MWMC Eugene-Springfield WPCF Facility Plan—Wet Weather Peak Flow Analysis

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Project File – Task 3.2

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Summary

This memorandum presents the estimated dry and wet weather peak flows for the planning period (for the year 2025 and for buildout), and presents the collection system and Eugene-Springfield Water Pollution Control Facility (E-S WPCF) influent pumping needs through the year 2025. Collection system modeling was conducted by updating the MWMC MOUSE hydraulic model to provide an estimate of wet weather peak hour flows to be used in the current planning effort. The most significant tasks in the modeling process were:

1. The conversion of the wet weather flow estimating method from a spreadsheet-based regression analysis to the new rainfall-derived infiltration and inflow (RDII) modeling module that is a part of the MOUSE model;
2. Calibration of the model based on more recent system flow monitoring data; and
3. The use of a new planning time frame not addressed in the WWFMP.

The current planning effort has a 20-year horizon and has been defined as the year 2025. The 2000 Wet Weather Flow Management Plan (WWFMP) did not explicitly evaluate peak flows for 2025. Current modeling efforts were also undertaken to assess, with the limited additional flow monitoring data (from six permanent monitoring locations), the effectiveness of ongoing I/I reduction efforts. In addition, the current modeling effort has incorporated system network configuration modifications such as physical upgrades to pump stations and/or pipelines.

This recent modeling effort indicated wet weather peak hour flows generated in the collection system to be comparable to those projected in the 2000 WWFMP after a flow adjustment factor was applied to the model input. The peak flow rate for existing conditions was estimated to be 265 mgd.

Similar to the data developed in 2000 (and documented in Section 4.2.5.2 of the WWFMP), a flow adjustment process was applied that typically reduced the peak model flows for the 5-year design event. This WWFMP process resulted from discussions with Eugene-Springfield staff and observation of trends in the volume of infiltration that enters the collection system for a given amount of rainfall (identified as the return ratio) based on WWFMP monitoring data. Ingress of I/I into a sewer system generally does not increase linearly with increasing rainfall and the rate of increase is highly variable across the sewer system. Without benefit of data across the range of rainfall events to be simulated, predicting the "tail-off" in I/I increase with increasing rainfall (often an exponential decay function) is a matter of engineering judgment.

The best current estimate of 2025 wet weather peak hour flow is 277 mgd and incorporates the application of WWFMP-derived adjustments to the current model flow estimates. Applying similar adjustments to those made in the WWFMP resulted in an aggregate 16 percent reduction in 5-year peak flows. This factor reduces the year 2025 modeled peak flow rate of 330 mgd to 277 mgd. The buildout flow rate of 350 mgd becomes 294 mgd. Based on these values and the 290 mgd peak flow rate for buildout predicted in the WWFMP, the peak flow in 2025 (based on the 5-year, 24-hour storm) that MWMC will control and manage to is 277 mgd.

In accordance with DEQ guidelines, the 10-year summer and the 5-year winter rainfall events were compared to determine which storm produced the defining (worst case) flow condition in the wastewater collection system. The 10-year summer rainfall event is typically of shorter sustained duration and higher intensity compared to the 5-year winter event. The 10-year, 24-hour storm event produced an unadjusted peak flow of 181 mgd for the 2025 condition, far less than the 277 mgd for the 5-year event. Therefore, the 5-year rainfall event was used as the design rainfall event.

To fully complete this effort using the WWFMP approach requires the use of additional existing and future flow monitoring data at more locations than the six permanent monitors used in the current analysis. A longer period of record at the monitoring locations is also desirable. This expanded analysis and an additional flow monitoring effort is recommended as a future action item for the refinement of modeled flows and assessment of improvements required in the collection system. It is recommended that temporary monitors be installed or relocated to selected locations within the collection system so that the I/I adjustments can continue to be refined.

If additional flow monitoring data becomes available, and if a more complete application of the WWFMP flow adjustments is conducted, it is possible that the peak for 2025 will be confirmed with a greater level of certainty.

Each of the pump stations (both MWMC and locally owned) that convey flow to the E-S WPCF via the Willakenzie and West Eugene pump station/force main systems were evaluated to define expected flows and required improvements to meet the year 2025 flow conditions. The analysis was focussed mainly on the MWMC-owned and operated Willakenzie pump station and E-S WPCF screw pumps. Analysis of the remaining non-MWMC pump stations was performed to provide additional guidance to the cities of Eugene and Springfield for their own individual planning efforts. It was assumed that all units were in service during the peak of the design storm (5-year, 24-hour wet season storm). Table 1 summarizes the results of the pump station evaluation.

TABLE 1
Pump Station Evaluation Summary Data
MWMC Facility Plan, Eugene-Springfield

Pump Station	Existing Firm/All Unit Capacity (mgd)	Recommended Capacity (mgd)	Proposed Improvement	Responsible Entity
Willakenzie	70.0/80.0	127.5	Install additional pump station with four new 10 mgd pumps; install new force main connections.	MWMC
Division Street	0.7/1.4	2.0	Upgrade pumps for higher head conditions at force main connection point.	Eugene
Skipper	3.0/8.0[(a)]	10.5	Upgrade pumps for higher head conditions at force main connection point; install additional pump to meet redundancy requirements.	Eugene
Greenwich	1.0/1.5	3.0	Upgrade pumps for higher head conditions at force main connection point.	Eugene
Irvington	7.2/13.5	15.0	Upgrade pumps for higher head conditions at force main connection point; install one additional pump.	Eugene[b]
West Irwin	18.0/21.0	28.5	Upgrade pumps for higher head conditions at force main connection point.	MWMC[c]
Terry Street	10.0/14.0	28.0	Upgrade pumps for higher head conditions at force main connection point; install additional pump to meet redundancy requirements.	MWMC[c]
Fillmore	34.0/44.5	44.7	Install additional pump to meet redundancy requirements.	MWMC[c]
Barger-Greenhill	3.7/7.5	32.0	Install phase 2 and phase 3 pumps in existing pump station; install new 24-inch force main.	Eugene
E-S WPCF Screw Pumps	63.0/84.0	99.0	Install one additional screw pump.	MWMC

(a) Review of existing and available data shows varying values for maximum pumping capacity, from 6 to 8 MGD. Modeling efforts used the value of 8 MGD.

(b) There is a possibility that the responsible entity for Irvington will change from Eugene to MWMC; if that change occurs the costs to upgrade to that pump station will have to be added to MWMC's 20-year project list.

(c) The responsible entity is expected to change from MWMC to Eugene, and therefore cost estimates these improvements have not been included in the MWMC Facilities Plan.

Preliminary cost estimates for recommended improvements to Willakenzie and E-S WPCF Screw pump stations are presented given in Attachment C. Cost estimates were limited to pump stations for which MWMC is the responsible entity.

Introduction

This technical memorandum has been prepared as part of the MWMC Facility Plan Update (MWMC Project No. 80010) and describes the development and modeling of peak wet weather flows in the wastewater collection system based on recent flow monitoring data collected by MWMC. A new approach, described below, was used to develop both dry and wet season flow inputs to the MWMC MOUSE wastewater collection system model. The model was used to support the evaluation of flow management alternatives and analyze MWMC pump station and force main capacities. Proposed improvements to collection system pump stations as well as which entity (MWMC, Eugene, or Springfield) should take the lead in implementing the improvements were then identified.

Model Set-Up

As part of the task of updating the MWMC MOUSE hydraulic model, the model was recalibrated using the latest flow monitor data from six permanent MGD Technologies monitor installations (herein referred to as MGD monitors) within the collection system and one at the E-S WPCF. Changes to the collection system pipes and pump stations were also incorporated into the updated model. The methodologies used to generate model flow inputs were different than those used for the WWFMP, although the relative distribution of flows within the collection system was consistent with the WWFMP.

The MOUSE dry weather flow module was used to create the diurnal sanitary flow based on population, and the MOUSE RDII module was used to generate system RDII flows from rainfall. This change in methodology allowed all of the flow inputs to be generated within MOUSE rather than as separate computations external to the MOUSE model. The other significant update was the use of individual pump curves (flow versus total dynamic head) to model each of the pump stations.

The dry weather flow diurnal patterns are derived directly from the six MGD monitors and the E-S WPCF meter. These patterns are multiplied by a dry weather flow rate and population equivalent from each of the 184 runoff catchments. The population equivalents and base flow rates were taken directly from *Technical Memorandum No. 3, Flow and Load Projections*, and include inputs from commercial and industrial areas.

Six RDII parameter sets were used in the model, one for each MGD monitor. Each RDII parameter set is associated with a runoff catchment. There are 184 runoff catchments in the model. The model RDII parameters are primarily calibration parameters for developing inflows to the collection system. Since the RDII model is a lumped parameter model (the parameters represent average values for the entire catchment), development of RDII parameter sets based on smaller areas (than the six MGD monitor basins), or areas with more uniform soil and RDII conditions would have value as part of a future analysis.

The pump stations were modeled using information from the June 1996 Eugene-Springfield Area Wastewater Pumping Stations Overview document, additional information transmitted from Larry Pederson for the Willakenzie pump station (dated July 1998), and various discussions with City of Eugene staff including Mike Shields, Gale Mills, and Rich Heil. The pump stations were modeled using the total dynamic head versus flow curve for each pump. This method creates a more accurate representation of actual pump station operation than previous modeling efforts.

Model Calibration

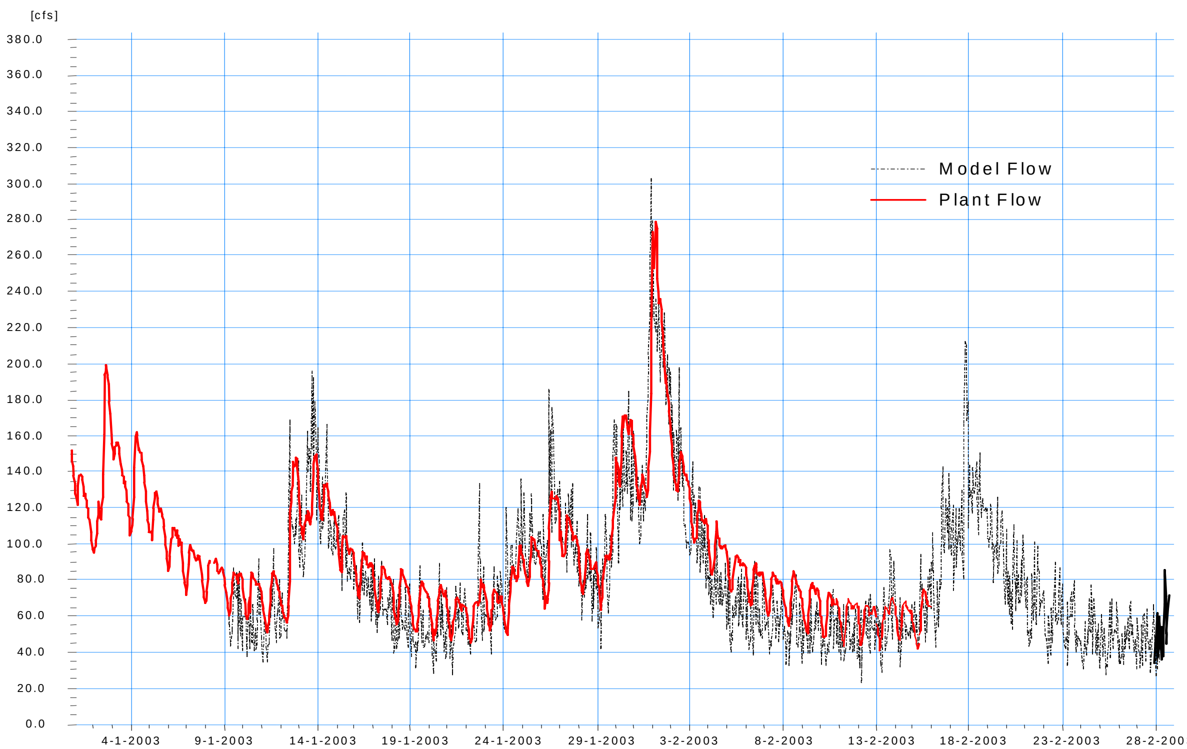
Calibration was performed for both dry season and wet season RDII flows. Dry weather flows were calibrated by modifying the dry weather flow rates for each of the 184 model catchments and comparing the resulting flows to actual measured summer flows (August 20, 2002 to September 17, 2002). Wet season RDII was calibrated by introducing a rainfall time series into the model and modifying RDII parameters (for slow and fast response RDII components) for the six MGD flow monitor basin areas. The RDII parameters were adjusted to achieve agreement between model and monitor flows during a wet season period (January 1, 2003 to February 28, 2003).

During the calibration process it was found that calibrating the model flows to the six collection system monitors resulted in model flow predictions at the E-S WPCF that were higher than the monitor data at the treatment plant. It is advisable to collect additional flow monitoring data during the upcoming wet season, and to locate (or relocate) temporary monitors where they might provide a check on the treatment plant and permanent (MGD) monitors. It was decided to calibrate the model primarily to E-S WPCF data and use the collection system monitors to set RDII module parameters relative to one another. This resulted in lower model flows predicted at some of the six monitor locations than was actually measured, some by more than 20 percent. The apparent flow measurement discrepancy warrants further investigation, and additional flow monitoring, so that the overall model calibration can be improved. MWMC has an ongoing flow monitoring program, and will continue to update and improve the collection system model calibration as additional flow data become available. Improvement of the model calibration could potentially change the peak design flows within the collection system and at the E-S WPCF. However, it should be noted that a system-wide calibration of the hydraulic model was also performed as part of the WWFMP, and the current calibration maintains the same distribution of collection system flows.

A calibration plot for flows at the plant is shown in Figure 1. Once the RDII parameters were calibrated to give accurate flows at the treatment plant the model could be used to generate collection system flows resulting from any rainfall event, and then route those flows through the collection system to the treatment plant.

The model runs performed do not limit the hydraulic grade line (HGL) elevation to below the ground surface. As a result the model may be predicting greater than actual flow rates in some pipelines. This is due to above ground surcharge in the conveyance system resulting in a hydraulic head and resulting HGL levels and slopes that are greater than are physically possible. However, this modeling approach does not result in flow exiting the system and therefore is a good estimate of the peak flows that are produced in the basins. As future modeling analyses are performed the HGL elevations must continue to be monitored.

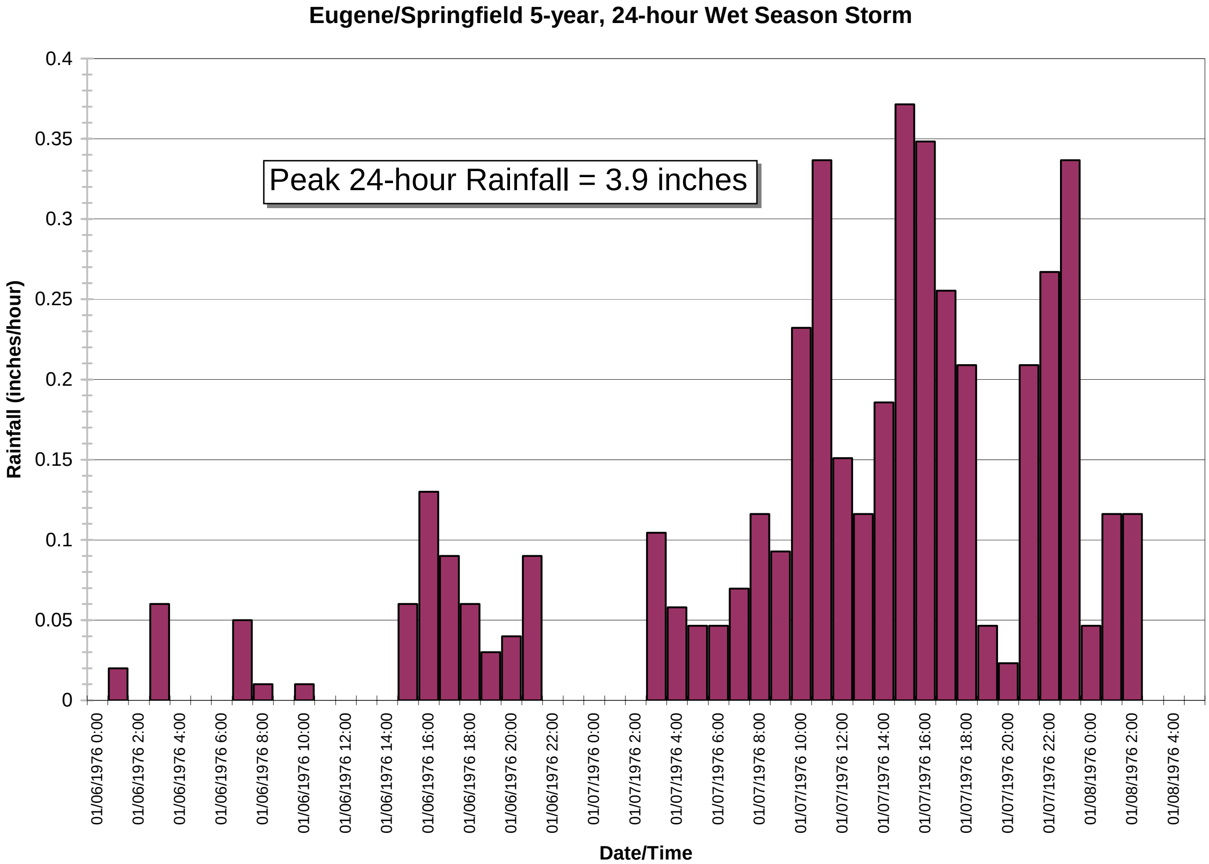
FIGURE 1
Actual vs. Predicted Flows at the E-S WPCF
MWMC Facility Plan, Eugene-Springfield



Design Storm Selection

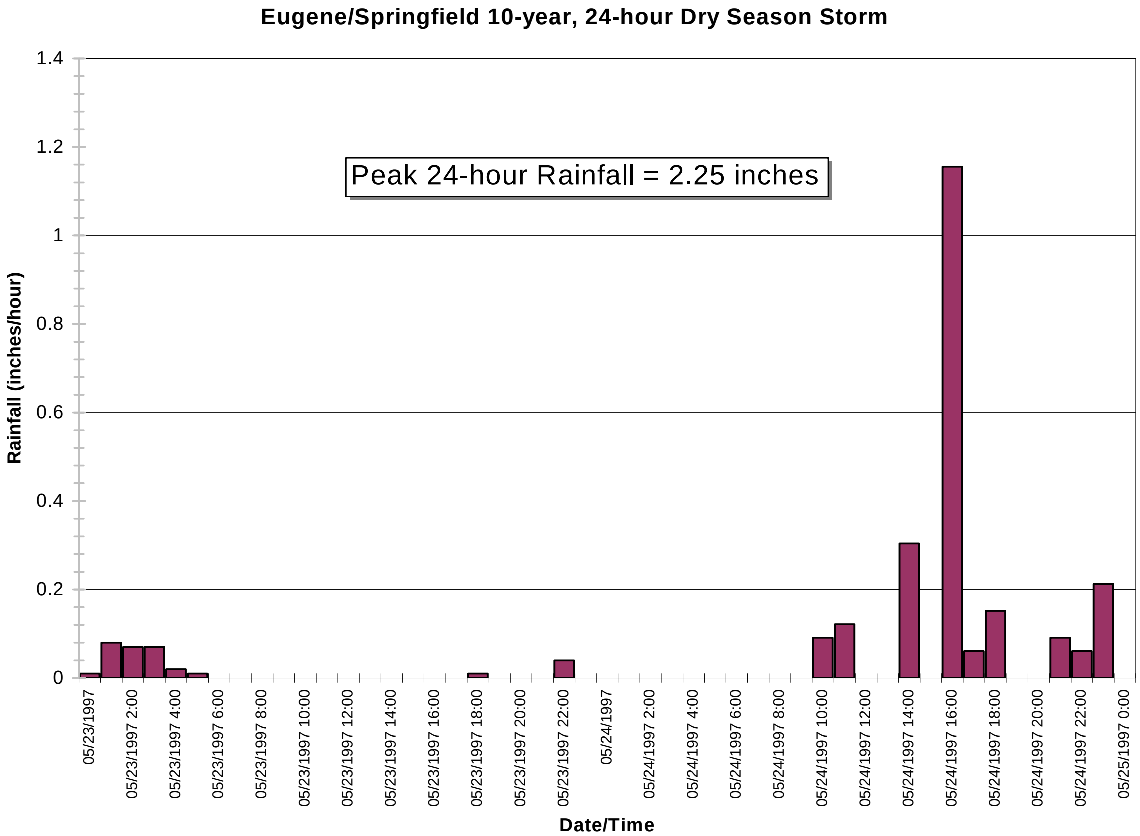
The Oregon Department of Environmental Quality (DEQ) requires that sanitary sewer overflows (SSOs) for the design storm event be eliminated by January 1, 2010. In accordance with DEQ guidelines, collection system flows resulting from the 10-year summer and the 5-year winter rainfall events were compared to determine the defining (or worst) design storm condition. DEQ requires that SSOs for the design storm event be eliminated by January 1, 2010. The 5-year storm results in 3.9 inches in 24 hours (NOAA Precipitation Frequency Atlas for Oregon, 1973) and the 10-year is 2.25 inches in 24 hours. However, because the timing of the rainfall during the 24-hour period is different than the 5-year winter storm the hydraulic model was run to compare peak flows. The 5-year wet season rainfall distribution is shown in Figure 2.

FIGURE 2
5-Year, 24-Hour Wet Season Rainfall Distribution
MWMC Facility Plan, Eugene-Springfield



The 10-year, 24-hour storm event produced an unadjusted peak flow of 181 mgd for the 2025 condition, far less than the 277 mgd for the 5-year event. The 10-year dry season rainfall distribution is shown in Figure 3.

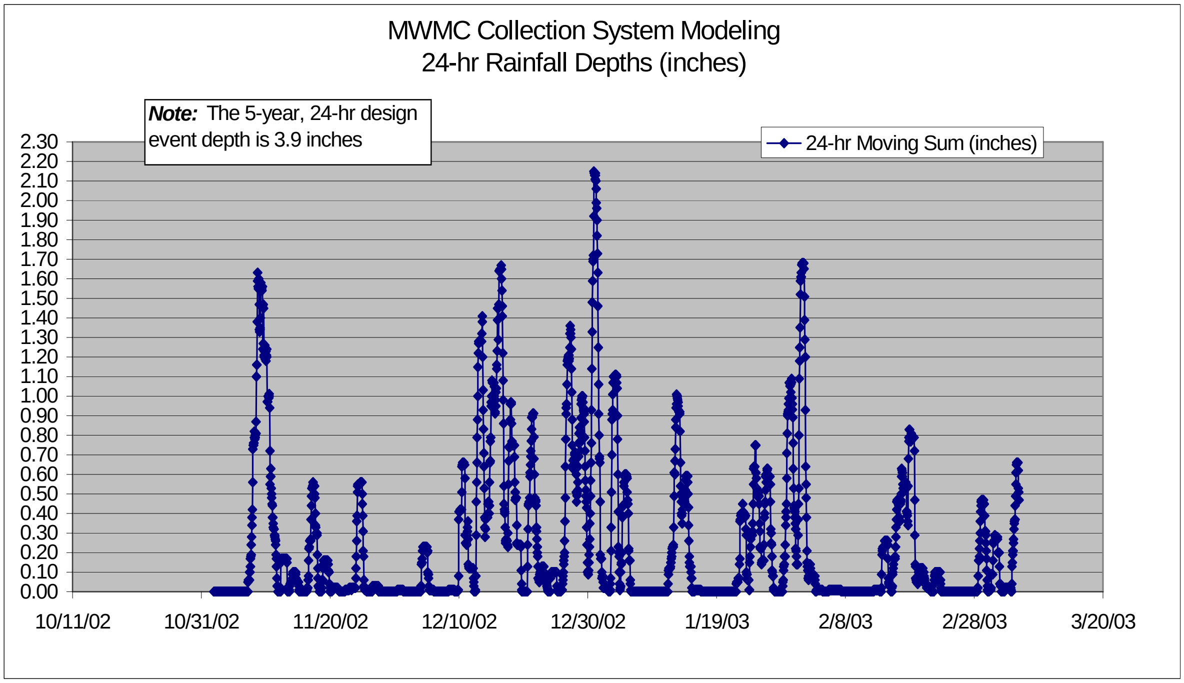
FIGURE 3
10-Year, 24-Hour Dry Season Rainfall Distribution
MWMC Facility Plan, Eugene-Springfield



Existing Conditions

Given that the model is well calibrated to the monitor data at the E-S WPCF, and the pump stations are simulated correctly throughout their operating ranges, the remaining variable is rainfall. The current model, now updated to reflect the 2003 collection system, was therefore calibrated using rainfall and flow data from the same time period. Rainfall data for the 2002/2003 wet weather period are presented in Figure 4. The maximum rainfall depth used in the model calibration was slightly more than 2 inches in 24 hours, and did not reach the 5-year, 24-hour design storm depth of 3.9 inches. Therefore, it was necessary to extrapolate to estimate a collection system flow response for the 3.9-inch rainfall design storm depth.

FIGURE 4
Rainfall Data from the 33rd and Donald Rain Gauge During the 2002/2003 Wet Weather Period
MWMC Facility Plan, Eugene-Springfield



For the WWFMP study, flow inputs were developed from regression equations, and were modified to reflect the experience of MWMC operations personnel and the observations of return ratio at monitor locations. This same process was not conducted for the current 2003 model update due to a lack of subbasin flow monitoring. So even though the existing conditions model for both the 2000 WWFMP and the current updated MOUSE model are calibrated, they will respond differently in the amount of flow they generate for the 5-year, 24-hour storm event.

Future Conditions

Assumptions for system rehabilitation identified under the WWFMP were incorporated in the future conditions model runs. The magnitude of RDII response for new development was estimated through a review of existing sewershed areas that represent fairly new and consistent construction. The WWFMP used a peak rainfall dependent infiltration and inflow (RDII) rate of 2,000 gallons per additional future developed acre per day (gpad) for the 5-year storm event. This value was obtained from an analysis of four historical storm events in 1998. Standard unit peak RDII rates used by other agencies in the Willamette Valley, and the measured RDII response at monitors F20 and F21, which drain the Santa Clara/River Road areas, were reviewed. Other Willamette Valley agencies are using values ranging from 1,000 to 3,500 gpad. F20 has a peak rate of less than 1,000 gpad for the 5-year storm event, and F21 has peak rate of 1,400 gpad. These basins drain areas with relatively new and uniform construction techniques. However, because they are only 5 to 10 years old and increased I/I may occur over time, a rate of 2,000 gpad was recommended as the value to use in the model for future undeveloped areas.

The updated MOUSE model also uses the 2,000 gallons per acre per day peak RDII rate for all future developed areas.

System rehabilitation recommendations included in the WWFMP for existing and future conditions were assumed to have been implemented for the 2025 peak flow estimates. These rehabilitation projects were included in the plan as a result of the cost effectiveness analysis that identified projects to reduce peak flows in the collection system.

Overview of Wet Weather Peak Flow Adjustments

Modeled flows have been calibrated to conditions observed in early 2003. During this period rainfall depths reached a maximum of slightly more than 2 inches in 24 hours, while the 5-year, 24-hour design storm depth is 3.9 inches. Without additional monitoring data the calibrated model likely over predicts flows for larger rainfall events. This typically results from observations that the capacity for the system to accept rainfall derived infiltration is not constant, and the rate of RDII into the pipe eventually decreases as the various flow paths are more fully utilized. That is, the rate at which RDII enters the system through the pipe defects (cracks, root intrusion, lateral connections, etc.) is greater during the earlier periods of the storm relative to the later stages, particularly for the larger storm events, such as the 5-year design storm. Therefore, an adjustment was made to the peak flow for the design event because no attenuation of peak I/I flows into the collection system is accounted for as the rainfall depth increases. The flow adjustment methodology is identical to that used for the WWFMP.

Adjustment Process

The first step of the WWFMP wet weather flow generation process was to develop multiple-linear regression equations to replicate wet weather hydrographs at each metering location. These regression equations were then calibrated and validated to monitored data. The calibration resulted in a set of *Base Regression Equations*.

Separate from the calibration exercise a return ratio (or R-Factor relationship) was calculated for each storm in the monitored data set (at each monitoring location). A return ratio is simply the volume, or peak flow rate, of RDII as a percentage of rainfall. R-Factor scatter plots were produced (see Appendix A of the WWFMP) and two trend lines were developed to describe the envelope of possible flow volumes that could occur for a given rainfall volume. The trend lines were in some cases linear and in others curvilinear. The upper envelope trend line was characterized as the HIGH trend line and the lower envelope bound the LOW trend.

The Base Regression Equations were adjusted to represent the HIGH and LOW trend lines. This was accomplished by adjusting regression equation coefficients until the regression-derived scatter points on the return ratio plot fell in line with the HIGH and LOW trend lines, respectively. These adjusted regression equations were called *Calibration Adjusted Regression Equations*.

The calibration adjusted regression equations were used to develop wet weather flow inputs for the design rainfall series. For each rainfall series used in the model, a decision was first made as to which set of equations were to be used, HIGH or LOW. Generally, all analyses in WWFMP used the HIGH trend (note the use of the term "5-year HIGH" throughout the WWFMP to denote the design flow event). The final step was to manually adjust the calibration adjusted regression equations so that the return ratio estimate of flow volume for the 3.9-inch design rainfall depth coincided precisely with the trend line. This was accomplished by adjusting regression equation coefficients until the desired result was realized. The percent adjustment varied at different monitoring locations.

For the current facility planning project, the WWFMP monitor locations that most closely coincide with the current monitor locations were identified. At these locations the percent reduction in the flow for the design storm was determined. The flow weighted average adjustment for meters that represent contributions from most of the major system branches was approximately a 16 percent reduction. Table 2 summarizes the information used to calculate the flow reduction percentage.

TABLE 2
Flow Reduction Summary Data
MWMC Facility Plan, Eugene-Springfield

	Peak 5-yr Flow Estimates			
Flow Meter ID	**5-yr WWFMP Calibration Equation (MG)**	**5-yr WWFMP Calibration RDII Equation Adjusted to HIGH trend line (MG)**	**Reduction %**	**Volume Reduction (MG)**
F10	79.0	72.0	8.9	7.0
F12	17.5	16.5	5.7	1.0
F14	26.0	23.5	9.6	2.5
F21	1.2	0.7	42.0	0.5
F22	140.0	109.0	22.1	31.0
Totals	**263.7**	**221.7**	**16.0**[a]	**42.0**

[a] Weighted average of meters with data/trend analysis and no upstream meters in series to be applied to current model results = 42.0 / 263.7 = **16 percent**

Discussion of Results

The modeling results are summarized in Table 3. After reviewing these results the consultant team recommended that a 2025 wet weather peak hour flow of 277 mgd be used for initial planning alternative evaluation. A description of each of the modeled scenarios that produced the results in Table 3 is included as Attachment A.

TABLE 3
MWMC Peak Flow Summary
MWMC Facility Plan, Eugene-Springfield

	WWFMP Year of Analysis: 2000		MWMC P80010 Year of Analysis: 2003					
			Existing		2025		Buildout	
	Existing	Buildout	Initial Peak	Adjusted Peak	Initial Peak	Adjusted Peak	Initial Peak	Adjusted Peak
Peak Hour without I/I Reduction (mgd)	264	340	315	265	350	294	370	311
Peak Hour with I/I Reduction (mgd)	257	290	NA	--	330	277	350	294

The buildout model run resulting in a peak flow of 294 mgd at the E-S WPCF was used to evaluate pump station and force main capacities.

Pump Station and Force Main Evaluation

Inflows to the E-S WPCF consist of three (3) components. The first is the West Bank Interceptor (WBI), a 72-inch diameter gravity pipeline (herein called the Gravity System). This component is capable of delivering a flow of 100 mgd to the screw pumps at the E-S WPCF. The second component is a pump station/force main system from the east side of the Willamette River (East Side Pump Station System). This system consists of the Willakenzie pump station and force mains. The final inflow component is a system of pump stations and force mains conveying flows to the E-S WPCF from the west (West Eugene Pump Stations System).

General criteria for the evaluation of collection system/influent pumping requirements for the MWMC facilities come directly from DEQ guidelines. Pump station capacity is defined as follows:

Firm Capacity – Convey the wet weather peak hour flow with the largest pump out of service.

Each of the pump stations (both MWMC and locally owned) that convey flow to the E-S WPCF via the above mentioned pump station/force main systems (East Side Pump Station System and West Eugene Pump Stations System) were evaluated to define expected flows and required improvements to meet the year 2025 flow conditions. Table 4 provides a summary of this evaluation.

TABLE 4
Pumping Capacity Evaluation Summary
MWMC Facility Plan, Eugene-Springfield

	Design Flow Rates (mgd)		Proposed Pump Station Improvements	
Pump Station	**Proposed Design Capacity Max. Day Flow**	**Proposed Design Capacity Peak Hour Flow**	**Proposed Pump Station Improvements for Year 2025 flows**	**Proposed Combined Station Capacity w/largest Pump off (MD)**
Willakenzie				
			Expand Existing Pump Station	
			add new wet pit/dry pit to side of	
			pump station, install new FM	
			connections to existing FM's	
			Note: Additive to Existing PS	
	107	**127**		**127**[6]
Division Street				
			Upgrade both pumps for higher head	
			(See note 4)	
	1	**1.5**		**2**
Skipper				
			Upgrade both pumps to have a	
			higher head and flow rate - add a	
			third pump for redundancy	
	7	**8**		**10.5**
Greenwich				
			Upgrade both pumps for higher head	
			(See note 4)	
	1.5	**2**		**3**
Irvington				
			Upgrade all Pumps with a higher	
			head pump	
	9	**13**		**15**
West Irwin				
			Upgrade all Pumps with a higher	
			head pump	
	16	**21**		**28.5**
Terry Street				
			Upgrade the pumps to have a	
			higher head and flow rate - add one	
			new pump to meet redundancy	
			requiremtents	
	17	**23.8**		**28**
Fillmore				
	41.9	**44**	Add one new pump to meet	
			redundancy requiremtents	
				44
Barger				
			Install Phase 2 and 3 pumps into	
			existing pump station - Install new	
			24-inch FM, length = 7350 feet	
	24	**29**		**32**
WWTP Screw Pumps				
			Install one additional screw Pump	
			Parallel with the Existing ones	
	84	**99**		**99**[6]
Summary of flows	**308.4**	**368.3**		**390**

Notes:

1. Field measured flow from MWMC.
2. Capacity with all pumps running is reduced from the additive capacity, due to increased head losses in the pipeline.
3. All flows shown are non-routed. Routing of flows will reduce the total inflow at the WWTP to approximately 277 MGD.
4. Hydraulic grade line has increased at connection point due to increased flow in force mains.
5. Design capacities of individual pump stations are not additive, since some pump stations discharge to others downstream.
6. The intent is to comply with DEQ redundancy requirements (to pump the peak hour flow with one unit out of service). Alternatives for expanding the capacity of the Screw Pumps/Willakenzie systems are being evaluated as part of follow-on work to this Facility Plan. When the final selected alternative for expanding these pumping systems is determined the approach to attain DEQ required redundancy will also be finalized. Currently, the improvements to these individual pump stations do not include a redundant pump at peak hour. It is expected that redundancy can be attained with these pump stations looked at as a system rather than individually.

West Bank Gravity System and E-S WPCF Screw Pumps

The existing 72-inch WBI gravity sewer conveys up to 100 mgd to the E-S WPCF directly to the existing screw pumps. Flows are controlled by the upstream gravity conveyance system and the Fillmore pump station. At the E-S WPCF, four existing screw pumps lift the flow into a common channel that flows into the influent screens and aerated grit removal process. These existing screw pumps have a capacity of 21 mgd per pump, or 63 mgd with one pump out of service. The capacity is 84 mgd with all of the screw pumps running.

Improvements to the Gravity System include an additional screw pump to be constructed alongside of the existing facility. This additional pump would bring the total capacity up to the 100 mgd gravity capacity of the influent 72-inch sewer line. The screw pump station structure would have to be expanded to accommodate this fifth pump. Table 5 shows the recommended pump station improvements. A preliminary cost estimate is presented in Attachment C. Control features are also recommended at the Fillmore pump station to control overflows. Presently overflows are controlled by manual gates that divert flow to the interceptor or the Willamette River. An adjustable gate or weir, linked by programmable logic controller (PLC) to the screw pumps at the E-S WPCF could reduce the number and volume of overflows by maximizing the flow in the interceptor to match the screw pump capacity.

TABLE 5
E-S WPCF Pumping Capacity Evaluation Summary
MWMC Facility Plan, Eugene-Springfield

	Design Flow Rates (mgd)		Proposed Pump Station Improvements	
Pump Station	**Proposed Design Capacity Max. Day Flow**	**Proposed Design Capacity Peak Hour Flow**	**Proposed Pump Station Improvements for Year 2025 flows**	**Proposed Combined Peak Hour Station Capacity w/largest Pump Off (mgd)**
WWTP Screw Pumps				
			Install one additional screw Pump	
			Parallel with the Existing ones	
	84	**99**		**99**
Summary of flows	**266.5**	**324.3**		**346**

East Side Pump Station and Force Main System

The East Side pump station and force main system consists of the Willakenzie pump station and force main under the Willamette River. The existing Willakenzie pump station consists of two pump stations linked together to convey wastewater flows from the 78-inch East Bank Interceptor, the influent gravity sewer. Improvements needed for conveyance of the year 2025 5-year, 24-hour flow for year 2025 land use and population to the E-S WPCF include the following items:

1. Installation of 55 mgd of additional capacity at the pump station to bring the total Willakenzie pump station capacity to 127.5 mgd. This would be accomplished by adding a third pump station west of the existing stations with connections to the wet well and discharge header. A new pump station is required due to space limitations in the existing pump stations. A comparison of existing pump station capacity, the required future flow rates and the resulting improvements are included in Table 6.
2. Automation of the intertie gates to provide automatic and/or remote control.
3. Replacement of several gate actuators.

TABLE 6
Willakenzie System Pumping Capacity Evaluation
MWMC Facility Plan, Eugene-Springfield

Pump Station	Proposed Design Capacity Max. Day Flow	Proposed Design Capacity Peak Hour Flow	Proposed Pump Station Improvements for Year 2025 flows	Proposed Combined Peak Hour Station Capacity w/largest Pump Off (mgd)
Willakenzie				
			Expand Existing Pump Station	
			add new wet pit/dry pit to side of	
			pump station, install new FM	
			connections to existing FM's	
			Note: Additive to Existing PS	
	107	**127**		**127.5**

West Eugene Pump Station and Force Main System

The West Eugene pump station system consists of seven pump stations connected by a series of parallel force mains. Force main sizes range from 14-inches to 48-inches in diameter, running generally west to east from the Barger-Greenhill pump station to the E-S WPCF. Flows from the west will increase from approximately 60 mgd to 100 mgd by the year 2025. This increase in flow rate results in a corresponding increase in head loss through the existing force mains. Table 7 shows the pumping improvements needed to convey the total 100 mgd flow rate to the E-S WPCF. All of the pump stations connecting to the force mains have been included in this evaluation without respect to ownership, since all stations will need to be upgraded prior to 2025.

TABLE 7
West Eugene Pump System Capacity Evaluation
MWMC Facility Plan, Eugene-Springfield

Pump Station	Proposed Design Capacity Max. Day Flow	Proposed Design Capacity Peak Hour Flow	Proposed Pump Station Improvements for Year 2025 flows	Proposed Combined Peak Hour Station Capacity w/largest Pump Off (mgd)
West Irwin				
			Upgrade all Pumps with a higher	
			head pump	
	16	**21**		**28.5**
Terry Street				
			Upgrade the pumps to have a	
			higher head and flow rate - add one	
			new pump to meet redundancy	
			requiremtents	
	17	**23.8**		**28**
Barger				
			Install Phase 2 and 3 pumps into	
			existing pump station - Install new	
			24-inch FM, length = 7350 feet	
	24	**29**		**32**

In addition to the pump station improvements, one section of force main will need to be upgraded. The addition of a new 24-inch diameter force main will be needed from the Barger-Greenhill pump station to the Terry Street pump station due to higher head conditions generated from downstream flows reaching the force mains.

Order of magnitude cost estimates for the major recommended pump station improvements are summarized in Table 8. A detailed cost estimate for recommended improvements to the major pump station/force main systems is given in Attachment C. Improvements will be necessary at the Fillmore pump station to meet DEQ redundancy requirements. Because the entity responsible for the Fillmore pump station is expected to change from MWMC to Eugene, the cost estimates for these improvements have not been included.

TABLE 8
Pump Station Improvement Cost Summary
MWMC Facility Plan, Eugene-Springfield

Pump Station	Existing Capacity with All Pumps Operating (mgd)	Proposed Capacity with All Pumps Operating (mgd)	Responsible Entity	Estimated Cost
Willakenzie	80.0	127.5[1]	MWMC	$6,000,000
E-S WPCF Screw Pumps	84.0	99.0[1]	MWMC	$1,700,000
MWMC Total				**$7,700,000**

1. The intent is to comply with DEQ redundancy requirements (to pump the peak hour flow with one unit out of service). Alternatives for expanding the capacity of the Screw Pumps/Willakenzie systems are being evaluated as part of follow-on work to this Facility Plan. When the final selected alternative for expanding these pumping systems is determined the approach to attain DEQ required redundancy will also be finalized. Currently, the improvements to these individual pump stations do not include a redundant pump at peak hour. It is expected that redundancy can be attained with these pump stations looked at as a system rather than individually. These cost estimates will be revised once the approach for meeting DEQ requirements is finalized.

There is a possibility that the responsible entity for Irvington will change from Eugene to MWMC; if that change occurs the costs to upgrade to that pump station will have to be added to MWMC's 20-year project list. At this time a cost estimate has not been provided as part of this MWMC Facilities Plan for the anticipated improvements at Irvington.

The responsible entity is expected to change from MWMC to Eugene, and therefore cost estimates these improvements have not been included in the MWMC Facilities Plan

An additional hydraulic model simulation was performed for a peak flow of 277 mgd at the E-S WPCF to evaluate the performance of the collection system after recommended pump station improvements were implemented.

For modeling purposes no improvements were assumed at the Fillmore Pump Station, and the existing gates at the Fillmore Pump Station that can be used to relieve the system to the Willamette River were considered to be closed. The analysis of the collection system showed that these pump station capacity improvements effectively resolve restrictions at these locations. However, there remain some HGL elevations that do not meet the criteria for allowable freeboard from HGL to ground surface of at least 2 feet. This primarily occurs in the Willakenzie area which was not specifically monitored with the permanent MGD monitors. As a result, it cannot be concluded that there are additional collection system improvements required until additional monitoring is performed and the flows are more accurately distributed across subbasins. The analysis performed is focused on the prediction of peak flows at the plant and in major conveyance system components, not throughout the collection system.

Flow Monitoring

The following paragraphs summarize the justification for additional monitoring and collection system analysis:

- While the newly modeled flows have been calibrated to conditions observed in early 2003, the rainfall depths (a maximum of slightly more than 2 inches in 24 hours) did not reach the 5-year, 24-hour design storm depth of 3.9 inches (see Figure 3). Therefore, the model predicts the response during the design event based on calibration storm depths of approximately half of the design storm. This can lead to the over prediction of flows for the design event because no attenuation of peak I/I flows into the collection system is accounted for as the rainfall depth increases. This attenuation can occur when the capacity of the soil to transmit flow to the pipe and/or the capacity of the pipe defects themselves are reached.
- During the 2000 WWFMP there was a significant amount of discussion with City staff regarding the model's flow predictions for observed storm events. As a result, adjustments to more closely estimate observed performance in the system were made to the regression equations developed to relate rainfall to RDII. This adjustment process has not been fully applied to the current modeling process where different storms (and a different process for estimating RDII) were used for calibration.
- If after conducting a more comprehensive peak flow adjustment/validation process and peak flows actually increase to a level in excess of the system's pipeline conveyance capacity, then other options for wet weather flow management should be considered to manage design storm flows. Potential wet weather controls include:
  - Additional system rehabilitation to increase I/I reduction and decrease flows.
  - Storage of peak flows and release back to the system when peak flows have subsided (note that the WWFMP plan reviewed the option of storage but found it to be less cost effective than I/I reduction and increased capacity at the Willakenzie pump station and the screw pumps).
  - Storage combined with remote wet weather treatment and associated discharge.
  - A combination of these measures.

Recommended Monitoring Plan

In order to improve the model calibration, and enhance design flow predictions, an analysis of current and future flow monitoring needs was performed. The analysis concluded that the current overall MWMC monitoring coverage is quite good. Several additional monitoring locations were suggested, however, to aid in refinement of the hydraulic model. Figure 4 shows these recommended locations as well as current and historic monitor locations.

As mentioned previously, the current model calibration work revealed a discrepancy between the MGD monitor flow measurements and the flow measured at the E-S WPCF. Because the MGD monitor flow and treatment plant flow measurements could not be reconciled, the model was calibrated to the treatment plant flow data, while the monitor data were used to proportion the flow within the collection system.

Recommendations

- As specified by Department of Environmental Quality guidelines, use the 5-year, 24-hour wet season storm as the design storm, since it results in a higher peak flow than the 10-year, 24-hour dry season event.
- This modeling effort determined the 2025 wet season peak flow based on the 5-year, 24-hour storm to be 277 mgd.
- Additional monitoring data should be gathered and incorporated as practicable into the model's wet weather flow (RDII) prediction module to refine and validate model flow predictions, particularly for larger rainfall events to account for RDII flow peak attenuation during higher magnitude storm events.
- Specific locations are recommended in areas that had not been monitored previously and/or where the hydraulic model showed a high hydraulic grade line for the 5-year wet season storm event. These additional recommended monitor locations are shown on Figure 4 and include:
    1. Upstream of the E-S WPCF screw pumps to verify that influent flows were being measured accurately.
    2. Tabor Street—This area has not been monitored previously and model shows elevated HGL for 5-year wet season storm event.
    3. Commercial Street at 32nd Street—This area has not been monitored previously and model shows elevated HGL for 5-year wet season storm event.
    4. "G" Street at 52nd Street—This area has not been monitored previously and model shows elevated HGL for 5-year wet season storm event.
    5. Royal Avenue at Williams Street—Model shows elevated HGL for 5-year wet season storm event.

A meeting with Eugene and Springfield staff was held to discuss consultant recommendations for the flow monitors to supplement the existing permanent and local temporary monitors that are in place. Meeting minutes are included as Attachment D.

- Peak flow estimates should be verified and the collection system evaluated for conditions that do not meet the established HGL freeboard criteria of 2 feet. Wet weather flow management options, if necessary, should then be explored.
- Pump station capacity increases are recommended for the MWMC owned and operated Willakenzie pump station and WPCF screw pumps to accommodate 2025 flows. It is also recommended that upgrades be made to the Fillmore, Skipper, Terry Street, and Barger-Greenhill pump stations (City of Eugene) to accommodate 2025 flows. In addition it is recommended that the pumps at the Division Street, Greenwich, Irvington, and West Irwin pump stations (City of Eugene) be upgraded due to higher head conditions at the force main connection points.

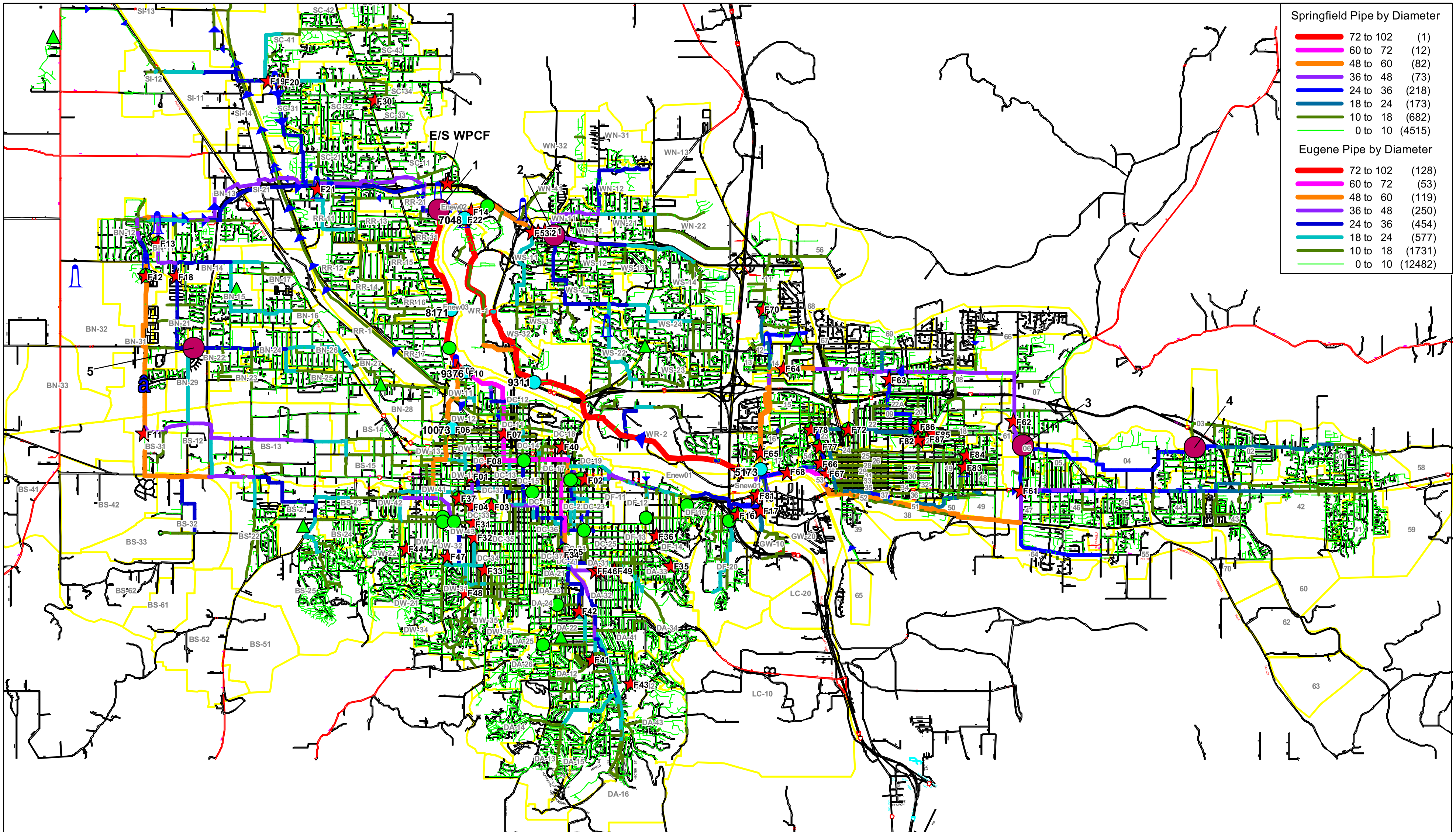


Figure 4: Current, Historic, and Recommended MWMC Flow Monitor Locations

CVO\043380031

Attachment A
Modeling Assumptions

Attachment A

The following text provides a summary of current modeling assumptions as well as changes since the 2000 WWFMP project model was developed.

1. Pump Stations

The number of pumps, pump curves and start stop elevations were based on historical model information and information provided to DHI during the model development.

In the Eugene-Springfield Area Wastewater Pumping Stations Overview document dated June 1996 and in a transmittal from Larry Pederson dated July 1998, it states the Willakenzie pump station has five 300-hp pumps. The consultant team was provided three pump curves for the Willakenzie pump station – 585 rpm, 450 rpm and 590 rpm. Without more detailed knowledge of the pump operation we chose the curve associated with the middle speed.

In the Eugene-Springfield Area Wastewater Pumping Stations Overview document dated June 1996, it states the Gateway pump station has two 15-hp pumps. The old MWMC model also had two pumps. We were provided one pump curve for the Gateway pump station. We used the curve for the two pumps. We can add the third pump to the model, if appropriate.

The flow/head relationship in the model incorporates the all four screw pumps at the WPCF headworks as one curve.

2. RDII Calibration

A mathematical hydrological model like RDII is a set of linked mathematical statements describing the various pathways by which rainwater enters a sewer system.

The RDII model is a deterministic, conceptual, lumped type of model with moderate input data requirements. A deterministic model is one which will, when given the same inputs and parameters, reproduce the same behaviour, which is a different model than a stochastic model. A conceptual model is one where the hydrologic processes have been simplified into a set of rules and relationships. A lumped model is one where the parameters and inputs are assumed to be evenly distributed over the sub-catchment areas. The parameters and variables are thus representing average values for the entire subcatchment.

A conceptual model like RDII is based on physical structures and equations used together with semi-empirical ones. Some of the parameters can be evaluated from physical sewer catchment data, but final parameters must be derived during calibration which compares concurrent model results and gauged data.

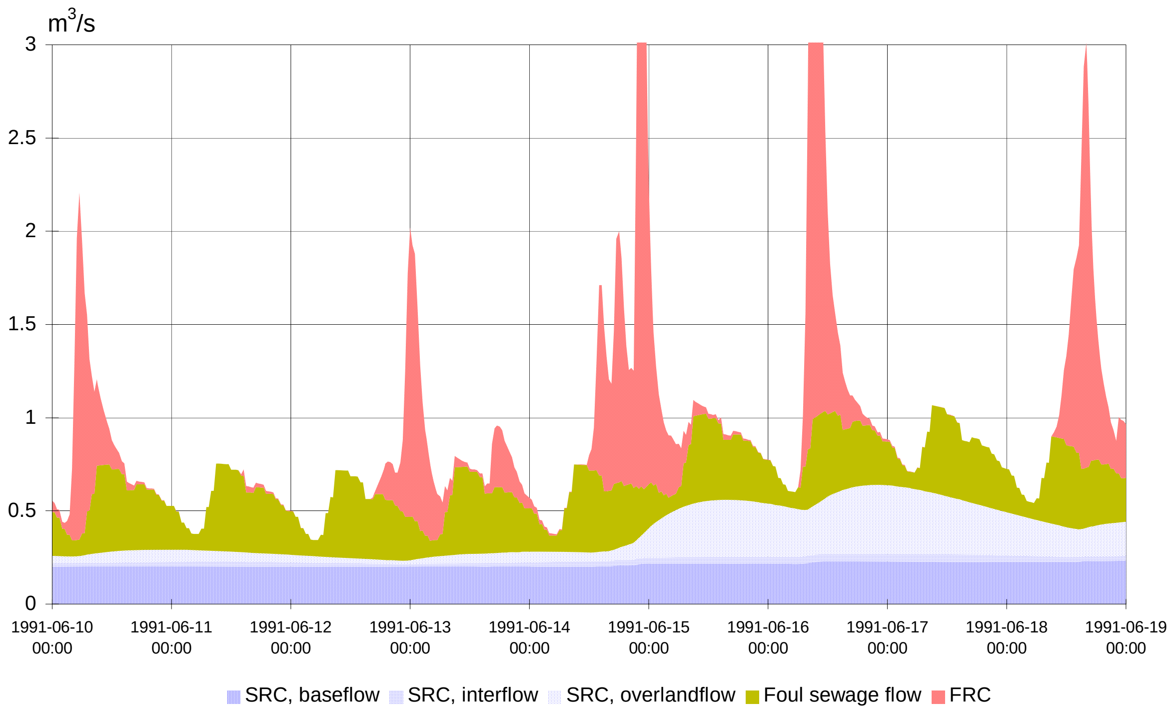
RDII simulates the process of ingress of rainfall-runoff in sewer catchments, and attempts to isolate the I/I components of sewer flow. These two components are called the Fast Response Component (FRC) which is analogous to inflow, and the Slow Response Component (SRC) which is analogous to infiltration. The classification of flow components as either inflow or infiltration is difficult, especially on larger catchments where inflow components may take several hours to travel to the outlet and can exhibit the same timing at the gauge as slow response infiltration components with their source close to the outlet.

The FRC component is distinguished because it is not influenced by the previous hydrological situation, i.e., high or low soil moisture content. It is a direct consequence of rainfall falling on hard or impervious areas that have little detention storage.

On the other hand, a strong characteristic of the SRC component is that it is highly dependent on the previous hydrological conditions and usually responds much more slowly to a rainfall. The SRC component consists of the rainfall-induced infiltration.

The figure below shows the different flow components and how they interact. The major purpose of RDII is to enable a reliable breakdown of the components of the measured flow into the FRC and SRC components, which can then be used to drive the appropriate remediation strategy.

FIGURE A-1
Components of Gauged Flow
MWMC Facility Plan, Eugene-Springfield



The above figure shows a long slow buildup of infiltration through the baseflow components, which underpins the dry weather flow. The SRC increases steadily through a long wet period. The FRC is a rapid response to rainfall that dies out fairly quickly, the timing depending mainly on the time of concentration of the rainfall.

3. Result and Model Files

File Extension	File Description	Data Description
*.mpr	MOUSE project file	References all files needed to run a MOUSE model
		References boundary condition files, such as rainfall, flow, etc.
*.und	MOUSE network file	Contains network information, such as pipe inverts, diameters, etc.
*.hgf	MOUSE hydrologic file	Contains hydrologic information, such as catchment locations, RDII parameter sets, etc.
*.dwf	MOUSE dry weather flow file	Describes sanitary sewer flow
*.rpf	MOUSE repetitive profile file	Describes the sanitary sewer flow pattern
*.msc	MOUSE scenario manager file	Contains information for all scenarios contained in the scenario manager

Result File Name	Scenario Description
Base	Current conditions
2025_277fin	Future 2025 population
	Includes future basins
	I/I rehabilitation as listed in Figure 7-1 in MWMC WWFMP
	Includes RDII flow reduction in subbasins F10, F12, F14, F21 and F22.
2025_10yr	Future 2025 population
	Includes future basins
	I/I rehabilitation as listed in Figure 7-1 in MWMC WWFMP
	Includes RDII flow reduction in subbasins F10, F12, F14, F21 and F22.
Future2025PartIIRehab_freeoutfall	Future 2025 population
	Includes future basins
	I/I rehabilitation as listed in Figure 7-1 in MWMC WWFMP
	Model was run using hypothetical free outfall condition, i.e. the screw pumps and Willakenzie Pump Station were modeled as free outfalls.
BO_294fin	Future Buildout population
	Includes future basins
	I/I rehabilitation as listed in Figure 7-1 in MWMC WWFMP
	Includes RDII flow reduction in subbasins F10, F12, F14, F21 and F22.

Result File Name	Scenario Description
FutureBuildoutIIRehab_freeoutfall	Future buildout population
	Includes future basins
	I/I rehabilitation as listed in Appendix E in MWMC WWFMP
	Model was run using hypothetical free outfall condition, i.e. the screw pumps and Willakenzie Pump Station were
FutureBuildoutPartIIRehab_freeoutfall	Future buildout population
	Includes future basins
	I/I rehabilitation as listed in Figure 7-1 in MWMC WWFMP
	Model was run using hypothetical free outfall condition, i.e. the screw pumps and Willakenzie Pump Station were

Attachment B
Pump Station Capacity Evaluation

MWMC Pumping Capacity Evaluation

	Design Flow - 5 Yr-24 Hr (MGD)		Existing Pump Station - Data							Design Flow Rates		Proposed Pump Station Improvements - Data								
Pump Station	Yr 1997	Yr 2025 Max. Day/Peak Hour	Number of Pumps	Existing Pump Capacity (MGD)	Pump Head (feet)	Pump Hp	Pump Control Method	Existing Station Capacity w/largest Pump off (MGD) (1)	Existing Station Capacity w/all Pumps running (MGD)(1) (2)	Proposed Design Capacity Max. Day Flow	Proposed Design Capacity Peak Hour Flow	Proposed Pump Station Improvements for Yr 2025 flows	Number of New Pumps	Pump Capacity (MGD)	Pump Head	Calc'd Hp	Pump Hp	Pump Control Method	Proposed Combined Station Capacity w/largest Pump off (MD)	Proposed Combined Station Capacity w/all Pumps running (PH)
Willakenzie																				
	112	107 / 126.5	1	17.5	50	300	VFD					Expand Existing Pump Station	1	10	57	148	225	VFD		
			1	17.5	50	300	VFD					add new wet pit/dry pit to side of	1	10	57	148	250	VFD		
			1	17.5	50	300	VFD					pump station, install new FM	1	10	57	148	250	VFD		
			1	17.5	50	300	VFD					connections to existing FM's	1	10	57	148	250	VFD		
			1	17.5	50	300	VFD					*Note: Additive to Existing PS*								
		Totals -				**1500**		**70**	**80**	**107**	**127**						**975**		**110.0**	**127**[6]
Division Street																				
	0.71	Not Modeled	1	0.7	60	20						Upgrade both pumps for	1	1	70	18	30			
			1	0.7	60	20						(See note 4)	1	1	70	18	30			
		Totals -				**40**		**0.7**	**1.4**	**1**	**1.5**								**1**	**2**
Skipper																				
	3.83	7 / 7.9	1	3	76	60						Upgrade both pumps to have a	1	3.5	86	78	100			
			1	3	76	60						higher head and flow rate - add a	1	3.5	86	78	100			
												third pump for redundancy	1	3.5	86	78	100			
		Totals -				**120**		**3**	**5**	**7**	**8**								**7**	**10.5**
Greenwich																				
	1.36	Not Modeled	1	1	61	30						Possible Pump upgrades	1	1.5	75	29	30			
			1	1	61	30						(See note 4)	1	1.5	75	29	30			
		Totals -				**60**		**1**	**1.5**	**1.5**	**2**								**1.5**	**3**
Irvington																				
	8.04	9 / 12.6	1	7.2	100	150	VFD					Upgrade all Pumps with a higher	1	5	138	179	250	VFD		
			1	7.2	100	150	VFD					head pump	1	5	138	179	250	VFD		
													1	5	138	179	250	VFD		
		Totals -				**300**		**7.2**	**13.5**	**9**	**13**								**10**	**15**
West Irwin																				
	18.7	16 / 18.7	1	9	149	200	VFD					Upgrade all Pumps with a higher	1	9.5	169	417	250	VFD		
			1	9	149	200	VFD					head pump	1	9.5	169	417	250	VFD		
			1	9	149	250	VFD						1	9.5	169	417	250	VFD		
		Totals -				**650**		**18**	**21**	**16**	**21**								**19**	**28.5**
Terry Street																				
	20.95	17 / 20.7	1	6.6	116	200	VFD					Upgrade the pumps to have a	1	7	121	220	225	VFD		
			1	6.6	116	200	VFD					higher head and flow rate - add one	1	7	121	220	225	VFD		
			1	6.6	116	200	VFD					new pump to meet redundancy	1	7	121	220	225	VFD		
												requiremtents	1	7	121	220	225	VFD		
		Totals -				**600**		**10**	**14**	**17**	**23.8**								**21**	**28**
Fillmore																				
	32.7	41.9 / 44.0	1	6.5	116	30	VFD					Add one new pump to meet						VFD		
			1	6.5	116	30	VFD					redundancy requiremtents						VFD		
			1	10.5	116	50	VFD											VFD		
			1	10.5	116	50	VFD											VFD		
			1	10.5	116	50	VFD											VFD		
		Totals -				**210**		**34**	**44**		**44**								**44**	**44**
Barger																				
	Not Modeled	24 / 28	1	3.74	160	188	VFD					Install Phase 2 and 3 pumps into	1	8	212	441	400	VFD		
			1	3.74	160	188	VFD					existing pump station - Install new	1	8	212	441	400	VFD		
												24-inch FM, length = 7350 feet	1	8	212	441	400	VFD		
													1	8	212	441	400	VFD		
						376		**3.74**	**7.48**	**24**	**29**								**24**	**32**
WWTP Screw Pumps																				
	Not Modeled	99	1	21								Install one additional screw Pump								
			1	21								Parallel with the Existing ones	1	15						
			1	21																
			1	21																
									84	**84**	**99**								**78**	**99**[6]
Summary of flows								**147.6**	**187.9**	**266.5**	**368.3**								**316**	**163**

Notes:

1. Field measured flow from MWMC
2. Capacity with all pumps running is reduced from the additive capacity, due to increased headlosses in the pipeline
3. All flows shown are non-routed, routing of flows will reduce the total inflow at the WWTP to approximately 300 MGD

Attachment C
Preliminary Cost Estimates-Pump Stations

Attachment C

Metropolitan Wastewater Management Commission
Eugene/Springfield WWTP Capital Improvement Plan
Order of Magnitude Construction Cost Opinions
Project No. 177360.CT.60.02 December 19, 2003

Influent Pumping

Item Description	Quantity		Unit Price	Line Total	Costing Assumptions
Willakenzie Pump Station					
General Conditions	$592,900				
General Conditions	1	LS	$ 388,260	$ 388,300	Allow 10% of Total Contract Amount
Bonds/Insurance	1	LS	$ 81,739	$ 82,000	Allow 2% of Total Contract Amount
Mobilization/Demobilization/Site Facilities	1	LS	$ 122,609	$ 122,600	Allow 3% of Total Contract Amount
Landscaping/Visual Screening	$158,560				
Landscaping, fences, walls, and berming	1	LS	$ 158,560	$ 158,560	Allowance (10% of other construction subtc
Earthwork/Yard Piping/Demolition	$1,031,000				
Demolition/Protection of Existing/Temp Pumping	1	LS	$ 100,000	$ 100,000	Allowance
Water & Dust Control	1	LS	$ 100,000	$ 100,000	Allowance
Pump Station Earthwork					
Pump Station Excavation	7,000	CY	$ 5	$ 35,000	
Pump Station Backfill	2,000	CY	$ 10	$ 20,000	
Wet Well Earthwork					
Wet Well Excavation	12,800	CY	$ 5	$ 64,000	
Wet Well Backfill	800	CY	$ 10	$ 8,000	
Pipe Trench Earthwork					
Pipe Trench Excavation	10,000	CY	$ 5	$ 50,000	
Pipe Trench Backfill	10,000	CY	$ 30	$ 300,000	
Piping--60" Suction Manifold	50	LF	$ 1,500	$ 75,000	
Piping--60" Suction--Wetwell to New P Sta	100	LF	$ 500	$ 50,000	
Piping--48" Force Main Manifold	25	LF	$ 1,000	$ 25,000	
Piping--48" Force Main Discharge	100	LF	$ 400	$ 40,000	
Piping--54" Force Main incl BFV	20	LF	$ 1,000	$ 20,000	
Misc Unquantified Earthwork	1	LS	$ 144,000	$ 144,000	

Item Description	Quantity		Unit Price	Line Total	Costing Assumptions
Structures	$1,500,000				
Pump Station Concrete					
Pump Station Slab On Grade--24"	200	CY	$ 300	$ 60,000	
Pump Station Walls--18"	320	CY	$ 750	$ 240,000	
Pump Station Unquantified Structure	1	LS	$ 150,000	$ 150,000	
Wet Well Concrete					
Wet Well Slab On Grade--24"	500	CY	$ 300	$ 150,000	
Wet Well Walls--18"	540	CY	$ 750	$ 405,000	
Pump Station Unquantified Structure	1	LS	$ 277,500	$ 280,000	
Misc Unquantified Structure	1	LS	$ 215,000	$ 215,000	
Equipment/Process Support	$580,000				
Pumping					
New 225hp Pumps	4	EA	$ 50,000	$ 200,000	Richardson's 100-290
New 225hp Pump VFD's	4	EA	$ 50,000	$ 200,000	Assumed equal to pumps cost
Mechanical--Gates/Wall Spools/et al	1	LS	$ 100,000	$ 100,000	Allowance--extent unknown
Electrical Upgrades	1	LS	$ 80,000	$ 80,000	Allowance--extent unknown

Subtotal Opinion of Construction Cost--Willakenzie Pump Station Upgrade	**$ 3,862,460**
+ Contingency @ 25%	$ 965,540
Subtotal Opinion of Construction Cost--Willakenzie Pump Station Upgrade	**$ 4,828,000**
+ Engineering, Legal & Administration @ 25%	$ 1,172,000
Total Opinion of Construction Cost--Willakenzie Pump Station Upgrade	**$ 6,000,000**

The cost estimates shown have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project financial decisions to help ensure proper project evaluation and adequate funding.

Metropolitan Wastewater Management Commission
Eugene/Springfield WWTP Capital Improvement Plan
Order of Magnitude Construction Cost Opinions
Project No. 177360.CT.60.02 January 6, 2004
Prepared by Dan Laffitte

Additional Screw Pump

Item Description	Quantity		Unit Price	Line Total	Costing Assumptions
Additional Screw Pump - 21 MGD Capacity					Based on quantity take offs.
General Conditions	$168,000				
General Conditions	1	LS	$ 109,470	$ 110,000	Allow 10% of Total Contract Amount
Bonds/Insurance	1	LS	$ 23,046	$ 23,000	Allow 2% of Total Contract Amount
Mobilization/Demobilization/Site Facilities	1	LS	$ 34,570	$ 35,000	Allow 3% of Total Contract Amount
Landscaping/Visual Screening	$99,078				
Landscaping, fences, walls, and berming	1	LS	$ 99,078	$ 99,078	Allowance (10% of other construction subtotals)
Earthwork/Yard Piping/Demolition	$198,878				
Demolition/Protection of Existing/Temp Pumping	1	LS	$ 25,000	$ 25,000	Allowance
Water & Dust Control	1	LS	$ 50,000	$ 50,000	Allowance
Structural Earthwork					
Structural Excavation	3,661	CY	$ 5	$ 18,305	Based on a 2 to 1 slope and assumed depths of excavation.
Structural Backfill	1,219	CY	$ 30	$ 36,573	Assumed 1/3 of excavation.
Misc Unquantified Earthwork	1	LS	$ 69,000	$ 69,000	
Structures	$279,900				
Pump Station Concrete					
Slabs (to match existing)	94	CY	$ 350	$ 32,900	Quantities are taken from sketch for one new pump.
Angled Slabs (to match existing)	77	CY	$ 500	$ 38,500	Quantities are taken from sketch for one new pump.
Elevated Floors / Roofs (to match existing)	99	CY	$ 750	$ 74,250	Quantities are taken from sketch for one new pump.
Various Concrete Structures (to match existing)	26	CY	$ 750	$ 19,500	Quantities are taken from sketch for one new pump.
Walls (to match existing)	94	CY	$ 750	$ 70,500	Quantities are taken from sketch for one new pump.
Elevated Floor and Stairs (to match existing)	59	CY	$ 750	$ 44,250	Quantities are taken from sketch for one new pump.

Item Description	Quantity		Unit Price	Line Total	Costing Assumptions
Equipment/Process Support	$344,000				
Equipment					
Screw Pump	1	EA	$ 195,000	$ 195,000	Based on costs from Pump Manufacturer.
Weir Gate with Operator	1	EA	$ 10,000	$ 10,000	Assumes one weir gate with operator is required for additional pump.
Pump VFD	1	EA	$ 24,000	$ 24,000	Based on costs from VFD representative
Mechanical--Gates/Wall Spools/et al	1	LS	$ 65,000	$ 65,000	Allowance--extent unknown
Electrical Upgrades	1	LS	$ 50,000	$ 50,000	Allowance--extent unknown

Subtotal Opinion of Construction Cost--Dry Water Headworks	**$1,089,856**
+ Contingency @ 25%	$272,144
Subtotal Opinion of Construction Cost--Dry Water Headworks	**$1,362,000**
+ Engineering, Legal & Administration @ 25%	$338,000
Total Opinion of Construction Cost--Dry Water Headworks	**$1,700,000**

The cost estimates shown have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project financial decisions to help ensure proper project evaluation and adequate funding.

Attachment D
MWMC Collection System Modeling Assistance

Attachment D

MEETING SUMMARY

CH2MHILL

Metropolitan Wastewater Management Commission - Collection System Modeling Assistance

ATTENDEES: Troy McAllister / City of Eugene
Rich Heil / City of Eugene
Matt Noesen / CH2M HILL
Paul Fager / City of Eugene
Keith Miata/ City of Springfield
Joe Plaskett / CH2M HILL

COPIES: Janis Freeman/ CH2M HILL
Project File – Task 3

FROM: Matt Noesen / CH2M HILL
Joe Plaskett / CH2M HILL

DATE: December 26, 2003

A meeting was conducted on **December 23, 2003** at Springfield City Hall for the Facility Plan Update project (MWMC Project No. 80010).

Project FTP Site

Deliverables are placed on the project FTP site as they become available. These meeting minutes will also be posted to the FTP site when complete. The link to the FTP site is:

ftp://ecology:C0n$erve@ftp.ch2m.com/pub/MWMC/Wastewater_Facilities_Plan

Meeting Objectives

The following meeting objectives were discussed and agreed upon:

1. Project understanding and work performed to date
2. Reach consensus on flow monitoring plan recommendations
3. Response to George Walker comments
4. Additional modeling assistance

Project Understanding and Work Performed To Date

The collection system modeling has thus far been focused on updating the model used for the 2000 Wet Weather Flow Management Plan (WWFMP), and the method used to generate flow inputs. The updated model was used to obtain planning level estimates of the existing, 2025, and buildout flows at the Eugene Springfield Water Pollution Control Facility (E-S WPCF). Wastewater collection system modeling work performed to date includes:

- Incorporation of changes to the collection system network and naming conventions.
- Reconfiguration of pump stations to operate based on the head differential between pump and system head curves.
- Development of separate dry and wet weather flow hydrographs for each monitor basin from monitor data.
- Development of existing dry weather flow component within the MOUSE model (Dry Weather Flow Module) and calibration to monitor data.
- Development of dry weather flow for 2025 and buildout populations.
- Development of existing wet weather flow component within the MOUSE model (RDII Module) and calibration to monitor data.
- Development of wet weather flow for projected 2025 and buildout land use configurations.
- Simulation of 5-year, 24-hour wastewater collection system flows for 2025 and buildout conditions with 1) recommended; and 2) full WWFMP system rehabilitation. Each of these four model scenarios was run for two additional conditions: 1) unrestricted capacities at the E-S WPCF screw pumps and Willakenzie pump station; and 2) existing pump station capacities with discharge allowed at Fillmore and the E-S WPCF.

Based on the latest hydraulic modeling the peak planning level treatment plant flows were defined for 2025 and buildout. The peak year 2025 flow at the treatment plant is 277 mgd. The peak buildout flow at the treatment plant is 294 mgd. These flows are based on recommended system rehabilitation and unrestricted capacities at the E-S WPCF screw pumps and Willakenzie pump station.

Reach Consensus On Flow Monitoring Plan Recommendations

Recommendations were presented for additional flow monitoring to aid in refining the collection system hydraulic model. A map showing current and historic (WWFMP) monitor locations, as well as five additional recommended locations was central to the discussion. A handout was also provided describing the location of each monitor, as well as the reason for monitoring each location.

The feasibility of installing a flow monitor at each of the five recommended locations was discussed. It was agreed that installation of four of the five monitors (two in Springfield, two in Eugene) was immediately feasible, and monitors were available. The fifth monitor location – the E-S WPCF influent – is considered problematic, although City of Eugene staff believed that influent flow monitoring had been done in the past.

Monitoring of the E-S WPCF influent was considered important so that the model could be calibrated to actual flow into the treatment plant rather than effluent flow where considerable attenuation of peaks has occurred. Monitoring the influent flow to the treatment plant may also shed light on the reason why the model could not be calibrated at the plant and all of the permanent flow monitors at the same time.

The map showed that a current temporary monitor (located at manhole 9227 on the 72-inch diameter West Bank Interceptor) was installed upstream of one of the permanent monitors. It was suggested that the flows measured by the two monitors could be compared as a check to verify that the permanent monitor was giving accurate and consistent flow readings, and then this monitor could be moved to the E-S WPCF influent line.

Part of the problem with influent flow monitoring is that the Marsh-McBirney Flo-Tote temporary monitors are not as accurate when installed in large diameter pipes, such as the influent line to the E-S WPCF. MWMC staff were interested in finding an alternative temporary monitoring technology for accurately measuring flow in large diameter pipes. A plan for monitoring the influent flow at the E-S WPCF in the near term is needed, and long term plans need to include influent flow measurement equipment that can accurately read peak flows.

It was agreed that the four recommended collection system monitors would be installed, and more equipment installation requirements for monitoring treatment plant influent flows would be looked into. The map showing monitor locations was also to be sent to MWMC staff as a PDF file for their use.

Responses to George Walker Comments

Written responses to several questions/comments about the updated collection system modeling were provided to the meeting attendees. Related to one of the responses, pump curves provided by DHI were reviewed, and City of Eugene staff noted that the representation of the Irvington pump station showed only two pumps rather than three. Previously George Walker had noticed that the Glenwood pump station representation showed only two pumps rather than three. It was later verified that both pump stations were modeled as having only two pumps. It was agreed that CH2M HILL would make sure that DHI has provided the most current pump station data.

Additional Modeling Assistance

The collection system pump station/force main capacity assessment was discussed. Some clarification is needed with respect to the scope of the pump station/force main planning level capacity assessment. The division between MWMC and cities jurisdiction is critical to defining the scope of the pump station/force main analysis. The current policy is that any asset that serves both cities belongs to MWMC, while the individual cities are responsible for assets that serve their own populations. By this division, the Fillmore pump station (which recently experienced an SSO) would not be included in the analysis because it serves only the City of Eugene. In terms of planning though, the current project (P80010) may still need to assess the capacity of all pump stations and force mains so that MWMC can tell the cities what needs to be done.

The performance of the system during the December 12-13 rainfall event was discussed, including the reported SSOs at the Willakenzie and Fillmore pump stations. City of Eugene staff explained that the Fillmore pump station may have had two pumps out of service during the peak of the storm. This rainfall event may have approached the 5-year, 24-hour event, and the rainfall and flow data would therefore be useful for verification of the updated model. It was agreed that CH2M HILL staff would check with Bob Canty to confirm that pumps were out of service at Fillmore, and discuss with him what he thinks would have happened if the pumps had been available.

Additional hydraulic modeling is needed to evaluate the collection system, pump stations and force mains at the 2025 and buildout 5-year, 24-hour peak design flows of 277 mgd and 294 mgd respectively. Current model simulations were performed using higher flow rates that did not incorporate the WWFMP flow reductions at some locations, and these flows were used for preliminary sizing of treatment plant components.

There is a need for field verification of the recent modeling update. This is a topic that needs to be discussed further with the steering committee and the MWMC management. Field verification should be done when and if the WWFMP is updated, or now as an amendment to the current project (P80010).

The current modeling work being done by CH2M HILL for the City of Springfield was discussed, particularly the more detailed and GIS integrated approach for generating model flows being used. This approach uses parcel data to generate model input data and RDII parameters, and once implemented, should make the generation of model flows more user friendly and flexible. The model results for the two flow generation methods (parcel based versus 2003 MWMC method) will be compared to the extent possible, and this will help guide MWMC/Eugene on whether or not the parcel approach might help them refine peak flow estimates, and to what extent this alternative approach might affect model results and/or accuracy.