

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:

Water Resources Science, University of Minnesota, 173 McNeal Hall, 1985 Buford Avenue, St. Paul MN 55108 (612-624-7456; fax: 612-625-1263)

Email: wrs@umn.edu

Website: <http://wrs.umn.edu/degrees-courses/degree-requirements>

- Program Type: Master's
- Requirements for this program are current for Fall 2015
- Length of program in credits: 30 to 33
- 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 emphasis at the M.S. level: aquatic biology, environmental chemistry, hydrologic science, limnology, water management technology, water policy, water quality, and watershed science and management. Approximately 80 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; Civil Engineering; Earth Sciences; Ecology, Evolution, and Behavior; Entomology; Environmental and Occupational Health; Fisheries, Wildlife, and Conservation Biology; Forest Resources; Geography; Horticultural Science; Microbiology, Plant Biology; 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; Geography; Geological Sciences; Physics; and Political Science; 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 adviser are important criteria for admission to the program.



Special Application Requirements:

Applicants must submit three letters of recommendation via the Graduate School Apply Yourself website. 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. Applicants should submit results of the GRE General Test. Students may be admitted any semester but are strongly encouraged to submit their application by December 15 for fall semester admission. More specific application instruction can be found on the program website: wrs.umn.edu/prospectivestudents/apply/index.htm.

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
 - Internet Based - Writing Score: 21
 - Internet Based - Reading Score: 19
 - Paper Based - Total Score: 550
- 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 17 major credits, 6 credits outside the major, and 10 thesis credits. The final exam is oral.

Plan B: Plan B requires 24 major credits and 6 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 adviser. The Plan B option is well suited to students who have little undergraduate coursework 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.

Students may choose Plan A, which requires a thesis, or Plan B, which requires additional coursework and a major project. Both plans incorporate courses offered on the Twin Cities and Duluth campuses.

Students must complete courses in four core areas: 1) hydrology (surface and/or hydrogeology); 2) environmental/water chemistry; 3) limnology; and 4) water resources policy, economics, and management, and two electives in such areas of emphasis as aquatic biology, hydrologic science, watershed science and management, and water management technology. One elective must be from an approved list of technical courses dealing with water quality science/management. A minimum of two related field courses (at least 6 credits) outside of aquatic science are required. Registration for the WRS Seminar during the first semester in residence and training in responsible conduct of research and ethics are also required.

Core Courses (12 - 13 cr)

Hydrology

Take 1 or more course(s) from the following:

- GEOL 5240 *{Inactive}* (4.0 cr)
- EES 5250 - Hydrogeology (4.0 cr)

- LIM 5101 - Physical Limnology (3.0 cr)

Environmental/Water Chemistry

Take 1 or more course(s) from the following:

- LIM 5102 - Chemical Limnology (3.0 cr)

Limnology

Take 1 or more course(s) from the following:

- BIOL 5833 - Stream Ecology (3.0 cr)
- BIOL 5861 - Lake Ecology (3.0 cr)
- LIM 5101 - Physical Limnology (3.0 cr)
- LIM 5102 - Chemical Limnology (3.0 cr)
- LIM 5103 - Geological Paleolimnology (3.0 cr)

Water Resources Policy

Take 1 or more course(s) from the following:

- WRS 5101 - Water Policy (3.0 cr)

Related Field Courses (6 cr)

Six credits of related field courses. Courses may not be from the list of approved WRS elective courses and they should be "non-water" courses. Examples include courses in statistics, GIS, remote sensing, economics, and microbiology. Courses must be approved by the Director of Graduate Studies.

WRS Seminar Series (.5 cr)

Take for .5 credits

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

Training in Ethics and Responsible Conduct of Research (.5 cr)

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

Plan A or Plan B**Plan A**

Register for 10 credits.

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

Take 4 or more credit(s) from the following:

Emphasis

Take 1 or more course(s) from the following:

- BIOL 4761 - Ichthyology (3.0 cr)
- BIOL 5777 *{Inactive}*(2.0 cr)
- BIOL 5801 - Microbial Ecology (2.0 cr)
- BIOL 5802 *{Inactive}*(2.0 cr)
- BIOL 5805 - Fisheries Ecology and Management (3.0 cr)
- BIOL 5833 - Stream Ecology (3.0 cr)
- BIOL 4839 - Coral Reef Field Studies [GLOBAL PER] (3.0 cr)
- BIOL 5861 - Lake Ecology (3.0 cr)
- BIOL 5862 *{Inactive}*(3.0 cr)
- BIOL 5863 - Ecosystems Ecology (3.0 cr)
- BIOL 5868 *{Inactive}*(3.0 cr)
- BIOL 5869 *{Inactive}*(3.0 cr)
- BIOL 5870 - Wetland Ecology (3.0 cr)
- GEOG 4446 - Water Processes and Management (3.0 cr)
- EES 4710 - Geochemistry (4.0 cr)
- EES 5210 - Glacial and Quaternary Geology (4.0 cr)
- GEOL 5215 *{Inactive}*(3.0 cr)
- EES 5220 *{Inactive}*(3.0 cr)
- GEOL 5240 *{Inactive}*(4.0 cr)
- EES 5250 - Hydrogeology (4.0 cr)
- EES 5260 - Fluvial Geomorphology (3.0 cr)
- LIM 5004 *{Inactive}*(2.0 cr)
- LIM 5101 - Physical Limnology (3.0 cr)
- LIM 5102 - Chemical Limnology (3.0 cr)
- LIM 5103 - Geological Paleolimnology (3.0 cr)
- WRS 5050 *{Inactive}*(1.0 - 3.0 cr)
- WRS 8095 - Plan B Project (3.0 cr)

Water Quality

Take 1 or more course(s) from the following:

- BIOL 5801 - Microbial Ecology (2.0 cr)
- BIOL 5833 - Stream Ecology (3.0 cr)
- BIOL 5861 - Lake Ecology (3.0 cr)

- BIOL 5868 *{Inactive}*(3.0 cr)
- BIOL 5869 *{Inactive}*(3.0 cr)
- BIOL 5870 - Wetland Ecology (3.0 cr)

or **Plan B**

Take 11 or more credit(s) from the following:

Emphasis

Take 2 or more course(s) from the following:

- BIOL 4761 - Ichthyology (3.0 cr)
- BIOL 5777 *{Inactive}*(2.0 cr)
- BIOL 5801 - Microbial Ecology (2.0 cr)
- BIOL 5802 *{Inactive}*(2.0 cr)
- BIOL 5805 - Fisheries Ecology and Management (3.0 cr)
- BIOL 5833 - Stream Ecology (3.0 cr)
- BIOL 4839 - Coral Reef Field Studies [GLOBAL PER] (3.0 cr)
- BIOL 5861 - Lake Ecology (3.0 cr)
- BIOL 5862 *{Inactive}*(3.0 cr)
- BIOL 5863 - Ecosystems Ecology (3.0 cr)
- BIOL 5868 *{Inactive}*(3.0 cr)
- BIOL 5869 *{Inactive}*(3.0 cr)
- BIOL 5870 - Wetland Ecology (3.0 cr)
- GEOG 4446 - Water Processes and Management (3.0 cr)
- EES 4710 - Geochemistry (4.0 cr)
- EES 5210 - Glacial and Quaternary Geology (4.0 cr)
- GEOL 5215 *{Inactive}*(3.0 cr)
- EES 5220 *{Inactive}*(3.0 cr)
- GEOL 5240 *{Inactive}*(4.0 cr)
- EES 5250 - Hydrogeology (4.0 cr)
- EES 5260 - Fluvial Geomorphology (3.0 cr)
- LIM 5004 *{Inactive}*(2.0 cr)
- LIM 5101 - Physical Limnology (3.0 cr)
- LIM 5102 - Chemical Limnology (3.0 cr)
- LIM 5103 - Geological Paleolimnology (3.0 cr)
- WRS 5050 *{Inactive}*(1.0 - 3.0 cr)
- WRS 8095 - Plan B Project (3.0 cr)

•**Water Quality**

Take 1 or more course(s) from the following:

- BIOL 5801 - Microbial Ecology (2.0 cr)
- BIOL 5833 - Stream Ecology (3.0 cr)
- BIOL 5861 - Lake Ecology (3.0 cr)
- BIOL 5868 *{Inactive}*(3.0 cr)
- BIOL 5869 *{Inactive}*(3.0 cr)
- BIOL 5870 - Wetland Ecology (3.0 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 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 insure 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 may choose Plan A, which requires a thesis, or Plan B, which requires additional coursework and a major project. Specific curriculum for the limnology and oceanography track follows WRS course requirements. Both plans incorporate courses offered on the Twin Cities and Duluth campuses.



Students must complete courses in four limnology and oceanography track core areas: 1) hydrology (surface and/or hydrogeology); 2) environmental/water chemistry; 3) limnology; and 4) water resources policy, economics, and management; and one elective must be from an approved list of technical courses dealing with water quality science/management. An additional one or two electives in limnology and oceanography are also required. A minimum of two related field courses (at least 6 credits) outside of aquatic science are required. Registration for the WRS Seminar during the first semester in residence and training in responsible conduct of research and ethics are also required.

A minimum of 20 course credits (plus 10 thesis credits) are required for Plan A and a minimum of 30 credits are required for Plan B (up to 3 credits may be used for the Plan B project). Students who had classes equivalent to those in the WRS core as undergraduates may substitute other classes to meet minimum credit requirements.

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

Approved limnology and oceanography track core and elective courses as well as a list of faculty are listed on the program website: wrs.umn.edu/degreesandcourses/landotrack/index.htm.