

2011



WEF Wastewater Challenge

Amendment No. 1 – MARCH 2011



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A. Introduction

The 2011 WEF Wastewater Challenge is a national competition that's both challenging and fun. This hands-on competition requires teams of students to treat agricultural runoff from a biosolids compost facility in order to protect a wetland ecosystem, using an assortment of household products. The challenge is an opportunity for students across the nation to work collaboratively, problem solve, and design an emergency wastewater treatment system by applying traditional wastewater treatment principles learned in the classroom in an extraordinary situation that requires true and innovative "outside-the-box" thinking.

The competition will take place on Sunday, May 22, 2011, in Sacramento, California, at the 2011 WEF Residuals and Biosolids Conference, which is held from May 22-25, 2011. To be eligible to compete, your team must submit a Design Report to the WEF Wastewater Challenge Committee. The top 12 teams will be selected to compete. The deadline to submit reports for entry is April 1, 2011, at 5 PM PST.

All team members must be a registered WEF member. For more information on how to join please visit: http://www.e-wef.org/timssnet/memberships/tnt_membership.cfm (click on "Student Package"). There is a limit of one team per student chapter.

B. Submission Requirements

1. All teams should submit a notice of intent as soon as possible. Submit NOI letter to WEFWastewaterChallenge@wef.org. List your team name, designated team leader, team members, contact information including emails and intent to compete. Team leaders will be sent updates to the guidelines and any additional information regarding the challenge.
2. All clarifications to the guidelines or additional information regarding the Challenge shall be submitted to WEFWastewaterChallenge@wef.org and all updates will be posted to <http://www.wef.org/wastewaterchallenge/>
3. The Design Report is due April 1, 2011. The report must be submitted electronically to WEFWastewaterChallenge@wef.org. Two hard copies of the report must be brought to the competition in Sacramento, CA, on the day of the competition.
4. Submit Material Safety Data Sheets (MSDS) for all chemicals by May 10, 2011. Submit MSDS sheets in a pdf file format compiled with all the sheets for your team.
- ~~4~~5. The competition will take place at the Sacramento Convention Center on Sunday, May 22, 2011, as part of the WEF Residuals and Biosolids Conference. Please visit the conference website for more details (<http://www.wef.org/wastewaterchallenge/>).

B.C. Case Scenario

A 200 acre Biosolids Compost Facility that has 100,000 cubic yards of composting, curing, and finished compost on site sits next to an earthen levee and just up-gradient from a sensitive wetland type ecosystem. The levee is expected to breach and for several hours 5,000 CFS of agricultural runoff and snow melt will run through the site with the normal runoff controls getting overloaded. It is expected that most of this now further contaminated water will reach the site fence line and if not stopped or successfully treated will devastate the wetland. The Army Corps of Engineers will be repairing the breach within 12 hours and therefore the solution to the problem should be considered temporary. The natural slope of the facility would channel the flow to an area of no more than 100 yards wide at the fence line.

Your team has been asked to design a system to control and treat the runoff for solids, nutrients and bacteria before releasing it to the wetland, if necessary. You are asked to design a system to control and mitigate the nutrient rich water, and you and your team will be asked to construct and run the emergency water treatment system component of the overall design at the competition to demonstrate the system's removal efficiencies. The overall design will have to demonstrate the control strategies and removal efficiencies of your system, in addition to the emergency water treatment system.

C.D. Materials

Your garage contains a large assortment of materials that can be used to create a treatment system. A list of materials is shown in Appendix A. Access to electricity will not be available.

Please note: Many of the materials listed in Appendix A can be made from recycled material or obtained in a sustainable manner. Environmentally-conscious practices are encouraged and recommended and will be considered in the overall score.

D.E. Cost Analysis

Each team is required to prepare a cost analysis for their design. The cost analysis will be presented to the judges as part of the presentation given during the competition. Two main components must be included in the cost estimate: material and operational costs. The total cost will be calculated as the sum of the material and operational costs.

Material costs will be calculated based on the spreadsheet (Appendix A). The unit costs for each material must be listed on the spreadsheet and be based on the items used in the design. Each team must calculate how much their system would cost to build from scratch.

Operational costs will be based on the number of operators required to set up the treatment system (at a burdened hourly rate of \$25.00 per operator; maximum of 4 operators; minimum set-up time of 1 minute; maximum set-up time of 2 hours); and the cost of tools used to set up the treatment system (during the two-hour set-up period prior to the competition; minimum/maximum set-up time of 2 hours; refer to spreadsheet [Appendix B] for hourly rates). The operational costs to treat 10 gallons of

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influent presented in the design report will be checked and updated based on actual costs accrued on the day of the competition.

Teams will be charged a minimum of 1 minute for one person for setup. Raw materials to be used for construction of the wastewater treatment system will be inspected when teams arrive at event and the components will be noted by the judges. Teams will place their raw materials in the competition area unassembled and build time will start when the team enters the box. Absolutely no assembly is allowed prior to the start. No precutting of lumber, pipe, or any other material is allowed. Materials may not be pre-sorted, pre-washed, or tampered with in any way, shape, or form. Only decoration of components for school and team spirit purposes is permitted ahead of time. Any team determined to have pre-assembled any component of their treatment system will be disqualified. The water treatment system is intended to be constructed for an emergency scenario; therefore, all teams should take this factor into consideration when designing the water treatment system. The ideal system would be relatively simple to construct in a short amount of time while producing the cleanest possible effluent at the same time.

Please note: If the team chooses to select an item, such as a “chemical” that must be added during the treatment process ~~as one of the bonus materials~~, the cost and quantity of the chemical to treat 10 gallons of influent must be included in the operational costs. This applies to any material item that is “consumed” during the course of the competition (i.e., chemicals, media, etc.). In addition, points will be deducted for interacting with the system during operation. Please refer to Section F for additional information regarding interaction deductions.

Format of Cost Tables:

Material Costs

Item	Per Unit Price	Quantity Used	Item Price
1" Copper Pipe	\$ 3.20 per Lin Ft	5	\$ 16.00
1" High Pressure Washer Hose	\$ 2.50 per Lin Ft	2	\$ 5.00
1" PVC Pipe	\$ 0.20 per Lin Ft	9	\$ 1.80

Operational Costs (To Treat 10 Gallons of Wastewater)

Item	Per Unit Price	Quantity Used	Hours Used	Item Price
Adjustable wrenches	\$ 3.00 per Unit-Hour	2	1	\$ 6.00
Basic Socket Set	\$ 5.00 per Unit-Hour	1	1	\$ 5.00
Caulking Gun	\$ 2.00 per Unit-Hour	2	1	\$ 4.00

E.F. Wastewater Constituents

The following constituents will be mixed with ten gallons of local tap water the night before the competition to simulate the wastewater. The contaminated wastewater will be placed in two 5-gallon buckets, and the team will have 10 minutes to pour the wastewater into their system. To compare the untreated and treated wastewater, an untreated wastewater sample will be used as a control.

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Contaminants (in 10 gallons of tap water):

½ lb. of Maxwell Coffee grounds	1 Dozen Size Egg Carton (Paper) - Shredded
1 oz. of grass	2 cups of Milorganite Organic Nitrogen Fertilizer
4 oz. of Tropicana Extra Pulp Orange Juice	2 cups of Scott's Advanced Brown Mulch
7 oz. of small plant leaves	2 cups of Scotts Potting Soil
4 oz. of Dannon Activia Peach Flavor	2 cups of Miracle-Gro Sphagnum Peat Moss

F.G. Scoring

The winner of the competition will have the highest number of points based on the following criteria:

Criteria	Maximum Points Possible
Design	45
Cost	45
Amount of Water Recovered	25
Speed and Efficiency	15 (First to Recover 1 Gallon)
Ortho-Phosphorus	12 (Lowest)
pH	12 (Most neutral; pH=7)
Turbidity	12 (Lowest)
Nitrate	12 (Lowest)
Dissolved Oxygen	12 (Lowest Highest)
Presentation	50
Design Report	50
Interaction Deduction	-10
Safety	10
Total	300

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a) Design

This component will evaluate the physical design of the treatment system. Each treatment system will be evaluated by a panel of judges experienced in the water/wastewater/biosolids industry. Factors to be considered include: simplicity, sustainability, efficiency, relevance, creativity, safety, and structural and operational durability. Each team is required to display the full name of the college or university either on the design or on a separate banner or sign to be displayed next to the design (this is not considered in the cost analysis).

Simplicity (15%): Is the system easy to assemble and operate?

Sustainability (25%): What resources are used, and what is the waste generated by the system? Are the materials used safe for humans and the environment? Could any materials used in the design result in any harmful byproducts in the effluent? What is the potential for recycling the system components at the end of its functional lifetime?

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Efficiency (25%): Are the minimum resources used to the maximum effect? Is the system designed to treat the wastewater in a manner that is time and resource-efficient?

Creativity/Theme (5%): Does the system make novel use of engineering principles? Does it show school spirit?

Structural and operational durability (20%): Can the system function more than just once? Is the system structurally sound?

Safety (10%): Was the treatment system constructed and operated safely using the proper tools and personnel protective equipment (i.e., hardhats, gloves, safety glasses, closed toed shoes, pants, etc.)?

b) Volume of Water Recovered

Each team will receive a percentage of the points based on the volume recovered. It is the team's responsibility to ensure that the water is collected in a container and manner that enables the judges to pour and measure the quantity of water in a measured container. (Total volume recovered / 10 Gallons x 25 = # of points)

c) Speed and Efficiency

The team that recovers the first gallon of water in the shortest amount of time will receive the maximum number of points. Each team after that will be awarded fewer points, based on the relative speed compared to the first team. Please note that the design must allow for accurate collection and measurement of the first gallon. Otherwise, the team forfeits the ability to earn any points for this criterion. (First team's time to recover 1 gallon / Time to recover 1 gallon x 15 = # of points)

d) Water Quality Parameters

Nitrate, ortho-phosphorus, dissolved oxygen, turbidity, and pH of the entire treated effluent will be measured using instruments provided onsite. Points will be awarded as listed in the scoring criteria table with the maximum number of points awarded to the team with the best measurements. For each parameter, remaining designs will receive a fraction of the maximum possible points.

e) Interaction Deduction

Your team will have ten minutes to load the treatment system with 10 gallons of influent by no more than two team members, and the system must run without any human interaction (i.e., no one may step foot inside the 100 square foot (10' x 10') treatment area after the 10 minute loading period. If any operators must step foot inside the 100 square foot treatment area for any reason, there will be a ten point deduction for each instance. Each interaction can be a maximum of one minute. Longer interactions will be counted as multiple interactions.

f) Presentation

Each team will give a 7-minute presentation on the team's design process with a 3-minute question and answer period afterward. The presentation should include a brief overview of the overall project description, design process, treatment principles utilized, environmental impacts, and cost analysis, at a minimum. Professionalism is encouraged and expected. The presentation scores will be determined by a panel of judges experienced in the water/wastewater industry.

The presentations will be given in front of the team's system. PowerPoint is not an option here as a computer will not be provided. Teams need to be prepared to speak over a loudspeaker system in front of a large group of their peers.

g) Design Report

A detailed Design Report is required for entry to this competition. The report can be a maximum of 10 pages and should include a detailed presentation of the overall project description, design process, treatment principles utilized, environmental impacts, and cost analysis. The Design Report should also include both the material cost and operational cost tables. This report will be used to evaluate which teams will be invited to participate in the national competition in Sacramento, CA. Emphasis will be put on the process and critical thinking that teams go through to develop their final design.

As it is in the water/wastewater industry, it is very important that teams follow the instructions. The Design Report shall be presented on 8 ½" by 11" pages in portrait orientation. All pages of the report shall maintain a minimum of 3/4" margins on all sides. Body text shall be in English and use 12-point, normal width character spacing, Times New Roman or Arial font. Section headings and subheadings shall be considered part of the body text, shall adhere to the margin requirements and may be of any font type or size. The report shall consist of a single-sided report cover, single-sided pages for the body and appendices, and a back cover. A protective plastic cover in front of the report cover is permitted and does not count towards the page limit. No additional pages separating the appendices are permitted. No blank pages shall be inserted into the report. Body pages, with the exception of the Table of Contents shall be numbered beginning with the number one (1). The Table of Contents shall be limited to a total of one (1) page, numbered with the lowercase Roman numeral *i*. Pages located in the appendices shall be numbered in such a way that the appendix and page number are clearly listed (e.g., A-1, A-2, B-1, B-2; A1, A2, B1, B2; etc.) as appropriate. Photographs, tables, line drawings, graphs, headers, and footers shall be permitted and shall be counted as part of the page limit defined herein. Captions used for any photographs, tables, line drawings, graphs or other figures shall be no less than 10-point, normal width character spacing, Times New Roman or Arial font. These items shall be restricted to the margins described herein. Items such as page numbers, logos, section headings, etc. may be incorporated into the header and footer of the pages and are not subject to the font requirements of the body text. The header and footer may be located within the margin itself (i.e., outside of the body text limits). Material on the report cover may not be referred to in the body pages.

Reference citations of the papers should conform to the official *WEF Author Guidelines for References and Citations*, which can be found on the WEF Publications website:
<http://www.wef.org/Publications/page.aspx?id=2834>

h) Safety

Each team shall construct and operate the system with proper safety procedures and with the use of appropriate personal protective equipment, including but not limited to, hard hats, safety glasses, long pants, closed-toed shoes, and latex/leather gloves. Teams are required to wear hard hats, safety glasses, long pants, closed-toed shoes, and latex/leather gloves at the minimum. Individual team members that do not have the proper safety personnel protective equipment (PPE) will not be allowed to compete. Teams that do not follow proper safety protocol will be penalized.

Format

The reports must adhere to the following format, and the following must be included at a minimum:

- a. **Report Cover:** Inside of the cover shall be left blank. Protective plastic cover is optional.
- b. **Table of Contents** (Page i)
- c. **Content** (Pages 1-X)
- d. **Appendices** (Pages A1-X)
- e. **Back Cover:** This cover shall be left blank. Protective plastic cover is optional

Note: Number of total pages is based only off of Content and Appendices.

Submissions

All design reports must be submitted electronically via e-mail to WEFWastewaterChallenge@wef.org by April 1, 2011, at 5 PM PST. Two hard copies of the report must be brought to the competition in Sacramento, CA, on the day of the competition.

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G.H. General Rules

1. Each team will receive 10 gallons of wastewater in two 5-gallon buckets at their source area (i.e., 10' x 10' treatment area).
2. A maximum of 0.25 gallons of tap water will be allowed for use as a primer for the treatment system. This water will be added prior to the presentation period.
3. Teams must physically introduce all of the wastewater into the system within 10 minutes from the designated start time.
4. Time for first gallon retrieved will be started at the beginning of the 10 minute wastewater loading segment.
5. Each team will have exactly sixty (60) minutes to treat all 10 gallons of the wastewater.
6. The first gallon of effluent will be collected in a gallon jug and retained for the speed and efficiency component of the judging criteria. The design of the system must allow the judges to effectively determine and retain the first gallon of effluent.

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7. Any design that violates the WEF Wastewater Challenge Guidelines will be penalized and/or disqualified.
8. Any design that is deemed dangerous or hazardous to the competitors, judges, or bystanders will be automatically disqualified. Each team must declare the quantity and method of use of any chemicals or other materials that may be considered hazardous explicitly in their design report.
9. In order to prevent any harmful spills, each team will be provided with a standard 6' diameter kiddie pool. The entire wastewater treatment system itself is not confined to this size requirement; however, the design must ensure that any spills, should they occur, will be captured by the kiddie pool.
10. Teams that interact with the system after the start of the hour allotted for the wastewater treatment process will be penalized 10 points for each interaction.

H.I. Time Constraints

Each team will have 120 minutes to construct the treatment system. Judges will then be able to evaluate and inspect the treatment systems for the design component of the competition, in addition to ensuring that each team has followed the guidelines. Prior to team presentations, each team will be allowed to prime their systems with 0.25 gallons of tap water. At a designated start time, each team will be allotted 10 minutes to pour the 10 gallons of effluent into the treatment system, at which point the timing of the first gallon collected will commence. Immediately at the conclusion of the 10 minute period, each team must vacate their respective treatment system areas and the one-hour treatment period will begin. Any interactions with the treatment system after the start of the one-hour treatment period will result in a deduction of points (see Interaction Deduction section for more details). The total amount of possible treatment time is exactly 1 hour and 10 minutes

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H.J. Site Constraints

Each team will be provided with a 10' x 10' treatment system area. During set-up, any team member not physically setting up the system should step outside of the 10' x 10' area. No part of the treatment system can exceed the limits of this 10' x 10' space. Two (2) five-gallon buckets containing the influent wastewater will also be located within this 10' x 10' space.

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H.K. Questions and Competition Location/Date

Questions regarding the rules will be addressed by the WEF Wastewater Challenge Committee (WEFWastewaterChallenge@wef.org). The competition will take place on ~~Wednesday~~Sunday, May ~~25~~22, 2011, as part of the WEF Residuals and Biosolids Conference. Please visit the conference website for more details (<http://www.wef.org/ResidualsBiosolids/>).

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K.L. Intent to Compete

If you and your team members would like to receive up-to-date information regarding any clarifications to the guidelines and/or any additional information regarding the WEF Wastewater Challenge, please send an email stating your interest to the WEF Wastewater Challenge Committee (WEFWastewaterChallenge@wef.org) as soon as possible.

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Appendix A: Construction Materials

Item	Per Unit Price		
1" Copper Pipe	\$ 3.20	per	Lin Ft
1" High Pressure Washer Hose	\$ 2.50	per	Lin Ft
1" PVC Pipe	\$ 0.20	per	Lin Ft
1/2" Copper Pipe	\$ 1.20	per	Lin Ft
1/2" Hardware Cloth	\$ 0.67	per	Sq. Ft
1/2" I.D. Soaker Hose	\$ 0.36	per	Lin Ft
1/4" Hardware Cloth	\$ 0.53	per	Sq. Ft
1-1/2" ABS Pipe	\$ 0.30	per	Lin Ft
1-1/2" PVC Pipe	\$ 0.30	per	Lin Ft
13 Gallon Trash Can	\$ 5.00	per	Trash Can
16 Qt. Igloo Can Cooler	\$ 23.00	per	Cooler
18 Gallon Tote	\$ 5.00	per	Tote
2' Ladder	\$ 30.00	per	Ladder
2" ABS Pipe	\$ 0.40	per	Lin Ft
2" PVC Pipe	\$ 0.40	per	Lin Ft
2"x4" 3M Steel Wool	\$ 0.83	per	Pad
20 Gallon Trash Can	\$ 8.00	per	Trash Can
25' Extension Cord	\$ 27.00	per	Cord
2x4 Dimensional Lumber (Doug Fir)	\$ 0.25	per	Lin Ft
3" Corrugated Pipe	\$ 0.50	per	Lin Ft
3/4" Black Electrical Tape	\$ 0.06	per	Lin Ft
3/4" Thick. Plywood	\$ 1.06	per	Sq. Ft
3/8" Nylon Rope	\$ 0.20	per	Lin Ft
3/8" Plywood	\$ 0.50	per	Sq. Ft
30 Gallon Tote	\$ 8.00	per	Tote
32 Gallon Trash Can	\$ 13.00	per	Trash Can
36 Gallon Garbage Bag	\$ 0.63	per	Bag
3M Compressed Air Dust Remover	\$ 4.67	per	Can
4' Ladder	\$ 40.00	per	Ladder
4" Corrugated Pipe	\$ 0.60	per	Lin Ft
409 Original Cleaner	\$ 0.16	per	Fl. Oz
4x4 Dimensional Lumber (Doug Fir)	\$ 0.75	per	Lin Ft
5 Gallon Bucket	\$ 2.50	per	Bucket
5 Gallon Bucket Lid	\$ 2.50	per	Lid
5/8" Carpet Pad	\$ 0.44	per	Sq. Ft
5/8" I.D. Garden Hose	\$ 0.66	per	Lin Ft
50 Gallon Tote	\$ 15.00	per	Tote
6' Ladder	\$ 60.00	per	Ladder
8"x6"x2" (Approx.) Grout Sponge	\$ 2.00	per	Sponge
94 Qt. Igloo Cooler	\$ 90.00	per	Cooler

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Item	Per Unit Price		
Armor-All Leather Care Protectant	\$ 0.35	per	Fl. Oz
Armor-All Original Protectant	\$ 0.31	per	Fl. Oz
Banana Boat SPF 50 Sunblock Lotion	\$ 1.31	per	Fl. Oz
Bolts	\$ 0.05	per	Bolt
Bounce Dryer Sheet	\$ 0.25	per	Sheet
Brawny Paper Towels	\$ 0.05	per	Sq. Ft
Burlap Blanket	\$ 0.14	per	Sq. Ft
<u>Barbecue</u> Charcoal	\$ 0.50	per	Lbs
Clorox Disinfecting Wipes	\$ 0.04	per	Wipe
Clorox Ultra Bleach	\$ 0.13	per	Fl. Oz
CLR Cleaner	\$ 0.31	per	Fl. Oz
Coarse Compost	\$ 3.00	per	Gallon
Coffee Filter	\$ 0.03	per	Filter
Cotton Balls	\$ 0.02	per	Cotton Ball
Diamond Strike Anywhere Matches	\$ 0.03	per	Match
Downy Fabric Softener	\$ 0.50	per	Fl. Oz
Drano Clog Remover	\$ 0.16	per	Fl. Oz
Duct Tape 20 Yd Roll	\$ 10.00	per	Roll
Febreze Fabric Refresher	\$ 0.22	per	Fl. Oz
Fram Car Air Filter S/N CA9482	\$ 12.00	per	Filter
Fram Extra Guard Oil Filter S/N PH4967	\$ 6.00	per	Filter
Fram Fuel Filter S/N G7612	\$ 23.00	per	Filter
Hydrogen Peroxide	\$ 0.06	per	Fl. Oz
Mylar Emergency Sleeping Blanket	\$ 3.00	per	Blanket
Nails	\$ 0.05	per	Nail
Nuts	\$ 0.05	per	Nut
Off! Deep Woods Insect Repellent	\$ 1.25	per	Fl. Oz
Original Swiffer Duster	\$ 1.08	per	Duster
Ortho Weed-B-Gon Max	\$ 0.44	per	Fl. Oz
Oxyclean Stain Remover	\$ 1.20	per	Lb
Paint Thinner	\$ 0.08	per	Fl. Oz
Painter's Plastic	\$ 0.10	per	Sq. Ft
Palmolive Ultra Dishwashing Liquid	\$ 0.23	per	Fl. Oz
Pine-Sol All-Purpose Cleaner	\$ 0.07	per	Fl. Oz
Play Sand	\$ 0.10	per	Lbs
Pledge Furniture Polish	\$ 0.22	per	Fl. Oz
Prestone Anti-Freeze 50/50	\$ 0.08	per	Fl. Oz
Pumice Stone (1/2"x2"x4" Max Size)	\$ 6.00	per	Stone
Screws	\$ 0.05	per	Screw
Sham-Wow	\$ 5.00	per	Sq. Ft
Silicone (Black Only)	\$ 6.00	per	Tube (10 oz)

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Item	Per Unit Price		
Stainless Steel Safety Wire	\$ 0.25	per	Lin Ft
Standard Air Conditioner Filter	\$ 2.67	per	Filter
Tarp	\$ 0.10	per	Sq. Ft
Tide Concentrated Liquid Detergent	\$ 0.25	per	Fl. Oz
Towels (12" x 12" Max Size)	\$ 1.00	per	Towel
Turtle Wax Hard Shell Paste Wax	\$ 0.55	per	Fl. Oz
WD-40 Lubricating Spray	\$ 0.75	per	Fl. Oz
Weed Control Fabric	\$ 0.11	per	Sq. Ft
Windex Glass Cleaner	\$ 0.16	per	Fl. Oz
Window Screen Mesh	\$ 0.31	per	Sq. Ft
Window Squeegee	\$ 6.00	per	Squeegee
Wood Mulch	\$ 6.00	Per	Cu. Ft.

Appendix B: Operational Costs

Item	Per Unit Price			
Adjustable wrenches	\$ 3.00	per	Unit-Hour	
Basic Socket Set	\$ 5.00	per	Unit-Hour	
Caulking Gun	\$ 2.00	per	Unit-Hour	
Channel Locks	\$ 1.50	per	Unit-Hour	
Cordless Drill	\$ 10.00	per	Unit-Hour	
Cordless Skill Saw	\$ 15.00	per	Unit-Hour	
Drill Bits (each)	\$ 1.50	per	Unit-Hour	
Hand Saw	\$ 10.00	per	Unit-Hour	
Operator Costs	\$ 25.00	per	Unit-Hour	
Pipe Wrench	\$ 5.00	per	Unit-Hour	
Pliers	\$ 1.50	per	Unit-Hour	
Screwdrivers (each)	\$ 1.00	per	Unit-Hour	
Standard Builder's Hammer	\$ 5.00	per	Unit-Hour	
Utility Knife	\$ 2.00	per	Unit-Hour	
Wire Cutters	\$ 2.00	per	Unit-Hour	