

NAU Parking Lot 46 Drainage Design Final Presentation



Surf and Turf Engineering

Sophia Fox

Mariam Alqabandi

Donovan Stewart

Saud Alazmi

CENE 476

April 15th, 2021



1.0 Project Understanding

Client and Stakeholders

- Northern Arizona University
 - Mark Lamer, Students, Faculty, Visitors.
- **1.1 Project Purpose**
- Improve the existing storm drainage system as a continuation of a previous project for parking lot 46 on NAU's campus.
 - To carry out the required task in accordance with Americans with Disabilities Act, 1990 (ADA), Universal Design Guidelines, and NAU Masterplan.

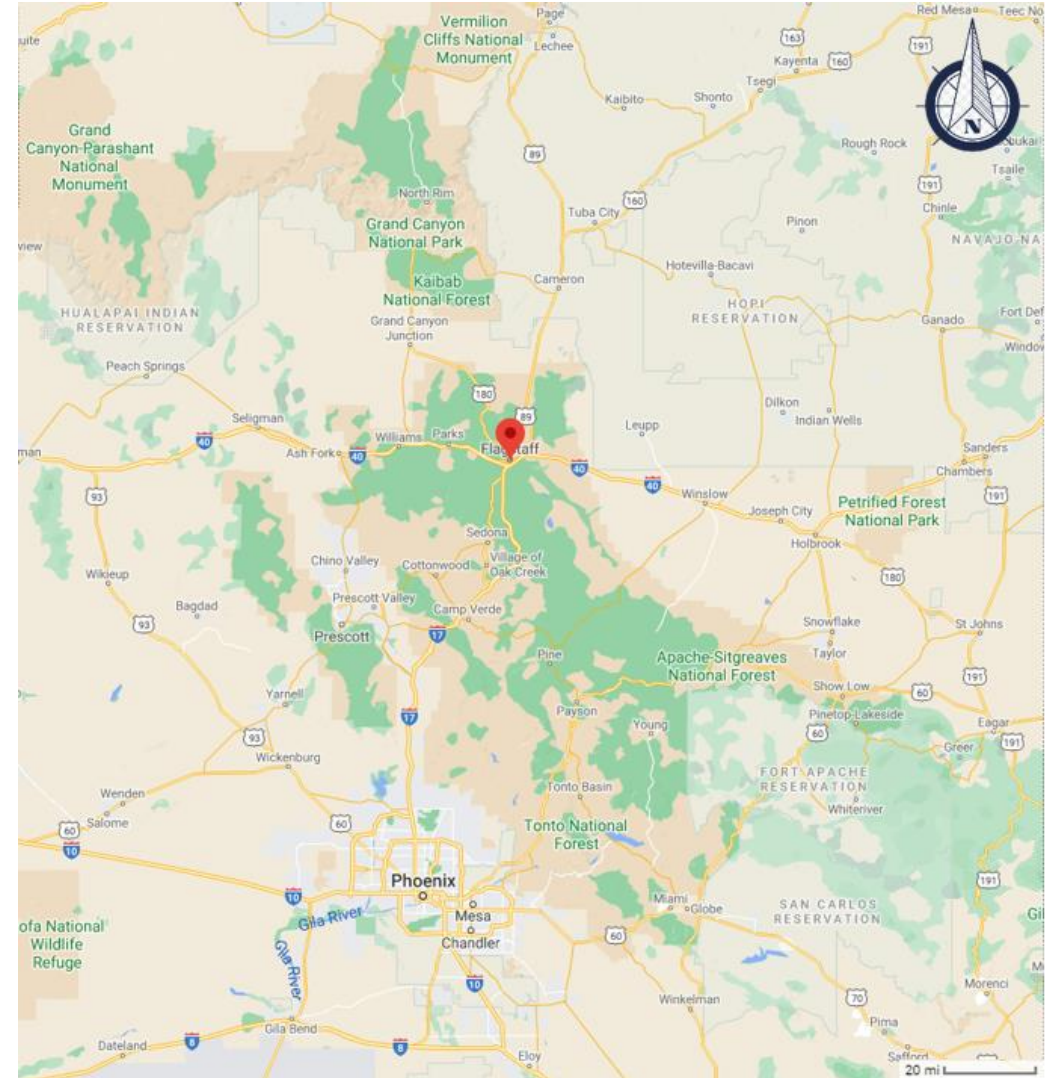


Figure 1-1: Project Site Within the State of Arizona

Location

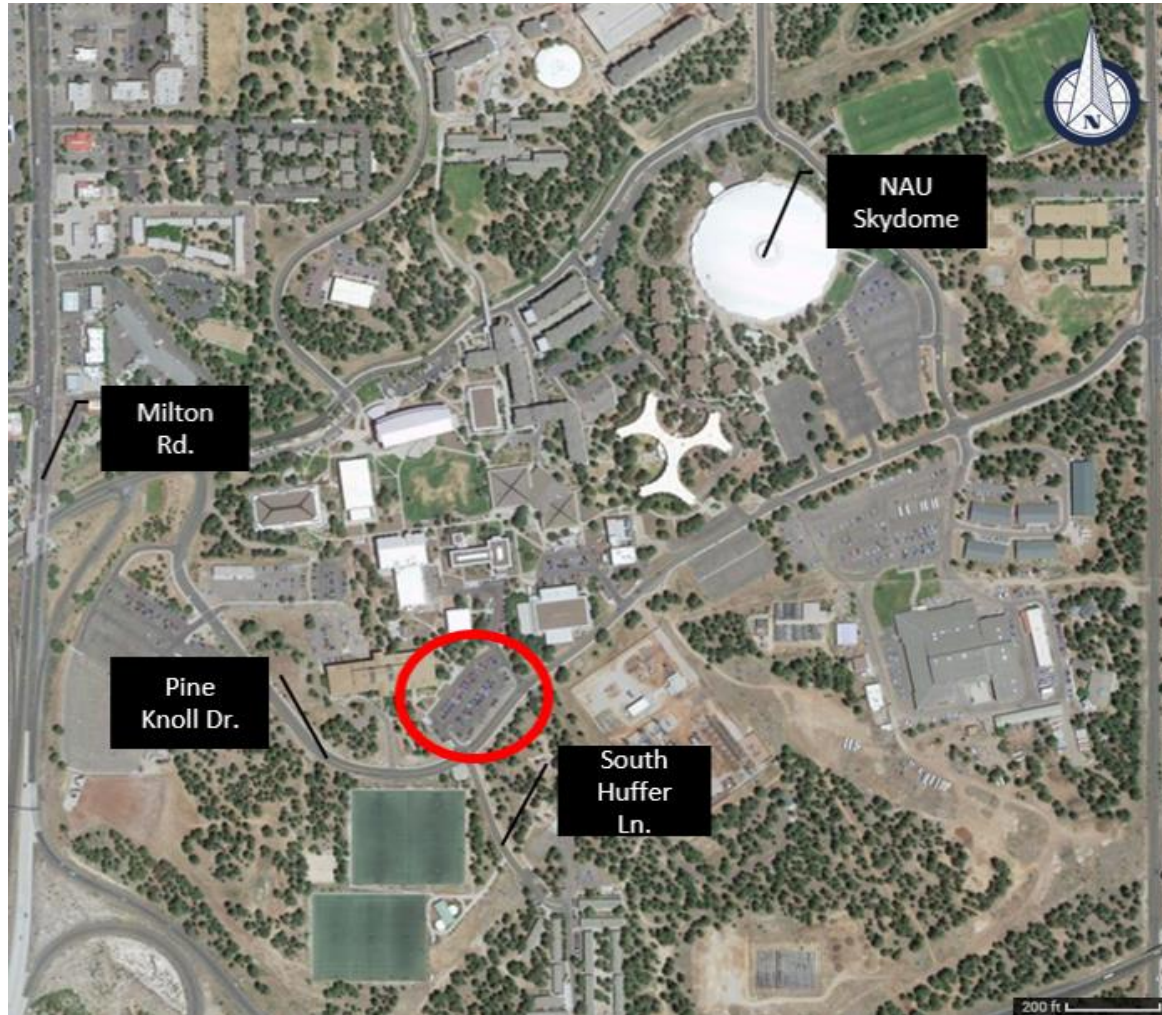


Figure 1-2: Project Site Within NAU's Campus [2]

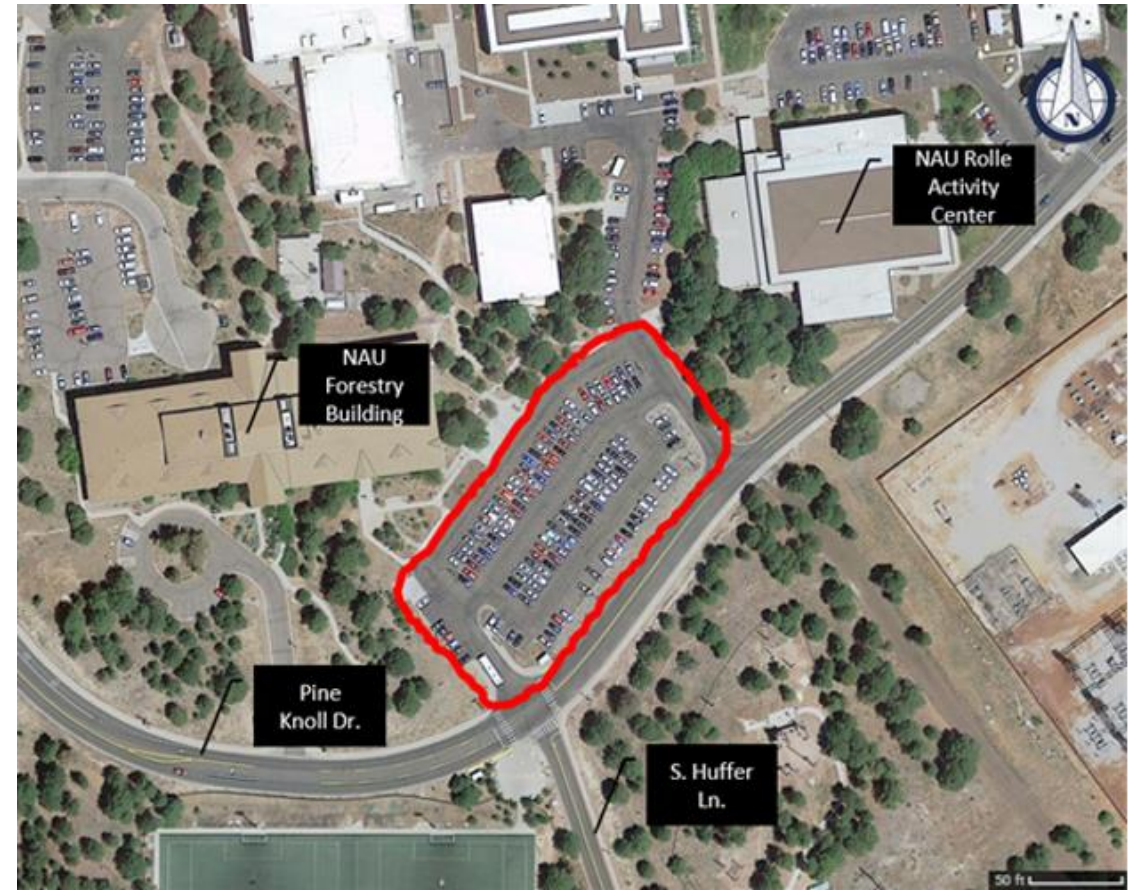


Figure 1-3: Project Site at NAU Parking Lot 46 [2]



Background

- Storm Water Drainage System
 - Eliminate the overland flow running through the parking lot.
 - Storm Drains
 - Can't handle peak storm water runoff
 - Storm Drain Outlet
 - Does not transport storm water efficiently
 - Spills into parking lot
 - Water collection area
 - Minor flooding in Rolle Activity Center and parking lot due to inadequate size.
- Pedestrian
 - Sidewalks and Crosswalks
 - Need additional sidewalks and crosswalks added in pedestrian usage areas.
 - Signage
 - Lack of pedestrian signage to warn drivers of pedestrian use of the area.



Figure 1-4: Current Pedestrian Signage, Credit: Sophia Fox



2.0 Scope of Services

- **Task 1: Existing Studies Review**
- **Task 2: Analyze Existing Site**
- **Task 3: Hydrologic Analysis**
- **Task 4: Hydraulic Drainage Analysis**
- **Task 5: Site Design**
- **Task 6: Project Management**



Figure 1-5: Southwest Corner of Parking Lot 46, Credit: Sophia Fox



Task 1: Existing Studies Review

- **Task 1.1: Northern Arizona University Data**
 - 2015 NAU Landscape Master Plan
- **Task 1.2: Previously Conducted Work**
 - 2020 Plan Set
 - Surveying Data
- **Task 1.3: Codes and Regulations**
 - Flagstaff Stormwater Management Design Manual
 - Coconino County Drainage Design Manual





Task 2: Analyze Existing Site

- **Task 2.1: Site Visit**
 - Determination of the design problems
- **Task 2.2: Survey**
 - Identification the horizontal and vertical position.
- **Task 2.3: Topographic Map**
 - Contour and planimetric



Figure 1-7: Entrance of Parking Lot 46, Credit: Sophia Fox



Task 3: Hydrologic Analysis

- **Task 3.1: Sub Basin Delineation**
 - Indication of the outlet or downstream point of the subbasin of focus
 - Marking of highpoints along both sides of the watercourse are marked
 - Delineated watershed will be used for further analysis
- **Task 3.2: Runoff Time of Concentration**
 - Time required for runoff to travel from the hydraulically most distant point in the watershed to the outlet
- **Task 3.3: Rational Runoff Method**
 - Rational equation used to calculate peak discharge of runoff.

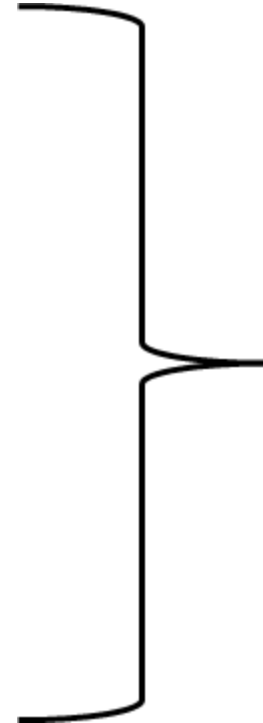


Figure 1-8: Culvert Outlet on South East Entrance of Parkinglot, Credit: Sophia Fox



Task 4: Hydraulics Analysis

- **Task 4.1: Street Gutter**
- **Task 4.2: Storm Drain Line and Inlets**
- **Task 4.3: Culvert Inlet/Outlet**
- **Task 4.4: Open Channel Outfall by Rolle Activity Center**
- **Task 4.5: Culvert Inlet/Outlet Protection**
- **Task 4.6: Low Impact Development (LID)**



- Flow Master
- Culvert Master



Task 5: Site Design

- **Task 5.1: Overall Site Layout**
- **Task 5.2: Stormwater**
 - 5.2.1 Storm Drain Plan and Profile
 - 5.2.3 LID Basin
 - 5.2.4 Culverts
- **Task 5.3: Pedestrian Pathway**
 - 5.3.1 ADA/Universal Design Compliance
 - 5.3.2 Path Plan View
 - 5.3.3 Signage and Striping
- **Task 5.4: Plan Set Development**
 - 5.4.1 Cover Sheet
 - 5.4.2 Project Notes
 - 5.4.3 Results of Survey Sheet
 - 5.4.4 Drainage Details
- **Task 5.5: Engineers Opinion Of Probable Cost to Construct**



Task 6: Project Deliverables

- **Task 6.1: Project Impacts**
 - 6.1.1 Environmental Impacts
 - 6.1.2 Economic Impacts
 - 6.1.3 Social Impacts
- **Task 6.2: Project Deliverables**
 - 6.2.1 30% Submittals
 - 6.2.2 60% Submittals
 - 6.2.3 90% Submittals
 - 6.2.4 Final Submittal
 - 6.2.5 Meeting Memo Binder
 - 6.2.6 Website



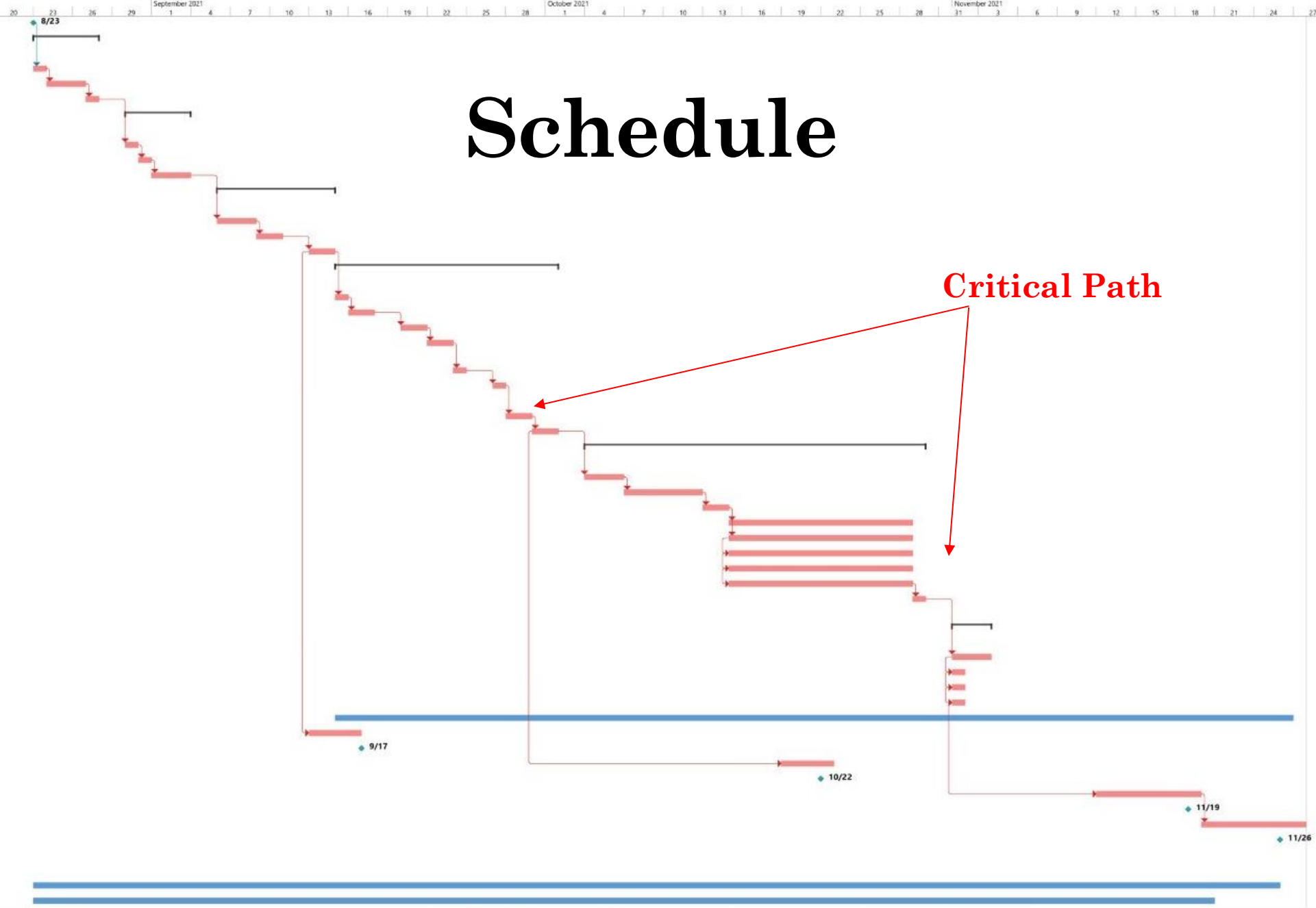
Task 7: Project Management

- **Task 7.1: Meetings**
 - 7.3.1 Client Meetings
 - 7.3.2 Technical Advisor (TA) Meetings
 - 7.3.3 Grading Instructor (GI) Meetings
 - 7.3.4 Team Meetings
- **Task 7.2: Resource Management**
 - 7.4.1 Schedule Management
 - 7.4.2 Budget Management
 - 7.4.3 Staff Management



Schedule

ID	Task Name
1	Project Start
2	Task 1: Existing Studies Review
3	Task 1: Existing Studies Review
4	1.1 Northern Arizona University Data
5	1.2 Previously Conducted Work
6	1.3 Codes and Regulations
7	Task 2: Analyze Existing Site
8	Task 2: Analyze Existing Site
9	2.1 Site Visit
10	2.2 Survey
11	2.3 Topographic Map
12	Task 3: Hydrologic Analysis
13	Task 3: Hydrologic Analysis
14	3.1 Sub Basin Delineation
15	3.2 Runoff Time of Concentration
16	3.3 Rational Runoff Method
17	Task 4: Hydraulic Drainage Analysis
18	Task 4: Hydraulic Drainage Analysis
19	4.1 Street Gutter
20	4.2 Storm Drain Line and Inlets
21	4.3 Culvert Inlet/Outlet
22	4.4 Open Channel Outfall by Rolle Activity Center
23	4.5 Culvert Inlet/Outlet Protection
24	4.6 Low Impact Design (LID)
25	4.7 Stormwater Runoff Modeling
26	4.7.1 FlowMaster
27	4.7.2 CulvertMaster
28	Task 5: Site Design
29	Task 5: Site Design
30	5.1 Overall Site Layout
31	5.2 Stormwater Feature Layout
32	5.3 Pedestrian Pathways
33	5.4 Plan Set Development
34	5.4.1 Cover Sheet
35	5.4.2 Project Notes
36	5.4.3 Results of Survey Sheet
37	5.4.4 Drainage Details
38	5.5 Engineers Opinion of Probable Cost to Construct
39	Task 6: Project Deliverables
40	Task 6: Project Deliverables
41	6.1 Project Impacts
42	6.1.1 Environmental Impacts
43	6.1.2 Economic Impacts
44	6.1.3 Socail Impacts
45	6.2 Project Deliverables
46	6.2.1 30% Completion
47	30% Completion
48	6.2.2 60% Completion
49	60% Completion
50	6.2.3 90% Completion
51	90% Completion
52	6.2.4 Final Presentation
53	Final Presentation
54	Task 7: Project Management
55	Task 7: Project Management
56	7.1 Meetings
57	7.2 Resource Management



Critical Path

Project: final presentation gantt
 Date: Thu 4/22/21

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



Staffing Personnel

Table 1: Staff Personnel Summary

Task	Hours Per Position					
	SR. ENG	PM	JR. ENG	EIT	I. ENG	Total
1.0 Existing Studies Review	5	0	15	10	10	40
2.0 Analyze Existing Site	2	0	16	12	12	42
3.0 Hydrologic Analysis	0	0	26	16	14	56
4.0 Hydraulic Analysis	3	1	38	38	24	104
5.0 Site Design	36	1	55	39	25	156
6.0 Project Deliverables	24	10	49	49	43	175
7.0 Project Management	14	29	14	14	14	85
Total	84	41	213	178	141	657



Cost of Engineering Services

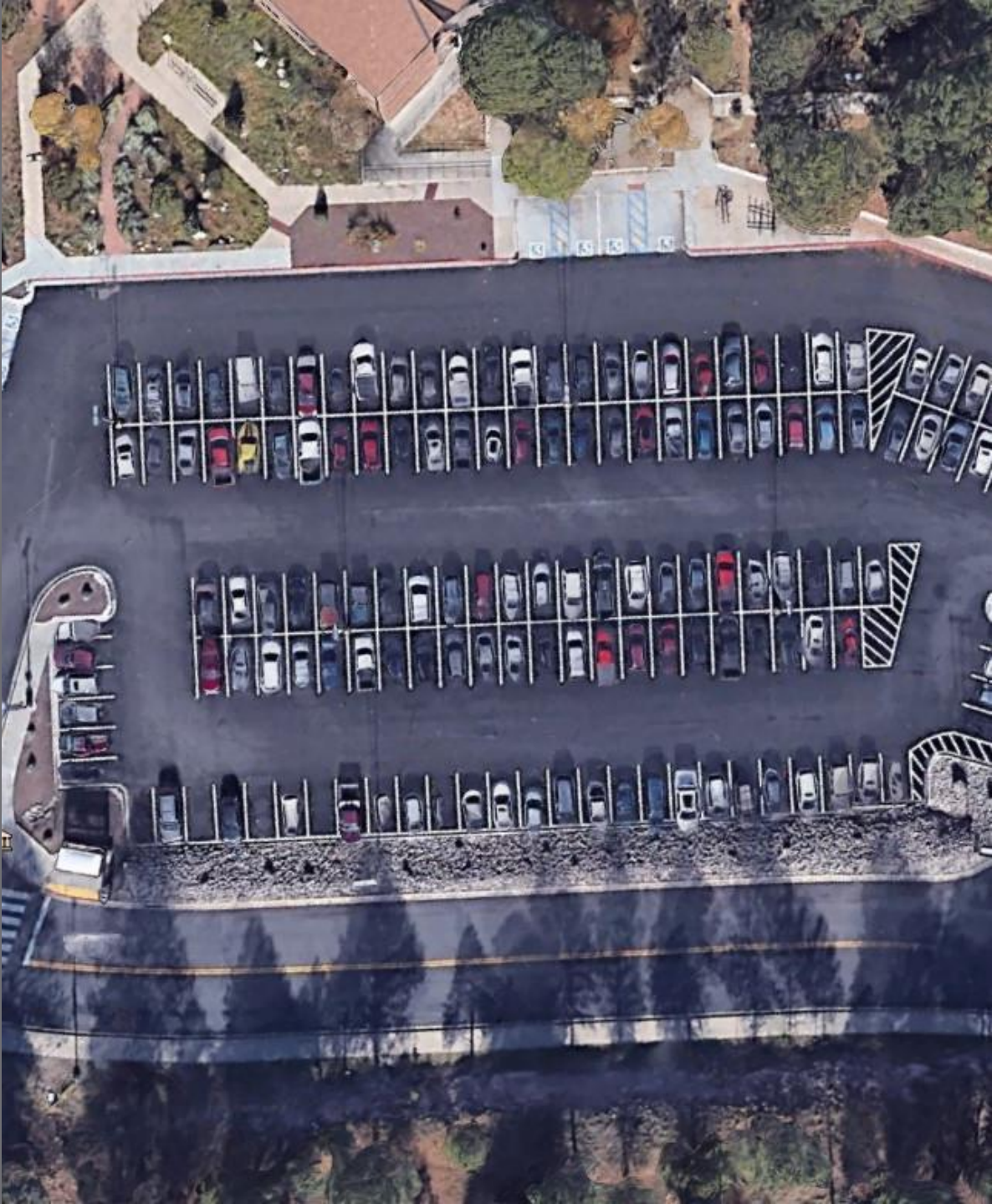
Table 2: Project Cost Breakdown

1.0 Personnel	Classification	Hours	Billing Rate (Dollars/hr)	Cost
	Sr. Eng	84	\$180	\$15,120
	PM	41	\$150	\$6,150
	Jr. Eng	213	\$120	\$25,560
	EIT	178	\$90	\$16,020
	I. Eng	141	\$26	\$3,666
	Total Personnel			\$66,516
2.0 Supplies	Classification	Days	Dollar/day	Cost
	Surveying	1	\$300	\$300
	Total Supplies			\$300
3.0 Total				\$66,816



References

- [1] "Arizona color county maps cities towns", Countymapsofarizona.com, 2021. [Online]. Available: <http://www.countymapsofarizona.com/>. [Accessed: 06- Feb- 2021].
- [2] "Google Maps", Google Maps, 2021. [Online]. Available: <https://www.google.com/maps>. [Accessed: 06- Feb- 2021].
- [3] "US Topo: Maps for America", Usgs.gov, 2021. [Online]. Available: https://www.usgs.gov/core-science-systems/national-geospatial-program/us-topo-maps-america?qt-science_support_page_related_con=0#qt-science_support_page_related_con. [Accessed: 06- Feb- 2021].
- [4] Resources, "Most Common Business Uses of Photogrammetry - GIS Resources", GIS Resources, 2021. [Online]. Available: <https://www.gisresources.com/common-business-uses-photogrammetry/>. [Accessed: 06- Feb- 2021].
- [5] "What is GIS? | Geographic Information System Mapping Technology", Esri.com, 2021. [Online]. Available: <https://www.esri.com/en-us/what-is-gis/overview>. [Accessed: 06- Feb- 2021].
- [6] "Surveying Basics: Reading a Contour Map | Onsite Installer", Onsite Installer, 2021. [Online]. Available: https://www.onsiteinstaller.com/online_exclusives/2019/04/surveying-basics-reading-a-contour-map. [Accessed: 10- Feb- 2021].
- [7] "6. Digital Line Graph (DLG) | The Nature of Geographic Information", E-education.psu.edu, 2021. [Online]. Available: https://www.e-education.psu.edu/natureofgeoinfo/c7_p7.html. [Accessed: 06- Feb- 2021].
- [8] "How to Read Construction Plans - A Beginner's Guide - Construct-ed.com", Construct-Ed, 2021. [Online]. Available: <https://www.construct-ed.com/beginners-guide-how-to-read-construction-plans/>. [Accessed: 08- Feb- 2021].
- [9] P. Bernie Roseke, "Guide to Project Resource Management", ProjectEngineer, 2021. [Online]. Available: <https://www.projectengineer.net/guide-to-project-resource-management/>. [Accessed: 08- Feb- 2021].



Questions?



Surf and Turf Engineering

Mariam Alqabandi

Sophia Fox

Donovan Stewart

Saud Alazmi