## City of West Linn

## Sanitary Sewer System Master Plan

The Sanitary Sewer Master Plan was authorized by the City to address the needs of the sanitary sewer system over the next 20 years. It is designed to help in establishing a capital improvement and capital maintenance plan for the sanitary sewer system. The report provides descriptions of the recommended improvements and an opinion of probable project cost for each item.

The most current version was completed on December 20, 1999.

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# City of west linn

## sanitary sewer master plan update

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# CITY OF WEST LINN
# SANITARY SEWER SYSTEM MASTER PLAN UPDATE

## EXECUTIVE SUMMARY

### PURPOSE AND SCOPE

This Sanitary Sewer Master Plan Update has been authorized by the City of West Linn to address the needs of the sanitary sewer system over the next 20 years. The study also reviews the effect on the sanitary sewer system of serving Urban Reserve No. 30. As a planning document, it is designed to help in establishing a capital improvement and capital maintenance plan for the sanitary sewer system. The report provides descriptions of the recommended improvements and an opinion of probable project cost for each item.

The Scope of this Master Plan Update is consistant with the work proposed in Exhibit A of the Professional Services Contract between the City of West Linn and Bookman-Edmonston Engineering, Inc.

### EXISTING SYSTEM

The City of West Linn sanitary sewer system consists of over 110 miles of public sewers. These sewers range in size from 6-inch to 24-inch in diameter. The City owns and operates eight (8) wastewater pump stations. Seven (7) of these are smaller stations which serve isolated pockets of West Linn which cannot be served by gravity alone. The other pump station, Mapleton, serves most of the Robinwood area of West Linn. All wastewater from West Linn is transported across the Willamette River to the wastewater treatment plant owned and operated by the Tri-City Service District (TCSD). The District operates three pump stations in West Linn (Bolton, River Street and Willamette Pump Station).

As the improvements to the interceptor sewer systems paralleling the Willamette River have been completed, the planned sanitary sewer bypass structures have been mostly eliminated. One bypass remains, just upstream of the Mapleton Pump Station. This bypass is permitted by the Oregon Department of Environmental Quality (DEQ). It is monitored and bypasses are reported to DEQ. Bypass of wastewater only occurs during prolonged, above normal, rainy periods. Only one bypass has occurred since the Mapleton Pump Station was rebuilt in 1997.

The City has developed a set of sewer maps which show the layout of the sanitary sewer system. These maps were developed (and are in the process of being updated and improved) using Geographical Information System (GIS) software. The maps are available in a version showing street rights-of-way and sanitary sewers only and in another version showing the sanitary sewers as an overlay to aerial photography, with street names annotated.

## OPERATION AND MAINTENANCE REVIEW

The operation and maintenance activities and procedures of the sewer maintenance division were reviewed. The current policy and procedures of the Division include a proactive, preventative maintenance philosophy. This philosophy has benefited the City in an exemplary record of sewer performance and a very low number of sewer complaints and overflows.

The Division has a published work plan that sets its maintenance and operational goals. Currently these goals are being met. The staffing level was reviewed and found to be appropriate and satisfactory.

The equipment utilized by the Division was reviewed. Recommendations for a replacement schedule for this equipment (vacuum truck, dump trucks, service trucks, pick-ups, and backhoes) were made. The purchase of a new piece of equipment -- a sewer jet cleaning truck -- is recommended. The repair (not replacement) of a sewer television camera is recommended.

## INFILTRATION AND INFLOW REVIEW

The level of Infiltration and Inflow (I/I) getting into the West Linn sewers was reviewed. Infiltration enters the sewers mainly from groundwater through cracks in the pipes and manholes walls. Inflow enters the sewers from direct connection of area drains, building sump pump discharges and other generally illegal sources, as well as through manhole lids.

The TCSD Master Plan Study, completed in 1999, concluded that I/I was not excessive, and that it was more cost effective to transport and treat the I/I than to fund extensive I/I identification and removal programs. An extensive review of I/I problems in West Linn was not within the scope of this project.

Based on a review of data collected during this study, the following recommendations were made:

1. Smoke test all of the sewers in the following areas:
   a. Mapleton Drive (13,708 LF)
   b. Hidden Springs Pump Station (1,370 LF)
   c. Marylhurst Pump Station (730 LF)
   d. Arbor Pump Station (5,673)

2. Schedule sewer replacement, based on review of television tapes, in the following service areas:
   a. West Willamette (30,071 LF)
   b. Buck Street (25,003 LF)
   c. River Street (79,074 LF)

## HYDRAULIC MODEL DEVELOPMENT

A computer hydraulic model was used to analyze portions of the West Linn sewer system. The XP-SWMM hydraulic model was used for this purpose. This model routes the flow through the system, accounting for time of travel of the flow, and calculates the water surface elevation of the wastewater in the sewers at specified intervals during the model run. It will calculate when sewers will surcharge (water surface above the top of the sewer in manholes) and if overflows would be expected.

The physical characteristics of the sewer systems were defined as model inputs. These consisted of sewer size, slope between manholes, manhole depth and top elevation. The sewer system was divided into 29 subbasins to adequately model the system. Each subbasin has a wastewater flow input point to introduce flow into the model.

Wastewater flow input into the model was defined by hydrographs. A hydrograph specifies the flow in the sewer at each point in time for the subbasin input point. The hydrographs were developed using sanitary sewer flow monitoring data developed during this study. City crews installed three flow monitors and collected flow data during a two-month period. Each flow monitor recorded flow rates from a different type of development.

A correlation was made between sanitary sewer flow rate and rainfall for each flow monitor. This data was used to adjust the data to varying rainfall events for each flow monitor.

The hydrograph for each subbasin was developed by adjusting the selected representative flow monitor’s hydrograph using the upstream population as the proportioning factor.

Prior to the analysis of the sewer system using the computer model, a verification of model results versus actual flow monitoring data was made. This analysis showed that the model predicted peak flow rates were close to the actual measured peak flow rates.

## POPULATION

Population estimates were necessary for the computer modeling to be completed. Population estimates were made for all of the sewer subbasins. The population data from the City's Draft Comprehensive Plan was utilized. The current population was estimated as 21,000 and the future population as 29,397. To be slightly conservative, the future population was increased to 32,000, with most of the extra population assigned to the developing areas in North Willamette.

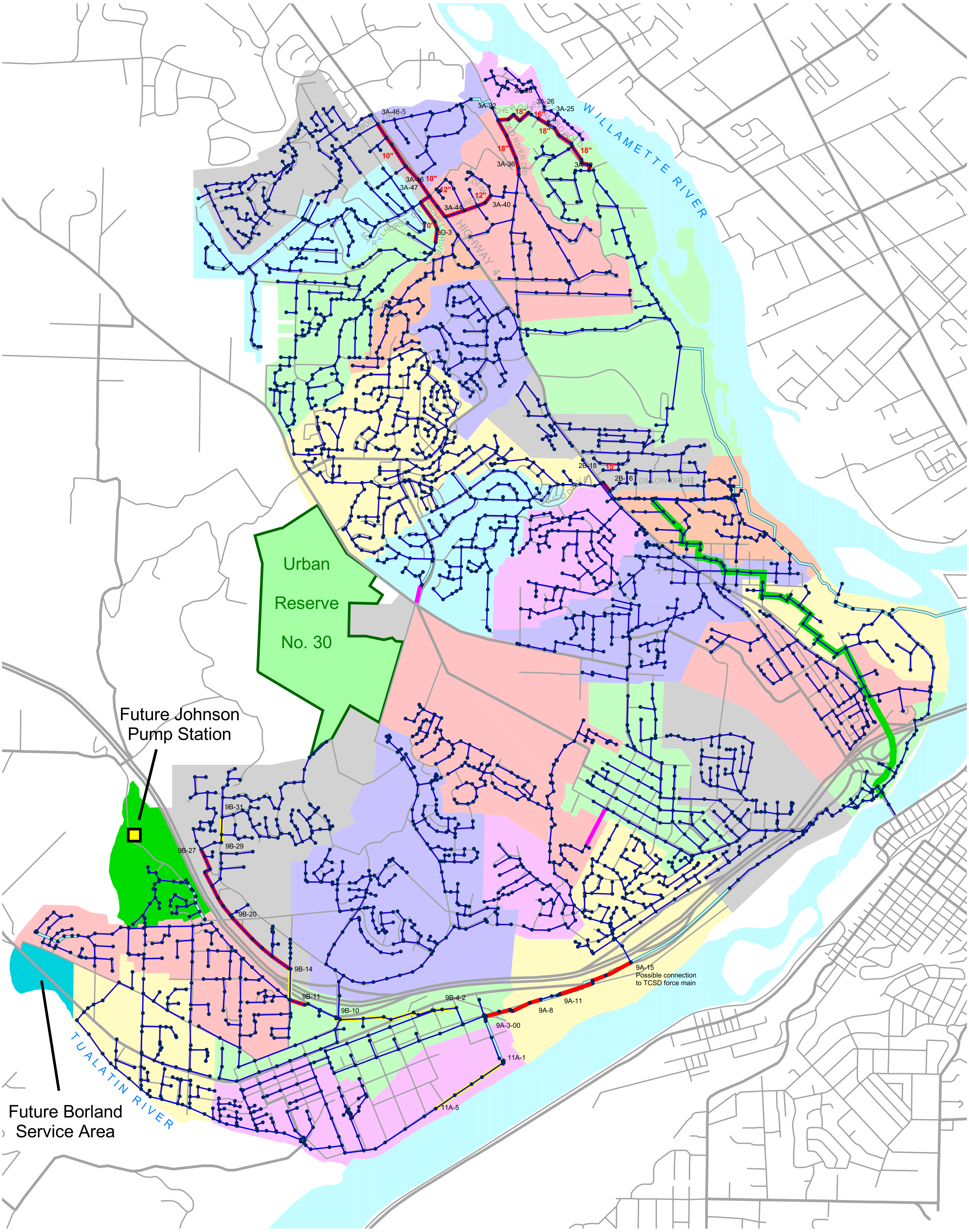
## SANITARY SEWER SYSTEM CAPACITY EVALUATION

The existing sanitary sewer system was evaluated for capacity problems using the XP-SWMM hydraulic model. Discussion with City staff resulted in the adoption of the following evaluation criteria:

- The sewer must not surcharge more that 1.0 feet when the peak design flows occur. A sewer surcharge occurs when the level of flow in a manhole is above the top of the sewer pipe.
- The design storm producing the peak design flows in the sewers will be a 24-hour duration storm with a return period of 5 years. Based on statistical analysis of historic rainfall events in this area, this type of storm is expected to occur only once in a 5-year period. The TCSD study used this same storm as the basis of their flow analysis. The Oregon Department of Environmental Quality (DEQ) has accepted this magnitude of storm as being a reasonable one on which to base analysis and design. For the West Linn area, this storm includes 2.7 inches of rain in a 24-hour period, distributed as shown in Figure 7-1. This distribution also has been accepted by DEQ.
- Each pump station must have adequate firm pumping capacity to pump the peak design flows. The firm capacity of a pumping station is defined as the pumping rate available with the largest pump out of service.

The results of the capacity analysis indicated that 50 sewer segments (manhole to manhole) required upgrading so that the sewer could carry the predicted peak flow rate under the existing population conditions. These segments are indicated on Figure ES-1.

All City owned and maintained pump stations were evaluated for capacity limitations under existing conditions. No problems were identified. All of these pump stations are monitored using the existing telemetry system. All monitoring and telemetry equipment at the pump stations was found to be adequate. The telemetry base station located at the Public Works Building on Norfork Street was recommended to be replaced.




**LEGEND**

- Sewer Manholes
- Gravity Sanitary Sewer
- Force Main Sanitary Sewer
- Upgrades to Meet Existing Deficiencies
- Upgrades to Meet Future Needs
- Tri-City Service District Improvements
- New Sewer (Developed Area)
- Major Streets
- Other Streets
- River/Open Water

0 1000 2000 3000 4000 5000 Feet

N

**BOOKMAN-EDMONSTON ENGINEERING, INC.**

**CITY OF WEST LINN**

**SANITARY SEWER SYSTEM UPGRADE UNDER EXISTING AND FUTURE CONDITIONS**

FIGURE ES-1

Based on the analysis of existing sewer ages, a sewer replacement program is recommended. The program should target replacing the oldest clay and concrete sewers first. This replacement should be prioritized based on a review of the condition of each sewer as shown on internal television inspection tapes.

**FUTURE CONDITIONS SANITARY SEWER CAPACITY ANALYSIS**

The sewer system was next analyzed for the future conditions, utilizing the projected future population distributions. It was assumed that all of the recommended improvements resulting from the existing condition assessment were in place. New input hydrographs were developed for each subbasin. Where new development in currently underdeveloped areas was predicted, an allowance for future I/I rehabilitation as well as new population was reflected in these hydrographs.

The future conditions model run predicted that 31 additional sewer segments would require upgrading to satisfy the selected criteria. These segments are shown on Figure ES-1.

Analysis of the pump stations under the future conditions indicated that all have sufficient pumping capacity. The required pumping capacity at each station should be reviewed each time the pumps are replaced under their normal maintenance schedule.

Urban Reserve No. 30

Urban Reserve No. 30 is located at the western edge of West Linn, as shown in Figure ES-2. This area may be served by the City in the future. Options were reviewed which would route the flow as shown on Figure ES-2. One alternative included all gravity sewers, and would require an easement on private property along Wisteria Road. The other alternative requires a pump station, but no easement along Wisteria Road. The all gravity sewer alternative is recommended.

Future Pump Stations

There are two currently unsewered areas in the Willamette area, where pump stations will be required. The Borland Pump Station, to be located at Borland Road and the Tualatin River will serve one of these areas, located on both sides of Borland Road (Willamette Falls Drive). When this station is constructed, it is recommended that the River Heights Pump Station be taken out of service by constructing a gravity sewer between these two stations, allowing the Borland Pump Station to serve both areas. An option exists to serve this area entirely by gravity sewers. This is discussed in Chapter 8.

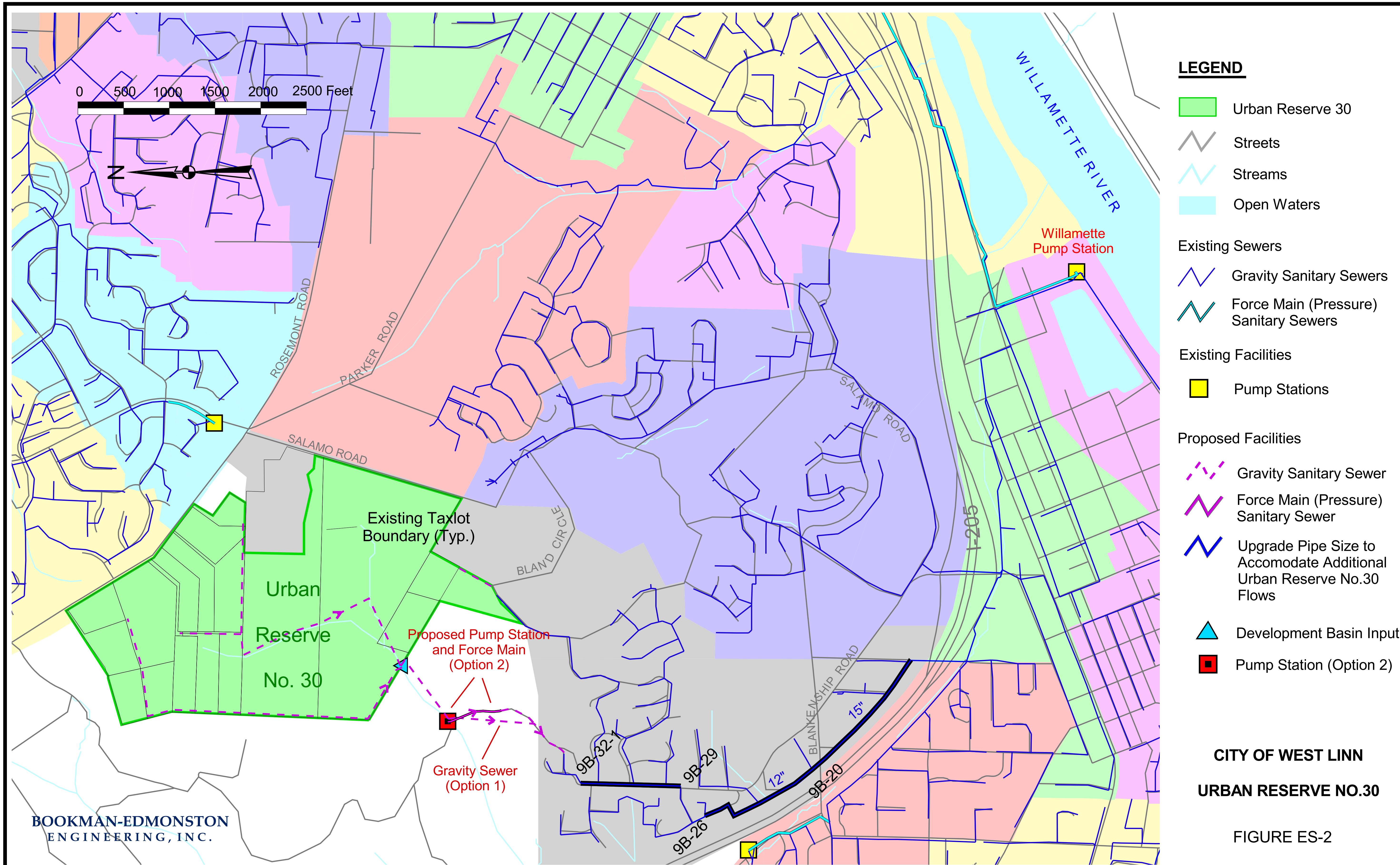

0 500 1000 1500 2000 2500 Feet
N
WILLAMETTE RIVER
Willamette Pump Station
ROSEMONT ROAD
PARKER ROAD
SALAMO ROAD
Existing Taxlot Boundary (Typ.)
BLAND CIRCLE
Urban Reserve No. 30
Proposed Pump Station and Force Main (Option 2)
Gravity Sewer (Option 1)
9B-32-1
9B-29
9B-26
9B-20
12"
15"
BLANKENSHIP ROAD
I-205
LEGEND
Urban Reserve 30
Streets
Streams
Open Waters
Existing Sewers
Gravity Sanitary Sewers
Force Main (Pressure) Sanitary Sewers
Existing Facilities
Pump Stations
Proposed Facilities
Gravity Sanitary Sewer
Force Main (Pressure) Sanitary Sewer
Upgrade Pipe Size to Accomodate Additional Urban Reserve No.30 Flows
Development Basin Input
Pump Station (Option 2)
BOOKMAN-EDMONSTON ENGINEERING, INC.
CITY OF WEST LINN
URBAN RESERVE NO.30

FIGURE ES-2

The area downstream of the Johnson Pump Station, adjacent to Johnson Road, will require construction of a Johnson Road Pump Station. When this station is constructed, flow can be pumped to the Johnson Pump Station, where it could be re-pumped.

Another alternative is to eliminate the existing Johnson Pump Station and allow gravity flow from its service area to the new Johnson Road Pump Station. These options are discussed in Chapter 8.

The locations of the future pump stations are shown on Figure ES-1.

## CAPITAL IMPROVEMENT PLAN AND CAPITAL MAINTENANCE PLAN

The recommended improvement projects for upgrading the sanitary sewer system have been incorporated into the Capital Improvement Plan. These projects total $ 4,908,090 (1999 dollars). These projects are spread over the next eighteen years, ending in year 2017.

The Capital Maintenance Plan includes replacement of vehicles and equipment, upgrading wastewater pump stations, upgrading the wastewater pump station monitoring base station and instigation of a sewer replacement program. The vehicle/equipment replacement costs total $ 1,431,700 (1999 dollars) over the next 20 years. Wastewater pump station and monitoring system upgrade costs total $260,000 (1999 dollars) over the next 20 years. The sewer replacement program is recommended to be funded at $500,000 per year (beginning in the year 2002) so that approximately 4,000 linear feet of old sewers can be replaced. These sewers have reached the end of their design life and are in danger of failure.

The Capital Improvement Plan will be funded using a mix of sewer user charge funds and System Development Charge funds. The Capital Maintenance Plan will be funded entirely with sewer user charge funds.

# CITY OF WEST LINN
# SANITARY SEWER MASTER PLAN UPDATE

## SECTION ONE

## INTRODUCTION

### BACKGROUND

The City of West Linn owns and operates its sanitary sewer system. Some of the public sewers are at or approaching 100 years old. The system includes approximately 110 miles of public sewer and eight city-maintained pumping stations. Three pumping stations owned and maintained by Tri City Service District (TCSD) are located in West Linn. All of the wastewater from West Linn is treated at the TCSD Wastewater Treatment Plant located in Oregon City. The last adopted Sanitary Sewer Master Plan report was prepared by Murray, Smith and Associates, in 1989. That master plan has served the city well and many of its recommendations have been implemented.

This Master Plan report meets the facility planning requirements of the State Land Conservation and Development Commission. It analyzes the existing sewerage system, projects future peak flow requirements in the system and recommends improvements where necessary. The operation and maintenance activities of the sewer maintenance department are reviewed and recommendations made concerning operation procedures and equipment purchases.

The ability of the City to provide sanitary sewer service for the Urban Reserve No. 30 area is analyzed. The costs for providing these facilities are presented.

A public involvement program was implemented during the master planning process. The plan was described in an informative article in the city newsletter and in a flyer included with a utility bill mailing. Presentations were made to and questions and comments were addressed from various city committees and decision-making bodies. These included:

1. City Council
2. Planning Commission
3. Utility Advisory Board
4. West Linn Tomorrow! Task Force

This Master Plan includes a Capital Improvement Plan and Capital Maintenance Plan for sanitary sewer related projects and equipment purchases and maintenance.

This Master Plan provides a general framework to guide the City in maintaining and improving its sanitary sewer system. The projects and purchases recommended should be reviewed in detail to determine if the proposed schedules for these activities are still valid. The capital requirements should be reviewed each year and a Capital Improvement Plan and Capital Maintenance Plan established, using the most up to date information available. The level of funding recommended in this Master Plan can be used to estimate overall revenue requirements as the City reviews its sewer user charge rates and System Development Charge fees.

**PROJECT OBJECTIVES**

The general project objectives of this Master Plan project are as follows:

1. To develop a Sanitary Sewer Master Plan that complies with the State Land Conservation and Development Commission requirements for facility planning.
2. To develop recommendations for improvements and additions to the sanitary sewer system so that it will continue to provide uninterrupted service to all buildings within the West Linn service area. These improvements will include extension to new areas and rehabilitation / upgrading of existing facilities to meet all future requirements.
3. To review the operations and maintenance facilities and procedures and recommend any additions and changes so that sewer service can be maintained in an efficient and cost-effective manner.
4. To adequately inform West Linn citizens and elected officials of the planning process and of improvements being considered.
5. To ensure that all-state and federal requirements pertaining to the sewer system are met.
6. To develop a Capital Improvement Plan and Capital Maintenance Plan to adequately plan for the capital needs of the sanitary sewer system.

## ACRONYMS AND ABBREVIATIONS

Throughout the nine chapters in this document, several acronyms and abbreviations were used. The table below contains a list of these acronyms and abbreviations to assist the reader's review and understanding of this Master Plan Update.

| **Acronym / Abbreviation** | **Definition** |
|---|---|
| CIP | Capital Improvement Plan |
| CMP | Capital Maintenance Plan |
| cfs | Cubic feet per second |
| DEQ | Oregon Department of Environmental Quality |
| Dia. | Diameter |
| EA | Each |
| ENR | Engineering News-Record |
| Equip | Equipment |
| FM | Flow monitor |
| FY | Fiscal year |
| GIS | Geographical Information System |
| hr | Hour |
| I/I | Infiltration/Inflow |
| in/hr | Inch per hour |
| LF | Linear feet |
| mgd | Million gallons per day |
| mod | Model |
| NPDES | National Pollution Discharge Elimination System |
| No. | Number |
| PVC | Polyvinyl Chloride |
| P.E. | Professional Engineer |
| RDII | Rainfall Dependent Infiltration and Inflow |
| Rep | Replacement |
| SWMM | Storm and Wastewater Management Model |
| SDC | System Development Charge |
| Sch | Schedule |
| TCSD | Tri-City Service District |
| TSP | Transportation System Plan |
| TAZ | Traffic Analysis Zone |
| UR30 | Urban Reserve No.30 |
| XP-SWMM | Computer Hydraulic Model |

# CITY OF WEST LINN
# SANITARY SEWER MASTER PLAN UPDATE

## SECTION TWO

## EXISTING CONDITIONS

The West Linn sanitary sewer system consists of both gravity sewers and pumping stations. The gravity sewers deliver the wastewater to the pumping stations, which pump it in a force main (pressure sewer) to another gravity sewer. All of the sanitary sewers carry only wastewater. Stormwater is carried in roadside ditches and separate storm sewers.

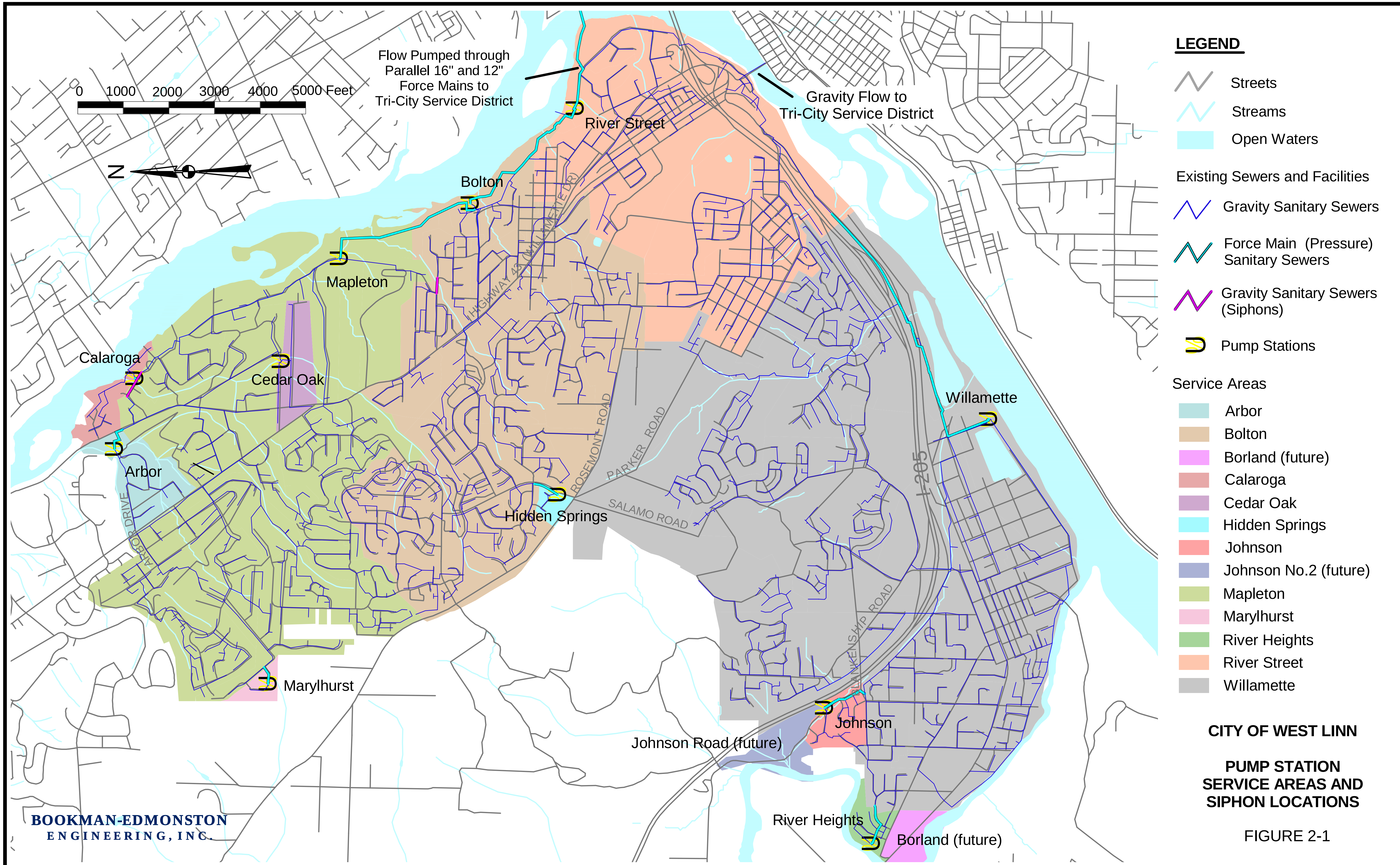
The wastewater is transported to the Tri-City Service District (TCSD) wastewater treatment plant for treatment. Wastewater from part of West Linn is pumped across the Willamette River in two force mains and the rest of the wastewater flows in a gravity sewer attached to the Oregon City Bridge.

The layout of the sanitary sewer system and the area served by each pump station is shown on Figure 2-1.

### GRAVITY SEWERS

The West Linn sanitary sewer system consists of over 110 miles of public sewers, ranging in sizes from 6-inch to 24-inch diameter. Building lateral sewers that connect to the public sewers are owned and maintained by each building owner. These building lateral sewers, which are generally either 4-inch or 6-inch in diameter, are estimated to total over 100 miles in length. About 25 percent of the public sewers are constructed of clay pipe, 25 percent polyvinyl chloride (PVC) and 50 percent concrete pipe. The PVC pipe almost exclusively has been installed since the early 1980s. The oldest pipe in the system is the clay pipe, which is mainly located in the Bolton and Sunset areas, with some in the Willamette area. Some of the older clay lines are approaching 100 years old. The concrete pipe is located mainly in the Robinwood, River Street and Willamette areas.

A breakdown of the lengths of each size of sewer by pumping station service area is given in Table 2-1. 8-inch diameter pipe comprises approximately 82 percent of the length of these sanitary sewers. The terrain in many areas of the City allows the sewers to be constructed on a steep grade, and 8-inch sewers, therefore, have adequate capacity to service relatively large areas. The steep slopes on these sewers also lead to higher flow velocities in them, which assists in keeping them free flowing.




**CITY OF WEST LINN**

**PUMP STATION SERVICE AREAS AND SIPHON LOCATIONS**

FIGURE 2-1

TABLE 2-1

**West Linn Sanitary Sewer Collection System**

**Sewer Length in Feet**

| Pump Station | 24" | 21" | 18" | 15" | 12" | 10" | 8" | 6" |
|---|---|---|---|---|---|---|---|---|
| Marylhurst | 0 | 0 | 0 | 0 | 0 | 0 | 717 | 0 |
| Arbor | 0 | 0 | 0 | 0 | 0 | 0 | 4,698 | 305 |
| Calaroga | 0 | 0 | 0 | 0 | 0 | 0 | 3,890 | 205 |
| Cedaroak | | 0 | 0 | 0 | 0 | 0 | 4,470 | 0 |
| Mapleton (Remaining Area) | 0 | 595 | 3,480 | 3,825 | 4,655 | 2,825 | 96,137 | 6,953 |
| **Mapleton Sub-Total** | 0 | 595 | 3,480 | 3,825 | 4,655 | 2,825 | 109,912 | 7,463 |
| | | | | | | | | |
| **River Street** | 5,775 | 737 | 3,520 | 1,721 | 3,606 | 3,380 | 54,579 | 4,625 |
| | | | | | | | | |
| Hidden Springs | 0 | 0 | 0 | 0 | 0 | 0 | 1,370 | 0 |
| Bolton (Remaining Area) | 0 | 0 | 2,155 | 2,640 | 4,229 | 7,325 | 114,172 | 3,035 |
| **Bolton Sub-Total** | 0 | 0 | 2,155 | 2,640 | 4,229 | 7,325 | 115,542 | 3,035 |
| | | | | | | | | |
| Johnson | 0 | 0 | 0 | 0 | 0 | 0 | 5,606 | 0 |
| River Heights | 0 | 0 | 0 | 0 | 0 | 0 | 5,000 | 0 |
| Willamette (Remaining Area) | 0 | 498 | 450 | 8,201 | 10,838 | 3,525 | 135,874 | 3,825 |
| **Willamette Sub-Total** | 0 | 498 | 450 | 8,201 | 10,838 | 3,525 | 146,480 | 3,825 |
| | | | | | | | | |
| **TOTAL** | 5,775 | 1,830 | 9,605 | 16,387 | 23,328 | 17,055 | 426,513 | 18,948 |

Sewers in the City's older neighborhoods are constructed of vitrified clay and non-reinforced concrete. Since about 1980, most of the sanitary sewers in West Linn have been constructed of polyvinyl chloride (PVC) pipe. Force mains are generally constructed of PVC pipe in the smaller sizes (4", 6", and 8" diameter) and of ductile iron for larger sizes.

## PUMP STATIONS

Most of the wastewater generated in the City is transported through these gravity sewers to the following major wastewater pump stations:

Mapleton (City owned and maintained)

River Street (TCSD owned and maintained)

Bolton (TCSD owned and maintained)

Willamette (TCSD owned and maintained)

Seven smaller wastewater pump stations service areas of the City which cannot be served by gravity sewers alone. These pump stations, all City owned and maintained, are as follows:

| Pump Station Name | Located in Following Major Pump Station Service Area |
|---|---|
| Marylhurst | Mapleton |
| Arbor | Mapleton |
| Calaroga | Mapleton |
| Cedaroak | Mapleton |
| Hidden Springs | Bolton |
| Johnson | Willamette |
| River Heights | Willamette |

The Calaroga Pump Station is a wetwell-mounted, drywell-wetwell type station, with two vacuum-primed pumps. All other pump stations are wetwell only, submersible pump designs. Each station has an Intrac-2000 telemetry system. Information and data for all of the pump stations owned and maintained by the City are shown in Table 2-2.

Table 2-2
**City-Owned and Maintained Pump Station Data**

| Pump Station | # of Pumps | Firm Capacity (gpm) | Date Built(B)/ Upgraded(U) | Level Control System | Comments |
|---|---|---|---|---|---|
| Mapleton | 3 | 2,300 | 1998 (B) | Multi-Trode | Diesel generator for emergency power, chemical oxidizer injection for $H_2S$ control in force main |
| Marylhurst | 2 | 225 | 1990 (U) | Floats | |
| Arbor | 2 | 300 | 1990 (U) | Floats | |
| Calaroga | 2 | 143 | 1993 (U) | Bubbler | Water tight hatch on dry well |
| Cedaroak | 2 | 200 | 1990 (U) | Floats | |
| Hidden Springs | 2 | 150 | 1986 (B) | Floats | To be abandoned soon |
| Johnson | 2 | 150 | 1998 (B) | Multi-Trode | Air injector to force main |
| River Heights | 2 | 118 | 1992 (B) | Floats | Pneumatic Pinch valve on force main |

The Marylhurst, Arbor, and Cedaroak Pump Station upgrades included installation of new pumps, valves, guide rails in the wetwell, access hatches and electrical panel change-outs (breakers, alternators, starters, etc.). Some current minor deterioration to access hatches and wetwells was noted at these stations.

All of the pumping stations can be operated in emergency conditions by using engine-powered electrical generators. Mapleton Pump Station has a generator mounted inside the control building. All other stations use a trailer-mounted generator, which must be towed to the site. All stations, except Mapleton and River Heights, may also be bypassed in an emergency, using a trash pump lowered into the wetwell which can pump through a bypass valve on the station force main. Mapleton Pump Station has a capacity requirement, which cannot be met by a small trash pump. The high hill over which the flow from the River Heights Pump Station must be pumped precludes a trash pump from being used.

The telemetry system installed at each of the pumping stations is designed to send a radio signal in response to an alarm condition at the station. Currently monitored alarm conditions that will trigger an alarm are high wetwell level, power failure, and pump seal failure. The telemetry system sends a radio signal to a repeater station located at the Rosemont Water Reservoir. The repeater sends a signal via telephone line to the master control unit located at the Public Works Operations Center. If the alarm is not acknowledged within three minutes, an automatic dialer telephones public works personnel at home to inform them of the alarm.

Wastewater, which flows to the Mapleton Pump Station, is pumped through a 12-inch diameter force main to the Bolton Pump Station. The Bolton Station pumps wastewater through a 16-inch diameter force main across the Willamette River to the TCSD interceptor in Oregon City. Similarly, wastewater which flows to the River Street Pump Station is pumped in a separate 12-inch diameter force main across the Willamette River to the same TCSD interceptor. Wastewater which flows to the Willamette Pump Station is pumped to a TCSD sewer located along Willamette Falls Drive. From that point, the flow crosses the Willamette River by gravity through an 18-inch diameter pipe supported below the old Oregon City Bridge to a TCSD interceptor in Oregon City. A portion of the wastewater originating within the service area of the River Street Pump Station is currently diverted across the river in the same gravity sewer.

## WASTEWATER PERMIT

All of the wastewater from West Linn is treated at the TCSD Treatment Plant in Oregon City. The National Pollution Discharge Elimination System (NPDES) permit for this plant is issued to TCSD by the Oregon Department of Environmental Quality (DEQ). The City of West Linn sanitary sewer system is covered by the TCSD NPDES permit. One of the permit conditions is that all inflow sources to the sanitary sewer system be identified and reviewed. The rules and regulations of the TCSD also prohibit excessive infiltration and inflow from entering into the sewer system.

## SIPHONS

There are two inverted siphon sewers in West Linn. One is a 12-inch, single-barrel siphon, located in Calaroga Drive upstream of the Mapleton Pump Station. The downstream manhole of this siphon is the force main discharge point for the Calaroga Pump Station.

The other siphon is located in Jolie Point Road at Marquette Drive. It is 8" in diameter and is also a single-barrel siphon. The locations of these siphons are shown on Figure 2-1.

## PARALLEL (RELIEF) SEWERS

A parallel (relief) sewer has been constructed in Dillow Drive, from Highway 43 to Failing Street. A 15-inch diameter sewer parallels an 8-inch diameter sewer there. The City has chosen to replace capacity-deficient sewers with larger, full-size sewers in other areas. This eliminates the double length of sewers (and problems associated with having an older sewer in service) in these areas.

## SEWER BYPASSES

Improvements to the interceptor sewer systems paralleling the Willamette River were completed, with the intention to abandon the bypasses to the Willamette River. This has been accomplished in the Willamette and River Street Pump Station service areas. One permitted bypass still exists upstream of the Mapleton Pump Station. This bypass has a check valve on it to prevent the river from backing into the 18-inch interceptor. The bypass is monitored by a float switch located in the Mapleton Pump Station wetwell. A copy of the DEQ approval of this bypass is included in Appendix A.

## DEPARTURE FROM PREVIOUS MASTER PLAN

A review of the existing layout of the sewers serving the Bland Circle developing area shows that flow from the northwest portion of this area is being routed through laterals designated as 9B-31 and 9B-32 instead of through the proposed interceptor which was to begin at Manhole 9B-20 as envisioned in the 1989 Master Plan. This sewer routing was done to facilitate development in this area. This modification results in larger areas being served between manholes 9B-20 and 9B-32 than was envisioned in the 1989 Master Plan. This system is analyzed in Section 7 and 8 of this Master Plan.

The 1989 Master Plan recommended increasing the capacity of Interceptor 1A from the River Street Pump Station to Manhole 1A-10, located at the intersection of River Street and Holly Street. The City and TCSD have agreed that diverting flow from areas upstream of this sewer segment into the gravity sewer on the old Oregon City Bridge can be done on a permanent basis. Therefore, increasing the capacity of Interceptor 1A between the River Street Pump Station and Manhole 1A-10 will no longer be required.

## SEWER MAPS

The City has developed a set of sewer maps which show the layout of the sanitary sewer system. These maps are annotated with manhole top elevation, sewer invert elevation, distance between manholes and sewer diameter. These maps are available in a version with street rights-of-way only shown and in another version as an overlay to aerial photography, with street names annotated. The City is developing these maps using Geographical Information System (GIS) software. The GIS system increases the maps' ease of use and allows the individual items to be easily located.

# CITY OF WEST LINN
# SANITARY SEWER MASTER PLAN UPDATE

## SECTION THREE

## OPERATION AND MAINTENANCE REVIEW

The recommendations contained in the 1989 Sanitary Sewer Master Plan concerning setting up a sanitary sewer maintenance program have largely been followed. The previous report noted that, at that time, the types of maintenance being done were mainly corrective. The City was mainly reacting to problems as they occurred, in contrast to being proactive and attempting to prevent problems from occurring in the first place. The current sewer maintenance division uses a proactive, preventative maintenance approach.

### REVIEW OF SEWER OPERATION AND MAINTENANCE PROCEDURES

Collection System, Staff Level

The City of West Linn operates and maintains approximately 110 miles of sanitary sewer collection system and eight (8) pump stations. The supervisor of the Sewer Maintenance Division divides his time between this and the Storm Maintenance Division. Three other workers are assigned full time to sewer maintenance. This crew is adequately trained and efficiently carries out all work plans. The personnel level is correct and staff members are accomplishing the goals outlined by the Division in the West Linn Public Works Department Strategic Plan for 1995-2005. (see Appendix B) These goals are still appropriate and the staff should continue to strive to meet them.

Annual, Monthly and Weekly Work Plans

The Sewer Division prepares an annual work plan that sets their maintenance and operational goals. This plan outlines how many miles of sewer collection system is to be video-taped and cleaned, how often the pump stations are to be cleaned, and which manholes are to be inspected. The personnel required to accomplish all goals are estimated for the year.

The annual work plan is further broken down into months and weeks. The work is well planned and carried out. Reports for the fiscal years 95/96, 96/97 and 97/98 were reviewed. The maintenance staff is meeting its goals and the system is being maintained in a very well-organized manner.

Collection System Maintenance

The goal of cleaning twenty percent (20%) of the sewer collection system per year is being met on a consistent basis. The staff has the proper equipment to accomplish this work and uses this equipment effectively. The collection system maintenance is providing great dividends to the City of West Linn, and the recording of only 41 plugged mains in ten years is commendable. The maintenance practices are responsible for this, and the steep slopes that exist also help keep the system clean.

Wastewater Pumping

The eight City-owned wastewater pump stations are maintained on a regularly scheduled basis. The wet wells are inspected and the pump station walls are cleaned each month. The wet wells are drained and cleaned annually. The work plan for maintaining this part of the collection system is adequate and the results are commendable. The existing cleaning schedule is recommended to be continued.

Manhole Inspection

Manhole inspection is a priority that is being carried out as part of the annual work plan. Records are kept that show which manholes have been inspected and rehabilitated each week, month, and year. This work is also showing dividends in the form of reduction of inflow into the system.

Conclusion

The City of West Linn should be pleased in the performance of its sewer maintenance staff. The result of their efforts to provide proper sewer system maintenance is apparent. System failures are at a low level and will be kept at that level if the system continues to be maintained as it has in the past ten years. No changes should be made to any procedure or work plan that would lessen the degree of attention that the system currently receives.

As the system ages further, the level of maintenance required will increase and decisions will have to be made concerning replacement of worn-out systems. The current record-keeping procedure will continue to provide the data necessary to make the “replacement versus continue-to-maintain” decision. The existing maintenance record-keeping software system is scheduled to be replaced. We concur with that decision. The current software system is outdated and lacks the ability to tie all systems together and be updated.

## REVIEW OF SEWER MAINTENANCE DIVISION EQUIPMENT

Collection System Cleaning Equipment

Currently the City utilizes a large combination vacuum and jet cleaning unit ("Guzzler") for most all cleaning and vacuuming of the collection system and the sewage pump station wet wells. This equipment is very necessary for the maintenance division to properly clean the system. This machine is nearing eight years of service and is showing signs of significant wear and tear. There is no similar piece of equipment to replace it if it should it be out of service for any reason.

There are two issues concerning the Guzzler that should be addressed:

1. The replacement schedule.
2. Purchase of a similar piece of equipment

A large chassis-mounted piece of equipment such as the Guzzler will reach a point in its life cycle when major working and load bearing parts will wear out. For instance the debris tank will wear thin from rocks repeatedly being discharged into the tank and the frame and truck chassis, and structural members on which the equipment sets, will show signs of fatigue and wear. It is recommended that replacement for the Guzzler be scheduled for fiscal year 2004-2005. It is estimated that the replacement cost will be $250,000 (1999 dollars) depending on the equipment furnished with the basic unit.

Since replacing the Guzzler is very expensive, the City needs to start accruing funds to replace it. The costs for this equipment replacement should be included in the Capital Maintenance Plan, which is discussed in Section 9 of this Master Plan report.

Another important issue is the efficient utilization of equipment. Currently the Guzzler is utilized for maintenance of the storm drain system and parks as well as the sanitary sewer system maintenance. Thus, there are often times when the equipment is not available when needed or not available to sustain an effective cleaning program for the storm drainage system. Also, there is a problem of not having the equipment available when it is out of service. Since no equivalent piece of backup equipment is available, system emergencies could have to wait until the equipment is back in operation or a rental piece of equipment is obtained. To rectify this problem it is recommended that the City purchase a jet cleaning truck in order to enable greater efficiency in cleaning systems and provide a piece of equipment in case the Guzzler is not available. The jet cleaning truck should hold a minimum of 1500 gallons of water and provide a jet of 80 gallons of water per minute at 2500 psi. Its chassis must have two rear axles to support the 1500 gallon water tank. The cost of this truck is estimated to be in the range of $150,000 dollars depending on the equipment included.

It is recommended that the City budget a minimum of $35,000 dollars to rehabilitate the Guzzler in the near future. This work should include rebuilding or the replacement of pumps and electrical system, replacement or rehabilitation of the hose reels and hoses, and performance of any needed maintenance on the chassis and power train. This maintenance activity should extend the life of the equipment for a period of three to six years if the amount of use does not exceed the present level.

Video Equipment

The City's sewer maintenance division has a small video camera designed for use in sanitary sewers that is in need of repair. After a review of how it is used, it is recommended that it be repaired rather than replaced. This camera repair cost should not exceed $2500.00 dollars.

The truck used to transport the video equipment is old (1975). Since it is used on an emergency basis only, it is not recommended for immediate replacement.

Replacement of Service Trucks, Dump Trucks and Pick-ups

The sewer maintenance division has four (4) service trucks, ranging in size from one-half ton to one ton. These trucks are aging to the point that replacement is imminent. Based on a review of the uses of the trucks, it is recommended that the City purchase a one ton service truck for hauling and towing heavy loads. The truck should be a 4X4 with dual rear wheels, a diesel engine and a long box. It should be equipped with either an automatic transmission or a manual four-speed transmission. It should have an extended cab. This vehicle, with a 165-inch wheelbase, is estimated to cost $28,375 dollars. This truck would be a good replacement for vehicle 902, which is a 1979 three-quarter ton truck. By up-sizing this truck, it could serve more purposes and haul heavier loads in a safer manner.

The City is replacing one of its two dump trucks this year. The dump box on the new vehicle will be a 5-yard box instead of the existing 7-yard box. This truck should be placed on an eight (8) year replacement schedule.

It is recommended that all service trucks and pickup trucks be replaced at 70,000 miles or six (6) years, whichever occurs first. In all cases, the overall condition of each vehicle should be reviewed before the final decision is made concerning its replacement.

Backhoes

The Sewer and Storm Maintenance Division has three backhoes which range in age from nine (9) years to twenty (20) years. The Street Division and the Parks Division also use these backhoes. They are used on a limited basis only. It is recommended that the nine-year-old backhoe be kept in service and that the others be disposed of. If an additional backhoe is needed on a short-term basis, it is recommended to be rented.

The recommended replacement schedule for a backhoe is fifteen (15) years with a major overhaul at seven (7) or eight (8) years. Again, this schedule may vary depending upon use. Each Division using this backhoe needs to be responsible for properly using it and not abusing it.

# CITY OF WEST LINN
# SANITARY SEWER MASTER PLAN UPDATE

## SECTION FOUR

## INFILTRATION AND INFLOW (I/I) REVIEW

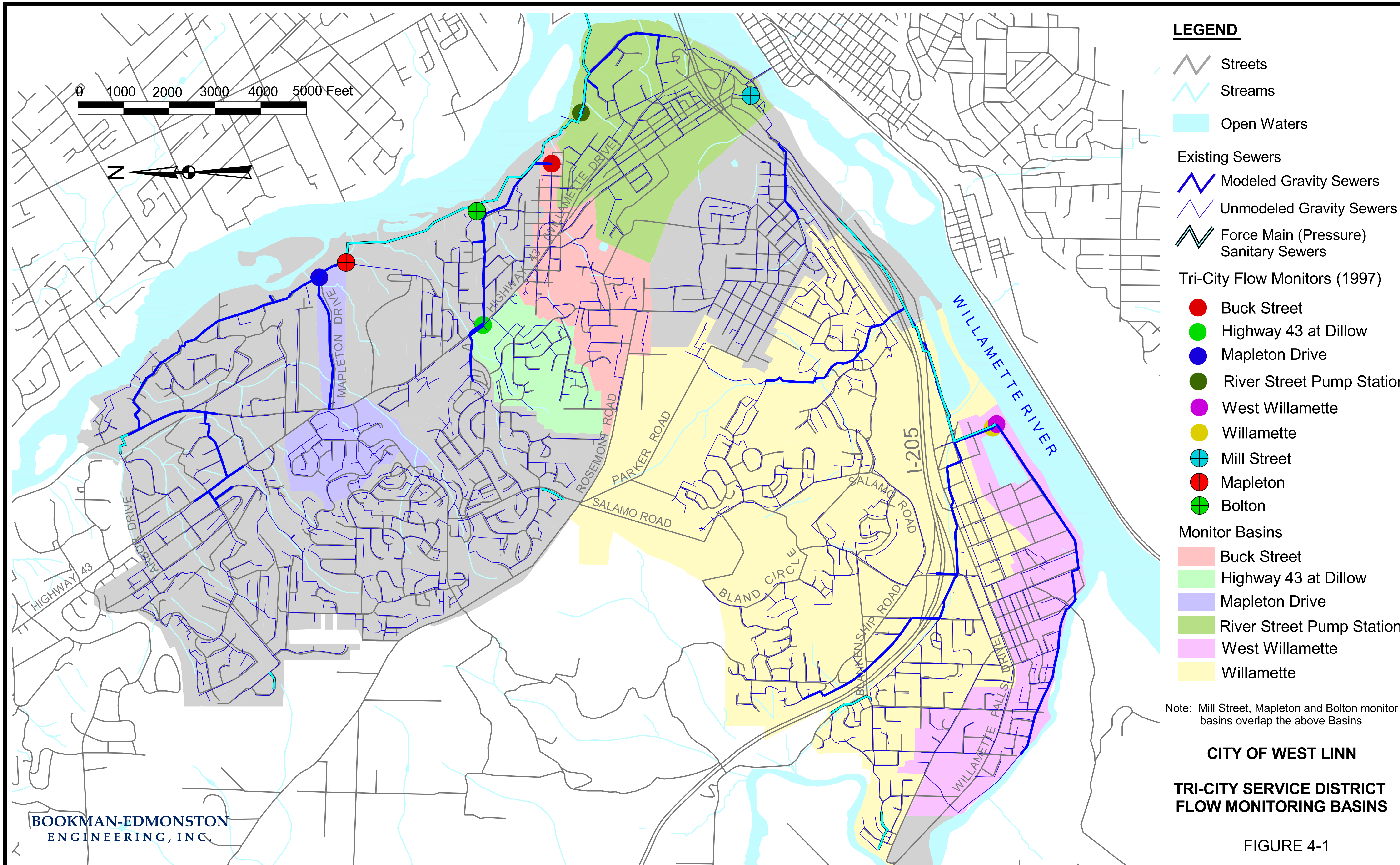
The characteristics of the flows in the sewer lines in West Linn are no different from those in most other cities. They are composed of the normal wastewater discharged to the sewer system from single and multi-family residences, commercial establishments and industrial buildings, along with infiltration and inflow. Infiltration enters the sewers mainly from groundwater, through cracks in pipes and manhole walls. As long as the groundwater level remains the same, the infiltration rate will remain relatively constant. As the groundwater level rises or falls, so does the infiltration rate. The flow in the sewers under relatively constant groundwater levels, in the absence of rainfall, is termed the "base flow". Inflow enters the sewers from direct connection of area drains, footing drains, sump pump discharges, and other generally illegal sources, as well as through holes in manhole lids. Inflow increases dramatically during a rainfall event, and quickly subsides after the rain ends. Increases in the sewer flowrates above the base flowrate during and after a rainfall event are termed "rainfall dependent infiltration and inflow" (RDII).

### TRI-CITY SERVICE DISTRICT STUDY

The Tri-City Service District (TCSD) conducted flow monitoring over its service area in 1997 as part of their Master Plan project. This flow monitoring included nine sites in West Linn. The locations of these flow monitors and the areas served by sewers tributary to each flow monitor are shown on Figure 4-1. A copy of the intergovernmental cooperative agreement allowing TCSD to install these flow monitors is included in Appendix A.

The TCSD study presented data for all of the flow monitors for four storms, which occurred in January, February, and April 1997. These storms all included approximately 0.70 inches of rainfall in a 24-hour period. This rainfall is not nearly as intense as the 5-year, 24-hour storm rainfall of 2.7 inches, on which the peak design sewer flows are based; however, sewer system response to rainfall can be characterized by the rainfall amounts that occurred during that study.

The TCSD study made the following recommendations concerning the sewers in the West Linn flow monitor basins:




**CITY OF WEST LINN**

**TRI-CITY SERVICE DISTRICT FLOW MONITORING BASINS**

FIGURE 4-1

| FLOW MONITOR BASIN | RECOMMENDATION |
|---|---|
| River Street Pump Station | Smoke test all sewers in basin - highest priority |
| Buck Street - southern Bolton Service Area | Smoke test - lesser priority |
| Mill Street - Willamette Service Area | Smoke test - lesser priority |
| Mapleton Drive - mid-south part of Mapleton Service Area | Smoke test - low priority |
| Highway 43 & Dillow - southwestern Bolton Service Area | Smoke test - low priority |
| Willamette - north portion of Willamette Service Area | Smoke test - low priority |
| West Willamette - west portion of Willamette Service Area | Smoke test - low priority |
| Mapleton Service Area | Television inspect |
| Highway 43 & Magone - western part of Bolton Service Area | Television inspect |

The recommendations in the TCSD Master Plan were made by considering the percentage of rainfall which fell over a sewer basin, which could be accounted for as excess flow after the rain event. The higher the percentage, the worse the sewer condition was assumed to be.

Based on these results, smoke testing was recommended for most of the City's sewers. Smoke testing involves blowing machine-generated smoke through the manhole tops, into the sewers. Smoke will be visible as it exits the sewers – through directly connected area drains, downspouts, or through cracks in the pipe (evidenced by smoke coming through cracks in the ground). Using this procedure, locations where infiltration and inflow can enter the sanitary sewer can be identified.

It was recommended that the River Street Pump Station service area be smoke tested first, followed by the sewers in the Buck Street and Mill Street service areas. It should be noted that the Mill Street flow monitor covered the entire service area of the Willamette Pump Station, plus the Sunset Avenue area. Since the sewers upstream of the two flow monitors at the Willamette Pump Station were rated for smoke testing (low priority), the recommendation for smoke testing includes only the Sunset Avenue area sewers.

The recommendation of the TCSD Master plan is that it is more cost-effective to transport and treat all the flows entering the West Linn (and other Tri-City customer cities) sanitary sewers than to attempt to significantly reduce the I/I entering the system. This being the case, a detailed study of the costs of eliminating part of the I/I flows was not included in the scope of this Master Plan. Removal of major sources of inflow (i.e. area drains, roof drains) from the sanitary sewers which are identified during the smoke testing work is normally cost effective, and is therefore recommended.

The relative condition of these sewers can be ranked by dividing the RDII for each storm by the linear feet of public sewers upstream of the flow monitor. This normalizes the RDII and gives an indication of relative "leakiness" per foot of the sewer system upstream of the flow monitor. The pertinent data and results of these calculations are given in Table 4-1.

**Table 4-1**
**Flow Monitor Basin RDII Analysis**

| Flow Monitor Basin | Upstream Sewer Length | RDII (gallons) per Linear Feet of Sewers | | | |
|---|---|---|---|---|---|
| | LF | Storm 1 | Storm 2 | Storm 3 | Storm 4 |
| Mapleton Drive | 13,708 | 28.45 | 40.85 | 40.12 | 16.05 |
| West Willamette | 30,071 | 22.28 | 58.52 | 36.24 | 16.63 |
| Buck Street | 25,003 | 24.79 | 53.59 | 21.20 | 16.00 |
| Bolton Pump Station | 134,399 | 20.31 | 15.62 | 19.71 | 7.96 |
| River Street | 79,074 | 14.29 | 31.99 | 26.18 | 7.20 |
| Mill Street | 206,655 | 12.82 | 30.96 | 22.64 | 7.64 |
| Hwy. 43 @ Dillow | 16,588 | 9.04 | 17.48 | 12.66 | 1.20 |
| Hwy. 43 @ Magone | 84,419 | 8.76 | 16.58 | 15.28 | 2.84 |
| Nixon Avenue | 114,611 | 7.67 | 11.86 | 10.20 | 0.95 |
| Willamette | 143,135 | 0.84 | 1.67 | 1.40 | 0.35 |

The important thing to notice in Table 4-1 is the relative RDII per linear foot in a given storm. This number is influenced not only by the number of sewer leaks, but also by the characteristics of the rainfall event and the antecedent moisture conditions. Based on this information, it is recommended that the sewers in the following flow monitor basins be considered for more study or remedial/rehabilitation work:

1. Mapleton Drive
2. West Willamette
3. Buck Street
4. River Street

**PUMP STATION I/I ANALYSIS**

The areas of the City which are served by the eight wastewater pump stations that are owned and maintained by the City are shown in Figure 2-1. In order to determine the relative rate of infiltration and inflow into the sewers tributary to each of these pump stations, the hours of pump operation during wet and dry periods were reviewed. The months of July and August 1998 were completely dry months, with a total of 0.00 inches of rain recorded at the West Linn Public Works Operation Center, located at 4100 Norfolk Street. The month of November 1998 was a relatively wet month, with a total of 10.19 inches of rain recorded on the same gauge. The total pumping hours of the pumps in each pump station for the months of August and November, 1998 are presented in Table 4-2. The ratio of the pumping times (wet month versus dry month) is also shown.

**Table 4-2**
**Pump Station Pump Cumulative Run Times (Hours/Day)**

| Pumping Station | Average Day November, 1998 | Average Day August, 1998 | Ratio November/August |
|---|---|---|---|
| Hidden Springs | 1.20 | 0.43 | 2.73 |
| Mapleton | 8.54 | 3.39 | 2.52 |
| Marylhurst | 0.69 | 0.28 | 2.47 |
| Arbor | 3.14 | 1.33 | 2.34 |
| Cedar Oak | 5.46 | 3.14 | 1.74 |
| Calaroga | 5.68 | 3.49 | 1.62 |
| River Heights | 1.22 | 0.83 | 1.46 |
| Johnson | 2.28 | 1.96 | 1.16 |

Based on this analysis, the sewers upstream of the following pumping stations appear to allow a larger amount of infiltration and inflow into them:

1. Hidden Springs
2. Mapleton
3. Marylhurst
4. Arbor

**RECOMMENDATIONS**

After reviewing the above information, the following investigations are recommended:

1. Smoke test all of the sewers in the following service areas:

    a. Mapleton Drive (13,708 LF)
    b. Hidden Springs Pump Station (1,370 LF)
    c. Marylhurst Pumping Station (730 LF)
    d. Arbor Pumping Station (5,673 LF)

This smoke testing can be completed either using City crews or an outside contractor. Once the smoke testing is completed, a program of disconnecting the inflow sources from the sanitary sewer and correcting any other major defects found during the smoke testing should be instituted. It is recommended that the City develop a policy on how these improvements (many of which will be on private property) are to be implemented. The policy should require that all illegal connections to these sanitary sewers (i.e. area drains, downspouts, sump pump discharges, etc.) found on private property be eliminated within a set period of time before the City institutes legal action against the property owner. The City may offer technical assistance as an incentive to get the illegal connections disconnected.

2. Review existing television tapes and schedule sewer replacements on sewers in the following service areas:

    a. West Willamette (30,071 LF)
    b. Buck Street (25,003 LF)
    c. River Street (79,074 LF)

The smoke testing is recommended in areas where the sewers are not approaching their normal design life of 50 years. Replacement of sewers (based on a review of television tapes) is recommended for the older sewers. All of these recommendations are included in the Capital Improvement and Capital Maintenance Plans.

# SECTION FIVE

# HYDRAULIC MODEL DEVELOPMENT

The West Linn sanitary sewer system must have sufficient capacity to carry the projected peak design flowrates without overflowing manholes or causing sewage backups in basements. Hydraulic computer modeling of the sewer system allows it to be analyzed under varying flow conditions. Where the model indicates inadequate capacity in a sewer segment, the model can be revised by changing pipe sizes, pipe slopes or manhole top elevations in the model database. The model can then be rerun on the "upgraded" sewer to determine how those revisions changed the flow carrying capacity of the sewer.

## MODEL REQUIREMENTS

In order to accurately model a sewer system the size of West Linn's, it is necessary that the computer model be able to account for the time wastewater takes to flow from one manhole to another. The model must calculate flow velocities based on the contributed flows at each input point and determine the time for this flow to reach the next flow input point. Flows are added at each input point and the total flow then is used to calculate the travel time to the next downstream manhole. The model must also determine the water surface elevation at each manhole so that sewer surcharges or overflows can be determined.

The XP-SWMM model was selected to be used for the hydraulic modeling on this project. XP-SWMM, marketed by XP-software, is an enhanced version of the SWMM (Storm and Wastewater Management Model) software developed by the United States Environmental Protection Agency in the 1970's. It is frequently used to model sanitary sewer systems as well as storm sewer systems. This model was recently used for the Tri-City Service District (TCSD) Master Plan model.

The basic information required to run XP-SWMM is as follows:

A. Sewer Physical Data
    1. Sewer Size (diameter)
    2. Sewer invert elevation at manholes
    3. Manhole top elevation
    4. Location of manholes using Cartesian Coordinates

5. Roughness of sewer pipe

B. Flow Input Data

1. Hydrograph (flow verses time) at each flow input

The sewer physical data was obtained using sewer maintenance division records supplemented by as-built drawings and the City sewer map. Where critical data was missing, field surveys were conducted. The consultant and City staff met to determine which sewers were required to be modeled. In general, the upstream, 8-inch diameter sewers were not expected to be a problem and therefore modeling of them was felt to not be necessary. The sewers included in the hydraulic model are shown on Figure 5-1. Flow input data was developed for these sewers.

**SYSTEM LAYOUT**

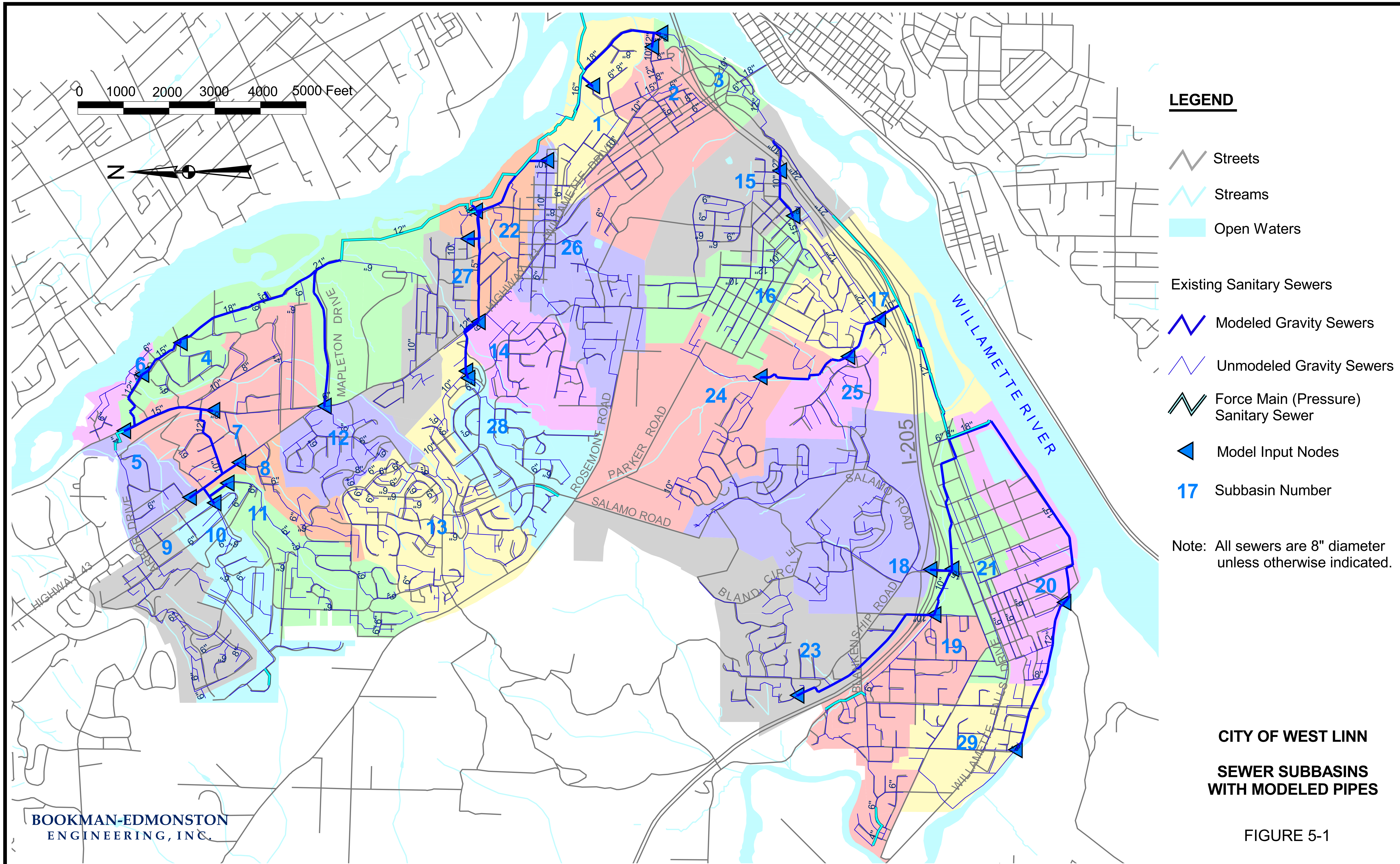
In order to estimate peak flowrates to be handled by the West Linn sewers, it was necessary to review the layout of the existing sewer system. This system was divided into 29 subbasins. The subbasin layout is shown on Figure 5-1. The downstream end of each subbasin was set at a point where the sewer serving that subbasin had one of two characteristics; it either branched off of another main sewer line or increased from an
8-inch diameter to a larger size. The subbasins were delineated mainly for the purpose of setting up the computer model so that the system could be adequately analyzed.

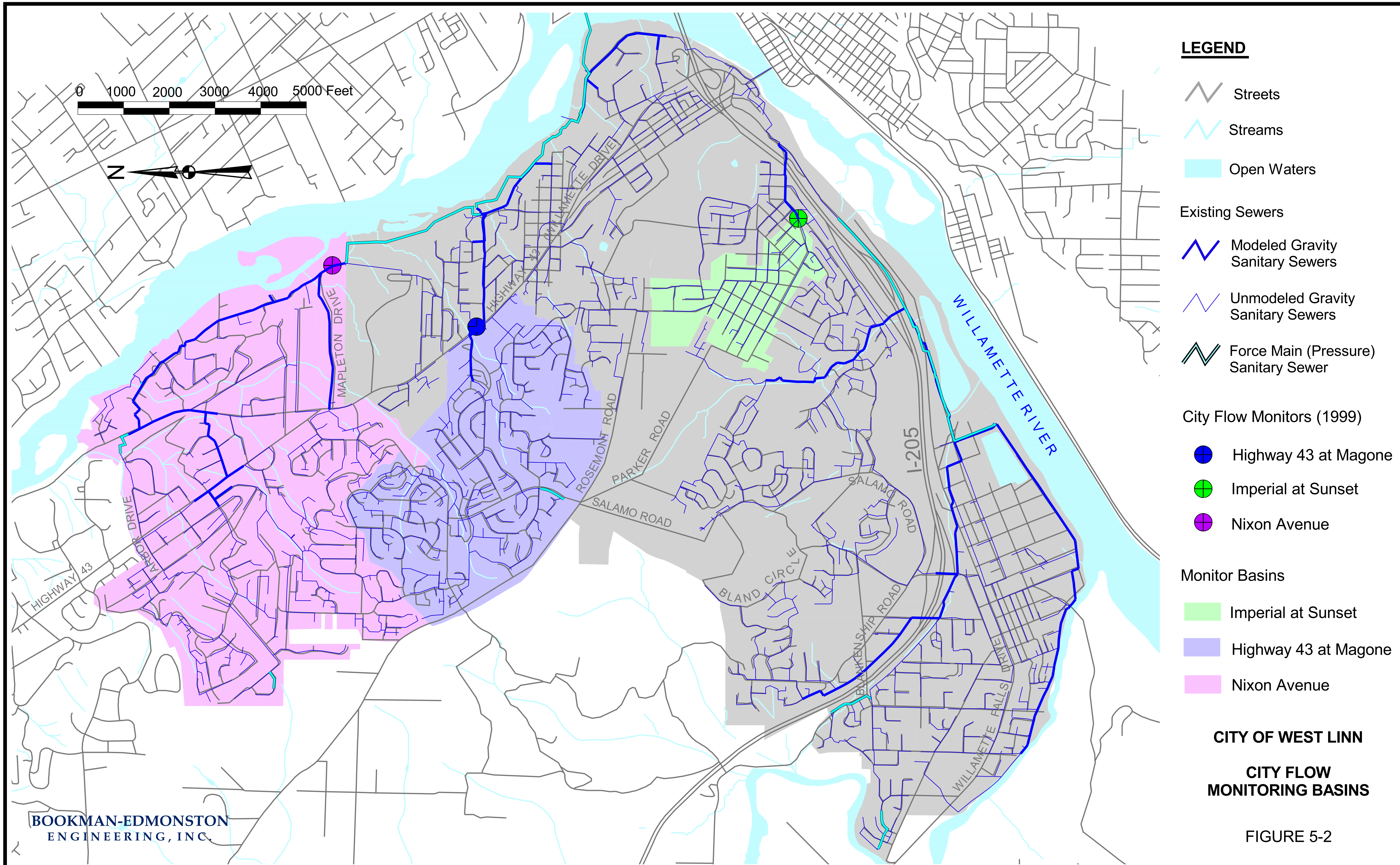
**FLOW MONITORING AND HYDROGRAPH DEVELOPMENT**

In order to estimate the quantity of I/I entering the sewers, the West Linn Sewer Maintenance Division set up three sewer flow monitors at key points in the system. These flow monitors were installed at the locations shown on Figure 5-2. They were in place from early January to mid-March, 1999. Each flow monitor recorded the flow depth and flow velocity continuously in the sewer in which it was installed. This information allowed calculation of the flows through the sewer and charting of flow versus time. The West Linn Public Works Operation Division furnished information on rainfall amounts versus time in West Linn during this same time period. This allowed a correlation to be made between rainfall amount and total sewer flowrate at each of the flow monitor locations.

The variation of flowrate in a given sewer over time is shown by the hydrograph of that sewer. A typical base flow (dry weather) hydrograph is shown in Figure 5-3. That hydrograph shows the repeating pattern of normal base flow in the sewer. Figure 5-4 shows a typical wet weather hydrograph over several days. The daily repeating pattern can be seen in Figure 5-4, but on days with measurable rainfall, the sewer flow greatly increases soon after the rainfall begins.

Figure 5-4 clearly illustrates that the total sewer flow consists of base flow plus RDII flow. It follows that RDII flow at a given point in the system can be estimated by subtracting base flow from the total flow if these flows are known. This calculation of RDII was performed at locations where a flow monitor exists so that total flow was known. Base flow on days of rain events was assumed to be equal to that of the most recent day with no rain event.


0 1000 2000 3000 4000 5000 Feet
N
LEGEND
Streets
Streams
Open Waters
Existing Sanitary Sewers
Modeled Gravity Sewers
Unmodeled Gravity Sewers
Force Main (Pressure) Sanitary Sewer
Model Input Nodes
17 Subbasin Number
Note: All sewers are 8" diameter unless otherwise indicated.
WILLAMETTE RIVER
I-205
MAPLETON DRIVE
ROSEMONT ROAD
PARKER ROAD
SALAMO ROAD
BLAND CIRCLE
BLANKENSHIP ROAD
WILLAMETTE FALLS DRIVE
HIGHWAY 43
ARBOR DRIVE
BOOKMAN-EDMONSTON ENGINEERING, INC.
CITY OF WEST LINN
SEWER SUBBASINS WITH MODELED PIPES
FIGURE 5-1




**CITY OF WEST LINN**

**CITY FLOW MONITORING BASINS**

FIGURE 5-2

Typical Average Base Flow Hydrograph
from Mapleton Flow Monitoring Data

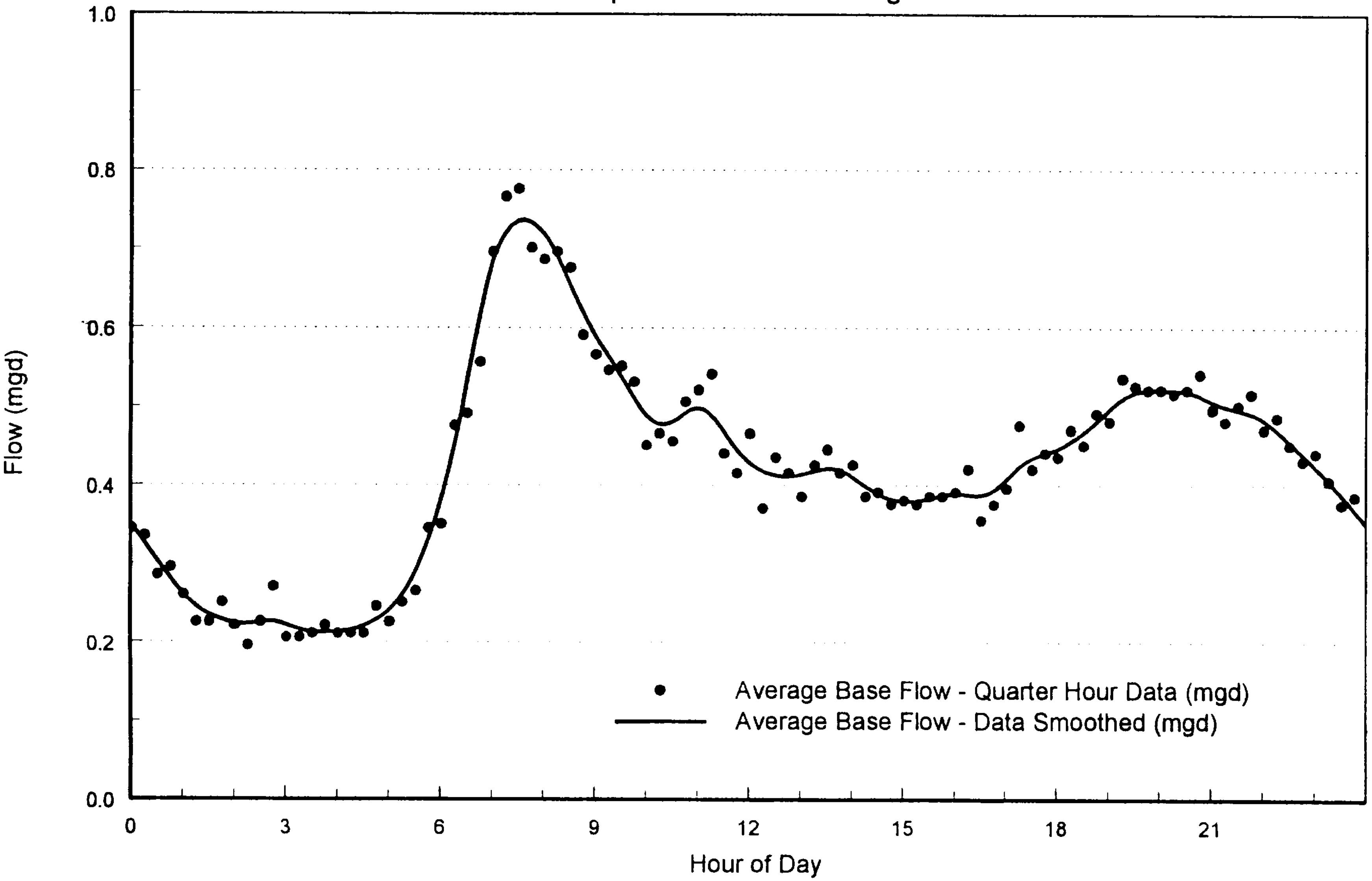



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FIGURE 5-3

## Typical Wet Weather Hydrograph as taken from Mapleton Flow Monitoring Data

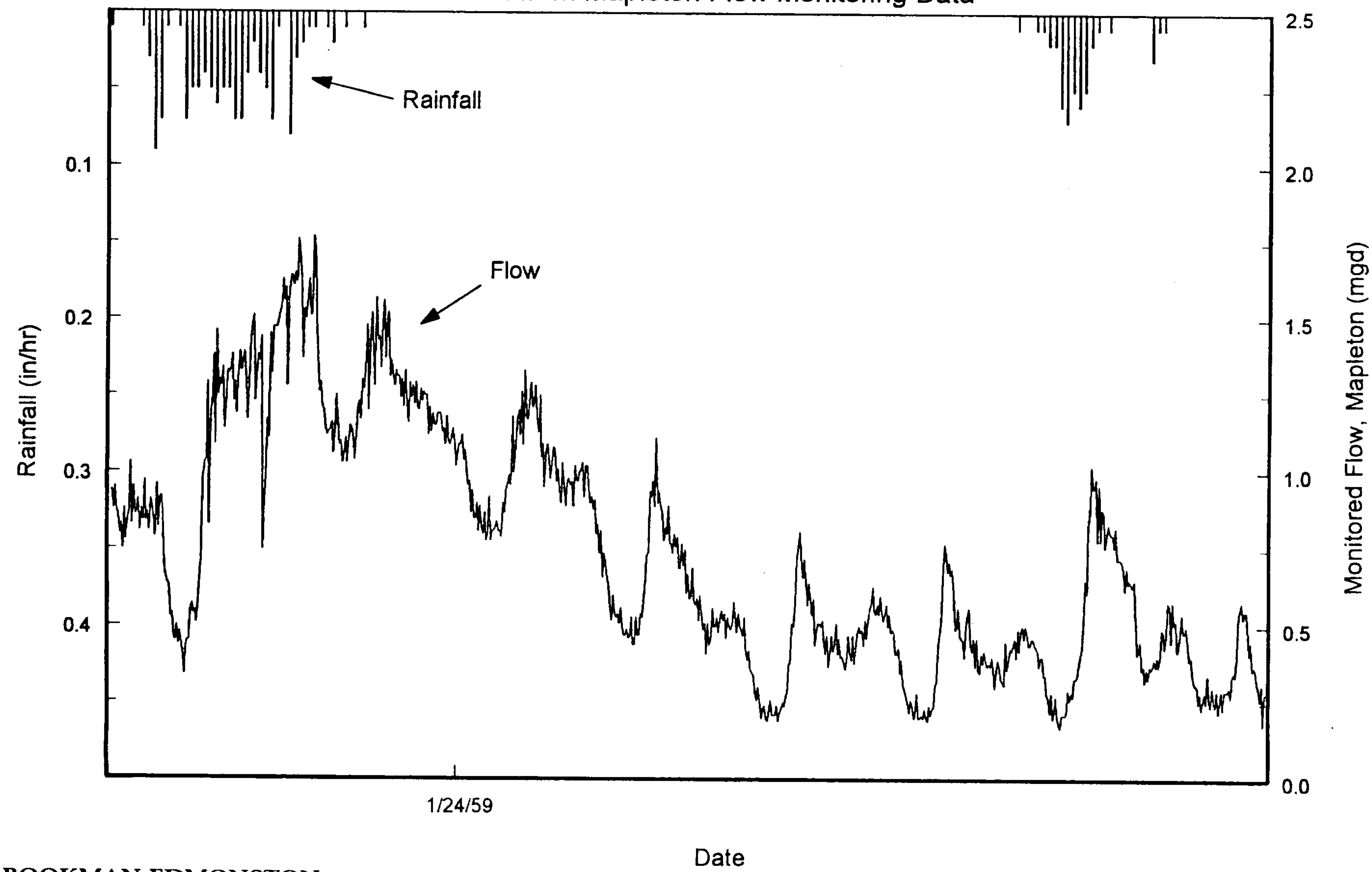


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FIGURE 5-4

Using the results of the RDII estimation and regression techniques, it was possible to estimate the relationship between the RDII component of sewer flow rate and rainfall with respect to time for each sewer where a flow monitor was installed. To test the validity of this estimation, the total flow at a monitored point in response to a known rainfall event was predicted. The model was calibrated by performing small corrections to the input hydrographs until the model predicted amounts of flow were close to the actual amounts. This model was used to estimate what the flowrate would be in the sewers at each flow monitoring manhole, based on the intensity and duration of the design rainfall event.

Actual flow data on all subbasins was not available because not all subbasins had flow monitors. For each subbasin with no flow monitor, flow data was used from a basin with similar characteristics (population density, sewer age) to approximate flow from the unmonitored basin. A hydrograph was created using this data for each of the unmonitored basins. For example, subbasins number 13, 14, 22, 27 and 28 were assigned the characteristic hydrograph shape developed in the flow monitor installed in the sewer at Highway 43 at Dillow, which was close to these subbasins. Sewers in the Willamette area, which did not have a representative flow monitor during this study, were assigned the characteristic hydrograph shape developed for the Mapleton Pump Station (Nixon Avenue).

Each subbasin within a monitored basin was assigned a hydrograph similar to the respective hydrograph of the monitored basin. By similar, it is meant that the shape of the hydrograph was the same, but the magnitude of the flow was smaller; the total flow of the basin was meted out across the subbasins within it. This apportionment of flow to subbasins was not divided equally; each subbasin was allotted a flow based on the estimated population within the subbasin (greater populations were allotted greater flows). Subbasins were allotted these "weighted" flows so that the sum of all subbasin flows within a given basin equaled the total flow in that basin. The following formula was used to weight flows:

$$\text{input node flow} = \frac{\text{input node basin population}}{\text{assigned FM basin population}} \times \text{assigned flow monitor flow},$$

for each hour of the day. The result was flow input node subbasin hydrographs with the same shape as the assigned basin flow monitor hydrograph, with the flowrate being proportional to the upstream population.

## MODEL OUTPUT

Once the physical data and flow data were available, the computer hydraulic model was run. The model output consisted of the following data for each section of modeled sewer:

1. Peak flowrate
2. Hydraulic grade line (the approximate water surface elevation in the sewer)
3. Whether or not a manhole overflowed
4. Quantity of overflow (if any) from a manhole

The discussions and results of the modeling are given in Section 7 (Existing Conditions) and Section 8 (Future Conditions).

## MODEL VERIFICATION

A verification of the validity of the above hydraulic model results was performed. This check was made by comparing model estimates of flow for an actual rain event to the measured flow (by flow monitor) for that event. The flow input hydrographs for each input node manhole (subbasin) were modified using the regression equations developed during this study for the rainfall event which occurred between February 21, 1999 and March 8, 1999. The hydraulic model was run for the same time periods and the model flow rate results compared well to the flow monitor recorded flow rates at the Highway 43/Magone Lane and also at the Mapleton Pump Station (at Nixon Avenue). These results are shown graphically on Figures 5-5 and 5-6.

A review of Figures 5-5 and 5-6, shows that the model predicted the peak flow rates quite well. It is important that the model gives accurate peak sewer flows during rainfall events since these are the times when having adequate sewer capacity is most important. The model should match the general shape of the actual hydrograph during non-peak flow periods. The flow monitor flow data should not be viewed as being “exact”, since the sewer environment is very harsh and inaccuracies may occur because of solids catching on the sensors, backups due to downstream blockages, turbulence in the sewer manhole where the flow monitor is installed, or other factors. The correlation between the model predicted and flow monitored flows is excellent when compared to similar work prepared for other studies.

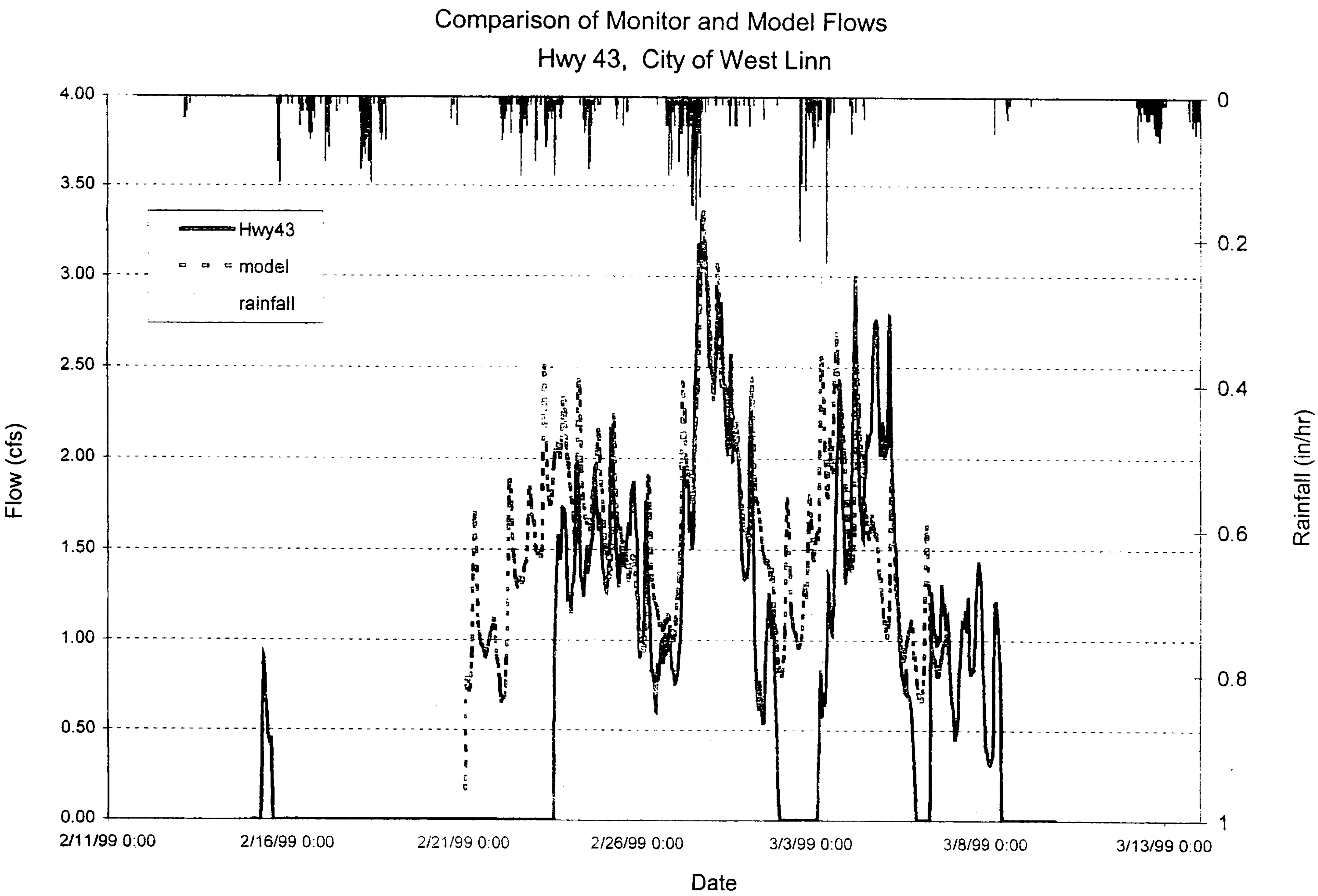


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FIGURE 5-5

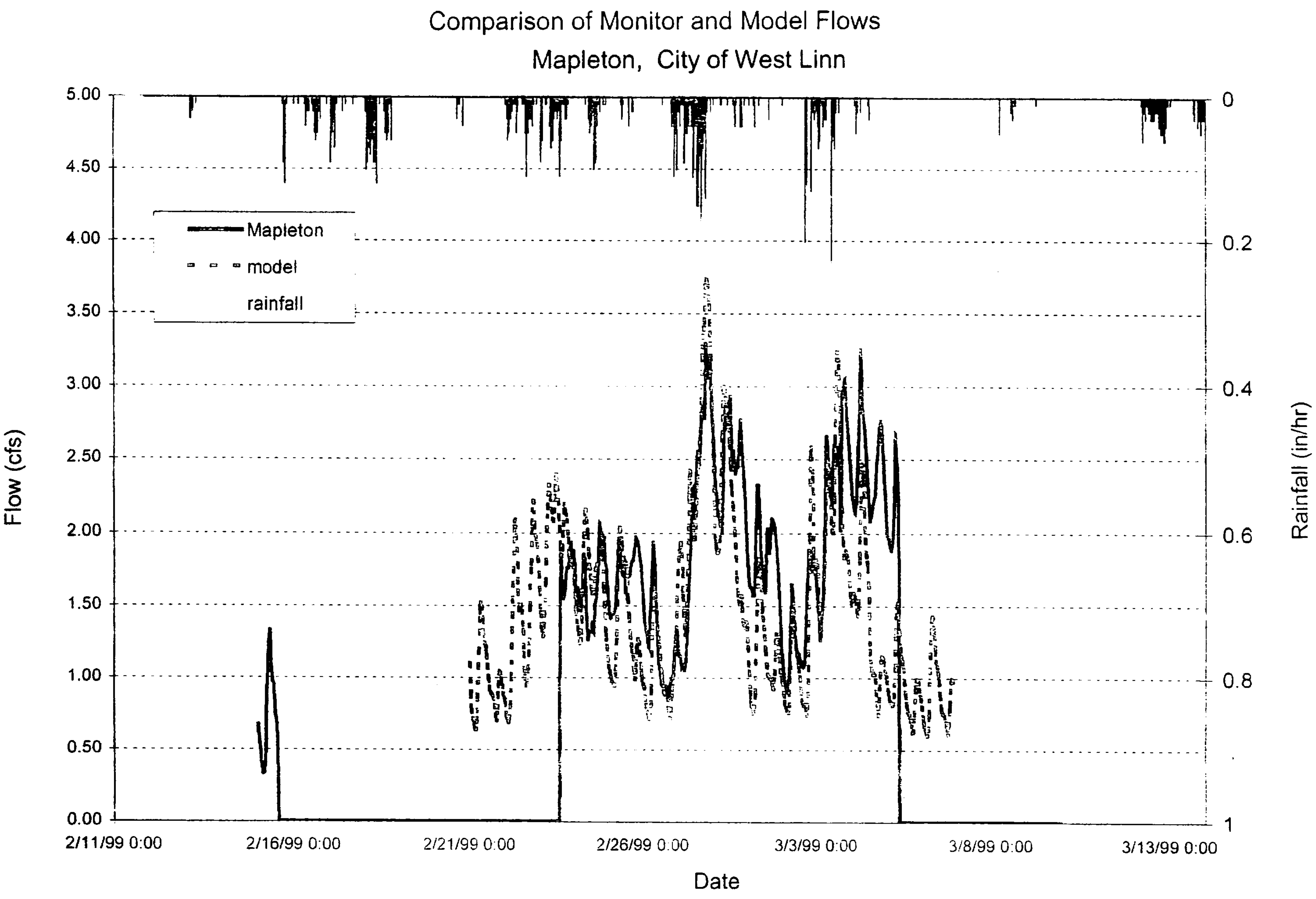


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FIGURE 5-6

# CITY OF WEST LINN
# SANITARY SEWER MASTER PLAN UPDATE

## SECTION SIX

## POPULATION

Population projections for West Linn were prepared for the West Linn Comprehensive Plan, which is currently being updated. The Street Element Update of the Transportation System Plan (TSP) is also currently in progress. In preparing the TSP, the population of West Linn was aggregated into zones based on land use within those zones. Further discussion of these zones, called Traffic Analysis Zones (TAZs) can be found in Section 3 of the 1999 TSP. The starting point for distributing the population to the sewer subbasins, as defined in Section 5 of this Master Plan, was the TAZ data. The TAZ boundaries were overlaid on the sewer subbasin boundaries and the population of the subbasins was determined based on a percentage of area apportioning method. For example, if 10% of a TAZ was within subbasin 1 and 90% was within subbasin 2, 10% of the population in the TAZ was assigned to subbasin 1 and 90% to subbasin 2.

### POPULATION DISTRIBUTIONS

The Comprehensive Plan population data was prepared using a realistic build-out scenario and not the capacity scenario that some estimates used. The build-out scenario used in the Comprehensive Plan is thought to be more realistic in that it does not assume that every square foot of land in the City is built upon to its peak housing density (based on the existing zoning regulations). Rather, it assumes more realistic build-out densities and populations. Build-out was assumed to occur by the year 2017. The total build-out population was estimated at 29,397. To be slightly more conservative, the consultant and City staff agreed that the build-out population would be set at 32,000 within the existing urban growth boundary. The existing population, using the figures in the Comprehensive Plan, was estimated at 21,000.

The extra population needed to reach the 32,000 build-out figure is the population over 29,397, which was included in the TAZ distributions. This was distributed by assigning 75% of it to the developing areas in subbasins 18, 23 and 24 (the subbasins with the largest amounts of undeveloped land), and evenly distributing the remaining 25% over the rest of the subbasins.

The population data was used to develop hydrographs for all input subbasins for the computer hydraulic model. The model was run to evaluate the adequacy of the sewer system under two scenarios: existing and build-out. The design rainfall event was identical for both scenarios. The existing scenario was the estimated 1999 population and the build-out scenario used the estimated 2017 population.

The population distribution data for both existing and build-out populations is given in Table 6-1.

**TABLE 6-1: POPULATION DISTRIBUTION**

| Subbasin Number | Total Subbasin Acreage | Existing Population 1999 | Build-Out Population 2017 |
|---|---|---|---|
| 1 | 117.65 | 406 | 574 |
| 2 | 206.64 | 851 | 1,146 |
| 3 | 43.94 | 19 | 81 |
| 4 | 321.94 | 418 | 878 |
| 5 | 48.78 | 203 | 272 |
| 6 | 27.48 | 74 | 113 |
| 7 | 204.40 | 684 | 977 |
| 8 | 56.93 | 282 | 364 |
| 9 | 153.05 | 723 | 942 |
| 10 | 131.84 | 532 | 720 |
| 11 | 150.18 | 580 | 795 |
| 12 | 95.17 | 658 | 794 |
| 13 | 262.93 | 1730 | 2,105 |
| 14 | 121.19 | 759 | 932 |
| 15 | 193.79 | 822 | 1,099 |
| 16 | 143.64 | 849 | 1,054 |
| 17 | 234.12 | 905 | 1,240 |
| 18 | 356.44 | 1,338 | 3,428 |
| 19 | 203.06 | 1,138 | 1,427 |
| 20 | 190.57 | 543 | 816 |
| 21 | 150.99 | 299 | 515 |
| 22 | 100.20 | 271 | 414 |
| 23 | 271.30 | 1,574 | 3,165 |
| 24 | 315.01 | 1,792 | 3,639 |
| 25 | 71.57 | 281 | 383 |
| 26 | 187.68 | 988 | 1,256 |
| 27 | 111.78 | 452 | 611 |
| 28 | 163.37 | 1,198 | 1,432 |
| 29 | 139.61 | 630 | 829 |
| **Total:** | **4,775.25** | **21,000** | **32,000** |

Average density (people / acre): 4.40 6.70

# SECTION SEVEN

# EVALUATION OF EXISTING SYSTEM

## EVALUATION CRITERIA

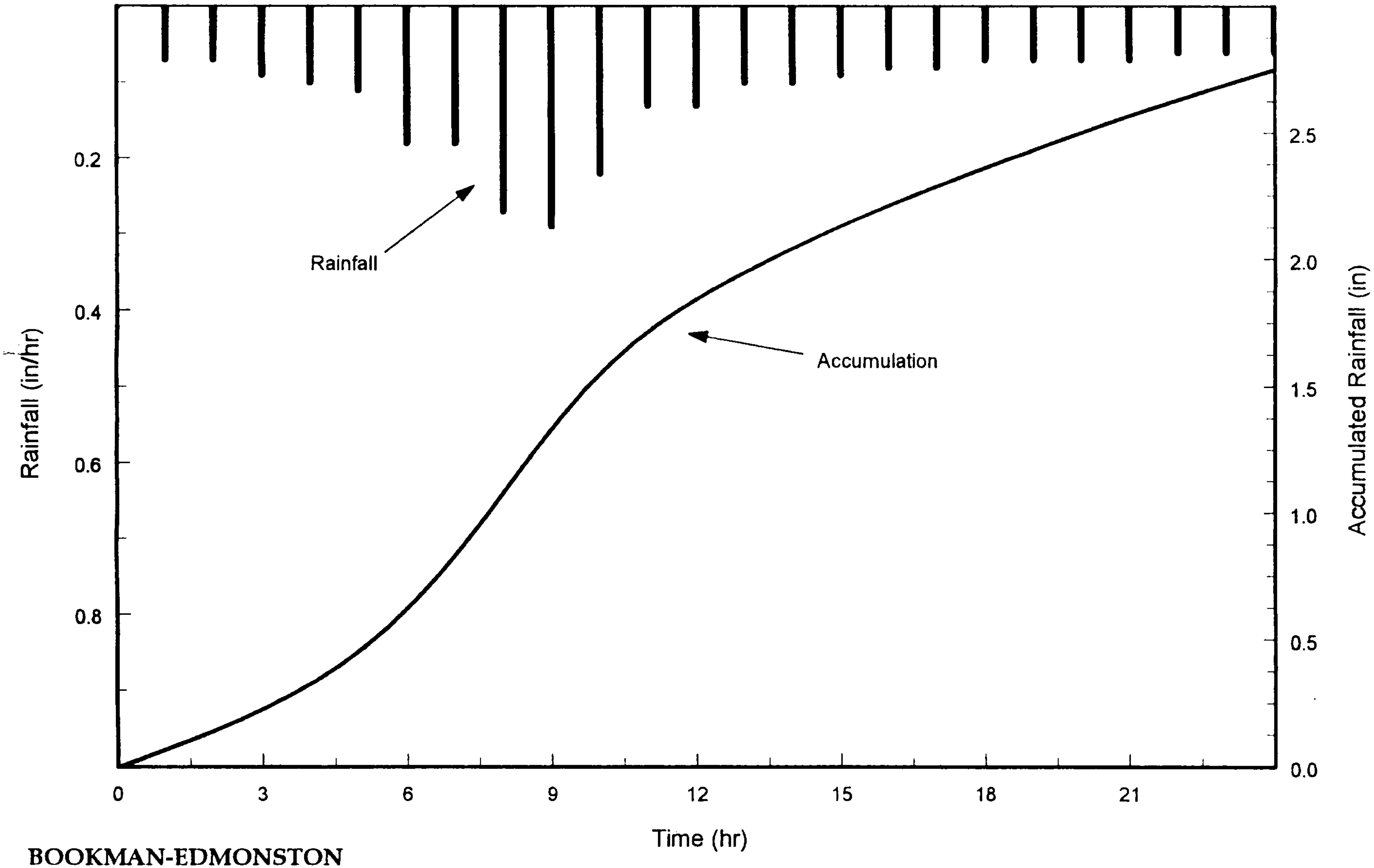
The existing sanitary sewer system was evaluated for capacity problems using the XP-SWMM hydraulic model. In order to analyze the adequacy of a given sewer or pump station, it was necessary to determine under what conditions it must perform and what criteria constitutes satisfactory performance. In discussions with the City of West Linn, it was determined that a reasonable standard for this analysis is as follows:

- Each sewer must not surcharge more that 1.0-foot when the peak design flow occurs. A sewer surcharge occurs when the level of flow in a manhole is above the top of the sewer pipe.
- The design storm producing the peak design flow in the sewers was a 24-hour duration storm with a return period of 5 years. Based on statistical analysis of historic rainfall events in this area, this type of storm is expected to occur only once in a 5-year period. The TCSD study used this same storm as the basis for their flow analysis. For the West Linn area, this storm includes 2.7 inches of rain in a 24-hour period, distributed as shown in Figure 7-1. The Oregon Department of Environmental Quality (DEQ) has accepted this magnitude of storm and distribution as reasonable for analysis and design.
- Each pump station must have adequate firm pumping capacity to pump the peak design flows. The firm capacity of a pumping station is defined as the capacity of a station when the largest pump is out of service.

## MODEL INPUTS

The characteristics of the sewer system were input into the model by defining the sewer size (diameter), upstream and downstream bottom of pipe (invert) elevation, manhole rim elevation, and roughness coefficient for each segment of sewer. Coordinates on each manhole were also input, so that the model could determine the lengths between manholes and a map of the modeled sewer system could be drawn. The hydrograph for each subbasin was input that reflected the subbasin existing population flows and the design storm flows.

24-Hour, 5-Year Rainfall Distribution Design Storm




BOOKMAN-EDMONSTON
ENGINEERING, INC.

FIGURE 7-1

## MODEL RESULTS

Once the model was run, deficiencies in the sewer system were indicated by sewer surcharging over 1.0 feet above the top of the sewer. In extreme cases, overflows occurred through the manhole top. When either of these situations occurred, adjustments to the sewer sizes were made and the model was run again. Based on the adopted criteria, the improvements listed in Table 7-1 were required to serve the existing population under design storm conditions. Manholes are numbered according to the existing system used by the City.

These sewer system improvements are shown in Figures 7-2 and 7-3. The portions of West Linn not included in these two figures did not have model indicated sewer capacity deficiencies. These indicated system deficiencies will establish a base of recommended sewer system improvements. Subsequent analysis of the system under future conditions with increased flows due to the larger population will necessitate larger diameter sewers in some areas. This base level of improvements will be used in the analysis of the funding sources under the Capital Improvements Plan.

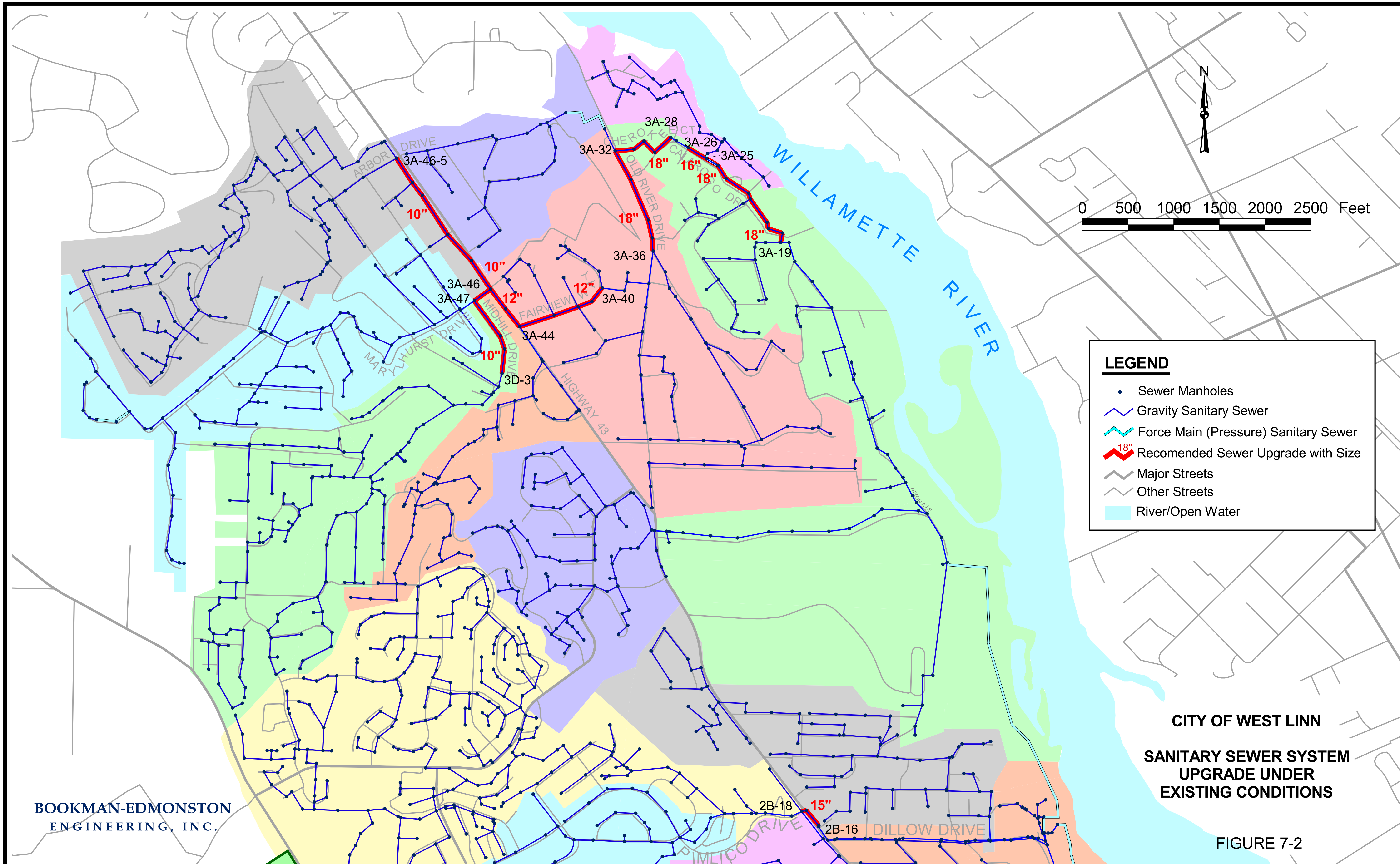
**TABLE 7-1**
**SEWER DIAMETER REVISIONS**
**FOR EXISTING CONDITIONS**

| Upstream Manhole No. | Downstream Manhole No. | Existing Dia. - Inches | Model Dia. - Inches |
|---|---|---|---|
| 2B-18 | 2B-17 | 12 | 15 |
| 2B-17 | 2B-16 | 12 | 15 |
| 3A-47 | 3A-46 | 8 | 10 |
| 3A-46 | 3A-45 | 10 | 12 |
| 3A-45 | 3A-44 | 10 | 12 |
| 3A-44 | 3A-43 | 10 | 12 |
| 3A-43 | 3A-42 | 10 | 12 |
| 3A-42 | 3A-41 | 10 | 12 |
| 3A-41 | 3A-40 | 10 | 12 |
| 3A-36 | 3A-35 | 15 | 18 |
| 3A-35 | 3A-34 | 15 | 18 |
| 3A-34 | 3A-33 | 15 | 18 |
| 3A-33 | 3A-32 | 15 | 18 |
| 3A-32 | 3A-31 | 15 | 18 |
| 3A-31 | 3A-30 | 15 | 18 |
| 3A-30 | 3A-29 | 15 | 18 |
| 3A-29 | 3A-28 | 15 | 18 |
| 3A-26 | 3A-25 (siphon) | 12 | 16 (parallel existing 12") |
| 3A-25 | 3A-24 | 15 | 18 |

**TABLE 7-1 Continued**
**SEWER DIAMETER REVISIONS**
**FOR EXISTING CONDITIONS**

| Upstream Manhole No. | Downstream Manhole No. | Existing Dia. - Inches | Model Dia. - Inches |
|---|---|---|---|
| 3A-24 | 3A-23 | 15 | 18 |
| 3A-23 | 3A-22 | 15 | 18 |
| 3A-22 | 3A-21 | 15 | 18 |
| 3A-21 | 3A-20 | 15 | 18 |
| 3A-20 | 3A-19 | 15 | 18 |
| 3A-19 | 3A-18 | 15 | 18 |
| 3A-18 | 3A-17 | 15 | 18 |
| 9B-27 | 9B-26 | 8 | 10 |
| 9B-26 | 9B-25 | 8 | 10 |
| 9B-25 | 9B-24 | 8 | 10 |
| 9B-24 | 9B-23 | 8 | 10 |
| 9B-23 | 9B-22 | 8 | 10 |
| 9B-22 | 9B-21 | 8 | 10 |
| 9B-21 | 9B-20 | 8 | 10 |
| 9B-20 | 9B-19 | 10 | 12 |
| 9B-19 | 9B-18 | 10 | 12 |
| 9B-18 | 9B-17 | 10 | 12 |
| 9B-17 | 9B-16 | 10 | 12 |
| 9B-16 | 9B-15 | 10 | 12 |
| 9B-15 | 9B-14 | 10 | 12 |
| 9B-13 | 9B-12 | 10 | 12 |
| 9A-15 | 9A-14 | 12 | 15* |
| 9A-14 | 9A-13 | 12 | 15* |
| 9A-13 | 9A-12 | 12 | 15* |
| 9A-12 | 9A-11 | 12 | 15* |
| 9A-8 | 9A-7 | 12 | 15* |
| 9A-7 | 9A-6 | 12 | 15* |
| 9A-6 | 9A-5 | 12 | 15* |
| 9A-5 | 9A-4 | 12 | 15* |
| 9A-4 | 9B-01 | 12 | 15* |
| 9B-01 | 9A-03-00 | 12 | 15* |

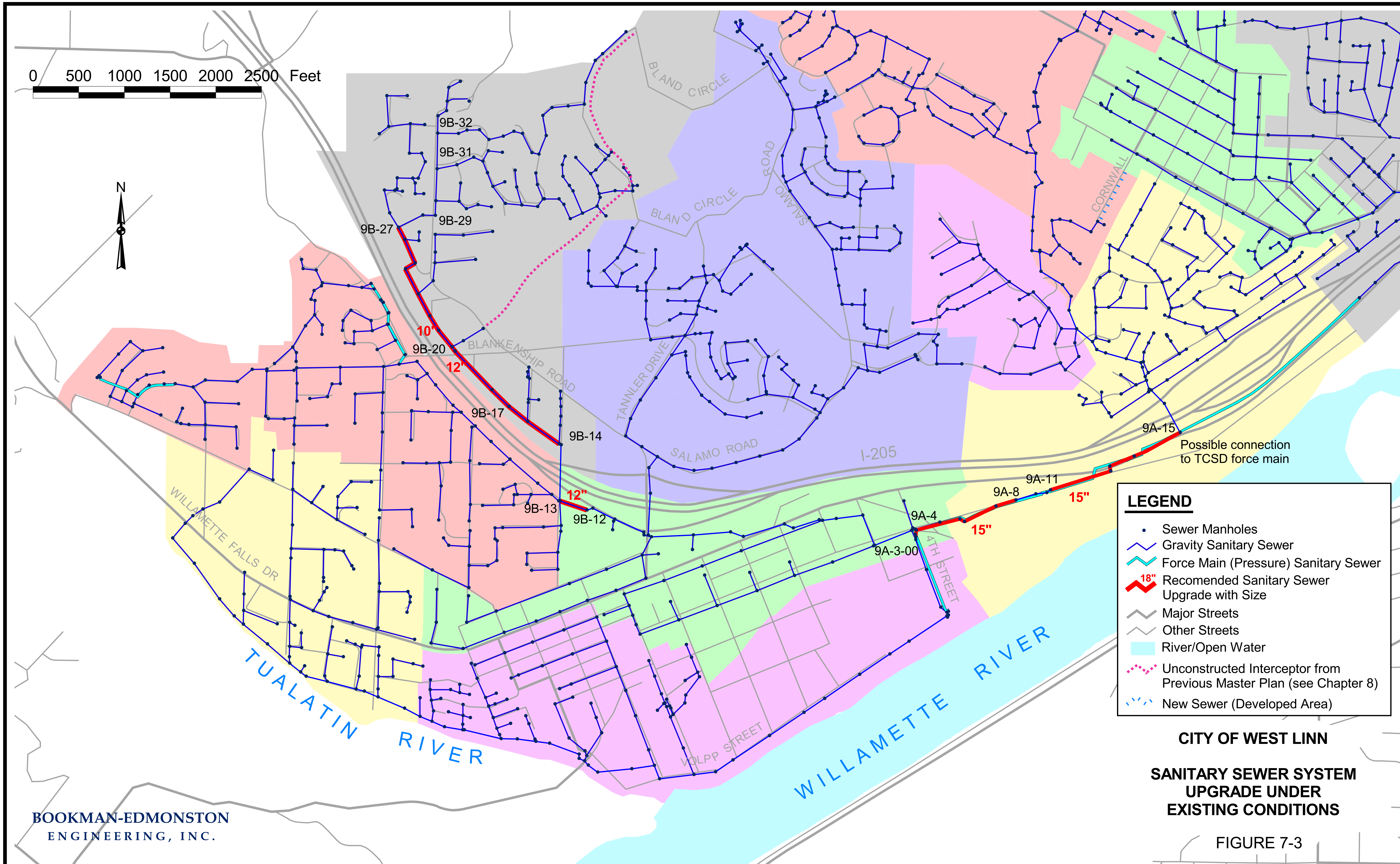
* - Not required if connection to TCSD force main occurs.




**CITY OF WEST LINN**

**SANITARY SEWER SYSTEM UPGRADE UNDER EXISTING CONDITIONS**

FIGURE 7-2




**CITY OF WEST LINN**

**SANITARY SEWER SYSTEM UPGRADE UNDER EXISTING CONDITIONS**

FIGURE 7-3

Consideration should be given to the option of rerouting the flow at manhole 9A-15 directly into the TCSD force main adjacent to it. This manhole is located on Willamette Falls Drive, near the I-205 Viewpoint. An analysis of the maintenance requirements of this option should be required before it is considered. If it is feasible, considerable cost savings may be possible. TCSD would also save on pumping costs at the Willamette Pump Station if this option was followed. This option is feasible only because of the large (100 feet) elevation difference of the area upstream of manhole 9A-15 and that of manhole 9A-15.

The model predicted peak flowrate in each sewer reach (manhole segment) under the design storm conditions with the existing population connected to the sewers is shown in Table 7-2. The recommended sewer size revisions are included in this model run.

TABLE 7-2
MODEL PREDICTED PEAK FLOW RATE
EXISTING CONDITIONS

| Upstream Manhole No. | Downstream Manhole No. | Model Dia. - Inches | Model Predicted Peak Flow Rate-cfs |
|---|---|---|---|
| 2B-23-1 | 2B-23 | 8 | 1.2 |
| 2B-23 | 2B-22 | 8 | 3.6 |
| 2B-22 | 2B-21 | 8 | 3.7 |
| 2B-21 | 2B-21-1 | 8 | 4.4 |
| 2B-21-1 | 2B-20 | 8 | 3.6 |
| 2B-20 | 2B-19 | 8 | 3.6 |
| 2B-19 | 2C-1 | 8 | 3.6 |
| 2C-1 | 2B-18 | 8 | 0.9 |
| 2B-18 | 2B-17 | 15 | 4.5 |
| 2B-17 | 2B-16 | 15 | 4.5 |
| 2B-16 | 2B-0-15 | 15 | 4.5 |
| 2B-0-15 | 2B-0-1-14 | 15 | 4.5 |
| 2B-0-1-14 | 2B-0-13 | 15 | 4.5 |
| 2B-0-13 | 2B-0-12 | 15 | 4.5 |
| 2B-0-12 | 2B-0-11 | 15 | 4.5 |
| 2B-0-11 | 2B-0-10 | 15 | 4.5 |
| 2B-0-10 | 2B-0-9A | 15 | 4.5 |
| 2B-0-9A | 2B-0-9 | 15 | 4.5 |
| 2B-0-9 | 2B-0-8 | 15 | 4.5 |
| 2B-0-8 | 2B-0-7 | 15 | 4.5 |
| 2B-0-7 | 2B-0-6B | 15 | 4.5 |
| 2B-0-6B | 2B-0-6A | 15 | 4.5 |
| 2B-0-6A | 2B-0-6 | 15 | 4.5 |
| 2B-0-6 | 2B-0-5 | 15 | 4.5 |
| 2B-0-5 | 2B-0-4 | 15 | 4.5 |
| 2B-0-4 | 2B-0-3 | 15 | 4.5 |
| 2B-0-3 | 2B-0-2 | 15 | 4.5 |
| 2B-0-2 | 2B-0-1 | 15 | 4.5 |
| 2B-0-1 | 2B-0-0 | 15 | 4.5 |
| 2B-0-0 | 2B-0 | 15 | 4.5 |
| 2B-0 | 2B-3 | 18 | 4.5 |
| 2B-3 | 2B-2 | 10 | 4.5 |
| 2B-2 | 2B-1A* | 10 | 0.9 |
| 2B-1A* | 2B-1 | 10 | 0.9 |
| 2B-1 | 2A-2 | 18 | 5.5 |
| 2A-11 | 2A-10 | 10 | 0.1 |
| 2A-10 | 2A-9 | 10 | 0.1 |
| 2A-9 | 2A-8 | 12 | 0.1 |
| 2A-8 | 2A-7 | 18 | 0.1 |
| 2A-7 | 2A-6 | 18 | 0.1 |
| 2A-6 | 2A-5-0 | 18 | 0.1 |
| 2A-5-0 | 2A-5 | 18 | 0.1 |
| 2A-5 | 2A-4-0 | 18 | 0.1 |

* Number assigned in this study

TABLE 7-2
MODEL PREDICTED PEAK FLOW RATE
EXISTING CONDITIONS

| Upstream Manhole No. | Downstream Manhole No. | Model Dia. - Inches | Model Predicted Peak Flow Rate-cfs |
|---|---|---|---|
| 2A-4-0 | 2A-4 | 18 | 0.1 |
| 2A-4 | 2A-3 | 18 | 0.1 |
| 2A-3 | 2A-2 | 18 | 0.2 |
| 2A-2 | 2A-1 | 18 | 1.1 |
| 3A-32-1 | 3A-32 | 8 | 0.3 |
| 3A-46-1 | 3A-46 | 8 | 1.1 |
| 3A-48 | 3A-47 | 8 | 0.9 |
| 3D-1 | 3A-47 | 8 | 2.4 |
| 3A-47 | 3A-46 | 10 | 2.1 |
| 3A-46 | 3A-45 | 12 | 3.2 |
| 3A-45 | 3A-44-1 | 12 | 3.2 |
| 3A-44-1 | 3A-44 | 8 | 1.7 |
| 3A-44 | 3A-43 | 12 | 3.6 |
| 3A-43 | 3A-42 | 12 | 3.6 |
| 3A-42 | 3A-41 | 12 | 3.6 |
| 3A-41 | 3A-40 | 12 | 3.6 |
| 3A-40 | 3A-39 | 12 | 3.6 |
| 3A-39 | 3A-38 | 12 | 3.6 |
| 3A-38 | 3A-37-1 | 15 | 3.6 |
| 3A-37-1 | 3A-37 | 8 | 1.8 |
| 3A-37 | 3A-36 | 15 | 4.4 |
| 3A-36 | 3A-35 | 18 | 4.4 |
| 3A-35 | 3A-34 | 18 | 4.3 |
| 3A-34 | 3A-33 | 18 | 4.3 |
| 3A-33 | 3A-32 | 18 | 4.3 |
| 3A-32 | 3A-31 | 18 | 4.6 |
| 3A-31 | 3A-30 | 18 | 4.6 |
| 3A-30 | 3A-29 | 18 | 4.6 |
| 3A-29 | 3A-28 | 18 | 4.6 |
| 3A-28 | 3A-27 | 12 | 4.6 |
| 3A-27 | 3A-26 | 12 | 4.6 |
| 3A-26 | 3A-26 | 12 | 5.8 |
| 3A-26 | 3A-25 | 16 | 4.1 |
| 3A-25 | 3A-24 | 18 | 4.8 |
| 3A-24 | 3A-23 | 18 | 4.8 |
| 3A-23 | 3A-22 | 18 | 4.8 |
| 3A-22 | 3A-21 | 18 | 4.8 |
| 3A-21 | 3A-20 | 18 | 4.8 |
| 3A-20 | 3A-19 | 18 | 4.8 |
| 3A-19 | 3A-18 | 18 | 4.9 |
| 3A-18 | 3A-17 | 18 | 5.3 |
| 3A-17 | 3A-16 | 18 | 5.1 |
| 3A-16 | 3A-15 | 18 | 5.1 |
| 3A-15 | 3A-14 | 18 | 5.0 |

TABLE 7-2
MODEL PREDICTED PEAK FLOW RATE
EXISTING CONDITIONS

| Upstream Manhole No. | Downstream Manhole No. | Model Dia. - Inches | Model Predicted Peak Flow Rate-cfs |
|---|---|---|---|
| 3A-14 | 3A-13 | 18 | 5.0 |
| 3A-13 | 3A-12 | 18 | 5.0 |
| 3A-12 | 3A-11 | 18 | 5.0 |
| 3A-11 | 3A-10 | 18 | 5.0 |
| 3A-10 | 3A-9 | 18 | 5.0 |
| 3A-10 | 3A-10-1A | 15 | 2.3 |
| 3A-10-1A | ByPass | 18 | 0.3 |
| 3A-9 | 3A-8 | 18 | 5.0 |
| 3A-8 | 3A-7 | 18 | 5.0 |
| 3A-7 | 3A-6 | 18 | 4.9 |
| 3A-6 | 3A-5 | 18 | 5.0 |
| 3A-5 | 3A-4 | 18 | 4.9 |
| 3A-4 | 3A-3 | 18 | 4.9 |
| 3A-3 | 3A-2 | 18 | 4.9 |
| 3B-12 | 3B-11-1 | 8 | 2.3 |
| 3B-11-1 | 3B-11 | 6 | 1.2 |
| 3B-11 | 3B-10 | 8 | 0.7 |
| 3B-10 | 3B-9 | 8 | 0.7 |
| 3B-9 | 3B-8 | 8 | 0.7 |
| 3B-8 | 3B-7 | 8 | 0.7 |
| 3B-7 | 3B-6 | 8 | 0.7 |
| 3B-6 | 3B-5 | 8 | 0.7 |
| 3B-5 | 3B-4 | 8 | 0.7 |
| 3B-4 | 3B-3 | 8 | 0.7 |
| 3B-3 | 3B-2 | 8 | 0.7 |
| 3B-2 | 3B-1 | 8 | 0.7 |
| 3B-1 | 3A-2 | 8 | 0.7 |
| 3A-2 | 3A-1 | 21 | 5.5 |
| 2A-0AA | 2A-1 | 21 | 5.4 |
| 2A-1 | 2A-0-2 | 18 | 10.4 |
| 2A-0-2 | 2A-1-0 | 18 | 10.4 |
| 1A-3-1 | 1A-3 | 8 | 0.4 |
| 1A-12 | 1A-11 | 24 | 0.2 |
| 1B-3 | 1B-2 | 12 | 1.0 |
| 1B-2 | 1A-11 | 15 | 1.0 |
| 1A-11 | 1A-10 | 24 | 1.2 |
| 1A-10 | 1A-9 | 15 | 1.2 |
| 1A-9 | 1A-8 | 18 | 1.2 |
| 1A-8 | 1A-7 | 18 | 1.2 |
| 1A-7 | 1A-6 | 18 | 1.2 |
| 1A-6 | 1A-5 | 18 | 1.2 |
| 1A-5 | 1A-4 | 18 | 1.2 |
| 1A-4 | 1A-3 | 18 | 1.2 |
| 1A-3 | 1A-2 | 18 | 1.6 |

TABLE 7-2
MODEL PREDICTED PEAK FLOW RATE
EXISTING CONDITIONS

| Upstream Manhole No. | Downstream Manhole No. | Model Dia. - Inches | Model Predicted Peak Flow Rate-cfs |
|---|---|---|---|
| 1A-2 | 1A-1 | 18 | 1.6 |
| 1A-44 | 1A-43 | 15 | 2.7 |
| 1A-43 | 1A-42 | 15 | 2.7 |
| 1A-42 | 1A-41 | 15 | 2.7 |
| 1A-41 | 1A-40 | 10 | 2.7 |
| 1A-40 | 1A-39-0 | 10 | 2.7 |
| 1A-39-0 | 1A-39 | 12 | 2.7 |
| 1A-39 | 1A-38 | 12 | 3.4 |
| 1A-38 | 1A-37-2 | 10 | 3.4 |
| 1A-37-2 | 1A-37-1-0 | 10 | 3.4 |
| 1A-37-1-0 | 1A-37-1 | 10 | 3.4 |
| 1A-37-1 | 1A-37 | 10 | 3.4 |
| 1A-37 | 9B-1-2 | 10 | 3.4 |
| 9A-17-12 | 9A-17-711 | 12 | 1.3 |
| 9A-17-711 | 9A-17-710 | 12 | 1.1 |
| 9A-17-710 | 9A-17-709 | 12 | 0.9 |
| 9A-17-709 | 9A-17-708 | 12 | 1.5 |
| 9A-17-708 | 9A-17-707 | 12 | 0.9 |
| 9A-17-707 | 9A-17-706 | 12 | 0.9 |
| 9A-17-706 | 9A-17-705 | 12 | 0.9 |
| 9A-17-705 | 9A-17-704 | 12 | 0.9 |
| 9A-17-704 | 9A-17-703 | 12 | 0.9 |
| 9A-17-703 | 9A-17-702 | 12 | 0.9 |
| 9A-17-702 | 9A-17-701 | 12 | 0.9 |
| 9A-17-701 | 9A-17-7 | 12 | 0.9 |
| 9A-17-7 | 9A-17-6 | 12 | 2.3 |
| 9A-17-6 | 9A-17-5 | 12 | 2.3 |
| 9A-17-5 | 9A-17-4 | 12 | 2.3 |
| 9A-17-4 | 9A-17-3-0 | 12 | 2.3 |
| 9A-17-3-0 | 9A-17-3 | 12 | 2.3 |
| 9A-17-3 | 9A-17-2 | 12 | 2.3 |
| 9A-17-2 | 9A-17-0-0 | 12 | 2.3 |
| 9A-17-0-0 | 9A-17-1-0 | 12 | 2.3 |
| 9A-17-1-0 | 9A-17-1 | 12 | 2.3 |
| 9A-17-1 | 9A-17 | 12 | 2.3 |
| 9A-17 | 9A-16 | 10 | 3.2 |
| 9A-16 | 9A-15 | 10 | 3.2 |
| 9A-15 | 9A-14 | 15 | 3.2 |
| 9A-14 | 9A-13 | 15 | 3.2 |
| 9A-13 | 9A-12 | 15 | 3.2 |
| 9A-12 | 9A-11 | 15 | 3.2 |
| 9A-11 | 9A-10 | 12 | 3.2 |
| 9A-10 | 9A-9 | 12 | 3.2 |
| 9A-9 | 9A-8 | 12 | 3.2 |

TABLE 7-2
MODEL PREDICTED PEAK FLOW RATE
EXISTING CONDITIONS

| Upstream Manhole No. | Downstream Manhole No. | Model Dia. - Inches | Model Predicted Peak Flow Rate-cfs |
|---|---|---|---|
| 9A-8 | 9A-7 | 15 | 3.2 |
| 9A-7 | 9A-6 | 15 | 3.2 |
| 9A-6 | 9A-5 | 15 | 3.2 |
| 9A-5 | 9A-4 | 15 | 3.2 |
| 9A-4 | 9B-1 | 15 | 3.2 |
| 9B-1 | 9A-3-00 | 15 | 3.2 |
| 9C-2 | 9C-1 | 8 | 1.7 |
| 9C-1 | 9B-27 | 8 | 1.7 |
| 9B-27 | 9B-26 | 10 | 1.0 |
| 9B-26 | 9B-25 | 10 | 1.2 |
| 9B-25 | 9B-24 | 10 | 1.2 |
| 9B-24 | 9B-23 | 10 | 1.2 |
| 9B-23 | 9B-22 | 10 | 1.3 |
| 9B-22 | 9B-21 | 10 | 1.3 |
| 9B-21 | 9B-20 | 10 | 1.3 |
| 9B-20 | 9B-19 | 12 | 1.3 |
| 9B-19 | 9B-18 | 12 | 1.2 |
| 9B-18 | 9B-17 | 12 | 1.2 |
| 9B-17 | 9B-16 | 12 | 1.1 |
| 9B-16 | 9B-15 | 12 | 1.1 |
| 9B-15 | 9B-14 | 12 | 1.1 |
| 9B-14 | 9B-13 | 10 | 1.1 |
| 9B-13 | 9B-12 | 12 | 2.6 |
| 9B-12 | 9B-11-1 | 15 | 2.7 |
| 9B-11-1 | 9B-10 | 10 | 2.6 |
| 9B-10 | 9B-9 | 15 | 2.7 |
| 9B-9 | 9B-8 | 15 | 2.7 |
| 9B-8 | 9B-8-00 | 15 | 5.0 |
| 9B-8-00 | 9B-7-00 | 15 | 5.1 |
| 9B-7-00 | 9B-7 | 15 | 4.9 |
| 9B-7 | 9B-6-00 | 15 | 4.9 |
| 9B-6-00 | 9B-6 | 15 | 4.9 |
| 9B-6 | 9B-5-00 | 15 | 4.9 |
| 9B-5-00 | 9B-5 | 15 | 5.0 |
| 9B-5 | 9B-4-3 | 15 | 5.0 |
| 9B-4-3 | 9B-4-2 | 15 | 4.9 |
| 9B-4-2 | 9B-3 | 15 | 4.9 |
| 9B-3 | 9B-2 | 15 | 4.9 |
| 9B-2 | 9A-3-00 | 15 | 4.9 |
| 9A-3-00 | 9A-2 | 18 | 8.1 |
| 9A-2 | 9A-1 | 21 | 8.1 |
| 9A-1 | 11A-32 | 21 | 8.1 |
| 11A-32 | 11A-31 | 12 | 0.9 |
| 11A-31 | 11A-30 | 12 | 0.9 |

TABLE 7-2
MODEL PREDICTED PEAK FLOW RATE
EXISTING CONDITIONS

| Upstream Manhole No. | Downstream Manhole No. | Model Dia. - Inches | Model Predicted Peak Flow Rate-cfs |
|---|---|---|---|
| 11A-30 | 11A-29 | 12 | 0.9 |
| 11A-29 | 11A-28 | 12 | 0.9 |
| 11A-28 | 11A-27 | 12 | 0.9 |
| 11A-27 | 11A-26 | 12 | 0.9 |
| 11A-26 | 11A-25 | 12 | 0.9 |
| 11A-25 | 11A-24 | 12 | 0.9 |
| 11A-24 | 11A-23-1 | 12 | 0.9 |
| 11A-23-1 | 11A-23 | 12 | 0.9 |
| 11A-23 | 11A-22-1 | 12 | 0.9 |
| 11A-22-1 | 11A-22 | 12 | 0.9 |
| 11A-22 | 11A-21 | 12 | 0.9 |
| 11A-21 | 11A-20 | 12 | 0.9 |
| 11A-20 | 11A-19 | 12 | 0.9 |
| 11A-19 | 11A-18 | 12 | 0.9 |
| 11A-18 | 11A-17 | 12 | 0.9 |
| 11A-17 | 11A-16 | 12 | 0.9 |
| 11A-16 | 11A-15 | 12 | 0.9 |
| 11A-15 | 11A-14 | 12 | 1.6 |
| 11A-14 | 11A-13 | 12 | 1.6 |
| 11A-13 | 11A-12 | 12 | 1.6 |
| 11A-12 | 11A-11 | 12 | 2.3 |
| 11A-11 | 11A-10 | 15 | 1.6 |
| 11A-10 | 11A-9-0 | 15 | 1.6 |
| 11A-9-0 | 11A-9 | 15 | 1.6 |
| 11A-9 | 11A-8 | 15 | 1.6 |
| 11A-8 | 11A-7 | 15 | 1.6 |
| 11A-7 | 11A-6 | 15 | 1.6 |
| 11A-6 | 11A-5 | 15 | 1.6 |
| 11A-5 | 11A-4 | 15 | 1.6 |
| 11A-4 | 11A-3 | 15 | 1.6 |
| 11A-3 | 11A-2 | 15 | 1.6 |
| 11A-2 | 11A-1 | 15 | 1.6 |
| 11A-1 | 11A-0-2 | 15 | 1.6 |
| 11A-0-2 | 11A-0-1 | 15 | 3.7 |

## SEWER REPLACEMENT PROGRAM

Sanitary sewers historically have been assigned a useful life of about 50 years. Since the use of PVC pipe did not begin until the late 1970's and 80's the book is still out on the useful life of these newer sewers. Certainly the older clay and concrete sewers in West Linn are reaching the end of their useful lives. In many of these older sewers, the joint material, which helps seal the sewer from infiltration by groundwater is either badly deteriorated or non-existent. The City often relies on spot repair (replacing a short section of sewer and tieing the new sewer section to the old sewer using couplings) to keep these older sewers in service, a practice that is not recommended because it is not cost-effective. These spot repairs are very expensive, on a cost per foot basis. In addition, the repairs may lead to future maintenance problems because of problems associated with the couplings. Spot repaired pipes must be entirely replaced at a later date due to these anticipated problems. Except in emergencies the better solution is to replace the entire length of pipe between manholes and skip the spot repair. To be proactive and attempt to reduce the number of sewer failures due to joint failure or pipe collapse, the routine replacement of these older sewers is prudent.

In order to upgrade the sanitary sewer system, a sewer replacement program is recommended. This program should target replacing the oldest clay and concrete sewers based on a review of the television tapes of these sewers. The aggressive television inspection program of the City's sewers in recent years will help facilitate this. A priority ranking for replacement of the oldest sewers can be made by reviewing these television tapes. As recommended in Section 4 sewers in the West Willamette, Buck Street and River Street service areas should be the highest priority areas for these sewer replacements.

In the early years of the replacement program, emphasis should be put on replacement of the older clay pipes. The schedule should be intense enough so that the oldest pipes in service are replaced before they are 100 years old. If these old pipes are allowed to remain in service, the likelihood of serious pipe failure problems will increase. To avoid these failure, it is recommended that the clay pipes be replaced within the next 20 years. This would require the replacement of about 7000 feet per year.

The sewer replacement program funding is recommended to be included in the Capital Maintenance Plan.

## PUMP STATION ANALYSIS

All City-owned and maintained pump stations were evaluated for capacity limitations under existing conditions. No capacity problems were identified. The Hidden Springs Pump Station can be taken out of service because gravity sewer service to the area this station serves is now available (see Section 9)

A summary of the analysis of the pump stations under future conditions is in Section 8.

All of the City-owned pump stations are monitored using a telemetry system. The monitors at the pump stations are adequate but the base station, located in the Public Works Operation Center, is outdated and needs to be replaced. The new system should allow querying individual stations remotely so that the source of the problems can be identified at the base station before the maintenance crew is sent to the station.

# CITY OF WEST LINN
# SANITARY SEWER MASTER PLAN UPDATE

## SECTION EIGHT

## FUTURE CONDITIONS ANALYSIS

### SEWER SYSTEM ANALYSIS

After the XP-SWMM model was run on the sewer system under existing population conditions with the design storm rainfall, several segments of under-capacity sewer lines were noted. In these areas, as detailed in Section 7, increasing the size of the sewer was recommended.

Next, a future condition analysis was run on the model for the year 2017. For this analysis, it was assumed that all of the recommended improvements resulting from the existing condition model run were in place. New input hydrographs were developed for each subbasin. These hydrographs were developed assuming the populations listed in Table 6-1 of this Master Plan for the build-out condition. In areas where the sewer system is presently complete, population growth is expected through development of undeveloped (and presently sewered) lots or redevelopment at higher housing densities. The level of infiltration and inflow (I/I) in the sewers in these areas was projected to be equal to that presently occurring. This projection was based on the assumption that reduction in I/I sources due to maintenance activities offsets new I/I sources. Sewer maintenance activities of the City can result in the reduction of some I/I sources; new I/I sources occur because of continuing pipe deterioration. Replacement of under-capacity lines is required in some areas to alleviate capacity problems in serving the present population. This replacement will result in newer lines and probable initial reduced I/I contributions from the lines (as compared to the older sewers they replace).

The increased population due to infill of existing developed areas was assigned a wastewater contribution of 80 gallons per capita per day. This contribution is based on historical average sewer flows from similar areas. This additional flow was spread over the day in the same proportion indicated by the existing hydrographs. For example, if the base flow hydrograph for a particular manhole (model input node) showed that 10 percent of the daily base flow occurred between 10 and 11:00 a.m., then an additional eight gallons of flow (80 x 10%) per person additional was added to the hydrograph during this time.

In areas where substantial new growth is occurring (subbasins 18, 23 and 24), new sewers will be constructed to serve new developments. New pump stations may be required to serve isolated areas where gravity sewers alone cannot serve the area. In laying out these new sewerage facilities, the environmental effect of the construction should always be considered. Extreme adverse environmental effects shall be avoided.

In these developing areas, the hydrographs were revised by assuming that I/I would contribute 3,500 gallons per new acre developed per day. This amount is the average I/I contribution found by analyzing the Mapleton Pump Station service area and is typical of the value used by other cities in this area. Although, the new sewers have low I/I contributions when first installed, it is assumed that as they age, I/I contributions will be similar to the existing system. As in the infill areas, additional population was assigned a flow contribution of 80 gallons per capita per day.

The hydraulic model was run using the sewer sizes required to upgrade the system, based on the existing conditions model run and revised hydrographs (which included larger flows than the existing conditions run because of the increased future population). The results of this analysis showed that additional sewer system upgrades would be needed to meet the required standards. These sewer upgrades are all located in the Willamette area and are listed in Table 8-1 and shown on Figure 8-1. Manholes are numbered according to the existing system used by the City.

**TABLE 8-1**
**SEWER DIAMETER REVISIONS FOR FUTURE CONDITIONS**

| Upstream Manhole No. | Downstream Manhole No. | Existing Diameter - Inches | Model Diameter - Inches |
|---|---|---|---|
| 9C-1 | 9B-8 | 8 | 10 |
| 9B-31 | 9B-30 | 8 | 8* |
| 9B-30 | 9B-29 | 8 | 8* |
| 9B-15 | 9B-14 | 10** | 15 |
| 9B-13 | 9B-12 | 10** | 15 |
| 9B-10 | 9B-9 | 15 | 18 |
| 9B-9 | 9B-8 | 15 | 18 |
| 9B-8 | 9B-8-00 | 15 | 18 |
| 9B-8-00 | 9B-7-00 | 15 | 18 |
| 9B-7-00 | 9B-7 | 15 | 18 |
| 9B-7 | 9B-6-00 | 15 | 18 |
| 9B-6-00 | 9B-6 | 15 | 18 |
| 9B-6 | 9B-5-00 | 15 | 18 |
| 9B-5-00 | 9B-4-3 | 15 | 18 |
| 9B-4-3 | 9B-4-2 | 15 | 18 |

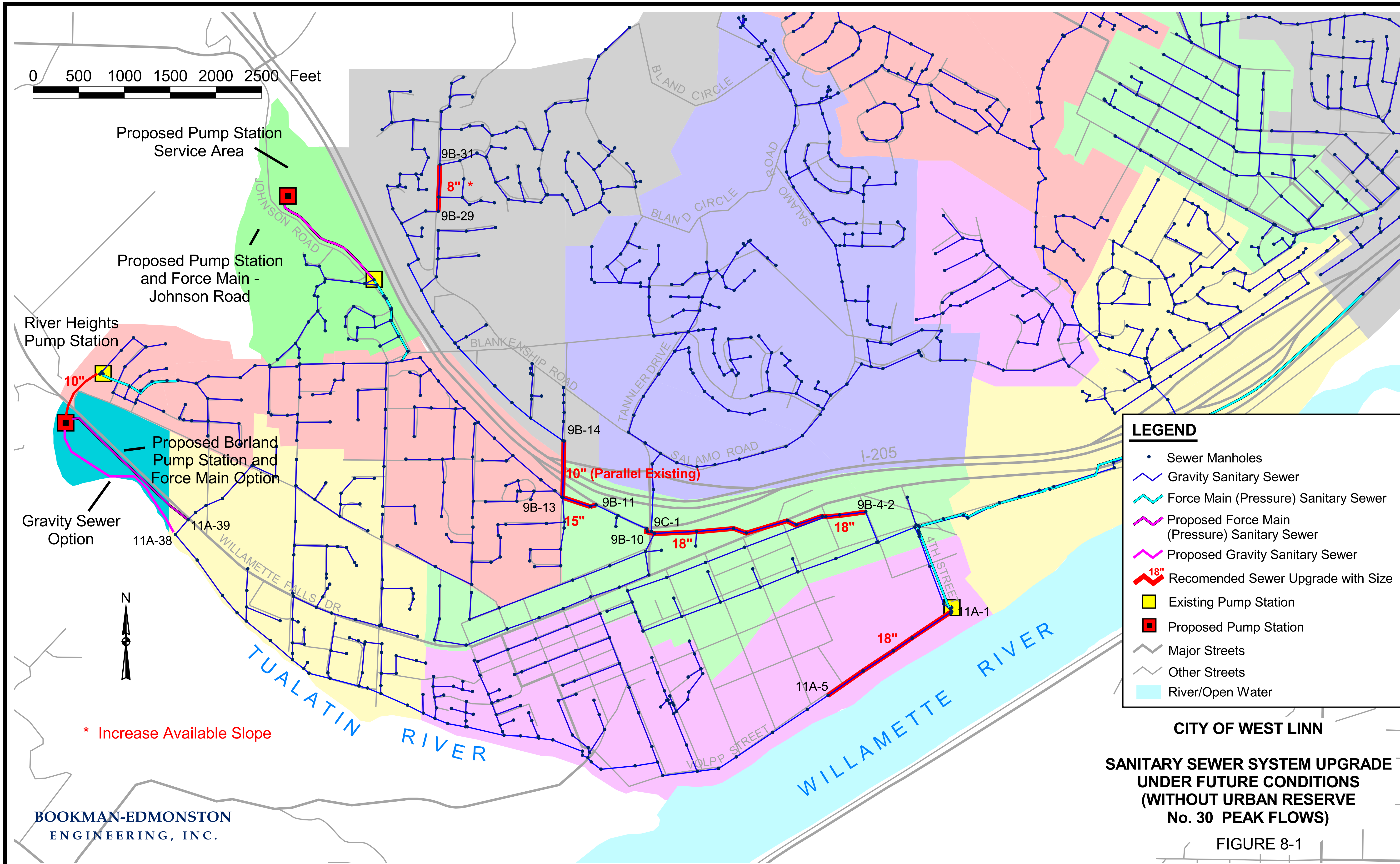
**TABLE 8-1 (Continued)**
**SEWER DIAMETER REVISIONS FOR FUTURE CONDITIONS**

| Upstream Manhole No. | Downstream Manhole No. | Existing Diameter - Inches | Model Diameter - Inches |
|---|---|---|---|
| 9B-4-2 | 9B-3 | 15 | 18 |
| 11A-5 | 11A-4 | 15 | 18 |
| 11A-4 | 11A-3 | 15 | 18 |
| 11A-3 | 11A-2 | 15 | 18 |
| 11A-2 | 11A-1 | 15 | 18 |

*Relay to steeper available slope
**Recommended to be increased to 12" diameter to carry existing conditions peak flowrates.

There is an interceptor system that has been built in the Tanner Basin that does not match the preliminary design shown in the 1989 Master Plan. The planned interceptor sewer is depicted on Figure 7-3 as a dashed line and was designed to serve the area somewhat encircled by Bland Circle and Salamo Road. Had that sewer been built, it would have discharged into Manhole 9B-20. Instead of constructing the long length of new sewer, the developer proposed and was permitted to construct an alternative. This alternative system discharges into Manhole 9B-32 and 9B-31. The advantage to the City with this alternative is that City workers have less pipeline to maintain. A disadvantage to the City is the added flow that begins in the Manholes 9B-32 and 9B-31, respectively, and ends at the interceptor, 9B-20. Most of the affected lines between these respective points have adequate capacity due to steep slopes in the area; however, two sections of sewer require an upgrade for the added flow from the Bland Circle area. These sewers carry flow between Manhole 9B-31 and 9B-29, Manhole 9B-27 and Manhole 9B-20. It is recommended that these lines be upgraded in lieu of constructing the sewer described in the 1989 Master Plan.

The model predicted peak flow rate in each sewer reach (manhole segment) under the design storm conditions with the future population connected to the sewers is shown in Table 8-2. Peak sewer flow rates under these conditions at selected locations are shown in Figure 8-2. The recommended sewer size revisions are included in this model run.




**CITY OF WEST LINN**

**SANITARY SEWER SYSTEM UPGRADE UNDER FUTURE CONDITIONS (WITHOUT URBAN RESERVE No. 30 PEAK FLOWS)**

FIGURE 8-1

TABLE 8-2
MODEL PREDICTED PEAK FLOW RATE
FUTURE CONDITIONS

| Upstream Manhole No. | Downstream Manhole No. | Model Dia. - Inches | Model Predicted Peak Flow Rate-cfs |
|---|---|---|---|
| 2B-23-1 | 2B-23 | 8 | 1.2 |
| 2B-23 | 2B-22 | 8 | 3.6 |
| 2B-22 | 2B-21 | 8 | 3.7 |
| 2B-21 | 2B-21-1 | 8 | 4.3 |
| 2B-21-1 | 2B-20 | 8 | 3.7 |
| 2B-20 | 2B-19 | 8 | 3.7 |
| 2B-19 | 2C-1 | 8 | 3.7 |
| 2C-1 | 2B-18 | 8 | 0.9 |
| 2B-18 | 2B-17 | 15 | 4.6 |
| 2B-17 | 2B-16 | 15 | 4.6 |
| 2B-16 | 2B-0-15 | 15 | 4.6 |
| 2B-0-15 | 2B-0-1-14 | 15 | 4.6 |
| 2B-0-1-14 | 2B-0-13 | 15 | 4.6 |
| 2B-0-13 | 2B-0-12 | 15 | 4.6 |
| 2B-0-12 | 2B-0-11 | 15 | 4.6 |
| 2B-0-11 | 2B-0-10 | 15 | 4.6 |
| 2B-0-10 | 2B-0-9A | 15 | 4.6 |
| 2B-0-9A | 2B-0-9 | 15 | 4.6 |
| 2B-0-9 | 2B-0-8 | 15 | 4.6 |
| 2B-0-8 | 2B-0-7 | 15 | 4.6 |
| 2B-0-7 | 2B-0-6B | 15 | 4.6 |
| 2B-0-6B | 2B-0-6A | 15 | 4.6 |
| 2B-0-6A | 2B-0-6 | 15 | 4.6 |
| 2B-0-6 | 2B-0-5 | 15 | 4.6 |
| 2B-0-5 | 2B-0-4 | 15 | 4.6 |
| 2B-0-4 | 2B-0-3 | 15 | 4.6 |
| 2B-0-3 | 2B-0-2 | 15 | 4.6 |
| 2B-0-2 | 2B-0-1 | 15 | 4.6 |
| 2B-0-1 | 2B-0-0 | 15 | 4.6 |
| 2B-0-0 | 2B-0 | 15 | 4.6 |
| 2B-0 | 2B-3 | 18 | 4.6 |
| 2B-3 | 2B-2 | 10 | 4.5 |
| 2B-2 | 2B-1A* | 10 | 0.9 |
| 2B-1A* | 2B-1 | 10 | 0.9 |
| 2B-1 | 2A-2 | 18 | 5.5 |
| 2A-11 | 2A-10 | 10 | 0.1 |
| 2A-10 | 2A-9 | 10 | 0.1 |
| 2A-9 | 2A-8 | 12 | 0.1 |
| 2A-8 | 2A-7 | 18 | 0.1 |
| 2A-7 | 2A-6 | 18 | 0.1 |
| 2A-6 | 2A-5-0 | 18 | 0.1 |
| 2A-5-0 | 2A-5 | 18 | 0.1 |
| 2A-5 | 2A-4-0 | 18 | 0.1 |
| 2A-4-0 | 2A-4 | 18 | 0.1 |

* Number assignment in this study

TABLE 8-2
MODEL PREDICTED PEAK FLOW RATE
FUTURE CONDITIONS

| Upstream Manhole No. | Downstream Manhole No. | Model Dia. - Inches | Model Predicted Peak Flow Rate-cfs |
|---|---|---|---|
| 2A-4 | 2A-3 | 18 | 0.2 |
| 2A-3 | 2A-2 | 18 | 0.2 |
| 2A-2 | 2A-1 | 18 | 1.2 |
| 3A-32-1 | 3A-32 | 8 | 0.3 |
| 3A-46-1 | 3A-46 | 8 | 1.1 |
| 3A-48 | 3A-47 | 8 | 0.9 |
| 3D-1 | 3A-47 | 8 | 2.4 |
| 3A-47 | 3A-46 | 10 | 2.1 |
| 3A-46 | 3A-45 | 12 | 3.2 |
| 3A-45 | 3A-44-1 | 12 | 3.2 |
| 3A-44-1 | 3A-44 | 8 | 1.7 |
| 3A-44 | 3A-43 | 12 | 3.6 |
| 3A-43 | 3A-42 | 12 | 3.6 |
| 3A-42 | 3A-41 | 12 | 3.6 |
| 3A-41 | 3A-40 | 12 | 3.6 |
| 3A-40 | 3A-39 | 12 | 3.6 |
| 3A-39 | 3A-38 | 12 | 3.7 |
| 3A-38 | 3A-37-1 | 15 | 3.6 |
| 3A-37-1 | 3A-37 | 8 | 1.8 |
| 3A-37 | 3A-36 | 15 | 4.4 |
| 3A-36 | 3A-35 | 18 | 4.4 |
| 3A-35 | 3A-34 | 18 | 4.4 |
| 3A-34 | 3A-33 | 18 | 4.4 |
| 3A-33 | 3A-32 | 18 | 4.4 |
| 3A-32 | 3A-31 | 18 | 4.7 |
| 3A-31 | 3A-30 | 18 | 4.7 |
| 3A-30 | 3A-29 | 18 | 4.7 |
| 3A-29 | 3A-28 | 18 | 4.6 |
| 3A-28 | 3A-27 | 12 | 4.7 |
| 3A-27 | 3A-26 | 12 | 4.8 |
| 3A-26 | 3A-26 | 12 | 5.8 |
| 3A-26 | 3A-25 | 16 | 4.1 |
| 3A-25 | 3A-24 | 18 | 4.7 |
| 3A-24 | 3A-23 | 18 | 4.7 |
| 3A-23 | 3A-22 | 18 | 4.7 |
| 3A-22 | 3A-21 | 18 | 4.6 |
| 3A-21 | 3A-20 | 18 | 4.7 |
| 3A-20 | 3A-19 | 18 | 4.7 |
| 3A-19 | 3A-18 | 18 | 4.8 |
| 3A-18 | 3A-17 | 18 | 5.2 |
| 3A-17 | 3A-16 | 18 | 5.2 |
| 3A-16 | 3A-15 | 18 | 5.2 |
| 3A-15 | 3A-14 | 18 | 5.1 |
| 3A-14 | 3A-13 | 18 | 5.1 |
| 3A-13 | 3A-12 | 18 | 5.1 |

TABLE 8-2
MODEL PREDICTED PEAK FLOW RATE
FUTURE CONDITIONS

| Upstream Manhole No. | Downstream Manhole No. | Model Dia. - Inches | Model Predicted Peak Flow Rate-cfs |
|---|---|---|---|
| 3A-12 | 3A-11 | 18 | 5.2 |
| 3A-11 | 3A-10 | 18 | 5.2 |
| 3A-10 | 3A-9 | 18 | 5.2 |
| 3A-10 | 3A-10-1A | 15 | 2.3 |
| 3A-10-1A | ByPass | 18 | 0.3 |
| 3A-9 | 3A-8 | 18 | 5.2 |
| 3A-8 | 3A-7 | 18 | 5.2 |
| 3A-7 | 3A-6 | 18 | 5.2 |
| 3A-6 | 3A-5 | 18 | 5.2 |
| 3A-5 | 3A-4 | 18 | 5.2 |
| 3A-4 | 3A-3 | 18 | 5.2 |
| 3A-3 | 3A-2 | 18 | 5.2 |
| 3B-12 | 3B-11-1 | 8 | 2.3 |
| 3B-11-1 | 3B-11 | 6 | 1.2 |
| 3B-11 | 3B-10 | 8 | 0.7 |
| 3B-10 | 3B-9 | 8 | 0.7 |
| 3B-9 | 3B-8 | 8 | 0.7 |
| 3B-8 | 3B-7 | 8 | 0.7 |
| 3B-7 | 3B-6 | 8 | 0.7 |
| 3B-6 | 3B-5 | 8 | 0.7 |
| 3B-5 | 3B-4 | 8 | 0.7 |
| 3B-4 | 3B-3 | 8 | 0.7 |
| 3B-3 | 3B-2 | 8 | 0.7 |
| 3B-2 | 3B-1 | 8 | 0.7 |
| 3B-1 | 3A-2 | 8 | 0.7 |
| 3A-2 | 3A-1 | 21 | 5.8 |
| 2A-0AA | 2A-1 | 21 | 6.1 |
| 2A-1 | 2A-0-2 | 18 | 10.4 |
| 2A-0-2 | 2A-1-0 | 18 | 10.4 |
| 1A-3-1 | 1A-3 | 8 | 0.4 |
| 1A-12 | 1A-11 | 24 | 0.2 |
| 1B-3 | 1B-2 | 12 | 1.0 |
| 1B-2 | 1A-11 | 15 | 1.0 |
| 1A-11 | 1A-10 | 24 | 1.2 |
| 1A-10 | 1A-9 | 15 | 1.2 |
| 1A-9 | 1A-8 | 18 | 1.2 |
| 1A-8 | 1A-7 | 18 | 1.2 |
| 1A-7 | 1A-6 | 18 | 1.2 |
| 1A-6 | 1A-5 | 18 | 1.2 |
| 1A-5 | 1A-4 | 18 | 1.2 |
| 1A-4 | 1A-3 | 18 | 1.2 |
| 1A-3 | 1A-2 | 18 | 1.6 |
| 1A-2 | 1A-1 | 18 | 1.6 |
| 1A-44 | 1A-43 | 15 | 2.7 |
| 1A-43 | 1A-42 | 15 | 2.8 |

TABLE 8-2
MODEL PREDICTED PEAK FLOW RATE
FUTURE CONDITIONS

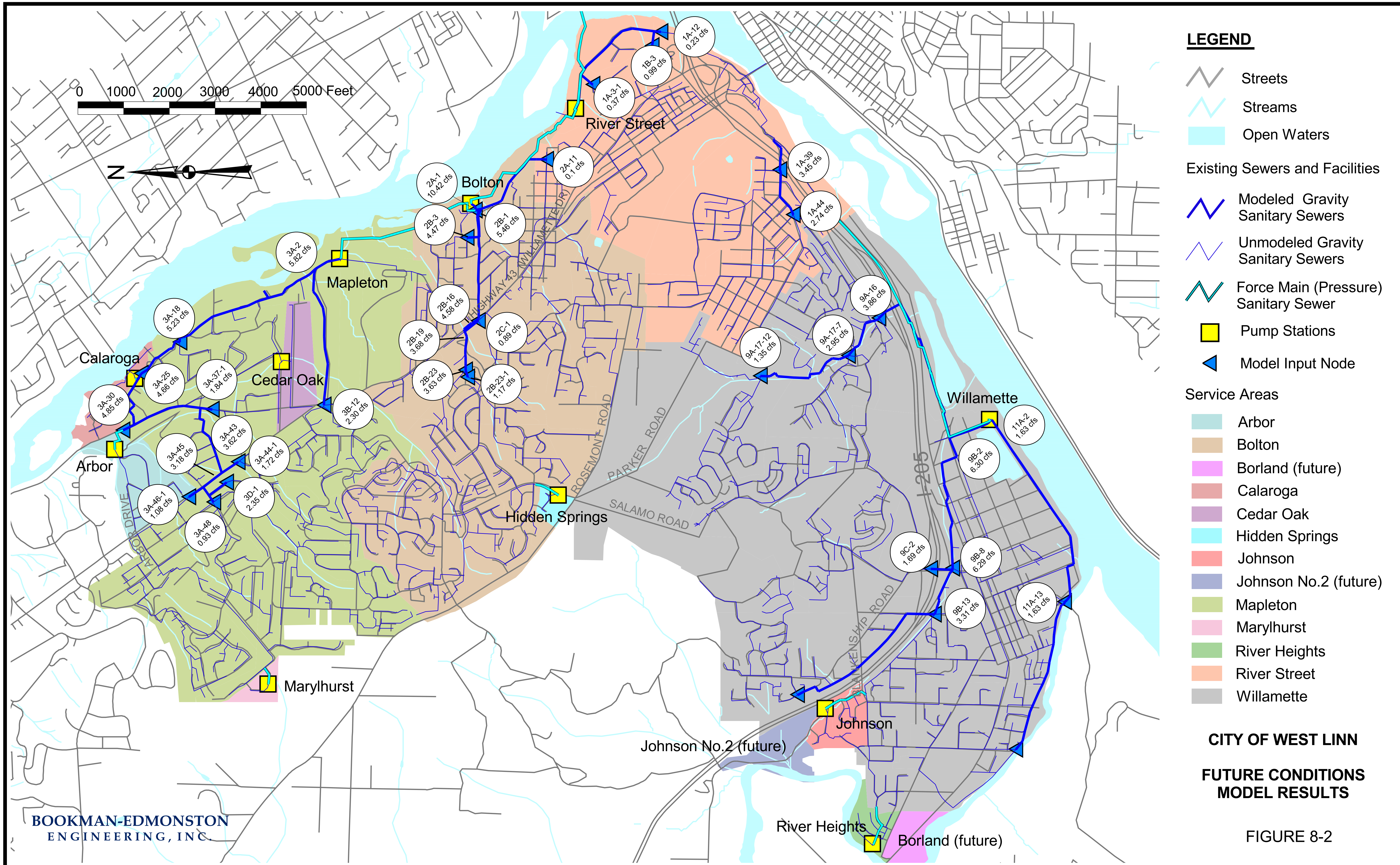
| Upstream Manhole No. | Downstream Manhole No. | Model Dia. - Inches | Model Predicted Peak Flow Rate-cfs |
|---|---|---|---|
| 1A-42 | 1A-41 | 15 | 2.8 |
| 1A-41 | 1A-40 | 10 | 2.8 |
| 1A-40 | 1A-39-0 | 10 | 2.8 |
| 1A-39-0 | 1A-39 | 12 | 2.8 |
| 1A-39 | 1A-38 | 12 | 3.4 |
| 1A-38 | 1A-37-2 | 10 | 3.5 |
| 1A-37-2 | 1A-37-1-0 | 10 | 3.5 |
| 1A-37-1-0 | 1A-37-1 | 10 | 3.5 |
| 1A-37-1 | 1A-37 | 10 | 3.5 |
| 1A-37 | 9B-1-2 | 10 | 3.5 |
| 9A-17-12 | 9A-17-711 | 12 | 1.3 |
| 9A-17-711 | 9A-17-710 | 12 | 1.6 |
| 9A-17-710 | 9A-17-709 | 12 | 1.6 |
| 9A-17-709 | 9A-17-708 | 12 | 1.6 |
| 9A-17-708 | 9A-17-707 | 12 | 1.6 |
| 9A-17-707 | 9A-17-706 | 12 | 1.6 |
| 9A-17-706 | 9A-17-705 | 12 | 1.6 |
| 9A-17-705 | 9A-17-704 | 12 | 1.6 |
| 9A-17-704 | 9A-17-703 | 12 | 1.6 |
| 9A-17-703 | 9A-17-702 | 12 | 1.6 |
| 9A-17-702 | 9A-17-701 | 12 | 1.6 |
| 9A-17-701 | 9A-17-7 | 12 | 1.6 |
| 9A-17-7 | 9A-17-6 | 12 | 2.9 |
| 9A-17-6 | 9A-17-5 | 12 | 3.0 |
| 9A-17-5 | 9A-17-4 | 12 | 3.0 |
| 9A-17-4 | 9A-17-3-0 | 12 | 3.0 |
| 9A-17-3-0 | 9A-17-3 | 12 | 3.0 |
| 9A-17-3 | 9A-17-2 | 12 | 3.0 |
| 9A-17-2 | 9A-17-0-0 | 12 | 3.0 |
| 9A-17-0-0 | 9A-17-1-0 | 12 | 2.9 |
| 9A-17-1-0 | 9A-17-1 | 12 | 2.9 |
| 9A-17-1 | 9A-17 | 12 | 2.9 |
| 9A-17 | 9A-16 | 10 | 3.9 |
| 9A-16 | 9A-15 | 10 | 3.9 |
| 9A-15 | 9A-14 | 15 | 3.9 |
| 9A-14 | 9A-13 | 15 | 3.9 |
| 9A-13 | 9A-12 | 15 | 3.9 |
| 9A-12 | 9A-11 | 15 | 3.9 |
| 9A-11 | 9A-10 | 12 | 3.9 |
| 9A-10 | 9A-9 | 12 | 3.9 |
| 9A-9 | 9A-8 | 12 | 3.9 |
| 9A-8 | 9A-7 | 15 | 3.9 |
| 9A-7 | 9A-6 | 15 | 3.9 |
| 9A-6 | 9A-5 | 15 | 3.9 |
| 9A-5 | 9A-4 | 15 | 3.9 |

TABLE 8-2
MODEL PREDICTED PEAK FLOW RATE
FUTURE CONDITIONS

| Upstream Manhole No. | Downstream Manhole No. | Model Dia. - Inches | Model Predicted Peak Flow Rate-cfs |
|---|---|---|---|
| 9A-4 | 9B-1 | 15 | 3.9 |
| 9B-1 | 9A-3-00 | 15 | 3.9 |
| 9C-2 | 9C-1 | 8 | 1.7 |
| 9C-1 | 9B-27 | 10 | 2.3 |
| 9B-27 | 9B-26 | 10 | 1.0 |
| 9B-26 | 9B-25 | 10 | 1.6 |
| 9B-25 | 9B-24 | 10 | 1.6 |
| 9B-24 | 9B-23 | 10 | 1.6 |
| 9B-23 | 9B-22 | 10 | 1.6 |
| 9B-22 | 9B-21 | 10 | 1.6 |
| 9B-21 | 9B-20 | 10 | 1.6 |
| 9B-20 | 9B-19 | 12 | 1.6 |
| 9B-19 | 9B-18 | 12 | 1.6 |
| 9B-18 | 9B-17 | 12 | 1.6 |
| 9B-17 | 9B-16 | 12 | 1.6 |
| 9B-16 | 9B-15 | 12 | 1.6 |
| 9B-15 | 9B-14 | 15 | 1.6 |
| 9B-14 | 9B-13 | 15 | 1.6 |
| 9B-13 | 9B-12 | 15 | 3.3 |
| 9B-12 | 9B-11-1 | 15 | 3.3 |
| 9B-11-1 | 9B-10 | 15 | 3.3 |
| 9B-10 | 9B-9 | 18 | 3.3 |
| 9B-9 | 9B-8 | 18 | 3.3 |
| 9B-8 | 9B-8-00 | 18 | 6.3 |
| 9B-8-00 | 9B-7-00 | 18 | 6.3 |
| 9B-7-00 | 9B-7 | 18 | 6.3 |
| 9B-7 | 9B-6-00 | 18 | 6.3 |
| 9B-6-00 | 9B-6 | 18 | 6.3 |
| 9B-6 | 9B-5-00 | 18 | 6.3 |
| 9B-5-00 | 9B-5 | 18 | 6.3 |
| 9B-5 | 9B-4-3 | 18 | 6.3 |
| 9B-4-3 | 9B-4-2 | 18 | 6.3 |
| 9B-4-2 | 9B-3 | 15 | 6.3 |
| 9B-3 | 9B-2 | 15 | 6.3 |
| 9B-2 | 9A-3-00 | 15 | 6.3 |
| 9A-3-00 | 9A-2 | 18 | 10.2 |
| 9A-2 | 9A-1 | 21 | 10.2 |
| 9A-1 | 11A-32 | 21 | 12.6 |
| 11A-32 | 11A-31 | 12 | 0.9 |
| 11A-31 | 11A-30 | 12 | 0.9 |
| 11A-30 | 11A-29 | 12 | 0.9 |
| 11A-29 | 11A-28 | 12 | 0.9 |
| 11A-28 | 11A-27 | 12 | 0.9 |
| 11A-27 | 11A-26 | 12 | 0.9 |
| 11A-26 | 11A-25 | 12 | 0.9 |

TABLE 8-2
MODEL PREDICTED PEAK FLOW RATE
FUTURE CONDITIONS

| Upstream Manhole No. | Downstream Manhole No. | Model Dia. - Inches | Model Predicted Peak Flow Rate-cfs |
|---|---|---|---|
| 11A-25 | 11A-24 | 12 | 0.9 |
| 11A-24 | 11A-23-1 | 12 | 0.9 |
| 11A-23-1 | 11A-23 | 12 | 0.9 |
| 11A-23 | 11A-22-1 | 12 | 0.9 |
| 11A-22-1 | 11A-22 | 12 | 0.9 |
| 11A-22 | 11A-21 | 12 | 0.9 |
| 11A-21 | 11A-20 | 12 | 0.9 |
| 11A-20 | 11A-19 | 12 | 0.9 |
| 11A-19 | 11A-18 | 12 | 0.9 |
| 11A-18 | 11A-17 | 12 | 0.9 |
| 11A-17 | 11A-16 | 12 | 0.9 |
| 11A-16 | 11A-15 | 12 | 0.9 |
| 11A-15 | 11A-14 | 12 | 1.6 |
| 11A-14 | 11A-13 | 12 | 1.6 |
| 11A-13 | 11A-12 | 12 | 1.6 |
| 11A-12 | 11A-11 | 12 | 2.3 |
| 11A-11 | 11A-10 | 15 | 1.6 |
| 11A-10 | 11A-9-0 | 15 | 1.6 |
| 11A-9-0 | 11A-9 | 15 | 1.6 |
| 11A-9 | 11A-8 | 15 | 1.6 |
| 11A-8 | 11A-7 | 15 | 1.6 |
| 11A-7 | 11A-6 | 15 | 1.6 |
| 11A-6 | 11A-5 | 15 | 1.6 |
| 11A-5 | 11A-4 | 18 | 1.6 |
| 11A-4 | 11A-3 | 18 | 1.6 |
| 11A-3 | 11A-2 | 18 | 1.6 |
| 11A-2 | 11A-1 | 18 | 1.6 |
| 11A-1 | 11A-0-2 | 15 | 1.6 |
| 11A-0-2 | 11A-0-1 | 15 | 7.6 |


0 1000 2000 3000 4000 5000 Feet
N
River Street
Bolton
Mapleton
Calaroga
Cedar Oak
Arbor
Hidden Springs
Marylhurst
Willamette
Johnson
Johnson No.2 (future)
River Heights
Borland (future)
HIGHWAY 43
WILLAMETTE DR
ROSEMONT ROAD
PARKER ROAD
SALAMO ROAD
ARBOR DRIVE
BLANKENSHIP ROAD
I-205
1A-12 0.23 cfs
1B-3 0.99 cfs
1A-3-1 0.37 cfs
2A-11 0.1 cfs
1A-39 3.45 cfs
1A-44 2.74 cfs
2A-1 10.42 cfs
2B-3 4.47 cfs
2B-1 5.46 cfs
3A-2 5.82 cfs
2B-16 4.58 cfs
2B-19 3.68 cfs
2C-1 0.89 cfs
2B-23 3.63 cfs
2B-23-1 1.17 cfs
3B-12 2.30 cfs
3A-18 5.23 cfs
3A-25 4.66 cfs
3A-37-1 1.84 cfs
3A-30 4.85 cfs
3A-43 3.62 cfs
3A-45 3.18 cfs
3A-44-1 1.72 cfs
3A-46-1 1.08 cfs
3D-1 2.35 cfs
3A-48 0.93 cfs
9A-16 3.86 cfs
9A-17-7 2.95 cfs
9A-17-12 1.35 cfs
11A-2 1.63 cfs
9B-2 6.30 cfs
9C-2 1.69 cfs
9B-8 6.29 cfs
9B-13 3.31 cfs
11A-13 1.63 cfs
LEGEND
Streets
Streams
Open Waters
Existing Sewers and Facilities
Modeled Gravity Sanitary Sewers
Unmodeled Gravity Sanitary Sewers
Force Main (Pressure) Sanitary Sewer
Pump Stations
Model Input Node
Service Areas
Arbor
Bolton
Borland (future)
Calaroga
Cedar Oak
Hidden Springs
Johnson
Johnson No.2 (future)
Mapleton
Marylhurst
River Heights
River Street
Willamette
BOOKMAN-EDMONSTON ENGINEERING, INC.
CITY OF WEST LINN
FUTURE CONDITIONS MODEL RESULTS
FIGURE 8-2

## PUMP STATION ANALYSIS

In order to analyze each pump station (except the Mapleton Pump Station, which is analyzed separately), the peak flows to the station under future population conditions were estimated using the following procedures:

- The estimated population served by each pumping station was determined by counting the number of connections to the sewers tributary to that pumping station.
- A population of 2.9 people per connection was assumed, as determined by the average population density referenced in the City's (draft) Comprehensive Plan.

The peak flow rate to each pumping station was estimated by first multiplying the population served by 642 gallons per person. This was the peak flow per person estimated by the computer model at the Mapleton Pump Station under the design flow condition, using the year 2017 population. The design flow condition includes the base flow plus the RDII resulting from a 24-hour duration, 5-year return interval storm. This flow rate was increased by 50 percent to reflect the much smaller tributary area served by these pump stations (as compared to the Mapleton Pump Station) and the expected higher peak flow to average flow ratio for the smaller pump stations.

The results of this analysis are shown in Table 8-3. All of the pump stations are indicated to have sufficient capacity to handle the future conditions design storm estimated peak flow rates.

**TABLE 8-3**
**PUMP STATION CAPACITY ANALYSIS**

| Pump Station | Firm Capacity (GPM) | No. of Houses Served | Population Served | Peak Flow Rate (GPM) |
|---|---|---|---|---|
| Arbor | 300 | 50 | 149 | 100 |
| Cedaroak | 200 | 28 | 81 | 55 |
| Calaroga | 143 | 43 | 124 | 84 |
| Johnson | 150 | 53 | 154 | 104 |
| River Heights | 118 | 35 | 102 | 69 |
| Marylhurst | 225 | 15 | 44 | 30 |

The Mapleton Pumping Station capacity was analyzed by reviewing the peak flow rate indicated to reach it by the computer hydraulic model. Under the future population design storm conditions, the peak flow rate to Mapleton is 5.8 cubic feet per second or 2600 gallons per minute. The firm pumping capacity of Mapleton is estimated as 2300 gallons per minute. The peak pumping capacity, with all three pumps operating is estimated as 2600 gallons per minute. An upgrade to the pumps at Mapleton is not recommended until the next scheduled major overhaul of the pump station occurs in about the year 2017. The required firm capacity of the Mapleton Pump Station should be reviewed at that time.

Each pump station should have a major overhaul at approximately 20-year intervals. Major overhauls should include the following:

1. Pump replacement
2. Shut-off valve / check valve replacement
3. Hatch replacement
4. Pump rail replacement (where applicable)
5. Replacement of electrical panel major components (circuit breakers, alternator, and starters)
6. Wetwell rehabilitation if corrosion is a problem
7. Compressor / bubbler system replacement (where applicable)
8. Emergancy generator overhaul (Mapleton only)

**URBAN RESERVE NO. 30**

Urban Reserve No. 30 (UR30) is located at the western edge of the City, as shown on Figure 8-3. The area of UR30 is approximately 192 acres. The ground slopes are moderate to steep over most of this area. Current development is limited to single family homes on large lots.

The amount of land having steep slopes in UR30 will limit the average population density. Slopes of 30% or greater predominate in the center of the area. Property that is easier to develop is adjacent to Rosemont Road and Salamo Road. Approximately 60 acres have been platted as two acre lots, in the southern part of the area. These lots are being developed on septic tanks under county permits.

Discussions with the City Planning Department indicate that a population of about 1400 people, or 7.3 persons per acre average, is predicted to live in UR30. This population would result in approximately 625 gallons per minute peak sewage flow rate, assuming 642 gallons per person peak flow rate, as was estimated for the Mapleton Pump Station (see previous page). Although the peak flow rate from the UR30 area will most likely be less than this initially, the above figure is recommended for design purposes. This allows for increased I/I flows as the sewers age. The sewers and pump station necessary to serve this area will be analyzed using this figure.

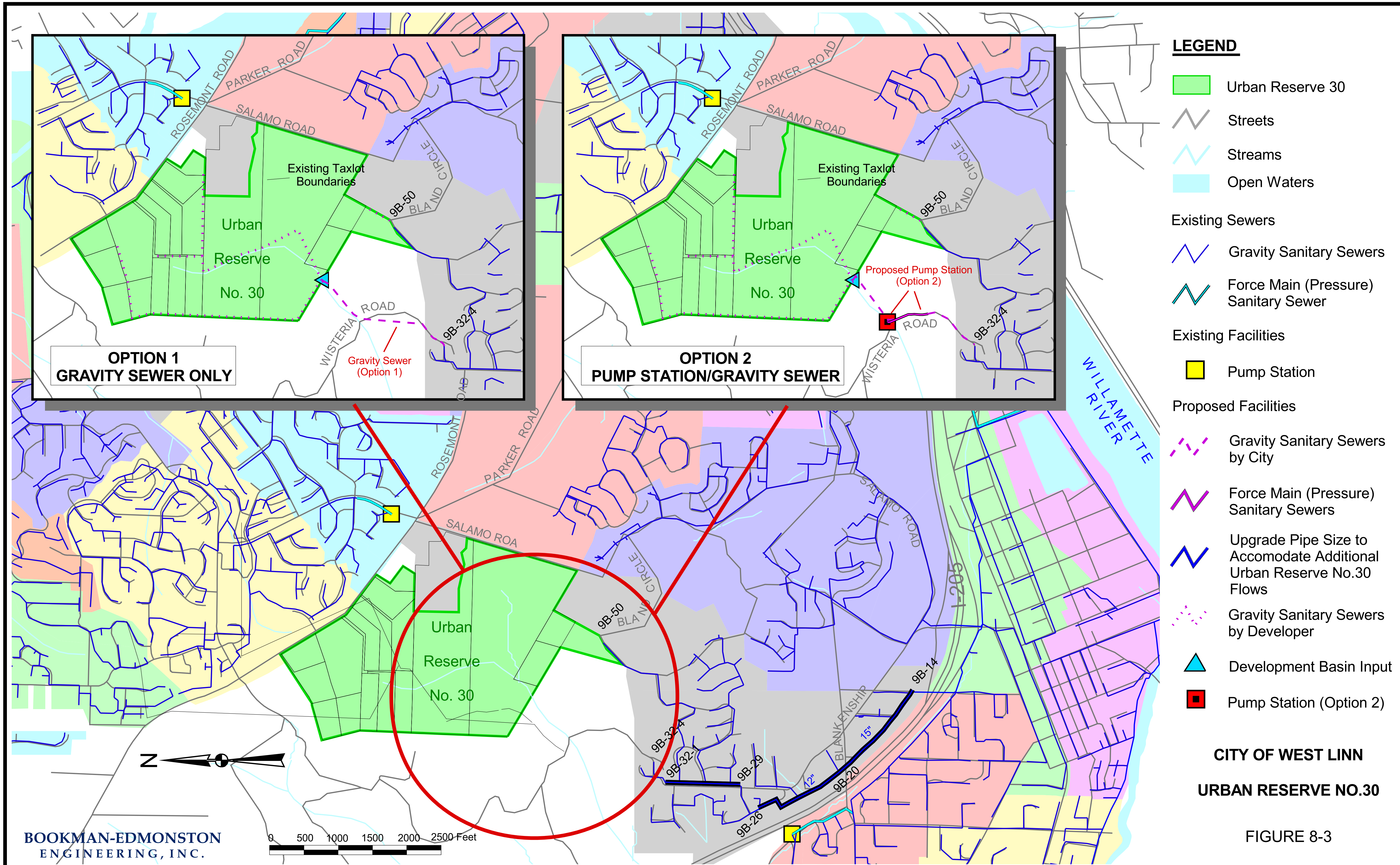
There are three parts to the problem of serving UR30. First sewers within the boundaries of UR30 must be constructed so that the entire area can be served by gravity sewers. Second, these new sewers within UR30 must be connected to the existing West Linn sewer system. Third the existing West Linn sewer system must be upgraded as required to accommodate the additional flow from UR30.

Regarding part one of the problem, the sanitary sewers necessary to serve all current land parcels within the boundaries of UR30 are shown on Figure 8-3 as dotted lines. These sewers are assumed to be constructed in easements donated by the developers or property owners. The sewers may be financed by developers, by the City using SDC funds, or by a combination of these two methods. An estimate of the construction cost of these sewers within the UR30 boundary is as follows:

| | |
|---|---:|
| 8,800 LF 8" PVC @ $60/LF | $528,000 |
| 20 4' Diameter Manholes @ $3,500/EA | 70,000 |
| Construction Contingencies, 20% | 119,600 |
| Administrative, Legal, Engineering, 25% | 179,400 |
| | $897,000 |

The actual sewer system constructed within the boundaries of UR30 may vary from this plan, due to the final platting of this area. The "Development Basin Input" point, shown as a blue triangle on Figure 8-3, should remain the same.

There are two possible options proposed for addressing the second part of the problem, connecting this input point to the existing sewer system. These options are detailed on Figure 8-3. The "finger" shaped area at the southern boundary of UR30 can be served by extending a new sewer upstream from Manhole 9B-50, located in Bland Circle. This is shown on Figure 8-3 as a dotted line.




CITY OF WEST LINN

URBAN RESERVE NO.30

FIGURE 8-3

Option 1, allows flow by gravity for all of the sewers required for serving UR30. This gravity flow is possible by locating one 750 feet sewer segment on private property to avoid a hill in Wisteria Road thereby eliminating the need to pump the flow uphill. The gravity sewers would extend down the natural valley from the development basin input point of UR30, where all of the flow generated in UR30 would enter the new interceptor sewer. Option 2 includes the same interceptor beginning at the development basin input point of UR30 and ends at a pumping station located at Wisteria Road. The pump station would pump the flow in a force main (pressure sewer) within Wisteria Road, running up and over the hill, and discharging to a new sewer in Wisteria Road, that would flow to Manhole 9B-32-4

Project costs for these two options are estimated as follows:

**Option 1 - All Gravity System to Wisteria Road, Manhole 9B-32-4**

| | |
|---|---|
| 8" PVC @ $60/LF X 1980 LF | $118,800 |
| 7 4' Diameter Manholes @ $3,500/EA | 24,500 |
| Pavement Repair, 500 LF @ $25/LF | 12,500 |
| Construction Contingencies, 20% | 31,160 |
| Easements | 10,000 |
| Administrative, Legal, Engineering, 25% | 49,240 |
| | $246,200 |

**Option 2 - Gravity to Pump Station at Wisteria Road; Pump to Gravity Sewer in Wisteria Road to Manhole 9B-32-4**

| | |
|---|---|
| 8" PVC @ $60/LF X 1950 LF | $117,000 |
| 6 4' Diameter Manholes @ $3,500/EA | 21,000 |
| 1 Pump Station | 125,000 |
| 8" Diameter Force Main, 300 LF @$35/LF | 10,500 |
| Pavement Repair, 1,350 LF @ $25/LF | 33,750 |
| Construction Contingencies, 20% | 56,650 |
| Easements | 4,000 |
| Administrative, Legal, Engineering, 25% | 88,475 |
| | $435,375 |

In addition, Option 2 has pump operation and maintenance costs.

A third option was also investigated. Option 3 included constructing a pump station at the development basin input point and a force main (pressure sewer) running easterly up a steep slope to Manhole 9B-50. The high hill (250 feet vertical rise) and relatively low flow rate make this Option 3 undesirable, because standard centrifugal wastewater pumps do not operate efficiently at this condition. Option 3, therefore, was not pursued.

Option 2, has a higher capital costs plus yearly pump station operation and maintenance costs, eliminating it from consideration. In conclusion, Option 1 is recommended.

Finally the third part of serving UR30, upgrading the existing West Linn sewer system as needed to accommodate the added flow from the UR30 area, will be addressed. A review of the downstream sewer capacity was made to see if the existing sewers could handle an additional 625 gallons per minute peak flow from UR30. The review included all mainline sewers from Manhole 9B-32-4 downstream to the Willamette Pumping Station. The sewer segments with inadequate capacity solely because of UR30 additional flow under future conditions are the ones that connect Manhole 9B-32-1 downstream to Manhole 9B-29 and Manhole 9B-26 downstream to Manhole 9B-14. These segments of sewer are shown on Figure 8-3. The recommended sewer sizes in these sewer segments are shown in Table 8-4.

**TABLE 8-4**
**REVISED SEWER SIZES REQUIRED IF**
**URBAN RESERVE NO. 30 IS SERVED - FUTURE CONDITIONS.**

| Upstream Manhole No. | Downstream Manhole No. | Sewer Size Without UR No. 30 Flow-Inches | Sewer Size with UR No. 30 Flow-Inches |
|---|---|---|---|
| 9B-32-1 | 9B-29 | 8 | 10 |
| 9B-26 | 9B-20 | 10 | 12 |
| 9B-20 | 9B-14 | 12 | 15 |

Table 8-4 indicates that significant sewer capacity problems could result if UR30 develops and the sewers indicated are not properly sized. Unless a decision is made to not allow UR30 to develop, it is recommended that the larger diameter sewers indicated in Table 8-4 be installed. The additional costs of providing this additional sewer capacity is recommended to be charged (plus accrued interest) to the property owners of UR30 when it is developed.

## JOHNSON ROAD PUMP STATION

The development of the area downstream from the Johnson Pump Station along Johnson Road in the future will require that an additional pump station be constructed. Present plans are for this new pump station to serve only the area downstream of the existing Johnson Pump Station and to pump to the existing station. The flow would then be repumped by the Johnson Pump Station. The location of these proposed improvements is shown in Figure 8-1.

One alternative that the City may consider is providing sufficient capacity in the new pump station to serve the entire Johnson Road service area. The flows currently served by the existing Johnson Pump Station will be able to flow by gravity to the new pump station. All sewers serving the development will be 8-inches in diameter (minimum size). The new pump station, under this second option, would pump the flow from the entire Johnson Road area. A cost analysis of both options is recommended when the area downstream of the existing pump station needs to be served. A cost savings gained by the existing station abandonment may or may not be outweighed by the added cost of constructing a gravity sewer from the existing pump station to the new one.

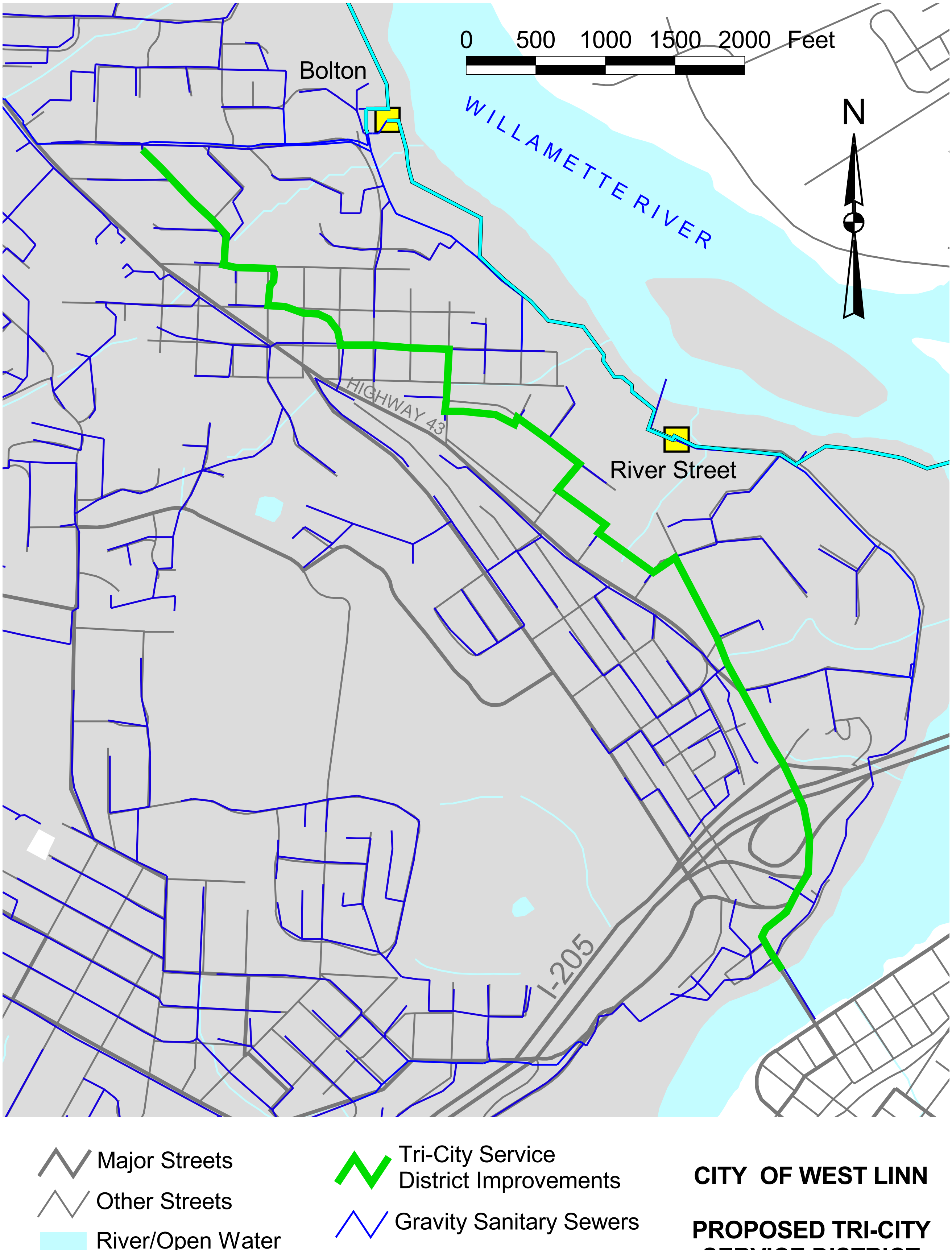
## BORLAND PUMP STATION SITE

The 1989 Master Plan indicated a pump station would be required at the Borland Road site (the area along Willamette Falls Drive close to the Tualatin River). This site is shown on Figure 8-1. The force main (pressure sewer) from this pump station would be constructed along Wilamette Falls Drive, discharging to Manhole 11A-39. When development occurs in this area, it is strongly recommended that a gravity sewer be extended to the Borland Pump Station site from the River Heights Pump Station. This will allow the area now served by the River Heights Pump Station to be served by the new pump station. The River Heights Pump Station could then be abandoned.

Further analysis during the current Master Plan has indicated that this area can be served entirely be gravity, discharging to Manhole 11A-38, as shown on Figure 8-1. Any proposed construction for this project will be in environmentally sensitive areas. A pumping station/force main alternate may still be desirable. It is recommended that an environmental assessment of these options be conducted before a decision is made for providing sewer service for this area by pump station or by gravity sewer only.

## TCSD WEST LINN INTERCEPTOR

The TCSD has conducted a study of pump station capacity problems for both the Bolton Pump Station and River Street Pump Station in West Linn. This study is titled “Pre-Design Report for Bolton and River Street Pump Station Capacity Upgrade Project”, and is dated August 1999. The results of this study indicate that a new interceptor should be constructed to transfer sewer flows away from these two pump stations. Under this plan, flow would be routed to a gravity sewer crossing the Willamette River attached below the Willamette River Bridge (better known as the old Oregon City Bridge). The alignment of this proposed sewer is shown on Figure 8-4.

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**CITY OF WEST LINN**

**PROPOSED TRI-CITY SERVICE DISTRICT IMPROVEMENTS**

FIGURE 8-4

In the construction of this sewer by TCSD, some of the City's older sewers will be replaced. The buildings along the new sewer alignment will be served by the new TCSD interceptor. The City should coordinate other street projects, water main replacements, and storm sewer projects with the TCSD project to occur at the same time as the TCSD project. By this coordination costs will be saved in street repairs and inconvenience to citizens by construction will be minimized.

The new TCSD interceptor does not change any recommendation contained in this Master Plan.

**CITY OF WEST LINN**
**SANITARY SEWER MASTER PLAN UPDATE**

# SECTION NINE

# CAPITAL IMPROVEMENT PLAN AND CAPITAL MAINTENANCE PLAN

The Capital Improvement Plan (CIP) and Capital Maintenance Plan (CMP) are developed from the data and information gathered during this study. The CIP includes three types of projects as follows: (1) projects which are new construction; (2) projects that will upgrade existing facilities that are currently undersized; and (3) projects to upgrade existing facilities that are projected to be undersized in the future because of growth. These projects have been designed to solve sewer capacity problems determined from the results of the computer hydraulic model, as presented in Sections 7 and 8. The CMP includes items that are to be replaced because they have reached the end of their normal useful life. These items include vehicle and equipment replacements, as described in Section 3, and the older sewer replacement program, as described in Section 7.

## SOURCES OF FUNDS

The projects recommended for funding are proposed to be paid for using a combination of sewer user charges and System Development Charge (SDC) Fees. Depreciation funds (money earmarked for replacement of existing facilities) generated through sewer user charges are the appropriate mechanism for funding replacement of sewer mains serving existing customers. For example, if a deteriorated sewer serving a fully developed area needed to be replaced with the same size pipe, with no increase in capacity included to serve future development, depreciation funds should be the source of revenue used to fund the project. SDC's are fees assessed against new development to help fund public infrastructure improvements needed to serve new development. SDC's are paid at the time the building permit is issued. SDC funds can be used to fund new sewers serving entirely new areas, or to pay new development's share of funding sewer enlargement projects needed to increase the capacity of an existing sewer that will serve both existing and future development. If both existing and future development will be served by a sewer project the funding is divided as follows: the percentage of the cost funded by SDC funds is the same percentage of the sewer capacity required for future development flow. Likewise, the percentage of the cost funded by depreciation funds is the same percentage of the capacity that is required for existing development flow.

For instance, if ten percent of the population that will be served by a new sewer is future development, then ten percent of the cost will be funded by SDC revenue and the remaining 90 percent will be used by the existing population and be funded by depreciation funds.

The sewer user charges will finance the CMP projects.

The effect of the recommended improvements in the CIP and CMP on the user fees and the SDC fees should be reviewed by the City in the near future. It is critical that the City collect sufficient revenues so that the sanitary sewer system can be improved as recommended in this Master Plan Report. This will allow the City to continue to provide uninterrupted sewer service under the peak design flow condition, without wastewater overflowing or backing up into basements.

## CAPITAL IMPROVEMENT PLAN

The sanitary sewer system upgrades identified in Sections 7 and 8 for required improvements to the system are all included in the Capital Improvement Plan (CIP). In several cases, a single project from the plan may have a cost that is greater than the entire budget that is typical for one fiscal year. These larger projects have been divided into segments so that they can be completed over a series of years and, therefore, be affordable to the City. In general, where improvements are recommended the project shall be constructed beginning at the downstream end, with work continuing upstream.

Additional projects to be included in the CIP include providing sewers for the section of Cornwall Street that is south of Sunset Avenue, a presently unsewered, developed area. Another CIP project is the elimination of the Hidden Springs (Santa Anita) Pump Station. This station is unnecessary because of the recent construction of a sewer line in Parker Road. The future update of the Sanitary Sewer Master Plan is also included in the CIP. Providing sewers for currently undeveloped areas will not be included in the CIP, since these projects will be funded by developers or by using SDC funds.

The unit costs on which the Construction Cost for Capital Improvement Plan estimates are based are given in Table 9-1.

Table 9-1
**CONSTRUCTION COST DATA**

| | | |
|---|---|---|
| 8" PVC Sewer Line | Per LF | $ 60 |
| 10" PVC Sewer Line | Per LF | $ 70 |
| 12" PVC Sewer Line | Per LF | $ 90 |
| 15" PVC Sewer Line | Per LF | $ 110 |
| 18" PVC Sewer Line | Per LF | $ 135 |
| 16" DIP Sewer Line | Per LF | $ 125 |
| 48-inch Diameter Manhole | Per EA | $ 3500 |
| Bored or jacked sewer | per inch diameter-LF | $ 9 |
| Asphalt street trench repair | Per LF | $ 25 |

The unit costs are based on typical construction costs for sewer construction in the West Linn area. These costs are based on typical construction conditions, and assume the following:

1. Sewer depths are in the range of 6 to 10 feet for sewer size 8" to 12", and 10 to 18 feet for larger sewer sizes.
2. Dewatering will not be required.
3. Rock excavation will not be required.
4. Street replacement consists of asphalt T-patch.
5. Costs of easements are not included.
6. Unusual permit requirements (i.e. wetland mitigation) are not included.
7. Building service laterals encountered will be replaced to right-of-way line only.

The costs included are planning level; that is, they are to be adjusted up or down as the exact details of the projects are developed during the design process. To account for the unknowns, a construction contingency of twenty percent (20%) has been added to each project. This contingency may turn out to be adequate, too high or too low as the case may be. Planning level estimates such as these are meant to be within plus or minus thirty percent (30%) of the actual contractors' bids.

To the estimated construction cost, an additional twenty-five percent (25%) has been added. This new total reflects the total estimated project cost (construction, design and administration). The engineering design may be completed by an outside consultant or internally by City staff. Similarly, construction observation may be by the City staff or outside consultant. Legal costs include legal fees necessary for contract award, review of change orders, contract disputes etc. Interest costs on loans or borrowed funds are not included.

Recommended CIP projects are listed in Table 9-2. The recommended sources of revenue (sewer user charges, system development charge and/or local improvement district funds) for each project are also listed. Project costs are based on 1999 cost opinions. In the future, when these costs are updated for inflation, it is recommended that the Engineering News-Record (ENR) construction cost index be utilized. This index is widely used, as an industry standard and it is updated monthly. The January 1999 index for the Seattle metro area is 6957. This Seattle index is routinely used in the Portland metro area because it is the closest metro area for which ENR determines an index.

Individual Project Sheets for all CIP projects are included in Appendix D.

Table 9-2

**Capital Improvement Plan**
**Sewer Capacity Improvement Projects**

| Project No. | Forecasted Fiscal Year | Area | Project Description | Project Location | Length(ft)* (diameter) | Project Cost ($) | Source of Funds | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | User Charge $ | SDC $ |
| CIP-1 | 2000-2001 | Bolton/Willamette | New 8" sewer to eliminate Hidden Springs Pump Station | Santa Anita Drive north of Rosemont | 275 (8") | 33,000 | 33,000 | |
| CIP-2 | 2001-2002 | Robinwood | Replace 15" with 18"; add 16" (new) parallel siphon | Robinview Dr.- Calaroga Ct. | 1270 (18")<br>370 (16") | 435,300 | 435,300 | |
| CIP-3 | 2003-2004 | Robinwood | Replace 12" with 18" | Old River Rd. - Cherokee Ct. - Robinview Dr. | 1950 (18") | 515,250 | 515,250 | |
| CIP-4 | 2004-2005 | Bolton | New 8" | Cornwall Street, South of Sunset | 750 (8") | 100,500 | **100,500 | |
| CIP-5 | 2005-2006 | Willamette | Replace 8" with 10" and 10" with 12" | North side of I-205 from Far Vista to 13th St. | 1528 (10")<br>1606 (12") | 560,200 | 385,200 | 175,000 |
| CIP-6 | 2007-2008 | Bolton | Replace 12" with 15" | Hwy 43 - Pimlico Dr. - Dillow | 270 (15") | 70,440 | 68,940 | 1,500 |
| CIP-7 | 2007-2008 | Robinwood | Replace 8" with 10" | View Dr., south of Marylhurst | 1130 (10") | 187,300 | 187,300 | |
| CIP-8 | 2007-2008 | Robinwood | Replace 10" with 12" | Hwy 43, Marylhurst to Fairview - Fairview, Hwy 43 to Chippewa Ct. | 1565 (12") | 306,710 | 306,710 | |
| CIP-9 | 2009-2010 | Robinwood | Replace 8" with 10" | Hwy 43, Marylhurst Dr. to Arbor | 1990 (10") | 304,565 | 304,565 | |
| CIP-10 | 2009-2010 | Citywide | Update Sanitary Sewer Master Plan | | | 75,000 | | 75,000 |
| CIP-11 | 2010-2011 | Willamette | Johnson Pump Station | Johnson Road at Tualatin River | | 448,400 | | 448,400 |
| CIP-12 | 2010-2011 | Willamette | Eliminate River Heights Pumping Station | Gravity sewer between River Heights and Borland Pump Stations. | 700 (10") | 99,000 | 49,500 | 49,500 |
| CIP-13 | 2011-2012 | Willamette | Replace 12" with 15" | Willamette Falls Dr. east of 4th St. | 2875 (15") | 552,375 | 452,375 | 100,000 |
| CIP-14 | 2013-2014 | Willamette | Replace 15" with 18" | 10th St. east to 5th Ave. | 2755 (18") | 578,350 | 449,850 | 128,500 |
| CIP-15 | 2015-2016 | Willamette | Parallel 10"; Replace 10" with 15" | 13th St I-205 crossing | 605 (10")<br>315(15") | 289,350 | 89,350 | 200,000 |
| CIP-16 | 2017-2018 | Willamette | Replace 15" with 18" | Volpp St. west of 4th St. | 1610 (18") | 352,350 | 352,350 | |
| | | | | | **TOTAL** | **4,908,090** | **3,730,190** | **1,177,900** |

Notes: All costs are in 1999 dollars
* To be field verified
* * May be local improvement district

## CAPITAL MAINTENANCE PLAN

The Capital Maintenance Plan (CMP) consists of projects which replace equipment which has reached the end of its cost-effective life for City use. These projects include replacing sewer maintenance division vehicles, pumping station equipment and other equipment. Also included will be the sewer replacement projects that are recommended to decrease the occurrence of sewer failures due to aging pipes but do not increase the size of the pipes. No increase in sewer capacity will result from these sewer replacement projects. This sewer replacement program is recommended to be funded at $500,000 per year at a minimum. This will fund the replacement of about 4000 feet of 8-inch diameter line. All sewers within the rights-of-way of the project location would be replaced, including the service line of each building from the sewer main connection to the point where it enters private property. The sewer replacement program is recommended to begin in the year 2002. The recommended Vehicle/Equipment replacement CMP projects are listed in Table 9-3. All recommended CMP projects are listed in Table 9-4. All CMP projects are to be funded with sewer user charge funds, since they replace existing equipment or sewers without providing additional capacity for new development. Project costs are based on 1999 dollars. The Consumer Price Index (CPI) can be used to update the equipment replacement items included in the CMP in future years. For reference, the CPI for the Seattle-Tacoma-Bremerton, Washington area (the closest metro area where the CPI is determined) is 172.2, for April 1999.

Table 9-3

# Capital Maintenance Plan
## Vehicle/Equipment Replacement

| Equip # | Equipment Discription | Mod. Yr | Rep. Sch | FY 2000-2001 | FY 2001-2002 | FY 2002-2003 | FY 2003-2004 | FY 2004-2005 | FY 2005-2006 | FY 2006-2007 | FY 2007-2008 | FY 2008-2009 | FY 2009-2010 | FY 2010-2011 | FY 2011-2012 | FY 2012-2013 | FY 2013-2014 | FY 2014-2015 | FY 2015-2016 | FY 2016-2017 | FY 2017-2018 | FY 2018-2019 | FY 2019-2020 | Equipment Replacement Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 702 | 1/2 ton Pickup | 1990 | A | $ 18,500 | | | | | | $ 18,500 | | | | | | $ 18,500 | | | | | | $ 18,500 | | |
| 704 | 1 ton pickup with service body | 1991 | A | 38,000 | | | | | | 38,000 | | | | | | 38,000 | | | | | | 38,000 | | |
| 711 | Ford 555 Backhoe | 1991 | S | | $ 75,000 | | | | | | | | $ 25,000 | | | | | | | | $ 75,000 | | | |
| 712 | Onan 240 Volt Generator | unknown | S | 10,500 | | | | | | | | | | $ 10,500 | | | | | | | | | | |
| 720 | 1 ton pickup with service body | 1975 | B | | | | $ 38,000 | | | | | | | | 38,000 | | | | | | | | $ 38,000 | |
| 731 | Rockwell Sewer Cleaner | 1977 | S | 150,000 | | | | | | | | | | 150,000 | | | | | | | | | | |
| 737 | Kohler 25 KW Generator | 1997 | B | | | | | | | | 14,250 | | | | | | | | $ 14,250 | | | | | |
| 739 | Ingersoll Rand Air Compressor | 1999 | B | | | | | | | | 12,250 | | | | | | | | 12,250 | | | | | |
| 740 | Freightliner 5yd Dump Truck | 1999 | B | | | | | | | | 68,000 | | | | | | | | 68,000 | | | | | |
| 741 | 3/4 ton Pickup | 1999 | A | | | | | | | 21,000 | | | | | | | $ 21,000 | | | | | 21,000 | | |
| 777 | Guzzler/vacuum Jet | 1991 | S | | | | | $ 250,000 | | | | | | | | | | | | $ 250,000 | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| Subtotal Per Year | | | | $ 217,000 | $ 75,000 | 0 | $ 38,000 | $ 250,000 | 0 | $ 77,500 | $ 94,500 | 0 | $ 25,000 | $ 160,500 | $ 38,000 | $ 56,500 | $ 21,000 | 0 | $ 94,500 | $ 250,000 | $ 75,000 | $ 77,500 | $ 38,000 | |
| Trade-in Value 10% First Cost | | | | 21,700 | 7,500 | 0 | 3,800 | 25,000 | 0 | 7,750 | 9,450 | 0 | N/A | 16,050 | 3,800 | 5,650 | 2,100 | 0 | 9,450 | 25,000 | 7,500 | 7,750 | 3,800 | |
| **Total Per Year** | | | | **$ 195,300** | **$ 67,500** | **0** | **$ 34,200** | **$ 225,000** | **0** | **$ 69,750** | **$ 85,050** | **0** | **$ 25,000** | **$ 144,450** | **$ 34,200** | **$ 50,850** | **$ 18,900** | **0** | **$ 85,050** | **$ 225,000** | **$ 67,500** | **$ 69,750** | **$ 34,200** | **$ 1,431,700** |

Notes: All Vehicles equiped w 2-way radios, service bodies, tool boxes, safety lighting, cranes appropriate for the individual vehicle
All Vehicles trade-in values estimated at 10% of origional cost
All Costs are in 1999 dollars

Replacement Schedule: (A) Six year 70,000 mile replacement schedule
(B) Eight year 100,000 mile replacement schedule
(S) Replacement schedule as shown

Table 9-4

## Capital Maintenance Program

| Project No. | Fiscal Year | Project Description | Project Cost | Source of Funds | Fiscal Year Total |
|---|---|---|---|---|---|
| CMP-1 | 2000-2001 | Vehicle/Equipment Replacement | $ 195,300 | User Charge | $ 195,300 |
| CMP-2 | 2001-2002 | Vehicle/Equipment Replacement | $ 67,500 | User Charge | |
| CMP-3 | 2001-2002 | Upgrade SCADA Base Station | $ 20,000 | User Charge | $ 87,500 |
| CMP-4 | 2002-2003 | Vehicle/Equipment Replacement | $ - | User Charge | |
| CMP-5 | 2002-2003 | Sewer Replacement | $ 500,000 | User Charge | $ 500,000 |
| CMP-6 | 2003-2004 | Vehicle/Equipment Replacement | $ 34,200 | User Charge | |
| CMP-7 | 2003-2004 | Sewer Replacement | $ 500,000 | User Charge | $ 534,200 |
| CMP-8 | 2004-2005 | Vehicle/Equipment Replacement | $ 225,000 | User Charge | |
| CMP-9 | 2004-2005 | Sewer Replacement | $ 500,000 | User Charge | $ 725,000 |
| CMP-10 | 2005-2006 | Vehicle/Equipment Replacement | $ - | User Charge | |
| CMP-11 | 2005-2006 | Sewer Replacement | $ 500,000 | User Charge | $ 500,000 |
| CMP-12 | 2006-2007 | Vehicle/Equipment Replacement | $ 69,750 | User Charge | |
| CMP-13 | 2006-2007 | Sewer Replacement | $ 500,000 | User Charge | $ 569,750 |
| CMP-14 | 2007-2008 | Vehicle/Equipment Replacement | $ 85,050 | User Charge | |
| CMP-15 | 2007-2008 | Sewer Replacement | $ 500,000 | User Charge | $ 585,050 |
| CMP-16 | 2008-2009 | Vehicle/Equipment Replacement | $ - | User Charge | |
| CMP-17 | 2008-2009 | Sewer Replacement | $ 500,000 | User Charge | $ 500,000 |
| CMP-18 | 2009-2010 | Vehicle/Equipment Replacement | $ 25,000 | User Charge | |
| CMP-19 | 2009-2010 | Sewer Replacement | $ 500,000 | User Charge | $ 525,000 |
| CMP-20 | 2010-2011 | Vehicle/Equipment Replacement | $ 144,450 | User Charge | |
| CMP-21 | 2010-2011 | Sewer Replacement | $ 500,000 | User Charge | |
| CMP-22 | 2010-2011 | Upgrade Marylhurst Pump Station | $ 35,000 | User Charge | $ 679,450 |
| CMP-23 | 2011-2012 | Vehicle/Equipment Replacement | $ 34,200 | User Charge | |
| CMP-24 | 2011-2012 | Sewer Replacement | $ 500,000 | User Charge | |
| CMP-25 | 2011-2012 | Upgrade Arbor Pumping Station | $ 35,000 | User Charge | $ 569,200 |
| CMP-26 | 2012-2013 | Vehicle/Equipment Replacement | $ 50,850 | User Charge | |
| CMP-27 | 2012-2013 | Sewer Replacement | $ 500,000 | User Charge | |
| CMP-28 | 2012-2013 | Upgrade Cedar Oak Pumping Station | $ 35,000 | User Charge | $ 585,850 |
| CMP-29 | 2013-2014 | Vehicle/Equipment Replacement | $ 18,900 | User Charge | |
| CMP-30 | 2013-2014 | Sewer Replacement | $ 500,000 | User Charge | |
| CMP-31 | 2013-2014 | Upgrade Calaroga Pumping Station | $ 35,000 | User Charge | $ 553,900 |
| CMP-32 | 2014-2015 | Vehicle/Equipment Replacement | $ - | User Charge | |
| CMP-33 | 2014-2015 | Sewer Replacement | $ 500,000 | User Charge | $ 500,000 |
| CMP-34 | 2015-2016 | Vehicle/Equipment Replacement | $ 85,050 | User Charge | |
| CMP-35 | 2015-2016 | Sewer Replacement | $ 500,000 | User Charge | $ 585,050 |
| CMP-36 | 2016-2017 | Vehicle/Equipment Replacement | $ 225,000 | User Charge | |
| CMP-37 | 2016-2017 | Sewer Replacement | $ 500,000 | User Charge | $ 725,000 |
| CMP-38 | 2017-2018 | Vehicle/Equipment Replacement | $ 67,500 | User Charge | |
| CMP-39 | 2017-2018 | Sewer Replacement | $ 500,000 | User Charge | $ 567,500 |
| CMP-40 | 2018-2019 | Vehicle/Equipment Replacement | $ 69,750 | User Charge | |
| CMP-41 | 2018-2019 | Sewer Replacement | $ 500,000 | User Charge | |
| CMP-42 | 2018-2019 | Upgrade Mapleton Pumping Station | $ 100,000 | User Charge | $ 669,750 |
| CMP-43 | 2019-2020 | Vehicle/Equipment Replacement | $ 34,200 | User Charge | |
| CMP-44 | 2019-2020 | Sewer Replacement | $ 500,000 | User Charge | $ 534,200 |

| | |
|---|---|
| Total, Vehicle/Equipment Replacement | $ 1,431,700 |
| Total, Pump Station Upgrade | $ 260,000 |
| Total, Sewer Replacement | $ 9,000,000 |

It should be noted that in developing the final Capital Improvement Plan or Capital Maintenance Plan for a given year, the costs outlined herein should be adjusted based on the following:

1. Changes in ENR construction cost index (construction projects) or consumer price index (equipment purchases).
2. Changes in the project scope.
3. Changes in unit costs due to unusual material or labor availability.

Oregon

DEPARTMENT OF ENVIRONMENTAL QUALITY

NORTHWEST REGION

JUNE 3, 1997

KEN KEMP
PROJECT MANAGER
CITY OF WEST LINN
2042 8TH AVENUE
WEST LINN OR 97068

RE: WQ - CITY OF WEST LINN
FILE NO. 70735
CLACKAMAS COUNTY
JOHNSON ROAD & MAPLETON PUMP
STATION IMPROVEMENTS
PLAN APPROVAL

Dear Mr. Kemp:

The Department of Environmental Quality (DEQ) is approving plans and specifications for the Johnson Road and the Mapleton pumping station improvements in the City of West Linn, Oregon. Plans were submitted by Mr. John L. Yarnall, P.E., of Westech Engineering, Incorporated, per Oregon Administrative Rule (OAR) Chapter 340, Division 52. A $1,000 Technical Activities Fee was received for DEQ's plan review, and DEQ gave the engineer verbal approval for construction start on May 30, 1997. A project description and our conditions of approval follow.

DESCRIPTION

Two new pumping stations, the Johnson Road and the Mapleton, will be constructed to replace two existing pump stations. The Johnson Road pump station discharges to an existing 4-inch diameter, continuously ascending, 1030 lineal foot (L.F.) asbestos-cement forcemain. The Mapleton pump station discharges to an existing 12-inch diameter, 3700 L.F. ductile iron forcemain.

The Johnson Road pump station is equipped with new, centrifugal, submersible, duplex, constant speed pumps, operating at 143 GPM and 70 feet Total Dynamic Head (TDH). Pumps are Flygt Model MP-3127(212). Three-phase electrical power is provided for normal operation, and a portable generator through a manual transfer switch provides emergency power. Multi-Trode probes control pump operation, and separate probes are supplied for "High water" and "emergency overflow" elevations. Alarms are connected to radio telemetry. A pressure

John A. Kitzhaber
Governor

2020 SW Fourth Ave
Suite 400
Portland, OR 97201-
(503) 229-5263 Voice
TTY (503) 229-5471

sensor, per DEQ's minimum standards is installed to monitor pump performance. An air compressor capable of delivering continuously at least 8 SCFM to the forcemain is installed at the pump station. Air is injected into the forcemain to control hydrogen sulfide formation and odors during low flow conditions. The designated overflow point for this pump station is the wetwell at elevation 130.5 feet with overflow to an existing storm drain via an 8-inch diameter pipe. The average time to overflow is 70 minutes at average annual flow.

The Mapleton pump station is equipped with new, centrifugal, submersible, triplex, constant speed pumps, operating at 1600 GPM and 70 feet TDH. Pumps are Flygt Model CP-3300(467). A permanent diesel powered generator provides emergency, three-phase electrical power through an automatic transfer switch. Separate Multi-Trode probes are set for "High water" and "emergency overflow" elevations, and alarms are connected to radio telemetry. A pressure sensor monitors each pump's performance. A chemical injection system supplies Bioxide by U.S. Filter, at a rate of 0.7 gallons per pound of dissolved hydrogen sulfide ($H_2S$) to control $H_2S$ formation in the forcemain. The designated overflow point for this pump station is the wetwell at elevation 33.56 feet. The emergency bypass is a 15-inch diameter pipe connected to manhole 3A-10-1 located in the vicinity of 19045 Nixon Avenue. The average time to overflow is 20 minutes at average annual flow.

CONDITIONS OF APPROVAL

1. Construction shall be inspected and certified in writing by Mr. John L. Yarnall, P.E., as required by OAR 340-52, prior to the project's Initiation of Operation. The engineer will certify by using the attached, "Inspection and Certification of Proper Construction," form.

2. All sanitary sewer materials, construction, and testing shall conform to the most recent standards and drawings of the Oregon Chapter of the American Public Works Association (APWA), Division 3.

3. The City shall not allow operation of either pumping station without an approved Operation and Maintenance (O&M) manual, per OAR 340-52, for each. Each manual shall conform with our current guidelines, which we will use as the basis for our review. On approval we will require one copy of each final O&M manual and as-built drawings from the project engineer.

OREGON ADMINISTRATIVE RULES
CHAPTER 340, DIVISION 52 - DEPARTMENT OF ENVIRONMENTAL QUALITY

## Responsibility of Treatment Works Owners, Designs Engineers and Developers After Approval of Plans for (Domestic) Sewage Projects

340-52-040

(1) Construction of all projects must be in accordance with the project plans and specifications approved by the Department. No substantial change in or deviation from such plans and specifications shall be made without the prior written approval of the Department, which shall make the final determination whether or not a change or deviation is in fact substantial.

(2) The owner of the sewerage system (generally a municipality) as recipient of any construction work on its system has a vested responsibility to review and approve project plans prior to the start of construction. Department approval of plans under these rules does not preclude the right and responsibility of review and approval by the owner. The owner may adopt more stringent construction standards and impose special conditions for sewer use, service connection, and related activities. Department approval of plans in such cases is contingent upon similar approval by the owner and prior approval of plans by the owner is encouraged.

(3) Inspection and certification of proper construction shall be governed by the following provisions:

(a) The construction of all sewerage projects shall be under the supervision of and shall be thoroughly inspected by the design engineer or his authorized representative, unless relieved under OAR 340-52-035(3)(b). At the completion of the project he shall certify in writing to the owner and the Department that such construction was inspected by him and found to be in accordance with the plans and specifications, including any changes therein approved by the Department. Nothing in the foregoing exempts an owner from monitoring the project for conformance to requirements and performing supplementary inspections or prevents an owner's qualified staff from assuming responsibility for inspection and certification;

(b) If the design engineer is to have no further involvement or have limited involvement with the project after obtaining Department approval of plans, he must so notify the Department, the owner, and the developer upon submittal of plans or immediately upon being disassociated or limited in control over materials or workmanship within the project. (Nothing precludes either the owner or the developer from giving such notice if this is more appropriate.) Thereupon, if the project is to continue on to construction, the owner shall assume necessary responsibility for satisfactory construction of the project in accordance with the approved plans. He shall employ or apply such construction engineering/inspection services as appropriate for the project. The owner shall thereupon certify in accordance with subsection (a) of this section. No project shall proceed to construction without adequate and capable construction engineering/inspection services. (This assumption of construction engineering/inspection services responsibility by the owner does not necessarily relieve the design engineer of design responsibility);

(c) Sewerage system integrity and watertightness is the system owner's ultimate responsibility. He shall monitor all private sewer construction and control all common sewer construction in the sewerage system to the extent necessary to this end.

(4) An appropriate final operation and maintenance manual, approved by the Department shall be prepared and submitted to the owner by the design engineer for all treatment works, disposal systems, and lift stations prior to start up of such facilities.

Stat. Auth.: ORS Ch. 468
Hist.: DEQ 3-1981, f. & ef. 2-6-81
(September, 1991)

INQUIRIES

Please contact me at telephone (503) 229-5690, if you should have questions about our conditions of approval.

Respectfully,

Garry L. Sage

Garry L. Sage, E.I.T.
Municipal Project Consultant

GLS:
johnmapl.doc
ENC:

FOR: James L. Van Domelen, P.E.
Senior Water Quality Engineer

(1) "Inspection and Certification of Proper Construction."

CC (with):

John L. Yarnall, P.E., Westech Engineering, Inc., 3421 25th St. SE, Salem, OR 97302

CC (w/o):

James Montgomery, Public Improvements Program Manager, City of West Linn, 2042 8th Avenue, West Linn, OR 97068

Dave Monson, P.E., City Engineer, City of West Linn, 2042 8th Avenue, West Linn, OR 97068

## WORK PLAN

## WEST LINN PUBLIC WORKS DEPARTMENT

## SEWER/STORM DIVISION

Operations of the division are provided through the following dimensions:

### Dimension 1: CUSTOMER RESPONSE/SERVICE/EDUCATION

**OBJECTIVE:**

Provide answers to the public with honest information and professional advise. Assure public we are doing the best possible job that can be done. Provide prompt, polite service in the identification and resolution of problems. Ensure protection of the public through the enforcement of regulations. Educate public through the publication of pertinent information.

**STANDARD:**

Provide maximum 2 hours response to situations which may affect life, health, safety, and property. Provide maximum 24 hour response to non-emergency inquiries and requests. Respond in compliance with city, state, and federal policies and regulations. Maintain knowledge of city policies and procedures and be able to communicate them to the public. Provide citizen response as #1 priority. Maintain professional skills and ability to provide professional advise through continuing education.

### DIMENSION 2: PUMP STATION OPERATION AND MAINTENANCE

**OBJECTIVE:**

To provide continuous and economic transmission of sewage while providing protection from health hazards, flooding, property damage, and environmental damage and meeting requirements of discharge permit and Tri-City Service District.

STANDARD:

Provide priority ½ hour response, stock emergency supplies and parts, maintain back-up system, maintain service contract on telemetry systems, meet health codes, maintain written emergency operation procedures, provide standby cross training, maintain contractors list.

BI-WEEKLY
1. Monitor components
2. Monitor hour meters
3. Check systems

WEEKLY
1. Check floats
2. Blow out bubbler system
3. Drain compressor
4. Check telemetry

MONTHLY
1. Wash down wet wells/pump dry
2. Inspect wet well bottom
3. Clean filters
4. Wash down perimeter/clean up

ANNUALLY
1. Pull and inspect pumps/service
2. Electrical preventative maintenance with licensed electrician
3. Open and inspect check valves
4. Paint components as necessary
5. Landscape maintenance

DIMENSION 3: EDUCATION AND PROFESSIONAL CERTIFICATION:

OBJECTIVE:

To assure the citizens of West Linn we are qualified and credible by displaying competence, meeting DEQ standards, continuing personal growth, seeking promotion and personal career satisfaction, maintaining a professional image, and increasing productivity through the continued promotion of new ideas, innovations and technology.

STANDARD:

Wastewater Certification
Commercial Drivers License
Minimum 2 CEU/2 years
First Aid/CPR/BBP certification
Competent person/trenching/shoring
Herbicide/pesticide license
Accredited courses
Continuous on the job training
Equipment bid specifications to include mandatory training
Shared information/experience with coworkers-workers

**DIMENSION 4: WORKER/WORK ZONE SAFETY**

**OBJECTIVE:**

To provide a work environment with safety as priority in order to avoid death, injury, property damage, time loss, fines, penalties, reprimands or discharge. To demonstrate concern for citizens, contractors and coworkers-workers, lower insurance costs and increase employee moral. To meet or exceed all federal, state, and local mandates.

STANDARD:

Meet or exceed all federal, state and local regulations
Maintain employee certifications
Provide continuing education
Provide continuous on the job training in new technology
Use common sense
Use of proper equipment
Equipment routine inspection/preventative maintenance
Physical and mental preparedness

DIMENSION 5: COLLECTION SYSTEM OPERATIONS AND MAINTENANCE

OBJECTIVE:

To operate and maintain the city's sewage collection system, which transports sewage through a pipe system, from source to treatment through a system meeting legal requirements, protecting environmental standards and the health of the citizens of West Linn.

OPERATIONS STANDARD:

Protection of the environment through the prevention of spillage, discharge, backup, and or blockage.

Routine inspection program.

Meet or exceed all federal, state, and local environmental standards.

Meet or exceed all federal, state, and local legal requirements.

Accurate recording/reporting.

Provide emergency response

2 hours maximum response to site

½ hour maximum telephone response

24 hour preparedness

Adequate inventory for repair

Interagency back up

Interdepartmental cross training

Major equipment backup

MAINTENANCE STANDARD:

Environmental protection through maintaining upgraded/sealed system.

System integrity - immediate repair/replacement of failed systems, systematic repair/replacement of problem lines.

Meet or exceed all EPA regulations, stand and local health requirements.

Provide preventative maintenance

Locates

Manhole rehabilitation

Vermin control

Root foaming

Public education

Quarterly flushing

Quarterly problem line cleaning

Hydraulic cleanings - 5 year cycle/20% of system annually.

TV inspections - 12 miles annually.

Visual inspections - 100% of all lines not cleaned or televised annually.

Continuous recording of system condition.

## DIMENSION 6: REGULATORY REPORTING/DATA MANAGEMENT

OBJECTIVE:

Maintenance of accurate records in order to provide a history of the division for identification of problem areas, condition of the system, information for budgeting purposes, public information, protection for liability, and as required to meet state, federal, and DEQ requirements.

Emergency response - 1 hour maximum

Non-emergency response - 1 week maximum as scheduling permits

Maintain good working relationships

## DIMENSION 8: WASTE TREATMENT/DISPOSAL

### OBJECTIVE:

Transportation of sewage to county pumping facility and/or solids to DEQ approved landfill.

### STANDARD:

Provide transportation to county pumping facility per Dimension 5.

Provide transportation to DEQ landfill as needed.

a) Remove from sewer main

b) Dewater

c) Dispose of at landfill

## DIMENSION 9: CAPITAL IMPROVEMENTS TO INFRASTRUCTURE

### OBJECTIVE:

Major repairs, replacement, improvements and additions to the sewer/storm infrastructure to assure working, functional system to meet the needs of the present and future population.

### STANDARD:

Maintain system data - daily

Categorize priorities

Meet requirements of Master Plan

Provide support services for engineering/contractors as requested

**DIMENSION 10: STORM WATER QUALITY ENHANCEMENT**

**OBJECTIVE:**

To assure the environmental safety of water delivered to rivers and streams through the City's storm drainage system.

**STANDARD:**

Inspect all storm lines - annual

Inspect/clean all catch basins - annual

Install new detention/retention facilities - new development

Erosion control measures on all construction projects

Maintain headwall as needed

Containment of hazardous spills as needed

Ditches for filtration of contaminants

Meet all federal, state, and local requirements

Repair/construct storm lines and catch basins as needed

Categorize priorities

Meet requirements of Master Plan

Provide support services for engineering/contractors as requested

## DIMENSION 10: STORM WATER QUALITY ENHANCEMENT

### OBJECTIVE:

To assure the environmental safety of water delivered to rivers and streams through the City's storm drainage system.

### STANDARD:

Inspect all storm lines - annual

Inspect/clean all catch basins - annual

Install new detention/retention facilities - new development

Erosion control measures on all construction projects

Maintain headwall as needed

Containment of hazardous spills as needed

Ditches for filtration of contaminants

Meet all federal, state, and local requirements

Repair/construct storm lines and catch basins as needed

INTERGOVERNMENTAL COOPERATIVE AGREEMENT

This Intergovernmental Cooperative Agreement ("Agreement") is made this 24th day of January, 1996, by and between Tri-City Service District, County Service District ("District") and the City of West Linn, Oregon, a municipal corporation ("City").

RECITALS:

District provides major collection, pumping, transmission, and treatment of waste water generated within the City. City provides collection sewer services within its boundaries and such facilities are connected to the District's facilities for ultimate conveyance to the District's wastewater treatment plant. The parties agree that it would be beneficial to quantify the wastewater flows to the District's facilities and that flow monitoring devices should be installed for that purpose. The parties have the authority pursuant to ORS 190.003 et seq. to enter into an Intergovernmental Cooperative Agreement such as this and being fully advised, it is agreed as follows:

1. Installation of Flow Monitoring Devices. City hereby grants to District the right to install, operate and maintain Flow Monitoring Devices in the City's collection system at District's cost and expense. Installation shall occur at the points listed below and as set forth on Exhibits 1, 2 and 3 attached hereto and incorporated by reference:

| | |
|---|---|
| Exhibit 1: | Sanitary Manhole IC-3 |
| Exhibit 2: | Willamette Pump Station |
| Exhibit 3: | River Street Pump Station |

2. Access by District Personnel. City hereby grants to District and its employees, contractors, consultants, and agents, the right to enter the City's sewer system to install, operate, maintain, repair, replace, and gather data from the monitoring devices as District determines to be reasonable and necessary. Entrance shall comply with all applicable safety requirements required by the City or other applicable statute or regulation.

3. Indemnity by the District. District agrees to indemnify and hold harmless the City from any and all claims and demands for damages to the City's sewer system arising out of acts, errors, or omissions of the District or its employees, contractors, consultants, and agents in performing the tasks pursuant to this Agreement.

4. Termination. The parties agree that this Agreement may be terminated by mutual agreement of the parties or five (5) years from the date hereof, whichever shall first occur. The Agreement may be renewed for successive five-year periods upon mutual consent of the parties. Notwithstanding the foregoing, if either party shall breach the terms of this Agreement upon thirty (30) days' written notice.

5. Notices. Notices for the parties shall be sufficient if delivered by United States mail, postage prepaid, at the following addresses:

1) Tri-City Service District
Attn: Director, Clackamas County
Department of Utilities
902 Abernethy Road
Oregon City OR 97045

2) City of West Linn
Attn: Public Works Director

6. Amendment. This Agreement may be amended by the mutual written agreement of the parties.

7. Entire Agreement. This Agreement embodies the entire agreement and understanding between the parties hereto and supersedes all prior agreements and understandings relating to the subject matter hereof.

8. Severability. In case any one or more of the provisions contained in this Agreement should be invalid, illegal or unenforceable in any respect, the validity, legality and enforceability of the remaining provisions contained herein shall not in any way be affected or impaired thereby.

9. Attorney's Fees. If a dispute should arise between the parties regarding any term or portion of this Agreement, the prevailing party shall be entitled to such reasonable attorney's fees as a trial court or arbitrator may award and on any appeal therefrom.

WITNESS whereof the parties have executed this Agreement as of the date set forth opposite their names below.

TRI-CITY SERVICE DISTRICT

By: ______________________
David Benfield
Interim Director

Date: ______________________

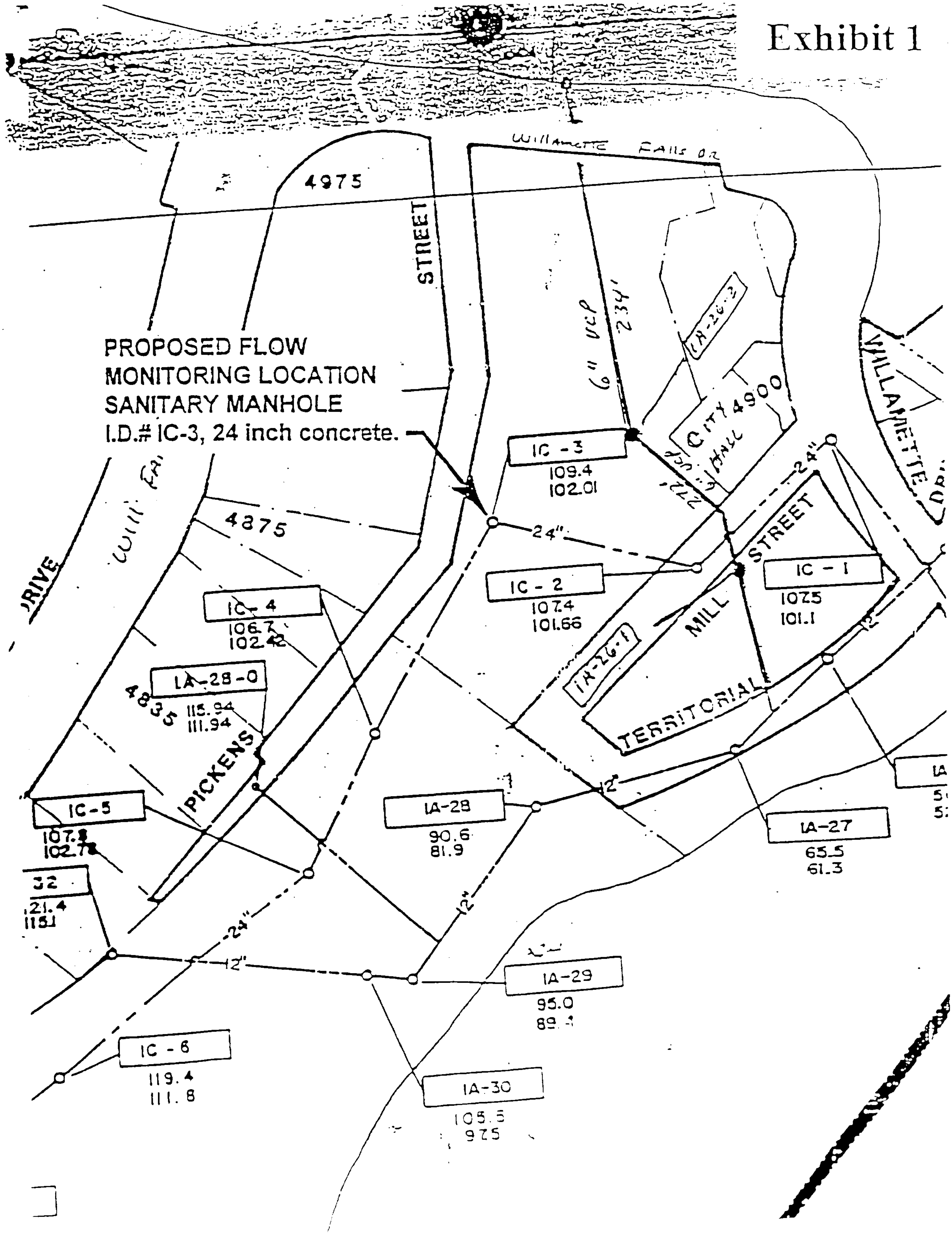
CITY OF West Linn

By: David Monson
Its: Public Works Director

Date: January 24, 1996

IGA.doc/12/95

# Exhibit 1



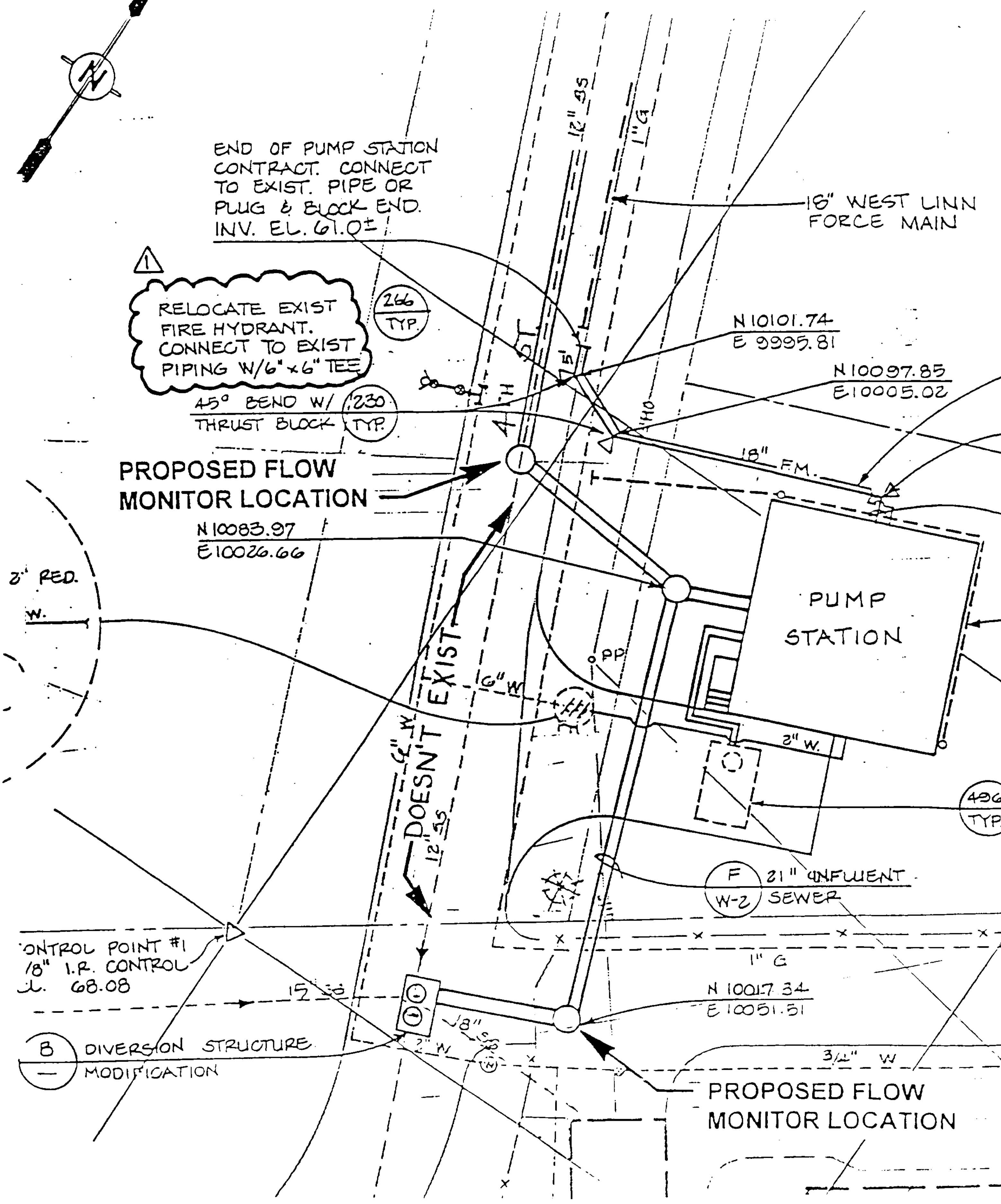
PROPOSED FLOW
MONITORING LOCATION
SANITARY MANHOLE
I.D.# IC-3, 24 inch concrete.
4975
STREET
4875
4835
PICKENS
DRIVE
MILL
STREET
TERRITORIAL
WILLAMETTE DR
CITY 4900
HALL
6" VCP
234'
24"
12"
IC - 3
109.4
102.01
IC - 2
107.4
101.66
IC - 1
107.5
101.1
IC - 4
106.7
102.42
IA-28-0
115.94
111.94
IC-5
IA-28
90.6
81.9
IA-27
65.5
61.3
IA-29
95.0
IC - 6
119.4
111.8
IA-30
105.5
97.5

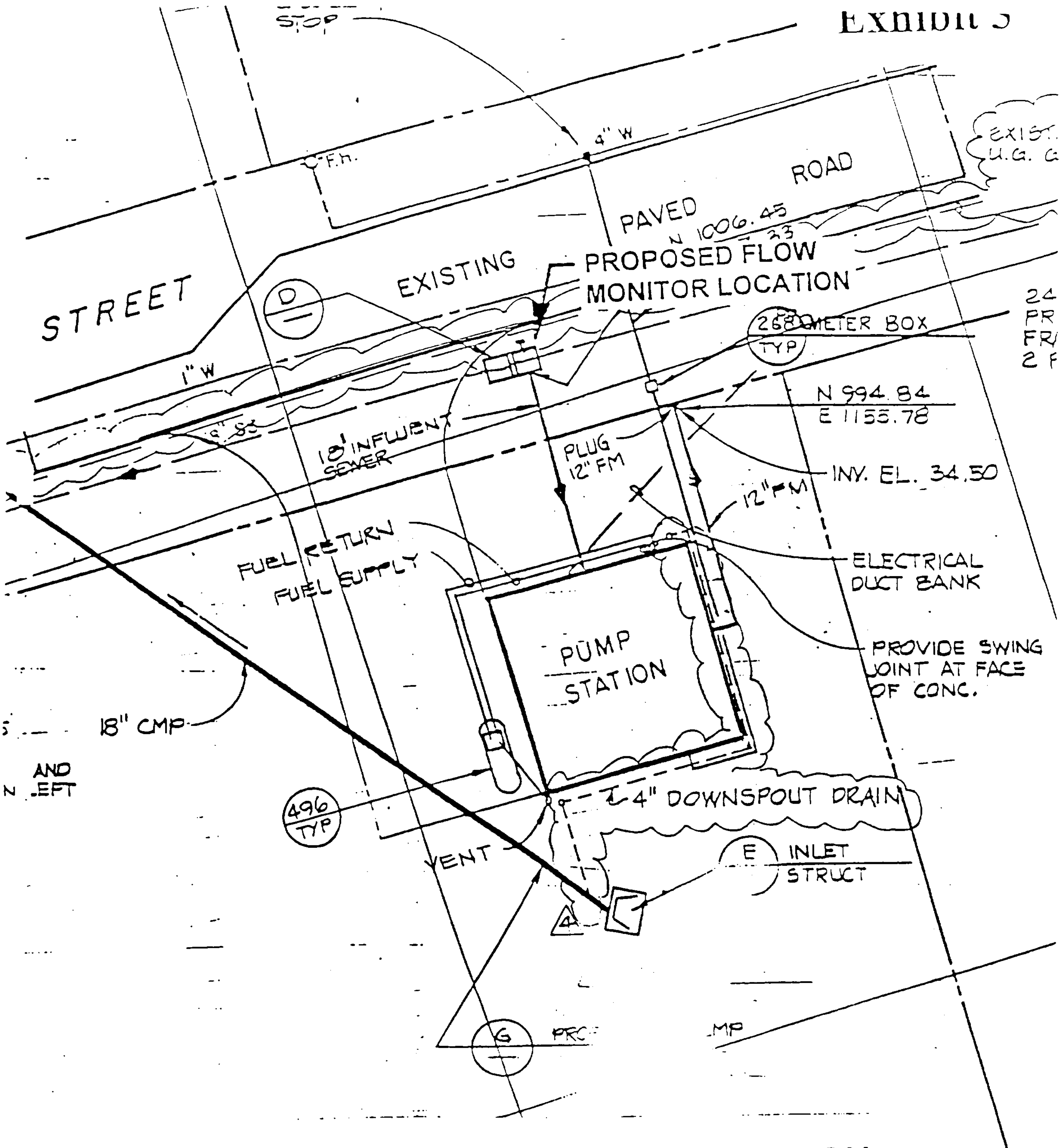
# WILLAMETTE PUMP STATION

## SITE PLAN

1 inch = 20 feet

Exhibit 2






## RIVER STREET PUMP STATION

SITE PLAN

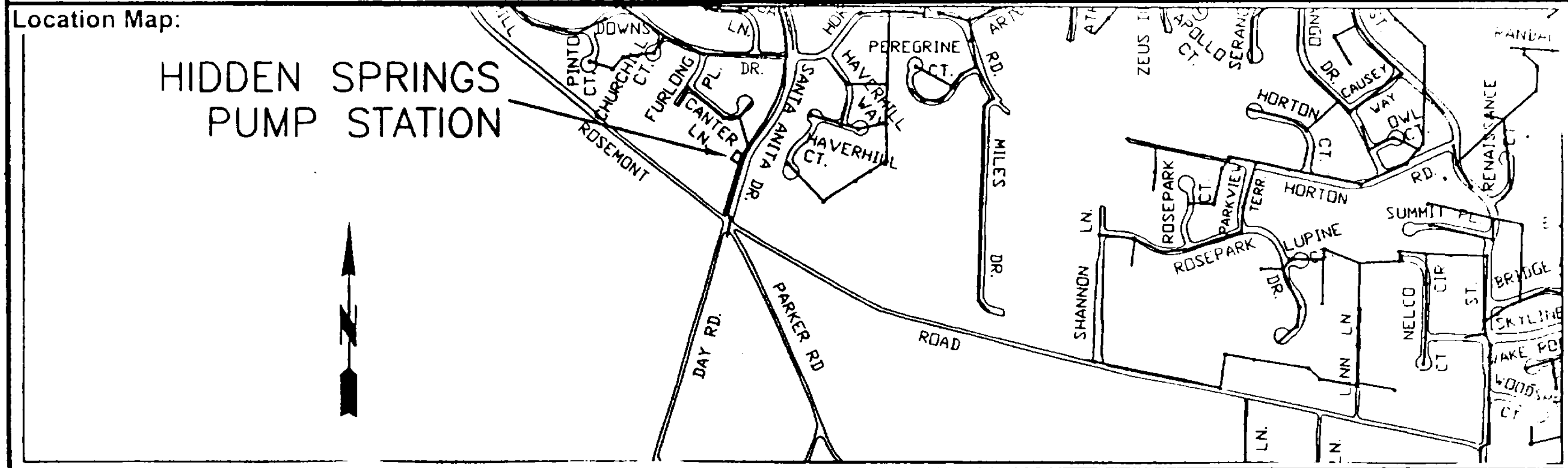
SCALE: 1inch = 20 feet

***City of West Linn, Oregon***
***Capital Improvement Plan***

**Capital Project Summary**
**FY 2000-2001**

| | |
|---|---|
| **Department:** Sewer | |
| **Project:** Abandon Hidden Springs Pump Station | **Project Number:** CIP-1 |

**Location Map:**




**Scope of Work:** Construct 275 LF of 8" PVC. Connect to existing Hidden Springs Pump Station wetwell.

**Objective:** This Project will allow the Hidden Springs Pump Station to be abandoned.

**Preliminary Budget**

| | Budget Number | | | Funding source | |
|---|---|---|---|---|---|
| | Cost | Acct | | Amount | Source |
| | | | | | |
| 8" PVC Sewer | 16,500 | | | | |
| Abandon Pump Station | 5,000 | | | 33,000 | User Charge |
| Construction Contengencies (20%) | 4,900 | | | | |
| Engineering, Legal Administrative (25%) | 6,600 | | | | |
| | | | | | |
| | | | | | |
| Total Cost | 33,000.00 | | | 33,000.00 | |

**Remarks/Status:**

General Form; CIP Project Form2.xls

## *City of West Linn, Oregon*
## *Capital Improvement Plan*

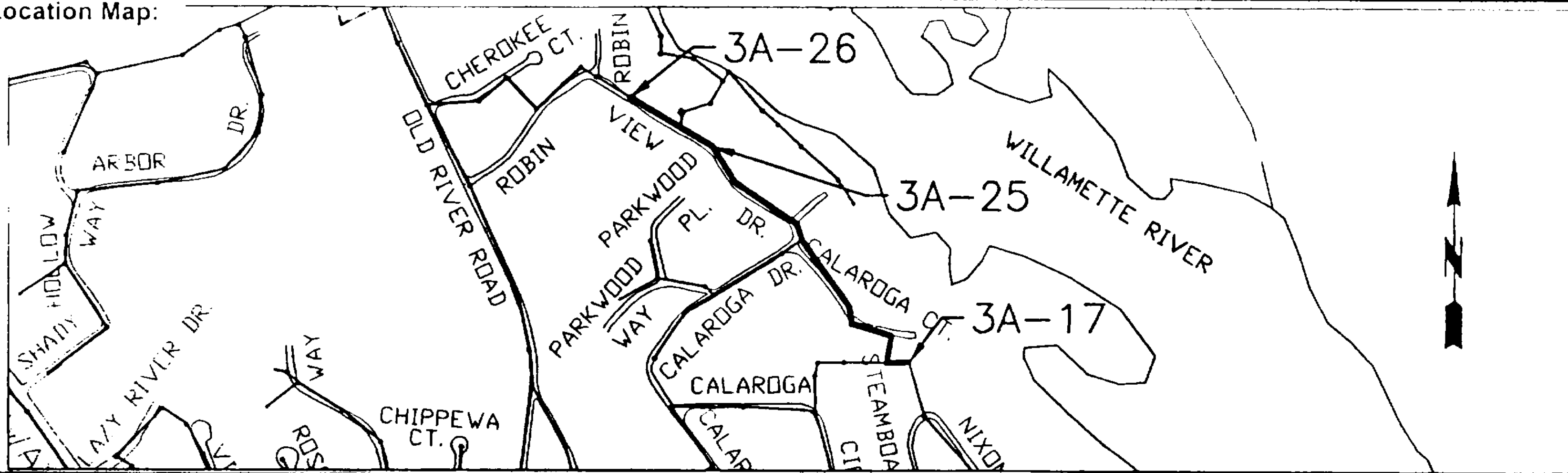
**Capital Project Summary**
**FY 2001-2002**

**Department:** Sewer

**Project:** Robinview Drive-Calaroga Court Sewer Replacement

**Project Number:** CIP-2

**Location Map:**




**Scope of Work:** Upgrade existing sanitary sewer between MH 3A-26 and MH 3A-25 to 16" siphon (370LF) and between MH 3A-25 and MH 3A-17 to 18" PVC (1270LF). Includes 10 new manholes and 1500 LF of street repair.

**Objective:** This project will reduce odor complaints and will upgrade the sewer so that it meets current design criteria.

**Preliminary Budget**

| | Budget Number | | Funding source | |
|---|---|---|---|---|
| | Cost | Acct | Amount | Source |
| 18" PVC Sewer | 171,450.00 | | | |
| 16" Siphon | 46,250.00 | | | |
| Manholes | 35,000.00 | | 435,300.00 | User Charge |
| Street Repairs | 37,500.00 | | | |
| Construction Contingencies (20%) | 58,040.00 | | | |
| Engineering, Legal, Administrative (25%) | 87,060.00 | | | |
| | | | | |
| Total Cost | 435,300.00 | | 435,300.00 | |

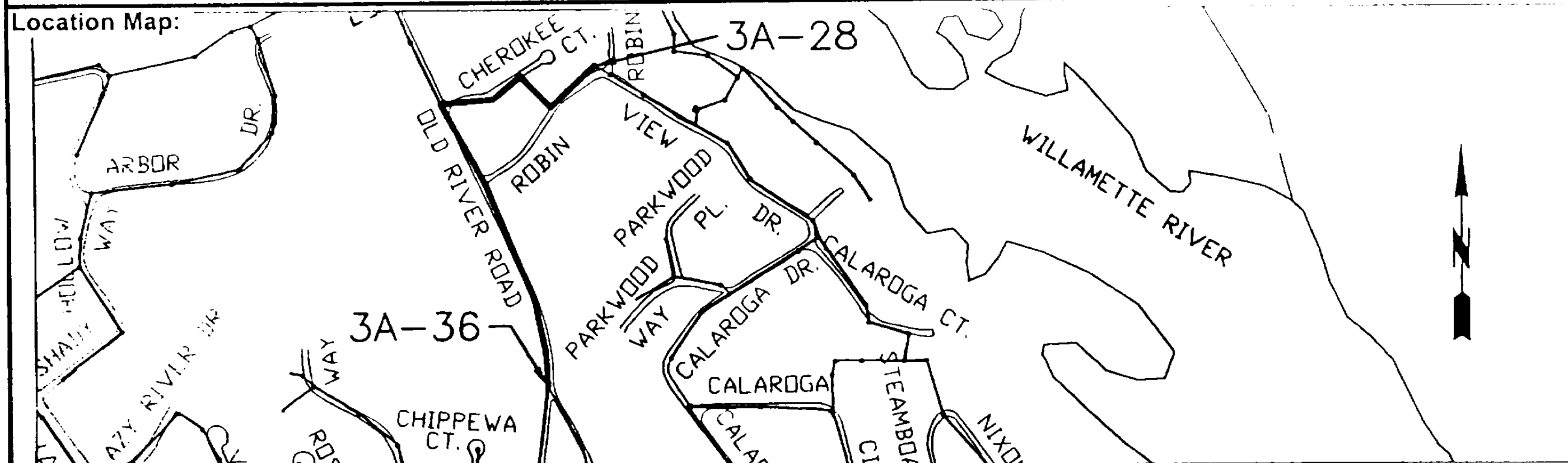
**Remarks/Status:**

# *City of West Linn, Oregon*
## *Capital Improvement Plan*

**Capital Project Summary**
**FY 2003-2004**

| | | | |
|---|---|---|---|
| **Department:** | Sewer | | |
| **Project:** | Old River Road-Cherokee Court-Robinview Drive Sewer Replacement | **Project Number:** | CIP-3 |

**Location Map:**




**Scope of Work:** Replace existing sanitary sewer (12" diameter) with 18" diameter sewer. Project includes 1950 feet of sewer, 9 manholes and 1950 feet of street repair

**Objective:** This project will provide additional capacity in this sewer to meet current design criteria.

**Preliminary Budget**

| | **Budget Number** | | **Funding source** | |
|---|---|---|---|---|
| | Cost | Acct | Amount | Source |
| 18" PVC Sewer | 263,250.00 | | | |
| Manholes | 31,500.00 | | | |
| Street Repair | 48,750.00 | | 515,250.00 | User Charge |
| | | | | |
| Construction Contingencies (20%) | 68,700.00 | | | |
| Engineering, Legal, Administrative (25%) | 103,050.00 | | | |
| | | | | |
| Total Cost | 515,250.00 | | 515,250.00 | |

**Remarks/Status:**

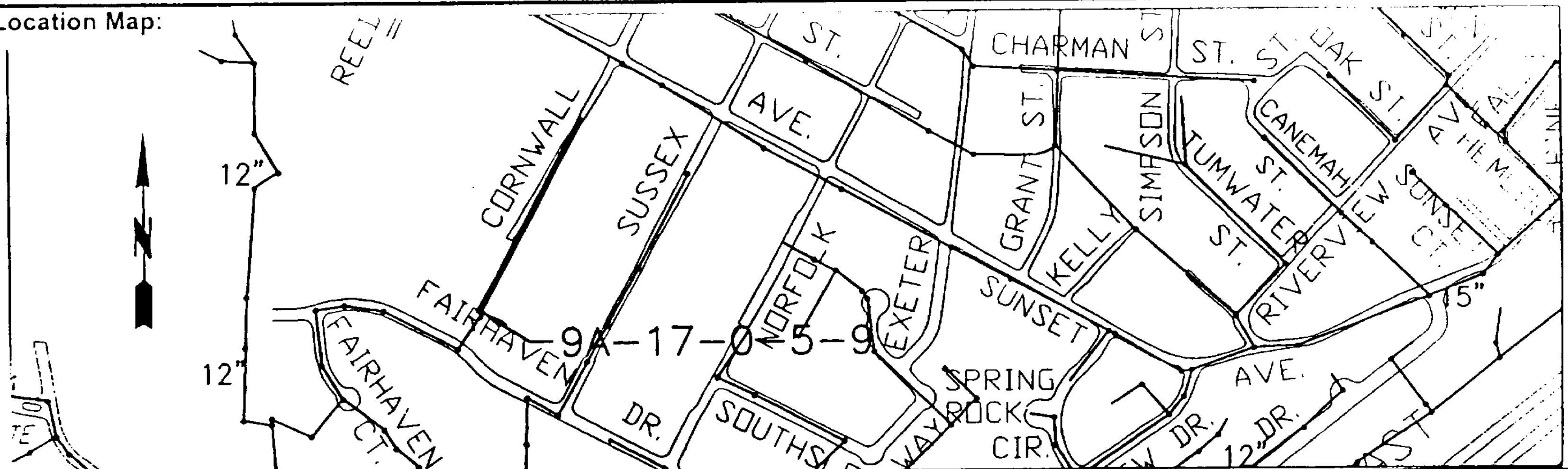
General Form; oldriver.xls

***City of West Linn, Oregon***
***Capital Improvement Plan***

**Capital Project Summary**
**FY 2004-2005**

| | | | |
|---|---|---|---|
| **Department:** | Sewer | | |
| **Project:** | Cornwall Street Sewer | **Project Number:** | CIP-4 |

**Location Map:**




| | | |
|---|---|---|
| **Scope of Work:** | Install new 8" sewer in Cornwall Street, south of Sunset Avenue | |
| **Objective:** | Provide sanitary sewers and eliminate septic tanks in this area | |

**Preliminary Budget**

| | Budget Number | | | Funding source | |
|---|---|---|---|---|---|
| | Cost | Acct | | Amount | Source |
| Permitting | | | | | |
| 8" PVC Sewer | 45,000.00 | | | 100,500.00 | Local Improvement District or |
| Manholes | 7,000.00 | | | | Sewer User Charge |
| Street Repair | 15,000.00 | | | | |
| Construction Contingencies (20%) | 13,400.00 | | | | |
| Engineering, Legal, Administrative (25%) | 20,100.00 | | | | |
| | | | | | |
| Total Cost | 100,500.00 | | | 100,500.00 | |

**Remarks/Status:**

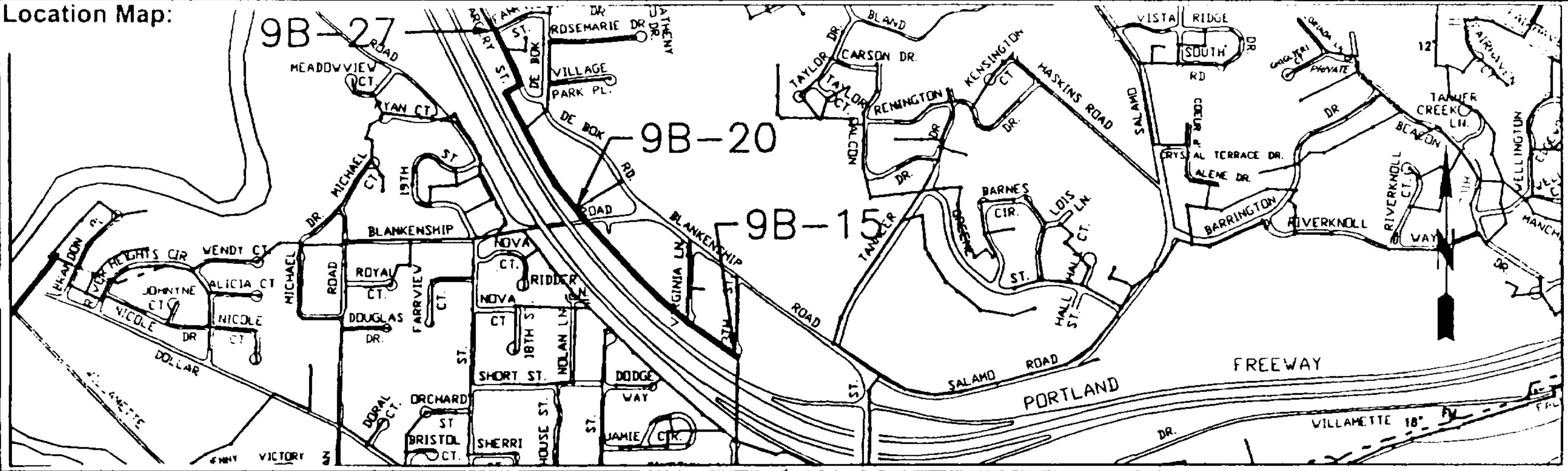
General Form; CornSt.xls

*City of West Linn, Oregon*
*Capital Improvement Plan*

**Capital Project Summary**
FY 2005-2006

| | | | |
|---|---|---|---|
| **Department:** | Sewer | | |
| **Project:** | I-205 Sewer Replacement | **Project Number:** | CIP-5 |

**Location Map:**




**Scope of Work:** Replace existing sanitary sewer (8" and 10" diameter) sewer with 10" and 12" diameter sewer. Project includes **1528 feet of 10" sewer 1606 feet of 12" sewer, 10 manholes and 410 feet of street repair.**

**Objective:** This project will provide additional capacity in this sewer to meet current design criteria and **to provide capacity for future growth.**

**Preliminary Budget**

| | Budget Number | | | Funding source | |
|---|---|---|---|---|---|
| | Cost | Acct | | Amount | Source |
| 10" PVC Sewer | 106,960.00 | | | | |
| 12" PVC Sewer | 144,540.00 | | | 175,000.00 | SDC |
| Manholes | 35,000.00 | | | 385,200.00 | User Charge |
| Street Repair | 10,250.00 | | | | |
| Construction Contingencies (20%) | 105,380.00 | | | | |
| Engineering, Legal, Administrative (25%) | 158,070.00 | | | | |
| | | | | | |
| Total Cost | 560,200.00 | | | 560,200.00 | |

**Remarks/Status:**

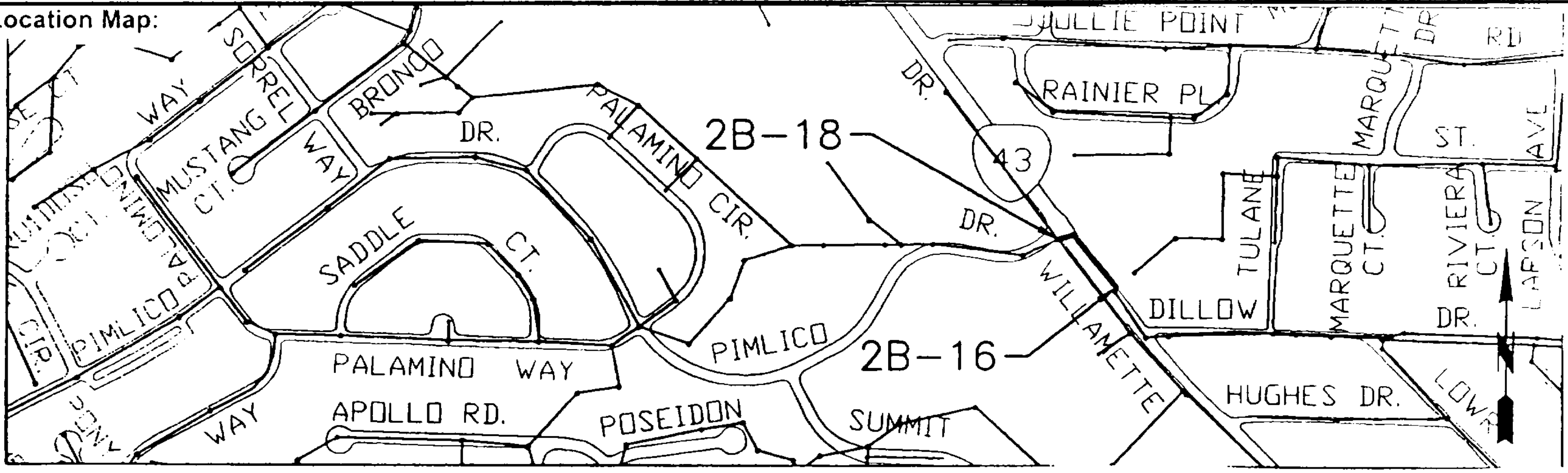
General Form; I205.xls

## *City of West Linn, Oregon*
## *Capital Improvement Plan*

**Capital Project Summary**
FY 2007-2008

| | | | |
|---|---|---|---|
| **Department:** | Sewer | | |
| **Project:** | Highway 43 at Dillow Sewer Replacement | **Project Number:** | CIP-6 |

**Location Map:**




| | |
|---|---|
| **Scope of Work:** | Replace existing sanitary sewer (12" diameter) sewer with 15" diameter sewer. Project includes 270 feet of 15" sewer, 3 manholes and 270 feet of street repair. |
| **Objective:** | Provide additional capacity so that the sewer will meet current design conditions and sewer overflows will be minimized |

**Preliminary Budget**

| | **Budget Number** | | | **Funding source** | |
|---|---|---|---|---|---|
| | Cost | Acct | | Amount | Source |
| 15" PVC Sewer | 29,700.00 | | | | |
| Manholes | 10,500.00 | | | 1,500.00 | SDC |
| Street Repair | 6,750.00 | | | 68,940.00 | User Charge |
| | | | | | |
| Construction Contingencies (20%) | 9,390.00 | | | | |
| Engineering, Legal, Administrative (25%) | 14,100.00 | | | | |
| | | | | | |
| Total Cost | 70,440.00 | | | 70,440.00 | |

**Remarks/Status:**

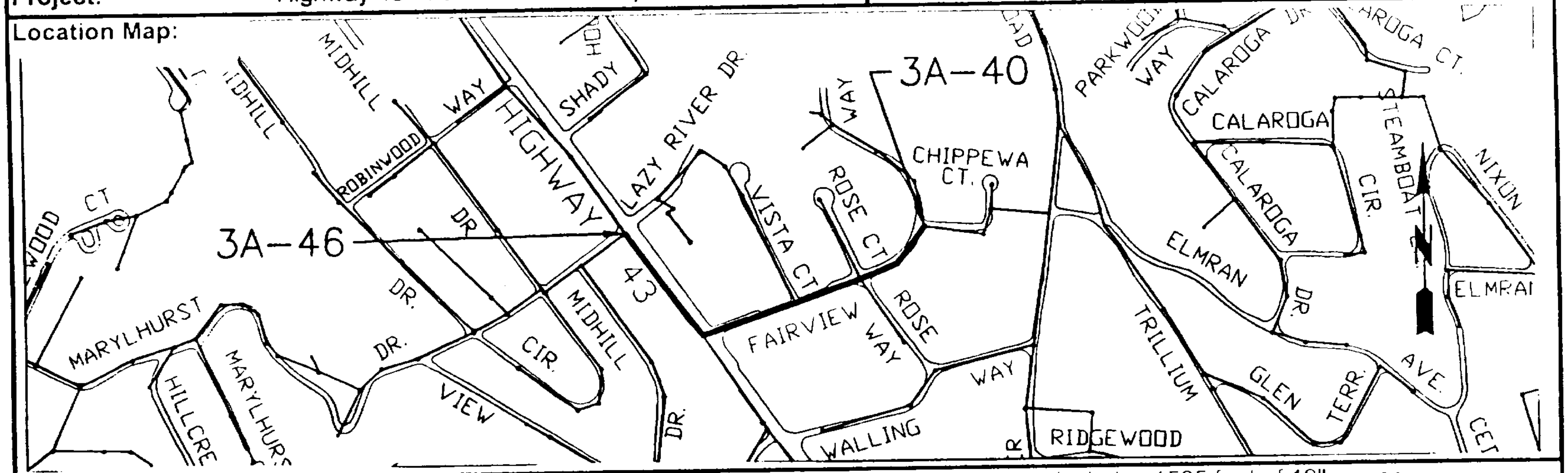
General Form; Hwy43dill.xls

*City of West Linn, Oregon*
*Capital Improvement Plan*

**Capital Project Summary**
FY 2007-2008

| | | | |
|---|---|---|---|
| **Department:** | Sewer | | |
| **Project:** | Highway 43 - Fairview Sewer Replacement | **Project Number:** | CIP-8 |

**Location Map:**




| | |
|---|---|
| **Scope of Work:** | Replace existing 10" diameter sewer with 12" diameter sewer. Project includes 1565 feet of 12" sewer, 7 manholes and 1565 feet of street repair |
| **Objective:** | Provide additional capacity so that the sewer will meet current design conditions and sewer overflows will be minimized |

**Preliminary Budget**

| | Budget Number | | Funding source | |
|---|---|---|---|---|
| | Cost | Acct | Amount | Source |
| 12" PVC Sewer | 140,850.00 | | | |
| Manholes | 24,500.00 | | | |
| Street Repair | 39,125.00 | | 306,710.00 | User Charge |
| | | | | |
| Construction Contingencies (20%) | 40,895.00 | | | |
| Engineering, Legal, Administrative (25%) | 61,340.00 | | | |
| | | | | |
| Total Cost | 306,710.00 | | 306,710.00 | |

**Remarks/Status:**

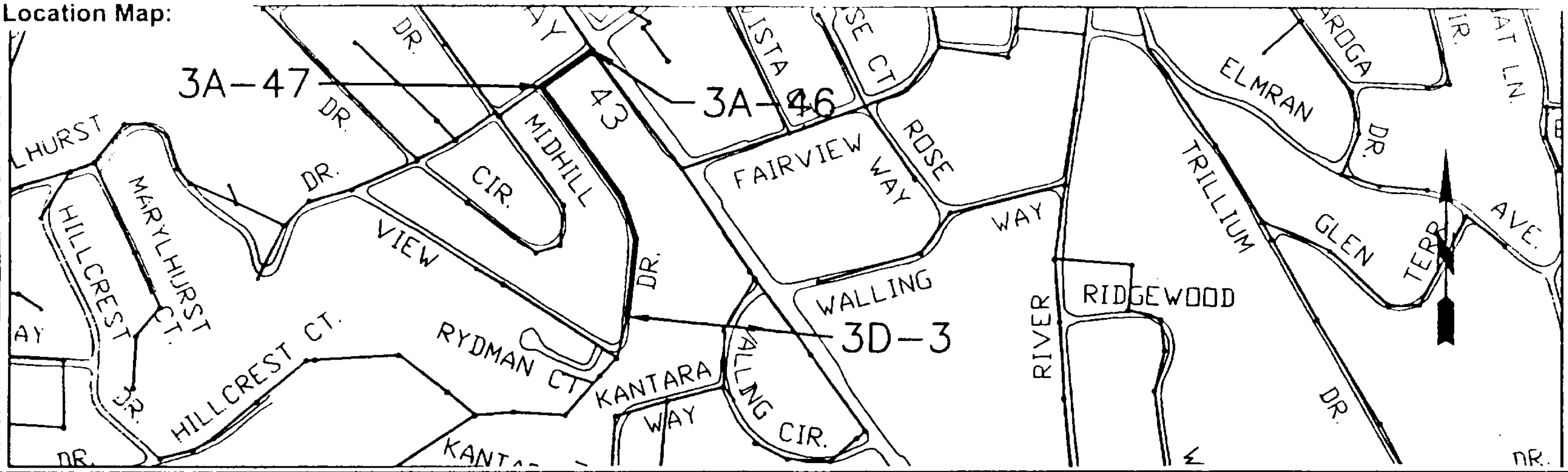
General Form; Hwy43fair.xls

***City of West Linn, Oregon***
***Capital Improvement Plan***

**Capital Project Summary**
FY 2007-2008

| | | | |
|---|---|---|---|
| **Department:** | Sewer | | |
| **Project:** | View Drive - Marylhurst Sewer Replacement | **Project Number:** | CIP-7 |

**Location Map:**




**Scope of Work:** Replace existing sanitary sewer (8" diameter) with 10" diameter sewer. Project includes 1130 feet of 10" sewer, 5 manholes and 1130 feet of pavement repair.

**Objective:** Provide additional capacity so that the sewer will meet current design conditions and sewer overflows will be minimized

**Preliminary Budget**

| | Budget Number | | Funding source | |
|---|---|---|---|---|
| | Cost | Acct | Amount | Source |
| 10" PVC Sewer | 79,100.00 | | | |
| Manholes | 17,500.00 | | | |
| Street Repair | 28,250.00 | | 187,300.00 | User Charge |
| | | | | |
| Construction Contingencies (20%) | 25,000.00 | | | |
| Engineering, Legal, Administrative (25%) | 37,450.00 | | | |
| | | | | |
| Total Cost | 187,300.00 | | 187,300.00 | |

**Remarks/Status:**

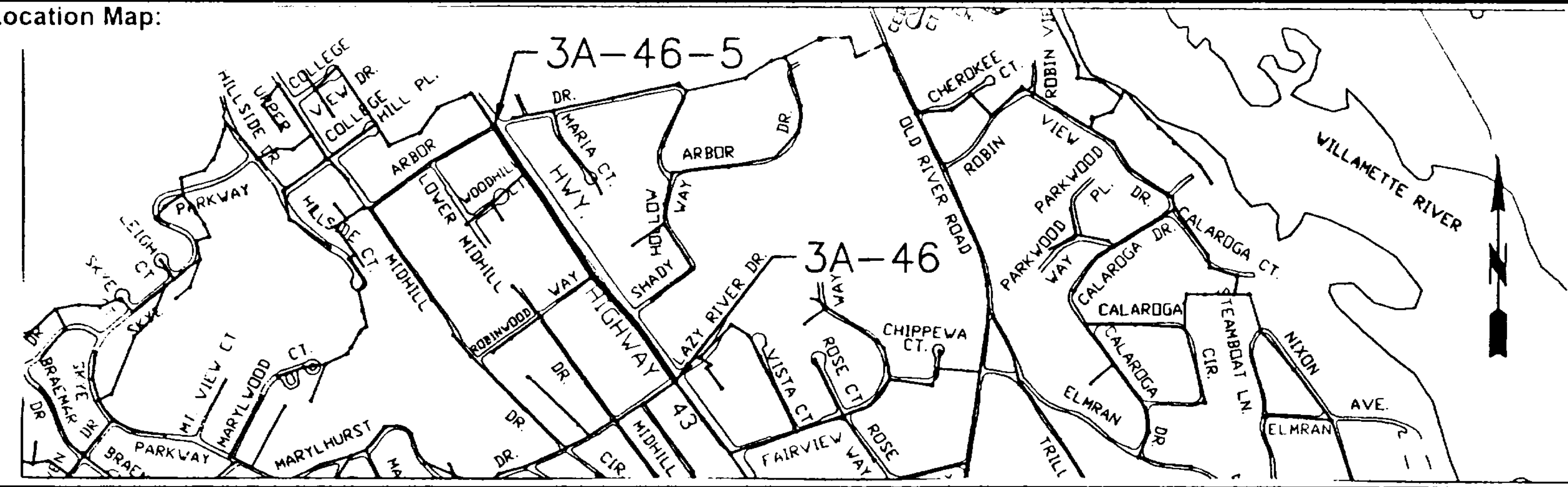
## *City of West Linn, Oregon*
## *Capital Improvement Plan*

**Capital Project Summary**
FY 2009-2010

**Department:** Sewer

**Project:** Highway 43 Sewer Replacement | **Project Number:** CIP-9

**Location Map:**




**Scope of Work:** Replace existing 8" diameter with 10" diameter sewer. Project includes 1990 feet of 10" sewer, 4 manholes and 1990 feet of street repair

**Objective:** Provide additional capacity so that the sewer will meet current design conditions and sewer overflows are minimized

**Preliminary Budget**

| | Budget Number | | Funding source | |
|---|---|---|---|---|
| | Cost | Acct | Amount | Source |
| 10" PVC Sewer | 139,300.00 | | | |
| Manholes | 14,000.00 | | | |
| Street Repair | 49,750.00 | | 304,550.00 | User Charge |
| | | | | |
| Construction Contingencies (20%) | 40,600.00 | | | |
| Engineering, Legal, Administrative (25%) | 60,900.00 | | | |
| | | | | |
| Total Cost | 304,550.00 | | 304,550.00 | |

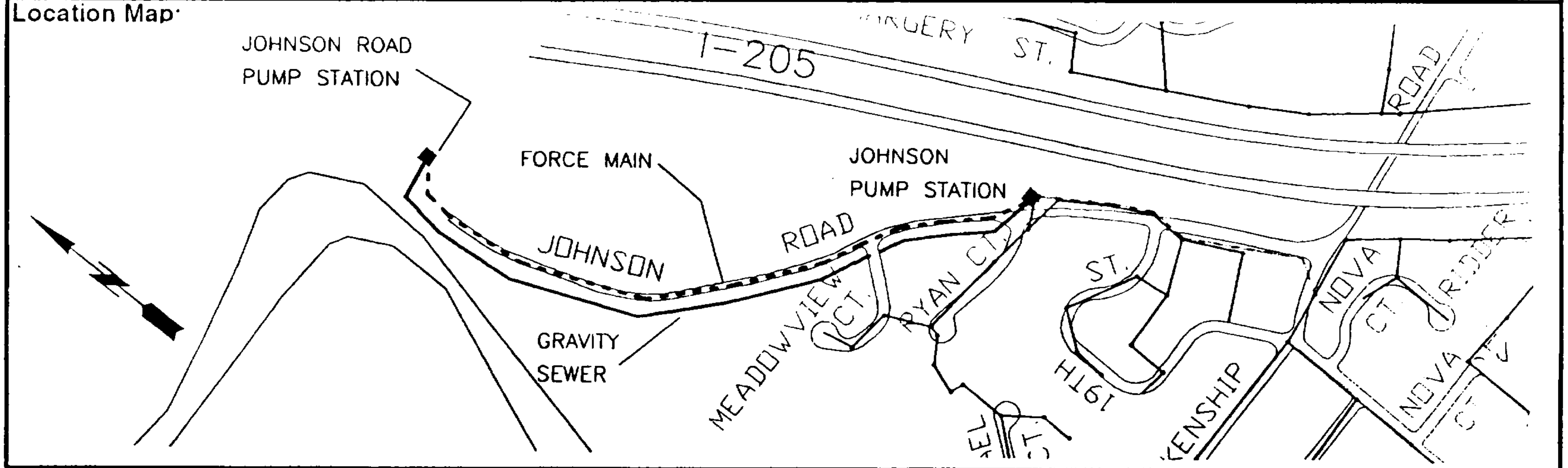
**Remarks/Status:**

## *City of West Linn, Oregon*
## *Capital Improvement Plan*

**Capital Project Summary**
FY 2010-2011

| | | |
|---|---|---|
| **Department:** | Sewer | |
| **Project:** | Johnson Road Pumping Station | **Project Number:** CIP-11 |

**Location Map:**




| | |
|---|---|
| **Scope of Work:** | Construct gravity sewer, pump station and force main - see Section 8 |
| **Objective:** | Sewer currently unsewered area |

**Preliminary Budget**

| | Budget Number | | Funding source | |
|---|---|---|---|---|
| | Cost | Acct | Amount | Source |
| | | | | |
| | | | 448,400.00 | Local Developer / SDC |
| | | | | |
| Construction plus contingencies | 358,725.00 | | | |
| | | | | |
| Engineering, Legal, Administrative (25%) | 89,675.00 | | | |
| | | | | |
| Total Cost | 448,400.00 | | 448,400.00 | |

**Remarks/Status:**

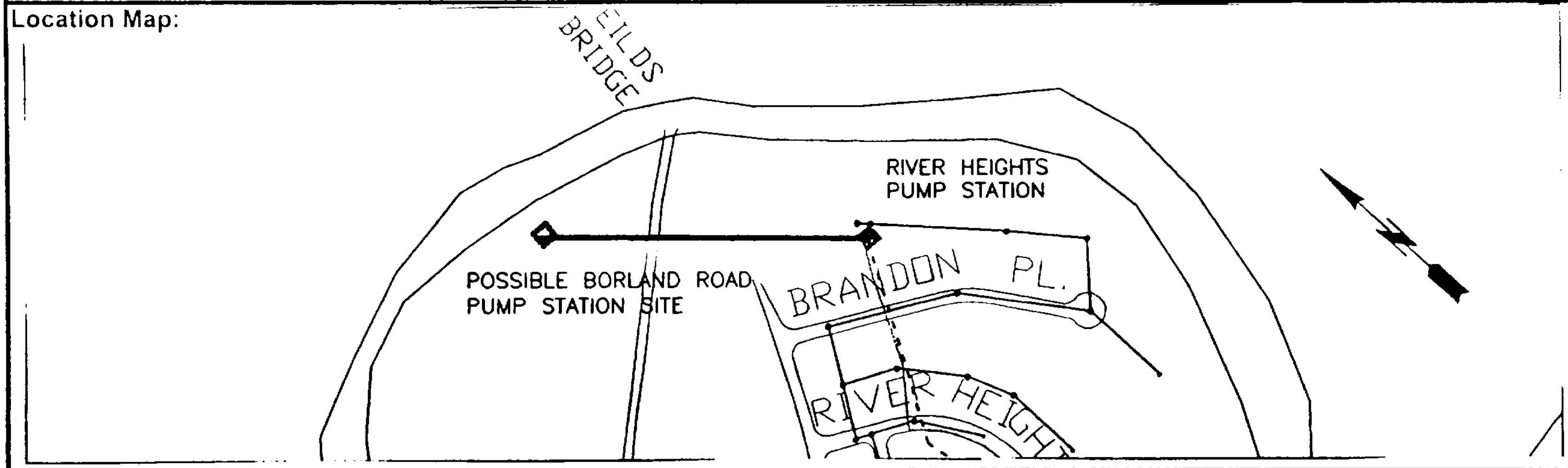
General Form; JohnPumpII

*City of West Linn, Oregon*
*Capital Improvement Plan*

**Capital Project Summary**
FY 2010-2011

| | | | |
|---|---|---|---|
| **Department:** | Sewer | | |
| **Project:** | Eliminate River Heights Pumping Station | **Project Number:** | CIP-12 |

**Location Map:**




| | |
|---|---|
| **Scope of Work:** | Eliminate River Heights Pumping Station by constructing gravity line to new Borland Road Pumping Station. Construct 700 feet of 10" sewer and 2 manholes. |
| **Objective:** | Reduce maintenance costs and operational problems. |

**Preliminary Budget**

| | Budget Number | | | Funding source | |
|---|---|---|---|---|---|
| | Cost | Acct | | Amount | Source |
| 10" PVC sewer | 49,000.00 | | | | |
| Manholes | 7,000.00 | | | 49,500.00 | User Charge |
| Abandon pump station | 10,000.00 | | | 49,500.00 | SDC |
| | | | | | |
| Construction Contingencies (20%) | 13,200.00 | | | | |
| Engineering, Legal, Administrative (25%) | 19,800.00 | | | | |
| | | | | | |
| Total Cost | 99,000.00 | | | 99,000.00 | |

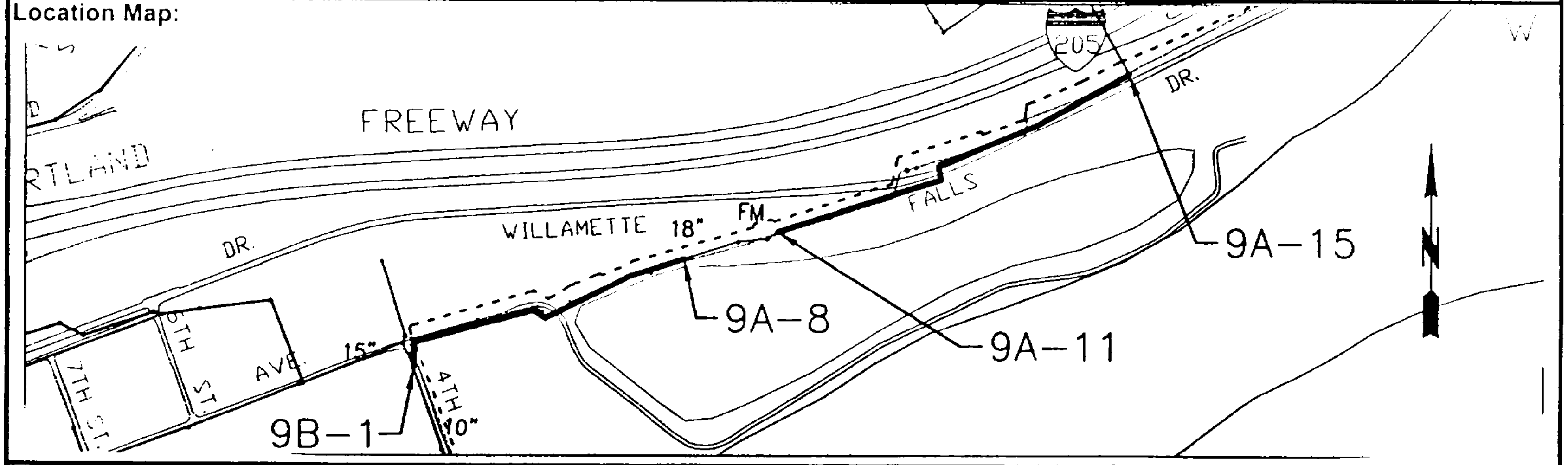
| | |
|---|---|
| **Remarks/Status:** | Borland Road Pump Station may not be required. All flow may be able to transport by gravity to existing sewer at Manhole 11A-38. |

*City of West Linn, Oregon*
*Capital Improvement Plan*

**Capital Project Summary**
FY 2011-2012

| | | | |
|---|---|---|---|
| **Department:** | Sewer | | |
| **Project:** | Willamette Falls Drive Sewer | **Project Number:** | CIP-13 |

**Location Map:**




**Scope of Work:** Replace existing 12" diameter sewer with 15" diameter sewer. Project includes 2875 feet of 15" sewer, 12 manholes and 400 feet of pavement repair.

**Objective:** Provide additional capacity so that the sewer will meet current design conditions and sewer overflows are minimized.

**Preliminary Budget**

| | Budget Number | | Funding source | |
|---|---|---|---|---|
| | Cost | Acct | Amount | Source |
| 15" PVC Sewer | 316,250.00 | | | |
| Manholes | 42,000.00 | | 100,000.00 | SDC |
| Pavement Repair | 10,000.00 | | 452,375.00 | User Charge |
| | | | | |
| Construction Contingencies (20%) | 73,650.00 | | | |
| Engineering, Legal, Administrative (25%) | 110,475.00 | | | |
| | | | | |
| Total Cost | 552,375.00 | | 552,375.00 | |

**Remarks/Status:** This sewer replacement may not be required if a connection can be made to the 18" force main adjacent to Manhole 9A-15

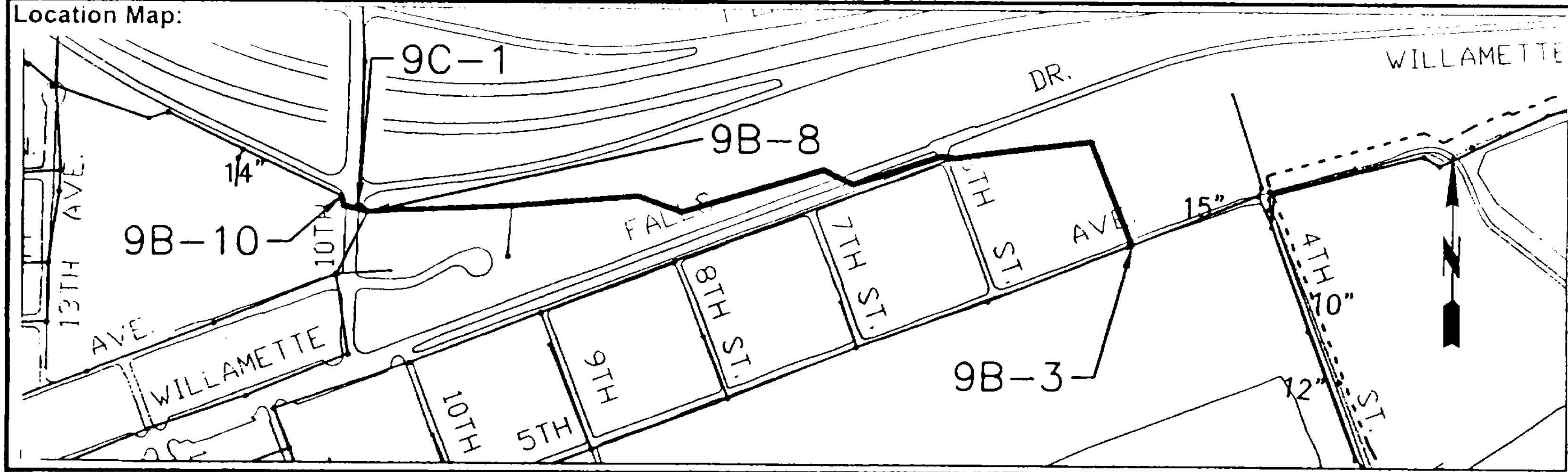
General Form; Willfall.xls

## *City of West Linn, Oregon*
## *Capital Improvement Plan*

**Capital Project Summary**
FY 2013-2014

| | | | |
|---|---|---|---|
| **Department:** | Sewer | | |
| **Project:** | Willamette Trunk | **Project Number:** | CIP-14 |

**Location Map:**




**Scope of Work:** Replace existing 15" diameter sewer with 18" diameter sewer. Project includes 2545 feet of 18" sewer and 12 manholes

**Objective:** Provide additional capacity so that the sewer will meet current design conditions and sewer overflows are minimized

**Preliminary Budget**

| | Budget Number | | | Funding source | |
|---|---|---|---|---|---|
| | Cost | Acct | | Amount | Source |
| | | | | | |
| | | | | 128,500.00 | SDC |
| 18" PVC Sewer | 343,575.00 | | | 449,850.00 | User Charge |
| Manholes | 42,000.00 | | | | |
| Construction Contingencies (20%) | 77,100.00 | | | | |
| Engineering, Legal, Administrative (25%) | 115,675.00 | | | | |
| | | | | | |
| Total Cost | 578,350.00 | | | 578,350.00 | |

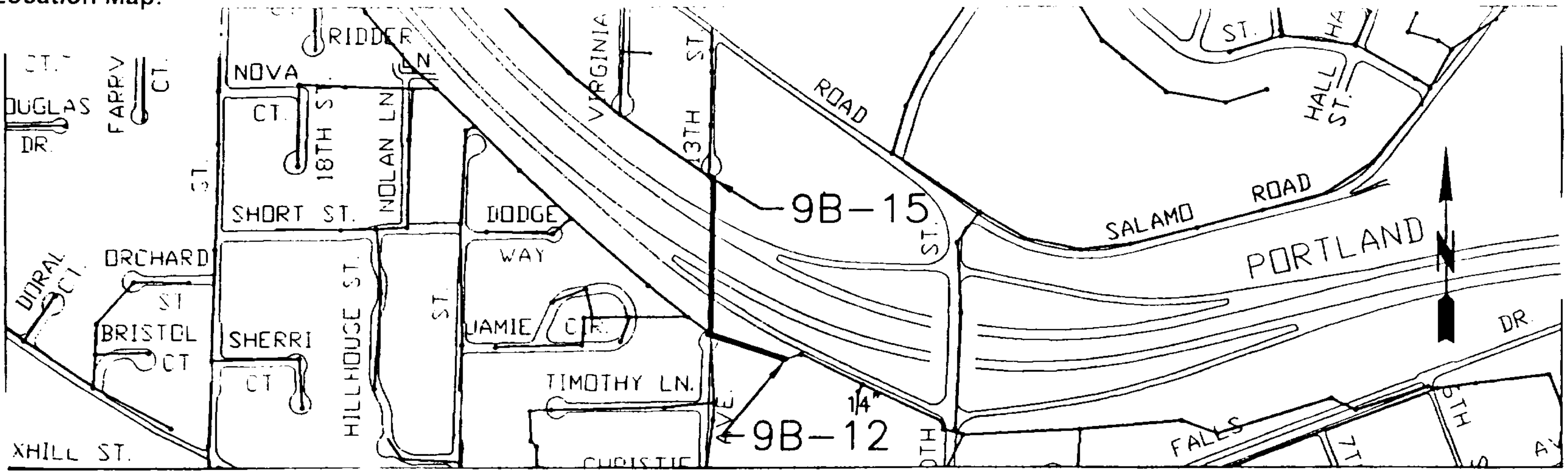
**Remarks/Status:**

# *City of West Linn, Oregon*
# *Capital Improvement Plan*

## Capital Project Summary
FY 2015-2016

| | | | |
|---|---|---|---|
| **Department:** | Sewer | | |
| **Project:** | 13th Street I-205 sewer crossing | **Project Number:** | CIP-15 |

**Location Map:**




**Scope of Work:** Install 10" diameter crossing of I-205 paralleling existing 10" diameter crossing. Project includes 605 feet of 10" diameter sewer installed by boring methods, 315 feet of 15" sewer and 2 manholes.

**Objective:** Provide additional capacity so that the sewer will meet future design conditions and sewer overflows are minimized

### Preliminary Budget

| | Budget Number | | | Funding source | |
|---|---|---|---|---|---|
| | Cost | Acct | | Amount | Source |
| 10" (in 20" casing) Bore | 151,250.00 | | | | |
| 15" PVC Sewer | 34,650.00 | | | 200,000.00 | SDC |
| Manholes | 7,000.00 | | | 89,350.00 | User Charge |
| Construction Contingencies (20%) | 38,600.00 | | | | |
| Engineering, Legal, Administrative (25%) | 57,850.00 | | | | |
| | | | | | |
| Total Cost | 289,350.00 | | | 289,350.00 | |

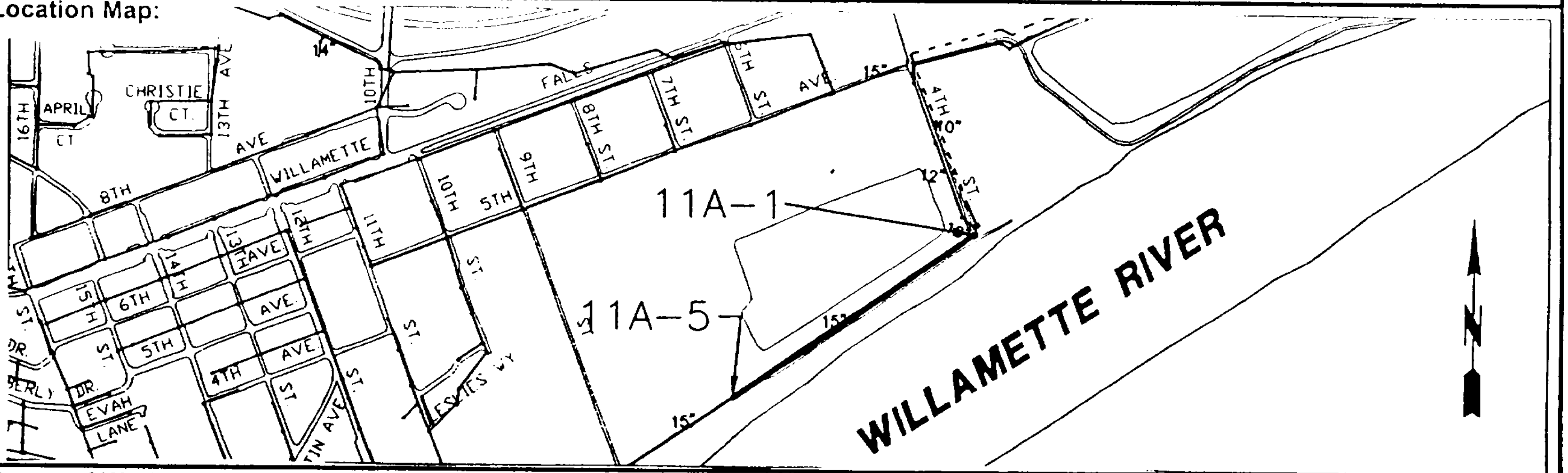
**Remarks/Status:** 10" Highway Crossing Required due to future development

## *City of West Linn, Oregon*
## *Capital Improvement Plan*

**Capital Project Summary**
**FY 2017-2018**

| | | | |
|---|---|---|---|
| **Department:** | Sewer | | |
| **Project:** | Volpp Street | **Project Number:** | CIP-16 |

**Location Map:**




**Scope of Work:** Replace existing 15" Diameter sewer with 18" diameter sewer.
Project includes 1610 feet of 18" sewer and 5 manholes

**Objective:** Provide additional capacity so that the sewer will meet current design conditions and sewer overflows are minimized.

**Preliminary Budget**

| | Budget Number | | | Funding source | |
|---|---|---|---|---|---|
| | Cost | Acct | | Amount | Source |
| 18" PVC Sewer | 217,350.00 | | | 352,350.00 | User Charge |
| Manholes | 17,500.00 | | | | |
| Construction Contingencies (20%) | 47,000.00 | | | | |
| Engineering, Legal, Administrative (25%) | 70,500.00 | | | | |
| | | | | | |
| Total Cost | 352,350.00 | | | 352,350.00 | |

**Remarks/Status:**

General Form; VolppSt.xls