

Hydrologic Sciences & Engineering at CSM

The hydrology program at Mines is an interdisciplinary graduate program comprised of faculty from several different CSM departments: Chemistry & Geochemistry, Engineering, Environmental Science & Engineering, Geology & Geological Engineering, Geophysical Engineering, Mining Engineering, and Petroleum Engineering.

Our students are prepared for and typically accept jobs in areas such as contaminant characterization and remediation, ground-water or watershed modeling, water-resources assessment, ecologic restoration, and environmental restoration. Employers include environmental consulting firms, the U.S. Geological Survey, the U.S. EPA, the petroleum industry, and state regulatory agencies. PhD graduates have additional opportunities with colleges and universities, national research laboratories, federal agencies, and self-owned consulting businesses.

Research

The program offers fields of study in fundamental hydrologic science *and* applied hydrology with engineering applications. Our program encompasses ground-water hydrogeology, surface-water hydrology, vadose-zone hydrology, watershed hydrology, contaminant transport and fate, contaminant remediation, hydrogeophysics, hydrochemistry, and water policy/law. Research is conducted in various centers and labs across campus including the Center for Experimental Study of Subsurface Environmental Processes and the International Ground Water Modeling Center.

Degree Program All hydrology students are required to complete a core curriculum of four formal graduate courses and a field session. Programs of study are interdisciplinary in nature and the remainder of the course work is obtained from multiple departments at CSM and is approved for each student by the student's advisor and thesis committee. The core curriculum consists of • [Ground Water Engineering \(GEGN 467\)](#) • [Surface-Water Hydrology \(GEGN 598 or ESGN 527\)](#) • [Environmental Chemistry \(CHGC 505\)](#) and • [Subsurface Fate and Transport \(ESGN 522\)](#) or • [Water Quality Modeling \(ESGN 520\)](#) Students are also required to complete a hydrology field session that will be offered through existing courses taught by Environmental Science & Engineering, Geology & Geological Engineering, or Geophysical Engineering.

Students who plan to incorporate hydrochemistry into their research may elect to replace CHGC 505 with a two-

course combination that includes an aqueous inorganic chemistry course (e.g., GEGN 509 or ESGN 500) and an aqueous environmental organic chemistry course (e.g., CHGC/ESGN 555). *The Master of Science -- Hydrology* To achieve the Master of Science (M.S.) degree, students may elect the Non-Thesis option, based exclusively upon course work and a project report, or the Thesis option. The thesis option is comprised of course work in combination with individual laboratory, modeling and/or field research performed under the guidance of a faculty advisor and presented in a written thesis approved by the student's committee.

M.S. Thesis Option: 36 total credit hours, consisting of course work (30 h), and Independent Study (6 h) working on a research project with HSE faculty.

Combined BS/MS

Any Mines undergraduates are eligible to apply for the combined program in hydrology. Students must maintain a B average in their undergraduate program and declare interest in their mid-Sophomore or beginning Junior year by contacting the Hydrology Program Chair listed below. A formal graduate application is completed by first semester senior year. Although the GRE is waived for combined applicants, students must submit three letters of recommendation along with their application.

Students must meet all master's degree requirements as listed above, however six 400-level credits from the undergraduate program may be double-counted for the master's degree.

The Doctor of Philosophy -- Hydrology

To achieve the Doctor of Philosophy (Ph.D.) degree, students are expected to complete a combination of course work and original research, under the guidance of a faculty advisor and Doctoral committee, that culminates in a significant scholarly contribution to a specialized field in hydrologic sciences or engineering. Full-time enrollment is expected and leads to the greatest success, although part-time enrollment may be allowed under special circumstances. All doctoral students must complete two semesters of full-time, on-campus residency.

Ph.D.: 72 total credit hours, consisting of course work (at least 15 h), minor course work (12 h), and research (at least 24 h). Up to 36 hours of transfer credit can be applied to the degree from a previous M.S. degree related to hydrology.

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Students must also successfully complete written and oral qualifying examinations, write and defend a dissertation proposal, write and defend a doctoral dissertation, and are expected to submit the dissertation work for publication in scholarly journals.

Admission and Entrance Requirements

Students applying to the Hydrology program must have a baccalaureate degree in a science or engineering discipline as well as the following course work:

- College calculus (two semesters)
- Differential equations (one semester)
- College physics (one semester)
- College chemistry (one year)
- College statistics (one semester)

Some prerequisites may be completed in the first semesters of the student's graduate program. Applicants should have a minimum cumulative GPA of 3.0 for admission to the graduate school.

Applications are reviewed twice a year; once for fall admission and once for spring admission. Students wishing to apply to the Hydrology program should submit a complete application to the Office of Graduate Studies. Students must also submit two official transcripts of all previous college work, three letters of recommendation, GRE results, financial affidavit (international students), and any supporting materials that the applicant wishes to provide. Foreign students whose native language is not English, except for those with degrees from English-

speaking universities, must submit TOEFL or IELTS scores. Applications are reviewed for admission by the Hydrologic Science & Engineering admission committee. If admitted, a student will be assigned an advisor in one of the participating departments.

Financial Assistance

Applicants seeking financial support should indicate such within the Application for Admission. Support may be in the form of teaching assistantships (TA), research assistantships (RA), or fellowships. Generally, these awards are reserved for students pursuing a research-based program.

TAs are generally offered by March 15 for the next academic year; hence, are not usually available beginning with the spring semester. RAs are offered by individual faculty to students whom they expect will contribute quickly to a particular funded research project. Applicants interested in RAs should contact directly the faculty members whose research interests parallel their own.

Dr. John McCray, Program Chair
Hydrologic Sciences and Engineering Program

Colorado School of Mines
Golden, Colorado 80401
Phone: 303/273-3700
Fax: 303/273-3719

Faculty in Hydrological Sciences & Engineering at CSM

Hussein Amery, Associate Professor Liberal Arts & International Studies. BS University of Calgary; MS Wilfrid Laurier University; PhD, McMaster University. Water management and politics in the Middle East; conflict resolution of transboundary water issues; water ethics.

David Benson, Associate Professor Geology & Geological Engineering. BS University of Nevada; MS San Diego State University; PhD New Mexico State University. Subsurface contaminant transport and fate; numerical modeling.

Ron Cohen, Associate Professor Environmental Science & Engineering. BS Temple University; PhD University of Virginia. Limnology; wetlands treatment of mine wastes; treatment systems for produced waters from petroleum operations; environmental site characterization and risk assessment.

Jörg Drewes, Associate Professor Environmental Science & Engineering. BS, PhD Technical University of Berlin. Water and wastewater treatment engineering; potable and non-potable water reuse; characterization of natural and effluent organic matter; contaminant transfer among environmental media; fate of compounds and pharmaceuticals in natural and engineered systems.

Michael Gooseff, Assistant Professor Geology & Geological Engineering. BS, Georgia Institute of Technology; MS, PhD University of Colorado. Surface water hydrology; snow hydrology; groundwater surface water interactions; biogeochemistry; numerical modeling; stable isotope hydrology.

Vaughan Griffiths, Professor Engineering. BS, PhD University of Manchester; MS University of California, Berkeley. Hydraulics; engineering hydrology.

Dave Hale, Charles Henry Green Professor Geophysics. BS Texas A&M University; PhD Stanford University. Seismology; computer graphics; image processing; subsurface modeling and fluid flow.

Bruce Honeyman, Professor Environmental Science & Engineering. BS, MS, PhD Stanford University. Surface chemistry; environmental radiochemistry; metal-organic interactions; the physical/chemical processes controlling the fate of chemical species in natural and engineering systems.

John Humphrey, Associate Professor Geology & Geological Engineering. BS University of Vermont; MS, PhD Brown University. Carbonate sedimentology, diagenesis and geochemistry; stable isotope geochemistry; reservoir characterization; paleoclimatology.

Tisa Illangasekare, Professor Environmental Science & Engineering. BS University of Ceylon; MS Asian Institute of Technology; PhD Colorado State University. Subsurface flow, transport and fate of chemicals in porous media; groundwater hydrology; numerical modeling; fracture flow; flow in snow; NAPLs.

Yaoguo Li, Associate Professor. BS Wuhan College of Geology; PhD University of British Columbia. Geophysical inverse theory; gravity, magnetic, and electrical methods in resource exploration.

Ning Lu, Professor Engineering. BS Wuhan University of Technology; MS, PhD The Johns Hopkins University. Groundwater hydrology; unsaturated soil mechanics; expansive soils; environmental geotechnics.

Don Macalady, Professor Chemical & Geochemistry. BS The Pennsylvania State University; PhD University of Wisconsin. Chemistry of natural organic matter; abiotic oxidation/reduction reactions; hydrolysis reaction rates and mechanisms; environmental partitioning from aqueous to soil/sediment and other systems; particle effects in aqueous chemistry; geochemical processes in systems contaminated with acid mine drainage; chemistry in wetlands.

Junko Manakata Marr, Assistant Professor Environmental Science & Engineering. BS California Institute of Technology; MS, PhD Stanford University. Biological degradation of organic compounds; microbial communities in groundwater and water treatment systems; application of molecular biology techniques to environmental systems.

John McCray, Director Hydrologic Sciences & Engineering, Associate Professor Environment Sciences & Engineering. BS West Virginia University; MS Clemson University; PhD University of Arizona. Contaminant hydrology; subsurface remediation; vadose-zone hydrology; subsurface vapor-transport; watershed hydrology; mathematical modeling; soil-based wastewater treatment.

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Gary Olhoeft, Professor Geophysics. BS, MS Massachusetts Institute of Technology; PhD University of Toronto. Petrophysics; ground penetrating radar; nonlinear complex resistivity.

Eileen Poeter, Professor Geology & Geological Engineering. BS Lehigh University; MS, PhD Washington State University. Ground water flow and transport modeling; inverse modeling; characterization of subsurface heterogeneity; uncertainty evaluation; data fusion; geostatistical simulation.

Jim Ranville, Research Assistant Professor Chemistry & Geochemistry. BS Lake Superior State University; MS, PhD Colorado School of Mines. Geochemical influences on metal transport and bioavailability; environmental colloids and suspended particles; natural organic matter; field-flow fractionation methods; ICP-AES/MS methods; chemistry of acid-mine drainage.

G. W. “Jerry” Sherk, Associate Research Professor Liberal Arts & International Studies. Water policy; water law.

Robert Siegrist, Professor and Director Environmental Science & Engineering. BS, MS, PhD University of Wisconsin. Environmental characterization and risk assessment; subsurface treatment of contaminated land, water, and waste-water treatment, and reuse in natural and alternative systems.

John Spear, Adjunct Assistant Professor Environmental Science & Engineering. PhD Colorado School of Mines. Environmental microbiology; metal bioremediation; environmental policy and impact analysis.

Geoff Thyne, Research Associate Professor Geology & Geological Engineering. BS University of South Florida; MS Texas A&M University; PhD University of Wyoming. Water-rock interactions; aqueous geochemistry; solute transport; evolution of groundwater chemistry; landfill geochemistry and impact on water quality; petroleum geology and geochemistry of tight gas sands; spatial-statistical analysis of hydrochemical data.

Tina Voelker, Associate Professor Chemistry & Geochemistry. BS, MS Massachusetts Institute of Technology; PhD Swiss Federal Institute of Technology. Fate and effects of toxic metals and organic contaminants in aquatic environments; oxidation of organic contaminants in natural and engineered systems; photochemistry of natural organic matter; reactions of oxygen species in aquatic environments; interactions between metals and natural organic matter.