EXPANSION OF SPECIAL PLANNING AREA (SPA) I WATER RECLAMATION FACILITY (WRF) FOR THE CITY OF SURPRISE

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CENE 476 - FINAL PRESENTATION

12/6/2024

PROJECT INTRODUCTION

- Purpose:
  - Expand functional treatment capacity of SPA 1 WRF from 12.8 MGD to 16.3 MGD
  - Compete in Water Environment Federation (WEF) Student Design Competition
- Client:
  - City of Surprise
  - Dr. Heiderscheidt
  - WEF

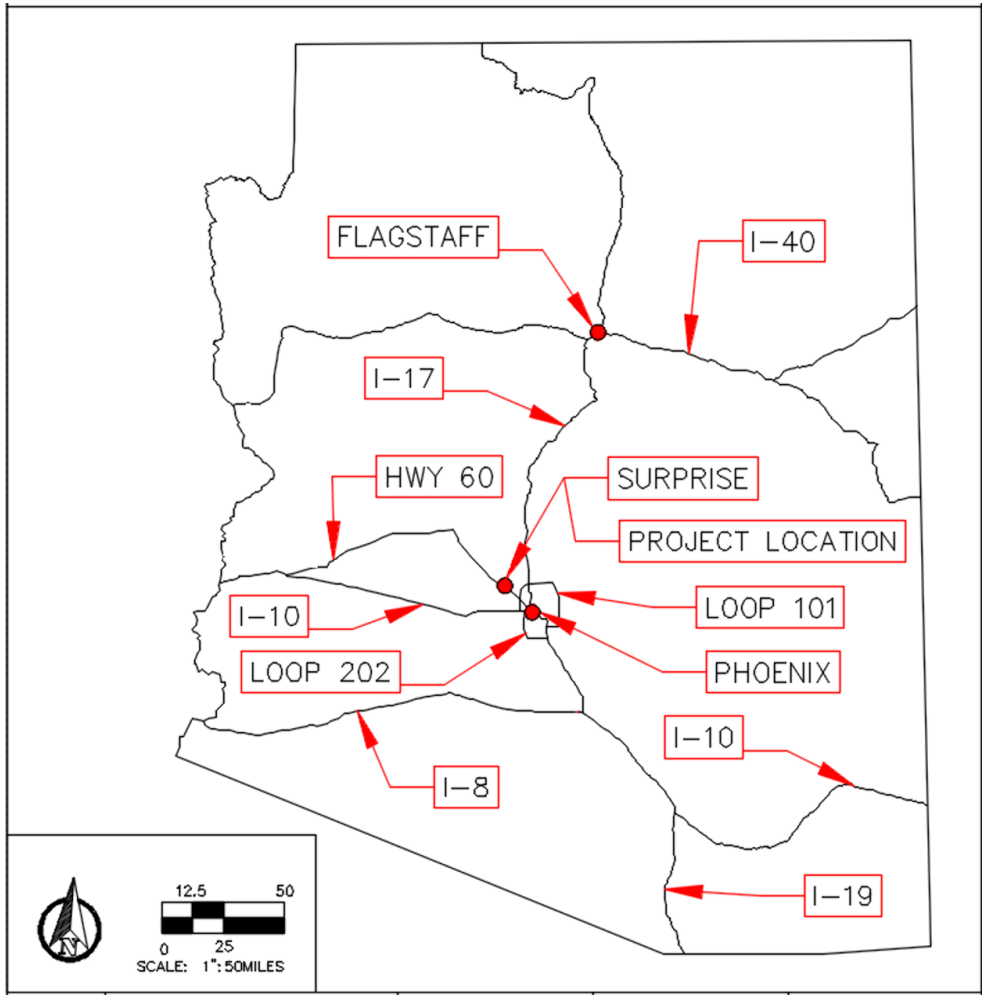

Figure 1: Location Map

Figure 2: Vicinity Map [1]

PROJECT INTRODUCTION (CONTINUED)

- Brief Background
  - SPA 1 has a total of 5 plants
  - Plants 1 and 2 are antiquated
  - Plants 4 and 5 are being upgraded per this project
  - Plant 3 will remain untouched and operational

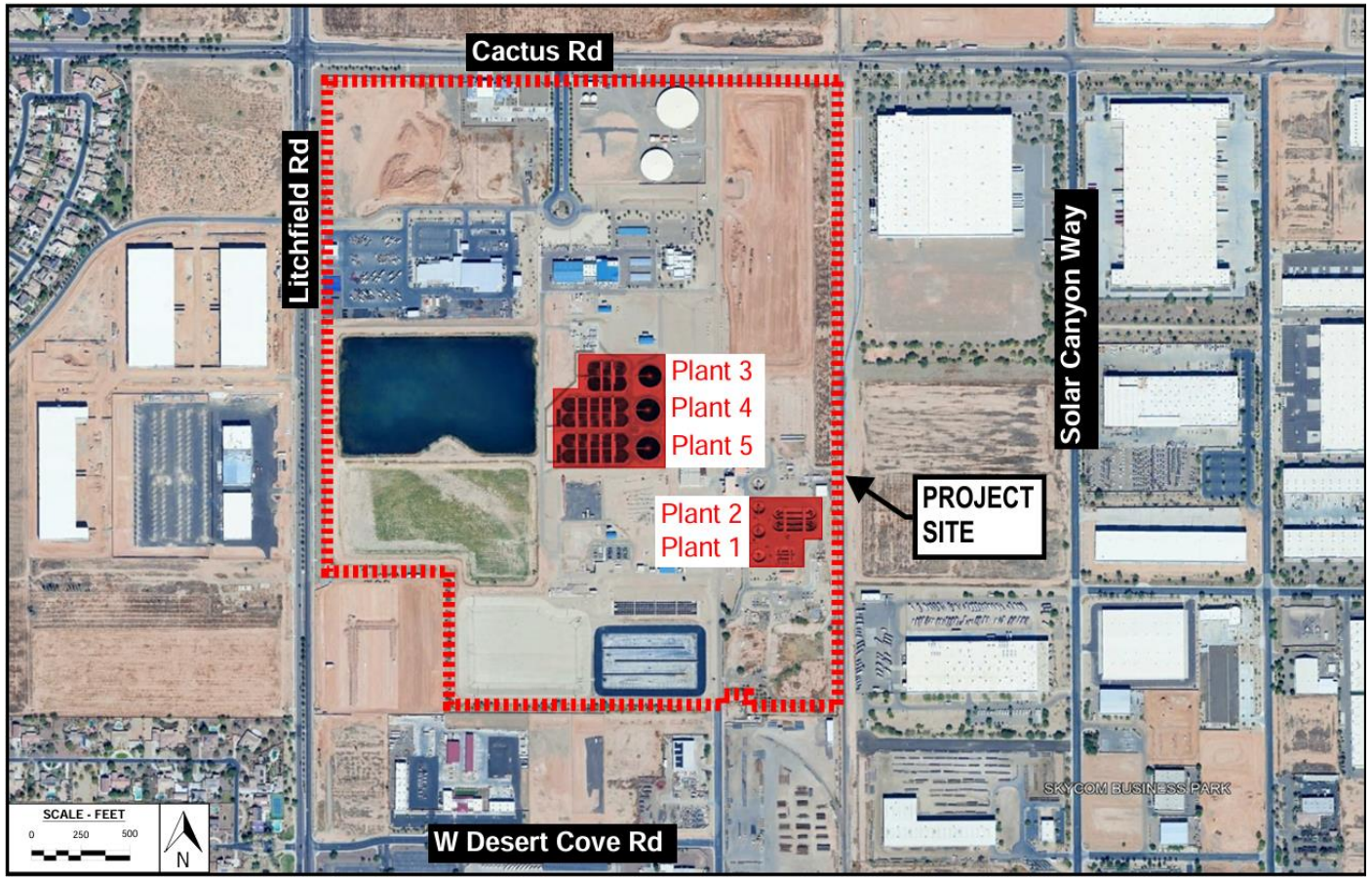

Figure 3: Site Map [2]

TASK 1: RESEARCH PREPARATION

- Task 1.1: Regulation Research
- Task 1.2: Wastewater Treatment Research
- Task 1.3: WEF Application

Figure 4: ADEQ Logo [3]

Figure 5: WEF Logo [4]

TASK 2: SITE ASSESSMENT

- Task 2.1: Site Visit
- Task 2.2: Data Analysis
- Task 2.3: Existing Hydraulic Profile

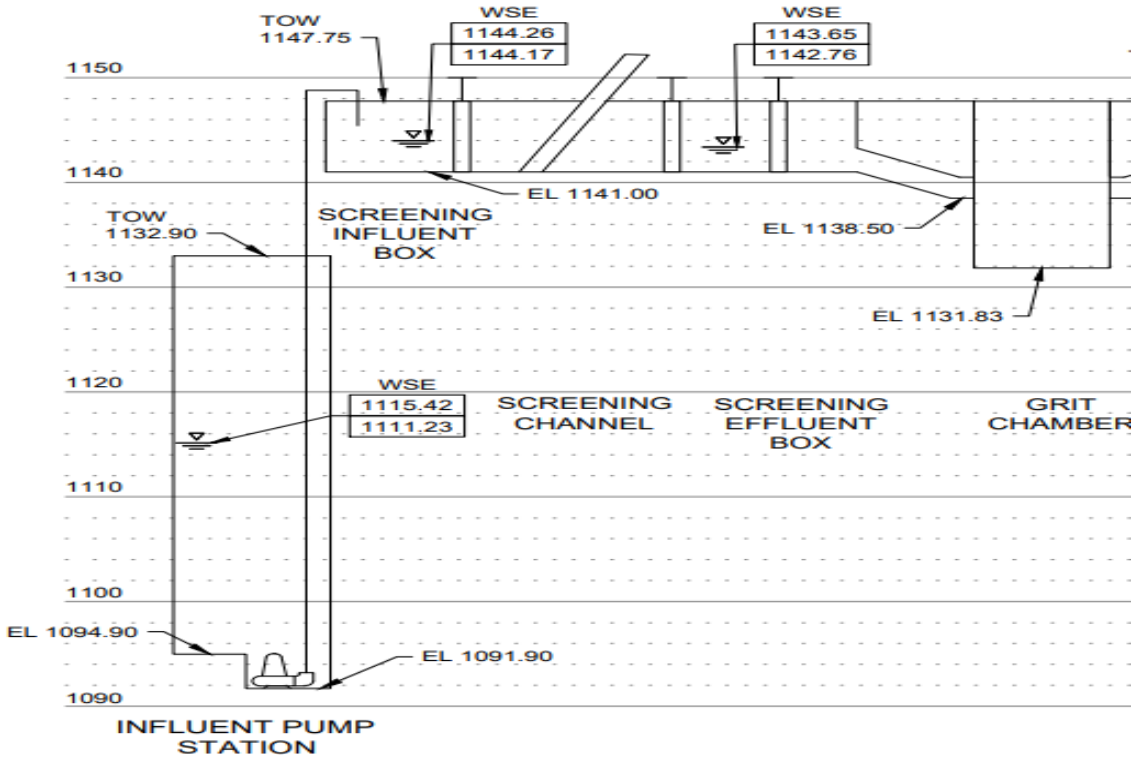

Figure 6: Example of Partial Existing Hydraulic Profile [2]

TASK 3: TREATMENT PROCESS SELECTION

- Task 3.1: Determine Plant Requirements
- Task 3.2: Preliminary Treatment Selection
  - Task 3.2.1: Determine Criteria
  - Task 3.2.2: Develop Preliminary Treatment Alternatives
  - Task 3.2.3: Choose Best Alternative
- Task 3.3: Primary Treatment Selection
- Task 3.4: Secondary Treatment Selection
- Task 3.5: Advanced Treatment Selection
- Task 3.6: Solids Management Selection
- Task 3.7: Disinfection Selection

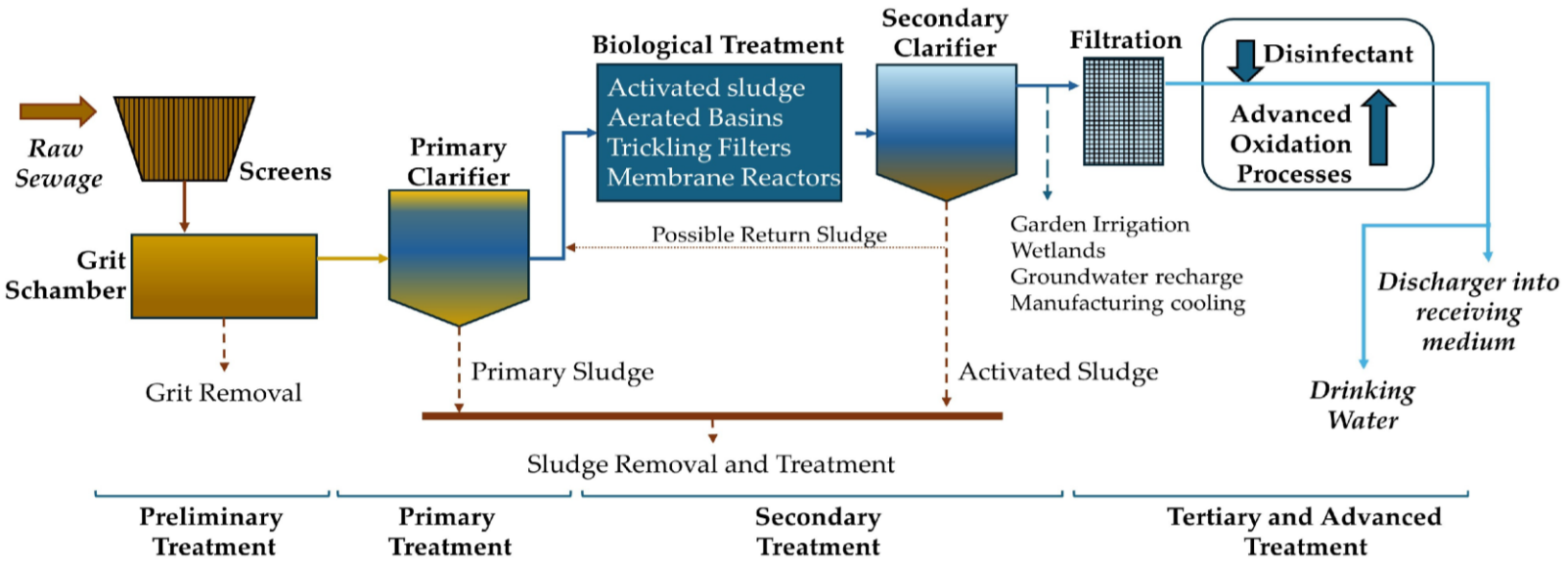

Figure 7: Wastewater Process Train [5]

TASK 4: FINAL DESIGN

- Task 4.1 Final Treatment Process Design
  - Task 4.1.1 Preliminary Treatment Design
  - Task 4.1.2 Primary Treatment Design
  - Task 4.1.3 Secondary Treatment Design
  - Task 4.1.4 Advanced Treatment Design
  - Task 4.1.5 Disinfection Design
  - Task 4.1.6 Solids Management Design
- Task 4.2: Site Layout

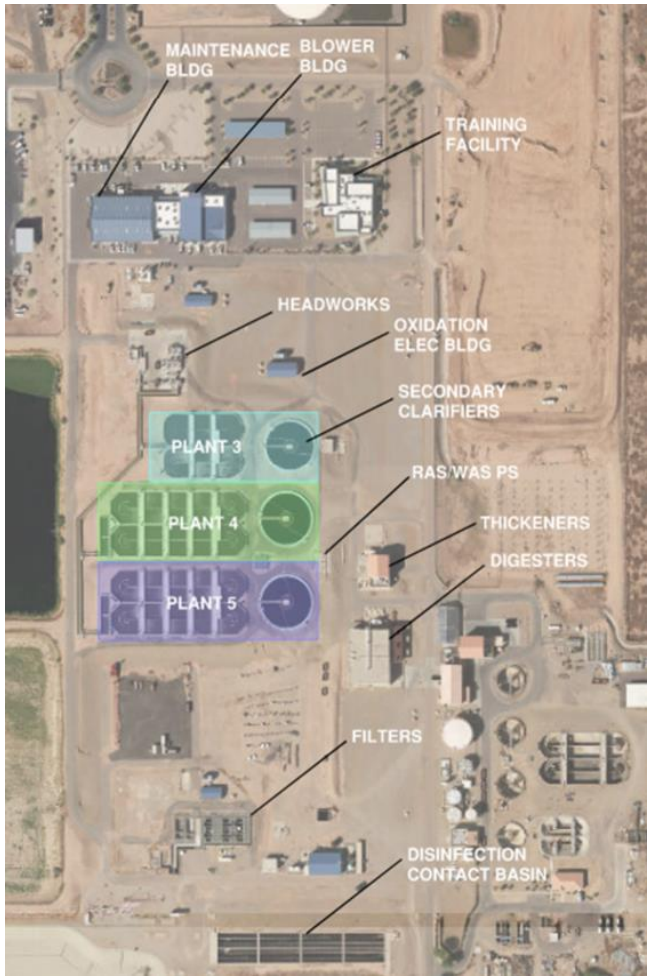

Figure 8: Existing SPA-1 Site Layout [2]

TASK 4: FINAL DESIGN CONTINUED

- Task 4.3: Hydraulic Analysis
  - Task 4.3.1: Existing Piping Analysis
  - Task 4.3.2: New Piping Design
  - Task 4.3.3 Pump Selection
  - Task 4.3.4 Develop New Hydraulic Profile
- Task 4.4: Construction Phasing
- Task 4.5: Economic Analysis
  - Task 4.4.1: Construction Cost
  - Task 4.4.2: Maintenance and Operation Costs
  - Task 4.4.3: Compute Life Cycle Cost

TASK 5, 6, AND 7

- Task 5: Project Impacts
- Task 6: Project Deliverables
  - Task 6.1: 30% Deliverable
  - Task 6.2: 60% Deliverable
  - Task 6.3: 90% Deliverable
  - Task 6.4: Final Deliverable
  - Task 6.5: Competition Final Report
  - Task 6.6: Competition Final Presentation
- Task 7: Project Management

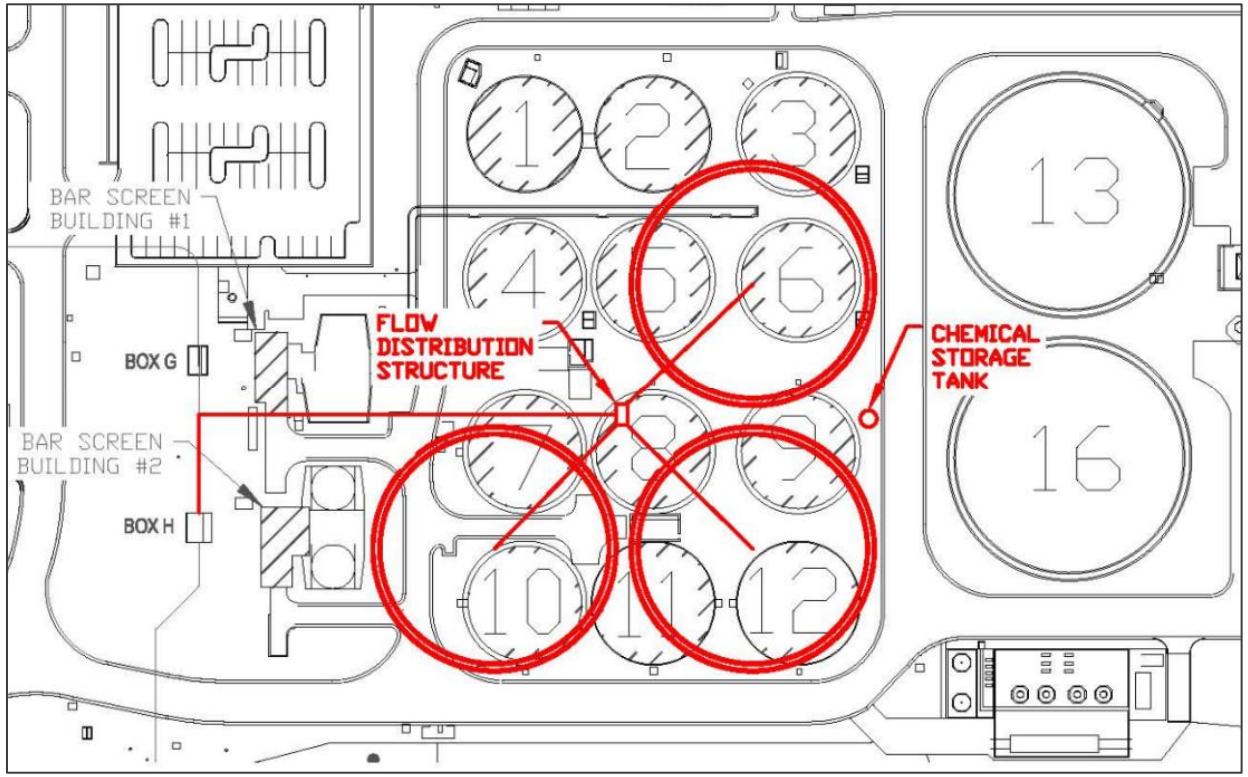

Figure 9: Sample Final Site Layout from the 2016 WEFTEC Winning Report [2]

EXCLUSIONS

- SPA 1 will be the only focus
- Conveyance of sewage or reclaimed water offsite
- Water quality of influent/effluent data
- Field survey of the site
- Onsite ground water recharge systems
- Construction plan sets

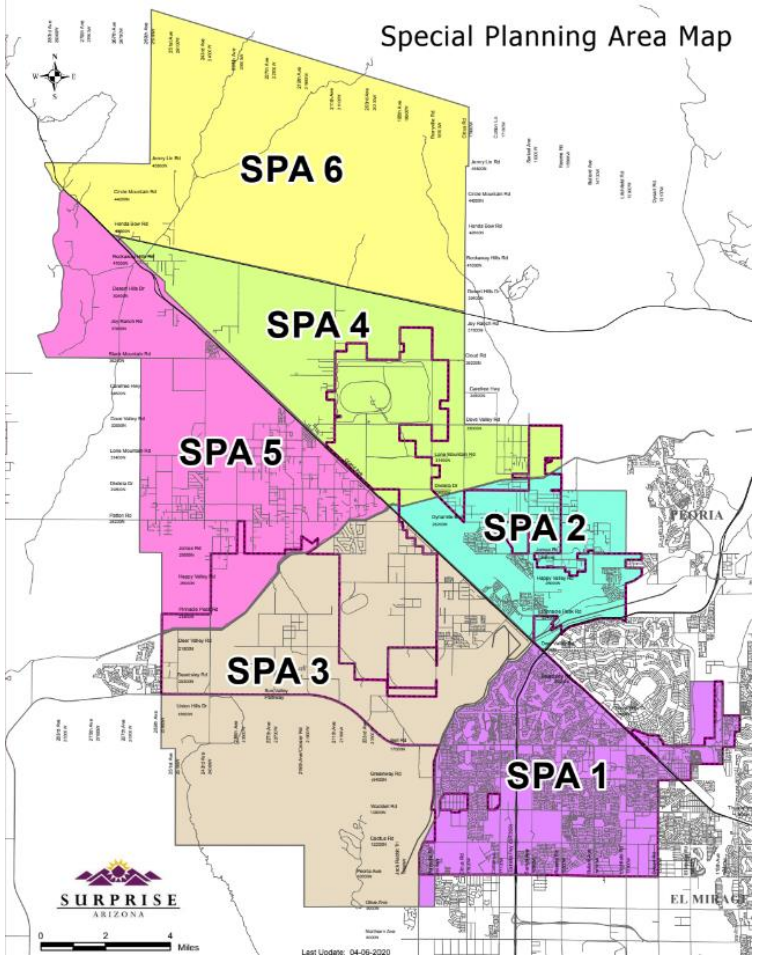

Figure 10: Special Planning Area Map [6]

SCHEDULE

ID	Task Name
1	**Task 1: Research Preparation**
2	Task 1.1: Regulation Research
3	Task 1.2: Wastewater Treatment Research
4	Task 1.3: WEF Application
5	**Task 2: Site Assessment**
6	Task 2.1: Site Visit
7	Task 2.2: Data Analysis
8	**Task 3: Treatment Process Selection**
9	Task 3.1: Determine Plant Requirements
10	**Task 3.2: Preliminary Treatment Selection**
11	Task 3.2.1 Determine Criteria
12	Task 3.2.2: Develop Preliminary Treatment Alternatives
13	Task: 3.2.3: Select Best Alternative
14	**Task 3.3: Primary Treatment Selection**
15	Task 3.3.1 Determine Criteria
16	Task 3.3.2: Develop Preliminary Treatment Alternatives
17	Task: 3.3.3: Select Best Alternative
18	**Task 3.4: Secondary Treatment Selection**
19	Tasks 3.4.1 Determine Criteria
20	Task 3.4.2: Develop Secondary Treatment Alternatives
21	Task: 3.4.3: Select Best Alternative
22	**Task 3.5: Advanced Treatment Selection**
26	**Task 3.6: Disinfection Technology Selection**
30	**Task 3.7: Solids Management Selection**
31	Tasks 3.7.1 Determine Criteria
32	Task 3.7.2: Develop Advanced Treatment Alternatives
33	Task: 3.7.3: Select Best Alternative
34	**Task 4: Final Design**
35	**Task 4.1: Final Treatment Process Design**
36	Task 4.1.1: Preliminary Treatment Design
37	Task 4.1.2: Primary Treatment Design
38	Task 4.1.3: Secondary Treatment Design
39	Task 4.1.4: Advanced Treatment Design
40	Task 4.1.5: Disinfection Design
41	Task 4.1.6: Solids Management Design
42	Task 4.2: Site Layout
43	**Task 4.3: Hydraulic Analysis**
44	Task 4.3.1 Existing Piping Analysis
45	Task 4.3.2: New Piping Design
46	Task 4.3.2 Pump Selection
47	Task 4.3.4: Develop New Hydraulic Profile
48	Task 4.4: Construction Phasing
49	**Task 4.5: Life Cycle Cost Analysis**
50	Task 4.5.1: Construction Cost
51	Task 4.5.2: Maintenance and Operation Costs
52	Task 4.5.3: Calculate Life Cycle Cost
53	Task 5: Project Impacts Analysis
54	**Task 6: Project Deliverables**
55	Task 6.1: 30% Deliverables
56	Task 6.2: 60% Deliverables
57	Task 6.3: 90% Deliverables
58	Task 6.4: Final Deliverable
59	Task 6.5: Competition Final Report
60	Task 6.6: Competition Final Presentation
61	Task 7: Project Management

Start Date: 12/9/2024
End Date: 04/25/2025
Duration: 138 days

STAFFING

STAFFING

Table 1: Summary Staffing Chart [7]

Task	SENG	DENG	CINT	EINT	TOTALS
Task 1: Research Preparation	1	0	12	12	**25**
Task 2: Site Assessment	8	8	12	12	**40**
Task 3: Treatment Process Selection	25	40	70	70	**205**
Task 4: Final Design	13	174	46	44	**277**
Task 5: Project Impact Analysis	4	16	2	2	**24**
Task 6: Project Deliverables	17	14	47	47	**125**
Task 7: Project Management	30	30	15	15	**90**
Summary	**98**	**282**	**203**	**201**	**786**

COST

Table 2: Overall Cost Breakdown [7]

Category	Sub-Category	Classification	Quantity	Unit	Rate	Unit	Cost ($)
1.0 Personnel		SENG	98	hours	250	$/hour	$24,500
		DENG	282	hours	150	$/hour	$42,300
		CINT	203	hours	50	$/hour	$10,150
		EINT	201	hours	50	$/hour	$10,050
						Subtotal:	**$87,000**
2.0 Supplies		Membership	4	memberships	20	$/subscription	$80
		Computer Lab Rental	10	days	100	$/day	$1,000
						Subtotal:	**$1,080**
3.0 Travel	**3.1 Site Visit**	Car	1	day	38.93	$/day	$39
		Gas	286	miles	0.445	$/mile	$127
	3.2 Competition	Car	2	day	38.93	$/day	$78
		Gas	286	miles	0.445	$/mile	$127
		Per Diem	8	day-person	36.75	$/day-person	$294
		Hotel	3	night-room	156	$/night-hotel	$468
						Subtotal:	**$1,133**
						Total Cost of Engineering Services:	**$89,213**

CITATIONS

- [1] Google Maps, Google, 2024. [Online]. Available: https://www.google.com/maps. [Accessed 21 September 2024].
- [2] A. W. Association, "2024-2025 AZWA Student Design Competition: Competition Details & Prompt Packet," Surprise, 2024
- [3] W. E. F.-W. Home, "WEF - WEF Home," wef.org. https://www.wef.org/
- [4] "ADEQ Arizona Department of Environmental Quality | Our mission is to protect and enhance public health and the environment," www.azdeq.gov. https://www.azdeq.gov/
- [5] Fernandes, P. Ramisio and H. Puga, "A Comprehensive Review on Various Phases of Wastewater Technologies: Trends and Future Perspectives," *MDPI,* vol. 5, no. 4, p. 3, 20
- [6] City of Surprise, "Development and Zoning Maps" [Online] Available: https://surpriseaz.gov/267/Development-Zoning-Maps
- [7] O. Lara, A. Layden, A. Shipley and T. Wade, *Project Proposal: Expansion of SPA 1 Water Reclamation Facility for the City of Surprise,* Flagstaff: NAU CENE Department, 2024.