PROPOSAL FOR THE CITY OF PHOENIX 91ST AVENUE ADVANCED WATER PURIFICATION FACILITY (AWPF)

CENE 476
DECEMBER 5, 2025

By: Clearwater Jacks Engineering (CJE)

Karen Vera, Cairo Linares, Zephaniah Espinosa-Cordova, & Amy Joy Schmitt

PROJECT INTRODUCTION

- Purpose
  - Design an Advanced Water Purification Facility (AWPF) that treats 30 MGD of Secondary Effluent
  - Lift station that pumps water from Tres Rio Flow Regulating Wetlands (FRW) to AWPF
  - Compete in AZ Water Student Design Competition
- Clients
  - Water Environment Federation (WEF)
  - City of Pheonix
  - Dr. Jeffrey Heiderscheidt

PROJECT INTRODUCTION CONTINUED

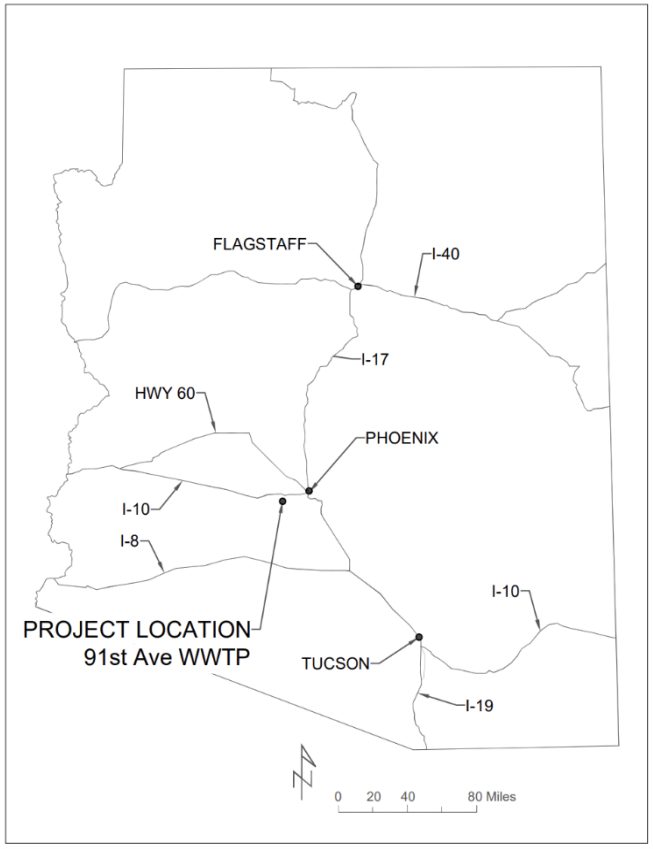


Figure 1: Location Map [1]

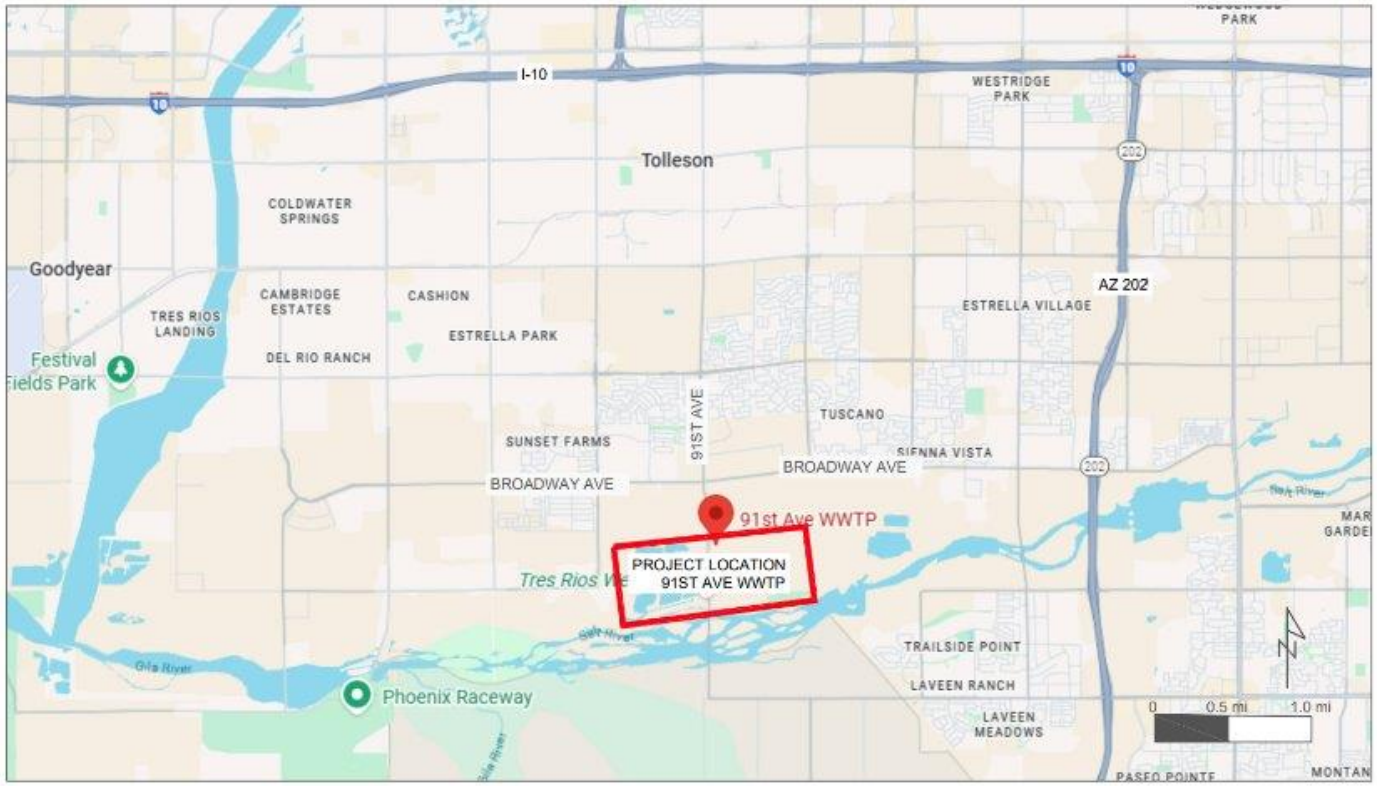


Figure 2: Vicinity Map [1]

PROJECT INTRODUCTION CONTINUED

- Background
  - Second effluent is pumped into the FRW
  - 91st Ave Wastewater Treatment Plant (91st Ave WWTP) will remain untouched and operational

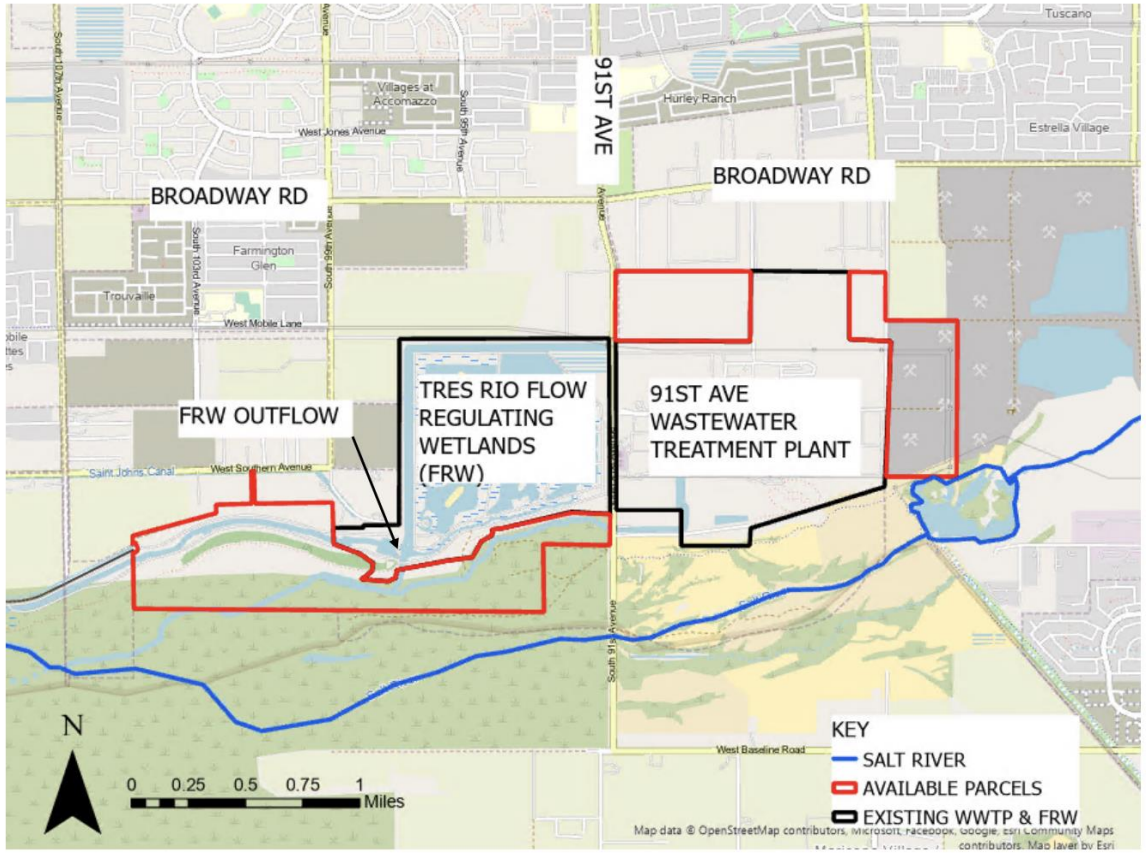


Figure 3: Site Map [1]

TASK 1.0: RESEARCH AND PREPARATION

- Task 1.1: Codes and Regulation Research
- Task 1.2: Water Treatment Research
- Task 1.3: WEF Application

Figure 4: MCESD Logo [2]

Figure 5: WEF Logo [3]

TASK 2.0: SITE INVESTIGATION

- Task 2.1: Site Visit
- Task 2.2: Site Data Analysis

Figure 6: Aerial Picture of FRW, WWTP, & Available Parcels [4]

TASK 3.0: TREATMENT SELECTION

- Task 3.1 Physical Separation
  - Task 3.1.1: Determine Criteria
  - Task 3.1.2: Develop Alternatives
  - Task 3.1.3: Eliminate Less Suitable Alternatives
- Task 3.2 Physical Treatment
  - *(Subtasks are identical to Task 3.1)*
- Task 3.3 Chemical Treatment
  - *(Subtasks are identical to Task 3.1)*

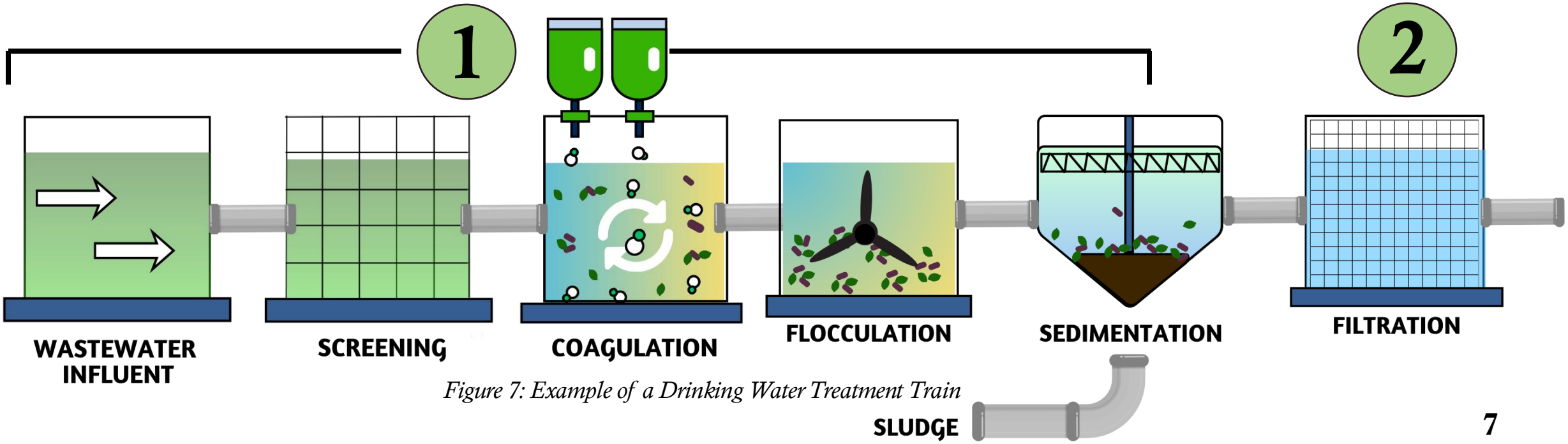


Figure 7: Example of a Drinking Water Treatment Train

TASK 3.0: TREATMENT SELECTION (CONT.)

- Task 3.4 Advanced Treatment
  - Task 3.4.1: Determine Criteria
  - Task 3.4.2: Develop Alternatives
  - Task 3.4.3: Eliminate Less Suitable Alternatives
- Task 3.5 Disinfection
  - *Subtasks are identical to Task 3.4*
- Task 3.6 Brine Handling
  - *(Subtasks are identical to Task 3.4)*
- Task 3.7 Select the Best Alternative
  - Task 3.4.1: Determine Criteria
  - Task 3.4.2: Develop Alternatives
  - Task 3.4.3: Choose the Best Alternative

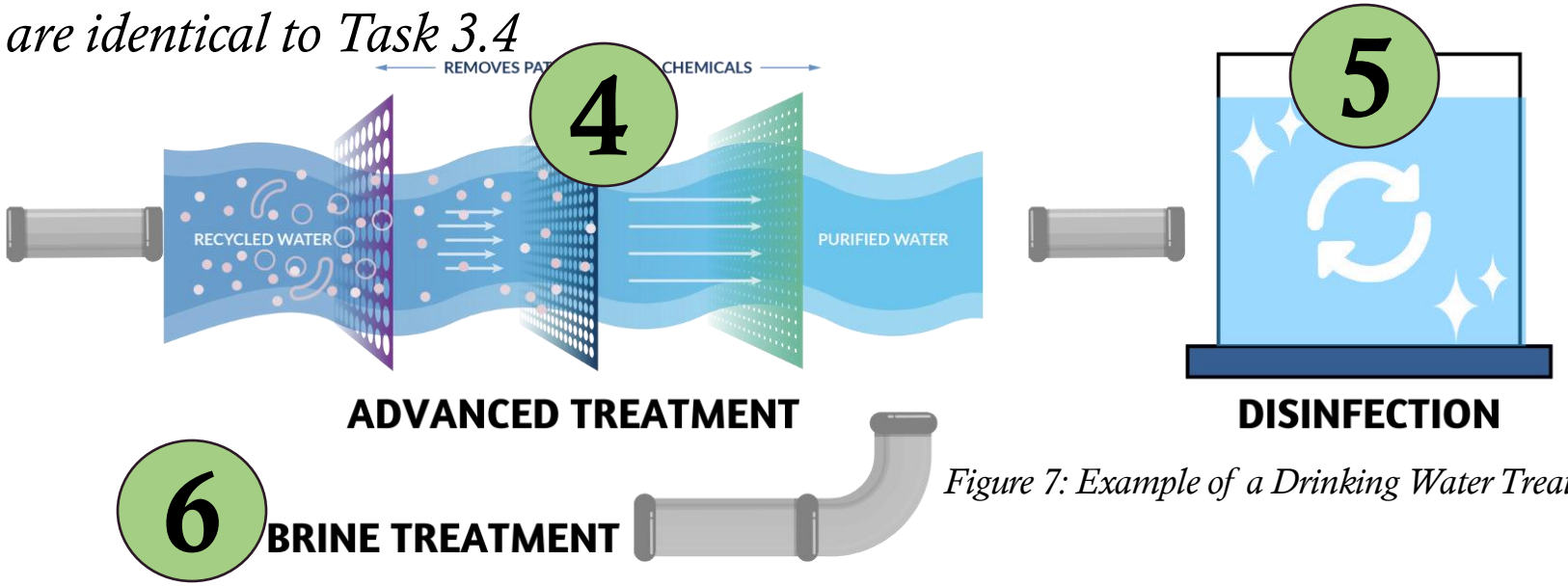


Figure 7: Example of a Drinking Water Treatment Train Cont. [5]

TASK 4.0 FINAL DESIGN

- Task 4.1 Treatment Design
- Task 4.2 Site Layout
- Task 4.3 Hydraulic Design
  - Task 4.3.1 Pipe Design
  - Task 4.3.2 Lift Station Design
  - Task 4.3.3 Pump Selection
  - Task 4.3.4 Hydraulic Profile Design
- Task 4.4 Construction Phasing
- Task 4.5 Public Outreach Plan

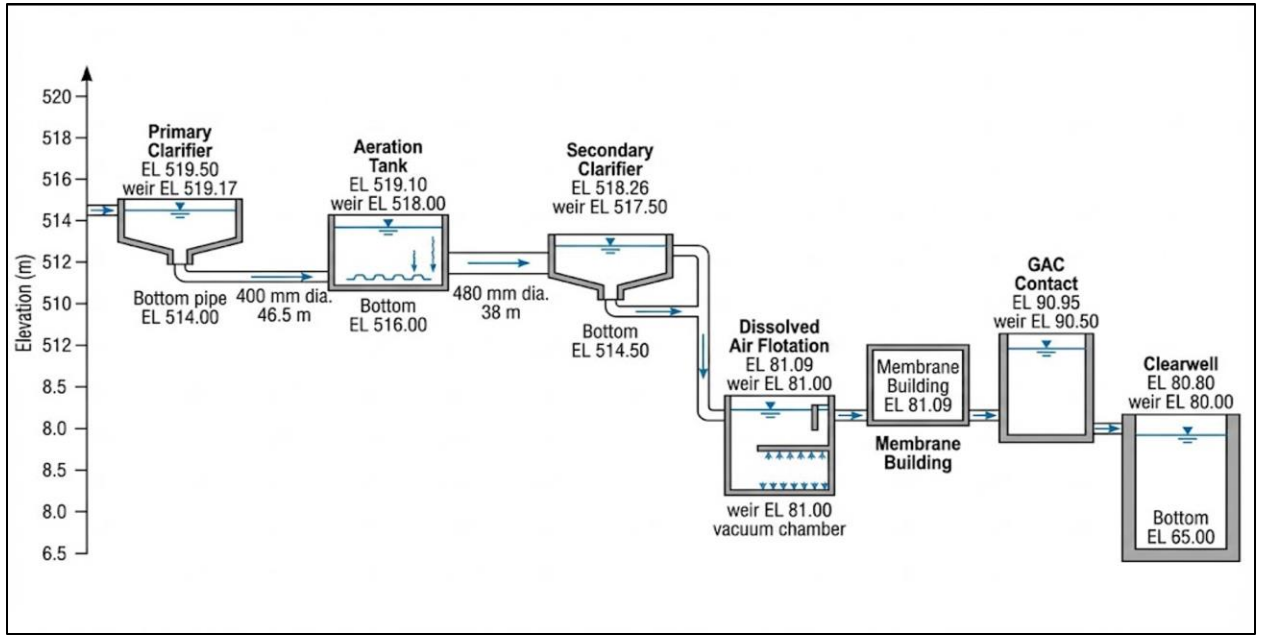


Figure 8: Hydraulic Profile Example [6]

TASK 5.0 COST ANALYSIS

- Task 5.1 Opinion of Probable Cost
- Task 5.2 Operations and Maintenance Cost
- Task 5.3 Life Cycle Cost

Figure 9: Cost and Benefit Image [7]

TASK 6.0 & 7.0

- 6.0 Project Impacts
- 7.0 Project Deliverables
  - Task 7.1 30% Deliverable(Task 1&2)
  - Task 7.2 60% Deliverable (Task 3&4)
  - Task 7.3 Competition Deliverable (Task 5&6)
  - Task 7.4 Competition Presentation and Report
  - Task 7.5 90% Deliverable
  - Task 7.6 Final Deliverable

Figure 10: Students Presenting at AZ Water Student Competition [8]

TASK 8.0 PROJECT MANAGEMENT

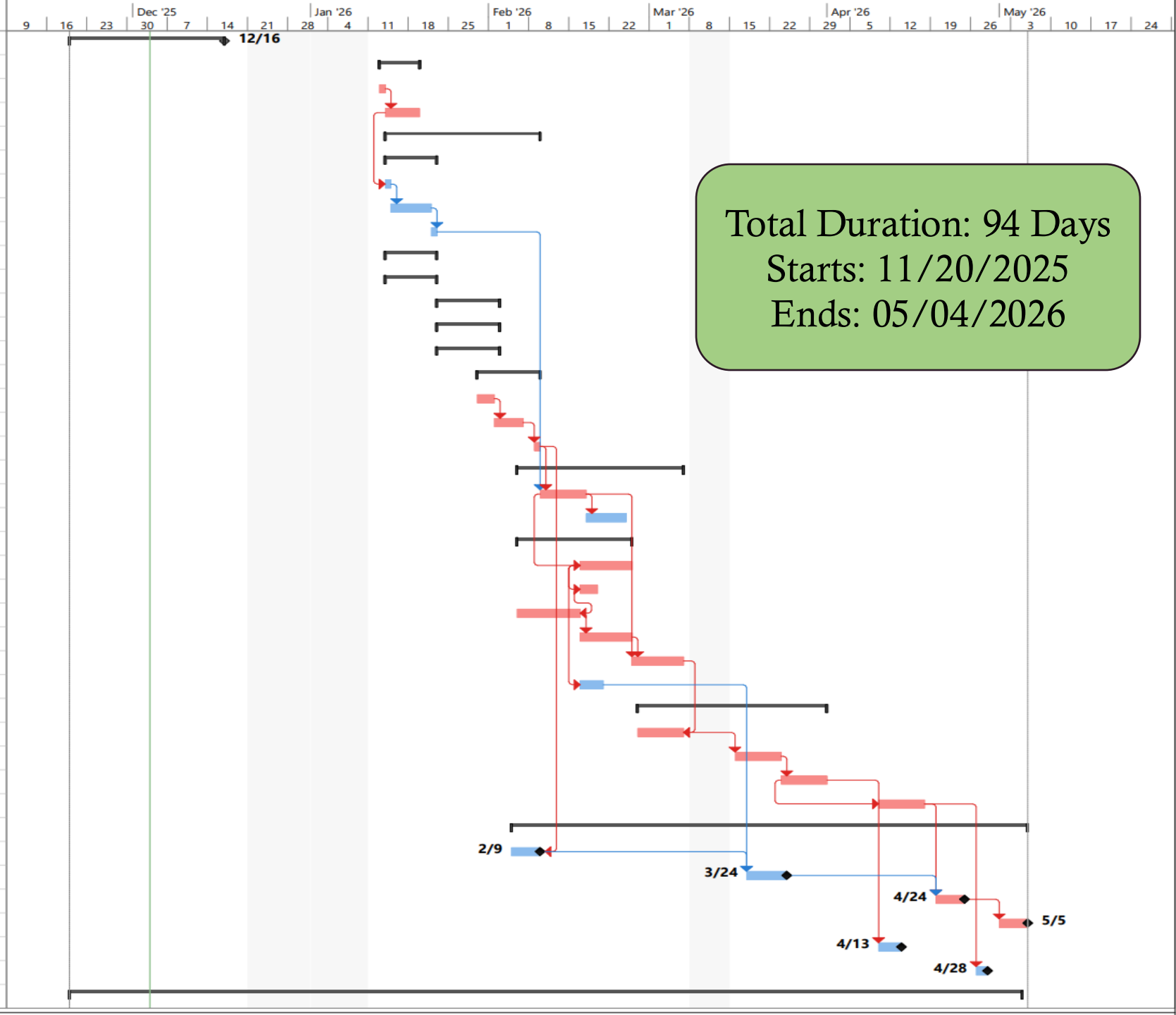
- 8.0 Project Management
  - Task 8.1 Meetings
  - Task 8.2 Schedule Management
  - Task 8.3 Resource Management

Figure 11: Project Management Visualization [9]

EXCLUSIONS

- Operations of the AWPF
- Conveyance of water
- Field Survey Data
- Water Quality Data

1	**Task 1.0: Research and Preparation**
5	**Task 2.0: Site Investigation**
6	Task 2.1 Site Visit
7	Task 2.2: Site Data Analysis
8	**Task 3.0: Treatment Selection**
9	**Task 3.1: Physical Separation**
10	Task 3.1.1 Determine Criteria
11	Task 3.1.2 Develop Alternatives
12	Task 3.1.3 Eliminate Less Suitable Alternative
13	**Task 3.2: Physical Treatment**
17	**Task 3.3: Chemical Treatment**
21	**Task 3.4: Advanced Treatment**
25	**Task 3.5: Disinfection**
29	**Task 3.6: Brine Handling**
33	**Task 3.7 Create Treatment Train Alternatives**
34	Task 3.7.1 Develop Criteria
35	Task 3.7.2 Develop Alternatives
36	Task 3.7.3 Select Best Alternatives
37	**Task 4.0: Final Design**
38	Task 4.1: Treatment Processes
39	Task 4.2: Site Layout
40	**Task 4.3 Hydraulic Design**
41	Task 4.3.1: Lift Station Design
42	Task 4.3.2: Pump Selection
43	Task 4.3.3: Pipe Design
44	Task 4.3.4: Hydraulic Profile Design
45	Task 4.4 Construction Phasing
46	Task 4.6 Public Outreach Plan
47	**Task 5.0 Cost Analysis**
48	Task 5.1 Opinion of Probable Cost
49	Task 5.2 Operations and Maintenance Cost
50	Task 5.3 Life Cycle Cost
51	Task 6.0: Project Impacts
52	**Task 7.0 Project Deliverables**
53	Task 7.1 30% Deliverable
54	Task 7.2 60% Deliverable
55	Task 7.3 90% Deliverable
56	Task 7.4 Final Deliverable
57	Task 7.5 WEF Competition Final Report
58	Task 7.6 WEF Competiton Final Presentation
59	**Task 8.0 Project Management**



- Senior Engineer (SENG)
  - 10+ Years Experience
  - P.E in Civil or Environmental
- Design Engineer (DENG)
  - 5+ Years Experience
  - PE in Civil
- Civil Engineering Intern (CINT)
  - Pursuing BS Civil Engineering
- Environmental Engineering Intern (EINT)
  - Pursuing BS Environmental Engineering

Table 2: Staffing Matrix Summary [1]

Task	SENG (hrs)	DENG (hrs)	CINT (hrs)	EINT (hrs)	Totals
Task 1.0: Research and Preparation	2	5	16	16	39
Task 2.0: Site Investigation	8	8	22	22	60
Task 3.0: Treatment Selection	14	29	51	52	146
Task 4.0: Final Design	11	121	35	34	201
Task 5.0: Cost Analysis	3	10	13	15	41
Task 6.0: Project Impacts	2	4	7	8	21
Task 7.0: Project Deliverables	5	15	28	28	77
Task 8.0: Project Management	13	45	15	15	88
Summary	**59**	**237**	**187**	**190**	**673**

Table 3: Cost of Services Breakdown [1]

Category	Sub-Category	Classification	Quantity	Unit	Rate	Unit	Cost ($)
1.0 Personnel		SENG	59	hours	315	$/hr	$18,585
		DENG	237	hours	225	$/hr	$53,325
		CINT	187	hours	40	$/hr	$7,480
		EINT	190	hours	40	$/hr	$7,600
						Subtotal:	**$86,990**
2.0 Supplies		WEF Membership	4	memberships	21	$/membership	$84
		Computer Lab Rental	15	days	100	$/day	$1,500
						Subtotal:	**$1,584**
3.0 Travel	**3.1 Site Visit**	Mileage	302	miles	0.28	$/mile	$85
		Car Rental	1	day	50.75	$/day	$51
	3.2 Competition	Mileage	284	miles	0.28	$/mile	$80
		Car Rental	2	days	50.75	$/day	$102
		Hotel (one night)	3	night-room	142	$/night-room	$426
		Per Diem (2 days)	10	Day-person	40	$/day-person	$400
						Subtotal:	**$1,144**
~~Total Cost of Engineering Services~~							**$89,718**

REFERENCES

[1] Z. Espinosa-Cordova, C. Linares, A. J. Schmitt, and K. Vera, "Proposal for the City of Phoenix 91st Avenue Advanced Water Purification Facility," Northern Arizona University, Dec. 2025.

[2] Maricopa County Environmental Services, "Instructions for Notice of Transfer for an Onsite Wastewater Treatment Facility," Feb. 2021. https://www.maricopa.gov/DocumentCenter/View/29735/Notice-of-Transfer-Instructions-PDF (accessed Nov. 23, 2025).

[3] Water, "WEF - WEF Brand Elements," *Wef.org*, 2025. https://www.wef.org/about/contact/media-resources/wef-logo-page/ (accessed Nov. 24, 2025).

[4] "About Tres Rios," City of Phoenix, https://www.phoenix.gov/administration/departments/waterservices/development-infrastructure/tres-rios-wetlands/about.html (accessed Dec. 3, 2025).

[5] "Advanced Purified Water," *Phoenix.gov*, 2025. https://www.phoenix.gov/administration/departments/waterservices/water-quality/advanced-purified-water.html

[6] Google Gemini, "Hydraulic profile diagram of water treatment process," [Generative AI image]. Generated: Dec. 4, 2025.

[7] "Benefit analysis stock illustrations – 10,259 benefit analysis stock illustrations, Vectors & Clipart," Dreamstime, https://www.dreamstime.com/illustration/benefit-analysis.html (accessed Dec. 1, 2025).

[8] AZ Water, *2025-202 Water Student Design Competition* , 2025.

[9] Insight, "Social Impact of a project how to measure it? - social insight," Insight, https://insightsocial.org/en/impacto-social-de-un-proyecto-como-medirlo-insight-social/ (accessed Dec. 1, 2025).