

8.0 EVALUATION OF ALTERNATIVES

The three potential management alternatives presented in Chapter 7 have been evaluated according to a specific set of criteria which evaluate the strengths and weaknesses of each management alternative. Ultimately, the preferred alternative must embody the most effective, equitable, and feasible solutions to managing the existing and future problems in the Percival Creek basin.

8.1 Evaluation Criteria

The criteria used to evaluate the three management levels are as follows:

- Effectiveness in solving flooding, habitat, and water quality problems.

Flooding: Considerations used to evaluate the effectiveness at solving flooding problems include: control of flood flows within the creek and reduction of development flooding problems.

Habitat: Considerations used to evaluate the effectiveness of managing habitat include: creek channel form, salmon survivability, biological diversity, and riparian and wetland integrity.

Water Quality: Effectiveness at resolving water quality problems has been evaluated according to: reduction of bacterial contamination problems, reduction of nonpoint pollution, and avoidance of future water quality problems.

- Environmental sustainability: The primary goal of environmental sustainability is meeting the needs of today's society without limiting the options of future generations. Sustainability is central to the basin planning process. Questions to be asked during the analysis of the basin plan include: Will the plan contribute to the long-term sustainability of the natural resources and human ecosystem of the basins? Could the proposed practices be continued indefinitely, meeting present needs without jeopardizing future prospects? Although striving for sustainability, attempts to return the creek to predevelopment conditions have not been considered as a management alternative.
- Cost: The cost criteria includes initial and ongoing costs to residents of the region, as well as additional costs imposed upon the sponsors of new developments. For an effective management alternative, these costs should be outweighed by the benefits derived from developing adequate stormwater conveyance systems, maintaining acceptable water quality, and protecting a viable natural resource. Many of these benefits are of a long-term nature and

reflect the importance of preserving the lifestyle enjoyed by those living in the region. Ecological and social costs associated with the potential loss of an urban natural resource, and avoided costs associated with potential remedial projects, are evaluated on a qualitative basis.

- **Feasibility:** The management alternative endorsed by the basin plan must be feasible. The long-term implementation of the plan necessitates meeting the financial and political realities of the three jurisdictions as well as being technically appropriate. The management scenarios represent varying degrees of technical, political, and financial feasibility.
- **Achievement of basin planning goals and objectives:** The goals and objectives for the basin plan are discussed in detail in Chapter 2 of this plan. It is crucial that the management alternative endorsed by the basin plan meet most or all of the goals established at the beginning of the basin planning process.

8.2 Evaluation Criteria Matrix

The criteria listed above have been applied to each of the alternatives discussed in Chapter 7 as shown in the following evaluation matrix (Table 5).

**Table 5: Management Alternative Evaluation Matrix
Percival Creek Basin Plan**

Criteria	Alternative I	Alternative II	Alternative III
Effectiveness in Solving Problems	Overall: Low—current level of service will allow for continued flooding problems in both developed areas and the creek, as well as continued degradation of water quality and habitat conditions.	Overall: Improved—stormwater storage and conveyance system upgrades, removal of fish barriers, reduction of future impervious surface, increased monitoring, and public education will work together to reduce flooding and improve habitat and water quality within the basin.	Overall: High—additional decreases in creek flows would further improve flooding habitat and water quality problems. Additional regulatory measures would preserve existing habitat.
• Flooding	Low—needed infrastructure improvements are not being pursued in a timely manner. Ability to upgrade and maintain existing stormwater facilities is poor. Computer modeling indicates that flows in the creek would increase by at least 30 percent in the future if present conditions are maintained.	Improved—flooding problems would be effectively corrected in developed areas. Measures necessary to prevent future problems would be undertaken. Future flows would be reduced by approximately 15 percent from existing levels, allowing the creek to establish a sustainable equilibrium condition.	High—flood flows in the creek would be reduced to 25 percent below existing flows.
• Habitat	Low—increasing flood flows and gradual degradation of priority sensitive areas threaten all elements of the biological community. Existing regulations are in many cases adequate, but poorly enforced due to lack of staff. Historical habitat problems such as culverts blocking fish passage would not be addressed.	Improved—enhanced management strategies would more effectively protect priority components of basin habitat. Stormwater storage and infiltration to moderate and reduce flows in the creek and provide groundwater recharge would be pursued. Continued impairment of instream habitat would be stabilized. Available fish habitat would be increased. Natural resource protection regulations would be enforced.	High—flood flows would be reduced below those in Alternative II. This would allow habitat conditions within the creek system to improve. Financial assistance would be made available to streamside property owners for projects to improve water quality. Conservation easements for priority habitats would be pursued.

Criteria	Alternative I	Alternative II	Alternative III
<ul style="list-style-type: none"> Water Quality 	<p>Low—existing regulations, limited enforcement, and PIE activities would be used to maintain or improve water quality in the creek. Existing problems would not be corrected. These measures may not adequately protect the creek's water quality.</p>	<p>Improved—effective protection of water quality through construction of a regional stormwater facility, increased enforcement activities, treatment of existing water quality problems, reduction of future flows, and expansion of public education opportunities would be pursued.</p>	<p>High—heightened water quality monitoring would improve ability to identify and track trends in the creeks and lakes.</p>
Environmental Sustainability	<p>Low—lack of increased management effort will allow the continued degradation of the basin's natural resources and therefore not promote environmental or community sustainability.</p>	<p>Improved—long-term commitment to maintaining the natural resource base would allow overall improvement of environmental and community sustainability. The natural resources of the basin would continue as community assets in the future.</p>	<p>High—commitment of funds and effort to substantially raise the level of protection within the basin would greatly improve the sustainability of the natural resource base.</p>
Cost	<p>Low—existing, insufficient funding levels would be maintained. Although present costs to community would remain low, lack of protection now may lead to necessary remedial action. These would most likely be extremely high.</p>	<p>Moderate—financial costs are higher than existing levels. These costs are associated with the high price of land needed to construct stormwater facilities, taking a proactive approach to potential future problems, enforcing regulations, and providing educational opportunities to the community. The ecological and social costs of Alternative II would be less than Alternative I and more than Alternative III.</p>	<p>High—Alternative III presents the highest short-term financial costs. It also goes the furthest towards avoiding future ecological and social costs.</p>
Feasibility	<p>High—Alternative I would maintain the existing management scenario. Projects would be funded and implemented utilizing current methods. Because Alternative I embodies the existing level of service it is highly feasible financially and politically.</p>	<p>Moderate—Alternative II would require increased funding, regulatory efforts, and cooperation between the jurisdictions. Although the costs would be higher than existing, a proactive approach to solving basin problems would serve to minimize potential technical and financial problems. Alternative II is highly feasible, though possible financial restraints may reduce its feasibility somewhat.</p>	<p>Low—Alternative III offers the most aggressive and proactive management scenario. For the promotion of sustainability and preservation of natural resources this alternative is highly feasible. Due to the higher costs and increased development regulations associated with Alternative III, it is the least politically and financially feasible.</p>

Criteria	Alternative I	Alternative II	Alternative III
Achievement of Basin Planning Goals and Objectives	<p>Low—maintenance of existing conditions falls short of meeting basin plan goals and objectives. Current management strategies are not adequate to protect natural resources within the basin. Capital funding is minimal, many program components are temporarily funded by grants, and development regulations are inadequate.</p>	<p>Moderate—the majority of basin plan goals and objectives would be met by Alternative II. Additional projects and funding sources would meet most existing and future needs of the basin, including a regional stormwater facility and ongoing public involvement activities. Sufficient information and analysis of conditions would exist to form a rational basis for decision making. Plan implementation would be enhanced by improved interjurisdictional coordination.</p>	<p>High—Alternative III would most effectively meet all the goals and objectives of the basin plan. It offers the highest level of service, and is designed to meet all the natural resource protection needs within the basin while correcting problems within the built environment.</p>

9.0 PREFERRED ALTERNATIVE AND RECOMMENDATIONS

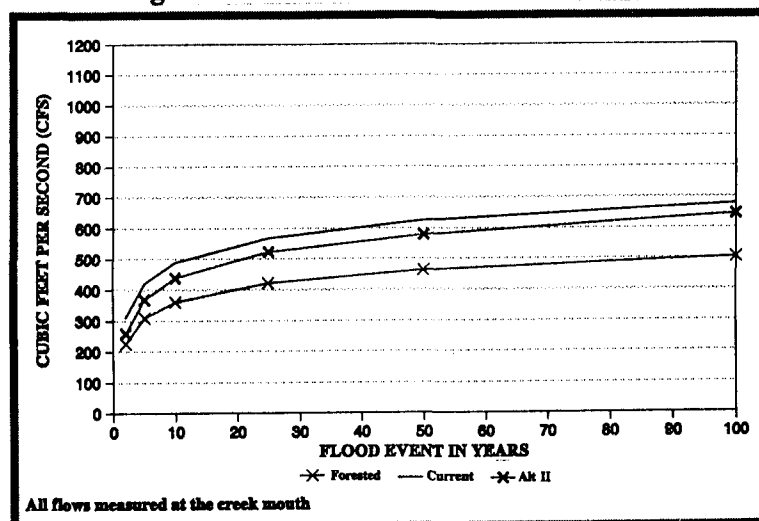
Based on the evaluation of the three alternatives, Alternative II is presented as the preferred choice. This alternative provides an appreciable improvement in surface water management and habitat conditions without seeking major changes in development patterns.

The specific recommendations comprising the alternative are presented in the following discussion. Each recommendation is followed by a brief discussion that describes the recommendation, and explains the benefits, public costs, and lead jurisdiction. Capitol improvement projects have been evaluated by hydrologic computer modeling techniques (HYDRA). Preliminary engineering cost estimates are based on site specific construction considerations and 1991 City of Olympia average bid item costs. Lead jurisdiction was determined based on project location, drainage contributing area, and/or staff expertise.

The effectiveness of Alternative II is entirely dependent upon the implementation of the nonstructural management program. If Alternative II is implemented without this program, improvements in the basin would be minimal. The nonstructural management program is presented in Chapter 11.

Unmanaged stormwater flows have been identified as the primary surface water problem in the basin. The ability of Alternative II in conjunction with the regional program to reduce creek flood flows is presented in the following figure:

Figure 3: Alternative II Flood Flows



9.1 Stormwater Facilities

Alternative II provides for considerable improvements in managing stormwater via drainage, storage, and treatment facilities. Many existing stormwater systems in the basin are not providing an adequate level of management. These systems would be retrofitted as feasible. Approximately 67 percent of the storage deficiencies in the basin would be

eliminated by implementation of Alternative II. Additionally, components of the stormwater system would be upgraded to accommodate future stormwater flows.

The location of structural projects is presented on Map 12 in Appendix 1.

RECOMMENDATION 9.1.1: Construct the North Percival Stormwater Management Facility to manage current and future flood flows.

Project Description: The regional stormwater facility would provide approximately 61 acre-feet of storage and treatment in the central portion of the basin. Stormwater flows to be managed by the facility include the contaminated, high flood flows from the Cooper Point commercial area, a portion of the unmanaged flows from the Lakemoor Subdivision at Ken Lake, and flows that are currently exceeding storage capacity at Mottman Industrial Park.

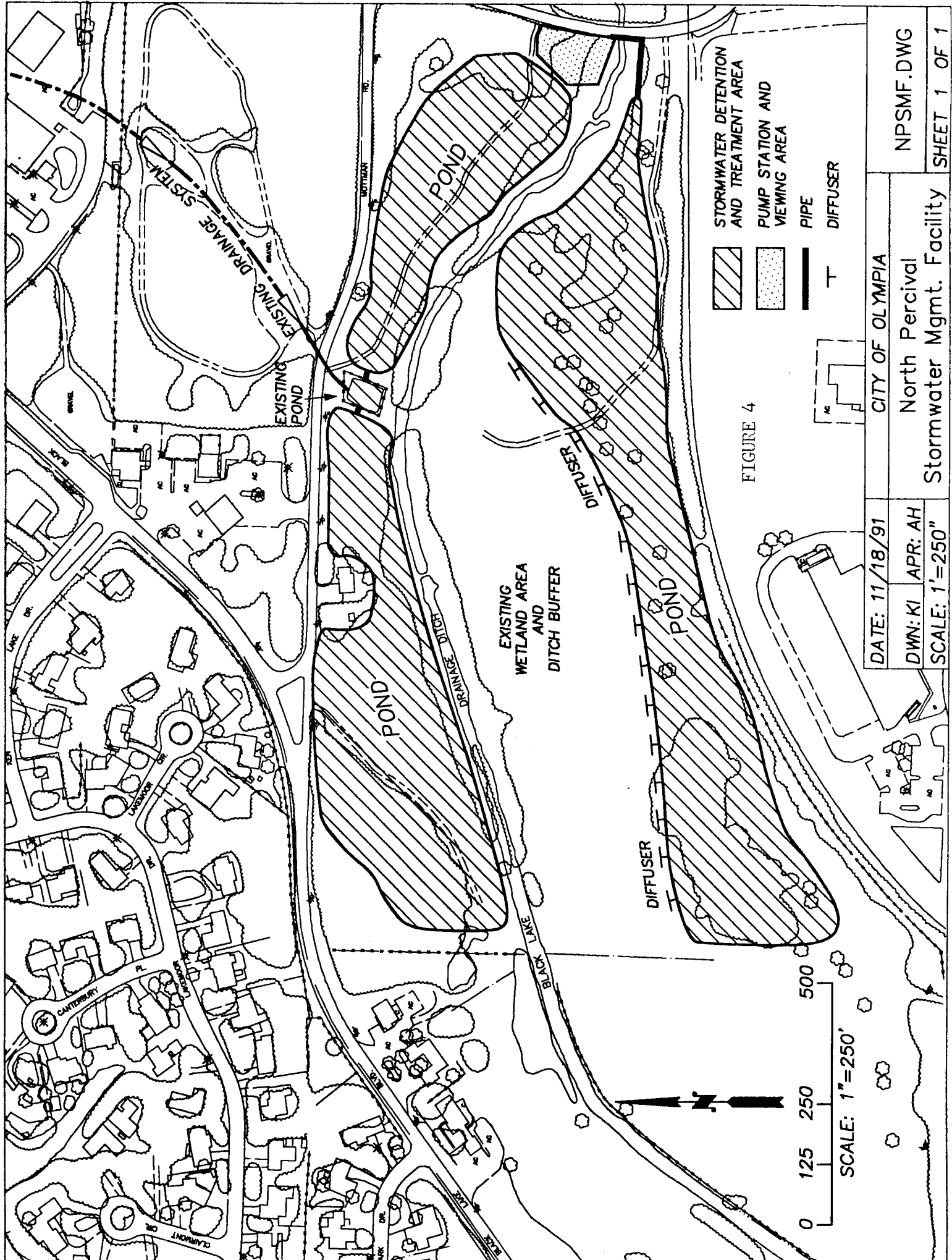
The facility would be located in a largely undevelopable area immediately upstream of the Mottman Road crossing of the Black Lake drainage ditch. Three interconnected storage ponds would be situated in the upland areas on both sides of the ditch. The wetlands adjacent to the ditch would remain intact. Following treatment, the facility would release nominal diffused flows to the ditch. A proposed site plan (Figure 4) for the facility is presented on the following page.

The large capacity of the facility would allow a high degree of flexibility in managing inflows. Depending upon design and management decisions, stormwater flows generated by the existing level of development in the contributing drainage area could be 90 to 100 percent detained by the facility. The resultant decrease in flows to Percival Creek would markedly compensate for stormwater storage deficiencies in other areas of the basin.

The facility storage capacity in comparison to the existing storage deficiency in the basin is presented in the following table. The deficiency has been estimated based on the requirements of the *Drainage Design and Erosion Control Manual for the Thurston Region, Washington*. The table indicates that the facility would effectively reduce the need to retrofit existing systems. Retrofitting many of these systems would be financially prohibitive.

<u>Jurisdiction</u>	<u>Existing Storage Deficiency, Acre-feet</u>	<u>Storage Provided by Facility, Acre-feet</u>
Olympia	73	55
Tumwater	29	6
Thurston County	7	0

The facility could also be managed such that future undetained flows are accommodated. This approach would allow future development to discharge directly to the facility without providing onsite stormwater treatment and storage.



A fee-in-leu policy would allow the jurisdictions to collect appropriate fees. Although highly variable, this approach could produce a cost recovery of about \$200,000 from the Cooper Point area. The following table presents the range of discharges to the facility with various development and onsite stormwater management approaches.

Alternative Facility Management Options

<u>Development Scenario</u>	<u>Westside Olympia,%</u>	<u>Ken Lake,%</u>	<u>Mottman Ind. Park,%</u>	<u>Facility Capacity Used,%</u>	<u>Facility Peak Outflow,cfs</u>
Existing	61	29	10	100	12
Full Development					
w/existing drainage regulations	65	25	10	100	17
w/proposed drainage regulations	63	27	10	100	13
w/o future upstream storage	66	24	10	100	19

Several other potential means to effectively reduce existing flood flows in the creek system have been investigated and dismissed:

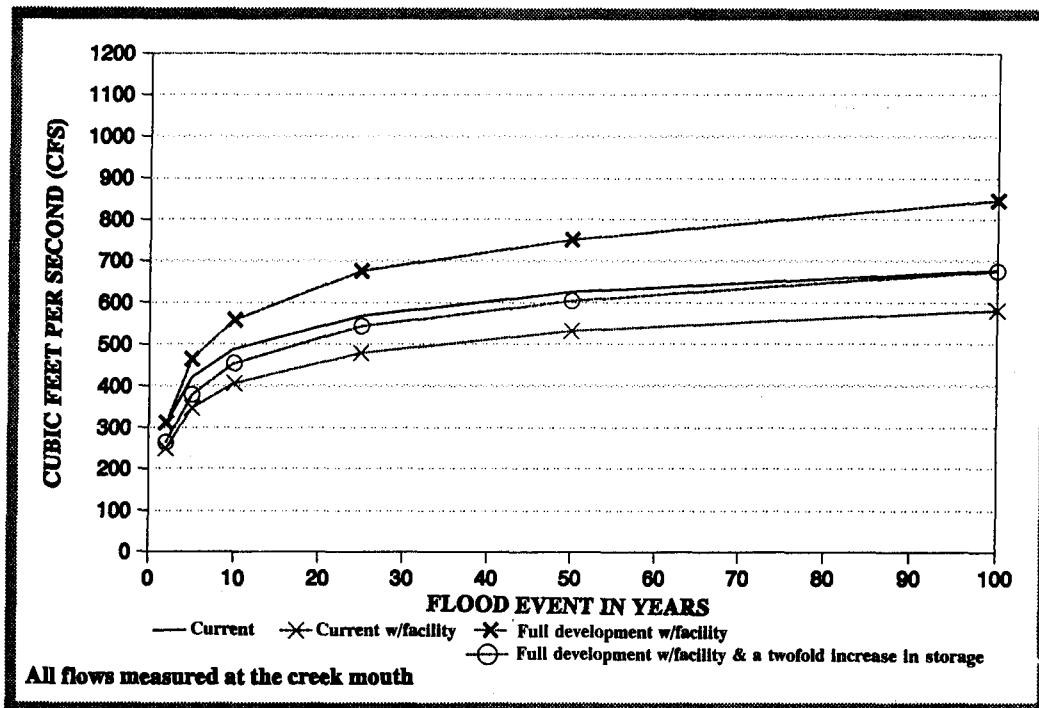
- Direct flows from Black Lake to the Black River instead of the Black Lake drainage ditch. Diverting additional flows to the river would jeopardize the integrity of an extensive, very high quality wetland at the headwaters of the river, as well as threaten property and habitat throughout the river system.
- Construct a high flow bypass pipe in the Percival Creek canyon. The pipe could conceptually follow the existing alignment of the railroad and a sanitary sewer line. The project is dubious from an engineering standpoint and, if feasible, highly expensive.
- Retrofit existing stormwater storage deficiencies throughout the basin. In general, this approach is not cost effective. Recommendation 9.1.8 discusses the potential improvements that may be achievable by retrofitting.

Benefit: The facility is the most expensive and effective capital project recommended in the basin plan. Benefits to be realized by the facility include:

- Eliminating approximately 56 percent of the basin's stormwater storage deficiencies.
- Providing appreciable improvements in creek water quality. The Cooper Point area is the greatest existing threat to water quality in the basin. The size of the facility and the incorporation of a wetland for final treatment are highly advantageous. The concentrations of contaminants such as suspended solids, nutrients, trace metals, organic compounds, and bacteria in stormwater could be reduced by as much as 90 percent by the facility.

- Managing stormwater flows upstream of the sensitive reaches of the creek system. The impact of the facility on flood flows in the creek are illustrated in the following graph (Figure 5). The graph also illustrates the potential improvements in creek flows provided by increased stormwater storage requirements for new development (Recommendation R-7 in Chapter 11).

Figure 5: North Percival Stormwater Management Facility Impact on Flood Flows



Estimated public cost: \$1,800,000

Project lead: Olympia

RECOMMENDATION 9.1.2: Upgrade the stormwater conveyance system serving the Cooper Point Road/Black Lake Boulevard area.

Project description: Flooding at the intersection of Cooper Point Road and Black Lake Boulevard has become a significant problem in recent years. The flooding has resulted from inadequate conveyance in the downstream portions of the system.

Several downstream locations in the complex system from Yauger Park to the Black Lake drainage ditch are problematic. A conveyance system problem located immediately north of Mottman Road was corrected in 1992. Although this improvement may moderate upstream problems at the intersection, major impediments to effective conveyance remain unsolved. Computer modeling indicates that as development in the drainage subbasin continues, the problem will escalate.

The needed system improvements revolve around a poorly designed conveyance system of detention ponds, pipes, ditches, and culverts from the intersection to the south side of S.R. #101. Two components of this system are at or close to capacity: the pipe system serving the intersection, and the twin culverts under S.R. #101.

The problem at the intersection is associated with downstream inadequacies at the detention pond southeast of the intersection. The elevation of the inlet and outlet of the pond do not facilitate the conveyance of runoff through the pond, thereby flooding the upstream intersection.

The other problem is associated with the capacity of the culverts under S.R. #101. These culverts are essentially operating at capacity under current conditions. Correcting the flooding problem at the intersection would provide additional flows to the culverts.

These inadequacies are indicated by the following table of peak flows under various development scenarios:

Conveyance System Peak Flows, cfs				
Development Scenario	Cooper Point Road/Black Lake Boulevard Intersection		State Route #101	
	<u>Existing</u>	<u>Capacity</u>	<u>Existing</u>	<u>Capacity</u>
Existing	51	28	59	63
Full development				
w/current drainage regulations	51	28	63	63
w/proposed drainage regulations	51	28	60	63
w/o future upstream storage	54	28	73	63

Several relatively simple partial improvements to the situation are readily available. These include:

- Reconstructing the berm between the conveyance ditch and Cooper Point Road immediately west of the intersection as per design specifications. The berm elevation was reduced during recent road improvements, thereby minimizing the design storage capacity of the adjacent parking lots. Flooding would be reduced by the additional storage and flows better conveyed through the downstream pipe system.

- Removing a retaining wall and 24-inch orifice located immediately west of the intersection. The conveyance pipe downstream of the bulkhead is 36 inches in diameter. Conveyance through the system would be modestly increased by this action.

An additional solution to the flooding problem will be necessary. Several long-term solutions to the problem have been evaluated. These include:

- Diverting an additional portion of the flows to the municipal system through the Top Food property.
- Diverting Black Lake Boulevard flows north of the intersection to a potential detention pond northeast of the intersection.
- Routing additional flows from Capital Mall Drive to Yauger Park.
- Retrofitting the existing system downstream of the pond.
- Constructing a conveyance pipe from the intersection south under Black Lake Boulevard to the south side of S.R. #101.
- Installing a third culvert under S.R. #101.

The recommended solution proposes installing a third culvert under S.R. #101 in conjunction with Washington Department of Transportation (WSDOT) upgrading of the Black Lake Boulevard interchange (Option #1). Additionally, the conveyance system between the ineffective pond and S.R. #101 would be retrofitted.

If scheduling conflicts do not facilitate cooperation with the State project, an alternative approach would be pursued. A 36-inch pipe would be installed from the intersection along Black Lake Boulevard and to the south side of S.R. #101 (Option #2). The system downstream of S.R. #101 has adequate long-term capacity for the flows.

Benefit: Threats to property and vital transportation routes would be eliminated and future development accommodated. The recommended approach would cost-effectively correct the problem.

Estimated public cost:

Berm construction/retaining wall removal: \$5,000

Option #1: S.R. #101 culvert and retrofit: \$125,000

Option #2: Black Lake Boulevard overflow system: \$194,000

Project lead: Olympia

RECOMMENDATION 9.1.3: Retrofit the drainage system serving the Mottman Industrial Park.

Project description: Computer modeling indicates that the industrial park currently generates approximately 3.5- and 12-acre-feet of unmanaged stormwater during 2- and 100-year storms, respectively. These flows flood and restrict the use of downstream industrial property.

Three potential alternatives to alleviate the problem have been evaluated:

- Constructing an onsite regional detention pond.
- Upgrading existing ponds within the industrial park.
- Routing excessive runoff to the North Percival Stormwater Management Facility (Recommendation 9.1.1).

An appropriate site within the western portion of the park for a regional pond could not be identified during the analysis. Similarly, upgrading existing ponds within the park was not considered feasible. Therefore, this plan principally looked at routine excessive runoff from the Mottman Industrial Park to the North Percival Stormwater Management Facility. Other possible alternative solutions to this problem may exist, such as onsite stormwater detention. These alternative solutions may be further investigated by the City of Tumwater at a later time.

The North Percival Stormwater Management Facility would have adequate capacity to accommodate these flows. The recommendation proposes constructing a 1300-foot ditch and culvert system parallel to the railroad grade and discharging to the North Percival facility. Approximately 10 percent of the North Percival facility capacity would be devoted to managing these flows.

Additionally, the ditches and ponds in the development are poorly maintained. Sediments should be cleaned from culverts, infiltration ponds, and the ditch system thereby reducing the potential for additional flooding. The conveyance systems should be revegetated for the purpose of treatment. The existing stormwater system consists of 12 privately owned infiltration ponds, approximately 4,500 feet of open channel conveyance, and pipes and culverts totaling approximately 6,500 feet. These maintenance projects would be provided by municipal crews as addressed in Recommendation R-1 of the nonstructural management program (Chapter 11).

Benefit: The proposed project would eliminate flooding and potential property damage, reduce roadway flooding, increase water quality treatment, and reduce stormwater management deficiencies in the basin.

Estimated public cost: Conveyance system: \$87,000

Project lead: Tumwater

RECOMMENDATION 9.1.4: Upgrade the conveyance system from the portion of the basin north of the Grass Lake wetland.

Project description: Flows to the culverts at Cooper Point Road and 14th Avenue currently exceed capacity, but are not creating a flooding problem. Computer modeling indicates that full development of this portion of the basin would generate an additional 12.5-acre-feet of runoff during a 100-year storm event. In addition to privately constructed onsite treatment and storage, these runoff flows would require upgrading the culverts at Cooper Point Road and 14th Avenue.

The need for these projects is highly dependent upon the drainage requirements for future development. With proposed drainage requirements (Recommendation R-7, Chapter 11) peak flows would be reduced below current levels, thereby eliminating the need to replace the culverts. Average flows during storm events would be greater than existing flows, but could be accommodated by the culverts. Therefore, implementation of the nonstructural management program would negate the need for the culvert upgrades.

Flows in these culverts under various development scenarios are as following:

Development Scenario	Culvert Peak Flows, cfs			
	Cooper Point Road		14th Avenue	
	<u>Existing</u>	<u>Capacity</u>	<u>Existing</u>	<u>Capacity</u>
Existing	20	17	15	12
Full Development				
w/current drainage regulations	23	17	18	12
w/proposed drainage regulations	13	17	9	12

These increased flows would discharge to the Grass Lake wetland. However, the hydrologic traits of the wetland would not be modified by the higher flows. In the future, the water surface elevation in the wetland during major storm events could increase by approximately 0.25 inches given current drainage requirements and insignificantly with proposed requirements (Recommendation R-7, Chapter 11).

Additional flows to the wetland would be treated for water quality according to existing requirements by utilizing detention ponds, swales, and ditches. The existing tributary, vegetated ditch system, and wet pond provide treatment in accordance with best management practices. Recommendation 9.3.2 further addresses management of the Grass Lake wetland.

The cost of this project would be borne by private parties constructing the upstream developments. This policy is in accordance with the requirements of the *Drainage Design and Erosion Control Manual for the Thurston Region, Washington*.

Benefit: The threat of flooding a major arterial roadway would be eliminated.

Future development estimated cost: \$47,000

Project lead: Olympia/Thurston County

RECOMMENDATION 9.1.5: Increase the flood control capacity of Yauger Park.

Project description: Continued high density development in the areas adjacent to Yauger Park can be expected to contribute additional flows to the park. Current practices for managing stormwater in the park and the downstream conveyance system to the Black Lake drainage ditch rely upon minimizing the flows out of the park during major storm events. Due to capacity limitations on the downstream conveyance system and the goal of minimizing flood flows to Percival Creek, this management approach is expected to continue in the future. The capacity of park is assumed to be maximized under current conditions.

The recommendation proposes an additional two feet of excavation in a two acre, unimproved soccer field at the south end of the park. These measures would add approximately four acre-feet of storage to the park. Additionally, the site would be utilized for additional stormwater treatment during small storms. Any modification to the unimproved soccer field would require an amendment to the grant received for the construction of Yauger Park.

The potential flows to the park compared to the existing flows as well as the potential capacity of the park are presented in the following table. The importance of the proposed drainage requirements (Recommendation R-7, Chapter 11) is also indicated:

<u>Development Scenario</u>	<u>Storage Needs, Acre-feet</u>
Existing	71
Full Development	
w/current drainage regulations	87
w/proposed drainage regulations	75

Additional management of the park would include the regulated, but expedient, release of stormwater following storm events. This practice would ensure the full utilization of the park's storage capacity during any given storm.

Benefit: The proposal provides a cost-effective means of fulfilling the municipal obligation to convey managed flows to receiving waters.

Estimated public cost: \$123,000

Project lead: Olympia Public Works and Parks and Recreation Departments

RECOMMENDATION 9.1.6: Develop an adequate conveyance system for the undeveloped area bounded by S.R. #101 and Capital Mall Drive.

Project description: The 130-acre area is currently undeveloped, but zoned for high-density residential and commercial development (Refer to Map 12 in Appendix 2). Due to the area's varying topography, managed runoff flows would be directed to Yauger Park, the Kaiser Road/S.R. #101 overpass system, and a culvert under S.R.#101 near Friendly Village of Olympia.

The discharges from the western-most 50 acres of the area could be routed to a conveyance and storage system associated with Kaiser Road. Flows from this system slowly discharge to the Gruen swale north of Ken Lake. Maximum additional flow through this system would be approximately 5.3 cfs with the proposed drainage requirements (Recommendation R-7, Chapter 11). The impact of these flows as well as other potential flows reaching Ken Lake are discussed in Recommendation 10.3.3.

Flows released from development in the southeastern portion of the area could be routed to a culvert passing under S.R. #101 near Friendly Village.

Lastly, and most problematic, a portion of the flows could be piped via upgraded downstream systems to Yauger Park. The approximate peak flows to Yauger Park would be approximately 4.5 and 1.9 cfs for existing and proposed drainage requirements, respectively. These flows would require the following conveyance system improvements:

- Upgrading approximately 400 feet of the Capital Mall Drive system.
- Redirecting the Capital Mall Drive system to discharge to Yauger Park rather than to the conveyance system downstream of the park. Recommendation 9.1.5 addresses the need for improvements to Yauger Park in order to accommodate these, as well as other, flows.

With the exception of the Capital Mall Drive system, existing and potential systems would be utilized for the appropriate routing. Storage of the flows in Yaeger Park would contribute to the goal of reducing flows to the Cooper Point Road/Black Lake Boulevard intersection, and ultimately reducing flood flows in Percival Creek.

The cost of this project would be borne by private parties constructing the upstream developments. This policy is in accordance with the requirements of the *Drainage Design and Erosion Control Manual for the Thurston Region, Washington*.

Benefit: Avoidance of future stormwater management problems.

Future development estimated cost: \$72,000

Project lead: Olympia

RECOMMENDATION 9.1.7: Construct a regional detention pond adjacent to Percival Creek immediately west of the Percival Bridge and improve the existing conveyance system to the pond.

Project description: WSDOT proposes developing a 4 acre-foot detention/treatment pond to accommodate flows from S.R. #101 improvements. The facility would be located on City of Olympia property. In exchange for the use of City property, the pond would be constructed, at no cost to the City, to accommodate approximately 2.0-acre-feet of runoff flows from developed and developable areas north of the site. Although an existing conveyance system with a capacity of 15 cfs can be used to accommodate flows to the proposed pond, improvements would be necessary in the long-term. The recommendation supports the development of the facility and the long-term need to improve the conveyance system to the proposed pond.

Benefit: Flows from existing and future development could be managed to meet the goal of reducing flood flows in Percival Creek. Current storage deficiencies within Olympia's jurisdiction would be reduced by approximately 2.0 acre-feet. Additionally, future flows would be adequately conveyed to receiving water without threatening existing development.

Future development estimated cost: \$40,000

Project lead: Washington Department of Transportation/Olympia

RECOMMENDATION 9.1.8: Upgrade existing private stormwater management systems operating at less than potential performance.

Project description: Approximately 80 stormwater management facilities are located in the Percival Creek basin. Field investigations indicate that many of the privately owned facilities are poorly maintained and/or designed, and could cost-effectively be improved to better manage runoff. Although maintenance is expected to be conducted by the owners, design upgrades to the ponds is beyond the responsibilities of the owners.

If necessary, the jurisdictions may choose to purchase the facilities and/or undertake the design improvements and grant a liability waiver to the owner of the pond. The improvements would be minor, inexpensive, and based on the capabilities of the individual pond. Emphasis would be placed on the more efficient management of runoff from relatively frequent storm events.

The 27 ponds with the potential for design improvements are indicated in the list of detention ponds presented in Appendix 3. Initial estimates indicate that these ponds may be able to increase storage by 5 to 30 percent. Roughly 5 acre-feet of additional detention may be obtainable through this recommendation.

Benefit: Optimum management of existing facilities offers reduced potential for flooding and creek degradation at minimal cost.

Estimated public cost: \$60,000

Project lead: Olympia/Tumwater

9.2 Habitat Enhancement/Sensitive Areas Protection

Alternative II provides measures to improve creek and wetlands conditions by basin-specific capital improvements and noncapital programs. Additional recommendations addressing natural resource protection are presented in the regional management program. Refer to Chapter 11.

RECOMMENDATION 9.2.1: Implement capital and noncapital projects in the basin plan in such a manner as to protect and maintain habitat conditions in the creek system.

Project description: Unnaturally high flood flows have been identified as the primary threat to the physical and biological integrity of the creek system. Given existing management conditions (Alternative I) future flood flows would be approximately 33 percent higher than existing flood flows.

With the implementation of Alternative II and the regional management program, flood flows in the creek system would be reduced approximately 17 and 5 percent for 2 and 100 year storm events, respectively. These percentages are based on expected flood flows with full development of the basin as compared to existing conditions.

Benefit: Physical and biological conditions in the creek system would be protected, and future management costs minimized. Current and potential detrimental impacts to the physical and biological traits of the creek are discussed extensively in Chapter 6.

Estimated public cost: As per the recommendations embodied in Alternative II and the regional management program.

Project lead: Olympia, Tumwater, Thurston County

RECOMMENDATION 9.2.2: Sequentially remove artificial barriers to fish passage in Percival Creek.

Project description: The height above streambed elevation and gradient of three culverts in the creek make fish passage to upstream stream segments extremely difficult, if not impossible. The culvert carrying Percival Creek under Mottman Road in the vicinity of South Puget Sound Community College is the first barrier to migrating salmon and is therefore the highest replacement priority on Percival Creek. The replacement of the culverts located at Chapparel Drive and Sapp Road are technically and financially less problematic than the replacement of the Mottman Road culvert.

The feasibility of constructing simple instream weirs downstream of the culverts thereby backwatering the culverts has been investigated and deemed inappropriate due to excessive elevation differences. Additionally, improvements to Mottman Road that might include culvert replacement are not foreseeable.

The recommended upper thresholds to facilitate fish passage through these culverts are one percent gradient, zero feet above water surface elevation, and four ft/sec stream velocity (WDF, 1990). The problematic traits of these culverts are presented in the following table:

<u>Culvert Location</u>	<u>Gradient, %</u>	<u>Height Above Water Elevation, in.</u>	<u>Water Velocity 2 Year Flood, ft/sec</u>
Mottman Road	1.2	18	7.8
Chapparel Road	1.5	16	7.5
Sapp Road	2.0	15	5.6

These projects would be pursued in the later stages of implementing the basin plan. A long-term effort to obtain grant moneys and/or donations for culvert replacement would be undertaken by local interest groups and jurisdictions.

Benefit: The Mottman Road culvert is considered a priority fisheries problem in the urban area by WDF. The culvert replacements would increase salmon access to approximately 2.1 miles of beneficial habitat. Investigations indicate that these portions of the creek would provide valuable salmon rearing habitat.

Estimated public cost:

Mottman Road: \$126,000

Chapparel Road: \$19,000

Sapp Road: \$20,000

Project lead: Tumwater

RECOMMENDATION 9.2.3: Improve fish passage through the culvert conveying the Black Lake drainage ditch under Mottman Road.

Project description: Relatively minor improvements to the wooden fish ladder and backwater weir located downstream of the twin culverts would increase fish access to the culvert and subsequent passage through the culvert. Volunteer labor would be relied upon for the completion of the project. Local jurisdictions would provide materials if necessary.

Benefit: Valuable salmon spawning and rearing habitat is provided by the Black Lake drainage ditch as well as three tributaries to Black Lake.

Estimated public cost: \$4,000

Project lead: Volunteer groups

RECOMMENDATION 9.2.4: Encourage the Washington Department of Fisheries to consider planting juvenile salmon in the upstream portions of Percival Creek.

Project description: Initial investigations by WDF support the suitability of two miles of upper creek segments for salmon rearing. Unfortunately, salmon distribution within this creek segment would be limited by the impassible barriers at Mottman, Chapparel, and Sapp Roads (See Recommendation 9.2.2).

A brief summary of habitat traits of the relevant creek segments are presented in the following table. Refer to Map 3 in Appendix 1 for subbasin locations. Additional information on instream habitat is provide in Chapter 5.

<u>Location</u>	<u>Segment Length, ft</u>	<u>Segment Gradient, %</u>	<u>Pool:riffle: glide Ratio</u>	<u>Substrate Composition</u>
Subbasin P-3	6923	0.58	1.0:0.39:2.23	Gravel/sand
Subbasin P-2	4397	0.39	0:0:1	Silt/organic
Subbasin P-1	1003	0.39	0:0:1	Silt/organic

Benefit: Salmonid habitat within the creek system would be better utilized.

Estimated public cost: None

Project lead: Tumwater

RECOMMENDATION 9.2.5: Support long-term efforts to acquire the Percival Creek and Black Lake drainage ditch corridors for recreational use and habitat protection.

Project description: In the event of railroad abandonment, the railroad grade adjacent to the creek from its mouth to Mottman Industrial Park could potentially provide a long-term recreation and transportation opportunity to the local community. With proper planning, ownership of the grade could revert to the local jurisdictions.

The recommendation supports the local jurisdictions' efforts to acquire the grade over the long-term. Additional regional efforts (Chapter 11) focus on the dedication of streamside lands to the local jurisdictions.

Benefit: Preservation and enhancement of an important local amenity.

Estimated public cost: None.

Project lead: Thurston County and Olympia Planning and Parks Departments

9.3 Regulation/Development Controls

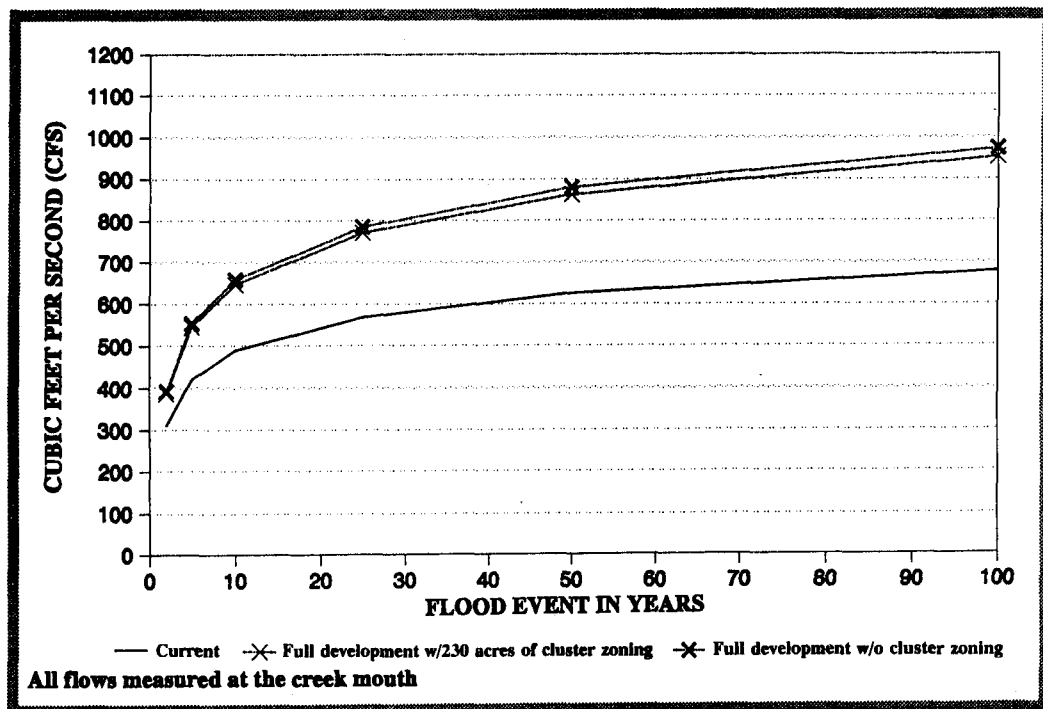
Alternative II includes basin specific recommendations for improved regulation of new development. The regional management program presented in Chapter 11 specifies additional regulations to be implemented regionwide. Those regulatory recommendations are critical to the success of Alternative II.

RECOMMENDATION 9.3.1: Encourage open space/cluster development in the basin where appropriate.

Project description: Open space/cluster development provides the most effective means of maintaining natural hydrologic conditions while allowing development densities as per zoning classifications. Studies have shown that creatively designed open space/cluster developments are desirable living areas and home values increased faster than in typical developments (Knack, 1990). Development would be limited to 40 percent of the parcel area. The areas proposed for consideration are indicated on Map 13 in Appendix 1. An illustrative description of open space/cluster development is provided in Appendix 6.

Benefit: The proposal would result in some reduction in flood flows in the creek system as presented in the following graph (Figure 6). Although not dramatic, the cluster recommendation in conjunction with the numerous other recommendations successfully reduces flood flows in the creek. The recommendation would also minimize potential flooding problems, lessen infrastructure needs, encourage replenishment of groundwater supplies, and preserve existing wildlife habitat.

Figure 6: Alternative II Cluster Development Flow Impacts



Estimated public cost: None

Project lead: Tumwater/Thurston County

RECOMMENDATION 9.3.2: **Ensure that optimum stormwater treatment practices are required for future discharges to the Grass Lakes wetland.**

Project description: A 160-acre segment of the extensive Grass Lake wetland has been purchased by the City of Olympia. The wetland is to be managed for open space, recreation, education, and research.

Full development of the area contributing hydrologically to the wetland would increase water surface elevations in the wetland system by approximately 0.25 inches. This increase is not expected to impact wetland hydrology and is therefore considered acceptable. However, wetland quality could be degraded without proper stormwater treatment. Treatment has been established by the *Drainage Design and Erosion Control Manual for the Thurston Region, Washington*.

This recommendation supports the use of current and potential best management techniques for water quality treatment of stormwater discharging to the wetland.

Benefit: Preservation of an important local natural resource amenity.

Future development estimated cost: Unknown

Project lead: Olympia/Thurston County

RECOMMENDATION 9.3.3: **Require that future development adequately manage stormwater flows from developable land west of the Lakemoor Subdivision at Ken Lake.**

Project description: Increased runoff from land clearing activity on the area bordering the western edge of the Lakemoor Subdivision currently crosses several residential properties prior to entering Ken Lake. Approximately 60 acres of forest land zoned for sparse and suburban residential development contributes topographically to the problem. Bedrock at shallow depths underlies the developable area. This geologic condition minimizes infiltration thereby making the area especially prone to high surface and subsurface flows.

If an adequate stormwater management system is not constructed by potential development, runoff to the residential neighborhood could be expected to increase and possibly lead to property damage. With full development, existing and

proposed drainage regulations (Recommendation R-7, Chapter 11) would allow maximum discharges from the 60 acre area of approximately 4.8 and 2 cfs, respectively. Efforts to manage the problem include preservation of natural vegetation onsite and effective collection and conveyance of runoff to Ken Lake.

Potential problems associated with the development of an additional 110 acres of land to the west of Ken Lake are minimal. Managed stormwater flows from these areas could be conveyed to the Gruen swale on the northern side of Ken Lake, and the Ken Lake tributary discharging to the Black Lake drainage ditch. Investigations indicate that these flows could be accommodated by the downstream culverts at Park Drive and Black Lake Boulevard. Potential increases in lake elevation during major storm events at full development conditions are estimated to be insignificant.

The recommendation proposes that caution be exercised in designing and constructing stormwater systems for potential development west of Lakemoor Subdivision. Additionally, any potential considerations of rezoning the area for higher density development should acknowledge the natural resource limitations of the area.

Benefit: Potential flooding problems can be averted by careful design and construction of future development.

Future development estimated cost: Unknown

Project lead: Thurston County

RECOMMENDATION 9.3.4: Support the urban village development approaches presented in the Draft Joint Plan for the Olympia Westside Joint Planning Area.

Project description: As presented in the draft joint plan, the "urban village" designation directs future development away from suburban sprawl to a more cohesive neighborhood approach. This designation would allow a variety of residential types, neighborhood oriented businesses, civic spaces, public greens, and workplaces to be built in close proximity to one another in an integrated manner. Narrower roads lined with planting strips and bicycle and pedestrian facilities would encourage alternative forms of transportation and create less urban runoff. The urban village approach also incorporates meaningful open space into the development design thereby providing viable wildlife habitat and maximizing stormwater infiltration.

Benefit: Benefits of innovative development design include increased stormwater infiltration, lessened stormwater infrastructure needs, and habitat protection.

Estimated public cost: None

Project lead: Olympia Planning Commission

9.4 Enforcement/Complaint Response

Regulations without adequate enforcement and complaint response are of limited effectiveness. The recommendations for increased enforcement staff are presented in the Nonstructural Surface Water Management Program (Chapter 11).

9.5 Pollution Source Control Programs

Alternative II places emphasis on preventing water quality contamination. In general, the quality of water in the Percival Creek system is relatively good. Discharges to the creek are of lesser quality.

With the exception of one recommendation, the pollution source control elements of the management approach are addressed by the regional management program. Those recommendations place emphasis on various public education and involvement techniques for long-term pollution source control.

RECOMMENDATION 9.5.1: Support jurisdictional efforts to expand sanitary sewer service in the basin.

Project description: Approximately 45 percent of the area in the basin is serviced by sanitary sewer. Though development in the unserved areas of the basin is largely sparse and scattered, these developments rely upon septic systems. The local jurisdictions have developed or are in the process of developing comprehensive sanitary sewer plans. The implementation of these plans would provide service to approximately 83 percent of the basin. The remaining unsewered areas are expected to develop at low densities and could therefore be adequately served by septic systems.

The recommendation supports increased sanitary sewer service as development continues.

Benefit: Based on water quality monitoring results, bacterial and nutrient loadings to the creek are modest. The development of an adequate sewer service would minimize the threat of these contaminants entering the creek system.

Estimated public cost: Funding for sanitary sewer needs are not addressed in the basin plan.

Project lead: Olympia/Tumwater/Thurston County

9.6 System Monitoring

Alternative II would provide for tracking and evaluating water quality and habitat trends in the creek system. Monitoring provides a cost effective means to identify and follow up on potential problems before serious long-term problems develop.

RECOMMENDATION 9.6.1: Initiate a long-term water quality and sediment monitoring program for the creek system and Trosper and Ken Lakes.

Project description: Water quality in the creek system is relatively good, but subject to unknown fluctuations due to the impacts of urbanization. Although water quality degradation in Trosper and Ken Lake has not reached problematic levels, monitoring would provide trend analysis information to staff and adjacent neighborhoods as development continues. Details of the long-term water quality monitoring program are presented in Appendix 8.

Benefit: Preservation of water quality, biological communities, and aesthetic amenities throughout the creek and lake system.

Estimated public cost: \$7,000/year (Embodied in Recommendation R-17, Chapter 11)

Project lead: Olympia/Thurston County Environmental Health Department

Recommendation 9.6.2: Initiate a long-term stream and riparian habitat monitoring program.

Project description: Monitoring efforts would track trends in the physical and biological integrity of the creek system and identify areas of concern. Habitat areas would be protected from continual unnoticed degradation. Volunteer groups would provide yearly cursory investigations; professional staff would conduct extensive surveys every three years.

The creek system was intensively evaluated by City of Olympia and Squaxin Island Tribe personnel in the summer of 1990 as part of the basin planning process. The evaluation methodology was adapted from regionally accepted protocol (TFW, 1989). In the future, a similar approach could be used.

Benefit: Implementation of the proposal would provide for the evaluation of the physical and biological trends in the creek system and the effectiveness of the basin plan.

Estimated public cost: \$3,000/year (Embodied in Recommendation R-17, Chapter 11)

Project lead: Olympia/Tumwater

9.7 Public Involvement and Education

Public involvement and education (PIE) activities are an important component of the basin plan. However, these activities are best supported at a regional, rather than a basin-specific, level. Recommendations for public involvement and education are presented in the nonstructural management program (Chapter 11).

9.8 Cooperative Program Management

Although the implementation of Alternative II would require increased management and interjurisdictional coordination, the additional needs for the basin would be minimal. Overall management needs are addressed in the nonstructural management program (Chapter 11).

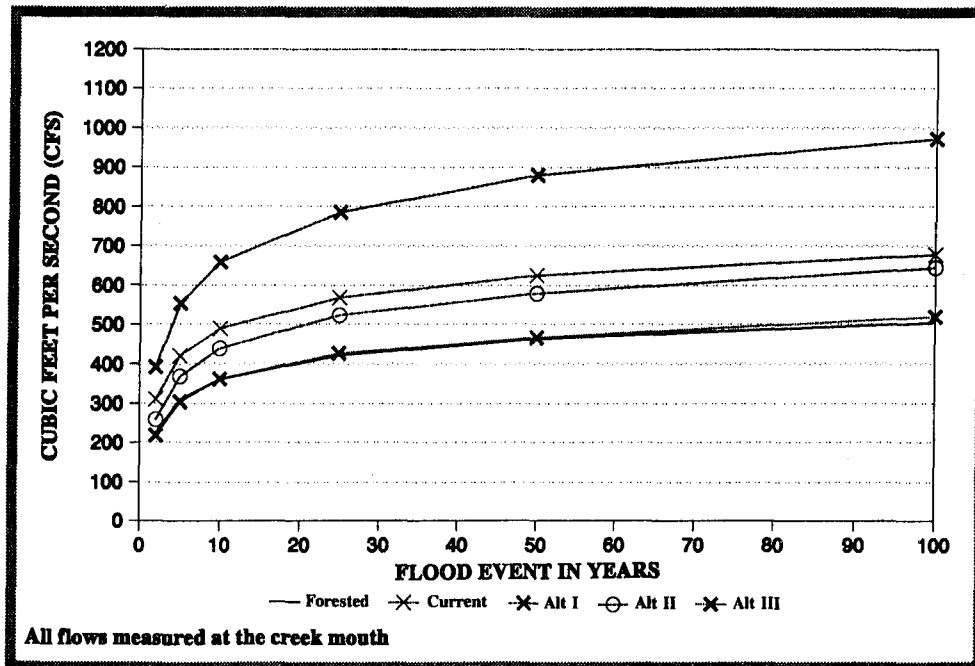
10.0 ALTERNATIVE III: OPTIMAL LEVEL OF SERVICE

The recommendations made in Alternative III are in addition to those included in Alternative II. For the most part, these recommendations focus on improving or protecting the natural resources within the basin to the maximum extent considered feasible. Further reductions in flood flows and improved habitat preservation are the primary focuses of the efforts to restore and improve habitat conditions.

Each recommendation is followed by a brief supporting discussion describing the recommendation and explaining the benefits, public costs, and lead jurisdiction.

The following graph (Figure 7) illustrates the creek flood flow reductions attainable with the implementation of Alternative III.

Figure 7: Alternative III Flood Flows



10.1 Stormwater Facilities

Regional infrastructure improvements to stormwater systems is a priority of the basin plan. The necessary public and private projects are presented in Alternative II. No additional projects would be considered for Alternative III.

10.2 Habitat Enhancement/Sensitive Areas Protection

Natural resource protection is largely dependent upon stormwater management of existing problems and improved regulation of future stormwater and habitat concerns. Most of these concerns are addressed by Alternative II and the regional management program (See Chapter 11). Several additional measures are proposed in Alternative III.

Recommendation 10.2.1: Stabilize and revegetate a major landslide area within the Percival Creek corridor.

Project description: In 1985, a broken water line caused an extensive landslide within the Percival Creek canyon. The site has been aggressively eroding in subsequent years. The 0.50-acre area is deeply ravined for 100 feet up the south slope of the canyon. Reducing flood flows in the creek as presented in Alternative II would slow the erosional process, but would not ensure cessation of activity.

This recommendation proposes that the site be permanently stabilized and reestablished with vegetation as feasible.

Benefit: A potential threat to upland developed property would be eliminated. The seasonal importation of sediments to the creek system from this site would moderate.

Estimated public cost: \$200,000

Project lead: Olympia

Recommendation 10.2.2: Provide ongoing funding for the purchase of critical creek corridor areas. Emphasis would be placed on protecting important habitat and acquiring streamside areas vital to the long-term goal of a publicly owned creek corridor.

Project description: The sensitivity and high quality of the Percival Creek corridor makes it a prime candidate for permanent preservation. The northern side of Percival Creek and a portion of the southern side of the Black Lake drainage ditch are currently occupied by the Burlington Northern Railroad. These areas could be acquired by the jurisdictions at the time of potential abandonment. The railroad plans to operate the line indefinitely.

Local jurisdictions currently do not plan to acquire the upstream portions of Percival Creek. Through public acquisition of the corridor, the creek and its habitat could be better protected and utilized by the public. Over time, portions of the creek that could not be preserved through conservation easements would be protected through fee simple purchase.

Benefit: The *Draft Urban Trails Plan* indicates that trails and open space are one of the north Thurston County residents' priorities for future park development. Trails offer a unique amenity to the community due to the numerous uses they support. Trails not only preserve open space corridors and wildlife habitat, but serve as alternative transportation links and places for walking, jogging, and biking. According to a survey conducted during the development of *Olympia's Plan for Parks, Open Space, and Recreation Facilities*, these activities are the first, second, and fifth most popular outdoor activities, respectively, of Olympia residents.

The proposal would ensure the preservation of creek habitat, urban open space, and a trail corridor.

Public cost: Unknown

Project lead: Olympia

10.3 Regulation/Development Controls

In addition to the critical recommendations made in Alternative II and the nonstructural management program, further development controls would be used to protect the natural resources within the basin. A greater emphasis on innovative development techniques would substantially improve natural resources and cultural amenities within the basin.

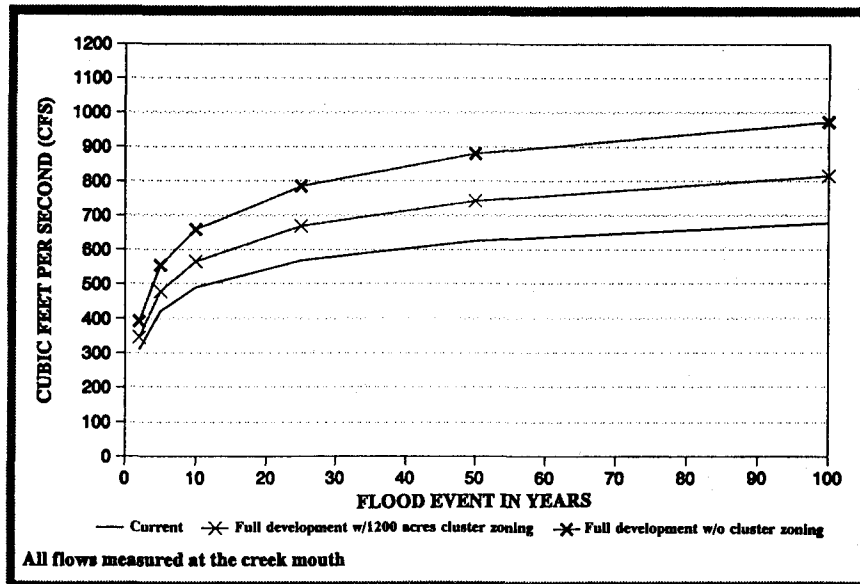
Recommendation 10.3.1: Require urban design techniques such as cluster development and urban villages on 1200 acres of land within the basin.

Discussion: Compact development techniques such as cluster housing utilize a number of techniques which greatly reduce the volume of stormwater generated. For instance, grouping homes on the least infiltrative area of a development site preserves the prime soils for infiltration purposes. In addition, clustered developments use fewer and narrower streets which generate substantially less runoff than typical residential neighborhoods. Preservation of a large open space area within a development not only reduces runoff, but also maintains wildlife habitat and offers recreational opportunities to residents. Approximately 50

percent of the proposed acres are zoned for high density residential and commercial/industrial development. Map 13 in Appendix 1 illustrates the location of the areas. A graphic description of cluster development is presented in Appendix 6.

The following graph (Figure 8) illustrates the appreciable benefits to flood flow management obtainable by the cluster development recommendation.

Figure 8: Alternative III Cluster Development Flow Impacts



Benefit: The potential improvements in infiltration and impervious surface reductions from open space/cluster development would contribute considerably to flood flow reductions and the preservation of wildlife habitat and open space.

Public cost: None

Project lead: Tumwater/Thurston County

Recommendation 10.3.2: Protect high quality wetlands by regulation of adjacent development.

Project description: Buffer and setback requirements adopted in Tumwater and Olympia critical areas ordinances will likely provide adequate long-term protection of several wetlands in the basin. The high quality wetlands of concern currently have minimal adjacent development. With the results of an ongoing Thurston County regional wetland study, these wetlands will be better delineated.

Additionally, the expected adoption of a new critical areas ordinance by Thurston County will encourage the protection of areas of local importance.

The wetlands addressed in the recommendation are located in the southern portion of the basin within the jurisdictions of Tumwater and Thurston County.

Benefit: Protection of existing high quality wetland habitat would be ensured.

Public cost: None

Project lead: Tumwater/Thurston County

10.4 Enforcement/Complaint Response

Adequate enforcement and complaint response would be met through the implementation of the nonstructural management program (See Chapter 11).

10.5 Pollution Source Control Programs

The recommendations in Alternative II and the regional management program would sufficiently meet the current and future needs for pollution source control programs.

10.6 System Monitoring

Alternative III proposes increased water quality monitoring.

Recommendation 10.6.1: Increase water monitoring efforts to include monitoring at more locations at a more frequent interval.

Project description: Alternative II proposes long-term water quality and sediment monitoring of the creek system at a minimum level. Under Alternative III, four additional water quality stations would be established at critical locations along the creek and tributaries.

The frequency of monitoring these stations would be increased from four times annually to six times annually. The increase would provide one additional dry weather sampling as well as an additional wet weather sampling.

Benefit: The quality of urban surface waters can widely fluctuate yearly, seasonally, and from storm to storm. The monitoring would thus generate higher quality data.

Estimated public cost: \$4,000/year in addition to the monitoring proposal presented in Alternative II.

Project Lead: Olympia/Thurston County Environmental Health Department.

10.7 Public Involvement and Education

Alternative III does not propose additional public involvement and education activities in addition to those presented by the two levels of service in the nonstructural management program (Chapter 11).

10.8 Cooperative Program Management

Alternative III supports the implementation of a comprehensive regionalized program for water resource management. While the effectiveness and efficiency of a regional program are perceivable, the overall needs and implications of a cooperative program have not been investigated as part of the basin planning effort.

11.0 NONSTRUCTURAL SURFACE WATER MANAGEMENT PROGRAM

Several basin plans are currently underway for watersheds within the north Thurston County area. In the future, additional basin plans are anticipated to be completed. Each current and future plan contains basin-specific capital recommendations that focus on problems that occur and that can be solved within the context of an individual drainage basin. In addition, the plans contain recommendations that address noncapital issues existing in every drainage basin throughout the region. Jurisdictions within the north Thurston County area have worked together to create a package of noncapital recommendations to be included in each basin plan. Until this package is implemented, all current and future basin plans will include identical recommendations for a noncapital program.

The following package of recommendations would be implemented by participating jurisdictions to the extent that adequate funding is available. It is not intended that all recommendations would be implemented in the first year following plan adoption. Rather, the highest priority recommendations be funded first, and others phased in over time.

A map of the drainage basins in the northern Thurston area (Figure 9) is presented on the following page. Estimated costs for implementing these recommendations are presented in Table 6 at the end of this chapter. These costs are expected to change over time as jurisdictions further analyze their specific approaches for implementing each recommendation.

11.1 Implementation Strategies for Nonstructural Recommendations

Two strategies have been developed to streamline implementation of the nonstructural recommendations. Both are described briefly below:

Coordinate and Implement Regionally: The scope of the recommendations under this strategy go beyond basin and jurisdictional boundaries and require cooperative participation to succeed. All jurisdictions would coordinate and contribute financially to one lead agency for each program recommendation, which would coordinate activities throughout the region.

Total recommendations under this strategy: 14

Examples: Multijurisdictional plan coordination, community grants.

Coordinate Regionally, Implement Locally: The scope of the recommendations under this strategy also go beyond basin and jurisdictional boundaries, but the recommendations would be implemented by individual jurisdictions. Each jurisdiction would have programs and staff in place to support these recommendations. Coordination would occur through existing processes.

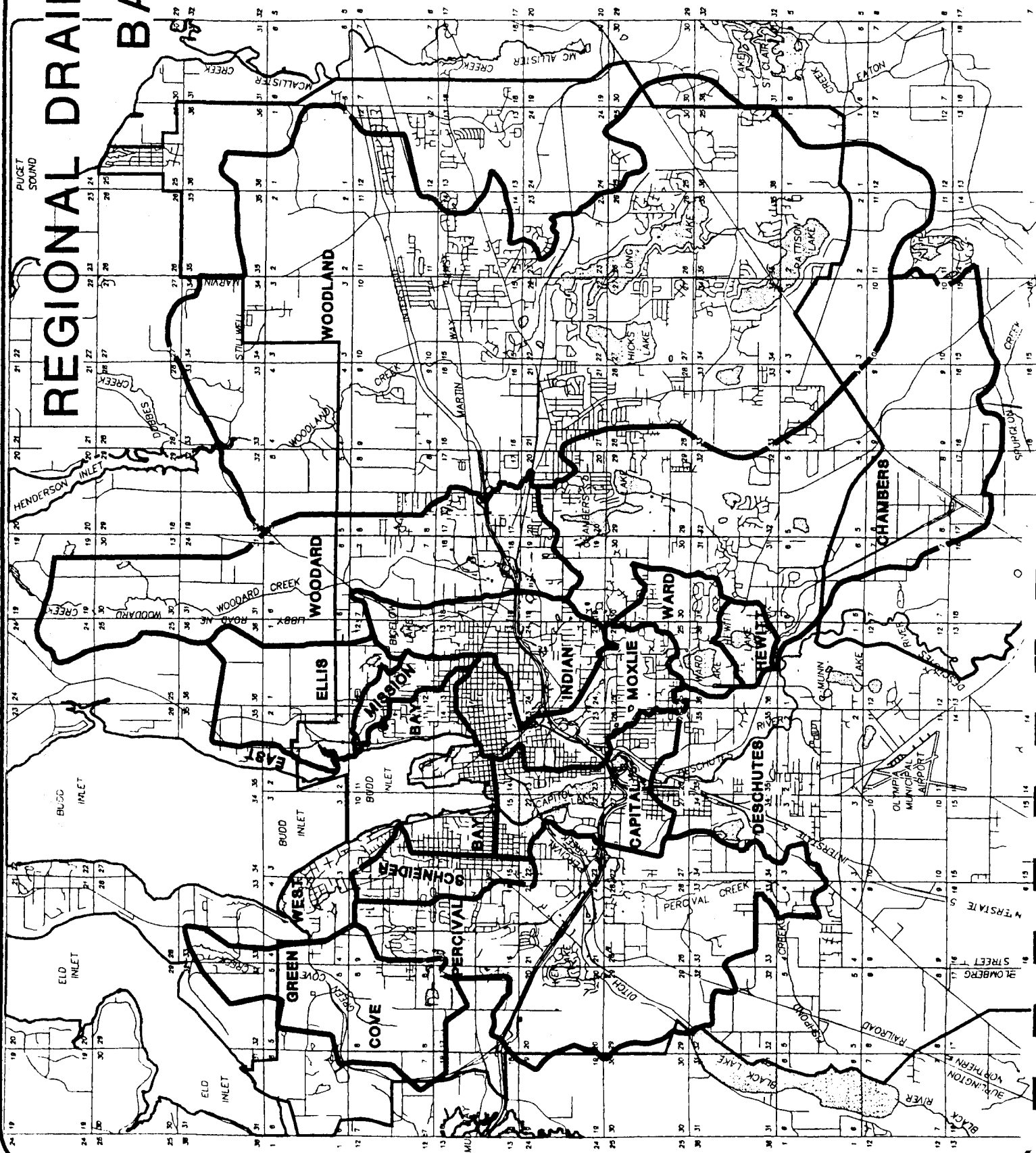
A map of the Sacramento-San Joaquin River Delta region, showing major waterways and the locations of various drainage basins. The map includes labels for 'SACRAMENTO RIVER', 'SAN JOAQUIN RIVER', and 'SACRAMENTO-SAN JOAQUIN RIVER DELTA'. A grid of numbered boxes (1-24) is overlaid on the map, with a legend indicating that these numbers correspond to the drainage basins listed in the adjacent table. The study area is highlighted in the upper right corner of the map, corresponding to basins 23 and 24.

**LONG TERM
URBAN GROWTH
MANAGEMENT BOUNDARY**

FIGURE 9



City of
Olympia



Total recommendations under this strategy: 22

Examples: Public information and outreach, drainage manual revisions.

11.2 Stormwater Facilities

While most stormwater facilities serve a particular basin, the jurisdictions can work together to achieve enhanced operation of existing facilities and construction of new ones.

Recommendation R-1: Maintain public and private stormwater management facilities on a scheduled basis.

Discussion: Sediment accumulations, excessive plant growth, and incidental structural failures periodically impair the design capacity of stormwater systems. To a large extent, maintenance has historically been conducted only in response to a problem. With the implementation of this recommendation, pipe systems would be cleaned every two to three years, ditches dredged every two to three years, and ponds dredged every eight to ten years. High maintenance systems would be identified and given more frequent attention. Vegetation management would be conducted yearly. New and existing private facilities would be required to enter into legally binding maintenance agreements with the respective jurisdictions.

Benefit: Elimination of many existing flooding problems within the basins.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-2: Identify public and private stormwater facilities that can be upgraded, and improve them as an alternative to building new facilities.

Discussion: Construction of new stormwater facilities is extremely costly. Often it is much more cost-effective to do minor improvements to ponds that already exist, but not functioning at full capacity. These improvements vary depending on the pond, but can be as easy as replacing an existing orifice with a smaller one, dredging, deepening, or widening the facility. If enough retrofits of existing ponds are accomplished, the need for new storage facilities can be reduced. Although retrofitting can reduce the need for construction of small storage facilities, usually it does not substantially reduce the need for regional storage facilities.

Benefit: Increased efficiency of existing ponds and reduced need for new ones.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

11.3 Habitat Enhancement/Critical Areas Protection

Habitat and wetlands can be protected efficiently using consistent management policies throughout the region. Critical habitat areas often cross jurisdictional boundaries and cannot be protected adequately using existing approaches.

Recommendation R-3: **Protect critical areas including streams, wetlands, buffer areas, and lands adjacent to these areas through regulation. Purchase of wetlands and other critical areas for the purposes of outdoor recreation, stormwater management, and education should continue to be considered as an option.**

Discussion: Because outright purchase of critical areas such as stream corridors and wetlands is often prohibitively expensive, regulations can be used to ensure the continuation of their beneficial functions. Existing regulations addressing critical areas within the jurisdictions are currently being modified to meet the requirements of the state's Growth Management Act.

Critical areas can be adequately protected by prohibiting certain detrimental uses and activities. Use of existing or enhanced regulations can protect the areas relatively well without additional public costs. When possible, purchase of important wetlands will be used to preserve these resources for outdoor recreation, educational purposes, research, and to further protect their natural functions and values.

Benefit: Cost effective protection of wetlands and other critical areas.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-4: **Provide technical and financial assistance to private parties pursuing open space preservation through programs such as conservation easements.**

Discussion: In order to place private property into permanent preservation, property owners must go through a lengthy and relatively expensive process. Preservation of open space is extremely important and should be made as easy as possible for anyone who is interested in pursuing these options. This includes the

availability of technical advice and financial assistance to cover the potential costs of the process. This program would compliment the work of the Capital Land Trust.

Benefit: Protection and preservation of critical areas currently in private ownership.

Project lead: To be determined.

Implementation strategy: Coordinate and implement regionally.

Recommendation R-5: Support and coordinate with parks and planning departments in the protection and acquisition of land offering unique open space attributes.

Discussion: The potential to lose valuable open space is extremely high due to the rapid rate of development in north Thurston County. Preservation of open space is an important component of protecting water resources. By supporting and coordinating with parks and planning on the protection and acquisition of lands that offer especially valuable open space traits, these areas will not be lost.

Benefit: Protection of lands providing exceptional visual and wildlife amenities. Preservation of the natural beauty and character of the north Thurston County area.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-6: Minimize the number of street and utility crossings through critical areas. When crossing creeks, encourage necessary street crossings to use bridges or arch culverts that maintain the natural creek substrate. Encourage new utilities to use existing utility corridors.

Discussion: Streams and wetlands are severely impacted by the construction and use of road and utility crossings. Minimization of the number of crossings would diminish resource impacts and hydrologic changes to the stream system. When no other reasonable alternative to creating a stream crossing exists, the use of arched culverts would maintain the natural stream substrate that is a critical component of stream habitat. Existing frameworks could be utilized to implement this recommendation; the most appropriate is probably through the development review process.

Benefit: Reduced degradation of water quality and habitat.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

11.4 Regulations/Development Controls

The jurisdictions can more effectively regulate development to protect natural resources if they work cooperatively.

Recommendation R-7: *Amend the Drainage Design and Erosion Control Manual for the Thurston Region, Washington (Regional Drainage Manual) to require half the current stormwater release rate for new development located on poorly drained soils, including all hydrologic Class C and D soils and many Class B soils as defined by the Regional Drainage Manual and the 1990 Soil Survey of Thurston County.*

Discussion: The Regional Drainage Manual established stormwater facility storage needs and release rates based on the best available information at the time. Section 1.3 of the manual supports the establishment of storage requirements and release rates by the basin planning process. Many jurisdictions in the Puget Sound area are evaluating the need to increase storage requirements. The recommendation is supported by recent Washington Department of Ecology (WDOE) proposals in the *Stormwater Management Manual for the Puget Sound Basin*.

The computer modeling efforts of the basin planning process have provided state-of-the-art analysis of the Indian/Moxlie, Percival, Woodard, and Woodland basins. These analyses provide far greater accuracy than past evaluations made possible.

These basins encompass approximately 49 square miles in the urban area. Much of the basins are within the Urban Growth Management Area (UGMA). The portions of the urban area not included in the basin planning areas include Ellis, Mission, Schneider, Green Cove, and Chambers basins. These basins and creek systems have been evaluated through a WDOE Centennial Clean Water Basin Reconnaissance grant (TAX90202). Through these various planning efforts, all basins and associated creek systems in the urban area have been investigated. The infiltration standards for these basins will be reevaluated and adjusted if necessary, when basin plans for them are developed.

The need to increase the drainage regulations is largely a function of the tendency of many local soil types to become saturated during storm events. Subsequently, rainfall creates runoff rather than being infiltrated. Although portions of the urban area have not been evaluated by the basin planning process, the soils in these areas are typically as prone to saturation as the soils in the evaluated basins.

The proposed drainage requirements are critical to the success of the basin plans. Failure to adopt this proposal would result in the continuation of existing management problems or a reliance on the local jurisdictions to provide appreciable quantities of stormwater storage.

In addition to the costs associated with the jurisdictions providing regional storage, numerous conveyance systems upgrades would be necessary to accommodate future high flows. The implications of appreciably higher future flows is readily apparent in the Indian Creek basin. Prior to its confluence with Moxlie Creek, Indian Creek is conveyed in pipe at 19 locations. Many of these pipes are currently at capacity. Without increased storage requirements, potential development could result in the need to replace many of the high cost pipe systems.

The recommendation to increase the storage requirements is being pursued with several qualifiers. These are as follows:

- Areas with highly permeable soils would not be required to comply with the proposed storage requirement. These soils may be capable of infiltrating stormwater and meeting the proposed release rate requirement without increasing storage volume. Numerous areas in the southern portion of the urban area typically have highly permeable soils.
- The proposed requirements provide an impetus for developers to minimize impervious surfaces and effectively infiltrate runoff within a development. Developments designed to accomplish these goals could expect an appreciable reduction in stormwater management requirements. Innovative design techniques are numerous and may include narrower road widths, porous pavement, yard infiltration, depressional landscaping, and cluster development.
- With the necessary jurisdictional fee-in-lieu policies in place, stormwater management requirements for a proposed development could possibly be reduced. The reduction would be contingent upon a jurisdictional need to correct an existing stormwater problem. Fee-in-lieu contributions could be used only in the same drainage area as the proposed development.

- The goal of this recommendation is to maintain existing, predevelopment stream flows through consistent design standards that do not place unnecessary complications on developers and engineers. For specific development sites, other methods may be considered to meet this goal.

The cost savings associated with more stringent standards are substantial when considered against potential necessary infrastructure upgrades.

Benefit: Stormwater runoff is often the primary detrimental influence on urban creek systems. Often, artificially high flood flows have a greater impact on the integrity of urban creeks than does water quality contamination. The effects of stormwater flows are apparent in the creeks in the urban area. More stringent storage requirements than those currently provided by the Regional Drainage Manual are justifiable for the protection of natural resources and the minimization of future flooding problems in developed areas.

The recommendation would also provide substantial saving in infrastructure needs. While the proposed storage requirement continues to allow increased flows to be released from a site following development, the recommendation does effectively reduce peak flows.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-8: Amend the Regional Drainage Manual to require adequate treatment of stormwater prior to infiltration in highly permeable, Class A soils in industrial/high risk areas as specified in the North Thurston County Ground Water Management Plan.

Discussion: Groundwater recharge is important to the health of creeks, water supplies, and the minimization of stormwater management costs. Stormwater infiltration is supported by current drainage design regulations. However, infiltrating contaminated waters through highly porous soils may provide inadequate treatment thereby threatening groundwater quality. A recent study conducted in the Puget Sound area supports the need for treatment prior to infiltration (Brown and Caldwell, 1990).

Benefit: Minimization of threats to groundwater quality.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-9: **Require new homes and remodels which increase impervious areas to install stormwater management systems capable of managing the volume of runoff generated by the new development.**

Discussion: While large development projects are required to install stormwater management facilities, single family home construction is not required to do so. This type of development, called infill, can have considerable cumulative effects on stormwater. There are several low cost, effective techniques that can be used for single family infill development that effectively reduce the quantity of runoff generated from the site. This recommendation does not propose that systems with sufficient capacity to accommodate the additional runoff should be upgraded.

Benefit: Reduced quantity of stormwater runoff from infill development.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-10: **Evaluate current staffing levels and employ adequate staff to fully implement and enforce key elements of the Regional Drainage Manual.**

Discussion: Many requirements of the Regional Drainage Manual require considerable staff time to implement and enforce effectively. Key elements such as analysis of upstream and downstream impacts caused by new development are critical to the protection of water resources. However, the jurisdictions cannot adequately meet these requirements due to current staffing and budgetary restraints.

Benefit: Minimization of future flooding and natural resource problems.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-11: **Restrict development in flood hazard areas so that existing flood elevations are not increased under build-out conditions.**

Discussion: New development within the 100-year flood plains of all north Thurston County creeks would be limited. Existing structures would be reduced over time. Flood plain filling and construction that results in loss of local stream capacity and increased downstream flows would be eliminated.

The intent of this recommendation is to restrict development in the flood plain, not to prohibit compatible uses such as agriculture, or parks and trails. The basin plans require developers and new homeowners to meet higher standards to prevent increases in flooding. Common sense dictates that the capacity of existing natural drainages should be maintained. Developments in the flood plain reduce natural drainage capacities and force flood waters further out into surrounding areas.

Benefit: The natural ability of streams to control floods would be protected.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-12: Consider development standards to minimize future impervious surfaces by such measures as narrower streets, porous pavements, reduced parking requirements, increased building heights, and revised landscaping requirements. Encourage common standards throughout the jurisdictions.

Discussion: Streets generate approximately 25 percent of total urban stormwater. Parking lots and driveways contribute lesser but appreciable quantities of runoff. Landscaping requirements can be incompatible with the efficient management of stormwater. Elimination of conflicting regulatory objectives and minimization of impervious surfaces reduces stormwater management costs and promotes groundwater recharge. Local planning departments are currently conducting preliminary investigations of these issues. The implementation of improved standards is important to effective long-term water resource management.

Benefit: Surface water management problems would be minimized by reducing the generation of runoff.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-13: Encourage innovative land use planning techniques (such as cluster housing) that preserve undisturbed open space and natural stormwater functions where appropriate throughout the region.

Discussion: Innovative development techniques such as cluster housing are effective means of reducing runoff, improving runoff quality, enhancing groundwater recharge, and protecting critical areas. Because cluster housing

maintains a substantial amount of undisturbed vegetation, the natural functions and characteristics of an area may continue after development. The areas most appropriate for cluster development and other creative development techniques will be identified on a basin-specific level.

Benefit: Reduction of runoff quantity and improved runoff quality, groundwater recharge, and sensitive area protection.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-14: Establish uniform standards for land clearing and grading within the Urban Growth Management Area that minimize removal of native vegetation, improve water quality, and reduce stormwater runoff quantity.

Discussion: The single largest impact on stormwater is the conversion of land from natural vegetation (including trees and shrubs) to grass or development. Olympia, Lacey, Tumwater, and Thurston County all regulate vegetation removal and grading through ordinances. A detailed clearing and grading plan is required for all new development. The plan must specifically identify vegetation to be removed, a schedule for vegetation removal and replanting, and the method of vegetation removal. Thurston County is developing a vegetation protection ordinance that will require a permit for all land clearing.

Uniform standards are an effective method to ensure that vegetation is properly managed during preparation of new development sites. Because the Urban Growth Management Area (UGMA) is intended to be developed at similar densities across the jurisdictions, uniform clearing and grading standards throughout the area are appropriate.

Benefit: Preservation of soil infiltration capacities, reduction of erosion, protection of creek channels, and protection of wildlife habitat.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

11.5 Enforcement/Complaint Response

Historically, jurisdictions in northern Thurston County have not supported a sufficient level of regulation enforcement and complaint response. Regulations would be more effective if consistently enforced throughout the region.

Recommendation R-15: Evaluate current staffing levels and employ adequate staff to fully enforce development and environmental protection regulations which impact water resources. Improve coordination, management, and effectiveness of complaint response to water quality, habitat, and flooding issues regionally.

Discussion: The jurisdictions in north Thurston County have limited staff available for the enforcement of existing local regulations. Mechanisms aimed at protecting water resources (such as maintenance agreements between homeowners associations and the jurisdictions) are not well enforced. Improving enforcement would help protect the important functions of wetlands, creeks, and other critical areas within the basins.

Cooperation among the jurisdictions would improve public access to complaint systems, increase technical assistance staff, and increase public awareness of complaint system availability. More highly publicized complaint phone numbers and staff for response would increase the efficiency and effectiveness of existing complaint response efforts. Complaint response would be coordinated with Stream Team database and monitoring.

Benefit: Protection of creek channels, preservation of soil infiltration capacities, and reduction of illegal land grading and alterations which will decrease flooding, habitat degradation, erosion, and sedimentation. Better field inspection and analysis, public access and involvement, and remedial action.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

11.6 Pollution Source Control Programs

Programs aimed at reducing pollution at its source are especially adaptable to regional implementation. The use of a diverse set of programs to stop the release of contaminants into the environment would improve the quality of water resources throughout the region.

Recommendation R-16: **Support the adoption of a nonpoint pollution source control ordinance that defines practices and procedures to protect the public health and water quality of the Thurston region from polluted surface water runoff. Define penalties for infractions, responsibilities for clean-up, and train enforcement staff.**

Discussion: The state has limited resources to enforce nonpoint source regulations. A nonpoint pollution source control ordinance will enable local jurisdictions within northern Thurston County to regulate nonpoint sources when state agencies are unable to enforce their regulations. Such an ordinance does not replace state regulations, but rather complements them. Thurston County is expected to adopt such an ordinance in 1992.

Benefit: Protection of water quality and public health.

Project lead: Thurston County Health Department

Implementation strategy: Coordinate and implement regionally.

11.7 System Monitoring

System monitoring is a crucial element of water resource protection. While many monitoring efforts will be specific to each individual basin, it is also important to establish a regional monitoring program to oversee all water resources in the north Thurston region.

Recommendation R-17: **Establish a long-term regional water quality, stream gauging, and stream assessment program for key streams throughout the north Thurston region.**

Discussion: Monitoring environmental trends permits staff to evaluate the effectiveness of corrective measures, and provides an early warning system for problems. This program could utilize both volunteers and professional staff.

Benefit: Protection of aquatic resources within the north Thurston region, remedial measures will be evaluated and improved, and impacts related to specific projects will be identified.

Lead jurisdiction: Thurston County.

Implementation strategy: Coordinate and implement regionally.

Recommendation R-18: Monitor stormwater facilities to assess the performance of best management practices (BMPs) and promote improved management techniques.

Discussion: The performance of stormwater treatment techniques is rarely evaluated. A degree of uncertainty exists regarding the long-term level of treatment provided by the best available, and current required, techniques.

Benefit: Accurate evaluations of performance would provide the basis for improvements in currently used techniques.

Project lead: To be determined.

Implementation strategy: Coordinate regionally, implement locally.

11.8 Public Involvement and Education

Recommendations are organized by the general categories of public involvement and education (PIE) activities discussed in Chapter 7: community grants, education and training, public information and outreach, coordination and evaluation, and data management.

COMMUNITY GRANTS

Recommendation R-19: Establish a regional community grants program to support volunteer action projects, school projects, and community education.

Discussion: A permanent funding source would provide community groups and businesses with the means to participate in solving local storm and surface water problems. Some of the grants would target high priority projects and activities in each basin. There are no existing community grant programs devoted to water resources issues.

Benefit: Community initiated projects to address local storm and surface water problems, and additional funding for school projects focusing on water resources.

Project lead: Thurston County.

Implementation strategy: Coordinate and implement regionally.

EDUCATION AND TRAINING

Recommendation R-20: **Present Stream Team activities for volunteers including: networking meetings, regional Stream Team workshops and action projects, and advanced training seminars. Involve school and community groups, and lake and streamside property owners in Stream Team activities and provide technical assistance for volunteers.**

Discussion: Volunteer projects increase the sense of responsibility for water resources among local residents. The Stream Team program will result in hundreds of skilled volunteers who are actively protecting and restoring water resources, training other volunteers, and educating their friends and neighbors. This measure will extend and expand the existing Stream Team program which currently relies exclusively on grant funding.

Benefit: Increased awareness and protection of water resources throughout the north Thurston region.

Project lead: Olympia and Thurston County.

Implementation strategy: Coordinate and implement regionally.

Recommendation R-21: **Establish Public Involvement and Education (PIE) internships or work-study positions in local stormwater programs, and encourage local colleges to offer graduate and undergraduate projects and classes on water resources public involvement and education.**

Discussion: College interns and projects will help to produce educational materials, interpret natural resources, coordinate volunteers, evaluate programs, and manage data. This will create a pool of trained, experienced resource people who can assist community water resources PIE programs in Thurston County. Currently, no local stormwater programs have PIE internships.

Benefit: Inexpensive assistance for local stormwater programs, and development of qualified public involvement professionals.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-22: Create a Stream Team Naturalist program.

Discussion: The Stream Team Naturalist program would present interpretive programs on the natural resources of the watersheds to schools, community groups, and the general public. Stream Team volunteers would also be trained to present information. The Stream Team program would coordinate training and field activities. No such program currently exists.

Benefit: Support for public involvement and outreach activities, and improved environmental awareness in the community.

Project lead: Olympia and Thurston County.

Implementation strategy: Coordinate and implement regionally.

Recommendation R-23: Provide business and industry with education and training opportunities.

Discussion: Business education activities will help forge a partnership between businesses and local government, with the common goal of protecting and improving water resources. Activities associated with this recommendation would include: workshops with Thurston Conservation District to implement conservation plans; workshops on implementing the new drainage manual and basin plan requirements; technical support on waste management and water resource issues (source control and BMPs through Operation: Water Works); and coordination with business organizations and public agencies.

The improved relationship between public and private sectors will eventually reduce the need for enforcement. Operation: Water Works is a temporary, grant-funded project to encourage best management practices for businesses; the other parts of this recommendation, such as drainage manual training and technical support would constitute a new program.

Benefit: Heightened awareness and understanding of water resources within the business community. Potential reduced need for enforcement of environmental codes.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-24: Present water resource training workshops for school teachers, and provide water resource education kits that include predesigned curricula and teaching aids.

Discussion: Water resource education for young people is a long-term investment in developing public values that support environmental protection and stewardship. Because environmental education is currently required in all Washington public schools, local governments have an opportunity to work cooperatively with school districts. Three educator workshops were presented in 1990 through a centennial grant that will expire in June, 1991.

Benefit: Increased environmental education within public schools focusing on water resources.

Project lead: Thurston County.

Implementation strategy: Coordinate and implement regionally.

Recommendation R-25: Train jurisdictional staff to implement and enforce basin plan recommendations such as new drainage standards and land use regulations.

Discussion: Adoption of the basin plan will result in a variety of new practices and regulations. Effective plan implementation will require retraining local government employees because they have the primary responsibility for enforcement and technical assistance. This recommendation would apply in Percival, Indian/Moxlie, and Woodard/Woodland basins.

Benefit: Heightened awareness and enforcement of basin plan recommendations by jurisdictional staff.

Project lead: Lead jurisdiction for basin plan.

Implementation strategy: Coordinate and implement regionally.

PUBLIC INFORMATION AND OUTREACH

Recommendation R-26: Provide opportunities to involve youth, families, teachers, and schools in special, water-related community activities.

Discussion: A program of special community activities will include Family Fun Days, children's Stream Team day camp, "hands-on" displays for schools, field trips to areas of special interest, cold water aquaria for classrooms, and classroom water quality presentations by staff. This program will involve residents who have not been reached by existing Stream Team programs, and will encourage active participation among entire family groups. No existing program meets this need.

Benefit: Helps local schools meet Washington's environmental education requirements, and creates long-term improvements in water resources management.

Project lead: Olympia and Thurston County.

Implementation strategy: Coordinate and implement regionally.

Recommendation R-27: Create a storm and surface water public information program to provide consistent, accurate information to the media and increase educational outreach to the public.

Discussion: The public information program would provide the primary communication between local water resource management agencies, the media, and the public. The program would manage all media contacts by arranging interviews and filming sessions, producing accurate news releases and briefings, publishing frequent articles in newspapers and periodicals, and mounting high profile media campaigns. Outreach activities would include publishing educational brochures, posters, and publicity materials for local events that highlight the national significance of local issues. This program would improve the public perception of local water resource protection efforts, and prevent damaging misinformation from reaching the public through the media.

Currently, numerous local agencies provide bits and pieces of public information on water resource issues, with little consistency between information sources. This measure would consolidate these scattered sources of information and provide reliable funding. Most existing outreach relies on temporary project funds.

Benefit: More accurate and consistent public information, improved public perception of resource protection programs, and increased public participation in water resources programs.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-28: Investigate financial incentives that encourage schools to incorporate water resources curriculum and meet established criteria.

Discussion: Utility rates will offer a financial incentive for schools to develop and maintain water resources education programs.

Benefit: Helps schools meet state environmental education requirements, and creates long-term improvements in water resources management.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-29: Create a Citizen Stream Patrol program.

Discussion: The Citizen Stream Patrol program will train local citizens to identify destructive practices such as illegal dumping, land clearing and grading, inadequate erosion controls, grazing in streams, and other violations. The Stream Team program will coordinate training and field activities. Stream-specific teams will work closely with existing enforcement and complaint-response programs. No such program currently exists.

Benefit: Increased personal responsibility for protection and stewardship of local stream basins, and improved regulations enforcement.

Project lead: Olympia and Thurston County.

Implementation strategy: Coordinate and implement regionally.

Recommendation R-30: Develop new water resource exhibits for fairs and local events.

Discussion: Public exhibits will include portable, free-standing display boards as well as permanent interpretive signs for critical resource sites. Portable displays will be updated regularly to show progress on current projects. Exhibit topics will include stream systems, volunteer projects, impacts of runoff, and suggestions for homeowners. Exhibits will be displayed at all major local events including Harbor Days, Wooden Boat Festival, Capitol Lakefair, Earth Day, Lacey Fun Fair, County Fair, Community Awareness Days, etc. Exhibits will also be displayed at schools, libraries, and community centers. Currently, exhibits often include out-of-date information.

Benefit: Improved outreach to audiences which have not received other types of public information, and increased public participation in volunteer projects

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-31: Manufacture and install watershed boundary signs for each major drainage in Thurston County using a region-wide design.

Discussion: The most important challenge for public water resource education is making residents aware of the existing natural resources in their local areas. Stream crossing signs have already helped improve public awareness, and watershed boundary signs will increase awareness by identifying drainage boundaries. Existing signs on Interstate-5 in the Nisqually watershed provide a good example.

Benefit: Increased public awareness of water resources.

Project lead: Thurston County.

Implementation strategy: Coordinate and implement regionally.

COORDINATION AND EVALUATION

Recommendation R-32: Devote staff to a regional Education Technical Advisory Committee (ETAC).

Discussion: Water resources education demands regional coordination because water resources transcend local boundaries. Each basin jurisdiction needs to devote ongoing staff to the regional PIE program, so as to avoid duplication with other programs and provide a consistent method for evaluating public involvement and education activities. The ETAC would be responsible for coordination and evaluation of plan PIE elements, implementation of the public education guidelines in the Puget Sound Water Quality Management Plan, creation of a database to help monitor and evaluate plan implementation, and organization of a regional citizen advisory committee to monitor public education and involvement.

Benefit: Enhanced interjurisdictional coordination on public education issues.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

DATA MANAGEMENT

Recommendation R-33: Create a computerized data management system to organize and analyze data collected by Stream Teams, public workshops, and volunteer projects. Publish results biannually, including photos, monitoring data, and volunteer participation.

Discussion: The data management system will help managers to coordinate and evaluate the effectiveness of PIE activities, provide quick access and consistent information to all stormwater programs, and could be expanded to improve existing complaint response programs. Currently, data management is haphazard and inconsistent between jurisdictions.

Benefit: Improved PIE coordination and public assistance.

Project lead: Olympia.

Implementation strategy: Coordinate and implement regionally.

11.9 Cooperative Program Management

Several basins in north Thurston County are the subject of basin plans. Because drainage basins do not recognize jurisdictional boundaries, it is imperative that the governments work cooperatively to implement the plans.

Recommendation R-34: Support multijurisdictional basin plan coordination and implementation.

Discussion: Although basin plan implementation would necessitate increased levels of interjurisdictional coordination and decision making, existing administrative practices could be utilized depending upon the funding approach chosen to facilitate these needs.

Benefit: More comprehensive approach to coordinating the implementation of current and future basin plans.

Project lead: All jurisdictions.

Implementation strategy: Coordinate regionally, implement locally.

Recommendation R-35: Establish a technical support position to assist jurisdictions in identifying appropriate funding sources and preparing grant applications for implementation of basin plan recommendations.

Discussion: Due to budgetary constraints, many of the recommendations within the basin plans will have to be implemented using outside financial assistance. Current staffing levels do not allow adequate time to be dedicated to searching for potential funding sources and preparing numerous grant applications.

Benefit: Heightened awareness of potential funding sources and competitiveness in the grant awarding process.

Project lead: Thurston County.

Implementation strategy: Coordinate and implement regionally.

Recommendation R-36: Establish a five-year implementation strategy for increased cooperation in water resources management within the Urban Growth Management Area.

Discussion: Stormwater issues are most effectively managed through regional cooperation. As the UGMA becomes increasingly developed it may be necessary for expanded regional management of stormwater issues. Interjurisdictional management is the most cost effective and least duplicative method of handling stormwater concerns.

Benefit: Increased effectiveness and comprehensiveness of stormwater management programs.

Project lead: To be determined.

Implementation strategy: Coordinate and implement regionally.

Table 5: Nonstructural Surface Water Management Program Costs

OLYMPIA					TUMWATER					LACEY					THURSTON COUNTY				
	Capital	Staff, FTE	Misc. Annual \$	One-Time Staff \$	Capital	Staff, FTE	Misc. Annual \$	One-Time Staff \$	Capital	Staff, FTE	Misc. Annual \$	One-Time Staff \$	Capital	Staff, FTE	Misc. Annual \$	One-Time Staff \$			
R-1					120,000	2			120,000	3			330,000	3.6					
R-2																			
R-3																			
R-4		0.04	1,000			0.04	1,000			0.04	1,000			0.04	1,000				
R-5		0.04				0.04				0.04				0.04					
R-6		0.02				0.02				0.02				0.02					
R-7				7,500				7,500				7,500				7,500			
R-8																			
R-9																			
R-10		0.2				0.4				0.4				1.0					
R-11				2,000				2,000				2,000				2,000			
R-12				10,000 ¹				10,000 ¹				10,000 ¹				10,000 ¹			
R-13																			
R-14				7,500				7,500				7,500				7,500			
R-15						1.0				1.0				2.0					
R-16																			
R-17			18,000				4,000				11,000				21,000				
R-18			5,000				5,000				5,000				5,000				
R-19		0.05	3,000			0.05	3,000			0.05	3,000			0.05	3,000				
R-20		0.6	1,200			0.6	1,200			0.6	1,200			0.6	1,200				
R-21		0.15	500			0.15	500			0.15	500			0.15	500				

OLYMPIA					TUMWATER					LACEY					THURSTON COUNTY				
	Capital	Staff, FTE	Misc. Annual \$	One-Time Staff \$		Capital	Staff, FTE	Misc. Annual \$	One-Time Staff \$		Capital	Staff, FTE	Misc. Annual \$	One-Time Staff \$		Capital	Staff, FTE	Misc. Annual \$	One-Time Staff \$
R-22				2,000					2,000					2,000					2,000
R-23				750					750					750					750
R-24		0.5	2,500				0.5	2,500				0.5	2,500				0.5	2,500	
R-25		0.125					0.125					0.125					0.125		
R-26																			
R-27			2,400					2,400					2,400					2,400	
R-28		0.25					0.25					0.25					0.25		
R-29		0.25					0.25					0.25					0.25		
R-30		0.025	500				0.025	500				0.025	500				0.025	500	
R-31				500					500					500					500
R-32		.25	500				.25	500				.25	500				.25	500	
R-33		0.05		1,250			0.05		1,250			0.05		1,250			0.05		1,250
R-34			5,000					5,000					5,000					5,000	
R-35		0.125					0.125					0.125					0.125		
R-36			5,000					5,000					5,000					5,000	
Total	0	2.675 \$120,375	44,600	31,500		120,000	5.875 \$264,375	30,600	31,500		120,000	6.875 \$309,375	37,600	31,500		330,000	9.075 \$408,375	47,600	31,500

¹ Assumes 120,000 Centennial Grant match.

12.0 IMPLEMENTATION COSTS

The improved management approaches presented in Alternatives II and III of the basin plan, in conjunction with the regional management program, provide the local jurisdictions with the ability to correct existing and prevent future flooding problems and protect the Percival Creek system from additional degradation. These alternatives represent a marked improvement in the way the local jurisdictions manage surface water concerns.

Because Alternatives II and III offer a proactive approach to problem solving, the municipal costs associated with the implementation of these alternatives are higher than the current funding levels. Many of these costs are associated with capital or constructed improvements aimed at correcting historical problems. Unfortunately, the construction of stormwater management facilities is typically land intensive. The rapid development of Percival basin in conjunction with the high density land use zoning classifications common to many of the remaining undeveloped areas continually reduces the availability of affordable land. With this development scenario in mind, the costs of capital improvement solutions can be expected to increase dramatically in future years. Capital solutions to the problems of the basin are most cost-effectively addressed by acting expediently. Other costs of the plan offer a multifaceted approach to problem prevention and, when feasible, emphasize less costly noncapital improvement techniques.

Components of the noncapital improvement aspects of the plan include effective operations and maintenance, improved enforcement and complaint response, cluster development zoning, creek monitoring, and public involvement and education. The need for these activities is not limited to the Percival basin, nor could the activities be cost-effectively implemented for only the basin. These activities necessitate specialized staff responsible for the implementation of a program or policy throughout the region or jurisdiction. The Percival Creek basin plan as well as the Woodland/Woodard Creek and Indian/Moxlie Creek plans include a consistent regional management program described in Chapter 11 that is suggested for adoption throughout the North Thurston County area.

Because Alternatives II and III encompass basin-specific as well as the regional management program, the funding needs for both aspects of the basin plan are presented in the cost analysis. The Indian/Moxlie Creeks and Woodard/Woodland Creeks plans will contain identical recommendations and associated costs for the regional management program.

12.1 Existing Basin Revenues

The combined stormwater utility rate revenues from the three jurisdictions within the Percival Creek basin total approximately \$490,000/year. These revenues were calculated by determining the number of single family residences, and the quantity of impervious surfaces associated with nonresidential utility accounts and public streets. Nonresidential accounts provide approximately \$310,000 of these funds. The distribution of the revenue for the jurisdictions of Olympia, Tumwater, and Thurston County is approximately 81 percent, 16 percent, and 2 percent, respectively.

General facilities charges (GFCs) provide stormwater funding in addition to the utility rates. GFCs are a one-time fee charged at the time of development that help sponsor continued improvements to the municipal stormwater infrastructure. In 1991, Olympia and Tumwater collected approximately \$30,000 and \$145,000, respectively, in GFCs from new developments in the basin. The City of Tumwater limits GFCs to new development on Tumwater Hill; Olympia's charge is city-wide.

Utility revenues provide for the existing level of management within the basin and contribute to the local jurisdictions' stormwater programs of policy development, regulatory oversight, enforcement, operations and maintenance, public involvement and education, and capital improvements. Several capital improvement projects are currently underway in the basin.

The revenue generated by utility payers in the basin compared to the entire stormwater management budget for the City of Olympia is roughly proportional to the land area within the basin compared to the entire land area within Olympia's jurisdiction. Although not feasible to calculate, this comparison indicates that revenues generated within the basin are most likely utilized within the basin. Similar relationships are expected for Tumwater and Thurston County. Additional funding from several planning and public education grants is currently providing appreciable program budget supplements.

12.2 Rate of Growth in Basin Revenues

Assuming that future development growth rates within the basin approximate present levels of growth, new development will provide a six percent yearly revenue increase. Annual increases in utility revenues for Olympia, Tumwater, and Thurston County may be as high as \$19,000, \$9,000, and \$1,500, respectively. At full development of the basin,

total revenues under the existing utility structure could approach \$1,300,000/year. Inflation can be expected to approximate this growth rate. Given this scenario, growth is expected to negate inflationary pressures but not to provide additional revenues.

12.3 Implementation Costs for Alternative II and III

The implementation costs associated with Alternatives II and III have been delineated based on whether the cost is basin-specific or regional in nature. Additional cost delineations segregate existing and future problems. The costs applicable to each of the three jurisdictions are also presented.

12.3.1 Basin-Specific Costs

Based on the recommendations presented in Chapter 9, the one-time public capital costs of Alternative II exceed the current level of basin-generated funding by \$2,338,000. The capital costs would be targeted for the construction of improved stormwater retention/detention, conveyance, and treatment facilities. Approximately 90 percent of the capital costs are associated with the correction of historical deficiencies. The noncapital costs associated with implementation of the alternative are addressed in the regional management program.

The public capital costs for Alternative III are \$200,000 higher than for Alternative II. Annual costs would not increase. Future private costs associated with upgrading downstream stormwater systems would be \$159,000 for both alternatives. Table A-16 in Appendix 2 summarizes these costs and presents potential funding sources.

12.3.2 Nonstructural Surface Water Management Program Costs

The nonstructural management program (Chapter 11) needed for the implementation of Alternatives II and III includes increased regulatory oversight, additional operations and maintenance services, improved enforcement, and enhanced public involvement and education. The annual cost of the program to the entire jurisdictions of Olympia, Lacey, Tumwater, and Thurston County is approximately \$1,264,000. A one-time cost of \$696,000 would be necessary. A delineation of the costs of the nonstructural recommendations and jurisdictional needs is presented in Table 6 in the previous chapter.

12.4 Cost Share Approaches

Regardless of the funding mechanisms implemented by the three jurisdictions, costs for capital and noncapital activities would have to be allocated between the jurisdictions. Three approaches to capital improvement project and noncapital program cost sharing are available. These are discussed below:

12.4.1 Cost Share Option A

Under cost share option A, necessary funding for the correction of existing and potential future problems would be tied to the current level of development within each jurisdiction that contributes to the problem. The area contributing to a specific problem would be defined topographically. Funding for water quality and stormwater detention for the purpose of improving conditions in the Percival creek system would be similarly distributed among the jurisdictions after determining the most effective location for the facility. Projects aimed at correcting an existing problem and/or providing the capacity to prevent future problems would be funded by evaluating existing and/or potential jurisdictional contributions.

The calculation of a jurisdiction's contributing area for any one project would be based on effective impervious surfaces. These surfaces are those impervious areas that generate runoff which leaves developed sites and reaches a downstream stormwater conveyance system. Conversely, many impervious surfaces generate runoff that is promptly infiltrated by adjacent permeable soils. For example, an office building and a single family residence may contain the same quantity of impervious surfaces, but due to the presence of a yard capable of infiltrating roof runoff the residential site would have less effective impervious surfaces than the office building. The calculation of effective impervious surfaces within each jurisdiction for existing and build-out conditions has been completed (Thurston Geographic Information Facility, 1990). Approximate cost shares for each basin-specific project based on Option A are presented in Table 7.

The broad-based nature of the noncapital components of the basin plan do not lend themselves well to a funding approach based on a topographic delineation of the source problem as is common for capital improvements. Cost sharing of noncapital programs is better addressed by cost share options B and C.

**Table 7: Implications of Cost Share Options
Alternative II Capital Improvements
Percival Creek Basin**

Recommendation	Cost Share Option A			Cost Share Option B			Cost Share Option C			
	Olympia	Tumwater	Thurston Co	Olympia	Tumwater	Thurston Co	Olympia	Tumwater	Thurston Co	Lacey
9.1.1 Construct North Percival Stormwater Management Facility	1,532,000	168,000	0	1,241,100	357,000	102,000	496,000	133,000	799,000	272,000
9.1.2 Upgrade Cooper Point/Black Lake Boulevard Conveyance System	199,000	0	0	145,000	42,000	12,000	58,000	16,000	93,000	32,000
9.1.3 Retrofit Mottman Industrial Park Drainage System	0	87,000	0	64,000	18,000	5,000	25,000	7,000	41,000	14,000
9.1.4 Upgrade North Basin conveyance System	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9.1.5 Increase the Flood Control Capacity of Yauger Park	110,000	0	13,000	49,000	54,000	20,000	36,000	10,000	58,000	20,000
9.1.6 Improve Capital Mall Drive Conveyance System	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9.1.7 Improve Conveyance System to Regional Detention Pond at Cooper Point Bridge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9.1.8 Upgrade Existing Private Stormwater Storage Facilities	54,000	6,000	0	44,000	13,000	3,000	18,000	5,000	27,000	10,000
9.2.2 Remove Fish Barriers in Percival Creek	17,000	118,000	30,000	120,000	35,000	10,000	48,000	13,000	78,000	26,000
9.2.3 Improve Fish Passage in the Black Lake Drainage Ditch	0	4,000	0	3,000	1,000	0	1,200	600	1,800	400
Total Financial Responsibilities	1,912,000	383,000	43,000	1,666,100	520,000	152,000	682,200	184,600	1,097,800	374,400

12.4.2 Cost Share Option B

Cost share option B proposes that the distribution of a specific project or program cost would be based on a jurisdiction's total quantity of effective impervious surfaces within the entire basin. This approach would utilize funding from all three jurisdictions regardless of a specific project's location within the basin.

The option provides a readily acceptable approach to the funding of noncapital improvement programs such as creek monitoring. For capital improvement projects, the option represents a departure from current cost share determinations. While not a regional approach to funding, the option takes the step of distributing the funding needs for projects among the jurisdictions sharing responsibility for the basin. By funding projects based on the total impervious surfaces within the basin, the option recognizes the interconnectedness of the basin's, and to a lesser extent the region's different land uses.

For this option, the financial responsibility of each jurisdiction in the basin has been evaluated based on the total acres of effective impervious surfaces located within each jurisdiction. The evaluation involved counting the number of single family residential homes in each basin using 1991 aerial photographs, measuring the surface area of public roads, and using HSPF computer model input data to tabulate commercial acres. Empirical values developed during the calibration of the HSPF model were necessary to convert impervious surface areas to effective impervious surface areas. Future contributions were estimated using current zoning and site coverage regulations.

The analysis provides an overview of existing and potential jurisdictional responsibilities. The percentage of existing and potential future acres of effective impervious surfaces within the basin are divided between jurisdictions as presented in the following table.

<u>Jurisdiction</u>	<u>Effective Impervious Surfaces, %</u>	
	<u>Existing</u>	<u>Potential Future</u>
Olympia	73	40
Tumwater	21	44
Thurston County	6	16

Based on these percentages, Olympia would be responsible for 73 percent of the existing stormwater management problems and 40 percent of all future management needs. As indicated by these values, Tumwater and Thurston County could be expected to be responsible for increasing percentages of the management needs as the urban area continues to expand in these jurisdictions. For example, growth in Tumwater is expected

to continue to increase and, with full development of the basin, contain slightly more effective impervious surfaces than Olympia. Tumwater's financial responsibility for preventing future problems is therefore greater than is Olympia's. These jurisdictional responsibilities for existing and potential needs are reflected by the cost evaluation of the proposed basin-specific projects presented in Table 7.

12.4.3 Cost Share Option C

Cost share option C is a regional approach to funding surface water management programs within the Urban Growth Management Area (UGMA). The 84-acre UGMA is the core of the region's urbanizing area as formally delineated by the four local jurisdictions. High density development is encouraged within the area to prevent urban sprawl and cost effectively provide municipal services.

The option expands the responsibility for funding basin management needs beyond the jurisdictions encompassing the basin. Historical problems within the urban core could be funded regionally, while rural problems could be addressed with the recognition that these areas may be more heavily urbanized in the future. The cost sharing option acknowledges that the successful management of surface water provides a critical element in the region's high quality of life, and is therefore a broad-based benefit and concern. Such management may also offer increased operational and managerial efficiencies.

Several levels of regionalization are available under this option. These levels could allow gradual and directed implementation of the option. Potential levels of regional consolidation are as follows:

- Public education and involvement activities could be funded at the regional level.
- Regulations addressing drainage requirements and sensitive areas could be consistent within the jurisdictions.
- Activities such as operations and maintenance and enforcement could utilize common staff and equipment.
- Utility rate surcharges for the funding of basin-specific projects could be imposed throughout the UGMA.
- Major capital improvement projects could be funded by a regional mechanism.
- The full scope of jurisdictional management responsibilities could be shifted to a single entity.

Depending upon the degree of consolidation, the implementation of cost share option C would represent a marked departure from existing jurisdictional policies. A cursory analysis of the financial implications of this option on basin-specific capital projects is presented in Table 7. Jurisdictional responsibilities under cost share option C have been estimated based on the respective current populations of the jurisdiction.

12.5 Proposed Cost Share Approach

The determination of an appropriate cost share option must consider equity, effectiveness, and feasibility. With these considerations in mind, different cost share approaches can be used for different types of projects and programs. Preferred approaches should accommodate implementation within a reasonable time frame.

All three cost share options are currently being utilized on a limited basis by the four local jurisdictions. The following assignment of cost share responsibilities is proposed given already existing cost share mechanisms.

<u>Management Components</u>	<u>Cost Share Option</u>
Stormwater Facilities	A
Habitat Enhancement/Sensitive Area Protection	A, B, or C
Regulations/Development Controls	B or C
Enforcement/Complaint Response	B
Pollution Source Control Programs	B or C
System Monitoring	B or C
Public Involvement and Education	B or C
Cooperative Program Management	C

The recommended cost share approach accepts the current governmental necessity of funding stormwater facilities based on the drainage area contribution of each jurisdiction (Table 7, cost share option A). Steps to increase the degree of cooperative management should be embodied in the preferred option for the remaining noncapital management components. Higher degrees of cost sharing can be readily implemented for specific activities within, for instance, the public involvement and education program. The nonstructural management program (Chapter 11) presents the proposed degree of noncapital projects considered appropriate for the short term. The basin-specific recommendations (Alternatives II and III), as well as the nonstructural management program support ongoing long-term efforts to increase the degree of cooperation among the local jurisdictions.