Existing Collection System

Redwood Sanitary Sewer Service District

Josephine County, Oregon

Parametrix, Inc.

3. EXISTING WASTEWATER COLLECTION SYSTEM

3.1 DESCRIPTION OF FACILITIES

In 1977-78, the District constructed a wastewater collection system and treatment facility. The collection system when completed, consisted of approximately 16.2 miles of concrete sewers ranging from 8 to 27 inches in diameter. Specifically, the sewers built consisted of the following components (Table 3-1):

Table 3-1
As-built Components of the District's Existing Wastewater Collection System[1]

Component	Interceptor System[2]	Collection System[2]
Manholes	143	132
8-inch sewer	2,606/ft.	37,825/ft.
10-inch sewer	10,041/ft.	—
12-inch sewer	12,315/ft.	—
15-inch sewer	5,076/ft.	—
18-inch sewer	5,673/ft.	—
24-inch sewer	11,646/ft.	—

(1) As shown in the final pay estimate for sewage collection and treatment facilities, Tab 302 and Tab 310, September 1978.

(2) As identified by either Schedule I - Interceptor System or Schedule C - Collection System in Contract Documents CH2M Hill, May 1974.

Since 1978, the only changes and modifications that have been made to the system added approximately 16,800 feet of mostly 8-inch-diameter PVC sewers. These sewers were added to serve new residential housing developments.

Also since then, some existing homes in the District, which were not originally connected to the sewer system, have been added. As of October 1998, with these new connections and the original system connections, the system now serves an estimated service population of 4,905.

The existing wastewater collection system serves residential units almost exclusively. Essentially, no industry discharges to the system. A collection system layout, showing pipeline routes and manholes, is provided in Figure 3-1.

3.2 MOST RECENT FLOW MONITORING

Since 1978, only flow monitoring in the wastewater collection system has been performed at the wastewater treatment plant. These data were collected by the plant effluent flow meter and recorder (Appendix B). These flow data are presented later in this report.

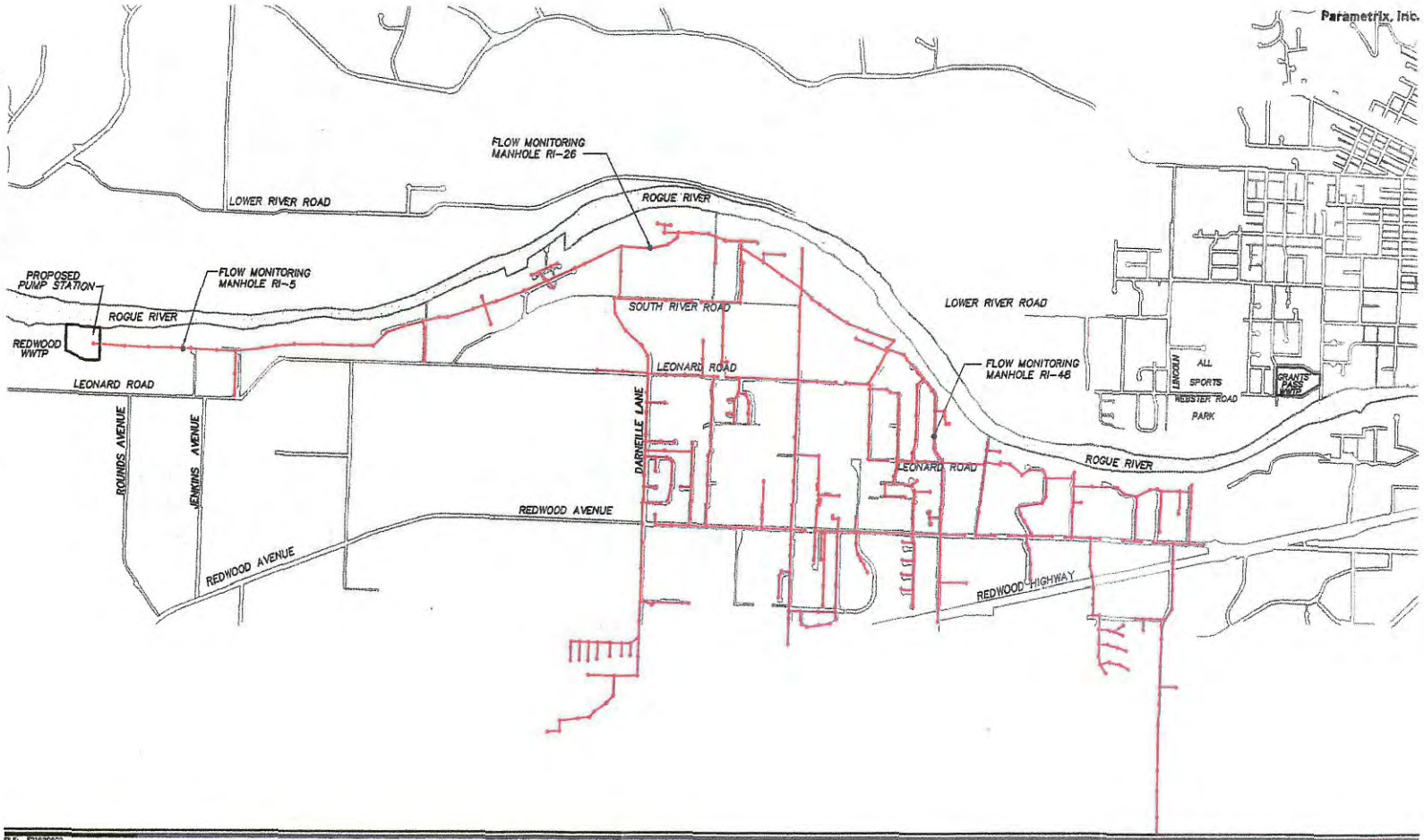


Figure 3-1
Existing Redwood Sanitary Sewer Service District Wastewater Collection System

To better assess the conditions for the wastewater collection system, more detailed flow monitoring was conducted. In September, October, and December 1992 and January 1993, continuous wastewater flow was measured in three different manholes of the collection system. ADS Environmental Services, Inc. measured these flows.

The flow measurements assessed the wastewater collection system inflow and infiltration (I&I) conditions. On each occasion, flow was measured during different groundwater and rainfall parameters. Differences in the observed wastewater flows could then be used to identify general infiltration and inflow sources to the collection system.

Generally, flow measurements at each occasion were made to assess the following conditions.

In September 1992, flow was monitored because it was anticipated that rainfall would be unlikely and that the groundwater level in the service area would be high due to irrigation and canal leakage. The impact of groundwater infiltration into the collection system could then be assessed.

In October 1992, wastewater flows were also measured because rainfall was unlikely and groundwater levels were expected to be low. At this time, irrigation had been stopped for about 30 days; the canals were dry, and the groundwater levels had probably dropped. Wastewater flows at this time would most likely indicate the base sewage flow in the system unaffected by infiltration and inflow.

Although it was believed that October 1992 would have little or no rainfall during the flow monitoring period, this did not occur. In fact, a severe rainstorm affected the later stages of the flow measurement. Specifically, rain began on October 28 and continued through the remaining flow monitoring days. Comparing these data to the historical rainfall data presented in Section 2.4 indicates that this storm was less than a 2-year, 24-hour storm event. The rainfall during this period is shown in Table 3-2.

Table 3-2
Rainfall During Flow Monitoring Period

1992 Monitoring Dates	Rainfall (Inches)
October 24-27	0.00
October 28	0.02
October 29	0.06
October 30	1.48
October 31	0.66

From December 1992 to January 1993, flow was monitored because it was anticipated that rainfall would be high and the impact of inflow into the collection system could then be assessed.

During this flow monitoring, significant rainfall events did, in fact, occur. The seven-day period with the most precipitation was selected for inflow analysis. The rainfall during this period is shown in Table 3-3.

Table 3-3
Rainfall During Flow Monitoring Period

1992 - 1993	Rainfall (inches)
December 27	0.75
December 28	1.37
December 29	0.77
December 30	0.35
December 31	1.73
January 1	0.28
January 2	0.04

The three manholes chosen to measure flow in the collection system were selected so as to divide the system roughly into thirds. This approach could then identify the condition(s) in particular portions of the system, if possible.

Flow in each manhole represents roughly the following:

Manhole RI-48 - Flow measured at point furthest from the treatment plant to represent roughly one-third of the collection system.

Manhole RI-26 - Flow measured at a point representing roughly two-thirds of the system.

Manhole RI-5 - Flow, measured at a point in the collection system closest to the treatment plant, represents roughly the entire system.

The collection system flow monitoring results are shown in Figures 3-2, 3-3, and 3-4. Flows in each manhole for each occasion are shown separately. The complete data files appear in the ADS Environmental Services, Inc. report, *Redwood Sanitary Sewer Service District Assessment of I/I for Facility Planning*, 1993.

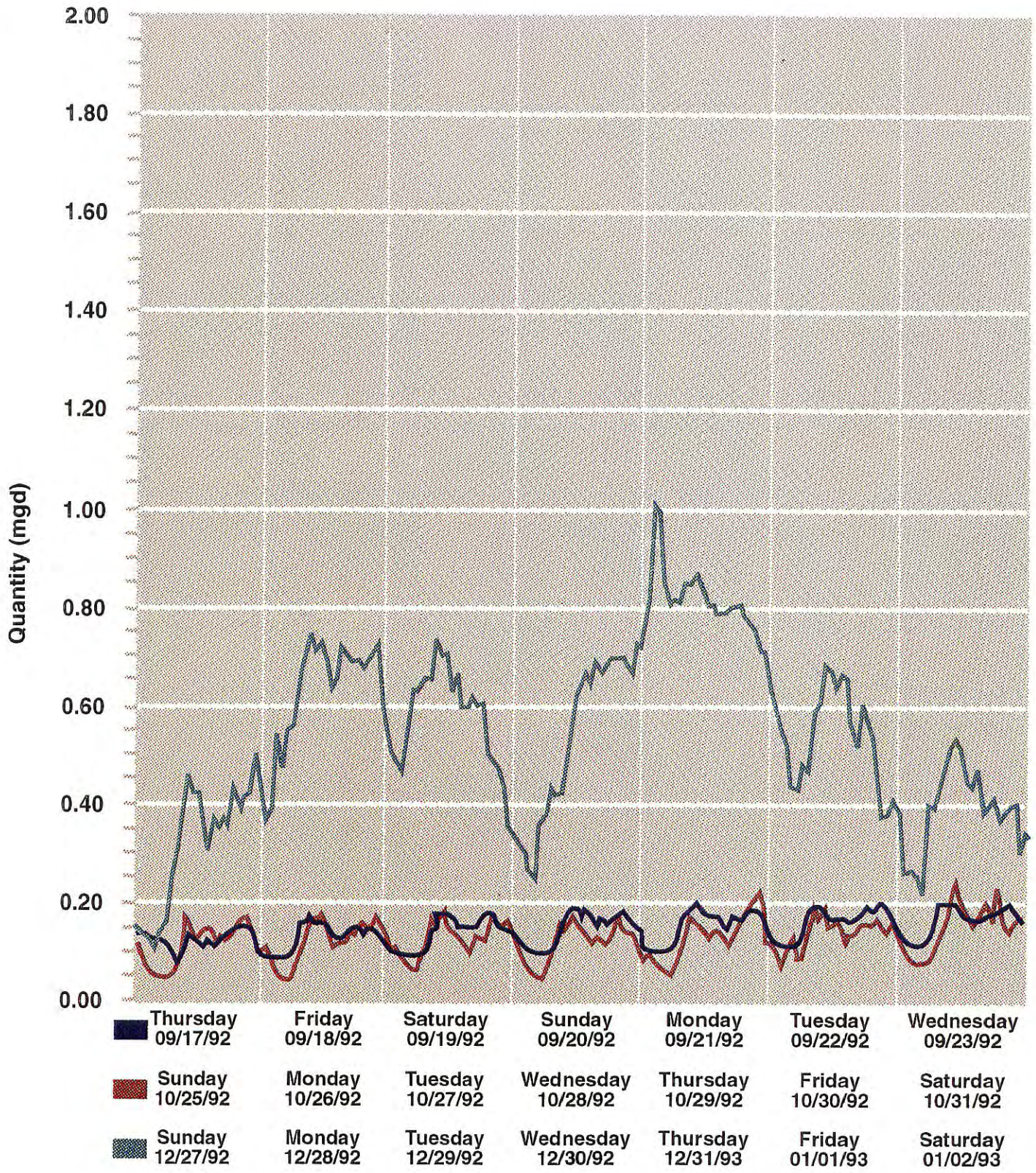


Figure 3-2
Flow Monitoring Results
Manhole RI-48

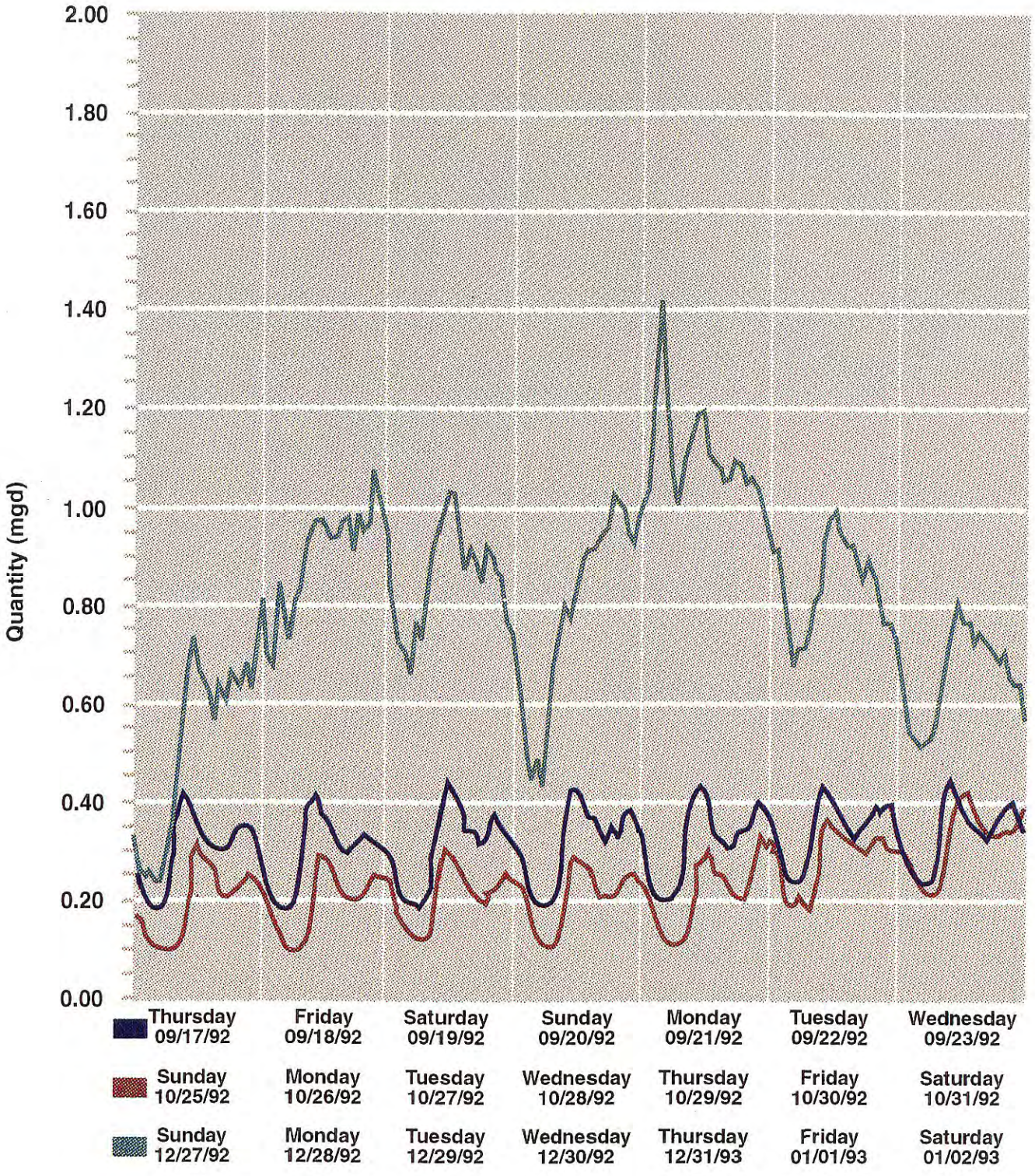


Figure 3-3
Flow Monitoring Results
Manhole RI-26

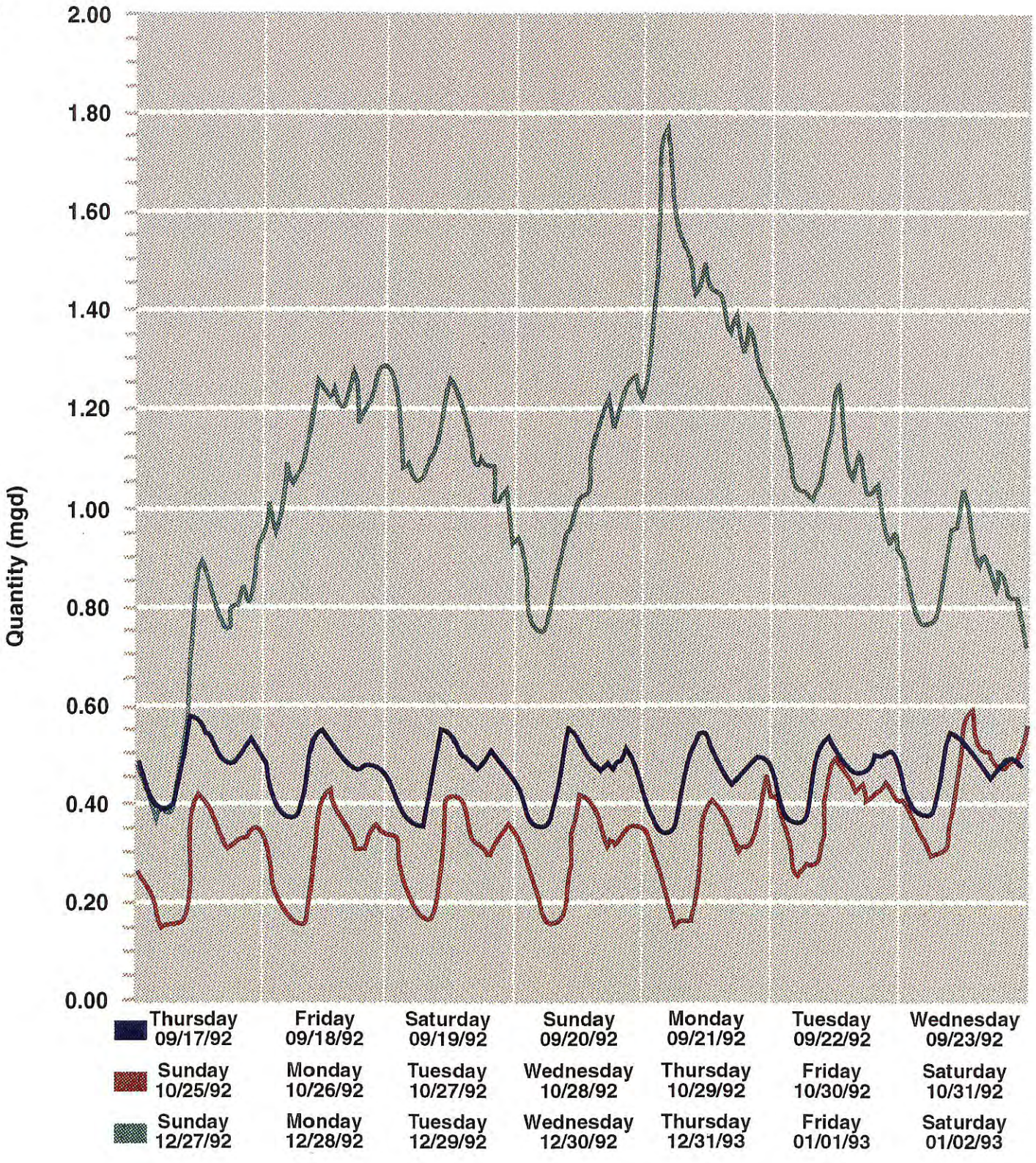


Figure 3-4
Flow Monitoring Results
Manhole RI-5

3.3 INFILTRATION AND INFLOW ASSESSMENT

3.3.1 Infiltration

The difference in flow measured at each manhole during September and October is significant, particularly at Manholes RI-26 and RI-5. It likely indicates that groundwater infiltrates into the collection system during the irrigation season and during extended rainfall events. This is apparent, based on the following observations:

- The lowest flows measured between 3:00 and 5:00 a.m. at Manhole RI-48 changed from ± 0.13 mgd in September to ± 0.06 mgd in October. The October flows probably represent a base flow without infiltration. The September flows probably represent flow with infiltration. Since the September flows are double the October flows, the difference is probably only infiltration from high groundwater conditions owing to irrigation.

- Flows measured at Manhole RI-26 were consistently almost 0.10 mgd higher in September than in the first four days of October flow measurement. Flow conditions at this point in the system were significantly affected by the high groundwater conditions in September, but not by rainfall, since no rainfall occurred until October 28. The 0.10 mgd difference in flow is therefore probably due to infiltration into the collection system.

- Flows measured at Manhole RI-5 were consistently almost 0.20 mgd higher in September than in the first four days of October flow measurement. As with Manhole RI-26, flow conditions at Manhole RI-5 were also significantly affected by the high groundwater conditions in September. The 0.20 mgd difference in flow is probably attributable to infiltration.

- During the latter days of October, flow measurements increased as a result of rainfall (October 28 to October 31). Flow increased appreciably on October 30, the highest rainfall event. Groundwater levels were presumably rising during each day of rainfall. This resulted in October flow measurements approaching September measurements during October 30 and 31. These flows resulted from infiltration of groundwater into the collection system.

Collection system infiltration is significant. Flow measurements to date indicate that infiltration into the collection system may amount to as much as 0.20 mgd during the highest groundwater levels. Highest groundwater levels occur either during the irrigation season (summer) because of irrigation and canal leakage, or during the winter rainy season. Low groundwater levels may occur only during the spring, before irrigation, or the fall, after irrigation ends but before significant rainfall occurs.

3.3.2 Inflow

The difference in flow measured at each manhole during October and December/January is also significant. Substantial differences occurred at all three manholes, likely indicating inflow into the collection system during prolonged heavy rainfall.

Figure 3-5 presents October, December, and January flow measurements at Manhole RI-5 and the daily rainfall records. Generally, the greater the daily rainfall, the greater the daily flow measurements. Inflow into the collection system is also significant.

Rainfall increased wastewater flow at all three manholes. All three portions of the collection system appear to be equally impacted by rainfall.

3.4 COLLECTION SYSTEM CONDITIONS

3.4.1 Non-Excessive I&I Definition

The U.S. Environmental Protection Agency (EPA), in a publication entitled, *I&I Analysis and Project Certification* dated May 1985 (EPA 1985), sets numerical limits for both non-excessive infiltration and inflow based on results of national surveys of sewerage agencies.

The EPA criteria for non-excessive I&I are as follows:

- If the average daily flow per capita (excluding major industrial and commercial flows greater than 50,000 gpd each) measured during 7- to 14-day dry periods during seasonal high groundwater is less than 120 gallons per capita day (gpcd), the collection system infiltration shall be considered non-excessive.

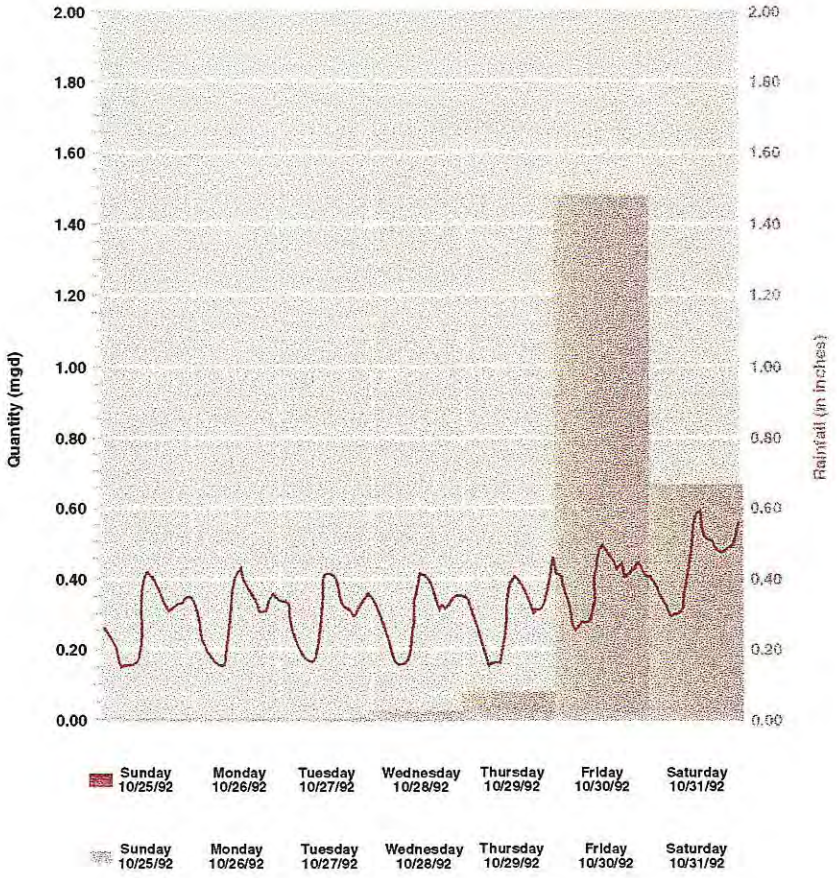
  The EPA criteria for determining non-excessive infiltration includes the following flow components:

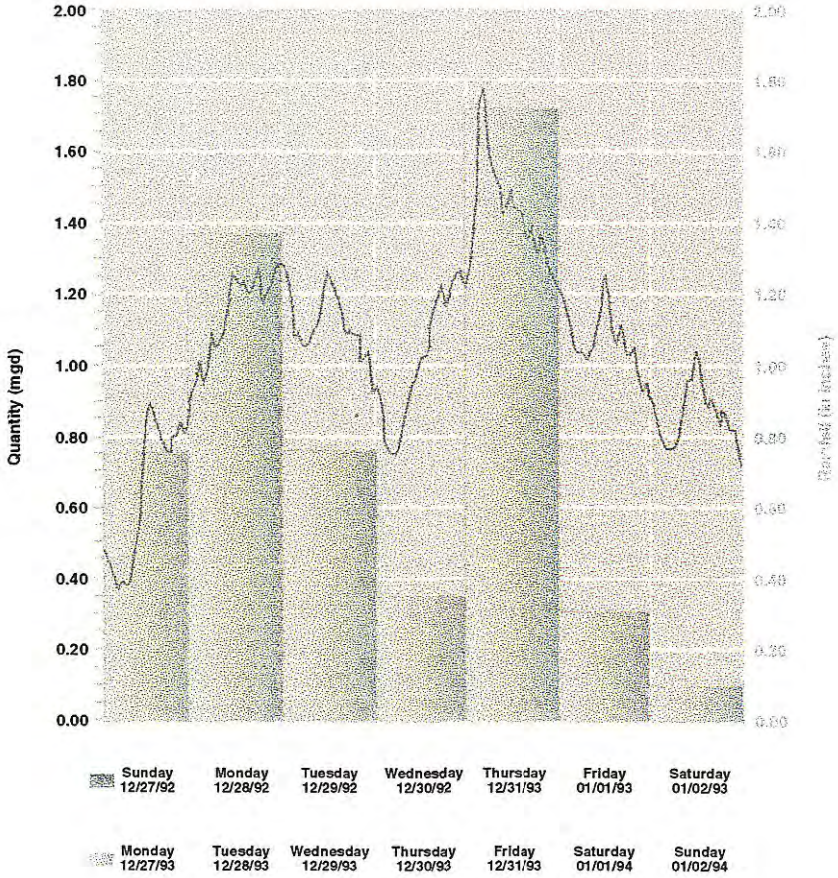
  a. 70 gpcd is considered the domestic wastewater base flow.

  b. 50 gpcd is considered the non-excessive infiltration flow.

  The total flow standard of 120 gpcd is based upon these two components.

- If the average daily flow per capita (excluding major industrial and commercial flows greater than 50,000 gpd each) measured during periods of significant rainfall during which the treatment plant does not experience hydraulic overloads is less than 275 gpcd, the collection system inflow shall be considered non-excessive.





Redwood Waste Water Treatment Plant
#27-2192-05 02/99

Figure 3-5
Flow Monitoring Results and Rainfall Data
Manhole RI-5

The EPA criteria for determining non-excessive inflow includes the following two flow components:

a. 70 gpcd is considered the base domestic wastewater flow.

b. 205 gpcd is considered the level of non-excessive inflow flow.

The total flow standard of 275 gpcd is based upon these two components.

If excessive infiltration and/or inflow is determined, further studies must quantify the excesses and evaluate corrective measures. Using the results of these studies, the most cost-effective solution is then selected. Possible solutions could include a sewer rehabilitation program, sizing of the treatment plant to handle inflow and infiltration, or some combination of these two approaches.

3.4.2 Comparison to Measured Flows

Infiltration

During September 1992, the measured seven-day average daily flow at Manhole RI-5 was 0.464 mgd. If the population served by the plant at that time was 3,775, this flow equates to 122 gpcd and is greater than the EPA 120 gpcd criteria.

It is greater than the criteria, however, only by 2 gpcd. At less than two percent of the standard, it is doubtful whether EPA would conclude the Redwood sanitary sewage collection system has excessive infiltration.

Inflow

The highest measured instantaneous flow occurred during December/January at Manhole RI-5 (1.86 mgd) where average daily flow was 1.07 mgd. This flow occurred on December 31, 1992.

The highest measured flow equates to 493 gpcd and the average daily flow equates to 283 gpcd using a service area population of 3,775. Both of these values are more than the EPA criteria for excessive inflow. The District's sanitary sewer does appear to have excessive inflow based on these data, particularly if rainfall on this date (of the highest measured flow) is considered.

Even though highest instantaneous flows occurred on December 31, 1992, only 1.73 inches of rainfall was measured. This is not a significant event. The 2-year, 24-hour rainfall event is 3.0 inches (Section 2.4), almost twice the rainfall on December 31, 1992. Had the rainfall been greater, undoubtedly the average daily flow at the plant would have been higher.

Historical plant flow records report flow exceeding 275 gpcd twice during the last five years of data; however, these data were recorded by an old flow meter.

3.5 INFILTRATION AND INFLOW RECOMMENDATION

The collection system exceeded EPA criteria for both I&I during the flow monitoring periods. The infiltration criteria was exceeded by only a modest amount, 2 gpcd over the criteria. However, the inflow criteria were exceeded during an event less than a 2-year, 24-hour storm event. This requires action(s) to correct inflow.

We recommend that the District establish an I&I correction program because (1) evidence indicates that inflow is excessive, whereas infiltration is only marginally excessive; and (2) we understand that the State of Oregon has an understanding with small municipalities and districts that if inflow problems are addressed and corrected in wastewater collection systems, the infiltration problems, unless severe, do not require correction. Correcting infiltration is generally not cost-effective.

3.5.1 Cost

To correct excessive collection system I&I, it is recommended that the District institute an annual I&I reduction program budget. Annual expenditures should be integrated into the District's financing for capital improvements and operations and maintenance.

It is recommended that an annual expenditure of $25,000 be budgeted for district I&I correction. This amount should be budgeted until 2003, at which time another evaluation of I&I in the system should be completed.