

WATER TREATMENT

COMPETITION RULES



WHAT DID THE EFFLUENT
SAY AFTER TREATMENT?

WHAT?



"I FEEL SO MUCH CLEARER
NOW."



HOSTED BY

SAN JOSE STATE UNIVERSITY

Water Treatment Competition Rules

Competition Date: Sunday, April 12th, 2026

Competition Location: San Jose State University

SUMMARY

The ASCE Mid-Pacific Water Treatment Competition includes the research, design, presentation, and the hands-on construction of a filtration system from household supplies. The filter will be loaded with standardized simulated wastewater to test. And will be judged based on water quality, design report, efficiency, sustainability, cost, and technical oral presentation.

IMPORTANT DEADLINES

Design Report & Poster submitted electronically in PDF format due by **Sunday, March 29th 11:59 PM Pacific Time** with subject line: University Name _Water Treatment Report

Name your PDF attachments as follows:

- University Name_Design Report Water Treatment.pdf
- University Name_Poster_Water Treatment.pdf

Presentations submitted electronically in power point format due by **Friday, April 3rd at 11:59 PM Pacific Time** with subject line: University Name _ Water Treatment Presentation

Name your PowerPoint attachment as follows:

- University Name_Presentation_Water Treatment.ppt

Questions & Materials Request: Emailed by **Tuesday January 20th 11:59 PM Pacific Time**

The Competition Chair will send teams confirmations emails when reports and presentations are received.

**Failure to comply with the above deadlines will result in a 5 point deduction from the team's final score.*

CONTACT

Any questions regarding the Water Treatment Competition can be sent to:

Tia Jackson-Brunette
Tia.Jackson-Brunette@sjsu.edu

*Please send any questions or inquiries about the Water Treatment Competition to the competition chair. Messages/emails sent to any other accounts will not be addressed. Replies may take up to 3 business days.

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Scenario

After several years of mishandling and illegally dumping of toxic waste from local corporations within the San Francisco Bay Area, industrial runoff has contaminated the imported surface water brought in from various sources across California, such as the Sacramento Delta. Additionally, the federal government has decided to strip the EPA Clean Water Act, which has further worsened this problem to an alarming level. Since a small percentage of imported water refills the groundwater basins, your remaining supply of drinking water is also in danger. The San Francisco Bay Regional Water Board has asked your team to build a filtration system to clean the water supply contaminated by the surface runoff.

DISCLAIMER: This scenario is entirely fictional. All references to real life agencies/legislation were used to provide a realistic scenario for this competition.

Influent Constituents

Two (2) 5-gallon buckets total will be prepared for each team. All constituents will be added and stirred 24 hours prior to competition and stirred again 5 minutes before construction/treatment.

Per 5 Gallon Bucket

Water	4.5 Gallons
Miracle-Grow Potting Mix	22 oz
Rumford Baking Powder	6 oz
Kool-Aid Drink Mix, Cherry	6 oz
Wyler's Beef Instant Boullion Cubes	6 oz
Folgers Ground Coffee Classic Roast	8 oz
Bob's Red Mill Yellow Corn Polenta	16 oz

**Images of wastewater constituents can be found in Appendix C*

Competition Scoring

Table 1: Point Breakdown Summary

Category	Sub-Category	Points
Water Quality	pH	10
	Turbidity	5
	Electrical Conductivity	5
	Dissolved Oxygen	5
	Chlorine	5
	Volume	5
	Subtotal	35
Design Report	Filter Design & Analysis	20
	Materials & Cost Analysis	5
	Sustainability	6
	Professional Quality	4
	Subtotal	35
Construction	Construction Time	7
	Cost of Treatment System	10
	Orderliness of Construction	1
	Overall Teamwork	2
	Subtotal	20
Oral Presentation	Technical Content	4
	Visuals	1
	Oral Presentation	3
	Question & Answer Sesion	2
	Subtotal	10
Poster	Technical Content	3
	Professional Quality	2
	Subtotal	5
TOTAL		105

Water Quality Testing: 35 Points

Immediately after construction and loading, the final effluent will be tested using university laboratory equipment. The following five (5) water quality parameters of your final treated product will be graded based on the scoring methods described below:

pH Value (Max: 10 Points)

pH range	Points
$6.5 \leq \text{pH} \leq 7$	10
$6 \leq \text{pH} < 6.5$ or $7 < \text{pH} \leq 7.5$	8
$5.5 \leq \text{pH} < 6$ or $7.5 < \text{pH} \leq 8$	6
$5 \leq \text{pH} < 5.5$ or $8 < \text{pH} \leq 8.5$	4
$4.5 \leq \text{pH} < 5$ or $8.5 < \text{pH} \leq 9$	2
All other pH ranges	0

Turbidity (Max:10 Points)

Target: Minimum NTU

Grading:

Turbidity Ranges	Points
NTU < 15	10
$15 \leq \text{NTU} < 50$	8
$50 \leq \text{NTU} < 85$	6
$85 \leq \text{NTU} < 120$	4
$120 \leq \text{NTU} < 155$	P2
NTU ≥ 155	0

Electrical Conductivity (Max: 5 Points)

Target: Minimal $\mu\text{S}/\text{cm}$

Grading:

$$\frac{\text{Your Rank}}{\text{Number of teams}} * 5 \text{ Points}$$

Teams will be ranked from worst to best with number one being the team with the electrical conductivity furthest from the target value.

Dissolved Oxygen (Max: 5 Points)

Target: DO is measured as % saturation

Grading:

Percentage of D.O. Saturation	Points
100%	5
$90\% \leq \text{D.O.} < 100\%$	4
$80\% \leq \text{D.O.} < 90\%$	3
$70\% \leq \text{D.O.} < 80\%$	2
$60\% \leq \text{D.O.} < 70\%$	1
All other DO values outside of these ranges	0

Volume (Max: 5 Points)

Target: 9 gallons

Grading:

$$\frac{\text{Your effluent volume in gallons}}{\text{Number of teams}} * 5 \text{ Points}$$

There is a maximum of 5 points allotted for volume. It is conceivable, however unlikely, that a team could have a volume greater than 9-gallons; in that case, the team would still only receive 5 points.

Design Report (35 Points)

Each team is required to submit a design report detailing the overall project. Each design report must contain the following information: a description of the design process, treatment principles utilized, environmental impacts and considerations, a cost analysis, and tables displaying materials and operational costs. The design report is worth 35 points and will be based on the details listed below. Please submit an electronic version of your design report in PDF format via email to ascemidpac2026@gmail.com by no later than **Sunday March 29th at 11:59 Pacific Time**. Hard copy submissions will not be required.

Formatting

- **Report Cover Page:** Each team's cover page must contain the following format:
 - The school's name
 - The team's name
 - The competition's name: "2026 ASCE Mid-Pacific Student Water Treatment Competition"
- **Table of Contents:** Limited to one (1) page for the report
- **Body of Contents (format):** Each design report must meet the formatting requirements below
 - Minimum 1,000 words
 - The page limit is ten (10) pages. The cover page, table of contents, appendices, and list of references are not included in the page count
 - Use 12-point font (Times New Roman), single-spaced format with 1" margins on all sides
 - Headings may be in any font, size, or color
 - Body pages shall be numbered, beginning on the page of your team's table of contents
- **Appendices:** Pages shall be numbered so that the appendix and page number are clearly listed (i.e. A1, A2, B1, B2, etc.). There is no limit to appendix length, but all material in the appendix must be relevant to the design process
- **Paper:** The design report shall be presented on 8.5"x 11" pages. The body of contents must be presented on portrait-orientated pages, but the appendices may be presented in either portrait or landscape-oriented pages
- **Miscellaneous:**
 - Captions used for any photographs, tables, line drawings, graphs, or other figures shall have normal width of character spacing and be no less than 10-point font
 - Photographs, tables, line drawings, graphs, headers, footers, or other figures included in a team's body of contents shall be included in the page count. At any point in the design report, a team may reference figures in the appendix
 - All work, figures, or tables not generated by the authors must be cited. A list of references (or works cited page) shall be included (if necessary). As previously mentioned, a reference page does not count toward the ten (10) page limit

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- Acknowledgements: Please show appreciation for any assistance received from other people not on the team by listing those sources at the bottom of the team's references page. Acknowledgements will not count toward the ten (10) page limit. One (1) point will be deducted from the team's design report score for each format violation

Report Content

The design report must include the following content. The point distribution for grading of each section is presented in Table 1

- **Filter Design & Analysis (20):** The body of the design report shall contain a description of the treatment system and how it works. The system design will be judged based on the approach each team used to solve the problem as well as the industry treatment principles implemented in the design process. This section must include clear descriptions of engineering design processes, lab techniques used, and test results obtained
- **Materials & Cost Analysis (5):** The design report must include a material list with a brief explanation and justification of each material selected. See Appendix A for a list of permitted materials. The design report must include a cost analysis which must include both a material cost estimate and an operational cost estimate. The total cost will be taken as a sum of the material and labor costs. Teams will be ranked by the lowest cost estimate. Material cost will be determined by the number of units bought regardless of how much was used. For example, if you buy a 12 oz. bottle of hydrogen peroxide but only use 5 oz, the total cost will be for the 12 oz. bottle. *Points will be adjusted during the competition if changes in cost are made to the filter after the initial submission of the design report*
- **Sustainability (6):** The design report must include an explanation of the sustainability aspects of the treatment system. This section must include a life cycle assessment (LCA) where the sustainability of materials, tools, and waste products are assessed. Include the environmental impacts of materials used and decisions made regarding choices to minimize cost or reduce environmental impact
- **Professional Quality (4):** Professional quality of the design report will be based on organization, presentation, quality of writing, and effectiveness of figures, tables, and other resources presented in the report
- **AI Policy:** The use of generative artificial intelligence (AI) and natural language processing models (NLP), such as OpenAI's ChatGPT®, is neither encouraged nor discouraged. However, if such models are used, all instances shall be cited as work completed by the respective generative AI/NLP. Failure to cite all instances of generative AI/NLP use will be considered plagiarism

Plagiarism of any kind will not be tolerated. Teams caught plagiarizing any portion of their design report will be disqualified.

Construction (20 Points)

Teams will construct their treatment system as described in their design report. This phase will include the construction, chemical treatment, loading, and filtration of the influent into their filter. This section is worth 20 total points and will be judged based on the orderliness of the construction site, construction and treatment time, cost of the treatment system, safety, and overall teamwork - see scoring and deduction methods presented below and in Table 1 for point distribution.

All teams will be required to use a plastic tarp during the construction process. Tarps will be provided for each team. Because the wastewater has the possibility of staining the ground, the school is requiring teams to build on tarps.

Construction and Treatment Time

Teams will be timed on the construction of their filters

- Each team will be limited to a total of thirty (30) minutes to construct their treatment systems
- The loading phase will follow, which includes ten (10) minutes for teams to chemically treat the influent and load their systems
- A twenty (20) minute treatment period will follow
- Any disinfectants in the system must be built into the final filtration system. Operators will not be allowed to add materials to their filtration system after the construction period
- Immediately after the treatment period is completed, the collection basin will be removed from the treatment site and taken to the lab for testing.

Construction Phase Details

Teams will construct their systems in a 8'x8' (2.4x2.4 m) space. Site limits will be based on the inside of the borders made, using either tape or chalk. Sites are not guaranteed to be completely flat or level. Sites will be located on either concrete, pavement, or bricks

- Teams will place all their unassembled raw materials and tools in the competition area along with two provided 5-gallon buckets of contaminated water and two provided stirring sticks. Prior to the construction phase, judges will compare the provided materials list in the team's design report to the materials present at the competition
- Teams shall not pre-assemble, pre-cut, pre-mark, or tamper with materials prior to beginning of the construction, although decoration is encouraged. Teams must provide their own markers, tape measure, measuring cups, and scales, on an as-needed basis. Items used for measuring or marking should not be included in the cost estimate
- All prewashed materials must be dry and must be placed in their original packaging. Loose sand, GAC, lava rocks, and pebbles may be placed in clear containers based on the predetermined quantity size options in Appendix A. A burlap sack may be used instead of a clear container but should be open for judges to inspect. Packaging for storage does not need to be included in the materials list or the cost analysis portion of the design report. All materials not prewashed should be in original sealed packaging, as if purchased from the store. For

example, if hydrogen peroxide is purchased, the hydrogen peroxide bottle should be sealed in the manner bought from the store

- All construction materials should be sorted to match the quantity lengths provided in the Competition Rules, for example, the lumber should be 4 linear feet before bringing the material to the competition regardless of the initial length of purchase. In an effort to be more environmentally mindful, items that are packaged in large quantities may be opened before the competition with materials used. For example, if the design requires two feet of nylon rope and the team purchases a package of pre-cut 16 feet long rope, the team is not required to purchase a new package of material for competing
- Battery-powered tools are permitted, with the exception of power saws or power blades. Corded power tools are not permitted
- Teams must provide their own tools based on the approved list given in Appendix B
- Treatment systems must include a collection basin or multiple collection basins capable of holding 9 gallons of water
- All construction materials, equipment, operators and chemicals must stay within the 8'x8' construction/treatment zone
- Teams may use up to 4 operators to construct their systems. Each operator will be charged for labor
- Construction time will start once the head judge says "go", and the clock will be started. After 30 minutes, construction time will end with the head judge saying "stop"
- Operators must leave the 8'x8' space when time is up or once they are finished with construction, whichever is earlier
- There will be a maximum of 30 minutes for each team to construct their filtration system
- Treatment systems must include a collection basin capable of holding 9 gallons of water.

Treatment, Loading, and Phases

At the designated start time of the loading phase, teams will have ten (10) minutes to chemically treat and load the influent into their filtration systems. Prescreening of influent prior to the loading phase is not permitted. A stirring stick will be provided. Teams will be given twenty (20) minutes after the loading phase to allow the water to filter through their systems. Immediately after the treatment phase, the collection basin will be removed from the filtration system and taken to a lab for testing.

Scoring

The Construction category is worth 20 points out of the 100 total points in the competition. Point allocations are shown in Table 1. Construction scoring will be based on construction time, cost of materials, and construction site organization, teamwork, and safety. All points are to be determined by the judges.

Construction time point will be awarded using the following equation:

$$\frac{\text{Your Rank}}{\text{Total Number of Teams}} * 7 \text{ points}$$

The construction score will be adjusted if any of the violations below occur during the construction, loading, or treatment phases of the competition.

Violation	Points
Any violations of construction limits	0.5-point deduction per incident
Any pre-marked, pre-assembled, or pre-cut materials	1-point deduction
Operator begins construction prior to the start of construction	1-point deduction
Any material not present in the team's material list reported in the design report	1-point deduction
Any tools used in construction not permitted in the Construction Rules, Appendix B	2-point deduction
Usage of powered saws or powered blades	5-point deduction
Teams will not be permitted to use more than 4 operators; any additional team members in the construction site at the start of the competition will be asked to step out of the area	1-point deduction (per additional student)
material or teammate crosses the construction site boundaries during the construction or treatment phases	1-point deduction

Cost of Treatment System

The cost of the treatment system is worth 10 points, with the lowest cost system receiving the most points. The cost of the treatment system includes materials, tools, and operation costs as listed in the Appendices. Cost will be based on how much material is purchased; it does NOT consider how much is used. For example, if you buy a 12 oz. bottle of hydrogen peroxide but only use 5 oz, the total cost will be for the 12 oz. Bottle.

Points will be awarded based on the following equation:

$$\frac{\text{Your Rank}}{\text{Total Number of Teams}} * 10 \text{ points}$$

Safety

Safety is critical to any engineering project. Operators must wear personal protective equipment including hard hats, safety gloves, safety glasses, closed-toed shoes, and long pants at all times during the construction and treatment phases. Any person handling chemicals must wear a long sleeved shirt or other article of clothing to cover arms and hands must be protected using chemical hazard protection gloves (i.e. latex or nitrile). If at any point a judge deems safety as a risk, the judge may

stop the team from proceeding and will review safety practices. The stopwatch will continue running during this time.

Oral Presentation (10 Points)

Each team shall prepare an oral presentation on their treatment system. Presentations will be evaluated on technical content and delivery. Oral presentations shall be presented in English. Presentation order shall be randomly selected before the competition begins and shall be provided at the time of on-site registration.

Teams are required to submit their presentations in PowerPoint format. Please submit your team's presentation via email to ascemidpac2026@gmail.com by 11:59 PM (Pacific Time) on Friday April 3rd 2026. Two points will be deducted from the overall Oral Presentation score for changes submitted after the deadline.

Scoring

The presentations will be scored by the parameters listed below. Point distribution is denoted in Table 1.

Timing (Seconds)	Presentation Durations		Points Deducted
± 1 - 5	4:55 - 4:59	6:01-6:05	0 (grace period)
± 6 - 15	4:45 - 4:54	6:06 - 6:15	1
± 16 - 25	4:35-4:44	6:16 - 6:25	2
± 26 - 35	4:25 - 4:34	6:26 - 6:35	3
± 35 and more	4:24 and under	6:36 and over	3
± 45 and more	4:14 and under	6:46 and over	4

- **Oral Presentation (3):**

- A maximum of two (2) team members may present and answer questions. No other members may stand up with the presenters
- The presentations should be five (5) to six (6) minutes in duration. There will be a 5 second grace period to account for timer (stopwatch) reaction times
- Point deductions will occur if the duration is not within the specified time range
- No notes or visual aids other than the PowerPoint (i.e. posters) are allowed during the presentation. The presenters will only be allowed to use their PowerPoint during the

presentation. The Director will give time cues when the time is at 5-minutes and 5:30-minutes

- **Technical Content (4):**
 - Presentations must include (at a minimum): the system design, treatment process used, materials used, a cost analysis, and a discussion of sustainability
 - The content may be presented in any order and is not limited to these components
- **Visuals (1):**
 - Teams may use PowerPoint or Google Slides for their presentations
 - Teams may use visual aids including graphs or photographs to enhance the presentation. Video clips may not be included
- **Question-and-Answer Session (2):**
 - There will be a 5-minute question-and-answer session immediately following the presentation. Only the panel judges will be permitted to ask questions

Poster Presentation (5 Points)

Each team must display a poster board of dimensions no larger than 36" x 24" next to their construction site. The point distribution for the poster is described in Table 1. Poster should be in English, but teams are welcome to display an additional poster in another language

- **Technical Content (3):** Poster must contain the purpose of the competition, material list, filter cost, and an overview of the filter's design
- **Professional Quality (2):** The professional quality of the poster will be scored based on organization, appearance, and quality of scientific writing.

Note: Teams must provide their own poster stands and/or any other equipment required to display the poster.

Water Treatment Competition Appendices

Appendix A: Materials List

Each team is permitted to submit a request to add one (1) material or tools to this list. Please submit for approval to ascemidpac2026@gmail.com by **January 20th, 2026**. If your suggestions are accepted, these materials will become accessible to all teams. Teams requesting additional material must also provide the unit of measure and the unit cost, which will be verified by the Competition Director.

Note: All items must be in their original packaging (see exceptions in the Construction and Treatment section). For example, if a store sells hardware cloth in 10 square foot sizes, bring the unopened packaging to the competition. The hardware cloth will therefore be charged as \$6.70 in the cost analysis section of the design report, regardless of the amount used during the construction phase.

Table 2: List of Material and Associated Costs

Item	Unit	Cost (\$/unit)
1/2" Hardware Cloth	/sq. ft.	0.67
1/4" Hardware Cloth	/sq. ft.	0.67
4 Gallon Trash Can	/unit	5.00
13 Gallon Trash Can	/unit	13.00
20 Gallon Trash Can	/unit	16.00
32 Gallon Trash Can	/unit	20.00
2' Ladder	/unit	30.00
4' Ladder	/unit	44.00
6' Ladder	/unit	60.00
2" Adjustable Spring Clamp	/unit	6.00
2" PVC Pipe Elbow	/unit	3.00
2" x 4" 3M Steel Wool	/unit	0.83
2" x 4" Dimensional Lumber	/lin. ft.	1.00
2" x 6" Dimensional Lumber	/lin. ft.	0.75
4" x 4" Dimensional Lumber	/lin. ft.	1.50
3/4" Black Electrical Tape	/lin. ft.	0.06
3/4" Thick Plywood	/sq. ft	4.00
3/8" Thick Plywood	/sq. ft	1.50
3/8" Nylon Rope	/lin. ft.	0.71
30 Gallon Tote	/unit	12.00
36 Gallon Garbage Bag	/unit	0.60
5 Gallon Bucket	/unit	4.00
5 Gallon Bucket Lid	/unit	1.50
5/8" Carpet Pad	/sq. ft	0.50

8" x 6" x 2" Grout Sponge	/unit	2.00
Alum (McCormick)	/oz.	2.00
Aqueon Water Clarifier	/fl. oz.	2.50
All Purpose Gravel (Quickrete)	/50 lb.	10.00
Astroturf	/sq. ft.	4.00
Baking Soda	/oz.	0.10
Borax (20 Mule Team)	/oz.	1.00
18 cup Brita Filter	/unit	12.00
1" 3 Ring Binder	/unit	3.00
2" 3 Ring Binder	/unit	5.00
Vinegar	/1 cup	1.00
Bounce Dryer Sheet	/20 units	5.00
Bentonite Clay	/oz.	1.50
Paper Towels	/roll	1.50
Burlap Landscape Fabric	/sq. ft.	0.75
Canvas Drop Cloth	/sq. ft.	0.50
Charcoal	/lb.	0.50
Clorox Bleach, Concentrated	/5 cups	2.50
Clorox Disinfecting Wipes	/15 units	1.25
Clorox Water Clarifier	/fl. oz.	2.50
Coarse Compost	/gallon	3.00
CoCo Liner, 18"	/unit	8.00
Coconut Coir Brick	/oz.	0.45
Coffee Filter (Basket) 8/12 Cups	/unit	0.01
(100%) Cotton Fabric (Broadcloth)	/sq. yard	3.00
Commercial Grade Fine Sand	/lb.	0.15
Commercial Grade Sand	/lb.	0.10
Cotton Balls	/50 units	0.50
Diatomaceous Earth	/lb.	2.50
Duct Tape	/yard	0.50
Epsom Salt	/oz.	0.50
Fiber Twine	/ft.	0.15
Gelatin (Knox Unflavored)	/5 oz.	1.50
Granular Activated Carbon	/oz.	0.50
Gypsum	/lb.	0.25
Hydrogen Peroxide	/3 cups	1.50
Lava Rock	/cu. ft.	12.50
Lemon Juice	/5 fl. oz.	.75
8 oz. Mason Jar	/unit	1.50
Masking Tape	/yard	0.20
Mylar Emergency Sleeping Blanket	/unit	3.00

Milk of Magnesia	/oz.	.65
6.5 Gallon Milk Crate	/unit	6.50
Paint Tray	/tray	2.00
Packing Tape	/yard	0.25
Powdered Activated Carbon	/oz.	0.50
Powdered Chalk	/oz.	0.50
Pebbles, Large	/5 lb.	2.50
Pebbles, Pond/Landscape	/0.5 cu. ft.	5.00
Pickling Lime	/oz.	0.40
Plaster of Paris	/lb.	1.50
Plastic Tarp	/sq. ft.	0.20
Play Sand	/lb.	0.15
Plumbing Epoxy Putty	/putty	2.50
OxiClean Stain Remover Powder	/lb.	3.50
Potassium Permanganate	/5 oz.	5.00
ABS Pipe, 1-1/2" Diameter	/5 lin. ft.	5.50
ABS Pipe, 2" Diameter	/5 lin. ft.	10.00
Copper Pipe, 1/2" Diameter	/5 lin. ft.	12.00
Copper Pipe, 1" Diameter	/5 lin. ft.	15.00
Corrugated Pipe, 3" Diameter	/5 lin. ft.	4.50
Corrugated Pipe, 4" Diameter	/5 lin. ft.	8.00
PVC Pipe, 1" Diameter	/5 lin. ft.	2.00
PVC Pipe, 1-1/2" Diameter	/5 lin. ft.	4.75
PVC Pipe, 2" Diameter	/5 lin. ft.	7.00
Pool Sand Filter	/lb.	0.40
Pumice Stone (1 CF)	/cu. ft.	3.00
Rubbing Alcohol	/3 cups	1.50
Salt (Morton Iodized Table Salt)	/20 oz.	1.00
Sham-Wow	/sq. ft.	3.00
Stainless Steel Safety Wire	/lb.	3.00
Standard Air Conditioning Filter	/unit	5.00
Sterilite 3 Drawer Medium Countertop (13 5/8" x 11" x 10")	/unit	11.00
Scotch Tape	/yard	0.25
Terrycloth Rag	/lb.	3.50
Tote, 5 Gallon	/unit	6.00
Tote Lid, 5 Gallon	/unit	1.00
Tote, 10 Gallon	/unit	8.00
Tote Lid, 10 Gallon	/unit	1.00

Tote, 13 Gallon	/unit	10.00
Tote Lid, 13 Gallon	/unit	1.00
Tote, 18.5 Gallon	/unit	12.00
Tote Lid, 18.5 Gallon	/unit	10.00
Toilet Paper	/roll	1.50
TSP/90	/lb.	4.50
Turtle Wax Hard Shell Paste Wax	/fl. oz.	0.50
Weed Control Barrier/Landscape Fabric	/sq. ft.	0.40
Window Screen Mesh	/1 sq. ft.	0.50
Wood Mulch	/cu. ft.	5.00
Vanity Fair Everyday Napkins	/10 napkins	0.30
21-31 in x 18 in Adjustable Window Screen	/screen	9.00
Ferric Chloride	/oz. or /fl. oz.	0.20
Bon Tool 5 Gal. Paint Strainer	/strainer	3.50
Scott Shop Towels 11" x 40" -Original (55 sheets)	/roll	4.50

Appendix B: Tools and Operational Costs

Note: As stated in the Construction and Treatment Section, teams must provide their own markers, tape measure, measuring cups, and scales, as needed. Items used for measuring or marking should not be included in the cost estimate.

Table 3: Breakdown of Tools and Operational Costs



Item	Cost (\$/unit)
Operator	30.00
Adjustable Wrench	3.00
Basic Socket Set	5.00
Caulking Gun	2.00
Channel Locks	1.50
Cordless Drill	10.00
Drill Bits (each)	1.50
Hand Saw	10.00
Pliers	1.50
Scissors	2.00
Screwdriver	1.00
Standard Builder's Hammer	5.00

Utility Knife	2.00
Wire Cutters	2.00
Pipe Cutters	10.00
Pipe Wrench	5.00

Appendix C: Wastewater Constituents

All wastewater constituents can be bought from multiple stores including Walmart, Target, or Amazon. Pictures are shown below as references when purchasing constituents.

Table 4: Wastewater Influent Constituents

Miracle-Grow Potting Mix	
Rumford Baking Powder	
Kool-aid Drink Mix, Cherry	

Herb-Ox Beef Bouillon Cubes	<div></div> <div><div>HERB-OX Beef Bouillon Cubes</div><div>3.25 oz</div></div>
Folgers Ground Coffee Classic Roast	<div></div>
Bob's Red Mill Yellow Corn Polenta	<div></div>