Hydrology and Water Security Education Graduate Programs

Undergraduate Capstone Course

HYDROLOGY & WATER SECURITY PROGRAM
The UNIVERSITY of OKLAHOMA

OUTLINE

- OBJECTIVES OF HWS PROGRAM
- PREMISE FOR HWS
- PROPOSED EDUCATIONAL PROGRAMS
- CEES UNDERGRADUATE CAPSTONE EXPERIENCE

OBJECTIVES OF HWS PROGRAM

1. Highlight the need for a graduate program that encompasses HWS

2. Develop an organizational structure for OU's research, teaching, service and public outreach efforts related to "hydrology" and "water security"

PREMISE FOR
"HYDROLOGY AND WATER SECURITY" PROGRAM

- Greatest societal challenge of the 21st century
  - meeting water needs of humans and ecosystems, and
  - mitigating water-related disasters
- High-impact events strongly influence transportation, military operations, utility grids, structures, homeland security, agriculture, health, and recreation
- Globally, flooding is costliest and deadliest natural disaster

- **Hydrology has traditionally been broken into sub disciplines focusing on separate components of the water cycle**

- **Emergence of a more comprehensive understanding of the water cycle and its components**

- **Increasing interest in holistic endeavors that focus on interactions between water, society, earth, biological systems, water economics, and virtual water trade**

- **Water resources management is second major challenge that affects both current practitioners and future hydrologists**
- **Increasing population places additional stresses on finite water resources**
- **Climate change alters the distribution of water, increasing scarcity for some and flood risks for others**
- **Water resources are frequently managed at the local scale, but solutions need to be devised with a global vision**

- **Education and training in hydrology have often led to gap between water sciences and engineering**

- **Environmental change is dictating need for adapting water infrastructures to changing boundary conditions and internal dynamics**

- **Engineering design still relies on modeling approaches devised several decades ago, without accounting for uncertainty or climate change**

- **Multi-objective planning for water quantity, water quality, and environmental quality offers opportunity to take advantage of interdisciplinary modeling to address water resources, environmental quality, and ecosystem sustainability**

PREMISE FOR
"HYDROLOGY AND WATER SECURITY" PROGRAM

- "Hydrology" and "Water Security" professionals oftentimes interact
- Hydrology is greatly influenced by the economic, social, and political (even geo-political) aspects
- Water Security professionals must have rudimentary knowledge of how water behaves in the physical and engineered environments
- Proposing a framework for an academic program that provides:
  - "in depth training" in chosen career fields
  - "breadth of knowledge" for functioning across disciplines

PROPOSED HWS DEGREE PROGRAMS

- **Four possible graduate degrees**
  1. **Online Master of Science in Hydrology and Water Security (MS HWS non-thesis)**
  2. **Accelerated Master's in Hydrology and Water Security (MS HWS thesis and non-thesis)**
  3. **On Campus Master of Science in Hydrology and Water Security (MS HWS thesis and non-thesis)**
  4. **Doctor of Philosophy (Hydrology) (dissertation)**

Online and On Ground Masters Degrees

Life Sciences and Engineering (Hydrology)

Cross-Disciplinary Common Core Courses

Management and Social Sciences (Water Security)

Online Masters Degree

Hydrology

Water Resources Management

Groundwater and Seepage

Computational Hydrology and Water Resources Systems

Management and Social Sciences (Water Security)

Online Masters Degree

Life Sciences and Engineering (Hydrology)

Fundamental Hydrology

Watershed Management

Water Reuse

Water Economics

Online Masters Degree

Life Sciences and Engineering (Hydrology)

Fundamentals of Project Management
Hydrometeorology
Understanding and Managing Flood Risk
Geographic Information Systems
Hydroclimatology
Water Security
Water Law

Management and Social Sciences (Water Security)

On-Ground Masters Degrees

Hydrology Track

Cross-Disciplinary Common Core Courses

Water Security Track

On-Ground Masters Degrees

Water Resources Management, Radar Hydrology, Hydroclimatology, Environmental Modeling ,Remote Sensing Hydrology, Climate Change, Water and Natural Hazards, Computational Hydrology and Water Resources Systems, Hydrologic Science

Water Security Track

On-Ground Masters Degrees

Hydrology Track

River Science, Water Technology for Emerging Regions, Fundamental Hydrology, Water Security, Aquatic Chemistry, Watershed Management, Groundwater Quality Protection, Climate Change, Water and Natural Hazards , Global Change Hydrology, Water Law

On-Ground Masters Degrees

Hydrology Track

Water Security Track

Fundamental Hydrology
Watershed Management
Water Reuse
Open Channel Flow
Hydrology
Groundwater and Seepage
Watershed Management
Natural Resources Economics
Global Change Hydrology
Fundamentals of Geographic Information Systems
Hydrometeorology
Hydrology and Water Security Seminar Series

Can Undergraduates Do "Engineering With Nature"?

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OU CEES Capstone Experience
Two Semester Course Sequence

- **Fall Pre-Capstone Class**
  - Project Description
  - Team Names and Logos
  - Team Organization
  - Project documents
- **Spring Capstone Experience**
  - Intensive team work
  - Completion of project work activities
  - Technical Reports
  - Oral Presentations

OU CEES Capstone Experience

- Fall Pre-Capstone Class
  - Project Description
  - Project Documents
    - Sampling and Analysis Plan
    - Health and Safety Plan
    - Quality Assurance Project Plan
    - Project Work Plan
  - Organizational structure
  - GANNT Chart

OU CEES Capstone Experience

- Spring Semester Class
  - Revise Project Documents
  - Implement and complete activities in revised Project Work Plan
  - Interim Deliverables
    - 33% and 66%
    - DRAFT Technical Reports
    - DRAFT Oral Presentations
  - Final Written Reports and Oral Presentations
    - Real world clients

Assessing the Hydrologic Function of Dave Blue Creek for Treated Wastewater Transport

HKL

HARD KNOX LIFE ENGINEERING

Project Background

- Norman water availability crisis
  - Statewide drought
  - Lake Thunderbird level and quality
  - Strategic Water Supply Plan (2013)
- Proposed indirect potable water reuse
  - 5 million gallons per day (MGD) treated wastewater effluent
  - Use Dave Blue Creek as "environmental buffer"
- What will be effects on Dave Blue Creek?

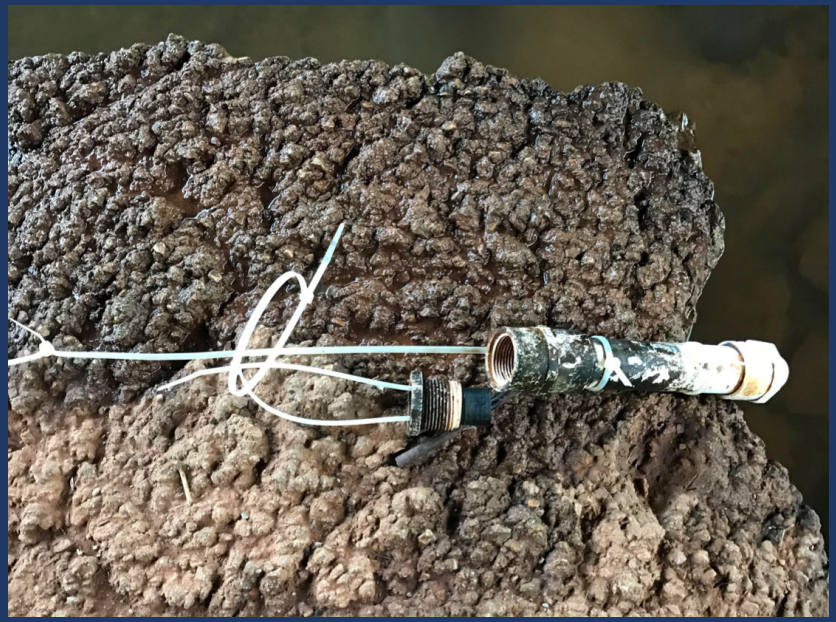
Image courtesy of https://www.ok.gov/conservation/documents/TbirdWBPdraft2_approved.pdf

Tasks Overview

- Cross-sections
- Flow and stage measurements
- Rating curves
- Tracer test
- Fluvial geomorphologic assessment
- Biological study
  - Habitat assessment
  - Rapid bioassessment

Fieldwork

Cross-Section Surveying



Pressure Transducer Deployment

Fieldwork

YSI Deployment

Tracer Test

Fieldwork

Flow Measurement

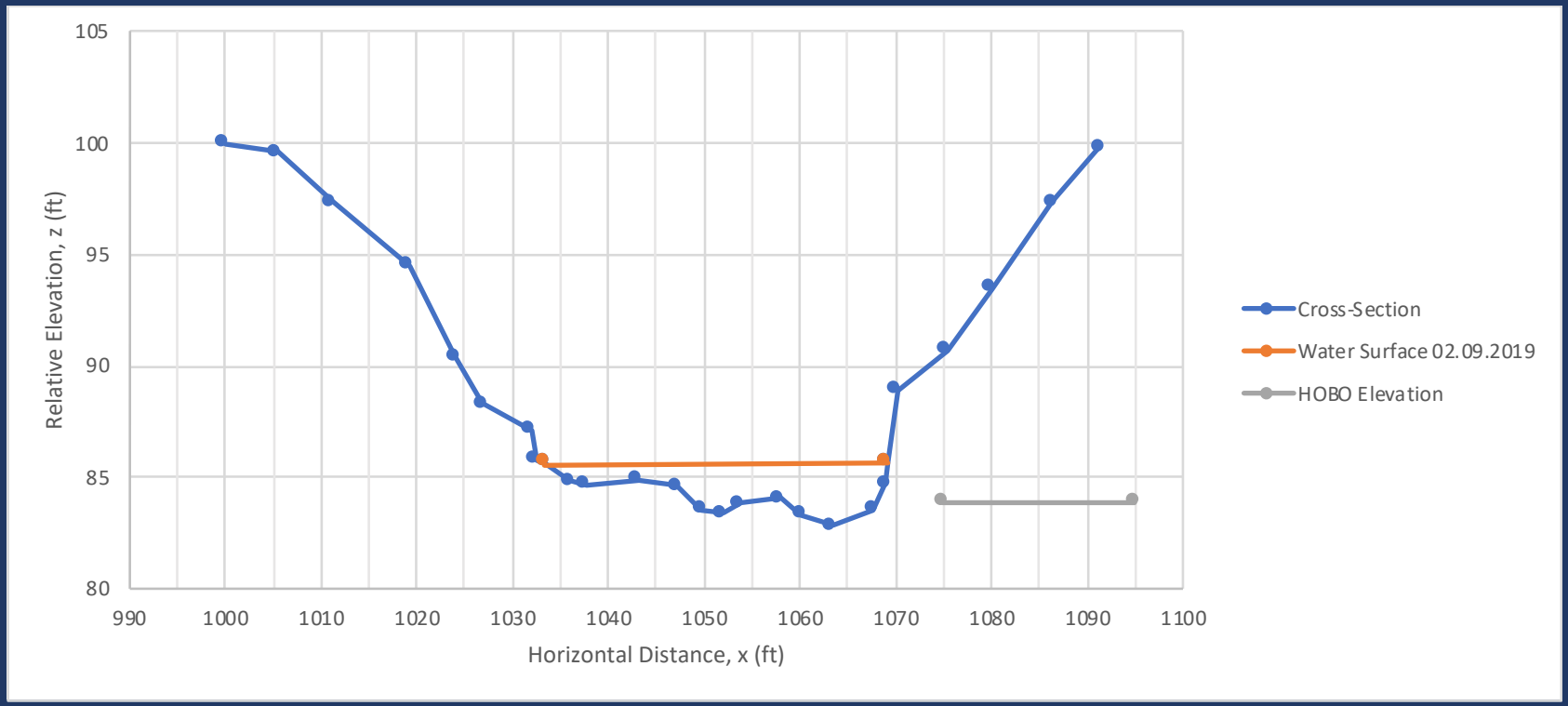
Fluvial Geomorphologic Assessment

Fieldwork

Habitat Assessment

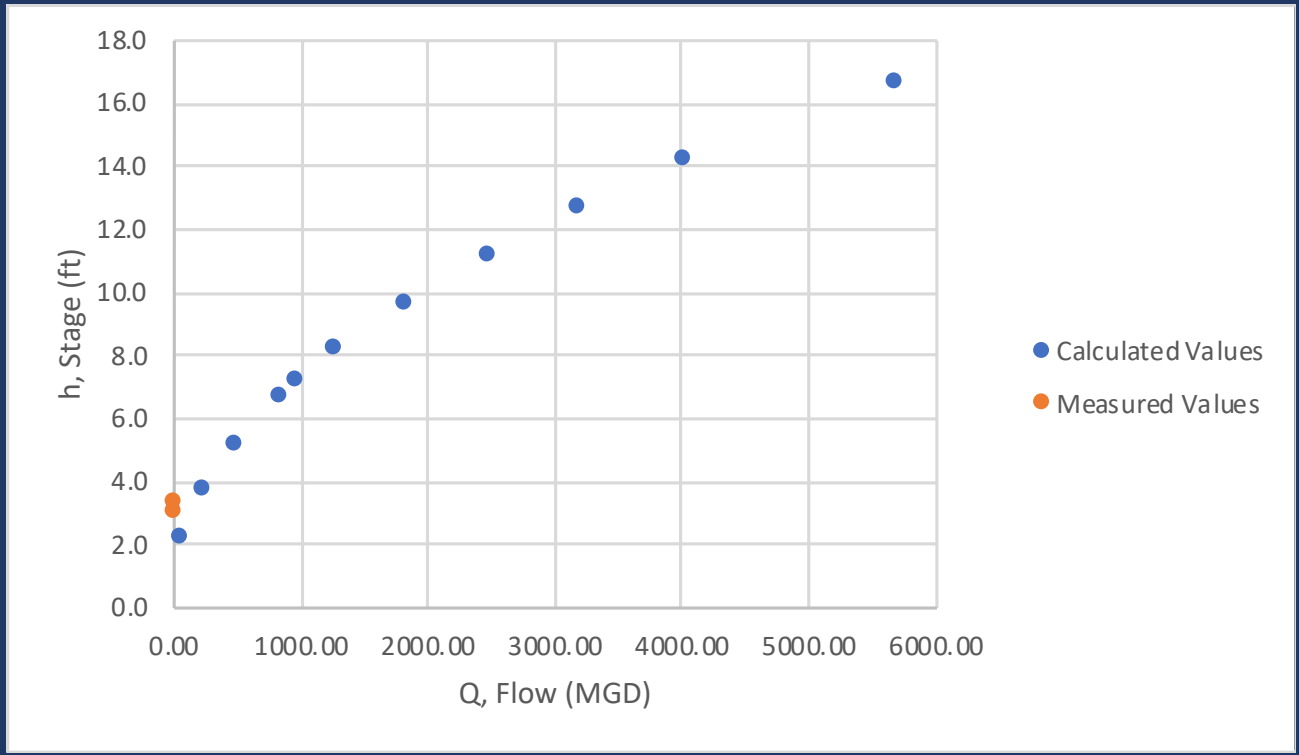
Rapid Bioassessment

Selected Results to Date



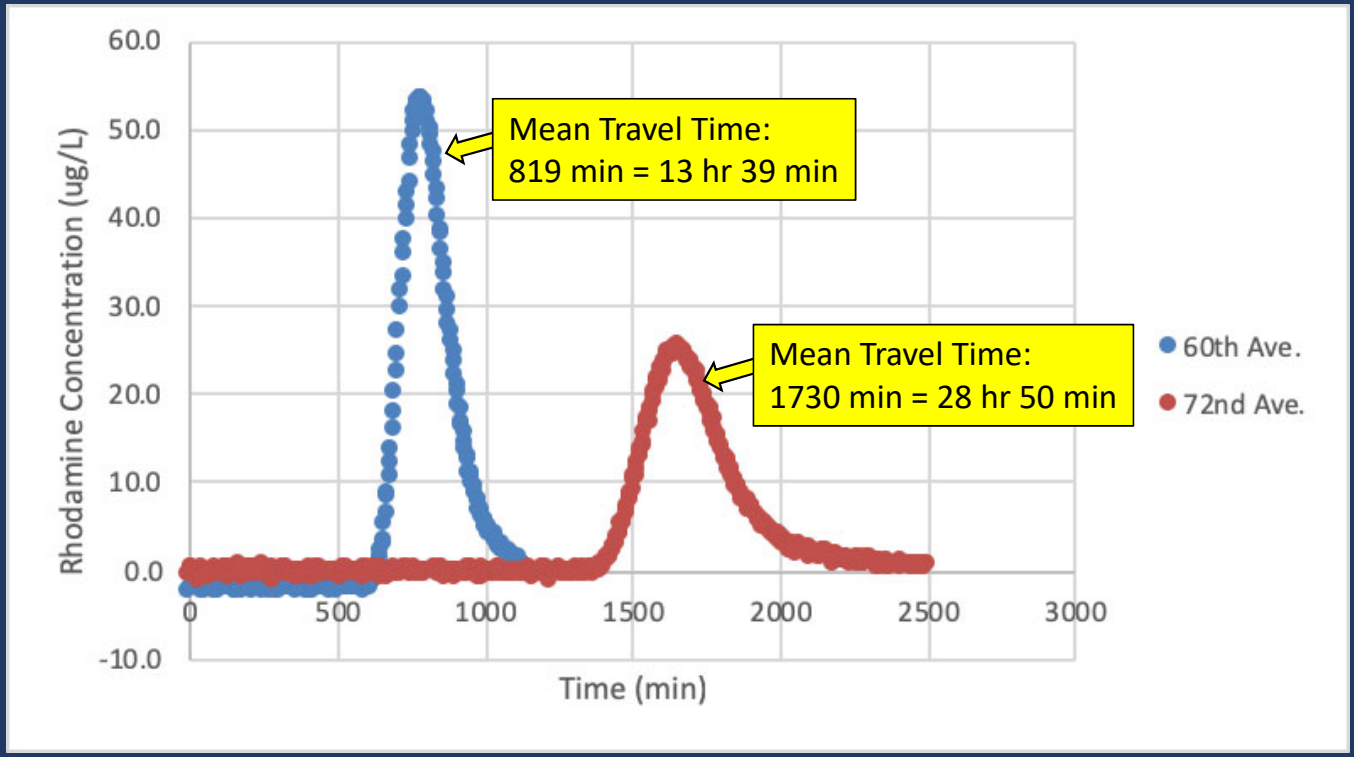
Cross-Section, 72nd Ave.

Selected Results to Date



Rating Curve, 72nd Ave.

Selected Results to Date

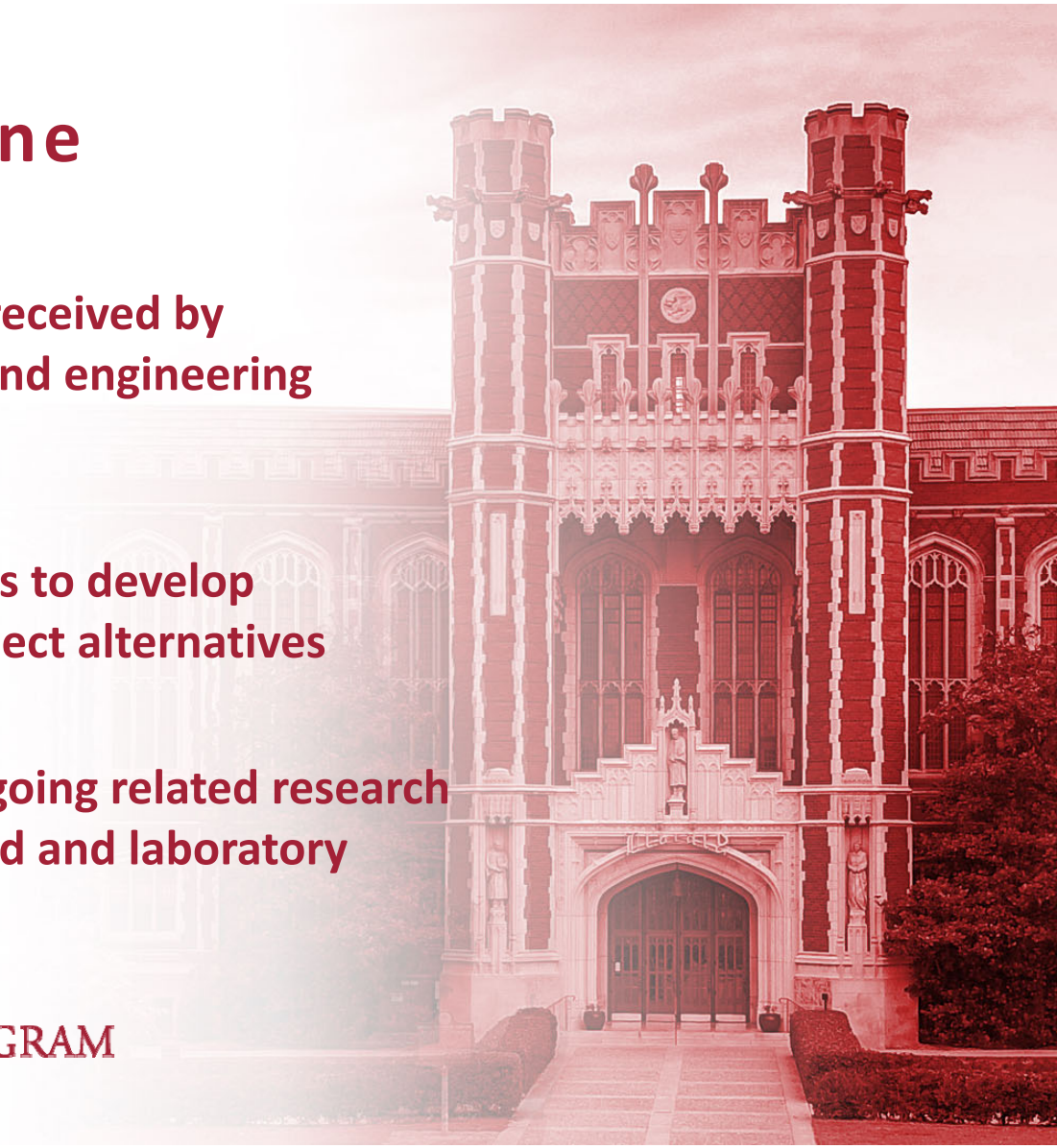


Tracer Test Breakthrough Curve

16	DRAFT 100% Written Report due
	Working Review Session
18	DRAFT 100% Oral Presentations due
	Working Review Session - feedback on drafts
23	Final 100% Written Report due
	Practice Oral Presentations
	Team Briefing Session
	Peer Evaluations
25	Team Working Session
	Practice Oral Presentations
30	
02 May	Final Oral Presentations to EESAB

Undergraduate Capstone

- Capstone projects are particularly well received by undergraduate environmental science and engineering students
- Can utilize the student capstone projects to develop preliminary screenings of proposed project alternatives
- Capstone projects can complement on-going related research efforts and augment project-funded field and laboratory research activities



OU CEES Capstone Clients

- Oklahoma Water Resources Board
- Oklahoma Conservation Commission
- Oklahoma Department of Environmental Quality (3)
- Grand River Dam Authority (3)

City of Norman (5)
City of Blanchard
City of Grove
City of Altus
University of Oklahoma (2)

USACE ?????