Collaborative science project

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1-IB

How can we help reduce motor product runoff and trash flowing into Rock Creek and later into the Chesapeake Bay?

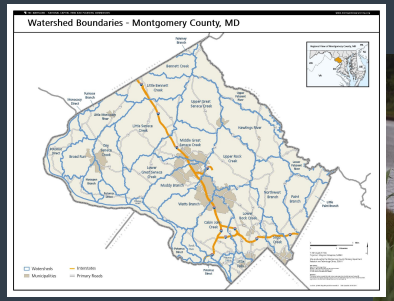
BayGuard Technologies presents

Multi Stage Filter

3 STAGES, INFINITE SOLUTIONS

Logo by BrandCrowd

The problem



- **Asphalt → tar oil →**Roads, parking lots, highways
- **Excess nutrients (phosphorus and nitrogen)**
- **Rainfall → runoff into the Potomac watershed**
  - Contamination releases carcinogens
  - Poses health risks for marine life
- **Flow threatens Potomac River, Chesapeake Bay**
- **Oil's composition is toxic**
  - Hydrocarbons like butane, hexane and methane
  - 2018: 84% of Chesapeake Bay is fully or partially impaired by toxic contaminants

- **Harm marine animals and plants**
  - Tissue, organ, gill injuries + Prevents photosynthesis,
  - Affects microscopic organisms with large surface area
    - Plankton or larvae suffocated
    - harms blue crab pop.: 900,000 blue crabs killed each year by pollution

Our solution

Installation of a 3 stage filter in stormwater drains

1. **Solids filter** ⇒ metal bar screen
   a. E.g. plastic cups, large debris pieces
   b. Material: Stainless steel / galvanized steel

2. **Sediment filter** ⇒ marsh mat
   a. E.g. Dirt buildup
   b. Material: Natural renewable coconut fibers

3. **Oil filter** ⇒ hair mat
   a. E.g. Tarmac runoff (due to vehicle use and spills)
   b. Material: Human head hair and thin mesh

Practicality of oil collection:

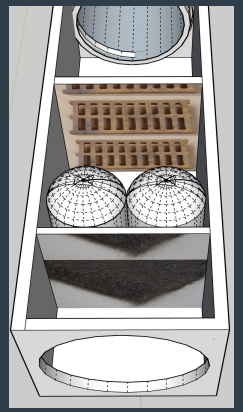
- Collection: excess hair from hair salons → economical, recycling, green

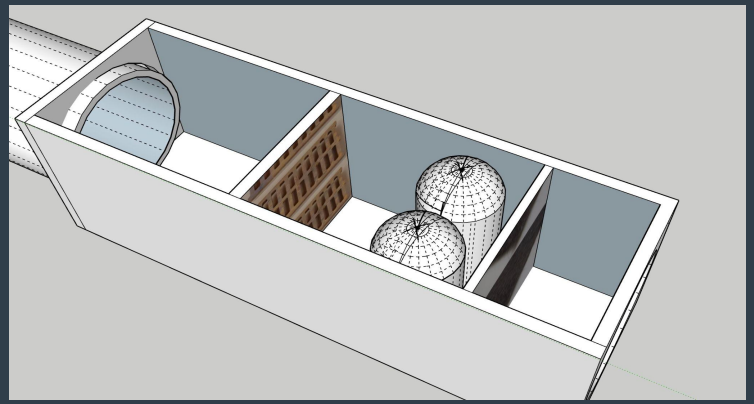
- Function:
  - Hair can absorb 5 times its weight in oil (Source: NASA)
  - Lipophilic material, hair repels water (optimal for rainwater avoidance)
  - Reusable and Replaceable

Visual

Sketchup 360 rendition + parts of filter separated

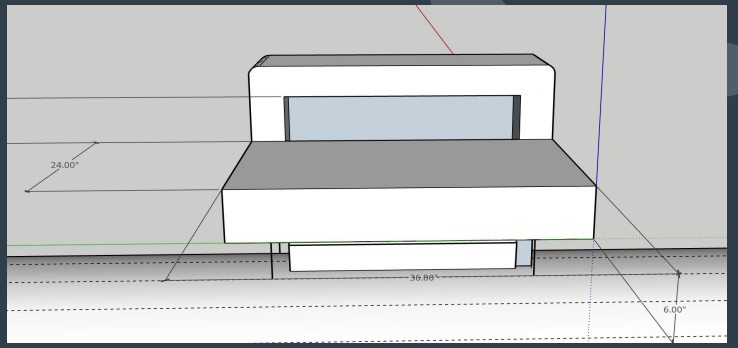
Filter System (Top)



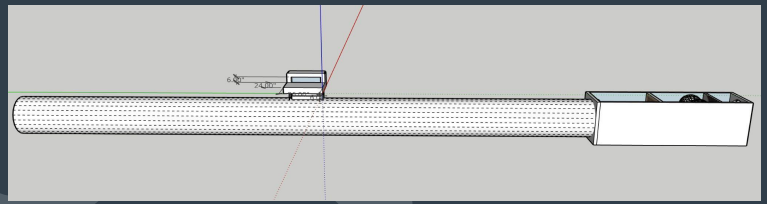


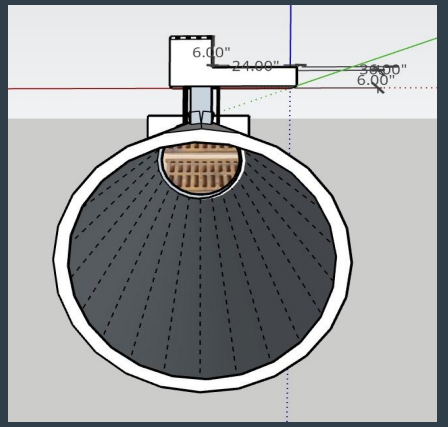
Filter System (Side)

Sewage inlet



Ensemble





System Input Main

Benefits

→ more effective than efforts to cleanup ecosystemic damages
→ Total cost of cleanup in Chesapeake Bay 2011-2025: $3.6 billion USD
→ Financed at a city level

- **Cost breakdown (size dependant):**
  - Bar trash rack: $100-200
  - Inlet filter: $100 (size dependant) / Aluminum mesh: $50<
  - Hair mat: $50 → collecting local waste, manufacturing

→ replaced based on weather

  - Total cost including labor is $2250
  - Entire DC area: $193 045k, including labor, material, and equipement

- **Local applications :**
  - Old Georgetown Rd. storm drains
  - Small scale project→ large scale impact

Sources

LOGO: BRANDCROWD

AI: for physics calculations

Roads with underlying tar asphalt - spreading, bioavailability and toxicity of their polycyclic aromatic hydrocarbons - ScienceDirect

https://stormwaterbook.safl.umn.edu/filtration-practices#:~:text=Underground%20sand%20or%20soil%20filters&text=The%20baffle%20wall%20retains%20floatable,can%20capture%20additional%20suspended%20solids.

https://oysterheaven.org/how-oysters-filter-water/

DC sewer map

NASA Tests Hair Technique To Clean Up Oil Spills

AMR.664.72

https://blocksom.com/sediment-and-erosion-control/

Sedimenterosion_inletfilter-install-maint.pdf