2016 AAPA ENVIRONMENTAL AWARDS COMPETITION
MARYLAND PORT ADMINISTRATION
BALTIMORE INNER HARBOR WATER WHEEL
MITIGATION CATEGORY

PROJECT SUMMARY

Trash in waterways around the world is a major environmental issue, and is especially troublesome in Baltimore's Inner Harbor. The Maryland Port Administration (MPA) saw an opportunity to co-sponsor a project that would provide a significant water quality improvement. As part of an offset from the construction of the dredged material placement site at Masonville, the MPA contributed substantial funding for construction and installation of a unique Water Wheel that collects debris at the mouth of the Jones Falls and prevents trash from entering the Inner Harbor.

The Water Wheel was designed to capture as much as 45,000 pounds of trash per day (22.5 tons). The Jones Falls watershed drains 58 square miles of land and is a significant source of trash that enters the harbor, which originates from garbage on the ground and gets carried into storm drains when it rains, flowing into neighborhood streams and eventually reaching the Baltimore Harbor and the Chesapeake Bay. It is estimated that 80% of the trash in the Inner Harbor comes from the Jones Falls.

A brief summary of how this projects meets the Awards Criteria is provided here:

1. Prior to installation, it was not uncommon to see the harbor filled with floating debris after a heavy rainstorm. After installation, the volume of debris has been reduced dramatically.
2. The Water Wheel is owned and operated by the Waterfront Partnership of Baltimore, a non-profit organization dedicated to improving Baltimore's Waterfront. The MPA provided major funding that enabled project startup, worked closely with the Maryland based designer and builder, Clearwater Mills LLC, and committed additional funding for trash collection and mechanical maintenance for the next 20 years.
3. The Water Wheel combines old and new technology to harness the power of water and sunlight to collect the trash and debris floating down the Jones Falls River. Containment booms funnel trash and debris towards the Water Wheel where a leaf rake pulls it in and onto a moving conveyor that drops the garbage into a dumpster. The dumpster is on a floating dock that can be pulled to shore by boat. The collected waste is then sent to a waste to energy facility and is used as a source to create electrical energy. The Water Wheel uses renewable energy - mostly river current which pushes from underneath to fill the water buckets to carry the wheel around. When there is not enough water current, a solar panel array provides additional power to keep the machine running.
4. According to statistics provided by the Waterfront Partnership Organization, the Water Wheel has collected 420 tons of garbage and debris starting from May 9, 2014 through March 31, 2016. Collect trash is transported to a nearby waste-to-energy plant.
5. The Water Wheel collects and removes trash and debris at a fraction of the per ton cost of other systems due to the use of renewable energy, reusable refuse containers, and low maintenance costs.
6. The Inner Harbor Water Wheel is a simple solution to what many thought was an unsolvable problem – trash in urban waterways. This technology can serve as a model for other ports as they aim to reduce impacts from pollutants on their effected water bodies, many of which are located in urban areas.

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Maryland Port Administration
Baltimore Inner Harbor Water Wheel

AAPA 2016 Environmental Improvement Award

Category: Mitigation

Title of Report: Baltimore Inner Harbor Water Wheel

Name of Applicant: Maryland Port Administration

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Introduction

Trash in waterways around the world is a major environmental issue, and is especially troublesome in Baltimore's Inner Harbor. So much so that EPA has recently implemented a TMDL for Trash and Debris for the Middle Branch and Northwest Branch portions of the Patapsco River in Baltimore City and County. Accomplishments at the Port of Baltimore are closely aligned with the stewardship of Maryland's natural resources and the well-being of neighboring communities. The Maryland Port Administration (MPA) saw an opportunity to co-sponsor a project that would provide a significant water quality improvement to Baltimore's Inner Harbor. As part of an offset from the construction of the dredged material placement site at Masonville, the MPA contributed substantial funding for construction and installation of a unique Water Wheel that collects debris at the mouth of the Jones Falls and prevents trash from entering the Inner Harbor. To ensure long term operation, the MPA has also committed additional funding for trash collection and mechanical maintenance for the next 20 years.

Goals and Objectives

The mission of the MPA is to stimulate the flow of waterborne commerce through Maryland in a manner that provides economic benefit to the citizens of the state. One of the MPA's major responsibilities is to serve as a steward of the Chesapeake Bay and Maryland's natural environment. Accomplishments at the Port of Baltimore are closely aligned with the stewardship of Maryland's natural resources and the well-being of neighboring communities. The MPA is committed to being a good neighbor and is also committed to meeting our

obligations for improved air and water quality, reduction of impacts to the Patapsco River and the Chesapeake Bay, and sound environmental management for dredging projects.

One of the six goals that supports the Maryland Department of Transportation's (MDOT) Vision and Mission is Environmental Stewardship by ensuring the delivery of the State's transportation infrastructure program conserves and enhances Maryland's natural, historic, and cultural resources.

The Baltimore Harbor Water Wheel project supports MDOT's and MPA's mission, goals and objectives as follows:

- Meet or exceed the standards of state and federal water quality regulations
- Minimize / Offset adverse impacts of a construction project
- Reduce water-borne trash
- Support innovative technologies

Discussion

i. Background

MPA's Harbor Development Department was tasked with finding projects that met mitigation requirements for the Masonville Dredged Material Containment Facility construction permits. A solution was found by partnering with the Waterfront Partnership of Baltimore, a group consisting of private enterprises that works with Baltimore City to manage, promote and advocate on behalf of the downtown

waterfront district. The MPA team worked closely with the designer/builder, Clearwater Mills, a Maryland owned and operated company, and the Water Wheel became fully operational in May of 2014.

The Inner Harbor Water Wheel, or “Mr. Trash Wheel” as it’s become known locally, combines old and new technology to harness the power of water and sunlight to collect trash and debris flowing down the Jones Falls River.

The river’s current provides power to turn the water wheel, which lifts trash and debris from the water and deposits it into a dumpster barge. When there isn’t enough water current, a solar panel array provides additional power to keep the machine running. When the dumpster is full, it’s towed away by boat, and a new dumpster is put in place.

ii. Objectives and Methodology

The Water Wheel was designed to capture as much as 45,000 pounds of trash per day (22.5 tons). The location sits at the mouth of the Jones Falls River in Baltimore's Inner Harbor. The Jones Falls watershed drains 58 square miles of land and is a significant source of trash that enters the harbor, which originates from garbage on the ground and gets carried into storm drains when it rains, flowing into neighborhood streams and eventually reaching the Baltimore Harbor and the Chesapeake Bay. It is estimated that 80% of the trash in the Inner Harbor comes from the Jones Falls.

iii. How the project fulfills the Award Criteria

1. Benefits to Environmental Quality

Baltimore Harbor has historically suffered from an abundance of trash and debris, especially after heavy rain events. Prior to the installation of the Water Wheel, it was not uncommon to see the harbor filled with floating debris after a rainstorm. The two photos below were taken after similar storm events. The picture on the left was taken prior to the installation of the Water Wheel, and the picture on the right was taken after installation.

The Inner Harbor is a high traffic tourist destination. The location of the Water Wheel in Baltimore's Inner Harbor provides high visibility to pedestrian traffic and the public can see it work to effectively manage trash from getting into the harbor. In addition, there is a live stream of the Water Wheel, which can be found at http://baltimorewaterfront.com/healthy-harbor/mr-trash-wheel-live-feed/

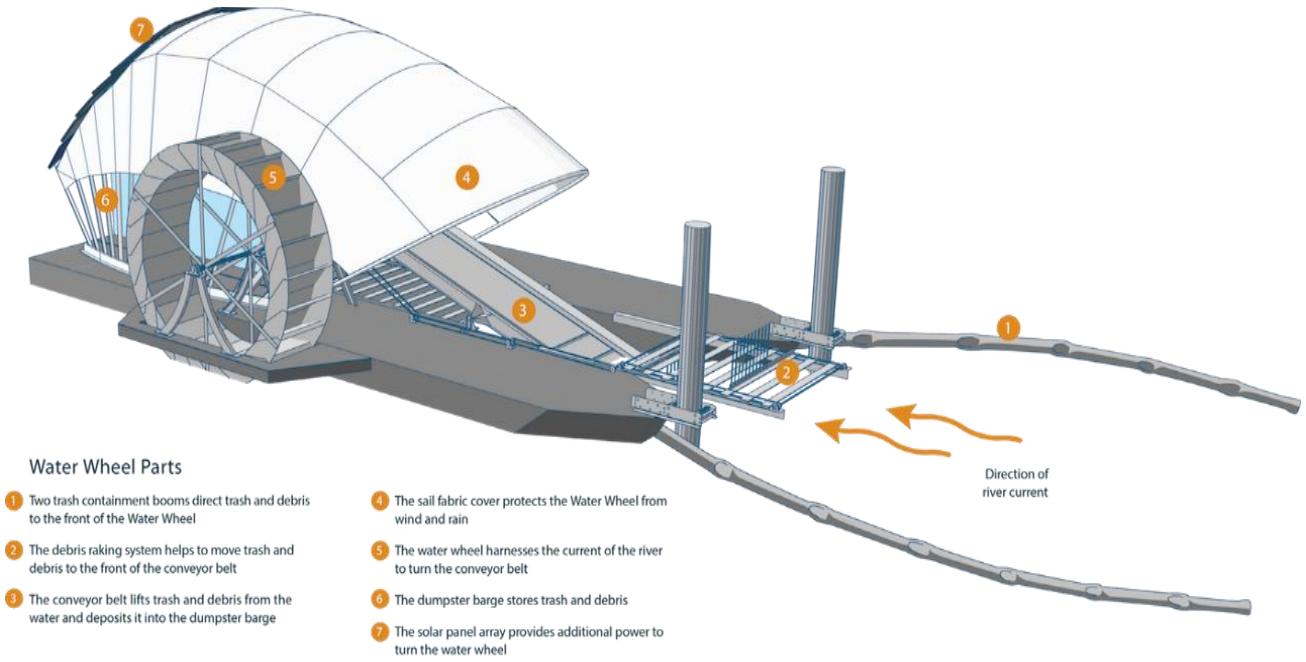
At the unveiling of the Water Wheel in May 2014, students from the John Eager Howard Elementary School gave an inspirational performance of an original song and dance on the importance of recycling and picking up litter. The students are members of the school's Green Team. One year later, the students are still committed to their fight for clean neighborhoods and healthy water. One young student was quoted as saying, "I feel sad, mad and angry when I see people litter. If I see someone litter I'll ask them to please pick it up. If they don't', I'll pick it up myself."

2. Level of Independent Involvement and Effort

The Baltimore Inner Harbor Water Wheel is owned and operated by the Waterfront Partnership of Baltimore, a non-profit organization dedicated to improving Baltimore's signature asset – the Waterfront. The Maryland Port Administration provided major funding for the project, along with Constellation, and worked closely with Maryland based designer and builder, Clearwater Mills, LLC. To ensure long term operation, the MPA has committed additional funding for trash collection and mechanical maintenance for the next 20 years.

3. Creativity of the Solution

The Water Wheel combines old and new technology to harness the power of water and sunlight to collect the trash and debris floating down the Jones Falls River. Containment booms funnel trash and debris towards the Water Wheel where a leaf rake pulls it in and onto a moving conveyor that drops the garbage into a dumpster. The dumpster is on a floating dock that can be pulled to shore by boat. The collected waste is then sent to a waste to energy facility and is used as a source to create electrical energy. The Water Wheel uses renewable energy - mostly river current which pushes from underneath to fill the water buckets to carry the wheel around. When there is not enough water current, a solar panel array provides additional power to keep the machine running. Smartphone controls are also used.



4. Project Results

According to statistics provided by the Waterfront Partnership Organization, the Water Wheel has collected 420 tons of garbage and debris starting from May 9, 2014 through March 31, 2016 including:

- 257,070 Plastic Bottles
- 327,819 Polystyrene Containers
- 7,498,000 Cigarette Butts
- 4,980 Glass Bottles
- 173,600 Plastic Grocery Bags
- 244,409 Chip Bags

Each ton of trash collected and transferred to a waste-to-energy facility generates on average 500 kilowatts of electricity.

On a sunny day, the solar panels can produce 2,500 watts of electricity.

On a single day in April 2015, a record 19 tons of trash and debris was collected, which is enough to fill 6 ½ dumpsters.

5. Cost-Effectiveness

The Water Wheel collects and removes trash and debris at a fraction of the per ton cost of other systems for the following reasons:

- Uses all renewable energy, therefore fuel costs are minimized
- Effectively contains and collects debris at a single point before being transported by barge to a nearby waste to energy facility, saving labor and effort
- Uses reusable refuse containers, instead of disposable nets, thus reducing operational costs
- Incorporates high quality construction for durability and low maintenance costs

6. Transferability to the Port Industry

The Inner Harbor Water Wheel is a simple solution to what many thought was an unsolvable problem – trash in urban waterways. This project has proven to be highly effective. So much so, that a second Water wheel is planned for Baltimore's Canton neighborhood which also empties into the Baltimore Harbor. To date, $461,052 has been pledged, including a $200,000 donation by the MPA. This puts the goal of raising $550,000 well within reach. Together the Water Wheels will capture trash and debris and keep it out of the Harbor, Chesapeake Bay and the Atlantic Ocean.

This technology can serve as a model for other ports as they aim to reduce impacts from pollutants on their effected water bodies, many of which are located in urban areas.

Conclusion

The most exceptional features of this project can be found in its simplicity of design, its operation from renewable energy sources, its high efficiency, and the ability to generate electricity from the trash that is collected. Also, additional Water Wheels can be constructed and placed in other locations to effectively manage trash from highly impacted rivers.

The location of the Water Wheel between the Pier Six Pavilion and the entrance to the fast developing Harbor East district in Baltimore's Inner Harbor allows for high visibility for pedestrian traffic.

The project has also generated tremendous media attention since becoming operational.

- The Water Wheel has been viewed over one million times online
- It has its own Twitter Account, https://twitter.com/MrTrashWheel
- Multiple articles have appeared in the Baltimore Sun and other print media
- Local television stations WBAL and WJZ have done stories about the project, as well as NBC News, https://www.youtube.com/watch?v=RkQbcrzyAeE
- National Public Radio's Morning Edition program featured a story about the project http://www.npr.org/2014/06/23/324738205/baltimores-water-wheel-keeps-on-turning-pulling-in-tons-of-trash?utm_source=facebook.com&utm_medium=social&utm_campaign=npr&utm_term=nprnews&utm_content=20140625.

However, social media may have generated the most buzz about this project. In October 2015, the project's builder and owner launched a Q&A with Mr. Trash Wheel on reddit, the self-proclaimed front page of the Internet. Within three hours, it shot to the top of reddit with more than 1,000 comments and questions.

https://www.reddit.com/r/IAmA/comments/3pidal/i_am_mr_trash_wheel_the_first_invention_of_its/

The most outstanding accomplishment was from the Ford Motor Company's "Go Further" campaign. The project won a competitive as an Everyday Heroes Winner 2015 "Go Further Award" for "Best Use of Technology".

https://www.youtube.com/watch?v=evo9VNVqlSE&feature=youtu.be