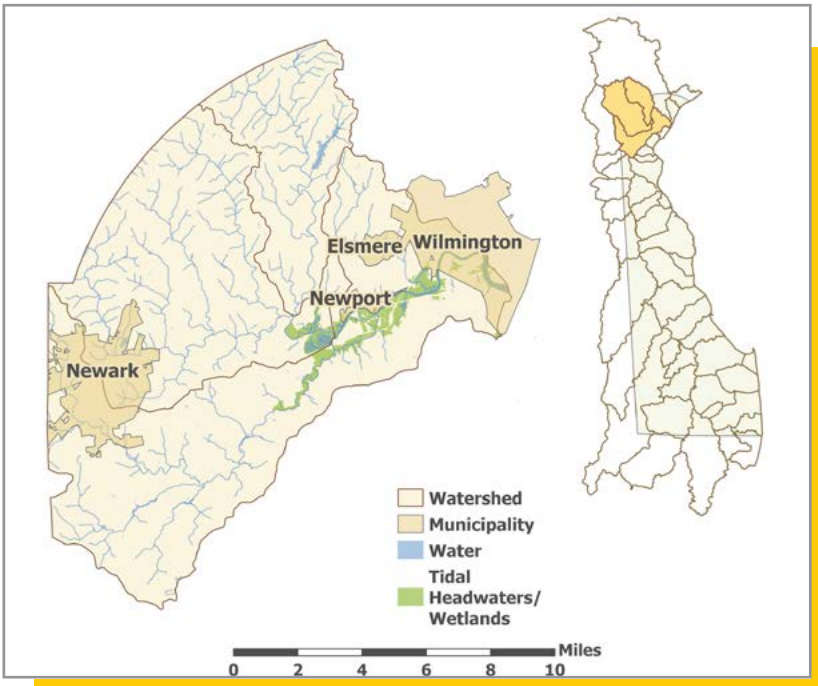
"A-Street Ditch"

Sediment Remediation Pilot Study - Wilmington

In 2019, DNREC initiated a pilot-scale project utilizing inoculated activated carbon pellets in an attempt to destroy PCBs in sediments in the A-Street Ditch adjacent to the Christina River.



Watershed Information: The Christina River watershed is one of four major watersheds in the 565 sq. mi. Christina Basin, which is part of the 13,000 sq. mi. Delaware River Basin. The White Clay, Red Clay, and Brandywine Creeks are tributaries of the Christina River and flow southward out of the Piedmont geologic province in Pennsylvania and into Delaware near Newark, Yorklyn, and Wilmington, respectively. The Christina River is tidal from just south of the town of Christiana to its confluence with the Delaware River at Wilmington. The Brandywine Creek flows through Wilmington and enters the Christina River just before the Christina flows into the Delaware River. Most of the Christina River watershed is located in New Castle County (De.). Towns in the Christina River watershed include Newark (De.), Wilmington (De.), Elkton (Md.), London Britain Township (Pa.), and Franklin Township (Pa.).

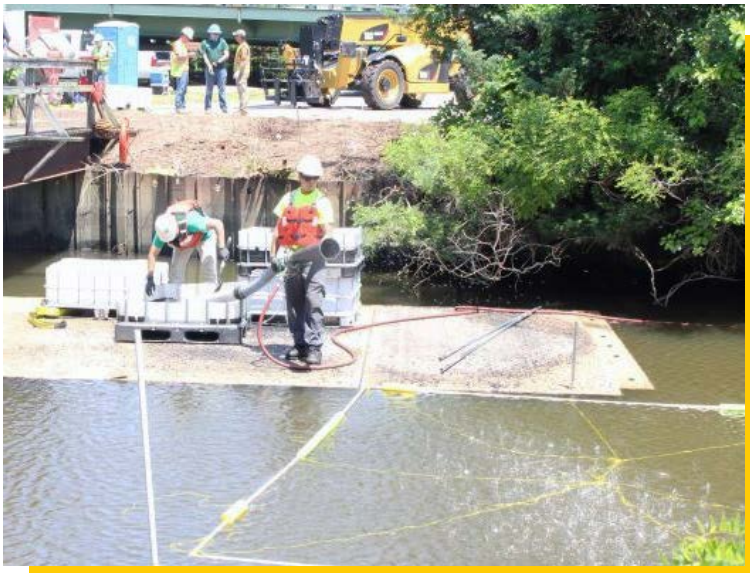
Problem: Based upon data collected in 2015 by DNREC's Watershed Approach to Toxics Assessment and Restoration (WATAR) team throughout the Christina Basin, the majority of toxic chemical impacts to sediments, surface water and fish are located within the lower tidal portions of the Christina and Brandywine Rivers. Contaminants of Concern are Polychlorinated biphenyls PCBs, dioxins and furans, and chlorinated pesticides. In order to achieve water quality goals, and subsequently sediment and fish tissue goals, two activities need to occur: 1) land-based source control; and 2) in-water sediment remediation. Regulatory measures aimed at land-based source control are ongoing throughout the watershed, and positive results have been seen in the form of relaxed fish consumption advisories (2018 Fish Advisory Update). Although there is still more work to be accomplished in the uplands to fully control the remaining known sources of toxic impact to the Christina Basin, DNREC and its partners are beginning to turn additional attention towards the next phase of improvement, in-water sediment remediation. Similar to the Mirror Lake Project in Dover (Mirror Lake Update Video), DNREC's second sediment remediation test project using SediMite™, an activated carbon-based product, is called the "A-Street Ditch Pilot Study." This study aims to enhance the innovative contaminant sequestration technology in order to destroy PCBs and reduce their overall mass in the environment. If the project is a success, then this technology will be available for use in the much larger Christina/Brandywine River Remediation in the future.

A-Street Ditch Pilot Study: The A-Street Ditch in Wilmington, Delaware drains the South Wilmington Wetland to the Christina River. Samples collected by DNREC's WATAR team in 2015 indicated that the ditch was a pathway/source of PCBs to the river. In conjunction with remedial activities within the South Wilmington Wetland in 2019, DNREC initiated this full-scale pilot project to evaluate the effectiveness of a new inoculated carbon pellet technology developed by partners at the University of Maryland Baltimore County (UMBC). The project aims to sequester, and destroy, the PCBs in the sediments of this drainage feature.

In addition, remediation of the A-Street Ditch will minimize recontamination of the newly constructed wetland by surface water and sediments moving tidally through the system.

DNREC initiated the A-Street Ditch Pilot Study as an interim measure to test this innovative sediment remediation technology for possible application at a largerscale, and as a compliment to the City of Wilmington's South Wilmington Wetland project (A-Street Ditch Video).

The A-Street Ditch project utilizes SediMite™, the same activated carbon technology that was successfully used at Mirror Lake in Dover in 2013. Therefore, DNREC is very confident that the carbon application will effectively sequester PCBs in the sediment, rendering them unavailable for uptake by benthic aquatic organisms. The pilot will determine the rate at which PCB degradation/ destruction can occur in this system with the added inoculant. To begin to answer the question, DNREC and their contractors (Brightfields, Inc. and Rembac Environmental) collected sediment, surface water, and porewater samples in late 2019 (only 5 months after inoculated SediMite™ application) to compare against baseline data collected prior to remedial activities. Additional post-remediation monitoring is scheduled for 1 year and 3 years post-application, or June 2020 and June 2022. The comparison of these data will show the long-term effects of the inoculant.



Initial Results: DNREC hydrologists observed signicicant average reductions, compared tothe baseline date. The following observations are noted: Total PCB concentrations in surficial sediments across the study area dropped between 25% and 28%, with an average reduction of approximately 25%. Total PCB concentrations in surface water across the study area dropped 23% to 47%, with an average reduction of approximately 35%. Finally, and most impressive, concentrations of total PCBs in sediment porewater dropped between 49% and 77%, with an average reduction of approximately 64%.

One-Year Post-Application Results: Results of the June/July 2020 monitoring as compared to the initial results are shown in the table below:

A-Street Ditch Remediation Pilot Study		
Total Reductions	**November 2019 (5-month results)**	**June/July 2020 (1-year results)**
Total PCB Reduction in Surface Sediments	25%	21%*
Total PCB Reduction in Surface Water	35%	57%*
Total PCB Reduction in Sediment Porewater	64%	68%

* total reductions based on data from 2 of 3 sample locations

The results show that the concentration of dissolved PCBs in the sediment porewater – the parameter which the technology is expected to influence most directly – has continued to decrease across the entire project area. Analytical results of two samples collected in July 2020 showed localized increases in PCB concentration and are not representative of the improved conditions observed in the rest of the ditch. The project team is evaluating the reason for the observed increases and will share their findings when they are available.

As previously mentioned, DNREC had planned to evaluate the progress of the remediation again in July 2022, three years after inoculated SediMite™ application. Based upon the results presented here, however, the project team will evaluate progress again at two years after application, or July 2021.

Two-Year Post-Application Results: Results of the June/July 2021 monitoring as compared to the initial (baseline) results and one year monitoring results are shown in the table below. Also, additional samples were collected to evaluate the anomalous data received in 2020:

A-Street Ditch Remediation Pilot Study			
Total Reductions	**November 2019 (5-month results)**	**June/July 2020 (1-year results)**	**June/July 2021 (2-year results)**
Total PCB Reduction in Surface Sediments	25%	21%*	50%
Total PCB Reduction in Surface Water	35%	57%*	10%
Total PCB Reduction in Sediment Porewater	64%	68%	32% (48%*)

* total reductions based on data from 2 of 3 sample locations

The results of the year two monitoring show several things. First, total PCB concentrations decreased at all monitoring locations, ranging between 43% and 57%, with an average reduction of 50% across all monitoring sites. This indicates that the microorganisms (inoculant) that were added to the carbon pellets are reducing PCB mass in the sediments, as anticipated.

Second, freely dissolved PCB concentrations in sediment porewater have rebounded across the site since the one-year monitoring, but are still 32% less than baseline conditions. This indicates that the carbon continues to sequester PCBs, thus reducing overall contaminant bioavailability after two years.

Third, freely dissolved PCB concentrations in surface water, in general, were close to or greater than baseline conditions. This is a clear indication that there were/are remaining impacts from the surrounding environment occurring. There are several known sources of PCBs in the Christina River watershed, including river bottom sediments in the Christina River itself, that are likely contributing to regional scale impacts. As such, the surface water data is not surprising, and also highlights the importance of source control in the overall sequencing of remediation and restoration activities.

Finally, a slightly deeper (0-6 inch) sediment core was collected in 2021 along with two other surface sediment (0-4 inch) samples in order to evaluate the elevated PCB concentration detected during the one-year monitoring, as noted above. Results from analyzed sections of the core showed that PCB concentrations increase with depth, to a concentration similar to the elevated concentration detected in 2020. The additional surface sediment sample PCB concentrations were generally consistent with baseline data and other surface sediment data collected across the site. In addition, an erosional feature (small channel) was noted during a site visit at low tide near the outfall structure between the South Wilmington Wetland and the A-Street Ditch. So even though there is some documented heterogeneity in the distribution of PCBs in surface sediments within the project area, it is most likely that the one-year monitoring sample was inadvertently collected within this small erosional feature, where deeper sediments (and higher PCB concentrations) were partially exposed.

DNREC plans to collect samples one final time, in July 2022, three years after the inoculated SediMite™ application. The data collected to date, however, show that the technology is working as designed.

Funding – A Street Ditch:

- Hazardous Substance Cleanup Act (HSCA) funds ($188,313) – For planning, remediation, and long-term monitoring.

- USEPA Multi-Purpose Grant ($30,000) – For 5-month post-application monitoring report, and year one post-application monitoring (sampling, analysis and report).

DELAWARE DEPARTMENT OF
NATURAL RESOURCES AND
ENVIRONMENTAL CONTROL

DNREC Press Release
July 9, 2019

WILMINGTON – A new DNREC YouTube Channel video details an innovative remediation project to remove PCBs from sediment in a ditch that discharges into the Christina River in Wilmington.

This spring, DNREC's Watershed Approach to Toxics Assessment and Restoration (WATAR) Team and its partner University of Maryland, Baltimore County and contractor Brightfields, conducted a full-scale pilot test, using approximately 7 tons of Sedimite pellets inoculated with PCB-degrading micro-organisms to isolate and destroy legacy PCB contamination in a one-acre wetland area on A Street in Wilmington. With PCBs as the main cause of fish consumption advisories in the Christina Basin, the goal of the project is to prevent the contaminants from entering the food chain and impacting fish and other aquatic life.

Sedimite™ was the same product used for the Mirror Lake Remediation and Restoration Project in Dover in 2013, which has resulted in more than 80 percent reduction of PCBs in resident fish tissue in the five years since it was applied. The difference in this application – the first commercial application of bio-amended Sedimite™ in the country – was the inclusion of the PCB-destroying micro-organisms.

The WATAR Team expects successful results from the innovative pilot project and that the technology may become another tool that can be utilized in cleaning up legacy PCB contamination in other water bodies in the state.

The video can be found on the DNREC YouTube Channel at A-Street Ditch.

About DNREC
The Delaware Department of Natural Resources and Environmental Control protects and manages the state's natural resources, protects public health, provides outdoor recreational opportunities and educates Delawareans about the environment. The Division of Watershed Stewardship develops and implements innovative watershed assessment, monitoring and implementation activities. The Division of Waste and Hazardous Substances ensures Delaware's wastes are managed to protect human life, health, safety and the environment. For more information, visit the website and connect with DNREC on Facebook, Twitter or LinkedIn.

Media contact: Joanna Wilson, joanna.wilson@delaware.gov DNREC Public Affairs, 302-739-9902

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DELAWARE DEPARTMENT OF
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For immediate release
April 21, 2020

DNREC's innovative Mirror Lake clean-up earns more national acclaim, while a groundbreaking enhancement to the same approach reduces pollutants in the Christina River

DOVER, Del. – For Earth Day 2020, the Department of Natural Resources and Environmental Control announced it has successfully used an innovative approach to reduce polychlorinated biphenyls (PCBs) in two Delaware waterways. Newly released scientific data are validating the new method of sequestering pollutants with activated carbon, which render them unavailable for uptake by fish and other aquatic organisms.

The first success was with an activated carbon product called SediMite™ at Mirror Lake in Dover in 2013. The project is featured in a new article co-authored by several project participants, including two DNREC scientists, and published in the May issue of Journal of Environmental Engineering. The article, titled "Full-Scale Application of Activated Carbon to Reduce Pollutant Bioavailability in a 5-Acre Lake" presents a summary of the monitoring data collected at the site between 2013 and 2018. Highlights include an approximate 80% reduction in PCB concentrations in sediment porewater, which is the water trapped between grains of sediment in the bottom of a water body. The study also found an approximate 70% reduction in PCB concentrations in Mirror Lake's resident fish.

"The recognition by the Journal of Environmental Engineering reflects how Delaware is on the leading edge of environmental technology, an area DNREC is exploring more and more" said DNREC Secretary Shawn Garvin. "Mirror Lake was a successful pilot, so DNREC's team sought a second opportunity to try the technology." The A Street Ditch project became a focus for DNREC's Watershed Approach to Toxics Assessment and Restoration (WATAR) team after samples confirmed drainage ditch sediments were a continuing source of PCBs to the Christina River. The project, in coordination with cleanup efforts at the adjacent South Wilmington Wetland Park site, provided an opportunity to evaluate an enhanced carbon sequestration technology developed by DNREC's partners at the University of Maryland Baltimore County (UMBC).

The enhanced technology involves the use of SediMite™ with the addition of PCB destroying micro-organisms (inoculant). In theory, the activated carbon will sequester PCBs, as shown in Mirror Lake. However, the micro-organisms (which exist naturally in the environment in much smaller numbers) will effectively degrade the PCB molecules over time. Initial results, collected only 5 months after the inoculated Sedimite™ was applied to the ditch sediments, show total PCB concentrations in the top layer of sediments across the A Street Ditch study area dropped by an average of 25%. In addition, surface water PCB concentrations across the site area have dropped by an average of 35%. Most impressive is that concentrations of total PCBs in sediment porewater have dropped by an average of 64%. Additional monitoring will occur in July 2020, and again in July 2022.

Another harbinger for clean water in Delaware is that sequestering or destroying legacy PCBs – the primary risk driver for most of the fish consumption advisories issued by DNREC and the Delaware Division of Public Health – prevents these contaminants from entering the food chain. With increasing confidence in these innovative sediment remediation technologies, DNREC is beginning to plan for larger-scale projects, in key watersheds across Delaware, with similar water quality impairments.

“What these projects have achieved brings the longstanding goal of clean water for all Delawareans a little closer,” said Secretary Garvin. “DNREC’s dedicated scientists and staff are committed to improving water quality and making smarter use of resources at our disposal, including the technology that has driven both the Mirror Lake and A Street Ditch projects.”

DNREC’s A Street Ditch pilot project was supported by $188,000 in Hazardous Substance Cleanup Act (HSCA) funds and a $30,000 US Environmental Protection Agency multi-purpose grant. For more information, view the DNREC YouTube video about the WATAR team’s A Street Ditch pilot and another video on the Mirror Lake project or visit the DNREC website.

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The Delaware Department of Natural Resources and Environmental Control protects and manages the state’s natural resources, protects public health, provides outdoor recreational opportunities and educates Delawareans about the environment. The Division of Watershed Stewardship develops and implements innovative watershed assessment, monitoring and implementation activities. The Division of Waste and Hazardous Substances ensures Delaware’s wastes are managed to protect human life, health, safety and the environment. For more information, visit the website and connect with DNREC on Facebook, Twitter or LinkedIn.

Media contact: Michael Globetti, michael.globetti@delaware.gov

DELAWARE DEPARTMENT OF
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For Immediate Release
Jan. 25, 2021

DNREC Updates A-Street Ditch PCB Cleanup Pilot Project

A new report prepared for the Delaware Department of Natural Resources and Environmental Control indicates that the innovative technology being tested in Wilmington's A-Street Ditch cleanup pilot project continues to show promise. The report summarizes data collected one year after biologically-enhanced carbon pellets were applied to sediments in the ditch to clean up polychlorinated biphenyls (PCBs).

Conducted by the DNREC's Watershed Approach to Toxics Assessment and Restoration (WATAR) program, the technology deployed in the A-Street Ditch project uses an activated carbon product (SediMite™) with the addition of PCB-destroying micro-organisms. The activated carbon sequesters PCBs and over time the microorganisms degrade and destroy PCB molecules. A similar technology was successfully demonstrated in an earlier DNREC project at Mirror Lake in Dover.

PCBs are persistent, bioaccumulative and toxic legacy industrial compounds. They pose ecological and human health risks and are the largest contributor to fish consumption advisories issued periodically by DNREC and the Delaware Division of Public Health.

Results of DNREC's July 2020 sampling of the A-Street Ditch show reduced concentrations of dissolved PCBs in the sediment porewater – the water trapped between grains of sediment in the bottom of a water body – across the entire project area. Results from two of the nine samples that were collected in July 2020 (one surface water sample and one sediment sample) showed localized increases in PCB concentrations. The WATAR team is evaluating potential reasons for these increasesand will make their findings public when available. DNREC is planning to assess PCB concentrations in sediment, surface water and sediment porewater again in July.

DNREC's A-Street Ditch pilot project was supported by Hazardous Substance Cleanup Act (HSCA) funds and a U.S. Environmental Protection Agency multi-purpose grant. Visit de.gov/watar for monitoring reports and a DNREC YouTube video about the A-Street Ditch project. Additional information about the Mirror LakeDover project can also be found at de.gov/watar.

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Media contact: Michael Globetti, michael.globetti@delaware.gov or Nikki Lavoie, nikki.lavoie@delaware.gov

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NATURAL RESOURCES AND
ENVIRONMENTAL CONTROL

Department of Natural Resources
and Environmental Control
89 Kings Hwy
Dover, DE 19901
dnrec.delaware.gov