GREEN FUND

Sustainability Through Student Innovation

# Project Application

**Green Fund Mission Statement:** "The NAU Green Fund promotes student participation in and provides funding for projects that reduce NAU's negative impact on the environment and create a culture of sustainability on-campus."

**Requirements for Funding:**

- The project must be implemented on campus.
- The person submitting the project must be a NAU student, faculty, or staff member.
- Projects must provide all necessary documents, letters of support, and authorizations prior to submission.
- The Green Fund distributes funding on a **reimbursement basis**. Project teams should partner with an administrative office to provide upfront funding for the project. Once the project has been successfully completed, the Green Fund will reimburse the administrative partner.
- All project applications should be submitted to greenfund@nau.edu for review.

**Disclaimer:** All applications will go through a comprehensive vetting process. We highly recommend meeting with a Green Fund Committee member prior to submitting the application. The Green Fund Committee member will assist you with every step of writing your project application. If your project is approved, you may be asked to provide more detailed information regarding specific deliverables. The Green Fund is not responsible for acquiring the necessary permits, permissions, or approvals for a project, although we are happy to assist with this process if needed. Additionally, the Green Fund does not provide any ongoing maintenance costs. A sponsoring department must take responsibility for operations and management.

**Review Process:** Upon project application submission, the Green Fund will review your project within two weeks. At this time, the Green Fund will provide comments on the project. Incomplete applications will not be reviewed until all components are submitted. **Note:** The Green Fund Committee only meets during the academic year. All projects submitted outside of the regular academic year will be reviewed at the start of the next academic session.

**Contact Information**

Project Leader Name: Sam Blustein_ Phone: 612-581-0906_ E-mail: sdb424@nau.edu_

Project Advisor Name: Andrew Iacona Phone: Andrew.Iacona@nau.edu_ E-mail: 928-523-3109__

Sponsoring Department: Facility Services_____

Project name: Geothermal Borehole Thermal Conductivity Test

NAU Department/Unit for funding reimbursements (Attach letter of commitment from departmental representative): Facility Services

# Project Overview

**Executive Summary**
Please provide a brief overview of your proposal. Please address how this project will support the goals of the Green Fund (student involvement, creating a culture of sustainability, and lessening NAU's impact):

The NAU office of sustainability wishes to drill one borehole to a depth of 500 feet and conduct one thermal conductivity test to determine the feasibility of implementing a geothermal heat pump system. Geothermal heat pump systems function based on the near constant subterranean temperatures at depths of ten feet and below. Water is pumped into closed-loop tubes and the ground transfers energy into, or out of, the water depending on the outside air temperature. In the winter, the ground temperature is warmer than the outside air and can be used to warm water for heating. In the summer, the ground temperature is cooler than the outside air and can be used to cool water for air conditioning.

The thermal conductivity test would determine if the subsurface geology is conducive (i.e. low porosity, high ground saturation, etc.) to replace the current high-temperature, water-heating boiler system with a low-temperature heat pump system powered by geothermal energy. The geothermal heat pump system is one of two future heating systems that NAU is exploring, however, has not conducted any feasibility testing to date. The main barrier to this is the high costs associated with drilling and testing. However, due to the decades-long lifespan of a new heating system, and the associated long-lived impacts of such a system, this investment should be made in the interest of long-term sustainability. Geothermal heat pumps utilize a carbon-free, renewable source of energy, which is not entirely true for the other potential future heating system (biomass combustion) or the current heating system (natural gas). This true, carbon-free energy system reflects NAU's aggressive carbon neutrality and sustainability efforts.

Additionally, there is potential for valuable student involvement in the form of subsurface geologic characterization using NAU's ground penetrating radar and shallow seismic units. While nothing has been solidified, some SES faculty have expressed interest in developing a student project using this equipment. The results of this work would be invaluable to determining the presence of any subsurface features that would reduce ground thermal conductivity (i.e. sinkholes, ground fractures, etc.) due to the presence of air pockets. It is important to note that, to date, subsurface characterization has not been performed on the NAU mountain campus. In turn, student findings could be used to inform future borehole placement if the geothermal heat pump system is adopted. Despite the fact that this equipment can only reach depths of ~60 feet, far shallower than the depth of the borehole being proposed, these estimates would reduce risk on a "borehole-to-borehole" basis. Whether or not a student component is developed around this work, students will inevitably have a direct connection to the data from this feasibility through student representation on the CAP energy and steering committees.

Regardless of the action taken by NAU for their future heating system, this test would provide essential data to inform that action. Without geothermal heat pump feasibility testing, an incompletely-informed decision will be made. To ensure an adequately-informed decision, as well as considering the recently accelerated carbon neutrality goals from NAU decision-makers, this test must take place sooner rather than later.

**Please answer the following questions detailing the components of your project:**

1. Does your project require space or construction on campus? If so, where? Please review the "Space Committee Document" located on our webpage and follow the steps to begin requesting a location.
    a. Yes, this testing will take place in one of two locations based on whichever is less intrusive. The first possible location is on the northern side of the athletic fields east of the Walkup Skydome. The second possible location is in the parking area south of the Walkup Skydome, either to the north or south of E Pine Knoll Drive.
2. Have you obtained all necessary approvals for this project? Please attach all letters of support to this application. Letters of support should include confirmation from the sponsoring department that the sponsoring department will cover all upfront expenses and work with the Green Fund Business Manager to acquire reimbursement after project completion. If any ongoing operations and maintenance is required of your project, provide a letter of support from the entity that will be covering those costs and/or services.
    a. Letter of Support attached, below, from Facility Services (Andrew Iacona)
3. Will this project provide funding for student wages?
    a. Most likely no, as the potential student component of the project will likely be an extracurricular project or part of class curriculum.
4. Please list all additional sources of funding you have pursued. Include departments, grants, ASNAU, Graduate Student Government, etc.
    a. None
5. Have any of the Green Fund Committee members been involved in this project?
    a. If Yes, please identify all committee members:
        i. Sam Blustein

# Project Specifics

Please address the following questions. One or more of these questions may not apply to your particular application. Answer as many questions as are applicable to your project.

**Relationship to NAU Climate Action Plan (CAP)**

1. How does your project align with one of the seven CAP categories (Energy, Water, Transportation, Waste Minimization, Sustainable Landscaping, Environmental Justice, Communication)?

    a. This plan is directly linked to the energy category of the CAP as it would help to inform the choice between pursuing a biomass or geothermal heating scheme into the future. The biomass option is currently being explored, however, the only path forward for the geothermal option is to conduct a live feasibility study to ensure a temperature differential of 6 to 12 degrees F (typical standard) between input and output water. In order to reduce NAU's carbon footprint in terms of energy generation, there are two options: 1) on-site renewable electrical energy and 2) on-site renewable heating/cooling energy. Given that APS, the electricity provider, has already pledged 100% carbon-neutral grid electricity by 2050, the logical place for NAU to look is in the heating system that is currently dependent on natural gas. Short of carbon capture and storage technology, there is nothing that can be done to a natural gas-combustion system to make it carbon neutral without changing the fuel. For this reason, the two alternatives, biomass and geothermal have been proposed.

**Community**

2. Is there a public outreach plan? How will faculty, staff, and students learn about this?

    a. Faculty are being consulted to determine the involvement of students to go towards a project (in or out of class).

3. Are you working with other groups on or off campus? If so, describe your partnership.

    *a. Not Yet*

**Project Parameters**

4. What are the environmental costs and benefits associated with your project?

   This project will not yield any direct environmental benefits as it is just a feasibility study. However, informing the feasibility of implementing one of the two future, low-carbon heating systems has potential to lead to indirect benefits if it contributed to the adoption of such a system. These benefits will amount to the elimination of the university's largest source of scope 1 emissions, as well as contribute to achieving the university's carbon neutrality goal. In terms of environmental costs, this project will require digging up a portion of ground surface (i.e. grassland north of the athletic fields or grass islands in the parking lots south of the walkup skydome). In either case, the contractor is responsible for restoring the surface to "pre-drilling condition."

5. Provide an economic cost/benefit analysis for your project. Focus on identifying specific cost savings.

   N/A; There are no direct financial benefits from the project. However, it is important to note the value of the information that would be gained from this feasibility study. As was similarly described in the above section, there are possible indirect economic benefits if this feasibility study were to contribute to the adoption of a future heating system that requires no direct-combustion fuel purchases. With the implementation of a complete geothermal heat pump system, there are significant projected cost savings for the university between the time of adoption and 2050. This study will directly inform the most cost-effective path to carbon neutrality, as well as the inputs for this heating system, which will be factored into a future cost-benefit analysis. There is limited opportunity for cost savings for this project, specifically, as it is a matter of negotiating with the drilling and testing contractors.

6. Is this a one-time expense or will you require future funding?

   a. This is a one-time expense.

7. When your project members no longer attend NAU, who will be responsible for running the project?

   a. Mostly N/A, but any further testing will be pursued by the Office of Sustainability.

8. How will you monitor the impact of your project after implementation?

   a. Mostly N/A, but I will stay informed as to the energy scheme that NAU decides to pursue.

# Project Budget

Please include a thorough breakdown of all project costs, **as well as a 5% line item for contingency**.

***Detailed budget attached, below***

# Project Timeline

The timeline should include significant implementation dates for your project. Please add information such as shipping time and consider any holidays or breaks.

***Detailed timeline attached, below***

# Project Checklist

Please ensure you have completed all of the following items before submitting your application:

- ☑ Meet with a Green Fund Committee member
- ☑ Obtain all necessary letters of support (sponsoring department, ongoing maintenance, etc.)
- ☑ Project Overview
- ☑ Project Specifics
- ☑ Project Budget
- ☑ Project Timeline
- ☑ Complete Project Checklist

*Thank you for your submission. We deeply appreciate your commitment to sustainability at NAU, and we look forward to working with you.*

NAU NORTHERN ARIZONA UNIVERSITY

| Date prepared: | 4/12/2021 |
|---|---|

# FS INTERNAL CPA PROJECT BUDGET

| PROJECT NAME: | Geothermal Test Bore | PROJECT #: | 11.050.201 |
|---|---|---|---|
| PROJECT MANAGER: | Andrew Iacona | PROJECT Sq Ft: | N/A |

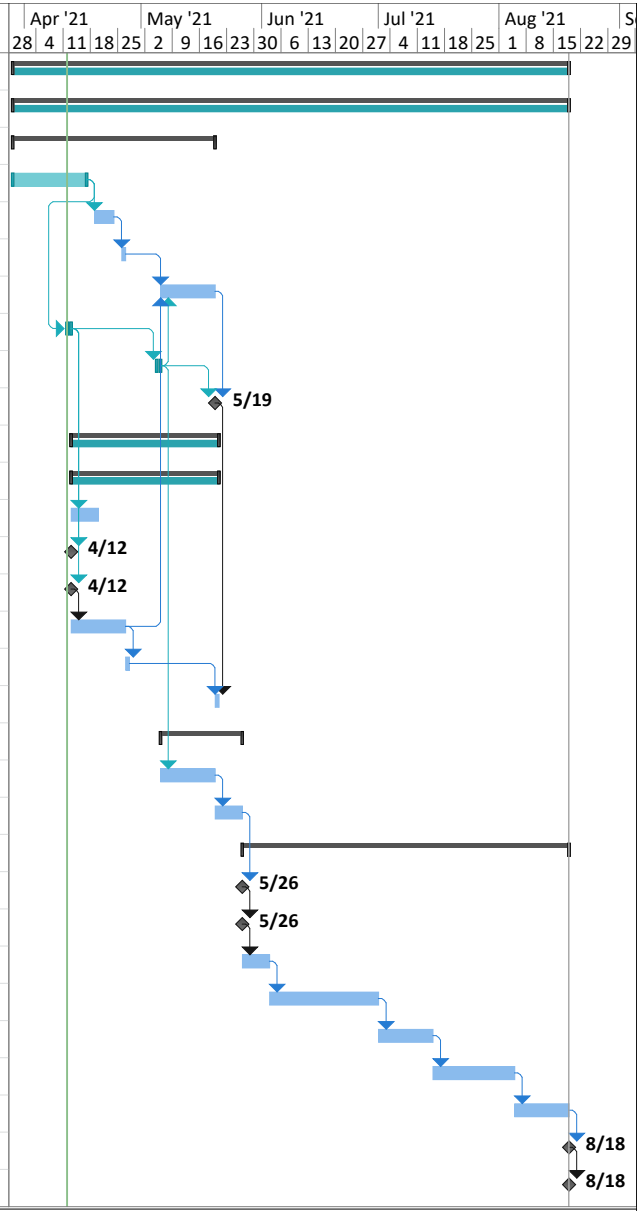
**PROJECT DESCRIPTION:**

***This project includes the drilling of at least one geothermal test bore at up to 500' depth at Northern Arizona University's mountain campus to help further evaluate the feasibility of one of the proposed carbon neutrality pathway solutions identified in the 2021 Climate Action Plan (CAP). The current CAP draft identifies two, either or solutions, to eliminating NAU's reliance on Natural Gas. These solutions include either a new Woody Biomass Plant or a Geothermal Heat Pump system. This project will specifically look at performing the drilling and conductivity testing of a geothermal test bore to help inform the plan's steering committee as to the feasibility and efficiency of the proposed low temperature Geothermal heat pump system that will play a key role in whether the steering committee can recommend this option as the best path for NAU. In addition to the drilling and testing, the consultant of the CAP will evaluate the test results to include with an executive summary in the CAP's final draft to be issued later this summer.***

| SCHEDULE: | | ORIGINAL CPA SCHEDULE | REVISED CPA SCHEDULE | |
|---|---|---|---|---|
| SCHEMATIC DESIGN: | | N/A | | |
| DESIGN DOCUMENTS: | | N/A | | |
| CONSTRUCTION DOCUMENTS: | | 5/12/2021 | | |
| BID DATE: | | N/A | | |
| CONSTRUCTION PERIOD (Months): | | 1 Month | | |
| OCCUPANCY DATE: | | N/A | | |
| **TOTAL APPROVED FUNDING** | | | | |

| DESCRIPTION OF CAPITAL COSTS | COST CODE | | ORIGINAL CPA BUDGET | REVISED CPA BUDGET | CURRENT CPA BUDGET |
|---|---|---|---|---|---|
| **REVISION DATE:** | | | **4/12/2021** | | |
| **CONSTRUCTION COSTS** | | | | | |
| **FEES** | | | | | |
| Specification, Oversight & Analysis - AEI | 750173 | | $5,000 | | $5,000 |
| Drilling of one (1) Test Bore (up to 500' Depth) | 750173 | | $48,000 | | $48,000 |
| Conductivity Testing & Report | 750173 | | $8,700 | | $8,700 |
| Parking Permits for Contractors | 780291 | | $300 | | $300 |
| Parking Stalls fees for Lay-Down area | 780291 | | $500 | | $500 |
| Plan Review | 780272 | | $528 | | $528 |
| Contingency (Owner) | 780500 | 5.0% | $3,151 | | $3,151 |
| Contingency (Owner) - Other | 750150 | 0.0% | $0 | | $0 |
| Construction Insurance: Risk Mgnt | 780269 | 0.34% | $225 | | $225 |
| Printing | 780293 | 0.25% | $165 | | $165 |
| Project Management Fee - Capital/Non-Capital | 780296/730296 | 8.0% | $5,326 | | $5,326 |
| Projects under $2,000,000 are 8% fee | 780296 | 8.00% | | | |
| **TOTAL COSTS** | | | **$71,895** | **$0** | **$71,895** |

| ID | Task Mode | Task Name | Duration | Start | Finish |
|---|---|---|---|---|---|
| 1 | | **Projects** | **103 days** | **Mon 3/29/21** | **Wed 8/18/21** |
| 2 | | **11.0050.201 - Climate Action Plan - Geothermal Test Bore** | **103 days** | **Mon 3/29/21** | **Wed 8/18/21** |
| 3 | | **Budget Prep** | **38 days** | **Mon 3/29/21** | **Wed 5/19/21** |
| 4 | | Receive Budget Proposals from Vendors | 15 days | Mon 3/29/21 | Fri 4/16/21 |
| 5 | | Develop Budget Spreadsheet | 5 days | Mon 4/19/21 | Fri 4/23/21 |
| 6 | | Budget Verification | 1 day | Mon 4/26/21 | Mon 4/26/21 |
| 7 | | Purchase Order Request Draft | 10 days | Thu 5/6/21 | Wed 5/19/21 |
| 8 | | Green Fund Review & Approval | 1 day | Mon 4/12/21 | Mon 4/12/21 |
| 9 | | CoCoSus Review & Approval | 1 day | Wed 5/5/21 | Wed 5/5/21 |
| 10 | | Purchase Order Issued | 0 days | Wed 5/19/21 | Wed 5/19/21 |
| 11 | | **Procurement** | **28 days** | **Mon 4/12/21** | **Thu 5/20/21** |
| 12 | | **Consultant - AEI** | **28 days** | **Mon 4/12/21** | **Thu 5/20/21** |
| 13 | | Insurance Review | 5 days | Tue 4/13/21 | Mon 4/19/21 |
| 14 | | Sub-Consultant Coordination | 0 days | Mon 4/12/21 | Mon 4/12/21 |
| 15 | | Pre-Lim Scope Coordination Meeting | 0 days | Mon 4/12/21 | Mon 4/12/21 |
| 16 | | Proposals Due | 10 days | Tue 4/13/21 | Mon 4/26/21 |
| 17 | | Proposal Review and PO Addition Development | 1 day? | Tue 4/27/21 | Tue 4/27/21 |
| 18 | | Contract Change Signed & Executed | 1 day? | Thu 5/20/21 | Thu 5/20/21 |
| 19 | | **Permits** | **15 days** | **Thu 5/6/21** | **Wed 5/26/21** |
| 20 | | NAU AHJ Plan Review | 10 days | Thu 5/6/21 | Wed 5/19/21 |
| 21 | | Construction Permit | 5 days | Thu 5/20/21 | Wed 5/26/21 |
| 22 | | **Drilling, Testing, & Analysis** | **60 days** | **Wed 5/26/21** | **Wed 8/18/21** |
| 23 | | Pre-Con Meeting | 0 days | Wed 5/26/21 | Wed 5/26/21 |
| 24 | | Notice to Proceed | 0 days | Wed 5/26/21 | Wed 5/26/21 |
| 25 | | Drill Rig Mobilization | 5 days | Thu 5/27/21 | Wed 6/2/21 |
| 26 | | Construction - Drilling | 20 days | Thu 6/3/21 | Wed 6/30/21 |
| 27 | | Conductivity Testing | 10 days | Thu 7/1/21 | Wed 7/14/21 |
| 28 | | GRTI Report Development | 15 days | Thu 7/15/21 | Wed 8/4/21 |
| 29 | | AEI Executive Summary & Report | 10 days | Thu 8/5/21 | Wed 8/18/21 |
| 30 | | Final Completion | 0 days | Wed 8/18/21 | Wed 8/18/21 |
| 31 | | Steering Committee Review & Use of Findings | 0 days | Wed 8/18/21 | Wed 8/18/21 |




Project: ProjectSchedule_SmallPr
Date: Mon 4/12/21

| | | | | | |
|---|---|---|---|---|---|
| Task | External Tasks | Manual Task | Finish-only | | |
| Split | External Milestone | Duration-only | Deadline | | |
| Milestone | Inactive Task | Manual Summary Rollup | Progress | | |
| Summary | Inactive Milestone | Manual Summary | Manual Progress | | |
| Project Summary | Inactive Summary | Start-only | | | |

NAU NORTHERN ARIZONA UNIVERSITY

April 12, 2021

To: NAU Green Fund Committee
From: Andrew Iacona, Project Manager Sr at Facility Services

Dear Green Fund Committee,

I am submitting this letter of support on behalf of Facility Services to confirm my full commitment and support for the proposed *Geothermal Test Bore Project* by Samuel Blustein, Graduate Student Representative of the Green Fund Committee. In collaborating with this proposed project, Facility Services has agreed to serve as the sponsoring department to the project.

This project proposes the drilling of at least one geothermal test bore at up to 500' depth at Northern Arizona University's mountain campus to help further evaluate the feasibility of one of the proposed carbon neutrality pathway solutions identified in the 2021 Climate Action Plan (CAP). The current CAP draft identifies two, either or solutions, to eliminating NAU's reliance on Natural Gas. These solutions include either a new Woody Biomass Plant or a Geothermal Heat Pump system. This project will specifically look at performing the drilling and conductivity testing of a geothermal test bore to help inform the plan's steering committee as to the feasibility and efficiency of the proposed low temperature Geothermal heat pump system that will play a key role in whether the steering committee can recommend this option as the best path for NAU. In addition to the drilling and testing, the consultant of the CAP will evaluate the test results to include with an executive summary in the CAP's final draft to be issued later this summer.

In collaborating with this project, Facility Services Planning, Design & Construction team will serve as the managing department. As Project Manager Sr at Facility Services and interim Business Manager to the Office of Sustainability, I can confirm the department's commitment to serve as the administrative unit for managing the Green Fund's expenses associated with the *Geothermal Test Bore Project*. Facility Services understands that only the requested fixed cost and reserve funds shall be expended by the Green Fund in support of this project.

Sincerely,

Andrew Iacona

Andrew Iacona
Project Manager, Sr. *Facility Services*
Interim Business Manager *Office of Sustainability*
Andrew.Iacona@nau.edu | 928 523 3109