Proposal for Chiricahua National Monument RV Housing Site Design

CENE 476 Engineering Design: Capstone Preparation

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Table of Abbreviations

ADA - Americans with Disabilities Act

ADEQ - Arizona Department of Environmental Quality

ADOT - Arizona Department of Transportation

ADWR - Arizona Department of Water Resources

AASHTO - American Association of State Highway and Transportation Officials

ASTM - American Society for Testing and Materials

EI – Engineering Intern

EIT – Engineering in Training

ENG - Engineer

FE – Fundamentals of Engineering

FHWA - Federal Highway Administration

NAU - Northern Arizona University

NPS - National Park Service

PM – Project Manager

RFI – Requests For Information

RV - Recreational Vehicle

SENG – Senior Engineer

US – United States

USDA - United States Department of Agriculture

1.0 Project Understanding

1.1 Project Purpose

Chiricahua National Monument wants to add ADA-compliant RV pads with full hookups to provide much-needed housing for seasonal and volunteer staff, who play a key role in the Monument's daily operations as the current housing options are limited.

The project will turn a 1.5-acre undeveloped area into functional green living space with concrete RV pads and a gravel road that will ensure accessible, compliant housing that meets Park Service and client requirements. The design will address drainage to prevent flooding and erosion while guaranteeing the structures are also suitable for the area's soil and usage needs. Without this, staffing could become a challenge, potentially affecting the Monument's operations and visitor experience.

1.2 Project Background

The national monument is located in the Southeast corner of Arizona, about 30 miles southeast of Willcox, as shown in Figure 1-1.

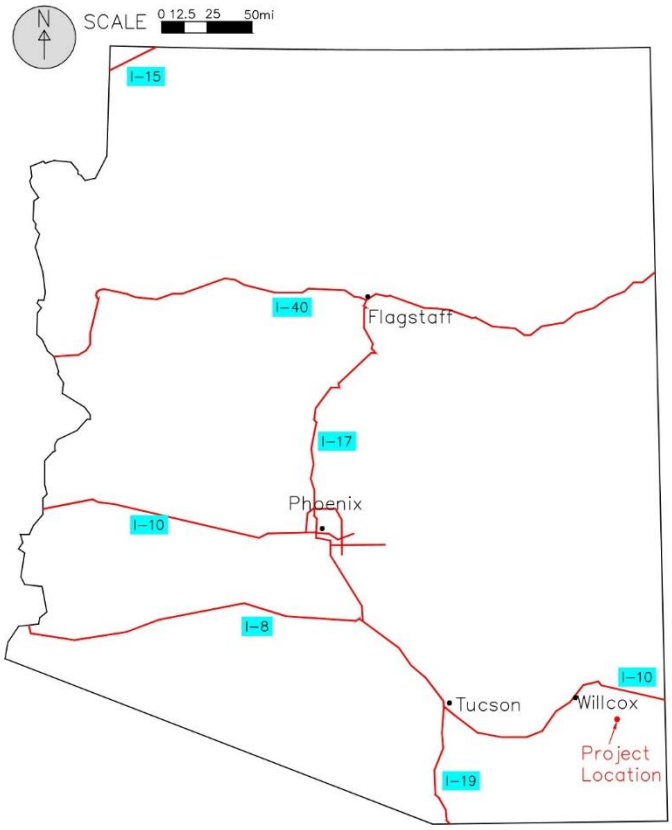

Figure 1-1: Location Map

The project site is on the east side of Pinery Canyon Rd, a well-maintained gravel road just off Arizona State Route 181. Both the monument entrance and sign are located at the intersection of the aforementioned roads, refer to Figure 1-2.

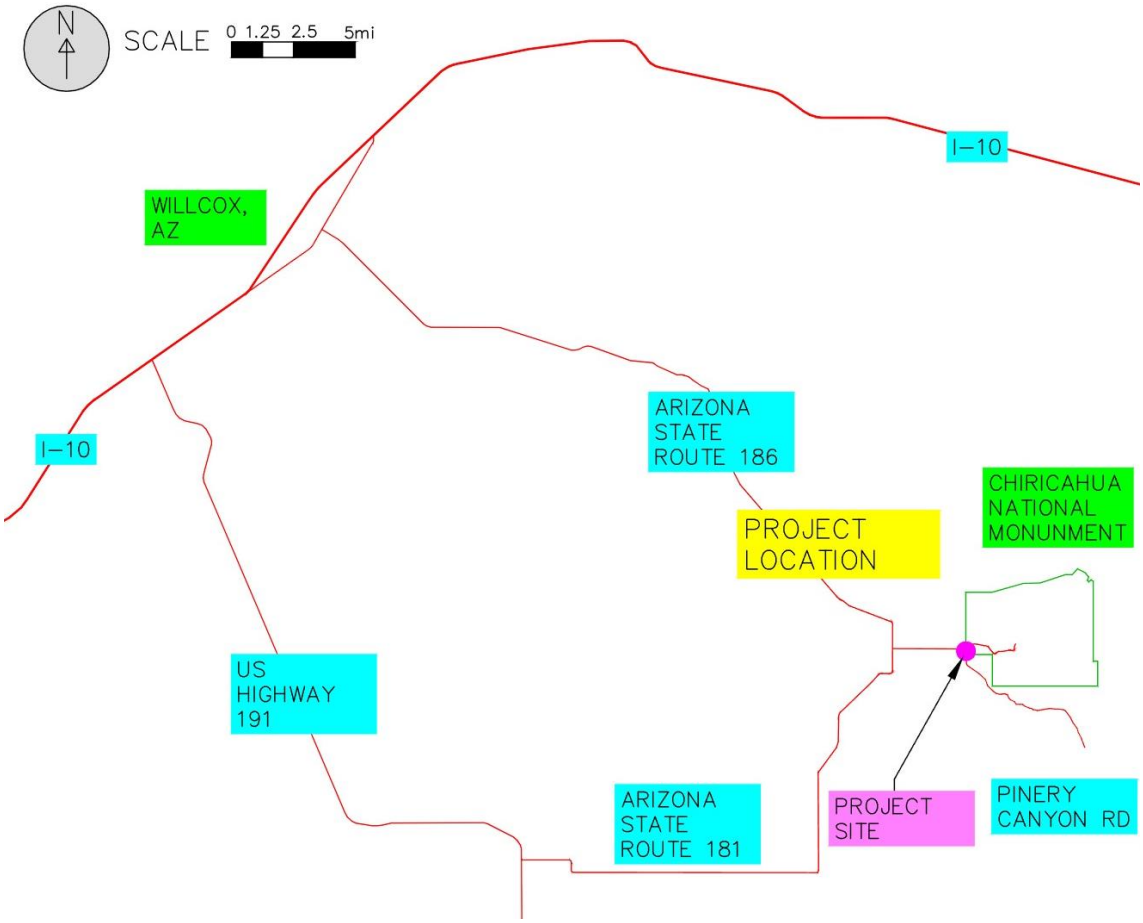

Figure 1-2: Vicinity Map

As shown in Figure 1-3, the site is an empty, mostly flat and brushless plot of land, with a naturally formed stream channel just north of the project area. This stream includes a culvert that travels under Pinery Canyon Rd. The only existing structures nearby and on the project, site are a powerline system on the west side of Pinery Canyon Rd, a storage shed, horse stalls, an NPS well-head, and a water treatment building connected to an existing domestic water supply line.

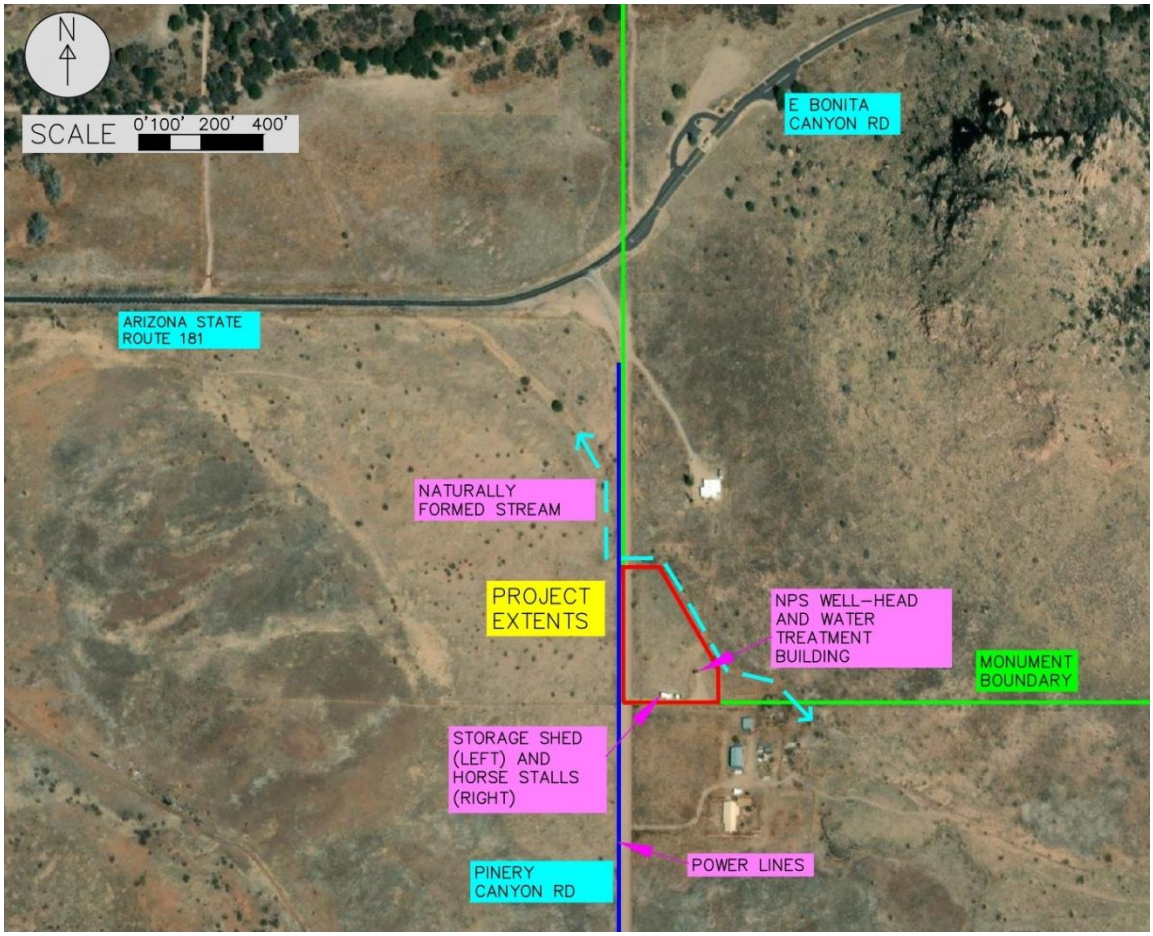

Figure 1-3: Project Site Map

1.3 Technical Considerations

For this project, RV pads will be designed with consideration of full utility hookups being designed by another team to meet client expectations and ADA accessibility standards. To ensure the project is executed properly, a variety of engineering work needs to be completed and taken into account prior to completing a plan set for this project.

A detailed survey of the project area is necessary to accurately map the site, identify existing land features, and ensure proper placement of the RV pads and road with acceptable grading. This step is critical for verifying the design is compatible with the landscape and helps avoid obstacles during construction. Survey data collected will then be imported into software mapping programs to create a topographical map to assist in the overall site design of the project.

Water and drainage analysis is essential for managing stormwater on the site and preventing problems like flooding and erosion. A hydrologic analysis will assess existing stormwater runoff and evaluate how it will change after construction and site improvements. This data is crucial for the design of the gravel roads.

Additionally, a hydraulic analysis is necessary to assess the existing stormwater management infrastructure's capacity and plan for any needed modifications or new installations. The design must incorporate an efficient drainage system that directs water away from the RV pads and roads, considering the site's soil characteristics to ensure stability. This analysis will guide the modifications to existing structures to meet the project requirements.

The RV pads must be wide and long enough to be able to fit newer, larger RVs. RV pads also have constraints that must be met on slopes to avoid puddling on the concrete, this includes a maximum slope and cross slope for the pad and a maximum slope for the driveway up to the pad. The concrete used for the pad must comply with AASHTO design standards to ensure the pads remain structurally sound and prevent water from ponding on the surface.

Another consideration is that a road design must be created that is able to accommodate the size and weight of RVs while guaranteeing easy access to each RV pad. This involves ensuring the gravel roadway is made with the appropriate material to handle frequent use. The cross section of the road must also be designed in a way that allows water to runoff into ditches parallel to the road stopping water from pooling on the road. Finally, the subgrade below the road must be a suitable soil that can firmly support the road and large vehicles.

1.4 Constraints & Potential Challenges

This project has several constraints that could create some challenges in the design of the RV park. One constraint is the regulations and standards of the National Monument Service (NPS), and any Arizona regulation bodies that enforce environmental standards such as the Arizona Department of Environmental Quality (ADEQ) and Arizona Department of Water Resources (ADWR).

The current site conditions are simple to develop on due its characteristics of being flat and relatively empty, however, endangered plants on the site such as agave or yucca need to be avoided both during planning and construction. A site visit will be conducted to confirm the locations of both on the project area.

Site geometry is a constraint, as there is limited space available with the given borders for the project, and the geometry is unique as seen in the figures. Fitting multiple RV Pads in the available space while still having space for other amenities/client requests, keeping the RV park aesthetically pleasing, and meeting other regulatory requirements will be a challenge.

One challenge in planning the site visit is the possibility of unforeseen factors, such as inclement weather, which could restrict the team's time and ability to conduct testing if a storm occurs. As briefly noted, equipment presents another challenge for the site visit, as tools for both surveying and soil testing will be needed. The team plans to use GPS surveying equipment which can be challenging due to weather because heavy rain, snow, or dense cloud cover can obstruct satellite signals, reducing accuracy and reliability. This might mean that the team will not be able to use GPS equipment and will need to be flexible due to weather, preparing an alternate survey method. Additionally, extreme temperatures or high winds can physically affect the equipment and hinder the surveyor's ability to operate it effectively.

1.5 Stakeholders

Some stakeholders for this project include NPS, volunteers/seasonal employees, Northern Arizona University (NAU), the State of Arizona, and visitors of the monument.

The main stakeholder of this project is the NPS, who owns and manages Chiricahua National Monument and is responsible for the land and access road of the project site. The employees of NPS who work at Chiricahua are stakeholders due to being a part of NPS and being responsible for the daily operations of the site. The monument volunteers and seasonal employees are stakeholders due to the site being designed for their usage while they stay/volunteer at the monument.

Both NAU and the State of Arizona are stakeholders due to the design and success/failure of the project reflecting on each in their own ways. For NAU, this project reflects their capstone program and engineering students. Comparably, for the State of Arizona, this project is located in one of the national monuments within the state, so it is a direct reflection of Arizona. The success of this project determines whether traffic into this monument rises or falls from what its current traffic is due to one of the final stakeholders being visitors of the monument.

2.0 Scope of Services

2.1 Task 1: Site Visit

A site visit will be completed to see general conditions of the site and gather necessary information for design and analysis of the project. Visiting it will allow the team to get a better understanding of the site conditions, like gradings, brush, distance from power lines between the site and road, current drainage conditions, and conditions of the existing wash on the northern border of the site. A topographical survey will be conducted and soil samples will be collected.

2.1.1 Task 1.1: Pre-visit Planning

Students will need to register with NAU to drive a vehicle to the site. A Thursday-Friday trip will be taken late January or early February, with limited time and only one trip to collect data. For geological testing, all that is needed is a closed container(s) to collect soil samples. For surveying, a 3D total station, tripod, battery (with charger), and prism pole will be borrowed from the NAU Engineering Department after proper paperwork is completed for lab and equipment access.

2.1.2 Task 1.2: Existing Infrastructure

Geometry of any existing infrastructure at the site will be documented to later put into consideration for mapping and drafting purposes. Neglecting such facilities could lead to the final design not working as planned.

2.1.3 Task 1.3: Surveying

A survey using a 3D total station will be completed to get a topographic map of the entire site. This is needed to ensure proper grading of the roads/paths and parking spurs for RVs, for ADA across the whole site, and for design of any drainage systems.

2.1.4 Task 1.4: Soil Sample Collection

Depending on similarities between the soil across different parts of the site, as many samples as needed will be collected, size and depth of sample will depend on the testing for that particular sample and be determined before the site visit, along with the number of containers that will be needed.

2.2 Task 2: Geotechnical Analysis

A good understanding of the soil present at the site is required in order to develop a design that will satisfy and fit the project necessities.

2.2.1 Task 2.1: Lab Access

The paperwork request for lab and equipment access will need to be completed at least one month prior to the site visit to ensure the paperwork is approved on time.

2.2.2 Task 2.2: Soil Proctor Compaction Test

A compaction test for the site's soil will be completed using ASTM D698-12 standard test method. This test will ensure the soil can handle the weight from adding concrete pads with RVs on them, without compressing it too much and causing damage to the concrete. It will also give the moisture content of the site soil.

2.2.3 Task 2.3: Sieve Test

A standard sieve analysis test will be completed using ASTM D6913. This test separates the different size particles of the soil, allowing the team to get a grade for it under AASHTO or USDA to understand if this soil is good for construction or not.

2.3 Task 3: Survey Data Analysis

The performed survey will provide the team with critical information about the site such as topographic data, existing features of the site, as well as geographic boundaries of the site. All data will be imported into Civil 3D in order to generate a topographic map of the site. All features and infrastructure will be included in the map for accuracy purposes.

2.4 Task 4: Hydrologic Analysis

2.4.1 Task 4.1: Watershed Delineation

Identifying natural features present at the site that compose and affect the flow of the water within the site. An initial site investigation will take place then the team will utilize any existing data of the site in addition to the surveying in order to define the geographic boundaries of the watershed.

2.4.2 Task 4.2: Determine Runoff Parameters

These are factors that directly affect the flow of water throughout the site and must be considered for accurate results. Historical rainfall data and site characteristics will be collected and utilized to determine parameters such as the runoff coefficient and intensity will be determined. Effectively determining the parameters would lead to accurate results on the future runoff calculations.

2.4.3 Task 4.3: Determine Runoff

The runoff consists of the total amount of water that runs through the site originated from rainfall, snowmelt, etc. Runoff can be calculated through calculations and/or software. Programs such as HEC-HMS could be considered, however, due to the small size of the site a simpler method such as a simple flow measurement or SCS curve number will be utilized . The total water volume will be considered for the stormwater management and drainage system of the design.

2.5 Task 5: Preliminary Design Development

Once all the available data has been collected from the site, preliminary design will be constructed to satisfy the clients request. Over the course of this task, multiple conceptual ideas and designs will be altered to ultimately present the most efficient design. Design development will include multiple phases regarding analysis, calculation, planning, and optimization will culminate in a final design.

2.5.1 Task 5.1: Develop Alternatives

By utilizing all the accessible data, a final conceptual design will be presented which will address all of the given requirements. A conceptual design is an early phase of the design process with abstract ideas which will later be polished and defined.

2.5.2 Task 5.2: Identify Selection Criteria

A set of criteria will be defined dependent on the objectives and requirements of the design. The criteria will be utilized to compare multiple aspects of each design to one another.

2.5.3 Task 5.3: Best Alternative

All alternatives will be compared to a team established criteria, they will be graded through a decision matrix to identify the final one that will move forward in the design process.

2.6 Task 6: Final Site Design

2.6.1 Task 6.1: Roadway Alignment and Geometry

Using the collected site survey information, a full road profile and alignment plan can be created. These plans are to be created in compliance with ADOT, FHWA, and any other applicable roadway standards.

2.6.2 Task 6.2: RV Pad Design

A concrete RV Pad design will be created using both the geotechnical data collected and larger RV dimensions. Using the geotechnical data, an RV Pad that is suitable for the ground below will be designed. Should the ground not suffice, a suitable fill will be brought in. The pad itself will be constructed in a way that is able to fit and support larger RV's.

2.6.3 Task 6.3: Post Development Hydrologic Analysis

Assessing how the RV Park's final layout affects runoff characteristics compared to pre-development conditions. This looks at changes in peak flow rates, runoff volumes, and flood risks using hydrologic models to assess new/improved stormwater management features and impervious surfaces. This task ensures post-development runoff meets compliance of regulatory requirements.

2.6.4 Task 6.4: Drainage

A full drainage system will be created if necessary based on the hydrologic analysis done previously.

2.6.5 Task 6.5: Utility Layout

A utility layout will be developed in collaboration with the Chiricahua Utility Design team to provide road and RV pad locations. The utility design team will then supply utility routing information to be included in the site plans.

2.7 Task 7: Develop Construction Cost Estimate

Once all design aspects are completed, a construction cost estimate will be developed for the client. The estimate will include items such as labor, materials, and equipment.

2.8 Task 8: Construction Plan Set

2.8.1 Task 8.1: Cover Sheet

A cover sheet containing all pertinent information for this project will be made. Such information includes client information, project information, engineer information, contractor information, and city/state approvals.

2.8.2 Task 8.2: Existing Site Plans

A map of the existing site will be created using the survey data collected during the site visit. Previous site plans from the client could also be used as either a reference or the site plans themself.

2.8.3 Task 8.3: Proposed Site Plans

The proposed site plans will include the locations for all added structures to the site, including the road, RV pads, and drainage system. Also on the proposed site plans will be the callouts to the detail sheets later in the plan set.

2.8.4 Task 8.4: Road Alignment and Profile

This sheet will contain the entire road alignment, including details such as centerline stationing and locations of the RV Pads. The profile will be a profile view of the road, showing the elevation of the road at any given station.

2.8.5 Task 8.5: Details

The detail sheet will include all of the fine details for things called out previously in the plan set. These details will include things such as dimensions and material. Such things that could have a detail include road cross section, drainage cross section, the RV Pads, and trash cans.

2.9 Task 9: Project Impacts

This property is designed from the start with “green property” in mind, making sure it has little to no impact on the surrounding environment and Chiricahua National Monument. The team must evaluate potential disturbances to flora, fauna, soil stability, and effectiveness of drainage systems in minimizing stormwater impacts on the surrounding ecosystem. All positive and negative impacts will be evaluated on an environmental, social, and economical level.

2.10 Task 10: Project Deliverables

2.10.1 Task 10.1: 30% Submittal

Most of the formatting and beginning of the project work has started for this submittal. This submittal will include a 30% construction plan set, survey results which will be turned into a topographic map, sampling/testing plan, and field investigation results. This will be a complete report, but the results of analysis and the sections following (except appendices and references) will not be completed yet. A 30% presentation will also be created and presented. The tentative due date for this submittal is February 13th, 2025.

2.10.2 Task 10.2: 60% Submittal

Most of the technical tasks will be completed and documented in this report. This submission builds on the 30% submittal by including data collection and analysis, initial site designs, construction drawings, and an assessment of alternatives leading to the final design. The report will cover all sections, primarily focusing on the results of analysis and proposed solutions. Additionally, a presentation will be developed and presented. The tentative due date for this submittal is March 13th, 2025.

2.10.3 Task 10.3: 90% Submittal

All technical tasks and documentation must be completed at this time, the report will be finished with minimal fine tuning afterwards. The 90% submittal will include a 90% report, website, construction plans, and draft final presentation. The partial construction plans complete for the 90% include the cover sheet and existing conditions. The tentative due date for this submittal is April 17th, 2025.

2.10.4 Task 10.4: Final Submittal

The final submittal consists of a final report, drawings, a website, and a final presentation that displays the entirety of the project. This is essentially the 90% submittal revised and with final touches. The tentative due date for this submittal is May 2nd, 2025.

2.11 Task 11: Project Management

2.11.1 Task 11.1: Schedule Management

The schedule will be monitored and updated as the project progresses. Any changes to the schedule will be recorded.

2.11.2 Task 11.2: Resource Management

Staff hours for the team will be logged for each section of the project. These hours will then be used to track the total staffing cost and ensure that the project is completed within budget.

2.11.3 Task 11.3: Meetings

Weekly team meetings will usually be held in person but some meetings are occasionally online. These meeting agendas and meeting minutes will be recorded and stored in an e-meeting binder. We will have several meetings each semester with our Technical Advisor (TA), along with Grading Instructor (GI) and client meetings as needed and upon request. During the first semester, there will be two meetings with the TA, one meeting with the GI, and one meeting with the client.

2.12 Exclusions

2.12.1 RV Hookups

For this project, a set of 5-7 RV Pads with full hookups will be designed. Full hookups include utilities such as water, electricity, and sewer. All of these items will be connected to the RV Pad itself as an available amenity for users. The design of the RV Pad hookup will be done by a different group while the design of the RV Pad itself, including size and material will be done in this project.

2.12.2 Utilities

For the utilities within the RV PAD full hookup to be functional, they will either need to be connected to existing utility lines, or to new utility lines. These utilities include water, electricity, and sewer. The design for all utilities, including connections to existing/new utility lines, will be created by a different group and not included in this project.

2.12.3 Structures

Within the scope of this project include certain structures for volunteers/seasonal workers. These structures could include things such as a laundry room, a bathroom, or a common room. The design for these structures, including aspects such as size, placement, and utility hookups will be done by a different group and not included in this project.

2.12.4 Permitting

All permitting for this project is to be done through NPS by National Monument employees. As the project area is considered federal land, everything is to be done through NPS. This process will not be included in this project.

3.0 Schedule

A schedule was be created to keep the project and team on track while also maintaining the necessary pace to meet deadlines and ensure all tasks are completed. The Gantt chart is located in Appendix A.

3.1 Overview - Gantt Chart Basics

The total duration of the proposed project will be 123 days based on the 5-day work week schedule including federal holidays, taking into consideration the starting date of 11/12/24 due to starting the process of being granted lab access. All other work for this project will start 01/13/25 and ending date of 05/02/25.

3.2 Major Tasks and Deliverables

Major tasks consist of a site visit, geotechnical analysis, survey data analysis, hydrologic analysis, preliminary design development, final site design, construction plan set, project impacts, deliverables, and project management. During the site visit, surveying will be conducted and the site conditions will be recorded. Geotechnical analysis, survey data analysis, and hydrologic analysis will follow the site visit, analyzing all of the collected data and formatting it in a way that can be used during the next major task, preliminary design developments. The initial project site design will be created during this task using the analyzed data. The final site design will be the final iteration of the site design selected by the team. The construction plan set will be a comprehensive plan set of all parts of the project design. Project impacts will be an analysis of how the final site design will impact the environment and future users of the site. The previously mentioned deliverables will include all of the submittals and presentations to the client. Finally, the project management task includes schedule and resource management to ensure the project is completed on time and within budget.

3.3 Critical Path

The critical path is shown in red on the Gantt Chart in Appendix A. These tasks are the sequence of activities which must be completed on time for the project to be completed on time. The tasks on the critical path include lab access, pre-visit planning, soil sample collection, geotechnical analysis, survey data analysis, watershed delineation, determining runoff parameters, determining runoff, developing alternatives, identifying selection criteria, selecting the best alternative, all of final site design except for utility layout, proposed plan set, road alignment and profile with details sheet, 90% and final submittal.

The critical tasks which can be viewed on the Gantt Chart include first gaining lab access followed by the pre-site visit planning. Next on the critical path is collecting soil samples and conducting the site visit. After the site visit is complete the next critical task is analyzing the geotechnical data with the soil proctor test also affecting the critical path. The hydrologic analysis is the next step in the critical path with the development of potential alternatives, identifying selection criteria, and choosing the best design option impacting the critical path. The final site design is a crucial element of the project's critical path, encompassing all areas except utility coordination. Once the final site design is completed, the construction drawings can be finished, which will include proposed site plans, road alignment, profile drawings, and detailed pages. The only deliverables considered part of the critical path are the 90% submittal and the final submittal.

During the team's weekly meetings, the team will assess the Gantt chart and critical path to determine if the tasks are still on track to complete the path and therefore project on time, and that no adjustments need to be made to durations of critical path tasks. In the case where adjustments do need to be made, the team will work during weekends and holidays and could also fast track tasks as required.

4.0 Staffing Plan

4.1 Staff positions

4.1.1 Senior Engineer (SENG)

The senior engineer is responsible for the overview of the project as a whole, making key decisions for the direction of the project, and for communication between the team and the client. The senior engineer is also responsible for ensuring that the project is completed both on time and within budget. This position requires at least a master's degree within an engineering discipline and 10 plus years of experience within engineering, and completion of the Principles and Practice of Engineering (PE) exam.

4.1.2 Engineer (ENG)

The engineer is responsible for the technical work related to the project including any surveying that needs to be done, the analysis of the collected data, and any detail/site designing for the project at hand. The engineer is also responsible for any major CAD drafting. This position requires at least a bachelor's degree with an engineering discipline and 3+ years of experience within engineering. Proficiency in AutoCAD, Excel, and any other prevalent software is also needed, along with the completion of the Fundamentals of Engineering (FE) Exam.

4.1.3 Engineer in Training (EIT)

The engineer in training is responsible for the editing and revision of all written submissions. This can include proposals, reports, and Requests For Information (RFI). The engineer in training will also aid in CAD drafting, designing, and any research that needs to be done. Any work completed by the EIT will be reviewed by either the ENG or the SENG. This position requires at least a bachelor's degree in an engineering discipline, completion of the FE Exam, an Engineer in Training certificate, and proficiency in AutoCAD.

4.1.4 Engineer Intern (EI)

The Engineering Intern is to collaborate with the ENG and EIT on technical work within this project. The EI may be responsible for the drafting of reports and smaller CAD drawings. This position may also be responsible for assisting in surveying or geotechnical lab work. This position requires actively pursuing a Bachelor's within an engineering discipline with a preferred GPA above a 3.0.

4.2 Staffing Hours

This project has an estimated total of 660 hours of working hours required to complete. . The senior engineer will overlook the entire project having final say on decision on the direction of the project, they will take around 10% of the total staffing hours. The engineer is responsible for technical task and will guide the EIT and EI, the engineering intern position will take around 30% of the staffing hours. Lastly, the engineer in training will invest the most time in the project, around 35% of the total hours. A summary of all work hours distributed to major tasks in the project are shown in table 4-1.

Table 4-1 – Staffing Summary Table

Task	SENG	ENG	EIT	EI	Total
Task 1: Site Visit	2	8	30	20	60
Task 2: Geotechnical Analysis	2	12	18	6	38
Task 3: Survey Data Analysis	2	3	10	6	21
Task 4: Hydrologic Analysis	6	17	26	16	65
Task 5: Preliminary Design Development	4	23	35	21	83
Task 6: Final Site Design	4	35	48	11	98
Task 7: Develop Construction Cost Estimate	2	2	8	2	14
Task 8: Construction Plan Set	7	10	18	13	48
Task 9: Project Impacts	2	6	0	0	8
Task 10: Project Deliverables	13	29	30	18	90
Task 11: Project Management	20	50	20	45	135
TOTAL	**64**	**195**	**243**	**158**	**660**

A detailed table with distributed hours for each subtask is present in Appendix B.

5.0 Cost of Engineering Services

Table 5-1 on the next page shows the cost of engineering services for the Chiricahua National Monument site design. The costs have been categorized into personnel, travel, and supplies & equipment. The total cost of engineering services is $105,861. Personnel is the majority of engineering service cost at $102,240, these billing rates for each position include hourly pay, benefits, company overhead, and profit. Travel consists of hotel, per diem, and vehicle rentals; the hotel and per diem were determined from the 2025 State of Arizona Accounting Manual, Meals and Lodging Cost Index. The vehicle rental and mileage rates were determined from NAU rental fleet prices, choosing "large AWD" as the vehicle, since it has room for all personnel and the equipment/supplies. Supplies & Equipment contains what is needed for geotechnical testing and surveying, along with other basic necessities for the site visit like storage containers for soil and safety vests. The lab and equipment rental rates for NAU's equipment and labs were provided.

Table 5-1 – Cost of Engineering Services

1.0 Personnel	**Classification**	**Hours**	**Rate**	**Cost**
	Senior Engineer	64	$280	$17,920
	Engineer	195	$195	$38,025
	Engineering in Training	243	$145	$35,235
	Engineer Intern	158	$70	$11,060
	Total Personnel			$102,240
2.0 Travel	**Classification**	**Quantity**	**Rate**	**Cost**
	Large AWD vehicle	3 days	$52.8/day	$158
	Mileage	750 miles	$0.31/mile	$233
	Hotel	3 rooms, 2 days	$145/day/person	$870
	Per Diem	3 days	$54/day/person	$648
	Total Travel			$1,909
3.0 Supplies & Equipment	**Classification**	**Quantity**	**Rate**	**Cost**
	Nikon/Topcon 3D Total Station	3 days	$35/day	$105
	Tripod	3 days	$10/day	$30
	GPS Rover (includes accessories)	3 days	$50/day	$150
	4 Reflective Vests	3 days	$5/day	$15
	Soil Storage Container	3 days	$4/unit	$12
	Compaction Lab access/testing	2 days	$100/day	$200
	Sieve Lab access/testing	2 days	$100/day	$200
	Computer Lab Access	10 days	$100/day	$1000
	Total Supplies and Equipment			**$1,712**
4.0 Total Cost of Engineering Services				**$105,861**

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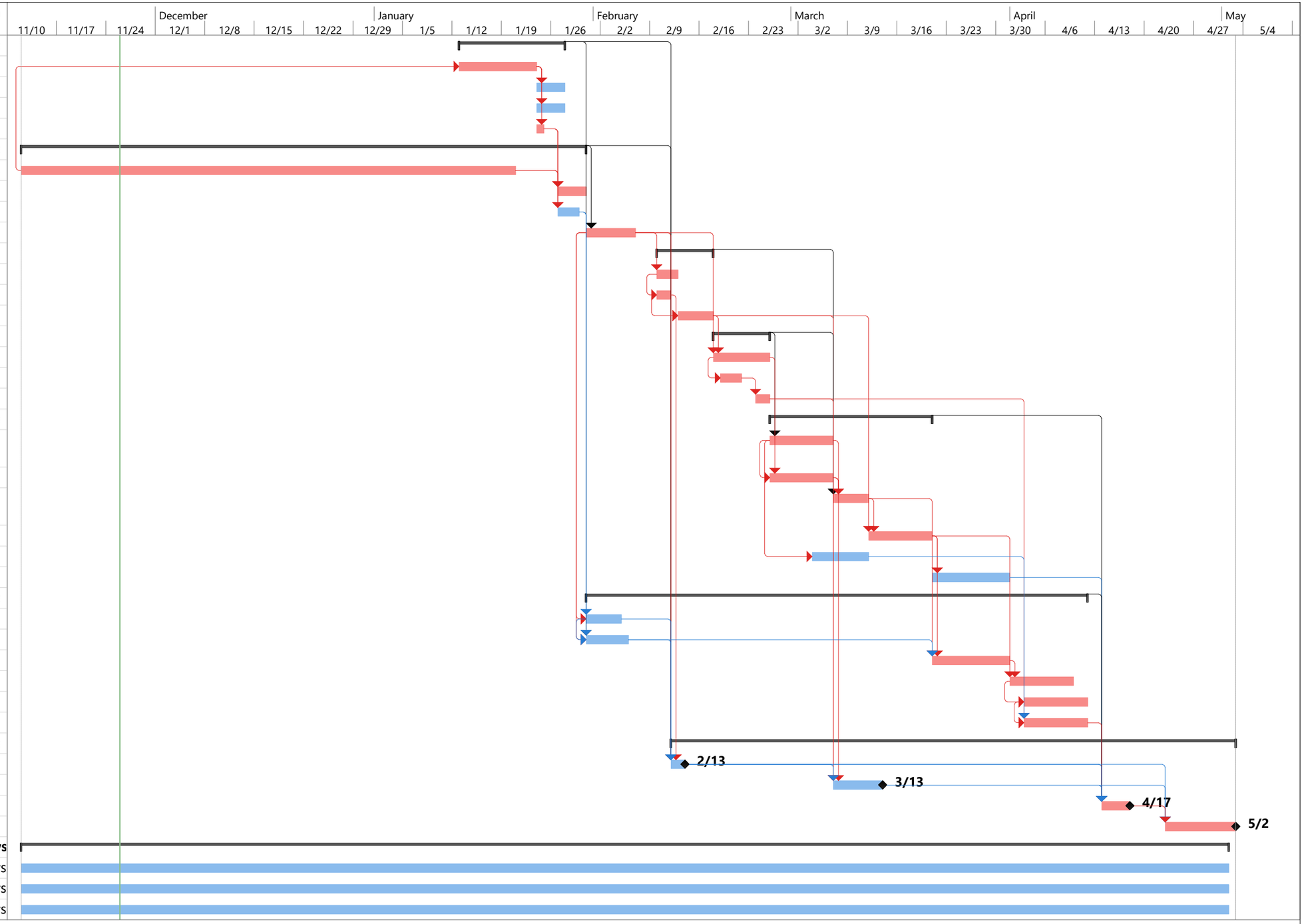
Appendices

Appendix A – Gantt Chart

Located on the next page.

ID	Task Name	Duration
1	**Task 1: Site Visit**	**11 days**
2	Task 1.1: Pre-Visit Planning	9 days
3	Task 1.2: Exisiting Infastructure	2 days
4	Task 1.4: Surveying	2 days
5	Task 1.5: Soil Sample Collection	1 day
6	**Task 2: Geotechnical Analysis**	**58 days**
7	Task 2.1: Lab Access	50 days
8	Task 2.2: Soil Proctor Compaction Test	4 days
9	Task 2.3: Sieve Test	3 days
10	**Task 3: Survey Data Analysis**	**5 days**
11	**Task 4: Hydrologic Analysis**	**6 days**
12	Task 4.1: Watershed Delineation	3 days
13	Task 4.2: Determine Runoff Parameters	2 days
14	Task 4.3: Determine Runoff	3 days
15	**Task 5: Preliminary Design Development**	**6 days**
16	Task 5.1: Develope Alternatives	6 days
17	Task 5.2: Identify Selection Criteria	3 days
18	Task 5.3: Best Alternative	2 days
19	**Task 6: Final Site Design**	**17 days**
20	Task 6.1: Roadway Alignement and Geometry	7 days
21	Task 6.2: RV Pad Design	7 days
22	Task 6.3: Post Development Hydrologic Analysis	3 days
23	Task 6.4: Drainage	7 days
24	Task 6.5: Utility Coordination	6 days
25	**Task 7: Develop Construction Cost Estimate**	**7 days**
26	**Task 8: Construction Plan Set**	**51 days**
27	Task 8.1: Cover Sheet	3 days
28	Task 8.2: Existing Site Plans	4 days
29	Task 8.3 Proposed Site Plans	7 days
30	Task 8.4: Road Alignment and Profile	7 days
31	Task 8.5: Details	7 days
32	**Task 9: Project Impacts**	**7 days**
33	**Task 10: Project Deliverables**	**58 days**
34	Task 10.1: 30% Submittal	2 days
35	Task 10.2: 60% Submittal	5 days
36	Task 10.3: 90% Submittal	4 days
37	Task 10.4: Final Design Submittal	8 days
38	**Task 11: Project Management**	**123 days**
39	Task 11.1: Schedule Management	123 days
40	Task 11.2: Resource Management	123 days
41	Task 11.3: Meetings	123 days



Project: Chiricahua Site Design
Date: Tue 11/26/24

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

Appendix B – Detailed Staffing Table

Located on the next page.

Appendix B – Staffing Estimates

Task	SENG	ENG	EIT	EI	Total
Task 1: Site Visit	**2**	**8**	**30**	**20**	**60**
Task 1.1: Pre-visit Planning	2	2	2	2	8
Task 1.2: Existing Infrastructure	0	2	8	5	15
Task 1.3: Surveying	0	3	15	10	28
Task 1.4: Soil Sample Collection	0	1	5	3	9
Task 2: Geotechnical Analysis	**2**	**12**	**18**	**6**	**38**
Task 2.1: Lab Access	2	2	0	0	4
Task 2.2: Soil Proctor Compaction Test	0	4	10	3	17
Task 2.3: Sieve Test	0	6	8	3	17
Task 3: Survey Data Analysis	**2**	**3**	**10**	**6**	**21**
Task 4: Hydrologic Analysis	**6**	**17**	**26**	**16**	**65**
Task 4.1: Watershed Delineation	2	8	10	6	26
Task 4.2: Determine Runoff Parameters	2	6	10	6	24
Task 4.3: Determine Runoff	2	3	6	4	15
Task 5: Preliminary Design Development	**4**	**23**	**35**	**21**	**83**
Task 5.1: Develop Alternatives	0	10	25	15	50
Task 5.2: Identify Selection Criteria	1	8	10	6	25
Task 5.3: Best Alternative	3	5	0	0	8
Task 6: Final Site Design	**4**	**35**	**48**	**11**	**98**
Task 6.1: Roadway Alignment and Geometry	0	8	12	2	22
Task 6.2: RV Pad Design	2	10	15	0	27
Task 6.3: Post Development Hydrologic Analysis	2	8	10	4	244
Task 6.4: Drainage	0	6	6	3	15
Task 6.5: Utility Layout	0	3	5	2	10
Task 7: Develop Construction Cost Estimate	**7**	**2**	**8**	**2**	**14**
Task 8: Construction Plan Set	**7**	**10**	**18**	**13**	**48**
Task 8.1: Cover Sheet	0	0	2	2	4
Task 8.2: Existing Site Plans	1	3	5	5	14
Task 8.3: Proposed Site Plans	2	2	4	3	11
Task 8.4: Road Alignment and Profile	2	3	4	2	11
Task 8.5: Details	2	2	3	1	8
Task 9: Project Impacts	**2**	**6**	**0**	**0**	**8**
Task 10: Project Deliverables	**13**	**29**	**30**	**18**	**90**
Task 10.1: 30% Submittal	2	5	6	5	18
Task 10.2: 60% Submittal	3	8	8	4	23
Task 10.3: 90% Submittal	4	10	10	6	30
Task 10.4: Final Submittal	4	6	6	3	19
Task 11: Project Management	**20**	**50**	**20**	**45**	**135**
TOTAL	**64**	**195**	**243**	**158**	**660**