Utilizing Green Infrastructure as a TMDL Implementation Tool: *A Case Study in the Kids Creek Watershed*

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May 2018

The Watershed Center
GRAND TRAVERSE BAY

AECOM

Kids Creek Restoration Project

Funds Raised: $3.4 million
- State/Federal ~ $2.5 million
- Private Grant: $100K
- Foundations: $65K
- Matching Funds (Private Businesses): $750K

Key Partners:
- EPA, DEQ, DNR
- Local units of gov't – City of TC, Garfield Twp
- Grand Traverse Conservation District
- Munson Medical Center
- Village at Grand Traverse Commons
- Grand Traverse Pavilions (GT County)

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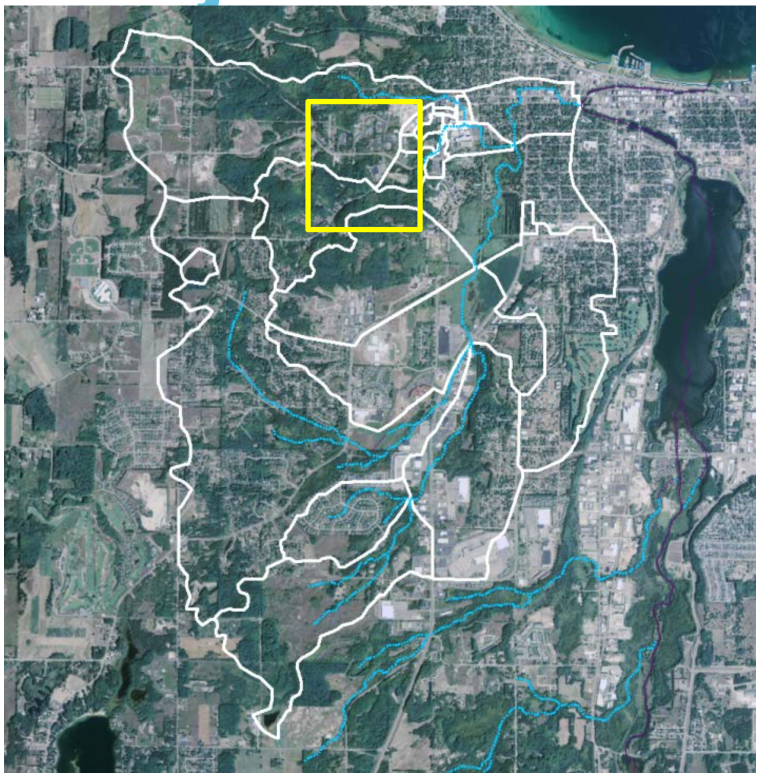
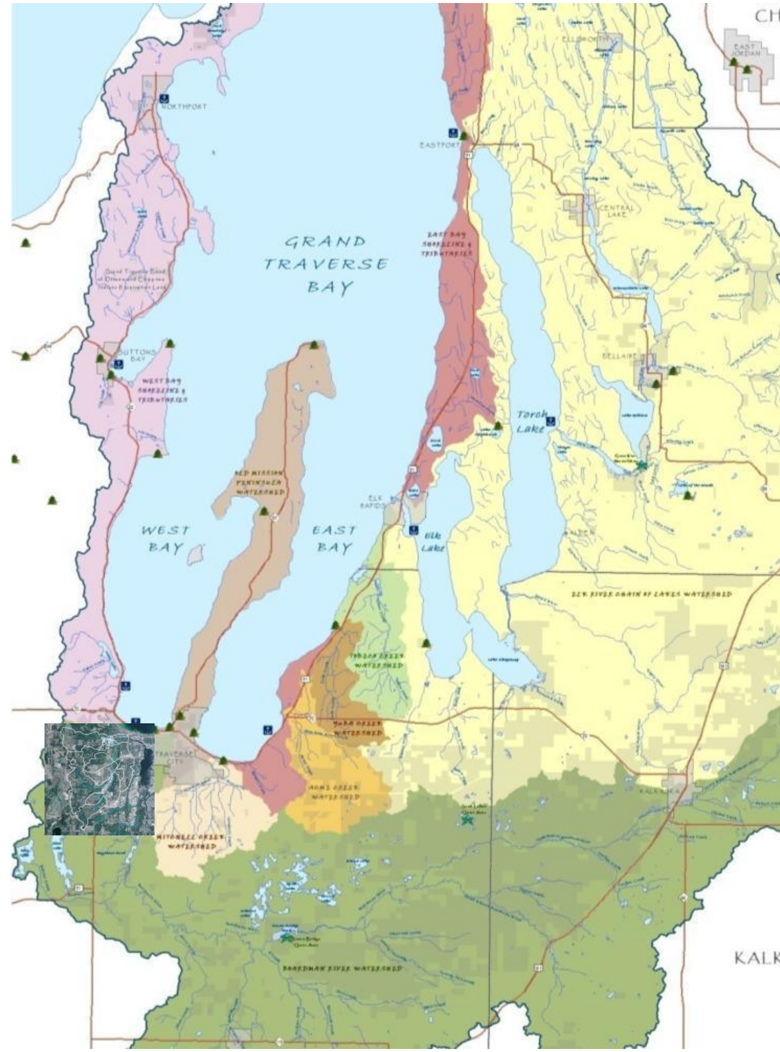
DEQ

MUNSON HEALTHCARE

Great Lakes RESTORATION

Project Location

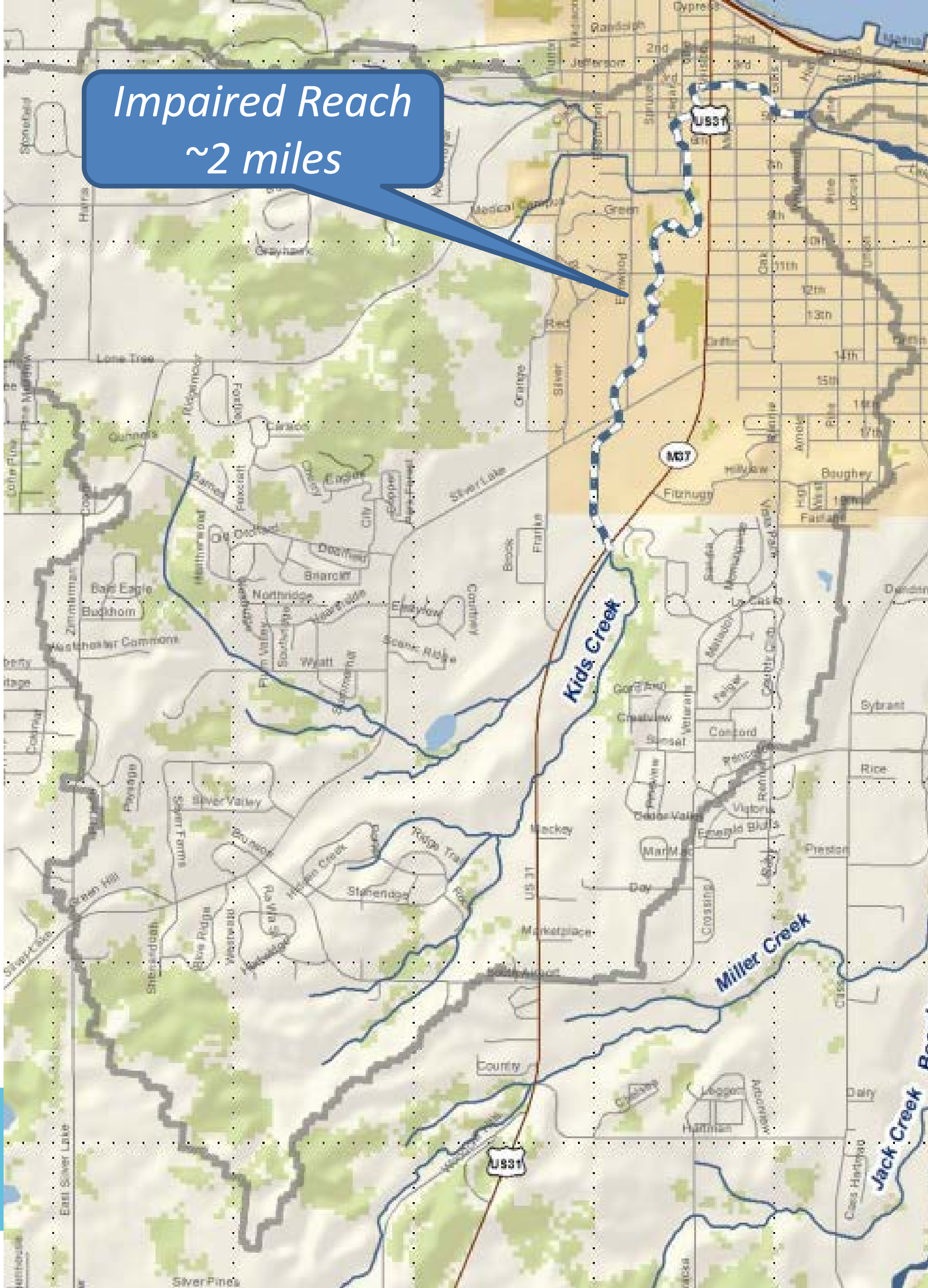




Tributary to Boardman River with watershed primarily composed of commercial, residential and institutional land uses.

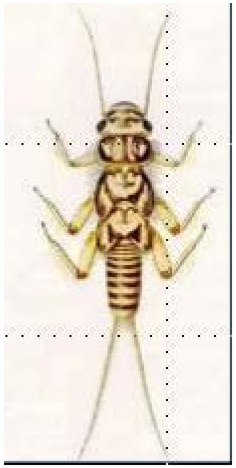
Kids Creek Impairment

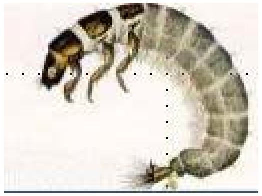
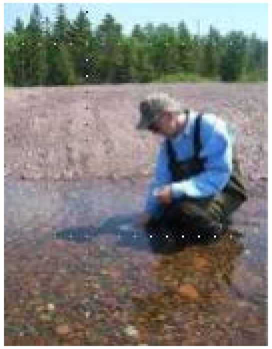
- Impaired Waters List for Aquatic Life and Wildlife
- Issues:
  - "Poor" macroinvertatebrate community 2003, 2008
  - Sedimentation
  - Flow regime alteration
  - Storm water quality and quantity
- TMDL not complete



Data Collected

- Qualitative aquatic organism and habitat data
- Limited VOC samples
- Limited water column samples for metals and nutrients

Data Collected

- Observations of flashy flows and increased turbidity
- Eroding bank inventory
- Historic information/ other sources

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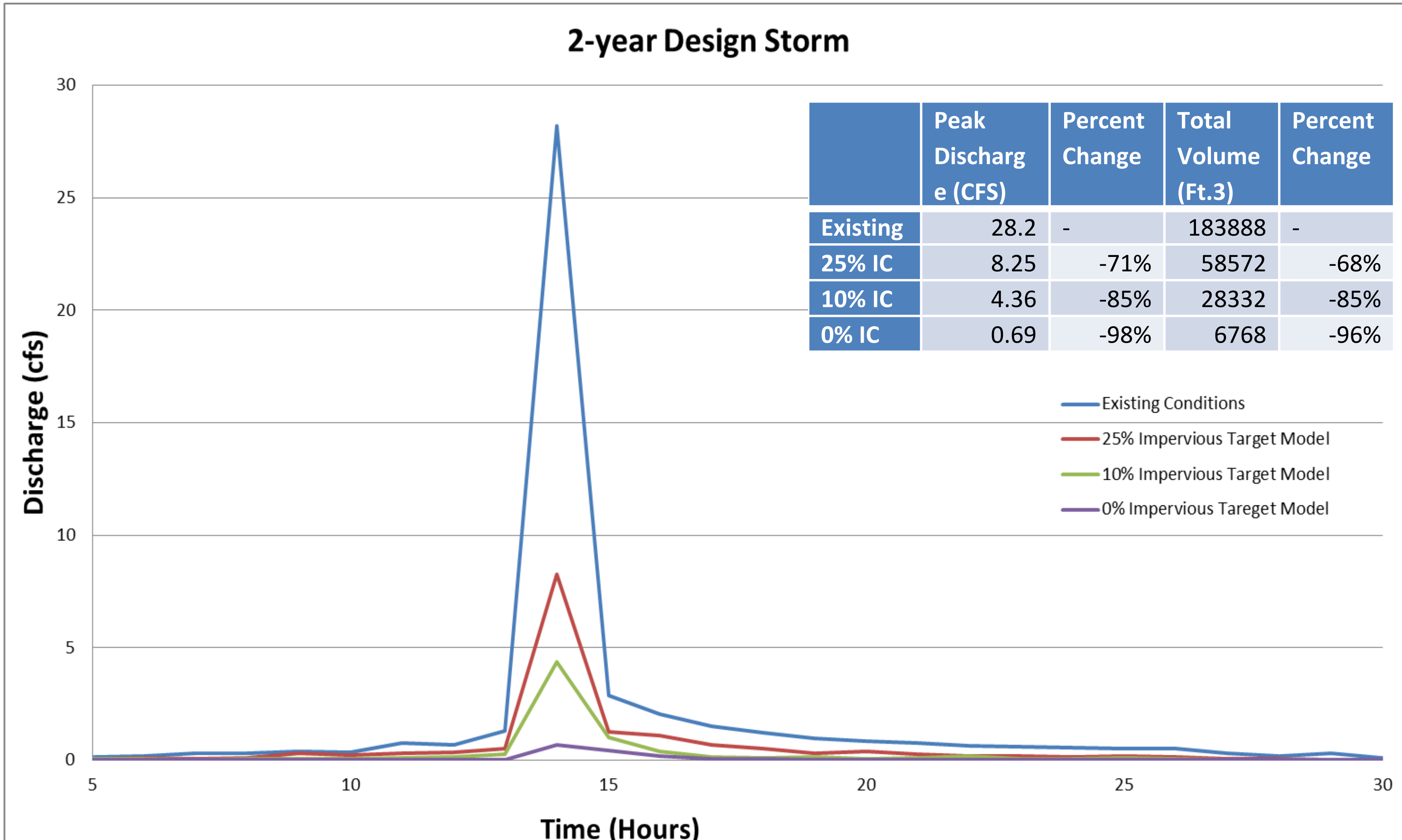
Grand Traverse
Conservation District
NATURE IS CALLING!

The Problem

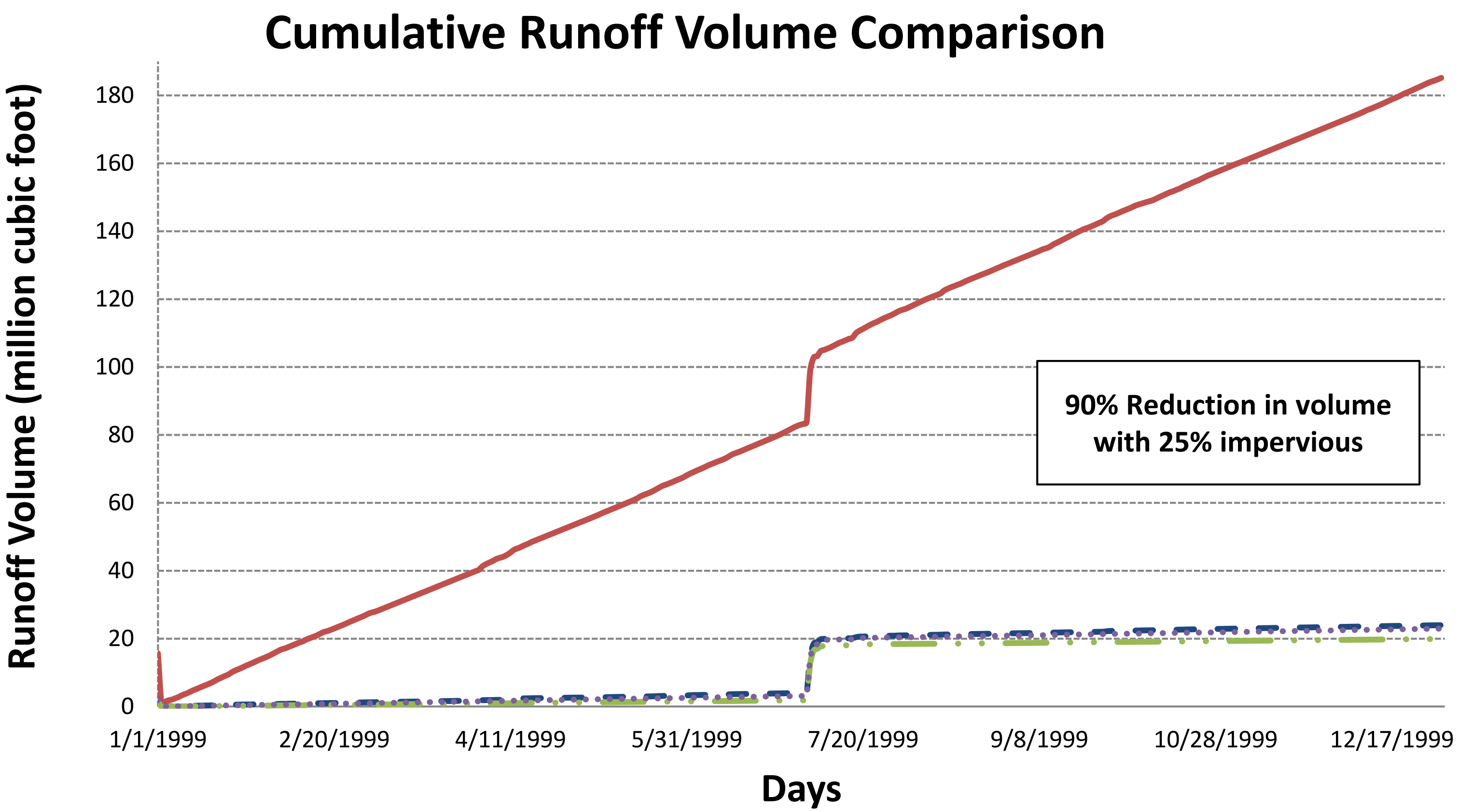
- Issues:
  - “Poor” macroinvertebrate community 2003, 2008
  - Sedimentation
  - Flow regime alteration
  - Storm water quality and quantity
- Causes:
  - Storm water
- Solutions:
  - Green Infrastructure

Flashy Flows from Stormwater

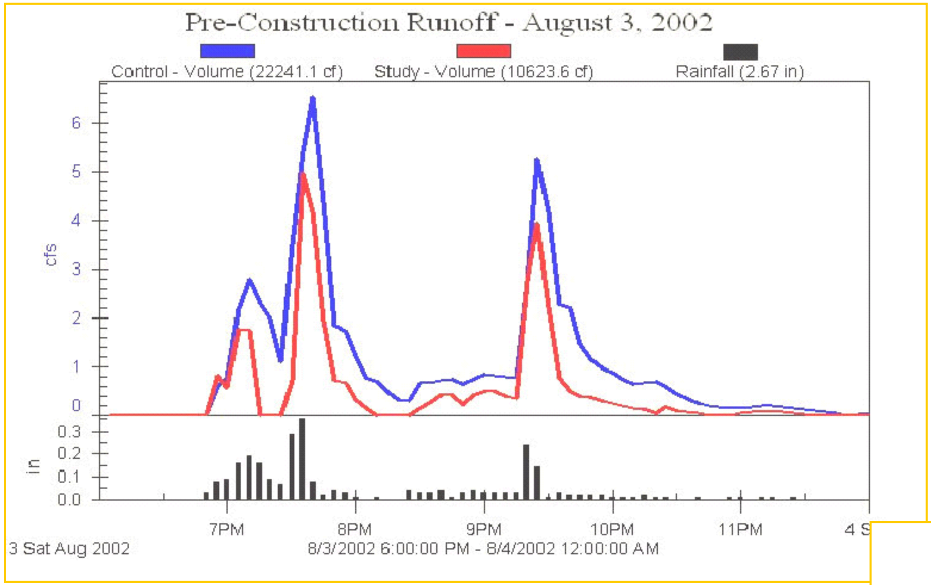


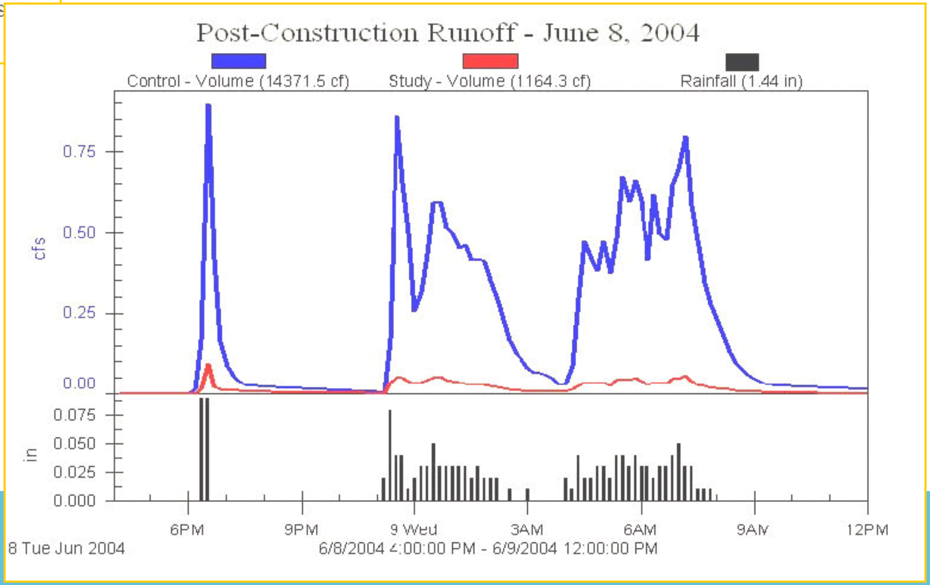
	Peak Discharge (CFS)	Percent Change	Total Volume (Ft.3)	Percent Change
Existing	28.2	-	183888	-
25% IC	8.25	-71%	58572	-68%
10% IC	4.36	-85%	28332	-85%
0% IC	0.69	-98%	6768	-96%

Flashy Flows from Stormwater



Proof of concept: Burnsville, MN





Blue: *Control*

Red: *With Rain Gardens*

Sediment Load from Stormwater

	SSCF (mg/L)	SSCC (mg/L)
Dry Weather		
Open Channel	12.0	5.7
Collection System	3.3	12.9
Wet Weather		
Open Channel	14.5	21.8
Collection System	11.5	245.1

Examples of watershed sediment storage

Impervious Cover: Impacts on Stormwater

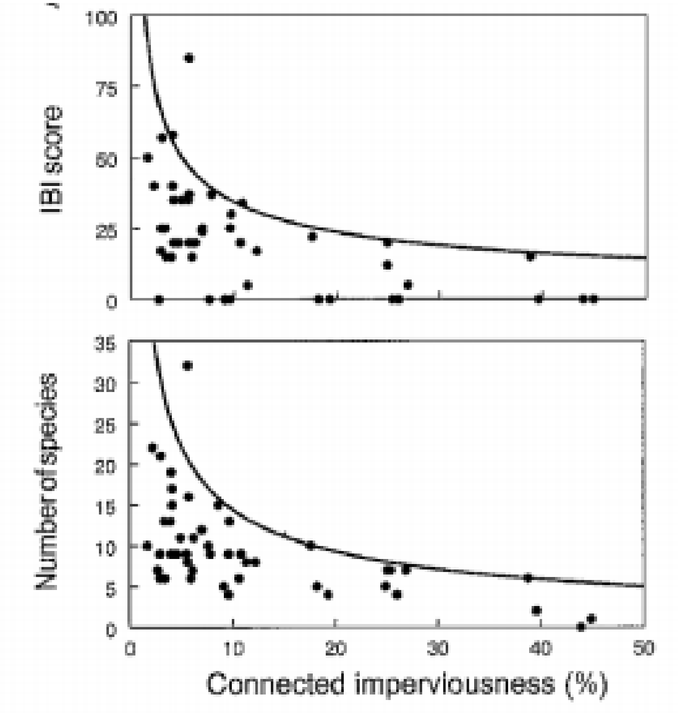


FIGURE 1-4 Plots of Effective Impervious Area (EIA, or "connected imperviousness") against metrics of biologic response in fish populations. SOURCE: Reprinted, with permission, from Wang et al. (2001). Copyright 2001 by Springer.

Planning Approach

Watershed Scale

- *Goals and Targets*
- *Regulatory Drivers*
- *Public Engagement*
- *Budget (Capital and O&M)*
- *Watershed Characterization*
- *Prioritize Locations*
- *Prioritize GI Types*
- *Alternatives*
- *Implementation Period*

Neighborhood Scale

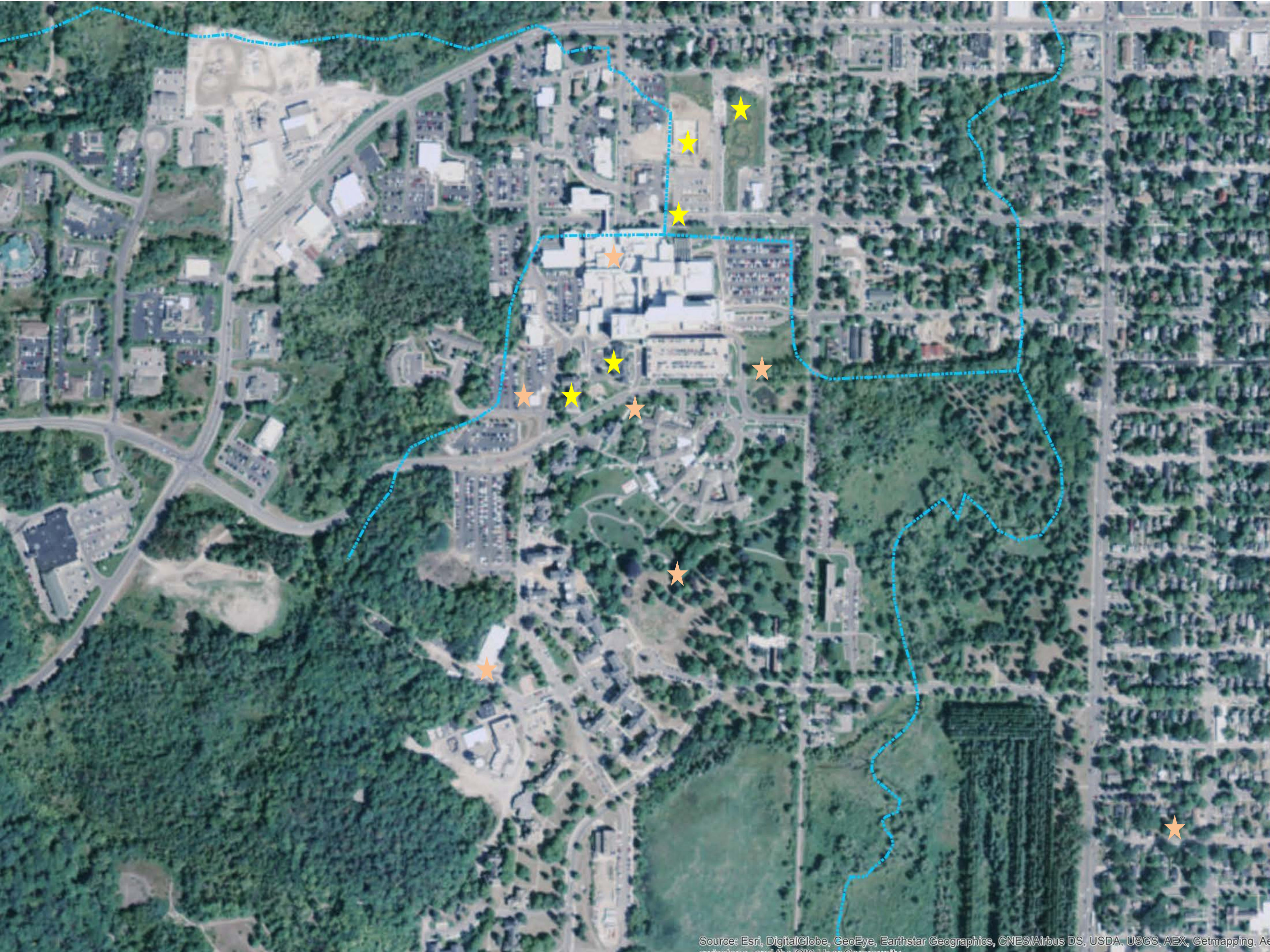
- *Verify Physical Suitability of Sites*
- *Collect Data*
- *Public Engagement*
- *Budget (Capital and O&M)*
- *Select Locations*
- *Select GI Types*
- *Develop Design and Construction Schedule*

Site Scale

- *Collect Data*
  - *Infiltration*
  - *Utilities*
  - *Contamination*
- *Cost Estimating*
- *Implement Design and Construction Schedule*

Outputs

Watershed Scale	Neighborhood Scale	Site Scale
Develop plan to meet goals within budget and other constraints	*Refine projects, project locations, and costs*	*Engineer, design, construct, and maintain*

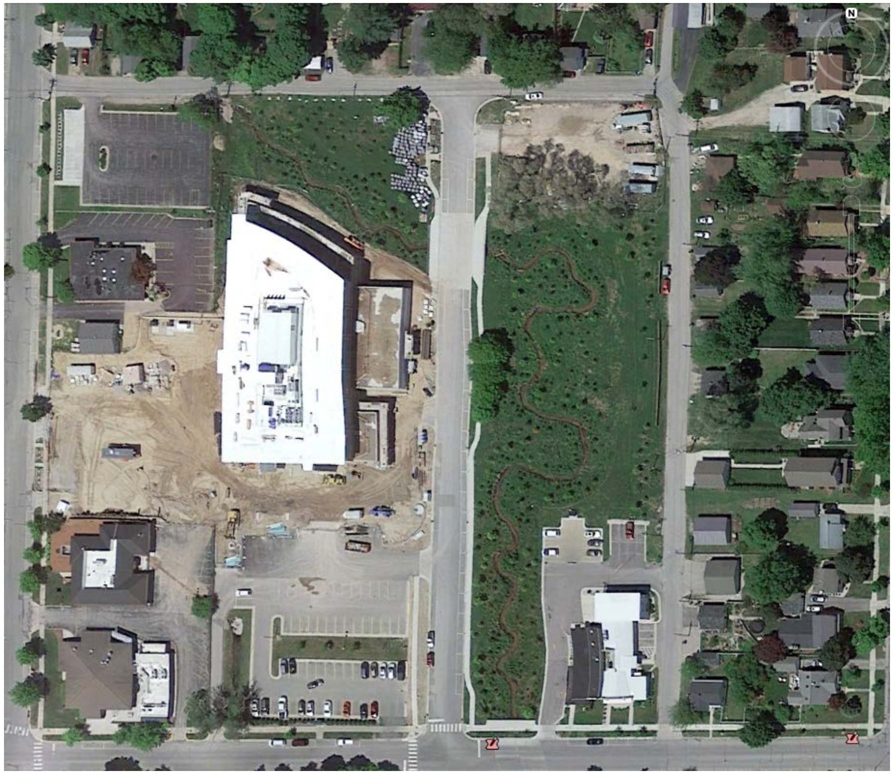

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Ae

Cowell Family Cancer Center

- Stream Daylighting – 1,275 feet of new channel replacing 900 feet of enclosed piping
- New 39,700 sq. ft. floodplain area.
- Reduction of 72,000 sq. ft. of impervious area.
- 26,000 cubic feet of infiltration trench
- 750 sq. ft. raingarden
- 3,179 sq. ft. of green roof

Restoration of Tributary AA to Kids Creek

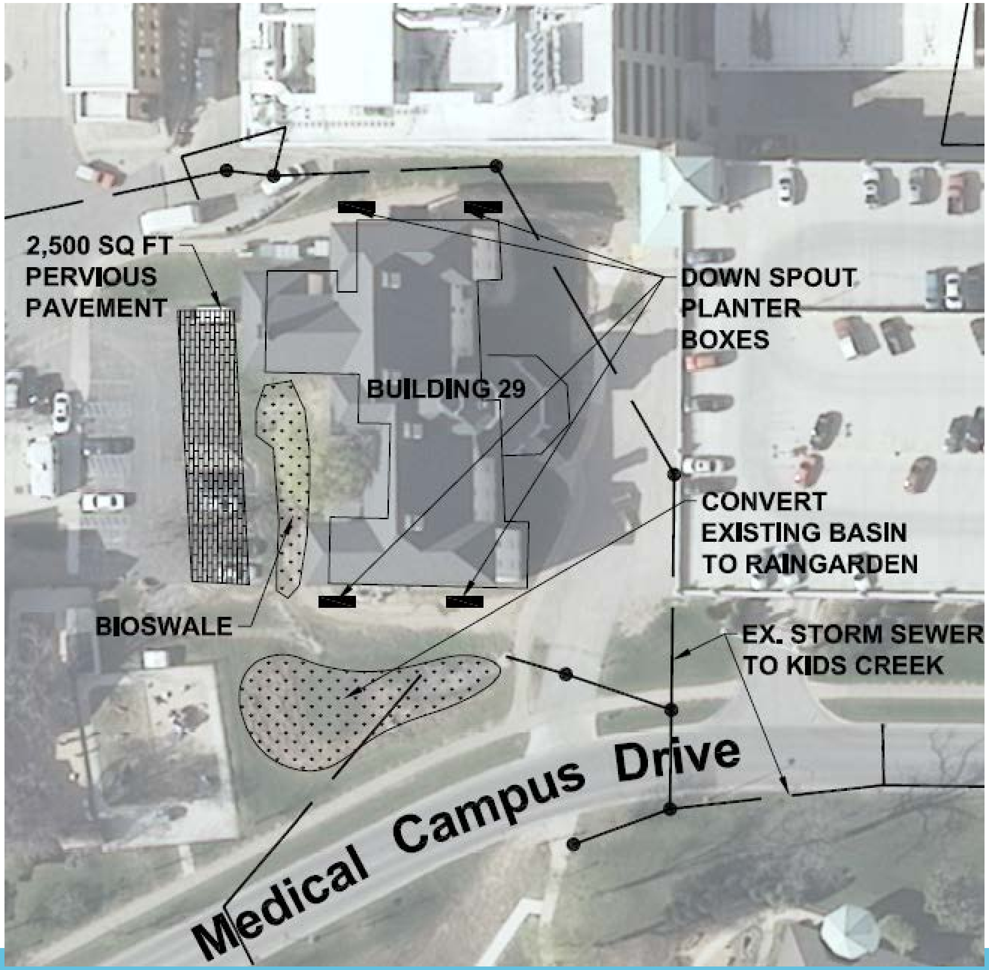
2012



2015

Building 29

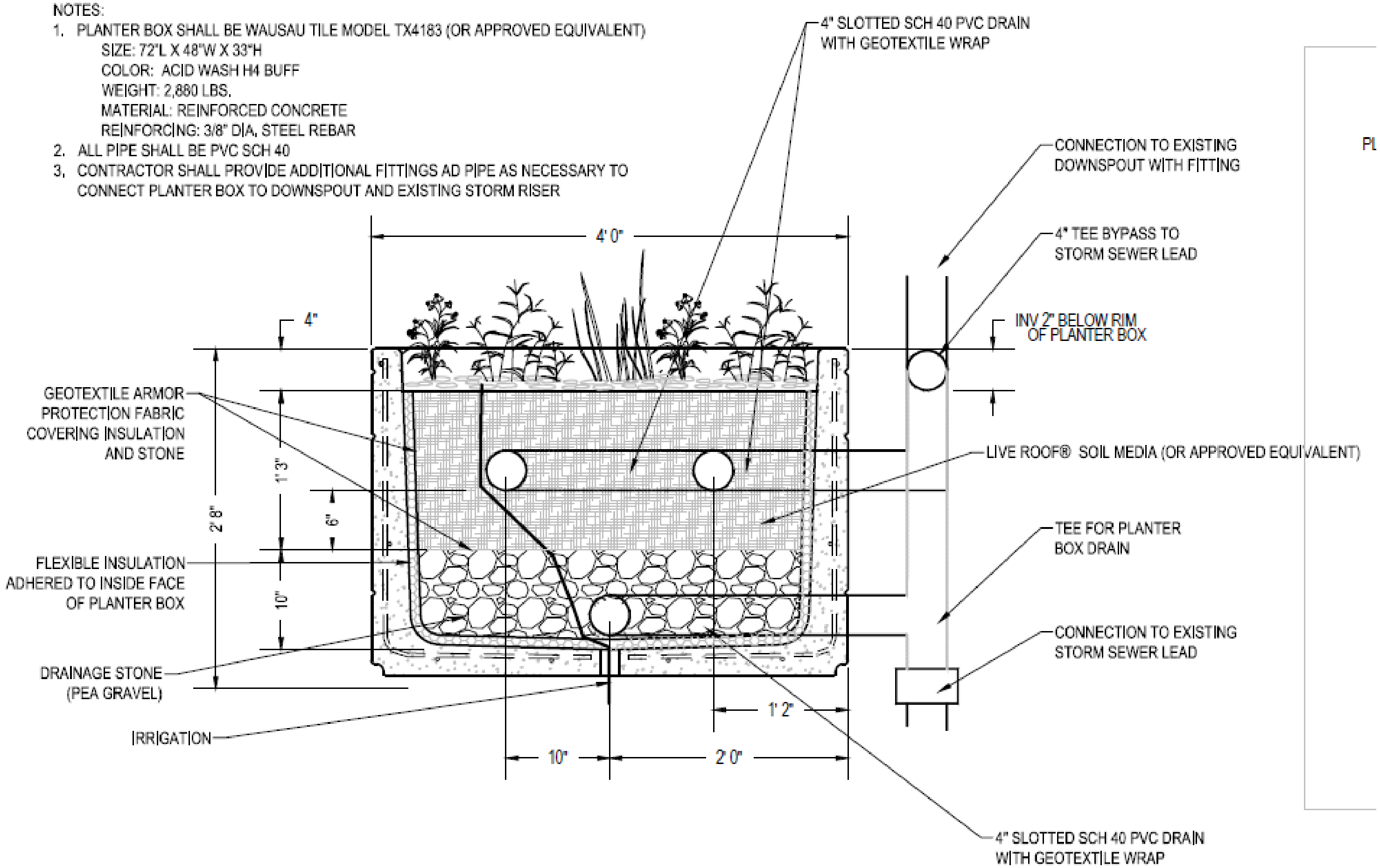
- 3 planter boxes added
  - 600 cubic feet of storage
  - Capture 2,000 sq. ft. of roof top.
- Pervious Pavement
  - 1,310 sq. ft.
- 1 large bio swale



Planter Box Detail

NOTES:

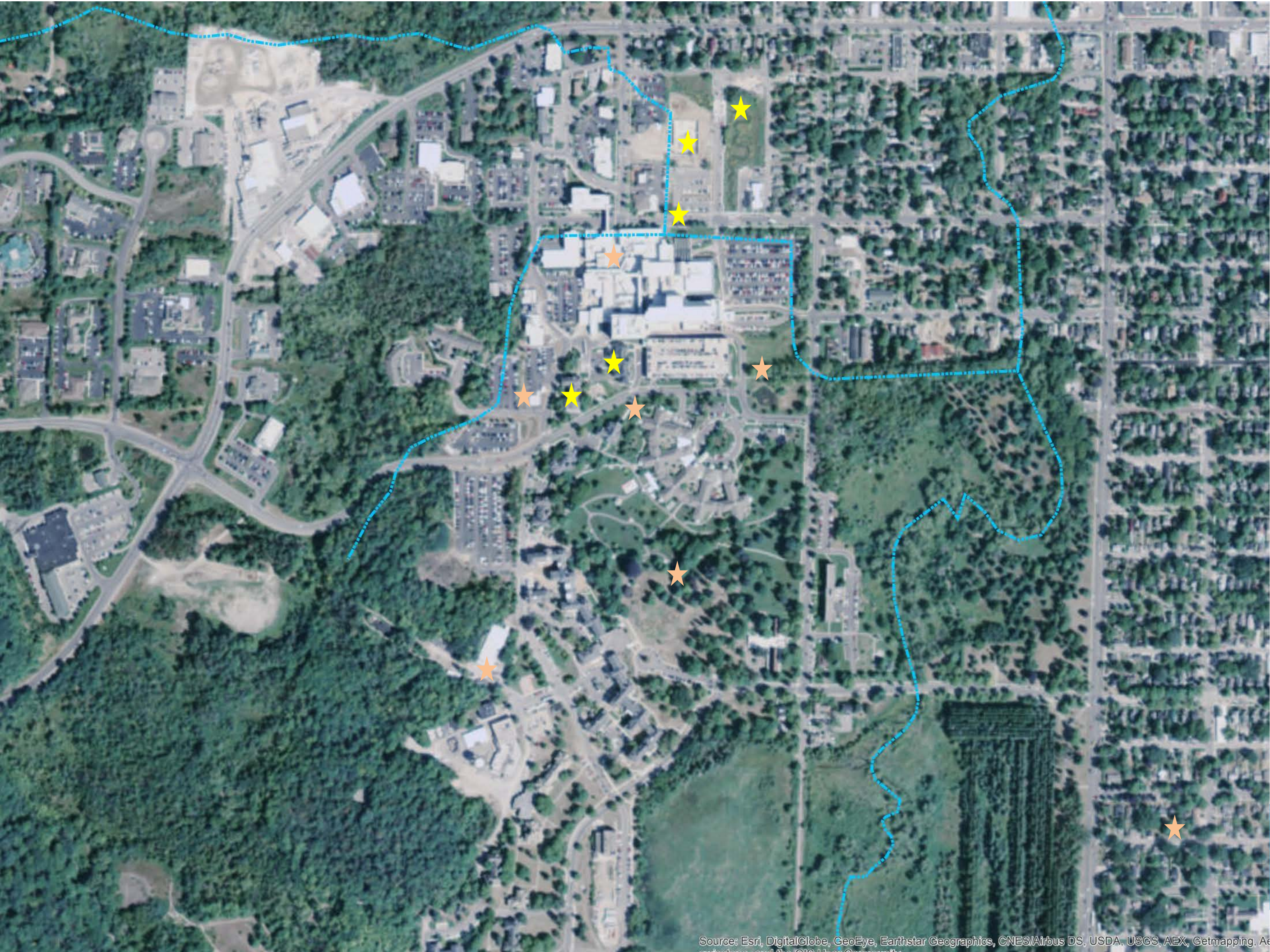
1. PLANTER BOX SHALL BE WAUSAU TILE MODEL TX4183 (OR APPROVED EQUIVALENT)
   SIZE: 72"L X 48"W X 33"H
   COLOR: ACID WASH H4 BUFF
   WEIGHT: 2,880 LBS.
   MATERIAL: REINFORCED CONCRETE
   REINFORCING: 3/8" DIA. STEEL REBAR
2. ALL PIPE SHALL BE PVC SCH 40
3. CONTRACTOR SHALL PROVIDE ADDITIONAL FITTINGS AD PIPE AS NECESSARY TO CONNECT PLANTER BOX TO DOWNSPOUT AND EXISTING STORM RISER





Planned BMPs

- 90° Creek/ Floodplain Restoration
- Medical Campus Drive Infiltration Practices
- Elmwood Wetlands
- Helipad bio infiltration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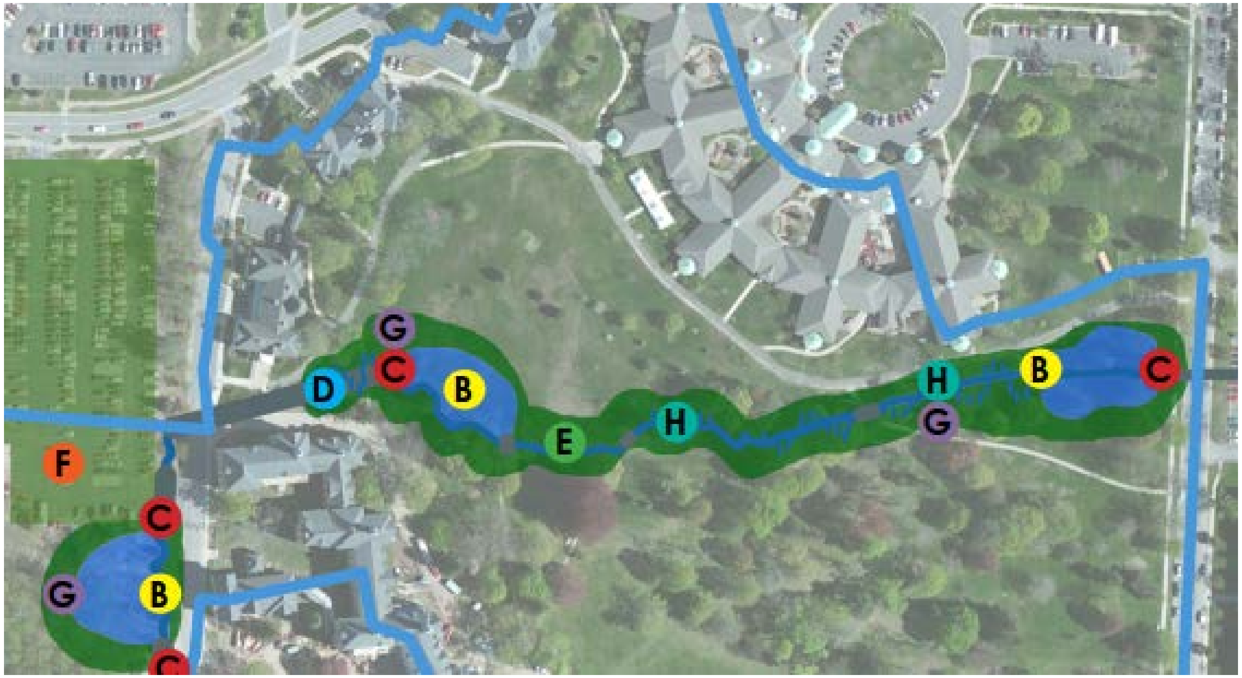
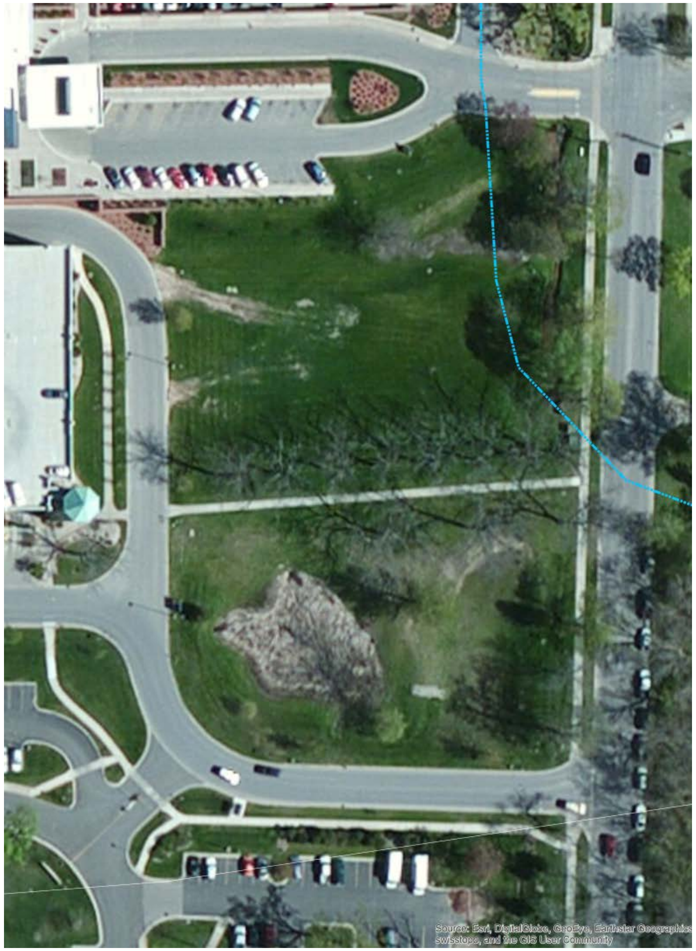
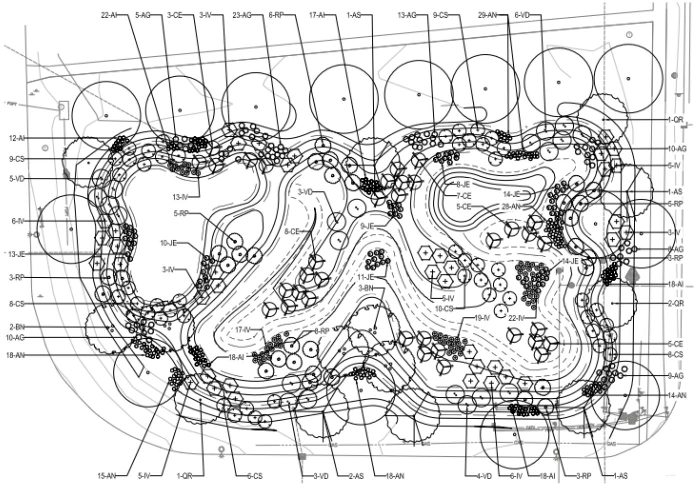
90◦ Creek/ Floodplain Restoration

- **B** Provide in line detention to increase capacity and water quality. This will also reduce flow rates and erosion.
- **C** Repair/replace clogged and sediment-filled culverts to reduce back-up.
- **D** Daylight part of culverted section to increase capacity and water quality.
- **E** Provide new headwall config-ureation to prevent erosion. swales.
- **H** Adjust channel profile and sinuosity
- **G** Increase or provide riparian buffer to increase water quality and infiltration and decrease flow rates.

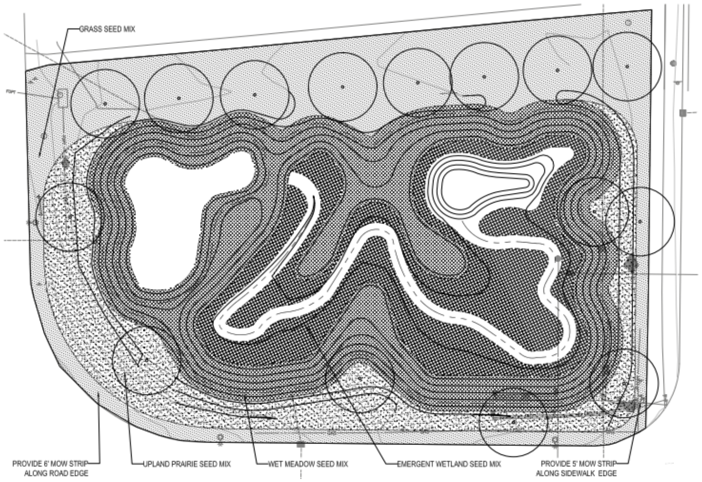


Elmwood Wetland





PLANTING PLAN



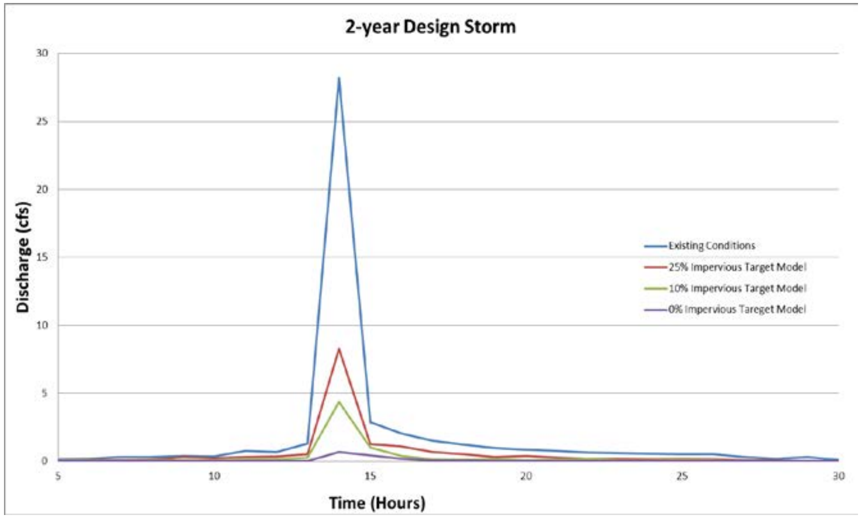
Medical Center Drive

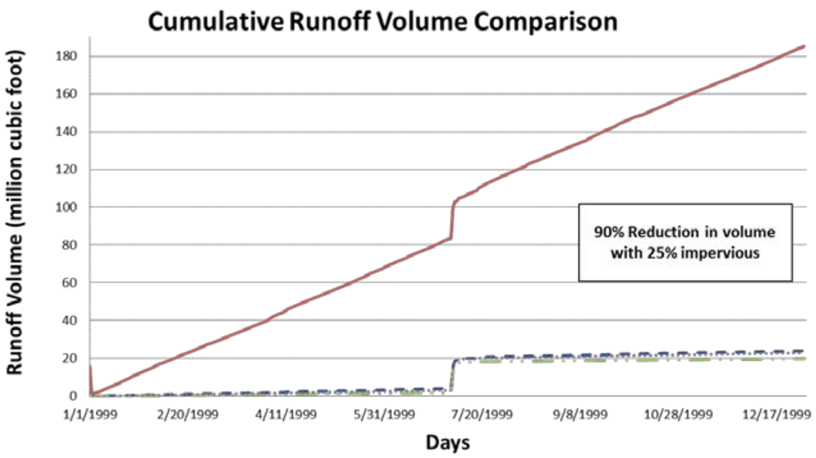
Elmwood Street SOM Building

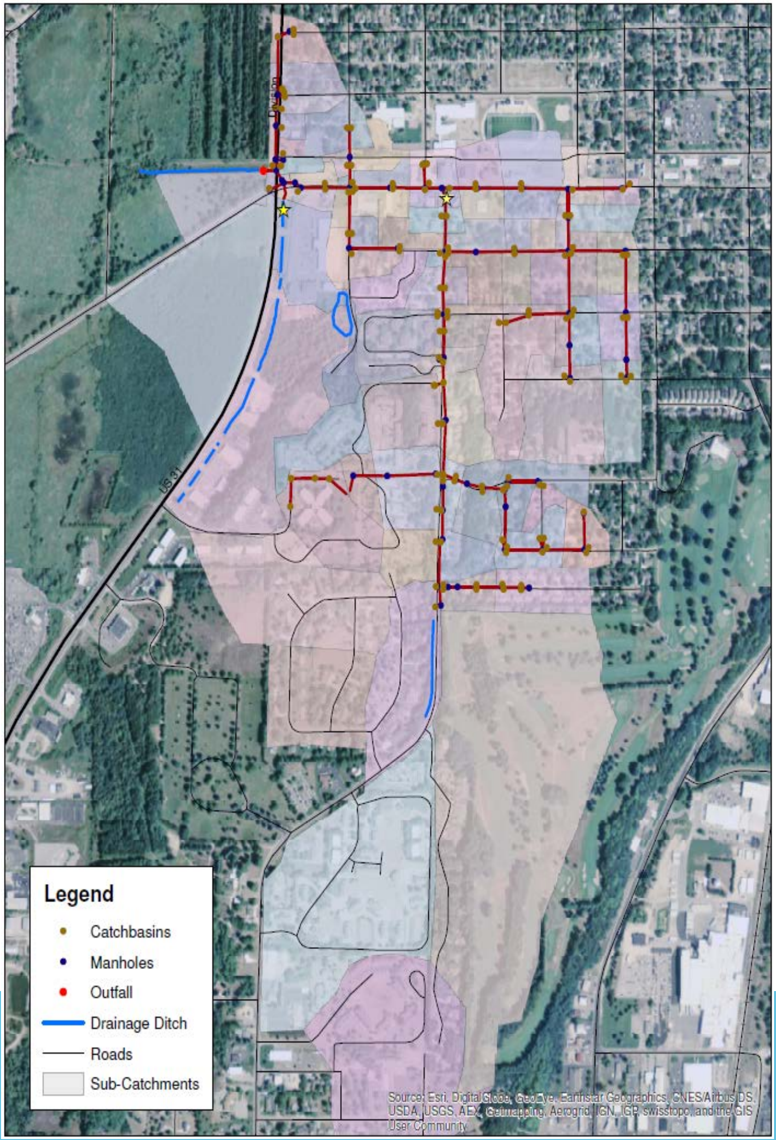
Future BMPs

- Focus on 14th Street Sub Watershed
  - Rain Gardens
  - Underground infiltration
  - Channel/ floodplain restoration
  - Pervious Pavement

14th Street Watershed







14th Street Watershed (preliminary!)

Green Infrastructure	Unit	Cost/Unit	# units obtainable with $1,000,000		Amt. of BMPs required to hit 25% target model results
Rain Garden	Area (sq. foot)	$20.00 - $25.00	40,000 -50,000	sq. ft.	59,677 sq. ft.
Inline Detention/ Infiltration	Volume (cb. Ft.)	$8-12	83,333– 125,000	cubic ft.	11,583 cubic ft.
Rain Barrel	Each	$100.00	10,000	barrels	10,510 barrels
Tree Box	Area (sq. foot)	$30 - $40	25,000 – 33,333	sq. ft.	184,694 sq. ft.
Pervious Pavement	Area (sq. foot)	$8 - $10	100,000 – 125,000	sq. ft.	83,200 sq. ft.

Caveats:

- BMPs need to be spread throughout watershed
- Costs are preliminary and will vary based on the site


Rain Gardens
A natural and beautiful way to protect our water resources

Planned BMP System: Infiltration Trenches

Key Points:

- Know what materials are available locally
- Review and question all as-built drawings

Summary and Conclusions

- Success! Through a collaborative and sustained process, a lot of BMPs have been installed and more are planned.
- Up front planning uses estimates of volume and load reduction to prioritize implementation activities.
  - SWMM modeling used to assess hydrologic impacts of BMPs – nearly 90% reduction in volume possible!
  - Large sediment sources easily mitigated
- Benefits of installed BMPs not being measured
  - Impaired water will be evaluated

Summary and Conclusions

- BMPs
  - Approximately $4.3 spent to date
  - Another $0.5M programmed
  - $1.5M proposed in future work

Questions?

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