

**Request for Statements of Interest
Funding Opportunity Announcement**

Federal Awarding Agency:

U.S. Army Corps of Engineers,
Engineer Research and Development Center
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Funding Opportunity No: W81EWF-22-SOI-0037

CFDA No: 12.630

Statutory Authority: 10 USC 4001

Program Title: Engineering with Nature Research Program - Microbial Induced Calcite Precipitation (MICP)

Announcement Type: Initial announcement

Issue Date: August 18, 2022

Statement of Interest/Qualifications Due Date: September 19, 2022; 1300 CDT

Full Application Package Due Date, if Invited: October 17, 2022; 1300 CDT

Estimated Award Ceiling: FY23 (base) - \$150,000

Estimated Total Program Funding: \$400,000 (\$150,000 base year and \$125,000 per year for 2 continuation phases)

Expected Number of Awards: One award is anticipated

Section I: Funding Opportunity Description

Background:

There are hundreds of reservoirs and thousands of miles of navigation channels that provide invaluable flood control, commercial transport of materials, water supply, recreation, and stream flow regulation. This navigation and flood control infrastructure protects millions of Americans who work and live beside these control structures. This protection of life and property is threatened by large-scale wildfires across the western United States” (Haring, et al. 2021). In 2021, 58,968 wildfires impacted 7.1 million acres and burned nearly 6,000 structures nationwide, 60% (3,577) of which were residences (USGS website). Also, in January 2018, directly following the nearby Thomas Fire, a storm struck Montecito, California, resulting in several landslides that killed 23 people.

Wildfires damage watersheds by denuding landscapes, reducing infiltration rates, and increasing runoff rates. “Immediately following a wildfire, [the ground is void of] vegetation, the organic soil horizons are reduced to ash, and the soil remaining is altered such that it repels [instead of absorbs] rainwater. These effects dramatically increase the potential for erosion, which destabilizes stream channels, and increases infilling of reservoirs thus reducing their capacity. Together these adverse ground conditions significantly increase runoff, discharge, sediment transport, and subsequently increase the risks of flash flooding and destructive debris flows, as described above.” (Haring, et al 2021).

As the climate has changed, fire seasons around the world have grown longer. According to Wibbenmeyer and McDarris (2020), the period from 2000-2018 was the driest 19-year span that southwestern North America has experienced since the late 1500s, and the second driest since 800 CE. These trends will only increase the likelihood of more wildfires and subsequent increased risks to our nation’s environment and flood protection infrastructure.

The primary technical objective of this project is to provide a sustainable, nature-based and cost effective soil treatment technology for improving the mechanical properties of wildfire-altered soils, to decrease erosion. The treatment of interest is Microbial Induced Calcite Precipitation (MICP). Microbial-induced calcite precipitation (MICP) is a relatively new process that uses naturally occurring bacteria to bind soil particles together through calcium carbonate (CaCO_3) precipitation. MICP is a biologically driven precipitation technology that is sustainable, does not introduce contaminants into the soil, and is not a high-energy process. The MICP treatment is a relatively new technique used by geotechnical engineers for ground improvement (strength) of sandy soils, like those in the western regions of the US. In theory, this method would also lessen the drying effects of drought on soils. The treatment increases water content of the soil, which deters erosion, slows runoff, and flash flooding.

Brief Description of Anticipated Work:

Determine the efficacy of MICP to improve engineering properties of soils affected by wildfires through conventional laboratory soil testing and through field demonstrations. To accomplish this, the following is anticipated:

Literature review on MICP and effect of wildfires on soils. This research, performed only by the ERDC, will provide the basis for identifying the best type of soils and soil conditions for MICP treatment as well as defining the effects of wildfire on soils. Information will be acquired through discussion with USACE Districts that commonly experience wildfires in their regional area of jurisdiction. The activities discussed below will be undertaken by the contractor, with guidance and consideration by ERDC Principal Investigator.

Activity 1: Identify the source(s) for soil sampling and testing. The contractor will consider ERDC’s findings from the literature research and start communication with ERDC and USACE Districts in the arid southwestern States and determine which wildfire affected site(s) will be researched. Government offices such as the Sacramento District, and Albuquerque District where wildfire clean up and forest restoration activities are common are the likely regions for conducting this research. Research locations will be determined based upon quantity and availability of site data and government experience (NRCS, USGS,

USACE) in the regions.

Activity 2: Acquire soil samples/travel. This activity will involve Government and University personnel acquiring soil samples from wildfire-affected areas discovered in Activity 2. Soil samples will be shipped to ERDC and University soil laboratories. The volume collected will be approximately of nine 5-gallon buckets.

Activity 3: Soil index properties testing and microscopic mineral identification. The soil collected will be tested for their index properties including: sieve analysis, specific gravity, organic content, triaxial and direct shear strength. The soil property testing requires standard equipment and must follow typical ASTM procedures.

Activity 4: Optimize MICP treatment. The duration and frequency of treatment as well as the concentration of the bacteria and type of nutrients to grow the bacteria will be determined in the lab. This activity requires a bio-engineering specialist.

Activity 5: Treat and test soil samples. Testing of treated soils will be performed by a civil engineering graduate student and supervised by a geotechnical faculty. Microscopic mineral identification will be performed by a junior ERDC engineer and supervised by the PI. Lab testing will include shear strength (direct and triaxial) infiltration properties, erodibility properties. The testing requires standard equipment and must follow ASTM procedures. Tests conducted in triplicates will ensure repeatability. Results and analyses will be documented in a data report or a technical paper.

Activity 6: Field demonstration. Select one site of the sampled wildfire sites that is most suitable to demonstrate the treatment application and protocol through a number of field tests including infiltration, erodibility and plate load. ERDC and university team members will coordinate testing plans and on wildfire exposed and un-exposed (control) sections of the site. The duration of treatment and field testing will be determined after the above field tests have taken place. This activity involves travel to the site, application tools, media and bacteria strain. Field activities, test results, and analyses will be documented in a data report and/or a technical paper.

Public Benefit:

Engineering with Nature research program, is the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental, and social benefits that improve public's quality of life through community collaboration. This project will investigate the implementation of a sustainable, economic and eco-friendly treatment for mitigating post-fire effects on the natural environment and communities downstream of wildfires. If successful, MICP treatment has potential to decrease the threat of flash flooding and debris flows that threaten communities and USACE flood protection projects downstream of wildfires. This project will involve a previous EWN research effort in the Santa Clara Pueblo in northern New Mexico. These are native American lands where engineering solutions to environmental problems should be consistent with the Native American culture.

Section II: Award Information

1. Responses to this Request for Statements of Interest will identify potential investigators for studies sponsored by the Engineer Research and Development Center. Studies will explore MICP for reducing the risk of debris flows and related consequences: loss of life, damage/destruction of private and public real estate, and infrastructure located in areas impacted by wildfire.
2. The estimated level of funding for FY23 is approximately \$150,000. An estimated level of funding \$125,000.00 per year for 2 additional years may be available, providing the potential funding of \$400,000.00 over 3 years to the successful Recipient/Awardee. Depending on findings in the early years of this effort, funding needs may increase above the anticipated \$125,000.00/year in subsequent years of this project; however, total funding will not exceed \$400,000.00 over the life of this cooperative agreement.

Government Involvement:

Federal government partners will perform initial literature research and determine the baseline for expected improvements in engineering properties using MICP treatments for typical geotechnical projects. The baseline will be determined from case histories. The government will identify the sources of wildfire altered soils, in the western United States to be tested before and after being treated with MICP, in cooperation with the USACE Seattle, Sacramento and Albuquerque District offices. ERDC PI will coordinate sample collection with Sacramento, Albuquerque, and Seattle Districts. The government will provide quality assurance during collection of the actual samples from each of the selected sites. A junior government engineer will conduct the microscopic mineral identification of soils from each site. The government PI will select the site for the field demonstration of the MICP treatment on actual wildfire site, with input from the university and USACE District offices within the area of concern.

The ERDC PI will write project fact sheets, and progress reports to post on the EWN public website. The government PI will co-author one or two journal articles with University professors and graduate students.

Section III: Eligibility Information

1. Eligible Applicants – This opportunity is restricted to non-federal partners of the Desert Southwest Cooperative Ecosystems Studies Unit (CESU).
2. Cost Sharing – This action will be 100% funded by USACE.

Section IV: Application and Submission Information – Two Phase Process

Phase I: Submission of a Statement of Interest/Qualifications.

1. Materials Requested for Statement of Interest/Qualifications:
 - a. Please provide the following via e-mail attachment to: chelsea.m.whitten@usace.army.mil (Maximum length: 2 pages, single-spaced 12 pt. font).
 1. Name, Organization and Contact Information
 2. Brief Statement of Qualifications (including):
 - Biographical Sketch,
 - Relevant past projects and clients with brief descriptions of these projects,
 - Staff, faculty or students available to work on this project and their areas of expertise,
 - Any brief description of capabilities to successfully complete the project you may wish to add (e.g. equipment, laboratory facilities, greenhouse facilities, field facilities, etc.).

Note: A proposed budget is NOT requested at this time.

The administrative point of contact is Chelsea Whitten, 601-634-4679;
chelsea.m.whitten@usace.army.mil

2. Statement of Interest/Qualifications shall be submitted NO LATER THAN September 19, 2022; 1300 CDT

Based on a review of the Statements of Interest received, an investigator or investigators will be invited to move to Phase II which is to prepare a full study proposal. Statements will be evaluated based on the investigator's specific experience and capabilities in areas related to the study requirements.

Phase II: Submission of a complete application package to include a full technical proposal including

budget, if invited.

1. Address to Request Application Package

The complete funding opportunity announcement, application forms, and instructions are available for download at Grants.gov.

The administrative point of contact is Chelsea Whitten, 601-634-4679;
chelsea.m.whitten@usace.army.mil

2. Content and Form of Application Submission

All mandatory forms and any applicable optional forms must be completed in accordance with the instructions on the forms and the additional instructions below.

- a. SF 424 R&R - Application for Federal Assistance
- b. Full Technical Proposal – Discussion of the nature and scope of the research and technical approach. Additional information on prior work in this area, descriptions of available equipment, data and facilities, and resumes of personnel who will be participating in this effort should also be included.
- c. Cost Proposal/Budget – Clear, concise, and accurate cost proposals reflect the offeror's financial plan for accomplishing the effort contained in the technical proposal. As part of its cost proposal, the offeror shall submit cost element breakdowns in sufficient detail so that a reasonableness determination can be made. The SF 424 Research & Related Budget Form can be used as a guide but is required if the sub-recipient uses it. The cost breakdown should include the following, if applicable:
 1. Direct Labor: Direct labor should be detailed by level of effort (i.e. numbers of hours, etc.) of each labor category and the applicable labor rate. The source of labor rates shall be identified and verified. If rates are estimated, please provide the historical based used and clearly identify all escalation applied to derive the proposed rates.
 2. Fringe Benefit Rates: The source of fringe benefit rate shall be identified and verified.
 3. Travel: Travel costs must include a purpose and breakdown per trip to include destination, number of travelers, and duration.
 4. Materials/Equipment: List all material/equipment items by type and kind with associated costs and advise if the costs are based on vendor quotes and/or engineering estimates; provide copies of vendor quotes and/or catalog pricing data.
 5. Subrecipient costs: Submit all subrecipient proposals and analyses. Provide the method of selection used to determine the subrecipient.
 6. Tuition: Provide details and verification for any tuition amounts proposed.
 7. Indirect Costs: Currently the negotiated indirect rate for awards through the CESU is 17.5%.
 8. Any other proposed costs: The source should be identified and verified.

3. Application package shall be submitted NO LATER THAN October 17, 2022; 1300 CDT

4. Submission Instructions

Applications may be submitted by e-mail or Grants.gov. Choose ONE of the following submission methods:

- a. E-mail:

Format all documents to print on Letter (8 ½ x 11”) paper. E-mail proposal to specialist@usace.army.mil

b. Grants.gov: <https://www.grants.gov/>:

Applicants are not required to submit proposals through Grants.gov. However, if applications are submitted via the internet, applicants are responsible for ensuring that their Grants.gov proposal submission is received in its entirety.

All applicants choosing to use Grants.gov to submit proposals must be registered and have an account with Grants.gov. It may take up to three weeks to complete Grants.gov registration. For more information on registration, go to <https://www.grants.gov/web/grants/applicants.html>.

Section V: Application Review Information

1. **Peer or Scientific Review Criteria:** In accordance with DoDGARs 22.315(c), an impartial peer review will be conducted. Subject to funding availability, all proposals will be reviewed using the criteria listed below (technical and cost/price). All proposals will be evaluated under the following two criteria which are of descending importance.

a. **Technical (items i. and ii. are of equal importance):**

- i. Technical merits of proposed R&D.
- ii. Potential relationship of proposed R&D to DoD missions.

b. **Cost/Price:** Overall realism of the proposed costs will be evaluated.

2. Review and Selection Process

a. **Categories:** Based on the Peer or Scientific Review, proposals will be categorized as Selectable or Not Selectable (see definitions below). The selection of the source for award will be based on the Peer or Scientific Review, as well as importance to agency programs and funding availability.

- i. **Selectable:** Proposals are recommended for acceptance if sufficient funding is available.
- ii. **Not Selectable:** Even if sufficient funding existed, the proposal should not be funded.

Note: The Government reserves the right to award some, all, or none of proposals. When the Government elects to award only a part of a proposal, the selected part may be categorized as Selectable, though the proposal as a whole may not merit such a categorization.

b. No other criteria will be used.

c. Prior to award of a potentially successful offer, the Grants Officer will make a determination regarding price reasonableness.

Section VI: Award Administration Information

1. Award Notices

Written notice of award will be given in conjunction with issuance of a cooperative agreement signed by a Grants Officer. The cooperative agreement will contain the effective date of the agreement, the period of performance, funding information, and all terms and conditions. The recipient is required to sign and return the document before work under the agreement commences. **Work described in this announcement SHALL NOT begin without prior authorization from a Grants Officer.**

2. Administrative Requirements

The cooperative agreement issued as a result of this announcement is subject to the administrative requirements in 2 CFR Subtitle A; 2 CFR Subtitle B, Ch. XI, Part 1103; and 32 CFR Subchapter C, except Parts 32 and 33.

3. Reporting

See 2 CFR Sections 200.327 for financial reporting requirements, 200.328 for performance reporting requirements, and 200.329 for real property reporting requirements.

Section VII: Agency Contact

Chelsea Whitten, Grants Officer

US Army Corps of Engineers, Engineer Research and Development Center

3909 Halls Ferry Road

Vicksburg, MS 39180-6199

chelsea.m.whitten@usace.army.mil

601-634-4679