



Michigan's Failing Infrastructure

Michigan's history of disinvestment in its infrastructure, communities, education and people, if not reversed, will cause Michigan to become the "come apart" state rather than the comeback state.

*- Michigan League for Public Policy,
March 2016*

"Our conclusion is that the State of Michigan has failed our cities," says former state treasurer Robert Kleine. "We have a dysfunctional system of local government organization and financing. The entire system needs to be overhauled. We cannot have a strong state without strong communities."

*- Tony Minghine, Associate Executive
Director of the Michigan Municipal League.*



The Importance of Water

New research has found that “blue space” including seas, rivers, lakes and even urban water features can have a positive impact on wellbeing.

- *Tim Smedly, The Guardian, March 2013*

The study found that introducing water into images, from a pond to a coastline, elicited a strong preference from participants for more water in the images.

“We repeated that with urban scenes, from fountains in squares to canals running through the city and, once again, people hugely preferred the urban environments with more water in them.”

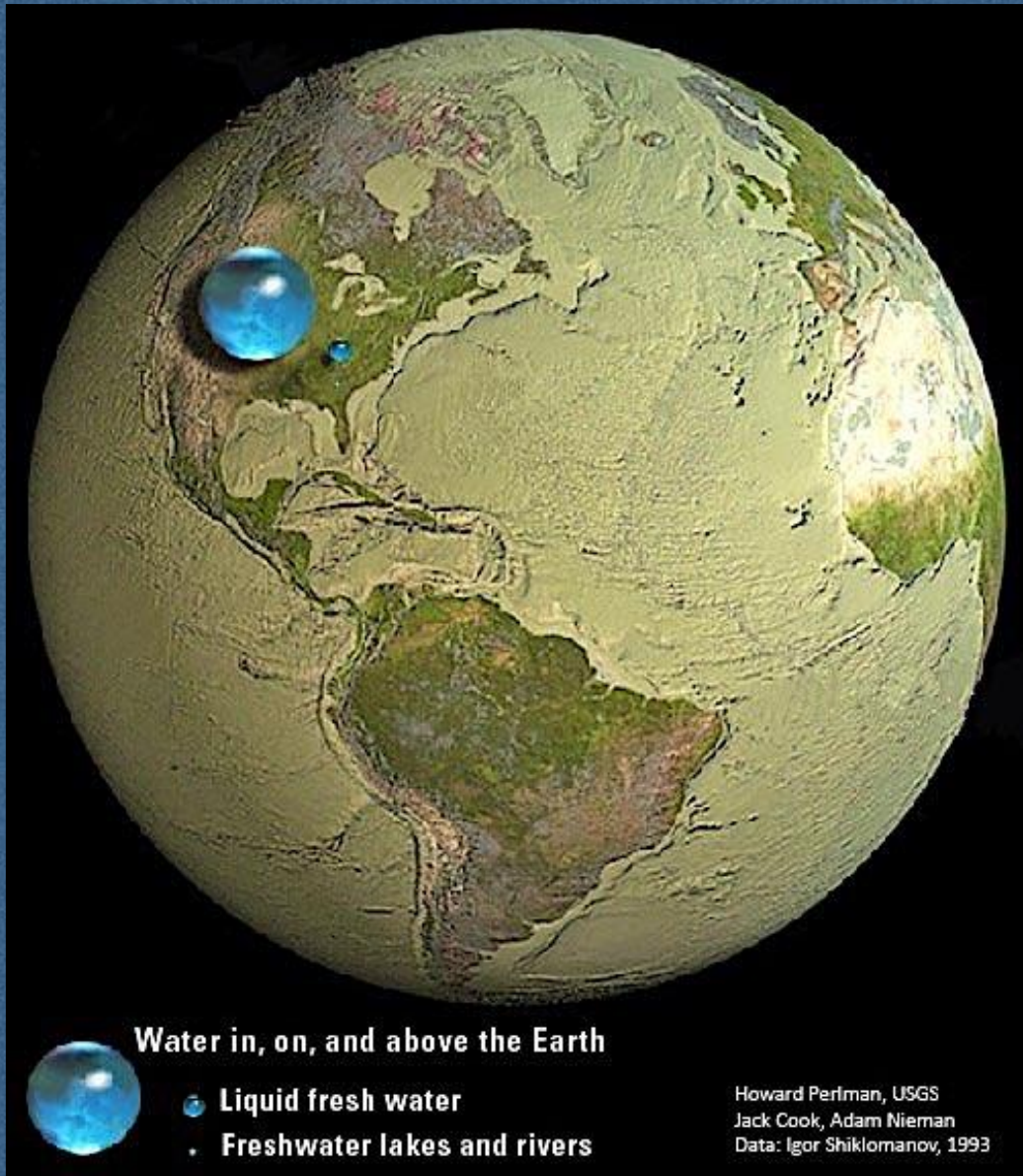
Images with green space were received positively but images with both green and blue got the most valuable response of all.

- *The Guardian, March 2013*

Study Confirms What We Already Knew: Living Near Water Can Reduce Stress

Health and topographic data were analyzed and found that “increased views of blue space is significantly associated with lower levels of psychological distress. We did not find that with green space.”

- *Michigan State University Health Geographer Amber L. Pearson.*



It seems remarkable to me that the earth, which seems to have so much water, really has so little water.

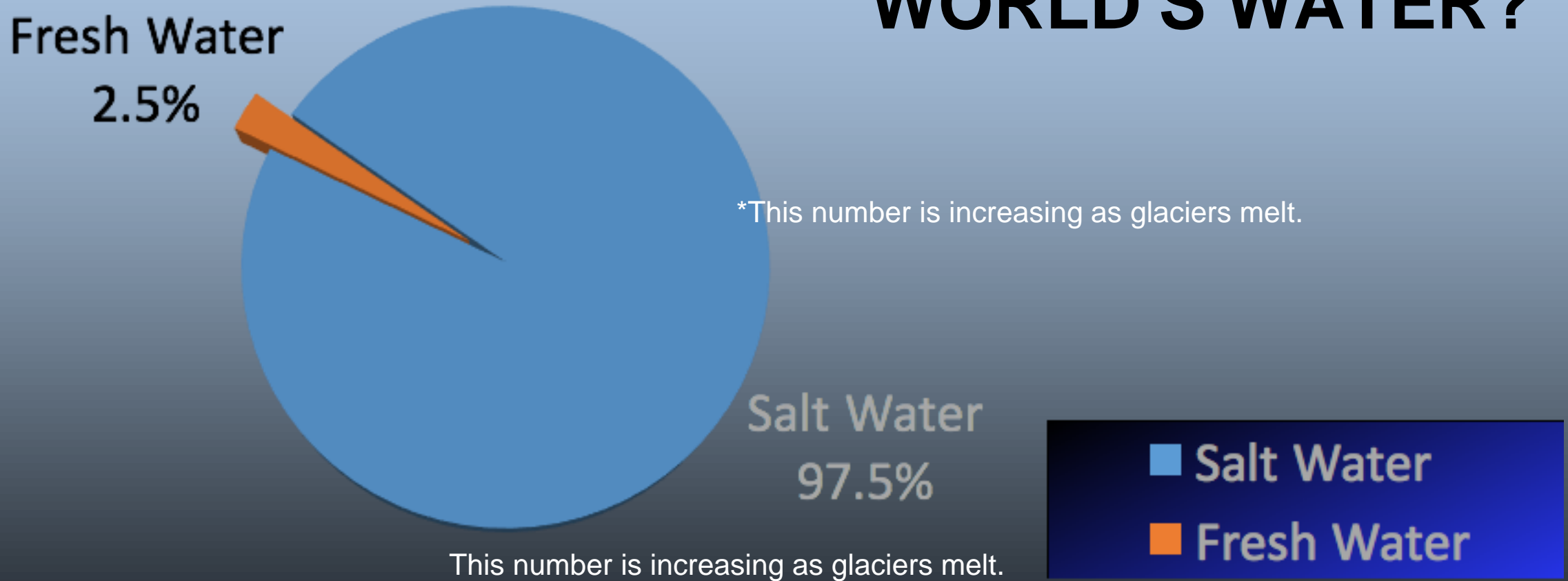
This graphic shows all the water in the world. The reality is, our water is really a thin layer on our globe's surface.

Note the size relationship between how much freshwater there is, compared to all the water there is.



70% of the world is covered in water.

WHERE IS THE WORLD'S WATER?



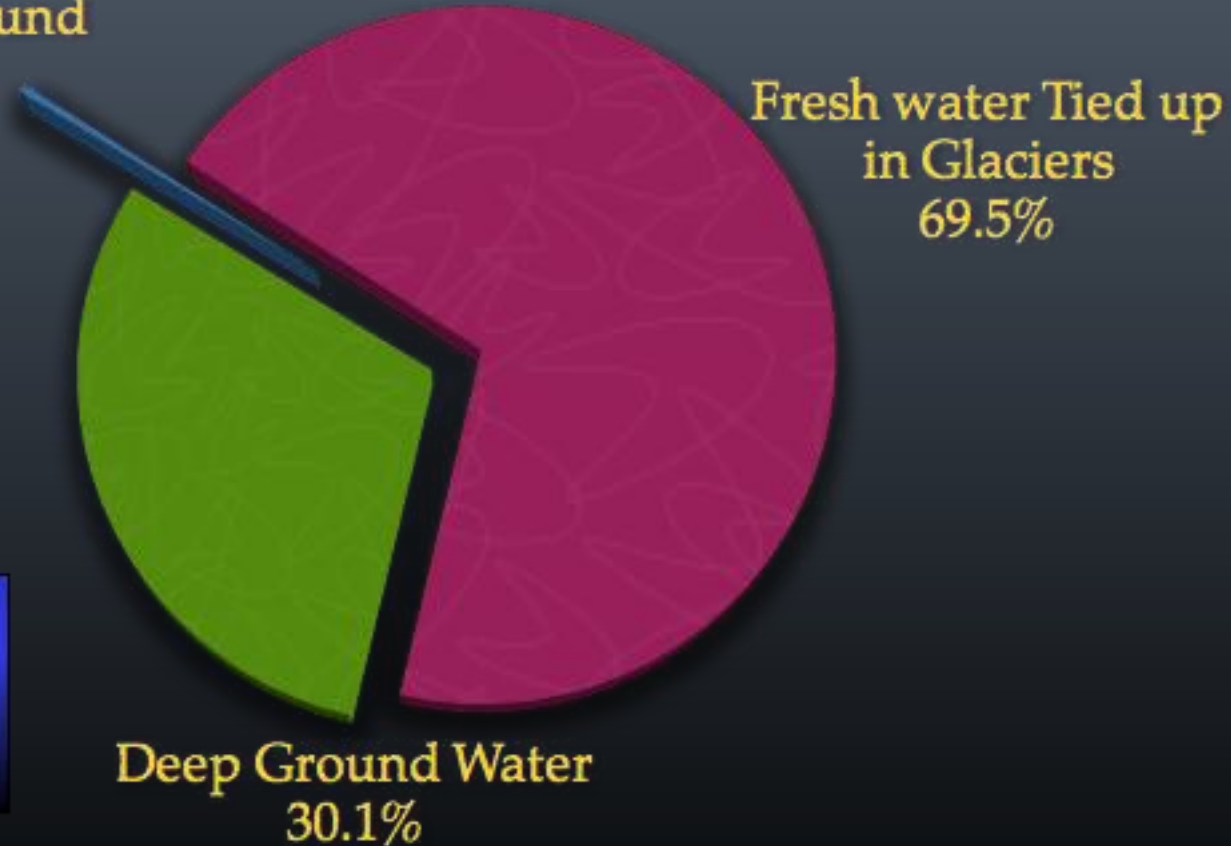
2.5% of all the World's Water is Fresh Water



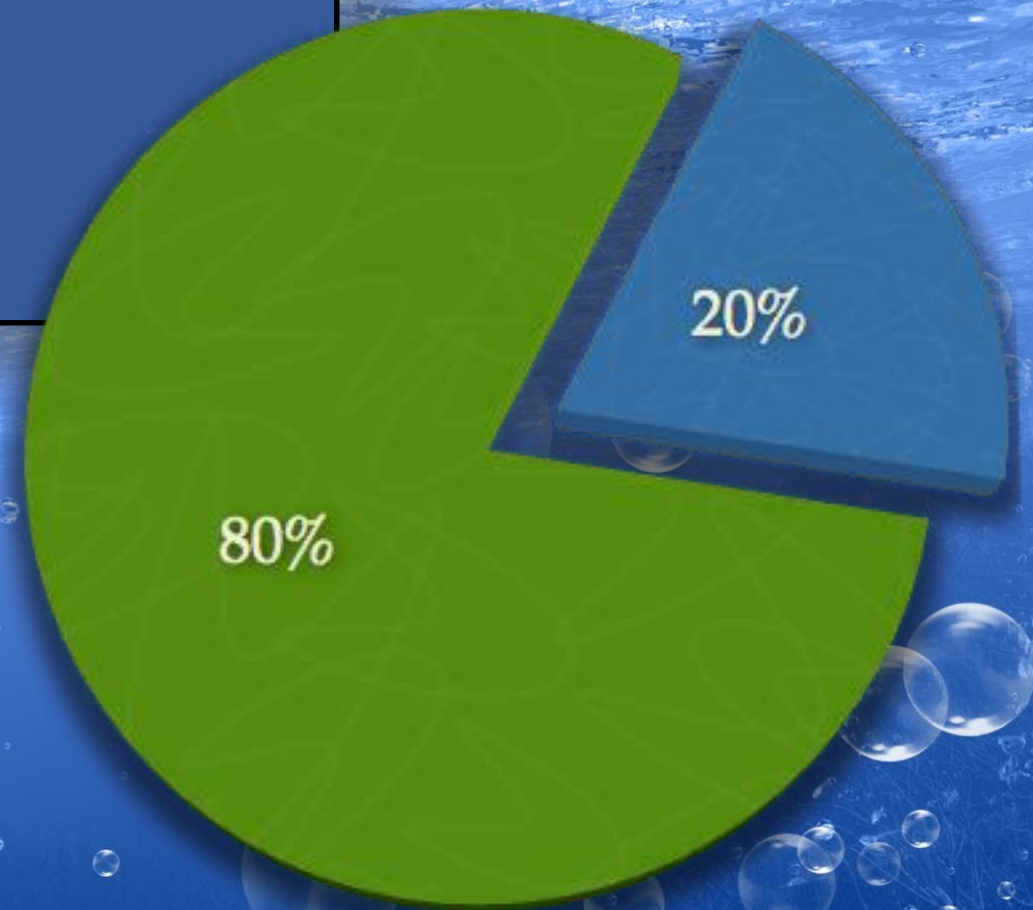
Usable Surface or
Shallow Ground
Water
0.4%

Most of the world's fresh water is not easily reached
and therefore not available to our use

- Fresh water Tied up in Glaciers
- Deep Ground Water
- Usable Surface or Shallow Ground Water



**Of the World's accessible or usable 0.4%
Fresh Water,
about 20% is in the
Great Lakes Basin**



■ **Great Lakes**
■ **The Rest of the World**

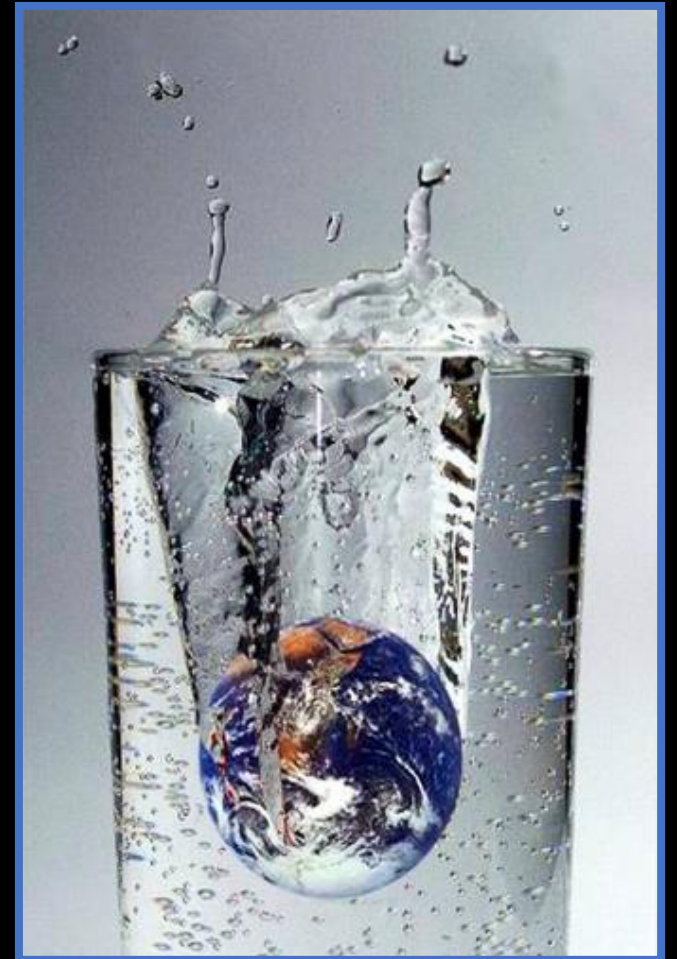
Improving Water Quality by managing the World's Fresh Water

Not for short term gain, but for the future

What folly we perform when we act
contrary to our best interest.

Why do we do it?
How can we stop?

You don't have to look far.
Just look at Flint Michigan

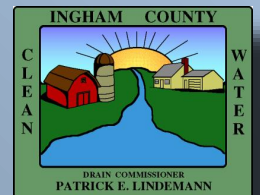


ПРИВІТ
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A watershed is a geographical area that holds a system of many complex and interrelated sets of an ecosystem (layers) that are interdependent on a common flow of energy, material transport (waste removal), and nutrient input and output as a result of water collection, storage and movement.

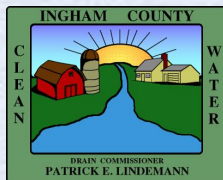


Patrick E. Lindemann (1996)



Thinking from a watershed perspective,
means thinking “systemically” or

“Systems Thinking.”





1966 MSU's Campus Canoe Livery

The problem Many years of land-use abuse

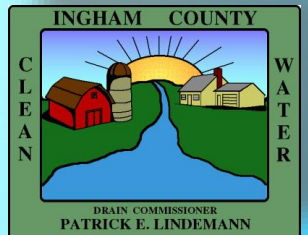
How could we ever have let this happen to our water resources?

Red Cedar River - Clean Water
Healthy Environment

INCLUDING

Land Development - Better Economy
More Jobs

MONTGOMERY DRAIN



The problem Many years of
land-use abuse

We have turned our backs
on the river and forgotten
its importance to our
communities



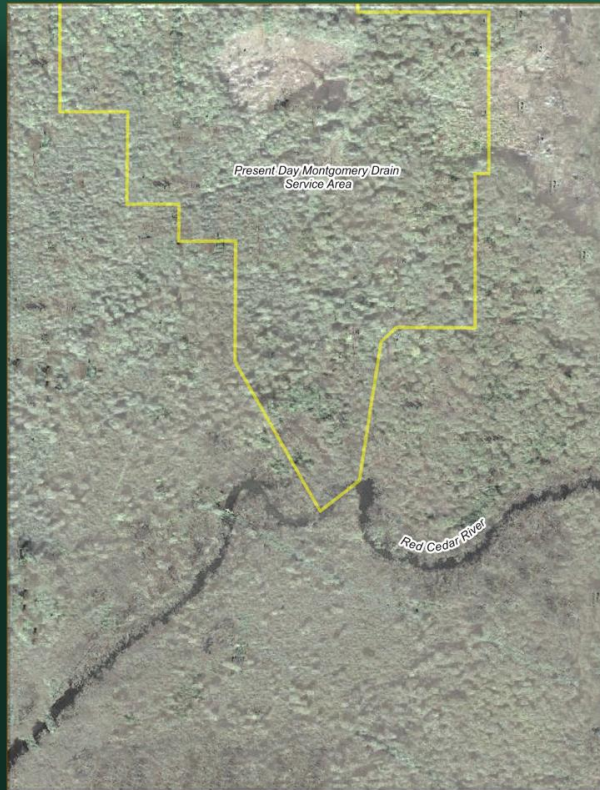
How Clean is Clean?

The Clean Water Act of 1972 Sets the Standard

- **“Fishable and swimmable” wherever attainable by 1983**
- Elimination of the discharge of pollutants (zero discharge) by 1985
- Prohibition of the discharge of “toxic pollutants in toxic amounts.”
- “Restore and maintain the chemical, physical, and biological integrity of the Nation’s water”



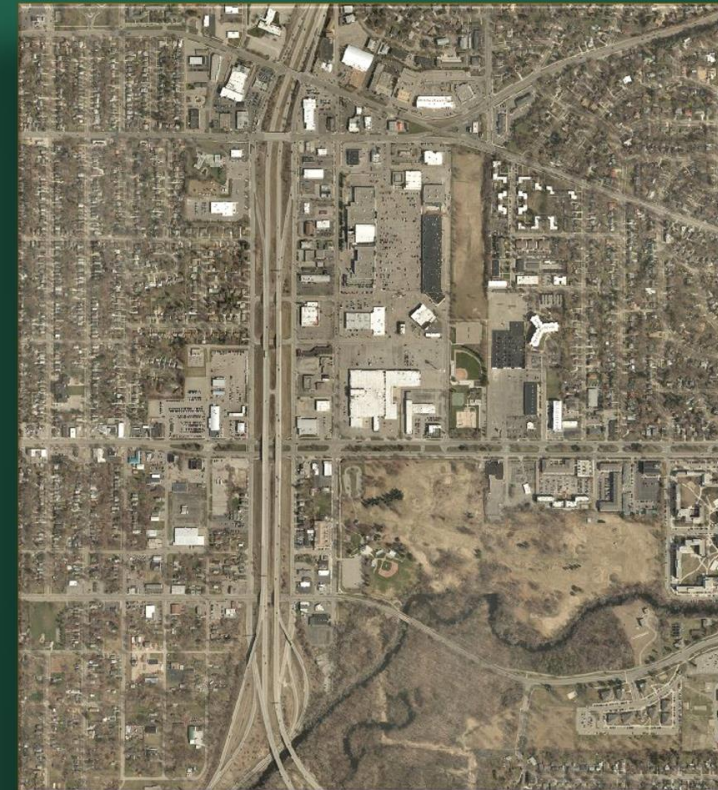
Montgomery Drain Service Area Chronological Change in Land Use



Pre-Settlement Conditions



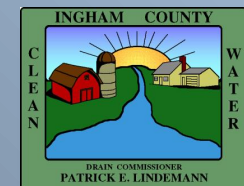
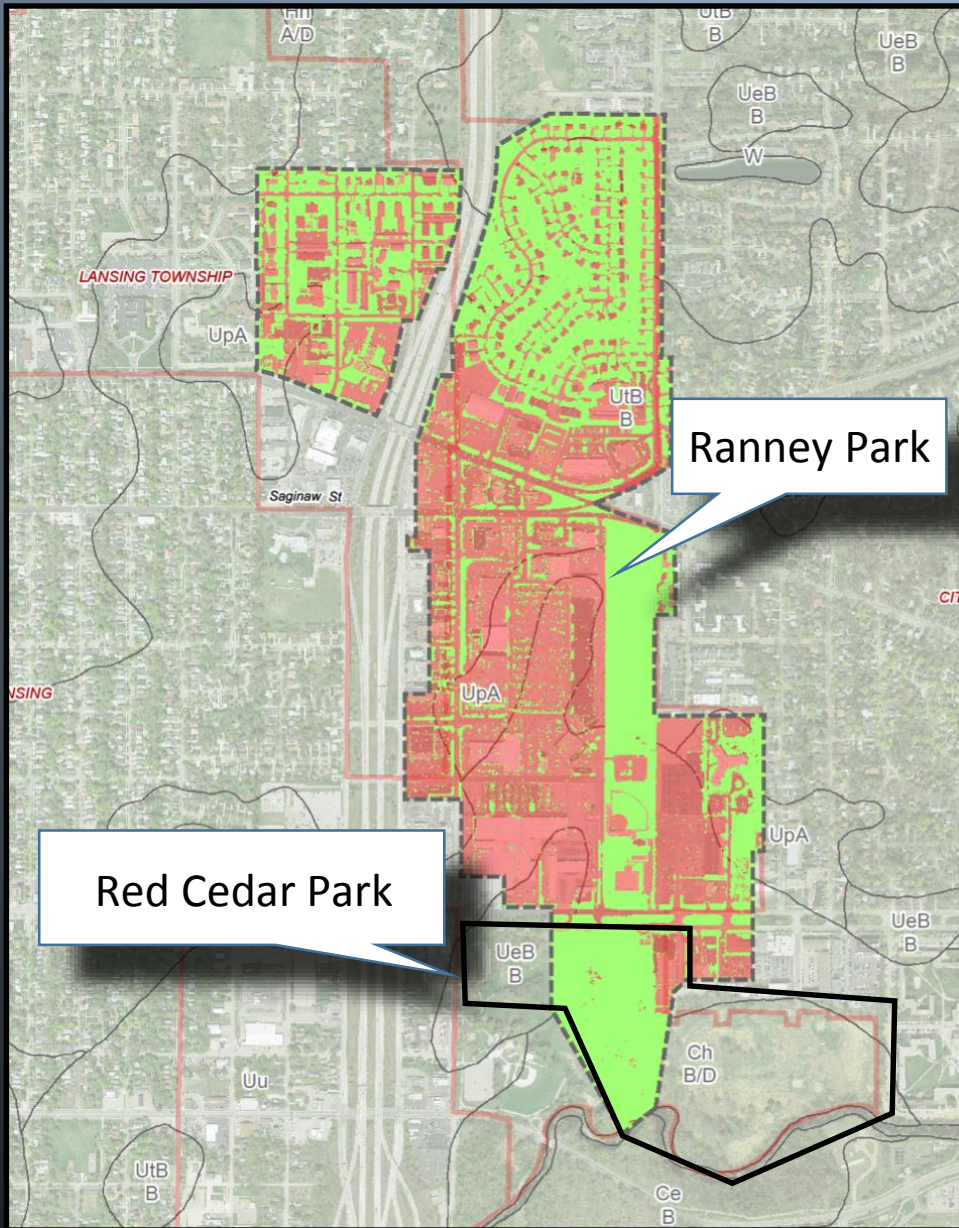
1938 Aerial Image



2015 Aerial Image

Intensive Land Use

Montgomery Drain's watershed is about 80% impervious. The stormwater from any storm event makes it to the Red Cedar River in a matter of hours or less, untreated and heavily polluted from impervious surfaces of its watershed.



Grants for this Project

SAW Grant

2016 Grant Award anticipated \$1,319,417

MDNR GRANT

2017 Grant applied for \$250,000

MDNR GRANT

2017 Grant applied for \$500,000



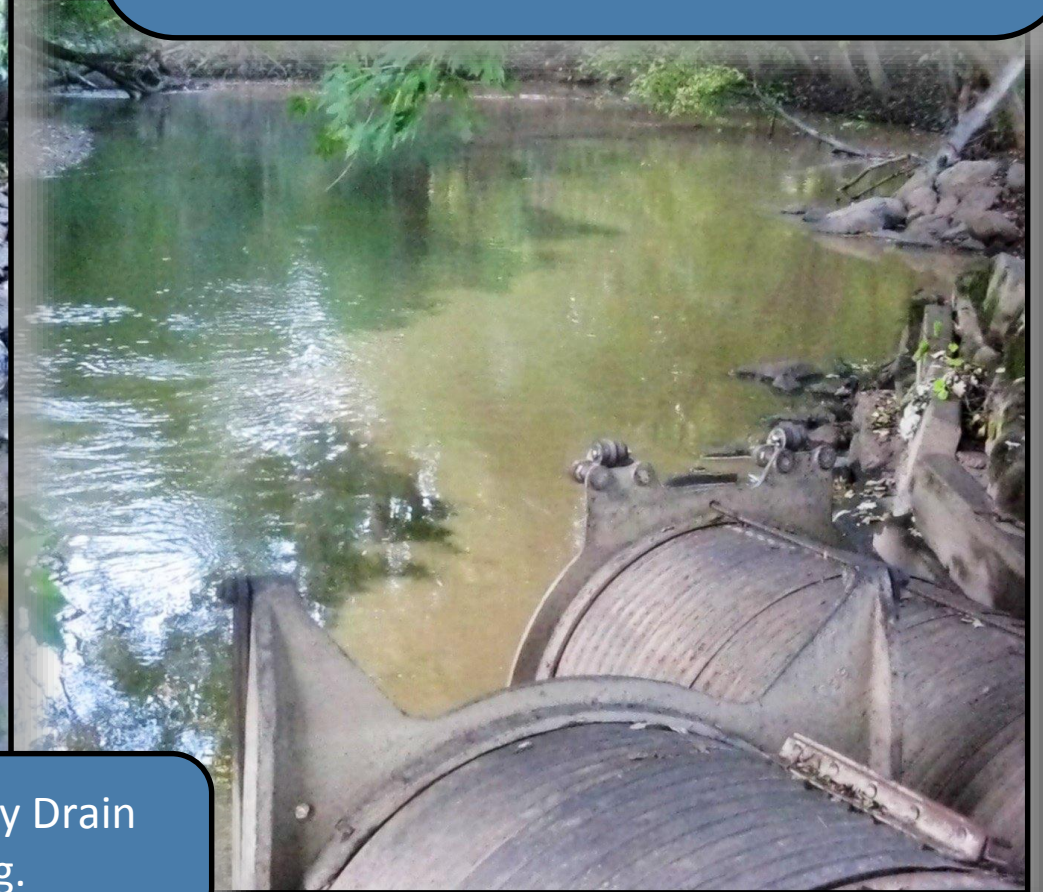
Grants to date total \$2,069,417

A PROBLEM WAS FOUND MID-90s



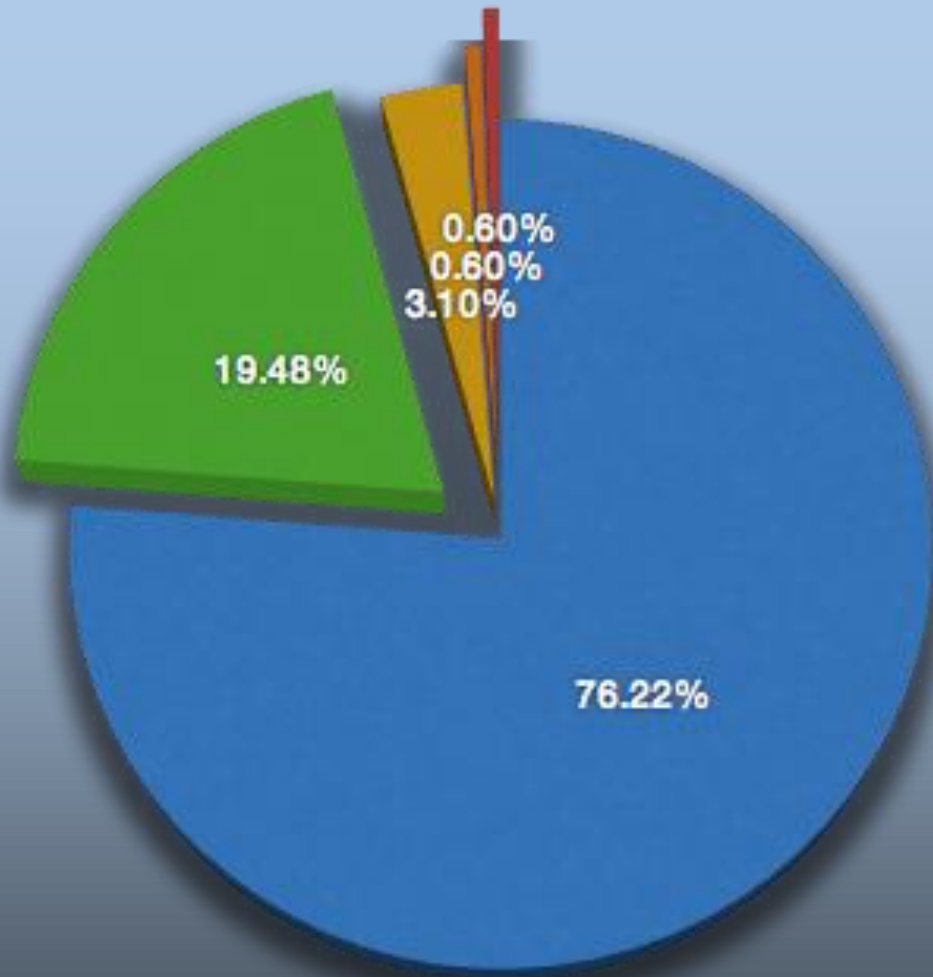
These pictures show pollution coming from the Montgomery Drain outlet into the Red Cedar River on a sunny day in late spring.

In 1995 and for many years after, the Drain Commissioners of Ingham and Livingston Counties looked closely at 236 County Drains, tributary to the Red Cedar River in both counties. Detailed analyses showed that the Montgomery Drain contributed the most pollutants by far.



This photo of the Montgomery Drain Outlet from Spring 2016 shows pollutant loading persists.





Project Goal

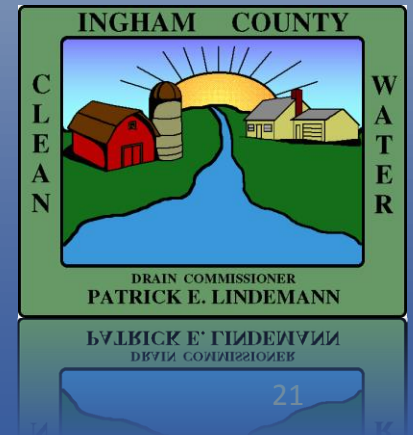
- The design concept for the Montgomery Drain aims to manage and clean 95.7% of all the storm events.
- Leaving only 4.3% partially cleaned.
- The design criteria for this project is to collect, store and clean the storm water before it is sent to the Red Cedar River.
- The capacity of this system can handle slightly over a 2 inch storm in 48 hours (which represents roughly 96% of all the storms).

■ 0-1in
 ■ 1-2in
 ■ 2-3in
 ■ 3-4in
 ■ 4in-+



Recent data collection on the condition of the stormwater runoff showed that this watershed is more polluted than we thought.

POLLUTION CAPTURED CATCH BASIN IN PARKING LOTS



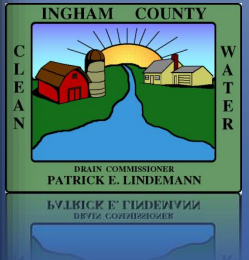
Samples of stormwater runoff on its way to the Red Cedar River from different places in the Montgomery's Watershed



Details of these runoff samples are available, location and contamination data

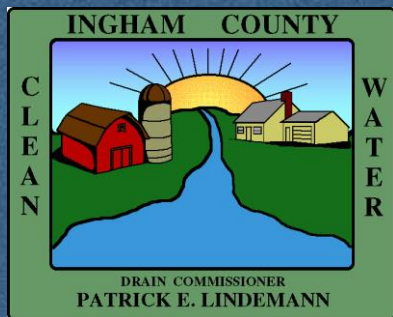


This project will reduce flooding from minor storms such as shown here. The amount of reduced flooding will vary depending on storm intensity and volume.



This presentation includes some of the data we've collected. There is much more data. If you wish to see more, let us know.

The contaminants of concern have been consistently identified in events we have sampled.



Runoff contaminated with pollutants from the drainage district flushes directly into the Red Cedar River.



Identified Contaminants of Concern

Metals

Hydrocarbons

Nitrogen

Phosphorous

Particulates

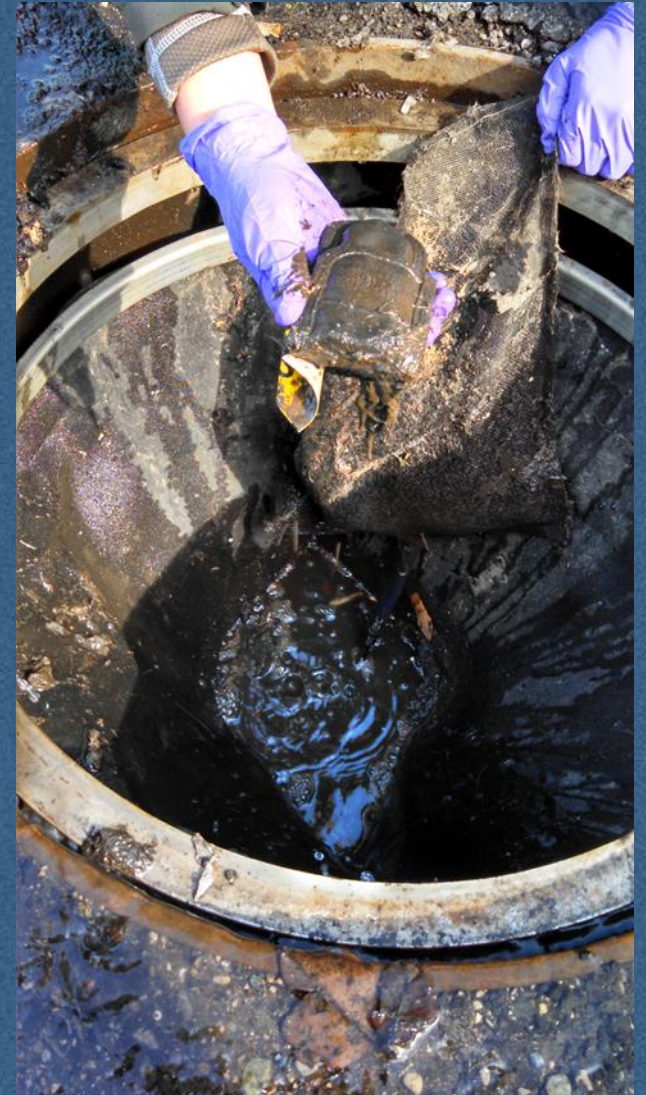
Low Dissolved Oxygen Concentrations

Chloride

Cyanide

Total Dissolved Solids

NOTE: Each contaminant listed exceeded Michigan Department of Environmental Quality and United States Environmental Protection Agency standards or recommendations for the protection of water quality.



Montgomery Drainage District, 2015.

Metals

Metals of concern:

Copper Sodium
Lead Zinc

Sources:

Auto fluids (oils, grease)
Auto Deterioration (brake pads, tires, rust)
Galvanized metals, Paints
Wood preservatives, Roofing materials
Asphalt wear, Road salt

Environmental and human health effects:

Environmentally non-biodegradable
Cellular damage
Builds up in the body
Many heavy metals highly toxic and/or lethal to organisms.



Montgomery Watershed, 2015.



Hydrocarbons

Hydrocarbons of concern

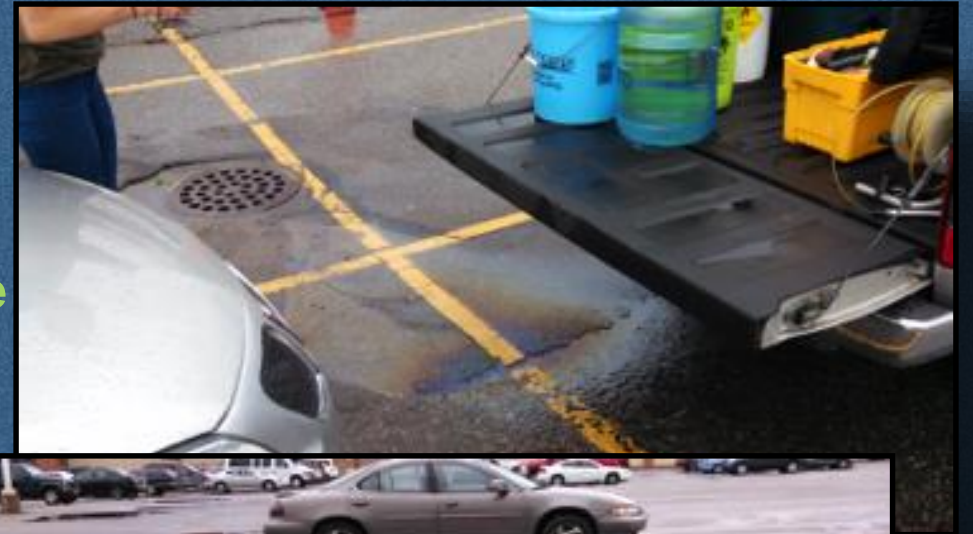
- benzo(a)anthracene , benzo(a)pyrene benzo(b)fluoranthene
- benzo(ghi)perylene, benzo(k)fluoranthene
- bis(2-ethylhexyl)phthalate, carbazole
- Chrysene, di-n-octyl phthalate
- Fluoranthene, indeno(1,2,3-cd)pyrene
- Phenanthrene, pyrene

Sources:

Combustion, Gasoline spills, vapor
Motor oil, Asphalt sealcoats

Environmental and human health effects:

- Likely cancer-causing
- Toxic effects on the immune, reproductive, nervous, and circulatory systems



Montgomery Watershed, 2015.

Nitrogen and Phosphorous

Sources:

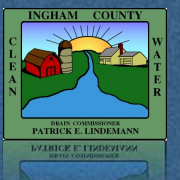
- Fertilizers
- Detergents
- Leaking sanitary sewers
- Animal waste
- Fossil fuel combustion



Algae Ingham County Stormwater Outlet, 2015.

Environmental and human health effects:

- Oxygen depletion in the water
- Excessive algal growth



Particulates

Sources:

- Construction activities
- Automotive deterioration
- Eroded pavement and landscape
- Dust buildup on surfaces
- High runoff flow rates



Montgomery Watershed, 2015

Environmental and human health effects:

- Heavy metals and hydrocarbons bind to particulates
- Particulates allow for mobilization and availability of metals and hydrocarbons
- Deteriorates aquatic species habitat and aesthetic quality of water bodies.

Oxygen demand concerns:

Microorganisms and chemical reactions can use up large amounts of oxygen from the water as it is required for many processes by which organic and chemical substances are broken down.

Sources:

Nutrients

Animal wastes

Detergents

Fats

Oils

Grease

Engine coolants

Antifreeze

Leaves and grass clippings

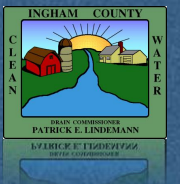
Environmental and human health effects:

- Reduced oxygen in water
- Poor environment for survival of aquatic organisms

Oxygen Demand



Snowmelt Samples from the Montgomery Watershed, 2015.



Low Dissolved Oxygen Concentrations

Dissolved oxygen concerns:
Concentrations observed below levels that support aquatic life.

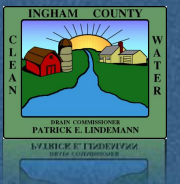
- Oxygen-demanding microorganisms
- Chemical reactions
- Decaying organic material
- High water temperatures
- Oxygen-demanding microorganisms
- Chemical reactions
- Decaying organic material
- High water temperatures



Snowmelt Samples from the Montgomery Watershed, 2015.

Environmental and human health effects:

- Inhibit the growth of aquatic life
- If DO levels are too low, it will be lethal to aquatic life



Chloride

Sources:

Road salts

Deicers

Water conditioning salt

Synthetic fertilizer (primarily KCl)



Environmental and human health effects:

Montgomery Watershed, 2015

Stress on aquatic organisms

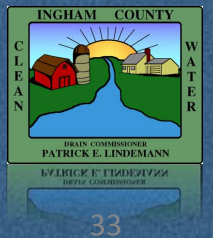
Inhibition of survival, growth and reproduction of aquatic organisms

Illness of wildlife species

Inhibits plant growth

Can increase the availability of other toxic substances in the water

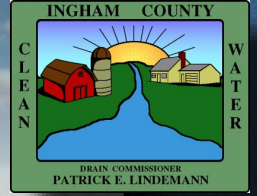
Lowers dissolved oxygen levels



Cyanide

Sources:

- Road salt (anti-caking agent)
- Vehicle exhaust
- Chemical processing



Montgomery Watershed, 2015

Environmental and human health effects:

- Cyanide inhibits reproductive, respiratory, and osmoregulation systems
- Is a neurotoxin
- Is lethal at low concentrations (in the parts per billion range for some aquatic organisms).

Total Dissolved Solids



Sources:

- Road salts
- Construction activities
- Poor landscape maintenance
- Auto leaks and deterioration
- Galvanized metals
- Paints

Wood preservatives

Roofing materials

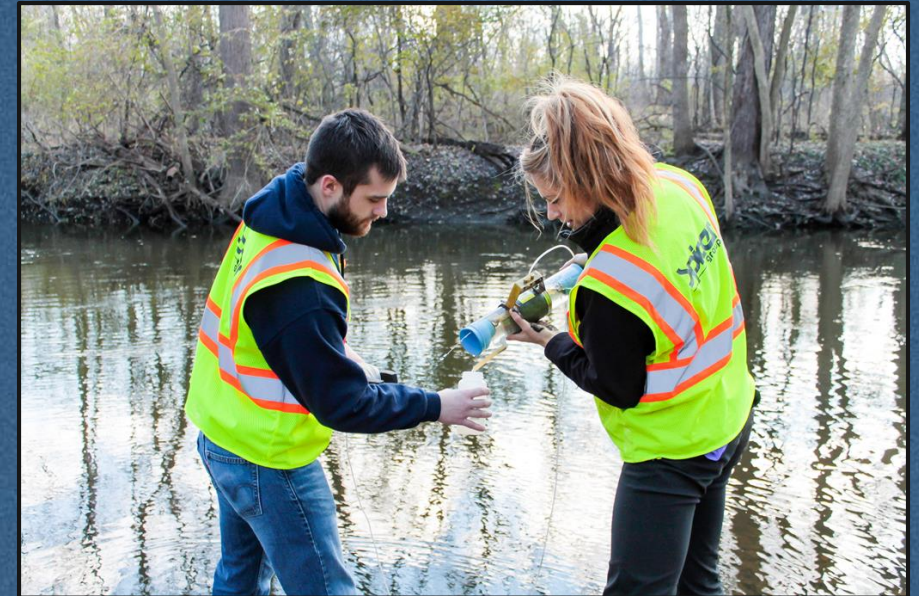
Excessive fertilizer and pesticide use

Atmospheric pollution

Dust buildup

Environmental and human health effects:

- Is a general indication of pollution
- Reduces spawning rates
- Aquatic organism juvenile mortality
- Increases salinity Increases toxicity of other contaminants



Sampling Red Cedar River, 2015

The next set of slides will include data collected from a single .5" rain event. There are much more data.

The contaminants identified here are consistently identified in other sample events.

We have collected data for multiple storm events. We found over 200 types of pollutants. In these next slides I will talk about 5 of these contaminants



Pollutant Loads-Metals

2.5 lbs of metals – Metal pollution of the tire wear of 6,069 motorists who drive the total Montgomery Watershed road mileage each day for a week.



Source: Faris Tires. Accessed 2016. http://www.faristires.com/tire_inventory_pictures

Pollutant Loads-Nutrients

Over 17 lbs of nutrients – Nitrogen and Phosphorous within 2 bags (total of 66 lbs) of 13-13-13 lawn care fertilizer (N-P-K)



Source: Smith Farm Supply, accessed 2016, http://www.smithfarmsupply.com/#!page_products



Algae Observed at an Ingham County Stormwater Outlet, 2015.

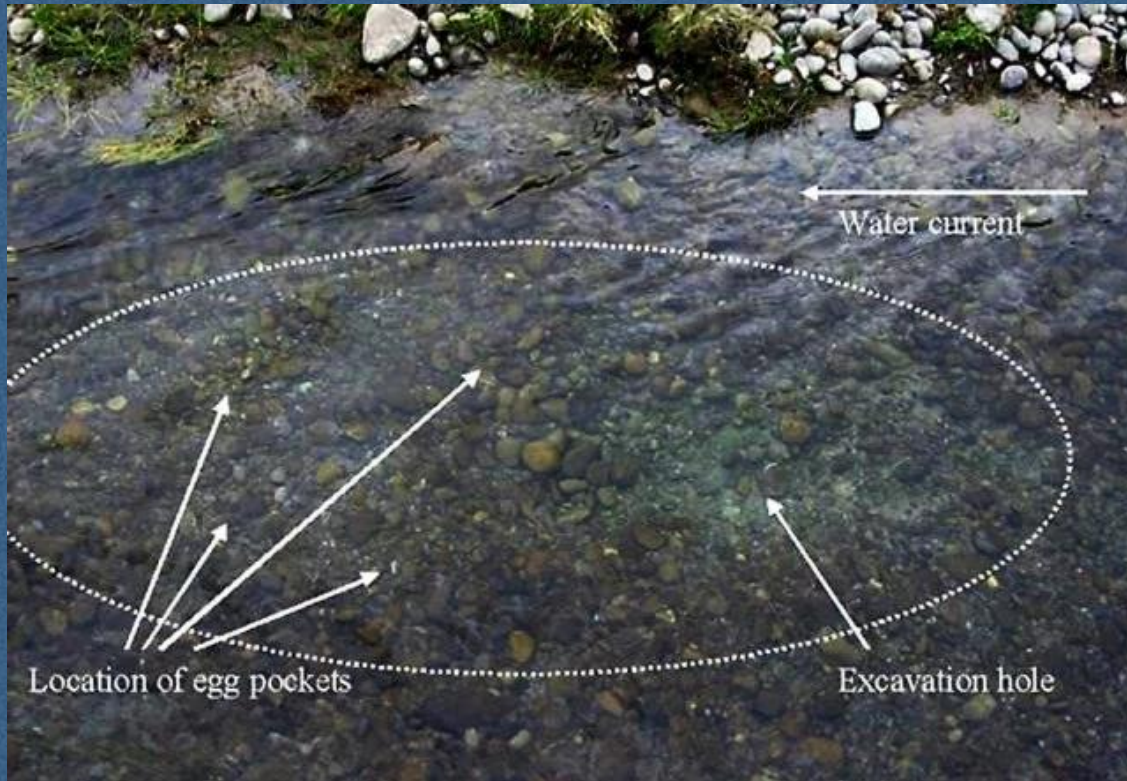
Pollutant Loads-Sediment

Over 900 lbs of sediment - Equal to the volume of water contained inside of a baseball infield 22 ft deep would be required to dilute the sediment load observed in runoff to levels of non-concern.



Pollutant Loads-BOD

Over 150 lbs of BOD— Is equal to Oxygen consumption of 26,747 steelhead trout beds (1000 eggs per bed) through a complete incubation period.



Source: Big Hole Lodge. Accessed 2016. <http://montanafishingblog.com/2011/04/page/2/>



Source: Biology Around Kris. Accessed 2016. <http://www.krisweb.com/stream/sediment.htm>

Pollutant Loads-Total Dissolved Solids

2500 pounds of total dissolved solids,
which is equal to 125 x 20 pound bags of sidewalk/road salt



Source: Population Education. Accessed 2016. <https://www.populationeducation.org/content/environment-under-salt>

Source: Cloud Snow Removal. Accessed 2016. <http://www.iceandsnowremovalservice.com/salt-sales.aspx>

The previous 5 slides showed data from a single half-inch storm. From that sample rain event, we identified five types of contaminants contributing more than 4,000 pounds of pollution to the Red Cedar river; additional pollutant loading from other sources was not detailed.

In any given year, the Montgomery Drain will discharge between 50,000 - 75,000 pounds of pollutants directly into the Red Cedar River and possibly as much as 100,000 pounds.

The yearly rainfall totals, along with storm intensity and duration, vary widely from year to year and season to season, making it very difficult to determine exact quantities. However, based on the data collected, we can confidently report that the level of pollutants discharged is not less than 50,000 pounds per year.



The City of Lansing and Ingham County Petition Drain Commissioner to solve the Montgomery Drain pollution problem in 2014.



EPA Clean Water Act - the “Six Minimum Measures”

- Public Education and Outreach
- Public Involvement / Participation
- Illicit Discharge Detection and Elimination
- Construction Site Storm Water Runoff Control
- Post-Construction Management
- Pollution Prevention / Good Housekeeping

Red Cedar Park - Infrastructure for Clean Water AND Economic Development





Ranney Park Summer



Ranney Park - Summer



Ranney Park - Winter

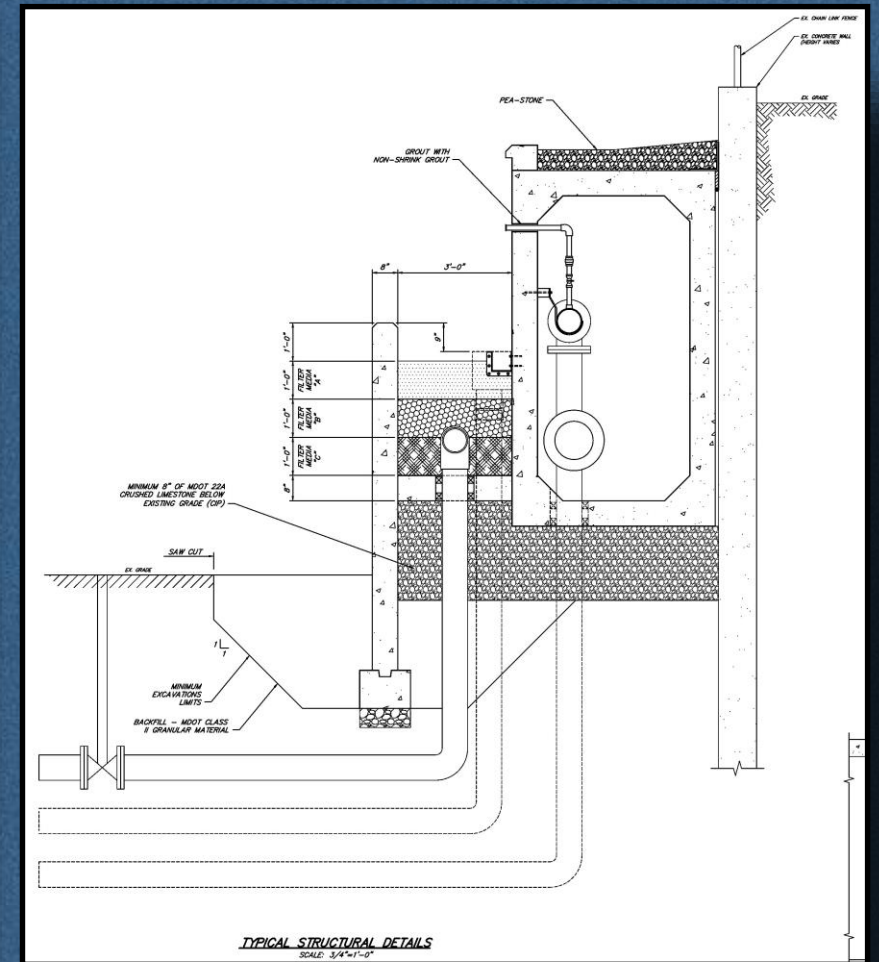


North End of
Frاندor Shopping Center
and
South of Saginaw Hwy.



Water Quality Walls

This wall can filter pollutants from about one half square mile of stormwater before the water flows further downstream to the river.





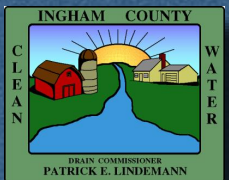
Water Quality Walls

These water quality walls can treat & clean the first flush (1st Half inch) from the whole Montgomery watershed in 64 hours.

Storms vary in size and intensity; rainfall from heavier storms may bypass parts of the system. That is why the system has to be designed with other Best Management Practices (BMPs) such as wetlands and other low-impact elements.



Michigan Ave. Looking West in front of Dunham's Sports





This is the Goal

EPA Clean Water Act - the “Six Minimum Measures”

- Public Education and Outreach

- Public Involvement / Participation
- Illicit Discharge Detection and Elimination
- Construction Site Storm Water Runoff Control
- Post-Construction Management
- Pollution Prevention / Good Housekeeping

So...How do we get people to the site to experience the educational aspects of Low Impact Design for Water Quality.

We turn STEM into STEAM

Science, Technology, Engineering & Math - add the Arts!



Artist: Linda Beeman

Art in the Wild

Mid-MEAC & Ingham County Drain Commissioner

Mission: Enhance environmental restoration through the integration of art and human imagination.

Goal: Fund, select, place and maintain in perpetuity, art in areas of environmental renewal.

Art in the Wild's Plans for this Project

Activities

Visual Art (In and Around The Drain Project)

- Sculptures
- Painting (artists on site)
- Wall Mural placements



Artist: Linda Beeman

Art in the Wild's Plans for this Project

Activities cont.

Live Literary Arts

- Stage Plays
- Poetry Reading



Art in the Wild's First Steps cont.

Essays

Fiction

Poetry



Displayed on Kiosks

Mid-MEAC & Ingham County Drain Commissioner

Art in the Wild's Plans for this Project

Activities cont.

Performing Arts

- Music
- Dance



Art in the Wild's Plans for this Project

Community Engagement

Living Classroom

- * Hosted Educational Tours
- * K-12 Curriculum
- * College & University Students



Mid-MEAC & Ingham County Drain Commissioner

Art in the Wild Sculpture



Supporting
Art in the Wild

Faces of Lansing

Art in the Wild Murals



Art in the Wild



Art in the Wild's First Steps

Wall Murals in and around the project area

- * First mural funded, to be placed soon
- * Art competitions for future murals
- * Photo Competition for inner-city kids



Artist: Linda Beeman

Art in the Wild Sculptures

**Celebrating Human
Imagination**

The Windlord

**Artist:
Martin Eichinger**



The Windlord

Through Art in the Wild, we can create a place that lifts us from the mundane to inspire the highest and best of who we are.

Sculpture by
Martin Eichinger
Bronze
Owned by City of Lansing



Art in the Wild Sculpture

Art in the Wild Sculpture



Floral Clock Sculpture
24 Feet in Diameter
Donated by Medawar Jewelry

Art in the Wild Sculpture



Celebrating MSU Basketball
Bronze

Artist: Doug DeLind

Donated by an
East Lansing Citizen

Art in the Wild's First Steps cont.

Performance Spaces

- * Music
- * Theater
- * Live Readings



Art in the Wild Sculpture



The Seurat Topiary Garden, Columbus Ohio

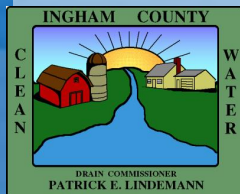


Questions and Answers

**The Lesson
Learned:**

Don't Wait

Just do it!

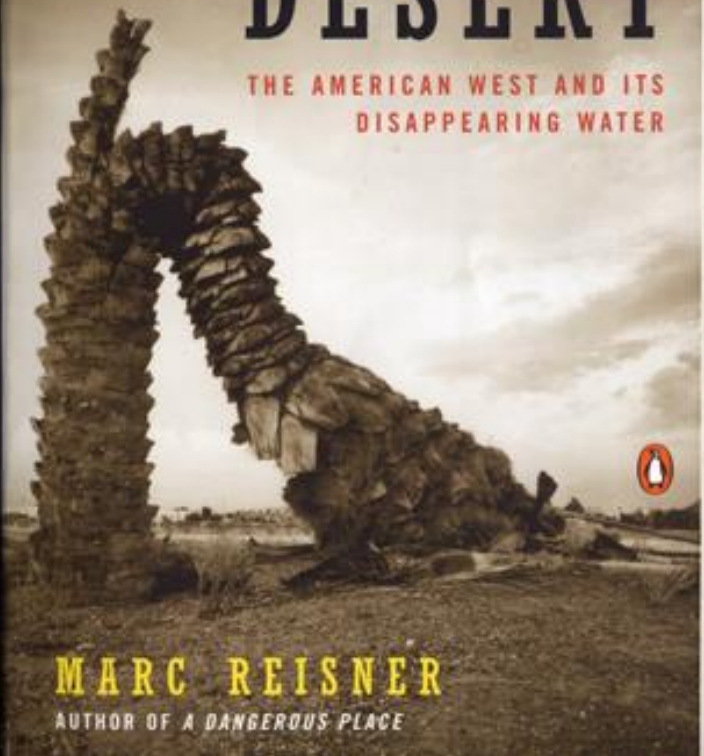


БҮЛІСК Е ПИДЕЛИШИ
DRAIN COMMISSIONER

"A savagely witty history of America's reckless depletion of its water resources"
—*Newsday*

CADILLAC DESERT

THE AMERICAN WEST AND ITS
DISAPPEARING WATER



MARC REISNER
AUTHOR OF *A DANGEROUS PLACE*

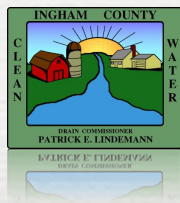
АВТОР ОД *А ДАНЖЕРОУС ПЛЕЙС*
МАРС РЕЙЗНЕР

WATER FOLLIES

GROUNDWATER PUMPING
AND THE
FATE OF AMERICA'S
FRESH WATERS

ROBERT GLENNON

РОБЕРТ ГЛЕННОН



References

WATER QUALITY CRITERIA:

Part 4: Michigan Department of Environmental Quality Part 4 Rules

Digital Source: http://www.michigan.gov/deq/0,4561,7-135-3313_3686_3728-350340--,00.html

Part 201: Michigan Department of Environmental Quality Part 201 Rules

Digital Source: http://www.michigan.gov/deq/0,1607,7-135-3311_4109_9846_30022-251790--,00.html

USEPA: United States Environmental Protection Agency (USEPA) National Recommended Water Quality Criteria

National Recommended Water Quality Criteria - Aquatic Life Criteria Table

Digital Source: <http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm#D>

National Recommended Water Quality Criteria - Human Health Criteria Table

Digital Source: <http://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table>

NURP: National Urban Runoff Program study conducted by the USEPA

Digital Source: http://www3.epa.gov/npdes/pubs/usw_b.pdf

ECO-25: Ecoregion VII Rivers and Streams study conducted by the USEPA

Digital Source: <http://www.epa.gov/sites/production/files/documents/rivers7.pdf>

RCRB: Red Cedar River Baseflow water quality criteria developed from measured parameters of the Red Cedar River under baseflow conditions—sampling and data analyses were performed by Spicer Group