

How to Make a Home Storm Resistant in the Huntington Area

STEM Reconstruction and Resiliency Challenge

Jack Abrams STEM Magnet School

5th Grade Class

Huntington School District

INTRODUCTION

During Hurricane Sandy, there was major damage in the Huntington area. High winds damaged buildings and homes and also uprooted trees. Heavy rains and storm surge caused flooding in basements. There were widespread power outages that lasted for days to weeks. These elements of Hurricane Sandy caused billions of dollars in damage. As a fifth grade class, we investigated these factors to build a more weather resistant house. We researched building materials, flood prevention, what trees will withstand a storm, alternative power sources, aerodynamics of a house, and reuses of rain water.

METHODS

We did our research in Jack Abrams Stem Magnet School. Forty-eight fifth grade students were split into six groups of eight. Each group investigated one aspect of the house to research. To complete our research, we used computers and iPads to find internet resources such as newspaper articles, journals, and building websites. Back in our classroom, some groups built models or completed scientific experiments. We talked to our mentor, Mr. Surti, using Skype on our iPads. Lastly, we documented our research and collaboration by taking pictures.

RESULTS

A: Building Materials

Many houses were destroyed and had very bad damage because of Hurricane Sandy. This damage was caused from falling trees and a lot of rain. As a group we tested the strength and

water resistance of some materials that make up a house. We tested cement, wood and sheetrock (Elliott, 2014).

To test the strength of the materials, we dropped books from different heights. We put two books apart and set the material we were testing on it. First we tested cement. We dropped the book from 30 in, 35 in, 40 in, 45 in, and 50 in. It didn't break from all the heights but when we tested human weight it broke. Then we tested sheetrock the same way only this time it broke at 35 in. The last thing we tested was wood. It didn't break at any of the heights we dropped the book from but it broke when we added human weight. We can conclude that cement is the strongest, wood is the second strongest, and sheetrock is the weakest.

For the water resistance we tested the same three materials. We filled up three beakers with water and soaked our small pieces of each material. We left them there for 24 hours. After 24 hours the cement was wet, still intact and still strong. The wood was wet, still intact, bendy, and squishy. The sheetrock crumbled and fell apart. We can conclude that the cement is the most water resistance than wood and sheetrock the least.

We found out that cement is the best material for a home during a hurricane. Wood can be the second choice for a home. Sheetrock can be the last. In Figure 12, you can see the strength and waterproof experiments that we did to test the building materials. Cement wouldn't break if a tree fell on it and it would still be strong if it rained. Wood would break if a tree fell on it and would turn squishy if it rained. Sheetrock would break easily if a tree fell on it and it would crumble and fall apart if it rained. Therefore cement is the best material for a house during a hurricane.

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B: Flood Prevention

Many houses had flooding problems during Hurricane Sandy. Large storm surge and rain caused this flooding. We researched ways to keep flood waters out of the house based on how high the flood levels were.

According to Figure 1, the storm surge levels around Long Island were nine to thirteen feet. In order to make our new home storm proof, we need a way to prevent flooding. We discovered that we could build a house on stilts and use flood barriers. A house on stilts would be useful during a hurricane because the water would flow right under the house. The stilts would be about 10-15 feet and made of concrete or cement. Figure 8 shows our house built up on stilts. Flood barriers would also help prevent water from getting into the house. Flood barriers are made out of aluminum planks and steel posts. You could put flood barriers between your house and the water. They would create a wall that keeps the water off of your property. Those are some ideas to prevent flooding in your home.

There are also some other minor things you can do to prevent flooding in your house. You can have water tight doors. You should also raise electrical outlets, put heating and air conditioning in the attic, and clean the gutters.

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C: Reuses of Rainwater

In Nassau County, water treatment plants were shut down and sewage contaminated the water so it wasn't safe to drink (Kenward, Yawitz & Raja, 2013). This could happen anywhere during another storm on Long Island, even Huntington. We researched how to reuse rain water because we get a lot of water during the storm so we won't have to rely on treatment plants. We also researched how to catch and contain rain water. We discovered that if you create a rain catcher, the water you catch will be safe to drink.

E: Aerodynamics of a House

During Hurricane Sandy, many houses were destroyed or at least damaged by the strong winds. 305,000 houses were destroyed in New York in total ("Hurricane sandy's impact," 2013). We believe that the houses are flawed because there shape is not aerodynamic. They are susceptible to wind and derbies damage. The features of the houses now are flat so the wind can't get around. We researched how to make a house more aerodynamic.

Our new aerodynamic house is a completely new design for this area. We discovered that a circular or octagonal house and walls will allow wind to move around the house with less damage. Having a dome or pyramid shaped roof will do the same. The house will be raised from the ground with stilts so the house will allow the wind to go under the house. All of these features listed can be seen in Figures 2 and 3. In addition, the house will have shatter proof and water proof windows and doors because they are weak points of a house.

F: Alternative Power Sources

People on Long Island had to deal with power problems during Hurricane Sandy. These problems include widespread power outages and long lines for gas for generators. We are trying to find another power source that will fix these problems. Two types of alternative power sources that we found are solar power and wind power. The two types of those types of power are solar panels and wind turbines.

According to LIPA, the average home on Long Island uses about 9,458 Kilowatts of power per year (LIPA, 2009). Energy from solar panels and wind turbines is used to light houses and heat the house during the cold. We researched solar panels as solar power and wind turbines as

wind power. Solar panels collect sunlight and store it in batteries then transform it into energy.

Solar panels are usually placed on the south part of the roof as can be seen in Figure 7. Wind turns the blades of a wind turbine which spin a ray which is connected to a generator and turns the kinetic energy to electricity as can be seen in Figure 4. For both alternative energy sources, the electricity then flows through a wire which is connected to the house which can be used to heat or light a home.

We found out solar panels are cheaper than the wind turbines. Solar panels cost about \$1,000 for a 1 square meter panel but can produce between 750 - 1,600 Kilowatts per year based on the amount of Sun at the location (Solar buzz, 2014). A wind turbine costs \$10,000 to \$70,000 for an entire system, but it produces between 8,000 – 18,000 kilowatts per year based on the size of the turbine (Bergey Wind Power, 2012). We prefer solar power as the best alternative power source during a black out or hurricane because it's cheaper, smaller, easier to install and it produces just enough power for a house.

SUMMARY

As seen in the many figures attached, our new house has new storm resistant trees, strong and waterproof building materials, wind and solar energy, an aerodynamic house design, and a rain catch. We recommend using this whole plan, and not just part of the plan, because it is more storm resistant. The estimated time to complete this plan is six months to a year. In conclusion we created a more storm resistant house for our Huntington area.

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FIGURE 1:

This picture shows the different flood levels from Hurricane Sandy around Long Island.



Lat: 40.9404 Lon: -74.0204

Legend

Height above NGVD-29 (feet)

0 to < 2	11 to < 13	23 to < 25
2 to < 3	13 to < 15	25 to < 27
3 to < 5	15 to < 17	27 to < 29
5 to < 7	17 to < 19	29 to < 36
7 to < 9	19 to < 21	
9 to < 11	21 to < 23	

Disclaimer



Historical Data:
NHC this storm
NHC all storms
MDL

Figure 2:

This is an aerial view of our home. It shows the octagonal shape of the walls of the home.

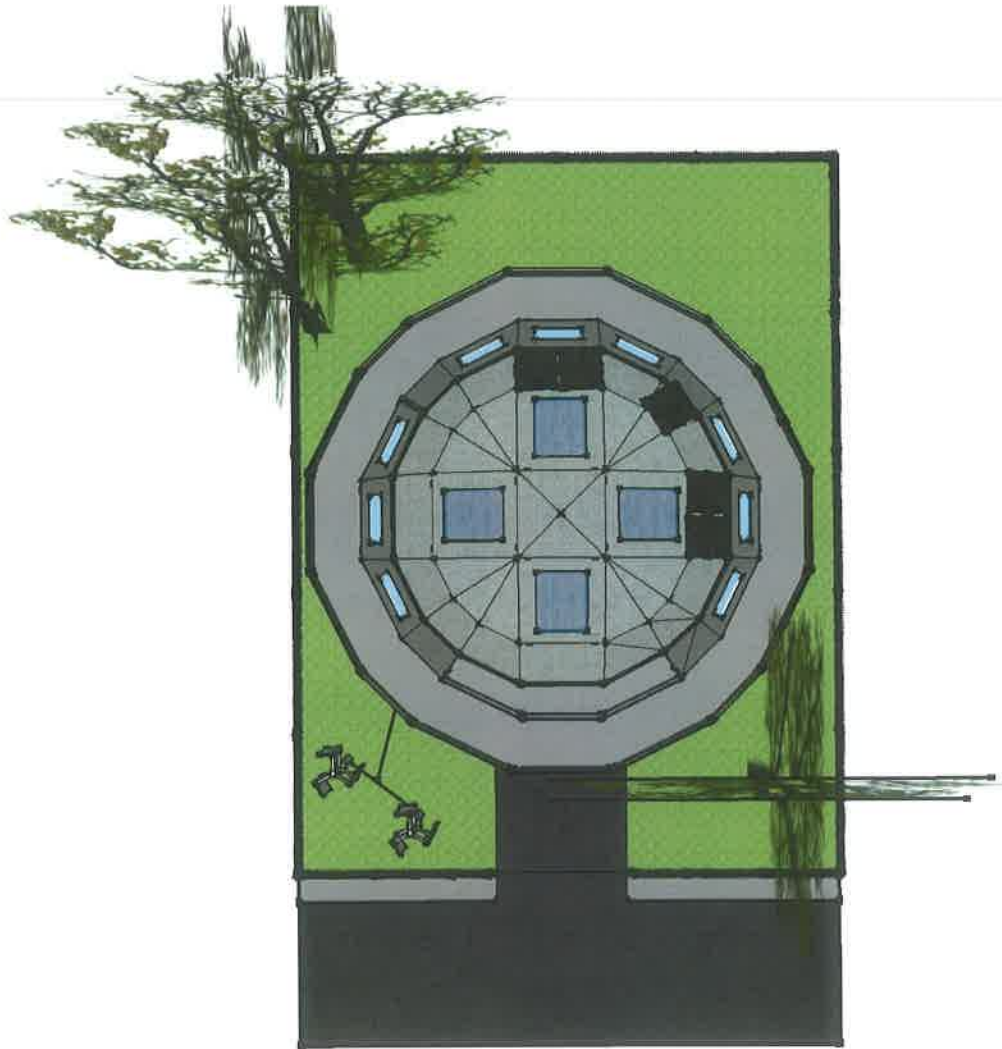


Figure 3:

This is a cross section view of our home. It shows the dome shape of the walls and roof.

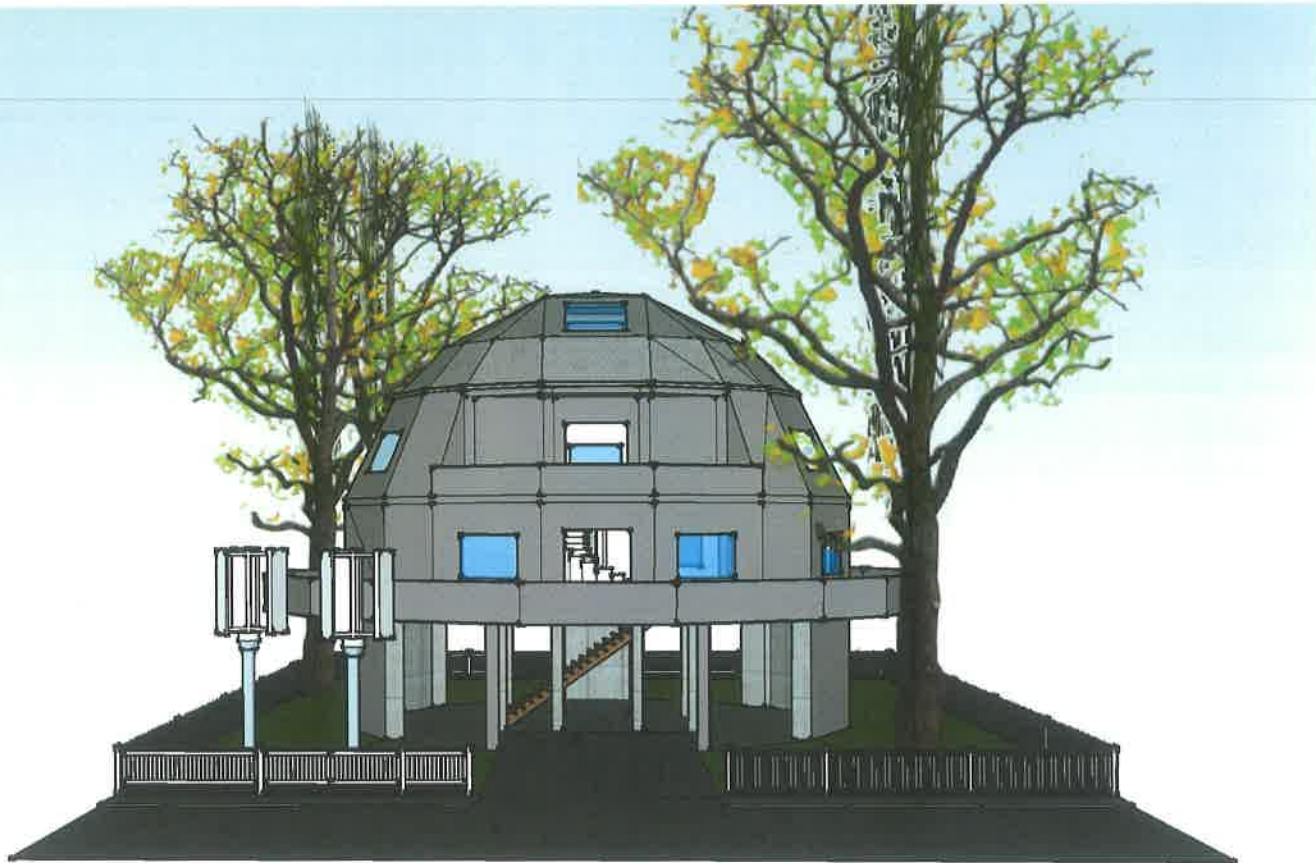


Figure 4:

This figure shows the homes 2 windmills that are used as an alternative energy source.

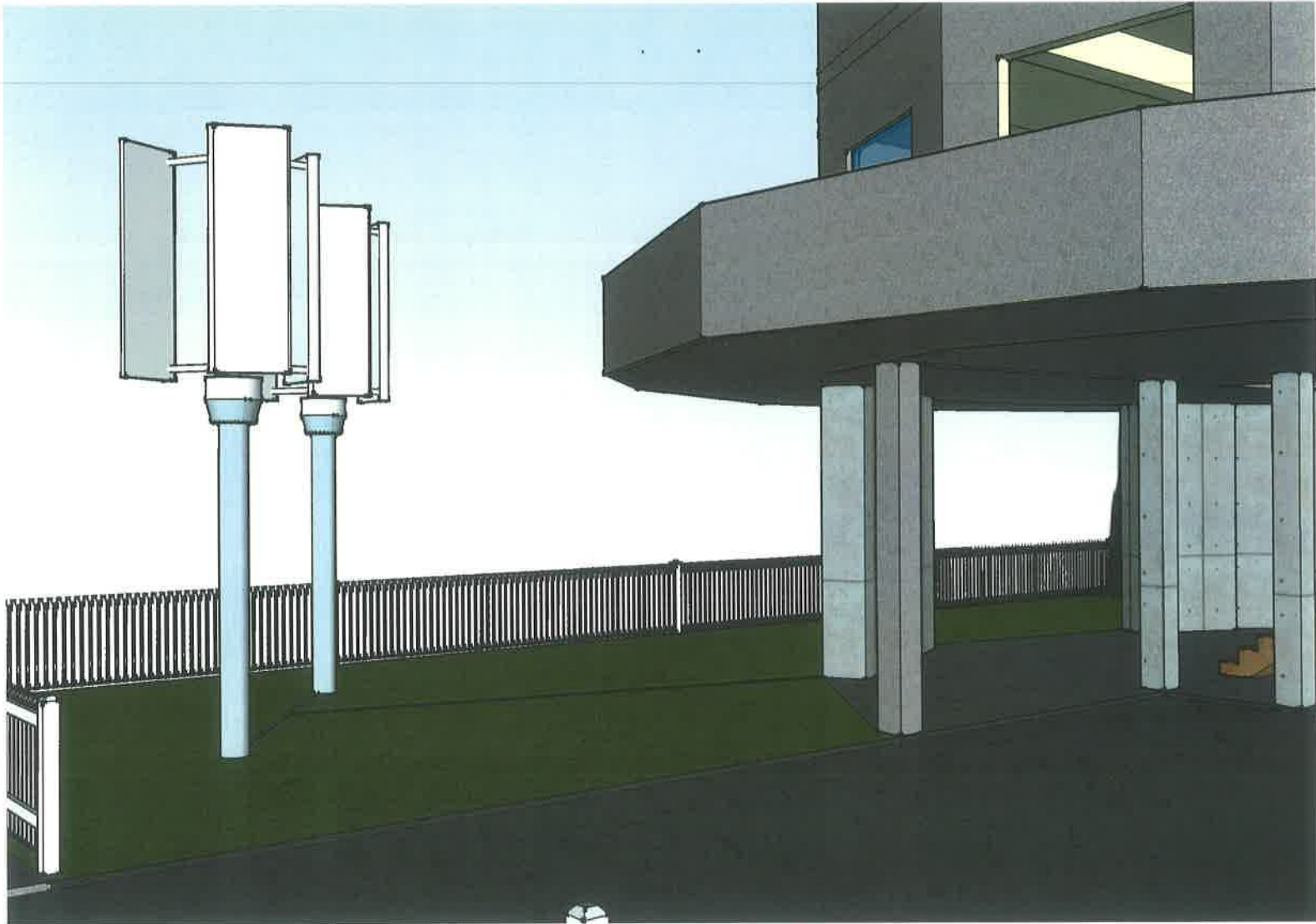


Figure 5:

This figure shows the homes gutter system attached to the roof. It is used to catch the rain water and filter it down into our rain catch below.

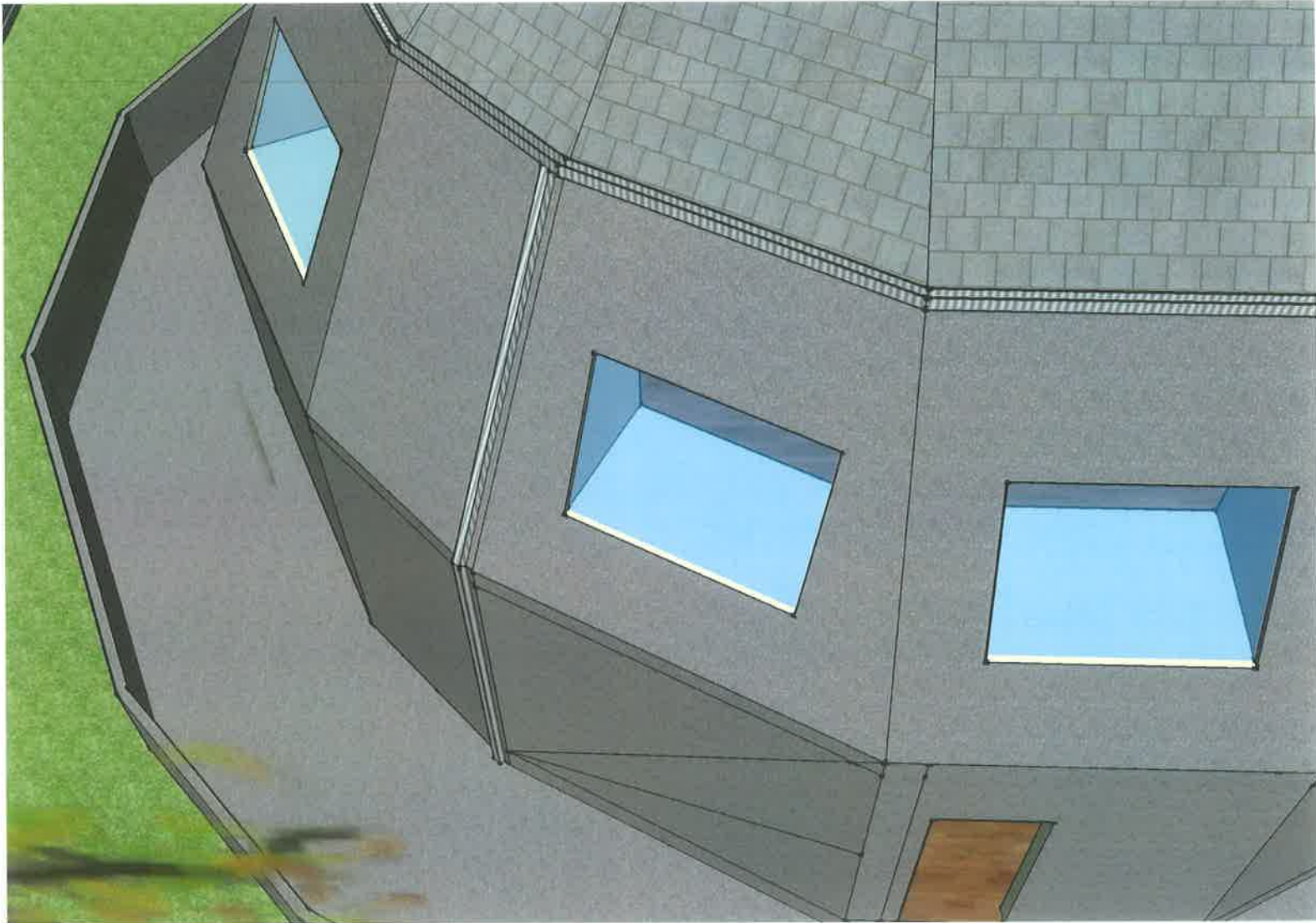


Figure 6:

This is the homes rain catch that is used to store rain water for multiple uses in the home.



Figure 7:

These solar panels are located on the South side of the home and use the Sun's rays as an alternative power source for the home.

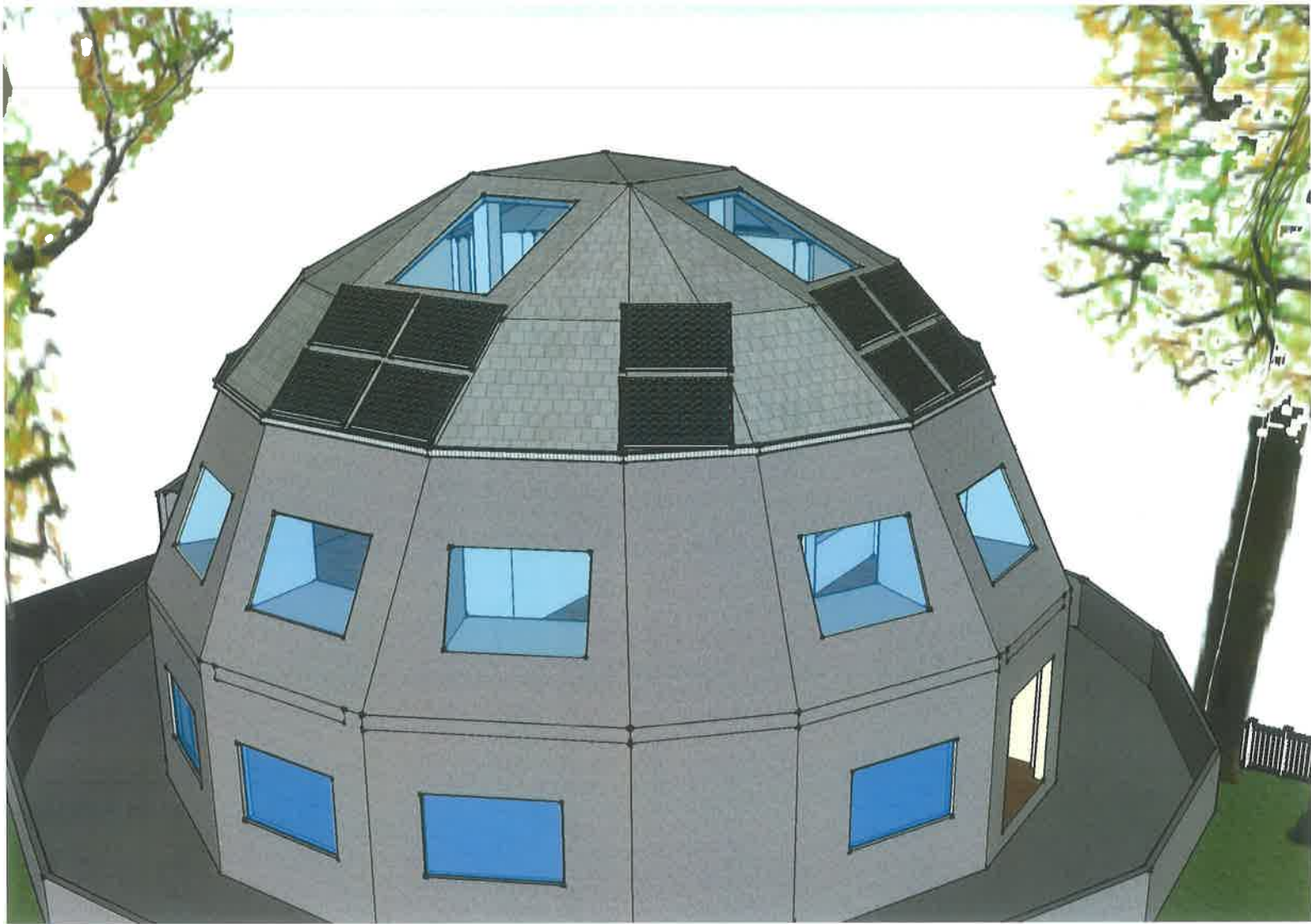


Figure 8:

The entire home is raised up on these stilts to prevent flooding in our home.



Figure 9:

This view of our home shows the 3 trees, Sycamore, Sweet Gum, and Red Maple, that are native to Long Island that were handpicked to survive a storm better.

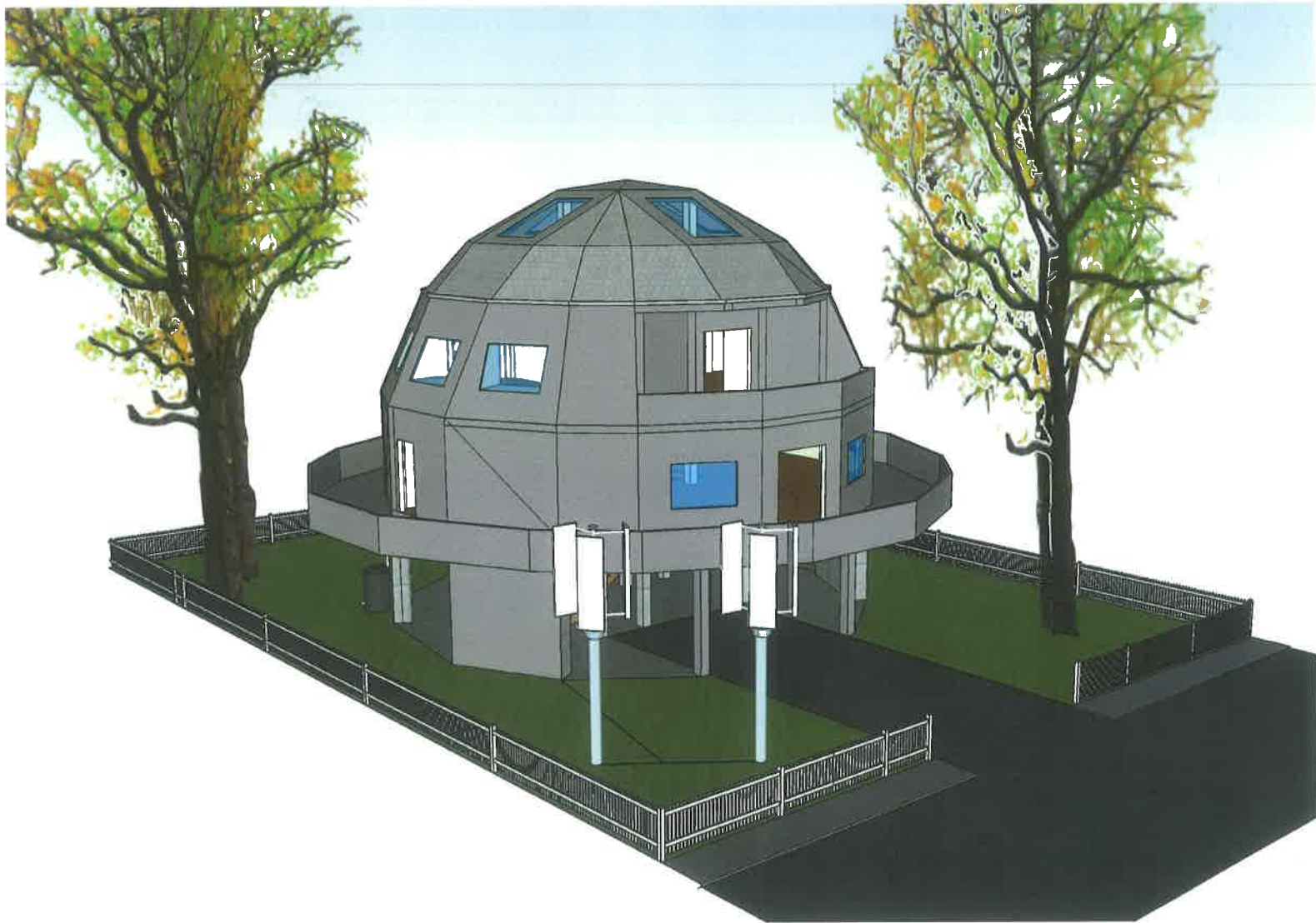


Figure 10:

The figure shows the house and the stilts that are made out of cement which was picked because of its strength and waterproof properties.

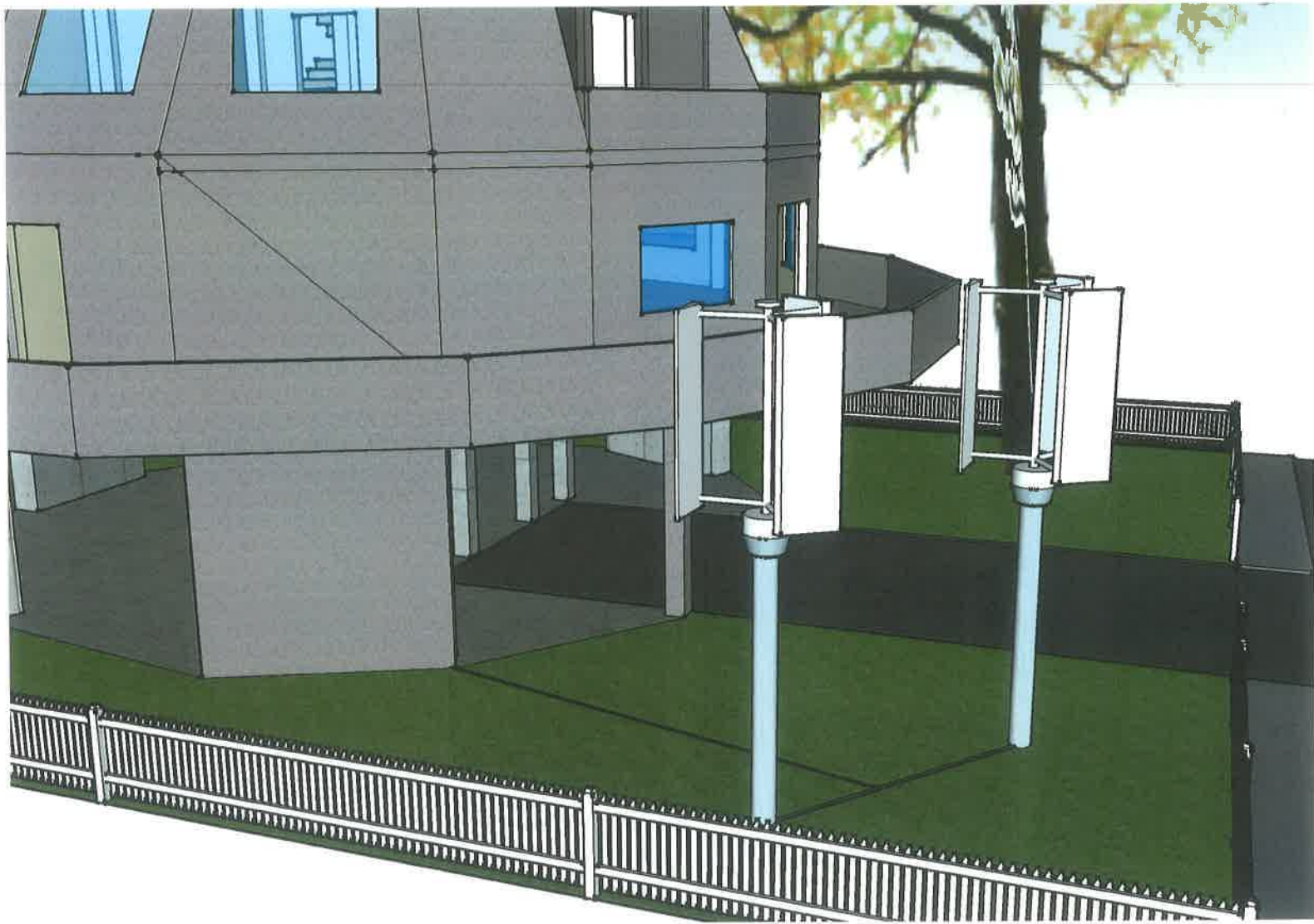


Figure 11:

Below are three hand picked trees that will be on the property of our new home.

A: Red Maple Tree



B: Sweet Gum Tree



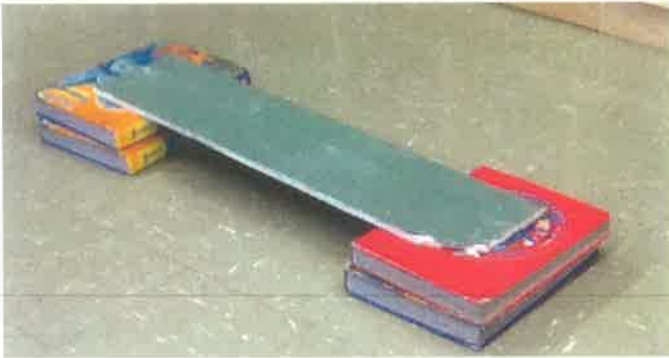
C: Sycamore Tree



FIGURE 12:

Below are experiments testing building materials of a home:

A. Before and after of testing strength of sheetrock.



B. Testing the strength of wood.



C. Testing the strength of cement.



D. Testing the water proofing of all three materials.

