

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 for the correction of existing flooding problems, and improvements in surface water management and habitat conditions without unrealistic expense or drastic changes in development patterns.

Alternative II is conservative. It proposes minor reductions in the current unnaturally high flood flows in the creek system. Although instream habitat would be improved, the technical and financial difficulties associated with rigorously reducing flood flows in Indian/Moxlie Creek basin are very high. Retrofitting stormwater systems to provide storage requires extensive land areas. These areas simply are not available in the basin without condemning existing developments. An alternative approach, underground storage is extremely costly. Those techniques are proposed in Alternative III, the optimal management option.

The specific recommendations comprising Alternative II 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. Capital improvement projects have been evaluated by hydrologic computer modeling techniques (EPA SWMM and HYDRA). Engineers 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 and drainage contributing area.

The effectiveness of Alternative II is dependent upon the implementation of the nonstructural management program (Chapter 11). For example, if Alternative II is implemented without the regional program, maintaining flood flows in the creek systems at existing levels would not be accomplished. Property and environmental damage would continue in the long term.

9.1 Stormwater Facilities

Alternative II would better manage stormwater in the basins. Deficiencies in the treatment, conveyance, and to some extent, storage are addressed by the actions prescribed by Alternative II. These recommendations are aimed at correcting existing and preventing future flooding of developments, increasing the quality of stormwater reaching the creek system, and modestly reducing the existing flood flows in the creeks.

RECOMMENDATION 9.1.1: Correct flooding problems in the Log Cabin/Cain Road area of Moxlie Creek Basin.

Discussion: Runoff generated by two new developments in the southern portion of Moxlie Creek basin has created flooding problems that impact downstream residential properties and roadways. A complex array of topography, stormwater infrastructure, land use, and habitat concerns has lead to difficulties in establishing a readily acceptable solution to the problems.

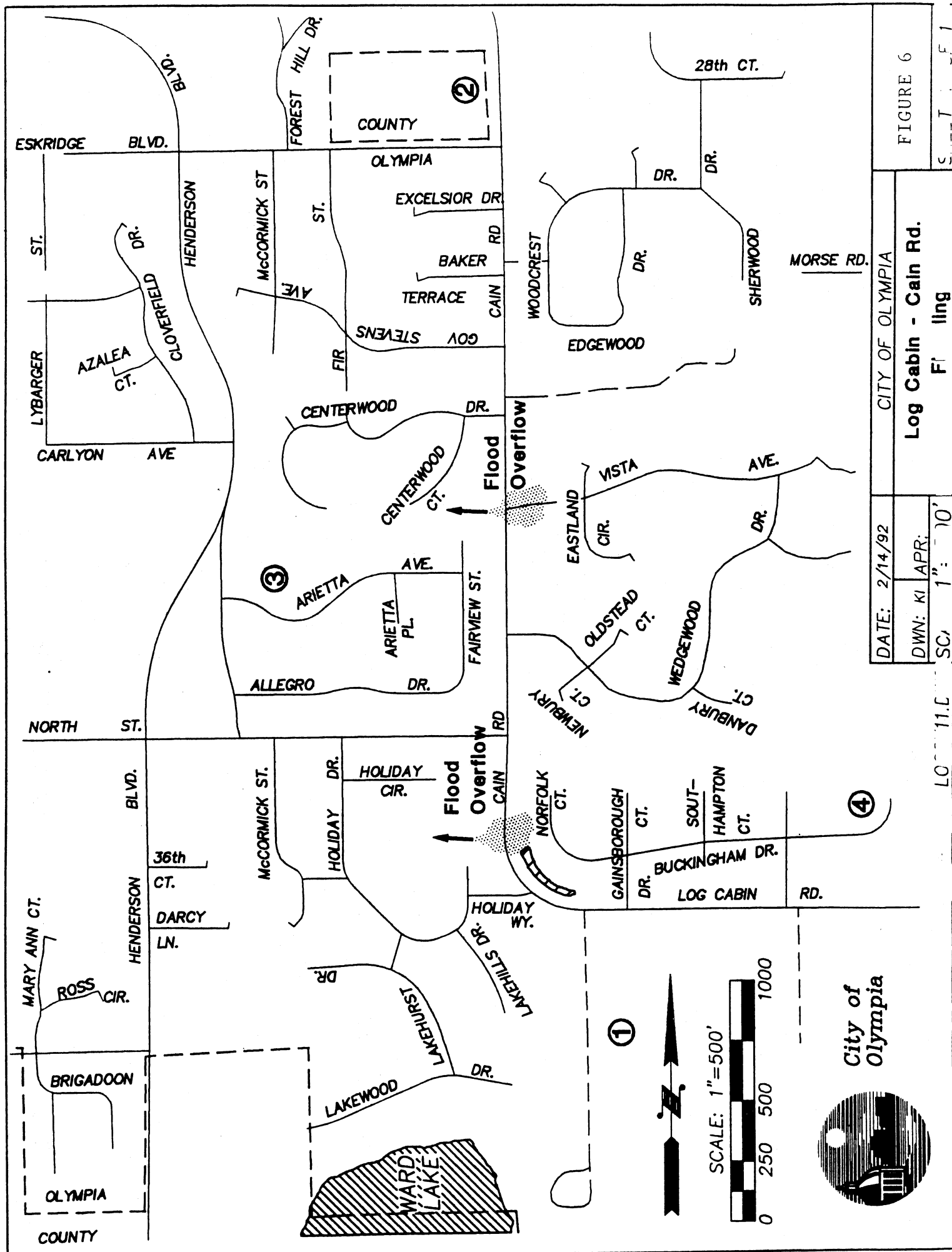
Figure 6 on the following page identifies the location of the flooding problems and five potential solutions. Although numerous potential solutions have been evaluated, the primary options are as follows:

- Option #1: Convey excessive flows to a privately owned kettle (glacial depression) east of Ward Lake. The runoff would be treated and infiltrated to groundwater.
- Option #2: Convey flows to a publicly/privately owned undeveloped pothole located off Cain Road and infiltrate.
- Option #3: Convey a portion of the flows to a publicly/privately owned undeveloped pothole located off of Arietta Avenue and infiltrate. This project would reduce but not eliminate the problems.
- Option #4: Pump a portion of the flows to a new detention pond on private property. Release managed flows to a ditch paralleling Boulevard Road.
- Option #5: Upgrade the existing pipe systems in North Street and Henderson Boulevard to carry the additional flows. Provide additional storage for these flows.

The advantages and disadvantages of each option are briefly summarized in Table 4 as follows:

**Table 4: Evaluation of Potential Solutions To Log Cabin/Cain Road Flooding
Indian/Moxlie Creek Basin**

Option	Advantages	Disadvantages
#1	Infiltration of stormwater Good water quality treatment Minimal construction	Private ownership Potential emergency overflow to Ward Lake
#2	Infiltration of stormwater Mostly public ownership	Neighborhood concern Potential natural resource impacts Difficult conveyance system construction
#3	Infiltration of stormwater Mostly public ownership Low cost	Partial solution only Neighborhood concern Potential natural resource impacts
#4	No environmental threat to potholes	Private ownership High operating and maintenance costs Release of managed flows to downstream ditch system
#5	No environmental threat to potholes	Stormwater release to Moxlie Creek Lack of feasible storage site No infiltration of stormwater Extensive construction



DATE: 2/14/92		CITY OF OLYMPIA	FIGURE 6
DWN: KI	APR:		
SC: 1" = 10'		Log Cabin - Cain Rd.	
LOC: 11.E		Filing	

Option #1 includes stormwater treatment, storage, and infiltration to groundwater with minimum construction and modifications to the kettles. This recommendation presents Option #1 as the preferred solution based on technical and financial concerns, but acknowledges that the project requires the use of private property potentially not available for municipal purchase. Neighborhood and property owner concerns will continue to play an important role in the ongoing evaluation of alternatives. Technical evaluations that began with the basin planning efforts will be further pursued in a engineering report scheduled for completion in Early 1992.

Benefit: Correction of a neighborhood flooding problem; groundwater recharge.

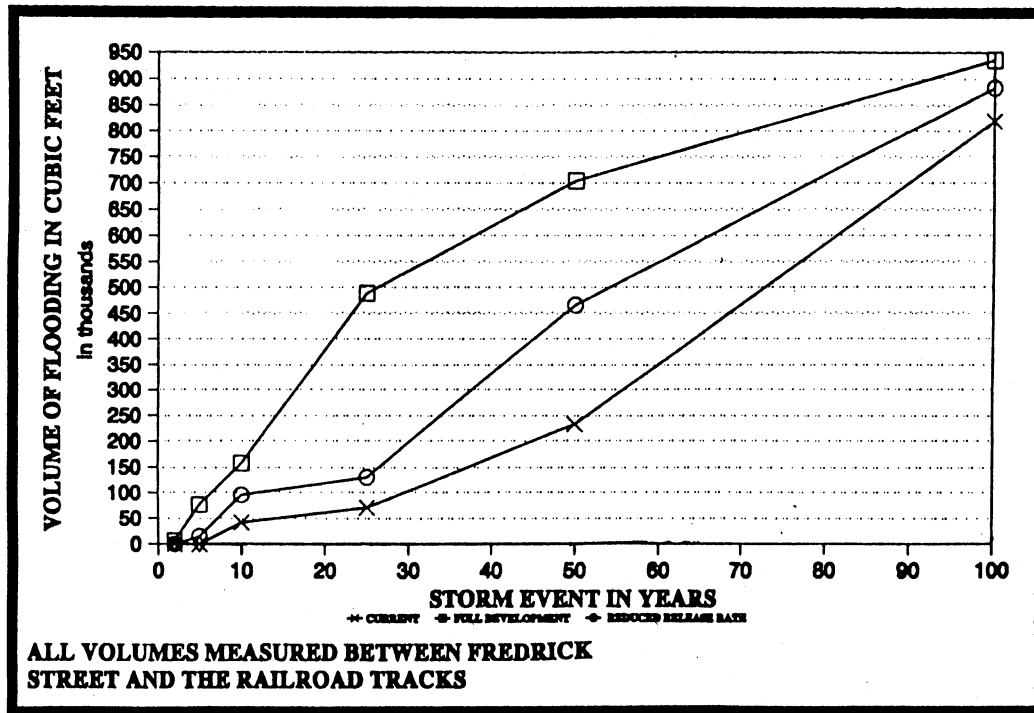
Public cost: \$400,000

Project lead: City of Olympia

RECOMMENDATION 9.1.2: Replace instream culvert and remove unnecessary pipes near the abandoned railroad grade west of Fredrick Street.

Discussion: The conveyance of Indian Creek flood flows upstream of the railroad grade west of Fredrick Street are highly restricted due to an inadequately sized culvert and several unnecessary instream pipes. The impoundment of flood waters behind these pipes has on several occasions threatened two homes. Although the threat was reduced in 1991 by the completion of several small projects and rigorous public and private maintenance, the risk of property damage continues and could become more prevalent in the future as upstream development continues. Figure 7 illustrates the magnitude of impoundment problem under current and potential land use conditions. The location of the proposed projects are identified in Figure 8.

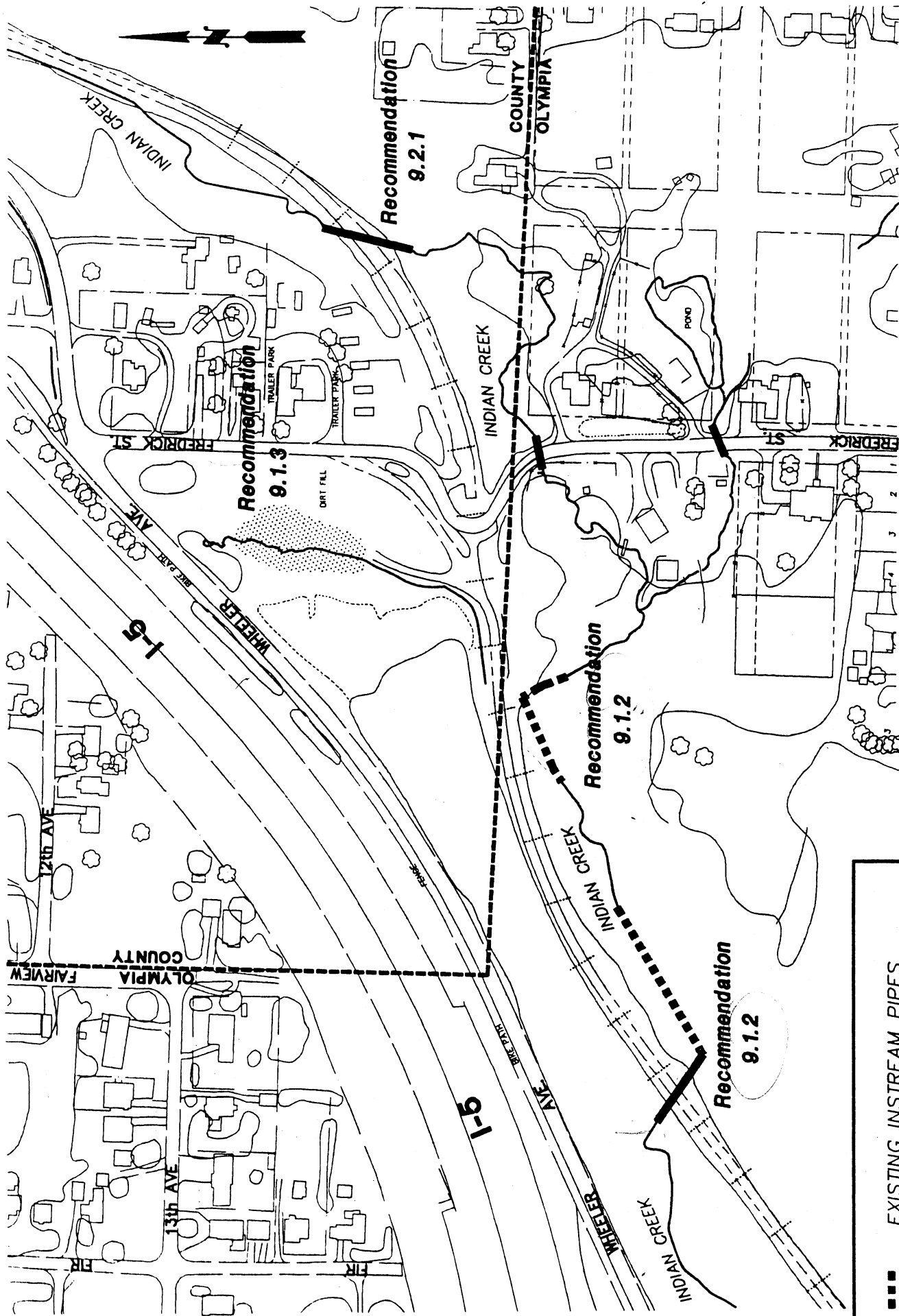
Figure 7: Current and Potential Flood Impoundment Near Fredrick Street



In order to protect downstream habitat and not exceed the capacity of downstream culverts, flood flows would continued to be partially impounded in this portion of Indian Creek, but downstream of any threats to property.

The aspects of the project are as follows:

- Replace the existing 24-inch culvert under the abandoned Burlington Northern railroad line with a 48-inch culvert and an emergency overflow pipe that would eliminate the threat of property flooding. The new culvert would continue to impound flood waters. The existing culvert is also a barrier to upstream fish passage; the new culvert would be installed to meet Washington Department of Fisheries guidelines for insuring fish passage.
- Indian Creek is piped immediately upstream of the culvert under the abandoned Burlington Northern grade. In all likelihood, the 255-foot long pipe was installed to mitigate a perceived threat to the adjacent railroad grade and/or sanitary sewer line. The pipe augments the flooding problem and requires extensive maintenance efforts to keep the pipe inlet clear of vegetative debris. Current streambank management practices are viable alternatives to stream piping. The pipe would be removed and the creek channel restored.



EXISTING INSTREAM PIPES

EXISTING CULVERTS

PROPOSED DETENTION POND

DATE: 2/13/92

DWN: KI APR:

CITY OF OLYMPIA

INDIAN CREEK

PROPOSED IMPROVEMENTS

FIGURE 8

SHEET 1 OF 1

FRED8-11.DWG

SCALE: 1"=200'

- A 150-foot long instream pipe was installed approximately 300 feet west of Fredrick Street in Indian Creek. The pipe contributes to the threat of property damage and requires rigorous maintenance. The pipe would be removed and the creek channel restored.

Benefit: The project would eliminate a current and future flooding threat as well as allow fish access to upstream spawning and rearing habitat. The section of creek between Wheeler Avenue and Boulevard Avenue could provide highly beneficial salmon spawning and rearing habitat.

Public cost: \$315,000

Project lead: City of Olympia

RECOMMENDATION 9.1.3: Construct a stormwater detention pond to manage a portion of the runoff from Interstate 5.

Discussion: Interstate 5 within the Indian/Moxlie Creek basin generates runoff from approximately 43 acres of impervious acres. These runoff flows are typically not managed for detention and/or water quality treatment prior to discharge to the creeks.

The proposed facility would moderate and treat runoff from approximately 10 acres of Interstate 5 west of the Boulevard Street overpass. An existing 36-inch outfall from the freeway discharges in a vacant, but disturbed, parcel of land approximately 500 feet from Indian Creek. Flows are then carried in an erosive open channel to the creek west of Fredrick Street.

Due to the impoundment of flood flows downstream of the outfall, the freeway discharge contributes to the flooding problem at Fredrick Street. This problem is discussed in Recommendation 9.1.2. The impoundment of flood flows in this creek segment would be reduced approximately seven percent by the construction of the Interstate 5 pond.

The facility would provide two acre-feet of stormwater storage as well as needed water quality treatment. The location of the proposed project is shown on Figure 8.

Benefit: Reduction of property flooding, improved water quality, and reduced creek flood flows.

Public cost: \$200,000

Project lead: City of Olympia/Washington State Department of Transportation

RECOMMENDATION 9.1.4: Retrofit an existing Washington State Department of Transportation pond located east of Eastside Street and north of Interstate 5.

Discussion: The existing stormwater management pond was designed to regulate a portion of the runoff generated by Interstate 5 between Boulevard Street and Eastside Street. The pond has minimal storage capacity and contaminated waters have been observed discharging from the pond to Indian Creek.

WSDOT is aware of the need to improve the facility and plans on increasing the capacity of the pond to the maximum extent feasible given the topographic site constraints. This work is to occur in 1992.

Benefit: Improved water quality and reduced creek flood flows.

Public cost: Currently budgeted by Washington State Department of Transportation

Project lead: Washington State Department of Transportation

RECOMMENDATION 9.1.5: Complete the reroute and channel reconstruction of Indian Creek in the vicinity of Plum Street and Union Avenue.

Discussion: The Plum Street/Union Avenue intersection and upstream businesses have experienced serious flooding problems. The flooding is the result of continued upstream development, inadequate conveyance systems, and high tides which limit flow capacity in the pipe carrying Indian/Moxlie Creek under downtown to Budd Inlet. The flood potential is especially high when peak flows coincide with high tides.

Efforts to correct the flooding began in early 1990 with the involvement of the City of Olympia and the Washington State Department of Transportation. A 230-foot open channel segment of Indian Creek southeast of the Union Avenue/Plum Street intersection was piped. With additional financial support from WDOE's Flood Control Assistance Account Program, a two phase construction program was developed as follows:

Phase I: Install a new culvert to carry the relocated Indian Creek under Henderson Boulevard to Moxlie Creek. Completed fall of 1991.

Phase II: Reroute Indian Creek from Eastside Street in a constructed, habitat-oriented open channel to Henderson Boulevard. The majority of flood flows would continue to be conveyed to Moxlie Creek by the existing pipe system. As well as correcting a flooding problem, the project will eliminate the historical salmon passage barrier associated with the 1,500-foot pipe system between Plum Street and Eastside Street. Completion of the project occurred in October 1992.

A schematic of the project is provided on Figure 9 of this section.

Benefit: Elimination of a flooding problem and associated public liability, improvement of salmon habitat, accommodation of salmon passage to approximately 3,000 feet of beneficial upstream habitat, and development of an aesthetically pleasing creek segment in the downtown area.

Public cost: \$900,000 (already funded)

Project lead: City of Olympia

RECOMMENDATION 9.1.6: Separate combined stormwater/sanitary sewer systems as needed.

Discussion: Many stormwater systems in downtown Olympia and surrounding residential neighborhoods discharge to the sanitary sewer system instead of Indian and Moxlie Creeks. During major storm events, stormwater flows to the LOTT wastewater treatment plant overtax treatment capacity and result in wastewater discharges to Budd Inlet. In recent years, several violations of LOTT's discharge permit have occurred due to the combined systems.

Although flow equalization tanks have been installed at LOTT to moderate storm flows, the capacity of these tanks is limited. An agreement between the City of Olympia and LOTT requires that combined systems be managed to the extent necessary to prevent exceeding tank capacities.

Managing the combined systems requires an inventory of such systems and subsequent determination of the most cost-effective approach. The evaluation needs to acknowledge tidal limitations on the capacity of the pipe conveying Indian/Moxlie Creek under downtown and the potential for additional discharges of untreated runoff to the creeks.

At this time, the public costs associated with correcting the problem are unknown.

Benefit: Improved LOTT wastewater treatment capacity.

Public cost: unknown

Project lead: City of Olympia

RECOMMENDATION 9.1.7: Gradually upgrade the stormwater systems located in downtown Olympia and adjacent neighborhoods.

Discussion: The downtown area experiences some flooding of streets and occasional threats to businesses. Although tidal influences limit the ability of stormwater systems to quickly convey flows to Budd Inlet, the problem would be improved by system upgrades.

The targeted downtown areas rely upon stormwater collection systems that utilize undersized and poorly designed inlet grates to catch basins. The catch basins are ineffective at collecting runoff, and costly to maintain and repair. Approximately 350 of these catch basins are located in the downtown area. Estimated replacement cost is approximately \$550,000. These projects will be pursued as future street improvements are undertaken or as flooding problems develop.

Benefit: Improved stormwater conveyance and flood reduction; three-fold reduction in system maintenance costs.

Public cost: \$35,000/annually

Project lead: City of Olympia

RECOMMENDATION 9.1.8: Retrofit private stormwater systems with minor design improvements for enhanced water quality treatment.

Discussion: Approximately 36 privately owned stormwater storage facilities are located in the basin. Field investigations show that some of these facilities are poorly designed, and could be improved to better manage runoff.

Unfortunately, site conditions limit the potential for upgrading the storage capacity of the facilities. Only 0.1 acre-feet of additional storage could be provided by retrofits. Therefore, retrofits should focus on improving the water quality treatment capability of the facilities. Since the private ponds fulfill the original stormwater design requirements, the costs of the projects would be assumed by the local jurisdictions.

A list of storage facilities and associated potential for upgrades is presented in Appendix 3. The location of the facilities are shown on Map 7 in Appendix 1.

Benefit: Reduced contaminants to the creek system and Budd Inlet.

Public cost: \$35,000

Project lead: City of Olympia

9.2 Habitat Enhancement/Wetland Protection

Alternative II would improve fish habitat, preserve important riparian areas, and protect priority wetlands and potholes. Elements of this program include removing unnecessary pipes from the creek channel, gradually acquiring important undeveloped areas for preservation and potentially public use, and to some extent reducing destructive flood flows.

Unnaturally high flood flows have been identified as an ongoing threat to the physical and biological integrity of the Indian and Moxlie Creek systems. The high level of urbanization in the basin would necessitate highly expensive remedial stormwater storage facilities in order to appreciably reduce flood flows. Given the numerous basins and creeks in the north Thurston region, limited public funds would be more effectively utilized on the prevention of similar problems in less developed basins with healthier creek systems.

Future flood flows in the creeks would be held at approximately current levels through the implementation of various recommendations presented in the nonstructural surface water management program (Chapter 11). These recommendations include reducing the release rate from new stormwater storage facilities (Recommendation R-7) and requiring storage for new in-fill residential development (Recommendation R-9).

Additional basin-specific projects for improving water quality and therefore aquatic habitat are presented in Section 9.5. Nonstructural programs such as regulations, enforcement, and public involvement and education that provide enhanced habitat management are included in Chapter 11.

RECOMMENDATION 9.2.1: **Replace a fish-barrier culvert east of Fredrick Street and remove 75 feet of unnecessary instream pipe near Boulevard Street.**

Discussion: The recommendation proposes the following habitat improvement projects:

- Replace the existing culvert under the railroad grade east of Fredrick Street. The existing culvert does not allow fish passage to 8,000 feet of beneficial upstream creek segments. Installing a new culvert at this location would follow the completion of downstream projects that accommodate fish passage (Recommendations 9.1.2). The location of the culvert is illustrated on Figure 8, page 85.
- Remove an unnecessary pipe located in Indian Creek approximately 150 feet west of the Boulevard Street overpass. Bank stabilization may have been the reason for installing the 75-foot pipe segment. Current

streambank management practices are viable alternatives to stream piping. The pipes have been placed in the historical creek channel and could be readily removed.

Extensive channel and habitat restoration would occur at the sites to enhance salmon habitat as well as allow fish passage. Recommendation 9.1.2 proposes removing an additional 400 feet of unnecessary pipe in order to minimize a flooding problem. These pipe removals would also include the restoration of the natural creek channel.

Benefit: The section of creek between Wheeler Avenue and Boulevard Avenue could provide highly beneficial salmon spawning and rearing habitat. Additionally, the area is within the open space/natural area proposed for the East/West Greenway (Recommendation 9.2.3) as shown on Figure 10 (page 93) in this chapter. Neighborhood support for habitat improvement and preservation in this portion of the creek system is high.

Benefit: Elimination of a fish passage barrier; fish access to approximately 8,000 feet of upstream habitat.

Public cost: \$91,000

Project lead: City of Olympia

RECOMMENDATION 9.2.2: Acquire the East/West Greenway for public use and habitat preservation.

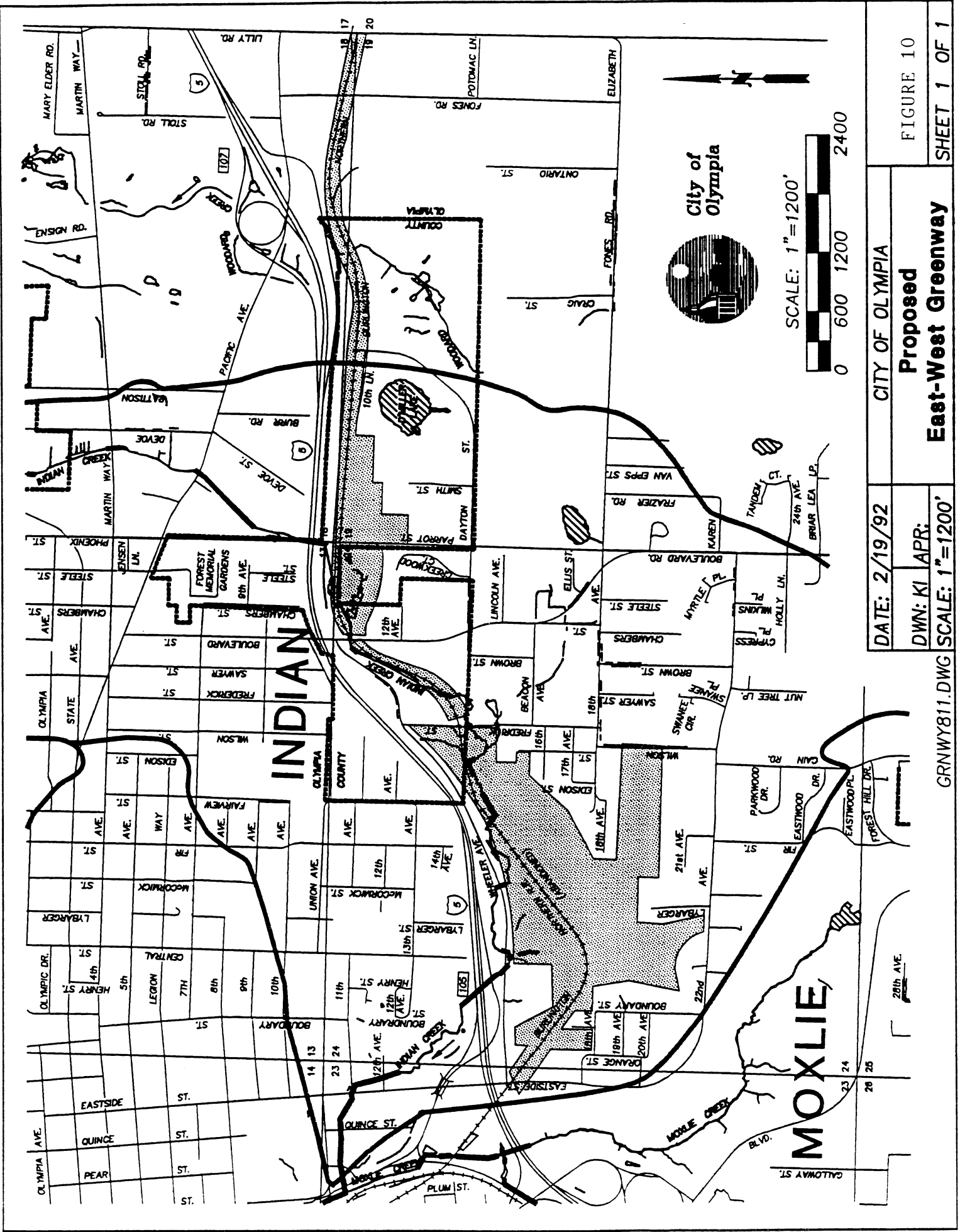
Discussion: The 100 acres of streamside woodlot/wetland and associated abandoned railroad grade along Indian Creek is an important urban resource with many current and potential benefits. The area provides valuable aquatic and upland habitat as well as an amenable environment for recreational and educational activities. The railroad grade parallels the creek and provides a walking/bicycling trail for the 1.2-mile corridor length. The extent of the proposed greenway is illustrated on Figure 10.

The corridor continues east of the Indian Creek basin to the Moxlie Creek basin, Capital Lake and downtown Olympia. West of Indian Creek basin, the corridor extends to the abandoned north/south Chehalis railroad grade and into Lacey. The corridor offers a potential urban transportation link.

Interest in the preservation of the corridor is demonstrated by its inclusion in the *Olympia Parks Plan* and the Cities of Olympia, Lacey, and Tumwater *Urban Trails Plan*, and by high levels of support from neighborhood associations and affected property owners.

The recommendation supports increased efforts to obtain necessary properties through donations and/or public purchases.

Benefit: Establish an extensive recreational and educational amenity, preserve a historical and potential future transportation corridor, and preserve an important instream and riparian habitat.



Public cost: Unknown at this time

Project lead: City of Olympia

RECOMMENDATION 9.2.3: Encourage the long-term preservation of 140 acres of wetlands associated with Bigelow Lake through conservation easements and property donations.

Discussion: Conservation easements assist in protecting critical areas as well as reducing the tax burden of affected property owners. The legally binding easements permanently eliminate the possibility of developing the area. Approximately 140 acres adjacent to Bigelow Lake are high-quality wetlands.

Technical and financial assistance for interested property owners would increase the likelihood of establishing easements and donations. Such a program supported on a multijurisdictional basis is presented as Recommendation R-4 of Chapter 11.

Benefit: Habitat preservation, flood flow management, and potential recreational benefits.

Public cost: Refer to Recommendation R-4, Chapter 11.

Project lead: Thurston County

RECOMMENDATION 9.2.4 Remove the pipe conveying Indian/Moxlie Creek between State Avenue and Marine Drive.

Discussion: Approximately 200 feet of the 3,200-foot pipe conveying Indian/Moxlie Creek to Budd Inlet could readily be removed and a more natural estuarine environment provided for aquatic life. The location of the proposed project is on undeveloped land immediately upstream of the creek's outfall to Budd Inlet.

The project would be pursued in conjunction with ongoing neighborhood efforts to develop a park in the area.

Benefit: Improved salmon habitat and recreational amenities.

Public cost: \$75,000

RECOMMENDATION 9.2.5: Support efforts to evaluate and recommend needed improvements to the aquatic habitat of Budd Inlet.

Discussion: The marine environment of Budd Inlet interacts importantly with the freshwater habitat of Indian and Moxlie Creeks. With the development of downtown Olympia, the historical estuary at the creek mouths was filled and the interface between marine and fresh waters degraded. Impacts throughout Budd Inlet affect the viability of the area's creek habitat.

This recommendation supports the development of a management plan for the aquatic habitat of Budd Inlet.

Benefit: Improved integrity and utilization of aquatic habitat.

Public cost: Unknown at this time

Project lead: Thurston County

9.3 Regulation/Development Controls

Alternative II includes recommendations for improved regulation of new development. Current regulations fall short of maintaining the natural resources within the basin and would be strengthened. The majority of the regulations and development controls are to be implemented on a regional basis and are therefore presented in Chapter 11. Only basin-specific recommendations are described in the following discussion.

Although open space/cluster development has been evaluated as a land use option in Indian/Moxlie Creek basin, the presence of relatively large tracts of undeveloped land is very limited. Typically, cluster development is effective only on areas of 10 acres or more. Since only three such land parcels still remain in the basins, cluster development is not being recommended as a viable management tool. Appendix 10 provides illustrations of open space/cluster development techniques.

RECOMMENDATION 9.3.1: Maintain the current zoning for the semi-rural area north of Bigelow Lake.

Discussion: The 200-acre largely undeveloped area adjacent to and north of Bigelow Lake is currently zoned for one residential unit/five acres. With the implementation of the long-term urban growth management area (UGMA) in 1998, allowable development densities in this area would increase to suburban levels. This recommendation supports maintaining the zoning at one residential unit/five acres.

Computer analysis indicates that increased flows to Bigelow Lake from potential development adjacent to the lake could trigger downstream flooding of developed and

developable properties, increased wetlands, further degradation of creek habitat, and culvert inadequacies. Specific impacts include the following:

- Wetland boundaries and buffers would expand and encroach upon currently developable land. These potential changes in wetland hydrology could represent the taking of private property and have an associated public liability.
- Degradation of highly sensitive and beneficial wetland and creek headwater habitat. The 140-acre Bigelow Lake wetland is a high-quality natural resource and potential cultural amenity.
- Excessive flood flows upstream of the culvert at 12th Avenue NE.

Benefit: Flood prevention, adequacy of existing instream culverts, and habitat preservation.

Public cost: None

Project lead: Thurston County

9.4 Enforcement/Complaint Response

Although local regulations may be adequate to protect habitat and critical areas, they are ineffectual without adequate enforcement. The City of Olympia currently has adequate enforcement and compliant response staff; Thurston County may be understaffed.

The regional management program (Chapter 11) addresses enforcement and complaint response needs throughout the north Thurston region.

9.5 Pollution Source Control Programs

Alternative II places emphasis on controlling pollution at its source. By reducing or eliminating pollution before it reaches the environment, water quality and habitat values within the creek and the basin as a whole can be cost-effectively improved.

The source control program for Indian and Moxlie Creeks relies on the following basin-specific projects as well as numerous components of the nonstructural surface water management program (Chapter 11).

RECOMMENDATION 9.5.1: Correct sources of bacterial contamination in the pipe conveying the creeks under downtown Olympia.

Discussion: Although several projects involving the separation of stormwater and sanitary sewer systems in the downtown area have been undertaken in recent years, the creeks continue to be contaminated with bacteria in the 3,200-foot pipe under downtown. Contamination from Indian and Moxlie Creeks has been identified as a major contributor to water quality degradation in Budd Inlet (URS, 1986).

Water quality monitoring conducted as part of the basin planning effort has provided seven rounds of sample analysis at the ten access points to the pipe. The sampling was conducted under various weather conditions as well as during various times of the day. Unfortunately, the results do not indicate a consistent discharge source or localized area of contaminant contribution.

Several more rounds of localized water quality monitoring are planned. If subsequent statistical analysis does not identify specific problem areas, future efforts will utilize dye testing of individual sanitary sewer systems. This level of investigation would be costly.

At this time, the public costs associated with correcting the problem are unknown.

Benefit: Improved water quality in the creeks and Budd Inlet.

Public cost: \$15,000, dye testing

Project lead: City of Olympia

RECOMMENDATION 9.5.2: Conduct on-site investigations of downtown businesses using and disposing of high risk water quality contaminants.

Discussion: Field investigations indicate the likelihood of discharges of toxic organic contaminants to the creeks under downtown Olympia. Although technically difficult to quantify, follow-up work is needed to establish the severity of the problem.

The recommendation would provide for staff investigations, education, and problem remediation for targeted business types in the downtown area.

Benefit: Improved water quality in the creeks and Budd Inlet.

Public cost: \$10,000

Project lead: City of Olympia

RECOMMENDATION 9.5.3: Conduct house-by-house surveys to identify failing septic systems in several targeted residential areas in the basins.

Discussion: Bacterial contamination in the creek system is currently at problematic levels. In upstream portions of the basin, this contamination is likely the result of failing septic systems. Investigations conducted as part of the basin planning process have identified specific suspect neighborhoods but not specific failing systems. Potential problem areas include:

- The neighborhood bounding the southern portion of the Bigelow Lake wetland.
- A small residential area southeast of downtown Olympia.
- Scattered homes along Indian Creek between Wheeler Avenue and Boulevard Street.
- Several small residential areas in the southern portion of Moxlie Creek basin.

An educational program on septic system maintenance would be a component of the investigative program. The results of the investigation may support the need for expanded sanitary sewer service in the basin (Recommendation 9.5.4).

Benefit: Improved water quality in the creeks and Budd Inlet.

Public cost: \$30,000

Project lead: City of Olympia/Thurston County

RECOMMENDATION 9.5.4: Support efforts to expand sanitary sewer service in the basin.

Discussion: Approximately 40 percent of the area within the basin is serviced by septic systems. Although much of this area encompasses wetlands and the Indian Creek corridor and is therefore only moderately developed, numerous residential developments rely upon septic systems.

The expansion of sanitary sewer service to the majority of the basin is foreseeable. Given the high levels of bacterial contamination in the creek system and the identification of several potential problem areas, the expansion of sanitary sewer service is encouraged.

Benefit: Improved water quality in the creeks and Budd Inlet.

Public cost: Unknown at this time

Project lead: City of Olympia

RECOMMENDATION 9.5.5: Upgrade the stormwater management facilities at the City of Olympia Maintenance Center.

Discussion: The Maintenance Center was constructed prior to the establishment of stormwater design practices aimed at treating stormwater contaminant discharges. While best management practices for waste reduction and containment are being used at the Maintenance Center, the existing stormwater system allows the potential conveyance of dispersed or concentrated industrial toxics to a small streamside artesian pond and subsequently to Moxlie Creek. Chemical analysis of the pond sediments indicate moderately elevated levels of trace organic and metal contaminants.

The recommendation proposes that the City's Maintenance Center Master Plan address the need for stormwater treatment systems and expanded waste management practices to minimize the threat of contaminated discharges.

Benefit: Reduced contaminant discharge to Moxlie Creek and Budd Inlet.

Public cost: \$150,000

Project lead: City of Olympia

RECOMMENDATION 9.5.6: Assist neighboring residents in improving and protecting the water quality of Bigelow Lake.

Discussion: Impacts to the lake would be minimized by an involved and knowledgeable citizenry. Efforts to improve water quality range from implementing residential best management practices to organizing volunteer lake monitoring programs. Olympia and the County would provide training and technical assistance to aid in these efforts.

Benefit: Improved water quality in Bigelow Lake and associated wetlands.

Public cost: Refer to Recommendation R-20, Chapter 11.

Project lead: Thurston County/City of Olympia

9.6 System Monitoring

Alternative II would provide for tracking and evaluating water quality and habitat trends in the creek system. Problems could be identified and dealt with in a cost-effective and timely manner.

RECOMMENDATION 9.6.1: Initiate a long-term water quality monitoring program for the creek system and Bigelow Lake.

Discussion: The water quality monitoring program would provide adequate information to identify and prevent potential water quality problems. The long-term water quality monitoring plan for the creek system is presented in Appendix 7.

Benefit: Improvement and maintenance of water quality and aquatic habitat in the creeks and Budd Inlet.

Public cost: Refer to Recommendation R-17, Chapter 11.

Project lead: City of Olympia/Thurston County Health Department

RECOMMENDATION 9.6.2: Initiate a long-term stream and riparian habitat monitoring program. Professional staff would investigate the creek system every three years.

Discussion: Habitat monitoring 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 through the long-term monitoring program.

Benefit: Protection of aquatic habitat.

Public cost: Refer to Recommendation R-17, Chapter 11.

Project lead: City of Olympia

9.7 Public Involvement and Education

Public involvement and education (PIE) activities are an important component of the basin plan. 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 surface water management program (Chapter 11).

9.8 Cooperative Program Management

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