NOAA's Experience with Green Infrastructure and Flood Impact Reduction: Assessing Green Infrastructure Costs and Benefits

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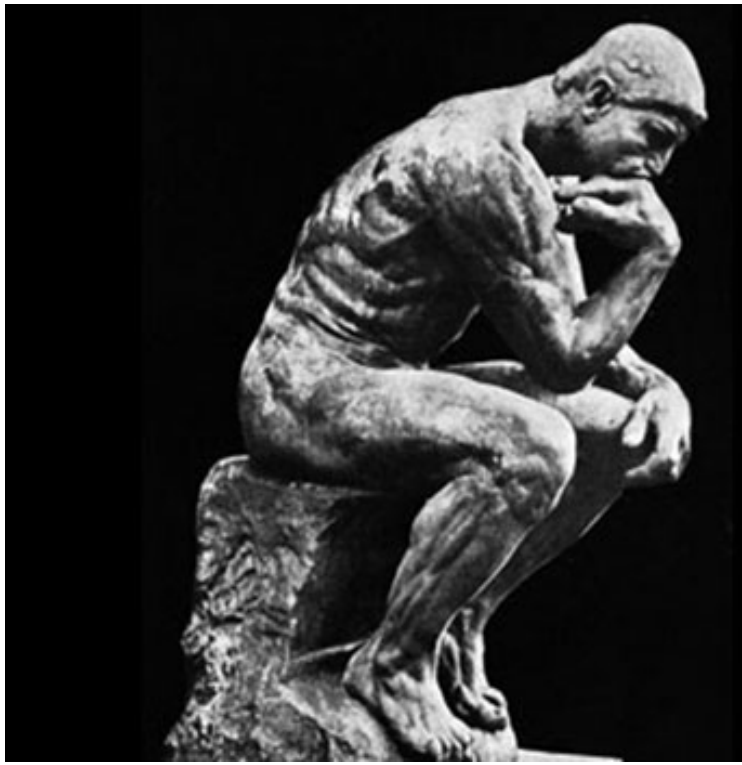
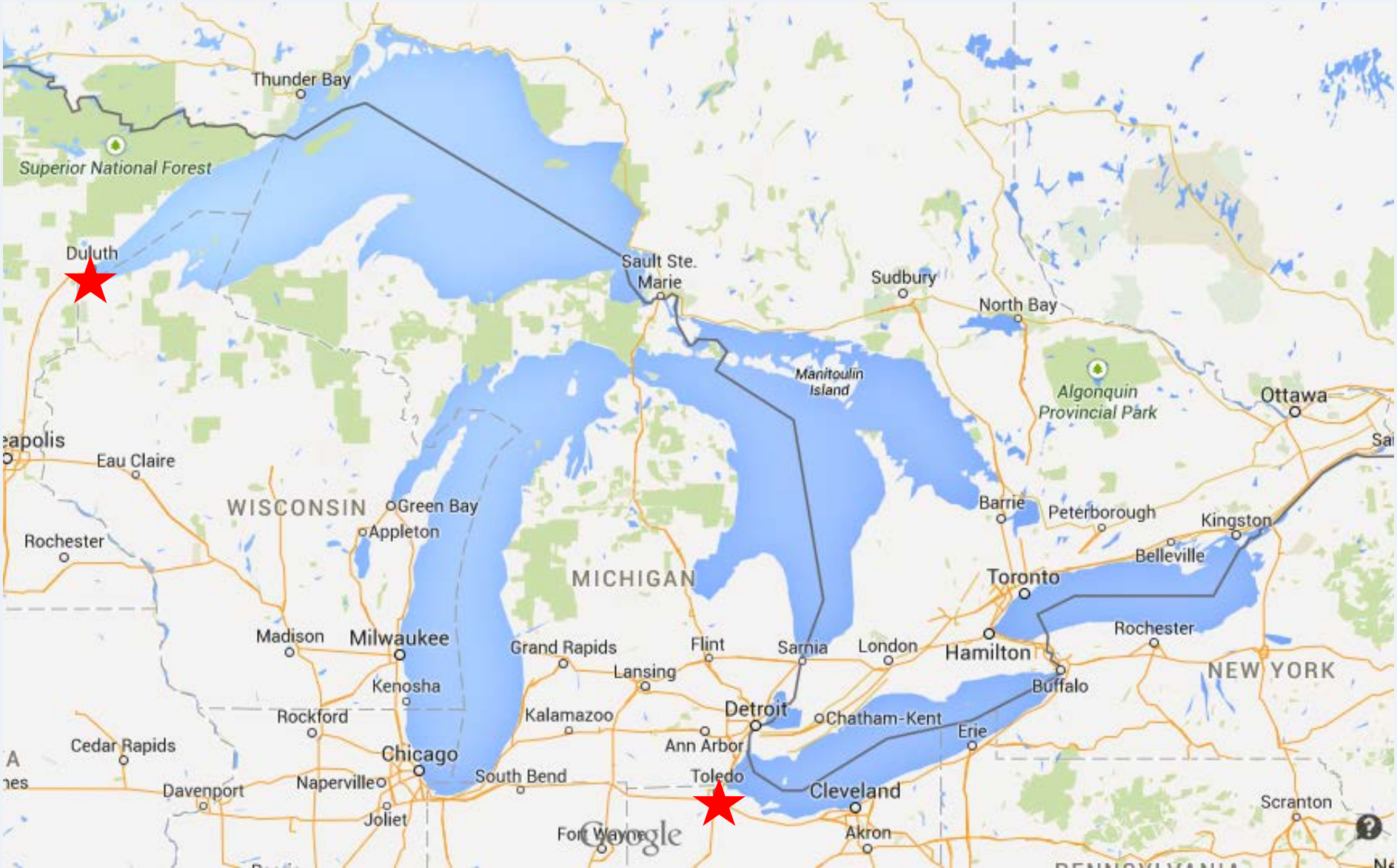
NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE



Think Nationally, Act Locally

Great Lakes Study Sites



Basement and Street Flooding Complaints 2007 - 2012

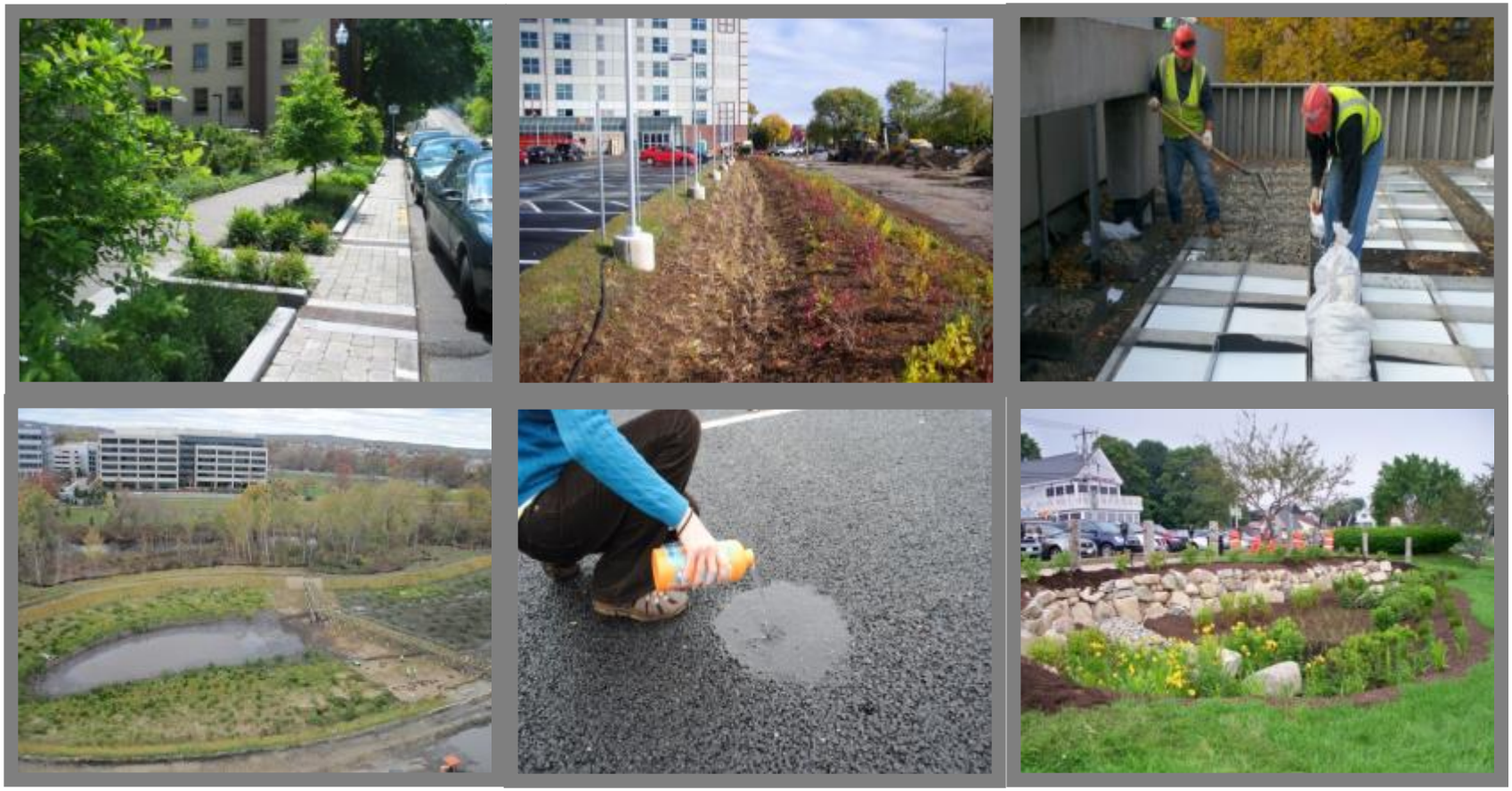
Toledo Research Area

Complaints

- WATER IN THE BASEMENT
- WATER STANDING IN STREET
- WATER STANDING OTHER

0 0.75 1.5 3 4.5 6

Need: Help with long-term planning green infrastructure



But where do we start?

Tell us...

So we worked with…

- Minnesota Sea Grant
- City of Toledo
- U.S. Army Corps of Engineers
- Association of State Floodplain Managers
- Eastern Research Group, Inc.
- American Rivers
- Old Woman Creek NERR

Economic Assessment

1. Define flood problem
2. Assess current and future flooding
3. Identify flood reduction options using GI
4. Assess flood scenarios with GI options
5. Compare benefits and costs

Step 1: Define flood problem

Scale of Study

Pilot Communities

Duluth, Minnesota

Toledo, Ohio

Step 2. Assess current and future flooding

Flood Impact Scenarios

1. Current precipitation and current land use

2. Future precipitation (2035) and future land use

Flood Reduction Scenarios

3. Current precipitation and current land use using GI

4. Future precipitation (2035) and future land use using GI

1. How much rain now and in the future?

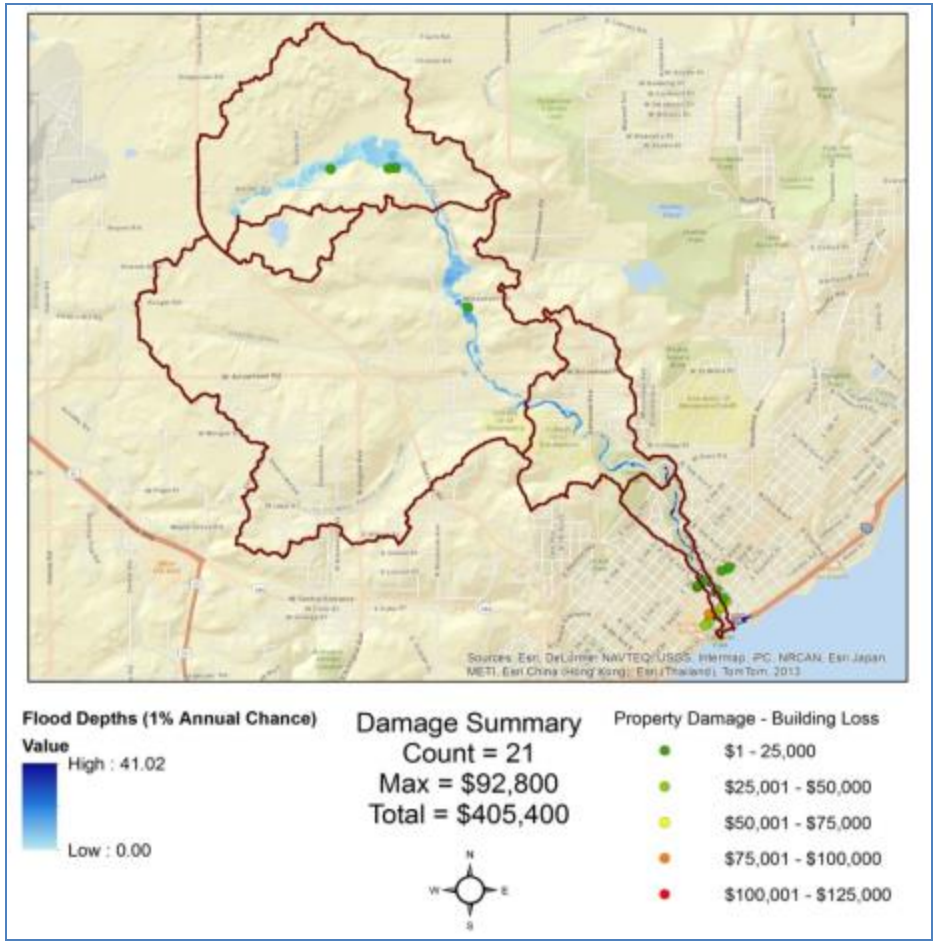
2. How much water could cause flooding?

3. Where could flooding occur?

Toledo Flood Damage Costs

Flood damage to buildings = $740K

Duluth Flood Damage Costs

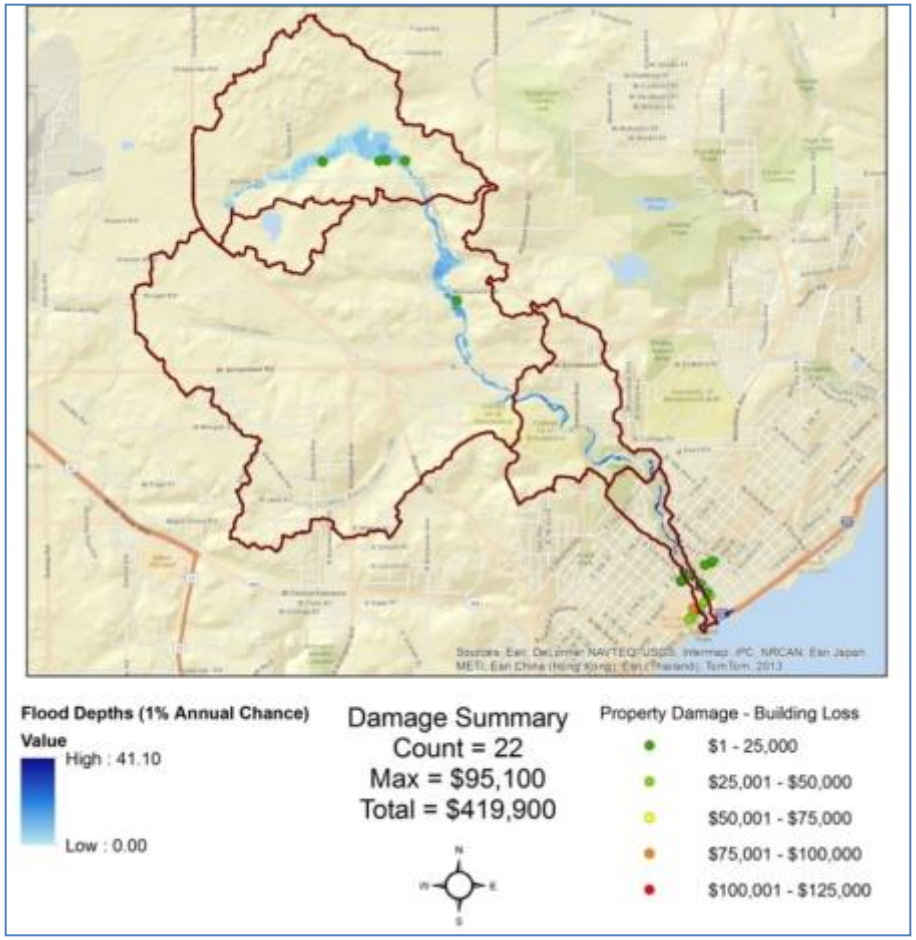


Flood damage to buildings = $400K

Toledo Flood Damage Costs

Flood damage to buildings = $930K

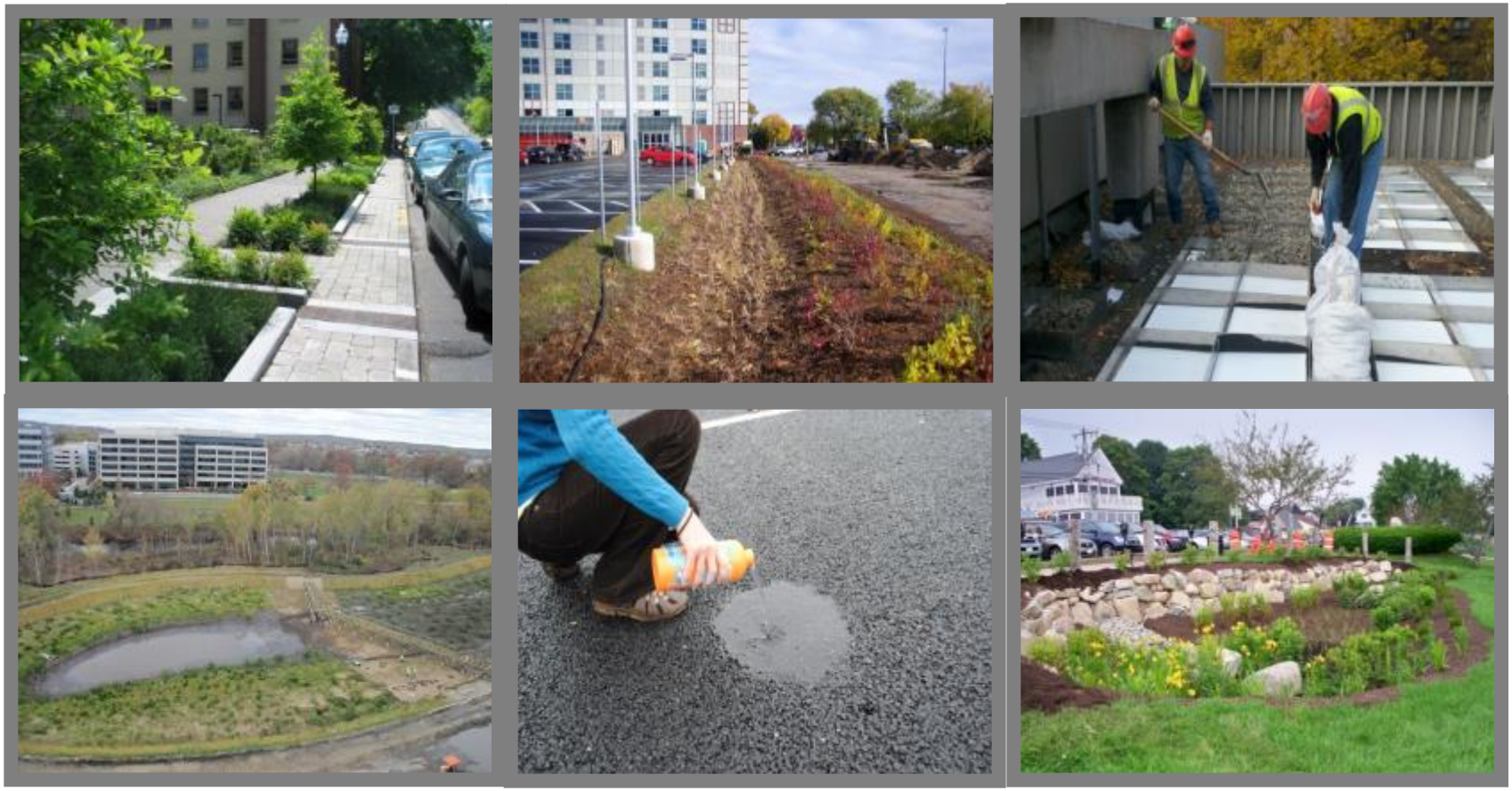
Duluth Flood Damage Costs



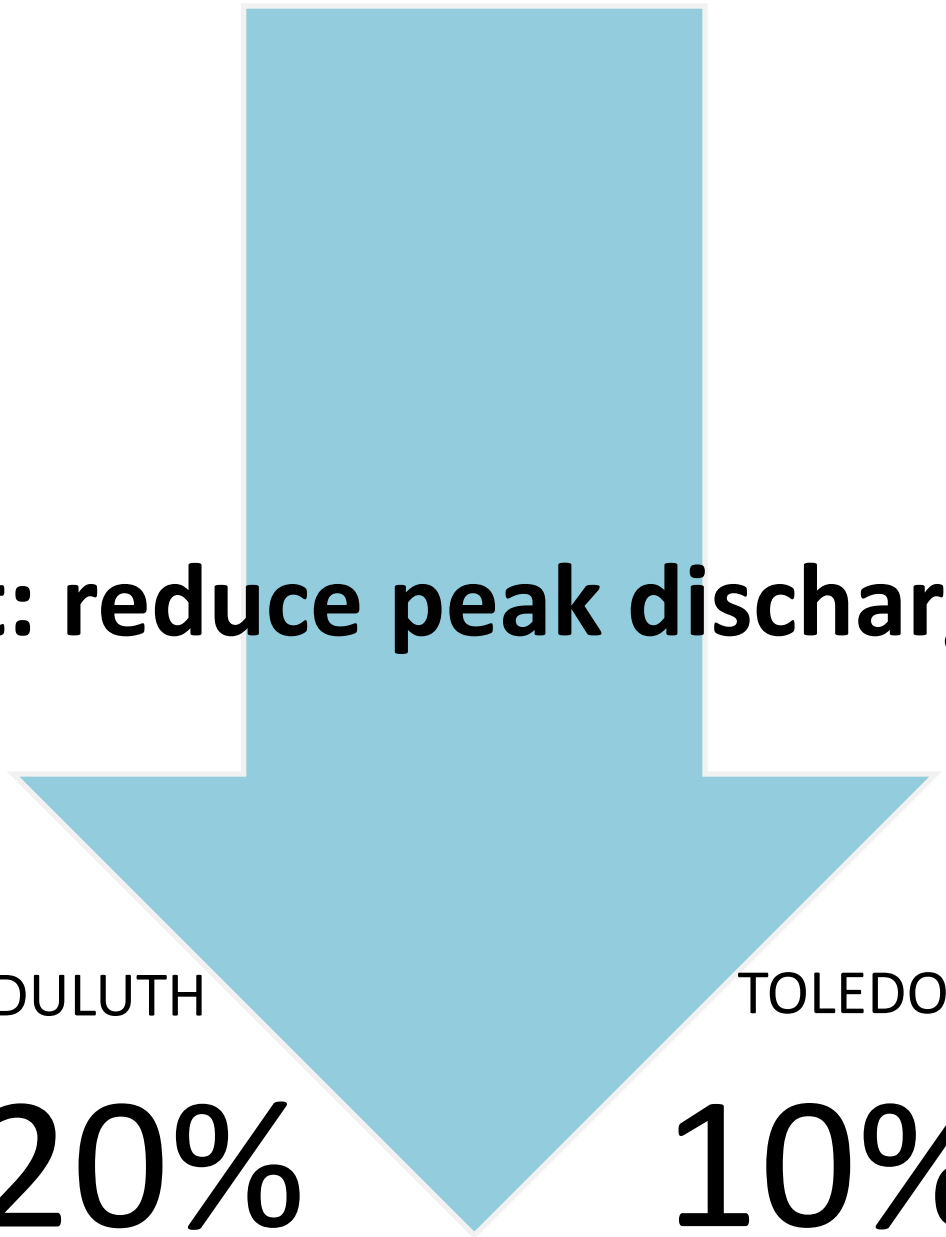
Flood damage to buildings = $420K


Step 3. Identify Flood Reduction GI Options

Many Options



Target: reduce peak discharge by



DULUTH

20%

TOLEDO

10%

How much green infrastructure <u>storage</u> is needed to reach this target?

DULUTH

76 acre-feet
(current conditions)

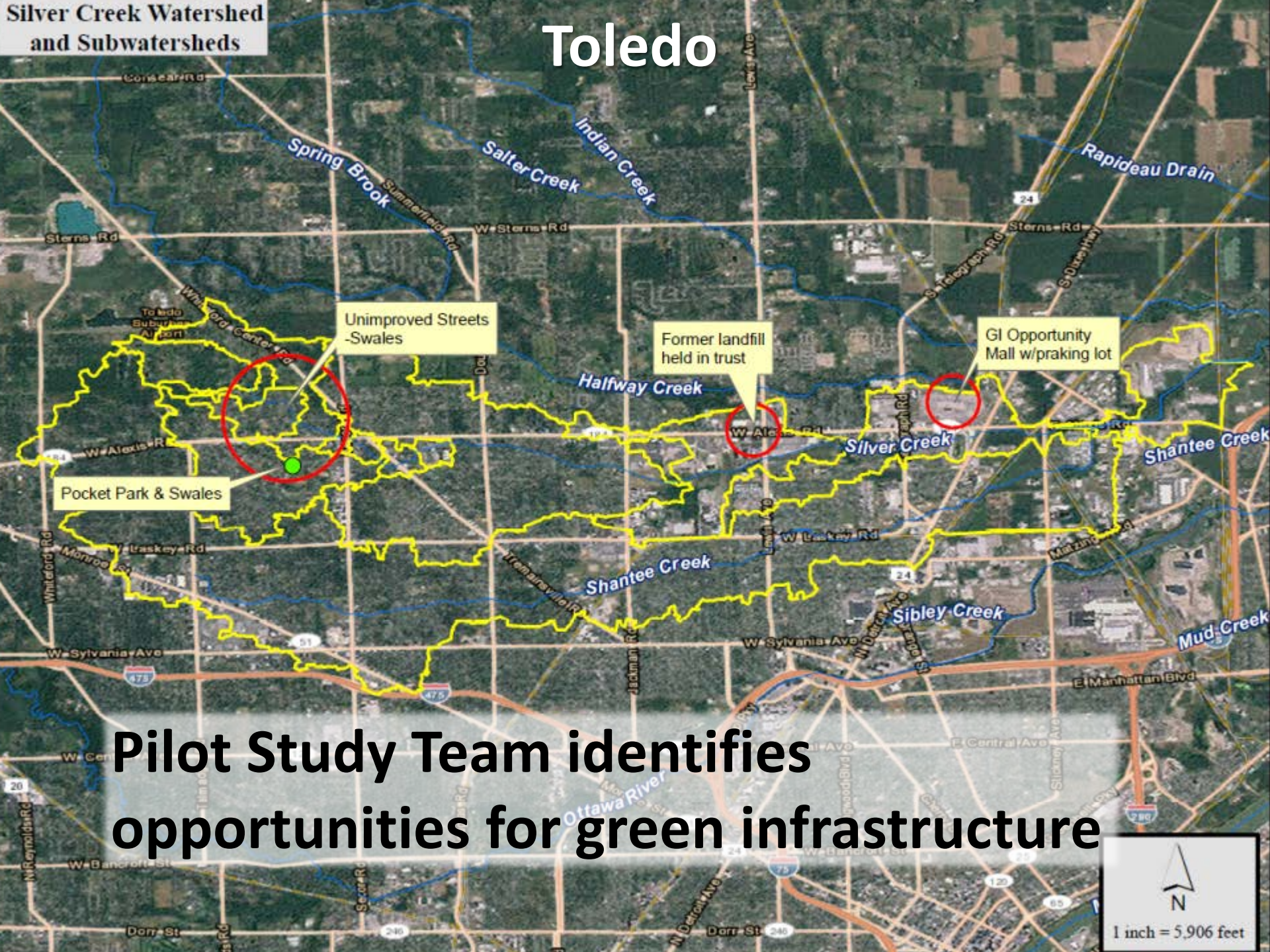
86 acre-feet
(future conditions)

TOLEDO

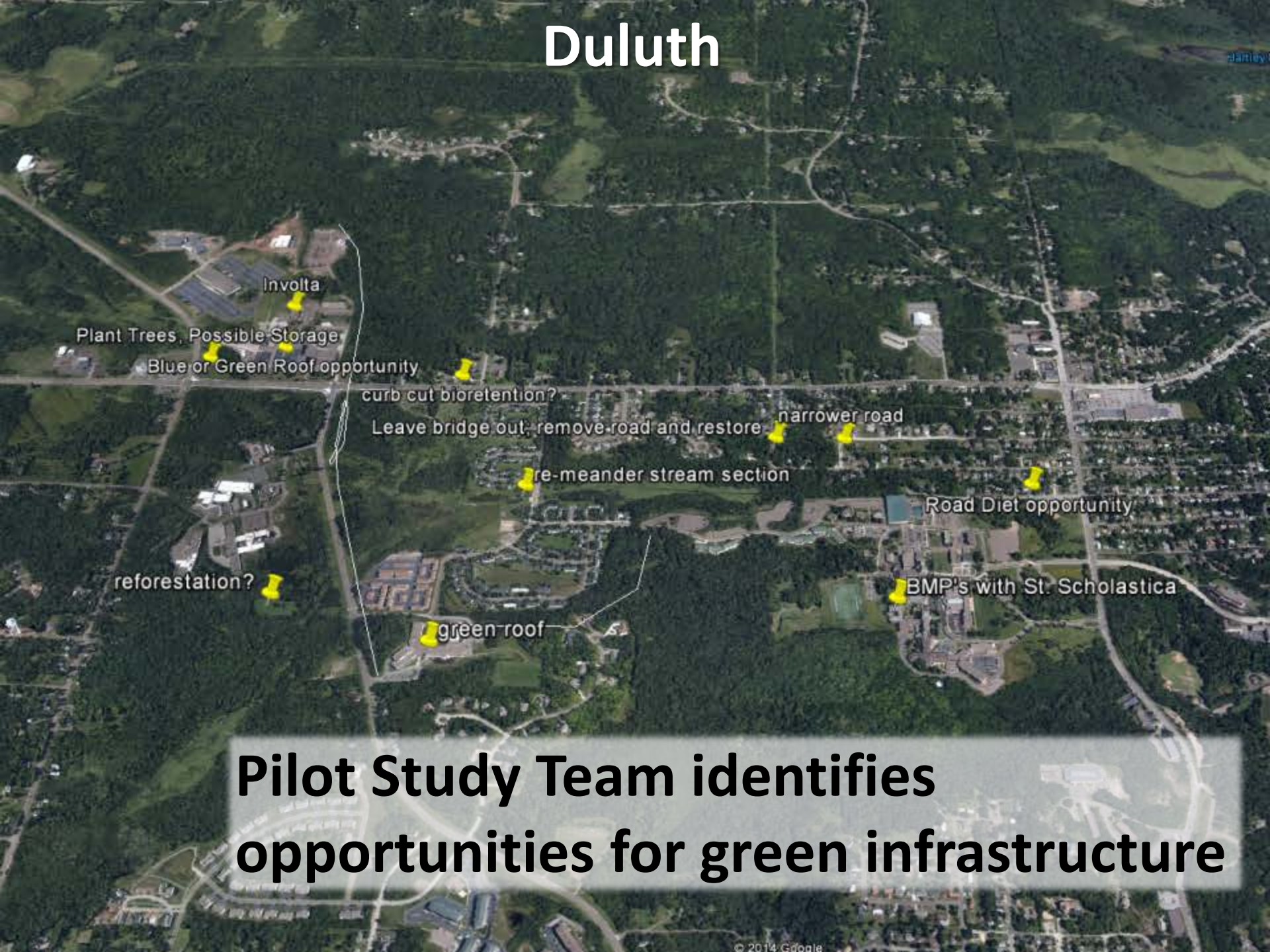
30 acre-feet
(current conditions)

32 acre-feet
(future conditions)

What and how much of each?


Silver Creek Watershed and Subwatersheds
Toledo
Spring Brook
Salter Creek
Indian Creek
Rapideau Drain
Halfway Creek
Silver Creek
Shantee Creek
Sibley Creek
Mud Creek
Ottawa River
Unimproved Streets -Swales
Former landfill held in trust
GI Opportunity Mall w/praking lot
Pocket Park & Swales
Pilot Study Team identifies opportunities for green infrastructure
N
1 inch = 5,906 feet

Duluth



Pilot Study Team identifies opportunities for green infrastructure

GI Options of Interest

- Bioretention/bioswales along unimproved roads
- Blue Roofs
- Permeable Pavement (Unimproved Roads)
- Permeable Pavement (Sidewalk)
- Underground Storage
- Parcel Buy-outs (for on site detention)

Step 4. Assess how much flood damages are reduced using GI

Flood Reduction Scenarios

3. Current precipitation and current land use using GI

4. Future precipitation and future land use using GI

Toledo

How much are flood damages reduced using GI?

*Flood damage to buildings

Toledo

How much are flood damages reduced using GI?

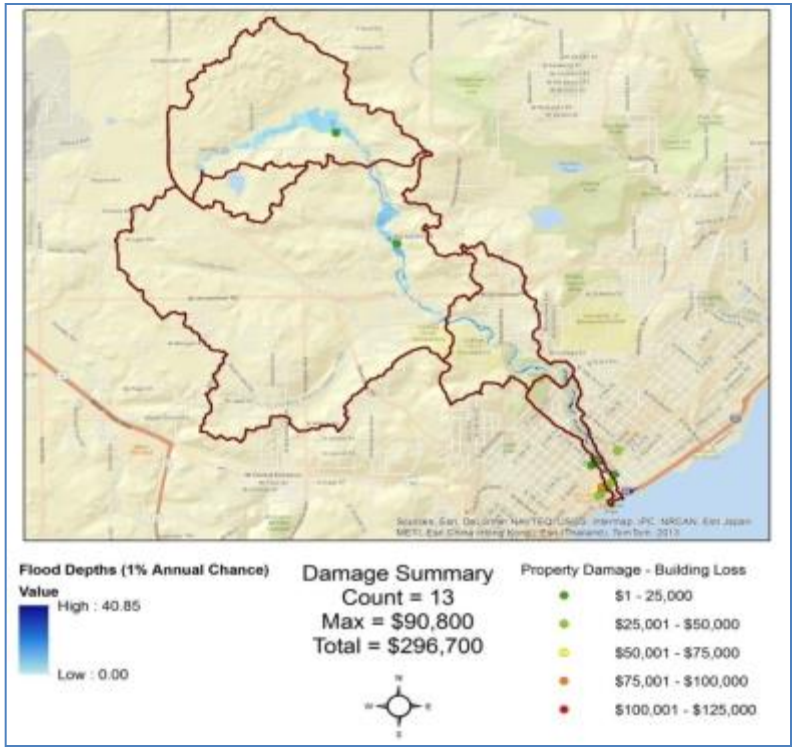
*Flood damage to buildings

Duluth

How much are flood damages reduced using GI?

$400K*

$296K*



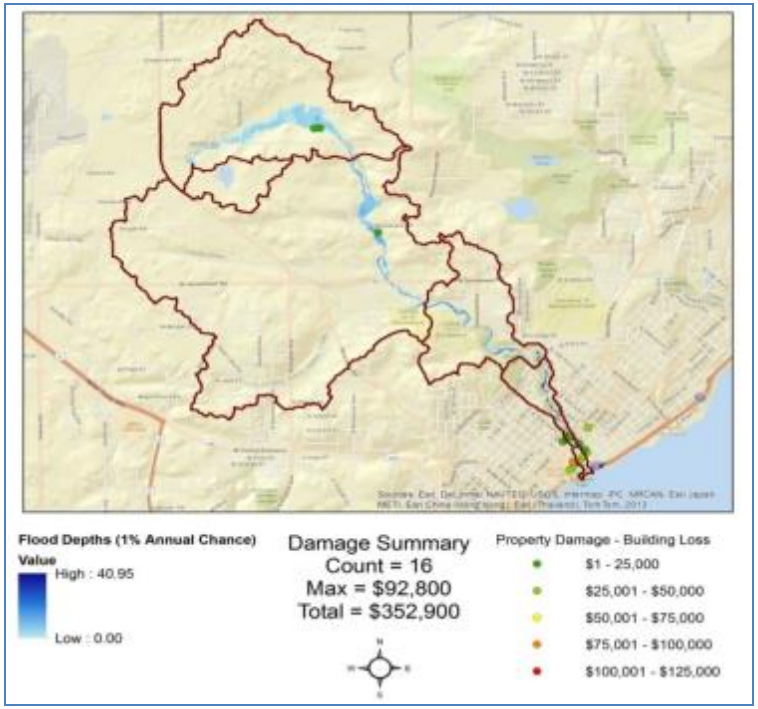
***Flood damage to buildings**

Duluth

How much are flood damages reduced using GI?

$420K*

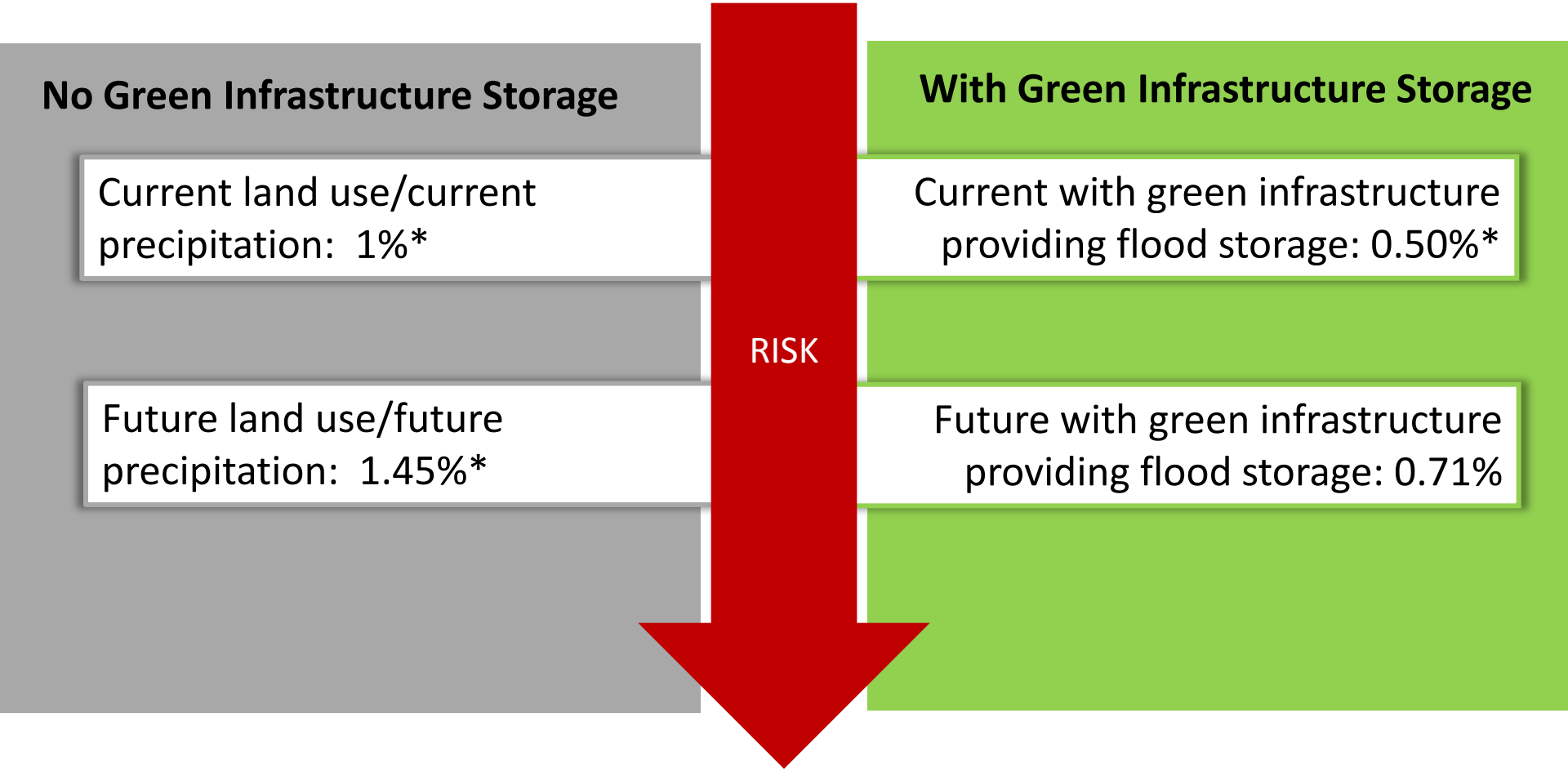
$352K*



***Flood damage to buildings**

Toledo

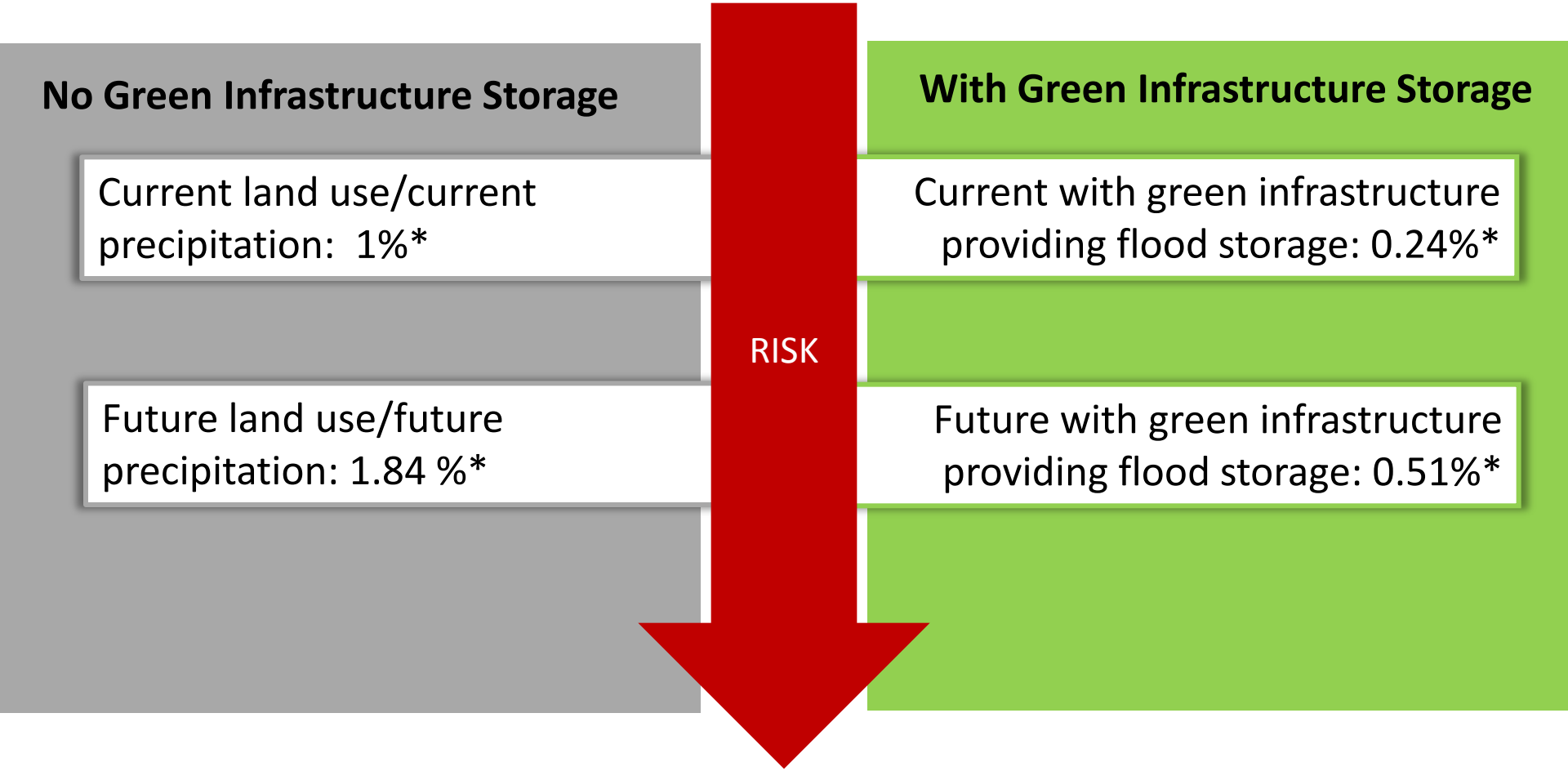
Risk Reduced with GI Storage



*Percent chance that a storm will occur in a year with peak discharge of 1,255 cfs and cause damages

Duluth

Risk Reduced with GI Storage



*Percent chance that a storm will occur in a year with peak discharge of 1,530 cfs and cause damages

Estimated unit cost of green infrastructure

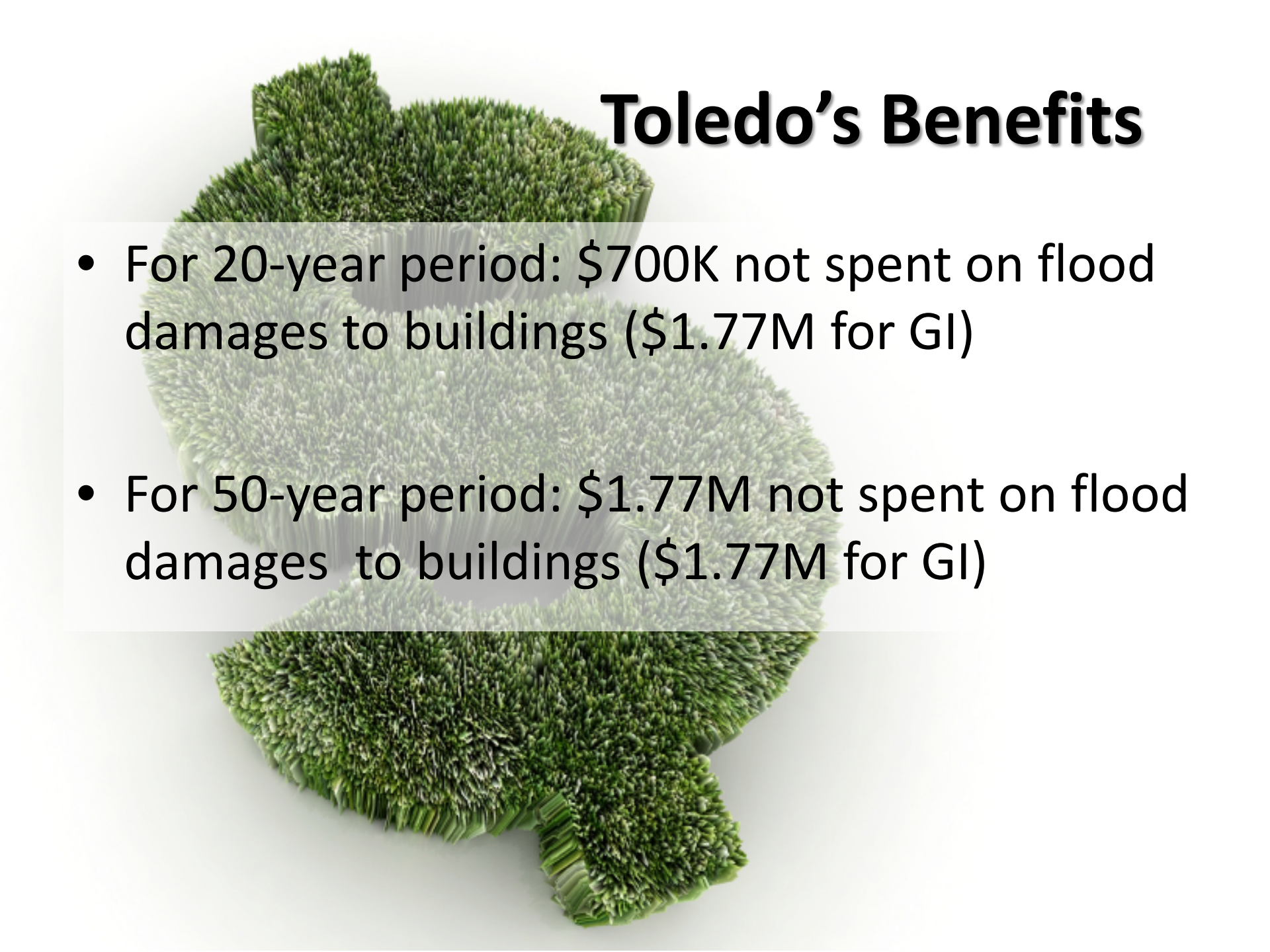
Step 5. Compare costs and benefits

Costs of green infrastructure to obtain storage using least expensive GI option

Toledo
30 acre-feet of storage with least expensive GI = $1.77M

Duluth
76 acre-feet of storage with least expensive GI = $4.3M


Benefits = Damages Avoided



Toledo's Benefits

- For 20-year period: $700K not spent on flood damages to buildings ($1.77M for GI)
- For 50-year period: $1.77M not spent on flood damages to buildings ($1.77M for GI)

Duluth's Benefits

- For 20-year period: $1.63 million not spent on flood damages ($4.3M for GI)
- For 50-year period: $4.6M not spent on flood damages ($4.3M for GI)

You may be thinking…

1. Numbers are low

2. Costs outweigh benefits

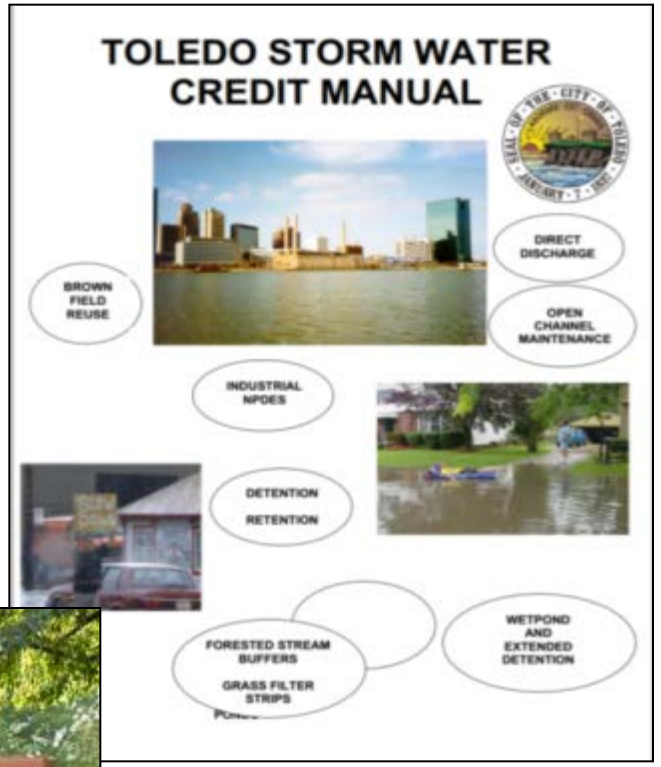
You Need Data…

- Buildings
- Roads, bridges
- Stormwater infrastructure
- Recreation
- Wages
- Land damages

We Had…

- Buildings (*Both communities*)
- ~~Roads, bridges~~
- Stormwater infrastructure (*Duluth only*)
- Recreation (*Duluth only*)
- ~~Wages~~
- Land damages (*Duluth only*)

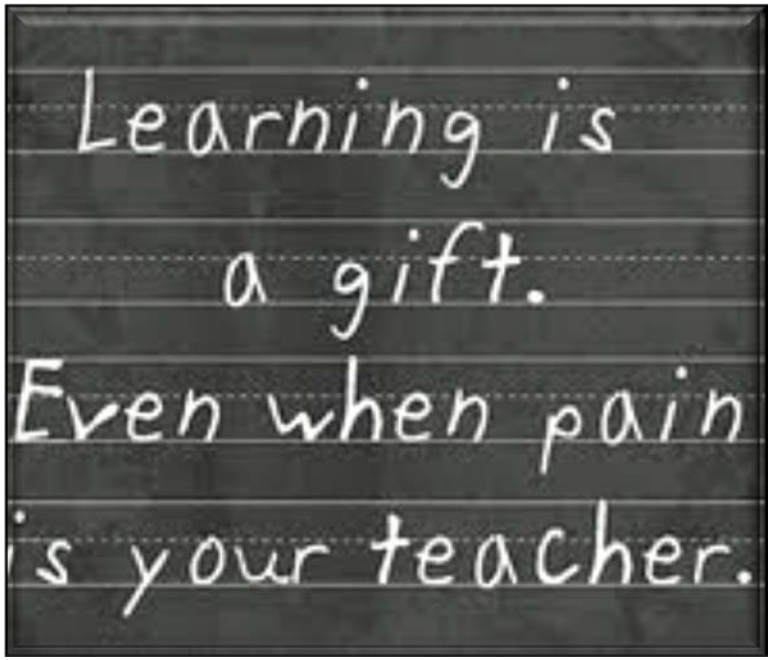
How Toledo Is Using Results



How Duluth Is Using Results

Lessons Learned

- Focus on longer term
- Hard to get all the data
- Look to implement GI over time
- Leverage other infrastructure investments
- Get a champion that is not elected or works for the city
- Consider benefits that cannot be monetized in decisions
- Partners are critical



What's Next for NOAA?

Sharing what we have learned!

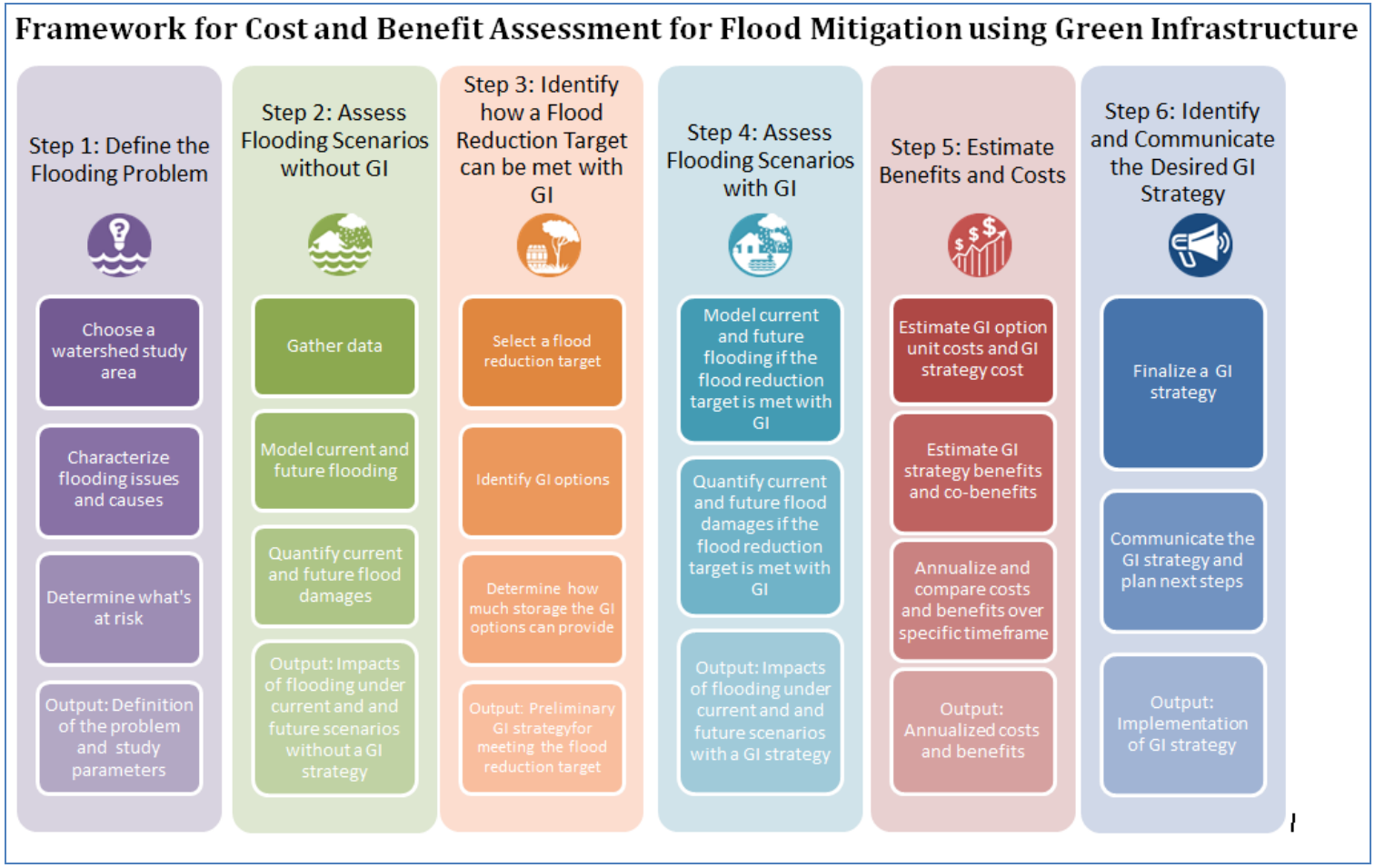
- Process Guide
- Data Matrix
- Green Infrastructure Options to Reduce Flooding

Digital Coast

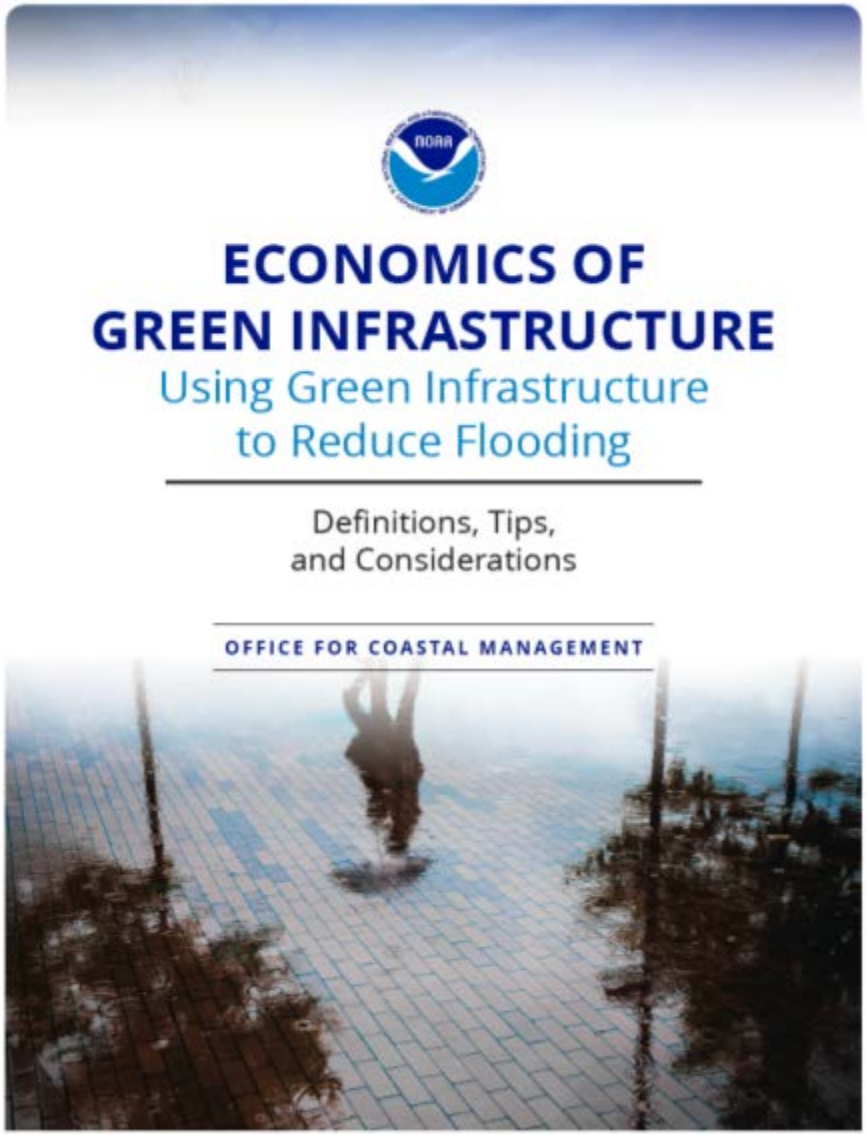
coast.noaa.gov/digitalcoast/

coast.noaa.gov/digitalcoast/publications/climate-change-adaptation-pilot

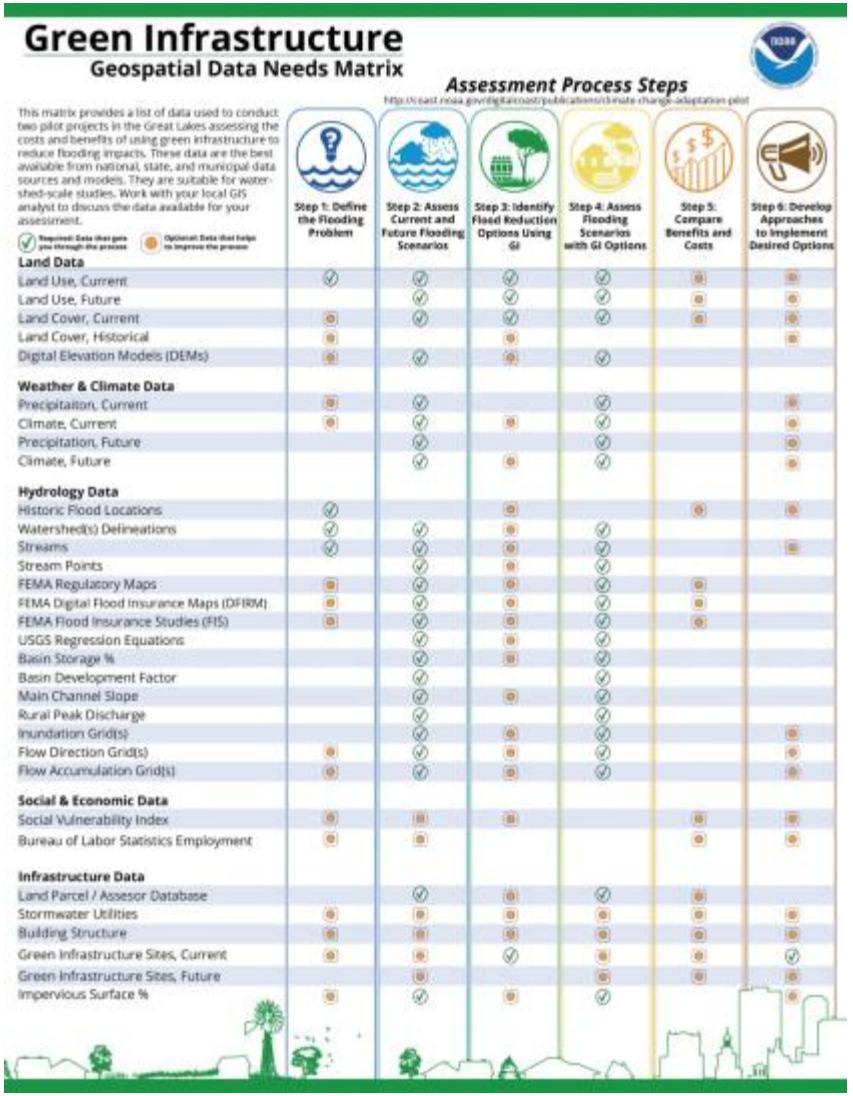
Assessing Costs and Benefits of Green Infrastructure for Flood Mitigation: A Process Guide for Communities



Companion Pieces



GI Options



Data Matrix

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Digital Coast

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