

## HarborRock and the Port of Baltimore & Chesapeake Bay Clean-up Initiative

**A Sustainable - Affordable - Mandatory  
Component of Long-Term Bay Health**

# **Briefing to Carroll County Environmental Advisory Council**

---

**Purpose & Objectives of this Briefing**

**Proposed Approach**

**Summation of Environmental Benefits**

**Port of Baltimore Project**

**Conowingo Dam Project**

**Next Steps**

**Who is HarborRock**

**Overview of Light Weight Aggregate (LWA)**

**HarborRock Test Locations and Technology Validation**

# Purpose & Objectives of Today's Meeting

---

## Purpose:

1. To Discuss Lightweight Aggregate (LWA) Reuse as the Best Method to Solve Two Sediment Management Needs in Maryland
2. Compare LWA Reuse to Current Methods Used to Address these Same Needs:

## Objectives:

1. To identify if there are any regulatory issues with implementation of LWA Reuse at the Cox Creek Dredged Material Containment Facility.
2. Identify the steps needed to use HarborRock as a management method at Conowingo Dam for the Chesapeake Bay TMDL:
  - Include HarborRock in Maryland's WIP
  - Establish nutrient trading with Pennsylvania and New York

# HarborRock's Sediment Reuse Approach

---

1. Install a Hydraulic Dredge in the Cox Creek Dredged Material Containment Facility (DMCF) & Conowingo Reservoir
2. Dredge the Sediments & Pump the Slurried Material Via Pipeline to the LWA Reuse Manufacturing Plant
3. Produce LWA Using Natural Gas Fired Kiln(s)
4. Return the Pumping Water to the Susquehanna River or DMCF
5. Sell the ASTM grade LWA to Local Users

*“Instead of mining, DREDGING for LWA is more cost effective; more efficient; and is symbiotic with a healthier Bay”*

# Environmental Benefits

---

1. Removal of the sediment and associated contaminants from the Chesapeake Bay Watershed (Cox Creek DMCF & Conowingo Reservoir) will help Maryland exceed the EPA's Bay TMDL goals.
2. The sediment is fired in the kiln for 40 minutes at over 2,200° F.
  - Proven to destroy organic contaminants & immobilize metals
3. The LWA produced is an ASTM certified, recycled aggregate, eligible for LEED credits
4. The manufacturing process improves the water quality

***“The environmental benefits are measurable & verifiable in real time”***

# Process Attributes & Environmental Controls

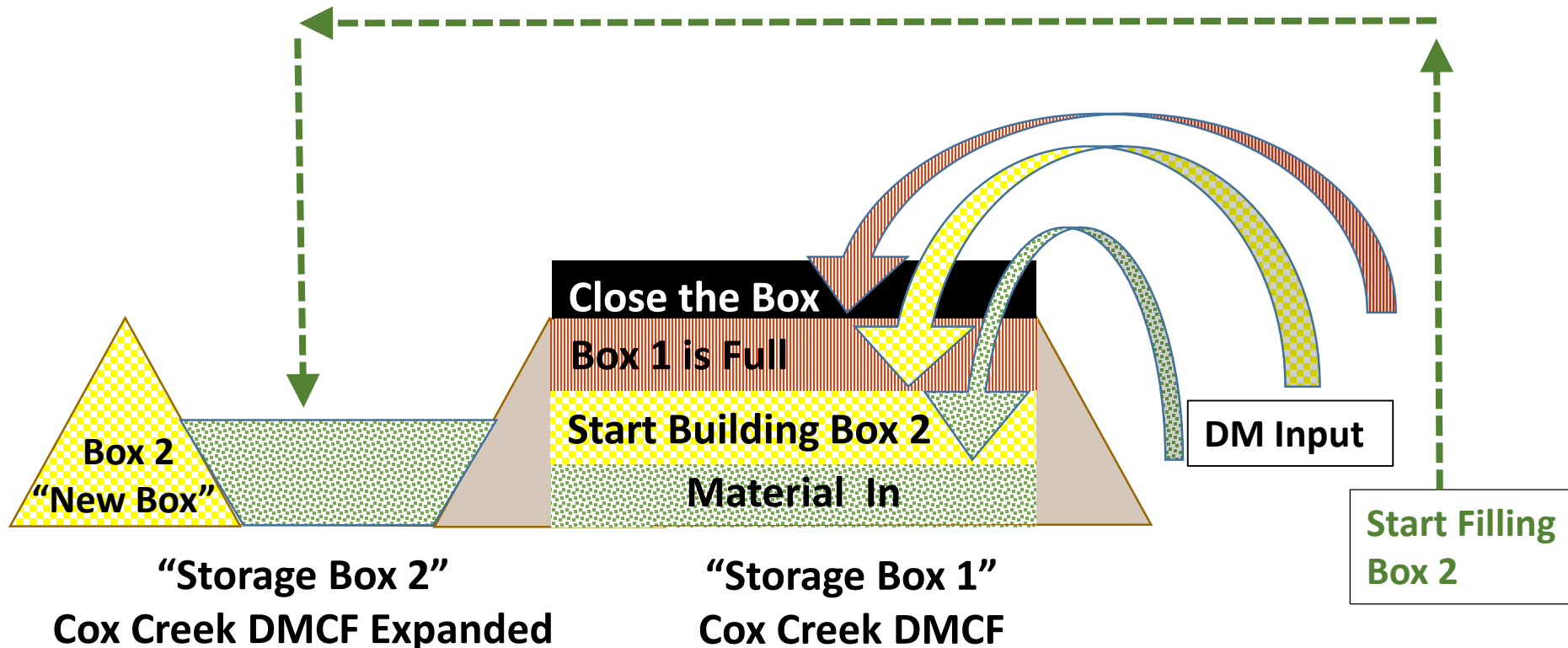
1. No chemicals are added to the dredged sediments
2. All components of the dredged material are reused:
  - Cobbles, Sand, Silt/Clay
3. The cobbles & sand are washed, screened & sold
4. The silt/clay is fired into LWA & tested to ASTM standards
5. All wash/process water is sent to WWT for pH control
6. Air emissions are controlled by the Best Available Technologies

*“Every emission point and product sold is controlled and routinely tested in the HarborRock process”*

# **Port of Baltimore Project Overview**

# Dredged Material Management the Old Way

Buy a Box, Fill the Box, Buy a New Box, Close & Manage the Old Box....

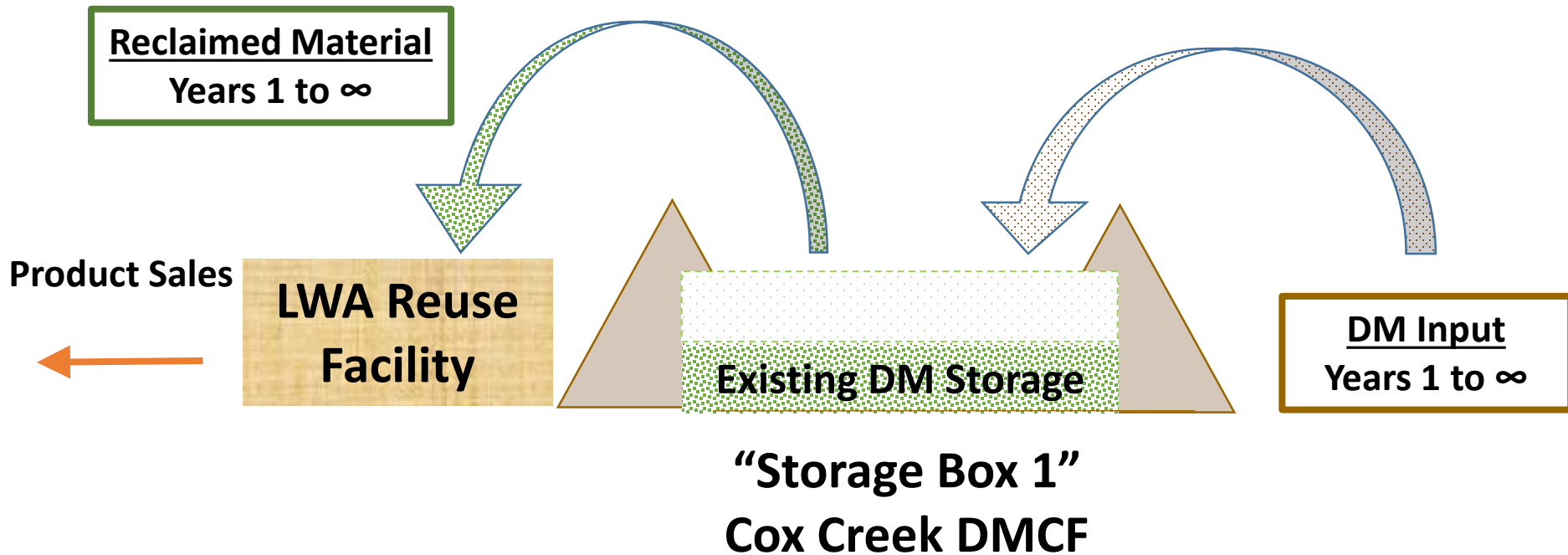


- The repetitive "Box" cycle only works when land is available to build more boxes
- "Box" economics depend on the: 1) cost of new land, 2) opportunity cost of the lost land, 3) on-going closure costs of retired boxes 8



# Dredged Material Management the New Way

Use an Existing Box, Put Raw Material In, Take Raw Material Out, Sell a Product...



LWA Reuse creates “renewable capacity” - the Box never fills up

LWA Reuse: 1) has defined economics, 2) eliminates risk of finding more sites, 3) creates family wage jobs, 4) preserves land for higher value uses

# Dredged Material Management the Old Way

The MPA's plan is to:

- 1) raise the dikes at the existing disposal area;
- 2) build dikes around the 100 upland acres.

This plan will provide disposal capacity for ~5 years, then another site is needed.



# Dredged Material Management the New Way

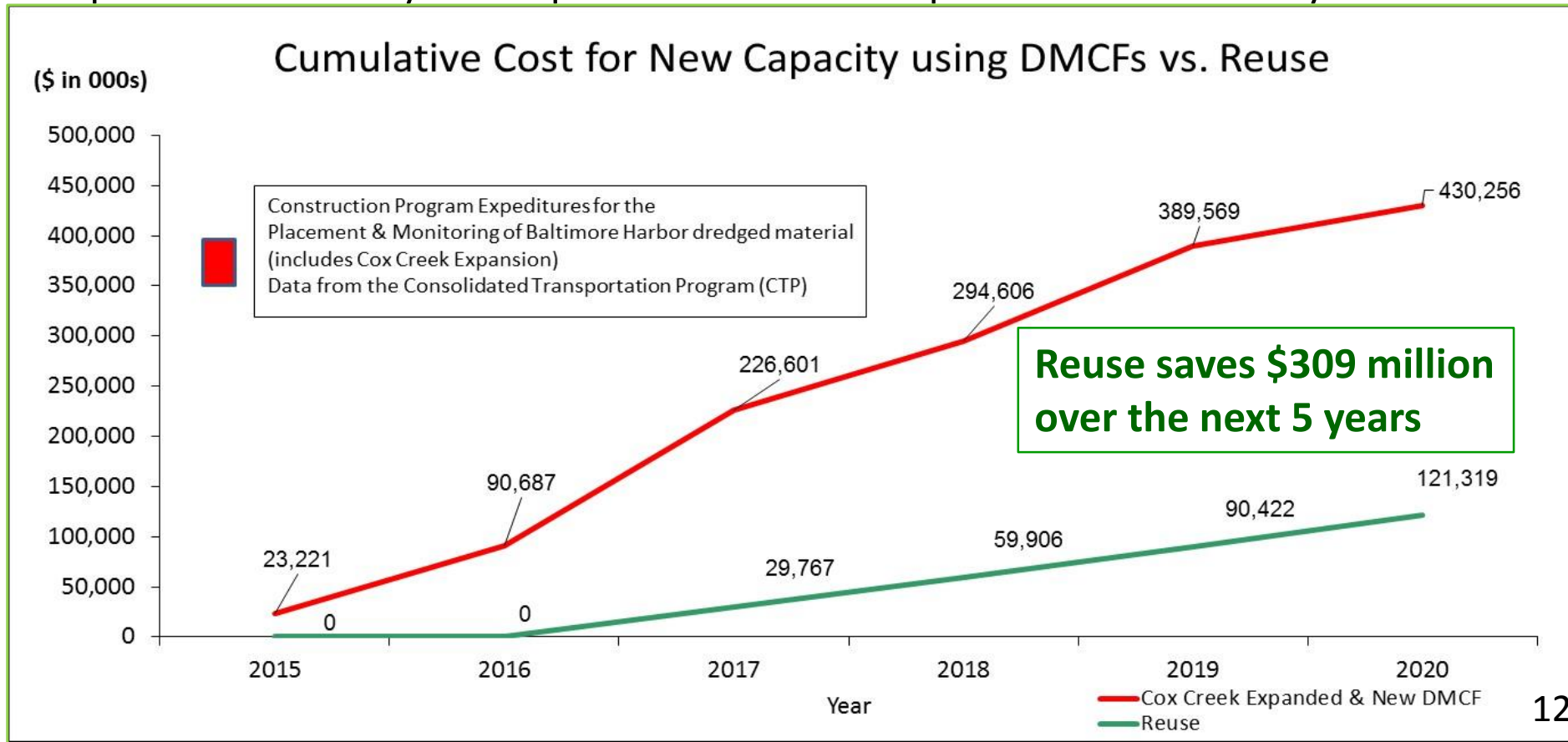
LWA Reuse will:

- 1) Extend the life of the current DMCF indefinitely;
- 2) Preserve all 100 acres for productive use;
- 3) Avoid building a landfill that will require perpetual service & cost



# LWA Reuse Costs Less with Better Cash Flow

1. Avoids MD spending ~ \$200 million over the next 2 years to expand Cox Creek
2. Eliminates the need spend over \$430 million by 2020 to build additional DMCFs – on sites not guaranteed to be available - to meet on-going disposal needs.
3. LWA Reuse requires no public capital, its reuse fee is guaranteed & the plant will operate indefinitely – this provides cost and disposal means certainty.



# LWA Reuse At Cox Creek

## *Good for the Environment, the Economy & Business*

---

1. **Does not require public capital investment – The \$100 million facility is financed by HarborRock.**
2. **Does not require a guaranteed supply of dredged material;**
3. **Saves Maryland more than \$309 million over the next 5 years**
4. **Creates 65 family wage jobs & \$2 million annually in new taxes**
5. **Does not have any regulatory impediments other than normal permitting .**
6. **The final products meet all environmental & product standards**

# **Conowingo Dam Project Overview**

# The 2025 Chesapeake Bay TMDL



[District of Columbia, Maryland, New York, Pennsylvania, Virginia, West Virginia and the District of Columbia](#) are to reduce water pollution in streams and rivers in connection with EPA's Total Maximum Daily Load to restore the Chesapeake Bay

[The Bay TMDL](#), a comprehensive "pollution diet," established in 2010 is based largely on [watershed implementation plans \(WIPs\)](#)

In 2012, the [7 jurisdictions submitted Phase II WIPs](#) designed to strengthen the initial cleanup strategies and reflect the involvement of local partners.

The Bay TMDL is a key part of an accountability framework [to ensure that all pollution control measures](#) needed to fully restore the Bay and its tidal rivers [are in place by 2025](#)

[Practices are to be in place by 2017 to meet 60% of the necessary pollution reductions](#)

# Current Status

---

**After more than 4 decades and billions of dollars in direct and indirect efforts...**

**Chesapeake Bay Foundation rates the Chesapeake Bay Water Quality a “32” (D+) in its 2014 State of the Bay Report**



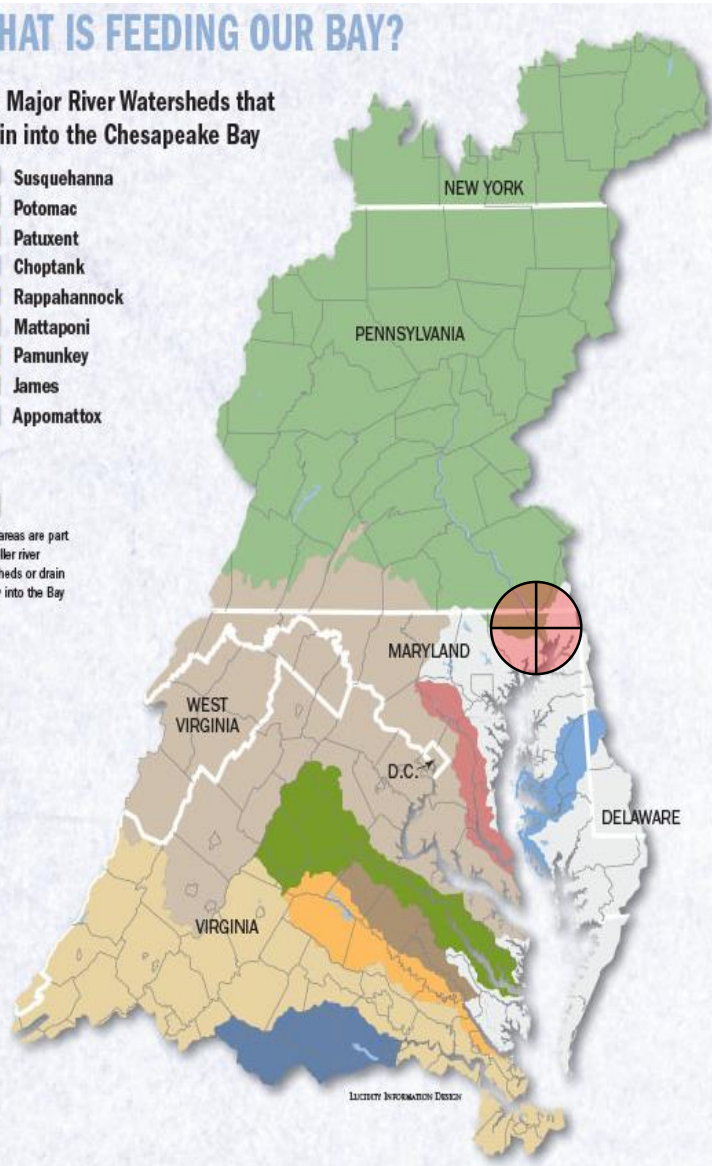
# The Susquehanna's Influence on the Bay

## WHAT IS FEEDING OUR BAY?

The Major River Watersheds that Drain into the Chesapeake Bay

- Susquehanna
- Potomac
- Patuxent
- Choptank
- Rappahannock
- Mattaponi
- Pamunkey
- James
- Appomattox

These areas are part of smaller river watersheds or drain directly into the Bay



## The Susquehanna River Drainage Basin:

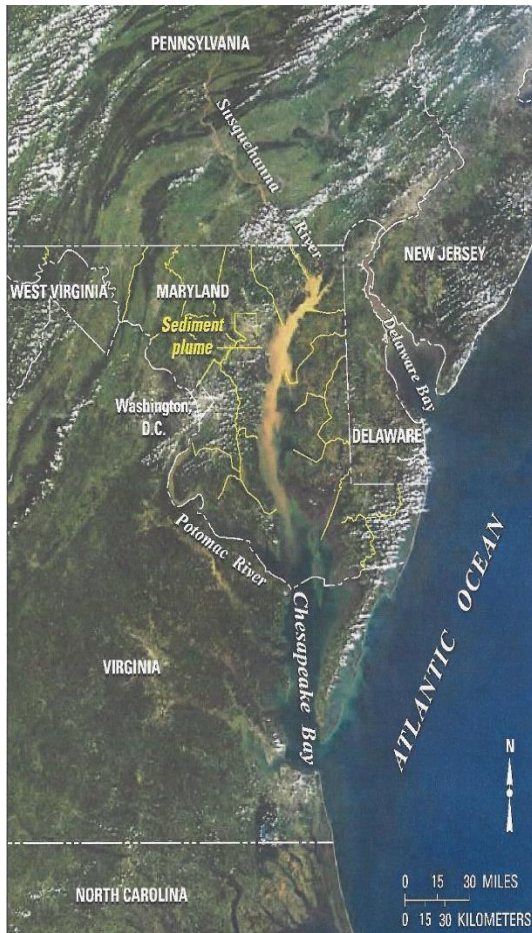
- ✓ 6,275 sq. miles in New York (23%)
- ✓ 20,960 sq. miles in Pennsylvania (76%)
- ✓ 275 sq. miles in Maryland (1%)

## Supplies to the Chesapeake Bay:

- 47% of the freshwater; > 90% to upper Bay
- 41% of the Nitrogen
- 25% of the Phosphorus
- 27% of the sediment

***“Due to sheer volume... There is concern all other actions related to the Bay WILL FAIL unless the Susquehanna River’s Conowingo Dam N-P-S outflows are mitigated. “***

# Tropical Storm Lee Dispelled any Doubts about the Relevance of the Susquehanna to the Bay



	Nitrogen	Phosphorus	Sediment
	(tons)	(tons)	(tons)
<b><u>Annual Reductions Needed to achieve the 2025 Susquehanna River TMDL</u></b>	18,210	702	320,116
<b>Tropical Storm Lee (over 9 days)</b>	<b>42,000</b>	<b>10,600</b>	<b>19,000,000</b>
	<b>&gt;2X</b>	<b>&gt;15X</b>	<b>&gt;59X</b>

***“In-rush damage from recurring tropical storms is disastrous to the Bay”***

# Quantities & Composition of Material Entering the Conowingo Reservoir & Overflowing the Dam

Sediment Inflow:

4,100 tons/day  
(1.5 million tons/year)

Sediment Overflow:

3,370 tons/day  
(1.2 million tons/year)

Nitrogen Overflow:

163 tons/day

Particulate Nitrogen with sediment: 69.3 tons/day

Phosphorus Overflow: 6.9 tons/day

Particulate Phosphorus with sediment: 5.7 tons/day

# Contaminant Reductions from Sediment Removal

To reduce net sediment into the Bay from the Dam....

- Dredging/Removal must exceed the inflow rate of 1.5 million tons/year
- Every 1,000 tons of sediment removed also removes:
  - 21 tons of particulate Nitrogen
  - 1.7 tons of particulate Phosphorous.

Dredging 1,776,000 tons/year of sediment from Conowingo Reservoir will reduce year-over-year sediment delivery into the Bay by 276,000 tons every year

See next slide for details

# The Effectiveness of Dredging on Contaminant Flow

Required reductions from 2010 loads for Maryland to meet its 2025 Bay TMDL		
Nitrogen	Phosphorus	Sediment
(tons/year)	(tons/year)	(tons/year)
5,795	245	13,000

	Reductions Obtained from Excess Dredging (% of 2025 TMDL)		
Excess Dredging	Nitrogen	Phosphorus	Sediment
(tons/year)	(tons/year)	(tons/year)	(tons/year)
13,000	273 (5%)	22 (9%)	13,000 (100%)
<b>276,000</b>	<b>5,795 (100%)</b>	<b>469 (191%)</b>	<b>276,000 (2,123%)</b>

***“Dredging 1,776,000 tons/year of sediment from Conowingo Reservoir will help Maryland immediately exceed its 2025 Bay TMDL”***

# Costs<sup>1</sup> to Achieve the Maryland 2025 Bay TMDL

Source Sector	Reductions from 2010 Loads to be Obtained by Current WIP Methods	WIP Cost 2010-2025
	<b>Nitrogen</b>	
	(tons/year)	(\$ millions)
<b>Agriculture</b>	<b>2,365</b>	<b>\$928</b>
<b>Wastewater</b>	<b>1,895</b>	<b>\$2,368</b>
<b>Stormwater</b>	<b>965</b>	<b>\$7,388</b>
<b>Septic Systems</b>	<b>575</b>	<b>\$3,719</b>
<b>Total</b>	<b>5,795</b>	<b>\$14,403</b>

- Costs do not count costs associated with:
  - Controlling combined sewer and sanitary sewer overflows (CSOs and SSOs)
  - Maryland’s Healthy Air Act (HHA) implementation
  - Financing costs and inflation
  - System(s) O&M and replacement

# The Cost of LWA Reuse for the Susquehanna?

HarborRock's all-inclusive cost to remove and reuse sediments from Conowingo Reservoir is estimated to range from \$36 to \$48 per ton of sediment

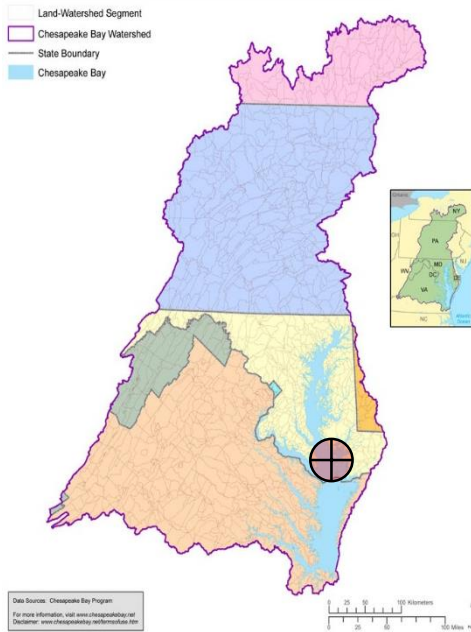
At these rates, **the cost to dredge and reuse 1,776,000 tons/year** of sediment from Conowingo Reservoir **would be \$64 to \$86 million per year**

**For perspective:**

***A Reuse plant could operate for 43 to 58 years for the same \$3.7 billion being spent over the next 10 years on MD's Septic program.***

**“The economics of dredging Conowingo for Reuse would enable the Administration to save MD Taxpayers billions of dollars”**

# Nutrient Trading with NY & Pennsylvania?



New York	Nitrogen	Phosphorus	Sediment
	(tons/year)	(tons/year)	(tons/year)
<b>Req't Reduction</b>	<b>205</b>	<b>78</b>	<b>13,670</b>

Pennsylvania	Nitrogen	Phosphorus	Sediment
	(tons/year)	(tons/year)	(tons/year)
<b>Req't Reduction</b>	<b>17,925</b>	<b>620</b>	<b>301,800</b>

Of the 1,776,000 tons/year of sediment that Maryland must remove from the Conowingo Reservoir to exceed its 2025 Bay TMDL, removal of:

**315,470 tons/year (18%)** would enable NY & PA to meet their sediment TMDLs

**863,333 tons/year (48%)** would enable NY & PA to meet their Susquehanna River TMDLs

**“Nutrient trading would get PA & NY into TMDL compliance, save those states time & money and help offset Maryland’s WIP costs”**



# LWA Reuse Can Begin Now

---

The best sequence for implementation is to:

1. Start construction for Port of Baltimore Reuse project; and
2. Begin development activities for the Conowingo project

HarborRock has completed a comprehensive demonstration of its technology for the MPA using Baltimore Harbor sediments

- Engineering data exists to start the permitting process
- MDE has preliminarily evaluated the air emissions data & the air emissions control system and found it acceptable

***There are no regulatory, financial or public acceptance issues limiting Reuse at Cox Creek***

# Who is HarborRock?

---

Established in 1996, HarborRock is a consortium of companies with the skills, track record and financial capability to:

- **Finance**
- **Build**
- **Own**
- **Operate**
- **Guarantee the performance of the LWA Reuse facilities**

# HarborRock Consortium Companies

- **FLSmidth (FLS)**: Global supplier to the minerals and cement industries. **[Engineering, equipment & process guarantee]**
- **Louis Berger Group, Inc. (LBG)**: a global engineering and environmental consulting firm **[Development, design & project management]**
- **Balfour Beatty Investments, Inc. (BBI)**: is the investment arm of Balfour Beatty plc headquartered in London. **[Finances]**

**Balfour Beatty**  
Investments, Inc.



*“HarborRock has resources and relationships with Internationally Respected Industry Leaders”*

# HarborRock Regional Affiliates

- **Cianbro:** Cianbro self-performs most project disciplines. Cianbro has a facility in Anne Arundel County, MD [**Constructor**]
- **TerranearPMC (TPMC):** Environmental services to clients nationally. TPMC has an office in Baltimore [**Operations**]
- **The Rasmussen Group:** Strategic planning and advisory services to clients nationally. Headquartered in Maryland [**Advisory**]

**Balfour Beatty**  
Investments, Inc.

**CIANBRO**

**FLSMIDTH**



Louis Berger

Terranear**PMC**

*“HarborRock has regional relationships  
with Respected Industry Leaders”*

# RECENT HarborRock SUCCESSES in Maryland

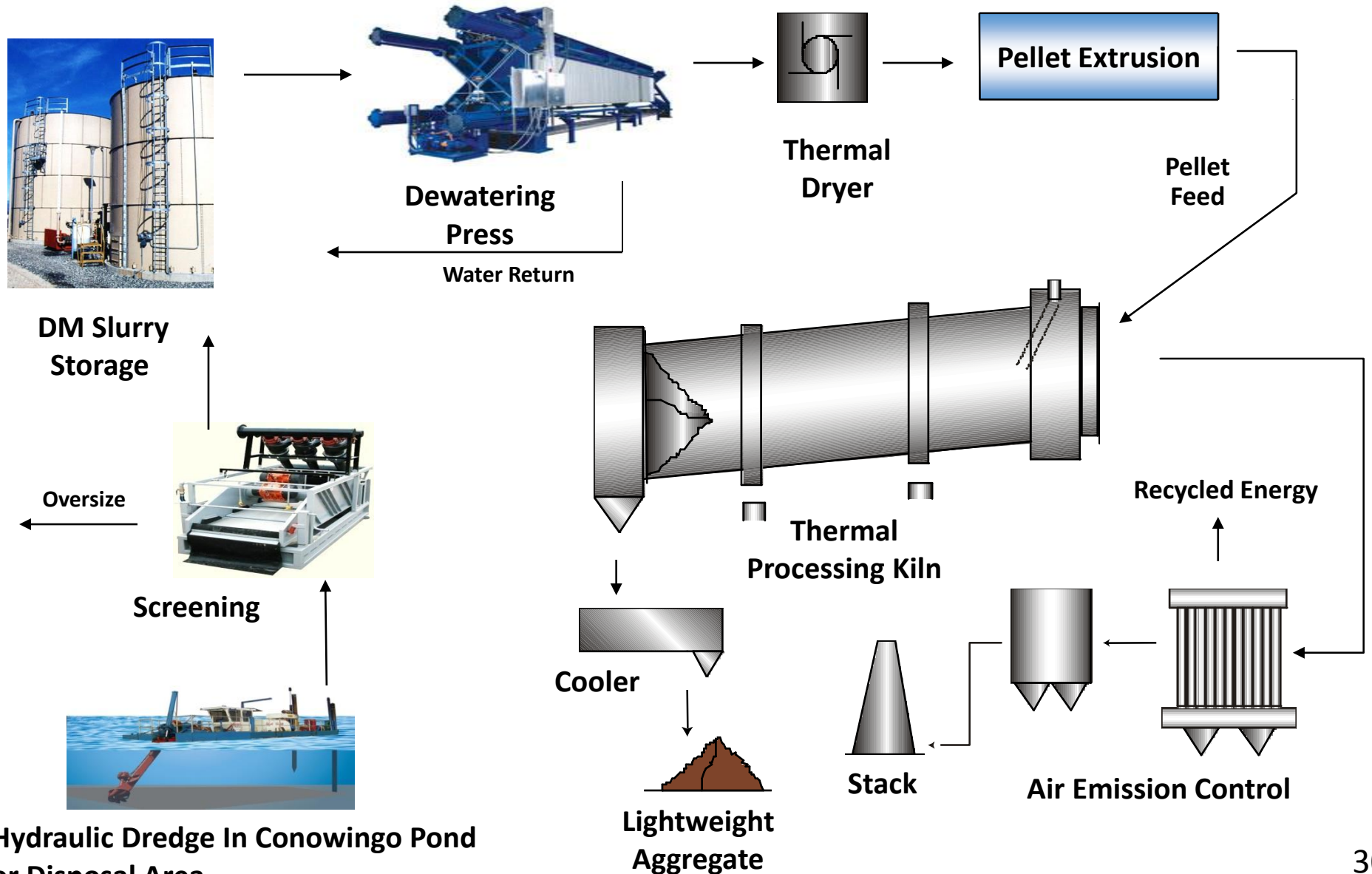
HarborRock has won **2 Maryland Port Administration (MPA)** request for proposals & **1** Request for information for the innovative reuse of dredged material

Over the past 3-4 years, **at least 6 different engineering & consulting firms retained by the MPA** have evaluated and confirmed HarborRock's business model including:

- Plant capital & operating costs
- Size & commodity price of the LWA market
- The quantity & quality of Baltimore Harbor dredged material
- Savings obtained in Cox Creek DMCF O&M costs with HarborRock

***“HarborRock has been vetted by private industry and public authorities and is recognized as a practical, common sense solution”***

# HarborRock - Simplified Process Flowsheet

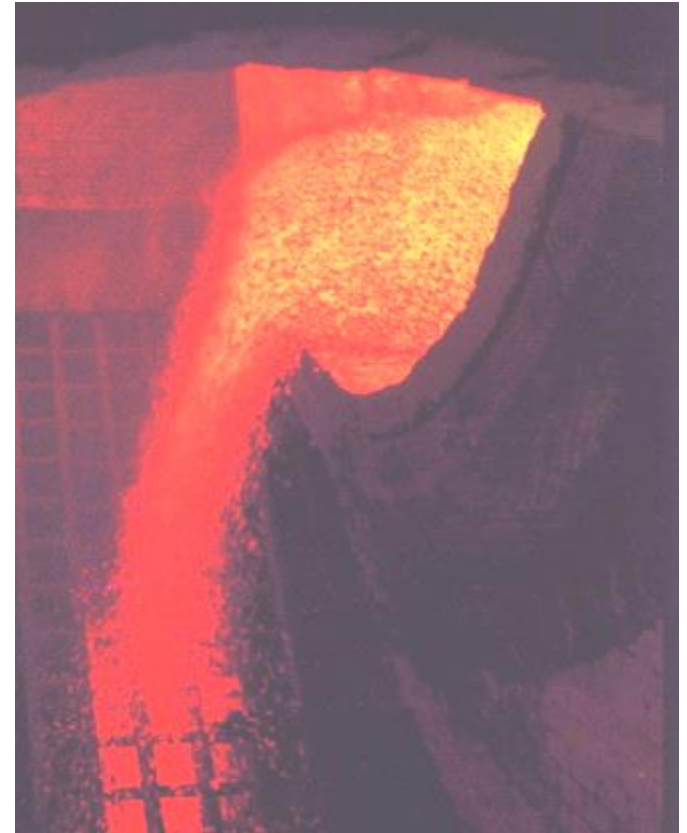


# What is Lightweight Aggregate?

Volcanic stone: pumice, lava

Shale, slate or clay expanded  
in rotary kilns that operate at  
temperatures over 2,000° F.

*Dredged material in Baltimore  
Harbor & Susquehanna River  
sediments are primarily clays/silts*



LWA exiting rotary kiln

# Why is Lightweight Aggregate Used?

---

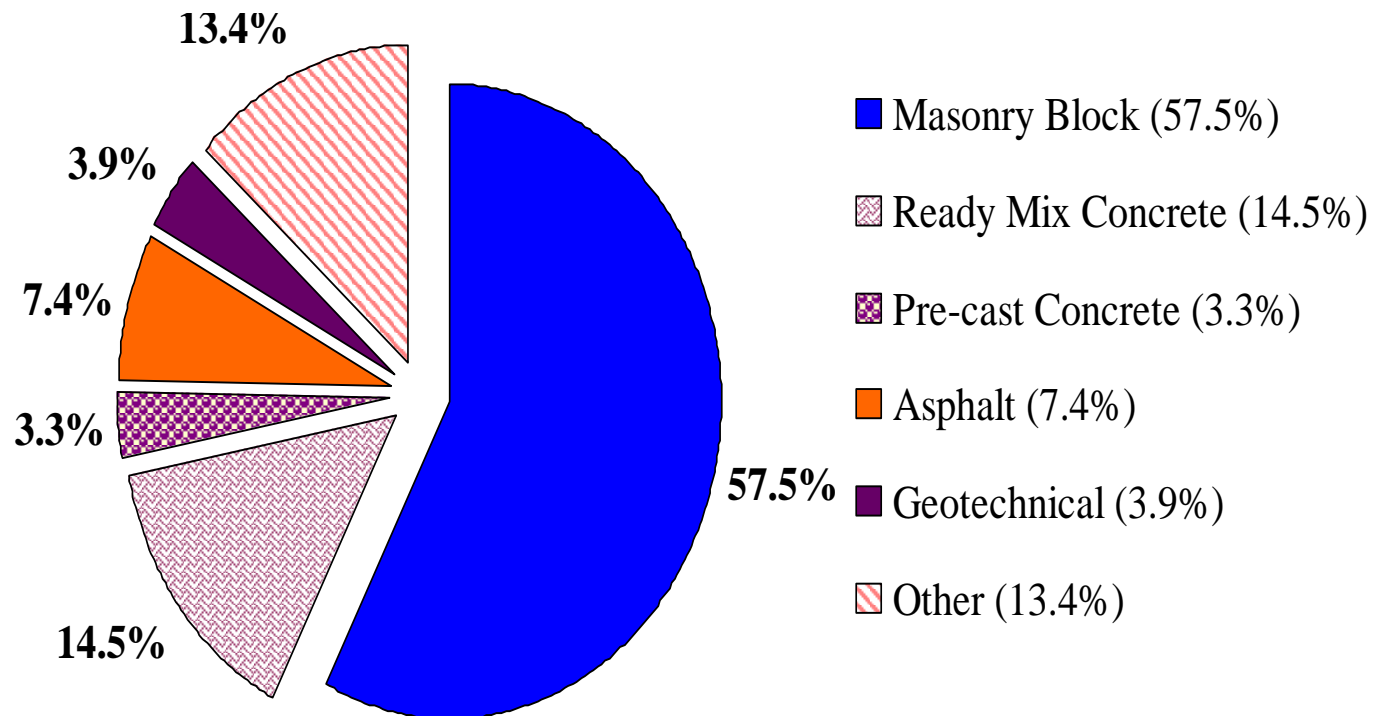
1. Lowers structural dead load – this reduces building cost
2. Increases labor productivity
3. Better fire rating
4. Lower sound transmission
5. Higher skid resistance - improves road safety

***“Sediment is a GREAT RAW MATERIAL that should be used to benefit Maryland, rather than being an on-going economic drain and persistent detriment to the health of the Chesapeake Bay.”***



# LWA Uses & Applications

HarborRock has perfected using fine-grained dredged material to make ASTM certified LWA and has a patent pending for the process



***Multiple buyers are in place for 100% of the LWA produced***

# LWA provides more than twice the volume for the same weight as conventional aggregates



1 lb. Soil

1 lb. Lightweight  
Aggregate

1 lb. Sand

1 lb. Gravel

1 lb.  
Limestone

# Advantages of HarborRock's LWA

## 1. Is Extruded & Highly Engineered:

- Uniform and consistent properties

## 2. Meets ASTM standards

- C330 LWA for Structural Concrete
- C331 LWA for Concrete Masonry Units
- C90 for Concrete Masonry Units

## 3. Is Inert & Highly Marketable:

- Complete destruction of organic contaminants
- Metals immobilized magnitudes below RCRA TCLP limits
- Not blended or mixed with other products
- Eligible for LEED Certification



---

# HarborRock Test Locations and Technology Validation

---

# U.S. HarborRock Test Locations

Beginning in 1996, HarborRock has made structural grade LWA in bench and pilot scale tests using dredged materials obtained from the following U.S. locations



# Technology and Business Plan Verification

Recommended by NJDEP's consultant, Louis Berger Inc.,  
for disposal of PCB contaminated materials from the **Passaic River, NJ**

Business model was validated in \$500,000 Test Program  
funded in part by NJ Commission on Science & Technology  
using **Delaware River** dredged materials

"Best Alternative and Most Viable Business" for disposal of  
sediments from the **Puget Sound**, according to WA  
State Department of Natural Resources

Selected by Shaw Environmental Inc. as the preferred  
solution for the long term disposal of dredged material at  
**Naval Station Mayport (Jacksonville), Florida**

Executed \$400,000 contract with **Maryland Port Administration**  
that proved reuse is a viable long term sediment management  
solution.



# Scope of Reuse Demonstration for Maryland

---

*Evaluated & tested all key aspects of the HarborRock business model*

- 1) **Chemical & Physical Analysis of: DM, CDF Water, Effluent & LWA**
- 2) **Dredged Material Dewatering Effectiveness with Filter Presses**
- 3) **Dredged Material Drying Operation (natural gas )**
  - a) Mass & Energy Balance, b) Emissions Testing
- 4) **Pilot Scale LWA Production (approx. 5 tons )**
  - a) Mass & Energy Balance, b) Emissions Testing
- 5) **LWA and Concrete Masonry Block Testing per ASTM standards**
- 6) **Engineering**
  - a) Process Flow Sheet, b) Equipment Configuration, c) Air Pollution Control
- 7) **Financial**
  - a) Capital & Operating Costs, b) LWA market

# Independent Verification by Maryland

*The Maryland Port Administration's consultants also verified HarborRock's business model*

**Environ:** Due Diligence of Process, Design & Capital Expenditure (CAPEX)

*Findings: The design is excellent and the CAPEX is conservative*

**Gahagan Bryant Associates (GBA):** Characteristics of Dredged Material in the CDF & Federal channels

*Findings: DM has consistent and uniform chemical and physical properties*

**Towson State University:** Suitability of DMCF & channel DM to make LWA

*Finding: DM has perfect mineralogy to make an expanded clay LWA*

**McCormick & Taylor & OA Systems:** Baltimore region LWA market study

*Findings: HR's selling price is conservative, the market size and the market demand are both robust*

**OA Systems:** Mass & water balance within CDF

*Findings: HarborRock is a net water user & improves water quality within the DMCF*

**Maryland Environmental Service MES:** Operation & Maintenance costs in DMCF with/without LWA Reuse

*Finding: HR would lower O&M costs by 25% because crust management is not needed in the DMCF*



# Summary

➤ **LWA Reuse is REAL– it has proven itself multiple times and, compared to others methods, provides many advantages and benefits for the State of Maryland:**

- ✓ **No capital investment by Maryland**
- ✓ **Less expensive**
- ✓ **Guaranteed costs**
- ✓ **Verifiable decontamination**
- ✓ **New tax generation**
- ✓ **Sustainable process**
- ✓ **No risks to the State**
- ✓ **Improves cash flow**
- ✓ **Guaranteed performance**
- ✓ **Job creation**
- ✓ **New manufacturing**
- ✓ **Positive Environmental Impact**

***“LWA Reuse could serve as a national model for environmental sustainability & innovation”***

# Meeting Purpose & Objectives – A Recap

---

## Purpose:

1. To Discuss Why LWA Reuse is the Best Solution for Two Sediment Management Needs in Maryland
2. Compare the Benefits & Cost of LWA Reuse to Current Methods Used to Address these Same Needs:

## Objectives:

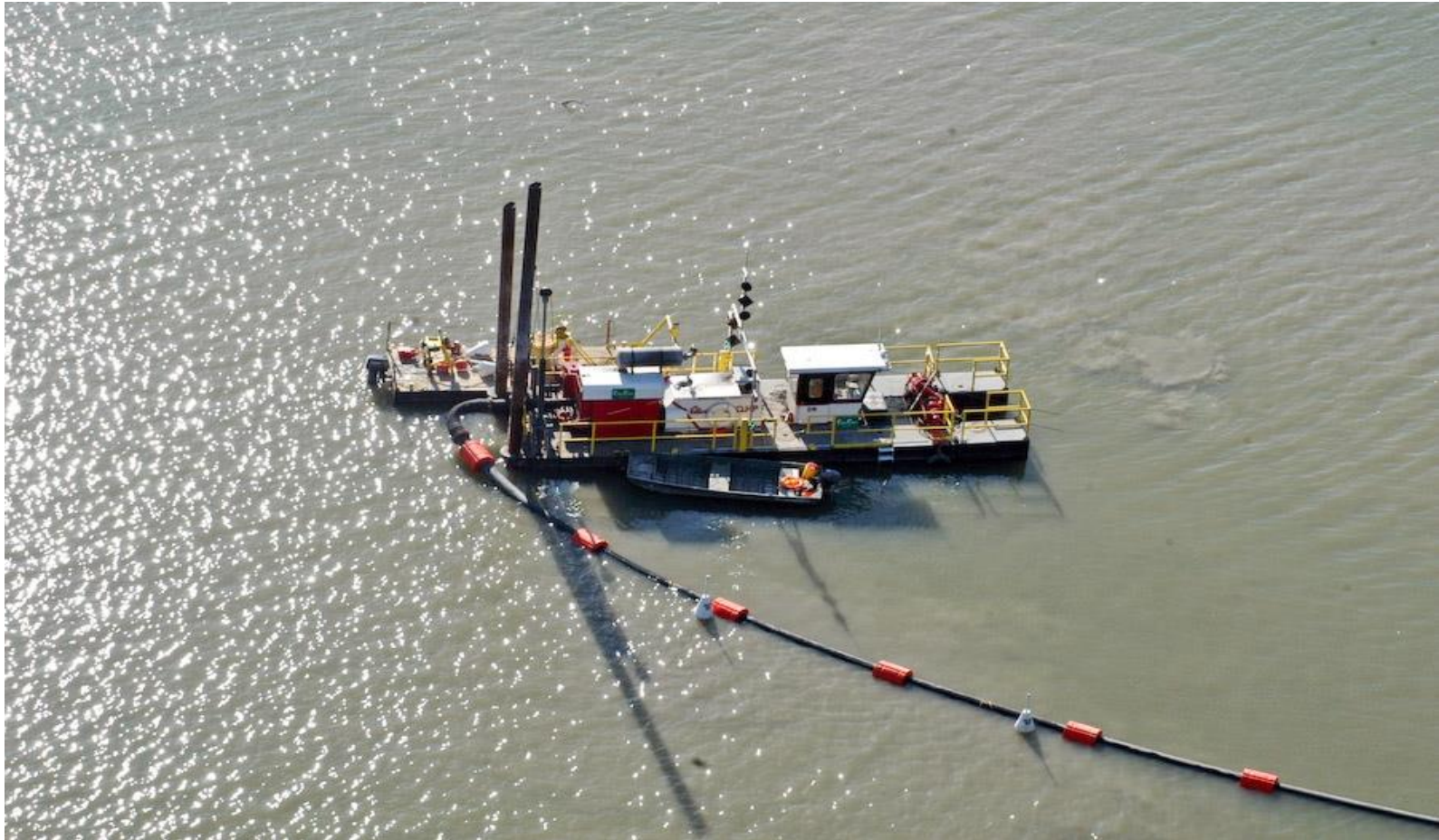
1. To identify if there are any regulatory issues with implementation of LWA reuse at the Cox Creek Dredged Material Containment Facility.
2. Identify the steps needed to use HarborRock as a management strategy at Conowingo Dam for the Chesapeake Bay TMDL:
  - Include HarborRock in Maryland's WIP
  - Establish nutrient trading with Pennsylvania and New York

---

# Supporting Materials

---

# Hydraulic Dredging



Over 125 years design/build experience in hydraulic dredges; two manufacturing plants in North America – one in Baltimore, MD



# Is Scour really a problem? Yes, it is and here's why:



## Suppose there is no disassociation of Nitrogen & Phosphorous?

1. Sediment alone is a serious problem and exceeds the Bay's assimilation abilities during major storms
2. *Even with a zero disassociation, the sediment smothers submerged aquatic vegetation and other lifeforms that are critical to the health of the Bay.*

## How about studies that suggest a scour rate of 14%?

1. These studies are based on assumed flow rates of 300,000 to 400,000 CFS.
2. However, during heavy storms, actual flow rates were reported at 770,000 CFS
3. Whereas kinetic energy is a function of the square of the velocity, the **actual kinetic energy of flows during tropical storms is likely as much as 4x higher.**

### Implications:

*The actual scour rate during heavy storms is likely 4x higher than current estimates - much greater damage to the Bay is occurring from scour.*

# Contact Information

---

**Jeffrey B. Otto, PE**, President

411 S. Ivy Lane

Glen Mills, PA 19342

Phone: 610.358.9366

Email: [JeffOtto@HarborRock.com](mailto:JeffOtto@HarborRock.com)

Web: [www.HarborRock.com](http://www.HarborRock.com)

