



(Before at right) Five acres of ponds at Portland Country Club in Falmouth, Maine, contained toxic levels of heavy metals that killed all pond life except the cattails. (After at top) Aquatic life was restored after OCARB was added and the pond now provides a habitat for nesting waterfowl.

TEE OFF AND BATTER UP!

Bioremediation successfully accomplished a cost-effective ecosystem restoration without disturbing neighboring sport facilities.

By Jo Davison and Cheryl Van Vorce

In March 1992, construction crews from Cleveland, Ohio's, Gateway Corp. discovered 32 leaking underground storage tanks (USTs) while setting the footers for the new Cleveland Indians stadium. Samsel Services was called, and a site assessment found that a total of 14,000 square feet of contaminated soil needed treatment. The initial concentration of total petroleum hydrocarbons (TPH) was more than 2,500 parts per million (ppm) and total benzene, toluene, ethylbenzene and xylene (BTEX) was more than 100 ppm, located at a depth of 21 to 26 feet.

Due to the time constraints of the

construction process, a passive approach to clean the site was needed. Cleveland's EDP Consultants Inc. constructed 10 wells to access the plume of contaminated soil. Following a microbial profile, the site was inoculated with 5,000 gallons of site-specific indigenous microbes provided by Lambda Bioremediation Systems Inc. Compliance levels to be achieved for closure by the Ohio Bureau of Underground Storage Tanks (BUSTR) were 300 ppm for TPH and 64.17 ppm for Total BTEX.

One month after the November 1992 injection, while construction proceeded, TPH levels were reduced to 1,300 ppm

and BTEX levels to 50 ppm. After four months the levels decreased to less than 100 ppm TPH and less than 1 ppm Total BTEX, as shown in **Table 1**. The final closure report was submitted and accepted by BUSTR. The site closed in July 1993, in time for Cleveland's boys of summer to play ball.

Fore!

Portland Country Club in Falmouth, Maine, had become a nightmare for superintendent Pat Lewis. The course's five acres of ponds had been filling in with an excessive growth of cattails and the members were complaining. Lambda

Bioremediation Systems Inc. was called in December 1989 to study the problem and found a nearly dead ecosystem due to the buildup of lead, mercury, arsenate, cyanide and chromate, as well as sulfates. The ponds also had a reduced water and soil pH due to the extended use of pesticides, herbicides and fungicides prior to Lewis' arrival at the 125-year-old club. The result was the overgrowth of cattails to the exclusion of other species and the disappearance of wildlife.

Lambda's scientists evaluated the problem and performed a bench study to determine the best way to safely and cost-effectively restore the ecosystem. In July 1990, 3½ tons of BIOCARB (bags of balanced microbes embedded in charcoal) were introduced into the ponds to attempt restoration of the natural system. The normal routine of the club was never interrupted during the procedure.

In one month, the water in the ponds showed less than 1 ppm for all the heavy metals and an increasing pH to drinking water standards (See Table 1). New Maine indigenous plant species, such as cattails, sedges, rushes, reeds, spartina, grasses and arrowroot, have since replaced the receding cattails and wildlife has recovered enough to form nesting communities. Site evaluations since the treatment have shown that the reestablished ecologically balanced conditions have held and continued to improve. Fish, muskrats, turtles, foxes and a large variety of ducks, Blue Herons, Kingfishers and song birds (none endangered), have repopulated the area and are helping to maintain a balanced macro and microecosystem. In 1995, the Audobon Society deemed the five acres of ponds a natural bird sanctuary and a wildlife preserve.

Settling the Score

Lambda, established in 1984, uses only natural, site-specific organisms. The versatile and unique approach can be adapted to a variety of problems. The key to the company's success is its microecological profile or "biofeasibility study" that verifies the presence of indigenous microbes and indicates their response to varying levels of pollution. The in-depth study can also provide a sound basis for allowing the site to undergo "natural attenuation" with no further treatment except quarterly monitoring. These projects demonstrate the vastly untapped possibilities of modern bioremediation as a treatment technology. Normally, only one in-

oculation is required, significantly reducing overhead and maintenance costs and long-term monitoring expenses.

The firm's bioremediation is not a "quick fix" and does not include any "magic microbes" or black boxes, but relies on a sound scientific approach to environmental problems. It is a proven technology with verified site closures

in Ohio, Kentucky and Michigan, along with happy baseball fans in Cleveland, Ohio, and golfers in Maine. **EP**

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For more information, circle 156 on card.

Table 1 **METALS & pH AT PORTLAND COUNTRY CLUB**

	Start 12/1/89	Plant 7/20/90	8/13/90	9/7/90	10/30/90	Federal Drinking H ₂ O Standards
Total Iron	20		.523	.424	.230	.3
Manganese	3.10		.032	.02	ND	.05
Aluminum	17.3		1.486	.03	ND	.01
Sulfate	4,190.0		150	34.4	19.8	500
Chromate	71		.02	.01	.0001	.05
Cyanide	71		.002	.001	ND	.20
Arsenate	36		.006	.005	ND	.05
Mercury	4		.00002	.0001	ND	.001
Lead	4.4		.011	.001	ND	.005
pH	5.9		6.87	7.4	8.0	6.5-8.5

Based on TCLP analysis for toxic metals method 1311. All in parts per million (ppm).

ND = Non Detect

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Continuous investment in automation and process improvement	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Eight of every 10 clients surveyed rate lab's performance as <u>exceeding</u> expectations	<input checked="" type="checkbox"/>	<input type="checkbox"/>

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**Portland Country Club
Falmouth, Maine
BEFORE**



**Portland Country Club
Falmouth, Maine
AFTER**