Reducing the Storm Water Footprint of GVSU through BMP's

Ottawa County

Eighth Annual Water Quality Forum

West Olive, MI

November 25, 2013

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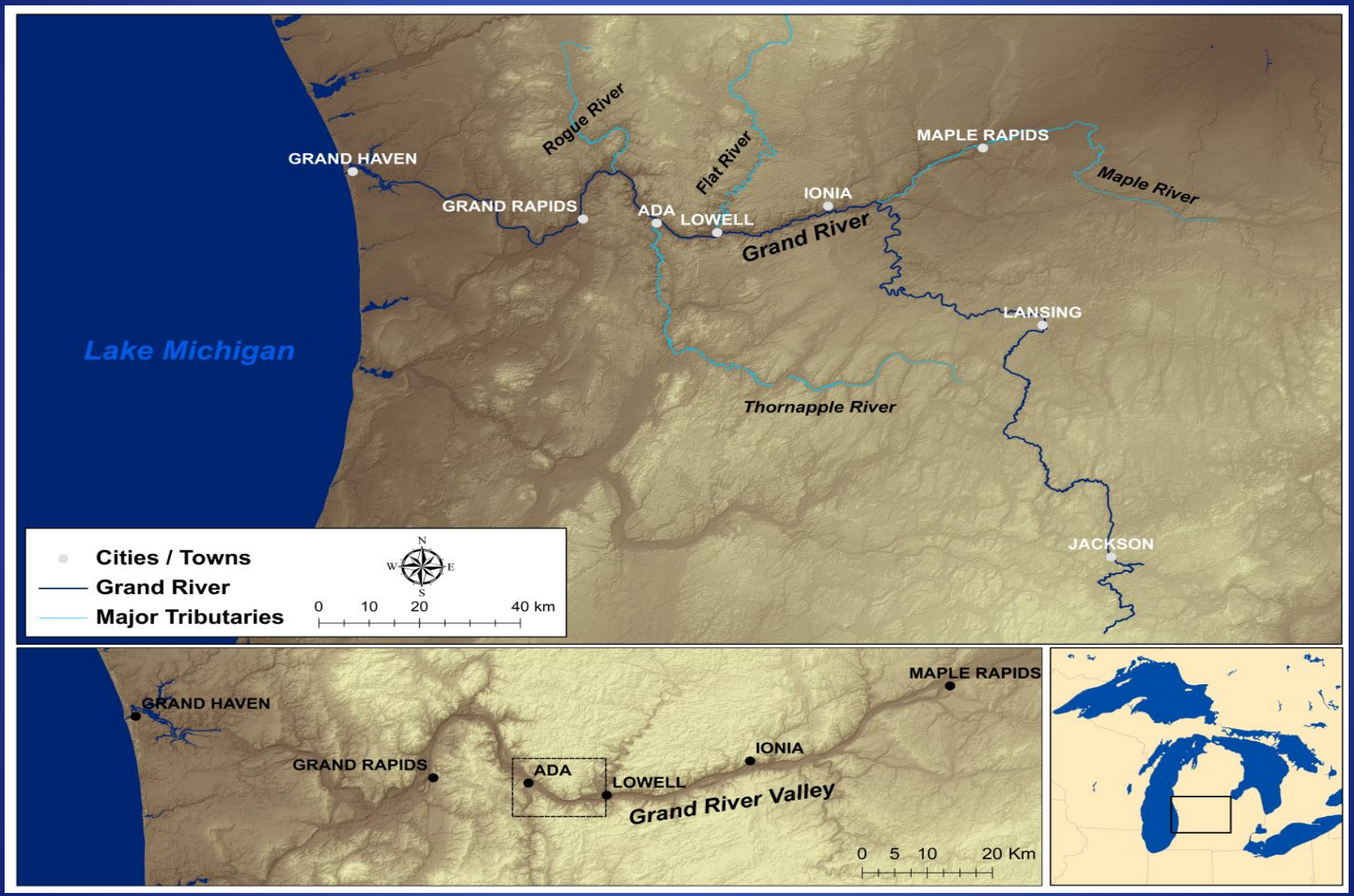
GRAND VALLEY STATE UNIVERSITY
GEOLOGY DEPARTMENT

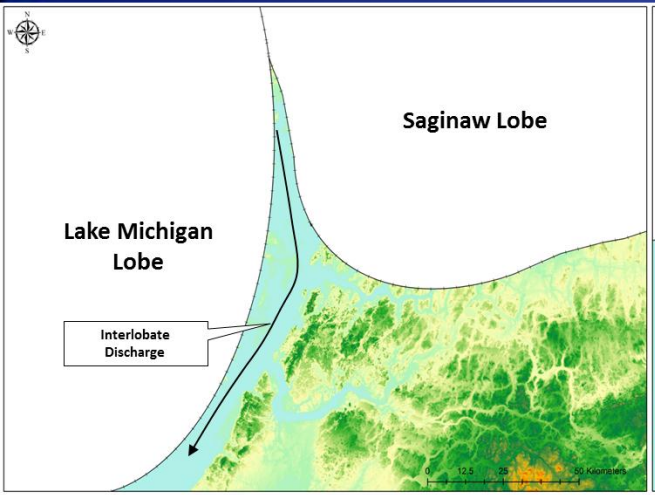
Talk Road Map

- Brief Geomorphic History of the Grand River and Grand River Ravines
- Historic storm water and Land Use practices at GVSU
- Storm water runoff monitoring and research
- Best Management Practices at GVSU
- The future of BMP's and storm water at GVSU

The Grand River and Grand River Valley

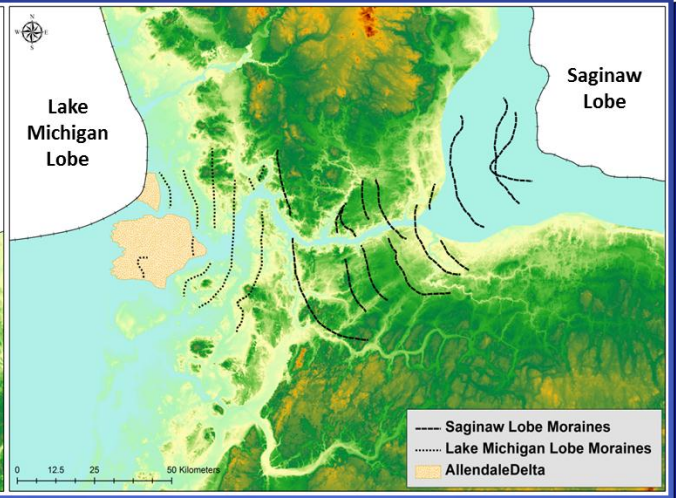


Churches and Wampler (2013)

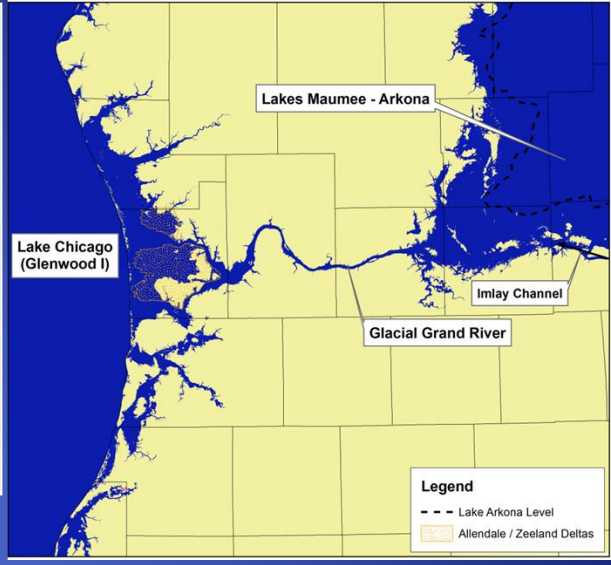


Churches and Wampler (2013)

~ 15,000 years ago

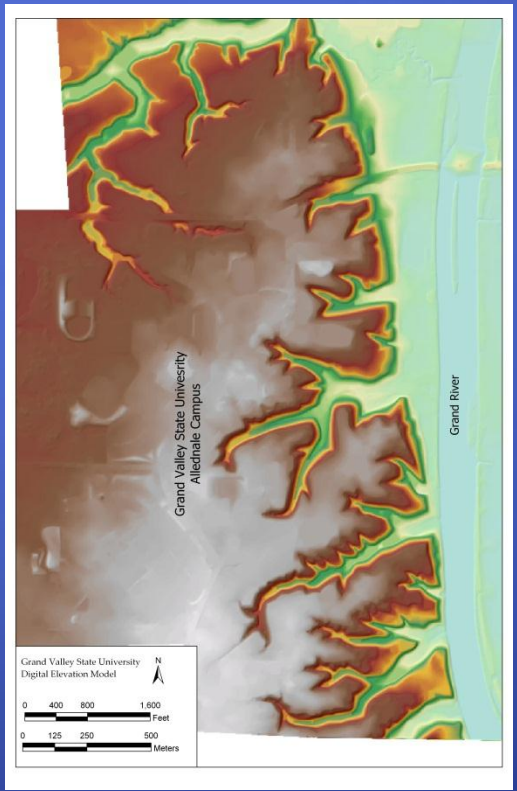


~ 14,000 years ago



~ 13,000 years ago

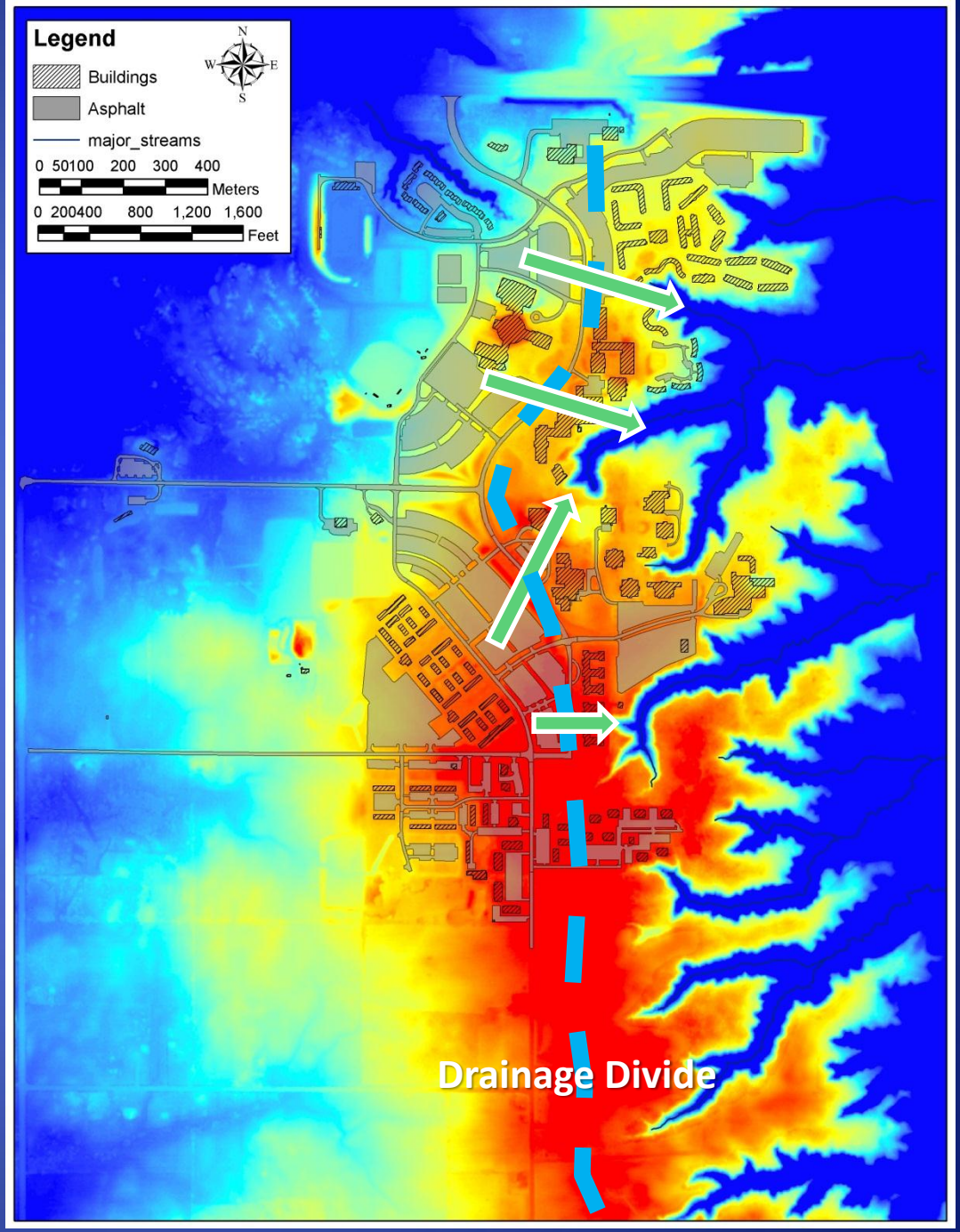
The Grand River Ravines are unique



Womble and Wampler (2006)

Runoff direction toward ravines

- Drainage divide bisects campus.
- Historically water was directed east into the ravines from parking lots and buildings



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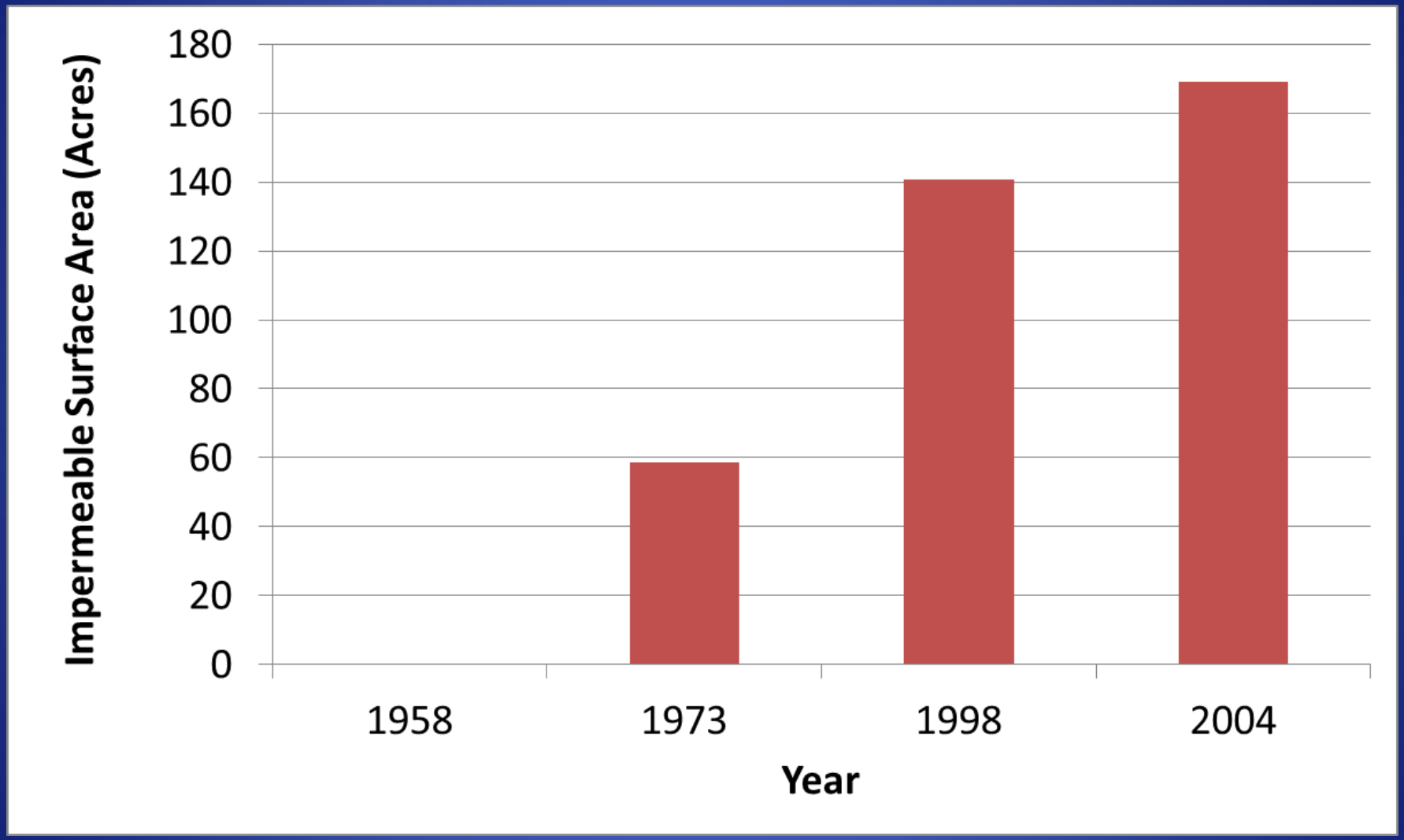
1958 Aerial Photo of the GVSU site

2004 Aerial Photo of the GVSU site

2011 Aerial Photo of the GVSU site

Changes in Impermeable Surface Area



Womble and Wampler (2006)

Storm water directed to ravines

Original library under construction

Drainage pipe into ravine behind Padnos


Erosion below one of the drainage pipes

Runoff and Erosion Control

Video courtesy of Steve Snell, facilities planning

2012 flooding in the ravines after a ~ 1 inch rain in 30 min

Runoff Impacts

- Erosion and sediment transport
- Slope stability
- Biological impacts
- Thermal impacts
- Water quality degradation

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Storm water research 2006-2013

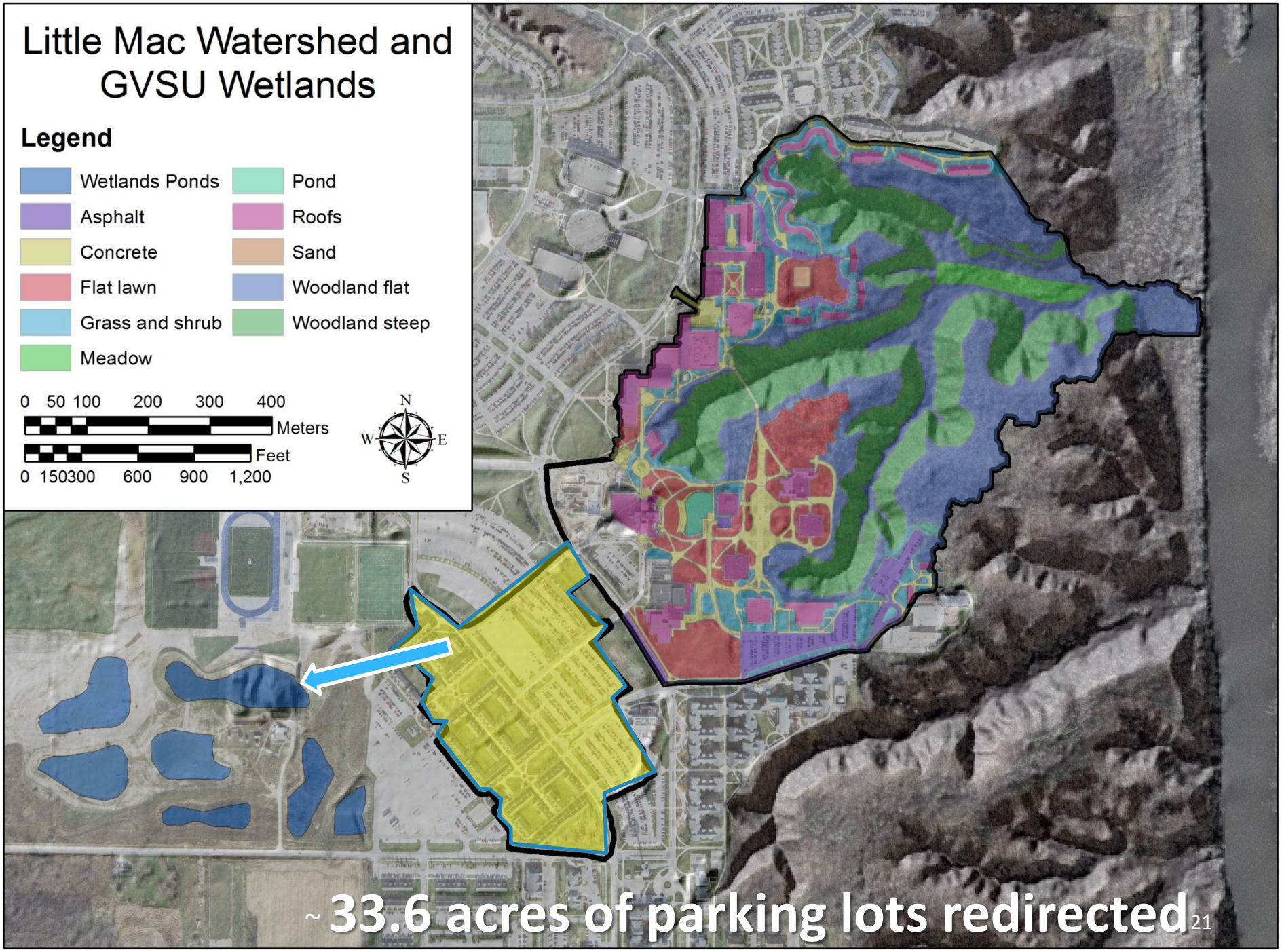
- 2006 – Runoff modeling and first discharge monitoring (Womble and Wampler 2006)
- 2007-2008 – Thermal impacts of runoff on the water quality in the ravines (Nagorsen et al. 2007)
- 2009 – Baseline biologic and hydrologic data collection (Snyder et al, 2009; Wampler, 2009)
- 2011 – Water quality analysis of ravine runoff (TSS, turbidity, conductivity, pH) and GIS-based watershed analysis to evaluate hydrologic impact of diversion of parking lots to newly constructed ponds. (Simonson et al., 2011)
- 2012 – Evaluation of water quality (nitrate; phosphate, turbidity, TSS) in the storm water pond system and the ravines. (Wampler and Kneeshaw, 2012)
- 2013 – Continued monitoring of water quality in Pond#1 of the pond system and Little Mac Ravine (in progress)

Research and Monitoring data can be found at www.gvsu.edu/stormwater

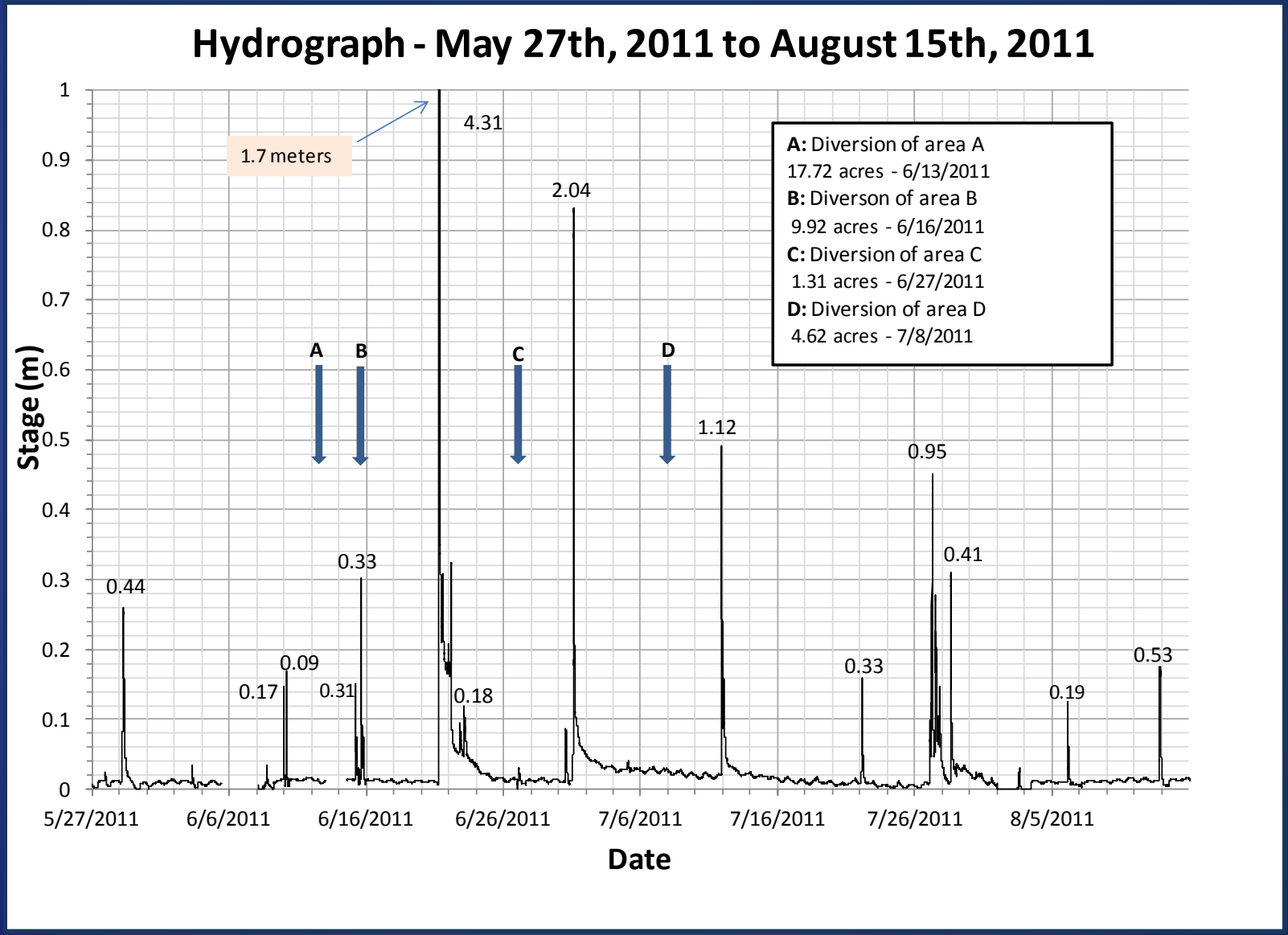
ISCO Sampler used for ravine Monitoring and sampling

Suction Head

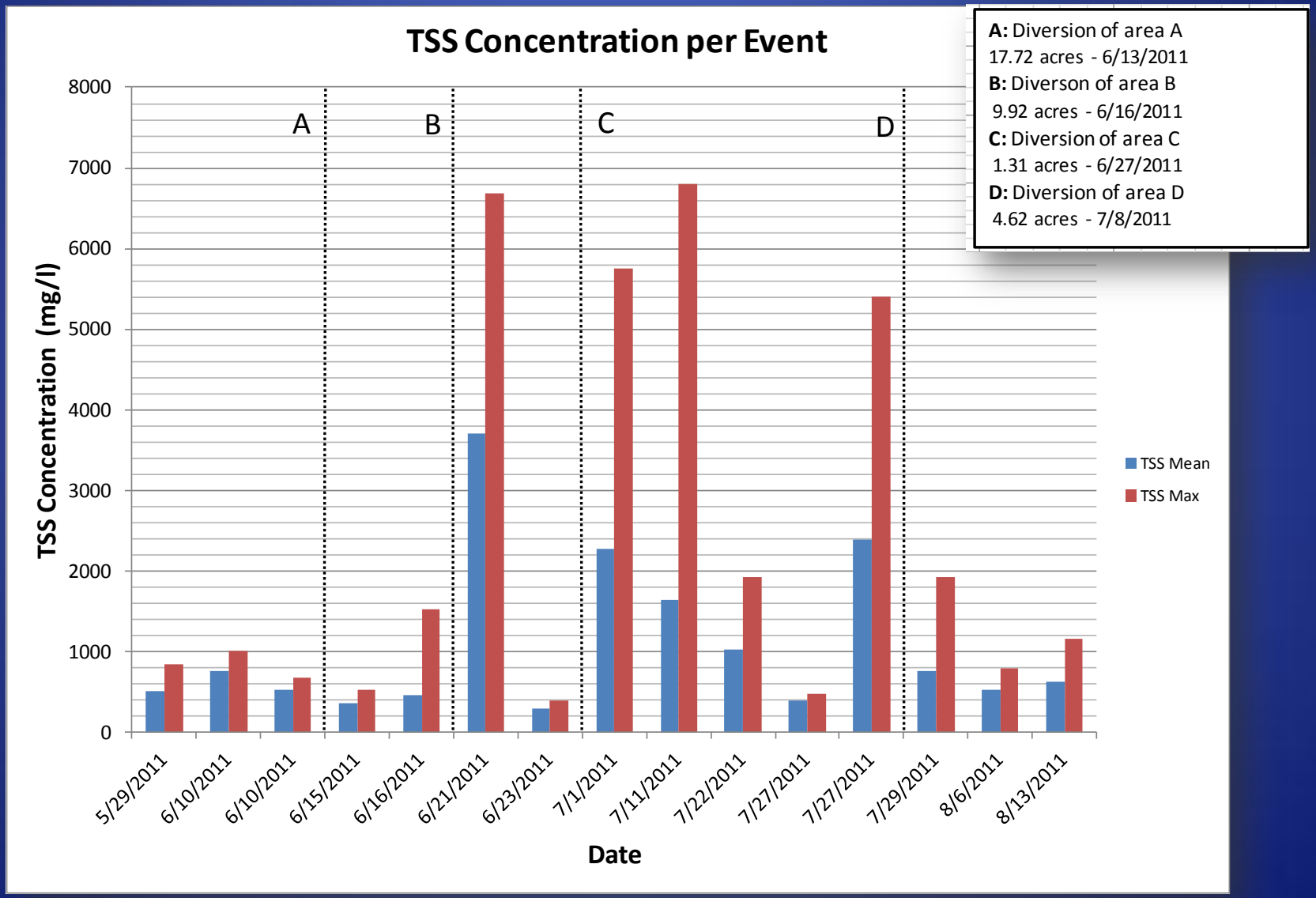
Sediment samples from 5/23/11


Little Mac Watershed and GVSU Wetlands
Legend
Wetlands Ponds
Pond
Asphalt
Roofs
Concrete
Sand
Flat lawn
Woodland flat
Grass and shrub
Woodland steep
Meadow
0 50 100 200 300 400
Meters
Feet
0 150300 600 900 1,200
N
W
E
S
~ 33.6 acres of parking lots redirected

Summer 2011 Hydrograph



TSS Concentration in Little Mac Ravine



GVSU Storm Water Management Complex

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2012 Storm Water Ponds Research

- Data from 936 samples and 9 precipitation events indicate that the system is efficient at removing suspended solids and contaminants.
- Many of the precipitation events in 2012 were hydrologically undetectable beyond the second pond, and the time required to pass through all the ponds during 2012 was on the order of 5 days
- Nutrient levels (nitrate and phosphate) were elevated (pond event average was 0.4 ppm and 0.1 ppm for nitrate and phosphate, respectively) above background levels during precipitation events; however, there is no clear indication that fertilizer-derived nutrients are adversely affecting water quality.

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Storm Water BMPS at GVSU

- Bio swales
- Permeable Concrete and Asphalt
- Rain Gardens (Large and Small)
- Detention Ponds
- Green roofs
- Vegetated buffers (no mow zones)

Mackinac Bio Swale after light rain

Mackinac Bio Swale after heavy rain

Other BMP examples

Permeable Concrete

Green Roof on Mackinac Hall

Bio swale with art

BMP examples

Permeable Asphalt

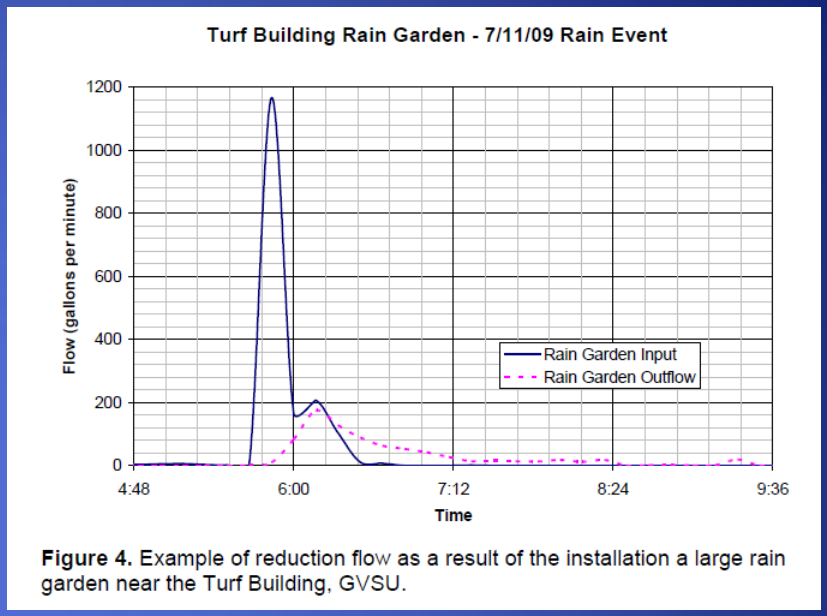

Figure 4. Example of reduction flow as a result of the installation a large rain garden near the Turf Building, GVSU.

Turf Building Rain Garden

BMP Benefits

Introductory geology students at storm water ponds

Bald Eagle at the Pierce Storm Water Management Complex 2011

Acknowledgements

- Dr. Eric Snyder, GVSU
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GVSU's Storm Water Future

- **Strategic Water Quality Initiative (SAW) grant to update GVSU storm water management plan**
- **Data collection and monitoring with students**
- **Faculty participation in planning process (SWAG)**
- **Collaboration with other's implementing storm water solutions in West Michigan**
- **Storm water art**

Questions ?

http://www.gvsu.edu/stormwater

http://faculty.gvsu.edu/wamplerp/

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