FSAWWA

Model Water Tower Competition

Student Information Packet

November 2022

American Water Works Association
FloridaSection

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Attention Middle/High School Teachers:

Your local region of the Florida Section American Water Works Association is proud to announce the tenth annual Model Water Tower Competition (MWTC). This competition provides students with a fun-filled, science oriented competition aimed at introducing middle and high school students to opportunities in the water profession. We are pleased to invite your students to participate with other AWWA Florida Region III (greater Orlando area) middle/high school students in this unique competition.

This competition requires students to design and build a water tower with specific size and height requirements. The models are judged based on 5 categories including cost efficiency, hydraulic efficiency, structural efficiency, design ingenuity, and materials ingenuity. All of the specific requirements for the water tower model judging are defined in the Judging Handout, and their associated scoring factors are listed on the Sample Score Card.

Every Contestant will receive a Certificate of Participation from AWWA. Grand Prizes will be awarded to the 3 Top Overall Models (based on the lowest accumulated score). **Grand prizes include $300, $200, and $100 cash for 1st, 2nd, and 3rd Place teams, respectively.**

This competition requires little of the classroom teacher's time, but success of the student is directly dependent on the student having the opportunity and encouragement to enter. We are asking Region III County Math, Science, and Technology middle and high school teachers to present the Model Water Tower Competition to their classroom, hand out the Model Water Tower Competition Student Pack to the students, and collect and return the student registration forms to the FSAWWA Region III - Model Water Tower Committee.

Each student will receive a packet that includes all necessary information to successfully enter and build a water tower model. Enclosed you will find a sample student pack with more detailed information regarding model building and the competition guidelines.

Please notify Robbie Gonzalez at 407-425-0452 (office) / 407-443-0269 (cell) or via email at RGonzalez@cphcorp.com if you are interested in promoting the Model Water Tower Competition to your middle school or high school students. We will be happy to provide support within your classroom if needed. We look forward to working with you and your students.

Thank you for your positive consideration for the Model Water Tower Competition in you classroom.

Robbie Gonzalez, P.E.
Coordinator – MWTC; FSAWWA Region III
CPH, LLC
1117 East Robinson Street, Orlando, Florida 32801

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Dear Middle/High School Parent:

Your local region of American Water Works Association, Florida Region III, is proud to announce the tenth Annual Model Water Tower Competition. This competition provides students with a fun-filled, science oriented contest aimed at introducing middle and high school students to engineering and the water profession. We are pleased to invite your students to participate with other AWWA Florida Region III (greater Orlando area) middle/high school students in this unique competition.

This competition requires students to design and build a water tower with specific size and height requirements. The judging takes place on **November 5, 2022,** at the **UCF Engineering Building II Atrium,** starting at **9:00 am**. The models are judged based on 4 categories including: cost efficiency, hydraulic efficiency, structural efficiency, and design/materials ingenuity. Cash prizes will be awarded to the top three overall winners. All of the specific requirements for the water tower model judging are defined in the Judging Handout, and their associated scoring factors are listed within this packet.

Each student will receive a packet that includes all necessary information to successfully enter and build a water tower model. The Model Water Tower Competition Registration Forms must be completed, signed by the team advisor, and returned to the teacher by **October 21, 2022.** While the individual or student team must build the models, parents are encouraged to coach and mentor their student throughout the design and build phase of their water tower model.

- **Classroom Registration** - Teachers shall have students register their teams online at https://www.fsawwa.org/page/mwtc by **October 21, 2022** and have signed participant release forms delivered to the event coordinator. **Students without Participant Release Forms will not be eligible to complete**.
- **Model Building** - will occur by students in their spare time up until the Judging Day.
- **Judging Day** – **November 5, 2022** at the **UCF Engineering Building II Atrium**. Registration is held from **9:00-11:00 am**. **Students arriving after 11:00 am will not be eligible to compete.** Judging and final awards will occur when all towers have been processed.

For additional information regarding the Model Water Tower Competition, please contact Robbie Gonzalez at 407-425-0452 (office) / 407-443-0269 (cell) or at RGonzalez@cphcorp.com.

Sincerely,

Robbie Gonzalez, P.E.
Coordinator – MWTC; FSAWWA Region III
CPH, LLC
1117 East Robinson Street, Orlando, Florida 32801

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OBJECTIVES

The objective of the competition is to make participants aware of the importance of reliable drinking water and the rewarding opportunities available in the water profession. The competition meets this objective by having students develop an idea into a functioning water tower, just like what water professionals do in the real world.

Prizes will be awarded to the top three finishers in the middle school and high school categories. The lowest scores win (similar to a golf score!). Judges decisions are final and non-refutable. Judging will be based on four criteria – structural score, hydraulic efficiency, cost efficiency, and design ingenuity. The judging criteria are explained below.

RULES

Each Region participating in the MWTC must incorporate the following rules into their Registration packages.

1. Footprint: The base of the model must fit in a 1ft by 1 ft square.
2. Tank Height: The tank must be between 1.5 and 2.5 feet high (See Reference Drawing).
3. Tank Volume: When full, the tank must hold between 1 and 2.5 gallons of water. (Hint: test the model in advanced to make sure the tower can hold the weight of the water!)
4. Leaks: The tank should not leak.
5. Vent/Lid: The tank must have a vent or removable lid so the judges can tell when it is full. (Note: Tanks may not be pressurized.)
6. 3/8 Inch Connector: The model must use the 3/8-inch connector as supplied by the FSAWWA Region IV MWTC Chair. The 3/8-inch connector will be mailed to the teacher or advisor of the Team upon receipt of the registration forms.
7. Receipts: Bring receipts for all materials purchased for your model. (Note: Donated or recycled items shall be documented.)
8. Materials' List: Bring your materials' list to the competition.
9. Structural Stability: The tower should be structurally stable throughout all parts of the competition.

STRUCTURAL SCORE

Structural efficiency is calculated by dividing the weight of the model when it is empty by the average height of the tank times the amount of water it holds. The lower this number the better your score. This is shown in the following formula:

$$Structural\ Efficiency = \frac{Weight\ of\ tower\ when\ empty\ (pounds)}{Average\ Tank\ Height\ (ft) * Amount\ of\ water\ that\ tower\ can\ hold\ (gallons)}$$

This criterion is similar to what engineers use in the real world. Remember, the tank should be between 1.5 feet and 2.5 feet high (see drawing provided) and hold at least 1 gallon of water but no more than 2.5 gallons! A more structurally efficient tower will have a better structural score. Remember, the towers with the lowest total scores win.

HYDRAULIC EFFICIENCY

Hydraulic efficiency is the amount of time it takes the judges to fill and drain the model with one (1) gallon of water. The judges will fill the tank by pumping water through the 3/8-inch connector. The tank will be drained by letting the water flow out of the tank by gravity only. The less time it takes to fill and drain the tank through the connector the better. The tank must have a vent or a removable cover so the judge can see into the tower. Coverless or non-vented towers will not be permitted. Each tank will be tested (filled and drained) twice and the average of the two fill and drain times (in minutes) will equal the hydraulic efficiency score. The hydraulic efficiency formula is as follows:

$$Hydraulic\ Efficiency\ \ (time in \min) = \frac{First\ Test\ (fill\ and\ drain) + Second\ Test\ (fill\ and\ drain)}{2}$$

COST EFFICIENCY

Cost efficiency measures your ability to save money while building your model. Donated or recycled items must be documented. Points will be assigned as follows (the lower the score the better):

$ 0.00 -$ 5.00	1 point
$ 5.01-$ 10.00	2 point
$ 10.01-$ 15.00	3 point
$ 15.01-$ 20.00	4 point
More than $ 20.00	5 point

List all items used in your model and their costs on the *Materials List Form*. This form is required on the day of the event. The *Materials List Form* includes many commonly used materials and their unit costs. Items already included on the *Materials List Form* do not require a receipt, simply enter the quantity used and calculate the total cost. The blank lines provided on the *Materials List Form* are for items purchased or recycled that are not already included, and a receipt or proof of cost must be attached for each of these additional items. A penalty of 1 point will be given for each missing receipt for items purchased that were not pre-included in the *Materials List Form*. A 3-point penalty will be added to the student's score if the *Materials List Form* is missing. The cost of glue, nails, screws, general adhesives, and items used to decorate the tower should not be counted towards the tower's total cost. For items to be counted as purely decorative, they must not aid in the structural integrity of the water tower. The cost of the tower should not include tax. Please see cost example at the end of this packet.

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DESIGN INGENUITY

Ingenuity is how much imagination and skills were used in your model. Water professionals must often use ingenuity; skill and imagination are used to solve difficult problems. The judges will look at several items:

1. Craftsmanship (is the model sturdy, effort and detail applied, do the parts fit together nicely)?
2. Imagination (are the design and materials unique)?
3. Artistic merit (does the model have creative ideas, colors or themes)?

REQUIRED DESIGN STANDARDS AND PENALTIES

Keep to the following standards when designing and constructing your model:

1. Footprint: The base of the model must fit in a 1 ft by 1 ft square. If not, a 2-point penalty will be assessed.
2. Tank Height: The tank must be between 1.5 and 2.5 feet high (See Drawing). If not, a 2-point penalty will be assessed.
3. Tank Volume: When full, the tank must hold between 1 and 2.5 gallons of water. Hint: test the model prior to competition to make sure the tower can hold the weight of the water! If not, a 2-point penalty will be assessed.
4. Leaks: The tank should not leak. If any part of the tower leaks (e.g. tank, piping, connector), then a 2-point penalty will be assessed.
5. Vent/Lid: The tank must have a vent or removable lid so the judges can tell when it is full. Uncovered towers or non-vented towers will result in a penalty of 1 point.
6. 3/8 Inch Connector: The model must use the 3/8-inch connector as supplied by the FSAWWA Region MWTC Chair. The 3/8-inch connector will be mailed to the teacher or advisor of the Team upon receipt of the registration forms. If the tower does not have this 3/8-inch connector, then a 1 point penalty will be assessed. (Note: The use of a non-supplied connector may result in the tower not being able to be tested causing ejection from the competition.)
7. Materials' List: Bring your materials' list to the competition. If the materials' list is not provided at the competition, a 3-point penalty will be assessed.
8. Receipts: Bring receipts for materials purchased for your model, as specified. A one point penalty will be assessed for each item not having a receipt (Maximum of 3 penalty points). A brief description for all recycled materials must be documented or penalty points may be assessed.
9. Structural Stability: The tower should be structurally stable throughout any part of the competition. If the tower exhibits structural instability (e.g. tower must be supported by a person during filling of water or during any part of the testing), then a 2-point penalty will be assessed.

Penalties will be assessed for not following the standards described above and these penalties will be directly added to the tower's score. These standards are demonstrated in the diagram attached to this handout.

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EVENT DAY PROCEDURE

Registration Table

1. Check-in at the Registration Table and provide a completed *Team Registration Form*, *Materials List Form*, a signed Participant Release Form if not already submitted by student's teacher. If student does not have the Release Form, provide them with one to be signed by their parent, guardian or teacher and add the signed Release Form to registration packet for team.
2. Each team will be given a Competition packet containing their *Data Entry Sheet*, student Certificates of Participation, one t-shirt per team member, and each model will be assigned a Model Number to be adhered to their model tower.
3. Teams will be directed to their next station

Structural Station

1. Provide *Data Entry Sheet* to the Structural Volunteer.
2. Models will be measured and weighed (both filled with 2.5 gallons of water and empty)
3. Structural Scores will be recorded by the Volunteer on the *Data Entry Sheet*
4. TAKE DATA ENTRY SHEET TO THE STRUCTURAL DATA ENTRY STATION- FAILURE TO DO SO WILL RESULT IN SCORES NOT BEING RECORDED!
5. Proceed to next station

Hydraulic Testing Station

1. Provide *Data Entry Sheet* to the Hydraulic Volunteer.
2. Models will be timed while being filled and drained. This process will be repeated.
3. Hydraulic Scores will be recorded by the Volunteer on the *Data Entry Sheet*
4. TAKE DATA ENTRY SHEET TO THE HYDRAULIC DATA ENTRY STATION- FAILURE TO DO SO WILL RESULT IN SCORES NOT BEING RECORDED!
5. Proceed to next station

Materials Station

1. Provide *Data Entry Sheet* and *Materials List Form* and all receipts needed
2. Materials list will be checked for validity and thoroughness.
3. Materials Scores will be recorded by the Volunteer on the *Data Entry Sheet*
4. Proceed to next station

Judging Station

1. Once the Teams have completed the three stations outlined above, they should return to the Registration Table to turn in their *Data Entry Sheet.*
2. After verifying that their Model Number is still attached, students must place their model on the Judges Table with the corresponding Model Numbers. Students need not and should not be present for judging.
3. You're done! Please wait for the judging and scoring phases to be complete before the winners will be announced.

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Registration

Team Name: _____

School/Grade: _____

Teacher or Advisor: _____

******Register on-line by October 21, 2022 at** https://www.fsawwa.org/page/mwtc

******Complete this form and return to your teacher by October 21, 2022.**

List the name of your team members below. Teams may have from 1 to 4 members.

Name	Grade	Telephone #	T-shirt Size

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Participant Release Form

INSTRUCTIONS: Complete this form with your parent or legal guardian's signature and return to your teacher. **Complete this form and return to your teacher by October 21, 2022. Students must have this form complete in order to compete.**

I AM THE PARENT/GUARDIAN OF _____

I HEREBY AUTHORIZE THE MEMBERS OF THE WATER TOWER COMPETITION COMMITTEE, A SPECIAL PROJECT OF THE AMERICAN WATERWORKS ASSOCIATION-YOUTH EDUCATION COMMITTEE TO:

1. PREPARE ANY PROMOTIONAL MATERIAL SUCH AS PRESENTATIONS, SLIDE SHOWS, VIDEO TAPES, PHOTOGRAPHS AND MOVIE FILMS IN WHICH MY CHILD WILL SPEAK AND/OR APPEAR.
2. USE, REUSE, PUBLISH AND REPUBLISH THE SAME IN THE WHOLE OR IN PART INDIVIDUALLY OR IN CONJUNCTION WITH OTHER PHOTOGRAPHS , VIDEO OR FILM IN ANY MEDIUM FOR ANY PURPOSES WHOSOEVER, INCLUDING (BUT NOT BY WAY OF LIMITATION) ILLUSTRATION, PROMOTION AND ADVERTISING BY THE COMMITTEE.

I HEREBY WAIVE ANY MONETARY RIGHTS OR OTHER RIGHTS THAT I MAY HAVE TO INSPECT AND/OR TO APPROVE THE FINISHED PRODUCT OR THE ADVERTISING COPY THAT MAY BE USED IN CONNECTION THEREWITH OR THE USE TO WHICH IT MAY BE APPLIED. I UNDERSTAND AND AGREE THAT ALL RIGHTS, ROYALTIES AND MATERIALS WILL BELONG TO THE COMMITTEE.

Parent/Guardian (Print Full Name)_____

Parent/Guardian (Signature)_____

Date_____ Phone #_____

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Materials List Form

Team Name: _____

Participants: _____

Complete and bring this form on the day of the contest. List the materials and costs used to construct your model water tower. If your model includes materials not shown in Table 1, you may manually include them in Table 2. Be sure to bring receipts or proof of cost for all items in Table 2.

Table 1

Item	Unit	$/Unit	Quantity	Total
Gallon Jug	EACH	$ 0.50		
.5" PVC Pipe	FOOT	$ 0.25		
.75" PVC Pipe	FOOT	$ 0.30		
1" PVC Pipe	FOOT	$ 0.45		
1.5" PVC Pipe	FOOT	$ 0.50		
2" PVC Pipe	FOOT	$ 1.00		
Tubing	FOOT	$ 0.75		
Styrofoam	EACH	$ 0.10		
3/8 Inch Connector	EACH	$ -		
Wooden Dowel	FOOT	$ 0.15		
Paint	-	$ -		
Paper Towel Roll	-	$ -		
Paper	-	$ -		
Tin Foil	EACH	$ 0.10		
Disposable Cups	EACH	$ 0.10		
Plywood	SQ FOOT	$ 2.00		
Funnel	EACH	$ 1.00		
Ribbon	FOOT	$ 0.05		
Frisbee	EACH	$ 2.00		
Screws	EACH	$ -		

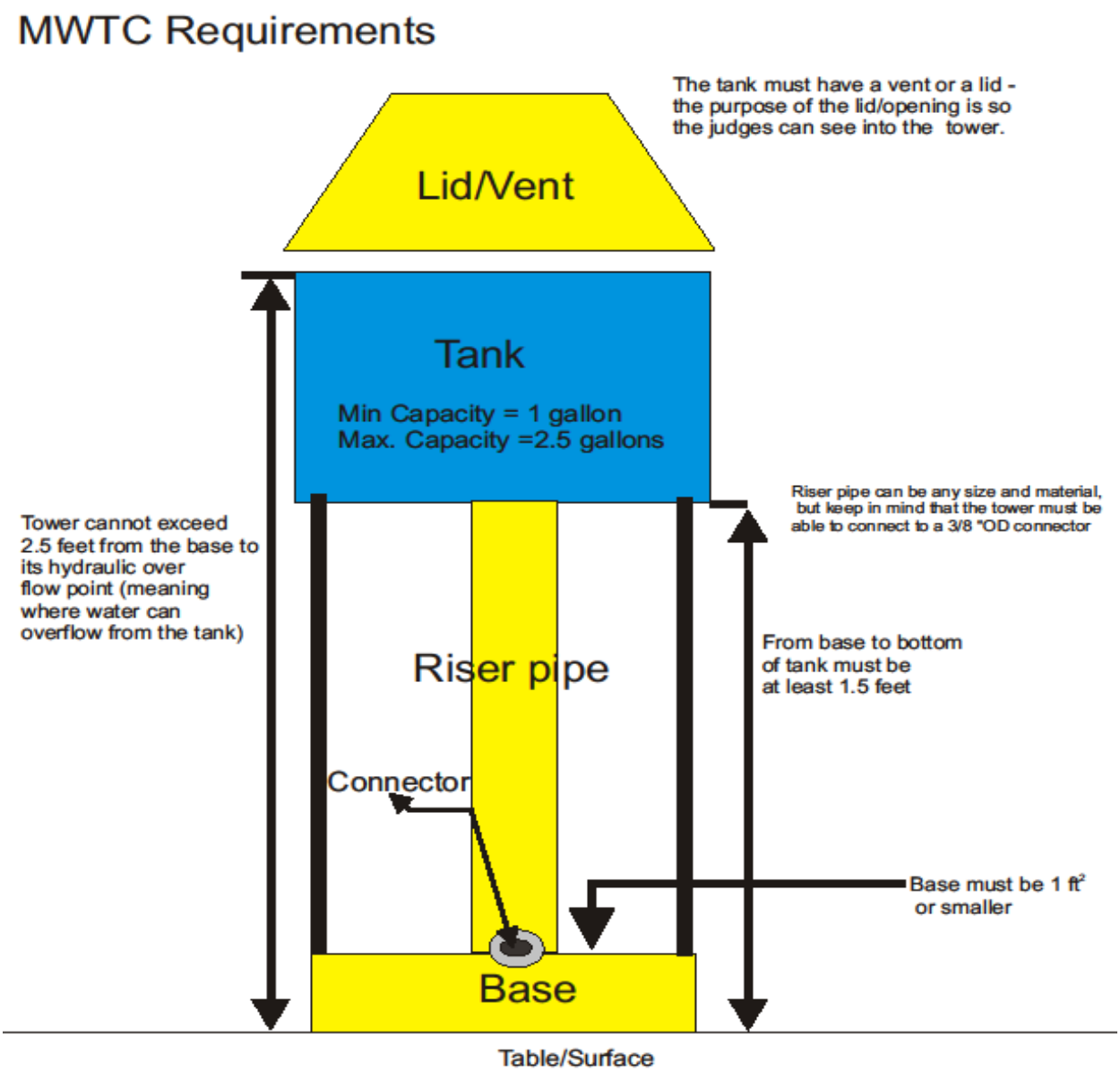
Velcro	INCH	$ 0.12		
Flex Seal	EACH	$ 2.00		
Soda Cans	EACH	$ 0.08		
String Lights	-	$ -		
Fishing Line	FOOT	$ 0.01		
Wax Paper	FOOT	$ 0.02		
Hose	FOOT	$ 0.20		
Mesh	SQ FOOT	$ 0.05		
Chicken Wire	SQ FOOT	$ 0.65		
Pencils	EACH	$ 0.05		
Tomato Stand	EACH	$ 2.00		
2"x4" Wood	INCH	$ 0.05		
Hose Clamp	EACH	$ 1.50		
Subtotal:				$

Table 2

Addition Items	**Unit**	**$/Unit**	**Quantity**	**Total**
Subtotal:				
Final Total				

*A penalty will be given for not bringing this form or receipts for items listed in Table 2.

MODEL DIAGRAM



Additional notes:
Your Model must be an elevated tank design including a riser pipe, a tank, a supporting structure to hold the tank and a base.

The Maximum and minimum volume requirements INCLUDE the storage in your riser pipe.

The maximum 2.5 feet height refers to the length from the base to the hydraulic height (ie the overflow height).

3/8" OD connector will be supplied by the MWTC Chair (registration required) and is the only allowable 3/8" OD connector that can be used on competition day.

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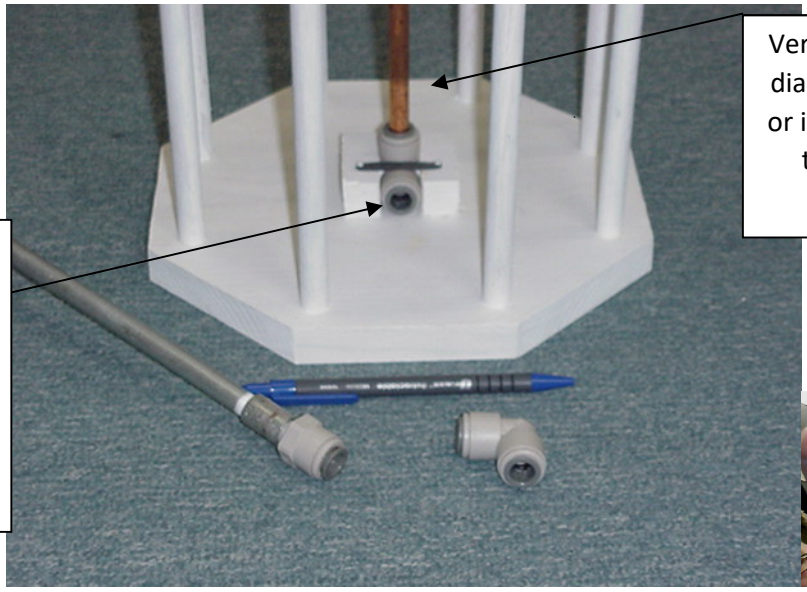
MODEL WATER TOWER CONNECTOR



Vertical tube may be any diameter - use a reducer or increaser as necessary to change tube size

Connector must be installed at the base of the model. Use the 3/8" diameter connector as supplied by the Youth Education Chair.

The proper 3/8" diameter push-on connector will be provided to all registered contestants. You must use the connector given to you to avoid a penalty. Contact your teacher sponsor to receive the connector. If you do not have a teacher sponsor, contact the event organizer as follows to receive a connector:

Robbie Gonzalez, P.E.

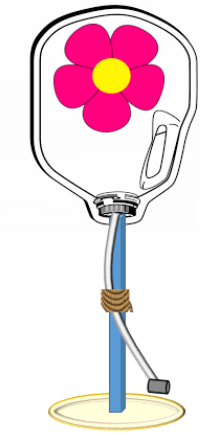
Coordinator – MWTC; FSAWWA Region III

CPH, Inc.

1117 East Robinson Street, Orlando, Florida 32801
407-425-0452 (office) / 407-443-0269 (cell)

RGonzalez@cphcorp.com

MATERIAL COST EXAMPLE



Team XYZ has built the following water tower. Their materials included:

- Water jug
- 1 foot of ½" plastic tubing
- 18 inches of 2"x4" wood
- A paper flower
- 3/8" connector
- 6" of purchased rope
- Recycled plastic plate.

Team XYZ is figuring out how to fill out their materials sheet. According to the Materials List:

1. They don't need to include a cost for the connector
2. They don't need a cost for the paper flower since it does not contribute to the function of the water tower
3. Per the Materials List, the water jug would cost $0.50, the 1 foot of plastic tubing would cost $0.75, the 2"x4" wood would cost $0.90.
4. Since the rope does not have a cost on the general Materials List, Team XYZ will have to add it to Table 2. Team XYZ bought 15 feet of rope for $5.00. That means the rope is $0.33 per foot, so the cost of rope for their water tower would be $0.17. Team XYZ must bring their receipt for the purchased rope.
5. Since the plastic plate does not have a cost on the general Materials List, Team XYZ will have to add it to Table 2. Because the item is recycled, the Team will have to find a comparable item for purchase and provide proof of cost. This can be a print out from online, or an in-store picture. They included the following screenshot:

If 50 plates costs $14.88, then one plate would cost $0.30.

The resulting total for Team XYZ's water tower would be $2.62!

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DIRECTIONS

The Engineering Atrium is near the center of campus, on the East side. Due to a conflicting event, participants should park in Garage B. You may park free of charge. Please note that the walk from Garage B to Engineering Atrium II is approximately 0.5 miles (path shown in yellow). You may use your vehicle to drop-off directly in front of the building using the route shown in red prior to parking. Google Maps recognizes buildings within UCF campus and can provide walking directions.