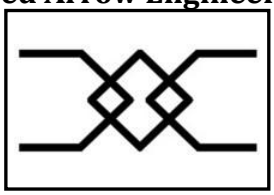
DEWEY SITE DESIGN FINAL PROPOSAL

Civil Engineering Capstone

MAY 3, 2022

CROSSED ARROW ENGINEERING
Northern Arizona University

Crossed Arrow Engineering



To: Dr. Wilbert Odem, PE (Grading Instructor)
Dr. Jeffery Heiderscheidt, (Technical Advisor)
Taylor Layland (Client)

From: Danielle Tom, Civil Engineer
Daniel Langsmith, Civil Engineer
Lanceford Quotskuyva, Civil Engineer
Kewei Ren, Civil Engineer

Re: Dewey Site Design Finial Proposal

Date: April 27, 2022

Dr. Odem, Dr. Heiderscheidt, Taylor Layland:

We have attached our team's Final Project Proposal of the Dewey Site Design located at 11800 E Prescott Dells Ranch Rd. The attached document contains Project Understanding, the Scope of Service, Schedule, Staffing and Cost of Engineering Services. The Project Understanding includes the Project Purpose, Project Background, Technical Considerations, Potential Challenges, and Stakeholders. Scope of Services identifies all the major tasks needed to complete the entire project. The Project Schedule is a Gantt chart that exhibits each task's start and end date. The Staffing part shows all the hours for each task completed by each role throughout the project. The Costs part shows the estimated cost for each position associated with the project.

If you have any questions, don't hesitate to reach out to the team members at Crossed Arrow Engineering with any questions or concerns that may arise.

Danielle Tom, Civil Engineer

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Kewei Ren, Civil Engineer

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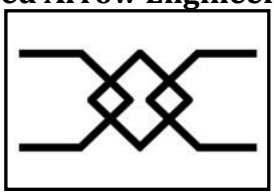

To: Taylor Layland (Client)

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Mr. Taylor Layland,

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If you have any questions, don't hesitate to reach out to the team members at Crossed Arrow Engineering with any questions or concerns that may arise.

Danielle Tom, Civil Engineer

Daniel Langsmith, Civil Engineer

Lanceford Quotskuyva, Civil Engineer

Kewei Ren, Civil Engineer

Kewei Ren

Table of Contents

1. Project Understanding

1.1 Purpose of Project

The client Taylor Layland is working with Northern Arizona University (NAU) to provide engineering services for the development of a 5-acre lot for a single-family residential home. The NAU Capstone team is assigned to supply a preliminary site plan, which includes a plot plan, a design of a drainage system, and a grading plan to distribute the uncontrolled surface runoff to meet the Yavapai County requirements. Engineering services are needed to ensure the safety of the client's home and that the drainage system is performing properly.

1.2 Project Background/Existing Conditions

The project site is in Dewey Arizona which is approximately 1.5 hours from Flagstaff. It is in Section 9, Township 13 North, Range 1 East of the Gila and Salt River Baseline and Meridian. The location of the site is in the Town of Dewey Humboldt, lot number 402-04-275C. The section township range is S09-T13N-R01E. The coordinates are 34°31'04.9" N 112°15'33.9" W. The site address is 11800 E Prescott Dells Ranch Rd. An exact location of the home on the site is still undetermined but will be confirmed by the client. Figure 1 and Figure 2 show the sites' location. Prescott Dells Ranch Rd runs east-west on the south side of the lot. The client has told Crossed Arrow Engineering that a site visit may not be possible, so the design may be conducted without exact surveying data. The site is in the zoning district R1L. This zoning district is for single family residential site-built structures only.

The client plans to place a 2500-gallon water tank next to the house with a private well and septic system. The footprint of the desired home will be 24'x 40' with a 40'x20' gravel parking lot with a 12' wide driveway connecting the parking area to the E Prescott Dells Ranch Rd. Adjacent to E Prescott Dells Ranch Rd, there is a 2' deep ditch to convey road runoff from upstream seeing in Figure 3. As part of the design, a culvert may be needed to ensure the ditch flow is conveyed under the driveway and through the site.

Electricity is available during construction provided by (APS) Arizona Power Service. Currently there is a temporary travel trailer on the site. It may be moved if necessary for the construction.

Figure 1 Vicinity Map

Figure 2 is an imagery map showing the layout of the area. The slope of this area is approximately 0.247 $^{ft}/_{ft}$ based on the topography map of this site in figure 3. The site location is outlined in red in both Figure 2 andFigure 3.

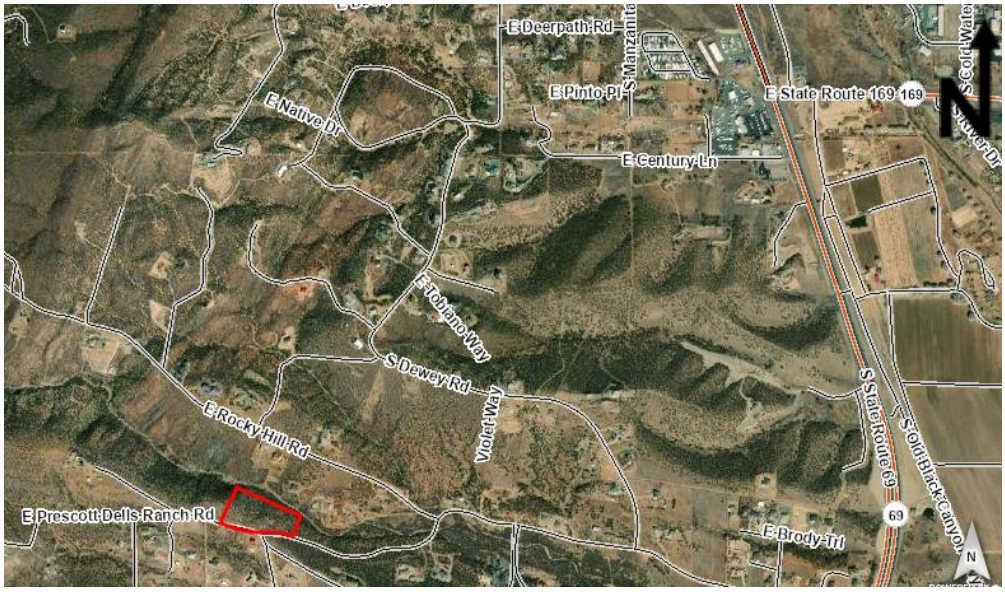


Figure 2 Local Area Map

Figure 3 Site Area Topographic Map

1.3 Technical Considerations

With the limitation of site visits, this project will be conducted remotely. GPS information will be collected from the Yavapai County GIS website, which has accurate survey data. The geospatial data will be uploaded into programs such as AutoCAD (where the plot plan, site plan, and grading/drainage plan will be created). NOAA Atlas 14, and StreamStats, may be used to aid in the determination of rainfall data and can help delineate watersheds and flow patterns on site. If a site visit is permitted, then the topographic information will be gathered by the team using equipment provided by NAU. Land features and existing topographic data will be recorded and used in this case.

Flow patterns will be determined using topographic data on the site to understand existing flow conditions. This data will also be used to analyze the need for culverts, retention basins, or ditches. The flow will be re-routed around structures and under the driveway. Any basin will be designed using data for 10-year design storms. [1]

1.4 Potential Challenges

A potential challenge of the project is the inability to make a site visit, which would give the benefit, if done, the optimal view of existing conditions of the property. The design may require that a retaining wall be engineered to ensure structures stability and the site grading to provide efficient drainage. The retaining wall will need to follow the codes provided by Yavapai County and the Town of Dewey-Humboldt. The client designed the home to face specific views of the landscape for their aesthetics.

1.5 Stakeholders

Primary stakeholders of this project are the client, Taylor Layland, and landowner, David Fowler of the property. The client Taylor Layland is the primary contact for all design and project questions, along with guidance of what David Fowler (landowner) would like.

2. Scope of Services

2.1. Task 1 Background Research

To perform the required tasks, the necessary code books and documents shall be obtained and reviewed to ensure the safe and timely completion of the project.

2.1.1. Review Existing Codes

The current codes for the JHA (Jurisdiction having authority) shall be reviewed to determine the zoning, utilities on the site, access points, and other existing conditions that may affect the design of the project.

2.1.2. Obtain and Review Existing Studies

Research shall be done to investigate existing hydraulic/hydrologic/geotechnical analyses that have been performed in the area.

2.1.3. Obtain and Review Existing Survey Data

Existing survey data shall include recent topographic data of the project site which may be used as a supplement to any additional data that may be collected from the Yavapai County GIS map system. [2]

2.1.4. Obtain FEMA Floodplain Information

FEMA (Federal Emergency Management Agency) map/data shall be collected to determine if the site is in a flood zone and the risk therein. [3]

2.2. Task 2: Site Investigation

2.2.1. Site Visit

2.2.1.1. Site Work Plan

Begin and identify points of site-work that need to be done.

2.2.1.2. Equipment

Computers provided by NAU will be used to retrieve and process the topographic data. If access to the site is granted, then the following applies; Create a list of and gather tools and equipment that will be used at the site for survey, note taking and observation

2.2.1.3. Land Survey

If access to the site is granted, then the following applies; Conduct land survey of area gathering photos, field notes, and any landscape anomalies

2.2.1.4. Processing Collected Survey Data

Data collected will be input into a CAD (Computer Aided Design) file to begin as starting file for project design.

2.2.2. Document Existing Topography

Provide existing topography of site location as reference for existing and to compare with for development of project.

2.3. Task 3: Hydrology Analysis

2.3.1. Rational Method Analysis

Hydrology analysis using the Rational Method. Delineate the designed area and determine the peak flow rate, time of concentration from land use type, and precipitation depth.

2.3.2. Hydraulics

The channel's capacity is the maximum rate at which information can be transmitted through a channel. Channel capacity is employed as the criterion to analyze the effects of the soil on data rates in the underground channel. All the existing channels need to pass through the culvert to avoid other negative impacts.

2.3.2.1. Channel Analysis

Use Culvert Master, Flow Master, and HEC-RAS to evaluate existing channel capacity and proposed design for channel analysis. Channel properties include Flowrate, velocities, channel grades, typical cross-sections, channel capacity, HGL and available freeboard are all needed to evaluate to meet the requirements from Drainage Design Manual for Yavapai County.

2.3.2.2. Design Recommended Channel Modifications

The site plan should show the dimensions and locations of all proposed development and detention systems including maximum water surface elevation and roof drainage. Culvert design criteria such as culvert slope, inlet and outlet elevations, headwater elevations, can be considered based on Drainage Design Manual for Yavapai County.

2.4. Task 4: Construction Plans

2.4.1. Cover Sheet

The cover sheet will provide information regarding the project's name, sheet index, permit information, key plan, and general notes.

2.4.2. Notes and Specifications

The notes will provide detailed information regarding the project's design and specifications will include details of work, materials, and installation requirements if needed.

2.4.3. General Details

The general details will include the general scope of work and current work conditions of the project.

2.4.4. Elevation Profiles

Elevation profiles for the site plan will be provided with information regarding cut and fill areas of the project. Providing details of certain elevation changes where the home will be placed on the site.

2.4.5. Existing Channel Plans

Using data generated from the National Oceanic and Atmospheric Administration website, which includes the rainfall intensity and depth report over many durations of storm types. This information will be in the analysis of channel flow and drainage details. Which will be used to determine grading plan for the site.

2.4.6. Existing Topographic Survey

Using Google Earth and National Wildfire Coordinating Group to obtain the sites contour lines.

2.4.7. Existing Floodplain Map

Using the provided contour lines, we will be able to delineate the water shed and determine its current basins. Which will provide the analysis of finding the flow path on the site. Our analysis will then be completed to the data provided on the NOAA website.

2.4.8. Proposed Channel Plans

Using hydrologic analysis to determine the channel plans and culvert design.

2.4.9. Proposed Plot Plan

Outlining site boundaries.

2.4.10. Erosion Protection Design

Using hydrologic analysis, the planning for mitigating flood and erosion control will be entailed in the document.

2.5. Task 5: Impact Analysis

2.5.1. Environmental Impacts

Identify environmental impacts such as endangered species, if any on property, sediment control, and changes to land.

2.5.2.Societal Impacts

Societal impacts would be linked to lifestyle for client in new area, possible stoppage on roads due to construction.

2.5.3. Economic Impacts

Economic impacts may be revenue/profit from project, budget losses.

2.6. Task 6: Project Deliverables

These deliverables are necessary for QA/QC. They shall be reviewed by peers and JHA to ensure the project is on schedule and being completed properly.

2.6.1. 30% Submittal

The 30% submittal is the first large set of deliverables and requires that certain parts of the design and drawings be completed. The completion thereof will ensure that the project is advancing according to plan. This submittal will be reviewed, revisions and additions will be made before the next submittal.

2.6.1.1. 30% Design Report

The design report will be used to convey the information upon which the drawings and presentation were created. The report will share information on the existing site conditions such as the site investigation, existing soil conditions, existing analysis, and reports.

2.6.1.2. 30% Presentation

The presentation will be a visual representation of the work completed by the team. The key information from the design report will be compiled and displayed.

2.6.1.3. 30% Construction Drawings

The construction drawings for the 30% submittal shall include existing topography, structure, and utilities.

2.6.2. 60% Submittal

The 60% submittal is the next milestone within the project design. It requires that 60% of the design work be completed. The completion thereof will ensure that the project is advancing according to plan. This submittal will be reviewed, revisions and additions will be made before the next submittal. All revisions that were given in the previous submittal will be corrected. The initial grading/drainage design and the site design will be completed.

2.6.2.1. 60% Design Report

The design report will be used to convey the information upon which the drawings and presentation were created. All information included in the 30% report will also be in this report, as well as the initial grading/drainage design and site design.

2.6.2.2. 60% Presentation

The presentation will be a visual representation of the work completed by the team. It will include all completed tasks for the 30% presentation and shall also include the initial grading/drainage design and the site design. The key information will be displayed and presented to the GI (Grading Instructor).

2.6.2.3. 60% Construction Drawings

The construction drawings for the 60% submittal shall include the updated items found in the 30% drawings as well as the initial proposed design and details.

2.6.3.90% Submittal

The 90% submittal is the second to last milestone of the project design. This submittal requires that all the design be complete. The completion thereof will ensure that the project is advancing according to plan. This submittal will be reviewed, revisions and additions will be made before the next submittal. All revisions that were given in the previous submittal will be corrected. The

final grading/drainage design and site design will be completed. All analysis and data collection will be completed as well.

2.6.3.1. 90% Design Report

The design report will be used to convey the information upon which the drawings and presentation were created. All information included in the 60% report will also be in this report, as well as the final grading/drainage and site design.

2.6.3.2. 90% Construction Drawings

The construction drawings for the 90% submittal shall include the updated items found in the 60% drawings as well as the final proposed design and details.

2.6.3.3. 90% Website

A website will be created and will contain all the work that the team has completed. It will be available to the public, the client, and to the GI. The website will show a prominent level of professionalism and competence. Project information and documents will be included as well as any material that the team sees it necessary to include.

2.6.4. Final Submittal

The final submittal will be the last milestone of the project. It shall compile all the work that was completed for the project. No current information will be included, it will be an updated version of the 90% submittal. It will also include the completed and refined website. This shall be submitted to the client, Grading Instructor (GI), and Technical Advisor (TA) for review.

2.6.4.1. 100% Design Report

The 100% design report will be a compilation of work that was completed to produce the final design for the project. All information will be revised and included, as well as the final design.

2.6.4.2. 100% Final Presentation

The final presentation will be a visual slideshow that will be narrated by team members. Key impacts, results, and recommendations will be included in the presentation. The final design will be explained to provide confidence and essential information to all necessary parties.

2.6.4.3. 100% Construction Drawings

The construction drawings for the 100% submittal will include all necessary information and details. All updates will be completed and finalized.

2.6.4.4. 100% Website

The final website will contain all the work that the team has completed. It will be available to the public, the client, and the GI. The website will show a prominent level of professionalism and competence. Project documents, photographs, and information will be included as well as any material that the team sees it necessary to include. Any needed revisions will be updated.

2.7. Task 7: Project Management

2.7.1. Project Meetings

All meetings will be documented and set throughout the project duration. Meeting notes and agendas will be provided.

2.7.1.1. Grading Instructor Meetings

Meetings with grading instructing after graded assignments will be conducted. These meetings will be documented and ensure our accuracy of project submittals.

2.7.1.2. Technical Advisor Meetings

Meetings will be conducted on a quarterly basis throughout the project's duration. Which will provide guidance for some in certain areas of our design.

2.7.1.3. Client Meetings

Client meetings will be scheduled when needed, but not necessary. The client prefers to communicate through email or by phone. Meetings will be documented, and notes will be provided.

2.7.1.4. Engineering Design Team Meetings

Design meetings will be held to focus on the progression of the project and will be scheduled with the date and time of when held.

2.7.2. Schedule Management

Schedule of meetings, work assignments, and anything related to the project will be documented and time stamped with date and time.

2.7.3. Resource Management

Use of outside resources to gather information on topics of the project will be documented and provided with citation and source.

3. Schedule

3.1. Task Outline

Tasks listed below with duration of time for each to be completed sum up to a total of 79 days (632 hours) approximately. This is an estimate of time that we may use or need for the entirety of the project depending on whether there will be any issues, concerns or conflicts that come up.

Task 1: Background research specify codes, jurisdiction having authority: 10 days
Task 2: Site investigation site visit, land survey, identify existing conditions: 21 days
Task 3: Hydrology analysis, use of rational method, delineation, hydraulic analysis: 18 days
Task 4: Construction plans of all grading, elevations existing and proposed topography: 15 days
Task 5: Impact analysis impacts of environment, economy, and society: 1 day
Task 6: Project deliverables all documents of work, proposal, Gantt chart, scope, cost, staffing: 14 days
Task 7: Project management the entire project portion of managing deliverables, meetings, comments, cost estimate/budget: 79 days

3.2. Critical Path

The overall flow and direction of the project, where tasks cannot start or be completed without the start or completion of certain previous tasks. These tasks will be tied into each other for the completion of the entire project. This will be shown in the provided Gantt chart for the site design in Dewey (Appendix A.) The critical path will be highlighted in red.

4. Staffing

The total duration of the project will be 81 days (about 2 and a half months). An estimate of how many hours each position will be working is provided below, along with a breakdown of all the positions needed to complete the project, and the qualifications for each position are shown below as well.

4.1. Staff Positions

The staff that will be utilized for this project along with the abbreviation of each is shown in Table 4-1.

Table 4–1 Staffing Nomenclature

Classification	***Abbreviation***
Senior Engineer	SENG
Engineer	ENG
Drafting Technician	DRFT
Survey Technician	STECH
Engineer in Training	EIT

The qualifications and responsibilities expected from each staff member are provided in the following section.

4.1.1. Senior Engineer

A senior engineer is an engineering professional who has encountered significant challenges throughout their career with a PE certification and more than 10 years of experience in the field. Senior Engineers need to hold a bachelor's degree in engineering or a STEM-related field. In this role, the senior engineer may oversee several projects simultaneously, performing engineering tasks and providing guidance for teams. The engineers work closely with teams to ensure engineering concepts and principles are applied to their own teams' responsibilities. [4]

4.1.2. Engineer

The qualifications of education for an engineer are necessary include having a bachelor's degree in Civil Engineering as well as a PE certification and one or two years of field experience. The Engineer should also have knowledge of professional skills for hydrology and hydraulic analysis using software such as CulvertMaster, FlowMaster. [5]

4.1.3. Drafting Technician

Drafting technicians prepare technical drawings and designs using specialized software. A technical draftsperson interprets architectural, engineering, and designer concepts and then uses computer-aided design (CAD) programs to turn them into technical drawings. Drafters typically need an associate of applied science in drafting or a related degree from a community college or technical school. Some drafters prepare for the occupation by earning a certificate or diploma**.** [6]

4.1.4. Survey Technician

The minimum education needed to be a survey technician is a high school diploma, although some employers require a bachelor's degree in the field. Survey technicians measure and record the Earth's land features, (both natural and manmade.) Survey technicians collect their data through global positioning, or geographical information systems (GIS). They also lay out markings for work locations. [7]

4.1.5. Engineer in Training

The minimum education preferred by employers to be, and Engineer in Training (EIT) is a bachelor's degree from a recognized University. Responsibilities of an EIT include, but are not limited to; minor drafting work, assisting engineers, drafting technicians and survey technicians with their respective responsibilities, compile design calculations, analyze code standards, reference specifications, and prepare engineering documents under close supervision, and make coffee for the office. [8]

4.2. Qualification of Senior Personnel

The following is a summary of experience and qualifications of the Crossed Arrow Engineering personnel.

4.2.1. Kewei Ren

Kewei Ren is a senior Civil Engineering student with the following qualifications and experience:

- AutoCAD software
- Rational Method for flowrate analysis
- Water Resources
- Traffic Analysis
- Geotechnical Engineering

4.2.2. Lance Quotskuyva

Lance Quotskuyva is a senior Civil Engineering student with the following qualifications and experience:

- CAD/ Civil3D experience
- Estimates
- Land Surveying
- Heavy equipment operator
- Construction: Woodruff Construction, LLC.
- Traffic analysis
- Bridge design

4.2.3. Danielle Tom

Danielle Tom is a senior Civil Engineering student with the following qualifications and experience:

- AutoCAD Drafting
- Land Surveying experience
- Water Resources I & II
- Municipal Engineering
- Traffic Analysis
- Structural Analysis
- Estimating
- Entering quotes into Heavy BID
- Internship: Field Engineer at FNF, INC. Construction

4.2.4. Daniel Langsmith

Daniel Langsmith is a senior Civil Engineering student with the following qualifications and experience:

- AutoCAD experience
- Land Surveying experience
- Water Resources I and II
- Municipal Engineering
- Traffic Analysis Experience
- Internship: Sunrise Engineering

4.3. Summary Table

The total estimated number of hours that each staff position will spend on the project is shown in Table 4-3. The total number of hours expected to be spent on this project is 632.

Table 4–2 Staffing Positions

Position	***Hours***
Senior Engineer	83
Engineer	150
Drafting Technician	122
Survey Technician	30
Engineer in Training	247
Total	**632**

The Survey Technician is estimated to work the least number of hours because the main responsibility of this position is to measure and collect data on the residential house and take the soil sample. The Engineer in Training will be spending the greatest number of hours since their work includes quantities of aspects, and the main priority is to assist the whole project team through several types of work.

5. Cost of Engineering Services

The total estimated cost of engineering services to be provided can be seen in Table 5-1. A summary of the hours and billing rates is provided for each staff member. This cost includes the expenses associated with business operations for the time of the project. These expenses include employee wages and benefits, a profit margin, and overhead costs. See Appendix B for a complete breakdown of hourly work. The supplies needed for the project include survey equipment to create the existing topographic map.

Table 5–1 Total Estimate of Hours and Cost

Classification	***Hours***	***Rate ($/hr.)***	***Cost***
Senior Engineer	83	$120.00	$9,960.00
Engineer	150	$85.00	$12,750.00
Drafting Technician	122	$65.00	$7,930.00
Survey Technician	30	$60.00	$1,800.00
Engineer in Training	247	$45.00	$11,115.00
	Days	*Rate ($/day)*	*Cost*
Survey Equip.	2	$100.00	$200.00
		Total Cost	$43,755.00

6. References

[1] Y. County, "Drainage Design Manual for Yavapai County," 1 July 2015. [Online]. Available: https://yavapaiaz.gov/Portals/43/ReferenceMaterials/2015_DDMforYavapaiCountyFinal.pdf. [Accessed 03 March 2022].

[2] "Yavapai County Interactive Map," ESRI, [Online]. Available: https://gis.yavapaiaz.gov/v4/. [Accessed 03 March 2022].

[3] U. D. o. H. Security, "FEMA Flood Map Service Center," FEMA, [Online]. Available: https://msc.fema.gov/portal/search?AddressQuery=DEWEy%20Arizon#searchresultsanchor. [Accessed 3 March 2022].

[4] D. &. D. E. Careers, "Zippia," 8 2021. [Online]. Available: https://www.zippia.com/senior-systems-engineer-jobs/.

[5] "American Concrete Institute," [Online]. Available: https://www.concrete.org/education/customseminars.aspx?gclid=CjwKCAjwopWSBhB6EiwAjxmqDW2chryasHrNVsZRUBMyZ9lSyz9ChCtvJRVbZRNXPsTG_IpLJ8tDQBoCMYsQAvD_BwE.

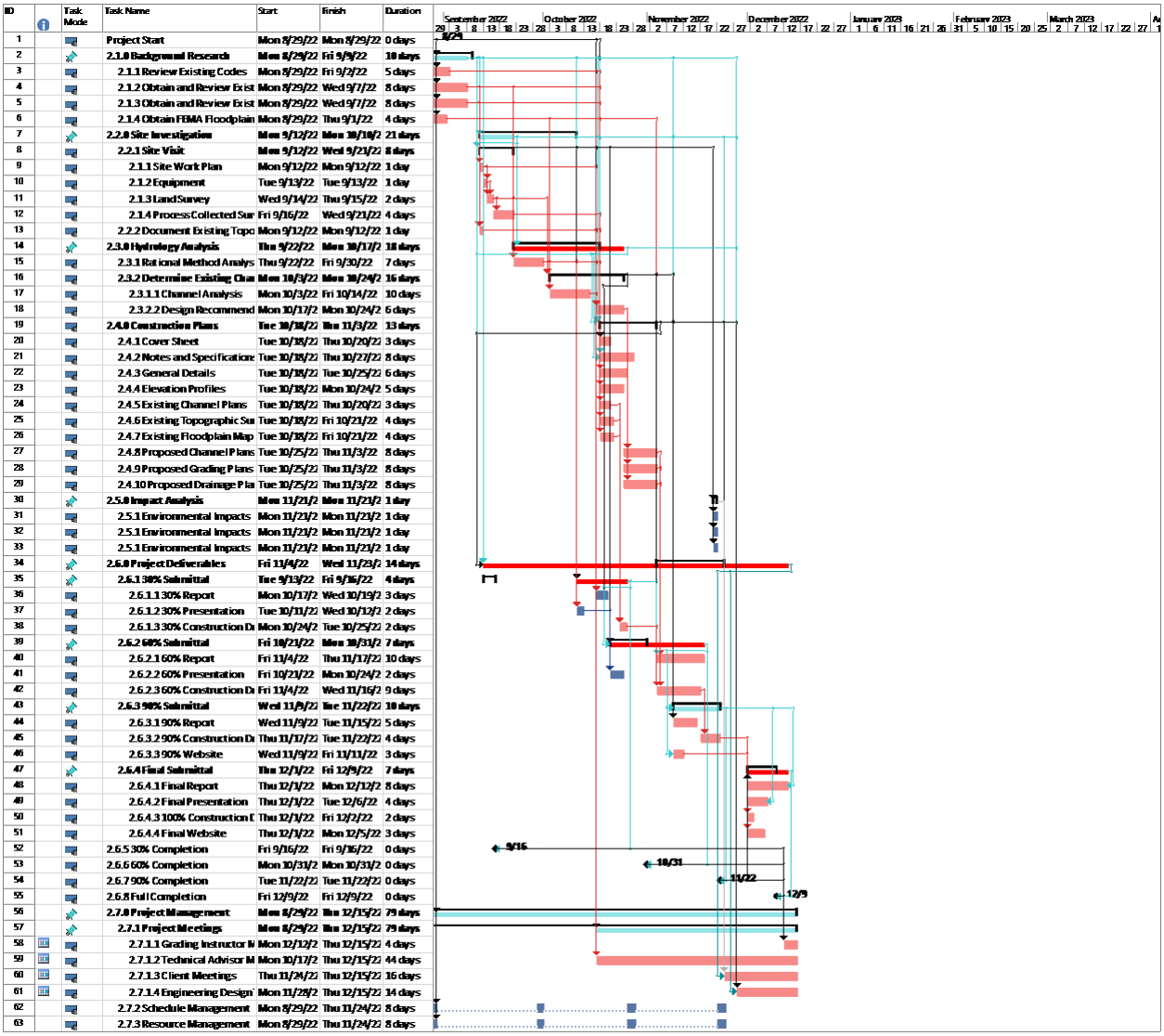
[6] "EducatingEngineering," 2017. [Online]. Available: https://educatingengineers.com/careers/drafting-and-design-engineer.

[7] B. Colleges, "Survey Technician: Job Description, Duties and Requirements," BestAccredited Colleges, 20 October 2021. [Online]. Available: https://bestaccreditedcolleges.org/articles/survey-technician-job-description-duties-and-requirements.html. [Accessed 29 March 2022].

[8] V. Jobs, "Training Engineer Job Description," 2022. [Online]. Available: 2022. [Accessed 29 March 2022].

7. Appendices

Appendix A: Gantt Chart for Dewey Site Design



ID	Task Mode	Task Name	Start	Finish	Duration
1		Project Start	Mon 8/29/22	Mon 8/29/22	0 days
2		2.1.0 Background Research	Mon 8/29/22	Fri 9/9/22	10 days
3		2.1.1 Review Existing Codes	Mon 8/29/22	Fri 9/2/22	5 days
4		2.1.2 Obtain and Review Exist	Mon 8/29/22	Wed 9/7/22	8 days
5		2.1.3 Obtain and Review Exist	Mon 8/29/22	Wed 9/7/22	8 days
6		2.1.4 Obtain FEMA Floodplain	Mon 8/29/22	Thu 9/1/22	4 days
7		2.2.0 Site Investigation	Mon 9/12/22	Mon 10/10/2	21 days
8		2.2.1 Site Visit	Mon 9/12/22	Wed 9/21/22	8 days
9		2.1.1 Site Work Plan	Mon 9/12/22	Mon 9/12/22	1 day
10		2.1.2 Equipment	Tue 9/13/22	Tue 9/13/22	1 day
11		2.1.3 Land Survey	Wed 9/14/22	Thu 9/15/22	2 days
12		2.1.4 Process Collected Sur	Fri 9/16/22	Wed 9/21/22	4 days
13		2.2.2 Document Existing Topo	Mon 9/12/22	Mon 9/12/22	1 day
14		2.3.0 Hydrology Analysis	Thu 9/22/22	Mon 10/17/2	18 days
15		2.3.1 Rational Method Analys	Thu 9/22/22	Fri 9/30/22	7 days
16		2.3.2 Determine Existing Cha	Mon 10/3/22	Mon 10/24/2	16 days
17		2.3.1.1 Channel Analysis	Mon 10/3/22	Fri 10/14/22	10 days
18		2.3.2.2 Design Recommend	Mon 10/17/2	Mon 10/24/2	6 days
19		2.4.0 Construction Plans	Tue 10/18/22	Thu 11/3/22	13 days
20		2.4.1 Cover Sheet	Tue 10/18/22	Thu 10/20/22	3 days
21		2.4.2 Notes and Specification	Tue 10/18/22	Thu 10/27/22	8 days
22		2.4.3 General Details	Tue 10/18/22	Tue 10/25/22	6 days
23		2.4.4 Elevation Profiles	Tue 10/18/22	Mon 10/24/2	5 days
24		2.4.5 Existing Channel Plans	Tue 10/18/22	Thu 10/20/22	3 days
25		2.4.6 Existing Topographic Su	Tue 10/18/22	Fri 10/21/22	4 days
26		2.4.7 Existing Floodplain Map	Tue 10/18/22	Fri 10/21/22	4 days
27		2.4.8 Proposed Channel Plans	Tue 10/25/22	Thu 11/3/22	8 days
28		2.4.9 Proposed Grading Plans	Tue 10/25/22	Thu 11/3/22	8 days
29		2.4.10 Proposed Drainage Pla	Tue 10/25/22	Thu 11/3/22	8 days
30		2.5.0 Impact Analysis	Mon 11/21/2	Mon 11/21/2	1 day
31		2.5.1 Environmental Impacts	Mon 11/21/2	Mon 11/21/2	1 day
32		2.5.1 Environmental Impacts	Mon 11/21/2	Mon 11/21/2	1 day
33		2.5.1 Environmental Impacts	Mon 11/21/2	Mon 11/21/2	1 day
34		2.6.0 Project Deliverables	Fri 11/4/22	Wed 11/23/2	14 days
35		2.6.1 30% Submittal	Tue 9/13/22	Fri 9/16/22	4 days
36		2.6.1.1 30% Report	Mon 10/17/2	Wed 10/19/2	3 days
37		2.6.1.2 30% Presentation	Tue 10/11/2	Wed 10/12/2	2 days
38		2.6.1.3 30% Construction Di	Mon 10/24/2	Tue 10/25/22	2 days
39		2.6.2 60% Submittal	Fri 10/21/22	Mon 10/31/2	7 days
40		2.6.2.1 60% Report	Fri 11/4/22	Thu 11/17/2	10 days
41		2.6.2.2 60% Presentation	Fri 10/21/22	Mon 10/24/2	2 days
42		2.6.2.3 60% Construction Di	Fri 11/4/22	Wed 11/16/2	9 days
43		2.6.3 90% Submittal	Wed 11/9/22	Tue 11/22/22	10 days
44		2.6.3.1 90% Report	Wed 11/9/22	Tue 11/15/22	5 days
45		2.6.3.2 90% Construction Di	Thu 11/17/2	Tue 11/22/22	4 days
46		2.6.3.3 90% Website	Wed 11/9/22	Fri 11/11/22	3 days
47		2.6.4 Final Submittal	Thu 12/1/22	Fri 12/9/22	7 days
48		2.6.4.1 Final Report	Thu 12/1/22	Mon 12/12/2	8 days
49		2.6.4.2 Final Presentation	Thu 12/1/22	Tue 12/6/22	4 days
50		2.6.4.3 100% Construction D	Thu 12/1/22	Fri 12/2/22	2 days
51		2.6.4.4 Final Website	Thu 12/1/22	Mon 12/5/22	3 days
52		2.6.5 30% Completion	Fri 9/16/22	Fri 9/16/22	0 days
53		2.6.6 60% Completion	Mon 10/31/2	Mon 10/31/2	0 days
54		2.6.7 90% Completion	Tue 11/22/22	Tue 11/22/22	0 days
55		2.6.8 Full Completion	Fri 12/9/22	Fri 12/9/22	0 days
56		2.7.0 Project Management	Mon 8/29/22	Thu 12/15/22	79 days
57		2.7.1 Project Meetings	Mon 8/29/22	Thu 12/15/22	79 days
58		2.7.1.1 Grading Instructor M	Mon 12/12/2	Thu 12/15/22	4 days
59		2.7.1.2 Technical Advisor M	Mon 10/17/2	Thu 12/15/22	44 days
60		2.7.1.3 Client Meetings	Thu 11/24/22	Thu 12/15/22	16 days
61		2.7.1.4 Engineering Design	Mon 11/28/2	Thu 12/15/22	14 days
62		2.7.2 Schedule Management	Mon 8/29/22	Thu 11/24/22	8 days
63		2.7.3 Resource Management	Mon 8/29/22	Thu 11/24/22	8 days

Appendix B: Task Staffing Matrix

Task	SENG	ENG	DRFT	STECH	EIT	TOTAL HOURS
1.0 Background Research						
1.1 Review Existing Codes	1	3				4
1.2 Obtain and Review Existing Studies		4				4
1.3 Obtain and Review Existing Survey Data		2	5			7
1.4 Obtain FEMA Floodplain Information	2				3	5
2.0 Site Investigation						
2.1 Site Visit						
2.1.1 Site Work Plan		2		5		7
2.1.2 Equipment				1	3	4
2.1.3 Land Survey				12	12	24
2.1.4 Process Collected Survey Data	2	2	11	1		16
2.2 Document Existing Topography		2	2		6	10
3.0 Hydraulic Analysis						
3.1 Rational Method Analysis		2			4	6
3.2 Determine Existing Channel Properties						
3.2.1 Channel Analysis		3			12	15
3.2.2 Design Recommended Channel Modifications	1	4	4		3	12
4.0 Construction Plans						
4.1 Cover Sheet			2		3	5
4.2 Notes and Specifications		1			4	5
4.3 General Details	1	1	3		4	9
4.4 Elevation Profiles			8		8	16
4.5 Existing Channel Plans			4		6	10
4.6 Existing Topographic Survey		1	8	1	3	13
4.7 Existing Floodplain Map	2		4		4	10
4.8 Proposed Channel Plans		8	4		6	18
4.9 Proposed Grading Plans		4	4		5	13
4.10 Proposed Drainage Plans		4	4		5	13
5.0 Impact Analysis						
5.1 Environmental Impacts	1	1			6	8
5.2 Societal Impacts	1	1			6	8
5.3 Economic Impacts	1	1			6	8
6.0 Project Deliverables						
6.1 30% Submittal						
6.1.1 30% Design Report	1	4			12	17
6.1.2 30% Presentation	1	3			6	10
6.1.3 30% Construction Drawings	1	1	8		2	12
6.2 60% Submittal						
6.2.1 60% Design Report	3	8			12	23
6.2.2 60% Presentation	1	3			6	10
6.2.3 60% Construction Drawings	1	1	16		8	26

6.3 90% Submittal						
6.3.1 90% Report	2	6			12	20
6.3.2 90% Construction Drawings	1	2	15		8	26
6.3.3 90% Website	2	6			12	20
6.4 Final Submittal						
6.4.1 100% Design Report	2	6				8
6.4.2 100% Final Presentation	2	4			8	14
6.4.3 100% Construction Drawings	1	2	10		6	19
6.4.4 100% Website	3	8			12	23
7.0 Project Management						
7.1 Project Meetings						
7.1.1 Grading Instructor Meetings	8	8			8	24
7.1.2 Technical Advisor Meetings	8	8			8	24
7.1.3 Client Meetings	8	8			8	24
7.1.4 Engineering Design Team Meetings	10	10	10	10	10	50
7.2 Schedule Management	8	8				16
7.3 Resource Management	8	8				16
Total Personnel Hours	**83**	**150**	**122**	**30**	**247**	**632**