



ENVS 330: Soil & Water Resources

Term: Fall 2026

Credits: 4.0

Lecture Times & Location: Monday, Wednesday, Friday 12:00–12:50 p.m., Meridian Science Center 160

Laboratory Time & Location: Thursday 1:00–3:50 p.m., Meridian Science Center 132

Modality: In-Person Lecture and Laboratory

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Instructor Information

- **Instructor:** Dr. Everett Moss (Associate Professor of Environmental Science)
- **Email:** emoss@university.alkimi.ai
- **Office:** Meridian Science Center 334
- **Office Hours:**
 - Wednesday & Thursday: 9:00–10:30 a.m. (In person, Meridian Science Center 334)
 - Monday: 3:00–4:00 p.m. (Virtual via Zoom; link posted in Canvas)
 - Also available by appointment.

Course Description

Soil formation and properties, hydrologic processes, watershed management, groundwater, water quality monitoring, and land use impacts, with a weekly three-hour field and analytical laboratory. ENVS 330 provides an advanced, quantitative examination of soil physics, chemistry, and hydrology, focusing on the fundamental resource systems that sustain terrestrial ecosystems and agricultural security. Students investigate soil pedogenesis, soil architecture, cation exchange capacity, unsaturated flow, watershed hydrology, groundwater hydrogeology, and contaminant fate and transport. The weekly field and analytical laboratory provides rigorous training in soil profile characterization, infiltration testing, Darcy's law aquifer permeametry, analytical spectrophotometry for water chemistry, and catchment-scale land-use impact modeling.

Prerequisites

ENVS 201 and CHEM 101.

Measurable Student Learning Outcomes

Upon successful completion of ENVS 330, students will be able to:

1. **Analyze Soil Pedogenesis and Physical Properties:** Classify soil profiles using USDA soil taxonomy, evaluate soil texture and structure, and quantify bulk density, porosity, and hydraulic conductivity.
2. **Evaluate Soil Biogeochemistry and Fertility:** Measure soil pH, cation exchange capacity (CEC), base saturation, and organic carbon fractions to evaluate soil fertility and contaminant sorption capacity.
3. **Quantify Surface Hydrologic Processes:** Calculate precipitation-runoff relationships, storm hydrographs, unit hydrograph routing, and catchment water balances.

4. **Apply Groundwater Hydrogeology Principles:** Formulate and solve Darcy's law equations for confined and unconfined aquifers, evaluate hydraulic head gradients, and model pumping cone depressions.
5. **Monitor Water Quality and Chemical Contaminants:** Collect and analyze surface and groundwater samples for nutrients (nitrate, phosphate), heavy metals, dissolved oxygen, and biological oxygen demand (BOD).
6. **Assess Watershed Management and Land Use Impacts:** Model agricultural and urban nonpoint source pollution loadings to propose watershed-scale best management practices (BMPs) and riparian buffer designs.

Required Course Materials & Approximate Costs

1. **Brady, Nyle C., and Ray R. Weil. *The Nature and Properties of Soils*. 15th ed., Pearson, 2016.** Approx. \$75 for digital rental; approx. \$155 for print purchase.
2. **Hornberger, George M., et al. *Elements of Physical Hydrology*. 2nd ed., Johns Hopkins University Press, 2014.** Approx. \$50.
3. **ENVS 330 Laboratory and Field Manual (Fall 2026). Alkimi University Copy Center.** Approx. \$20.
4. **ANSI Z87.1 splash goggles, waterproof field notebook, and rubber field boots.** Approx. \$40.
5. **Total estimated cost:** \$70 to \$265.

Generative AI Policy (AI Level 2: AI Permitted with Disclosure for Specified Tasks)

In accordance with Alkimi University Academic Policies (Student Handbook §5.8), ENVS 330 operates under **AI Level 2**.

- **What is permitted:** You may use AI tools to assist in writing Python or spreadsheet scripts for hydrologic hydrograph separation, clarify soil chemistry equilibrium concepts, and improve readability in draft report sections.
- **What is prohibited:** You may not use AI to generate synthetic soil test data, write complete laboratory discussion sections, calculate Darcy flux assignments without personal derivation, or access AI during exams.
- **Disclosure:** Include an AI disclosure paragraph in each laboratory write-up and the watershed assessment report specifying any AI tools consulted and detailing your data verification procedures, or state that no AI tools were used.

Grading Components and Weights

- **Midterm Exam 1:** 15% (In class, Friday, September 25)
- **Midterm Exam 2:** 15% (In class, Friday, October 30)
- **Laboratory Reports & Field Notebooks:** 25% (Weekly laboratory reports due in Canvas Thursdays at 11:59 p.m.)
- **Watershed Hydrologic Assessment Project:** 15% (Due Friday, November 20 at 11:59 p.m.)
- **Weekly Hydrologic Problem Sets:** 10% (Canvas problem sets due Mondays at 11:59 p.m.; lowest dropped)
- **Final Comprehensive Examination:** 20% (Tuesday, December 15, 2026, 3:30–5:30 p.m.)

Grading Scale (Alkimi University Standard)

- **A:** 93–100% | **A-:** 90–92%
- **B+:** 87–89% | **B:** 83–86% | **B-:** 80–82%
- **C+:** 77–79% | **C:** 73–76% | **C-:** 70–72%
- **D+:** 67–69% | **D:** 60–66% | **F:** Below 60%
- **Extra credit:** None is offered.

Course Schedule (Fall 2026)

Week	Dates	Topics & Readings	Laboratory	Assignments & Deadlines
Week 1	Aug 26, 28	Introduction to Soil Systems and the Critical Zone: Soil ecological functions, pedosphere interface with atmosphere and hydrosphere, soil-forming factors (CLORPT), and global soil degradation. <i>Reading: Brady Ch. 1</i>	<i>No lab meetings this week.</i>	<i>First day of classes: Wed Aug 26.</i>
Week 2	Aug 31–Sep 4	Soil Mineralogy, Weathering, and Pedogenesis: Primary and secondary minerals, silicate clays, weathering pathways, diagnostic epipedons and endopedons, and USDA soil taxonomy. <i>Reading: Brady Ch. 2</i>	Lab 1: Soil Profile Description and Pedon Morphological Sampling.	<i>Wed Sep 2: Add/section change deadline.</i>
Week 3	Sep 9, 11	Soil Architecture, Texture, and Structure: Sand, silt, clay fractions, textural triangle, soil aggregation, bulk density, particle density, porosity, and compaction effects. <i>Reading: Brady Ch. 4</i>	Lab 2: Particle Size Distribution via Hydrometer Method.	<i>Mon Sep 7: Labor Day (no classes). Wed Sep 9: Census date (last day to drop without a W).</i>
Week 4	Sep 14–18	Soil Water Potential and Retention Characteristics: Matric, gravitational, and osmotic potentials, soil moisture characteristic curves, field capacity, permanent wilting point, and plant-available water. <i>Reading: Brady Ch. 5.1–5.4</i>	Lab 3: Soil Moisture Retention and Pressure Plate Extractor.	—
Week 5	Sep 21–25	Saturated and Unsaturated Hydraulic Flow & Midterm Exam 1: Darcy's law in soils, hydraulic head, unsaturated hydraulic conductivity, Richards equation, and preferential macropore flow; Midterm Exam 1 in class. <i>Reading: Brady Ch. 5.5–5.9</i>	Lab 4: Infiltration Rates via Double-Ring Infiltrometer.	Midterm Exam 1 (in class).
Week 6	Sep 28–Oct 2	Soil Aeration, Redox Chemistry, and Organic Carbon: Gas exchange in soils, oxygen diffusion rate, redox potential (Eh), hydric soils, wetland delineation, and soil carbon storage dynamics. <i>Reading: Brady Ch. 7</i>	Lab 5: Soil Organic Matter Determination by Loss-on-Ignition.	—
Week 7	Oct 5–9	Colloid Chemistry and Cation Exchange Capacity: Permanent and pH-dependent charge, diffuse double layer, cation exchange capacity (CEC), anion retention, and base saturation calculations. <i>Reading: Brady Ch. 8</i>	Lab 6: Cation Exchange Capacity and Exchangeable Bases Extraction.	—
Week 8	Oct 14, 16	Soil Acidity, Alkalinity, and Salinity Dynamics: Active and reserve acidity, aluminum toxicity, buffering capacity, soil liming equations, saline and sodic soils, and electrical conductivity. <i>Reading: Brady Ch. 9 & 10</i>	Lab 7: Soil pH, Electrical Conductivity, and Lime Requirement Testing.	<i>Oct 12–Oct 13: Fall break (no classes).</i>
Week 9	Oct 19–23	Hydrologic Cycle and Catchment Water Budgets: Global hydrologic reservoirs, precipitation mechanisms, Thiessen polygons, Penman-Monteith potential evapotranspiration, and water balance modeling. <i>Reading: Hornberger Ch. 1–3</i>	Lab 8: Pan Evaporation and Penman-Monteith Evapotranspiration Calculations.	—
Week 10	Oct 26–30	Runoff Generation and Hydrograph Mechanics & Midterm Exam 2: Horton overland flow, Dunne variable source area concept, storm hydrographs, hydrograph peak	Lab 9: Stream Discharge Gauging; Acoustic Doppler Profiler.	Midterm Exam 2 (in class).

Week	Dates	Topics & Readings	Laboratory	Assignments & Deadlines
		timing, and catchment lag; Midterm Exam 2 in class. <i>Reading: Hornberger Ch. 4–5</i>		
Week 11	Nov 2–6	Hydrograph Routing and Unit Hydrographs: Direct runoff hydrographs, baseflow separation techniques, Sherman's unit hydrograph theory, S-curves, and flood routing algorithms. <i>Reading: Hornberger Ch. 6</i>	Lab 10: Storm Hydrograph Separation and Catchment Lag-Time Modeling.	<i>Fri Nov 6: Last day to withdraw (W) or elect Pass/No Pass.</i>
Week 12	Nov 9–13	Subsurface Hydrogeology and Darcy's Law: Unconfined and confined aquifers, potentiometric surfaces, storativity, transmissivity, Darcy flux derivations, and anisotropic aquifer media. <i>Reading: Hornberger Ch. 7</i>	Lab 11: Constant-Head and Falling-Head Permeameter Assays.	—
Week 13	Nov 16–20	Groundwater Hydraulics and Well Mechanics: Theis and Cooper-Jacob nonequilibrium pumping test solutions, steady-state Thiem equation, cone of depression, and well capture zones. <i>Reading: Hornberger Ch. 8</i>	Lab 12: Groundwater Flow Net Construction and Aquifer Drawdown Analysis.	Watershed Hydrologic Assessment Project due Fri Nov 20 at 11:59 p.m.
Week 14	Nov 23	Solute Transport and Contaminant Hydrogeology: Advection, mechanical dispersion, molecular diffusion, hydrodynamic dispersion tensor, retardation factors, and point versus nonpoint pollutants. <i>Reading: Hornberger Ch. 9</i>	<i>No lab meetings this week (holiday).</i>	<i>Nov 25–Nov 27: Thanksgiving break (no classes).</i>
Week 15	Nov 30–Dec 4	Soil Erosion, Sediment Budgets, and Conservation: Water and wind erosion mechanisms, Revised Universal Soil Loss Equation (RUSLE), sediment delivery ratios, and agricultural conservation tillage. <i>Reading: Brady Ch. 17</i>	Lab 13: Soil Loss Modeling via RUSLE and Watershed BMP Design.	—
Week 16	Dec 7, 9	Integrated Watershed Management and Policy Review: Total Maximum Daily Loads (TMDLs), watershed scale best management practices, riparian buffer design, water policy frameworks, and review. <i>Reading: Hornberger Ch. 10 & Review</i>	<i>No lab meetings this week (holiday).</i>	<i>Wed Dec 9: Last day of classes. Thu Dec 10: Reading Day.</i>
Finals	Dec 15	Final Comprehensive Examination: Tuesday, December 15, 2026, 3:30–5:30 p.m., Meridian Science Center 160.	—	Comprehensive examination covering soil physics, soil chemistry, catchment hydrology, and groundwater mechanics.

Course Policies

Attendance Policy

Punctual attendance at all lectures and laboratory sessions is required. Analytical lab instruments (spectrophotometers, permeameters) and field hydrologic stations cannot be replicated outside scheduled laboratory periods. Notify Dr. Moss in advance of excused absences. More than two unexcused lab absences results in an automatic grade of F. Students who miss the first two class meetings without notifying the instructor may be dropped. Students may miss class for religious observance without penalty if they notify the instructor in writing within the first two weeks of the semester (by Wednesday, September 9, 2026).

Absences for university-sponsored activities (athletics, performances, conferences) are excused with a letter from the sponsoring office at least one week in advance.

Late Work Policy

Laboratory reports lose 10% per day late and cannot be submitted more than three days past the deadline. Problem sets submitted late receive a 20% point deduction and are not accepted after solutions are released. The lowest problem set score will be dropped.

Laboratory Safety and Outdoor Field Protocol

Laboratory activities include chemical extractions (dilute acids and bases) and outdoor stream and soil sampling. ANSI Z87.1 safety goggles, lab coats, and closed-toe footwear are mandatory in Meridian Science Center 132. For field days, bring rugged footwear, durable clothing, and foul-weather gear.

Final Exam Policy

The final examination (Tuesday, December 15, 2026, 3:30–5:30 p.m.) is scheduled by the University Registrar and can't be moved without the Dean's written approval (Faculty Handbook §5.5). A student with three or more final exams on the same calendar day may reschedule one of them. Requests go to the instructor of the middle exam by the last day of classes. For this term, send the request by Wednesday, December 9, 2026 (Student Handbook §6.4).

Academic Integrity

Alkimi University is an academic community devoted to rigorous scholarship, open intellectual inquiry, and uncompromising ethical conduct. All students are subject to the regulations of the Alkimi University Academic Integrity Policy. Academic dishonesty—including plagiarism, cheating on examinations, unauthorized collaboration, fabrication of empirical data, and unauthorized submission of academic work generated by artificial intelligence—undermines the integrity of the university and carries severe disciplinary sanctions. Sanctions range from a failing grade on an assignment or exam to an administrative course failure recorded as an 'XF' on the official transcript, academic suspension, or expulsion. Suspected violations are formally investigated and resolved through the Office of Academic Integrity in accordance with Faculty Handbook §6. For detailed information, consult the Office of Academic Integrity, Lovell Hall 315, (555) 555-0163, integrity@university.alkimi.ai.

Accessibility Services

Alkimi University is committed to providing equitable educational access and reasonable accommodations for all students with documented disabilities, including physical, sensory, psychological, learning, and chronic health conditions. Students requesting academic accommodations must formally register with the Office of Accessibility Services, Harlan Hall 204, (555) 555-0155, access@university.alkimi.ai. Once approved, students will receive an official Faculty Accommodation Letter detailing approved accommodations. Students should present this letter to the instructor as early in the semester as possible, and at least one week prior to any exam or assignment requiring accommodation. Accommodations cannot be applied retroactively.

Student Wellness and Mental Health

Your physical health, psychological well-being, and mental health are essential to your academic success. If you experience heightened stress, anxiety, depressive symptoms, personal trauma, or academic burnout, free, confidential counseling and medical care are available through the Hollis Health & Counseling Center, located in the Hollis Center. Routine appointments are available Monday–Friday 8:00 a.m.–6:00 p.m. and Saturday 10:00 a.m.–2:00 p.m. during the semester by calling (555) 555-0190 or emailing health@university.alkimi.ai. Urgent, 24/7 crisis psychological counseling is accessible immediately at (555) 555-0199.

Campus Student Support Services

- **Academic Advising Center:** Lovell Hall 101 | (555) 555-0158 | advising@university.alkimi.ai
- **Writing Center:** Whitcombe Library 3rd Floor | Free consultations on papers, reports, and research projects at any stage.
- **Whitcombe Library:** Whitcombe Library, Main Floor | (555) 555-0170 | askalibrarian@university.alkimi.ai
- **Hollis Health & Counseling Center:** Hollis Center | (555) 555-0190 | 24/7 Counseling Line: (555) 555-0199 | health@university.alkimi.ai
- **Science Tutoring Center:** Drop-in peer tutoring and quantitative science assistance are available Monday through Thursday from 4:00 to 8:00 p.m.