Urban Wetlands

Hooking students to Geosciences

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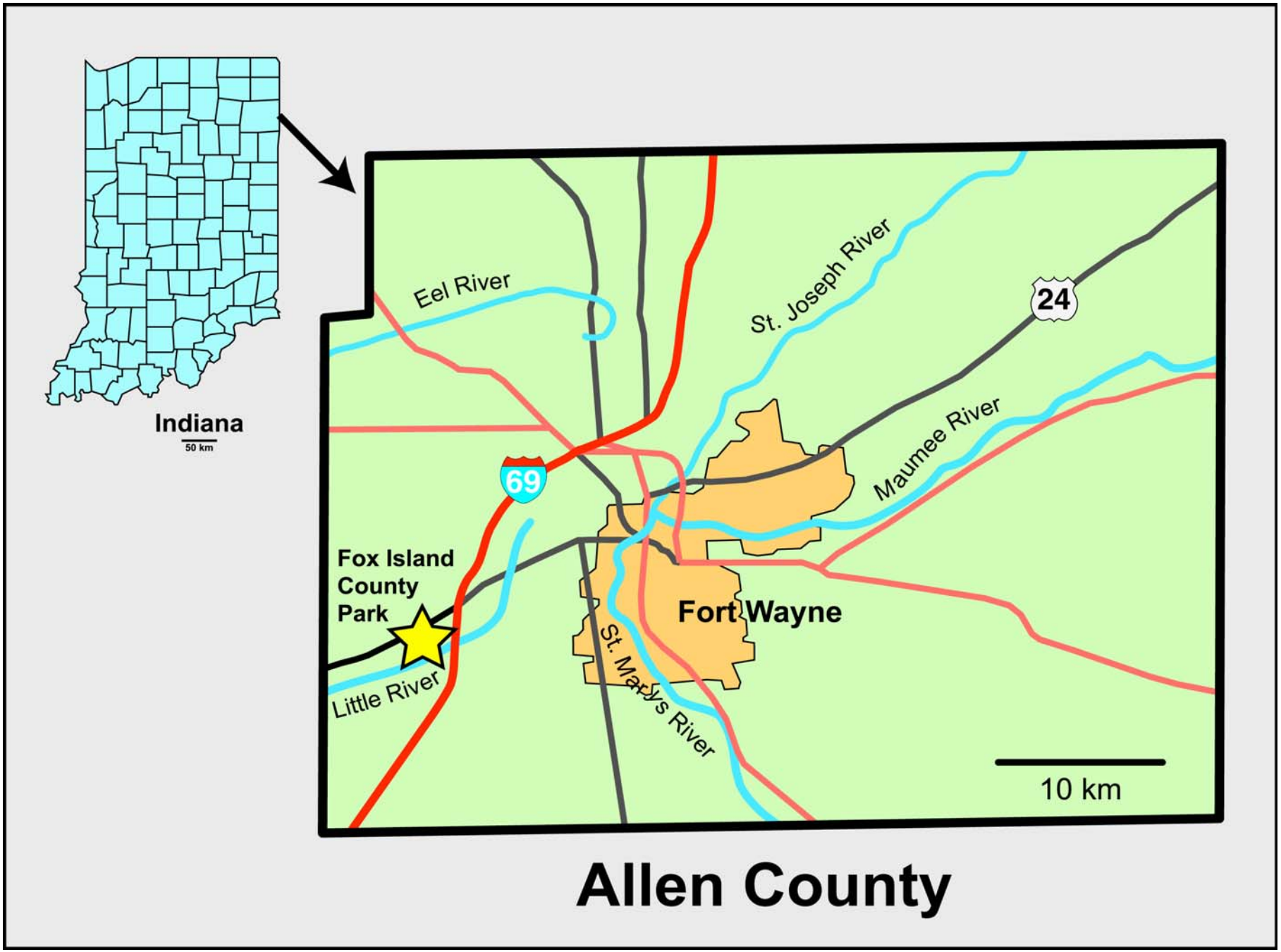
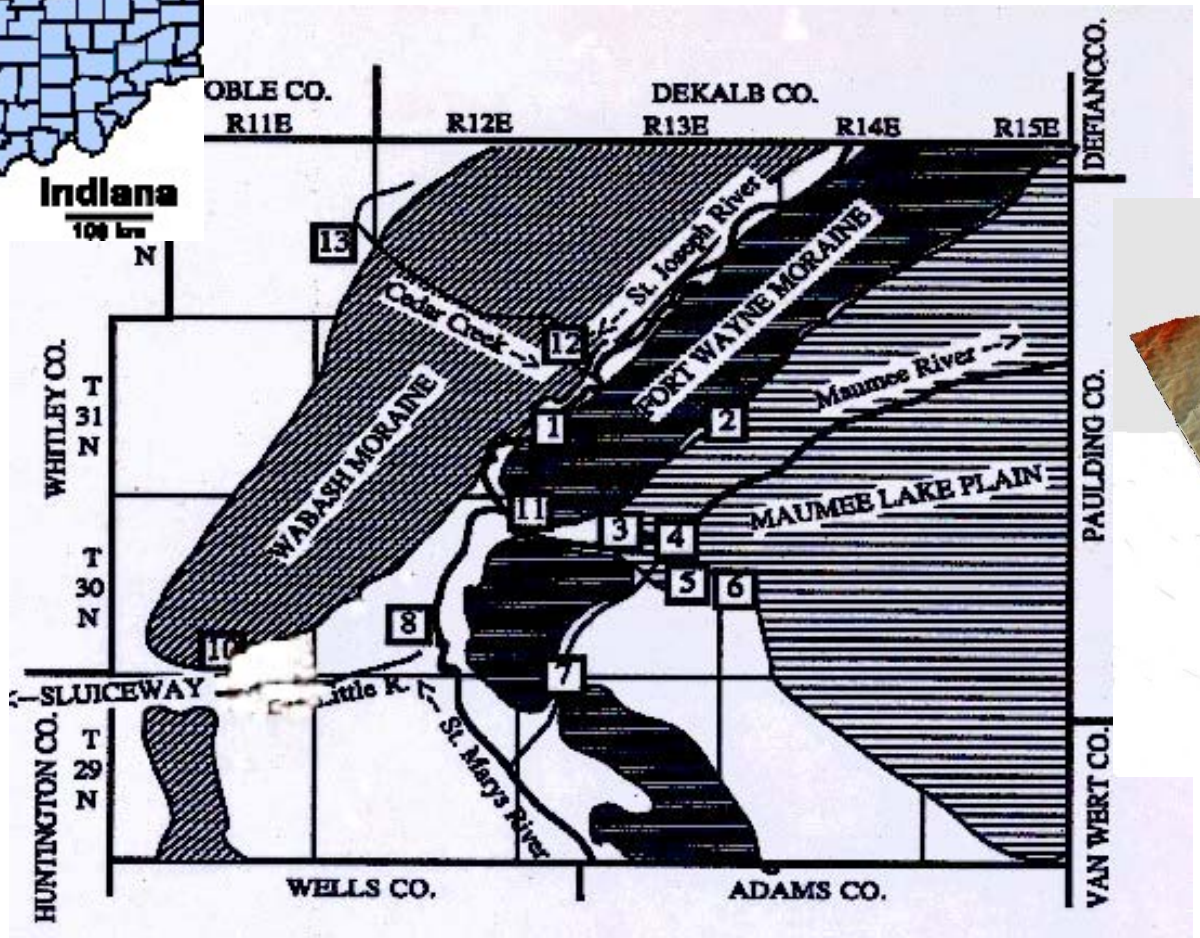
Courses

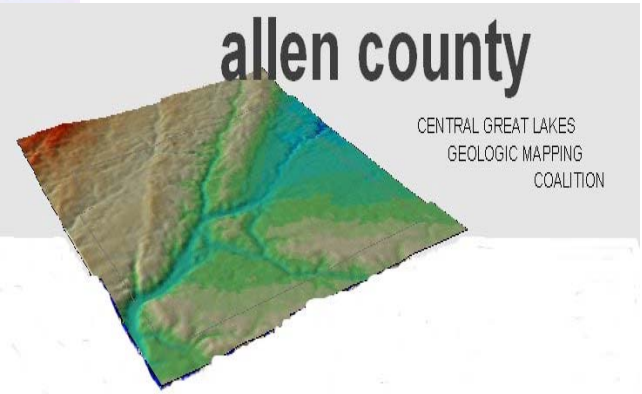
- Hydrogeology
- Environmental Geology & Urban Geology
- Environmental Conservation
- “Understanding” Wetlands
- Hydrogeology
- Physical Geology Lab

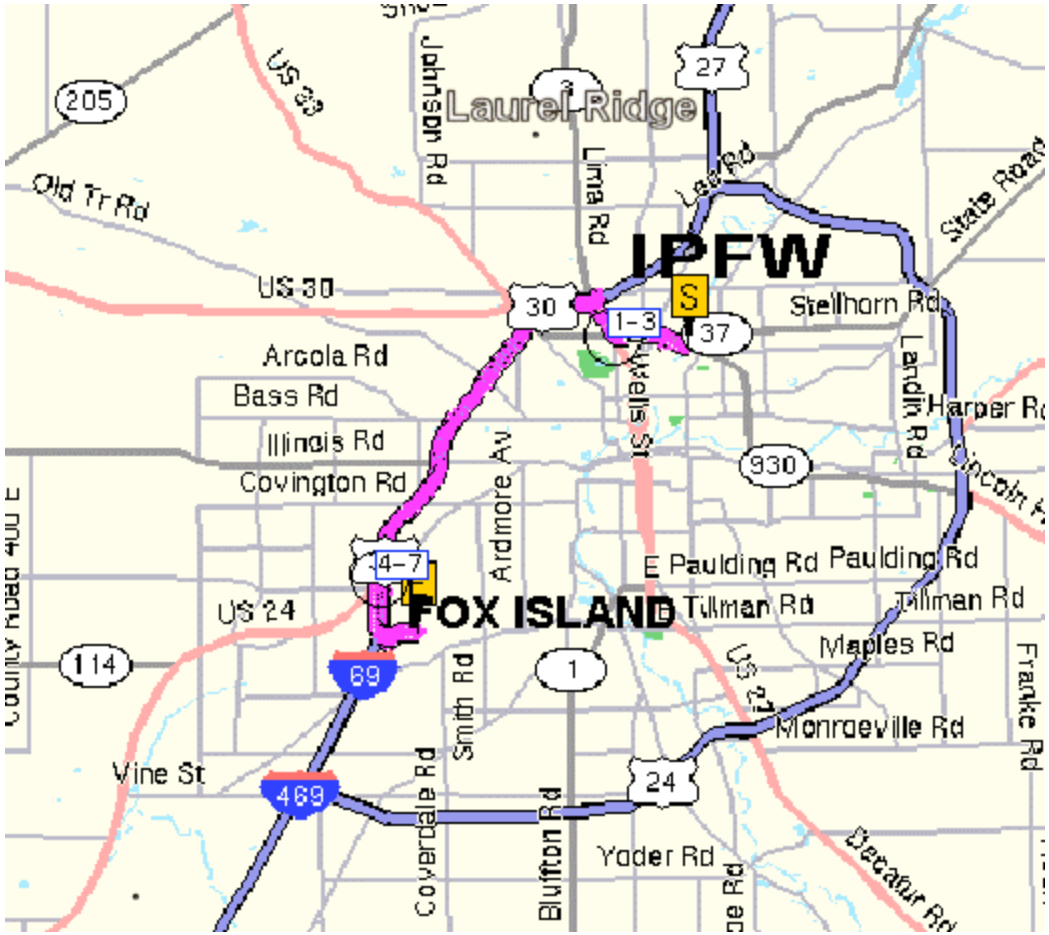


Allen County

Area: Glacial Geology & Geomorphology of Allen County, Indiana







Map showing study areas

Teaching Levels (TLs) in ascending order

Samuelowicz & Bain (1992)

*Impart information…teacher centered

. **Transmit knowledge…develop competence…skills and conceptual abilities

. ***Facilitate understanding … to understand subject matter … apply

. ****Change students' conceptions … reality … different knowledge … develop conceptual framework …same level , and

. *****Support student learning…student centered…more at graduate level

TLs can be used to gauge faculty effectiveness in engaging undergraduates…most faculties are at the first two levels (Akerson et al, 2005).

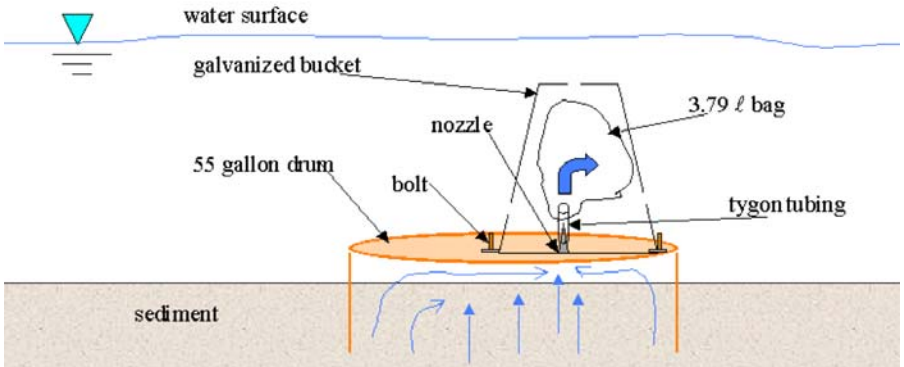
Getting faculty to be at or near the upper level would require that faculty review and change their teaching methods, injecting some research based or service learning into the curriculum.

Why choose wetlands?

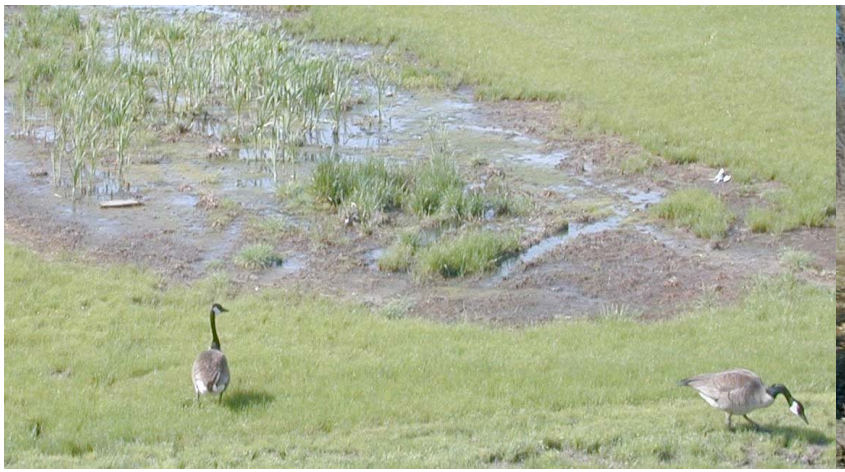
- They are ubiquitous …both natural & artificial
- Within driving distance of most schools
- Varied types
- Depth to groundwater is low in most cases
- Can serve as outdoor labs for various courses: Wetlands, Hydrogeology, Environmental Geology, Environmental Conservation, Introduction to Physical Geology Lab, Sedimentology, Geomorphology, Geophysics, etc.

Why use wetlands?

- Disappearance of wetlands
- Students learn methods, use of instruments, develop ideas, design, collect, analyze, report, & get published…
- Importance
  - Location, demise of wetlands, involving stakeholders, and education



http://www.geo.sunysb.edu/lig/Conferences/Abstracts99/O'Rourke/O'Rourke_MS.htm



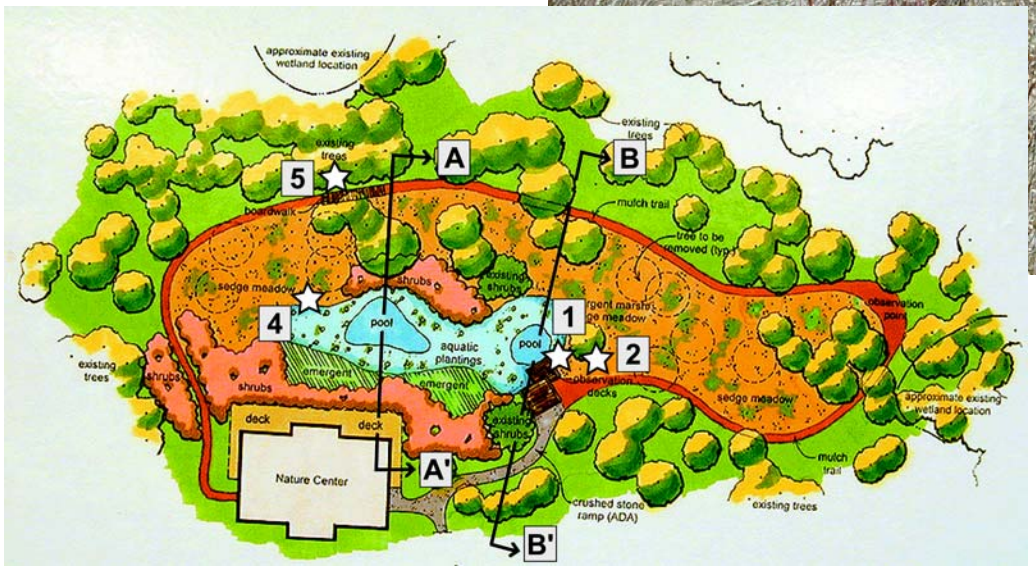
Activities

- **Groundwater monitoring well field**
- **Groundwater levels with time**
- **Groundwater flow direction calculation**
- **Making of seepage meter**
- **Basic water chemistry: oxidation reduction potential (ORP), conductivity, and temperature. Also, Iron, Phosphates, and Nitrate/Nitrogen**
- **Collection of precipitation data**

Activities Contd

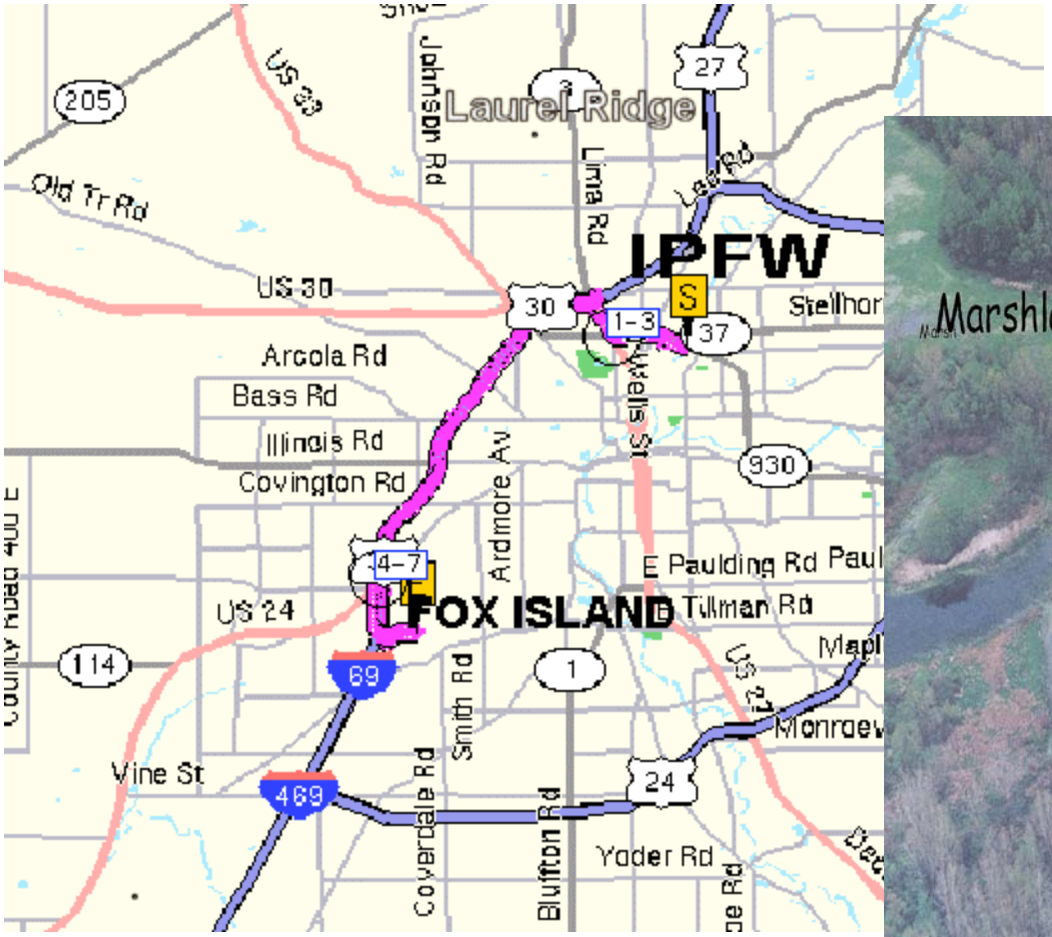
- **Collection of Soil samples**
- **Sieve analysis**
- **Analysis of sediments: mineral/rock composition**
- **Sedimentology … provenance**
- **Stratigraphy … using soil cores**
- **Geophysics…ground penetrating radar**
- **Surveying of wells**

Constructed Wetland



Natural Wetlands (Fox Island)

Allen County Indiana

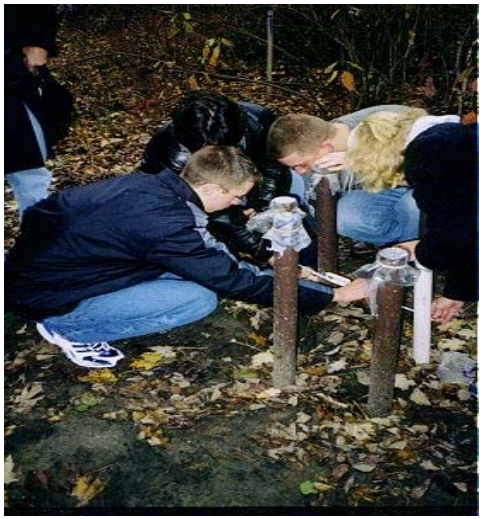


Water Level Elevations: Well Elevations

Well	Elevation
PV1	756.84
PV2	757.13
PV3	757.43
12"	757.25
Mutt	757.55
Pete	757.95
Near	757.30
1	756.38
2	756.75
2a	756.74
2b	756.00
3	756.24
4	757.32
5	756.92
6	756.93
7	757.61
8	756.91
9	756.66

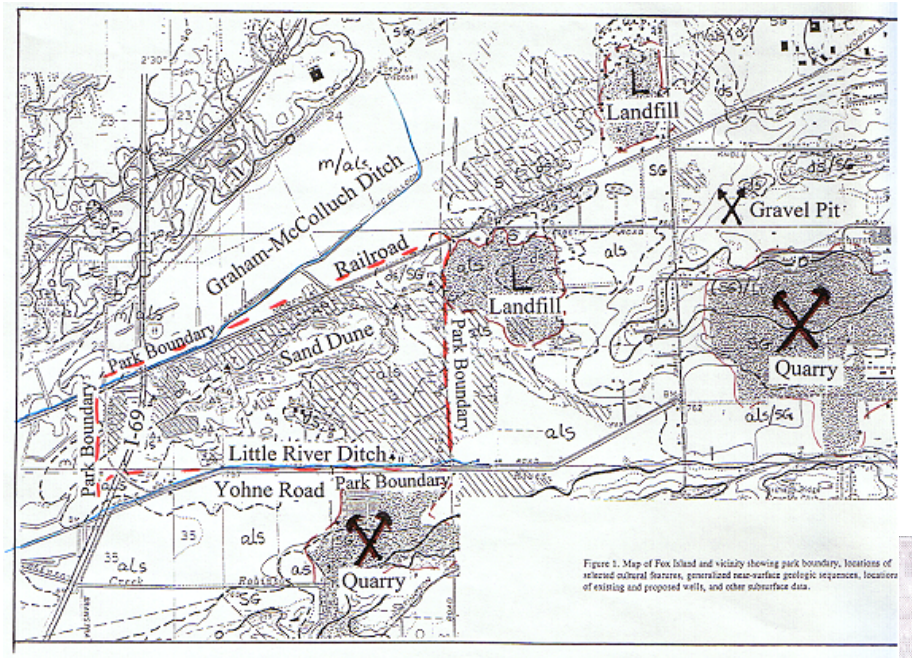
Activities

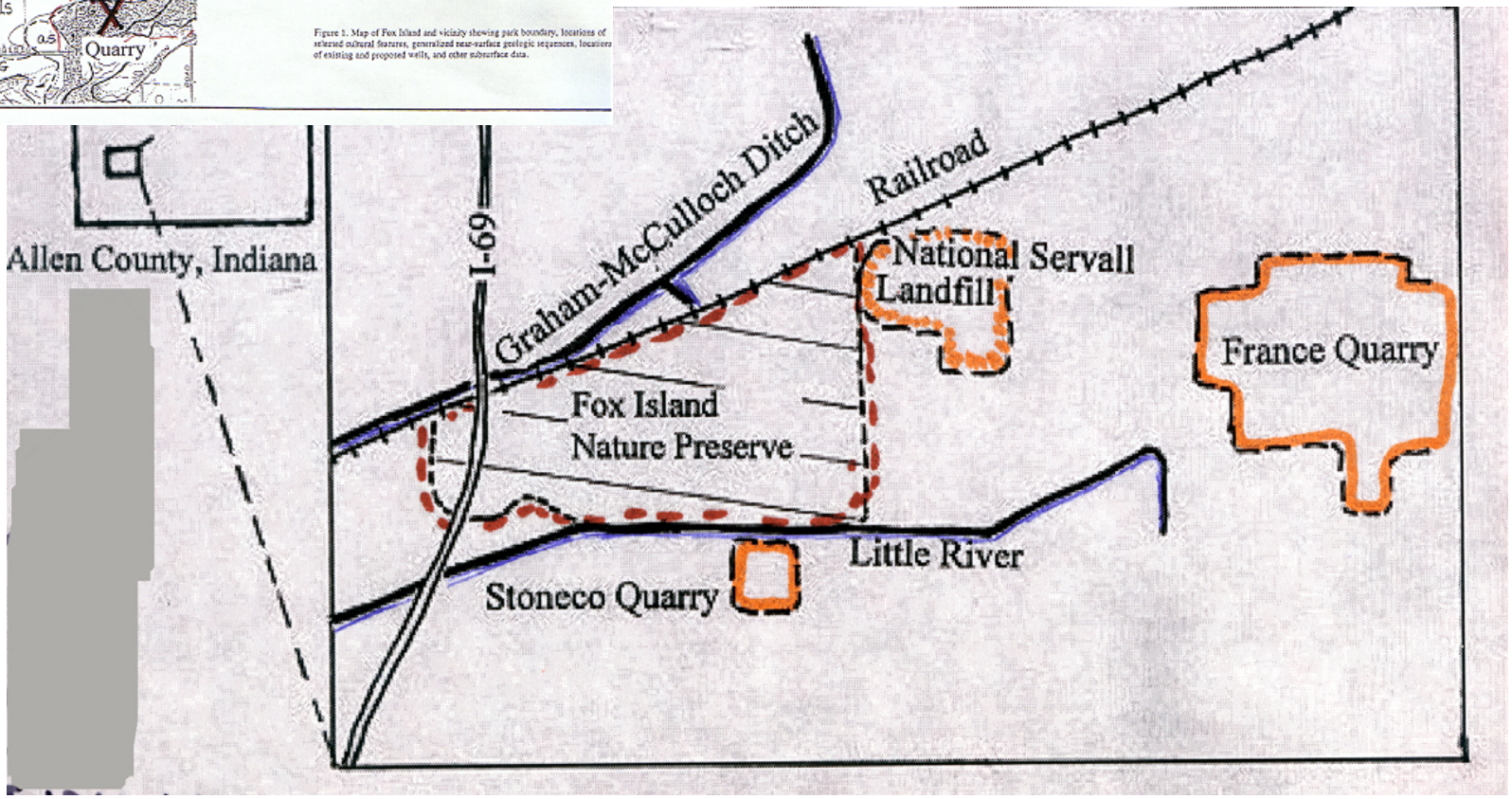
- Depth to Groundwater level



- Simulations

Effects of Anthropogenic Activities





Activity
Water Table maps

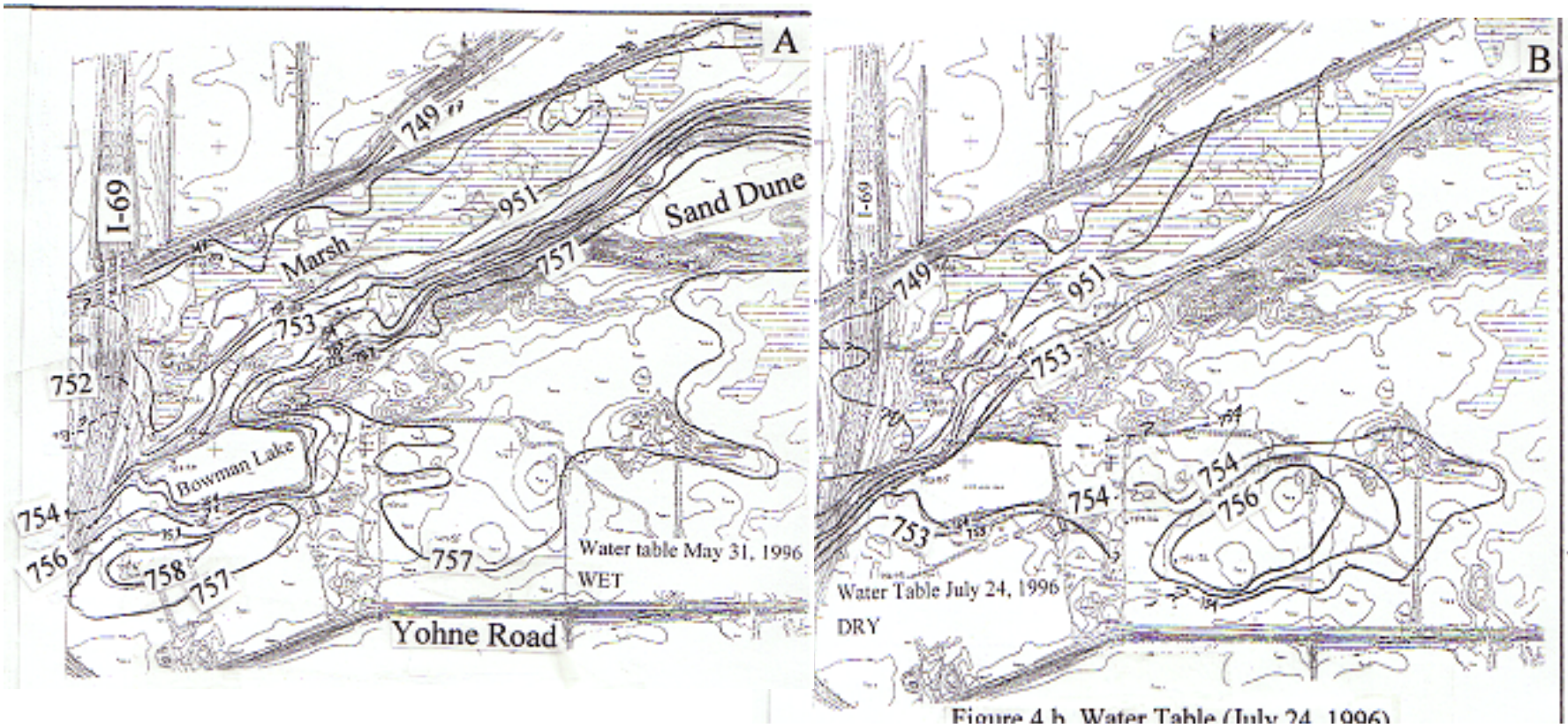
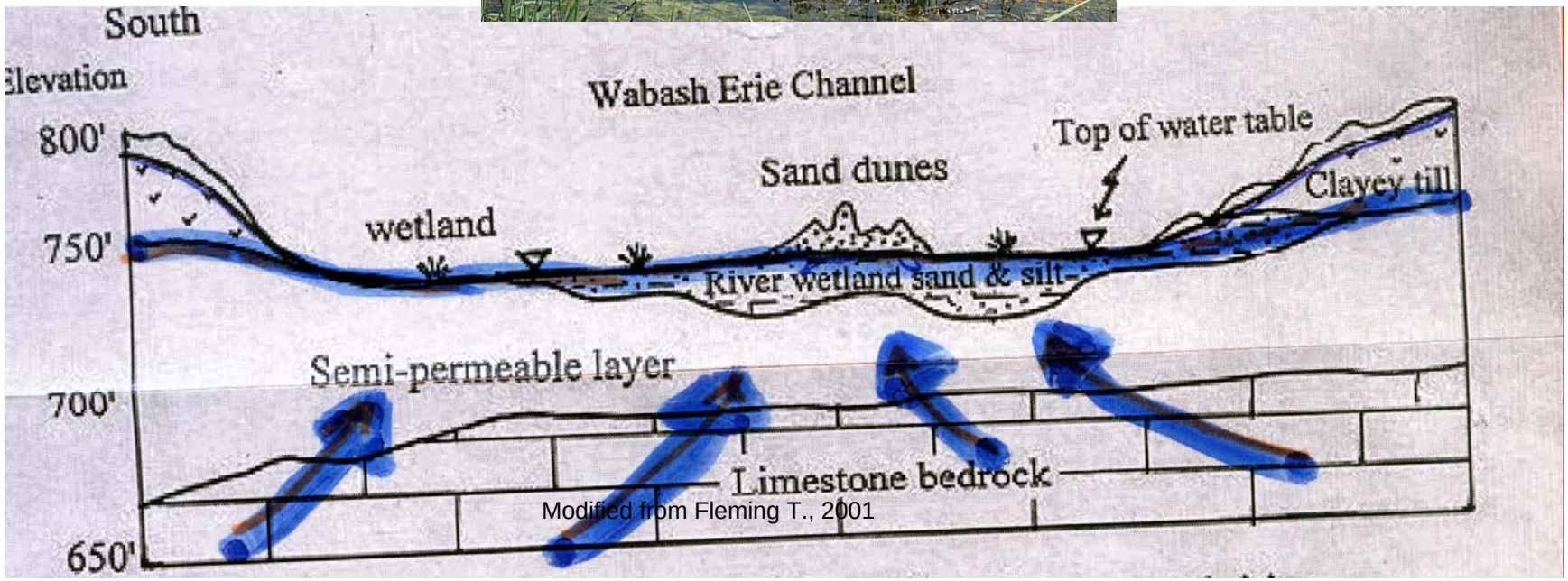
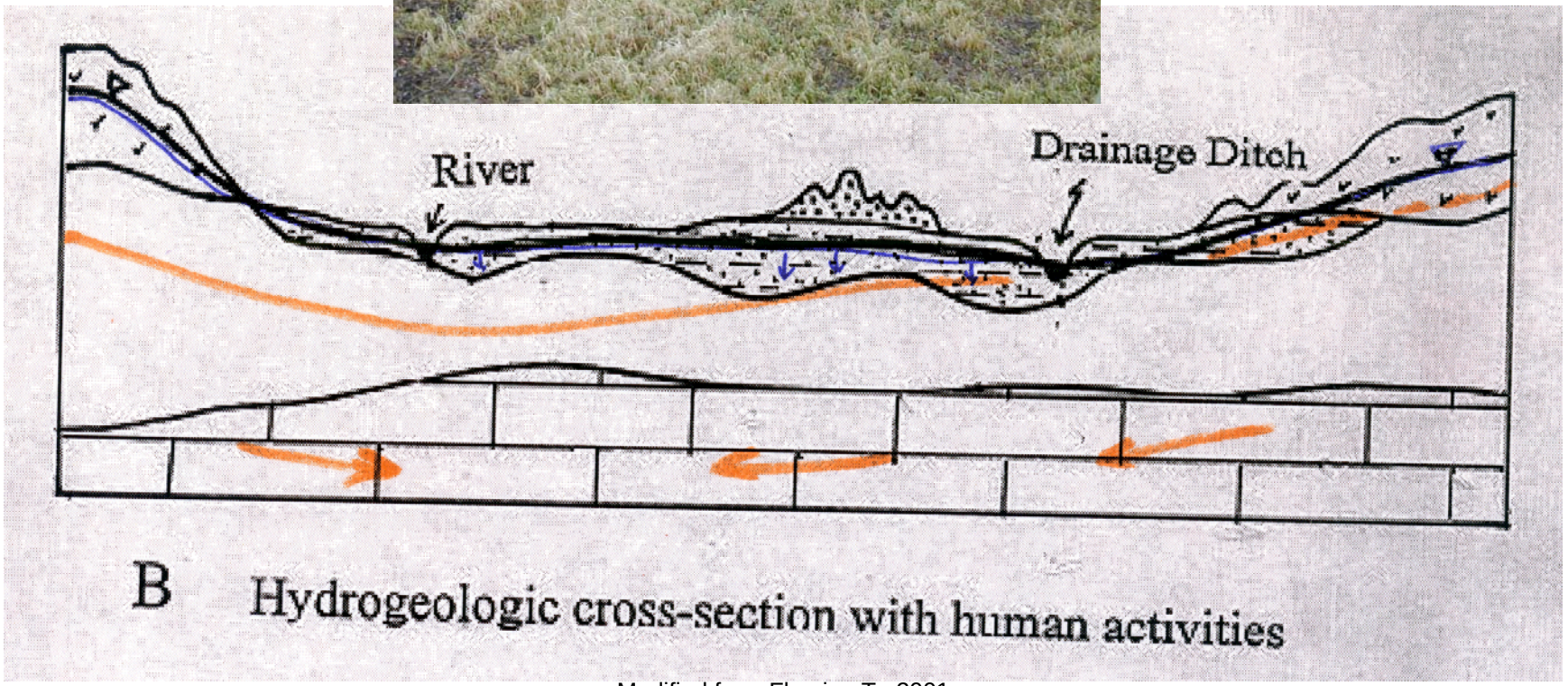


Figure 4 b. Water Table (July 24, 1996)

Groundwater flow direction

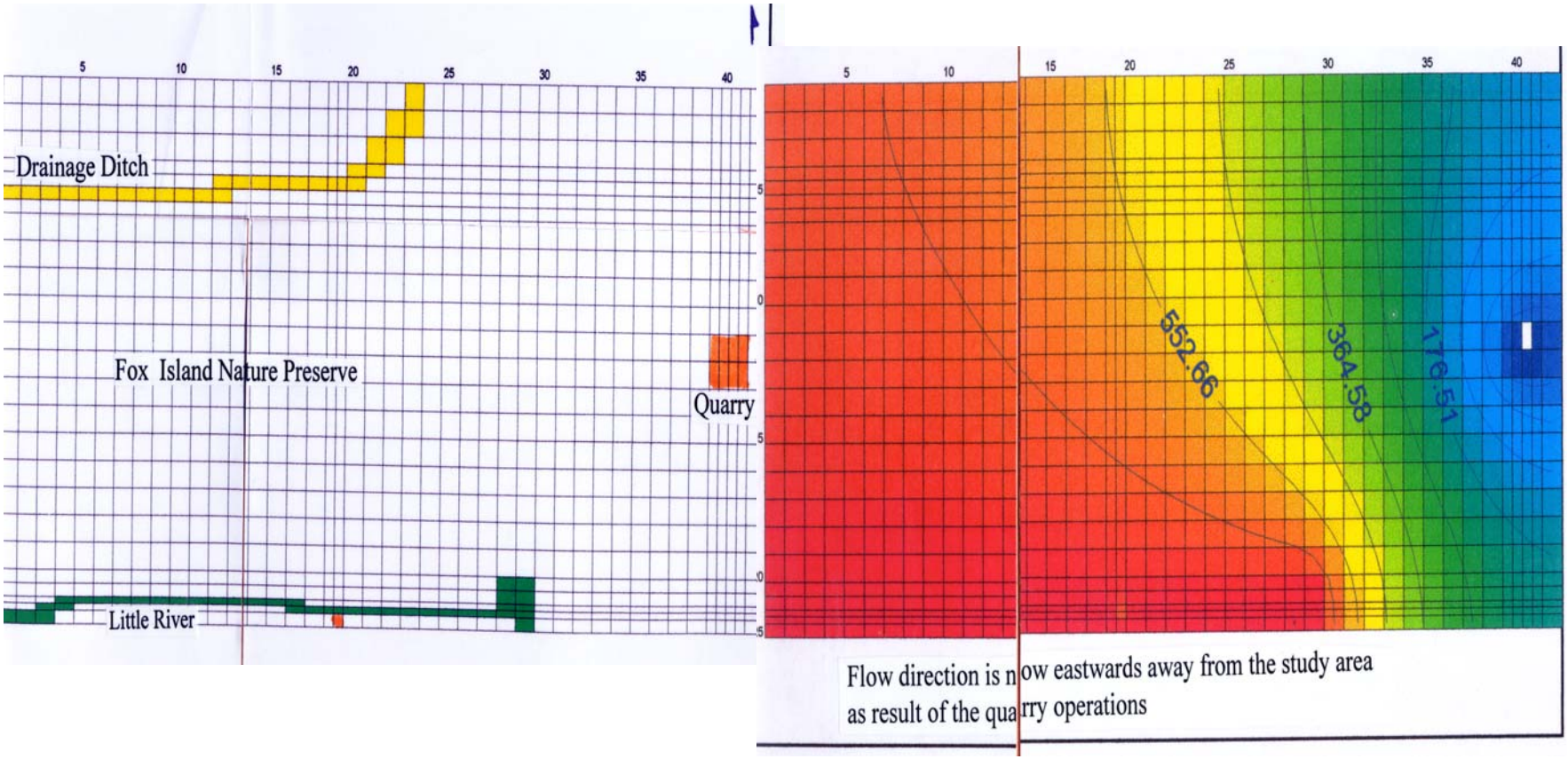




Modified from Fleming T., 2001

- Steady state condition
  - Grid used 42 x 25 x 3 representing 19,000 x 9,500 x 150 feet

- Steady state condition
  - Pumping rate ~3 million gallons per day



AREA II IPFW

ST. JOSEPH RIVER
W. CAMPUS DRIVE
S. CAMPUS DRIVE
E. COLISEUM BLVD.
E. CAMPUS DRIVE
N. ANTHONY BLVD.
WHITE DR.
SOUTH CAMPUS
930
P-1
P-2
P-3
P-4
P-5
P-6
P-7
P-8
P-9
1
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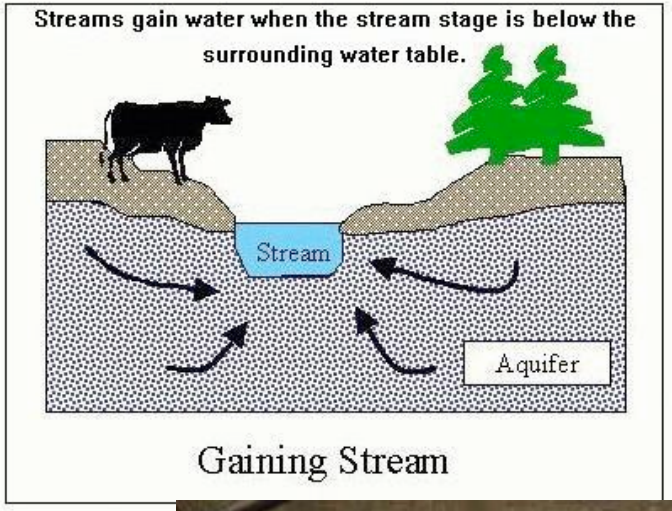
Activity
Well Field

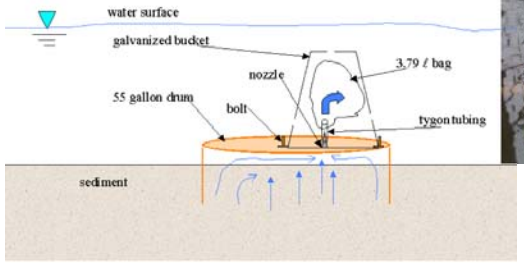


Activity

- Water level measurements
- Relationships between wells

Drawing from http://www.if.uidaho.edu/~johnson/ifiwrri/sr3/swgw.html

Relationship between depth of PVC pipe Below Ground Level (BGL) and water level in the pipes

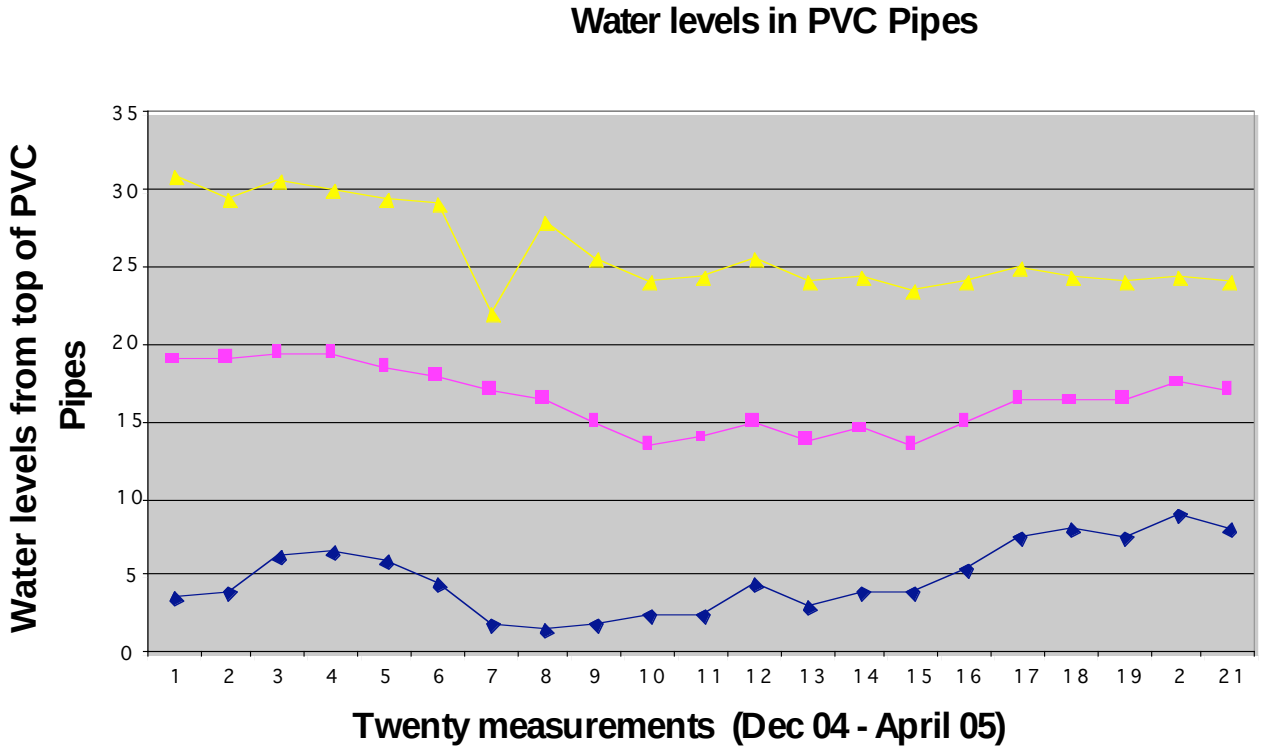


- The deep PVC pipe (31" below ground level (BGL)) had a water level of 56 inches, the intermediate PVC pipe (27" BGL) has 43 inches of water and the shallowest (23" BGL) has 33 inches of water…..upwelling condition & groundwater discharge

- The correlation (r) between the length of PVC BGL and water is very high (r =0.997) and this can be used to model the water level in PVC pipes with the depth. However, the correlation coefficient between the water level in the deepest PVC to the creek's water level is very low (r = 0.114).

Water levels in PVC Pipes

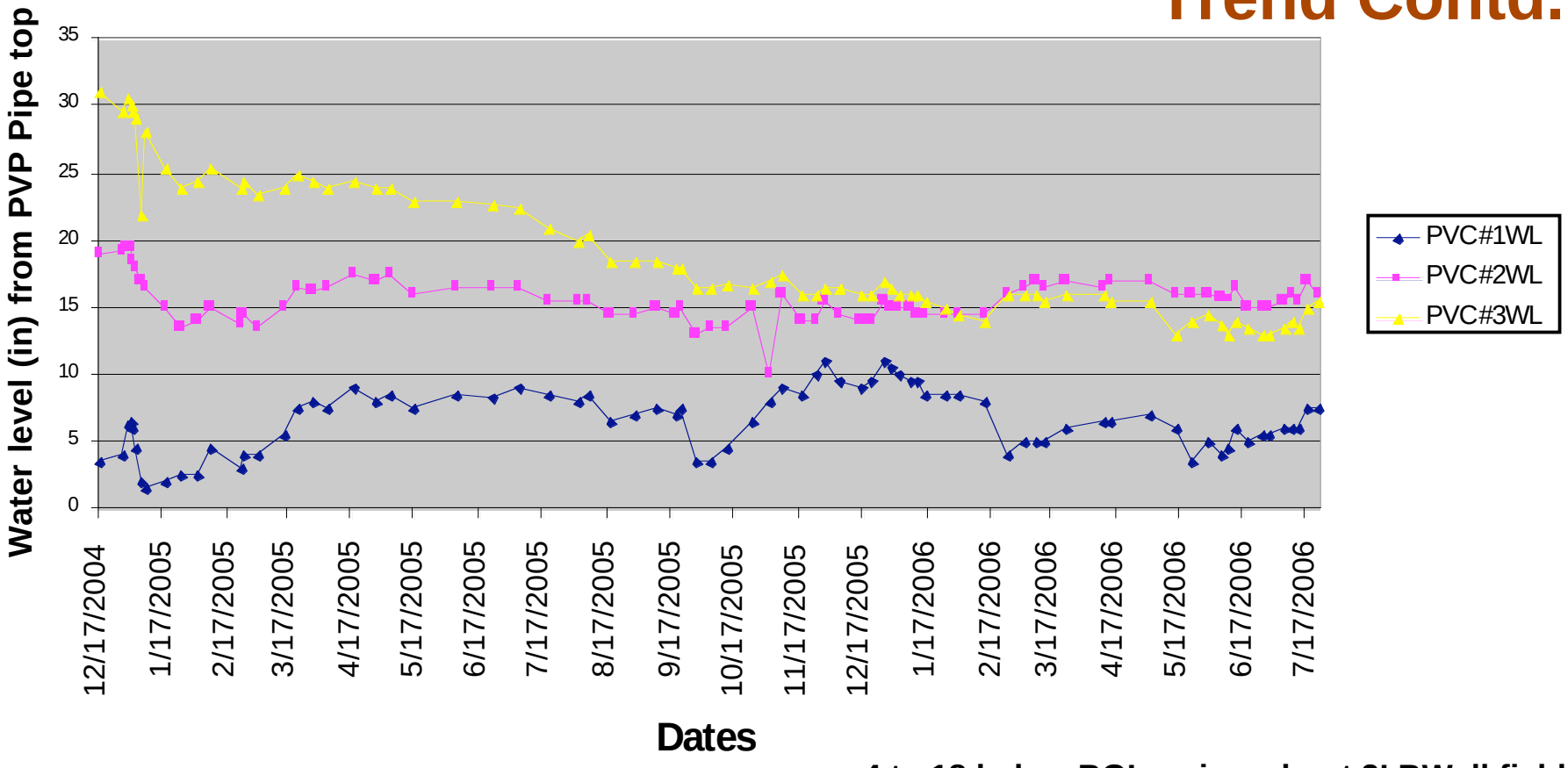
- **Correlation between pipes 1 & 2 is (r) = 0.379;**
- **Pipes 1 & 3 is (r) = 0.010 &**
- **Between pipes 2 & 3 is (r) = 0.765**



- **Effect of nearby construction**

Water Levels

Trend Contd.



4 to 18 below BGL…, i.e., about 2’ BWell field

Summary & Conclusions

- Get urban students excited about science using available resources…make geology relevant
- Can do a lot with WETLANDS
- Wetlands have ecological and societal importance and their demise should be looked into.
- Involve students early as the future of science and our future depend on them

Some recent publications

- *Watson, L, and Isiorho, S. A. 2008. Teaching Environmental Education in Middle School Science-Radical Reflections of a Middle School Classroom Teacher. Fort Wayne Teaching Conference. February 8, 2008.

- Isiorho, S. A. 2007. Math, Science, and Field Geology. An Oral and Poster presentation at the Chicago Symposium Series. The First Midwest Symposium on "Excellence in Teaching Mathematics and Science: Research and Practice" p 7 of Schedule and Abstract. Roosevelt University, Chicago, Illinois. October 12-14, 2007

- Isiorho, S. A. 2007. Showing students the art of presentation: Leading by example. Published in GSA Abstracts with Programs Vol. 39, No. 3, p. 53

- Isiorho, S. A. and *Daughdrill, G F. 2007. Student observes the effect of construction on water levels in a nearby Creek. Published in GSA Abstracts with Programs Vol. 39, No. 3, p. 21

- Isiorho, S. A. 2007. A presentation "Research as a component in Undergraduate Upper Level Curses" at the Role of Departments in preparing Geosciences professional workshop. William and Mary College, Williamsburg. Jan 10-12

- *Daughdrill, G. F. and Isiorho, S. A. 2006. The importance of understanding groundwater movement to the management and preservation of wetlands. Published in the 51st Midwest Ground Water Conference, Program with Abstract p17-18. Lincoln NE, November 7-9, 2006.

- *Daughdrill, G. F. and Isiorho, S. A. 2006. The preservation of Wetlands in Northeastern Indiana. Abstract published in the Indiana Academy of Science 122nd Annual meeting, Ball State, Muncie, IN. Nov. 2-3, 2006. p 60.

Publications Contd.

- Isiorho, S. A. 2006. The Challenge of Maintaining Urban Wetlands. *International Symposium: Wetlands 2006: Applying Scientific, Legal, and Management Tools to the Great Lakes and Beyond.* Grand Traverse Resort, Traverse City, Michigan. August 28-31, 2006

- Isiorho, S. A. 2006. Wetlands, the ultimate outdoor laboratory for geology students. Published in GSA Abstracts with programs Vol. 38, No. 4, p. 25

- Isiorho, S. A. 2005. Bringing Geology home to undergraduates using your surrounding. Published in GSA Abstract with Programs Vol. 37, No. 5, p 98

- Isiorho, S. A. 2005. Involving undergraduates in the determination of the relationship between surface water and groundwater. Published in GSA Abstract with Programs Vol. 37, No. 5

- *Zollinger, Chris and Isiorho, S. A. 2004. What is in the natural and anthropogenic wetland soils of NE Indiana? In: Indiana Academy of Science 120th Annual meeting Oct. 28-29, 2004. Hanover College. p76

- *Zollinger, Chris and Isiorho, S. A. 2004. Comparing Natural Wetland Soils with Anthropogenic Wetland Soils in NE Indiana. GSA Abstracts with Programs Vol. 36, No. 3, March 2004