ENVIRONMENTAL SCIENCE AND ENVIRONMENTAL ENGINEERING CAPSTONE
CEES 4913/4923

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Prerequisites: Completion of, or concurrent enrollment in, all professional electives and required environmental science or environmental engineering courses up to the first semester of the senior year (i.e., students must be scheduled for graduation in either Spring 2017 or Fall 2017).
Location: CEC 123
Times: Tuesday and Thursday 1500-1750
Credit hours: 3 credit hours

Course Description

The capstone experience is a course in which students draw upon various aspects of their undergraduate course work for a comprehensive analysis of an open-ended, real-world problem (Spring 2017 problem description attached). Faculty coordinators serve in advisory capacities only. They will introduce field, laboratory, and computational methods and coordinate class meetings and presentations. All other in-class presentations will cover non-traditional (non-technical) topics. Because of the required prerequisites, students are presumed to have been adequately trained in the basic natural and engineering sciences and have been introduced to environmental sampling/analysis and impact/risk assessment methods.

Course Objectives

- Apply knowledge of mathematics, science, and engineering to address a real-world problem
- Collect, analyze, and interpret data as part of a designed experiment or study
- Design a system to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- Function on multidisciplinary teams
- Communicate effectively
- Understand the impact of science and engineering solutions in a global, economic, environmental, and societal context
- Recognize the need for, and an ability to engage in life-long learning
- Use the techniques, skills, and modern tools necessary for engineering and science practice

Required Textbook: None. A variety of project-specific references will be provided.

Course Management

We will be attempting to use Canvas course management software in this course, http://canvas.ou.edu/. Much class information will be disseminated via Canvas and email. Students are encouraged to submit questions to the instructors via email at any time. Responses will be made as quickly as possible. It is the responsibility of each student to regularly access their OU email account.

Class Policies

Codes of behavior: Each student should acquaint her or his self with the University's codes, policies, and procedures involving academic misconduct, grievances, sexual and ethnic harassment, and discrimination based on physical handicap. Any instance of classroom disruption will be dealt with in a prompt and serious manner.

Cell phones and other electronic devices: Although note-taking on laptops or other devices is permitted, use of any electronic device for anything other than course-related work is prohibited. ***Turn off cell phone ringers/beepers during class time and completely refrain from text messaging*. Texting will not be tolerated. Students seen texting in class will be asked to leave.** All electronic devices must be stored out of view to both the students and instructor during class lectures and discussions. If you must leave your cell phone engaged for some reason, please discuss this with the instructor.

Reasonable accommodation: Any student in this course who has a disability that may prevent the full demonstration of his or her abilities should contact Dr. Nairn personally as soon as possible so an appropriate contact may be provided to discuss accommodations necessary to ensure full participation and facilitate your educational opportunities. For more information, please visit http://www.ou.edu/drc.html. The OU policy states:

"The University of Oklahoma is committed to the goal of achieving equal educational opportunity and full participation for students with disabilities. Consistent with the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act of 1990, as amended, The University of Oklahoma ensures that no "qualified individual with a disability" will be excluded from participation in, be denied the benefits of, or otherwise be subjected to discrimination solely on the basis of disability under any program or activity offered by The University of Oklahoma. Accommodations on the basis of disability are available by contacting the Disability Resource Center in Room 166, Goddard Center (405) 325-4173/TDD or (405) 325-3852 Voice."

Adjustments for pregnancy/childbirth related issues: Should you need modifications or adjustments to your course requirements because of documented pregnancy-related or childbirth-related issues, please contact Dr. Nairn as soon as possible to discuss. Generally, modifications will be made where medically necessary and similar in scope to accommodations based on temporary disability. For commonly asked questions, please see http://www.ou.edu/eoo/faqs/pregnancy-faqs.html.

Title IX resources: For any concerns regarding gender-based discrimination, sexual harassment, sexual misconduct, stalking, or intimate partner violence, the University offers a variety of resources, including advocates on-call 24/7, counseling services, mutual no contact orders, scheduling adjustments, and disciplinary sanctions against the perpetrator. Please contact the Sexual Misconduct Office 405-325-2215 (8-5, M-F) or OU Advocates 405-615-0013 (24/7) to learn more or to report an incident.

Religious observances: It is the policy of the University to excuse the absences of students that result from religious observances and to reschedule examinations and additional required classwork that may fall on religious holidays, without penalty.

Academic misconduct: It is the responsibility of each student to be familiar with the definitions, policies and procedures concerning academic misconduct. **Instances of academic misconduct and classroom disruption will be dealt with in a serious and appropriate manner.** "The Academic Misconduct Code is available at http://integrity.ou.edu/

By accepting this syllabus, all students agree to the following contract: "As a member of The University of Oklahoma, I understand that enrollment creates special obligations beyond those attendant upon membership in the general society. In addition to the requirement of compliance with the general law, I assume the obligation to comply with all University policies and campus regulations. I understand that behavior that it considered, by the instructor; to be a disruption or obstruction of teaching will not be tolerated. I further understand that if my behavior is considered to be of such a nature, I will be asked to leave the classroom and may be formally charged under The University of Oklahoma Student Code of Responsibilities and Conduct and, if so, will be subject to appropriate sanctions under Title 17 of the Code. I also agree to uphold the academic integrity of The University of Oklahoma. I understand that any incidents of academic misconduct discovered by the instructor will be handled in accordance with the Academic Misconduct Code."

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For every assignment, students are encouraged to adhere to the *Integrity Pledge* as provided by the Student Government Association and Faculty Senate: "On my honor, I affirm that I will neither give nor receive inappropriate aid in the completion of this exercise."

A special note on plagiarism: Submission of written documents is a substantial component of student evaluation in this course. All students are encouraged to familiarize themselves with information on plagiarism available at http://integrity.ou.edu/. Be sure to examine this information, including the videos, tutorial and document entitled "Nine Things You Should Already Know about Plagiarism":
(http://integrity.ou.edu/files/nine_things_you_should_know.pdf).

The University subscribes to the online plagiarism-detection service Turnitin.com. Turnitin is integrated into the course management system. Papers submitted automatically generate an originality report indicating passages identical to other student papers or Internet sources. Further information is available from the integrity website.

Assignments and grading: Assignments, examinations, or projects worth less than 10 percent of a student's grade may be assigned at any time prior to pre-finals week and may be due during pre-finals week. However, no assignments, examinations, or projects may be due on the last two days of pre-finals week. Assignments, take-home examinations, in-class examinations, or projects worth more than 10 percent of a student's grade have been scheduled at least 30 days prior to the first day of finals and must be due or given prior to pre-finals week. Any assignment that is to take the entire semester to complete (the team semester project in this course) may be accepted or presented during pre-finals week and this syllabus explicitly states that the assignment can be turned in prior to pre-finals week. Special requests made by students for an extension of assignment deadlines into pre-finals week may be granted subject to the discretion of the instructor.

Making up work: Only Provost-approved university-sponsored activities such as scholarly competitions, fine arts performances, academic field trips, and legally required activities, such as emergency military service and jury duty, are covered by these guidelines. If notice is given two class periods before an exam or quiz (excluding pop quizzes), the instructor will make every effort to find a reasonable accommodation. Students missing an exam because of jury duty must be allowed an accommodation by OU policy. Students missing class due to illness must be supported by a certified note of illness. Student's missing any assignment or exam for other reasons not specified herein will be subjected to a failing grade for said assignment.

Student Responsibilities and Expectations

Project Teams: The nature of the proposed project (described below) will require the services of truly multi-disciplinary teams. Each project team is comprised of civil and environmental engineers and environmental scientists. Each team member is required to participate equitably in the completion of the project. Because of the variable nature of the proposed activities (i.e., literature review, field sampling, laboratory analyses, data analysis, computer simulations,

technical writing, oral presentations) each team will be required to identify the relative strengths of each team member. **Peer evaluations** (described below) will be conducted periodically throughout the semester (typically when a deliverable is due) to ensure that all individual team members are participating equitably in team assignments. If problems are identified, immediate action will be taken to address the known issues.

Participation: Each student is expected to contribute equitably to their team's project including written submittals and group oral presentations. The nature of the semester project will require extensive time outside the regularly scheduled class period. Class meetings will rarely last for the full three-hour periods each week; hence, **attendance is mandatory**.

Team Working Sessions and Documentation: All work will be conducted in a professional atmosphere similar to that found in any consulting firm or state regulatory office. Students are organized into project teams and led by a project manager. The professors-in-charge will function as on-site advisors, and will conduct short weekly review sessions with each team to monitor project status. Several weekly class periods will be devoted to Team Working Sessions, where student teams will work to complete project tasks on their own. Successful team working sessions are critical to project success, therefore **attendance is mandatory**.

Team Briefings/Working Review Sessions: The project teams will meet weekly with faculty advisors to provide progress reports (Team Briefings). In addition, the project teams will meet with the faculty advisors after each interim submittal (Working Review Session) to discuss the focus of remaining work tasks. These meetings provide opportunities for valuable insight and direction; hence, **attendance is mandatory**.

Project Reports and Final Presentations: The culmination of the semester project will be a written technical report submitted two weeks prior to the final oral presentation (**Tuesday April 18, 2017**). After review and revision, the reports will be distributed to members of the Environmental Engineering and Science Advisory Board (EESAB) for review on **Tuesday April 25, 2017**. Members of EESAB include practicing environmental engineers and scientists, as well as representatives of the project client. **It is professional courtesy to give reviewers at least one week to review reports; hence, there will be no extension to this deadline.** The final presentations will be held at the City of Altus Municipal Complex on the evening of **Tuesday May 2, 2017**. Oral presentations will summarize each team's findings and recommendations. Oral presentations can include selected members of each team, but must use available multimedia technology and must be well-rehearsed. Practice presentations before selected CEES faculty members will be held one week prior to the final presentations. All team members should be in attendance at the practice and final oral presentations.

Evaluations: **Each student is expected to participate equitably in the development of their team's project.** To evaluate the level of individual participation, each team will evaluate team members at least four times during the semester. Peer evaluations for each individual will be computed as the percent of the total possible from all responses. The peer evaluations, other

deliverables, and project evaluations (i.e., composite evaluations of reports and presentations by faculty advisors and EESAB) will be combined to develop final course grades.

Deliverables and Due Dates: Semester deliverables will include Topical Presentations (details below), Sampling and Analysis Plan (SAP), Health and Safety Plan (HSP), Quality Assurance Project Plan (QAPP), Project Work Plan, DRAFT Written Project Reports, Final Written Project Reports, Draft Oral Presentations, and Final Oral Presentations, as outlined below.

Deliverable	Due Date
• Final SAP, HSP, QAPP, Work Plan	24JAN
• Field Sampling Trip to City of Altus	27-29JAN or 03-05FEB
• Topical Oral Presentations Reservoir Docs Water Technicians, LLC – applicable sediment sampling and analyses H_2Orbital – applicable water quality sampling and analyses/hydrologic analyses Possum Trot Consulting – dam slope stability/reservoir rehabilitation	31JAN
• 33% Written Progress Reports – written presentations of work to date.	14FEB
• 66% Written Progress Reports – written presentations of work to date, including information from topical reports as it applies to the project. This report should include preliminary data analyses from the sampling episode.	09MAR
• 66% Oral Presentations	23MAR
• DRAFT 100% Written Project Report – complete written report draft including all data, analyses, and recommendations.	18APR
• DRAFT 100% Oral Practice Presentations - complete oral presentations draft including all data, analyses, and recommendations.	20APR
• FINAL Written Project Report	25APR
• FINAL Practice Oral Presentations – to selected members of the CEES faculty	25APR

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- FINAL Oral Presentations to City of Altus and EESAB 02MAY

Grading:

Homework, class exercises, interim deliverables:	20%
Peer Evaluations:	20%
Final Report:	30%
Final Presentation:	30%

Schedule (subject to change)

Week		Date	Session Type/Topic(s)
1	T	17 January	Class/Project Introduction
	R	19	Feedback/Review Project Documentation
2	T	24	**Revised SAP/HSP/QAPP/WP due**
			Team Briefing Session
			Peer Evaluations
	R	26	Working Review Session
			Field trip prep
	F	27	*TENTATIVE:* Field sampling and analyses trip to Altus (could be moved to
	Sa	28	03-05FEB)
	Su	29	
3	T	31	**Topical Report Oral Presentations due**
	R	02 February	Working Review Session - feedback on topical reports
	F	03	*TENTATIVE:* Field sampling and analyses trip to Altus (if not completed
	Sa	04	27-29JAN)
	Su	05	
4	T	07	Team Working Session
	R	09	Team Working Session
5	T	14	**33% Written Report due**
			Peer evaluations
			Team Briefing Session
	R	16	Working Review Session
6	T	21	Working Review Session - feedback on 33%
	R	23	Team Working Session
7	T	28	Team Working Session
	R	02 March	Team Working Session

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8	T	07	Working Review Session
	R	09	**66% Written Report due**
			Peer Evaluations
			Team Briefing Session
9	T	14	Spring Break
	R	15	Spring Break
10	T	21	Working Review Session - feedback on 66%
	R	23	**Oral Presentation of 66% report**
11	T	28	Working Review Session
	R	30	Team Working Session
12	T	04 April	Team Briefing Session/Working Session
	R	06	Team Working Session
13	T	11	Team Briefing Session/Working Session
	R	13	Team Working Session
14	T	18	**DRAFT 100% Written Report due**
			Working Review Session
	R	20	**DRAFT 100% Oral Presentations due**
			Working Review Session - feedback on drafts
15	T	25	**Final 100% Written Report due**
			Practice Oral Presentations
			Peer Evaluations
	R	27	Team Working Session
			Practice Oral Presentations
16	T	02 May	**Final Oral Presentations at City of Altus**
	R	04	Team Briefing Session

Nairn, R.W. and R.C. Knox. October 2016.
"Feasibility Study of Altus Reservoir Rehabilitation and Development"
Project Description for CEES 4803, October 2016, University of Oklahoma, Norman, OK

The objectives for this capstone project are to evaluate the hydraulic, hydrologic, geotechnical, environmental and dam safety aspects of the Altus City Reservoir in Altus, OK, regarding the need to increase water supply and drought resilience and to develop a destination park, and to produce a report on the feasibility of dredging and or raising the dam to increase water supply.

Background

The Altus City Reservoir was constructed in phases from 1916 through 1935 and is thought to hold about 960 acre-feet of water. With no natural inflow or outflow, the reservoir has been filled periodically from irrigation water from the Lake Lugert-Altus. Evaporation losses of about 3-feet per year have concentrated minerals and organics such that the water is not desirable as a drinking water source. The extreme drought of 2010-2015 seriously jeopardized water supply in Southwest Oklahoma.

The City owns about 67 acres of land surrounding the reservoir, most of which is available for park development. The City wishes to develop a unique destination reservoir park that will attract visitors and boost the local economy.

Services

The following services were tasked by the City of Altus as part of the study.

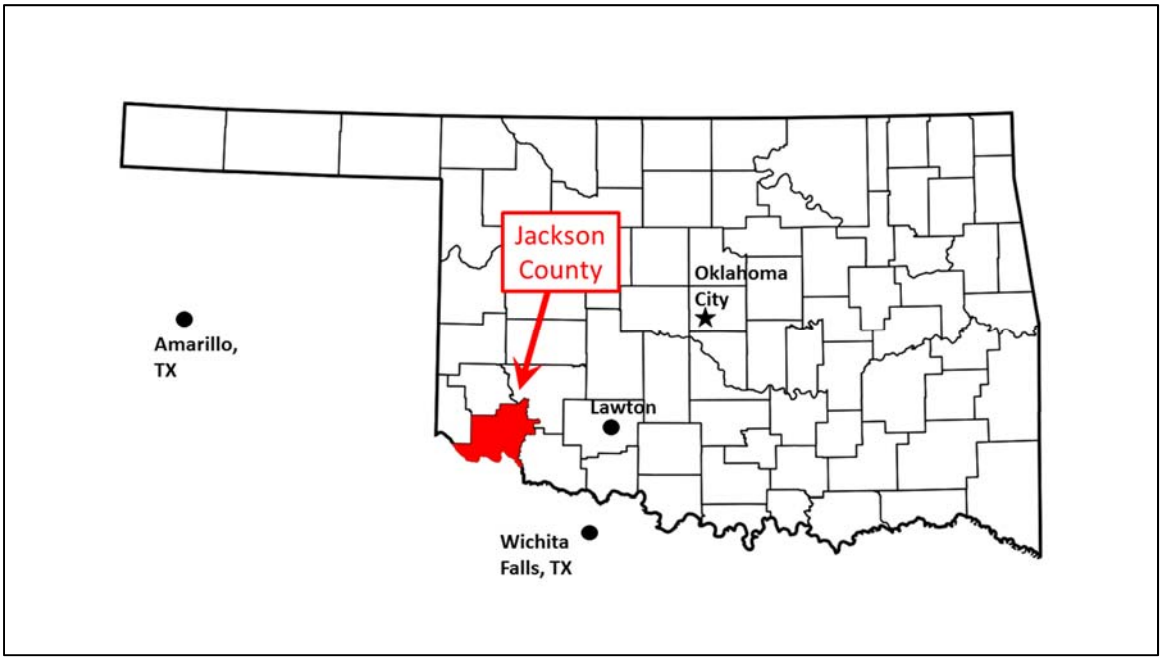
Service	Description	Deliverables
Bathymetric Survey	Determine elevations of sediments in the Reservoir	Topographic map of reservoir bottom with one foot contour intervals
Sediment Analyses	Chemical and geophysical analysis of accumulated sediments to evaluate potential for leaching pollutants into drinking water and to evaluate the suitability of sediment for uses as structural fill	Report with supporting laboratory data
Water Quality Analysis	Chemical analysis of organic and inorganic pollutants	Report with supporting laboratory data
Environmental Analysis	Evaluation of potential impacts to downstream receiving waters if reservoir were drained; evaluation of	Report

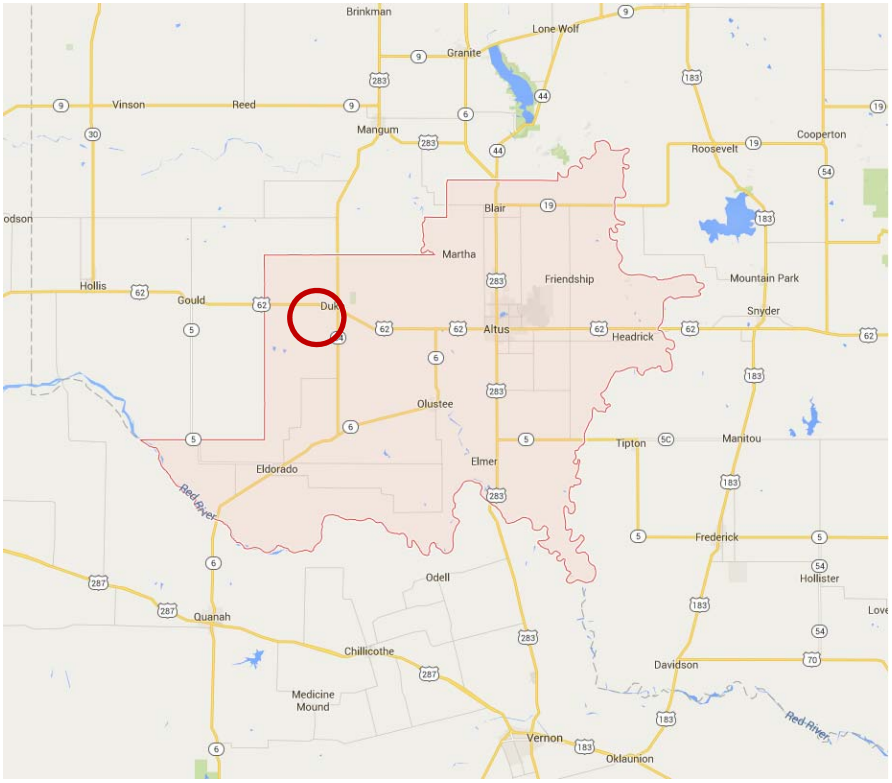
	impacts to habitat by proposed rehabilitation and development.	
Dam Evaluation	Collection of soil samples from borings to evaluate composition of earth embankment dam and perform slope-stability analysis. Preliminary design and cost estimate of improvements needed to raise dam.	Report with supporting laboratory data, preliminary design and cost estimate
Feasibility of Reservoir Rehabilitation	Compute the amount of dredging and/or dam raising needed to provide nine months of water supply with cost estimates.	Report with cost estimate
Hydrologic Assessment of Regional Detention	Evaluate the loss of the City Reservoir as an overspill detention pond for the adjacent regional detention facility and assess the feasibility of relocating the regional detention pond further downstream	Report with cost estimate
Evaporation Study	Evaluate likely evaporative losses from the City Reservoir given likely climate scenarios.	Report
Permit Review	Provide evaluation of likely permits necessary for work to proceed, including CWA 401 and 404 and dam safety.	Report

Major Design Elements and Associated Design Issues:

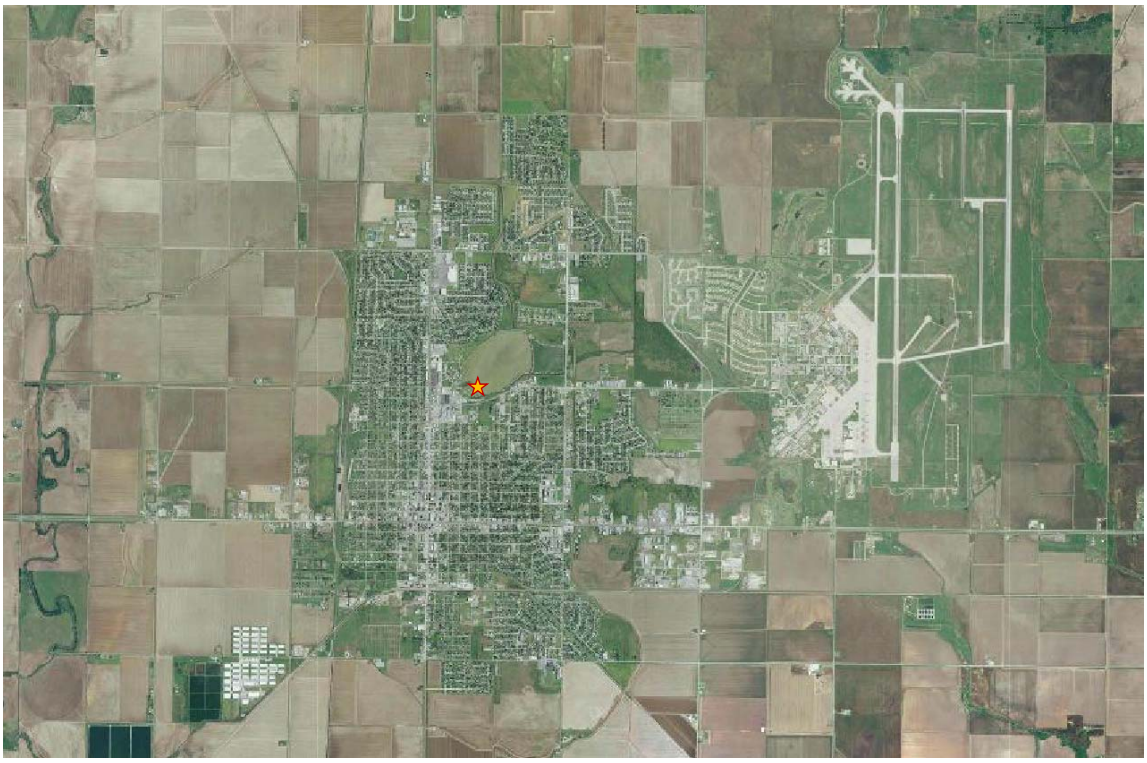
- Development of project documents
- Sample collection and analysis (overnight trip)
- Data reduction and interpretation
- Review of Applicable Codes, Regulations, and Permits
- Literature review regarding likely fate and transport of pollutants
- Survey – dam and bathymetry
- Hydraulic and hydrologic evaluations
- Water quality assessments
- Sediment evaluation
- Engineering report with accompanying drawings
- Development of preliminary cost estimates
- Construction scheduling diagram
- Oral presentation to the City of Altus and Environmental Engineering and Science Advisory Board (overnight trip)

Attachment A: Figures





Road map showing boundaries of Jackson County and location of the City of Altus



Aerial photo of the city of Altus. The star indicates the City Reservoir.

Aerial view of the Altus City Reservoir. The west basin is 116 acres and is thought to have an average depth of ~5 feet. The east basin is 24 acres and thought to be ~16 feet deep.