

# Environmental Concerns and Bridge and Culvert Design

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2015 Michigan Bridge Conference

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# The Flow.....

- 4(f) Issues
- Impact Avoidance
- Animal Passage
- Floodplain Management
- Water Quality Issues
- 2015 NPDES Permit Requirements



# 4(f) Issues

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# What is the Section 4(f) law?



Federal law which prohibits a transportation agency from using property from a public park, wildlife or waterfowl refuge, unless there is no feasible and prudent alternative to such use, and the project includes all possible planning to minimize harm.

# Recreational Section 4(f)

## Publically Owned Recreational Properties

- Parks, paths/trails
- State Game Areas
- Wildlife/Waterfowl Refuges
- Playgrounds, athletic fields, golf courses
- Designated waterways or similar areas



## 4 (f) Impact Review

- MDOT must determine there is no feasible and prudent option to using the property





# 4 (f) Impacts

## TEMPORARY IMPACTS

- Coordination required between Environmental Section and the Official with Jurisdiction (OWJ)
- OWJ/FHWA approval required
- Must be left in as good or better condition





# 4 (f) Impacts

## PERMANENT IMPACT

- ROW
- Easement
- De Minimis impact – no adverse effect



# 4 (f) Impacts

## PERMANENT IMPACT

- Public meeting held
- Formal coordination between OWJ and MDOT
- After approval from OWJ, environmental document sent to FHWA for approval



Saugatuck

# SP for Construction Staging Areas

- Contractor must not use any public recreational area as a staging area unless defined in the contract



Chippewassee Park, Midland

# SP for Construction Staging Areas

- Any agreements negotiated between the Contactor and the owner of the public recreational area, before or after the award of the contract invalid



Riverfront Park, Niles

Mt. Clemens

M-3

Shadyside Park

Clinton River





M-3

Shadyside Park

Clinton River



# Impact Avoidance

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Environmental Services Section Specialists  
MDOT

# Why is it important?

- Minimizes damage to the environment
- Financial considerations – mitigation
- Permits/project delays



US-2 Cut River Bridge



# Questions to Consider in Design



US-131 Constantine Bypass

# Floodplain



# Remove Scuppers (Deck Drains)



Photo by Jo O'Keefe

# Pull Back Outlets

Three Outlets



**I-69/Black River Crossing at Port Huron**

**Grassy swale carrying bridge deck and approach drainage from outlets approximately 300 feet from the Black River, which is behind the photographer.**

# Culverts

- Minimize habitat fragmentation - flow variability and natural sediment transport
- Structures without bottoms preferred
- Mimic natural alignment
- Embed structures, use natural substrate



# Animal Passage

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Aquatic – Barb Barton, Aquatic Resource Specialist  
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T&E – Jeff Grabarkiewicz, Wildlife Ecologist  
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# Wildlife Crossings – Why the Need?

- 1 million animals killed per day
- Death and suffering – animals and humans
- Loss of livestock or pets
- Harm to endangered species
- Economic losses
- Roadkill particularly costly to tourist areas



# Stream Crossings – Travel Corridor

- Many species use stream corridors
- Fish, herptofauna, mammals
- How to reduce/eliminate mortality...



David M. Thorson



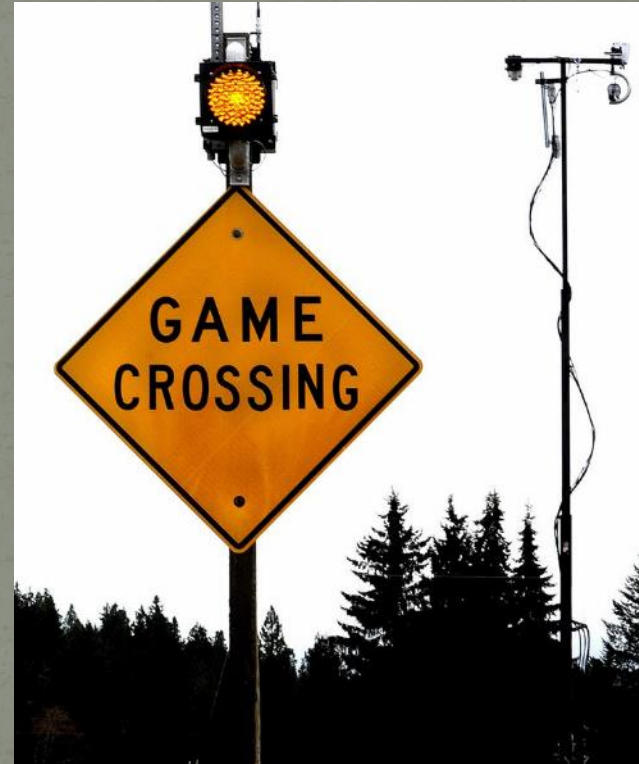
# Change Driver Behavior



| ATTENTION  |   |   |
|--|---|---|
| <b>WILDLIFE<br/>CROSSING</b><br>next <b>3 km</b>   |  | <b>PASSAGE<br/>D'ANIMAUX</b><br>sur <b>3 km</b>   |
|  Drivers for Wildlife |   |  Conducteurs pro-faune |

# Detections Systems

- Roadway Animal Detection System (RAD)
  - inconclusive results
- Microwave radar sensors
- Animal crash avoidance system in autonomous vehicles - Toyota



# Education

## herp|crossing

helping reptiles and amphibians cross the road



Like virtually all of Pennsylvania's wildlife, reptiles and amphibians must cross the road at some point in their lives. Unfortunately, they fare much worse on the roads than most wildlife because they are slower and more difficult to see. For some species, road mortality can have drastic long-term effects on entire populations. This is especially true for turtles, because turtles don't start reproducing until they are at least 5-10 years old. They produce very low numbers of offspring each year and the eggs and hatchlings suffer heavily from predation. A turtle must live a long time in order for even one of its offspring to successfully make it to adulthood and replace it in the population. Unfortunately, the world is a far more dangerous place for turtles than it once was. Road mortality is one of the main reasons.

Amphibians also suffer heavily. On rainy nights in the Spring, millions of amphibians make their annual migrations to their breeding pools, often having to cross a road on their way. If it's a busy road, the mortality rate can be extremely high. Some roads in Pennsylvania actually have such a large number of amphibians crossing to make it to the breeding pools that they are closed at night during the spring migration season. Unfortunately, closing roads is seldom a feasible option.

**Here are some tips to help you be a better steward and safely help reptiles an amphibians you encounter on the roadways:**

- ★ Safely stop your car and put on your flashers. Make sure it is safe for you to exit your car. Do not put yourself at risk.
  - ★ Move the animal to the other side of the road in the direction it was traveling. This is important because most reptiles and amphibians have a good sense of direction and they are determined to get where they were going. If you put them on the side they came from, it is extremely likely that they will move back onto the roadway.
  - ★ Snakes can usually be coaxed off the road with out handling. If you are unsure of the snake species do not handle it. Coming in a stop an letting the animal cross over its own may also work with snakes.
  - ★ Turtles, frogs, lizards and salamanders can be moved easily by hand. Large turtles may bite, but they can be handled by carefully grabbing them by the back of the shell. No birds should ever be picked up by their tail.
- Though it may be tempting to take the animal home with you, it is almost always best to leave the animal in nature. Many of Pennsylvania's reptiles and amphibians are protected and it is illegal to take them from the wild.

Written By: Andrew Wolf  
Photos By: Matt Nordgren, Jason Poston, Kyle Louder



# Changing Wildlife Behavior

- Pathways under bridges
- I-80 in Utah



Photo by Alan Keller



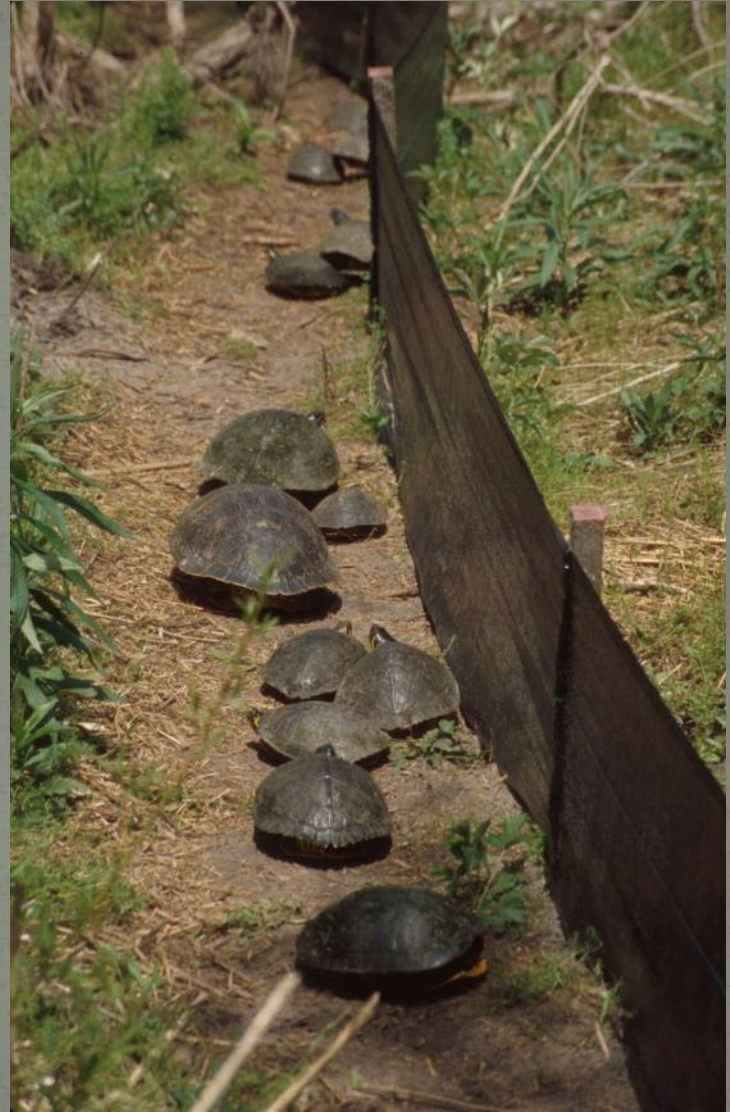
# Fencing

- Permanent - used to direct animals to safe passageway



# Fencing

- Temporary silt fence should be removed



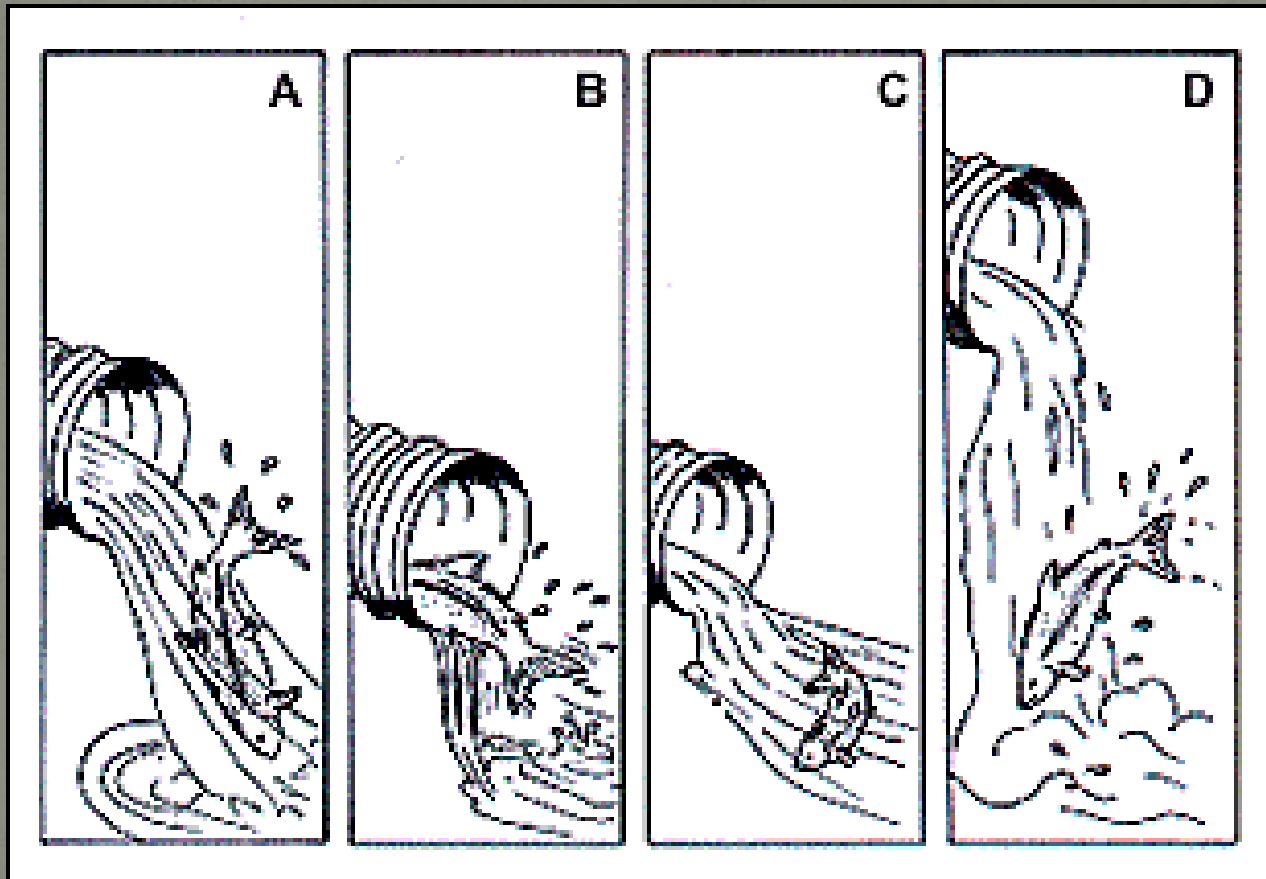
# Fish Passage - Culverts

H<sub>2</sub>O velocity ↑

Too shallow

No resting pool

Jump too high



Redrawn by USFWS from Evans and Johnston 1980





“If a bed placed in a culvert has similar dimensions and substrate as the adjacent stream channel, then the velocity and passage conditions would be similar to the stream.”

Water Crossings Design Guidelines, WA Dept Fish and Wildlife

# Need for Effective Means to Reduce/Eliminate Animal Mortality

- More driver education
- Technological advancement for detection
- New ideas



# Floodplain Management

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MDOT Environmental Services Section

Hydraulics Unit

# Update - Executive Order 11988

- Update Floodplain Management EO
- Federally funded projects
- FFRMS – Federal Flood Risk Mgmt. Standard



Grand River, 2013. MI Public Radio

# Changes - Executive Order 11988

- Hazard area based on climate science
- Current floodplain elevation plus 2 feet
- Plus 3 feet if critical action
- 500 year flood event



Muskegon River, 2014. WOOD TV

# Affect on Transportation Agencies

- Larger areas designated as Floodplains
- Increase in mitigation, “green” methods preferred
- Changes to State floodplain/wetland statutes unknown



Ontonagon River

# Affect on Transportation Agencies

- 60 day comment period began Feb. 6
- Comments go to FEMA
- FHWA not accepting comments
- Federal agencies have 30 days to submit implementation plans



Pere Marquette River



# Water Quality

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# Water Crossings

| Surface Water          | # MDOT Road Crossings |
|------------------------|-----------------------|
| Streams                | 13271                 |
| Drains                 | 9374                  |
| Trout Streams          | 2892                  |
| Wild and Scenic Rivers | 41                    |
| Natural Rivers         | 164                   |
| Impaired Waters**      | 7782                  |

1394 Bridges over Water

\*\* Does not include PCBs, Mercury, or *E. coli*.

# Pollutants in Stormwater

- PAHs
- Metals, Gas and Oil
- Fecal coliform and E. coli
- Suspended solids – pollutant carriers
- Salts and Cyanides (in some deicing solution)



# Effects of Direct Discharge into Rivers

- No sediment removal - concentrates pollutants
- Snow and ice berms trap and concentrate pollutants - wash off during snow melt
- Galvanized bridge drains – important source of metals in runoff (zinc)



# National Pollutant Discharge Elimination System (NPDES)

- Required of any public agency that discharges to the waters of the state
- DEQ administers and enforces on behalf of the EPA



# 2015 NPDES Permit Water Quality Standards

- Treat the first inch of runoff from the entire site or runoff from 90% of all runoff producing storms
- BMPs must be designed to remove 80% of sediments



# 2015 NPDES Permit Channel Protection Standard

- Retain all new stormwater up to the two-year, 24-hour storm



# Both Standards

- May be met by site-specific measures, or alternatively by off-site mitigation within the watershed, or by payment-in-lieu.



Rain Garden, City of Lansing



# Best Management Practices

- BMPs include retention basins, green infrastructure, deeper vegetated ditches, deep sumps
- Will likely require additional right-of-way for some projects
- Bridge projects have special challenge – limited land area



Rain Garden, Grayling

# Issues Unique to Bridge Design: Retention

- Bridges
  - What to do with the water?
  - How to remove sediment?
- Approaches
  - Generally 50 feet long with outlet
  - 200 foot minimum filtration distance through vegetation



# TROLLS Committee

- Formed in fall of 2012
- Created to find solutions to eliminating direct discharge
- Members represent variety of disciplines within MDOT
- Conducted survey of other states
- Developing recommendations



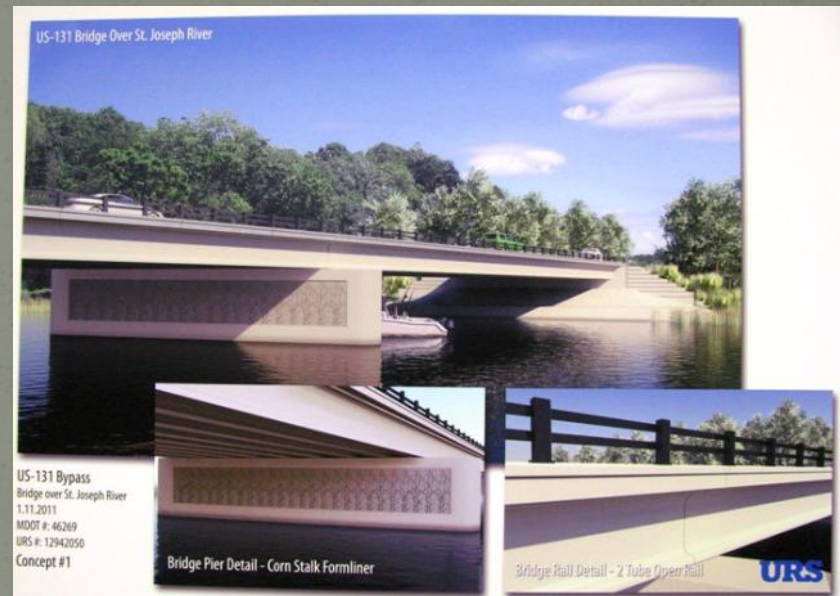
Left to Right: Doug, Raja, Hal, Barb

# M150/Clinton River Drain Project



# Bridges Under Construction: Drainage Collected

- M-231 over Little Robinson Creek (Trout Stream)
- M-231 over Grand River in Ottawa County
- US-131 over St. Joe River, Constantine



# Questions



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