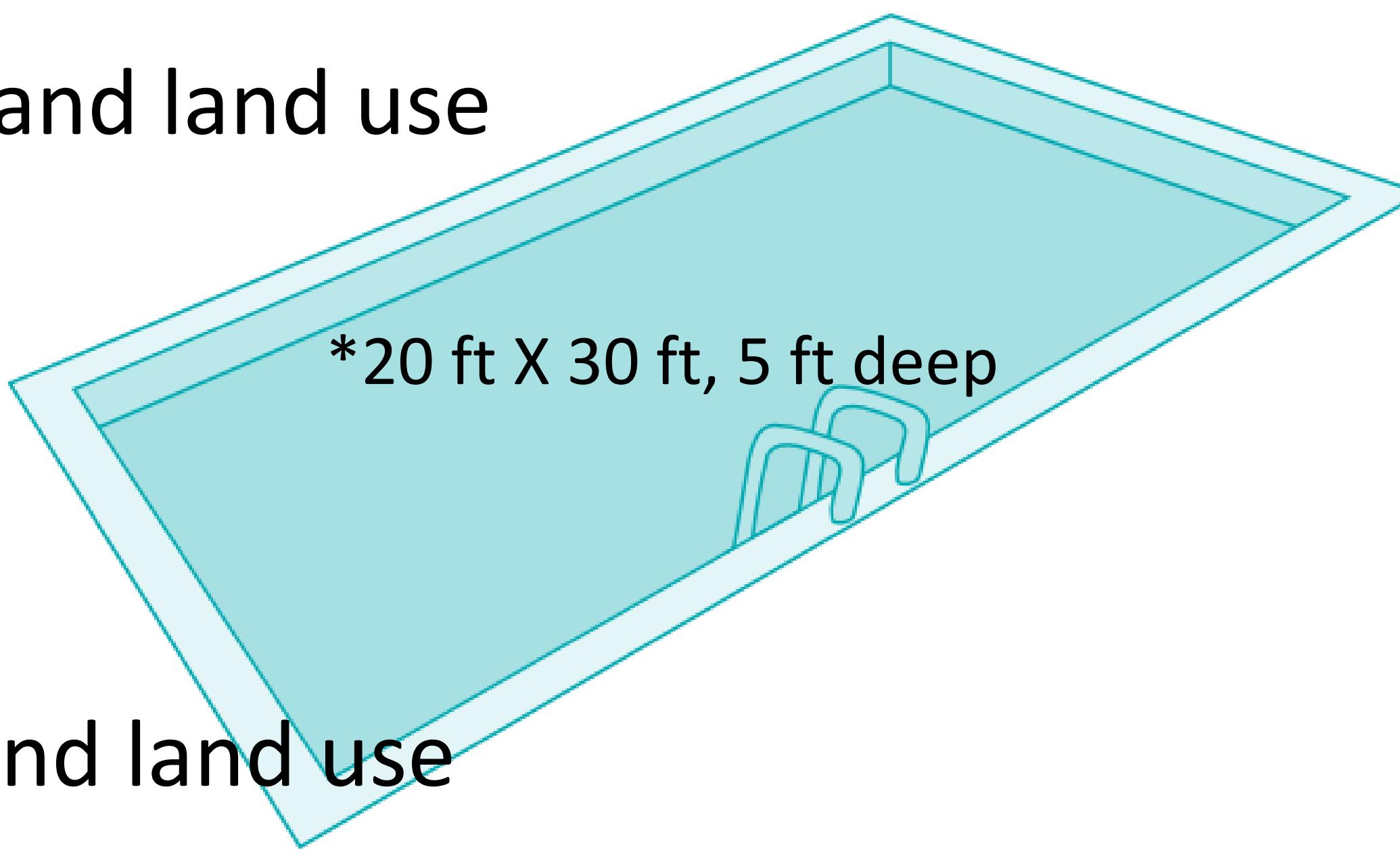
Station 5

GREEN INFRASTRUCTURE NEEDED TO REDUCE FLOODING FROM BIG STORMS

GOALS

To reduce the damaging 100-year storm peak discharge by **10%**, we need to store this amount of storm water:

- 31 acre-feet** needed under current rainfall and land use
 - That's **448 swimming pools***



- 33 acre-feet** needed under future rainfall and land use
 - That's **477 swimming pools***

How can we reach this goal?

The City of Toledo, its homeowners, and businesses can work together to implement different green infrastructure techniques.

These techniques will vary in the amount of water storage they provide, but it all adds up to contribute to the goal!



Source: Natural Resources Defense Council

What is an acre-foot?

1 acre-foot = 1 acre of water 1 foot deep OR 326,000 gallons of water.



Risk Reduction

- With **31** acre-feet of storage, the annual chances of the damaging peak discharge goes down to **0.50%** from **1%**.
- With **33** acre-feet of storage, the annual chances of the damaging peak discharge goes down to **0.71%** from **1.45%**.

By choosing to install more green infrastructure throughout the Silver Creek watershed, the City of Toledo and its residents would avoid \$40,000 in building-related flood damage each year. This estimate only looks at building damages within the Silver Creek watershed and does not account for all the possible damages that do occur from flooding.



WHAT'S HAPPENING NOW TO REDUCE FLOODING?

CURRENT PROJECTS UNDERWAY

EPA and City of Toledo Fund Bioswale Project to Reduce Flooding

- U.S. Environmental Protection Agency (EPA) grant is being used to build bioswales in portions of the Silver Creek Watershed area to reduce flooding. This study helped provide results on the benefits of using green infrastructure. Contact Patekka Bannister (patekka.bannister@toledo.oh.gov) to learn more.
 - Benefits: Federal money is being leveraged, less stormwater flooding, potential for increase property value



Examples of a bioswale project (before and after)

County, City, and Business Partnership to Reduce Stormwater Flooding

- A Green Stormwater Infrastructure Task Force is meeting monthly to work on stormwater issues. Their goal is to improve water quality and flooding issues by using green stormwater infrastructure. They have several pilot projects underway. Contact Katie Rousseau (krousseau@americanrivers.org) to learn more.
 - Benefits: Region-wide coordination and less stormwater flooding



Reducing Flooding and Adding Parks in Urban Neighborhoods

- Toledo Metropolitan Area Council of Governments is using a recent grant to help urban parts of the region improve stormwater flooding using green infrastructure. Working with the Ohio Lake Erie Commission and the Lucas County Land Reutilization Corporation (the Land Bank) foreclosed and vacant properties will be put to use. There is a potential to install modern stormwater management in older neighborhoods where structures are being demolished. This could result in increasing green space and recreational areas for residents. Contact Kari Gerwin (gerwin@tmacog.org) to learn more.
 - Benefits: Less stormwater flooding, possibly increase property values, parks and open space



WHAT GREEN INFRASTRUCTURE WOULD YOU BE INTERESTED IN PUTTING ON YOUR PROPERTY?



Put a  next to the green infrastructure practices you could do on your property.

Plant Trees



Divert Downspouts to Permeable Area



Replace Lawn with Native or Perennial Plants



Install Permeable Sidewalk, Patio, or Driveway



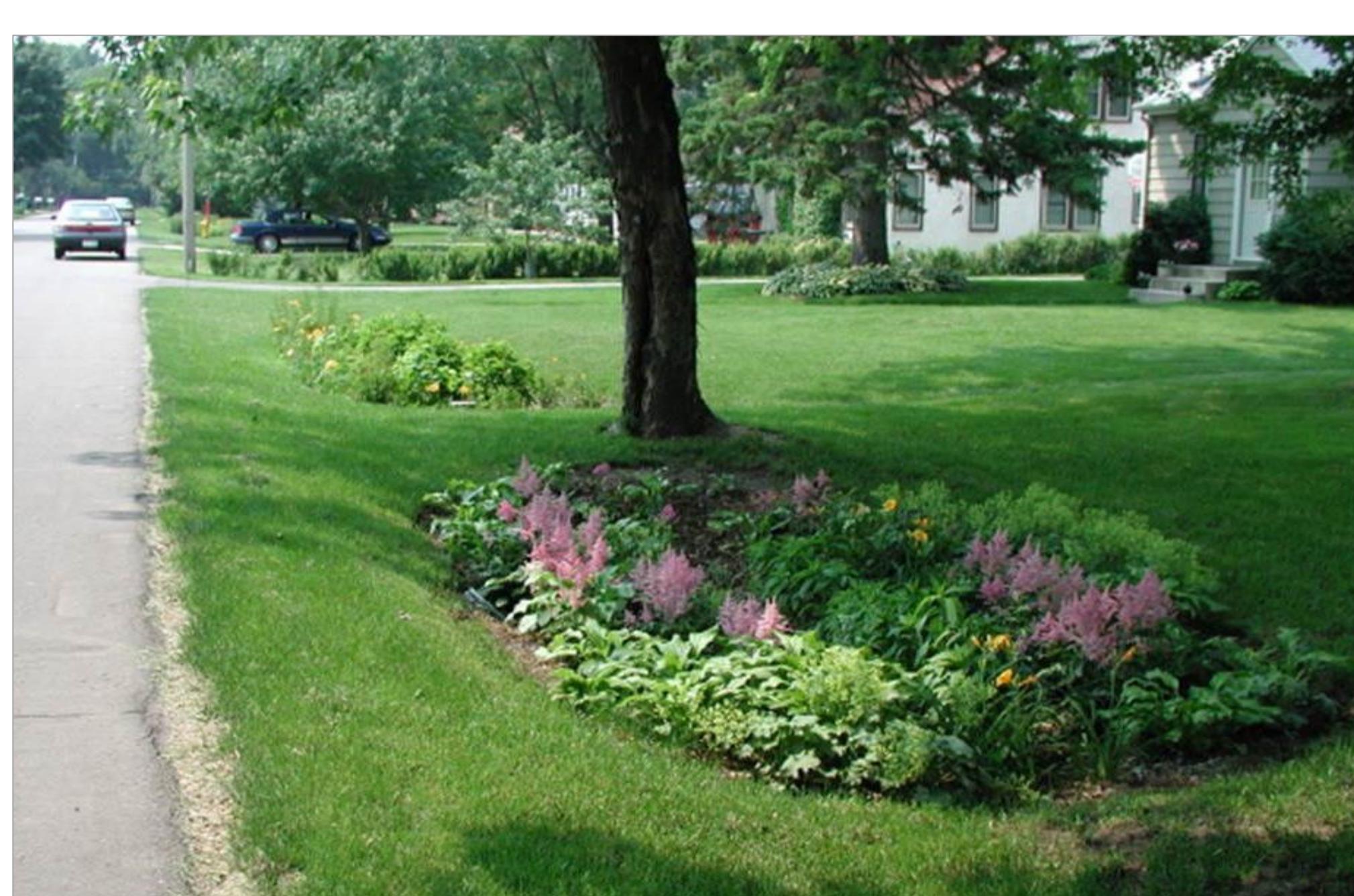
Install a Rain Barrel



Install a Green Roof



Install a Rain Garden



CAST
YOUR
VOTE!

WHAT GREEN INFRASTRUCTURE WOULD YOU LIKE TO SEE IN SILVER CREEK WATERSHED?

Put a  next to your top 3 green infrastructure choices.

Conservation of Natural Areas



Rainwater Cisterns



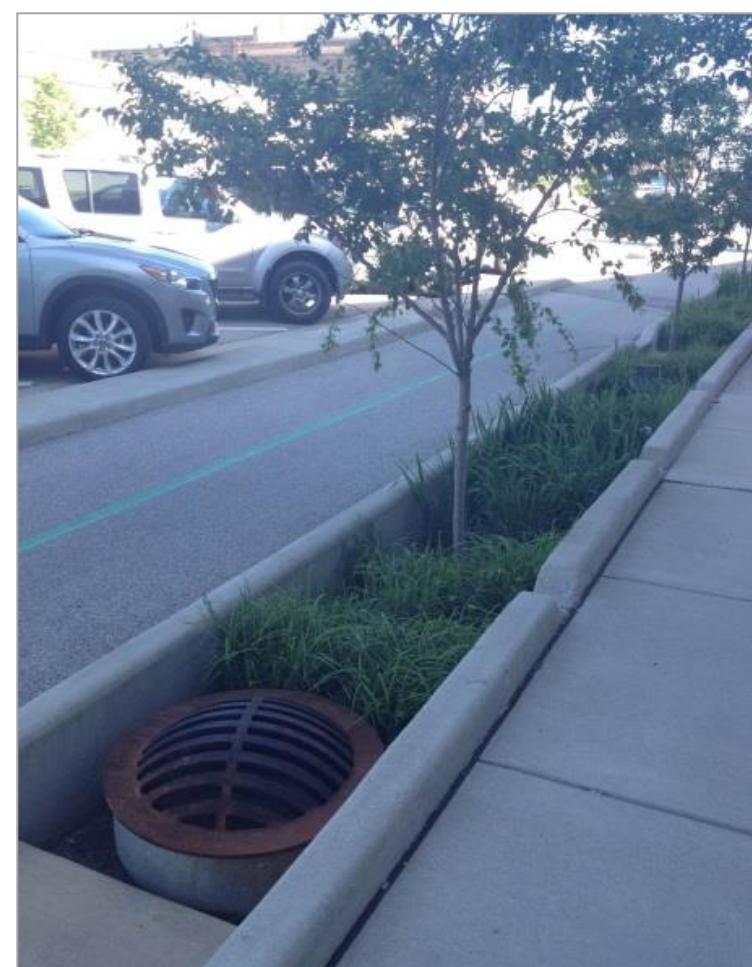
Rain Gardens and Bioswales



Permeable Sidewalks, Pavement



Stormwater Tree Trenches



Plant More Trees



Underground Storage

