

MINNESOTA'S TOXIC STORMWATER POND SLUDGE

Abstract:

Minnesota's stormwater retention ponds are filling with hazardous waste material. A 2009 survey found sediment in 9 of 15 ponds in the metro area contained unsafe levels of a toxic group of compounds called polycyclic aromatic hydrocarbons (PAHs). Coal-based tar sealant, used commonly on driveways and parking lots for aesthetic purposes, contains over 200 PAHs and is the main contributor to pond contamination. As the sealant wears, PAHs are released into the environment and concentrate in stormwater sediment.

Sediment, which could have been reused, is considered hazardous waste material when PAHs are present at the levels many municipalities are recording. The dredged material must be hauled to a lined landfill, at an estimated \$1 million/acre. Minnesota cities do not have the money nor landfill space for such an operation. Ponds are designed to collect pollutants and prevent contaminated water from reaching the groundwater system or public lakes and streams. Without sediment removal, ponds will not function properly. **This paper seeks to identify methods by which to properly address PAH contaminated material.**

A cost efficient removal method must be developed if we wish to address the issue. Alternative methods using plants, microbes or fungus for mitigation are currently being researched in several labs around the world, and have found great success with *Helianthus annuus* L. – the common sunflower. **Sunflowers work best—environmentally and economically—for PAH removal in**

Methods:

This project was completed using a literature review of primary sources on stormwater management, common contaminants, PAHs, coal-based tar sealants, laws and regulations on coal-based tar sealant use, and alternative methods for PAH removal. The best removal method was determined based on removal rates and cost. Through Interviews with the MPCA, University of Minnesota's Soils Departments, trucking companies, a White Bear Lake municipality director, and soil engineer, information was gathered regarding possible efforts to address PAH contamination in Minnesota. With the help of the White Bear Lake municipality department, data was collected on treatment area, land available, land use, cost, monitoring devices, PAH contamination levels, volume of runoff, additional materials, and budget. I designed a mitigation plan based on a project currently being researched at Varney Pond, a stormwater pond, in White Bear Lake. Based on their model and speaking with hauling companies, I was able to estimate costs of varying mitigation ef-

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What are Polycyclic Aromatic Hydrocarbons (PAHs) :

PAHs are organic chemicals found in the environment which pose a health risk to animals, plants, and people at elevated concentrations. Certain compounds are known carcinogens and have mutagenic properties. They are formed during the incomplete combustion of organic materials such as wood, oil, and coal. PAHs can be traced to coal-based tar sealant, motor oil, cigarette smoke, car exhaust, and burnt toast.

Case Study: White Bear Lake, MN

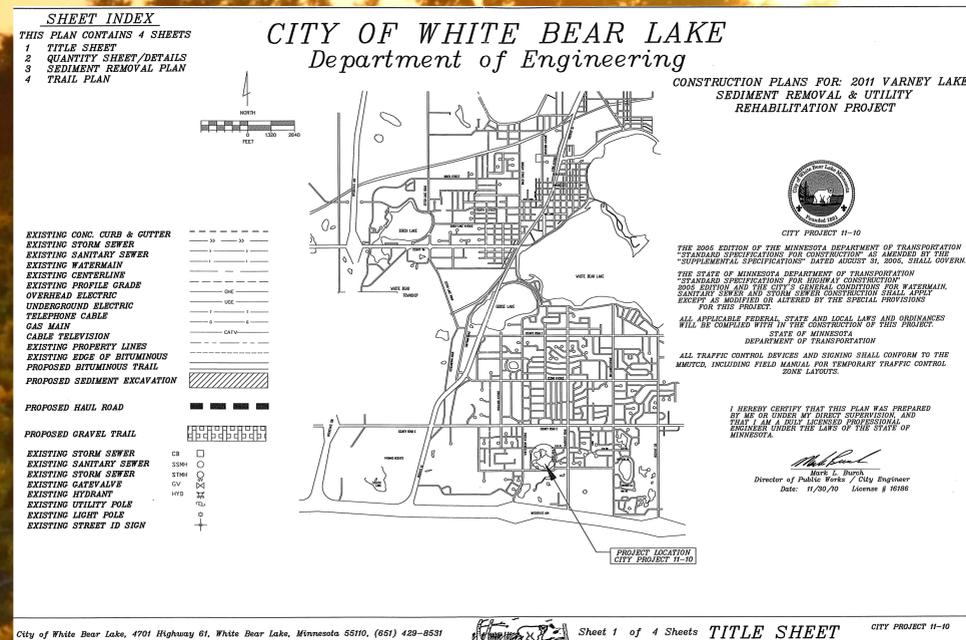


Figure 1: Varney Pond Treatment Site

Location: Varney Pond, White Bear Lake, Minnesota (See Figure 1).

Contamination Level: Dredge Management Level 3: exceeds SRV 2 and must be treated or disposed in a landfill with MPCA approved industrial waste (between 2 and 7,880 mg/kg).

Treatment: To avoid further contamination, 10,000 cubic yards of material will be hauled in the winter months from Varney Lake. The material will be and then mixed with composted manure in a 4:1 ratio to make it a suitable growing medium. The material will be placed in a nine foot long berm on two acres north of the pond with a wood fine base to avoid possible leaching. Topsoil from the site will be removed to top the berm with a two foot layer. In the spring, approximately 700 *Helianthus annuus* L. seeds, obtained from the U.S. Department of Agriculture, will be planted on the berm. Soils will be re-evaluated in late summer to determine PAH removal rates. The sunflowers can be till into the berm or brought to a landfill

Estimated Cost: \$160,000 for construction and treatment; \$10,000 in soil testing.

Results and Conclusion:

If 50% of the estimated 20,000 contaminated ponds in the seven county metro area were to haul 1,000 cubic yards per pond to one to three nearby lined landfills, this would total 10,000,000 cubic yards of material which would exceed existing landfill space by 77% and cost \$2.6 billion in hauling and tipping fees.

Bioremediation techniques are the best option for PAH contamination. They allow for treatment on-site, remove high levels of PAHs and save landfill space. Of 11 dicotyledonous species surveyed, *Helianthus annuus* L. degrades the greatest amount of PAHs. They can reduce PAH concentration levels by 93% in 90 days (30% greater than other methods). Additionally, they are the only plant to exhibit a better response to seed germination and root elongation in the presence of PAHs. The sunflowers degrade PAHs so that the plants can be composted or hauled to a landfill and allow for sediment to be re-used.

Varney Pond in White Bear Lake would cost around \$400,000 to haul the material to a landfill. Treating the material with sunflowers would reduce this cost by 50%. With the help of grants from the State of Minnesota and the MPCA, this is a viable option for many cities. If municipalities are to solve the issue of PAH

Key References:

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Acknowledgements:

Background Image: Williams, Desrae. *Sweet Summertime*. 2013.