

Greening of the Drains

*Exploring the New Paradigm in
Water infrastructure*
LID and Source Control



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

folly • *fol-ly /fɒli:/*

noun

1. the trait of acting stupidly or rashly • *syn:* foolishness, unwiseness
2. a stupid mistake • *syn:* stupidity, foolishness, imbecility
3. the quality of being rash and foolish • *syn:* foolishness, craziness, madness
4. foolish or senseless behavior • *syn:* foolery, tomfoolery, craziness, lunacy, indulgence

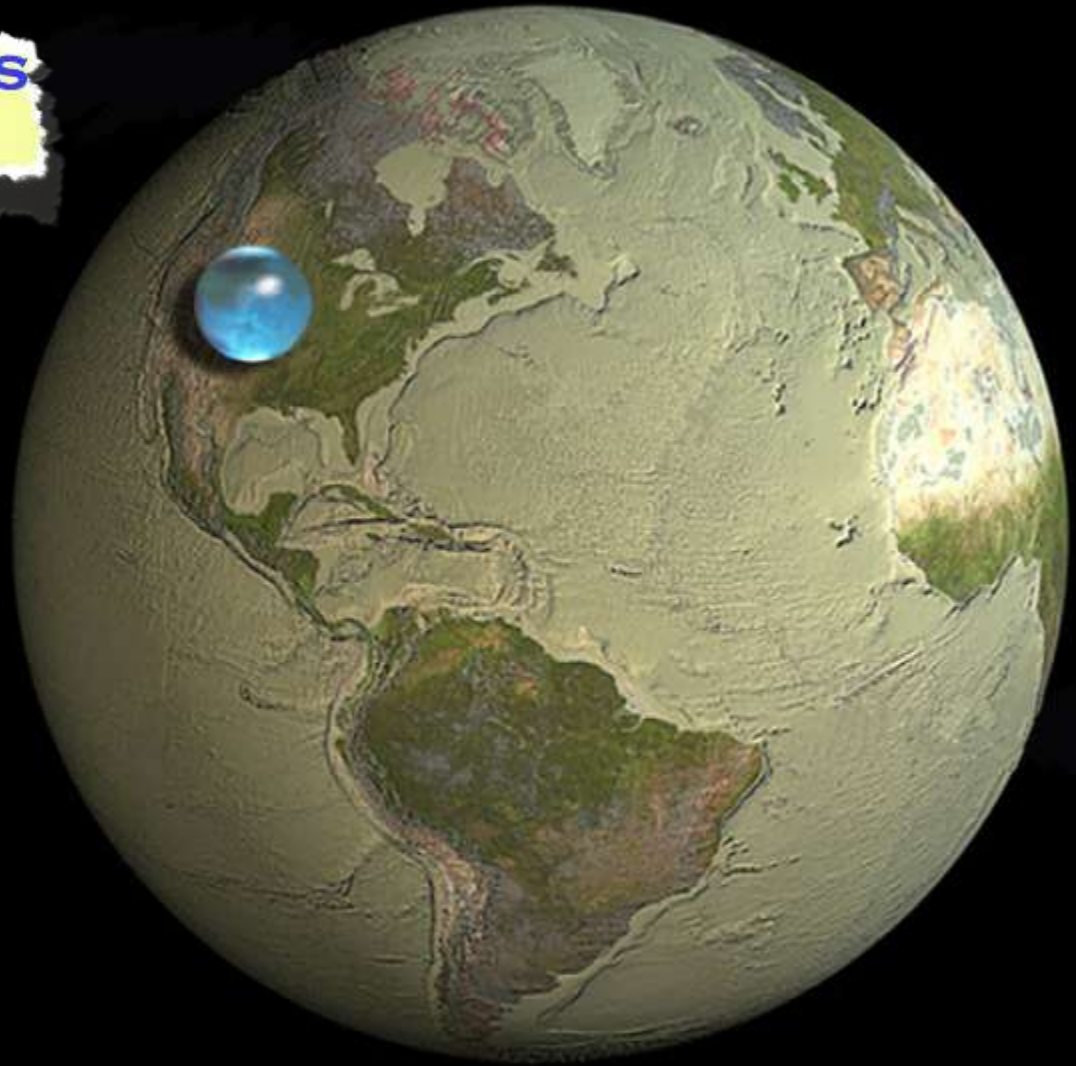


Is this really enough water

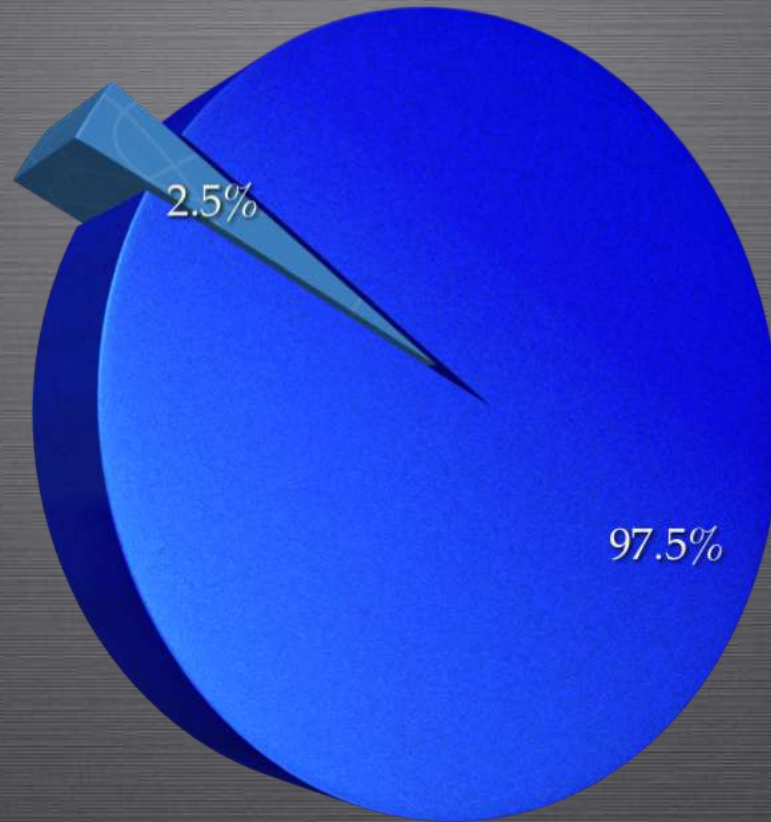
**ABOUT 860 MILES
IN DIAMETER**

Picture of Earth showing if all Earth's water (liquid, ice, freshwater, saline) was put into a sphere it would be about 860 miles (about 1,385 kilometers) in diameter. Diameter would be about the distance from Salt Lake City, Utah to Topeka, Kansas, USA.

Credit: Illustration by Jack Cook, Woods Hole Oceanographic Institution; USGS.



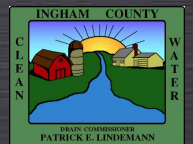
70% of the world is covered in water.



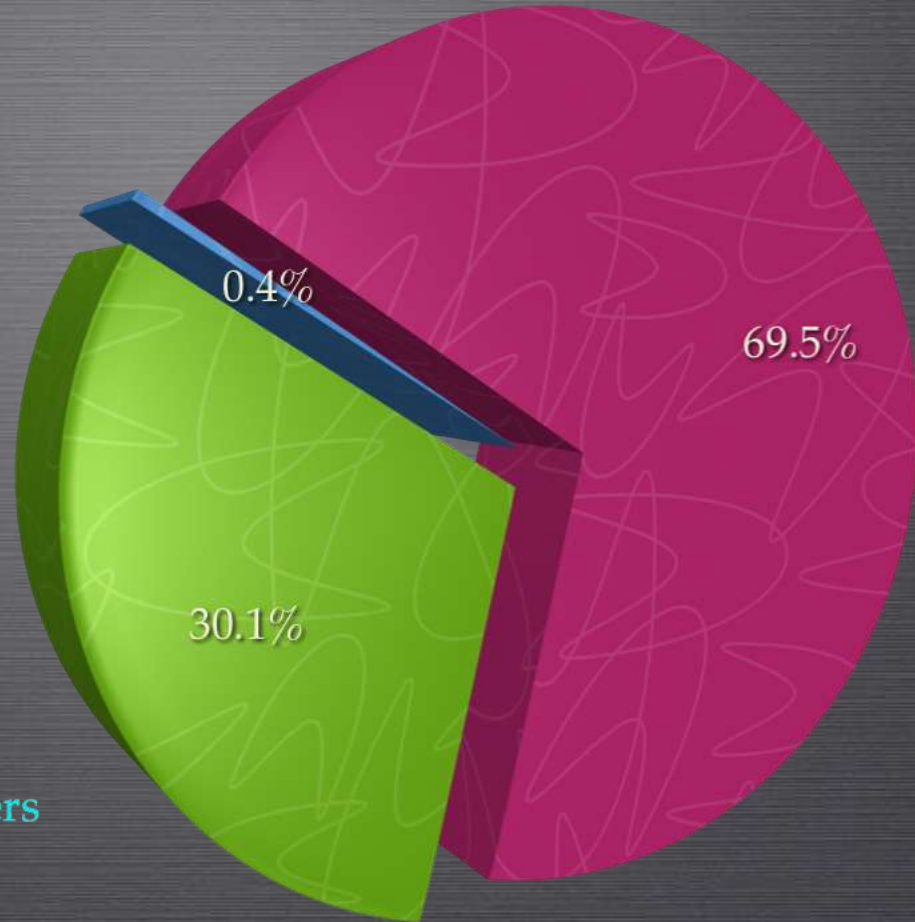
● Salt Water

● Fresh Water

All the water in the world



2.5% of all the Worlds Water is Fresh Water



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

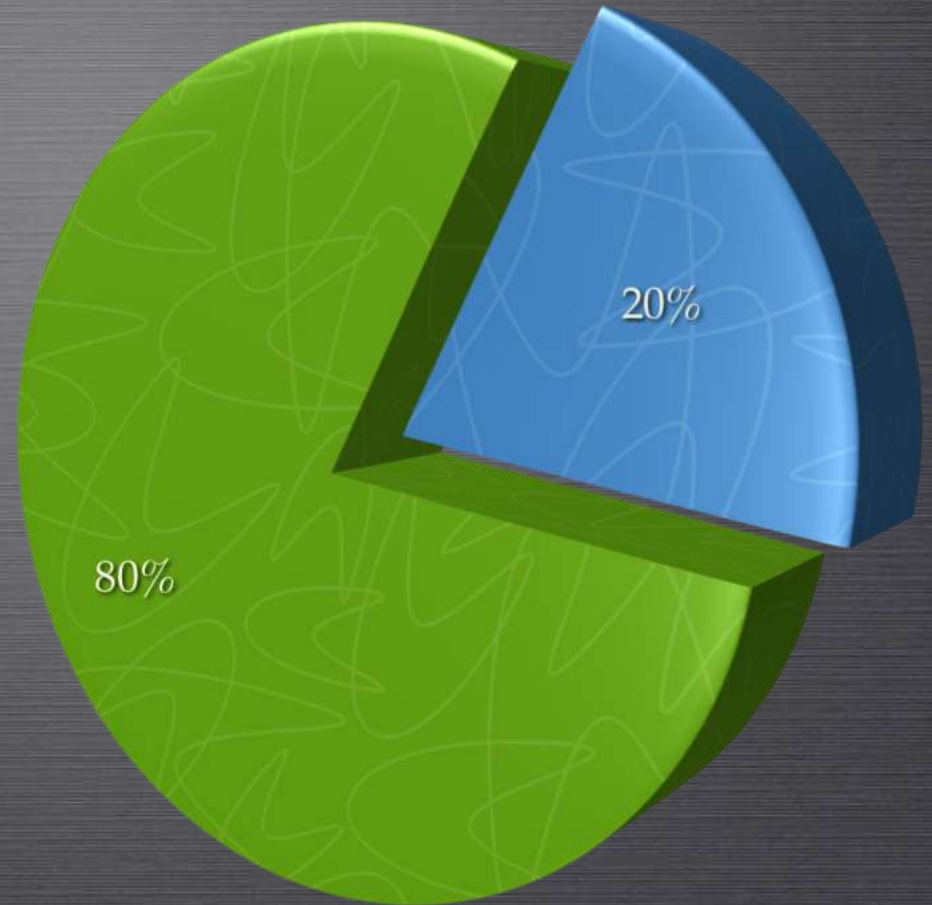
All the worlds fresh water



All the Usable Fresh Water in the World

- Great Lakes
- The Rest of the World

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

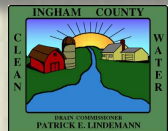


All The Usable Fresh Water in the World





**Red Cedar River • 1966 • Picture taken from Farm Lane Bridge on MSU
Campus**





Red Cedar River 2001
Picture taken from Farm Lane Bridge
on MSU Campus

We have come far
But we have a long way to go

The US consumes 200 gallons of fresh water per person per day. Urban sprawl and ill-planned, land-use-change decisions create increasing volumes of storm water runoff

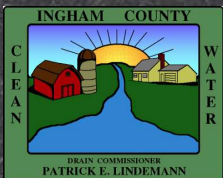
We currently draw, use or waste fresh water at TWICE the rate required to replenish it.



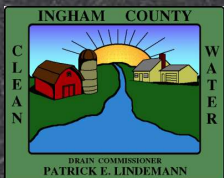
Urban Sprawl



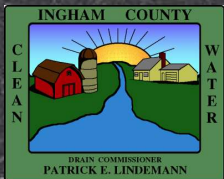
Okemos 1938



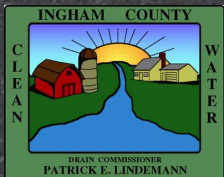
Okemos 1992



Lansing/East Lansing 1938



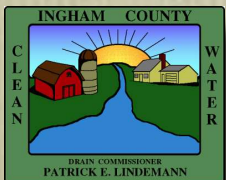
Lansing/East Lansing 1992



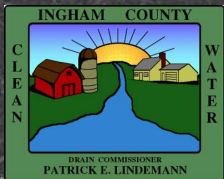
Lansing - East Lansing 2005

Over 75% impervious

Montgomery Drain

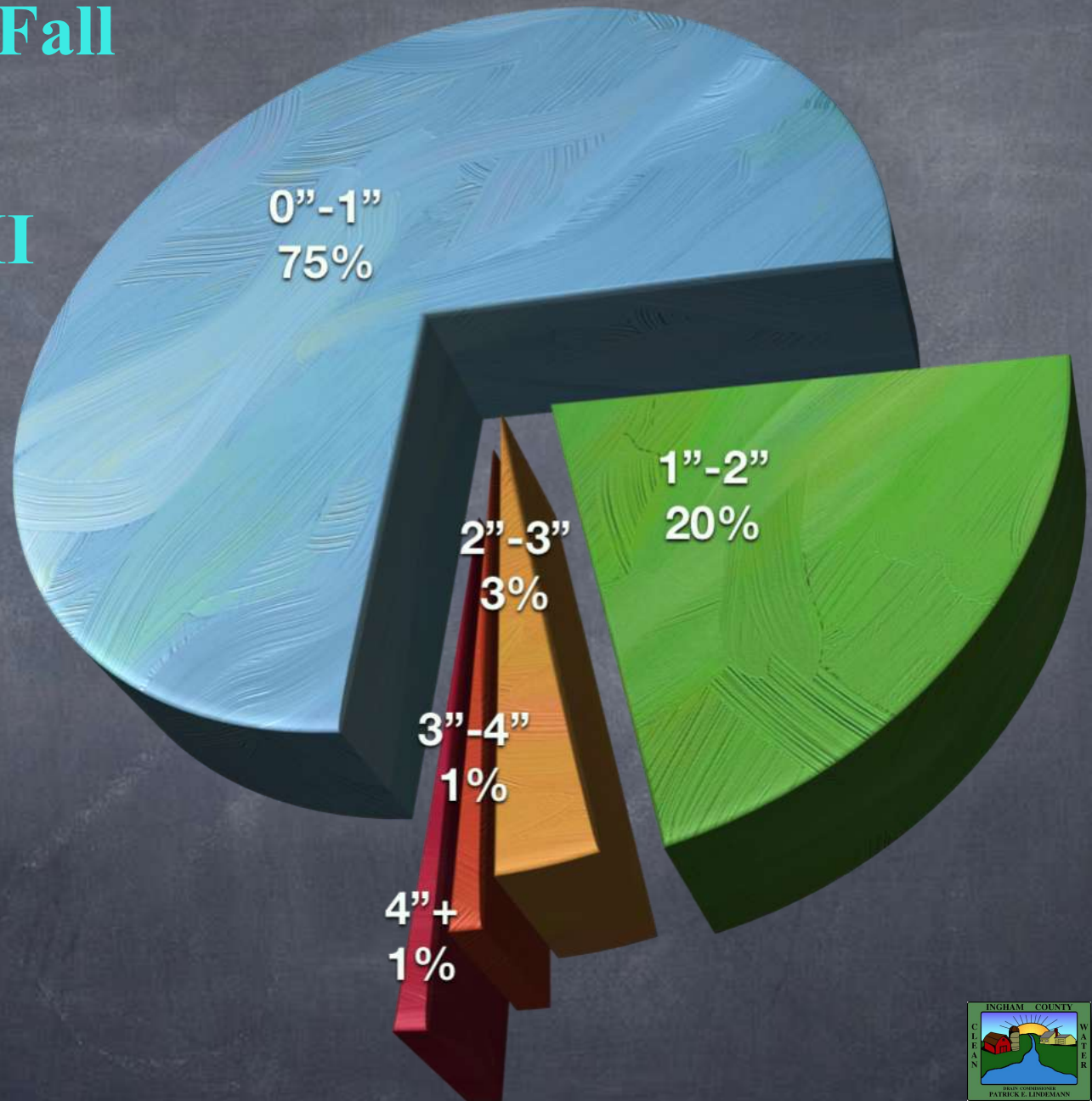


Accelerated Storm Water Runoff and Landscape Modification



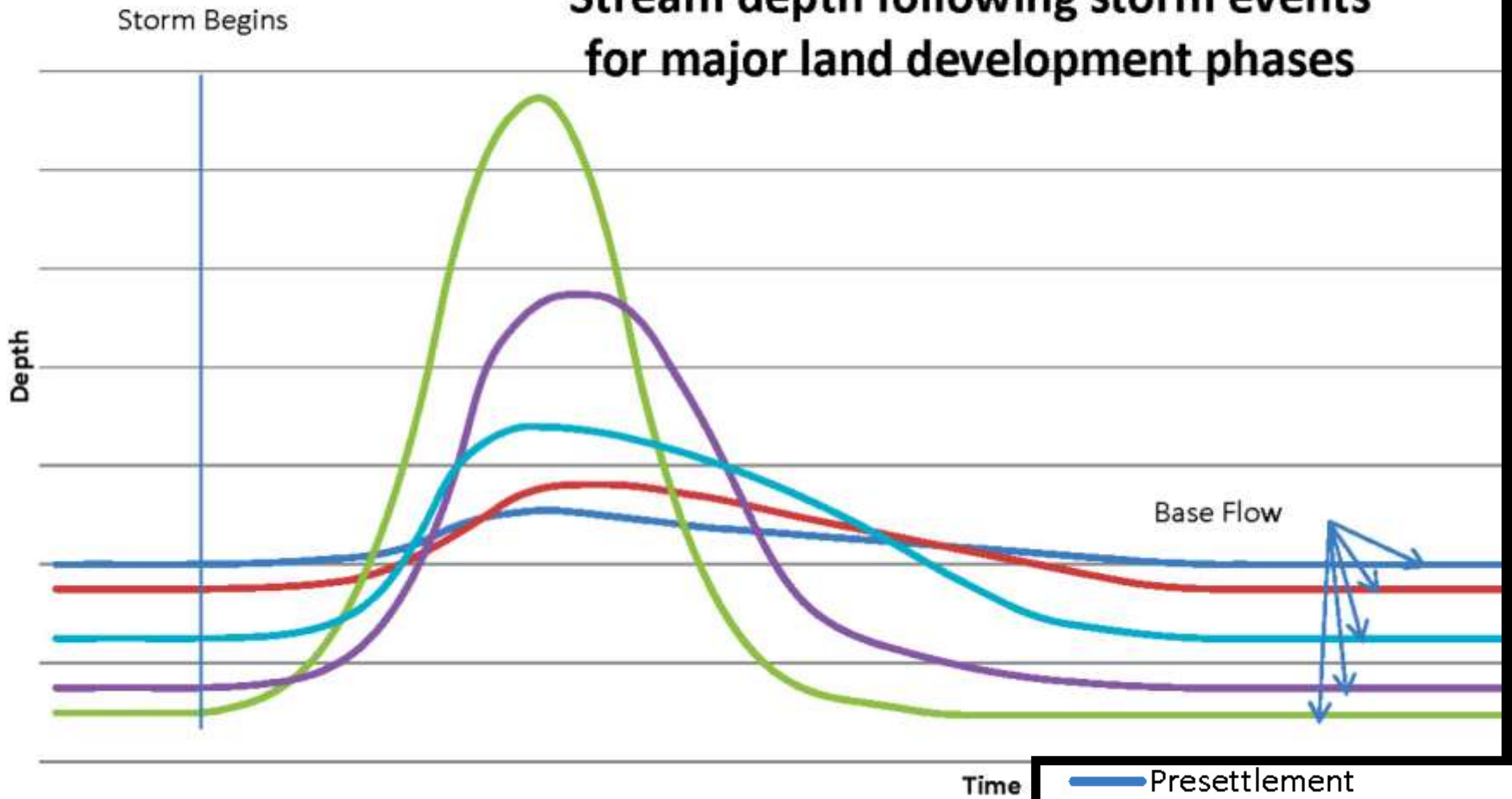
Major causes of erosive velocities of water: Parking lots & de-vegetation

Percent Rain Fall by Storm Lansing, MI

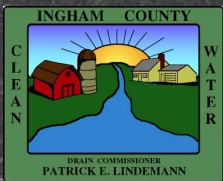


- 0"-1"
- 1"-2"
- 2"-3"
- 3"-4"
- 4"+

Stream depth following storm events for major land development phases



- Presettlement
- Deforestation and agriculture
- Fast Urban Runoff
- Stormwater Detention
- Low Impact Development



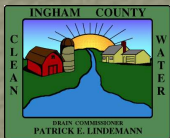
Is There Hope? YES!

Over the past 200 years we have managed water through a strategy based on moving water from Point A to Point B--out of sight out of mind.

Somewhere in the 1950's just moving water downstream caused a whole new set of problems. We set up a practice of trying to move water by controlling the rates of flow. Detention ponds and retention ponds became the standard for commercial and residential development. We then switched to a process of trying to manage water between Point A and Point B.

Today, we enter a new paradigm. For the past 20 years managing water at its source has become the new standard, not only in the United States but around the globe.

We call this management strategy--**Source Control.**



Source Control

Low Impact Design (LID) has many possible components. Including Bio-swales, Rain Gardens, Green Roofs, Constructed Wetlands and many more.

Cost of LID

Total capital cost savings range from 15% to 80%.

Maintenance cost savings range between \$3,950 and \$4,583 Per acre, per year over 10 years for native landscaping approaches over turf grass approaches.

Source: USEPA, 2007



Source control

using

Low Impact Design

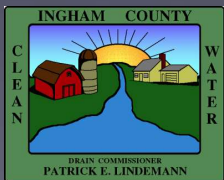
Cost Less than

Traditional Design

Long Term and Short Term.



LID Makes Economic,
Environmental,
Regulatory and Social
long term and short
term sense.



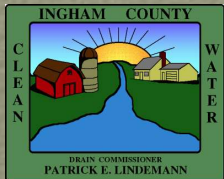
There are hundreds of types of Low Impact Design The list is restricted to only your imagination

Narrow Roads • Constructed Wetlands • Green Roofs • Bio Swales • Rain Gardens • Baffle Boxes • No Curb and Gutter • Planting Trees • Rain Barrel • Cluster Housing Subdivision Design • Taller Buildings On Smaller Lots • Building & Using Mass-Transit • More Gardens/Less Lawns
Gray Water Reuse •

These are just a few of the hundreds of things that make up “Low Impact Design”

Low Impact Design is more than just building something, like Rain Gardens. It's a way of life, a personal and collective commitment to living in a way that has a “Low Impact” for the earth we live on. To make this happen we need to change public attitudes, along with local ordinances, State and Federal laws.

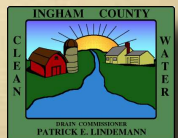
Are we really ready for this change?





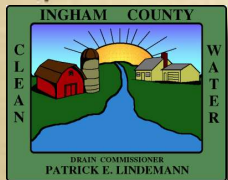
Rain Gardens fit easily in
to the street scape

Low impact designed
BMP' s fit into any
landsape



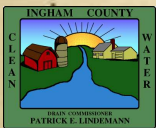


LID designed parking lots provide just as many parking spaces as traditional parking lots.





Rain Gardens in parking lots provide detention while taking up less room than traditional detention basins and provide more parking area.



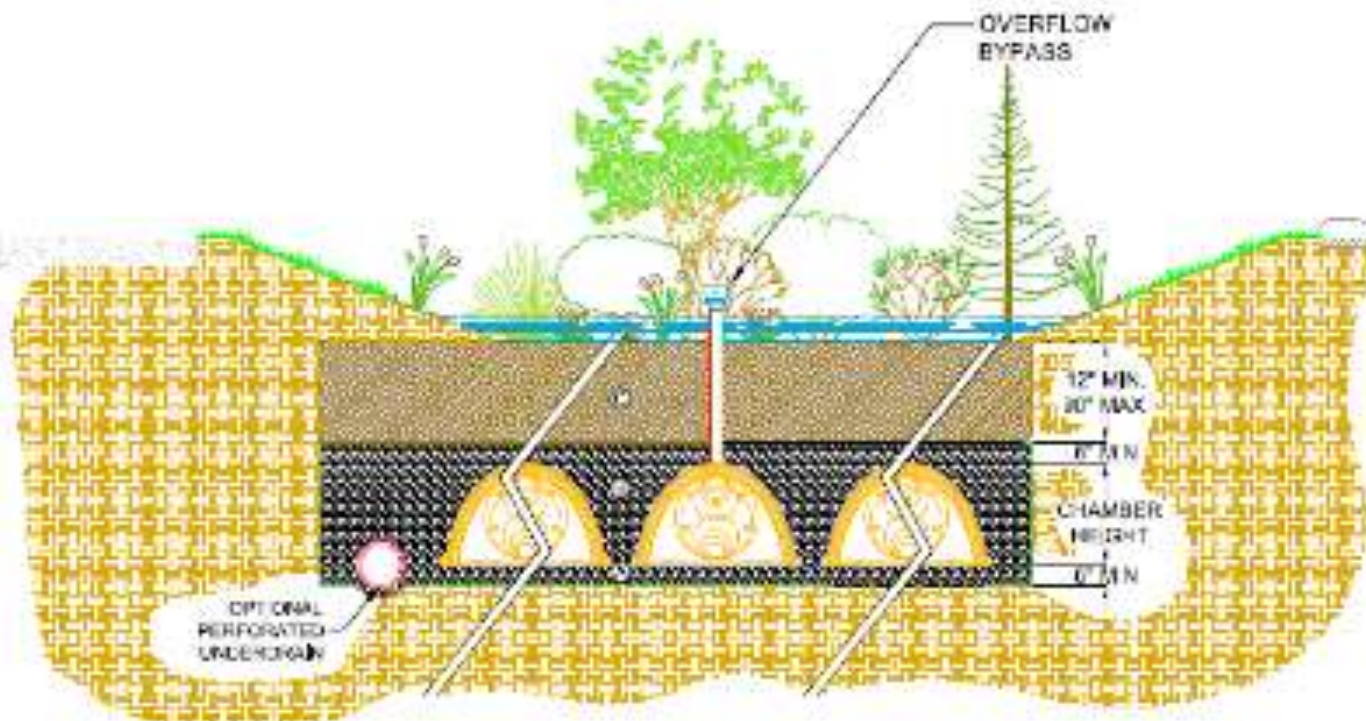


Rain Gardens in parking lots with under drain systems work very well at meeting LID goals



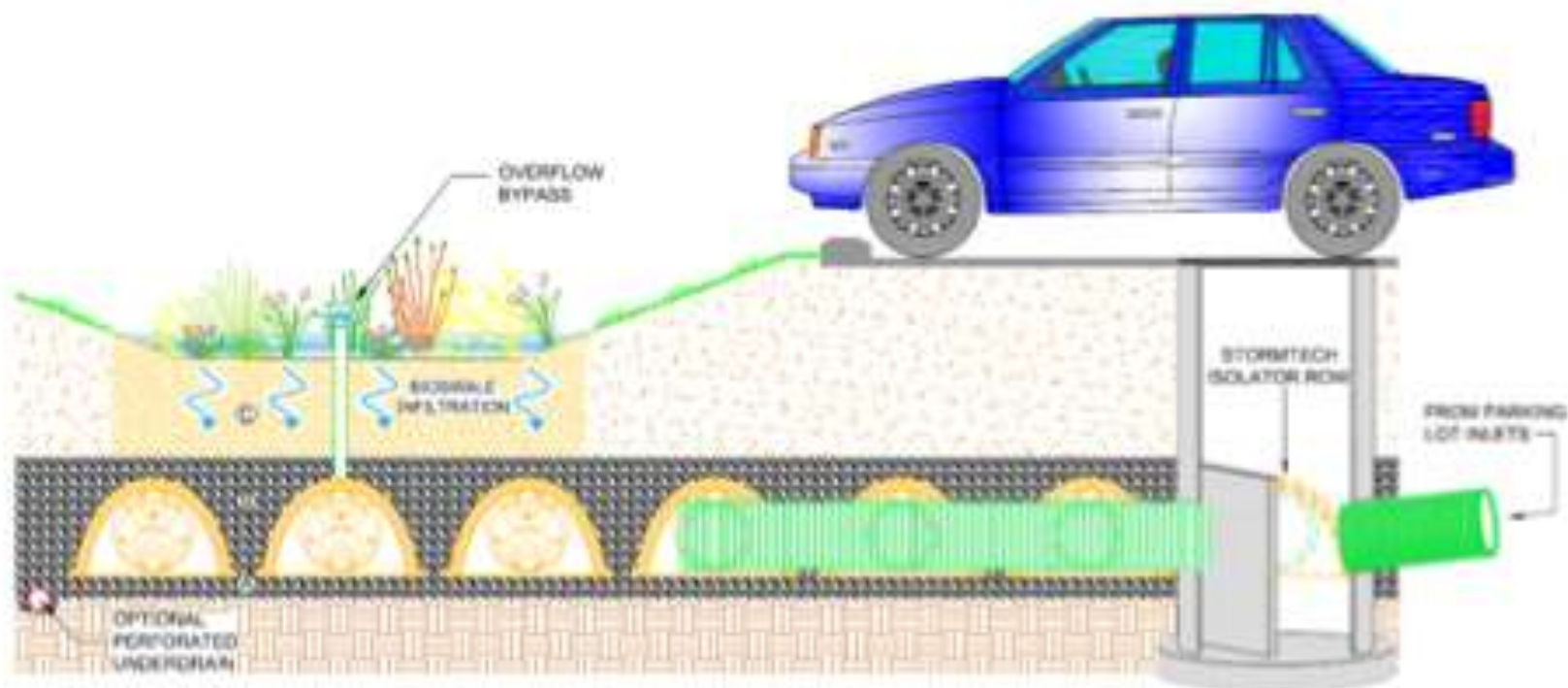
Green Infrastructure & StormTech

Rain Gardens



Green Infrastructure & StormTech

Bioretention

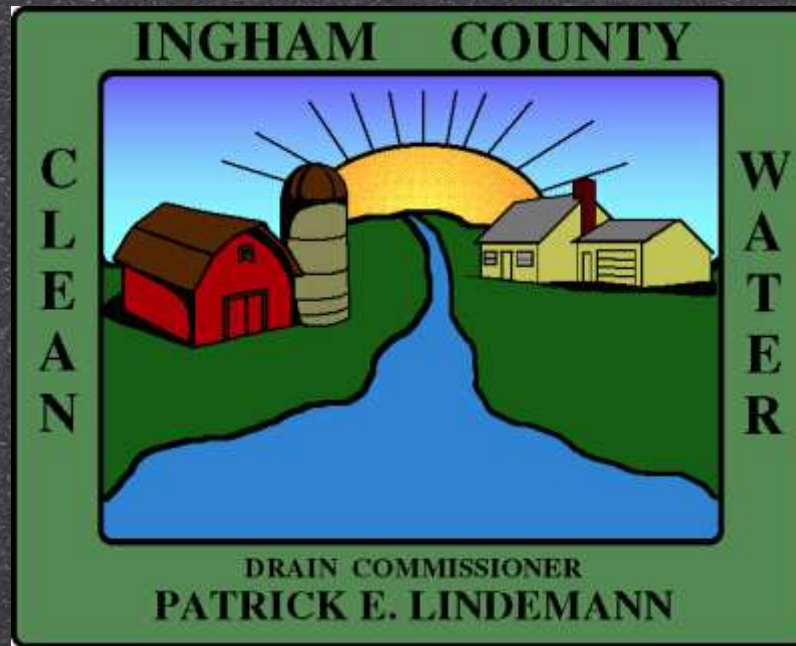


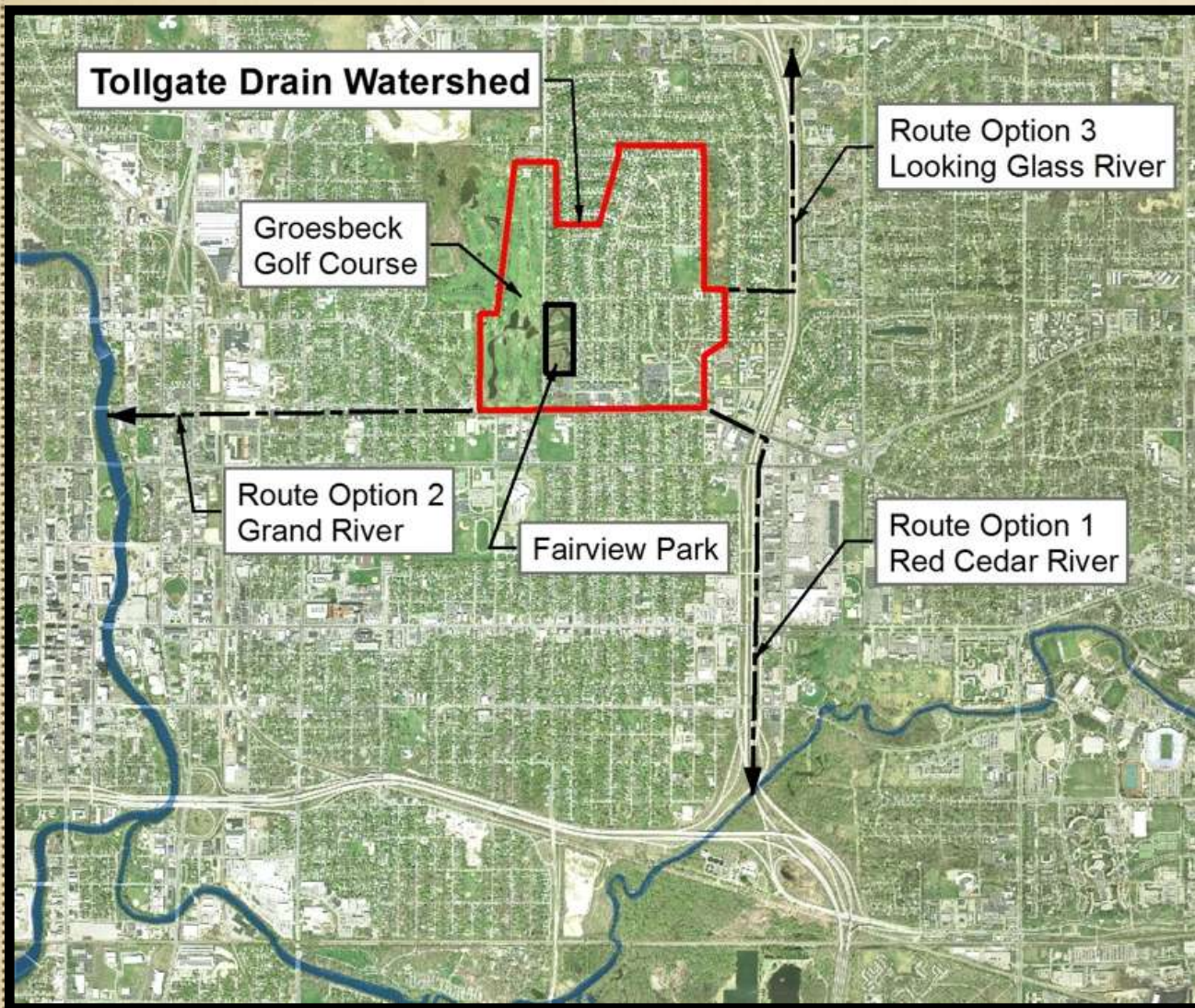






Case Studies





Traditional Options

Option 1

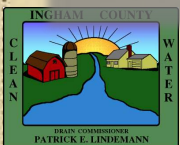
Take storm water to the south and outlet to the Red Cedar River. Cost about 23 million dollars.

Option 2

Take storm water to the west and outlet to the Grand River. Cost about 26 million dollars.

Option 3

Take storm water to the north and outlet to the Looking Glass



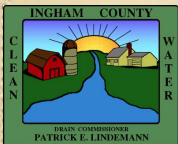
The Tollgate Drain as built was \$6.2 Million

THE TOLLGATE DRAIN'S WATERSHED

- 234 acre watershed
- 554 residential properties
- 20+ commercial properties
- 1000+ apartment units

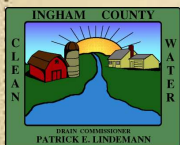


The Tollgate Watershed is a densely developed neighborhood.



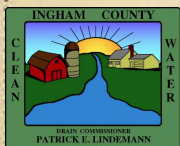


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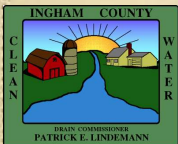
The Solution

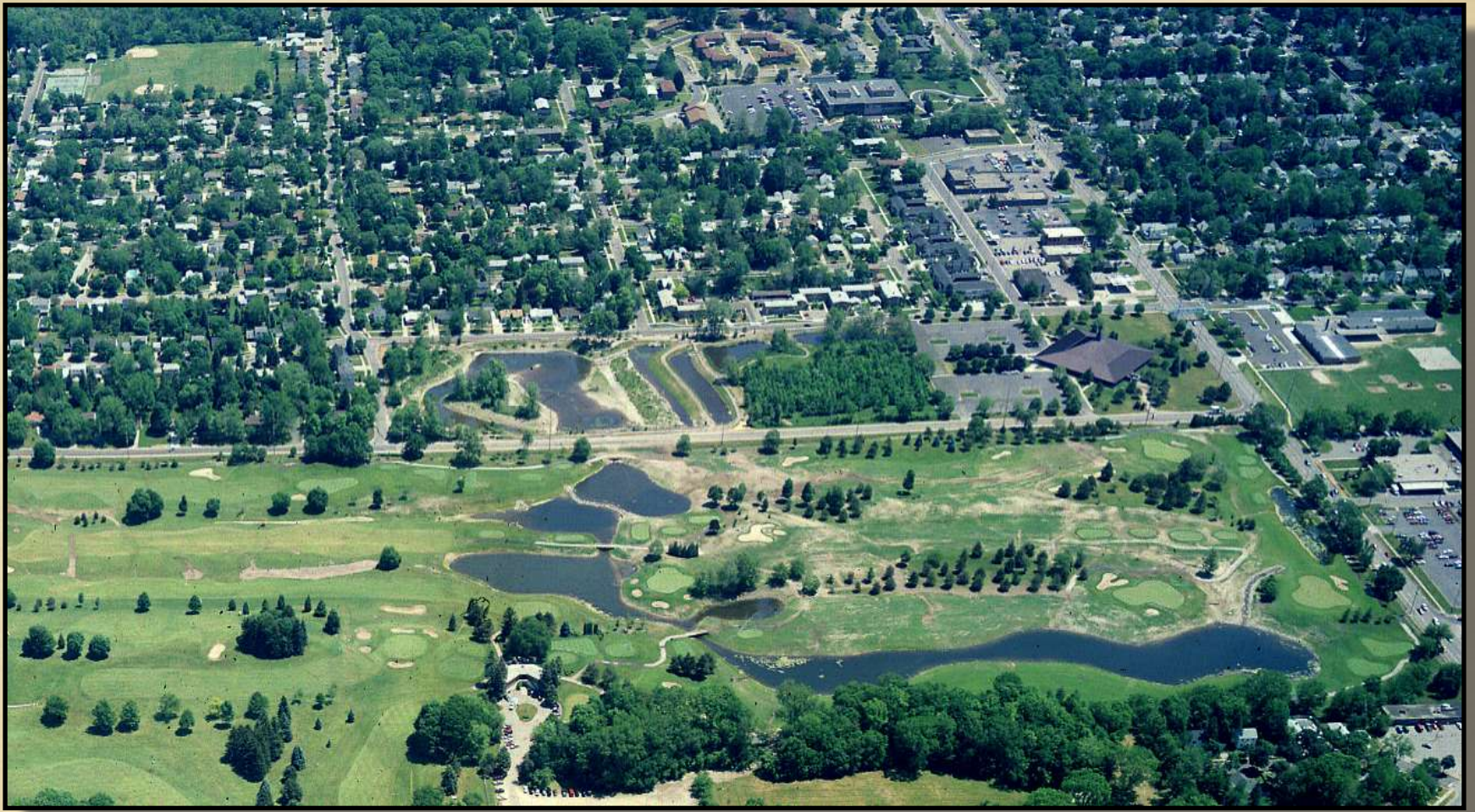
- **Develop Multi-objective Project Concept to address Problems**
- **Build Consensus and Stakeholder Buy In**
- **Intergovernmental Agreements**
- Permits
- Easement
- Cost Sharing
- **Ongoing Public Outreach**



The Multi-objective Project

- Separating Sanitary and Storm Sewers
- Create Wetland/ Upland Retention and Water Treatment System
- Improve Golf Course
- Create Aesthetic, Environmental, and Recreational Neighborhood Amenity
- Education and Public Outreach





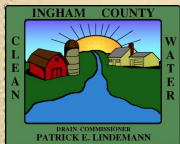
The Tollgate Drain Project And Its Watershed

Photo taken right after construction was finished



Criteria for Plant Selection

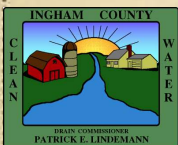
- Native to area
- Foraging and/or habitat functions
- Water quality and/or quantity effects



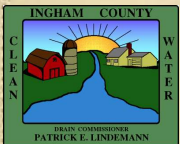
Create Wetland/Upland Retention and Water Treatment System



One of many water falls
that are made using Lime
Stone

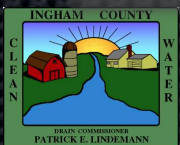


Create Aesthetic, Environmental, and Recreational Neighborhood Amenities

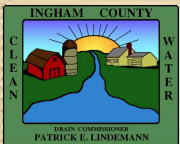




Looking north after construction on Fairview Street.



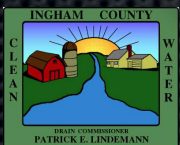
After 6 months the transition is clear



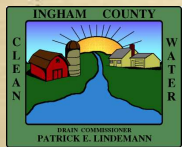
Second waterfall draining into the peat filter.



Second waterfall draining into the peat filter.



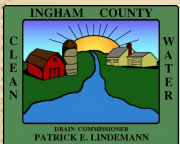
**Water Lilies in one of the ponds at the Tollgate Drain
These Lilies will trans-evaporate into the air thousands of
gallons of water in a day.**



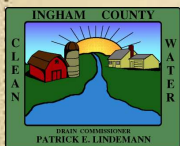
Green Heron looking for food at the Tollgate Drain



Great Blue Heron with food at the Tollgate Drain



Great White Heron
feeding at the Tollgate Drain

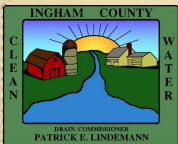


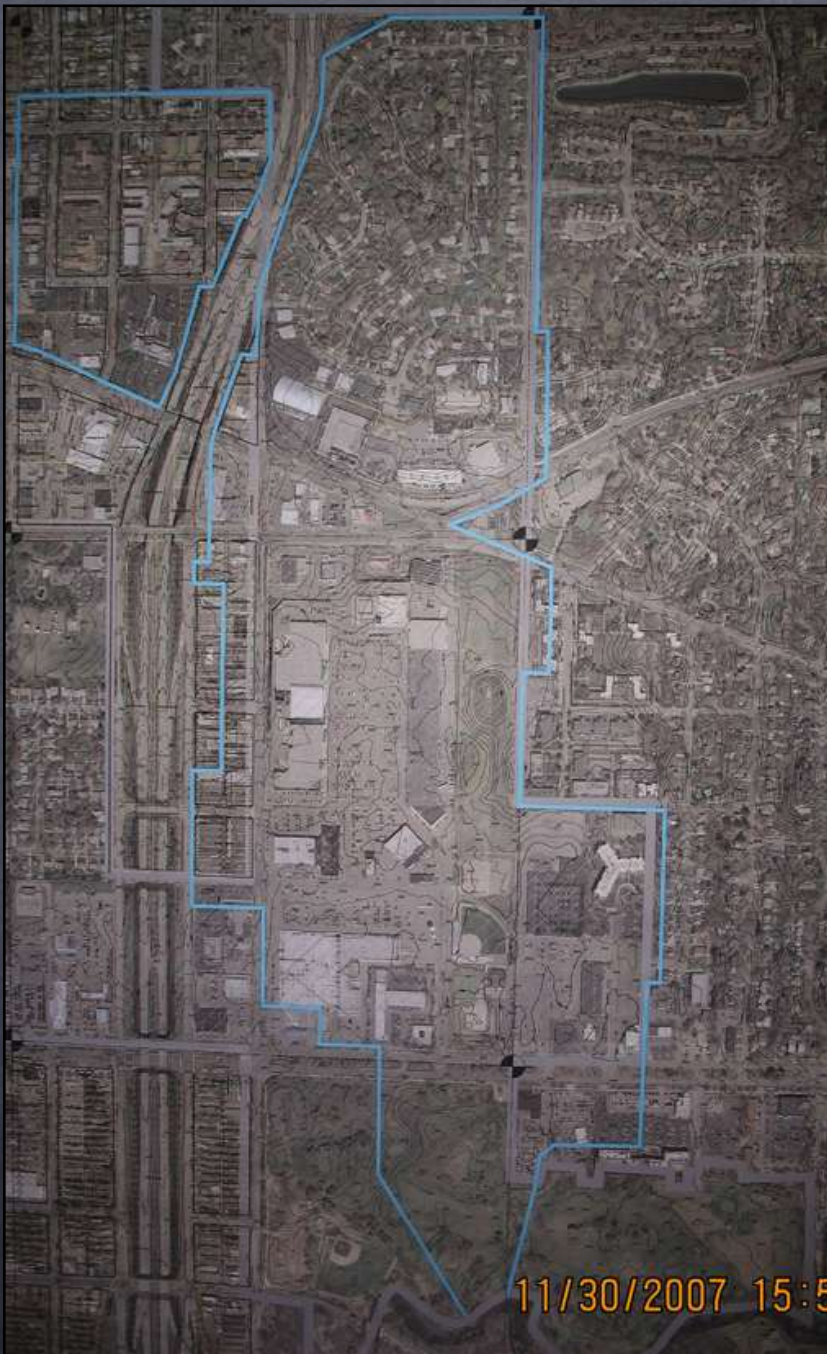


Opening Day



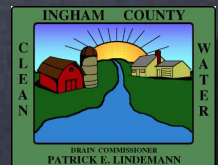
**Wildflower and native vegetation buffer
strip around the storm water ponds**





Montgomery Drain

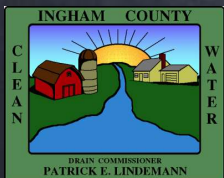
Frاندor Shopping Center and other Commercial Properties, make over an over 80% impervious watershed.





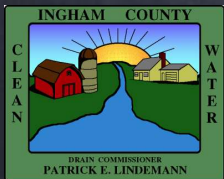
Frandor Shopping Center in Lansing, MI.

Watershed 80%
impervious





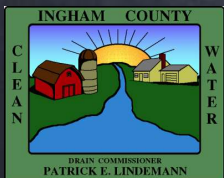
Parking lot storm water runoff going into the Red Cedar River in Lansing



Frandor Shopping Center in Lansing, MI.

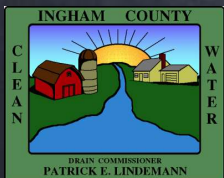
Total Watershed
over 80%
impervious

Commercial
Properties
over 95%
Impervious



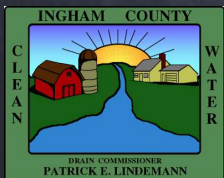


Parking lot storm water runoff going into the Red Cedar River in Lansing at the Red Cedar Park



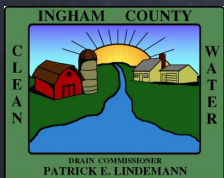


Parking lot storm water runoff going into the Red Cedar River in Lansing at the Red Cedar Park





Parking lot storm water runoff going into the Red Cedar River in Lansing at the Red Cedar Park



Our Vision for the Montgomery Drain





Urban Mall in Salt Lake City



Urban Mall in Salt Lake City





Urban Mall in Salt Lake City



Urban Mall in Salt Lake City



Urban Mall in Salt Lake City





Urban Mall in Salt Lake City





Urban Mall in Salt Lake City





Urban Mall in Salt Lake City





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