CHAPTER 10

WATERSHED PLANNING AND ANALYSIS: GARFIELD BASIN

10.1 INTRODUCTION

The Garfield watershed lies between the Dixon Creek watershed to the south and the Sequoia Creek watershed to the north. The topography of the watershed is flat with slopes of less than 3 percent. The watershed's soils are poorly drained silts, reflecting the area's origin as alluvial terraces formed by the Willamette River. The upper reaches of the watershed are almost completely developed and their high degree of imperviousness contributes to much of the flows through the relatively undeveloped reaches downstream of Highway 99. Most of the watershed also experiences a high groundwater table that reduces the volume and rates of stormwater infiltration.

The Garfield watershed contains less than 350 acres, making it one of the smallest watersheds in the Corvallis area. Currently, 70 percent of the watershed is zoned industrial. The City's comprehensive zoning indicates that, in the future, the zoned industrial area may decrease to 61 percent; however, the amount of impervious surfaces will remain constant due to an increase in commercial zoning.

Widespread road closures occurred in the Garfield watershed during the February 1996 flood event. Closures were reported in the upper reaches of the Garfield drainage system, along 9th Street, Garfield Avenue, and Cleveland Avenue.

10.2 WATERSHED FINDINGS

Information on watershed conditions was obtained by working with City staff to identify maintenance and operation problems, and by modeling the conveyance system for the existing and future build-out scenarios. Figure 10-1 identifies the layout of the Garfield watershed drainage system and some of the major observations made during the watershed study.

The drainage system in the lower reaches of the Garfield watershed consists mostly of open channels. The channels flow through City property that, for the most part, has a vegetative buffer between the channel and developed areas, as shown in Figure 10-2, Photo 1. Canopy coverage is generally good in the lower reaches, with large trees and thickets of willows bordering the channel. The channel is dry in the summer and consists mainly of packed earth, as shown in Figure 10-2, Photo 2. Little or no canopy exists from the railroad tracks to the upper reaches. Much of the vegetation along the channel in this upper reach is blackberry thicket, as shown in Figure 10-2, Photo 3. The channel bottom consists of bare earth; gravel and woody debris are absent from most of the channel as shown in Figure 10-2, Photo 4. The channel and streambanks provide little habitat value and show signs of eroding during storm flows.

10.2.1 Public Comments

Public input into the citywide watershed planning process has been encouraged and facilitated through a number of public meetings, although no meetings were held specifically for the Garfield watershed. Comments specific to the Garfield watershed were not received in any of the citywide meetings held during the course of the project.

10.2.2 City Staff Reports

City Engineering and Utilities Operations staff is familiar with the Garfield watershed. Not only is City staff involved with the review of development plans and maintenance of drainage facilities, but Corvallis Public Works offices and shops are located within the lower reaches of the Garfield watershed. City staff is therefore uniquely aware of conditions in and along the channel. City staff provided input into the planning process by identifying known problem areas, recommending areas for stream enhancement activities, and recounting the extent and duration of flooding during major storm events. The City provided extensive records of flooding in the Garfield watershed during the February 1996 flood.

10.2.3 Field Study Observations

Field investigations in portions of the lower reaches of the Garfield watershed, downstream of Highway 99, were conducted in August 2000. The piped drainage system in the upper reaches was not observed. The entire system was dry during the investigation, thus limiting habitat value for fisheries or amphibious wildlife. The highest value canopy coverage was found on City property downstream of the railroad, although this area has been used to store construction debris and machinery.

10.2.4 Modeling Results

A computer model for the Garfield watershed identified the hydraulic capacity and projected flows in the culverts and channels of the conveyance system for existing and future build-out scenarios. The model based existing conditions on land use information from the City's GIS maps. Future conditions were based on full development of the watershed (build-out) as identified in the City's Comprehensive Plan. Field observations revealed that much of the area currently identified as industrial has not yet been developed; hence, the modeled flows for the existing scenario may be higher than those that actually occur in the field.

A full range of storm events was modeled for the existing and future scenarios, including the 2-, 5-, 10-, 25-, and 100-year storm events. Table 10-1 lists the hydraulic structures (pipes, culverts, bridge crossings, channels, etc.) that are undersized for the City's 10-year design storm. A complete summary of all modeled segments is in Appendix C.

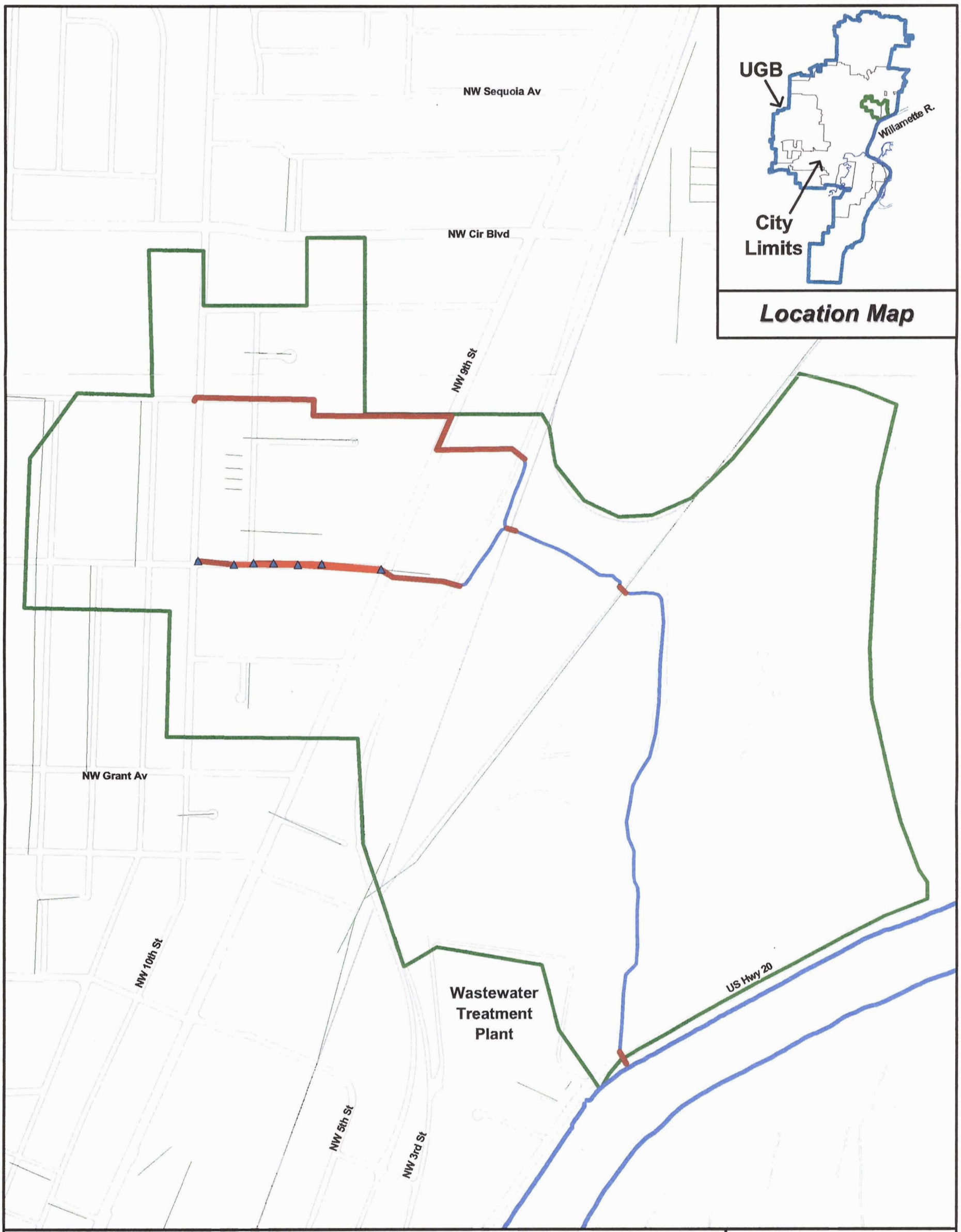

Figure 10-1 Garfield Creek Problem Areas

LEGEND

- Pipes/Bridges
- Channels
- Basin Boundary
- Reported Problems (recorded at open house)
- Surcharged Manholes (10-year future storm)
- Flooded Manholes (10-year future storm)
- High Velocity Areas (> 4 fps, 2-year future storm)
- Undersized Conduits (10-year future storm)
- Undersized Channels (10-year future storm)

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report/figures/final/Fig10-1.wor, November 6, 2000, base data from City of Corvallis GIS Department

Figure 10-2. Watershed Photos

Photo 1. Channel upstream of Highway 20.

Photo 2. Channel near access road, downstream of railroad.

Photo 3. Blackberry thickets along railroad tracks.

Photo 4. Exposed channel bottom between Highway 99 and railroad tracks.

Table 10-1. Modeled Flow for Undersized Hydraulic Structures within the Garfield Watershed, cubic feet per second (cfs)

Reach/Location/Model segment	Flow capacity[1]	Existing[2] flows 10-year storm	Future[2] flows 10-year storm	Flood predicted by model	Flood reported by staff or public
Garfield Avenue, between Division Street and 9th Street (GAR095)	3.3	1.7	1.9	No	Yes
Garfield Avenue, between Division Street and 9th Street (GAR090)	3.2	4.2	4.4	No	Yes
Garfield Avenue, between Division Street and 9th Street (GAR085)	3.5	4.2	4.4	No	Yes
Garfield Avenue, between Division Street and 9th Street (GAR080)	19	4.2	4.4	No	Yes
Garfield Avenue, between Highland Drive and Division Street (GAR075)	7.7	7.6	7.6	No	Yes
Garfield Avenue, between Division Street and 9th Street (GAR070)	7.4	7.6	7.6	No	Yes
Garfield Avenue, between Division Street and 9th Street (GAR065)	7.1	7.5	7.5	No	Yes

[1] Capacity is based on Manning's Equation.
[2] Model results are based on dynamic routing and may result in a lower capacity than reported by Manning.

Only a few sections of the conveyance system are undersized according to the model results. The first is along Garfield Avenue from Highland Drive to 9th Street. Pipes in this section are constructed with a low gradient (low slope) and downstream constrictions cause water to back up within the system. The culvert at Highway 99 failed to pass the 10-year design storm event. This culvert has a diameter of 3 feet and is downstream of two 4-foot culverts that convey flow beneath the two railroad crossings. Although undersized, the culvert installation at Highway 99 appears to have adequate storage and freeboard to safely back up water without threatening property or the structural integrity of the highway.

Backwater from the Marys and Willamette Rivers was not included in the model, since the flooding problems associated with these two rivers cannot be solved by channel improvements in the Garfield watershed.

The hydrologic/hydraulic model also estimated stream velocities in channel segments to determine areas at risk for channel or streambank erosion. Stream velocities in excess of 4 feet per second (fps) may cause erosion of the streambank or streambed. A 2-year storm event—the storm size most responsible for determining the channel configuration—was used to predict channel velocities. None of the channel velocities in the Garfield watershed exceeded the 4 feet-per-second criteria.

10.2.5 Stream Reach Summaries

The Garfield watershed was divided into four stream reaches. The first reach begins at the outfall to the Willamette River and continues upstream to the northeast edge of the Corvallis Wastewater Treatment Plant (WWTP) storage lagoons. The second stream reach runs from the storage lagoons to the east railroad crossing. The third reach runs from the east railroad crossing to Highway 99. The fourth reach included all of the piped drainage system upstream of Highway 99.

Willamette River to WWTP Lagoons

Public Comments: No public comments were received.

City Staff Reports: No staff comments received pertaining to this reach.

Field Observations: The channel was dry during the summer field investigation. The bottom is exposed soil through most of the reach. The banks are covered with a heavy growth of willows and other shrubs. Several acres along the channel are maintained as a grassy meadow. Entrance to the meadow is via an access road over a small culvert. The access road and culvert are just upstream of the fire station training area. Flows exceeding the capacity of the culvert flow over the access road without causing flooding problems. Some sections of the WWTP expansion are located close to the channel in this reach. The fire station training area is located close to the channel as well, and may present a water quality concern due to chemicals used to put out practice fires.

Modeling Results: Modeling showed no flow velocities exceeding the 4 feet-per-second erosion criteria. The culvert under Highway 20 is undersized during the 10-year storm event, but there appears to be adequate storage volume in the overbank area for water that leaves the main channel.

WWTP Lagoons to East Railroad Crossing

Public Comments: No public comments were received.

City Staff Reports: The City uses the access road behind the Public Works facilities to store construction debris. This practice is currently under evaluation.

Field Observations: The area that drains to this stream reach is mostly undeveloped. The existing woods show signs of past high water. A gravel access road runs from the Public Works facilities along the railroad tracks back to the drainage channel. The City's Public Works Department uses the area for disposing construction debris and machinery. The drainage channel has good canopy coverage, but the bare earth bottom has little habitat value. A poorly maintained dirt track starts at the access road turn-around and runs along most of the channel length. This track crosses the road at an iron pipe used for a culvert. It appears that any substantial flow in the channel overtops the pipe and runs across the dirt track.

Modeling Results: Modeling showed no flow velocities exceeding the erosion criteria. No culverts were modeled in this reach. The iron pipe at the track crossing is undersized by inspection, but flow is free to overtop the structure without harmful impacts to surrounding property.

East Railroad Crossing to Highway 99

Public Comments: No public comments were received.

City Staff Reports: No staff comments received pertaining to this reach.

Field Observations: This reach was investigated from Highway 99 to the western railroad track. The segment between the east and west railroad tracks was not investigated. Flows from the upstream piped system cross under Highway 99 via two culverts, about 1,000 feet apart. Both culverts discharge to a ditch between the bike path and western railroad tracks. The north culvert's outlet is located below the bottom of the ditch, reducing its capacity and causing erosion of the surrounding ditch. The remainder of the ditch has been scoured clean by stormwater flows. Canopy coverage is poor throughout this reach.

Modeling Results: Modeling showed no culvert capacity problems or flow velocities exceeding the 4 feet-per-second erosion criteria.

Piped System Upstream of Highway 99

Public Comments: No public comments were received.

City Staff Reports: During the February 1996 storm, road closures and high water were reported for 9th Street, Garfield Avenue from 9th Street to Highland Drive, Cleveland Avenue from Division Street to 11th Street, and along Division Street, up to, and including, parts of Spruce Avenue.

Field Observations: A field inspection was not done for this reach.

Modeling Results: The main stem of the piped system that drains the upper reach of the Garfield watershed was modeled. The model reports that the parallel pipe system along Garfield Avenue from Highland Drive to 9th Street surcharges under the 10-year storm event. This result corresponds to one of the high water areas reported by the City.

10.3 WATERSHED MANAGEMENT OPTIONS

Watershed management options for the Garfield watershed were developed by the consultant team, based on input from City staff, field observations, and modeling results. Table 10-2 lists recommended options that include the following:

- Ensure that an adequate stream buffer is maintained between WWTP activities and the channel.
- Plant trees along the ditch for shade.
- Conduct field investigation in cooperation with the railroad.

All of the recommendations for the Garfield watershed were assigned to the short-term program listed in Table 10-3.

Table 10-2. Garfield Options

Reach	Abridged observations	Recommended activity	Priority
Willamette River to WWTP Lagoons	1) Banks are covered with willows and other shrubs.	a. Maintenance required to thin willows and shrubs to improve flow passage.	Short-term
	2) WWTP expansion is located close to channel.	a. Ensure that adequate stream buffer is maintained between WWTP activities and channel.	Short-term
	3) Water and chemicals from Fire Station training area are a concern.	a. Coordinate with Fire Department to minimize and possibly treat fire-training flows before flows leave the site.	Short-term
WWTP Lagoons to East Railroad Crossing	1) City uses access road to store construction debris.	a. Designate confined area away from channel and high water table for debris storage.	Short-term
	2) Existing woods show signs of high water.	a. Investigate possibility of allowing woods to revert to wetlands for habitat and treatment of stormwater from upstream reaches.	Short-term
	3) Good canopy but bare earth channel.	a. Do not maintain channel, but allow it to become dispersed wetland flow.	Short-term
	4) Poorly maintained dirt track along most of channel length with an iron pipe culvert.	a. Block access to dirt track unless essential for utility services. Remove iron pipe or upgrade crossing with rock.	Short-term
East Railroad Crossing to Highway 99	1) No field investigation was conducted between the east and west railroad lines.	a. Conduct field investigation in cooperation with railroad.	Short-term
	2) Northern culvert lower than ditch bottom, causing erosion and loss of capacity.	a. Monitor extent of erosion and loss of capacity. Remove excess sediment to restore hydraulic capacity as required.	Short-term
	3) Bottom of ditch scoured.	a. Anchor woody debris in channel to help dissipate erosive forces.	Short-term
	4) Poor canopy coverage throughout the investigated part of the reach.	a. Plant trees along ditch for shade.	Short-term
Piped System Upstream of Highway 99	1) Several areas of high water and flooding of roads in this reach during February 1996 storm.	a. Conduct detailed study of the pipe hydraulics in this section of the drainage system to determine potential reasons for flooding.	Short-term
	2) Model reports surcharging pipes along Garfield Avenue.	a. Upsize pipes to prevent surcharging.	Short-term

Table 10-3. Garfield Short-Term Program

Reach	Recommended activity	Capital cost ($)	Annual O&M ($)	Project type[1]
Willamette River to WWTP Lagoons	1) Maintenance required to thin willows and shrubs to improve flow passage.	NA	1,100	
	2) Ensure that adequate stream buffer is maintained between WWTP activities and channel.	NA	400	
	3) Coordinate with Fire Department to minimize flows from site.	400	NA	
WWTP Lagoons to East Railroad Crossing	1) Designate confined area away from channel and high water table for debris storage.	2,800	NA	
	2) Investigate possibility of allowing woods to revert to wetlands for habitat and treatment of stormwater from upstream reaches.	1,640	NA	
	3) Do not maintain channel, but allow it to become dispersed wetland flow.	NA	NA	
	4) Block access to dirt track unless essential for utility services. Remove iron pipe or upgrade crossing.	2,000	NA	
East Railroad Crossing to Highway 99	1) Conduct field investigation in cooperation with railroad.	1,120	1,100	
	2) Monitor extent of erosion and loss of capacity. Remove excess sediment to restore hydraulic capacity as required.	NA		Yellow line
	3) Anchor woody debris in channel to help dissipate erosive forces.	4,000	600	
	4) Plant trees along ditch for shade.	24,000	1,200	Orange line
Piped System Upstream of Highway 99	1) Conduct detailed study of the pipe hydraulics in this section of the drainage system to determine potential reasons for flooding.	15,000	NA	
	2) Upsize pipes to prevent surcharging.	181,200	NA	
Total		**232,160**	**4,400**	

NA – Not applicable

[1]Project types are in the Figure 10-3 map legend.

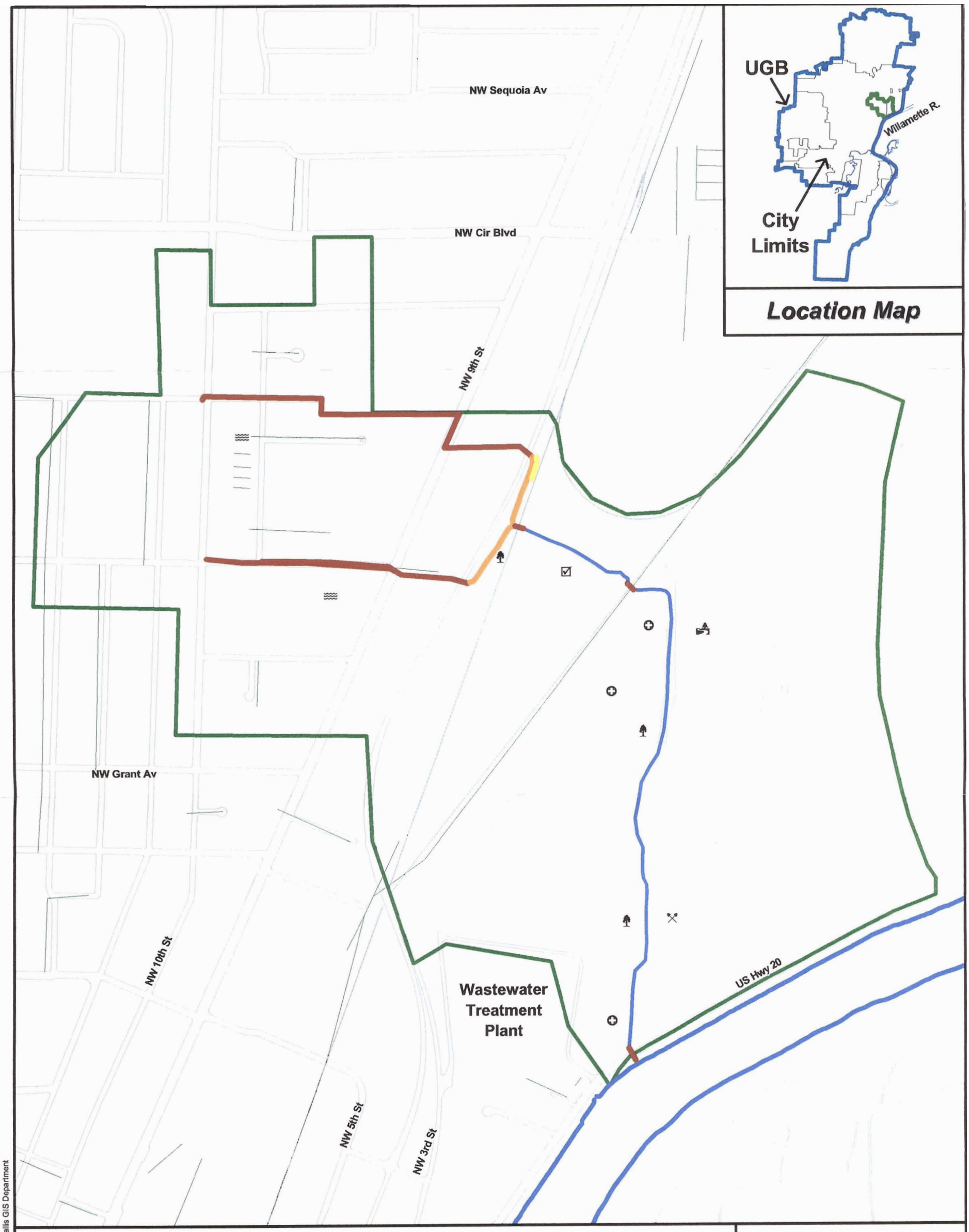

Figure 10-3 Short Term Project Locations

LEGEND

- Pipes/Bridges
- Bank Stabilization
- Replace Pipe/Bridge
- Floodplain Reconnection
- Maintenance
- Channels
- Canopy Revegetation
- Fish Passage
- Water Quality BMP
- Monitor
- Basin Boundary
- Channel Improvement
- Buffer/Riparian Habitat
- Flood BMP
- Multi-Use Facility

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report/figures/final/Fig10-3.wor, November 6, 2000, base data from City of Corvallis GIS Department