Letter of Transmittal

April 23, 2020

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Flagstaff, AZ 86001

Dear Professor Lamer,

This document was written to solicit comments on Team Outlier's understanding of the project at hand. The purpose of the project understanding is for Team Outliers to comprehend what the project entails before beginning the design process.

The team would appreciate any feedback on the document by April 30, 2020, or at your earliest convenience so that any suggested modifications can be promptly addressed.

Thank you for reviewing this document, and Team Outliers looks forward to hearing your feedback.

Sincerely,

Courtney Freeman- Environmental Engineer
Max Burke- Civil Engineer
Andrew Singer- Civil Engineer

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Team Outlier
Engineering

PROJECT PROPOSAL

CENE 476C

Coppermine Road Water & Sewer Line Extension

Version 5

Prepared for:
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Date: April 23, 2020

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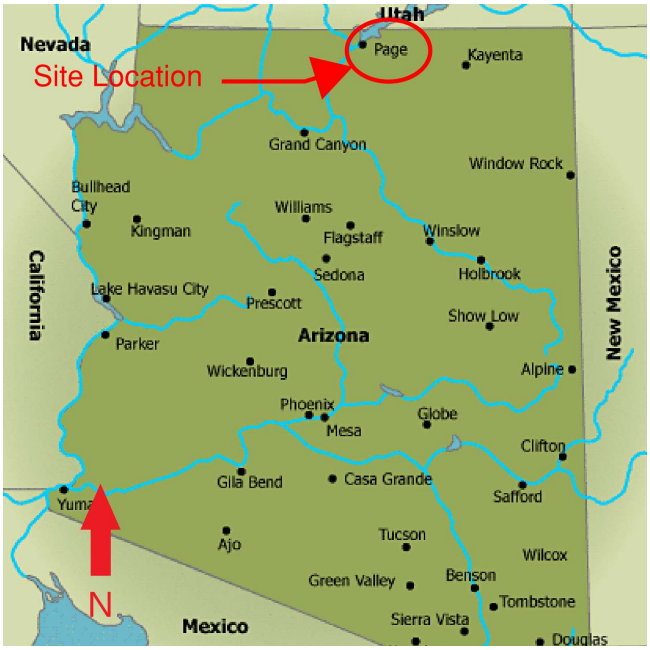
1.0 Project Understanding

1.1 Project Purpose

The goal of the project is to extend water and sewer main across commercial property 947 N. Coppermine Rd. to adhere to Page, AZ city standards. The sewage and potable water lines are currently capped at Bruce's Sales and Leasing and needs to be extended to the new property before construction of the new building begins. The project is needed to deliver potable water to the new property and remove the sewage once the development is in use. The testing and analysis of this project will determine the proper pipe sizes, materials, sloping, and design functions needed to comply with the necessary standards and regulations for sewage and water line design.

1.2 Project Background

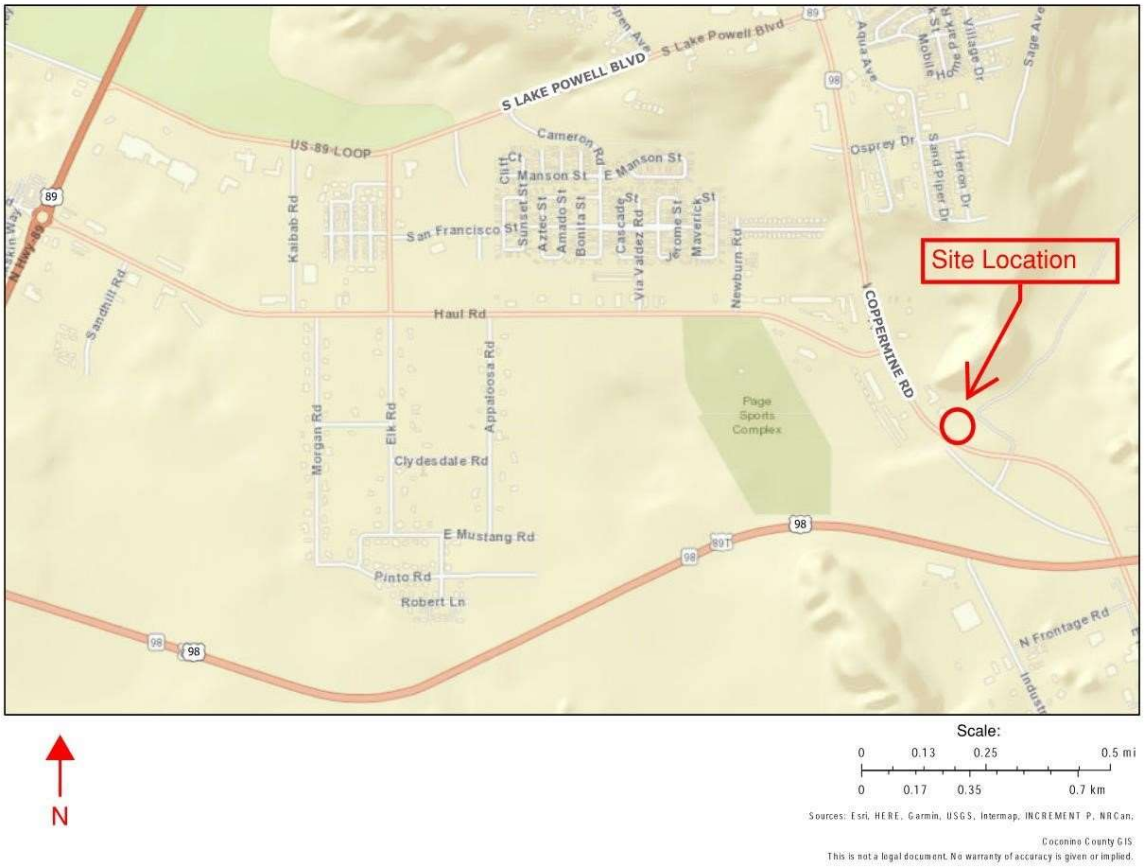
The project location is at parcel number 80210007W in Section 5 T40N, R9E of the Gila and Salt River Meridian in southern Page, AZ along Coppermine Rd. Figure 1-1 shows where Page is located in relation to the state of Arizona. Page is in the North central part of Arizona and borders Utah.



[1]

Figure 1-1: Location of Page in Arizona

Figures 1-2 and 1-3 displays aerial views of the property location. The property lies on Coppermine Road and meets up with AZ-98.



[2]

Figure 1-2: Project Vicinity Map

Figure 1-3 shows in detail the site location and the properties surrounding the project.

[2]

Figure 1-3: Project Vicinity Map (Zoomed In)

The property is currently undeveloped and borders two commercial establishments on the northwest side of the property. The future water and sewer line extension will service a storage warehouse on the property. The property is only located inside the city of Page limits, so there will be no construction on the Navajo Reservation. The area is fairly isolated in the south and northeast from other infrastructure in the area. However, as for construction purposes, there will be heavy traffic volumes due to the new highway that leads through Coppermine Road to downtown Page.

1.3 Technical Considerations

Some technical considerations that the team will be prepared to accomplish in the field visit are a site investigation of existing geographies and land surveying. This will help the engineering team to better understand the geological and topographical conditions of the project site. As for the office, it is necessary for the engineers to conduct topographic mapping through programs like AutoCAD and Civil 3D with the survey data that was found in the field. Other programs that will be used in the analysis and design include, Bentley WaterGems, Bentley FlowMaster, and

Microsoft Excel. These programs will aid in determining the pipe size, slope, and supply pressure of the potable water and sanitary sewer line, along with the codes and regulations that are provided by City of Page and Coconino County.

Other major technical considerations are grading and drainage designs and the erosion control plan. These are essential to this project because the new pipeline extension can not cause runoff issues that were not previously a problem. The engineers will follow the strict guidelines that are addressed by the Coconino County Engineering Design and Construction Manual. The grading for this project will consider the best possible cut and fill slopes that follow closest to the topography of the land. The erosion control plan will be set in place by the engineers for permanent erosion control and during the construction phase as part of the SWPPP requirements.

1.4 Potential Challenges

Like any other project, challenges may be present during project design. Challenges may include weather during the site investigation, availability of equipment, existing topography, and existing conditions. Due to the surveying team living in Flagstaff, AZ, which is two hours from the site, then it will not be easy to reschedule if weather becomes a problem. The surveying team would not be able to conduct a survey of the land until the precipitation in the area has moved pass. This could push the schedule back and create a delay on deadlines. The equipment being available could also be an issue because there are other projects that may be renting the equipment over a extended period. The team will try their best to request the equipment ahead of time for specified dates. Existing topography and conditions can create a challenge in the future if there is large elevation change that is unexpected. The team will better understand if this is an obstacle once the site investigation is complete. Team Outlier will rely on effective communication and extensive preparation to prevent these from happening.

1.5 Stakeholders

The potential stakeholders include Page Utility Enterprises, the developer, Mark Lamer, City of Page, Arizona Department of Environmental Quality (ADEQ), and Team Outlier Engineering. Page Utility Enterprises provides and manages its customer's water distribution, sewer collection, wastewater and water treatment. The Water Treatment Plant maintained by Page Utility Enterprises complies with the strict guidelines provided by the ADEQ to ensure safety to the public. Team Outliers Engineering will follow the City of Page's codes and regulations thoroughly for the design of the sewage/water line extension. This is important to the stakeholders so that no cross-connections leak in the potable water supply. Mark Lamer, the client for the project is counting on the engineers at Team Outlier to develop a plan set for a sewage and potable water line extension that addresses the needs of the developer and the City of Page.

2.0 Scope of Project

2.1 Task 1.0: Analyze Existing Conditions

2.1.1 Task 1.1: Site Visit Planning

Prior to a site visit, Team Outlier will plan and prepare for what is needed to perform a site investigation. This preparation will allow the team to complete all tasks needed for a site investigation in a single trip and avoid unnecessary revisits. Preparation includes checking out surveying equipment with appropriate materials, researching and bringing codes/standards literature, and plan travel arrangements with team, client, and technical adviser.

2.1.2 Task 1.2: Site Investigation

Team Outlier will conduct an on-site investigation of the existing property at 947 N. Coppermine Road, Page, Arizona. The site investigation will provide valuable insight to what the team will be working with regarding existing utilities and project site topography. Additionally, identifying the existing utilities will provide safety precautions for those involved with working in potentially hazardous conditions. The team will identify and map existing water & sewer main stubouts for service connections, and overhead power lines. This task will be completed by walking the site and overviewing existing site plans.

2.1.3 Task 1.3: Land Survey

A topographic land survey will be conducted to create a contour map of the property. This will not include any form of a boundary survey or construction survey. It will only be done to locate natural and man-made features on the property. The City of Page requires that a survey be performed using tripods and total stations rather than aerial photography. These instruments will be borrowed from the Northern Arizona University.

2.2 Task 2.0: Mapping and Modeling Existing Conditions

2.2.1 Task 2.1: Create Topographic Map

A topographic map with plots for the proposed potable water and sewer line extensions will be made utilizing AutoCAD/AutoCAD Civil 3D. The use of these programs will aid the client and engineering team to visually understand the project design from computer generated imaging. All AutoCAD drawings will be completed using personal computers or NAU Engineering computers.

2.2.2 Task 2.2: Hydrologic Analysis

A final drainage report is required by the state of Arizona to ensure proper drainage and detention/retention for all development that adds impervious surface to a site. This includes pre- and post-development land use and flood paths, a hydrology and hydraulics section with data sheets and calculations, a grading plan, erosion protection, inflow and outflow hydrographs, detention plans, etc. The drainage report is extensive, and many items will not apply to our project. The items that do apply will be considered in the construction plans and outlined in the final proposal.

Proper site grading will be necessary post-construction. A slope of 3% is desired, if closer to 10% or -5%, a fill, retaining wall, or swale may be necessary to ensure surface runoff will be contained after construction. This is to allow stormwater runoff and will be important for future construction on that site. Considerations for grading will be outlined in construction plans. Erosion will occur post-construction in the pipe trench and the rest of the property. Specifically, with pipe corrosion and earth movement.

2.3 Task 3.0: Hydraulic Analysis

2.3.1 Task 3.1: Determine Water Demand and Sewer Design Flow

The water demand must be determined to properly design the pipe. The average daily demand must be calculated by using typical distribution of per-capita water demand or from information provided by Page Utility Resources or the client. Team Outlier will use this data to determine maximum daily demand, maximum hourly demand, and need fire flow based on the proposed development. These values will determine the required design flow for our system.

2.3.2 Task 3.2: Municipal Potable Waterline

Selection of a pipe size will be selected for a potable water extension. Pipe size selection will provide water to the project site and for any future extensions. City of Page General Development and Subdivision Regulations requires that a pipe network analysis will be performed using the Hardy Cross Method or equivalent analysis. Pipe material that is safe for potable drinking water will be selected. Pipes will be located, examined, and a material will be determined based on the pipe conditions and existing material. Pipe pressure for the potable water network will be determined. This is to assure that the minimum pressure of 20 psi is available during open flow. Checking pressure will be completed by using Bernoulli's principle and with a hydrant test. Calculations for major and minor losses for potable water lines will be determined. The finding of major and minor losses will be used for pipe network design.

2.3.3 Task 3.3: Sanitary Sewer

For the development of a sanitary sewer network, a complete analysis will be considered. A complete analysis for sewer design will allow the sewer extension design to meet codes and standards. Items that will be considered for the design are pipe size, pipe material, slope, velocity, and self-cleansing. The use of Manning's equation, tractive force method, and City of Page General Development and Subdivision Regulations will be used for the sanitary sewer design. Slope of the landscape along the roadway will be measured through topographic analysis and physical measurement. Ground slope is crucial for pipe networks, especially when gravity is the main director. Slope measurement will be done with a laser level, survey equipment, and/or potentially field measurement using string and stakes. Design calculations will be done using the Manning's formula based on the determined velocity.

2.4 Task 4.0: Construction Plans

2.4.1 Task 4.1: Potable Waterline

Construction plans for the potable waterline extension design will follow the set standards in the CADD Engineering Design Manual. A cover page, code plans and details, civil details, grading and drainage plan, utility plan and profile of the potable waterline extension, and an erosion control plan will be included. The construction plans are for the future construction of a potable waterline extension design. It will be designed using information found from the site investigation to determine pipe location, pipe size, pipe pressure, and pipe material.

2.4.2 Task 4.2: Sanitary Sewer Line

The construction plans for the sanitary sewer line will be designed to follow all the set standards in the CADD Engineering Design Manual. The construction plans are necessary for the future construction of the sanitary sewer line design. It is going to be designed using the information found in the site investigation to determine the best possible location, pipe size, and pipe material.

2.4.3 Task 4.3: Construction Cost Estimate

The cost of construction will be estimated based on several factors. These cost factors will take a variety of sources into consideration. These include technical advisors, previous projects, and construction procedures from reliable sources. Team Outliers will seek out the expertise from technical advisors and other professionals. Previous projects team members worked on will be applied in the cost estimation. Team Outliers will research similar construction projects in Northern Arizona. The project will take the cost of materials, labor, equipment, and engineering services into consideration.

2.5 Task 5.0: Project Management

2.5.1 Task 5.1: Project Impacts

Team outlier will address the impacts as they arise throughout the project.

2.5.1.1 Task 5.1.1: Regulatory

Regulatory impacts ensures that the engineering team follows and abides policies set by city, state, and federal organizations. This allows the success of the project while following codes and standards.

2.5.1.2 Task 5.1.2: Health/ Environmental

The safety and protection of the people and the environment will be upheld by Team Outliers. This is to ensure that no person or the environment is harmed in the design and construction process for the water and sewer extension.

2.5.1.3 Task 5.1.3: Economic

The financial impact to the property owner and city of Page will be considered throughout the project design. This is so that no entity is burdened with any unforeseen financial expenses.

2.5.1.4 Task 5.1.4: Social

Team Outliers effect on the surrounding community is valuable. The success of the project will be based on the successful completion and the positive impact it has on the community.

2.5.2 Task 5.2: Resource Management

Budgeting will be incorporated into the design work. This is to manage and track a budget with considerations to work, materials, travel expenses, equipment, and team hours. Budgeting will be managed through tracking hours and expenses on timesheets and a Gantt chart.

2.5.3 Task 5.3: Schedule Management

A schedule will be created to map out individual tasks with the number of days each one will take. Developing and maintaining a structured schedule will be important to completing our deliverables and milestones on time. The schedule may be adjusted depending on the team's ability to stay ahead of schedule or potential obstacles that put us behind schedule.

2.5.4 Task 5.4: Meetings

2.5.4.1 Task 5.4.1: Team Meetings

Team meetings will be conducted on a weekly basis to share and discuss progress on the project. These meetings will be held in the NAU Engineering building.

2.5.4.2 Task 5.4.2: Technical Advisor Meetings

Meetings with the technical advisor will be held for technical guidance and input. These meetings will be held in the NAU Engineering building.

2.5.4.3 Task 5.4.3: Grading Instructor Meetings

Meetings with the grading instructor will be held to ensure the project stays on task. These meetings will be held in the NAU Engineering building.

2.5.4.4 Task 5.4.4: Client Meetings

Meetings with the client will be held to ensure a full understanding of the client's demands. These meetings will be held in the NAU Engineering building.

2.5.5 Task 5.5: Project Deliverables

2.5.5.1 Task 5.5.1: 30% Report

A report will be done with 30% of the project completed. The 30% project completion will include the tasks 1.1, 1.2, and 1.3. Additionally, tasks 2.1 and 2.2 will be completed by the engineering team

2.5.5.2 Task 5.5.2: 60% Report

A report will be provided with 60% of the project completed by completing up to the Hydraulic Analysis. This will include tasks up to 3.1, 3.2, and 3.3.

2.5.5.3 Task 5.5.3: 90% Report

A report will be provided with 90% of the project completed with tasks 4.1 and 4.2 being completed by the engineering team.

2.5.5.4 Task 5.5.4: 90% Website

A project website will be 90% complete with relevant project information. This entails that most documents and links will be uploaded with exclusion to the final proposal and final presentation.

2.5.5.5 Task 5.5.5: Final Presentation

A final presentation will be presented by all team members to a board for final review. A presentation will demonstrate the team's final design for the water and sewer extension. The final presentation will utilize Microsoft PowerPoint with design information inputted from Team Outlier.

2.5.5.6 Task 5.5.6: Final Report and Website

Team Outliers will submit a fully completed report for the final design. A website will be developed by the engineering team. The website will provide available documents, proposals, presentations, and reports. These documents will be available for the client to view. A company domain with website information uploaded into it will make up a fully functioning website.

2.6 Project Exclusions

Project exclusions are to identify items that will not be performed by Team Outlier Engineering. Team Outlier will be designing the water/sewer extension and will not be involved with the construction of the utility extensions and connections. Due to the size of the project being relatively small, no geotechnical, highway/transportation, or environmental engineering work will be performed for this project. The analysis for the existing sewer and water main extension to the property will be excluded.

3.0 Project Schedule

3.1 Overview

The Coppermine Road water and sewer main extension project design will begin August 25, 2020 and will be completed by December 10, 2020. Major tasks include analyze existing conditions, mapping & modeling existing conditions, hydraulic analysis, construction plans, and project management. The project will meet 30%, 60%, and 90% milestone deliverables. Deliverables for task completion can be seen in the Gantt chart provided.

3.2 Milestones

There are five milestones throughout the project. These milestones are important dates along the project, including project deliverables. The milestones are site visit, 30% submittal with presentation, 60% submittal with presentation, 90% submittal with presentation, and 100% final submittal with presentation. The milestone tasks are highlighted in green on the Gantt chart.

3.3 Critical Path

Appendix A contains the completed Gantt chart with a critical path shown in red. Team Outlier will maintain the timing of all the critical path items by meeting milestones set in place throughout the project. The critical paths include the site investigation and land survey at the initial start of the project. This leads to creation of a topographic map. This map will then allow team to perform hydraulic analysis by determining the design flow for potable waterline and sanitary sewer. From this construction plans will be developed for both potable and sanitary

sewer lines. The project deliverables for 30%, 60%, 90%, and final report will be provided by Team Outliers. As well as final presentation and website.

4.0 Staffing

There are four staff members working on this project including a senior engineer, professional engineer, design engineer, and intern. The Senior Engineer (SEGR) is a licensed professional engineer with more than 10 years of experience in civil design. A SEGR is an individual that passed the Fundamentals of Engineering Exam (FE) and the Professional Engineering Exam (PE) and has 10+ years of engineering experience. They also are required to have a master's degree at a minimum. The Professional/Municipal Engineer (PEGR) has at a minimum taken the Fundamental Engineering Exam (FE) and it is preferred that they have a Professional Engineer License. They must also at a minimum have a bachelor's degree and have five or more years of experience in the engineering field. The Design Engineer (DEGR) is experienced in creating detailed schematics, surveying, and municipal projects. They must have a minimum of three years of CAD experience and bachelor's degree. The design engineer will perform a bulk of the field work. The Engineering Intern (INT) will assist all aspects of the engineering project. The position requires that the intern is enrolled into a ABET accredited institution, in good academic standing, and able to multitask.

Table 4-1 demonstrates the staff hours for each sub-task as they pertain to each member. The senior engineer is scheduled to work 71 hours for the completion of the project. Most of their hours will be coming from managing the project, which include attending meetings and red-lining the report deliverables. The professional engineer is scheduled to work 182 hours. Their job will be to assist in the site visit, attend meetings, aid in the design of the topographic map, complete an analysis, and help in the creation of the construction plans. The design engineer will work the most hours for this project, with a total of 235 hours. These hours will be spent in the field surveying, verifying the existing conditions, aiding in the analysis, designing the construction plans, and guiding the company intern. The intern will assist primarily the design engineer in surveying, analysis, and project management within their ability. The total hours the intern will be working is 205 hours.

Table 4-1: Staffing Analysis

Task	Staff (hr)				Total Task
	Senior Engineer	Professional Engineer	Design Engineer	Intern	
Task 1.0: Analyze Existing Conditions	**0**	**22**	**22**	**22**	**66**
Task 1.1: Site Visit Planning	0	6	6	6	18
Task 1.2: Site Investigation	0	8	8	8	24
Task 1.3: Land Survey	0	8	8	8	24
Task 2.0: Existing Conditions	**2**	**16**	**25**	**25**	**68**
Task 2.1: Create Topographic Map	1	6	15	15	37
Task 2.2: Hydrologic Analysis	1	10	10	10	31
Task 3.0: Hydraulic Analysis	**3**	**24**	**24**	**18**	**69**
Task 3.1: Determine Water Demand and Sewer Design Flow	1	8	8	6	23
Task 3.2: Municipal Potable Waterline	1	8	8	6	23
Task 3.3: Sanitary Sewer	1	8	8	6	23
Task 4.0: Construction Plans	**8**	**50**	**50**	**26**	**134**
Task 4.1: Potable Waterline Design	4	16	16	10	46
Task 4.2: Sanitary Sewer Line Design	4	16	16	10	46
Task 4.3: Cost Estimation	2	8	8	6	24
Task 5.0: Project Management	**58**	**70**	**114**	**114**	**356**
Task 5.1: Project Impacts					
Task 5.1.1: Regulatory	0	0	6	6	12
Task 5.1.2: Health/Environmental	0	0	6	6	12
Task 5.1.3: Economic	0	0	6	6	12
Task 5.1.4: Social	0	0	6	6	12
Task 5.2: Resource Management	4	4	0	0	8
Task 5.3: Schedule Management	0	8	0	0	8
Task 5.4: Meetings					
Task 5.4.1: Team Meetings	12	12	12	12	48
Task 5.4.2: Technical Advisor Meetings	4	4	4	4	16
Task 5.4.3: Grading Instructor Meetings	4	4	4	4	16
Task 5.4.4: Client Meetings	4	4	4	4	16
Task 5.5: Project Deliverables					
Task 5.5.1: 30% Report	4	5	8	8	25
Task 5.5.2: 60% Report	6	6	10	10	32
Task 5.5.3: 90% Report	8	8	12	12	40
Task 5.5.4: 90% Website	4	5	8	8	25
Task 5.5.5: Final Presentation	4	5	8	8	25
Task 5.5.6: Final Report & Website	4	5	20	20	49
Staff Total	**71**	**182**	**235**	**205**	**693**

5.0 Cost of Engineering Services

The total cost for the completion of the project amounts to $66,382. Table 5-1 shows the final estimate for the overall cost of the personnel, travel, and supplies. Personnel base pay rates have been assigned to each title based on market average values. The travel includes one roundtrip equivalent of gas mileage to Page from Flagstaff and a full day vehicle rental. The only supplies needed for the completion of the project is personal protection equipment and survey equipment rental for the day. The hourly rates presented in this proposal is for the employee wage and overhead. Overhead includes employee office supplies, software programs (AutoCAD, Bentley, etc.), travel arrangements, office property expenses, and insurance.

Table 5-1: Final Cost Estimate

Cost of Engineering Services				
1.0 Personnel	**Classification**	**Rate ($/hr)**	**Hours**	**Cost**
	SEGR	$ 190	71	$ 13,490
	PEGR	$ 130	182	$ 23,660
	DEGR	$ 100	235	$ 23,500
	INT	$ 25	205	$ 5,125
	Total Personnel			**$ 65,775**
2.0 Travel	**Classification**	**Item Total**	**Unit Cost**	**Cost**
	1 visit @ 260 mi/visit	260	$0.49	$127
	Vehicle Rental (per day/trip)	1	$125.00	$125
	Total Travel		**Per Diem**	**$252**
3.0 Supplies	**Classification**	**Days**	**Unit Cost ($/day)**	**Cost**
	Surveying	1	$275	$275
	PPE	1	$80	$80
	Total Supplies			**$355**
4.0 Total				**$66,382**

6.0 References

[1] "Arizona Map," Destination 360, 2020. [Online]. Available: http://www.destination360.com/north-america/us/arizona/map. [Accessed 22 February 2020].

[2] "Coconino County Parcel Viewer," Coconino County Arizona , Page, 2020.