

Five

Recommended Programs To Meet Utility Goals

This chapter describes recommended programs to meet the Surface Water Utility's goals of flood reduction, water quality improvement, and aquatic habitat protection and restoration. The recommended programs are designed to address requirements for compliance with state and federal regulations, as well as the City's vision for protection and restoration of its water resources. Table V.1 provides a summary of the new program elements being recommended in relation to the goals addressed and Surface Water Utility programs for implementation. The program elements described in this chapter are in accordance with the overall strategies of (1) protecting the city's natural resources, (2) optimizing infrastructure, (3) balancing public and private responsibilities, (4) involving the community, and (5) exploring and encouraging innovative solutions to stormwater problems. Table V.2 gives an overview of recommended staffing to accomplish Utility goals. Implementation of the programs described in this chapter will set the course for the sustainable management of Kirkland's watersheds.

V.A Operations and Maintenance Introduction

The Operations and Maintenance (O&M) Division provides cleaning and rehabilitation of City infrastructure with the objectives of protecting public health and safety, minimizing life cycle costs, and protecting water quality. Since creation of the utility in 1998, the O&M Division has made significant gains in annual cleaning frequency and quantity of system rehabilitation over pre-utility times. The first part of this section will lay out existing system inventory, maintenance standards, crew configurations, and production standards and will summarize tasks and costs of the existing maintenance program. The second part recommends changes to services that will meet regulatory and other needs over the next 5 to 10 years.

Existing Program

The existing program is described in terms of these elements:

- system inventory
- program overview – task and direct cost detail
- average productivity
- crew configurations
- frequency of cleaning activities

A more accurate facility inventory is now available (Table V.A.1) as a result of work by the O&M Division in cooperation with the Citywide Geographic Information System (GIS) Program. The current number and length of facilities exceeds that estimated in the 1994 Surface Water Master Plan (Beck 1994) due to the addition of structures and improved mapping capabilities. The current system inventory is the basis for program cost estimation.

Table V.A.2 lists the current work program of the O&M Division. The following items augment basic cleaning, maintenance, and rehabilitation activities conducted by the O&M Division:

- Creation and maintenance of a computerized stormwater system inventory (mapping and GIS)
- Implementation of a maintenance management information system (MMIS) and associated data entry to allow for improved performance measurement and documentation of activities
- Video inspection of pipes to determine need for repair and replacement
- Maintenance and rehabilitation work in support of the annual street overlay program

Table V-1. Summary of New Surface Water Utility Program Elements																	
PROGRAM	Element Number	Description	Surface Water Utility Goals Addressed			Programs Involved (Bold indicates primary program)						Cost					
			Flood Reduction	Water Quality Improvement	Aquatic Habitat Protection and Restoration	Maintenance and Operations	Capital Improvement Program	Development Review and Standards	Public Education and Outreach	Code Enforcement and Technical Assistance	Policy Analysis and Regulatory Compliance	Monitoring and Research	One Time	Annual	New Staff		
MAINTENANCE	1	Increased Maintenance Frequencies	X		X	X											
	2	Condition Rating System	X		X	X											
	3	System rehabilitation Associated with Transportation Projects	X	X	X	X										\$90,000	
CAPITAL IMPROVEMENT	4	Surface Water CIP Project List (includes private streambank stabilization projects)								X							\$494,167
	5	System Replacement Fund	X	X													\$581,000
											Subtotal Maintenance Costs		\$0	\$90,000	1.0 FTE		
											Subtotal Capital Improvement Costs		\$0	\$1,075,167			

Table V. 2 Recommended Staffing for the Surface Water Utility	
Position Title	Full Time Employees (FTE)
Customer Service	
Senior Surface Water Utility Engineer	1.0
Surface Water Utility Engineer	2.5 [includes 0.5 new FTE]
Subtotal	3.5
Maintenance Supervision and Administration	
Storm/Sewer Division Manager	0.5*
Senior Accountant	0.2*
Accounting Associate	0.32*
Office Specialist	0.1*
Subtotal	1.12
Maintenance	
Lead Person	0.75*
Senior Maintenance Person	2.5*
Utility Craftsperson	0.15*
Utility Person	6.0 [includes 1.0 new FTE]
Yard Maintenance/Inventory Control	0.15*
Subtotal	9.55
Grand Total	14.17

Note: Fractional FTEs marked with a * represent full-time positions that are funded jointly by other Utility funds and/or the General Fund.

Table V-A.1 Stormwater System Inventory			
System Element	Number or Length	Estimated Number in 1994 Master Plan	Change Since 1994 Plan Estimate
Catch-basins, manholes, and cleanouts	9,859 structures: Type I Type II Cleanouts 7	6691 structures	+ 3168 structures
Tanks	309 structures	75 structures	+ 370 structures
Vaults	136 structures		
Detention Ponds	39 ponds	16 ponds	+23 ponds
Private Detention/WQ Facilities (inspection only)	400 structures	220 structures	+180 structures
Ditches and Swales	179,226 linear feet (33.94 miles)	163,680 linear feet	+ 15,546 linear feet
Culverts	789 structures, total 39,112 linear feet (7.4 miles)	40 "outfalls, major culverts, streams"	Can't compare
Pipes	110,761 structures, total 831,332 linear feet (157.45 miles)	520,576 linear feet	+ 310,750 linear feet
Streets	165 miles	143 miles	+22 miles

TABLE V.A.2 Surface Water Maintenance Program Summary						
		Cost Detail		Sample Average Annual Production ¹	Frequency of Citywide Task Completion ²	Task as percent of overall direct maintenance expenditures
Small Works Capital Construction						
	Add new structures as needed to maintain system function, and construct small neighborhood projects	Labor	\$21,144	455 feet of pipe and 8 catch basins	N/A	
		Professional Services (engineering)	\$1,650			
		Tools and Supplies	\$4,750			
		Equipment	\$16,324			
		Subtotal	\$43,868			6%

TABLE V.A.2 Surface Water Maintenance Program Summary (cont.)

		Cost Detail		Sample Average Annual Production ¹	Frequency of Citywide Task Completion ²	Task as percent of overall direct maintenance expenditures
Pipe, and catch basin and maintenance hole cleaning						
	Remove sediment and roots and clean structures	Labor	\$73,701	1,375 catch basins and maintenance holes, and 17,400 linear feet (3.3 miles) of pipe cleaned resulting in approximately 260 cubic yards of material removed from the City drainage system.	Catch basins and maintenance holes and pipes cleaned once every 3 to 5 years as needed based on inspection	
		Tools and Supplies	\$5,350			
		Equipment	\$66,712			
		Subtotal	\$145,763			19%
Video Inspection³						
	Inspect condition of pipes, and determine causes of blockages or other problems	Labor	\$20,856	Program is new in 2005 and production measures are not yet available	N/A	
		Equipment	\$11,520			
		Subtotal	\$32,376			4%
Detention System Maintenance						
	Inspection and maintenance of detention systems. Maintenance includes sediment removal, vegetation management (open ponds), and repair of structures.	Labor	\$47,124	57 detention facilities inspected, 21 detention facility structures repaired, 72 underground detention facilities cleaned, vegetation maintenance performed 10 times per year at 39 ponds	All City flow control and water quality facilities inspected once per year	
		Tools and Supplies	\$19,300			
		Equipment	\$10,351			
		Subtotal	\$76,775			10%

TABLE V.A.2 Surface Water Maintenance Program Summary (cont.)

		Cost Detail		Sample Average Annual Production ¹	Frequency of Citywide Task Completion ²	Task as percent of overall direct maintenance expenditures
Rehabilitation						
<i>It is recommended that this category be increased by 29% in labor supplies and equipment to reflect 29% increase in the Annual Street Preservation Program Budget</i>	Repair and replace pipes catch-basins and other structures in advance of the annual street preservation program	Labor	\$125,566	115 catch basins and maintenance holes rehabilitated, 45 catch basins and maintenance holes 580 feet of pipe removed and replaced	Needs depend on Annual Street Preservation Program, which typically include 5 miles of streets	
		Tools and Supplies	\$66,050			
		Equipment	\$68,111			
		Subtotal	\$259,727			34%
Ditch Cleaning						
	Clear out debris, regrade reseed roadside ditches	Labor	\$6,857	1,000 feet of ditch regraded and reseeded	Most ditches in the City are maintained by the adjacent property owner	
		Tools and Supplies	\$1,250			
		Equipment	\$13,790			
		Subtotal	\$21,897			3%
Waste Disposal						
	Dipose of solid and liquid wastes from maintenance tasks including educator waste, street sweeping waste, debris from vegetation removal at detention ponds, and asphalt concrete and metal debris from rehabilitation activities	Labor	\$18,610	1200 cubic yards of material exported	N/A	
		Sample analysis of wastes	\$750			
		Disposal fees	\$30,000			
		Equipment	\$8,127			
		Subtotal	\$57,487			8%

TABLE V.A.2 Surface Water Maintenance Program Summary (cont.)

		Cost Detail		Sample Average Annual Production ¹	Frequency of Citywide Task Completion ²	Task as percent of overall direct maintenance expenditures
Street Sweeping⁴						
	Sweep streets to reduce discharge of sediment and associated pollutants to the storm drainage system	Labor	\$30,418	Approximatley 3400 lane miles ⁵	Each street swept approximately 11 times per year with high traffic areas and downtown swept more frequently	
		Equipment	\$63,699			
		Subtotal	\$94,117			12%
ESA Impacts to Roadway, Roadside, and Sidewalk Maintenance						
This fund pays for ESA-related costs of General Fund roadway, roadside, and sidewalk activities	Additional labor materials and equipment to minimize pollution from maintenance activities in order to protect water quality as required under the Endangered Species Act listing of Chinook Salmon as a Threatened Species	Labor	\$31,238	N/A	N/A	
		Equipment	\$2,119			
		Subtotal	\$33,357			4%
Total Annual Direct Costs			\$765,367			100%
Benefits Overhead and Supervision			\$640,000			
Current Total Annual Program Cost			\$1,405,367			
Recommended Annual Program Cost			\$1,495,367			

TABLE V.A.2 Surface Water Maintenance Program Summary (cont.)

Notes:

1. Annual productivity is estimated by averaging actual productivity from 2003 and 2004 without taking into account any shifts in priorities and budget allocations. Actual productivity varies greatly depending on weather conditions (the system collects more sediment in wet years, and thus the number of structures cleaned may be smaller even though the amount of sediment removed from the system is greater), nearby construction activities, high traffic volumes, and condition of the system (rehabilitating a relatively new catch basin takes less time than rehabilitating an older structure), and geographic location of work (replacing two short sections of pipe in different parts of town takes more time than replacing a long section in a single location). This column includes samples of productivity measures and does not represent all work performed under that maintenance category. Some tasks such as system investigation and mapping do not lend themselves to development of productivity measures.

2. This refers to the percentage of the citywide occurrence of that task that is done each year. For example, if there are 1000 catch-basins citywide, and average annual production is 500 catch basins, this would mean that all catch basins in the city are cleaned once every 2 years.

3. Costs for video inspection are shared between the Sewer and Surface Water Utilities.

4. Costs of street sweeping are split 50-50 between the Street Maintenance Fund (part of the City General fund) and the Surface Water Utility fund

Table V.A.2 lists average annual productivity for selected maintenance activities in 2003 and 2004. Several factors have influenced productivity over the last 10 years. The addition of a second eductor truck, which occurred with Surface Water Utility formation in 1998, increased productivity for cleaning tasks. At the same time, modification of maintenance practices to comply with the ESA Regional Road Maintenance Program has reduced productivity because of requirements for increased pollution prevention; increased setup and cleanup time for jobs that must control sediment discharges and wet weather or seasonal work restrictions reduce efficiency. The amount of cleaning required for each structure is largely determined by the weather (more sediment reaches the system in wet years), construction activities, and traffic volumes, so cleaning work productivity is variable. Examination of sediment removal rates gives a good indication of this issue.

The standards and thresholds for cleaning and maintenance of stormwater facilities are drawn from the 1998 King County Surface Water Design Manual (King County 1998). Current maintenance frequencies are shown in Table V.A.2. These frequencies are in line with those of other local municipalities and appear to be sufficient, as staff have indicated that most structures are within maintenance standards when cleaning takes place.

Optimal crew configurations for various tasks are listed in Table V.A.3. These configurations have not changed significantly since the 1994 plan was completed.

Recommended Program

Changes are recommended to the existing O&M program to address (1) increased inspection and maintenance frequencies to meet requirements of the City's Phase II NPDES permit and reduce debris-related flooding, (2) infrastructure rehabilitation associated with the expanded street overlay program, and (3) implementation of a condition rating system for aging or failing infrastructure. The operations and maintenance changes described below meet several City objectives, including reduced flooding, improved water quality and aquatic habitat, and compliance with applicable stormwater regulations.

Increased Inspection and Maintenance Frequencies

The draft NPDES Phase II permit (Ecology 2005) was issued by the Washington State Department of Ecology in May 2005 (the permit is to be finalized in spring of 2006). The draft permit outlines O&M requirements by permittees, including inspection and maintenance frequencies and requirements. The City's existing inspection and maintenance frequencies appear to be within the range required in the draft permit, therefore no changes are recommended solely for the purpose of meeting permit conditions. However, between-storm maintenance inspections should be increased to reduce debris-related flooding. Increased inspection and maintenance, in conjunction with expanded resident education (described in Section V.D.), should help alleviate fall flooding associated with clogged catch basins. When the final NPDES Phase II permit is issued, the inspection and maintenance frequencies should be reviewed for compliance with the final permit conditions.

Infrastructure Rehabilitation Associated with the Street Overlay Program

There is a proposed increase in the annual street overlay program from \$1.4 million to \$1.8 million per year. The proposed 29% increase will require increased infrastructure rehabilitation work by the Surface Water Utility O&M program; a proportional increase for infrastructure rehabilitation is recommended.

Rehabilitating surface water infrastructure in conjunction with the annual street overlay program makes a lot of sense from an efficiency standpoint. Resources, such as traffic control and construction equipment, can be utilized by both departments, minimizing costs and disruption to the traveling public. Capacity issues should be identified prior to the start of rehabilitation work so that facilities can be replaced with appropriately sized facilities to alleviate capacity-related flooding problems.

Infrastructure Condition Rating System

An infrastructure condition rating system was recommended in the 1994 Surface Water Master Plan but was never implemented due to insufficient mapping of the existing system and the lack of video inspection equipment. Mapping of the stormwater system was completed in 2003 and video inspection equipment was funded in 2004, making it now feasible to implement a condition rating system. A condition rating system and periodic inspection program will help the utility prioritize maintenance, rehabilitation, and CIP work; more accurately budget for replacement of aged or failing infrastructure; and conduct proactive maintenance. This will provide a higher level of service by preventing safety issues and flooding that could be caused by unanticipated failures.

In 2004 the City developed and implemented Maintenance Management and Information System (MMIS) software. Condition rating is an integral part of this system, which manages inventory and maintenance history of structures. MMIS also can interface with the Citywide GIS database, so that maps of system condition can be produced. The MMIS should be the starting point for development of the condition rating system.

As infrastructure is identified for replacement through the condition rating system, hydraulic modeling should be conducted to determine the correct pipe sizes to accommodate flows from existing and potential future development (especially from infill development that may not trigger flow control thresholds).

Staff and Resource Needs

Table V.A.3 gives an overview of staffing needs for the proposed O&M program. Costs associated with any increase in maintenance frequency required by the NPDES Phase II permit should be evaluated once the final permit is issued. It is recommended that 1 FTE utility worker and associated equipment be added to support the increase in the annual street preservation program. Direct labor and equipment costs of this increase are approximately \$73,000 per year, and total costs (in other words including benefit costs for workers) are approximately \$90,000 per year. Costs to implement a condition rating system will be minimal and can be accommodated with existing staff and equipment levels. Hydraulic modeling associated with condition rating can be accommodated within the existing study budget in the Monitoring and Research Program (See Section G of this chapter).

The recommended program would be fully funded with a budget of approximately \$1.7 million, which includes an increase of \$90,000 per year, or about 5%, over existing funding. Tasks would be as shown in Table V.A.2 with the major change being the 29% increase in rehabilitation activities associated with the Annual Street Preservation Program.

TABLE V.A.3 Optimal Crew Configurations		
	Activity	Recommended Crew Configurations
1	Clean Catch Basins	2 Maintenance Workers 1 Eductor
2	Clean Manholes	2 Maintenance Workers 1 Eductor
3	Clean Outfalls, Major Culverts, Streams	2 Maintenance Workers 1 Flatbed
4	Roadside Ditches (Remove sediments)	4 Maintenance Workers 1 Backhoe, 1 Dumptruck, 1 Pickup
5	Biofiltration Swales (Vegetation control)	1 Maintenance Workers 1 Mower
6	Clean Pipes	2 Maintenance Workers 1 Eductor
7	Regional Detention Basins (Vegetation Control)	2 Maintenance Workers 1 Flatbed
8	Regional Detention Basins (Remove Sediments)	2 Maintenance Workers 1 Backhoe, 1 Dumptruck
9	On-site Detention Basins (Inspect)	2 Maintenance Workers 1 Eductor
10	Clean Streets	1 Maintenance Workers 1 Street Sweeper
11	Clean Detention Vaults	3 Maintenance Worker 1 Eductor, 1 Flatbed
12	Repair Replace Catch Basins	3 Maintenance Workers 1Backhoe, 1 Dumptruck,1 Flatbed
13	Repair, Replace Manholes	3 Maintenance Workers 1 Backhoe, 1 Dumptruck,1 Flatbed
14	Repair, Replace Pipes	3 Maintenance Workers 1 Backhoe, 1 Dumptruck,1 Flatbed

V.B Capital Improvement Program

Introduction

The Capital Improvement Program (CIP) includes construction projects to reduce flooding, improve water quality and restore aquatic habitat. Most CIP projects proposed here either mitigate impacts that occurred prior to regulation of the quantity and quality of stormwater discharges from development projects or serve to protect and maintain existing stormwater infrastructure and natural areas. In aggregate, the projects will provide significant increases in the use and enjoyment of our water resources.

This section includes discussion of *which* projects will get built and in what order: process and procedures for *how* design and construction are achieved lies within the Capital Projects Group within Public Works. The Capital Projects Group provides design and construction management for all areas within Public Works, including water, sewer, transportation, and surface water. The Surface Water Utility will provide support and coordination to the Capital Projects Group as needed on design, construction, and environmental issues, especially regarding watershed-level analyses.

Proposed Surface Water Capital Projects

Potential CIP projects were identified using data and information from a variety of sources, including citizen complaints, maintenance staff issues/complaints, and the habitat survey and HSPF modeling conducted by Parametrix (Appendices E and J). A list of potential projects was compiled (see Table 4-3 of Stream Inventory and Habitat Evaluation Report, Appendix F), and then technical and feasibility analyses and engineering judgment were used to refine the list. A recommended alternative for each project was developed using cost analysis and engineering judgment. In addition to location-specific projects with identified alternatives, two citywide projects were identified for inclusion in the CIP. These projects are (1) a fund for the replacement of aging and failing infrastructure, and (2) regional detention in Forbes Creek watershed (location to be determined). A fund has also been established for the surface water portion of transportation projects, although this is not listed as a separate CIP project, as discussed in Section V.B.3.

Table V.B.1 and Figure V.B.1 present a summary of proposed projects. Full descriptions, including a map and detailed costs, are presented in Appendix H. The total cost of these projects is \$8,665,000 in 2004 dollars. Financial analysis of costs, including inflation, is discussed in Chapter VI.

It is recommended that all of the proposed CIP projects, with the exception of CIP FO-09 (daylighting Forbes Creek under the Airshow Industries parking lot), be constructed within the next 6 to 10 years. The projects have been prioritized, as shown in Table V.B.1. The prioritization criteria (see Appendix I) used as a starting point in this process include the following:

- Nexus between the project and other City projects/efforts
- Impact of the project on public health and safety (i.e., projects to protect health and safety will generally be built first)
- Location of an aquatic habitat project within a watershed – it is generally preferred to construct habitat projects beginning at the headwaters of the system and working downstream, unless there are fish blockages limiting upstream access by anadromous salmonids, in which case fish barriers should be removed first
- Impact of the project on maintenance needs
- Impact of the project on fish habitat
- Impact of the project on water quality
- Level of public interest in and support for the project

Projects have been identified on both public and private property. The decision to construct on public vs. private property depended on cost and ecological benefits. Funding for projects located on private property would come from the private streambank stabilization fund. Projects eligible for these funds were ranked using the private streambank stabilization criteria shown in Appendix J. These criteria focus on the impact of the project on public and private property and fish habitat. General descriptions of CIP projects recommended for private and public property, as well as non location-specific CIP projects are discussed below.

Table V.B.1 Proposed Surface Water CIP Projects - Prioritized with Private Streambank Projects Identified									
Comp Plan Project #	2004-2009 CIP Project #	Project Name/ description	2004 Estimated Cost	Basin	Major Focus	2005 cip ranking	Streambank Eligible?	Associated Projects	Comments
CA-1		Carillon Woods Park Erosion Control	\$188,000	Carillon	Water Quality (erosion)	28	No	None	Monitor stream channel to determine whether project is needed
CO-01		Culvert improvement at Lake Washington Blvd	\$845,000	Cochran Springs	Habitat/ Flooding (proactive)	39	No	None	Berm installed by adjacent property owner may have solved problem
CW-1		Regional detention in Forbes and Juanita	\$1,500,000	Forbes and Juanita	Habitat	46	No	Habitat projects on Forbes Creek: FO-05, FO-07, FO-08	Construct before habitat projects, after I-405 construction - prioritize once specific concept developed
CW-2		Replacement of aging/failing infrastructure	per year cost	Various	Flooding/ Water Quality		No		Identify projects through video inspection and condition rating
CW-3a, CW-3b	SD-0036	Surface water sediment pond reclamation	\$156,000	Various	Water Quality		No		
FO-01		108th Ave NE fish passage improvements	\$129,000	Forbes	Habitat	52	No	FO-05/FO-07/FO-08	Construct before I-405 construction, before FO-05/FO-07/FO-08
FO-03		NE 95th/126th NE flood control	\$50,000	Forbes	Flooding	32	Yes	FO-14	Observe conditions after FO-14 NE 85th Detention construction - may not need project
FO-04	SD-0537	Streambank Stabilization at NE 86th Street	\$385,000	Forbes	Water Quality (erosion)	31	Yes	FO-14	Construct after FO-14 NE 85th Detention
FO-05		Forbes Creek Culvert (King County Property)	\$249,000	Forbes	Habitat	62	Yes	FO-07/FO-08	Construct after I-405 fish passage improvements, and at same time as FO-07/FO-08
FO-06		Driveway crossing repair at 10041 Slater Ave NE	\$50,000	Forbes	Habitat	34	Yes		low priority - work with property owner on intermediate fix
FO-07		Channel grade controls near Coors pond	\$234,000	Forbes	Habitat	59	Yes	FO-05/FO-08	Construct after I-405 fish passage improvements, and at same time as FO-05/FO-08
FO-08		BNSF fish passage	\$194,000	Forbes	Habitat	50	Yes	FO-05/FO-07/FO-08	Construct after I-405 fish passage improvements, and at same time as FO-05/FO-07
FO-09		Culvert under parking lot at Airshow Industries	don't include - not a feasible project	Forbes	Habitat		Yes		
FO-10		Riparian planting upstream of 98th Ave NE bridge	\$58,000	Forbes	Habitat	38	No		Coord with Juanita Bay Park Veg Mngmt Plan
FO-11		Fish passage and riparian planting at in-line ponds	\$76,000	Forbes	Habitat	30	Yes		Coord with private property owners
FO-12	SD-0033	NE 90th/120th NE Sediment Control	\$169,000	Forbes	Water Quality	32	No		

Table V.B.1 Proposed Surface Water CIP Projects - Prioritized with Private Streambank Projects Identified (cont.)									
Comp Plan Project #	2004-2009 CIP Project #	Project Name/ description	2004 Estimated Cost	Basin	Major Focus	2005 cip ranking	Streambank Eligible?	Associated Projects	Comments
FO-13	SD-0043	124th Ave NE/NE 100th Place Drainage Improvements	\$132,000	Forbes	Flooding	48	No		In response to claim - high priority
FO-14	SD-0025	NE 85th Street Detention and Sediment Control	\$485,000	Forbes	Flooding/ Water Quality	42	No		
HSB-1	SD-0044	NE 47th Place Surface Water Outfall	\$96,000		Water Quality (erosion)	46	Yes		potential claim - high priority
JU-02		Channel improvements in Juanita Beach Park	\$262,000	Juanita	Habitat	65	No	JU-03/JU-04/JU-10	coord w/ \$500k Finkbeiner grant - reduce sediment delivery to Juanita Beach as Finkbeiner project is constructed
JU-03	SD-0039/0041	NE 126th Pl at 94th Ave NE Channel restoration	\$164,000	Juanita	Water Quality (erosion)	44	Yes	JU-02/JU-04/JU-10	coord w/ \$500k Finkbeiner grant - reduce sediment delivery to Juanita Beach as Finkbeiner project is constructed
JU-04	SD-0039/0041	NE 125th Pl at 95th Ave NE sediment pond	\$169,000	Juanita	Water Quality (erosion)	59	No	JU-02/JU-03/JU-10	coord w/ \$500k CTED grant - reduce sediment delivery to Juanita Beach as Finkbeiner project is constructed
JU-06		NE 128th Street riparian planting	\$69,000	Juanita	Habitat	35	No		combine planting project with sediment pond reclamation - relatively low priority
JU-09		Totem Lake Blvd flood control	\$1,017,000	Juanita	Flooding	41	No		coordinate with Totem Lake Mall redevelopment - conduct HEC_RAS modeling of area between Totem Lake and Juanita High School
JU-10		Bank stabilization at NE 121st St	\$97,000	Juanita	Water Quality (erosion)	63	Yes	JU-02/JU-03/JU-04	Highest priority habitat project on Juanita Creek
JU-11	SD-0037	Juanita High School ped bridge and channel restoration	\$269,000	Juanita	Water Quality	40	Yes		move to unfunded - good project but lacks current support of school district
JU-12	SD-0029	124th Ave NE/NE 124th Water Quality Treatment	\$362,000	Juanita	Water Quality	51	No		Coordinate with transportation project
UMB-01		Everest Park Channel and Riparian Restoration	\$518,000	Urban - Moss Bay	Water Quality (erosion)	41	No		sediment control
UMB-02		Post Office Creek flood control	\$161,000	Urban - Moss Bay	Flooding	39	No		have paid flooding claims - high priority
Total Cost		Estimated Cost of Projects	\$8,084,000						

Table V-B.2 Summary of Surface Water Management Capital Projects On or Adjacent to Park Property					
Project ID	Project Name	Park Affected	Purpose	Estimated Cost	Comments
CA-01	Carillon Woods stream channel erosion control	Carillon Woods Park	Stabilize channel, reduce delivery of sediment to Carillon Point	\$188,000	Coordinate with master plan for park
CO-01	Culvert improvement at Lake Washington Blvd and sediment control downstream of Lake Washington Blvd	Yarrow Bay Wetlands	Increase culvert capacity, improve fish passage conditions, reduce flooding of office park	\$845,000	Adjacent to park (may required small amount of construction in wetland). Project low priority unless flooding of Lake Washington Boulevard is observed
CW-1	Regional detention in Forbes and Juanita	Location to Be Determined	Reduce peak flows to reduce channel and protect/restore aquatic habitat	To Be Determined	Facilities could be multi-use (flooded occasionally, used for recreation most of the time)
FO-01	108th Ave NE fish passage improvements and roadway drainage	Juanita Bay Park	Improve fish passage	\$129,000	Coordinate with vegetation management plan and master plan for park
FO-10	Riparian planting upstream of 98th Ave NE (Market Street) Bridge	Juanita Bay Park	Increase shade and food sources by removing invasive species and adding native vegetation	\$58,000	Coordinate with vegetation management plan and master plan for park
JU-02	Channel improvements in Juanita Beach Park	Juanita Beach Park	Improve in-stream physical habitat and add riparian vegetation	\$262,000	The Washington State Legislature has allocated \$500k for improvements, including stream work – coordinate with master plan work
JU-06	Riparian planting on City-owned parcel downstream of NE 128th Street	Brookhaven Park	Increase shade and food sources by removing invasive species and adding native vegetation	\$69,000	Good opportunity for volunteer restoration project
UMB-01	Everest Park channel and riparian restoration	Everest Park	Reduce erosion and improve water quality by stabilizing channel, removing invasive species, and planting native vegetation	\$518,000	Build on volunteer restoration work already completed by Surface Water Program
Total				\$2,069,000	

Private Streambank Stabilization Projects

Projects are proposed on private property when the public benefits of doing so outweigh those of an alternative that could be constructed on public property. Restoration of an eroding stream channel on private property, for example, may provide greater public benefit at a lower cost than a project to bypass high flows around the eroding area that is located on public property. A side benefit of these projects may be protection and restoration of private property.

In 2001, the City Council voted to allocate \$350,000 per year toward private streambank stabilization projects. This money is segregated within the surface water CIP, as it was found that streambank erosion projects could not be prioritized against projects that solve large-scale flooding problems with associated safety hazards; safety hazards would and should always take precedence, meaning that streambank projects would not get funded. Table V.B.1 identifies eleven “Private Streambank Eligible” projects that would be constructed on private property. The private streambank stabilization projects are designed to reduce erosion and delivery of sediment to the public drainage system, improving water quality.

Projects on City Parks Property

Seven projects are proposed on City Park property (Table V.B.2). These projects represent a good opportunity to showcase City management of natural areas, improve water quality, and provide educational opportunities for park users. Most of these projects are designed to improve water quality and aquatic habitat through enhanced riparian planting, in-stream channel improvements, bank stabilization, and elimination of fish passage barriers. These projects will need to be carefully coordinated with the Parks Department, including development of a public outreach process on project design, construction management to minimize impacts to park use, and determination of maintenance responsibility. The Park Planning and Development section of the Parks Department will be the main point of contact for this work, and the Natural Resources Management Team will get involved as necessary.

Fund for Replacement of Aging and Failing Infrastructure

A fund to replace aging and failing infrastructure is recommended for inclusion in the CIP so that infrastructure replacement can be budgeted and planned for, rather than conducting replacement in an emergency situation. Projects will be identified through the condition rating system implemented in the maintenance and operations program (Section V.A.3.c).

Regional Detention Facility

One of the purposes of conducting hydrologic modeling for this plan (HSPF Analysis of Forbes and Juanita Creeks, Appendix C) was to evaluate the impact a regional detention facility would have on mitigation of peak streamflow volumes, durations and frequencies for existing and future developed conditions. The results indicate that regional detention constructed within the Kirkland city limits would have little impact on reducing downstream peak flows in the Juanita Creek watershed. The facility would have little impact if it detained to existing conditions criteria. It would have significant impact if detaining to a predeveloped flow criteria, but the ponds would be enormous and not feasible. Most of the Juanita Creek basin is currently outside the City limits. If the portion of the Juanita Creek basin currently located in King County is annexed by the City, regional detention possibilities upstream should be reevaluated at that time.

In the Forbes Creek watershed, regional detention in combination with on-site flow control associated with new development, would be the most effective method of reducing peak stream flows from new development and from existing impervious surfaces. The size of a regional facility is dependent on the where in the watershed the facility is located and to what conditions the City chooses to mitigate. For example, if a facility was sited in the upper part of Forbes Creek watershed where a lot of future development is projected, the facility would need to be approximately 18 acre-feet to mitigate future flows to existing conditions. In the same location, the facility would need to be 660 acre-feet in size if the City chooses to mitigate future and existing flows to pre-developed, forested conditions. It is therefore not feasible to mitigate future and existing flows to pre-developed, forested conditions solely with a regional detention facility, however, with a combination of flow control strategies such as regional and on-site detention, in addition to the adoption of low impact development techniques, it may be possible to reduce the deleterious effects of past development on instream flow regimes in Forbes Creek. There is still more policy-related analysis that needs to occur before a regional detention facility can be sized and sited in the Forbes Creek watershed. This analysis will occur over the next several years through the policy and regulatory compliance and development review and standards programs.

Surface Water Portion of Transportation Projects

In October of 2004, the City Council voted to dedicate approximately \$1 million per year in Surface Water Utility funds toward the surface water portion of transportation projects. This money will be used to construct surface water facilities that are required under current drainage regulations to mitigate for the impacts of transportation projects. In addition, these funds can be used to add water quality treatment and detention facilities to transportation projects, providing watershed-scale benefits.

Funding these facilities out of the Surface Water Utility will allow and encourage a watershed-scale approach to mitigation. The utility will make efforts to coordinate and consolidate facilities and to plan facilities that will provide the greatest environmental benefit for dollars invested.

Transportation projects can affect surface water resources in two ways. First, crossing over or passing through streams and wetlands degrades or eliminates physical habitat features and associated ecological functions. Second, peak stormwater flows and discharge of pollutants increases as impervious surface is added. Surface water design requirements for transportation projects are similar to those required for other types of development projects (see discussion in Section V.C., Development Review and Standards).

To minimize impacts and potentially provide watershed-wide benefits, it is recommended that the utility study and coordinate the following issues at the watershed level:

- stream/wetland mitigation
- water quality treatment, both required and voluntary augmentation
- flow control facilities
- incorporation of low-impact development projects and techniques

GIS analysis and hydraulic and/or water quality modeling can be used at the watershed or subbasin scale to determine the best way to mitigate impacts and to provide retrofit benefits as feasible.

The HSPF modeling conducted for this plan (Appendix C) will serve as a starting point for locating flow control facilities and analyzing conveyance issues and facilities in the Forbes and Juanita Creek watersheds.

Resource Needs

The total cost of the recommended list of surface water capital projects is \$8,084,000 in 2004 dollars. An additional \$1million per year will be allocated to the surface water portion of transportation projects and \$581,000 will go to fund a system replacement reserve. It is also recommended that funds be allocated for study and coordination of transportation-related surface water impacts as discussed in Section V.G., Monitoring and Research. Funding for capital projects includes City staff time as well as design and construction-related costs, so no additional staff resources are needed. Review will be conducted with the Capital Projects Group to ensure that staff levels in that group are sufficient to support the proposed surface water CIP program and schedule.

V.C Development Review and Standards

Current Work and Priorities

The development review and standards program provides the following services to other City departments and private developers:

- Review the surface water portion of development proposals to ensure that these projects meet City codes and standards for surface water management.
- Adopt and maintain codes and standards for surface water design.
- Provide watershed-level tools and information to developers so that impacts are mitigated in an efficient and cost-effective manner, providing the greatest possible protection of water resources.

These services protect water resources and reduce public costs while minimizing cost and impact to development projects.

Recommended Priorities and Work

The general work of development review and standards will continue as listed above. The following work items are recommended to ensure City compliance with state and federal regulations and to increase public/private coordination where environmental benefits and cost savings could be achieved.

Surface Water Design Standards

As part of the NPDES Phase II permit, the City will likely be required to adopt surface water design standards that are equivalent to those in the 2005 *Stormwater Management Manual for Western Washington* (Ecology manual) (Ecology, 2005). Choices for meeting this requirement are the 2005 Ecology manual itself, or the 2005 King County Surface Water Design Manual (KCSDM) (King County 2005). Use of either manual will result in significantly increased flow control requirements, especially for redevelopment projects. Appendix K shows flow control volumes that would be required under existing and proposed standards for several sample projects in Kirkland. Water quality treatment volumes under the new standards would also increase significantly over those currently required. Regardless of which manual is adopted, the new surface water design standards are more protective of receiving waters and will help the Surface Water Utility make progress towards reducing flooding and minimizing impacts to water quality and aquatic habitat in Kirkland.

It is recommended at this point that the City adopt the 2005 KCSDM. The 2005 KCSDM contains better and more detailed design information while providing equivalent standards to the 2005 Ecology manual. In the past, King County has provided superior technical assistance and support/interpretation of their manual. As an example of this, Appendix K contains a comparison of requirements under the 1998 and 2005 KCSDMs that was produced by King County.

As of the publication of this plan, we have not been able to gather public opinion or comments on the two design manuals because both are too new to have been used in actual projects. A public outreach process will be conducted in late 2005 regarding adoption of new stormwater standards. Engineers and developers will have had a chance to use the two manuals by late 2005 and will be better equipped to provide feedback to the City on manual preference.

Public-Private Partnerships

Public/private partnerships should be pursued where it appears that cost efficiencies and environmental benefits can be realized. In 2003, the City successfully partnered with Northwest University to expand a detention pond to reduce existing streamflows (as opposed to mitigating for impacts of a particular development).

As the City conducts planning (see below), parcels should be identified for potential projects regardless of current ownership or use of the land. For example, it may make sense to partner with a commercial property to install water quality facilities below their private parking lot, rather than to put these facilities in a high-traffic public right of way. In return for siting facilities on private property, the City could offer to treat water from the commercial development (provided that the treatment system is sized for this) and provide treatment facility maintenance.

Watershed-Level Planning

Watershed-level studies support City planning efforts as well as the potential for public-private partnerships. Examples of watershed-level studies that have been conducted for this plan include the following:

- Analysis and identification of areas in the City likely to be developed or redeveloped (see discussion in Chapter III and Appendix B).
- Hydrologic/hydraulic modeling to examine the potential use of regional flow control facilities (see discussion below and Appendix C).

Studies that would further help with coordination of public/private planning efforts as include water quality modeling and examination of normative flows for fish-bearing streams. These studies are discussed in Section V.G., Monitoring and Research.

Regional Flow Control and/or Water Quality Facilities

Regional flow control and water quality facilities should be further evaluated with regard to how such facilities could be used by the City and new development. Initial hydrologic modeling was conducted to determine the potential benefits of providing regional flow control facilities in Juanita and Forbes Creek watersheds (Appendix C), which contain the highest value fish resources of any in the City. The modeling indicates that regional flow control would be effective at reducing peak streamflows, durations and frequencies from new and existing development in the Forbes Creek basin. What remains to be done is to determine how the City uses a regional facility. Regional flow control facilities could be used to (1) reduce existing peak flows, (2) mitigate for impacts of future development in lieu of on-site facilities, or (3) a combination of the two. It may also be possible to provide regional water quality facilities in combination with flow control facilities. A summary of the model and resulting conclusions is contained in Chapter III and in Section V.B.2.d; the full modeling results are included in Appendix C.

Low-Impact Development

Low-impact development (LID) techniques include alternative methods for approaching development, all the way from site planning (reducing impervious surfaces) and construction methods (minimizing disturbed areas) to on-site treatment of stormwater (such as infiltration). Use of LID is one of the recommended municipal stormwater management program elements in the Puget Sound Water Quality Management Plan (PSWQMP – see Section V.F., Policy Analysis and Regulatory Compliance for details). Development standards and review can encourage use of LID by adopting standards that provide incentives or credits for its use and by identifying locations in which the City can partner with private development to install LID street improvements adjacent to development projects. A study to evaluate the feasibility of using LID in Kirkland, as well as identifying potential incentives to encourage use of LID, is a recommended program element proposed in the Policy Analysis and Regulatory Compliance section of this plan (see Section V.F. and Appendix L for details).

Staff and Resource Needs

Currently, approximately 0.5 full-time equivalent employee are devoted to development review and standards. Current staff and resources are sufficient to address the recommended work items.

V.D Public Education and Outreach

Current Work and Priorities

Education and outreach activities encourage stewardship and promote behaviors that protect and restore watersheds. Education and outreach is one of the most effective tools available, being both low cost and potentially high impact. Effectiveness is certain but hard to measure, as education results in cultural change, which is a slow, steady, and incremental process. Just as garbage recycling was once a fringe activity and now is commonplace, the eventual result of education and outreach would be that items such as the following become commonplace:

- Brown lawns would become an accepted part of the summer landscape.
- Pesticide use by home gardeners would be considered strange or even unacceptable.
- Charity groups would sell tickets for reduced-cost use of commercial car washes rather than holding their own local car washes.
- Residents would reduce vehicle use, choosing walking, bicycling, riding the bus, or combining trips.
- Use of native vegetation would be the norm in gardens, especially along stream channels.
- People would dispose properly of used oil and other chemicals rather than dumping them in the storm drainage system.
- People would talk to neighbors that are clearing or otherwise degrading streamside areas and help them to be good stewards of these lands.

The Surface Water Utility currently has many programs that address water quality and stewardship issues, as shown in Table V-D.1. The following priorities guide these programs:

- Participate in regional education efforts whenever possible to maximize efficient use of resources. Examples of regional programs that have been conducted in Kirkland include Natural Yard Care Neighbors, Horses for Clean Water, and Salmon Watcher.
- Conduct volunteer monitoring and planting activities to actively involve residents in care of their local watersheds.
- Provide materials and information to schools, nonprofit organizations, and the general public on water quality and flooding issues. Table V.D.1 lists existing activities; staff members regularly look for groups that could be addressed through materials, speakers, or other outreach activities.
- Provide technical assistance and outreach to businesses on water quality protection (see Section V.E., Code Enforcement and Technical Assistance for details).

Table V-D.1 Current Public Education and Outreach Activities

Category	Activity	Target Audience	Resources	Comments	Current Status
Outreach Events					
	Natural Yard Care Program	Single family residents	Staff time, funds for the Frause Group to organize	2005 target audience is Moss Bay, Everest, Houghton, and Lake View Neighborhoods	Seminars to be held in May 2005
	Horses for Clean Water Program	Horse owners, stable managers	Funds – program is run by contractor		Last done in 2000
	Kirkland July 4 th Parade	General public	Staff time, pop-up sponges, Bert the Salmon costume	Pop-up sponges were printed with the message “Keep our Streams and Lake Washington Clean” and a contact phone number	Last done in 2002
	Osprey Festival	General public	Staff time, brochures	Info/brochures table	Will attend in 2005
	Summer Fest	General public	Staff time, brochures	Info/brochures table	Will attend in 2005
Volunteer Involvement					
	Forbes Lake water quality sampling		Staff time, sampling equipment, funds for laboratory analysis of samples	Completed 1 year of sampling	Summer 2004 – may repeat in future
	Volunteer planting at Everest Park		Staff time, plants and equipment	Maintenance of plantings by volunteers is on going	Continuing through 2005
	IBI sampling in Juanita Creek		Staff time, equipment, funds for laboratory analysis of samples	Difficulty in scheduling volunteers, so program conducted by staff in 2004	
Databases					
	Businesses by category	Internal – for City staff use	Staff time	To be used for business outreach regarding pollution prevention	
	Educational materials/programs	Internal – for City staff use	Staff time	Being done at the request of the Natural Resources Management Team	
	Contacts at local schools	Internal – for City staff use	Staff time		

Table V-D.1 Current Public Education and Outreach Activities (cont.)

Category	Activity	Target Audience	Resources	Comments	Current Status
Bulk Mailings					
	Fat/oil/grease outdoor pollution prevention	Restaurants	Staff time	Coordinated with fat/oil/grease ordinance letters that address indoor concerns	
	Car washing practices	Car dealerships, rental agencies, and autobody/detail shops	Staff time	Aimed at keeping soap, oil, and grease out of storm drains	
	Leaf blower use	Landscape contractors	Staff time	Problems with people blowing debris into the street and into catch basins	
	Pressure washing	Downtown businesses	Staff time	Washing of paved areas and awnings	
	Benefit car wash kits	Gas stations, charity groups	Staff time	Letter describes kits and asks that kits be used for all benefit car washes	
Erosion Control					
	Notice of correction site visits	Contractors	Staff time	Work with contractors to develop erosion control methods and practices	
	General fact sheet	Construction contractors for single-family houses and commercial developments	Staff time		
	Dewatering fact sheet	Construction sites where dewatering of excavations is necessary	Staff time		

Table V-D.1 Current Public Education and Outreach Activities (cont.)

Category	Activity	Target Audience	Resources	Comments	Current Status
Miscellaneous					
	Benefit Car Wash Kit Program	Benefit groups, general public	Staff time, occasional equipment replacement or repair	Kits are made available for use in benefit car washes to keep soap out of storm drains Kits lent out to businesses that hold carwashes on most weekends	
	Storm drain stenciling	General public, scout troops, those needing community service hours	Staff time, minimal materials (paint, gloves, etc.)	Coordinate volunteers, maintain supplies	
	Stream Team Survey	General public	Staff time	Survey is distributed to current volunteers, neighborhood associations, and made available at public information areas; survey is designed to gauge level of interest among citizens and areas of greatest concern	
Brochures/ Publications					
	The Stormwater Utility		Funds for printing		
	Why Stormwater Maintenance?		Funds for printing		
	Business Guide to Storm Water Pollution Prevention	Businesses within Kirkland, to be distributed with new/renewed business licenses	Staff time, funds for printing	Guide explains why/how to protect the water quality of the Kirkland Watershed and gives practical solutions to prevent pollution	Sent out with new/renewing business licenses "quick reference" poster Available on request
	City Update articles		Staff time		
	Watershed Observer newsletter	Distributed as an insert in the Kirkland Courier	Staff time, costs to print and insert newsletter into Kirkland Courier	Future newsletter issues may be distributed electronically	

Table V-D.1 Current Public Education and Outreach Activities (cont.)

Category	Activity	Target Audience	Resources	Comments	Current Status
ESA/WRIA 8 (Regional Activities)					
	Public Outreach Committee Participation		Staff time	See WRIA 8 Public Outreach Committee Work Plan	
	Salmon Watcher		Utility bill inserts and other publicity, Staff time to plan/ attend/lead training sessions, coordinate volunteers, and review data with King County	Volunteers spend 15-minute intervals at various times during the week watching for salmon and recording sitings; the data is used to determine salmon abundance and distribution	Ongoing
West Nile Virus					
	Placement of information in Kirkland Courier and on City website	General public	Staff time to develop and place information and to respond to citizens concerns about mosquitoes	Public is being advised to identify and eliminate standing water on their properties, to avoid being outside during prime mosquito activity times, and to wear protective clothing and mosquito repellent.	

In addition to efforts by the Surface Water Utility, efforts by other City departments and divisions support efforts to keep water clean and available:

- The Solid Waste Utility partners with the King County Local Hazardous Waste Management Program to provide free or low-cost disposal of hazardous wastes.
- The Water/Wastewater Utility provides education on water conservation and private septic system maintenance.
- The Planning Department provides outreach and education on vegetation management, especially as related to tree pruning.
- The Parks Department sponsors volunteer events to remove invasive species and plant native vegetation.
- The Parks Department conducts educational tours of Juanita Bay Park through the Juanita Bay Rangers program
- The Parks Department looks for ways to incorporate low-impact development techniques into highly visible park settings.
- The Parks Department has an extensive Integrated Pest Management program to reduce pesticide and herbicide use—this could be used as a springboard for educational/interpretive activities at Parks.
- The Transportation Group within the Public Works Department provides information on ways to limit vehicle use, including commuting options and trip reduction programs.

Coordination of efforts and messages will increase the impact of our efforts and reduce costs.

Recommended Alteration/Expansion of Priorities

Public education will continue to be a mainstay of the Surface Water Utility. As noted in the Public Opinion Survey (Appendix A), residents are interested in education and outreach activities, especially as they relate to yard care and water quality. Additionally, education and outreach are requirements of the City's pending NPDES Phase II permit coverage (expected to be issued in spring of 2006). Expanded publicity about existing programs, in addition to the following recommended additions, would help to efficiently reach the largest possible number of people and groups with educational programs. The expanded program should be evaluated for compliance with NPDES Phase II permit requirements once the permit is finalized in 2006.

Coordination with Other City Departments and Divisions

Educational and outreach activities span multiple City departments and divisions. The Surface Water Utility should coordinate its activities and messages with other departments to reduce redundancies and better manage the educational resources available. Examples of this coordination include (1) using the Natural Resources Management Team or City Manager's Office as a clearinghouse for educational activities, and (2) creating and maintaining a citywide database of educational brochures.

Develop Limited Local Programs

Public educational and outreach programs specific to Kirkland's unique demographics and natural resources should be developed in addition to those currently being implemented by the Surface Water Utility. Multi-family housing residents and landscaping businesses, in particular, would be the target benefactors of the programs listed below.

- Develop a Streamside Demonstration Garden at a Multi-family Complex

This program would provide outreach to multi-family housing residents to adopt natural landscaping techniques and develop a streamside demonstration garden that could be used as a resource by other multi-family complexes. A large and increasing proportion of Kirkland's residents live in multi-family complexes, either apartments or condominiums. There are often large common areas in condos and apartment complexes that are cared for by landscape contractors. Education regarding (1) acceptance of native vegetation and a less-manicured look and (2) the potential water quality impacts of pesticides and herbicides may encourage residents to request landscape contractors and services that use more environmentally friendly maintenance and management techniques. Most multi-family complexes have associations that are a point of outreach to large numbers of people on these topics. The "Complex Creek Care" grant application contained in Appendix M is an example of the type of program that would be used to reach out to this population.

- "Green" Landscaper Certification Program

A corollary program to providing direct outreach to multi-family housing residents and managers would be development of a program to certify landscapers that service these complexes. Similar to the King County Envirostars Program, the "Green" Landscaper Certification Program would provide free advertising (through utility bill inserts) to those businesses that use environmentally friendly, pesticide-free landscaping techniques. The City would benefit by such a program if environmentally friendly landscaping became the norm, reducing landscape-related pollutants entering receiving waters. Appendix L contains a preliminary scope and budget to develop this certification program.

- Increase Educational Signage in Parks.

Many of Kirkland's parks are located on Lake Washington and/or contain the City's highest quality streams and natural resources. City parks provide great locations to educate residents about water quality and habitat issues and would be particularly beneficial in combination with surface water CIP projects that are recommended in this plan (see Section V.B. for a list of projects on Parks property). Opportunities to provide educational signage in City parks should be identified and coordinated with Natural Resources and Parks staff.

c. Expand Stewardship Activities

Stewardship activities can be very successful to motivate neighborhood-wide behavior changes. Most of the existing stewardship activities are related to water quality and/or aquatic habitat concerns in the City's watersheds. An additional program that could be added is the enlistment of neighborhood volunteers to keep catch basins clear of debris to prevent localized flooding.

Staff and Resource Needs

Currently, approximately 0.5 full-time equivalent employees are devoted to education and outreach. Additional funds are needed to develop limited local programs and to continue implementation of regional programs. It is estimated that full funding would require \$55,000 in one-time costs.

V.E Code Enforcement and Technical Assistance

Current Work and Priorities

The code enforcement and technical assistance program is designed to help Kirkland residents, developers, and businesses conduct their activities in such a way that they comply with existing regulations and do not cause harm to the City's surface water resources. Current code enforcement and technical assistance activities fall into three basic categories, including (1) investigation and resolution of water quality and drainage complaints, (2) investigation and assistance regarding erosion control practices at construction sites, and (3) inspection and maintenance notification for privately owned drainage facilities.

Water Quality and Drainage Complaints

Complaints help the City to identify and correct (or facilitate correction of) environmental problems and provide good opportunities for education and outreach. Drainage and water quality complaints come from citizens and are received via phone, e-mail, or neighborhood service requests. Table V.E.1 shows the number and type of complaints that have been received and investigated in each year since 2000. In general, the number of complaints has increased as citizens have become aware of City resources. The weather also has a significant impact on the number of drainage complaints received in a given year. Complaints mostly involve private property, with the exception of spills or dumps that sometimes occur in the public drainage system.

Table V.E.1 Summary of Water Quality and Drainage Complaints 2000-2005

Year	Surface and ground water drainage concerns	Surface Water Quality Violations	Erosion Control Violations	Total Complaints Investigated
2000 ¹	5	23	6	34
2001	24	61	12	97
2002	28	34	8	70
2003	42	51	10	103
2004	27	41	10	78
2005 ²	16	19	6	41

¹ data for partial year, April through December.

² data for partial year, January through July.

Resolution of complaints usually involves a field investigation followed by education, technical assistance, or simple facilitation of a discussion between neighbors. If the public drainage system is involved, the investigator coordinates with maintenance staff for resolution. In cases where these methods are not successful in resolving the situation, formal code enforcement action can be taken against the responsible party. Chapter 15.52 of the Kirkland Municipal Code allows for fines and civil and criminal penalties to be levied against those committing water quality and drainage violations. Since 1998, only one formal code enforcement action has been taken by the Surface Water Utility. This speaks to the skill of staff in facilitating resolution of complaints, even in cases where resolution has required significant cost and effort on the part of the violator.

Construction Site Erosion Control Assistance

Surface Water Utility staff provide technical assistance and support to construction inspection staff and contractors for construction site erosion control. Although construction inspectors are the first point of contact for erosion control, they rely on Surface Water Utility staff for supplementary erosion control inspection (especially for single-family residential construction) and for technical assistance regarding design, installation, and maintenance of erosion control facilities.

Inspection and Maintenance of Privately Owned Drainage Facilities

Utility staff provide inspection and maintenance of privately owned drainage systems, including retention/detention ponds and water quality facilities. Owners are required to clean and maintain drainage facilities on their property by Kirkland Municipal Code Chapter 15.52. City staff inspect facilities once every 2 years, and then send letters to owners detailing needed cleaning and maintenance. Currently, the program includes only properties that include detention or water quality facilities; those properties containing only conveyance systems are not inspected.

Recommended Additional Work

Several additions to the Code Enforcement and Technical Assistance program are recommended to ensure City compliance with pending NPDES Phase II requirements (see Section V.F., Policy Analysis and Regulatory Compliance for an explanation of this permit program) and to encourage private developers and local businesses to do their part to improve water quality and aquatic habitat conditions in Kirkland.

Dry Weather Sampling Plan

A dry weather sampling plan designed to locate and eliminate illicit connections to the City's stormwater system is outlined in Appendix N. This is a requirement of the City's pending NPDES Phase II permit to be issued in the spring of 2006.

Expand and Review Inspection Services

Wet weather inspection of erosion control facilities should be expanded to reduce sediment discharges from active construction sites. Additionally, the frequency of private drainage system inspections should be reviewed to determine adequacy with NPDES Phase II requirements once the permit is finalized.

Adopt the King County Stormwater Pollution Control Manual

The King County Stormwater Pollution Control Manual (formerly known as the King County BMP Manual) is being revised in 2005 and provides an array of practical information for businesses to use in implementing pollution controls for activities specific to their work. Appendix L contains a preliminary scope and budget for adoption of the manual by the City.

Conduct Routine Audits of Kirkland Businesses

Routine audits of Kirkland businesses that have the potential to add contaminants to the stormwater system should be conducted to assess compliance with surface water codes and help community businesses make informed decisions about how to reduce pollutant discharges to surface water. Appendix L contains a preliminary scope and budget to conduct this work.

Centralize Spill Response and Incident Documentation

Currently, documentation for spills and spill responses is handled by the fire department, surface water maintenance staff, and other agencies (Ecology), depending on who receives the notification that a spill or incident has occurred. In order to meet reporting requirements under the NPDES Phase II permit, after-the-fact documentation of spills and spill responses should be centralized in the Surface Water Utility. This could consist of a system where each Department or group provides data to the Surface Water Utility on a quarterly basis. Utility staff would then compile a summary report.

Staff and Resource Needs

Currently, the Code Enforcement and Technical Assistance staff includes approximately one full-time equivalent engineer, one full-time equivalent engineering intern (usually two half-time interns for the summer months), and oversight/coordination with a senior engineer. One additional half-time engineer is needed to conduct the routine business audits and ensure timely completion of private drainage facility mapping and inspection. Additionally, approximately \$35,000 in one-time study costs are needed to set up the routine business maintenance program and adopt the King County Stormwater Pollution Control Manual.

V.F Policy Analysis and Regulatory Compliance

Current Work and Priorities

Policy Analysis and Regulatory Compliance includes development of policies that involve interdepartmental or regional effort for implementation and development of strategies and documentation for meeting state and federal regulations that apply to the City. Projects over the past few years have included one-time and ongoing efforts such as the following:

- Write and present Municipal Code sections concerning surface water to meet the intent of the Puget Sound Water Quality Management Plan.
- Develop a response plan for the West Nile Virus threat.
- Participate in development of the City's Natural Resources Management Plan.
- Provide input and comments on Zoning Code changes proposed by the Planning Department that affect water resources, including tree and sensitive areas regulations.
- Participate in development and review of the WRIA 8 Chinook Salmon Conservation Plan—a regional effort to restore this species, with the ultimate goal of achieving sustainable fish populations that will result in removal of the species from the federal Endangered Species Act threatened list.

Work in this area is aimed at increasing coordination between the Surface Water Utility and other City projects and programs. Effective management of surface water requires work with other departments and divisions that affect land use and land management: Parks, Planning, and other divisions within Public Works. As watersheds cross city boundaries and fish populations range throughout the region, cooperation at the regional level is necessary as well.

Kirkland has a forward-thinking stance on surface water issues. Environmental protection is a community value, and programs and projects within the Surface Water Utility reflect that value. As a result, compliance with state and federal regulations is largely an exercise in documentation, with only minor program alterations to meet specific standards.

Recommended Additional Work

Policy Work

The following policy work will support regulatory compliance and will address key issues in surface water management in the next 5 to 10 years:

- Implement and maintain a West Nile Virus response plan. As of 2005, the virus has yet to be observed in humans in Washington State, but it is expected to arrive soon. The purpose of the plan is to protect City workers, to minimize mosquito breeding habitat in stormwater structures, and to educate the public about measures that will reduce the risk of mosquito breeding and mosquito bites.
 - Coordinate Citywide implementation of LID. LID techniques will help to meet water quality and aquatic habitat goals and are recommended as part of the Puget Sound Water Quality Management Plan (see Section V.F.2.b). Implementation will require study of feasibility (see Section V.C., Development Review and Standards), coordination between departments for Zoning and Municipal Code changes, and funding and construction of pilot projects. The Surface Water Utility will lead citywide implementation through policy development. An LID study to evaluate options for implementation of LID is recommended in the Monitoring and Research section (Section V.G.).
- Assist the Planning Department on policy and criteria for daylighting streams. Although requirements to daylight streams are contained in the Zoning Code and are under the auspices of the Planning Department, the Surface Water Utility has an interest in seeing that daylighting proposals make sense from an engineering and ecological perspective and that they fit with proposed capital projects and other projects of the utility. The watershed-level study of daylighting may also serve to assist in identifying watershed-level mitigation options for development proposals.
 - Assist the Sewer Utility on policy and criteria for prioritization and connection of private residences (currently on septic systems) to the public sewer system.
 - Continue to participate in the Natural Resources Management Team. Participation in this team has yielded great benefits to the Surface Water Utility by coordinating efforts on items such as education, salmon protection, and vegetation management.
 - Conduct watershed planning with King County to determine actions that would benefit the Juanita Creek Watershed.
 - Conduct evaluation and ranking of pollutant sources by watershed to further focus priorities for water quality treatment as discussed in the Monitoring and Research section (Section V.G.).

Regulatory Compliance

There are several regulatory programs that will require City efforts on water quality and aquatic habitat. There is considerable overlap between these regulations. In addition, City compliance may largely be a matter of documentation of existing efforts, rather than significant new programs or projects. What follows is an initial look at strategy for complying with regulations, as well as identification of work that will be needed in the next few years to gain compliance.

NPDES Phase II

The “First Preliminary Draft Proposed Municipal Stormwater NPDES General Permit for Western Washington Phase II Municipal Separate Stormwater Sewer Systems” (NPDES Phase II General Permit) was issued by the Department of Ecology in May of 2005. The city will need to obtain coverage under this general permit in order to maintain compliance with the federal Clean Water Act. The permit will require applicants to document how they are implementing specific details of six “minimum control measures.” Municipalities will be expected to apply for coverage as soon as possible after the final permit is issued, which is expected to be in spring of 2006.

The City is in a very good position to comply with NPDES Phase II permit requirements. The City’s visionary, rather than reactionary, stance on surface water management means that most required programs and policies are already in place. Although this plan will be complete before the final permit is issued, it can likely provide the basis for the City’s application for coverage. Table V.F.1 shows current City efforts that will fall under each of the six minimum measures as shown in the draft permit dated May 16, 2005.

Under the draft NPDES Phase II General Permit, the most significant changes that would be required of the City would be (1) adoption of a surface water design manual that is essentially equivalent to the 2005 Stormwater Management Manual for Western Washington (Ecology, 2005), and (2) implementation of more extensive monitoring. The City is preparing for adoption of a surface water design manual that would meet the permit requirement, as discussed in the Development Review and Standards section (Section V.C). This will have cost implications for both private developers and the City CIP. At the same time, staff are aware of controversy surrounding this draft requirement, and are participating in discussions with other Phase II jurisdictions and with the Department of Ecology concerning this issue.

Draft monitoring requirements in the permit are extensive but vague as discussed in the Monitoring and Research section (Section V.G). Again staff are participating in a process to comment on the draft requirements. It is likely that monitoring requirements in the final permit may look quite different from those contained in the draft permit.

Significant staff time will be required to develop and submit the permit application and to document ongoing compliance with the terms of the permit.

Puget Sound Water Quality Management Plan

Element SW-1.2 of the PSWQMP details 13 points that should be addressed by city and county comprehensive stormwater programs. Table V.F.2 details how the City meets each point of the recommended program. It is intended that this Surface Water Master Plan will constitute the City’s submittal under PSWQMP.

Endangered Species Act

The listing of Chinook salmon as a threatened species under the federal Endangered Species Act (ESA) requires that all parties take steps to prevent harm to the listed species. The definition of harm includes actions that directly or indirectly degrade or eliminate habitat. Although Kirkland streams do not currently support populations of Chinook salmon, our streams drain into Lake Washington, which does support significant populations, and the city contains a large length of Lake Washington shoreline. Thus Kirkland’s responsibility under ESA largely centers around the quality of water that is delivered to Lake Washington, and protection and restoration of lakeshore habitat.

Kirkland has two areas of potential liability under ESA: direct proprietary actions such as maintenance and construction of City facilities, and indirect actions such as the granting of development permits and associated land use regulations. Reduction of liability and protection of water quality and habitat will require coordination between the Public Works, Planning, and Parks Departments. Actions to prevent harm from proprietary activities are ongoing and include the following:

- Use of King County ESA regional road maintenance practices (King County 2002)
- Review of CIP projects for potential impacts to salmon habitat, and submittal of proposals to appropriate federal agencies for review and permitting
- Water quality protection and improvement efforts

TableV-F.1 NPDES Phase II - Six Minimum Measures and Current City Efforts

Minimum Measure		Performance Measures	Existing City Programs that Fulfill Requirement (see program section for details)	Changes/Upgrades Needed For Compliance
1	Public Education and Outreach on Stormwater Impacts		Public Education and Outreach	Continue present level of effort, tailor to needs of multi-family housing residents and other target audiences
2	Public Involvement/Participation		Public Education and Outreach	Conduct outreach on master plan, continue to hold volunteer participation events
3	Illicit Discharge Detection and Elimination		Code Enforcement and Technical Assistance	Implement dry weather sampling plan in test basin in summer 2006; I.D. and prioritize sources of pollutants
4	Construction Site Runoff Control		Code Enforcement and Technical Assistance	Make sure that inspectors are participating in appropriate training sessions
5	Post-Construction Stormwater Management in New Development and Redevelopment		Development Review and Standards	Adopt development standards equivalent to those in the 2005 Ecology manual
6	Pollution Prevention/Good Housekeeping for Municipal Operations		Policy Analysis and Regulatory Compliance	Write Stormwater Pollution Prevention Plan (SWPPP) for maintenance shop and maintenance activities; Review water quality impact of City facilities and practices

Note: Draft of permit was issued in May of 2005. Final permit is expected to be issued the summer of 2006.

**Table V.F.2
Kirkland Surface Water Programs to Meet Requirements of the Puget Sound Water Quality Management Plan Element SW-1.2.
Comprehensive Stormwater Programs for Cities and Counties**

Element ID	Element Description	City Programs and Codes That Meet the Requirement	Comments
A	Stormwater Controls for New Development and Redevelopment	Development Review and Standards KMC 15.52	Need to adopt new surface water design standards that are equivalent to Ecology standards
B	Stormwater Site Plan Review	Development Review and Standards KMC 15.52	
C	Inspection of Construction Sites	Development Engineering Group within Public Works KMC 15.52	Surface Water Group provides supplementary inspection on erosion control issues as detailed in Development Review and Standards section
D	Maintenance of Permanent Facilities	Maintenance and Operations (City facilities) Code Enforcement and Technical Assistance (private facilities) KMC 15.52	Review maintenance and inspection frequencies
E	Source Control	Public Grounds Division of Public Works (roadside vegetation) Maintenance and Operations Public Education and Outreach Capital Improvement Projects	
F	Illicit Discharges and Water Quality Response	Code Enforcement and Technical Assistance	
G	Identification and Ranking of Problems	All programs	This plan identifies and ranks problems and estimates cost and schedule for implementing solutions
H	Public Education and Involvement	Public Education and Outreach Code Enforcement and Technical Assistance	
I	Low Impact Development Practices	Policy Analysis and Regulatory Compliance	Implementation will take place in all programs and in coordination with other City Departments
J	Watershed or Basin Planning	Policy Analysis and Regulatory Compliance	Juanita Creek is the only watershed that contains significant area outside the City Continue participation in WRIA 8 Chinook Salmon Conservation Plan Will need to focus more on watershed-wide water quality modeling/planning
K	Funding	Surface Water Utility established in 1998	Financial analysis conducted as part of this plan to determine rates
L	Monitoring	Monitoring and Research	
M	Schedule for Implementation	See separate section	

Changes to land use regulations will be made once the City can align changes with regional efforts to recover the species. Update of the City's Shoreline Master Program, for example, has begun and will include examination of ESA-related needs. Recovery and delisting of the species would reduce the economic burden of federal regulation and oversight and would preserve a species that has significant cultural and economic value to the region. Recovery planning is taking place by Water Resource Inventory Area, or WRIAs, which are watershed definitions used by the State of Washington. Kirkland is located in WRIA 8, otherwise known as the Greater Lake Washington/Sammamish River Watershed. The WRIA 8 Chinook Salmon Conservation Plan (WRIA 8, 2005) was completed in spring of 2005 and was adopted by the City Council on June 21st, 2005.

Total Maximum Daily Load Plans

The Department of Ecology will be required to conduct a TMDL process and develop a cleanup plan for fecal coliform, temperature, and dissolved oxygen levels in Forbes and Juanita Creeks. City staff will need to participate in development of the TMDL, particularly for Forbes Creek, which is entirely within City boundaries. Water quality sampling to prepare for the TMDL process is discussed in the Monitoring and Research section (Section V.G.).

Staff and Resource Needs

Currently, approximately 0.75 full-time equivalents of a senior engineer are devoted to Policy Analysis and Regulatory Compliance. Current staff are sufficient to address the recommended work items. Costs for regulatory compliance beyond staff time are detailed in other sections. Costs for implementation of the West Nile Virus response plan are uncertain, and so are not included here.

V.G. Monitoring and Research

Current Work and Priorities

Current monitoring and research work includes (1) sampling of physical, chemical, and biological parameters of Kirkland's streams and lakes to determine general overall condition, (2) general research and special studies to identify goals and determine needs in individual watersheds, and (3) monitoring of the success and maintenance needs of stream and wetland mitigation projects for the Capital Projects Group within Public Works.

Water Quality Monitoring and Sampling

Physical and chemical parameters of water quality have been sampled in Forbes and Juanita Creeks since 1997 by King County and/or the City of Kirkland. Juanita Creek was included in an urban stream pesticide monitoring studies by the United States Geological Survey (USGS), the Washington State Department of Ecology, and King County in 1998–1999 (see Appendix O for a review of water quality monitoring data). The USGS also sampled organic compounds and trace elements in streambed sediment and fish tissue in 1995. The data are included in Appendix D and show that the quality of water in these streams is typical of urban streams in the Puget Sound region. Both Forbes and Juanita Creeks do not meet water quality standards for fecal coliform, temperature, and dissolved oxygen. The streams were listed on the State's 1998 303(d) list of impaired water bodies due to elevated fecal coliforms and are also listed on the State's draft 2004 303(d) list (Ecology, 2004) for fecal coliform, as well as temperature and dissolved oxygen. Current water quality sampling efforts have been discontinued pending determination of specific monitoring requirements of the NPDES Phase II permit to be issued in spring of 2006. Table V.G.1 summarizes results of water quality sampling efforts conducted by the City.

Benthic index of biological integrity (B-IBI) monitoring has been conducted by the City since 2001 at three locations on Forbes Creek and four locations on Juanita Creek. B-IBI monitoring examines the population of benthic macroinvertebrates ("bugs" such as mayflies and caddis flies) with the theory that the general health of the in-stream invertebrate community can be used as an indicator for overall habitat quality. "Bug" samples are collected in late fall and are analyzed for the number of species present and the abundance of individuals within each species. Sampling has been conducted in Kirkland both to determine the overall health of the Juanita and Forbes watersheds and to determine whether stream habitat improvement projects have had an impact on stream health. Results of B-IBI sampling in Forbes and Juanita Creeks indicate "poor" to "very poor" ratings for overall habitat quality. Sampling at individual stream project sites has shown that slight improvements have occurred, likely because of the habitat mitigation measures. Table V.G.2 presents a summary of B-IBI results.

Table V.G.1a Forbes Creek Water Quality			
2002/2003 Average Values			
	Headwater Site #1	Mid-Watershed Site # 3	WAC Class AA Surface Water Criteria
Temp. Water (C)	12.55	12.25	16 or below
pH	7.12	7.22	6.5 to 8.5
D.O. (mg/L)	9.40	10	greater than 9.5
Turbidity (NTU)	3.91	3.56	n/a
Flow (cfs)	2.45	2.53	n/a
Fecal Coliform (CFU/100ml)	330	238	less than 50
Ammonia Nitrogen (mg/L)	0.030	0.07	n/a
TKN (mg/L)	0.575	0.81	n/a
Nitrate + Nitrite (mg/L)	0.601	0.9	n/a
Total Phosphorus (mg/L)	0.137	0.11	n/a
Surfactants (mg/L)	0.050	0.08	n/a
Surfactants as CTAS (mg/L)	0.10	0.1	n/a
Zinc (mg/L)	0.007	0.01	n/a
See Map in Appendix D - Water Quality and B-IBI Data for Specific Site Locations			

Table V.G.1a Forbes Creek Water Quality			
2003/2004 Average Values			
	Headwater Site #1	Mid-Watershed Site # 3	WAC Class AA Surface Water Criteria
Temp. Water (C)	12.78	10.71	16 or below
pH	7.43	6.01	6.5 to 8.5
D.O. (mg/L)	9.33	8.17	greater than 9.5
Turbidity (NTU)	2.75	2.96	n/a
Flow (cfs)	2.22	0.98	n/a
Fecal Coliform (CFU/100ml)	159	117	less than 50
Ammonia Nitrogen (mg/L)	0.046	0.007	n/a
TKN (mg/L)	0.714	0.564	n/a
Alkalinity (ppm)	101	83	n/a
Nitrate + Nitrite (mg/L)	0.495	0.739	n/a
Surfactants (mg/L)	0.078	0.025	n/a
Total Phosphorus (mg/L)	0.007	0.006	n/a
See Map in Appendix D - Water Quality and B-IBI Data for Specific Site Locations			

Table 5.G.1b Juanita Creek Water Quality 2004 Average Values			
	Headwater Site #1	Mid-Watershed Site # 4	WAC Class AA Surface Water Criteria
Temp. Water (C)	18	18.33	16 or below
pH	7.27	7.47	6.5 to 8.5
D.O. (mg/L)	10.67	10.33	greater than 9.5
Turbidity (NTU)	15.39	16.22	n/a
Fecal Coliform (CFU/100ml)	869	722	less than 50
TKN (mg/L)	0.273	0.410	n/a
Alkalinity (ppm)	103	116	n/a
Total Phosphorus (mg/L)	0.084	0.079	n/a
Zinc (mg/L)	0.013	0.012	n/a

See Map in Appendix D - Water Quality and B-IBI Data for Specific Site Locations

Table 5.G.2 Macro-Invertebrate Sampling Results							
Site	Forbes Creek			Juanita Creek			
	FC1	FC2	FC3	JC1	JC2	JC3	JC4
2001	14	16	14	14	18	16	16
2002	14	14	12	14	18	16	16
2003	18	20	16	22	16	*	18
2004	*	*	*	*	*	10	*

* Samples not taken

Key to Macro-Invertebrate Sampling Values		
Score	Grade	
46-50	Excellent	
38-44	Good	
28-36	Fair	
18-26	Poor	
10-16	Very Poor	

Taken from <http://www.cbr.washington.edu/salmonweb>

Special Studies

The Surface Water Utility uses special studies to support watershed-level planning. The following studies were conducted as part of this plan:

- Development/redevelopment analysis (Appendix B)
- Hydrologic/hydraulic analyses of Juanita and Forbes Creeks (Appendix C)

Studies such as these are helpful in determining overall goals and focus for individual watersheds within the city.

Stream and Wetland Mitigation Monitoring

City Surface Water Utility staff provide technical assistance and monitoring for mitigation projects installed as part of City CIP projects. Examples of this service include the following:

- Juanita Lift Station Elimination and Emergency Response Connection (City CIP project CSS-0047): Hydrologic and vegetation monitoring at a wetland creation/recreation project associated with removal of a sewer lift station and rerouting of a sewer line.
- Surface Water Sediment Pond Reclamation (Hour Glass Pond)(City CIP project CSD-0036): Vegetation monitoring at an in-line surface water sediment pond following sediment removal and regrading of the facility.
- Northwest College Creek (City CIP project SD-0237): Stream channel and vegetation monitoring at a stream restoration project that was designed to reduce sediment delivery to the City drainage system.

City staff provide this service more efficiently than consultants, allowing for closer coordination between monitoring staff and those performing maintenance on these projects (usually City storm maintenance crews).

Recommended Priorities and Work

Water Quality Monitoring and Sampling

Monitoring will be a requirement of the pending NPDES Phase II permit, although specifics have not yet been determined. Once the final permit is issued in spring of 2006, a program will be developed to meet monitoring and associated documentation requirements. Ecology is soliciting comments on the proposed monitoring program outlined in the draft May 2005 permit. It is likely that the monitoring requirements will be modified in the final permit, so it is difficult to speculate what the requirements may be. Draft requirements include provisions for long-term water quality monitoring in receiving waters to evaluate the effectiveness of stormwater management programs covered under the permit. Additionally, best management practice (BMP) effectiveness monitoring is currently proposed in the draft permit. If these monitoring requirements are included in the final permit, Kirkland will need to continue water quality monitoring on Juanita and Forbes Creeks and may need to add additional sampling locations in other receiving waters in the city. A monitoring program for BMP effectiveness will also need to be established. Ecology is recommending collaboration with other municipalities with Phase I and Phase II NPDES permits to establish monitoring programs. Phase I municipalities, such as King County, have already established monitoring programs, and it may be possible to collaborate to meet Phase II requirements.

Another requirement of the draft NPDES Phase II permit will be compliance with established total maximum daily loads (TMDLs) for impaired waterbodies that fail to meet state water quality standards. Both Forbes and Juanita Creeks fail to meet state water quality standards for fecal coliform bacteria, temperature, and dissolved oxygen and are listed on the state's draft 2004 303(d) list for impaired waters. The state has not developed TMDLs for either of these water bodies, but is expected to in 2006 or 2007. The TMDL plans will determine amounts of allowable discharge for various parties in the watershed such that the level of the water quality parameter is brought within state water quality standards. To prepare for this process, it is recommended that sampling of fecal coliform, temperature, and dissolved oxygen levels be conducted in Juanita and Forbes Creeks with the goal of establishing levels and sources of these parameters on a watershed scale. Forbes Creek is contained entirely within the city, so the TMDL and its implementation will largely be a City responsibility. Currently, over half of Juanita Creek is outside the city, but sampling within city limits would help to establish potential City actions and responsibilities. Discussion of specifics of water quality monitoring and fecal coliform source tracking are contained in Appendices C and D.

It is recommended that B-IBI sampling continue in Forbes and Juanita Creeks. B-IBI provides an inexpensive snapshot of the health of our streams. In addition, regulatory agencies are considering use of B-IBI in lieu of more extensive water quality sampling for some regulatory programs.

Special Studies

The field of surface water management is rapidly developing and changing. Study of selected surface water issues will benefit the City by providing good information to focus programs and identify capital construction projects and by providing information to developers that will facilitate sound environmental design and mitigation of impacts. The following recommended studies and projects are described below:

Low-Impact Development Study

The implementation of low-impact development (LID) techniques in the City of Kirkland fits with the overall vision of the City and many of the goals and policies outlined in the City Comprehensive Plan. The goal of this study is to (1) identify existing City codes that may conflict with or restrict the use of LID, (2) identify LID techniques that would be appropriate for Kirkland, (3) evaluate possible incentive programs to encourage use of LID, and (4) identify potential City pilot LID projects. Appendix L contains a preliminary scope and budget for this study.

Improved Soils Map of Kirkland

An improved surface soils map would be of great benefit to the City. Currently, designers rely on the 1975 map of King County soils produced by the United States Department of Agriculture (USDA) Soil Conservation Service. This map is often inaccurate; it leads developers to spend time and resources investigating use of infiltration in areas with poorly drained soils and fails to alert them to areas that could easily support such facilities. Mapping techniques have improved greatly since the USDA map was created. The University of Washington is currently producing improved soils maps by combining subsurface data from construction site geotechnical reports, Light Detection and Ranging (LIDAR), and geologic maps. The City of Seattle has successfully participated in this program; they now have much more accurate information about areas where infiltration is a viable stormwater control option, as well as improved landslide hazard mapping. The University of Washington mapping project can be extended to Kirkland if funding is made available. It is estimated that full-scale mapping of the city would cost approximately \$125,000 and would take 3 years to complete.

Evaluation of Drainage in Totem Lake Area

Standing water occurs throughout the year in the channel and tributary stormwater system of Juanita Creek between Totem Lake and Juanita High School. This situation lowers the available stormwater capacity of the system and could make the proposed redevelopment of Totem Lake Mall difficult if solutions aren't identified to alleviate the problem. This study will model the hydraulic conditions of Juanita Creek and City infrastructure between Totem Lake and the wetlands west of 116th Avenue NE and identify potential solutions. The HSPF modeling of Juanita Creek done for this plan would form the basis of this work. Appendix L contains a preliminary scope and budget for this study.

Test Effectiveness and Feasibility of Street Washing Technologies

Materials such as heavy metals and oil deposited on roadways are one of the major sources of pollutants to our region's streams (City of Bellevue, 1995). Treatment of stormwater to remove these pollutants is expensive. Street sweeping has promise to control these pollutants before they are washed off in stormwater, providing control at a much lower cost. Current street sweeping practices and machinery, however, provide only limited control of the fine sediments that carry most of the pollutant load. The City of Olympia is interested in partnering with other cities in the region to investigate the effectiveness and feasibility of various high-efficiency street washing machines and techniques. Participation in this study would potentially lead to more cost-effective treatment technology that could be readily applied in Kirkland.

Evaluation and Ranking of Pollutant Sources

This study will help identify locations in Kirkland that are acting as major sources of pollutants to receiving waters, based on (1) position in the watershed/drainage basin, (2) types of land activities, (3) degree of possible attenuation, and (4) the presence of operational or structural source control BMPs or water quality treatment BMPs. The study will largely be a GIS-based exercise, analyzing possible sources of pollutants based on land use, commercial activity, road network, and/or maintenance practices. The types of pollutant loadings that one might expect for the particular land uses will be identified, as well as BMPs that are in place to remove such pollutants or prevent pollutants from reaching receiving waters. Appendix L contains a preliminary scope and budget for this study.

Ongoing Study Budget

The City needs to continue to budget for surface water studies through an ongoing study budget. Watershed-level studies conducted by the City yield benefits for the environment and in many cases facilitate development projects. Examples of issues that could be studied in the next 5 to 10 years include the following:

- Potential for conversion of existing undersized and ineffective detention facilities on private property for use as water quality treatment facilities
- Expansion of the concepts of the King County Normative Flow Study to Forbes Creek (the study already includes Juanita Creek)
- Water quality modeling to focus treatment efforts

An average of \$20,000 per year would fund this type of study.

Staff and Resource Needs

Approximately 0.2 full-time equivalent employees (FTEs) are currently devoted to monitoring and research. State and federal regulations may require significant increases in monitoring, and this would require an increase in the associated FTEs. Until final permit requirements are known, it is recommended that FTEs for monitoring and research be kept at current levels. As summarized in Table V.G.3, approximately \$305,000 in studies are recommended one-time costs. It is recommended that \$35,000 per year in annual costs be allocated to support monitoring and ongoing study needs.

Table V.G.3 Monitoring and Research Resource Needs				
Study or Project Title	Estimated Cost	Annual Cost	One-time Cost	Year to Begin
Water Quality Sampling	\$60,000	\$10,000/year		Ongoing
IBI Sampling	\$30,000	\$5,000/year		Ongoing
Fecal Coliform Source Tracking				Not recommended at this time
LID Feasibility and Implementation	\$50,000		X	2006
Improved Soils Map	\$125,000		X	2006
Street Washing/Investigation	\$50,000		X	2007
Juanita Creek – Totem Lake Hydraulics Investigation	\$40,000		X	2006
Evaluation and Ranking of Pollutant Sources	\$40,000		X	2007
Ongoing Study Budget	\$120,000	\$20,000/year		Ongoing
TOTAL	\$515,000			