

New Academic Program Workflow Form

General

Proposed Name: Sustainable Mineral Resources

Transaction Nbr: 00000000000116

Plan Type: Minor

Academic Career: Undergraduate

Degree Offered:

Do you want to offer a minor? N

Anticipated 1st Admission Term: Fall 2022

Details

Department(s):

ENGR

DEPTMNT ID	DEPARTMENT NAME	HOST
2309	School of Mining and Mineral Resources	Y

Campus(es):

MAIN

LOCATION	DESCRIPTION
TUCSON	Tucson

Admission application terms for this plan: Spring: Y Summer: Y Fall: Y

Plan admission types:

Freshman: Y Transfer: Y Readmit: N Graduate: N

Non Degree Certificate (UCRT only): N

Other (For Community Campus specifics): N

Plan Taxonomy: 14.2101, Mining and Mineral Engineering.

Program Length Type: Program Length Value: 0.00

Report as NSC Program:

SULA Special Program:

Print Option:

Diploma: Y Sustainable Mineral Resources

Transcript: Y Sustainable Mineral Resources

Conditions for Admission/Declaration for this Major:

Meet with school advisor or program coordinator; minimum GPA of 2.0

Requirements for Accreditation:

N/A

Program Comparisons

University Appropriateness

The Sustainable Mineral Resources minor supports UArizona's mission and strategic plan. The minor is focused on developing adaptive learners and innovative problem-solvers who look forward to tackling the world's challenges in meaningful ways that improve society.

The University of Arizona has been a global leader in mining education since 1885, when mining was one of the university's two foundational programs along with agriculture. Today, the university has one of only 12 accredited mining engineering programs in the US and among the only economic geology and mining law programs. UArizona also has leading programs in other critical disciplines required by mineral resources industries including environmental science, business, data science, social sciences, hydrology, public health, and policy, and a whole host of other engineering disciplines – meaning the UArizona is uniquely placed within the Arizona University System to cross-pollinate mining knowledge with other critical fields to provide the quality, depth and breadth of talent needed. This minor offers the opportunity to improve how we educate and innovate by developing a transdisciplinary education model.

While UArizona has created and sustained successful proof-of-concept interdisciplinary education programs including the Global Mining Law program, and interdisciplinary research centers such as Center for Environmentally Sustainable Mining, and other highly specialized, solutions-oriented programs like the Geotechnical Center of Excellence, there are more opportunities for growth in this area. In a workshop with 10 faculty, the current state of mining and mineral resources education at UArizona was described as siloed and unable to attract the quality or diversity of students needed. The group felt UArizona has

not leveraged existing strengths to nearly its potential. This minor is a step towards bringing transdisciplinary perspectives and adaptive problem-solving to the challenges faced in mining and mineral resources. By rallying students and faculty from various departments, the quality of education improves, the value of various perspectives is acknowledged, and the overall student experience is enhanced.

Arizona University System

NBR	PROGRAM	DEGREE	#STDNTS	LOCATION	ACCRDT
1	Engineering Management minor	2MS	52	Arizona State University	N
2	Environmental Engineering minor	2MS	4	Northern Arizona University	N

Peer Comparison

Similar to: The proposed minor program is like the ASU Engineering Management, Minor and the NAU Environmental Engineering, Minor in that all three offer either core or elective courses that delve into some aspects of engineering. The core courses offered through the proposed minor provide high level overviews of engineering and its integration with the mining industry. The other two minors, focus on important topics in engineering that are touched on in the Sustainable Mineral Resources minor. Additionally, each of the other minors is a potential track from which students can choose courses in the Sustainable Mineral Resources minor. The environmental track of the proposed minor covers several of the same topics covered in NAU's Environmental Engineering minor including sustainability with land, air, and water. The basic principles and introductory information covered in each is much the same. The leadership and communication track of the proposed minor focuses on communication aspects of leadership and this is briefly touched on in a few of the courses in ASU's Engineering Management minor. All three programs can include engineering students in their enrollment. ASU's Engineering Management minor and the proposed minor can also include students from other departments.

Different from: The primary difference between the proposed minor and the other Arizona University System programs is the interdisciplinary purpose and structure of the proposed minor. Current mining related programs at each University operate largely independently of other departments, with limited integration or interaction between departments. This represents both a missed opportunity, and a risk. Currently, the courses and advising needed to attract students from important disciplines like hydrology, economics, data science and other engineering disciplines to mining and minerals related studies are not available.

The minor is designed to attract a diverse range of students (diverse in terms of demographics and disciplines) to broaden the aperture of who engages in mineral resources related studies. The minor will build on the introductory/general education course and provide students both holistic context and an opportunity to dive deeper into areas of interest (business and economics, society and policy, health and safety, environment, data analytics and automation, mining and recycling, and leadership and communication) to compliment their degree focus. The minor strives to bring diverse students together to learn to collaborate, problem solve, and communicate with people with different knowledge and perspectives. Ideally, experience with the minor will inspire students to study related topics at depth and explore career opportunities in natural resource development. The minor is envisioned to provide flexible options.

NAU's minor enrollment is limited to students in science and engineering fields and is, therefore, not reaching the same interdisciplinary audience as the proposed minor. ASU's program is open to enrollment by students from other departments, however, the intent is to have those students learn specific engineering knowledge. The proposed minor specifically seeks to integrate the knowledge and perspectives from other departments into the mining and mineral resources coursework.

Neither of the other two programs have curriculum specifically designed to pull from the perspectives of students from other disciplines to solve problems in a holistic and innovative way. The proposed minor is intended to have diverse groups of students from various disciplines solve problems by taking into consideration environmental, social, economic, and technical perspectives. Neither of the other two programs have curriculum built in this manner. The structure of integrating numerous disciplines into mining and mineral resources is unique to the proposed minor.

How do these differences make this program more applicable to the target student population and/or a better fit for the University of Arizona? As stated, the minor is designed to attract a diverse range of disciplines. The courses chosen for the minor reflect that diversity. Twenty different departments from eight colleges were brought into this minor to support adaptive learning, enhance the student experience, and achieve the minor's vision to equip students with the skills needed to work effectively with others from a variety of backgrounds and value the different perspectives others bring to the ever-changing mining industry. In doing so, the target student audience is directly integrated into the coursework itself. The minor becomes more valuable as a more diverse student population enrolls and provides their discipline's perspective as groups of transdisciplinary students work to problem-solve in more holistic ways.

The University of Arizona strives to drive student success in a rapidly changing world; this minor prepares students with the skills and mind set to be

leaders in the mining industry. The University of Arizona strives to expand educational opportunities and address important societal changes; this minor provides opportunities for students to bridge the gap between humans ever-increasing demand for minerals and societies changing priorities toward the environment and communities. The University of Arizona strives to build upon our unique location and people to drive social, cultural and economic impact; this minor pulls from Arizona's unique mineral-rich setting (recently ranked 2nd in the world for mining jurisdiction attractiveness) and the university's history of leading mining and mineral resources workforce development and preparation to inspire students to innovate sustainable solutions to environmental, technical, social and economic mining and mineral resource challenges. The University of Arizona aspires to operate as a best in class place to learn where innovations are encouraged and incorporated; this minor innovates the learning experience itself by intertwining the perspectives from various disciplines in order to achieve learning outcomes. It is the differences of the proposed minor that set it apart from other educational experiences at the University of Arizona

Faculty & Resources

Faculty

Current Faculty:

INSTR ID	NAME	DEPT	RANK	DEGREE	FCLTY/%
01655481	Paul Ferre	0469	Professor	Doctor of Philosophy	.01
02550093	Bradley Ross	2802	Prof. Pract.	Doctor of Philosophy	.01
02560413	Isabel Barton	2802	Assit. Prof	Doctor of Philosophy	.01

Additional Faculty:

No additional faculty members anticipated.

Current Student and Faculty FTE is marked zero because this is a new school without any programs. This proposed minor is the first program and includes the first courses for the school/department.

Current Student & Faculty FTE

DEPARTMENT	UGRD HEAD COUNT	GRAD HEAD COUNT	FACULTY FTE
2309	0	0	.10

Projected Student & Faculty FTE

DEPT	UGRD HEAD COUNT			GRAD HEAD COUNT			FACULTY FTE		
	YR 1	YR 2	YR 3	YR 1	YR 2	YR 3	YR 1	YR 2	YR 3
2309	30	55	85	0	0	0	.80	.95	1.10

Library

Acquisitions Needed:

No additional library acquisitions are needed during the next three years.

Physical Facilities & Equipment

Existing Physical Facilities:

Current physical facilities and equipment are adequate.

Additional Facilities Required & Anticipated:

No additional physical facilities or equipment are anticipated during the next three years for the proposed program.

Other Support

Other Support Currently Available:

Support currently available for the proposed program include a School of Mining and Mineral Resources Sr Program Coordinator, Program Manager of Lowell Institute for Mineral Resources, Interim Director of the School, and a Minor Curriculum Committee.

Other Support Needed over the Next Three Years:

No additional staff or other assistance needed for this proposed minor over the next three years. Other hires for the School of Mining and Mineral Resources are anticipated (Director, Program Outcome Assessment Professional, and Advisor, but nothing specific to the minor).

Comments During Approval Process



New Academic Program – Minor ([Undergraduate](#))
CURRICULAR INFORMATION

I. MINOR DESCRIPTION:

The Sustainable Mineral Resources minor studies the interconnected issues surrounding the sustainable and responsible production and use of non-renewable mineral resources. Diverse perspectives are provided by faculty from disciplines across the Colleges of Engineering, Science, Social and Behavioral Sciences, Agriculture & Life Sciences, Architecture, Planning & Landscape Architecture, the Eller College of Management, and Mel and Enid Zuckerman College of Public Health. Students engage in experiential learning on technical, economic, social, and environmental issues. Students learn to work with people across disciplines, cultures, and national borders and value differing beliefs as they implement data-driven decision making, effective communication, and critical thinking to bridge the gap between humans' ever-increasing demand for minerals and societies' changing priorities toward the environment and communities.

II. JUSTIFICATION/NEED FOR THE MINOR:

Purpose

The minor is designed to attract a diverse range of students (diverse in terms of demographics and disciplines) to broaden the aperture of who engages in mineral resources related studies. The minor will build on the introductory/general education course and provide students both holistic context and an opportunity to dive deeper into areas of interest (business and economics, society and policy, health and safety, environment, data analytics and automation, mining and recycling, and leadership and communication) to complement their degree focus. The minor strives to bring diverse students together to learn to collaborate, problem solve, and communicate with people with different knowledge and perspectives. Ideally, experience with the minor will inspire students to study related topics at depth and explore career opportunities in natural resource development.

Minor Design and Student Progression

The minor is envisioned to provide flexible options while still providing foundational knowledge and shared application of the students' diverse experiences.

Building a common foundation: All students will take six units to provide a broad overview of what society uses mineral resources for and how we obtain them, and issues pertaining to their sustainable development. These courses will introduce students to the technical, economic, social, and environmental aspects of mining and mineral resources, provide them with basic literacy in mining and mineral resources lifecycle, and are intended to help students find their area of interest to select thematic elective track(s). For additional information regarding the content of the core courses and how each core course aligns to the seven tracks, see Appendix II. Students must complete one foundational course prior to progressing to electives (exceptions may be allowed with advisor approval).

Exploring the intersection of mining and mineral resources with other disciplines through thematic elective tracks: Thematic tracks will be offered as elective options to students and students will choose nine units from one or two of the tracks: mining and recycling; leadership and

communication; business and economics; data analytics and automation; environmental; health and safety; and society and policy. The purpose of the electives is to help students develop a deeper understanding of the intersection between their own area of study and at least one other subject area. Note that these elective tracks are not officially notated on the student transcript or diploma.

Of the nine units, a minimum of six units must be upper division so students, regardless of track, spend time building higher level skills that can be utilized during the capstone experience and in their future careers. To ensure the comprehensive selection of courses needed to achieve the transdisciplinary and upper and lower division educational goals of this proposed minor, each track includes seven or eight bulleted options for courses. The only exception being the Health and Safety track which has nine bullets because three courses are one unit each. Many of the courses can be cross listed under multiple tracks. While the courses are not duplicated to keep the tracks simplified, students may take courses from two different tracks. The students should discuss alternate tracks for a course when they meet with the school advisor, program coordinator, or program manager.

Track 1: Mining and Recycling – Establishes an understanding of the lifecycle of minerals including how minerals are located, mined, processed, used, and recycled. Based on the principle that demand for basic mineral resources to sustain modern society will continue to grow at an ever-faster rate, students need knowledge to apply responsible and innovative techniques as they explore new and alternative mineral frontiers; discover and recover future resources; increase productivity and safety; and advance reclamation and repurposing processes. There are currently no undergraduate recycling courses offered at the University, but the School of Mining and Mineral Resources will build a new course to cover the topic (listed in the Mining and Recycling track below).

Track 2: Leadership and Communication – Cultivates skills and tools needed for influencing positive change from within the mining and mineral resource sector and from those impacted by the industry. Built on a foundation of active listening, respect, and cross-cultural understanding, students learn to inspire innovation and lead through influence.

Track 3: Business and Economics – Offers students insight into financial, organizational, and market-related factors in the mineral resource industry. As the industry looks to grow in responsible and diverse ways, it is essential to adjust supply to demand variations; recognize indicators of profitability and financial feasibility; weigh the economics of competing land uses; use economic modeling and forecasting; and distribute the economic benefits of mining and recycling.

Track 4: Data Analytics and Automation – Equips students with an understanding of the growing role of data science and technology in sustainable production and use of mineral sustainable mineral resource development. The mining industry often relies on sparse and skewed data sets, predictive analytics, and automation such as artificial intelligence, robotics, and software to improve exploration, operations, safety, and environmental impact.

Track 5: Environmental – Prepares students to appreciate how mining-related physical and chemical processes may extend beyond the boundaries of a facility and into the environment, and how responsible environmental stewardship requires consideration from multiple perspectives to protect ecosystems, maintain support from communities, and achieve social and environmental justice.

Track 6: Health and Safety – Helps students appreciate the potential adverse effects to the physical well-being of those in mineral resource workplaces, neighboring communities, and the world population. Risks to human health must be monitored, mitigated, and communicated in ways that prevent death, illness, and injury, promote safe and healthy people, and empower individuals.

Track 7: Society and Policy – Builds an understanding of the relations between people, society, and mineral resources, and the decision-making processes in mineral resource extraction. Students will examine interconnections between societies and the extraction and use of natural resources including how different cultures value, access, discuss, and govern resources.

Mining and mineral resources is a broad field that requires many disciplines. Offering multiple tracks provides the students the opportunity to choose the courses that fit their interests and enhances the minor by providing the flexibility needed to incorporate multiple disciplines that impact the sustainability of mining and mineral resources.

Bringing it all together with the capstone experience: At the end of their undergraduate experience in the Minor, students will be challenged to put their knowledge and skills to the test. The purpose of this component is to bring diverse students together to explore real-world issues and debate or problem-solve, with a requirement to address the issue from a holistic perspective, and consider technical, economic, social, and environmental issues. Flexibility is also demonstrated in the capstone experience. Students learn in a multitude of ways and benefit from different types of assessment. There are two capstone pathways. While both capstone options will meet the purpose, the way in which students best demonstrate their learning varies by capstone option.

- 1. The Team Problem Solving Capstone Course**, 3 units, to be developed prior to Fall 2024
This option challenges students to apply the knowledge and skills they have gained in their program as part of a transdisciplinary project team to solve a complex but realistic problem. The project will be substantial and require the efforts, understanding and input of multiple disciplines. Teams will present their solutions, answer questions, and defend conclusions.
- 2. Flexible Individual Research /Experiential Learning /Seminar Capstone**, units vary, to be developed prior to Fall 2024
This option offers more flexibility, while providing students of different disciplinary backgrounds the opportunity to come together to learn about and discuss emerging issues in sustainable mineral resources. Students can mix and match any combination of 1-credit options for a total of 3-credits. For example, a student could choose 1 of each, or 3 of one type, a mix of only 2 types.

Interdisciplinary, Mentored Research Projects

Students will propose an interdisciplinary research project related to mining and mineral resources and work with a faculty mentor to complete.

Internships

Students may complete a semester or summer long internship related to mining and mineral resources with a summary report to a faculty advisor.

Seminars

Students will have the opportunity to hear guest speakers representing multiple perspectives and stakeholder groups on mining and mineral resources related topics. Students will have writing and/or debate assignments.

The school advisor, program coordinator, program manager, and information available on the school website will help guide students through understanding the tracks and capstone options. This will include explaining information about why specific tracks are important to mining and mineral resources and jobs related to those tracks, and the benefits of each capstone option to a student's learning experience. This guidance will also include information on enrollment requirements. Many of the courses in this minor have pre-requisites that must be completed prior to enrolling in the course. These pre-requisites will be made clear when assisting students with a progression path in-person or online.

Need

In January 2021, a briefing and feedback session with faculty and researchers from across disciplines explored the idea of integrating many disciplines such as business, public health, and social and environmental sciences into a mining and mineral resources program by rallying students and faculty around real-world challenges rather than a single discipline. The idea was that doing so could not only improve the sustainability and competitiveness of each individual program, but also improve the quality of education, increase research output, bring visibility to an important topic, and enhance the student experience. 86% of responders agreed or strongly agreed that this is an important initiative for the University of Arizona, and 83% of responders agreed or strongly agreed they would like to participate in this initiative.

Additionally, demand for mineral resources is increasing due to global population growth, the shift toward clean energy, increasing reliance on technology, and infrastructure development needs, as well as growing concern over securing domestic supply of the mineral resources we rely on every day. Optimizing supply has never been more important. This includes improving the safety and efficiency and reducing negative environmental and social impacts of primary production (mining), as well as finding new methods of recovering minerals from non-traditional sources (e.g., brines, waste), and overall innovation regarding how we manage resources, how we make and use products, and what we do with the materials afterwards (recycling and circular economy). It is important to note that while advancing the recycling and reuse of minerals can play an important role in meeting demand, mining will still be required to supply critical minerals needed so there is a need to meet remaining primary demand in the most effective, and environmentally and socially responsible manner.

Mineral resources, mining and mining technology are also important to the economic development of the communities that hold the resources, whether in developing nations or right here in Arizona, bringing infrastructure like schools, hospitals, and water treatment facilities to the former (and even in rural US communities), and jobs to both. Ensuring maximum and equitable benefits to communities remains a complex challenge that requires input from multiple disciplines. There are also growing environmental, social and governance concerns over issues like carbon emissions, wise land use, impact to biodiversity and ecosystem services, water and energy consumption, community health and safety, protection of cultural heritage sites near mine sites, and ethical sourcing. Manufacturers of everything from automobiles to cell phones face pressure from investors and consumers to ensure the materials they use are obtained in an ethical and sustainable way.

There is a widening gap between the talent and innovation needed, and what universities provide. Industry interviews coupled with studies commissioned by industry bodies such as Minerals Council Australia and conducted by management consulting firms including Ernst and Young, and Deloitte, as well as articles and publications citing interviews with faculty from global minerals programs were consistent in their conclusions:

1. Mining skills of the future are broader and more sophisticated, requiring more data, systems, social, complex problem solving, and resource management skills in addition to traditional technical skills
2. There is a perceived widening gap between industry and academia, with universities often seen as operating in isolation
3. Mining curriculum is seen as outdated, and too narrow, failing to incorporate the latest technology, or emerging critical issues like environmental and social aspects
4. Research is often seen as irrelevant, or takes too long (not practical to apply, or it is obsolete by the time it is finished)
5. Minerals programs fail to attract the very best talent, and are currently facing critically low enrolments globally, with workforce shortages projected
6. Finally, siloization and a lack of diversity in the workplace (in both disciplines and demographics) is not only hindering progress and innovation but is considered a threat. The industry is seeking diverse talent that can work and communicate across boundaries, with critical thinking skills and an appreciation for systems thinking to solve the complex problems of the future.

Looking specifically at the University of Arizona, the following mining and mineral resources specific degrees are available:

- Mining Engineering BS
- Mining, Geological, and Geophysical Engineering MSc, ME, PhD
- Economic Geology MSc, PSM, PhD
- Mining Law and Policy Concentration LLM, MLS
- Mining Engineering minor

With such limited and targeted programs, most University of Arizona students do not get the opportunity to engage with the subject of mineral resources and mining and are therefore not well informed about the materials they use every day and how they are obtained, or related education and career opportunities. According to a University of Arizona study conducted on University of Arizona students¹:

- 72 percent agree mineral resources are important to their daily lives
- 74 percent are aware Arizona has active mines
- 66 percent are aware the University of Arizona offers a Mining Engineering degree
- 67 percent say they know little to nothing about mining

In addition, a survey to mining industry personnel about this proposed minor conducted in November and December 2021:

- 91.5% of respondents indicated their top interdisciplinary need is for students from different disciplines to understand economic, social, and environmental impacts of mining, and what sustainable development means

¹ 2 UArizona mining perception study surveys were conducted face-to-face using tablet computers November-December 2019. Sample size =344, confidence level of 95 percent, and margin of error of +/- 5.25 percent.

- When asked about soft skills, the following four skills ranked the highest (percentages indicate respondents marked “very important” or “extremely important”)
 - Communicate effectively in a variety of modes (written, verbal, presentation) – 97.4%
 - Listen effectively – 95.5%
 - Solve problems as part of a team – 88.9%
 - Learn to work effectively with others from a variety of backgrounds, and value different perspectives – 88.1%
- All elective tracks rated 3.6/5 or higher on importance
- When asked how valuable the capstone experience will be for preparing students to enter the workforce, “very valuable” or “extremely valuable” was marked
 - 81.2% of the time when working as a team
 - 66% of the time when working individually
- 78.5% of respondents “agree” or “agree strongly” that this minor will give students a competitive advantage when getting a job
- 92.2% of respondents “agree” or “agree strongly” that this minor will better prepare students to participate effectively in the workplace

This minor is a step toward increasing awareness and bridging the gaps and needs found in these studies.

III. MINOR REQUIREMENTS:

Minimum total units required	18
Minimum upper-division units required	9
Total transfer units that may apply to minor	9
List any special requirements to declare/admission to this minor (completion of specific coursework, minimum GPA, interview, application, etc.)	Meet with department advisor or program coordinator. Minimum GPA of 2.0
Minor requirements. List all required minor requirements including core and electives. Courses listed must include course prefix, number, units, and title. Mark new coursework (New). Include any limits/restrictions needed (house number limit,	<p>Core courses – Students must complete a minimum of 6 units of core coursework.</p> <ul style="list-style-type: none"> • MNE/ANTH 201 (3 units): Nonrenewable Resources and World Civilizations (Will be modified for new Gen Ed curriculum as Exploring Perspectives in the future) • MNE/ENGR 422 (3 units): Perspectives of Sustainability: Supplying Mineral Resources for Society (Current course, but modified and submitted to Gen Ed as Building Connections for Fall 2022) • MIN 236 (3 units): Materials, Societies, & Choices (New; submitted to Gen Ed as Exploring Perspectives for Fall 2022)

etc.). Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department.

Elective courses – Students must complete a minimum of 9 units (**at least 6 units must be upper division to build on higher level skills development**) from up to two tracks.

Track 1: Mining and Recycling

- GEOS 251 (4 units) Physical Geology
- GEOS 446 (3 units) Economic Mineral Deposits
- MNE 205 (3 units) Introduction to Mining Engineering
- MNE 210 (3 units) Minerology and Petrology for Engineers
- MNE 411 (3 units) Mineral Processing
- MNE 427 (3-4 units) Geomechanics
- MSE 450 (3 units) Materials Selection for the Environment
- MIN XXX: Recycling and Reclamation – To be developed

Track 2: Leadership and Communication

- BNAD 302 (3 units) Human Side of Organizations
- COMM 117 (3 units) Culture and Communications
- COMM 201: Introduction to Public Relations
- COMM 312 (3 units) Applied Organizational Communications
- COMM 404 (3 units) Communications and Leadership
- ENVS 415 (3 units) Translating Environmental Science
- PR 423 (3 units) Crisis Communication and Public Relations

Track 3: Business and Economics

- ACCT 250 (3 units) Survey of Accounting
or BNAD 304 (3 units) Survey of Finance
- GEOG 305 (3 units) Economic Geography
- GEOG 362 (3 units) Environment and Development
- MNE 205 (3 units) Introduction to Mining Engineering
- MNE 430 (3 units) Mine Examination and Valuation
- MGMT 202 (3 units) Ethical Issues in Business
or PHIL 322 (3 units) Business Ethics
- SIE 265 (3 units) Engineering Management I
- SIE 422 (3 units) Engineering Decision Making Under Uncertainty

Track 4: Data Analytics and Automation

- ESOC 214 (3 units) Introduction to Data Science
- GEOG 222 (3 units) Working with Numeric, Spatial, and Visual Data
Fundamental Geographic Techniques
- GEOS 280 (3 units) Programming and Data Analysis in the Earth Sciences
- RNR 403 (3 units) Application of Geographic Information Systems
- ISTA 131 (4 units) Dealing with Data
- ISTA 321 (4 units) Data Mining and Discovery
- ISTA 322 (3 units) Data Engineering

Track 5: Environmental

- EHS 426 (1 unit) Topics in Environmental Justice
or ENVS 310 (3 units) Ecosystem Health and Justice
- ENVS 305 (3 units) Pollution Science
- ENVS 340 (3 units) Environmental Chemistry

- ENVS 482 (3 units) Reclamation and Redevelopment of Impacted Lands
- HWRS 201 (3 units) Water science and the Environment
- HWRS 350 (3 units) Principles of Hydrology
- PA 484 (3 units) Environmental Management
- SIE 466 (3 units) Life Cycle Analysis for Sustainable Design and Engineering

Track 6: Health and Safety

- EHS 375 (3 units) Introduction to Environmental & Occupational Health
or EHS 484 (3 units) Fundamentals of Industrial and Environmental Health
- EHS 418 (3 units) Introduction to Human Risk Assessment
- MNE 424 (3 units) Miner Health: Fitness-for-Duty, Mitigating, Exposures, and Managing Disease Risk
- MNE 423 (3 units) Historic and Contemporary Role of US Regulatory Agencies (OSHA, MSHA, EPA)
or PHP 421 (3 units) Introduction to Public Health Law and Ethics
- MNE 297A (1 unit) Underground Mine Safety
- MNE 297B (1 unit) Operation and Maintenance of Heavy Mining Equipment
- MNE 297C (1 unit) Fundamentals of Mine Rescue
- MNE/GEN 426/426A (3 units) Health and Safety in Mining
- MNE 425 (3 units) Mine Emergencies and Disasters: Prevention, Response, and Recovery

Track 7: Society and Policy

- AIS 220 (3 units) Contemporary American Indian Issues
or GEOG 250 (3 units) Environment and Society in the Southwest Borderlands
- AIS 441A (3 units) Natural Resource Management in Native Communities
or ANTH 331 (3 units) Anthropology and Development
- GEOG 462 (3 units) Environmental Law, Geography, and Society
or RNR 480 (3 units) Natural Resources Policy and Law
- PA 482 (3 units) Environmental Governance
- PHIL 323 (3 units) Environmental Ethics
- RNR 485 (3 units) The Economics & Social Connections to Natural Resources
- SBE 201 (3 units) Sustainable Design and Planning
- SOC 307 (3 units) Environmental Sociology

Capstone Options – Students must complete a minimum of 3 units with at least one unit completed in the final semester of the minor.

- Capstone Course (3 units) MIN 4XX – To be developed
- Seminar 1 (1 unit) MIN 4XX – To be developed
- Seminar 2 (1 unit) MIN 4XX – To be developed

	<ul style="list-style-type: none"> • Seminar 3 (1 unit) MIN 4XX – To be developed • Research Project (1 unit) MIN 4XX – To be developed • Internship (1-2 units) MIN 4XX – To be developed
Internship, practicum, applied course requirements (Yes/No). If yes, provide description.	Students have the option to complete an internship, seminars, research project, or capstone course. The internship option requires alignment with the interdisciplinary goal of the School and must be work outside of their home (major) department.
Additional requirements (provide description)	<p>Substituting Courses – Substitutions are allowed for elective courses but must be approved by a school advisor, program coordinator, or program manager.</p> <p>See appendix 1 for examples of student progression through the minor.</p>
Any double-dipping restrictions (Yes/No)? If yes, provide description.	No. Students are encouraged but not required to take courses from outside their major and other minors.

IV. NEW COURSES NEEDED: If new courses are required for the proposed program, [UA Course Add forms](#) must be submitted before/simultaneously with this proposal. List all course additions in progress in the table below. Add rows as needed.

Course prefix and number (include cross-listings)	Units	Title	Pre-requisites	Modes of delivery (online, in-person, hybrid)	Course Fee? (Y/N)	Course Form transaction number	Anticipated first term offered	Use in the program (required/elective)
MIN 236	3	Materials, Societies, & Choices	None	In-person	N		Fall 2022	Required
MIN 4XX– To be developed	3	Capstone Course	None	In-person	N			Required – See section, “Internship, practicum, applied course requirements (Yes/No). If yes, provide description.” for details
MIN 4XX – To be developed	1	Seminar 1	None	In-person	N		Fall 2023	Required – See section, “Internship, practicum....” above for details
MIN 4XX – To be developed	1	Seminar 2	None	In-person	N		Fall 2023	Required – See section, “Internship, practicum....” above for details
MIN 4XX – To be developed	1	Seminar 3	None	In-person	N		Fall 2023	Required – See section,

								“Internship, practicum....” above for details
MIN 4XX – To be developed	1	Research Project	None	N/A	N		Fall 2023	Required – See section, “Internship, practicum....” above for details
MIN 4XX – To be developed	1-3	Internship	None	N/A	N		Fall 2023	Required – See section, “Internship, practicum....” above for details
MIN XXX – To be developed	3	Recycling and Reclamation	None	In-person	N		Fall 2024	Elective

Subject description for new prefix (if requested). Include your requested/preferred prefix, if any: MIN (School of Mining and Mineral Resources)

- V. Learning Outcomes** - Complete this table as a summary of the learning outcomes from your assessment plan, using these examples as a model. If you need assistance completing this table and/or the Curriculum Map, please see the resources at the [Office of Instruction and Assessment](#) or contact them [here](#).

Learning Outcome #1 Students will incorporate verbal and written strategies including active listening to share information, defend ideas clearly and correctly, and learn from others.
Concepts: Students will apply active listening skills during transdisciplinary discussions on mineral resources and share and defend mining and mineral resource information and ideas using verbal and written communication.
Competencies: Students will apply effective communication.
Learning Outcome #2 Students will design and assess evidence, inferences, assumptions, values, purposes, conclusions, and solutions of their own and others’ inquiries through the lens of multiple disciplines.
Concepts: Students will incorporate multiple discipline’s perspectives when solving a central mining and mineral resources problem. Students will assess and challenge their own and others’ thoughts.
Competencies: Students will apply critical thinking skills.
Learning Outcome #3 Students will recognize economically, socially, and environmentally sustainable impacts of the mineral resources lifecycle from the initial need to results over time.
Concepts: Students will apply the mineral resources’ lifecycle to challenges and issues in the mining industry.
Competencies: Students will understand the mineral resources’ lifecycle.
Learning Outcome #4 Students will advocate for their discipline’s perspective with clear and relevant support while integrating the diverse opinions and ideas of other disciplines within the same context.
Concepts: Students will integrate their own perspective on mineral resources with other perspectives on mineral resources to develop a more holistic view. Students will integrate their own expertise into an interdisciplinary setting.
Competencies: Students will integrate interdisciplinary literacy.

Learning Outcome #5 Students will evaluate the reliability and validity of data and information from a variety of sources and perspectives, including gaps and biases, and ask questions that lead to accurate, actionable insights.

Concepts: Students will synthesize information from multiple disciplines to develop a more holistic view of mineral resources. Students will evaluate data from diverse sources to better understand mining and mineral resources.

Competencies: Students will evaluate data and information.

VI. REQUIRED SIGNATURES

Program Director (print name): Brad Ross

Program Director signature: *Brad Ross*

Date: Feb 7, 2022

College of Science

Associate Dean (print name): Rebecca Gomez

Associate Dean's signature: *R Gomez*

Date: Feb 7, 2022

Dean (print name): Carmala Garziona

Dean's signature: *Carmala Garziona*

Date: Feb 7, 2022

Associate Dean (print name): Jim Baygents

Associate Dean's signature: *James C. Baygents*

Date: Feb 7, 2022

Dean (print name): David Hahn

Dean's signature: *David W. Hahn*

Feb 7, 2022

For use by Curricular Affairs:

Undergraduate:

Committee	Approval date
APS	
Undergraduate Council	
Undergraduate College Academic Administrators Council	
Faculty Senate	

Undergraduate:

Committee	Approval date
APS	
Undergraduate Council	
Undergraduate College Academic Administrators Council	
Faculty Senate	

NewAcadPrgm_Minor_UG_21_SustainableMineralResourcesFinal

Final Audit Report

2022-02-08

Created:	2022-02-07
By:	Jodi Hope Banta (jhbanta@email.arizona.edu)
Status:	Signed
Transaction ID:	CBJCHBCAABAA1n0Lk1Qqpli5p_Ftjq3vgvullVrynJXU

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 Agreement completed.

2022-02-08 - 3:27:59 AM GMT

Attachment: Reallocation of existing College funds

In June 2021, the Arizona Board of Regents approved the new School of Mining and Mineral Resources. The proposal included the expectation to develop a new transdisciplinary minor including new coursework. As such, the intent was to use School funding to help support the new minor. Some of the expenditures for faculty and other personnel, employee related expenses, graduate assistantships, and operations (materials, supplies, phones, etc.) were intended to be spent on the start up of this proposed minor. The following breaks down the costs covered by reallocating these existing College funds.

		Year 1	Year 2	Year 3	Years 4/5
Total reallocated from School budget		\$132,700	\$80,020	\$22,000	No money reallocated in year 4 or beyond as Funding will offset all Expenditures.
Faculty	Year one of faculty pay will be covered by reallocating from the School budget. In years two and beyond, no reallocation is projected to be needed for Faculty as other funding (listed on budget form) will cover the costs. Faculty is not full time to the minor.	\$65,400	\$0	\$0	
Other Personnel	Approximately 25% of Sr Program Coordinators time is calculated for the first year. As a School Adviser and other employees are added to the school, less time from each individual will be needed and more of the initial work needed in course development will be finished so the cost will remain approximately the same. The reallocation from the School budget covers this in year one. For year two, \$11,600 from the reallocated School budget will apply toward the \$20,000 total. The rest comes from other funding. After year three, no reallocation funding is needed as other funding (listed on budget form) will cover the costs.	\$20,000	\$11,600	\$0	
Employee Related Expenses	Faculty, grad assistants, and other personnel's percentage of expenditures is calculated in the ERE which the reallocation from the School budget covers. In year two and beyond, no reallocation funding is needed as other funding (listed on budget form) will cover the costs.	\$31,300	\$38,420	\$0	
Graduate Assistantships	Dollar amount listed is for time spent specifically on the minor. The reallocation from the School budget covers this for years one and two. For year three, \$20,000 from the reallocated School budget will apply toward the \$28,000 total. The rest comes from other funding (listed on budget form).	\$14,000	\$28,000	\$20,000	
Operations (materials, supplies, phones, etc.)	The reallocation from the School budget covers this for years one, two, and three.	\$2,000	\$2,000	\$2,000	



BUDGET PROJECTION FORM

Name of Proposed Program or Unit: Sustainable Mineral Resources minor

Budget Contact Person: Suzanne Madrigal	Projected		
	1st Year 2022 - 2023	2nd Year 2023 - 2024	3rd Year 2024 - 2025
METRICS			
Net increase in annual college enrollment UG	30	55	75
Net increase in college SCH UG	180	495	900
Net increase in annual college enrollment Grad	-	-	-
Net increase in college SCH Grad	-	-	-
Number of enrollments being charged a Program Fee	-	-	-
New Sponsored Activity (MTDC)	-	-	-
Number of Faculty FTE	1	1	1
FUNDING SOURCES			
<u>Continuing Sources</u>			
UG RCM Revenue (net of cost allocation)	30,600	84,150	153,000
Grad RCM Revenue (net of cost allocation)	-	-	-
Program Fee RCM Revenue (net of cost allocation)	-	-	-
F and A Revenues (net of cost allocations)	-	-	-
UA Online Revenues	-	38,250	51,000
Distance Learning Revenues	-	-	-
Reallocation from existing College funds (attach description)	132,700	80,020	22,000
Other Items (attach description)	-	-	-
Total Continuing	\$ 163,300	\$ 202,420	\$ 226,000
<u>One-time Sources</u>			
College fund balances	-	-	-
Institutional Strategic Investment	-	-	-
Gift Funding	-	-	-
Other Items (attach description)	-	-	-
Total One-time	\$ -	\$ -	\$ -
TOTAL SOURCES	\$ 163,300	\$ 202,420	\$ 226,000
EXPENDITURE ITEMS			
<u>Continuing Expenditures</u>			
Faculty	96,000	114,000	132,000
Other Personnel	20,000	20,000	20,000
Employee Related Expense	31,300	38,420	44,000
Graduate Assistantships	14,000	28,000	28,000
Other Graduate Aid	-	-	-
Operations (materials, supplies, phones, etc.)	2,000	2,000	2,000
Additional Space Cost	-	-	-
Other Items (attach description)	-	-	-
Total Continuing	\$ 163,300	\$ 202,420	\$ 226,000
<u>One-time Expenditures</u>			
Construction or Renovation	-	-	-
Start-up Equipment	-	-	-
Replace Equipment	-	-	-
Library Resources	-	-	-
Other Items (attach description)	-	-	-
Total One-time	\$ -	\$ -	\$ -
TOTAL EXPENDITURES	\$ 163,300	\$ 202,420	\$ 226,000
Net Projected Fiscal Effect	\$ -	\$ -	\$ -



New Academic Program PEER COMPARISON

Select three peers (if possible/applicable) for completing the comparison chart from [ABOR-approved institutions](#), [AAU members](#), and/or other relevant institutions recognized in the field. The comparison programs are not required to have the same degree type and/or title as the proposed UA program. Information for the proposed UA program must be consistent throughout the proposal documents. Minors and Certificates may opt to include only 2 peer comparisons.

Note: Comparisons to two University of Arizona undergraduate minors (*Climate Change and Society* and *Mining Engineering*) are available upon request.

Program name, degree, and institution	UArizona Sustainable Mineral Resources, Undergraduate Minor	ASU Engineering Management, Minor	NAU Environmental Engineering, Undergraduate Minor
Current number of students enrolled		52	4
Program Description	<p>The Sustainable Mineral Resources minor studies the interconnected issues surrounding the sustainable and responsible production and use of non-renewable mineral resources. Quality faculty from diverse disciplines, provide unique and equally valuable perspectives and experiential learning on technical, economic, social, and environmental issues. Students learn to work effectively with and value the differences of people from a variety of backgrounds and beliefs as they implement data-driven decision making, effective communication, and critical thinking to bridge the gap between humans' ever-increasing demand for minerals and societies' changing priorities toward the environment and communities.</p>	<p>The minor in engineering management program provides students with the skills for effective management and leadership of engineering-driven enterprises.</p> <p>The minor curriculum supplements students' majors by adding to the breadth of engineering science and design and equipping the student with additional management and design skills. This knowledge is augmented with an understanding of business practices, organizational behavior and management skills to enable the student to succeed in the management of a scientific or engineering enterprise. Topics such as project and resource management, financial engineering, risk management, configuration management, service plans, product liability, entrepreneurship and operations management are covered, in addition to product design and process development.</p>	<p>This minor is designed for other engineering majors or plans that emphasize math and science and provides environmental engineering fundamentals with an emphasis on solving air, water, waste and health problems.</p> <p>A minor in environmental engineering complements your major in engineering or science by providing the fundamentals of the discipline, adding breadth to your knowledge base. Students with majors in environmental science, chemistry, physics, biology, geology, forestry, mechanical engineering, electrical engineering or computer science are candidates for this minor. Content includes basic unit operations of environmental engineering, material balance, fate and transport in soils, equilibrium and water process design, experiments in water or soil media, plus electives in soil/hazardous waste management, air quality/treatment, biological</p>

			<p>treatment, and water/wastewater treatment. This additional knowledge increases your opportunities for a wider range of employment or graduate school options.</p> <p>Upon graduation, students will have developed the following:</p> <p>An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.</p> <p>An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.</p>
Target Careers	Any careers within the mining industry (mining engineering, other engineering, hydrology, data science, business, economics, social sciences, public health, environmental health, government, etc.)	Can help students pursuing careers in engineering and business fields gain valuable skills in management for engineering-related professions	Engineering or science careers who work with Environmental concerns
Emphases? (Yes/No) List, if applicable	No	No	No
Minimum # of units required	18	18	19
Level of Math required (if applicable)	Nothing specific although some elective courses may require math pre-requisites	MAT 265 and MAT 266 (or an equivalent calculus sequence) with a grade of "C" or better in each	MAT 137 – Calculus II
Level of Second Language required (if applicable)	N/A	N/A	N/A
Pre-Major? (Yes/No) If yes, provide requirements.	N/A	No	No
Special requirements to declare/gain admission? (i.e. pre-requisites, GPA, application, etc.)	Meet with academic advisor or program coordinator	Students who are not required to take IEE 380 as part of their major requirements should plan to take it for the minor instead of IEE 220 to be eligible for more required electives.	Cumulative GPA of at least 2.0

		Interested students should consult with a School of Computing, Informatics and Decision Systems Engineering advisor to verify eligibility and to review all courses required for the minor.	
Internship, practicum, or applied/experiential requirements? If yes, describe.	Internship is an option for 1-3 units but it is not a requirement	No	No

Additional questions:

1. How does the proposed program align with peer programs? Briefly summarize the similarities between the proposed program and peers, which could include curriculum, overall themes, faculty expertise, intended audience, etc.

The proposed minor program is like the ASU Engineering Management, Minor and the NAU Environmental Engineering, Minor in that all three offer either core or elective courses that delve into some aspects of engineering. The core courses offered through the proposed minor provide high level overviews of engineering and its integration with the mining industry. The other two minors, focus on important topics in engineering that are touched on in the Sustainable Mineral Resources minor. Additionally, each of the other minors is a potential track from which students can choose courses in the Sustainable Mineral Resources minor. The environmental track of the proposed minor covers several of the same topics covered in NAU's Environmental Engineering minor including sustainability with land, air, and water. The basic principles and introductory information covered in each is much the same. The leadership and communication track of the proposed minor focuses on communication aspects of leadership and this is briefly touched on in a few of the courses in ASU's Engineering Management minor.

All three programs can include engineering students in their enrollment. ASU's Engineering Management minor and the proposed minor can also include students from other departments.

2. How does the proposed program stand out or differ from peer programs? Briefly summarize the differences between the proposed program and peers, which could include curriculum, overall themes, faculty expertise, intended audience, etc.

The primary difference between the proposed minor and the other Arizona University System programs is the interdisciplinary purpose and structure of the proposed minor. Current mining related programs at each University operate largely independently of other departments, with limited integration or interaction between departments. This represents both a missed opportunity, and a risk. Currently, the courses and advising needed to attract students from important disciplines like hydrology, economics, data science and other engineering disciplines to mining and minerals related studies are not available. The minor is designed to attract a diverse range of students (diverse in terms of demographics and disciplines) to broaden the aperture of who engages in mineral resources related studies. The minor will build on the introductory/general education course and provide students both holistic context and an opportunity to dive deeper into areas of interest (business and economics, society and policy, health and safety, environment, data analytics and automation, mining and recycling, and leadership and communication) to compliment their degree focus. The minor strives to bring diverse students together to learn to collaborate, problem solve, and communicate with people with different knowledge and perspectives. Ideally, experience with the minor will inspire students to study related topics at depth and explore career opportunities in natural resource development. The minor is envisioned to provide flexible options.

NAU's minor enrollment is limited to students in science and engineering fields and is, therefore, not reaching the same interdisciplinary audience as the proposed minor. ASU's program is open to enrollment by students from other departments, however, the intent is to have those students learn specific engineering knowledge. The proposed minor specifically seeks to integrate the knowledge and perspectives from other departments into the mining and mineral resources coursework.

Neither of the other two programs have curriculum specifically designed to pull from the perspectives of students from other disciplines to solve problems in a holistic and innovative way. The proposed minor is intended to have diverse groups of students from various disciplines solve problems by taking into consideration environmental, social, economic, and technical perspectives. Neither of the other two programs have curriculum built in this manner. The structure of integrating numerous disciplines into mining and mineral resources is unique to the proposed minor.

3. How do these differences make this program more applicable to the target student population and/or a better fit for the University of Arizona?

As stated, the minor is designed to attract a diverse range of disciplines. The courses chosen for the minor reflect that diversity. Twenty different departments from eight colleges were brought into this minor to support adaptive learning, enhance the student experience, and achieve the minor's vision to equip students with the skills needed to work effectively

with others from a variety of backgrounds and value the different perspectives others bring to the ever-changing mining industry. In doing so, the target student audience is directly integrated into the coursework itself. The minor becomes more valuable as a more diverse student population enrolls and provides their discipline's perspective as groups of transdisciplinary students work to problem-solve in more holistic ways.

The University of Arizona strives to drive student success in a rapidly changing world¹; this minor prepares students with the skills and mind set to be leaders in the mining industry. The University of Arizona strives to “expand educational opportunities and address important societal changes”¹; this minor provides opportunities for students to bridge the gap between humans’ ever-increasing demand for minerals and societies’ changing priorities toward the environment and communities. The University of Arizona strives to “build upon our unique location and people to drive social, cultural and economic impact”¹; this minor pulls from Arizona’s unique mineral-rich setting (recently ranked 2nd in the world for mining jurisdiction attractiveness²) and the university’s history of leading mining and mineral resources workforce development and preparation to inspire students to innovate sustainable solutions to environmental, technical, social and economic mining and mineral resource challenges. The University of Arizona “aspires to operate as a best in class place to learn...where innovations are encouraged and incorporated”¹; this minor innovates the learning experience itself by intertwining the perspectives from various disciplines in order to achieve learning outcomes. It is the differences of the proposed minor that set it apart from other educational experiences at the University of Arizona

¹ The University of Arizona, 2021, Strategic Plan: Overview of Pillars, The University of Arizona (<https://strategicplan.arizona.edu/overview-pillars>)

² Yunis, J., and Aliakbari, E., 2020, Fraser Institute Annual Survey of Mining Companies 2020, Fraser Institute (<https://www.fraserinstitute.org/sites/default/files/annual-survey-of-miningcompanies-2020.pdf>)

Appendix 1 - Example Student Progression

Example 1 – Society & Policy Track with Internship and Seminar

Freshman				
Semester	Course Prefix: Title	Units	Type	Track
Spring	MNE/ANTH 201: Nonrenewable Resources and World Civilizations	3	Core	N/A
Sophomore				
Fall	GEOG 250: Environment and Society in the Southwest Borderlands	3	Elective	Society & Policy
Spring	MIN 236: Materials, Societies, and Choices	3	Core	N/A
Junior				
Fall	RNR 485: The Economics & Social Connections to Natural Resources	3	Elective	Society & Policy
Spring	PA 482: Environmental Governance	3	Elective	Society & Policy
Summer	MIN 4XX: Internship	2	Internship	N/A
Senior				
Fall	MIN 4XX: Seminar #2	1	Seminar	N/A
Total		18 (9 upper division)		

Example 2 – Mining & Recycling and Leadership and Communication Tracks with Capstone

Freshman				
Semester	Course Prefix: Title	Units	Type	Track
Spring	MIN 236: Materials, Societies, and Choices	3	Core	N/A
Sophomore				
Fall	MNE 205: Introduction to Mining Engineering	3	Elective	Mining & Recycling
Spring	PR 423: Crisis Communication and Public Relations	3	Elective	Leadership & Communication
Junior				
Fall	MIN 422: Perspectives of Sustainability: Supplying Mineral Resources for Society	3	Core	N/A
Spring	COMM 404: Communications and Leadership	3	Elective	Leadership & Communication
Senior				
Spring	MIN 4XX: Capstone Course	3	Capstone	N/A
Total		18 (12 upper division)		

Appendix II. Core Course alignment to tracks

The core courses provide students with a broad overview of what society uses mineral resources for and how we obtain them, and issues pertaining to their sustainable development. These courses will introduce students to the technical, economic, social, and environmental aspects of mining and mineral resources, and provide them with basic literacy in mining and mineral resources lifecycle. Each course is briefly described below.

MNE 201 covers the ways humans have extracted and used nonrenewable resources over time, the ways that resource use has shaped the development of civilizations, and how societies have been influenced by the uneven natural distribution of nonrenewable resources. Other topics include resource exhaustion, space mining, resource substitution and associated energy costs, unintended social and environmental consequences of nonrenewable resource extraction and use.

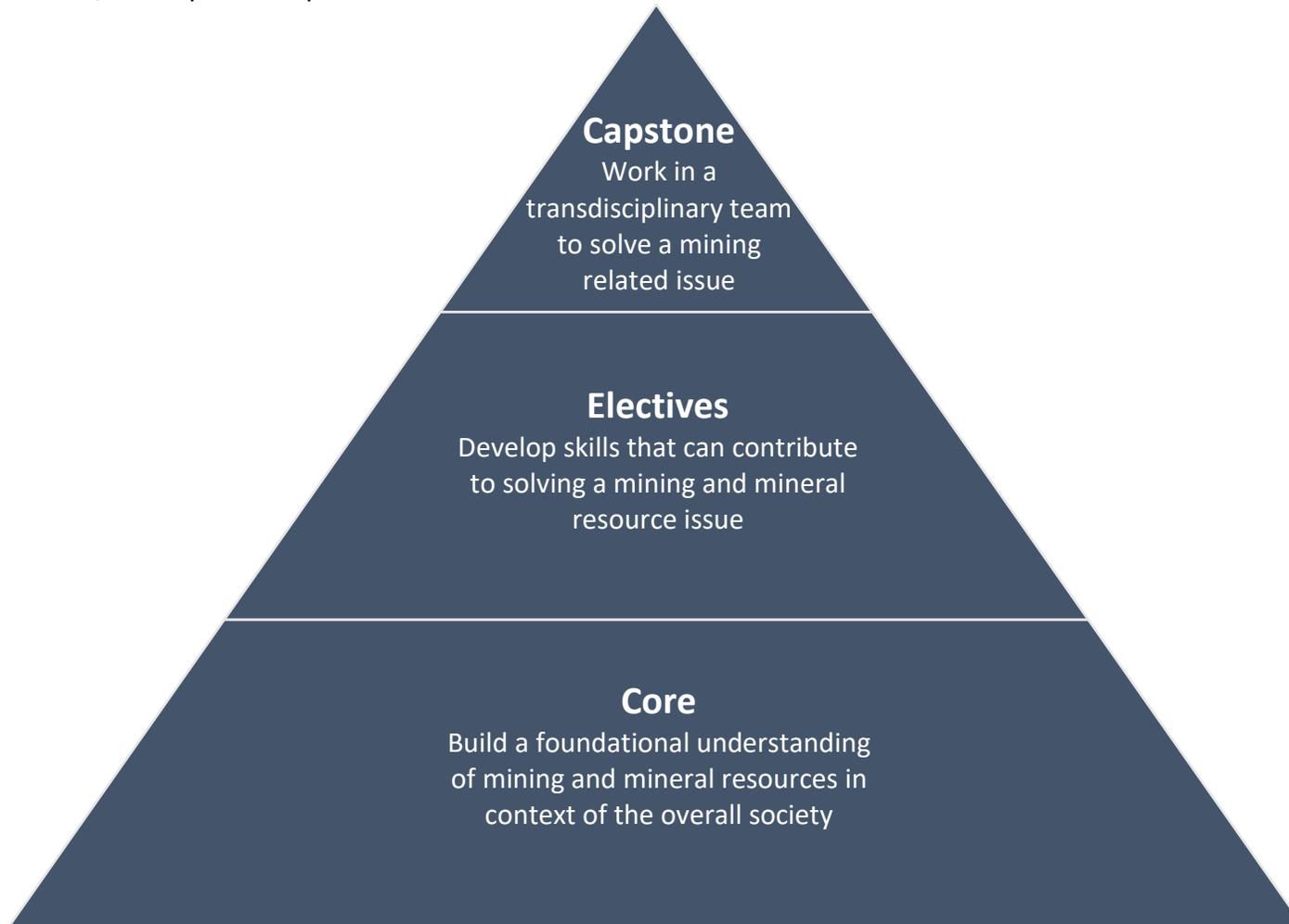
MIN 236 covers decision-making in the context of the diverse types and uses of earth materials, their full life cycles, and the challenges that arise from the many needs and perspectives of users, producers, and myriad other stakeholders. The course also introduces and applies decision science to the issues of meeting resource needs in the most environmentally sustainable, equitable, and affordable ways possible.

MNE 422 covers modern sustainable development issues in supplying mineral resources for today’s society. Through environmental, societal, and economic perspectives, students consider complex and inter-related sustainable development issues applicable to many disciplines within the context of supplying minerals for society. The course also covers sustainable development issues in industrialized and developing nations and communities, and the environment in which they operate

Each of these courses is intended to help students find their area of interest to select thematic elective track(s). To meet the needs of multiple tracks, each core course introduces concepts that will be covered in most of the tracks. The elective tracks themselves develop skills that can contribute to solving mining and mineral resource issues. Below is a table showing which core courses align with each track.

	Mining & Recycling	Leadership & Communication	Business & Economic	Data Analytics & Automation	Environmental	Health & Safety	Society & Policy
MNE 201	X		X	X	X		X
MIN 236	X	X	X	X	X	X	X
MNE 422	X	X	X		X	X	X

The knowledge gained from the core and elective courses is then applied to a capstone experience where students work in a transdisciplinary team to solve a mining-related problem. The figure below shows the connection between the core courses, elective courses, and capstone experience.



followed by a list of how the core course's objectives align to each track.

Core course objectives alignment to each track

Mining and Recycling

MNE 201 – Students will understand the basic scientific, engineering, social, and economic factors in the extraction and use of coal, hydrocarbons, metals, industrial minerals, and other nonrenewable resources

MIN 236 – Students will learn the basics of industrial ecology by understanding where the materials used in modern society come from, how they (re-)cycle through society, where they eventually end up, and the impacts of extraction, manufacturing, recycling, and disposal on local, regional, and national communities.

MIN 236 – Students will apply decision science to questions of materials procurement, use, recycling, and disposal, including geological, engineering, economic, social, policy, and equity factors

MIN 236 – Students will evaluate the trade-offs involved in decisions about material resources from a socially informed industrial ecology perspective

MNE 422 – Students will build a basic understanding of the mining and mineral resources sustainability issues and how they differ between industrial and developing nations for issues such as renewable energy, water, communities, stakeholders, outrage, and risk

Leadership and Communication

MIN 236 – Students will apply decision science to questions of materials procurement, use, recycling, and disposal, including geological, engineering, economic, social, policy, and equity factors

MNE 422 – Students will develop an understanding of different global perspectives of mining and mineral resources sustainability issues from areas such as community, industry, business, NGO, and government

MNE 422 – Students will practice teamwork across multiple disciplines by working within small groups to compare and contrast sustainability issues for different projects

MNE 422 – Students will compose multiple business communications on a variety of sustainability topics

MNE 422 – Students will expand oral communications skills by making in class presentations

Business and Economics

MNE 201 – Students will understand the basic scientific, engineering, social, and economic factors in the extraction and use of coal, hydrocarbons, metals, industrial minerals, and other nonrenewable resources

MIN 236 – Students will articulate how social, cultural, and economic as well as material factors determine attitudes toward the extraction, use, reuse, and disposal of materials in the modern US

MIN 236 – Students will apply decision science to questions of materials procurement, use, recycling, and disposal, including geological, engineering, economic, social, policy, and equity factors

MNE 422 – Students will develop an understanding of different global perspectives of mining and mineral resources sustainability issues from areas such as community, industry, business, NGO, and government

MNE 422 – Students will build a basic understanding of the mining and mineral resources sustainability issues and how they differ between industrial and developing nations for issues such as renewable energy, water, communities, stakeholders, outrage, and risk

Data Analytics and Automation

MNE 201 – Students will understand the basic scientific, engineering, social, and economic factors in the extraction and use of coal, hydrocarbons, metals, industrial minerals, and other nonrenewable resources

MIN 236 – Students will apply decision science to questions of materials procurement, use, recycling, and disposal, including geological, engineering, economic, social, policy, and equity factors

Environmental

MNE 201 – Students will critically evaluate the consequences of resource extraction, use, and depletion for modern and future human society and the environment

MIN 236 – Students will identify what renewable/green materials can and cannot be substituted for nonrenewable/environmentally damaging materials and why

MIN 236 – Students will articulate how social, cultural, and economic as well as material factors determine attitudes toward the extraction, use, reuse, and disposal of materials in the modern US

MIN 236 – Students will evaluate the trade-offs involved in decisions about material resources from a socially informed industrial ecology perspective.

MNE 422 – Students will develop an understanding of different global perspectives of mining and mineral resources sustainability issues from areas such as community, industry, business, NGO, and government

MNE 422 – Students will build a basic understanding of the mining and mineral resources sustainability issues and how they differ between industrial and developing nations for issues such as renewable energy, water, communities, stakeholders, outrage, and risk

Health and Safety

MIN 236 – Students will evaluate the trade-offs involved in decisions about material resources from a socially informed industrial ecology perspective

MIN 236 – Students will learn the basics of industrial ecology by understanding where the materials used in modern society come from, how they (re-)cycle through society, where they eventually end up, and the impacts of extraction, manufacturing, recycling, and disposal on local, regional, and national communities.

MNE 422 – Students will develop an understanding of different global perspectives of mining and mineral resources sustainability issues from areas such as community, industry, business, NGO, and government

Society and Policy

MNE 201 – Students will compare and contrast the ways in which different human societies have used and valued natural resources over history

MNE 201 – Students will analyze how the evolution of human societies over time has been influenced by the distribution, extraction, and use of nonrenewable resources, through trade, technology, and conflict

MIN 236 – Students will identify historical and modern inequities in access to, extraction of, and distribution of mineral resources, and propose action that could address them

MIN 236 – Students will articulate how social, cultural, and economic as well as material factors determine attitudes toward the extraction, use, reuse, and disposal of materials in the modern US

MIN 236 – Students will apply decision science to questions of materials procurement, use, recycling, and disposal, including geological, engineering, economic, social, policy, and equity factors

MNE 422 – Students will develop an understanding of different global perspectives of mining and mineral resources sustainability issues from areas such as community, industry, business, NGO, and government

MNE 422 – Students will build a basic understanding of the mining and mineral resources sustainability issues and how they differ between industrial and developing nations for issues such as renewable energy, water, communities, stakeholders, outrage, and risk

10 November 2021

Suzanne Switzer Madrigal
Sr Program Coordinator
School of Mining and Mineral Resources
University of Arizona
-CAMPUS-

Dear Suzanne:

With this memo we seek to memorialize an agreement between the University of Arizona Department of Communication and College of Engineering's new School of Mining and Mineral Resources. The School is developing a thematic minor with a Leadership and Communication track for which they seek access to the following Communication courses for students in the track:

- COMM 117: Culture and Communication
- COMM 119: Public Speaking
- COMM 201: Introduction to Public Relations
- COMM 312: Applied Organizational Communication
- COMM 404: Communication and Leadership
- PR 423: Crisis Communication and Public Relations

As we discussed, the Communication Department has an obligation to reserve the majority of seats in these courses for declared majors. However, once Communication majors have had the opportunity to enroll, we would welcome Mining and Mineral Resources students into these classes.

Mining students in the Communication and Leadership minor will have access to enrollment after priority registration in Fall and Spring semesters in all listed courses except COMM 119 and COMM 201, which are open to all students. Students will work with their advisors and will be manually enrolled in open seats by the Undergraduate Program Coordinator in the Communication Department.

As always, it is a best practice to let your students know that when they enroll in upper division Communication courses, they are likely to find themselves in a learning environment with other students with considerably more preparation and training in the discipline. This is not to imply that your students are unlikely to do well in these courses, but simply that not having the core courses in the discipline (i.e., COMM 101, 228, 300) could create a competitive disadvantage for some. At the



same time, we feel confident that all of the aforementioned courses will provide excellent learning opportunities for your students.

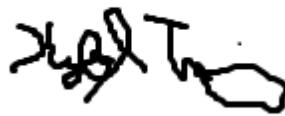
The Communication department reserves the right to periodically review this agreement as staffing and enrollment trends change to implement adjustments and alternatives that will allow for continued delivery of instruction to your students. Similarly, we would anticipate that if you find that any of these courses are not serving your students' needs, the School will alert us to that fact, and we can seek to make adjustments in the curriculum.

We will look forward to working with your students in the Leadership and Communication minor.

Sincerely,



Chris Segrin
Department Head
Steve and Nancy Lynn Professor of Communication



Kyle Tusing
Director of Undergraduate Studies
Professor of Communication



Thursday, 12/16/2021, 1:39pm

Hi Suzanne:

SNRE supports the inclusion of the three RNR courses in the School of Mining and Mineral Resources minor program:

- RNR 150C1: Sustainable Earth: Natural Resources and the Environment – Kathleen Prudic
- RNR 403: Application of Geographic Information Systems – Craig Wissler
- RNR 480: Natural Resources Policy and Law – Laura Lopez Hoffman
- RNR 485: The Economics & Social Connections to Natural Resources – Jose Soto

Best regards,
Wim

Willem J.D. van Leeuwen, Professor and Interim Director
School of Natural Resources and the Environment
Professor School of Geography, Development & Environment
Director Arizona Remote Sensing Center

ENR2 Bldg. N333
1064 E. Lowell Street
The University of Arizona
Tucson, AZ 85721

Phone:520 626-0058 Fax:520 621-8801

e-mail: leeuw@email.arizona.edu

<http://snre.arizona.edu/people/willem-van-leeuwen>

<https://ARSC.Projects.story.maps/>

<https://droughtview.arizona.edu/>

<https://snowview.arizona.edu/>

<http://snre.arizona.edu/facilities/arisc>



THE UNIVERSITY OF ARIZONA
COLLEGE OF AGRICULTURE & LIFE SCIENCES
**Norton School of Family
& Consumer Sciences**
Retailing and Consumer Sciences

650 N. Park Avenue
P.O. Box 210078
Tucson, AZ 85721-0078

Ofc: (520) 621-1075
Fax: (520) 621-9445

cals.arizona.edu/fcs

November 7, 2021

Ms. Suzanne Madrigal
Academic Programs Officer
School of Mining and Mineral Resources
University of Arizona
Tucson, AZ 85721

Dear Ms. Madrigal:

This letter serves to confirm our support for including the course RCSC 150B1: Consumers, Environment, and Sustainability, in the new minor being developed by the School of Mining and Mineral Resources. We agree that the course is a good fit with your stated goal of transforming the way we prepare future citizens and professionals to work across disciplines and promote the sustainable and responsible production and use of Earth's resources. We are pleased to be a part of this new endeavor.

Wishing you much success as you launch this new program!

Sincerely,

Dr. Laura Scaramella
Director, Norton School of Family and Consumer Sciences



November 12, 2021

To Whom It May Concern:

On behalf of the Department of Materials Science and Engineering, I offer this letter in support of including the following department courses in the School of Mining and Mineral Resources' Sustainable Mineral Resources minor.

- MSE 450: Materials Selection for the Environment

The ever-increasing demand for mineral resources requires collaboration with multiple disciplines within the university setting and beyond to develop sustainable and responsible practices. By partnering with the School of Mining and Mineral Resources, students will be exposed to additional perspectives that will enhance mineral resource development.

We look forward to this opportunity to support this program.

Sincerely,

Sammy Tin, Ph.D.

Department Head and Professor
Materials Science and Engineering
University of Arizona

MEMO

Date: February 8, 2022

To Whom It May Concern:

On behalf of the Department of Mining and Geological Engineering, I offer this letter in support of including the following department courses in the School of Mining and Mineral Resources' Sustainable Mineral Resources minor:

MNE 205: Introduction to Mining Engineering
MNE 210: Minerology and Petrology for Engineers
MNE 297A: Underground Mine Safety
MNE 297B: Operation and Maintenance of heavy Mining Equipment
MNE 297C: Fundamentals of Mine Rescue
MNE 411: Mineral Processing
MNE 423: Historic and Contemporary Role of US Regulatory Agencies (OSHA, MSHA, EPA) – NEW COURSE
MNE 424: Miner Health: Fitness for Duty, Mitigating Exposures, and Managing Disease Risk – NEW COURSE
MNE 425: Mine Emergencies and Disasters – Prevention, Response, and Recovery – NEW COURSE
MNE 426/426A: Health and Safety in Mining
MNE 427: Geomechanics
MNE 430: Mine Examination and Valuation

Please note that due to 'Advanced Standing' and enrollment requirements, only students in the College of Engineering can enroll in upper division engineering courses (MNE 411, 423, 424, 425, 426, 427 and 430).

The ever-increasing demand for mineral resources requires collaboration with multiple disciplines within the university setting and beyond to develop sustainable and responsible practices. By partnering with the School of Mining and Mineral Resources, students will be exposed to additional perspectives that will enhance mineral resource development.

We look forward to this opportunity to support this program.

Sincerely,



Moe Momayez, PhD
Interim Department Head
David & Edith Lowell Chair in Mining and Geological Engineering
520-621-6580
moe.momayez@arizona.edu



November 22, 2021

To Whom It May Concern:

On behalf of the Systems and Industrial Engineering (SIE) Department, I offer this letter in support of including the following department courses in the School of Mining and Mineral Resources' Sustainable Mineral Resources minor.

- SIE 265: Engineering Management I
- SIE 422: Engineering Decision Making Under Uncertainty
- SIE 466: Life Cycle Analysis for Sustainable Design and Engineering

The Department of Systems and Industrial Engineering has been working closely with the Department of Mining and Geological Engineering in collaborative efforts in both research as well as education. The SIE department is highly interested in working with the School of Mining and Mineral Resources, supporting the Sustainable Mineral Resources minor. The above SIE courses are regularly offered as part of our existing curriculum and seats are generally available in these classes.

We look forward to this opportunity to support this program.

Sincerely,



Young-Jun Son
Professor and Head of Department of Systems and Industrial Engineering



COLLEGE OF SOCIAL AND BEHAVIORAL SCIENCES

School of Government
and Public Policy

School of Government & Public Policy
315 Social Science
P.O. Box 210027
Tucson, AZ 85721-0027
Tel: (520) 621-7600
Fax: (520) 621-5051
<http://sgpp.arizona.edu>

November 30th, 2021

Re: SGPP Courses for SMMR Minor

On behalf of the School of Government and Public Policy, I offer this letter in support of including the following courses in the School of Mining and Mineral Resources' minor in Sustainable Mineral Resources:

- PA 482: Environmental Governance
- PA 484: Environmental Management

Partnering with SMMR provides students with additional perspectives that will enhance mineral resource development. Specifically, SGPP's classes offer the opportunity to develop a strong policy background to complement the scientific study of mineral resources.

Sincerely,

A handwritten signature in black ink, appearing to read "J. H. H. H.", written in a cursive style.

Director, Undergraduate Studies
Associate Professor, Political Science
School of Government and Public Policy





November 4, 2021

Dear all concerned with the proposed School of Mining and Mineral Resources minor,

This is a letter of support for the use of any of our iSchool courses to support the proposal. We are so pleased to be a part of this as we aim to serve the campus in interdisciplinary projects like this one. We look forward to working with you and wish you a positive experience with your new plan.

There is no conflict with School of Information programs and there are certainly opportunities for synergy moving forward. We are eager to welcome your students into our relevant courses and we do have seats available to support the students in this new program.

Further, we see the need for this new program. As many know, iSchools are meant to provide interdisciplinary courses that can work well for programs like this, and also aim to explore grand challenges that occur at the intersections of people and technology. This new program focused on serving learners engaging in matters of mining is thus one we are absolutely thrilled to be a part of.

We look forward to our ongoing collaboration.

Sincerely,

Catherine Brooks
Director, School of Information



Dr. Barbara Carrapa
Professor and Department Head
Department of Geosciences
Gould-Simpson Building
Tucson, AZ 85721-0077



Tel. (520) 621 5011
Fax (520) 621 2672

Tucson, November 22, 2021

To Whom It May Concern:

On behalf of the Department of Geosciences I offer this letter in support of including the following department courses in the School of Mining and Mineral Resources' Sustainable Mineral Resources minor.

- GEOS 251: Physical Geology
- GEOS 280: Programming and Data Analysis in the Earth Sciences
- GEOS 446: Economic Mineral Deposits

Through these classes the department of Geosciences will be providing important resources and skills to students in this minor. The ever-increasing demand for mineral resources requires collaboration with multiple disciplines within the university setting and beyond to develop sustainable and responsible practices. By partnering with the School of Mining and Mineral Resources, students will be exposed to additional perspectives that will enhance mineral resource development.

We look forward to this opportunity to support this program.

Sincerely,

Barbara Carrapa, Professor and Department Head of Geosciences

A handwritten signature in black ink that reads "Barbara Carrapa".



THE UNIVERSITY OF ARIZONA
COLLEGE OF SCIENCE

Hydrology &
Atmospheric Sciences

Harshbarger Building
Room 122
1133 E. James E. Rogers Way
P.O. Box 210011
Tucson, AZ 85721-0011
Ofc: 520-621-7120
Fax: 520-621-1422

Physics and Atmospheric Sciences Building
Room 542
1118 E. 4th St.
P.O. Box 210081
Tucson, AZ 85721-0081
Ofc: 520-621-0275
Fax: 520-621-6833

November 11, 2021

To Whom It May Concern:

On behalf of the Hydrology and Atmospheric Sciences Department I offer this letter in support of including the following department courses in the School of Mining and Mineral Resources' Sustainable Mineral Resources minor.

- HWRS 431: Hydrogeology
- HWRS 350 Principles of Hydrology
- HWRS 201: Water Science and the Environment

The Hydrology and Atmospheric Sciences Department has long had broad and deep collaborations with the mining and geology programs at the University of Arizona. Additionally many of our graduates end up working in or with the mining industry here in Arizona or globally. The training of people with careers in mining on the hydrologic aspects of the environment will be of great value to them and to our department. The ever-increasing demand for mineral resources requires collaboration with multiple disciplines within the university setting and beyond to develop sustainable and responsible practices. By partnering with the School of Mining and Mineral Resources, students will be exposed to additional perspectives that will enhance mineral resource development.

We look forward to this opportunity to support this program.

Sincerely,

Thomas Meixner
Professor and Head
tmeixner@email.arizona.edu

4 January 2022

To Whom it May Concern:

On behalf of the School of Sociology, I offer this letter in support of including the following courses in the School of Mining and Mineral Resources' Sustainable Mineral Resources minor.

· SOC 307 Environmental Sociology

The ever-increasing demand for mineral resources requires collaboration with multiple disciplines within the university setting and beyond to develop sustainable and responsible practices. By partnering with the School of Mining and Mineral Resources, students will be exposed to additional perspectives that will enhance mineral resource development.

We look forward to this opportunity to support this program.

Sincerely,



Erin Leahey
Professor and Director
School of Sociology
University of Arizona



COLLEGE OF SOCIAL & BEHAVIORAL SCIENCES

American Indian Studies

Jodi Banta
Program Manager
Lowell Institute for Mineral Resources
The University of Arizona
1235 E. James Rogers Way
Tucson, Arizona 85721

January 6, 2022

Dear Ms. Banta,

I am writing as Head of American Indian Studies (AIS) to confirm that AIS approves the following courses to be included in the Sustainable Resources Minor:

AIS 200 Introduction to American Indian Studies
AIS 220 Contemporary American Indian Issues
AIS 441 Natural Resource Management in Native Communities

Thank you for your interest in AIS. We very much appreciate your willingness to include AIS courses in the new minor!

Sincerely,

A handwritten signature in black ink, appearing to read 'MSG'.

Matthew Sakiestewa Gilbert
Professor and Head



To Whom It May Concern:

On behalf of the School of Geography, Development & Environment, I approve of the use of the following courses for the proposed Sustainable Mineral Resources minor and support the minor's creation. We look forward to collaborating with other units to offer students the opportunity to explore various perspectives that may enhance their understanding of the sustainability issues surrounding mining activities. We believe that some of our majors may also benefit from the creation of this minor, whether from a wider array of voices in class discussions or from the opportunity to pursue this minor as a complement to their studies.

We approve the use of the following SGDE-homed courses for the minor:

- GEOG 222: Working with Numeric, Spatial, and Visual Data Fundamental Geographic Techniques
- GEOG 250: Environment and Society in the Southwest Borderlands
- GEOG 304: Water, Environment, and Society
- GEOG 305: Economic Geography
- GEOG 362: Environment and Development
- GEOG 462: Environmental Law, Geography, and Society

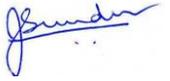
Regards,

Dereka Rushbrook
Associate Professor of Practice &
Director of Undergraduate Studies



Date: November 30, 2021
To: Whom It May Concern

From: Jayanthi Sunder, Vice Dean of Academic Programs, Eller College of Management
Subject: Eller Courses in new Mining and Mineral Resources Minor



This memo indicates the Eller College's support for the School of Mining and Mineral Resources to offer a minor, which uses courses taught through the Eller College of Management. In addition to core classes and a capstone, students are required to take a minimum of 9 units of Mining and Mineral Resources minor electives, with multiple courses available from more than one department within the 7 track options. The Eller departments impacted have been made aware and approve the students pursuing the take these courses with the following registration considerations.

Students enrolled in the Mining and Mineral Resources minor will be able to select courses that fulfill minor elective options within the following tracks:

Leadership and Communication:

- **BNAD 302 (Human Side of Organization):** Typically available year round, should be planned for Junior or Senior year.

Business and Economics:

- **ACCT 200 (Introduction to Financial Accounting) or ACCT 250 (Survey of Accounting):** Non-Eller students are encouraged to take ACCT 250, which is typically offered Fall, Spring and Summer. If students would prefer to take ACCT 200, it should be planned for Winter, Spring, or Summer. Fall enrollment is restricted to Eller Pre-Business students only.
- **BNAD 304 (Survey of Finance):** Typically available in Winter/Summer, should be planned for Junior or Senior year.
- **MGMT 202 (Ethical Issues in Business):** Typically available year round, offered Fall, Spring, and Summer.
- **FIN 150C1 (Finance and Society: The Good, the Bad, and the Ugly):** Typically offered Fall and Spring (subject to University "double dip" policies).



Mel and Enid Zuckerman
College of Public Health

Office of Academic
Affairs

1295 N. Martin Avenue
P.O. Box 245209
Tucson, AZ 85724
Tel: (520) 626-6317
Fax: (520) 626-8716
www.publichealth.arizona.edu

January 4, 2022

Suzanne Madrigal, M.ED, PMP
Sr Program Coordinator
School of Mining and Mineral Resources
University of Arizona

Dear Suzanne

Re: Mining and Mineral Resources Minor

On behalf of the Mel and Enid Zuckerman College of Public Health (MEZCOPH), I offer this letter in support of including the following MEZCOPH courses in the School of Mining and Mineral Resources' Sustainable Mineral Resources minor:

- EHS 375: Introduction to Environmental and Occupational Health
- EHS 418: Introduction to Human Health Risk Assessment
- EHS 422: Intro to Occupational Safety
- EHS 426: Topics in Environmental Justice
- EHS 484: Fundamentals of Industrial and Environmental Health
- EHS 489: Public Health Preparedness
- HPS 200: Intro to Public Health
- HPS 481: Health Education Intervention Methods
- PHP 421: Introduction to Public Health Law and Ethics

The value that your proposed minor places on public health aspects of mineral resources development is important, and we are pleased to partner with you.

We look forward to working with you on this program.

Sincerely,

A handwritten signature in blue ink, appearing to read 'John Ehiri'.

John Ehiri, PhD
Associate Dean for Academic Affairs





THE UNIVERSITY OF ARIZONA

College of Architecture, Planning
& Landscape Architecture

SCHOOL OF LANDSCAPE ARCHITECTURE & PLANNING | 520-621-1004 | capla@arizona.edu

November 16, 2021

To Whom It May Concern:

On behalf of the School of Landscape Architecture and Planning, I offer this letter in support of including the following department courses in the School of Mining and Mineral Resources' Sustainable Mineral Resources minor.

- SBE 201 Sustainable Design & Planning

The ever-increasing demand for mineral resources requires collaboration with multiple disciplines within the university setting and beyond to develop sustainable and responsible practices. By partnering with the School of Mining and Mineral Resources, students will be exposed to additional perspectives that will enhance mineral resource development.

We look forward to this opportunity to support this program.

Sincerely,

Lauri Macmillan Johnson
Director and Professor, School of Landscape Architecture and Planning

David Lowenthal
Department of Computer Science



Gould-Simpson Building
Tucson, Arizona 85721-0077
dk1@cs.arizona.edu
(520) 626-8282

November 12, 2021

To Whom It May Concern:

On behalf of the Department of Computer Science, I offer this letter in support of including the following department courses in the School of Mining and Mineral Resources' Sustainable Mineral Resources minor.

- CSC 110, Computer Programming I
- CSC 460, Database Design (**note: this class may only be taken by Computer Science majors**)

Understanding computer programming and computer science in general requires collaboration with multiple disciplines. By partnering with the School of Mining and Mineral Resources, students will be exposed to additional perspectives that will enhance mineral resource development. We look forward to this opportunity to support this program.

Sincerely,

A handwritten signature in black ink that reads "David Lowenthal". The signature is written in a cursive style with a large, stylized "D" and "L".

David Lowenthal
Professor and Interim Head

November 11, 2021

School of Mining and Mineral Resources
University of Arizona

To Whom it May Concern:

I am pleased to provide this letter of support from the School of Anthropology for the new minor in *Mining and Mineral Resources* being offered within the School of Mining and Mineral Resources. Specifically, in support of this minor, the School of Anthropology will offer **ANTH 150B Many Ways of Being Human** and **ANTH 331 Anthropology and Development** on a regular basis. We do not anticipate any problems having seats available for Mining and Mineral Resources students in these courses.

Please do not hesitate to contact me if you have any questions.

Sincerely yours,



Diane E. Austin
Professor and Director





November 16, 2021

To whom it may concern;

This letter is to confirm the Department of Philosophy's support for the inclusion of PHIL 322 – Business Ethics and PHIL 323 – Environmental Ethics in the *Minor in Mining and Mineral Resources* proposed by the School of Mining and Mineral Resources.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Jason Turner', with a long horizontal flourish extending to the right.

Jason Turner
Head, Department of Philosophy



THE UNIVERSITY OF ARIZONA
COLLEGE OF AGRICULTURE & LIFE SCIENCES
Environmental Science

1177 E. Fourth Street
P.O. Box 210038 Tucson, AZ 85721-0038
Tel: (520) 621- 1646
Fax: (520) 621- 1647
<http://swes.cals.arizona.edu/>

November 29th, 2021

To Whom It May Concern:

On behalf of the Department of Environmental Science, I offer this letter in support of including the following department courses in the School of Mining and Mineral Resources' Sustainable Mineral Resources minor.

- ENVS 340: Environmental Chemistry
- ENVS 310: Ecosystem Health and Justice
- ENVS 415: Translating Environmental Science
- ENVS 482: Reclamation and Redevelopment of Impacted Lands
- ENVS 170A1: Introduction to Environmental Science
- ENVS 195D: Water and the Environment
- ENVS 305: Pollution Science

The ever-increasing demand for mineral resources requires collaboration with multiple disciplines within the university setting and beyond to develop sustainable and responsible practices. By partnering with the School of Mining and Mineral Resources, students will be exposed to additional perspectives that will enhance mineral resource development.

We look forward to this opportunity to support this program.

Sincerely,

Joan E. Curry
Professor and Associate Head