COMPREHENSIVE SURFACE WATER MANAGEMENT PLAN

FINAL PLAN

City of Mount Vernon

CITY OF MOUNT VERNON

NOVEMBER 1995

R·W·BECK

November 20, 1995

R·W·BECK

Mr. John Wiseman
City Engineer
City of Mount Vernon
P. O. Box 800
Mount Vernon, Washington 98273

Dear Mr. Wiseman:

Subject: **City of Mount Vernon**
Final Comprehensive Surface Water Management Plan

We are pleased to submit this final Comprehensive Surface Water Management Plan for the City of Mount Vernon. The plan contains recommendations for a combination of policies, ordinances, regulations, public education, increased maintenance activities, and capital improvements to solve current and future flooding, water quality, and environmental resource protection problems.

The plan also contains a maintenance and operations and a financial plan to guide the City's long-term implementation of this plan.

We have enjoyed working with the City of Mount Vernon on the preparation of this plan, and appreciate the valuable assistance that the staff members have given to us.Sincerely,

R. W. BECK

Steve Swenson
Project Manager

SS:ec

Attachments

File: 12-00029-10101-0109
X1279120.987

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COMPREHENSIVE SURFACE WATER MANAGEMENT PLAN

CITY OF MOUNT VERNON

Project funded with assistance from:

Washington State Department of Ecology
Centennial Clean Water Fund

Prepared for

City of Mount Vernon
Engineering Department

R·W·BECK

November 1995

ACKNOWLEDGEMENTS

R. W. BECK

November 1995

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CITY OF MOUNT VERNON

COMPREHENSIVE SURFACE WATER MANAGEMENT PLAN

The technical material and data contained in this report were prepared under the supervision and direction of the undersigned, whose seal as registered professional engineer licensed to practice as such in the State of Washington is affixed below.

Steven J. Swenson
Project Manager
R. W. Beck

MOUNT VERNON SURFACE WATER MANAGEMENT PLAN

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SECTION I
EXECUTIVE SUMMARY

SECTION I

EXECUTIVE SUMMARY

The City of Mount Vernon Surface Water Management Plan was developed with funding from the City of Mount Vernon and the Washington State Department of Ecology under the Centennial Clean Water Fund (CCWF). This plan consists of a comprehensive examination of the existing surface water management system with primary focus on water quantity and quality control as well as the preservation and enhancement of valuable environmental resources such as wetlands, riparian corridors, and fish habitat.

Through the use of field observations, results of past studies, hydrologic/hydraulic computer modeling, public input, and City input, the plan identifies existing problems and potential future problems that may result from continued development within the study area. A combination of policies, ordinances, regulations, public education, increased maintenance activities and capital improvements are recommended to solve these problems. The major plan elements include the following:

- Establishment of a Citizen Advisory Committee (CAC) and a series of several meetings in which public input was collected.
- Development of an environmental resources inventory.
- Continuous hydrologic and hydraulic computer modeling analysis of the major streams within Mount Vernon to simulate existing flows, project future flows and evaluate system requirements.
- Development of public education programs to increase the understanding and awareness of citizens and business owners about flood control and how their actions can affect water quality and environmental resources.
- Development of a Capital Improvement Program.
- Development of a Maintenance and Operations Plan.
- Development of a financial strategy and funding mechanism to support the recommended surface water management program.
- Review of local, state and federal policies, regulations, and programs relevant to surface water management and development of recommended changes to City regulations to be consistent with current and pending state and federal programs.

The City of Mount Vernon is an area that typifies the problems associated with protecting natural resources while accommodating development. Much of the study area has developed to urban and suburban densities and displays many of the unintended surface water problems associated with rapid growth. These problems include flooding, erosion, sedimentation, destruction of fish habitat, and degraded water quality.

The plan recommends a comprehensive surface water management program that relies on a combination of education, regulations, operation and maintenance, and capital projects to protect surface water resources. The recommendations, if implemented, will aid in preventing future flooding, improving the existing water quality, and protecting and enhancing valuable environmental resources.

The purpose of a Maintenance and Operations Program is to ensure system reliability, achieve the lowest life-cycle cost for facility replacement, and to use maintenance methods and standards that promote water quality. The recommended stormwater maintenance and operations program will require an annual budget of approximately $195,300 in 1995 dollars, which includes the equivalent of approximately three full-time staff persons. This represents an increase of the current budget and the addition of two maintenance workers. Specific maintenance and operation recommendations include increasing the frequency of catch basin cleaning an average of once every eight months, more maintenance of pipes and small culverts, and modified maintenance of roadside ditches.

The implementation of the 10-year capital improvement program was estimated to cost $7,129,500 in 1995 dollars. A summary of these costs is provided on Table X-1. The estimated total annual costs, minus maintenance, for ongoing programs is $278,200. The City has established a utility service charge to finance the program shown on Table I-1. The rate is set at $3.95 per month for each single family residence or duplex and each commercial Equivalent Service Unit (ESU).

TABLE I-1

Recommended Plan Summary

Brief Description	Annual Cost	Estimated Project Cost
Annual Maintenance Program	$195,300	
Surface Water Manager-Engineering and Regulatory Support	$ 88,200	
Operations	$ 41,000	
Public Education	$ 16,000	
Finance/Billing/Accounting/Payroll	$ 21,000	
Utility Taxes	$ 72,000	
Engineering[1]	$40,000	
Capital Improvements Program		
Years 1–10		$7,129,500
Years 11–20	———	$2,582,000
	$473,500	$9,711,500

[1] Costs to be incurred through the year 2000.

SECTION II
INTRODUCTION

SECTION II

INTRODUCTION

A. Purpose

A large percentage of the City of Mount Vernon has been developed into residential, commercial, and industrial land uses. As the City continues to grow and development continues, this conversion of natural pervious land areas to impervious areas will result in increased volumes of runoff entering the surface water drainage system. With existing development, the City experiences localized flooding, ponding, channel erosion, water quality, and sensitive resource problems. The flooding, water quality, and sensitive resource problems are the result of uncontrolled runoff from developed areas, inadequate capacity in existing storm drainage systems, and the loss of the natural flood-reducing capacity of wetlands, closed depressions and stream channel corridors. With future development, these problems will become worse unless proper surface water management strategies are implemented.

The purposes of this study are to:

- Analyze the existing drainage system with respect to flooding, water quality, and sensitive resources;
- Predict future flooding and storm water runoff patterns;
- Recommend revisions to existing policies and regulations to reduce future flooding, reduce water quality problems, and protect environmental resources;
- Recommend improvements to the existing surface water system to reduce future flooding and water quality problems, and to protect and enhance existing sensitive resources;
- Recommend a long-term maintenance and operation program that ensures system reliability and incorporates maintenance methods and standards that promote water quality and sensitive resource preservation; and
- Recommend a financing plan capable of funding recommended capital improvements, long-term education and monitoring programs, and maintenance and operations program.

B. Authority and Cooperation

Preparation of this Surface Water Management Plan was authorized by the City of Mount Vernon by an engineering agreement with R. W. Beck and Associates dated September 23, 1991.

The study area includes the entire Urban Service Area, as currently proposed and discussed in Section III. The study area is shown on Figure III-1.

The Washington State Department of Ecology (Ecology) provided funding assistance on this project through the Centennial Clean Water Fund (CCWF). Ecology will also provide a detailed review of this draft document prior to final approval of this plan.

C. Scope of Work

The scope of work was developed through discussions between City staff, Ecology staff, and R. W. Beck and Associates. Ecology staff and the City initially negotiated a scope of work for the project as part of the CCWF grant agreement. The City then negotiated a scope of work with R. W. Beck and Associates as part of the consultant contract that includes the scope of work items contained in the CCWF grant agreement. In accordance with the grant requirements, the plan will create a coordinated long-term management approach to issues affecting flood hazards, water quality, and protection of natural resources.

D. Public Involvement

To date, the public involvement program has included a series of eight Citizen Advisory Committee (CAC) meetings, one public meeting and two presentations to City Council. It is anticipated that several more CAC meetings and City Council presentations will be required before final completion of the final plan.

Public participation is an important part of the preparation of this plan. The public's opinions and concerns were expressed during meetings held throughout the duration of the project. Issues covered at the CAC and public meetings held to date were as follows:

1. Citizen's Advisory Committee

CAC Meeting 1 . . . . October 20, 1992

- Surface water needs and problems
- Planning process
- Role of CAC
- Goals and objectives of CAC

CAC Meeting 2 . . . . November 17, 1992

- Goals and objectives of the Surface Water Management Plan
- New City ordinance specifying surface water system standards for new development

CAC Meeting 3 . . . . December 15, 1992

- Goals and objectives of the Surface Water Management Plan
- New City ordinance specifying surface water system standards for new development

- Wetlands and Ecology regulations
- Financing the Surface Water Management Plan Recommendations

CAC Meeting 4 .... **January 19, 1993**

- Financing the Surface Water Management Plan Recommendations
- New City ordinance specifying surface water system standards for new development

CAC Meeting 5 .... **February 16, 1993**

- Funding direction
- Utility financial policies
- Preliminary budget for plan recommendations
- Sample rates and revenue projections
- Surface water utility ordinance framework
- New City ordinance specifying surface water system standards for new development

CAC Meeting 6 .... **March 16, 1993**

- Surface water utility service charge
- New City ordinance specifying surface water system standards for new development

CAC Meeting 7 .... **May 18, 1993**

- Results of April public meeting
- Surface water utility charge
- Surface water management plan status
- New City ordinance specifying surface water system standards for new development

CAC Meeting 8 .... **September 21, 1993**

- Management Plan Capital Improvements Program
- Preliminary Service Charge Rate Calculation

CAC Meeting 9 .... **October 19, 1993**

- Surface Water Management Plan Draft Document
- Utility Service Charge Revised Rate Analysis
- Utility Rate Ordinance
- Draft Drainage Ordinance

CAC Meeting 10 .... **November 20, 1993**

- Draft Drainage Ordinance

CAC Meeting 11 .... **January 18, 1994**

- Draft Drainage Ordinance

CAC Meeting 12 .... **February 8, 1994**

- Draft Drainage Ordinance

CAC Meeting 13 .... **March 8, 1994**

- Draft Drainage Ordinance

2. Public Meetings

Public Meeting 1 .... **April 27, 1993**

- Project introduction
- Problem identification
- Storm water management planning process
- Financing alternatives
- Questions and answers

These public meetings resulted in considerable discussions and input from local residents.

3. Council Presentation

Council Presentation 1 .... **March 24, 1993**

- Surface water issues
- What the Surface Water Management plan will provide
- Recommendations
- Surface water requirements
- Funding
- Next steps

Council Presentation 2 .... **July 14, 1993**

- Utility Formation Ordinance Public Hearing

Council Presentation 3 . . . . **November 3, 1993**

- Surface Water Management Plan - Draft Document
- Citizen's Committee
- Surface Water Program Financing
- Surface Water Utility Rate Ordinance

Council Presentation 4 . . . . **November 10, 1993**

- Surface Water Utility Rate Ordinance Public Hearing

Council Presentation 5 . . . . **July 12, 1995**

- Drainage Ordinance Public Hearing

Council Presentation 6 . . . . **November 29, 1995**

- Surface Water Management Plan—Final Document

Appendix D contains additional information about the public involvement process. Information includes:

1. Meeting agenda for each meeting.

2. Meeting graphics, which provided a partial summary of what was discussed at each meeting.

3. Meeting minutes for each meeting.

E. Goals and Objectives

Goals and objectives for the City of Mount Vernon's surface water management program were developed through input from City staff and the CAC. These goals, and the objectives to be met so as to accomplish each goal, are as follows.

<u>Goal #1</u> - Prevent property damage from flooding

a. **OBJECTIVE:** Require adequate peak flow controls for new development.

The plan recommends and the City has adopted a new drainage ordinance consistent with the minimum requirements contained in Ecology's <u>Stormwater Management Manual for the Puget Sound Basin</u>. This ordinance includes requirements for peak flow controls. The adopted ordinance is contained in Appendix H.

b. **OBJECTIVE:** Perform the necessary analysis and recommend solutions for existing flooding problems.

As discussed in Section VII, the existing drainage system was analyzed to determine existing conveyance problems, and problems that might occur under future development conditions as well. Solutions to these problems are presented in the recommended plan under both the regional and local system solutions.

c. **OBJECTIVE:** Employ management strategies in flood prone areas to ensure that new development is not exposed to significant flood risk.

The recommended plan includes a number of management strategies to minimize flood risk. These include a recommendation for a new drainage ordinance with strict detention standards and requirements for an offsite analysis to determine any adverse impacts downstream. The plan also includes management strategies for streamside corridors and wetlands that will also minimize flood risk for new development.

<u>Goal #2</u> - Maintain good water quality

a. **OBJECTIVE:** Attempt to meet state Class A Water Quality Standards in area streams.

A number of recommendations for are proposed for improving water quality such as a public education program, source controls, erosion control, maintenance, spill response, prevention of illicit dumping, wetland protection, new ordinances, and residential, commercial, and agricultural water quality BMPs. A sampling program has also been recommended to monitor water quality parameters and progress towards achieving water quality goals.

b. **OBJECTIVE:** Require adequate erosion and sedimentation controls from new construction sites.

The plan recommends that the City enforce its new drainage ordinance consistent with the minimum requirements contained in Ecology's <u>Stormwater Management Manual for the Puget Sound Basin</u>. This ordinance includes requirements for erosion and sediment controls. The ordinance is contained in Appendix I.

c. **OBJECTIVE:** Require adequate water quality controls for new development.

The plan recommends that the City enforce its new drainage ordinance consistent with the minimum requirements contained in Ecology's <u>Stormwater Management Manual for the Puget Sound Basin</u>. This ordinance includes requirements for water quality BMPs. The ordinance is contained in Appendix I.

d. **OBJECTIVE:** Implement public education programs to reduce the source of pollutants entering surface waters.

The plan recommends that a public education program be implemented to improve stormwater quality. This education program includes components to inform citizens about surface water quality source controls, erosion control, spill response, prevention of illicit dumping, maintenance of private drainage systems, and residential, commercial, and agricultural water quality BMPs.

<u>Goal #3</u> - Preserve sensitive resources and maintain varied use

a. **OBJECTIVE:** Preserve fish and wildlife habitat.

The plan includes a number of preservation and enhancement projects for fish habitat. The plan includes an inventory of City streams by category, and the City's Critical Areas Ordinance provides adequate protection for stream corridors by specifying minimum setback requirements according to the stream category.

b. **OBJECTIVE:** Preserve wetlands and implement a wetlands management strategy.

The plan includes a recommendation that the City review the wetlands management section of the City's Critical Areas Ordinance to determine the need for a wetland classification system and associated buffers. The report also suggests several alternative wetlands management strategies with the recommendation that these be reviewed and that a policy decision be made as to which alternative should be implemented.

c. **OBJECTIVE:** Provide public access and recreation opportunities.

The plan does not include specific recommendations on public access and recreation opportunities. A number of opportunities exist within areas along the City's streams for trails and passive recreation. If these recreational opportunities are pursued, additional buffer requirements may be necessary so that human recreation does not interfere with fish and wildlife habitat needs.

d. **OBJECTIVE:** Preserve open space.

The plan does not include specific recommendations on preserving open space, but recommendations on preservation of wetlands and fish habitat will preserve open space associated with surface water resources.

e. **OBJECTIVE:** Review the City's Sensitive Areas Ordinance to ensure consistency with the surface water management program goals.

As mentioned previously, the plan includes a recommendation to that the City review the wetlands management section of the City's Critical Areas Ordinance to determine the need for a wetland classification system and associated buffers.

Goal #4 - Develop a continuous and comprehensive program for managing surface water.

a. **OBJECTIVE:** Ensure a dedicated funding source for program implementation.

The plan recommends and the City has implemented primary and secondary funding sources. The City implemented a surface water utility as the primary funding source for implementing the plan.

b. **OBJECTIVE:** Coordinate the City program with the Skagit County program.

Several recommendation have been included to coordinate the City of Mount Vernon's program with programs in Skagit County and adjacent drainage districts. These include coordination with Drainage District 17 and Skagit County on future preparation of a watershed plan for Madox Creek. The plan also lists the recommendations as they relate to Mount Vernon, from the Nookachamps Creek Watershed Plan prepared by Skagit County.

F. Agency Coordination

In the preparation and review of this plan, various agencies and jurisdictions were contacted to obtain input:

- Puget Sound Water Quality Authority: Regarding regulations for storm water management plans. Presenting information to the public and City Council.
- Department of Ecology: CCWF grant administration, attendance at CAC meetings, and information on wetlands management.
- Department of Fisheries: Participation of regional habitat manager on CAC and habitat inventory field trip.
- Department of Wildlife: Telephone contract, deferred to Department of Fisheries.

G. Previous Studies

The primary investigations previously conducted in the study area that were consulted in preparation of this report are as follows:

1. Storm Drainage Study (Riverside Drive/ Freeway Drive Basins)

The Storm Drain Study (Bell-Walker Engineers, Inc., 1987) analyzed the area within the City of Mount Vernon that presently drains to the Kulshan Creek Pump Station and Skagit River outfall system located west of Freeway Drive and south of Riverbend Road. The purpose of the study was to determine the probable runoff from the study area, and to establish a recommended network of storm drainage trunk lines, open conveyance systems, and detention facilities needed to transport and dispose of the stormwater runoff.

2. Comprehensive Sewer and Combined Sewer Overflow Reduction Plans for the City of Mount Vernon.

The Comprehensive Sewer and Combined Sewer Overflow Reduction Plans (R. W. Beck and Associates, 1991) addresses alternatives for reducing combined sewer overflows (CSOs) in order to help protect the health and safety of the public, the environment, and property while maintaining the economic capability of the City.

3. Wetlands Mitigation Banking

The guidance document Wetlands Mitigation Banking (Castelle et al, 1992), recently published by Ecology, discusses many mitigation banking issues from agency, developer, and environmental view point. The report addresses planning considerations and general guidelines for potential mitigation bank implementation.

4. Nookachamps Watershed Nonpoint Action Plan

The Nookachamps Watershed Nonpoint Action Plan (Skagit County, May 1995) evaluated a number of source control strategies such as programs to repair or eliminate failing septic systems, improve forest and agriculture Best Management Practices, control stormwater runoff, and implement a public education program.

SECTION III
CHARACTERISTICS OF THE STUDY AREA

R·W·BECK

SECTION III

CHARACTERISTICS OF THE STUDY AREA

A. Study Area

The study area is shown on Figure III-1. When this project began in 1991, this study area was designated as the proposed GMA Urban Growth Boundary (UGB). Between 1991 and 1995, the Urban Growth Boundary, as shown in the City's 1995 Comprehensive Plan, changed. The 1995 UGB is slightly larger than the 1991 UGB. It was decided that the 1991 UGB would still be adequate in this plan for addressing the majority of surface water issues for the City. The major differences between the study area for this plan and the UGB in the 1995 Comprehensive Plan is the addition of a small area to the north along the Skagit River and over to Nookachamps Creek, the addition of an area on the east that is east of Sections 15, 22, 27, and 34, and a reduction of the area along Hickox Road to the south. The study area includes all the existing city incorporated areâ, plus some portions of Skagit County. Although the UGB changed, portions of Skagit County were included in the study area as a result of the growth management planning process which in 1991 identified areas that the City will likely annex in the future. These areas were included so that the Plan would represent the ultimate system the City may have to manage. There are seven drainage basins that make up the study area. The basins in the study area are as follows: Kulshan Creek, Madox Creek, Carpenter Creek, the area tributary to Nookachamps Creek, Trumpeter Creek, Britt Slough, and West Mount Vernon.

B. Climate

The average annual precipitation and temperature are approximately 30 inches and 50 degrees Fahrenheit, respectively. Precipitation data from the NOAA station in Burlington, Washington as well as data collected at the City's waste water treatment plant and the Washington State University Research Station were used in this study. How the different precipitation data sets were used is discussed in Section IV.

C. Topography and Soils

The study area slopes in all directions with all the surface water eventually draining into the Skagit River or Nookachamps Creek. The study area is situated above the surrounding area so all surface water runoff exits the area, and no runoff is contributed from outside areas. The highest elevation is approximately 910 feet above mean sea level. Slopes range from zero in the lower areas to 96 percent around Little Mountain. The upper reaches of Madox Creek, Flower Creek, and Carpenter Creek are situated in Ravines with sideslopes of 35 to 45 percent.

Information on area soils was obtained from the "Soil Survey of Skagit County Area, Washington," Soil Conservation Service, U. S. Department of Agriculture, 1979. Approximately 35 different soil types exit within the study area. For the purposes of this study these soil types were combined into four basic categories based on their hydrologic properties. The four categories are glacial till, glacial outwash, flood plain, and wetland soils.

The flood plain soils, which are found in the lower areas within the flood plain of the Skagit River, cover approximately 30 percent of the study area. Till soils cover approximately 65 percent. The wetland and outwash soils cover the remaining area. The areas covered by the different soil categories are shown in Figure III-2.

D. Vegetation

The Puget Sound region is part of the Coastal Coniferous Fir Zone, the largest vegetation zone in Western Washington. The zone, also known as the Cedar-Hemlock zone, reaches from British Columbia to Oregon. Two dominant types of vegetation characterize the region: Fir-Cedar-Hemlock and Alder-Maple-Cottonwood.

Coniferous trees of the Fir-Cedar-Hemlock association include Western Red Cedar, White and Douglas Fir, Sitka Spruce, and Western Hemlock.

Deciduous or native broadleaf species of the Alder-Maple-Cottonwood association include Black Cottonwood, Pacific Madrona, Oregon Ash, Red Alder, Broadleaf Maple, Vine Maple, Sitka Willow, Coast Willow, Brown Dogwood, Pacific Dogwood, and Bunchberry Dogwood.

Salal, Oregon Grape, Bracken and Sword Fern, Red Elderberry, Salmonberry, Creambush and Grand Oceanspray, Shinyleaf Spirea and various currants are the most common varieties of understory vegetation.

Typical urban area vegetation is found throughout the study area, including lawns, ornamental plants, and landscaped areas. While most of the natural vegetation that remains is concentrated on steep slopes, in riparian areas, and on the undeveloped parcels, there are a few developed areas in which mature natural vegetation remains.

E. Land Use

The land use in the study area are single family residential, multi-family residential, commercial, schools and churches, parks and open spaces and agricultural. Figures III-3 and III-4 show the areas of the various land use for existing conditions and future buildout conditions respectively. Aerial photos taken in 1987 and 1991 along with field observations were used to evaluate the existing land use conditions. Future land uses were evaluated based on information presented in the City's Comprehensive Plan assuming full buildout. For the purposes of the hydrologic analysis, the land uses were categorized in a slightly different manner as described in Section IV.

F. Existing Surface Water System

1. Major Streams and Associated Drainage Basins

The study area is comprised of seven separate drainage basins: Kulshan Creek, Madox Creek, Carpenter Creek, Nookachamps Creek, Trumpeter (College Way) Creek, Britt Slough, and West Mount Vernon. Each of these drainage basins were further divided into several smaller subbasins. The surface water conveyance system in the study area consists of open channels, ditches, and pipes. Figure III-5 shows the drainage basins and subbasins within the study area. The existing surface water system is shown on Figure B-1 through B-14 in both Appendix B and Appendix C.

The Kulshan Creek drainage basin is 1,404 acres and is made up of subbasins 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14. It is located in the northwest corner of the study area. The creek begins just east of LaVenture and flows west between College Way and Fir Street to the Kulshan Creek Pump Station. When Skagit River water levels are low, the flow from Kulshan Creek flows by gravity into the Skagit River. At high Skagit River water levels, the pump station can pump up to 20 cfs of the flow in Kulshan Creek into the river.

The Madox Creek drainage basin is 1,984 acres and is made up of subbasins 22, 19, 34, 37, and 51. It is located in the south central portion of the study area. Madox Creek originates in the Eaglemont Golf Course Residential Development and flows southwest into Drainage District 17. After it exits the study area, Madox Creek flows south for several miles before discharging through tide gates into Skagit Bay south of Conway. Flowers Creek is a tributary to Madox Creek that begins at Blackburn Road near South 16th Street. Flowers Creek flows southwest and crosses Blodgett Road and eventually joins Madox Creek east of the freeway near Anderson Road.

The Carpenter Creek drainage basin within the Urban Service Area is 3,753 acres and is comprised of subbasins 35, 36 and 38. It is located in the southeast corner of the study area. Carpenter Creek flows out of the study area as it crosses Hickox Road, and then continues to flow southwest along the base of the hill until it joins the Skagit River south of Conway.

The three basins that drain directly to the Nookachamps Creek, subbasins 2, 38 and 39 are 254, 303 and 90 acres respectively. They are located on either side of Trumpeter Creek in the northeast portion of the study area. Neither basin has a well established conveyance system.

The Trumpeter (College Way) Creek drainage basin is 2,013 acres and is made up of subbasins 4, 15, 16, 17, and 18. It is located in the in the east central portion of the study area. The main stem of Trumpeter Creek originates just north of Fir Street. Two tributaries (southwest fork and southeast fork) east of the main stem join together at College Way and then join the main stem about 900 feet north east of College Way. Trumpeter Creek flows east from its confluence and eventually joins Nookachamps Creek.

The Britt Slough drainage basin is 73 acres and is represented by subbasin 30. It is located in the southwest portion of the study area. The slough flow southwest and enters the Skagit River just upstream of where the Skagit splits around Fir Island.

The West Mount Vernon drainage basin is 450 acres and is comprised of subbasins 24, 25, and 26. It is a portion of the study area located west of the Skagit River. The main drainage system in the basin flows east along Memorial Highway (SR 536) and then heads south along Wall Street. After Wall Street ends, the storm drain crosses undeveloped property south to a small pump station. The pump station pumps the stormwater runoff from the basin through the dike into the Skagit River.

The major streams were analyzed to determine if they have the capacity to carry the 100-year storm flow. This analysis and a discussion of stream segments, pipes, or culverts that do not have the capacity to pass the 100-year peak flow is contained in Section VI.

Subbasin 23 is 462 acres and is a combined sewered area. All of the surface runoff in that area flows to the sanitary sewer and is treated at the waste water treatment plant. Previous work on the combined sewer system concluded that it was not cost effective to separate the storm and sanitary flows. Therefore, it is not likely that the City will ever have to manage a separate storm drain system in this area.

2. Major Storm Drainage Pipe and Ditch Systems

The major storm drain systems that feed the major streams include the pipe system along Riverside Drive, the pipe system along Stanford Drive between Division and Fir Streets, the pipe system under I-5 south of Blackburn Road, the culverts along the southwest fork of Trumpeter Creek near Fir Street, the culvert and ditch system between Britt Slough and Blackburn Road near Walter Street, the pipe system along Memorial Highway and Wall Street, and the pipe system along Fox Hill Street. Pertinent information about theses systems was gathered from surveys or as-builts, and the information was entered into the computer program Flow Master (Haestad, 1991) to determine the capacity of each system. The major storm drain systems were analyzed to determine if they have capacity to handle the 10-year storm flow. A discussion of the systems that did not have the capacity to pass the peak flow from the 10-year storm event is contained in Section VI.

G. Existing Resources

1. Fish Habitat

The existing fish habitat was assessed based on field observations and agency consultations. A complete discussion and maps describing the fish habitat assessment are presented in Appendix B. According to the Washington Department of Fisheries, all five streams (Kulshan Creek, Madox Creek, Trumpeter Creek, Carpenter Creek, and Flowers Creek) in the study area are used to some extent by salmonids for rearing and spawning. Species include coho, chum and chinook salmon, and steelhead and cutthroat trout. The field survey indicated that all the streams had available fish habitat and met the criteria of Mount Vernon's Critical Areas Ordinance Category II streams (streams that are used by a substantial number of anadromous or resident game fish for spawning, rearing, or migrating) in at least some portion of the study area. The field survey also indicated that each of the drainages displayed varying effects from past and present development. Portions of some drainages have been channelized or ditched and riparian vegetation has been removed. This has resulted in a loss of pools and riffles, a loss of cover for fish, increased erosion, and loss of shade which results in increased summertime stream temperatures. Culverts have been installed for road crossings of streams which often result in fish migration barriers during certain stream flow conditions.

2. Wildlife

A reconnaissance level evaluation of wildlife habitat was conducted to determine the general availability of wildlife habitat within the study area. A complete discussion and maps describing the wildlife habitat assessment are presented in Appendix B.

Riparian corridors, forested areas, and wetlands existing within the study area provide habitat for a variety of wildlife. Mammals that are likely to occur in these habitats include raccoons, coyotes, opossums, various rodents, cottontail rabbit, and blacktailed deer. In addition, a variety of songbirds, waterfowl, reptiles, and amphibians are expected to use these habitats.

Three important sensitive species have been identified by the Washington State Department of Wildlife (DOW) as inhabiting the study area. The bald eagle is on the DOW's priority species list and is federally designated as a threatened species. The osprey is listed as a state monitor species on the DOW's priority species list. The DOW manages monitor species, as needed, to prevent them from becoming endangered, threatened, or "sensitive". Trumpeter swans are protected under the Migratory Bird Treaty Act and the Skagit County lowlands provide important winter feeding habitat for the birds.

In addition, other priority wildlife species not specifically identified in the study area by DOW, but whose distribution range and habitat characteristics suggest that they may be within the study area, are blue grouse, Columbian black-tailed deer, great blue heron, pileated woodpecker, and several species of waterfowl.

3. Wetlands

As part of the Surface Water Management Plan, a wetland reconnaissance level inventory was conducted. The inventory included the following three tasks:

1) a wetlands paper inventory with limited on-site and roadside surveys,
2) a discussion of wetlands resources problem areas, and
3) a discussion of wetlands resources protection measures.

The inventory study area included the city's Urban Service Area, but concentrated on the area located within the city's Urban Growth Boundary. The characterization of wetlands according to the U.S. Fish and Wildlife Service classification system (Cowardin et al., 1979) and further classification of these wetlands based upon their qualitative functional values. The location and type of each wetland is indicated in Appendix A. A complete wetland inventory report is also contained in Appendix A. No formal wetland delineations were conducted as part of this project.

The inventory was limited to a reconnaissance-level survey. Performing a detailed survey would require extensive fieldwork and was beyond the scope of this planning effort.

a. <u>Wetland Definition and Regulations</u>.

Wetlands are formally defined as "... those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." (Federal Register, 1980, 1982).

Numerous federal, state, and local regulations govern development and other activities in or near wetlands; at each level, there are typically several agencies charged with such powers (Appendix A). Mount Vernon has adopted a Critical Areas Ordinance (CAO) (Ordinance No. 2482) in compliance with the Washington State Growth Management Act. A summary of some of the regulatory implications of the city's ordinance is also included in Appendix A.

b. <u>Methods</u>.

Two levels of investigation were conducted for the analysis of wetlands located within the study area: a review of existing information and an on-site reconnaissance survey.

A review of existing literature, maps, and other materials was conducted to identify wetlands or site characteristics indicative of wetlands in the study area. Note that these sources can only indicate the likelihood of the presence of wetlands; actual wetland determinations must be based upon data obtained from field investigations.

Several documents were available for this review:

- U.S. Geological Survey 7.5-Minute Topographic Map, Mount Vernon Quadrangle (1981)
- Soil Survey of Skagit County Area, Washington (Klungland and McArthur, 1989)
- *National Wetland Inventory*, Mount Vernon Quadrangle (1989)
- *Hydric Soils of the State of Washington* (SCS, 1985)
- Aerial photograph, 1"=800'
- Mount Vernon wetlands paper inventory (Jones and Stokes, 1991)
- Previous wetland delineation reports

Given that there were no rights-of-entry granted for this survey, in most instances site reconnaissance was limited to roadside surveys. However, several landowners and tenants encountered during the survey invited somewhat closer observations of a few parcels. Wetland hydrology (such as standing water) and dominant vegetation types were the features most readily identified from the roadways. In some instances, soil saturation at the surface could be observed in places where water was not ponded. Binoculars were used to facilitate these assessments. Additional soils information was limited to published documents and readily apparent features; no soil cores were taken.

c. Wetland Characteristics.

Wetland Functions and Values. Wetlands play important roles that provide valuable benefits to the environment and society. Detailed scientific knowledge of wetland functions is limited, so that evaluations of the functions of individual wetlands are often necessarily qualitative and dependent upon professional judgement.

Several wetland functional evaluation methods have been developed. The most common methods applicable in the Pacific Northwest were developed by the Army Corps of Engineers (Reppert et al., 1979; Adamus, 1983; Adamus et al., 1987). These methods were modified for use for wetland evaluations of the following wetland functions: (1) water quality improvement; (2) storm and flood flow attenuation and storage; (3) hydrologic support; and (4) natural biological support.

Water quality improvements functions of wetlands include the ability of wetlands to remove sediments from surface waters passing through the wetlands. This helps prevent the siltation of fish spawning gravels, particularly for economically-important salmonid species. Because many pollutants are associated with particulates, sediment removal results in better water chemistry in receiving waters. Further, many wetland plants and microbial communities associated with plants have the ability to directly remove pollutants or to transform them into less harmful chemical compounds.

Storm and flood flow attenuation and storage results in smoother (less "flashy") hydrographs for streams and other surface waters. The helps prevent flooding conditions on private and public lands, reduces streambank erosion, and maintains the hydrology necessary to support wetland plants.

Because stormwater is detained in wetlands, water is released to surface and occasionally to groundwater receiving waters at a slower rate. Such hydrologic support helps maintain proper flow rates in streams and may help recharge aquifers. The hydrologic support function of some wetlands may also assist in providing readily available irrigation water for agricultural uses.

Natural biological support functions of wetlands includes providing the necessary hydrologic regime for aquatic organisms and providing the habitat resources (for example, food, cover, and nesting materials) for wildlife. Wetlands may be particularly important for biological support because many organisms are partially or completely dependent on wetlands for their survival. In Washington for example, the number of sensitive, threatened, and endangered species which are associated with wetlands is disproportionately high relative to the extent of wetlands in the landscape.

d. Findings.

The National Wetlands Inventory (Mount Vernon quadrangle, 1989) was used as a rough indicator of wetland presence; this inventory identified only four wetlands within the study boundary. A preliminary wetlands inventory limited to the Urban Growth Boundary area was prepared in 1991 (Jones and Stokes and Associates, 1991). That document identified 31 wetlands and proved to be a valuable resource. However, many wetlands identified in the earlier inventory were found to differ in size from this current inventory due to both development activity and because this inventory included field studies. For example, one of the wetlands identified in the earlier work was determined to be completely upland, and one new wetland was identified. Several other areas identified as discrete wetlands in the earlier inventory were determined to be contiguous wetlands through site reconnaissance. As a result, the locations of 28 wetlands were verified within this portion of the study area. Note that a few wetland sites inventoried in the fall of 1991 were under development only a few months later.

Differences in wetland classification using the 1987 Corps Manual versus the 1989 Federal Manual are largely due to vegetation ratings. Many of the pastures in Mount Vernon were dominated in part by facultative species such as colonial bentgrass (Agrostis tenuis) with additional dominant species having facultative upland or upland ratings. As a result, many of these pastures failed to meet the hydrophytic vegetative criteria under the 1987 Manual. A discussion of these manuals is included in Appendix A.

The most common type of wetlands within the study site are fresh water, non-tidal ("palustrine"), emergent wetlands. The majority of these are used as grazing areas for livestock, but others are fallow fields and open pastures. Large tracts of relatively undisturbed forested wetlands are also somewhat common. Scrub/shrub wetlands are primarily restricted to small streamside corridors and successional areas. Open water areas are limited to a few small farm ponds and the seasonal flooding of Barney Lake. Note that while it is likely that additional wetlands would be identified with more intensive field surveys (for example, those resulting in formal wetlands delineations), it appears unlikely that additional wetland types would be identified. The following summaries describe the types of wetlands located within the study area.

- Palustrine Open Water (POW) Wetlands. Few open water wetlands are found within the study site boundary. These are essentially farm ponds likely used to water livestock, and with the exception of Barney Lake, are typically inclusions in emergent wetland areas. Characteristic vegetation includes common cattail (Typha latifolia), reed canarygrass (Phalaris arundinaceae), and soft rush (Juncus effusus). Due to their small size - typically less than one acre - and low vegetative diversity, they do not merit a high rating for habitat. However, Barney Lake provides relatively high wetland functions.

- Palustrine Emergent (PEM) Wetlands. The typical fresh water emergent wetland in the study area ranges from five to 30 acres in size, with saturated soils and fewer than 10 plant species. Often these sites are active pastures or have other agricultural use. Common vegetation includes soft rush, creeping buttercup (Ranunculus repens), hardhack (Spiraea douglasii), and reed canarygrass. Depending on size, overall diversity, and adjacent land uses, these wetlands have low to moderate wetland functional value.

- Palustrine Scrub/ Shrub (PSS) Wetlands. Scrub/shrub wetlands are commonly found along stream corridors and at the edge of emergent sites. These areas often have low plant species diversity; those observed include hardhack, red alder, reed canarygrass, red osier dogwood (Cornus stolonifera), and blackberries (Rubus spp.). Their role in providing streamside habitat and water quality protection generally gives them a moderate functional rating.

- Palustrine Forested (PFO) Wetlands. Forested sites are the second most common wetland in the study area. These wetlands are included as portions of other wetland areas, or in strictly forested tracts of up to 100 acres. Western red cedar and red alder are the typical dominant species. Forested wetlands are considered a more unusual wetland type in western Washington, and therefore merit higher functional value ratings.

e. <u>Summary</u>.

The following is a summary of the functional levels of the wetland types found in the study area.

Generally, larger, more diverse wetlands provide the highest wetland functions and small, less diverse, and disturbed wetlands provide the lowest degree of wetland function. Water quality improvements are best realized in larger wetlands, simply because they can "treat" relatively large volumes of water, and by wetlands located either near pollutant sources or near receiving waters. In Mount Vernon, these wetlands include the larger of the emergent wetlands, Barney Lake, much of the forested wetland, and most of the riparian scrub/shrub wetlands located near the creeks and the skagit River. The small, isolated emergent wetlands, particularly those located in active pastures, function at a low level for water quality improvements.

Storm and flood flow attenuation and storage are best realized in the same types of wetlands which provide the most water quality improvement. This is because the longer water is held in a wetland (that is, the greater the storage capacity), the more water quality improvement is possible. In this regard, Barney Lake appears to be the most valuable wetland in the study area with respect to water storage functions.

Hydrologic support, particularly of surface waters, is best provided by wetlands located near streams and other surface water bodies. These wetlands, even if moderately-sized, release water over time to help maintain important base flows in the city's streams. In this regard, Barney Lake may be viewed both as receiving water for many of the wetlands and small tributaries of the Nookachamps Creek system, and as a wetland which itself helps hydrologically support the Skagit River. The smaller, isolated wetlands provide low hydrologic support.

Biological support is primarily a function of size and habitat diversity. Accordingly, the larger, undisturbed wetlands, particularly Barney Lake and the city's forested wetlands, provide high biological support. Additionally, the scrub/shrub wetlands located in riparian areas provide food and cover for fish and other aquatic organisms. This is particularly important since salmonids are known to utilize many reaches of the streams located in the city. Further, suitable habitat for salmonids is known to exist through the study; however, downstream obstructions are preventing the full utilization of these streams by salmonids. Maintenance of the riparian wetlands are an important element of maintaining viable habitat so that as the obstructions are removed, salmonids may reclaim greater portions of the creeks. The small, isolated emergent wetlands provide habitat for some songbirds, and during the dry season may help support small mammals. While their individual contributions to wildlife support are quite low, in conjunction with surrounding upland areas they provide food resources for larger wildlife such as raptors and coyotes.

H. Existing Water Quality

A water quality assessment was prepared as part of the surface water management plan. Its purpose was to characterize the quality of the surface waters and to identify potential sources of pollution in the Mount Vernon study area. A complete discussion of the water quality assessment is presented in Appendix G. Pollutant loading for existing and future land uses is presented in Appendix H. Historical information (Skagit River basin study, Entranco 1991; Nookachamps management plan, Cook 1980; A catalog of Washington streams and salmon utilization, WDF 1975; Baseline monitoring at proposed Sea-Van Development Site, Sea-Van fisheries resources, W&H Pacific 1992; Predicted water quality impacts from the proposed Sea-Van golf course and residential site, Harding Lawson Associates), was used to characterize the Skagit River, Nookachamps Creek and streams in the study area. A water quality monitoring program and a stormwater pollutant loading study were used to characterize the streams in the study area. The monitoring program was used to identify specific pollutant problems in the study area, while the pollutant loading study, which estimates loadings based on land use activity, was used to indicate the relative pollutant problem in each of the study area major drainage basins and also the relative increase in pollutants in each basin due to future urbanization.

1. Monitoring Program

The monitoring program was implemented to identify the water and sediment quality of the streams in the study area. The monitoring program was conducted according to the water quality monitoring and quality assurance plan prepared for the surface water management plan. Five monitoring stations were used and they are located as listed below:

- Station 1 is located at the mouth of Kulshan Creek, which flows west into the Skagit River

- Station 2 is located on main stem of Trumpeter (College Way) Creek at Waugh Road, which flows east into Nookachamps Creek

- Station 3 is located on Madox Creek near Anderson Road, which flows southwest into the Skagit River

- Station 4 is located on Carpenter Creek at Hickox Road, which also flows southwest into the Skagit River

- Station 5 is located on a tributary to Madox Creek along freeway north of Anderson Road that flows south into Madox Creek below Station 3.

Water samples were collected as grab samples three times at each station between January and July 1992. Sampling occurred twice during storm flow conditions and once during base flow conditions. At each station, five sediment subsamples were collected to a depth of 2 cm in sediment deposition areas, then combined into a single sample for each station. All of the deposition areas were located less than 60 feet downstream of the water sampling stations, except for Station 1 on Kulshan Creek where the nearest deposition area is located 2,400 feet upstream of the mouth, upstream of a long piped section of the stream.

The results of the monitoring program and the review of historical information indicates that all four study area streams have pollutant parameter concentrations greater than those in the Skagit River upstream of Mount Vernon. Kulshan Creek is the most urbanized and has the highest pollutant parameter concentrations of the four streams, while Carpenter Creek is the least urbanized and has the lowest pollutant parameter concentrations.

From this preliminary assessment of the water quality in the study area, moderate contamination by metals and petroleum hydrocarbons was observed in streams located in developed basins. Kulshan Creek had the highest levels of these pollutants, as a result of runoff from paved areas and perhaps from commercial activity. Contamination by fecal coliform bacteria and nutrients was observed in each stream, probably from a combination of poor agricultural (livestock) practices, failing septic systems, and improper sewer line connections. These pollutants were most elevated in the Kulshan Creek basin, probably as a result of sewage contamination. Further discussion of water quality problems is contained in Section VI.

2. <u>Stormwater Pollutant Loading Study</u>

A stormwater pollutant loading study was performed to estimate the relative stormwater pollutant loading for each basin based on land use activities. Basins that had the highest relative estimates, and thus contribute the greatest amount of pollution, were identified and targeted as having the greatest need for water quality protection. This information is contained in Appendix H.

The national urban runoff model, developed by the U.S. Environmental Protection Agency (USEPA,1983), was used to determine annual pollutant loadings from five major basins draining from the Mount Vernon Urban Service Area. Each of the drainage basins were divided into one of four land use categories based on current land use and future zoning. The four land use categories are: commercial, residential, forest, and pasture. Five target pollutants were selected due to their association with stormwater. The pollutants are total suspended solids, nitrate + nitrite nitrogen, total phosphorus, lead, and fecal coliform bacteria. The concentration of stormwater pollutants used to estimate loadings for each land use type were obtained from the City of Portland's Clean Rivers Program (Wooward-Clyde 1993).

The results of the pollutant loading study indicates that the Kulshan Creek drainage basin is the most significant contributor of stormwater-related pollution from the urban service area for the existing conditions, followed by Trumpeter Creek, then the Madox Creek drainage basins. Despite its large area, Carpenter Creek contributes relatively lower loadings of pollutants. Existing pollutant washoff estimates for the area draining to Nookachamps Creek were the lowest of all basins due to the high percentage of rural area within this basin. This pollutant loading analysis was used primarily to describe problems associated with relative increases in pollutant loads with future development. These problem descriptions are discussed in Section VI.

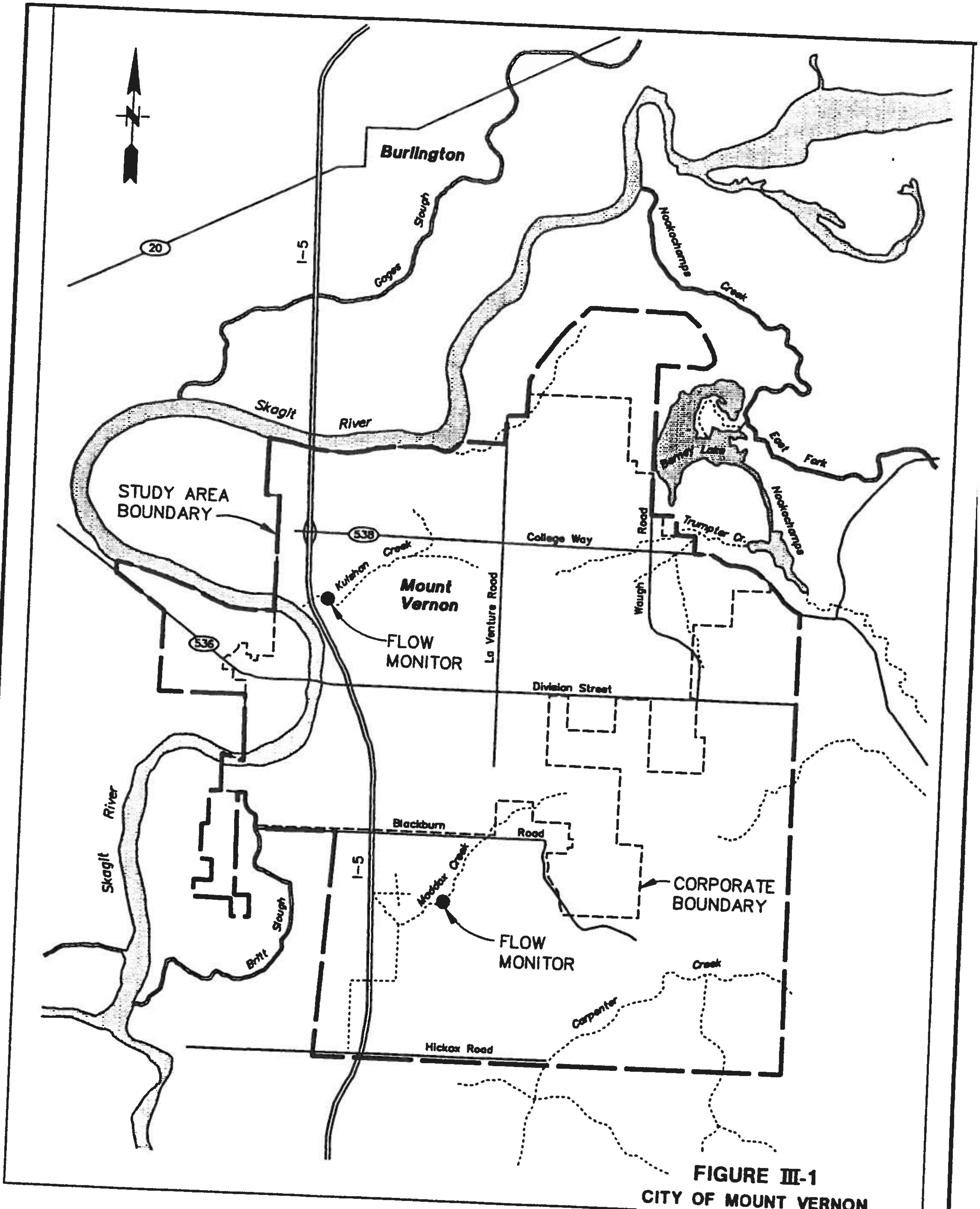

FIGURE III-1
CITY OF MOUNT VERNON
WASHINGTON
SURFACE WATER
MANAGEMENT PLAN
STUDY AREA

R·W·BECK

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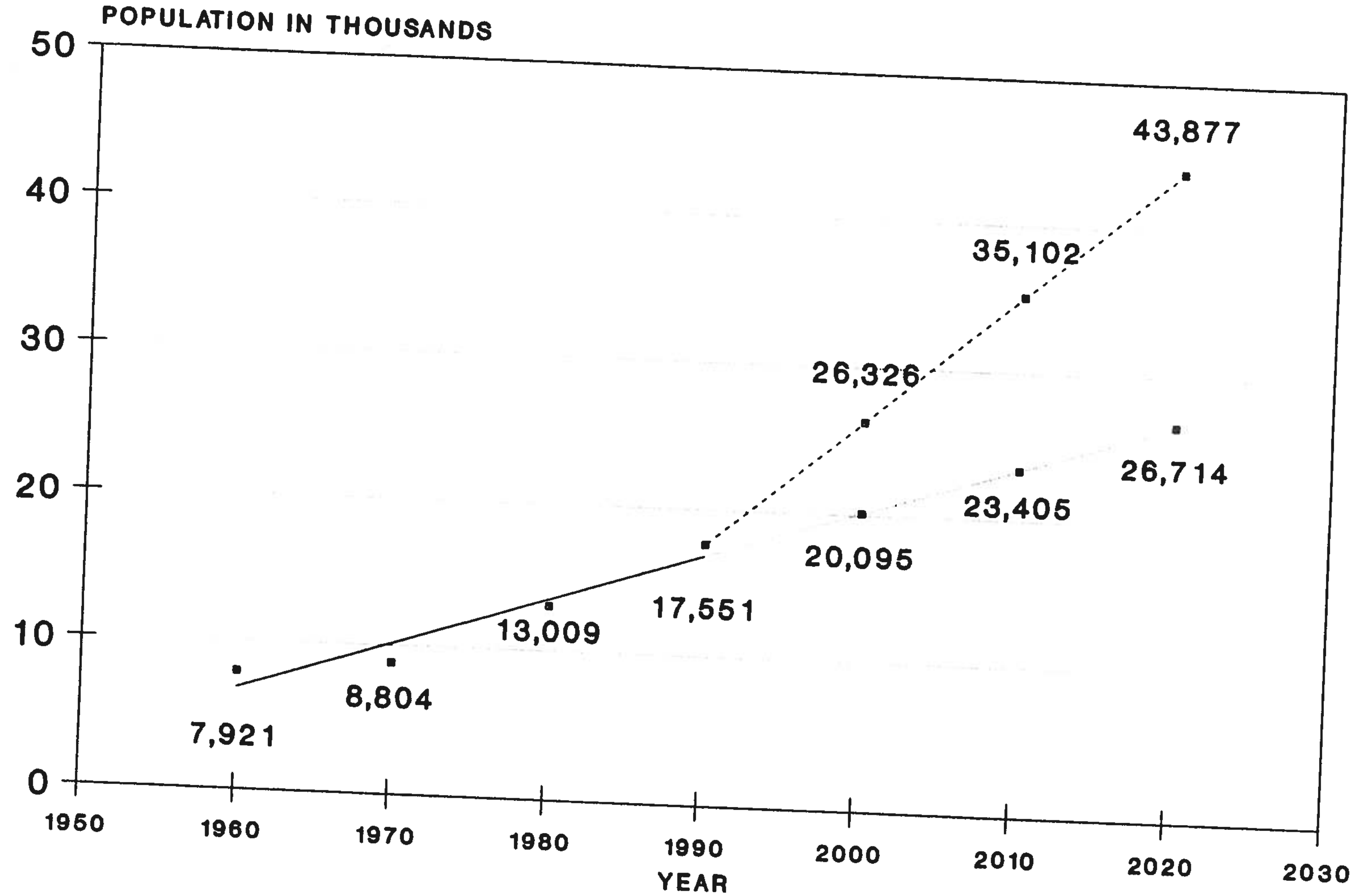

FIGURE II-2
HISTORICAL POPULATION AND
PROJECTED POPULATION GROWTH

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

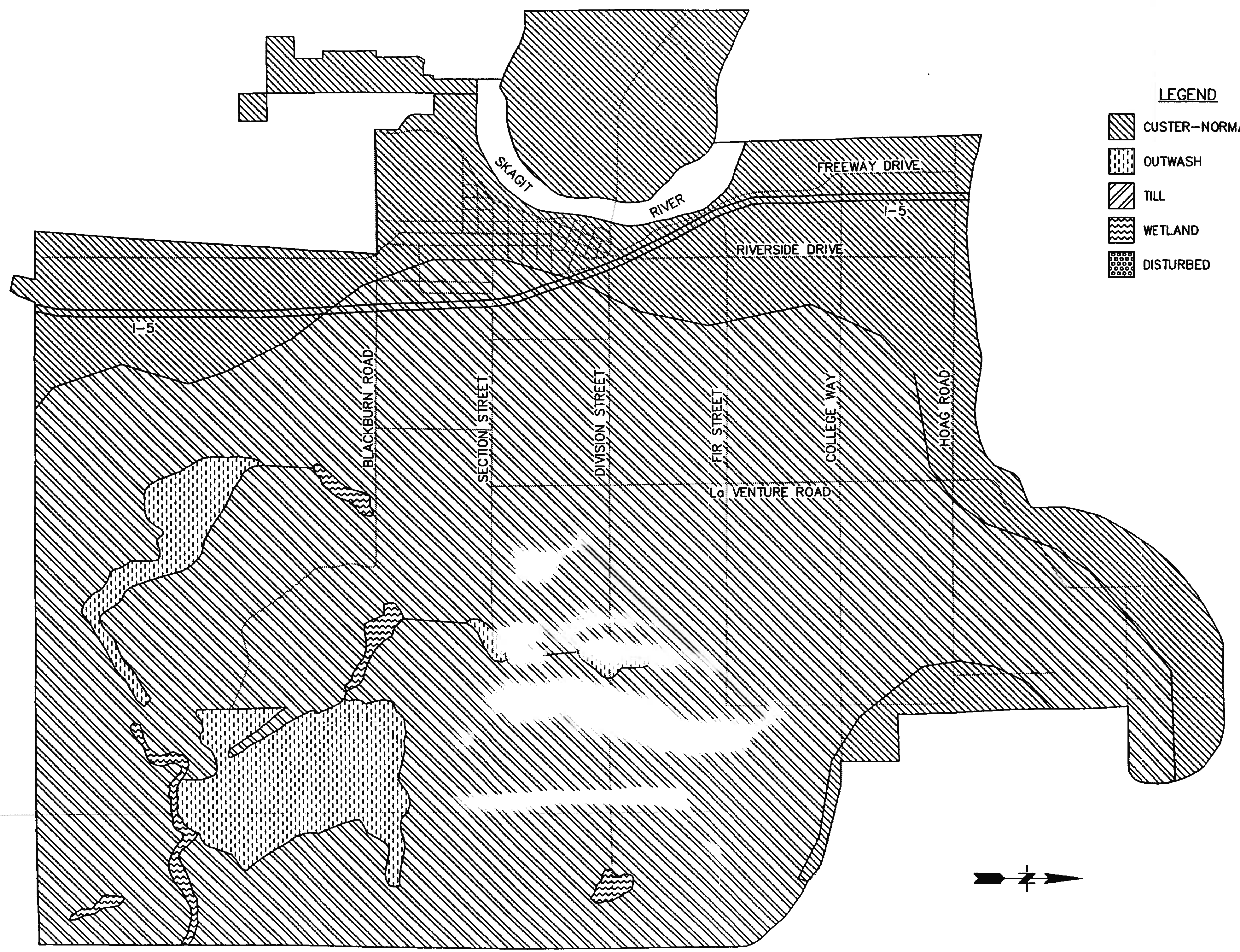

FIGURE III-2
CITY OF MOUNT VERNON
SURFACE WATER
MANGEMENT PLAN

SOIL TYPES

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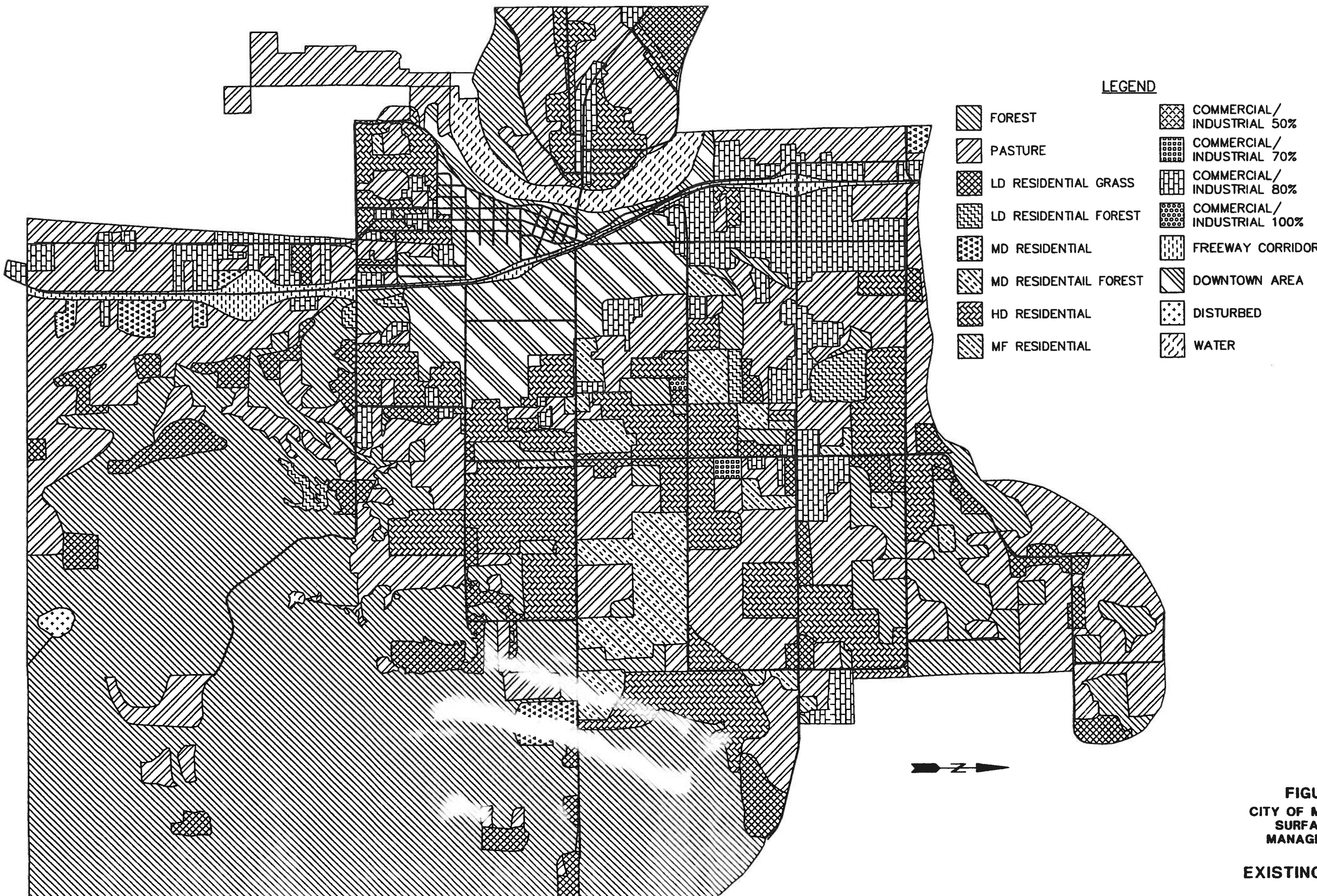

FIGURE III-3
CITY OF MOUNT VERNON SURFACE WATER MANAGEMENT PLAN

EXISTING LAND USE

R·W·BECK

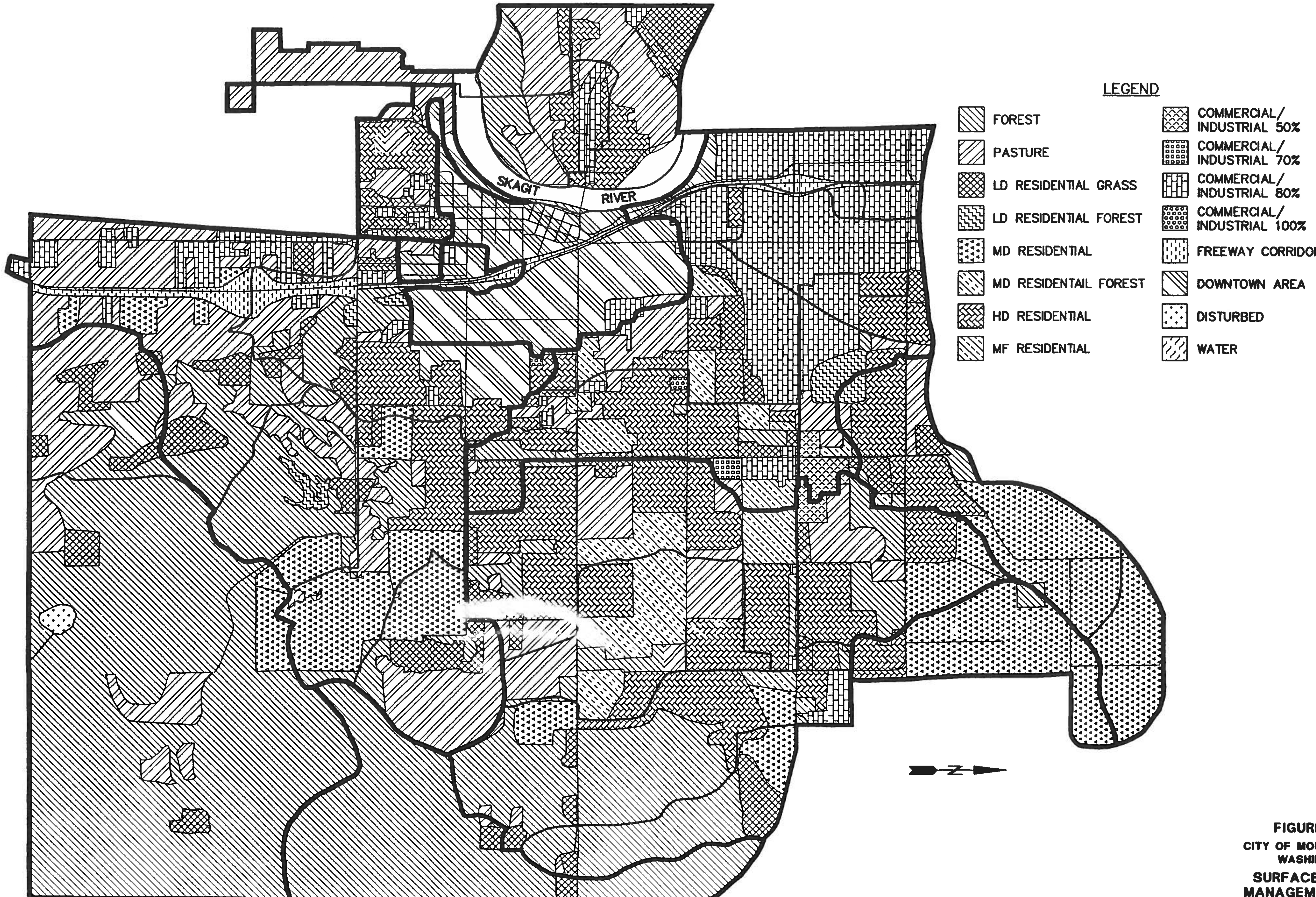

FIGURE III-4
CITY OF MOUNT VERNON
WASHINGTON
SURFACE WATER
MANAGEMENT PLAN
FUTURE LAND USE

R.W. BECK

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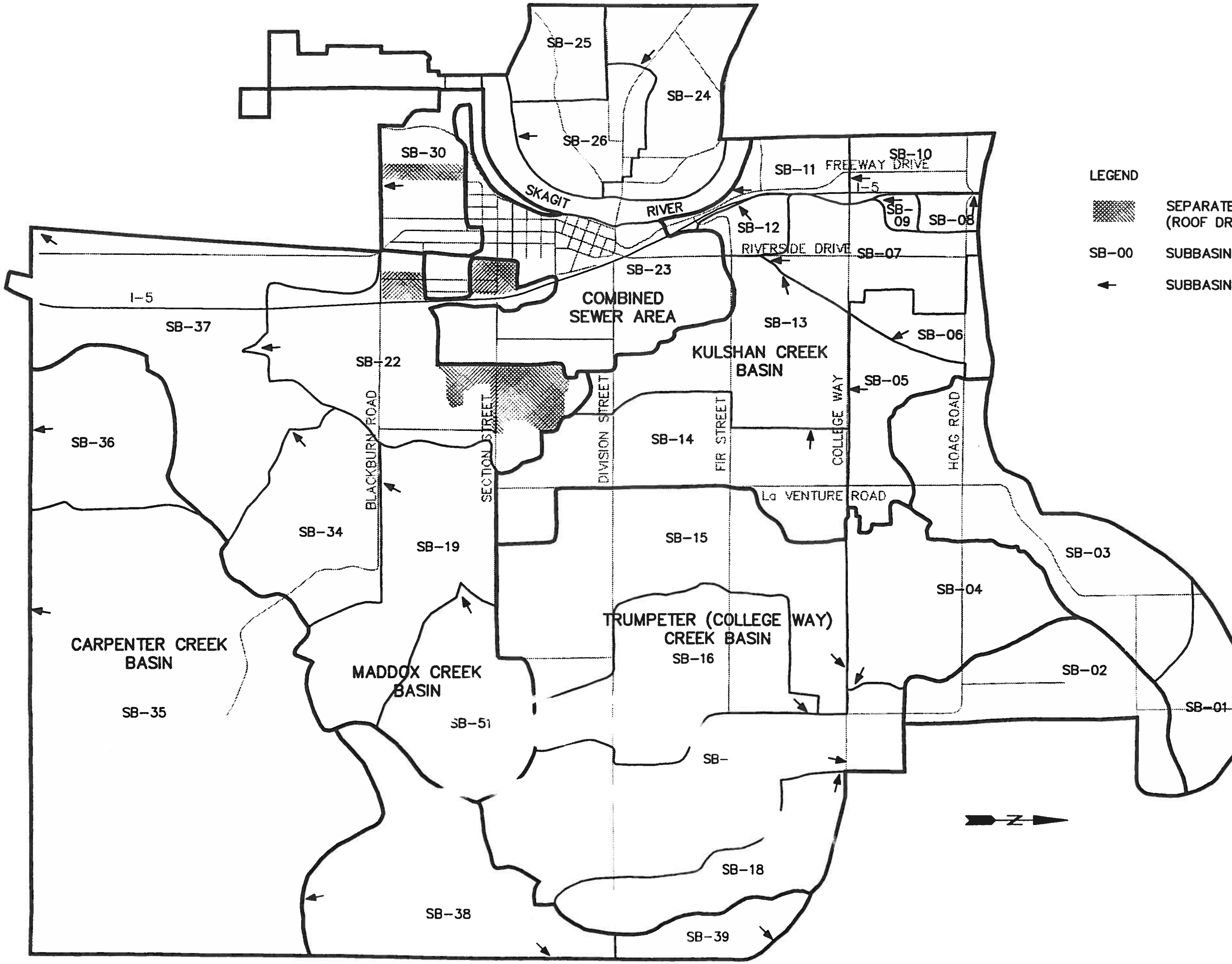

LEGEND

SEPARATE SEWER AREA (ROOF DRAINS GO TO SANITARY SEWER)

SB-00 SUBBASIN NUMBERS

SUBBASIN DRAINAGE EXIT LOCATION

FIGURE III-5

CITY OF MOUNT VERNON
WASHINGTON

SURFACE WATER
MANAGEMENT PLAN

DRAINAGE SUB BASINS

R·W·BECK

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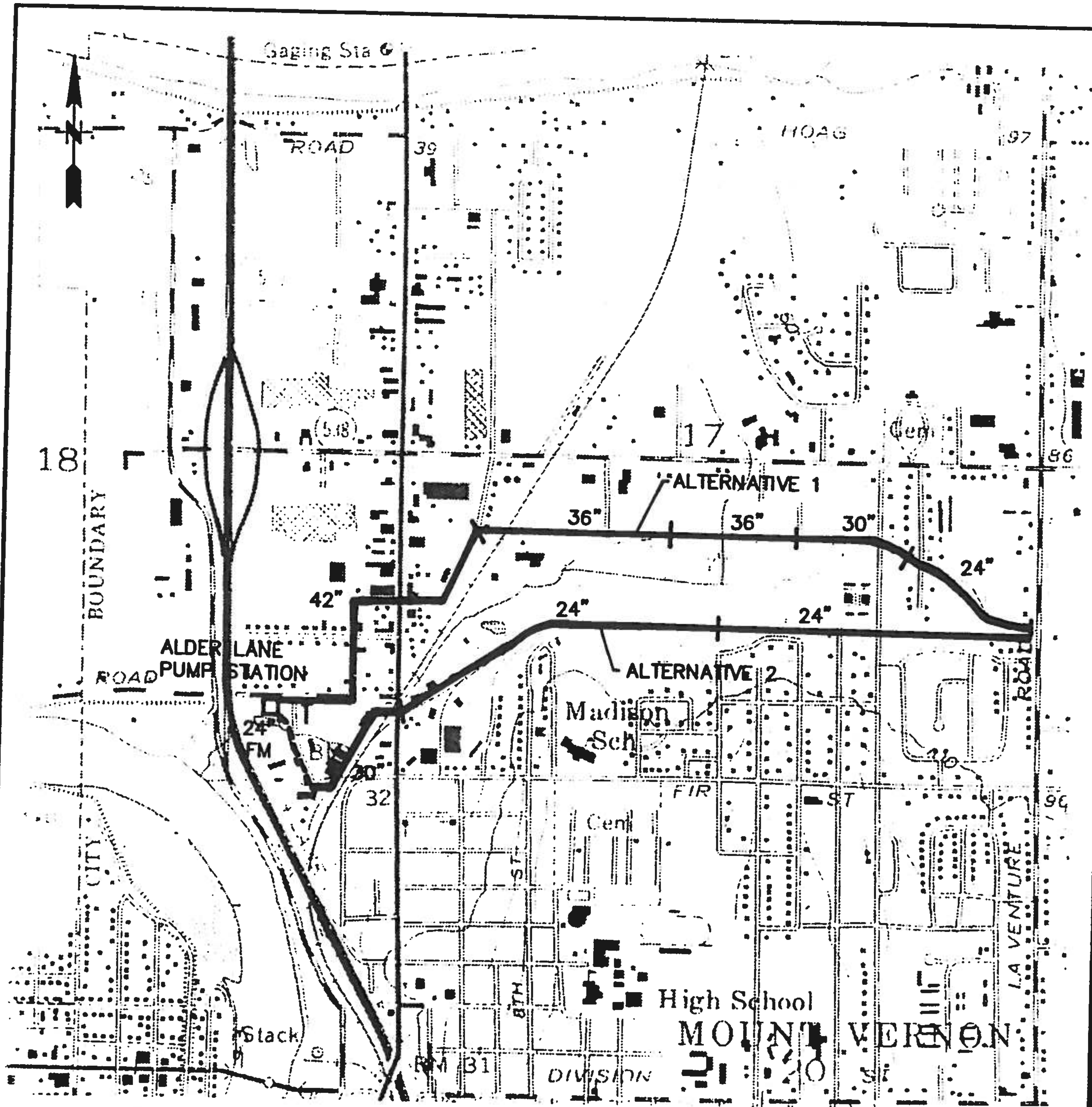

FIGURE III-3

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE SEWER PLAN
KULSHAN INTERCEPTOR ALTERNATIVES

R·W·BECK

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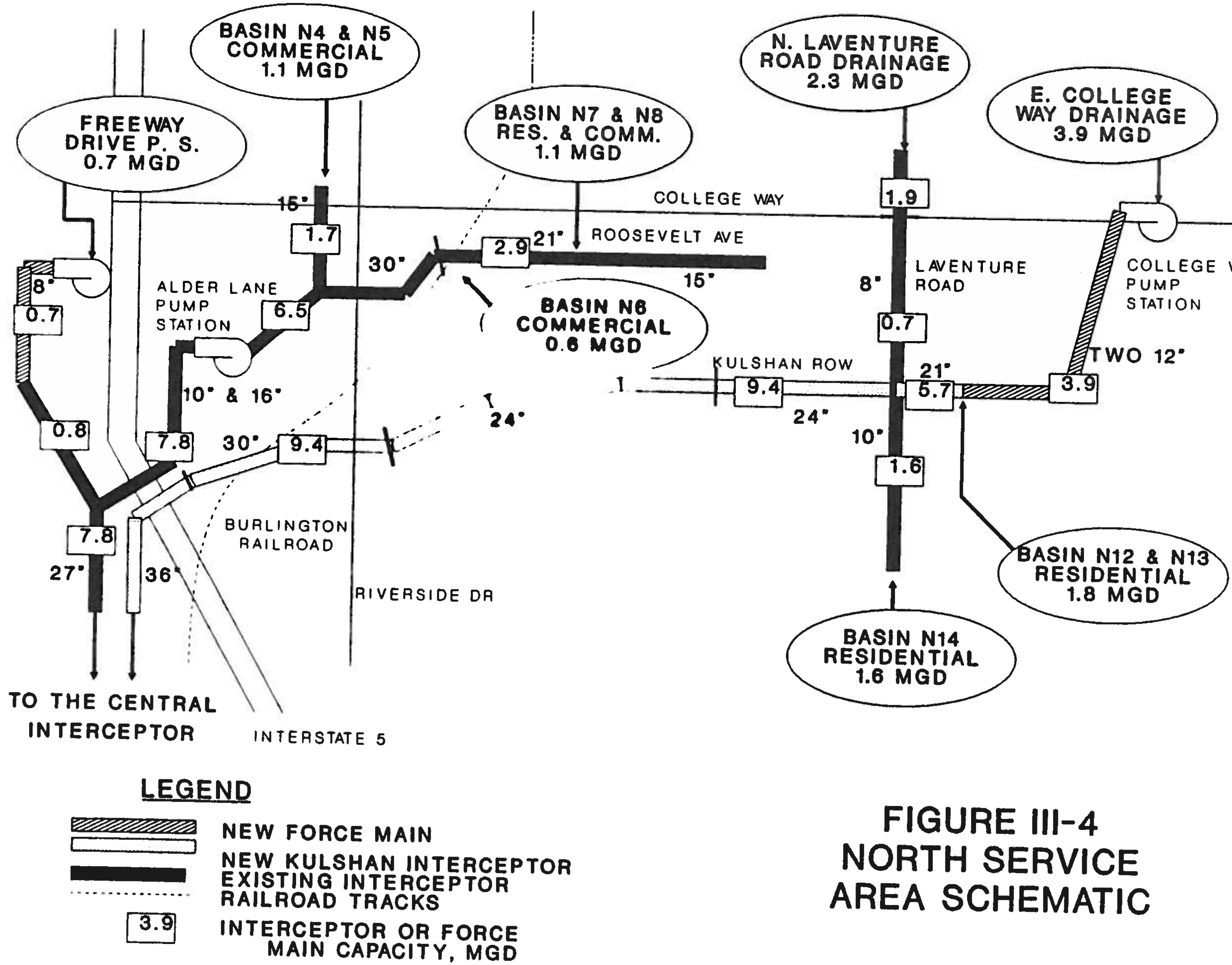


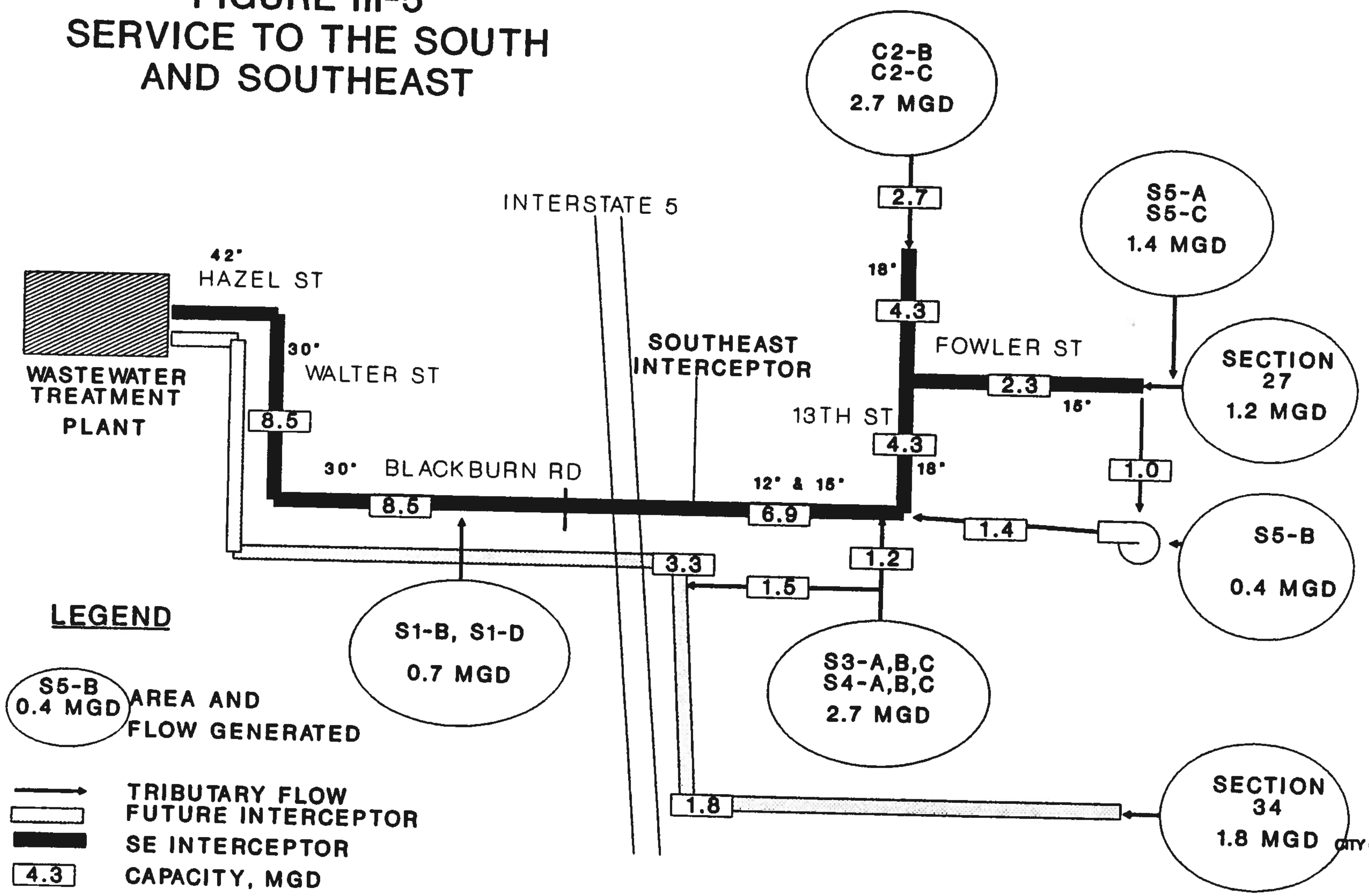
FIGURE III-4
NORTH SERVICE
AREA SCHEMATIC

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINEI
SEWER OVERFLOW
REDUCTION PLANS

R·W·BECK

FIGURE III-5
SERVICE TO THE SOUTH AND SOUTHEAST

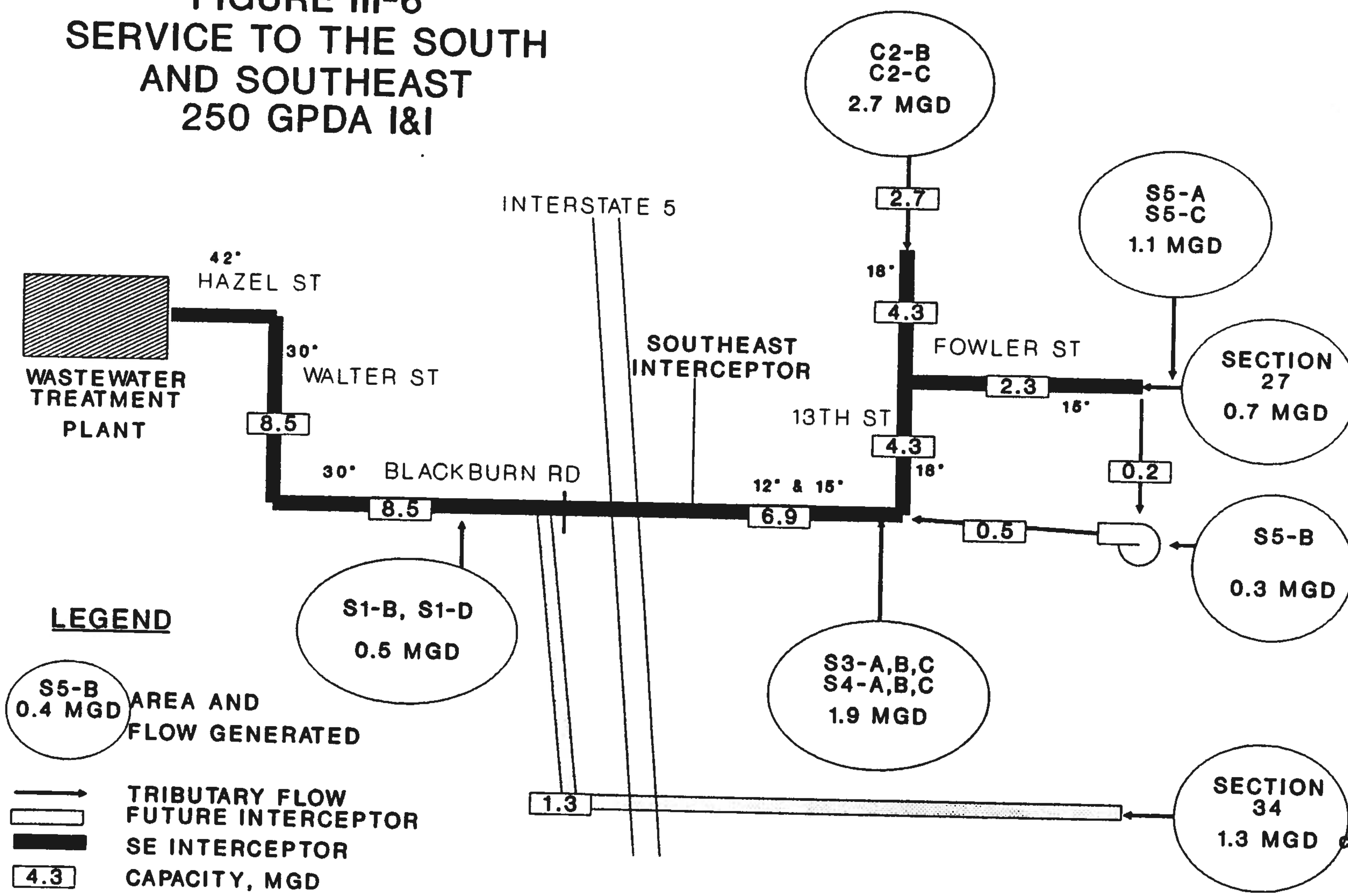


CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINE
SEWER OVERFLOW
REDUCTION PLANS

R·W·BECK

FIGURE III-6
SERVICE TO THE SOUTH AND SOUTHEAST
250 GPDA I&I



CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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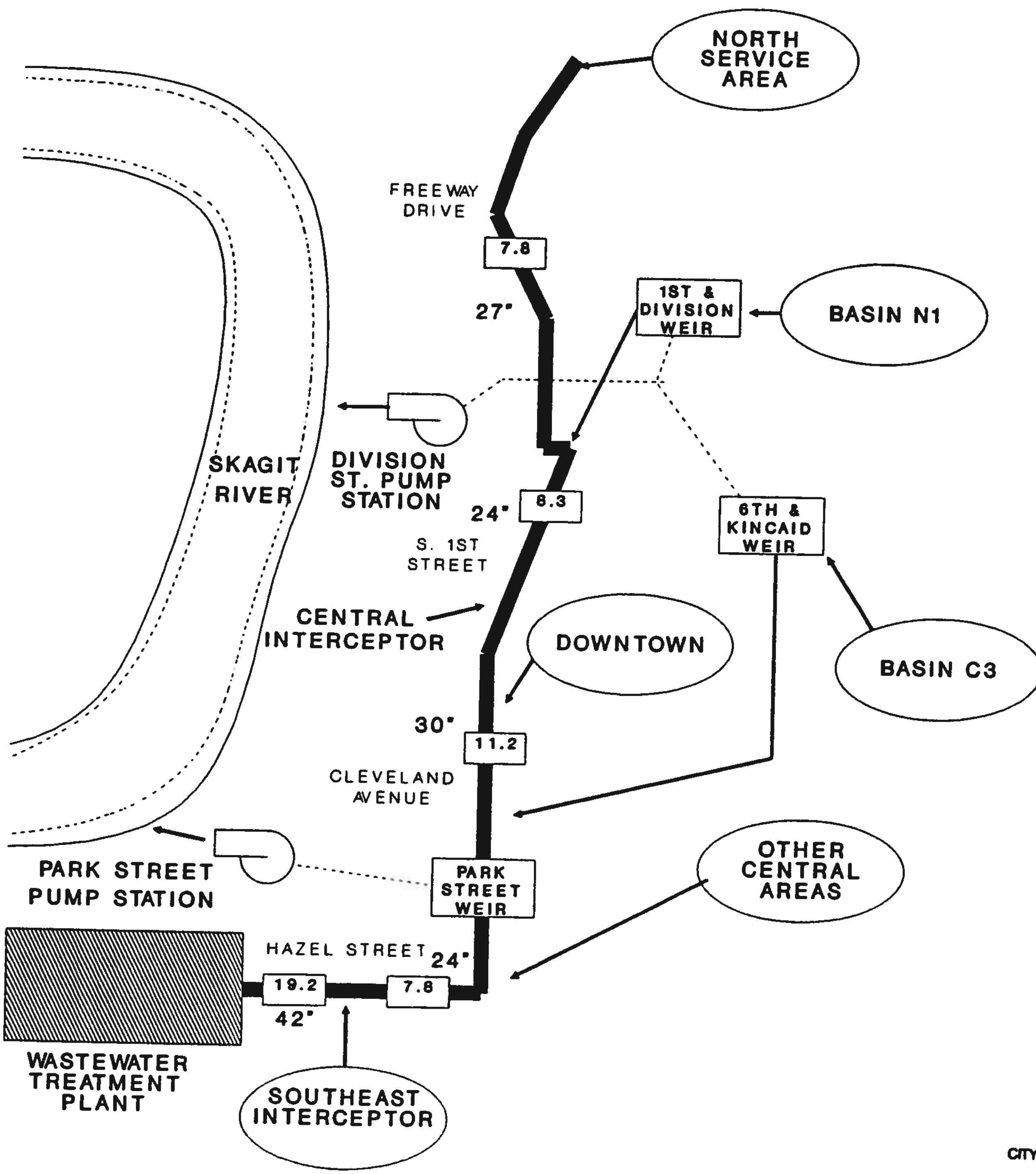
FIGURE III-7
EXISTING CENTRAL AREA DRAINAGE

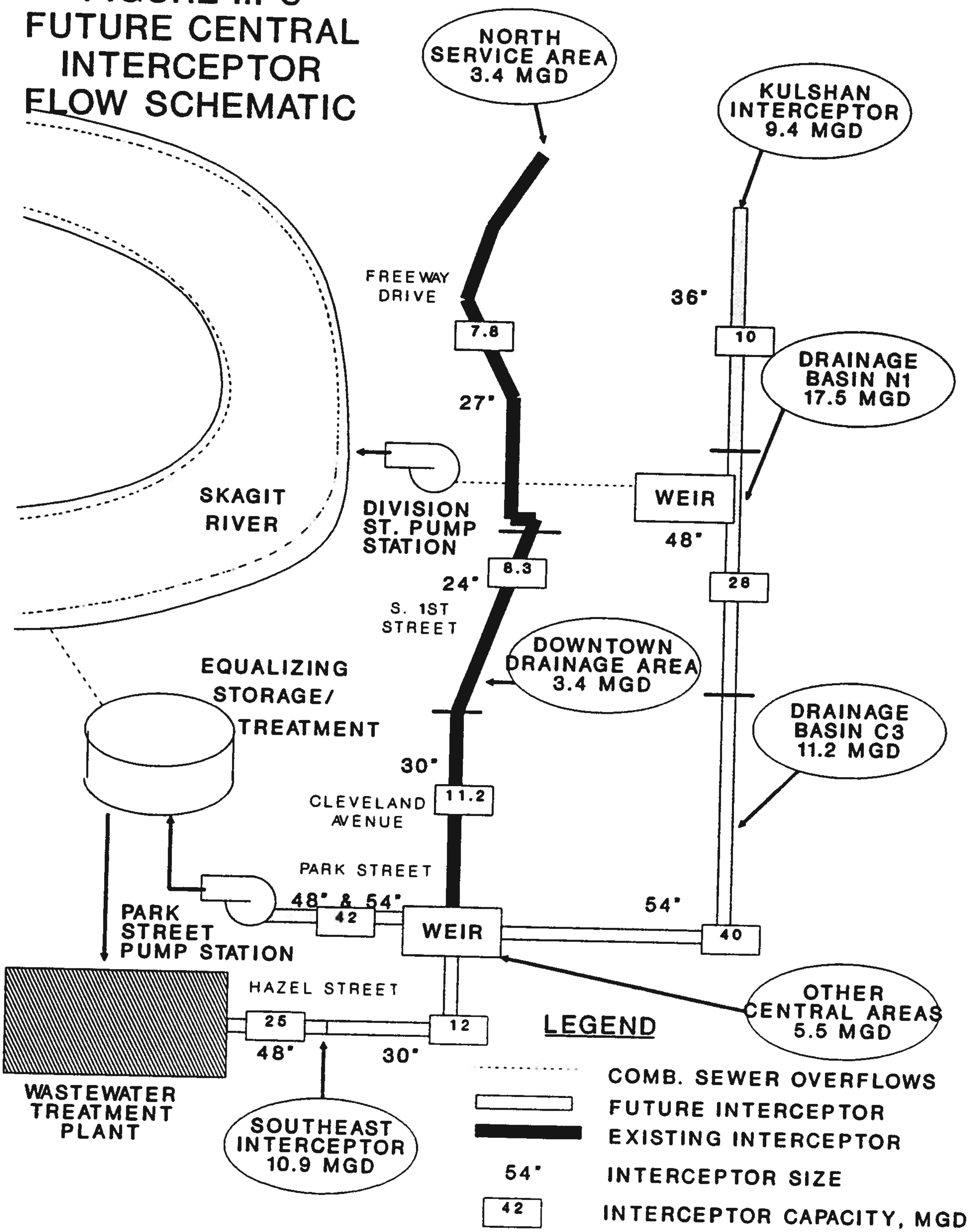


CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

R·W·BECK

FIGURE III-8
FUTURE CENTRAL INTERCEPTOR FLOW SCHEMATIC



SECTION IV
HSPF HYDROLOGIC COMPUTER ANALYSIS

SECTION IV

HSPF HYDROLOGIC COMPUTER ANALYSIS

A. General

A sophisticated hydrologic analysis was performed for each of the major drainage basins within the study area. This analysis was used to predict runoff volumes and peak flows for storm events with a specified return frequency. This information is necessary to establish design criteria for conveyance, water quality controls, and fish habitat preservation.

B. Hydrologic Modeling

Hydrologic modeling was performed using EPA's HSPF model. HSPF is a sophisticated computer modeling program that simulates land surface and instream hydrologic processes on a continuous basis. The model is used to transform a long time-series of observed rainfall and evaporation data into a time-series of runoff using continuous accounting of soil moisture levels.

The HSPF model provides a distinct advantage over more traditional event-based models. Event-based models simulate streamflow for individual synthetic storms, and their accuracy depends on the user's ability to accurately portray watershed conditions (primarily soil moisture levels) existing before the storm being modeled.

Hydrologic modeling involved four basic steps:

- definition of drainage basin and subbasin characteristics;
- calibration with recorded flow data;
- simulation of runoff for current and future land use conditions; and
- frequency analysis of simulated runoff data to provide design inflow hydrographs to the storm drainage system.

To provide the necessary hydrologic design data for this project, HSPF was used to simulate an extended period of runoff data that was then subject to a frequency analysis.

As noted earlier, HSPF operates by transforming a long sequence of rainfall data into a sequence of runoff data. The exact nature of this transformation is controlled by a number of model parameters. Application of HSPF involves appropriate configuration of the model by characterizing each of the study area basins, selection of model parameters to represent the rainfall/runoff transformation by calibrating the model to continuous flow monitoring devices, performing long-term simulations by applying a time-series of rainfall data representative of local meteorological conditions, and frequency analysis to estimate 2-, 10-, and 100-year runoff values.

1. Basin Characterization

The study area is comprised of seven separate drainage basins: Kulshan Creek, Madox Creek, Carpenter Creek, Nookachamps Creek, Trumpeter Creek, Britt Slough, and West Mount Vernon. Each of those subbasins were further divided into several smaller subbasins. The land use for each subbasin were divided into seven different land use categories: forest, grassland, low-density residential, medium-density residential, high-density residential, multi-family residential, and commercial/industrial. Presented in Tables IV-1 and IV-2 are the existing and future land uses for the study area by basin. Figure III-5 shows the drainage basins and subbasins within the study area. The Flowers Creek basin (subbasin 22) was further divided to perform a hydrologic analysis and evaluate the surface water impacts of the proposed Blackburn Ridge development on the south side of Blackburn Road. The results of that analysis are presented in Appendix M.

HSPF differentiates between impervious and pervious surfaces. The effective impervious area is that portion of the impervious area contributing runoff directly to the drainage system. In low-density residential, medium-density residential, high-density residential, multi-family residential, and commercial/industrial, this was estimated to be 4, 10, 18, 50, and 85 percent, respectively, of the total area in each land use. The commercial/ industrial areas were further divided into 50 percent impervious, 70 percent impervious, and 100 percent impervious. Non-effective impervious areas in residential and commercial districts were assumed to have the same hydrologic characteristics as grass or as open pasture overlying the appropriate soil type.

The areas identified in Figure III-5 with shading are unique in terms of the surface runoff they generate. Because these are formerly combined sewered areas, the homes in the areas have roof drains that are connected to the City's sanitary sewer. Therefore, it is assumed that only the runoff generated from the streets and driveways enters the storm drainage system. Subbasin 23 is a combined sewered area and was excluded from the hydrologic and hydraulic analysis. All of the surface runoff in that area flows to the sanitary sewer and is treated at the waste water treatment plant.

The pervious areas within each of the subbasins were further divided into 11 categories based on soil type. Each pervious area category was assumed to have homogeneous hydrologic characteristics. The nine categories of pervious area used were:

(1) Forested outwash soils
(2) Pastured outwash soils
(3) Grassed outwash soils
(4) Forested till soils
(5) Pastured till soils
(6) Grassed till soils
(7) Forested flood plain soils
(8) Grassed flood plain soils
(9) Wetland soils

2. Model Calibration

The hydrologic response of the various pervious and impervious areas is controlled in HSPF by a number of model parameters. The parameter values were adjusted to reflect actual streamflow measurements so that the model will accurately simulate the hydrologic response of a drainage basin. This process of parameter values adjustment is known as model calibration. Model calibration was performed for both the Madox Creek and Kulshan Creek drainage basins where flow monitoring equipment was installed at the beginning of this planning effort. The two drainage basins are very different in terms of existing land use conditions.

Madox Creek is mostly undeveloped with only a small amount of effective impervious surface in that basin. A continuous flow recording device was installed in a 200-foot-long 84-inch-diameter corrugated metal pipe approximately 1200 feet upstream from Anderson Road. The device was used to monitor depth of flow in the pipe. The recorded depths were then converted to flow in CFS using Manning's equation, which was verified by comparison with selected flows measured by a flume at this same location. The total basin area tributary to the monitoring location is approximately 900 acres.

The Kulshan Creek Basin is mostly developed and has a high percentage of effective impervious area. A continuous flow recorder was installed in the 48-inch concrete pipe section of the creek where it parallels the Burlington Northern railroad track on the east side of and approximately 200 feet downstream of Riverside Drive. The total basin area tributary to the monitoring location is approximately 1125 acres.

Calibrating both of the drainage basins using recorded flow data verified that the selected parameter values produced reasonable results for both Madox Creek and Kulshan Creek. Once the parameter values were adjusted for the Madox and Kulshan Creek basins, these same values were used to produce predicted flowrates for the other five drainage basins within the study area.

The period used to calibrate the model was from December 1991 through February 1993. Flow data were collected on both Kulshan Creek and Madox Creek during that period at the locations identified in Figure III-5 and previously described. Precipitation data were collected at the Mount Vernon Waste Water Treatment Plant during the same period. Both the flow and precipitation data were collected with equipment that provided this information on a fifteen minute time increment.

The calibration process involved adjustment of certain model parameter values to produce simulated flow volumes for the calibration period which were similar to the recorded flow volumes. Once the volumes were accurately simulated, other parameter values were modified to produce simulated hydrographs for individual precipitation events which were similar to the recorded hydrographs.

The calibration period was extended from the original plan to monitor only the 91-92 wet weather season because of the lack of data for a large storm. By including the 92-93 wet season, there was a greater chance that data from a large storm could be collected.

which would improve the accuracy of the model simulation for larger storm events. In spite of this extended calibration period, the largest precipitation event that occurred during the calibration period was in January of 1992. The flow and precipitation data from that storm event were used to fine tune the calibration of the HSPF model. Based on the frequency analysis performed for the long term simulation as described in the subsequent subsection the return period for the January 1992 event is approximately a three-year event.

The calibration process produced a set of parameter values that could be used to represent both Kulshan Creek and Madox Creek drainage basins. One parameter was assigned different values for the Madox Creek and Kulshan Creek calibration. The value for "DEEPFR" used for the Kulshan Creek calibration was 0.85. This means that 85 percent of the portion of the rainfall that enters the groundwater system never reenters the creek and continues down gradient until it reaches the Skagit River. This assumption is based on the fact the topography is flat. Also, the creek in the lower portion of the basin is contained in a 48-inch concrete conduit, which precludes subsurface groundwater flows from entering the system. Because of the length of time it takes for groundwater flows to reach surface waters downgradient, the peak flows in the area streams are not affected by the groundwater flows in the system. However, because some portion of the groundwater flows do eventually reach surface waters, the volumes of surface water runoff are affected by the groundwater contribution. For that reason, in areas where the HSPF model was used to simulate alternative solutions involving detention storage, careful consideration was given to the amount of groundwater that could reasonably be expected to enter the surface water system. The value of the "DEEPFR" parameter was set to 0.0 for the other basins.

There are some indications that the peak flow estimates generated by the HSPF model may be too high and could lead to overly conservative designs. One indication is the flow period used to calibrate the model. Although the flow monitoring was extended to include the 92-93 wet season in addition to the 91-92 wet season, unfortunately this period coincided with two of the driest winters in recent years. As noted above, only one moderately large storm event occurred during this period (January 1992) and it was only approximately a three-year event. The calibration is therefore based on minimal amount of high flow data.

Further uncertainty about the peak flows estimates arises when comparing flows predicted by HSPF with reported occurrences of flooding on Kulshan Creek. The HSPF model for current land use conditions predicts peak flows on Kulshan Creek below Riverside Drive of 110 cfs with a return period of about 2.5 years. Hydraulic analysis of the current pipeline capacity below Riverside Drive indicates that flows of this magnitude with free outflow to the Skagit River would produce water levels at about elevation 27 feet. Since serious flooding would occur if the water level in the area exceeded elevation 26, this would indicate that serious flooding should occur about once in every two years on average. Although serious flooding occurred in November 1990 as a result of inadequate pump station capacity, there is no evidence to suggest that flooding occurs as frequently as once every two years as the result of limitations in the pipeline capacity under gravity flow conditions. This observation therefore suggests that the current estimates of peak flows under current and future land use conditions are too high. It follows that design based on these peak flows might be overly conservative.

The graphs in Figures IV-1 and IV-2 show the results of the calibration for the January 1992 event for Madox Creek and Kulshan Creek respectively. Each graph shows two lines. One line represents actual flow measurements, and the other line represents the HSPF computer simulation of flow at the same location.

3. Long Term Runoff Simulation

The calibrated HSPF model was then used by inputting 36 years of hourly rainfall data from the NOAA Weather Station in Burlington, Washington to simulate 36 years of runoff for each subbasin for each pervious land use category and for impervious areas. For pervious areas, HSPF splits runoff into a surface, interflow and groundwater component. For each subbasin, careful consideration was given as to which of these three components of runoff could reasonably be assumed to enter the pipe or channel system. In general, it was assumed that the surface runoff component generated within a subbasin would leave the subbasin as a surface water discharge at its defined outlet point in either a stream channel or a major storm drain. Interflow (shallow groundwater flow) generated within a subbasin was assumed to either leave the subbasin by reaching a surface water system at its defined outlet point or the interflow would continue to accumulate as subsurface flow moving downslope in a dispersed manner to the next downslope subbasin. Interflow was assumed to enter the surface water system only if shallow subsurface movement of water could reasonably be expected to be intercepted by roadside ditches. Otherwise, the model assumed it continues to flow downhill until intercepted by a perennial stream channel. The groundwater component of runoff was generally assumed not to enter pipe systems in the basin. Remaining groundwater was assumed to flow downslope until it reached a defined stream channel.

HSPF was used to combine runoff data from the effective impervious and pervious areas for the surface, interflow, and groundwater runoff components. This process gave a 36-year time-series of outflows at selected points for each subbasin.

Runoff was simulated for both the existing land use and the future buildout condition.

4. Frequency Analysis

Peak annual discharges were determined for each of the 36 years of simulated flows and subjected to frequency analysis. Frequency analyses were used to estimate the peak 2-, 10-, and 100-year runoff values at selected locations for both existing and future land use conditions. The results of the frequency analyses are presented in Tables IV-3 and IV-4 for future and existing land use conditions, respectively. The future runoff condition assumes that no onsite or regional controls are effective in reducing peak flows. As part of the work performed for Section VII, frequency analyses were also used to evaluate the effectiveness of alternative structural solutions. The HSPF model was modified as part of that work to simulate the effects of alternatives involving detention. As discussed in Section VII, comparisons of peak runoff were made for the alternatives to evaluate their effectiveness.

C. Use of Hydrology for Evaluating New Development Projects

The hydrologic data contained in Table IV-4 can be used to determine peak flows from smaller areas within individual subbasins. This may be useful for establishing design criteria for new conveyance improvements. This table shows the total acreage, and return period flows for each subbasin in the study area under future land use conditions. The return period flows listed are for the 2, 10, and 100 year return frequencies.

To provide flow information for design, the drainage area tributary to any proposed conveyance improvements should be calculated. This smaller tributary area should be divided by the total subbasin area in which it is contained to determine the fraction of the subbasin area tributary to the proposed conveyance improvements. This fraction is multiplied by the flows for the subbasin presented in Table IV-4 to determine the appropriate flow for the smaller tributary area for the various return periods.

Some care should be taken when applying this methodology. This methodology assumes that the future land use within the entire larger subbasin is somewhat uniform. If a significant portion of the future land use within a subbasin is undeveloped, the undeveloped area should be subtracted from the total subbasin area before the subbasin area is used in any of the calculations described above. To assist in determining whether the future land use within any individual subbasin is uniform, the subbasin boundaries are shown together with the future land use on Figure III-4.

Table IV-1
City of Mount Vernon

Existing Land Use in Acres

LAND USE	Drainage Subbasin				
	Kulshan Cr.	Trumpeter Cr. (College Way Cr.)	Madox Cr.	Carpenter Cr.	Area to Nookachamps
Commercial					
100% Impermeable	3.10	0.00	1.50	0.00	0.00
80% Impermeable	388.80	22.60	212.60	0.00	0.00
50% Impermeable	31.00	15.40	0.00	0.00	0.00
Total Commercial	422.90	38.00	214.10	0.00	0.00
Residential					
Multifamily	89.00	25.70	0.00	0.00	0.00
High Density	242.10	442.60	156.80	0.00	30.40
Medium Density	50.50	208.60	35.80	0.00	0.00
Low Density (forested)	36.50	6.00	20.80	35.70	0.00
Low Density (grassland)	40.50	106.10	146.40	18.80	16.30
Separate Sewer Area	0.00	0.00	103.00	0.00	0.00
Total Residential	458.60	789.00	462.80	54.50	46.70
Forest	87.70	700.60	730.20	3,319.60	340.30
	435.10	485.20	577.00	378.60	100.50
Total Land Use Area	1,404.00	2,013.00	1,984.00	3,753.00	488.00

Table IV-2
City of Mount Vernon

Future Land Use in Acres

LAND USE	Drainage Subbasin: Kulshan Cr.	Trumpeter Cr. (College Way Cr.)	Madox Cr.	Carpenter Cr.	Area to Nookachamps
Commercial					
100% Impermeable	3.10	0.00	1.50	0.00	0.00
80% Impermeable	682.02	27.10	212.60	0.00	0.00
50% Impermeable	30.99	15.36	0.00	0.00	0.00
Total Commercial	716.11	42.46	214.10	0.00	0.00
Residential					
Multifamily	97.12	70.55	0.00	0.00	0.00
High Density	319.47	619.40	200.73	0.00	30.40
Medium Density	31.97	328.39	320.00	118.01	448.90
Low Density (forested)	26.18	6.00	20.77	0.00	0.00
Low Density (grassland)	58.58	127.42	142.71	54.41	0.00
Separate Sewer Area	0.00	0.00	103.00	0.00	0.00
Total Residential	533.32	1,151.76	787.21	172.42	479.30
Forest	37.13	560.10	431.03	3,129.77	8.17
Pasture	117.30	258.71	551.24	450.18	0.00
Total Land Use Area	1,404.00	2,013.00	1,984.00	3,753.00	488.00

Table IV-3
City of Mount Vernon

Existing Land Use and Existing Drainage System
Peak Flows (cfs)

Drainage Basin	Drainage Subbasin	Return Period (years)		
		2	10	100
Skagit River Tributary	SB-01	4.6	7.4	10.8
	SB-03	19.7	32.4	51.8
Riverbend Road	SB-08	2.0	3.1	5.0
	SB-09	1.2	1.8	2.8
	SB-10	8.3	12.7	20.2
	SB-11	10.3	15.6	23.9
West Mount Vernon	SB-24	10.8	17.2	27.9
	SB-25	3.9	6.0	8.2
	SB-26	10.2	15.2	23.1
Kulshan Creek	SB-05	13.1	20.1	30.8
	SB-14	37.2	58.2	91.5
	SB-13	57.3	74.0	90.9
	SB-06	11.7	18.0	27.1
	SB-07	25.2	38.5	57.9
Entire Kulshan Creek Basin at Pump Station	SB-05, 14, 13, 06, 07, 12	96.9	132.0	173.0
Trumpeter Creek	SB-04	18.3	31.9	54.7
	SB-15	42.2	74.5	134.0
	SB-04, 15	59.3	103.0	183.0
	SB-16	21.9	40.4	82.0
	SB-17	30.9	53.5	100.0
	SB-16, 17	51.8	91.2	160.0
	SB-18	8.7	15.0	22.5
Nookachamps Creek	SB-02	11.6	19.5	30.6
Madox Creek	SB-51	12.0	20.0	32.0
	SB-51, 19	17.0	25.0	40.0
	SB-51, 19, 34	28.0	45.0	70.0
	SB-22	40.1	64.6	107.0
	SB-37	40.3	61.6	93.6
Entire Madox Creek Basin	SB-51, 19, 34, 22, 37	95.0	170.0	280.0
Carpenter Creek	SB-35	99.2	174.0	267.0
	SB-36	10.9	19.1	29.8
Britt Slough	SB-30	14.6	22.4	35.7

Table IV-4
City of Mount Vernon

Future Land Use and Existing Drainage System Peak Flows (cfs)

Drainage Basin	Drainage Subbasin	Area (Acres)	Return Period (years)		
			2	10	100
Skagit River Tributary	SB-01	125	4.8	8.32	13.2
	SB-03	395	25.1	41.9	73.4
Riverbend Road	SB-08	27	5.9	8.9	71.4
	SB-09	15	3.4	5.1	7.4
	SB-10	99	21.6	32.5	47.1
	SB-11	91	19.9	29.9	43.4
West Mount Vernon	SB-24	208	10.8	17.2	27.9
	SB-25	101	3.9	6.0	8.2
	SB-26	140	10.2	15.2	23.1
Kulshan Creek	SB-05	146	15.8	24.2	37.0
	SB-14	384	41.4	64.3	99.7
	SB-13 (includes SB-05 and 14)	843	66.6	84.7	106.0
	SB-06	89	16.1	24.4	36.0
	SB-07	190	34.5	52.3	77.0
Entire Kulshan Creek Basin at Pump Station	SB-05, 14, 13, 06, 07, 12	1172	121.0	163.0	210.0
Trumpeter Creek	SB-04	327	23.3	41.5	77.2
	SB-15	561	52.1	88.1	154.0
	SB-04, 15	888	74.1	127.0	226.0
	SB-16	365	26.8	30.0	100.0
	SB-17	543	33.3	57.1	105.0
	SB-16, 17	908	58.6	103.0	190.0
	SB-18	216	9.4	16.0	24.2
Nookachamps Creek	SB-02	253	19.1	34.9	65.2
Madox Creek	SB-51	283	18.0	31.0	70.0
	SB-51, 19	615	35.0	70.0	120.0
	SB-51, 19, 34	901	50.0	90.0	170.0
	SB-22	469	40.7	65.9	109.0
	SB-37	616	40.3	61.6	93.6
Entire Madox Creek Basin	SB-51, 19, 34, 22, 37	1989	110.0	205.0	350.0
Carpenter Creek	SB-35	2622	100.0	177.0	230.0
	SB-36	261	11.3	19.7	31.2
Britt Slough	SB-30	169	14.5	22.4	35.6

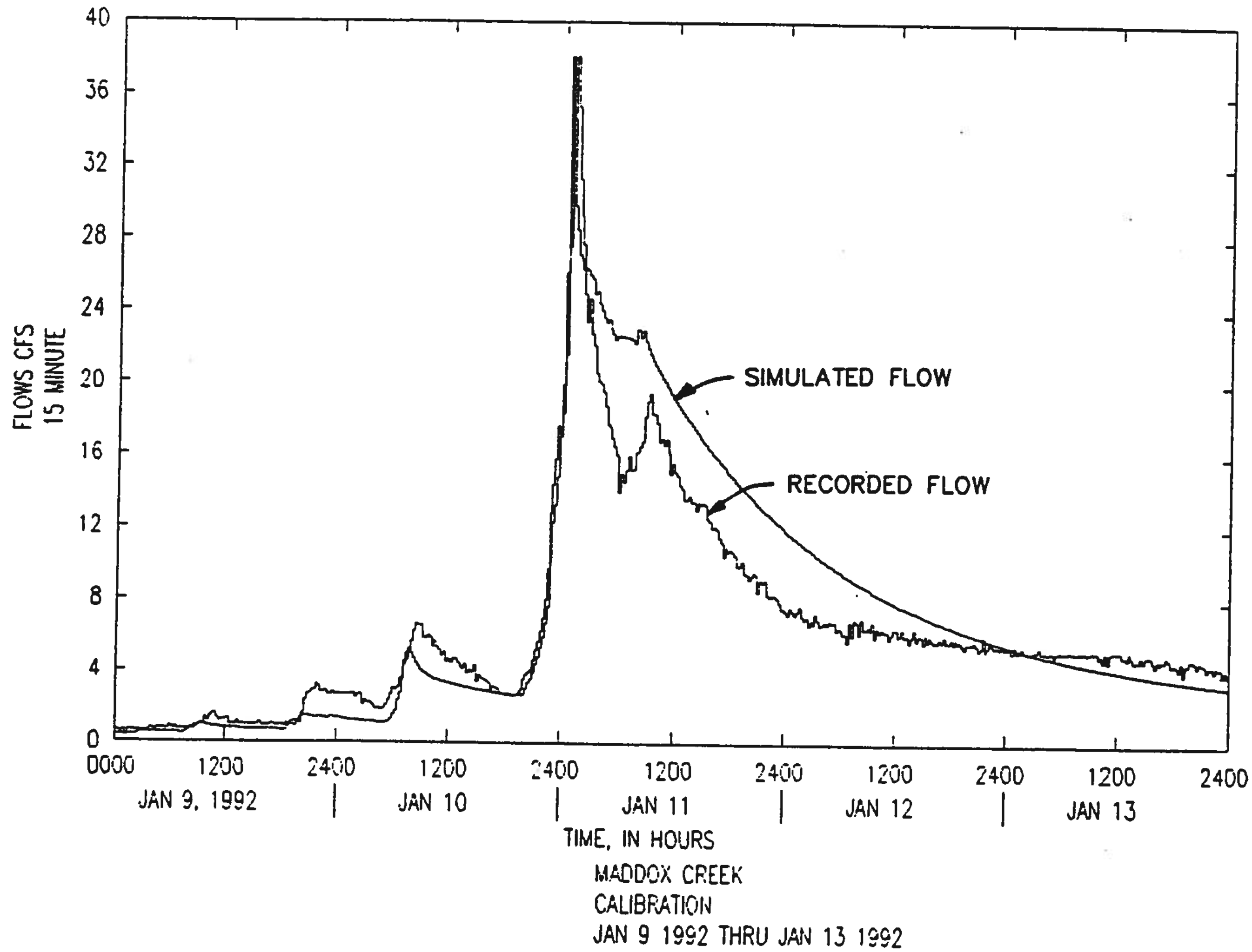


FIGURE IV-1
CITY OF MOUNT VERNON
SURFACE WATER MANAGEMENT PLAN
HSPF RESULTS FOR JANUARY 1992 EVENT ON MADDOX CREEK

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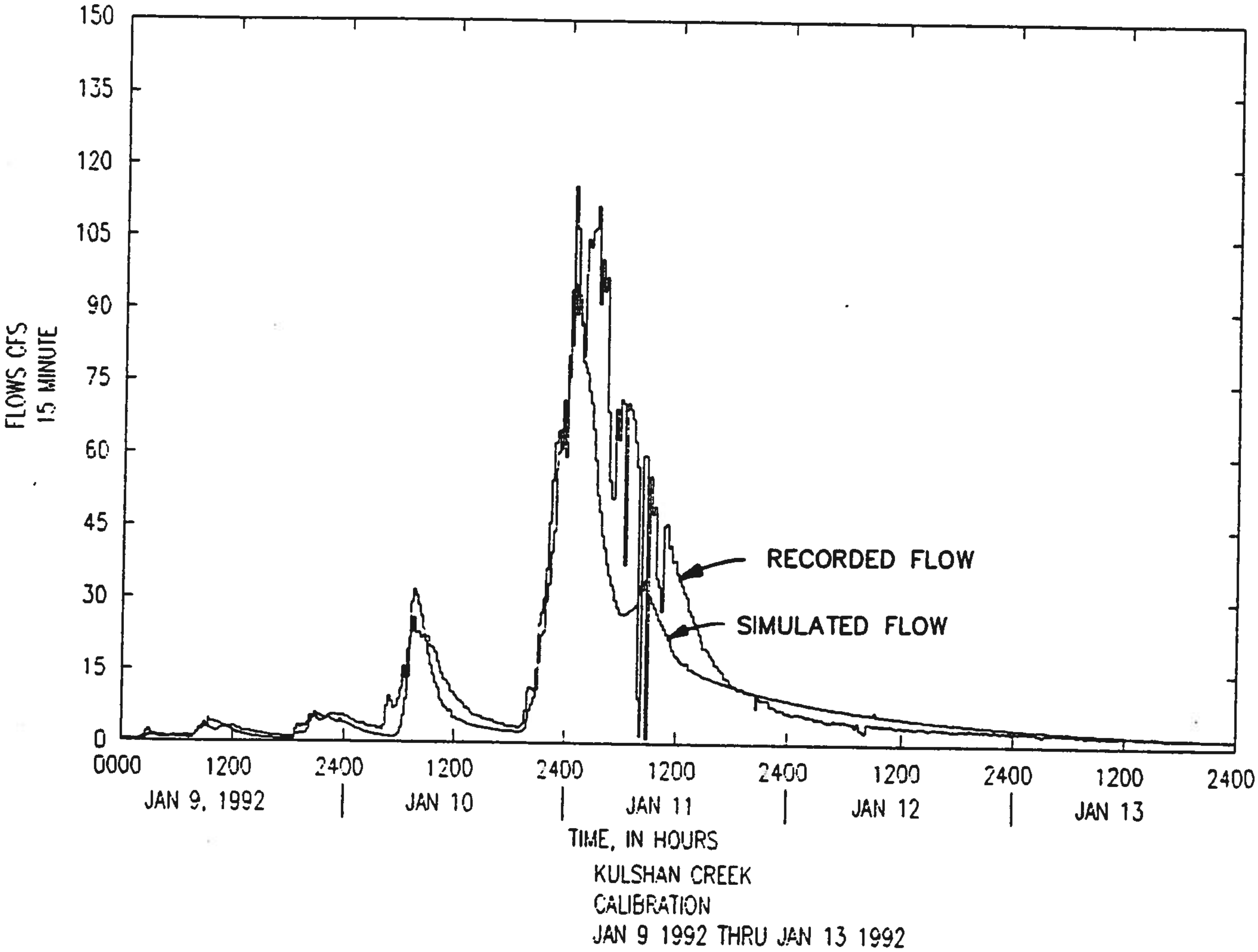

FIGURE IV-2
CITY OF MOUNT VERNON
SURFACE WATER MANAGEMENT PLAN
HSPF RESULTS FOR JANUARY 1992 EVENT ON KULSHAN CREEK

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SECTION V
EXISTING POLICIES, ORDINANCES AND REGULATIONS

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SECTION V

EXISTING POLICIES, ORDINANCES AND REGULATIONS

A. Introduction

This section includes a review of the existing City, state, and federal policies, regulations, and ordinances relevant to surface water management.

B. Relevant City Policies, Ordinances and Regulations

This section provides an overview of the City's relevant policies, ordinances, and regulations to surface water management.

1. City of Mount Vernon Municipal Code

   a. Chapter 2673 Drainage Ordinance. The City has recently adopted a new drainage ordinance that fulfills the minimum requirements for development standards as required by the *Puget Sound Water Quality Management Plan*. These minimum requirements for stormwater facilities and Best Management Practices (BMPs) are described in Ecology's *Stormwater Management Manual for the Puget Sound Basin*.

   b. Chapter 16.32 Short Plats and Sub-Divisions. This chapter includes requirements for specific design standards for short plats and subdivisions served by private roads.

      These include requirements that storm drainage runoff from the easement road be directed away from other properties and preferably into the public storm-sewer or drainage system and that all sewer, drainage and roadway improvements be designed by a professional civil engineer registered in the state of Washington.

   c. Chapter 15.36 Floodplain Management Standards. This chapter outlines regulations and conditions for floodplain development. City development regulations are identical to State of Washington floodplain development regulations. State regulations are, in turn, consistent with National Flood Insurance Program regulations promulgated by FEMA, with the single exception of residential development within a designated floodway.

      City regulations require the submittal of a development permit application for properties within an "area of special flood hazard" so that the City Building Official may review flood hazard area status and proposed flood control/floodproofing measures in consideration of the permit.

Significant features of City floodplain management standards include the following:

(1) City-designated "areas of special flood hazard" are identified by FEMA in its Flood Insurance Study and associated Flood Insurance Rate Maps (FIRM) prepared in 1985. These include the extent of the 100-year base flood, based on topography and the base (100-year) flood elevation profile.

(2) Residential and nonresidential development within the areas of special flood hazard is permitted under specific fixed floor elevation and floodproofing conditions for new construction or substantial improvements of existing structures. New residential construction or substantial improvements are required to elevate lowest floors one foot above the base flood elevation. Nonresidential construction or substantial improvements are required either to elevate lowest floor one foot above the base flood elevation or provide watertight floodproofing to one foot above the base flood elevation.

(3) Construction of residential structures in the floodway (designated as Zone AI on the FIRM maps) is prohibited except for repairs to an existing structure that do not exceed 50 percent of its market value.

(4) New construction within the AO zones must be elevated one foot above the elevation specified on the FIRM.

(5) Regulations specify conditions for structure anchoring and pressure equilibration, floodproofing materials, piling, and development utility provisions.

(6) Provisions for noncompliance penalties, appeals, and variances are provided. Variances involving floodway development will not be considered if an increase in base flood elevation will result.

2. <u>Critical Areas Ordinance #2482</u>

This ordinance was adopted February 26, 1992 to comply with the requirements of the Growth Management Act (GMA) which was passed by the Washington State Legislature in 1990. A brief summary is also provided here.

The GMA requires the fastest growing counties (including Skagit County and the Cities within Skagit County) to comply with the act. The act requires these cities and counties to develop local comprehensive land use plans and development regulations. It also requires that cities and counties classify, designate and develop regulations to protect certain critical areas prior to the completion of comprehensive land use plans. The critical areas include:

- Wetlands;
- Streams;

- Fish and wildlife habitat conservation area;
- Areas of potential geologic instability or hazard; and
- Hillside developments.

The first three critical areas have a direct impact on surface water and are discussed in detail later in this section.

The intent of the critical area designation is to require cities and counties to provide regulatory protection of these critical areas prior to the development and adoption of comprehensive land use plans. Mount Vernon's critical areas ordinance requires that permits be obtained from the City for any activity which alters or disturbs an environmentally sensitive area as defined by the Critical Areas Inventory Maps or by separate studies. Further, no development permits shall be granted for any lot which contains or is adjacent to an environmentally sensitive area until approvals as required by this ordinance have been granted by the City.

The following paragraphs provide a summary of the recommendations pertaining to critical area designations and interim policies for each critical area.

a. Wetlands. Wetlands and associated buffers may be altered provided that:

- The city approves a mitigation plan, construction techniques and appropriate permits before any site work occurs.

- The plans and proposals comply with all applicable state and federal laws and regulations.

A wetland buffer zone is defined as the area up to 25 feet from a wetland edge as marked in the field. Regulating activity in the 25-foot buffer is presumed to provide necessary and sufficient protection to the wetland, but may be increased pursuant to the following paragraph.

The City may require increased buffer widths as necessary to protect wetland functions and values, based on local conditions. The areas where an increased buffer may be required include areas where adjacent land is susceptible to severe erosion, areas where a larger buffer is necessary to maintain viable populations of existing species or to prevent degradation or alteration of existing hydro-regime.

Building setback of ten feet is required from the edge of any wetland buffer. Minor structural intrusions into the area may be allowed if the City determines that such intrusions will not negatively impact the wetland.

b. Streams. The standard buffer width for streams depends upon the stream's classification according to WAC 222-16-030, Forest Practice Regulations.

- Category I. Category I streams are those streams inventoried as "Shoreline of the State" under Chapter 90.58 RCW. Within the City of Mount Vernon, those portions of the Skagit River which lie within the City's jurisdiction are classified as Category I. The buffer required for this category shall be determined by the City's Shoreline Management Plan.

- Category II. Category II streams are those streams that are classified as Type 2 and Type 3 waters by WAC 222-16-030. The characteristic Category II stream is, in part, one used by a substantial number of anadromous or resident game fish for spawning, rearing, or migration. According to this ordinance, the buffer for this category shall be 100 feet total width centered on the stream.

- Category III. Category III streams concern, in part, protection of the downstream water quality and includes streams that are naturally intermittent or ephemeral during years of normal rainfall and are not used by anadromous or resident game fish. According to this ordinance, the buffer for this category shall be 50 feet total width centered on the stream.

The City may require increased buffer widths to protect streams when they are particularly sensitive to disturbance or the development poses unusual impacts. Such circumstances may include:

- Stream reaches affected by the development proposal serves a critical fish habitat for spawning or rearing.

- The stream or adjacent riparian corridor is used by endangered, threatened, rare, sensitive, or monitored species, or provides critical or outstanding actual habitat for such species.

- The riparian corridor is underlain by highly infiltrative soils that provide ground water which nourishes the stream or by till soils that produce high runoff if cleared of vegetation.

- The riparian corridor provides a significant source of water, provides shading of stream waters, or contributes organic material important to stream habitat areas.

- A drainage improvement or water quality feature such as a grass lined swale is proposed within the buffer.

A building setback of ten feet from the edge of all stream buffers is required to prevent any encroachment into the buffer area during and after construction.

c. Fish and Wildlife Habitat. If a development is proposed within or adjacent to a priority habitat area, a wildlife assessment shall be prepared by a qualified professional. The assessment shall include recommendations for protection of the habitat and species of concern.

3. Shoreline Master Program

The Skagit County Shoreline Master Program was originally developed in 1976 in accordance with the State Shorelines Management Act, and was adopted by the City of Mount Vernon. The program provides for orderly management and regulation of uses along significant stream, lake, and marine shorelines of the City. The program seeks to accommodate water-dependent uses in a balanced manner that will achieve shoreline planning objectives of public access, economic development, historical/cultural amenities, circulation, recreation, and conservation.

The program authorizes the Planning Department to administer a shorelines permit program for development within or adjacent to regulated shorelines. The process includes submittal of a permit application to the City Planning Department for consideration, public notification of development intent, and a public hearing if warranted. The process culminates in a recommendation from the Shoreline Planning Commission to grant or deny the permit, and transmittal of its decision to Ecology and the State Attorney General's Office for review. Provisions are outlined for conditional use, variance, and appeals procedures.

Within the study area, only the Skagit River is considered to be waters of the state and thereby under the program. Because all of the streams within the study area have a mean annual flow of less than 20 cubic feet per second, they are not regulated under this program. The scope of this plan includes only surface waters that are tributary to receiving waters such as the Skagit River and none of these streams are regulated by this program. Therefore, this program does not include any areas regulated by this program.

4. City of Mount Vernon Comprehensive Plan

To comply with the Washington State Growth Management Act, the City adopted its Comprehensive Plan in January 1995. This plan contains policies and recommendations to direct public and private decisions affecting future growth and development. It contains elements relating to land use, housing, transportation, utilities, public facilities and services, and parks and open space. The Comprehensive Plan includes a brief summary of the City of Mount Vernon Draft Surface Water Management Plan, October 1993. This summary describes the surface water plan goals and objectives, the study area and drainage area subbasins, problem and solution identification, and the plan capital improvements program.

C. Relevant State and Federal Regulations and Programs

1. Stormwater Management Standards/Guidelines

There are a number of recently promulgated programs relevant to stormwater management planning in the study area. These are discussed below.

a. Puget Sound Water Quality Management Plan. The Puget Sound Water Quality Management Plan (PSWQMP) establishes a comprehensive plan to protect and improve water quality and aquatic resources in Puget Sound. The Puget Sound Water Quality Authority (PSWQA) was directed to identify water quality problems and corresponding pollution sources affecting marine life and human health, and to develop effective pollution control and management programs that could be implemented in a comprehensive multijurisdictional manner throughout the Puget Sound basin.

The 1994 plan incorporates and builds on the Authority's 1991, 1989, and 1987 management plans. The 1994 plan is also the draft Puget Sound Comprehensive Conservation and Management Plan (CCMP) under the Puget Sound Estuary Program, as authorized by the federal Clean Water Act.

A continuing planning process was established through 1994, with a revised management plan to be produced every two years. The revised plans evaluated progress toward Plan goals and addressed new concerns. Plan revisions were produced in 1987, 1989, and 1991.

In addition to plan development, the Authority carries out responsibilities in the areas of planning, coordination, analysis, education, contract and grant administration, studies and research relating to Puget Sound water quality, and the implementation of programs to implement Chapter 90.70 RCW.

A number of programs regarding stormwater management have been included in the 1994 plan. State authority to require jurisdictions to implement the provisions contained within the PSWQMP is inherent with the 1994 plan adoption. These programs are as follows:

(1) Development Standards and Operations and Maintenance Programs for All Cities and Counties.

The provisions within the 1994 PSWQMP for achieving the program's goal of controlling pollution from stormwater is to implement best management practices (BMPs), assess their effectiveness, and, as necessary, require further water quality controls that may include treatment. This includes a requirement for jurisdictions to adopt minimum standards for new development and redevelopment.

These ordinances shall address, at a minimum: (1) the control of off-site water quality and quantity impacts; (2) the use of source control best management practices and treatment best management practices; (3) the effective treatment, using best management practices, of the 6-month design storm for proposed development; (4) the use of infiltration, with appropriate precautions, as the first consideration in stormwater management; (5) the protection of stream channels and wetlands; (6) erosion and sedimentation control for new construction and redevelopment projects; (7) local enforcement of these stormwater controls.

In addition, each county and city shall also develop and enforce operation and maintenance programs and ordinances for new and existing public and private stormwater systems. Each county and city shall maintain records of new public and private storm drainage systems and appurtenances.

The 1994 plan also requires that in conjunction with the runoff control ordinances for new development and redevelopment, each jurisdiction shall adopt a stormwater management manual containing state-approved BMPs. A local government may adopt the manual prepared by WSDOE or prepare its own manual as long as it has equivalent technical standards to those prepared by WSDOE. The City staff is currently working with the study's Citizen Advisory Committee on developing this manual.

Education programs to inform citizens about stormwater and its effects on water quality, flooding, and fish-wildlife habitat, and to discourage dumping of waste material or pollutants into storm drains, are also included in the Education and Public Involvement Program and the Household Hazardous Waste Program sections of the 1994 plan.

Each city or county that adopts a comprehensive land use plan and development regulations under the provisions of Chapter 36-70A RCW (the Growth Management Act), shall incorporate the goals of the local stormwater program into the goals of the comprehensive plan and shall incorporate the ordinances required by this element into the development regulations.

Consistent with the Growth Management Act, each local jurisdiction in the Puget Sound Basin is expected to cooperate with neighboring jurisdictions in growth management stormwater planning and stormwater basin planning.

WSDOE will monitor compliance with these requirements, reviewing the status of city and county operation and maintenance and runoff control programs every two years to ensure consistent and adequate implementation and report to the Authority. WSDOE's oversight role shall pertain only to compliance with the objectives of the plan's stormwater program and appropriate rules and statutes and technical suggestions to improvement implementation. This should ensure maximum flexibility and creativity for local governments to resolve site-specific stormwater problems in accordance with their land use and other local policies.

(2) Comprehensive Urban Stormwater Programs: Stormwater Management Programs for Urbanized Areas. Starting with the five larger jurisdictions in the Puget Sound basin named in the EPA stormwater NPDES regulation and eventually expanding to cover all urbanized areas, each city must develop

and implement a stormwater management program consistent with the requirements in appropriate subsections of the stormwater NPDES regulations.

- The purposes of the comprehensive urban stormwater management program will be:

  - To control erosion and manage the quantity and the quality of stormwater runoff from public and private activities

  - To protect and enhance water quality, and achieve water quality and sediment quality standards

  - To reduce the discharge of pollutants to the maximum extent practicable within the constraints of federal and state laws

  - To protect beneficial uses, as described in Chapter 173-201 WAC

  - To achieve the four items above in a manner that makes efficient use of limited resources to address the most critical problems first

Each urban stormwater program shall seek to control the quality and quantity of runoff from public facilities and industrial, commercial, and residential areas, including streets and roads. Each program shall cover both new and existing development. Early action by urbanized areas that are prepared to implement stormwater control programs shall be allowed. Emphasis shall be placed on controlling stormwater through source controls and BMPs. Where local programs are not effectively solving stormwater problems, Ecology shall ensure compliance through its oversight role or through issuance and enforcement of individual or watershed-based NPDES permits. Each city or urban area shall have the flexibility to design its own program, but the content, priorities, and deadlines for compliance shall be subject to review by Ecology for consistency with the Puget Sound Plan and NPDES regulations.

In some cases, significant stormwater problems may be originating in urbanized areas outside of a local jurisdiction. In those situations, the sequencing of areas for urban stormwater programs may be modified to address problems in shared watersheds. The neighboring jurisdictions will develop local coordination mechanisms to cooperatively resolve the identified problems. Where joint programs are not developed, WSDOE shall ensure consistency in programs through its oversight role.

At a minimum, each urban stormwater program shall include:

- Identification and ranking of significant pollutant sources and their relationship to the drainage system and water bodies through an ongoing assessment program.
- Investigations and corrective actions of problem storm drains, including sampling.
- Programs for operation and maintenance of storm drains, detention systems, ditches, and culverts.
- A water quality response program, to investigate sources of pollutants, and respond to citizen complaints or emergencies such as spills, fish kills, illegal hookups, dumping, and other water quality problems. These investigations should be used to support compliance/ enforcement efforts.
- Assurance of adequate local funding for the storm water program through surface water utilities, sewer charges, fees, or other revenue-generating sources.
- Local coordination arrangements such as interlocal agreements, joint programs, consistent standards, or regional boards or committees.
- Ordinances requiring implementation of stormwater controls for new development and redevelopment.
- A stormwater public education program aimed at residents, businesses, and industries in the urban area.
- Inspection, compliance, and enforcement measures.
- An implementation schedule.
- If, after implementation of the control measures listed in the points above, there are still discharges that cause significant environmental problems, retrofitting of existing development and/or treatment of discharges from new and existing development may be required.

Stormwater quality in public stormwater systems in commercial and industrial areas shall have a high priority in the city programs. WSDOE shall determine, in compliance with EPA regulations, and in consultation with local governments, the appropriate approach to controlling stormwater discharges from industrial and commercial

facilities that are not currently required to have stormwater NPDES or point source discharge permits. Stormwater controls are included in NPDES permits for discharges of stormwater from commercial and industrial point source facilities, which are addressed in the Municipal and Industrial Discharges Program.
WSDOE shall have oversight responsibilities for the urban stormwater programs. WSDOE shall review each urban stormwater program every two years to ensure consistent and adequate implementation and report to the Authority.
This Surface Water Management Plan fulfills many of these requirements.

(3) Technical Manuals and Assistance on Stormwater and Erosion Controls.

Technical Manuals. WSDOE has produced a technical manual for use by local jurisdictions in stormwater planning. The technical manual provides technical guidance for implementing local programs.

Vactor Waste. In the 1994 plan, Ecology has committed to develop a program for a vactor waste disposal program.

Monitoring Guidance. In the 1994 plan, Ecology has also committed to develop guidance on how to monitor stormwater runoff compliance and the effectiveness of BMPs.

(4) Local Government Stormwater Assistance Service.

The intent of the 1994 PSWQMP is to provide technical assistance to local governments through people who have hands-on experience with (1) the design and implementation of stormwater programs at the local level, (2) current Best Management Practices for stormwater, and (3) local basin characteristics. WSDOE shall work with the City with current stormwater expertise to establish a technical assistance service.

This service will support the exchange of technical information and assistance on stormwater among local governments, will train WSDOE and local government staff in current practices and real world application and problems in stormwater technology, and will operate as an integral part of the state technical assistance program. The service will have the goal of acting as an in-the-field branch of WSDOE's technical assistance program.This service will support the exchange of technical information and assistance on stormwater among local governments, will train WSDOE and local government staff in current practices and real world application and problems in stormwater technology, and will operate as an integral part of the state technical assistance program. The service will have the goal of acting as an in-the-field branch of WSDOE's technical assistance program.

NPDES Coordination. In the 1994 plan, Ecology has been designated to provide technical assistance to local governments that are required to obtain NPDES permits.

(5) Guidance and Model Ordinances.

WSDOE will prepare and update guidance and model ordinances for stormwater programs for all cities and for comprehensive urban stormwater programs. All cities will adopt stormwater programs that include minimum requirements for new development and redevelopment set by the plan and in guidance developed by WSDOE.

The guidance shall include:

- Procedures for development local programs, including procedures for review and approval of programs.

- Minimum requirements for runoff controls and system maintenance required in local ordinances.

- Minimum requirements for control of private sector maintenance of private drainage systems.

- Minimum requirements for the operation and maintenance programs, including recordkeeping requirements for new drainage systems and facilities.

- Methods for assuring practical and appropriate disposal procedures for decant water, solid, and other substances from drainage system clean out and maintenance. Methods shall address catch basins, oil/water separators, pipelines, swales, detention/retention basins, and other appropriate drainage elements.

Additionally, the guidance for the comprehensive urban stormwater programs will include:

- Procedures for identification and ranking of significant pollutant sources and their relationship to the drainage system and water bodies

- Procedures for source tracing investigations, including sampling of problem storm drains

- Procedures for investigations, implementation of spill control measures, enforcement, and remedial actions

- Methods for assuring adequate local funding for the urban stormwater program

- Provisions for agreements with neighboring jurisdictions when stormwater and watersheds do not follow jurisdictional boundaries

- Requirements for public education programs

- Requirements for retrofitting and/or treatment measures, if necessary

- Procedures for inspection, compliance, and enforcement measures

- Requirements for implementation schedules

- Methods to coordinate stormwater management with other watershed habitat protection and growth management activities

The guidance will lay out acceptable approaches to control stormwater from new development and redevelopment, such as water quality policies for use in SEPA, NPDES, and other permit decisions; density controls to limit development in sensitive areas; development standards to limit the amount of impervious surfaces; regional detention ponds; oil separators or other treatment facilities; grading and drainage ordinances; erosion control programs; buffers next to waterways; preservation of wetlands; and other appropriate elements.

a. Federal Requirements - National Pollutant Discharge Elimination System. The Environmental Protection Agency (EPA) has determined that stormwater discharges will be regulated under the National Pollutant Discharge Elimination System (NPDES) process. As a result, some stormwater dischargers will be required to submit permit applications.

On October 31, 1990, the EPA administrator signed into law final regulations requiring NPDES permits for three categories of stormwater discharges: (1) medium cities with population between 100,000 and 250,000; (2) large cities with population greater than 250,000; and (3) discharges associated with industrial activity.

The non-point source permits will differ from standard NPDES permits in that the industrial discharge permits can be issued to a class or group of dischargers, and the municipal stormwater permit can be issued on a jurisdiction-wide basis. EPA stated that the ideal permit basis would be the watershed. In other words, individual permits for each outfall would not be required.

The municipal stormwater permit programs will include a combination of required ordinances, mapping, discharge characterization, source identification, and public education. Stormwater associated with industrial activities would also be regulated. Some industrial activities within the City may be regulated depending on their Standard Industrial Code (SIC). The City of Mount Vernon may also conduct certain activities that would require NPDES permits for stormwater. This includes operation of the City's waste water treatment plant.

The City of Mount Vernon is not required by federal law to apply for a municipal permit because it's population is less than 100,000. The State of Washington has been given the authority to administer the federal NPDES program.

2. Growth Management Act

A general discussion of the Growth Management Act is provided in this section because it contains land use planning requirements for designating and protecting critical environmental areas such as wetlands and fish habitat areas.

a. Purpose. The Growth Management Act became effective July 1, 1990. The Act's goal is to manage growth in Washington State's fastest growing counties through the adoption of local comprehensive land use plans and development regulations. The City of Mount Vernon adopted its Comprehensive Plan in conformance with the Growth Management Act in January 1995.

b. Who Must Develop Comprehensive Plans. The Act requires the following jurisdictions to adopt comprehensive land use plans:

- Counties with population of 50,000 or greater and an increase in population of more than 10 percent in the last 10 years and any cities in such a county.
- Counties that have a population increase of more than 20 percent in the last 10 years and any cities in such a county.
- Counties that elect to conform with the Act.

Eleven counties in Washington, including Skagit County must adopt comprehensive plans under the Act. Mount Vernon, as a city in Skagit County, must comply with this Act. Those required to adopt comprehensive land use plans must do so on or before July 1, 1994.

c. Comprehensive Plans - Advisory Goals. The standard for all plans are thirteen advisory goals aimed solely at guiding the development of local comprehensive plans. These advisory goals include encouraging urban growth where reasonable, reducing urban sprawl, encouraging efficient transportation systems based on regional priorities, encouraging the availability and variety of affordable housing, encouraging the retention of open space and recreational opportunities, and protecting the environment.

d. Comprehensive Plans - Requirements

(1) Comprehensive plans must contain design elements for the following:

- land use
- housing
- capital facilities
- utilities
- rural areas (counties only)
- transportation

(2) Where applicable, the land use element must:

- provide for protection of the quality and quantity of groundwater used for public water supplies;

- shall review drainage, flooding, and stormwater runoff in the area and nearby jurisdictions; and

- provide guidance for corrective actions to mitigate or cleanse those discharges that pollute waters of the state, including Puget Sound, or waters entering Puget Sound.

(3) Comprehensive plans must be consistent with plans of neighboring jurisdictions.

e. Development Regulations - Natural Resource Lands and Critical Areas. Cities and counties subject to the act must:

(1) Inventory and designate natural resource lands and critical areas on or before September 1, 1991. This has been completed by the City with the adoption of Ordinance #2482.

(2) Adopt development regulations on or before September 1, 1991 to ensure the conservation of agricultural, forest, and mineral resource lands. This has been completed by the City with the adoption of Ordinance #2482.

(3) Adopt development regulations on or before September 1, 1991, precluding land uses or development that is incompatible with designated "critical areas," which include the following areas and ecosystems:

- Wetlands
- Areas with a critical recharging effect on aquifers used for potable water
- Fish and wildlife habitat conservation
- Frequently flooded areas
- Geologically hazardous areas

This has been completed by the City with the adoption of Ordinance #2482.

f. Implementation. Within one year of the adoption of its comprehensive plan, counties and cities must enact development regulations, such as zoning ordinances, official controls, and planned unit development ordinances, that are consistent with and implement the comprehensive plan.

Each county and city that adopts a comprehensive plan under the Act is required to report to the Department of Community Development annually for a period of five years, beginning on January 1, 1991, and each five years thereafter, on the progress made by that county or city in implementing the requirements of the Growth Management Act.

3. Wetlands - Relevant Federal and State Regulations

Wetlands are identified and delineated within the City of Mount Vernon using the *Corps of Engineers Wetlands Delineation Manual* (1987 Manual) (Environmental Laboratory, 1987). The 1987 Manual is required for review of wetlands within the City as well as required by the U.S. Army Corps of Engineers for federal review of wetland impact. As of September 1995, the State of Washington also follows the 1987 Manual in determining the presence and extent of jurisdictional wetlands. The methodology outlined in this manual is based upon three characteristics of wetlands: 1) hydrophytic vegetation, 2) hydric soils, and 3) wetland hydrology. All three of these characteristics must be present in order to make a positive wetland determination using the 1987 Manual (unless disturbed areas are encountered).

a. Federal Regulations. The primary federal laws that regulate activities in or near wetlands are Sections 401 and 404 of the Clean Water Act (CWA), Section 10 of the River and Harbor Act of 1899, and the "Swampbuster" provision of the Food Security Act (FSA) of 1985. All federal actions are also subject to the 1969 National Environmental Policy Act (NEPA) and many to the Coastal Zone Management Act of 1972.

Section 401 of the CWA mandates that federally permitted activities in wetlands comply with the CWA and state water quality standards. Under Section 404 of the CWA, the U.S. Army Corps of Engineers (Corps) has been given the responsibility and authority to regulate the discharge of dredged or fill materials into waters and adjacent wetlands of the United States (Federal Register, 1986). Under the River and Harbor Act, the Corps also issues permits for construction in or along navigable waters, including any wetlands within those waters. The "Swampbuster" provision of the FSA denies eligibility for all U.S. Department of Agriculture farm programs to farmers who convert wetlands to croplands.

Of the above regulations, Section 404 permitting is the most commonly applicable to freshwater wetlands. Two kinds of permits are issued by the Corps: General and Individual. General Permits (also known as Nationwide Permits, or NWPs) cover proposals that would have minimal adverse impacts on the environment. The most commonly used NWP for wetland alterations is NWP 26; this NWP specifically addresses wetlands which are (1) above the headwaters of a river or stream (that point in the watercourse at which the mean annual discharge is less than five cubic feet per second) or (2) hydrologically isolated. Such permits apply to fills and other impacts of less than one acre, although impacts of up to two acres may be covered by a General Permit. However, proposed impacts from one to two acres require a Water Quality Certification under Section 401 of the CWA from the Department of Ecology (as discussed under Washington State regulations, below). Other NWPs allow impacts to wetlands for specific purposes. For example, a NWP 12 is used for wetland impacts due to utility installation and maintenance. Unless they may be covered by one of the NWPs, projects with wetlands impacts of more than two acres require Individual Permits. The Corps evaluates Individual Permits based upon the probable impacts of a project on environmental quality and on a determination of whether or not the project is in the public interest. Actions seeking Individual Permits must comply with the Section 404(b)(1) guidelines which require that an applicant prove that there are no other practicable alternatives to the proposed project and that the project has avoided and/or minimized impacts to wetlands to the maximum extent practicable.

b. Washington State Regulations. The principal Washington State regulations that govern activities in or near wetlands are the Shoreline Management Act (SMA) of 1971 (Chapter 90.58 RCW), the 1949 State Hydraulic Code (RCW 75.20.100-140), State 401 (Water Quality) Certification, Coastal Zone Management (CZM) determinations, and the Floodplain Management Program. All actions are also subject to the State Environmental Policy Act (SEPA) of 1971 (with new implementation rules adopted in 1984, Chapter 197-11 WAC) and, in Western Washington, to the Puget Sound Water Quality Act (Chapter 90.70 RCW). Some actions may also be subject to the Forest Practices Act (Chapter 76.09 RCW). The Shoreline Master Program, Hydraulic Project Approval, and the Floodplain Management Program were discussed previously.

4. Wetlands Standards/Guidelines

The preservation/enhancement of wetlands has recently become a prominent issue in the Pacific Northwest, spurred in large part by the Growth Management Act. Two relevant wetland protection programs which provide guidelines and standards for wetlands protection are the Washington Department of Ecology's (Ecology) Model Wetlands Protection Ordinance (September 1990) and element W-2 of the Puget Sound Water Quality Management Plan (May 1994).

a. Model Wetlands Protection Ordinance, Department of Ecology. The purpose of Ecology's model wetlands ordinance is to provide guidance to cities and counties in developing standards and regulations governing wetlands. It is written as a template which cities and counties may adopt and modify according to their needs and provides minimum guidelines for wetlands protection. The model ordinance establishes a definition of wetlands, recognizes their value and the negative impacts which may result from construction, and provides guidelines for the following:

(1) Lands to which the ordinance applies. This section provides standards for regulated activities which are subject to approval if they are conducted in wetlands or their buffers; standards for wetland delineation; and suggestions for adopting either the Washington State rating system or the Puget Sound Region wetlands rating system in order to categorize wetlands. The newly adopted Washington State Wetlands Rating System for Eastern and Western Washington (October 1991) provides guidelines for categorizing wetlands. The wetlands rating system is a process that differentiates wetlands according to specific characteristics or functional attributes. The rating system includes four categories of wetland that are used to determine the size of buffer zones and the ratio for replacing wetlands. A Category I wetland has exceptional resource value and contains rare plant or animal species; a category IV wetland has ordinary resource value, with generally one type of vegetation, and is isolated from other aquatic systems. Categories II and III are intermediate in terms of species diversity and resource value. The Model Ordinance requires a 200- to 300-foot buffer (depending upon surrounding land use) for a category I wetland, a 100- to 200-foot buffer for Category II, a 50- to 100-foot buffer for Category III, and a 25- to 50-foot buffer for a Category IV wetland. Permit decisions can then be considered in light of the wetland rating and the potential development impact. The Puget Sound Region wetlands rating system provides slightly more specific criteria for classification of wetlands than the Washington State system.

(2) Regulated and allowed activities. This section lists the types of activities which will be regulated and allowed in wetlands under the ordinance. Examples of regulated activities include the removal, excavation, grading, or dredging of soil, sand, gravel, minerals, organic matter, or material of any kind; and the destruction or alteration of wetlands vegetation through clearing, harvesting, shading, intentional burning, or planting of vegetation that would alter the character of the wetland. Examples of allowable activities include conservation of soil, water, vegetation, fish, shellfish, and other wildlife; and existing or ongoing agricultural activities.

(3) Procedures for wetland permits. This section provides guidelines on information required and procedures for obtaining, complying with, and processing wetlands permits.

(4) Standards for wetland permit decisions. This section establishes standards and conditions for wetlands permits, including: establishing wetland buffers according to classification category; permitted uses within buffers; procedures for minimizing and/or avoiding impacts to wetlands; density transfers; special use conditions for sensitive areas; and compensatory mitigation requirements for wetlands impacts.

b. 1994 Puget Sound Water Quality Management Plan - Section W-2 Puget Sound Local Government Wetland Protection Programs. The Puget Sound Water Quality Authority (PSWQA) has adopted minimum standard guidelines for local governments to use in protecting wetlands in the Puget Sound area under the Growth Management Act. Local governments are encouraged to use these guidelines for reviewing actions that impact wetlands.

The goal of the standards is to protect wetlands by achieving no net loss of wetlands in the short-term and a long-term wetlands gain. The proposed standards call for all local governments in the Puget Sound planning area to develop and carry out a wetlands protection program. The PSWQA standards present a framework for wetlands protection, allowing local governments to decide specifics in implementing the program, such as permitting requirements, penalties, etc.

Under the standards, local governments would use permits or other mechanisms to avoid impacts on wetlands or to minimize and compensate for unavoidable and necessary impacts. Permits would be required for dredging, dumping, draining, construction or clearing in wetlands.

The PSWQA standards include a minimum definition of regulated wetlands and compensatory mitigation for wetlands impacts. The standards also specify regulated activities, methods to avoid wetland impacts, and general permits to allow some activities.

The PSWQA standards require that damage or destruction of a wetland is allowable only if there is no reasonable alternative. If the destruction is unavoidable and necessary, compensation is required to replace it by creating or restoring wetlands at an increased ratio. The proposed replacement ratio for category IV is 1.25 to one, e.g., for every one acre of wetland destroyed, it must be replaced with 1.25 acre of wetland.

5. Floodplain Regulations

a. State Floodplain Regulations. Chapter 86.16 RCW establishes statewide authority through regulations promulgated by WSDOE for coordinating the floodplain management regulation elements of the National Flood Insurance Program. Under Chapter 173-158 WAC, WSDOE requires local governments to adopt and administer regulatory programs compliant with the minimum standards of the NFIP. WSDOE provides technical assistance to local governments for both identifying the location of the 100-year (base) floodplain and in administering their floodplain management ordinances.

WSDOE also establishes land management criteria in the base floodplain area by adopting the federal standards and definitions contained in 44 CFR, Parts 59 and 60, as minimum state standards. In addition to adopting the federal standards, the state regulations provide for additional regulation of residential development in the floodplain. Federal regulations allow residential and nonresidential development in the floodplain if the proponent can demonstrate there is no resultant increase in base flood elevations within the floodway. State regulations allow only for repair or reconstruction of existing residential structures within the floodway that do not increase the building footprint and that cost less than 50 percent of the value of the existing structure.

b. Federal Floodplain Regulations. The Federal Emergency Management Agency, (FEMA), implements provisions of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This legislation and companion administrative regulations support the availability of flood insurance for development in flood-prone areas and ensures that the availability of insurance is conditional on the development of a floodplain management plan that will limit flood damages.

A detailed outline of the National Flood Insurance Program (NFIP) and its companion regulations is presented in 44 CFR. Selected elements of FEMA regulations with special significance to Mount Vernon are as follows:

(1) The technical basis for the NFIP is the development of a flood boundary map and the corresponding Flood Insurance Rate Map (FIRM). The flood boundary map is the product of a hydrologic/hydraulic analysis that designates base flood elevations and corresponding lateral boundaries of flood hazard. This map serves as the technical basis for an approved floodplain management plan. The FIRM identifies appropriate insurance premium rates for zones of varying risk within the floodplain.

Flood Insurance Studies were performed in the City in 1979 and 1980. The studies included the preparation of Flood Insurance Rate Maps, which show the 100-year flood boundary and were adopted by the City. The flood zones are shown in Figure V-1.

The flood hazard zones each have a specific flood potential or hazard as is indicated by one of the following flood insurance zone designations:

Zone A: Special flood hazard areas inundated by the 100-year flood, determined by approximate methods.

Zone AO: Special flood hazard areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; depths are shown on the FEMA maps.

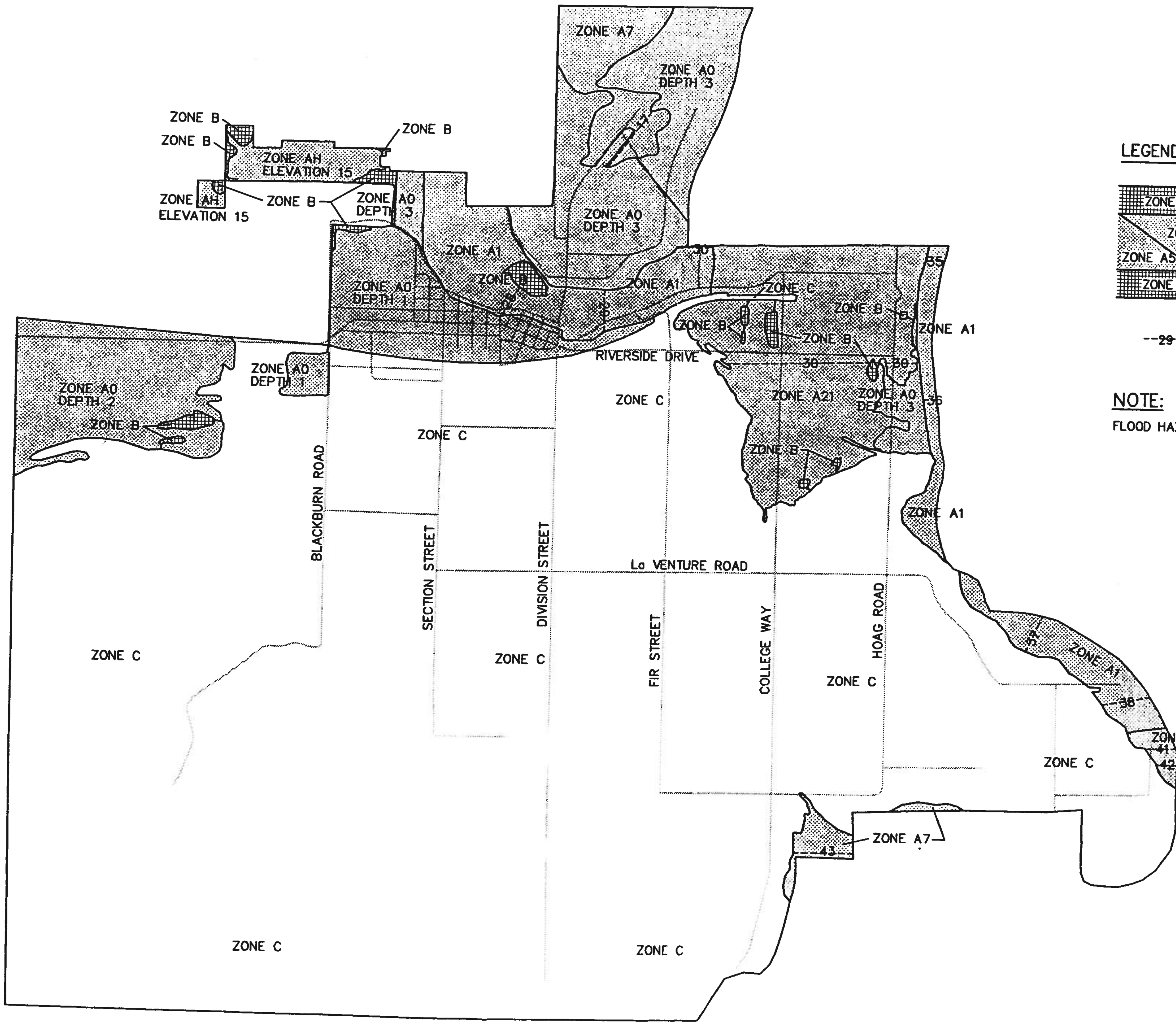
Zone AH: Special flood hazard areas inundated by types of 100-year shallow flooding where the depths are between 1.0 and 3.0 feet; base flood elevations are shown on the FEMA maps.

Zones A1,
A7 and A21: Special flood hazard areas inundated by the 100-year flood, determined by detailed methods; base flood elevations and zones subdivided according to flood hazard factors are shown on the FEMA maps.

Zone B: Areas between the special flood hazard areas and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where the depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile.

Zone C: Areas of minimal flooding.

(2) Specific floodplain management criteria for development are presented in 44 CFR Section 60.3. These measures, and more restrictive measures, have been adopted by the State of Washington and the City of Mount Vernon under Chapter 15.36 of the Mount Vernon Municipal Code.



LEGEND

- ZONE B ← 500 YEAR FLOOD BOUNDARY
- ZONE A1 ← 100 YEAR FLOOD BOUNDARY
- ZONE A5
- ZONE B ← 100 YEAR FLOOD BOUNDARY
- ← 500 YEAR FLOOD BOUNDARY
- --29-- BASE FLOOD LEVEL ELEVATION LINE WITH ELEVATION IN FEET (NATIONAL GEODETIC VERTICAL DATUM OF 1929)

NOTE:

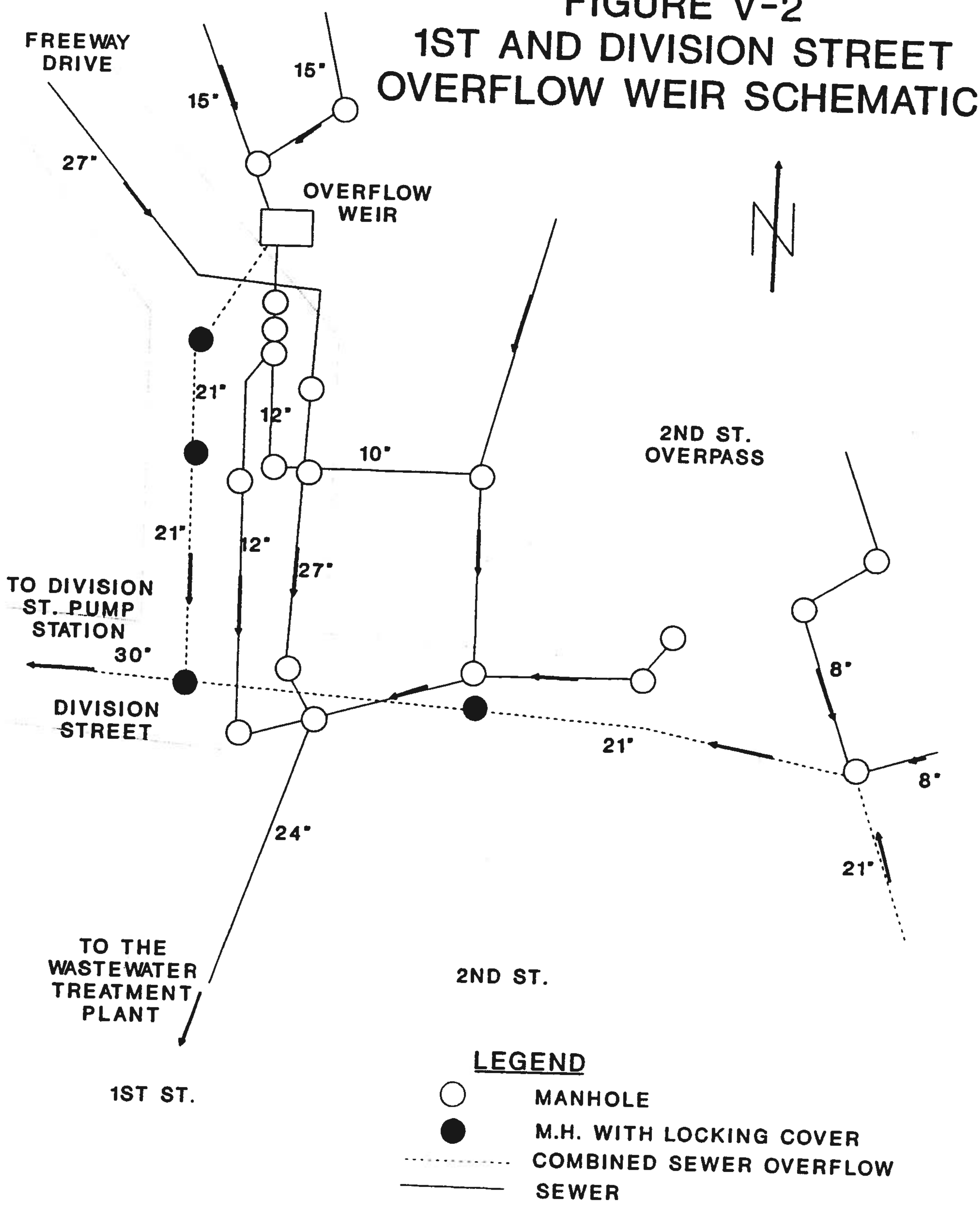
FLOOD HAZARD ZONE DESIGNATION ARE DEFINED IN THE TEXT.

FIGURE V-1
CITY OF MOUNT VERNON SURFACE WATER MANAGEMENT PLAN

FLOOD ZONES

DAVID EVANS

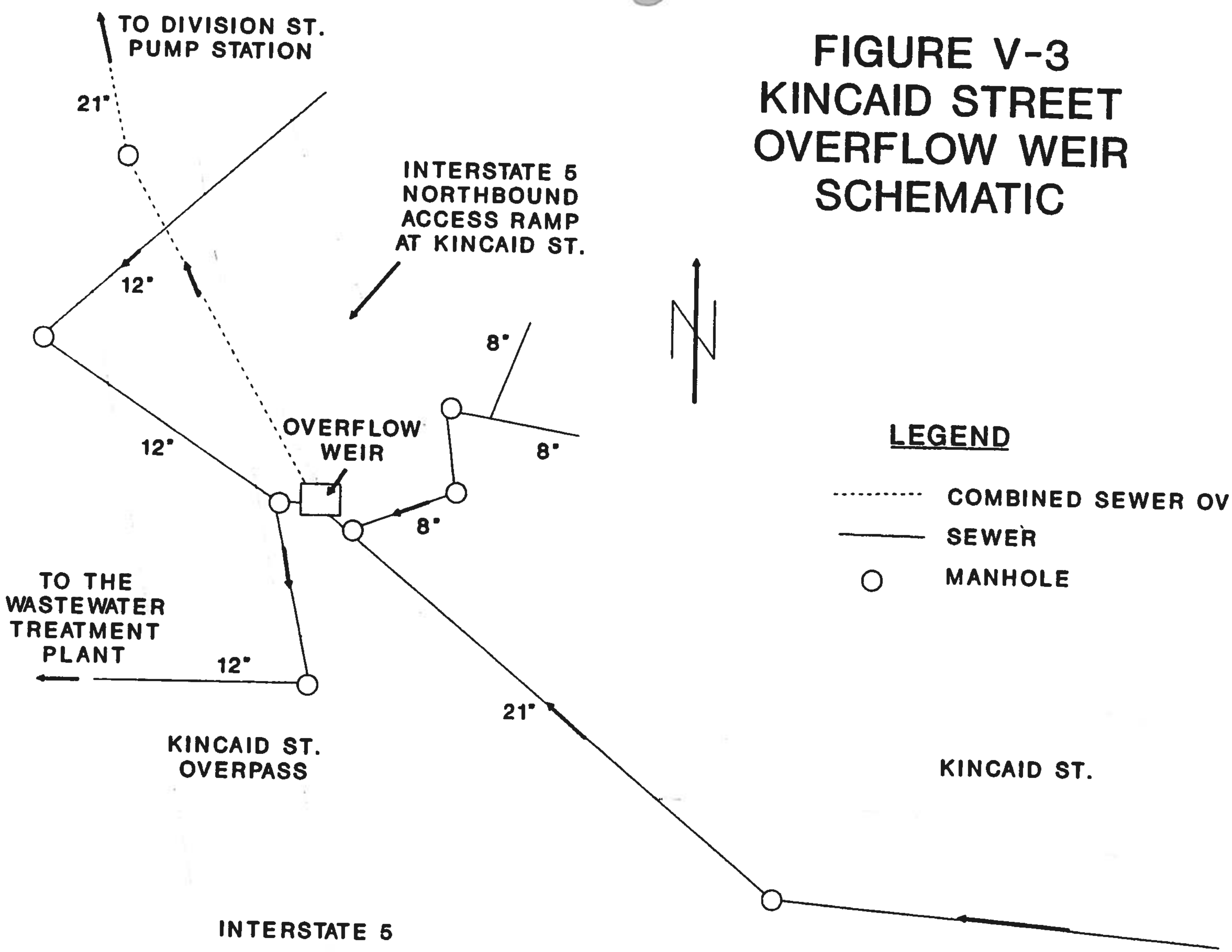
FIGURE V-2
1ST AND DIVISION STREET OVERFLOW WEIR SCHEMATIC



CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW

FIGURE V-3
KINCAID STREET OVERFLOW WEIR SCHEMATIC

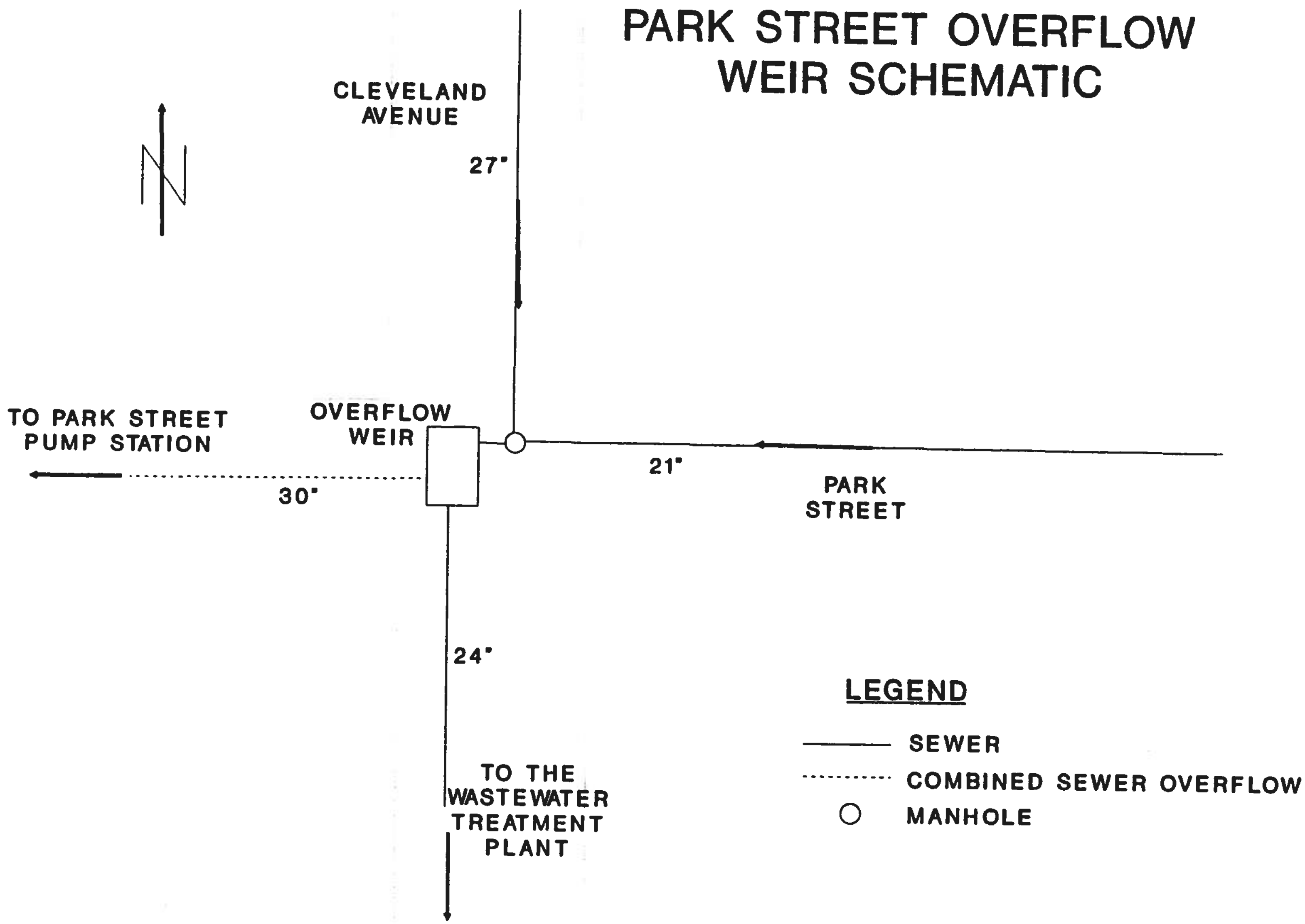


CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

R·W·BECK

FIGURE V-4
PARK STREET OVERFLOW WEIR SCHEMATIC



CITY OF MOUNT VERNON WASHINGTON

COMPREHENSIVE SEWER AND COMBINE SEWER OVERFLOW REDUCTION PLANS

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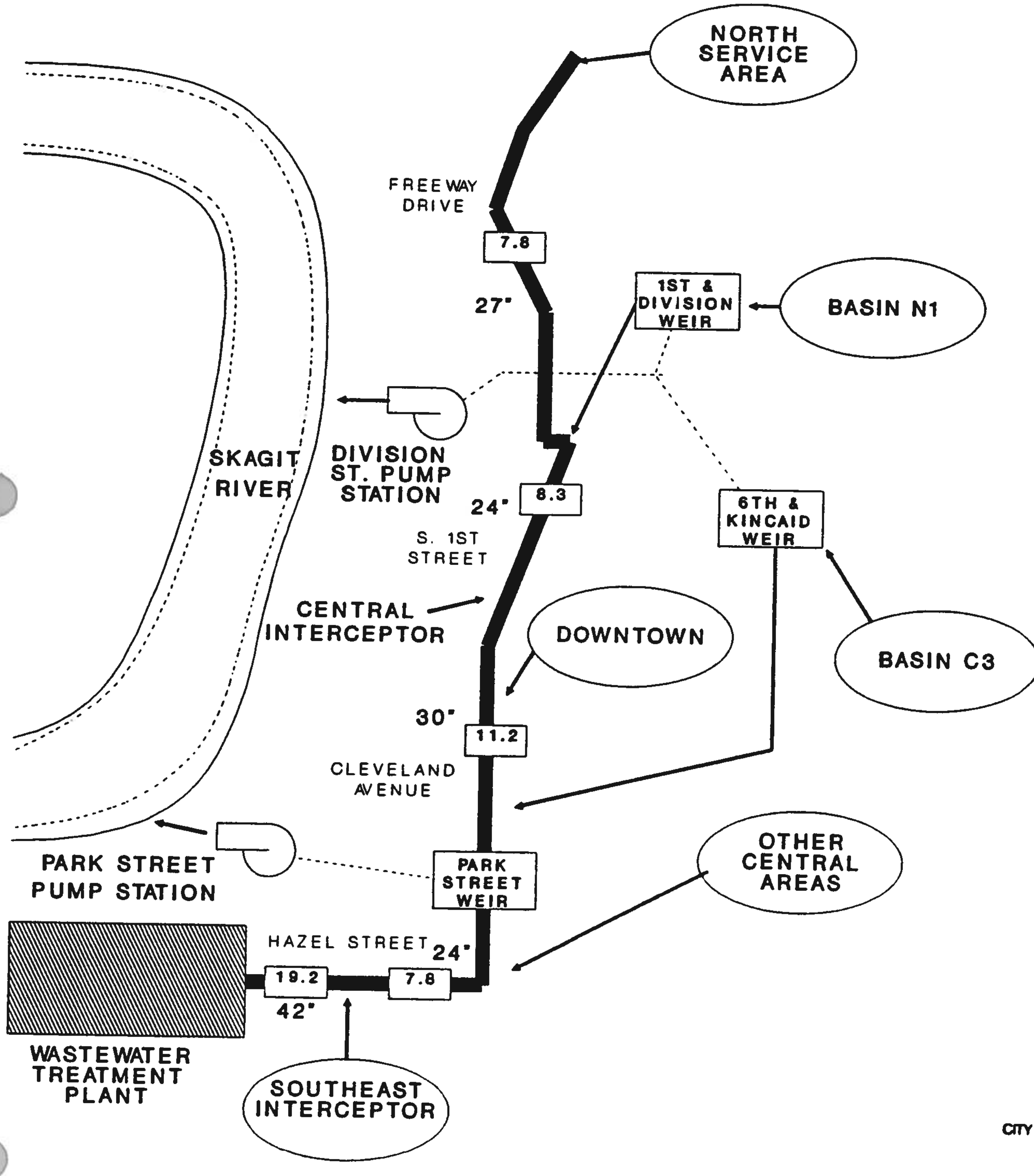
FIGURE V-5
EXISTING CENTRAL AREA DRAINAGE



CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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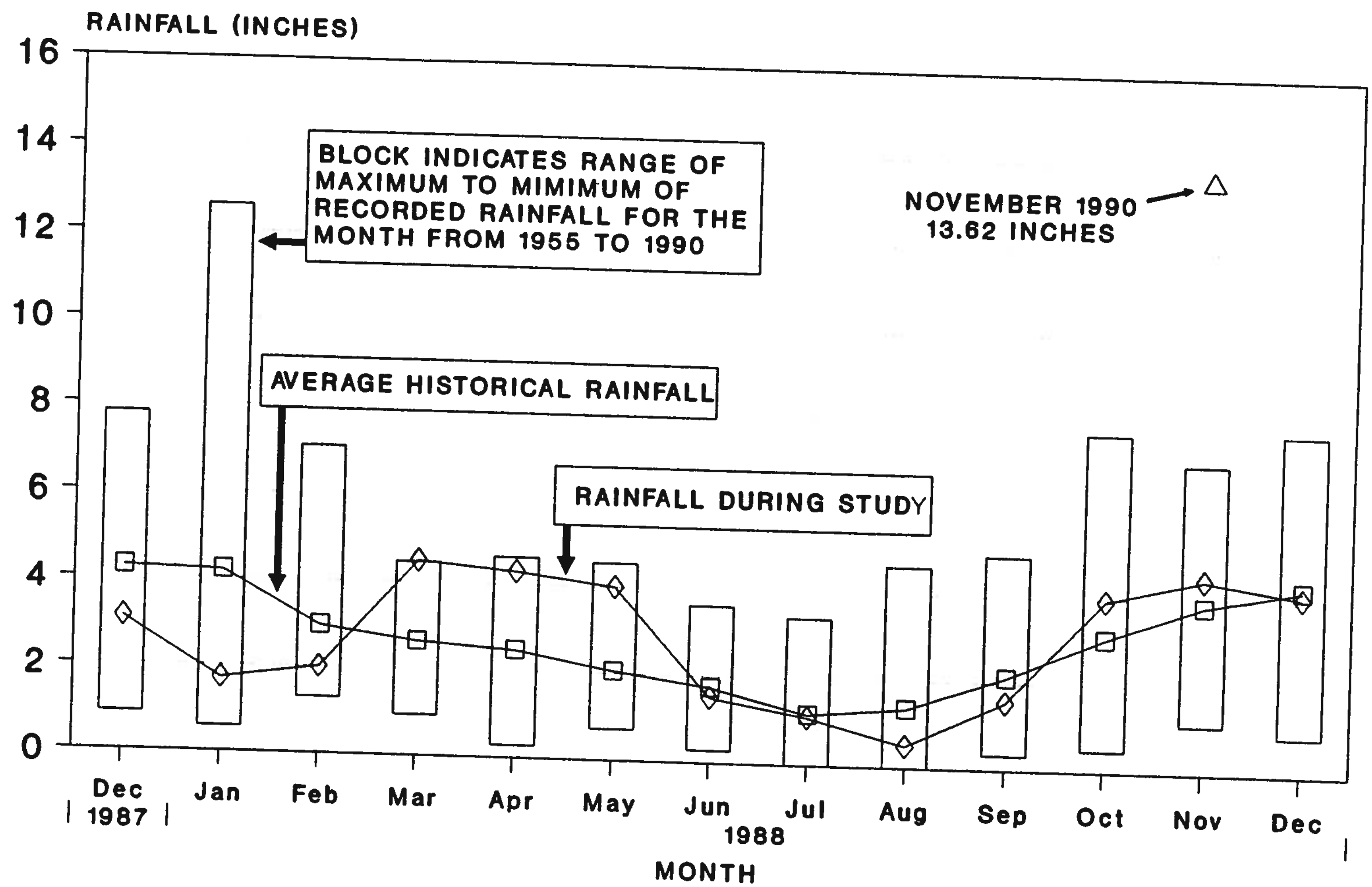

FIGURE V-6
RAINFALL DURING THE STUDY AND HISTORICAL RAINFALL PATTERNS FOR WSU RESEARCH STA.

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE SEWER AND COMBINED SEWER OVERFLOW REDUCTION PLANS

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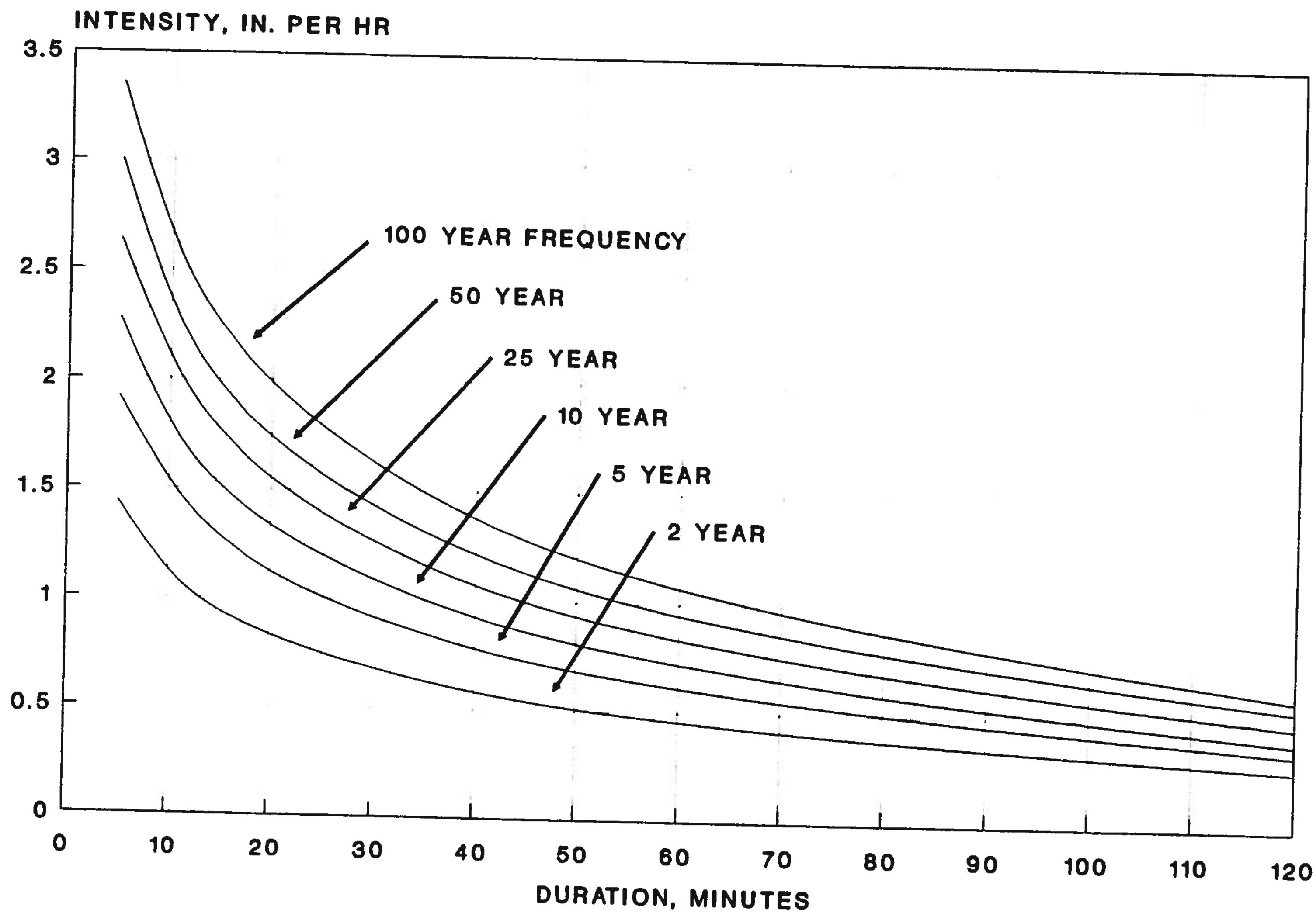

FIGURE V-7
RAINFALL - INTENSITY - DURATION

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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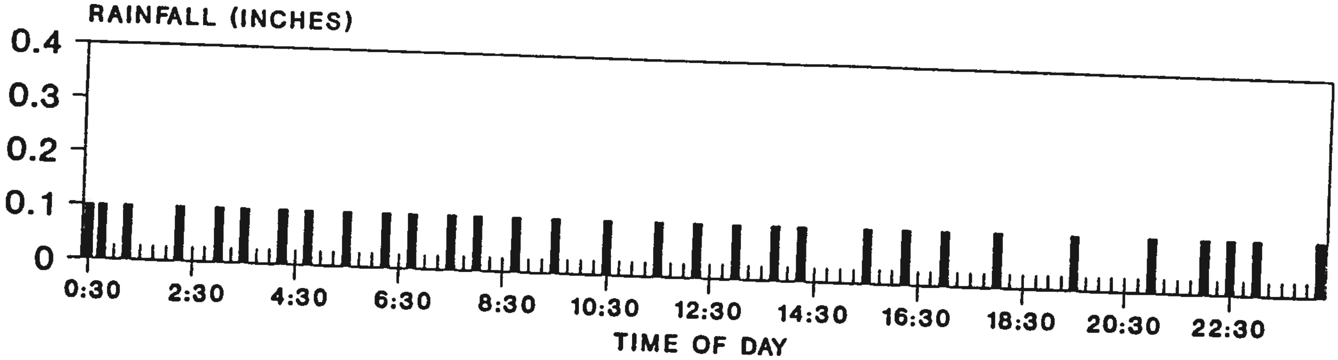
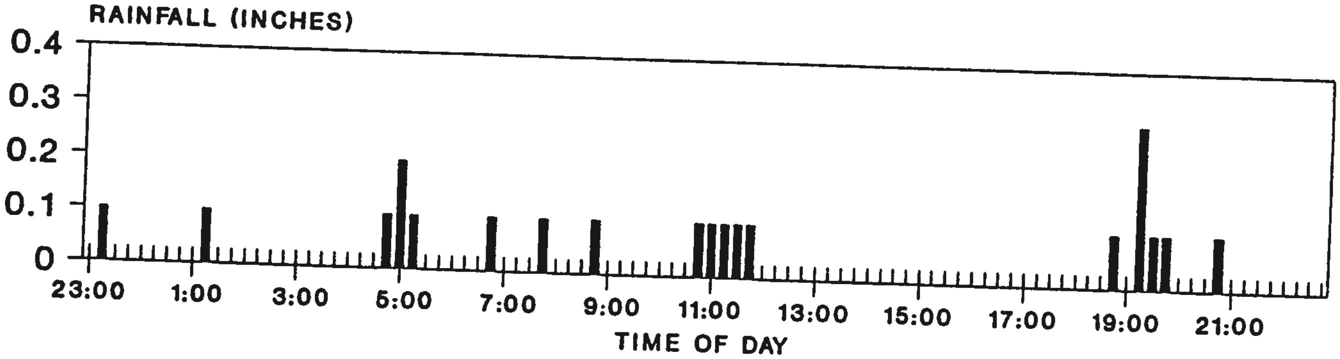
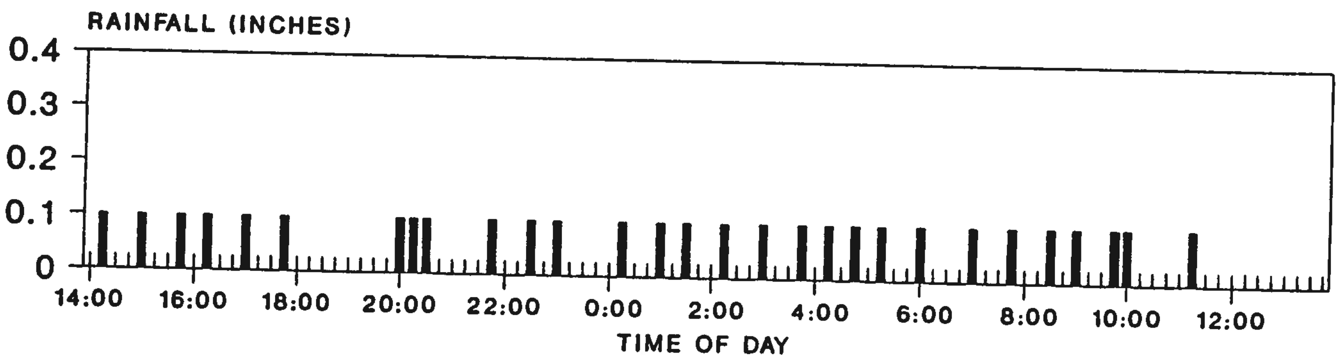
FIGURE V-8
STORMS OF NOVEMBER 1990



NOVEMBER 9, 1990
3.1 INCHES OF RAINFALL IN 24 HOURS
25 YEAR -24 HOUR STORM



NOVEMBER 12 - 13, 1990
2.1 INCHES OF RAINFALL IN 24 HOURS
2 TO 5 YEAR - 24 HOUR STORM



NOVEMBER 23 - 24, 1990
3.0 INCHES OF RAINFALL IN 24 HOURS
ALMOST A 25 YEAR - 24 HOUR STORM

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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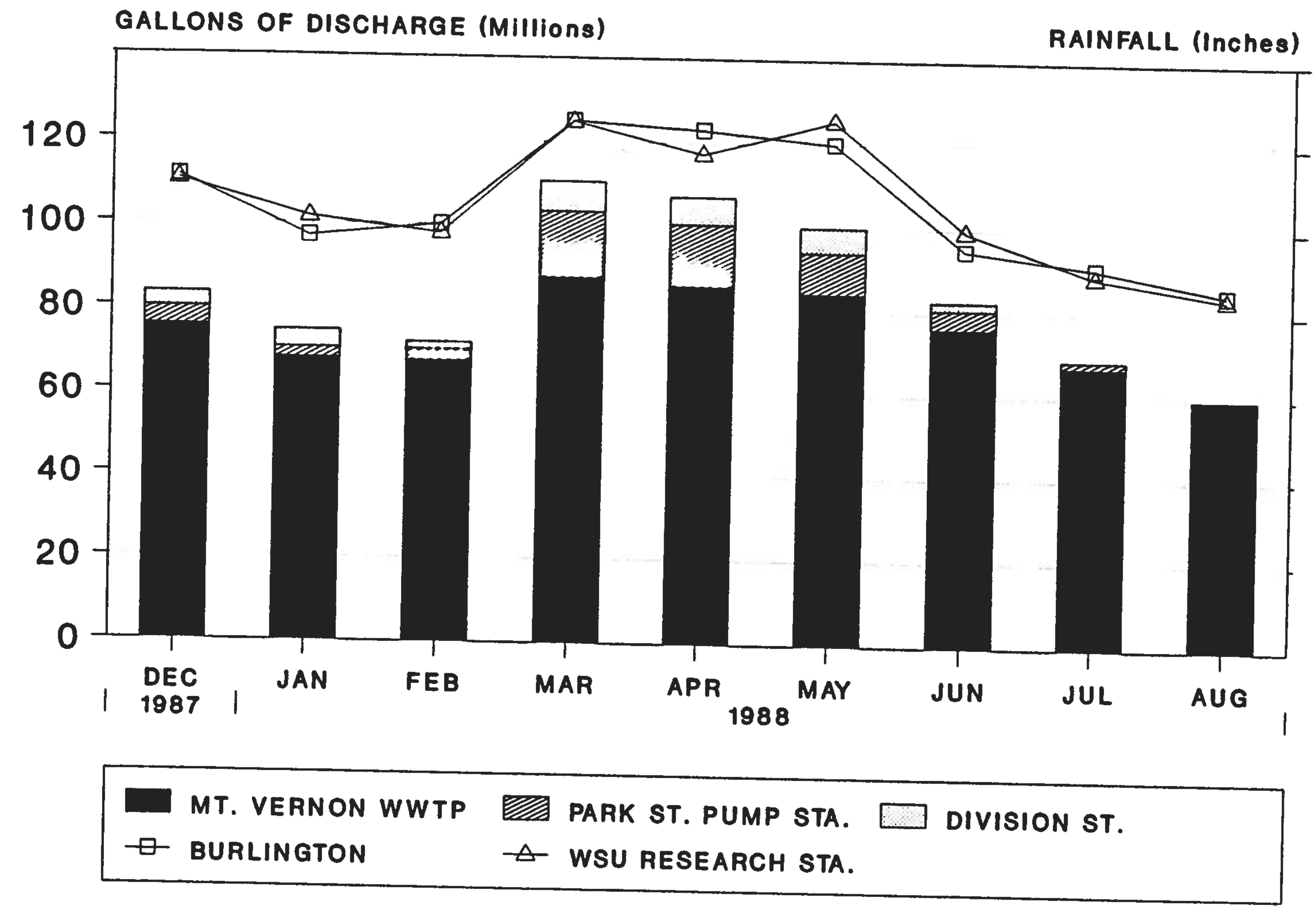

FIGURE V-9
MONTHLY RAINFALL AND DISCHARGES TO THE SKAGIT RIVER DURING THE STUDY

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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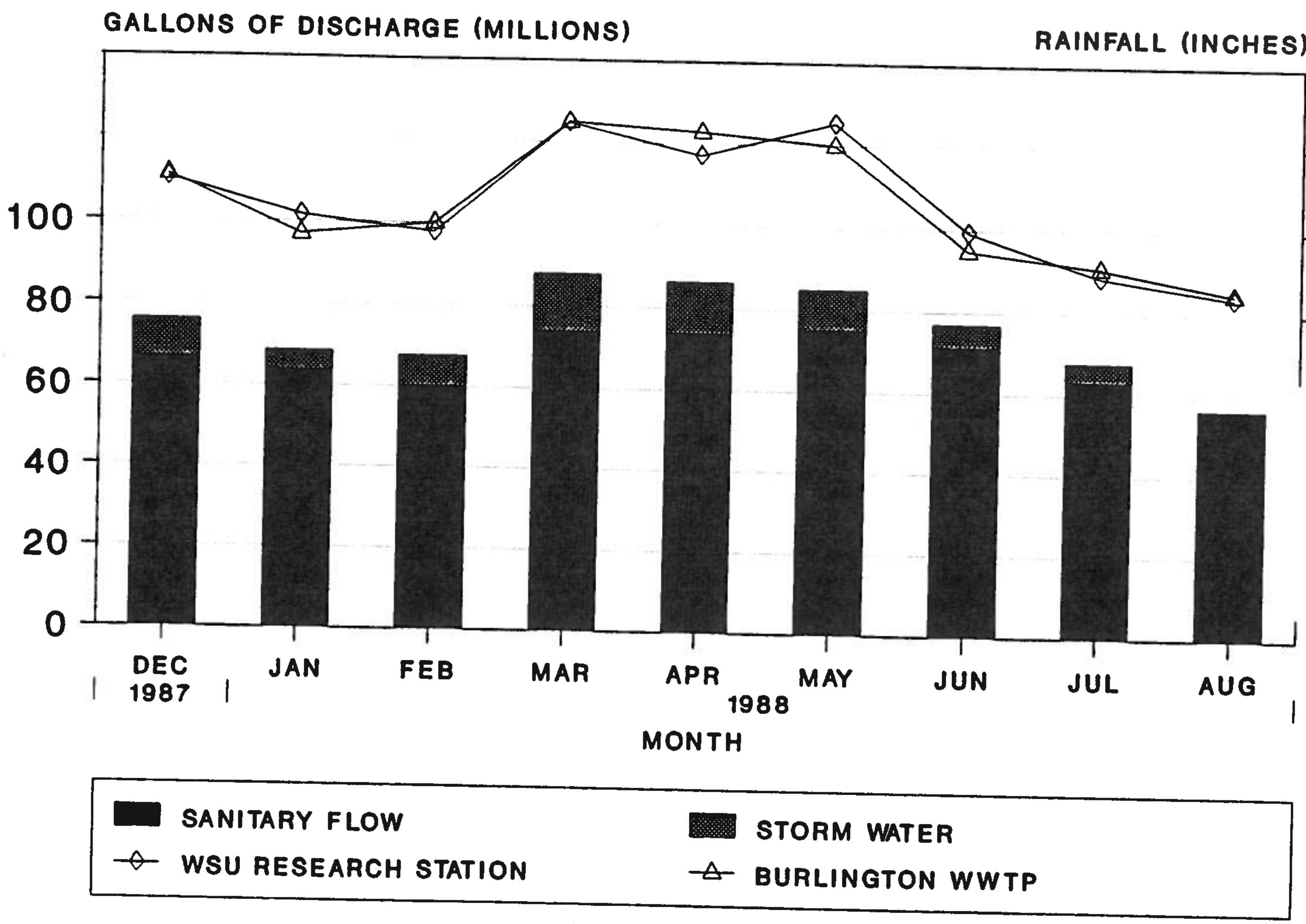

FIGURE V-10
TOTAL FLOWS TREATED AT THE MT. VERNON WWTP - SANITARY FLOW AND STORM WATER

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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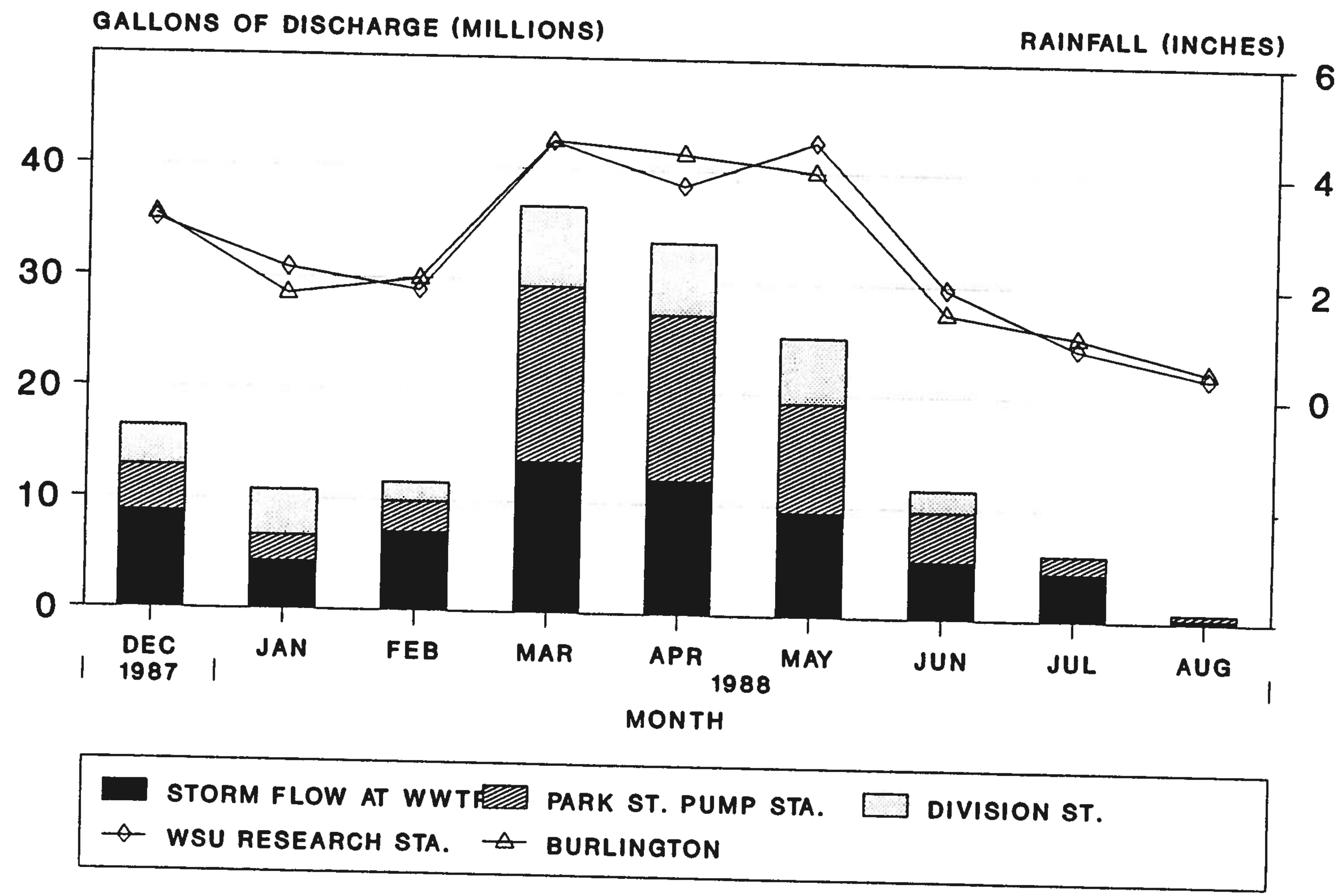

FIGURE V-11
MONTHLY STORMWATER FLOW AND
RAINFALL DURNING THE STUDY

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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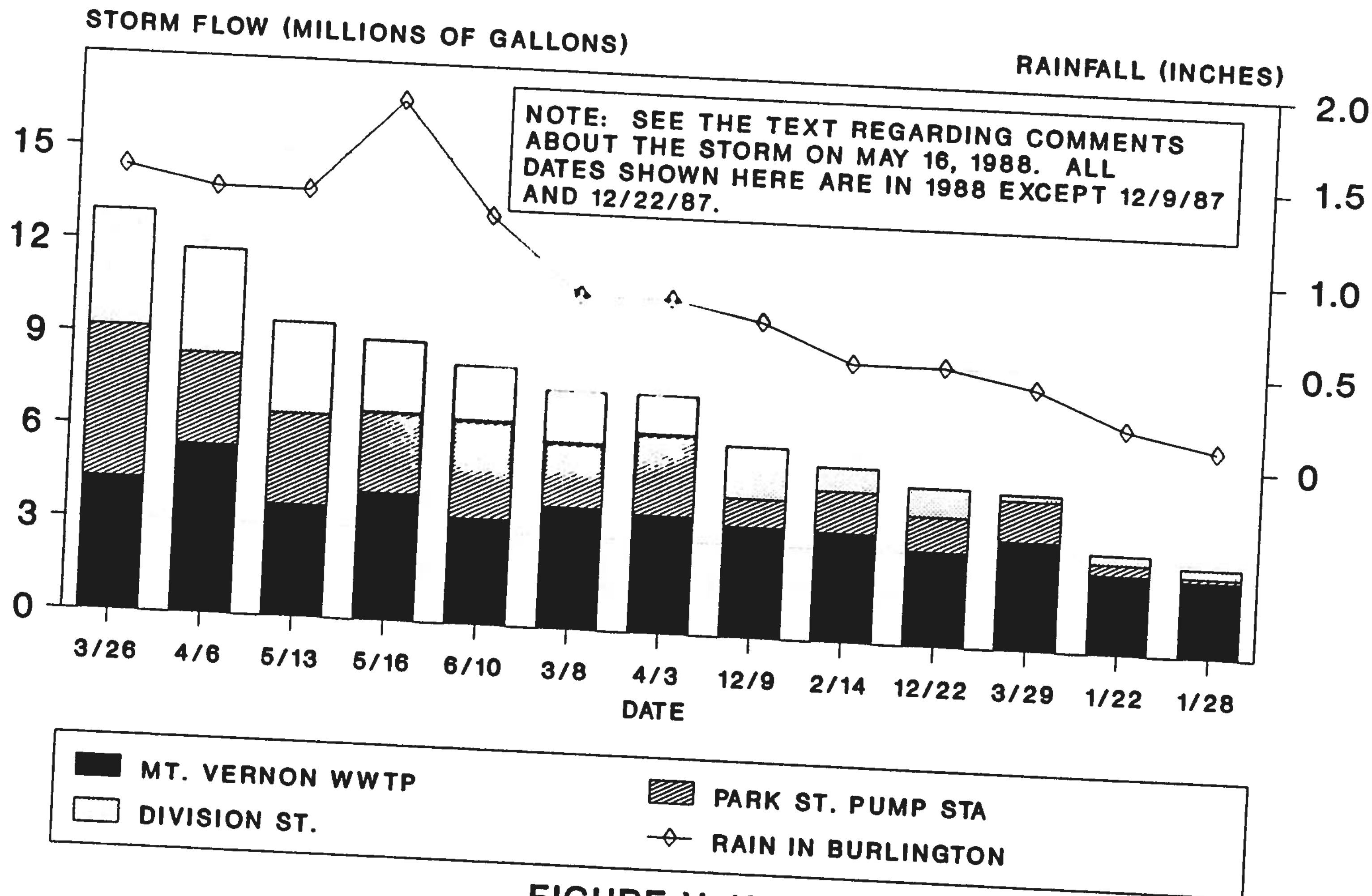

FIGURE V-12
DISCHARGES TO THE SKAGIT RIVER AND RAINFALL FOR SIGNIFICANT STORM EVENTS

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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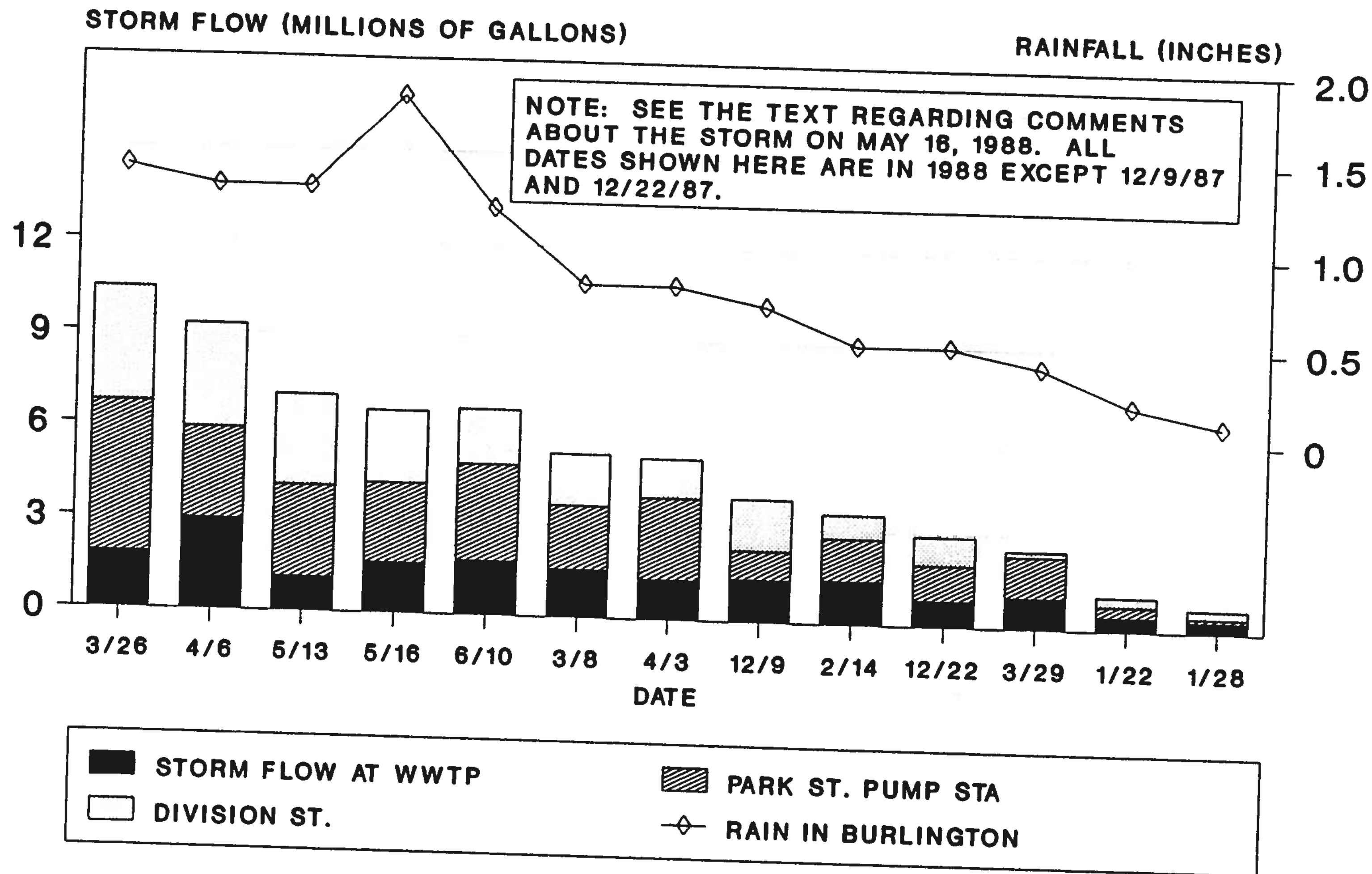

FIGURE V-13
STORM FLOW AND RAINFALL FOR
SIGNIFICANT STORM EVENTS

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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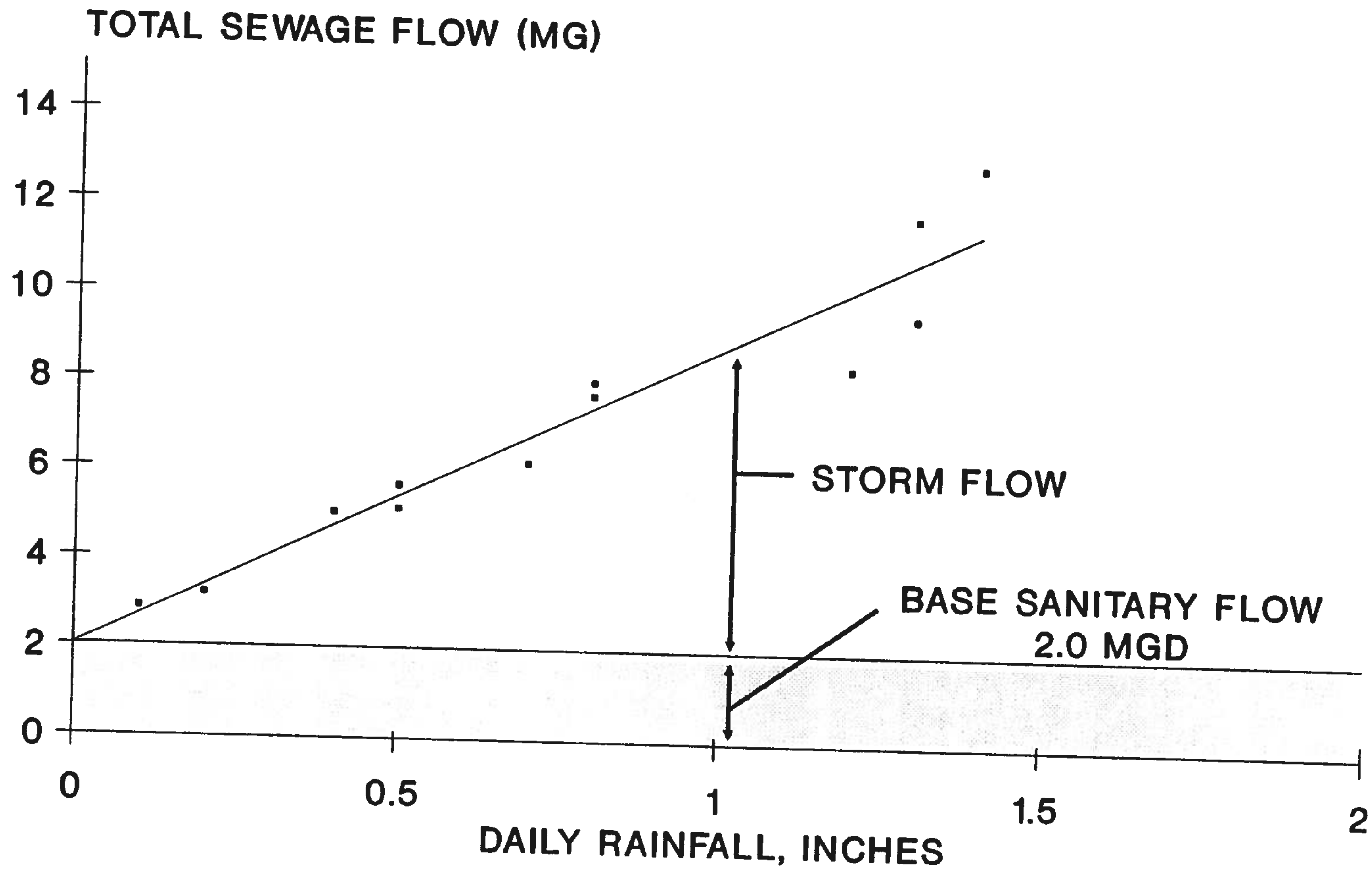

FIGURE V-14
TOTAL SEWAGE FLOW FROM STORM EVENTS VS. RAINFALL

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE SEWER AND COMBINED SEWER OVERFLOW REDUCTION PLANS

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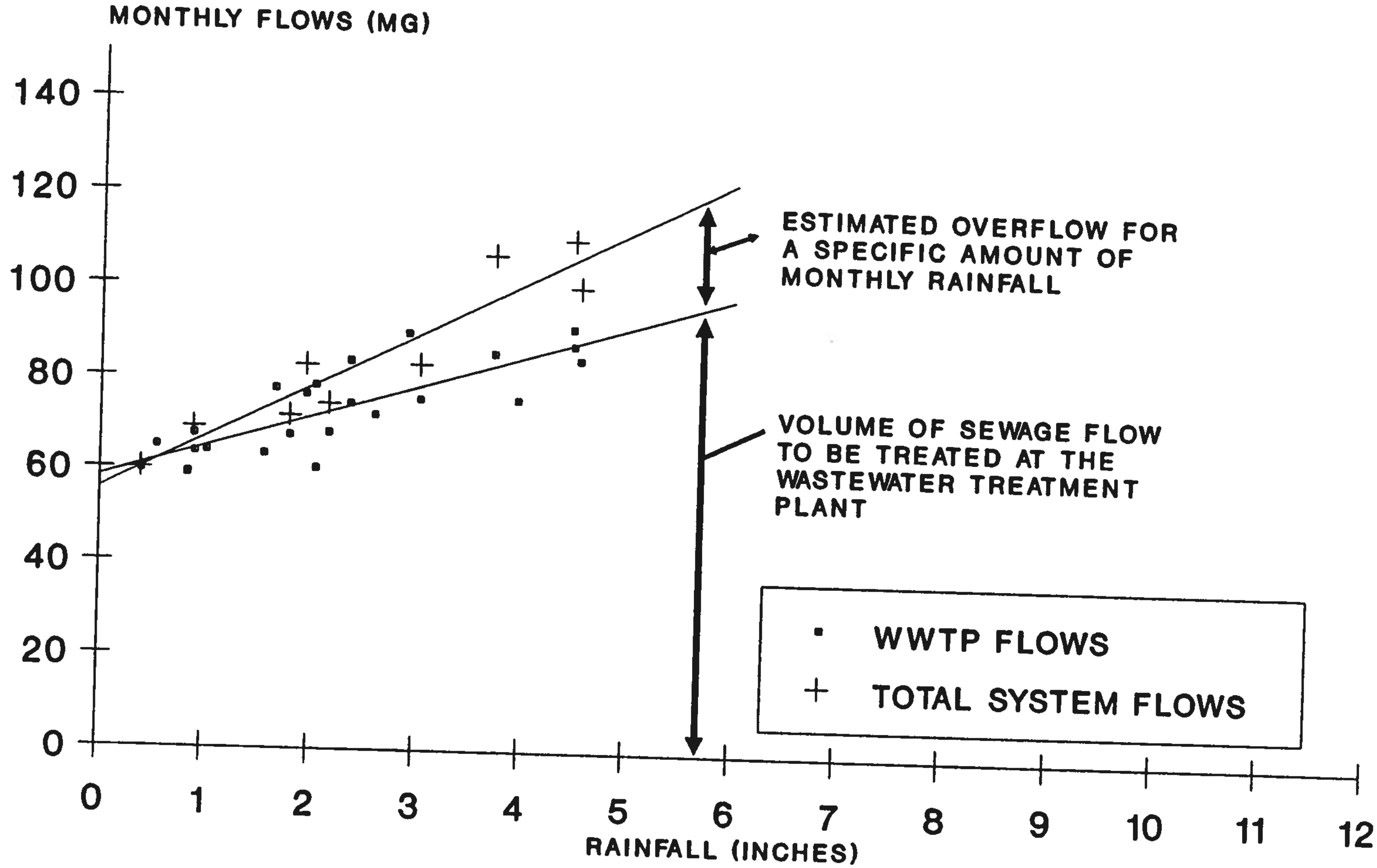

FIGURE V-15
MONTHLY WWTP FLOWS AND TOTAL
SEWER SYSTEM FLOWS VS. RAINFALL

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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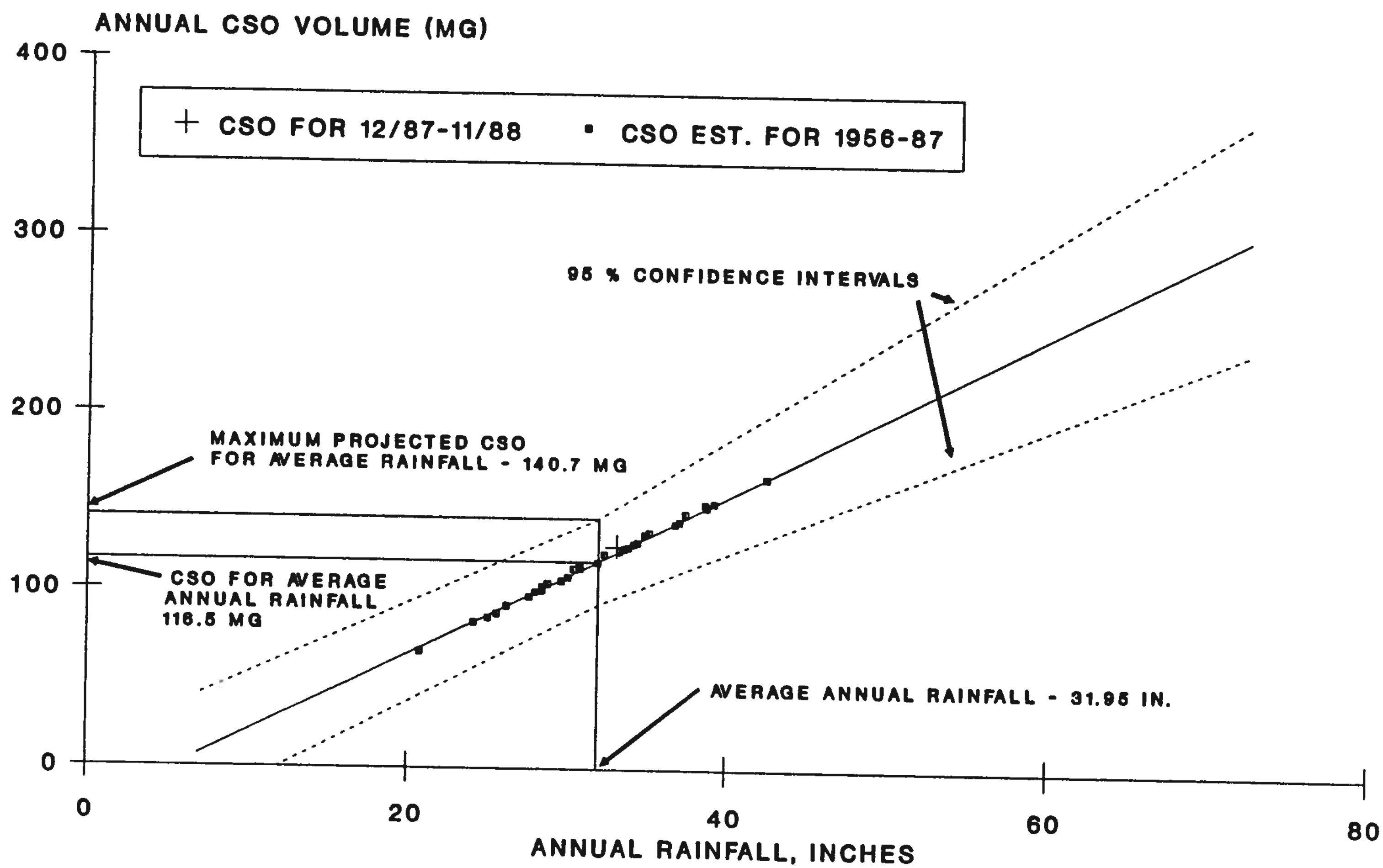

FIGURE V-16
CSO BASELINE FOR THE MOUNT VERNON SEWER SYSTEM: ESTIMATED CSO VS ANNUAL RAINFALL

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE SEWER AND COMBINED SEWER OVERFLOW REDUCTION PLANS

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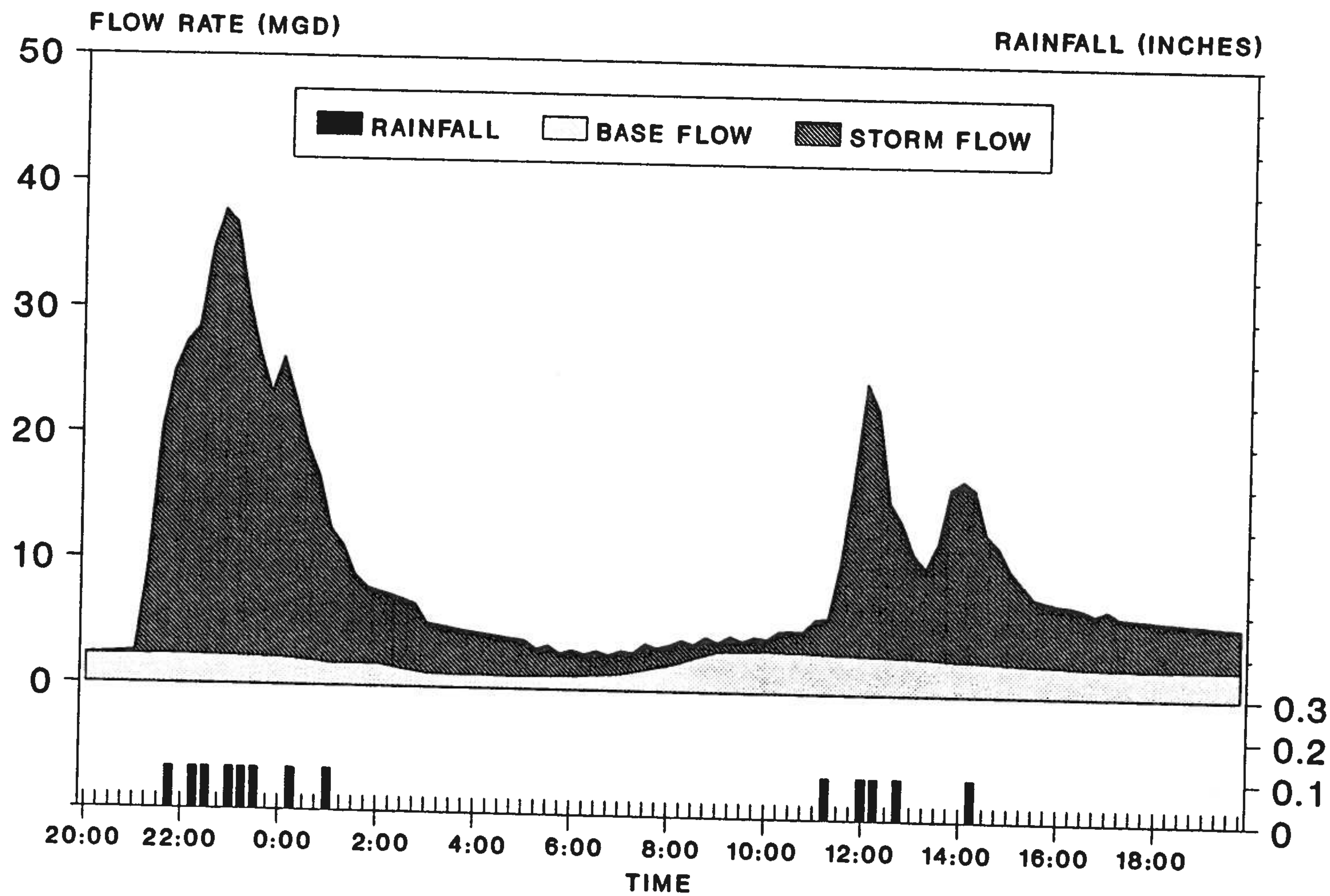

FIGURE V-17
SANITARY AND STORMWATER FLOWS
MAY 12 - 13, 1988

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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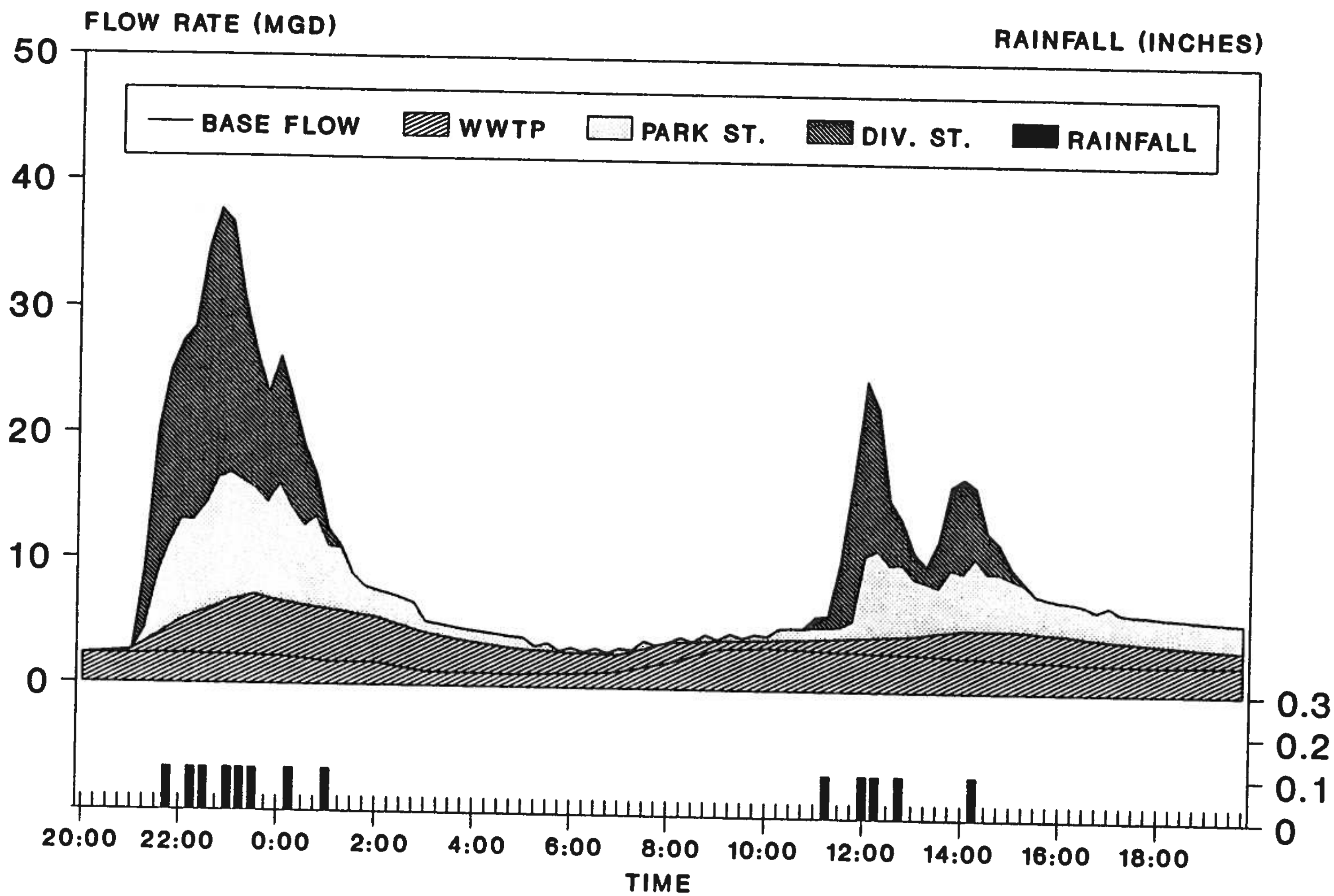

FIGURE V-18
COMBINED SEWER FLOWS
MAY 12 - 13, 1988

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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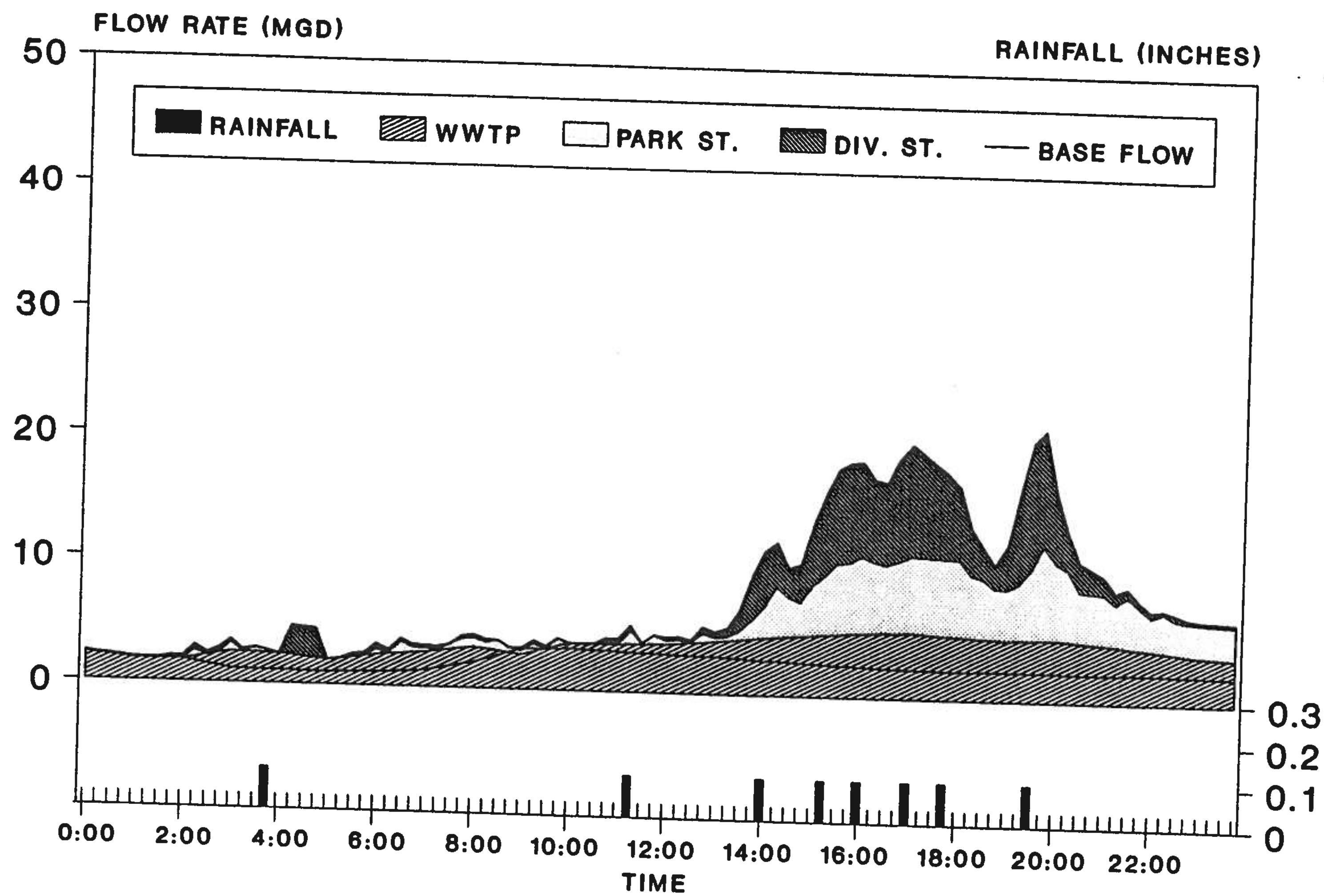

FIGURE V-19
COMBINED SEWER FLOWS
MARCH 8, 1988

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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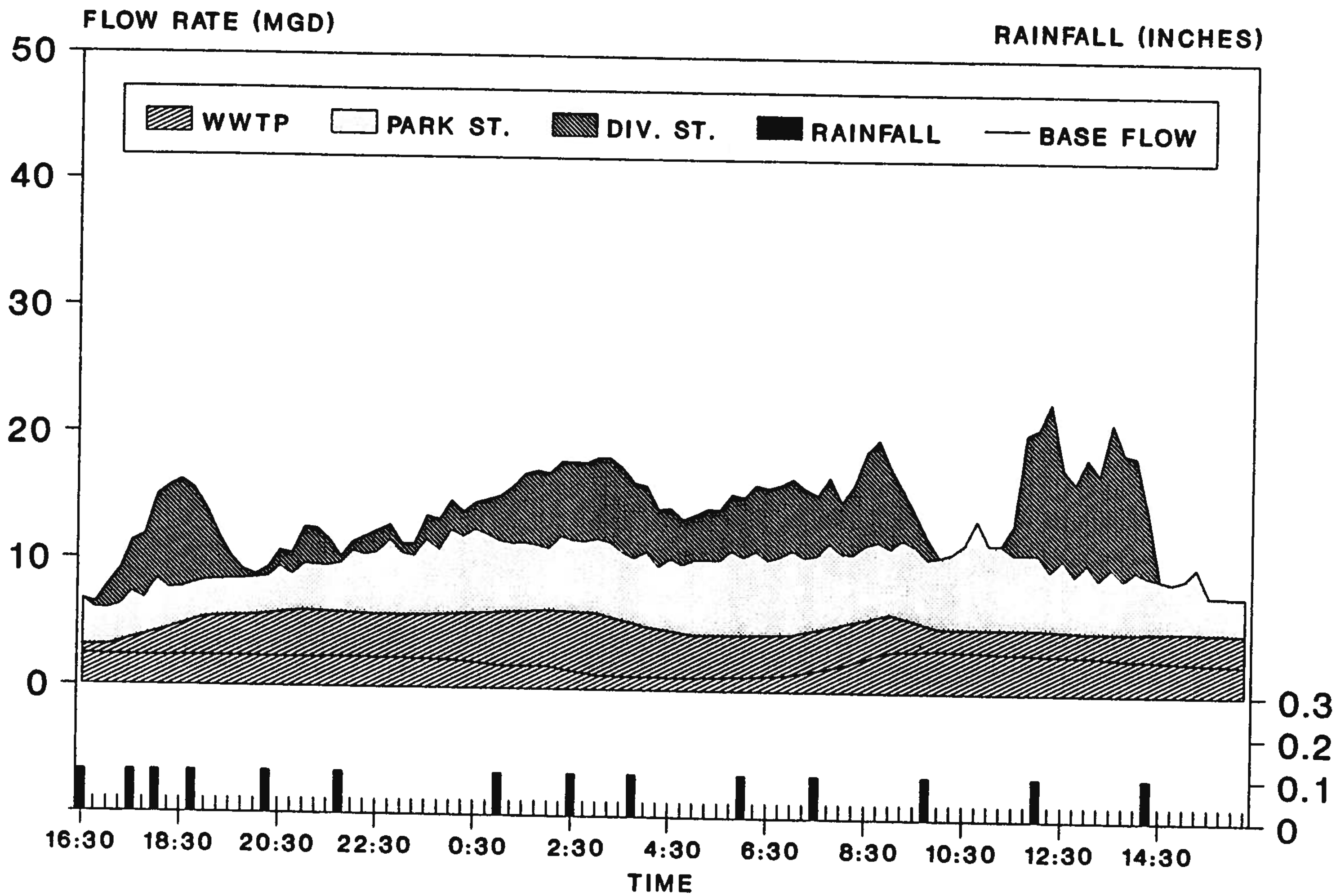

FIGURE V-20
COMBINED SEWER FLOWS
MARCH 25-26, 1988

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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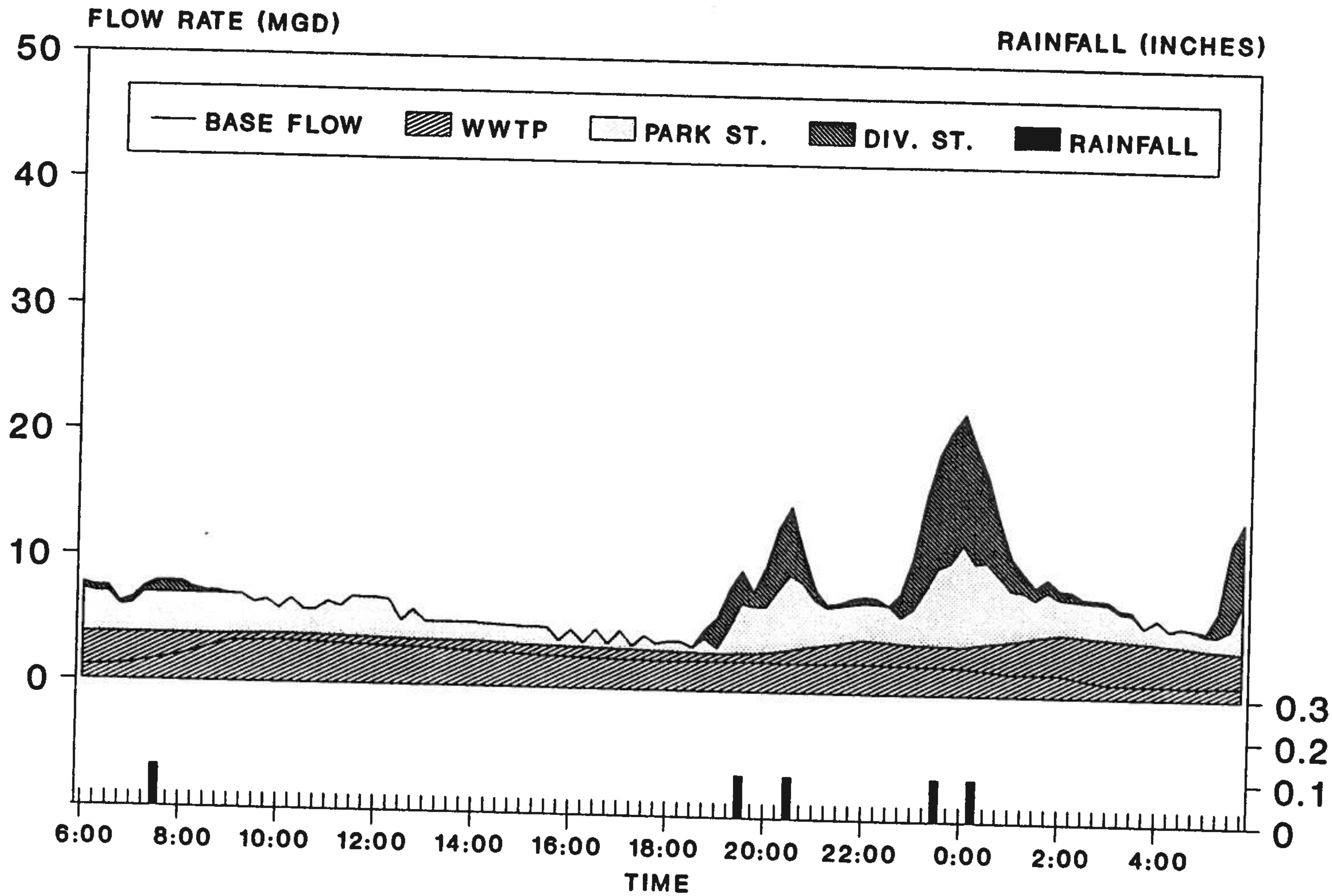

FIGURE V-21
COMBINED SEWER FLOWS
APRIL 3 - 4, 1988

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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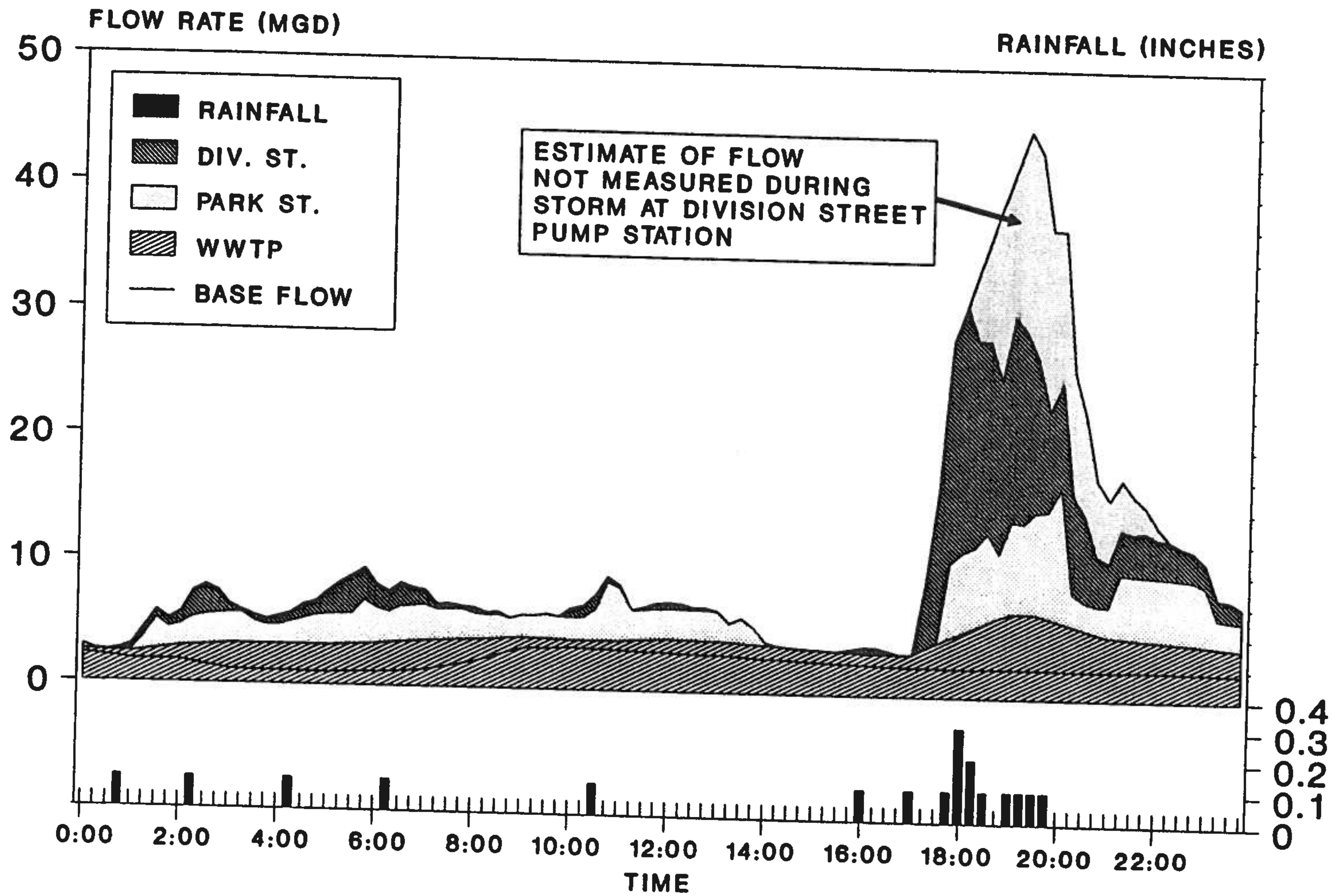
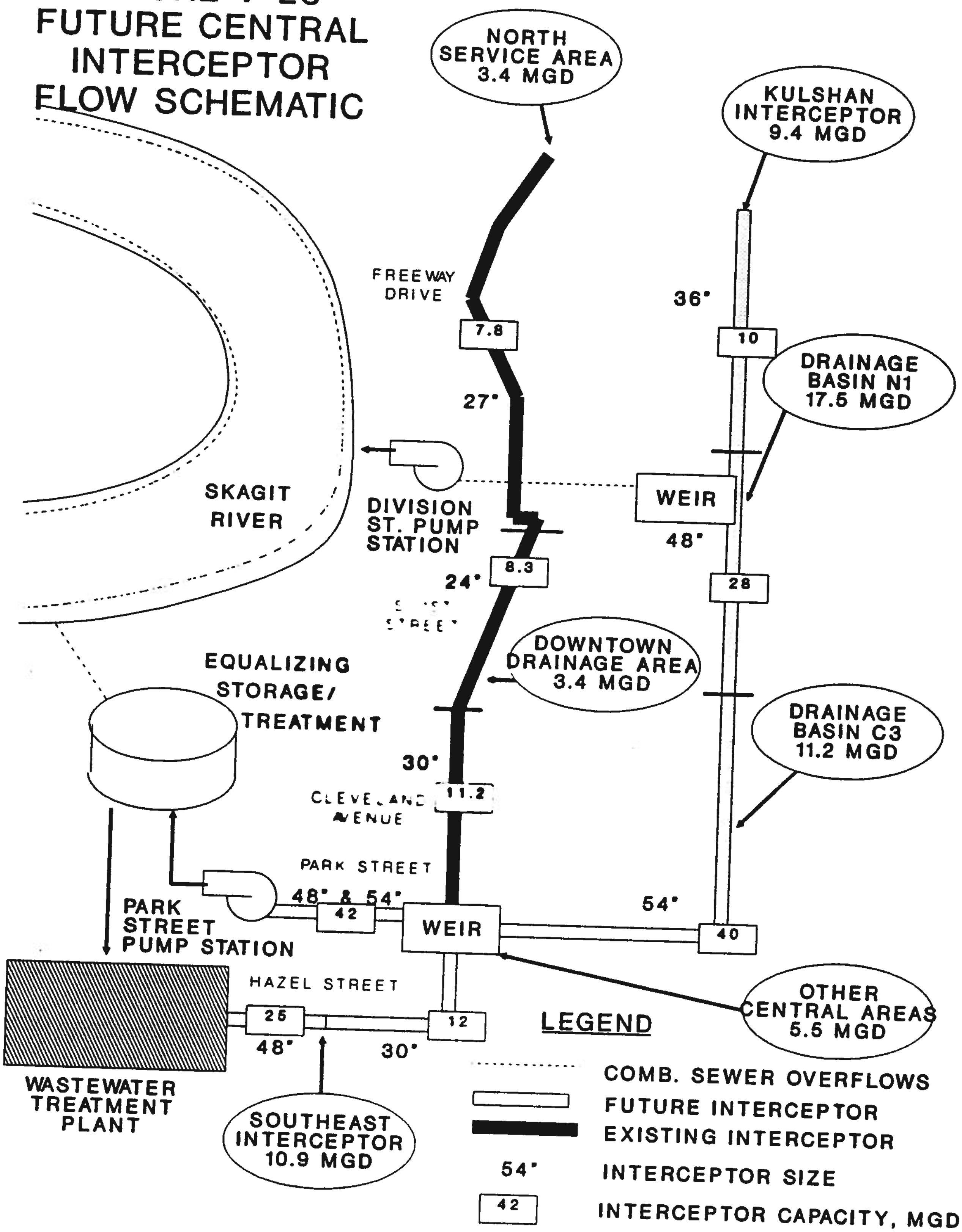


FIGURE V-22
COMBINED SEWER FLOWS
MAY 16, 1988

FIGURE V-23 FUTURE CENTRAL INTERCEPTOR FLOW SCHEMATIC



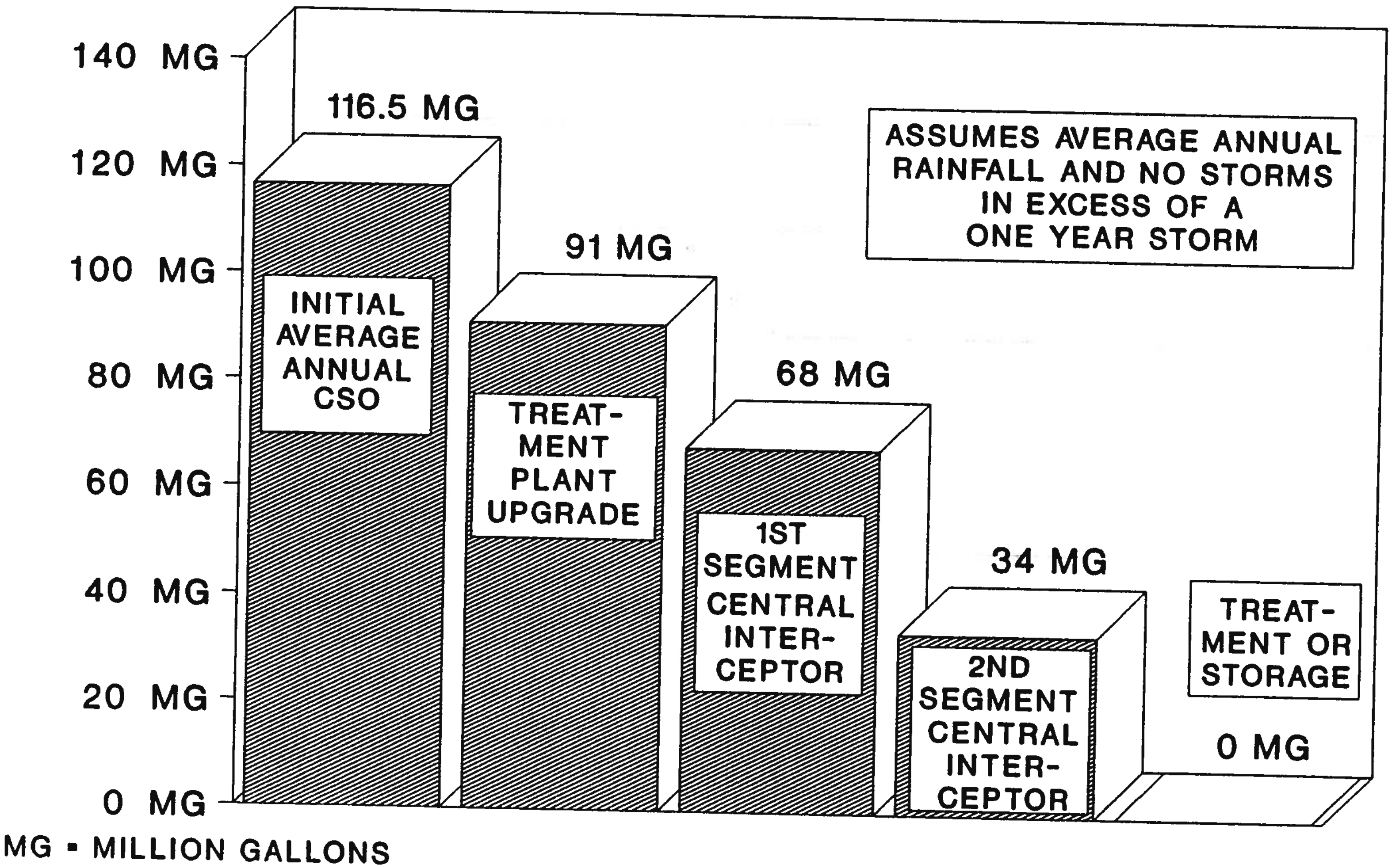


FIGURE V-24
ESTIMATED ANNUAL OVERLFOWS
WITH CSO REDUCTION FACILITIES

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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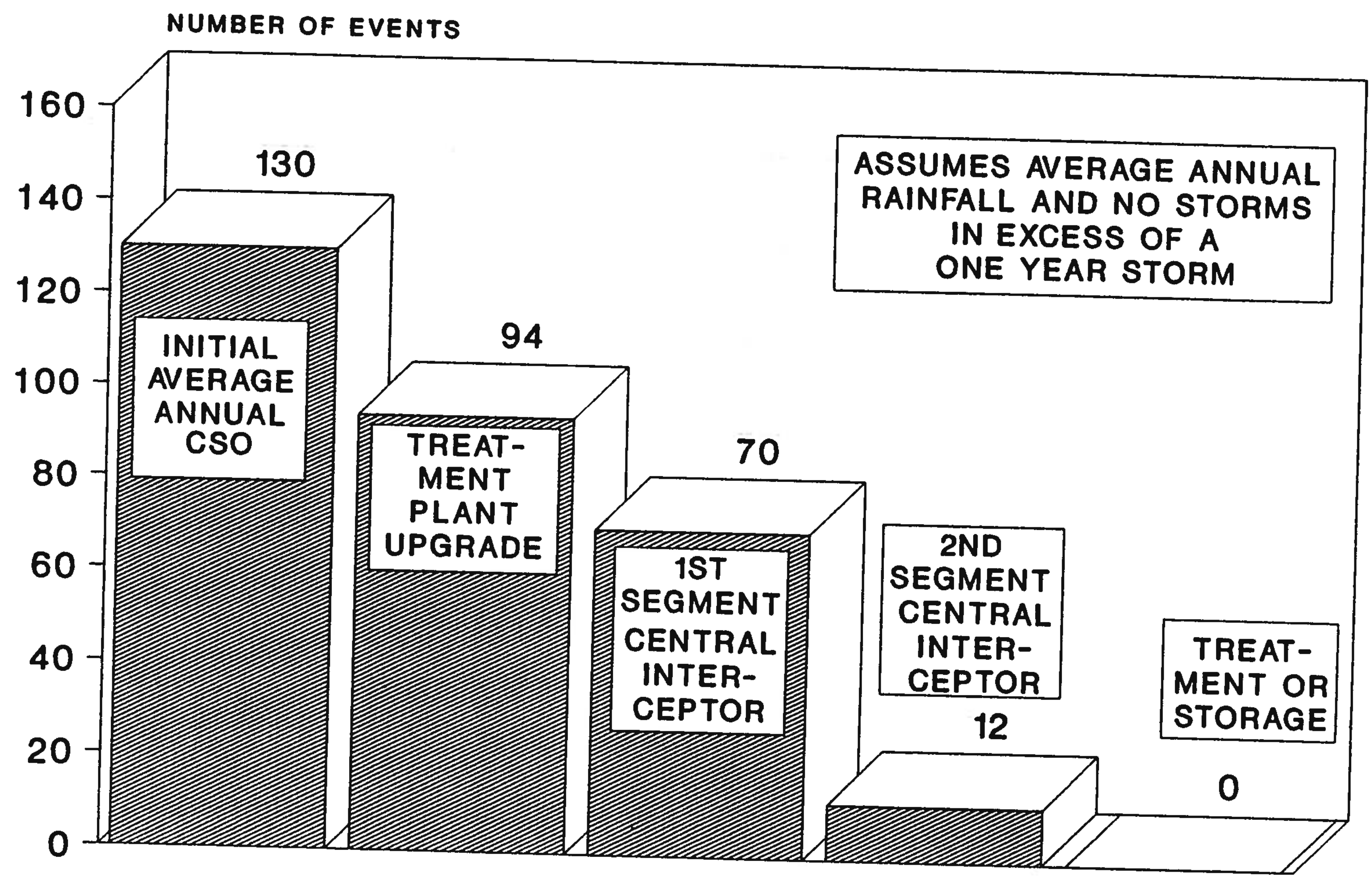

FIGURE V-25
ESTIMATED FREQUENCY OF OVERFLOWS
PER YEAR WITH CSO REDUCTION FACILITIES

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

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SECTION VI
PROBLEM IDENTIFICATION

SECTION VI

PROBLEM IDENTIFICATION

A. General

This section describes surface water problems in the study area and the methodology used to identify them. Problems are categorized into one of the following type:

- System problems, such as flooding, channel erosion, and damaged or old-substandard storm drainage systems

- Water quality problems

- Environmental resource problems, such as fish habitat and wetlands preservation problems

The development of solutions to address these problems is discussed in Section VII.

B. Problem Identification Methodology

Developing a comprehensive summary of stormwater problems in the study area involved a combination of conducting interviews, field observations, and performing specific technical investigations. Detailed descriptions of the information sources used and technical investigations performed are described in the following paragraphs.

1. Public Input

Input from the public regarding drainage problems was solicited through a notice that was sent out in a citywide mailing. The notice described the comprehensive surface water management plan and requested individuals to attend a public meeting to help identify existing drainage problems.

2. City Staff

Both the City engineering staff and the maintenance personnel provided input on problems. Several of the staff have personal knowledge of historical flooding problems.

3. Interviews with Agencies/Jurisdictions

Agencies and jurisdictions were contacted, informed about the planning effort, and solicited for information regarding problems occurring in the study area. Agencies and jurisdictions contacted as a part of this planning effort were listed in Section II.

4. Citizen's Advisory Committee

A Citizen's Advisory Committee (CAC) was formed by the City to assist in formulating the history of problems and facilities in the drainage basins, make recommendations to the final goals and objectives, and assist in developing the surface water management plan.

5. Hydrologic/Hydraulic Computer Analysis

Hydrologic and hydraulic computer models were developed to simulate the response of the drainage basins to storm events. The computer models were used to help assess the magnitude and frequency of flooding problems in the basins, and also to identify flooding problems not already identified by City staff or the public.

a. Hydrology. Hydrologic modelling of the study area was performed using EPA's HSPF computer model. The hydrologic computer model was developed to simulate the runoff hydrographs from the study area during storm events. The hydrologic computer analysis was described in Section IV.

b. Hydraulics.

(1) Regional System Problems, as defined in Part C. of this section, were analyzed using the future and existing flows at various points in the study area based on the results from the HSPF hydrologic computer simulation. HEC-2, Water Surface Profiles computer program (US Army Corps of Engineers, 1990) was used to assess the impacts of these flows in Kulshan Creek upstream of Riverside Drive. The computer program HY8, Culvert Analysis (Federal Highway Administration, 1987) was used to estimate the performance of culverts on channels other than Kulshan Creek.

(2) Local System Problems

Local system problems, as defined in Part C. of this section, were analyzed by comparing the peak flows from the runoff hydrographs generated by the HSPF computer model, with the capacity of existing drainage systems determined using Flowmaster computer program (Haestad, 1991). The capacity of these systems were compared with the peak flows for the 10-year 24-hour storm event to estimate the magnitude and frequency of flooding problems. The results are tabulated in Table VII-1.

6. Water Quality Investigations

A water quality assessment was prepared as part of the surface water management plan. Its purpose was to characterize the quality of the surface waters and to identify potential sources of pollution in the Mount Vernon study area. A complete discussion of the water quality assessment is presented in Appendix G. Historical information (Skagit River basin study, Entranco 1991; Nookachamps management plan, Cook 1980; A catalog of Washington streams and salmon utilization, WDF 1975; Baseline monitoring at proposed Sea-Van

Development Site, Sea-Van fisheries resources, W&H Pacific 1992; Predicted water quality impacts from the proposed Sea-Van golf course and residential site, Harding Lawson Associates), was used to characterize the Skagit River, Nookachamps Creek and streams in the study area. A water quality monitoring program and a stormwater pollutant loading study was used to characterize the streams in the study area. The monitoring program was used to identify specific pollutant problems in the study area, while the pollutant loading study, which estimates loadings based on land use activity, was used to indicate the relative pollutant problem in each of the study area major drainage basins and also the relative increase in pollutants in each basin due to future urbanization.

7. Fish Habitat Inventory and Investigation

A field inventory of the fish habitat and riparian corridors was conducted for Kulshan Creek, Trumpeter (College Way) Creek, Maddox Creek, Flowers Creek, and Carpenter Creek. The inventory describes fish habitat and associated riparian areas of importance to both fish and wildlife. As part of this inventory, fish habitat problems were identified and are discussed in Section VII.

C. System Problems

System problems such as flooding and channel erosion are a result of uncontrolled runoff from developed areas, inadequate capacities or material failures in existing storm drainage systems, and the loss of flood reducing storage capacity in natural depressions and riparian areas. Some of the problems are considered local system problems if they are located in areas tributary to major streams or drainage systems. Other problems are considered regional system problems if they are associated with a major stream or drainage system. The following problems have been identified by City staff, modelling efforts based on existing and future land use, and the public. The locations of these problems are shown in Figure VI-1.

1. Regional System (RS) Problems

a. Problem RS1 The drainage system along Freeway Drive north of College Way, including the detention pond constructed with the Eagle Hardware development and the existing 2.67 cfs pump station, does not have enough capacity to adequately convey flows with proposed future development in the area. There is also no drainage system along Freeway Drive south of College Way.

b. Problem RS2 The two 36-inch-diameter culverts under Parker Way along Kulshan Creek have insufficient capacity to prevent overtopping of the road.

c. Problem RS3 The existing culvert for a tributary to Kulshan Creek across College Way east of Continental Place has insufficient capacity to pass the 10-year storm event. This problem may be aggravated by routing flows from areas west of the Burlington Northern Railroad tracks into this system.

d. Problem RS4 Kulshan Creek is conveyed to the Skagit River via a pipe system from Riverside Drive to an existing pump station west of Freeway Drive. When the water levels in the Skagit River are normal and low enough for gravity flow, the existing pipe conveyance system to the Kulshan Creek Pump Station has a capacity of 100 cfs with an upstream water surface elevation of about 25 feet at Riverside Drive. When the water level on the Skagit River is high, the water from Kulshan Creek must be pumped into the Skagit River. The combined capacity of the existing two pumps at the pump station is about 20 cfs at 20 feet total dynamic head. Therefore, if the flow from Kulshan Creek is more than 20 cfs when the Skagit water level is high or if the flow from Kulshan Creek is more than 100 cfs during normal Skagit River levels, extensive flooding is possible along Kulshan Creek upstream of the pump station. This is one of the most severe flooding problems in the City, which resulted in extensive property damage during flood events in November 1990.

e. Problem RS5 According to the hydrologic analysis, future development in the Trumpeter Creek basin could cause peak flows to increase by up to 30 percent in some areas over existing conditions if no additional detention were provided. This would cause an increase in local flooding and erosion problems, as well as water quality and fish habitat problems.

f. Problem RS6 Large amounts of undeveloped property remain in the Madox Creek basin and, without adequate controls, development to current zoning would result in significant increases in peak flows at all points along the main stem of Madox Creek. Some of the areas of the basin could experience an increase in peak flows that would be triple the peak flow under existing conditions. Such a significant increase in peak flows would undoubtedly create local flooding problems and aggravate the existing erosion problems along Madox Creek.

g. Problem RS7 Erosion problems on the main stem of Madox create have been noted just below Blackburn Road. At this point, Madox Creek enters a well defined steep-sided ravine with a bed slope of approximately 0.05 foot/foot. Erosion of the channel bed and banks has resulted in downcutting of the channel bed up to three feet in places and a number of side slope failures over a distance of several hundred yards downstream from Blackburn Road. The channel bed has been eroded down to an underlying layer of relatively hard glacial till, which will likely impede further down cutting. Similar erosion problems on a tributary to Madox Creek, Flowers Creek, have also occurred downstream from Blackburn Road. Continued erosion of the stream banks and further side slope failures are likely in the future and the problems will likely become more severe in the absence of adequate stormwater controls. In addition, the material eroded from Madox Creek and Flowers Creek will be carried downstream and deposited in the low gradient reaches downstream of Blodgett Road. Deposition of eroded material will reduce the capacity of the downstream reaches of Madox Creek and may result in increased incidence of flooding.

h. Problem RS8 Madox Creek exits the City of Mount Vernon into Drainage District 17 south of the City. Concerns have been raised by the district as to the overall responsibility of the City to contribute to maintenance and operations of the Madox

Creek system within the district. The primary concern is related to costs associated with maintaining and operating a stormwater pump station near Conway, and removal of sediment near Blodgett Road. This problem relates to determining how much the City contributes to problems in the district, and to what degree the City should be responsible for maintaining and operating the pump station at Conway.

2. Local System (LS) Problems

a. Problem LS1 During periods of high water levels in the Skagit River, flooding occurs in the area west of LaVenture Road and north of Hoag Road. One house on the corner of Hoag Road and Horizons Street has sustained flood damage.

b. Problem LS2 Flooding occurs northwest of the intersection of Hoag Road and the Burlington Northern Railroad. There is no drainage system in this area so once runoff collects in this area it has no means of escape.

c. Problem LS3 Flooding has occurred at the residence located west of where La Venture Road turns east several blocks north of Hoag Road. It was reported that drainage from La Venture Road was running off into the property. It appears that the problem may have already been resolved. During a field visit, it was noted that a concrete berm had been placed along the outside of the curve to prevent runoff from entering the property.

d. Problem LS4 Ponding occurs on a commercial site northeast of the College Way - Urban Avenue intersection. The loading bays were graded much lower than the rest of the site and therefore collect site runoff.

e. Problem LS5 Runoff from the south side of Fir Street flows north across the roadway just west of North 14th Street because of an inadequate drainage system in that area. This problem was recently solved with system improvements that were installed as part of the Fir Street reconstruction.

f. Problem LS6 Erosion is occurring in a small stream channel tributary to Kulshan Creek north of Cedar Lane. The channel has incised down to a glacial till soil layer.

g. Problem LS7 Erosion is occurring in an open channel tributary to Kulshan Creek north of Viewmont Drive and downstream from an 18-inch pipe outlet. The erosion problem originated where the channel descends a steep grade immediately south of Kulshan Creek. Over time, the channel erosion has progressed south towards the 18-inch pipe outfall.

h. Problem LS8 There is an undersized culvert along the west side of North 16th Street just south of the railroad grade which is causing flooding in the area.

i. Problem LS9 There are two problems in trailer parks adjacent to Trumpeter Creek. One flooding problem occurs in a trailer park east of North 30th Street and 1,300 feet south of College Way as runoff overtops a ditch and flows overland to

Trumpeter Creek. There are several areas where flows overtop the ditch which is adjacent to the south property line of the trailer park. Another problem occurs in the Park Village trailer court north of First Street and east of LaVenture Road. This problem occurs on the main stem of Trumpeter Creek along the east property line of the development. It is our understanding that this flooding problem is limited to landscaped areas and has not caused property damage to adjacent structures.

j. <u>Problem LS10</u> There are stream channel erosion and deposition problems along the southeast fork of Trumpeter Creek where it crosses Kiowa Drive west of Seneca Drive and east of Waugh Road.

k. <u>Problem LS11</u> A storm drain runs through an easement along the east property line of the second house east of Nez Perce Drive on the south side of Kiowa Drive. Sediment and debris plug a pipe inlet behind the house which is flooded as a result.

l. <u>Problem LS12</u> There is localized flooding along Memorial Highway (SR 536) in West Mount Vernon due to insufficient capacity of the storm drain system. The storm drain system which collects drainage for most of West Mount Vernon is only 12 inches in diameter.

m. <u>Problem LS13</u> Flooding occurs near the intersection of Garfield Street and Wall Street in West Mount Vernon. When the Skagit River is high, the groundwater table rises above the ground surface in the low spots in this area causing flooding of several residences.

n. <u>Problem LS14</u> Ponding occurs at the intersection of Cosgrove Street and Wall Street in West Mount Vernon.

o. <u>Problem LS15</u> Flooding occurs at the intersection of Division Street and South 20th Street as a result of an undersized conveyance system north of Division Street. Several homes are affected.

p. <u>Problem LS16</u> Erosion is occurring along a portion of the southwest fork of Trumpeter Creek between Mohawk Drive and Apache Drive east of Comanche Drive.

q. <u>Problem LS17</u> Uncontrolled runoff from an undeveloped parcel south of Commanche Drive flows north into a ditch on the south side of Commanche Drive. The ditch capacity is insufficient and high flows spill out of the ditch, causing flooding of two homes on the north side of Commanche Drive just east of 30th Street.

r. <u>Problem LS18</u> There is a 12-inch-diameter culvert under Shoshone Drive just east of Sioux Drive that is overtopped during high flows.

s. <u>Problem LS19</u> The two detention ponds north of Division Street and west of Waugh Road do not have emergency overflow spillways. Lack of well armored spillways for emergency use may lead to failure of the pond in an extreme flood event. Also, residents have encroached with landscaping into the easements around these ponds which may inhibit access for maintenance.

t. Problem LS20 Several homes are flooded on the west side of South 6th Street north of Blackburn Road. There is no drainage system in the area.

u. Problem LS21 Flooding occurs on the west side of Riverside Drive in the vicinity of Willow Lane and Alder Lane.

v. Problem LS22 Flooding occurs northwest of the Riverside Drive - Fir Street intersection in the area south east of the Burlington Northern Railroad. There is no drainage system to convey runoff from the area. Three businesses in the area are affected by the flooding.

w. Problem LS23 Flooding occurs along the east side of Interstate 5 where Fir Street curves into Cameron Way. Several businesses are affected by the flooding. There is no drainage system to convey runoff from this area.

x. Problem LS24 Flooding occurs in a large commercial area on the west side of Interstate 5 south of College Way. Because of the flat topography and lack of any conveyance system, the runoff that is generated remains on site.

y. Problem LS25 It was determined from the hydraulic analysis that portions of the pipe and ditch system between Blackburn Road and Britt Slough appear to be under capacity and may cause water to back up in the system and cause flooding during a 10-year storm event.

z. Problem LS26 It was determined from the hydraulic analysis that portions of the storm drain system containing the North Fork of Trumpeter Creek along Fox Hill Street have insufficient capacity to pass the 10-year storm event. This may cause flow to back up and flood the streets and homes in the area. In addition, safety problems associated with a deep ditch west of 32nd need to be resolved.

aa. Problem LS27 It was determined from the hydraulic analysis that the culvert under Interstate 5 on the system tributary to Madox Creek between Blackburn Road and Anderson Road appears to have insufficient capacity. In fact, the pipe section on the east side of Interstate 5 is set at a reverse grade. Therefore, in order for flow to pass through this pipe, water must pond upstream of the pipe and create enough pressure to force the flow through.

D. Water Quality Problems

1. Introduction

For purposes of discussion, water quality problems in the study area are separated into water quality problems attributable to urban development and water quality problems attributable to rural development. Stormwater runoff from these distinct land uses typically contains different types of pollutants and are discussed below. In addition to these two types of general water quality problems, several specific water quality problems identified in the water quality monitoring program are also discussed. Problems associated with pollutant loading increases from future development are also discussed based on the pollutant loading analysis.

2. Water Quality Problems Resulting From Urban Development

The problem of contaminated urban runoff is not unique to the Mount Vernon urban service area. This pollution problem is prevalent everywhere urban development occurs, and nationwide efforts to clean up surface waters reflect the increasing concern with this form of water pollution. Urban development results in increased contamination of runoff as a variety of commercial and residential activities introduce chemicals, petroleum products, solid wastes, and other pollutants onto the land surface, and stormwater runoff subsequently carries those pollutants into receiving waters. Urban development also causes an increase in the volume and peak rate of stormwater runoff. As more buildings, paved areas, and other impervious surfaces are constructed in an area, a greater proportion of the precipitation over the area becomes surface runoff rather than infiltrating into the ground. Greater areas of impervious surfaces also lead to increased peak runoff rates because roof drains, streets, gutters, storm sewers, and other stormwater drainage facilities quickly convey runoff to receiving waters. With the increased volume and peak rate of surface runoff, there is greater potential for pollutants to be washed off the land surface and carried into surface waters.

The general causes of water quality problems related to urban development in the study area can be classified into several broad categories, including illicit wastewater discharges to the storm drainage system; erosion, transport, and deposition of sediments; contamination of runoff by diffuse sources of pollutants on the land; spills of solid and liquid materials; and illegal dumping of materials into the storm drainage system. These general urban water quality problems within the study area are discussed individually below. Specific water quality problem sources within the study area are discussed in a later section of this report.

a. Problem WQ-1—Illicit Connections of Wastewater Discharges to the Storm Drainage System. A common problem that occurs in urbanized areas is illicit wastewater discharges into a designated storm drainage system. Examples are plumbing connections for sanitary sewer pipes, process wastewater discharges, sump overflows, and internal shop floor drains that enable wastewater to enter storm sewers and drainage ditches, and ultimately to receiving waters. These discharges should be directed to sanitary sewers, combined sewers, septic systems, onsite process water treatment systems, or isolated sumps so that the wastewater is treated (or collected for treatment) before entering the surface water environment.

In many instances these connections are unknown to the business or home owner, and may not even show up on building drawings. The pollution problems these discharges cause can be severe, and they may persist because detection of the illicit wastewater discharge locations may never occur. Cross-connections of sanitary sewer pipes to the storm drainage system were discovered at the Heritage

Apartments on 19th Street, and have since been rerouted to the sanitary sewer system (Enquist 1993 personal communication). It is likely that other illicit wastewater discharges exist in the study area.

b. Problem WQ-2—Erosion, Transport, and Deposition of Sediments. Erosion within the study area results in increased sediment loading to surface waters. Sedimentation degrades receiving water quality and impacts aquatic habitat. Sediment can be the result of several phenomena. The major causes of sediment deposition include:

- Erosion of stream channels and ditches

- Erosion of cleared or disturbed land

- Particulates, such as wintertime traction sand, which settle on surfaces such as roadways, are washed off and carried to the drainage system.

Pollutants often found in stormwater, including metals, nutrients, bacteria, and petroleum products, can accumulate in sediments deposited near the outfalls from storm drainage systems. Significant sediment deposition was observed in the lower reaches of Madox Creek and Flowers Creek.

Urbanization within the study area has resulted in increased soil erosion from developed land, subsequent deposition of sediments in receiving waters, and scouring of sediments in streams receiving elevated rates of stormwater runoff. Construction sites typically create conditions where soils are vulnerable to erosion by wind or rain. Soils that are stripped bare during site preparation can easily erode. Heavy equipment operating on a construction site can track sediments off the site onto adjacent roads, where the sediments are picked up by wind or stormwater runoff and carried into receiving waters. The steeper the ground slope, the greater the potential for construction-related erosion problems. Erosion can also occur in residential and commercial areas where lawns, landscaped planters, and gardens typically have reduced amounts of ground cover compared to predevelopment conditions.

Sediments that are picked up by wind or stormwater runoff can be carried into receiving waters, where they eventually settle to the bottom. Sediments that are suspended in water can cause problems for the normal functioning of fish and other aquatic organisms. When sediments deposit in the bottom of lakes, wetlands, and streams, they can destroy the habitat for fish and a variety of aquatic organisms.

Erosion and sedimentation problems are aggravated by existing maintenance practices for grass-lined ditches which, in some instances, resulted in removing all the vegetation in the ditch. This practice results in exposing ditch soils to increased erosion, and eliminates the biofiltration capacity of the grass-lined ditch. It also increases runoff velocity through the ditch, which in turn results in increased erosion.

c. Problem WQ-3—Contamination of Runoff by Diffuse Sources of Pollutants on the Land. Urbanization leads to a variety of diffuse sources of pollution. These pollution sources are called nonpoint sources because they cannot be traced to a single location. Rather, they occur in a widespread and uneven manner over the developed land surface. Examples of nonpoint pollution sources in the study area, and urban areas in general, are oil and grease that drip from the undercarriages of automobiles in parking lots, roadways, and driveways; pesticide and fertilizer residues that wash off lawns and other landscaped areas; animal wastes that wash off residential yards; and automobile emissions and other airborne particulates that fall from the air. The collective adverse impact of these nonpoint sources of pollution on the quality of receiving waters can be great. This unseen and previously ignored type of pollution is increasingly being targeted nationwide as a major cause of environmental degradation. Nonpoint pollution sources within the Mount Vernon study area are a major threat to the continuing health of surface and ground water resources.

Results of water quality monitoring conducted as part of this study indicate the existence of several water quality problems that are caused by nonpoint pollution of urban runoff. The general trend of the monitoring results shows that streams in the more urbanized drainage basins have lower dissolved oxygen levels; higher turbidities; higher nutrient concentrations; higher metals concentrations; higher fecal coliform bacteria concentrations; and higher concentrations of oil, grease, and metals in the sediments (Herrera 1993).

Based on the stormwater pollutant loading study, urban runoff water quality problems will become exacerbated with new growth. Concentrated growth will occur in the Mount Vernon area, and existing stormwater regulations to protect water quality from new development may not be adequate.

Nonpoint sources such as sediment and associated pollutants that are carried into storm drain systems can be trapped in catch basins and then removed and disposed of. A potential cause of water quality problems in the study area is infrequent cleaning of catch basins or other urban storm drainage facilities. Nearly all of the urbanized portions of the study area drain into a constructed conveyance system. The stormwater conveyance system includes numerous catch basins. These devices are located where two or more drainpipes join together as well as beneath many surface drains. Catch basins usually have sumps in the bottom that provide storage spaces to collect floating materials, street grit, and other particulates in runoff. If the materials that collect in catch basin sumps are frequently removed and properly disposed of, the sumps do not contribute to pipe clogging problems and can continue to effectively prevent many pollutants from traveling downstream into receiving waters. However, if catch basin sumps are not frequently cleaned out, the collected materials can build up to a point where turbulent inflows easily dislodge the mucky contents, including pollutants, and move them downstream. When this happens, the catch basins may actually contribute to downstream pollution problems because concentrated amounts of polluted material are conveyed into receiving waters within a short period of time.

d. Problem WQ-4—Spills of Solid and Liquid Materials. An obvious source of pollution in urban areas is spills of solid and liquid materials. Countless types of chemicals, petroleum products, manufactured parts, packaging materials, and other synthetic materials are handled every day within the study area. Many of these materials are toxic in the receiving water environment, even in minimal concentrations or quantities. Spills, drips, and inadvertent littering of many of these materials occur frequently in urbanized areas. If spills go unreported and uncontrolled, they can reach a storm drain or surface water directly. Spilled, dripped, and littered materials that are not cleaned up can be carried into the receiving water environment with stormwater runoff and can cause subsequent water quality problems.

The potential for transportation-related and storage-related spills of hazardous materials is a concern for protection of groundwater and surface water resources. If a hazardous materials spill is not adequately cleaned up, residual contamination will contaminate the soil and groundwater and acts as a long-term pollutant source.

The major highways are generally of greatest concern from transportation-related spills because they have high traffic volumes and tend to have a high number of traffic accidents. Traffic accidents associated with automobiles can lead to spillage of crankcase oil, transmission fluid, and gasoline. Accidents associated with truck traffic can lead to more intense spills of oil and gas and spills of hazardous materials such as chemicals being transported. Water quality impacts from transportation related spills can occur either through infiltration of contaminants into groundwater, or by discharge directly into surface waters.

The City of Mount Vernon has no formal spill prevention regulations or written requirements for storage or handling of hazardous materials applicable to businesses. The city fire department relies on the Skagit County Department of Emergency Management for hazardous material spill response and cleanup resources. Thus, individual businesses that handle solid and liquid materials are not required by the city to develop spill control, response, or cleanup plans to prevent pollution problems from occurring (Lindall 1993 personal communication).

e. Problem WQ-5—Illegal Dumping into the Storm Drainage System. Another source of surface water pollution is illegal dumping of solid and liquid materials into street drains, roadside ditches, and other features of the storm drainage system. This often includes litter, lawn clippings, construction waste, landscaping refuse, used crankcase oil, and household hazardous wastes. It is common in many urbanized areas for a variety of materials to be dumped illegally (often by people who do not know it is illegal), including such substances as used motor oil, excess paints and solvents, and assorted refuse. Illegal dumping can introduce high concentrations of contaminants into the storm drainage system, causing severe water quality problems downstream.

3. Water Quality Problems Resulting From Rural Development

Rural development within the study area has led to water quality problems stemming from failure of septic systems, erosion of pasture land, and loading of animal wastes into surface waters. Each of these problems is discussed individually below.

a. Problem WQ-6—Failure of Septic Systems. Although the portion of the study area within the City of Mount Vernon is serviced by sanitary sewers, there are still active septic systems outside the City, but within the Urban Service Area. Septic system failures are a known problem within parts of this area (Herrera 1993). Malfunctioning septic systems have the potential to allow untreated sewage to reach receiving waters. Septic system failures have various causes: If a septic tank is ruptured or otherwise leaking, untreated sewage can seep into the surrounding soil and migrate toward ground water. If sandy and gravelly soils are present in a septic drain field, wastewater will quickly pass through the soil, potentially surfacing downslope or migrating toward ground water. If a drain field is underlain by a hard layer of clay or other impermeable material, percolating wastewater can travel laterally along the hard layer and move quickly away from the drain field without being fully treated. Infrequent maintenance of septic systems may also lead to drainfield failures. Finally, tree roots and other obstructions may cause drainpipes to rupture or collapse, resulting in partial failure of the system.

b. Problem WQ-7—Erosion of Pasture Land. Land that is converted into pasture can be a source of surface water pollutants if it is not managed properly. Overgrazing can strip the ground bare, leaving the soil vulnerable to erosion. If animals are allowed to graze near unprotected stream banks, they may trample the banks and eliminate streamside vegetation. This trampling and loss of vegetation can lead to sloughing of large amounts of soil and sediment into streams and can also cause longer-term erosion problems as gullies develop in the stream banks.

c. Problem WQ-8—Loading of Animal Wastes in Runoff and Directly to Surface Waters. Heavy grazing in certain spots can lead to concentrated areas of animal wastes. Rain that falls on these areas can carry high concentrations of fecal coliform bacteria and nutrients with runoff, degrading downstream surface waters. Similarly, if livestock are allowed to roam in streams or wetlands, they may introduce these pollutants directly to those waters in even greater concentrations than would occur in overland runoff.

4. Specific Water Quality Problems in the Study Area

Based on a review of previous studies, interviews with city staff members, analysis of records of registered businesses in the study area, and field reconnaissance, limited information on specific water quality problems has been identified within the study area. The few specific problems that were discovered are discussed below.

a. Problem WQ-9—Sewage Overflows in the Kulshan Creek Basin. Recent water quality monitoring in Kulshan Creek indicates numerous water quality problems.

One of the primary water quality problems in this 1,404-acre drainage basin is caused by discharges of untreated sewage into the creek (Herrera 1993). A sanitary sewer line adjacent to Kulshan Creek overflows during storm events, causing untreated sewage to spill into Kulshan Creek. This problem has been studied recently, and a bypass sewer line will be constructed next year to eliminate this raw sewage discharge (Bergstrom 1993 personal communication).

b. Problem WQ-10—Contaminated Sediments in Kulshan Creek. Water quality monitoring conducted for this plan indicates that sediments in Kulshan Creek have total petroleum hydrocarbon (TPH) contamination as high as 3,200 milligrams per kilogram (mg/kg) dry weight, a level that far exceeds the state Model Toxics Control Act cleanup level for soil of 200 mg/kg dry weight. This high sediment TPH contamination may be due to concentrations of TPH in runoff from streets and parking lots in the drainage basin, but it appears to be indicative of other sources in addition to urban runoff.

The sediment monitoring station was located approximately 2,400 feet upstream of the mouth of Kulshan Creek near the inlet to the pipe system. Field reconnaissance in the basin did not indicate any obvious sources of TPH contamination in the vicinity of the monitoring station. A former fuel oil storage and distribution business located on the south side of College Way to the west of the railroad crossing is under consideration as a state toxic waste site (Buckenmeyer 1993 personal communication). This site may be a significant contributor to TPH contamination in Kulshan Creek via contamination of stormwater runoff. Another source of TPH may be untreated stormwater runoff from numerous parking lots in the basin that discharges into Kulshan Creek. Several large parking lots are located near the sediment sampling station.

The city now requires new developments and redevelopments to comply with the Washington Department of Ecology (Ecology) stormwater management regulations, which require oil/water separators in some instances. However, existing developments are not required to be retrofitted to provide stormwater treatment (Buckenmeyer 1993 personal communication). Thus, most of the parking lots in the Kulshan Creek basin do not treat runoff using oil/water separators or other stormwater treatment devices. Other sources of oil in runoff, such as unprotected waste oil drums, may also be contributing to the problem.

5. Future Water Quality Problems in the Study Area

a. Problem WQ-11—Future Water Quality Problems. Increasing development within the study area will lead to a greater potential for contamination of stormwater runoff, which in turn will lead to increased surface water quality problems. Table 2 in Appendix H shows projected future land uses within the study area. Pollutant loading changes associated with the land use changes in the study area are shown in Table 4 of Appendix H. As Table 2 shows, most of the projected development is for residential uses, with a lower level of commercial development expected. While the new development will be required to incorporate stormwater treatment measures to satisfy Ecology standards, there remains a likelihood of degraded water quality in study area streams because stormwater treatment methods are not capable of removing all of the runoff pollutants that result from development.

Of particular concern is the impact that construction activities may have on water quality. Erosion and sedimentation controls on construction sites are often ineffective, even when they are designed and implemented according to established pollution control standards. Thus, increased sediment loading in study area streams is anticipated. In addition, the expansion of residential development in many parts of the study area will present a variety of potential stormwater quality problems. Pesticides, animal wastes, yard wastes, and automobile-related pollutants are typical sources of water quality problems that are difficult to control in residential areas.

Future water quality problems will also persist due to existing developments unless they are targeted for retrofitting of stormwater treatment facilities. This may be an even greater concern than stormwater contamination caused by new developments.

E. Environmental Resource Problems

1. Wetlands

This subsection identifies and describes wetlands management problems facing the City of Mount Vernon. Wetlands management problems have been divided into two groups: (1) "at-risk" wetlands, and (2) balancing wetlands protection with economic growth.

The City of Mount Vernon recognizes the presence and importance of wetlands within the city, and realizes that many of the wetlands are threatened by the encroachment of urbanization, agriculture, and other land uses. Several types of wetlands are particularly subject to degradation for a variety of reasons. This subsection first identifies and describes these threatened wetland areas, summarizing the nature of the problem affecting the wetland, and identifying the potential or known causes of the degradation. The second portion of this subsection describes potential difficulties the city may encounter in balancing wetlands protection while encouraging sound economic growth.

a. "At-Risk" Wetlands. Due to rapid growth in the City of Mount Vernon, wetland areas, particularly those located within the most urbanizing portions of the City, are threatened by the encroachment of development. These threatened wetland areas fall into five broad categories:

- Disturbed Areas
- Prior Converted Cropland and Farmed Wetlands
- High Value Wetlands Adjacent to Potentially Damaging Land Uses
- Unbuffered Wetlands
- Wetlands Historically Subjected to Filling

The following sections describe each of these categories.

Problem WT1—Disturbed Areas. Wetlands which have been disturbed are often difficult for the layperson to recognize as wetland. Many such wetlands lack one or more of the three wetland criteria (hydrophytic vegetation, hydric soils, and wetland hydrology). For example, areas without vegetation or those planted in tree plantations are considered disturbed areas. These areas are often disturbed by human activity such as ditching, diking, clearing, and filling. A disturbance may also be due to natural events such as landslides, beaver dams, or flooding. Should these man-made or natural disturbances occur in a wetland, the land would still be considered, and therefore regulated, as wetland, although the area may not be readily recognized as wetland. Further, although wetlands are still present after the disturbance, their ability to provide valuable wetland functions is often diminished by the disturbance.

The 1987 Manual describes most disturbed areas under the heading of "atypical situations." These are defined as those situations where one or more indicator is missing due to unauthorized activity (filling or dredging) or natural events. The 1987 Manual definition of atypical situations also includes wetlands dominated by facultative plant species (those plants equally likely to be found in wetlands and in uplands). A red cedar swamp is an example of an area described by this definition of an atypical situation.

Problem WT2—Prior Converted Cropland and Farmed Wetlands. Land that was historically wetland presently under agricultural use may fall under two different designations: prior converted cropland and farmed wetland. The following defines prior converted cropland; a summary of farmed wetlands follows.

The Soil Conservation Service has defined "Prior Converted Cropland" in the August 1988 National Food Security Act Manual as:

> Wetlands which were both manipulated (drained or otherwise physically altered to remove excess water from the land) and cropped before 23 December 1985, to the extent that they no longer exhibit wetland values. Specifically, prior converted cropland is inundated for no more than 14 consecutive days during the growing season.

This designation includes many areas that have been ditched or filled for use as pasture or cropland. The Soil Conservation Service is the only agency empowered to determine if agricultural land is indeed prior converted cropland. There are potentially many examples of prior converted cropland in Mount Vernon, as this area has been extensively used for agriculture.

These areas are exempt from regulation by the federal government. However, Washington State does not exempt prior converted cropland associated with Waters of the State from the Washington State Shorelines Management Act, and state and local agencies may consider prior converted croplands to be wetlands subject to regulation.

Another type of agricultural wetlands is known as "farmed wetlands." According to the 1988 National Food Security Act Manual, the Soil Conservation Service has defined "farmed wetland" as farmland where the soil and hydrology remain unchanged, and therefore still exhibit wetland characteristics. Ditched or filled farmland that is inundated for 15 or more days during the growing season is considered farmed wetland. In other words, hydric soil and wetland hydrology exist on the farmed land, and hydrophytic vegetation would return with the cessation of farming practices. There are many examples of farmed wetland within the city; most of these farmed wetlands are being used primarily for pasture. Farmed wetlands are still subject to wetlands regulation at all levels of government. However, no permitting is necessary to continue to use farmed wetlands for agricultural purposes.

The difference between prior converted cropland and farmed wetlands is important for several reasons. As mentioned above, prior converted croplands are exempt from federal regulation while farmed wetlands are regulated at all levels. Unfortunately, it is often difficult to distinguish one type of agricultural wetland from another. This makes it difficult for individual property owners and public planners alike to anticipate the regulatory constraints which may confront a given project without a detailed investigation. Additionally, often neither type of agricultural area appears to be wetlands to those lacking substantial training and expertise.

<u>Problem WT3—High Value Wetlands Adjacent to Potentially Damaging Land Uses</u>. High quality wetlands are those which perform valuable functions in the natural ecosystem and in the human environment. In general, wetlands are considered to be of high value if they (1) are large, (2) contain thick or diverse vegetative cover, (3) are close to a perennial stream or river, (4) are able to detain runoff and retain sediments and other pollutants, and (5) are located directly upstream from urban and developable areas. A number of wetlands located within the study area fulfill these criteria, and provide valuable storm and flood water control, water quality improvement, and biological support.

Residential development and small commercial development is the primary land use within the study area. These uses increase the stormwater runoff in the watersheds and degrade water quality by the non-point introduction of metals and excess nutrients.

Agricultural use can pose a threat to water quality in wetlands. One large dairy is located in close proximity to, and upslope from a valuable wetland in the northeast portion of the study area. The excess nutrients generated by the dairy are potentially damaging to the large wetland below.

Commercial operations such as the large nursery located off East College Way east of Waugh Road, may be a source of non-point pollutants such as fertilizers and herbicides. This operation is adjacent to a perennial stream and associated wetlands.

Problem WT4—Unbuffered Wetlands. Buffers are strips of land utilized to protect one type of land use from the effects of another. Buffers have been found to be effective at mitigating the effects of surrounding development on wetlands (Castelle et al. 1992a).

Buffers protect wetlands by providing the following functions:

- Stabilizing Soil and Preventing Erosion
- Filtering Suspended Solids, Nutrients, and Harmful or Toxic Substances
- Moderating Impacts of Stormwater Runoff
- Moderating System Microclimate
- Protecting Wetland Habitat from Adverse Impacts
- Maintaining and Enhancing Habitat Diversity and Integrity
- Supporting and Protecting Wetland Species and Providing Wildlife Corridors for Wetland and Upland Species
- Discouraging Adverse Human Impacts to Wetlands

Scientific studies have demonstrated that buffer effectiveness varies with buffer size. Buffer widths of between 25 and 600 feet are necessary to protect wetlands, depending upon site-specific conditions.

Numerous wetlands in the study area are surrounded by little or no upland buffer. They are bordered by roads, agricultural areas, and residential and commercial development.

Problem WT5—Wetlands Historically Subjected to Filling. Wetlands in urban and rural areas are often vulnerable to dumping of yard waste, construction debris, and refuse. The debris impacts wetland functions such as water quality, wildlife habitat, and aesthetic values.

Evidence of dumping of small amounts of yard waste, soil, and household refuse was observed during the field survey but was not widespread.

b. Wetlands Protection and Economic Growth.

Problem WT6: One of the main problems facing wetlands protection is the public's lack of recognition of (1) what wetlands are, and (2) what values wetlands may contribute to society. This lack of recognition of what many wetlands are and what benefits they may provide has resulted in the innocent loss of a significant amount of wetlands.

While most people would recognize an open water pond, ringed with cattails and full of turtles and waterfowl, as a wetland, this type of wetland is uncommon in Mount Vernon (see Chapter One). For example, one of the most common types of wetlands in the city, particularly within the Urban Growth Boundary, is wet meadows. Few individuals may realize that an area which has been used for pasturing livestock for generations could be considered a valuable natural resource. As a result, they are not likely to realize that the conversion of wet meadows to developed land uses results in a loss of wetlands.

Even those who may realize that a pasture may be a wetland may not appreciate the functional values provided by the wet meadows. For example, it has been a common mitigative practice to "compensate" for the loss of wet meadows by constructing open water wetlands. Most feel that since ponds have a more wetland-like appearance, then a meadow-for-pond trade-off actually results in a net gain for the environment. While this may be true in some instances, many ponds cannot provide the water quality improvement functions provided by wetland pasture grasses. Further, water fowl which utilize ponds may contribute significant excess nutrient and bacterial loading to streams and other natural water bodies. Additionally, many wildlife species which utilize wet meadows cannot survive in an open water setting. For example, most small mammals, which are important prey for sustaining raptors such as eagles and hawks, cannot survive if the soil is permanently inundated.

Problem WT7: Another problem may be contained within the city's CAO. This ordinance does not distinguish between higher- and lower-valued wetlands. As a result, no greater measure of protection is afforded the city's most valuable wetlands than is given to the least valuable wetlands. Because all wetlands are treated equally, there is no mechanism to plan for long-term protection of the most important wetlands. In some instances, for example, a developer may have a choice of impacting either a low-value or high-value wetland. Without a means of distinguishing one from the other, or without a regulatory disincentive to avoid the high-value wetland, the developer might spare the low-value wetland while destroying the high-value wetland. Note that both state and federal agencies (for example, the Washington Department of Ecology and the U.S. Army Corps of Engineers) do recognize that not all wetlands are of equal value. Differences between wetland functions and values are often reflected in permitting and mitigation requirements established by these agencies. However, projects which impact less than one acre of many wetlands are often not subject to state regulation, and may not receive the scrutiny from federal agencies which projects with larger impacts would. As a result, some higher-value wetlands may be impacted even though they appear to be protected by state and federal regulation.

Even the most restrictive wetlands management ordinances allow for the opportunity to impact some wetlands provided some form of compensatory mitigation is performed. The Mount Vernon CAO is an exception: there are no specific provisions for compensatory mitigation. As a result, each project proponent is left to develop a wetlands mitigation plan independently of any other wetlands management programs or projects. Without a means of coordinating wetlands protection and mitigation measures, the diversity and distribution of wetlands may be significantly altered. As in the example given above, it is common for open water wetlands to be created as compensation for the loss of wet meadows; open water wetland creation has also been used to compensate for the loss of scrub/shrub, forested, and other wetland types. If this were to occur in Mount Vernon, the city could see an increase in the number of small ponds, but a decrease in all other types of wetlands. Such a decrease in wetlands diversity may result in the degradation of the water quality of the city's streams, a reduction of the number of wildlife species, flood water storage capacity, and the diminution of other important wetland functions.

Problem WT8: Another problem regarding wetlands protection is that there are currently few incentives to protect wetlands, nor are there any mechanisms to fund or otherwise complete wetlands restoration and enhancement projects unless they are the result of some compensatory mitigation. In the absence of incentives, many people who own wetlands may view them as nothing but an economic liability; that is, as areas which have no or low recognizable intrinsic value to the land owners, but which cannot be fully developed. Further, despite development constraints placed on wetlands, many times the land is assessed as though it were non-wetland and may be fully developed.

Problem WT9: There are wetlands located within the study area of this report which have been degraded through past land use practices. Other wetlands have been eliminated or significantly reduced in size in locations where they may be particularly important. Currently, there are no programs which are aimed at enhancing or restoring these wetlands to a highly functioning condition. Further, as an ever-increasing amount of the city becomes developed, the opportunities for pro-active wetlands protection and enhancement are diminished.

2. Fish Habitat

Fish habitat problems identified within the study area generally fall into one of two categories: fish passage barriers and habitat limitations. Passage problems inhibit or prevent fish migration upstream or downstream. Fish habitat limitations generally include spawning and rearing habitat variables that limit the natural production of fish. Spawning habitat limitations deal with the quantity or quality of spawning gravels. Rearing habitat limitations include instream cover, food supply, temperature, and other water quality parameters.

a. Problem E1 A pump station on the piped section of Kulshan Creek at the outlet to the Skagit River presents a nearly total barrier to fish passage. Passage is only obtainable when conditions are such that the flap gate on the pipe outlet is propped open from flow and the Skagit River is high enough to create a take-off pool below the flap gate but not high enough to force the gate shut.

b. Problem E2 An existing manhole section in Kulshan Creek located east of the railroad collects debris and creates a partial fish passage barrier.

c. Problem E3 A culvert for Cedar Lane in an unnamed tributary to Kulshan Creek creates a partial fish passage barrier due to a 1-foot drop at the outlet.

d. Problem E4 The portion of Kulshan Creek upstream of Riverside Drive to about North 18th Street lacks riparian vegetation as well as pools and riffles that provide good instream habitat.

e. Problem E5 There is a lack of riparian vegetation as well as pools and riffles to provide good stream habitat along Trumpeter Creek from the confluence with Nookachamps Creek to 2,700 feet upstream and in portions of the mainstem from College Way to Fir Street.

f. Problem E6 The culvert along the Southeast Fork of Trumpeter Creek at Seneca Drive plugs with debris which causes fish passage problems.

g. Problem E7 The culvert along the Southeast Fork of Trumpeter Creek at Kiowa Drive presents a partial barrier to fish migration due to a 1-foot drop at the culvert outlet.

h. Problem E8 The culvert along the Southeast Fork of Trumpeter Creek at Lupine Street is blocked with debris and presents a barrier to fish passage.

i. Problem E9 A 42-inch-diameter culvert at Fir Street on the east side of Bakerview Park presents a partial fish passage barrier on the Southwest Fork of Trumpeter Creek due to a 1-foot drop at the culvert outlet.

j. Problem E10 A 210-foot-long 60-inch-diameter culvert on Maddox Creek 1,200 feet upstream from Anderson Road creates a fish barrier. The culvert is too long for fish to be able to maintain the energy to swim against the current in the culvert, and the fish would not be able to enter the culvert due to the 2-foot drop at the culvert's outlet.

k. Problem E11 The culvert on Maddox Creek at Blackburn Road is nearly a total fish passage barrier due to a 2-foot drop at the culvert's outlet.

l. Problem E12 The outfall pipe at the lower detention pond on Maddox Creek south of Section Street and east of Little Mountain Estates is plugged and creates a total fish passage barrier.

m. Problem E13 The section of Flowers Creek between its confluence with Maddox Creek and Blodgett Road lacks riparian vegetation.

n. Problem E14 The culvert for Flowers Creek at Blodgett Road presents a partial barrier for fish at low flows due to a 1-foot drop in elevation between the culvert outlet and the streambed.

o. Problem E15 The lower portion of Carpenter Creek along Bacon Road lacks pools and riffles as well as riparian vegetation that provide instream habitat.

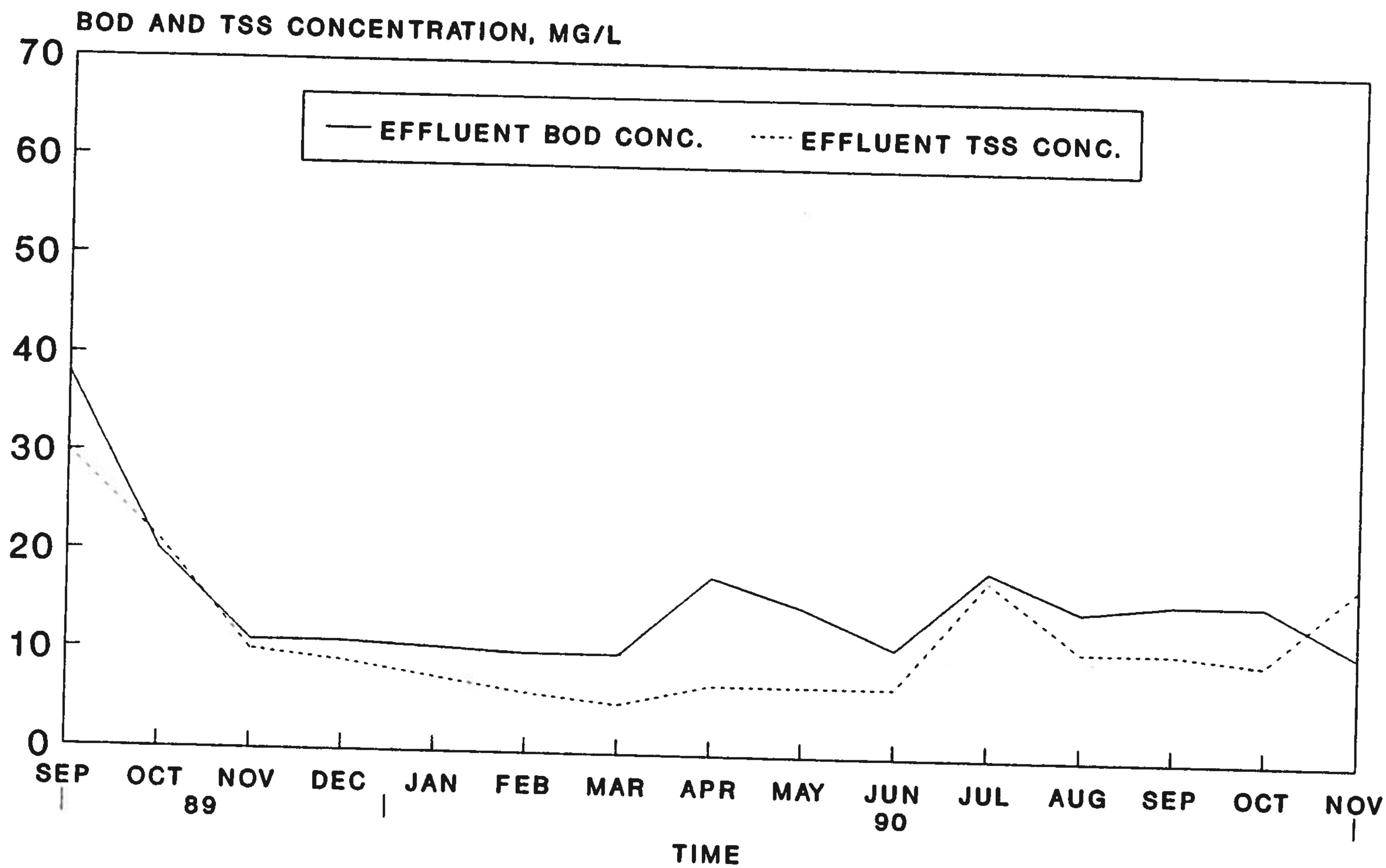

FIGURE VI-1
AVERAGE MONTHLY EFFLUENT BOD AND TSS
CONCENTRATION SINCE PLANT STARTUP

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

R·W·BECK

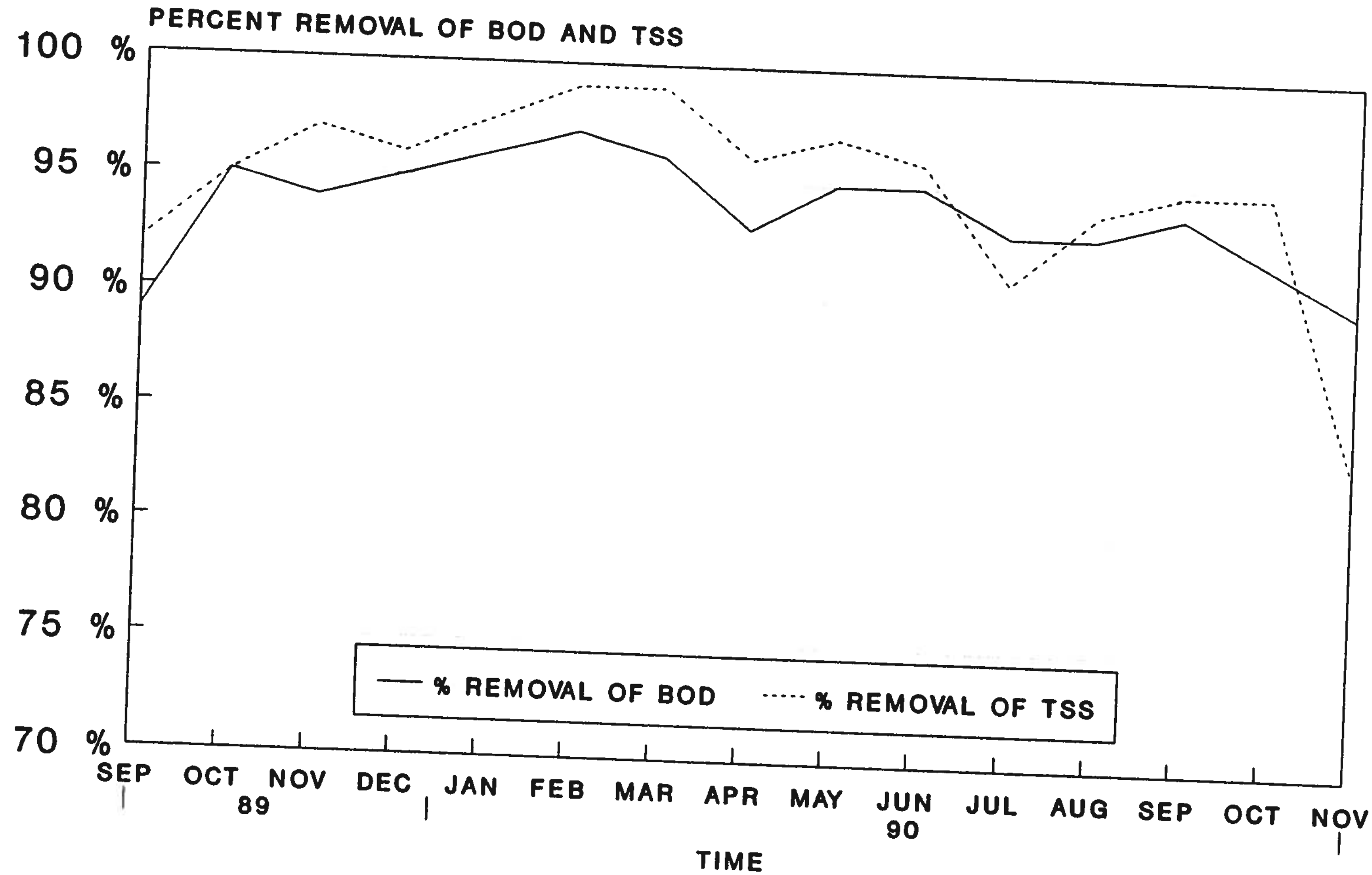

FIGURE VI-2
MONTHLY PERCENT REMOVAL OF BOD AND TSS SINCE PLANT STARTUP

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

R·W·BECK

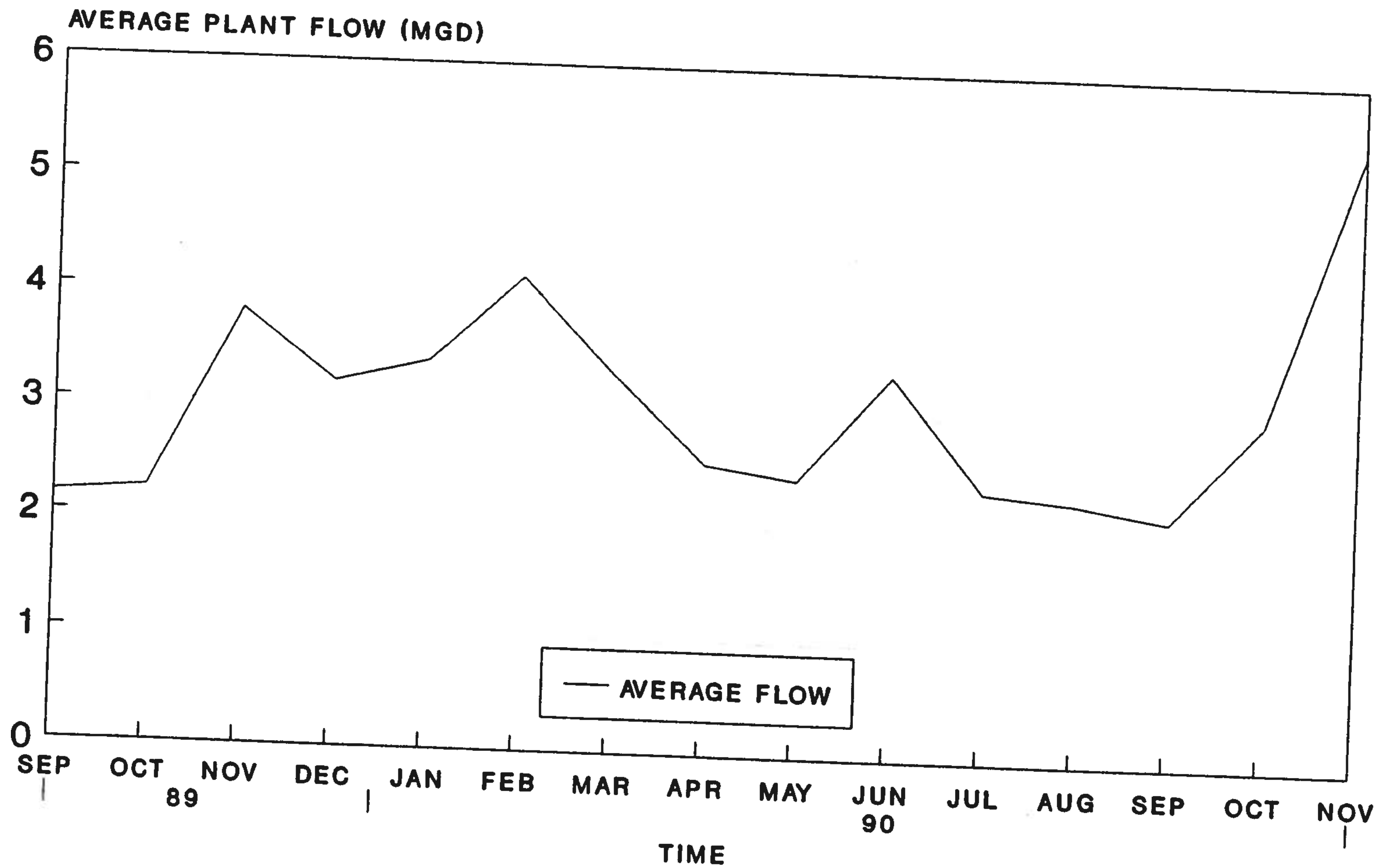

FIGURE VI-3
AVERAGE DAILY PLANT FLOWS
SINCE PLANT STARTUP

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

R·W·BECK

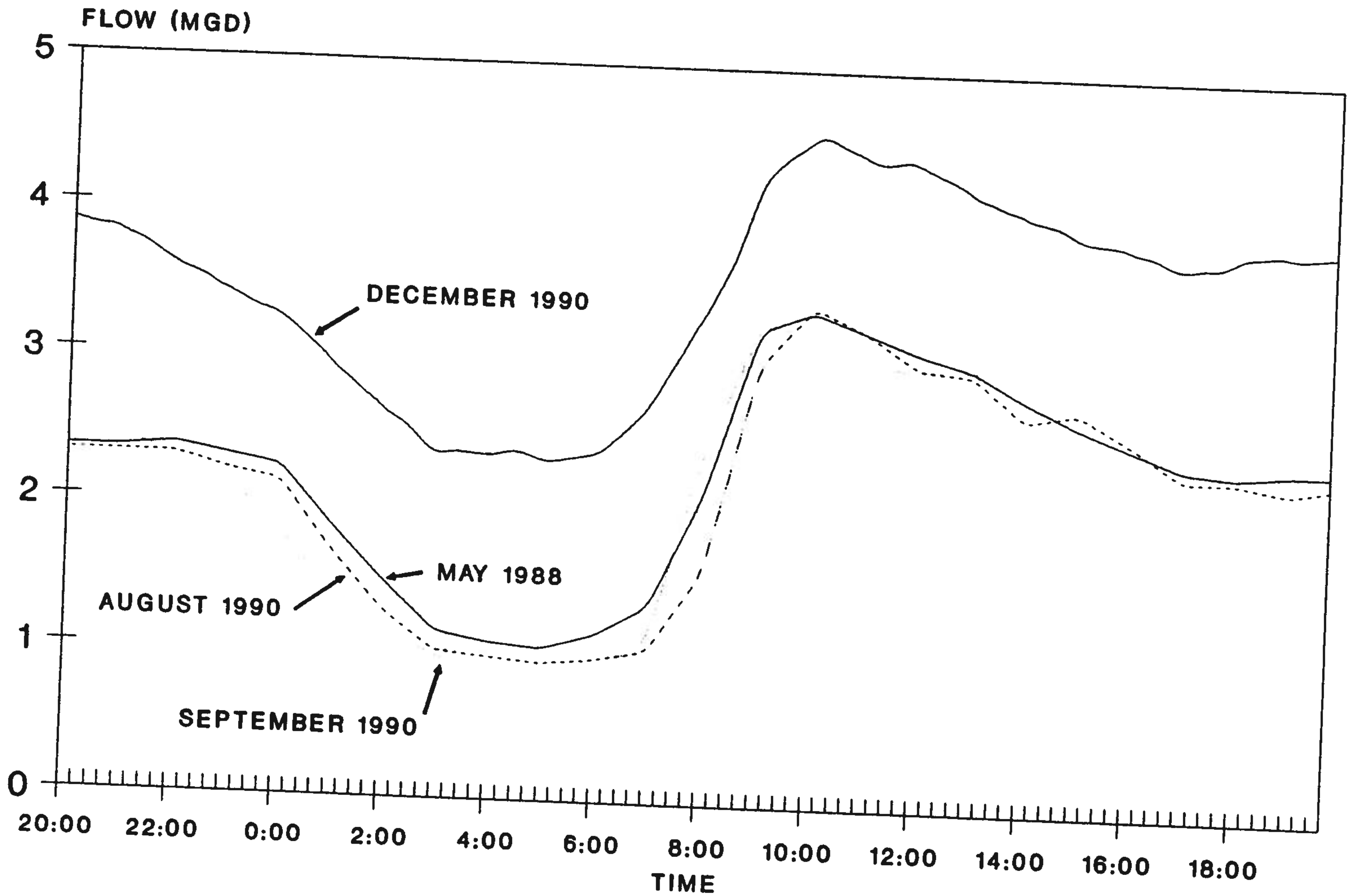

FIGURE VI-4
DIURNAL CURVE FOR FLOWS ENTERING THE WASTEWATER TREATMENT PLANT

CITY OF MOUNT VERNON
WASHINGTON

COMPREHENSIVE
SEWER AND COMBINED
SEWER OVERFLOW
REDUCTION PLANS

R·W·BECK

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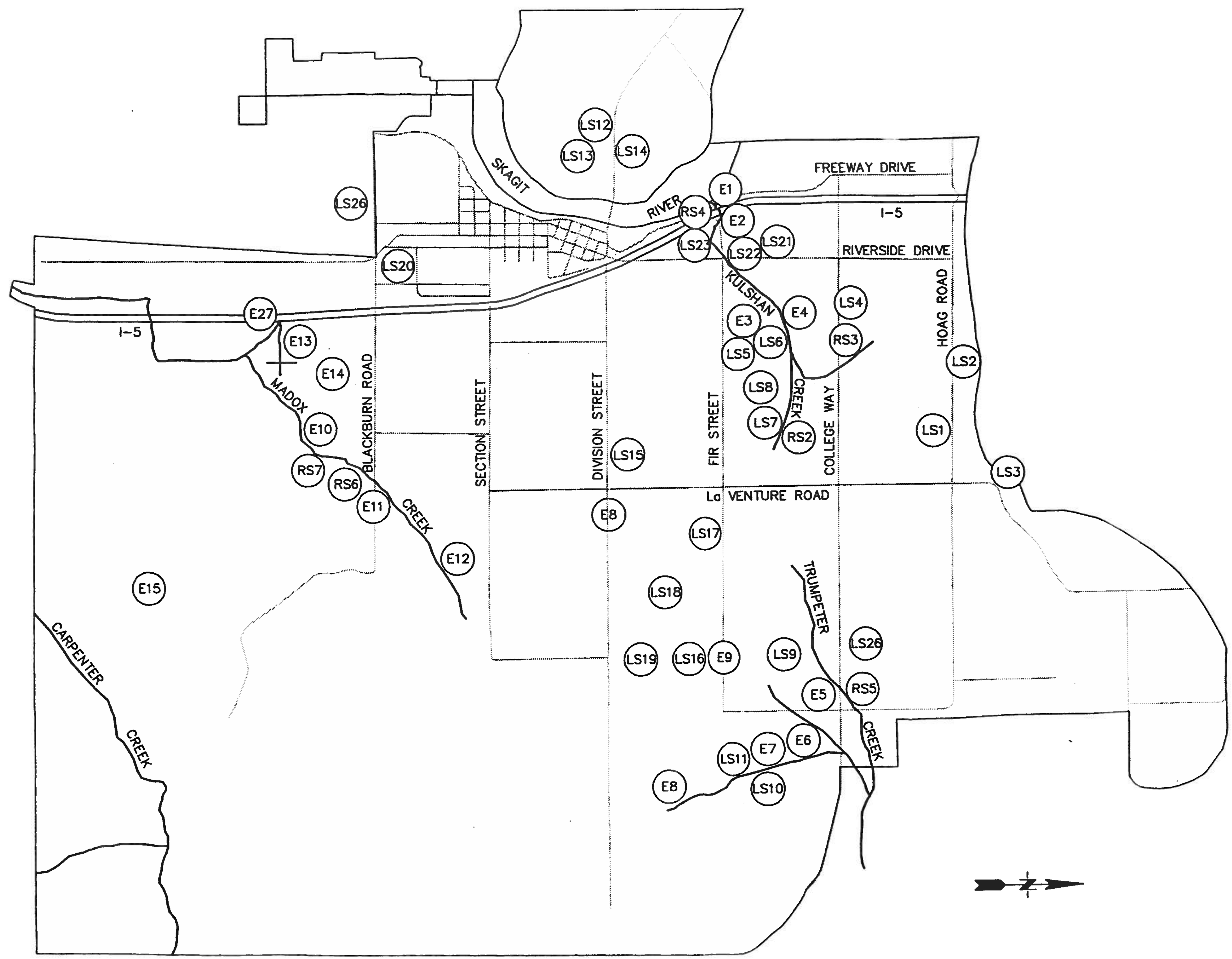


LEGEND

RS4 REGIONAL SYSTEM PROBLEMS

LS9 LOCAL SYSTEM PROBLEMS

E6 FISH HABITAT PROBLEMS

FIGURE VI-1
CITY OF MOUNT VERNON
SURFACE WATER
MANGEMENT PLAN

PROBLEM LOCATION MAP

R.W. BECK

SECTION VII
EVALUATION OF PROBLEM SOLUTIONS AND RECOMMENDATIONS

SECTION VII

EVALUATION OF PROBLEM SOLUTIONS AND RECOMMENDATIONS

A. General

The following paragraphs describe the alternative solutions to the problems identified in the preceding section. For each problem, appropriate structural measures and/or non-structural measures are evaluated and recommendations are presented. Tables VII-1 and VII-2 show typical structural and nonstructural solutions to stormwater problems. Structural measures are capital improvements such as pipe replacement, a pump station, channel widening, or construction of detention facilities. Non-structural solutions include policies, ordinances, regulations, public education, and increased maintenance activities. The alternative solutions were evaluated and a recommendation is given to solve the problem. The alternative analysis for each problem is based upon criteria such as effectiveness; cost; environmental impacts; consistency with the long and short term goals; consistency with existing or proposed local, State, or Federal requirements for managing storm water; and public acceptance. Sketches of selected alternative solutions are also shown.

Two basic types of structural solutions to flooding and erosion problems are recommended due to the regional or local nature of the water quantity problems. Construction or modification of regional facilities may be required to solve problems that provide benefits throughout the stream system. Local improvements to the conveyance system may be all that is required to solve local water quantity problems.

For the regional system problems, flooding and erosion can be solved by sizing detention facilities to reduce peak outflows so that they can be accommodated by the existing conveyance system. The advantage of this type of structural solution is that it results in a reduction in downstream peak flow rates. The disadvantage is that in order to get the required peak flow reductions to prevent flooding, substantial storage volumes may be required, and the detention facilities needed may require large areas of land. Where land is not available, or where appropriate, increasing the capacity of the conveyance system is also used to solve regional problems.

For the large regional problems, alternative solutions are described. As part of this plan, the recommended alternatives were subject to environmental review, including a planning level SEPA checklist.

Local flooding or erosion problems can be solved at any specific location usually by increasing the capacity of the conveyance system. The advantage of this type of structural solution is that it does not require large areas of land. In some instances, undersized drainage system components result in flooding, but also create a significant amount of water storage. A disadvantage to increasing the system capacity is that in cases where eliminating flooding also eliminates significant storage volumes, downstream peak flow rates are increased, which can impact aquatic resources and increase flooding further downstream. The conveyance system improvements recommended here generally do not involve loss of flood storage of any significance and do not result in appreciable increases in downstream peak flows.

Cost estimates for several problems have been updated as part of several design projects and review of developer proposals. These estimates are shown in Appendix E. Estimates for the remaining problems have been taken from the 1993 draft plan and escalated at 4.5 percent per year for two years. The 1993 estimates for the remaining problems prior to escalation to 1995 costs are also shown in Appendix E. The 1993 estimates include an allowance of 10 percent for mobilization; 30 percent for construction contingency; 8 percent for sales tax; 2 percent for administration; and 30 percent for surveying, permitting, and engineering. Pipe replacement costs are based on using corrugated HDPE for pipes 24-inches in diameter or less, and concrete for pipes with diameters greater than 24 inches.

B. System Solutions

1. Regional System Problems

As described in Section VI - Problem Identification, regional system problems are those associated with flooding or erosion of major streams or drainage systems. These problems generally affect a larger geographic area and represent the most serious surface water problems within the City. Much of the work performed to identify the regional problems was performed as part of a separate task report contained in Appendix F. The problem solutions contained in that task report, with a few exceptions, are summarized under the following Regional System Problem solutions. It should be noted that the design criteria for solving regional system problems is to provide flood protection for a 100-year event. All the proposed solutions also assume runoff under future build-out land use conditions.

a. Problem RS1 — Riverbend Road (Freeway Drive) Drainage Problem.

RS1 Problem Description: The drainage system along Freeway Drive does not have enough capacity to convey flows from future development, nor does it provide service to the area south of College Way.

RS1 Structural Solutions: Two alternative structural solutions involving increased pumping capacity are proposed to provide drainage for the drainage basin around Freeway Drive. The first alternative solution would increase the capacity of the existing pump station. This solution would provide additional pumping and conveyance system capacity to service full development of the basin area around Freeway Drive north of College Way without construction of additional detention storage. It was found through model simulations that the pump capacity would need to be increased from 2.67 cfs to about 10 cfs to keep the frequency of pond overtopping to about once in 50 to 100 years. The 10-cfs pump station would be accompanied by 2,600 feet of 24-inch force main to carry the increased flow. This system would not provide drainage along Freeway Drive south of College Way.

Construction Cost = $983,000
Approximate Annual Energy Cost = $600–$1,200

The second alternative structural solution would provide gravity flow and pumping capacity to service all of the Freeway Drive drainage basin, both north and south of College Way, without construction of additional detention storage. This would require the construction of 2,600 feet of 48-inch gravity main and a 50-cfs pump station. The 48-inch gravity flow pipe would begin at the Eagle Hardware detention pond and run south along the western city boundary to a new pump station located near the Skagit River along Riverbend Road. The pump station would only operate under high water conditions in the Skagit River. This solution would limit the Eagle Hardware detention pond overtopping to about once in 100 years.

Construction Cost = $1,750,000
Design Cost = $242,000
Approximate Annual Energy Cost = $50–$100

<u>RS1 Nonstructural Solutions</u>: Because all of the existing commercial development along Freeway Drive is served by an existing pump station that is greatly undersized, serving this area under full build-out conditions, will require additional conveyance. Construction of additional on-site detention systems would not preclude the need for construction of additional conveyance capacity. Detention times in the existing Eagle Hardware pond are already becoming excessive, and this extra time that the pond is full causes a risk of additional flooding in back-to-back storms. For this reason, this problem is better solved by structural solutions.

<u>RS1 Recommendations</u>: To provide adequate flood protection for the full development of the basin, both north and south of College Way, the second alternative solution is recommended. The first alternative has a higher annual energy cost because all the flow is pumped. The second alternative has a lower annual energy cost because flow will only need to be pumped when the river levels are high.

b. <u>Problem RS2 — Kulshan Creek Culverts</u>.

<u>RS2 Problem Description</u>: The two 36-inch-diameter culverts under Parker Way have insufficient capacity to prevent overtopping of the road.

<u>RS2 Structural Solutions</u>: To prevent Kulshan Creek from overtopping Parker Way and possible local flooding upstream, two additional 36-inch diameter culverts are needed to supplement the capacity of the existing two 36-inch-diameter culverts.

Construction Cost = $13,100

<u>RS2 Nonstructural Solutions</u>: Since most of this basin is already developed, this problem is best solved by structural solutions. Nonstructural solutions such as new development standards will not solve this problem.

c. Problem RS3 — College Way Culvert.

RS3 Problem Description: The culverts for a tributary to Kulshan Creek across College Way and Continental Place have insufficient capacity to pass the 100-year storm event.

RS3 Structural Solution: To prevent local flooding upstream of the pipe system across College Way and Continental Place along a tributary to Kulshan Creek, both culverts should be replaced in accordance with the NHC report included in Appendix N. This report recommends installing a parallel 54-inch concrete or 6.42 x 4.33 CMP pipe arch at College Way, and adding a second 36-inch CMP culvert at Continental Place. It also recommends keeping this channel clear. In discussions with City Staff, an additional 24-inch pipe crossing of College Way is located a short distance to the east of the existing culvert for the Kulshan Creek Tributary. This crossing will provide some additional capacity, but will not preclude the need for constructing a new crossing for the Kulshan Creek Tributary.

Cost = $109,000

RS3 Nonstructural Solutions: The existing system is undersized for meeting design criteria for a major creek culvert crossing so that the solution to this problem is better accomplished by structural methods.

d. Problem RS4 — Kulshan Creek Pump Station.

RS4 Problem Description: The existing gravity pipe system and pump station discharge for Kulshan Creek is undersized and results in severe flooding of this area.

RS4 Structural Solutions: Several alternative structural solutions involving conveyance and pump station improvements were investigated to improve the drainage along Kulshan Creek. The alternatives describe several conveyance options, but they involve the same basic pump station design to provide capacity to serve a 100-year flow of 210 cfs. The basic design includes four vertical shaft centrifugal pumps in a concrete sump. Other alternatives to reduce the pump station capacity requirements through the use of upstream flood storage are described later in this problem solution section. The pump motors, controls and other associated equipment would be located in a frame structure above the sump. A below-grade reinforced concrete horizontal and vertical expansion structure would provide the room for a hydraulic transition between the supply pipe(s) and pump sump. The exact configuration of the expansion structure and sump will need to be determined during final design so that an economical structure can be devised that will not result in vortexes and pump cavitation. It may be cost effective to test the operation of a minimally sized expansion structure during design with the aid of a physical scale model. The alternatives discussed here primarily involve the location of the pump station and conveyance system.

The first alternative solution would be with a pump station sited at the same location as the existing pump station (see Appendix F, Figure 3.2). This location would require removing the existing pump station, and installing 1,600 feet of 60-inch-diameter supply pipe to supplement the existing 48-inch supply pipe. About 150 feet of the new 60-inch-diameter supply pipe would need to be installed under Interstate 5 either by jacking or some other trenchless method that would not require highway closure. The existing 10-inch-diameter force main from the Freeway Drive area basin would discharge directly into the sump. A concrete outlet structure would be adjacent to the downstream wall of the pump sump and would include a flap-gate to prevent back flooding from the Skagit River. Both the gravity drain and the pumps would discharge into the outlet structure then through the existing water course to the river. The outlet structure would be integral with the pump station structure.

The second alternative solution would be with a pump station sited on a portion of City of Mount Vernon property presently used for equipment storage and maintenance located on the east side of Interstate 5, opposite the existing pump station (see Appendix F, Figure 3.3). This alternative would allow gravity flow from the Kulshan Creek basin. The proposed location for this alternative would require supplementing 1,400 feet of existing 48-inch-diameter supply pipe with an additional 72-inch-diameter supply pipe, and will ultimately require the use of two force main pipelines under Interstate 5. Installation of a 72-inch pipe will allow for future service at the design flow with the existing 48-inch supply pipe out of service. One of the two force mains could be created by slip-lining the existing 48-inch-diameter gravity flow pipe; the second force main would require that an additional 48-inch pipe be installed either by jacking or some other trenchless method that will not require highway closure. Installing higher head pumps can defer construction of the second 48-inch force main under the freeway to beyond the 20-year planning period.

The third alternative solution would be sited with a pump station immediately southwest of existing manhole K-3 (see Appendix F, Figure 3.4). The existing pump station and outlet structure would remain in place and accommodate flow from the existing 10-inch-diameter force main from the Freeway Drive area basin as well as gravity flow from the Kulshan Creek basin. The existing 48-inch-diameter supply pipe between manholes K-5 and K-3, about 500 feet, would be supplemented by a new 60-inch-diameter pipe. Manhole K-3 would be modified to permit up to 20 cfs to flow to the existing pump station gravity outlet. Discharges in excess of 20 cfs and the entire discharge when gravity drainage is not possible, would flow into the new pump station sump and then be pumped through a new 1,200-foot-long 60-inch-diameter force main located along the railroad right-of-way. The force main would go under the Interstate 5 overpass to a new outlet structure that would be located on the left bank of the Skagit River at the north end of Riverside Park.

The fourth alternative solution is similar to the third alternative except that the pump station would be located on a portion of the City of Mount Vernon equipment maintenance and storage property (see Appendix F, Figure 3.5). This location will require 500 feet of new 72-inch-diameter supply line from the pump station to Manhole K-3, and supplementing about 500 feet of the existing 48-inch-diameter pipe between Manholes K-3 and K-5 with a new 60-inch-diameter pipe. Manhole K-3 would be modified the same as described for the third alternative solution. The force main from the pumps to the Skagit River would be the same as the third alternative solution, except the main would follow Cameron Way to the interstate highway overpass and then on the same route to the river as the third alternative solution.

Each of the pump station alternatives and modifications to the existing conveyance system would provide the required pumping capacity to prevent flooding in Kulshan Creek Basin; however, each alternative presents its own construction and operation considerations. The following presents a discussion of some of the more significant of these considerations.

- **Phased Construction.** To minimize initial construction costs, but still provide an appreciable reduction in flood risk for the initial investment, the overall layout of the pump station, related structures and piping should allow for phased construction. Items to be considered would include deferring construction of additional pipelines and using the existing 48-inch-diameter pipe to supply to a new pump station which would have the mechanical and electrical equipment to match the capacity of the existing pipe. The first and second alternative solutions allow phased construction that incorporates these items. The other alternatives do not.

- **Pumping Costs.** Pumping costs should be considered in the selection of the preferred alternative. Long force mains will require pumps with a larger total dynamic head, consequently larger horsepower motors and larger operating costs. Both the third and fourth alternative solutions will have the greatest operating costs due to the long force mains associated with these alternatives. The second alternative solution will also have some increase in operating costs when compared to the first alternative solution, which does not have any force mains.

- **Sited on City-owned Property.** Siting of the pump station on the identified city-owned property will reduce costs of acquiring real estate, will provide an added measure of security and reduced liability, could reduce problems in obtaining construction permits, and allow for construction out of the designated floodway. The second and fourth alternative solutions are sited on the city-owned property.

- **Construction Under Interstate Highway 5.** In order to convey Kulshan Creek floodwater to the Skagit River, a pipe must be passed under the interstate highway without interrupting the flow of traffic during construction. This means that the pipe must be tunneled or jacked under the roadway, or it must utilize an existing interstate overpass. The third and fourth alternative solutions utilize the overpass via long force mains. The first and second alternative solutions will ultimately require tunneling or jacking of at least one pipe under the interstate road bed. The existing 48-inch-diameter line under Interstate 5 could be slip-lined to provide a force main with an approximate 90 cfs capacity which would eventually be supplemented with another new 48-inch force main for the second alternative solution.

- **Access During Construction and for Operation.** Ease of access and ample room for construction will result in lower construction costs. Ease of access for operation and maintenance, especially during flood conditions, will result in lower operation costs and greater pumping reliability. Alternatives 2, 3, and 4 appear to allow reasonably good access. Alternative 1 has inadequate room for construction and would be the least accessible during flood conditions.

Considering the above factors, the preferred alternative appears to be Alternative 2 sited at the City of Mt. Vernon storage and maintenance yard on the east side of I-5 opposite the existing pump station. It is on city-owned property on the outside of the Skagit River floodway, there is ample room for construction and maintenance, construction can be phased to use the existing supply pipe, and future pump operating costs will be lower than other alternatives (3 and 4) with longer force mains.

In addition to evaluating alternatives for locating the pump station and conveyance system, opportunities for regional detention facilities were considered as a means to reduce peak flows and downsize the necessary pumping and conveyance system requirements. This would save on construction costs.

Preliminary costing for pump station improvements showed that using detention storage to reduce the required pump capacity is cost effective if it results in reducing peak flows from about 210 cfs to 100 cfs, which is the gravity-flow capacity of the existing system. If the required system capacity is reduced to the capacity of the existing system, then construction of new pipelines will not be required, resulting in significant cost savings. If peak flows exceed 100 cfs, major pipe system improvements would be required between Riverside Drive and the Skagit River. Pipe system improvements are a major part of the estimated $1.6 million cost difference for a 210 cfs versus 100 cfs capacity system for Kulshan Creek, assuming the recommended Alternative 2 pump station configuration.

Because of the previously mentioned cost difference and flow capacities, regional detention facilities would be cost-effective relative to downstream conveyance improvements only if 100-year peak flows at the downstream end of the Kulshan Creek basin could be limited by detention facilities to 100 cfs for a cost less than roughly $1.60 million dollars. 100-year peak flows at the downstream end of the Kulshan Creek basin under full development with on-site storage are estimated to be about 210 cfs. Of this amount, about 100 cfs originates east of the BNR railway tracks (sub-basins 5, 13, and 14). Another 90 cfs originates north and west of the railway tracks (sub-basins 6 and 7), and the remaining flow originates in the area west of Riverside Drive and south of Willow Lane (sub-basin 12). For regional detention to limit 100-year peak flows to 100 cfs, facilities would be required both east and west of the railway tracks or else sufficient hydraulic conveyance would need to be constructed under the tracks to equalize storage in both areas.

Two alternatives were evaluated to estimate the required storage volume to reduce the 100-year peak flow to 100 cfs. Under the first alternative, a hypothetical detention facility was modeled at the location which makes the most efficient use of the available storage. This ideal location is immediately downstream of the Kulshan Creek railway track crossing. It was found that about 30 acre-feet of storage between elevations 21.0 feet and 24.5 feet would keep 100-year peak flows to under 100 cfs. Unfortunately, 30 acre-feet of storage is not available at this location and land acquisition costs alone for this hypothetical facility, assuming 8 acres at $130,000 per acre, would exceed $1.0 million dollars. This alternative would not be acceptable relative to the larger pump station alternative because land acquisition is not possible given that this area is already developed. Given that this storage cannot realistically be provided at this preferred downstream location where the full basin flow could be intercepted, more than 30 acre-feet of storage would be required for alternative detention sites further upstream in the basin.

The locations of potential detention pond sites where land is available are shown on Figure 3.1. The site immediately west of the railroad marked as "vacant land" on Figure 3.1 in Appendix F is presently undeveloped, except for about five large power poles for a 55,000 Volt 3-phase transmission line (Puget Sound Power & Light Co. Easement No. 176764), and a sewer line (Easement No. 567033) as some of its easements. The property is about 1.5 acres in size.

The other potential detention site is on about 10 acres of land already owned by the City adjacent to Kulshan Creek as shown by Figure 3.1 in Appendix F. However, the land at this site has been tentatively classified as wetlands, which would make it very difficult to obtain the necessary permits to develop this area as a detention facility. The cost of a wetland development permit application would be in the order of $125,000. If approved, and there is no assurance of approval, there would likely be additional wetland mitigation costs of more than $0.50 per square foot of impacted wetland. Wetland mitigation costs for 10 acres would likely exceed $200,000. In addition to the wetland permitting and mitigation costs, additional costs would be required to provide fish passage since this would be an in-stream facility.

The maximum amount of detention storage which could realistically be developed at the two identified sites is about 7 acre-feet at the vacant land site west of the railway, and about 50 acre-feet at the city-owned site east of the railway along Kulshan Creek. Initial HSPF simulations found that if these sites were both fully developed for detention storage, and the drainage system in sub-basin 13 (see Figure III-5) were modified to directed all flows from this sub-basin to or above the 50 acre-foot pond, the frequency of downstream flood peaks exceeding 100 cfs would be reduced to about once every 50 to 100 years.

RS4 Nonstructural Solutions: The Kulshan Creek Basin is nearly built out so that implementation of nonstructural solutions such as strict onsite peak flow controls will not solve the existing flooding problems. The existing pump station is grossly undersized and the conveyance system must also be increased if this system is to provide 100-year protection. For these reasons, structural solutions will be necessary to solve this problem.

RS4 Recommendations

Nonstructural Recommendations: Developers should be required to provide on-site detention following accepted standards and guidelines to minimize further increases in flows in this basin.

Structural Recommendations: As discussed in the following paragraphs, the City should construct a 210-cfs pump station in the City-maintenance yard east of Interstate 5. Increase conveyance with the addition of a 72-inch-diameter gravity flow pipe from Riverside Drive to the new pump station, and a second 48-inch-diameter force main from the pump station to the outlet structure west of I-5. This work can be accomplished in two phases as discussed previously, and the City has obtained $724,500 in grant funds to offset the cost of constructing phase 1. Phase 2 would include the second 48-inch force main under I-5 and one 50-cfs pump. Phase 2 can be deferred beyond the 20-year planning period.

Phase 1 Cost	City Funds	=	$3,339,000
	Hazard Mitigation Grant	=	$ 724,500
	Total Phase I Design and Construction Cost	=	$4,063,500
Total Phase 2 Construction Cost (deferred past 20 years)		=	$ 672,000

The cost of constructing a 7-acre-foot detention facility west of the railway would be approximately $220,000. Land acquisition would be as much as $200,000 for a total cost of about $420,000. Construction costs are however uncertain because of lack of information on requirements to accommodate the existing utilities crossing the site.

The cost of constructing a 50-acre-foot detention facility in the city-owned property east of the railway would be in the order of $1,400,000, for a total cost including $325,000 for permitting and wetland mitigation of about $1,725,000. Fisheries mitigation costs could increase the cost of this facility.

The total cost of providing regional detention facilities to limit peak flows in Kulshan Creek at Riverside Drive to 100 cfs for return periods of 50- to 100-years would therefore be at least $2.145 million, which is greater than the cost of increasing pump station system capacity from 100 to 210 cfs. Also, provision of regional detention is subject to considerably greater risk because of uncertainty about the ability to obtain necessary wetland permits.

e. Problem RS5 — Problems in Trumpeter Creek Basin from Increased Flows.

RS5 Problem Description: Increases in peak flows in the Trumpeter Creek basin due to future development will occur and will result in aggravating existing flooding, water quality, and fish habitat problems downstream.

RS5 Structural Solutions: Structural solutions for this problem consist of two opportunities for improved or new regional detention facilities in the Trumpeter Creek basin as described below.

(1) The existing detention pond in the northeast corner of Bakerview Park was assessed to maximize the performance of this facility. The existing pond has a capacity of about 2.4 acre feet. Water backs up into the pond via a 24-inch plastic pipe from a ditch which runs along the north side of the pond. Discharge from the pond is by the same 24-inch pipe. Backup of water into the pond is caused by an 18-inch berm in the bed of the ditch downstream from the 24-inch pipe through which passes a 12-inch plastic pipe with its invert at the ditch invert. Apparently there was no detailed design for the pond or its control structure. It is unlikely that the current design makes effective use of the available storage since much of the storage is filled at relatively low flows. Improved performance could be achieved by eliminating the pond intake from the ditch on the north side of the pond and replacing it with an intake from the channel flowing along the pond's east edge. This inlet would consist of a side channel weir to divert high flows into the pond. The outlet structure should be modified as well. This project was constructed as a part of the Park Meadows project.

Cost = $0

(2) Preliminary analyses were done for a new detention pond south of the new school on Martin Road along the north fork of Trumpeter Creek to determine the storage requirements to keep future flows to current levels at the confluence of the north fork and mainstem of Trumpeter Creek. There is potential for considerable new development in the area draining to the north fork of Trumpeter Creek. This system at present consists of a number of small drainage ditches which enter a 30-inch-diameter pipe system near North 32nd and Fox Hill St. The pipe system has a current capacity of

between 6 and 21 cfs with the lowest capacity corresponding to the most upstream section of line which has the flattest grade. A new 7.5-acre-foot detention pond would control peak flows, reducing the 100-year peak to 15 cfs. This solution would require that the most upstream section pipe in the drainage system be replaced so that the entire system has a capacity of 15 cfs or greater. The City currently owns a parcel of property along the north fork of Trumpeter Creek that was intended to be developed as a regional detention pond. Because this parcel was determined to be a wetland, the City was not able to receive the necessary permits to construct a detention pond. Developing a pond on the north fork would require that the City purchase additional property.

Cost = $500,000

<u>RS5 Nonstructural Solution</u>: Because of the high cost of property along the north fork of Trumpeter Creek, it would be better for the City to enforce the new detention standards as described in Appendix I.

<u>RS5 Recommended Solutions</u>: The Bakerview Pond improvements were constructed.

Enforce new development peak flow control detention standards in accordance with the ordinance contained in Appendix I. As discussed previously, these standards should be applied in the Kulshan Creek Basin as well.

f. <u>Problem RS6 — Problems in Madox Creek Basin from Increased Flows</u>.

<u>RS6 Problem Description</u>: A large portion of the Madox Creek Basin remains undeveloped. Based on the HSPF hydrologic modeling, 100-year peak flows in Madox Creek at Blackburn Road are expected to triple with future buildout in the basin and assuming no peak flow control facilities. In addition, Madox Creek downstream from Blackburn Road has experienced severe erosion problems that would be aggravated by any increase in peak flows from new development.

<u>RS6 Structural Solutions</u>: In order to control the increase in peak flows due to future development in the Madox Creek basin, peak flow controls must be constructed. A structural solution would be to increase regional detention. One of the largest (11.1 acre-feet) existing detention facilities was built as part of the Little Mountain Estates subdivision. Analysis of this detention facility shows that a relatively large amount of available storage is not being used effectively due to improperly sized inlet and outlet structures. Analysis shows that the current inlet structure is too small to divert more that a small percentage of the peak stream flows into the diversion structure. Similarly, the orifices in the outlet structure are too large to maximize use of the available storage. Considerable improvements in the effectiveness of this pond could be gained by reconstructing the intake structure and adjusting the orifice sizes in the outlet structure. Design details on modifications to this regional detention facility are given in

Appendix F. The effectiveness of these modifications on peak flows is shown on Table 5.1 in Appendix F. These improvements are scheduled to be constructed by a developer as a condition for our upstream project.

Cost = $0

<u>RS6 Nonstructural Solutions</u>: Given the relatively steep topography in the Madox Creek basin, it is difficult to site regional detention facilities which alone could prevent future peak flow increases to the eroding reach of Madox Creek below Blackburn Drive. If peak flows are to be controlled, an alternative would be to impose stringent on-site detention standards for new developments in those areas of the basin which discharge to Madox Creek below the Little Mountain Estates pond.

For the Madox Creek basin, we suggest that on-site detention be designed either using an HSPF approach or by the SCS-based hydrograph procedures as required by the draft drainage ordinance in Appendix I, and as described in the King County Surface Water Design Manual (revised November 1992). If the SCS procedures are used, the following particular requirements are suggested for the design of on-site detention facilities in the Madox Basin:

- Time of concentration calculations for existing land use conditions must include travel time for the longest realistic distance of sheet flow, computed by the formula presented on page 3.5.2-6 of the KCSWDM as Manning's kinematic solution.

- All Madox Creek basin soils in SCS group "D" should be treated as SCS group "C" soils for purposes of selecting SCS runoff curve numbers.

- The SCS runoff curve number (CN) for current conditions land use should be the lowest number which could reasonably be selected for the existing land use (see table on page 3.5.2-3 of the KCSWDM).

- On-site pond volumes and orifices should be initially sized to meet the detention standards stated in the draft drainage ordinance in Appendix H, and then pond volumes at each depth should be increased by 30 percent for a factor of safety. This factor of safety is necessary because calibrated continuous hydrologic modeling has shown that SCS procedures used to size detention facilities to the standards in Appendix H do not reduce post-developed peak flows to predeveloped flows.

<u>RS6 Recommended Solutions</u>: Construct modifications to Little Mountain Estates Pond. Also, strict onsite stormwater control detention standards should be implemented for the Madox Creek Basin as described previously.

g. Problem RS7 — Erosion of Madox Creek Downstream of Blackburn Road.

RS7 Problem Description: The erosion on Madox Creek and Flowers Creek below Blackburn Road will likely continue in the future causing bank failures and increased sediment accumulation downstream reducing the channel capacity.

Madox Creek

RS7 Structural Solutions: Further erosion of the steep section of Madox Creek could be minimized by construction of a pipeline to divert peak flows around the steep reach of the channel (see Appendix F, Figure 5.1). Approximately 4,500 feet of pipe would be required to transport water from an intake constructed just above Blackburn Road to an outlet returning flow to the main channel below Blodgett Road. Assuming that improvements are made as recommended to the Little Mountain Estates pond, the diversion system should be sized for a 100-year flow of about 56 cfs, this being the difference between the current 100-year peak flow at Blackburn Road and the projected 100-year peak flow after future development. The first 1,400 feet of pipe would be at a flat grade and would need to be about 60-inch-diameter (CMP) to minimize head losses. The remaining pipe would mostly be on a steep grade with a slope of 0.019 or more and would need to be about 42-inch-diameter (CMP) to avoid pressure buildups by keeping the pipe friction slope less than the ground slope. However, the high-flow bypass pipeline will serve only to limit erosion through the steep reach of Madox Creek; the effect of increased peak flows below Blodgett Road have not been assessed. The cost estimate of this alternative, includes inlet and outlet structures and five road crossings.

Cost = $688,000

Another structural alternative to solving the erosion problem in Madox Creek is to construct bio-engineered stream channel protection that will prevent further erosion. Bio-engineered channel protection uses a combination of vegetation, log structures, and rock to reinforce the existing banks and stream but still provide opportunities for fish habitat. Prior to constructing any channel protection, a detailed examination of the erosion potential and further geotechnical and geomorphic investigations should be performed to determine the likelihood and risk of continued erosion, and to recommend what type of remedial actions should be taken. The estimated cost of any instream channel protection depends on the results of additional investigations. For budget purposes, it is anticipated that a moderate combination of bed control weirs and bank protection will be required for approximately 400 feet of channel.

Cost = $44,000 for additional geotechnical and geomorphic investigations
Cost = $349,000 for construction of channel restoration improvements

Flowers Creek

A structural solution to the erosion problem along Flowers Creek can be solved by installing a high flow bypass. How this can be constructed in conjunction with a nearby development project is described in Appendix M.

Cost = $0, to be constructed by the developer

RS7 Nonstructural Solutions: Nonstructural solutions to help solve erosion problems in Madox Creek are the same nonstructural solutions proposed for Problem RS6. These are strict onsite detention for new development.

RS7 Recommended Solutions: Because of the higher cost of constructing a bypass pipeline for Madox Creek, additional geotechnical and geomorphic investigations should be performed and recommended channel stabilization projects should be constructed. For Flowers Creek, a bypass pipeline could be constructed as part of an adjacent development project. Also, enforce strict onsite detention requirements for new development that are described under Problem RS6.

h. Problem RS8 — Madox Creek and Drainage District 17 Maintenance Responsibility.

RS8 Problem Description: It is uncertain as to what portion of the sediment removal work at Blodgett Road and the maintenance and operation of the Conway Pump Station is the responsibility of the City of Mount Vernon. This work and this facility is located in Drainage District 17, but Mount Vernon contributes flow to this system.

RS8 Recommended Solution: The Madox Creek system within Drainage District 17 is very complex. It extends south of Conway for several miles prior to discharging to Skagit Bay via tide gates. Backwater from the tide gates could affect water surface elevations in the wide channel all the way upstream to the pump station at Conway. Runoff from the entire basin could cause water levels to rise and thus trigger operation of the Conway Pump Station. Determining how much of the pump station maintenance and operation is necessary because of the area in Mount Vernon contributing to the system is not readily apparent. Additional hydraulic analysis of the Madox Creek system is necessary to answer this question. Mount Vernon's share in the cost of this analysis has been included in the surface water program budget.

The cost to remove sediment at Blodgett Road is not significant, and the City and the District have agreed to share this cost.

Cost of Mount Vernon's Share in Analysis Work = $44,000

2. Local System Problems

Local system problems are those flooding and erosion problems that are tributary to major streams or drainage systems. These problems generally affect only a small, localized area and represent mostly citizen complaints or staff-identified problems. These types of existing problems cannot be solved by nonstructural solutions such as new development standards or other regulations. For this reason, only structural solutions are presented for these more localized problems.

a. Problem LS1 One alternative to prevent the floodwater from the Skagit River from backing up over Hoag Road west of La Venture Road would be to build approximately 700 feet of berm along the north side of Hoag Road to an elevation of 385 feet.

Cost = $224,000

A less expensive alternative is recommended. This would involve warning potentially affected residences during a flood, and sandbagging their homes.

b. Problem LS2 This area northwest of the intersection of Hoag Road and the Burlington Northern Railroad is lower than the surrounding areas that have been filled for the road to the south, the railroad to the east and the Skagit River levee to the north. Any new development in the area would likely be built at least as high as the roadway and therefore it would be difficult for any new drainage system to include a connection to drain this area. The property owner could install a small pump station to discharge into the storm drain system being constructed for the new development on the south side of Hoag Road at this location. This should be the individual property owners' responsibility.

c. Problem LS3 Flooding has occurred at the residence located west of La Venture Road where it turns east several blocks north of Hoag Road. This problem appears to have been solved. A concrete curb has been placed on the west side of La Venture Road above the affected property.

d. Problem LS4 Ponding occurs on a commercial site northeast of the College Way - Urban Avenue intersection. The loading bays on this site have been graded much lower than the surrounding grounds and they collect water. The surrounding undeveloped area is heavily grassed and appears to be slightly lower in elevation than the commercial site, and therefore could not contribute any appreciable runoff to the site. Any water collected on the site would be from runoff generated on the site itself. Therefore, any water collected is the result of site grading and drainage problems that are the responsibility of the private property owner.

e. Problem LS5 This problem was resolved as part of a City project that improved portions of Fir Street.

f. Problem LS6 The Kulshan Creek tributary north of Cedar Lane has eroded the stream channel down to a firm till layer. Since the till layer is hard and resistant to erosion, the stream bed is not expected to erode any further. However, the channel banks are steep and not yet completely stabilized. The steep banks will most likely slough to the angle of repose where they will then be stable. Since this is a short section of stream, only 100- to 150-feet-long, it is recommended that the banks be allowed to come to the angle of repose naturally. This will be less disruptive to the environment than manually regrading the bank slopes. It is also recommended that a small log structure be placed across the creek downstream from the culvert outlet. The weir structure would help to stabilize the stream bed at the pipe outlet and prevent undermining of the culvert and therefore, would protect the stability of the roadway embankment. The weir would also provide better fish access to the culvert.

Cost = $11,000

g. Problem LS7 Flow from an 18-inch pipe north of Viewmont Drive is causing erosion where it descends a fairly steep grade down to Kulshan Creek. It is recommended that the pipe be extended to Kulshan Creek. A manhole drop structure near Kulshan Creek should be installed to dissipate energy and to allow the pipe to enter Kulshan Creek at the same elevation as the stream bottom.

Cost = $48,000

h. Problem LS8 The flooding problem along the west side and north end of North 16th Street north of Florence Street is caused by an undersized culvert. The culvert should be replaced with approximately 200 feet of 24-inch-diameter pipe.

Cost = $29,000

i. Problem LS9 Flooding occurs in a trailer park east of North 30th Street and south of College Way as runoff overtops a ditch 1300 feet south of College Way and flows overland to Trumpeter Creek. The ditch was analyzed based on current survey information and appears to have adequate capacity to carry the 10-year storm event. However, the ditch is not large enough to provide any freeboard for the 10-year peak flow. It is recommended that when the sewer interceptor is constructed along the north side of the ditch that an additional 6 to 12 inches be added to the top of the berm to provide additional room for freeboard.

Flooding also occurs at the Park Village Trailer Park north of First Street. To solve this flooding problem, a two-stage low flow and high flow channel is recommended. The low flow channel would handle flows up to the two-year peak and the high flow channel would be excavated to the east to accommodate the 100-year flow event. To obtain a Hydraulic Project Approval from the Department of Fish and Wildlife, fish habitat improvements would be required such as in stream elements like boulders and logs and out-of-stream elements such as trees for shade.

Cost = $53,000

j. Problem LS10 The southeast fork of Trumpeter Creek east of Waugh Road and south of College Way has problems with erosion and deposition. Channel erosion and mass wasting upstream of the culverts crossing Seneca Drive and Kiowa Drive has caused large amounts of material to move downstream and plug the culverts. Downstream of the culverts the stream bed is being eroded. This has created a large drop between the culvert outlets and the stream bottom causing fish passage problems.

One alternative solution would be a combination of stream bed control weirs and an enhanced maintenance program. A series of stream bed control log weir structures downstream of the culverts would accomplish two objectives. First, the weirs would dissipate some of the energy in the stream and would eliminate any channel incision downstream of the culverts. Second, they would create a series of pools that would facilitate fish access to the culverts. Regular mining of sediment deposited upstream of the culverts by maintenance staff during periods when fish are not migrating could prevent the culverts from filling up with sediment.

Cost = $22,000

Another alternative solution is to replace the existing culverts under Seneca and Kiowa drives with large concrete box culverts. The culverts would be large enough so that there is enough open area to pass both the 10-year peak flow and also allow most of the material moving downstream to pass through rather than plugging the culverts. This would also minimize the scour that is occurring downstream from the culverts.

Cost = $131,000

Because of the lower construction cost, the construction of bed control weirs is recommended.

k. Problem LS11 A trashrack should be installed behind the house that is east of Nez Perce on the south side of Kiowa Drive. Upstream from the inlet behind this house there is a driveway culvert. A trashrack should be installed upstream from the driveway culvert to prevent sediment and debris from plugging the downstream inlet. The driveway culvert with the trashrack and the inlet behind the house to the north should be included in a maintenance program and checked and cleaned regularly.

Cost = $500

l. Problem LS12 The solution to localized flooding problems in West Mount Vernon could be resolved by replacing the 12-inch-diameter storm drain system along Memorial Highway with a 30-inch-diameter system. The current 12-inch-diameter system is the main storm drainage for West Mount Vernon and is greatly undersized. This will increase the system's capacity and allow more flow to reach the pump station south of Wall Street and be pumped out into the Skagit River.

Cost = $557,000

m. Problem LS13 During periods of high water levels in the Skagit River, the ground water table in this portion of Mount Vernon is also high and reaches the ground surface in a low spot near the intersection of Wall Street and Garfield Street. Several homes are flooded as a result. To ensure that the water can drain once the Skagit recedes, catch basins should be placed in the low spots. Also, a notification system should be implemented. The residents in the areas should be notified when the Skagit River rises so they can move their belongings to higher levels. The only other alternative solution would be to demolish the affected houses and regrade the site to a higher elevation.

Cost = $14,000

n. Problem LS14 The flooding of the intersection of Cosgrove Street and Wall Street in West Mount Vernon is due to a lack of a drainage system at a low spot. The solution to this problem is to install a new inlet at the low spot and connect it to the storm drain on Wall Street north of Memorial Highway with a 12-inch-diameter pipeline.

Cost = $40,000

o. Problem LS15 Portions of the storm drain system north of Division Street along Stanford Drive, Streeter Place, North 21st Street and Fir Street west of LaVenture should be replaced due to insufficient capacity to carry a 10-year storm flow. Refer to Figure VII-1 and Table VII-3 for details of this solution.

Cost = $371,000

p. Problem LS16 There are two alternative solutions to control the channel incision between Mohawk Drive and Apache Drive east of Comanche Drive.

The first alternative is to install a rock lining in the stream between Mohawk Drive and Apache drive to protect the channel bed from further erosion.

Cost = $9,000

The second alternative solution is to install log structures across the channel to act as bed control weirs downstream of the culvert under Mohawk Drive. This would not only reduce the erosion in the stream bed, but would also facilitate upstream fish migration by creating a "ladder" with resting pools and access to the culvert under Mohawk Drive.

Cost = $11,000

It is recommended that the second alternative solution, the log weir structures, be implemented. Since the alternative solutions are fairly close in price, the second solution was chosen because constructing the log weir structures would provide better fish passage and habitat than lining the channel with rock.

q. Problem LS17 The flooding of the two homes on the north side of Comanche Drive east of 30th Street could be prevented by the implementation of one of two following alternative solutions.

The first alternative solution would be to construct a ditch on the north side of Comanche Drive (see Figure VII-2) and construct a 24-inch-diameter culvert across Comanche Drive from the ditch on the south side to the new ditch on the north side of the road. The upstream invert of the new culvert would be placed higher than the elevation of the bottom of the south ditch. This would allow the low flows to travel down the south ditch, as it currently does. But, during higher flows, some of the flow would spill into the new 24-inch pipe and then travel down the north ditch. The additional capacity provided by the north ditch would help contain high flows and transport them to the ditch system that is parallel to and 200 feet east of North 30th Street.

Cost = $14,000

The second alternative solution would be to install a 24-inch-diameter storm drain on the south side of Comanche Drive (see Figure VII-2 for details). The storm drain would begin upstream of the curve in Comanche Drive east of North 30th Street. The storm drain would follow Comanche Drive and then connect to the existing storm drain on North 30th Street. Sections of the storm drain on North 30th Street will also need to be upgraded to accommodate the additional flow from Comanche Drive.

Cost = $153,000

The first alternative solution is the recommended solution to this problem. Since either solution would solve the flooding problem adequately, the least cost solution is recommended.

r. Problem LS18 The 12-inch-diameter culvert under Shoshone Drive east of Sioux Drive should be replaced with 100 feet of 36-inch-diameter culvert.

Cost = $24,000

s. Problem LS19 Armored emergency overflow spillways should be constructed for the two detention ponds west of Waugh Road and north of Division Street. The armored spillways help ensure the stability of the embankment in case the control structure plugs or during an extreme event. The armoring may consist of gabions, heavy riprap or concrete lining. The spillways would channelize overflow and allow it to reach the downstream system without jeopardizing the embankment. Also, encroachments into the detention pond easements by the local residents should not be allowed so that proper maintenance of the ponds is ensured.

Cost = $59,000

t. Problem LS20 There is a low area behind several homes on the west side of South 6th Street north of Blackburn Road that collects water. During certain storm events, runoff drains to this low spot and can accumulate to where it floods several homes. It is recommended that two catch basins be placed in the low spot and a new storm drain system be constructed north on Railroad Avenue to Lind Street and east to the fork of Madox Creek that runs along the west side of Interstate 5. This would allow the area to drain and help prevent any further flooding in the area.

Cost = $155,000

u. Problem LS21 The flooding on the west side of Riverside Drive in the vicinity of Willow Lane and Alder Lane should be somewhat alleviated by the storm drain that was recently installed along the east side of Interstate 5 in this area. Also, the Kulshan Creek pump station as described in the solution to Problem RS 4 should significantly reduce the chance of flooding in this area from Kulshan Creek.

v. Problem LS22 The flooding in the low-lying area northwest of the Riverside Drive-Fir Street intersection is due to the lack of a drainage system to convey runoff. A catch basin should be installed in the low spot and it should be connected to the storm drain system west of the railroad tracks from this intersection. The cost for installing this system is high because it involves tunneling or jacking a new pipe under the railroad track.

Cost = $100,000

w. Problem LS23 Flooding occurs along the east side of I-5 where Fir Street curves into Cameron Way. Several businesses are affected by the flooding. This flooding problem could be solved by installing a storm drain system along the east side of I-5 that connects a new system along Cameron Way to the existing storm drain system to the north that contains Kulshan Creek.

Cost = $73,000

x. Problem LS24 With construction of the recommended solution to regional system problem RS1, drainage will be provided to the area south of College Way west of Interstate 5.

y. Problem LS25 From the hydraulic analysis, portions of the pipe and ditch system between Blackburn Road and Britt Slough are under capacity and may cause water to back up in the system and cause flooding during a 10-year storm event. The possibility of flooding could be reduced by replacing three of the pipes as indicated in Table VII-3 and Figure VII-3 with 30- to 36-inch-diameter concrete pipe.

Cost = $284,000

z. Problem LS26 From the hydraulic analysis, it was determined that portions of the storm drain system containing the North Fork of Trumpeter Creek along Fox Hill Street have insufficient capacity to pass the 10-year storm event. This may cause flow to back up flooding the streets and homes in the area. Since the recommended solution to regional solution RS5 was not to construct a regional detention facility, one of the two following alternatives for conveyance improvements can solve this problem.

The first alternative solution would be to replace the inadequate portions of the existing storm drain system. This would require that five sections of the storm drain system be replaced. See Figure VII-4 and Table VII-3 for the details of this solution.

Cost = $235,000

To solve the safety problem associated with the deep ditch west of 32nd will require placement of approximately 400 feet of 36-inch storm drain.

Cost = $66,000

The second alternative solution is to reroute flows from the portion of the subbasin north of Hoag Road. These flows would be directed into a new stormdrain system built as part of the extension of 30th Street from Hoag Road to College Way. The rerouted flows would travel south along the future 30th Street system to the existing system on College Way. The existing system on College Way flows east to where it discharges into Trumpeter Creek approximately 500 feet west of Waugh Road. By directing a portion or all of these flows away from the Fox Hill Street system, replacement of the portions of the system described under the first alternative might not be necessary. A hydraulic analysis was performed on the existing College Way system to determine if there is sufficient capacity to carry the additional flows rerouted down a future 30th Street stormdrain. The existing system on College Way is a 30-inch concrete stormdrain from west of 30th Street to east of 33rd Street. From this point east of 33rd Street, the College Way system is a 36-inch concrete stormdrain to where it discharges into Trumpeter Creek approximately 500 feet west of Waugh Road. Our hydraulic analysis indicates that the 30-inch portion of the College Way system has a capacity of approximately 40 cfs. The 36-inch portion has a capacity of 46 cfs. The 100-year return flow from the part of Subbasin 4 south of Hoag Road and west of 30th Street is 28 cfs. This means that 12 cfs can be directed to the College Way system from the area of the subbasin north of Hoag Road and still not exceed the 40 cfs capacity of the College Way System.

The existing system on Fox Hill Street and the existing system on College Way can provide a 10-year level of protection if 12 cfs is diverted from the area north of Hoag Road into the new system on 30th Street. The 10-year return flow for the area north of Hoag Road is 14 cfs. The 10-year flow for the area south of Hoag Road, but east of 30th Street, is 13 cfs. This means that during a 10-year event, 27 cfs will be routed through the Fox Hill Street system. The capacity of all but one segment of the Fox Hill system is 16 cfs. If 12 cfs out of the 27 cfs is diverted into the new 30th Street system, the Fox Hill Street system can carry the remaining 15 cfs in a 10-year event. With the 12-cfs diversion, the College Way system can still provide a 100-year level of protection. If the City wishes to provide a 100-year level of protection for the Fox Hill Street system, we recommend that, in addition to diverting 12 cfs of flow from north of Hoag Road through the new system on 30th Street, the pipe replacements described in Figure VII-4 and Table VII-3 should also be constructed. It is assumed that since pipe Number 7 shown on Figure VII-4 only has a capacity of 6 cfs, this segment will need to be replaced to provide even a 10-year level of protection.

aa. Problem LS27 From the hydraulic analysis, part of the storm drain system that crosses under Interstate 5 at Anderson Road is determined to have insufficient capacity to pass a 100-year flow. Two pipe sections of this storm drain system were determined to have insufficient capacity. These include the pipe section on the east side of Interstate 5 parallel to the frontage road that is set at a reverse grade and the pipe section that crosses the frontage road. In order to correct this problem, the two inadequate sections of this system must be replaced and set at a positive grade. Details of this solution are presented in Figure VII-5 and Table VII-3.

Cost = $50,000

C. Water Quality Solutions

1. Introduction

The combination of the effects of urban and rural development on the quality of stormwater runoff and receiving waters results in a complex stormwater pollution prevention problem. For new development, water quality control facilities should be required because it is difficult to control the quality, volume, and rate of runoff once the areas are developed. Once pollutants are entrained in runoff, it is difficult to remove them before they reach receiving water bodies. Thus, the most effective approach to controlling water pollution attributable to existing developments is to implement source control best management practices (BMPs) for prevention of stormwater contamination. Source control BMPs are a variety of managerial, behavioral, and physical measures designed to prevent the release of pollutants and their entrainment into stormwater runoff. The following discussion of water quality problem solutions relies heavily on source control BMPs, although some water quality problems necessarily require more elaborate structural solutions.

2. Urban Water Quality Problems

a. Problem WQ1 — Illicit Connections of Wastewater Discharges to the Storm Drainage System.

WQ1 Problem Description: There may be cross-connections between the sewer and storm drain systems. Such cross-connections are usually caused by direct pipe connections between the sanitary sewer and the publicly maintained storm drain.

WQ1 Structural Solutions: Generally, the solution to this problem is more appropriately addressed by nonstructural solutions to identify cross-connections. However, when cross-connections are located, structural measures to eliminate the illicit connection would be required.

WQ1 Nonstructural Solutions: The first step in controlling pollution problems due to illicit connections is identifying locations where illicit connections to the storm drainage system exist (for example, where shop floors, appliances, or wastewater flows discharge to the storm drainage system rather than the sanitary sewer system). These plumbing connections are often unknown to the property owner. The list of registered businesses attached to the task report in Appendix G should be used to develop an initial prioritized list of the businesses that could adversely impact receiving water quality if they have illicit connections to the storm drainage system.

A program of water quality monitoring, smoke testing, dye testing, and pipe video inspections of storm sewers should be used to identify potential entry points for cross-connections as well as other water quality problems. The City's pipe video system will be very helpful in this effort. The video system can be used to identify pipe connections, leaks, damaged pipe, and the source of inflows during dry conditions.

The recommended approach for this water quality and illicit connection program is as follows:

Step (1) Water Quality Monitoring: A monitoring program should be initiated to confirm cross-connections or any other water quality problems.

Water quality monitoring should be conducted at strategic locations in the storm drainage system to assist in determining subareas of the city that have abnormally high pollutant concentrations in runoff. The monitoring program should include three wet weather and three dry weather sampling events. Samples collected during each event should be tested for several pollutant parameters, including fecal coliform bacteria and surfactants. The surfactants test is recommended because it will confirm that the source of contamination is a sanitary sewer cross-connection rather than some other fecal coliform contamination source (e.g., pet waste). Soaps and detergents, which are associated with sanitary sewage, will be indicated by a positive surfactants test.

Step (2) Smoke Testing, Die Testing and Pipe Video Inspections: After obtaining water quality data for specific systems that might indicate a problem, these tests are used to pinpoint cross-connection locations.

Step (3) Correct Cross-Connections: Cross-connections found that are part of the City maintained storm drainage system (in the right-of-way) can be corrected by City maintenance crews. Cross-connections that are part of private facilities are the responsibility of the private property owner, and the City will need to enforce corrective action.

Step (4) Additional Monitoring: Once it is believed that all cross-connections have been corrected for each of the systems determined to have a problem in Step 1, the City should conduct a follow-up monitoring program (similar to Step 1) for each system. This information can be used to evaluate whether all cross-connections have been corrected.

In addition, while the City is conducting this monitoring program, additional testing of outfall samples for other pollutant parameters is recommended.

<u>WQ1 Recommendations</u>: The City should conduct a monitoring and investigative program such as that described above (steps 1–4) for water quality parameters. The same protocol of six sampling events should be used. All major stream systems and outfalls should be sampled during each sampling effort. These pollutants include:

- Total petroleum hydrocarbons
- Suspended solids
- Nitrate plus Nitrite Nitrogen
- Total phosphorus
- pH
- Ammonia Nitrogen
- Temperature
- Lead
- Copper
- Zinc
- Dissolved oxygen
- Hardness

Sampling for these pollutants would provide additional information about the quality of water entering receiving waters and could be evaluated to determine the existence of other water quality problems in the City. This data could also be used as baseline information to evaluate the effectiveness of source control programs. It is recommended that the City conduct the monitoring program initially as a high priority and then a second time, a few years later, to determine the effectiveness of source control programs. In addition, this sampling program should include some sediment sampling in the Kulshan Creek Basin as discussed under problem WQ9.

Cost Estimate:	$19,500 baseline monitoring (staff time and sample costs)
	$19,500 follow-up monitoring
TOTAL	$39,000

b. Problem WQ2 — Erosion, Transport, and Deposition of Sediments.

WQ2 Problem Description: Erosion within the study area results in increased sediment loading to surface waters. Sedimentation of these systems degrade receiving water quality and impact aquatic habitat. Two types of erosion commonly occur: stream channel erosion and erosion associated with land disturbance activities.

Structural solutions are appropriate for solving existing stream channel erosion problems, whereas nonstructural solutions such as regulations requiring BMPs for erosion and sedimentation control are appropriate for erosion associated with existing and future land clearing. Nonstructural solutions are also effective in areas where measures to prevent future flooding and stream channel erosion are appropriate.

WQ2 Structural Solutions: Structural solutions for stream channel erosion problems consist of channel armoring or controlling peak runoff rates and reducing velocities through the use of detention facilities, diversions, check dams, and infiltration. Properly sized sedimentation facilities, either alone or combined with a detention facility, can effectively remove sediment load from surface waters.

WQ2 Nonstructural Solutions: Nonstructural solutions for erosion due to land clearing include ordinances and regulations that require new development to provide onsite erosion control devices. The City has adopted erosion and sedimentation control standards that meet the minimum requirements in Ecology's *Stormwater Management Manual for the Puget Sound Basin.*

Prompt revegetation requirements for cleared areas are required by the new standards and will reduce sediment loads to the stream system. BMPs, including minimizing the amount of clearing conducted, avoiding exposing denuded areas to runoff by stabilizing these areas, and prompt revegetation or replacement with sod, plastic covering, or mulch would help reduce land related erosion.

Retaining or promoting development of vegetated buffers between developed areas and surface water systems is an important mechanism in preventing sediment laden water from reaching the stream. Sheet flow runoff that must travel through a vegetated area is filtered and sediments are removed.

Catch basin cleaning at regular intervals has been shown to be an effective sediment removal technique. By increasing the frequency of cleaning private catch basin systems, sediment loads to surface water are significantly decreased. Increased maintenance is discussed further under problem WQ3.

WQ2 Recommendations: Recommendations for structural solutions for specific erosion problems are presented under specific system problems and environmental resource problems. Recommendations for nonstructural solutions for erosion problems include:

(1) The City has adopted a new ordinance that meets the PSWQA minimum requirements contained in Ecology's *Stormwater Management Manual*. The City must accompany the new standards with a public education and enforcement program to achieve the objectives of the erosion control ordinance. The City should develop a program to inform and educate area contractors about the new erosion control requirements. It is suggested that the City develop this program jointly with Skagit County. A joint City and County effort would likely be more successful in attracting area contractors.

This education program can be one component of an overall public education program. The recommended overall education program is discussed later in this section.

(2) Increase the stream buffer requirements from the City's current standard described in Section 5. This is described in greater detail under the environmental resource problem solutions.

(3) Increase the frequency of catch basin cleaning from once a year to once every eight months. Increasing the frequency of catch basin cleaning is part of the recommended maintenance and operation plan, discussed in Section VIII. In addition, identify areas of potential high pollutant loading, such as streets that receive runoff from shopping center parking lots. Develop more frequent cleaning schedules for these areas, such as once every three months during the rainy season, or at least once every six months. The cost associated with catch basin cleaning is included in the annual maintenance and operation program costs.

c. Problem WQ3 — Contamination of Runoff by Diffuse Sources of Pollutants on the Land.

WQ3 Problem Description: Urban runoff from the City of Mount Vernon and surrounding area contributes to nonpoint source pollution in area streams and the Skagit River.

Existing problems associated with urban runoff will be addressed with both structural and nonstructural solutions as appropriate. Solutions for future urban runoff problems caused by anticipated future development will be addressed by nonstructural solutions.

WQ3 Structural Solutions: Structural solutions used for improving runoff water quality from existing development often requires the use of subsurface structures such as oil/water separators and oversized catch basins. Site constraints can cause difficulty in locating above ground facilities in existing development areas. Catch basins in the existing storm drainage system should be outfitted with inverted elbow outflow restrictors that enable trapping of floatable materials and some oil/water separation. These devices can significantly reduce the suspended solids loading to receiving waters and can trap larger-sized oil droplets in runoff. Currently, few of the city's catch basins have the capability to trap floating material (Haehn 1993 personal communication). Key locations such as large parking lots, maintenance facilities, and gas stations should be targeted for installation of inverted elbow outflow restrictors in catch basins. Maintenance personnel generally agree that oil/water separators are effective if frequently maintained. Depending upon the rate of accumulation (which is greatest during the rainy season), oil/water separators may require cleaning as frequently as every three months.

Installing oversized catch basins will provide greater sediment trapping than a standard catch basin, thereby reducing pollutant loading to the receiving water.

In some areas with existing development, it might be possible to install above ground stormwater quality control facilities. These types of facilities include biofiltration swales, extended detention ponds, and wet ponds. These facilities are described further under the nonstructural solutions required for new development.

WQ3 Nonstructural Solutions: Nonstructural solutions can help solve urban runoff water quality problems for both existing and future development. The nonstructural solutions for water quality improvement include methods for source control, regulatory strategies, and maintenance practices.

(1) Source Controls

(a) Reduce and Properly Dispose of Household Hazardous Waste

Conscientious use of household cleaning products, water disposal, and do-it-yourself automobile change practices by residents, will reduce the risk of stormwater contamination. Vehicles and other equipment should be washed either under covered areas where the drain is connected to the sanitary sewer, on a lawn where wash water can infiltrate, or at a commercial washing establishment. Liquid chemicals, waste oils, solvents, paints, and other household hazardous materials should be stored indoors and disposed of as hazardous waste. If these types of materials must be stored outside, a lean-to roof or other protective cover should be provided to keep them out of the rain. Care should be taken when changing automotive oil, and used oil should be brought to a gas station or proper disposal area. Skagit County Department of Public Works has begun a new program for collection of household hazardous waste materials. The County has opened a new Moderate Risk Waste Collection Center at the County's Resource Recovery Facility at 1200 Ovenell Road, Mount Vernon, Washington 98273. Information can be obtained by calling the facility at 424-7807.

(b) Eliminate Illegal Dumping of Waste

Residents should emphasize proper disposal of oil and liquid waste products as well as yard waste. Also, dumping of pet waste into roadside ditches should be avoided. Pet waste can contribute to bacteriological contamination of water resources.

(c) Minimize Exposure of Pollutants to Stormwater

Prevention measures undertaken by business owners that reduce the amount of waste materials that can come in contact with stormwater are the most effective ways of reducing stormwater pollution. It is much easier to keep pollutants out of stormwater than it is to remove them from contaminated stormwater ("an ounce of prevention is worth a pound of cure"). Measures include the proper storage of waste materials or other potential pollutants as an effective method of reducing stormwater pollution. Replacing aging, leaking, and otherwise ineffective outdoor waste containers (such as dumpsters and garbage cans) and ensuring that all containers have tight-fitting lids is also an effective method of controlling source pollution.

Reduction of impervious surfaces within the study area that are exposed to pollutants will reduce pollutant loading and improve stormwater quality. Viable impervious area limitation measures have been identified as: (1) development clustering; (2) porous pavement applications; (3) development conditions limiting impervious area; (4) subsurface parking or covered parking areas; and (5) downzoning to lower development density or intensity.

(d) Safely Use Pesticides and Herbicides

When businesses, groundskeepers, and residents emphasize conservative and correct use of herbicides and pesticides on gardens and lawns within urban areas, the potential for stormwater contamination by these products is reduced. Taking steps to limit over-application (and application preceding storm events) of fertilizers and/or pesticides used in landscaping activities can also reduce risks associated with these products and improve water quality. Information on the use of integrated pest management (IPM) should be made available to these groups to reduce dependence on chemical fertilizers and pesticides.

(e) Implement Public Education Programs

Several different types of public education programs regarding stormwater pollution prevention have been undertaken by other jurisdictions to educate targeted groups such as businesses, the public, contractors, and special industries. Table VII-4 provides examples of public education programs initiated in the Puget Sound area. Information can be communicated to the public in the form of workshops, flyers, pamphlets, and public meetings. A wealth of information on implementing stormwater management public education programs is contained in Ecology's *Stormwater Program Guidance Manual for the Puget Sound Basin.*

Implementation of a public education program for specific groups such as business owners, residents, and contractors regarding the need to help control stormwater pollution is an important first step in stormwater pollution source control. Public assistance with simple pollution control measures can be implemented to help improve stormwater quality. Educate contractors regarding the importance of stormwater source control related to erosion and sedimentation control procedures. Prepare a plastic coated pocket sized pamphlet that presents information on erosion control measures and distribute it to the contractors. Public works maintenance and inspection staff should also be educated in these areas. Many of these types of educational materials have already been developed by other local governments or state and federal agencies. These materials could be obtained from them and used in Mount Vernon as well.

Abatement of this large-scale water quality problem depends upon many applicable BMPs that collectively can reduce the pollution of receiving waters. A public education program should be developed to inform businesses and residences about various BMPs they should implement. Educational efforts should distinguish between residential activities of concern and commercial/industrial activities of concern. The list of registered businesses at the end of the task report in Appendix G can be of assistance in tailoring the educational program for businesses to focus on prevalent business types and related activities.

Many BMPs, including stormwater treatment measures that can be used if source controls are not feasible, are potentially applicable to businesses and residences. King County has developed a comprehensive BMP manual that outlines many of these additional measures. Additionally, Ecology's *Stormwater Management Manual for the Puget Sound Basin* contains BMP requirements for businesses in specific standard industrial codes (SIC). These manuals can serve as reference documents for further steps that can be taken to clean up nonpoint source discharges to streams in the study area.

Development of an outreach and education program on the importance of catch basin cleaning of private systems on a regular basis, and specific methods for cleaning the systems, would improve the success of implementing maintenance practices for private systems. These efforts should target commercial and industrial uses. Information could be distributed in the form of flyers, town meetings, newspaper articles, and workshops. Providing businesses with information and guidance on the importance of maintaining private catch basins would improve sedimentation problems within these systems. The City should also implement a new ordinance requiring maintenance of private systems. A model ordinance prepared by Ecology for this purpose is included in Appendix I.

The City could issue window stickers designating businesses as "environmentally friendly" (or something similar) if they actively implement and maintain pollution prevention BMPs. Other incentives to accomplish voluntary pollution prevention should be explored.

(2) Regulations and Ordinances

(a) Enforce New Development Standards Meeting PSWQA Minimum Requirements

In accordance with the *PSWQMP*, the City has adopted minimum requirements for water quality controls for new development. These standards will include erosion and sediment control requirements and runoff treatment BMPs.

(b) Adopt Regulations for Maintenance of Privately Owned Stormwater Control Facilities

As mentioned previously, maintenance of stormwater control facilities is important for improving water quality. Maintenance of privately owned facilities should be performed and encouraged by the City through public education. If education efforts fail, the City should have an ordinance that requires maintenance to be performed. A model ordinance developed by Ecology for this purpose is included in Appendix I.

(3) Maintenance

(a) Increase Frequency of Catch Basin Cleaning

Increased frequency of catch basin cleaning is needed along with the establishment of a list of priority catch basins. Catch basins should be prioritized for cleaning according to both the rate at which sediment accumulates in the trap and the degree to which land use in the upstream drainage area may contribute pollutants. The high priority catch basins to be cleaned most frequently should be those that accumulate the greatest sediment load and those that show signs of poor water quality. These catch basins may be located adjacent to areas used for automotive work, roadways following winter application of traction grit, and areas subject to new land clearing and development. Regular maintenance of catch basins is an effective means of reducing stormwater pollution because it reduces the amount of contaminants flushed into the storm drainage system. In areas known to generate high quantities of pollutants, catch basins may require increased maintenance especially during the rainy season.

A catch basin cleaning program should be developed that includes a schedule giving cleaning priority to those catch basins that are most frequently clogged with sediment and areas with the highest levels of stormwater pollutants. The schedule should provide for cleaning of the high priority sites as frequently as is necessary and the cleaning of the remaining catch basins a minimum of once every eight months.

(b) Improve Ditch Cleaning and Biofiltration Swale Maintenance Practices

The method and frequency of ditch maintenance should be conducted to improve water quality. Increased erosion and reduced filtration efficiency in drainage ditches due to maintenance practices can lead to increased stormwater pollution. Ditch maintenance should preserve vegetation lining to prevent erosion and to capture pollutants. Vegetation should only be disturbed when it is necessary to remove sediments in order to regain hydraulic capacity. When this type of ditch maintenance is required, it is best done so that some vegetative material remains to regenerate the vegetation lining. Reseeding or sodding of ditches should be performed as required to help prevent erosion.

(c) Maintain Detention Pond Vaults

Regular maintenance of detention ponds and vaults such as removal of sediment build-up will improve water quality and maintain the quantity control functions of the facility.

WQ3 Recommendations

Structural Recommendations

Two alternative structural measures were described above. They include the installation of oil/water separators at appropriate locations to reduce oils from entering area streams or the Skagit River, and the installation of enlarged catch basins/manholes where necessary to increase the volume of sediment and associated pollutants removed from the system. As part of the decision-making process over where it would be beneficial to install such facilities, it is recommended that the City perform monitoring investigations which would identify the severity of pollution from oil associated pollutants in these systems. A water quality monitoring program is recommended as a part of the solution to water quality problem WQ1 (sewer cross-connections). It is recommended that the City include tests for total petroleum hydrocarbons (to determine extent of contamination from oils) at each of the City major streams and outfalls when conducting the monitoring program as outlined under WQ1. If it is determined that a particular drainage area has a problem, the City should consider further investigations similar to the steps described under WQ1 solutions. These investigations may determine that installation of oil/water separators is appropriate at certain locations. For the purpose of cost estimates, it is assumed that 5 oil/water separators will be installed each year. Cost for the monitoring for this problem is included in WQ1.

Construction Cost = $16,350 per year

Installation of enlarged catch basins costs approximately $6,000 for a 72-inch manhole and $9,000 for a 96-inch manhole. Because of these high construction costs and because the increased frequency of catch basin cleaning can also reduce sediment entering the system at a lower cost, it is recommended that installation of enlarged catch basins be considered only if the increased frequency of catch basin cleaning does not adequately solve the problem. Under the catch basin cleaning program described above, the City will identify priority catch basins that need to be cleaned out more frequently than the standard eight months (e.g. every two months during the winter). If the more frequent cleaning does not solve the problem, source control measures should be pursued in the areas tributary to these catch basins. If these specific catch basins continue to be filled with sediment, it is recommended that these specific catch basins be replaced with oversized catch basins. In addition, water quality monitoring for suspended solids could be included in the monitoring program discussed under the solution for WQ1. This information would help identify sediment loads throughout the system and the associated need for source control measures, increased maintenance, and possibly enlarged catch basins. For the purpose of estimating costs, it is assumed that the increased frequency of catch basin cleaning and source control measures will solve the problem and that oversized catch basins will not be required. The cost associated with monitoring for suspended solids is included under water quality problem WQ1.

Nonstructural Recommendations

(1) Source Controls: Develop a public education program that encourages source control of stormwater pollution and includes the following objectives:

   (a) Residents should reduce the use of household products that are harmful to the environment. When these products are used, they should be disposed of as hazardous waste at the County's new Moderate Risk Waste Collection Center.

   (b) Eliminate illegal dumping of oils, liquid waste products, lawn clippings, pet waste and other pollution sources by the public and area businesses.

   (c) Reduce stormwater exposure whenever and wherever possible through the use of recommended BMPs.

   (d) Use pesticides and herbicides wisely and always follow application instructions. Also, whenever possible implement an Integrated Pest Management Plan (IPMP) rather than use chemical treatment.

   (e) Implement public education programs such as those indicated in Table VII-4 and in Ecology's *Stormwater Program Guidance Manual for the Puget Sound Basin*, Volume 2. Develop an educational program that educates commercial and industrial business owners of proper catch basin cleaning. Information could be distributed in the form of flyers, town meetings, newspaper articles and workshops. This education program can be a component of an overall public education program. The recommended overall commitment to an effective education program will require at least 25 percent to 30 percent of the City's new stormwater manager's time.

(2) Regulations and Ordinances:

   (a) Enforce new development standards meeting PSWQA minimum requirements.

   (b) Adopt a new ordinance requiring maintenance of privately owned stormwater control facilities.

(3) Maintenance:

   (a) Develop a catch basin cleaning program that (1) includes cleaning catch basins at a minimum frequency of once every eight months, and (2) develops a list of priority catch basins for more frequent cleaning.

(b) Educate City maintenance crews as to how to maintain ditches to leave a vegetative lining. It is recommended that the staff person responsible for this activity conduct interviews with other jurisdictions which have successfully implemented such practices. The Cities of Bellevue and Mountlake Terrace have historically focused on water quality and could provide valuable information.

(c) The recommended changes to current maintenance practices and associated costs are discussed in Section VIII — Maintenance and Operations.

d. Problem WQ4 — Spills of Solid and Liquid Materials.

WQ4 Problem Description: The potential for transportation-related and storage-related spills of hazardous materials causes concern for protection of groundwater and surface water resources. In addition, in cases where spilled material is not adequately cleaned up, pollution can act as long-term environmental contamination.

WQ4 Structural Solutions: Nonstructural and structural solutions are appropriate for addressing transportation-related spills whereas nonstructural solutions are more appropriate for storage-related spills. State highways and roadways are of greatest concern for transportation-related spills. Because of the risk of direct surface water contamination from spills of hazardous or toxic materials, implementation of roadway spill containment facilities at key intersections and other roadway areas of concern should be used to protect water resources. Generally, spill containment facilities consist of detention basins, oil/water separators, oil holding tanks, and high flow diversion systems. Other options for spill containment include oversized catch basins with overflow provisions designed for containing spills and an overflow device capable of separating floating material. All spill containment facilities should be constructed according to design standards adopted by the Federal Highway Administration (FHWA).

The City should perform a preliminary study to determine the need for spill containment facilities. The study should identify the areas of greatest concern, whether there is a problem, and whether corrective action is needed. The study should include the following:

(1) Traffic counts and historical accident counts on State Highways. The Department of Transportation will provide this information for a small fee.

(2) A summary of historical spills from City records, fire department records, Department of Transportation records, and Department of Ecology may also have records. Locations of these spills and proximity to resources should be noted.

(3) The ability of the Fire department to respond to a spill.

(4) An assessment as to the environmental damage that could result from a potential spill.

(5) The City should coordinate the study with the Department of Transportation.

WQ4 Nonstructural Solutions: Nonstructural solutions for handling transportation-related and storage-related spills include District Fire Department training and public education programs.

Spills of solid and liquid materials at businesses can be prevented or controlled in several ways. For certain types of businesses the state already has spill control requirements, for others an education program should be used to encourage spill control planning. Presently only businesses that work with chemicals listed as "extremely hazardous" by the EPA are required to prepare an emergency response plan (Bumgarner 1993 personal communication). There are many other chemicals and petroleum products of concern that are not on the EPA list.

State regulations require generators of "dangerous wastes" to obtain a Department of Ecology identification number if they generate more than 220 pounds of dangerous waste per month, or if they generate more than 2.2 pounds per month of wastes classified as "extremely hazardous." Ecology has several requirements related to waste storage, spill containment, and spill response for businesses that generate this much dangerous or extremely hazardous waste. Based on the list of registered businesses in the study area provided at the end of the task report in Appendix G, there should not be many businesses in Mount Vernon that fit the above category of dangerous waste generators. Ecology should already be communicating with these businesses.

Businesses that always generate less than 220 pounds of dangerous wastes or 2.2 pounds of extremely hazardous wastes per month, and that always dispose of the waste before it accumulates to these levels, are considered "small quantity generators" by state regulations. Small quantity generators (SQGs) are prevalent in all urbanized areas, and many of them are unaware of the state's regulations. Based on the types of registered businesses listed at the end of the task report in Appendix G and the limited ability of Ecology to identify and regulate SQGs, it is likely that several SQGs in the Mount Vernon urban service area are not following the state requirements. These requirements include characterizing wastes to determine if they are hazardous, properly packaging and labeling dangerous wastes, and disposing or recycling of dangerous wastes appropriately. As part of an overall education program for the Surface Water Management Plan, the city should inform potential businesses that might be SQGs of the state's dangerous waste regulations and work with Ecology to distribute appropriate educational materials that Ecology should already have available. Skagit County Department of Public Works has recently begun operation of a Moderate Risk Waste Collection Center. This collection center is currently collecting household hazardous waste as well as hazardous waste from SQGs.

It is likely that businesses that properly label, store, and dispose of dangerous wastes will be better prepared to prevent and control spills. Educational efforts for businesses of all types should encourage business owners and managers to implement spill control plans; educate employees about spill prevention, control, and reporting; and stock spill cleanup materials. Businesses in the automotive, printing, and manufacturing industries should especially be targeted for educational material on spill prevention and control because they have a greater likelihood of working with hazardous materials.

Similar educational efforts should be made for non-waste materials of concern, such as pesticides, paints, petroleum products, and a variety of solid and liquid chemicals. The Uniform Fire Code contains provisions for storing and working with reactive, ignitable, and flammable materials; the Mount Vernon Fire Department can enforce these provisions. As part of an overall pollution prevention education program for businesses, the City of Mount Vernon Engineering Department along with the Mount Vernon Fire Department, and the Skagit County Department of Emergency Management should work together to develop and distribute information on appropriate (and required) material handling storage, and spill control practices.

Fire Department Staff should be trained to address a hazardous or toxic spill within the City in a way that protects both human health and the environment. Clean up should include the use of methods that completely remove the material from the area, including contaminated soil. In addition, the fire department staff should be trained about the drainage system layout, including major storm drain system locations and discharges into the various creeks and the Skagit River. A copy of the drainage system maps should be available at the Fire Department. The Fire Department should also have emergency procedures for contacting affected agencies including the Department of Ecology, Department of Fisheries, and Department of Transportation.

A public education program that provides residents and business owners with information regarding who to contact in the event of a spill is an effective method of improving clean up time and protecting human health and the environment.

Nonstructural solutions for storage-related spills include a spill response program, training of the district Fire Department, and an inventory of industrial activities within the study area.

The development of a spill response program for large, but particularly for small, industrial and commercial business is a good first start in storage-related spill containment and control. Businesses to be targeted include gas stations, laundromats, Car washes, and automotive shops. The response program should provide information to the business owner or operator regarding who to contact in the event of spill and other important first steps to take immediately following the spill. All spill containment systems put into place will require effective response in the event of a spill.

The fire department should be trained to handle storage-related spills of hazardous or toxic materials. Training should include knowledge of the location and operation of spill containment facilities and other clean up procedures depending on the type of spill.

An inventory of all industrial activities within the study area has been conducted, and is included at the end of the task report in Appendix G. These facilities have been classified according to their standard industrial classification (SIC) code. Those facilities with SIC codes of concern that are in close proximity to water resources should be made a priority for spill prevention and containment facilities and programs. In addition, information on these sites should be available to the fire department and routine monitoring and inspection of these facilities should be performed.

<u>WQ4 Recommendations</u>:

(1) The City should conduct a study to identify the need for spill containment facilities to prevent spills from entering area streams and the Skagit River. The contents of the study were described above under structural solutions. This work should be accomplished by the new City stormwater manager who will be hired to administer the City's stormwater program.

(2) A City staff person should be assigned to develop information on how to handle transportation and storage related spills. It is suggest that this staff person interview the City of Renton Maintenance Department regarding the program Renton has developed for emergency spill response. The City of Renton has one of the most extensive emergency spill response programs in Washington. This staff person should then educate the fire department on appropriate methods and procedures. The staff person should also provide the fire department with all the necessary information on the City's storm drain system layout and the major outfalls to area streams and the Skagit River. This work should be accomplished by the new City stormwater manager who will be hired to administer the City's stormwater program.

(3) Develop a public education program to inform individuals of what to do in the event of a spill such as to report spills immediately using the 911 telephone number. This could be one component of the City's overall public education program that is budgeted for under a separate task.

(4) The City should develop a comprehensive information network to facilitate communication between the public, city staff, agencies and fire department spill clean up personnel in the event of a spill. Also, the City should develop a spill response program for the study area. The City should interview cities with successful programs such as the City of Renton to

develop the contents of the plan. This work will be accomplished by the City's new stormwater manager as well.

(5) Conduct an inventory of industrial facilities that store hazardous materials and keep their drainage system maps on file at the City and Fire Department. Those facilities with SIC codes of concern that are in close proximity to water resource should be made a priority for spill prevention and containment facilities and programs. In addition, information on these sites should be available to the fire department and routine monitoring and inspection of these facilities should be performed. Again, these types of nonstructural solutions will be coordinated by the City's stormwater manager.

e. Problem WQ5 — Illegal Dumping into the Storm Drainage System.

WQ5 Problem Description: Illegal dumping of material such as oil, antifreeze, vegetation and pet waste into the storm drain system has resulted in increased pollution of stormwater within the study area. Such dumping is often done due to ignorance of the harmful effects to water quality and the environment.

WQ5 Structural Solutions: This problem is best addressed by non-structural measures (e.g. public education).

WQ5 Nonstructural Solutions: An education program on the impacts of improper disposal of waste material on storm and surface water quality would provide guidance to the public regarding practices to improve water quality. Information could be provided in the form of public notices, outreach to targeted business by City staff, public events, flyers, and newspaper articles. Also, development of an area where individuals can safely, easily, and legally dispose of waste material such as motor oil, yard waste, and household chemicals would reduce the probability of these materials being dumped illegally. Information on Skagit County's household hazardous waste program was described under the solutions for Problem WQ3. Increased enforcement and the establishment of fines is also an effective deterrent for illicit dumping. A section of the new drainage ordinance in Appendix I defines illicit discharges to the storm drain system and establishes this as an illegal activity and describes penalties. Local citizens should be encouraged to report any illicit dumping actions. Increased patrolling of areas typically used for dumping will also help to reduce these actions.

Storm drains should have warning signs stenciled or posted near them with wording such as "dump no waste; drains to stream." Some storm drains in the city currently are stenciled in this manner, but many more are not. This simple measure can prevent much of the illegal dumping that occurs due to ignorance of the downstream effects. Other municipalities have had success stenciling warning signs near a large number of storm drains by means of educational or volunteer projects involving school students, Boy Scouts, church groups, etc. Mount Vernon should impose fines on individuals who illegally dispose of materials in drainage ditches, street drains, and other drainage system features. Citizens should be educated about the problems illegal dumping can cause and the associated penalties.

WQ5 Recommendations:

(1) Educational programs should be developed to inform the public of the impact to stormwater quality associated with illicit dumping of waste. This public education component and associated cost shall an element of the recommended overall public education program.

(2) The City should adopt the drainage ordinance and strictly enforce it to deter illegal dumping. Along with a public education element, this will reduce the potential for stormwater contamination associated with illegal waste disposal. Local citizens should be encouraged to report any illicit dumping to further help prevent these actions.

3. Rural Water Quality Problems

a. Problem WQ6 — Failure of Septic Systems. Since nearly all the existing septic systems in the study area are between the existing City corporate boundary and the urban growth boundary, the City should establish a policy of requiring sewer construction for new areas to be annexed to the City.

b. Problem WQ7 — Erosion of Pasture Land, and WQ8 — Loading Animal Wastes Directly to Surface Waters.

WQ7 and WQ8 Problem Description: Livestock farms are contributing to fecal coliform bacteria contamination and erosion and sedimentation within the study area. Another common problem associated with agricultural activities includes overgrazing by livestock which leads to land erosion within the study area.

WQ7 and WQ8 Structural Solutions: These problems are best addressed by nonstructural measures such as regulations and public education.

WQ7 and WQ8 Nonstructural Solutions:

Maintaining vegetation, and ground cover on grazed lands, croplands, and stream banks in the watershed will further protect the stream bank and preserve water quality. Vegetation helps to stabilize soil thereby decreasing soil erosion potential.

Maintaining vegetation on stream banks plays an important role in filtering pollutants from farm runoff. Maintenance of vegetated ground cover slows the velocity of runoff enabling more biofiltration to occur which reduces the potential for contamination by runoff that reaches the Creek. Vegetation filters out pollutants in runoff and reduces the amount of soil particles that become suspended in runoff thus diminishing the erosion process.

Several steps can be taken to limit erosion of farm lands used for livestock grazing, including limiting livestock density in grazing areas, rotating grazing pastures with the help of temporary fencing to maintain grass cover, and fencing off steep slopes to prevent livestock access to these erosion-prone areas.

The city should work with the Skagit Conservation District, the Washington State University/Skagit County Cooperative Extension, and the U.S. Department of Agriculture Cooperative Extension to develop an educational program and a set of BMPs for pastures within the study area. Commercial farms are likely to be getting information on pasture management BMPs from the above agencies. Therefore, educational efforts should target hobby farms. Examples of erosion control BMPs for pastures include the following:

- Preventing animal grazing access to steep slopes
- Reducing the density of animals on a given pasture size
- Rotating grazing areas with temporary fencing or other means to prevent overgrazing in any one area of the pasture
- Maintaining vegetated buffers between pastures and drainage paths
- Preventing animal access to stream banks and drainage ditches to prevent trampling of the banks.

Providing education to farmers regarding BMPs for farming practices may help to reduce fecal coliform bacteria contamination and bank erosion throughout the study area. BMPs should focus on those discussed below.

Restricting animal access to area creeks will reduce stream contamination and bank erosion. Installing sturdy fences along the banks of area creeks where livestock are kept will restrict direct access to the creek. In addition, fencing off drainage ditches and other significant tributary drainage paths that feed into the Creek is another effective measure for controlling source pollution. Fences can help in two ways; 1) animals are not able to defecate in the stream, thereby reducing the potential for fecal coliform bacteria contamination, and 2) trampling of the stream banks can be avoided thereby reducing the potential for bank erosion. Provision of a watering trough or pond away from the creek can also help to keep a particular farm's livestock out of the creek and off of its banks.

Other important BMPs limit contamination of farm runoff by manure and fertilizers. These include covering manure piles to protect them from precipitation, spreading manure in grazing pastures to avoid concentrated pollution source areas, applying fertilizers after a period of light rain (such that the soil is not saturated) and dry weather is expected, avoiding over-application of fertilizers and ensuring that fertilizers are worked into the soil when applied rather than simply dumped on the soil surface.

Erosion and runoff pollution can be further prevented by implementing source controls that limit contact between potential pollutants and stormwater. This will reduce the quantity of contaminated water that drains off of farms in the watershed. If possible, gutters and downspouts should be provided for all buildings and the runoff from these buildings should be routed away from animal confinement areas and/or manure piles.

The city should work with the Skagit Conservation District, the Washington State University/Skagit County Cooperative Extension, and the U.S. Department of Agriculture Cooperative Extension to develop an educational program and a set of BMPs aimed at limiting the amount of livestock waste that reaches receiving waters. Again, larger farms are probably getting this information already. Therefore, smaller commercial farms and hobby farms should be targeted for the educational outreach.

The simplest preventive measure is to fence off stream banks and drainage ditches so that livestock do not have direct access to them. Other BMPs that can reduce the problem of high fecal coliform concentrations in runoff include rotating grazing areas so that accumulations of manure do not develop, and maintaining vegetated buffers between grazing areas and drainage paths.

<u>WQ7 and WQ8 Recommendations</u>:

(1) The City should improve water quality by requiring the use of fences to keep farm animals out of area streams. The effort to install fences within the City should include a public education program for farm owners, development of an ordinance requiring the use of fences, and the possible development of assistance programs such as low interest loans for farmers to lessen the cost of fence installation. Methods of waste and pasture management should be established to reduce erosion and fecal coliform bacteria contamination from farms within the study area. Again, these efforts will be coordinated by the City's surface water manager.

2) The City should coordinate with area farmers to maintain riparian vegetation that will improve filtration of pollutants and reduce erosion thereby improving water quality. The City should prepare a public education program to inform farmers of the importance of riparian vegetation for water quality protection. As before, these efforts will be coordinated by the City's surface water manager.

4. Specific Water Quality Problems

a. Problem WQ9 — Sewage Overflows in Kulshan Creek Basin. A new sewer interceptor will be constructed in the spring and summer of 1996, which will eliminate future sanitary sewer overflows within the Kulshan Creek basin.

b. Problem WQ10 — Contaminated Sediments in Kulshan Creek. The problem of total petroleum hydrocarbon (TPH) contaminated sediments in Kulshan Creek may result from one or more specific sources that have yet to be identified, or from urban development in the basin in general. The city should collect additional sediment samples as part of the sampling program discussed under Problem WQ1 at various points in Kulshan Creek to determine if the TPH contamination problem can be traced to a localized area. More information should also be collected on the extent of soil contamination at the former fuel oil storage and distribution site on College Way near the railroad crossing. Leaching of contaminants from the soils on this site may be a major cause of the sediment contamination problem in Kulshan Creek. If the primary problem appears to be urban development in general, then educational efforts should be stepped up to convince businesses and residences within the drainage basin to implement many of the BMPs described in this report. In addition, if general urban runoff is found to be the problem, coalescing plate oil/water separators should be considered for installation in the larger parking lots of the basin as discussed under the solutions to Problem WQ3.

5. Future Water Quality Problems

a. Problem WQ11 — Future Water Quality Problems.

The first step the City should take to implement stormwater pollution control measures is to enforce the new drainage ordinance that meets the minimum requirements set forth in Ecology's *Stormwater Management Manual for the Puget Sound Basin*. The City should also educate residents and businesses in the study area about simple source control BMPs that can be used to reduce or prevent stormwater contamination. The City should encourage local schools to incorporate stormwater pollution prevention issues into environmental education programs.

Streams in the study area should also be monitored periodically, as discussed under Problem WQ1, to determine whether water quality improvements are being made. Where persistent problems are found, educational and enforcement efforts can be targeted at the sources.

D. Environmental Resource Solutions

1. Wetlands

a. Problems WT1, WT2, WT3, WT4, and WT5 — At-risk Wetlands.

To preserve "at risk" wetland areas described in Section VI that are threatened by encroachment of development, the following solutions have been developed. Since preservation of wetland areas is primarily a regulatory issue, these solutions are nonstructural by nature.

Public Information. As part of the City's overall public information/education program, land owners, and others may be assisted in understanding which types of land may be wetlands, and in recognizing the important functions and values which the wetlands provide to society and the environment.

A public information/education program should be combined with other public education program elements for water quality. For example, information regarding wetlands recognition, value, and regulation may be disseminated via mailing brochures, at demonstrations and question-and-answer sessions at public meetings, on posters displayed at public buildings, and through educational programs incorporated into primary, secondary, and post-secondary curricula.

Numerous pamphlets and brochures, many written for the non-scientific public, which describe wetlands and discuss their unique value, are available from public agencies such as the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, and the Washington Department of Ecology. Some organizations have prepared videos which present such information. Of course, the wetlands inventory maps compiled in support of the City of Mount Vernon Surface Water Management Plan should be included in the list of available information. Wetlands experts, such as those from public agencies, private consulting firms, and conservation organizations, are often available to speak at public information meetings. Further, several organizations have or are developing wetlands educational materials which may be incorporated into formal education at nearly any level.

Critical Areas Ordinance Revision. Other solutions may be accomplished by revising the CAO. For example, a revised CAO might contain a wetlands rating system based on wetland functional value. There are several wetlands ratings paradigms, but the most common models used in Washington are either a three- or four-tiered rating system. The three-tiered system was perhaps pioneered by King County and was adopted by many of the local governments which drafted wetlands management ordinances prior to being forced to do so by the state Growth Management Act (GMA). The primary criteria for establishing a wetlands' rating under this system are wetland size, the number of wetland habitats available within the wetland, and the presence or absence of sensitive or rare plant or animal species. Assigning a rating to a wetland under this system is a relatively easy task since few criteria must be quantified. Since the GMA, many jurisdictions have adopted wetlands ordinances which are based on the Model Wetlands Protection Ordinance prepared by the Washington Department of Ecology. These ordinances rely on a four-tiered system. Instead of relying on a few easily quantified criteria, this model uses a four-page rating form which requires that numerous questions be answered. Points are awarded for a wetlands' having certain physical attributes. In many cases, wetlands ratings are then determined by the number of points assigned to a wetland as a result of completing the data form.

Under both systems, wetlands protection varies as a function of wetland rating. For example, higher value wetlands are often protected by larger buffers. Further, the compensatory mitigation requirements for higher value wetlands are typically greater than for lower value wetlands. This in turn provides some disincentive for developers to impact high-value wetlands. For example, if a developer has a choice of impacting a low-and high-value wetland, and he knows that mitigation for impacts to the higher value wetland will cost more money, will require additional permit review time, or will necessitate setting aside a larger amount of land for compensatory purposes, then in most instances the developer will choose to avoid impacts to these wetlands.

b. Problems WT6, WT7, WT8, and WT9 — Wetlands Protection and Economic Growth.

All of the above solutions address case-by-case wetlands protection problems. This subsection presents two programmatic solutions which address a coordinated approach towards achieving both wetlands protection and economic growth goals. The first of these programs is known as "wetlands mitigation banking," and the second is known as a "Special Areas Management Plan," or "SAMP."

Wetlands Mitigation Banking. Wetlands mitigation banks involve the off-site creation, restoration, and/or enhancement of wetlands to compensate for unavoidable adverse impacts associated with development activities. The concept of mitigation banking was developed in the early 1980's as a mechanism to compensate for unavoidable habitat losses primarily associated with the federal Section 10 (Rivers and Harbors Act) and Section 404 (Clean Water Act) permit programs for wetland development projects (Short, 1988). The Washington Department of Ecology recently published a guidance document, Wetlands Mitigation Banking (Castelle et al., 1992b) which discusses many mitigation banking issues from agency, developer, and environmental viewpoints. A copy of this document is included in the task report in Appendix A.

Mitigation banking differs from most compensatory mitigation projects in that mitigation banking is a program created by agencies or other organizations to provide a relatively large compensatory mitigation site (or sites) to be used to collectively compensate for many, usually unrelated, development projects. This contrasts with more traditional compensatory mitigation measures which typically involve individual projects implemented by developers (Castelle et al., 1992b). In addition, most wetlands mitigation banking programs are established so that the compensation is accomplished prior to the wetlands impacts. This is one means of assuring that the compensatory measures will be successful and that there will be no net loss of wetlands.

An advantage of mitigation banking is that this type of program may reduce the cost of mitigation, thus allowing large, otherwise cost-prohibitive, mitigation projects to be completed (Borsch, 1987). Another advantage may be that large mitigation projects like those typical of mitigation banks are more useful than several small project in various locations. Arguably, larger mitigation projects provide more habitat, are easier to create, and prevent cumulative impacts (for example, habitat fragmentation) associated with many small, scattered mitigation projects (Castelle et al., 1992b).

However, mitigation banking programs also have several potential disadvantages. For example, there are relatively large up-front costs for establishing a mitigation bank. While these costs are sometimes borne by private groups, on other occasions public agencies must provide the "up-front" money. Further, these costs may never be recovered if the bank does not become fully utilized or utilized in a timely fashion. There are also ecological concerns about mitigation banking. For example, the same problems which have contributed to low success rates for individual compensation projects in many locations will also exist for mitigation bank sites. Lastly, widespread use of mitigation banks may be perceived, especially by conservation groups, to be a "wetlands give-away," wherein the normal mitigation process of first attempting to avoid and minimize wetlands impacts will be by-passed.

In Mount Vernon, mitigation bank sites might be established in one or several of the many large meadows which cover a significant portion of the city within the Urban Growth Boundary. In particular, meadows which fail to meet the mandatory criteria for wetlands identification only because they lack wetland plants may be useful. In these fields, wetland hydrology and wetland soil conditions are often present or can be established at low cost and with a high probability of success. Unfortunately, many of the areas which are best suited for banking sites are also well suited for development. However, with proper coordination, the city could achieve no net loss of wetlands while providing both large, high-value wetlands and sustained economic growth potential.

Lastly, consideration of a mitigation banking program for the city should include regulatory implications. For example, although the city may choose to promote, and perhaps to fund, the use of mitigation banking, all other pertinent wetlands permits must be obtained by each project proponent on a case-by-case basis. Despite the availability of using mitigation banks, any of the other agencies which may have permitting authority of wetlands impacts may decide against the use of the mitigation banking program. Unfortunately, project proponents may not be able to determine if their projects may be included in the banking program until after substantial resources are expended.

A recent strategy developed to help avoid the permitting uncertainties of a typical mitigation banking program is a SAMP; the following section summarizes this potential programmatic solution.

Special Areas Management Plans. Special Areas Management Plans, or SAMPs, like mitigation banking, represent a more global approach to managing wetlands resources and balancing natural resources protection with economic growth than a case-by-case approach. Unlike wetlands mitigation banking, however, SAMPs are designed to provide wetlands permitting on a "one-stop shopping" basis.

This is accomplished by generating an agreement, signed by all affected regulatory and resource agencies, as well as affected tribes and, in some instances, conservation groups. As a result of a SAMP, a local public agency, in this instance the Mount Vernon city government, would receive a "regional" permit. This permit transfers all permitting responsibilities from agencies such as the U.S. Army Corps of Engineers and the Washington Department of Ecology to the local agency. From that point forward, project proponents need only to secure a permit from the city, instead of having to approach each agency in turn.

The potential ecological advantages and disadvantages of SAMPs are essentially identical to those for mitigation banking. While larger, better planned wetlands may be created or restored, many conservation groups are concerned that the full mitigation process may be short-circuited.

Another advantage of a SAMP is the significant time savings for project proponents. Further, most SAMPs identify both the wetlands which may be impacted as part of the program and appropriate mitigation sites. The SAMP might also identify certain wetlands which are not included in the plan; those wetlands, typically the most highly valued wetlands, would still be subject to the standard permitting process. Therefore, a significant amount of both ecologically and economically sound planning is completed prior to the first wetland impact. Some SAMPs have incorporated a mitigation banking strategy.

Another disadvantage of SAMPs, however, is the relatively long time required for all agencies and other affected parties to reach an agreement. For example, a SAMP is being developed in the Auburn-Kent area of King County. Like Mount Vernon, these cities have large areas marked by low- to moderate-value wetlands, primarily wet meadows. The SAMP development process in that area has already taken in excess of four years, and only now the process seems as if an agreement may be reached. Until the Auburn-Kent SAMP is completed, it may be difficult to estimate the resources necessary to complete a SAMP in Mount Vernon.

c. Wetlands Recommendations.

Public information programs concerning the value of wetlands should be incorporated into the overall public education program and any costs will be incurred by that program.

The City could review its Critical Areas Ordinance in the future and evaluate its effectiveness, and consider the need to develop a rating system accompanied by associated buffer sizes.

Whether the City should sponsor a programmatic solution such as mitigation banking or a SAMP for managing wetlands, is a policy decision that should be made by City staff and elected officials.

2. Fish Habitat

A number of fish habitat problems were identified in Section VI that involve either fish passage problems or fish habitat problems. These problem solutions require physical changes to the existing environment and, therefore, are best handled through the use of structural solutions. Implementing nonstructural solutions such as new development standards will help preserve fish habitat in areas to be developed in the future. Nonstructural solutions to regulate new development were described in the water quality solutions section.

a. Problem E1 A pump station on Kulshan Creek above the outlet to the Skagit River presents a nearly total barrier to fish passage. Passage is only obtainable when flow from Kulshan Creek is sufficient to open a flap gate, and the Skagit River is high enough to create a take-off pool below the gate, but not high enough to force the gate shut. The problem with the flap gate can be solved by construction of the new pump station described under the solution to regional system problem RS4 which would eliminate the flap gate and replace it with a mechanically operated gate that will only close during high river levels. Allowing for fish access to the system will be solved by installing a vertical fishway. The cost of the fishway is included under RS4.

Cost= $0, included under solution for RS4

b. Problem E2 An existing manhole in the section of Kulshan Creek located east of the railroad collects debris and creates a partial fish passage barrier. There are two solutions to this problem. The first alternative is to increase the frequency of maintenance at the manhole. The second alternative is to remove the manhole. Removal of the manhole is recommended since there is no purpose for the structure in the middle of Kulshan Creek.

Cost = $2,000

c. Problem E3 A culvert in an unnamed tributary to Kulshan Creek north of Cedar Lane creates a partial fish passage barrier due to a one-foot drop at the outlet. One alternative solution to this problem is to replace the existing 24-inch-diameter culvert with a 36-inch diameter culvert.

Cost = $17,000

Another alternative solution is to install a series of two log weir structures at the outlet of the culvert that would create take-off pools downstream that would facilitate fish passage into the culvert.

Cost = $11,000

Installation of the log weir structure is the recommended solution because it is less expensive.

d. Problem E4 Approximately 2,200 feet of Kulshan Creek upstream of Riverside Drive to about North 18th Street lacks riparian vegetation as well as pools and riffles that would provide good stream habitat. Instream logs, root wads or other strategically placed devices should be added to this section of Kulshan Creek to create pools and riffles within the channel. Also, native riparian vegetation should be planted such as willow, red osier dogwood, and salmonberry. Utilizing volunteers and/or local schools will reduce costs. Constructing these habitat restoration projects can be phased, with only certain sections of the creek being restored in any given year.

Total Cost = $104,000 or $10,400 every other year over a 20-year period

e. Problem E5 There is a lack of riparian vegetation as well as pools and riffles to provide good stream habitat along Trumpeter Creek from its confluence with the Nookachamps Creek to 2,700 feet upstream, and in portions of the mainstem from College Way to Fir Street. All of this amounts to approximately 7,000 feet of stream channel. The solution to this problem would be the same as in Problem E4. Instream logs, root wads or other strategically placed devices should be added to these sections of stream to create pools and riffles within the channel. Also, native riparian vegetation should be planted such as willow, red osier dogwood, and salmonberry. Utilizing volunteers and/or local schools will reduce costs. Constructing these habitat restoration projects can be phased, with only certain sections of the creek being restored in any given year.

Total Cost = $327,000 or $32,700 every other year for 20 years

f. Problem E6 The culvert along the South Fork of Trumpeter Creek at Seneca Drive plugs up with debris which causes fish passage problems. Downstream there is a large drop between the culvert outlet and the stream channel. To correct the debris problem, the frequency of normal maintenance of this culvert should be increased. Maintenance costs are included in the cost of the stormwater maintenance program discussed in Section VIII. To correct the fish passage problem the log weirs proposed under the solution to local system problem LS10 provide the solution.

g. Problem E7 The culvert along the Southeast Fork of Trumpeter Creek at Kiowa Drive presents a partial barrier to fish migration due to the one-foot drop at the culvert outlet. This problem would also be solved by implementing the recommended solution to Problem LS10.

h. Problem E8 The culvert along the Southeast Fork of Trumpeter Creek at Lupine Street is blocked and presents a barrier to fish passage. This problem could be resolved by increasing the frequency of maintenance at the culvert.

i. Problem E9 A culvert at Fir Street on the east side of Bakerview Park presents a partial fish passage barrier on the Southwest Fork of Trumpeter Creek due to a one-foot drop at the culvert outlet. No action is recommended for this problem. Providing fish passage at this location would be unproductive because the creek immediately upstream of this pipe is completely enclosed in a pipe system and would not be suitable fish habitat.

j. Problem E10 The 210-foot-long culvert on Madox Creek 1,200 feet above Anderson Road is too long to allow fish passage. This culvert should be removed and the stream channel restored.

Cost = $40,000

k. Problem E11 The culvert on Madox Creek at Blackburn Road is a nearly total fish passage barrier due to a two-foot drop at the culvert outlet. Two alternative solutions could solve this problem. The first solution is to replace the culvert.

Cost = $33,000

The second solution is to install a series of log weir structures to create a series of pools downstream of the culvert that would raise the water surface level at the culvert outlet minimizing the distance fish would have to jump to enter the culvert.

Cost = $11,000

Installation of the log weir structures is the recommended solution because it would be less expensive.

l. Problem E12 The outfall pipe at the lower detention pond on Madox Creek south of Section Street and east of Little Mountain Estates is plugged and creates a total fish passage barrier. Two alternative solutions could solve this problem. The first solution is to replace the plugged culvert.

Cost = $19,000

The second solution is to clean out and maintain the existing culvert. This maintenance is included in the normal maintenance program. The second alternative solution is recommended.

m. <u>Problem E13</u> The section of Flowers Creek between its confluence with Maddox Creek and Blodgett Road lacks riparian vegetation. Plant streamside vegetation of native species such as willow, red osier dogwood, and salmonberry. Cost is based on planting 1,500 feet of stream.

Cost = $38,000

n. <u>Problem E14</u> The culvert along Flowers Creek at Blodgett Road presents a partial fish barrier at low flows due to a one-foot drop in elevation between the culvert outlet and the streambed. Again, two alternative solutions could solve this problem. The first solution would be to replace the culvert.

Cost = $19,000

The second solution is to install a series of log weir structures to create a series of pools downstream of the culvert that would raise the water surface level at the culvert outlet minimizing the distance fish would have to jump to enter the culvert.

Cost = $11,000

Installation of the log weir structures is the recommended solution because it would be less expensive.

o. <u>Problem E15</u> The lower portion of Carpenter Creek along Bacon Road lacks pools and riffles that provide instream habitat as well as riparian vegetation on one bank. Instream logs, root wads or other strategically placed devices should be added to this section of stream to create pools and riffles within the channel. Also, native riparian vegetation should be planted such as willow, red osier dogwood, and salmonberry. Utilizing volunteers and/or local schools will reduce costs.

Cost = $21,000

TABLE VII-1

STRUCTURAL STORMWATER CONTROL SOLUTIONS

Typical Structural Solutions	Reduce Flooding	Reduce Channel Erosion	Improve Water Quality
Detention Facilities			
Ponds with Vegetation	✓	✓	✓
Closed Systems	✓	✓	
Detention/Sedimentation	✓	✓	✓
Infiltration	✓	✓	✓
Pipe Systems/Structures	✓		
Grass Swales		✓	✓
Stormwater Diversions	✓	✓	
Oil/Water Separators			✓
Check Dams		✓	✓
Channel Stabilization		✓	

TABLE VII-2

NONSTRUCTURAL STORMWATER SOLUTIONS

Typical Structural Solutions	**Reduce Flooding**	**Reduce Channel Erosion**	**Improve Water Quality**
Public Education	✓		✓
Improved Drainage Facility Maintenance	✓	✓	✓
Maintain Stream Vegetation and Natural Wetlands	✓	✓	
Regulation Enforcement		✓	✓
Ordinances (Clearing, Grading, Site Drainage Plan Requirements, and Maintenance)	✓	✓	✓
Revegetation		✓	✓
Coordination with Adjacent Jurisdictions	✓	✓	✓

TABLE VII-3

RESULTS OF HYDRAULIC ANALYSIS FOR VARIOUS PIPE SYSTEMS CITY OF MOUNT VERNON

Pipe System along Stanford between Division and Fir Streets LS15				
Pipe No.	**Capacity (cfs)**	**10-Year Flow (cfs)**	**Existing Diameter**	**Required Diameter**
1	2.13	32.15	18 CMP	36 CP
2	2.79	32.15	18 CMP	36 CP
3	6.92	32.15	18 CMP	36 CP
4	9.99	32.15	18 CMP	24 HDPE
5	5.57	32.15	15 CMP	24 HDPE
6	5.00	32.15	15 CMP	24 HDPE
7	5.93	32.15	15 CMP	24 HDPE
8	5.76	32.15	15 CMP	24 HDPE
9	5.80	32.15	15 CMP	24 HDPE
10	5.58	32.15	15 CMP	24 HDPE
11	22.66	42.90	24 CMP	24 HDPE[1]
12	19.37	42.90	24 CMP	24 HDPE[1]
13	12.38	42.90	24 CMP	30 HDPE
14	32.41	42.90	24 CMP/CP	24 HDPE[1]
15	45.72	42.90	24 CP	OK
16	20.35	42.90	21 CP	30 CP
17	16.72	42.90	18 CP	30 CP
Culvert and Ditch System between Britt Slough and Blackburn Road near Walter Street LS25				
Pipe No.	**Capacity (cfs)**	**10-Year Flow (cfs)**	**Existing Diameter**	**Required Diameter**
1	16.16	22.40	36 CMP	36 CP
2	5.71	22.40	21 CP	36 CP
3	129.75	22.40	Ditch	OK
4	19.79	22.40	36 CMP	30 CP
5	20.44	22.40	36 CMP	30 CP
Pipe System along Fox Hill Street LS26				
Pipe No.	**Capacity (cfs)**	**10-Year Flow (cfs)**	**Existing Diameter**	**Required Diameter**
1	59.2	41.50	42 CMP	OK
2	111.13	41.50	48 CMP	OK
3	16.63	41.50	30 CMP	36 CP
4	15.39	41.50	30 CMP	36 CP
5	16.63	41.50	30 CMP	36 CP
6	21.08	41.50	30 CMP	36 CP
7	6.07	41.50	30 CMP	36 CP
Pipe System under I-5 South of Blackburn LS27				
Pipe No.	**Capacity (cfs)**	**10-Year Flow (cfs)**	**Existing Diameter**	**Required Diameter**
1	11.11	11.00	30 CMP	OK
2	0.00[2]	13.18	30 CMP	24 HDPE[1]
3	7.37	13.18	30 CMP	30 CP[1]

NOTES: CP — Concrete Pipe
CMP — Corrugated Metal Pipe
HDPE — Smooth-lined Corrugated HDPE Pipe

[1] Smoother pipe material will accommodate additional flow.

[2] Existing pipe set at reverse grade.

PUBLIC EDUCATION PROGRAMS

General

Clean Water Community (Steilacoom)
Purpose: Educate community in water quality issues
Methods:
1) Development of a "Puget Sound Promoter" theme with various activities to encourage participation
2) Water quality presentations in schools
3) Student monitoring of local waters
4) County declaration of Puget Sound Promoter Week
5) Distribution and collection of pledge cards endorsing water quality

Clean Water Action Committee (North Mason Community)
Purpose: Build community support for the addition of the water quality element to the Mason County Comprehensive Plan
Methods:
1) Brochures to increase awareness
2) Developing water quality element of comprehensive plan based upon community recommendations
3) Increase general awareness about water quality using information gathering technique called "sondeo"

Water in Whatcom County
Purpose: Broaden community involvement in watershed issues
Methods:
1) Developing educational materials
2) Establishing network for disseminating information
3) Promoting watershed related events

Opportunities for Public Involvement
Purpose: Increase public awareness of importance of watershed in involving citizens in developing watershed plans
Methods:
1) Public awareness meetings
2) Training for citizen advisory committees
3) Involvement of boy scouts in cleaning up stormwater detention ponds
4) Establishment of an Adopt-a-Wetlands program

Puget Sound Project
Purpose: Give educators a program focusing on the science an social issues that will determine the future of Puget Sound and to use that program as a basis for public outreach
Methods:
1) Developing curricula on Puget Sound for elementary, middle, junior, and senior high students

Public Service Announcements for Radio
Purpose: Increase public awareness of water quality issues and positive steps listeners may follow to improve water quality
Methods:
1) Development of 18 - 30 second public service announcements

Rainy Days Festival: The Problem of Stormwater Runoff (Federal Way)
Purpose: Inform residents of the damaging effect of stormwater runoff on Puget Sound and about remedies to correct the problem
Method:
1) Junior high school science students developing a video tape and fact sheet

School Stormwater Education Project (Roosevelt)
Purpose: Increase household and small business awareness about how their activities affect stormwater runoff and what they can do to reduce pollution
Method:
1) A year long curriculum for students including classroom, field, and community activities

Household Hazardous Waste

Household Hazardous Waste Collection
Purpose: To give households a safe way to dispose of hazardous waste
Method:
1) Collection events (e.g., 3 per year)
2) Public notice (advertising) events, flyers, newspaper, etc.

C.A.R. (change and Recycle) Oil Committee
Purpose: Encourage proper disposal of oil for the do-it-yourself oil changer
Methods:
1) Establishment of Committee consisting of representatives of auto supply stores and related businesses
2) Video to help train staff at these stores to encourage oil recycling when they sell oil
3) Brochure explaining consequences of improper disposal and identifying locations for proper disposal

Hazard Free Community
Purpose: Decrease household use of hazardous materials and increase knowledge of alternative materials
Methods:
1) Get households and businesses to sign Hazard Free Community Pledges
2) Recruit and train 50 community volunteers to be actively involved in the project
3) Distribute information to all students in area

Oil Recycling Project
Purpose: Increase proper disposal of oil by do-it-yourself auto oil changers
Methods:
1) Bring together high school students enrolled in science, vocational marketing, and graphics to market a product (the Gott Drain Tainer) which makes it easy for car owners to properly dispose of oil

Wetlands

Wetlands Awareness (for Mercer Slough)
Purpose: Involve community in protecting wetlands (Mercer Slough)
Methods:
1) Development of interpretive trail and canoe tour
2) Wetland clean-up day
3) Stream and wildlife enhancement projects
4) Training of park naturalist in water quality issues
5) Environmental studies by Bellevue Community College students

Wetlands Public Education Program (San Juan Islands)
Purpose: To demonstrate the value of wetlands
Methods:
1) Coordination with planning department
2) Contacting wetland owners to inform them of protective measures
3) Booth at fair emphasizing value of wetlands

Water Resources Poster
Purpose: Increase a community's awareness of its largest wetland and other resources
Method:
1) Inventory of Wetland and Creeks
2) Design of poster (map, text, and photos)
3) Evaluation survey
4) Distribution of survey and poster

Small Businesses

Waste Information Network
Purpose: To reduce amount of hazardous waste produced and/or improperly disposed of by small businesses
Method: 1) Gain support/assistance from trade associations
2) Staging a waste information network trade fair
3) Informational brochures on waste disposal

Waste Management for Auto Shops
Purpose: To show people in auto shops what to do with hazardous waste
Method: 1) Workshops/trade fair on waste disposal
2) Hazardous waste turn-in day at local treatment facility
3) Poster campaign aimed a auto shop employees

Team Consultations for Small Businesses
Purpose: Increase pollution prevention from small businesses
Methods: 1) Formation and training of industry/agency consultation teams to address pollution control faced by small businesses
2) Team Consultations conducted for small business requesting consultation
3) Development of a resource guide containing compliance expectations, pollution prevention suggestions, and listing resource contacts.

Hazardous Waste Management Assistance
Purpose: Inform area dry cleaners of proper pollution control
Methods: 1) One on one consultations with dry cleaner operators informing them of costs associated with improper disposal and of the benefits of proper disposal

Painting Contractor Education
Purpose: Inform paint contractors of proper disposal and waste reduction
Methods: 1) Brochure, posture, and live telephone information shall be used to communicate information
2) Information shall be disseminated through local paint suppliers

Water Quality Monitoring

Water Quality Monitoring Project
Purpose: Train students to perform scientific investigation of water quality in Green River that will be used by regulatory bodies
Methods: 1) Selecting teachers to devote class time to technical training
2) Using college science students to teach testing techniques

Volunteer Monitoring Program (Stilliguamish River)
Purpose: Involve diverse groups of citizens in collecting baseline data on water quality
Methods: 1) Designating 13 sites for sampling over 7 month period
2) Recruiting, training, and coordinating students, trout fisherman, tribal members, and environmentalist in water quality monitoring techniques and related issues

Construction/Erosion Practices

Water Quality and Construction Practices
Purpose: Encourage contractors to understand construction related impacts to water quality
Method: 1) Bring together contractors and discuss problems/solutions (seminars)
2) Distributing information to contractors
3) Compile regulations which apply to contractors

Streams

Stream Enhancement Newsletter
Purpose: To communicate the details of successful stream enhancement projects
Methods: 1) Publication of a quarterly newsletter

Stream Team Program (City of Bellevue)
Purpose: Involve people in caring for their neighborhood stream and to provide data on those streams to regulatory agencies
Methods: 1) Creating stream teams for specific areas
2) Workshops training volunteers to observe, gather data, and enhance streams
3) Public information campaign, city mailings, local media, and presentations to community groups

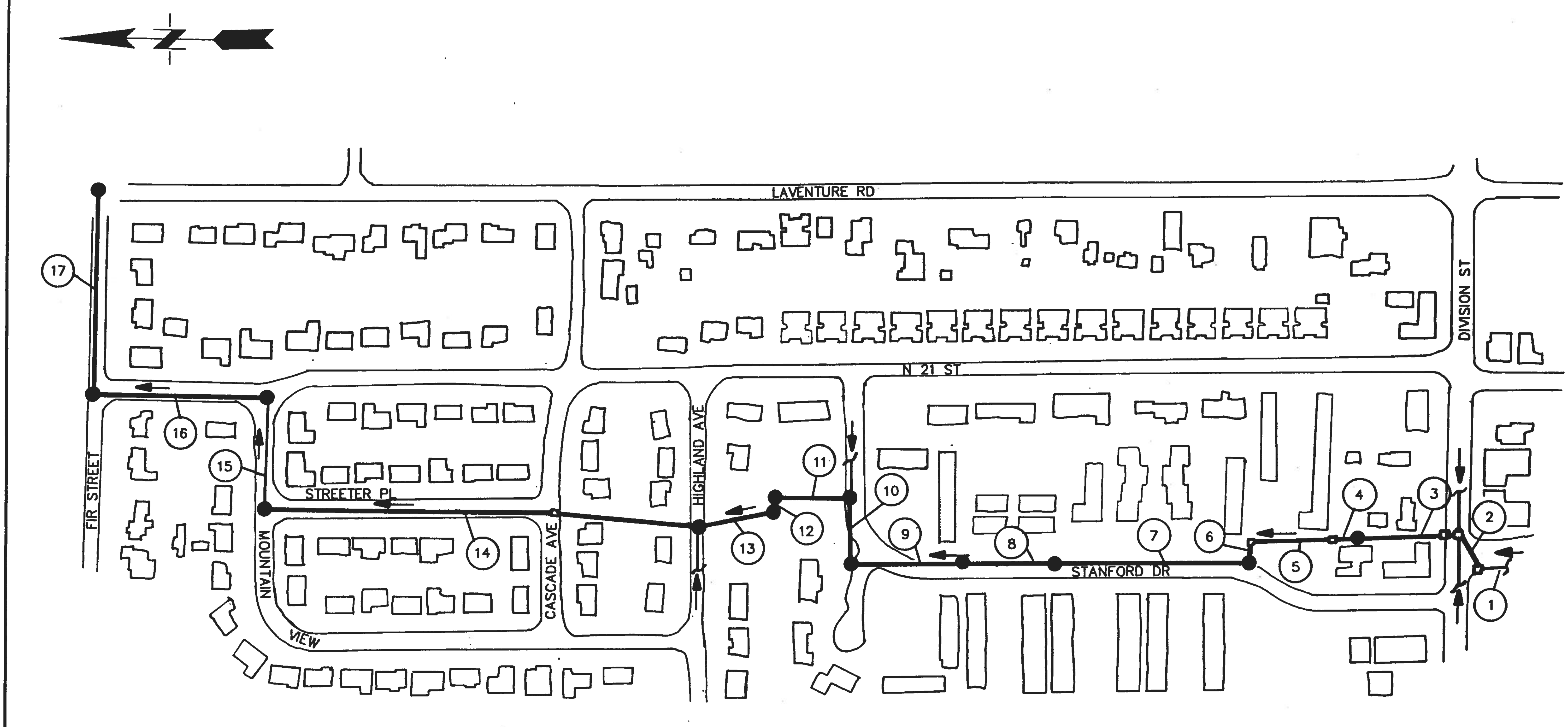
Blackjack Creek Brochure
Purpose: Increase awareness of the value of Blackjack Creek which was one of the few remaining salmon spawning stream in the City of Port Orchard
Methods: 1) Development/distribution of information brochure
2) Boy scouts stencilling storm drains to discourage dumping of oil

Miscellaneous

Horse Waste and Land Management Education
Purpose: Teach horse owners methods of waste and pasture management
Method: 1) Producing/distributing information about environmentally responsible methods for keeping horses

SOUND Gardening, SOUND Farming
Purpose: Educate gardeners and small farmers about the effects of their activities on water quality
Methods: 1) Developing instructional materials to be used in the ongoing Master Gardener and Seattle Food Gardener programs
2) Training and sending volunteers to educate proper gardening practices
3) Conference on better farming practices
4) Newsletter on water quality tips for farmers

J.M. K:\MAA07\MAA07001 9-27-93 @ 08:52



KEY

- PIPE TO BE REPLACED
- EXISTING PIPE TO REMAIN
- DITCH / STREAM
- MANHOLES
- CATCH BASINS
- ③ PIPE REPLACEMENT REFERENCE NUMBER, SEE TABLE VII-1

FIGURE VII-1

CITY OF MOUNT VERNON

SURFACE WATER MANAGEMENT PLAN

PROBLEM LS15 SOLUTION

R·W·BECK

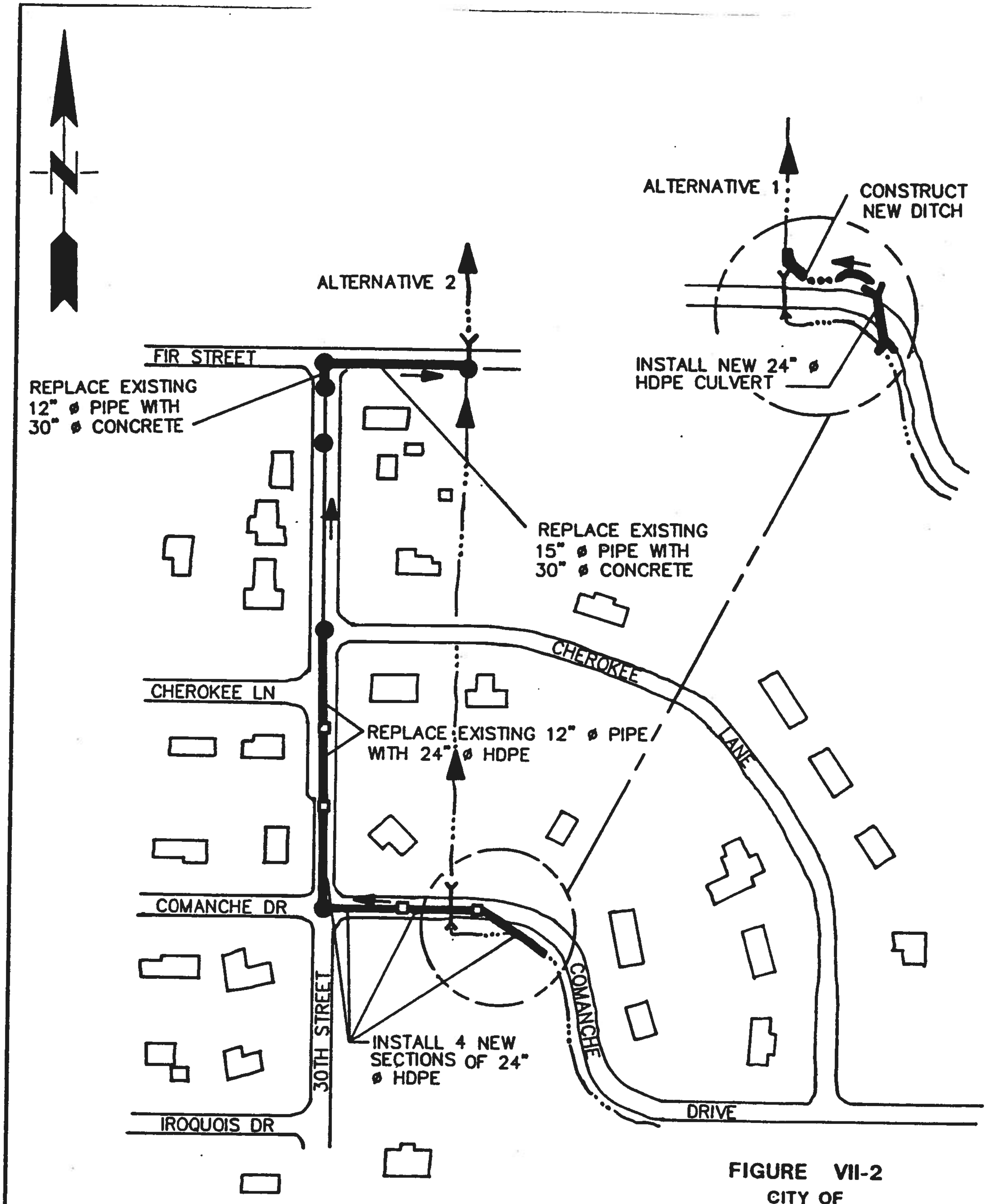


FIGURE VII-2

CITY OF MOUNT VERNON

SURFACE WATER MANAGEMENT PLAN

PROBLEM LS17 SOLUTION

R·W·BECK

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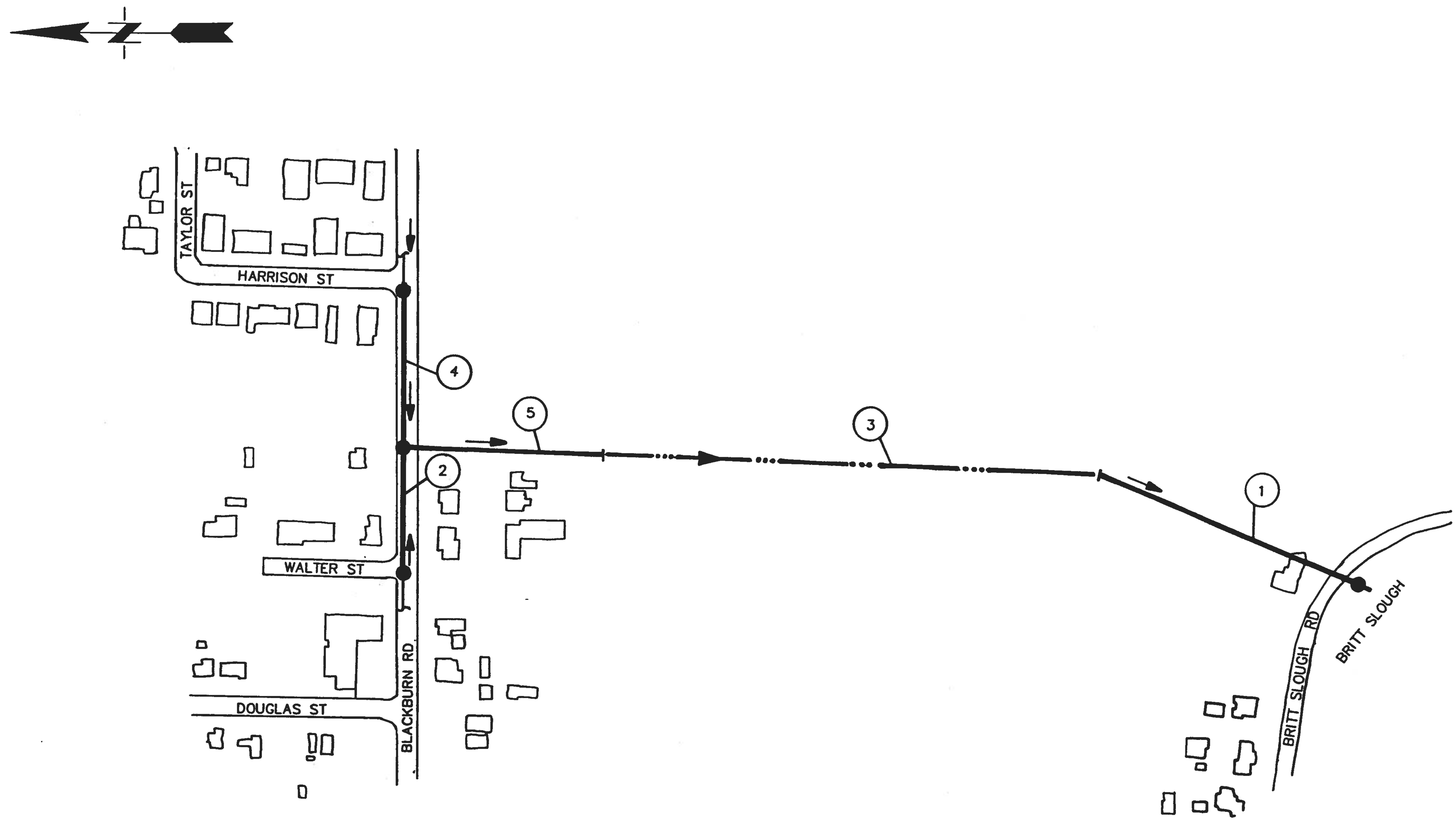

KEY

- PIPE TO BE REPLACED
- EXISTING PIPE TO REMAIN
- DITCH / STREAM
- MANHOLES
- CATCH BASINS
- (3) PIPE REPLACEMENT REFERENCE NUMBER, SEE TABLE VII-1

FIGURE VII-3
CITY OF
MOUNT VERNON
SURFACE WATER
MANAGEMENT PLAN
PROBLEM LS25
SOLUTION

R·W·BECK

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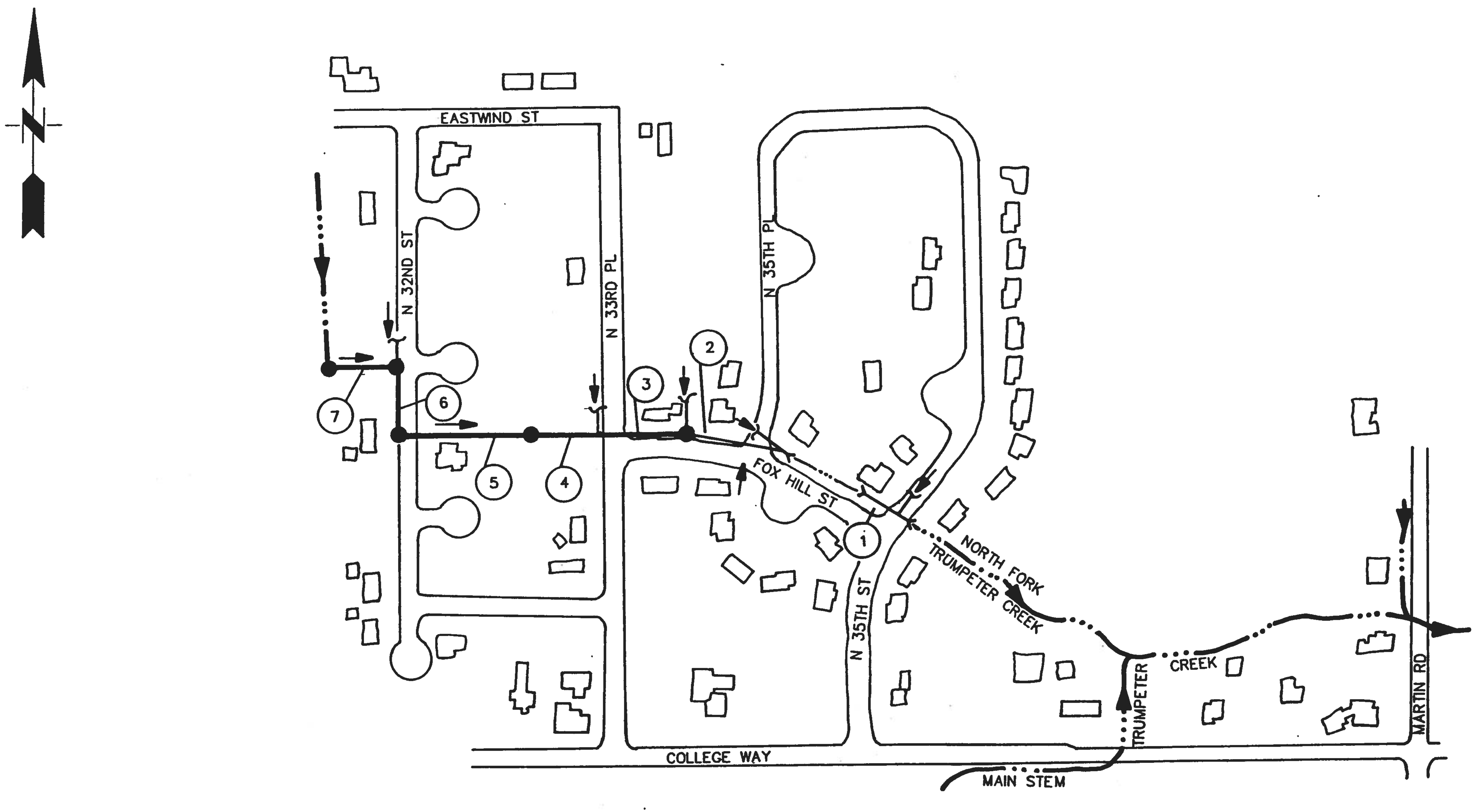

KEY

- PIPE TO BE REPLACED
- EXISTING PIPE TO REMAIN
- DITCH / STREAM
- MANHOLES
- CATCH BASINS
- (3) PIPE REPLACEMENT REFERENCE NUMBER, SEE TABLE VII-1

FIGURE VII-4
CITY OF
MOUNT VERNON
SURFACE WATER
MANAGEMENT PLAN
PROBLEM LS26
SOLUTION

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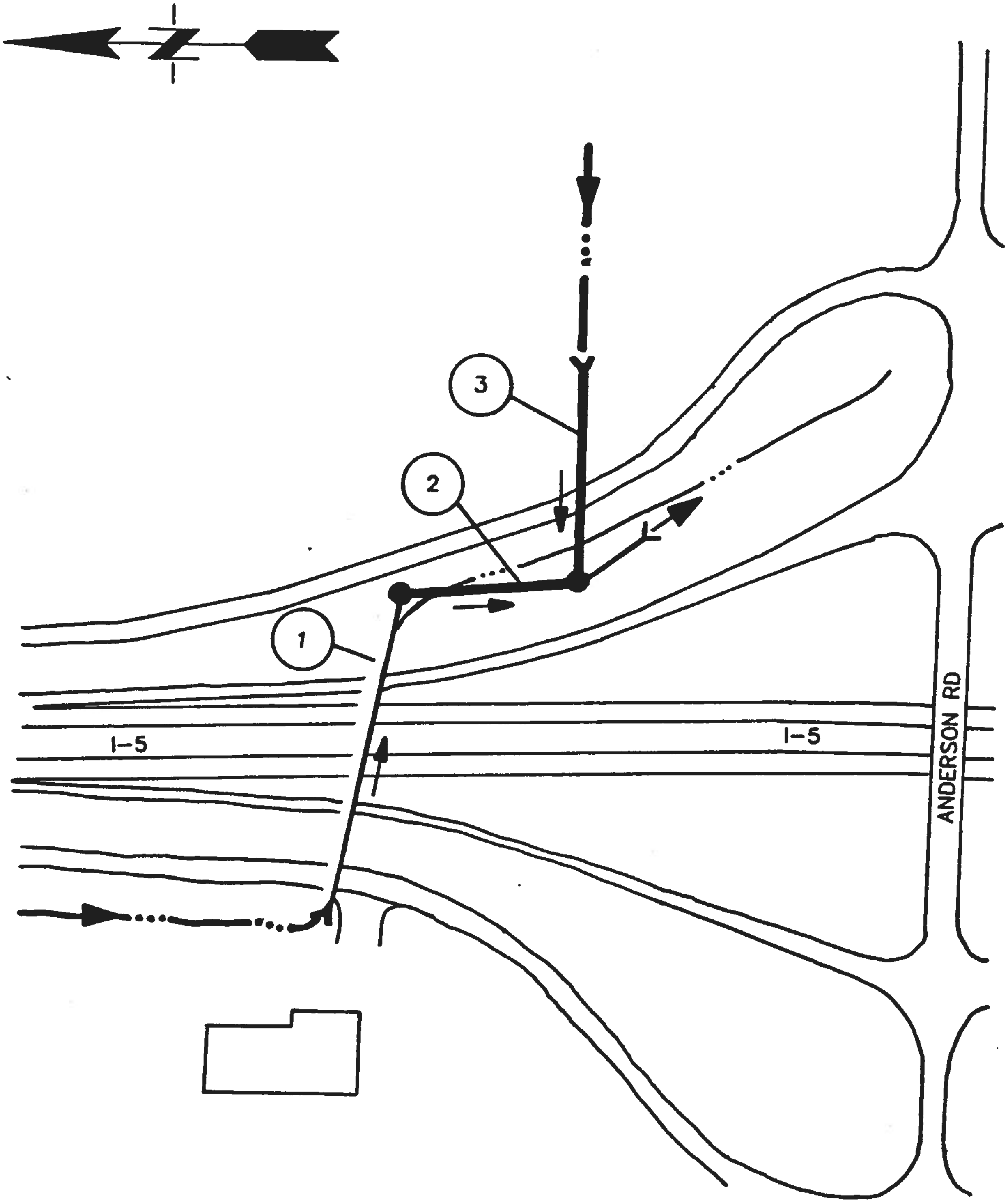

KEY

- PIPE TO BE REPLACED
- EXISTING PIPE TO REMAIN
- DITCH / STREAM
- MANHOLES
- CATCH BASINS
- 3 PIPE REPLACEMENT REFERENCE NUMBER, SEE TABLE VII-1

FIGURE VII-5
CITY OF
MOUNT VERNON
SURFACE WATER
MANAGEMENT PLAN
PROBLEM LS27
SOLUTION

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SECTION VIII
MAINTENANCE AND OPERATIONS

R·W·BECK

SECTION VIII

Maintenance and Operations

A. General

The objective of a surface water maintenance and operations program is to assure the reliability and dependability of the surface water infrastructure including, but not limited to, catch basins, pipe networks, detention basins, and open ditches. Such a program is designed to minimize life-cycle costs, protect the lives and property of the residents living in the affected watershed, and enhance water quality.

Too often, a "fix it when it's broken" philosophy prevails. In the long term, this approach will cost far more than ongoing maintenance. Maintenance management programs include analysis of the frequencies and levels of maintenance required to ensure reliability and achieve the lowest life-cycle cost.

Findings are presented in Part B of this section and recommendations are provided in Part C. A typical maintenance management program is described in Part D. Recommended elements of a surface water maintenance management program for the City of Mount Vernon are identified in Part E. This subsection includes an inventory of facilities, maintenance frequencies, optimal crew configurations, equipment requirements, and performance standards. Staffing and equipment budget estimates are presented in Part F. Section G contains a brief discussion regarding maintenance management software.

The surface water program described in this section of the report uses generally accepted maintenance practices and planning standards. All data are based on best available estimates.

B. Findings

The City of Mount Vernon is making commendable efforts to maintain its surface water infrastructure, especially given that the City does not have a dedicated surface water maintenance crew. For instance, the City has implemented a comprehensive street cleaning program. All downtown streets and most arterials are cleaned daily, curb residential streets are cleaned every three weeks, and non-curb residential streets are cleaned every two months. Another example is the City's curb inlet cleaning program. Twice a year three two-person crews clean all curb inlets over a three day period.

However, the City has experienced water quality and quantity problems, which are especially apparent during heavy rain storms. A comprehensive maintenance program will help to alleviate some of the problems.

C. Recommendations

Four primary changes to the current surface water maintenance program are recommended. First, increase the maintenance frequencies for cleaning catch basins and manholes from once a year to once every eight months. This is an effective way to improve both water quality and water quantity carrying capacity. By cleaning these surface water collection facilities more frequently, sediments and accompanying contaminants will be removed from the surface water system. This will reduce both the level of contaminants in the water and the amount of sediments inhibiting the flow of water.

Second, decrease the maintenance frequency of downtown streets and arterials from once every day to once every week. Although it is commendable that the City is cleaning all downtown streets and arterials every day, once a week is more consistent with what is performed by other jurisdictions and will result in more efficient use of human resources.

Third, in accordance with recommendations in other sections of this plan to convert dirt ditches to grass swales, focus maintenance activities for these facilities on vegetation control and trash removal and away from sediment removal, especially removal that involves a backhoe. Backhoe operation can be extremely intrusive to a swale. Operation of a backhoe in a swale should be limited to removing pockets of sedimentation, such as those that form near culvert openings. Extensive reshaping of swales should be performed with a ditchmaster.

Fourth, incorporate inspections into maintenance activities. For example, prior to sending out a vactor crew to clean catch basins in an area of the City, conduct an inspection of the catch basins in the area to determine which need cleaning and which do not. This will ultimately save time since catch basin cleaning can be much more efficiently accomplished if catch basins that require cleaning have been identified in advance. This approach can be applied to the maintenance of all surface water facilities. It will also facilitate development of a condition and maintenance history of the facilities if the inspections are used to indicate condition and date of maintenance activity.

As part of an inspection program, utilize indicators to determine when maintenance is necessary. The following conditions indicate the need for maintenance:

- Pipes — accumulated sediment exceeds 20 percent of the pipe diameter.
- Catch basins — accumulated sediment exceeds 35 percent of basin capacity.
- Detention basins — accumulated sediment exceeds 10 percent of the design forebay/basin depth and unmowed grass/ground cover exceeds 18 inches.
- Detention pipes — accumulated sediment exceeds 10 percent of pipe diameter for 1/2 length of the pipe or exceeds 15 percent of pipe diameter at any point.
- Biofiltration swale — accumulated sediment inhibits healthy grass cover.

In order for the City's surface water system to function properly, the Recommended Surface Water Maintenance Program presented in Part E of this section, which reflects the above recommendations, should be followed. Implementation of this program, along with the recommended capital improvements will improve the performance of the surface water infrastructure. The maintenance program described in Table VIII-6 will require an estimated annual budget of $195,300 and approximately three full-time persons, along with a one-time purchase of additional equipment needed to support new maintenance activities at a cost of approximately $20,000. Table VIII-1, Annual Maintenance Costs, illustrates the distribution of maintenance costs for the major components of the surface water system, based on the recommended program described in Part E.

Current surface water maintenance activities are performed by street maintenance crews. Approximately one full-time equivalent of surface water maintenance service is realized by the combined efforts of several street crews. Achieving the workload required by the recommended surface water maintenance program will necessitate two additional surface water maintenance workers, which will bring surface water maintenance resources to three full-time equivalents.

The recommended surface water maintenance program places significant additional demands on the City's vactor, which is shared by the Sewer and Street departments. This piece of equipment is currently used primarily by the Sewer Department. The Sewer and Street departments will need to continue to work closely to coordinate the shared use of the vactor, given the increased demands on this vital piece of equipment. Over the next two years, when additional surface water maintenance personnel have been acquired and increased levels of service begin, the City should conduct an overall Sewer and Street department utilization assessment to determine if additional equipment is necessary. If the vactor cannot be shared to the extent that it is needed, a reduced level of service over what is proposed may be necessary until an additional vactor is obtained.

Table VIII-1
Annual Maintenance Costs

Structure	Maintenance Cost	Percent of Total Cost
Pipes	$ 37,500	19%
Catch Basins	$ 37,400	19%
Streets	$ 46,400	24%
Roadside Ditches	$ 22,100	11%
Manholes	$ 15,600	8%
Detention Basins	$ 19,700	10%
Pump Stations	$ 9,400	5%
Curb Inlets	$ 7,200	4%
Total	$195,300	100%

D. Typical Maintenance Management Program

A maintenance management program is a set of policies, procedures, and management tools for planning, organizing, directing, and controlling maintenance activities. Maintenance management is not a "speed up the work," highly controlled, punitive approach to work, but rather a system of "working smarter."

A typical maintenance management program, shown in schematic form in Figure VIII-1, Maintenance Management Program Development Process, consists of six basic modules: (1) inventory of facilities, (2) needs assessment, (3) optimal crew configurations, (4) planning factors, (5) schedule and resource allocation, and (6) reporting and control. These modules are described in more detail below.

1. Inventory of Facilities

An inventory is a complete record of all physical facilities that are maintained. This inventory should document the number, condition, and locations of each facility. A procedure for keeping the inventory current is critical.

2. Needs Assessment

Assessing needs (i.e., determining which facilities need how much maintenance, of what type, and why) is the initial step in a comprehensive maintenance management program. This module consists of several components, each of which assist in answering those questions. These components include:

a. Condition Assessment. Closely connected to the facilities inventory is the condition assessment. Some form of rating scale must be established for describing the condition of each type of facility that is maintained. A procedure is needed to describe the methods for evaluating and recording the condition of each facility. Like the inventory, the condition needs to be updated regularly.

b. Level of Service. Level of service goals or standards identify the conditions that necessitate maintenance (e.g., sedimentation exceeding 20 percent of pipe diameter or 35–50 percent of catch basin capacity as measured by depth).

c. Frequencies. Frequencies identify how often maintenance activities must be performed if the program is to achieve the desired level of service.

3. Optimal Crew Configurations

Optimal crew configurations are based on the accepted fact that for every activity, there is a combination of resources that results in the most efficient performance of work. Thus, optimal crew configurations are the compilation of the number and skills of people, the types of equipment, and the kinds and amounts of materials required to perform a task most efficiently.

4. Planning Factors

Inventorying needs, converting those needs to long- and short-term work plans, scheduling, and assigning individual work projects are all ingredients of the single most important aspect of effective maintenance management, which is planning. To engage in these planning activities, to "work smarter", it is necessary to establish planning tools.

Planning factors are those identifiers, measurement units, and standards that are necessary for planning and budgeting maintenance activities and reporting actual versus planned costs and performance. Planning factors include a list of all tasks and activities performed by the municipality and charts of accounts, output measures, and performance standards for each task or activity.

a. Chart of Accounts. A chart of accounts is a list by task code of all tasks or activities for which the municipality needs to plan and collect costs. As a general rule, a separate task code should be established for each activity.

b. Output Measures. Output measures are the appropriate units of measure for documenting production for each of the work tasks or activities contained within the chart of accounts. Examples of output measures include lineal feet, number of catch basins, and lane-miles.

c. Planning/Performance Standards. These standards are used to determine resource requirements as measures of efficiency. They are expressed in number of output units (e.g., numbers of catch basins cleaned) per unit of time (e.g., days).

5. Scheduling and Resource Allocation

In order to perform needed work activities at the appropriate time, a program for prioritizing work needs to be established. Given established priorities, a long-term work plan and budget can be developed to make the most efficient use of available resources. Once a long-term plan is completed, short-term scheduling facilitates the actual performance of maintenance activities.

a. Priorities. Priorities represent the relative importance of maintaining each type of facility and, therefore, conducting each type of maintenance activity. Priorities are used in preparing both long- and short-term work plans and schedules.

b. Annual Work Plans and Budgets. Annual work plans and budgets identify the types and locations of maintenance work to be performed during the coming year. The work plan is derived by scheduling work to be performed during the year over quarterly, monthly, or seasonal periods, in order of priority. Attention is given to 1) spreading the workload throughout the time period (i.e., resource leveling), and 2) preparing the work program in light of resource constraints (e.g., budget limitations).

The work that needs to be performed is determined by applying the desired level of service or frequencies to the inventory of physical facilities. In developing the work plan, consideration must also be given to emerging or unexpected needs, complaint response, non-project loss factors such as vacations, holidays, and sick leave, as well as requirements for replacements and improvements.

Cost estimates for work included in the proposed annual work plan are computed by applying optimal crew configurations and planning standards to the quantity of work to be performed to determine the crew-hours, various skill types, and equipment required. The cost of the necessary resources can then be computed by applying wage rates and equipment rental rates. Material costs for budgeting purposes also need to be determined, using estimated or historical data.

c. Short-term Work Plans and Schedules. Short-term work plans and schedules are the means by which the work activities identified in the annual program are translated into actual work assignments in the field. The process of work planning and scheduling determines who will do the work, where it will be done, when it will be done, and how much will be done.

6. Reporting and Control

a. Reports. Work reporting is the critical feedback mechanism that enables the comparison of actual versus planned costs, production, and efficiency. Work reporting is necessary to provide deserved recognition for a job well done, develop a database that can be used for improved planning and maintenance management in future years, and monitor group performance in order to take corrective action as needed to bring actual and planned performance into conformance.

Work reporting should provide a timely and accurate flow of information with a minimum of paperwork. Variables include time, equipment hours, materials used, and units of production. Reporting encompasses a hierarchy of reports that provide the appropriate level of detail to each level of management.

b. Control. Control includes establishing clear accountability for specific results and for the resolution of problems or variances from plans. Consequently, it is necessary to establish thresholds which, when exceeded, will trigger corrective action on the part of the appropriate manager. Thresholds will vary in sensitivity depending on the level of detail contained in the report and level of management that is receiving the report. Exception reporting is useful for highlighting only those instances where thresholds have been exceeded.

Finally, control includes determining the cause of the variance, assigning the appropriate resources to take corrective action, and describing the nature of the corrective action. Corrective actions may include changing work practices or amending the original work plan.

E. Proposed Maintenance Management Program

1. Inventory of Facilities

With the assistance of the municipal staff, the consultant team identified the number of each type of facility included within the City of Mount Vernon's present surface water system that requires maintenance. This information is summarized in Table VIII-2, Existing Inventory Summary.

Table VIII-2
Existing Inventory Summary

Maintenance Item	Quantity	Measurement Unit
Catch Basins	1,500	Each
Manholes	250	Each
Curb Inlets	800	Each
Roadside Ditches	105,600	Feet
Pipes	264,000	Feet
Regional Detention Basins	5	Each
Streets	80	Miles
Detention Pipes	25	Each
On-site Detention Basins	30	Each

2. Needs Assessment

a. Condition assessment. If the maintenance frequencies recommended in this report are adhered to, it will not be necessary to conduct separate periodic condition assessments of the surface water facilities. The condition of facilities, such as catch basins, manholes, and pipes, should be recorded at the time maintenance is performed. A condition assessment scheme, or a common rating system, is recommended below. Four levels of criticality are suggested to prioritize maintenance needs for each type of surface water facility.

(1) Maintenance Needed Immediately — Failure to perform maintenance will threaten public health or safety or will result in imminent damage to other publicly-owned facilities or private property.

(2) Maintenance Needed Sooner Than Scheduled — Maintenance can be scheduled on a short-term basis but will be required before the following year's annual work plan is developed or before the regularly scheduled preventive maintenance for a particular facility or piece of equipment.

(3) Regularly Scheduled Maintenance Program — The regularly scheduled preventive maintenance activities will be sufficient.

(4) Maintenance Done Only When Unused Resources Are Available — Maintenance should be performed only after the above three categories of maintenance requirements have been accomplished.

b. Level of Service. Desired levels of service have been established with staff and are expressed in terms of maintenance frequencies.

c. Frequencies. As stated above, the levels of service for surface water facilities have been established in terms of maintenance frequencies. These frequencies are the time intervals for performing recurring maintenance in order to realize the desired level of service. Average annual frequencies appear in Table VIII-3, Maintenance Frequencies.

Table VIII-3
Maintenance Frequencies

	Activity	Recommended Frequency
1	Clean Catch Basins	1.50 times/year
2	Clean Manholes	1.50 times/year
3	Clean Curb Inlets	2.00 times/year
4	Roadside Ditches (Remove sediments)	0.20 times/year
5	Roadside Ditches (Vegetation control)	2.00 times/year
6	Clean Pipes	0.33 times/year
7	Detention Basins (Vegetation Control)	1.00 times/year
8	Detention Basins (Remove Sediments)	0.33 times/year
9	Clean Streets	See Table VIII-6
10	Clean Detention Pipes	1.00 times/year
11	Pump Station Maintenance	See Table VIII-6

3. Optimal Crew Configurations

As a part of the maintenance management program development effort, optimal crew configurations were established for the City of Mount Vernon. These optimal configurations, assumed to be the most efficient complement of labor and equipment to perform each of the tasks, appear in Table VIII-4, Optimal Crew Configurations.

Table VIII-4
Optimal Crew Configurations

	Activity	Recommended Crew Configurations
1	Clean Catch Basins	2 Maintenance Workers 1 Vactor
2	Clean Manholes	2 Maintenance Workers 1 Vactor
3	Clean Inlets	6 Maintenance Workers 3 1 Ton Trucks
4	Roadside Ditches (Clean, reshape, remove sediments)	3 Maintenance Workers 1 Backhoe, 2 Dumptrucks
5	Roadside Ditches (Vegetation control)	1 Maintenance Worker 1 Mower
6	Detention Basins (Vegetation Control)	1 Maintenance Worker 1 Mower
7	Detention Basins (Remove Sediments)	2 Maintenance Workers 1 Backhoe, 1 Dumptruck
8	Clean Streets	1 Maintenance Worker 1 Street Sweeper
9	Clean Detention Pipes	2 Maintenance Workers 1 Vactor
10	Pump Station Maintenance	Work to continue to be performed by Sewer Department

4. <u>Planning Factors</u>

   a. <u>Chart of accounts</u>. The surface water maintenance program should include the 10 surface water activities identified in Table VIII-4.

   b. <u>Output Measures</u>. As a part of the development of this surface water maintenance program, measurement units were identified for each of the activities. These output measures, which appear in Table VIII-2, are used to document the amount of activity or production. They also allow for the identification of unit costs, which are the costs of labor, equipment, and materials associated with one unit of production. This information is used for planning, budgeting, scheduling, and reporting actual accomplishment.

   c. <u>Planning/Performance Standards</u>. Planning/performance standards are expressed in terms of an average or reasonable amount of daily crew accomplishment. Standards recommended for the City of Mount Vernon are provided in Table VIII-5, Planning/Performance Standards.

Table VIII-5
Planning/Performance Standards

	Activity	Recommended Standard
1	Clean Catch Basins	30 per day
2	Clean Manholes	12 per day
3	Clean Inlets	266 per day
4	Roadside Ditches (Remove sediments)	750 lf/day
5	Roadside Ditches (Vegetation Control)	2500 lf/day
6	Clean Pipes	See Table VIII-6
7	Regional Detention Basins (Veg. Control)	1 per day
8	Regional Detention Basins (Remove Sed.)	1 per day
9	Clean Streets	See Table VIII-6
10	Clean Detention Pipes	2 per day
11	On-site Detention Basins (Veg. Control)	2 per day
12	On-site Detention Basins (Remove Sed.)	2 per day

The above performance standards are consistent with those standards used by other comparable municipalities. In the consultant's opinion, these represent a reasonable starting point. These standards should be reviewed at least annually, and refined as historical daily production data become available.

5. Scheduling and Resource Allocation

a. Priorities. While a maintenance management program is designed to ensure that all facilities will receive the appropriate level of maintenance, the reality is that this may not always be possible, due to emergencies, weather, inadequate resources, etc. Consequently, there is a need to establish relative priorities for various types of facilities and associated deficiencies. Under Needs Assessment, a general prioritization scheme was suggested. This scheme should be used to prioritize the need for certain types of maintenance activities on specific facilities.

b. Annual Work Plans and Budget. An annual work plan displays the amount and type of work, when it should be performed, and anticipated costs. It is used to compare actual versus planned performance of the maintenance program. The annual work program is also used to develop short-term schedules.

To develop annual resource requirements and budget estimates for a surface water maintenance program, recommended annual maintenance requirements and the associated resources were documented. The proposed program appears in Table VIII-6, Recommended Surface Water Maintenance Program.

c. Short-term Work Plans and Schedules. Short-term (e.g., weekly or bi-weekly) schedules should be prepared by the maintenance supervisor. Schedules should be based on planned preventive maintenance activities, improvements or small works projects, and outstanding work orders generated from complaints, system failures, and emergency needs. Schedules should be approved by the appropriate supervisor and posted for the crew's information.

Weekly scheduling permits the flexibility to respond to:

- Unscheduled breakdowns and failures
- Weather
- Reduced resource availability due to vacation and sick leave
- Construction projects planned by private utilities and other City crews

Most importantly, the weekly schedule permits the supervisor to coordinate and plan in detail the resources, labor, and equipment needed to accomplish the proposed monthly work plan.

6. Reporting and Control

a. Reports. A cost and performance report by activity should be produced monthly, which provides both monthly and year-to-date data. By tracking labor hours, equipment hours, and production data, comparisons can be made of planned versus actual costs and performance. This will enable supervisors and management to identify and reconcile performance problems in a timely manner. The records of actual production and cost will also be valuable for developing an historical database that can be used to refine planning, scheduling, and budgeting.

b. Control. Management control is based on the establishment of clear accountability for specific results. Reporting provides the critical feedback mechanism that enables supervisors and managers to track accomplishment or results as compared with the approved plan. Through this exercise, performance problems and deviations from the plan can be identified early on. This allows supervisors and managers to complete the control cycle by identifying causes for unacceptable production and taking action to either solve the problem or revise the plan.

Table VIII-6

City of Mount Vernon
Recommended Surface Water Maintenance Program

Item No.	Maintenance Activity	Units to be Maint.	Prod. Unit	Freq. (times/ year)	Daily Prod.	Crew Size	Equipment	Annual Crew Days	Full-time Equip. Equiv.	Annual Person Days	Full-time Labor Equiv.	Annual Labor Cost	Annual Equipment Cost	Total Cost	Percent of Program
1	Clean Catch Basins	1,500	EA	1.50	30.00	2	1 Vactor	75.00	0.34	150.00	0.68	$28,462.91	$8,947.88	$37,410.78	19.15
2	Clean Manholes	250	EA	1.50	12.00	2	1 Vactor	31.25	0.14	62.50	0.28	$11,859.55	$3,728.28	$15,587.83	7.98
3	Clean Curb Inlets	800	EA	2.00	266.00	6	3 Trucks	6.02	0.03	36.09	0.16	$6,848.22	$321.92	$7,170.14	3.67
4	Roadside Ditches Remove Sediments	70,400	LF	0.20	750.00	3	1 Backhoe 2 Dumptrucks	18.77	0.09	56.32	0.26	$10,686.87	$4,538.12	$15,224.99	7.79
5	Roadside Ditches Vegetation Control	35,200	LF	2.00	2,500.00	1	1 Mower	28.16	0.13	28.16	0.13	$5,343.44	$1,664.12	$7,007.55	3.59
6	Clean Pipes (18" dia. or less)	132,000	LF	0.33	1,500.00	2	1 Vactor 1 Truck	29.04	0.13	58.08	0.26	$11,020.84	$3,982.69	$15,003.53	7.68
7	Clean Pipes (over 18" dia.)	132,000	LF	0.33	1,000.00	2	1 Vactor 1 Truck	43.56	0.20	87.12	0.40	$16,531.26	$5,974.04	$22,505.29	11.52
8	Regional Detention Basins Veg. Control	5	EA	2.00	1.00	1	1 Mower	10.00	0.05	10.00	0.05	$1,897.53	$590.95	$2,488.48	1.27
9	Regional Detention Basins Remove Sed.	5	EA	0.33	1.00	2	1 Backhoe 1 Dumptruck	1.65	0.01	3.30	0.02	$626.18	$243.58	$869.77	0.45
10	Clean Streets Downtown/Arterials	16	MI	50.00	12.00	1	1 Street Sweeper	66.67	0.30	66.67	0.30	$12,650.18	$16,130.33	$28,780.52	14.73
11	Clean Streets Curb Residential	24	MI	15.00	14.00	1	1 Street Sweeper	25.71	0.12	25.71	0.12	$4,879.36	$6,221.70	$11,101.06	5.68
12	Clean Streets Non-Curb Residential	40	MI	6.00	16.00	1	1 Street Sweeper	15.00	0.07	15.00	0.07	$2,846.29	$3,629.33	$6,475.62	3.32
13	Clean Detention Pipes	25	RT	1.00	2.00	2	1 Vactor	12.50	0.06	25.00	0.11	$4,743.82	$1,491.31	$6,235.13	3.19
14	On-site Detention Basin Veg. Control	30	EA	2.00	2.00	1	1 Mower	30.00	0.14	30.00	0.14	$5,692.58	$1,772.85	$7,465.43	3.82
15	On-site Detention Basins Remove Sed.	30	EA	0.33	2.00	2	1 Backhoe 1 Dumptruck	4.95	0.02	9.90	0.05	$1,878.55	$730.75	$2,609.30	1.34
16	Pump Station Maintenance	5	EA	*	*	*	*	*	*	*	*	*	*	$9,400.00	4.81
17	Catch Basins Repair/Replace	1,500	EA	0.02	1.00	3	1 Dumptruck 1 Backhoe	0.00	0.00	0.00	0.00	$0.00	$0.00	$0.00	**

City of Mount Vernon
Recommended Surface Water Maintenance Program

Item No.	Maintenance Activity	Units to be Maint.	Prod. Unit	Freq. (times/ year)	Daily Prod.	Crew Size	Equipment	Annual Crew Days	Full-time Equip. Equiv.	Annual Person Days	Full-time Labor Equiv.	Annual Labor Cost	Annual Equipment Cost	Total Cost	Percent of Program
18	Manholes Repair/Replace	250	EA	0.02	3.00	3	1 Dumptruck 1 Backhoe	0.00	0.00	0.00	0.00	$0.00	$0.00	$0.00	**
19	Curb Inlets Repair/Replace	800	EA	0.02	3.00	3	1 Dumptruck 1 Backhoe	0.00	0.00	0.00	0.00	$0.00	$0.00	$0.00	**
20	Pipes Repair/Replace	264,000	LF	0.02	50.00	3	1 Dumptruck 1 Backhoe	0.00	0.00	0.00	0.00	$0.00	$0.00	$0.00	**
								398.28	1.81	663.85	3.02	$125,967.57	$59,967.84	$195,335.41	100.00

Assumptions			
Labor Costs (Maintenance Worker)		Equipment Costs	
Average cost per hour	$20.07	Vactor	$119.31/day
Regular Workday (hrs.)	8 hours	10 Yard Dump	$94.11/day
		Mower	$59.10/day
		Street Sweeper	$241.96/day
		1 Ton Truck	$17.84/day
		Backhoe	$53.52/day

* Pump stations are maintained by the Sewer Department.

** These costs are typically covered in street replacement programs.

F. Budget, Staffing, and Equipment Requirements

Proper maintenance of the surface water facilities requires adequate budget, staff, and equipment to support the desired level of service. Annual resource requirements and direct costs necessary to accomplish the recommended maintenance program for the City of Mount Vernon appear in Table VIII-7, Annual Budget, Staffing, and Equipment Requirements.

Table VIII-7
Annual Budget, Staffing and Equipment Requirements

	Person Days	Crew Days	Budget Estimate
Direct Labor	663.85		$126,000
Pump Station Maintenance			$ 9,400
Equipment			
Vactor		191.35	$ 22,800
10 Yard Dumptruck		44.14	$ 4,100
1 Ton Truck		90.66	$ 1,600
Backhoe		25.37	$ 1,400
Mower		68.16	$ 4,000
Street Sweeper		107.38	$ 26,000
Equipment Subtotal			$ 69,300
TOTAL			$195,300

If actual time is assumed to be 220 days per year or about 85 percent of available time, then 3.03 full-time equivalents are required to perform surface water maintenance activities. This is determined by dividing 663.85 person-days by 220 annual work days.

In order to facilitate the performance of some new maintenance activities such as cleaning manholes and mowing detention basins, the City will need additional equipment. Equipment acquisitions should include safety equipment for cleaning manholes and a mower and trailer for vegetation control of regional detention basins. Approximately $20,000 should be budgted for purchase of this equipment.

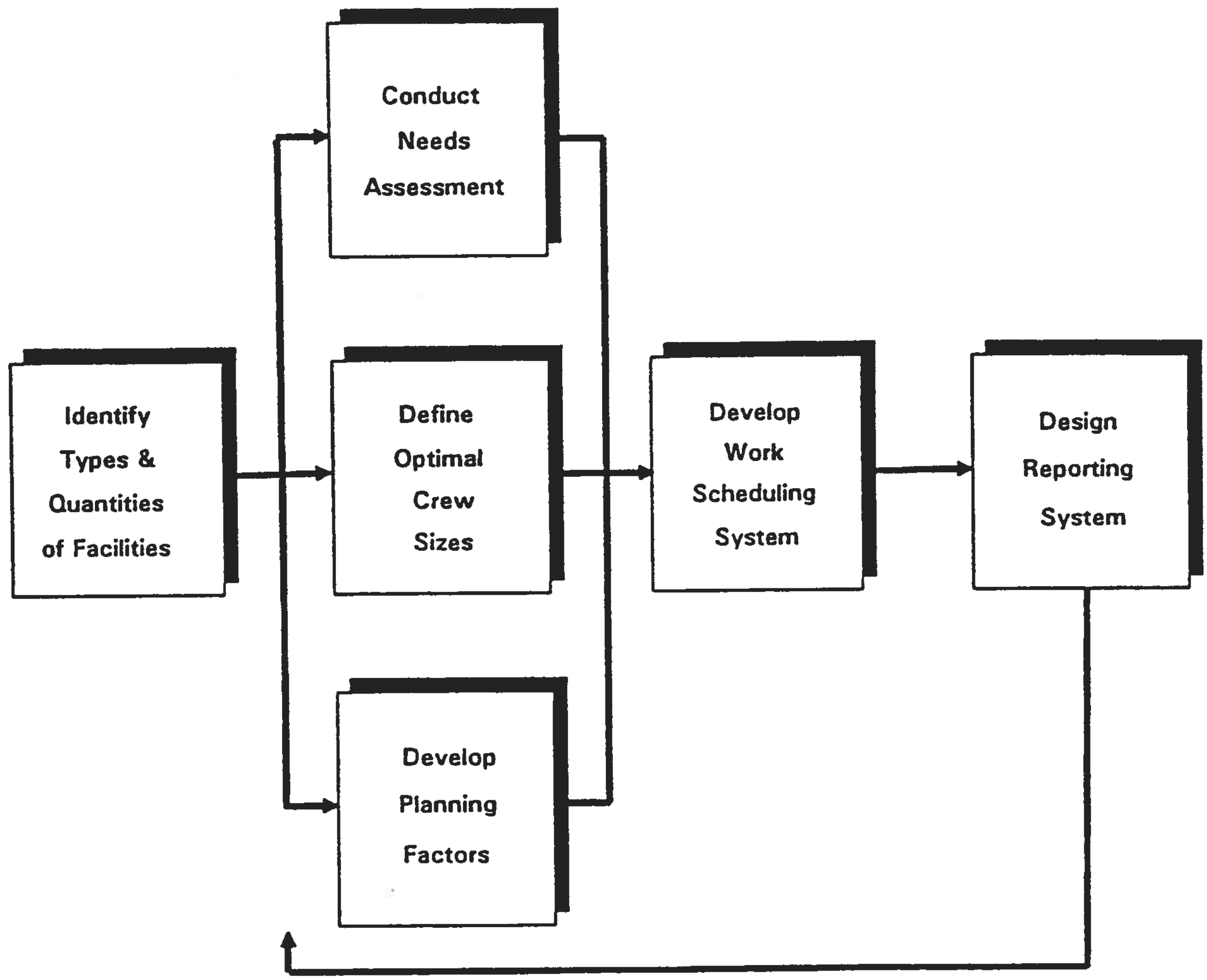
G. Maintenance Management Software

The ideal next step in establishing a Surface Water Maintenance Management Program is to automate the program. An automated program will support scheduling, tracking, reporting, and accomplishment of maintenance activities. Ideally, an automated maintenance program should be linked with other databases, such as a Geographic Information System. The reporting component of the program should be integrated with cost-accounting and financial reporting systems, so that performance and associated cost data is easily available in a useful format. Once maintenance standards are adopted, and planning, scheduling, and reporting procedures are in place, software can either be acquired or developed to meet data management requirements.

Software can be developed in-house or purchased through a vendor. Developing programs in-house using common database management software (e.g., DBASE, RBASE, and Paradox) is not recommended based upon the amount of time, effort, and knowledge necessary to develop an effective maintenance management program.

Vendor-supplied software can be acquired in two ways. First, software can be acquired by issuing a Request for Proposals (RFP) to develop a "custom" program. Second, software can be obtained by acquiring "off-the-shelf" packages. Custom developed programs can be time consuming and costly. Commercially available maintenance management software packages represent the most cost effective product.

Figure VIII-1
Maintenance Management Program Development Process



SECTION IX
FUNDING

R·W·BECK

SECTION IX

FUNDING

A. Background

1. Authority and Council Mandates

The financial portion of Mount Vernon's Surface Water Master Plan was considered critical in moving the engineering recommendations, water quality requirements and fish habitat recommendation from concept to reality. The City established a Citizen's Advisory Committee (CAC) to provide recommendations on the development of the Surface Water Management Plan, with specific emphasis on the funding program necessary to support implementation of the Plan. The stated goal for the Committee was to "ensure that the Surface Water Management Program, including financing alternatives, reflects the needs, priorities, and concerns of Mount Vernon's citizens and impacted organizations." The CAC members, meeting agendas, and meeting minutes are contained in Appendix D.

2. Process

Development of this financial program required the commitment of personnel from the City's Engineering Department, Street Department, Finance, and Building Inspection. Beyond these project team members were the persons who dedicated their time to participation on the Surface Water Citizen's Advisory Committee. These persons reviewed the analyses prepared by the Project Team and made recommendations to the Council. However, it was the Citizen's Committee who provided ongoing guidance to the Project Team in the design and implementation of the surface water financial program and ultimately the utility approach.

B. Surface Water Needs

Like many jurisdictions in the Northwest and throughout the country, surface water management in Mount Vernon has historically been considered a funding priority only after a major storm event. The 1990 floods and the management planning conducted as part of this project reemphasized the fact that surface water required an elevation of status supported by a dedicated and predictable funding source. This recognition is critical as Mount Vernon addresses not only surface water flooding issues and fish habitat, but also the water quality regulations from the Puget Sound Water Quality Authority and possible future federal requirements under the National Pollutant Discharge Elimination System (NPDES).

When evaluating Mount Vernon's management approach toward surface water, three functional areas have been addressed through this Plan. These focus on the technical, institutional and financial areas. A major milestone was passed when the City passed its Surface Water Utility Formation Ordinance in August in 1993 and the Surface Water Utility Rate Ordinance in November 1993. These ordinances will provide the financing to allow the City to undertake the institutional and technical issues necessary to implement a comprehensive surface water management program.

In order to implement the program, an assessment was made of Mount Vernon's current ability to support compliance with water quality nonpoint source regulations; maintain, repair and improve the City's overall surface water management system; and preserve, and possibly enhance, sensitive environmental resources. The Citizen's Committee reviewed the funding options available and concluded that the service charge represented a reasonable and equitable approach. Most surface water activities in Mount Vernon have been funded through piecemeal allocations from the City's General Fund, Street Fund or Sewer Fund. The Citizen's Committee agreed that given the magnitude of surface water flooding, water quality, and sensitive resource issues facing Mount Vernon, a dedicated funding source to surface water management needed to be given strong consideration. The idea of a utility approach toward funding surface water was considered to be the best option as the primary revenue source. Many if not most of the cities and counties in the Puget Sound area have implemented or are in the process of implementing a similar funding approach. The legal framework underlying development of this funding mechanism has long been established through Revised Code of Washington (RCW) 35.67 and has been upheld by the Washington Courts in Teter v. Clark County/City of Vancouver.

1. Management Plan Priorities

Comprehensive basin planning is the fundamental building block for long term surface water management in Mount Vernon. The water quality, flooding, and sensitive environmental resource needs identified through the planning effort provide the basis for prioritizing the capital needs and operations requirements. These needs are then translated to costs and construction schedules. Many of these needs are, or will be, mandated by new state and federal requirements. This includes the state's Puget Sound Water Quality Authority, which has issued its own rules pertaining to the quality and quantity of surface water discharges to the Sound. As discussed in the regulatory section of this Plan, legal mandates require specific actions of the City in terms of design standards, enforcement and maintenance. While the state does make some funds available for loans and grants, the on-going commitment required to meet these regulations mandates a financial approach far exceeding available grant funding.

C. Utility Design and Implementation

1. Introduction

The stated objective for financing the City's surface water program has been development of a consistent and dedicated surface water funding mechanism. This issue is also listed in the state PSWQA surface water requirements for Comprehensive Urban Stormwater Programs. Although Mount Vernon is not included in the urbanized areas that are required to implement the Comprehensive Urban Stormwater Program elements of the Puget Sound Plan, recent and future growth may soon trigger these requirements.

Specifically, the kind of commitment required by the Comprehensive Urban Stormwater Program is an assurance that there be adequate local funding for the stormwater program. This requires that a financial analysis be performed that includes:

- What funding options are available
- How these options compare in terms of accessibility and process for implementation
- What the cost estimates are for the principal nonpoint source controls being proposed
- What level of revenue can be anticipated and whether it meets the program's needs

The process of constructing Mount Vernon's funding program addressed each of these funding elements and identified a reasonable and implementable strategy for financing the program's surface water management program.

2. Funding Approaches—Citizen's Committee Evaluation Process

The Citizen's Committee reviewed the full spectrum of surface water funding options over the nine month evaluation process. The criteria used to evaluate funding options included:

- **Timing/Ease of Implementation**—How long will it take to implement the option(s) and is it flexible enough for use in the City's operating and political environment?
- **Responsiveness**—Will the option(s) be responsive/accountable to customers within the service area?
- **Start-up Costs**—Can the funding option be merged into existing data bases and accounting systems or will it require a separate process?
- **Equity**—Does the option produce an equitable allocation of surface water service costs?
- **Legal Framework**—Is the funding option consistent with local and state laws?
- **Revenue Capacity**—Can the option(s) produce the revenue necessary to meet the program needs/priorities identified in the Master Plan?

As a further guide toward developing a financial strategy for surface water management, the Citizen's Committee was focused on establishing a funding mechanism that equitably allocates program costs and ensures that the cost of program elements is commensurate with their benefits. Within this evaluation framework, the Citizens

Committee received staff reports and recommendations on each of the funding mechanisms being considered. It was also emphasized that no single source of funding would satisfy the overall surface water quality and quantity program requirements. Although the funding options discussed were presented individually, none of them were considered to be mutually exclusive. The Committee emphasized the need to recognize the difference between getting the existing surface water system working properly versus those future system requirements resulting from new development. Given this direction, the following options for funding the surface water program were reviewed by the Committee.

3. Funding Mechanisms—Surface Water Management

The Citizen's Committee review of the following options was geared toward the immediate objective of developing the funding required to meet the needs identified in the Surface Water Management Plan. However, these funding mechanisms were also evaluated in light of their flexibility to adjust as more data was developed regarding specific application of water quality charges to individual system users. A short discussion of funding options follows:

a. State/Federal Grants and Loans. Historically, local governments have experienced significant infrastructure funding support from state and federal government agencies in the form of block grants, direct grants in aid, interagency loans, and general revenue sharing. Federal deficit reduction pressures and virtual elimination of federal revenue sharing dollars are clear indicators that cities such as Mount Vernon will be left to their own devices regarding infrastructure finance in general and surface water funding in particular. Presently, the primary sources of assistance in the areas of surface water are the federally funded grants provided by the Housing and Urban Development's Community Development Block Grant (CDBG) Program. However, access to this funding mechanism becomes much more difficult in relation to surface water facilities. Numerous applicants compete for a very limited resource pool making this a questionable funding source and one that cannot be credibly relied upon as a consistent element of this program's on-going revenue base. Experience indicates that even when jurisdictions secure grants for their programs, the revenue rarely provides for a fully funded capital improvement program. The typical scenario is to apply these grant monies to a master planning process which often does not address the long term funding issues necessary to sustain the program.

   State funding, primarily through the Department of Ecology, presents opportunities for support of specific surface water related projects. These include the Centennial Clean Water Fund, DOE's Water Quality Financial Assistance Program; State Revolving Fund, Public Works Trust Fund, and the Flood Control Account Assistance Program (FCAAP). It is expected that the City will continue to aggressively pursue these sources of funds.

b. Debt Financing. General Obligation Bonds - Washington statute enables municipal issuance of bonds for the purposes of paying the cost of acquisition or construction of service facilities. General Obligation (G.O.) Bonds are debt instruments backed by the full faith and credit of the issuing jurisdiction. The bonds are secured by an unconditional pledge of the City to levy the necessary assessments, charges or ad valorem taxes necessary to retire the bonds. G.O. bonds are the lowest-cost form of debt financing available to local governments and can be combined with other revenue sources such as specific fees, grants/loans, or special assessment charges to form a dual security through the City's revenue generating authority. These bonds are supported by the City as a whole, so the amount of debt issued for stormwater management purposes will be a function of Mount Vernon's overall debt capacity. G.O. bond financing requires voter approval.

c. Revenue Bonds. This form of debt financing would also be available to Mount Vernon if and when a surface water utility revenue stream was established. Unlike G.O. bonds, revenue bonds are not backed by the City as a whole, but constitute a lien against the operating revenues of the City's surface water utility. Revenue bonds present a greater risk to the investor than do G.O. bonds, since repayment of debt depends on an adequate revenue structure and sound fiscal management by the issuing jurisdiction. Due to this increased risk, revenue bonds generally command a higher interest rate than G.O. bonds. This type of debt also has very specific coverage requirements in the form of a reserve fund specifying an amount, usually expressed in terms of average or maximum debt service due in any future year. This debt service is required to be held as a cash reserve for annual debt service payment to the benefit of bondholders. Typically, voter approval is not required when issuing revenue bonds.

d. System Development Charges. Mount Vernon does not presently employ impact or connection fees for surface water. However, some members of the Citizen's Committee did express an interest in keeping this option open as the surface water program gets further into its capital improvement programming. These charges are designed to provide a mechanism by which owners of properties to be developed in the future will share in the current cost of constructing surface water improvements. Surface water and flood control improvements are characteristically designed to last twenty years or more into the future. This charge offsets the inequity which results when owners of developed properties bear the entire cost of the surface water improvements while owners of property developing in the future enjoy the benefits of these improvements at no incremental cost.

The use of system development charges will provide important flexibility in terms of equitably allocating the cost of new development on the surface water quality or quantity infrastructure. Questions regarding who should pay for required upsizing of the surface water system due to new development, or how historical payers into the system can recover their costs in oversizing facilities that enable future growth, are exactly the types of equity issues that system development charges can be designed to accommodate. This method is also being considered for nonpoint source water quality controls by providing incentives for new development in order to maximize the mitigation of surface water quality impacts at the development site.

e. Fee-in-lieu-of Onsite Detention. In-lieu-of fees can either be a regulatory requirement or a development option that enables the City to offer developers the opportunity to construct on-site detention facilities in accordance with the established design criteria, or pay a fee into a fund dedicated to the construction of an off-site (regional) detention facility serving multiple properties.

This approach can be effective within the context of promoting the siting and construction of more regional versus on-site detention/retention facilities. This objective is consistent with the intent of fee-in-lieu-of ordinances which have proven practical as a vehicle to guide development patterns within a watershed and as a tool to encourage comprehensive surface water planning.

The shortcomings associated with fee-in-lieu-of construction revolve around cash flow and construction timing. The customary fee for a single property or development is rarely large enough to fund the construction of a regional facility. Therefore, either multiple developments must occur simultaneously in a given area to generate enough revenue to fund the construction of a regional facility, or more realistically, the project must be initially funded from Mount Vernon's utility rate reserves. Many surface water programs are finding it necessary to provide seed monies in order to successfully establish fee-in-lieu-of structures. It is also important to note that monies collected for fee-in-lieu-of purposes be "earmarked" for use in constructing the specific facility identified. Courts have generally held that commingling these funds and allocating them to unrelated surface water projects is illegal.

f. Improvement Districts and Special Assessments. The use of special drainage districts for funding surface water programs has decreased significantly due, in part, to the difficulty in quantifying the benefit to individual properties. In water, street, or sewer special assessments the benefit is normally determined as a function of the total area benefitted. The situation in surface water differs in that upstream or hillside properties that are major runoff contributors may not be specific recipients of project/maintenance benefits. Because the level of benefit could not be quantified, these properties would not be required to participate in the assessment base. In addition, the concept of local improvement or special assessment districts creating facilities or systems to mitigate surface water problems within narrowly defined areas can be counter-productive to a comprehensive approach to surface water management.

g. Plan Review and Inspection Fees. These fees are intended to recoup the expense of examining development plans to ensure consistency with comprehensive or master plans, and to insure that construction standards and regulations are met in the field. These fees are not designed to be primary revenue generating sources. Specific tasks are usually limited to engineering review and field inspection/certifications. In theory, a detailed cost accounting system can determine the actual costs of providing these services to developers. However, in practice most surface water authorities monitor the accumulated cost of providing this service so that the resulting fee is based on an average of the total cost.

One of the major concerns regarding current surface water development review operations is the lack of regulatory enforcement in the field. Plan review and inspection fees are designed to allocate direct costs back to those receiving service. These services are typified by the code enforcement work done by field inspection personnel. By implementing a plan review/inspection charge based on the true cost of providing an adequate level of service, the surface water program could enhance the development/construction review process (timeliness and predictability) and avoid passing the costs of these direct services back to the general rate or tax payers.

h. General, Street, Sewer Fund Support. These funding sources have historically been accessed by local governments to pay for minor drainage improvements and complaint/emergency response. Mount Vernon has allocated a portion of its general operating revenues to road related drainage maintenance in order to protect the integrity of the roadway network and for surface water emergency response activities. Overall, this characterizes the traditional approach toward funding surface water emergency response or protection of the transportation system. In most cases, the number of public services becoming reliant on general fund support is increasing. Therefore, services with potential customer bases, such as surface water, are being required to become self sufficient to the greatest extent possible. This self sufficiency is particularly true in terms of nonpoint source compliance.

i. Surface Water Service Charges. As conventional funding sources for surface water management become more difficult to access and as the costs of meeting surface water quality requirements are gaining focus, the utility or service charge approach toward surface water funding is becoming broadly applied and generally accepted by local government. There are numerous combinations and variations for surface water service charges. The generally accepted characteristics of a surface water service charge or rate are described below:

- **Amount of Impervious Surface**—Rates under this approach are set in direct proportion to the measured, estimated, or assumed extent of impervious area for each parcel of land. Impervious surface is that land occupied by building footprints, pavement or other non-permeable surfaces.

- **Density of Development**—Under this approach rates are determined by a runoff coefficient which is deemed to be appropriate for the type of land and the nature of the improvements on each parcel.

- **Flat Fee**—This mechanism utilizes a constant or uniform fee for each property within pre-existing classes or can be applied on a community-wide basis.

A service charge for surface water management reflects a rationale that those who contribute runoff to the surface water system should pay in relation to the amount of runoff conveyed by the systems and facilities operated by the surface water management entity. This approach is consistent with current rate structures for wastewater in Mount Vernon. As in the other rate structure, surface water service charges are based on an equivalent service/residential unit. Typically, the equivalent residential unit represents the average amount of impervious surface on a single family residential lot. Courts have consistently held that this type of approach toward a surface water service charge is reasonable and logical. The key test is whether the rate methodology relates the service charge with a measurable factor causing runoff. Impervious surface or other density of development factors are typically used as the basis for the rate structure. Jurisdictions including Anacortes, Everett, Snohomish County, Lynnwood, Mountlake Terrace, Seattle, King County, Tacoma, Auburn, Puyallup, Sumner, Steilacoom, Olympia, Thurston County, etc. have operating utilities. Nationally, it is estimated that 250 larger municipalities have implemented a surface water service charge.

j. Property Taxes. The property tax approach, while administratively straightforward, is flawed in relation to surface water because use or contribution of runoff to the system is not closely correlated with the value of the property. It is the increased emphasis on equity in allocating surface water costs to those contributors of runoff to the system that is the basis for moving away from taxes as the primary revenue source. A property tax approach toward funding surface water management in Mount Vernon would exempt the numerous developed properties owned by churches, schools and other owners enjoying tax exempt status. A key observation made by the Citizen's Committee in comparing the taxation versus service charge approach was that program costs are not affected by tax exempt status and if properties drop out of the revenue base due to tax status, program costs are shifted to the remaining properties. The bottom line is that all developed properties in Mount Vernon would be served by the utility, but only taxable properties would pay for these surface water services. This was considered inequitable by the Citizen's Committee.

4. Utility Approach and Financial Flexibility

While it is important that Mount Vernon's program develop a funding mix to support operations, it is also true that the elements of this mix will be designed and implemented over time. While financing techniques such as developer charges, plan review fees and grants/loans can serve to offset new facility or direct service costs, they cannot provide the revenue stream necessary to support a full-time, comprehensive surface water management program.

The following information summarizes the specific advantages correlated with the service charge approach in terms of Mount Vernon's specific situation:

a. <u>Flexibility and Ability to Generate Required Revenue</u>. As the surface water program develops, the need to adjust the funding plan to meet identified needs will be critical. The service charge can be adjusted to meet these requirements and the rate structure altered to most equitably allocate cost. As an example, some programs have involved surface water rate structures that consider the unique maintenance and capital requirements for each basin.

b. <u>Process to Implement Database</u>. Given the fact that Mount Vernon has a billing system in place for solid waste and sewer, economies of scale can be gained if a surface water service charge were to be added. However, there will be a one time cost in preparing the data base for surface water customer accounts.

c. <u>Equity</u>. The optimal approach for funding any infrastructure program is to allocate the cost of service/facilities based on levels of use. The stronger the correlation between use of the system and individual level of payment, the greater the equity of the cost allocation methodology. Jurisdictions employing surface water service charges (based on a measure of impervious surface for an individual property) have done so because, as a public utility, there must be a relationship between surface water rates and use of the surface water system.

Given the chief criteria of equity, flexibility and overall revenue capacity, the surface water service charge was endorsed by the Citizen's Committee as the optimal primary revenue source. The Committee also determined that secondary funding sources should be evaluated to further refine the equity of the revenue base.

5. <u>Funding Recommendation and Citizen's Committee Evaluation</u>

The Citizen's Committee's evaluation of the primary revenue sources available to support the overall surface water program resulted in the following direction to staff:

> A (surface water utility) service charge should be implemented based on a property's contribution of runoff to the surface water system with single family residences treated as one residential/dwelling service unit and other properties charged based on their estimated total runoff as primarily determined by the amount of impervious surface.

Based on the financial directions established through the Committee, the dedicated, predictable and consistent element for nonpoint management is the surface water service charge. At the same time, the flexibility to implement essential secondary funding options is preserved as the overall funding mix for addressing surface water quality and quantity needs is determined.

6. Program Directions and Costs

The services to be provided through the surface water management program emphasize activities that will enable the program to meet water quality requirements and, from an overall surface water management perspective, "not let current problems get worse." The program responds to the need for Mount Vernon to begin thinking of surface water quality and quantity management as an on-going and critical component of the public infrastructure. In order to begin this process, the initial program establishes a capital improvement schedule and a commitment to maintenance; implements a nonpoint source management plan; promotes regulatory and design criteria consistency; and actively involves the public with surface water management issues.

Revenue requirements for the surface water program have been prepared for the following budget categories (FY 95-96):

- Maintenance
- Engineering, Regulation, Erosion Control
- Operations
- Public Education
- Administration/Billing
- Utility Taxes
- Sewer Fund Repayment
- Capital Improvement

The functional service areas for the initial surface water program are summarized below.

a. Maintenance. There will be an increased emphasis on field maintenance operations throughout the City. Preservation of natural conditions while maintaining the hydrologic characteristics of these drainages is a delicate balance which often results in more labor intensive procedures for maintenance of these systems. This emphasis, in addition to the increased frequencies and enhanced maintenance procedures necessary to realize water quality nonpoint source reductions, will require a commensurate commitment of resources to this program element.

1995 Budget $195,300

b. Engineering, Regulation, and Erosion Control.

(1) Water Quality Management—Implementation of a water quality nonpoint source pollution control program will require additional expenditures for monitoring, enforcement and problem mitigation. Therefore, compliance monitoring will be an on-going and expanding cost to the City.

It should be emphasized that activities related to compliance with state, and possible federal, surface water regulations are contained in virtually all the budget categories. The costs contained in water quality management are specific to a response to the regulatory requirements issued by the PSWQA and EPA.

(2) Engineering Services—This function involves implementation of the projects identified in the management plan in a manner that is consistent with water quality flood control, and sensitive resource preservation policies and programs. With the management plan, overall guidance can be provided for directing the program toward more than meeting nonpoint source load allocations, but developing a full range of surface water services to the City. This document also provides the necessary data for estimating program costs and establishing legally defensible system development charges.

This program element will also be the lead in water quality nonpoint source management and will work with all program areas in assuring that: (a) a nonpoint source identification/monitoring program is implemented (b) control strategies are implemented, and (c) pollutant load reductions are achieved and measured. This process will include the necessary monitoring to measure the impacts of various nonpoint source mitigation measures in the field. This program area will also play a key role in water quality related regulations and conduct special analyses as required to evaluate the effectiveness of nonpoint source technologies.

The Engineering element will provide lead technical support for all surface water program areas and be a direct service provider in the area of plan review, design, field inspection and enforcement, including erosion and sedimentation control. While project management will be an increasingly important function, emphasis will also be placed on non-structural program planning. Initial program priorities will include preparing consistent design criteria and standards, developing an accurate surface water system inventory and implementing a hazard mitigation program. An overall physical feature (structures, floodplain, streams, problem areas, hazard locations) and problems assessment of the surface water system within the service area has not been prepared but will be an important element within this program heading.

The non-structural regulatory functions include enforcement and overseeing of surface water policies within the service area. It is through enforcement of the regulatory provisions that the overall surface water management program will be applied on a consistent basis and maximize nonpoint load reductions from all tributaries in the service area. Also, this mechanism provides the means to monitor the consistent application of standards and criteria to provide a uniform level of water quality, flood, and sensitive resource protection to the public.

1995 Budget $88,200

c. Operations. This function involves costs related to operational factors such as supplies, energy and equipment services.

1995 Budget $41,000

d. Public Education. Includes expenditures for public awareness brochures/flyers regarding surface water program needs, costs and rates. Billing stuffers and newsletters will also be developed as part of the short term utility implementation information effort and longer term program of public involvement regarding site quantity/quality controls.

1995 Budget $16,000

e. Finance/Billing/Accounting/Payroll. Are the utility support functions related to surface water data processing, invoicing, remittance handling and accounting? The surface water program's *pro rata* share of revenue generated in relation to the City's other utility programs is estimated based on projected staffing impacts and allocations based on the total number of additional accounts generated as a result of the program.

1995 Budget $21,000

f. Utility Taxes. For the upcoming year, includes state utility taxes and other costs which are allocated to Mount Vernon's surface water utility for city manager, city attorney and human resources time. This category also includes the utilities allocation for general government support.

1995 Budget $72,000

g. Sewer Fund Repayment. A loan from the Sewer Fund to support development of the Surface Water Master Plan is being paid back in equal installments through the year 2000.

1995 Budget $40,000

h. Capital Improvement Program. The Master Plan has identified numerous important projects to be scheduled over a 20-year planning period. A key element of the financial analysis is determining whether these projects will be funded on a "pay as you go" basis versus the debt service options discussed previously. In reviewing the financing strategies within the context of the projects, the Committee expressed its desire to minimize debt service costs while implementing a ramping of rates. As these options are further evaluated with the Committee, annual capital costs will be determined. Additional analysis on the funding of capital projects has been performed and is included in Appendix L, *Engineering Report Debt-Funded Stormwater Capital Projects*, April 1995, and this analysis was updated as described below. The Capital Improvements Program is listed on Table X-1 in the following section.

7. Historical and Forecasted Cash Flows

Historical and Forecasted Cash Flows for the Mount Vernon Surface Water Utility are shown in Section 4 of the *Engineering Report Debt-Funded Stormwater Capital Projects* contained in Appendix L. This cash flow analysis has been updated to:

- Reflect escalation of 1993 cost estimates to 1995 prices
- Update design costs for the Riverbend Road Pump Station
- Solve the flooding problem at the Park Village Trailer Court
- Update costs to provide adequate conveyance capacity in a tributary to Kulshan Creek across Continental Place and College Way.

This updated cash flow analysis is shown on Table IX-1.

D. Billing/Service Charge Implementation

The Citizen's Committee reviewed and voted on staff recommendations contained in a series of "issue papers." These papers, designed as decision tools for development of the surface water utility rate structure, became the building blocks of the rate structure.

This recommendation and the supporting issue papers were presented to Council with the following recommendations:

1. Three specific policies should be reflected in the surface water service charge:
   - Undeveloped properties, defined as those properties left in a natural state, would not be included in the service charge.
   - All publicly owned property should be included in the surface water service charge, except publicly owned streets which operate as part of the City's storm water conveyance system.
   - No exemptions be allowed from the rate based on property use (other than undeveloped) or tax exempt status.
2. The surface water service charge should be set at a level that recovers total surface water program costs while recognizing the cumulative impact of rates for water, sewer and solid waste.

3. Implementation of the surface water rate be accomplished in a manner that allows adequate time to inform the public about the program, regulatory mandates, costs and rate approach.

Based on these rate provisions, project staff and the City Attorney were directed to prepare a utility formation ordinance and a second ordinance establishing a system and structure for rates. These ordinances are contained in Appendix K.

The Project Team began the process of developing a customer inventory and surface water service charge system for all properties within Mount Vernon. This process involved not only Project Team members but also included utility billing personnel from the City's Finance Department and EDEN Systems (the City's Utility Billing software/programming consultant) in constructing an accurate data base on impervious area and downloading this data into a utility billing system.

City of Mount Vernon
Surface Water Program
Cash Flow Analysis

Table IX-1
CASH FLOW ANALYSIS

Term (yrs.) of Interfund Loan:	6
Kulshan Creek Alternative:	5
RS1 Year of Construction:	1996
Year Staff Added:	1995

Assumed Monthly Rate:	$3.95	$3.95	$5.35	$5.35	$6.05	$6.05	$6.05	$6.05	$6.05
Assumed Growth:	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Assumed # of ESUs:	15,190	15,494	15,804	16,120	16,442	16,771	17,106	17,448	17,797
Assumed Bond Issue: (1)	$0	$2,084,875	$0	$0	$0	$0	$0	$0	$0
Assumed PWTF Loan (2)	$0	$3,100,000	$0	$0	$0	$0	$0	$0	$0

	Estimated Cash Flow								
	1995	1996	1997	1998	1999	2000	2001	2002	2003
Beginning Balance	$477,962	$584,960	$293,268	$67,062	$57,798	$178,734	$320,442	$228,608	$354,042
Revenues									
Rate Revenue	$720,000	$734,400	$1,014,588	$1,034,879	$1,193,690	$1,217,564	$1,241,915	$1,266,753	$1,292,088
Fund Earnings	$22,703	$27,786	$13,930	$3,185	$2,745	$8,490	$15,221	$10,859	$16,817
Rev. Bond Proceeds	$0	$1,825,531	$0	$0	$0	$0	$0	$0	$0
PWTF Loan Proceeds	$0	$3,100,000	$0	$0	$0	$0	$0	$0	$0
Total Available Funds	$1,220,666	$6,272,676	$1,321,786	$1,105,126	$1,254,233	$1,404,787	$1,577,578	$1,506,220	$1,662,947
Expenditures									
Operating Expenses	$473,500	$455,175	$477,934	$501,830	$526,922	$553,268	$580,931	$609,978	$640,477
Capital Spending	$123,184	$5,325,320	$284,813	$58,415	$66,390	$53,784	$334,661	$113,719	$117,995
Interfund Loan Repayment	$39,022	$39,022	$39,022	$39,022	$39,022	$39,022	$0	$0	$0
Rev. Bond Debt Service	$0	$145,941	$196,797	$196,797	$196,797	$196,797	$196,797	$196,797	$196,797
PWTF Debt Service	$0	$13,950	$256,158	$251,263	$246,368	$241,474	$236,579	$231,684	$226,789
Total Expenditures	$635,706	$5,979,408	$1,254,724	$1,047,328	$1,075,500	$1,084,345	$1,348,969	$1,152,179	$1,182,058
Ending Balance	$584,960	$293,268	$67,062	$57,798	$178,734	$320,442	$228,608	$354,042	$480,888
Coverage Attained	0.00	2.10	2.80	2.72	3.40	3.42	3.44	3.39	3.40
Target Balance (3)	$38,918	$37,412	$39,282	$41,246	$43,309	$45,474	$47,748	$50,135	$52,642

NOTES
1 Assumes bond reserve funded with proceeds.
2 Assumed match: 10% ; Interest rate: 3.00% ; 1st yr draw: 15% .
3 Target balance = 30 days of cash operating expenses.

Shaun Pigott Associates / FCS Group
Last Edited: 03-Nov-95

SECTION X
RECOMMENDED PLAN

SECTION X

RECOMMENDED PLAN

A. General

The recommended plan consists of five major components and includes non-structural (regulatory) recommendations, structural solutions (capital improvements), operations and maintenance program, financing plan, and interjurisdictional coordination. Collectively, these components will help solve current and future water quality and flooding problems, preserve and enhance valuable environmental resources, and establish a comprehensive and long-term approach to surface water management.

In general, non-structural solutions were emphasized to solve these problems because they do not require major capital expenditures. Non-structural solutions include public education, policies, ordinances and regulations, maintenance, monitoring and investigative studies. Where non-structural solutions could not, by themselves, solve these problems, structural solutions were recommended to supplement non-structural solutions. Recommended non-structural and structural solutions were developed in Section VII. The recommended operations and maintenance program was developed in Section VIII. The recommended financing plan was developed in Section IX.

This section also lists the goals and objectives that were developed in Section II and provides an explanation of how these goals and objectives can be achieved by implementing the recommended solutions.

Table X-1 lists the capital improvements plan. All costs are in 1995 dollars. This table also identifies relative priorities for implementation. These priorities were generally arrived at by considering, in order of importance, safety and human health, potential for property damage, correcting environmental problems, and enhancing environmental resources. The 1995 costs were escalated at 4.5 percent per year to show the future project cost in the year it is scheduled for implementation.

B. Cost Estimates

Cost estimates were developed for the recommended structural solutions. Cost estimates for several problems have been updated as part of several design projects and review of developer proposals. These estimates are shown in Appendix E. Estimates for the remaining problems have been taken from the 1993 draft plan and escalated at 4.5 percent per year for two years. The 1993 estimates for the problem solutions prior to escalation to 1995 costs are also shown in Appendix E. The 1993 cost estimates include an allowance for mobilization of 10 percent; construction contingency of 30 percent; state sales tax of 8 percent; administration of 2 percent; and surveying, permitting and engineering of 30 percent. All cost estimates are based on 1993 costs with an ENR construction cost index of 5,600.

C. Recommended Plan

1. Recommended Non-Structural Solutions

a. Public Education. The benefits of a strong public education program have been demonstrated by other communities and is recommended as a high priority for the City of Mount Vernon. The public education program should include elements to protect and improve water quality, protect against flooding, and preserve environmental resources. The purpose of public education is to increase the understanding of citizens and business owners about flood control and how their actions can affect water quality and environmental resources. The program should foster public ownership of and responsibility for stormwater quality and quantity.

Public education was identified as a solution, or as one component of a solution for several drainage system, water quality and environmental resource problems described in Section VII. A summary of the recommended public education elements is provided below; more specific detail about each of the program elements is contained in Section VII.

(1) Maintenance of Private Systems: Develop an educational program that educates commercial and industrial business owners of the benefits of proper catch basin cleaning and maintenance of detention systems. Information could be distributed in the form of flyers, town meetings, newspaper articles, outreach by City staff, and workshops. In addition, the City should adopt an ordinance requiring maintenance of private facilities similar to the model ordinance in Appendix J.

(2) Proper Erosion Control: Develop a program to inform and educate area contractors about the new erosion control requirements that the City has implemented as part of the new drainage ordinance that complies with the Puget Sound Water Quality Management Plan. It is suggested that the City develop this program jointly with Skagit County. A coordinated joint program would likely be more effective in attracting area contractors.

(3) Source Controls: Develop a public education program that encourages source control of stormwater pollution and includes the following objectives:

(a) Residents should reduce the use of household products that are harmful to the environment. When these products are used, they should be disposed of as hazardous waste at the County's new Moderate Risk Waste Collection Center.

(b) Eliminate illegal dumping of oils, liquid waste products, lawn clippings, pet waste and other pollution sources by the public and area businesses.

(c) Reduce stormwater exposure whenever and wherever possible through the use of recommended BMPs.

(d) Use pesticides and herbicides wisely and always follow application instructions. Also, whenever possible implement an Integrated Pest Management Plan (IPMP) rather than use chemical treatment.

(e) Implement public education programs such as those indicated in Table VII-4 and in Ecology's *Stormwater Program Guidance Manual for the Puget Sound Basin*, Volume 2. Develop an educational program that educates commercial and industrial business owners of proper catch basin cleaning. Information could be distributed in the form of flyers, town meetings, newspaper articles and workshops. This education program can be a component of an overall public education program. The recommended overall commitment to an effective education program will require at least 25% to 30% of the City's new stormwater manager's time.

(4) Spill Response: Develop a public education program to inform individuals of what to do in the event of a spill such as to report spills immediately using the 911 telephone number.

(5) Illicit Dumping: Develop a public educational program to inform the public of the impact to stormwater quality associated with illicit dumping of waste.

(6) Riparian Corridors: Develop an education program to increase community awareness of stream resources. The City could establish a volunteer program with school children or interested citizens, to assist in a planting program. The planting program would include planting additional native plant species to improve the quality of stream corridors by increasing cover, shade, visual buffer and filtration functions. The City should coordinate this effort with the Department of Fisheries to define the corridors most needing improvement. Several capital projects to help restore and enhance fish habitat could use volunteer labor for some portions of the work.

(7) Wetlands: Public information programs concerning the value of wetlands should be incorporated into the public education program.

(8) Agriculture BMPs: The City should coordinate with area farmers to maintain riparian vegetation that will improve filtration of pollutants and reduce erosion thereby improving water quality. The City should prepare a public education program to inform farmers of the importance of riparian vegetation for water quality protection. Example BMPs include:

- use fences to keep farm animals out of the area creeks.

- cover manure piles with plastic or spreading manure piles to avoid a concentrated pollution source, and

- maintain riparian vegetation along streams to improve filtration of pollutants and reduce erosion thereby improving water quality

To be effective, the above public education programs should be ongoing. It is therefore recommended that the City's new surface water manager be responsible for implementing and maintaining these education programs. It is estimated that these programs would require approximately a one-quarter to one-third full time staff equivalent.

b. Recommended Changes to Policies, Ordinance, and Regulations.

(1) Enforce the new drainage ordinance consistent with the minimum requirements of Ecology's *Stormwater Management Manual for the Puget Sound Basin.* The ordinance is contained in Appendix I.

The City should implement the new standards with a public education program designed to inform and educate affected parties about the new regulations. These public education programs were described earlier in this section. The City should attempt to use education as the primary mechanism to successfully implement the new regulations, and then enforcement as a last resort for those who fail to comply.

(2) Adopt a new ordinance requiring maintenance of privately owned stormwater control facilities. A draft model ordinance is contained in Appendix J.

(3) Enforce the new drainage ordinance provisions to deter illegal dumping. The drainage ordinance in Appendix I includes provisions to deter illegal dumping of material into or near the drainage system. Increased enforcement and prosecution of illicit dumpers will help to reduce the problem. Local citizens should be encouraged to report any illicit dumping to further help prevent these actions.

(4) Review existing wetland protection standards and wetlands management strategy. The City should review its Critical Areas Ordinance and evaluate the need to develop a rating system accompanied by associated buffer size. Whether the City should sponsor a programmatic solution such as mitigation banking or a SAMP for managing wetlands, is a policy decision that should be made by City staff and elected officials.

(5) Require fences to keep animals out of area streams. The City should improve water quality by adopting an ordinance requiring the use of fences

to keep farm animals out of area streams. The effort to install fences within the City should include a public education program for farm owners, development of an ordinance requiring the use of fences, and the possible development of assistance programs such as low interest loans for farmers to lessen the cost of fence installation.

(6) Require sewer construction for new construction. The City should establish a policy of requiring sewer construction for new construction in areas to be annexed to the City.

c. Monitoring/Investigative Studies.

(1) Investigating/Monitoring Program. The City should conduct a monitoring and investigative program for water quality parameters. Six sampling events should be used. All major stream systems and outfalls should be sampled during each sampling effort. These pollutants include:

- Total petroleum hydrocarbons
- Suspended solids
- Nitrate plus Nitrite Nitrogen
- Total phosphorus
- pH
- Ammonia Nitrogen
- Temperature
- Lead
- Copper
- Zinc
- Dissolved oxygen
- Hardness

Sampling for these pollutants would provide additional information about the quality of water entering receiving waters and could be evaluated to determine the existence of other water quality problems in the City. This data could also be used as baseline information to evaluate the effectiveness of source control programs. It is recommended that the City conduct the monitoring program initially as a high priority and then a second time, a few years later, to determine the effectiveness of source control programs. In addition, this sampling program should include some sediment sampling in the Kulshan Creek Basin.

(2) Spill Containment Needs Assessment. The City should conduct a study to identify the need for spill containment facilities to prevent transportation related spills from entering area streams and the Skagit River. This work would be accomplished by the City's new stormwater manager.

(3) Emergency Spill Response Program. The City should implement a emergency spill response program. A City staff person should be assigned to develop information on how to handle transportation and storage related spills. This staff person should then educate the fire department on appropriate methods and procedures. The staff person should also provide the fire department with all the necessary information on the City's storm drain system layout and the major outfalls to area streams and the Skagit River. The City should develop a comprehensive information network to

facilitate communication between the public, city staff, agencies and fire department spill clean up personnel in the event of a spill. The City should conduct an inventory of industrial facilities that store hazardous materials and keep their drainage system maps on file at the City and Fire Department. Those facilities with SIC codes of concern that are in close proximity to water resource should be made a priority for spill prevention and containment facilities and programs. In addition, information on these sites should be available to the fire department and routine monitoring and inspection of these facilities should be performed. This work should be coordinated by the City's stormwater manager.

d. Maintenance.

(1) Increase the Frequency of Catch Basin Cleaning. The City should increase the frequency of catch basin cleaning from once a year to once every eight months. Increasing the frequency of catch basin cleaning is part of the recommended maintenance and operation plan, discussed in Section VII. In addition, the City should identify areas of potential high pollutant loading, such as streets that receive runoff from shopping center parking lots and develop more frequent cleaning schedules for these areas, such as once every three months during the rainy season, or at least once every six months.

(2) Maintain Ditches to Preserve Vegetative Lining. Ditch maintenance should preserve vegetation lining to prevent erosion and to capture pollutants. Vegetation should only be disturbed when it is necessary to remove sediments in order to regain hydraulic capacity. When this type of ditch maintenance is required, it is best done so that some vegetative material remains to regenerate the vegetation lining. Reseeding or sodding of ditches should be performed as required to help prevent erosion.

2. Recommended Structural Solutions

a. General. Table X-1 lists the recommended structural solutions that were developed in Section VII. Structural solutions were developed to solve both regional and local system problems, water quality problems, and sensitive environmental resource problems.

b. Regional System Structural Recommendations.

- To provide adequate flood protection for the full development of the Freeway Drive basin, a 2,600-foot, 48-inch gravity main and a 25-cfs pump station should be constructed. The 48-inch gravity flow pipe would begin at the Eagle Hardware detention pond and run south along the western city boundary to a new pump station located near the Skagit River along Riverbend Road. The pump station would only operate under high water conditions in the Skagit River. This solution would limit the Eagle Hardware detention pond overtopping to about once in 100 years.

- To prevent Kulshan Creek from overtopping Parker Way and possible local flooding upstream, two additional 36-inch diameter culverts are needed to supplement the capacity of the existing two 36-inch-diameter culverts.

- To prevent local flooding upstream of the pipe systems across College Way and Continental Place along a tributary to Kulshan Creek, a parallel 54-inch concrete or 6.42 x 4.33 CMP pipe arch should be constructed. An additional 36-inch CMP culvert should also be constructed across Continental Place.

- As discussed in Section VII, the City should construct a 210-cfs pump station for Kulshan Creek in the City-maintenance yard east of Interstate 5. Increase conveyance with the addition of a 72-inch-diameter gravity flow pipe from Riverside Drive to the new pump station, and a second 48-inch-diameter force main from the pump station to the outlet structure west of I-5. This project can be phased as discussed previously.

- Construct modifications along Madox Creek to the Little Mountain Estates Pond.

- Construct bio-engineered stream channel protection that will prevent further erosion along Madox Creek. Prior to constructing any channel protection, a detailed examination of the erosion potential and further geotechnical and geomorphic investigations should be performed to determine the likelihood and risk of continued erosion, and to recommend what type of remedial actions should be taken.

- Work with the developer to construct a high flow bypass on Flowers Creek.

c. Local System Structural Recommendations. Local - system structural recommendations are shown on Table X-1 and described in Section VII.

d. Water Quality Structural Recommendations. As shown on Table X-1 and described in Section VII, water quality structural recommendations consist of a water quality sampling program, and a program to install oil/water separators where sampling results indicate problems with oil and grease.

e. Sensitive Environmental Resource Structural Recommendations. Sensitive environmental resource structural recommendations are shown on Table X-1 and described in Section VII.

3. Recommended Maintenance and Operations Plan

The purpose of a Maintenance and Operations Program is to ensure system reliability, achieve the lowest life-cycle cost for facility replacement, and to use maintenance methods and standards that promote water quality. The recommended stormwater maintenance and operations program will require an annual budget of approximately $195,300, including the equivalent of approximately three full-time staff persons. This represents a slight increase of the current budget and the addition of two maintenance workers. Specific maintenance and operation recommendations include increasing the frequency of catch basin cleaning an average of once every eight months; more maintenance of pipes and small culverts; maintenance of stormwater pump stations; modified maintenance of roadside ditches; purchasing equipment; and, purchasing and implementing a maintenance management software package to support the reporting, scheduling, and completion of maintenance activities.

4. Recommended Financial Plan

The purpose of the financial plan is to develop a financial strategy that will support the recommended surface water management program on a long-term basis. Now that the surface water utility is in place, the overall financial plan is described in more detail in the document *Engineering Report Debt-Funded Stormwater Capital Projects*, April 1995, in Appendix L, as well as updated cash flow projections in Section IX.

Available state and federal grant programs should also be utilized whenever possible, particularly to implement the recommended capital improvement program. Grant funds, as well as other secondary funding sources, can serve to reduce the need for anticipated rate increases.

5. Interjurisdictional Coordination

Many of the recommendations included in this plan will require interjurisdictional coordination. Opportunities may also exist for joint funding of projects. Some of the major coordination efforts are listed in the following paragraphs.

a. Coordination with the Washington State Department of Transportation regarding recommended drainage improvements along state highways.

b. Coordination with Skagit County regarding possible joint public education efforts, and a consistent approach to stormwater management regulations.

c. Coordination with Drainage District 17 and Skagit County on future preparation of a watershed plan for Madox Creek.

d. Coordination of the City's plan with the watershed plan recently completed by Skagit County for Nookachamps Creek. The Nookachamps Creek Plan did not evaluate specific non-point problems related to stormwater runoff, because it suggested these issues are already being addressed by Mount Vernon and Skagit

County in their respective plans. The Nookachamps Plan does recommend that Mount Vernon adopt clearing and grading ordinances that meet the intent of Ecology's minimum requirements (this ordinance was adopted by the City in July 1995). The Nookachamps Plan also recommends that a memorandum of agreement be developed between Mount Vernon and Skagit County to define a process for project review when a development proposal in either jurisdiction can have an impact on surface water resources in the other jurisdiction. The Nookachamps Plan also recommends that the City of Mount Vernon fund pollution control equipment on drainage systems that are part of the Nookachamps basin. The Nookachamps Plan also recommends that the City of Mount Vernon allocate a specific percentage of time for an inspector to inspect drainage projects in the City that are also in the Nookachamps Watershed. The Nookachamps Plan also recommends that the City of Mount Vernon should implement a storm drain stenciling program. The Nookachamps Plan also recommends cross training Skagit County and Mount Vernon staff involved in permitting and inspection to identify code violations that might impact water quality. The Nookachamps Plan also recommends education forums for Skagit County Commissioners and the Mount Vernon City Council on stream protection and recycling programs.

e. Coordination with the Washington State Department of Fisheries regarding habitat management and improvements to the area streams.

D. Plan Goals

Implementation of the recommended solutions will enable the City to achieve the goals and objectives that were defined in Section II. The following paragraphs provide an explanation of how these goals and objectives can be achieved by implementing the recommended solutions.

Goal #1 - Prevent property damage from flooding

a. **OBJECTIVE:** Require adequate peak flow controls for new development.

This objective has been accomplished because the City has adopted a new drainage ordinance consistent with the minimum requirements contained in Ecology's *Stormwater Management Manual for the Puget Sound Basin*. This ordinance includes requirements for peak flow controls. The ordinance is contained in Appendix I.

b. **OBJECTIVE:** Perform the necessary analysis and recommend solutions for existing flooding problems.

As discussed in Section VII, the existing drainage system was analyzed to determine existing conveyance problems, and problems that might occur under future development conditions as well. Solutions to these problems are presented in the recommended plan under both the regional and local system solutions.

c. **OBJECTIVE:** Employ management strategies in flood prone areas to ensure that new development is not exposed to significant flood risk.

The recommended plan includes a number of management strategies to minimize flood risk. These include enforcement of the new drainage ordinance with strict detention standards, and requirements for an offsite analysis to determine any adverse impacts downstream. The plan also includes management strategies for streamside corridors and wetlands that will also minimize flood risk for new development.

<u>Goal #2</u> - Maintain good water quality

a. **OBJECTIVE:** Attempt to meet state Class A Water Quality Standards in area streams.

A number of recommendations for are proposed for improving water quality such as a public education program, source controls, erosion control, maintenance, spill response, prevention of illicit dumping, wetland protection, new ordinances, and residential, commercial, and agricultural water quality BMPs. A sampling program has also been recommended to monitor water quality parameters and progress towards achieving water quality goals.

b. **OBJECTIVE:** Require adequate erosion and sedimentation controls from new construction sites.

This objective has been accomplished because the City adopted a new drainage ordinance consistent with the minimum requirements contained in Ecology's *Stormwater Management Manual for the Puget Sound Basin*. This ordinance includes requirements for erosion and sediment controls. The ordinance is contained in Appendix I.

c. **OBJECTIVE:** Require adequate water quality controls for new development.

This objective has been accomplished because the City adopted a new drainage ordinance consistent with the minimum requirements contained in Ecology's *Stormwater Management Manual for the Puget Sound Basin*. This ordinance includes requirements for water quality BMPs. The ordinance is contained in Appendix I.

d. **OBJECTIVE:** Implement public education programs to reduce the source of pollutants entering surface waters.

The plan recommends that a public education program be implemented to improve stormwater quality. This education program includes components to inform citizens about surface water quality source controls, erosion control, spill response, prevention of illicit dumping, maintenance of private drainage systems, and residential, commercial, and agricultural water quality BMPs.

Goal #3 - Preserve sensitive resources and maintain varied use

a. **OBJECTIVE:** Preserve fish and wildlife habitat.

The plan includes a number of preservation and enhancement projects for fish habitat. The plan includes an inventory of City streams by category, and the City's Critical Areas Ordinance provides adequate protection for stream corridors by specifying minimum setback requirements according to the stream category.

b. **OBJECTIVE:** Preserve wetlands and implement a wetlands management strategy.

The plan includes a recommendation that the City review the wetlands management section of the City's Critical Areas Ordinance to determine the need for a wetland classification system and associated buffers. The report also suggests several alternative wetlands management strategies with the recommendation that these be reviewed and that a policy decision be made as to which alternative should be implemented.

c. **OBJECTIVE:** Provide public access and recreation opportunities.

The plan does not include specific recommendations on public access and recreation opportunities. A number of opportunities exist within areas along the City's streams for trails and passive recreation. If these recreational opportunities are pursued, additional buffer requirements may be necessary so that human recreation does not interfere with fish and wildlife habitat needs.

d. **OBJECTIVE:** Preserve open space.

The plan does not include specific recommendations on preserving open space, but recommendations on preservation of wetlands and fish habitat will preserve open space associated with surface water resources.

e. **OBJECTIVE:** Review the City's Sensitive Areas Ordinance to ensure consistency with the surface water management program goals.

As mentioned previously, the plan includes a recommendation to that the City review the wetlands management section of the City's Critical Areas Ordinance to determine the need for a wetland classification system and associated buffers.

Goal #4 - Develop a continuous and comprehensive program for managing surface water.

a. **OBJECTIVE:** Ensure a dedicated funding source for program implementation.

The City has implemented a surface water utility as the primary funding source for implementing the plan.

b. **OBJECTIVE:** Coordinate the City program with the Skagit County program.

Several recommendation have been included to coordinate the City of Mount Vernon's program with programs in Skagit County and adjacent drainage districts. These include coordination with Drainage District 17 and Skagit County on future preparation of a watershed plan for Madox Creek. The plan also lists the recommendations as they relate to Mount Vernon from the Nookachamps Creek Watershed Plan prepared by Skagit County.

11/15/95

Table X-1
CITY OF MOUNT VERNON CAPITAL IMPROVEMENT PLAN

REGIONAL SYSTEM PROBLEMS

Problem No	Location	1995 Costs	Escalated Costs 1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
RS1	Construct new Riverbend Road (Freeway Drive) System	1750000		1750																	
RS1	Design new Riverbend Road (Freeway Drive) System	242000	121	121																	
RS2	Install two additional 36" culverts at Parker Way	13000									19										
RS3	Culvert replacement at College Way update price	109000							142												
RS4a	Kulshan Creek Pump Station Phase I (1)	3339000		3489																	
RS4b	Kulshan Creek Pump Station Phase II - Beyond 20 Years	672000																			
RS6	Little Mountain Estates Detention Pond modifications	Developer Build																			
RS7	Erosion control on Madox Creek	393000										584									
RS8	Madox Creek-Drainage District 17 Study	44000			48																

LOCAL SYSTEM PROBLEMS

Problem No	Location	Cost	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
LS6	Install log bed control weir to control erosion north of Cedar Lane	11000			12																
LS7	MH drop structure and pipe extension on Kulshan tributary near Viewmount	48000			52																
LS8	Culvert replacement along N 16th north of Florence	29000											46								
LS9	Park Village Mobile Home Park	53000							69												
LS10	Culvert Replacement at Kiowa and Seneca	22000			24																
LS11	Install trashrack at storm drain inlet near Kiowa and Nez Percé	500			1																
LS12	Replace storm drain system in W. Mount Vernon along Memorial Highway	557000														987					
LS13	Install additional catchbasins at Wall Street and Garfield Street	14000			16																
LS14	Install a new catchbasin and storm drain connection at Wall Street north of Memorial Hwy	40000								55											
LS15	Replace 16 of the storm drains between Division and Fir just west of LaVenture	371000																		785	
LS16	Install log bed control weir in stream between Mohawk and Apache.	11000								15											
LS17	Install culvert and ditch at Comanche Drive	14000									20										
LS18	Culvert replacement at Shoshone east of Sioux	24000							31												
LS19	Install armoured spillway in two detention ponds near Waugh and Division	59000											92								
LS20	Install storm drain west of S 6th upto Lind and connect to Madox tributary	155000										230									
LS22	Install catchbasin and storm drain connection for the NW corner of Riverside and Fir	100000													170						
LS23	Install storm drain connection along I-5 between Cameron and Kulshan Pump Station	73000															135				
LS25	Replace 3 pipes between Britt Slough and Blackburn Road	284000																	574		
LS26a	Upgrade drainage system on Fox Hill Street - Replace Pipes in Street	235000										349									
LS26b	Upgrade drainage system on Fox Hill Street - Install Pipe in Deep Ditch	66000			72																
LS27	Replace 2 pipes along I-5 between Blackburn and Anderson Road	50000															93				

WATER QUALITY PROBLEMS

Problem No	Location	Cost	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
WQ1	Water Quality Monitoring Program	39000			21							29									
WQ3	Oil/water separators	328000			21	22	23	24	25	26	27	29	30	31	33	34	36	37	39	41	43

ENVIRONMENTAL RESOURCE PROBLEMS

Problem No	Location	Cost	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
E1	Kulshan Creek Pump Station - Fish ladder	Included in RS4																			
E2	Manhole barrier in Kulshan east of Railroad	2000	2																		
E3	Log weir fish structure - Kulshan Creek north of Cedar Lane	11000						14													
E4	Restore channel on Kulshan from Riverside to N 18th (2,200 feet)	104000				15		16		18		19		21		23		25		27	
E5	Restore channel on mainstem of Trumpeter (7,000 feet)	328000			40		43		47		52		57		62		67		74		80
E10	Remove Culvert and restore stream channel on Madox near Anderson	40000																		85	
E11	Log weir fish passage structure d/s of culvert on Madox Creek at Blackburn Road	11000																			24
E13	Add riparian vegetation on Flowers Creek between Madox and Blodgett (1,500 feet)	38000				44															
E14	Log weir fish passage structure on Flowers Creek at Blodgett Road	11000																			24
E15	Restore channel on Carpenter Creek along Bacon Road (1,600 feet - one side)	21000																			46

			1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
	Total	$9,711,500	123	5360	306	80	66	54	315	114	118	1241	224	52	265	1044	332	62	687	938	217
	Total 1995-2004	$7,129,500																			
	Total -After 2005	$2,582,000																			

(1) Project cost adjusted to reflect $724,500 grant.

SECTION XI
BIBLIOGRAPHY

SECTION XI

BIBLIOGRAPHY

Barfield, B.J. and Warner, R.C. Applied Hydrology and Sedimentology for Disturbed Areas. Department of Agricultural Engineering, University of Kentucky. 1987.

Bell-Walker Engineers, Inc. 1987. Storm Drainage Study (Riverside Drive/ Freeway Drive Basins).

Canada Department of Fisheries and Oceans, Province of British Columbia Minister of Environment. Stream Enhancement Guide. Vancouver, British Columbia. March 1980.

Castelle et al. 1992. *Wetlands Mitigation Banking*. Prepared for Shorelands & Coastal Zone Management Program, Washington State Department of Ecology, Olympia, Washington.

City of Bellevue. Storm and Surface Water Utility department. Water Quality Database for Washington State Department of Ecology Grant G0088155. 1991.

City of Mount Vernon. 1988. Comprehensive Plan, City of Mount Vernon.

Cook. 1980. Nookachamps Management Plan. Huxley College of Environmental Studies, Western Washington University, Bellingham, WA.

Entranco. 1991. *Lower Skagit River Basin Monitoring Project, Final Monitoring Plan.*

Entranco. 1991. *Lower Skagit River Basin Water Quality Study, Analysis of Historical Water Quality Data.* Revised December 4, 1991.

Haestad Methods Civil Engineering Software. Flow Master

Harding Lawson Associates. 1991. Predicted Water Quality Impacts from the Proposed Sea-Van Golf Course and Residential Development.

Herrera Environmental Consultants. Black Hawk/Port Blakely Surface Water Quality Evaluation. January 1993.

Nookachamps Watershed Nonpoint Action Plan. May 1995. Nookachamps Watershed Management Committee; Skagit County Department of Planning and Community Development.

Orsborn, John F. and Powers, Patrick D. Analysis of Barriers to Upstream Fish Migration. Submitted to Bonneville Power Administration. August 1985.

Phillips, E.L. Washington Clime for These counties: Challam, Jefferson, Island, San Juan, Skagit, Snohomish and Watcom. Washington State University, College of Agriculture, Cooperative Extension service, Pullman, WA. 1966

Puget Sound Water Quality Authority. 1991. Puget Sound Water Quality Management Plan.

R. W. Beck and Associates. 1991. Comprehensive Sewer and Combined Sewer Overflow Reduction Plans.

Soil Conservation Service, U.S. Department of Agriculture. 1979. Soil Survey of Skagit County Area, Washington.

State of Washington. Department of Ecology. *Water Quality Standards for Surface Waters of the State of Washington.* Chapter 173-201A WAC. November 25, 1992.

U.S. Environmental Protection Agency, Washington, D.C. Water Planning Division. Result of the Nationwide Urban Runoff Program: Volume I-Final Report. 1983.

U.S. Environmental Protection Agency. Hydrologic Simulation Model - FORTRAN, Release 9.

WDF. 1975. A catalog of Washington streams and salmon utilization, Volume 1: Puget Sound. Washington Department of Fisheries, Olympia, WA.

W&H Pacific. 1992. Baseline Monitoring at Proposed Sea-Van Development Site.

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Prepared for

City of Mount Vernon, Washington

Mount Vernon

November 2004

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SECTION 1: INTRODUCTION

City of Mount Vernon Comprehensive Stormwater Management Plan Update

1. Introduction

1.1 Background

The purpose of the Comprehensive Stormwater Management Plan Update (Stormwater Plan Update) is to provide an update to the strategic framework for the management of stormwater within Mount Vernon. The Stormwater Plan Update is intended to be a flexible document that may be readily revised should the priorities and focus of the City change. It is also intended to act as a reference for other City departments whose activities may impact storm and surface water and could be affected by drainage.

Because this is an Update to an existing plan, the 1995 Comprehensive Surface Water Management Plan (1995 Surface Water Plan) will be referenced frequently and should be considered a companion document. As a general practice, only new material, findings, and recommendations will be included in this update. Occasionally material from the existing plan will be re-iterated in the interest of clearly communicating a point.

The role of surface water management in Mount Vernon is to:

1. Respect and preserve the City's watercourses
2. Minimize water quality degradation and control sedimentation of creeks, streams, ponds, lakes, and other water bodies
3. Protect the life, health, and property of the general public
4. Preserve and enhance the suitability of waters for contact recreation and fish habitat
5. Preserve and enhance the aesthetic quality of the waters
6. Maintain and protect valuable ground water quantities, locations, and flow patterns
7. Insure the safety of City roads and rights-of-way
8. Decrease drainage-related damages to public and private property

The City uses the following tools and regulations to manage stormwater:

- Mount Vernon Comprehensive Surface Water Management Plan, (R.W. Beck and Associates, November 1995) (1995 Surface Water Plan)
- Mount Vernon Comprehensive Plan (January 1995)
- Mount Vernon Municipal Code (Specifically, Chapter 2673, Chapter 16.32, and Chapter 15.36)

- Mount Vernon Development Code (Title 13, Sewers; Title 14, Land Use and Development; and Title 15, Buildings and Construction)
- Comprehensive Sewer and Combined Sewer Overflow Reduction Plans for the City of Mount Vernon (R.W. Beck and Associates, 1991)
- Critical Areas Ordinance #2482 (February, 1992)
- Section 4(d) of the Endangered Species Act (National Marine Fisheries Service)
- Shoreline Management Act (RCW Chapter 90.58, 1971) and the Skagit County Shoreline Master Program (developed in 1976 in accordance with the State Shorelines Management Act)
- State Hydraulic Code (RCW Chapter 75.20.100-140, 1949)
- State 402 (Water Quality) Certification
- Coastal Zone Management Determinations
- Floodplain Management Program
- State Environmental Policy Act (1971, with new implementation rules adopted in 1984, WAC Chapter 197-11)
- Puget Sound Water Quality Management Plan (Puget Sound Water Quality Authority, 1994)
- NPDES Phase II Minimum Control Measures (EPA, October 1990)
- Sections 401 and 404 of the Clean Water Act
- Section 10 of the River and Harbor Act of (1899)
- National Environmental Policy Act (1969)
- Coastal Zone Management Act of (1972)
- Forest Practices Act (RCW Chapter 76.09)
- State Floodplain Regulations (Chapter 86.16 RCW)
- National Flood Insurance Act of 1968 and Flood Disaster Protection Act of 1973 (FEMA)
- Model Wetlands Protection Ordinance (Ecology, September 1990)
- DRAFT Capital Improvements Plan for Surface Water for the Years 2005 – 2010 (Developed June 2004, Pending Council Approval)
- City Design Standards - MVMC Title 12 Streets, Sidewalks and Public Works, Title 13 Sewers, Title 14 Land Use and Development, Title 15 Buildings and Construction, Title 16 Subdivisions, Title 17 Zoning, and various ordinances.

The City of Mount Vernon Comprehensive Plan (Comp Plan) provides guidance to direct public and private decisions affecting future growth and development. The Surface Water

Plan gives the Public Works Department a guide to implement the policy impacting surface water set in the Comprehensive Plan and is intended to assist the City in meeting its surface-water-related legislated responsibilities as well as recommend improvements to operations and maintenance activities and the CIP. The Capital Improvements Plan (CIP) identifies and discusses program elements, project and funding. Brief descriptions of the other tools and regulations in this list can be found in the 1995 Surface Water Plan or in the Regulations and Policies portion (Section 4) of this Update.

This document is the first update since the first Surface Water Management Plan was prepared in 1995. It addresses changes that have taken place since 1995, including new federal regulations and changing surface water management techniques and strategies. The City has implemented many of the recommendations contained in the initial Surface Water Plan and has addressed its most pressing basic issues related to property damage from flooding. As the City moves through its hierarchy of needs, it is expected that the focus will shift from addressing these basic quantifiable needs to goals that relate more to the character of the City and the vision of its citizens and leaders.

1.2 Goals and Objectives

The objective of the Surface Water Plan is to provide a surface water management framework that will protect the public's safety, health and property, conserve and enhance natural systems within the City, and comply with local, state, and federal regulations. This update was developed using the following principles:

- The Surface Water Plan should be a "living" document that encompasses alternative solutions such as Low Impact Development and can be adapted to conditions and priorities.
- The recommendations should meet the current and anticipated requirements of federal regulations, particularly the Endangered Species Act (ESA) and Phase II of the National Pollution Discharge Elimination System (NPDES).

Specific goals and objectives for the City of Mount Vernon's Surface Water Management Program are articulated in Section II of the 1995 Surface Water Management Plan.

1.3 Report Organization

The body of this plan summarizes the general surface water conditions in the City. Technical conclusions are detailed in appendices. The Plan comprises the following:

- **Section 1:** Introduction to the City of Mount Vernon Comprehensive Surface Water Management Plan Update
- **Section 2:** Summary of the physical surface water, drainage, and drainage-related characteristics of the City
- **Section 3:** Description of the surface water storage and conveyance system analyses performed for this update. Discussion of results and potential solutions to surface water issues.

- **Section 4:** Review of the regulatory framework to assure the City's surface water management policies are in compliance with federal, state, and local regulations. Discussion of "Street Edge Alternatives" and criteria for potential candidate sites in Mount Vernon is included in Appendix B.
- **Section 5:** Identification of CIP recommendations and potential program funding sources.
- **Section 6:** Documentation of the existing O&M programs and recommendations to increase the efficiency and effectiveness of that program.
- **Section 7:** Stormwater rate analysis.
- **Section 8:** Recommendations.
- **Appendixes:** Provide surface water modeling analysis, regulations and policies, storm drainage capital improvement plan projects, and operations and maintenance.

SECTION 2: DRAINAGE BASIN CHARACTERISTICS

2. Drainage Basin Characteristics

Topography, land use, climate, soils, and other physical characteristics affect surface water runoff quantity and quality in the City. These characteristics, along with other watershed resources such as fish habitat, wildlife and wetlands are described in the 1995 Surface Water Plan. Because this is an Update to that plan, it will be referenced frequently and should be considered a companion document. Updated information about the characteristics of the drainage basins that was performed for this Update will be the focus of this chapter. Occasionally, material from the existing plan will be repeated in this chapter to provide clarity.

2.1 General Description

The study area includes the City of Mount Vernon's urban growth boundary, as shown in Figure 2-1. This area is similar to the study area described in the 1995 Surface Water Plan, with the exception that the corporate City Limits have expanded since that plan was prepared. The urban growth boundary has not changed.

The climate is typical of areas west of the Cascade Mountains and is strongly influenced by the Pacific Ocean. Winters are generally wet and mild with temperatures varying from 30°F to 50°F. Summers are usually relatively dry and cool with temperatures rarely exceeding 80°F. The average annual temperatures and precipitation are approximately 50 degrees Fahrenheit and 30 inches, respectively. Precipitation data used in the updated hydrologic modeling analyses performed for this Update were obtained from the National Oceanic and Atmospheric Administration (NOAA) station at Burlington (10/1/56 – 11/30/93) and from the Washington State University Cooperative Extension Public Agricultural Weather System (PAWS) station at Mount Vernon for the period of 12/2/1993 through 11/23/2002.

The topography is highly variable within the study area, comprising relatively steep slopes of the hillsides of the eastern portion of the City and flat floodplains of the Skagit River and Nookachamps Creek in the western and northern portions of the City, respectively. The study area slopes in all directions, with all the surface water eventually draining into the Skagit River and Nookachamps Creek. The highest elevation is approximately 910 feet above mean sea level. Slopes range from zero in the floodplain area to 96 percent around Little Mountain.

Soils categories in the study area are comprised of four types: glacial till, glacial outwash, flood plain, and wetland soils. A more detailed description of the soil types can be found in the 1995 Surface Water Plan.

2.2 Drainage Basins

The study area is comprised of seven separate drainage basins: Kulshan Creek (including the Freeway Drive subbasin system), Maddox Creek, Carpenter Creek, Nookachamps Creek, Trumpeter Creek (College Way), Britt Slough, and West Mount Vernon. There is an additional drainage basin not associated with a stream which includes the downtown Mount Vernon combined sewer system area. These basins were delineated as part of the 1995 Surface Water Plan. The basins were further divided into several smaller subbasins. The authors of the original plan used topographic maps and drainage system inventories to

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map the basins and subbasins. The original basin delineations are shown on maps and figures in the 1995 Surface Water Plan.

As part of this plan Update, one of the tasks was to develop GIS layers and prepare drainage maps of the City's storm drainage data inventory and associated drainage features. Drainage basins were then redelineated using detailed topography of the GIS, storm drainage network, and basin delineation features associated with the GIS software. Drainage basin delineations were field checked for two specific detailed modeling areas: Freeway Drive and Upper Maddox Creek (Little Mountain Estates area). All the original basins and subbasins are included in the Update, and no new basins were added to the system with one exception: one subbasin was added to the Kulshan Creek basin for modeling purposes (subbasin 8A). Figure 2-1 shows the revised drainage basins and subbasins, as well as the drainage inventory.

The following sections describe the updated basin delineations and available resources used to complete the task. For a complete description of each of the major streams and associated drainage basins, refer to the 1995 Surface Water Plan, Section III.

2.2.1 Available Resources

Several resources were used to prepare the drainage basemaps in accordance with the Scope of Work. These included existing GIS shapefiles, City storm drainage inventory, and AutoCAD basemap files. The City initially provided some of the GIS shapefiles from their existing data inventory, and the remaining shapefiles were prepared as a part of this Update. The City provided the following data sets: streets, parcels, City boundaries, water bodies, streams, wetlands, and stormwater management facilities (i.e., ponds). A subconsultant to the City had recently inventoried the wetlands, streams, fish habitat, and stormwater facilities. This information was incorporated into the City's GIS.

Several resources came from information that resided in the City's AutoCAD files. This included the 2-foot topographical contours within the City limits, and the drainage basin delineations from the 1995 Surface Water Plan. The AutoCAD files were converted to GIS format and then adjusted to align with the City's datum.

The storm drainage inventory (storm sewers and catch basins) came from the City's inventory. The City had been inventorying their storm sewer system for several years. Most of this information was collected by City staff on handwritten log books and field maps. Information such as pipe size, depth of the pipes, and pipe and catch basin type and material was collected by the staff. As part of the plan Update, CH2M HILL assisted the City staff with setting up the GIS storm drainage shape files and inputting the inventory into the database. Personnel from the City's GIS group digitized the locations of catch basins in GIS format and connected the catch basins with storm pipes. Pipe and catch basin information from the field books was added to the data set. CH2M HILL did not verify or field check the data inventory. As of the date of this plan Update, the City is still in the process of completing the data inventory. The GIS figure included in this section reflects the most up-to-date inventory of storm drains and catch basin at the time of writing of this report.

The original drainage basin delineations were hand-drawn on AutoCAD maps, and these were also used to refine the basins. These maps are included in Appendix C of the 1995 Surface Water Plan.

2.2.2 Updated Basin Delineations

As described in the previous subsection, the City provided the AutoCAD-converted drainage basin delineations from the 1995 Surface Water Plan. City staff digitized the shapefiles into GIS, using the hardcopy basemaps. Many of the basins required adjustment to reflect the detailed, topographic information (2-foot contours) that was recently incorporated into the City's GIS, and the drainage system inventory. An automatic delineation routine within the GIS program that uses digital elevation data was used to help refine the basin boundaries. Boundaries were checked against the drainage inventory (pipe flow directions) as well as the original AutoCAD drainage maps from the 1995 Surface Water Plan.

For several of the basins that are partially located within the study area, some of the basin outer boundaries were extended to reflect the new City Limits, thereby increasing the basin sizes. Also, some of the original basin boundaries were "cut off" at the study limits (i.e., the entire basin was not mapped), and these basins have been extended to accurately reflect the basin drainage area, even though some of these areas are outside the City Limits. The majority of the other basins that are contained within the City Limits were unchanged with respect to total drainage area.

Table 2-1 lists the basins and subbasins, drainage areas, and original drainage areas from the 1995 Surface Water Plan. The updated basins are shown in Figure 2-1.

TABLE 2-1
Drainage Basin Areas

Basin Name	Subbasin	Subbasin Area (acres)	Basin Area (acres)	Original Basin[1] Area (acres)
Britt Slough	SB-30	386	386	73
Carpenter Creek Basin		-	1760	3753
	SB-35	1519	-	-
	SB-36	241	-	-
Combined Sewer Area	SB-23	438	438	462
Kulshan Creek Basin		-	1396	1404
	SB-14	394	-	-
	SB-05	147	-	-
	SB-06	89	-	-
	SB-11	80	-	-
	SB-12	55	-	-
	SB-09	9	-	-
	SB-10	122	-	-

TABLE 2-1
Drainage Basin Areas

Basin Name	Subbasin	Subbasin Area (acres)	Basin Area (acres)	Original Basin[1] Area (acres)
	SB-08	21	-	-
	SB-13	303	-	-
	SB-08A	5	-	-
	SB-07	171	-	-
Maddox Creek Basin		-	2058	1984
	SB-22	477	-	-
	SB-37	633	-	-
	SB-19	177	-	-
	SB-51	383	-	-
	SB-34	388	-	-
Nookachamps Creek		-	1073	347
	SB-02	431	-	-
	SB-39	77	-	-
	SB-38	565	-	-
Skagit River Tributary		-	842	
	SB-01	191	-	-
	SB-03	651	-	-
Trumpeter Creek Basin		-	2046	2013
	SB-04	339	-	-
	SB-18	205	-	-
	SB-17	553	-	-
	SB-15	564	-	-
	SB-16	384	-	-
West Mount Vernon		-	350	450
	SB-26	114	-	-
	SB-25	80	-	-
	SB-24	156	-	-

[1]Basin areas were calculated and delineated as part of the 1995 Surface Water Plan. Subbasin areas were not included in the plan.

2.2.3 Freeway Drive Subbasin

The Freeway Drive subbasin is part of the Kulshan Creek basin. As part of the Stormwater Plan Update, CH2M HILL and its subconsultant Northwest Hydraulic Consultants (NHC) performed a detailed hydrologic and hydraulic modeling exercise to simulate existing and future conditions of this area. The area is flat with developing commercial properties, and the storm drainage is pumped via a pump station and force main to the Skagit River. The City requested that an analysis be performed to determine the existing capacity of the system and the current level of system performance, and to identify the system pump station improvements which would be needed for future build-out of the basin.

The detailed modeling task required a review of drainage basin areas for the Freeway Drive stormwater system so that the hydrologic model could be updated. The City provided information about the existing storm drainage system and the operation of the detention ponds in the area. As-built drawings, 2-foot topographical contours, and drainage inventory provided information about drainage basins. Field investigations were also performed to help in the delineation process.

The subbasins tributary to the Freeway Drive pump station were updated using the information described above. Three changes were made to the basin delineations that are different than the original plan. First, a new subbasin 8A was added to the system. This subbasin was originally part of the north section of subbasins 7 and 6 (See Figure III-5, 1995 Surface Water Plan). Subbasins 6 and 7 drain south to the Kulshan Creek pump station. It was determined through conversations with City Staff that a portion of those subbasins drain to the west and then to the Freeway Drive system. Therefore, subbasin 8A was delineated and included in the Freeway Drive system.

The second change to the system involved removing the tributary area of subbasin 9. During a meeting, City staff indicated drainage from subbasin 9 (previously assumed to be tributary to the Freeway Drive pump station) likely flows instead to the separate College Way system (Kulshan Creek).

The third change is an addition to the Freeway Drive system within the non-tributary subbasin 11. Part of subbasin 11 south of College Way (the area bounded by the centerlines of Interstate 5 to the east and Freeway Drive to the west) was determined to drain to the Freeway Drive pump station. The drainage corridor follows the alignment of the force main for the Freeway Drive pump station.

2.2.4 Upper Maddox Creek

The analysis of upper Maddox Creek and the Little Mountain Estates area was a detailed hydrologic and hydraulic modeling study to determine the performance of the Little Mountain Estates Regional detention facility and determine if there is unused capacity in the detention storage systems. As part of the analysis, a redelineation of the areas tributary to the facility was performed to more accurately reflect the conditions at the facility. A review of the subbasin delineation for the Little Mountain Estates detention facility showed this subbasin (51) to be nearly twice as large as previously estimated for the 1995 Surface Water Plan. For this reason, the tributary basin was redelineated based on the GIS 2-foot contour interval topographic mapping, recent drainage inventory, drainage reports, and visual field observations. This Little Mountain Estates subbasin was further subdivided into

5 separate subbasins to account for the routing effects of two upstream detention ponds tributary to Maddox Creek.

SECTION 3: SURFACE WATER MODELING AND ANALYSIS

3. Surface Water Modeling and Analysis

This section describes the surface water analyses performed for the surface water comprehensive plan update. The purpose of the analysis presented in this section is to provide updated surface water models to more accurately reflect land use and floodplain storage in the Maddox Creek basin. The information presented in this analysis will also be used to develop Capital Improvement Program (CIP) projects and may be used to support future stormwater planning efforts.

3.1 Maddox Creek HSPF Model Update

The hydrologic analysis of the Maddox Creek basin was performed using the Hydrologic Simulation Program – Fortran (HSPF) model. This model was selected because it uses historical rainfall records to generate a long-term series of surface water flows. This long-term flow record gives a more accurate estimate of flood-frequency at a given point than provided by single-event design storm analysis. A long-term flow record also allows analysis of flow duration, which is useful when studying the flow effects on channel erosion.

An HSPF model for the Maddox Creek basin was originally developed in 1993 to support the 1995 Surface Water Plan. For this plan update, the model was updated and recalibrated to include a longer meteorological record, changed land use, and a more accurate representation of storage volumes in the lower portion of the basin. The updated HSPF analysis is fully documented in Technical Memorandum No. 1 found in Appendix A.

The updated Maddox Creek HSPF model will be used for future analysis. The updated meteorological and calibrated input parameters developed for this model form the basis for HSPF models developed for detailed study areas described in Section 3.2.

3.1.1 Model Set-up

The Maddox Creek HSPF model continuously simulated streamflows for existing land use conditions at a one-four time step. The simulation was performed using a 46-year meteorological record extending from October 1956 to December 2002. This model was based on the original HSPF model developed to support the 1995 Surface Water Plan. Revisions to the model included:

- Extending the meteorological data set to include recent precipitation data
- Updating land-use to reflect current (2002) land use conditions
- Refining instream storage volume estimates

Meteorological Inputs

Meteorological inputs included 1-hour precipitation data from the NOAA precipitation station at Burlington and WSU Public Agricultural Weather Station (PAWS) precipitation station at Mount Vernon. Data from the Mount Vernon precipitation station were adjusted to represent the slightly higher rainfall amounts at the Burlington precipitation station. Daily pan evaporation data were obtained from the WSU PAWS Puyallup pan evaporation station.

Subbasin and Land Use

The 1995 Surface Water Plan divided the Maddox Creek basin into 5 separate subbasins. This analysis used the subbasin delineation developed for the 1995 Surface Water Plan (see Figure III-5 in the 1995 Plan).

Land segment parameter values were defined to represent the conditions that allow rainfall to infiltrate into the soil, cause rainfall to pond and evaporate, and produce runoff in the drainage systems and streams. These values are based on a combination of land use, surface vegetation, and soils.

A review of the 1992 and 2001 aerial photography of the basin showed that land development in the Maddox Creek basin is about midway between full buildout and the level of development that existed when the original HSPF model was created. Therefore, existing conditions land use (year 2002) was approximated as an average of the current (1991) and future build-out estimated in the 1995 Surface Water Plan. Future land use conditions were based on a recently completed land use analysis.

Land use is converted to HSPF land segment parameter values representing the amount of surface effective impervious areas (EIA), vegetation, and soils. Effective impervious area is the area that is directly connected to the conveyance system and does not infiltrate into the ground. Surface vegetation was classified into three general categories (forest, pasture, and grass) which affect how much rainfall is intercepted before reaching the ground. Finally, soils have a major impact on how much and how fast the rainfall can infiltrate into the ground before it begins to generate stormwater runoff. Four general soils categories were used: till, outwash, Custer-Norma, and saturated. Table 3-1 describes the HSPF land use parameters used in the analysis.

TABLE 3-1
2002 Existing Conditions HSPF Land Use Parameters (area in acres)

	SB 51	SB 19	SB 34	SB 22	SB 37	TOTAL
Till Forest	100.1	95.7	200.1	82.3	82.2	560.4
Till Pasture	102.1	77.2	51.1	57.5	62.3	350.1
Till Grass	53.8	123.1	20.1	146.9	15.9	359.8
Outwash Forest	--	--	--	--	23.7	
Outwash Pasture	6	12.1	--	--	13.7	31.8
Custer Norma Grass	--	--	--	27.5	301.9	329.4
Saturated	2	14.3	11.8	--	--	28.1
Impervious (EIA)	6.8	21.5	2.7	133.1	116.4	280.4
TOTAL	270.6	343.8	285.7	447.3	616.1	1963.6

Detention and Instream Storage

The original Maddox Creek models did not account for the significant amount of channel floodplain storage in the relatively flat lower basin areas. As a result, the original estimates of peak flows at Hickox Road were overestimated. Additional analysis showed that approximately 120 acre-feet of floodplain storage exists at this location during peak flow conditions.

Existing detention facilities were generally not included in the model. These facilities likely provide little flow attenuation because they are small in size and were designed using ineffective flow control standards. The exception is the large regional detention facility at Little Mountain Estates.

The regional detention pond at Little Mountain Estates is an 8.7-acre-foot facility that provides critical control of peak flows from the upstream basin area. A side-flow weir located adjacent to Maddox Creek controls inflow to the facility. This weir, as originally designed, was intended to divert high streamflows into the detention facility while allowing relatively low flows to remain in the channel. However, this weir failed after a short period of service, causing a large portion of creek flow to be directed into the pond. Sandbags have been placed as a temporary measure to keep at least some flow in the main channel, but these are expected to be ineffective under high flow conditions. For this reason, the revised HSPF model was configured so that the Little Mountain Estates pond receives all streamflow from the upper basin flows to reflect the failed condition of the side-flow weir. The flow routing table for this facility was also updated to reflect a more accurate estimate of the outlet structure discharge rating. Additional analysis of the Little Mountain Estates regional detention facility and side-flow weir is presented in Section 3.2.2.

Calibration

This calibration effort focused on streamflow data collected at Hickox Road during the period December 2001 through February 2002. The largest peak flow event during this period occurred on December 13, 2001. The magnitude of this event was estimated to be equivalent to a 2-year recurrence interval peak flow event. The original Maddox Creek HSPF models were calibrated to streamflow data collected during the 1991-92 and 1992-93 wet weather seasons at a culvert located 1,200 feet upstream from Anderson Road. The largest flow during the original calibration period had a return period estimated as approximately a three-year event, resulting from a storm on January 11, 1992.

The revised model was unable to match measured streamflow during the initial calibration effort. Calibration was improved when two revisions were made to the original model. First, the original land segment parameter values were replaced with regional parameters develop by the USGS for basins in Western King and Snohomish Counties (Dinacola, 1990). The second revision routed groundwater from the upper basin directly to the lower basin, bypassing the stream channels in the upper basin.

3.1.2 Flood Frequency Analysis

Peak flood frequency is the probability that a given peak flood event will occur in any year. Flood frequency is commonly expressed as a return-period, which is the inverse of the probability, and represents the average interval between the occurrences of a specific magnitude flood. Peak flood-frequency was determined from the 46 peak annual discharge values computed with the updated HSPF model.

Tables 3-2 lists the peak flows for existing land use conditions determined with the updated Maddox Creek hydrologic model for the 2-, 10-, and 100-year recurrence intervals. Table 3-3 shows this information from the 1995 CSWMP.

TABLE 3-2
Existing Conditions Peak Flood Frequency Computed With Updated Maddox Creek HSPF Model

Subbasin	2-Year Peak Flow (cfs)	10-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)
SB 51 - Maddox Creek Below Little Mountain Estates Pond	4	11	14
SB 19 - Maddox Creek at Blackbum Road	19	34	67
SB 34 - Maddox Creek above Anderson Road	28	61	105
SB 22 - Flowers Creek & I-5 Highway Corridor	46	77	100
SB 37 - Maddox Creek at Hickox Road	46	75	95

Note: Flow values reported in the table include contributions from upstream tributary subbasins.

TABLE 3-3
Existing Conditions Peak Flood Frequency Computed With 1993 CSWMP Maddox Creek HSPF Model

Source: City of Mount Vernon Comprehensive Surface Water Management Plan (R.W. Beck, 1995)

Subbasin	2-Year Peak Flow (cfs)	10-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)
SB 51 - Maddox Creek Below Little Mountain Estates Pond	12	20	32
SB 19 - Maddox Creek at Blackburn Road	17	25	40
SB 34 - Maddox Creek above Anderson Road	28	45	70
SB 22 - Flowers Creek & I-5 Highway Corridor	40	65	107
SB 37 - Maddox Creek at Hickox Road	95	170	280

Note: Flow values reported in the table include contributions from upstream tributary subbasins.

The updated land use and revised HSPF parameter set used in the updated Maddox Creek HSPF model resulted in higher predicted peak flows for most upland subbasins in the Maddox Creek basin. Subbasin SB 51 is the exception where peak flows decreased due to the revised stage-discharge relationship used for Little Mountain Estates pond. However, the increase in peak flows from the upland subbasins (SB-19, SB-22, and SB-34) was offset by the floodplain storage added in lower Maddox Creek (SB 37). Including the floodplain storage in the lower reach of Maddox Creek (SB 37) resulted in a significant reduction in peak flow at this location and more closely represents the actual flood condition observed in this reach.

3.2 Detailed Study Area Investigation

Detailed technical analysis was performed for four separate study areas in the City of Mount Vernon. Three of these studies investigated stormwater flooding issues using detailed numerical analysis and information developed with the updated Maddox Creek HSPF model. The fourth study was more qualitative and investigated the use of Low Impact Development (LID) techniques to reduce stormwater impacts.

3.2.1 Maddox Creek Floodplain Encroachment

The current Mount Vernon Critical Areas Ordinance (CAO) requires 25- to 50-foot buffer widths for Maddox Creek. Because these buffer widths are substantially lower than recommended by current scientific research, the City is considering updating the CAO to require larger buffer widths. The Lower Maddox Creek floodplain area is under considerable development pressure to fill and otherwise encroach upon the floodplain. Because much of the floodplain area lies outside the stream buffer, current regulations would allow this area to be filled.

Output from the updated HSPF model described in Section 3.1 was used to analyze the hydrologic impacts of two encroachment scenarios. The two scenarios are:

- Scenario 1 - Allow the floodplain to be encroached upon up to the existing 25-foot buffer width (50-foot-wide corridor) for natural and constructed channels.
- Scenario 2 - Limit floodplain encroachment to the proposed 100-foot buffer width (200-foot-wide corridor) for natural channels and 25-foot buffer width (50-foot-wide corridor) for constructed channels.

A peak flow event occurring in November 1990 was selected as the design event for this analysis. The recurrence interval for this event is estimated to be roughly equivalent to a 100-year peak flow event. This hydrograph was routed through an unsteady flow hydraulic model to accurately compute the peak water surface elevation and peak flow impacts.

Table 3-4 shows the results of the floodplain encroachment analysis. This table shows that potential loss of floodplain storage in the lower basin could result in a 50 percent increase in the 100-year peak flow in Maddox Creek at the City's urban growth boundary (Hickox Road) for the existing buffer width requirement (Scenario 1). The floodplain analysis also showed that Maddox Creek flood water levels within the city limits could increase by up to 1.6 feet at some locations.

TABLE 3-4
Peak Flow Increase at Hickox Road for Floodplain Encroachment Scenarios

	Peak Flow (cfs)	Percent Increase[1]
Scenario 1 – 25-foot buffer	200	52
Scenario 2 – 100-foot buffer	182	38

Note:
[1]100-year peak flow is 132 cfs under future land use conditions.

The HSPF analysis for floodplain encroachment is fully documented in Technical Memorandum No. 1 found in Appendix A.

The floodplain encroachment analysis documented in this section demonstrates the effectiveness of floodplain storage in attenuating peak flows during large storm events. When fill is placed in the floodplain, the attenuating affects of storage are lost. This loss of attenuation usually results in higher peak flood stages and/or downstream increased peak flow rates. More flooding leads to the need for flood control projects that ultimately result in transferring stormwater management costs to the public.

3.2.2 Little Mountain Estates Regional Detention Facility Evaluation

The Little Mountain Estates detention facility is located in the southeastern part of the City (SB-51) of the Maddox Creek basin (see Technical Memorandum No. 3 in Appendix A). This pond was built in the 1990s to provide 8.7 acre-feet of stormwater detention for the Little Mountain Estates subdivision and to serve as a regional facility to attenuate peak streamflow rates caused by future development in the upper Maddox Creek basin. A concrete side-flow weir was constructed at the southeast corner of the pond to divert high streamflow in Maddox Creek into the facility. The weir has failed in recent years allowing a greater volume of streamflow into the pond.

Two detention ponds were constructed upstream of the Little Mountain Estates facility to provide stormwater control for all phases of the Maddox Creek Planned Urban Development (PUD). There may be unused storage capacity in these ponds because not all phases of the PUD were constructed as planned.

The hydrologic analysis of the Little Mountain Estates regional detention facility was performed using the HSPF model. This analysis used the land use parameters and meteorological inputs developed for the regional Maddox Creek HSPF model described in Section 3.1. This model was used to investigate:

- The potential to mitigate peak flow increases due to future land development,
- The availability of unused detention storage in the Maddox Creek PUD detention ponds, and
- Alternative diversion weir/outlet structure configurations for Little Mountain Estates Regional Detention Facility.

The HSPF analysis was performed for five scenarios assuming three land use conditions in combination with three routing scenarios. Table 3-5 describes the five scenarios.

TABLE 3-5
HSPF Modeling Scenarios

Scenario	Land Use Condition	Routing Scenario
1	Pre-Developed (forested)	No Ponds
2	Existing Condition	Damaged diversion weir and existing control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2

TABLE 3-5
HSPF Modeling Scenarios

Scenario	Land Use Condition	Routing Scenario
3	Existing Condition	Modified Diversion and control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2
4	Future Condition	Damaged diversion weir and existing control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2
5	Future Condition	Modified Diversion and control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2

A review of the subbasin delineation for the Little Mountain Estates detention facility (SB-51) showed this subbasin to be nearly twice as large as previously estimated for the 1995 CSWMP. For this reason, the tributary basin was redelineated based on new, 2-foot contour interval topographic mapping, recent drainage inventory, drainage reports, and visual observation. This Little Mountain Estates subbasin was further subdivided into 5 separate subbasins to account for the routing effects of two detention ponds serving the Maddox Creek PUD.

Predeveloped conditions were assumed to be forested except for wetland areas. Existing and future land use conditions were recomputed for this analysis to account for the larger tributary area. More precise techniques were used to determine land use because this analysis required a higher level of accuracy than was needed for the regional HSPF model. Existing conditions land use was updated to reflect current (2004) development conditions. The current development conditions were based on aerial photography, drainage reports for existing developments, and visual observations. Future conditions land use was updated based on current land use zoning with a few exceptions. Existing undeveloped, and low-density residential areas were assumed to be redeveloped to higher-density land use unless in a critical or protected area.

The existing and modified channel bypass and weir diversion configuration were explicitly modeled in this analysis. The characteristics of the existing weir were approximated based on actual site conditions observed in February 2004. The characteristics of the modified diversion weir were based on recommendations provided in the draft letter report on *Hydraulic Structure Modifications for Little Mountain Estates Detention Facility* (R.W. Beck, 1995).

Table 3-6 shows the peak flood frequency for Little Mountain Estates Regional Detention Facility. This table shows that for the existing land use condition, the Little Mountain Estates Regional Detention Facility with the current diversion weir and control structure configuration (Scenario 2) attenuates peak flows to predeveloped conditions peak flows for events less than or equal to the 10-year event. If the diversion weir and control structure are modified as proposed in the R.W. Beck report, peak flow rates will increase for events below the 2-year return frequency but decrease for less frequent return periods.

Table 3-6 shows that flows are predicted to significantly increase under future land use conditions (Scenario 4). The peak flow increase ranges from a doubling for the 2-year event to about a 60 percent increase for events with a return period equal to or higher than the 100-year event. The diversion weir and control structure modifications (Scenario 5) mitigate the peak flows, but the increase will still be greater than peak flows under existing land use conditions.

TABLE 3-6
Peak Flood Frequency at Little Mountain Estates Regional Detention Facility

Scenario	Land Use Condition	Diversion and Control Structure Configuration	2-Year Peak Flow Rate (cfs)	10-Year Peak Flow Rate (cfs)	100-Year Peak Flow Rate (cfs)
1	Predeveloped (forested)	None	10.0	18.7	20.3
2	Existing	Existing	8.9	18.0	24.4
3	Existing	Modified	10.5	15.5	19.9
4	Future	Existing	20.0	32.5	39.1
5	Future	Modified	16.5	24.4	34.5

Table 3-7 shows the peak annual stage for the Little Mountain Estates Regional Detention Facility. This table shows that approximately 0.5 feet of unused storage depth (0.8 acre-feet) is available in the pond for Scenario 2. The storage volume will be fully utilized for Scenario 3 and Scenario 4. The storage volume will be 0.7 feet higher than the maximum allowable high water elevation for Scenario 5 (0.9 acre-feet over-utilized).

TABLE 3-7
Peak Stage Frequency at Little Mountain Estates Regional Detention Facility

Scenario	Land Use Condition	Diversion and Control Structure Configuration	2-Year Peak Elevation (feet)	10-Year Peak Elevation (feet)	100-Year Peak Elevation (feet)	Comparison to Maximum Pond Elevation (assuming 1-foot freeboard)
2	Existing	Existing	215.6	217.0	217.3	0.5 feet remain
3	Existing	Modified	216.6	216.1	217.8	Fully utilized
4	Future	Existing	217.0	217.5	217.8	Fully utilized
5	Future	Modified	215.8	218.3	218.5	Over-utilized

Note: Overflow elevation = 218.8 feet. Maximum pond elevation = 217.8 assuming 1 foot freeboard.

Flow duration analysis was performed for the reach downstream of Little Mountain Estates Regional Detention Facility. This reach was assumed to include the predicted outflow from the Little Mountain Estates pond with the predicted discharge in the bypass reach. Flow duration is the amount of time (generally expressed as a percent of total) in which a given flow is equaled or exceeded. Table 3-8 shows the results of this analysis. This table shows that the flow duration under Scenario 2 is slightly higher than the predeveloped condition

(Scenario 1) flow duration. This table also shows that flow duration will increase under future land use conditions.

TABLE 3-8
Flow Duration at Little Mountain Estates Regional Detention Facility

	Flow Duration (cfs)				
Percent Time Exceeded	Scenario 1 – Predeveloped Land Use, No Pond	Scenario 2 – Ex. Land Use, Ex. Structure Configuration	Scenario 3 – Ex. Land Use, Mod. Structure Configuration	Scenario 4 – Fu. Land Use, Ex. Structure Configuration	Scenario 5 – Fu. Land Use, Mod. Structure Configuration
0.01	14.3	16.6	14.9	26.3	21.9
0.05	10.1	11.6	11.2	18.4	16.4
0.1	8.4	9.2	10.0	14.9	14.3
0.2	6.9	7.5	8.9	11.4	12.1
0.5	4.9	5.6	7.0	7.7	9.5
1	3.4	4.3	5.2	6.0	8.0
5	1.2	2.2	2.0	3.2	3.5
10	0.6	1.4	1.2	2.2	1.8
30	0.1	0.3	0.3	0.4	0.4
90	0.01	0.02	0.02	0.02	0.02

The HSPF analysis showed that the Maddox Creek PUD ponds are fully utilized and have no excess capacity.

The Little Mountain Estates Regional Detention Facility in its current configuration is able to match predeveloped peak flow for the current land use condition. However, this facility is not large enough to mitigate the increase in peak flow rates predicted for future land use conditions.

3.2.3 Freeway Drive

The Freeway Drive subbasin is an internally drained, 46-acre basin located west of Interstate 5 within a meander loop of the Skagit River. Stormwater from this basin flows to a regional detention facility located west of Freeway Drive and is then pumped to the Skagit River. The current pond/pump configuration is adequately sized to convey stormwater for existing development but does not have the capacity to convey stormwater from future development.

The hydrologic analysis of the Freeway Drive basin was performed using an updated HSPF model. This analysis used the land use parameters and meteorological inputs developed for the regional Maddox Creek HSPF model described in Section 3.1.

The tributary subbasin area was revised to better reflect actual drainage conditions. More precise techniques were used to determine land use because this analysis required a higher level of accuracy than was needed for the regional HSPF model. Predeveloped conditions were assumed to be forested. Existing land use conditions were revised to reflect the current (2004) development conditions based on aerial photography, drainage reports for existing developments, and visual observations. Future land use conditions were based on the assumption that undeveloped parcels would develop as commercial property.

The routing elements of the model were updated to better include:

- Additional volume in the Freeway Drive Regional Stormwater Facility. The previous estimate of storage volume was based on the live storage level shown in the design plans. As-built drawings showed the live storage level to be 2 feet lower than assumed.
- Pump station improvements. Recent pump station improvements more than doubled the conveyance capacity of the system from 557 gpm to 1325 gpm.
- Storage in large ditch adjacent to Freeway. The previous analysis assumed this ditch would be replaced with a large diameter pipeline. According to City staff, this project is unlikely to occur.
- Additional detention storage due to construction of new facilities. The updated model includes a new facility constructed for the Riverside Bridge project and a composite detention pond that incorporates the cumulative storage routing characteristics for all detention facilities constructed since the time of the original analysis.

The performance standard used for this analysis assumed that the volume of overflow from the Freeway Drive facility should not be greater than the runoff volume that occurred under predevelopment conditions. This subbasin is a closed depression, so controlling peak flows is not necessary because there are no streams to protect. Because this subbasin is a closed depression, controlling the duration of inundation (or volume) is critical. For this analysis, the performance standard was to limit the volume of overflow from the Freeway Drive regional detention facility to 8 acre-feet. This value corresponds to the amount of runoff volume estimated to occur under predevelopment conditions.

Figure 3-1 shows the performance of the current Freeway Drive pump/pond configuration. This figure shows that the Freeway Drive pond has enough capacity to mitigate about 28 of the available 56 acres of new commercial development in the subbasin. This corresponds to 50 percent of the current development potential in the subbasin.

The HSPF analysis for the Freeway Drive Pump Station analysis is fully documented in Technical Memorandum No. 2 found in Appendix A.

To accommodate full buildout of the Freeway Drive basin north of College Way, the existing 10-inch force main should be replaced with an 18-inch diameter pipe. An 18-inch-diameter pipe will allow the existing pump to operate at a higher capacity. The recommended improvement will control buildout condition overflows from the regional stormwater pond to a runoff volume less than what occurred under predeveloped (forested basin) conditions. Construction of this improvement should be timed to occur before the development of the next 28 acres.

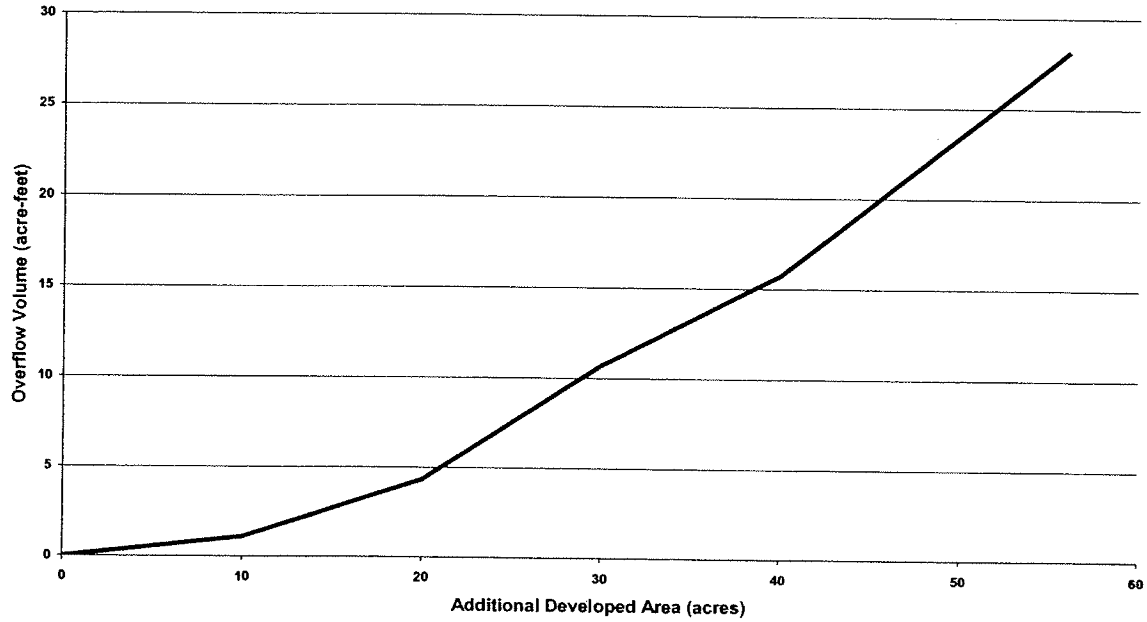

FIGURE 3-1
Development Potential in Freeway Drive Subbasin

Figure 3-2 shows the effect of pump capacity on overflow volume. This figure shows that a pump with a capacity of 2400 gpm (or greater) will limit overflow volume to less than 8 acre-feet.

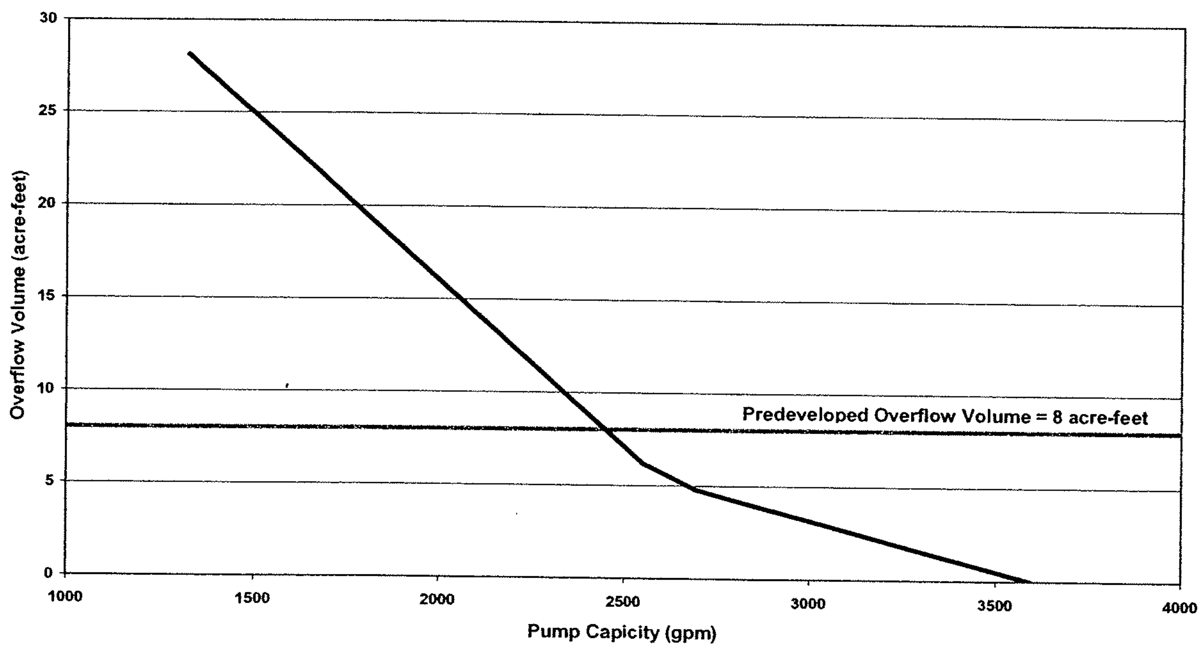

FIGURE 3-2
Effect of Pump Capacity on Overflow Volume

3.2.4 Stormwater Management at Cascade Christian Center Using Low Impact Development Techniques

Low Impact Development (LID) strategies are being introduced to the Western Washington area as a means of reducing impacts to aquatic systems by identifying development measures which promote natural hydrologic functions such as evaporation and infiltration and reduce or eliminate water quality impacts. The premise is that the natural hydrologic function cannot be achieved with conventional development and large end-of-the-pipe facilities. Rather, a new approach to site development is needed that creates less runoff and preserves more of the functions of the native forest. LID strategies allow natural infiltration to occur as close as possible to the original area. By engineering the terrain, vegetation, and soil features to perform this function, costly conveyance, treatment and detention systems can be avoided, and the landscape can retain more of its natural hydrological function.

The Cascade Christian Center of Skagit County development project was selected as the LID demonstration project. Alternative site designs were developed showing various LID techniques that can be included in the project.

Phase I of the Cascade Christian Center includes the construction of a new church building and parking lot and eight residential lots on an 8 acre site. This development will include about 5 acres of impervious area directly connected to the storm drain system. The impervious area consists of rooftops, parking areas, streets and sidewalks. The remaining area is landscaped or grass. Runoff control will be provided in a 2.1 acre-foot detention facility.

An alternative design was prepared that includes LID techniques such as biorentention cells, permeable pavers, forest retention and rainfall dispersion from impervious areas. The overall design promotes a decrease in impervious area and a more engineered landscape to facilitate storage and infiltration of stormwater runoff. This will decrease the required detention storage by 1.1 acre-feet. The result of the LID design was an overall reduction of total impervious area (primarily parking areas) of approximately 1.5 acres.

The LID approach reduced the effective impervious areas from 65 percent to 44 percent. In the process, the total volume of total stormwater runoff decreased from approximately 35% to approximately 3% with more effective water quality treatment.

The LID approach is fully documented in Technical Memorandum No. 4 found in Appendix A.

SECTION 4: REGULATIONS AND POLICIES

4. Regulations and Policies

4.1 Regulatory Compliance Gap Analysis Summary

4.1.1 Introduction

A variety of state and federal regulations affect City storm and surface water programs. These regulations include the Clean Water Act (CWA), National Pollutant Discharge Elimination System (NPDES) Phase II Stormwater Program, the Endangered Species Act (ESA), and the Puget Sound Water Quality Management Plan (PSWQMP). Additionally, there are related guidance documents that recommend actions that are likely necessary to achieve compliance with the regulations. As an initial step in developing a comprehensive stormwater management plan update, Mount Vernon's existing regulatory compliance was evaluated to identify where potential "gaps" may lie between the City's existing policies, plans, codes, and practices and the regional and federal laws and guidance documents. Because they are enforceable federal laws, this analysis focuses on the CWA and ESA listings of salmon. The Washington State PSWQMP also specifies stormwater programs that jurisdictions must implement. This manual has not been enforced consistently, but the PSWQMP and the NOAA Fisheries Model ESA recommendation will be used by regulatory agencies to assess compliance. This section of the Surface Water Plan Update summarizes the major areas, where the City of Mount Vernon may not meet the requirements set forth by the above-mentioned programs, and identifies actions that are underway and future actions needed to fill existing gaps.

A detailed analysis of findings was prepared and a report was submitted previously to the City of Mount Vernon. The full report can be found in Appendix B of this Surface Water Plan Update. The discussion herein is a summary and update of that earlier report. The City has already initiated a number of actions to address potential gaps in regulatory compliance.

4.1.2 Methods

To identify potential "gaps" in Mount Vernon's regulations, policies, and practices, the following were reviewed:

- Mount Vernon Municipal Code
- Mount Vernon Comprehensive Plan
- Mount Vernon Comprehensive Surface Water Management Plan
- NPDES Phase II Minimum Control Measures
- NMFS 4(d) Municipal, Residential, Commercial, and Industrial (MRCI) Development Standards
- Tri-County Model 4(d) Proposal
- Puget Sound Water Quality Management Plan

A series of interviews related to regulatory compliance were also conducted with Mount Vernon Staff. These interviews contributed to the identification of potential "gaps." It was necessary to interview City staff from a variety of departments to understand the current level of enforcement and implementation of existing regulations and policies. In addition, staff members were able to identify particular areas of concern and desired outcomes associated with the Surface Water Plan Update.

4.1.3 Findings

4.1.3.1 NPDES Phase II Permit Requirements

EPA's Stormwater Phase II Final Rule requires Municipal Separate Storm Sewer Systems (MS4s) serving cities whose population is less than 100,000 to obtain an NPDES Phase II Municipal Stormwater Permit. Stormwater discharges are considered "point sources" of pollution, and the Clean Water Act requires all point source discharges to be covered by federally enforceable NPDES permits.

Mount Vernon complied with the regulatory requirements by submitting an application for coverage under a permit by the deadline of March 10, 2003. Ecology has not yet developed or issued a final permit for Phase II jurisdictions. Thus, the actual permit conditions are not yet known, and jurisdictions have no current mechanism to obtain a permit or permit coverage. In the interim, EPA has identified 6 minimum requirements that are discussed below. Ecology is likely to require more than the EPA 6 minimum requirements to provide consistency with the PSWQMP and the more stringent requirements of Phase I municipal stormwater permit jurisdictions. Mount Vernon does not yet meet the minimum requirements of 3 of the 6 EPA elements and only partially meets the minimum requirements of 1 of the 6 elements (Table 4-1):

TABLE 4-1
Mount Vernon and the NPDES Minimum Control Measure Requirements

Minimum Control Measure	Minimum Requirements Met
1. Public Education and Outreach on Stormwater Impacts	Yes[1]
2. Public Involvement/Participation	No
3. Illicit Discharge Detection and Elimination	No
4. Construction Site Stormwater Runoff Control	Yes[1]
5. Post-Construction Stormwater Management in New Development and Redevelopment	Partial[2]
6. Pollution Prevention/Good Housekeeping for Municipal Operations	No

[1]While the minimum requirements are currently met, the city will still need to set measurable goals to be in full compliance.
[2]Partial means that some of the minimum requirements have been implemented, but further additions are needed for compliance.

To meet the conditions of the NPDES permit, Mount Vernon will need to meet the minimum requirements of the 6 above listed measures. While some of the requirements include a substantial number of actions to implement them, others do not require a tremendous effort to achieve full compliance. Table 4-1 summarizes the 6 minimum control measures. The complete list of NPDES Phase II Requirements and NMFS Municipal, Commercial, Residential and Industrial Development Standards for a "Take" Exemption are provided in Appendix B.

For example, Minimum Control Measure (MCM) 2, "Public Involvement/Participation," only requires a jurisdiction to comply with applicable state, tribal, and local public notice requirements. On the other hand, MCM 3 requires an operator of a regulated small MS4 to develop, implement, and enforce an illicit discharge detection and elimination program. The permit requires that the program include a number of components including completing a storm sewer system map, which shows the location of all outfalls, and the names and location of all waters of the United States that receive discharge from those outfalls. The measure also requires the City to develop a program to detect non-stormwater discharges and illegal dumping. Since a complete inventory of the storm sewer system in Mount Vernon still needs to be completed, and because there is not a program for the detection of illicit discharges to storm sewers, the minimum requirements set forth in MCM #3 have not been met.

Additionally, the City will be required to keep records related to permit compliance and make them available for review for at least 3 years and prepare an annual report in years 2 and 4 of the permit.

4.1.3.2 Endangered Species Act 4(d) Rules for Incidental "take" Allowances

The ESA provides for the protection of endangered and threatened species. Two sections of the ESA directly affect local jurisdictions:

Section 4(d) relates to the listing of species as threatened or endangered. It allows the listing agency to publish rules that define conditions under which "incidental" take is permissible. The National Marine Fisheries Service (NMFS) issued the final 4(d) rules governing the conservation of steelhead and salmonids in the Northwest. To qualify for incidental take protection, municipalities must demonstrate compliance with the 4(d) rule. NMFS 4(d) rule allowing incidental take requires municipalities to conduct program actions and create and issue regulations which will provide for the conservation of threatened species.

Section 9 defines specific actions that are prohibited, which may result in a "take" of endangered species. A "take" could involve harming, harassing, pursuing, hunting, or killing a listed or endangered species. Destruction or changes to habitat (supporting listed and threatened species) is defined as a "harm" under the ESA, and Mount Vernon could be liable. However, the 4(d) rule for Northwest salmonids has an exemption for certain governmental activities if they meet the municipal, commercial, residential, and industrial (MRCI) development standards outlined in the final rules released in July 2000.

Recently NOAA Fisheries prepared a document that provides guidance for their staff when reviewing projects or evaluating municipal programs for ESA compliance. The guidance is based on the best science and commercial data available. The document lists best management practices (BMPs) to avoid and minimize the effects of stormwater on listed salmonids using natural watershed features. Furthermore, the document includes model terms and conditions that may be applied to programs that predict effects of hydrology and water quality as a result of stormwater runoff. It mentions that these terms and conditions can also be used to minimize impacts of programs being evaluated in the Section 4(d) process. Two "Reasonable and Prudent Measures" define the basis for the terms and conditions that are presented in the document:

The (Federal action agency) shall:

1. Minimize incidental take from development or land conversions by avoiding or minimizing adverse effects to watershed processes, or riparian or aquatic systems through the protection of subwatershed or reach water quality and natural hydrology.
2. Complete a monitoring and reporting program to ensure the objective of this Opinion is met, to minimize the likelihood of take from activities that result in stormwater runoff with the potential to affect water quality and hydrology in streams with listed salmonids.

Table 4-2 below presents NOAA Fisheries Model Terms and Conditions to minimize "take" and to support the survival and recovery of listed salmonids, and how Mount Vernon plans to accomplish each of them.

TABLE 4-2
NOAA Fisheries Model Terms and Conditions[1] to Minimize "take" and to Support the Survival and Recovery of Listed Salmonids

To Implement Reasonable and Prudent Measure #1, Mount Vernon Shall:	Will Be Accomplished By:
1A. Use a subwatershed or landscape approach to look for opportunities to restore natural hydrology.	Critical Areas Ordinance Update in progress
1B. Develop and implement a Stormwater Management Plan.	Comprehensive Surface Water Management Plan Update in progress
2. During construction, prevent pollutants from entering stormwater runoff.	Staff working to clarify responsibilities and improve inter-departmental communication
3. Minimize alteration of natural soils and vegetation.	Critical Areas Ordinance Update in progress
4. If designated (i.e., engineered) facilities are needed to minimize or avoid effects to hydrology and water quality; continuous rainfall/runoff models must be used to calculate the design facility.	Adoption of New (August 2001) Ecology Manual
To Implement Reasonable and Prudent Measure #2, Mount Vernon Shall:	**Area to Be Addressed:**
1. Implementation monitoring. Ensure that a monitoring report is submitted within 120 days of program implementation describing the success of implementing and meeting permit conditions. This shall include review of the Stormwater Management Plan.	Underway, will be refined in Comprehensive Surface Water Management Plan Update
2. Effectiveness monitoring. Gather any other data or analyses deemed necessary or helpful to complete an assessment of habitat trends in hydrology and water quality as a result of the permitted actions. Monitoring must demonstrate that the facility is operating as designed.	To be defined in Comprehensive Surface Water Management Plan Update

[1]These are generalized terms and conditions, and, therefore, should not be applied *pro forma*.

Low impact development (LID) techniques can be effective BMPs to minimize stormwater impacts on listed species. A document titled "Identifying Sites for 'Street Edge Alternatives'" is included in Appendix B as one example of BMPs that may be applicable to the City of Mount Vernon.

4.1.3.3 Puget Sound Water Quality Management Plan

The Puget Sound Water Quality Management Plan lists the elements of a comprehensive stormwater program that are required for local jurisdictions. The elements are similar to EPA's 6 minimum measures, but include the following additional requirements:

- "Assurance of adequate funding for the stormwater program through surface water utilities, sewer charges, fees, or other revenue-generating sources."
- "Local coordination arrangements such as interlocal agreements, joint programs, consistent standards, or regional boards or committees."

The PSWQMP also requires jurisdictions to include a stormwater element in their land use plans.

4.1.3.4 Growth Management Act

The growth management act requires land use plans to address stormwater as described in the PSWQMP and to provide concurrency of stormwater facilities with growth.

The GMA also directs growth in cities, creating a challenge for cities to accommodate growth and protect water quality and aquatic resources.

SECTION 5: STORM DRAINAGE CAPITAL IMPROVEMENT PLAN PROJECTS

5. Storm Drainage Capital Improvement Plan Projects

5.1 Purpose

The Capital Improvement Program (CIP) is a list of priority projects showing the estimated costs and available funding for each capital project over a 20-year period (2005 – 2024). The CIP implements and is consistent with the policies contained in the *Capital Improvements Plan (2004-2009)*, a regularly updated component of the *City of Mount Vernon Comprehensive Plan (1995)*.

5.2 Identification of Proposed Projects and Prioritization

The 1995 Surface Water Plan identifies a number of CIP and non-CIP problems in Section VI "Problem Identification." Table X-1 in Section X of the 1995 Plan summarizes the suggested Surface Water CIPs and shows a proposed schedule for improvements. This table has been reproduced in Appendix C to show the recommended projects and their disposition. The 1995 Plan's methodology of developing a comprehensive summary of stormwater problems involved public input, interviews with City Staff, interviews with agencies and jurisdictions, field observations and the performance of hydrologic and hydraulic modeling for specific areas.

This Stormwater Plan Update includes the pending projects identified by City staff as a result of the 1995 Surface Water Plan's CIP. It also includes CIP recommendations from the Shannon and Wilson, Inc. report "Inventory and Evaluation of the Kulshan and Trumpeter Stream Systems, Mount Vernon, Washington" (March 2001). In addition, several specific problems were identified by City staff and included in modeling analyses for this Plan Update. Of these, one will be included in the CIP.

The Surface Water section of the City's latest overall CIP (2004 – 2009), and a more current, Draft Surface Water CIP (for 2005 – 2010), received from the City were also referenced in the development of this CIP Update. The Draft CIP will need to obtain Planning Commission and Council Approval before it becomes official; however, it is an important planning tool for the development of this CIP.

The City's overall CIP for the years 2003 - 2008 (prepared by the Finance Department) lists the following priorities for the City's projects:

1) A safe and livable community
2) Infrastructure that assists in economic development
3) Completing unfinished projects

The approach to developing the CIP list shown herein focuses on clearly identifiable local improvements, with emphasis later in the planning period on projects requiring considerable analysis, design, and/or larger amounts of funding.

The entire list of recommended Surface Water CIP Projects for the City of Mount Vernon is shown in Table 5-1. This table identifies the CIP projects for a 20-year planning period, beginning in 2005, and lists estimated project costs. Costs developed for the 1995 Surface Water Plan have been escalated to 2005 levels using a 1.422 multiplier (based on ENR indices between 1995 and 2005). Detailed CIP sheets have been developed for 8 projects from the larger list. Table 5-2 lists these projects and Figure 5-1 shows their locations. The detailed CIP sheets are located in Appendix C.

TABLE 5-1
Surface Water Capital Improvement Projects – DRAFT, August 2004: Pending Council Approval

Project ID	Project Title	Project Cost in 2005 Dollars	Comments
D-01-01	Blackburn Road Culvert Replacement	~~$85,000~~ 194k	
D-01-02	Maddox Creek Restoration and Pond Retrofit	$50,000	
D-01-05	Park Street Pump Station	$30,000	Shared funding for this $60k total project: $30k Sewer Capital Reserve and $30k Surface Water Utility
D-05-01	Downtown Floodwall – Semi-Permanent	$180,000	Shared funding for this $250k total project: $70,000 Dike District, $180,000 Surface Water Utility
D-05-02	UGA Drainage Analysis	$80,000	
D-05-03	West MV Storm Force Main Upgrade	$35,000	
D-94-11	Erosion Problem Repairs	$12,000	
D-94-14	Log Weir Fish Structure	$12,500	
D-98-01	Downtown Floodwall – Permanent	$1,367,400	
D-06-01	Freeway Drive Force Main Replacement[1]	$765,000	
Regional System Problems[3]			
RS4b	Kulshan Creek Pump Station Phase II – Beyond 20 Years	$956,000	Not completed
RS6	Little Mountain Estates Detention Pond Modifications	Developer Build	Not completed. Included as analysis and recommendation element in the 2004 Surface Water Plan Update.
RS7	Erosion Control on Maddox Creek	$559,000	In progress (culvert removal). Project may incorporate with road improvements and become a County project. Centennial Grant obtained for stream enhancement, and Eaglemont development will fund culvert replacement.
Y	Maddox Creek Floodplain Encroachment – Future Channel Restoration[2]	[illegible]	

Local System Problems			
LS1	700-Foot-Long Berm along Hoag Road	$319,000	Not completed. City working with Wildlands, Inc.
LS6	Log Bed Control Weir Installation to Control Erosion North of Cedar Lane	$16,000	Not completed
LS7	MH Drop Structure and Pipe Extension on Kulshan Tributary Near Viewmount	$68,000	Not completed
LS11	Trashrack Installation at Storm Drain Inlet Near Kiowa and Nez Perce	$700	Not completed
LS12	Replacement of Storm Drain System in W. Mount Vernon along Memorial Highway	$792,000	Not completed
LS13	Additional Catchbasins Installation at Wall Street and Garfield Street	$20,000	Not completed
LS14	New Catchbasin Installation and Storm Drain Connection at Wall Street North of Memorial Hwy	$57,000	Not completed
LS15	Replacement of 16 Storm Drains Between E. Division and E. Fir Just West of N. LaVenture	$528,000	Not completed
LS16	Log Bed Control Weir Installation in Stream Between Mohawk and Apache	$16,000	Not completed
LS17	Culvert and Ditch Installation at Comanche Drive	$20,000	Not completed
LS18	Culvert Replacement at Shoshone East of Sioux	$34,000	Not completed
LS19	Armoured Spillway Installation in Two Detention Ponds Near Waugh and Division	$84,000	Not completed
LS20	Storm Drain Installation West of S 6th up to Lind and Connect to Maddox Tributary	$220,000	Not completed
LS24	*Drainage Improvement in Commercial Area on West Side of I-5 South of College Way.*	*Fix anticipated in conjunction w/RS1*	*Not completed*
LS25	Replacement of 3 Pipes Between Britt Slough and Blackburn Road	$404,000	In progress. Interlocal agreement with school district.
LS27	Replacement of 2 Pipes Along I-5 Between Blackburn and Anderson Road	$71,000	In progress

	Available Funds for Drainage Complaint Solutions	$600,000	$30,000 per year for 20-year planning period
Water Quality Problems			
WQ3	Installation of Oil/water separators	$466,000	Not completed
Environmental Resource Problems			
E2	Manhole Barrier Removal in Kulshan East of Railroad	$2,800	Not completed
E3	Log Weir Fish Structure Installation – Kulshan Creek North of Cedar Lane	$16,000	Not completed
E4	Restoration of Channel on Kulshan from Riverside to N 18th (2,200 feet)	$148,000	Not completed
E5	Restoration of Channel on Mainstem of Trumpeter (7,000 feet)	$466,000	Not completed
E11	Log Weir Fish Passage Structure Installation d/s of Culvert on Maddox Creek at Blackburn Road	$16,000	Not completed
	Conservation of Prime Headwater Habitats (Land Acquisition)[4]		
	Protection of Wetland Connections (Land Acquisition)[4]		
	Removal of Fish Passage Barriers in Trumpeter Creek System[4]		
	Protection of Remaining Riparian Conditions (Study/Policy Development)[4]		
	Restoration of In-Stream and Riparian Habitats[4]		
	Restoration of Wetland Connections[4]		

Total Project Costs $ 8,496,400

Footnotes:

[1] Upgrades will involve an optimization study; however, WSDOT has performed a regional study that may allow for a simplified look at Mount Vernon's specific issue. Results of the WSDOT study should be available in June 2004.

[2] There should be no filling of the original channel. While floodplain encroachment is a policy issue; ultimately, there is an opportunity for future restoration of the channel.

[3] See R.W. Beck Comprehensive Surface Water Management Plan, November 1995.

[4] See Shannon & Wilson Inventory and Evaluation of the Kulshan and Trumpeter Stream Systems, March 2001, for detailed list of projects under this category. Reference Appendix J "Review and Comment Letter from WDFW, Dated 9/25/02" for direction on completion of projects.

TABLE 5-2
Surface Water Capital Improvement Plan Project Funding by Source – DRAFT, June 2004: Pending Council Approval

Project ID	Project Title	Project Cost in 2005 Dollars
D-01-02	Maddox Creek Restoration and Pond Retrofit	$50,000
D-05-03	West Mount Vernon Storm Force Main Upgrade	$35,000
D-94-11	Erosion Problem Repairs	$12,000
D-94-14	Log Weir Fish Structure	$12,500
X	Freeway Drive Force Main Replacement	$765,000
LS1	700-Foot-Long Berm Along Hoag Road	$319,000
LS12	Replacement of Storm Drain System in W. Mount Vernon Along Memorial Highway	$792,000
LS15	Replacement of 16 Storm Drains Between E. Division and E. Fir, West of N. LaVenture	$528,000
	Total Cost	**$2,513,500**

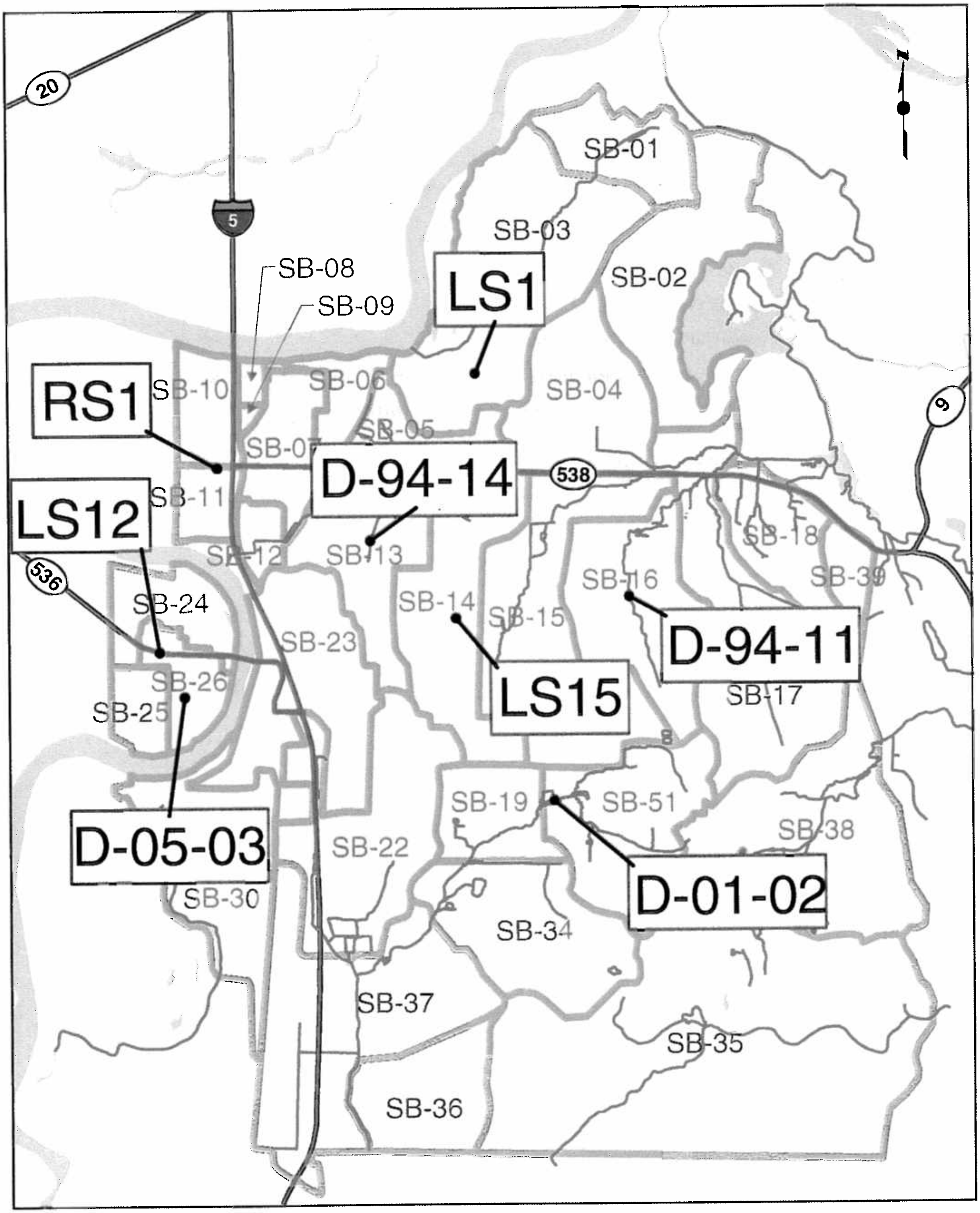

Figure 5-1
Detailed CIP Sheet
Location Map
See Sheets in Appendix C

SECTION 6: OPERATIONS AND MAINTENANCE

6. Operations and Maintenance

6.1 Purpose

The Washington State Growth Management Act requires the City of Mount Vernon to implement a stormwater facilities (public and private) maintenance program. This section provides an update to the 1995 Comprehensive Surface Water Management Plan's maintenance and operations section.

6.2 Current Level of Maintenance

6.2.1 Facilities Description/Inventory

Stormwater facilities include the storm sewer conveyance system (i.e., stormwater pipe, ditches, catch basins, and other structures) and retention/detention facilities. The City is currently working on a field update to their catch basin and stormwater conveyance inventory, with data being entered into the City's GIS Database. In the September 13, 2002, Pentec Environmental Report titled *Mount Vernon Stormwater Pond Inventory*, an inventory of the City's ____ retention/detention facilities is detailed. These facilities have been included in Figure 2-1, along with the City's most up-to-date GIS inventory of catch basins and stormwater conveyance facilities. Appendix D contains individual inventory sheets for the City's retention/detention facilities, as prepared by Pentec.

The City's stormwater facilities consist of the following system elements:*

__________ feet of stormwater conveyance pipe

__________ catch basins

__________ feet of open ditches

__________ residential retention/detention stormwater facilities

__________ commercial retention/detention stormwater facilities

__________ oil/water separators

__________ regional facilities (channels, pipes, enclosed drains)

* *This information to be filled in with the final GIS inventory data (currently being compiled by the City of Mount Vernon).*

6.2.2 Existing Stormwater Facilities Maintenance Program

As detailed in the 1995 Surface Water Plan, the City of Mount Vernon has an effective operations and maintenance program for certain elements of its stormwater system; however, some systemic issues, such as water quality and quantity problems, are apparent during heavy storms. The 1995 Surface Water Plan (Section VIII, Maintenance and Operations) suggested improvements to the existing plan to ensure that a comprehensive maintenance program would be employed. Refer to "C. Recommendations" in the 1995 Plan for a complete list of these suggested improvements.

6.3 Recommended Level of Maintenance

6.3.1 Proposed Maintenance Type/Frequency

Refer to the recommendations in the 1995 Surface Water Plan. No updates are proposed at this time. Tables 6-1 and 6-2, provided herein, are updated versions of the Annual Maintenance Costs and the Recommended Surface Water Maintenance Program tables from the 1995 Plan, respectively. The costs associated with maintenance activities have been updated from 1995 dollars to 2005 dollars using a standard index multiplier of 1.422, based on *Engineering News Record*'s cost indices.

TABLE 6-1
Annual Maintenance Costs

Structure	Maintenance Cost[a]	Percent of Total Cost
Pipes	$53,300	19%
Catch Basins	$53,200	19%
Streets	$66,000	24%
Roadside Ditches	$31,400	11%
Manholes	$22,200	8%
Detention Basins	$28,000	10%
Pump Stations	$13,400	5%
Curb Inlets	$10,300	4%
Total	$277,700	**100%**

[a]A conversion factor of 1.422 was used to turn 1995 dollars into 2005 estimate.
Final inventory quantities may affect the total maintenance costs.

TABLE 6-2
City of Mount Vernon Recommended Surface Water Maintenance Program

Note that the "units to be maintained" column will need to be updated when the City completes its system inventory.

Item No.	Maintenance Activity	Units to be Maint.	Prod. Unit	Freq. (times/ year)	Daily Prod.	Crew Size	Equipment	Annual Crew Days	Full-time Equip. Equiv.	Annual Person Days	Full-time Labor Equiv.	Annual Labor Cost[a]	Annual Equipment Cost[a]	Total Cost[a]	Percent of Program
1	Clean Catch Basins	1,500	EA	1.50	30.00	2	1 Vactor	75.00	0.34	150.00	0.68	$40,474.26	$12,723.89	$53,198.15	19.15
2	Clean Manholes	250	EA	1.50	12.00	2	1 Vactor	31.25	0.14	62.50	0.28	$16864.28	$5,301.61	$22,165.89	7.98
3	Clean Curb Inlets	800	EA	2.00	266.00	6	3 Trucks	6.02	0.03	36.09	0.16	$9,738.17	$457.77	$10,195.94	3.67
4	Roadside Ditches Remove Sediments	70,400	LF	0.20	750.00	3	1 Backhoe 2 Dumptrucks	18.77	0.09	56.32	0.26	$15,196.73	$6,453.21	$21,649.94	7.79
5	Roadside Ditches Vegetation Control	35,200	LF	2.00	2,500.00	1	1 Mower	28.16	0.13	28.16	0.13	$7,598.37	$2,366.38	$9,964.75	3.59
6	Clean Pipes (18" dia. or less)	132,000	LF	.33	1,500.00	2	1 Vactor 1 Truck	29.04	0.13	58.08	0.26	$15,671.63	$5,663.39	$21,335.02	7.68
7	Clean Pipes (over 18" dia.)	132,000	LF	0.33	1,000.00	2	1 Vactor 1 Truck	43.56	0.20	87.12	0.40	$23,507.45	$8495.08	$32,002.53	11.52
8	Regional Detention Basins Veg. Control	5	EA	2.00	1.00	1	1 Mower	10.00	0.05	10.00	0.05	$2698.29	$840.33	$3,538.62	1.27
9	Regional Detention Basins Remove Sed.	5	EA	0.33	1.00	2	1 Backhoe 1 Dumptruck	1.65	0.01	3.30	0.02	$890.43	$346.37	$1,236.80	0.45

TABLE 6-2
City of Mount Vernon Recommended Surface Water Maintenance Program

Note that the "units to be maintained" column will need to be updated when the City completes its system inventory.

Item No.	Maintenance Activity	Units to be Maint.	Prod. Unit	Freq. (times/ year)	Daily Prod.	Crew Size	Equipment	Annual Crew Days	Full-time Equip. Equiv.	Annual Person Days	Full-time Labor Equiv.	Annual Labor Cost[a]	Annual Equipment Cost[a]	Total Cost[a]	Percent of Program
10	Clean Streets Downtown/ Arterials	16	MI	50.00	12.00	1	1 Street Sweeper	66.67	0.30	66.67	0.30	$17,988.56	$22,937.33	$40,925.89	14.73
11	Clean Streets Curb Residential	24	MI	15.00	14.00	1	1 Street Sweeper	25.71	0.12	25.71	0.12	$6,938.45	$8,847.26	$15,785.71	5.68
12	Clean Streets Non-Curb Residential	40	MI	6.00	16.00	1	1 Street Sweeper	15.00	0.07	15.00	0.07	$4,047.42	$5,160.91	$9,208.33	3.32
13	Clean Detention Pipes	25	RT	1.00	2.00	2	1 Vactor	12.50	0.06	25.00	0.11	$6,745.71	$2,120.64	$8,866.35	3.19
14	On-site Detention Basin Veg. Control	30	EA	2.00	2.00	1	1 Mower	30.00	0.14	30.00	0.14	$8,094.85	$2,520.99	$10,615.84	3.82
15	On-site Detention Basins Remove Sed.	30	EA	0.33	2.00	2	1 Backhoe 1 Dumptruck	4.95	0.02	9.90	0.05	$2,671.30	$1,039.13	$3,710.43	1.34
16	Pump Station Maintenance	5	EA	*	*	*	*	*	*	*	*	*	*	$13,366.80	4.81
17	Catch Basins Repair/Replace	1,500	EA	0.02	1.00	3	1 Dumptruck 1 Backhoe	0.00	0.00	0.00	0.00	$0.00	$0.00	$0.00	**
18	Manholes Repair/Replace	250	EA	0.02	3.00	3	1 Dumptruck 1 Backhoe	0.00	0.00	0.00	0.00	$0.00	$0.00	$0.00	**
19	Curb Inlets Repair/Replace	800	EA	0.02	3.00	3	1 Dumptruck 1 Backhoe	0.00	0.00	0.00	0.00	$0.00	$0.00	$0.00	**

TABLE 6-2
City of Mount Vernon Recommended Surface Water Maintenance Program

Note that the "units to be maintained" column will need to be updated when the City completes its system inventory.

Item No.	Maintenance Activity	Units to be Maint.	Prod. Unit	Freq. (times/ year)	Daily Prod.	Crew Size	Equipment	Annual Crew Days	Full-time Equip. Equiv.	Annual Person Days	Full-time Labor Equiv.	Annual Labor Cost[a]	Annual Equipment Cost[a]	Total Cost[a]	Percent of Program
20	Pipes Repair/ Replace	264,000	LF	0.02	50.00	3	1 Dumptruck 1 Backhoe	0.00	0.00	0.00	0.00	$0.00	$0.00	$0.00	**
								398.28	1.81	663.85	3.02	$179,125.90	$85,273.99	$277,766.99	100.00

[a]A conversion factor of 1.422 has been used to convert 1995 dollars into 2005 dollars.

*Pump stations are maintained by the Sewer Department

**These costs are typically covered in street replacement programs.

Assumptions			
Labor Costs (Maintenance Worker)		**Equipment Costs**	
Average cost per hour	$29.44	Vactor	$169.66/day
Regular Workday (hrs.)	8 hours	10 Yard Dump	$133.82/day
		Mower	$84.04/day
		Street Sweeper	$34.07/day
		1 Ton Truck	$25.37/day
		Backhoe	$76.11/day

SECTION 7: STORMWATER RATE ANALYSIS

7. Stormwater Rate Analysis

This section describes the results of a surface water utility rate study based on the proposed stormwater programs and capital projects. The rate study entailed projecting utility revenue needs, projecting revenue under current rates, and projecting revenue if rates are (a) reduced for commercial properties with on-site detention facilities, and (b) reduced temporarily for newly annexed areas. The expectation is that rates will meet the utility's objectives for revenue generation, equity among customers, rate defensibility, and administrative ease.

This report discusses the following:

- Surface water utility customer base and growth projections
- Existing surface water rates and revenue projections based on this rate structure
- Annual surface water system capital and operating cost projections, and 5-year revenue requirements (calendar year 2005-2009)
- Discussion of costs/savings associated with on-site detention facilities, policy issues, and implications for revenue generation of a rate reduction for these properties
- Discussion of costs/savings associated with the South Mount Vernon annexation area, policy issues, and implications for revenue generation of reducing rates for 5 years
- Pro forma projections of revenues, operating and maintenance expenses, with presentation of rates for three alternatives:
  1. A uniform rate per equivalent service unit (ESU), at the current rate level
  2. Same as #1, but with a reduced rate for property with on-site detention facilities
  3. Same as #2, but with a 5-year reduction in rates for the South Mount Vernon annexation area, under two rate reduction scenarios

Key findings include:

- The current rates are adequate to support the existing services and a small portion of the proposed CIP.
- Additional funding will be needed to fund the bulk of planned capital projects or to expand services.
- Discounts in rate for on-site detention facilities are defensible and would have a modest financial impact on the utility, but should be established only if these do not interfere with the utility's ability to fully fund operational and capital needs.
- Temporary rate reductions for newly annexed areas are defensible from an equity and financial perspective; the level of service could be proportional to revenue generated from rates in these areas.

7.1 Customer Base

Table 7-1 presents the customer base as of March 31, 2004. The table shows the number of accounts and ESUs for the different land uses in the system. An ESU, as defined in the Mount Vernon Municipal Code, is:

> ...a configuration of development, or impervious surfaces on a parcel, estimated to contribute an amount of runoff to the city's surface water management system which is approximately equal to that created by the average developed single-family residential parcel within Mount Vernon. One ESU is equal to 2,657 square feet of impervious surface area [Section 13.35.101 D].

The Code continues with a definition of "impervious surface" as:

> ... that hard surface that either prevents or retards the entry of water in the soil mantle and/or causes water to run off the surface in greater quantities or at an increased rate of flow from that present under natural conditions. Impervious surfaces may include, but are not limited to, rooftops, concrete or asphalt paving, walkways, patios, driveways, parking lots or storage areas, trafficked gravel, and oiled, macadam or other surfaces which similarly impede the natural infiltration or runoff of surface water [Section 13.35.101 E].

TABLE 7-1
Account Data (as of March 31, 2004)

Account Type	# Accounts	# ESUs
Single Family Residential	5,518	5,995
SFR Seniors*	335	335
Duplex	228	229
Restaurant	51	393
Commercial	517	5,791
Apartment	239	1,734
Government	126	2,897
Multiple Family Residential	4	23
Industrial	1	52
Total	**7,019**	**17,449**
Of Total – with Detention**	187	3,612
Detention as % if total	3%	21%
Seniors as % of total	5%	2%

* Assumes all senior accounts are single-family residential (SFR)

** On-site detention as of June 25, 2004

As Table 7-1 shows, in March 2004 there were a total of 7,019 accounts and 17,449 ESUs in the system. Industrial, government, and commercial accounts have the largest number of ESUs per account. While one ESU is equal to an average single-family account, it is assumed that there are more ESUs than single-family accounts due to some misclassification of customers into the single-family residential category. The table also notes that 187 accounts (excluding single-family residential, as discussed below) have on-site detention facilities, which contain 3,612 ESUs (21 percent of the system's total ESUs).

Table 7-2 presents the projected ESUs in the system through 2009, based on the existing service area, along with the projected surface water fee revenues, based on the utility's current rates (discussed below). It is assumed that the number of accounts and ESUs in the system will grow at a rate of 2 percent per year for all property types (based on information provided by the City). The table shows the number of ESUs in each year as of March 31 (the date of the base data provided by the City), the new/growth ESUs, and the mid-year/average ESUs for the year (as of July 31). The mid-year/average ESUs are used to project revenue.

7.2 Existing Rate Structure and Associated Revenue Projections

The existing surface water rates are designed to fund administration, planning, design, construction, water quality programming, operation, maintenance and repair of surface water system facilities, conveyance and program needs. The charges, which are per ESU, were established in 1994, to meet the needs identified in the Comprehensive Surface Water Management Plan.

The charges, per ESU, were set at $3.95 per month in 1994 through 1996, $5.35 per month in 1997 and 1998, and $6.05 per month in 1999 through 2003, and have not changed since. The charge for single-family residential customers is equal to one ESU per month; for duplexes it is equal to two ESUs per month; undeveloped parcels are not charged; all other parcels are charged based on the total amount of impervious surface area divided by the impervious area of one ESU (2,657 square feet), rounded to the nearest whole number, and multiplied by the rate per ESU. Low-income elderly persons are charged 75 percent of the otherwise applicable rate (currently $4.54 per ESU). The amount charged is included in the City's monthly utilities bill as a surface water line item.

Table 7-2 shows revenue projections through 2009, applying the current rate structure and the customer growth projections discussed above. It should be noted that the 2004 projection is approximately 3.7 percent below that projected by the City. The City's projection is based on cash inflows without receivables, and the prior year's revenue. Table 7-2 bases the projection on actual and projected new accounts/ESU data and the utility's current rates, which are used as the basis for projecting revenue under different rate structure scenarios. It is assumed that this modest discrepancy results from the timing of cash inflows and account growth (which is not evenly paced through the year). It should be noted that the revenue projection assumes that there are no unpaid accounts as, according to the City, unpaid accounts do not have an appreciable bearing on revenue generation.

TABLE 7-2
Projected ESUs and Surface Water Utility Revenues (2004 – 2009)

	March 31					
	2004	**2005**	**2006**	**2007**	**2008**	**2009**
Number of ESUs						
Single Family Residential	5,995	6,115	6,237	6,362	6,489	6,619
SFR Seniors	335	342	349	356	363	370
Duplex	229	234	238	243	248	253
Restaurant	393	401	409	417	425	434
Commercial	5,791	5,907	6,025	6,145	6,268	6,394
Apartment	1,734	1,769	1,804	1,840	1,877	1,914
Government	2,897	2,955	3,014	3,074	3,136	3,199
Multiple Family Residential	23	23	24	24	25	25
Industrial	52	53	54	55	56	57
Total	17,449	17,798	18,154	18,517	18,887	19,265
Growth Rate	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
New ESUs During Year						
Single Family Residential	118	120	122	125	127	130
SFR Seniors	7	7	7	7	7	7
Duplex	4	5	5	5	5	5
Restaurant	8	8	8	8	8	9
Commercial	114	116	118	120	123	125
Apartment	34	35	35	36	37	38
Government	57	58	59	60	61	63
Multiple Family Residential	0	0	0	0	0	0
Industrial	1	1	1	1	1	1
Total	342	349	356	363	370	378
ESUs at end of July (mid-year average)	17,535	17,885	18,243	18,608	18,980	19,360
Charge per ESU	$6.05	$6.05	$6.05	$6.05	$6.05	$6.05
Discounted Senior Charge	$4.54	$4.54	$4.54	$4.54	$4.54	$4.54
Projected Fee Revenues	$1,267,000	$1,292,000	$1,318,000	$1,344,000	$1,371,000	$1,399,000

7.3 Revenue Requirements

This section presents costs that the surface water system is projected to incur over the 5-year period 2005 through 2009. These costs must be recovered through surface water utility rates and other sources. The system revenue requirements for this calculation are based on the system's cash needs, and thus exclude non-cash expenses such as depreciation. The following categories of expenditure make up the revenue requirements: operation and maintenance expenses, CIP, and debt service requirements. No transfers out are anticipated.

7.3.1 Operation and Maintenance Expenses

The City's operation and maintenance (O&M) expenses include administration (primarily personnel and administrative overhead), maintenance, capital projects (non-CIP renewal and replacement), professional services, public education outreach, taxes, and miscellaneous expenses. The historical and projected operation and maintenance expenses of the surface water system are summarized in Table 7-3.

As Table 7-3 shows, operating expenses grew from 2001 to 2003, when they spiked upward; expenses are expected to decline precipitously in 2004, and then to increase gradually through 2009. The sharp increase in O&M costs in 2003 was due to one-time professional services and flood control costs. The projected 2004 O&M costs are based on the 2002 actual costs, adjusted by a 2 percent annual escalation factor for inflation. O&M costs are projected to continue to escalate at 2 percent per year from 2005 through 2009. Taxes are also projected to increase by 2 percent per year from 2005 through 2009. ("Taxes" refer to the business and occupation tax that the utility collects from its customers; it passes 85 percent of this revenue to the City's general fund and 15 percent to the state.) It is assumed that there will be no non-CIP capital costs included in operating expenses from 2005 through 2009.

TABLE 7-3
Actual and Projected Expenditures – 2001 through 2009

	Actual	Actual	Actual	*Estimated*	Projected				
	2001	2002	2003	2004	2005	2006	2007	2008	2009
Operations/ Maintenance	$796,927	$794,216	$1,230,240	$826,302	$842,828	$859,685	$876,879	$894,416	$912,305
Taxes	$99,248	$209,049	$102,310	$102,162	$104,205	$106,289	$108,415	$110,583	$112,795
Capital Expenses (non-CIP)	$454,108	$211,100	$192,858	$75,840	$0	$0	$0	$0	$0
Total Operating Expenses	$1,350,283	$1,214,365	$1,525,408	$1,004,304	$947,034	$965,974	$985,294	$1,005,000	$1,025,100

Source: City of Mount Vernon, Strategic Outlook, 2004 – modified with assumption that 2004 O&M is based on 2002 actual, adjusted by a 2% annual escalation factor for inflation (based on discussion with the City's Director of Finance).

7.3.2 Capital Improvement Program and Debt Service

The surface water system's 6-year CIP is presented in Section 5. The total known capital needs are $8,500,000. Of this total, $600,000 is expected to be funded by rates in 2005 through 2007. The remaining $7,900,000, which is 93 percent of the total, is currently unfunded. The City does not plan on issuing new debt during the forecast period to cover these CIP costs.

The utility obtained a Public Works Trust Fund loan of $3.1 million in 1997 to cover system capital improvement costs. This loan, which has a 3 percent interest rate, has a term of 20-years and thus is scheduled to be paid off in 2016. Debt service payments, comprised of principal and interest, are close to $230,000 in 2004. They will decline to approximately $200,000 in 2009, and to $170,000 in 2016, following which the loan will be retired. The loan covenants require the City to set aside funds each month to meet the July debt service payments.

Additional revenues will be needed to fund capital projects after the next three years.

7.3.3 Transfers Out

In the 4 years between 1998 and 2001, the utility transferred more than $1.0 million to other City departments. The utility has not transferred out funds since 2001, and no transfers are projected during the study period.

7.3.4 Potential Additional Revenues

Additional revenues would be needed to fund the recommended expansions in services and capital projects. There are several potential sources for additional revenue. The most common include:

- Increased SWM fee
- Grants
- Debt
- Capital facility fees
- Existing Taxes

A mixture of these sources should be considered. The most straight forward source is an increase in the SWM fee. However, this is unlikely to receive public support without an extensive public process to build understanding among the public and develop support for specific program elements and specific capital projects.

Grants are available from a variety of sources but are very competitive and largely focused on habitat or water quality projects. An exception is the Flood Control Assistance Account Program (FCAAP) created by Washington state. This program funds projects related to flooding but also gives priority to projects that provide a benefit to fish or water quality. The City has been successful in competing for and winning grants and should continue pursuit of grants for appropriate projects.

There are also a variety of sources for debt including some that provide low interest rates. Debt is not recommended at this time because the City already has a substantial debt payment and there is not adequate revenue to repay additional debt.

Capital facility fees are a potential source of funding for capital projects related to growth. Such fees are charged against new development to support necessary public drainage facilities or improvements. The analyses and the list of capital projects in this plan may provide an adequate basis to support a capital facility fee.

Existing tax revenues are fully allocated for other issues and there is far more demand than supply. This is a major reason that the Storm and Surface Water Utility was created. Thus, the use of existing tax revenues for surface water projects is unlikely.

Table 7-4 below illustrates a potential combination of funding sources for capital projects. The complete list of individual capital projects is found in Section 5.

TABLE 7-4
Illustration of Capital Project Funding Needs and Potential Revenue Needs

Total Identified Capital Project Needs	$8,496,400
Potential CIP Projects with Existing Revenues	$(584,500)
Potential FCAAP funding for flood wall @50% ($250,000 plus $1,367,000 for semi-permanent and permanent wall)	$(808,500)
Assume SRFB or other grants for habitat related projects	$(300,000)
Six Year Revenue Shortfall	$6,803,400
Annual Revenue Shortfall	$1,133,900
Annual Revenue Generated by $3.00 Rate Increase*	$648,000

* Based on approximately 18,000 ESUs

Revenue sources and the need for the projects should be evaluated during the annual budget processes.

7.4 Pro Forma Projections and Rate Adjustments

This section presents a 5-year pro forma projection of the surface water system's financial performance based on projected system growth and costs discussed above. The proposed adjustments in the City's monthly surface water rates are calculated to meet the system's policy goals, primarily associated with equity, along with financial commitments, including debt service coverage requirements.

Table 7-5 presents a pro forma projection of system revenues and expenses for 2005 through 2009. The top portion of the table shows the calculation of the system revenue requirements. Revenues from sources other than rates are then deducted to determine the amount of revenue that needs to be generated through surface water rates to cover the system costs in each year. These rate revenue requirements are then compared with projected revenues under existing rates – and, in addition, with a potential on-site detention discount, which is discussed below. Any revenue surplus or shortfall is then calculated, which is added to or deducted from the cash balance.

7.5 System Revenue Requirements From Rates and Projected Revenue Under Existing Rates

As Table 7-5 shows, the total system revenue requirements amount to about $1.4 million in 2005, and decline to about $1.2 million in 2009. Revenue requirements are projected to decline during the 5-year period as rate-funded improvements decline from $255,000 in 2005 to zero in 2008 and 2009.

Nonrate revenues, in the case of the City, consist of interest income. Interest income is projected to be 3 percent per year of the beginning cash balance (under the existing rates scenario). As the table shows, interest income would fluctuate over the 5-year period from a low of approximately $13,000 in 2007, to a high of $21,000 in 2009. Given the small contribution of nonrate revenue to cover the system's costs, the amount of revenue that is needed to be generated through surface water fees is close to the total system revenue requirements.

As Table 7-5 shows, under the current rate structure, the system would experience a deficit and dip into reserves in 2005 and 2006, when rate-funded CIP improvements are highest, but would experience an operating surplus for the last 3 years of the period, which would enable the utility to fully replenish its reserves. Rate revenue, under the current rate structure, would be adequate to meet the system's anticipated needs for the 5-year period.

7.5.1 Surface Water Rate Modifications and Projected Revenue

Two alternatives for stormwater rate reductions are under consideration by the City:

- Reduced rate for properties with on-site detention facilities
- Temporarily reduced rate for properties in newly annexed areas.

Apart from these two changes, the City would like to maintain the current rate structure and fee levels.

The following paragraphs identify and evaluate the implications of the two potential changes to the rate structure. The analysis explored how rate reductions would impact the utility's objectives for revenue generation, equity among customers, rate defensibility, and ease in rate administration.

Before delving into the specifics of the two potential rate reductions, it should be noted that if a class of properties has a reduced need for surface water services, a rate reduction is defensible. Other jurisdictions offer surface water rate reductions or credits for properties with inspected and approved on-site detention facilities and it is not uncommon for jurisdictions to provide a reduced rate for a particular sub-zone of the service area, where this can be justified. From a legal perspective, a nexus must exist between the rate and the demand for service.

TABLE 7-5
Surface Water Fee Revenue Requirement Calculations, 2005-2009

Revenue Requirements	2005	2006	2007	2008	2009
Operating Expenditures	$947,034	$965,974	$985,294	$1,005,000	$1,025,100
Debt Service	$224,505	$219,553	$214,601	$209,648	$204,696
Rate Funded Improvements	$255,000	$252,500	$77,000	$0	$0
Transfers Out	$0	$0	$0	$0	$0
Total Revenue Requirements	$1,426,539	$1,438,027	$1,276,895	$1,214,648	$1,229,796
Non-Rate Revenues					
Interest Income	$19,749	$16,305	$13,193	$15,602	$20,761
Other Non-Rate Revenues	$0	$0	$0	$0	$0
Total Non-Rate Revenues	$19,749	$16,305	$13,193	$15,602	$20,761
Surface Water Fee Revenue Requirements	$1,406,790	$1,421,722	$1,263,701	$1,199,045	$1,209,035
Projected Surface Water Fee Revenues					
1. Under Current Rate Structure	$1,292,000	$1,318,000	$1,344,000	$1,371,000	$1,399,000
Operating Surplus/(Deficit)	($114,790)	($103,722)	$80,299	$171,955	$189,965
Cash Carried Forward (beginning balance)	$658,292	$543,502	$439,780	$520,078	$692,033
2. With On-Site Detention Discount	$1,238,505	$1,263,435	$1,288,344	$1,314,231	$1,341,095
Operating Surplus/(Deficit)	($168,285)	($158,287)	$24,642	$115,185	$132,060
Cash Carried Forward (beginning balance)	$658,292	$490,007	$331,719	$356,362	$471,547

7.5.2 Rate Reduction for Properties with On-Site Detention Facilities

The question of whether properties with on-site detention and water quality treatment facilities should be given a credit against the surface water rate has public policy dimensions as well as revenue generation implications. A discussion of these issues follows.

7.5.2.1 Policy Considerations – On-Site Detention Discount

The concept of a rate reduction for properties with on-site detention and water quality treatment facilities is based on the premise that these properties do not create the same impacts and therefore do not require the same level of service as properties without such facilities. This assumes that the facilities were adequately designed and constructed, are adequately maintained and perform as intended. Where this is the case, these properties result in reduced need for public capital projects and related maintenance.

As on-site detention facilities only partially mitigate impacts to natural systems, there is still a need for publicly-funded capital projects to mitigate drainage impacts. In addition, these properties would not reduce the need for general storm/surface water services, such as planning, inspection, monitoring, administration and education.

The City's current surface water budget has a portion dedicated to maintenance of facilities on single-family developments, but no budget for maintenance of facilities on all other privately-owned or public properties. It is proposed that a rate reduction be extended only to non-single-family residential properties, in proportion to the ongoing cost savings to the City associated with facility maintenance. This savings represents 20 percent of the cost to provide service to these properties. Thus, a credit of 20 percent is proposed.

7.5.2.2 Revenue Projections – On-Site Detention Discount

As of June 25, 2004, 187 accounts (excluding single-family residential) in the existing service area, with a total of 3,612 ESUs, benefit from private on-site detention facilities. While this is only 3 percent of accounts, it represents 21 percent of the system's ESUs. It is assumed that the number of such accounts and ESUs will grow at a rate of 2 percent per year, which is the growth rate for the service area. Table 7-6 shows the financial implications of establishing a 20 percent discount for these customers. As the table indicates, a 20 percent discount would result in a 4 percent reduction in revenue (i.e., 20 percent of 21 percent of the ESUs). Over the 5-year period, this represents $278,391 in lost revenue.

TABLE 7-6
On-Site Detention Discount - Projected Revenues, 2005-2009

	2005	2006	2007	2008	2009	Total
Detention Discount per ESU	$4.84	$4.84	$4.84	$4.84	$4.84	
Number of ESUs with Detention	3,684	3,758	3,833	3,910	3,988	
Lost Revenue Due to Discount	$53,495	$54,565	$55,656	$56,769	$57,905	$278,391
Lost Revenue as % of Fee Revenue	4%	4%	4%	4%	4%	4%

Table 7-5 shows the total projected surface water fee revenues during the 5-year period, with an on-site detention discount. As the table shows, while the discount would detract from net revenue, its impact would not be large enough to create a deficit in 2007, 2008 or 2009. While the utility would meet its financial obligations during the period, reserves would decline by approximately $187,000 (from the beginning balance of 2005 to the beginning balance of 2009), due primarily to the on-site detention discount.

7.5.3 Temporary Rate Reduction for Properties in Newly Annexed Areas

Discussions are underway concerning the annexation of South Mount Vernon into the service area. It is anticipated that other areas may be annexed in the future. Policy considerations along with associated revenue projections follow.

7.5.3.1 Policy Considerations – Newly Annexed Areas

It is expected that, in the long run, the cost of providing surface water utility service to the South Mount Vernon annexation area – and any other annexation areas – will be comparable, per ESU, to the cost of providing service within the current service area. In the long-run, therefore, the monthly surface water fee, per ESU, should be uniform throughout the service area. However, a reduced monthly fee is suggested during a 5-year transition period, for the following reasons:

- Customers in the annexation area currently pay an annual fee to the Skagit County Surface Water Utility for services, at a level that is about one-third or less than that of the City's fee; the City's monthly fee of $6.05 per ESU would be a significant increase for these customers, many of whom would not have a chance to budget accordingly.
- Customers in the annexation area have contributed fees to the South Mount Vernon sub-flood control zone (SFCZ), although these fees were last assessed in 1987. Unspent resources associated with these fees amount to approximately $58,700, which should be earmarked for annexation area projects or services – offsetting, as appropriate, City fees in the short-term.
- The utility has not budgeted for or scheduled work for the annexation area, and would be unlikely to provide full service to this area immediately.
- The utility does not have available resources to initiate service to the annexation area (and that area has not yet paid for such service).
- The utility does not have a thorough understanding of the surface water system in the annexation area – its condition, maintenance needs and capital needs – and currently lacks resources to meet those needs.
- The annexation area is more rural than the existing service area, and surface water service costs may be lower in this area per ESU; within 5 to 6 years, the annexation area is expected to be significantly more built out and its surface water service costs then are expected to be comparable with those in the rest of the service area.
- Reduced rates were instituted for a 5-year transitional period, between 1994 and 1998, when the City introduced its surface water rate, as discussed above; a similar approach should be taken with newly annexed areas.
- Service in the annexation area could be scaled to equal revenue generated, during a transitional period.

The City considered rate alternatives that would transition annexation area customers from their existing County surface water rates to those charged by the City. Two transitional rate alternatives were considered – a 50 percent transitional rate, and a stepped increase. For both alternatives, a 5-year transitional period is proposed, as it is expected that in year 6 the service level and associated costs in the annexation area will be comparable with those in the existing service area. It should be noted that these alternatives are illustrative of many transitional rate schedules that the City might consider.

7.5.3.2 Existing Skagit County Surface Water Rate

Customers in the annexation area are currently subject to the surface water rates shown in Table 7-7. As the table indicates, the County charges an annual fee per parcel for residential properties excluding apartments, and a fee per impervious area for apartments, commercial and industrial properties. It also charges $.30 per acre for all parcels – developed and undeveloped. The City's fee is only applied to properties with impervious area (i.e., developed properties). The County also charges the surface water fee for County roads ($0.007 per impervious square foot) and State roads ($0.0021 per impervious square foot), which the City does not do.

TABLE 7-7
Annual Surface Water Rates, City of Mount Vernon and Skagit County

	Single Family Residential	Duplex	Multiple Family (assume fourplex)	Apts, Commercial, Industrial
City Rate per ESU	$72.60	$72.60	$72.60	$72.60
County Rate				
per Parcel	$25.80	$31.79	$31.79	
per Impervious Sq. Ft.				$0.007
per Acre	$0.30	$0.30	$0.30	$0.30
Total (w/o acreage fee)	$25.80	$15.90	$7.95	$18.60
	per dwelling	per dwelling	per dwelling	per City ESU
County as % of City	36%	22%	varies	26%

The majority of South Mount Vernon annexation area is nonresidential property. These customers' current rates are approximately 26 percent of what they would be under the City's existing rates, per ESU, excluding the County's acreage fee. (This is calculated by multiplying $0.007 per square feet x 2,657 square feet per ESU = $18.60 per ESU, which is 26 percent of $72.60.) The fee per acre is modest ($0.30) and results in limited revenue, as there are only 518 total acres in the annexation area (121 acres of state and county roads and 397 parcel-related acres); this fee component is therefore excluded from the analysis.

7.5.3.3 Stepped Transitional Rate

Customers in the annexation area would not be subject to the Skagit County Surface Water Utility fee when they join the Mount Vernon service area. It is therefore suggested that, following annexation, these customers continue to pay a "typical" County fee for their first year of service with the Mount Vernon Surface Water Utility. That fee would be $0.007 per impervious square foot, which is $18.60 per year per ESU (2,657 square feet), or $1.55 per month per ESU. This fee would cover the cost of maintaining the level of service performed by the County, for 1 additional year. The fee would then increase each year in equal steps of $10.80 per ESU, to arrive at $72.60 per year per ESU in year 6; on a monthly basis, the fee would increase $0.90 per year, to arrive at $6.05 per month in year 6. The gradual, step-wise rate increase would be commensurate with the step-wise expansion of service and increase in associated costs. This gradual approach would ease customers into the new/increased rates.

7.5.3.4 Fifty Percent Transitional Rate

This alternative would set the transitional rate at the mid-point between the typical customer's Skagit County rate ($18.60 per year per City ESU) and the City's existing rate ($72.60 per year per ESU) for 5 years, representing an increase of $27.00 per ESU and a 145 percent increase from the County's rates. On a monthly basis, the fee would be $3.80 per ESU. After the 5-year period, the annexation area rate would increase to match the City's rate of $6.05 per ESU. The higher rate in year 1, relative to the stepped alternative, recognizes initial/start-up costs associated with the annexation – such as developing an inventory of the annexed surface water system, a work-plan and budget – while maintaining service on par with that provided by the County. By providing more resources up-front, this averaged approach would give the utility slightly more flexibility in terms of timing projects in the annexation area during the initial 5-year period. From the customer's perspective, this approach would represent a larger initial jump than the stepped alternative, but the fee would then remain constant for 5 years, before it would jump again.

7.5.4 Revenue Projections – Newly Annexed Areas

Table 7-8 shows revenue projections for the South Mount Vernon annexation area under three scenarios, over the 5-year period:

- Full rates
- Fifty percent transitional rates
- Stepped transitional rates

The following parameters were used and assumptions made regarding the South Mount Vernon annexation area, for the revenue projections:

- There were an estimated 2,905 ESUs in the annexation area, based on aerial photography in May 2003, and it is assumed (per the City) that there have been minimal changes to date.

- There are 914 ESUs (per the City) that have benefited from on-site detention facilities and would be eligible for an on-site detention discount, which is about 31 percent of ESUs.

- There is almost no residential development in the annexation area, and therefore no accounts (or an unappreciable amount) would be eligible for a senior discount.

- Following annexation, a spurt in growth would occur at a rate of approximately 5 percent per year for 5 years; following that growth, the area's development would resemble that of the rest of Mount Vernon, and future growth would be at a relatively slower pace.

Table 7-8 shows the potential revenue generated under the three scenarios, with and without a discount for on-site detention. As the table indicates, if the discount is granted for on-site detention facilities, this would reduce annual revenue by 6 percent under all three scenarios (which is the 20 percent discount on 31 percent of ESUs). Assuming this discount is granted, revenue at full rates would be approximately $207,000 in 2005 and would increase to approximately $252,000 in 2009, with total revenue of $1.1 million over the 5-year period. Under the 50 percent transitional rate scenario, revenue would increase from approximately $130,000 in 2005 to approximately $158,000 in 2009, with total revenue of $720,000 over the 5-year period. Under the stepped transitional rate scenario, revenue would increase from approximately $53,000 in 2005 to approximately $215,000 in 2009, with total revenue of $651,000 over the 5-year period. Over the 5-year period (assuming there is a discount for on-site detention facilities), revenue under the 50 percent transitional rate scenario would be $426,000 less than or 63 percent of that of the full fee, while revenue for the stepped transitional rate scenario would be $495,000 less than or 57 percent of that of the full fee.

TABLE 7-8
South Mount Vernon Annexation Area - Projected Revenues of Transitional Rate Scenarios, 2005-2009

	2005	2006	2007	2008	2009	
South Mt. Vernon ESUs	3,050	3,202	3,362	3,531	3,707	
Number of ESUs with Detention	960	1,008	1,058	1,111	1,167	
1. Revenue - Fee at 100%						
Monthly Fee per ESU	$6.05	$6.05	$6.05	$6.05	$6.05	
Potential Revenue	$221,417	$232,488	$244,113	$256,318	$269,134	
Lost revenue if Detention Discount	($13,935)	($14,632)	($15,363)	($16,131)	($16,938)	
2. Revenue - 50% (midpoint) Transitional Rate						
Monthly Fee per ESU	$3.80	$3.80	$3.80	$3.80	$3.80	
Potential Revenue	$139,070	$146,024	$153,325	$160,991	$169,041	
Lost revenue if Detention Discount	($8,752)	($9,190)	($9,649)	($10,132)	($10,639)	
3. Revenue - Stepped Transitional Rate						
Fee Steps (% of $6.05)	26%	40%	55%	70%	85%	
Monthly Fee per ESU	$1.55	$2.45	$3.35	$4.25	$5.15	
Potential Revenue	$56,724	$94,146	$135,168	$180,057	$229,097	
Lost Revenue if Detention Discount	($3,570)	($5,925)	($8,507)	($11,332)	($14,418)	
Total Revenue with Detention Discount						**Total**
1. Revenue - Fee at 100%	$207,482	$217,857	$228,749	$240,187	$252,196	$1,146,471
2. Revenue - 50% Transitional	$130,318	$136,834	$143,676	$150,860	$158,402	$720,090
3. Revenue - Stepped Transitional	$53,154	$88,221	$126,661	$168,725	$214,679	$651,439

7.5.5 Rate Reduction for Properties with On-Site Detention Facilities

CH2M HILL recognizes that a rate reduction for properties with on-site detention facilities is defensible from an equity and legal standpoint, and would be reasonably easy to implement from an administrative perspective. However, implementing this rate reduction would, over the course of the coming 5-year period, cost the utility approximately $280,000, depleting reserves that could be used for needed capital improvements.

CH2M HILL recommends that the City establish a rate reduction for properties with on-site detention facilities only if this does not interfere with the ability to fully fund Surface Water Utility expenditure needs. Rates, coupled with other projected sources of revenue, should fully fund operational and capital needs. The policy decision should rest on carefully considered O&M projections. If the City is confident that O&M costs will reflect Table 7-5 projections (or be lower), and that other revenue sources will be identified to fund capital needs, the City should proceed with the rate reduction. If O&M costs are expected to be higher than those projected in Table 7-5, and/or if other revenue sources cannot be identified to fund capital needs, CH2M HILL recommends that the City consider coupling the rate reduction for properties with on-site detention facilities with an overall rate increase. This would serve both the City's equity objectives and revenue generation needs.

7.5.6 Temporary Rate Reduction for Properties in Newly Annexed Areas

CH2M HILL recommends that the City establish a temporary rate reduction for properties in newly annexed areas, with a 5-year timeframe. This timeframe would enable the City to inventory, budget and plan projects in the newly annexed area, and to scale up the level of service as resources become increasingly available. Of the two alternatives discussed, CH2M HILL recommends the transitional-stepped rate increase, as this approach would enable customers to budget for and get accustomed to higher rates, as their level of service increases in proportion to the rates they pay. The City might consider other transitional rate schedules, as the needs of the annexation area and associated costs become more apparent.

CH2M HILL recommends that if the City increases or otherwise modifies its surface water rates for existing service area customers during the 5-year transitional period, the rates of annexation area customers should be increased/modified proportionately, so that in year 6 the rates in the annexation area are the same as those in the City's larger service area.

If the City implements a rate reduction for on-site facilities in the existing service area, CH2M HILL recommends the same policy should apply to properties in newly annexed areas.

CH2M HILL also recommends that the unspent revenue that customers in the annexed areas have contributed to the South Mount Vernon sub-flood control zone ($58,700), should be transferred to the City's utility. If these funds were earmarked for capital projects – or if there are pressing capital needs in the annexed area – the funds should be spent on capital projects. If there are no pressing capital needs in the annexation area, these funds should offset annexation area surface water rates and be used for general operating expenses.

It is suggested that the customers in the annexation area be billed on a monthly basis, once they are integrated into the City's utilities billing system.

SECTION 8: RECOMMENDATIONS

8. Recommendations

The following recommendations have been synthesized from the information and analyses in the previous sections of this plan.

8.1 Regulations and Policies: Adopt Ecology "Stormwater Management Manual for Western Washington, August 2001"

The City should adopt the Ecology "Stormwater Management Manual for Western Washington" (as required by state law). The manual requires the use of a continuous simulation hydrologic model to evaluate impacts and determine the size of detention facilities. It will require the definition of pre-development conditions as forested for the purpose of hydrologic modeling. These two factors (continuous simulation and forested conditions) will result in larger detention ponds for most new developments which will provide better protection of stream resources and reduce future flooding and erosion in streams.

8.2 Enhance Education

The City should continue to contract with Skagit River non-profit groups to provide education related to stormwater. Additionally, the City should develop targeted educational information for commercial and industrial property owners regarding illicit discharges. Examples of printed information are available from other jurisdictions.

8.3 Implement Detection of Illicit Connections and Discharges

The City should develop a regular program for detection of illicit connections and illicit discharges to reduce pollutants within the City's stormwater conveyance system and the potential discharge of those pollutants to receiving waters. This is an action that is required by NPDES municipal stormwater permits. This is a relatively inexpensive activity that can be very effective. Stormwater systems in commercial and industrial areas should be visually inspected during the dry portions of the year. If there are flows, they are likely illicit discharges, particularly if they are not consistent flows (consistent flows could be groundwater).

Field screening of storm drain connections begins with a visual inspection, and consists of the following actions if the visual inspection indicates the potential for an illicit connection:

- Observe the physical conditions of the catch basin and the contributing pipes
- Photograph the catch basin rim and bottom (and incoming pipes if possible)
- Perform onsite water quality analysis of flows into the catch basin
- Estimate flow rate into the catch basin
- Repeat these water quality and flow analyses between 4 and 24 hours after completion of the first sample set at each site.

Storm drains should be inspected no sooner than 72 hours after the last measurable precipitation event to determine if there is flow in any of the incoming drainage pipes, or if an incoming drainage pipe is aligned directly with a business or industry. If there is flow, the water coming from the pipe in question (or the catch basin itself when the pipe flow cannot be isolated) should be analyzed as described below. In cases where water quality sampling is performed, it is necessary to resample the site 4 to 24 hours after the completion of the first analysis.

It is recommended that City staff use a commercial storm drain kit to perform on-site evaluations of storm drains exhibiting flow after a 72-hour dry period. The parameters that should be monitored and their analysis methods are listed in Table 8-1.

TABLE 8-1
Illicit Storm Drain Connection Monitoring Parameters and Analysis Methods

Parameter	Analysis Method	Parameter	Analysis Method
Odor	Observation	Flow rate	Volume and time estimation
Color	Observation	PH	Field meter
Clarity	Observation	Phenol	Colorimetric test kit
Floatables	Observation	Total chlorine	Colorimetric test kit
Deposits/stains	Observation	Copper	Colorimetric test kit
Vegetation	Observation	Detergents	Colorimetric test kit
Structural condition	Observation	Turbidity	Colorimetric test kit
Biological growth	Observation	Color	Colorimetric test kit

In the event that a suspected illicit storm drain connection is confirmed by the results of field monitoring, the City's building official should be contacted for enforcement of building and drainage regulations. Enforcement may consist of physically disconnecting sources, educating site owners regarding proper disposal of pollutants, or making referrals to Ecology of other water quality agencies.

8.4 Improve and Document Enforcement Actions

Additional resources should be provided and inspections of new development should be increased. Native growth protection easements and aquatic resource setbacks should be field marked and inspected prior to construction . Regular inspection should document that these areas remain marked and are not violated during construction. Erosion control facilities should also be installed prior to construction, regularly inspected throughout construction, and removed and stabilized following construction. Drainage facilities such as swales, ditches, pipes, catch basins, and detention ponds should be inspected to assure that they are constructed in accordance with the design and are properly functioning at the completion of construction.

The responsibility among City departments for inspection should be clarified for each type and stage of permit review and construction. This will require an evaluation of the specific needs for inspection, training, staffing and assignments.

Additional training should be provided for all staff involved in permit review or inspection. Training should include the value of aquatic resources, potential impacts and methods to avoid, minimize, and compensate for impacts. Specific training is needed for marking and maintaining aquatic resource setbacks, and for erosion and sediment control.

8.5 Complete Inventories and GIS

The City is currently preparing inventories of the drainage system, streams, and wetlands. These inventory activities should be completed and periodically updated as appropriate. The information should be placed in the Geographical Information System for display on maps. The maps should be available at the City permit counters for use by property owners and developers.

8.6 Complete Capital Improvement Projects

Capital projects should be completed within available annual funding limits. Priorities for capital projects are listed in Section 5 of this plan. At the present funding levels and with the required annual debt payment for prior capital projects, new capital projects will be minimal. The capital improvement plan should be incorporated annually into the overall City capital improvement plan (normally completed as part of the budget process).

8.7 Evaluate the Need of Additional Funding to Complete Capital Improvement Projects

The demand for capital projects exceeds the available revenues for the stormwater utility. While this may not be unusual, there may be compelling reasons for some of the capital projects that warrant consideration of additional revenue (for example, a rate increase). The proposed capital improvement program should be reviewed by the Planning Commission or other public group to evaluate the demand for surface water capital projects and balance the demand against the desire to reduce or at least avoid increases in stormwater rates. The Planning Commission recommendations should be forwarded to the City Council for consideration.

There is no allowance in the budget for long-term replacement of the drainage infrastructure. Since much of the City is relatively new, this may not be critical at this time. But, it would be advantageous to start setting aside funding for eventual replacement before the issue becomes critical.

There are a number of grant programs available for capital projects that should be pursued aggressively. Most grants are for innovative projects, water quality, or habitat protection. There are very limited grant opportunities for typical stormwater projects to address local drainage problems as these are expected to be locally funded.

8.8 Rate Reductions

Rate reductions for on-site detention facilities and for newly annexed areas should be considered as discussed in Section 7 of this plan.

8.9 Update Plan in Five Years

Mount Vernon is growing rapidly, resulting in additional impervious surfaces and reduction in forests and open spaces and encroachment in riparian corridors. Changes will degrade streams and wetlands and increase flooding and erosion. This plan should be updated in 5 years to reflect changing regulatory requirements, growth, and changing public interests.

8.10 Maintenance

Continue maintenance activities as currently practiced. Develop documentation of tasks performed, the level of effort required, and known "hot spots," such as frequent drainage, erosion, or water quality problems. Use the documented level of effort to develop unit costs for each activity. This will allow appropriate budgets and billing for stormwater maintenance. Complete and regularly update the inventory of drainage facilities. Incorporate the inventory findings in the GIS system.

Develop and maintain a spill response program. Provide training for maintenance crews in containment and cleanup of spills.

8.11 Stormwater Pollution Prevention

Inspect existing facilities owned or operated by the Public Works and Parks Departments for stormwater pollution prevention. Identify and eliminate exposed sources of potential stormwater pollutants. Assure secondary containment of liquids that could become contaminants if spilled or leaked. Assure vehicle maintenance is performed in appropriate areas (either covered or in an areas that drains to the sanitary sewer or a separate treatment facility). Storage and transfer of potential pollutants should be under cover.

Review Integrated Pest Management Plans for the Department of Public Works and the Department of Parks. Update as appropriate.

8.12 LID

Continue to encourage and promote the use of Low Impact Development techniques. Suggest approaches to developers. Explore the potential to offer incentives to developers, such as reduced detention requirements or increased density. Allow flexibility in design standards to accommodate LID techniques. Amend design standards to specify pervious pavement for walkways and parking areas and allow narrow streets in residential areas if Low Impact Development features are implemented.

Review each City capital project for opportunities to incorporate LID techniques. Develop and adopt a City policy that directs inclusion of appropriate LID techniques. These projects can become examples for the development community to increase understanding and confidence in the approach.

Select a street upgrade project and fully incorporate LID techniques as a demonstration. Incorporate LID techniques in all road improvement projects as feasible.

8.13 Flood Protection

The original stormwater utility did not include actions to address flooding from the Skagit River since these actions are funded by various dike, drainage, and flood control districts. There are certain capital projects that would provide additional flood protection for the City that are not likely to be provided by the existing flood control districts. It would be beneficial if the City had a designated funding source for these activities. The potential to expand the use of the Storm and Surface Water Utility funds for this purpose should be evaluated by the City. This use of the funds would reduce funding available for other on-going stormwater actions. Thus, additional revenues may be necessary if river flood response actions are added.

8.14 Advocate

At the present time, there is no individual position that is dedicated or entirely available to manage the stormwater program. Therefore, there is no clear voice or advocate for surface water in the City.

Stormwater and related regulations are changing rapidly. As a relatively new field, the technology is also rapidly changing. With the amount of change, it is difficult to stay up to date. It would be helpful to have at least one staff dedicated (subject to budget constraints) to stormwater with primary responsibility in the City for monitoring changing regulatory conditions and technology.

Mount Vernon is blessed with an abundance of surrounding open space and productive aquatic resources. With the anticipated growth, this may change. If it does, citizens may become more outspoken about the need to protect or restore the City's aquatic resources. Having an advocate in the City now may prevent some of the loss of existing aquatic resources.

City staff should evaluate the departmental organizations and clarify responsibilities regarding surface water management. A position should be identified as the primary contact and representative for surface water issues.

APPENDICES

Appendix A
Surface Water Modeling and Analysis

- Technical Memorandum No. 1
- Technical Memorandum No. 2
- Technical Memorandum No. 3
- Technical Memorandum No. 4

TECHNICAL MEMORANDUM #1

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Prepared For: CH2M HILL

Prepared By: Bill Rozeboom, P.E.

Subject: City of Mount Vernon Comprehensive Surface Water Management Plan Update; Maddox Creek HSPF Model and Lower Basin Channel Encroachment.

Date: June 30, 2004

Introduction

Hydrologic Simulation Program – Fortran (HSPF) hydrologic models for the Maddox Creek basin were originally developed in 1993 during preparation of the 1995 City of Mount Vernon Comprehensive Surface Water Management Plan (CSWMP). In the current work, the models were updated with meteorological data through December 2002 and modified to provide a more realistic representation of storage volumes in the lower portion of the basin. Model accuracy was reviewed by comparing the results of the updated HSPF simulations with Maddox Creek recorded streamflow data at Hickox Road for the period of May 2001 through September 2002. Finally, an assessment was made of potential lower-basin channel encroachments and loss of floodplain storage, and the effects of such encroachments on flood levels and peak discharges.

The Maddox Creek basin above the original calibration point, located 1,200 feet upstream from Anderson Road, is relatively steep-sloped and well-drained. The original Maddox Creek models did not include any channel storage in the relatively-flat lower basin areas below the calibration point. Because significant storage in the lower basin areas was neglected, model estimates of Maddox Creek peak flows at Hickox Road (the City's urban growth boundary and the downstream end of the HSPF model) were overestimated.

Model Update

Revisions to the Maddox Creek models included: 1) extending the meteorological data sets through mid-December 2002; 2) developing approximate land use data reflecting current (2002) land use conditions; 3) simulating the current (2002) performance of the regional detention pond at Little Mountain Estates; and 4) using a FEQ hydraulic model of the lower basin to estimate realistic lower-basin storage characteristics for HSPF simulations. Each of these updates is discussed below. The update work made use of available HSPF model sequences previously prepared by R.W. Beck and therefore relied upon the original soils mapping, the original land use mapping, and the original sub-basin delineations presented in the 1995 CSWMP. Sub-basin delineations from the 1995 CSWMP are reproduced in Figure 1, with annotations to highlight locations of interest to the current work.

Meteorological Data Update

Precipitation data used in the updated hydrologic modeling were obtained from the National Oceanic and Atmospheric Administration (NOAA) station at Burlington for the period of October 1, 1956 through November 30, 1993, and from the Washington State University (WSU) Cooperative Extension Public Agricultural Weather System (PAWS) Mt. Vernon station for the period of December 1, 1993 through December 23, 2002. Data from the PAWS station were increased by 11% to represent the generally-higher rainfall amounts at Burlington and in the Maddox Creek basin. The NOAA Station at Burlington is located about 3 miles north of downtown Mount Vernon and has a reported station elevation of 30 feet. The Mount Vernon PAWS station is located about 3 miles west of downtown Mount Vernon, and has a reported station elevation of 10 feet. A comparison of monthly data for these two stations for 83 concurrent months between years 1991 and 1999 found that rainfall amounts at the NOAA (Burlington) gage are, on average, about 11% greater than at the PAWS gage. This variation is consistent with isopluvial mapping, which shows an eastward increase in rainfall amounts across the area.

Although the Burlington gage was assumed to best represent precipitation characteristics in the Maddox Creek basin based on isopluvial mapping, there are significant gaps in the records for that gage, and no concurrent rainfall records are available for either of the two documented high streamflow events in June 2001 and December 2001. Because of its relatively-complete record, the post-1993 rainfall data set was based exclusively on the PAWS data times a 1.11 multiplier. It should be noted that, on a monthly basis, total rainfall amounts at Burlington typically range from being about 10% lower to 20% higher than at the PAWS station. Similar monthly variability, and greater storm-specific variability, is expected between the PAWS rain gage and the Maddox Creek basin. Because of uncertainty over the actual rainfall in the Maddox Creek basin, HSPF validation results for individual storm events should be interpreted with caution.

Daily pan evaporation data were obtained from the Puyallup pan evaporation station, with winter months filled using the Jensen-Haise equation. The Puyallup station operated from water year 1960-1995. Daily values prior to 1960 (by others) and for 1996 and 1997 were assumed to have been copied from existing years. Evaporation values for water year 1998 and subsequent years were based on long term monthly averages. The latter assumption may not be appropriate for evaluating summer low flows but will have negligible impact on modeled storm flows.

Land Use Update for Current (Year 2002) Conditions

Land use characteristics representing current (year 2002) conditions were approximated as an average of estimates from the 1995 CSWMP of then-current (1991) and future buildout conditions for each sub-basin. This approach was based on a cursory visual inspection of basin aerial photographs showing the basin conditions in years 1992 and 2001. This was considered to be a reasonable and cost-effective approach.

Previous estimates of sub-basin land-use conditions were not tabulated in the 1995 CSWMP and had to be recovered from a combination of sources. Data sources included: 1) HSPF input sequences from 1993 of existing and future conditions, prior to the addition of sub-basin 51 above the Little Mountain Estates Pond; 2) a land-use breakdown (estimated in 1993) for sub-basin 51; and 3) an HSPF input sequence of future buildout land use conditions, based on a reanalysis of land-use by RW Beck in 2000. Table 1 summarizes the land-use conditions used for the current work, developed from the above sources.

Three irregularities were noted during the review of the previously-developed land-use data. First, the year 1993 and year 2000 estimates of the areas of sub-basins 19 and 52 differed by 24 acres or 4% of the combined total area of 614 acres. The reason for the difference is unclear, but may be due to use of different map products for the two analyses. The difference is small in relation to the total basin area and is felt to be inconsequential to model results. Second, in sub-basin 22 (which includes the Flowers Creek basin and about 1.3 miles of I-5 highway corridor) the year 2000 estimate of future impervious surface was 78 acres greater than the year 1993 estimate, even though both estimates were reportedly based on the same RW Beck land use mapping. The discrepancy was reduced, but not eliminated, by excluding 20 acres representing rooftop drainage in an area served by a combined sanitary-storm sewer. The third irregularity is in sub-basin 37 which includes lower Maddox Creek from Hickox Road to the confluence with Flowers Creek. The previous land use analysis for sub-basin 37 did not show any change in land use between the current (1991) and future buildout conditions. The "future" land use data based on the past work and recreated here is therefore believed to reflect outdated 1991 conditions rather than a future buildout scenario.

Note that the future land use data presented in Table 1 were used in the current study as a means to estimate the current land use, but were not used to develop a new future-conditions HSPF hydrologic model of the basin. The focus of the current study was to calibrate the HSPF model to flows recorded near the city urban growth boundary and, using an FEQ hydraulic model with previously-estimated future conditions flows, to assess the impacts of lower basin channel encroachment.

Table 1
Maddox Creek Soil and Land Use Data for HSPF Modeling
Land Use In Acres

1991 Existing Conditions (estimated in 1993)

	SB 51	SB 19	SB 34	SB 22	SB 37	TOTAL
Till Forest	174.0	146.5	218.0	82.2	76.4	697.1
Till Pasture	80.0	114.3	54.6	78.2	84.4	411.6
Till Grass	15.0	23.8	0.1	155.0	-	193.9
Outwash Forest	-	-	-	-	24.1	24.1
Outwash Pasture	5.0	24.2	-	-	13.4	42.6
Custer Norma Grass	-	-	-	28.5	303.0	331.5
Saturated	4.0	13.2	11.8	-	-	29.0
Impervious (EIA)	5.0	9.7	0.9	102.9	115.2	233.6
TOTAL	283.0	331.7	285.5	446.8	616.4	1963.3

2002 Existing Conditions (estimated in 2003)

	SB 51	SB 19	SB 34	SB 22	SB 37	TOTAL
Till Forest	100.1	95.7	200.1	82.3	82.2	560.4
Till Pasture	102.1	77.2	51.1	57.5	62.3	350.1
Till Grass	53.8	123.1	20.1	146.9	15.9	359.8
Outwash Forest	-	-	-	-	23.7	23.7
Outwash Pasture	6.0	12.1	-	-	13.7	31.8
Custer Norma Grass	-	-	-	27.5	301.9	329.4
Saturated	2.0	14.3	11.8	-	-	28.1
Impervious (EIA)	6.8	21.5	2.7	133.1	116.4	280.4
TOTAL	270.6	343.8	285.7	447.3	616.1	1963.6

Future Conditions (estimated in 2000, adjusted in 2003)

	SB 51	SB 19	SB 34	SB 22	SB 37	TOTAL
Till Forest	26.1	44.9	182.2	82.3	88.1	423.6
Till Pasture	124.1	40.0	47.6	36.8	40.1	288.6
Till Grass	92.5	222.4	40.0	138.9	31.9	525.7
Outwash Forest	-	-	-	-	23.3	23.3
Outwash Pasture	6.9	-	-	-	14.0	20.9
Custer Norma Grass	-	-	-	26.5	300.9	327.4
Saturated	-	15.3	11.7	-	-	27.1
Impervious (EIA)	8.6	33.2	4.4	163.3	117.6	327.2
TOTAL	258.2	355.8	286.0	447.9	615.9	1963.8

NOTE: Future conditions adjustment in 2003 was to reduce the SB 22 impervious area by 19.6 acres, which is the amount by which the total SB 22 area (estimated in 2000) exceeded the original SB 22 area (estimated in 1993). The increased total and impervious area in the year 2000 estimate is thought to have resulted from not deducting areas of roofs in SB 22, which drain to the sanitary sewer. Figure III-5 of the 1995 CSWMP shows that such areas exist.

Existing Detention Pond Update

The effects of existing detention ponds in the Maddox Creek basin were ignored in the existing conditions (2002) model, except for a large regional detention pond at Little Mountain Estates. This approach is the same as was adopted for the 1995 CSWMP. The rationale for ignoring other existing ponds is uncertainty over the historical ineffective design standards that regulated the design of these facilities, coupled with the expense of researching and modeling multiple discrete facilities which likely provide little peak flow control during major storm events. Consideration was given to modeling a new large detention pond in the Flowers Creek basin (part of model sub-basin 22), but this was not done in favor of putting more effort towards developing realistic channel storage characteristics for modeling the lower basin.

The regional detention pond at Little Mountain Estates is a significant facility which provides peak flow control for the entire basin (model sub-basin 51) upstream of the pond. As originally designed, a side weir on the main Maddox Creek channel was intended to split high streamflows into the detention facility while allowing relatively low flows to remain in the channel. However, the side weir failed after a short period of service, causing the entire creek flow to be directed into the pond. Sandbags have been placed as a temporary measure to keep at least some flow in the main channel, but these are expected to be ineffective under high flow conditions. Work is underway by the City to address the failed side weir.

For assessing current (year 2001-02) basin conditions, the HSPF model was configured to have the Little Mountain Estates pond receive 100% of the upper basin flows, reflecting the failed condition of the side weir during the validation period. Prior estimates of pond stage, area, and volume characteristics were retrieved from working files for the 1995 CSWMP. The outlet structure stage-discharge relationship was re-computed to accurately represent the hydraulic controls described in facility as-built drawings. Table 2 summarizes the hydraulic characteristics of the pond in its as-built configuration, assuming unobstructed orifices and no backwater effects from the outlet channel.

Table 2
Little Mountain Estates Detention Pond
As-Built Hydraulic Characteristics**

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow (cfs)
0.0	0.1	0.0	0.0
0.5	1.5	0.0	1.2
5.0	1.5	5.1	3.9
5.5	1.5	5.8	4.1
6.0	1.5	6.6	5.7
6.5	1.5	7.2	9.4
7.0	1.5	8.1	17.2
7.5	1.5	8.7	28.3
8.0	1.5	9.6	42.5
8.5	1.5	10.6	65.2
9.0	1.5	11.2	111.5

** The flows in Table 2 above reflect the discharges computed through four orifices at pond depths of 0.0 through 6.4 feet and a control structure overflow riser at a depth of 7.6 feet. The crest (overflow) elevation of the pond emergency spillway is at a pond depth of 8.4 feet.

Lower Basin Storage Update

Previous HSPF modeling of the Maddox Creek basin did not incorporate any channel storage below the original calibration point located about 1,200 feet upstream from Anderson Road. For the current work, lower basin channel storage was estimated by modifying an FEQ (Full Equations) hydraulic model developed for a separate project along lower Maddox Creek. This model[1] includes the lower reach of Maddox Creek from Hickox Road to the inlet side of a long culvert crossing I-5, and simulates hydraulic conditions for the month of November 1990 with inflows based on basin future conditions as estimated by RW Beck. November 1990 produced the highest peak flows in the hydrologic simulation period of January 1956 through February 1993. The original FEQ model was set up to route flows from the entire month of November 1990 because the large amount of flood storage along lower Maddox Creek would cause peak water levels to be the result of a prolonged large-volume event rather than a 24-hour peak flow event.

For the present work, the upstream limit of the original FEQ model for November 1990 was extended upstream about 1,600 feet to the confluence of Maddox Creek and Flowers Creek. Model output was processed at 12-hour increments to identify flows at Hickox Road and the

[1] The source (original) FEQ model is described in the July 2002 report "Maddox Creek Hydraulic and Hydrologic Analysis -Final," prepared by RW Beck for the City of Mount Vernon

corresponding total channel and floodplain storage between Hickox Road and the confluence with Flowers Creek. Figure 2 provides a sketch of the lower reach covered by this analysis and also a plot of the resulting volume-discharge data used in the HSPF model.

Analysis of the FEQ model results determined that nearly 120 acre-feet of water could be stored in the lower Maddox Creek channel and floodplain areas during a major flood such as occurred in November 1990. To put this in some context, the regional detention pond at Little Mountain Estates has a total storage volume of only about 11 acre-feet before overflow.

The HSPF model update work did not attempt to develop (and does not include) an accurate estimate of additional storage in model sub-basin 22, upstream of the confluence with Flowers Creek. This area consists of the Flowers Creek channel and roadway ditches along approximately 1.3 miles of I-5 highway corridor. From a cursory review, storage in this area is expected to be small relative to the lower basin storage shown in Figure 2.

Comparison of Maddox Creek Simulated and Recorded Flows at Hickox Road

Continuous water level and velocity data for Maddox Creek at Hickox Road have been collected since May 9, 2001 at a site known as the Carpenter School gage. Preliminary streamflow data from that gage through September 23, 2002, were provided to **nhc** for purposes of comparison with the simulation results from the updated HSPF model for current (year 2002) conditions.

A review of the preliminary streamflow data sets and comparison with available stream gaging measurements determined that reliable continuous streamflow data were available only for the months of December 2001 through February 2002. This period of reliable streamflow record includes an event on December 13, 2001 with a peak flow having about a 2-year recurrence interval, based on subsequent analysis.

Figure 3 presents HSPF simulation results, using USGS generalized parameters, for Maddox Creek at Hickox Road for water years 2001 and 2002 (October 2000 through September 2002). Figures 4, 5, and 6 compare the simulation results from the updated HSPF model with recorded flows at Hickox Road for the months of December 2001 through February 2002, for which the recorded streamflow data are reliable. Two versions of updated HSPF model results are presented to provide an assessment of the runoff parameters used in the HSPF modeling. The first set of HSPF simulation results uses the 1993 calibration parameters developed during preparation of the 1995 CSWMP. The second set of HSPF simulation results uses generalized parameters published by the USGS for basins in Western King and Snohomish Counties (Dinicola, 1990). It can be seen from Figures 4 through 6 that, of the two HSPF simulations, the flows produced with the USGS generalized parameters provide the best fit to the recorded data and a reasonably good reproduction of the recorded peak flows and volumes for these months. Subsequent HSPF simulations for the Maddox Creek basin are based exclusively on the USGS generalized parameters.

Comparison of Maddox Creek Simulated and Recorded Flows at Former Calibration Point above Anderson Road

The original Maddox Creek HSPF model was calibrated to streamflow data collected during the 1991-92 and 1992-93 wet weather seasons at a culvert located 1,200 feet upstream from Anderson Road, using concurrent 15-minute rainfall data collected at the Mount Vernon Waste Water Treatment Plant. The largest flow during the original calibration period had a return period estimated as approximately a three-year event, resulting from a storm on January 11, 1992.

The basin tributary to that original calibration point is relatively steep-sloped and well-drained. As a check on the revised parameter selection, an HSPF model input sequence was developed using the USGS generalized parameters and the 1991 land cover data from Table 1. The model was run to evaluate whether the use of USGS generalized parameters, in place of the calibration parameters developed for the 1995 CSWMP, would adversely affect model ability to simulate flows in the upper basin.

In the updated model for 1991 conditions, groundwater from the upper basin was assumed to bypass the original calibration gage site, emerging instead in the flat lands of the lower basin. This groundwater routing assumption is different from that in the earlier work; the change was made to improve model calibration while using the generalized parameters. The original model for the 1995 CSWMP assumed that upper basin groundwater would be measurable as streamflow at the original calibration gage site, and the model parameters had been adjusted to suppress groundwater flow.

Available results of the original calibration are limited to a single figure in the 1995 CSWMP showing simulated and recorded flows for a flood event in the period January 9-13, 1992. Figure 7 superimposes a plot of the updated simulation results onto an image of that figure. It can be seen from Figure 7 that the use of the USGS generalized parameters, together with updated groundwater routing assumptions, produces simulated flows which are in reasonable agreement with the recorded flows for the upper basin gage site and are at least as good as the original calibration results. This finding supports the use of the USGS generalized parameters for subsequent HSPF simulations in the Maddox Creek basin.

Maddox Creek Updated Flood Frequency Curves for Existing Conditions

Flood frequency curves for Maddox Creek were developed from the updated HSPF simulation results. Figure 8 plots the current-condition (year 2002) flood frequency curves for all five sub-basins represented in the updated Maddox Creek HSPF model.

Table 3 provides a summary of the flood quantiles for the basin, based on a visual evaluation of the frequency curve plots. Note that these curves reflect the current (failed) condition of the side weir at the Little Mountain Estates regional detention pond, and that land use in the lower basin (model sub-basin 37) reflects 1991 rather than 2002 conditions.

Table 3
Maddox Creek Peak Flows, Existing (2002) Conditions

Location (Cumulative flows to sub-basin outlet)	Flows (cfs) by Recurrence Interval 2-year	10-year	50-year	100-year
SB 51 - Maddox Creek Below Little Mountain Estates Pond	4	11	13	14
SB 19 - Maddox Creek at Blackburn Road	19	34	55	67
SB 34 - Maddox Creek 1200 ft above Anderson Road	28	61	90	105
SB 22 - Flowers Creek & I-5 Highway Corridor	46	77	95	100
SB 37 - Maddox Creek at Hickox Road	46	75	90	95

Lower Basin Channel Encroachment Assessment

The FEQ hydraulic model was used to assess the hydraulic impacts of possible channel encroachment in the lower basin. The FEQ model used for this purpose was the same model which was used to develop the stage-storage relationship presented in Figure 2 for the lower basin area.

Flood-prone areas in the lower Maddox Creek basin were identified from output of the FEQ model. As stated previously, this model computes flows and water levels for the month of November 1990 assuming future basin conditions as simulated by RW Beck. The peak flows and water levels determined from the model results reflect a major flood with a recurrence interval likely in the range 50 to 100 years.

Approximate inundation limits corresponding to the FEQ estimates of flood event peak water levels were estimated using City digital topographic mapping with two-foot contour intervals. Figure 9 presents the Maddox Creek inundation limits on a standard USGS base map. Included on Figure 9 are peak water levels and flows for the base condition of current channel conditions as well as for alternative encroachment scenarios discussed below.

Two encroachment scenarios were assessed. The first and most severe scenario assumed a 25-foot wide buffer from the centerline of channel, providing a total stream corridor width of 50 feet for both natural and ditched sections of channel. In the second scenario, the 25-foot buffer was retained for ditched sections of channel, and a 100-foot buffer (providing a 200-foot wide stream corridor) was assumed for the natural channel reaches. Figure 9 shows the locations of the ditched and natural sections of channel. The natural channel is located to the east of Interstate 5; the ditched reach of channel is located west of Interstate 5 and is connected to the natural channel by culverts beneath the highway. The modeling of these encroachment scenarios assumes that fill (eliminating floodplain storage) will be placed to the encroachment limits and that flow will be confined to the protected stream corridor.

Assessment results are summarized in Figure 9. The results show that both encroachment scenarios will result in noticeably higher peak water levels within the city as well as higher peak flows where Maddox Creek flows cross the city urban growth boundary at Hickox Road. The greatest water level increase of up to 1.6 feet will occur at the upper end of the ditched reach of channel, causing upstream backwater impacts of up to 1.3 feet in the natural channel. Very similar water level impacts will occur with both scenarios, presumably because the greatest impacts are associated with encroachment along the ditched section of channel where a constant 25-foot buffer (50-foot corridor) was assumed for both scenarios.

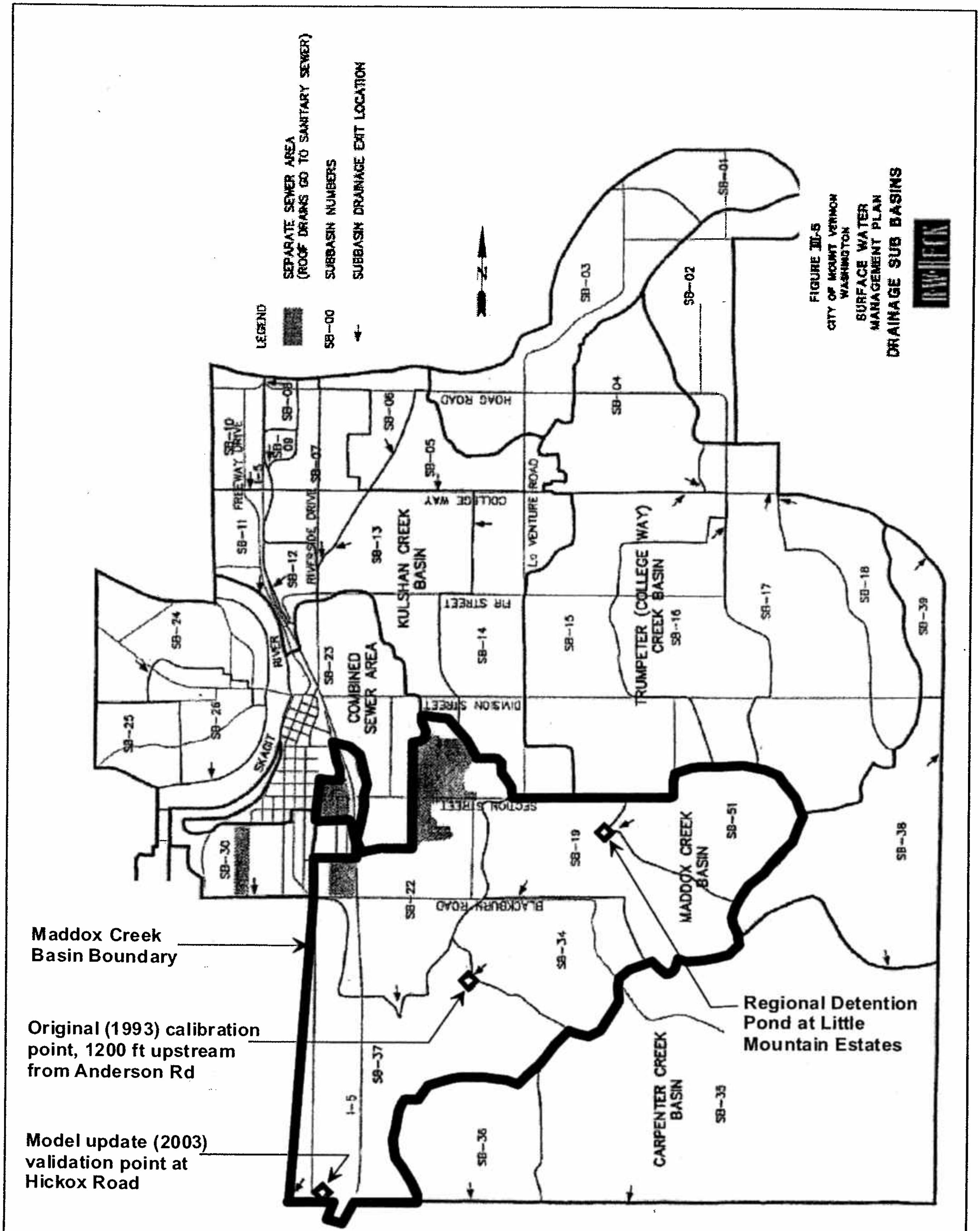
The combined peak flows at the ditch and channel crossings of Hickox Road (flow points 4 and 2 on Figure 9) would increase by up to 50%, from a base condition of 132 cfs to 200 cfs under the first encroachment scenario and 182 cfs under the second encroachment scenario. It should be noted that all of the modeled scenarios assume future buildout of the basin without effective onsite flow control and result in conservatively high estimates of peak flow. However, because the identical hydrology is assumed in each of the modeled scenarios, the estimated changes to peak flows and water levels provide a reasonable measure for comparison of the alternatives.

Summary

The HSPF model for Maddox Creek was updated with meteorological data through December 2002, realistic storage data for the flat lower basin, and land use data reflecting current (year 2002) conditions. Simulation results from two versions of the updated model—one version using calibrated parameters from the 1995 CSWMP and a revised version using USGS generalized parameters and alternative groundwater routing assumptions—were compared to available observed streamflow data for Maddox Creek at Hickox Road. Results from the revised model using USGS generalized parameters produced the best match to the observed flows. Simulation results using USGS generalized parameters and 1991 land use data were then compared to calibration results presented in the 1995 CSWMP for a site located upstream from Anderson Road. The results of the revised model are at least as good as those of the earlier work in matching observed streamflows at the original calibration site.

The updated HSPF model for Maddox Creek produces credible results based on comparisons of simulated and observed flows in the upper basin above Anderson Road and in the lower basin at Hickox Road. Conditions represented in the current-conditions (year 2002) model include the failed side weir at the Little Mountain Estates regional detention pond, and considerable channel and floodplain storage in the lower basin below the confluence of Flowers and Maddox Creeks. Application of the models, particularly for future land-use conditions, should be done with caution. The potential loss of storage, resulting from fill placement at flood-prone properties that would likely occur during development of the lower basin, could have a significant effect on peak flows at the City's urban growth boundary.

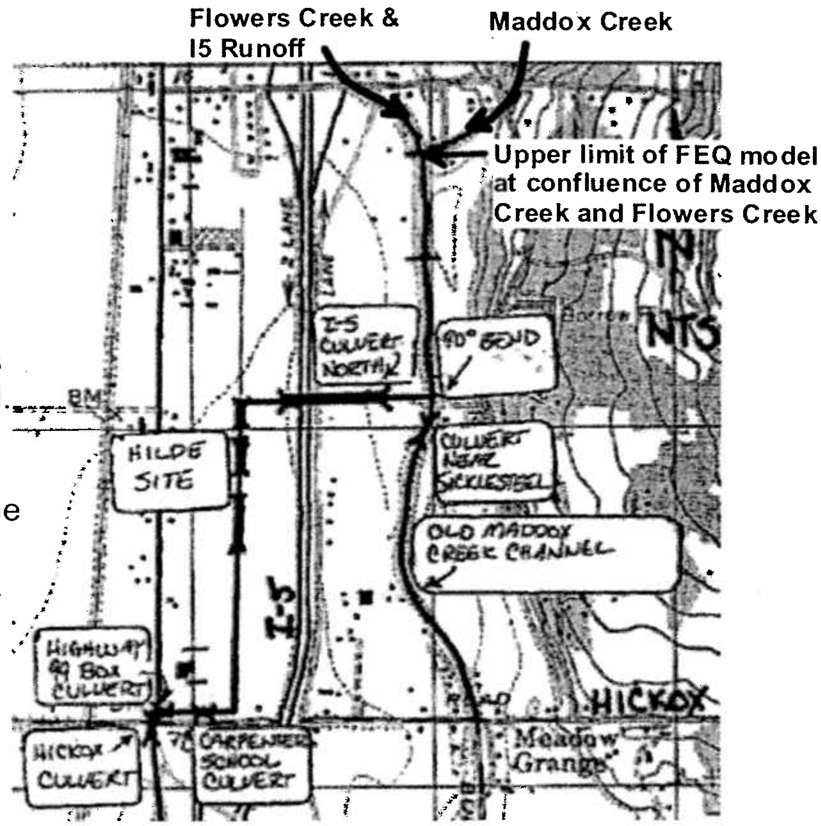
Potential loss of floodplain storage in the lower basin could result in Maddox Creek the future condition 100-year peak flows at the City's urban growth boundary (Hickox Road) being increased by as much as 50% above conditions without floodplain fill. Maddox Creek flood water levels within the city limits could be locally increased by up to 1.6 feet.



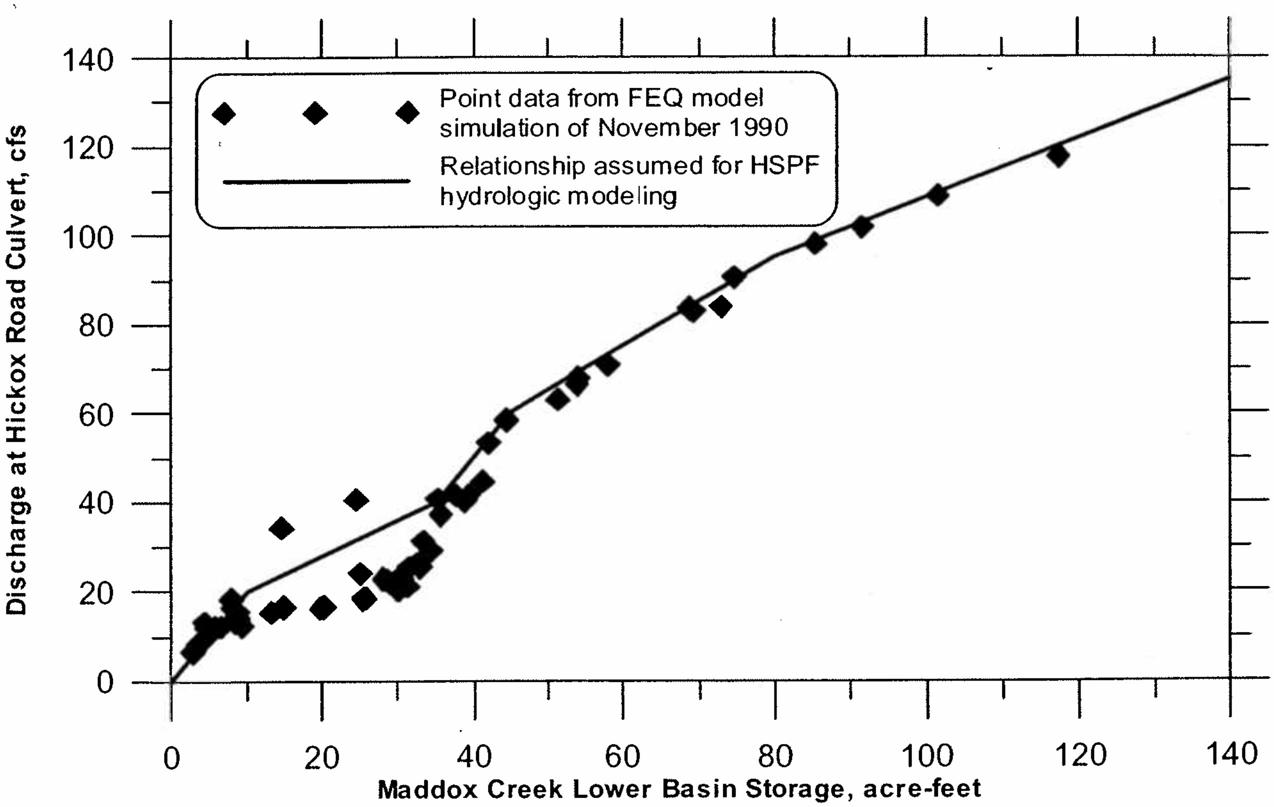
City of Mount Vernon, Comprehensive Surface Water Management Plan (CSWMP) Update northwest hydraulic consultants, June 2004	FIGURE 1 Sub-Basin Boundaries from 1995 CSWMP

Stage-storage points for the lower Maddox Creek basin determined by an FEQ hydraulic model of the reaches shown, beginning at the confluence of Maddox and Flowers Creeks and ending at Hickox Road.

The old Maddox Creek channel above Hickox road is included in the storage calculations, in addition to storage in the active ditched reach. Storage amounts are paired with FEQ-modeled discharges at "Hickox Culvert."

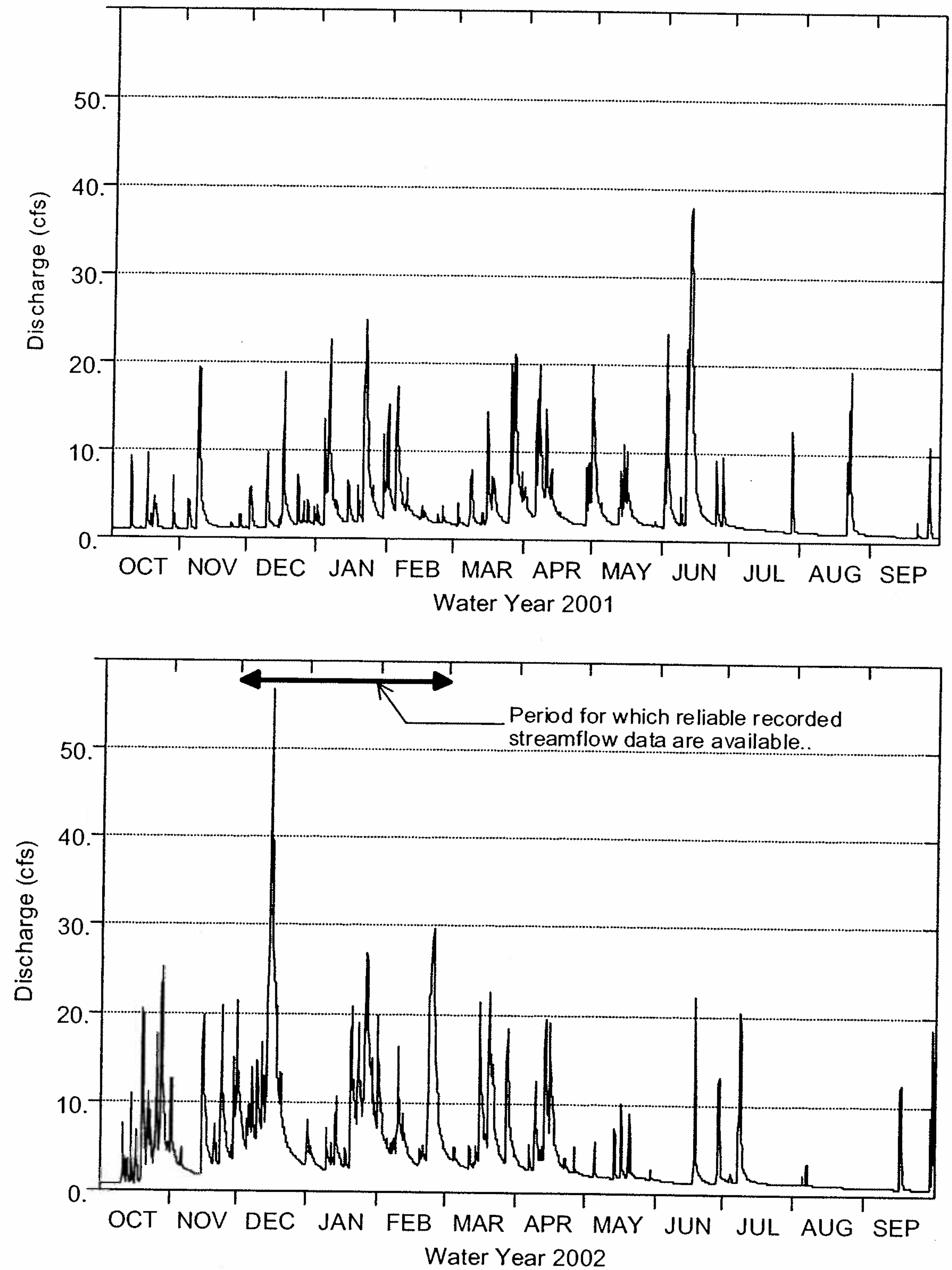


Base Map of FEQ model components from RW Beck Report dated July 2002

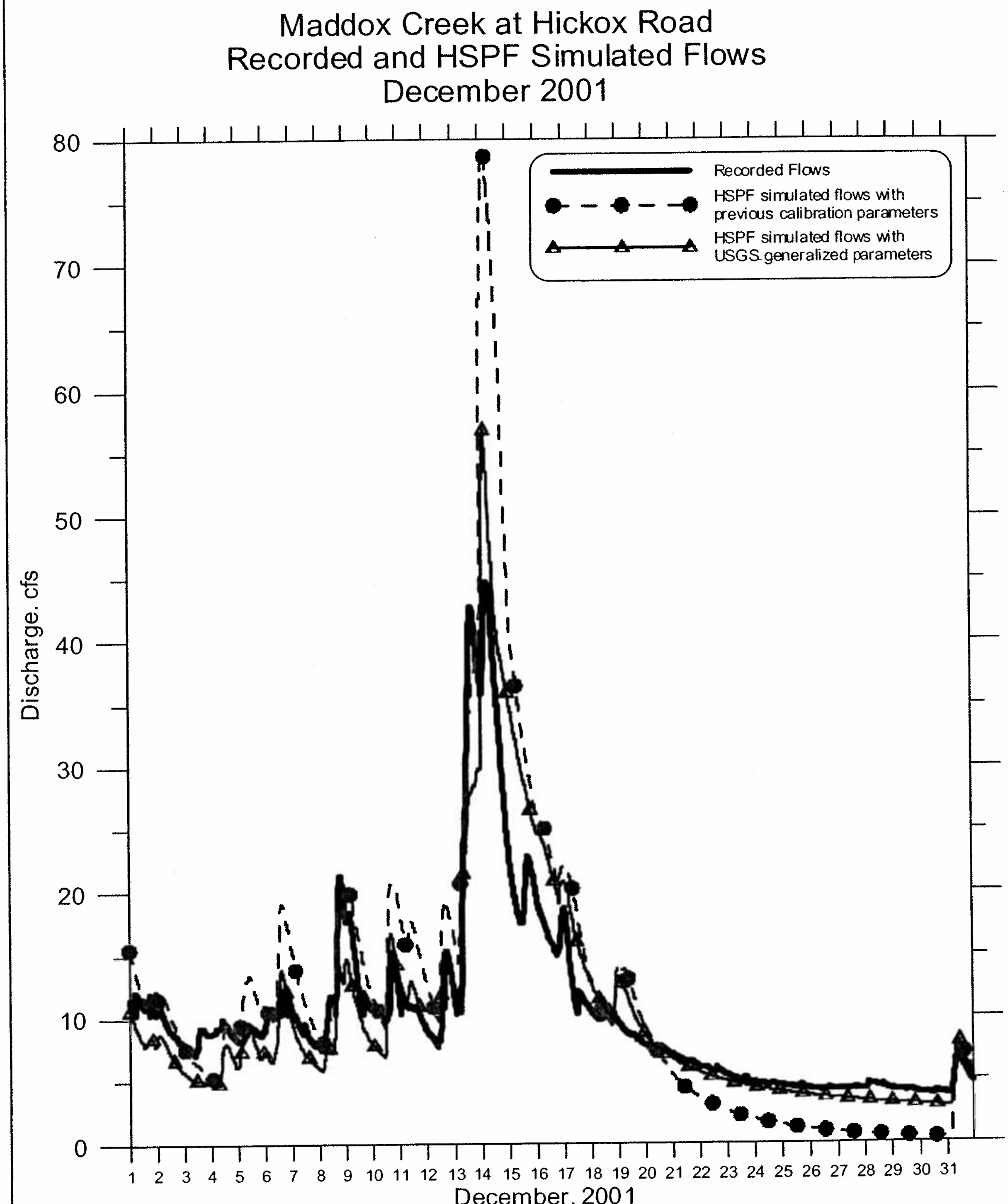


City of Mount Vernon, Comprehensive Surface Water Management Plan (CSWMP) Update northwest hydraulic consultants, June 2004	FIGURE 2 Maddox Creek Lower Basin Storage

Maddox Creek at Hickox Road
HSPF Simulated Flows With USGS Generalized Parameters

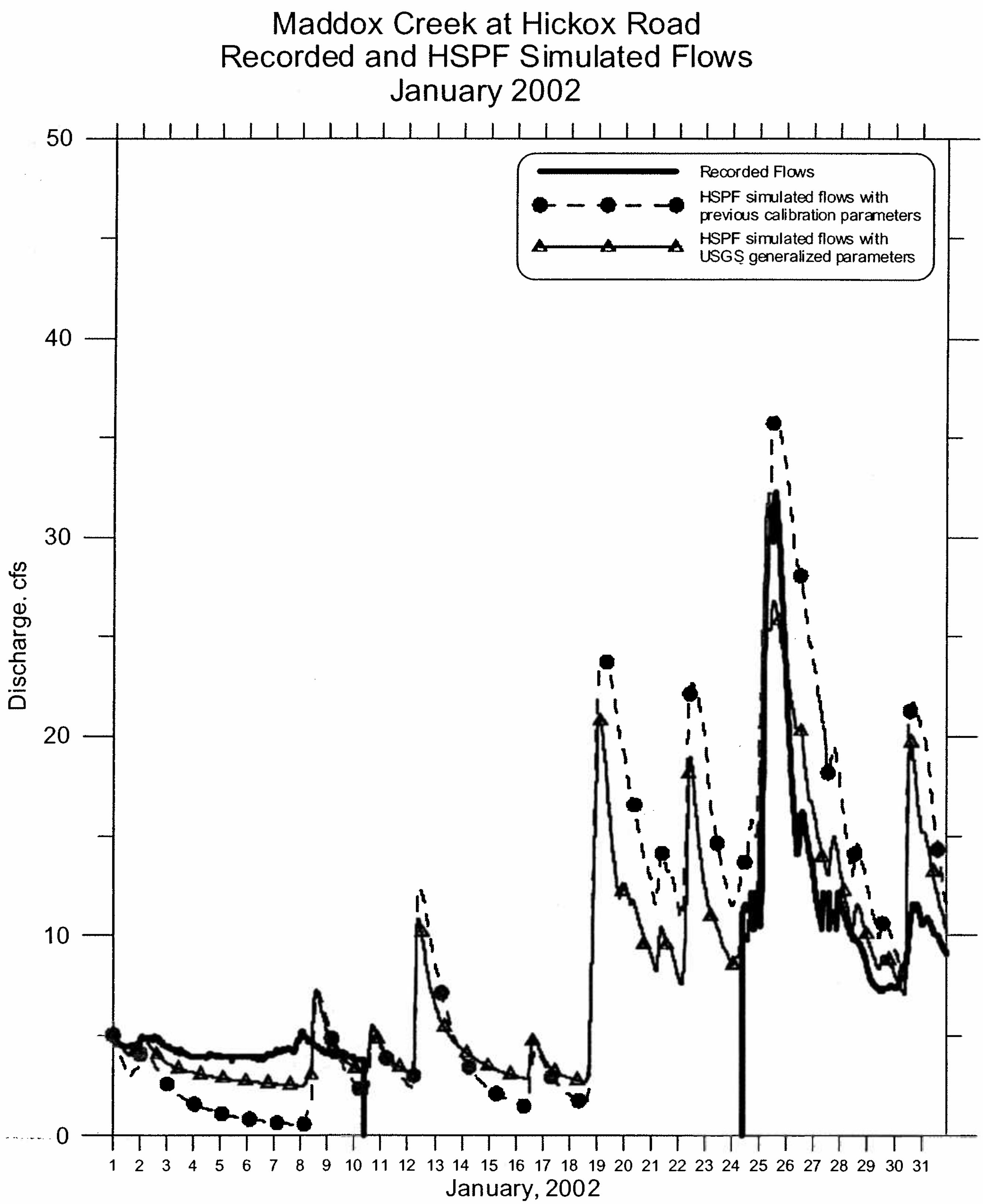


City of Mount Vernon, Comprehensive Surface Water Management Plan (CSWMP) Update northwest hydraulic consultants, June 2004	FIGURE 3 Simulated Flows at Gage Site, 2001-02

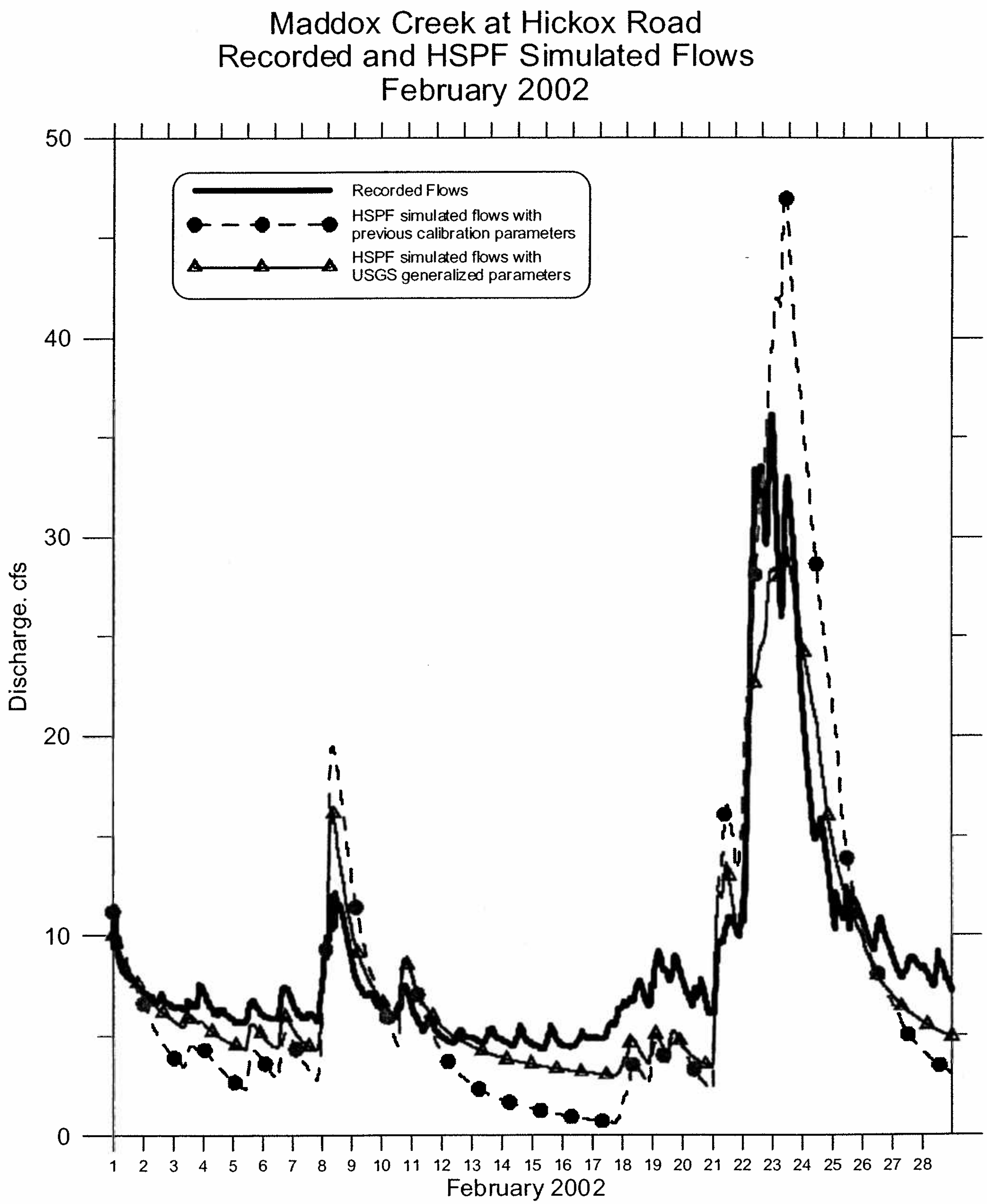


City of Mount Vernon, Comprehensive Surface Water Management Plan (CSWMP) Update
northwest hydraulic consultants, June 2004

FIGURE 4
Flow Comparison for December 2001

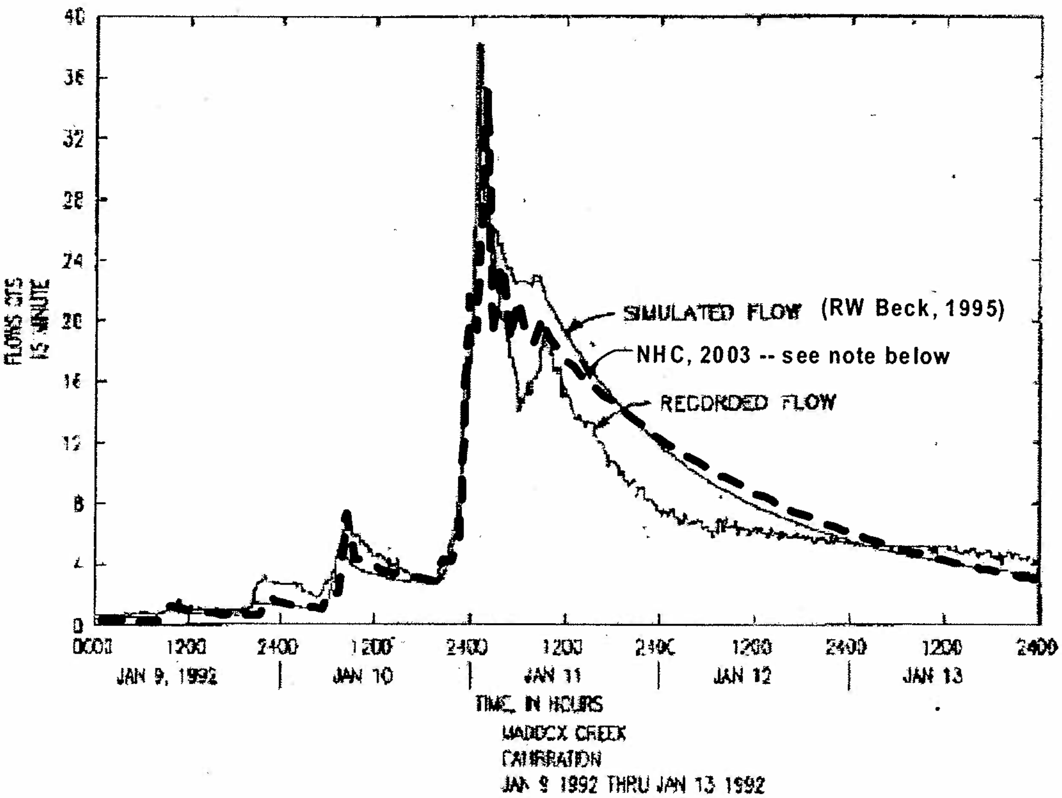


City of Mount Vernon, Comprehensive Surface Water Management Plan (CSWMP) Update northwest hydraulic consultants, June 2004	FIGURE 5 Flow Comparison for January 2002



City of Mount Vernon, Comprehensive Surface Water Management Plan (CSWMP) Update northwest hydraulic consultants, June 2004	FIGURE 6 Flow Comparison for February 2002

Maddox Creek above Anderson Road
Recorded and HSPF Simulated Flows
January 1992 Event



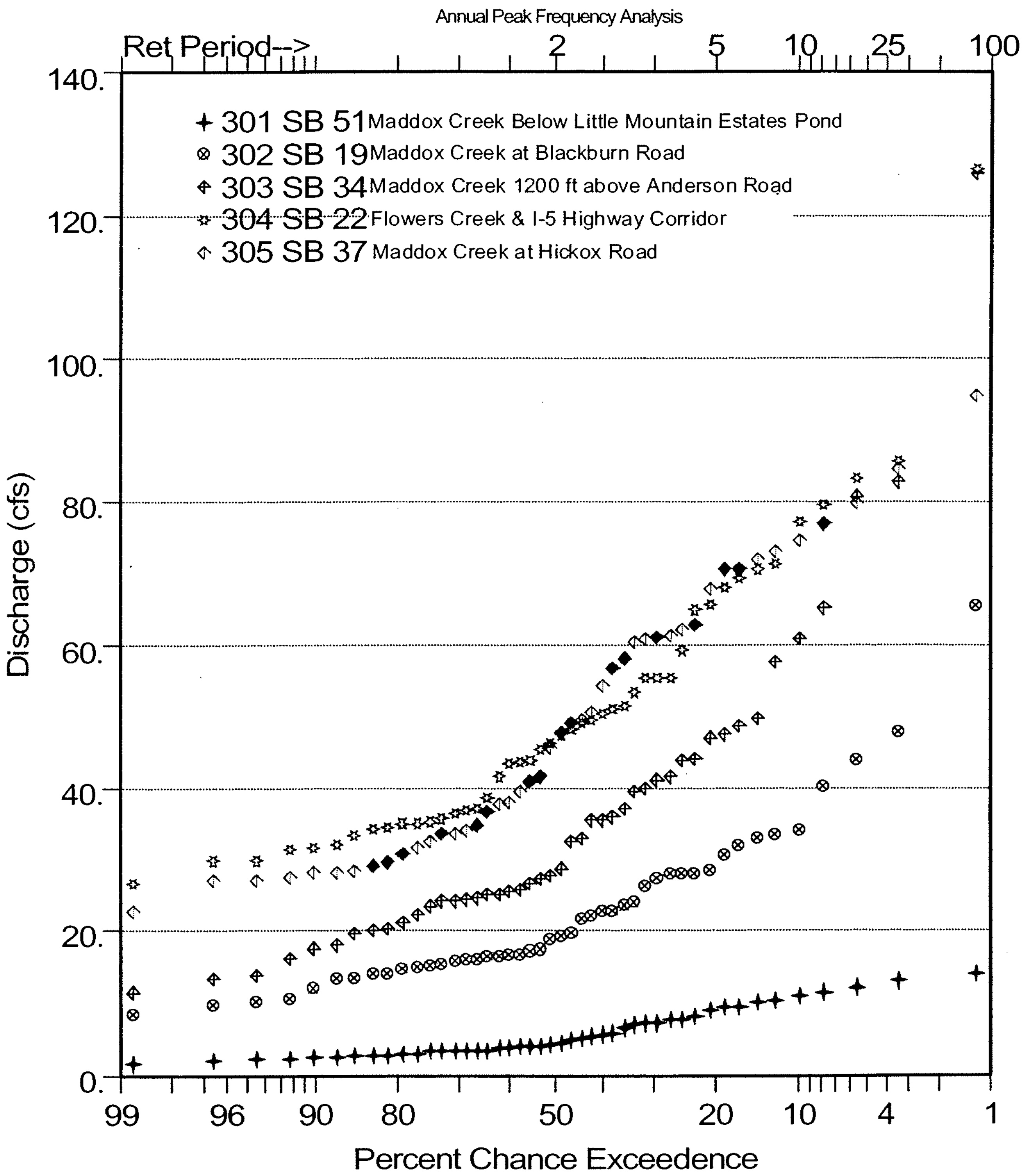
Heavy dashed line shows HSPF hourly simulation results by NHC in 2003 using 1990 land use data, USGS generalized HSPF parameters for King and Snohomish Counties, and hourly rainfall data from the NOAA Burlington gage.

In the NHC simulations with USGS generalized parameters, groundwater in the upper basin is assumed to surface in the the lower basin, and does not contribute to streamflows at the calibration location represented in the above plot.

FIGURE IV-1
CITY OF MOUNT VERNON
SURFACE WATER MANAGEMENT PLAN
HSPF RESULTS FOR JANUARY 1992 EVENT ON MADDOX CREEK

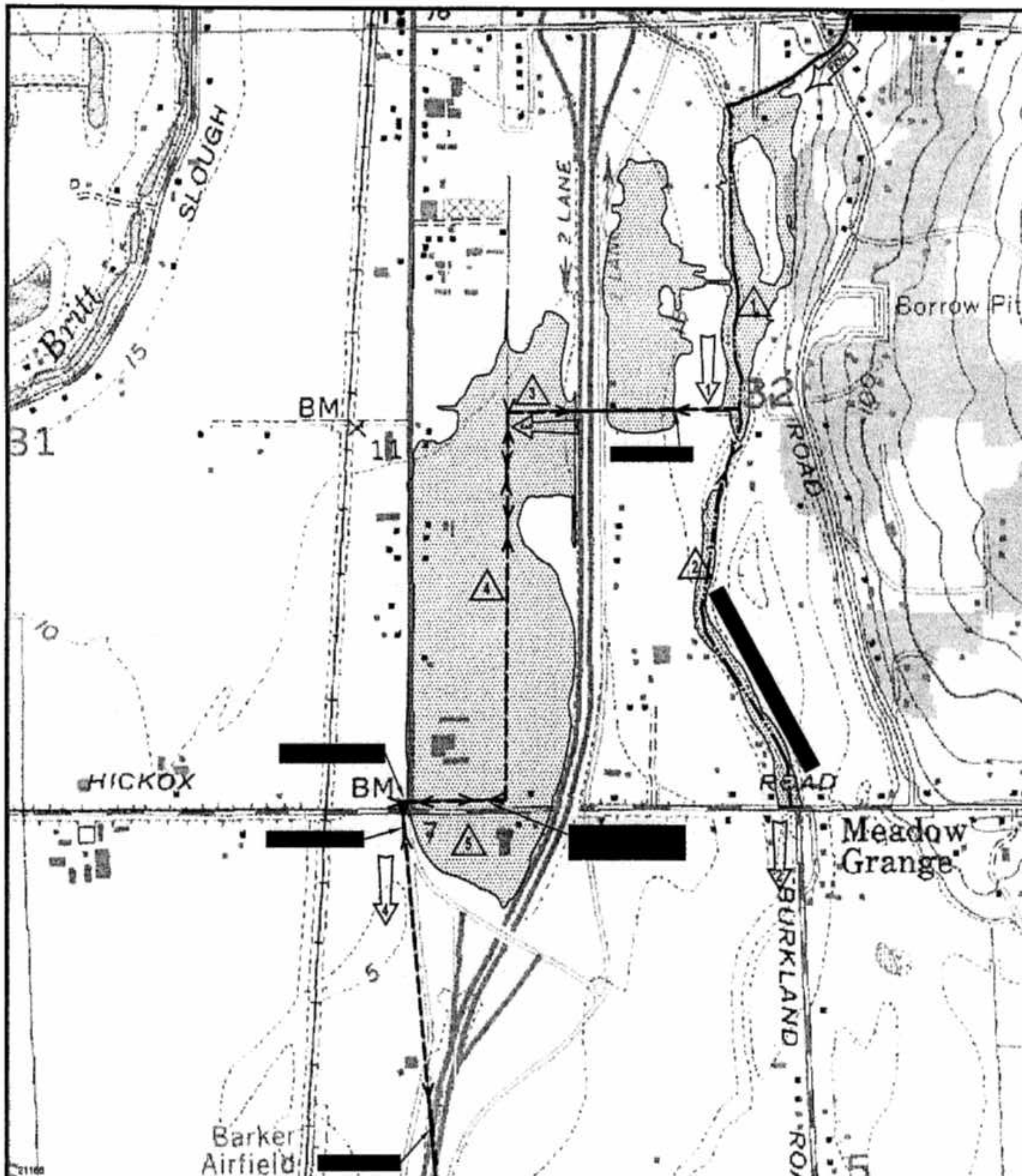
R.W. BECK AND ASSOCIATES

City of Mount Vernon, Comprehensive Surface Water Management Plan (CSWMP) Update northwest hydraulic consultants, June 2004	FIGURE 7 Flow Comparison for January 1992 Event



City of Mount Vernon, Comprehensive Surface Water Management Plan (CSWMP) Update
northwest hydraulic consultants, June 2004

FIGURE 8
Peak Flows, Existing (Year 2002) Conditions



Legend

- Natural Channel
- Ditched Channel
- Base Condition Flood Innundation Limits
- Peak Water Levels Along Channel Reach
- Peak Flows

Base Condition Scenario:

Peak flows, peak water levels, and innundation limits derived from an FEQ model of Maddox Creek for the flood event of November 1990, developed by RW Beck for the City of Mount Vernon (July 2002). Hydrology for the base condition and all scenarios reflects future build-out of the tributary basin.

Alternative 1 Encroachment Scenario:

Establish a buffer (no fill) width of 25 feet from centerline of channel. This provides a stream corridor 50 feet wide for both natural and ditched sections of channel.

Alternative 2 Encroachment Scenario:

Establish a buffer (no fill) width of 25 feet from centerline of ditched reaches of channel, and of 100 feet from centerline of natural reaches of channel. This provides a stream corridor 200 feet wide for natural sections, including the now-abandoned segment of natural channel upstream from Hickox Road.

Peak Water Levels:

1. Base: 15.3' / Alt 1: 16.6' / Alt 2: 16.5'
2. Base: 12.0' / Alt 1: 12.1' - 12.3' / Alt 2: 12.1' - 12.2'
3. Base: 9.3' - 9.4' / Alt 1: 10.9' / Alt 2: 10.7'
4. Base: 9.2 - 9.3', / Alt 1: 9.5 - 10.9' / Alt 2: 9.4' - 10.7'
5. Base: 9.2' / Alt 1: 9.3' - 9.4' / Alt 2: 9.3'

Peak Flows:

- Base: 111cfs / Alt 1: 186 cfs / Alt 2: 162 cfs
- Base: 15 cfs / Alt 1: 57 cfs / Alt 2: 50 cfs
- Base: 123 cfs / Alt 1: 151 cfs / Alt 2: 136 cfs
- Base: 117 cfs / Alt 1: 143 cfs / Alt 2: 132 cfs

800 0 800 1600 feet

Lower Maddox Creek Flood Assessment

November 1990 Event
Peak Flows
& Water Levels

northwest hydraulic consultants inc.

Date: June 2004 | Figure 9

TECHNICAL MEMORANDUM #2

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Prepared For: CH2M HILL

Prepared By: Bill Rozeboom, P.E.

Subject: City of Mount Vernon Comprehensive Surface Water Management Plan Update; Freeway Drive Basin Update.

Date: June 30, 2004

Introduction

The Freeway Drive basin is a poorly drained area along the Freeway Drive commercial district in the northwest corner of the city of Mount Vernon. Basin boundaries are shown by Figure 1. The basin is confined by diked reaches of the Skagit River to the north and to the south, and by the city limits to the west. The eastern boundary to the basin generally follows the I-5 highway corridor and includes some additional area along the northern city limit adjacent to the Skagit River east of I-5. The natural drainage from the basin is by a combination of infiltration and unconcentrated surface flow to the agricultural lands west of the city. The area west of the city is contained within a meander loop of the Skagit River and includes Ledger Lake as a closed depression drainage feature and a surface expression of the local groundwater table.

College Way divides the Freeway Drive basin approximately in half. The area to the south of College Way, sub-basin 11 on Figure 1, presently lacks a defined drainage outlet, and most runoff from this area either infiltrates to groundwater or flows westward to Ledger Lake. The area to the north of College Way, including sub-basins 8, 8A, and 10, is served by a regional drainage system including a large stormwater detention pond adjacent to Lowe's Hardware and a stormwater pump station located near the intersection of College Way and Freeway Drive. The basin stormwater system does not have a gravity outlet; runoff either infiltrates as seepage from the stormwater system or is pumped to the Skagit River.

Hydrologic analysis was performed to investigate the performance of the Freeway Drive pump station for current and future conditions. The Hydrologic Simulation Program – Fortran (HSPF) was used for this analysis.

HSPF hydrologic models for the Freeway Drive basin were originally developed in 1993 during preparation of the 1995 City of Mount Vernon Comprehensive Surface Water Management Plan (CSWMP). In the current work, the models for current and future conditions were updated with meteorological data through December 2002, and modified to reflect updated estimates of pump station capacity, stormwater storage, and land use. The updated models were used to determine the current level of system performance and to identify the system pump station improvements which would be needed for future build-out of the basin.

Model Update

The revisions to the Freeway Drive Basin models involved extending the simulation period through mid-December 2002 using meteorological data sets developed during the update of the HSPF models for Maddox Creek, and developing models for past, current, and future conditions as summarized below.

- Past-Conditions (Validation) Model. A past-conditions validation model was developed to represent the historical condition of the Freeway Drive stormwater system and pump station during the period of 1994 through 2001. The modeled tributary basin area was 46 acres, and the modeled pump capacity was 1.24 cfs, consistent with past conditions.

- Current Conditions Model. A current conditions model was developed to represent the condition of the Freeway Drive stormwater system as of early 2004. The modeled tributary basin area was 82.4 acres and the modeled pump capacity was 2.95 cfs, consistent with current conditions.

- Future Conditions Models. A series of future conditions models was developed to represent buildout of the Freeway Drive basin north of College Way. The modeled tributary basin area incrementally increased by up to 56 additional acres for a total tributary basin area of 138.4 acres, and various pump station capacities were evaluated. The analysis did not include potential development in the Freeway Drive basin south of College Way.

<u>Past-Conditions (Validation) Model</u>

The HSPF models previously developed for the Freeway Drive basin reflected a conservative assumption of a constantly-high groundwater table which limits the amount of live storage in the regional stormwater detention pond. Conservatism was warranted because of anecdotal reports of a high groundwater table, combined with uncertain rates of seepage inflow from the Skagit River during periods of high river flow. Because the original HSPF analysis (1993) preceded the pond construction (1994), there was no opportunity for model validation at the time of the earlier work. For this update, the original existing-conditions model was reconfigured to more accurately reflect conditions since the pond was constructed and model simulation results for 1994-2001 were compared with available information on actual system performance.

Previous land use analysis of existing conditions in 1994 determined that the Freeway Drive Pump Station and the Lowe's (formerly Eagle) Hardware Regional Stormwater Pond would receive runoff from 46 acres of effective impervious surface, including the surface area of the regional pond. All pervious area in the basin, at both developed and undeveloped sites, was assumed to not have access to the storm drain system and to not contribute any flow to the pump station. The model conservatively assumed that a constantly high groundwater table would fill the regional pond to an elevation of 19 feet and that live storage would occur only above that elevation.

A review of basin areas for the Freeway Drive stormwater system found that two offsetting adjustments to the previously-mapped basin areas are indicated. The areas involved in these adjustments are identified on Figure 1. From a December 2003 meeting with City of Mount Vernon staff, it was determined that drainage from developed areas of sub-basin 9 (previously assumed to be tributary to the Freeway Drive pump station) likely drains instead to the separate College Way system. In the prior analysis, that sub-basin had been assumed to contribute runoff from 8.6 acres of impervious surface to the pump station, representing 22% of the inflow volume in 1995. The deduction is largely offset by an additional area south of College Way which had previously been included as part of (non-tributary) sub-basin 11. The offsetting area south of College Way consists of a north-sloping corridor bounded by the centerlines of Interstate 5 to the east and Freeway Drive. For the current work it is assumed that the year 1994 tributary area to the stormwater system and pump station is 46 acres of impervious surface, as described in the earlier analysis.

The modeled basin storage in the Freeway Drive stormwater system was adjusted to better reflect actual storage conditions in the regional facilities. Significant storage volumes exist at two locations: the regional stormwater pond behind Lowe's Hardware and in a large open ditch along the west side of Freeway Drive. In the updated analysis, pumped-outflow live storage in the regional pond begins at outlet elevation 17.4 feet, which corresponds to the top of existing stoplogs at the outlet structure as confirmed by a field inspection in late 2003. Low-rate seepage flow of 0.03 inches per hour is modeled as occurring from the dead storage pool and to draw the pond down to its bottom, elevation 15.2 feet. In the previous analysis, live storage was assumed to be available only above elevation 19 feet, which is the top of stoplogs as shown on the pond engineering plans. Higher stoplogs are believed to have been initially proposed due to concerns of a high groundwater table at the pond location.

The regional stormwater pond behind Lowe's Hardware is an unlined excavation in an area mapped as having Custer Norma soils. Actual infiltration rates from this pond are expected to be highly variable due to groundwater table effects and the amount of organics and silts found at the surface. The Custer Norma soil series has a limiting infiltration capacity in the upper soil layers in the range of 0.2 to 0.6 inches per hour. If the surface layers are removed (e.g., by pond excavation), the infiltration capacity at depth can be as great as 20 inches per hour. However, the pond will tend to seal over time as sediments are deposited from the stormwater runoff, and no infiltration will occur during periods of high river level and high groundwater of concern. As a simplifying assumption, the infiltration from the dead storage pool was modeled at a conservatively low rate of 0.03 inches per hour, which is representative of relatively fine-grained Alderwood soils. That rate corresponds to 0.044 cfs over the 1.5-acre area of the pond bottom. Modeled infiltration was furthermore set to zero during relatively wet periods, when the water level in the Freeway Drive Regional Pond is in the live storage range and when the system pump station is in operation. Subsequent evaluation of model results determined that the modeled infiltration rate produced significant drawdowns (to below elevation 17 feet) only during the summer months.

Storage in the large ditch along Freeway Drive was ignored in the previous analysis with the conservative assumption that the ditch would be replaced by a pipe system in the future. However, the ditch exists under current conditions and is now considered likely to remain in the future. In discussions with city staff in November 2003, it was concluded that future development of the Freeway Drive basin would preserve the ditch and the stormwater storage that it provides.

For the model update, regional pond stage-storage data were computed from the pond as-built engineering plans[1]. Stage-storage data for the Freeway Drive ditch were computed from a representative measured ditch section having a bottom width of 6 feet at elevation 17 feet, side slopes of 1:1, and a length of 1800 feet. The resulting storage characteristics in the Freeway Drive basin are summarized in Table 1 below. Relative to the previous analysis, the storage below the spillway crest is increased by 6.5 acre-feet in the active storage (pumped-outflow) range from elevation 17.4 to 22.5 feet and by 3.7 acre-feet in the limited-use storage (seepage outflow) range below 17.4 feet.

Table 1
Freeway Drive Basin Regional System Stormwater Storage

Regional Pond Reference Point	Elevation Feet	Storage Volume, Acre-feet Pond	Ditch	Combined
Bottom of pond	15.2	0.00	0.00	0.00
	15.3	0.15	0.00	0.15
Invert of outlet pipe	17.0	2.94	0.00	2.94
	17.1	3.13	0.03	3.15
Top of stoplog (actual)	17.4	3.68	0.11	3.79
	17.5	3.87	0.13	4.01
Top of stoplog (plans)	19.0	6.95	0.66	7.61
	20.0	9.25	1.12	10.36
Crest of spillway	22.5	15.91	2.61	18.52
	23.0	(17.40)*	(2.98)*	(20.38)*
Top of perimeter berm	23.5	(18.95)*	(3.36)*	(22.31)*

(*Values in parentheses are for an overflow condition which exceeds pond full supply level)

The other revision to the validation-period model was to reduce the pump capacity. The original report had estimated the capacity of the pump station to be 2.67 cfs, but subsequent pump tests by the city determined that the actual capacity was only 1.24 cfs. The lesser capacity corresponds to the then-existing10 hp pumps and 10" diameter PVC forcemain.

[1] Final dimensions shown as annotations on approved engineering plans for storm drainage system and detention pond for City of Mount Vernon, Eagle Hardware & Garden. Plans dated 04/30/93 by Bell Walker Engineers, Inc and approved 05/18/93 by the city of Mount Vernon..

Larger 25 hp motors were installed in 2002, which has increased the current pump capacity to 2.95 cfs (1325 gpm). For the purpose of model validation to conditions in 1994-2001, simulations were run with the original 1.24 cfs capacity.

Historical records of monthly total operating hours and estimated pumped volumes at the Freeway Drive Stormwater Pump Station are the only data available to describe system performance over the validation period, years 1994 through 2001. No records, photographs, or other anecdotal reports could be located by the city to describe maximum levels or water level fluctuations in the regional pond, and the city was unable to comment on the reasonableness of simulated pond stage hydrographs.

Model Validation

Evaluation of the validation model results focused on the period of November 1995 through January 1996 and which included a prolonged period of wet weather and high river levels. This period was also used by nhc to calibrate a previous water level model for the City of Mount Vernon of the Ledger Lake area immediately west of the Freeway Drive basin. The results of the previous Ledger Lake study showed that the maximum groundwater level (and Ledger Lake level) was 20.0 feet and occurred in November 1995. This groundwater level was the second-highest in the 40-year simulation period with an estimated recurrence interval between 25 and 50 years. The only higher groundwater level in the Ledger Lake study simulation period was 20.2 feet, occurring in November 1990.

The best available estimates of local groundwater levels over the validation event are from the prior Ledger Lake analysis, which considered the lake to be a surface expression of groundwater levels. Figure 2 presents the results of that earlier study for the period of the validation event. This figure shows that the local groundwater table at Ledger Lake immediately west of the Freeway Drive basin may have been in the live storage range for the regional stormwater pond (higher than 17.4 feet) for most of December 1995 and well below the live storage range for most of November as well as for all of January.

Table 2 compares the predicted basin outflow with the pump station records for the November 1995 to January 1996 validation event. Pump station inflow volumes were computed by multiplying monthly rainfall by the impervious tributary area of 46 acres. Predicted pump station outflow volumes were computed by adjusting the inflow volumes for the simulated changes in pond storage over each month, with an additional manual adjustment for refill of approximately 4 acre-feet of limited use storage below pond elevation 17 feet at the start of the period. The manual adjustment was made to correct for the discrepancy between actual conditions and the simulations results at the start of the validation event. The HSPF simulation results produced a water level of 17.1 feet on November 1, 1995; whereas, the estimated actual groundwater level on that date, based on the Ledger Lake analysis, was about 10 feet, indicating a dry pond. Values presented in Table 2 as actual pumped outflow volumes are based on data obtained from the City's Station Time Records for the Freeway Drive Storm Station. The station time records report total pumped volumes for each month as determined from pump operating hours and an assumed pump rate of 1.24 cfs.

Table 2
Validation Event Predicted and Pumped Outflow Volumes

Month	Rain (inches)	Pumped Outflow Volume (acre-feet)		
		Predicted	Actual	Difference
Nov 1995	11.1	30.5	6.6	+23.9 (362%)
Dec 1995	3.5	20.8	23.5	-2.7 (-11%)
Jan 1996	5.6	21.4	15.4	+6.0 (+39%)

Variations in seepage losses over the validation period are presumably responsible for the inconsistent match of predicted and actual outflows. The Freeway Drive stormwater system is mostly an open system, and seepage losses from the system can occur from the unlined ditches as well as from the bottom area (1.5 acres) of the unlined regional detention facility. During periods of low groundwater, infiltration losses from the pond bottom will occur at rates significantly greater than simulated in the model.

The validation period results show that the model greatly over-estimates pumped-outflow volumes during the high-rainfall month of November 1995, when groundwater levels were initially low. However, model predictions for the high-groundwater, low-rainfall condition in December 1995 are reasonably consistent with the actual pumped volumes. These results suggest that modeled pumped volumes are reasonable under conditions of a high groundwater table, such as occurred in December 1995 but will overestimate pumped outflows in other periods. The HSPF analysis assumed that high groundwater persists throughout all winter months.

A second finding from the validation exercise is that external (Skagit River) horizontal seepage inflows to the storm drain system appear to be minor relative to the existing pump capacity. As stated above, elevated groundwater conditions are thought to have been present for most of December 1995, with groundwater levels above elevation 17 feet for most of the month and a peak water level of nearly 20 feet. Seepage inputs to the stormwater system, if significant, should have shown up in the pump records for December 1995. Instead, the pump station records show pump operation for only 230 hours (or 31 % of the available hours in the month), and the pumped volumes are within 11% of the estimated stormwater runoff from the basin. For December 1995, the excess pumped volume of 2.7 acre feet is equivalent to an average seepage inflow 0.04 cfs over the month or 0.09 cfs if the seepage inflows occurred over the two week-period with the highest estimated local groundwater levels above 19 feet elevation.. While the estimated rates of seepage inflow are approximate, the point to be made is that the limited excess pumping during a prolonged period of high groundwater conditions suggests that seepage inputs from groundwater are small relative to the pump capacity and are not significant to the performance of the Freeway Drive stormwater system.

<u>Updated Current Conditions Model (Year 2004)</u>

The HSPF model of the Freeway Drive basin was configured to current conditions by setting the pump capacity to the upgraded station capacity of 2.95 cfs (1325 gpm) and by adjusting the tributary basin to reflect conditions as of early 2004. Tributary basin adjustments were made to reflect areas of new commercial development within the basin service area north of College Way, and to include additional basin areas identified as sub-basin 8A on Figure 1 which will result from stormwater routing for the Riverside Bridge Replacement Project. New areas of commercial development over the period 1994-2003 were identified by comparing the basin land use mapping from the 1995 CSWMP with a current aerial image from the City GIS system. The basin areas to drain by gravity and pumped flows to a new detention pond for the Riverside Bridge Replacement Project[2] and thence to the Freeway Drive stormwater system, were confirmed by correspondence with the project drainage engineers, Leonard, Boudinot & Skodje, Inc.

Commercial properties which had been developed as of 1994 are assumed to have 80% effective impervious coverage, with only the impervious portion, totaling 46 acres, being directly tributary to the Freeway Drive storm drain system. That assumption is consistent with the prior analysis conducted in 1993 and also the current model validation run. New properties developed from 1994 to 2004 are assumed to have runoff from both impervious and pervious surfaces routed through an on-site stormwater detention facility, meeting the city's current stormwater standards, prior to discharge to the regional Freeway Drive system. Ponds constructed over this period have been at an elevation range which avoids backwater effects, with the consequence that local detention storage is independent of (rather than a part of) the live storage pool of the Freeway Drive regional pond and ditch system. The total acreage of new commercial development from 1994 to 2004, excluding the Riverside Bridge Replacement Project, is estimated to be 16.5 acres at 80% effective impervious cover. The bridge project, which first drains to its own on-site stormwater detention facility, adds an additional basin area of 19.9 acres at 55% effective impervious cover.

The HSPF model of current (year 2004) conditions includes three stormwater ponds. These are: 1) the Freeway Drive regional pond, described above, with pumped outflow at 2.95 cfs; 2) the Riverside Bridge Project stormwater detention pond with stage-storage-outflow characteristics as presented in the design report for that project; and 3) a composite detention pond reflecting the cumulative performance of on-site stormwater detention facilities assumed to have been constructed since 1994. Inflow to the Freeway Drive Regional Pond consists of the outflow from the other two ponds, plus direct runoff from the 46 acres of original tributary basin.

Hydraulic characteristics for the Riverside Bridge Project stormwater detention pond were determined from the project design report and are summarized in Table 3. Hydraulic characteristics for the Composite Detention Pond were determined by scaling the pond hydraulic data presented in the design report[3] by Semrau Engineering for a detention pond recently constructed for an 80% impervious, 4-acre site on Freeway Drive, about 1000 feet north of College Way. Pond hydraulic data of storage and discharge values were scaled to

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[2] "Riverside Bridge Replacement Project Stormwater Drainage Analysis; City of Mount Vernon, Washington, City of Burlington, Washington" dated February 7, 2002 by Leonard, Boudinot & Skodje, Inc. for Harding Lawson Associates.
[3] "Drainage Report for W.L. and Kathleen M. Massey Fill and Grade Application; Section 18, T.34N, R.4E., W.M. City of Mount Vernon, Job NO. 91-045A" dated April 29, 1999 by Semrau Engineering & Surveying for W.L. and Kathleen M. Massey.

unit area values, representing a one-acre commercial site, by dividing the design report values by the basin area. For the composite pond, Table 4 presents stage-storage discharge data in both unit-area amounts as well as the composite values used in the model of current conditions.

Table 3
Detention Pond Hydraulic Characteristics
Riverside Bridge Replacement Project
19.9-Acre Basin at 55% Effective Impervious Area

Stage Ft	Depth ft	Storage ac-ft	Discharge Cfs
30.0	0.0	0	0
30.5	0.5	0.13	0.31
31.0	1.0	0.28	0.43
31.5	1.5	0.44	0.92
32.0	2.0	0.61	1.19
32.5	2.5	0.80	1.41
33.0	3.0	1.01	2.04
33.5	3.5	1.23	3.24
34.0	4.0	1.47	4.38

Table 4
Detention Pond Hydraulic Characteristics
Composite On-Site Stormwater Detention Pond
Developments at 80% Effective Impervious Area

		Unit Area Values 1-Acre-Increment		Composite Pond 16.5-Acres of Development	
Stage ft	Depth Ft	Storage ac-ft	Discharge cfs	Storage ac-ft	Discharge cfs
23.0	0.0	0.0000	0.0000	0.00	0.00
23.5	0.5	0.0057	0.0192	0.09	0.32
24.0	1.0	0.0140	0.0271	0.23	0.45
24.5	1.5	0.0252	0.0332	0.42	0.55
25.0	2.0	0.0393	0.0384	0.65	0.63
25.5	2.5	0.0566	0.0429	0.93	0.71
26.0	3.0	0.0772	0.1178	1.27	1.94
26.5	3.5	0.1014	0.4751	1.67	7.84
27.0	4.0	0.1293	1.5824	2.13	26.11

Key elements of the HSPF model of current (Year 2004) conditions are a total tributary basin area of 82.4 acres, two on-site detention ponds with a combined live storage of about 2.7 acre feet before overflow, a total of 14.7 acre-feet of pumped-outflow live storage in the regional detention pond and ditch system, and a regional system pump capacity of 2.95 cfs (1325 gpm). The HSPF simulation results for this condition showed that the level of protection against uncontrolled overflows from the regional pond is presently greater than once in 100 years.

Future Development Scenarios

The future development scenarios considered here address buildout of the Freeway Drive basin areas north of College Way, which have drainage access to the Freeway Drive regional detention pond and pump station. The assessment does not address existing or future development in those Freeway Drive basin areas located south of College Way (and west of Freeway Drive), which at present drain by percolation into the ground and by westward overland flow at the city limits. The 1995 CSWMP had explored scenarios which included a relocated pump station to serve the presently non-draining area. However, for the current work it was decided, in consultation with City of Mount Vernon staff, to evaluate scenarios which could be accomplished without relocation of the existing pump station. Evaluation of the non-draining area would be deferred for future study.

The remaining developable area in the tributary basin to the Freeway Drive regional storm drain system was determined from a recent aerial image from the City's GIS system. Four properties within the city limits, totaling approximately 56 acres, remain to be developed as follows: 1) a 40-acre property immediately north of Lowe's Hardware and the regional stormwater pond; 2) a 4.2-acre property adjacent to the Skagit River at the northwest corner of the city limits; 3) a 2.9-acre property adjacent to the Skagit River east of Interstate 5; and 4) an 8.9-acre property about 1,000 feet south of the river and east of Interstate 5. The land use assumption used in the model for the future build-out condition of these commercial-zoned properties is to have effective impervious coverage at 80% with runoff from both pervious and impervious surfaces being conveyed to the Freeway Drive regional storm drain system.

An initial simulation of basin buildout with the existing pump station determined that frequent overflows would occur from the emergency spillway of the regional (Lowe's Hardware) pond. Model results, which reflect the conservative assumption of a constantly high groundwater table and minimal seepage losses from the storm drain system, showed spillway overflow in nearly one half of the 46 years of the simulation. Table 5 presents the dates of the largest nine overflow events, ranked by both pond peak level and total overflow volume. Included in Table 5 are the estimated groundwater conditions for each event, based on the previously-identified water level model of the Ledger Lake area.

Table 5
Major Stormwater Events and Coincident Groundwater Conditions
Based on Preliminary Basin Buildout Modeling of Freeway Drive Stormwater System
(events ranked by total modeled volume of overflow at emergency spillway)

Overflow Volume (rank)	Event Period		Monthly Rainfall (inches)	Pond Peak Level (HSPF Model)		Est'd Actual GW Elev. (ft)	
	Month	Year		Date	(rank)	On Date of Pond Peak	Max in Next 7 days
1	Nov	1990	14.8	24-Nov-90	4	**19.0**	**20.2**
2	Nov	1989	10.7	10-Nov-79	2	13.6	16.4
3	Nov	1995	11.1	28-Nov-95	8	**18.1**	**20.0**
4	Jan	1971	12.3	26-Jan-71	5	14.0	15.9
5	Jan	1982	8.7	23-Jan-82	6	11.0	12.7
6	Dec	1979	8.6	14-Dec-79	1	12.8	17.2
7	Dec	1967	7.3	25-Dec-67	3	12.5	14.8
8	Jan	1974	7.6	24-Jan-74	9	15.0	15.8
9	Jan	1984	8.3	24-Jan-84	7	11.8	13.9

The information in Table 5 was compiled to assess the reliability of the simulation results given the findings of the model validation exercise. Table 5 shows that only two of the nine largest runoff (pond overflow) events in the simulation period had high coincident groundwater conditions as estimated by the prior analysis of the Ledger Lake area. It is likely that the modeled overflows in other events are overestimated because of the conservative assumption of high groundwater through the winter months, with infiltration at a correspondingly low rate. As discussed earlier, the findings of the validation exercise were that modeled pond outflows appeared to be reasonably accurate for periods of high groundwater conditions but could significantly overestimate pond outflow in other periods. The model is particularly likely to overestimate peak pond levels and outflow volumes for events in which the actual groundwater level is below the bottom of the regional pond at 15.2 feet.

Model results summarized below for future development scenarios include the peak rates and total volumes of overflow for the November 1990 event. The simulation results for the November 1990 event, during a period of high groundwater, are felt to be the most accurate and useful for quantifying system performance under design storm conditions. The modeled pond overflows for the other major events previously identified in Table 5 are not included in the future scenario results because the model is believed to significantly overestimate overflows for all but the November 1990 and November 1995 events. The November 1990 event is adopted here as a design storm because it is the most severe storm in the period of record. It has the highest simulated overflow volumes in the 46-year HSPF simulation period from 1957 to 2002 and also the highest estimated groundwater level in the 40-year Leger Lake analysis period from 1957 to 1996.

Table 6 summarizes the results of future scenario model runs to assess system performance with incremental levels of additional basin development, with increased pump station capacity, and with optional on-site detention storage. Basin development is increased in regular increments up to the buildout condition of 56 acres more than existing conditions. Simulated pump capacities of 2.95 cfs and 5.68 cfs, respectively, represent the existing capacity of the Freeway Drive Stormwater Pump Station and the capacity which, per a concurrent CH2M Hill analysis, would be achieved by replacing the existing 10" diameter forcemain with a larger 18" diameter pipe. Other simulated pump capacities are arbitrary. Most of the simulations assume that new development will not be required to follow the city's current detention standards for stream bank erosion control, with the belief that those standards may be inappropriate in the context of the pumped-outflow Freeway Drive system, and that existing standards are likely to be relaxed. The issue of alternative detention standards in the Freeway Drive basin was deferred for future study. In those scenarios where additional detention is modeled, the composite on-site stormwater facility for recent development under the current city regulations (Table 4) was scaled up to reflect the additional development.

Table 6
Future Conditions Scenario Analysis
Freeway Drive Regional Stormwater System

Additional Development (acres)	Pump Capacity (cfs)	Additional on-site detention?	Stormwater Pond Overflows Overflow in Nov 1990 design event volume (ac-ft)	peak Q (cfs)
+ 0 ac	2.95	No	0	0
+ 10 ac	2.95	No	1.1	1.4
+ 20 ac	2.95	No	4.3	3.1
+ 30 ac	2.95	No	10.7	6.9
+ 40 ac	2.95	No	15.7	11.5
+ 56 ac	2.95	No	28.1	16.5
+ 56 ac	2.95	Yes	24.8	12.8
+ 30 ac	5.68	No	0	0
+ 40 ac	5.68	No	0.7	1.3
+ 56 ac	5.68	No	6.2	6.2
+ 56 ac	5.68	Yes	1.7	2
+ 56 ac	6.0	No	4.8	5.5
+ 56 ac	8.0	No	0	0

Table 6 quantifies how the volume and peak rate of overflow for the design event increase with increasing basin development and are diminished by increasing pump size. The presence of additional on-site stormwater ponds per the city's existing regulations does not appreciably affect buildout development impacts on overflow volumes unless the pump station capacity is also increased.

A well-defined performance standard does not exist for the Freeway Drive regional stormwater system. The issue is discussed here because some definition of "acceptable" performance is essential to designing stormwater facilities and interpreting performance results. Guidelines adopted by the Department of Ecology and other jurisdictions would suggest that a suitable performance standard would generally be to preserve discharges to the natural location (e.g. maintain the flow pathways which exist prior to basin development), without adversely increasing the rates or volumes of flow at the point of discharge. Determination of a reasonable performance standard for the Freeway Drive system therefore requires consideration of the natural discharges which would occur without development, the condition of the downstream flow path, and the potential damage which could result from development-related increases to flow rates and flow volumes.

One reasonable performance standard for the Freeway Drive regional stormwater system would be to limit the design event outflow volume to an amount which does not exceed the estimated runoff volume to the overflow point under natural conditions. Peak flows are not felt to be an issue because any overflow from the stormwater facility would discharge to a shallow closed depression.

The Freeway Drive regional stormwater pond is located in a very broad swale which discharges to a closed depression located west of the city limits. At an elevation of 20 feet, representing the level of flooding which occurred during the November 1990 event, the closed depression has a surface area of about 60 acres and is separated from the adjacent Ledger Lake area by a low ridge. The depressional area was described in the prior Ledger Lake analysis as "the eastern fields." The natural-conditions tributary basin from city lands to the eastern fields includes approximately 80 acres north of College Way and west of Interstate 5. Under buildout development conditions, those areas will drain to the Freeway Drive storm drain system and will normally be pumped to the Skagit River rather than discharging to their natural location. During major storm events, water in excess of the system capacity will spill to the eastern fields, which is the natural discharge point. The area of the eastern fields closed depression is used for agricultural production.

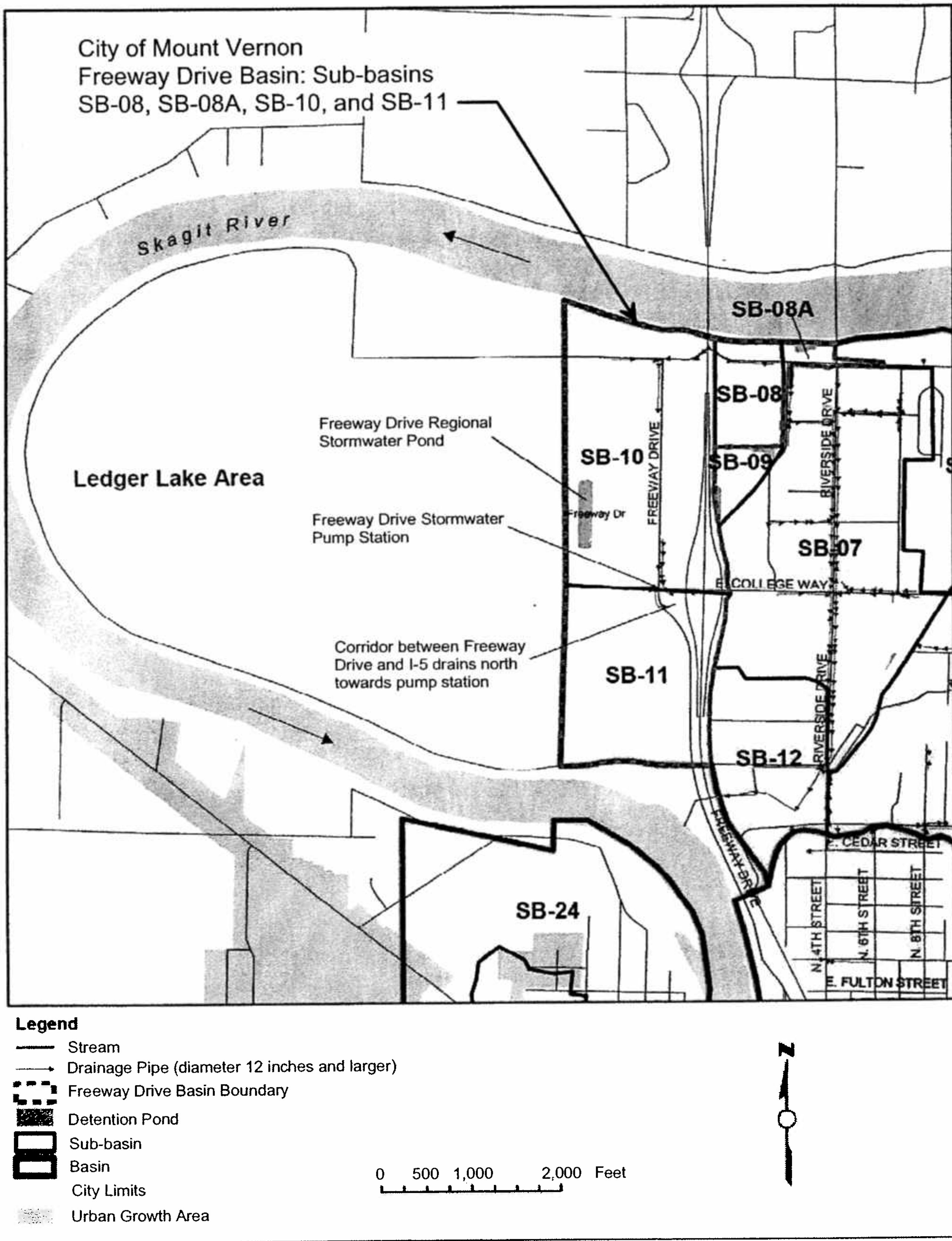
A simple HSPF model was developed to estimate the volume of runoff which, under natural conditions, would have flowed to the eastern fields closed depression during the month of November 1990. The model assumed a basin condition of 80 acres of forested land on Custer Norma soils as shown on soils mapping for the area. Generalized parameters developed by the USGS were used to characterize the basin runoff response for this combination of soil and land cover. Runoff volumes were determined by summing the modeled surface flows plus interflow runoff (SURO plus IFWO); modeled groundwater flows (AGWO) were not counted in the runoff total. The model results showed that under natural forested conditions, the tributary basin within the city limits would have contributed approximately 8 acre-feet of runoff to the eastern fields in the month of November 1990. An additional 6 acre-feet of runoff would have flowed into the eastern fields the following month. The peak discharge was approximately 0.5 cfs, occurring on November 24, 1990.

The proposed performance standard for the stormwater system is to limit the modeled overflow volume for November 1990 to no more than 8 acre feet, which is the same as the monthly runoff volume under the pre-development (forested) basin condition.

Recommendation

It our recommendation that, to accommodate full buildout of the Freeway Drive basin north of College Way, the capacity of the existing Freeway Drive stormwater pump station should be increased from 2.95 cfs to 5.68 cfs. According to a concurrent analysis by CH2M Hill, this increased capacity can be achieved by replacing the existing 10" forcemain with an 18" diameter pipe. The recommended pump station improvements will control buildout condition overflows from the regional stormwater pond to amounts less than runoff from pre-development (forested basin) city lands to the same discharge point.

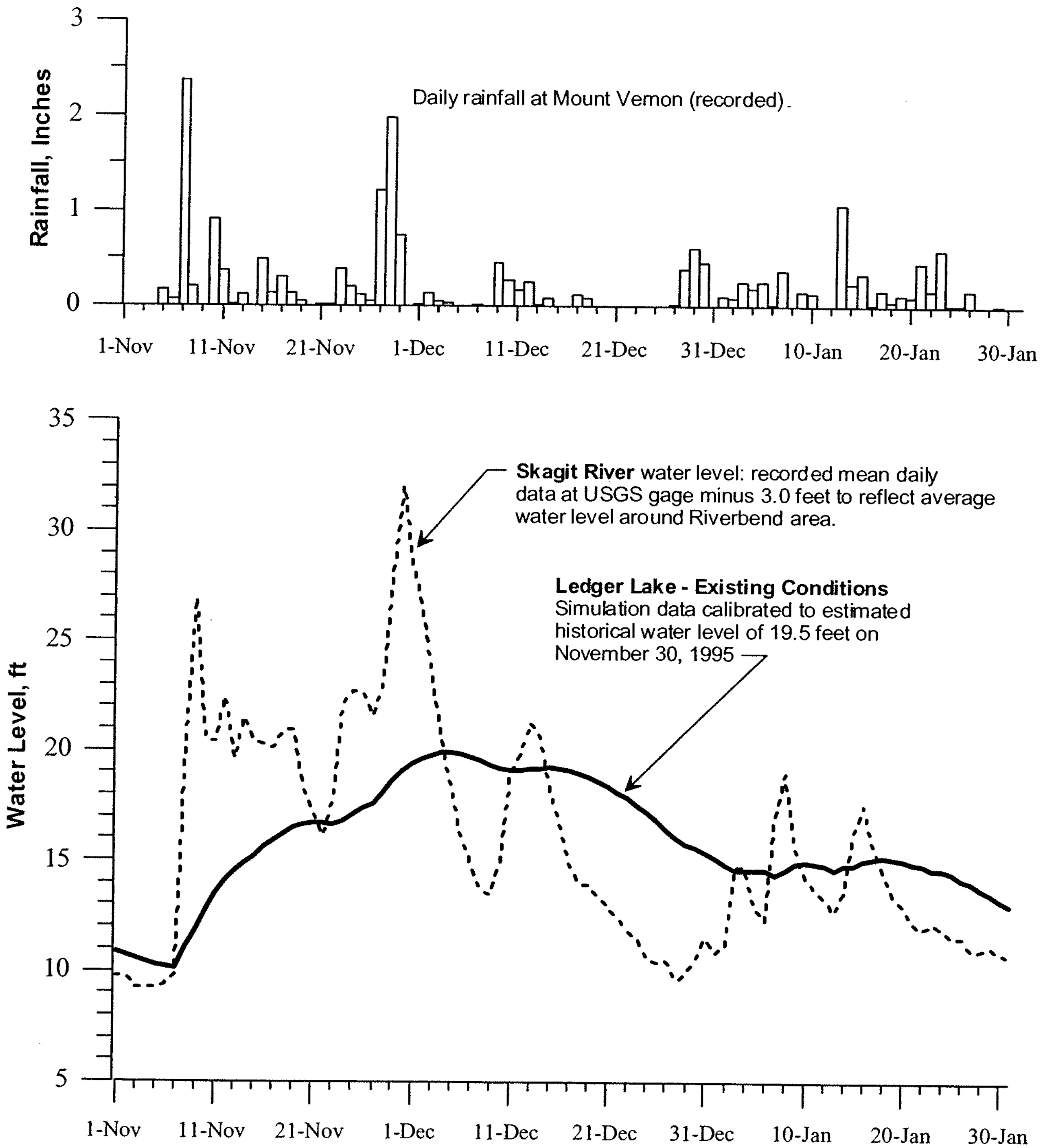
The natural discharge point for the Freeway Drive basin under both predevelopment and developed conditions is a closed depression in an agricultural area west of the city. The regional stormwater pond behind Lowe's Hardware is expected to overflow to the natural discharge point during major events which occur coincident with high groundwater conditions such as those that occurred in November 1990 and November 1995. The pond overflow volume during the most severe event on record, November 1990, is equivalent to less than 2" of water over an already-flooded depressional area and is less than the runoff volume to the area which would have occurred with the city basins in a forested condition.



City of Mount Vernon, Comprehensive Surface Water Management Plan (CSWMP) Update northwest hydraulic consultants, June 2004	FIGURE 1 Freeway Drive Basin Location Map

Mount Vernon Riverbend Analysis
Ledger Lake Simulated Water Levels
Flood of November-December 1995

Model Results for November 1, 1995 to January 31, 1996



City of Mount Vernon, Comprehensive Surface Water Management Plan (CSWMP) Update northwest hydraulic consultants, June 2004	FIGURE 2 Ledger Lake Regional Groundwater, Nov 1995

Hydrologic Analysis of Little Mountain Estates Regional Detention Facility

PREPARED FOR: City of Mount Vernon, Washington

PREPARED BY: Jerry Scheller/CH2M HILL

COPIES: Bill Derry/CH2M HILL

DATE: March 31, 2004

1.0 Introduction

This technical memorandum documents the hydrologic analysis performed to evaluate the effectiveness of the Little Mountain Estates regional detention facility located in the upper reach of the Maddox Creek basin.

The purpose of this study was to:

1. Analyze the performance of the Little Mountain Estates detention facility to facilitate development of a project.
2. Analyze the performance alternative structure modification developed in previous study efforts.
3. Determine if there is unused capacity in the Maddox Creek PUD Ponds 1 and 2.

2.0 Description of the Study Area

The Little Mountain Estates detention facility is located in the southeast part of the City in the Maddox Creek basin. This pond was built in the 1990's to provide 8.7 acre-feet of stormwater detention for the Little Mountain Estates subdivision and to also serve as a regional facility to attenuate peak streamflow rates in Maddox Creek. A concrete side-flow weir was constructed at the southeast corner of the pond to divert high streamflow in Maddox Creek into the facility. The weir has failed in recent years allowing a greater volume of streamflow into the pond.

The area tributary to the Little Mountain Estates pond is about 380 acres. The topography of the basin is flat to moderately sloped in the vicinity of the pond but relatively steep in the upland areas. Existing land use in the northern half of the basin is characterized as primarily medium density residential development with pockets of low- and high-density mixed in. Land use in the southern half of the basin is primarily low-density residential with some undeveloped pasture and forested areas. A large wetland area exists immediately to the east of the Little Mountain Estates subdivision (between S 36th Street and Maddox Creek Road). There are two additional stormwater detention ponds, PUD Ponds 1 and 2, upstream of the

Maddox Creek Pond, that collect and store runoff from some of the residential development in the upper part of the basin.

3.0 Hydrologic Model Development

The hydrologic analysis of the Little Mountain Estates pond was performed using the Hydrologic Simulation Program – Fortran (HSPF) model. This model was selected because it uses historical rainfall records to generate a long-term series of surface water flows. This long-term flow record gives a more accurate estimate of flood-frequency at a given point than provided by single-event design storm analysis. A long term flow record also allows analysis of flow duration which is useful when studying the flow effects on channel erosion.

This analysis builds on previous analyses in support of the 1993 City of Mt. Vernon Comprehensive Surface Water Management Plan (CSWMP), (RW Beck, 1993). This analysis also uses information recently developed by Northwest Hydraulic Consultants (nhc) for the update to the Maddox Creek HSPF model.

The HSPF analysis was performed for five scenarios assuming three land use conditions in combination with three routing scenarios. Table 1 describes the five scenarios.

TABLE 1
HSPF Modeling Scenarios

Scenario	Land Use Condition	Routing Scenario
1	Pre-Developed (forested)	No Ponds
2	Existing Condition	Damaged diversion weir and existing control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2
3	Existing Condition	Modified Diversion and control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2
4	Future Condition	Damaged diversion weir and existing control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2
5	Future Condition	Modified Diversion and control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2

3.1 Meteorological Data Inputs

This analysis used the updated precipitation data set developed by nhc for the Maddox Creek HSPF model. This data set was developed by combining rainfall data from the National Oceanic and Atmospheric Administration (NOAA) station at Burlington, Washington, with rainfall data collected at Washington State University Cooperative Extension station at Mt. Vernon.

Daily pan evaporation data were obtained from the Washington State University Cooperative Extension station at Puyallup, Washington.

The rainfall and evaporation data sets include the period from October 1956 through December 2002. The development of these data sets are fully documented in the nhc Maddox Creek Model Update report.

3.2 Subbasin Delineation

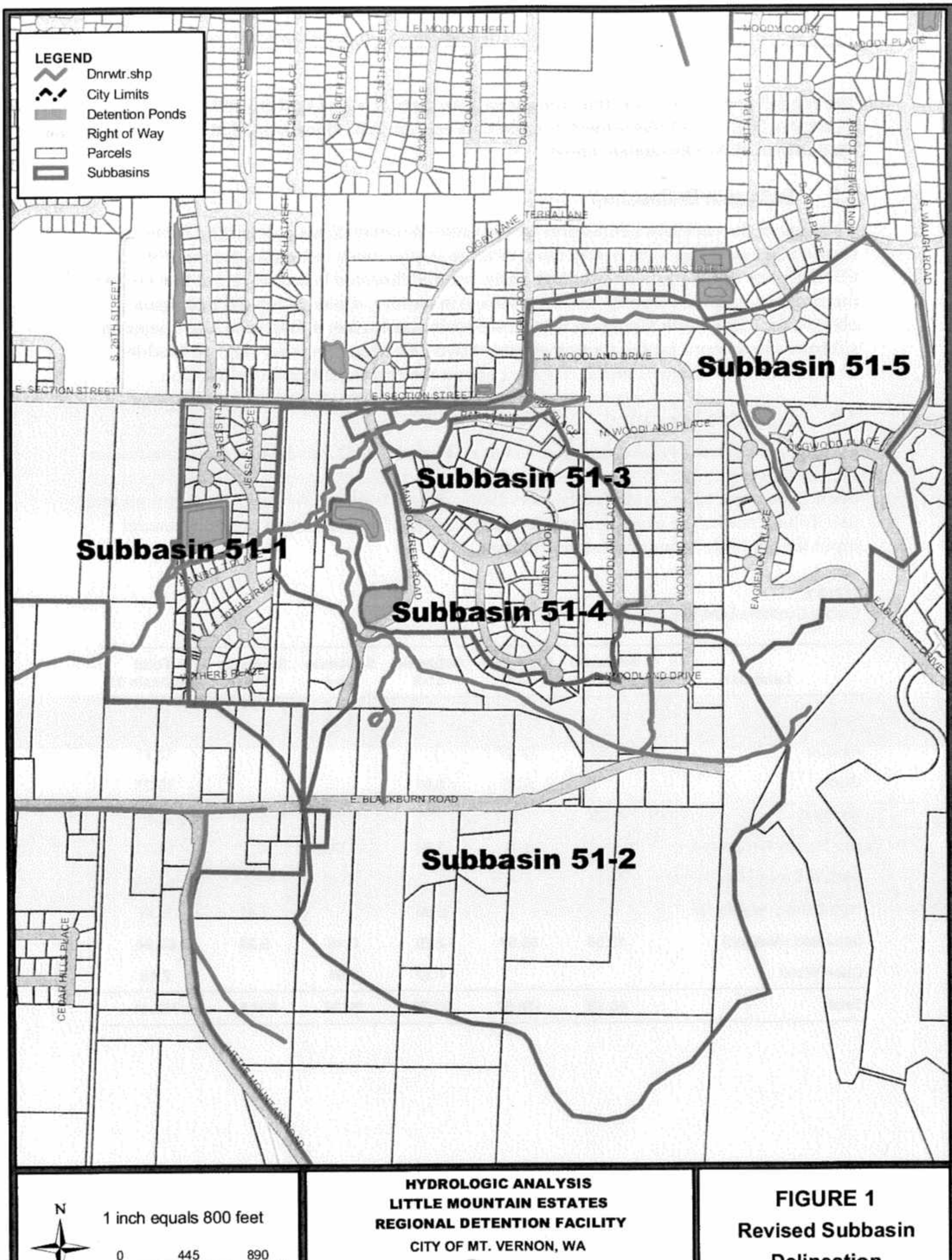
A review of the subbasin delineation for the Little Mountain Estates detention facility showed this subbasin to be nearly twice as large as previously estimated for the 1993 CSWMP. For this reason, the tributary basin was redelineated based on new 2-foot contour interval topographic mapping, recent drainage inventory, drainage reports and visual observation. This Little Mountain Estates subbasin was further subdivided into 5 separate subbasins to account for the routing effects of two detention ponds serving the Maddox Creek PUD (PUD Ponds 1 and 2). Figure 1 shows the revised subbasin delineation.

3.3 Land Use Scenarios

Existing conditions land use was updated to reflect current (2004) development conditions. The current development conditions was based on aerial photography, drainage reports for existing developments, and visual observations. Figure 2 shows the existing conditions land use. Table 2 shows the existing conditions land use and Table 3 shows the HSPF model input for the Little Mountain Estate subbasin.

TABLE 2
Existing Conditions Land-Use

Land Use	Subbasin 51-1	Subbasin 51-2	Subbasin 51-3	Subbasin 51-4	Subbasin 51-5	Total Subbasin 51
Forest		113.80	7.09	3.38	34.98	159.26
Pasture	1.63	12.07				13.71
Grass		5.26	5.01			10.27
Roadway	0.85			1.64	6.38	8.87
Low Density Residential		9.64	5.63	2.84	36.11	54.23
Medium Density Residential	24.11	2.23		19.40	19.35	65.09
High Density Residential			6.55		2.44	8.99
Saturated (Wetland)	13.54	35.57	2.29	0.16	9.29	60.84
Open Water			1.22	0.94		2.16
Total	40.13	178.57	27.79	28.37	108.55	383.41



HYDROLOGIC ANALYSIS
LITTLE MOUNTAIN ESTATES
REGIONAL DETENTION FACILITY
CITY OF MT. VERNON, WA

CH2MHILL

FIGURE 1
Revised Subbasin Delineation

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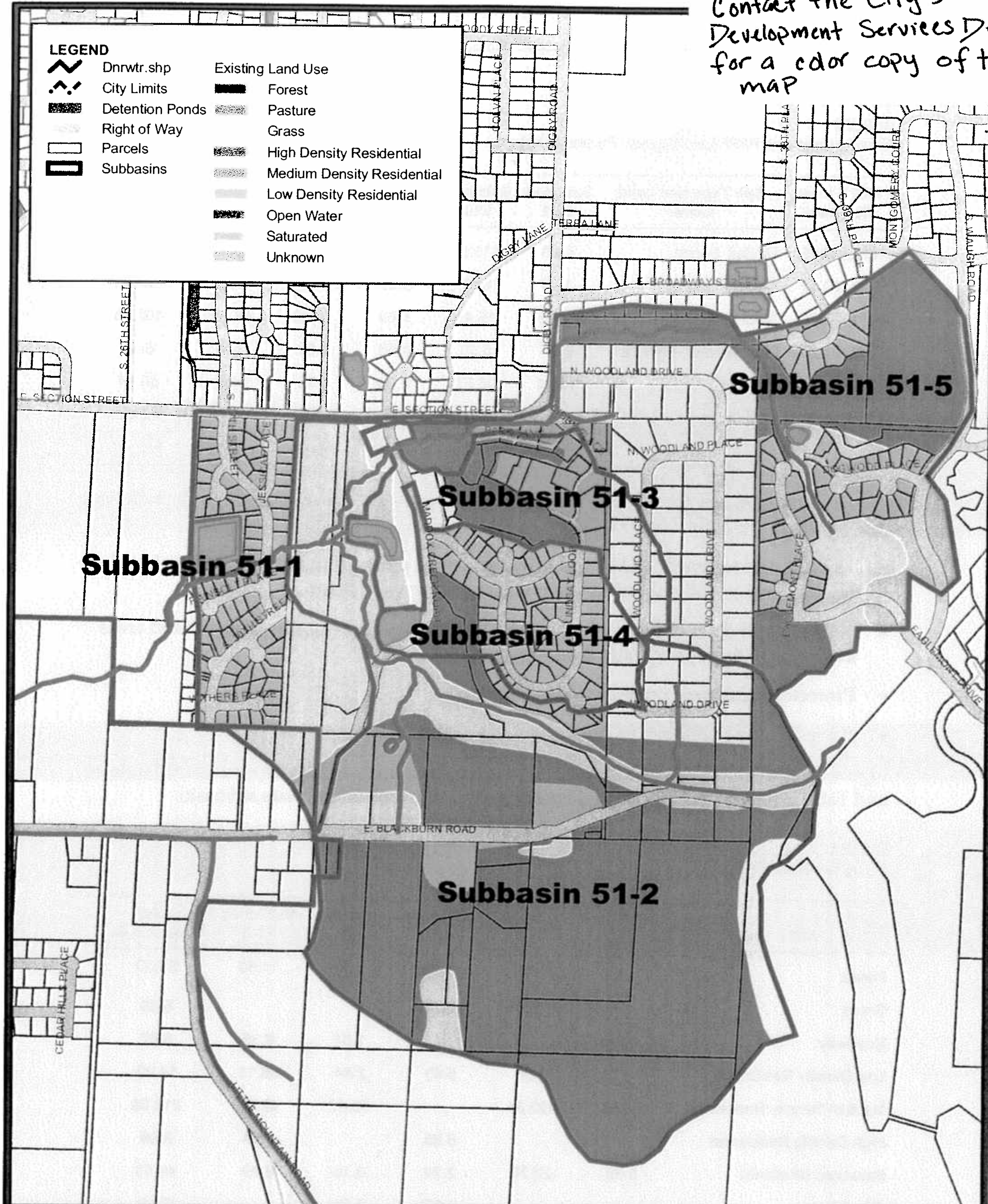
Contact the City's Development Services Dept. for a color copy of this map



N

1 inch equals 800 feet

0 445 890 Feet

HYDROLOGIC ANALYSIS
LITTLE MOUNTAIN ESTATES
REGIONAL DETENTION FACILITY
CITY OF MT. VERNON, WA

CH2MHILL

FIGURE 2
Existing Conditions Land Use

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TABLE 3
Existing Conditions HSPF Land Segment Parameter Values

HSPF Land Segment	Soil Type and Land Cover	Subbasin 51-1	Subbasin 51-2	Subbasin 51-3	Subbasin 51-4	Subbasin 51-5	Total Subbasin 51
PERLND 15	Till Soil, Forest	0.00	113.80	7.09	3.38	34.98	159.26
PERLND 17	Till Soil, Pasture	1.63	6.07	0.00	0.00	0.00	7.71
PERLND 25	Till Soil, Grass	14.46	15.41	8.69	15.69	48.28	102.53
PERLND 27	Outwash Soil, Pasture	0.00	6.00	0.00	0.00	0.00	6.00
PERLND 51	Wetland	13.54	35.57	2.29	0.16	9.29	60.84
IMPLND 11	Impervious	10.49	1.72	9.72	9.13	16.01	47.07
Total		40.13	178.57	27.79	28.37	108.55	383.41

Future conditions land use was updated based on current land use zoning and the following assumptions:

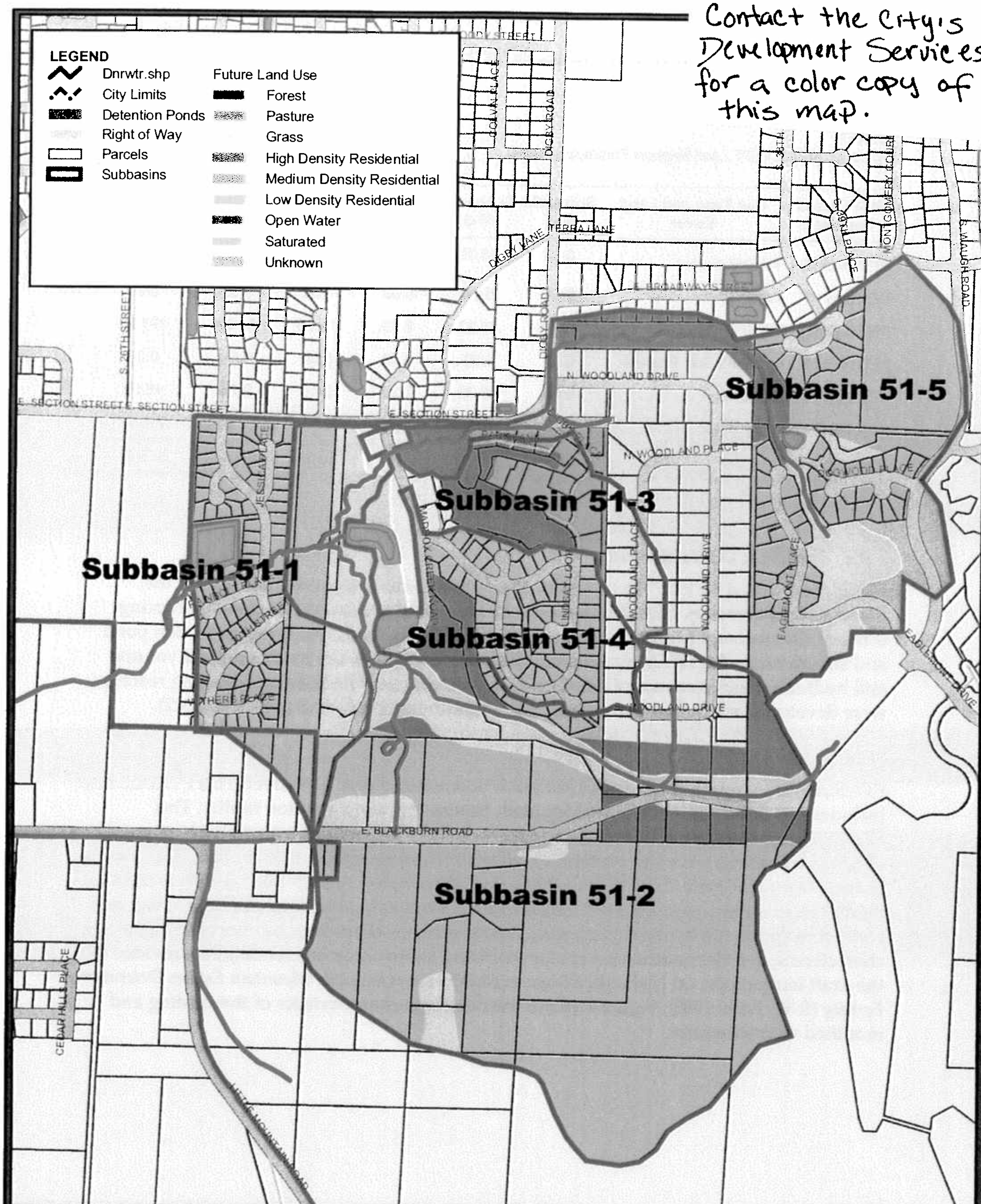
- Existing undeveloped, and low-density residential areas are assumed to redeveloped to higher density land use unless in a critical areas as noted below.
- No development will occur in critical areas. Critical areas are defined as wetland areas and areas with slopes greater than 40 percent.
- Protected areas were not assumed to develop.
- No redevelopment to a lower density will occur.

Figure 3 shows the future conditions land use. Table 4 shows the future conditions land use and Table 5 shows the HSPF model input for the Little Mountain Estate subbasin.

TABLE 4
Future Conditions Land-Use

Land Use	Subbasin 51-1	Subbasin 51-2	Subbasin 51-3	Subbasin 51-4	Subbasin 51-5	Total Subbasin 51
Forest		16.26	7.09	3.38	11.60	38.33
Grass		0.63	5.01			5.65
Roadway	0.85			1.64	6.38	8.87
Low Density Residential		9.64	5.63	2.84	36.11	54.23
Medium Density Residential	33.18	123.34		19.40	42.73	218.66
High Density Residential			6.55		2.44	8.99
Saturated (Wetland)	6.09	28.70	2.29	0.16	9.29	46.53
Open Water			1.22	0.94		2.16
Total	40.13	178.57	27.79	28.37	108.55	383.41

Contact the City's Development Services Dept. for a color copy of this map.



N 1 inch equals 800 feet 0 445 890 Feet	**HYDROLOGIC ANALYSIS** **LITTLE MOUNTAIN ESTATES** **REGIONAL DETENTION FACILITY** CITY OF MT. VERNON, WA CH2MHILL	**FIGURE 3** **Future Conditions** **Land Use**

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TABLE 5
Future Conditions HSPF Land Segment Parameter Values

HSPF Land Segment	Soil Type and Land Cover	Subbasin 51-1	Subbasin 51-2	Subbasin 51-3	Subbasin 51-4	Subbasin 51-5	Total Subbasin 51
PERLND 15	Till Soil, Forest	0.00	16.26	7.09	3.38	11.60	38.33
PERLND 17	Till Soil, Pasture	0.00	0.00	0.00	0.00	0.00	0.00
PERLND 25	Till Soil, Grass	19.91	83.32	8.69	15.69	64.02	191.63
PERLND 27	Outwash Soil, Pasture	0.00	0.00	0.00	0.00	0.00	0.00
PERLND 51	Wetland	6.09	28.70	2.29	0.16	9.29	46.53
IMPLND 11	Impervious	14.12	50.30	9.72	9.13	23.65	106.93
Total		40.13	178.57	27.79	28.37	108.55	383.41

3.4 FTABLE Development

FTABLEs are used by HSPF to represent stage-storage-discharge relationships for the Maddox Creek reaches. FTABLEs are used by the model to simulate stormwater routing through the system. FTABLEs generated for this analysis are of two types: detention pond and stream reach. FTABLEs representing detention facilities were based on pond volume and hydraulic characteristics of the flow control structures. FTABLEs representing reaches were developed using the open channel hydraulic model HEC-RAS (US COE, 2002).

FTABLE 510

FTABLE 510 represents Maddox Creek reach downstream of S. 27th Street. This FTABLE also includes the diversion to the Little Mountain Estates regional detention facility. This FTABLE for this reach was developed using the HEC-RAS model. Cross sections were obtained from the draft letter report on *Hydraulic Structure Modifications for Little Mountain Estates Detention Facility* (R.W. Beck, 1995). The lateral weir option in HEC-RAS was used to model the existing and modified diversion weir. The physical characteristics of the existing weir were approximated based on actual site conditions observed in February 2004. The characteristics of the modified diversion weir were based on recommendations provided in the draft letter report on *Hydraulic Structure Modifications for Little Mountain Estates Detention Facility* (R.W. Beck, 1995). Figure 4 shows the discharge characteristics of the existing and modified weir structure.

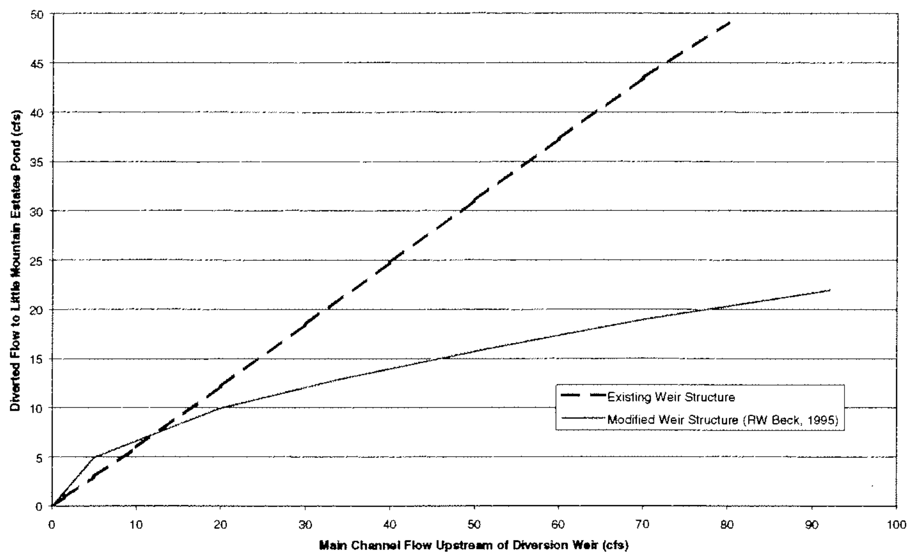

FIGURE 4
Diversion Weir Discharge Rating

FTABLE 511

FTABLE 511 represents the Little Mountain Estates regional detention facility. Stage-storage discharge characteristics for the existing pond and control structure were obtained from the draft Maddox Creek HSPF Model Update (nhc, 2003). Control structure modifications were based on recommendations provided in the draft letter report on *Hydraulic Structure Modifications for Little Mountain Estates Detention Facility* (R.W. Beck, 1995). Figure 5 shows the storage volume and Figure 6 shows the control structure stage discharge rating for the Little Mountain Estates regional detention facility.

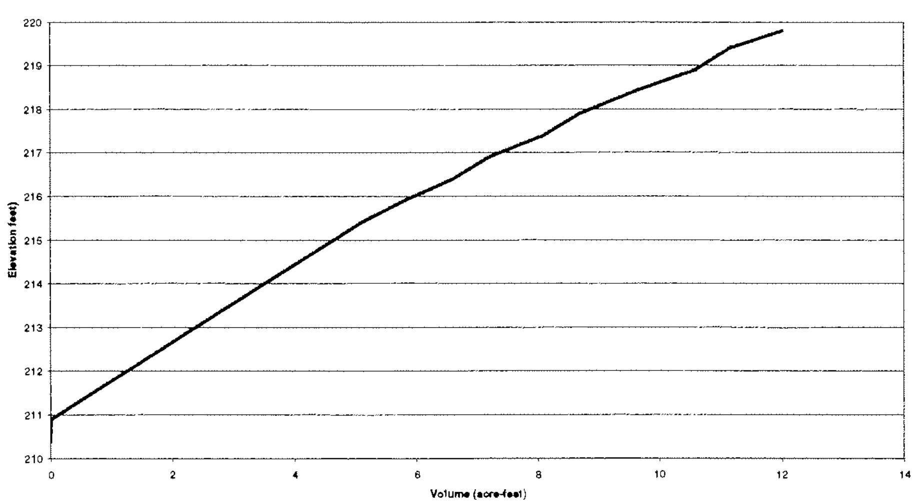

FIGURE 5
Storage Volume in Little Mountain Estates Regional Detention Facility

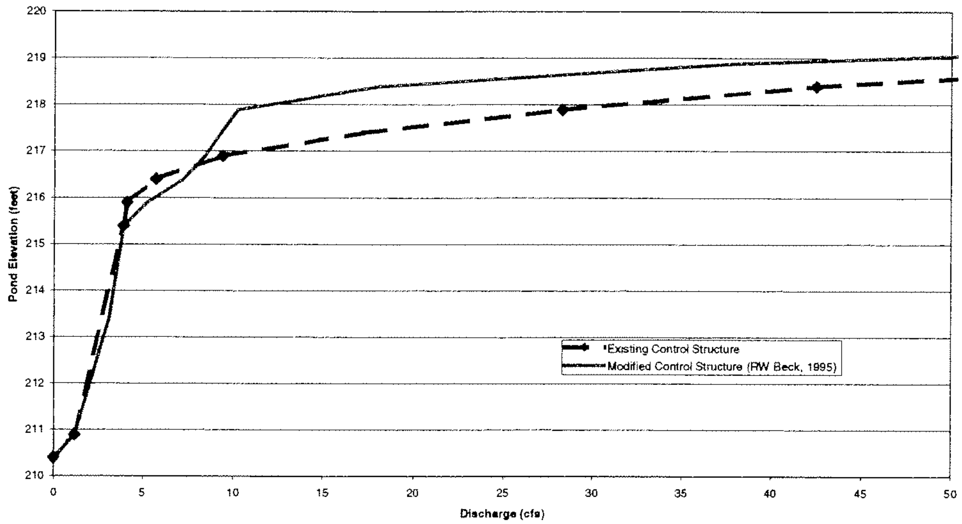

FIGURE 6
Discharge Rating for Little Mountain Estates Regional Detention Facility

FTABLE 512

FTABLE 512 represents the 1,200 foot reach between S. 27th Street and Maddox Creek Road. This FTABLE also includes a 2,400 foot reach of a tributary ditch extending from E. Blackburn Road to the confluence with Maddox Creek. HEC-RAS was used to develop the FTABLE for this reach. HEC-RAS cross sections were based on existing 2-foot topographic mapping.

FTABLE 513

FTABLE 513 represents the Maddox Creek PUD detention facility POND 1. Stage-storage discharge characteristics were obtained from existing drainage reports (Semrau and Lisser, 1995 and 1999). Figure 7 shows the storage volume for this detention pond.

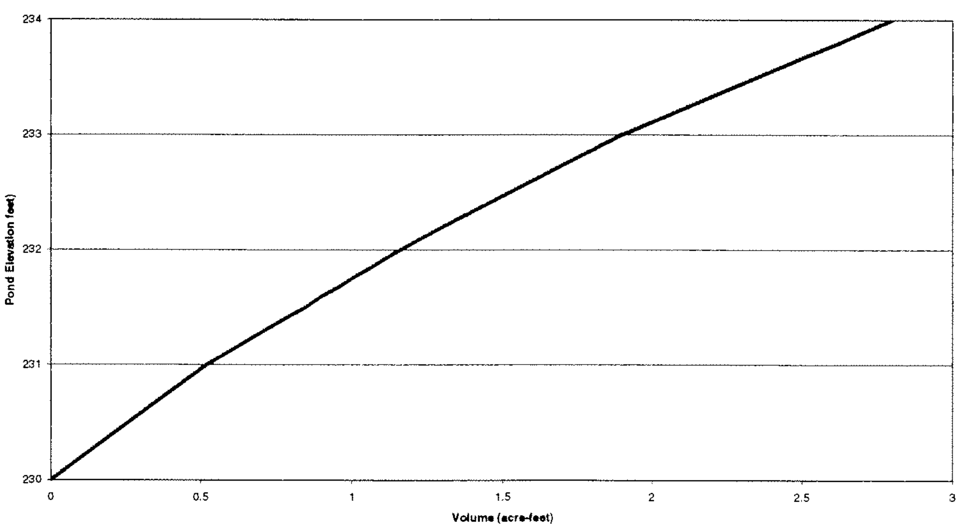

FIGURE 7
Storage Volume in Maddox Creek PUD Pond 1

FTABLE 514

FTABLE 514 represents the Maddox Creek PUD detention facility POND 2. Stage-storage discharge characteristics were obtained from existing drainage reports (Semrau and Lisser, 1995 and 1999). Figure 8 shows the storage volume for this detention pond.

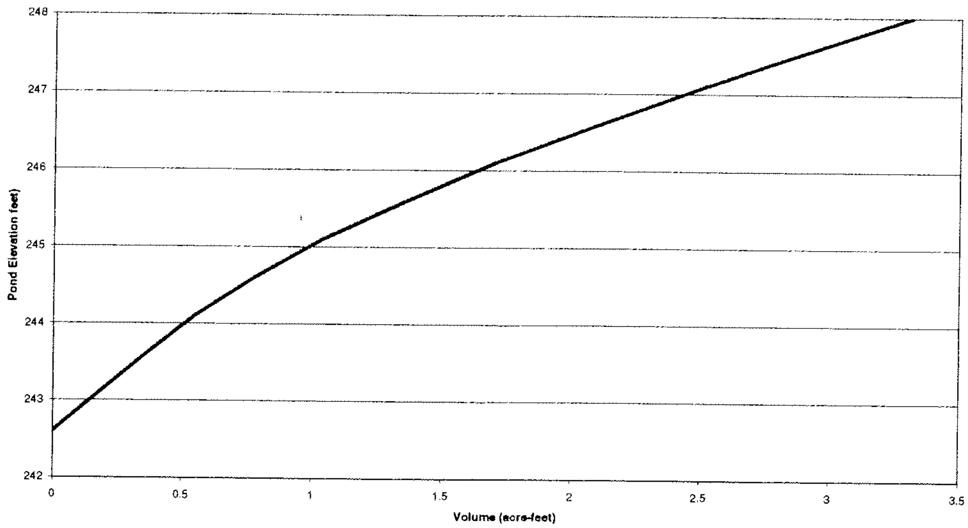

FIGURE 8
Storage Volume in Maddox Creek PUD Pond 2

FTABLE 515

FTABLE 515 represents the 4,200 foot reach upstream of Maddox Creek Road adjacent to E. Section Street. HEC-RAS was used to develop the FTABLE for this reach. HEC-RAS cross section were based on existing 2-foot topographic mapping.

3.5 HSPF Model Schematic

Figure 9 shows the HSPF model schematic used in this analysis.

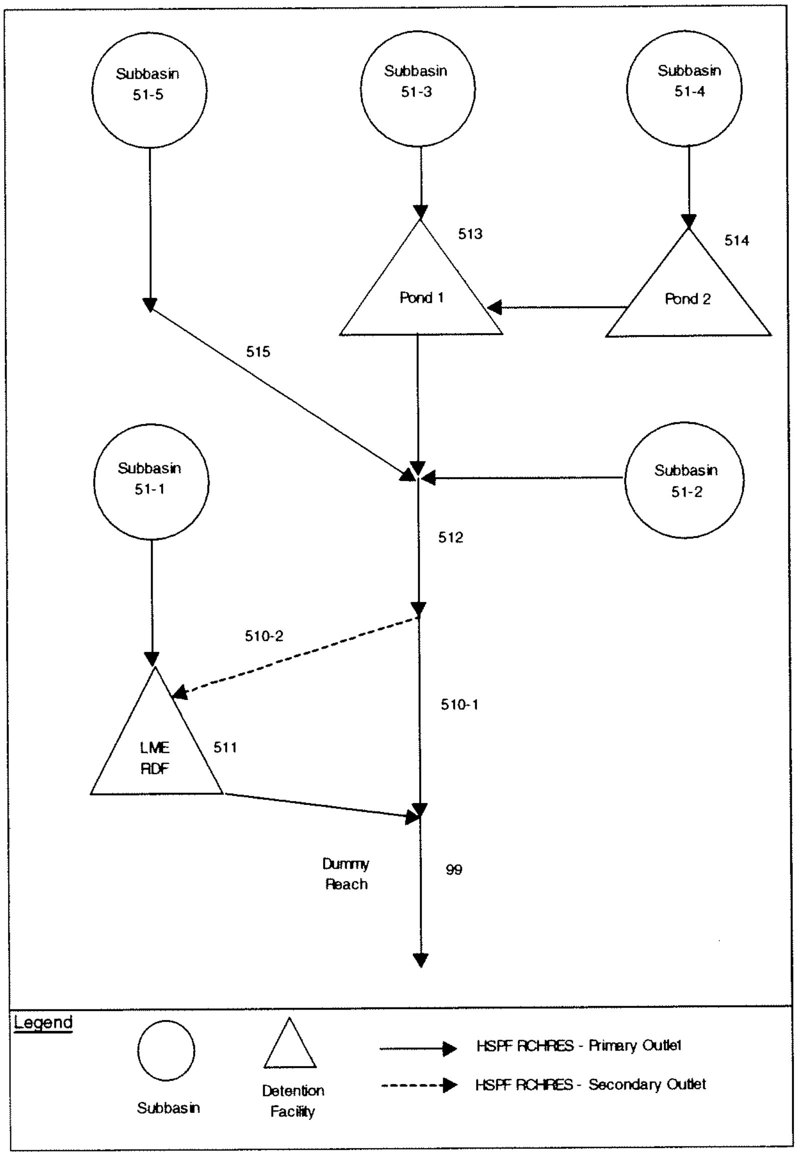

FIGURE 9
HSPF Model Schematic

4.0 Results of the Analysis

4.1 Peak Flood and Stage Frequency

Peak flood frequency is the probability that a given peak flood event will occur in any year. Flood frequency is commonly expressed as a return-period which is the inverse of the probability, and represents the average interval between the occurrence of a specific magnitude flood. For instance, a peak flood with a 50 percent probability of occurring in any given year is equivalent to a 2-year return period (1/0.5 = 2).

Table 3 shows the results of the HSPF analysis. Flood frequency was computed using the standard Log-Person Type III distribution (USGS, 1982).

TABLE 6
Flood Frequency for HSPF Analysis – Peak Flow in cfs

RCHRES	Location	2-year	10-year	25-year	100-year
Scenario 1 - Pre-Developed Condition (Forested)					
511[1]	Little Mountain Estates Pond Outlet	10.0	18.7	19.6	20.3
512	S. 24th Street	8.9	16.3	17.3	18.1
515	Maddox Creek Road	2.4	4.5	4.9	5.0
Scenario 2 - Existing Land Use Condition, Existing Diversion and Control Structure Configuration					
99[1]	Little Mountain Estates Pond Outlet	8.9	18.0	23.3	24.4
512	S. 24th Street	13.8	24.7	28.9	35.6
513	Maddox Creek PUD Pond 1	2.6	4.4	5.1	6.1
514	Maddox Creek PUD Pond 2	1.0	2.2	2.7	3.4
515	Maddox Creek Road	6.9	11.8	14.9	20.3
Scenario 3 - Existing Land Use Condition, Modified Diversion and Control Structure Configuration					
99	Little Mountain Estates Pond Outlet	10.5	15.5	18.6	19.9
512	S. 24th Street	13.8	24.7	28.9	35.6
513	Maddox Creek PUD Pond 1	2.6	4.4	5.1	6.1
514	Maddox Creek PUD Pond 2	1.0	2.2	2.7	3.4
515	Maddox Creek Road	6.9	11.8	14.9	20.3
Scenario 4 - Future Land Use Condition, Existing Diversion and Control Structure Configuration					
99	Little Mountain Estates Pond Outlet	20.0	32.5	37.9	39.1
512	S. 24th Street	29.8	50.0	62.3	83.5
513	Maddox Creek PUD Pond 1	2.6	4.4	5.1	6.1
514	Maddox Creek PUD Pond 2	1.0	2.2	2.7	3.4
515	Maddox Creek Road	9.3	15.6	19.4	26.0
Scenario 5 - Future Land Use Condition, Modified Diversion and Control Structure Configuration					
99	Little Mountain Estates Pond Outlet	16.5	24.4	28.4	34.5
512	S. 24th Street	29.5	49.6	60.7	78.5
513	Maddox Creek PUD Pond 1	2.6	4.4	5.1	6.1
514	Maddox Creek PUD Pond 2	1.0	2.2	2.7	3.4
515	Maddox Creek Road	9.3	15.6	19.4	26.0

1. Flood-frequency estimated from a graphical fit of the data plotted using the Gringorton plotting position

Figure 10 shows the peak flood frequency for Little Mountain Estates pond. This figure shows that for the existing land use condition, the Little Mountain Estates regional detention facility with the current diversions weir and controls structure configuration (Scenario 2) attenuates peak flows to predeveloped conditions (Scenario 1) peak flows for events less than or equal to the 10-year event. If the diversion weir and control structure are modified as proposed in the RW Beck report, peak flow rates will increase for events below the 2-year return frequency but decrease for less frequent return periods.

Figure 10 shows that flows are predicted to significantly increase under future land use conditions (Scenario 4). The peak flow increase ranges from a doubling for the 2-year event to about a 65 percent increase for events with a return period higher than the 25-year. The diversion weir and control structure modifications (Scenario 5) mitigate the peak flow increase will still be greater than peak flows under existing land use conditions.

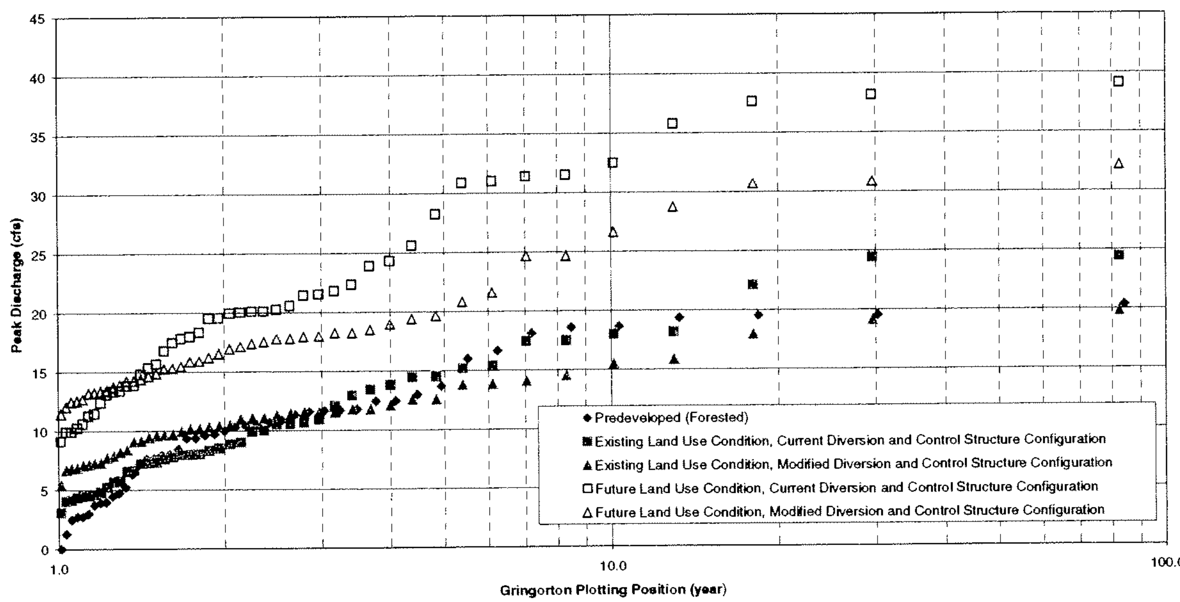

FIGURE 10
Peak Flood Frequency at Little Mountain Estates Pond
Plot shows creek flow for predeveloped condition and combined bypass and pond outflow for existing and future land use condition

Figure 11 shows the peak annual stage for Little Mountain Estates pond. This figure shows that:

- Approximately 0.8 acre-feet of unused storage volume is available in the pond for the existing land use condition and the current diversion weir and control structure configuration (Scenario 2).
- The storage volume will be fully utilized for the existing land use condition and the modified diversion weir and control structure configuration (Scenario 3) and future land use conditions the current diversion weir and control structure configuration (Scenario 4).

- The storage volume will be over utilized by 0.9 acre-feet for the future land use conditions and modified current diversion weir and control structure configuration (Scenario 5).

These conclusions are based on the assumption that there is 8.7 acre-feet of useable storage volume in the facility at the maximum allowable high water level of 217.8 feet (overflow elevation – 1 foot freeboard).

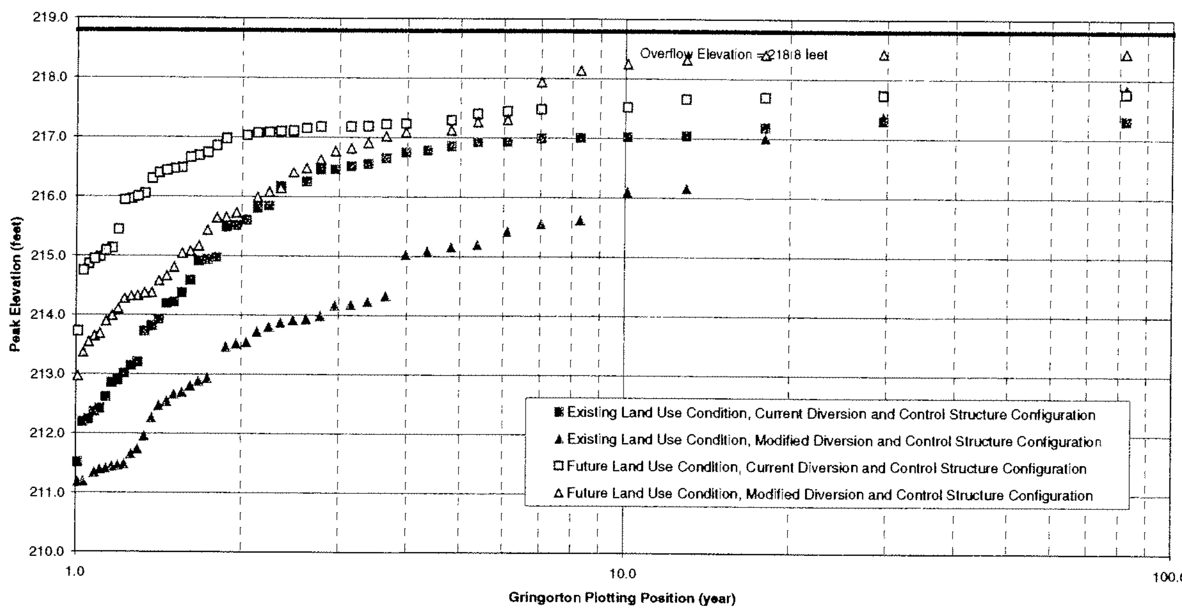

FIGURE 11
Ranked Peak Annual Stage at Little Mountain Estates Pond

Figures 12 and 13 show the peak annual flow for the Maddox Creek PUD Ponds 1 and 2 respectively. These figures show that the detention volume in these ponds is fully utilized (based on the 1 foot freeboard assumption).

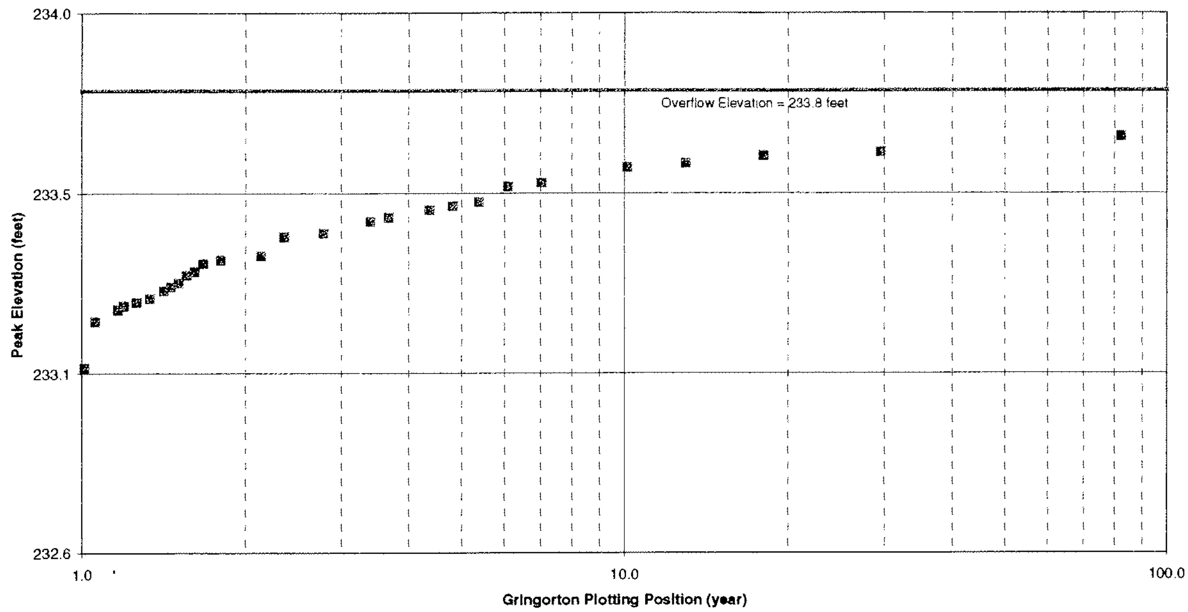

FIGURE 12
Ranked Peak Annual Stage at Maddox Creek PUD Pond 1

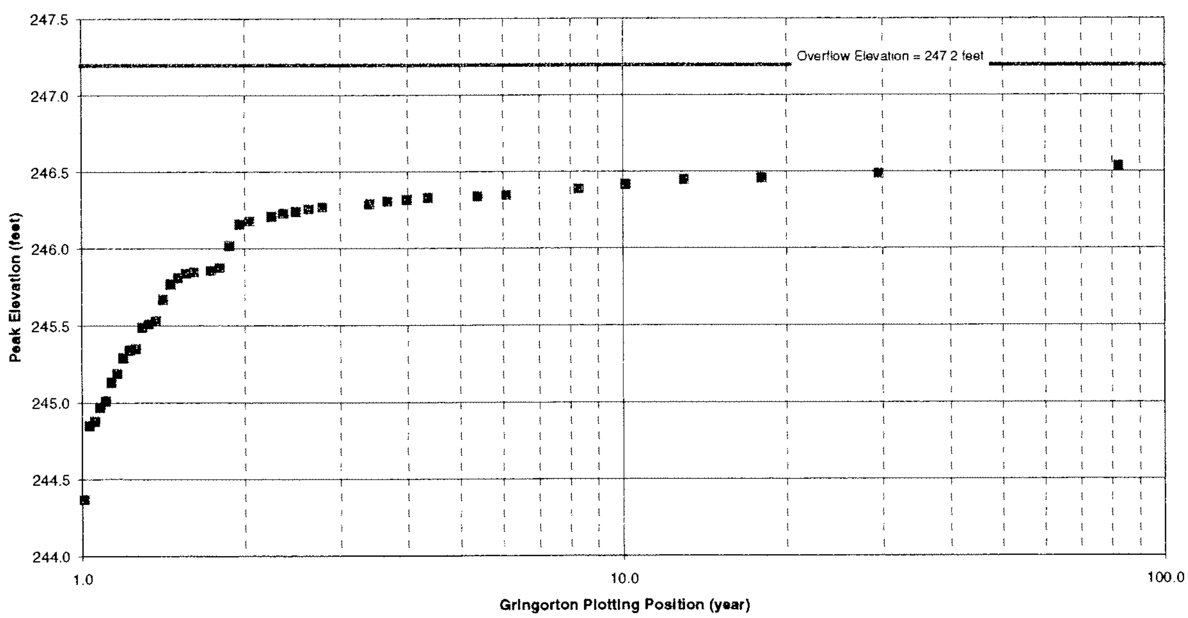

FIGURE 13
Ranked Peak Annual Stage at Maddox Creek PUD Pond 2

4.2 Duration Analysis

Flow duration analysis was performed for reach downstream of Little Mountain Estates pond. This reach was assumed to include the predicted outflow from the Little Mountain Estates pond with the predicted discharge in the bypass reach. Flow duration is the amount of time (generally expressed as a percent of total) in which a given flow, is equaled or exceeded. Figure 14 shows the results of this analysis. This figure shows that the flow duration under the existing land use condition and the current diversion weir and control structure configuration (Scenario 2) is slightly higher than the predeveloped condition (Scenario 1) flow duration. This figure also shows that flow duration will increase under future land use conditions.

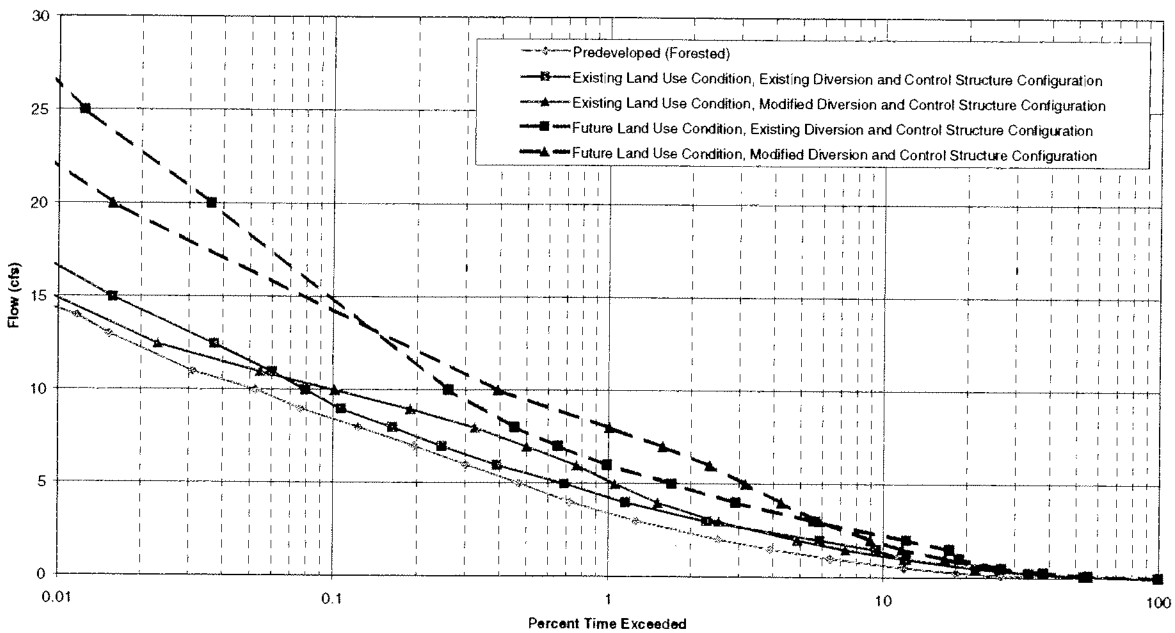

FIGURE 14
Flow Duration at Little Mountain Estates Pond
Plot shows creek flow for predeveloped condition and combined bypass and pond outflow for existing and future land use condition

5.0 References

R.W. Beck, 1993 City of Mt. Vernon Comprehensive Surface Water Management Plan, Seattle, Washington.

R.W. Beck, 1995. Hydraulic Structure Modifications for Little Mountain Detention Facility, Draft Letter Report, Seattle, Washington.

NHC, 2003. Maddox Creek HSPF Model Update, Draft Report, Tukwila, Washington.

Semrau and Lisser, 1995. Drainage Report for Maddox Creek P.U.D., Phase 1, 2, and 4, Mount Vernon, Washington.

Semrau and Lisser, 1999. Drainage Report for Maddox Creek P.U.D., Phase 3 and Post Construction Analysis of Detention Ponds, Mount Vernon, Washington.

United States Army Corp of Engineers, Hydrologic Engineering Center, 2002. HEC-RAS, River Analysis System, Davis, California.

United States Geological Survey, 1982. Guideline for Determining Flood Flow Frequency, Reston, Virginia.

United States Geological Survey, 2002. Hydrologic Simulation Program – FORTRAN, Reston, Virginia.

Appendix B
Regulations and Policies

- Regulatory Compliance Gap Analysis - Full Report
- NPDES Phase II Requirements
- NMFS Municipal, Commercial, Residential, and Industrial Development Standards for a "Take" Exemption
- Tri-County Proposal - Model Planning Policies
- Identifying Sites for "Street Edge Alternatives"

1.0 Introduction

1.1 Purpose

A variety of state and federal regulations affect City storm and surface water programs. These regulations include the Clean Water Act (CWA) National Pollutant Discharge Elimination System (NPDES) Phase II Stormwater Program, the Endangered Species Act (ESA), and the Puget Sound Water Quality Management Plan (PSWQMP). Additionally, there are related guidance documents that recommend actions that are likely necessary to achieve compliance with the regulations. As an initial step in developing a comprehensive stormwater management plan (CSMP) update, Mount Vernon asked CH2M HILL to identify where potential "gaps" may exist between the City's existing policies, plans, codes, and practices and the regional and federal laws and guidance documents. Because they are enforceable Federal laws, this analysis focuses on the CWA and ESA listings of salmon. The Washington State PSWQMP also specifies stormwater programs that jurisdictions most implement. This manual has not been enforced consistently, but the PSWQMP and the Tri-County ESA recommendation will be used by regulatory agencies to assess compliance. While this paper emphasizes the Federal laws and guidance, it also identifies areas where there are substantial differences between the Federal guidance and State or regional guidance documents.

1.2 Methods

To identify potential "gaps" in Mount Vernon's regulations, policies, and practices, the following were reviewed:

- Mount Vernon Municipal Code
- Mount Vernon Comprehensive Plan
- Mount Vernon Comprehensive Surface Water Management Plan
- Mount Vernon Staff Interviews
- NPDES Phase II Minimum Control Measures
- NMFS 4(d) Municipal, Residential, Commercial, and Industrial (MRCI) Development Standards
- Tri-County Model 4(d) Proposal
- Puget Sound Water Quality Management Plan

It was necessary to interview city staff from a variety of departments to understand the current level of enforcement and implementation of existing regulations and policies. In addition, staff members were able to identify particular areas of concern and desired outcomes associated with the surface water plan update. The following City staff members were interviewed:

- Skye Richendrfer, Mayor
- Jennifer Aylor, Manager, Surface Water Utility
- Dan Eises, Capital Projects Manager
- Walt Enquist, Supervisor, Wastewater Utility
- Andrew Denham, Sewer, Drainage Maintenance Foreman

- Fred Buckenmeyer, Engineering Director
- Roxanne Michael, Planning Director
- Gloria Rivera, Senior Planner.

A list of the pre-prepared questions for each is attached in Attachment A. A detailed list of responses was previously provided.

This analysis will be used to identify the need for new or expanded City regulations and policies, program modifications, and/or management activities, which may be required for compliance with relevant state and federal regulations.

2.0 Tri-County Proposal

2.1 Tri-County Proposal Response Background

Although Mount Vernon was not part of the Tri-County ESA response effort, the Tri-County proposal provides the best guidance available regarding what is needed to qualify for a 4(d) take limitation. The current 4(d) rule (see ESA discussion below) allows local jurisdictions to receive an exemption for certain governmental activities like park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and stormwater maintenance. Rather than each jurisdiction having to get approval, NMFS encouraged regional responses to the rule.

The Tri-County Proposal is an attempt to create a set of regulations that will meet the MRCI standards set forth by NMFS, in order to qualify for the 4(d) take limitation. While no elements of the Tri-County Proposal have been approved yet by NMFS and the USFWS, if is important to see if Mount Vernon's existing policies and code are consistent with the model regulations set forth in the Tri-County Proposal.

2.2 The Tri-County Model Response Proposal

The Tri-County Model 4(d) Rule Response Proposal consists of three regulatory and programmatic components:

- Regional Road Maintenance
- Stormwater
- Land Management

For the purposes of this report, the main focus of this analysis will look at the stormwater and land management components of the Tri-County Proposal. Since Mount Vernon is not located within the boundaries of the Tri-County proposal area, it is not required to adopt or comply with the Tri-County Model Response Proposal. However, if Mount Vernon wants to be sure it's going to be eligible for "take" protection, the City must have adequate policies and regulations in place to protect habitat functions.

2.2.1 Stormwater

The Tri-County Proposal includes a Stormwater Management Checklist that lists mandatory program elements, which can then be applied to Mount Vernon's existing programs, to identify areas lacking regulatory components. The following six areas of stormwater regulations were reviewed:

- Technical Standards

- Erosion Control
- Inspection and Enforcement
- Maintenance
- Source Control
- Discharge Reduction

Each of the requirements set forth in the Stormwater Management Checklist corresponds to a particular MRCI Standard and/or NPDES Phase II Minimum Control Measure. To prevent repetition, only the Tri-County Standards that were not previously addressed/considered have been included in Sections 4.0 and 5.0 under the headings "Minimum Requirements" or "Regulatory Guidance" respectively. Due to time and budget constraints, Mount Vernon's Programs, Policies, and Regulations were not analyzed in regard to the Tri-County proposed standards/checklist.

2.2.2 Land Management

The land management component consists of two parts:

Model Planning Policies (MPPs)
MPPs provide the policy basis to conserve salmonids listed under the ESA. These could include countywide planning policies or policies adopted through individual comprehensive plans. These model land management goals and policies act as the foundation for development regulations. The Tri-County Model suggests MPPs that adequately address issues related to salmonids; these have been included in Section 5.4 of this report.

Development Regulations
Model development regulations that apply to activities in the aquatic and adjacent near-shore areas that either provide salmonid habitat or are connected to waters that supply salmonid habitat. The Tri-County program provides three options for local governments, who can choose one or any combination of the following:

- Fixed Regulations – development proposals must comply with a standard set of prescribed development regulations without deviation. Regulations include inner and outer Management Zones (MZ) with specific provisions for each zone, designed to protect habitat functions from adverse project impacts.

- Site-Specific Habitat Evaluations – proposals for development are required to complete a Habitat Evaluation (HE), which will look at the habitat functions that are likely to be impacted as a result of the project. The HE requires the applicant provide conservation measures that are consistent with the program's habitat goals and objectives, in addition to mitigating for impacts to key habitat functions.

- Programmatic Regulations – conduct a HE on a specific geographic area or specific type or category of development activity. Based on the results of the HE, the jurisdiction will identify allowable activities and appropriate protection and mitigation measures that are consistent with the habitat goals and objectives of the Tri-County Program.

Of the three options, the Fixed Regulations option is the only option that sets default-buffer widths for streams and wetlands. Mount Vernon currently has fixed regulations regarding buffer widths. Therefore, the Tri-County development regulation standards for the Fixed Regulations option looked at in the following sections:

5.4 *MRCI #1 – Ensure that Development Avoids Critical Areas*

5.6 *MRCI #3 - Protect Riparian Areas*

3.0 Puget Sound Water Quality Management Plan

The Puget Sound Water Quality Management Plan (PSWQMP) is Washington's long-term strategy for protecting and restoring Puget Sound. The management plan takes a proactive approach towards pollution prevention, and recognizes that it will cost us far more to clean up pollution later than to prevent it now.

The recently adopted 2000 PSWQMP consists of 21 programs that address major concerns about Puget Sound and its resources. These programs aim to coordinate the roles and responsibilities of federal, state, tribal, and local governments. While almost all of the programs will ultimately have some effect on Mount Vernon, the following programs require direct action on the part of local governments:

- Marine and Freshwater Habitat Protection
- Municipal and Industrial Discharges
- Non-point Source Pollution
- Agricultural Practices
- Forest Practices
- Local Watershed Action
- On-Site Sewage Systems
- Stormwater and Combined Sewer Overflows
- Education and Public Involvement

Each of these programs includes various requirements and recommendations for local governments that will most likely require revisions and additions to comprehensive plans, municipal code sections, and city programs.

4.0 NPDES Phase II Stormwater Program

4.1 Background

Published in the Federal Register (64 FR 68722) in December, 1999, EPAs Stormwater Phase II Final Rule requires Municipal Separate Storm Sewer Systems (MS4s) serving cities whose population is less than 100,000, to obtain an NPDES Phase II Municipal Stormwater Permit. Stormwater discharges are considered "point sources" of pollution, and the Clean Water Act requires all point source discharges to be covered by federally enforceable NPDES permits. The NPDES Phase II Rule states the regulated jurisdiction must:

- Specify best management practices (BMPs) for six Minimum Control Measures (MCMs)
- Identify measurable goals
- Show an implementation schedule, and
- Define the entity responsible for implementation.

EPA provides very specific regulatory guidance (40 CFR 122.34(b)), for stormwater management BMPs, in regard to each of the six MCM requirements. This guidance is what Mount Vernon's existing regulations and practices were evaluated against, and therefore it has been included in Attachment B. BMPs, when implemented together, are expected reduce pollutants discharged into receiving water bodies to the Maximum Extent Practicable (MEP).

4.2 Organization and Level of Analysis

The following sections analyze each of the six MCMs and their minimum BMP requirements in relation to what was learned through staff interviews and from the review of Mount Vernon's existing regulations and policies. In order to identify potential gaps, the following had to be looked at and evaluated for each MCM:

- Minimum control measure requirements set forth in the Code of Federal Regulations
- Regulatory guidance and potential BMPs suggested by the EPA
- Applicable Mount Vernon Municipal Code (MVMC) sections
- Applicable goals, policies, and objectives of the Mount Vernon Comprehensive Plan
- Information from staff interviews

Table 1 provides an overview of the NPDES Phase II minimum control measure requirements in regard to Mount Vernon's existing programs, policies, and practices.

Table 2 provides an in-depth look at the specific requirements of each MCM in regard to Mount Vernon's programs, policies, and regulations. Gaps were identified, where they existed, and potential actions were recommended to fill those gaps.

Table 1
Mount Vernon's Regulations and Policies and the NPDES Minimum Control Measure Requirements*

Minimum Control Measure	Minimum Requirements Met	Current Implementation	Extent of Enforcement	Comprehensive Plan Coverage	Municial Code Coverage
1) Public Education & Outreach on Stormwater Impacts	Yes	Yes	Adequate	Adequate	Inadequate
2) Public Involvement/Participation	No	Partial	Inadequate	Inadequate	Inadequate
3) Illicit Discharge Detection & Elimination	No	No	Inadequate	Inadequate	Inadequate
4) Construction Site Stormwater Runoff Control	Yes	Partial	Partial	N/A	Adequate
5) Post-Construction Stormwater Management in New Development & Redevelopment	Partial	Partial	Partial	Partial	Adequate
6) Pollution Prevention/Good Housekeeping for Municipal Operations	No	No	Inadequate	N/A	Inadequate

*Preliminary draft

Notes:

Partial = Means that some of the minimum requirements have been implemented, but further additions are needed for compliance.
Adequate = Means that the provisions set forth within the MCM are adequately being enforced and or covered within the City's code or comprehensive plan.
Inadequate = Means that the provisions set forth within the MCM are not adequately being enforced and or covered within the City's code or comprehensive plan.

Table 2 (11x17) NPDES Phase II Requirements and Mount Vernon's Policies and Regulations (5 Pages)

4.3 MCM #1 - Public Education and Outreach on Stormwater Impacts

4.3.1 Minimum Requirements

"Implement a public education program to distribute materials to the community or conduct equivalent outreach activities about the impacts of stormwater discharges on water bodies and the steps that the public can take to reduce pollutants in stormwater runoff."

4.3.2 Regulatory Guidance

The public education program should inform individuals and households about different ways to reduce stormwater pollution, such as:

- Proper septic system maintenance
- Proper use and disposal of landscape and garden chemicals including fertilizers and pesticides
- Protecting and restoring riparian vegetation
- Properly disposing of used motor oil and household hazardous wastes

In addition, the program should be tailored, using a mix of strategies, to target specific audiences and communities. Examples of strategies include:

- Distribute brochures or fact sheets
- Sponsoring speaking engagements before community groups
- Providing public service announcements
- Implementing educational programs targeted at school age children
- Conducting community-based projects such as storm drain stenciling and watershed cleanups

EPA recommends that some of the materials be directed towards targeted groups of commercial, industrial, and institutional entities likely to have significant stormwater impacts.

4.3.3 Mount Vernon Municipal Code

This section is not applicable to MCM Standard #1.

4.3.4 Mount Vernon Comprehensive Plan

The plan recommends a comprehensive, surface water management program that relies on a combination of education, regulations, operation and maintenance, and capital projects to protect surface water resources.

A major comprehensive plan element, within Chapter 6, *Utilities,* supports the requirements of MCM #1. The element includes, "Development of public education programs to increase the understanding and awareness of citizens and business owners about flood control and how their actions can affect water quality and environmental resources".

In addition, Chapter 6 identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 2 is to maintain good water quality.

Objective “d” of this goal reads, “Implement public education programs to reduce the source of pollutants entering surface waters”.

4.3.5 City Staff Interviews

The following are highlights of the information and opinions obtained during individual staff interviews.

- The general public doesn’t understand how their utility bill is divided, and what their money pays for or whom it benefits. One bill is sent out for wastewater, water, SWM, and solid waste, and the bills don’t show a breakdown of costs.
- There is concern about how the public would perceive another rate increase on the utility bill because Mount Vernon already has one of the highest property tax rates in the County because of the low commercial tax base.
- The average resident is quite conservative and not open to the idea of paying extra money to restore habitat while potentially loosing property rights due to buffer increases. The City should improve communication regarding the benefits to salmon protection.
- The City should complete a couple projects such as walking and bike paths so the public can see the results and enjoy the restoration they pay for (ex. watching salmon spawn, interpretive trails, school field trips, etc.).
- More money could be spent on the implementation side rather than the regulatory side to ensure that results can clearly be seen.
- Explore more volunteer programs to aid in policy implementation and help save money.

4.3.6 Positive Aspects of the City’s Current Programs

The City teams up with the Skagit Fisheries Enhancement Group (SFEG) to engage communities in habitat restoration and watershed stewardship. This program, called the Stormwater Education Program, has been implemented as a result of the Mount Vernon Comprehensive Stormwater Management Plan developed in 1994. The education program is aimed at teaching residents how to prevent stormwater pollution. Recently, 4th through 12th grade students participated in a storm drain stenciling program while being educated about the problem of pollution in local creeks, streams and rivers. Also, a television channel, Mount Vernon Television (MVTV), occasionally features segments regarding stormwater education. The City has a brochure showing “Home Tips for Healthy Streams” which has a variety of good ways to reduce pollution to stormwater and limit runoff.

4.3.7 Gaps or Deficiencies Identified

The City meets the minimum requirements of MCM #1 because the City has a contract with SFEG to develop and implement a stormwater education program. However, it should also target adults, homeowners, and businesses. The City should:

- Develop a program to educate business owners, especially those thought to have significant stormwater impacts (developers, etc.).

- Sponsor speaking engagements and slide shows before community groups and homeowners living along streams and rivers.
- Hold demonstrations showing the things people can do to reduce runoff and stormwater pollution, such as planting native vegetation.
- Create a series of fact sheets that expand on each of the tips suggested in the existing brochure.

4.4 MCM #2 - Public Involvement/Participation

4.4.1 Minimum Requirements

The public must be involved in developing the SWM program, complying with state, tribal, and local public notice requirements when implementing a public involvement/participation program.

4.4.2 Regulatory Guidance

The public shall be included in creating, implementing, and updating the storm/surface water management program. Municipalities should make efforts to reach out and engage all economic and ethnic groups. Opportunities for public involvement include:

- Serving as citizen representatives on a local stormwater management panel
- Attending public hearings
- Serving as citizen volunteers to educate other individuals about the program
- Assisting in program coordination with other pre-existing programs
- Participating in volunteer monitoring efforts

4.4.3 Mount Vernon Municipal Code

No sections within the Mount Vernon Municipal Code (MVMC) currently address MCM #2.

4.4.4 Mount Vernon Comprehensive Plan

A major comprehensive plan element, within Chapter 6, *Utilities,* supports the requirements of MCM #2. The element includes, "Establishment of a Citizen Advisory Committee (CAC) and a series of several meetings in which public input was collected".

4.4.5 City Staff Interviews

The City currently has a Citizens Advisory Committee, which comprises elected members. However, a collaboration needs to be developed between the CAC and the general public to make them feel as though they were part of the process. A coalition may reduce the number of complaints received if utility rates are increased. It may help to get the public focused on the issues and not on the government. The CAC should report to the Mayor not the City Council. There should be diversity in public involvement, not just interest groups. Utilize MVTV and the stormwater education program to target all income levels and ethnicity's.

4.4.6 Positive Aspects of the City's Current Programs

The City currently has a CAC. The City currently has a TV channel that can help engage the community and notify them about upcoming public hearings or workshops. The City used a CAC to develop the initial CSMP.

4.4.7 Gaps or Deficiencies Identified

Additional effort is needed to engage the public and create a local stormwater CAC. The general public should be engaged in the process of updating the stormwater plan. Page 6-6 of the Comprehensive Plan mentions a comprehensive, surface water management program that relies on a combination of education, regulations, operation and maintenance, and capitol projects to protect surface water resources. It appears that the City is lacking involvement between the public and the CAC. Since the CAC comprises elected citizens, it is important to encourage the general public to work with the CAC, so they can convey information directly to the mayor.

4.5 MCM #3 - Illicit Discharge Detection and Elimination

4.5.1 Minimum Requirements

Develop, implement, and enforce a program to detect and eliminate illicit discharges into the city's MS4. This includes:

- complete a storm sewer system map, showing the location of all outfalls and the names and location of all waters of the United States that receive discharge from those outfalls,
- effectively prohibit, through ordinance, or appropriate enforcement procedures and actions, non-stormwater discharges into your system, including illegal dumping to your system,
- inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper disposal of waste.

Tri-County standards for source control requires local jurisdictions to:

- compile a list of existing commercial, multifamily, industrial, and government sites to assist in a monitoring and inspection program.
- fund site inspections and enforcement of source control BMP's,
- establish source control program policies and procedures and provide appropriate staff training to implement a six-year inspection schedule/plan.

In addition to source control requirements, the Tri-County Propôsal sets standards for the reduction of illicit discharges. The proposed standards require jurisdictions to adopt ordinances, to make it illegal to dump or spill contaminants into the storm drainage system, or have connections to the storm drainage system that discharge contaminants. Jurisdictions must allocate funding for investigation, referral, and enforcement as needed for illicit discharges identified from complaints, inspections, or other monitoring information. Investigation or referral to an appropriate agency of complaints/reports (indicating a potential illicit discharge) shall occur within 7 days on average.

4.5.2 Regulatory Guidance

Illicit discharge detection programs should include the following four components:

- Procedures for locating priority areas likely to have illicit discharges
- Procedures for tracing the source of an illicit discharge
- Procedures for removing the discharge
- Procedures for program evaluation and assessment.

EPA recommends that the program also promotes, publicizes, and facilitates public reporting of illicit connections or discharges and distributes outreach materials.

4.5.3 Mount Vernon Municipal Code

MVMC 13.33.050 (parts B and C) address part (ii) B of MCM requirement #3 as the section prohibits illicit discharges to public drainage control systems, in addition to defining "illicit discharges" and providing a list of common substances considered to be "illicit".

Chapter 13.33.050 (part F) partially addresses part (ii) C of MCM #3, mentioning that an engineer can hire someone to sample and analyze a discharge thought to be illicit. The code however only allows for sampling when an engineer has reason to believe a discharge is illicit.

4.5.4 Mount Vernon Comprehensive Plan

A major comprehensive plan element, within Chapter 6, *Utilities,* supports the requirements of MCM #3. The element includes, "Development of public education programs to increase the understanding and awareness of citizens and business owners about flood control and how their actions can affect water quality and environmental resources".

In addition, Chapter 6 identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 2 is to maintain good water quality. Objective "d" of this goal reads, "Implement public education programs to reduce the source of pollutants entering surface waters".

4.5.5 City Staff Interviews

Currently, surfacewater staff do not monitor water quality/pollution levels, and have expressed that they don't want to. Ecology has sampled Kulshan Creek in the past for dissolved oxygen and fecal coliform. Mount Vernon currently monitors for illicit discharges to sanitary systems, but not stormwater systems.

4.5.6 Positive Aspects of the City's Current Programs

The City already has its own television station named MVTV, which can be utilized to inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper disposal of waste. The program could display a phone number that people could call if they happened to know of violators or locations where illegal dumping occurs. The City has already signed a contract with SFEG to develop and implement a stormwater education program. SFEG could work with volunteers to detect illicit discharges.

4.5.7 Gaps or Deficiencies Identified

The minimum requirements include completing a storm sewer system map which shows the location of all outfalls and the names and location of all waters of the United States that receive discharge from those outfalls. Since a complete inventory of the storm sewer system in Mount Vernon, still needs to be completed, and because there is not a program for the detection of illicit discharges to storm sewers, the minimum requirements set forth in MCM #3 have not been met.

The code does not currently include provisions for illicit discharge detection and elimination program to be created. The comprehensive plan does not mention the hazards associated with illicit discharges and illegal dumping.

4.5.8 Recommendations for Compliance

To comply with the minimum requirements, Mount Vernon must develop a program to detect non-stormwater discharges and illegal dumping, unless these are not significant contributors of pollutants to their MS4. It is also recommended that the City create and distribute a pamphlet to inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper waste disposal and provide a telephone number they can call to report violators. Chapter six of the Comprehensive Plan should have another Objective added to Goal #2 – Maintain Good Water Quality. The Objective should read, "Implement an illicit discharge detection and elimination program to keep harmful substances from entering surface waters."

4.6 MCM #4 - Construction Site Runoff Control

4.6.1 Minimum Requirements

Develop, implement, and enforce a program to reduce pollutants in any stormwater runoff to the MS4 from construction activities that result in a land disturbance of greater than or equal to one acre. At a minimum your program must include:

(A) An ordinance or other regulatory mechanism to require erosion and sediment controls (ESC), as well as sanctions to ensure compliance to the extent allowable under State, Tribal, or local law.

(B) Requirements for construction site operators to implement appropriate ESC BMPs

(C) Requirements for construction site operators to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality.

(D) Procedures for site plan review which incorporate consideration of potential water impacts

(E) Procedures for receipt and consideration of information submitted by the public

(F) Procedures for site inspection and enforcement of control measures

Tri-County standards prevent the transport of sediment from development sites during and after construction. The standards also require the application of various erosion and sedimentation control BMP's. In addition, projects that add or replace 2,000 square feet or more of impervious surface or clear more than 7,000 square feet must prepare a Construction SWPPP (Stormwater Pollution Prevention Plan).

4.6.2 Regulatory Guidance

EPA encourages municipalities to provide appropriate education and training measures to ensure that construction site operators implement ESC measures correctly. Procedures for site plan review should include the review of individual pre-construction site plans to ensure consistency with local ESC requirements. Procedures for site inspections and enforcement could include steps to identify priority sites based on the nature of the construction activity, topography, characteristics of soils, and receiving water quality. Examples of sanctions to ensure compliance include non-monetary penalties, fines, bonding requirements, and/or permit denials for non-compliance.

4.6.3 Mount Vernon Municipal Code

MVMC13.33.090, lists eleven Large Parcel Minimum Requirements (LPRs) aimed at controlling erosion and sediment movement to protect water quality during construction. LPRs apply to new development that includes the creation or addition of 5,000 square feet, or greater, of new impervious area or any land-disturbing activity of one acre or greater. The language within this section directly relates to MCM #4, part (A).

<u>LPR #1 – Erosion and Sediment Control Plan.</u> Requires developers to create a large parcel stormwater plan showing how a variety of BMPs will be accomplished. This requirement addresses MCM #4, part (B).

<u>LPR #3 – Source Control of Pollution.</u> Requires source control BMPs to be applied to all projects to the maximum extent possible. This requirement addresses MCM #4, part (C).

MVMC 13.33.120, provides the enforcement to make sure ESC measures get implemented properly, by requiring site inspections at various stages of work. It is necessary that the city develops a prioritization plan and supplies sufficient staff to carry out this provision, especially as development increases. This directly relates to MCM #4, part (F).

4.6.4 Mount Vernon Comprehensive Plan

Chapter 6, *Utilities,* identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 2 is to maintain good water quality, Objective b of this goal reads, "Require adequate erosion and sedimentation controls from new construction sites". Objective "c" reads, "Require adequate water controls for new development. Both objectives support, and are consistent with MCM #4.

4.6.5 City Staff Interviews

Regulations are not adequate to protect aquatic resources because the existing regulations are not properly enforced. The responsibility for, who is supposed to do enforcement, is not clear. Staff is limited, which also makes enforcement and site inspections hard. Mount Vernon has adopted both the DOE and King County manuals for its current drainage coded and ECS code. The ESC code includes provisions for turbidity monitoring, and if it's too high, a letter of non-compliance will be issued. If turbidity levels don't drop, then a stop-work order will be issued. Two stop-work orders were issued in 2002. A few developers cause the majority of Mount Vernon's erosion issues associated with development. It is unclear to the Planning Department how to enforce provisions set forth within the critical areas code which require buffers along streams and wetlands. They expect engineers to do this when in theory, they need to have trained people visiting large parcel construction sites on a regular basis to ensure code compliance.

4.6.6 Positive Aspects of the City's Current Programs

The City's regulations show consistency with the requirements set forth in MCM #4. These regulations act as the cornerstone for Mount Vernon's ability to comply with state and federal regulations. Implementation and enforcement of the code could enhance compliance.

4.6.7 Gaps or Deficiencies Identified

Interviews with City staff reveal that there is a deficiency in the amount of staff available to inspect large parcel sites for adequate ESC measures during construction. In addition, existing regulations are not being enforced because the responsibility for enforcement is not clear, as previously mentioned, staff is limited. There is a lack of good resource inventory maps and materials available to planners to ensure development is not occurring within a critical area. No training for site inspections and monitoring has been provided for the Planning Department. For more information, see MRCI #1 in Section 5.4 of this report.

Language supporting the following minimum requirement of MCM #4 could not be found within the MVMC or Mount Vernon Comprehensive Plan:

(E) Procedures for receipt and consideration of information submitted by the public.

4.6.8 Recommendations for Compliance

For the most part, the language of the code does not need revision, as it supports the requirements set forth in MCM #4. What is needed is the addition of staff members, who can read, understand, and adequately implement and enforce the existing code. If budget is limited, it is recommended that a site inspection prioritization plan be developed, based on the nature of the construction activity, topography, characteristics of soils, and receiving water quality . This would give priority to construction activities thought to pose the greatest risk to water quality, etc.

4.7 MCM #5 - Post-Construction Stormwater Management in New Development and Redevelopment

4.7.1 Minimum Requirements

Develop, implement, and enforce a program to address stormwater runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger plan of development. The program must ensure that controls are in place that would prevent or minimize water quality impacts. At a minimum, the program must:

(A) Develop and implement strategies which include a combination of structural and non-structural BMPs best suited for the community.

(B) Use an ordinance or regulatory mechanism to address post-construction runoff.

(C) Ensure adequate long-term operation and maintenance of BMPs.

Tri-County technical stormwater standards require water quality treatment facilities/BMPs that treat 90% of the annual runoff from new and redeveloped pollution-generating surfaces using the following thresholds:

Threshold 1 – All projects that add 5,000 square feet or more of new impervious surface or create 35,000 square feet or more of new cleared area.

Threshold 2 – All transportation redevelopment projects, in which new impervious surface is 5,000 square feet or more and equal to 50% or more of the existing impervious surface within the project limits.

Threshold 3 – All non-transportation redevelopment projects, in which the total of new plus replaced impervious surface is 5,000 square feet or more, and for which the valuation of proposed improvements exceeds 50% of the assessed value of the existing site improvements.

Proposed Tri-County inspection/enforcement standards require an inspection schedule/plan for all private flow control and water quality facilities that ensures the inspection of each facility at least once in the first six years after the start date. Furthermore, inspection of all new flow control and water quality treatment facilities in subdivisions is required every six months during the period of heaviest house construction (1-2 years after approval).

4.7.2 Regulatory Guidance

The guidance provided within 40 CFR 122.34(b)(5)iii recommends that the City take a proactive approach towards reducing water quality impacts associated with new development and redevelopment. A good mixture of structural BMPs and non-structural BMPs will lead to the most successful stormwater management program. Non-Structural BMPs are preventative actions that involve management and source controls such as:

- Policies and ordinances that provide requirements and standards to direct growth to identified areas
- Protect sensitive areas such as wetlands and riparian areas
- Maintain and/or increase open space (dedicate a funding source just for acquisition)
- Provide buffers along sensitive water bodies
- Minimization of percent impervious area after development
- Minimize disturbance of soils and vegetation
- Encourage infill development in higher density urban areas with policies or ordinances
- Provide education programs for developers and the public about designs that minimize water quality impacts

For more guidance from the EPA and a list of structural BMPs, see Attachment A.

4.7.3 Mount Vernon Municipal Code

MVMC 17.69, establishes a Planned Unit Development (PUD) district which provides for innovative land use management techniques aimed at proactively dealing with storm water impacts. This non-structural BMP can help to encourage infill while rewarding developers who choose to avoid critical areas. This chapter of the MVMC follows the regulatory guidance provided under MCM #5, and meets the minimum requirement (A).

MVMC 17.119, establishes a Transfer or Purchase of Development Rights (TDRs) program. This is another example of a non-structural BMP that deals with stormwater impacts proactively. This chapter of the MVMC follows the regulatory guidance provided under MCM #5, and meets the minimum requirement (A).

MVMC 13.33.090, requires a permanent stormwater quality control plan (PSQCP) to be completed as part of the submittal requirements set forth in LPR #11. This regulation addresses the minimum requirements set forth in MCM #5, part (B).

MVMC 13.33.090, requires an operation and maintenance schedule for all proposed stormwater facilities and BMPs as part of LPR #10, including identifying the party or parties responsible for maintenance and operation. This regulation meets the minimum requirements set forth under MCM #5, part (C).

4.7.4 Mount Vernon Comprehensive Plan

Chapter 1, *Background Analysis*, discusses various "implications for the plan", which are like goals and objectives, but they are not numbered. One of the implications says, "Development regulations should support retention of natural areas and include design criteria to achieve subdivision and site layouts which will be sensitive to the environmental constraints and optimize open space and views." This is consistent with the regulatory guidance provided under MCM #5, and meets the minimum requirement (A).

Chapter 6, *Utilities,* identifies various objectives to be met in order to accomplish the goals set forth in the water management program. Goal 2 is to maintain good water quality, Objective "c" reads, "Require adequate water controls for new development". The objective supports, and is consistent with MCM #4.

4.7.5 City Staff Interviews

Ordinances, which support non-structural BMPs, such as the ones mentioned above provide a proactive way to reduce stormwater impacts. According to the interviews, there is a significant lack of knowledge among staff, regarding how to implement the provisions currently set forth in the code. Developers have been allowed to construct projects, in which they negatively impact sensitive areas, such as cutting down trees which are located within a streamside buffer. Developers have not mitigated for adverse impacts to water quality in the past. In an extreme example, Stonebridge developers ended up violating federal regulations and federal and state agencies jumped in to stop the development. This sends a bad message to agencies about Mount Vernon's ability to comply with state and federal regulations. In addition, it has drawn the attention of the agencies to keep a closer watch on the City.

4.7.6 Positive Aspects of the City's Current Programs

The City currently has a variety of good non-structural BMP programs in place, which encourage preservation of critical areas and infill in already developed areas with existing infrastructure. Unfortunately, there is inadequate enforcement to support the regulations.

4.7.7 Gaps or Deficiencies Identified

There is a lack of understanding among staff, regarding how to identify critical areas, and how to review development proposals for compliance with the municipal code. Furthermore, responsibility and a plan for enforcement of BMPs and mitigation measures is unclear between departments, most noticeably planning and engineering. It appears that from interviews, certain staff are unfamiliar with enforcement procedures and requirements set forth in the development code.

While the City's code currently addresses the minimum requirements set forth under MCM #5, the comprehensive plan could include more objectives, goals, and policies directed towards proactive thinking and land use management. The use of non-structural BMPs (mentioned above) should be encouraged and included as a goal of the comprehensive plan.

4.8 MCM #6 - Pollution Prevention/Good Housekeeping for Municipal Operations

4.8.1 Minimum Requirements

Develop and implement an operation and maintenance program that includes a training component and has the ultimate goal of preventing or reducing pollutant runoff from municipal operations. The program must include employee training to prevent and reduce stormwater pollution from activities such as:

- Park and open space maintenance
- Fleet and building maintenance
- New construction and land disturbances
- Stormwater maintenance

Tri-County maintenance standards/programs require local jurisdictions to "Adopt the regulatory authority necessary to enforce adopted maintenance standards and allocate funding for inspection and maintenance of stormwater facilities. The following inspection requirements apply to public/municipal facilities:

- Inspection of all public flow control and water quality facilities annually except where a lesser or greater frequency is appropriate to ensure compliance with standards.
- Inspection of all public flow control and water quality facilities after major storm events.
- Require inspection of all public culverts that have a history of maintenance-related fish passage problems once in spring and once in summer.
- Take appropriate maintenance actions based on the findings of the inspections.

4.8.2 Regulatory Guidance

At a minimum, EPA recommends the following is considered when developing an operation and maintenance program for municipal operations:

- Maintenance activities, schedules, and long-term inspection procedures for structural and nonstructural stormwater controls to reduce floatables and other pollutants discharged from the MS4.
- Controls for reducing or eliminating the discharge of pollutants from streets, roads, highways, municipal parking lots, maintenance and storage yards, and waste transfer stations.
- Procedures for properly disposing of waste removed from the separate storm sewers and areas listed above (such as dredge spoil, accumulated sediments, floatables, and other debris).

Operation and maintenance programs can reduce the risk of water quality problems when they are developed and implemented properly. This measure is intended to improve the efficiency of these programs, which should be an integral component of all stormwater management programs

4.8.3 Mount Vernon Municipal Code

No language regarding an operation and maintenance program for municipal activities was found within Chapter 13.33, *Drainage Utility* or Chapter 13.34, *Surface Water Utility.*

4.8.4 Mount Vernon Comprehensive Plan

A major comprehensive plan element, within Chapter 6, *Utilities,* is consistent with the requirements of MCM #6. The element includes, "Development of a Maintenance and Operations Plan".

The comprehensive plan goes on to mention that the purpose of a Maintenance and Operations Program is to ensure system reliability, achieve the lowest life-cycle cost for facility replacement, and to use maintenance methods and standards that promote water quality.

4.8.5 City Staff Interviews

An inventory of the drainage system is needed to establish a maintenance schedule so crews can react and update/revise the inventory and data regarding routine maintenance schedules. Jennifer Aylor is waiting for an intern to help out with doing the inventory and to transfer existing data into digital format. The following facilities have not yet been inventoried: pipes, catch basins, roadside ditches, manholes, and curb inlets. Detention ponds and pump stations have already been inventoried. There is a need to identify methods to prevent fish from accessing the closed conduit system. Salmon have been "vactored" up in the past by maintenance staff. Need to identify stormwater discharge locations that currently have no source control or treatment prior to discharge. Present treatment options to meet water quality standards.

4.8.6 Positive Aspects of the City's Current Programs

Existing wastewater utility staff are already aware of improvements that are needed to the operations and maintenance program. In addition, the wastewater utility staff understands what updates need to occur to comply with NPDES Phase II requirements. The City has dramatically reduced the number of annual overflow events by completing an interceptor project and by making improvements to its WWTP. The utility has met Ecology's requirements ahead of schedule.

4.8.7 Gaps or Deficiencies Identified

There is no benchmark/frequency for all maintenance activities. Inventory and mapping of the existing storm sewer system is not complete. Software and survey crews are needed to complete the inventory, to begin tracking service requests, maintenance, and street sweeping schedules.

There is no language within the *Drainage Utility* or *Surface Water Utility* Chapters of the code that mentions an operations and maintenance plan for municipal activities. The Goals at the end of Chapter 6 of the comprehensive plan, could include a statement that a good maintenance and operations program is an objective of Goal #2 – Maintain Good Water Quality.

5.0 Section 4(d) of the Endangered Species Act

5.1 Background

The ESA provides for the protection of endangered and threatened species. Two sections of the ESA directly affect local jurisdictions:

Section 4(d) relates to the listing of species as threatened or endangered. It allows the listing agency to publish rules that define conditions under which "incidental" take is permissible. The National Marine Fisheries Service (NMFS) issued the final 4(d) rules governing the conservation of steelhead and salmonids in the Northwest. To qualify for incidental take protection, municipalities must demonstrate compliance with the 4(d) rule. NMFS 4(d) rule allowing incidental take requires municipalities to conduct program actions and create and issue regulations which will provide for the conservation of threatened species.

Section 9 defines specific actions that are prohibited, which may result in a "take" of endangered species. A "take" could involve harming, harassing, pursuing, hunting, or killing a listed or endangered species. Destruction or changes to habitat (supporting listed and threatened species) is defined as a "harm" under the ESA, and Mount Vernon could be liable. However, the 4(d) rule for Northwest salmonids, has an exemption, for certain governmental activities, if they meet the municipal, commercial, residential, and industrial (MRCI) development standards outlined in the final rules, released in July 2000.

5.2 MRCI Standards /Evaluation Considerations

There are a total of twelve evaluation considerations when NMFS reviews a local jurisdiction's comprehensive plan and development regulations when determining a city's ability to conserve listed species, by protecting and restoring their habitat. These MRCI Standards have been taken directly from the 4(d) rule, and are provided in Attachment B. If NMFS approves Mount Vernon's policies and regulations, the city will be granted an exemption under the MRCI standards to a "take". Mount Vernon would be protected from action from NMFS and would have their support in the event of any third party lawsuits against the jurisdiction for action under the MRCI standards.

Some of the MRCI standards are very similar to the NPDES Phase II Minimum Control Measure Requirements. Therefore, in order to reduce repetition, the analysis will not go into detail regarding the following MRCI Standards:

- MRCI #2 – *Avoid Stormwater Discharge Impacts*, is covered under MCM #5 - Post-Construction Stormwater Management in New Development and Redevelopment
- MRCI #9 - *Prevent Erosion and Sediment Run-off During Construction,* is covered under MCM #4 - Construction Site Runoff Control.

5.3 Organization and Level of Analysis

The following sections analyze each of the twelve evaluation considerations in relation to what was learned through staff interviews and review of Mount Vernon's existing regulations and policies. In order to identify potential gaps, the following had to be looked at and evaluated for each MRCI:

- Regulatory guidance and suggested actions by NMFS
- Sections of the Mount Vernon Municipal Code, relating to the MRCI requirements
- Applicable goals, policies, and objectives of the Mount Vernon Comprehensive Plan
- Information from staff interviews

Table 3 provides an overview of the MRCI standards and the extent of Mount Vernon's existing programs, policies, and practices.

Table 3
Mount Vernon's Regulations and Policies and the NMFS 4(d) MRCI Standards*

MRCI Standard	Current Implementation	Extent of Enforcement	Comprehensive Plan Coverage	Municial Code Coverage
#1) Ensure that Development Avoids Critical Areas	No	Inadequate	Inadequate	Inadequate
#2) Avoid Stormwater Discharge Impacts	Partial	Partial	Partial	Adequate
#3) Protect Riparian Areas	Partial	Inadequate	Inadequate	Inadequate
#4) Avoid Stream Crossings	No	N/A	N/A	Inadequate
#5) Protect Channel Migration Zones	Partial	N/A	N/A	Inadequate
#6) Protect Wetlands and Wetland Functions	No	Inadequate	Inadequate	Inadequate
#7) Preserve Hydrologic Capacities of Streams	Partial	N/A	N/A	Adequate
#8) Include Provisions for Native Vegetation	No	N/A	Inadequate	Inadequate
#9) Prevent Erosion and Sediment Run-off During Construction	Partial	Partial	N/A	Adequate
#10) Ensure Water Supply Diversions Don't Harm Salmon	No	Inadequate	N/A	Inadequate
#11) Enforcement, Funding, and Implementation Mechanisms	Yes	N/A	Adequate	Adequate
#12) Compliance w/ State and Federal Laws/Permits	Partial	Inadequate	Adequate	Adequate

*Preliminary draft

Notes:

Partial = Means that some of the standards have been met, but further actions are needed for compliance.
Adequate = Means that the provisions set forth within the MRCI Development Standards are adequately being enforced and or covered within the City's code or comprehensive plan.
Inadequate = Means that the provisions set forth within the MRCI Development Standards are not adequately being enforced and or covered within the City's code or comprehensive plan.

5.4 MRCI #1 - Ensure that Development Avoids Critical Areas

5.4.1 Regulatory Guidance

Ensuring that development will avoid inappropriate areas such as unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites. Activities such as development, timber harvest, or other soil disturbance should be sited in appropriate areas--avoiding unstable slopes, wetlands, areas already in a proper functioning condition, areas that are more functional than neighboring sites, and areas with the potential to be fully restored.

The Tri-County Proposal fixed regulations option requires the creation of Inner and Outer "Management Zones" along with a separate set of regulations for each. Management Zones (MZs) are just like buffers in the sense that they restrict development on property, which lies immediately adjacent to a defined water body that either provides salmonid habitat or contributes to the proper functioning of salmonid habitat. Tri-County requirements for MZ widths for streams are provided in Section 5.6, which discusses the protection of riparian areas.

5.4.2 Mount Vernon Municipal Code

MVMC Chapter 15.40, *Additional SEPA Guidelines*, consists of a variety of regulations aimed at protecting critical areas such as wetlands, streams, fish and wildlife habitat, and steep hillsides. This chapter would be reviewed when evaluating MCRI Standard #1.

5.4.3 Mount Vernon Comprehensive Plan

Chapter 1, *Background Analysis,* page 1-19 of the comprehensive plan does not identify threatened and endangered species within the City of Mount Vernon.

Chapter 1, *Background Analysis*, also discuses various "implications for the plan", which are like goals and objectives, but they are not numbered. One of the implications says, "Development regulations should support retention of natural areas and include design criteria to achieve subdivision and site layouts which will be sensitive to the environmental constraints and optimize open space and views." This is consistent with the regulatory guidance provided under MRCI #1

Another implication for the plan states that, "Wildlife habitat should be created or enhanced along riparian areas as part of wildlife protection and enhancement". This is consistent and supports MRCI #1.

The following Tri-County MPPs are good examples of comprehensive plan policies that Mount Vernon could adopt, to acknowledge and comply with the listing of Puget Sound Chinook under the ESA. Additional guidance regarding the implementation of each MPP is provided in Attachment C. The following policies address MRCI Standard #1 by providing framework for the creation, implementation, and enforcement of development regulations:

<u>Model Policy No. 2</u>: The city should preserve, protect, and where possible, restore natural habitat critical for the conservation of salmonid species listed under the federal ESA, through the adoption of comprehensive plan policies that seek to protect, maintain

or restore aquatic ecosystems, associated habitats and aquifers through the use of management zones, development regulations, incentives for voluntary efforts of private landowners and developers, land use classifications or designations, habitat acquisition programs or habitat restoration projects.

Model Policy No. 4: All jurisdictions shall work together to identify and protect natural habitat networks that cross jurisdictional boundaries.

Model Policy No. 6: All jurisdictions shall cooperatively work together to create and adopt modifications to their Critical Areas Regulations that include the best available science for the protection of existing habitat, wetlands, estuaries, riparian areas by avoiding negative impacts.

Model Policy No. 7: Upon adoption of a state classification system, the cities and the county shall work together to establish a single system for stream typing.

Model Policy No. 9: All jurisdictions shall establish a monitoring and evaluation method, which is designed to determine the effectiveness of restoration, enhancement, and recovery strategies for listed species.

Model Policy No. 10: All jurisdictions shall recognize that the best available science, to address listed species recovery issues, is evolving. Each jurisdiction shall apply an adaptive management strategy to determine how well the objectives of listed species recovery and critical habitat preservation/restoration are being achieved.

5.4.4 City Staff Interviews

As previously mentioned, a critical areas code exists, but it is hard to locate because it is titled, "Additional SEPA Guidelines". Wetland buffers set forth within the code are inadequate. Wetlands types are not classified or considered when impacts are mitigated. Enforcement through site visits is lacking.

5.4.5 Positive Aspects of the City's Current Programs

The City has a stream and wetlands inventory that shows the presence or absence of fish in streams. The "Shannon and Wilson" report is a reconnaissance level report, which includes maps of streams and wetlands in Mount Vernon.

5.4.6 Gaps or Deficiencies Identified

There may be a lack of understanding regarding how to identify critical areas, and how to review development proposals for compliance with the critical areas code. Furthermore, responsibility and a plan for enforcement appears unclear between departments. There were two "stop work" orders issued to developers in 2002, who failed to comply with the MVMC, resulting in state and federal agency involvement.

The current code, "Additional SEPA Guidelines" should be renamed "Critical Areas Ordinances" so it will be easier to find/stand out.

The City doesn't have geologic hazards (steep hillsides) critical areas mapped out as critical areas to avoid.

The Planning Department should revise the way they average buffer widths.

The City currently has a wetland setback/buffer that is a standard 25 feet. There are no increases in wetland buffer width depending on the rating or overall function of a wetland. Furthermore there are no compensatory requirements or replacement ratios provided for impacts to or filling of wetlands.

The comprehensive plan does not have an "environmental" chapter/element with specific goals and policies for salmon protection. It is recommended that the City adopt comprehensive policies and goals similar to the Tri-County MPPs mentioned above.

5.5 MRCI #2 - Avoid Stormwater Discharge Impacts

5.5.1 Regulatory Guidance

Adequately preventing stormwater discharge impacts on water quality and quantity and stream flow patterns in the watershed--including peak and base flows in perennial streams. Stormwater management programs must require development activities to avoid impairing water quality and quantity.

This evaluation consideration is identical to the NPDES Phase II minimum control measure #5, which requires the development, implementation, and enforcement of a stormwater runoff program. See page 10 for a complete analysis.

5.6 MRCI #3 - Protect Riparian Areas

5.6.1 Regulatory Guidance

Protecting riparian areas well enough to attain or maintain Properly Functioning Conditions (PFC) around all rivers, estuaries, streams, lakes, deepwater habitats, and intermittent streams. Compensatory mitigation shall be provided, where necessary to offset unavoidable damage to PFC in riparian management areas. Activities should be quite limited in areas adjacent to all perennial and intermittent streams and waters supporting listed salmon and steelhead in order to avoid soil disturbance and maintain vegetated riparian corridors.

As previously mentioned the Tri-County Proposal Fixed Regulations Option requires the creation of Inner and Outer "Management Zones", along with a set of restrictions for each zone. Management Zones (MZs) are basically stream buffers, which aim to protect salmonid habitat, or areas that contribute to the proper functioning of salmonid habitat. The minimum prescribed widths of MZs are determined by water types, as established by the Washington *Forest and Fish Report*. This method of classification is "habitat-driven" instead of designating streams according to geomorphic parameters. The following MZ widths are recommended for the adequate protection of threatened salmonids:

Water Type S: 200 feet

Water Type F: 200 feet

Water Type F – Steep Ravine: 100 feet or 25 feet from the top of the bank

Water Type N – Within a ¼ mile upstream of a Type S or F stream: 115 feet

Water Type N – More than ¼ mile upstream of a Type S or F stream: 65 feet

5.6.2 Mount Vernon Municipal Code

MVMC 15.40.010, *Purpose,* includes goals which are applicable/address MRCI Standard #3:

C. Preserve and protect environmentally sensitive areas by regulating development within and adjacent to them.

E. Prevent adverse cumulative impacts to the water quality, wetlands, streams, stream corridors, and fish and wildlife habitat.

MVMC 15.40.080, *Buffers and Setbacks,* mentions that a 10-foot building setback from the edge of all critical area buffers may be required to prevent encroachment into the buffer.

The section of the code should be revised to say that a 10-foot setback is required.

In addition, this section needs to refer back to MVMC 15.40.050, *Regulated and Allowed Activities*, because that section mentions what activities are allowed and what activities are prohibited in buffers.

MVMC 15.40.050.C, *Wetland and Buffer Alteration*, starts off by mentioning that, "Wetlands and associated buffers may be altered provided that..."

This language could be changed to say, "Alterations to wetlands and buffers is

MVMC 15.40.120, *Stream Buffer Requirements,* provides stream ratings, which place streams into three different categories pursuant to WAC 222-16-030, Forest Practice Regulations.

MVMC 15.40.120 provides stream buffer requirements for minimum buffer widths:

Category I – Determined by the Skagit County Shoreline Master Program

Category II – 100 total width centered on the stream (i.e., 50 feet on each side of the centerline of the stream)

Category III – 50 total width centered on the stream (i.e., 25 feet on each side of the centerline of the stream)

MVMC 15.40.130, *Stream Preservation/Alternatives and Mitigation*, addresses stream mitigation, but fails to mention mitigation requirements for Category II and III streams. It mentions that "All Category I streams shall be preserved in accordance with the Shoreline Management Master Program". The previous sentence should mention the actual name of the shoreline program (i.e. Skagit County Shoreline Master Plan).

MVMC 15.40.140, *Fish and Wildlife Habitat Conservation Areas,* mentions that certain areas within the City shall be named Priority Habitat. In order for an area to be classified as priority habitat, it must meet one of the following:

1. Presence of a species federally or state listed or proposed for listing as threatened, endangered, sensitive, or as priority species, or outstanding potential habitat for those species.
2. Areas contiguous with large blocks of habitat extending outside the city limits and providing a travel corridor to a significant resource.
3. Areas adjacent to or contiguous with wetlands and streams which enhance the value of those areas for fish and wildlife.

If a development is proposed within or adjacent to a priority habitat area, the applicant shall provide a wildlife habitat assessment prepared by a professional.

The existing code only mentions that the habitat assessment shall include recommendations for protection of the identified habitat areas and species of concern. It is recommended that the code include more stipulations for the assessment.

The Tri-County Proposal provides a habitat evaluation outline, which requires the developer to look at habitat goals and objectives, inherent site potential, and conservation measures to mitigate for impacts.

5.6.3 Mount Vernon Comprehensive Plan

Chapter 1, *Background Analysis,* page 1-11 of the comprehensive plan mentions that the City of Mount Vernon's current development and future growth are controlled largely by it's existing physical features:

"The Skagit River defines the edge of the City to the north and west, except adjacent to downtown. A number of streams, some salmon bearing, provide natural corridors which should be protected from development by adequate buffers".

This is consistent with MRCI Standard #3, protect riparian areas.

Chapter 1, *Background Analysis*, page 1-22, also discuses various "implications for the plan", which are like goals and objectives, but they are not numbered. One of the implications says, "Wildlife habitat should be created or enhanced along riparian areas as part of wildlife protection and enhancement". This goal or policy is consistent with MRCI #3.

Page 1-18 of the plan, *Riparian Habitat,* also mentions that riparian habitat along streams usually supports diverse and productive wildlife communities.

5.6.4 City Staff Interviews

It is currently unclear who is responsible for enforcing the City's Critical Area Ordinances each time a project comes up for review. The City has a Problem Enforcement Team (PET) that comprises policy, fire, public works and planning staff. The Kulshan Ridge development was approved, and then a "stop work" order had to be issued because the developer did not obey stream buffer ordinances. Construction staging inspections and buffer inspections are lacking due to staffing issues. The way that the planning department averages buffers should be clarified and strengthened.

5.6.5 Positive Aspects of the City's Current Programs

The current comprehensive plan supports the protection and enhancement of riparian areas. The city already has a transfer of development rights program and other density credit programs in place to protect sensitive areas such as riparian corridors.

5.6.6 Gaps or Deficiencies Identified

The EPA mentions that streamside activities, carried out within a distance equal to the height of the tallest tree that can grow on that site (site potential tree height), can significantly affect essential habitat functions. This science-based method allows stream buffers to vary, depending on the type of habitat the stream supports.

Based on a comparison the existing Mount Vernon requirements for riparian/stream buffer widths and the requirements set forth within the Tri-County Proposal, it appears that the required widths of stream buffers may not be wide enough for Category II and III streams.

Staff lacks knowledge of how to apply the current "Shannon and Wilson Report" or utilize it when reviewing a project proposal. The planning department does not do many site visits/inspections to make sure trees are not getting cut down or that riparian areas/buffers are being preserved. Mount Vernons' Municipal Code should have more strict enforcement; it should be clarified who is responsible for enforcing which provisions.

Induce more penalties for developers who have deliberately and repeatedly broken sensitive area ordinances.

5.7 MRCI #4 - Avoid Stream Crossings

5.7.1 Regulatory Guidance

Avoiding stream crossings--whether by roads, utilities, or other linear development--wherever possible and, where crossings must be provided, minimize impacts. One method of minimizing stream crossings and their associated disturbances is to optimize transit opportunities to and within newly developing urban areas.

Where a crossing is unavoidable, the plan or ordinance should minimize its affect by preferring bridges over culverts; sizing bridges to a minimum width; designing bridges and culverts to pass at least the 100-year flood (and associated debris).

5.7.2 Mount Vernon Municipal Code

MVMC 15.40.130.B.2 address road stream crossings and states, "Culverting within a stream shall only be permitted to provide access to a lot when no other feasible means of access exists. Use of common access points shall be required for abutting lots which have no other feasible means of access. Culverting shall be limited to the minimum number of stream crossing required to permit reasonable access.

This section should mention that where crossings are unavoidable, bridges are preferred over culverts, and widths should be minimized. It should apply to City streets in addition to private roads or driveways.

MVMC 13.33.90.D.1, part i, *Underground Utility Construction,* includes guidance for developers regarding the construction of underground utilities. A section (4) should be added which urges the avoidance of stream crossing wherever possible, and if a utility must cross a stream, than underground boring is preferred over open trench construction.

5.7.3 Mount Vernon Comprehensive Plan

Polices, goals, and objectives within comprehensive plans are generally to broad to apply to MRCI Standard #4, Avoiding Stream Crossings.

5.7.4 Gaps or Deficiencies Identified

It is clear in the municipal code that new stream crossings are not recommended and should be avoided. Development standards should be more specific, and mention that stream crossings, if absolutely necessary, should be bridges, not culverts, and widths should be minimized. Also, the code should mention that installing cable underground should avoid stream crossings if at all possible. The code should encourage utilization of existing utility crossing corridors where streams or riparian buffers are present, and must be crossed.

5.8 MRCI #5 - Protect Channel Migration Zones

5.8.1 Regulatory Guidance

Adequately protecting historic stream meander patterns and channel migration zones (CMZs) and avoiding hardening of stream banks and shorelines. Any MRCI development should be designed to allow streams to meander in historic patterns of channel migration. Activities on the landscape must protect conditions that allow gradual bank erosion, flooding, and channel meandering in the zone within which it would naturally occur. This natural channel migration promotes gravel recruitment, geomorphic diversity, and habitat development.

If unusual circumstances require bank erosion to be controlled, it should be accomplished through vegetation or carefully bioengineered solutions. Rip-rap blankets or similar hardening techniques would not be allowed, unless particular site constraints made bioengineered solutions impossible.

"Management Zones", as prescribed within the Tri-County Proposal Fixed Regulations Option, seek to protect meander patterns and historic flow patterns of streams by encompassing CMZs and their associated wetlands. The Tri-County Proposal requires jurisdictions to conduct a jurisdiction-wide study, to set initial CMZ boundaries for all stream reaches where stream power, soil conditions, and valley-floor widths are sufficient enough to cause channel migration.

5.8.2 Mount Vernon Municipal Code

MVMC Chapter 15.36, *Floodplain Management Standards*, is the most applicable section of the code in regard to MRCI #5.

MVMC 15.36.020, *Methods of Reducing Flood Losses,* includes methods and provisions for reducing flood losses:

C. Controlling the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel floodwaters.

"Channel Migration Zones" should be added to this provision.

MVMC Chapter 15.36 should have a special section that discuses the protection of historic stream meander patterns and channel migration zones. A section adequately addressing the regulatory guidance set forth in MRCI #5 could not be found.

MVMC 15.36.030, *Definitions*. A definition for "Channel Migration Zones" should be added.

MVMC 15.40.010, includes one goals which is applicable and addresses MRCI Standard #5:

F. Protect the public and public resources and facilities from injury, loss of life, property damage, or financial losses due to flooding, erosion, land uses, soil subsidence or steep slopes failure.

MVMC 15.40.130, *Stream Preservation/Alternations and Mitigation,* should include a section that provides for the protection of historic stream meander patterns and channel migration zones. It should require that development, near streams, must allow for gradual bank erosion, flooding, and channel meandering in the zone where it would normally occur.

5.8.3 Mount Vernon Comprehensive Plan

The comprehensive plan mentions that a surface water management program will aid in preventing future flooding as a result of new development. It doesn't mention any specifics regarding the protection of channel migration zones and meander patterns. This is too specific for a comprehensive plan.

5.8.4 Gaps or Deficiencies Identified

The code does not discuss and define "channel migration zones". The planning department may not review maps showing channel migration areas and historic stream flow patterns when signing off on a development proposal.

5.9 MRCI #6 - Protect Wetlands and Wetland Functions

5.9.1 Regulatory Guidance

Adequately protecting wetlands, wetland buffers, and wetland function--including isolated wetlands. Activities on the landscape must protect wetlands and the vegetation surrounding them to avoid disturbing soils, vegetation, and local hydrology. Such conditions on the landscape contribute to the natural succession of wetlands and protect wetland functions needed to meet salmonid habitat requirements such as food chain support, shoreline protection, water purification, storm and flood water storage, and groundwater recharge. These conditions are also needed to protect the freshwater, marine, and estuarine wetland systems that provide vital habitat for rearing and migrating salmon and steelhead.

5.9.2 Mount Vernon Municipal Code

MVMC 15.40.010, includes goals which are applicable/address MRCI Standard #6:

C. Preserve and protect environmentally sensitive areas by regulating development within and adjacent to them.

E. Prevent adverse cumulative impacts to the water quality, wetlands, streams, stream corridors, and fish and wildlife habitat.

MVMC 15.40.050 discusses activities that are regulated and allowed (with a permit) within environmentally sensitive areas, such as wetlands.

<u>D. Compensatory Mitigation.</u> As a condition of any permit allowing alteration of wetlands and associated buffers the applicant may propose to restore, create, or enhance wetlands and their associated buffers.

This provision is inadequate because it says developers "may" propose not "will". This section should include more guidance for developers such as off-site and out-of-kind opportunities such as a wetland mitigation-banking program or financial contributions to an established water quality program.

<u>E. Mitigation Plan.</u> The city shall approve a mitigation plan before issuing any permits for development activity on a lot upon which a wetland alteration, restoration, creation, or enhancement is proposed.

This provision is inadequate because it fails to include "wetland buffers" as areas that require a mitigation plan if they are impacted.

In addition, the mitigation section provides no ratios or standards for the amount of wetland creation/replacement that would need to occur when a developer fills wetlands.

MVMC 15.40.080, *Buffers and Setbacks*, includes a provision under section (C) Fencing and Signage, that requires, "a split rail fence to be installed along the boundaries of all critical area buffers and, in a prominent location, one wetland/stream sign shall be posted per lot, or every 150 feet of buffer." This provision supports MRCI #6.

MVMC 15.40.090, *Wetland Delineation*, mentions that "wetlands shall be identified and delineated in accordance with the 1987 Corps of Engineers Wetlands Delineation Manual".

MVMC 15.40.100, *Wetland Buffers*, requires a buffer zone of 25 feet for all regulated activities adjacent to regulated wetlands. According to the Tri-County Proposal, this buffer width requirement is not adequate to protect wetland functions, and therefore does not address or meet MRCI Standard #6. The Tri-County standards require a minimum buffer of 100 feet around wetlands.

5.9.3 Mount Vernon Comprehensive Plan

Environmentally Sensitive Areas, Page 1-13 of the comprehensive plan addresses the need and objective of a wetland inventory:

"The objective of a wetland inventory is to assist the city with identifying the approximate location and extent of wetlands within the existing City limits and proposed urban growth area."

The section goes on to mention that the accuracy of the current wetland inventory is limited by a number of factors (i.e. age of photographs reviewed, limited time spent in the field verifying, etc.). In addition, it mentions that it is possible that additional wetlands are present, that were not located during the inventory.

Fish and Wildlife Priority Habitat and Species, Page 1-18 of the comprehensive plan briefly mentions that wetlands are an important type of wildlife habitat, but it does not make the link that wetlands act as filters and detention areas for run off, and that protecting wetlands will significantly improve water quality. There is no mention of threatened salmon, and how wetland protection will play a role in their recovery.

Chapter 6, *Utilities,* identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 2 is to maintain good water quality, but there is no objective that relates to the preservation of wetlands and their associated buffers.

Chapter 6, *Utilities,* identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 3 is to preserve sensitive resources and maintain varied use. Objective "b" of this goal reads, "Preserve wetlands and implement a wetlands management strategy." This objective supports, and is consistent with MCM #6.

5.9.4 City Staff Interviews

Mount Vernon does have a stream and wetlands inventory that shows the presence or absence of fish in streams. Referred to as the, "Shannon and Wilson Report," this report is a reconnaissance level report, which includes maps of streams and wetlands in Mount Vernon. It appears that the planning department does not look at this report when reviewing a project proposal._A hot issue is the City's wetland setback buffer that is a standard 25 feet. Interviews with staff suggested that this was not adequate and that it is not based on the function of a wetland. Certain tribes tell the City that the setbacks are not adequate, and that they should be equal or greater to the setbacks required by Skagit County.

5.9.5 Gaps or Deficiencies Identified

The Mount Vernon Municipal Code has one standard buffer width for wetland protection, regardless of the type and/or function of the wetland. The standard buffer width of 25 feet is inadequate and does not comply with state and federal regulations and requirements. There is no wetland overlay/map layer to show the location of all the regulated wetlands within the City. Language within the code prohibiting impacts to wetlands is weak and is not adequate for the protection of wetlands and wetland buffers. The comprehensive plan should include more goals, policies, and objectives that address how important wetland protection is, especially when it comes to water quality and salmon recovery.

5.10 MRCI #7 - Preserve Hydrologic Capacities of Streams

5.10.1 Regulatory Guidance

Adequately preserving a permanent and intermittent streams' ability to pass peak flows. Activities that decrease a stream's hydrologic capacity by filling in its channel for road crossings or other development will increase water velocities, flood potential, and channel erosion, as well as degrade water quality, disturb soils and groundwater flows, and harm vegetation adjacent to the stream.

Minimum Tri-County flow control standards for new impervious surfaces/cleared areas include matching discharge durations ranging from 50% of the 2-year rate to 100% of the 50-year rate for the site condition that existed prior to any development in the region. For existing and incremental new impervious surfaces/ cleared areas require site-specific flow control facilities to mitigate for runoff from these surfaces in accordance with specific thresholds and design information specified within the Tri-County Proposal.

5.10.2 Mount Vernon Municipal Code

MVMC 13.33.90.D.2, *LPR #2 - Preservation of Natural Drainage Systems,* requires that natural drainage patterns shall be maintained in conformance with general design and construction standards. It goes on to mention that surface water entering the subject property shall be received at the naturally occurring locations and surface water exiting the subject property shall be discharged into the naturally occurring drainage basin.

MVMC 13.33.90.D.8, *LPR #8 - Off-Site Analysis and Mitigation,* requires all large parcel development projects to conduct a downstream analysis of water quality and quantity impacts resulting from the project. MRCI Standard #7 requires the following impacts to be evaluated and mitigated:

b. Stream bank and stream bed erosion

f. Inadequate storm water conveyance capacities

g. Excessive stormwater velocities

MVMC 13.33.190.A, also addresses MRCI #7, "Development which would increase the volume or rate of discharge due to any storm from the subject property shall not be permitted in areas designated by the engineer.

5.10.3 Mount Vernon Comprehensive Plan

Chapter 6, *Utilities,* identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 1 is to prevent property damage from flooding. Objective b of this goal reads, "Require adequate peak flow controls for new development". This objective supports, and is consistent with MCM #7.

5.10.4 City Staff Interviews

The engineering director felt that infiltration would be a good thing to work into the development code. Water quality credits for developers who implement rain gardens, vegetated roofs, or place houses on pins to allow for greater infiltration may improve water quality and preserve hydrologic capabilities of streams. However, infiltration does not work well everywhere. The City could develop a map of potential sites where infiltration would work well, and then these would be the only areas where developers could receive water quality credits.

5.10.5 Gaps or Deficiencies Identified

Adequate regulations in the MVMC appear to be in place to comply with these requirements. The City should require continuous simulation modeling for sizing new facilities. Cumulative impacts and imperfect enforcement should be addressed and a method of compensation should be developed through the CSMP update process. A gap may exist when it comes to reviewing drainage plans for development proposals. Additional staff may be required to adequately enforce the existing municipal code, in regard to downstream drainage concerns and preservation of hydrologic stream capacities.

5.11 MRCI #8 - Include Provisions for Native Vegetation

5.11.1 Regulatory Guidance

Providing adequate provisions for landscaping with native vegetation to reduce the need to water and apply herbicides, pesticides, and fertilizer. Plans must describe the techniques that local govemments will use to encourage planting with native vegetation, reducing lawn area, and lowering water use. These provisions will maintain essential habitat processes by helping conserve water and reduce flow demands that compete with fish needs. They will also reduce the amount of chemicals contributing to water pollution.

One of the minimum technical standards that the Tri-County Proposal sets forth, requires rural single-family residential developments to use runoff dispersion techniques. Dispersion BMPs, wherever possible, shall minimize effective impervious surface to less than 10% of the development site or be used for "fully dispersing" runoff from impervious surfaces and cleared areas of development sites that protect at least 65% of the site in a forest or native condition. This is known as the "65/10 Standard".

5.11.2 Mount Vernon Municipal Code

MVMC 13.33.090, requires a permanent stormwater quality control plan (PSQCP) to be completed as part of the submittal requirements set forth in LPR #11. The PSQCP is required to show the existing and proposed vegetative cover, soil types including trees, shrubs, and grasses shall be depicted on a map of the site. Measures for controlling runoff after construction are required in accordance with the Ecology and King County Manuals, but there is no mention of required vegetation to be planted.

MVMC Title 16, *Subdivisions*, fails to include any sections relating to a vegetation management plan, or retention of significant trees. Chapter 16.16, *Design Standards*, mentions nothing about tree retention or minimum vegetation requirements.

MVMC 16.32.032, *Design of short plats – Standards,* mentions nothing in regard to native vegetation requirements or tree retention.

5.11.3 Mount Vernon Comprehensive Plan

Chapter 6, *Utilities,* identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 2 is to maintain good water quality. Objective "d" of this goal reads, "Implement public education programs to reduce the source of pollutants entering surface waters." This objective supports the regulatory guidance provided above, and is therefore consistent with MCM #6.

5.11.4 City Staff Interviews

Interviews revealed that the average Mount Vernon resident is unaware of things they can do to reduce impacts to stormwater runoff. Residents tend to be conservative in nature, and may be unaware of the importance of planting native vegetation to help reduce runoff.

5.11.5 Gaps or Deficiencies Identified

The current development code for subdivision development has no regulations for a vegetation plan or minimum standards for tree retention. The municipal code is inadequate in regard to MRCI Standard #8.

Plans must describe the techniques that local governments will use to encourage planting with native vegetation, reducing lawn area, and lowering water use. It appears that this element is lacking from the current surface water program in Mount Vernon.

The stormwater education program should focus more on educating homeowners (living adjacent to critical streams/buffers) about specific alternatives to using harmful pesticides and fertilizers and changing the type of plants they have in their back yard. Interactive displays or workshops may be necessary to fully engage the public.

More programs should be developed that are aimed at teaching developers and businesses new ways of reducing runoff and ways to limit impacts to water quality.

5.12 MRCI #9 - Prevent Erosion and Sediment Run-off During Construction

5.12.1 Regulatory Guidance

Preventing erosion and sediment run-off during (and after) construction, which thus prevents sediment and pollutant discharge to streams, wetlands, and other water bodies that support listed salmonids. These provisions, at a minimum, should include detaining flows, stabilizing soils, protecting slopes, stabilizing channels and outlets, protecting drain inlets, maintaining Best Management Practices (BMPs), and controlling pollutants.

This evaluation consideration is identical to the NPDES Phase II minimum control measure #4, which requires jurisdictions to develop, implement, and enforce a program to reduce pollutants in any stormwater runoff to the MS4 from construction activities. See page 8 for a complete analysis.

5.13 MRCI #10 - Ensure Water Supply Diversions Don't Harm Salmon

The City of Mount Vernon currently contracts with the Skagit PUD to provide drinking water. MRCI Standard #10 applies to the PUD and not the Mount Vernon Surface Water Division. Therefore, an analysis of this standard is not included in the scope of this report.

5.13.1 Regulatory Guidance

Ensuring that water supply demands can be met without affecting–either directly or through groundwater withdrawals--the flows that threatened salmonids need. A plan must ensure that any new water diversions are positioned and screened in a way that prevents salmonid injury or death.

5.13.2 Mount Vernon Municipal Code

Not covered within the existing municipal code

5.13.3 Mount Vernon Comprehensive Plan

Not covered within the existing comprehensive plan.

5.13.4 City Staff Interviews

Not discussed during interviews.

5.13.5 Gaps or Deficiencies Identified

The existing municipal code is lacking regulations that protect threatened salmon from new water diversions and diversion facilities. The comprehensive plan fails to include a policy or objective that mentions the importance of water conservation and salmon protection.

5.14 MRCI #11 – Enforcement, Funding, and Implementation Mechanisms

5.14.1 Regulatory Guidance

Providing mechanisms for monitoring, enforcing, funding, reporting, and implementing a program. Formal plan evaluations should take place at least once every five years. The plan should make a commitment to (and assign responsibility for) regular monitoring and maintenance activities for any detention basins, erosion and sediment control measures, and other management tools over the long term.

Practices should be adapted, as needed, based on monitoring results. In addition, to ensure that development activities comply with the ordinance or plan and that PFC is attained or maintained, commitments must be made for regular funding, enforcement, reporting, implementation, and plan evaluations.

A proposed Tri-County standard, regarding inspection/enforcement, requires the establishment of policies and procedures along with staff training/certification, to ensure that the following activities are carried out:

- Review all stormwater design plans required to be submitted for proposed development activities.
- Inspect all development sites that are hydraulically near a sediment/erosion sensitive site prior to clearing and construction.
- Inspect all development sites during construction to ensure proper installation and maintenance of erosion and sediment controls.
- Inspect all development sites upon completion of construction and prior to final approval/occupancy to ensure proper installation of permanent erosion controls and stormwater facilities/BMP's.
- Investigate reported water quantity/quality problems and potential violations within 7 days on average.

5.14.2 Mount Vernon Municipal Code

The code includes many sections that provide language for enforcement of regulations:

MVMC

5.14.3 Mount Vernon Comprehensive Plan

The following comprehensive plan element, located on page 6-6 of the *Utilities* section, is consistent with MRCI #11:

"Development of a financial strategy and funding mechanism to support the recommended surface water management program"

The comprehensive plan recommends a comprehensive stromwater management program that relies on a combination of the following, to protect surface water resources:

- Education
- Regulations
- Operation and Maintenance
- Capitol Projects

For this to be consistent with the MRCI Standards, "Public Input" should be added to this list.

Chapter 6, *Utilities,* identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 4 is to develop a continuous and comprehensive program for managing surface water. Objective a of this goal reads, "Ensure a funding source for program implementation" This objective is directly consistent with MCM #11.

5.14.4 City Staff Interviews

As previously mentioned, interviews with staff members has revealed that certain regulations are unknown to some city staff. Without having a good knowledge of where regulations/ordinances exist and what they mean, enforcement will be difficult.

Implementation will require additional revenues. Unfortunately, residential property rates in Mount Vernon are currently high. City staff are worried about discouraging new residents and commercial development because property taxes are high. Enforcement of environmental regulations may further discourage new development. Burlington (which lies just to the north) has a large amount of commercial development because it has no salmon bearing streams and development regulations are less strict. Mount Vernon may continue to lose commercial businesses to Burlington. There is a perception among developers that Mount Vernon already has strict development regulations.

5.14.5 Gaps or Deficiencies Identified

Enforcement, enforcement, enforcement...Also, a financial plan for program implementation should be developed with as much public knowledge and input as possible. More training is needed for the staff to adequately implement provisions set forth with the MVMC.

5.15 MRCI #12 - Compliance with State and Federal Laws and Permits

5.15.1 Regulatory Guidance

Complying with all other state and Federal environmental and natural resource laws and permits.

This standard, unlike the others, is too broad to be applied to individual regulations, policies, and programs identified within the City code and Comprehensive Plan. However, this gap analysis report will help Mount Vernon significantly, to identify the areas where they are lacking policies or regulations, which are needed for them to comply with State and Federal regulations

ATTACHMENT A

NPDES Phase II Minimum Control Measure Requirements and Regulatory Guidance

(Source: 40 CFR 122.34(b))

(1) Public Education and Outreach on Stormwater Impacts

Minimum Requirements – *40 CFR 122.34(b)(1)(i)*
You must implement a public education program to distribute educational materials to the community or conduct equivalent outreach activities about the impacts of storm water discharges on water bodies and the steps that the public can take to reduce pollutants in storm water runoff.

Regulatory Guidance – *40 CFR 122.34(b)(1)(ii)*
You may use storm water educational materials provided by your State, Tribe, EPA, environmental, public interest or trade organizations, or other MS4s. The public education program should inform individuals and households about the steps they can take to reduce storm water pollution, such as ensuring proper septic system maintenance, ensuring the proper use and disposal of landscape and garden chemicals including fertilizers and pesticides, protecting and restoring riparian vegetation, and properly disposing of used motor oil or household hazardous wastes. EPA recommends that the program inform individuals and groups how to become involved in local stream and beach restoration activities as well as activities that are coordinated by youth service and conservation corps or other citizen groups. EPA recommends that the public education program be tailored, using a mix of locally appropriate strategies, to target specific audiences and communities. Examples of strategies include distributing brochures or fact sheets, sponsoring speaking engagements before community groups, providing public service announcements, implementing educational programs targeted at school age children, and conducting community-based projects such as storm drain stenciling, and watershed and beach cleanups. In addition, EPA recommends that some of the materials or outreach programs be directed toward targeted groups of commercial, industrial, and institutional entities likely to have significant storm water impacts. For example, providing information to restaurants on the impact of grease clogging storm drains and to garages on the impact of oil discharges. You are encouraged to tailor your outreach program to address the viewpoints and concerns of all communities, particularly minority and disadvantaged communities, as well as any special concerns relating to children.

(2) Public Involvement/Participation

Minimum Requirements – *40 CFR 122.34(b)(2)(i)*
You must, at a minimum, comply with State, Tribal and local public notice requirements when implementing a public involvement/ participation program.

Regulatory Guidance – *40 CFR 122.34(b)(2)(ii)*

EPA recommends that the public be included in developing, implementing, and reviewing your storm water management program and that the public participation process should make efforts to reach out and engage all economic and ethnic groups. Opportunities for members of the public to participate in program development and implementation include serving as citizen representatives on a local storm water management panel, attending public hearings, working as citizen volunteers to educate other individuals about the program, assisting in program coordination with other pre-existing programs, or participating in volunteer monitoring efforts. (Citizens should obtain approval where necessary for lawful access to monitoring sites.)

(3) Illicit Discharge Detection and Elimination

Minimum Requirements – *40 CFR 122.34(b)(3)(i-iii)*
(i) You must develop, implement and enforce a program to detect and eliminate illicit discharges (as defined at § 122.26(b)(2)) into your small MS4.

(ii) You must:

(A) Develop, if not already completed, a storm sewer system map, showing the location of all outfalls and the names and location of all waters of the United States that receive discharges from those outfalls;
(B) To the extent allowable under State, Tribal or local law, effectively prohibit, through ordinance, or other regulatory mechanism, non-storm water discharges into your storm sewer system and implement appropriate enforcement procedures and actions;
(C) Develop and implement a plan to detect and address non-storm water discharges, including illegal dumping, to your system; and
(D) Inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper disposal of waste.

(iii) You need address the following categories of non-storm water discharges or flows (i.e., illicit discharges) only if you identify them as significant contributors of pollutants to your small MS4: water line flushing, landscape irrigation, diverted stream flows, rising ground waters, uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)), uncontaminated pumped ground water, discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, dechlorinated swimming pool discharges, and street wash water (discharges or flows from fire fighting activities are excluded from the effective prohibition against non-storm water and need only be addressed where they are identified as significant sources of pollutants to waters of the United States).

Regulatory Guidance – *40 CFR 122.34(b)(3)(iv)*
EPA recommends that the plan to detect and address illicit discharges include the following four components: procedures for locating priority areas likely to have illicit discharges; procedures for tracing the source of an illicit discharge; procedures for removing the source of the discharge; and procedures for program evaluation and assessment. EPA recommends visually screening outfalls during dry weather and

conducting field tests of selected pollutants as part of the procedures for locating priority areas. Illicit discharge education actions may include storm drain stenciling, a program to promote, publicize, and facilitate public reporting of illicit connections or discharges, and distribution of outreach materials.

(4) Construction Site Stormwater Runoff Control

Minimum Requirements – *40 CFR 122.34(b)(4)(i)*
You must develop, implement, and enforce a program to reduce pollutants in any storm water runoff to your small MS4 from construction activities that result in a land disturbance of greater than or equal to one acre. Reduction of storm water discharges from construction activity disturbing less than one acre must be included in your program if that construction activity is part of a larger common plan of development or sale that would disturb one acre or more. If the NPDES permitting authority waives requirements for storm water discharges associated with small construction activity in accordance with § 122.26(b)(15)(i), you are not required to develop, implement, and/or enforce a program to reduce pollutant discharges from such sites.

(ii) Your program must include the development and implementation of, at a minimum:

(A) An ordinance or other regulatory mechanism to require erosion and sediment controls, as well as sanctions to ensure compliance, to the extent allowable under State, Tribal, or local law;
(B) Requirements for construction site operators to implement appropriate erosion and sediment control best management practices;
(C) Requirements for construction site operators to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality;
(D) Procedures for site plan review which incorporate consideration of potential water quality impacts;
(E) Procedures for receipt and consideration of information submitted by the public, and
(F) Procedures for site inspection and enforcement of control measures.

Regulatory Guidance – *40 CFR 122.34(b)(4)(iii)*
Examples of sanctions to ensure compliance include non-monetary penalties, fines, bonding requirements and/or permit denials for non-compliance. EPA recommends that procedures for site plan review include the review of individual pre-construction site plans to ensure consistency with local sediment and erosion control requirements. Procedures for site inspections and enforcement of control measures could include steps to identify priority sites for inspection and enforcement based on the nature of the construction activity, topography, and the characteristics of soils and receiving water quality. You are encouraged to provide appropriate educational and training measures for construction site operators. You may wish to require a storm water pollution prevention plan for construction sites within your jurisdiction that discharge into your system. See § 122.44(s) (NPDES permitting authorities' option to incorporate qualifying State, Tribal and local erosion and sediment control programs into NPDES permits for storm water

discharges from construction sites). Also see § 122.35(b) (The NPDES permitting authority may recognize that another government entity, including the permitting authority, may be responsible for implementing one or more of the minimum measures on your behalf.)

(5) Post-Construction Stormwater Management in New Development and Redevelopment

Minimum Requirements – *40 CFR 122.34(b)(5)(i)*
You must develop, implement, and enforce a program to address storm water runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, that discharge into your small MS4. Your program must ensure that controls are in place that would prevent or minimize water quality impacts.

(ii) You must:

(A) Develop and implement strategies which include a combination of structural and/or non-structural best management practices (BMPs) appropriate for your community;
(B) Use an ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects to the extent allowable under State, Tribal or local law; and
(C) Ensure adequate long-term operation and maintenance of BMPs.

Regulatory Guidance – *40 CFR 122.34(b)(5)(iii)*
If water quality impacts are considered from the beginning stages of a project, new development and potentially redevelopment provide more opportunities for water quality protection. EPA recommends that the BMPs chosen: be appropriate for the local community; minimize water quality impacts; and attempt to maintain pre-development runoff conditions. In choosing appropriate BMPs, EPA encourages you to participate in locally-based watershed planning efforts which attempt to involve a diverse group of stakeholders including interested citizens. When developing a program that is consistent with this measure's intent, EPA recommends that you adopt a planning process that identifies the municipality's program goals (*e.g.,* minimize water quality impacts resulting from post-construction runoff from new development and redevelopment), implementation strategies (e.g., adopt a combination of structural and/or non-structural BMPs), operation and maintenance policies and procedures, and enforcement procedures. In developing your program, you should consider assessing existing ordinances, policies, programs and studies that address storm water runoff quality. In addition to assessing these existing documents and programs, you should provide opportunities to the public to participate in the development of the program. Non-structural BMPs are preventative actions that involve management and source controls such as: policies and ordinances that provide requirements and standards to direct growth to identified areas, protect sensitive areas such as wetlands and riparian areas, maintain and/or increase open space (including a dedicated funding source for open space acquisition), provide buffers along sensitive water bodies, minimize impervious surfaces, and minimize disturbance of soils and vegetation; policies or ordinances that encourage infill development in higher density urban areas, and areas with existing infrastructure; education programs for developers

and the public about project designs that minimize water quality impacts; and measures such as minimization of percent impervious area after development and minimization of directly connected impervious areas. Structural BMPs include: storage practices such as wet ponds and extended-detention outlet structures; filtration practices such as grassed swales, sand filters and filter strips; and infiltration practices such as infiltration basins and infiltration trenches. EPA recommends that you ensure the appropriate implementation of the structural BMPs by considering some or all of the following: pre-construction review of BMP designs; inspections during construction to verify BMPs are built as designed; post-construction inspection and maintenance of BMPs; and penalty provisions for the noncompliance with design, construction or operation and maintenance. Storm water technologies are constantly being improved, and EPA recommends that your requirements be responsive to these changes, developments or improvements in control technologies.

(6) Pollution Prevention/Good Housekeeping for Municipal Operations

Minimum Requirements – *40 CFR 122.34(b)(6)(i)*
You must develop and implement an operation and maintenance program that includes a training component and has the ultimate goal of preventing or reducing pollutant runoff from municipal operations. Using training materials that are available from EPA, your State, Tribe, or other organizations, your program must include employee training to prevent and reduce storm water pollution from activities such as park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and storm water system maintenance.

Regulatory Guidance – *40 CFR 122.34(b)(6)(ii)*
EPA recommends that, at a minimum, you consider the following in developing your program: maintenance activities, maintenance schedules, and long-term inspection procedures for structural and non-structural storm water controls to reduce floatables and other pollutants discharged from your separate storm sewers; controls for reducing or eliminating the discharge of pollutants from streets, roads, highways, municipal parking lots, maintenance and storage yards, fleet or maintenance shops with outdoor storage areas, salt/sand storage locations and snow disposal areas operated by you, and waste transfer stations; procedures for properly disposing of waste removed from the separate storm sewers and areas listed above (such as dredge spoil, accumulated sediments, floatables, and other debris); and ways to ensure that new flood management projects assess the impacts on water quality and examine existing projects for incorporating additional water quality protection devices or practices. Operation and maintenance should be an integral component of all storm water management programs. This measure is intended to improve the efficiency of these programs and require new programs where necessary. Properly developed and implemented operation and maintenance programs reduce the risk of water quality problems.

ATTACHMENT B

National Marine Fisheries Service Municipal, Commercial, Residential, and Industrial (MRCI) Development Standards for a "Take" Exemption

(Source: 50 CFR 223.203(b)(12))

"...The prohibitions of paragraph (a) of this section relating to threatened species of salmonids listed in Sec. 223.102 (a)(5) through (a)(10), and (a)(12) through (a)(19) do not apply to municipal, residential, commercial and industrial (MRCI) development (including redevelopment) activities provided that:

(i) Such development occurs pursuant to city, county, or regional government ordinances or plans that NMFS has determined are adequately protective of listed species; or within the jurisdiction of the Metro regional government in Oregon and pursuant to ordinances that Metro has found comply with its Urban Growth Management Functional Plan (Functional Plan) following a determination by NMFS that the Functional Plan is adequately protective. NMFS approval or determinations about any MRCI development ordinances or plans, including the Functional Plan, shall be a written approval by NMFS Northwest or Southwest Regional Administrator, whichever is appropriate. NMFS will apply the following 12 evaluation considerations when reviewing MRCI development ordinances or plans to assess whether they adequately conserve listed salmonids by maintaining and restoring properly functioning habitat conditions:

(A) MRCI development ordinance or plan ensures that development will avoid inappropriate areas such as unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites.

(B) MRCI development ordinance or plan adequately avoids stormwater discharge impacts to water quality and quantity, or to the hydrograph of the watershed, including peak and base flows of perennial streams.

(C) MRCI development ordinance or plan provides adequately protective riparian area management requirements to attain or maintain PFC around all rivers, estuaries, streams, lakes, deepwater habitats, and intermittent streams. Compensatory mitigation is provided, where necessary, to offset unavoidable damage to PFC due to MRCI development impacts to riparian management areas.

(D) MRCI development ordinance or plan avoids stream crossings by roads, utilities, and other linear development wherever possible, and where crossings must be provided, minimize impacts through choice of mode, sizing, and placement.

(E) MRCI development ordinance or plan adequately protects historic stream meander patterns and channel migration zones and avoids hardening of stream banks and shorelines.

(F) MRCI development ordinance or plan adequately protects wetlands and wetland functions, including isolated wetlands.

(G) MRCI development ordinance or plan adequately preserves the hydrologic capacity of permanent and intermittent streams to pass peak flows.

(H) MRCI development ordinance or plan includes adequate provisions for landscaping with native vegetation to reduce need for watering and application of herbicides, pesticides and fertilizer.

(I) MRCI development ordinance or plan includes adequate provisions to prevent erosion and sediment run-off during construction.

(J) MRCI development ordinance or plan ensures that water supply demands can be met without impacting flows needed for threatened salmonids either directly or through groundwater withdrawals and that any new water diversions are positioned and screened in a way that prevents injury or death of salmonids.

(K) MRCI development ordinance or plan provides necessary enforcement, funding, reporting, and implementation mechanisms and formal plan evaluations at intervals that do not exceed five years.

(L) MRCI development ordinance and plan complies with all other state and Federal environmental and natural resource laws and permits.

(ii) The city, county or regional government provides NMFS with annual reports regarding implementation and effectiveness of the ordinances, including: any water quality monitoring information the jurisdiction has available; aerial photography (or some other graphic display) of each MRCI development or MRCI expansion area at sufficient detail to demonstrate the width and vegetation condition of riparian set-backs; information to demonstrate the success of stormwater management and other conservation measures; and a summary of any flood damage, maintenance problems, or other issues.

(iii) NMFS finds the MRCI development activity to be consistent with the conservation of listed salmonids' habitat when it contributes to the attainment and maintenance of PFC. NMFS defines PFC as the sustained presence of a watershed's habitat-forming processes that are necessary for the long-term survival of salmonids through the full range of environmental variation. Actions that affect salmonid habitat must not impair properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long-term progress of impaired habitat toward PFC. Periodically, NMFS will evaluate an approved program for its effectiveness in maintaining and achieving habitat function that provides for conservation of the listed salmonids. Whenever warranted, NMFS will identify to the jurisdiction ways in which the program needs to be altered or strengthened. Changes may be identified if the program is not protecting desired habitat functions, or where even with the habitat characteristics and functions originally targeted, habitat is not supporting population productivity levels needed to conserve the ESU. If any jurisdiction within the limit does not make changes to respond adequately to the new information in the shortest amount of time feasible, but not longer than one year, NMFS will publish notification in the Federal Register announcing its intention to withdraw the limit so that take prohibitions would then apply to the program as to all other activity not within a limit. Such an announcement will provide for a comment period of not less than 30 days, after which NMFS will make a final determination whether to subject the activities to the ESA section 9(a)(1) prohibitions.

(iv) Prior to approving any city, county, or regional government ordinances or plans as within this limit, or approving any substantive change in an ordinance or plan within this limit, NMFS will publish notification in the Federal Register announcing the availability of the ordinance or plan or the draft changes for public review and comment. Such an announcement will provide for a comment period of no less than 30 days."

Identifying Sites for "Street Edge Alternatives"

The City of Mount Vernon is interested in identifying sites for "street edge alternatives" to promote infiltration along city streets. Street edge alternatives incorporate strategic site planning with micro-management techniques to achieve environmental protection, while allowing for development or infrastructure rehabilitation to occur. There are budgetary and environmental limitations that affect where the types of street edge alternative facilities discussed in this report are most applicable. Therefore it is necessary first to identify areas where the approach is feasible and second, areas with highest priority for implementation. This section describes the criteria, methodology, results and conclusions from an analysis of feasible and high priority locations for application of street edge alternative facilities.

Street Edge Alternative Concept

Street Edge Alternatives are also referred to as low impact development (LID) and natural drainage systems (NDS). LID involves practices such as incorporating existing land contours, native vegetation, native soil, longer time of concentration, natural drainage systems, raingardens, less effective impervious area and clumping (to name a few) in the initial development of the land, that result in less stormwater runoff.

Level of Service

Prioritization of street edge alternatives projects will require information on the selected level of service associated with each potential project site. Levels of service generally include:

- Traditional drainage system (curb and gutter, pipe and detain)
- Natural drainage system without sidewalks or curved streets
- Natural drainage system with sidewalks and curved streets

The City of Seattle implemented several variations of street edge alternatives projects. The SEA Streets model includes full re-development of a residential street right-of-way, including vegetated swales, a curvilinear street, and a sidewalk on one side of the street. The 110th Cascade model includes a series of stair-stepped natural pools, with extensive tree and shrub cover on one side of the roadway and a sidewalk on the opposite side. The High Point re-development incorporates street edge alternatives into a 129-acre housing development. This project differs from other street edge alternatives projects in that it integrates natural drainage elements into a traditional curb, gutter, and sidewalk approach throughout a highly dense area.

The City of Mount Vernon will need to prioritize which of these street edge alternatives variations is most appropriate for each project selected. Implementation decisions will be based on site characteristics, cost/benefit analysis, and community input. The SEA Streets model can be very costly, if it includes full re-development of the street and sidewalk within the right-of-way. The Cascade model is most appropriate for steep residential streets. Incorporating sidewalks and curvilinear streets adds cost to street edge alternatives projects, but also provides safety and aesthetic benefits to the immediate neighborhood surrounding the project. The City of Mount Vernon must work with the neighborhood residents to determine the correct level of service (size and scale) for each individual street edge alternatives project.

Criteria for Candidate Project Sites

The following criteria were used to identify potential project sites for street edge alternative drainage implementation. These criteria include:

- Areas of the City not served by a combined sewer system
- Roadway grade from 1 percent to 4 percent
- Areas without clay soils
- Residential streets only (no arterials)
- Sites with existing flooding problems or known drainage problems

Methodology

Geographic information systems (GIS) technology was used to screen and map candidate street edge alternatives project sites. GIS allows one or more criteria to be applied to a specific geographic area to produce a map of potential street edge alternatives project sites.

The areas in the City of Mount Vernon that meet the basic criteria described above were identified using GIS. Areas were excluded that have roadway slopes greater than 8 percent, steep slopes and 300-foot buffers around those steep slopes, clay soils, arterial streets, or combined sewer systems. This analysis provided an initial sense of which areas are potentially suitable for a street edge alternatives, based on physical characteristics (slope, soils, and drainage system).

Once the areas with inadequate physical characteristics were excluded, an analysis of the existing flooding and drainage problems throughout the City were reviewed. These areas were identified by consulting with the City of Mount Vernon Public Works staff and the Comprehensive Surface Water Management Plan, 1995. The resulting sites were identified as high priority for street edge alternatives, based on their physical characteristics and the community issues surrounding them (see Figure 1).

The GIS analysis identified potential candidate sites for street edge alternatives implementation, based on an objective set of established screening criteria. The general topography in the City has slopes that range from zero in the lower areas to 96 percent around Little Mountain. The upper reaches of Maddox Creek, Flower Creek, and Carpenter Creek are situated in ravines with sideslopes of 35 to 45 percent.

The cumulative results of this screening process identify high-priority sites that meet all of the screening criteria. These sites have the appropriate roadway slopes and soil conditions, have existing drainage problems, are not on arterial roadways and are located in traditional ditch and culvert drainage areas for street edge alternatives implementation.

Site Visit

Additional analysis will be necessary to make final selections of sites. Field investigations may provide additional information regarding feasibility. Although the GIS results are useful for initial planning, selection of individual project sites requires a much more detailed process that includes site visits to verify physical characteristics and a detailed community involvement process conducted to gain buy-in from residents that would be affected by project implementation.

Community Involvement

A comprehensive community involvement strategy is required to select final candidate sites for street edge alternatives implementation. This strategy will include:

- A survey of neighborhood residents to determine their willingness to participate in a street edge alternatives project
- Community meetings to explain street edge alternatives concepts, costs/benefits, and risks, and to solicit feedback and design considerations from potential affected neighbors
- City-resident partnership agreements once final site locations are determined
- Ongoing communication with residents (e.g., newsletters, meetings) during site design and construction phases

Final street edge alternatives project sites should be selected with the approval of the affected neighbors. Residents should agree to the location and design of the project, as well as to any financial and/or maintenance agreements with the City related to the project.

Project Selection Policy Decisions

The City of Mount Vernon will need to address several challenging policy issues when prioritizing and selecting street edge alternatives project sites, including:

- How will project sites be distributed geographically throughout the City?
- How will environmental issues (flooding, water quality, habitat) be prioritized in the selection of project sites? Is protecting salmon in one watershed more important than preventing flooding in another watershed?
- How will the appropriate scale and level of service for individual projects be determined?
- What maintenance agreements with residents will be needed at project sites?
- Will residents be asked to contribute financially to street edge alternatives projects?

These policy issues are summarized in Figure 5-8.

SPU NDS Policy Issues

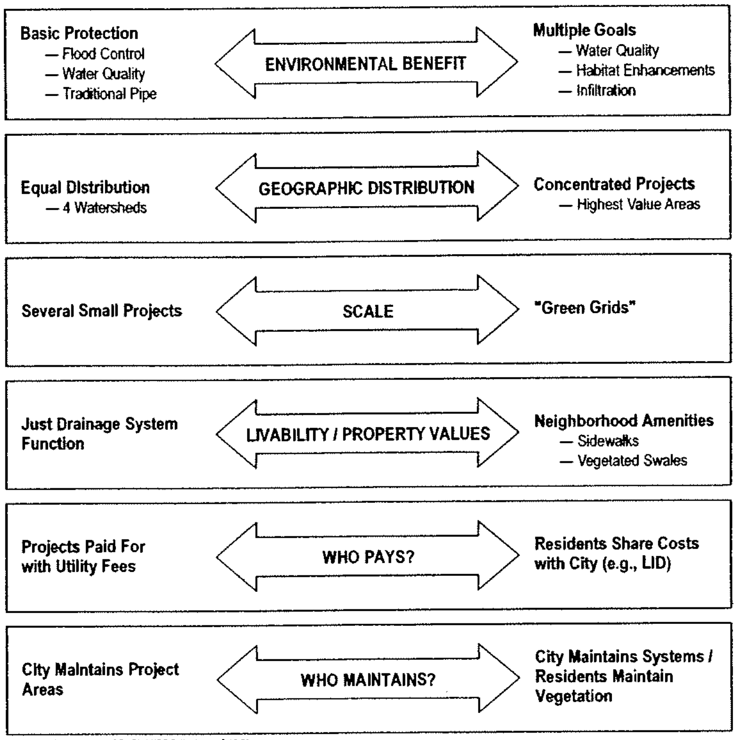

Figure 5-8

Maintenance Agreements

The City of Mount Vernon should make a policy decision regarding the maintenance practices required for various street edge alternatives projects. Residents might be expected to maintain the landscaping and vegetation associated with individual street edge alternative installations. This maintenance agreement should be described in all communications with neighbors in a potential project site area. Residents must agree to support the level of maintenance required for the selected street edge alternatives level of service.

Financial Assistance

The City of Mount Vernon could pursue an option for creating financial partnerships with neighborhood residents in areas that receive street edge alternative projects. This option could be included in community outreach surveys to potential candidate project site recipients. A financial partnership could include a Local Improvement District (LID) or some other form of short-term arrangement between the City and neighborhood residents for project development.

Considerations for the Future

In the future, it might be appropriate to revisit the issue of excluding areas with combined sewers. Applying street edge alternatives would reduce the amount of water entering the combined system, thus reducing the costs of conveyance and treatment of the combined sewage. Proper application of a street edge alternatives approach should eliminate the need for treatment of stormwater runoff.

Expanding the concept to private properties as they are rebuilt could provide further advantages in all areas, including areas with combined sewers. If homeowners collected rooftop runoff, which is relatively clean, and used it to flush toilets, wash clothes, or irrigate, there would be substantial benefits to the City's natural resources and infrastructure costs. In a residential area, approximately one-third of the impervious area is rooftops. If this source of runoff were eliminated, there would be a corresponding reduction of runoff entering either the stormwater system or the combined sewer system during peak flows.

Toilet flushing and clothes washing are responsible for nearly half the water consumption year round in residences. In the summer, peak demand for water is driven largely by landscape irrigation. If an alternate source, such as rooftop runoff could be used for these tasks, there could be a reduction of as much as half the demand for domestic water in residential areas. This would in turn reduce the public cost of infrastructure for the water system and would allow more water to be left in the rivers that supply the City's water. These rivers are productive salmon habitat, and reducing the water demand would benefit that habitat. In terms of abundance and diversity of fish, habitat improvements in these rivers would far outweigh improvements in urban streams.

ATTACHMENT C

Tri-County Proposal – Model Planning Policies

Overview:
It is the intent of the Tri-County proposal to use the process established under the Growth Management Act ("GMA") (Ch. 36.70A RCW), to have individual jurisdictions ensure their planning policies and thus their implementing regulations, adequately address issues related to salmonids. With the adoption of the GMA, the seemingly logical step of a direct link between policies and implementing regulations and programs became mandated. For the purpose of this Model program, local jurisdictions that don't already have the requisite policy basis to provide protection for listed species should adopt relevant and appropriate model planning policies, either through the regional process of adopting countywide planning policies and/or through the adoption of planning elements of individual comprehensive plans.

The following is a list of proposed Model Planning Policies (MPPs) which jurisdictions planning under GMA that need to adopt policies may consider in order to provide the policy basis to conserve salmonids listed under the Endangered Species Act. While the Tri-County Model suggests the use of the county-wide planning policy process, it also recognizes the same end can be achieved by local jurisdictions individually adopting comprehensive plan policies covering the same topics.

General:
<u>Model Policy No. 1:</u> The county and cities should protect and enhance the natural ecosystems through comprehensive plan policies and development regulations that reflect natural constraints and protect sensitive features.

Discussion:

> *Regulate land use and development in a manner which respects fish and wildlife habitat in conjunction with natural features and functions (water quality, hydrologic and hydraulic functions, vegetation retention, etc.).*
>
> *Manage natural resources and the built environment to protect, improve and sustain environmental quality while minimizing public and private costs.*
>
> *Adopt an ecological approach to improving in-stream habitat including the establishment of water quality and quantity parameters to address impacts to critical fish species.*
>
> *Work towards reducing the total effective impervious surface area within individual development sites and also within watershed[1] basins or larger geographic boundaries.*

---

[1] A "watershed" is a geographic area that drains toward or contributes flow to the stream or river of interest. The geographic limits of the watershed are defined by the points at which the topography breaks to drain surface water into the tributaries which feed the stream or river system.

Model Policy No. 2: The county and cities should preserve, protect and, where possible, restore natural habitat critical for the conservation of salmonid species listed under the federal Endangered Species Act, through the adoption of comprehensive plan policies that seek to protect, maintain or restore aquatic ecosystems, associated habitats and aquifers through the use of management zones, development regulations, incentives for voluntary efforts of private landowners and developers, land use classifications or designations, habitat acquisition programs or habitat restoration projects.

Discussion:

Designate fish and wildlife habitat conservation areas[2] *as a priority for acquisition programs such as Conservation Futures and Floodplain Buyout programs*

Utilize incentive programs to encourage the preservation and/or restoration of critical habitat areas.

- *Counties should adopt a Public Benefit Rating System under the Current Use Assessment Program (RCW 84.34) that includes a higher priority for fish and wildlife habitat conservation areas.*
- *All jurisdictions should provide other types of incentive programs such as Transfer of Development Rights (TDR) and Purchase of Development Rights programs.*

Consider fish and wildlife habitat conservation areas when designating land use designations and companion zoning regulations.

Amend existing critical area regulations, as necessary, to protect fish and wildlife habitat conservation areas from development impacts.

Coordination of Watershed Planning and Land Use Planning:

Model Policy No. 3: The county and cities should protect the natural habitat critical for the conservation of salmonid species listed under the federal Endangered Species Act, through the adoption of comprehensive plan policies which encourage the use of planning activities or study techniques that are capable of determining changes in stream hydrology and water quality under different land use scenarios at full build-out of designated land use classifications.

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[2] The term "fish and wildlife habitat conservation area" is defined in RCW 36.70A.030(5).

Inter-jurisdictional Cooperation:

Model Policy No. 4: All jurisdictions shall work together to identify and protect natural habitat networks that cross jurisdictional boundaries.

Discussion:

Networks shall link large protected or significant blocks of fish and wildlife habitats within and between jurisdictions to achieve a continuous countywide network.

Networks shall be mapped and displayed in comprehensive plans and may be incorporated into open space/greenbelt corridor maps.

Establish informational sharing workshops or present information at established coordinating committees.

Whenever possible, utilize watershed boundaries instead of jurisdictional boundaries for plans and studies.

Model Policy No. 5: All jurisdictions shall coordinate watershed/aquatic restoration planning and implementation activities within a watershed.

Discussion:

Consider the implications of planning and implementation activities not only within jurisdictional boundaries, but also the implications of decisions and activities on habitat for critical fish species that is located outside jurisdictional boundaries but within the shared watershed.

Model Policy No. 6: All jurisdictions shall cooperatively work together to create and adopt modifications to their Critical Areas Regulations that include the best available science for the protection of existing habitat, wetlands, estuaries, riparian areas by avoiding negative impacts.

Discussion:

Provide for the removal of invasive species and the replanting of natural vegetation.

Support local community groups in critical habitat restoration and enhancement efforts through reduced or waiver of permit fees and streamlined permitting procedures.

Provide incentives to encourage landowners to retain, enhance, or restore critical habitat.

Development Standards:
Model Policy No. 7: Upon adoption of a state classification system, the cities and the county shall work together to establish a single system for stream typing.

Model Policy No. 8: All jurisdictions shall maintain or enhance water quality through control of runoff and best management practices to maintain natural aquatic communities and beneficial uses.

Monitoring, Best Available Science and Adaptive Management:
Model Policy No. 9: All jurisdictions shall establish a monitoring and evaluation method, which is designed to determine the effectiveness of restoration, enhancement, and recovery strategies for listed species.

Discussion:

> *Monitoring and evaluation strategies should be linked to future policy choices and management actions.*
>
> *Adoption of local plans, which include Conservation Plans or watershed basin plans, and regulations, should include monitoring and evaluation criteria and timelines for conducting such activities.*
>
> *Fish and wildlife habitat preservation or restoration plans, prepared by applicants who are proposing developments within critical habitat areas designated under Critical Area Regulations adopted pursuant to GMA and/or identified under SEPA, should include monitoring and evaluation criteria and timelines for conducting such activities.*
>
> *At a minimum, monitoring and evaluation techniques should address:*
> - *Pre-development conditions including data on species viability and habitat, and when appropriate, watershed quality.*
> - *A discussion of the limiting factors related to the proposal and suggested methods to eliminate a potential "take" of the species as a result of the proposal.*
> - *A commitment to change conservation approaches if monitoring data indicates a potential degradation of the listed species.*
>
> *Develop complementary, coordinated, integrated, and flexible approaches for the collection, analysis, and sharing of monitoring information (e.g., GIS data, hydrologic and hydraulic analysis, etc.).*

Model Policy No. 10: All jurisdictions shall recognize that the best available science to address listed species recovery issues is evolving. Each jurisdiction shall apply an adaptive management strategy to determine how well the objectives of listed species recovery and critical habitat preservation/restoration are being achieved.

Discussion:

Incorporate the results of pilot developments into land use regulations, zoning, and technical standards.

Model Policy No. 11: The counties and the cities shall ensure that any proposal to consider moving the current[3] UGA boundary provide at least the same level of protection afforded salmonid species habitat pursuant to the area's previous rural or resource designation. If the UGA is expanded prior to the completion of WRIA conservation plans, rural or resource standards previously applied to the areas will be maintained UNLESS a biological assessment has been conducted and demonstrates that revised standards are justifiable.

Discussion:

Continue the use of the rural standards in areas later designated to be within the urban growth area unless a study has been done to identify other protective measures that will be equal to those previously in plac

[3] The "current" UGA boundary refers to the boundary adopted as of the date the jurisdiction receives a take limit from the NMFS or USFWS.

Appendix C
Storm Drainage Capital Improvement Plan Projects

- 1995 Plan Projects and Disposition
- Detailed CIP Sheets for Select Projects

TABLE X-1
City of Mount Vernon Capital Improvement Plan from 1995 RW Beck Comprehensive Surface Water Management Plan

Problem Number	Location	1995 Cost	Disposition
Regional System Problems			
RS1	Construct new Riverbend Road (Freeway Drive) System	$1,750,000	Not yet completed
RS1	Design new Riverbend Road (Freeway Drive) System	$242,000	Not yet completed
RS2	Install two additional 36-inch culverts at Parker Way	$13,000	Completed or not needed
RS3	Culvert replacement at College Way update price	$109,000	Completed or not needed
RS4a	Kulshan Creek Pump Station Phase I (1)	$3,339,000	Completed or not needed
RS4b	Kulshan Creek Pump Station Phase II – Beyond 20 Years	$672,000	Not yet completed
RS6	Little Mountain Estates Detention Pond modifications	Developer Build	Not yet completed
RS7	Erosion control on Maddox Creek	$393,000	In progress. Shared funding.
RS8	Maddox Creek-Drainage District 17 Study	$44,000	?
Local System Problems			
LS6	Install log bed control weir to control erosion north of Cedar Lane	$11,000	Not yet completed
LS7	MH drop structure and pipe extension on Kulshan tributary near Viewmount	$48,000	Not yet completed
LS8	Culvert replacement along N 16th north of Florence	$29,000	Completed or not needed
LS9	Park Village Mobile Home Park	$53,000	Completed or not needed
LS10	Culvert replacement at Kiowa and Seneca	$22,000	Completed or not needed
LS11	Install trashrack at storm drain inlet near Kiowa and Nez Perce	$500	Not yet completed
LS12	Replace storm drain system in W. Mount Vernon along Memorial Highway	$557,000	Not yet completed
LS13	Install additional catchbasins at Wall Street and Garfield Street	$14,000	?

TABLE X-1
City of Mount Vernon Capital Improvement Plan from 1995 RW Beck Comprehensive Surface Water Management Plan

Problem Number	Location	1995 Cost	Disposition
LS14	Install new catchbasin and storm drain connection at Wall Street north of Memorial Hwy	$40,000	Not yet completed
LS15	Replace 16 of the storm drains between Division and Fir just west of LaVenture	$371,000	Not yet completed
LS16	Install log bed control weir in stream between Mohawk and Apache	$11,000	Not yet completed
LS17	Install culvert and ditch at Comanche Drive	$14,000	Not yet completed
LS18	Culvert replacement at Shoshone east of Sioux	$24,000	Not yet completed
LS19	Install armoured spillway in two detention ponds near Waugh and Division	$59,000	Not yet completed
LS20	Install storm drain west of S 6th up to Lind and connect to Maddox tributary	$155,000	Not yet completed
LS22	Install catchbasin and storm drain connection for the NW corner of Riverside and Fir	$100,000	Completed or not needed
LS23	Install storm drain connection along I-5 between Cameron and Kulshan Pump Station	$73,000	Completed or not needed
LS25	Replace 3 pipes between Britt Slough and Blackburn Road	$284,000	Completed or not needed
LS26a	Upgrade drainage system on Fox Hill Street – Replace Pipes in Street	$235,000	Completed or not needed
LS26b	Upgrade drainage system on Fox Hill Street – Install Pipe in Deep Ditch	$66,000	Completed or not needed
LS27	Replace 2 pipes along I-5 between Blackburn and Anderson Road	$50,000	In progress
Water Quality Problems			
WQ1	Water Quality Monitoring Program	$39,000	Completed or not needed
WQ3	Oil/water separators	$328,000	Not yet completed

TABLE X-1
City of Mount Vernon Capital Improvement Plan from 1995 RW Beck Comprehensive Surface Water Management Plan

Problem Number	Location	1995 Cost	Disposition
Environmental Resource Problems			
E1	Kulshan Creek Pump Station – Fish ladder	Included in RS4	Completed or not needed
E2	Manhole barrier in Kulshan east of Railroad	$2,000	Not yet completed
E3	Log weir fish structure – Kulshan Creek north of Cedar Lane	$11,000	Not yet completed
E4	Restore channel on Kulshan from Riverside to N 18th (2,200 feet)	$104,000	Not yet completed
E5	Restore channel on mainstem of Trumpeter (7,000 feet)	$328,000	Not yet completed
E10	Remove Culvert and restore stream channel on Maddox near Anderson	$40,000	Completed or not needed (Centennial grant through Skagit County to be used??)
E11	Log weir fish passage structure d/s of culvert on Maddox Creek at Blackburn Road	$11,000	
E13	Add riparian vegetation on Flowers Creek between Maddox and Blodgett (1,500 feet)	$38,000	Not yet completed
E14	Log weir fish passage structure on Flowers Creek at Blodget Road	$11,000	Not yet completed
E15	Restore channel on Carpenter Creek along Bacon Road (1,600 feet – one side)	$21,000	Not yet completed

Mount Vernon **Comprehensive Stormwater Management Plan Update**

CIP ITEM # D-01-02: Maddox Creek Restoration and Pond Retrofit

Location

Maddox Creek at S. 27th and
Section ____

Concerns

- Failed detention pond causing drainage and water quality treatment problems

Proposed Action

- Retrofit failed detention pond
- Re-channelize Maddox Creek
- Re-plant site

Benefits

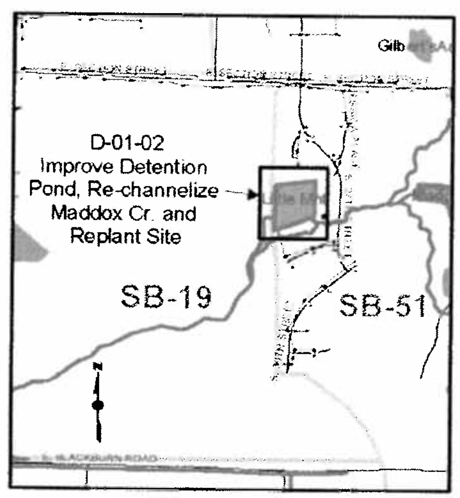
- Improved drainage and water quality treatment
- Separation of Maddox Creek from failed detention pond
- Elimination of jurisdictional wetlands from detention pond

Costs

Engineering:	$10,000
Construction:	$40,000
	$50,000

Revenue Source

City Surface Water Utility Fund



Linkage to Other Projects

CFP #	Project
D-99-05	Digby Road and Woodland Drive Stream Enhancement
T-00-04	Digby Road Improvements and Maddox Creek Relocation

- ☒ In Prior Plan and in Progress
- ☒ In Prior Plan and Appropriated
- ☐ In Prior Plan but not Appropriated
- ☐ New Project
- ☒ Consistent with Comprehensive Plan

Mount Vernon

Comprehensive Stormwater Management Plan Update

CIP ITEM # D-05-03: West Mount Vernon Storm Surface Main Upgrade

Location

West Mount Vernon Storm Station

Concerns

- Storm sewer surcharges
- Localized flooding

Proposed Action

- Construct 75 feet of 18-inch ductile pipe from pump discharge through dike

Benefits

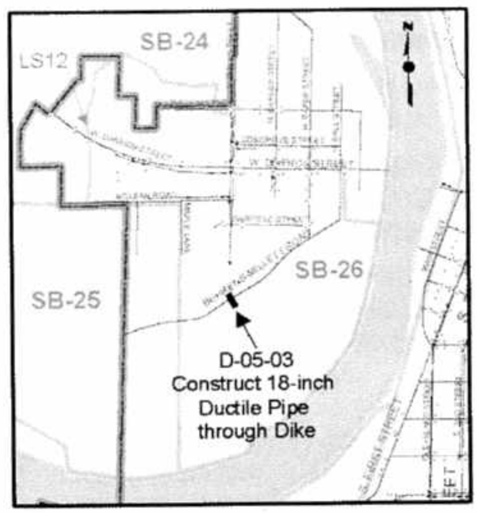
- Surcharging and flood reduction and consequent liability reduction for damages

Costs

Engineering:	$10,000
Construction:	$25,000
	$35,000

Revenue Source

City Surface Water Utility Fund



Linkage to Other Projects

CFP #	Project

- ☐ In Prior Plan and in Progress
- ☐ In Prior Plan and Appropriated
- ☐ In Prior Plan but not Appropriated
- ☒ New Project
- ☒ Consistent with Comprehensive Plan

CIP ITEM # D-94-11: Erosion Problem Repairs

Location

Trumpeter Creek between Mowhawk and Apache, east of Comanche

Concerns

- Erosion along portion of Southwest Fork of Trumpeter Creek
- Sedimentation

Proposed Action

- Install bed control weirs
- Restore stream channel between Mowhawk and Apache

Benefits

- Control and prevention of erosion and sedimentation

Costs

Engineering:	$2,100
Construction	$9,900
	<u>$12,000</u>

Revenue Source

City Surface Water Utility Fund

Linkage to Other Projects

CFP #	Project

- ☐ In Prior Plan and in Progress
- ☐ In Prior Plan and Appropriated
- ☒ In Prior Plan but not Appropriated
- ☐ New Project
- ☒ Consistent with Comprehensive Plan

CIP ITEM # D-94-14: Log Fish Weir Structure

Location

Tributary to Kulshan Creek near Cedar Lane

Concerns

- Partial fish barrier created by 1-foot drop in culvert outlet

Proposed Action

- Place log weirs at culvert outlet to facilitate fish passage

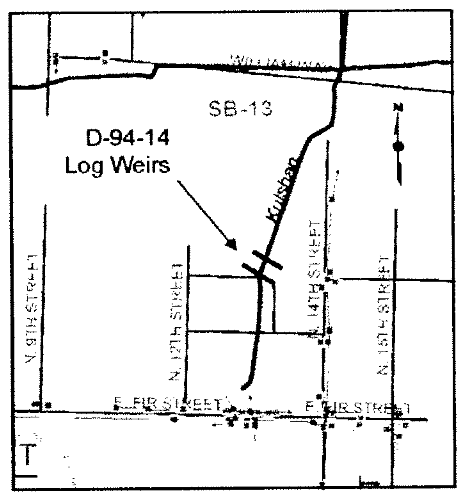
Benefits

- Improved fish habitat
- Increased fish population and survival rate

Costs

Engineering:	$2,100
Construction:	$10,400
	<u>$12,500</u>

Revenue Source



Linkage to Other Projects

CFP #	Project
D-94-07	Cedar Lane Erosion Control

- ☐ In Prior Plan and in Progress
- ☐ In Prior Plan and Appropriated
- ☒ In Prior Plan but not Appropriated
- ☐ New Project
- ☒ Consistent with Comprehensive Plan

Mount Vernon Comprehensive Stormwater Management Plan Update

CIP ITEM # LS1: 700-Foot Long Berm along Hoag Road

Location

Hoag Road west of LaVenture Road

Concerns

- Flooding during high water events in the Skagit River

Proposed Action

- Construct 700-foot-long berm along the north side of Hoag Road to an elevation of 385 feet

Benefits

- Flood reduction and consequent liability reduction for damages

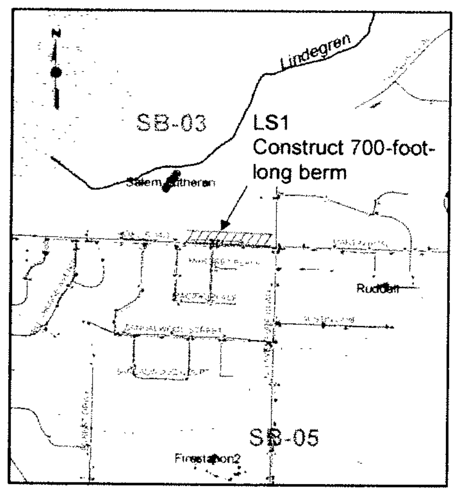
Costs

Engineering: $29,000
Construction: $290,000

$319,000

Revenue Source

City Surface Water Utility Fund



Linkage to Other Projects

CFP #	Project

- ☐ In Prior Plan and in Progress
- ☐ In Prior Plan and Appropriated
- ☒ In Prior Plan but not Appropriated
- ☐ New Project
- ☒ Consistent with Comprehensive Plan

CIP ITEM # LS12: Replacement of Storm Drain System in W. Mount Vernon along Memorial Highway

Location

Memorial Highway west of S. Wall Street

Concerns

- Localized flooding along Memorial Highway (SR 536) due to insufficient capacity in storm drain system

Proposed Action

- Replace 1,700 feet of 12-inch storm drainage pipe with 30-inch pipe

Benefits

- Flood reduction and consequent liability reduction for damages

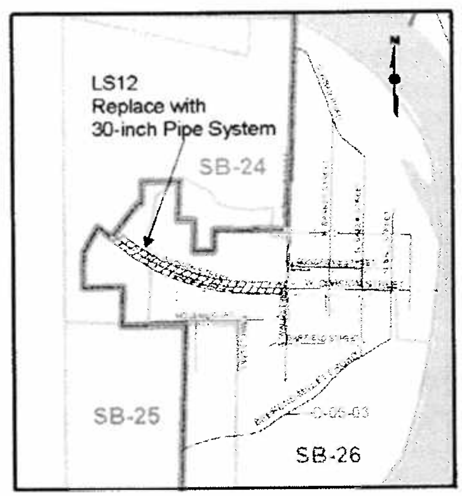
Costs

Engineering: $118,800
Construction: $673,200

<u>$792,000</u>

Revenue Source

City Surface Water Utility Fund



Linkage to Other Projects

CFP #	Project

- ☐ In Prior Plan and in Progress
- ☐ In Prior Plan and Appropriated
- ☒ In Prior Plan but not Appropriated
- ☐ New Project
- ☒ Consistent with Comprehensive Plan

Mount Vernon Comprehensive Stormwater Management Plan Update

CIP ITEM # X: Freeway Drive Force Main Replacement

Location

Along Freeway Drive, north of College Way, detention pond and pump station near Lowe's Hardware

Concerns

- Inadequate conveyance capacity for predicted future development flows

Proposed Action

- Replace 2,600 linear feet of existing 12-inch stormwater conveyance pipe with 18-inch ductile iron pipe (DIP)

Benefits

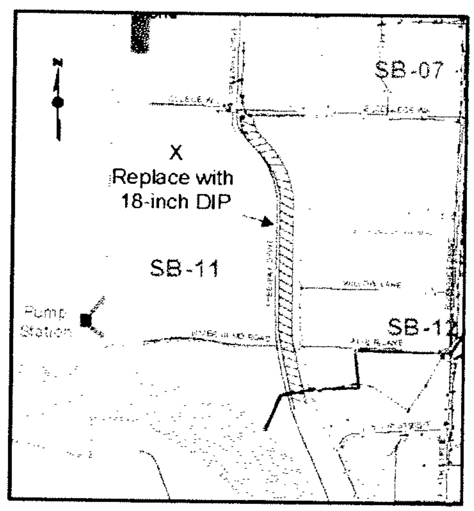
- Capacity to convey stormwater flows from predicted future development

Costs

Engineering:	$80,000
Construction:	$685,000
	$765,000

Revenue Source

City Surface Water Utility Fund



Linkage to Other Projects

CFP #	Project

- ☐ In Prior Plan and in Progress
- ☐ In Prior Plan and Appropriated
- ☒ In Prior Plan but not Appropriated
- ☐ New Project
- ☒ Consistent with Comprehensive Plan

Comprehensive Stormwater Management Plan Update

CIP ITEM # LS15: Replacement of 16 Storm Drains between E. Division and E. Fir, West of N. LaVenture

Location

Between E. Division Street and E. Fir Street, West of N. LaVenture Road, including portions of Stanford Drive, Streeter Place, N. 21st Street and Fir Street

Concerns

- Localized flooding affecting several homes at the intersection of Division Street and South 20th Street
- Insufficient capacity in conveyance system north of Division Street for 10-year design flows

Proposed Action

- Replace 2,350 feet of undersized 15-inch to 24-inch CMP/CP storm drainage pipes with 24-inch to 36-inch CP and HDPE pipes along portions of streets identified in location description above

Benefits

- Flood reduction and consequent liability reduction for damages

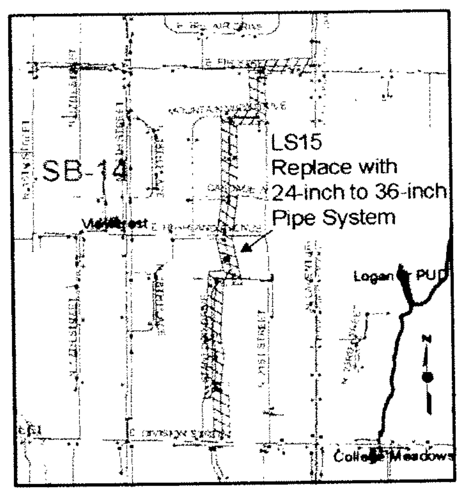
Costs

Engineering: $79,200
Construction: $448,800

<u>$528,000</u>

Revenue Source

City Surface Water Utility Fund



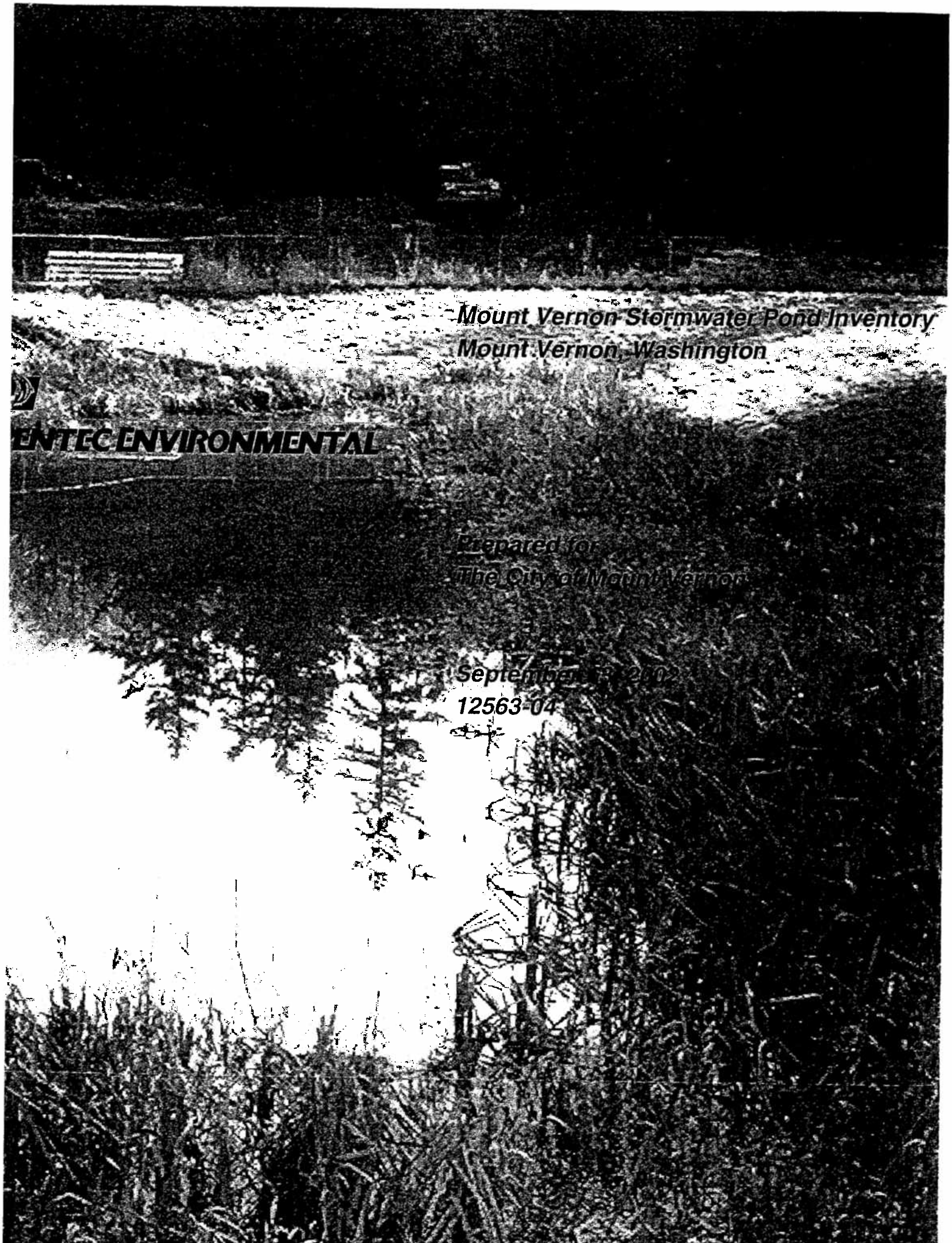
Linkage to Other Projects

CFP #	Project

☐ In Prior Plan and in Progress
☐ In Prior Plan and Appropriated
☒ In Prior Plan but not Appropriated
☐ New Project
☒ Consistent with Comprehensive Plan

Appendix D
Operations and Maintenance

- Pentec Environmental's Mount Vernon Stormwater Pond Inventory



Mount Vernon Stormwater Pond Inventory
Mount Vernon, Washington

ENTEC ENVIRONMENTAL

Prepared for
The City of Mount Vernon

September [illegible], 2002
12563-04

Mount Vernon Stormwater Pond Inventory
Mount Vernon, Washington

Prepared for
The City of Mount Vernon

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MOUNT VERNON STORMWATER INVENTORY

INTRODUCTION

The City of Mount Vernon (City) contracted with Pentec Environmental (Pentec) to conduct an inventory of the City's stormwater detention facilities. This report documents the findings of the inventory of all stormwater ponds that are known by City staff to be the responsibility of the City. The report will be used by the City to form the basis of an ongoing maintenance program and cost estimates for the stormwater ponds for which the City is responsible.

This report includes information collected from the City's files, information collected during site visits to each pond, and detailed knowledge of the stormwater system conferred by City Wastewater Utility staff.

METHODS

The stormwater pond inventory was conducted by Michael Muscari and Mary Lear of Pentec, and John Dilley, lead operator for the City's Wastewater Utility. The field survey was completed between February 20 and April 11, 2002.

At each pond a Trimble Pathfinder Pro XRS global positioning system (GPS) was used to map the boundaries of the pond. The Trimble GPS has a horizontal precision to less than 1 meter (m), and at most ponds the precision was to less than 0.5 m. A level scope mounted on a tripod and staff gage were used to take relative elevation measurements. At a minimum, relative elevations were taken at the invert of the outlet, at the top of berm, and at the emergency overflow. The area of each pond, derived from the GPS data, and the relative elevations were used to calculate an approximate live storage volume for each of the ponds that have a flow control structure (FCS). The few ponds and swales without flow control structures were assumed to have little if any detention and so were not included in the calculations. These volume estimates are approximations only. An accurate measurement of volume would require a detailed topographic survey because of the varying slopes at most of the ponds. A detailed topographic study was not within the scope of this project.

Digital photographs were taken of each pond. Rough sketches were made at each site to document features such as inlet pipes, outlet pipes, FCS, spillways, etc. Sketches and photographs of each pond are included on the summary sheets. The lids were removed at every FCS to inspect the design and condition of standpipes and other flow restricting devices. It was not in the scope of this project to enter the subterranean FCS vaults, so only information readily seen or measured from outside the hole was collected. A staff gage was used at each FCS to take approximate measurements of sediments in the vaults.

The information collected on the condition and function of the ponds was used to assign a maintenance priority rating. The purpose of the priority rating is to provide the City with a decision-making tool for scheduling improvements, repairs, and maintenance. Rating scores of High, Medium, and Low were given based on the conditions seen on the day of the site visit. Ponds were given a rating score based on the following scale.

- **High**—In need of immediate maintenance or repairs (sediment clogging FCS, berm erosion, sediment in pond or swale restricting flow, etc.);
- **Medium**—Repairs or maintenance needed but not urgent to function of detention pond (sediment in FCS but not clogging orifice, access road needs improvements or maintenance, remove small amount of vegetation from outlet); or
- **Low**—No repairs needed, maintain on regular schedule (mow to prevent invasive plant growth, check FCS for sediment, check outlet and inlet).

In consultation with City staff a cost estimate was made for recommended repairs and maintenance at each pond. The cost estimates are provided in Table 2.

DEFINITIONS AND ACRONYMS

Wet pond—Ponds constructed with the invert of the outlet pipe at a higher elevation than the bottom of the pond, resulting in permanent standing water at least 1 foot deep, but generally greater than 2 feet deep.

Dry pond—Ponds constructed with the invert of the outlet pipe at the same, or at only a slightly higher, elevation than the bottom of the pond. Dry ponds typically do not retain water more than a few days following a storm, but can have standing water up to 1 foot deep during the winter and into early spring.

Wetland Pond—Ponds with permanent standing water greater than 2 feet deep that do not have a flow control structure and usually do not provide a significant amount of live storage.

Swale—Linear shaped basins that are constructed to slow and treat road runoff, but do not have a flow control structure and therefore do not detain a significant amount of stormwater.

Detention Swale—Linear-shaped basins that have a flow control structure and are constructed to slow, treat, and detain stormwater. These swales do not receive a significant amount of water and likely detain stormwater only during the peak of large storm events.

Siltation Pond—Shallow ponds constructed to slow water flow and settle out suspended solids. There is no regulated flow control structure therefore there is no significant amount of stormwater detention.

FCS—Flow control structure.

CB—Catch basin.

PVC pipe—Polyvinyl chloride pipe.

CMP—Corrugated metal pipe.

HDPE pipe—High-density polyethylene pipe.

RESULTS

The results of the compilation of background information and the field survey are summarized for all of the ponds in the sections below. Detailed results for each of the ponds are provided on the attached data sheets. Figure 1 shows the approximate location of each pond on a map of the City.

General Conditions

A total of 69 stormwater treatment facilities were surveyed for this inventory. Four of the facilities were later determined to be private ponds, and so are not included in the following summaries or maintenance recommendations, but are included in a list of known private ponds in Appendix A. The 11 ponds (Eaglemont-56 to Eaglemont-66) on Eaglemont golf course will be discussed in a separate section from the ponds in the rest of the City, but six are maintained by the city and are included in the summary sheets. Of the 54 facilities within the city limits, there are 31 dry detention ponds, 14 wet detention ponds, 5 swales, 1 detention swale, 2 wetland ponds, and 1 siltation pond.

Seven ponds received a high maintenance rating, 23 ponds received a medium rating, and 26 ponds received a low rating (Table 1 and Data Sheets).

Of the 69 ponds included in the inventory 35 are owned by the City of Mount Vernon, and were mostly acquired through dedication. Four files are silent on ownership (older ponds), but are assumed to be the City's. The ownership of one pond is still to be determined. The remaining 29 ponds are privately owned and are typically part of a lot. Responsibility for maintenance of the ponds generally follows the guideline that if the pond filters city street water, then maintenance is assumed to be the City's responsibility. Forty-nine of the ponds are wholly the responsibility of the City. The City maintains an additional four ponds, although the older files do not address ongoing maintenance. Maintenance is shared for six of the ponds, the City being responsible for structural maintenance and homeowners' associations being responsible for aesthetic maintenance. Maintenance responsibility is still to be determined for one pond. Nine of the ponds are wholly private. Ownership and maintenance are reported for each pond on the data sheets.

Maintenance Recommendations

Maintenance recommendations vary for each pond and are discussed on each of the data sheets. Routine maintenance includes mowing of berm slopes, inspection of FCS, cleanout (vactor) of FCS, and cleanout of vegetation from around inlet and outlet pipes.

Mowing of berm slopes is recommended for most of the ponds in order to prevent the spread of invasive woody plant species such as Himalayan blackberry (*Rubus discolor*) and Scot's broom (*Cytisus scoparius*). Some of the berms have been planted with native trees and shrubs. Mowing is not recommended at these ponds. Weeding around the planted trees and shrubs is often necessary to promote healthy growth. Most of these plantings are assumed to have been done by local residents and homeowners associations and appear to be weeded and maintained by them. Generally, mowing once in the early summer and once in the late summer should be sufficient. Some of the dry ponds (Loveless-23) are used as parks and are mowed frequently to maintain a lawn.

Although in the early stages of growth woody plants (e.g., willows, alder, cottonwood, dogwood, etc.) provide additional functions at the detention ponds, removal of woody vegetation is recommended for a few of the ponds. Dense woody vegetation can slow the flow of water through the ponds and aid in removal of sediments, and provide wildlife habitat. Growth of non-woody plants (specifically cattail) can also aid in sediment removal and is also known to remove toxins from the water. Cattail should be retained when not interfering with the inlet or outlet pipes. At some point the growth of trees within the detention area could begin to remove a significant amount of storage capacity from the pond. It is recommended that large trees be removed from the detention ponds before they become so large that the trunks start to take up detention volume, and before they are so large that removing the trees becomes difficult and requires heavy equipment. Most of the trees and shrubs that grow in the detention ponds will regenerate from the remaining roots within the next growing season, and so water quality and wildlife habitat functions will only be temporarily affected. It is recommended that trees be cut and removed from detention ponds when they have a diameter at breast height (dbh) of greater than 6 inches.

Dredging of detention ponds and drainage ditches is recommended at some of the sites. It is difficult to assign a schedule for dredging of ponds because of the variety of factors influencing the input and deposition of sediments to the ponds. In general it is recommended that each facility be inspected annually to assess the sediment deposition in the ponds and in the inlet and outlet pipes.

It is also difficult to assign a schedule for removal of sediments from the FCS because of the varied and changing factors affecting input of sediments to the system. Annual inspection of all FCS is recommended to avoid problems with clogging of the orifices in the FCS. Sediment build-up greater than 4 inches deep should be removed.

Improvement and Repair Recommendations

Improvements recommended are minor and include installing trash racks on outlet pipes, flap gates on inlet pipes, safety bars on large pipe openings, and woody plants on erosion-prone slopes. Specific improvement recommendations are included on the summary sheets.

Repairs are specified on the summary sheets and include repair of an erosion-damaged berm, reattachment of standpipe to vault wall, and replacement of a vandalized emergency overflow pipe.

Although not in the scope of this inventory, sites were evaluated for their potential for wildlife habitat enhancement. Native shrub and tree plantings can add wildlife habitat functions to many of the ponds without interfering with the detention function. Trees and shrubs planted along the slopes of the berms, outside of access ramps and paths, can provide habitat for birds, amphibians, and small mammals while providing shade for the pond. Shade on the pond can help reduce water temperature, which could be beneficial for fish downstream of the pond. Because funding for wildlife habitat enhancement can be tight, plantings should be directed at sites where the most benefit would be received and where the highest probability of success can be assured. To control costs, tree and shrub plantings can often be accomplished with the help of volunteers and civic groups. Relatively small planting effort at some of these ponds could result in relatively large increases in wildlife habitat.

At one pond (Thunderbird-07), enhancement of wildlife habitat could be accomplished with little or no cost. There is a double-celled pond at this location with a low area between the two cells. This low area is connected to a wetland to the east and is likely partially wetland itself. The low area appears to be mowed on a regular basis along with the berm slopes. Ceasing mowing in the low area would not affect the detention functions of the ponds. If mowing were to continue along the berm slopes, but were discontinued in the low area between the pond cells, it is assumed that native shrubs would grow. Many native shrub stumps were seen in this area that are regularly mowed, but appear to be alive. Additional plantings of native trees in this area would speed the establishment of native vegetation.

Cost Estimates

Cost estimates for improvements, repairs, and maintenance are in Table 2. Cost estimates are based on information provided by the City on material and labor costs for tasks related to maintenance and repairs. Site-specific maintenance and repair cost estimates were made by giving consideration to the specific repairs or maintenance needed as well as the site conditions and access. These estimates provide an approximate cost only and are therefore most useful for relative comparison between different maintenance and repair needs.

The following rates were provided by the City and were used in the estimates of repair and maintenance costs.

- Vactor—$195 per hour including two operators.
- Dump Truck—$70 per hour including operator.
- Back hoe—$65 per hour including operator.
- Tractor mower—$65 per hour including operator.
- Operator—$25 per hour.

Routine maintenance of detention ponds includes periodic inspection of FCS and outlet/inlet pipes for sediment and debris accumulation, minor shovel work to clear plants and debris from inlet and outlet pipes, vactor sediment from FCS, and mowing of berm slopes and access roads. It is assumed that mowing at most of the detention ponds can be accomplished by one operator with tractor mower in under 2 hours. It is assumed that inspection of FCS and minor shovel work to clear debris from inlet and outlet pipes can be accomplished by one staff member in under two hours. It is assumed that at most ponds removing small amounts of sediment from FCS can be accomplished by two staff members is less than 2 hours.

Eaglemont Golf Course Ponds

Based on the detention pond index map (November 24, 1999) provided by the City, it is estimated that there are 31 detention ponds on the Eaglemont Golf Course property. There are four types of ponds described on the map and in the stormwater operation manual (June, 1994): 1 residential detention pond, 4 wet/detention ponds, 11 golf course detention ponds with underdrains, and 15 wetland/weir wall detention ponds.

Eleven ponds were inventoried on the Eaglemont property. Six of these ponds were determined to be maintained by the City. The remaining five ponds do not receive runoff from City streets, and are included in the list of private ponds in Appendix A.

Some of the golf course detention ponds and one of the wet/detention ponds could not be located. The detention pond index map shows a different configuration of fairways and greens than was constructed, and it appears that the location and number of ponds constructed is also different than shown on the map.

Rating of the 11 ponds for maintenance and repair needs resulted in 3 high, 6 medium, and 2 low scores. Ratings for each pond are shown on 11 data sheets titled Eaglemont 56 to Eaglemont 66 (6 data sheets in Sheets; 5 data sheets in Appendix A). Problems requiring maintenance or repairs include large amounts of sediment in FCS, clogged underdrains, nonfunctional charcoal filter units, insufficient berm height, erosion damage to berms, trees and shrubs growing on emergency overflow spillway, and trees and shrubs blocking access road to FCS. Although not included in the inventory, it was observed that several of the wetland/weir detention ponds had clogged outlets and remained filled to capacity more than 48 hours after the most recent storm.

LIMITATIONS

Work for this project was performed, and this report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of the City of Mount Vernon for specific application to the referenced property. This report is not meant to represent a legal opinion. No other warranty, express or implied, is made.

Any questions regarding our work and this report, the presentation of the information, and the interpretation of the data are welcome and should be referred to the authors of this document.

We trust that this report meets your needs.

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UPDATE

City of Mount Vernon Comprehensive Stormwater Management Plan

August 2009

City of Mount Vernon
Public Works Department
1024 Cleveland Avenue
Mount Vernon, Washington 98273

City of Mount Vernon Comprehensive Stormwater Management Plan

2009 Update

1. Introduction

1.1 Background

The policies of the Mount Vernon Comprehensive Plan provide guidance for making decisions that may affect the quality of life in Mount Vernon, the environment in the City and surrounding area, and the City's future growth and development. Components of this plan, two companion documents, the 1995 Mount Vernon Comprehensive Surface Water Management Plan and its 2004 update, the Comprehensive Stormwater Management Plan Update, provide policies specifically intended to guide decisions that impact surface water. The role of surface water management in Mount Vernon is to:

- Protect the life, health, and property of the general public
- Ensure the safety of City roads and rights-of-way
- Respect and preserve the City's watercourses
- Minimize water quality degradation and control sedimentation of creeks, streams, ponds, lakes, and other water bodies
- Preserve and enhance the suitability of waters for contact recreation and fish habitat
- Preserve and enhance the aesthetic quality of the waters
- Maintain and protect valuable ground water quantities, locations, and flow patterns
- Decrease drainage-related damages to public and private property

1.2 Goals and Objectives of the 1995 Comprehensive Surface Water Management Plan

Goals and objectives for the City of Mount Vernon's Comprehensive Surface Water Management Plan were developed through input from City staff and the Citizen Advisory Committee. These goals, and the objectives to be met so as to accomplish each goal, area as follows:

1.2.1 Goal #1: Prevent property damage from flooding

- Objective: Require adequate peak flow controls for new development.
- Objective: Perform the necessary analysis and recommend solutions for existing flooding problems.
- Employ management strategies in flood prone areas to ensure that new development is not exposed to significant flood risk.

1.2.2 Goal #2: Maintain good water quality

- Objective: Attempt to meet state Class A Water Quality Standards in area streams.
- Objective: Require adequate erosion and sedimentation controls from new construction sites.
- Require adequate water quality controls for new development.
- Implement public education programs to reduce the source of pollutants entering surface waters.

1.2.3 Goal #3: Preserve sensitive resources and maintain varied use.

- Objective: Preserve fish and wildlife habitat.
- Objective: Preserve wetlands and implement a wetlands management strategy.
- Objective: Provide public access and recreation opportunities.
- Objective: Preserve open space.
- Objective: Review the City's Sensitive Areas Ordinance to ensure consistency with the surface water management program goals.

1.2.4 Goal #4: Develop a continuous and comprehensive program for managing surface water.

- Objective: Ensure a dedicated funding source for program implementation.
- Objective: Coordinate the City program with the Skagit County program.

1.3 Objectives of the 2004 Comprehensive Stormwater Management Plan Update

The objectives of the Comprehensive Stormwater Management Plan, 2004 Update was to provide a surface water management framework that would protect the public's safety, health and property, conserve and enhance natural systems within the City, and comply with local, state, and federal regulations. The update was developed using the following principles:

1. The Surface Water Plan should be a “living” document that encompasses alternative solutions such as Low Impact Development and can be adapted to conditions and priorities.
2. The recommendations should meet the current and anticipated requirements of federal regulations, particularly the Clean Water Act (CWA), Endangered Species Act (ESA), and Phase II of the National Pollution Discharge Elimination System (NPDES).

2. 2009 Comprehensive Plan Amendment

2.1 Capital Facilities, Public Services, and Utilities Element of the Comprehensive Plan

The 2004 Comprehensive Stormwater Management Plan Update (update of the 1995 Comprehensive Surface Water Management Plan) is Appendix CF-5 of Chapter 7 of the Mount Vernon Comprehensive Plan, the Capital Facilities, Public Services, and Utilities Element

The purpose of periodic updates of the Stormwater Management Plan is to provide an update to the strategic framework for the management of stormwater within Mount Vernon. The Stormwater Management Plan is intended to be a flexible document that may be readily revised should the priorities and focus of the City change. It is also intended to act as a reference for other City departments whose activities may impact storm and surface water and could be affected by drainage.

2.2 The 2009 Stormwater Plan Update

The Stormwater Plan Update, an amendment to the Comprehensive Plan Amendment proposed by the Mount Vernon Public Works Department, would revise previous plans, by adopting the Washington State Department of Ecology 2005 Stormwater Management Manual for Western Washington.

The City of Mount Vernon is one of nearly 100 Washington municipalities covered by the Phase II Municipal State Stormwater Permit. The Permit was issued by the Washington State Department of Ecology in January 2007, under authority of the federal Clean Water Act. One of the key Permit requirements is that cities adopt, by August 2009, either the 2005 Stormwater Management Manual for Western Washington or another municipal stormwater management manual that Ecology has approved as “equivalent.” The City of Mount Vernon intends to adopt the 2005 Stormwater Management Manual.

One of the first steps required in order to adopt the Ecology Manual is to update the City’s Comprehensive Plan, specifically Chapter 7 of the Comprehensive Plan, the Capital Facilities, Public Services, and Utilities Element. Appendix CF-5 of Chapter 5 is the Comprehensive Stormwater Management Update, prepared by CH2MHill, dated November 2004. This Appendix needs to be updated to reflect the Permit requirements from Ecology with which the City is required to comply.

The principal change to the current Stormwater appendix will be to revise the existing language that states, “Adopt Ecology Stormwater Management Manual for Western Washington, August 2001,” so that it states the City will adopt the latest edition of the Ecology Stormwater Management Manual for Western Washington.

3. 2005 Stormwater Management Manual for Western Washington

3.1 Background

The Department of Ecology updated the previous manual, the 2001 Stormwater Management Manual for Western Washington, to correct errors, clarify statements, update design criteria and procedures, and apply recent research. Local governments use the manual to set stormwater requirements for new development projects, redevelopment projects, and to set operation and maintenance standards. Land developers and development engineers use the manual to help design site plans and determine stormwater infrastructure. Businesses use the manual to help design their stormwater pollution prevention plans. The manual is useful for anyone needing guidance on sediment and erosion control for construction sites.

Stormwater is the water that runs off surfaces such as rooftops, paved streets, highways, and parking lots. It can also come from hard grassy surfaces like lawns, play fields, and from graveled roads and parking lots.

Urban development causes significant changes in patterns of stormwater flow from land into receiving waters. Increased surface runoff flows cause stream channel changes that destroy habitat for fish. Water quality can be harmed when runoff carries pollutants such as eroded soil, oil, metals or pesticides into streams, wetlands, lakes, rivers, and marine waters or into ground water. Managing stormwater runoff helps to reduce these significant pollution problems that make waterways unhealthy for people and fish.

The stormwater management advocated in this manual involves: careful application of site design principles; construction techniques to prevent erosion and the discharge of sediments and other pollutants; source controls to keep pollutants out of stormwater; flow control facilities to reduce discharge flow rates; and treatment facilities to reduce pollutants.

3.2 2005 Stormwater Management Manual Objectives

The objective of the 2005 update of the Stormwater Management Manual for Western Washington is to provide guidance on the measures necessary to control the quantity and quality of stormwater produced by new development and redevelopment such that they comply with water quality standards and contribute to the protection of beneficial uses of the receiving waters.

The manual establishes minimum requirements for development and redevelopment projects and provides guidance concerning how to prepare and implement stormwater site plans. These requirements are, in turn, satisfied by the application of Best Management Practices (BMPs) from Volumes II through V. Projects that follow this approach will apply reasonable, technology-based BMPs and water quality-based BMPs to reduce the adverse impacts of stormwater. The manual is applicable to all types of land development – including residential, commercial, industrial, and roads.