

SECTION A - Overview**1. Provide a brief description of the new certificate.**

The certificate in water resources prepares undergraduate students in topics related to hydrologic science and their application to water resources management. Exciting career opportunities exist in this field within government agencies, private sector consulting and engineering firms and non-profit organizations. The sequence of classes offered through the certificate build from a foundation in geological sciences up to water policy and design aspects of hydrology, as selected by the student.

2. This proposed certificate: (check one)

- is cross disciplinary; or
- is certified by a professional or accredited organization/governmental agency; or,
- clearly leads to advanced specialization in a field; or,
- is granted to a program that does not currently have a major

3. Why should this be a certificate rather than a concentration or a minor?

The proposed plan of study is best offered as a certificate rather than a concentration or minor due to the nature of the coursework and the student population that will be interested in completing the program. The principal source of students for the program will be current degree-seeking Earth and Space Exploration (ESE) students with a concentration in geological sciences. Consequently, these students would be ineligible for the program if it were to be offered as a concentration because they are already participating in the concentration. In addition to current geoscience students, we anticipate participation in this program by post-baccalaureate geoscience graduates, graduate students and industry professionals who are interested in expanding their skillset to include water resources. In order for these individuals to be eligible for this program it is necessary that this program be offered as a certificate rather than a minor as the minor must be affiliated with an active degree program.

4. Affiliation

If the certificate program is affiliated with a degree program, include a brief statement of how it will complement the program. If it is not affiliated with a degree program, incorporate a statement as to how it will provide an opportunity for a student to gain knowledge or skills not already available at ASU.

The proposed water resources certificate program would be appropriate to students in degrees related to the earth processes, such as geological sciences, sustainability, environmental studies and civil engineering. Because of the breadth of required and elective coursework for these diverse programs, this certificate would be particularly attractive to students who wish to focus their career path or graduate studies specifically on the management of water resources, which is not a current undergraduate offering at ASU.

5. Demand

Explain the need for the new certificate (e.g., market demand, interdisciplinary considerations).

With a job outlook increasing at a rate faster than other job averages (>11% by 2024) for those working in water resources, the demand for individuals with these skills is clear. Moreover, this growth is likely to accelerate as water resources are irreplaceable and ever increasingly in demand and endangered as populations grow. New fields in hydrology open regularly in environmental consulting, mining and oil companies, as well as government regulatory agencies. The skills gained from completion of this certificate could benefit the more than 500 B.A and B.S earth studies undergraduate students in the School of Earth and Space Exploration and School of Sustainability interested in working in the area of water resources or going on to pursue graduate studies in this sub-discipline of earth science.

6. Projected enrollment

What are enrollment projections for the first three years?

3-YEAR PROJECTED ANNUAL ENROLLMENT			
	1st YEAR	2nd YEAR <i>Yr 1 continuing + new entering</i>	3rd YEAR <i>Yr 1 & 2 continuing + new entering</i>
Number of Students (Headcount)	75	150	225

SECTION B - Support and Impact

7. Faculty governance

Attach a supporting letter from the chair of the academic unit verifying that the proposed certificate has received faculty approval through appropriate governance procedures in the unit and that the unit has the resources to support the certificate as presented in the proposal, without impacting core program resources.

8. Related programs

Identify related ASU programs and outline how the new certificate will complement these existing ASU programs. *Statements of support from potentially affected academic unit administrators must be included with this proposal.*

School of Sustainability

9. Letter(s) of support for courses

Provide a supporting letter from each college/school dean from which individual courses are taken.

SECTION C - Academic Curriculum and Requirements

10. Knowledge, competencies, and skills

List the knowledge, competencies, and skills (learning outcomes) students should have when they complete this proposed certificate. Examples of program learning outcomes can be found at <https://uoeee.asu.edu/assessment>. While learning outcomes are needed, the measures and performance criteria are not needed for certificates.

Outcome1.1: Recipients of the Certificate in Water Resources will demonstrate the ability to analyze and evaluate scientific data to create conclusions about water flow at or near Earth’s surface in response to gravitational, atmospheric, topographic, and hydrologic characteristics of the medium through which it moves.

- Measure1.1: Oceanography (GLG325) Exam 1
- Performance Criterion1.1: 80% will earn an average grade of ‘B’ or better.
- Measure1.2: Hydrogeology (GLG 470) homework assignments and term project
- Performance Criterion1.2: 80% will earn an average grade of ‘B’ or better for this portion of the course.
- Measure1.3: Earth’s Critical Zone (GLG 327) homework assignments
- Performance Criterion1.3: 80% will earn an average grade of ‘B’ or better for this portion of the course.

Outcome2.1: Recipients of the Certificate in Water Resources will demonstrate advanced understanding of the hydrologic cycle and the interactions among physical, biological, and chemical components of a particular geologic setting.

- Measure2.1: Oceanography (GLG 325) final exam.
- Performance Criterion2.1: 80% will earn an average grade of ‘B’ or better.
- Measure2.2: Hydrogeology (GLG 470) homework assignments
- Performance Criterion2.2: 80% will earn an average grade of ‘B’ or better for this portion of the course.
- Measure2.3: Earth’s Critical Zone (GLG 327) final exam
- Performance Criterion1.3: 80% will earn an average grade of ‘B’ or better for this portion of the course.

11. Enrollment criteria

Describe the procedures and any qualifications for enrollment in the proposed certificate. Please note if they are identical to the admission criteria for the existing major and degree program under which this certificate will be established.

Students must be admitted to an undergraduate degree program or already have a completed bachelor’s degree from ASU or another institution in order to enroll in the certificate. Additional enrollment requirements may include completion of the following courses or their equivalencies with a C or better:

GLG 101/103 or SES 121/123; MAT 170, 171, 210, 251, 265 OR 270, 266 or 271; PHY 101, 111 or 121, or CHEM 101, 107, 113, 114 or 117 or BIO 100, 181, 182, 281, or 282

12. Program Map

Attach a copy of the “proposed” map for this certificate program.

See the [Build a Major Map Training Guide](#) for instructions on how to create a “proposed certificate map” in [BAMM](#).

13. Minimum residency requirement

How many hours of the certificate must be ASU credit?

A minimum of 9 credit hours must be completed at ASU. Credit hours not completed by ASU must be approved for use within the certificate in water resources.

14. New courses

List new courses in alphanumeric order and provide a brief course description for each one.

Prior to submitting this proposal, all new courses must be at the *University Review* level in [Curriculum ChangeMaker](#).

At present no new courses have been created for this certificate.

SECTION D - Administration and Resources

15. Administration

How will the proposed certificate be administered (including admissions, student advisement, retention, etc.)?

Administration of the certificate, including, admissions, student advisement and retention, will be handled by existing administrative support staff and by faculty mentors.

16. Resources

What are the resource implications for the proposed certificate, including any projected budget needs? Will new books, library holdings, equipment, laboratory space and/or personnel be required now or in the future? If multiple units/programs will collaborate in offering this certificate, please discuss the resource contribution of each participating program. Letters of support must be included from all academic units that will commit resources to this certificate.

No additional resources or budget needs will be necessary to support the Water Resources Certificate.

17. Primary faculty

List the primary faculty participants regarding this proposed certificate. For interdisciplinary certificates, please include the relevant names of faculty members from across the University. The areas of specialization should refer to

FACULTY NAME	TITLE	AREA(S) OF SPECIALIZATION
Kelin Whipple	Professor	Processes Geomorphology
Arjun Heimsath	Professor	Critical Zone Processes
Jim Tyburczy	Professor	Hydrogeology
Enrique Vivoni	Professor	Hydrology
Hilairy Hartnett	Associate Professor	Oceanography, Water Geochemistry

SECTION E - Additional Materials

18. Complete and attach the Appendix document.

19. Provide one or more model programs of study (if appropriate).

20. Attach other information that will be useful to the review committees and the Office of the Provost.

APPENDIX**Operational Information for Undergraduate Certificates**

This information is used to populate the [Degree Search/catalog website](#).
Please consider the student audience in creating your text.

1. Certificate Name: Water Resources**2. Marketing Text** *Optional, 50 words maximum*

The marketing text should make an emotional connection with prospective students to draw them in so they continue reading. Do not repeat content found in the program description.

With a job outlook increasing at a rate faster than other job averages (>11% by 2024, U.S. B.L.S.) for those working in water resources, the demand for individuals with these skills is clear. This growth will likely accelerate as water resources are irreplaceable, and increasingly in-demand and endangered as populations grow.

3. Program Description *150 words maximum*

Present factual basic and specialized information about the program to help students decide if the program is the right fit. This section is not the place for hyperbole, information about enrollment or admission, campus, course requirements, or potential careers.

The certificate program in water resources prepares undergraduate students in topics related to hydrologic science and their application to water resources management. Exciting career opportunities exist in this field within government agencies, private sector consulting and engineering firms and non-profit organizations. The sequence of classes offered through the certificate program build from a foundation in geological sciences up to water policy and design aspects of hydrology, as selected by the student.

4. Contact and Support Information

Building code and room number: (Search ASU map)	ISTB4 795
Program office telephone number: (<i>i.e.</i> 480/965-2100)	480/965-5081
Program Email Address:	sese-advising@asu.edu
Program Website Address:	https://sese.asu.edu

5. Program Requirements

These requirements will be drawn from the “proposed certificate map” that must be submitted with this proposal. Instructions to create a “proposed certificate map” in [BAMM](#) can be found in the [Build a Major Map Training Guide](#).

6. Enrollment Requirements

If applicable, list any special enrollment requirements applicable to this certificate in addition to the standard text.
Enrollment requirements for all undergraduate certificates include the following text.

A student pursuing an undergraduate certificate must be enrolled as a degree-seeking student at ASU. Undergraduate certificates are not awarded prior to the award of an undergraduate degree. A student already holding an undergraduate degree may pursue an undergraduate certificate as a nondegree-seeking graduate student.

Depending on a student's undergraduate program of study, prerequisite courses may be needed in order to complete the requirements of this certificate.

7. Keywords

List all keywords used to search for this program (limit 7). Keywords should be specific to the proposed program.
All parts of the certificate name are automatically included as keywords.

Sustainability, civil engineering, environment, geology, hydrology

8. Delivery/Campus Information Options: Campus immersion (ground and/or iCourses)

9. **Campus/Locations:** Indicate all campus immersion locations where this program will be offered

Downtown Phoenix Polytechnic Tempe West Other: _____

2020 - 2021 CERTIFICATE Map

Water Resources (Proposed)

Program Requirements

The certificate requires a minimum of 16 credit hours. At least 12 credit hours must be completed in upper-division coursework and at least nine credit hours must be completed at ASU. At least six upper-division hours in the certificate must be completed in courses offered by The College of Liberal Arts and Sciences. A grade of "C" (2.00 on a 4.00 scale) or higher is required for each course used to fulfill a certificate requirement.

Required Courses -- 10 credit hours

[GLG 108 / SOS 182: Water Planet \(SQ\)](#) (4)

[GLG 327 / SOS 374: Earth's Critical Zone](#) (3)

[GLG 470: Hydrogeology](#) (3)

Electives (choose two) -- 6 credit hours

[CEE 441: Water Resources Engineering](#) (3)

[GLG 325 / BIO 325 / CHM 385: Oceanography](#) (3)


[GLG 362: Geomorphology](#) (3)

[GLG 471: Hydrology](#) (3)

[GLG 481: Geochemistry](#) (3)

[SOS 433: Sustainable Water Use](#) (3)

Depending on a student's undergraduate program of study, prerequisite courses may be needed in order to complete the requirements of this certificate.

To: ASU Curriculum Planning
From: J Ramón Arrowsmith, Professor of Geology & Deputy Director, School of Earth and Space
Exploration 
Date: March 8, 2018
RE: Unit support for Certificate in Water Resources

Understanding the hydrologic and hydrogeologic fundamentals of water resources management is essential for Arizona and for ASU students.

The School of Earth and Space Exploration strongly supports this request for the Certificate in Water Resources. This certificate has been under discussion for nearly a year among the SESE Faculty and has their approval. We can support this certificate with existing faculty and staff resources.

Sincerely,



J Ramón Arrowsmith, Professor of Geology & Deputy Director, School of Earth and Space Exploration

March 2, 2018

To whom it may concern:

The School of Sustainable Engineering and the Built Environment has considered the proposal for a certificate in Water Resources and we support it. This proposal will impact us through the required course GLG 470, which is cross-listed with CEE 440. It also lists CEE 441 as an elective.

Our understanding is that the expected impact is about five additional students in CEE 441 and 5-10 additional students in CEE 440 each year. We confirm that we can manage the additional load with current resource allocations.

Sincerely,



G. Edward Gibson, Jr., PhD, PE
Director, Professor and Sunstate Chair

From: Christopher Boone Christopher.G.Boone@asu.edu

Subject: Re: Water Resources Certificate

Date: March 7, 2018 at 11:18 AM

To: Duane DeVecchio duane.devecchio@asu.edu, Professor Childers Dan.Childers@asu.edu, Chris Groppi cgroppi@asu.edu

CB

Duane,

The School of Sustainability is very happy to support the Water Resources Certificate and for including SOS 433 as a regular offering for the certificate.

Christopher Boone
Dean and Professor
School of Sustainability
Arizona State University

From: Duane DeVecchio <duane.devecchio@asu.edu>

Date: Wednesday, March 7, 2018 at 12:22 PM

To: Christopher Boone <Christopher.G.Boone@asu.edu>, Professor Childers <Dan.Childers@asu.edu>, Chris Groppi <cgroppi@asu.edu>

Subject: Re: Water Resources Certificate

Hi all,

I'm following up on the email below. SESE would need a support letter/email for including SOS 433 in the certificate by Monday March 12th.

Thanks.

Duane

Duane E. DeVecchio, Ph.D.
Assistant Research Professor
School of Earth & Space Exploration
Arizona State University
PO Box 871404 | Tempe, AZ 85287-1404
Ph: (480) 727-2636 | Office: Moeur 140b
E-mail: duane.devecchio@asu.edu
Web: devecchio.asu.edu | sese.asu.edu

On Mar 1, 2018, at 11:46 AM, Duane DeVecchio <duane.devecchio@asu.edu> wrote:

Dean Boone and Professor Childers,
I would like to thank you for the very productive meeting a few weeks back with both myself and Professor Chris Groppi. Chris and I both left the rainy meeting feeling as though we had a clear path going forward in which SESE and SOS could work together to expand the course requirements (new potential courses) to encourage greater interest among SOS undergraduates in this certificate. As

discussed in the meeting, we have added the cross-listed course Water Planet (GLG108/SOS182) to the required certificate course list, along with Earth's Critical Zone (GLG327/SOS374) and Hydrogeology (GLG470, no prerequisites).

In order to get the certificate approved and include Sustainable Water (SOS 433), which is taught every fall by Professor Smith, in the certificate elective course list is a measure of support from SOS. An email response or brief letter of support to this effect will suffice.

Thank you again for your time and consideration of SESEs certificate in water resources.

Duane

Duane E. DeVecchio, Ph.D.
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