City of Vancouver
WATER RESOURCES PROTECTION - CATCH BASIN FILTER PROGRAM

Introduction

The City of Vancouver initiated a catch basin filter program in 2004 based on a program called "Grate Mate" which was developed by the Seattle-based non-profit organization *Planet CPR.* The goal of *Planet CPR's* Grate Mate is to install catch basin filters ("grate mates") in streets and parking lots with help from local student groups. They also revisit installation sites and inspect the filters, replacing them as needed. The program has been successfully implemented by a variety of cities, mostly in the western U.S.

Rather than implementing a long-term filter installation and maintenance program, as is typically done with Grate Mate, the City of Vancouver contacted local businesses to participate in a project to identify problem catch basin areas that receive excessive amounts of sediment, trash or petroleum contaminants. Students from Vancouver's Clark College were recruited to help install the filters and evaluate results. A final report was then generated for each business which included recommendations on how to remedy any problem catch basin areas.

In addition to identifying and remedying problem catch basins, the project provided outreach to local businesses, catch basin maintenance training and hands-on water quality experience to student volunteers.

Program Implementation

The City's Water Resource Protection (WRP) team selected the Andresen Basin as the site of the project because of the density of commercial development and proximity to Burnt Bridge Creek. The creek is the site of a major riparian restoration project integrating storm water treatment, improved wildlife habitat and recreational trails (see *Figure 1*). Sections of the creek have been listed as not meeting water quality standards by Washington's Department of Ecology.

Figure 1: Burnt Bridge Creek Projection

Water Resources Protection staff contacted businesses within the Andresen Basin and offered catch basin cleaning and performance evaluation services as enticements to enter the program. Of the 6 businesses that accepted, 2 were shopping centers that leased to several commercial

tenants. The accepting businesses signed "Business Agreement Letters" permitting the City and volunteers access to the catch basins. The City subsequently cleaned 25 private catch basins in preparation for the filter installation. Additionally, each catch basin was located and numbered on a schematic map of the City stormwater system.

Figure 2: City staff and student volunteers from Clark College

Students enrolled in Clark College's Environmental Studies Department were approached to provide volunteer support. The Department requires that its students perform a certain number of hours of environmental-related volunteer work. WRP staff gave a presentation and recruited 5 students for the program. The students each received one hour of training on stormwater catch basin and filter installation.

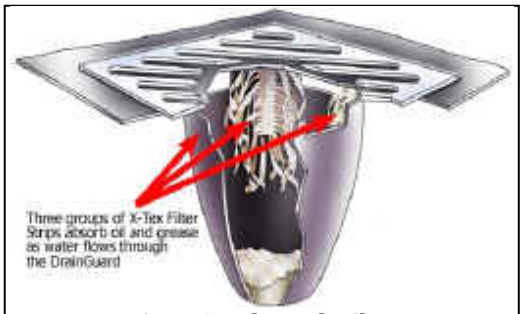

Figure 3: Ultratech Filter

The City chose Ultratech brand sock filters to install in catch basins. Published performance data indicates that these filters are capable of removing sediments down to the 80 µm range and over 90% of oils. The filters had a reported oil capacity of 1.38 gallons of oil and a sediment capacity of up to 40 lbs[1]. Note that although a filter may structurally hold 40 lbs, sediment levels begin to approach the overflow ports at 20-25 lbs.

Oil capture performance was evaluated by WRP staff using a synthesized oil-water solution and comparative testing. The City's lab data and calculations verified that a filter could capture over 90% of the oil and retain over a gallon of oil in the filter fabric. These results are presented in Tables 1 and 2.

Table 1: Filter Oil Removal Results

Sample Name	Concentration (mg/l)	Concentration Removed (mg/l)	Percentage Removed
Oil Solution	341.0		
Filtered Solution (New Filter)	15.6	325.4	95%
Filtered Solution (Used Filter)	33.4	307.6	90%

Table 2: Oil Capacity Data

	Avg. Eff. Oil Porosity (%)	Volume Oil (in^3)	Volume Oil (gal)
Geo-Textile Fabric	70%	161.26	0.70
XTEX Strips	93%	94.72	0.41
Total		**255.98**	**1.11**

Figure 4: City evaluating oil retention capability

[1] *Ultra-Drain Guard® Oil & Sediment Plus Catch Basin Insert*, Ultra Tech International sales documentation 2004

Filter Removal and Evaluation

The filters were installed starting at 7:00 AM on two successive Saturday mornings to ensure access to the catch basins and reduce traffic safety concerns. The student volunteers were provided with orange safety vests, a mechanical grate lifter and traffic cones to improve site safety. Typically one volunteer evaluated the catchment area for sources of sediment, oil contamination or trash, while three others installed the filter. After placement, the excess filter material was trimmed. Filters were installed in 4 hour shifts, with installation time for each filter averaging about 15 minutes. The catchment area of each catch basin was determined through field measurements and with the help of a Water Resources Protection GIS application.

Figure 5: Filter installation

Three of the proposed filters could not be installed due to blockage or inaccessibility of the grate. To complete their 10 hour volunteer commitment, during the next few months the students assisted City staff in lab work and filter evaluation.

Since the filters were in place for 6 months, the student volunteers were not available to help remove them. City staff removed the filters after an average service time of 185 days using a pickup truck equipped with a winch and crane. The filters were recovered with sediments intact so that they could be evaluated and studied. The crane permitted one person to safely lift the grate with the filter suspended below. The filter was then bagged and tagged for identification. Catch basin conditions and site conditions were recorded.

Figure 6: Filter sediment evaluation

The filters were transported to a covered area and hung to dry. After about 3 weeks of drying, they were examined and re-weighed.

Measurements

Of the 27 filters installed one was found missing at the end of the program. The remaining filters drained a total catchment area of 7.6 acres. The amount of rainfall in the program area was calculated to be about 17 inches, resulting in 3.5 million gallons (10.8 acre-ft) of flow through the filters. This averages to 135,000 gallon of water per filter.

The filters held a total of approximately 180 lbs of sediment for an average of about 7 lbs per filter. A metals analysis of the sediments, conducted as part of a separate study, found an average lead concentration of 174.8 ppm which indicates lead was removed with the sediment in the filters. Table 3 provides sediment accumulations for the individual catch basins and identifies problem areas. Sediments from 4 filters were analyzed for grain size distributions using standard testing sieves. Soil size distributions for the individual filters are shown in Table 4.

Table 3: Sediment Accumulation and Catch Basin Problem Areas

Catch Basin	Wet Sediment less filter (lbs)	Time in Service (days)	Average Rate of Accumulation (lbs/day)	Months to Replace Filter (20 lbs sediment)	Catch Basin Problems
CCB 1	8.4	190	0.0442	15	
CCB 2	7.2	190	0.0379	18	
CCB 3	11.4	190	0.0600	11	Dumpsters
CCB 4	3.0	188	0.0160	42	Oil
CCB 5	8.8	188	0.0468	14	Oil
CCB 6	Couldn't install				
CCB 7	2.8	188	0.0149	45	Leaves, Trash
CCB 8	Couldn't install				
CCB 9	2.8	188	0.0149	45	Oil
CCB 10	3.5	188	0.0186	36	Oil
CCB 11	2.1	188	0.0112	60	
CCB 12	Filter missing				
CCB 13	1.7	188	0.0090	74	
CCB 14	Couldn't install				Landscaping
CCB 15	16.4	188	0.0872	8	Sediment
CCB 16	2.6	188	0.0138	48	
CCB 17	7.0	190	0.0368	18	
CCB 18	11.6	190	0.0611	11	
CCB 19	11.9	188	0.0633	11	
CCB 20	4.2	188	0.0221	30	Trash
CCB 21	5.5	188	0.0293	23	Landscaping
CCB 22	5.9	184	0.0321	21	Trash
CCB 23	6.8	188	0.0362	18	
CCB 24	9.9	184	0.0538	12	Dumpsters
CCB 25	2.2	184	0.0117	57	
CCB 26	7.2	190	0.0379	18	
CCB 27	6.9	190	0.0363	18	
CCB 28	5.8	190	0.0305	22	Oil
CCB 29	11.9	190	0.0626	11	Oil
CCB 30	7.1	190	0.0374	18	Landscaping

Table 4: Sediment Size Distributions – Free Sediment from Sieve Analysis

Catch Basin	>1.18 mm (g)	>1.18 mm (%)	>212 µm (g)	>212 µm (%)	>75 µm (g)	>75 µm (%)	<75 µm (g)	<75 µm (%)	Total grams
CCB 2	1158.02	61%	539.3	28%	162.08	8%	50.22	3%	1909.62
CCB 9	261.92	51%	182.97	36%	54.13	11%	11.61	2%	510.63
CCB 11	268.08	68%	108.48	27%	16.09	4%	3.88	1%	396.53
CCB 28	743.96	53%	502.58	36%	127.91	9%	34.2	2%	1408.65
AVG		**58%**		**32%**		**8%**		**2%**	

Recommendations to Businesses

After evaluating the filters, a report was sent to each participating business to let them know the findings of the study. Although most of the catch basins were found to be functioning well, each report recommended a cleanout period for the catch basins. It was found that cleaning out the catch basins every year or two would be sufficient for the majority of the sites.

There were some catch basins that captured significant amounts of sediment or trash, and some filters had noticeable petroleum contamination. For those with high quantities of sediment, the site was evaluated. Often all that was required was a repair of curbing near landscaping. In some cases there were nearby trees that were contributing leaves or needles. One site in particular located near a Christmas tree sales area became clogged with needles in the winter. In that case a recommendation was made to install a filter during the Christmas season.

For the 4 areas exhibiting signs of petroleum contamination (indicated in the filters visually and by the distinct odor) recommendations were made to continue to use the catch basin filters and replace them annually. In these cases the lots had high volumes of traffic and parking, but sediment loads were average or below average, so annual replacement of filters was sufficient.

One site had a catch basin located in a recessed area by a loading dock. This location attracted windblown trash and debris, which tended to clog the catch basin quickly (Fig.7). For this site the City recommended installing a trash screen over the catch basin grate along with frequent site cleanups.

Figure 7: Filter with trash

Costs

The major costs for implementing the program were in hiring a temporary worker to coordinate the program and purchasing the filters. The college students' time was all volunteer.

Figure 8: City Operations designed grate lifter

The City Operations crew performed quick and effective catch basin cleaning at a rate of $65 per catch basin. A hook scale was purchased for $150 to provide sediment weight data.

A staff member in the City's Surface Water Operations group designed and built a useful grate lifting tool which allows one person to easily lift catch basin grates (Fig. 8).

The total cost of the program, not including any water analysis, was approximately $12,300. Table 5 shows a breakdown of the costs for implementing the Grate Mate type program.

Table 5: Program Cost Data

Item Description	Vendor	Unit Cost	Quantity	Total Cost
Filters (50)	Planet CPR	$ 84.50	50	$4,225
Grate Mate Coordinator	Temp Agency	$20 / hour	280 hrs	$5,600
Vacuum Catch Basins	City of Vancouver	$ 65	25	$1,625
Grate Lifter	City of Vancouver	$ 350	1	$350
Safety Vests	Sanderson's	$ 18	5	$90
pH Meter	Online	$ 240	1	$240
Scale (100 lbs)	Online	$ 150	1	$150
Miscellaneous Supplies				$50
Total				**$12,330**

Funding for this program was provided by the City of Vancouver and by a Centennial Clean Water grant through the Washington Dept. of Ecology.

Conclusions

In implementing a Grate Mate style program the City hoped to install and monitor catch basin filters to detect which catch basins were receiving excessive quantities of sediment, trash or petroleum contaminants. Rather than implementing a long-term program of catch basin filter installation and maintenance, the City believed that making one-time modifications to problem areas would provide a cost effective way of improving water quality in the Andresen Basin.

Although most of the catch basins in the private roads and parking lots were functioning well, City staff and students were able to identify a few catch basins with excessive accumulation problems. These problems were significantly reduced or eliminated by providing focused site maintenance and catch basin filters. Final program reports sent to the business owners provided GIS maps of the sites (Fig. 9) and detailed catch basin recommendations.

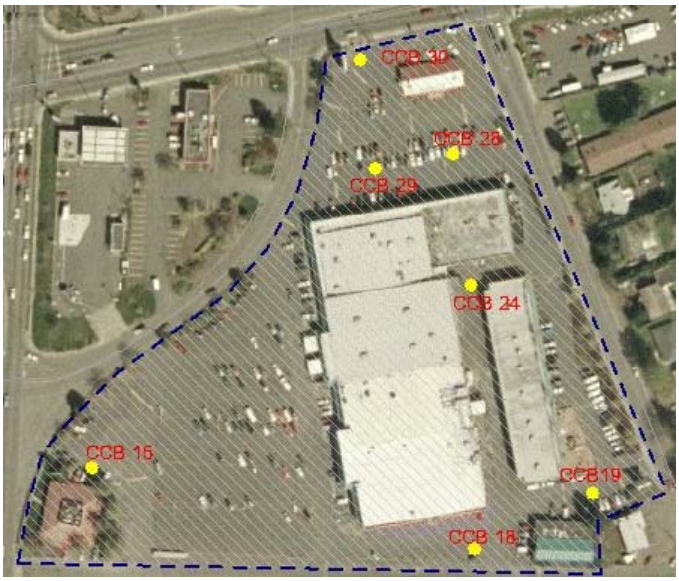

Figure 9: A GIS site map sent to a participating business

The City is sampling Burnt Bridge Creek for water quality, but it will be a while before we see any measurable impact to the stream. We will, however, continue to work with businesses in the area to keep their private storm systems maintained and functioning effectively.