

Water Environment Federation & AZ Waters Student Competition

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CENE 476 Proposal
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Project Description

- **Purpose:** To design, retrofit, and/or expand a wastewater treatment facility
- **Client:** AZ Water & WEF
- **Location:** A city in Arizona
- **Stakeholders:** AZ Water, AZ Department of Environmental Quality, WEF, NAU, and the City benefiting from the design
- **Constraints:** Site dimensions, budget, demand



Figure 1: Map of Arizona [1]

Task 1: Research Preparation

1.1 Application Process

Join AZ Water & WEF

1.2 Treatment Technology Research

Both Conventional and Innovative Technology

Task 2: Site Assessment

2.1 Site Research

2.2 Site Visit

2.3 Site Layout



Professionals Dedicated To Arizona's Water



Figure 2: Logo of AZ Water [2]

Task 3: Treatment Design

3.1 Plant Requirement

Ex. Water Demand, Codes, Source Water Quality

3.2 Pretreatment Design

Ex. Mechanical Screens, Grit Chambers

3.3 Primary Treatment

Ex. Settling Chamber, Coagulation & Flocculation, Primary Sludge

3.4 Secondary Treatment

Ex. Aeration Basins, Membrane Biofilters, Microbial Fuel Cells, etc.

3.5 Tertiary/Advanced Treatment

Ex. Nitrogen Removal, Disinfection, etc.

3.6 Biosolids/Sludge Handling

Ex. Land Application, Incineration, Beneficial Use, Landfills



Figure 3: Example of Bar Screens in WWTP [3]

Task 4: Cost Economics

4.1: Construction Costs

Material for construction (steel, concrete), Equipment (pumps, treatment technology), Labor cost, Design life expectancy, Life cycle analysis cost

4.2: Maintenance Costs

May be affected by population fluxes, Wear-and-tear, up-keep needs of determined technology and replacements

4.3: Operation Costs

Energy Costs (treatment and pumping), Chemicals (Coagulation & Flocculation, Disinfection), Supplies, Pay of operators

Task 5: Project Impact

5.1: Social Impacts

Brief analysis of effects that WWTP has on community

5.2: Economic Impacts

Brief analysis on effects of WWTP location to residency and new jobs

5.3: Regulatory Impacts

Brief analysis of how WWTP will be affected by local, state, and federal regulations

5.4: Environmental Impacts

Brief analysis on the effect of discharge on environment & effect of operations on environment



Figure 4: Bad effluent discharge into river [4]

Task 6: Project Deliverables

6.1 Reports

- 30%: Registration to Design Requirements
- 60%: Complete Task 3: Treatment Design
- 90%: All tasks completed with the exception of final submittals and UGRADS
- Final: All tasks completed with edits

6.2 Presentations

- 30%, 60%, 90%, & Final

6.3 Website

6.4 Competition Submittals

- Design Report
- Presentation

Task 7: Project Management

7.1 Meetings

Keep track of meetings with the team, advisors, and clients

7.2 Scheduling

Ensure the schedule is being updated according to any changes needed or made

7.3 Resource Management

Manage financial resources, human skills, information technology and natural resources

Exclusions

Environmental Impact Study (EIS)/Environmental Impact Assessment (EIA)

- Analysis done surrounding the area of the Wastewater Treatment Plant.

Construction

- Construction plan for structural analysis and values.
- Safety site planning.

Site Surveying

- Not responsible for cut and fill and other similar actions.

Permit Acquisition

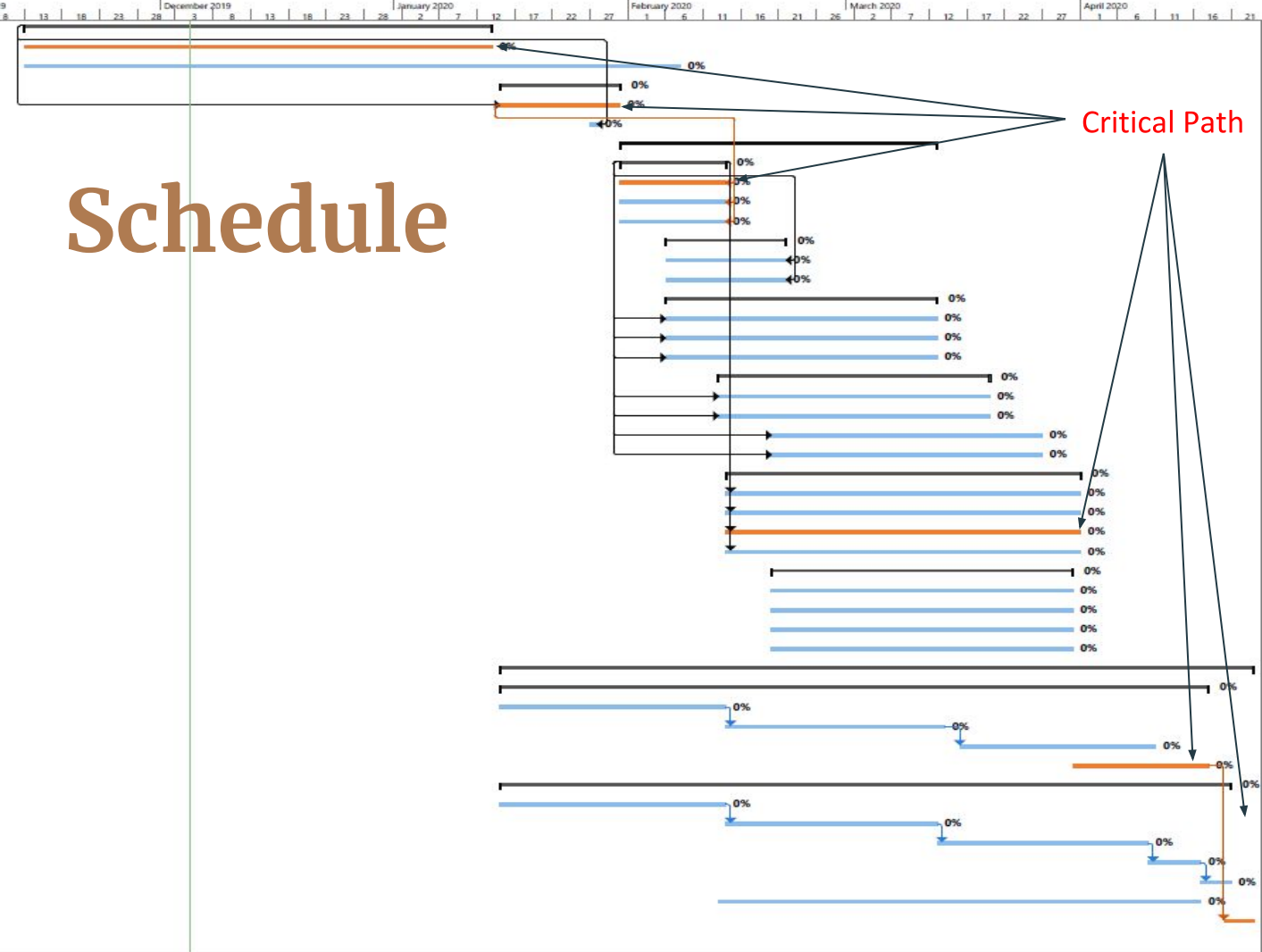
- Permits for the operation of the WWTP.

Lab/Pilot Studies

- No need for new data, use established data

Schedule

1	Task 1: Research Preparation	Wed 11/13/19	Mon 1/13/20
2	Task 1.1: Application Process	Wed 11/13/19	Mon 1/13/20
3	Task 1.2: Treatment Research	Wed 11/13/19	Fri 2/7/20
4	Task 2: Site Assessment	Wed 1/15/20	Thu 1/30/20
5	Task 2.1: Site Research	Wed 1/15/20	Thu 1/30/20
6	Task 2.2: Site Visit	Mon 1/27/20	Mon 1/27/20
7	Task 3: Treatment Design	Fri 1/31/20	Thu 3/12/20
8	Task 3.1: Plant Requirement	Fri 1/31/20	Thu 2/13/20
9	Task 3.1.1: Source Water Quality	Fri 1/31/20	Thu 2/13/20
10	Task 3.1.2: Population Estimation	Fri 1/31/20	Thu 2/13/20
11	Task 3.1.3: Codes and Effluent Limits	Fri 1/31/20	Thu 2/13/20
12	Task 3.2: Preliminary Treatment	Thu 2/6/20	Fri 2/21/20
13	Task 3.2.1: Screen Design	Thu 2/6/20	Fri 2/21/20
14	Task 3.2.2: Grit Chamber Design	Thu 2/6/20	Fri 2/21/20
15	Task 3.3: Primary Treatment	Thu 2/6/20	Thu 3/12/20
16	Task 3.3.1: Sedimentation Basin Design	Thu 2/6/20	Thu 3/12/20
17	Task 3.3.2: Coagulation and Flocculation	Thu 2/6/20	Thu 3/12/20
18	Task 3.3.3: Primary Sludge Handling	Thu 2/6/20	Thu 3/12/20
19	Task 3.4: Secondary Treatment	Thu 2/13/20	Thu 3/19/20
20	Task 3.4.1: OM and BOD Removal	Thu 2/13/20	Thu 3/19/20
21	Task 3.4.2: Disinfection	Thu 2/13/20	Thu 3/19/20
22	Task 3.5: Tertiary Treatment	Thu 2/20/20	Thu 3/26/20
23	Task 3.6: Sludge/Biosolids Management	Thu 2/20/20	Thu 3/26/20
24	Task 4: Cost/Economics	Fri 2/14/20	Tue 3/31/20
25	Task 4.1: Construction Costs	Fri 2/14/20	Tue 3/31/20
26	Task 4.2: Maintenance Cost	Fri 2/14/20	Tue 3/31/20
27	Task 4.3: Operation Cost	Fri 2/14/20	Tue 3/31/20
28	Task 4.4: Design Cost	Fri 2/14/20	Tue 3/31/20
29	Task 5: Project Impacts	Thu 2/20/20	Mon 3/30/20
30	Task 5.1: Social Impacts	Thu 2/20/20	Mon 3/30/20
31	Task 5.2: Economic Impacts	Thu 2/20/20	Mon 3/30/20
32	Task 5.3: Regulatory Impacts	Thu 2/20/20	Mon 3/30/20
33	Task 5.4: Environmental Impacts	Thu 2/20/20	Mon 3/30/20
34	Task 6: Project Deliverables	Wed 1/15/20	Thu 4/23/20
35	Task 6.1: Project Reports	Wed 1/15/20	Fri 4/17/20
36	Task 6.1.1: 30% Progress Report	Wed 1/15/20	Thu 2/13/20
37	Task 6.1.2: 60% Progress Report	Fri 2/14/20	Fri 3/13/20
38	Task 6.1.3: 90% Progress Report	Mon 3/16/20	Fri 4/10/20
39	Task 6.1.4: Final Report	Tue 3/31/20	Fri 4/17/20
40	Task 6.2: Presentations	Wed 1/15/20	Mon 4/20/20
41	Task 6.2.1: 30% Presentation	Wed 1/15/20	Thu 2/13/20
42	Task 6.2.2: 60% Presentation	Fri 2/14/20	Thu 3/12/20
43	Task 6.2.3: 90% Presentation	Fri 3/13/20	Thu 4/9/20
44	Task 6.2.4: Final Presentation	Fri 4/10/20	Thu 4/16/20
45	Task 6.2.5: U-Grad Presentation	Fri 4/17/20	Mon 4/20/20
46	Task 6.3: Website and Submittal	Thu 2/13/20	Thu 4/16/20
47	Task 6.4: Competition Submittal	Mon 4/20/20	Thu 4/23/20
48	Task 7: Project Management	Mon 1/13/20	Fri 4/24/20



Staffing

Task	SENG	ENG	EIT	AA	Intern	Task Total
1.0 Research Preparation	2	2	12	7	32	55
2.0 Site Assessment	5	8	18	3	8	42
3.0 Treatment Design	15	133	77	17	52	372
4.0 Cost/Economics	8	16	16	12	8	60
5.0 Project Impacts	4	8	32	0	0	44
6.0 Project Deliverables	16	150	82	27	27	302
7.0 Project Management	14	41	21	21	0	97
TOTAL	64	358	258	87	127	894

Cost

1.0 Personnel	Classification	hours	Rate \$/hr	Cost
	Senior Engineer	64	195	\$12,480
	Engineer	358	120	\$42,960
	EIT	258	100	\$25,800
	Admin. Assist	87	50	\$4,350
	Intern	127	20	\$2,540
		Personnel Sub-total		\$88,130
2.0 Travel	Classification	Items	Rates	Cost
	Site Visit	288 mi max	\$0.58 / mi	\$168
		Van Fee	\$43 / day	\$43
	Competition	310 mi	\$0.58 / mi	\$180
		Van Fee	\$43 / day	\$ 129
		2 Rooms 2 Nights	\$ 133/room/ night	\$532
		Travel Sub-total		\$1,040
3.0 Supplies	Classification	Items	Rate \$/mi	Cost
	3D Printing	1kg	\$0.05 / g	\$50
	Memberships	5 people	\$35 / person	\$175
		Supplies Subtotal		\$225
Total				\$89,395



Questions?



References

- [1] Maps, T., Maps, U., Atlases, H. and Us, C. (2019). State and County Maps of Arizona. [online] MapofUS.org. Available at: <https://www.mapofus.org/arizona/> [Accessed 8 Oct. 2019].
- [2] Azwater.org. (2019). AZ Water Association. [online] Available at: <https://www.azwater.org/> [Accessed 9 Oct. 2019].
- [3] “Tap water industry wastewater treatment preceding stage screening equipment - bar screen (grilling spotter)” *Alibaba.com*, Available]: https://www.alibaba.com/product-detail/Tap-water-industry-waste-water-treatment-preceding_60620634515.html
- [4] Kelly, Rachel. “Gore Council blames Gloves for Discharge into River”. *Stuff*, 4 Feb. 2019, [Available]: <https://www.stuff.co.nz/southland-times/southland-top-stories/110336052/gore-council-blames-glove-for-discharge-to-river>