Watershed Monitoring Programs

Presented for the
Indiana Watersheds Webinar Series
December 11, 2013

Indiana Department of Environmental Management
Office of Water Quality
Watershed Assessment and Planning Branch

Presentation

- Water Quality Monitoring Strategy
- Summarize Monitoring Programs
  - Site selection
  - Parameters
  - Frequency
  - Assessment of designated uses
- Where are we in 2014?

Strategy

- Plan to gather quality scientific data to monitor and assess Indiana's water resources
- Protection of human health and fulfill Clean Water Act in reporting on quality of rivers and streams, lakes and reservoirs, ground water and wetlands
- Provide information to other program areas, public and governmental agencies

Monitoring Objectives

- Support public health advisories
- Water quality assessments and list of impaired waters in Integrated Report to U.S. Environmental Protection Agency
- Trends and trophic status of Indiana's lakes
- Develop or refine water quality criteria
- Total Maximum Daily Loads
- Support watershed planning and identify successful restoration efforts

Monitoring Objectives continued…

- Determine ambient ground water quality and extent of contaminated areas
- Support source water protection
- National Pollutant Discharge Elimination System (NPDES) permits
- Develop environmental indicators
- Respond to citizen complaints

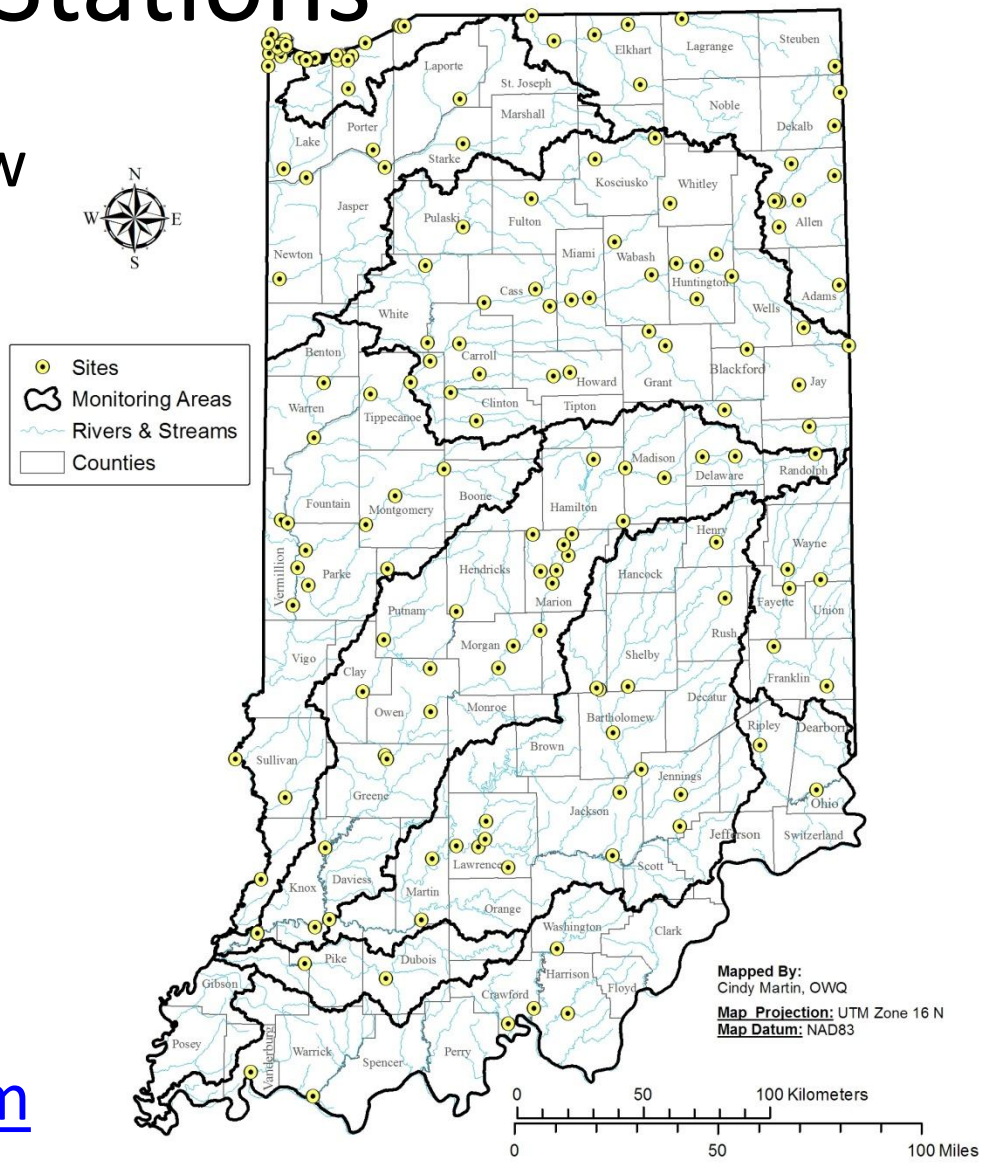
Targeted Monitoring

- Targeted sites based on previous sample collections or special design requirements
- Utilized to provide local water quality information, look for watershed improvements and address contaminants of concern or previous impairments
- Data collected include chemical, physical and biological parameters

Fixed Stations

- Began in 1957 (49 sites), now 163 fixed locations on rivers and streams
- Water chemistry, bacteria (*E. coli*), field analytical data collected monthly
- Recreational Use, Drinking Water Use, Aquatic Life Use
- Long-term data set to reveal water quality trends

www.idem.IN.gov/4677.htm



Recreational Use

- Bacteria (*E. coli*) Human Health
- Violation if five samples equally spaced over a 30-day period have a geometric mean >125 colony forming units (cfu) per 100 mL
- Where there are at least 10 grab samples (no five equally spaced over 30-day period), violation where more than 10% of the samples is >576 cfu/100 mL or more than one sample is >2,400 cfu/100 mL

Drinking Water Use

- Community water supply has drinking water intake
- Dissolved metals, pesticides, PCBs, free cyanide, total dissolved solids, specific conductance, sulfate, chloride, Nitrate-N+ Nitrite-N
- For any one pollutant (grab or composite sample), not supporting if more than one exceedance of the acute or chronic criteria within a three-year period
- Taste and odor requiring additional treatment

Aquatic Life Use

- Data sets must consist of three or more measurements
- Water Quality Standards

  [327 Indiana Administrative Code (IAC) 2-1-6]

  – Dissolved metals, pesticides, polyaromatic hydrocarbons (PAH), free cyanide, ammonia, dissolved oxygen, pH, sulfates and chlorides
- Not supporting aquatic life use if more than one exceedance of the acute or chronic criteria

Resource for IAC www.IN.gov/legislative/iac/

Resource for assessing designated uses
www.watersheds.IN.gov/2639.htm

Fish Consumption

- Began in the late 1970s with sites targeted on rivers and lakes
- Analysis includes select metals, pesticides and organic compounds
- Not supporting if mercury in trophic level weighted arithmetic mean concentration value >0.3 mg/kg wet weight and/or PCBs in fish tissue sample >0.02 mg/kg
- Fish Consumption Advisory

  www.IN.gov/isdh/23650.htm

Blue-Green Algae

- Taste and odor, skin and eye irritant, nausea, tingling fingers and toes
- Monthly from June-September (increase frequency with high densities of blue-green algae and/or microcystin toxin)
- Drinking Water Use
  - Not supporting if the public water supply received a pesticide (algaecide) application permit for algae to prevent taste and odor problems
- Advisory process: www.idem.IN.gov/algae/

State Park Beaches
Potato Creek
Pokagon
Chain O' Lakes
Salamonie
Mississinewa
Cecil Harden
Brookville
Whitewater
Monroe
Hardy Lake

Lake Water Quality

- Random sampling of 600 targeted sites each year by Indiana University School of Public Environmental Affairs
- Analysis includes select physical, chemical and biological (plankton) samples
- Aquatic Life Use and Recreational Use (Aesthetics)
- Indiana Clean Lakes Program

  www.indiana.edu/~clp/

Aquatic Life Use: Lakes and Reservoirs

- Temperature and pH
  - Thermal modifications caused adverse effect on aquatic life and/or pH not between 6.0 and 9.0 standard units
- Indiana Department of Natural Resources information on trout stocking
  - www.IN.gov/dnr/fishwild/3622.htm
  - Not supporting if native cisco population gone or lake unable to support stocked trout

Recreational Use: Lake and Reservoir Aesthetics

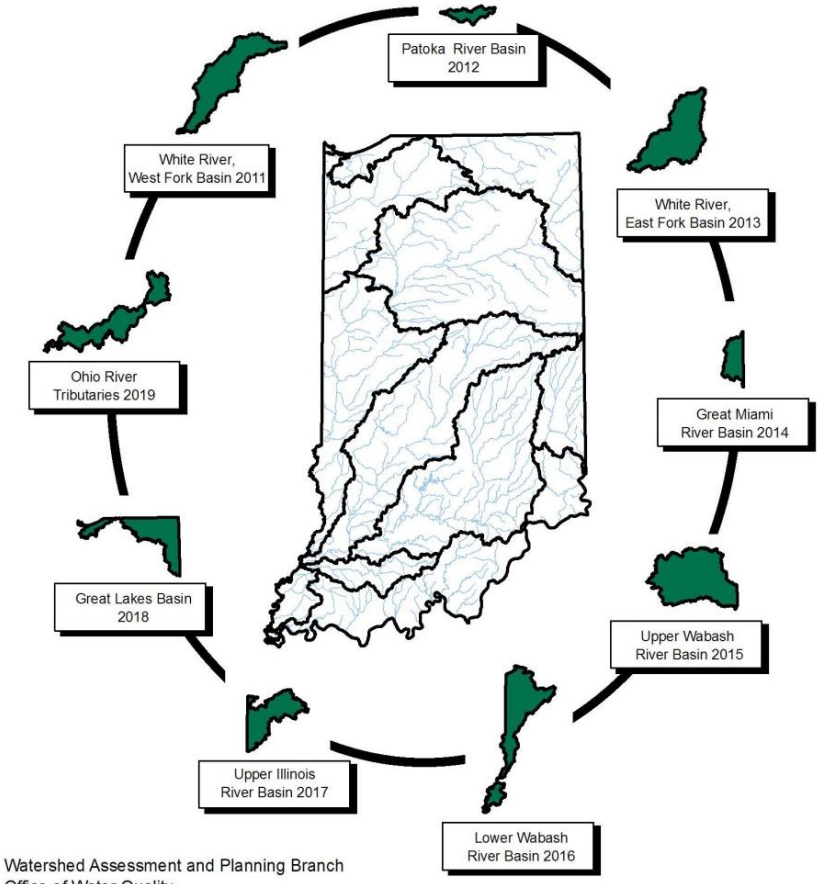
- Natural Lakes
  - Fully supporting if no more than 10% of all total phosphorus values >54 µg/L and their associated chlorophyll *a* values <20 µg/L
- Reservoirs
  - Fully supporting if no more than 10% of all total phosphorus values >51 µg/L and their associated chlorophyll *a* values <25 µg/L

Lake and Reservoir Trophic Status

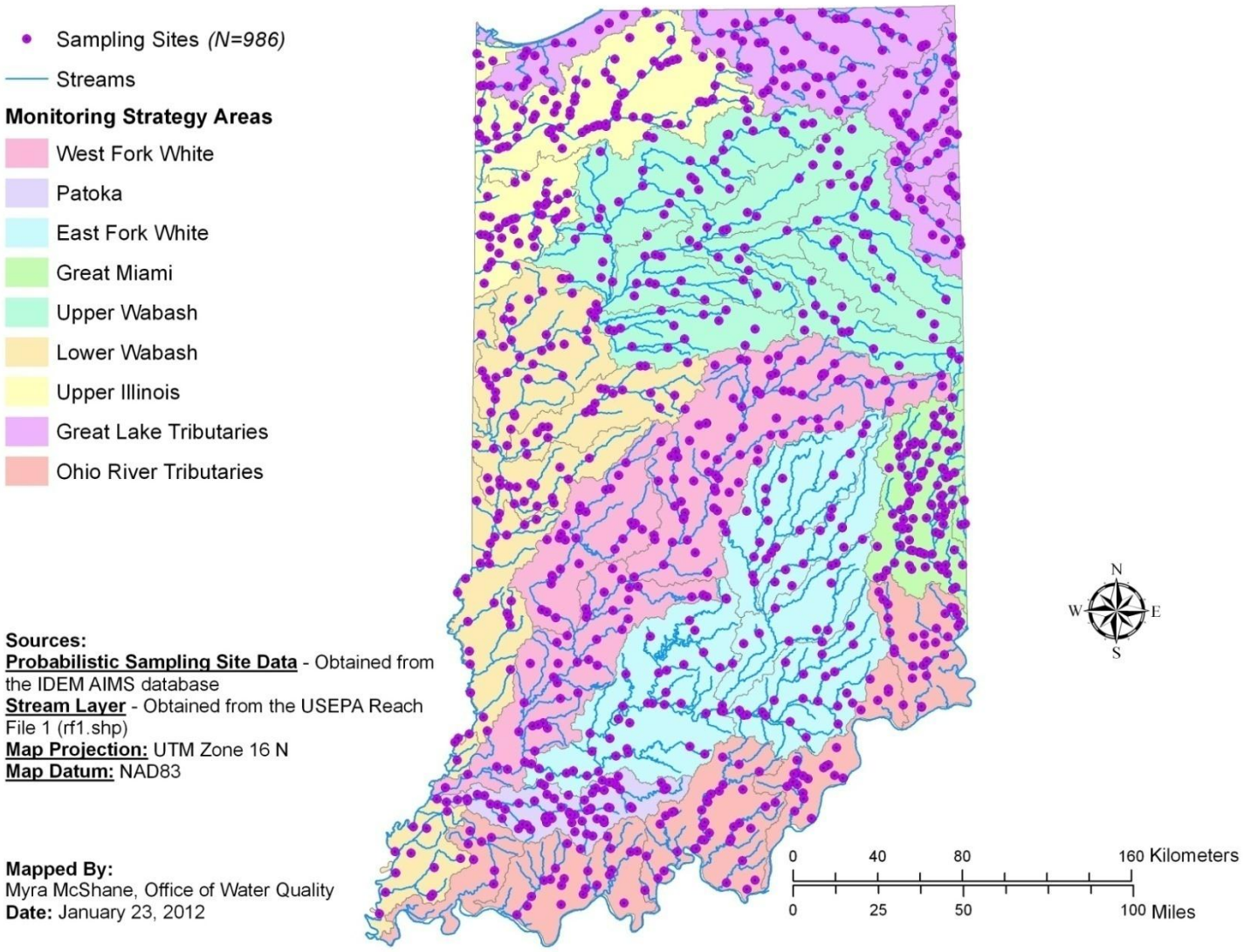
- Assess trends in trophic scores for publicly owned lakes and reservoirs to fulfill Clean Water Act Section 314
- Indiana Trophic State Index (TSI)
  - Nutrients, ammonia, dissolved oxygen, light transmission and penetration in the water column and plankton densities
- Classify lakes according to TSI (range 0-75)
  - 0-15, highest quality (oligotrophic)
  - 16-30, intermediate quality (mesotrophic)
  - 31-45, low quality (eutrophic)
  - 46-60, lowest quality (hypereutrophic)

Probabilistic Monitoring

- Randomly generated sites in rotating basins
- Characterize water quality for basin of interest and site-specific assessments
- Monitor trends in water quality over time within each basin and basin-to-basin comparisons
- Data collected include chemical, physical and biological parameters



Probabilistic Monitoring 1996-2011



Water Chemistry

- Field and laboratory water chemistry
- Three sampling events (May-October)
- General water chemistry, metals and nutrients
- Drinking Water Use and Aquatic Life Use

Algal Samples

- Phytoplankton (seston) and periphyton
- Chlorophyll *a* and pheophytin *a*
- Algal identification and enumeration
- One sampling event (September-October)
- Aquatic Life Use
  - Nutrient benchmarks for total phosphorus, nitrogen, dissolved oxygen, pH and algal conditions

Bacteriological

- Ambient *E. coli* concentrations as well as field chemistry
- Sampling once each week for five consecutive weeks (April-October)
- Human Health Recreational Use and Aquatic Life Use
  - Violation if five sample geometric mean >125 colony forming units (cfu) per 100 mL

Aquatic Life Use: Rivers and Streams

- Well-balanced aquatic community [327 IAC 2-1-9(60)]
  - Diverse in species composition
  - Several different trophic levels
  - Not primarily composed of pollution tolerant species
- Fish and macroinvertebrate communities
  - Impaired when Index of Biotic Integrity <36
  - Range = 0 (no fish or macroinvertebrates) to 60 (excellent assemblage of species)

Macroinvertebrate Community

- Insects, crayfish and mussels
- Sampling once (mid-July – October)
- Kick one minute with D-frame net in riffle, sweep bank habitat 50 meters, 15-minute pick for diversity
- Aquatic Life Use Index of Biotic Integrity
  - Number of taxa
  - Number of individuals
  - % intolerant
  - % predators
  - % sprawlers

Fish Community

- Sampling once (mid July-October)
- Electrofishing 50-500 meters
- Aquatic Life Use Index of Biotic Integrity
  - Dependent on watershed location and stream size
    - Number of species
    - Number of sensitive species
    - % omnivore individuals
    - % simple lithophilic individuals
    - Total number of individuals
    - % individuals with deformities, eroded fins, lesions and tumors

Habitat Evaluations

- Qualitative Habitat Evaluation Index (QHEI)…Ohio EPA 2006
  - Substrate composition
  - Instream cover
  - Channel morphology
  - Riparian zone and bank erosion
  - Pool/glide and riffle/run quality
  - Gradient
- Completed for sampling areas after macroinvertebrate and fish collections
- Score ranges from 0-100

  (<51 considered poor for biology)

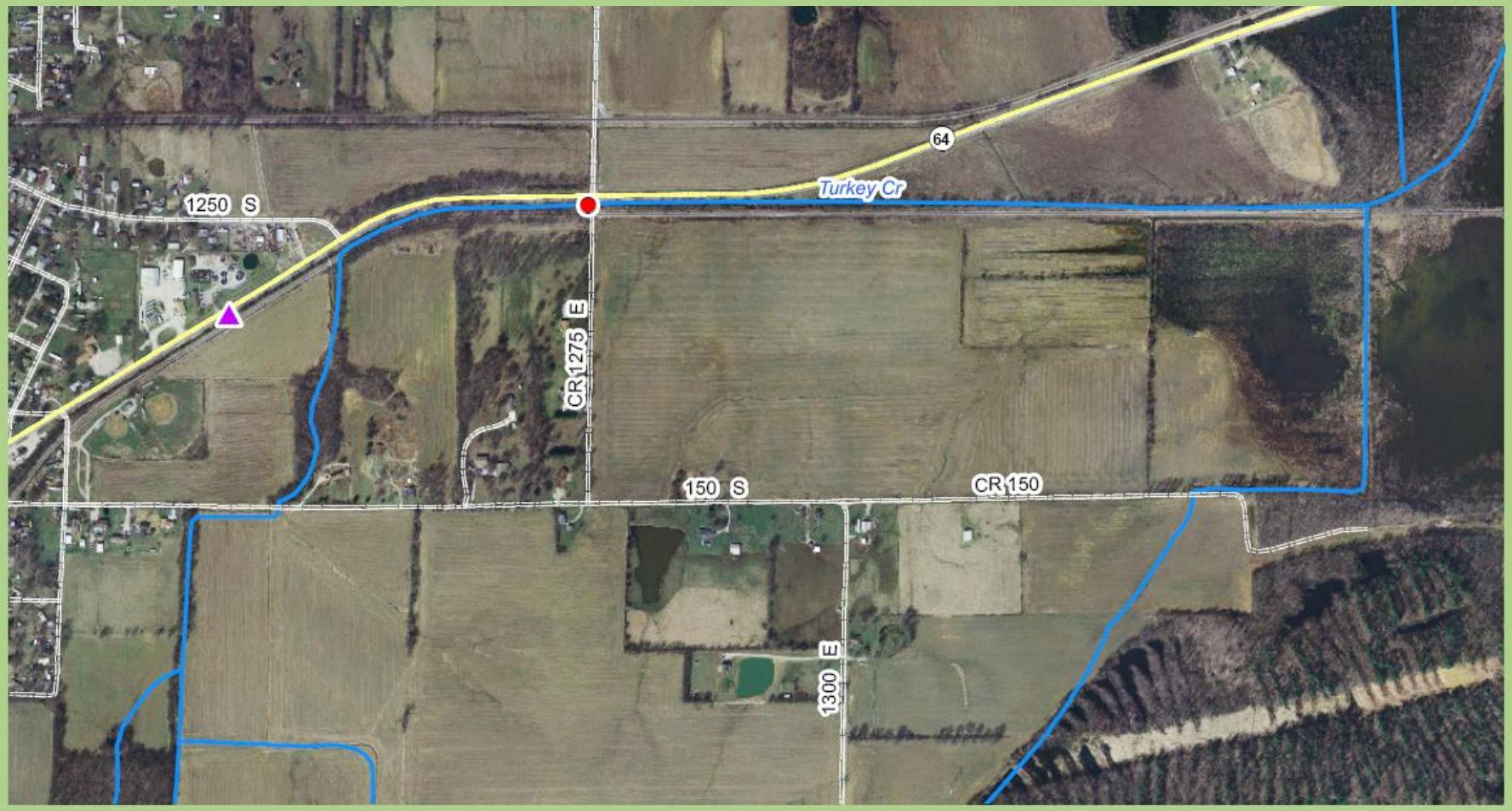
Impairment Cause/Source

- Cause:
  - Parameter violating Water Quality Standard and/or Impaired Biological Community (IBC)
- Source:
  - Unknown pending further investigation
  - Best professional judgment based on type of chemical violation and looking at point sources, aerial photos, riparian land use, and in-stream habitat

Extent of Impairment

- Best professional judgment based on
  - Permitted facility locations
  - Agricultural practices
  - Land use characteristics
  - Tributary influences

Turkey Creek Assessment



Permitted Pipe
Site Location
NHD Flowing Water
Local Roads
Interstate
State Route
US Hwy

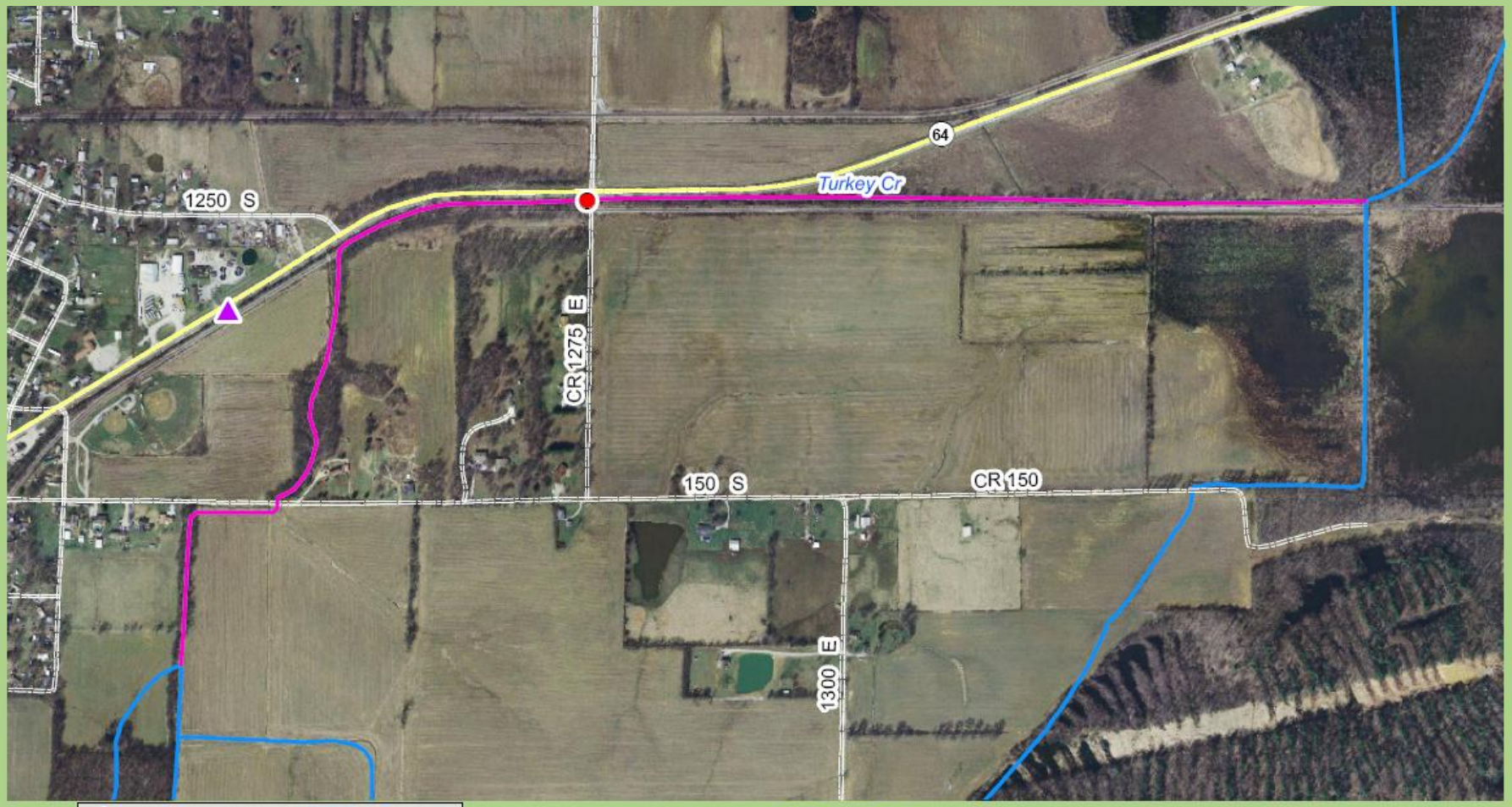
0 125 250 500 Meters
0 250 500 1,000 1,500 Feet

N
W E
S

IDEM

This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.
Mapped By: Stacey Sobat, Office of Water Quality
Date:03/19/2009
Sources:
Site Location Data - Obtained from the IDEM AIMS database
Orthophotography Data - Obtained from Indiana Map Framework Data (www.indianamap.org)
Non Orthophotography Data - Obtained from the State of Indiana Geographical Information Office Library
Map Projection: UTM Zone 16 N **Map Datum:** NAD83

Turkey Creek Impairment



Permitted Pipe
Site Location
Impaired Segment
NHD Flowing Water
Local Roads
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State Route
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0 125 250 500 Meters

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IDEM
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
EST. 1986

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Total Maximum Daily Loads

- Identify sources of impairments, recommend limits for pollutants and suggest actions to improve water quality
- Targeted watersheds based on type and number of impairments as well as active groups to implement recommendations
- Generally, 20-40 sites sampled multiple times for general chemistry and nutrients, bacteria, or both depending on previous impairments
- Human Health Recreational Use, Drinking Water Use and Aquatic Life Use

Baseline Monitoring

- Comprehensive information to identify sources of impairment and designate critical areas for planning purposes
- Targeted sites in small watershed based on a progression of drainage area "snapped" to the nearest bridge
- Physical, chemical and bacteriological data collected monthly for one year and biology once per year
- Human Health Recreational Use, Drinking Water Use and Aquatic Life Use
- Baseline data for measuring performance of best management practices

Hydrograph Control Release Facilities

- Some issues with discharge from lagoons
  - Improper design and location
  - Poor construction
  - Poorly operated or installed equipment
  - Inadequate maintenance
- Evaluate placement and accuracy of flow measuring equipment in stream
- Calibration and operation of flow measuring equipment in the plant facility
- Assist facility managers in operating flow measuring devices

Watershed Improvements

- Must identify changes in water quality to receive federal Clean Water Act funds
- Targeted monitoring of waters previously impaired (best management practices and sufficient recovery time)
- Sampling sites and parameters monitored vary based on original impairment (up to 20 sites)
- Human Health Recreational Use, Drinking Water Use and Aquatic Life Use

Hoosier Riverwatch Program

- Volunteer Stream Monitoring Program
- Train participants in water monitoring methods
- Provide support and equipment opportunities to certified volunteer monitors
- Workshops located throughout the state
- Participants decide their monitoring goals and location
- Online database

Summary

- Monitoring Strategy Objectives
- Sampling Programs
  - Site selection
  - Parameters
  - Frequency
  - Assessment for designated uses
- Where are we in 2014?

Monitoring 2014

- Fixed Stations = Continue monthly sampling at 163 sites
- Fish Tissue = Lower Wabash River Basin, Kankakee & Iroquois River Basins, Targeted Lakes
- Blue-Green Algae = May drop some lakes and add others
- Lake Water Quality = Continue random sampling of lakes
- Probabilistic = Whitewater River Watershed
- TMDL/Baseline = Southern Whitewater River Watershed and Mississinewa River Watershed
- Hydrograph Control Release Facilities = Continue as needed
- Watershed Improvements = Yet to be determined

Questions?

Office of Water Quality

Watershed Assessment and Planning Branch

www.idem.IN.gov/5512.htm

Probabilistic Monitoring Section

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