**Academic Course Requirements**
The MS WSP degree requires completion of 32 units, distributed as follows:

- **Core Courses** 12-13 units
- **Water, Society and Policy Seminar** 2 units
- **Electives** 12-14 units
- **Master's Project** 6 units

Students select appropriate coursework in consultation with a program advisor. Core courses are designed to provide students with exposure to water policy and hydrology. Electives allow students to focus on science or the human dimensions of water management. Students also take the Water, Society and Policy seminar for two semesters to learn about water research conducted on campus and elsewhere, and to interact with their peers and faculty.

A Master’s Project (6 units) is required. The project will be supervised by one of the WSP participating faculty. Each student will give a public presentation of their master’s project.

**Core classes (12-13 units)**
(Note: These may be taken as electives if they are not chosen for the core.)

Choose any 3 of the following 4 courses (9 units):

**AREC 575 - Economic Evaluation of Water and Environmental Policy**
Theory and application of economic concepts needed to evaluate water and environmental laws and policies, including benefit cost analysis, externalities, public goods and valuation methodologies. Case studies include federal, state, tribal and international water and environmental policies.

**SWES 596B - Arizona Water Policy**
This course focuses on current Arizona water policy from a multi-disciplinary perspective. Through readings, research, discussion and presentations, the student is exposed to current water resource issues facing Arizona and other parts of the West and policies to address them.

**GEOG 596I - Comparative and International Water Policy**
This course examines major issues in comparative and international water policy, including water markets, privatization, dams and river basin management, environmental flows, social equity, and water governance. The course is interdisciplinary and builds on law, geography, political economy, and institutional economics.

**GEOG 596J - Water Management and Policy**
Management and policy challenges driven by surface water and groundwater scarcity will be assessed for the Southwest US, Mexico, and globally. Critical review of institutions coupled with assessment of emerging management systems will lead to consideration of policy alternatives.

**GEOG 696O - Adaptation & Resilience in Water Resources Systems**
Climate change, urban growth, energy demand, and global food trade alter water in coupled human-natural systems. This seminar addresses adaptation and resilience using material on river basins, aquifers, infrastructure, policy, and institutions from Southwest U.S., transboundary U.S.-Mexico, and international cases.
Choose 1 of the following 4 courses (3-4 units):

**WS M 552 - Dryland Ecohydrology and Vegetation Dynamics** (Fall)
Overview of ecological and hydrological interrelationships and associated vegetation dynamics for water-limited, dryland ecosystems.

**WS M 560 - Watershed Hydrology** (Fall)
Application of fundamental principles to quantifying the basic hydrologic processes occurring on watersheds.

**WSM 568 - Wildland Water Quality** (Spring)
Introduction to water quality and its influences in natural environments. Interactions with land management and relationships to the larger issues of environmental quality. Graduate-level requirements include a class report and presentation on a negotiated topic of interest.

**CHEE 525 - Emerging Issues in Water Quality** (Spring)
This course will investigate, discuss, and debate major emerging water quality issues which threaten our water sustainability and the regulatory paradigms to address these challenges.

**HWRS 517A – Fundamentals of Water Quality** (Fall)
Introduction to chemical processes affecting the behavior of major and minor chemical species in the aquatic environment. Physical, equilibrium, inorganic/organic, and analytical principles as applied to natural waters. Graduate-requirements include writing a review paper and oral presentation, differential problem sets for homework and exams.

**Elective Courses (12 units minimum)**

**ARL 642 - Use and Management of Arid Lands**
Major issues surrounding land uses in the world's arid and semi-arid zones. Examination of issues which will determine the future of land management in much of the arid and semi-arid lands of the western United States. The debate over the management of lands in relation to ownership, tenure, and access; intergenerational transfers, and the economic, environmental, and social consequences of proposed changes in current arrangements.

**CHEE 525 - Emerging Issues in Water Quality (3 units)**
Burgeoning human population and urbanization is creating increased demands on fresh water resources and generating larger and more concentrated waste streams. Droughts throughout many parts of the world also have placed unique challenges on historically abundant river systems. Therefore, many communities are considering the utilization of alternative water resources, including desalination of brackish waters and the reuse of wastewater for potable and non-potable applications. This course will investigate, discuss, and debate major emerging water quality issues which threaten our water sustainability and the regulatory paradigms to address these challenges. Specific issues include endocrine disrupting chemicals, pharmaceuticals, unregulated disinfection by-products, perfluorinated organic compounds, algal toxins, nanoparticles, and others. Through this course, students will become educated as to the Federal and State paradigm for addressing emerging water contaminants, as well as discuss key examples from other countries (i.e., Australian Guidelines for Water Reuse). Students will also learn the history which led to major discoveries related to emerging contaminants (i.e., endocrine disruptors and pharmaceuticals) and the path forward in terms of analytical and bioanalytical quantification techniques, water treatment, and green chemistry. Students will work independently, and as groups, to investigate a key issue relative to water, write a term paper on this topic, and present and defend their findings before the class.

**GEOG 532 - Climate and Water**
This course explores the connections between climate and water resources from the perspective of the past, the present, and the future to foster an appreciation of the finite nature of water in the western U.S. and other regions in the face of a changing climate.
GEOG 696J - Water Resources Geography
Based on the exchange of scholarly information, usually in a small group setting, this course examines contemporary developments in water resources geography. The selected topics rotate according to the interests of the faculty convener and the graduate student enrollees. Typical topics include water issues in the Western U.S., comparative and international water policy, arid lands, border regions, a warming world, groundwater management, water and urban growth, energy-water linkages, water rights, markets, and transfers, and public and cultural perceptions of water. The scope of work shall consist of research by course registrants, with the exchange of the results of such research through discussion, reports, and/or papers.

LAW 603J - Sustainability and Environmental Policy
Over the past twenty years “sustainability” (or “sustainable development”) has emerged as a central goal of environmental policy making. Contemporary tools of environmental policy including ecosystem management, adaptive management, and restoration have been displaced by what seems like a clearer goal that captures ends as well as means. Sustainability has moved from the work of scholars and activists to laws and administrative regulations. The language of sustainability has extended to the world of business and commerce.

LAW 641 - Water Law

LAW 669 - Environmental Law
A survey course covering major environmental statutes and common law doctrines. Topics include the Clean Air Act, Clean Water Act, National Environmental Policy Act, CERCLA, regulatory takings, standing in environmental cases, the law of nuisance, and the public trust doctrine.

LAW 696I - International Environmental Law
This course analyzes the expanding framework of and the legal process leading to international regulation of the human environment, including regional and international regulation of air and water pollution and the protection of marine mammals and endangered species; the relationship between environmental and trade issues; protection of the “global commons”; conflicts between protecting the environment and economic development; enforcement of international environmental obligations by the United States and other nations; and regional regulation of environmental matters, including the NAFTA and the North American Agreement on Environmental Cooperation.

RNR 517 - Geographic Information Systems for Natural and Social Sciences
Introduction to the application of GIS and related technologies for both the natural and social sciences. Conceptual issues in GIS database design and development, analysis, and display.

RNR 580 - Natural Resources Policy and Law
This course examines the natural resource and environmental policy formulation process, the participants in that process and the policies themselves. The course emphasizes public policy as it applies to federal lands. However, the principles apply to state lands and policies as well.

RNR 585 - Natural Resources Economics and Planning
This course examines methods for planning and decision-making in the management of renewable natural resources on public lands. The course topics are: economic welfare and market failure, cost-benefit analysis, market and non-market valuation, linear programming, input-output analysis, multi-criteria decision methods, and timber harvest scheduling. The renewable natural resources considered are water, timber, wildlife, wilderness, fisheries, range and recreation.

SWES 554 - Water Harvesting
Course focuses on water harvesting principles and techniques. Students will learn how to apply concepts at their own residences and participate in applying them on the UA campus. Graduate-level requirements include working with other graduate students to evaluate water harvesting practices on campus. Two examples of good & poor water harvesting on campus plus two sites that might be considered for future harvesting must be surveyed with results posted on website.

SWES 474 - Aquatic Plants and the Environment
The role of riparian areas, estuaries, and constructed wetlands in the environment. Emphasis on plants as wildlife habitat for nutrient cycling and bioremediation.
WFSC 541 - Limnology
Study of lakes and streams; biological characteristics, as related to physical, chemical, geological, and historical processes operating on fresh waters. Graduate-level requirements include a report that synthesizes literature on a research issue of current concern, an in-class presentation and several discussion meetings.

WFSC 571 - Stream Ecology
This course will examine the structure and function of stream ecosystems with emphasis on the interaction of physical and biotic elements of streams in arid regions. We will examine the role of natural and anthropogenic stressors in shaping aquatic assemblages in streams. Quantification of impairment of stream structure and function requires a thorough understanding of fundamental ecological concepts of natural streams; this will be a major focus. Also, students will learn to use current methods to assess stream condition and signs of impairment. Graduate-level requirements include additional essay questions on exams and graduate student must meet with the instructors to discuss selected research articles. Presentations will be longer than undergraduates.

WS M 544 - Applied Environmental Law
A guided journey through real world environmental law; U.S. legal system, major environmental laws-criminal and civil; common 5 marketplace problems and solutions; high profile cases; essential professional skills.

WS M 562 - Watershed Management
Evaluating hydrologic impacts of management activities on watersheds to include silviculture, range, mining, and recreation use.

WS M 568 - Wildland Water Quality
Introduction to water quality and its influences in natural environments. Interactions with land management and relationships to the larger issues of environmental quality.

RNR 909 - Master's Report
Students are required to complete a major project for the MS WSP degree. The topic of the project will be selected during the first year of study by the student in consultation with his/her advisor. It should focus on a water policy issue of importance, ideally in a semi-arid environment. The student will prepare for the advisor's approval a brief (2 to 3 pages) proposal outlining the objectives of the project, work plan, and deliverables. The project may stem from an internship; however a formal internship is not required. The time and effort invested should represent six-units of academic credit. According to the Arizona Board of Regents, each unit awarded should represent 45 hours of study. However, the acceptability of the final project is the decision of the advisor. The final deliverables are for the student and the advisor to determine. However, at a minimum a written report and an oral presentation are required. The project is to be completed by the end of the second year of study or by the expected graduation date, whichever comes later.