

John Wesley Powell Blvd Extension-East



CENE476 2023 Capstone Scope
Presentation
December 8, 2023



CITY
ENGINEERING
DIVISION
CITY OF FLAGSTAFF



Rainbow Road Engineering

“Let's-A-Go”



Delaney Phillips



Owen Allen



Bradon Schield



James
Hollingsworth

Project Background

Project Purpose

- Design approximately 2.5 mile road extension to existing JWP Blvd
- Additional arterial to network
- Aides future development

Client

- City of Flagstaff & Metroplan Flagstaff

Location

- Western terminus north of Pine Canyon subdivision
- Connect with Fourth Street intersection on east side of town

Project Area

- Rio de Flag & Arizona Trail
- Multiple landowners in area

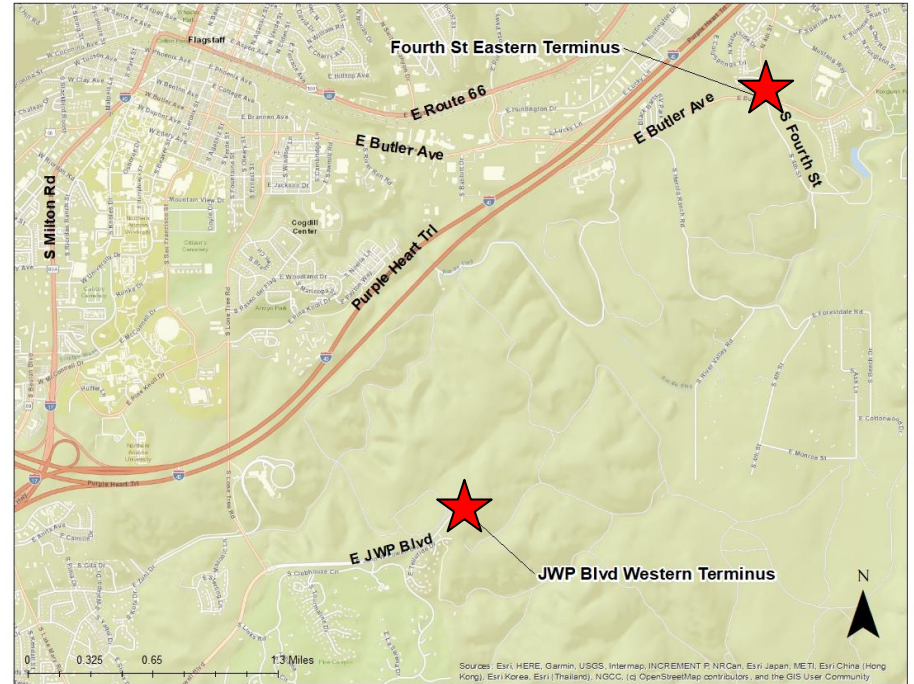
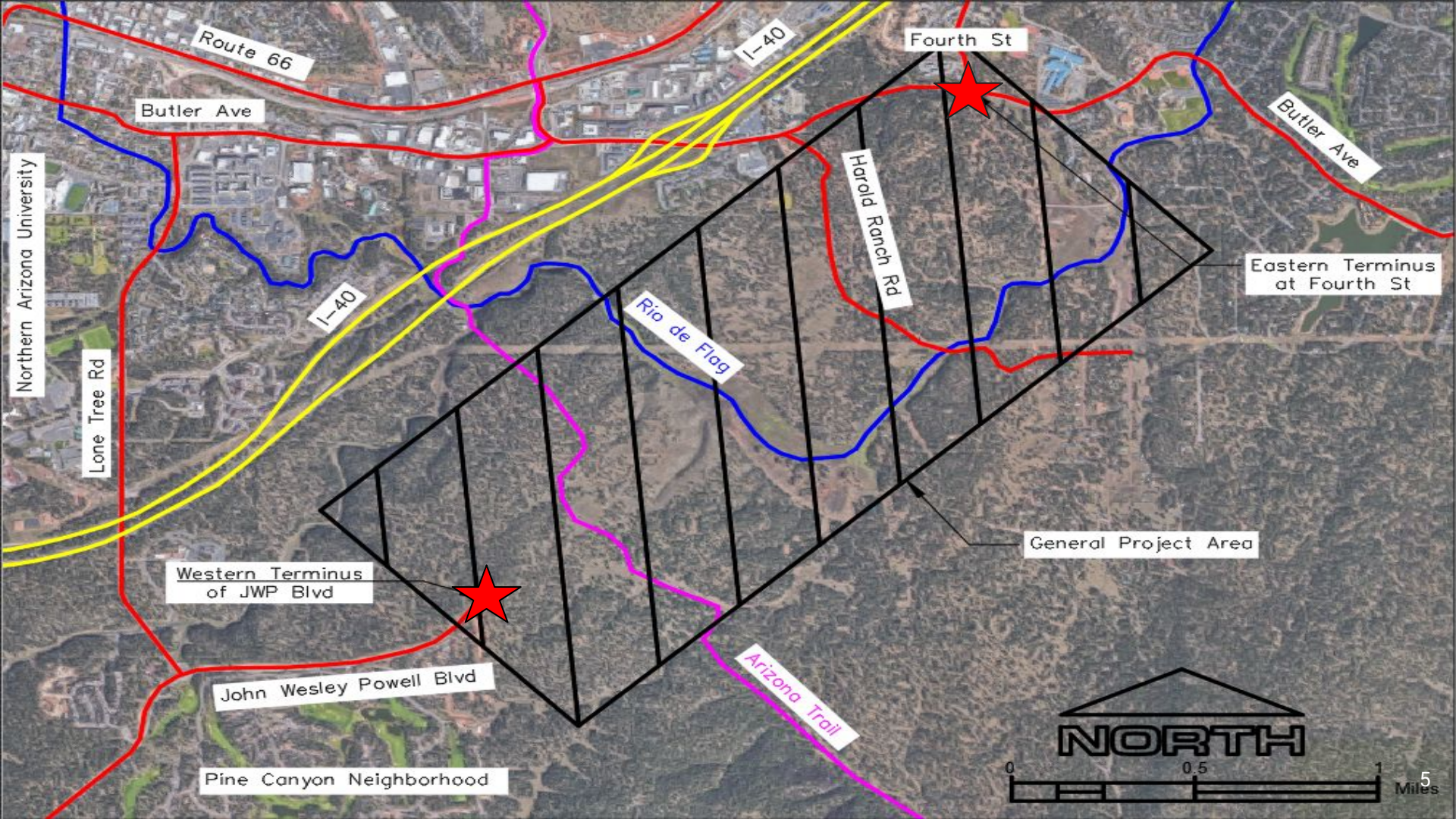


Figure 1 : Project Location within Flagstaff [1]

Project Area



Route 66

I-40

Fourth St

Butler Ave

Butler Ave

Northern Arizona University

Lone Tree Rd

I-40

Harold Ranch Rd

Eastern Terminus at Fourth St

Rio de Flag

General Project Area

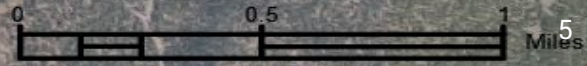
Western Terminus of JWP Blvd

John Wesley Powell Blvd

Arizona Trail

Pine Canyon Neighborhood

NORTH



Background Information and Site Investigation

Task 1.0: Obtain Existing Data

- Task 1.1: Topo/GIS Data
- Task 1.2: Land Ownership Data
- Task 1.3: Geotechnical Data
- Task 1.4: Traffic Projections Data

Task 2.0: Site Visit

Task 3.0: Preliminary Traffic Assessment

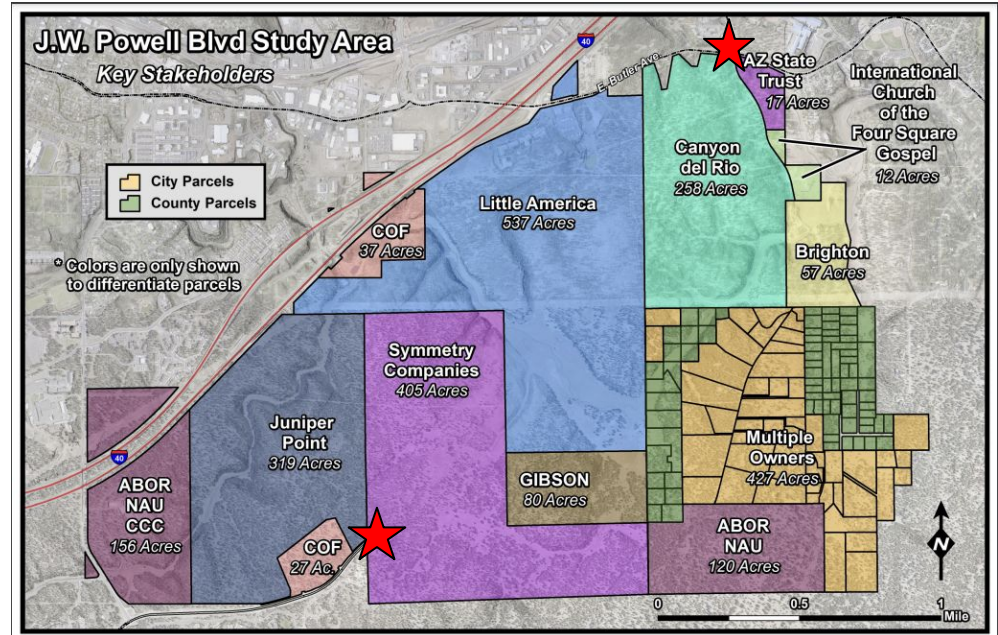


Figure 2 : J.W.P Stakeholders Area Map [2]

Analysis and Design

Task 4.0: Hydrologic Analysis

- Task 4.1: Identification of Watersheds and Determination of Peak Flows
 - Task 4.1.1: Delineate Watersheds
 - Task 4.1.2: Determine Time of Concentration
 - Task 4.1.3: Determine Peak Flows
- Task 4.2: Modeling

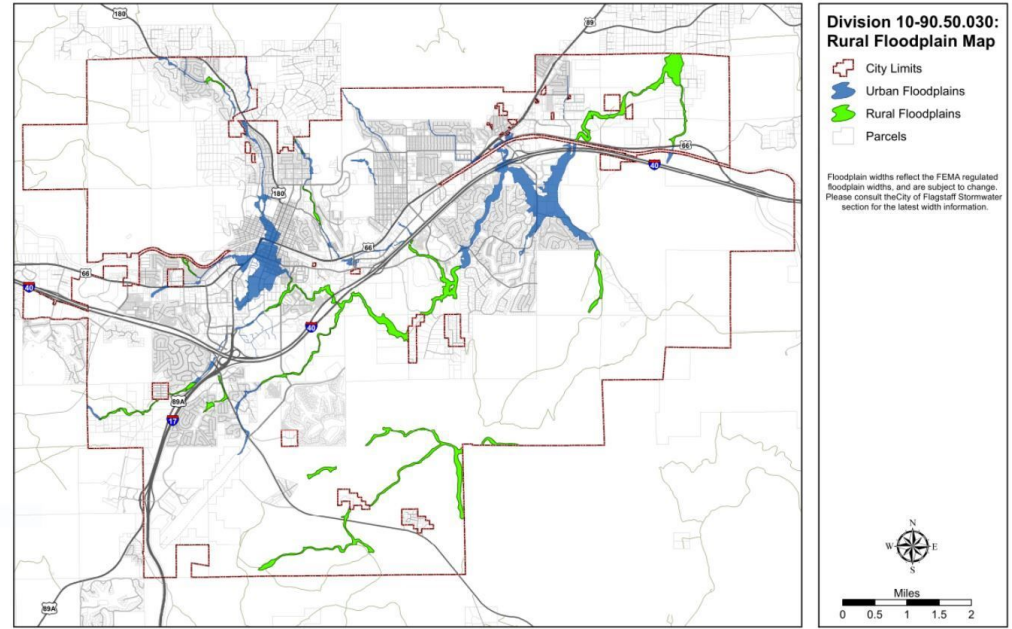


Figure 3 : Flagstaff Floodplain Area Map [3]

Analysis and Design

Task 5.0: Roadway Design

- Task 5.1: Base Map Development
- Task 5.2: Roadway Design
 - Task 5.2.1: Determine Alignment
 - Task 5.2.2: Intersection Design
 - Task 5.2.3: Sidewalk Design
 - Task 5.2.4: Signing and Striping Plan
 - Task 5.2.5: Lighting Plan
- Task 5.3: Wildlife Mitigation Considerations

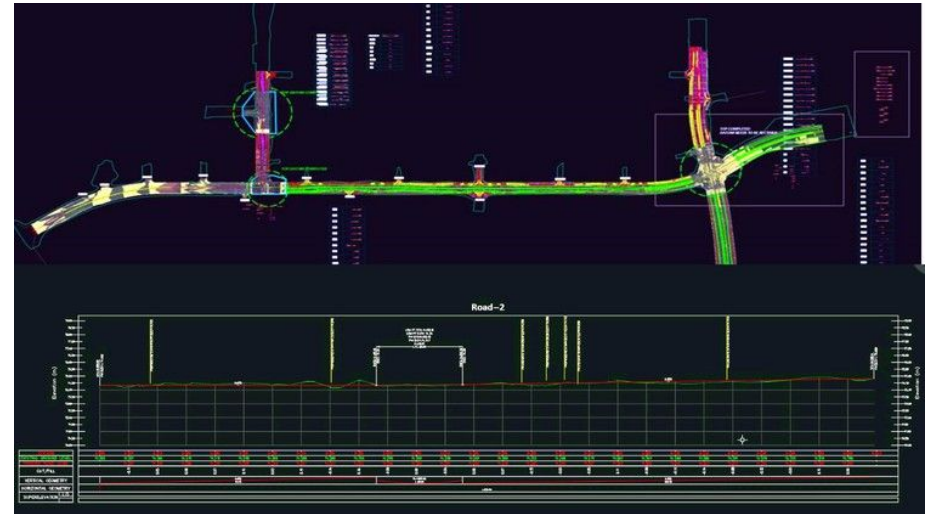


Figure 4: Example of Roadway Alignment [4]

Analysis and Design Cont.

Task 6.0: Post Design Hydrologic and Hydraulic Analysis

- Task 6.1: Selection of Hydraulic Structures for Water Crossings
- Task 6.2: Design of Hydraulic Structures for Water Crossings
- Task 6.3: Post-Design Hydrologic and Hydraulic Analyses

Task 7.0: Plan Set Development and Cost Estimate

- Task 7.1: Plan Set
- Task 7.2: Construction Cost Estimate

Task 8.0: Impacts of Project



Figure 5: Rio de Flag Flooding by Harold Ranch Rd [5]

Administration Tasks

Task 9.0: Deliverables

- Task 9.1: 30% Submittal
- Task 9.2: 60% Submittal
- Task 9.3: 90% Submittal
- Task 9.4: Final Submittal

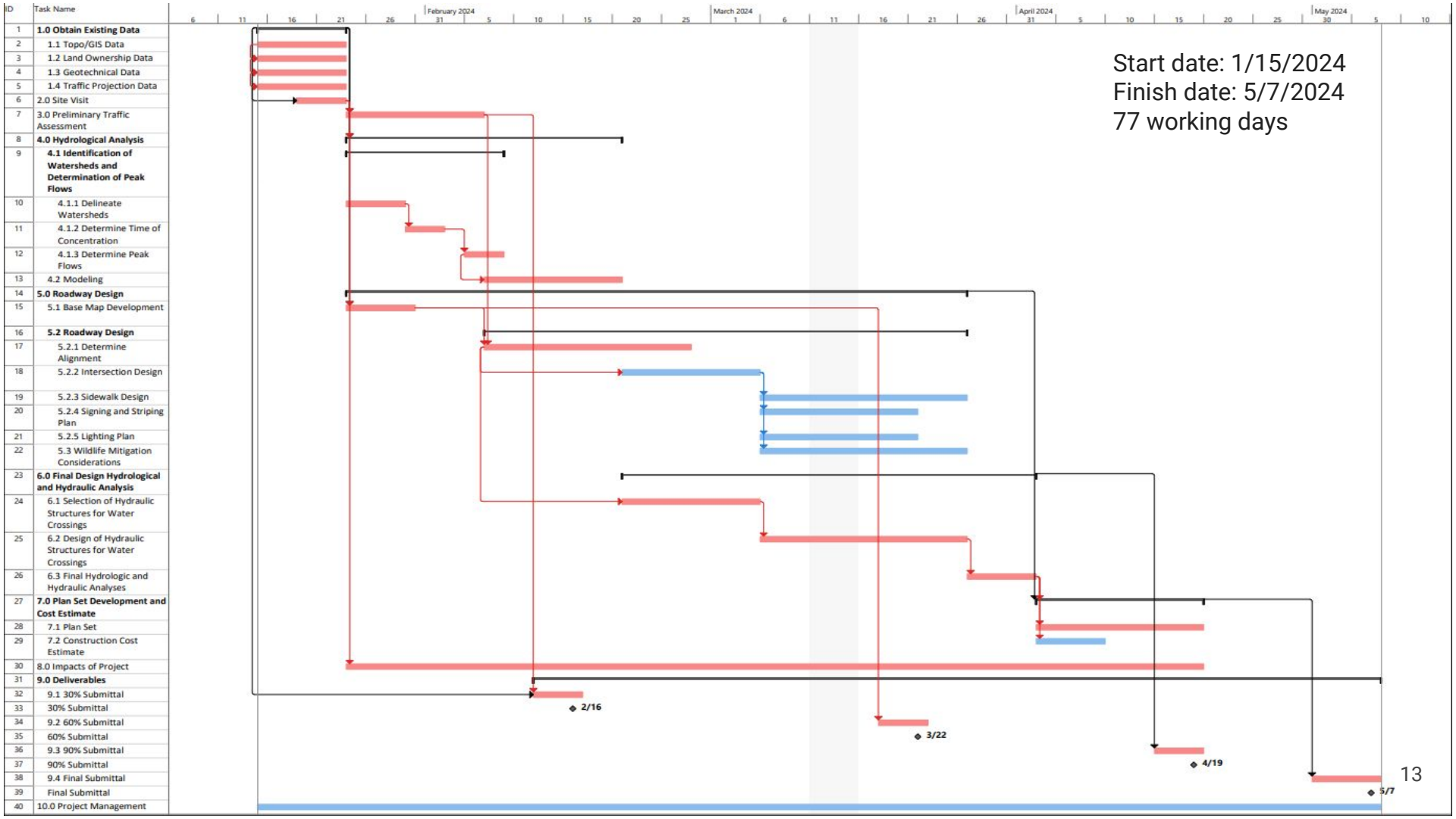
Task 10.0: Project Management

- Task 10.1: Meetings
- Task 10.2: Schedule Management
- Task 10.3: Resource Management



Figure 6 : Engineering Administrative tasks [6]

Gantt Chart



Staff Positions

“Let's-A-Go”



Senior Engineer [6]

- M.S. Civil Engineering
- PE
- 15 Years of Experience
- Leadership, mentoring, project management, complex problem-solving



Engineer [6]

- B.S. Civil Engineering
- PE/EIT
- 3 Years of Experience
- Problem-solving, implementation of solutions, technical writing



Engineer-in-Training [6]

- B.S. Civil Engineering
- EIT
- Foundational knowledge in engineering principles and technologies



Staffing Matrix

Table 1: Staffing Matrix by Position

Task	SENG Hours	ENG Hours	EIT Hours
1.0 Obtain Existing Data			
1.1 Topo/GIS Data		5	5
1.2 Land Ownership Data		5	5
1.3 Geotechnical Data		5	5
1.4 Traffic Projections Data		5	5
2.0 Site Visit			20
3.0 Preliminary Traffic Assessment	2	8	25
4.0 Hydrologic Analysis			
4.1 Identification of Watersheds and Determination of Peak Flows			
4.1.1 Delineate Watersheds		5	15
4.1.2 Determine Time of Concentration		5	5
4.1.3 Determine Peak Flows		5	10
4.2 Modeling	2	10	30

Task	SENG Hours	ENG Hours	EIT Hours
Continued Staffing Table			
5.0 Roadway Design			
5.1 Base Map Development		5	15
5.2 Roadway Design			
5.2.1 Determine Alignment	2	30	40
5.2.2 Intersection Design	2	30	30
5.2.3 Sidewalk Design		10	5
5.2.4 Signing and Striping Plan		10	5
5.2.5 Lighting Plan		10	5
5.3 Wildlife Mitigation Considerations	5	10	10
6.0 Final Hydrologic and Hydraulic Analyses			
6.1 Selection of Hydraulic Structures for Water Crossings		30	5
6.2 Design of Hydraulic Structures for Water Crossings		20	20
6.3 Final Design Hydrologic and Hydraulic Analyses	5	30	15
7.0 Plan Set Development and Cost Estimate			
7.1 Plan Set	10	40	60
7.2 Construction Cost Estimate	5	10	
8.0 Impacts of Project	5	10	5
10.0 Project Management	20	10	5
Subtotal	58	308	345
Total (person-hours)	711		

Cost of Engineering Services

Table 2: Engineering Cost of Services

- Largest expense is Personnel
- Computer lab time based on time to complete data analysis
 - CENE Traffic Lab
 - CEIAS Computer Lab
 - Civil 3D, HEC-HMS, VISSIM or Synchro

Categories	Classification	Hours	Rate, \$/hr	Cost, \$
1.0 Personnel	SENG	58	228	13,224
	ENG	308	143	44,044
	EIT	345	76	26,220
Total Personnel				83,488
2.0 Supplies	Computer Lab Rental	76 days	\$100/day	7,600
3.0 Total				91,088

References

- [1] Esri, "ArcMap," 2023.
- [2] D. Peterson, J.W Powell Study Area, Flagstaff, 2021.
- [3] City of Flagstaff , CITY OF FLAGSTAFF RURAL FLOODPLAINS, Flagstaff, Arizona, 2009.
- [4] Autodesk Help, Example roadway Alignment, Autodesk, 2019.
- [5] S. Golightly, "Hundreds of Flagstaff residents stranded behind floodwaters," Arizona Daily Sun, 22 March 2023. [Online]. Available: https://azdailysun.com/news/local/weather/hundreds-of-flagstaff-residents-stranded-behind-floodwaters/article_ffd59454-c901-11ed-8a55-3b301ad80c11.html. [Accessed 2023].
- [6] M. Tobias, "Why To Hire Same Engineering Firm for Design and Construction Admin," Nearby Engineers, [Online]. Available:
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- [8] Bitontawan, Artist, technician and builders and engineers and mechanics People teamwork ,Vector illustration cartoon character. stock illustration. [Art]. iStock, 2017.

Questions?