Duluth Campus

Water Resources Science M.S.

Swenson College of Science & Engineering
University of Minnesota Duluth

Link to a list of faculty for this program.

Contact Information:
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Website: http://wrs.umn.edu/degrees-courses/degree-requirements

- Program Type: Master's
- Requirements for this program are current for Fall 2020
- Length of program in credits: 30 to 32
- This program does not require summer semesters for timely completion.
- University of Minnesota, Twin Cities
- Degree: Master of Science

Along with the program-specific requirements listed below, please read the General Information section of the catalog website for requirements that apply to all major fields.

This cross-campus interdisciplinary program provides comprehensive training in water resources science, with integration across scientific disciplines. A structured interdisciplinary graduate curriculum is offered. The program includes a set of core courses plus electives in the following areas of interest: aquatic biology, environmental chemistry, hydrologic science, limnology, water management technology, water policy, water quality, and watershed science and management.

A limnology and oceanography track is also offered. Approximately 50 courses offered within 15 other graduate programs are available to students majoring in water resources science. The goal of the program is to produce scientists with strong technical skills in disciplines relevant to water resources and a broad understanding of 1) the hydrologic cycle and associated ecosystems, 2) the interconnectedness of the sciences involved in managing aquatic resources, and 3) the interplay between the biophysical sciences and social sciences in developing and implementing public policies related to water.

Students in the program develop the breadth of scientific knowledge appropriate to understand the complicated aquatic ecosystems and watersheds on which they will work, as well as social dimensions of the topic, including the public policy and legal frameworks in which water resources are protected and managed.

The program involves faculty from the following departments on the Twin Cities campus: Applied Economics; Bioproducts and Biosystems Engineering; Chemistry; Civil Engineering; Earth Sciences; Ecology, Evolution, and Behavior; Entomology; Environmental and Occupational Health; Fisheries, Wildlife, and Conservation Biology; Forest Resources; Horticultural Science; Landscape Architecture; Soil, Water, and Climate; and the Humphrey Institute of Public Affairs. It also involves faculty from the following departments on the Duluth campus: Biology; Chemical Engineering; Chemistry; Civil Engineering; Geological Sciences; Physics; as well as the Large Lakes Observatory and the Natural Resources Research Institute in Duluth.

Program Delivery

This program is available:
- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission

The preferred undergraduate GPA for admittance to the program is 3.00.

The program is flexible enough to accommodate students from a variety of backgrounds. Normally students have a bachelor's degree in physical or biological science or engineering.

Other requirements to be completed before admission:
Recommended academic preparation includes one year (or two semesters) each of calculus, physics, and chemistry, and one biology course.

Availability of funding and willingness of a member of the graduate faculty to serve as an advisor are important criteria for admission to the program.

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Special Application Requirements:
Applicants must submit three letters of recommendation via the University's application system. These letters should be from professors qualified to estimate applicant's class rank and evaluate their ability to complete a program of graduate study, or from persons who can assess their professional or research potential.

Applicants must also submit a résumé of their academic history and professional experience and a statement of purpose, including the proposed area of emphasis. Students may be admitted any semester but are strongly encouraged to submit their application by December 1 for fall semester admission. More specific application instruction can be found on the program website: https://wrs.umn.edu/prospective-students/admissions-info.

Applicants must submit their test score(s) from the following:
- GRE

International applicants must submit score(s) from one of the following tests:
- TOEFL
  - Internet Based - Total Score: 79
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80

The preferred English language test is Test of English as Foreign Language

Key to test abbreviations(GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

Plan A: Plan A requires 22 major credits, 0 credits outside the major, and 10 thesis credits.The final exam is oral.

Plan B: Plan B requires 30 major credits and 0 credits outside the major.The final exam is oral. A capstone project is required.
Capstone Project: The Plan B project is defined by the faculty advisor. The Plan B option is well suited to students who have little undergraduate course work in water resources science and thus need more coursework to gain the combination of depth and breadth needed in this field. Plan B projects involve field, laboratory, or computer work and the analysis, synthesis, or interpretation of data.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 1 semesters must be completed before filing a Degree Program Form.

Courses offered on both the A/F and S/N grade basis must be taken A/F.

Students with WRS-equivalent core courses taken as undergraduates may substitute other classes to meet program requirements, with advisor approval.

Core Courses (13 credits)
Select at least one course from the following in consultation with the advisor:
Hydrology (3 credits)
CE 4228 - Watershed Engineering (3.0 cr)
or GEOG 4446 - Water Processes and Management (3.0 cr)
or EES 4201 - Watershed Hydrology (3.0 cr)
or EES 5250 - Hydrogeology (4.0 cr)
or LIM 5101 - Physical Limnology (3.0 cr)
Environmental/Water Chemistry (3 credits)
Select at least one course from the following in consultation with the advisor:
CE 5241 - Water Chemistry (3.0 cr)
or CHEM 5150 - Organic and Stable Isotope Biogeochemistry (3.0 cr)
or LIM 5102 - Chemical Limnology (3.0 cr)
Limnology (3 credits)

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Select at least one course from the following in consultation with the advisor:
BIOL 5833 - Stream Ecology (3.0 cr)
or BIOL 5861 - Lake Ecology (3.0 cr)
or EES 5103 - Geological Paleolimnology (3.0 cr)
or LIM 5010 - Integrated Approaches to the Study of Inland Waters (3.0 cr)
or LIM 5103 - Geological Paleolimnology (3.0 cr)

Water Resources Policy (3 credits)
Take the following course:
WRS 5101 - Water Policy (3.0 cr)

Water Seminar Series (.5 credits)
Take the following course:
WRS 8100 - Interdisciplinary Seminar in Water Resources (0.5 - 3.0 cr)

Ethics and Responsible Conduct in Research (.5 credits)
Take the following course:
WRS 8581 - Research and Professional Ethics in Water Resources and Environmental Science (0.5 cr)

WRS Electives (9 to 17 credits)
Plan A students select 9 credits, and Plan B students select 17 credits from the following, in consultation with the advisor. Plan A students cannot apply WRS 8095 to this requirement.
BIOL 4761 - Ichthyology (3.0 cr)
or BIOL 5201 - Leverage bioinformatic tools to manage big data and answer primary biology questions (3.0 cr)
or BIOL 5801 - Microbial Ecology (2.0 cr)
or BIOL 5805 - Fisheries Ecology and Management (3.0 cr)
or BIOL 5808 *{Inactive}*(3.0 cr)
or BIOL 5809 - Ecological Statistics (3.0 cr)
or BIOL 5833 - Stream Ecology (3.0 cr)
or BIOL 5861 - Lake Ecology (3.0 cr)
or BIOL 5863 - Ecosystems Ecology (3.0 cr)
or BIOL 5870 - Wetland Ecology (3.0 cr)
or CE 4213 - Open Channel Hydraulics (3.0 cr)
or CE 4215 - Hydraulic Design (3.0 cr)
or CE 4228 - Watershed Engineering (3.0 cr)
or CE 5203 *{Inactive}*(3.0 cr)
or CE 5216 - Applications in Environmental Modeling (3.0 cr)
or CE 5237 - Water Quality Engineering (3.0 cr)
or CE 5241 - Water Chemistry (3.0 cr)
or CE 5246 - Environmental Remediation Technologies (3.0 cr)
or CHEM 5150 - Organic and Stable Isotope Biogeochemistry (3.0 cr)
or ESCI 5201 *{Inactive}*(3.0 cr)
or GEOG 4446 - Water Processes and Management (3.0 cr)
or EES 4201 - Watershed Hydrology (3.0 cr)
or EES 5103 - Geological Paleolimnology (3.0 cr)
or EES 5210 - Glacial and Quaternary Geology (4.0 cr)
or EES 5220 *{Inactive}*(3.0 cr)
or EES 5250 - Hydrogeology (4.0 cr)
or EES 5260 - Fluvial Geomorphology (3.0 cr)
or EES 5601 - Introduction to Stream Restoration (3.0 cr)
or EES 5603 - Stream Crossing Design (2.0 cr)
or EES 8602 - Stream Restoration Practice (2.0 cr)
or GIS 4565 *{Inactive}*(4.0 cr)
or GIS 5572 - Environmental Application of GIS (4.0 cr)
or LIM 5010 - Integrated Approaches to the Study of Inland Waters (3.0 cr)
or LIM 5011 - Laboratory and Discussion in Integrated Approaches to the Study of Inland Waters (2.0 cr)
or LIM 5012 - Integrated Approaches to the Study of Inland Waters II (3.0 cr)
or LIM 5013 - Laboratory and Discussion in Integrated Approaches to the Study of Inland Waters II (2.0 cr)
or LIM 5101 - Physical Limnology (3.0 cr)
or LIM 5102 - Chemical Limnology (3.0 cr)
or LIM 5103 - Geological Paleolimnology (3.0 cr)
or LIM 5104 *{Inactive}*(2.0 cr)
or LIM 5105 - Research Frontiers and New Directions in Limnology and Environmental Science (1.0 cr)
or PHYS 5541 - Fluid Dynamics (3.0 cr)
or WRS 5050 *{Inactive}*(1.0 - 3.0 cr)
or WRS 8095 - Plan B Project (3.0 cr)

Plan A
Plan A students take 10 masters thesis credits.

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WRS 8777 - Thesis Credits: Master's (1.0 - 18.0 cr)

Program Sub-plans

A sub-plan is not required for this program.
Students may not complete the program with more than one sub-plan.

Limnology and Oceanography

The science of inland waters, or "limnology," includes the study of streams, lakes, ponds, and wetlands. While Lake Superior falls into this category, the style of research, particularly the nature of sampling and the scale of the processes investigated, makes the study of Lake Superior and other Great Lakes more akin to oceanography than to classical limnology. A program that focuses on the study of both limnology and oceanography strengthens understanding of both systems, through comparative studies and by fostering interaction between groups that focus more strongly on one or the other system. Limnology and oceanography are by necessity interdisciplinary fields, with major components contributed by biological, geological, physical, and chemical sciences. Such interdisciplinary fields in the modern research university require mechanisms to ensure cross-fertilization of ideas, approaches, methods, techniques, and knowledge. The limnology and oceanography track in WRS provides just such a much-needed mechanism.

The goal of the program is to produce scientists with strong technical skills in aquatic science and a broad understanding of limnology and oceanography.

Students with WRS equivalent coursework taken as undergraduate students may substitute other classes to meet minimum credit requirements.

The faculty advisor must be a member of the limnology and oceanography track faculty.

Core Courses (11 cr)

Liminology

LIM 5010 - Integrated Approaches to the Study of Inland Waters (3.0 cr)
LIM 5011 - Laboratory and Discussion in Integrated Approaches to the Study of Inland Waters (2.0 cr)
LIM 5013 - Laboratory and Discussion in Integrated Approaches to the Study of Inland Waters II (2.0 cr)

Water Policy

CE 5201 - Water Policy (3.0 cr)

Ethics

WRS 8581 - Research and Professional Ethics in Water Resources and Environmental Science (0.5 cr)

Seminar

WRS 8100 - Interdisciplinary Seminar in Water Resources (0.5 - 3.0 cr)

WRS Electives

Plan A students need at least 11 credits from the following list and may not use WRS 8095 as an elective. Plan B students need at least 19 credits from the following list:
BIOL 4761 - Ichthyology (3.0 cr)
or BIOL 5201 - Leverage bioinformatic tools to manage big data and answer primary biology questions (3.0 cr)
or BIOL 5801 - Microbial Ecology (2.0 cr)
or BIOL 5805 - Fisheries Ecology and Management (3.0 cr)
or BIOL 5808 *{Inactive}*(3.0 cr)
or BIOL 5833 - Stream Ecology (3.0 cr)
or BIOL 5861 - Lake Ecology (3.0 cr)
or BIOL 5863 - Ecosystems Ecology (3.0 cr)
or BIOL 5870 - Wetland Ecology (3.0 cr)
or CE 4213 - Open Channel Hydraulics (3.0 cr)
or CE 4215 - Hydraulic Design (3.0 cr)
or CE 4228 - Watershed Engineering (3.0 cr)
or CE 5216 - Applications in Environmental Modeling (3.0 cr)
or CE 5237 - Water Quality Engineering (3.0 cr)
or CE 5241 - Water Chemistry (3.0 cr)
or CE 5246 - Environmental Remediation Technologies (3.0 cr)
or CHEM 5150 - Organic and Stable Isotope Biogeochemistry (3.0 cr)
or GEOG 4446 - Water Processes and Management (3.0 cr)
or EES 4201 - Watershed Hydrology (3.0 cr)
or EES 5103 - Geological Paleolimnology (3.0 cr)
or EES 5210 - Glacial and Quaternary Geology (4.0 cr)
or EES 5220 *{Inactive}*(3.0 cr)
or EES 5250 - Hydrogeology (4.0 cr)
or EES 5260 - Fluvial Geomorphology (3.0 cr)
or EES 5601 - Introduction to Stream Restoration (3.0 cr)
or EES 8602 - Stream Restoration Practice (2.0 cr)

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or GIS 4565 *{Inactive}*(4.0 cr)
or GIS 5572 - Environmental Application of GIS (4.0 cr)
or LIM 5010 - Integrated Approaches to the Study of Inland Waters (3.0 cr)
or LIM 5011 - Laboratory and Discussion in Integrated Approaches to the Study of Inland Waters (2.0 cr)
or LIM 5012 - Integrated Approaches to the Study of Inland Waters II (3.0 cr)
or LIM 5013 - Laboratory and Discussion in Integrated Approaches to the Study of Inland Waters II (2.0 cr)
or LIM 5101 - Physical Limnology (3.0 cr)
or LIM 5102 - Chemical Limnology (3.0 cr)
or LIM 5103 - Geological Paleolimnology (3.0 cr)
or LIM 5104 *{Inactive}*(2.0 cr)
or LIM 5105 - Research Frontiers and New Directions in Limnology and Environmental Science (1.0 cr)
or PHYS 5541 - Fluid Dynamics (3.0 cr)
or WRS 5050 *{Inactive}*(1.0 - 3.0 cr)
or WRS 8095 - Plan B Project (3.0 cr)

Plan A

Register for 10 credits
WRS 8777 - Thesis Credits: Master's (1.0 - 18.0 cr)

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