Potential Muck Removal and Disposal Methods

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Background is in various water quality protection programs:

• MDSH, MDPH, MDNR, MDEQ
  – NPDES, NPS, Stormwater, Surface Water, Groundwater, IPP, CSO/SSO, Municipal, Industrial,
  – System Design, Operations, Compliance, and Enforcement
  – Environmental Engineering, Limnology
• Approvals of P removal with physical-chemical and biochemical processes
• Committees for water quality standards, disinfection, microorganism standards
WHMD Programs include:

- **Solid Waste Management**
  - Landfills, Transfer Stations, Industrial, Municipal

- **Scrap Tire Management**

- **Liquid Industrial Waste Management**
  - Transport, Disposal

- **Hazardous Waste Management**
  - Transport, Storage, Treatment, Disposal

- **Storage Tank, AST, LPG, UST, H2**
Assistant to note parked innovative ideas.

- We haven’t had proposals or requests to evaluate removal and disposal methods. Therefore, we aren’t recommending specifically one muck removal or disposal method is better than another.
  - So far, there have not been many large projects to observe and evaluate
  - We are all encouraging private innovations
- There are no pilot or large scale proposals for removal or disposal under DEQ review at this time
  - Difficult to explain hypothetical
Property owners have been performing a variety of innovative approaches, all of which work to some extent:

- Hand rakes
- Barber Surf Rake at Bay City State Recreation Area
- Disposal on site in gardens, burial, garbage bags, and probably some compost piles
- Excavators and dozers used on larger sites
This is a Brainstorming Session:

- DEQ encourages innovative thinking and approaches to remove, and reuse materials as a resource, or dispose of muck. Partnerships.
  - May be challenging and complicated, but WHMD is keeping disposal aspects simple
  - Opportunities for partnerships and companies, e.g., waste companies
- Removal methods and disposal endpoints go hand-in-hand! (as a Liquid Slurry, or Solid), so we’ll discuss all!
Topics

• **A. Potential Methods to Remove Muck**
  • 1. Remove muck at the Beach
  • 2. Not Removal, but boom off the Beach
  • 3. Remove muck from the water
  • 4. Remove muck & sand mixtures

• **B. Methods of Disposal : as Liquid**

• **C. Methods of Disposal : as Slurry or Solid**
A. Potential Methods of Removal:

- Large projects will need state and federal review.

- Large projects will need permitting by one or more divisions of DEQ and potentially the United States Army Corps of Engineers (USACE).

- Small residential lot-sized projects will need a DEQ LWMD shoreline management permit for mechanized muck removal (not the vegetation removal question) below the Ordinary High Water Mark (OHWM)
  - whether below or above the existing water line
  - with or without discharges or offsite disposal
1. Potential Methods involving: 
Removal at Beach (in Water or on Shore):

– When remove, **do not cause any** of the following:

  - Significant **releases of wastewaters** or pollutant or nutrient loads to surface waters while storing at site--or will potentially need permits/authorizations
  - Any **releases while transporting** solids and liquids on public roads to another site for disposal
  - **Nuisances**, e.g., nuisance odor, vectors, pest animals
  - **Fugitive dust** problems
  - **Violations of exemption** conditions
  - **Impact threatened or endangered species**
  - **Spread invasive species**
Again,

- A State DEQ Land and Water Management Division and/or a federal USACE permit is needed for any mechanized “Work” on the beach or in the water, below the OHWM, e.g., from a boat:
  - More concerns if disturb and/or remove soil sediments from the water or beach areas
Discharges to surface water or groundwater from significantly sized *dewatering processes* will likely need to be authorized by a permit or other type of authorization from the DEQ.

– **Examples:**
  - Lagoons
  - Machinery
  - Watercraft discharges or hopper overflows
  - Other Innovations?
Discharges to groundwater from significantly sized disposal operations, e.g., land application, will likely need to be authorized by a permit or other DEQ approval.

- Permit
- Letter of approval or authorization
- Exemption
2. Some Potential Methods to keep muck off the Beaches!

- Silt screens, booms, baffles, e.g., “Gunderboom”, to keep algae/weeds out of swim areas and off beach:
  - Muck might accumulate in boomed area or near it
  - Method might consume less energy than removing, transporting, and disposal
  - Control screens, booms, etc. will need maintenance after storms
  - May work best in calm areas, e.g. in lakes, not a large bay
  - Might reduce transport and disposal challenges
3. Potential Methods to Remove Muck Only from the Water:

- Harvest aquatic weeds and algal mats directly from the swim zone waters:
  - Use machines in the water
    - Travel on bottom in shallow areas, must be sufficiently solid and not rocky bottom)
    - Floating watercraft, or cabled
  - Advantages:
    - Don’t need riparian land access along shores
    - May disturb less sediment and beach sand
Advantages, cont’d:

- **Advantages for corporate ventures:**
  - If large scale, might be able to recover C:N:P and other nutrient resources more efficiently from the solely algae and macrophyte vegetation, and limit mixture of soil sediments

  - Could convert nutrients to energy, heat, fertilizer & compost materials, or to animal feed ingredients (various methods in later slide)

  - Potential sustainable cost recovery revenue? (This can be crucial due to ongoing and repeated muck accumulations on beaches.)
Conditions of Potential Methods to Remove Muck Only from the Water:

- Conditions and Factors:
  - Must prevent plant parts from restarting more growth
  - May need to be repeated more frequently (after wind storms) than methods that effectively keep muck out of public swim and beach areas
  - May help if removal operations are performed during the calmest wave conditions, e.g., during some morning hours
  - Algal mats may be difficult to remove after start to decay
Hydraulic pumping of muck and liquids (various “muck sucking machines”)

– Large Scale Handling Options:
  • Pump to lagoon ashore for:
    – Settling of organic materials and sands
    – Water overflow back to bay or a wetland
    – Dewatering and drying of solids in lagoon, test as needed, pile & remove
      • Potentially use muck sands for beach nourishment, if not contaminated
      • Limit pile to 90 days to avoid waste piles
      • may reuse sands and organic materials
Hydraulic pumping of muck and liquids, Large Scale Handling Options, cont’d:

• Pump to mechanical dewatering machinery or processes ashore (would likely include polymer additions), with overflow, decant, or filtrates returned to surface waters (requires a NPDES discharge permit)

• Options needing power or pumping, but feasible:
  – Rotary Drum Thickener machine
  – Belt press machine
  – Gravity Thickener tank
  – Centrifuge, or vortex separator
  – Clarifier, or upflow clarifier
Hydraulic pumping of muck and liquids, Pump to Non-Machines:

Not as much power need:
- Geo-tube ("sock"), e.g., used for lagoon and river dredging projects
- Sand drying bed, dewater, scrape & haul solids to agricultural land as a resource

- Hydraulic dredge, pump to
  - Isolated areas:
    - Overflow Waters: route to coastal wetlands
    - Solids: test solids, as needed

- What other methods?
Pump into a silt screen zone in water or geonet area on land that concentrates muck:

• In water, a moderate distance away from swimming zones
• Ashore, which could be built with sand berms

– Ought to evaluate N, P, and bacterial indicators in drainage back to bay
Pull “screen filters”, or “algae nets” through the muck that screen/filter the water and drag muck ashore to dewater.

– After dewatering ashore, then load and transport muck away as a solid, if no free liquids in trucks

– If there is free liquids, then transport in lined-bed trucks or tankers, to prevent releases

– Soils/sediments may need to be tested from some areas. Note: testing can utilize data already available from DEQ, Local Health Depts, NOAA, universities, etc.
4. Potential Methods to Remove Muck and Sediment/Soil Mixtures:

- These methods are less efficient
- Need more Permits from LWMD and USACE
- Mechanical bucket, scoop, try to lift out only muck solids (difficult without removing a mixture of muck and soils)
- Hydraulic dredging, sometimes hard to control depths, might accidentally go deeper:
  - Control along shoreline
  - If on wheels/tracks, then function of machine depends on weight and the solidity of the sand/silt bottom in the littoral zone, and beach.
Methods to Remove **Muck and Sediment/Soil Mixtures**, cont’d:

- Must handle and dispose of both sediments and algal muck together.
  - Probably land apply solids
- Potentially pump water to nearby isolated channels
- **Avoid nuisances:** dewater and dry out quickly
- Similar discharge evaluations and permitting requirements as above.
B. Potential Methods of Disposal: Liquids

- **Liquids**: i.e. free liquids
  - must be contained, no releases
  - minimize direct contact exposures to workers

- **Liquids Disposal Options/Recommendations:**
  - Discharge Liquids (after separating solids) to:
    - Surface Waters (may need NPDES Permit)
    - Wetlands (may need NPDES Permit)
    - Land application, with a groundwater discharge approval if < 1% total solids concentration
      - injection is best for odorous materials
      - surface application, mix in within 48 hr
Methods of Disposal: Liquids, cont’d:

- **Livestock Manure Lagoon**
  - liability and responsibility for material must be accepted by the lagoon owner
  - land apply agronomically with manure

- **Anaerobic Digester**
  - Can be mixed with other organic liquid wastes
  - generate methane gases for heat or energy
  - land apply solid residuals

- **WWTPs** – if accepted; but costly to treat

- Note: burial of muck < 1% solids (99%+ water) -- is not allowed w/o a groundwater discharge permit and will probably cause problems
C. Potential Methods of Disposal: Slurries and Solids

- **Solids** (slurries > 1% total solids concentration; solids > 20-25% solids)
  - Beach sand nourishment, in other areas, if sand content of mixture is high (~95%) and material is not contaminated
  - Landfill Solids if no free liquids; test by LF
  - Land application of slurry or solids on farmland, **if apply at agronomic rates:**
    - If slurry, then injection method is usually best
    - If solid, (e.g., > 25% total solids concentration) then use manure spreader and mix into soils within 24 - 48 hrs
  - Aquatic plants are exempt from “solid wastes”, if apply at agronomic rates.
Methods of Disposal: Solids (cont’d)

- Registered yard waste compost facility
  - Mix in plenty of bulk materials, absorb water
  - After sufficient stabilization and pathogen kill then direct contact exposure acceptable
- Commercial Composting with other separated organic materials, e.g., manures, vegetable processing plant wastes
- Municipal Composting with yard wastes (leaves, some grass, tree trimmings, etc.)
- Silviculture reuses
- Process into animal feed ingredients
  - Would need MDA evaluation and approval
Methods of Disposal: Solids (cont’d)

- **Burial on site** (> 25% total solids concentration)
  - Not recommended for small or large projects
  - Could be a nutrient threat to area wells
  - Nutrients could leach back to the bay
  - Not being regulated now, but might become so
  - Risky. Might need a property deed restriction if muck is contaminated.

- **Burial off site**: Waste? Probably not approvable.

- Use as Fill Material: muck/sediment disposal as fill would be viewed as waste disposal, not reuse. It is not inert material, no benefits, and would **not** likely be approved.
Methods of Disposal: Solids (cont’d)

- Other **considerations**:  
  - **Limit direct contact** to raw muck because it is a form of “pollution”.  
  - **Unstabilized Muck** might contain:  
    - Accumulated **infectious organisms**, e.g., bacteria, viruses, protozoa, etc. from wildlife, livestock, domestic animals, and human sources  
    - **Decaying materials**, mussel meat, etc.  
    - Potentially some **organic chemicals**  
  - Stabilized and dried muck could generate **dust** that could cause nuisance, and allergic or health effects  
  - Characterizations might change in the future  
  - Remember to **control odors and dusts**!
Questions?