

NORTHERN
ARIZONA
UNIVERSITY



*College of
Engineering, Forestry
& Natural Sciences*

CENE 476 - Project Proposal

Montezuma Castle National Monument Parking Lot Redesign

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December 14th, 2017



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1.0 Introduction

The Montezuma Castle National Monument is in central Arizona along the I-17 Highway between Camp Verde and Sedona. Refer to Figures 1 and 2 for the project site location. Richard Goepfrich Jr. our client, in association with the National Park Service has the following concerns about the existing conditions of the visitor parking lot: poor striping and signage, no accessible picnic area for visitors, poor pedestrian facilities, no drop off area, and insufficient space for large quantities of buses/RV's and passenger cars. Due to these limitations, passenger cars are either turned away from the site or forced to park on the road shoulder during busy visitation days. Frequently, buses giving field trips will have to idle at the Cliff Castle Casino approximately 2.7 miles away.



Figure 1: Statewide view of Montezuma Castle National Monument in Arizona



Figure 2: Parking Lot to be Redesigned

1.1 Project Objectives

The objectives of this project are to:

- Provide a design for improved parking lot layout through striping and signage plan
- Provide a design for a new bus/RV parking lot
- Provide a design for bus drop off zone
- Provide a plan to increase sidewalk usage through improved pedestrian facilities including striping and signage
- Design a usable and accessible picnic area in the existing center island with an interior sidewalk
- Verify that proposed changes do not affect the archaeological, ecological, and natural characteristics of the surrounding area
- Improve aesthetic appearance of the existing center island in the existing parking lot
- Do not change the existing road alignment that enters/exits the park
- Provide a safe sight distance and road conditions for drivers turning into and out of the proposed parking lot
- The intersection onsite may be required to be a controlled intersection for safety of traffic leaving the monument and parking lots.

The intent of this project is to improve the existing conditions of the Montezuma Castle National Monument parking lot in accordance with federal and ADA regulations. These improvements are: to provide more parking spaces reflective of the traffic flow and projected growth of the site, design a picnic area that will be available for visitors, improve facilities for pedestrians within the parking area, and provide better accommodations for large vehicles with a drop off zone and additional parking facilities.

1.2 Project Understanding

Within the Project Understanding section a description on the background of Montezuma Castle, the current site, and technical aspects for this project is provided.

1.2.1 Site Background

Montezuma Castle is home to some of the most magnificent cliff dwellings made of local clays, wood, and stone created by the Sinagua people. Estimated to be nearly 800 years old, the structure consists of 45 – 50 rooms that are hidden in the side of the cliff walls. A significant amount of artifacts found within the ruins of the once thriving culture and are now on display at the visitor center of the park [1]. Since Montezuma Castle is in a hidden location it quickly became an adventure from reality for many. On December 8, 1906, Montezuma Castle was officially registered as a National Monument under the authority of President Theodore Roosevelt. Since then it has continued to attract visitors and grow as a landmark of the Southwest. Figure 3 below shows the highest visitor count for the year of 2016. The peak visitation months are March, April, and October. These months attract visitors for their cool, moderate temperature compared to alternate times of the year. The most popular month was March at 52,776 visitors. The lowest three months are December, January, and August, mainly because they offer the harshest of temperatures from both freezing to heat. The least visited in a month was December at 21,874 visitors. These counts include employee, non-recreational and recreation vehicles on top of the passenger car total.



Figure 3: Number of Visitors of Montezuma Castle per Month

1.2.2 Site Description

The parking lot is currently equipped with 60 regular parking spaces, four ADA parking spaces, and four spaces available for large buses/RV's. In the middle of the parking lot there is a small vegetation area. Buses share the parking lot with passenger cars, and it is difficult for buses to safely navigate the tear-dropped shaped bend due to their high turning radii required, which poses safety threats to passengers and visitors. Pictures of the existing conditions of the site are available in *Figure 4* and more pictures are located in Appendix I.



Figure 4: Existing Site Features

The physical boundaries of the existing parking lot are steep, leading to a very deliberate existing design that fits within the topography of the area. Beaver Creek, a nearby water stream, flows into the Verde River southwest of the site. All existing runoff from the impervious surfaces of the existing parking lot currently flows into Beaver Creek. To assist in the comprehension of the features on site, an existing site schematic has been prepared. The schematic conveys existing passenger car parking, bus/RV parking, the vegetation area, the existing intersection, and beaver creek which runs adjacent to the site. The schematic shows a birds-eye view of the area and it is available in Appendix I. The site schematic was developed in BlueBeam Revu.

1.2.3 Technical Aspects

The project has several aspects that will require technical expertise. These include: surveying, drainage analysis, drafting, and complying with regulations/codes, which are the primary areas of focus.

1.2.3.1 Surveying (Topographic)

For this site, the topographic survey will be very critical because of the precarious location of the site. The boundaries of the existing parking lot appear to be steep, leading to a very deliberate existing design. This could make expansion challenging. It will be important to get precise topographic information to have a clear understanding of the existing conditions around the site in the event that cut-fill values have to be calculated.

1.2.3.2 Drainage Analysis

A drainage analysis of the site will involve considering the changes in impervious area and determining the effect of storm water flow as a result of the proposed design. The site is a National Monument and therefore site design will be under federal jurisdiction. Federal drainage requirements will be the authority on all modifications and design. For this site, it could become challenging as there is a nearby water source where drainage will end up unless directed elsewhere. If the governing requirements do not allow stormwater to drain to this nearby river, a detention basin may have to be designed to accommodate drainage. There could be potential need for an environmental study evaluating the runoff, which will have to fall outside of the scope of this project.

1.2.3.3 Site Plan Design

Design software such AutoCAD and Civil 3D will be critical to delivering the final visual for the new parking lot design. This visual will show the Site Plan Design on a plan view. Ultimately the goal is to produce a set of plans that can effectively show the proposed changes to the site and to do this, team will have to rely heavily on a good survey and drafting skills acquired through schooling and relevant internships.

1.2.3.4 Governing Regulations and Codes

The site is in an interesting jurisdictional position. Though it lies in Yavapai County, research indicates that since it is a National Monument it is federal land. Therefore development only has to comply with the federal standards [2]. In design, it is important to have a set of codes to abide by that give direction to the general development of the site. Therefore, for the team will use federal guidelines if available and Yavapai County guidelines if needed to generate a compliant document.

1.2.4 Potential Challenges

The following section discusses the potential challenges the team will encounter during the project. Firstly, the leading challenge the team will face is coordination of all schedules. The team contains six members, which is 1.5 times the typical capstone team. Coordinating each

other's schedules to where all members can meet at one time will present problems. For example, conflicting class schedules and work schedules will make meeting times difficult.

Secondly, a prominent potential challenge is travel constraints. Montezuma Castle National Monument is located 53 miles South of Flagstaff. Additionally, not all team members have access to a personal vehicle.

Minor challenges for the group include harsh weather impacts and limiting factors of the department such as building availability, limited computer availability and other resource availability such as survey equipment.

1.2.5 Stakeholders

This is a very involved project with a lot of tangible stakeholders in the area. The stakeholders can potentially make the project successful and/or fail. Their opinion should be considered in the final design. .

1.2.5.1 Visitors

Visitors of site will be impacted by this project during the construction period and will want to minimize disturbances at the site. Visitors will also have significant interaction with the final design, so their interests will need to be considered in the design stage.

1.2.5.2 Employees

The employees of Montezuma Castle will be similarly impacted both on a day to day basis and by the improvements made to the site. New design allowed more visitors to be in the site safely will help employees avoid any issues can happen.

1.2.5.3 National Park Service (NPS)

Ultimately this site belongs to the National Park Service (NPS), so improving the overall functionality, safety, and aesthetic of the site will be something the NPS will want to have a say in.

1.2.5.4 Native American Tribes

The site is a Native American monument, so local tribes are impacted by any kind of improvements made in the area and will want to ensure minimal impact is being made to the surrounding environment.

1.2.5.5 Northern Arizona University Capstone Team

The NAU site design team is looking for an effective solution to the current conditions, and are therefore also a stakeholder in the outcome. The team represents Northern Arizona University, who will want their brand tied to a quality design.

2.0 Scope

The following section will convey the work the team will perform to improve the existing conditions of Montezuma Castle National Monument Parking Lot.

2.1 Site Investigation

The first step in the analysis of Montezuma Castle National Monument is to characterize existing conditions at the site.

2.1.1 Assess Current Conditions

A preliminary field visit is required to assess existing conditions of the parking lot. A count of the number of parking spaces must be conducted. Count of passenger car stalls, ADA stalls, and bus/RV spots must be considered. Conversing with the client will provide light on previous issues that need to be considered.

2.1.2 Survey

The first task towards design is the development of a topographic map through surveying. When field work is being conducted, all necessary Personal Protection Equipment (PPE) will be worn. A digital topographic map conveys real life elevations using a modeling. Traditional definitions require a topographic map to show both natural and manmade features existing in the area. A topographic map will be made by surveying the area. Multiple points of elevations will be measured using a total station and a prism rod. The collected data will be processed into AutoCAD, Civil 3D, or other similar software.

2.2 Drainage Analysis

Becoming familiar with the site will require assessment of drainage basins and stormwater systems to allow adequate flow of stormwater when precipitation events occur. Through design and analysis, a new drainage basin and storm water system to the improved parking lot and new bus/RV parking lot will be proposed to accommodate changes in impervious area of the site.

2.2.1 Existing Hydrology

This analysis will require researching previous hydrologic studies of the area. Research on the drainage analysis for similar parking lots with similar conditions will be conducted. For example, an existing drainage basin map and the existing stormwater flow will be analyzed and TR-55 Hydrology Modeling through HydroCAD or similar software will be performed to determine flow on the site. HydroCAD is a design tool to model stormwater runoff.

2.2.2 Existing Hydraulics

Existing infrastructure will be characterized for stormwater conveyance to increase capacity and mitigate problems with the current system. Any modeling for existing or proposed culverts and structures will be completed through FlowMaster, HydroCAD, or similar software. These models will be used and implemented in the parking lot redesign.

2.2.3 Hydrology Design

Once the new parking lot is designed, the flow of water on the surface will change because impervious surfaces are being increased. A TR-55 Hydrology Model through HydroCAD or similar software will be required to examine this change. This model will be used and implemented in the new parking lot design.

2.2.4 Hydraulics Design

To stray stormwater flow away from the parking lot and pedestrian, a sidewalk new stormwater conveyance system is necessary. The design will be to convey up to the 100 year event and not influence the surrounding environment. This design will be implemented into the parking lot redesign construction plans.

2.3 Site Plan

To develop an adequate site plan, familiarization of the area is necessary. All existing conditions must be observed. Once the team becomes familiar with the site, previous as-built drawings provided by the United States National Park Services will be reviewed, if available. These As-Builts will bring awareness of features not accounted for during site visits, such as underground water lines, sewer lines, or missed above ground features.

2.3.1 Existing Parking Lot Features

The existing parking lot turning radii for buses/RV's, ADA compliance on the number of parking stalls, and accessible pathways will be analyzed.

2.3.2 Proposed Parking Lot Feature Design

The proposed parking lot is less than 1000 feet from the Visitor Center and will include new sidewalks and high visibility crosswalks. The proposed parking lot will provide room for bus and RV maneuverability. The new parking lot will provide bio swales, islands of existing land to allow water to runoff. A picnic area in the center of the existing parking lot will be considered with recommendations on which landscape vegetation will be removed or trimmed. Signs will be installed in the site to guide pedestrians to sidewalks and increase the visibility of crosswalks. Having pedestrians use the sidewalks will increase overall safety of the site.

A proposed site schematic has been prepared to assist in the comprehension of the proposed parking lot features. The schematic conveys the proposed picnic area, potential crosswalks, the parking lot that will be redesigned, and the new proposed area for the Bus/RV Parking Lot, and potential sidewalks which will border the picnic area and the road running adjacent to the new lot. The proposed site schematic is available in Appendix I.

2.4 Traffic Analysis

Over the past few years, Montezuma Castle National Monument has struggled to keep up with the increasing number of visitors. During the park's peak seasons, January to April parking lot frequently fills up, causing visitors to park on the shoulder of the road north of the parking lot. This section will include traffic data collection and analysis on traffic control currently in place. To properly analyze traffic, statistical data collection is required. Based off the collected data, further analysis will need to be performed to determine if the intersection to the new parking lot will warrant certain traffic control.

2.4.1 Traffic Data Collection

The first task in conducting the traffic analysis is to record the number of visitors during peak hours. Due to heavy visitation, the main parking lot fills up and guests must park on the side of the road and this causes visitors to not utilize the sidewalks. In addition to traffic counts, the team will research and recommend site signage to persuade visitors to use the sidewalks and new proposed crosswalks. Data collection will be performed by counting passenger cars, buses, and RV's with a JAMAR board with cross references to traffic counts provided by the United States National Park Services. Next, the team will determine stay durations for visitors arriving in tour buses, RV's and passenger cars. This will be done by timing visitors when they enter the National Monument until they leave.

2.4.2 Traffic Control

Adding a parking lot to the site potentially warrants a traffic controlled sign. The type of traffic controlled intersection will be analyzed using the Manual on Uniform Traffic Control Devices (MUTCD) 2009 Edition Chapter 4C: Traffic Control Signal Needs Studies [3]. Considering existing conditions regarding overgrown vegetation around the controlled intersection, a stopping sight distance and line of sight analysis is required to ensure motorist safety and comfortability turning into/out of the parking lot.

By driving along the downhill slope near the entrance of the National Monument, visitors are likely to surpass the posted speed limit. As such, design on posted speed limits and warrants for installing a traffic control device shall be required. This traffic control device if required will be determined based off the MUTCD. All visitors shall be made aware of changed conditions through proper signage.

2.5 Impacts

Due to the sacred nature of the site, the team must not disturb the environmental and ecological aspects of the area. The team will carefully consider every task being performed on site to ensure preservation of surroundings. The team will use hydrologic modeling and HydroCAD to determine the runoff peak discharge for the existing and future parking lot. The team will make sure to include a crosswalk to the picnic area to increase the safety of the lot. The team will analyze the proposed parking lot for efficiency, safety, and capacity. In relation to the client's needs, the picnic area and walking paths must be aesthetically appealing. Finally, the team will analyze and estimate the movement of visitors to ensure a greater use of sidewalks.

2.6 Construction Plans

The National Park Services is requesting a set of construction plans for review in the form of plan set sheets. The plan set will include the following sheets:

- The cover provides an overview of the location with respect to Camp Verde, AZ, along with all appropriate contact information for the client, engineers, and utility companies as applicable.
- The notes and details sheet include applicable codes and standards the contractor will abide by, along with referenced details throughout the plan set.
- An existing site plan will show surveying control points and current site infrastructure. This plan will also show demolition necessary to the current conditions.
- The grading and drainage sheets will highlight the proposed parking lot grading plan with all necessary contours, details, and plan/profiles of stormwater infrastructure.

- The improvements sheet will show striping and signage of the new parking lot and improvements to curb and gutter.
- The final sheets include Safety/Risk factors that show hazardous areas and a stormwater Pollution Prevention Plan (SWPPP) that describes the recommended mitigation practices the contractor is allowed to utilize in order to reduce pollution in stormwater systems during construction.

2.7 Deliverables

Eleven deliverables are being provided to the client. Cost of engineering, staffing, and scheduling will be provided to the client to inform them of the people involved with the engineering team. In addition, progress reports at 50% design, construction plans, and status presentations will be given to the client. Providing 50% completion plans allows time for the client to make the designer aware of minor changes (engineer's discretion) to occur without fees. The final design report and construction plans are provided to the client for bidding purposes. A final presentation, with a finalized website, for the client at the Undergraduate Presentation event will indicate closure to the project and allow stakeholders to ask any final questions.

2.8 Project Coordination

The engineering team is required to meet with the Grading Instructor (*Alarick Reiboldt*), Technical Advisor (*Stephen Irwin*), Secondary Technical Advisor (*Brendan Russo*), and Client (*Richard Goepfrich Jr.*) every three weeks or as necessary. Budget tracking, resource allocation, and scheduling management will occur weekly, and notifications for team meetings will be sent to the grading instructor, technical advisors, and/or client as necessary for updates. Lastly, coordinating schedules can be difficult because the team contains six members. Using a calendar availability software, the team will determine the meeting times for the group.

2.9 Project Limitations

All work in this section is excluded from our scope of services and will require a specialized licensed engineer to complete tasks within those fields. Our firm will not provide electrical, data, or similar calculations, specifications, or products for the plan sheet, landscaping details, geotechnical and structural specifications.

2.9.1 Risk Management

The following section will discuss how to mitigate the challenges presented in Section 1.2.4. The leading challenge the team will face is coordination of all schedules. Coordinating each other's schedules to ensure all members can meet at one time will present problems. To assist in accommodating this challenge, whenisgood.net was used to see an overview of the team's

availability [4]. Each member inputs their respective availability and an overview of “free times” can be seen. Based off the availability each teammate provided, the team will meet on Friday at 3PM through the completion of the project.

The second challenge discussed was travel constraints. Montezuma Castle National Monument is located 53 miles South of Flagstaff, thus, when site visits are required, vehicular travel is required. Additionally, not each team member has access to a personal vehicle. To assist in overcoming this challenge, Northern Arizona University will provide transportation. The university loans out vehicles for school related matters, consequently, the team will take full advantage of their accommodations and make travel plans in advance to ensure accessibility to a vehicle.

To manage minor challenges, the team will conduct field work only on acceptable weather conditions, and use school computers on non-peak hours.

2.9.2 Exclusions

The following list conveys tasks the team will not perform. Scope exclusions include: Environmental Impact Analysis, Archaeological Classification, and Geotechnical components, Construction Management (post design services), Structural Design, Utility Conflicts and Design, Floodplain Impacts. Any work not explicitly defined in the scope will be excluded from the project.

2.9.3 Project Assumptions

Listed below are all assumptions to the project. Anything not explicitly stated is not included.

- Client will provide fees for entrance.
- Client will provide fees for any permits or licenses.
- Unfamiliarity with the site may cause project delay such as utility lines, water, and waste.
- Design to be part of Federal and/or County Design Standards where necessary.

3.0 Schedule

A schedule has been created to map out the eventual completion of the project. The schedule is based on scope of project tasks, subtasks, and time duration for each task. It is assumed each team member will work 10 hours per week for the next 14 weeks of the spring semester.

Work on the project for next semester will commence January 17, 2018. The project will be completed on May 6, 2018. Table 1 below conveys the major tasks, including the time duration for each. The schedule was developed using Microsoft Project. The full schedule for the entire project is available in the Appendix. The critical path for project is shown as a red line.

Table 1 below outlines the major tasks with durations and completion dates. The final week and a half of the project will be used for construction document review. The team, the client, and the technical advisor will thoroughly review documents. The revision process will take place between April 25, 2018 and May 6, 2018.

Table 1: Task with Duration and Completion Date

Task Name	Duration	Mandatory Completion Date
Site Investigation	8 Days	January 30, 2018
Traffic Analysis	4 Days	April 1, 2018*
Hydrology	45 Days	March 27, 2018
Site Plan	56 Days	April 10, 2018*
Impacts	44 Days	April 3, 2018
Construction Documents	66 Days	April 25, 2018

* Denotes not on critical path

Table 2 displays milestones which are the final deliverables of this project. These deliverables will be provided to our client. They include 50% and 100% Design Report, 50% and 100% Construction Documents, and a Hydrology and Hydraulics with a Traffic Analysis Impact Report.

Table 2: Milestones with Completion Dates

Milestone	Completion Date
50% Design Report & Construction Documents	March 16, 2018
Hydrology and Hydraulic Impact Report	April 3, 2018
Traffic Analysis Impact Report	April 13, 2018

100% Design Report & Construction Documents	May 8, 2018
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The 50% Design Report with 50% Construction Documents are important for our client to display that our team is moving forward smoothly with the design of the scope listed above. This is the point in the project where our client can ask questions about the design and determine whether if this design fits their needs. Minor modifications can be suggested at this time to the engineering team.

The 100% Design Report and 100% Construction Documents and impact reports are the final deliverables. The design report is a written clarification of our design and the Construction Documents are used for construction and bidding for our client.

The Hydrology and Hydraulic Impact Report will state the existing hydrology and how it will change with the new parking lot. This also states why our team recommends certain hydraulic features to mitigate the change.

The Traffic Analysis Impact Report will state the existing traffic conditions such as counts, sight distances, traffic movements, and turning radii. With the addition of a parking lot the onsite intersection may require to be controlled and the report will provide our recommendation on mitigating conflicts.

The complete schedule can be viewed in the Appendix where the critical path is highlighted. Many of the tasks are on the critical path because the project design cannot move forward until it meets the tasks prior.

4.0 Staffing

The staffing will include the job descriptions and pay rate for each entity will receive. The listed pay rates below are under assumption that tasks will be completed during normal business hours. Overtime and/or outside rates will be charged 1.5 times the normal rate. All rates below include employee compensation, benefits and overhead associated with their employment.

4.1 Senior Engineer

Senior Engineer Description:

- Must have the right to work and remain in the United States
- Plans, assigns, trains, instructs, assists, supervises, and evaluates the work of professional and technical staff.

- Provides technical expertise on matters pertaining to policies, procedures, practices, standards, and departmental position on pending discretionary actions to public and private agencies and individuals.
- Reviews and checks designs, calculations, contractors' shop drawings, and engineering drawings for construction, repair, and maintenance projects.

Senior Engineer Skills:

- Must hold an applicable Professional Engineering license and not have demerits on record within the United States or governing body of region.
- Must be familiar with governing bodies' ordinances relating to grading, drainage, street improvements, subdivisions, and land use regulations.
- Communicate effectively with a variety of individuals representing diverse cultures and backgrounds and function calmly in situations which require a high degree of sensitivity, tact, and diplomacy.

The Senior Engineer billing rate is \$120/hr. This rate includes all compensation, overhead, and fees.

4.2 Staff Engineer

Staff Engineer Description:

- Must have the right to work and remain in the United States
- Responsible for project management
- Coordination along with more technical design
- Bachelor's Degree in Civil and/or Environmental Engineering
- Consider health and safety regulations
- Projecting the financial costs

Staff Engineer Skills:

- Must hold an applicable Professional Engineering license and not have demerits on record within the United States or governing body of region.
- Experience in Project Management
- Skillful with computer aided drafting and engineering design
- Ability to collaborate and lead others
- Quick problem-solving skills

The Staff Engineer billing rate is \$100/hr. This rate includes all compensations, overhead, and fees.

4.3 Surveyor

Surveyor Description:

- Must have the right to work and remain in the United States
- Complete a degree in surveying or a related area
- Pass the FS/FE exam
- Travel to the site and select reference points to determine the exact location of important features.

- Research land and survey records, and land titles

Surveyor Skills:

- Mathematic and engineering skills
- Ability to work with others
- Ability to work and present work neatly and accurately
- Ability to use a range of sophisticated surveying equipment and software
- Ability to analyze and interpret graphical and survey data.

The Surveyor billing rate is \$90/hr. This rate includes all compensation, overhead, and fees.

4.4 Engineer in Training (EIT)

EIT Description:

- Must have the right to work and remain in the United States
- Bachelor's Degree in Civil and/or Environmental Engineering
- Conduct test and surveys
- Basic knowledge of engineering systems and applications of startup and commissioning methods.

EIT Skills:

- Being able to articulate concepts and ideas both contextually and visually
- Good technical and IT skills
- Ability to perform written and verbal communication skills
- Strong work ethic

The EIT billing rate is \$90/hr. This rate includes all compensation, overhead, and fees.

4.5 Administration

Administration Description:

- Must have the right to work and remain in the United States
- Preparing and submitting all deliverables
- Scheduling and coordinating meetings, interviews, events and other similar activities
- Managing documents and files

Administrative Skills:

- Communication Skills
- Technical Skills (Microsoft Office, AutoCAD, ETC...)
- Ability to work independently or on a team

The Administrator billing rate is \$60/hr. This rate includes all compensation, overhead, and fees.

4.6 Tech

Drafter Description:

- Must have the right to work and remain in the United States
- Must have a Bachelor's Degree in Drafting or a related field area

- Update and correct plans submitted
- Assemble Site plans, Drawings, and details

Drafter Skills:

- Ability to work independently and within a team
- Perform good communication skills
- Basic knowledge on Drafting softwares (AutoCAD, Civil 3D, ETC...)

The Drafter billing rate is \$60/hr. This rate includes all compensation, overhead, and fees.

4.7 Intern

Intern Description:

- Working towards a degree in Civil and/or Environmental Engineering or Construction Management.
- Assist the Engineer with obtaining information and approvals for processing drawings and submittals.
- Monitor field variations and keep the Project Superintendent informed of any changes
- Must have the right to work and remain in the United States

Intern Skills:

- Familiarity with technical systems (AutoCAD, WaterGEMS, etc...)
- Ability to Problem Solve and Critically think
- Ability to communicate and work within a team

The Intern billing rate is \$50/hr. This rate includes all compensation, overhead, and fees.

5.0 Cost of Engineering Services

The cost of engineering services is summarized in two categories; staff hours and reimbursable. These costs are expanded upon below.

5.1 Staff Hours

Most of the project cost is attributed to the man hours associated with design. The above section outlines the billing rates for all staff members on the project team along with their specific role to the project. Each major task was broken up by smaller subtasks as seen in section 3.0 above. The smaller tasks were divided among the team by staff member to calculate the hours required. The total hours per staff member per major task can be seen in Table 3 below. A full breakdown of the staffing per subtask can be seen in Appendix 3. The total hours for each task were multiplied by their respective billing rates. The project is expected to total 881 billable hours and cost \$67,745

Table 3: Summary of Cost of Services

Task	Staff (Hours)							Total Task
	Project Engineer	Staff Engineer	Survey	EIT	Admin	Tech	Intern	
Site								
Investigation	4	4	35	30	2	2	4	81
Traffic Analysis	4	2	0	23	2	0	2	33
Hydrology	8	15	5	49	2	6	15	100
Site Plan	8	12	0	22	2	10	12	66
Impacts	8	7	0	20	2	5	7	49
Construction								
Plans	20	34	0	64	5	40	34	197
Deliverables	2	2	2	106	25	5	2	144
Project								
Coordination	5	5	5	132	25	5	5	182
Hours Total	59	81	47	446	65	73	81	852
<i>Billing Rate</i>	\$120	\$100	\$90	\$80	\$65	\$60	\$50	
<i>Position Total</i>	\$7,080	\$8,100	\$4,230	\$35,680	\$4,225	\$4,380	\$4,050	\$67,745
Reimbursable								
	Rate (\$/Mi)	Expected	Total				PROJECT TOTAL	
Mileage*	0.65	212	\$137.8				\$67,883	

Plan Production To be billed per sheet as required for deliverables

*Assumed two site visits. Additional costs associated with travel included in hourly rate schedule shown above

5.2 Reimbursable

In addition to staff hours, mileage will be billed to the project at a rate of \$.65/mile. Two round trips are expected over the course of design, which totals \$137.80. Plan production is another anticipated reimbursable, which would be billed per page and on an as required basis. The total cost of the project is expected to be \$67,883.

6.0 References

- [1] Nps.gov. (2017). History & Culture - Montezuma Castle National Monument. [Online] Available at: <https://www.nps.gov/moca/learn/historyculture/index.htm> [Accessed 27 Oct. 2017].
- [2] "Design Standards - (U.S. National Park Service)", Nps.gov, 2017. [Online]. Available at: <https://www.nps.gov/dscw/dstandards.htm>. [Accessed: 13- Sep- 2017].
- [3] Manual on Uniform Traffic Control Devices - For Streets and Highways (2009 Edition). (2009). [Place of publication not identified]: U.S. Dept. of Transportation - Federal Highway Administration, p.Chapter 4C.
- [4] Whenisgood.net. (2017). WhenIsGood. [Online] Available at: <http://whenisgood.net/> [Accessed 20 Nov. 2017].

7.0 Appendix

Pictures of the existing site, taken September 2017.





Existing Site Schematic:



