Ecological Flows

- The amount and timing of water flows required to maintain the species, functions, and resilience of freshwater ecosystems and the livelihoods of human communities that depend on those healthy ecosystems
Ecological Flows

• The amount and timing of water flows required to maintain the species, functions, and resilience of freshwater ecosystems and the livelihoods of human communities that depend on those healthy ecosystems
What are instream flows?

[Graph showing discharge levels with a line indicating the current flow standard.]
Economic Sustainability

- Agriculture
  - Irrigation
  - Livestock
- Recreation
  - Fishing
  - Kayaking
  - Swimming
- Aesthetics
- Waste dilution
What are instream flows?

- Variability in element of the flow regime
  - Magnitude
  - Timing
  - Duration
  - Frequency
  - Rate of Change

- How much can flow regimes be altered before having an appreciable affect on ecosystem function?
Freshwater biodiversity relationship to flow – Kiamichi River

Discharge (cfs)

Bottomland Forests
- active growth
- seed dispersal and establishment
- dormant season

Smallmouth Bass
- active growth
- breeding
- active growth

Ouachita Rock Pocketbook
- adults gravid
- glochidia released
- active growth
- adults gravid

Month
Several Options for Moving Forward:

- Status Quo – Assume domestic set-aside will provide coverage
- Be Proactive – work together to find a collaborative solution
Ecological Limits of Hydrologic Alteration (ELOHA)

- Quantifies trade-offs between streamflow alteration and ecological degradation
- Informs the determination of environmental flow targets
- Integrates environmental flows into a computerized DSS
SCIENTIFIC PROCESS

Step 1. Hydrologic Foundation
- Baseline Hydrographs
- Hydrologic Model and Stream Gauges
- Developed Hydrographs

Step 2. Stream Classification
- Stream Hydrologic Classification
- Geomorphic Stratification

Step 3. Flow Alteration
- Degree of Hydrologic Alteration
- Hydrologic Alteration by River Type

Step 4. Flow-Ecology Relationships
- Flow - Ecology Hypotheses
- Ecological Data and Indices
- Flow Alteration-Ecological Response Relationships by River Type

SOCIAL PROCESS

Implementation
- Environmental Flow Standards
- Acceptable Ecological Conditions
- Societal Values and Management Needs

Adaptive Adjustments

Monitoring
Characterization of natural flow regime

Prioritization of protection needs

Societal values and needs

Streamflow information under natural and/or human-altered conditions

Biologic, Ecologic, and Geomorphic Data

Identification of streamflow elements that are critical

Management of instream flows

Adaptive Management

Identification of instream flow needs
Great Lakes Compact: “no significant individual or cumulative adverse resource impact” due to withdrawals

Michigan 2006 Public Act 34: An “adverse resource impact” is defined as: “decreasing the flow of a stream by part of the index flow such that the stream’s ability to support characteristic fish populations is functionally impaired.”
Fish surveys for 60+ spp. from 1,720 sites, 1980-2006

Basic Data

- July mean water temp (JMT) (predicted by Brenden, personal communication)
- Baseflow (median August) yield (BFY) (estimated by Hamilton et al 2008 model)
- Catchment area (CA; GIS)
- Surficial geology (GIS)

Methods

- Multivariate regression tree analysis plus expert refinement
- Clustering of river reaches, plus expert refinement

Results averaged within river types

- Fish metric response curves for each river type; river types assigned to all segments statewide.

References:
1. Brenden et al. 2006
2. Brenden et al. 2007b
Determining Impact For New & Expanding Uses

Michigan fish response curves and river condition goals

GO w/local education
Site review and conservation
Site review & mitigation?

Characteristic Species Remaining
Thriving Species Thriving

Increasing hydrologic alteration

Adverse Resource Impact
You may use this Assessment Tool test site to register a new or increased large quantity withdrawal. The results page provides a quick link to submitting a registration. A registration is valid for 18 months; the withdrawal capacity must be installed within that 18 months or the registration becomes void.

Michigan’s Water Withdrawal Assessment Tool
beta version 1.1

Information Window
- About the Tool
- Educational Material
- Feedback
- FAQ
- Run the Tool

www.miwwat.org
Finding the Location of Your Water Withdrawal

Please select one of the following options for locating the position of your water withdrawal.

Locate by Address

Enter the address and zip code at or near the withdrawal location. Please spell street names correctly in order to ensure system accuracy.

Address: 
Zip Code: 

Find Address

Locate by County

To select the county where the water withdrawal will occur, click the map or choose from the drop down menu.

Find County

Locate by Latitude and Longitude

Enter the latitude and longitude coordinates at or near the withdrawal location. Please input data correctly in order to ensure system accuracy.

Longitude(X): 
Latitude(Y): 

Decimal Degrees 
Degree Minute Second 

Find Point Clear
ENTER WITHDRAWAL INFORMATION

Pumping Source and Frequency

Withdrawal Source:
- Surface Water (from stream)
- Ground Water
- Shallow Pond

Pumping Frequency:
- Continuous
- Intermittent

Pumping Parameters

Pumping Capacity (GPM): 70
Coordinates (X,Y): -84.84137, 42.683384
Well Depth (FT): 25-50 ft
Aquifer Type:
- Bedrock
- Glacial

Current Stats at Location
- Depth to Bedrock (FT): 130
- Average Well Depth (FT): 83
- Percent Wells in Glacial: 25
- Percent Wells in Bedrock: 64

Send to Model
**Water Withdrawal Screening Results**

**Adverse Resource Impact (ARI) Graph**

The ARI graph above illustrates the estimated removal of water from a nearby stream and its potential for causing an adverse resource impact (ARI).

The proposed withdrawal has passed in Zone A.

**Screening Results - PASSED**

**STREAM CLASSIFICATION:** Cool small river

**TEST VERSION RESULTS:**
The proposed withdrawal would pass the screening process. The projected impact of the withdrawal lies within 'Zone A' and is not likely to cause an adverse resource impact.

**REGISTRATION:**
A large quantity withdrawal (LQW) with a capacity of 70 gpm or greater must be registered with the Michigan Department of Environmental Quality or with the Michigan Department of Agriculture if the LQW is for an agricultural purpose, before the withdrawal can begin. A registration is valid for 18 months. The withdrawal capacity must be installed within this time period or the registration becomes void. Registration may be done at this time through the button at the right.

You may register at this time, or come back to this site at a later time, or you may obtain a form to register the withdrawal by contacting Andrew LeBaron at 517-241-1435, or on-line at: www.michigan.gov/degwateruse

**DISCLAIMER:**
The Water Withdrawal Assessment Tool is designed to estimate the likely impact of a proposed water withdrawal on nearby streams. It is not an indication of how much groundwater may be available for your use. The quantity and quality of groundwater varies greatly with depth and location. You should consult with a water resources professional or a local well driller about groundwater availability at your location.

**WARNING:**
This computer program is provided for the public to evaluate the water withdrawal assessment tool before it becomes effective on July 9th, 2009. It incorporates the zones and adverse resource impact lines defined in Part 327 of the Natural Resources and Environmental Projection Act. You may use it to register a new or increased large capacity withdrawal, but the assessment results are not official until the tool is fully implemented on July 9th, 2009.
The ARI graph above illustrates the estimated removal of water from a nearby stream and its potential for causing an adverse resource impact (ARI).

The proposed withdrawal is in Zone D, and is likely to have an adverse resource impact.

Screening Results - SITE SPECIFIC REVIEW IS REQUIRED.

STREAM CLASSIFICATION: Cool stream

TEST VERSION RESULTS: The projected impact of the withdrawal lies within 'Zone D' and would likely cause an adverse resource impact. The withdrawal cannot be initiated without a site-specific review conducted by the Michigan Department of Environmental Quality. To pursue approval for the withdrawal as proposed, submit a request for a site-specific review through the button at the right.

MODIFYING A PROPOSED WITHDRAWAL:
Changing certain characteristics of the proposed withdrawal may decrease the flow taken from nearby river systems, thereby lessening the likelihood of an adverse resource impact. The following withdrawal characteristics may be altered in the screening process to reduce the potential impact to nearby river systems:

- Reduce the pumping frequency
- Reduce the pumping capacity
- Increase the well depth
- Relocate the withdrawal farther from nearby river systems

You can use the button at the right to rerun the Water Withdrawal Assessment Tool and change the proposed withdrawal characteristics.
Water wars are exactly what we need to avoid in Oklahoma.

- Representative Tom Cole, U.S. House of Representatives
- Oklahoma Governor's Water Conference, October 26th, 2010
• http://conserveonline.org/workspaces/eloha

For More Information: