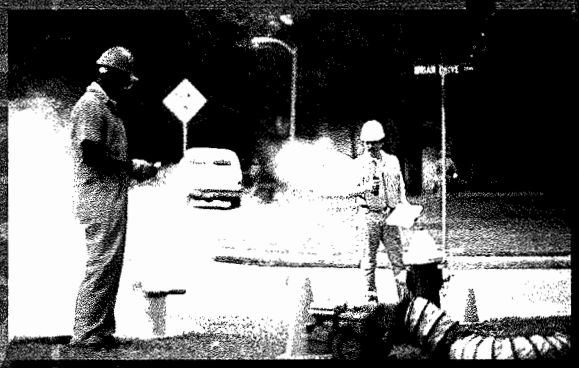

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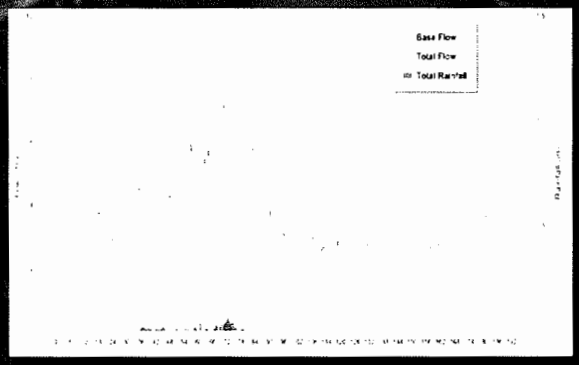

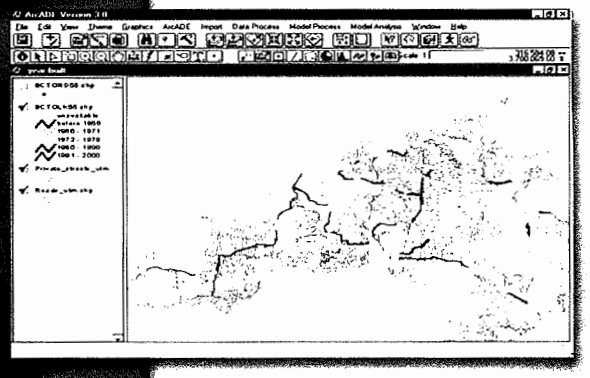

City of Thousand Oaks

Wastewater Interceptor Master Plan Final Report

MWH
MONTGOMERY WATSON HARZA

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List of Acronyms

ADS – Subconsultant to MWH for monitoring and inspections
AS400 – IBM mainframe database system
CCTV – Closed Circuit Television
CIP – Capital Improvement Program
CIPP – Cured in Place Pipe
CMOM – Capacity, Management, Operation, and Maintenance Program
CUES – Company Specializing in CCTV Inspection Equipment
DWF – Dry Weather Flow
EPA - Environmental Protection Agency
GASB34 - Government Accounting Standards Bureau regulation
GBA – George Butler Associates (data management software vendor)
GIS – Geographic Information System
GWI – Groundwater Infiltration
I/I – Infiltration and Inflow
ILS – Industrial Lift Station
MGD – Million Gallons per Day
MH – Manhole
MWH – Montgomery Watson Harza, Inc.
NEXRAIN – Subconsultant to MWH for radar rainfall data
NPDES - National Pollutant Discharge Elimination System
O&M - Operation and Maintenance
OSHA – Occupation Safety and Health Administration
PDWF – Peak Dry Weather Flow
Pipe Materials:
- AC or ACP – Asbestos Cement Pipe
- DIP – Ductile Iron Pipe
- PVC – Polyvinyl Chloride Pipe
- RCP – Reinforced Concrete Pipe
- RPMP - Reinforced Plastic Mortar Pipe (Techite)
- VC or VCP – Vitrified Clay Pipe

PWWF – Peak Wet Weather Flow
"R" value – Ratio of RDI/I volume to rainfall volume
RDI/I – Rainfall-Dependent Infiltration and Inflow
RWQCB - Regional Water Quality Control Boards
SSO – Sanitary Sewer Overflow
SWRCB - California State Water Resources Control Board
WWF – Wet Weather Flow

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Section 1

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CHAPTER 1 – SUMMARY

The City of Thousand Oaks Wastewater Interceptor Master Plan presents a comprehensive assessment of the structural condition and hydraulic capacity of the City's interceptor sewer system, and a phased 10-year plan for capital improvements. The Master Plan is the culmination of over a year of work by the staff of the City's Public Works Department (City) and its consultant, MWH Americas (MWH).

The City's wastewater collection system consists of 382 miles of separate sanitary sewers ranging in size from 6 inches to 48 inches in diameter. The oldest sewers in the system date back to 1958, when the area was first sewered and the Hill Canyon Plant was constructed. In 1965, the City took over the system and plant from the Conejo Valley Sanitation District. At that time, there were approximately 90 miles of sewers, or about a quarter of the today's total. As shown in Figure 1-1, the system expanded greatly between 1975 and 1979; about a third of the total system was built in this 5-year period.

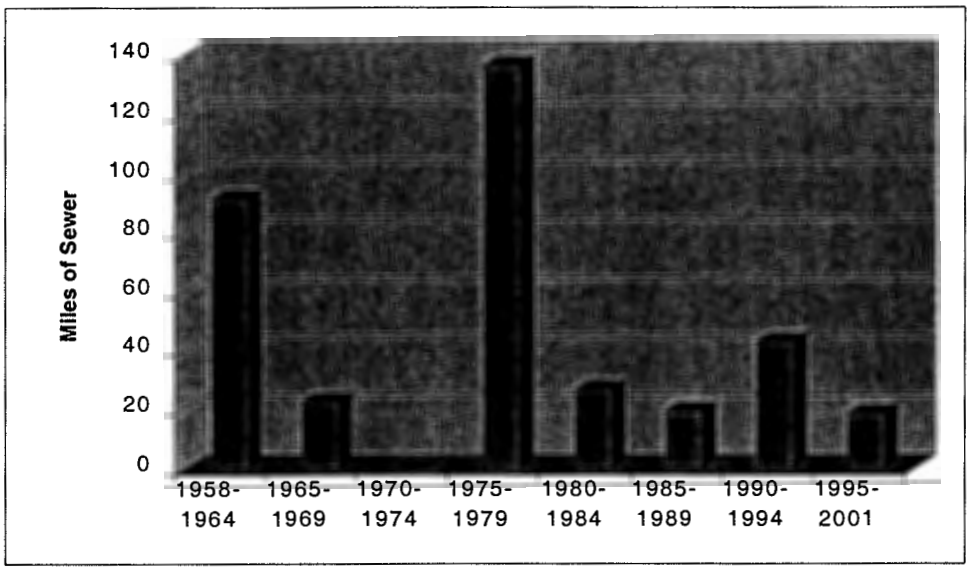

Figure 1-1
City of Thousand Oaks Sewer System – Miles by Year of Construction

The collection system is divided into 11 tributary areas called "units", which have letter designations (A, B, C, E, F, G, U, V, W, X, and Y). The largest sewers serving these units are called interceptors, and represent 34 miles, or about 9 percent of the total length of sewers in the system (see Figure 1-2). These interceptors are the focus of this Master Plan.

Figure 1-3 shows the Master Plan study scope elements, and illustrates the general flow of information from the initiation of the project through to the development of recommended improvements.

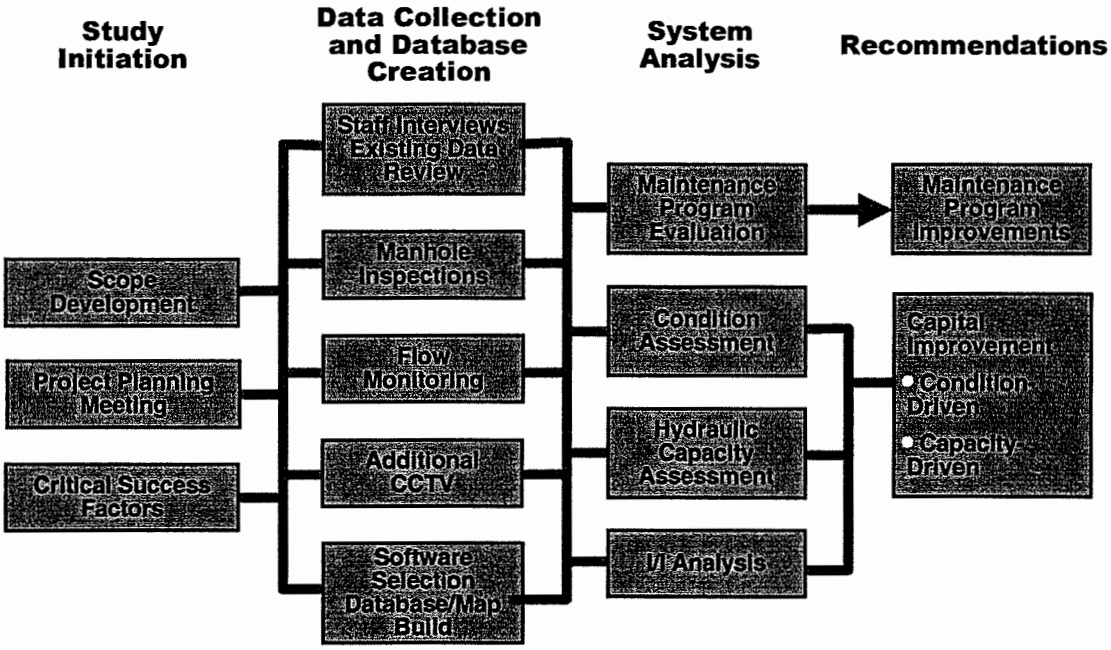

Figure 1-3
Master Plan Scope Elements

Following initial meetings to refine the scope and define the critical success factors, the project team focused on collecting data on the interceptors through review of existing maps and inspection logs, performing additional inspections, monitoring flows, and interviewing City staff responsible for the planning and maintenance of the sewer system. This stage of the project also included the selection and implementation of software to manage sewer data during the study, as well as to assist City staff in future ongoing asset management. The analysis phase of the project consisted of assessing the structural condition and hydraulic capacity of the interceptors, and analyzing the extent of infiltration and inflow of storm water and ground water during wet weather conditions. These assessments provided the basis for recommendations of capital improvement projects to address both hydraulic capacity and structural condition. Recommendations were also made regarding the maintenance and management of the system, including consideration of possible upcoming Federal and State collection system regulations.

A major finding of the study was that the overall structural condition of the interceptor sewers is very good. Although infiltration and inflow of storm water and groundwater occur, the magnitude and impact of those extraneous flows is low relative to that found in most sewer systems. The hydraulic capacity of the interceptors is also adequate to convey the existing wastewater flows under both dry weather and wet weather conditions. When compared to other high-performing agencies surveyed in a nationwide study, the City's system ranked in the upper half. This strong performance is attributable in part to the relatively young age of the sewers, but also to the City's collection system management and maintenance practices.

Sewers, like any other infrastructure asset, deteriorate with time and have a limited useful life expectancy, typically considered to range from 50 to 75 years. Deteriorated sewers cost more to maintain, and run an increased risk of failure, possibly resulting in wastewater overflows. Deteriorated sewers may also allow entry of more storm water and groundwater (infiltration/inflow), which can use up the hydraulic capacity of the sewers during storms and increase the risk of sewage backups and overflows. In some cases, growth and the resultant increases in wastewater flow require that existing sewers be relieved or replaced with larger sewers. These potential problems can be avoided by proactively assessing the system condition and capacity, and implementing capital improvements before failures occur. The recommendations of this Master Plan constitute such a proactive program.

Table 1-1 lists the recommended interceptor improvements and their associated planning-level costs, which include allowances for contingencies and technical services.

Table 1-1
Summary of Recommended Capital Improvement Projects

Project ID	Phase	Basis	Description	Capital Cost
A1	Long-Term	Techite Pipe	Replace 2472' with 12" to 20"	$1,250,000
B1	Medium-Term	Condition	Line 966' of 10"	$110,000
C1	Short-Term	Condition	Line 4530' of 12"	$635,000
E1	Medium-Term	Condition	Line 1950' of 18" to 30"	$525,000
E2	Long-Term	Capacity	Replace 4620' with 39"	$3,850,000
E3	Short-Term	Capacity	Replace 2507' with 30"	$2,240,000
E4	Medium-Term	Capacity	Replace 1725' with 27"	$1,445,000
E5	Medium-Term	Capacity	Replace 3317' with 24"	$2,015,000
E6	Short-Term	Maintenance	New 21" freeway crossing +	$485,000
G1	Short-Term	Capacity	Replace 670' with 21"	$370,000
V1	Long-Term	Capacity	Replace 993' with 18"	$470,000
W1	Short-Term	Capacity	Install new 415' of 21"	$200,000
X1	Short-Term	Condition	Line 455' of 12"	$90,000
Y1	Short-Term	Erosion	Creek bank erosion protection	$250,000
Y2	Long-Term	Techite Pipe	Replace 3119' with 24" gravity Replace 4536' with 18" siphons	$2,700,000 $3,800,000
Y3	Short-Term	Capacity	Seal siphon gate structure Line 280' of 24"	$100,000
Spot Repairs MH Rehab	Short-Term	Condition	3 spot repairs 14 manhole rehabilitations	$85,000 $84,000
Phase Subtotal	Short-Term	All		$4,539,000
Phase Subtotal	Medium-Term	All		$4,095,000
Phase Subtotal	Long-Term	All		$12,070,000
Grand Total	All Phases	All		$20,704,000

These recommended projects address several situations where the condition of the interceptor has deteriorated to the extent that action should be taken in the near future. Likewise, additional capacity needs were identified in several interceptors in order to ensure that future peak wastewater flows will be accommodated with an adequate margin of safety. All projects can be implemented using the City's normal processes for project design and construction.

Each project was assigned to one of three implementation phases, based on its relative priority. These phases are defined as follows:

- Short-term projects to be implemented immediately and completed within two years.
- Medium-term projects to be completed within a 2 to 5 year period.
- Long-term projects to be completed within a 5 to 10 year period.

Based on the capital costs of projects in each of the priority categories, the capital requirements to meet this goal are as follows:

Short-term Projects:	$4,539,000 ($2.3 million per year for 2 years)
Medium-term Projects:	$4,095,000 ($1.4 million per year for 3 years)
Long-term Projects:	$12,070,000 ($2.4 million per year for 5 years)
All Projects:	$20,704,000 ($2.1 million per year for 10 years)

These numbers suggest that the City should budget for annual capital expenditures of about $2 million for interceptor improvements.

As noted earlier, the Master Plan focussed on the interceptor sewers, which constitute only about 9 percent of the sewers by length. In general, these larger sewers are the most critical sewers because they carry high volumes of wastewater and are more likely to have hydraulic capacity problems than smaller sewers. Nevertheless, the City needs a strategy for assessment and long-term rehabilitation/replacement of the remaining 91 percent of the sewers. The Master Plan includes recommendations for such a long-term program. The program would initially focus on the inspection and assessment of all sewers over the next 10 years to establish remaining lifetimes, beginning with older and more critical sewers. These assessments would provide a sound basis for the development of a rational and adequately-funded long-term sewer asset management program.

Computerization is a key to efficient implementation of an asset management program. A key ancillary benefit of the Master Plan study was the initiation of the computerization process through selection of appropriate asset management software (GBA Sewer Master), initial database development, and development of a Geographic Information System (GIS) of the entire sewer system. The Master Plan includes recommendations for further development of the asset management system. These recommendations include tasks such as expanding the sewer database to include additional information such as the age and material of each pipe segment, standardization and computerization of inspection records, and implementation of a computerized maintenance management system.

Another ancillary benefit of the Master Plan was to proactively position the City to comply with upcoming new Federal and State regulations for wastewater collection systems. The study included a preliminary assessment of the City's collection system capacity, management, operation and maintenance (CMOM) program, with recommendations for enhancing the current program to ensure compliance with anticipated future sanitary sewer overflow (SSO) regulations.

Section 2

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CHAPTER 2 – INTRODUCTION

2.1 Background and Study Objectives

The City's previous interceptor Master Plan was completed in 1982. Since that time, the capital improvements that have been implement plus regular system maintenance and repair have resulted in generally good interceptor system performance. However, in view of the time that has passed since the last Master Plan, and in the interest of proactive planning to ensure continued good performance, the City of Thousand Oaks Public Works Department (City) began work on this Wastewater Interceptor Master Plan (Master Plan) in late 2000. The City has been assisted in this effort by the firm of MWH Americas Inc. (MWH) and its three subconsultants: ADS Environmental Services (flow monitoring, manhole inspections, flow isolations, and smoke testing), National Plant Services (sewer television inspections), and Ken Kerri (CMOM assessment).

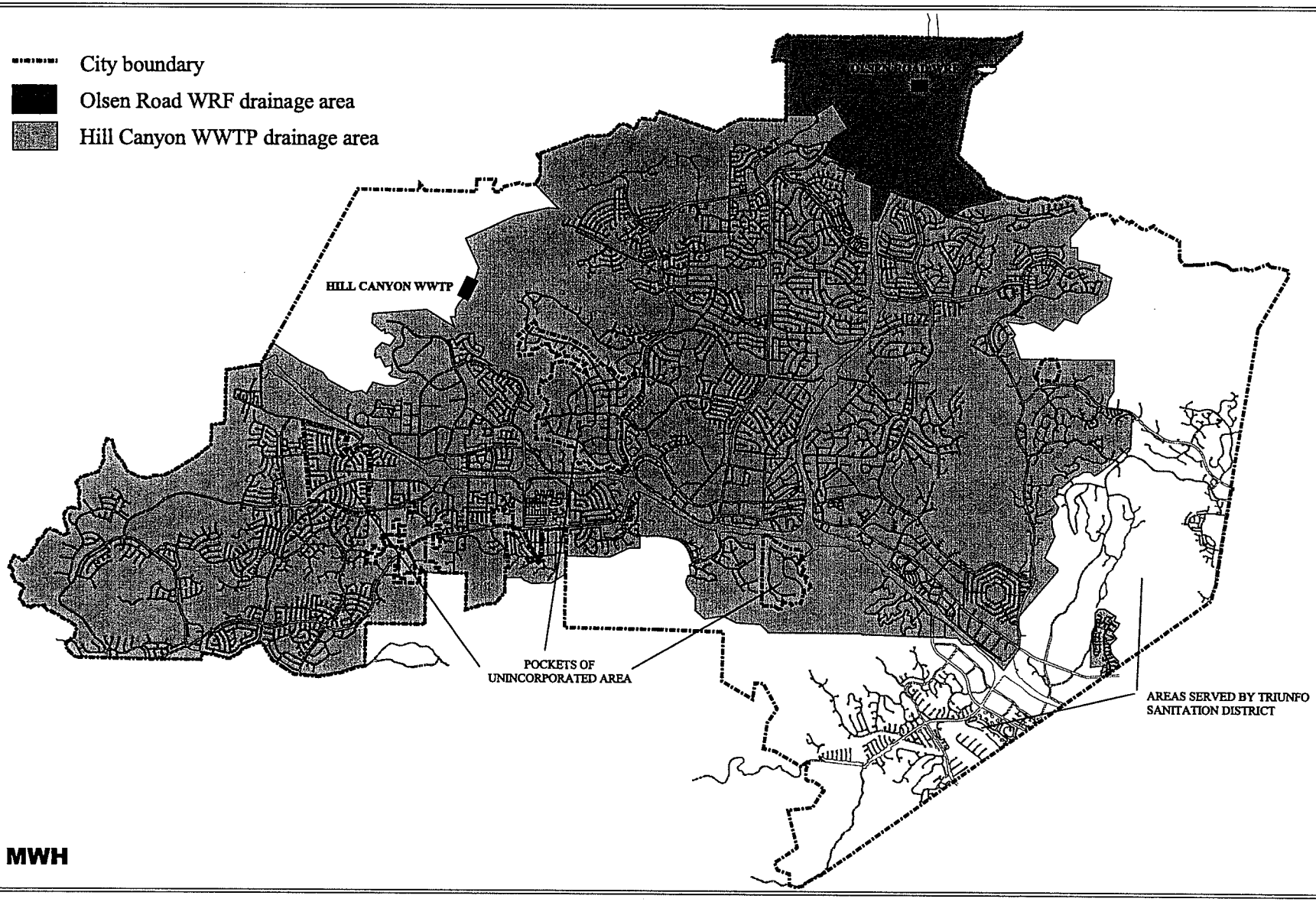
The major objectives of the Master Plan study were:

- Assess the current physical condition of all interceptors.
- Quantify infiltration/inflow of storm water and groundwater into the sewer system.
- Analyze the hydraulic capacity of the interceptors under existing and future flows.
- Proactively identify required capital improvements to the interceptors to ensure adequate capacity and sound structural condition.
- Perform a preliminary assessment of the City's collection system capacity, management, operation and maintenance (CMOM) program in anticipation of future sanitary sewer overflow (SSO) regulations.
- Begin the development of a sewer asset management system, including the selection and application of software for storing physical asset data, inspection findings, and maintenance activities, with links to a geographic information system (GIS).
- Recommend future activities to implement capital improvements, infiltration/inflow control measures, long-term sewer rehabilitation/replacement program, CMOM program enhancements, and computerized systems for sewer asset management, GIS, and maintenance management.

2.2 Study Area

The study area for this Master Plan consists of the service area of the City's Hill Canyon Wastewater Treatment Plant, as shown in Figure 2-1. The current population in the service area is about 108,000. The service area of the Olsen Road Water Reclamation Facility was also included in this study, since the facility will soon be abandoned and replaced by a pump station that will deliver wastewater from that area (about 0.3 mgd) to the Hill Canyon Plant.

Figure 2-1
City of Thousand Oaks Wastewater Service Area



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The service area boundaries largely coincide with the boundaries of the City of Thousand Oaks, although there are some small unincorporated pockets that are served as well as some areas within the southeastern part of the city that are served by the Triunfo Sanitation District. The City is responsible for all of the publicly owned sewers within this service area.

Land use in the City is primarily residential and commercial, with one major industrial area. Amgen, a large biotechnology firm, is headquartered in the City and generates about six percent of the City's average wastewater flow. Most of the land in the study area is fully developed, but there are some major vacant areas yet to be developed. This future development, combined with Amgen's planned expansions and the abandonment of the Olsen Road Water Reclamation Facility, are expected to eventually increase the average wastewater flow to the Hill Canyon Plant by 18 percent.

2.3 Existing Collection System

The City's collection system consists of 382 miles of separate sanitary sewers ranging in size from 6 inches to 48 inches in diameter. Approximately 80 percent of the sewers are 8 inches in diameter. The majority of the pipes are made of vitrified clay or PVC plastic, although there are reaches of reinforced concrete, asbestos cement, RPMP (Techite), and ductile iron pipe. There are approximately 8,300 manholes and cleanouts in the system.

Figure 2-2 shows the distribution of sewer miles by year of construction, based on data for 360 miles of sewer stored in the City's AS400 asset database. The value of 382 miles for the entire system is the total mileage of pipe shown on the City's atlas maps, and is considered to be more accurate than the asset database. The oldest sewers in the system date back to 1958, when the area was first sewered and the Hill Canyon Plant was constructed. In 1965, the City took over the system and plant from the Conejo Valley Sanitation District. At that time, there were approximately 90 miles of sewers, or about a quarter of the today's total. As shown in Figure 2-2, the system expanded greatly between 1975 and 1979; about a third of the total system was built in this 5-year period.

The collection system is divided into 11 tributary areas called "units", which have letter designations (A, B, C, E, F, G, U, V, W, X, and Y). The major trunk sewers serving these units are called interceptors and are also referred to by the letter designation of the units they serve. The interceptors represent 34.1 miles, or about 9 percent of the total length of the system. Figure 2-3 shows the entire collection system, with the interceptors highlighted.

There are currently no pump stations or force mains in the collection system. The Olsen Road Pump Station and force main were designed in 2001 and are scheduled to be built in 2002.

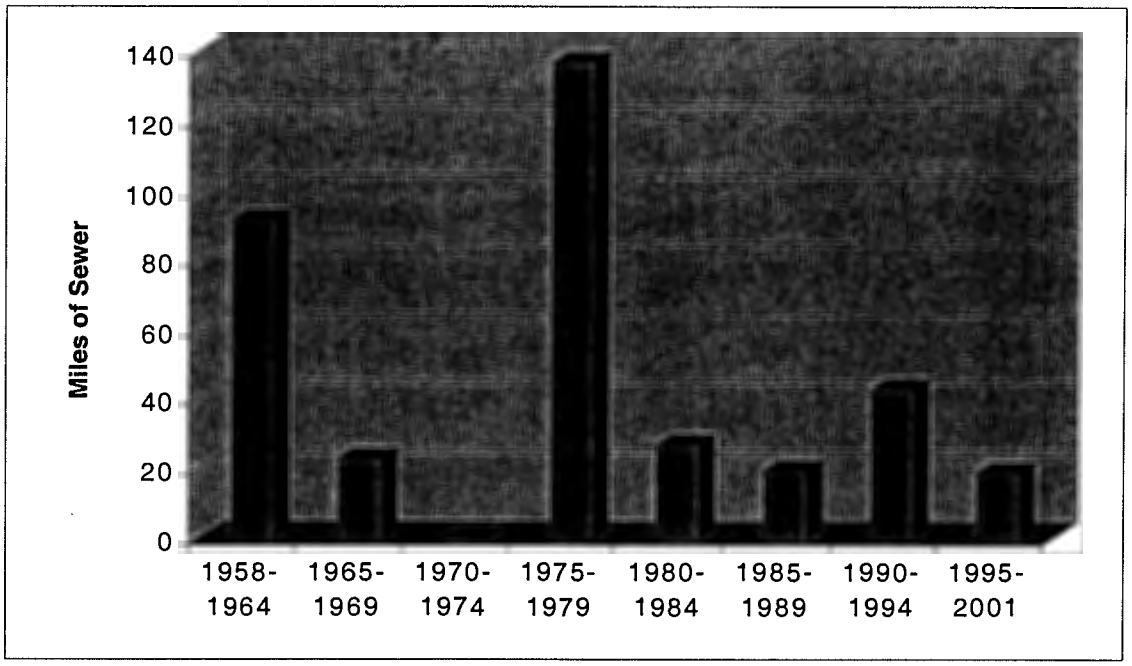


Figure 2-2
City of Thousand Oaks Sewer System – Miles by Year of Construction

2.4 Scope of Study

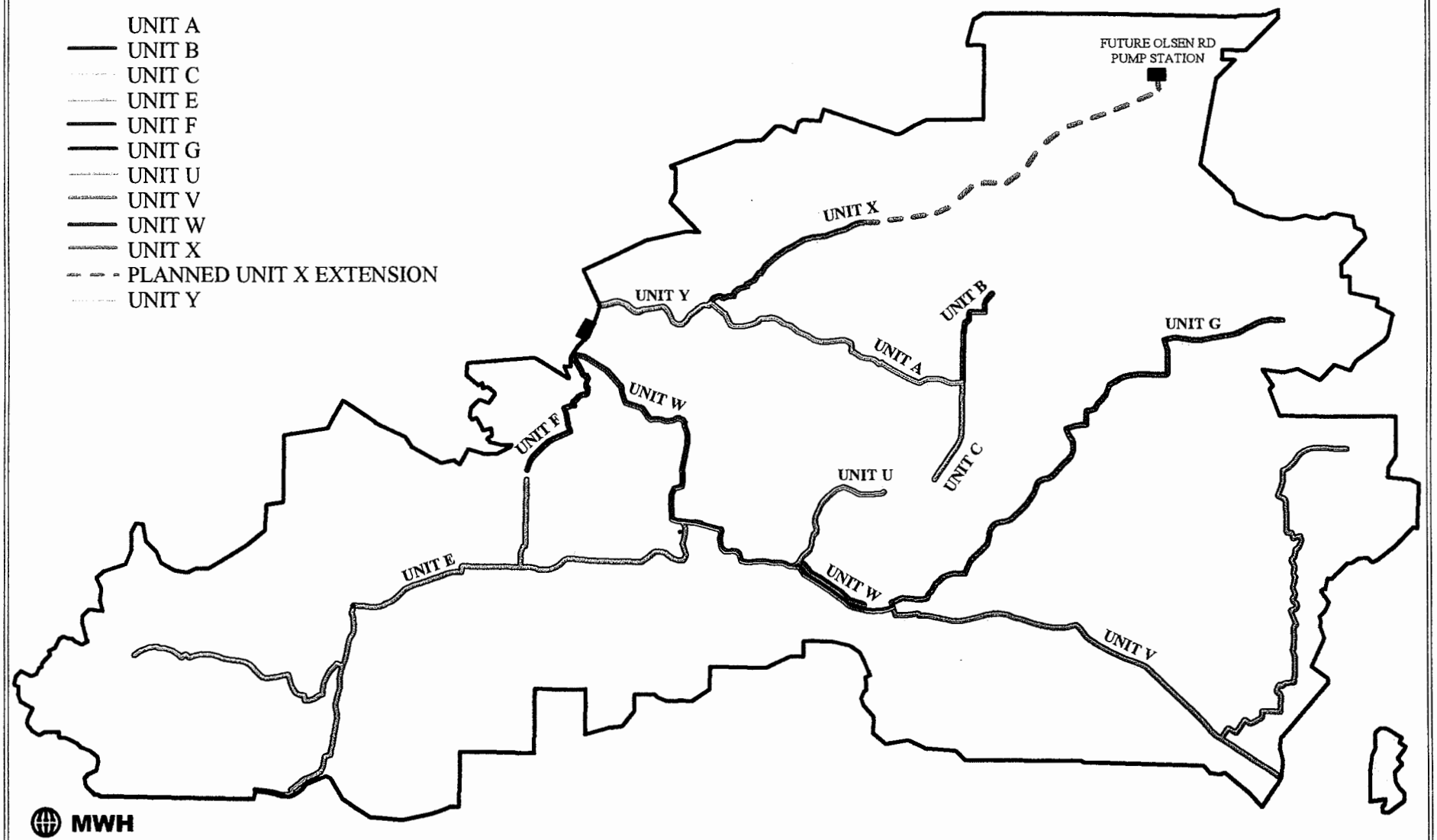
As implied by its title, this Master Plan focuses on the interceptor sewers. The interceptors are the largest sewers, convey the highest volumes of wastewater, and are potentially affected by future development. Much of the scope of this study was related to assessing the physical condition and capacity of the existing interceptors, and identifying capital improvements required to ensure that they continue to operate properly over the next ten-year period.

A few additional miles of major sewers were included in the capacity analysis and some aspects of the condition assessment, although they are not technically designated as interceptors. These sewers were added because they are similar to interceptors in terms of their size and tributary areas. These additional sewers are in the Dos Vientos area off Unit E, and in the North Ranch area off Unit V. They are generally included under the term "interceptor" in this report.

The study assesses only **existing** interceptors and recommends relief, rehabilitation, or replacement projects as needed. These existing interceptors will serve all new development, and thus new interceptors will not be required.

Although the focus of the Master Plan is on the existing interceptors, some of the project tasks were performed for the entire collection system. For example, every manhole and sewer (not only interceptors) was digitized and included in a computer database to

Figure 2-3
City of Thousand Oaks
Wastewater Interceptor Units



establish the foundation for a computerized sewer asset management system. In this project, comprehensive information was input only for the interceptors (i.e., invert and ground elevations, pipe materials, years of construction, capacities, peak flow projections, inspection findings, photographs, digital as-built drawings, etc.). However, the software and database framework was established to allow similar information plus maintenance information to be input on all the sewers in the future.

Another task that extended beyond the interceptor system was the infiltration and inflow (I/I) assessment. This assessment was based primarily on monitoring of flows at several locations along the interceptors during wet weather events, but also included flow isolation measurements and smoke testing in selected non-interceptor sewers which were suspected of being I/I sources. The Master Plan also includes recommendations for a long-term sewer system rehabilitation/replacement program for the entire sewer system.

2.5 Study Tasks

Figure 2-4 shows the Master Plan scope elements, and illustrates the general flow of information from the initiation of the project through to the development of recommended improvements. Following initial meetings to refine the scope and define the critical success factors, the project team focused on collecting data on the interceptors through review of existing maps and inspection logs, performing additional inspections, monitoring flows, and interviewing City staff responsible for the planning and maintenance of the sewer system. This stage of the project also included the selection and implementation of software to manage sewer data during the study, as well as to assist City staff in future ongoing asset management. The analysis phase of the project consisted of assessing the structural condition and hydraulic capacity of the interceptors, and analyzing the extent of infiltration and inflow during wet weather. These assessments provided the basis for recommendations of capital improvement projects to address both hydraulic capacity and structural condition. Recommendations were also made regarding the maintenance and management of the system, including consideration of possible upcoming collection system regulations.

2.6 Report Organization

This section describes the contents of each of the eight chapters and the appendices of this Master Plan report. These chapter descriptions provide further details on the specific tasks included in the scope of this study and illustrated in Figure 2-4.

Chapter 1 Summary

Chapter 1 is a brief stand-alone summary of the Master Plan, with emphasis on the major findings and recommendations. The introductory chapter provides useful background information on the scope and objections of the Master Plan study, the City's sewer system and service area, and the organization of the Master Plan report.

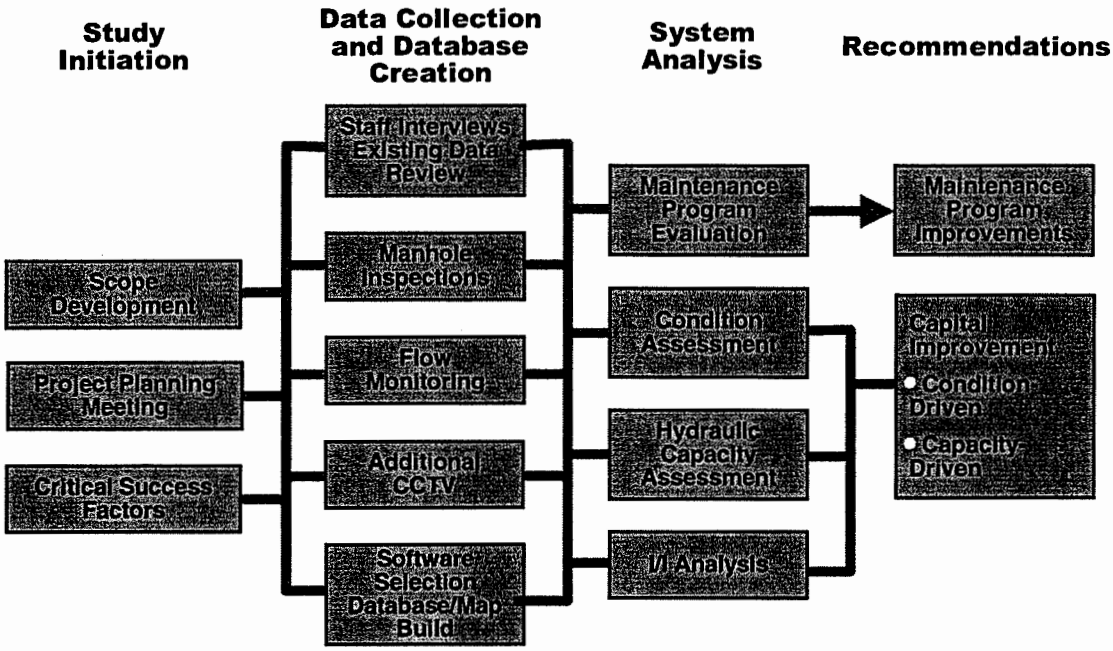


Figure 2-4
Master Plan Scope Elements

Chapter 2 Introduction

The introductory chapter provides background information on the scope and objectives of the Master Plan study, the City's sewer system and service area, and the organization of the Master Plan report.

Chapter 3 Sewer System Database

The preparation of this Master Plan involved the gathering and analysis of a large amount of data on the sewer system and service area. This chapter describes each major data type, its source (maps, record drawings, previous or new field inspections, etc.), and how it was used in the study. This chapter also describes the computerized sewer asset management system and geographical information system (GIS) that was developed to store and analyze the data.

Chapter 4 Interceptor Condition and CMOM Assessment

A major objective of the Master Plan study was to assess the physical condition of the interceptor sewers, using City records on past internal television inspections, plus additional television inspections, manhole inspections, and other field inspections and testing performed during the course of the study. Chapter 4 describes the various

inspections, how they were performed, and how the results were assessed. General conclusions on physical conditions are made in this chapter, while recommended improvements are presented in Chapter 7 (Recommended Capital Improvement Program). Another study objective was to perform a preliminary assessment of the City's collection system capacity, management, operation and maintenance (CMOM) program in anticipation of future sanitary sewer overflow (SSO) regulations. Chapter 4 also includes the results of that assessment.

Chapter 5 Infiltration/Inflow Analysis

Infiltration/Inflow (I/I) of storm water and groundwater into sewers (interceptors, mains, and private laterals) increases peak wastewater flows that must be conveyed within the pipes. There are many factors that can affect the magnitude of I/I, and it can vary greatly in different parts of a sewer system. Chapter 5 presents the findings of the I/I analysis performed as part of this study, which included dry and wet weather flow and rainfall monitoring, wet weather flow isolation measurements, and dry weather smoke testing. Conclusions on the magnitude and location of I/I throughout the sewer system are presented, as well as recommendations for follow-up work.

Chapter 6 Interceptor Capacity Analysis

The hydraulic capacity of the interceptor sewers must be sufficient to convey peak wastewater flows both now and in the future, including infiltration and inflow (I/I). The capacity analysis described in Chapter 6 involved quantifying dry and wet weather flows using land use information provided by the City's Planning Department and unit flow rates and I/I parameters determined from the temporary flow monitoring data. A dynamic computerized hydraulic model of the interceptor system was calibrated and applied to identify sewers requiring additional capacity. This chapter presents the findings and conclusions of the capacity analysis.

Chapter 7 Recommended Capital Improvement Program

Chapter 7 describes the specific capital projects that are recommended for inclusion in the City's capital improvement program (CIP) over the next ten years. Each project write-up includes a project description and map, condition/capacity assessment, project details, planning-level capital cost estimates, and recommended implementation phasing (short, medium, or long term). These projects comprise a proactive program to replace or rehabilitate the interceptor sewers to ensure adequate hydraulic capacity and structural integrity into the future. None of the projects require emergency action; they may be implemented using the City's normal planning, permitting, and design process. This chapter also presents recommendations for a long-term rehabilitation/replacement strategy addressing the entire collection system.

Appendices

The ten appendices present additional supporting data and reports:

A. CCTV INSPECTION FORMS AND REPORTS
B. MANHOLE INSPECTION FORMS AND REPORTS
C. LINE LAMPING FORMS AND REPORTS
D. UNIT Y EXTERNAL INSPECTION
E. CMOM PROGRAM ASSESSMENT
F. RAINFALL-DEPENDENT I/I ANALYSIS PLOTS FOR EVENT 5
G. FLOW ISOLATION REPORT
H. SMOKE TESTING REPORT
I. DRY AND WET WEATHER MODEL CALIBRATION PLOTS
J. GBA MASTER SERIES AND ARCVIEW REFERENCE MANUAL
K. UNIT E SEWER AND ILS AREA ALTERNATIVES (PROJECT E6)

Section 3

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CHAPTER 3 – COLLECTION SYSTEM DATABASE

The preparation of this Master Plan involved the gathering and analysis of a large amount of data on the sewer system and service area. This chapter describes each major data type, its source (maps, record drawings, previous or new field inspections, etc.), and how it was used in the study. This chapter also describes the computerized sewer asset management system and geographical information system (GIS) that was developed to store and analyze the data.

3.1 Data Management Objectives

A stated objective of the Master Plan was to begin the development of a sewer asset management system, including the selection and application of software for storing physical asset data, inspection findings, and maintenance activities, with links to GIS. Specific objectives for the sewer asset management system were:

- Assist City staff in the selection of appropriate commercial software that can serve the data management needs of this project and the future needs of the city for sewer and other infrastructure asset management.

- Select GIS software and create a GIS map of the entire sewer system with links to the sewer asset database.

- Populate the sewer asset database with physical attribute data, using as-built drawings to obtain details on the interceptor sewers, and atlas maps and manhole cards for general information on all sewers. Create links to allow scanned images of the maps, drawings, and cards to be accessed via the database or GIS.

- Store the results of interceptor television inspections and manhole inspections in the asset database. Use the data management software and the GIS to help analyze and present the findings of the condition and capacity analyses of the interceptors.

- Deliver the software and databases to the City and provide basic documentation and training for City staff.

These objectives were met during the course of this study. The following paragraphs describe the details of the sewer asset management system that was created. Presenting this information near the start of this Master Plan report provides the reader with an opportunity to develop a good appreciation for the source and quality of the information that formed the basis for the subsequent analyses and development of the recommended capital improvements. Additional documentation is provided in Appendix J.

3.2 Software Selection

MWH assisted the City in selection of a commercial sewer asset management software package. The basic requirements that were established in the selection process included:

- Windows PC-based
- Store sewer attributes and inspection results in an industry-standard database
- Log sewer complaints and service requests
- Issue emergency and preventive maintenance work orders
- Capture work completed on specific pipe segments
- Interface with ArcView GIS
- Support multiple seats
- Expandable to other infrastructure systems such as water, storm drainage, and roads

Following a review of literature from several vendors, four packages meeting these basic requirements were short-listed and the vendors were invited to demonstrate their software in person and to answer a standard set of questions which included cost information. The short-listed vendors were:

- GBA Master Series
- Hansen Software
- RJN Cassworks
- Sussex

All of the vendors demonstrated their software and provided the required information for evaluation. Current users were contacted for their opinions on the quality of the software and technical support. The GBA Master Series software was selected. The City and MWH concluded that the GBA software provides the best combination of desired features, simplicity, and low cost.

A single-seat license of the sewer management, work management, and GIS modules was purchased for use by MWH during the project, and later turned over to the City. MWH created the sewer database and populated it with sewer attributes and inspection results, using the MS Access database (other database software is also supported). In the future, the City will configure the software for maintenance management applications.

3.3 GIS Mapping and Digital Images

The City had previously selected ArcView by ESRI as its standard geographic information system (GIS) software. However, the City had not yet begun implementation of a GIS, and no City-specific GIS data were available. As part of this project, MWH developed the following GIS and digital image data and products:

- A double-line city street map and associated parcel and city boundaries and atlas map grid were converted from AutoCAD drawing files into a GIS themes and registered to

UTM NAD 27 coordinates. The accuracy of the base map was determined to be adequate for master planning applications. See Figure 3-1.

- All sewer manholes and cleanouts, and the pipe segments connecting them, were digitized into GIS themes using custom digitizing tools. The City's paper atlas maps (1" = 300') were the source maps, and the manholes were digitized over the base map image using a heads-up method. The manholes were placed relative to streets and parcels, essentially maintaining the level of accuracy of the atlas maps. The City's existing interceptor-based manhole identifiers were input as indicated on the atlas maps. See Figure 3-2.

- Manhole index cards previously prepared by City staff were scanned, and the digital images were linked to the appropriate manhole in the GBA database. Each image includes a location sketch of the manhole with distances to landmarks. The images can be accessed through the database or GIS interface by clicking on the manhole. Unresolved discrepancies in the manhole identifiers or missing cards resulted in a small percentage of the manholes in the GIS not having linked card images. Additional work could be performed in the future to resolve these discrepancies. See Figure 3-3.

- The City had previously scanned the as-built drawings of most of the sewers. The digital image files for the as-built drawings of the interceptor sewers were linked to the associated manholes in the GBA database. A small number of the as-built drawings had not been scanned and were therefore not linked. These drawings could be scanned and linked in the future. See Figure 3-4.

- Digital image files of the sewer atlas maps were linked to the associated manholes in the GBA database. The maps can be accessed through the database. See Figure 3-5.

- A separate GIS theme for the interceptor sewers only was developed to facilitate the display of hydraulic modeling and inspection results, which relate only to the interceptors. A series of GIS layouts and views were developed over the course of the project to display sewer attributes (e.g., sewer age, pipe materials), results of assessments (e.g., condition ratings of pipes and manholes, capacity utilization), and project details. These layouts and views were saved for future use by City staff. Many of these layouts are figures in this report. Figure 3-6 is an example showing interceptor pipe diameters in different colors.

3.4 Physical Attributes and Data Sources

The GBA database for all sewers was populated with the following data from the indicated sources:

- Manhole identifiers: from atlas maps
- Manhole Atlas map references: from AS400 manhole database, which was input from data on cards
- Manhole cover types: from AS400 manhole database
- Manhole cover diameters: from AS400 manhole database
- Manhole shaft diameters: from AS400 manhole database
- Manhole wall materials: from AS400 manhole database
- Manhole general locations: from AS400 manhole database
- Manhole rim elevations: from as-built drawings (interceptors only)
- Pipe diameters: from atlas maps
- Pipe materials: from as-built drawings, updated with CCTV records and available pipe replacement records (interceptors only) or atlas maps (non-interceptors)
- Pipe invert elevations: from as-built drawings (interceptors only)
- Pipe lengths: from as-built drawings (interceptors only) or digitized length between manholes, with manhole placement based on atlas maps (non-interceptors)
- Pipe years of construction: from as-built drawings (interceptors only)

GIS interceptor maps showing pipe diameters, pipe materials, and year of construction are shown in Figures 3-6 through 3.8.

3.5 Inspection and Testing Data

The observations obtained from internal closed-circuit television (CCTV) inspections of interceptor sewers performed by City staff and additional inspections performed by National Plant Services were manually entered into the GBA database for further analysis and rating. Interceptor manhole inspections and smoke testing conducted by ADS included observations and photographs, which were also input to the GBA database for analysis, display, and record-keeping. (See Figures 3-9 and 3-10).

Details on the inspection and testing information and its analysis are found in Chapter 4 of this report.

3.6 Maintenance Data

The GBA software includes a work management module for recording customer complaints, issuing work orders, and tracking emergency and preventive maintenance activities. Once configured and implemented, the module will allow City staff to computerize its maintenance program and track the maintenance history on individual manholes and pipe segments. At this time, the manhole and pipe databases have been created, but the work management module has not yet been implemented. Therefore, no maintenance history data currently exists in the GBA database.

Figure 3-1
City of Thousand Oaks GIS Base Map

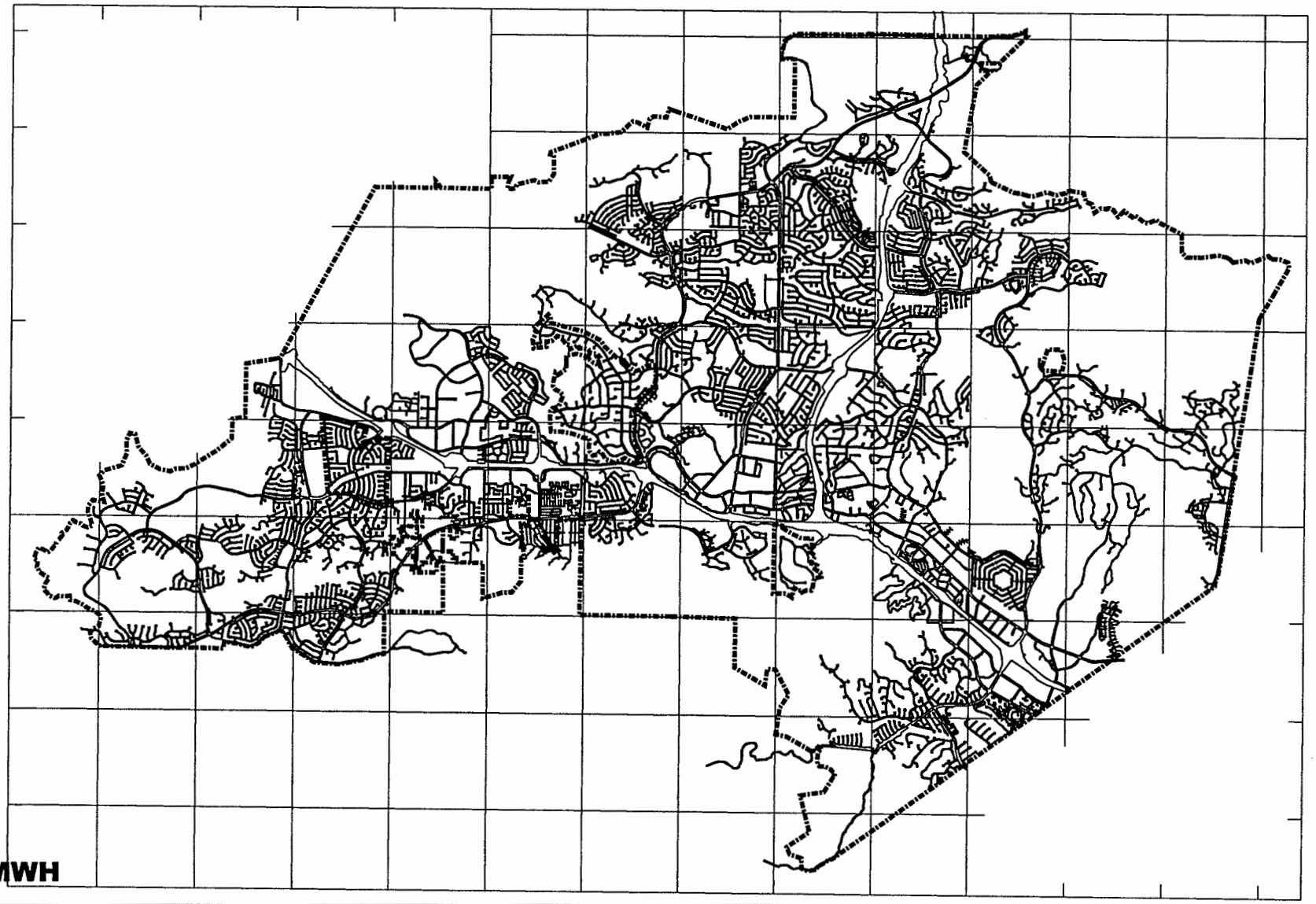

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Figure 3-2
City of Thousand Oaks GIS Sewer Map

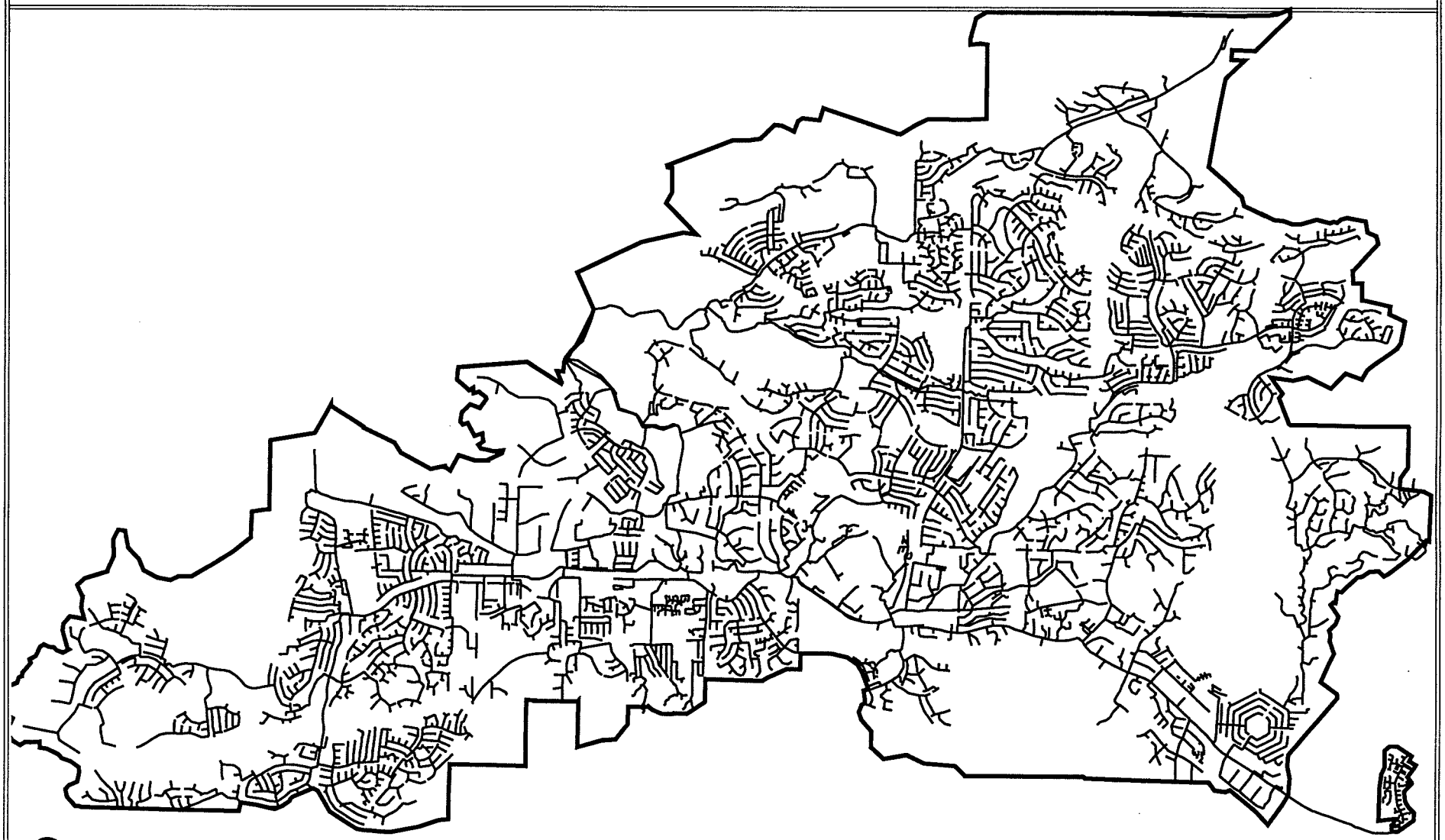

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Figure 3-3. Example of GIS Linkage to Scanned Manhole Cards

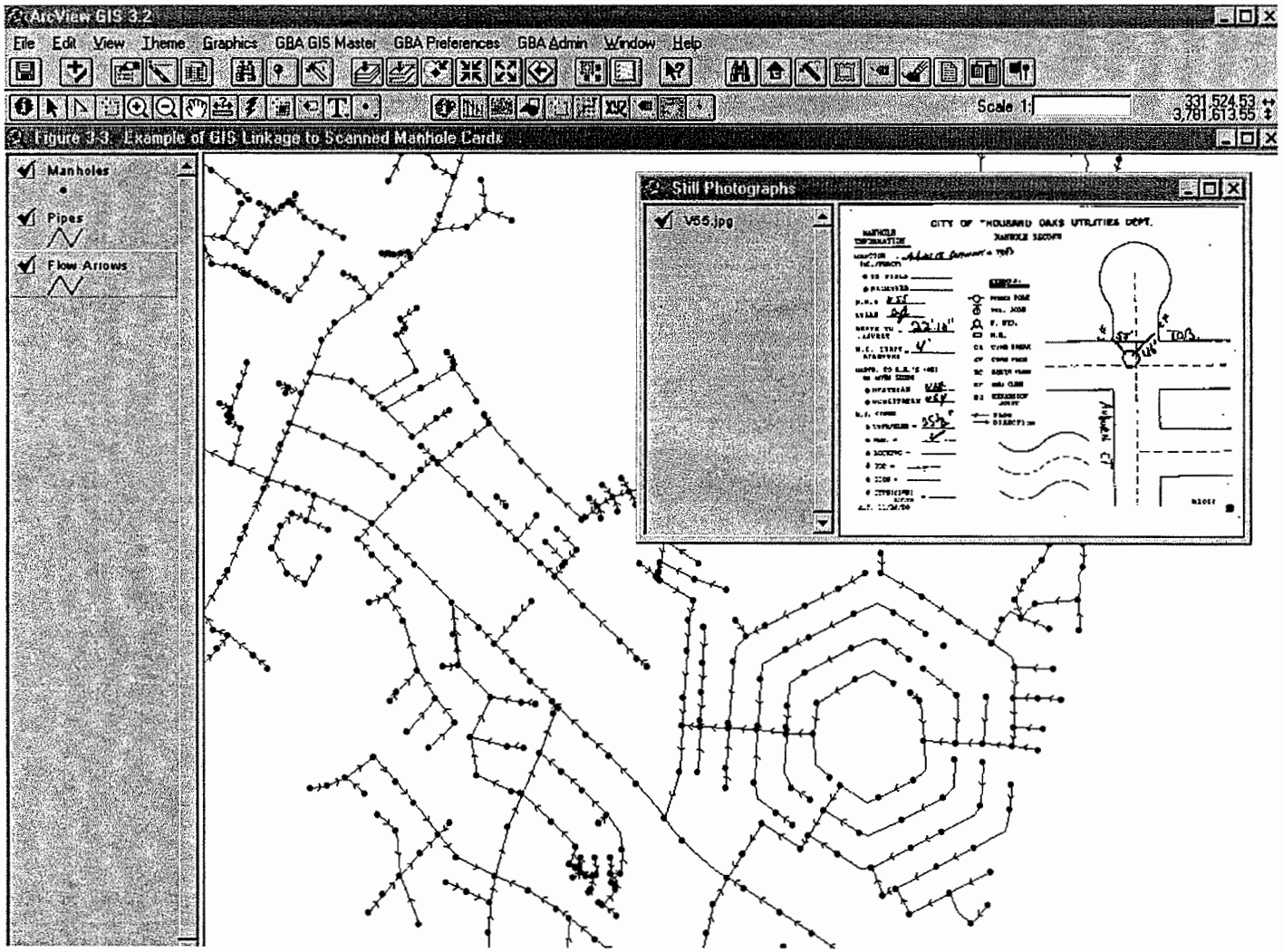

Figure 3-4. Example of GBA Data Management System - Linkage to Scanned As-Built Drawings of Interceptors

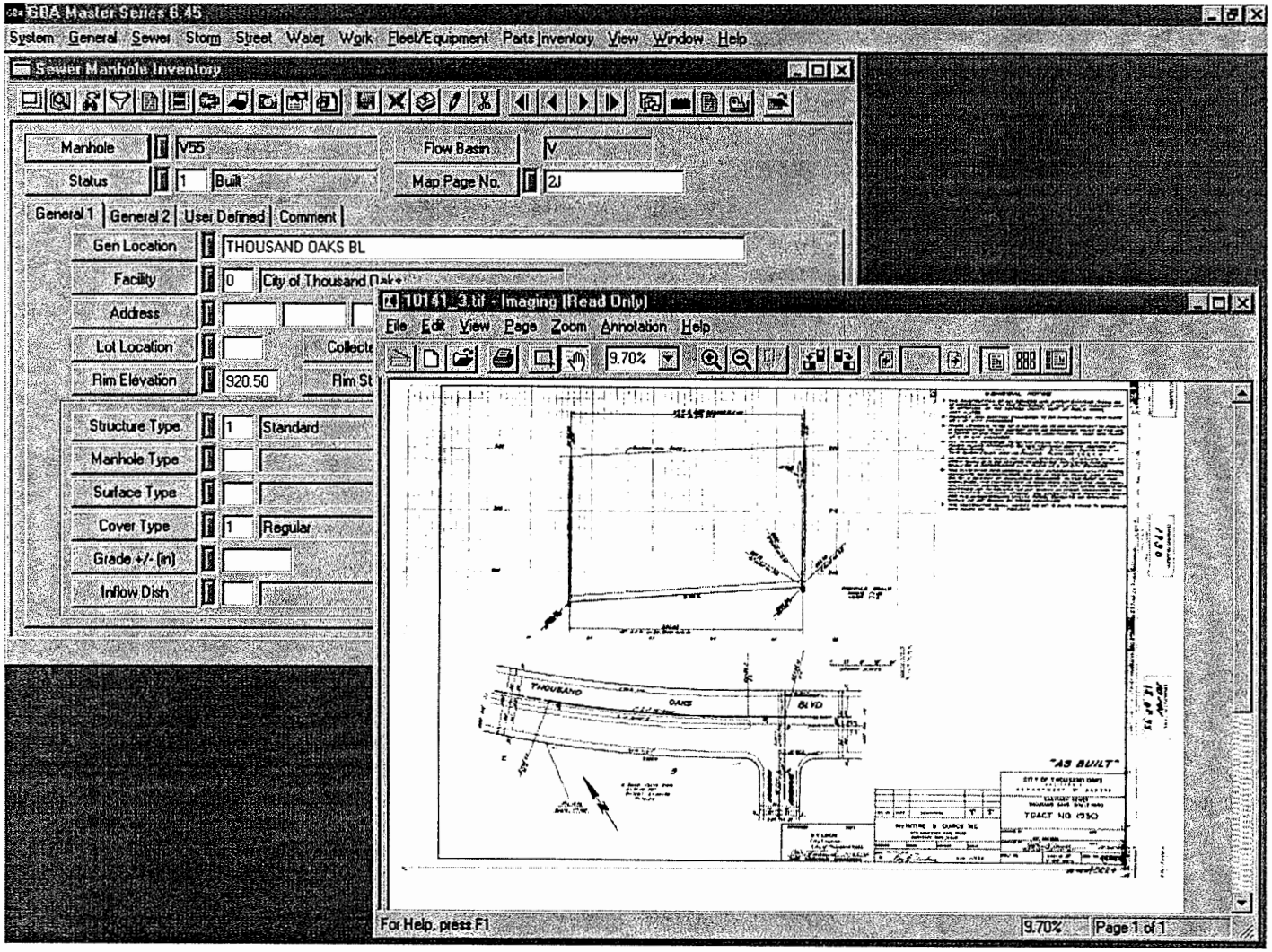

Figure 3-5. Example of GBA Data Management System - Linkage to Scanned Atlas Maps

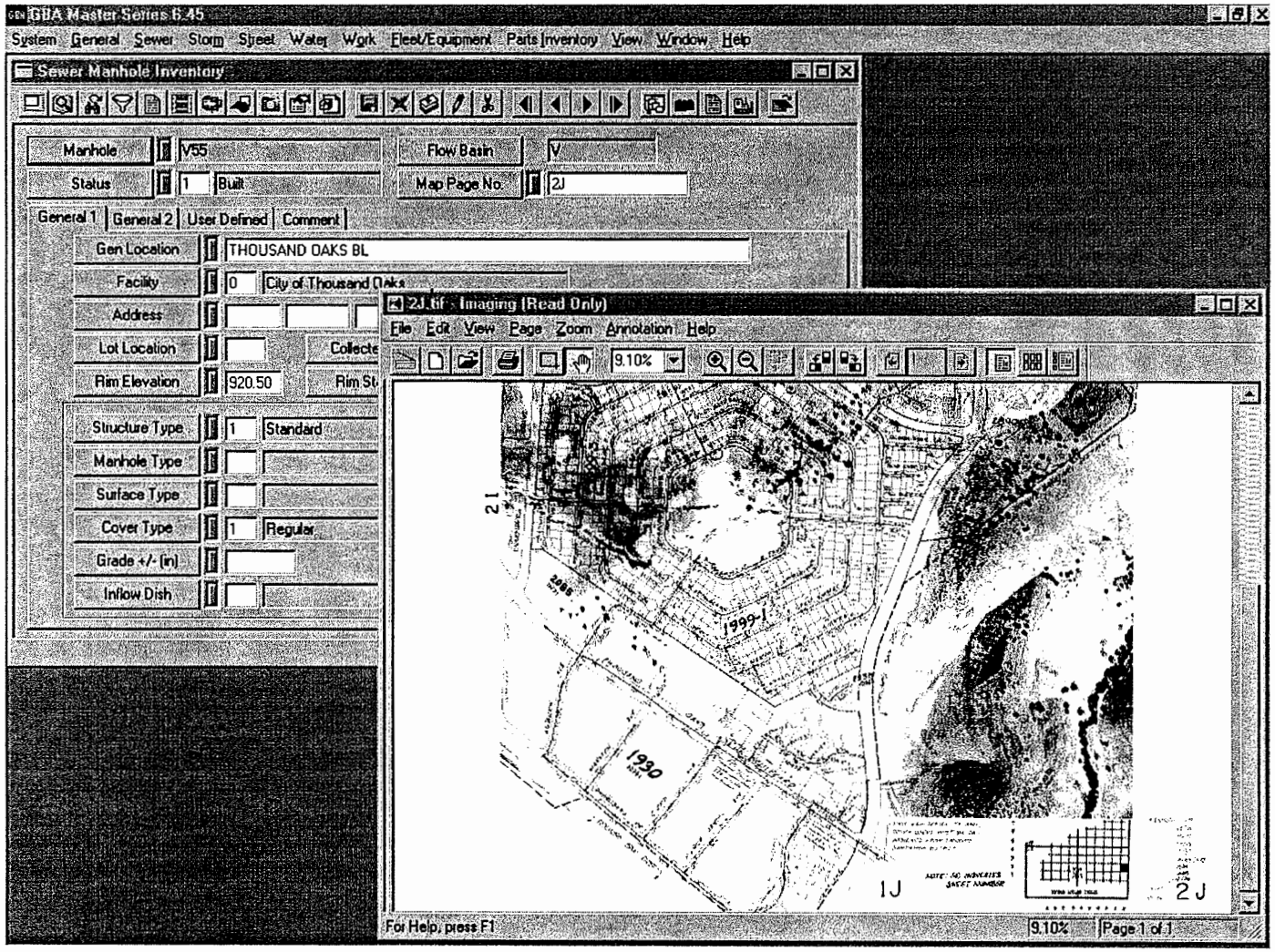

Figure 3-6
City of Thousand Oaks GIS Interceptor Map
Pipe Diameters

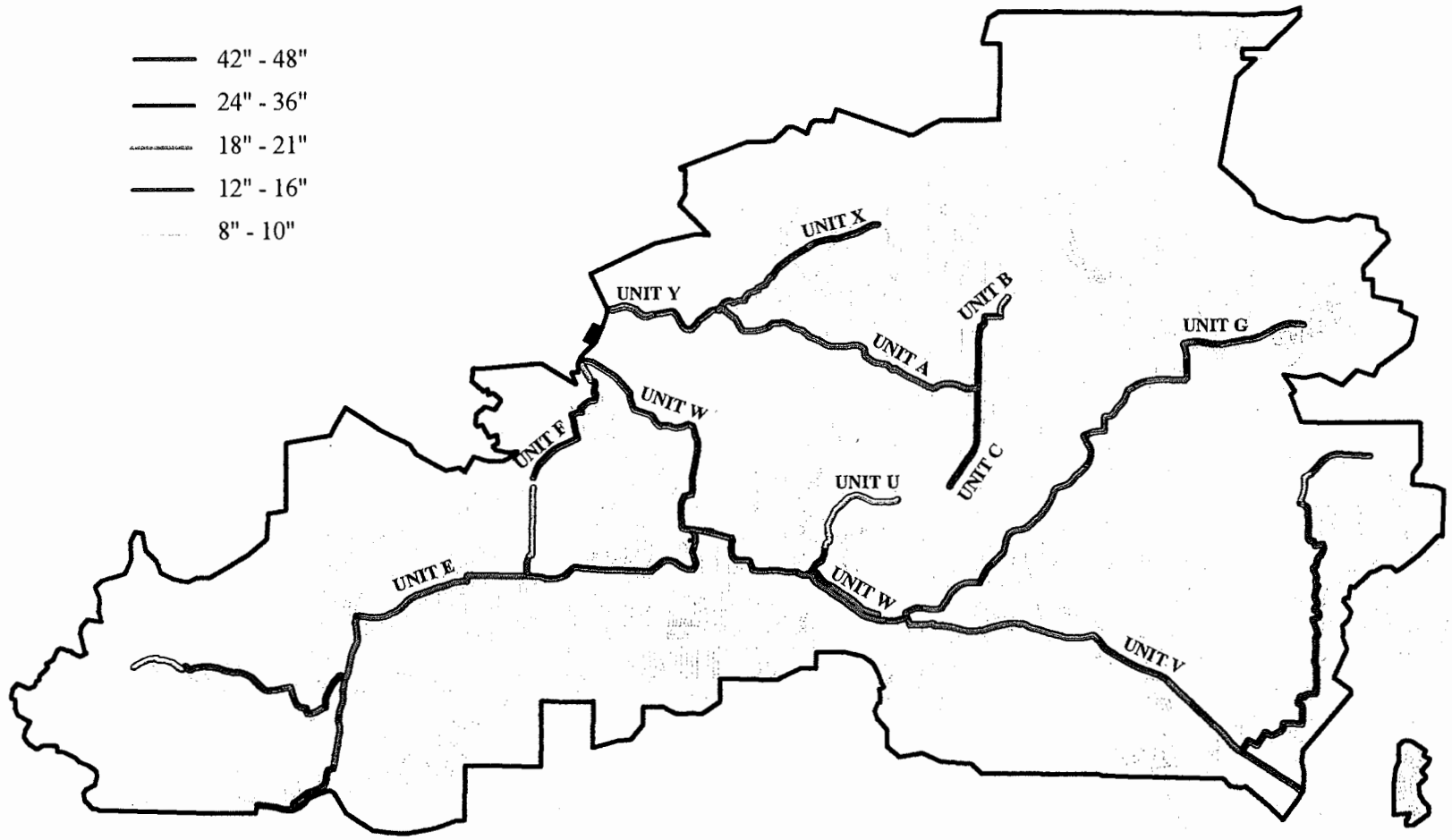

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Figure 3-7
City of Thousand Oaks GIS Interceptor Map
Pipe Materials

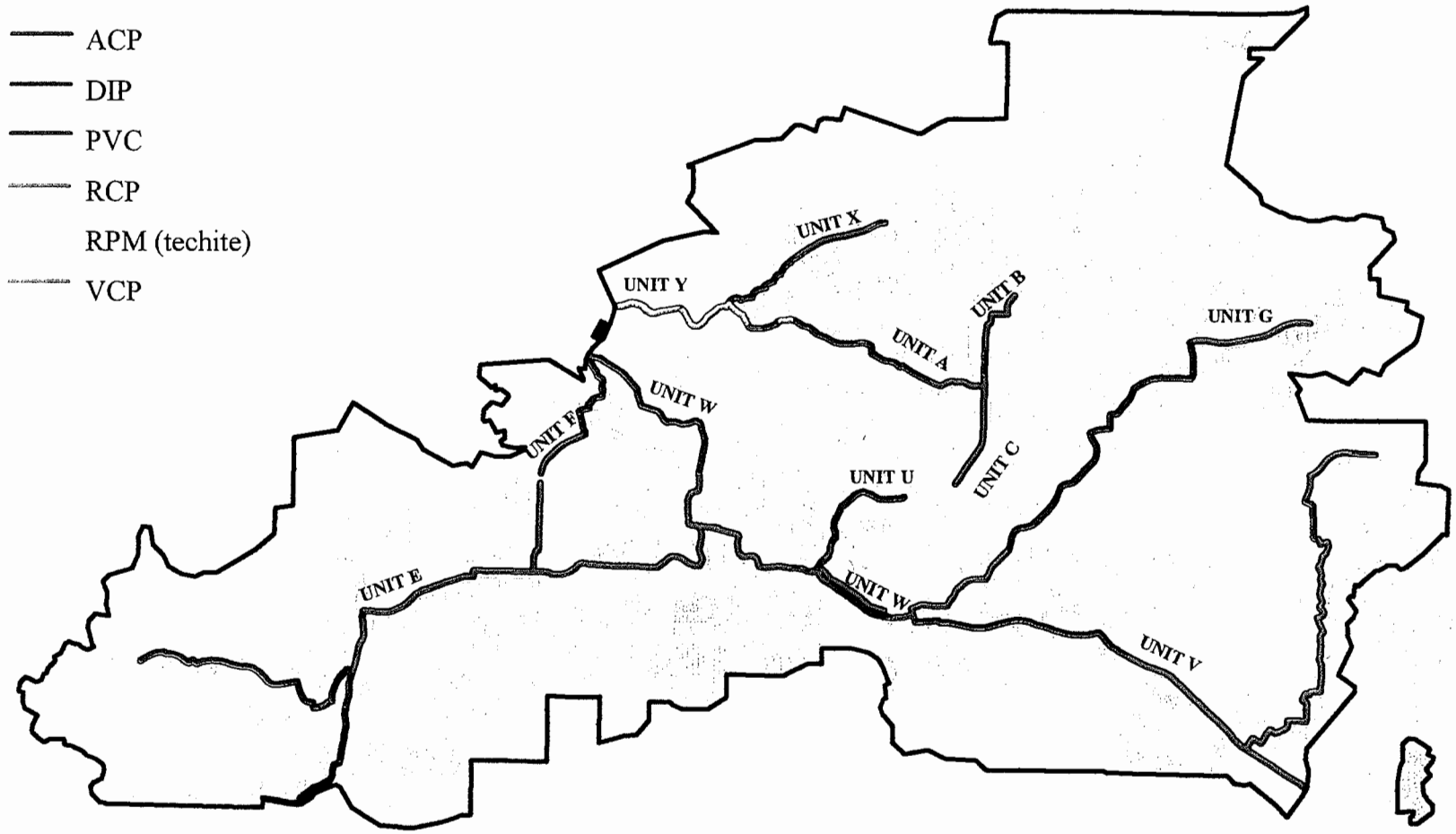

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Figure 3-8
City of Thousand Oaks GIS Interceptor Map
Year of Construction

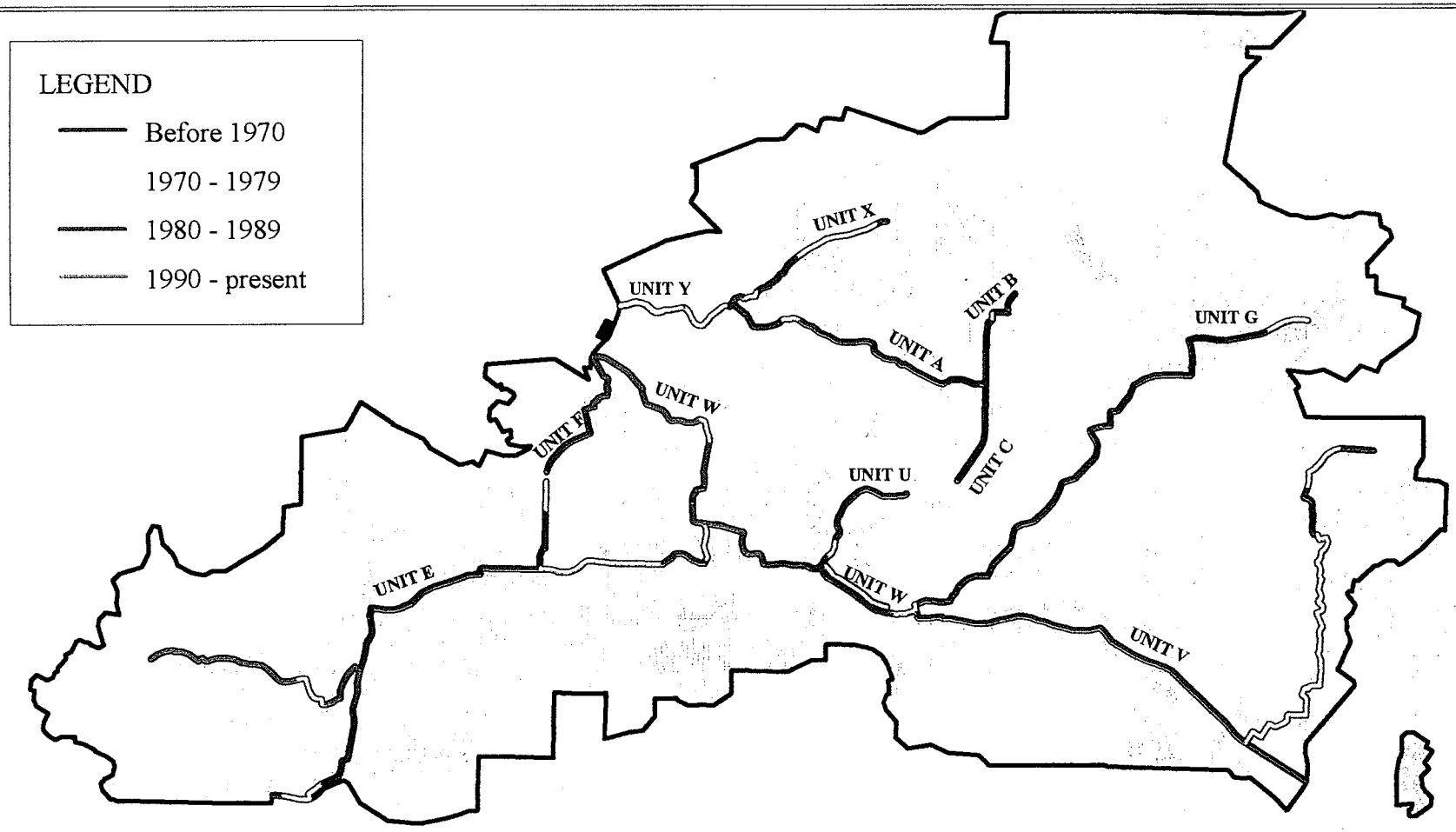

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Figure 3-9. Example of GBA Data Management System – CCTV Inspection Data

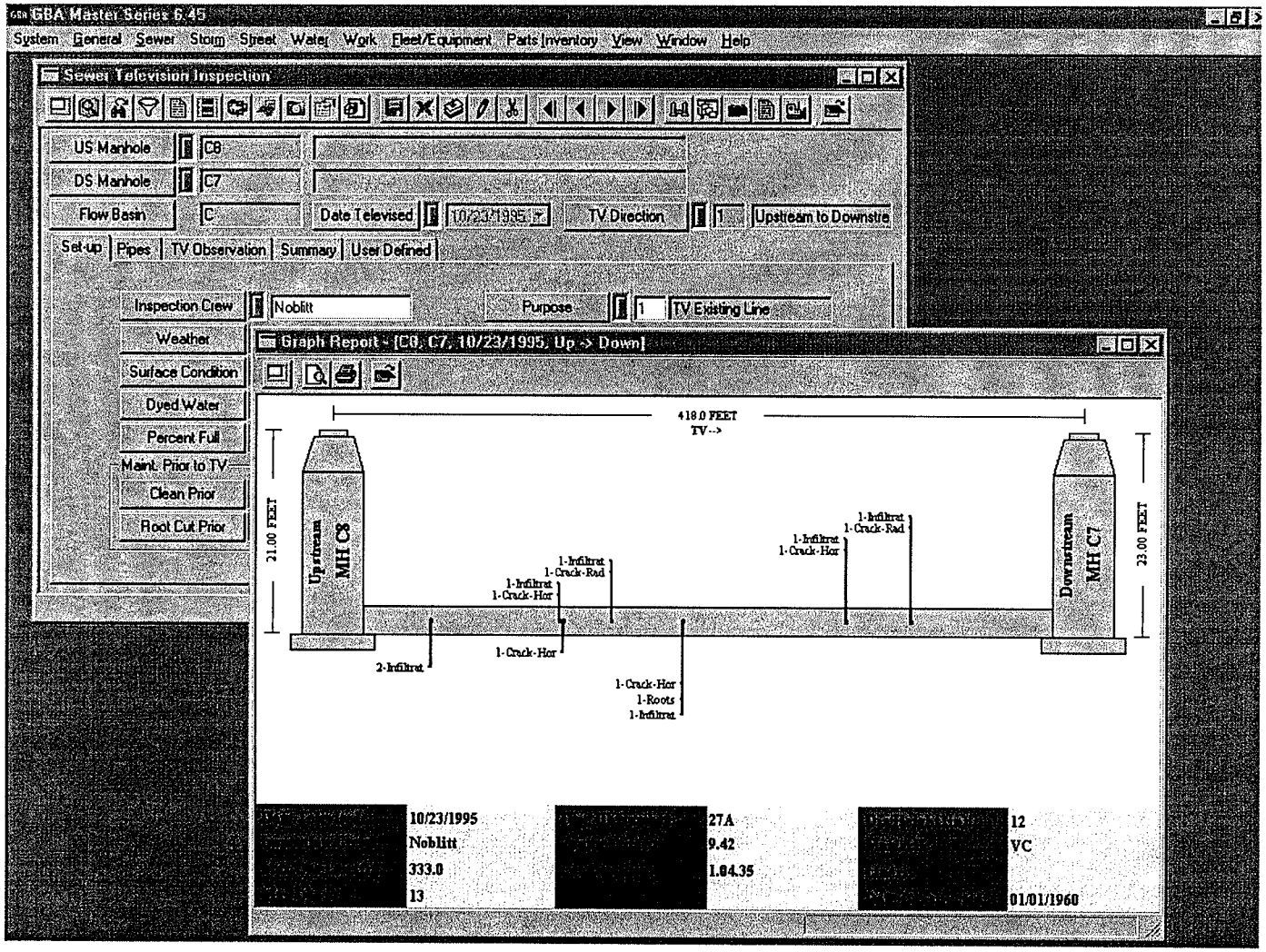
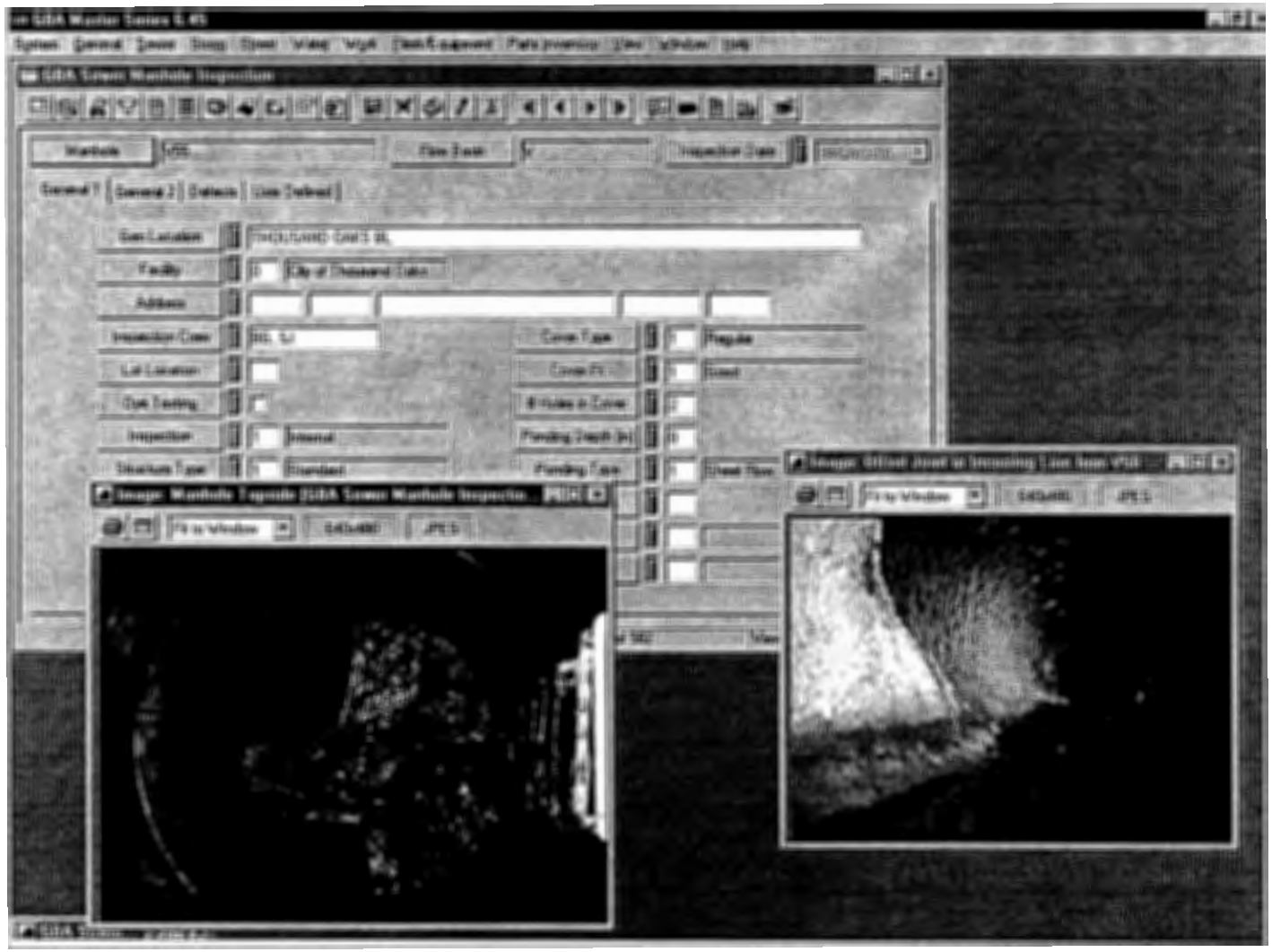


Figure 3-10. Example of GBA Data Management System – Manhole Inspection Data



Section 4

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CHAPTER 4 – INTERCEPTOR CONDITION AND CMOM ASSESSMENT

A major objective of the Master Plan study was to assess the physical condition of the interceptor sewers, using City records on past internal television inspections, plus additional television inspections, manhole inspections, and other field inspections and testing performed during the course of the study. Chapter 4 describes the various inspections, how they were performed, and how the results were assessed. General conclusions on physical conditions are made in this chapter, while recommended improvements are presented in Chapter 7 (Recommended Capital Improvement Program). Another study objective was to perform a preliminary assessment of the City's collection system capacity, management, operation and maintenance (CMOM) program in anticipation of future sanitary sewer overflow (SSO) regulations. Chapter 4 also includes the results of that assessment.

4.1 Condition Assessment Objectives

The interceptor condition assessment had the following objectives:

- Compile the information available from internal closed-circuit television (CCTV) inspections of interceptor sewers previously performed by City staff. Observations are recorded on paper logs, and the videotapes are generally retained.

- Standardize and computerize the observations on the CCTV logs so they can be input to the GBA database, compute a structural score for each reach based on observed defects, identify the reaches in the worst condition, and create reports and GIS maps highlighting these reaches.

- Use the GBA software to identify reaches that have not been inspected in the past 10 years. Perform and analyze additional CCTV inspections (by subcontract or City staff) on those reaches.

- Perform manhole inspections for all 582 interceptor manholes built more than 10 years ago, including taking digital photographs and recording any defects in the manhole or the visible portions of the pipes entering and exiting the manhole. Use the GBA software to compute structural scores to identify the manholes in the worst condition and recommend appropriate improvements.

- Review videotapes for selected interceptor reaches having high structural scores to confirm the observed defects and to develop appropriate capital improvements, considering the adequacy of pipe capacity.

- Perform a preliminary assessment of the City's collection system capacity, management, operation and maintenance (CMOM) program in anticipation of future sanitary sewer overflow (SSO) regulations.

The following paragraphs describe how the inspections and assessments were performed, and present general conclusions.

4.2 Internal Television Inspections

4.2.1 Completeness of Inspections

City crews have performed CCTV inspections of the interceptors and smaller sewers for over 20 years. The City retains the original videotape and hardcopy log sheets documenting the footage location of each observation and defect. For the purposes of this condition assessment, MWH assembled the log sheets for the most recent inspections on all interceptor sewers, and then entered the inspection data into the GBA database.

This information was initially used to identify reaches that had not been inspected in over 10 years or for which no inspections were documented. In some cases, logs were located for these missing reaches, but in most cases the reaches were scheduled for inspection by City crews during the course of the Master Plan study. The entire downstream reach of Unit W and a short reach near the upstream end of Unit E have been replaced within the past few years and were therefore not included in the condition assessment. Some reaches had not been televised due to difficult inspection conditions such as high flow depths or velocities or poor access. For these reaches, MWH retained the firm of National Plant Services to perform additional inspections. In all, National Plant Services televised 1.8 miles of interceptor sewers.

These new inspections identified one severely deteriorated pipe reach (downstream end of Unit X) that was replaced during the course of the Master Plan study, and several corroded reaches (downstream portion of Unit E) that will require rehabilitation within a few years.

4.2.2 Standardization of Defects

The City's CCTV log sheets document the observations and defects by footage along each pipe reach. City staff uses a relatively small set of observation/defect codes and severity ratings for each defect. A typical City CCTV log sheet is shown in Appendix A. The GBA software is supplied with a more comprehensive set of observation/defect codes, and a scoring system that assigns points based on the type and severity of defects (see table in Appendix A). The GBA manuals also include sketches that assist the user in assigning consistent severity ratings (1 through 5) to each defect type. Although the user can customize these defect codes and points, the supplied set is comprehensive and appropriate for use by City staff for future inspections. MWH converted the historical

observations into the GBA observation codes and severity ratings during data entry. City staff provided a conversion guide, which is also included in Appendix A.

During the process of converting the City's logs and entering the data into the GBA database, MHW noted that the logs occasionally did not specify the defects to the level of detail that the GBA software allows. In some cases, City staff made general observations regarding long sections of pipe or the entire pipe reach rather than specifying each defect. For the purposes of computerized record keeping and scoring, operators should specify each defect so that the pipe reaches can be properly assessed in a quantitative way. MWH, in consultation with City staff, made assumptions during the conversion and data entry process to allow a reasonably representative quantitative score to be computed for each pipe reach. For example, continuous cracks were scored as if there was a separate defect every 3 feet (a new defect type covering a 30-foot crack with 10 times the points of a single crack was used to simplify data entry). As the City implements its planned new CUES CCTV system, the provided software will be compatible with the GBA software and will help assure the appropriate level of detail is captured in future inspections.

Table 4-1 summarizes the type and severity of all the CCTV observations and defects stored in the GBA database for interceptors. The most common observations were minor cracks, roots, corrosion, scaling, and infiltration. The relatively small number of more severe defects fell in these same categories, plus sags and broken pipes.

4.2.3 CCTV Structural Scores

As noted earlier, the GBA software computes a score indicating the structural condition of each manhole-to-manhole pipe segment for which the results of CCTV inspections have been input. The points assigned are based on the type of defect and the severity of the defect, as listed in previously cited table in Appendix A. The total structural score for each reach is the sum of the scores assigned to each defect. For example, a broken pipe with a severity of 4 (out of 5) gets a score of 100. A crack with a severity of 3 gets a score of 5. A pipe with a broken section and 5 separate cracks would get a total score of 125.

Most of the interceptor reaches have very low structural point totals, indicating that they are relatively free of major defects such as broken or collapsed pipes, severe offset joints, advanced corrosion, break-in connections, etc. Pipe reaches with scores below 30 are considered to be in good condition, having only a small number of minor defects. Figure 4-1 shows the City's interceptor sewers color-coded based on their structural scores. Table 4-2 summarizes the structural scores for each interceptor, excluding sewers that could not be inspected, were built within the past 10 years, or whose CCTV records were not analyzed (these are sewers that are not officially interceptors, but were included in the manhole inspections and the capacity analysis). Over 90 percent of these interceptor system was found to have no defects or a score under 30. The worst sewers were found on Units X, C, and E.

Figure 4-1
City of Thousand Oaks Interceptor Sewers
Structural Scores Based on CCTV Inspections

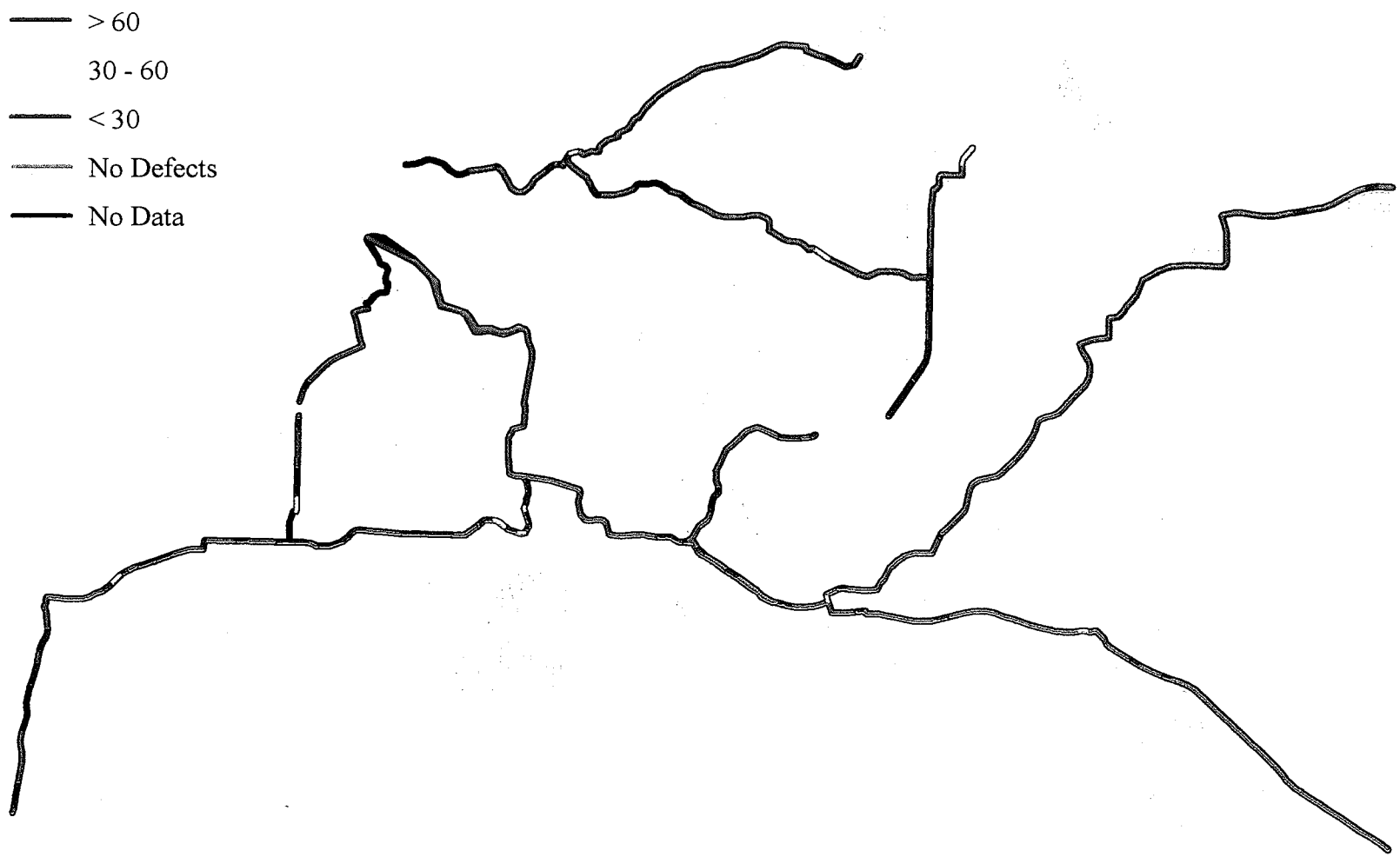

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Table 4-1
Summary of CCTV Observations and Defects

Defect	# of Observations				
	Severity				
	1	2	3	4	5
Crack - Radial	6	0	1	1	1
Crack - Horizontal	70	2	0	0	6
Broken Pipe	1	1	0	0	4
Collapsed Pipe	0	0	0	3	0
Wye Service	499	0	0	0	0
Break-in Connection	1	0	0	0	0
Extended Tap	0	1	1	0	0
Offset	3	1	5	0	1
Gapped Joint	1	0	0	0	0
Roots	75	36	10	9	7
Debris	0	0	0	2	4
Grease	0	0	0	0	2
Corrosion	42	15	21	4	0
Scaling	110	0	13	1	1
Sag	0	1	9	8	11
Infiltration	110	6	8	7	27
New Manhole	1	0	0	0	0
30' Horizontal Crack	16	0	0	0	13
Pipe Seal	4	0	0	0	0
Hole	2	0	0	0	0

Table 4-3 lists the pipe segments having structural scores over 30. Reports listing the details of the specific defects in these pipes are included in Appendix A. These reports list all of the observed defects and their rated severity and the total structural score for the pipe segment. The reports also show a "cleaning" score and an estimated flow based on default flow values for each defect, but these values are not relevant to the condition assessment and were not used in this study.

Some of the reaches having major defects were repaired or replaced after the inspections were performed. For example, the City replaced the most deteriorated reach at the downstream end of Unit X on an emergency basis after it was discovered. The un-repaired reaches with high structural scores were reviewed on videotape (along with other reaches that had capacity deficiencies) and then considered for lining or replacement projects. Table 4-3 notes which of the capital improvement projects described in Chapter 7 includes each of the segments. Segments not included in projects can be addressed through maintenance (e.g., root removal).

Table 4-2
Summary of CCTV Structural Scores by Interceptor

Unit	Total Length (Miles)	Length Scored (Miles)	Length of Pipe with Structural Score				No Data		
			No Defects (Miles)	< 30 (Miles)	30 - 60 (Miles)	> 60 (Miles)	Could Not Televise (Miles)	Built within Last 10 Years (Miles)	Not Analyzed (Miles)
A	2.28	2.05	1.86	0.11	0.08	0.00	0.24	0.00	0.00
B	0.90	0.90	0.66	0.07	0.12	0.05	0.00	0.00	0.00
C	0.84	0.84	0.00	0.24	0.00	0.61	0.00	0.00	0.00
E	7.81	4.49	1.88	1.96	0.32	0.33	0.19	1.99	1.14
F	1.23	0.67	0.64	0.07	0.00	0.00	0.00	0.56	0.00
G	4.45	4.45	4.22	0.17	0.00	0.05	0.00	0.00	0.00
U	1.18	1.18	0.86	0.32	0.00	0.00	0.00	0.00	0.00
V	7.05	3.32	3.08	0.17	0.00	0.07	0.00	0.00	3.73
W	5.59	1.85	1.38	0.33	0.04	0.10	0.00	3.74	0.00
X	1.33	1.33	1.12	0.05	0.04	0.13	0.00	0.00	0.00
Y	1.48	0.62	0.51	0.10	0.00	0.00	0.86	0.00	0.00
Total miles	34.14	21.69	16.20	3.58	0.60	1.35	1.29	6.29	4.86
% of scored miles			74.7%	16.5%	2.8%	6.2%			

Table 4-3
Pipe Segments with High CCTV Structural Scores

Upstream Manhole	Downstream Manhole	CIP Project	Inspection Date	Diameter	Length	Material	Structural Score
C2	C1	C1	10/24/95	12	464	VC	1025
C5	C4	C1	10/24/95	12	595	VC	1018
C1	A1	C1	10/24/95	12	430	VC	620
W58-1	W58	replaced 2001	1/20/2000	21	180	PVC	600
C4	C3	C1	10/24/95	12	378	VC	551
X1	X0	replaced 2001	10/26/00	12	465	PVC	440
W24-3	W24-2	E1	12/20/01	24	266	RCP	335
W24-2	W24-1	E1	12/20/01	21	489	RCP	335
X3	X2	X1	10/26/00	12	230	AC	331
X2	X1	X1	10/26/00	12	223	AC	181
W24-11	W24-10	E2	12/20/01	33	400	RCP	150
C3	C2	C1	10/24/95	12	490	VC	148
G3	G2	G1	12/21/01	15	285	VC	130
G3	G2	G1	12/21/01	15	285	VC	130
C6	C5	C1	10/24/95	12	342	VC	117
C7	C6	C1	10/23/95	12	495	VC	113
W56	W55	Spot Repair	1/23/00	21	325	AC	105
W24-10	W24-9	E2	12/20/01	33	204	RCP	100

Table 4-3 (continued)
Pipe Segments with High CCTV Structural Scores

Upstream Manhole	Downstream Manhole	CIP Project	Inspection Date	Diameter	Length	Material	Structural Score
B11	B10A	B1	3/9/00	10	285	VC	96
F14	F15		11/19/01	8	343	VC	89
V11	V10-1		8/2/00	18	393	VC	85
W24-4B	W24-4	E1	12/20/01	8	177	RCP	84
X1	X0	replaced 2001	3/19/01	12	465	PVC	68
A13	A14		10/21/98	18	410	AC	57
V27	V26	Spot Repair	8/1/00	20	289	AC	55
W24-4	W24-3	E1	12/20/01	24	196	RCP	54
E21	E20	E5	4/3/00	18	305	VC	50
W24-9	W24-8	E2	12/20/01	33	394	RCP	50
W24-5	W24-4A	E1	12/20/01	30	157	RCP	49
B12	B11	B1	3/9/00	10	315	VC	48
X3	X2	X1	3/19/01	12	230	VC	45
W24-7	W24-6	E1	12/20/01	30	270	RCP	45
G2	G1	G1	12/21/01	15	389	VC	45
F21	F22	E6	3/13/01	8	355	VC	35
X2	X1	X1	3/19/01	12	223	AC	35
B13	B12	B1	3/9/00	10	322	VC	32
F13	F12		4/3/89	12	401	VC	30
G1	W62		11/5/81	18	118	VC	30
W62	W61		11/5/81	18	86	VC	30

4.3 Interceptor Manhole Inspections

4.3.1 Manholes Inspected

The firm of ADS, under subcontract to MWH, used PipeCam (digital camera with light at the end of a long pole inserted from the surface into the open manhole) to inspect 582 manholes during the months of March, April, and May of 2001. The inspections excluded interceptor manholes built within the past 10 years, but included manholes on some of the larger non-interceptor sewers that were also selected for inclusion in the hydraulic capacity analysis. These additional sewers are in the Dos Vientos area off Unit E, and in the North Ranch area off Unit V.

4.3.2 Manhole Inspection Forms and Defects

The form used in the inspection of the manholes is shown in Appendix B. This is the standard GBA form for manhole inspections. The inspectors completed the forms in the field and later entered the findings into the GBA database. The inspection consisted of gathering basic information about the manholes (dimensions, materials, types, etc.) as well as recording defects in terms of location, type, and severity.

Digital photographs were taken and are stored along with the inspection data in the GBA database. In general, photographs include one looking down into the manhole. Additional photographs are taken of significant defects observed. Examples of typical photographs are included in Appendix B.

Table 4-4 summarizes the number of observed defects by type and location within the interceptor manholes, as stored in the GBA database. Roots were observed in several locations of some manholes, but the most frequent observation of roots in walls was made in only 72 manholes, or 12 percent of those inspected. Slightly more common were breaks in manhole walls and benches (15 percent of manholes). Most of these defects were minor, but 14 manholes had breaks rated as moderate or severe and were recommended for rehabilitation in the capital improvement program.

4.3.3 Manhole Structural Scores

The GBA software computes a structural score for each inspected manhole based on the number, type, and severity of observed defects. The factors and equations used to compute the score are included in Appendix B. The score depends on the part of the manhole having a defect (wall, cone, bench, trough, etc.), the type of defect (broken, corrosion, roots), and the combination of severity and density (density refers to the percentage of the manhole part which is affected by the defect). For example, a broken wall with severity of 2 (out of 3) and density of 3 (out of 4) gets a structural score of 24. Roots with the same severity and density would get a structural score of 12. If both defects were present, the total score would be 36.

Table 4-4
Summary of Manhole Inspection Observations and Defects

Defect Location	Defect Type		
	Broken	Corrosion	Roots
Cover	2	0	N/A
Frame	1	0	1
Frame Seal	0	0	8
Grade Adjustment	1	0	26
Cone	3	0	32
Wall	88	12	72
Bench	89	7	46
Trough	6	1	13

Figure 4-2 shows the inspected manholes color-coded based on their structural scores. Table 4-5 summarizes the structural scores for manholes on each interceptor. Sixty percent of the interceptor manholes were found to have no defects, and thus had structural scores of zero. It can be seen that only 59 manholes, or 10 percent of those inspected, had scores over 20. Table 4-6 lists the manholes with structural scores over 30. These manholes are mostly found on Unit E, and on portions of Units C, X and V. Reports listing the details of the defects in these manholes are included in Appendix B. These reports show that the dominant defect is broken walls and/or extensive roots.

Table 4-5
Summary of Manhole Structural Scores by Interceptor

Unit	# of Manholes with Structural Score			
	No Defects	< 20	20 - 40	> 40
A	24	16	1	0
B	10	4	1	0
C	4	3	3	0
E	80	43	15	4
F	25	1	0	0
G	68	22	2	0
U	7	11	3	2
V	82	36	17	0
W	19	19	2	0
X	22	13	7	0
Y	8	6	2	0
Total	349	174	53	6
% of 582 Inspected	60.0%	29.9%	9.1%	1.0%

Figure 4-2
City of Thousand Oaks Interceptor Sewers
Structural Scores Based on Manhole Inspections

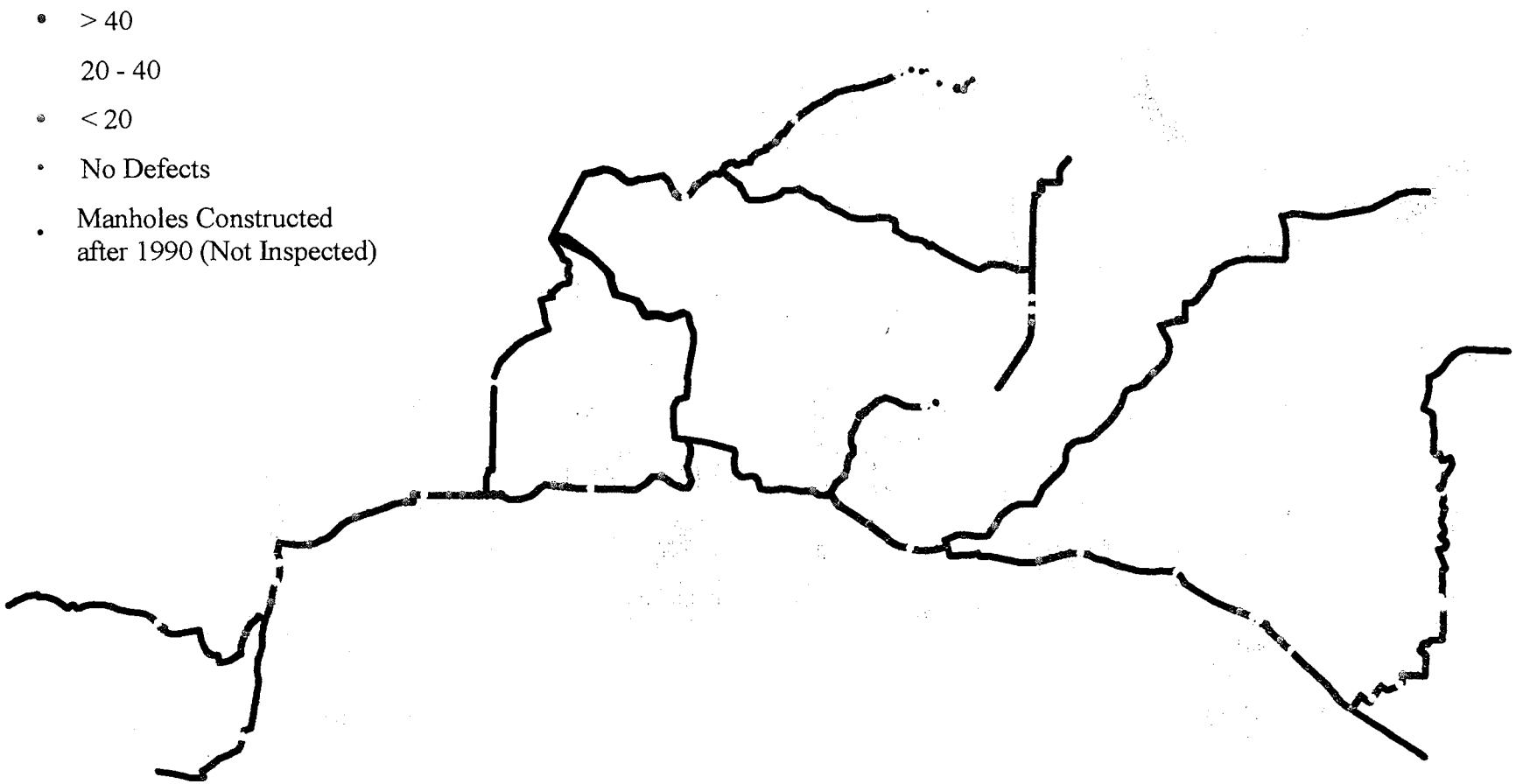

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Table 4-6
Manholes with High Structural Scores

Manhole #	CIP Project	Inspection Date	Manhole Location	Structural Score
F22-15.6	Borchard Rd. Inter.	4/17/01	Storm Ditch	60
E2	Rehab	4/18/01	Storm Ditch	58
E40-18	Rehab	5/1/01	Street	48
U14	Rehab	3/15/01	Grass	43
E3	E3	4/18/01	Storm Ditch	42
U15		3/15/01	Grass	41
V41	Rehab	4/24/01	Street	40
B8-1		4/18/01	Grass	39
GIII23		3/22/01	Grass	37
V55-70.27		3/30/01	Grass	36
F22-15.5	Borchard Rd. Inter.	4/19/01	Storm Ditch	36
X-30		3/30/01	Grass	35
GIV1.1		5/9/01	Grass	34
U23	Rehab	3/14/01	Grass	32
V55-69.9		4/4/01	Grass	32
X12B	Rehab	3/14/01	Storm Ditch	32
X24	Rehab	4/9/01	Grass	32
V40	Rehab	4/24/01	Street	32
E40-19	Rehab	5/1/01	Street	32
U22		3/14/01	Grass	30
V55-70.26		3/30/01	Street	30
C2	C1	4/4/01	Sidewalk	30
C3	C1	4/4/01	Sidewalk	30
E9	E3	4/18/01	Storm Ditch	30
X27	Rehab	4/9/01	Grass	30
X23		4/9/01	Grass	30
X29		4/9/01	Storm Ditch	30
Y7A		3/29/01	Grass	30
V45	Rehab	4/24/01	Street	30
V28	Rehab	4/24/01	Street	30
E47-128	Rehab	3/23/01	Street	30
E31		5/15/01	Street	30
E29		5/15/01	Street	30
V14		5/17/01	Street	30

The condition of the manholes was considered in the development of capital improvements described in Chapter 7. A total of 14 manholes having moderate or several broken walls or benches are recommended for rehabilitation or are included in other projects. These manholes are indicated in Table 4-6. Manholes not assigned to projects can be addressed through maintenance. The City should use the information in the manhole inspection database to focus its maintenance and minor repair activities.

4.3.4 Line Lamping Inspections

All sewer lines flowing in or out of inspected manholes were also inspected using PipeCam at the same time as the manhole inspections. In general, the inspector is able to see about 25 feet into the lines. It should be recognized that the condition of this short section of a pipe may not be representative of the condition of the pipe reach as a whole.

4.3.5 Line Lamping Inspection Forms and Defects

The form used in the line lamping inspections is shown in Appendix C. This is the standard GBA form for line lamping. The inspector completed the forms in the field and later entered the findings into the GBA database. The inspection consists of gathering basic information about the lines (dimensions, materials, etc.) as well as recording defects in terms of location, type, and severity. The observation and defect codes are the same as those used for the CCTV inspections.

Digital photographs were taken and are stored along with the inspection data in the GBA database. In general, photographs include one looking into each pipe. Additional photographs are taken of significant defects observed. Examples of typical photographs are included in Appendix C.

Table 4-7 summarizes the type and severity of all the line lamping observations and defects stored in the GBA database for interceptors. Defects observed were mostly offset joints, grease and roots.

4.3.6 Line Lamping Structural Scores

The GBA software computes a structural score for each lamped line based on the number, type, and severity of observed defects. The factors and equations used to compute the score are the same as those used for the CCTV structural scores, and are included in Appendix C.

Figure 4-3 shows the inspected lines color-coded based on their structural scores from the line lamping. Most of the lines were found to have no defects, and thus had structural scores of zero. Table 4-8 summarizes the structural scores for each interceptor. As can be seen, only a small number of pipes (less than 5 percent) had defects.

Table 4-9 lists all the pipe segments that had structural scores over 10. Reports listing the details of the defects in the all lines with defects are included in Appendix C.

Figure 4-3
City of Thousand Oaks Interceptor Sewers
Structural Scores Based on Line Lamping

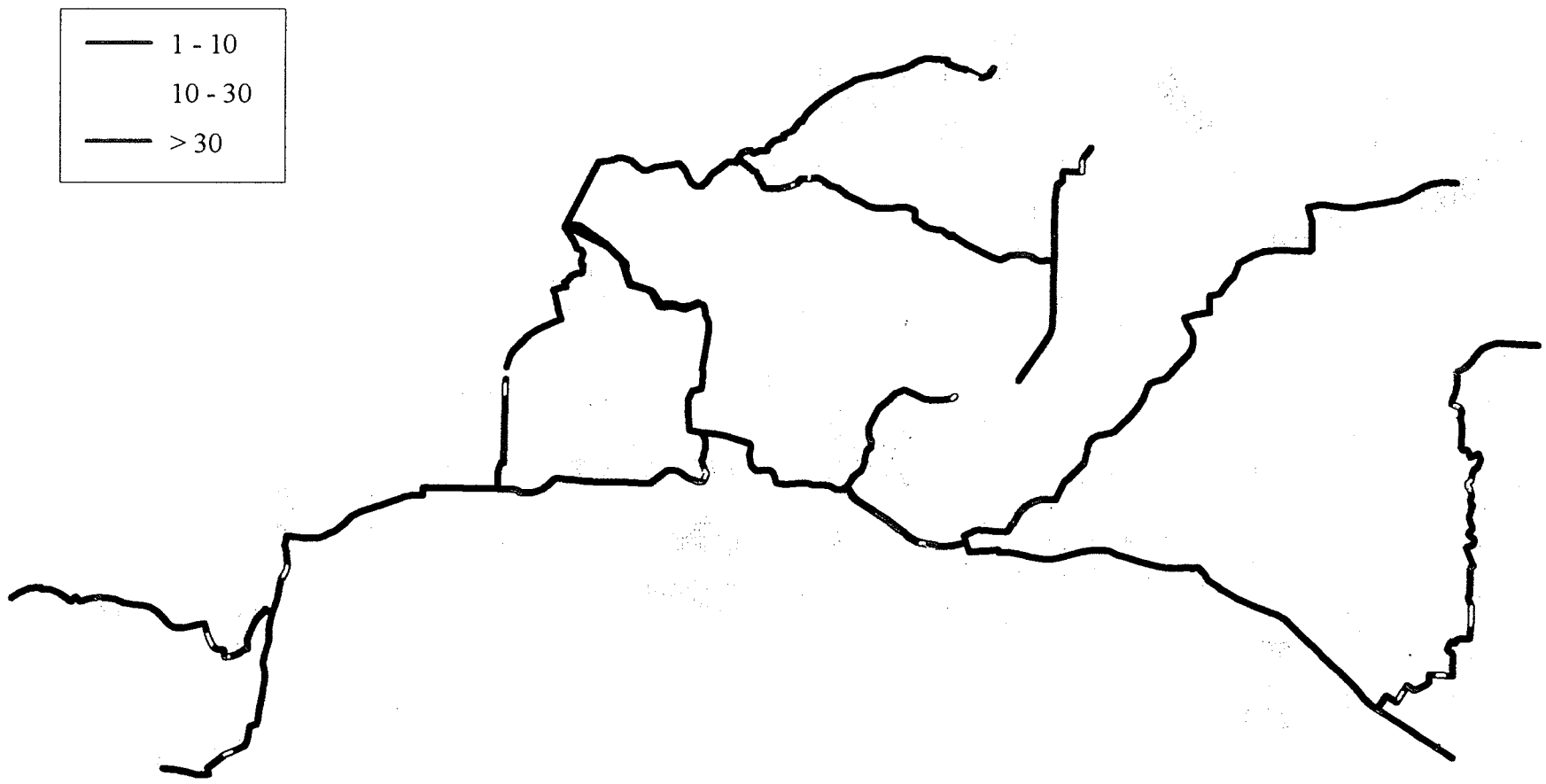

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Table 4-7
Summary of Line Lamping Observations and Defects

Defect	# of Observations				
	Severity				
	1	2	3	4	5
Crack - Radial	0	0	0	0	0
Crack - Horizontal	1	1	0	0	0
Broken Pipe	0	0	0	0	0
Collapsed Pipe	0	1	0	0	0
Wye Service	0	0	0	0	0
Break-in Connection	0	0	0	0	1
Extended Tap	0	0	0	0	0
Offset	68	20	11	1	5
Gapped Joint	1	3	0	1	0
Roots	16	6	3	5	6
Debris	0	1	4	0	0
Grease	45	20	3	2	0
Corrosion	7	0	0	0	0
Scaling	0	1	2	0	0
Sag	1	2	0	0	0
Infiltration	2	5	9	1	0
New Manhole	0	0	0	0	0
30' Horizontal Crack	0	0	0	0	0
Pipe Seal	1	0	0	0	0
Hole	0	0	0	0	0

Comparisons of the line lamping data with the CCTV inspections show general agreement concerning the structural condition of most of the interceptor sewers. One exception is Unit C, where the lamping did not detect the scaling and horizontal cracks that were noted in the CCTV inspection. Another is the upstream end of Unit A, where the offset joints and break-in connection detected in the line lamping were not noted in the CCTV inspection. Defects that were observed during line lamping (performed in 2001) but not during television inspections suggest that some sewer reaches may have developed defects since their last television inspection. Defects that were observed during television inspections but not line lamping have most likely been repaired or are located more than 25 feet from the manhole.

No CIP projects have been recommended based on line lamping scores alone, due to the limited scope of the inspections. The City should use the information in the line lamping database to focus its maintenance and minor repair activities, particularly in cases of severe root problems. Re-televising is recommended for the 8 pipe reaches that had structural scores over 25, to examine the observed defects in more detail and to determine if spot repairs are appropriate.

Table 4-8
Summary of Line Lamping Structural Scores by Interceptor

Unit	# of Pipe Sections with Structural Score			
	No Defects	< 10	10 - 30	> 30
A	104	3	0	2
B	34	4	1	0
C	26	0	0	0
E	289	7	7	2
F	57	0	0	1
G	188	5	3	0
U	51	1	1	0
V	294	6	6	3
W	80	2	1	1
X	95	2	1	0
Y	32	0	1	0
Total	1250	30	21	9

4.4 Unit Y External Inspection

MWH performed an inspection of the visible ground features along the route of the Unit Y interceptor in February and May of 2001. The inspection consisted of a walk-over of 3,400 feet of Unit Y from Manhole Y1 (at the junction with Units X and A) to the inlet structure of the twin-pipe siphon. Unit Y follows the course of the North Branch Arroyo Conejo, and past experiences with creek bank erosion have exposed the sewer and made it susceptible to structural failure due to loss of earth burial cover or impact of debris (trees, rocks, etc.) carried by the high creek flows which periodically occur. The Unit Y interceptor material is RPM (aka Techite), which is a fiberglass resin composite material which is relatively thin-walled and therefore more susceptible than rigid pipe from damage due to impact from objects or from the loss of uniform support from surrounding earth cover.

The inspection identified several areas along the Unit Y interceptor where the creek bank is eroding. Installation of rock gabions is recommend to protect the pipe in these areas. Appendix D is a technical memorandum that includes a map and photographs of the observed conditions, including the specific areas that require bank protection.

Table 4-9
Pipe Segments with High Line Lamping Structural Scores

Upstream Manhole	Downstream Manhole	Inspection Date	Diameter	Length	Material	Structural Score
A7	A8	4/2/01	18	263	VC	400
V55-72.37	V55-72.38	4/4/01	10	356	VC	120
W58-1	W58	3/21/01	21	180	PVC	120
E47-138A	E47-138	3/23/01	N/A	N/A	N/A	120
V29-1	V29	4/24/01	N/A	157	N/A	120
A6	A7	4/2/01	18	317	VC	75
E40-24.4	E40-24.3	5/15/01	12	44	PVC	70
F3-3	F3-2	5/17/01	15	330	PVC	70
B11	B10A	4/18/01	10	285	VC	25
E31	E30	5/15/01	18	372	VC	25
E40-8	E40-7	5/1/01	16	374	AC	25
E47-141	E47-140	3/23/01	15	244	UNKN	25
U24	U23	3/14/01	10	113	AC	25
V55-73.10	V55-73.9	4/18/01	10	154	PVC	25
E40-4	E40-1	5/1/01	15	114	PVC	25
Y14-1	A29.2	4/2/01	8	203	N/A	25
F14	F15	4/17/01	8	343	VC	20
V55-30	V55-29	4/5/01	15	256	VC	20
V55-63	V55-41	4/5/01	15	256	VC	20
V55-70.27	V55-70.26	3/28/01	12	208	VC	20
V55-71.1	V55-70.27	3/28/01	12	202	VC	20
X30	X29	3/30/01	10	298	AC	20
GIII6-1	GIII6	3/27/01	N/A	N/A	N/A	20
V55-44	V55-29	4/5/01	8	315	N/A	20
V55-69.7	V55-69.6	3/28/01	12	399	VC	10
W58	W57	3/21/01	21	345	AC	10
GIV1.2	GIV1.1	5/9/01	N/A	N/A	N/A	10
GIII8-1	GIII8	3/22/01	N/A	N/A	N/A	10
W24-4A	W24-4B	4/20/01	30	148	RCP	10
W24-5	W24-4A	4/20/01	30	157	RCP	10

4.5 Conclusions of Condition Assessment

The following are general conclusions that can be drawn from the condition assessment. More details on problem areas and specific project recommendations are included in Chapter 7 (Recommended Capital Improvement Program).

- The overall condition of the interceptor sewers is very good, as evidenced by the lack of defects found in most of the inspected pipes and manholes. The relatively young

age of the sewers and good maintenance practices by the City account for the good condition.

- The most significant problems found from the CCTV inspections were cracked and broken asbestos cement pipe at the downstream end of Unit X (steep pipe descending into a canyon – worst segment replaced on an emergency basis), corrosion of reinforced concrete pipe at the downstream end of Unit E (another steep pipe into a canyon), and major cracks, sags, and joint scaling of vitrified clay pipe in most of Unit C.

- The great majority of the interceptor manholes had no defects. A small number of manholes were found to have sufficient cracking of walls and root entry so as to require rehabilitation.

- The creek bank in several areas along the alignment of Unit Y requires additional erosion protection to ensure that the interceptor will not become exposed during major storms.

- Reaches of Units A and Y are made of Techite, which is a fiberglass resin composite material which is relatively thin-walled and has a history of premature failure in other sewer systems. The City had a failure of a Techite pipe segment on Unit Y in 1998, and has been concerned about the possibility of future failures for some time. The CCTV inspections of the Techite pipes in the City do not show major defects or deterioration (pending finalization of inspections). However, Techite pipe failures have been known to occur even when internal inspection does not detect major defects prior to failure. For this reason, replacement of the Techite pipe in the City was considered in the development of capital projects.

- The interceptors which were assessed comprise less than 10 percent by length of the entire collection system. Since these are the largest sewers and carry the highest flows, structural failure would have much greater consequences than failure of small diameter pipe. Giving first priority to the condition assessment and rehabilitation of the interceptors is therefore appropriate. The condition of the remaining 90 percent of the sewers was not assessed in this study. Recommendations for a long-term strategy that addresses the assessment and rehabilitation/replacement of all sewers is included in Chapter 7 of this report

4.6 CMOM Program Assessment

MWH, with subconsultant Ken Kerri, performed an assessment of the City's CMOM program. CMOM is an acronym for Capacity, Management, Operation, and Maintenance. In the future, it is expected that all wastewater collection system agencies will be required through their NPDES permits to develop and comply with a formal CMOM program. The CMOM requirement is part of a new SSO (Sanitary Sewer Overflow) Rule that is under consideration by the EPA, the California State Water

Resources Control Board (SWRCB), and the Regional Water Quality Control Boards (RWQCB). In addition to being a useful self-assessment and self-improvement tool for wastewater agencies, a well-documented and implemented CMOM program is expected to be a consideration in an affirmative defense against regulatory action which could be taken in the event of a major sewer spill.

The CMOM Program Assessment report prepared as part of this Master Plan is included in its entirety as Appendix E, and is briefly summarized here. The report is a summary and assessment of those aspects of the City of Thousand Oaks' wastewater collection system program that would constitute the City's CMOM program. The report describes the City's collection system administration program and operation and maintenance program in terms of several categories and subcategories that comprise a CMOM program. Tables 4-10 and 4-11 summarize the findings in each of these assessment categories and subcategories.

The City of Thousand Oaks' collection system performance was compared with other high-performing agencies using information from the report: COLLECTION SYSTEMS: METHODS FOR EVALUATING AND IMPROVING PERFORMANCE. This report, prepared by Kenneth D. Kerri and Rick Arbour for the U.S. Environmental Protection Agency, contains the results of a research project which evaluated the adequacy and effectiveness of collection system O&M programs throughout the United States. Detailed system and operations performance data from 13 high-performing collection system agencies were included. The performance of the City was compared to the 13 other agencies in terms of the following performance measures:

(1) annual SSOs per 100 miles of sewer
(2) percent of system inspected annually by CCTV
(3) percent of system cleaned annually
(4) annual O&M cost per capita
(5) annual O&M cost per mile
(6) average annual rate for residential users
(7) annual complaints per 100,000 population, and
(8) annual number of lost time injuries.

Table 4-12 summarizes the findings for each performance measure, and additional comparison graphs are included in Appendix E. The City ranks near the top in most performance measures, including measures related to controlling operation and maintenance costs. The City's average annual residential sewer rate of $250 is higher than most of the surveyed agencies, however, which had a median value of about $200 per year. Besides operation and maintenance costs, the City's sewer rate includes charges for capital equipment replacement and capital improvements, and a liability allowance.

Analysis of the City's program and comparisons with other programs reveals that the City's performance is very high, which indicates an effective and efficient program. The number of SSOs and complaints in the City are low when compared with other collection

Table 4-10
Summary of City of Thousand Oaks CMOM Program Assessment
(Collection System Administration)

Assessment Category	Findings and Recommendations
Organizational Structure	Organizational structure, job descriptions, and adequate staffing are in place.
Financial Planning	User service charges and connection fees are in place. User charge includes O&M, capital equipment and improvement charge, and liability allowance. Funding is adequate to cover current O&M and capital programs.
Personnel Training and Safety	
O&M Policies and Procedures	Manual is in place and updated.
Operator Training	Formal program is in place, including system to track and document training. Operator certification is required only at supervisory level.
Safety Training	Safety Policy Statement and Operations and Safety Manual are in place. Citywide Safety Committee and Accident Review Board are in place. Cal-OSHA consultation service is invited twice a year. Excellent safety record.
Equipment and Tools	Equipment/tools lists are available as well as written equipment maintenance procedures. In-house vehicle and equipment maintenance available. Acceptable turnaround time. Life-cycle budgeting is used to fund replacements.
Sewer Ordinances	Sewer-Use Ordinance and grease ordinance are in place. Discharge of stormwater to sewers is prohibited. Laterals are privately owned.
Engineering	
System Mapping	Manual Atlas maps are being converted to CAD and GIS. As-built maps are available on paper; many have been scanned. Recommend additional work on GIS.
Capacity Analysis/Modeling	Master Plan included monitoring and development of computer model of interceptors and identification of capacity needs. Capacity certification is required for new connections.
Condition Assessment and Rehabilitation	Master Plan included condition assessment of all interceptors and rehabilitation recommendations, as well as long-term program for all mains. Regular CCTV inspections are performed. Recommend additional work to systematically assess condition of smaller mains, identify rehabilitation/replacement needs, and ensure adequate capital funding for long-term replacement.
Design	Adequate Design and Construction Standards document is in place.
Construction	Adequate Design and Construction Standards document is in place. New construction is inspected by City inspectors. Air-testing and CCTV of new sewers are required before acceptance. Warranty inspection is performed at end of warranty period.

Assessment Category	Findings and Recommendations
Water Quality Monitoring	Creek waters are sampled for four days after a spill.
Information Systems	Asset database and maintenance management software (GBA) and GIS of all sewers initiated during Master Plan. Manhole cards were recently digitized and linked to asset database. Interceptor CCTV logs were input to database. Interceptor flows and capacities were input to database. Other historical CCTV logs as well as maintenance schedules and records are manual. Recommend additional work to automate maintenance work order program and CCTV records. Several recommendations on information systems are included in CMOM report.
Complaint Handling	Phone system is in place to receive calls and respond at all hours. Manual work order system is in place. Recommend computerization of complaint management and work orders.
Public Relations	Public relations program is in place, covering information booklets and bill inserts, and public notification of construction/maintenance work or spills.
Emergency Maintenance	Written emergency maintenance plans in place, including Policy for Wastewater Related Spills and Overflows. Procedures are in place for notification of agencies and public after spills. Causes of spills are investigated by CCTV. Recommend expansion of policy manual to include details on actions to prevent similar future spills from occurring.
Emergency Preparedness	Emergency response plan and contingency plans, including critical contacts, are in place. Material safety data sheets are available. Vulnerability analysis and risk assessments are performed regularly. Staff is trained for emergency situations.
Spare Parts Inventory	Spare parts centrally stored, with warehouse computer tracking and ordering. Monthly checks and annual audit are performed.

Table 4-11
Summary of City of Thousand Oaks CMOM Program Assessment
(Operation and Maintenance Program)

Assessment Category	Findings and Recommendations
Maintenance Scheduling	Preventive-oriented maintenance program. Preventive (cleaning and CCTV) and corrective maintenance are scheduled manually. Productivity of crews is tracked. Recommend computerization of maintenance scheduling and tracking.
Sewer Cleaning	Entire system is cleaned at least once every 2 years. Problem areas are cleaned as often as monthly. Debris and grit are removed during cleaning.
Inspection and Cleaning Equipment	New CCTV unit has been ordered to replace existing unit. Two hydroflush units, two balling units, and several trunks are available.
Root Control	Severe root problem areas are identified and place on a "root scraping" list for regular maintenance.
Hydrogen Sulfide Control	Bioxide injection is used at two interceptor locations. Master Plan identified some hydrogen sulfide corrosion on Unit E Interceptor, and project to replace bad sections. Most sewers are constructed of inert materials.
Lift Stations	No lift stations currently in system. Future Olsen Road Pump Station.
Sewer System Evaluation	
Flow Monitoring	Master Plan included 14 temporary wet weather monitors and an I/I assessment. Up to 12 permanent monitors to be installed in near future. City crews have 4 temporary monitors for use as-needed.
Manhole Inspection	Master Plan included inspection and numerical condition assessment of nearly 600 manholes on interceptors, and identification of rehabilitation projects. City crews perform regular manhole inspections, and external inspections of remote canyon sewers following major storms. Recommend entry of City inspection data to asset database.
CCTV Inspection	CCTV performed for field acceptance of all new sewers, and on rotation for existing sewers. About 7 percent of system is televised annually. Recommend standardization and computerization of inspections to allow more quantitative rehabilitation and maintenance planning.
Smoke Testing and Dyed Water Flooding	Master Plan included smoke testing of suspected inflow areas. Results show negligible inflow sources. Additional smoke testing not recommended.
Sewer Rehabilitation	CIPP is used, as well as full replacement and spot repairs. Manholes are repaired using spray linings, cured in place linings, and full replacement.
Service Laterals	Laterals are the responsibility of private owners. Written procedures exist for inspection and approval of new laterals.
Maintenance of Right-of-Way	Scheduled maintenance of easements in canyons. Staff monitors street paving projects and has a program to locate and adjust manhole covers.
Regulatory Compliance	No major collection system violations have occurred in the past three years. All spills reported immediately. Recommend reporting to Regional Board both the causes of spills and actions to prevent similar future spills. Treatment plant has had one or two violation per year, due to wet weather flows.

Table 4-12
City of Thousand Oaks Collection System Performance
Relative to Other Agencies

Performance Measure	Thousand Oaks Performance	Number of Surveyed Agencies With Better Performance*
SSOs per 100 miles	1.0	5
Annual percentage inspected by CCTV	7%	4
Percent of system annually cleaned	50%	1
Annual O&M cost per capita	$9.35	3
Annual O&M cost per mile of sewer	$2,800	5
Average annual residential sewer rate	$250	10
Annual complaints per 100,000 population	21	5
Annual number of lost-time injuries	0	0

* 13 high-performing agencies surveyed in COLLECTION SYSTEMS:METHODS FOR EVALUATING AND IMPROVING PERFORMANCE, U.S. Environmental Protection Agency.

system agencies. The safety program is very effective. The level of funding and staffing are adequate. A Capital Improvement Program (CIP) and an equipment replacement program are in place and funded. Staff has indicated that their efforts are productive and appreciated.

While the City's performance is very good, a number of areas relating to information management systems and facility planning have been identified as requiring improvement. Several recommendations are included in the CMOM report, dealing with development and population of databases, GIS mapping, computerized maintenance and inspection data management, hydraulic modeling, and CIP master planning. These improvements will not only better prepare the City to satisfy the intent of the SSO Rule and CMOM Program, but will also improve work efficiency, further reduce the risk of SSOs, and protect the public's investment in the collection system assets.

Many of these recommended improvements were addressed during the development of this Master Plan. Implementing these recommended improvements and further documenting the City's CMOM program will put the City in a good position to satisfy the expected requirements of the SSO Rule and will constitute a strong defense against possible future regulatory action following an SSO.

Section 5

MWH
MONTGOMERY WATSON HARZA

CHAPTER 5 – INFILTRATION/INFLOW ANALYSIS

Infiltration/Inflow (I/I) of storm water and groundwater into sewers (interceptors, mains, and private laterals) increases peak wastewater flows that must be conveyed within the pipes. There are many factors that can affect the magnitude of I/I, and it can vary greatly in different parts of a sewer system. Chapter 5 presents the findings of the I/I analysis performed as part of this study, which included dry and wet weather flow and rainfall monitoring, wet weather flow isolation measurements, and dry weather smoke testing. Conclusions on the magnitude and location of I/I throughout the sewer system are presented, as well as recommendations for follow-up work.

5.1 I/I Analysis Objectives

The I/I analysis had the following objectives:

- Conduct temporary flow and rainfall monitoring during wet weather to determine the relative amount of rainfall-dependent I/I and groundwater infiltration in different parts of the collection system.
- Perform flow isolation spot measurements during storm periods to further isolate possible sources of I/I in small areas suspected of having high I/I.
- Perform smoke testing during dry weather in small areas that exhibited high I/I in the wet weather flow isolations to identify possible sources of direct inflow to the sewers.
- Draw conclusions on the magnitude, type, and location of I/I in the City's collection system, and recommend the next steps the City should take to address I/I.

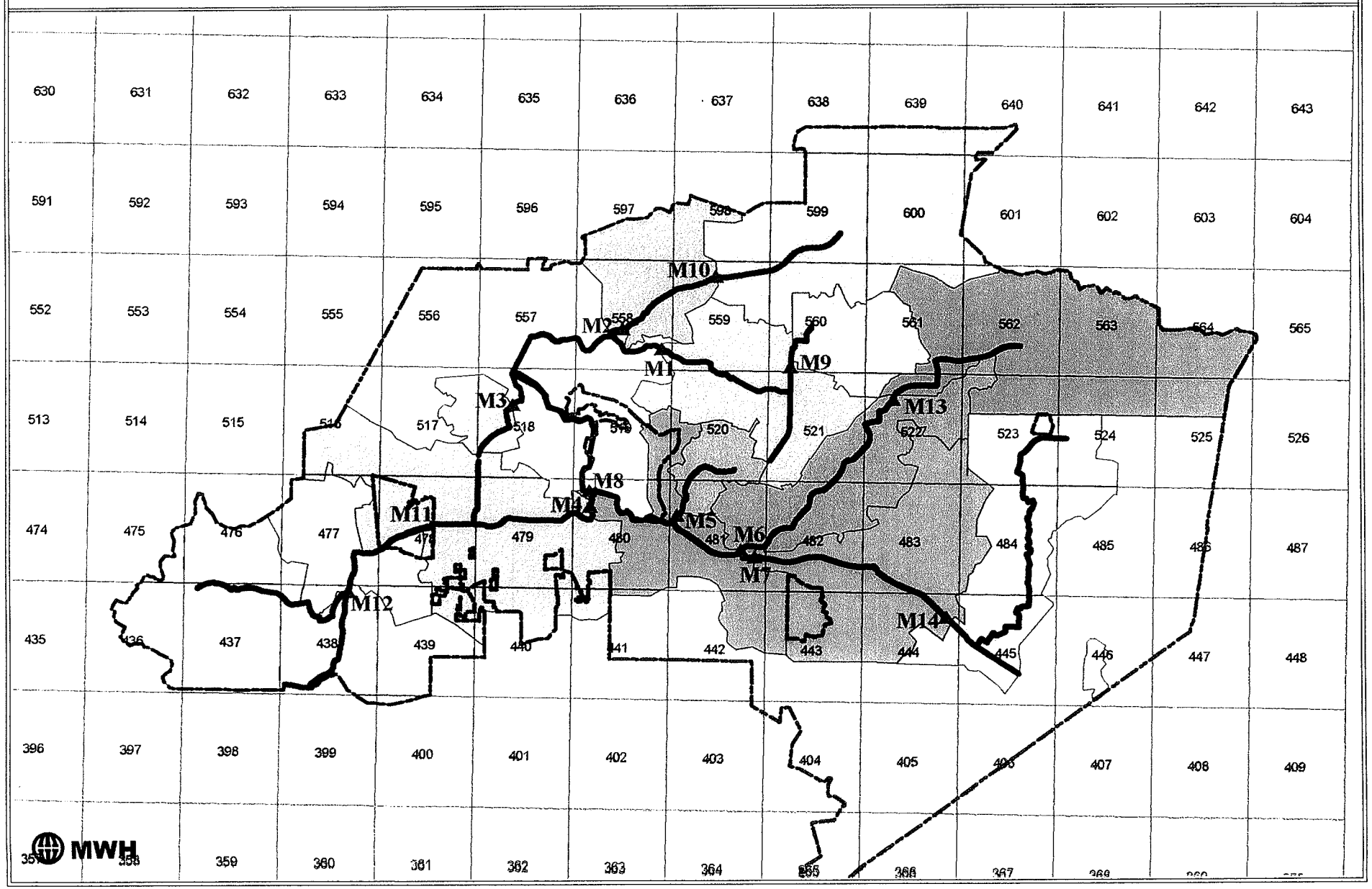
5.2 Temporary Flow and Rainfall Monitoring

5.2.1 Flow Monitoring

The firm of ADS Environmental Services, under subcontract to MWH, installed and maintained 14 depth/velocity flow meters (15-minute data interval) at key locations on the interceptors during the period January 28 through March 10, 2001. A separate report prepared by ADS provides details on the meters and tables and plots of all flow data.

Figure 5-1 shows the meters and their tributary areas, and Table 5-1 presents summary information on the meter locations. Montgomery Watson chose the sites in consultation with City staff, with the objective of monitoring the major interceptor units and dividing the service area into tributary areas that are roughly equal in flow. The flow data from these monitors will also be used later in this project to determine dry weather unit flow

Figure 5-1
Temporary Flow Monitors and Radar Rainfall Cells



factors for capacity modeling, as well as for estimating I/I. The City also intends to install permanent flow monitors at several of these key locations to monitor future flow trends.

Table 5-1
Temporary Flow Monitors

Meter ID	Manhole*	Interceptor	Diameter (in)	Upstream Meters
M1	A26	Unit A (lower)	18	M9
M2	X3B	Unit X (lower)	21	M10
M3	F2	Unit F	15	
M4	W24-3	Unit E (lower)	24	M11, AMGEN
M5	U2	Unit U	12	
M6	W62	Unit G (lower)	18	M13
M7	V3	Unit V (lower)	21	M14
M8	W-U30	Unit W (middle)	36	M5, M6, M7
M9	B3	Unit B	14	
M10	X24	Unit X (upper)	12	
M11	E12	Unit E (middle)	21	M12
M12	E34	Unit E (upper)	18	
M13	GIII29	Unit G (upper)	18	
M14	V47	Unit V (upper)	15	

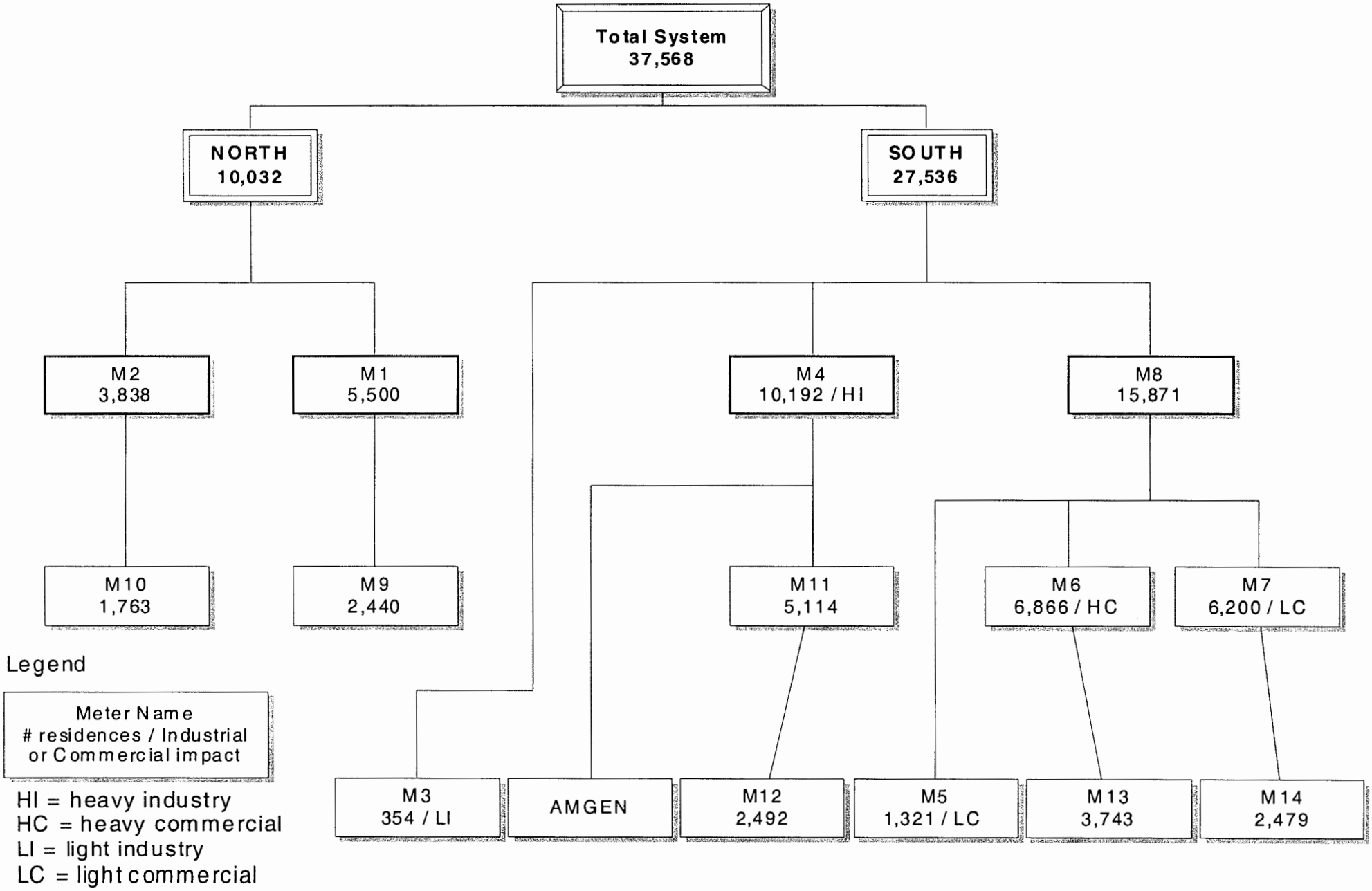
* All meters installed in the incoming (upstream) pipe.

Figure 5-1 and Table 5-1 show that some of the meters were installed in series along an interceptor. The downstream meters in these situations monitored "incremental" areas. For example, Meters M2 and M10 both monitored Unit X. The flow measured at M10 represented the upper part of the Unit X area, and the incremental flow at M2 (i.e., flow at M2 minus flow at M10) represented the lower part of Unit X. Subtraction of flows (with a small time lag as needed) in this manner is an acceptable and accurate method of monitoring, provided the incremental flow is a significant percentage of the total downstream flow. The sites were chosen to ensure that would be the case.

Figure 5-2, a schematic of the meters, shows the approximate number of dwelling units tributary to each meter and how the incremental areas are generally about the same size as the upstream monitored areas. The one exception is M8, which has a relatively small incremental area, but which was selected due to its key location on Unit W near the junction with Unit E. In spite of the small incremental area of M8, the incremental flow data was useable, but is less accurate than for the other meters.

There are also permanent meters located at the Hill Canyon Treatment Plant and at Amgen, the City's largest wastewater generator. The Amgen meter data was used in the I/I analysis. The Plant meters were reviewed to assess I/I trends, but were not suitable for incremental flow calculations.

Figure 5-2.
Schematic of Temporary Flow Meters



The flow monitoring data obtained from Meter M11 was found to be invalid, and could not be used in the analysis. The incremental flows for Meter M4 were therefore computed by subtracting the flows from Meter M12 rather than from M11 (Amgen flows were also subtracted from M4 flows).

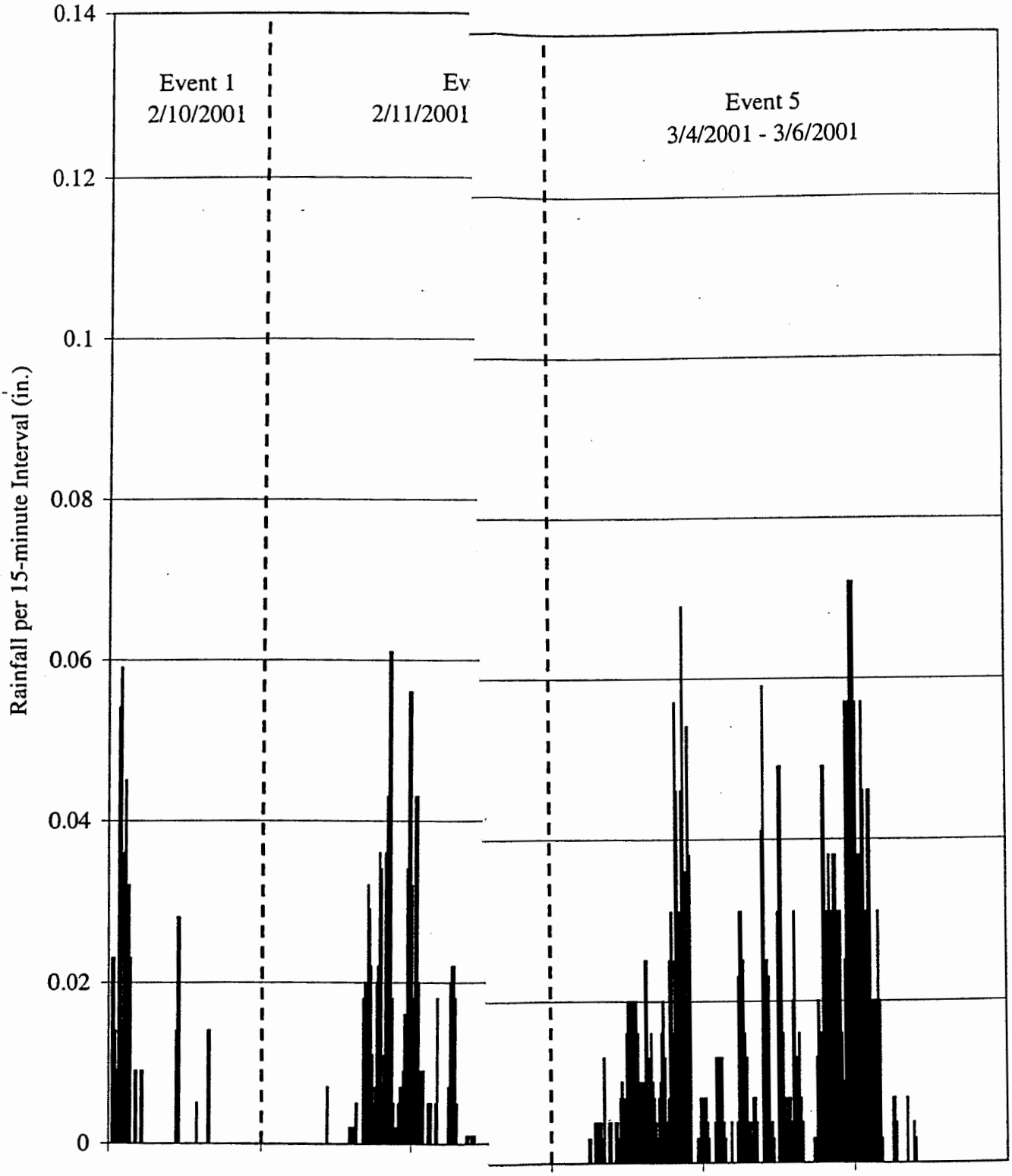
5.2.2 Rainfall Monitoring

The NEXRAIN Corporation provided gauge-adjusted radar-based rainfall data for this I/I assessment under subcontract to MWH. A separate report by NEXRAIN dated April 26, 2001 documents their methods. NEXRAIN's product was 15-minute rainfall data throughout the flow monitoring period for each of the 2-kilometer grid cells shown in Figure 5-1. The use of gauge-adjusted radar data provides accurate rainfall data with great spatial definition (about 50 cells) at a much lower cost than installation of an equivalent number of raingauges. The rainfall for each meter tributary area was determined by area-weighting the rainfall from the several cells overlying the tributary area. The resulting average rainfall for each tributary area was related to the rainfall-dependent I/I from the area to allow fair comparisons of I/I from different storms and from different tributary areas for the same storm.

Several significant rainfall events occurred during the flow monitoring period. Figure 5-3 presents a rainfall graph for a representative area within the City. Note that the graph is limited to days in which significant rainfall occurred, and that five separate events have been defined for the purposes of this analysis. Table 5-2 summarizes the dates and the range of rainfall amounts for each of these storms. There was also one significant rainfall event on January 10, prior to the flow monitoring period.

Table 5-2
Rainfall Events

Event	Date of Event	Total Rainfall (in)
1	February 10	0.4 - 0.8
2	February 11 - 13	2.8 - 3.5
3	February 19	0.3 - 1.0
4	February 23 - 28	1.8 - 2.3
5	March 4 - 6	2.5 - 3.4


0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Rainfall per 15-minute Interval (in.)
Event 1
2/10/2001
Ev
2/11/2001
Event 5
3/4/2001 - 3/6/2001

5.3 Rainfall-Dependent I/I Analysis

5.3.1 RDI/I Analysis Method

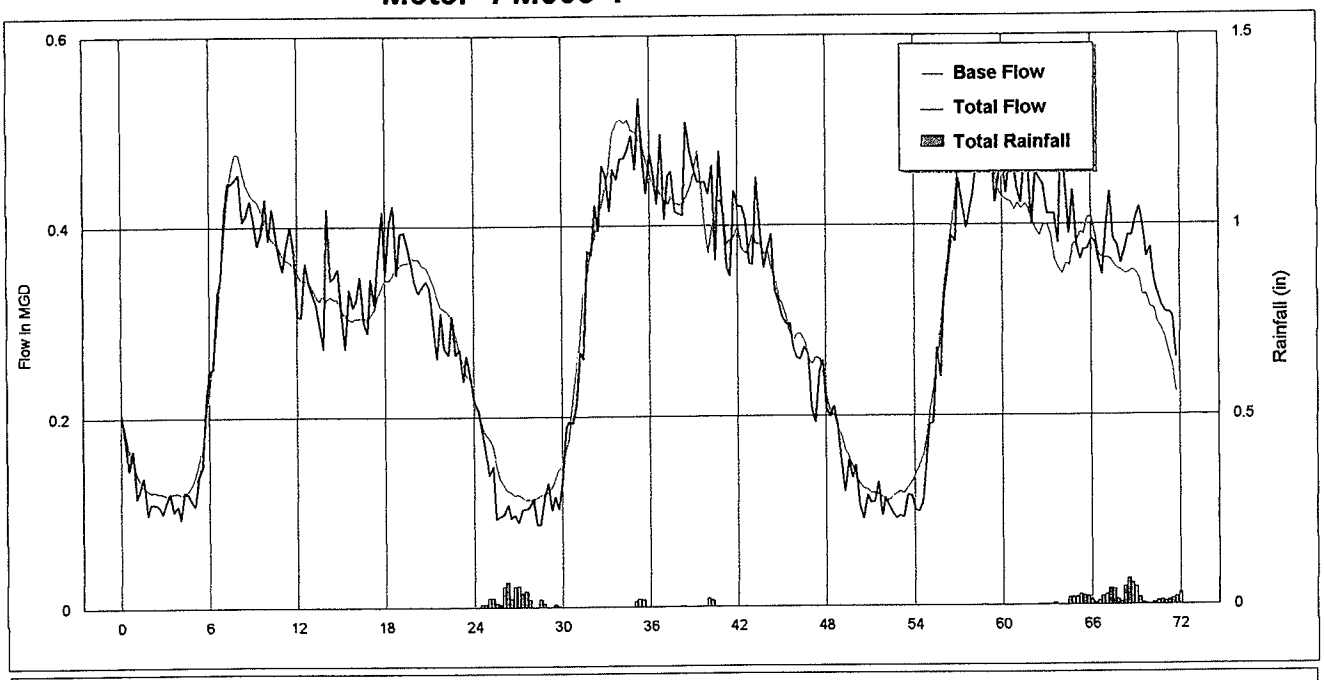
The amount of rainfall-dependent I/I (RDI/I) at each meter and each rainfall event was computed with the aid of a custom spreadsheet program. All calculations are for the "incremental" areas tributary to the meters, where relevant. The volume of RDI/I is calculated as the difference between the measured flow during the storm and a typical base flow that would be expected to occur on those same days if there had been no rainfall. The base flow hydrographs for typical Saturdays, Sundays, and weekdays were separately determined for each meter to account for the differences in the amount and hourly pattern of flow on those days. The program separates out groundwater infiltration that may exist before and/or after the storm event and excludes it from the RDI/I calculations.

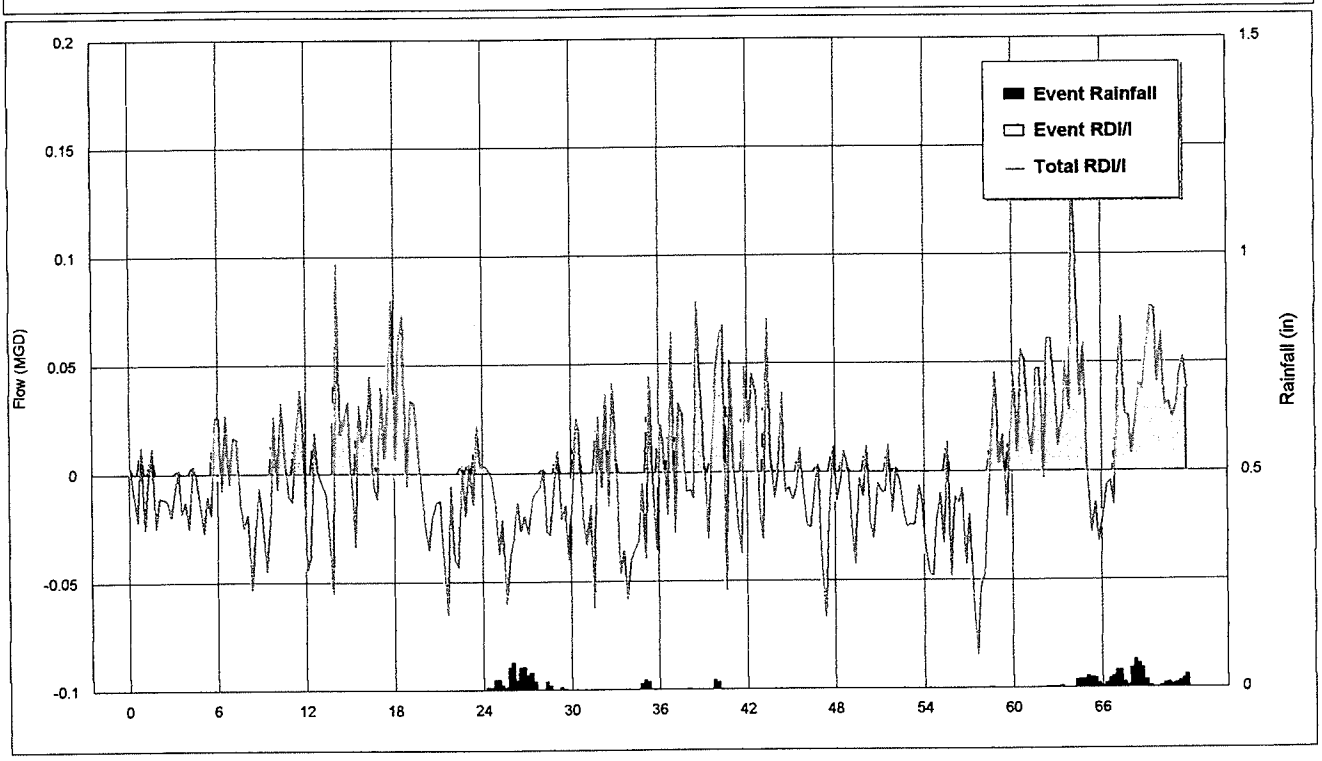
Examples of the graphical output from the program are shown on the following 5 pages. These examples are for Meter M5 (Unit U) for each of the 5 storm events. The title at the top of each page indicates the meter and the event numbers (FM005-4 is the analysis for Meter M5, Event 4). The top plot shows the base flow and the flow during the storm event (labeled as "total flow" in legend), as well as the relevant rainfall (bars at the bottom). The lower plot on each page shows the RDI/I based on the subtraction of base flow from storm flow. The shaded portion of the RDI/I hydrograph represents the volume of flow attributed to that storm event. Note how the RDI/I response for Event 1 is essentially zero (no significant difference between flow during the storm and base flow periods) and that the RDI/I response is quite clear for all the other events. Also note that the analysis determines the peak RDI/I flow as well as the volume. For example, the peak RDI/I was 0.22 mgd for Event 4 and 0.45 mgd for Event 5.

In order to compare relative RDI/I from tributary areas of different sizes, the volume of RDI/I must be compared to the volume of rainfall that fell on the area during the storm event. The ratio of RDI/I volume to rainfall volume is called the "R" value and is expressed as a percent. It is a good indicator of the magnitude of RDI/I in a given area - the higher the R, the higher the RDI/I. The R value was computed for each of the 5 events for each of the meters. For meters which have upstream meters, the R values apply to the incremental area between the two meters and not to the entire tributary area.

The rainfall volume for a given meter was computed by multiplying the average rainfall depth for the tributary area (i.e., the area-weighted radar cell data) by an effective tributary area. For the purposes of this analysis, the effective area was not a measured land area, but was instead an area proportional to the average base flow at the meter. The effective area in acres was computed by dividing the base flow by the somewhat arbitrary typical unit flow rate of 1000 gpd/ac. Computing areas in this way indexes the R value to the base flow. For example, if a tributary area has twice the RDI/I volume as a second area, but it also has twice the base flow, the two areas would have the same R value. Alternatively, for two areas having the same base flow, the area with 50% more RDI/I volume would have a 50% higher R value.

Meter FM005-1





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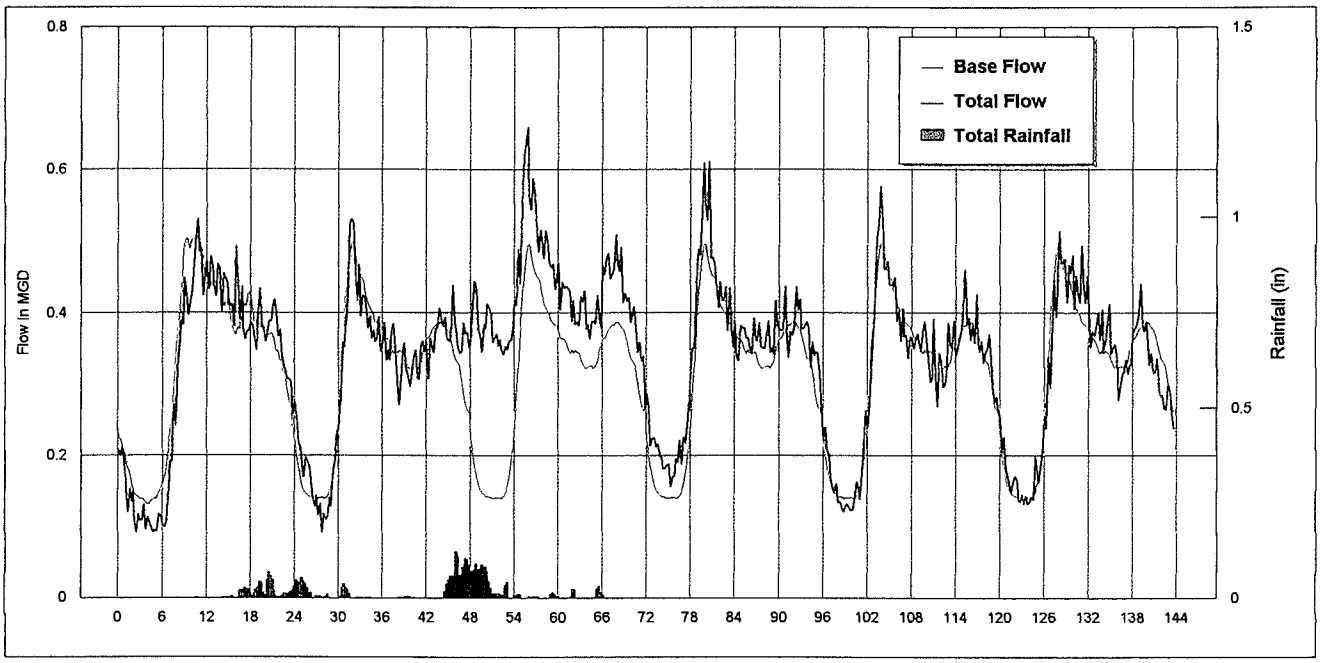
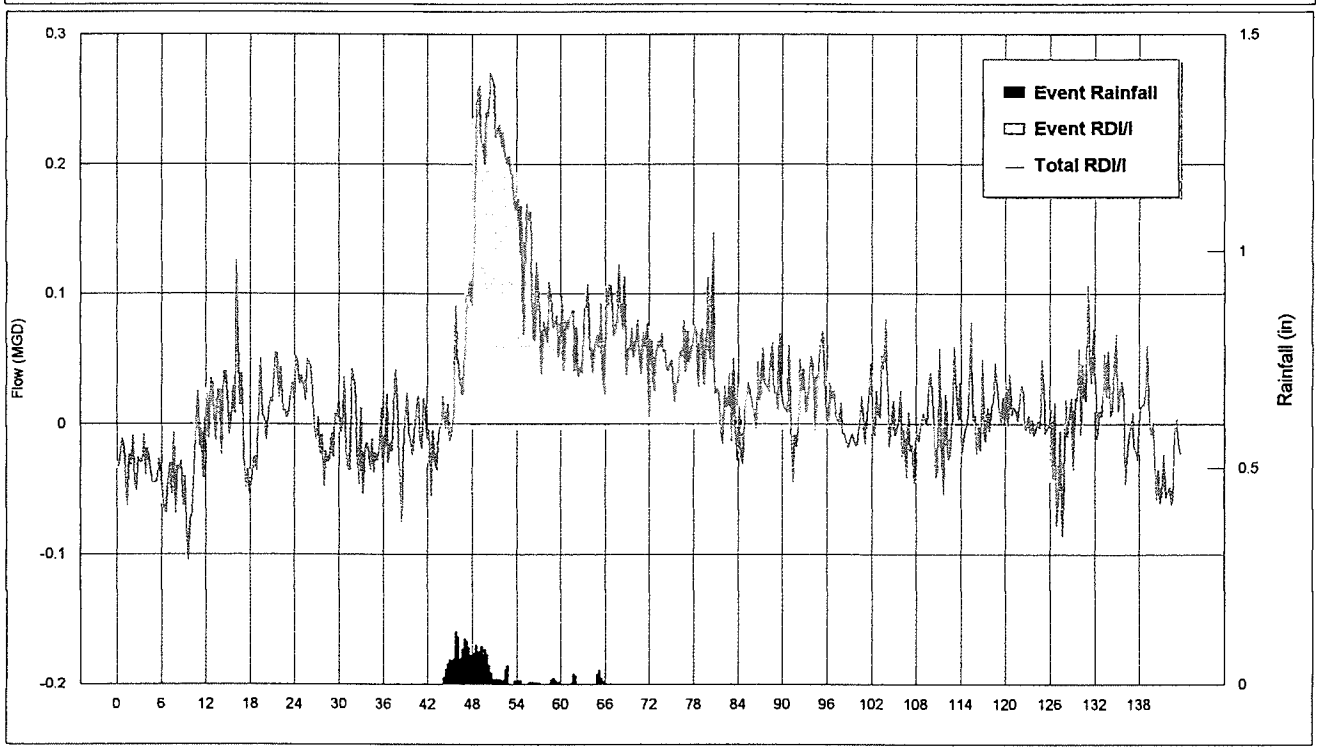
Meter FM005-2





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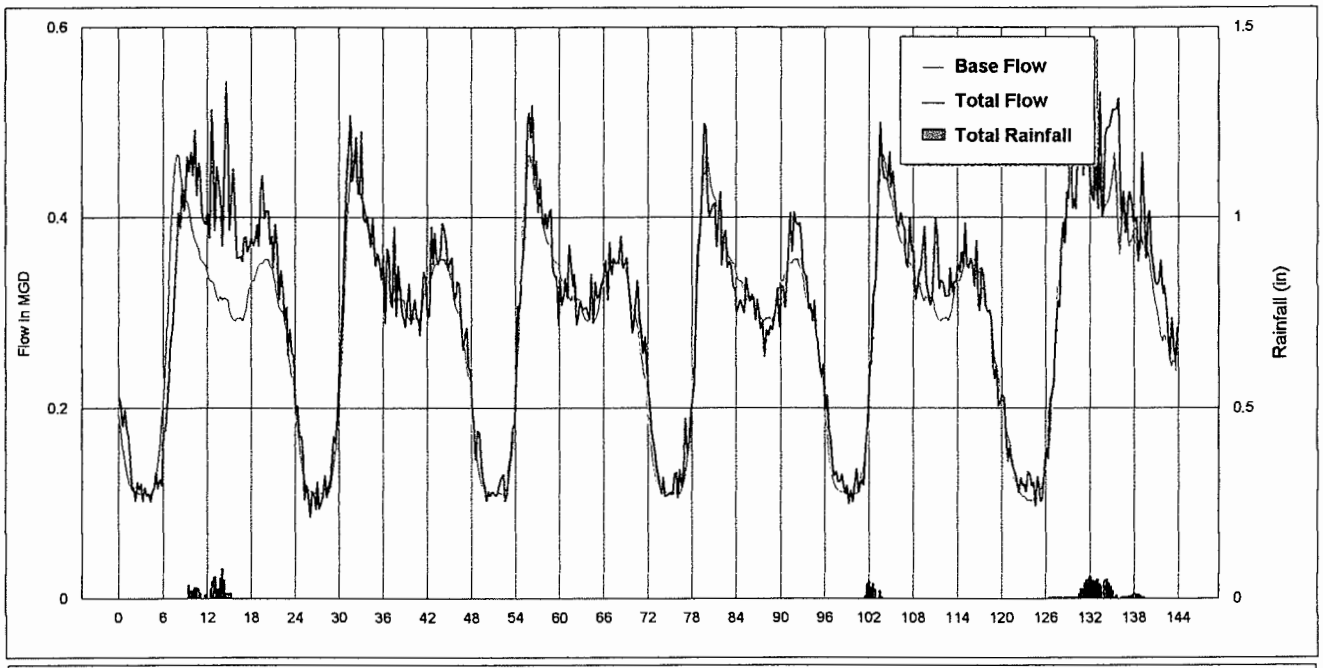
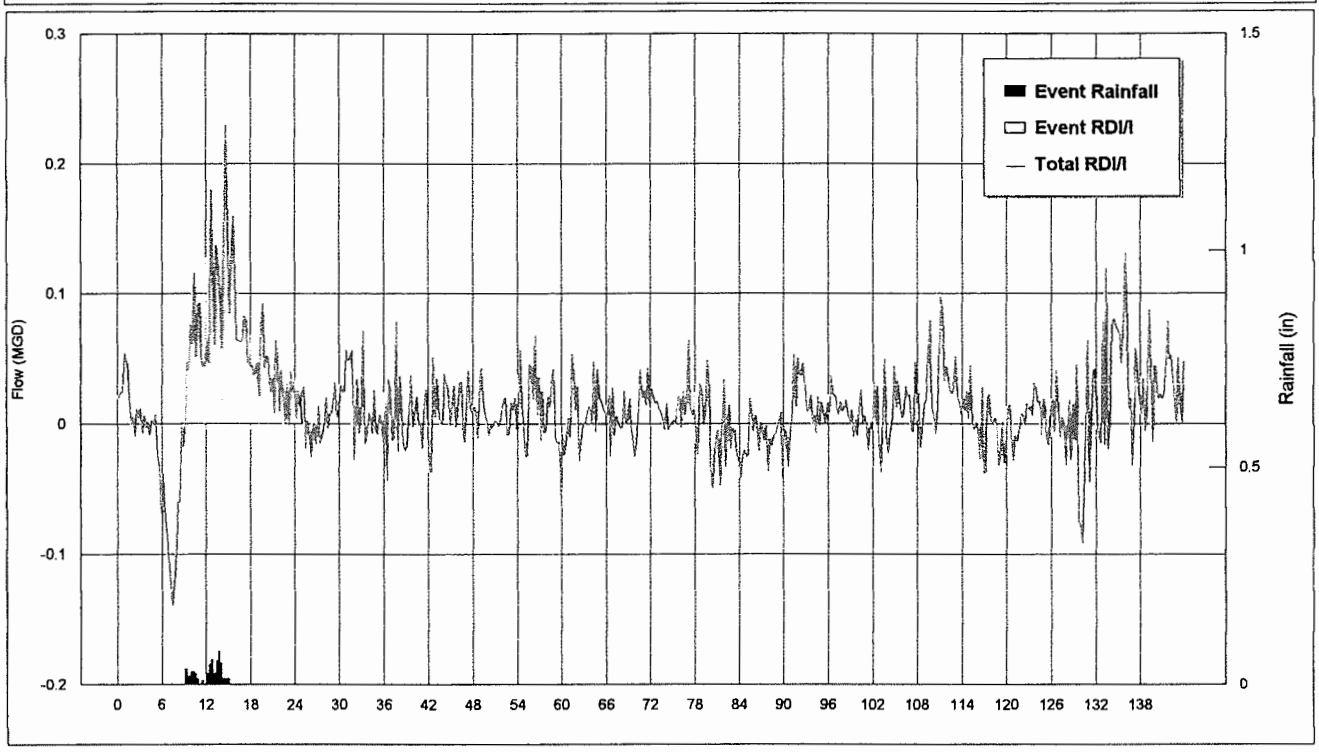
Meter FM005-3





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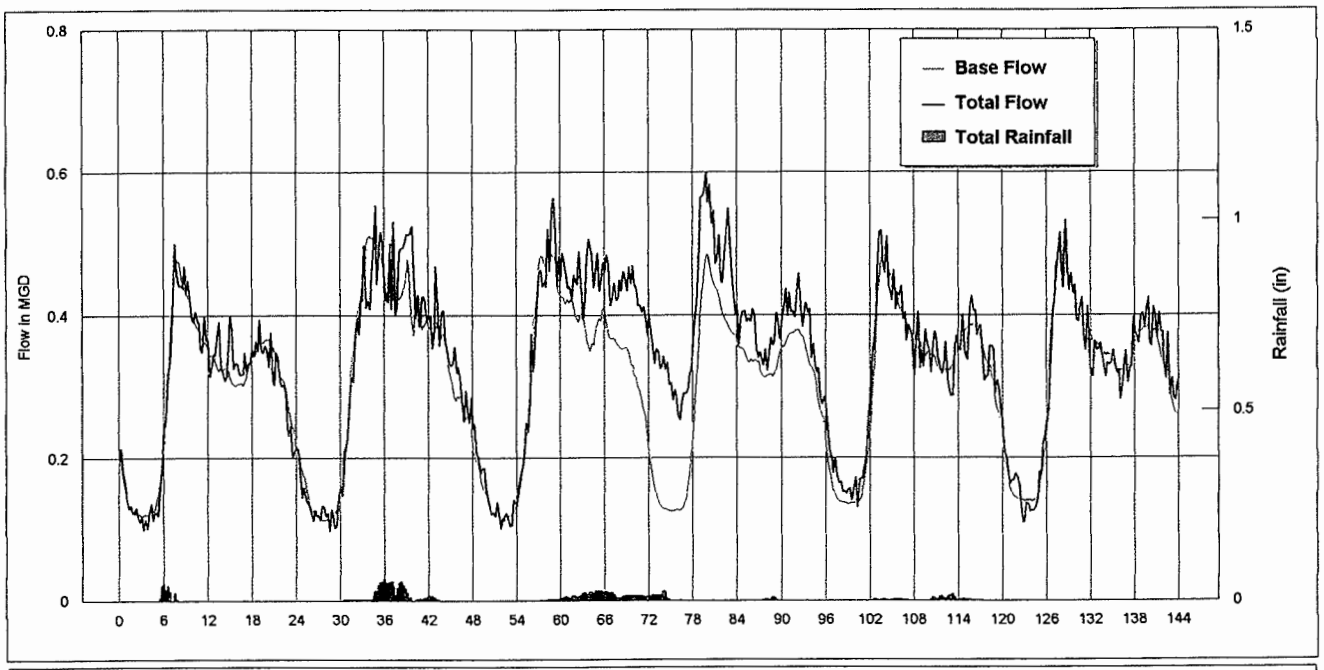
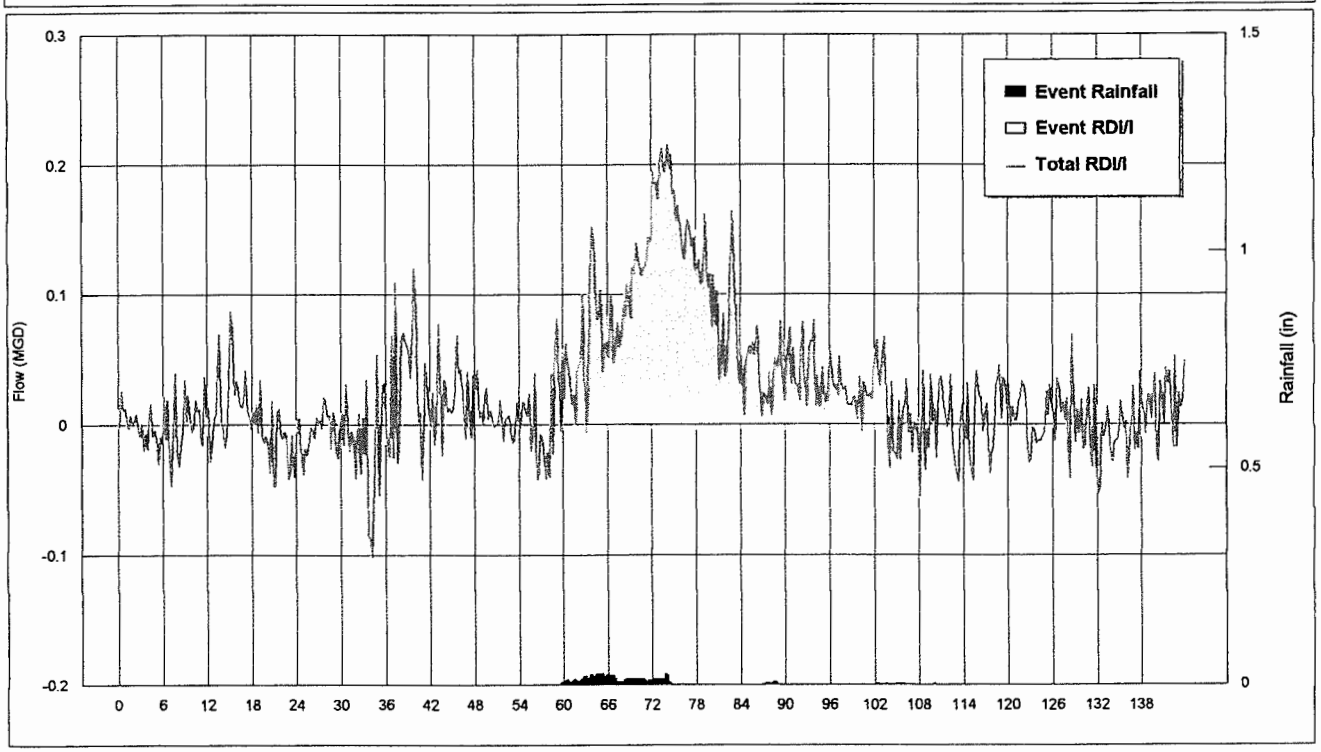
Meter FM005-4





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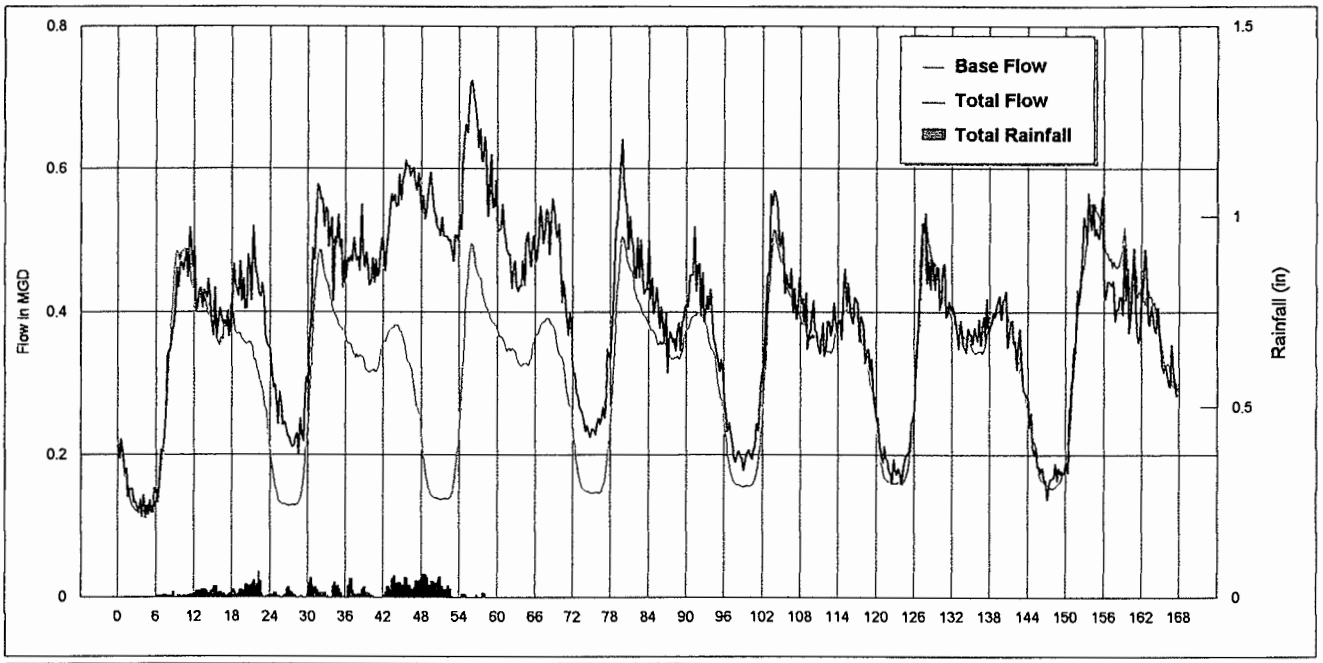
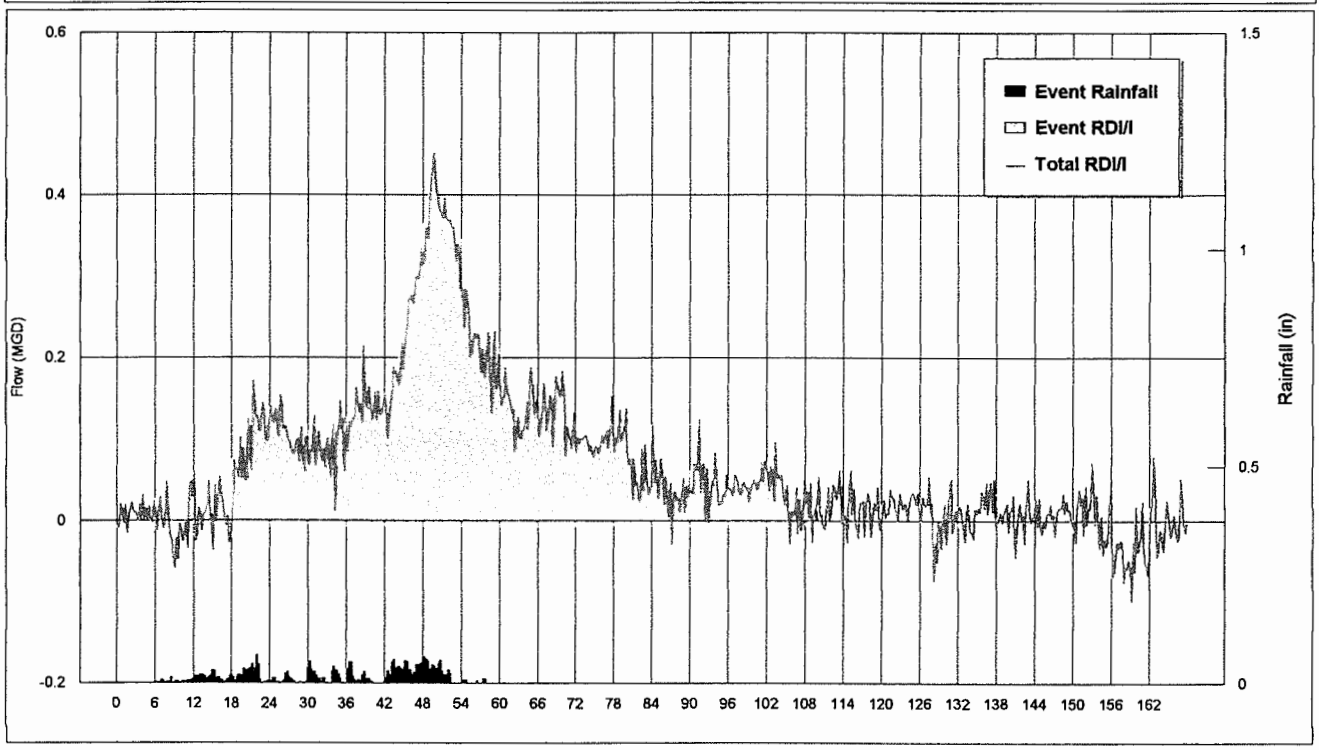
Meter FM005-5





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5.3.2 RDI/I Analysis Results

Table 5-3 presents a summary of the results of the RDI/I analysis, which includes the R value for each event. In addition, the table shows the average base flow and peak RDI/I during the period. An RDI/I peaking factor is also shown, which is equal to the sum of the peak RDI/I (typically for Event 5) and the average base flow, divided by the average base flow. This is the peaking factor that would be expected if the peak RDI/I occurred during the time of day when the base flow was average. The wet weather peaking factor is an indicator of the relative magnitude of peak RDI/I, whereas the R value indicates relative RDI/I volume.

Figures 5-4 and 5-5 show the results for each meter graphically. Figure 5-4 shows the maximum R values for any event, which always occurred in Event 5. Figure 5-5 shows the highest RDI/I peaking factors, which again typically occurred in Event 5. Due to the significance of Event 5, the RDI/I analysis graphical output hydrographs for all meters for Event 5 are included in Appendix F. The Amgen hydrograph displayed no significant RDI/I. Again, all flows and R values in the tables and figures and in Appendix F are for the incremental area between two meters and not to the entire tributary area.

Table 5-3
Summary of RDI/I Analysis

Meter ID	Event 1 R (%)	Event 2 R (%)	Event 3 R (%)	Event 4 R (%)	Event 5 R (%)	Peak RDI/I (mgd)	Avg. Base Flow (mgd)	RDI/I Peaking Factor
M1	0	1.7	0	1.1	2.6	2.4	1.00	3.4
M2	0	0	0.9	1.0	1.8	0.66	0.42	2.6
M3	0	0	0	0	0.3	0.32	0.23	2.4
M4	0	1.2	0.9	1.1	2.7	6.43	2.74	3.3
M5	0	0.9	0.8	1.8	1.8	0.45	0.30	2.5
M6	0	0.7	1.9	0.9	1.1	1.20	0.76	2.6
M7	0.6	0.7	1.4	1.5	1.8	1.63	0.58	3.8
M8	0	2.2	2.5	2.8	4.9	3.13	1.06	4.0
M9	0	0	0	0.7	1.6	1.00	0.58	2.7
M10	0	0.7	0.9	1.0	1.3	0.73	0.62	2.2
M11	ND	ND	ND	ND	ND	ND	ND	ND
M12	0	1.2	0	1.8	3.6	1.29	0.64	3.0
M13	0	0.3	0	0.4	0.4	0.52	1.00	1.5
M14	0	0.8	1.3	0.9	1.4	1.40	0.85	2.6

ND: No data. Meter M11 failed. For M4, incremental calculations were for the area between M12 and M4.

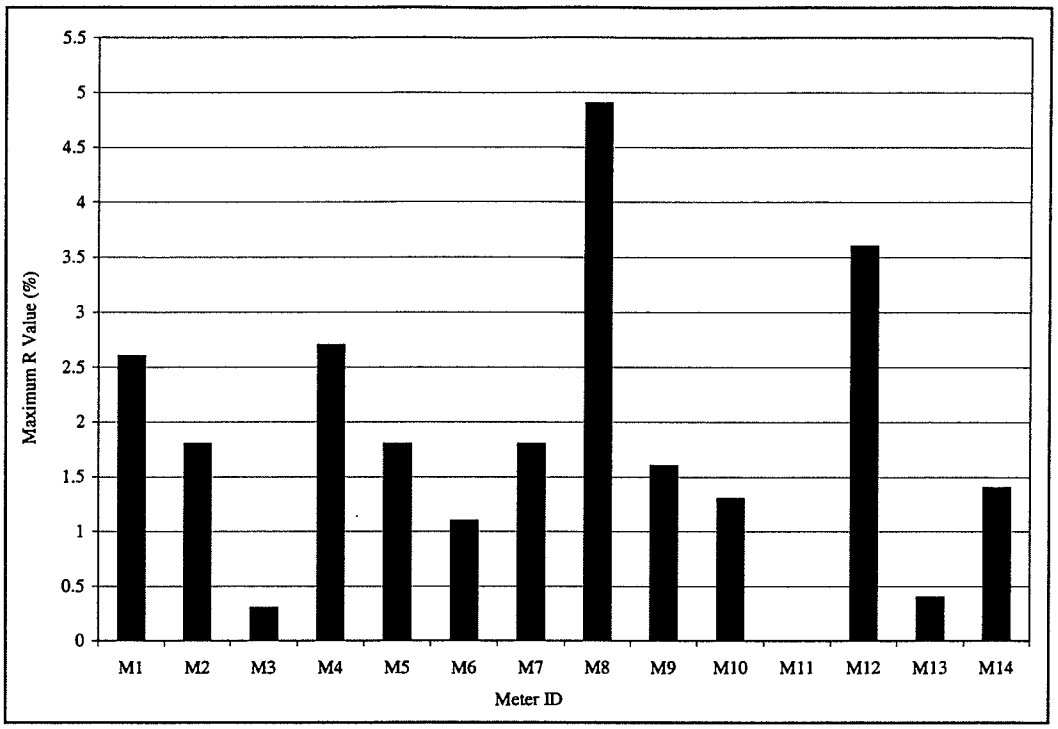

Figure 5-4
Maximum R Values (RDI/I Volumes) Observed In Temporary Meter Areas

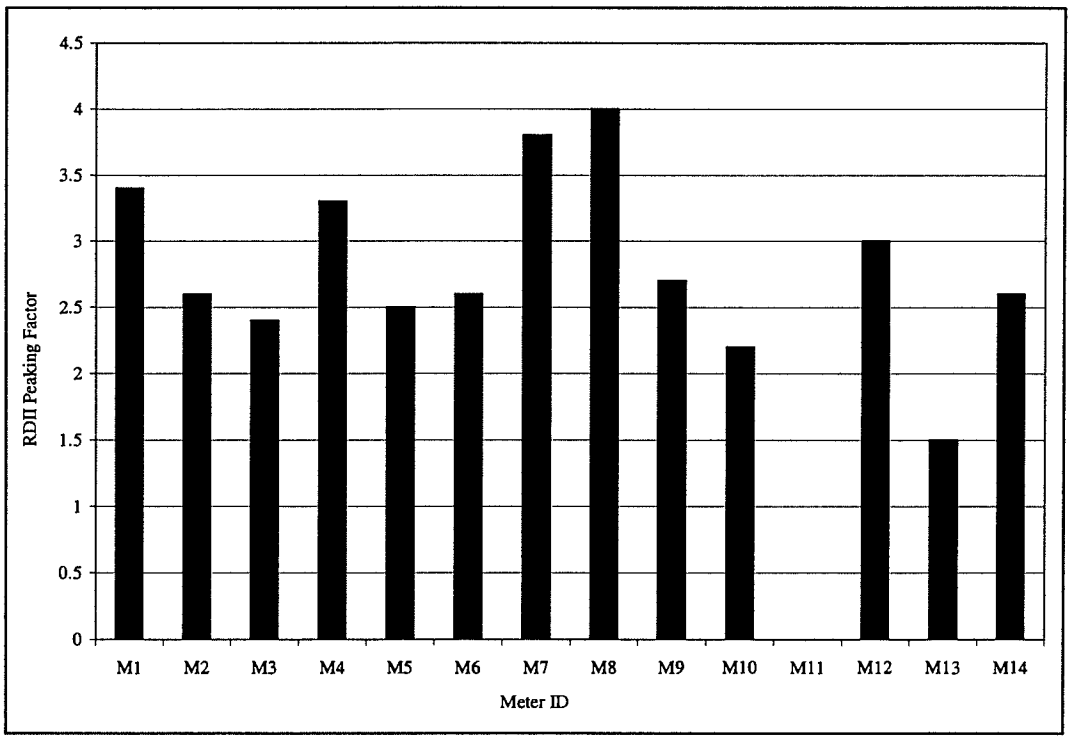

Figure 5-5
RDI/I Peaking Factors Observed In Temporary Meter Areas

5.3.3 Discussion of RDI/I Analysis Results

The temporary flow monitoring period was a very wet period having several significant storm events totaling between 8 and 11 inches depending on location (average annual rainfall is only about 16 inches). Event 5 was particularly significant in that it was a large event that followed several other storms. When major storms occur following a series of other storms that saturate the soils, RDI/I response is maximized. This is evident from the fact that RDI/I for Event 5 was much greater than for Event 2, even though Event 2 (a 2-year return period rainfall event for a six-hour duration) was larger in terms of rainfall. One indication of the severity of Event 5 was that the RDI/I volume and peak response at the Hill Canyon Treatment Plant for that event was very similar to the response from the major "El Nino" storms in February of 1998 (see Figures 5-6 and 5-7). The El Nino storms are generally considered to be extreme events, and produced the greatest RDI/I response observed at the Hill Canyon plant in several years. The conclusion is that Event 5 is an excellent event for characterizing relative RDI/I in different parts of the collection system. It is also noteworthy that no overflows were recorded during the event, so that all of the RDI/I reached the meters.

In general, the analysis shows that RDI/I in the City's collection system is measurable and significant, although not high. R values under 3 percent and RDI/I peaking factors under 4.0 are considered low under the rainfall conditions analyzed, even for a relatively new sewer system such as the City's. In older sewer systems in high-rainfall areas of the country, it is not unusual to measure R values over 10 percent and peaking factors in excess of 10.

In addition to having relatively low RDI/I overall, the variation in RDI/I from one part of the collection system to another was generally not as great as is typical in most cities. This is probably because there are no truly "old" sections of the city. Nevertheless, it is clear that certain areas of the collection system are subject to higher amounts of RDI/I than others, and deserve further consideration. These areas are:

Unit E (Meters M12 and M4). Meters M12 and M4 were among the worst in terms of both RDI/I volume (R values) and peak flows. In addition, the depth of flow near Meter 11 (which produced valid depths, but invalid velocity readings) approached the diameter of the interceptor at that location. Portions of this interceptor run along a major storm drain channel, which could be contributing to the problem.

Unit W (Meter M8). The incremental area to Meter M8 shows high RDI/I. However, these findings may not be very accurate due to the small size of this incremental area, as noted earlier.

Unit V (Meter M7). The lower portion of Unit V shows relatively high peak flows, but not particularly high R values. This area was also the only area that had a measurable response during Event 1, which occurred on drier soils. This

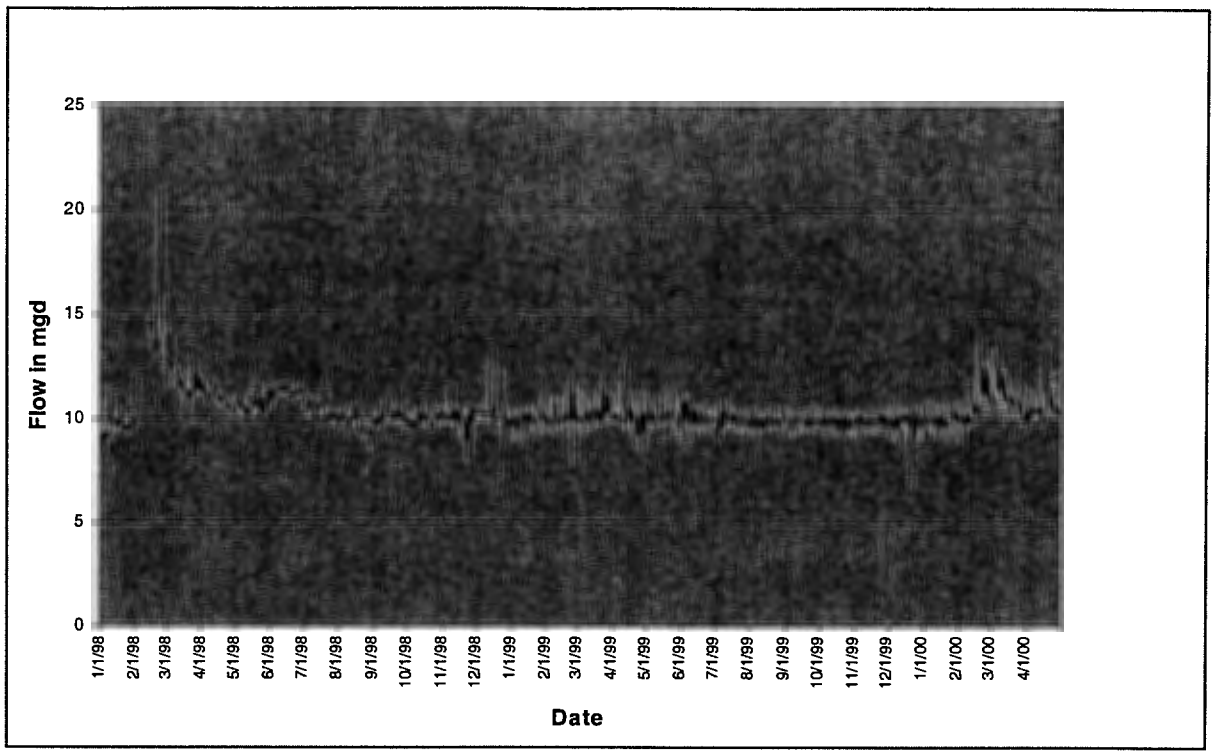

Figure 5-6
Hill Canyon Treatment Plant Influent – January, 1998 to May, 2000

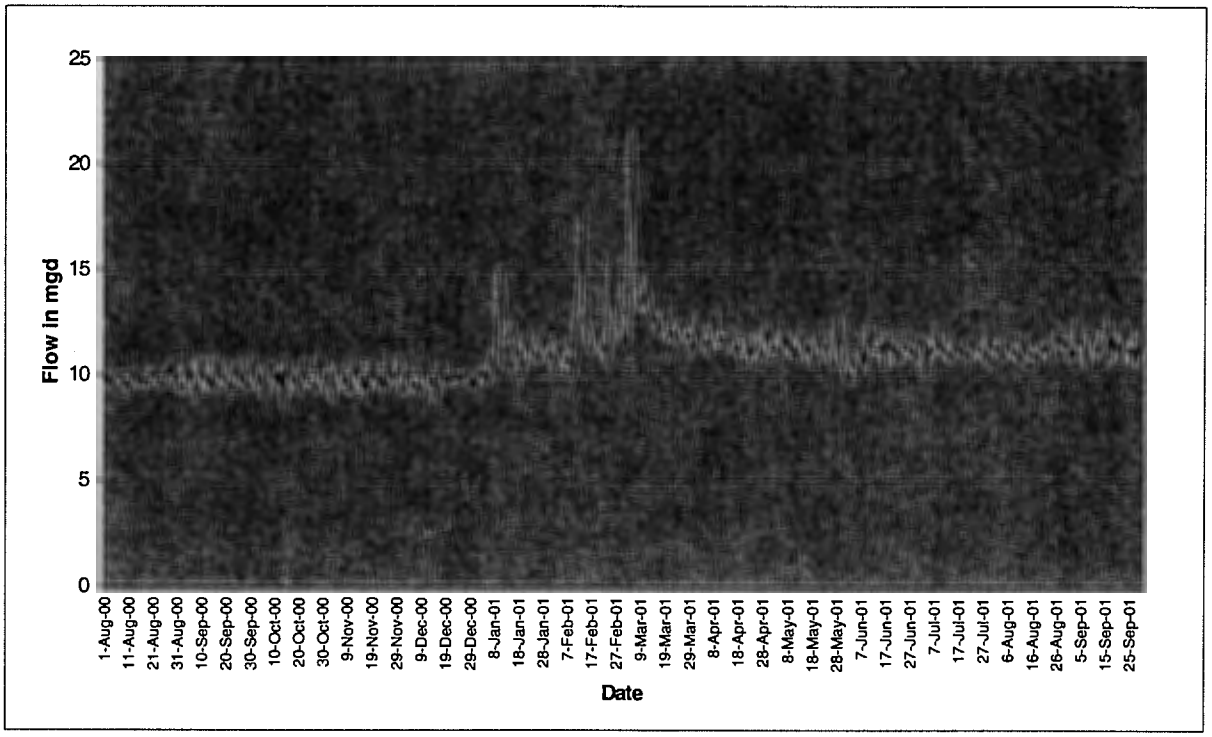

Figure 5-7
Hill Canyon Treatment Plant Influent – August, 2000 to September, 2001

suggests the some of the sources of RDI/I from this area may be more direct than the case in other areas (e.g., direct inflow).

Units A and C (Meter M1). The peaking factor in this area was relatively high.

5.4 Groundwater Infiltration Analysis

Groundwater infiltration (GWI) has been differentiated from RDI/I for this analysis. The GWI component of flow has been defined to be the increase in flow from a typical dry day at the start of the flow monitoring period (early February) to a day at the end of the period after the RDI/I from Event 5 receded. This recession occurred by about three days after the final hour of rainfall. Any residual GWI resulting from rainfall earlier in the wet season is probably not significant. Because the monitoring period was so wet, it was an excellent period for quantifying GWI variations.

Table 5-4 presents the results of the GWI analysis, again based on the incremental areas for each meter. The actual GWI is given, as well as a GWI peaking factor, which is the sum of the average base flow and GWI divided by the average base flow.

The GWI analysis indicates that GWI is very low in most of the collection system, generally only a few percent of the base flow. The only exceptions are the upper reaches of Unit E (Meter M12) and lower reaches of Unit X (Meter M2).

Table 5-4
Summary of GWI Analysis

Meter ID	GWI (mgd)	Avg. Base Flow (mgd)	GWI Peaking Factor
M1	0.23	1.00	1.23
M2	0.17	0.42	1.40
M3	0.00	0.23	0.00
M4	0.00	2.74	0.00
M5	0.04	0.30	1.13
M6	0.02	0.76	1.03
M7	0.01	0.58	1.02
M8	0.00	1.06	0.00
M9	0.08	0.58	1.14
M10	0.00	0.62	0.00
M11	ND	ND	ND
M12	0.32	0.64	1.50
M13	0.04	1.00	1.04
M14	0.16	0.85	1.12

ND: No data. Meter M11 failed. For M4, incremental calculations were for the area between M12 and M4.

5.5 Flow Isolation Study

To further identify possible sources of high I/I, a flow isolation study was performed by ADS Environmental Services on four nights from March 4 to March 8. Flow isolations normally are performed to find areas having high GWI, but because the study was performed during Event 5, the measured flows represent mostly RDI/I. The study consisted of a series of spot flow measurements in 56 manholes within the collection system between the hours of midnight and 6 a.m. Sanitary flow in the sewers during these hours is minimal, so the measured flow is mostly I/I. The flows were reported by ADS as both absolute values and as flows per inch-diameter-mile of tributary sewer.

Figure 5-8 shows the flow isolation sites and tributary areas, which were selected because of suspected high I/I. They includes areas tributary to Units E, X, and A. Additional details and results of the flow isolation study are contained in a report submitted by ADS and attached as Appendix G.

The flow isolation study was successful in identifying areas having relatively higher I/I. However, reading taken on the night of March 5-6 were not directly comparable to reading taken on the other nights, since it was raining much more heavily that night. In order to compensate for this, readings taken that night were adjusted downward by a factor based on the relative RDI/I that night versus the other nights, as measured at the appropriate temporary flow meter. The adjustment factors were on the order of one half to a third.

Following the adjustments, the flows per inch-diameter-mile were input to a GIS database and used to create color-coded maps of the tributary areas, highlighting areas having the highest flows. Figures 5-9, 5-10, and 5-11 each show one of the three main study areas in which flow isolations were performed, with the highest-flow tributary areas in darker colors.

The results of the flow isolation study are consistent with those of the RDI/I analysis, in that areas tributary to Unit E generally showed the highest I/I. The flow isolation study provides additional detail on specific small areas that are the greatest sources of RDI/I or GWI. Smoke testing of some of those areas was performed in October and November of 2001 to determine if the relatively high I/I from those areas might be the result of direct inflow from roofs, drains, or other impervious areas.

5.6 Smoke Testing Study

A smoke testing study was performed by ADS Environmental Services between October 29 and November 2, 2001. Smoke testing is performed to identify specific sources of direct stormwater inflow into sewers and private laterals. Examples of direct inflow sources are roof leaders, yard and area drains, storm sewer cross-connections, open cleanouts on private property, and low-lying manholes. In general, correcting inflow sources is inexpensive and cost-effective compared to correcting infiltration sources.

Figure 5-8
Overview of Flow Isolation Study Areas

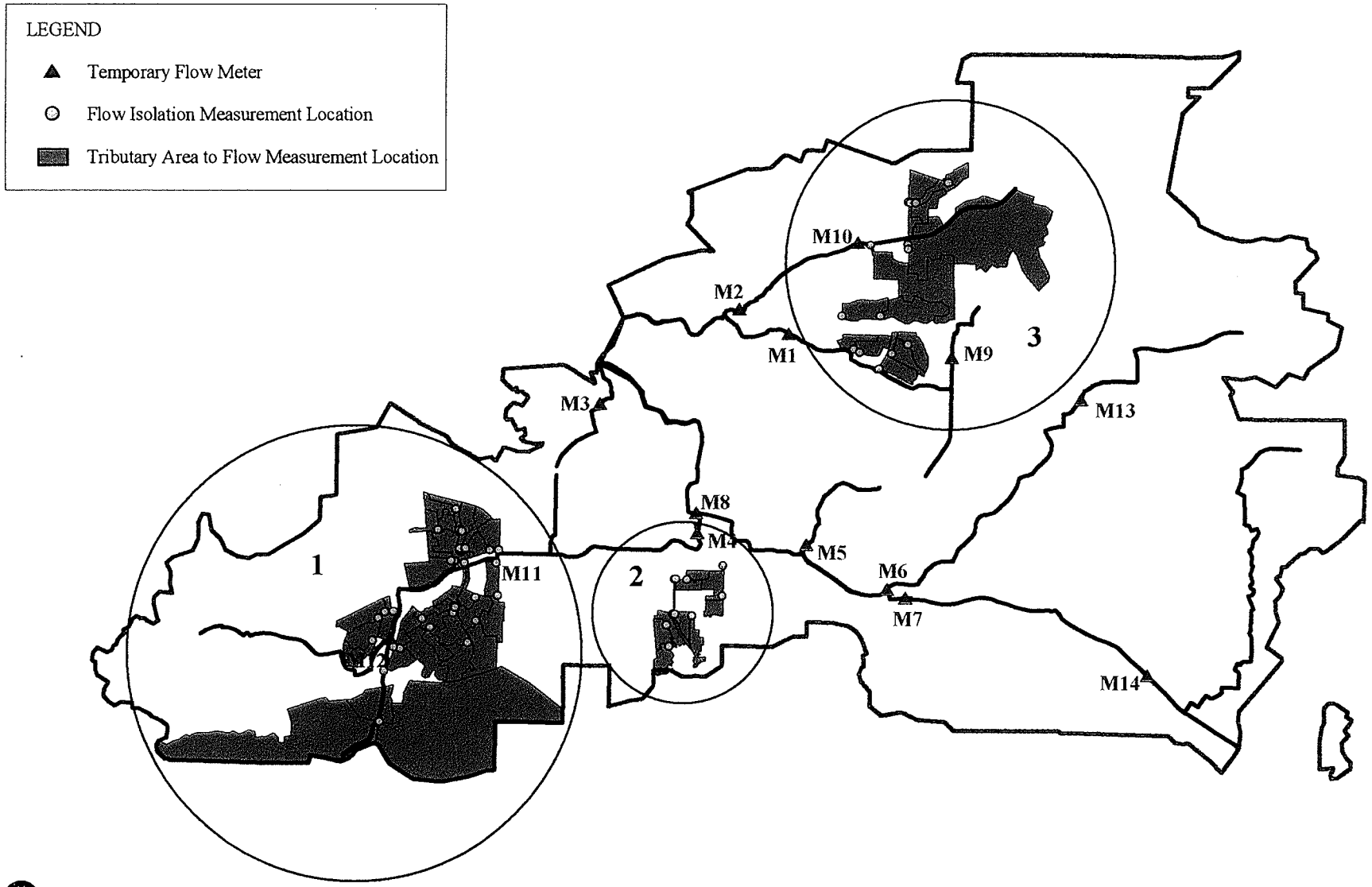

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Figure 5-9
Flow Isolation Results for Area 1

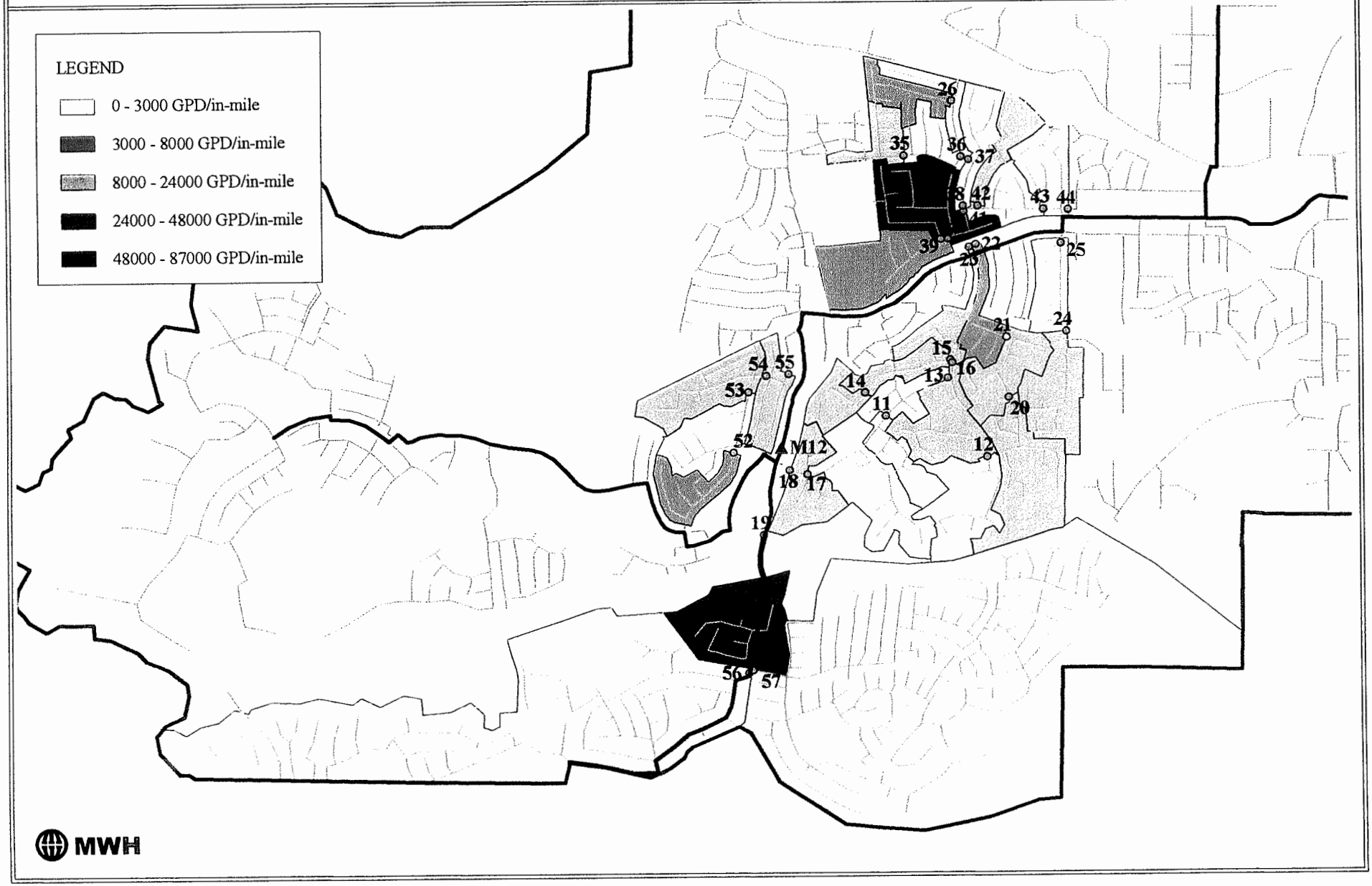


Figure 5-10
Flow Isolation Results for Area 2

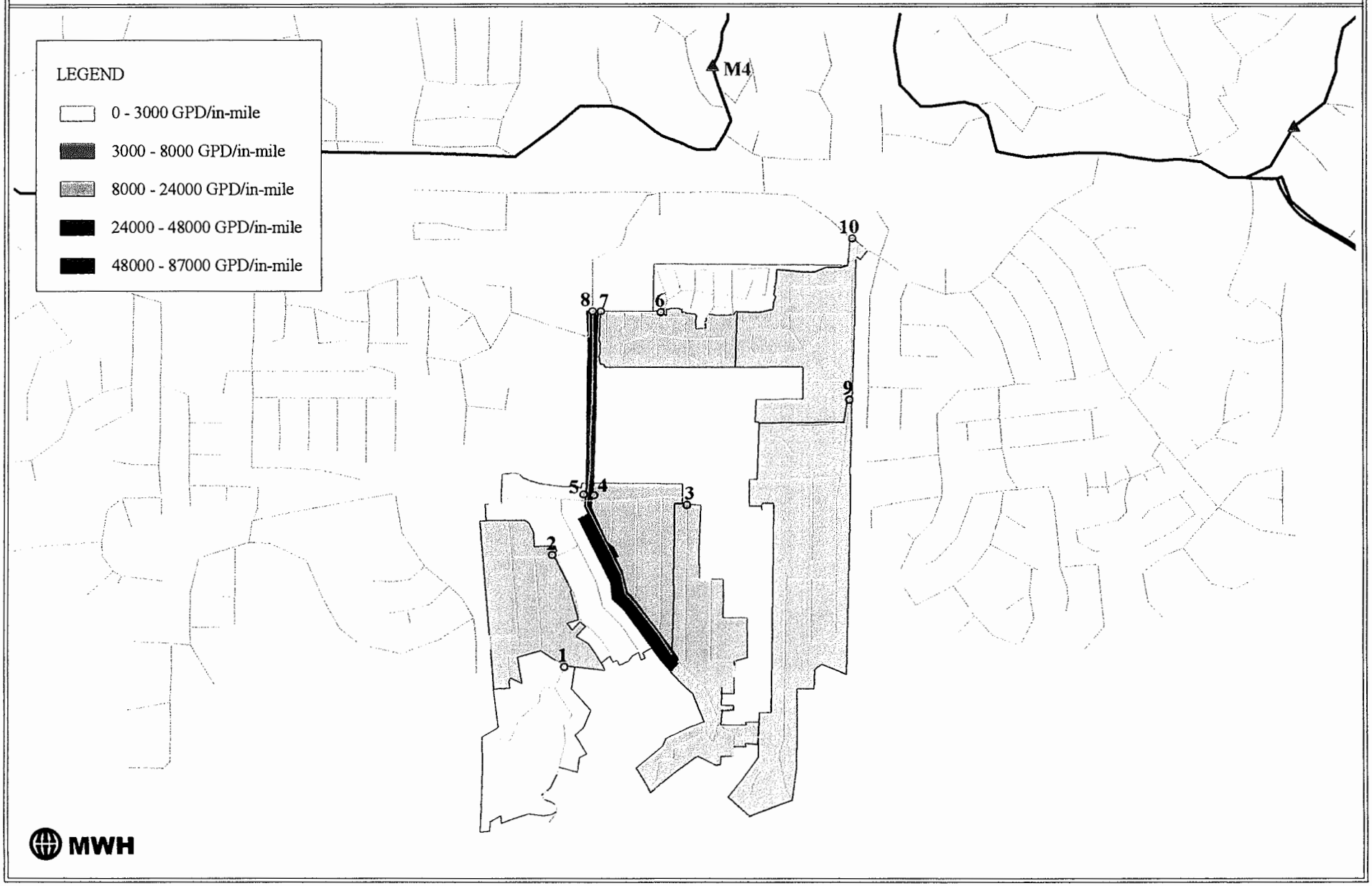
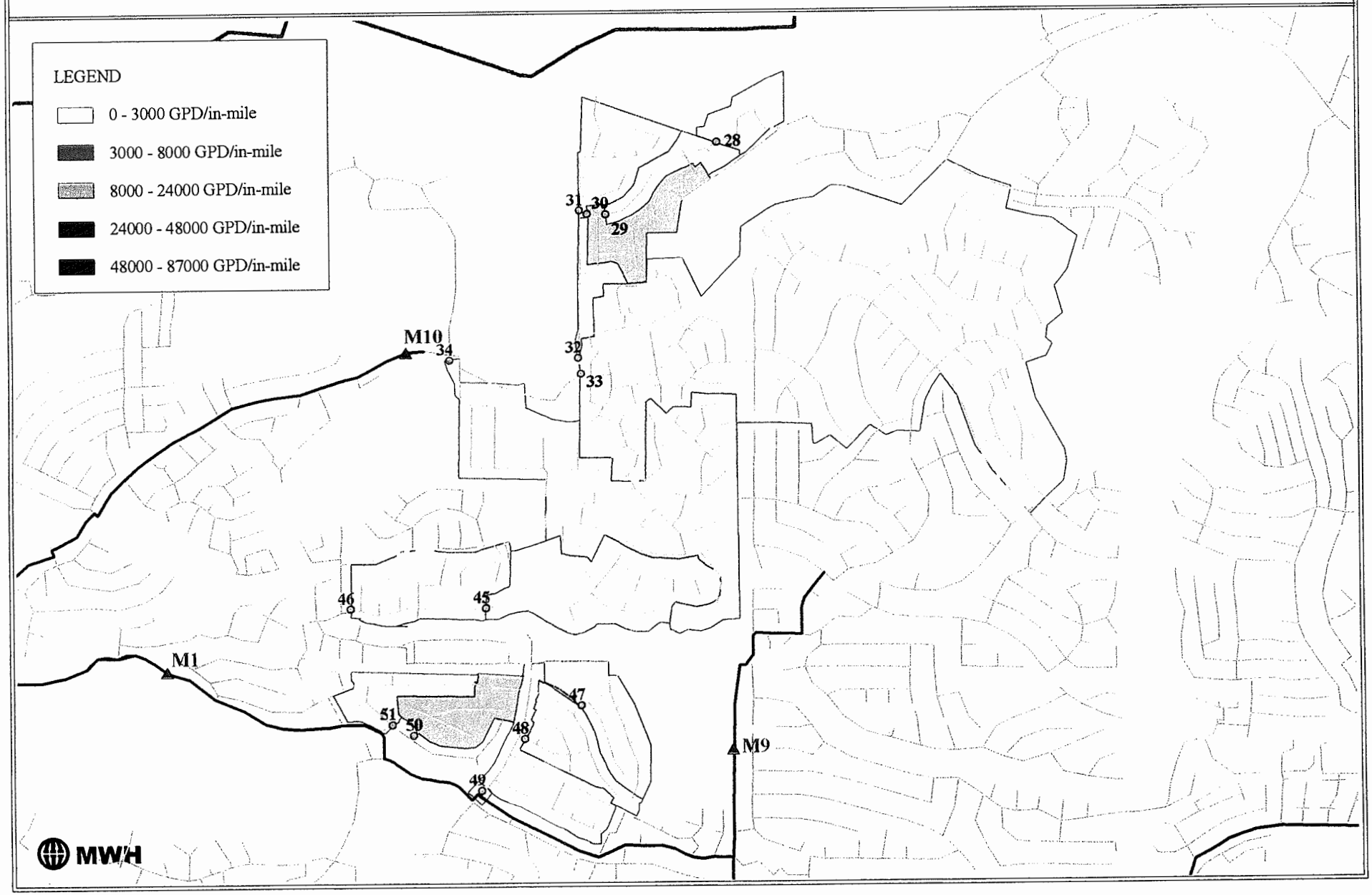


Figure 5-11
Flow Isolation Results for Area 3



Smoke testing is performed by inserting smoke candles in a manhole and pressurizing the sewers using a powerful air blower. Smoke will then fill the sewers in the immediate area and rise from any direct connections or from the ground above a defect if the defect is close to the surface (e.g., a shallow lateral). The testing is conducted during dry weather when the soil is dry. Smoke testing will not generally identify sources of infiltration of storm water or groundwater into sewers, because these sources are deep under soil and the smoke cannot easily penetrate the soil to reach the surface.

The sewers selected for this smoke testing study were those which had the highest measured I/I in the flow isolation study. Since the flow isolation study was performed during a storm period, the sources of I/I could have included direct inflow as well as infiltration of storm water. Figures 5-12 and 5-13 show the areas selected for smoke testing. A total of 24,426 feet of sewer were tested. Additional details and results of the smoke testing study are contained in a report submitted by ADS and attached as Appendix H.

Eight defects and one suspected defect were identified and documented during the smoke testing study. Most of the defects consisted of open cleanouts on private property. The details of these defects were input to the GBA database, along with digital photographs showing the smoke emerging from the defect. In addition, the potential rate of flow that each defect could contribute to the sewer system was estimated. The City should use the report and information in the GBA database to follow-up and eliminate these inflow sources.

The inflow sources discovered and quantified during the smoke testing were minor and not significant contributors to the I/I observed in the test areas during the flow isolation study. The conclusion is that the defects that contributed to the I/I were not inflow sources.

5.7 Conclusions and Recommendations

The following conclusions on the I/I in the City's collection system are based on the analysis of the wet weather flow monitoring data, flow isolation measurements, and smoke testing:

- The overall magnitude of I/I in the City's collection system is considered low relative to most collection systems. This is attributable to the lack of older sewers (all sewers are post-1958), good sewer maintenance practices, and relatively low rainfall (16 inches per year).

- Although there are variations in I/I throughout the collection system, the amount of variation is lower than typical. This can also be attributed to the lack of any truly "old" sewers.

Figure 5-12
Smoke Testing Area 1

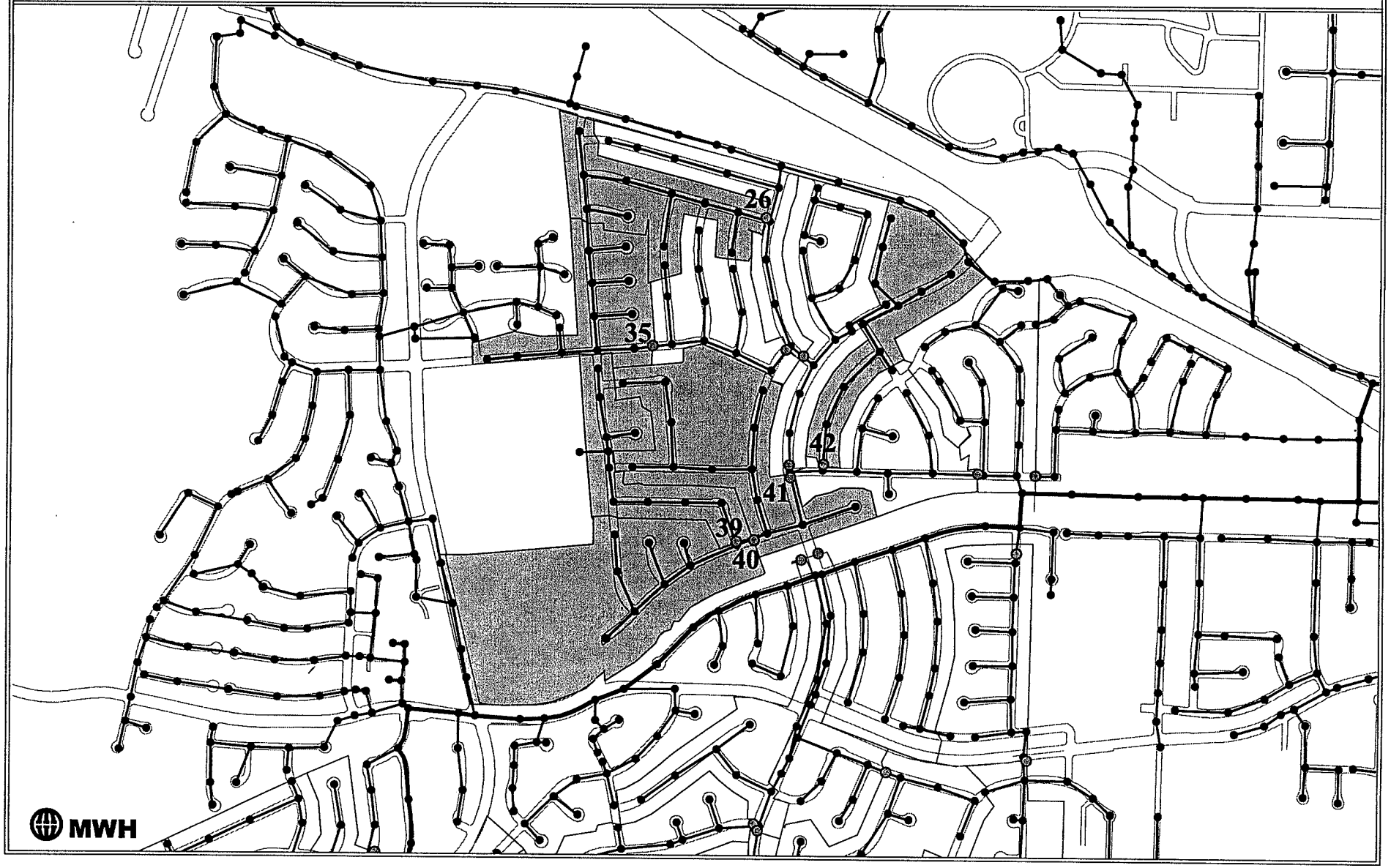
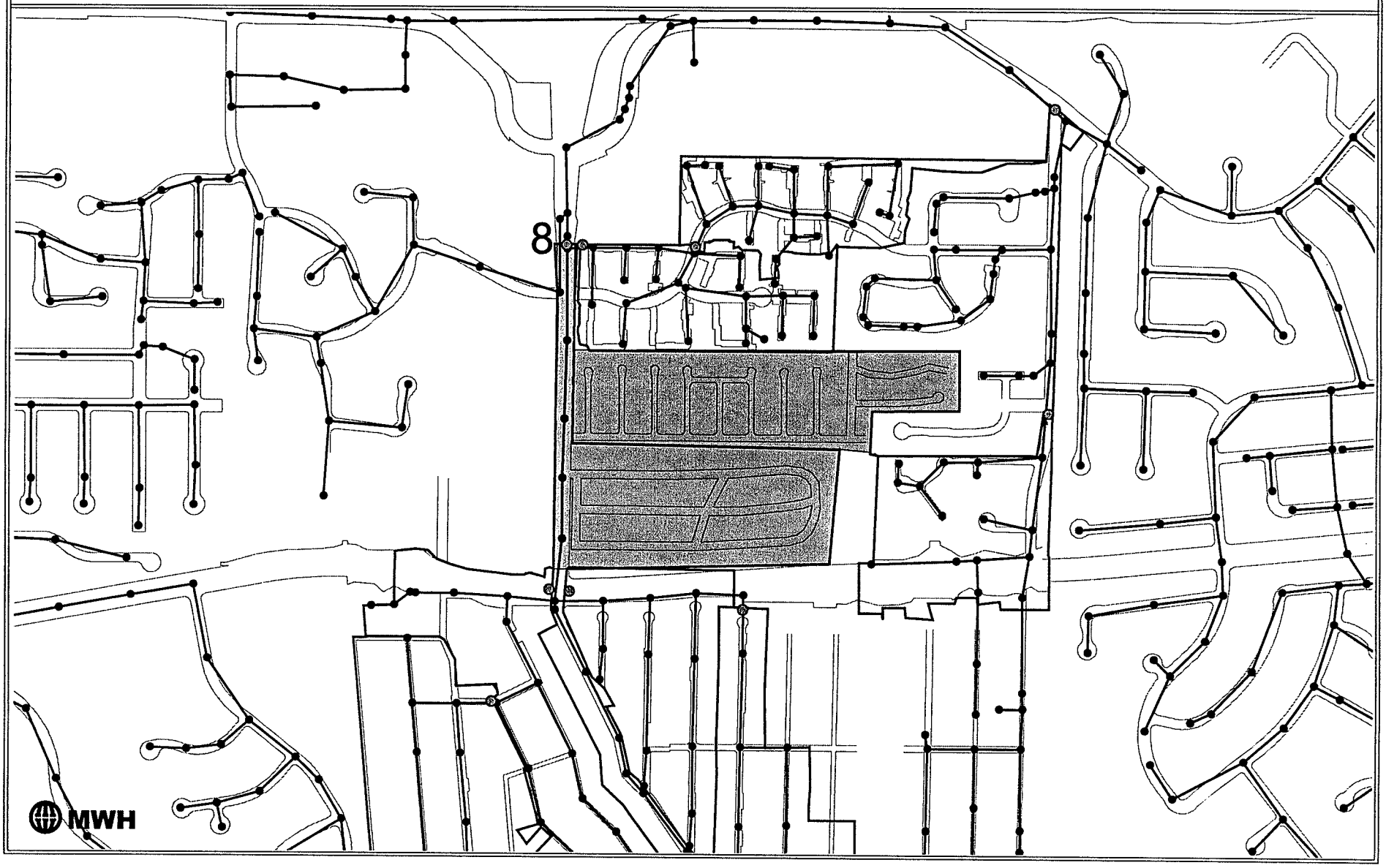


Figure 5-13
Smoke Testing Area 2



- Evidence suggests that there is very little direct inflow of stormwater into the sewer system from connections of impervious surfaces such as roof, drains, etc. This is supported by the general lack of RDI/I response during Event 1, which occurred on relatively dry soils. It is further supported by the lack of inflow sources identified during smoke testing, even though the testing focused on areas known to have relatively high RDI/I based on flow isolation measurements.

- Given the apparent lack of significant direct inflow (which is always cost-effective to remove), experience in other cities suggests that it would not be cost-effective to perform sewer rehabilitation or replacement for the purposes of reducing I/I in even the worst areas of the City's collection system. Providing additional sewer capacity where needed to convey peak wet weather flows will be more economical than I/I source detection and reduction. Chapter 6 presents the capacity analysis and Chapter 7 presents several capacity improvement projects.

- Over time, it is normal for I/I to increase as sewers deteriorate with age, including deterioration of private laterals. The extent of the increase is uncertain, but is likely to be less significant in newer systems like the City's. Periodic or permanent wet weather flow monitoring is recommended to track trends in I/I. Relief and replacement sewers should be designed with sufficient capacity to accommodate possible future increases in I/I.

- Rehabilitation or replacement of aging sewers to maintain structural integrity can also help offset increases in I/I. Several interceptor sewer improvement projects recommended in this Master Plan should help control I/I, particularly the projects on reaches of Unit E that run adjacent to the Arroyo Conejo flood channel. In addition, a long-term sewer rehabilitation/replacement strategy is recommended in Chapter 7.

Section 6

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CHAPTER 6 – INTERCEPTOR CAPACITY ANALYSIS

The hydraulic capacity of the interceptor sewers must be sufficient to convey peak wastewater flows both now and in the future, including infiltration and inflow (I/I). The capacity analysis described in Chapter 6 involved quantifying dry and wet weather flows using land use information provided by the City's Planning Department and unit flow rates and I/I parameters determined from the temporary flow monitoring data. A dynamic computerized hydraulic model of the interceptor system was calibrated and applied to identify sewers requiring additional capacity. This chapter presents the findings and conclusions of the capacity analysis.

6.1 Capacity Analysis Objectives

The objectives of the capacity analysis were:

- Quantify existing and future land uses in subareas throughout the City to provide the basis for calibrating dry weather unit flow rates and projecting future flows.
- Develop a hydraulic model of the interceptors, and use temporary flow monitoring data to calibrate it to match observed dry and wet weather flows.
- Apply the model to identify and prioritize existing and future capacity deficiencies.

6.2 Modeling Methodology

The hydraulic modeling methodology and criteria are summarized below. Additional details are presented in subsequent paragraphs.

- Extract from the sewer database the information on each interceptor pipe segment and manhole required for modeling with HydroWorks dynamic modeling software (spatial coordinates, manhole identifiers and rim elevations, pipe invert elevations, diameters, and lengths).

- Divide the service area into subareas (134 were delineated), each contributing flow to a specific manhole on the interceptor system.

- Compile information on existing and future (through buildout) land uses in each subarea using information provided by the City Planning Department. Also compile flow information on major wastewater dischargers.

- Select representative dry weather days from the temporary flow monitoring period and load the flow data from each of the 13 flow monitors for those days into the model for comparison to modeled flows.

- Calibrate the residential and non-residential unit flow rates (e.g., average flow per single-family dwelling unit, flow per developed square foot of commercial, etc.) and 24-hour diurnal flow profiles to match the observed flow volumes and peaks at each monitor.

- Select a wet weather event for use in wet weather flow calibration. For the selected event (Event 5, March 4 to 6, 2001), load the 15-minute flow monitoring data for each flow monitor and the 15-minute radar rainfall data for each rainfall grid cell.

- Calibrate the wet weather parameters to match the observed flows at each monitor.

- Determine appropriate dry and wet weather flow design criteria.

- Run the calibrated model for existing (Year 2000) and buildout land use scenarios under design dry and wet weather flow conditions.

- Quantify capacity utilization in each pipe segment and present the results on GIS interceptor maps.

- Identify and prioritize sewer reaches having capacity deficiencies.

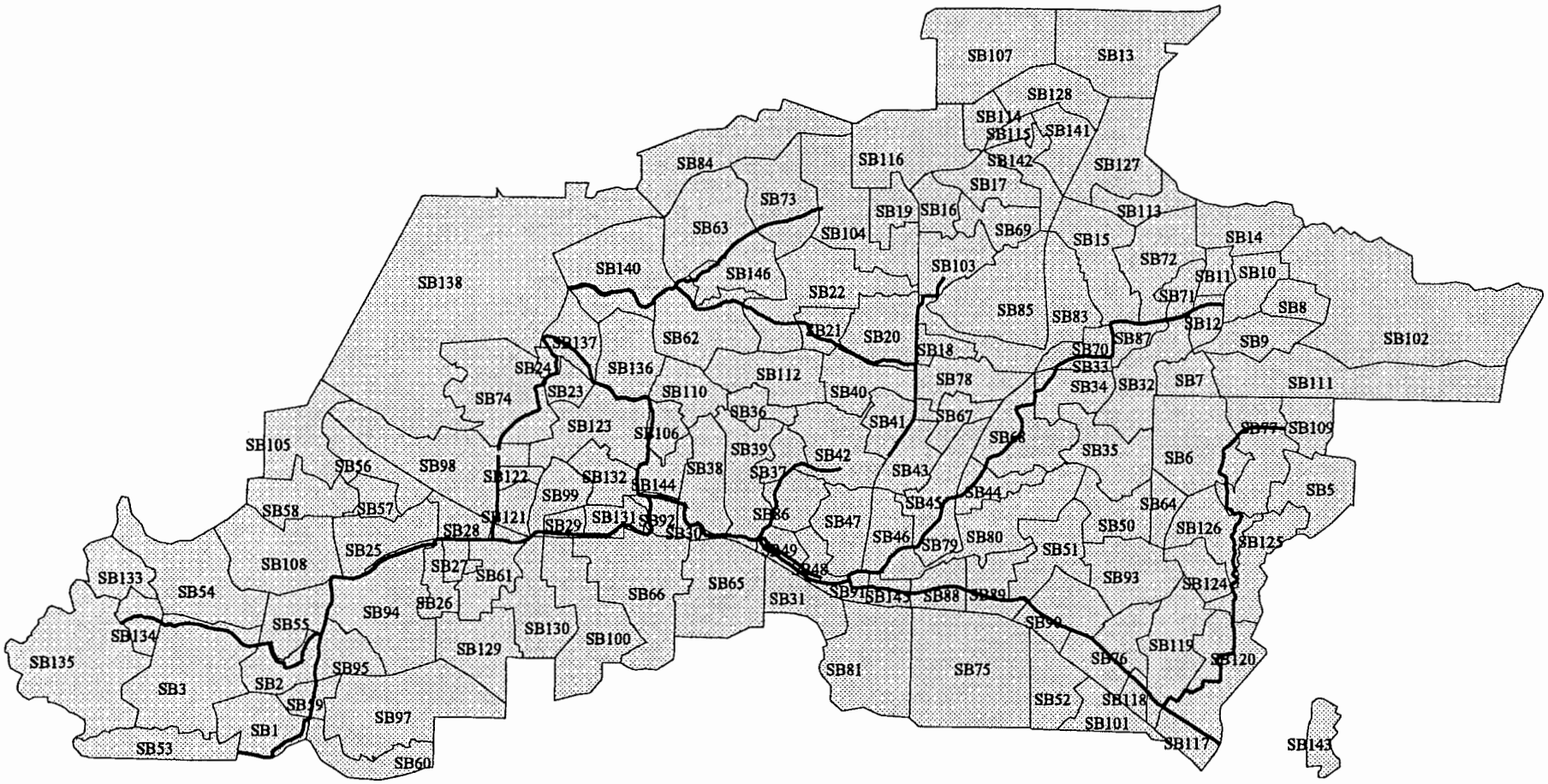
6.3 Existing and Future Land Use

The City's Planning Department maintains an excellent detailed inventory on existing and future development projects that served as the basis for the dry weather flow estimates and projections used in the hydraulic model. The City tracks the information in two spreadsheets: one for residential projects and one for non-residential projects.

The residential project spreadsheet provides the number and type (single-family, apartments, condominiums, group quarters) of dwelling units in each of about 950 projects. These projects range from a single building to a subdivision. The dwelling unit estimates are provided for existing conditions (Year 2000), as well as for years 2005, 2010, and for "buildout holding capacity". The non-residential spreadsheet provides (among other information) developed square footage for about 735 commercial/ industrial/public projects (buildings or groups of buildings), number of rooms for 10 hotels, and number of students for 40 schools. Again, information is provided for existing conditions through buildout.

To prepare these data for use in modeling wastewater flows, City planners assigned each of the over 1700 projects to one of the 134 sewer subarea. The subareas were digitized into a GIS drawing (see Figure 6-1), assigned identifiers, and printed to a scale that facilitated the work of the planners. The planners entered the subareas numbers into a new column in the spreadsheet, and MWH then aggregated the project information by subarea for existing and buildout scenarios.

Figure 6-1
Interceptor Sewer Modeling Subareas



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6.4 Model Calibration and Unit Flows

6.4.1 Major Dischargers

For modeling purposes, sufficient accuracy is typically achieved by applying generalized unit wastewater flow rates to different categories of residential dwelling units, square footage of non-residential development, and number of students and hotel rooms. However, if there are major individual dischargers that contribute much more flow than would be estimated by these general unit flow rates, they are typically singled out and included as point discharges in the model. Following a review of the major dischargers in the City, the firm of Amgen was the only one sufficiently large to warrant being modeled as a point discharge.

The Amgen campus was modeled as a separate subarea. Amgen has its own wastewater flow monitor, which measures an average dry weather flow of 0.66 mgd. Based on its square footage and the final calibrated unit flow rate for industrial land uses, the model computed an average flow of only 0.24 mgd for Amgen. Therefore, a point discharge of 0.42 mgd was added to this subarea. At buildout, the point discharge was increased by 67 percent, which is the projected increase in square footage for Amgen.

6.4.2 Dry Weather Calibration

The dry weather flow calibration involved determining the unit flow rates and 24-hour diurnal flow profiles in the model that would result in the best match of modeled flows to monitored flows for a typical dry period at the 13 temporary monitors. The period of January 31 through February 4 was selected to characterize a dry period within the temporary monitoring period. This period had no rainfall, and was preceded by 4 to 7 days without significant rainfall. Also, there had been less than one inch of rainfall in the preceding 18 days. Any small amount of residual infiltration from previous storms was considered to be dry weather flow for the purposes of determining unit flow rates.

Separate diurnal profiles were developed for residential and non-residential land uses, and for typical weekdays and weekends. Initial profiles were based on typical profiles observed in other cities, and were modified as needed to best match the monitored flows in Thousand Oaks. Figure 6-2 shows the four final calibrated profiles used in the model.

A single set of unit flow rates were determined that resulted in the best overall match to the 13 flow meters, which varied as to the percentage of different land uses. In the case of schools and hotels, unit flow rates were based on typical rates observed elsewhere, since these land uses do not contribute enough flow to any single meter to justify site-specific calibration. For the different categories of residential dwelling units, the relative unit flow rates were based on the City's estimates of the average number of persons per dwelling unit in each category. Trial unit flow rates were input to the model and the modeling results were compared to the monitored flows at each meter. Figure 6-3 shows an example comparison for Meter M1 (Unit A) for two weekdays. Calibration plots for all of the meters are in Appendix I.

Figure 6-2a. Calibrated Wastewater Flow Diurnal Profiles - Weekday

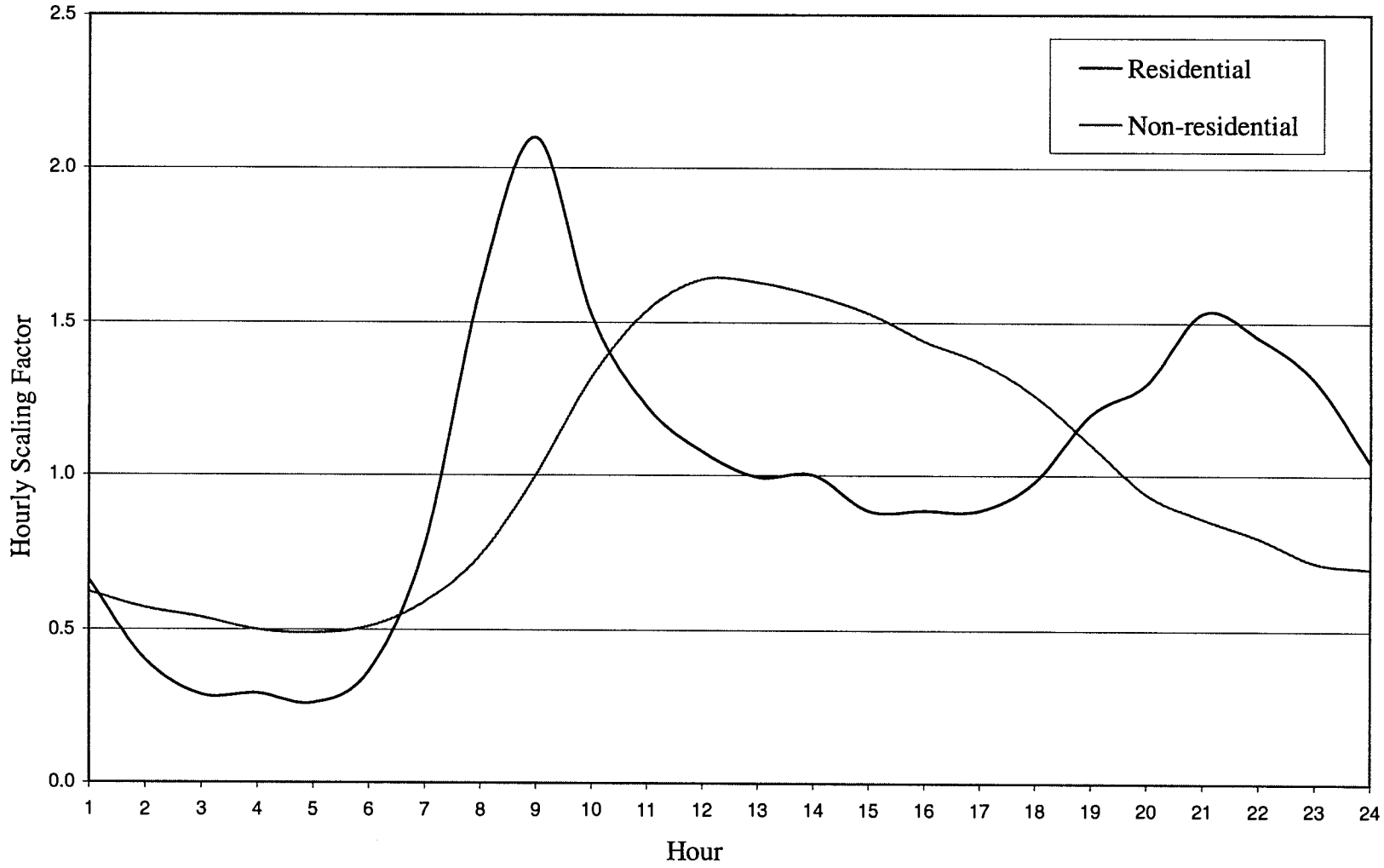


Figure 6-2b. Calibrated Wastewater Flow Diurnal Profiles - Weekend

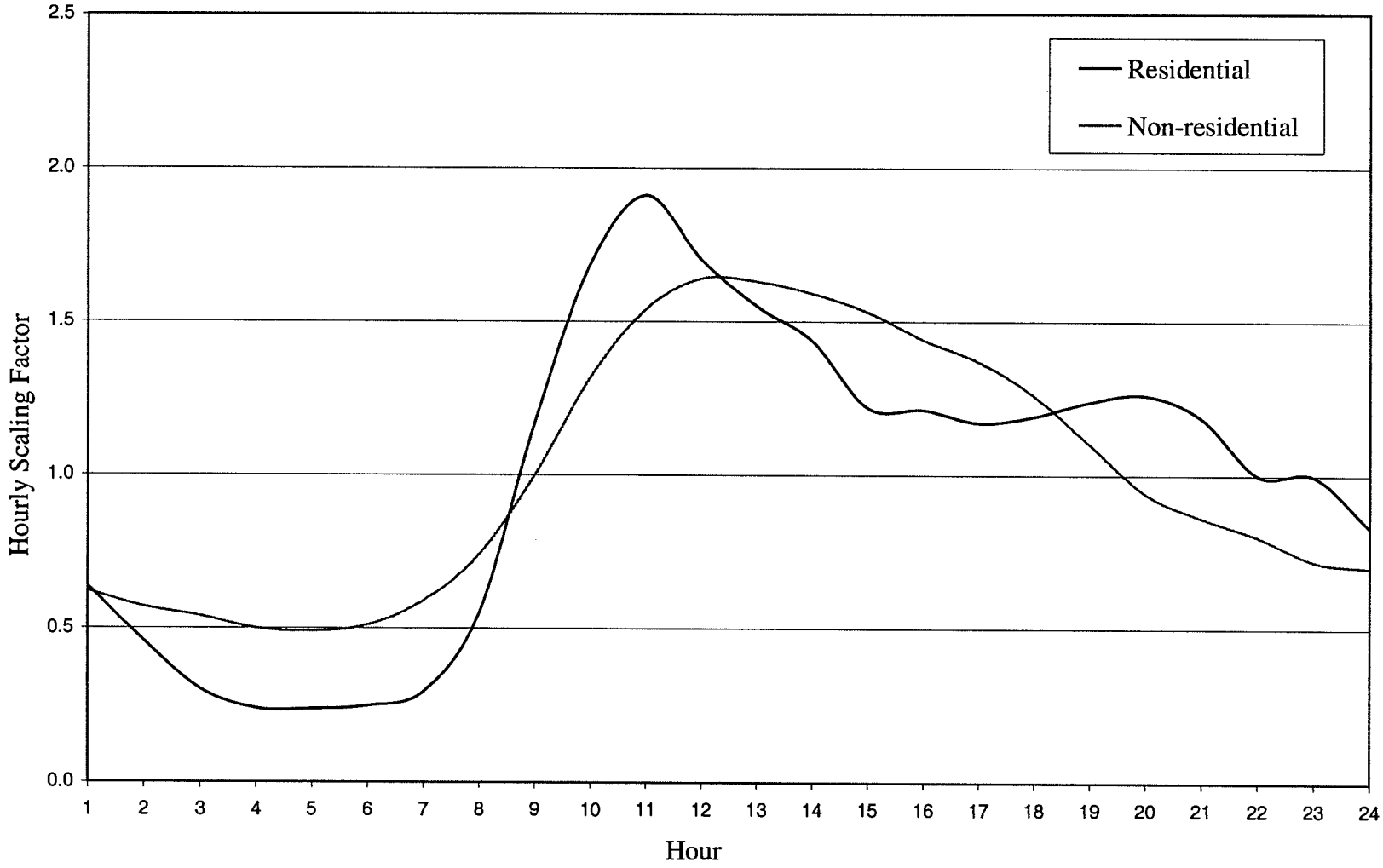
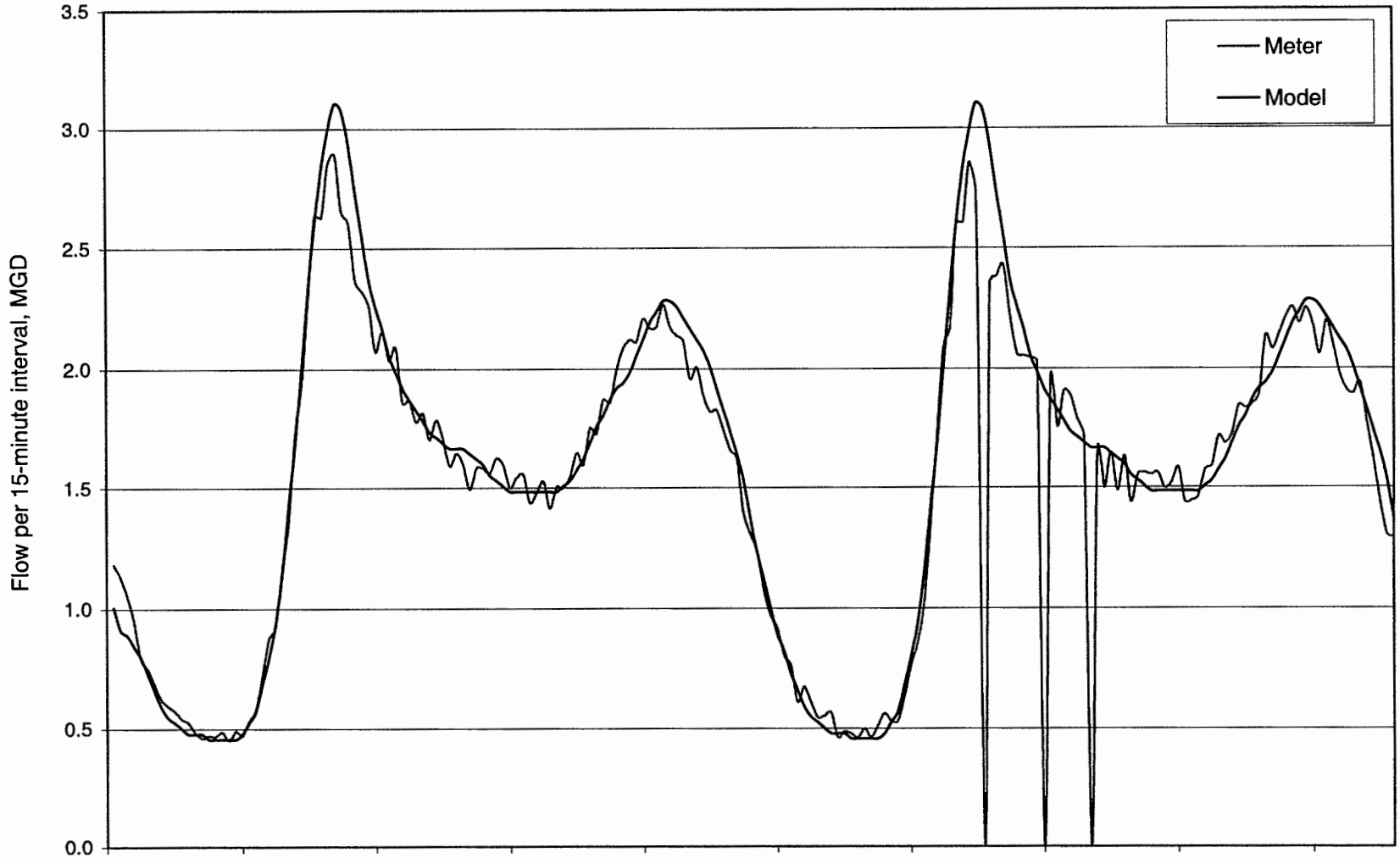


Figure 6-3. Example Dry Weather Flow Calibration - Meter M1, Weekday



The dry weather calibration yielded excellent results with the exception of Meter M14 (upper end of Unit V). The monitored flow at that location was higher than the modeled flow by 0.15 mgd, or about 15 percent. This is not a large error, but all the other meters calibrated much more closely. No errors in the model subareas or land use information in that area could be found, nor could a specific likely source of the extra flow be identified. Flow meter error is a possible, but not probable, explanation. To be conservative, an additional flow of 0.15 mgd with a non-residential profile was added to the model to represent the extra flow. Since applying a non-residential profile resulted in the best match, it is likely that the unidentified extra flow is from a non-residential source.

The following are the final calibrated dry weather unit flow rates:

Single family dwelling unit: 269 gallons per day (gpd) per unit
Multiple family dwelling unit: 186 gpd/unit
Group quarter dwelling unit: 128 gpd/unit
Commercial and industrial: 0.1 gpd per developed square foot
Schools: 12 gpd/student
Hotels: 40 gpd/room

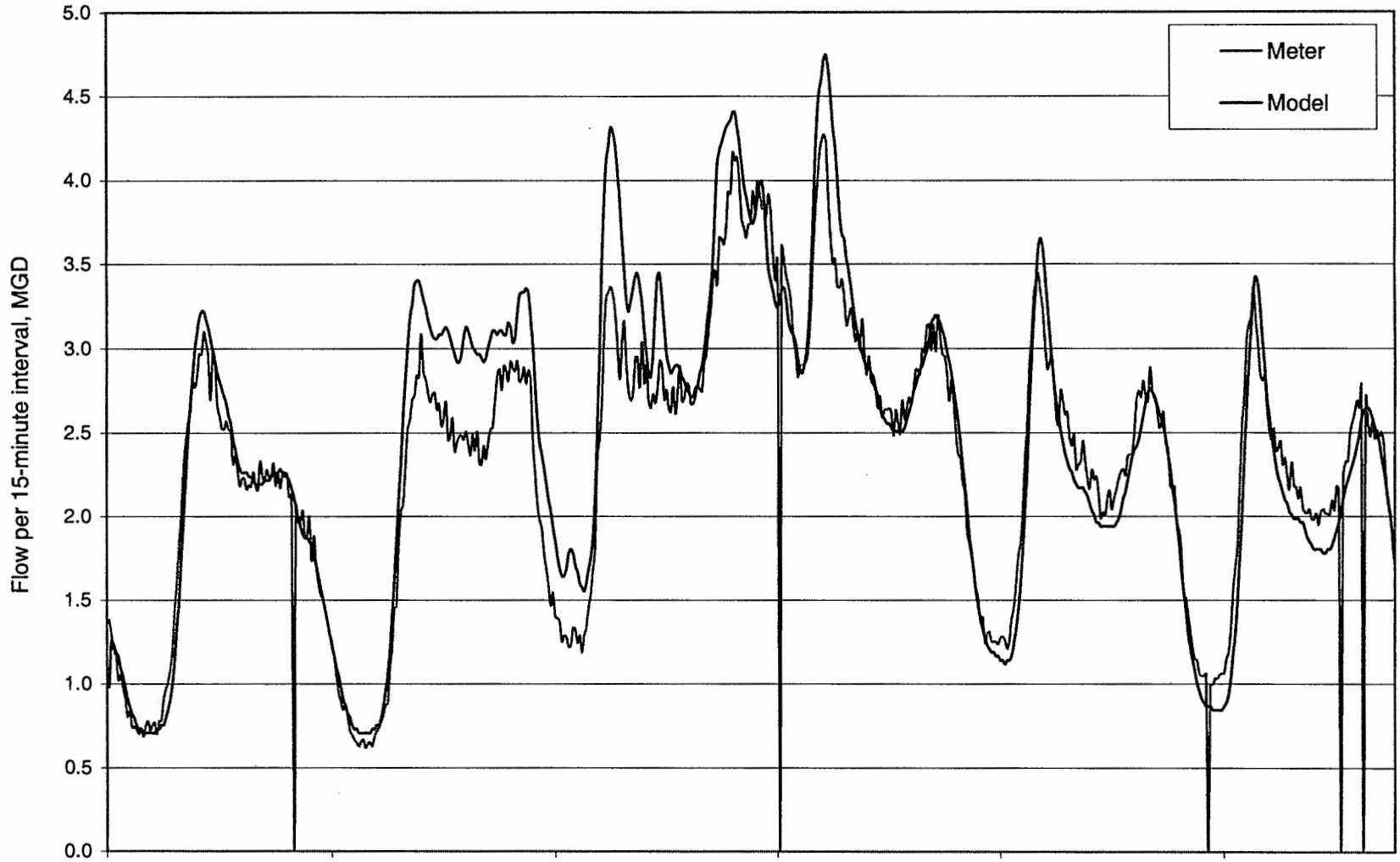
The residential unit flow rates equate to 85 gpd/capita based on the City's estimates of the number of persons per dwelling unit. The commercial/industrial unit flow rate translates to about 1200 gpd/net acre, based on average floor area ratios in the City. These values are well within the expected range for similar cities.

6.4.3 Wet Weather Calibration

Following completion of the dry weather calibration, the model was calibrated for wet weather conditions, using the monitored rainfall and flows from Event 5 (March 4-6, 2001). As discussed in Chapter 5, this event produced the highest wet weather response in several years, and is an excellent event for characterizing relative RDI/I in different parts of the collection system.

The hydraulic model used in this study (HydroWorks) includes hydrologic algorithms that translate 15-minute rainfall data into I/I hydrographs for each of the 134 sewer subareas. Rainfall that fell on each subarea in each time period was accurately determined from the radar rainfall data by grid cell (see Figure 5-1). Wet weather calibration parameters determine the percentage of rainfall that enters the sewers as I/I and the speed at which the I/I rises and falls. The model is calibrated by determining the most appropriate parameters separately for each meter, and the same parameters are assumed to apply uniformly to all subareas upstream of that meter.
Figure 6-4 shows an example wet weather calibration for Meter 1, covering Event 5 and the days immediate before and after. Calibration plots for all of the meters are in Appendix I. As would be expected, wet weather calibration is a less exact process than dry weather calibration, but the results in this study are deemed excellent.

Figure 6-4. Example Wet Weather Flow Calibration - Meter M1, Event 5



6.5 Design Criteria

The following design criteria were applied in this capacity analysis:

- The same calibrated dry weather unit flow rates were applied to generate flows throughout the interceptor system under both existing and buildout conditions. This assumes that there will be no significant reductions (e.g., from water conservation), or increases (e.g., from more intense water-using industry) in the rates in the future.

- The same calibrated wet weather flow parameters were applied to generate flows throughout the interceptor system under both existing and buildout conditions. This assumes that there will be no significant reductions (e.g., from rehabilitation or replacement of older sewers), or increases (e.g., from sewer deterioration) in I/I in the future. In addition, future new sewers are assumed to add no significant I/I to the system.

- In the buildout scenario only, wastewater currently treated at the Olsen Road Water Reclamation Facility is assumed to be delivered to the Unit X interceptor via a new pump station.

- The storm of March 4-6, 2001 (with a time shift) was used as the design storm for determining peak wet weather flows. The severity of this storm in terms of antecedent conditions and I/I response was documented in Chapter 5. Figures 6-5 and 6-6 show how the storm generated similar rainfall intensities throughout the entire service area over both short and long durations (i.e, it was not heavily concentrated in certain parts of the city, which would make it less critical in some areas than others).

- A time shift was applied to the design storm, so that the peak I/I response in the model runs would coincide with normal afternoon flows rather than very low flows in the middle of the night (which is what actually occurred in the real event). This time shift adds an element of conservatism to the wet weather analysis. Figure 6-7 illustrates the effect of this time shift at Meter M14. The bold line is the modeled flow with the time shift, and the light line is the monitored flow, obviously without a time shift. In this case, the time shift increased the peak flow from about 2.0 mgd to about 2.5 mgd. The percentage increase in peak wet weather flow due to the time shift varies by location depending on the shape of the dry weather profile and the I/I hydrograph, but is generally somewhat less than in this example for Meter M14.

- Where peak design flows exceeded the City's design criteria of two-third full by depth (which corresponds to 78 percent of full-pipe flow capacity), with a Manning's friction factor of 0.013, a capacity project was defined. Replacement sewers were conservatively sized to flow at no greater than 60 percent of capacity at peak wet weather design flow. This provides a margin of safety to cover the possibility of hydraulic inefficiencies or higher-than-expected future flows, including higher I/I due to pipe deterioration.

Figure 6-5
Peak 3-Hour Rainfall Intensities (in/hr) For Event 5

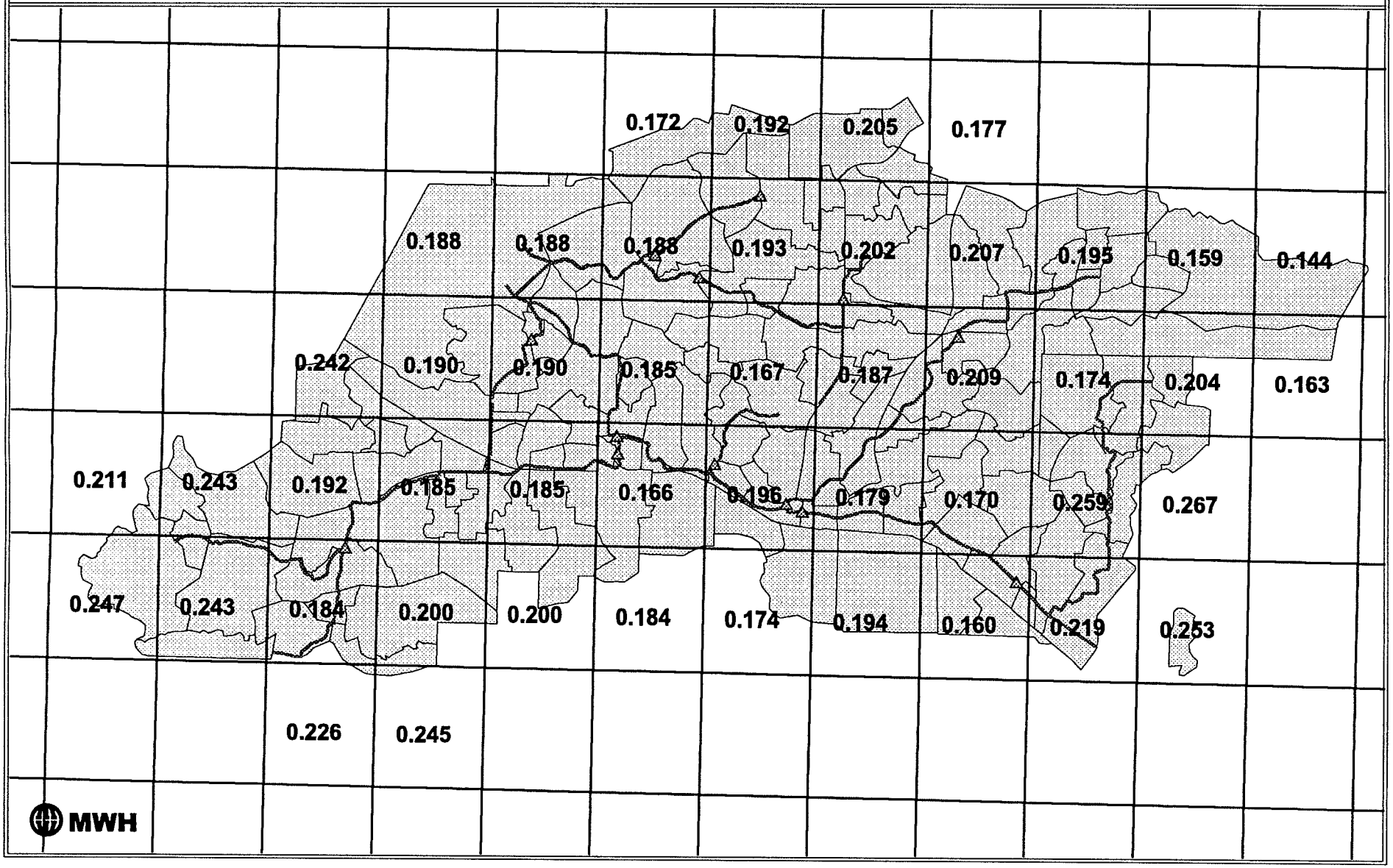


Figure 6-6
Peak 12-Hour Rainfall Intensities (in/hr) For Event 5

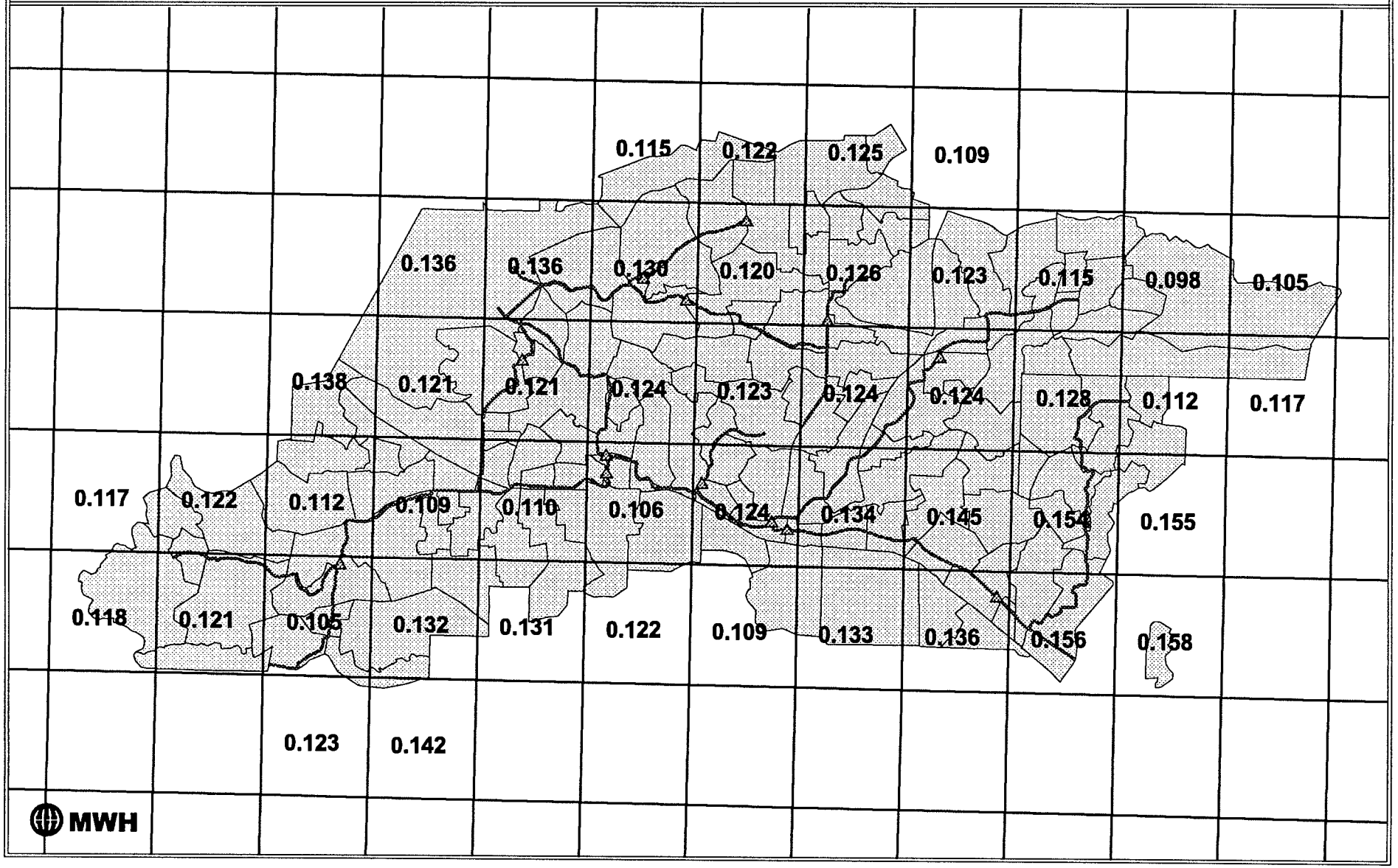
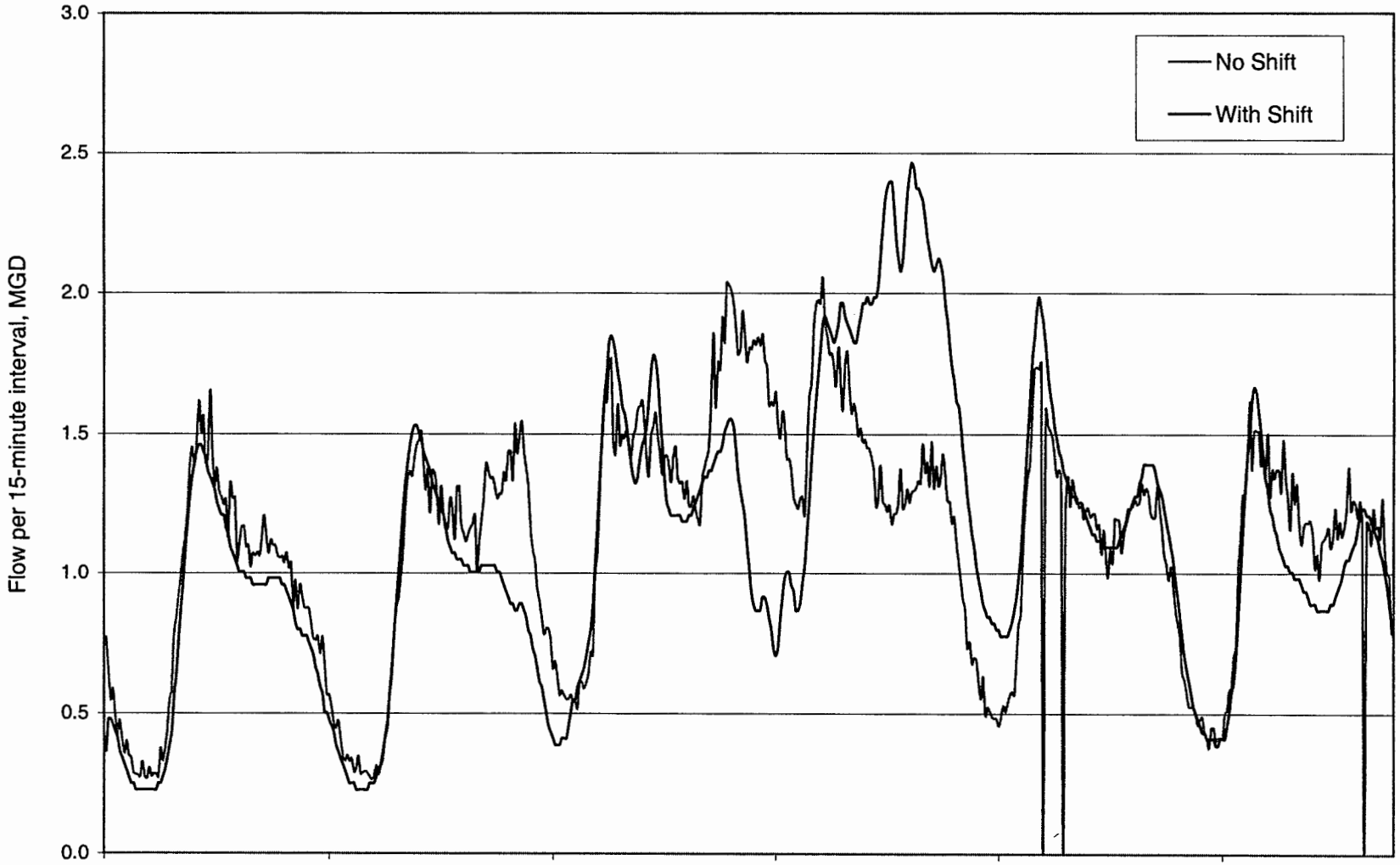


Figure 6-7. Example of Effect of Design Storm Time Shift - Meter M14



6.6 Modeling Results and Conclusions

6.6.1 Existing and Projected Peak Flows

The calibrated model was run for design dry and wet weather flows, under both existing and buildout land use scenarios. Table 6-1 presents average and peak flows for each scenario at the downstream end of each interceptor unit. As indicated, peak wet weather flows of up to 33.7 mgd would occur at the Hill Canyon Wastewater Treatment Plant under future design conditions. Modeling results indicate that the existing interceptors could convey up to 40 mgd to the Plant before overflowing, should design conditions be exceeded. This peak flow will increase as interceptor improvements are made.

Table 6-1
Estimated and Projected Flows (mgd) by Interceptor Unit

Unit	2000 ADWF	2000 PDWF	2000 PWWF	Buildout ADWF	Buildout PDWF	Buildout PWWF
A	1.59	3.06	4.66	1.59	3.06	4.66
B	0.69	1.39	1.85	0.69	1.42	1.85
C	0.15	0.30	0.66	0.15	0.30	0.69
E	3.71	5.89	13.10	4.76	7.39	14.17
F	0.21	0.30	.37	0.49	0.73	0.80
G	1.69	3.20	3.47	1.82	3.45	3.70
U	0.31	0.59	0.80	0.32	0.59	0.80
V	1.72	3.08	4.52	2.02	3.63	4.86
W	8.41	14.33	24.12	9.84	16.48	25.58
X	1.08	2.19	2.83	1.49	3.04	3.38
Y	2.70	5.25	7.28	3.09	6.07	7.49
Plant	11.33	19.84	31.70	13.47	23.16	33.68

6.6.2 Interceptor Capacity

The key modeling results, such as peak flow and depth of flow in each modeled pipe segment, are output to a database linked to the interceptor GIS. This allows the results to be displayed graphically. The key capacity indicator used to identify potential deficiencies was the ratio of peak flow to full-pipe capacity, or capacity utilization. Figures 6-8 to 6-11 show the capacity utilization in each pipe segment for the four analysis scenarios. Table 6-2 summarizes the length of pipe segments in each interceptor that exceeds a capacity utilization of 75 percent for each of the analysis scenarios. These are the pipe segments that appear as yellow or red in Figures 6-8 to 6-11. These modeling results are consistent with observations by City staff.

As can be seen from the capacity utilization figures, existing peak dry weather flows remain within pipe capacities except for a short reach at the downstream end of Unit G, and exceed 75 percent of capacity in Unit B. At buildout, capacity utilization is projected

Figure 6-8
Modeled Capacity Utilization
Existing Dry Weather Flow

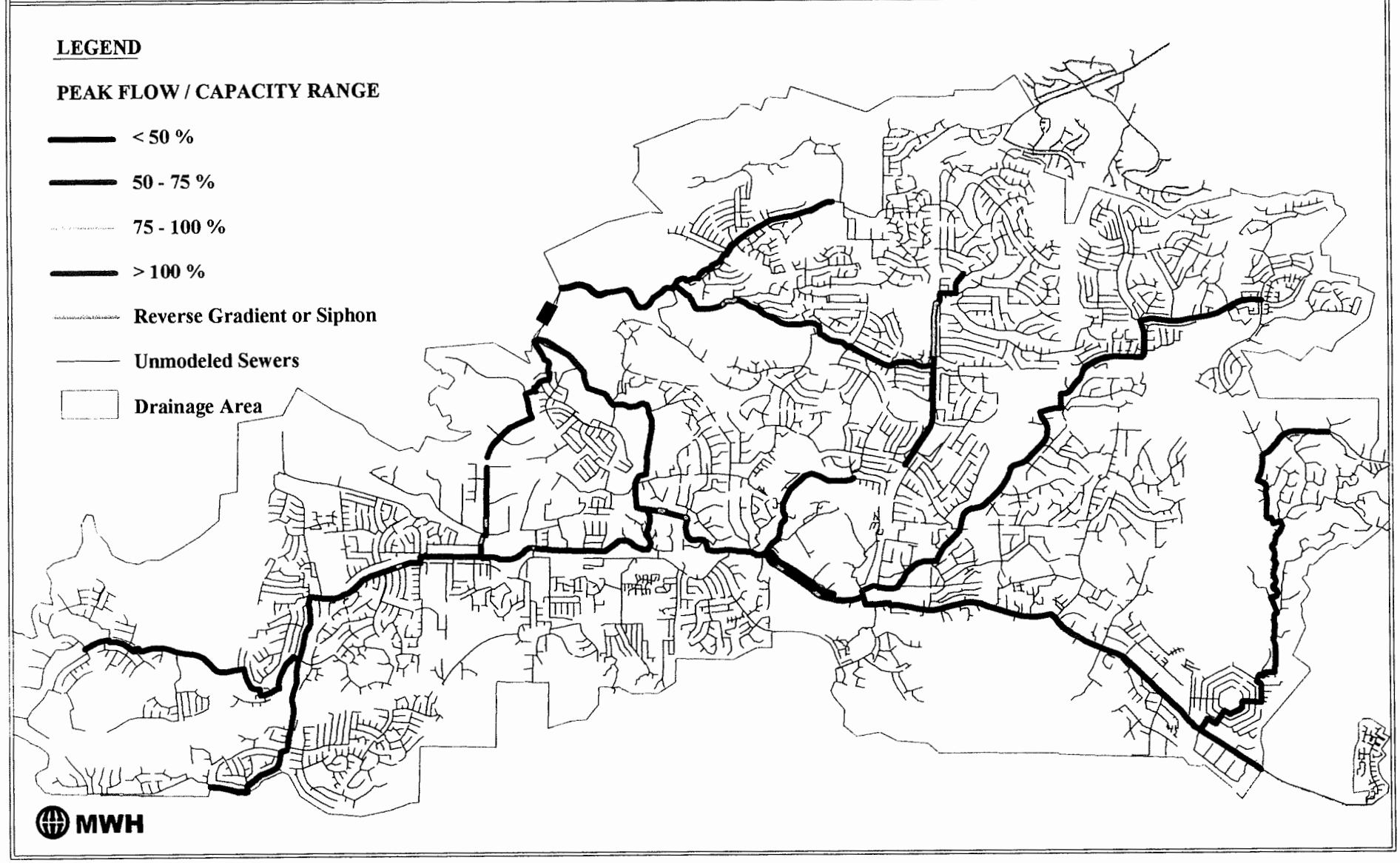


Figure 6-9
Modeled Capacity Utilization
Buildout Dry Weather Flow

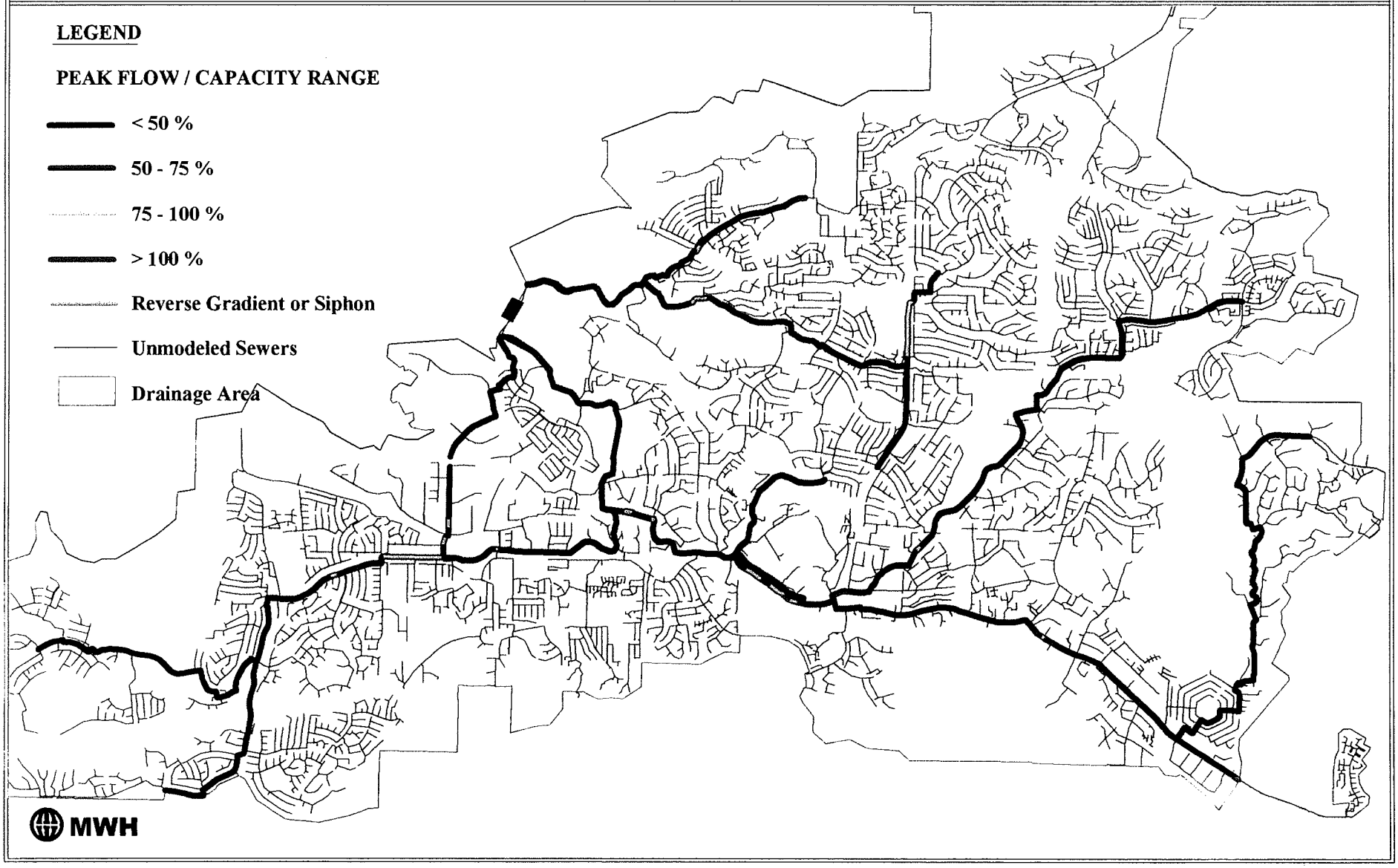


Figure 6-10
Modeled Capacity Utilization
Existing Wet Weather Flow

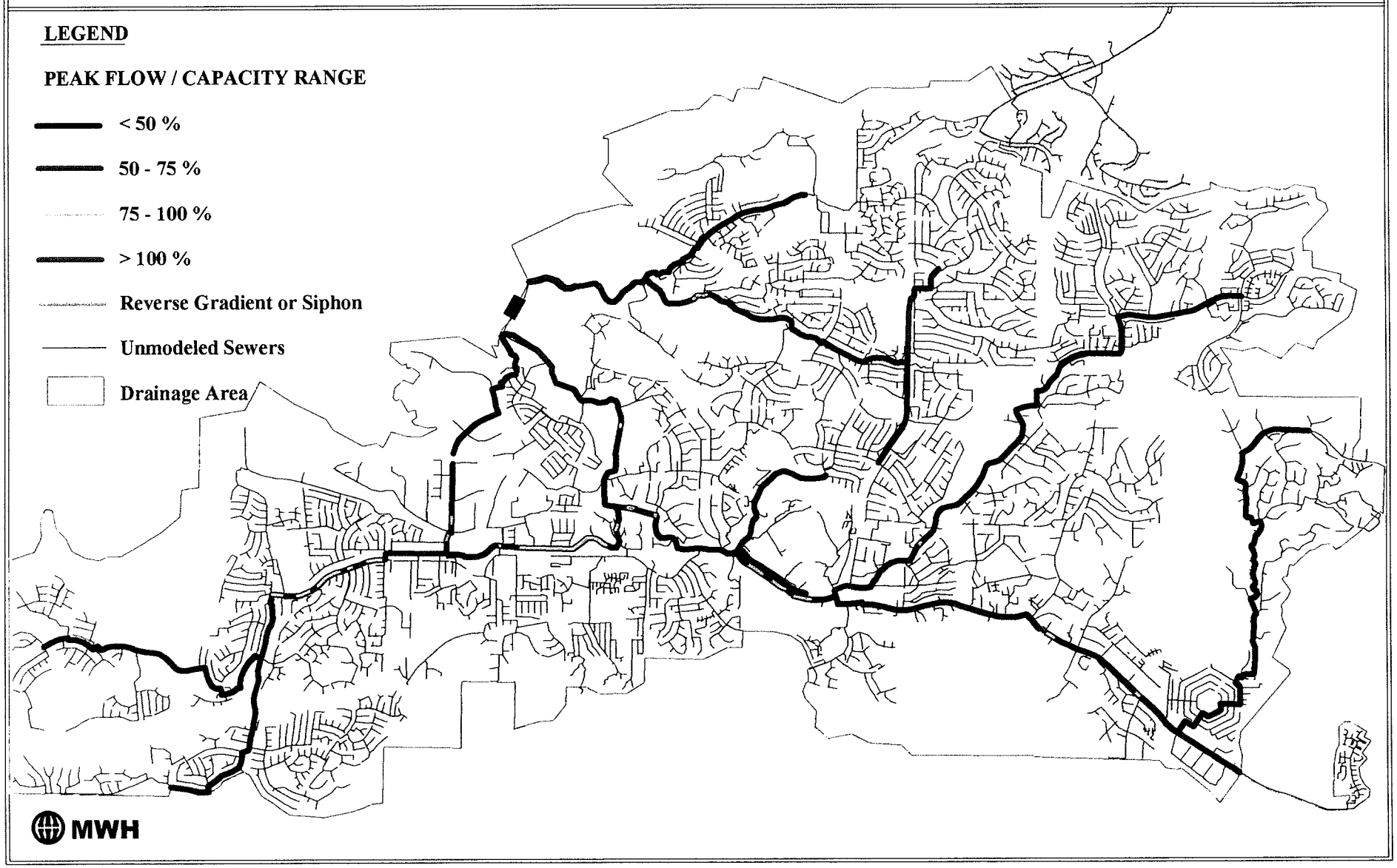


Figure 6-11
Modeled Capacity Utilization
Buildout Wet Weather Flow

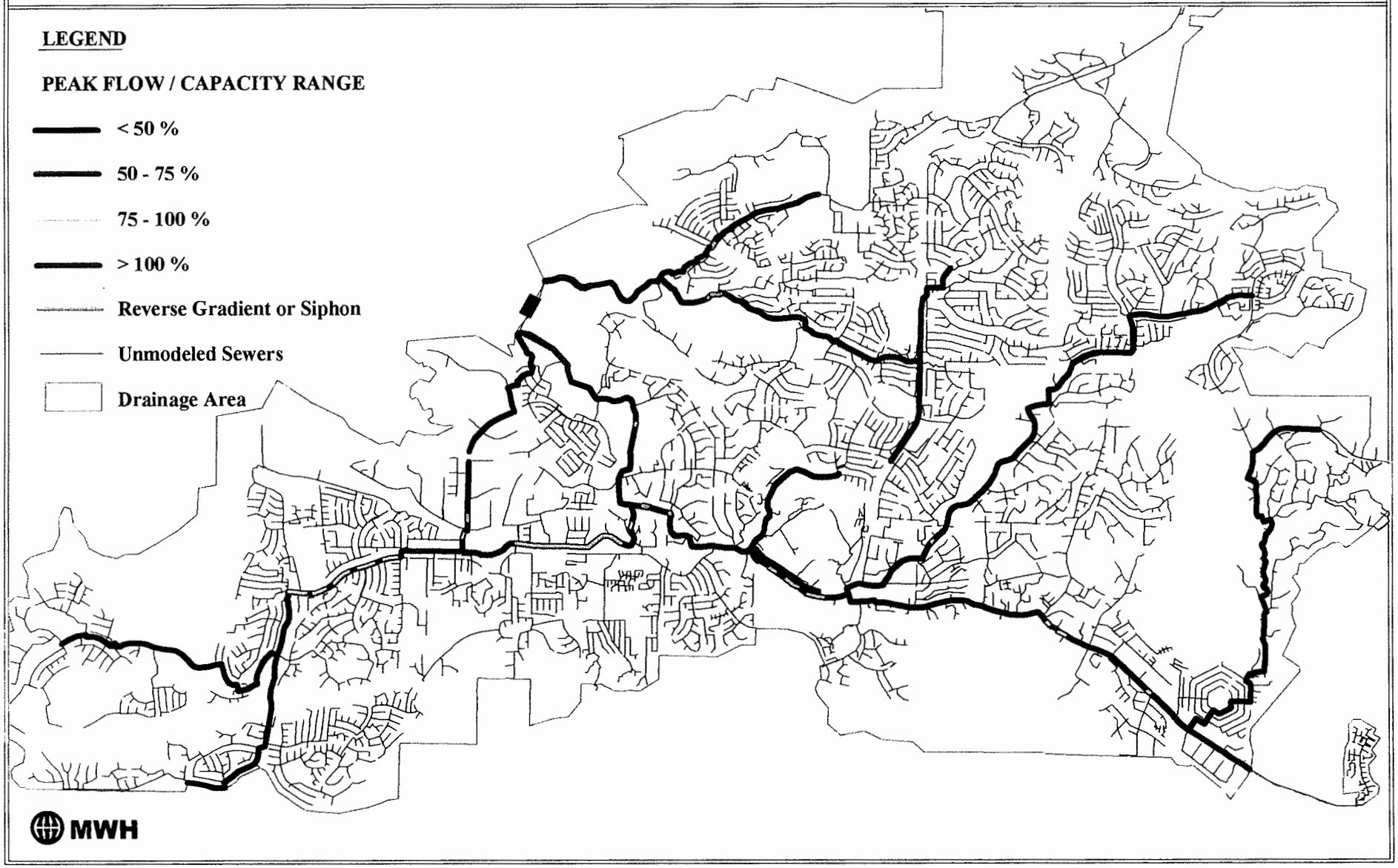


Table 6-2
Summary of Interceptor Hydraulic Capacity Analysis

Unit	Modeled Length (Miles)	Length of Pipe with q/CAP >= 75%			
		Existing Population		Buildout Population	
		Peak DWF (Miles)	Peak WWF (Miles)	Peak DWF (Miles)	Peak WWF (Miles)
A	2.54	0.00	0.00	0.00	0.00
B	0.92	0.45	0.45	0.45	0.45
C	0.86	0.00	0.00	0.00	0.00
E	7.83	0.05	2.22	0.57	2.40
F	1.39	0.00	0.00	0.00	0.00
G	4.57	0.13	0.23	0.23	0.23
U	1.20	0.00	0.00	0.00	0.00
V	7.35	0.00	0.18	0.04	0.18
W	4.72	0.14	0.69	0.50	0.71
X	1.58	0.00	0.00	0.06	0.16
Y	1.48	0.00	0.36	0.36	0.36
Total	34.43	0.77	4.13	2.22	4.50
% of Modeled Length	100.0%	2.2%	12.0%	6.5%	13.1%

to exceed 75 percent in a portion of Unit E and the upper end of Unit W as well. For existing peak wet weather, capacity would be exceeded in Unit B, the upper end of Unit W, a short section of Unit V, and portions of Unit E. At buildout, additional portions of Unit E are projected to approach or exceed capacity. Although there are clearly some reaches that require additional capacity, the overall capacity of the interceptor system is very good.

When capacity utilization exceeds 100 percent for several consecutive pipe segments, the pipe will generally flow full and the water level will rise above the crown of the pipe (i.e., surcharge). The model indicates that surcharging occurs in several locations in the interceptor system and will worsen over time. However, the level of surcharging never reaches the ground surface (i.e., overflow) in any of the model scenarios, indicating that the overflows are not expected to occur. Nevertheless, the model identified the need for several capital improvements to ensure that the interceptor system operates within the design criteria and that the risk of overflows is minimized. These improvements and their priorities are detailed in Chapter 7.

6.6.3 Unit Y Siphon Capacity

A special hydraulic modeling analysis was performed for the Unit Y siphon in the vicinity of the Hill Canyon Wastewater Treatment Plant. Figure 6-12 illustrates the interceptor configuration in that area. The 18-inch diameter double-barrel siphon extends

from the upstream gate structure (YS) to the north headworks (YD). A single 20-inch diameter pipe through the Plant allows the flexibility to divert the flow to the Plant's south headworks. The gates allow one of the two barrels to be closed off to increase flow velocities. The Unit Y siphon is completely sealed and pressurized from the gate structure to either of the headworks.

The controlling elevation at the north headworks is 305.0 feet, while the controlling elevation at the south headworks is 314.5 feet. The ground elevation at the gate structure is 323.8 feet. When Unit Y flow is diverted to the south headworks, the available head difference is therefore reduced from 18.8 feet (323.8 – 305.0) to 8.3 feet (323.8 – 314.5), and additional headloss is introduced in the 20-inch pipe through the plant to move the flow to the south headworks. The current mode of operation is to discharge Unit Y flow to the north headworks during the winter, and to the south headworks during the rest of the year. Both barrels are used.

The purpose of this hydraulic analysis was to determine the acceptable operating modes under existing and future flow conditions, using the HydroWorks dynamic computer model. Table 6-3 shows the scenarios that were analyzed. Each scenario is a combination of flow condition (existing or buildout peak dry weather flow; existing or buildout peak wet weather flow), headworks used (north or south), and number of barrels

Table 6-3
Unit Y Siphon Analysis Results

	North Headworks		South Headworks	
Flow Condition*	**2 Barrels**	**1 Barrel**	**2 Barrels**	**1 Barrel**
Existing PDWF	(NA)**	Figure 6-14 Surcharged at YS	Figure 6-17 Surcharged at YS	Figure 6-19 Seal YS and Y14
Buildout PDWF	(NA)	Figure 6-15 Seal YS	Figure 6-18 Seal YS	Figure 6-20 Seal YS and Y14 Y13 surcharged
Existing PWWF	(NA)	(NA)	(NA)	(NA)
Buildout PWWF	Figure 6-13 No surcharge	Figure 6-16 Seal YS and Y14	(NA)	(NA)

* PDWF: Peak Dry Weather Flow; PWWF: Peak Wet Weather Flow
** (NA): Not Analyzed

(one or two). Most of the increase in future flow will come from the new Olsen Road Pump Station when it begins to discharge to Unit X. Several possible combinations were not analyzed because the results of other scenarios demonstrated that they were obviously feasible or infeasible. Those combinations are labeled (NA) for "not analyzed". For the analyzed combinations, the table gives the figure number that shows the modeled hydraulic profile and notes any surcharging or required manhole sealing for that flow condition to work.

The manholes on the gravity portion of Unit Y upstream of the siphon were sealed in the model to pass the flow downstream without overflows. If the water level on the hydraulic profile is shown to be above the ground surface at any of the gravity manholes,

Figure 6-13. Hydraulic Profile of Unit Y Siphon - Two Barrel Operation, Buildout PWWF (Flows to North Headworks)

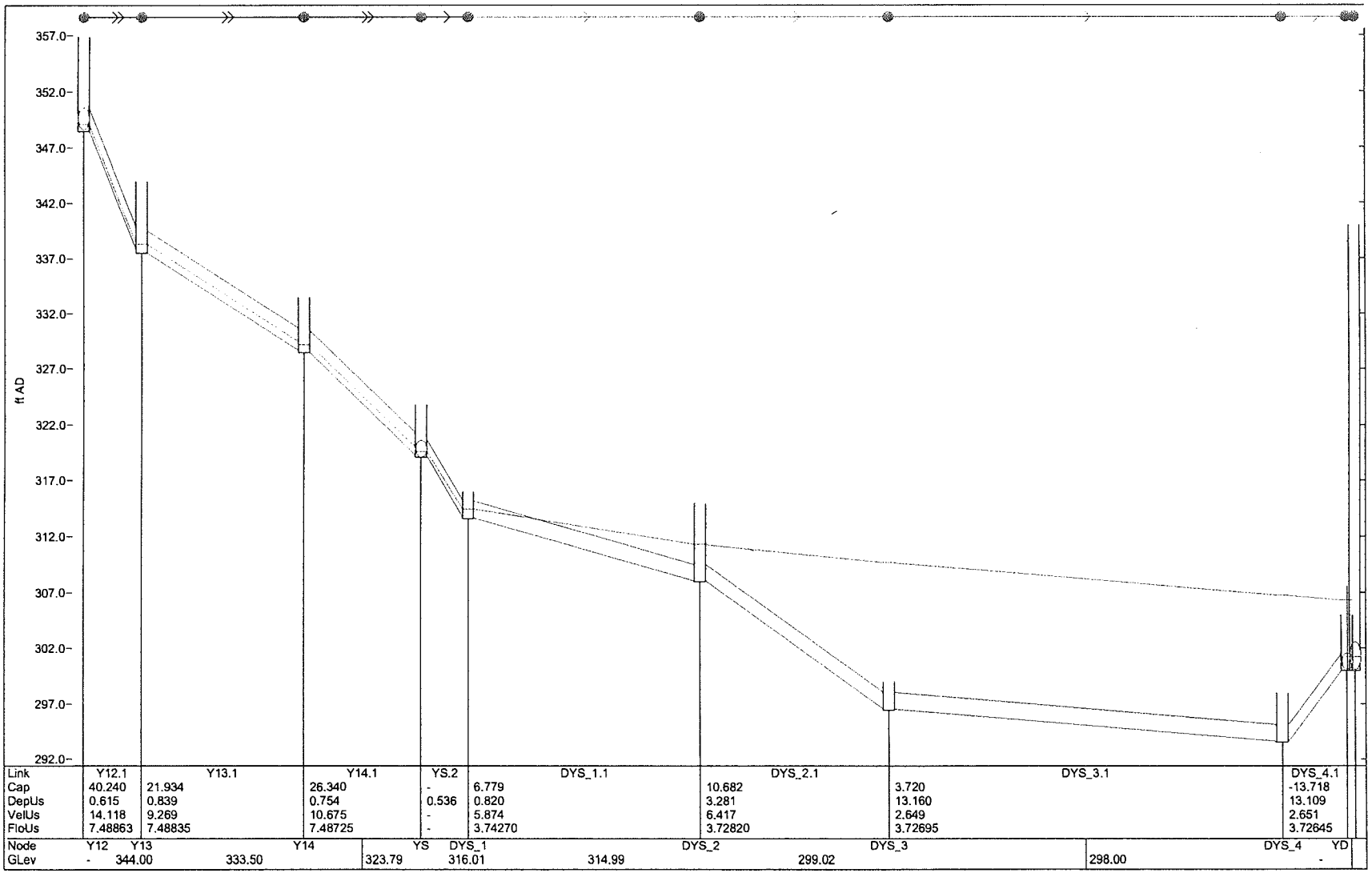


Figure 6-14. Hydraulic Profile of Unit Y Siphon - One Barrel Operation, Existing PDWF (Flows to North Headworks)

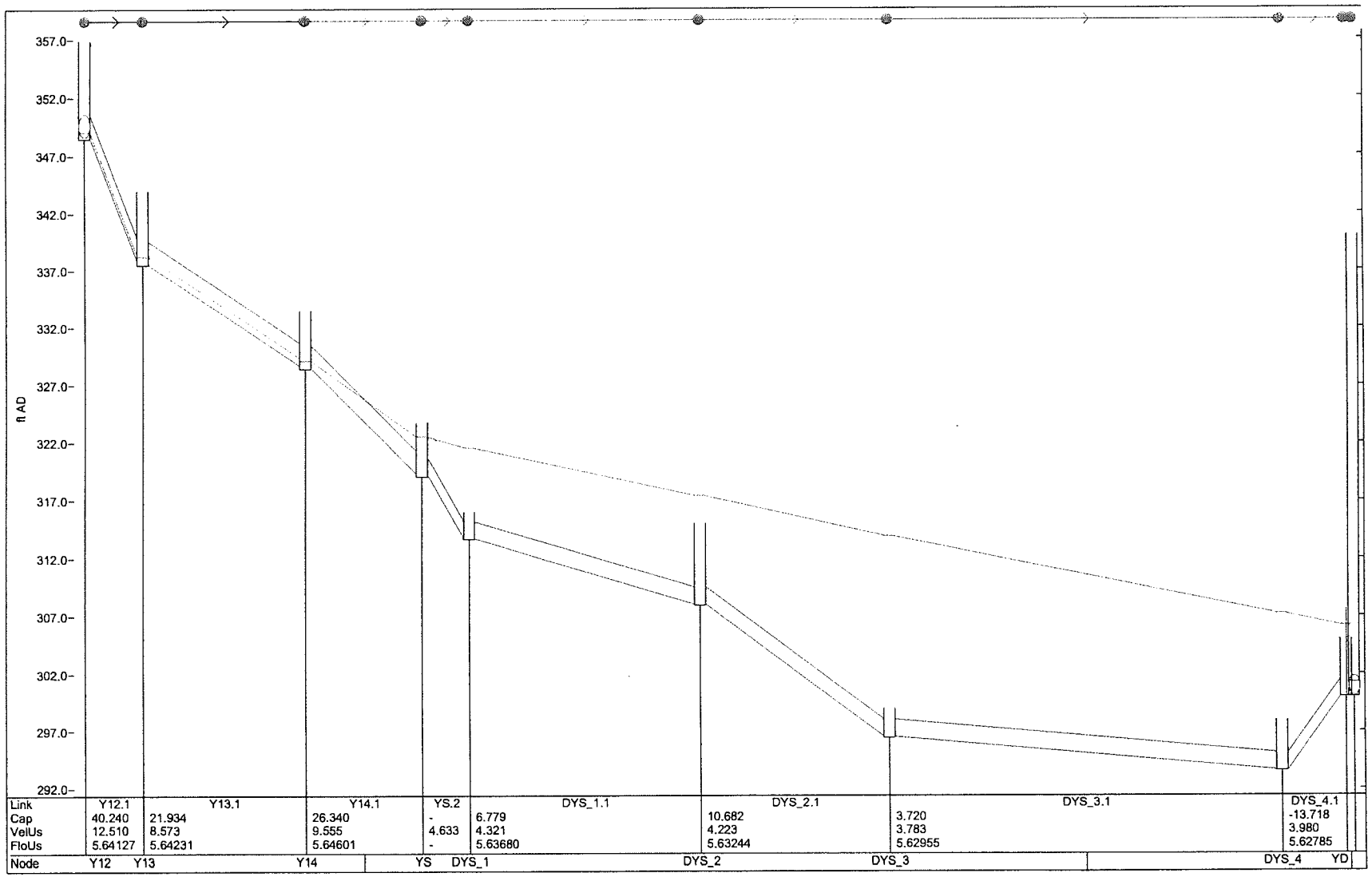


Figure 6-15. Hydraulic Profile of Unit Y Siphon - One Barrel Operation, Buildout PDWF (Flows to North Headworks)

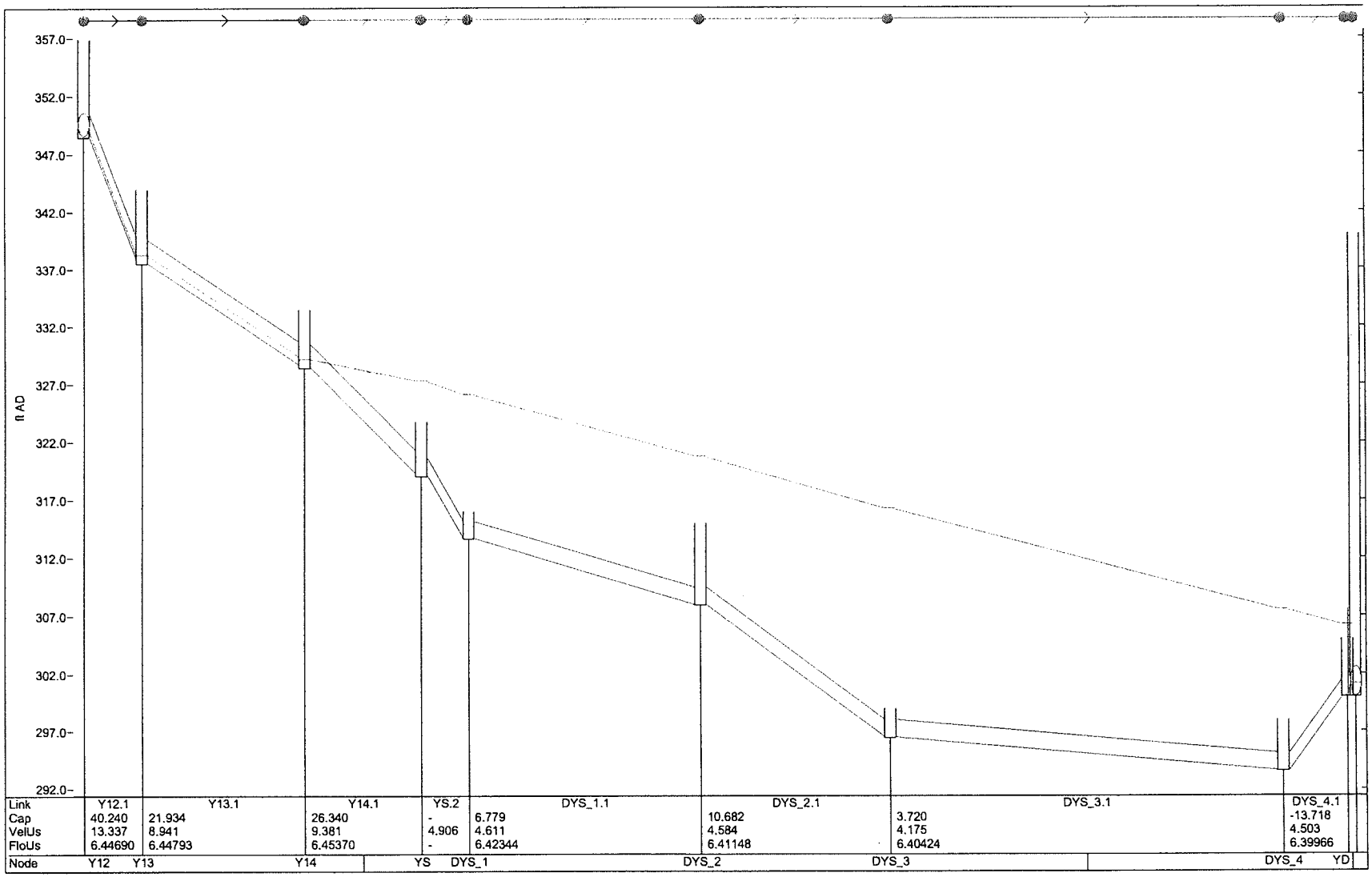
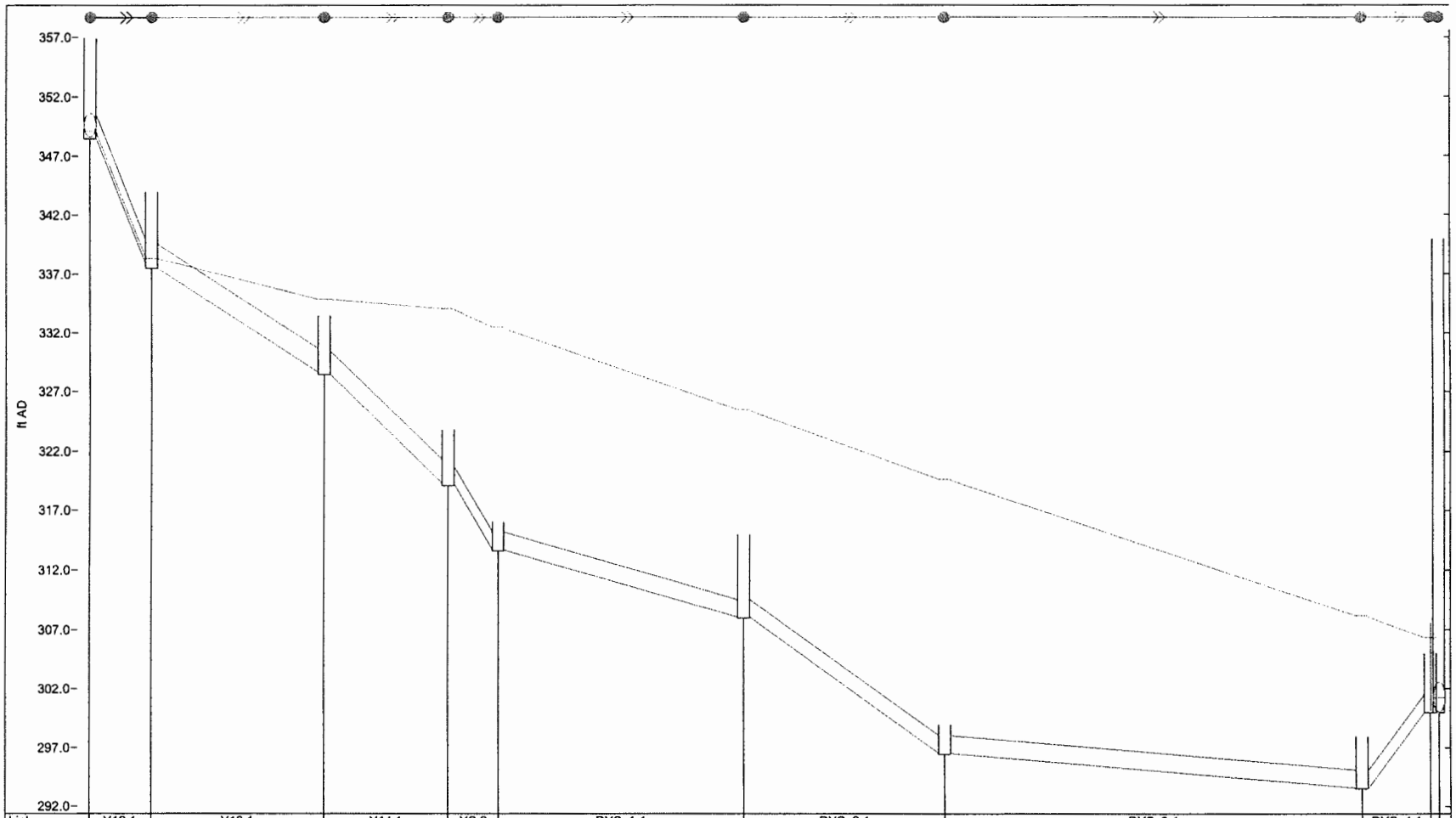


Figure 6-16. Hydraulic Profile of Unit Y Siphon - One Barrel Operation, Buildout PWWF (Flows to North Headworks)



Link	Y12.1	Y13.1	Y14.1	YS.2	DYS_1.1	DYS_2.1	DYS_3.1	DYS_4.1
Cap	40.240	21.934	26.340	-	6.779	10.682	3.720	-13.718
DepUs	0.615	0.839	6.438	-	18.775	17.428	23.032	14.412
VelUs	14.119	9.265	10.835	-	6.100	6.551	4.601	5.138
FloUs	7.48897	7.48866	7.37765	-	7.36300	7.35420	7.35368	7.35355

Node	Y12	Y13	Y14	YS	DYS_1	DYS_2	DYS_3	DYS_4	YD
GLev	-	344.00	333.50	323.79	316.01	314.99	299.02	298.00	-

Figure 6-17. Hydraulic Profile of Unit Y Siphon - Two Barrel Operation, Existing PDWF (Flows to South Headworks)

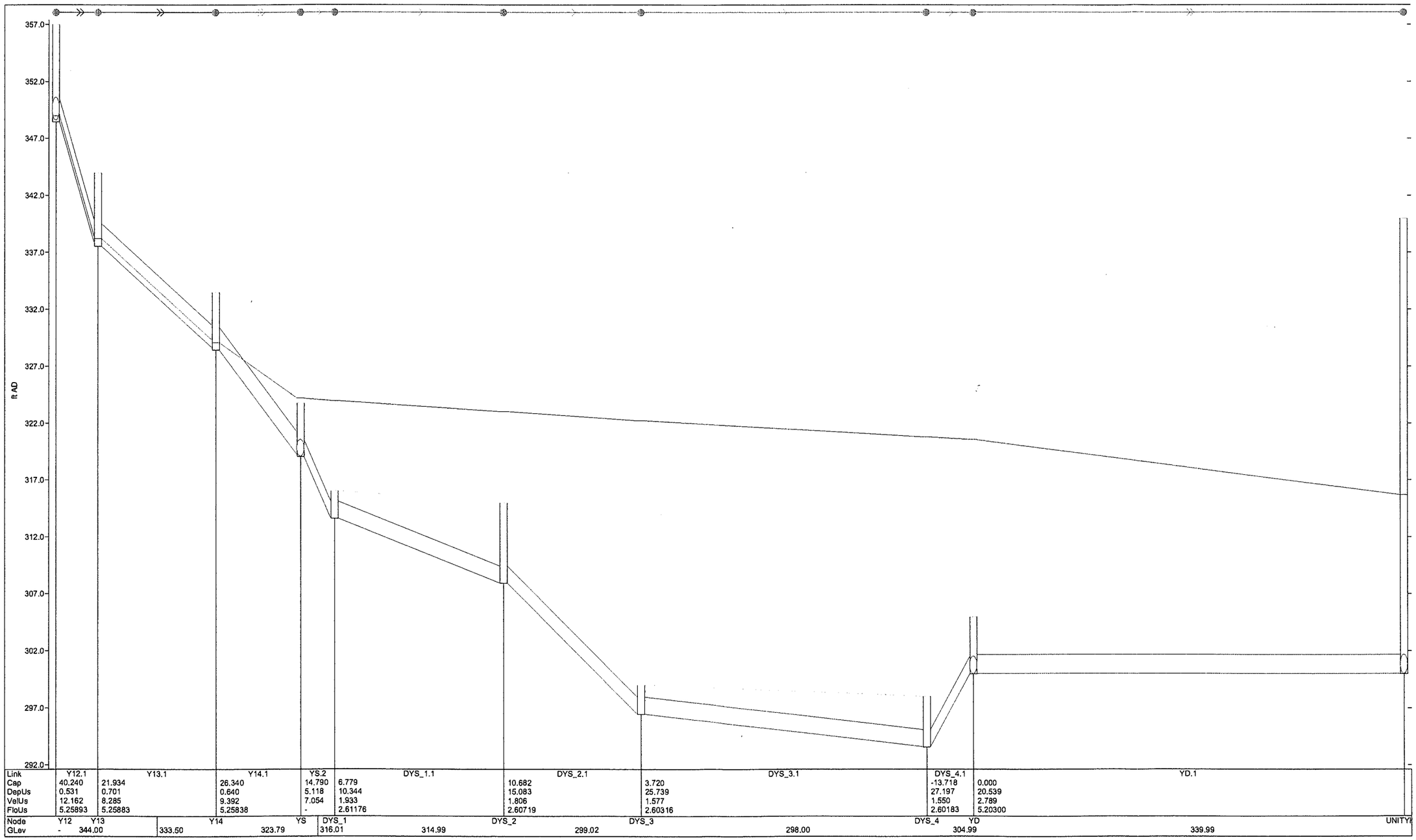


Figure 6-18. Hydraulic Profile of Unit Y Siphon - Two Barrel Operation, Buildout PDWF (Flows to South Headworks)

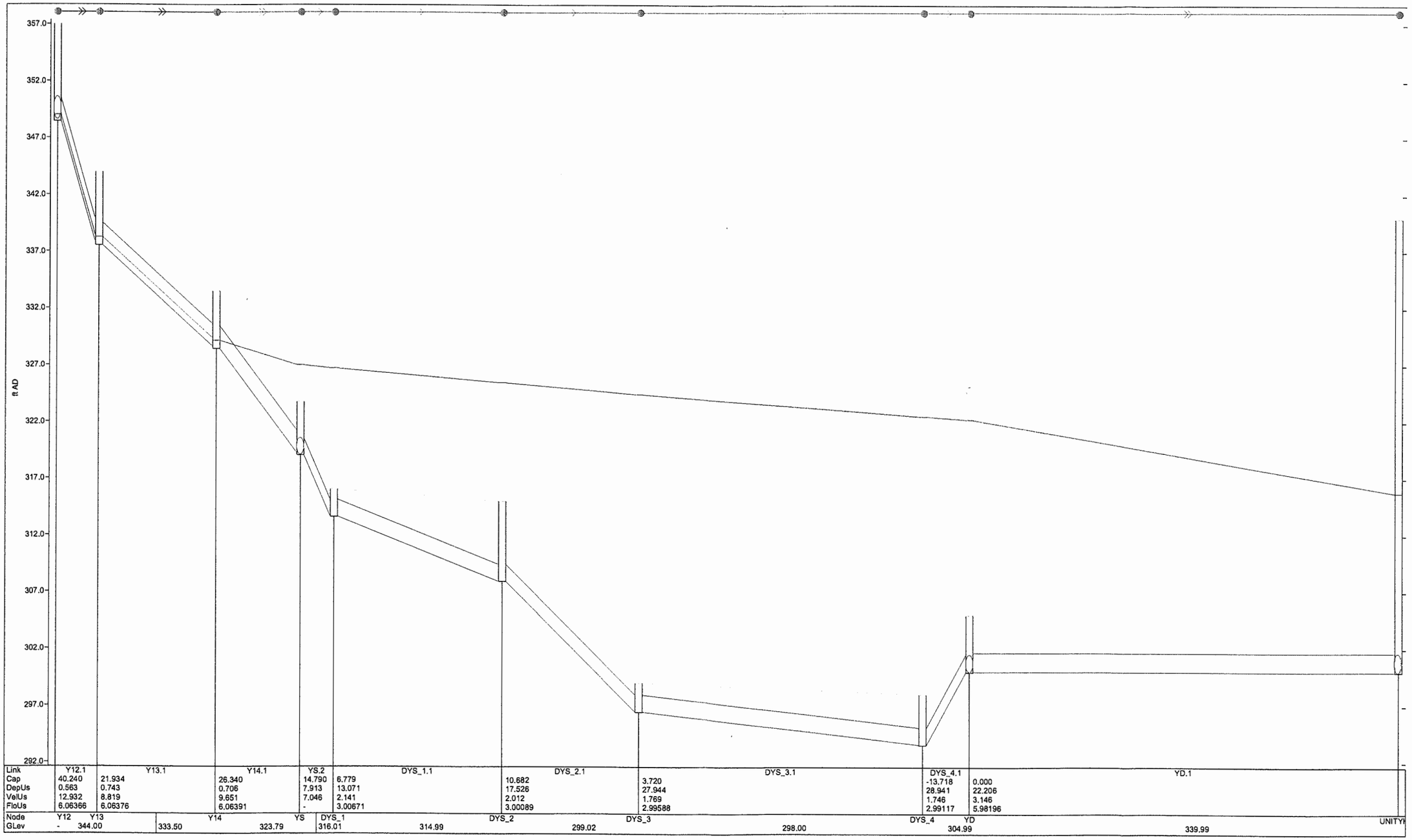
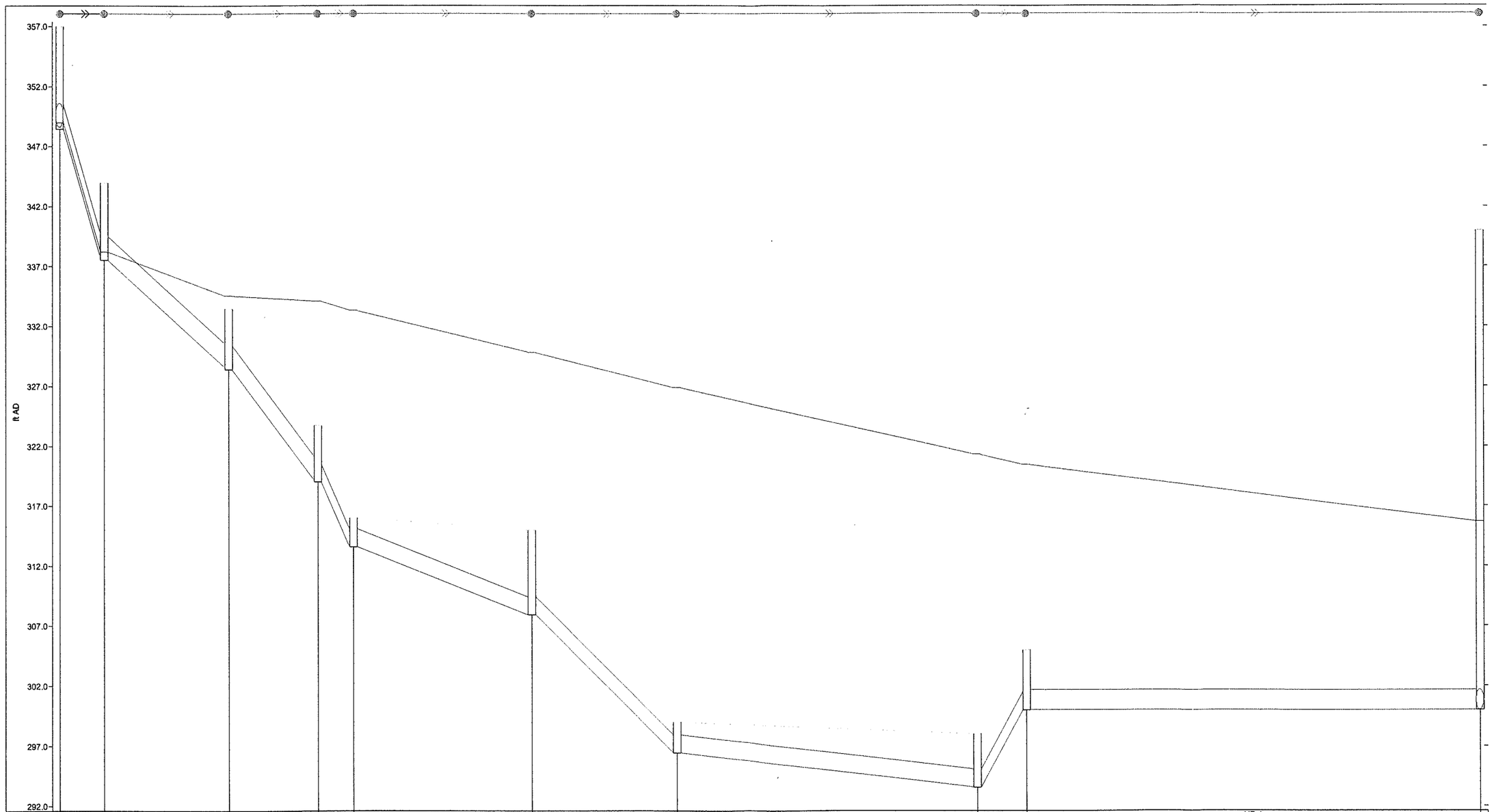


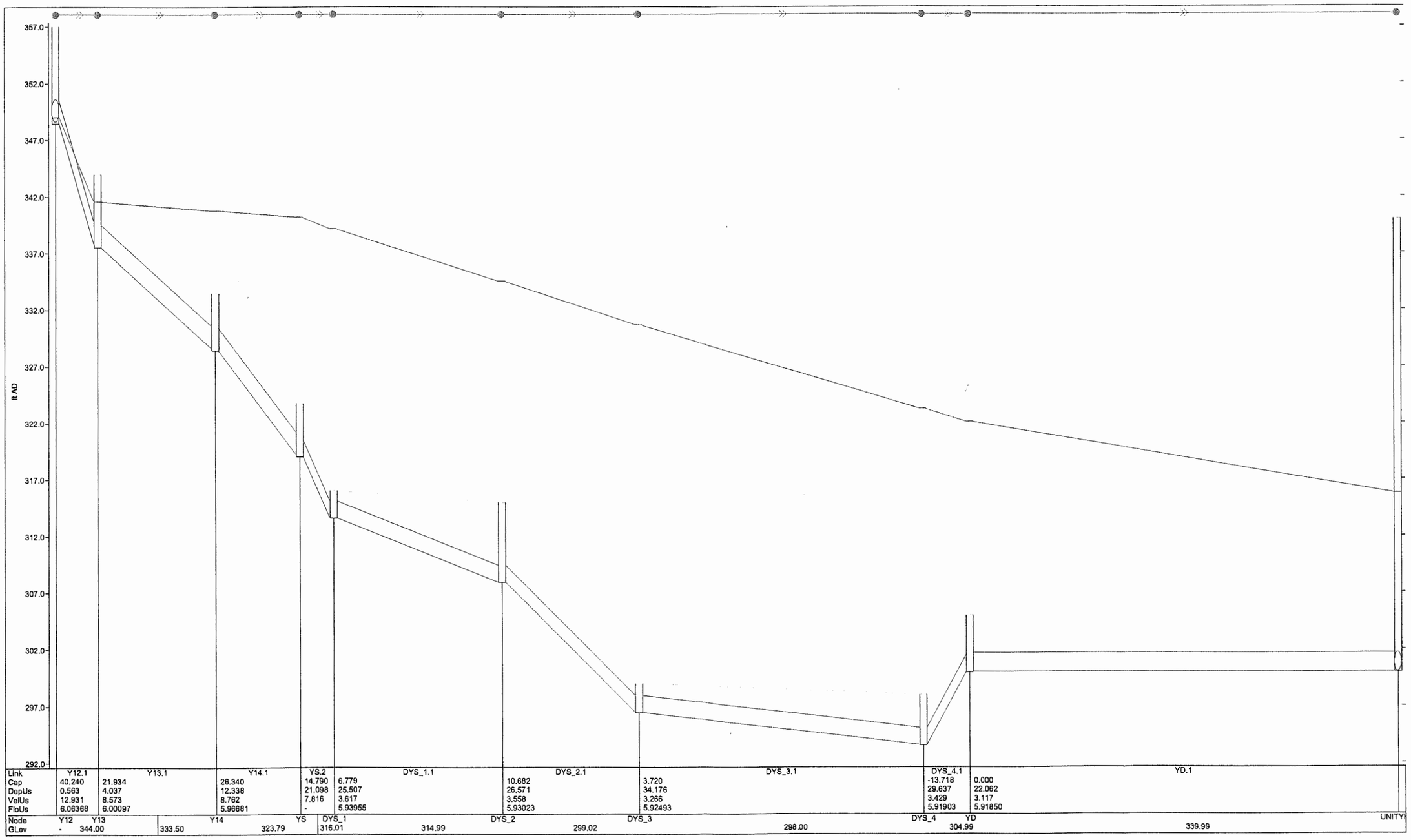
Figure 6-19. Hydraulic Profile of Unit Y Siphon - One Barrel Operation, Existing PDWF (Flows to South Headworks)



Link	Y12.1	Y13.1	Y14.1	YS.2	DYS_1.1	DYS_2.1	DYS_3.1	DYS_4.1	YD.1
Cap	40.240	21.934	26.340	14.790	6.779	10.682	3.720	-13.718	0.000
DepUs	0.531	0.701	6.134	15.039	19.696	21.883	30.413	27.700	20.416
VelUs	12.162	8.284	8.674	7.822	3.361	3.266	2.953	3.045	2.759
FloUs	5.25893	5.25883	5.16530	-	5.15238	5.14489	5.14283	5.14165	5.14105

Node	Y12	Y13	Y14	YS	DYS_1	DYS_2	DYS_3	DYS_4	YD	UNITY
GLev	- 344.00	333.50	323.79		316.01	314.99	299.02	298.00	304.89	339.99

Figure 6-20. Hydraulic Profile of Unit Y Siphon - One Barrel Operation, Buildout PDWF (Flows to South Headworks)



then an overflow would have occurred in reality, since the manholes are not currently sealed. The hydraulic profiles show the how much pressure sealed manholes would be under.

The following conclusions are drawn from the analysis:

1. The capacity of the siphons is controlled primarily by the headworks elevations, as velocities and friction losses in the siphon are low. For example, velocities under two-barrel operation would be only 1.6 feet/second under existing peak dry weather flows. One-barrel operation would increase velocities to over 3 feet/second. Thus, maintaining flexibility to use one-barrel operation is important to allow flushing of the siphons.

2. The only operating mode that is clearly acceptable under all flow conditions is two-barrel operation to the north headworks.

3. Two barrel operation to the south headworks surcharges the gate structure under peak dry weather flow conditions, and this surcharging has been confirmed by observations. The model shows that the peak water level should be right at the ground level, whereas observations suggest that the level remains two feet or more below the ground. The modeled peak dry weather flows are about 10 percent higher than the actual peak flows on a normal day, and this difference in flow accounts for most of the difference between modeled and observed surcharge levels. Also, the actual friction losses in the siphon pipes may be somewhat less than computed in the model, which assumes a Manning's n value of 0.0130. In any case, proactive measures should be taken to mitigate the situation if Unit Y flow is to continue to be sent to the south headworks. Project Y3 (sealing of the gate structure and lining of the pipe between Y14 and YS) is recommended in Chapter 7 to eliminate any chance of an overflow.

4. If the gate structure is sealed, normal operation to the south headworks should be limited to 2 barrels and dry weather flows. The south headworks should not be used in the wet weather season, consistent with current procedures. One-barrel operation to the north headworks could be used under dry weather conditions only (including buildout flows).

5. If further study indicated that sealing of Y14 and additional pipe lining would be feasible, one-barrel operation to the north headworks would be acceptable under all flow conditions. One-barrel operation to the south headworks would be acceptable under existing dry weather flow conditions, but may not be possible after the Olsen Road Pump Station begins operation (field verifications of actual water levels would be required before allowing this mode of operation). The south headworks could still not be used in the wet weather season.

6. Any project involving sealing of manholes must include measures to ensure that existing gravity sewers will not leak under pressurized conditions (which may require lining) and that the existing siphons can handle the added pressure. In the long term, a project to replace or rehabilitate the siphons and gravity reaches of Unit Y (due to concerns related to the Techite material) should be designed considering the desired operating modes. In particular, lining of the existing pipes would increase the friction losses, but would add structural integrity. As a result, it would be possible to extend the pressurized system to higher elevations to increase capacity and allow the desirable one-barrel operation to be used under additional flow conditions.

Section 7

MWH
MONTGOMERY WATSON HARZA

CHAPTER 7 – RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

Chapter 7 describes the specific capital projects that are recommended for inclusion in the City's capital improvement program (CIP) over the next ten years. Each project write-up includes a project description and map, condition/capacity assessment, project details, planning-level capital cost estimates, and recommended implementation phasing (short, medium, or long term). These projects comprise a proactive program to replace or rehabilitate the interceptor sewers to ensure adequate hydraulic capacity and structural integrity into the future. None of the projects require emergency action; they may be implemented using the City's normal planning, permitting, and design process. This chapter also presents recommendations for a long-term rehabilitation/replacement strategy addressing the entire collection system.

7.1 Project Identification and Prioritization

Capital improvement projects were identified to proactively address potential problems discovered in the interceptor condition assessment and capacity analysis. Table 7-1 summarizes the recommended projects. Each project was assigned an identifier based on its interceptor unit (e.g., Project E1). In some cases, separate projects were defined for adjacent reaches along the same interceptor because they had significantly different hydraulic or structural conditions affecting their priority or recommended solutions. During project implementation, it may be appropriate to combine two or more of these projects into a single design and construction project.

For the purposes of CIP planning and budgeting, the projects are described in terms of the length and diameter of the new pipe or lining. Lining is generally proposed where the project is required to address a structural deficiency and the hydraulic capacity is adequate. Pipe replacement in the same right of way is proposed in cases where the project is required to address a capacity deficiency. Project alternatives that should be further investigated at the pre-design stage may include replacement rather than lining, relief sewers rather than replacement (retain existing sewer), alternative pipeline alignments, and alternative pipe materials. In some cases, promising alternatives are noted in the project descriptions. The feasibility and relative cost-effectiveness of these alternatives depends on the collection and analysis of site-specific information beyond the scope of a Master Plan.

Each project was assigned to one of three implementation phases, based on its relative priority. These phases are defined as follows:

- Short-term projects to be implemented immediately and completed within two years.
- Medium-term projects to be completed within a 2 to 5 year period.
- Long-term projects to be completed within a 5 to 10 year period.

Table 7-1
Summary of Recommended Capital Improvement Projects

Project ID	Phase	Basis	Description	Capital Cost
A1	Long-Term	Techite Pipe	Replace 2472' with 12" to 20"	$1,250,000
B1	Medium-Term	Condition	Line 966' of 10"	$110,000
C1	Short-Term	Condition	Line 4530' of 12"	$635,000
E1	Medium-Term	Condition	Line 1950' of 18" to 30"	$525,000
E2	Long-Term	Capacity	Replace 4620' with 39"	$3,850,000
E3	Short-Term	Capacity	Replace 2507' with 30"	$2,240,000
E4	Medium-Term	Capacity	Replace 1725' with 27"	$1,445,000
E5	Medium-Term	Capacity	Replace 3317' with 24"	$2,015,000
E6	Short-Term	Maintenance	New 21" freeway crossing +	$485,000
G1	Short-Term	Capacity	Replace 670' with 21"	$370,000
V1	Long-Term	Capacity	Replace 993' with 18"	$470,000
W1	Short-Term	Capacity	Install new 415' of 21"	$200,000
X1	Short-Term	Condition	Line 455' of 12"	$90,000
Y1	Short-Term	Erosion	Creek bank erosion protection	$250,000
Y2	Long-Term	Techite Pipe	Replace 3119' with 24" gravity Replace 4536' with 18" siphons	$2,700,000 $3,800,000
Y3	Short-Term	Capacity	Seal siphon gate structure Line 280' of 24"	$100,000
Spot Repairs MH Rehab	Short-Term	Condition	3 spot repairs 14 manhole rehabilitations	$85,000 $84,000
Phase Subtotal	Short-Term	All		$4,539,000
Phase Subtotal	Medium-Term	All		$4,095,000
Phase Subtotal	Long-Term	All		$12,070,000
Grand Total	All Phases	All		$20,704,000

Projects that add hydraulic capacity were assigned to a phase based on the hydraulic model results in terms of capacity utilization (ratio of peak flow to capacity) and the depth of the predicted maximum surcharged water level below ground level. Projects to improve structural condition were assigned to a phase based on the structural point ratings and engineering judgement on overall pipe condition based on viewing of the inspection videotapes.

7.2 Capital Cost Estimates

The estimated capital cost for each project is shown in Table 7-1. The following paragraphs describe the methodology used to develop these cost estimates.

MWH subscribes to the American Association of Cost Engineers, International (AACE) guidelines on accuracy ranges for estimating purposes. The accuracy ranges are identified by the use of percentages +/- in reference to the expected average bid cost of the work. These ranges differ with the type of estimate performed. The cost estimates for the improvements described in this Master Plan can be categorized as the Planning-Level or the "Class E Order of Magnitude" Cost. As such, the cost estimate can be expected to range from +50% to –30% of the eventual cost of the project. These estimates have been developed through a proven process of monitoring average contractor bid costs, budget negotiation, and the design and construction experience of the estimating staff. The bid costs used were for similar work in the Los Angeles area, which MWH maintains in a cost database. Cost data for sewer work in the City of Thousand Oaks was provided by the City, but was not extensive enough to be used as the basis for cost estimates for the range of projects included in this Master Plan.

All estimates have been prepared using current (January, 2002) U.S. dollars. The cost index used for escalation of past bid prices is the ENR-CCI for Los Angeles. The index value for January 2002 is 7432, which is about a 5 percent escalation from one year ago. For this report, the costs for all projects are given in today's dollars. An cost inflation rate of 4 percent per year is recommended to estimate the future cost of a project.

Contingencies are cost allowances used to compensate for commonly encountered, but unspecified and unidentified, cost elements within the planned project scope. Since the estimates in this Master Plan are preceding any preliminary or final design work on specific projects, the scope contains unknown elements. For lining projects, a contingency of 20 percent of the estimated construction cost has been included. For cut-and-cover pipe installations, a higher contingency of 30 percent was applied due to the greater number of unknown factors (such as utility interferences and trench shoring requirements) that can affect the ultimate cost. An additional markup of 15 percent has been applied to the cost estimates (after adding contingencies) for technical services to implement the project, such as construction service inspection and contract administration; engineering design; surveying; soils and geotech engineering; environmental impact mitigation; and similar technical requirements. No land or easement purchase costs have been assumed.

7.3 Project Descriptions

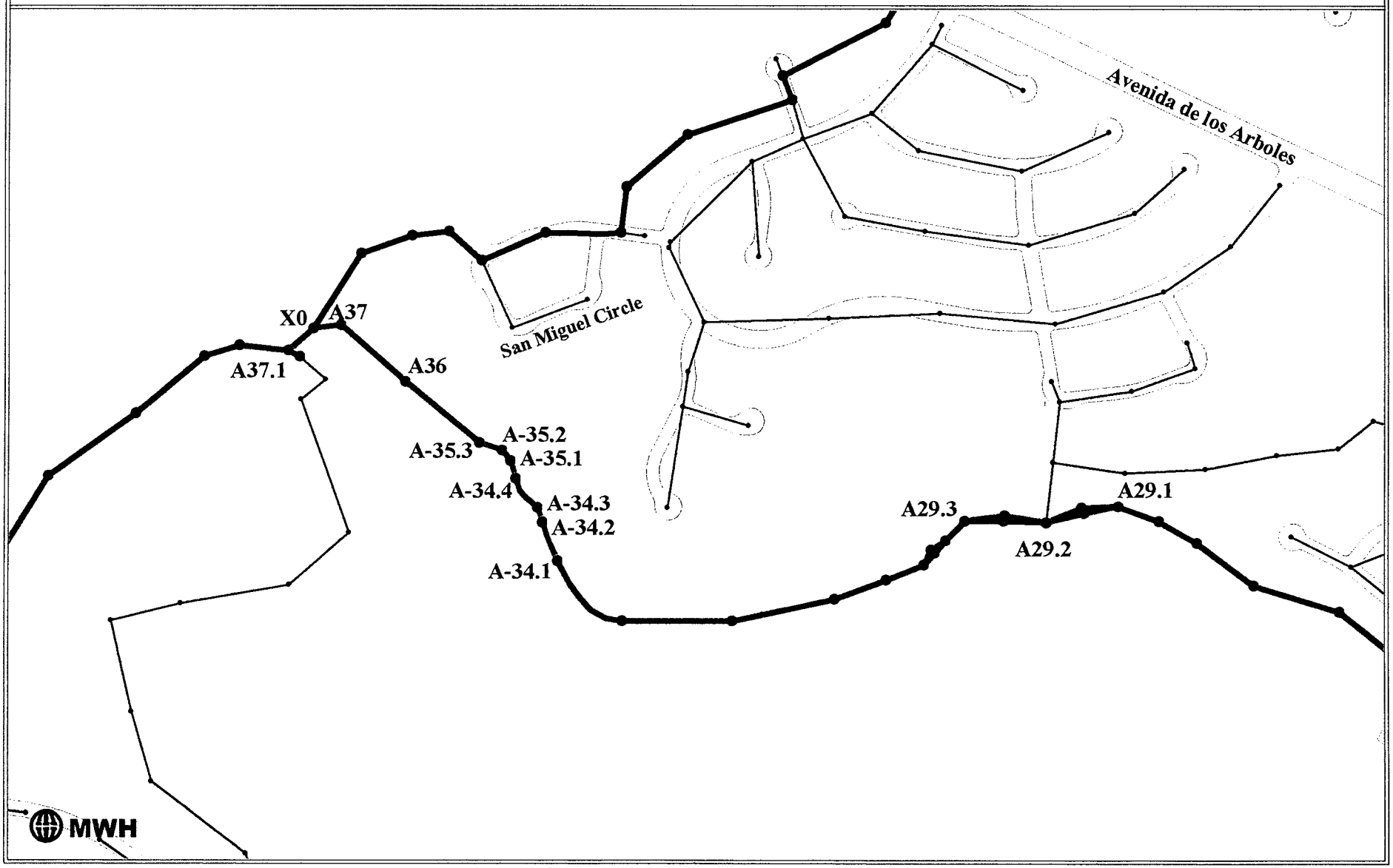
The recommended projects are described on the following pages. The descriptions are each contained on a single page and follow a standard format that consists of a summary project description, cost estimate, implementation phase, project basis (e.g., capacity or condition), project issues, and alternatives. Hydraulic capacity information is provided for projects that are based on capacity requirements. The projects are listed in alphabetical order by their unit-based identifiers. In addition, a single project is included to cover spot repairs and manhole rehabilitation projects throughout the system.

The project description is followed by plan and profile views. The profiles include the invert and crown of the sewer (red lines), and the ground surface (green line) based on elevations at all manholes. One profile shows the maximum water surface (blue line) for the existing wet weather scenario, and a separate profile shows the maximum water surface for the buildout wet weather scenario.

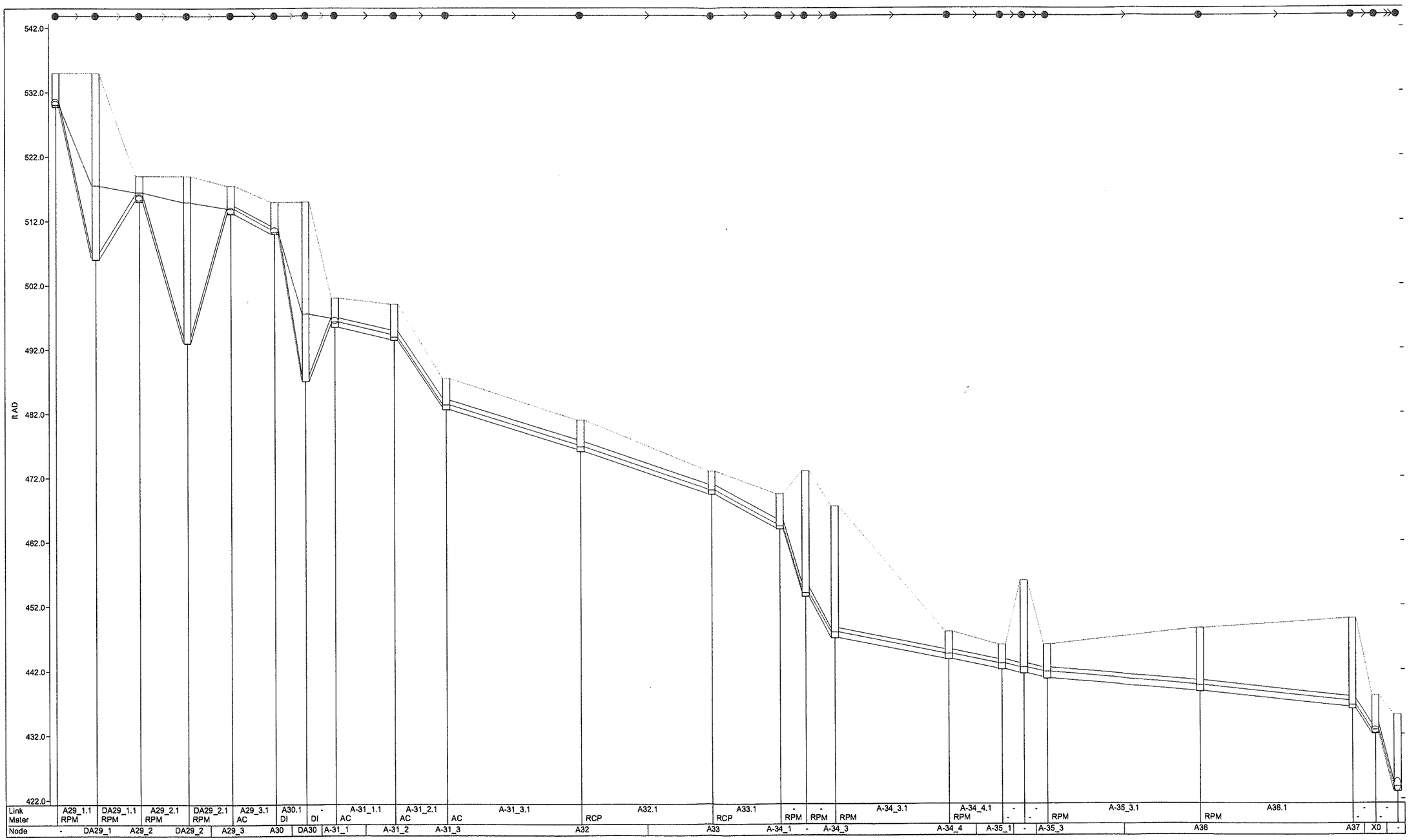
Capital Improvement Project A1

Project Description	Replace the following reaches of Techite pipe in open space easements with same diameter pipe: A-34.1 to A-35.3: 795 feet of 18-inch pipe A-35.5 to A37: 781 feet of 20-inch pipe A37 to A37.1: 115 feet of 18-inch pipe A29.1 to A29.2: 215 feet (each of 2 barrels) of 12-inch siphon A29.2 to A29.3: 233 feet (each of 2 barrels) of 12-inch siphon
Planning-Level Cost Estimate	$1,250,000
Implementation Phase	Long-Term
Project Basis	Techite Pipe. Capacity is adequate (see hydraulic profiles). These reaches of Unit A are constructed of Techite pipe material installed between 1976 and 1982. Techite is a fiberglass resin composite material that is relatively thin-walled and has had high failure rates in other installations throughout the country. The City had a failure of a Techite pipe segment on Unit Y in 1998, and has been concerned about the possibility of future failures for some time. Failures can occur even when internal inspection does not detect major defects prior to failure.
Project Issues	This reach of Unit A was inspected by CCTV in 2000 and found to be in good condition. It is being included for long-term future replacement because of the history of failures associated with Techite pipes.
Alternatives	Alternatives to replacement include lining or encasement. If feasible, lining would minimize disruption to habitat. Encasement would eliminate the need to bypass flows, and would utilize the existing pipe as an inert liner.

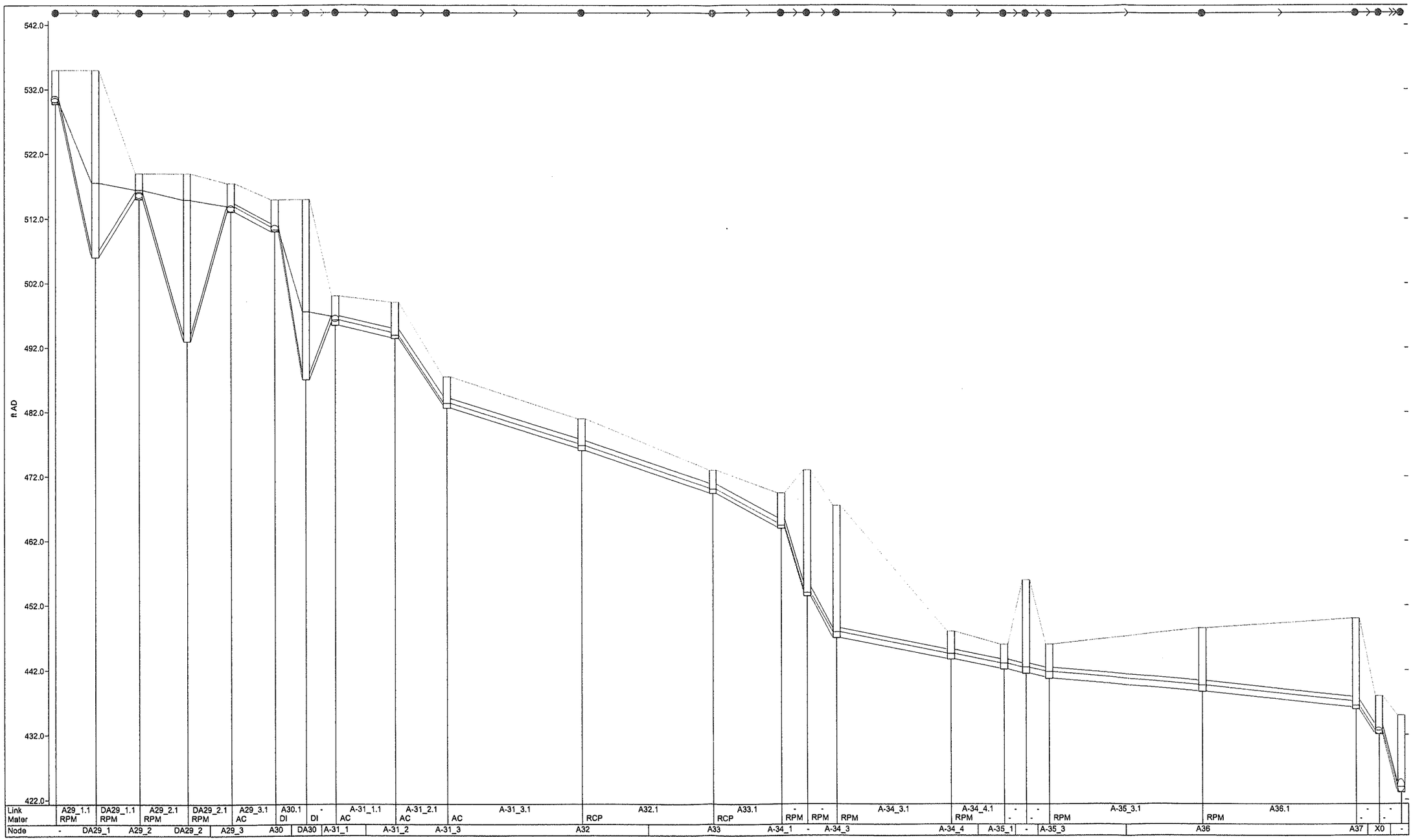
Capital Improvement Project A1



Capital Improvement Project A1 - Existing WWF



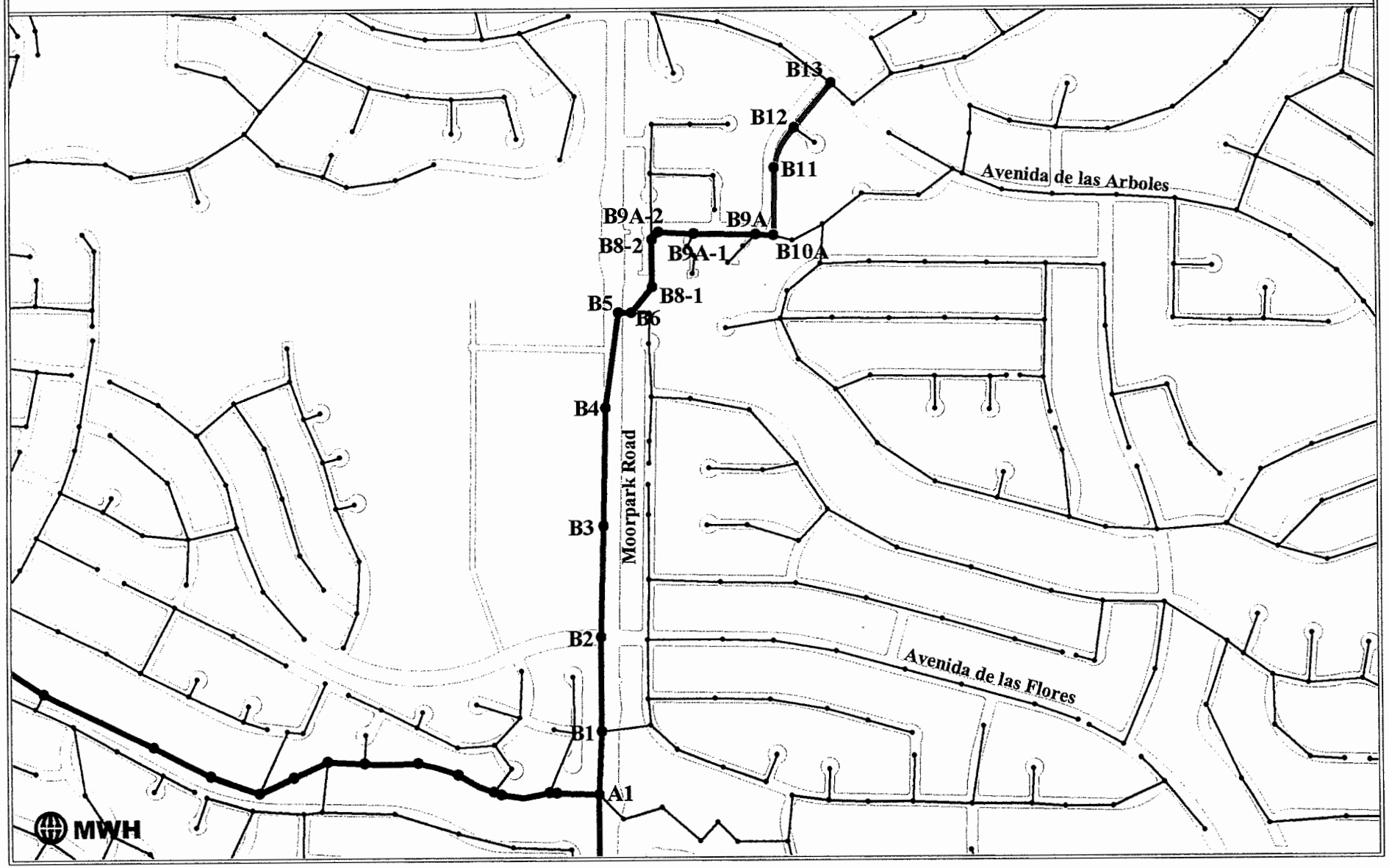
Capital Improvement Project A1 - Buildout WWF



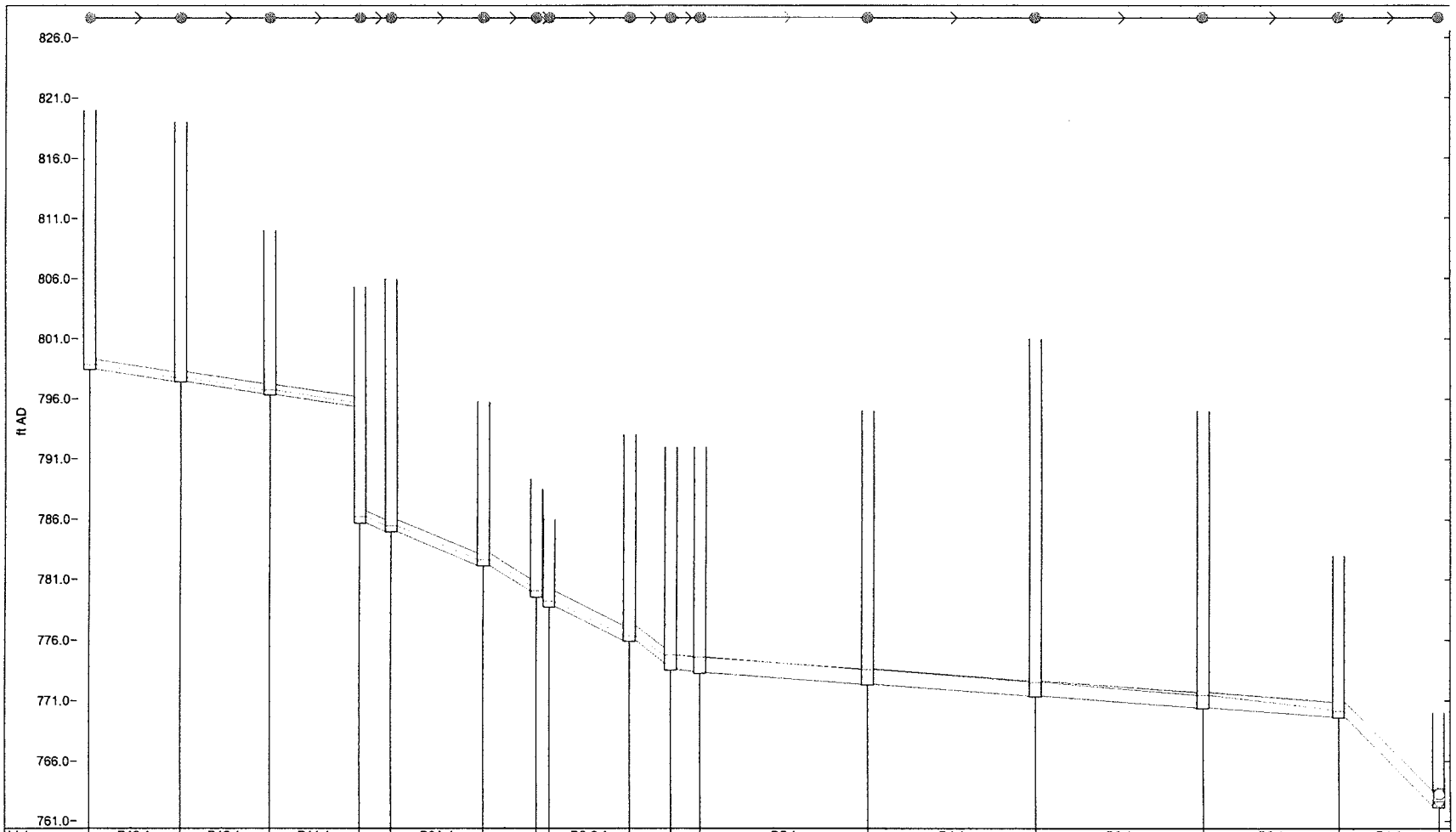
Capital Improvement Project B1

Project Description	Line 966 feet of 10-inch diameter VC pipe between Manholes B13 and B10-A in Calle Abedul.
Planning-Level Cost Estimate	$110,000
Implementation Phase	Medium-Term
Project Basis	Condition. This reach was built in 1960 and is in poor condition based on CCTV inspection in 2000. The structural scores of the pipe segments from Manholes B13 to B10A ranged from 32 to 96, ranking among the worst 25 interceptor segments. Major cracks, broken pipe, roots, and some sagged sections with pulled joints account for the poor condition. Peak flows are under 50 percent of capacity (see hydraulic profiles).
Project Issues	Lining of the reach between Manholes B13 and B10-A is recommended due to depths between 10 to 20 feet and adequate capacity. The condition of the (non-interceptor) mains upstream of Manhole B13 should be determined and the project extended upstream if appropriate. The hydraulic profiles show a minor capacity bottleneck exists in the 2393 feet of 15-inch diameter VC pipe (portions inversion-lined) between Manholes B6 and B1 in Moorpark Road south of Calle Abedul. The existing and buildout peak wet weather flows are projected to approach the capacity of this reach. Because the sewer is 20 to 30 feet deep, there is no risk of an overflow. Temporary flow monitor M6 was located in this reach (Manhole B3) and confirmed the accuracy of the modeled dry and wet weather peak flows. This situation is not considered significant enough to warrant upsizing, particularly since much of reach was lined in 1994 and all of it is in good condition. The pipe segments between these two reaches (Manholes B10-A to B5) were replaced in 1981 and are in good condition and have adequate capacity.
Alternatives	Replacement with same diameter pipe could be used if lining were not feasible. There is a 10-foot drop at Manhole B10-A that would allow additional gradient for the replacement sewer upstream, but the current velocity of 4.6 mgd at the existing slope is good. Diverting flow from the upper end of Unit B to Unit X to relieve the lower reach of Unit B was investigated, but no low-cost option was identified that would have a significant benefit.

Capital Improvement Project B1



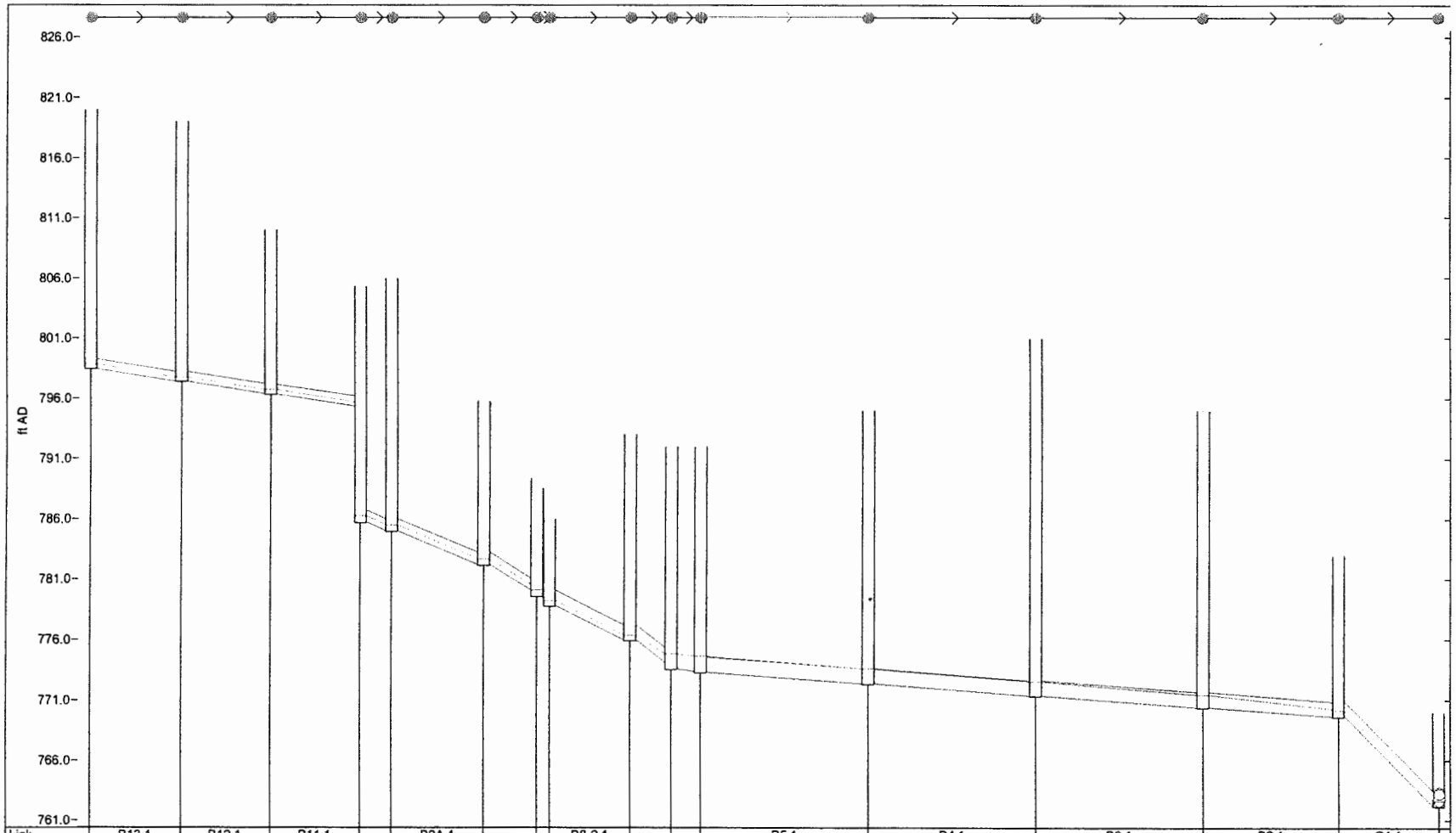
Capital Improvement Project B1 - Existing WWF



Link	B13.1	B12.1	B11.1	-	B9A.1	-	B8-2.1	-	-	B5.1	B4.1	B3.1	B2.1	B1.1
Cap	0.799	0.799	0.776	-	2.123	2.442	4.154	-	-	1.666	1.666	1.666	1.666	6.026
Mater	VC	VC	VC	VC	VC	VC	VC	VC	-	VC	VC	PVC	PVC	VC
VelUs	2.147	2.146	2.098	-	4.179	4.484	4.356	-	-	2.403	2.402	2.398	2.472	6.337
FloUs	0.36255	0.36253	0.36252	-	1.09937	-	1.09933	-	-	1.71999	1.71857	1.71719	1.71633	1.85026

Node	B13	B12	B11	B10A	B9A	B9A-1	-	B8-2	B8-1	B6	B5	B4	B3	B2	B1	A1

Capital Improvement Project B1 - Buildout WWF



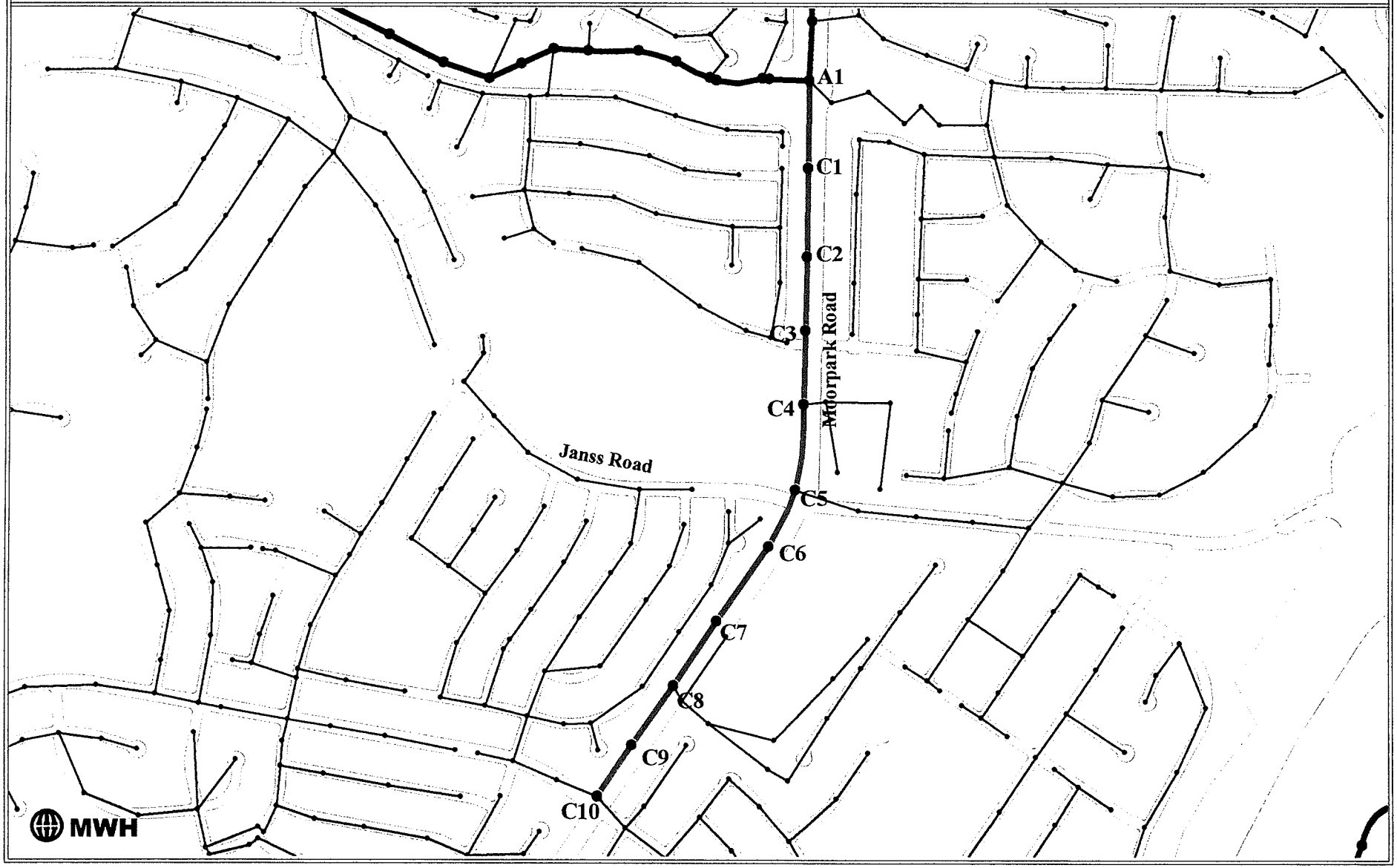
Link	B13.1	B12.1	B11.1	-	B9A.1	-	B8-2.1	-	-	B5.1	B4.1	B3.1	B2.1	B1.1
Cap	0.799	0.799	0.776	-	2.123	2.442	4.154	-	-	1.666	1.666	1.666	1.666	6.026
Mater	VC	VC	VC	VC	VC	VC	VC	VC	-	VC	VC	PVC	PVC	VC
VelUs	2.147	2.146	2.098	-	4.181	4.488	4.361	-	-	2.403	2.402	2.398	2.473	6.339
FloUs	0.36254	0.36252	0.36251	-	1.10215	-	1.10210	-	-	1.72339	1.72202	1.72067	1.71982	1.85456
Node	B13	B12	B11	B10A	B9A	B9A-1	B8-2	B8-1	B6	B5	B4	B3	B2	B1

A1

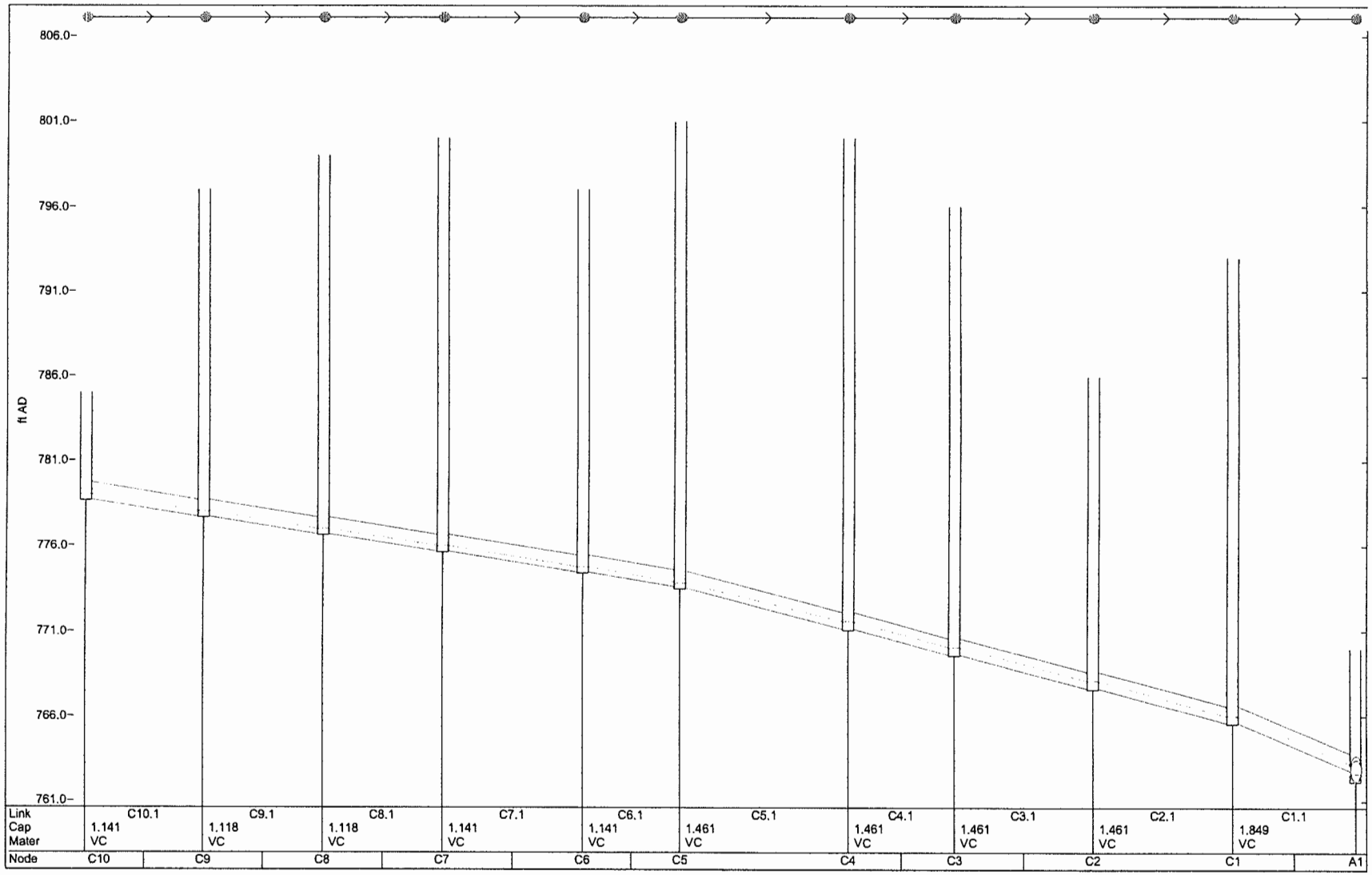
Capital Improvement Project C1

Project Description	Line 4530 feet of 12-inch diameter VC pipe between Manholes C10 and A1 in Moorpark Road.
Planning-Level Cost Estimate	$635,000
Implementation Phase	Short-Term
Project Basis	Condition. This reach was built in 1960 and is in very poor condition based on CCTV in 1995. The upstream end of the reach, between Manholes C10 and C8 (836 feet), is in relatively good condition, with light roots and some sags, and only minor infrequent cracks. Structural scores were under 30 points per pipe segment. The manhole-to-manhole pipe segments from C8 to A1 are among the worst segments in the interceptor system based on structural scores from City television inspection, ranging from about 100 points to 1000 points per segment. These segments are generally marked by major longitudinal cracks and mineral scale deposits at joints indicative of infiltration. Peak flows are under 50 percent of capacity (see hydraulic profiles).
Project Issues	Lining of this reach is appropriate due to its depth of 20 to 30 feet and its adequate capacity. Velocities at half-full pipe are an acceptable 2.7 feet per second. Several segments of Unit B, just north on Moorpark Road, were successfully inversion-lined in 1994. Lining of the entire reach from Manhole C10 to Manhole A1 is recommended. Lining of the segments from Manholes C10 to C8 could be deferred, but have been included in anticipation of future deterioration. Addition of a manhole between C4 and C5 should be considered during design of the project. Since Unit C was not monitored, verification of peak wet weather flows is recommended prior to a final decision to line the pipe. The entire interceptor should be cleaned and re-inspected, since the previous inspection was in 1995 and conditions may have changed. Removal of scale and sealing of I/I sources will be required prior to lining.
Alternatives	Replacement should be considered if lining proves infeasible or if flow monitoring indicates that additional capacity is required.

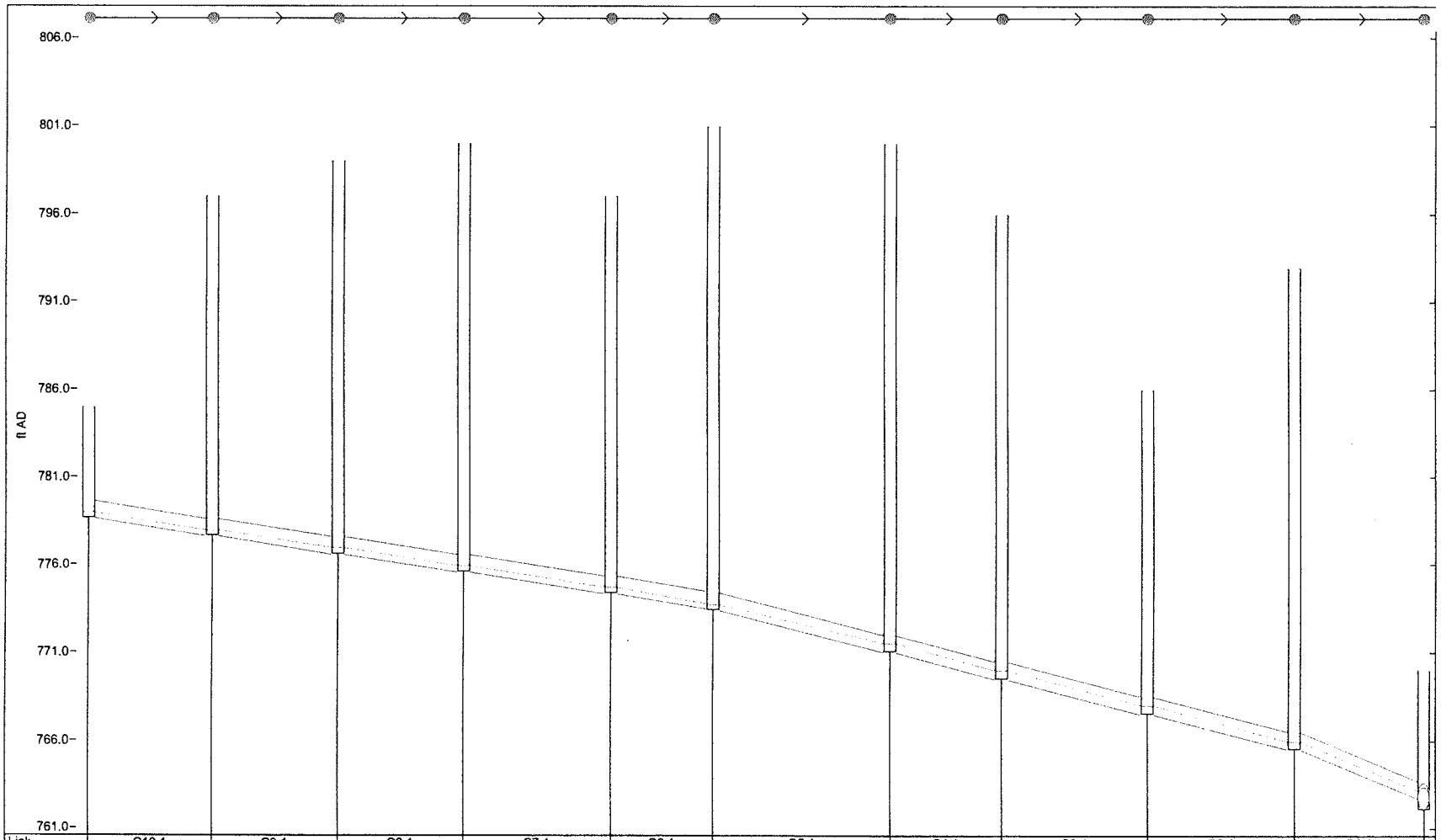
Capital Improvement Project C1



Capital Improvement Project C1 - Existing WWF



Capital Improvement Project C1 - Buildout WWF



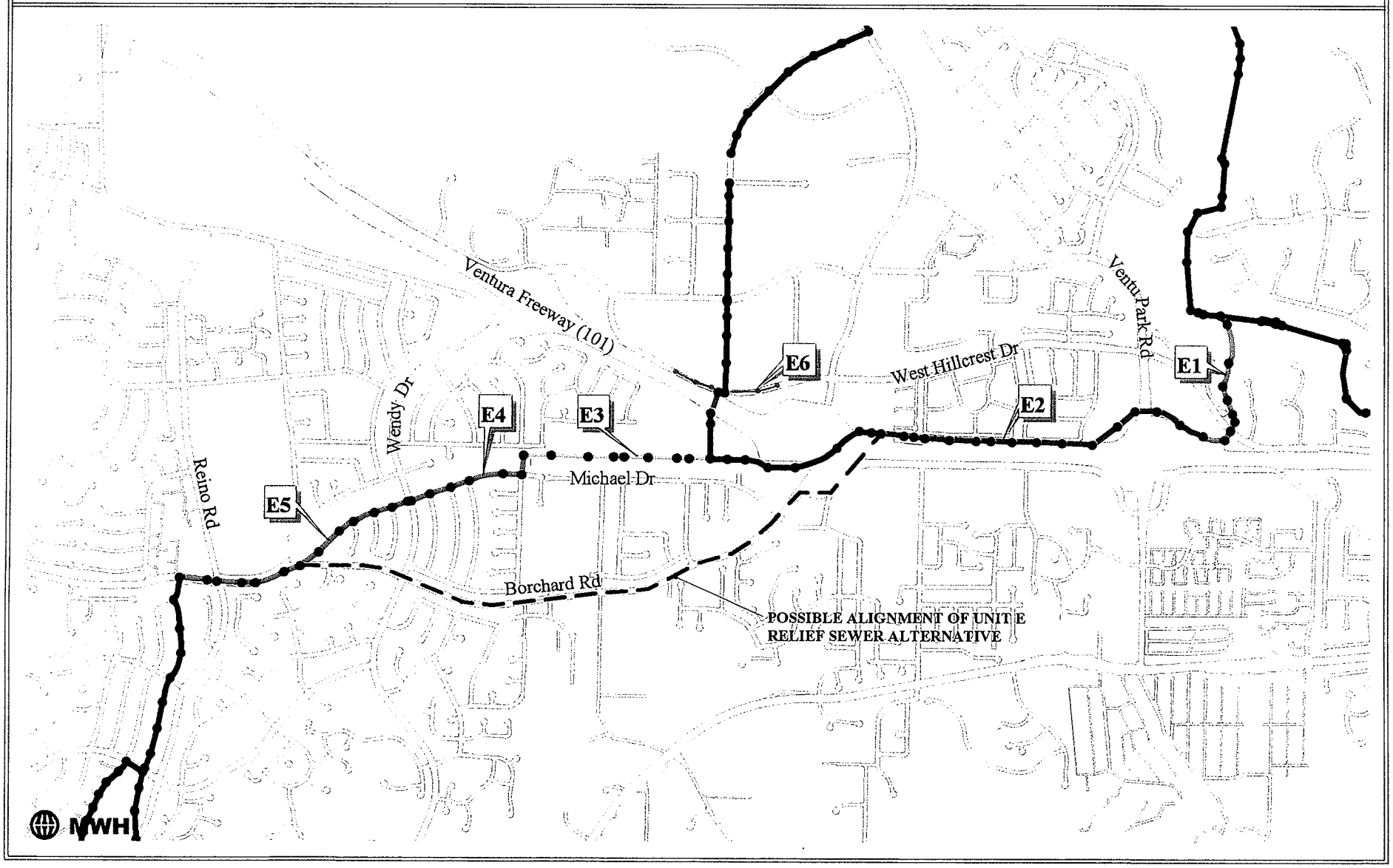
Link	C10.1	C9.1	C8.1	C7.1	C6.1	C5.1	C4.1	C3.1	C2.1	C1.1
Cap	1.141	1.118	1.118	1.141	1.141	1.461	1.461	1.461	1.461	1.849
Mater	VC	VC	VC	VC	VC	VC	VC	VC	VC	VC
FloUs	0.27124	0.27095	0.27081	0.27044	0.27025	0.27005	0.66902	0.66833	0.66806	0.66747

Node	C10	C9	C8	C7	C6	C5	C4	C3	C2	C1	A1

Capital Improvement Projects on Unit E

Project Description	Five separate projects along Unit E (E1, E2, E3, E4, and E5). See plan view on following page for the limits of each project reach.
Planning-Level Cost Estimate	E1: $525,000 E2: $3,850,000 E3: $2,240,000 E4: $1,445,000 E5: $2,015,000 Total: $10,075,000
Implementation Phase	E1: Medium-Term E2: Long-Term E3: Short-Term E4: Medium-Term E5: Medium-Term
Project Basis	Capacity for E2, E3, E4, and E5. Condition for E1. See individual project descriptions for details. Project E3 is the most restrictive reach and causes the highest surcharged water levels.
Project Issues	Although each project reach could be built independently, beginning with E3, combining one or more of the projects may be cost-effective and allow alternative routes to be utilized. A predesign study including all five projects should be performed to identify the best routes and construction sequence. The next reach upstream from project E5 is an 18-inch VC pipe built in 1963, in Maynard Avenue between Kimber Drive and Borchard Road. The projected peak wet weather flow at buildout in that reach would be in the range of 50% to 60% of capacity. The condition of the pipe is still good, based on CCTV inspection. Therefore, no improvements to that reach are recommended.
Alternatives	One alternative route for a replacement or relief sewer would be in Borchard Road, from Manhole E22 all the way to the Borchard Road interchange with Highway 101 (see plan view). A sewer in this route would replace or relieve the three most deficient sections of Unit E in one project (combine Projects E3, E4, and E5), as well as an additional reach of Unit E between the junction with Unit F and the Highway 101 Interchange.

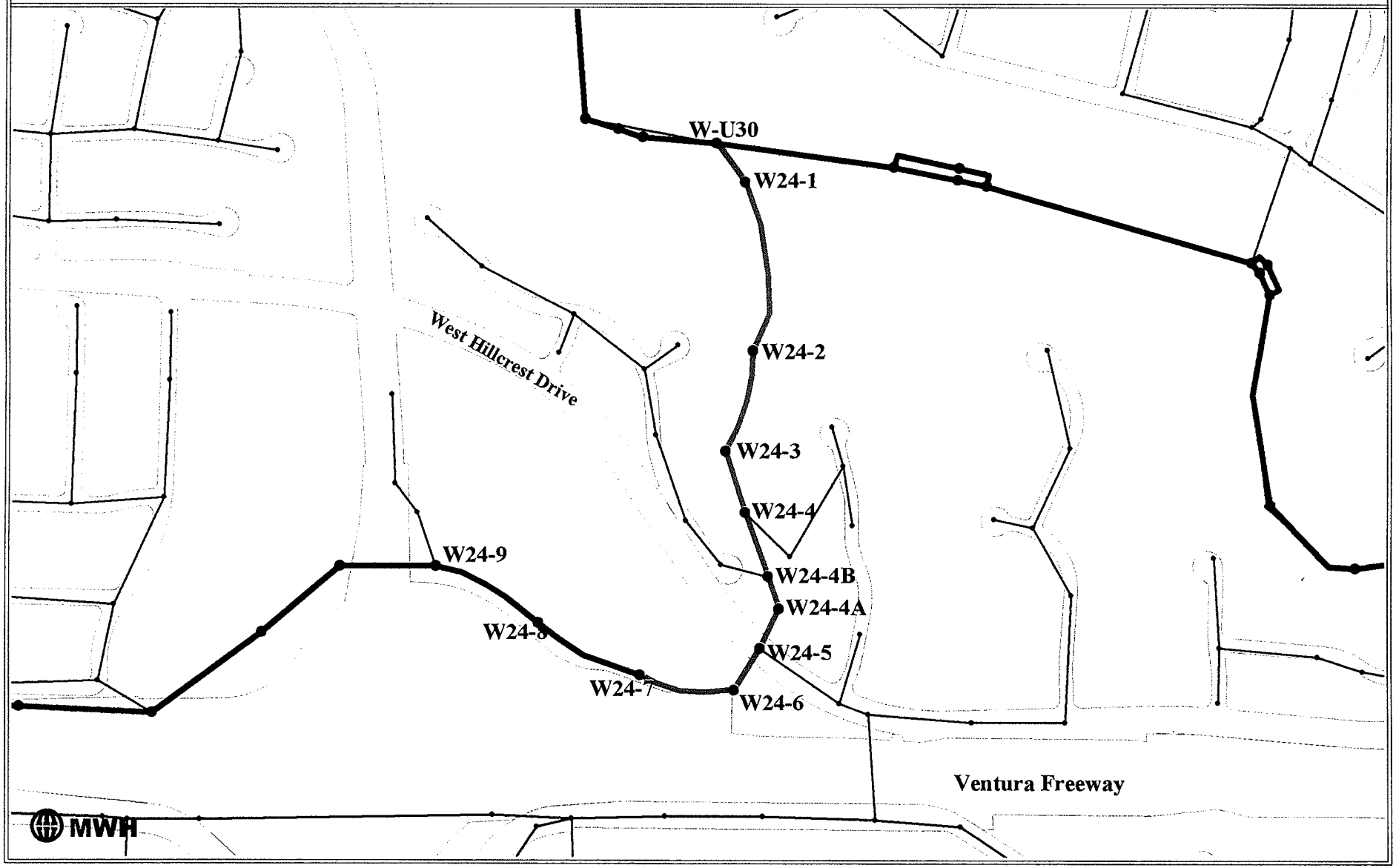
Overview of Capital Improvement Projects on Unit E



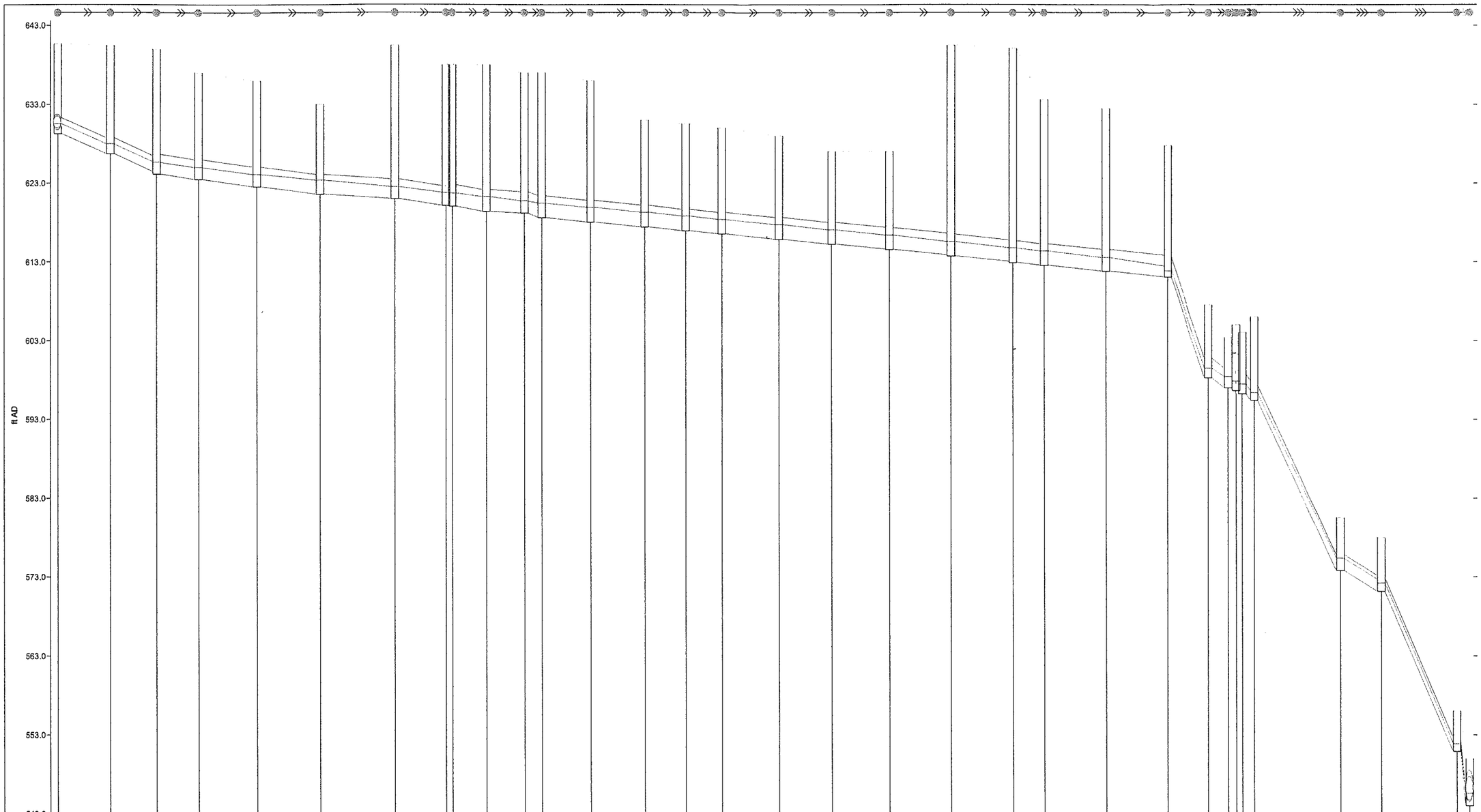
Capital Improvement Project E1

Project Description	Line a total of 1950 feet of 18-inch to 30-inch diameter RC pipe between Manholes W24-7 and W-U30 in easements (82 feet of 18-inch, 489 feet of 21-inch, 816 feet of 24-inch, and 563 feet of 30-inch).
Planning-Level Cost Estimate	$525,000
Implementation Phase	Medium-Term
Project Basis	Condition. These sewers were built between 1969 and 1973 and were televised by National Plant Services in December of 2001. Significant areas of mild to moderate corrosion were found. The reach has a steep gradient and velocities over 8 feet per second, coming at the end of a relatively long interceptor with a generally lower gradient and velocities. This creates a condition in which hydrogen sulfide is released and attacks the unprotected concrete surfaces. The corrosion has not yet reached a critical point at which the structural integrity of the pipe is compromised, but corrosion will continue if the concrete is left unprotected. Lining of the reach with a non-corrosive pipe material will provide this protection.
Project Issues	The capacity of the reach is adequate for existing and future peak flows, even if the lining reduces the diameter by up to an inch. In most manhole-to-manhole segments, the depth of flow is projected to remain under 50 percent of the pipe diameter at buildout peak wet weather flow. There are two segments which have milder slopes and lower capacities (Manhole W24-4 to W24-3 and Manhole W24-3 to W24-2). A hydraulic analysis assuming a reduction of diameter of 1 inch throughout the project reach showed that one of these two segments (Manhole W24-3 to W24-2) would surcharge at peak wet weather flow, but that the surcharging would be no more than 0.6 feet, no closer than 4.2 feet from the ground surface, and would occur only in the immediate area of this reach and only during the peak of major wet weather events. Given these hydraulic conditions, lining is acceptable.
Alternatives	Consideration could be given to replacing one or more of the sections to eliminate the minor surcharging. Replacement could also be considered if lining should prove to be very difficult or more expensive than replacement.

Capital Improvement Project E1



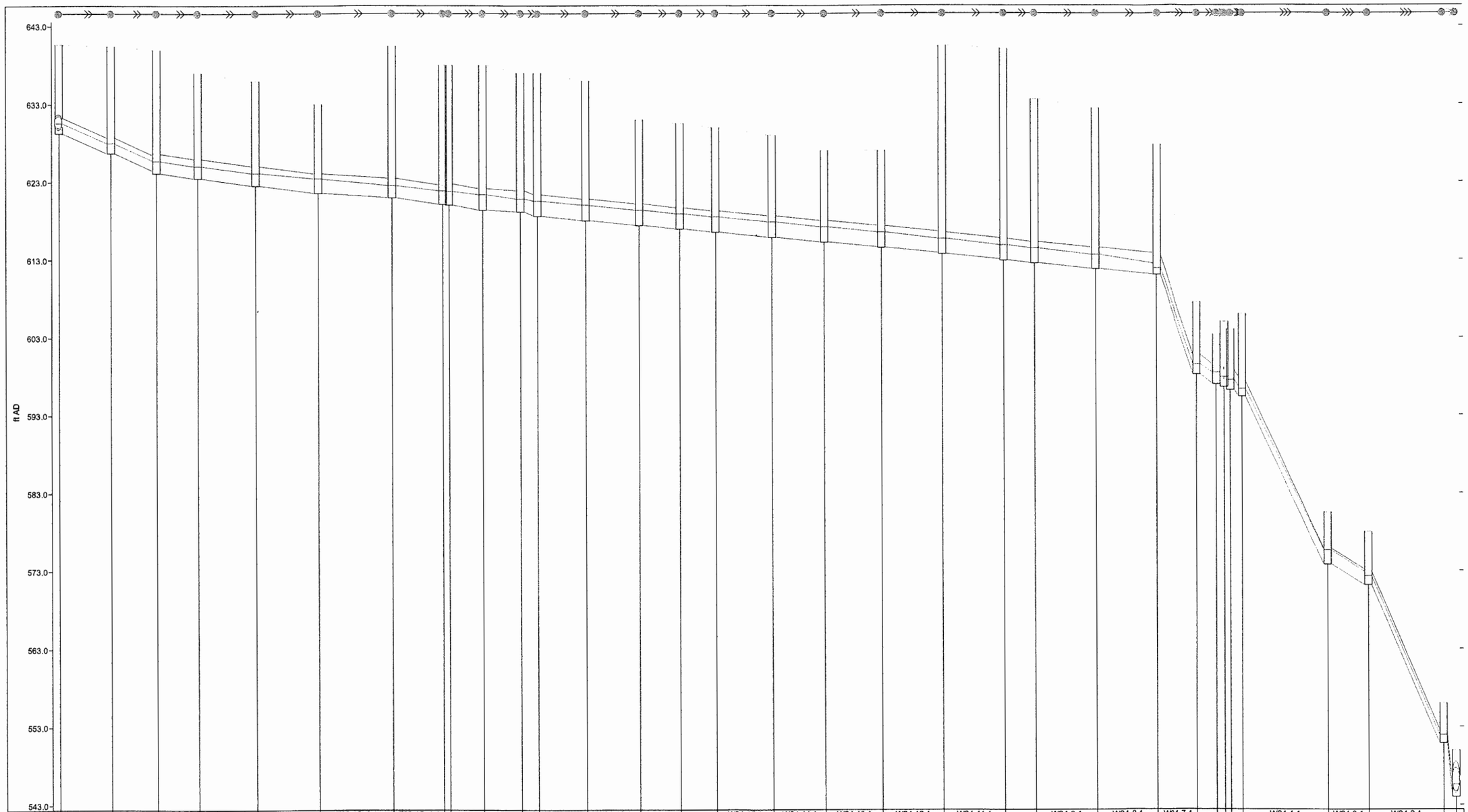
Capital Improvement Projects E1 and E2 - Existing WWF



Link	E2.1	-	-	F22-15_4.1	F22-15_3.1	F22-15_2.1	F22-15_1.1	-	-	-	W24-19.1	W24-18.1	-	-	W24-15.1	W24-14.1	W24-13.1	W24-12.1	W24-11.1	-	W24-9.1	W24-8.1	W24-7.1	-	-	W24-4.1	W24-3.1	W24-2.1	-
Cap	12.759	12.645	13.033	12.964	13.010	9.449	13.284	18.579	10.659	-	14.379	14.562	14.859	14.106	14.516	14.334	14.631	14.585	14.608	-	14.539	15.064	57.883	-	-	28.896	14.676	20.839	-
DepUs	1.236	1.245	1.519	1.530	1.564	1.798	1.528	1.663	1.887	-	1.838	1.839	1.866	1.894	1.867	1.858	1.821	1.814	1.815	1.835	1.821	1.743	0.799	-	-	0.977	1.518	1.019	-
VelUs	6.711	6.650	4.380	4.340	4.208	3.596	4.331	4.658	4.023	-	4.160	4.166	4.214	4.134	4.192	4.194	4.288	4.305	4.302	4.250	4.287	4.506	13.226	-	-	13.273	8.051	13.946	-
FloUs	8.79003	8.78824	8.78765	8.78745	8.78655	8.78487	8.78386	-	-	-	11.28438	11.28243	-	-	11.56743	11.56573	11.56412	11.56318	11.56320	-	11.56218	11.56126	-	-	-	13.09093	-	13.09073	-

Node	E2	F22-15_6	F22-15_5	F22-15_4	F22-15_3	F22-15_2	F22-15_1	-	-	-	-	W24-18	W24-17	W24-16	W24-15	W24-14	W24-13	W24-12	W24-11	W24-10	W24-9	W24-8	W24-7	W24-6	-	-	W24-4	W24-3	W24-2	W24-1	-

Capital Improvement Projects E1 and E2 - Buildout WWF



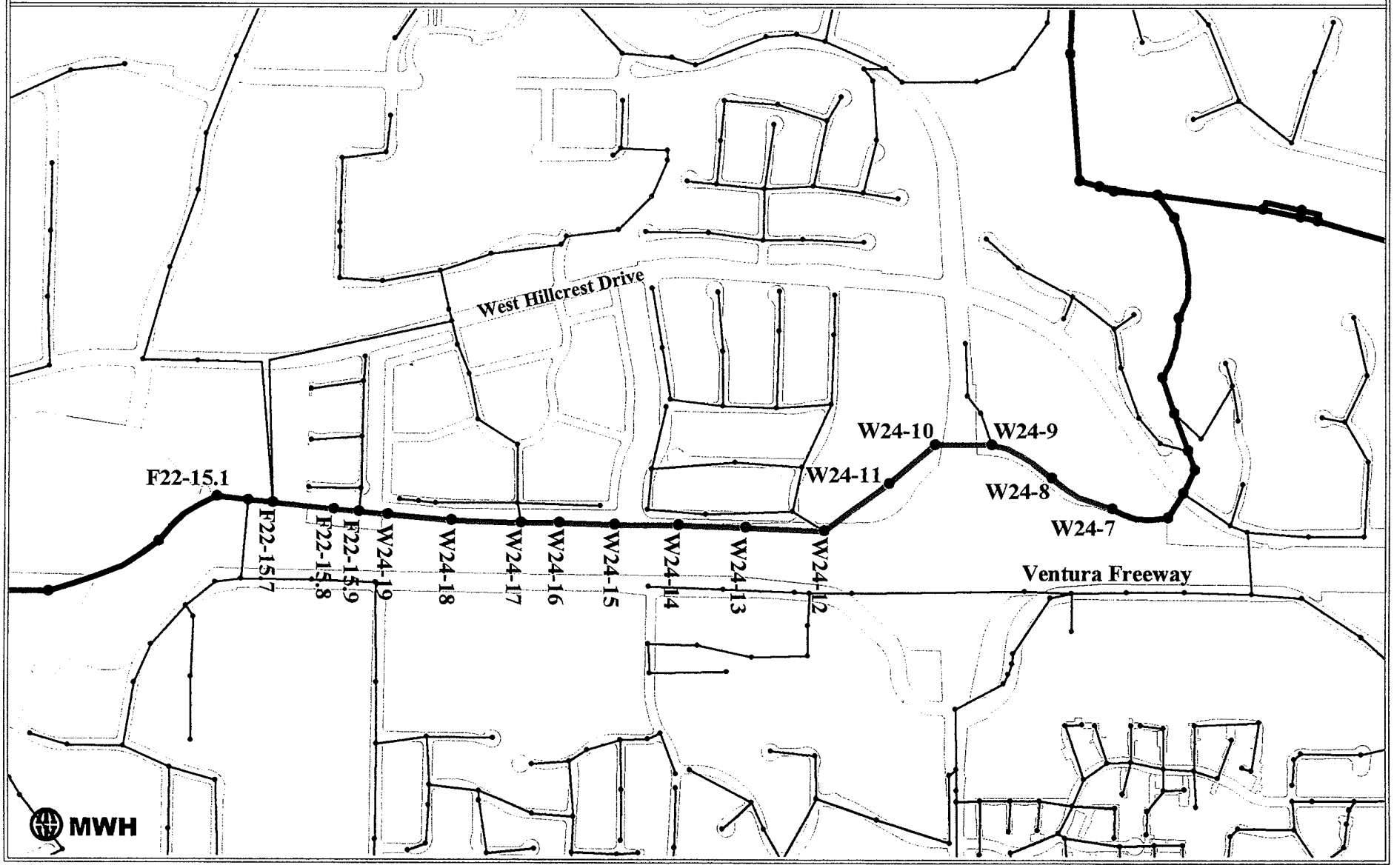
Link	E2.1	-	-	F22-15_4.1	F22-15_3.1	F22-15_2.1	F22-15_1.1	-	-	-	W24-19.1	W24-18.1	-	-	W24-15.1	W24-14.1	W24-13.1	W24-12.1	W24-11.1	-	W24-9.1	W24-8.1	W24-7.1	-	-	-	W24-4.1	W24-3.1	W24-2.1	-
Cap	12.759	12.645	13.033	12.964	13.010	9.449	13.284	18.579	10.659	-	14.379	14.562	14.859	14.106	14.516	14.334	14.631	14.585	14.608	-	14.539	15.064	57.883	-	-	-	28.896	14.676	20.839	-
DepUs	1.277	1.282	1.579	1.585	1.615	1.861	1.591	1.768	1.999	-	1.963	1.957	1.968	1.996	1.977	1.981	1.960	1.952	1.953	1.963	1.945	1.823	0.836	-	-	-	1.010	1.757	1.090	-
VelUs	6.765	6.733	4.386	4.367	4.272	3.656	4.347	4.705	4.105	-	4.186	4.198	4.271	4.208	4.251	4.243	4.301	4.330	4.319	4.282	4.325	4.648	13.497	-	-	-	13.781	8.053	14.011	-
FloUs	9.26229	9.26145	9.26069	9.26036	9.26040	9.25945	9.25834	-	-	-	12.26718	12.26634	-	-	12.55503	12.55514	12.55496	12.55438	12.55325	-	12.55119	12.55136	-	-	-	-	14.18026	-	14.17984	-

Node	E2	F22-15_6	F22-15_5	F22-15_4	F22-15_3	F22-15_2	F22-15_1	-	-	-	-	W24-18	W24-17	W24-16	W24-15	W24-14	W24-13	W24-12	W24-11	W24-10	W24-9	W24-8	W24-7	W24-6	-	-	W24-4	W24-3	W24-2	W24-1	-

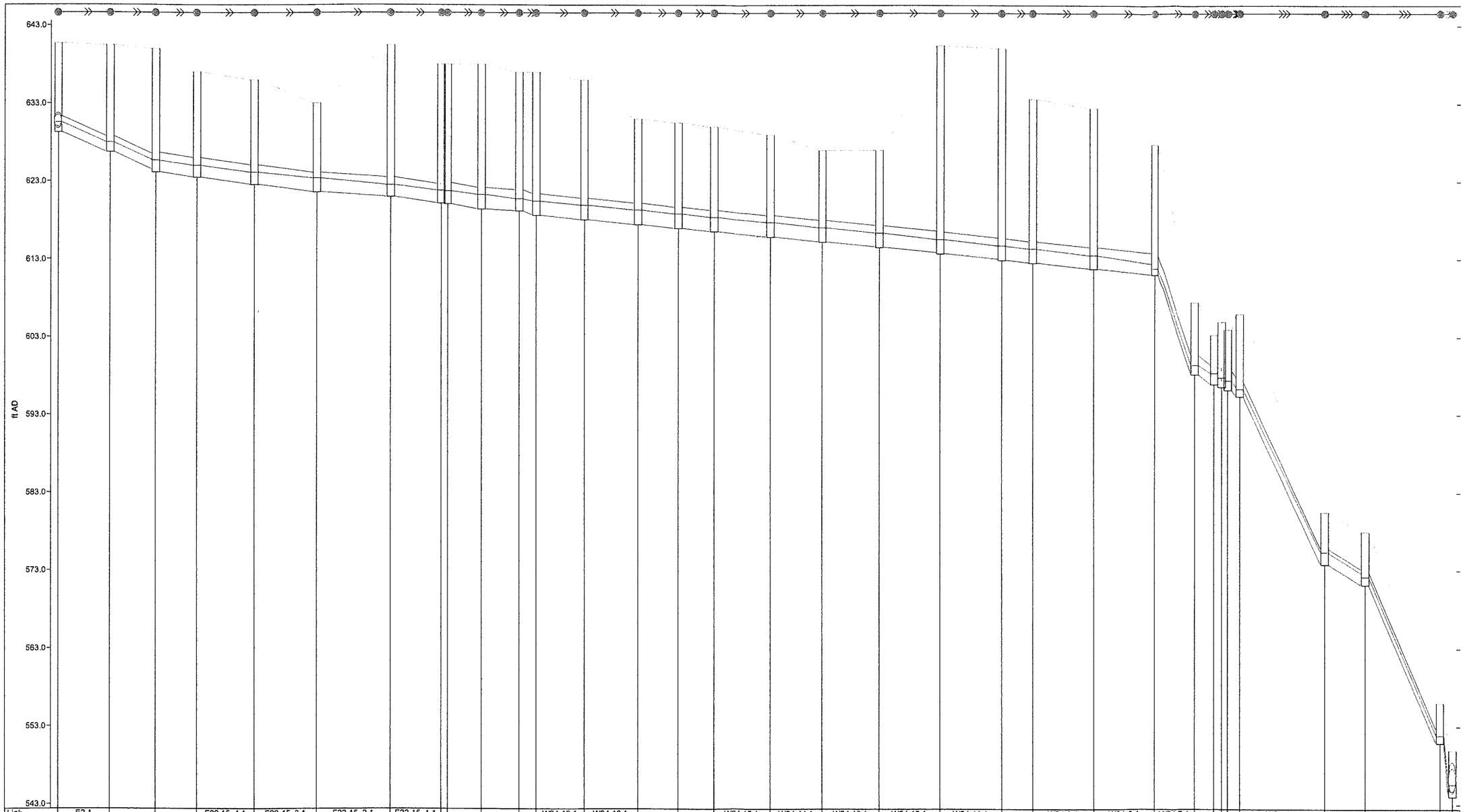
Capital Improvement Project E2

Project Description	Replace 4620 feet of 33-inch diameter RC pipe with 39-inch pipe between Manholes F22-15.7 and W24-7 north of the Arroyo Conejo flood control channel from east of Rancho Conejo Boulevard to east of Ventu Park Road.
Planning-Level Cost Estimate	$3,850,000
Implementation Phase	Long-Term
Project Basis	Capacity. This reach has marginal capacity. Existing dry weather peak flow of 5.3 mgd is 37 percent of the average nominal full-pipe capacity of 14.1 mgd. The existing peak wet weather flow of 11.6 mgd is 82 percent of capacity. At buildout, the peak dry and wet weather flows are projected to increase to 6.6 mgd and 12.6 mgd (89 percent of capacity). During buildout peak wet weather flow conditions, this reach would flow at a depth of 73 percent of the diameter. This reach was built in 1961 and was televised by National Plant Services in December of 2001. Most of the reach has minor surface corrosion and minor infiltration defects. Also, the pipe segments under the Ventu Park Road crossing sag significantly, causing the camera to be submerged for about 540 feet. However, the structural condition is adequate at this time. The capacity of this reach will be adequate unless future peak wet weather flows are higher than anticipated. Replacement of more critical upstream reaches of Unit E may have beneficial effects in terms of reducing infiltration. The condition of this reach is relatively good. With only minor corrosion, it is much less advanced than the moderate corrosion present in the steeper downstream reach that is recommended for lining with medium priority (Project E1).
Project Issues	Upsizing to a 39-inch pipe throughout will increase the capacity to 22.0 mgd. The buildout peak wet weather flow would then be 57 percent of the full-pipe capacity. If a 36-inch pipe were built instead, the peak flow would be 71 percent of capacity, which may be adequate but would not provide a good margin of safety.
Alternatives	Consideration could be given to building a smaller relief sewer either in the same or another alignment, and retaining the existing 33-inch sewer.

Capital Improvement Project E2

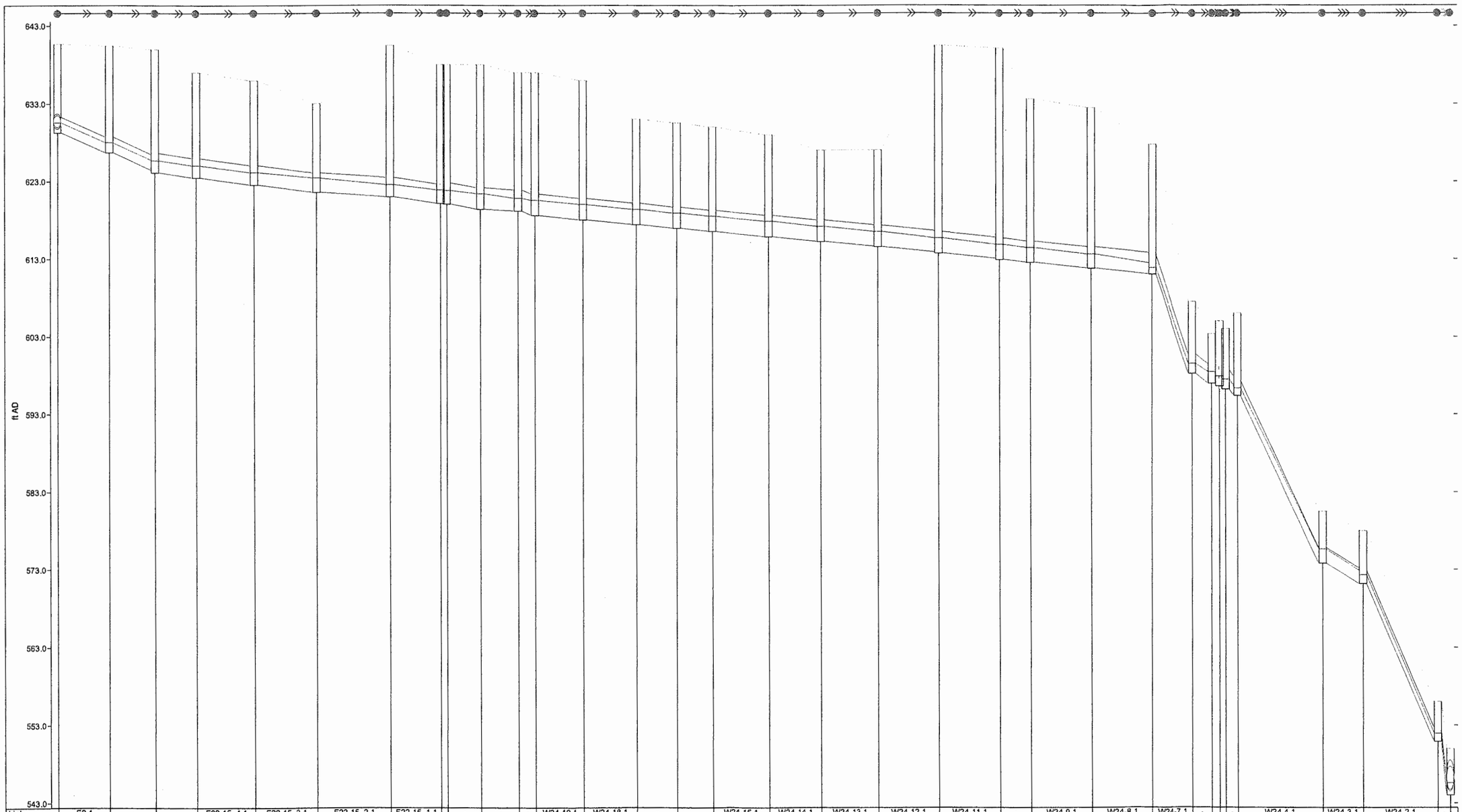


Capital Improvement Projects E1 and E2 - Existing WWF



Link	E2.1	-	-	F22-15_4.1	F22-15_3.1	F22-15_2.1	F22-15_1.1	-	-	-	W24-19.1	W24-18.1	-	-	W24-15.1	W24-14.1	W24-13.1	W24-12.1	W24-11.1	-	W24-9.1	W24-8.1	W24-7.1	-	-	-	W24-4.1	W24-3.1	W24-2.1	-
Cap	12.759	12.645	13.033	12.964	13.010	9.449	13.284	18.579	10.659	-	14.379	14.562	14.859	14.106	14.516	14.334	14.631	14.585	14.608	-	14.539	15.064	57.883	-	-	-	28.896	14.676	20.839	-
DepUs	1.236	1.245	1.519	1.530	1.564	1.798	1.528	1.663	1.887	-	1.838	1.839	1.866	1.894	1.867	1.858	1.821	1.814	1.815	1.835	1.821	1.743	0.799	-	-	-	0.977	1.518	1.019	-
VelUs	6.711	6.650	4.380	4.340	4.208	3.596	4.331	4.658	4.023	-	4.160	4.166	4.214	4.134	4.192	4.194	4.288	4.305	4.302	4.250	4.287	4.506	13.226	-	-	-	13.273	8.051	13.946	-
FloUs	6.79003	8.78824	8.78765	8.78745	8.78655	8.78487	8.78386	-	-	-	11.28438	11.28243	-	-	11.56743	11.56573	11.56412	11.56318	11.56320	-	11.56218	11.56126	-	-	-	-	13.09093	-	13.09073	-
Node	E2	F22-15_6	F22-15_5	F22-15_4	F22-15_3	F22-15_2	F22-15_1	-	-	-	-	W24-18	W24-17	W24-16	W24-15	W24-14	W24-13	W24-12	W24-11	W24-10	W24-9	W24-8	W24-7	W24-6	-	-	W24-4	W24-3	W24-2	W24-1 -

Capital Improvement Projects E1 and E2 - Buildout WWF



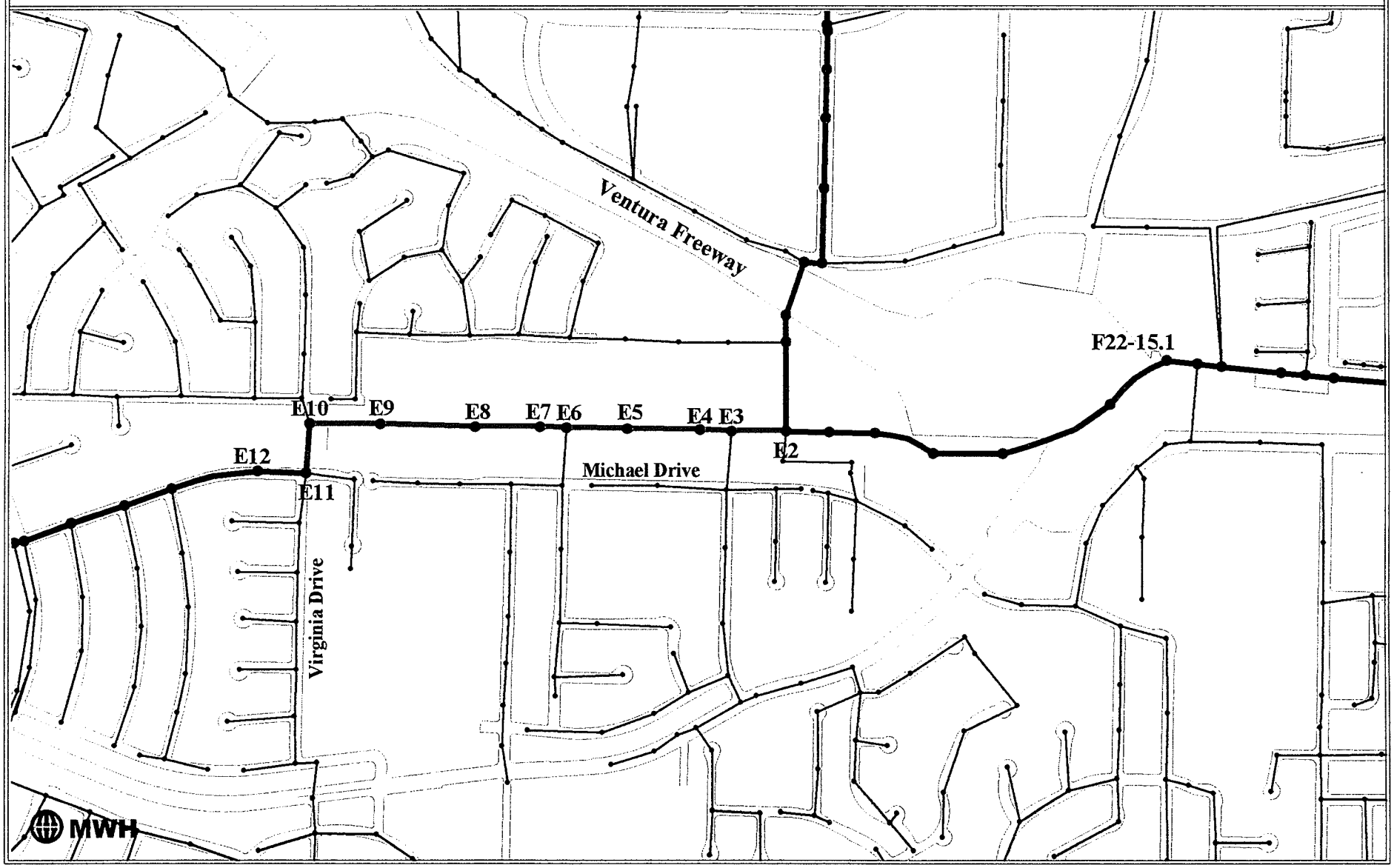
Link	E2.1	-	-	F22-15_4.1	F22-15_3.1	F22-15_2.1	F22-15_1.1	-	-	-	W24-19.1	W24-18.1	-	-	W24-15.1	W24-14.1	W24-13.1	W24-12.1	W24-11.1	-	W24-9.1	W24-8.1	W24-7.1	-	-	-	W24-4.1	W24-3.1	W24-2.1	-
Cap	12.759	12.645	13.033	12.964	13.010	9.449	13.284	18.579	10.659	-	14.379	14.562	14.859	14.106	14.516	14.334	14.631	14.585	14.608	-	14.539	15.064	57.883	-	-	-	28.896	14.676	20.839	-
DepUs	1.277	1.282	1.579	1.585	1.615	1.861	1.591	1.768	1.999	-	1.963	1.957	1.968	1.996	1.977	1.981	1.960	1.952	1.953	1.963	1.945	1.823	0.836	-	-	-	1.010	1.757	1.090	-
VelUs	6.785	6.733	4.386	4.367	4.272	3.656	4.347	4.705	4.105	-	4.186	4.198	4.271	4.208	4.251	4.243	4.301	4.330	4.319	4.282	4.325	4.648	13.497	-	-	-	13.781	8.053	14.011	-
FloUs	9.26229	9.26145	9.26069	9.26036	9.26040	9.25945	9.25834	-	-	-	12.26718	12.26634	-	-	12.55503	12.55514	12.55496	12.55438	12.55325	-	12.55119	12.55136	-	-	-	-	14.18026	-	14.17984	-

Node	E2	F22-15_6	F22-15_5	F22-15_4	F22-15_3	F22-15_2	F22-15_1	-	-	-	-	W24-18	W24-17	W24-16	W24-15	W24-14	W24-13	W24-12	W24-11	W24-10	W24-9	W24-8	W24-7	W24-6	-	-	W24-4	W24-3	W24-2	W24-1	-

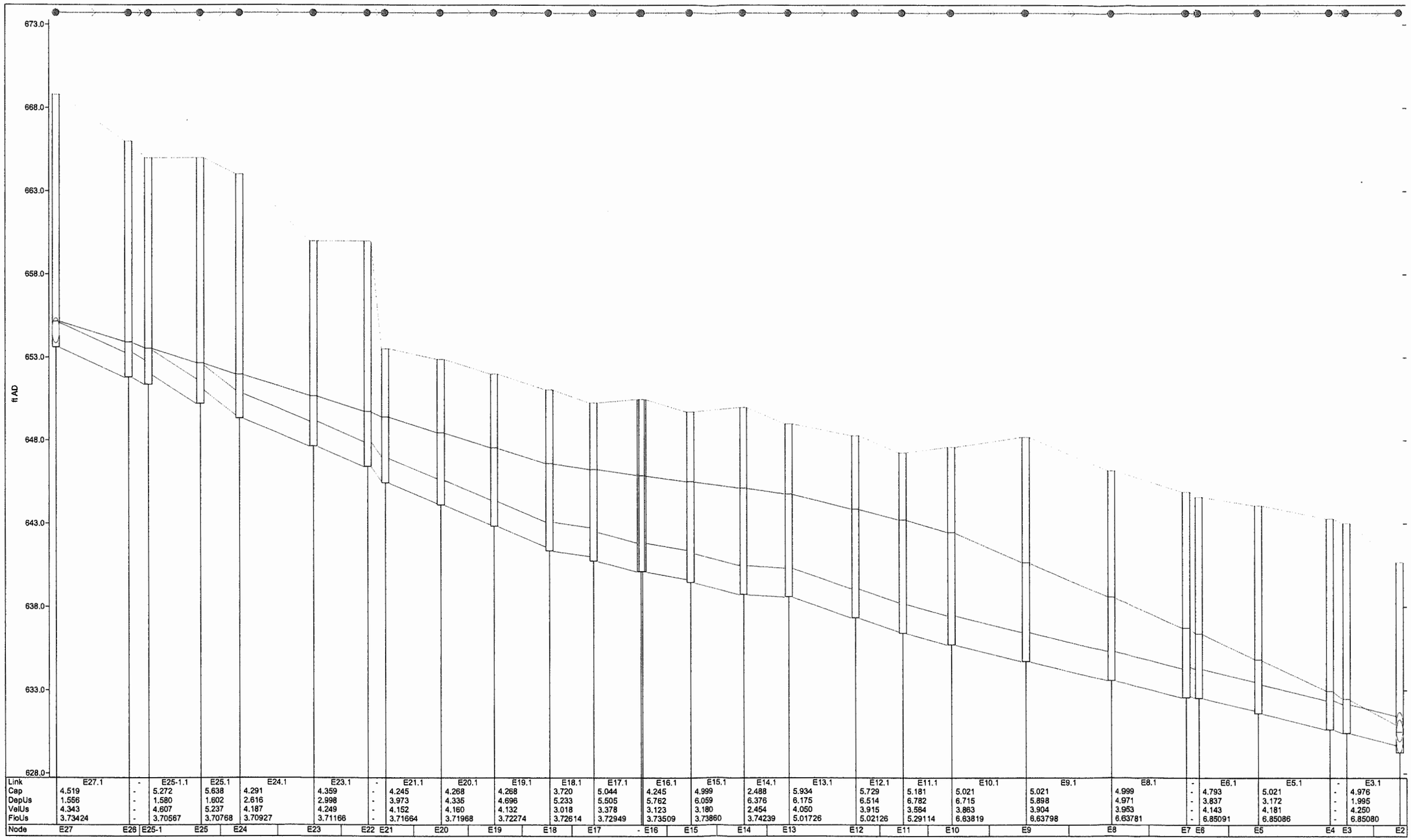
Capital Improvement Project E3

Project Description	Replace 2507 feet of 21-inch diameter VC pipe with 30-inch pipe between Manholes E10 and E2 north of the Arroyo Conejo flood control channel between Virginia Drive and the junction with Unit F.
Planning-Level Cost Estimate	$2,240,000
Implementation Phase	Short-Term
Project Basis	Capacity. Existing dry weather peak flow of 3.3 mgd is 66 percent of the nominal full-pipe capacity of 5.0 mgd. The existing peak wet weather flow of 6.8 mgd is 136 percent of capacity. At buildout, the peak dry and wet weather flows are projected to increase to 4.0 mgd and 7.2 mgd. As shown on the hydraulic profiles, at buildout peak wet weather flow conditions, the depth of flow is predicted to rise 5 feet above the crown of the pipe and to within about 2 or 3 feet of the ground at Manhole E10 and 11 upstream manholes. The flow depths would be about 1.5 feet lower under existing peak wet weather conditions. Temporary flow monitor M11 confirmed the flows in this reach and recorded surcharging under wet weather conditions. The existing sewer was built in 1960 and is in relatively good condition, but has potential sources of I/I and would require some point repairs if not replaced.
Project Issues	Upsizing to a 30-inch pipe will increase the capacity to 12.9 mgd. The buildout peak wet weather flow would then be 56% of the full-pipe capacity. If a 27-inch pipe were built instead, the peak flow would be 73% of capacity, which does not provide an adequate margin of safety. The existing sewer is in a 12-foot wide easement along the north side of a County flood control channel. The southern 3 feet of this easement is within the flood channel easement. In order to build the new pipe alongside the existing sewer and thus avoid bypassing flow, the City would need to acquire another 10 feet of permanent easement, either from the County (south toward the channel) or from private owners north of the existing easement.
Alternatives	Consideration could be given to building a smaller relief sewer either in the same or another alignment, and retaining the existing 21-inch sewer. An alternative route for a replacement or relief sewer would be south of the flood control channel, possibly in Michael Drive.

Capital Improvement Project E3



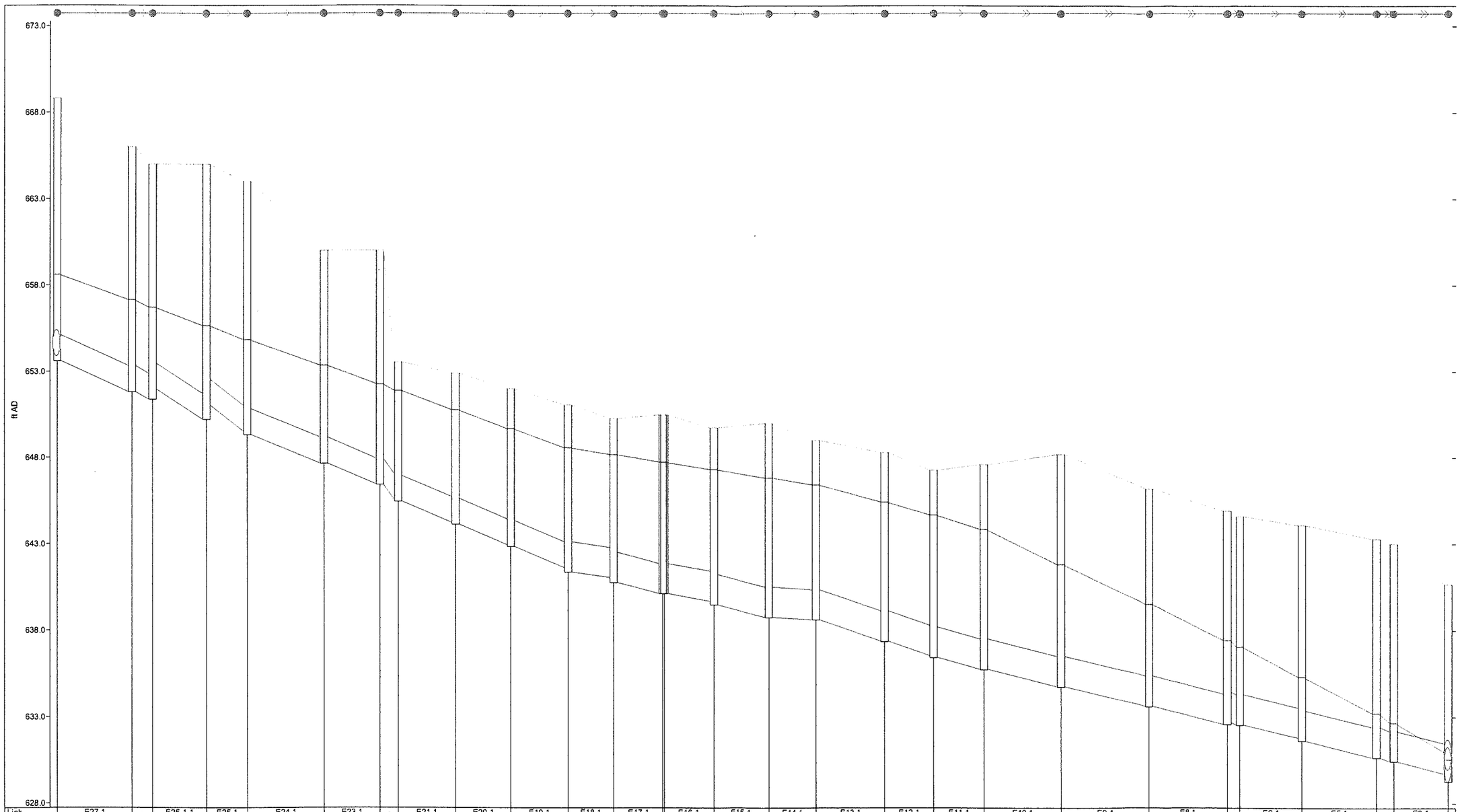
Capital Improvement Projects E3, E4 and E5 - Existing WWF



Link	E27.1	-	E25-1.1	E25.1	E24.1	E23.1	-	E21.1	E20.1	E19.1	E18.1	E17.1	E16.1	E15.1	E14.1	E13.1	E12.1	E11.1	E10.1	E9.1	E8.1	-	E6.1	E5.1	-	E3.1
Cap	4.519	-	5.272	5.638	4.291	4.359	-	4.245	4.268	4.268	3.720	5.044	4.245	4.999	2.488	5.934	5.729	5.181	5.021	5.021	4.999	-	4.793	5.021	-	4.976
DepUs	1.556	-	1.580	1.602	2.616	2.998	-	3.973	4.335	4.696	5.233	5.505	5.762	6.059	6.376	6.175	6.514	6.782	6.715	5.898	4.971	-	3.837	3.172	-	1.995
VelUs	4.343	-	4.607	5.237	4.187	4.249	-	4.152	4.160	4.132	3.018	3.378	3.123	3.180	2.454	4.050	3.915	3.564	3.863	3.904	3.953	-	4.143	4.181	-	4.250
FloUs	3.73424	-	3.70567	3.70768	3.70927	3.71166	-	3.71664	3.71968	3.72274	3.72614	3.72949	3.73509	3.73860	3.74239	5.01726	5.02126	5.29114	6.63819	6.63798	6.63781	-	6.85091	6.85086	-	6.85080

Node	E27	E26	E25-1	E25	E24	E23	E22	E21	E20	E19	E18	E17	-	E16	E15	E14	E13	E12	E11	E10	E9	E8	E7	E6	E5	E4	E3	E2

Capital Improvement Projects E3, E4 and E5 - Buildout WWF



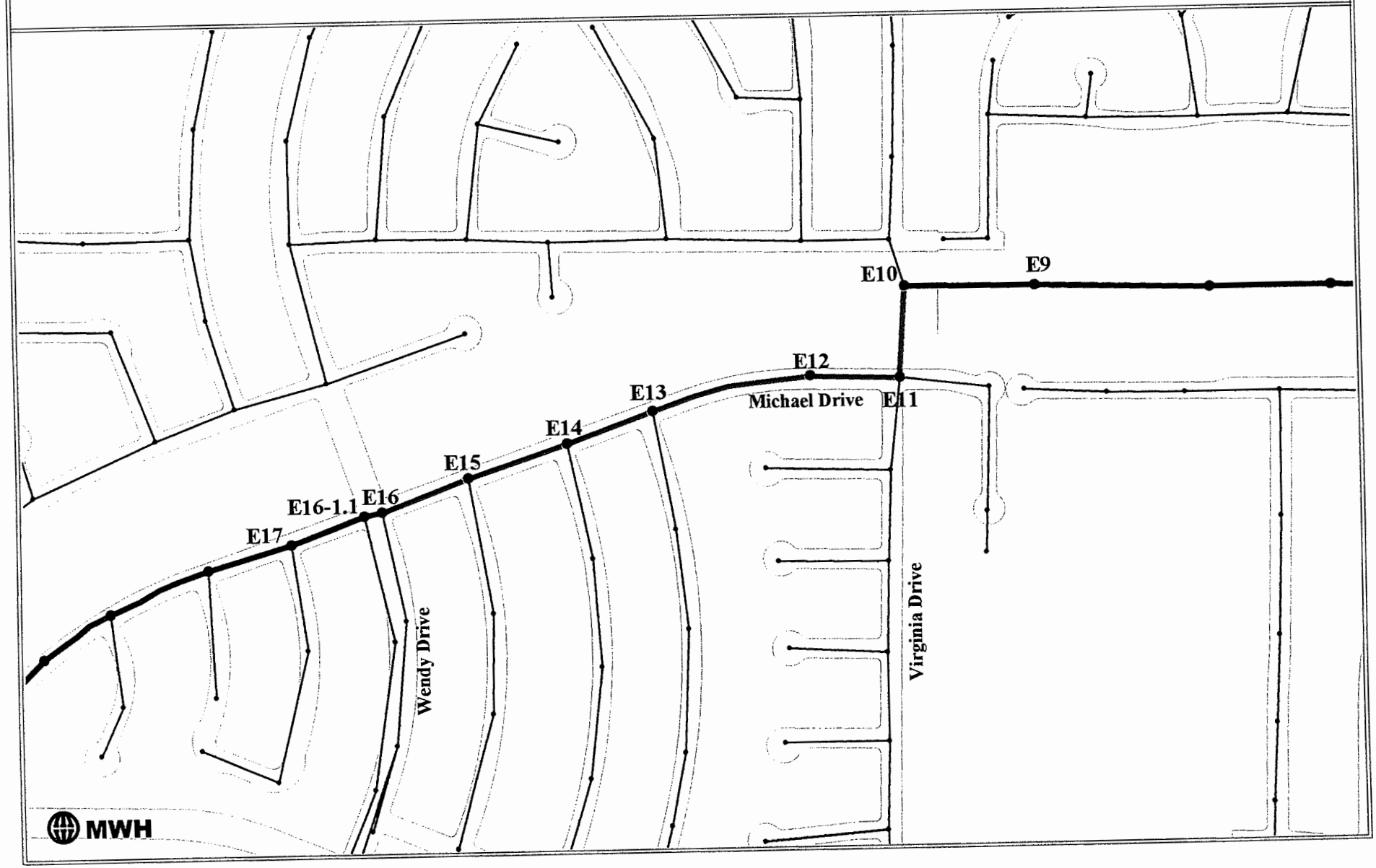
Link	E27.1	-	E25-1.1	E25.1	E24.1	E23.1	-	E21.1	E20.1	E19.1	E18.1	E17.1	E16.1	E15.1	E14.1	E13.1	E12.1	E11.1	E10.1	E9.1	E8.1	-	E6.1	E5.1	-	E3.1
Cap	4.519	-	5.272	5.638	4.291	4.359	-	4.245	4.268	4.268	3.720	5.044	4.245	4.999	2.488	5.934	5.729	5.181	5.021	5.021	4.999	-	4.793	5.021	-	4.976
DepUs	4.965	-	4.718	4.580	5.487	5.654	-	6.411	6.603	6.805	7.181	7.392	7.584	7.823	8.067	7.805	8.034	8.219	8.061	7.029	5.858	-	4.465	3.633	-	2.158
VelUs	4.342	-	4.614	5.290	4.207	4.249	-	4.153	4.169	4.168	3.130	3.435	3.238	3.254	2.654	4.127	3.989	3.588	4.013	4.067	4.130	-	4.338	4.387	-	4.478
FloUs	4.02213	-	4.02403	4.02557	4.02745	4.02999	-	4.03378	4.03611	4.03848	4.04115	4.04385	4.04839	4.05119	4.05414	5.32133	5.32486	5.60089	7.01897	7.01831	7.01777	-	7.23462	7.23441	-	7.23422

Node	E27	E26	E25-1	E25	E24	E23	E22	E21	E20	E19	E18	E17	-	E16	E15	E14	E13	E12	E11	E10	E9	E8	E7	E6	E5	E4	E3	E2

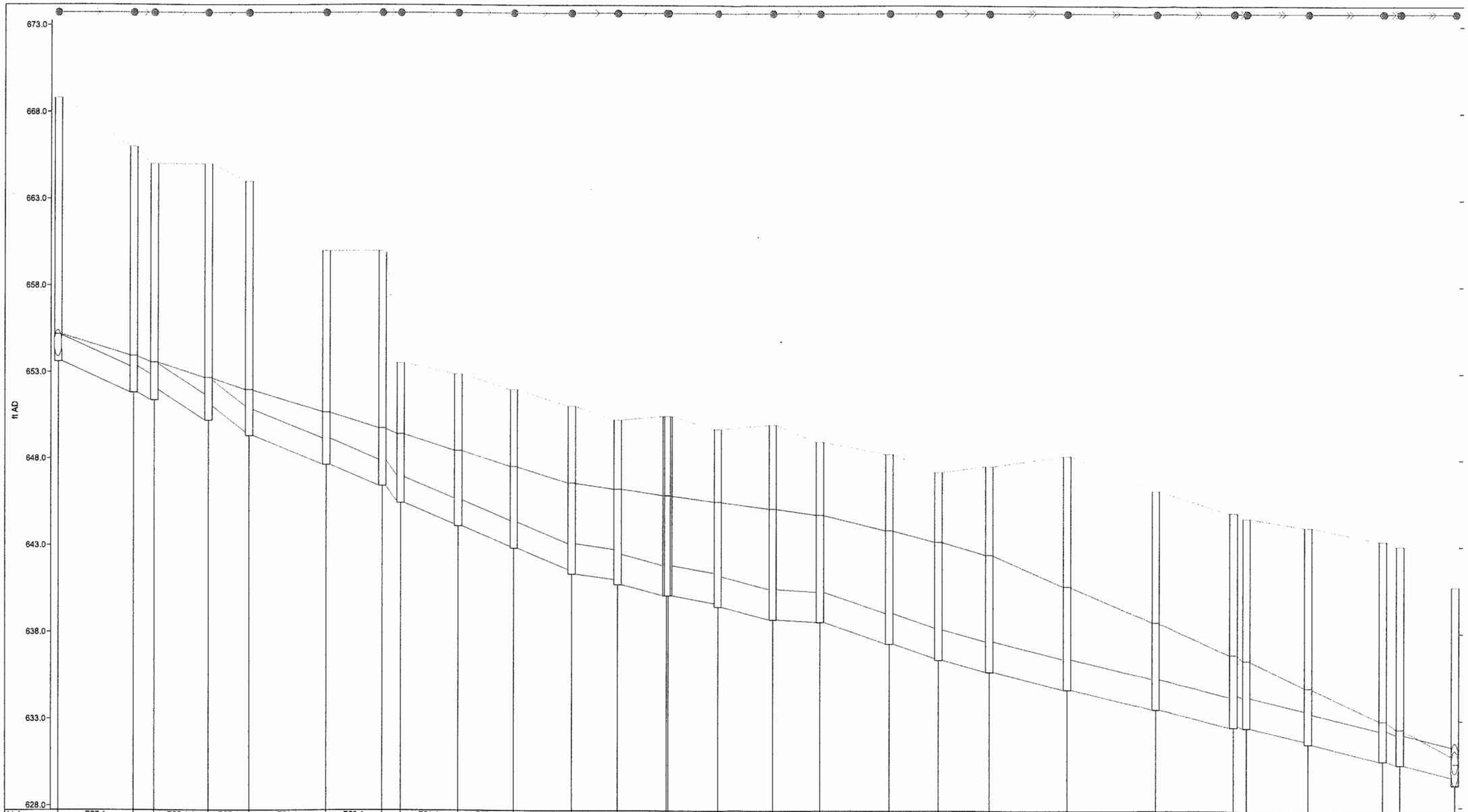
Capital Improvement Project E4

Project Description	Replace 1725 feet of 21-inch diameter VC pipe with 27-inch pipe between Manholes E16 and E10 in Michael Drive between Wendy Drive and Virginia Drive.
Planning-Level Cost Estimate	$1,445,000
Implementation Phase	Medium-Term
Project Basis	Capacity. Existing dry weather peak flow of 2.7 mgd is 52 percent of the average nominal full-pipe capacity of 5.2 mgd. The existing peak wet weather flow of 5.0 mgd is 96 percent of capacity. At buildout, the peak dry and wet weather flows are projected to increase to 3.4 mgd and 5.3 mgd. During buildout peak wet weather flow conditions, this reach would be surcharged some 5 feet due to the severe downstream flow restriction between Manholes E10 and E2, but would flow full even if the downstream reach were relieved via Project E3. The existing sewer was built in 1961 and is in relatively good condition, but has potential sources of I/I.
Project Issues	Upsizing to a 27-inch pipe will increase the capacity to 10.1 mgd. The buildout peak wet weather flow would then be 52% of the full-pipe capacity. If a 24-inch pipe were built instead, the peak flow would be 72% of capacity, which does not provide an adequate margin of safety. The most downstream pipe segment of this project (Manhole E11 to E10) crosses the flood control channel (not a siphon). An additional 10 or 12 foot wide easement crossing the channel would be required to build the project alongside the existing sewer to avoid the need to bypass flow.
Alternatives	Consideration could be given to building a smaller relief sewer either in the same or another alignment, and retaining the existing 21-inch sewer.

Capital Improvement Project E4



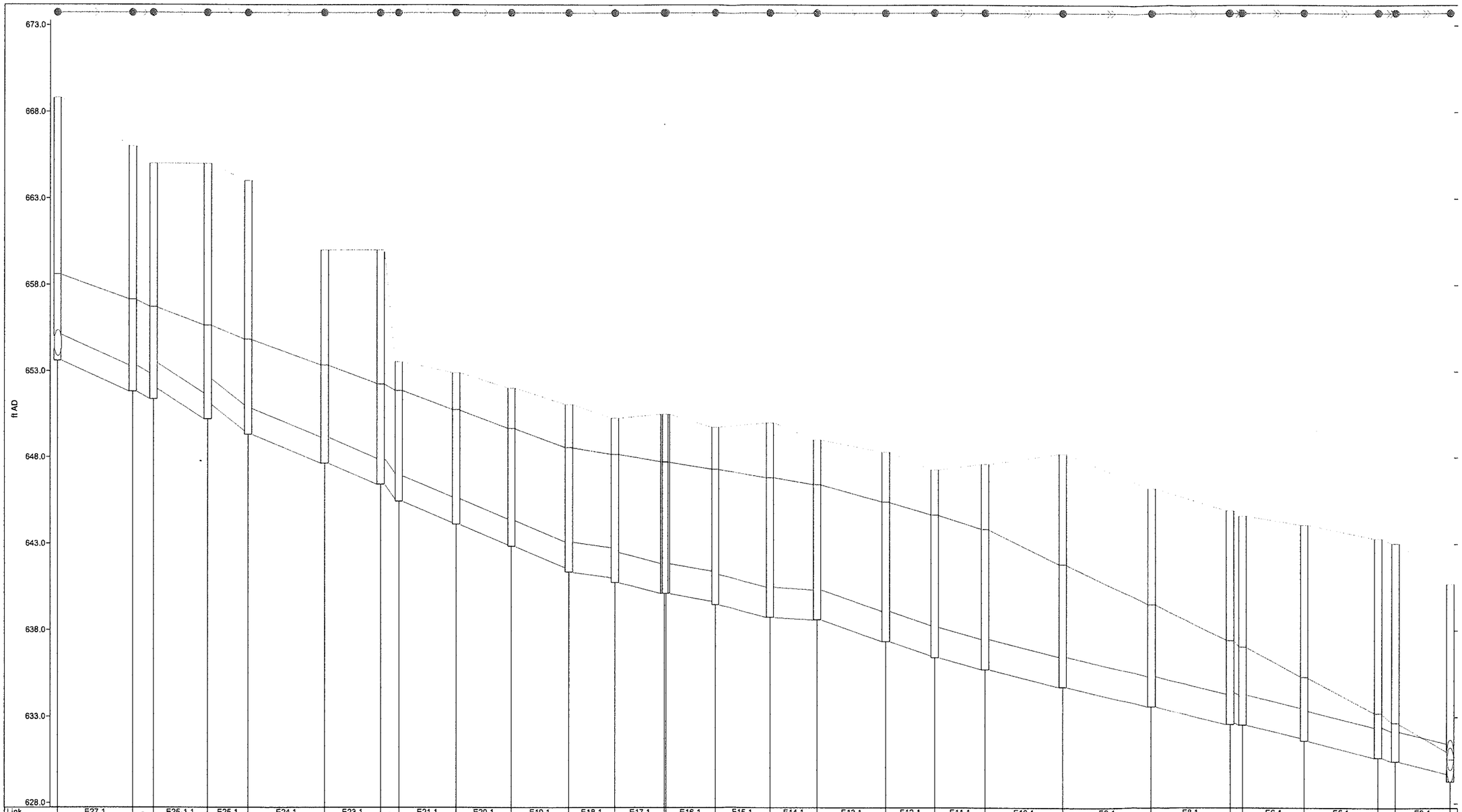
Capital Improvement Projects E3, E4 and E5 - Existing WWF



Link	E27.1	-	E25-1.1	E25.1	E24.1	E23.1	-	E21.1	E20.1	E19.1	E18.1	E17.1	E16.1	E15.1	E14.1	E13.1	E12.1	E11.1	E10.1	E9.1	E8.1	-	E6.1	E5.1	-	E3.1
Cap	4.519	-	5.272	5.638	4.291	4.359	-	4.245	4.268	4.268	3.720	5.044	4.245	4.999	2.488	5.934	5.729	5.181	5.021	5.021	4.999	-	4.793	5.021	-	4.976
DepUs	1.556	-	1.580	1.602	2.616	2.998	-	3.973	4.335	4.696	5.233	5.505	5.762	6.059	6.376	6.175	6.514	6.782	6.715	5.898	4.971	-	3.837	3.172	-	1.995
VelUs	4.343	-	4.607	5.237	4.187	4.249	-	4.152	4.160	4.132	3.018	3.378	3.123	3.180	2.454	4.050	3.915	3.564	3.863	3.904	3.953	-	4.143	4.181	-	4.250
FloUs	3.73424	-	3.70567	3.70768	3.70927	3.71166	-	3.71664	3.71968	3.72274	3.72614	3.72949	3.73509	3.73860	3.74239	5.01726	5.02126	5.29114	6.63819	6.63798	6.63781	-	6.85091	6.85086	-	6.85080

Node	E27	E26	E25-1	E25	E24	E23	E22	E21	E20	E19	E18	E17	-	E16	E15	E14	E13	E12	E11	E10	E9	E8	E7	E6	E5	E4	E3	E2

Capital Improvement Projects E3, E4 and E5 - Buildout WWF



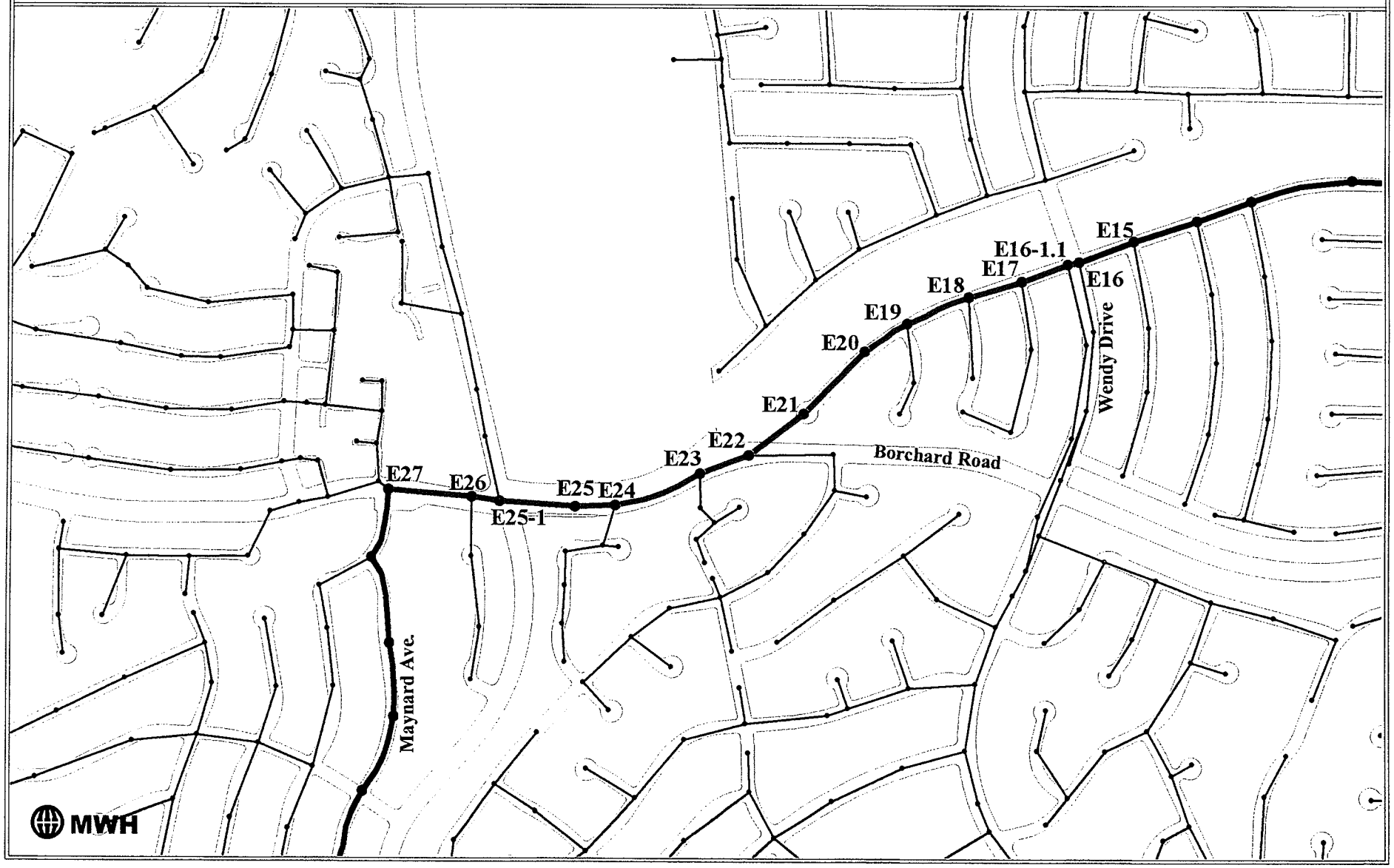
Link	E27.1	-	E25-1.1	E25.1	E24.1	E23.1	-	E21.1	E20.1	E19.1	E18.1	E17.1	E16.1	E15.1	E14.1	E13.1	E12.1	E11.1	E10.1	E9.1	E8.1	-	E6.1	E5.1	-	E3.1
Cap	4.519	-	5.272	5.638	4.291	4.359	-	4.245	4.268	4.268	3.720	5.044	4.245	4.999	2.488	5.934	5.729	5.181	5.021	5.021	4.999	-	4.793	5.021	-	4.976
DepUs	4.965	-	4.718	4.580	5.487	5.654	-	6.411	6.603	6.805	7.181	7.392	7.584	7.823	8.067	7.805	8.034	8.219	8.061	7.029	5.858	-	4.465	3.633	-	2.158
VelUs	4.342	-	4.614	5.290	4.207	4.249	-	4.153	4.169	4.168	3.130	3.435	3.238	3.254	2.654	4.127	3.989	3.588	4.013	4.067	4.130	-	4.338	4.387	-	4.478
FloUs	4.02213	-	4.02403	4.02557	4.02745	4.02999	-	4.03378	4.03611	4.03848	4.04115	4.04385	4.04839	4.05119	4.05414	5.32133	5.32486	5.60089	7.01897	7.01831	7.01777	-	7.23462	7.23441	-	7.23422

Node	E27	E26	E25-1	E25	E24	E23	E22	E21	E20	E19	E18	E17	-	E16	E15	E14	E13	E12	E11	E10	E9	E8	E7	E6	E5	E4	E3	E2

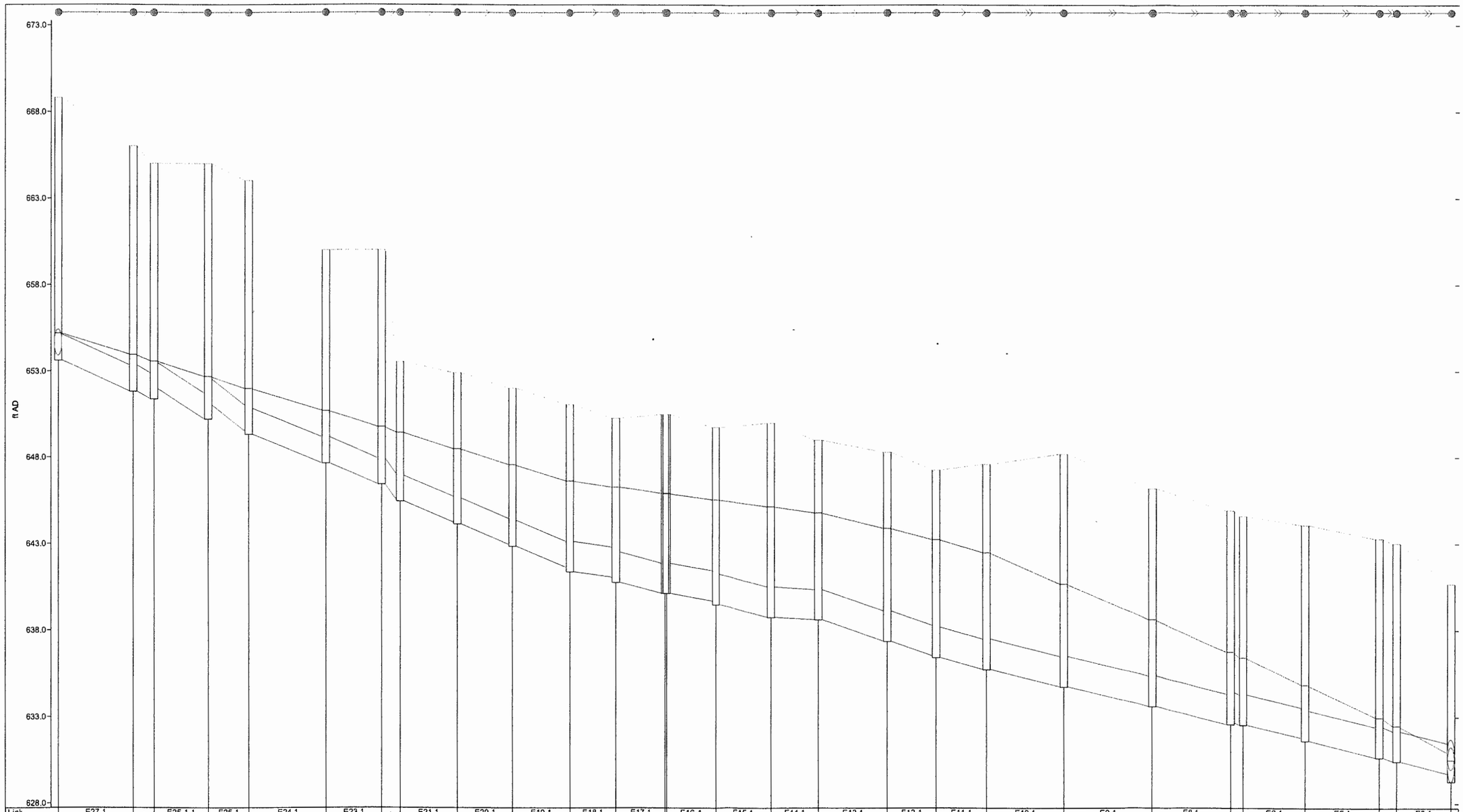
Capital Improvement Project E5

Project Description	Replace 3317 feet of 18-inch diameter VC pipe (includes a short reach of 21-inch pipe) with 24-inch pipe between Manholes E27 and E16 in Borchard Road and Michael Drive between Maynard Avenue and Wendy Drive.
Planning-Level Cost Estimate	$2,015,000
Implementation Phase	Medium-Term
Project Basis	Capacity. Existing dry weather peak flow of 2.2 mgd is 51 percent of the average nominal full-pipe capacity of 4.3 mgd. The existing peak wet weather flow of 3.7 mgd is 86 percent of capacity. At buildout, the peak dry and wet weather flows are projected to increase to 2.8 mgd and 4.0 mgd. During buildout peak wet weather flow conditions, this reach would be surcharged due to the severe downstream flow restriction between Manholes E10 and E2, but would flow nearly full even if the downstream reach were relieved via Project E3. The existing sewer was built in 1961 and is in relatively good condition, but has potential sources of I/I.
Project Issues	Upsizing to a 24-inch pipe throughout will increase the capacity to 9.3 mgd. The buildout peak wet weather flow would then be 43% of the full-pipe capacity. If a 21-inch pipe were built instead, the peak flow would be 62% of capacity, which may be adequate but would not provide a full margin of safety desired (i.e, flow less that 60% of capacity).
Alternatives	Consideration could be given to building a smaller relief sewer either in the same or another alignment, and retaining the existing 18-inch sewer.

Capital Improvement Project E5



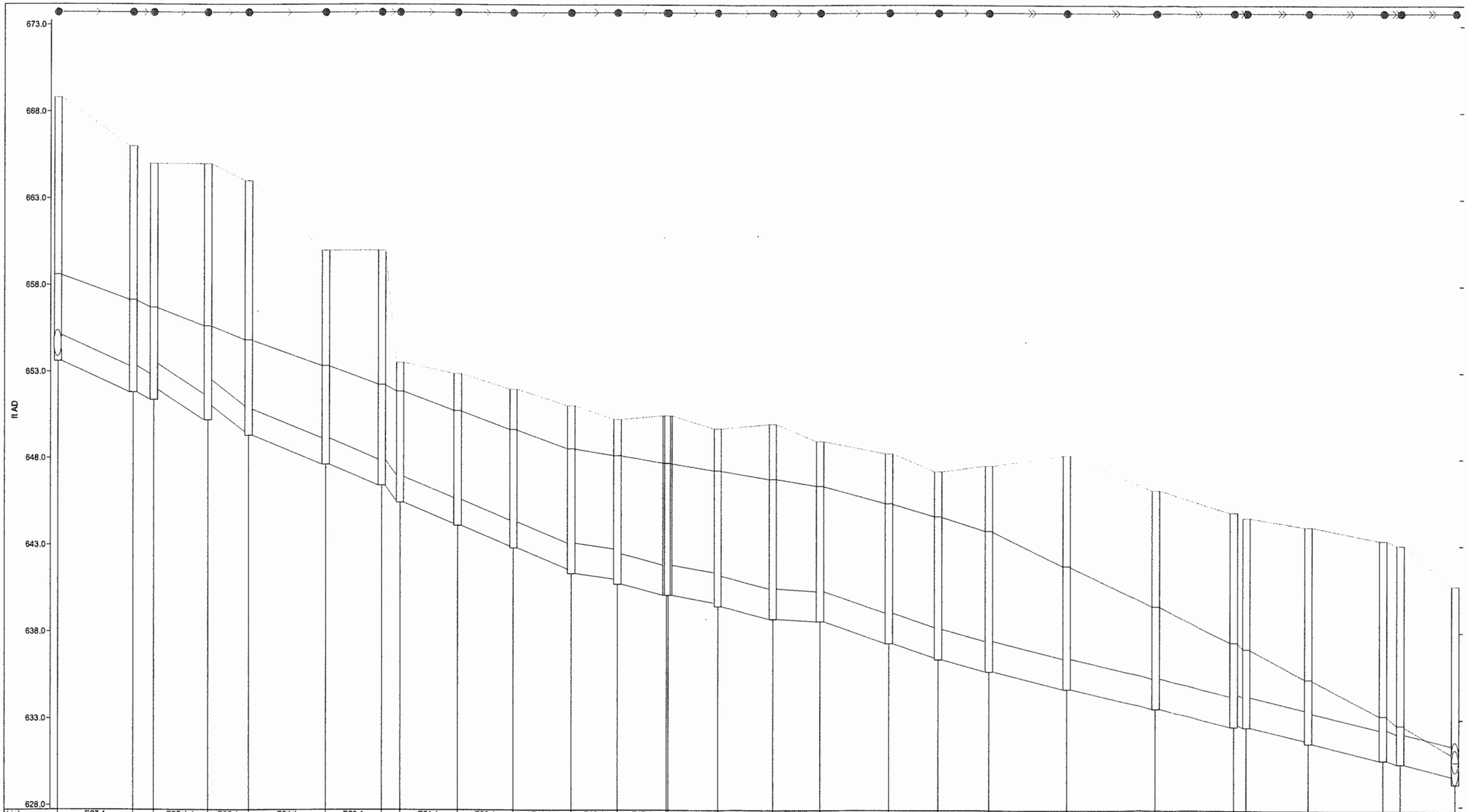
Capital Improvement Projects E3, E4 and E5 - Existing WWF



Link	E27.1	-	E25-1.1	E25.1	E24.1	E23.1	-	E21.1	E20.1	E19.1	E18.1	E17.1	E16.1	E15.1	E14.1	E13.1	E12.1	E11.1	E10.1	E9.1	E8.1	-	E6.1	E5.1	-	E3.1
Cap	4.519	-	5.272	5.638	4.291	4.359	-	4.245	4.268	4.268	3.720	5.044	4.245	4.999	2.488	5.934	5.729	5.181	5.021	5.021	4.999	-	4.793	5.021	-	4.976
DepUs	1.556	-	1.580	1.602	2.616	2.998	-	3.973	4.335	4.696	5.233	5.505	5.762	6.059	6.376	6.175	6.514	6.782	6.715	5.898	4.971	-	3.837	3.172	-	1.995
VelUs	4.343	-	4.607	5.237	4.187	4.249	-	4.152	4.160	4.132	3.018	3.378	3.123	3.180	2.454	4.050	3.915	3.564	3.863	3.904	3.953	-	4.143	4.181	-	4.250
FloUs	3.73424	-	3.70567	3.70768	3.70927	3.71166	-	3.71664	3.71968	3.72274	3.72614	3.72949	3.73509	3.73860	3.74239	5.01726	5.02126	5.29114	6.63819	6.63798	6.63781	-	6.85091	6.85086	-	6.85080

Node	E27	E26	E25-1	E25	E24	E23	E22	E21	E20	E19	E18	E17	- E16	E15	E14	E13	E12	E11	E10	E9	E8	E7	E6	E5	E4	E3	E2

Capital Improvement Projects E3, E4 and E5 - Buildout WWF



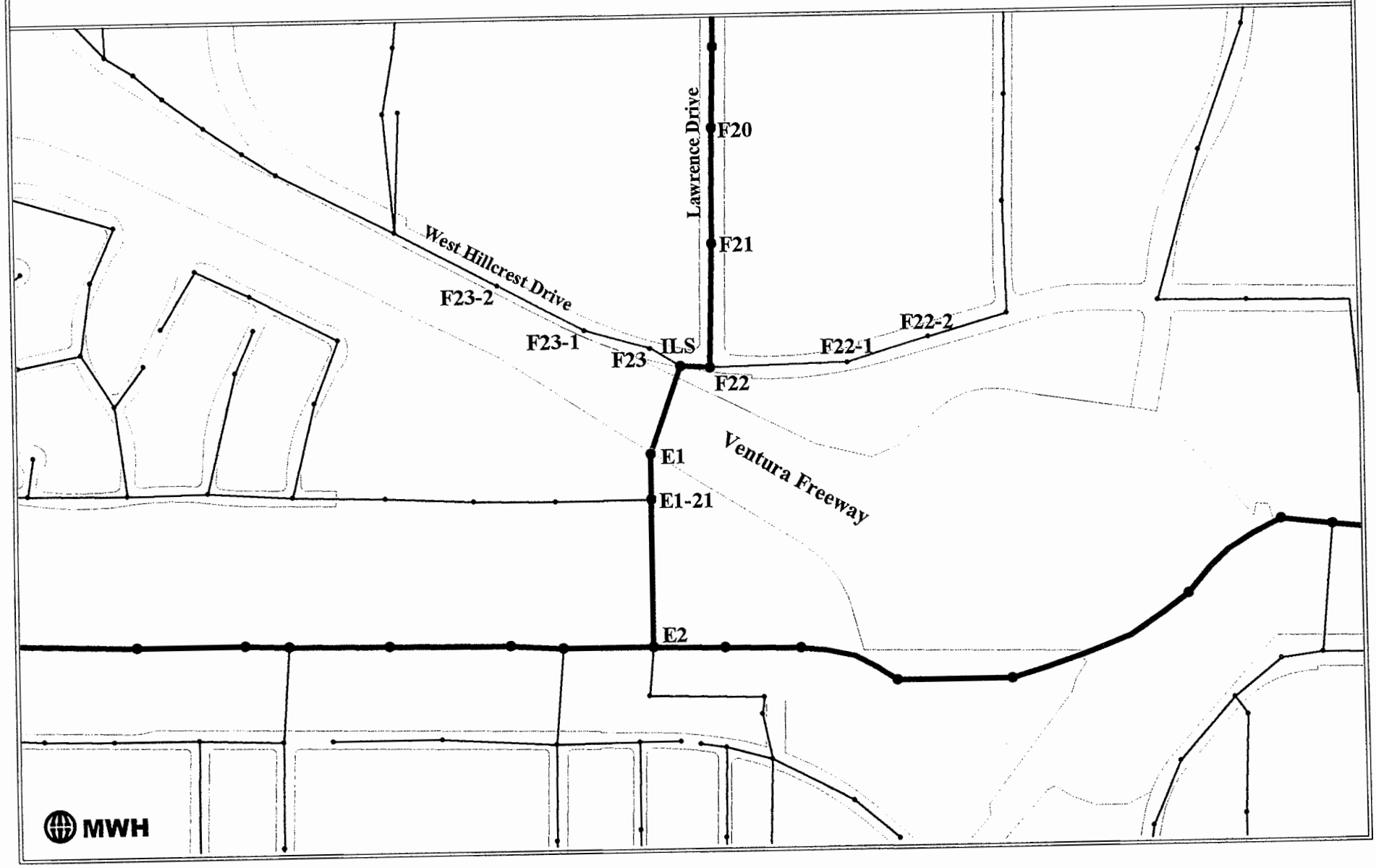
Link	E27.1	-	E25-1.1	E25.1	E24.1	E23.1	-	E21.1	E20.1	E19.1	E18.1	E17.1	E16.1	E15.1	E14.1	E13.1	E12.1	E11.1	E10.1	E9.1	E8.1	-	E6.1	E5.1	-	E3.1
Cap	4.519	-	5.272	5.638	4.291	4.359	-	4.245	4.268	4.268	3.720	5.044	4.245	4.999	2.488	5.934	5.729	5.181	5.021	5.021	4.999	-	4.793	5.021	-	4.976
DepUs	4.965	-	4.718	4.580	5.487	5.654	-	6.411	6.603	6.805	7.181	7.392	7.584	7.823	8.067	7.805	8.034	8.219	8.061	7.029	5.858	-	4.465	3.633	-	2.158
VelUs	4.342	-	4.614	5.290	4.207	4.249	-	4.153	4.169	4.168	3.130	3.435	3.238	3.254	2.654	4.127	3.989	3.588	4.013	4.067	4.130	-	4.338	4.387	-	4.478
FloUs	4.02213	-	4.02403	4.02557	4.02745	4.02999	-	4.03378	4.03611	4.03848	4.04115	4.04385	4.04839	4.05119	4.05414	5.32133	5.32486	5.60089	7.01897	7.01831	7.01777	-	7.23462	7.23441	-	7.23422

Node	E27	E26	E25-1	E25	E24	E23	E22	E21	E20	E19	E18	E17	-	E16	E15	E14	E13	E12	E11	E10	E9	E8	E7	E6	E5	E4	E3	E2

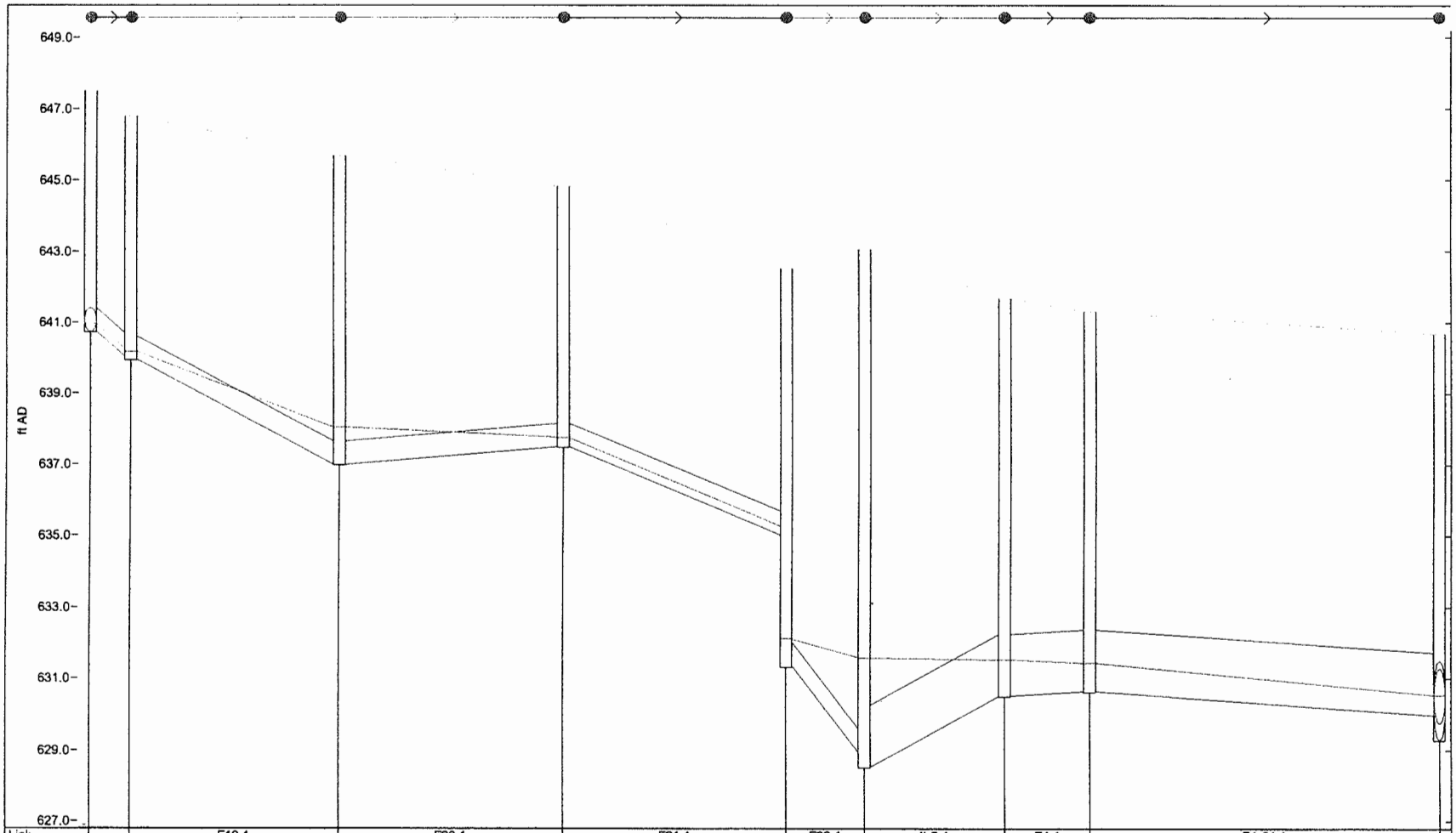
Capital Improvement Project E6

Project Description	Details of a preliminary design study for this project are provided in Appendix K. The project will bypass flow around the abandoned Industrial Lift Station (ILS) and construct a new pipe crossing under Highway 101. The project includes: Construct new junction manhole near ILS Jack and bore steel casing under Highway 101 to Manhole E1 Install approx. 220 feet of 21-inch PVC gravity sewer in casing Replace and raise 650 ft of sewer west of ILS in W. Hillcrest Dr. Replace and raise 800 ft of sewer east of ILS in W. Hillcrest Dr.
Planning-Level Cost Estimate	$485,000
Implementation Phase	Short-Term
Project Basis	Maintenance. The existing 21-inch diameter pipe under Highway 101 was originally built to flow south-to-north into the ILS. Although the ILS was abandoned many years ago, flow still runs through the wet well and the system must be operated in a surcharged mode to push flow south. The reverse gradient of the pipe under Highway 101 is 1.9 feet, based on a recent survey performed as part of this study. The constant backup of flow in the wet well extends up into the influent sewers in West Hillcrest Drive and creates an ongoing maintenance and odor problem. On the south side of Highway 101, the 21-inch diameter sewer is essential flat from Manhole E1 to Manhole E1-21, and then drops 0.6 feet to Manhole E2. Although the pipe from E1 to E2 has a relatively flat slope, modeling indicates that flow velocities are adequate to avoid deposition. This project recommended for short-term implementation since it addresses an existing and ongoing maintenance problem, and construction south of the freeway will be problematic after the property is developed. However, this is not a critical capacity or condition problem that could lead to an overflow. Deterioration of the upstream sewers has not been observed, although the current mode of operation could lead to faster deterioration.
Project Issues	In order to create a positive gradient under Highway 101, the new sewer near the ILS must be raised, requiring the reconstruction of the downstream ends of the two sewers on W. Hillcrest Dr. The sewer on Lawrence Dr. is sufficiently high as-is to tie in. This project provides a long-term solution to the maintenance and odor problem, and can be built without bypassing flow.
Alternatives	See Appendix K for analysis of 5 alternatives, including pumping options. The recommended project is Alternative 3.

Capital Improvement Project E6



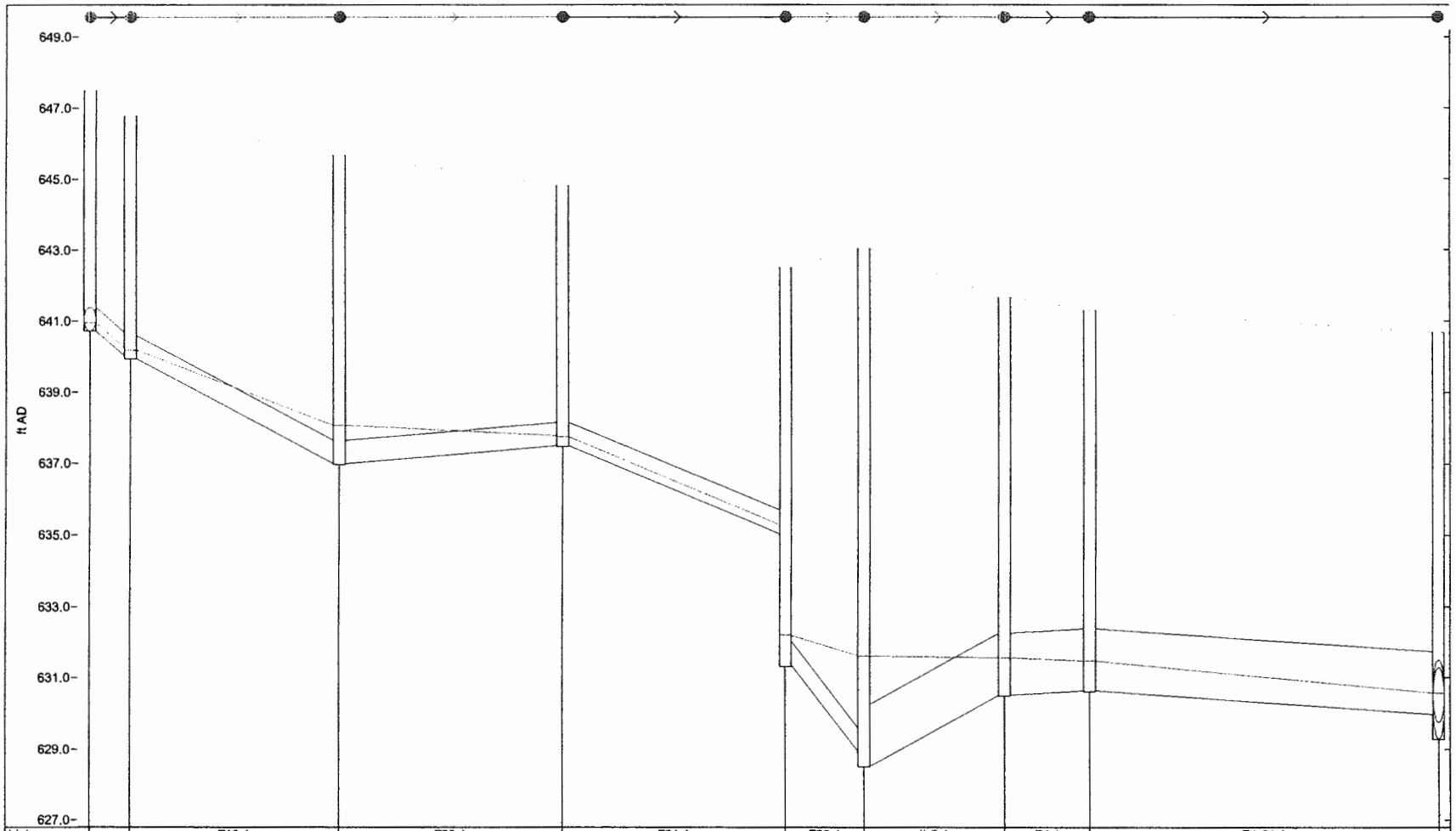
Capital Improvement Project E6 - Existing WWF



Link	-	F19.1	F20.1	F21.1	F22.1	ILS.1	E1.1	E1-21.1
Cap	-	0.753	-0.297	0.662	1.096	-9.792	-3.104	3.561
DepUs	-	0.239	1.067	0.253	0.779	3.063	1.035	0.816
VelUs	-	2.633	0.806	2.427	3.254	0.867	1.482	2.229
FloUs	-	0.19083	0.19065	0.19065	0.49251	1.41784	1.41769	1.58232

Node	-	F19	F20	F21	F22	ILS	E1	E1-21	E2

Capital Improvement Project E6 - Buildout WWF



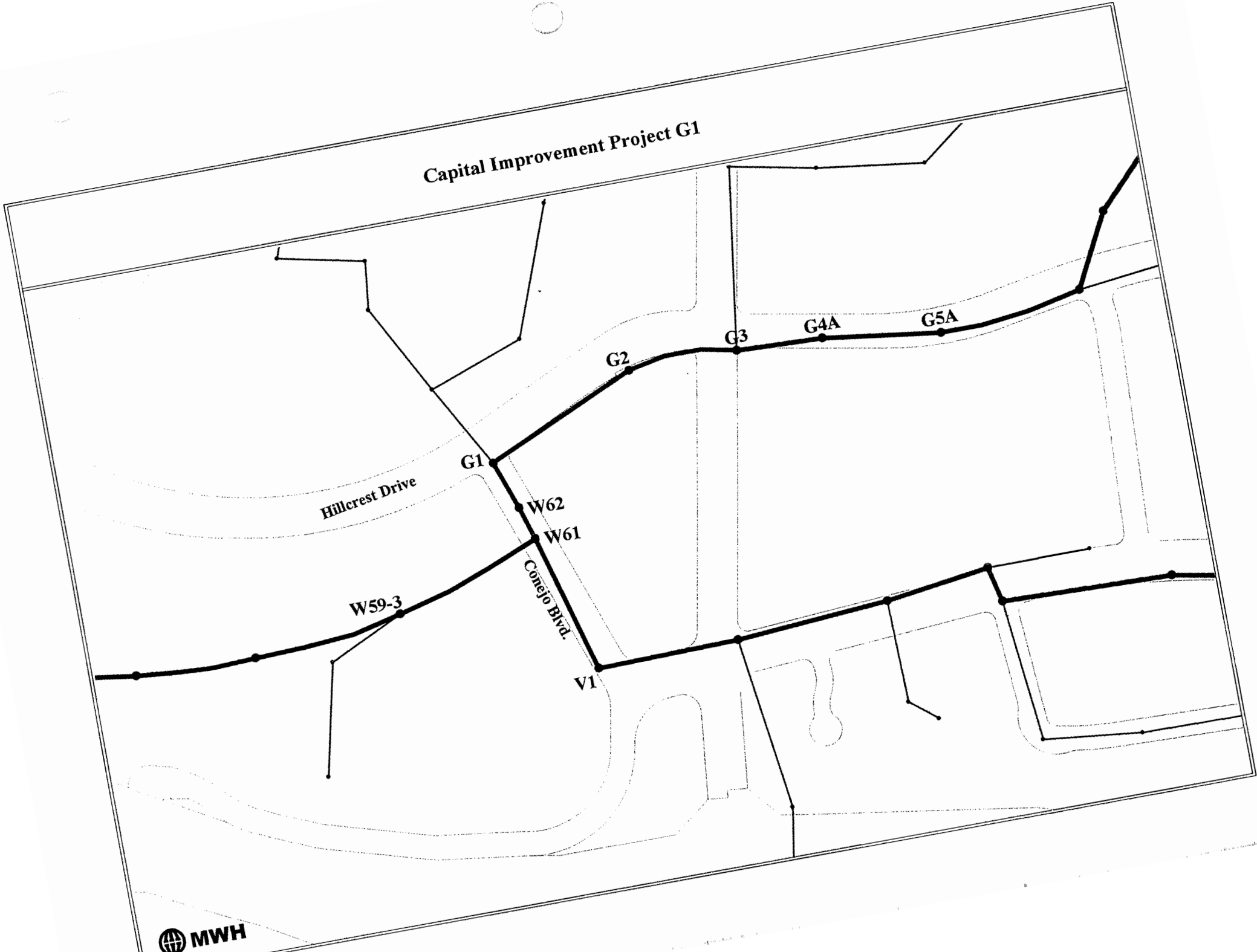
Link	-	F19.1	F20.1	F21.1	F22.1	ILS.1	E1.1	E1-21.1
Cap	-	0.753	-0.297	0.662	1.096	-9.792	-3.104	3.561
DepUs	-	0.243	1.092	0.261	0.849	3.092	1.061	0.843
VelUs	-	2.689	0.845	2.445	3.239	0.899	1.493	2.248
FloUs	-	0.20014	0.19998	0.19995	0.51190	1.47110	1.47098	1.66549

Node	-	F19	F20	F21	F22	ILS	E1	E1-21	E2

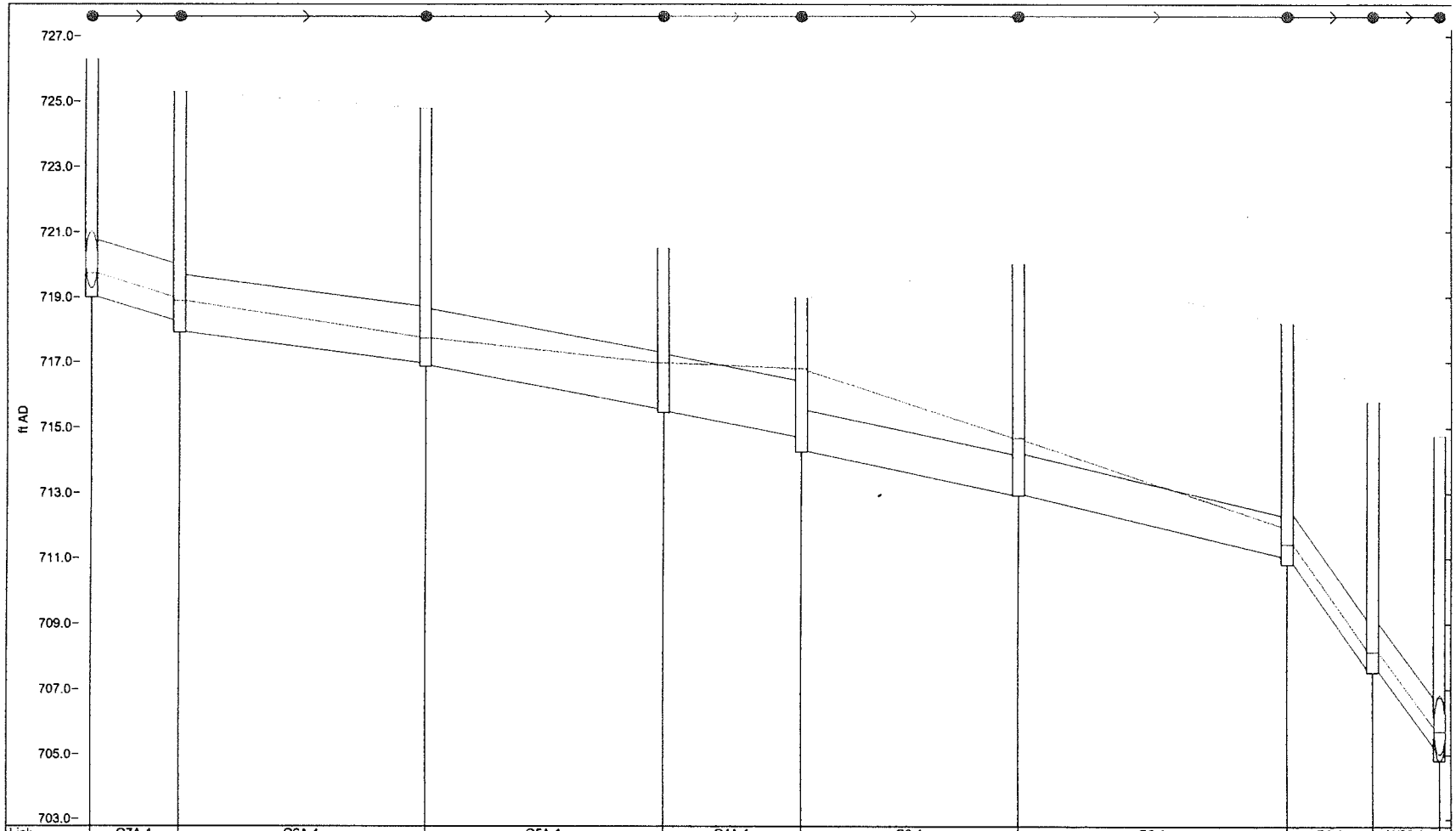
Capital Improvement Project G1

Project Description	Replace 670 feet of 15-inch diameter VC pipe with 21-inch pipe between Manholes G3 and G1 in Hillcrest Drive west of Moorpark Road. Manhole G3 should be sealed as an interim measure.
Planning-Level Cost Estimate	$370,000
Implementation Phase	Short-Term
Project Basis	Capacity. This reach is a major capacity bottleneck, as indicated in the hydraulic profiles. Existing dry weather peak flow of 3.2 mgd is 110 percent of the nominal full-pipe capacity of 2.9 mgd. During existing peak wet weather flow conditions (3.4 mgd), the depth of flow is predicted to rise 1.25 feet above the crown of the pipe at Manhole G3, where there is only 3.5 feet of cover over the crown. At buildout, the peak wet weather flow is projected to increase to 3.7 mgd, and surcharging would increase to within 1.5 feet of the ground. Surcharging in the project reach has been confirmed by City staff and has prevented this reach from being televised in the past. Temporary flow monitor M6 was located just downstream of the project reach and confirmed the accuracy of the modeled dry and wet weather peak flows.
Project Issues	This reach was built in 1961. A nighttime television inspection was performed in December 2001. High flow depths prevented inspection of all but the most upstream 100 feet of the reach between Manholes G3 and G2. A severe offset joint was observed. The reach between Manholes G2 and G1 was inspected and found to have several severe sags. City staff inspected the reach downstream from Manhole G1 to Manhole W61 in December 2001 and no defects were observed. The reach upstream of Manhole G3 was built in 1981 and is in good condition based on television inspection in 1997.
Alternatives	Due to the age and condition problems in this reach, replacement is required. Alternatives are limited to sizing of the new pipe. Upsizing to a 21-inch pipe will increase the capacity to 7.1 mgd, with a velocity of 4.6 ft/sec. The buildout peak wet weather flow would then be 52% of the full-pipe capacity. If an 18-inch pipe were built instead, the peak flow would be 78% of capacity, which does not provide an adequate margin of safety. The use of a 21-inch replacement pipe is also appropriate since the pipes immediately upstream were replaced with 21-inch pipes in 1981 (capacity of 6.5 mgd), as part of a 4800-foot replacement project.

Capital Improvement Project G1



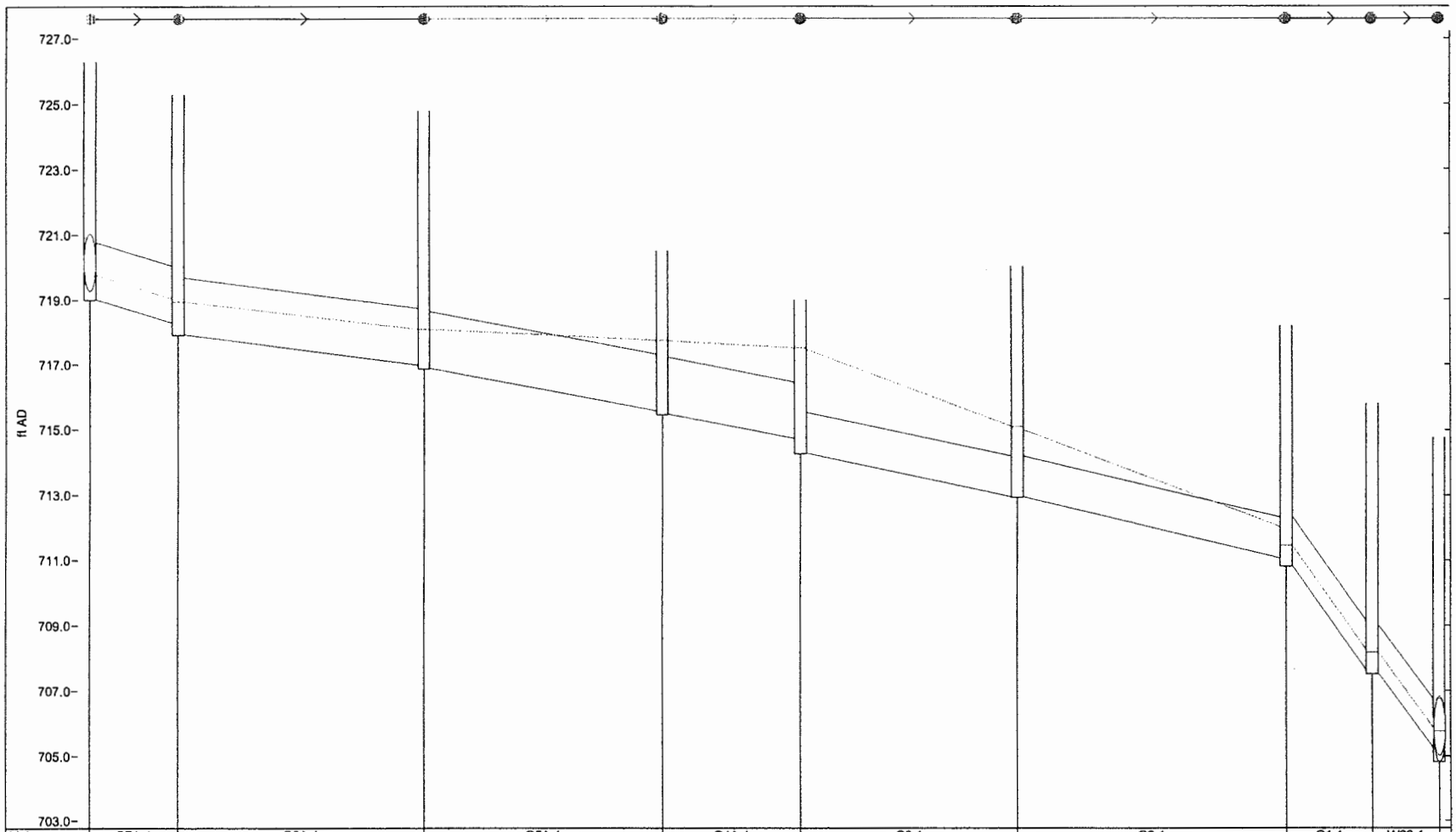
Capital Improvement Project G1 - Existing WWF



Link	G7A.1	G6A.1	G5A.1	G4A.1	G3.1	G2.1	G1.1	W62.1
Cap	7.874	5.455	6.459	6.459	2.785	2.967	11.184	10.728
DepUs	0.729	0.953	0.874	1.519	2.499	1.687	0.618	0.629
VelUs	4.548	3.608	4.035	3.930	4.111	4.272	8.307	8.102
FloUs	2.78785	3.12082	3.12103	3.11466	3.45704	3.45703	3.68298	3.68297

Node	G7A	G6A	G5A	G4A	G3	G2	G1	W62	W61

Capital Improvement Project G1 - Buildout WWF



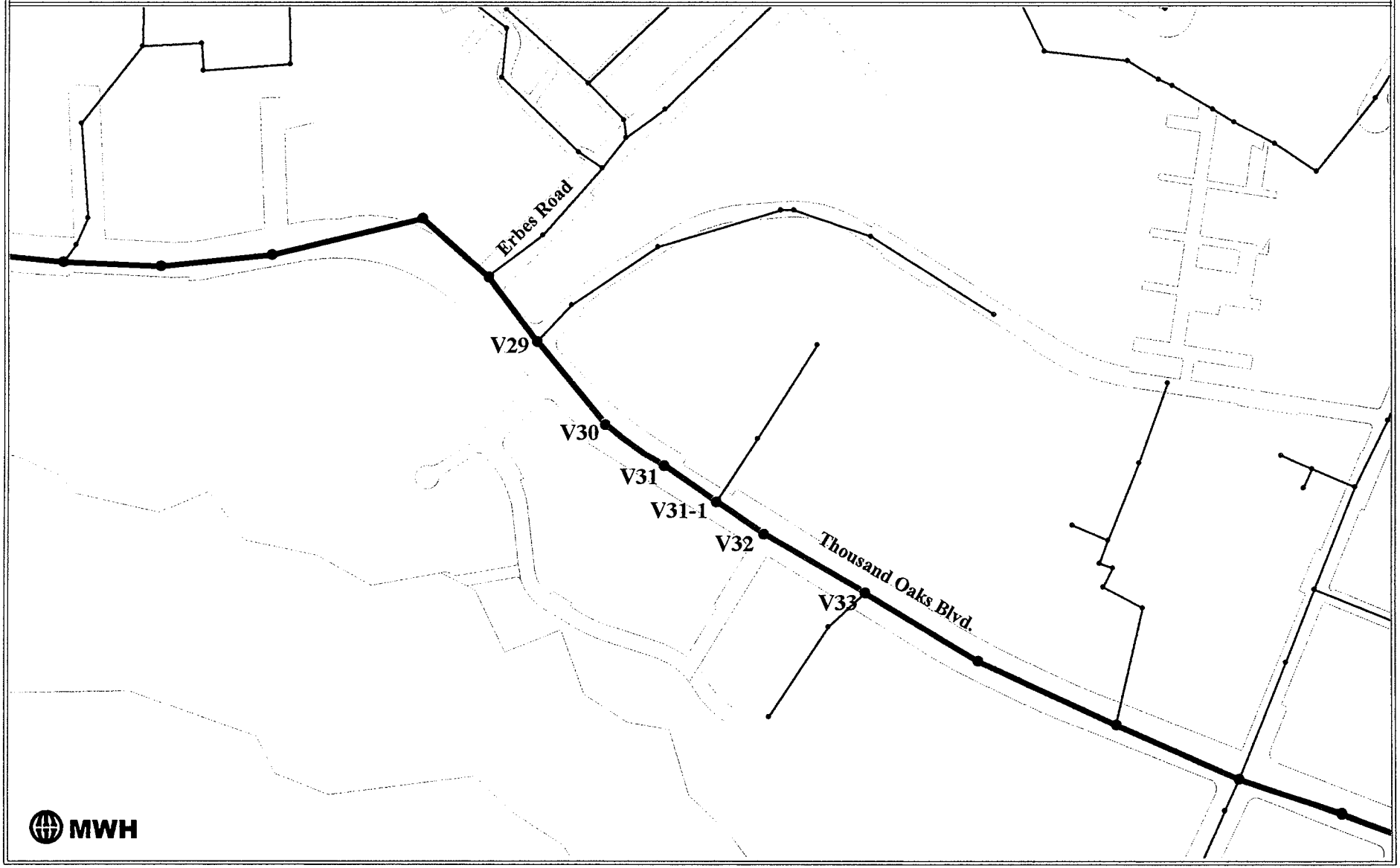
Link	G7A.1	G6A.1	G5A.1	G4A.1	G3.1	G2.1	G1.1	W62.1
Cap	7.874	5.455	6.459	6.459	2.785	2.967	11.184	10.728
DepUs	0.757	1.002	1.222	2.260	3.209	2.080	0.638	0.647
VelUs	4.728	3.685	4.100	3.939	4.347	4.442	8.552	8.382
FloUs	3.04496	3.38916	3.36797	3.36407	3.70528	3.70516	3.95463	3.95455

Node	G7A	G6A	G5A	G4A	G3	G2	G1	W62	W61

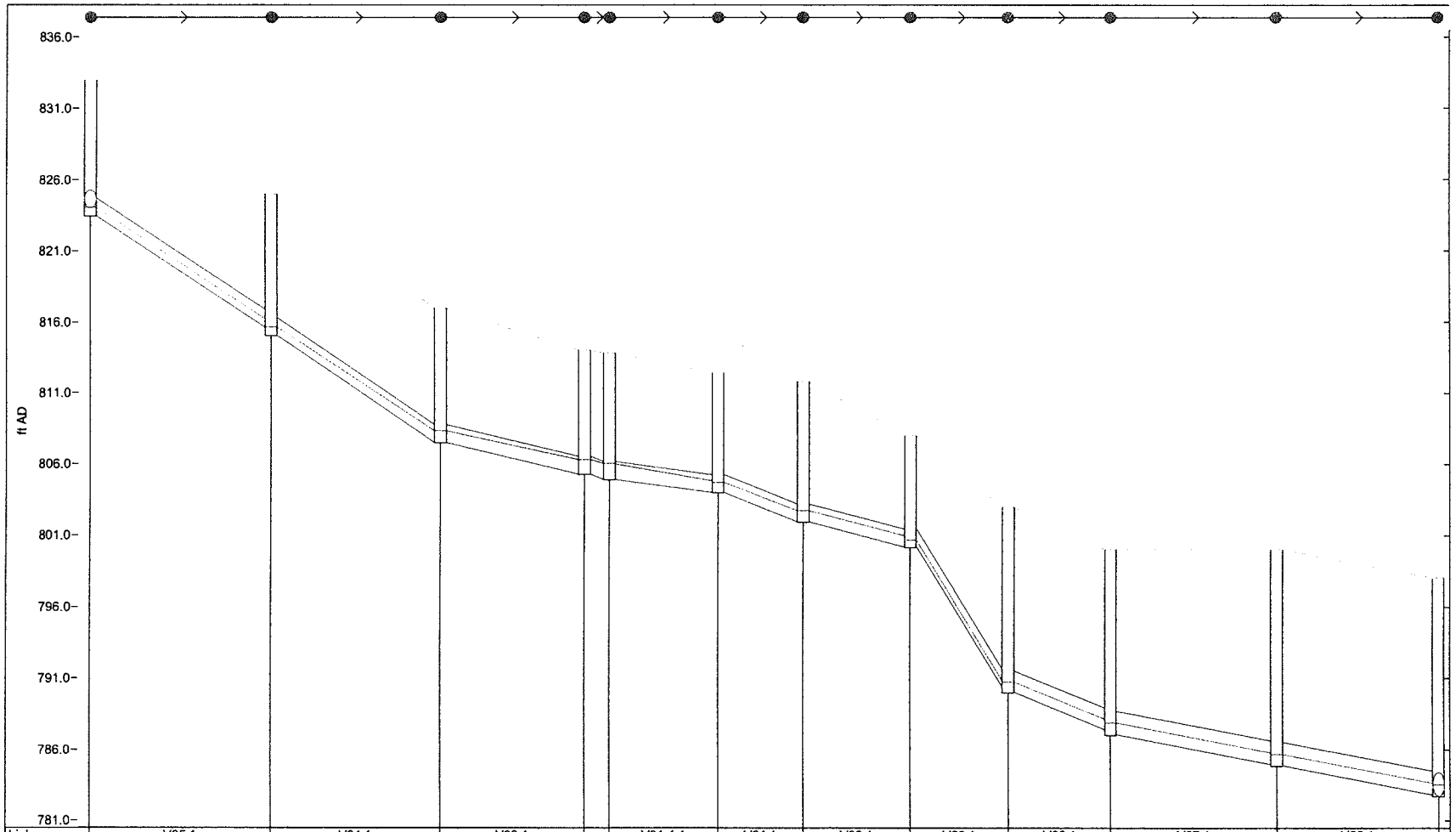
Capital Improvement Project V1

Project Description	Replace 993 feet of 15-inch diameter AC pipe with 18-inch pipe between Manholes V33 and V29 in Thousand Oaks Boulevard east of Erbes Road.
Planning-Level Cost Estimate	$470,000
Implementation Phase	Long-Term
Project Basis	Capacity. This reach is a minor capacity bottleneck, as indicated in the hydraulic profiles. Existing wet weather peak flow of 2.8 mgd is 78 percent of the average nominal full-pipe capacity of 3.6 mgd. However, the capacity of one section (Manhole V31-1 to V31) is only 2.6 mgd, which results in a depth of flow near the crown at Manhole V32. There is a depth of cover of 7.5 feet over the crown. At buildout, the projected peak wet weather flow is only slightly higher at 2.9 mgd. This bottleneck is expected to cause only minor surcharging and negligible risk of overflow now or at buildout, unless I/I increases in the future.
Project Issues	Most of Unit V was built in 1962 and is in good overall condition based on CCTV inspection in 2000. The street in this reach has been recently re-paved, but that should not be a factor since this is a long-term project. Upsizing to an 18-inch pipe will increase the capacity to 5.9 mgd. The buildout peak wet weather flow would then be 50% of the full-pipe capacity. Also, the capacity would be similar to the 6-mgd capacity of the upstream pipe reaches. The velocity in the new 18-inch pipe would be a good 5.1 feet/sec.
Alternatives	Another option would be to extend the project downstream to Manhole V28 or V27 (an additional 207 feet or 422 feet). The invert at Manhole V28 is 10 feet lower than Manhole V29. Utilizing this additional gradient would allow the bottleneck to be essentially eliminated with a replacement 15-inch pipe at a steeper gradient. The replacement pipe would have a capacity of 5.0 mgd, and the buildout peak wet weather flow would be an acceptable 58% of that capacity. Manhole V27 sits in the bottom of storm drainage box near Erbes Road. Extending the project to Manhole V27 would allow this manhole to be relocated away from the storm drain to reduce the risk of inflow.

Capital Improvement Project V1



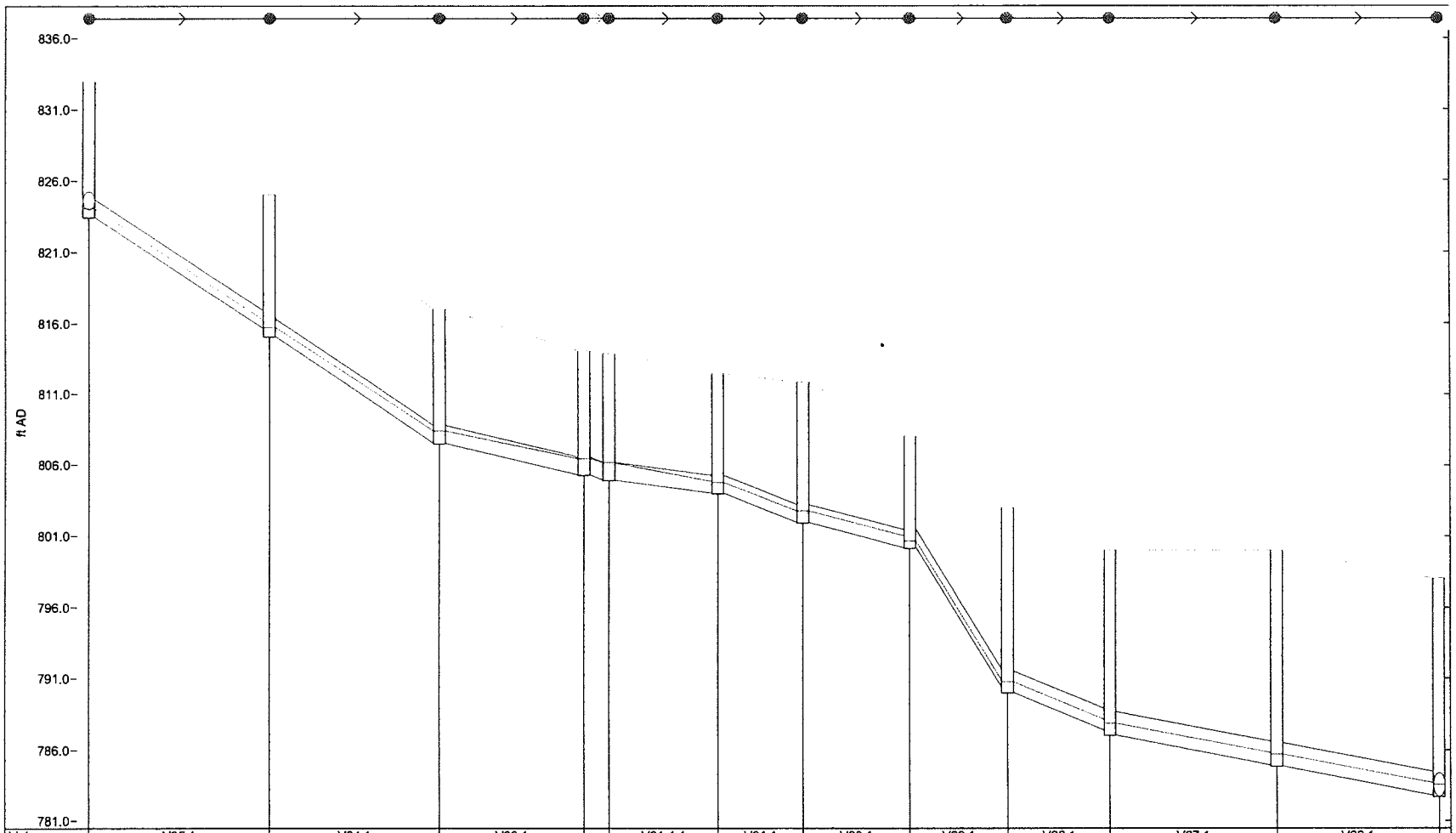
Capital Improvement Project V1 - Existing WWF



Link	V35.1	V34.1	V33.1	-	V31-1.1	V31.1	V30.1	V29.1	V28.1	V27.1	V26.1
Cap	6.003	6.094	3.561	-	2.625	4.474	3.698	9.084	7.464	6.939	6.916
DepUs	0.618	0.614	0.837	-	1.129	0.726	0.811	0.494	0.733	0.829	0.830
VelUs	7.139	7.198	4.960	-	3.815	5.832	5.121	9.564	6.121	4.848	4.842
FloUs	2.79034	2.78999	2.78937	-	2.78721	2.78733	2.78725	2.78709	3.39636	3.39621	3.39576

Node	V35	V34	V33	V32	V31-1	V31	V30	V29	V28	V27	V26	V25

Capital Improvement Project V1 - Buildout WWF



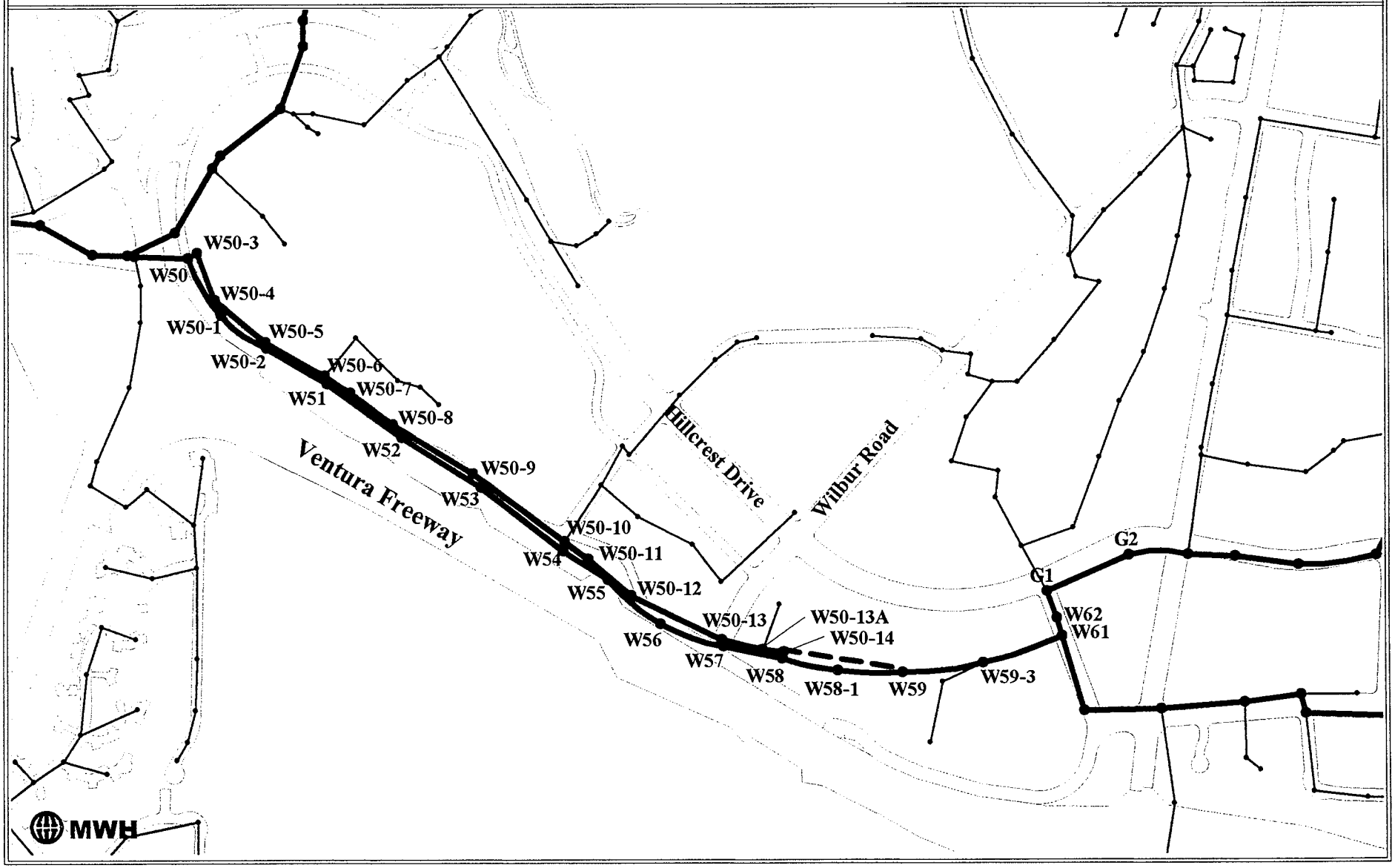
Link	V35.1	V34.1	V33.1	-	V31-1.1	V31.1	V30.1	V29.1	V28.1	V27.1	V26.1
Cap	6.003	6.094	3.561	-	2.625	4.474	3.698	9.084	7.464	6.939	6.916
DepUs	0.630	0.626	0.879	-	1.232	0.755	0.844	0.509	0.756	0.857	0.859
VelUs	7.317	7.371	4.962	-	3.811	5.863	5.164	9.658	6.335	4.994	4.984
FloUs	2.93134	2.93097	2.93051	-	2.92784	2.92780	2.92759	2.92676	3.65063	3.65034	3.64922

Node	V35	V34	V33	V32	V31-1	V31	V30	V29	V28	V27	V26	V25

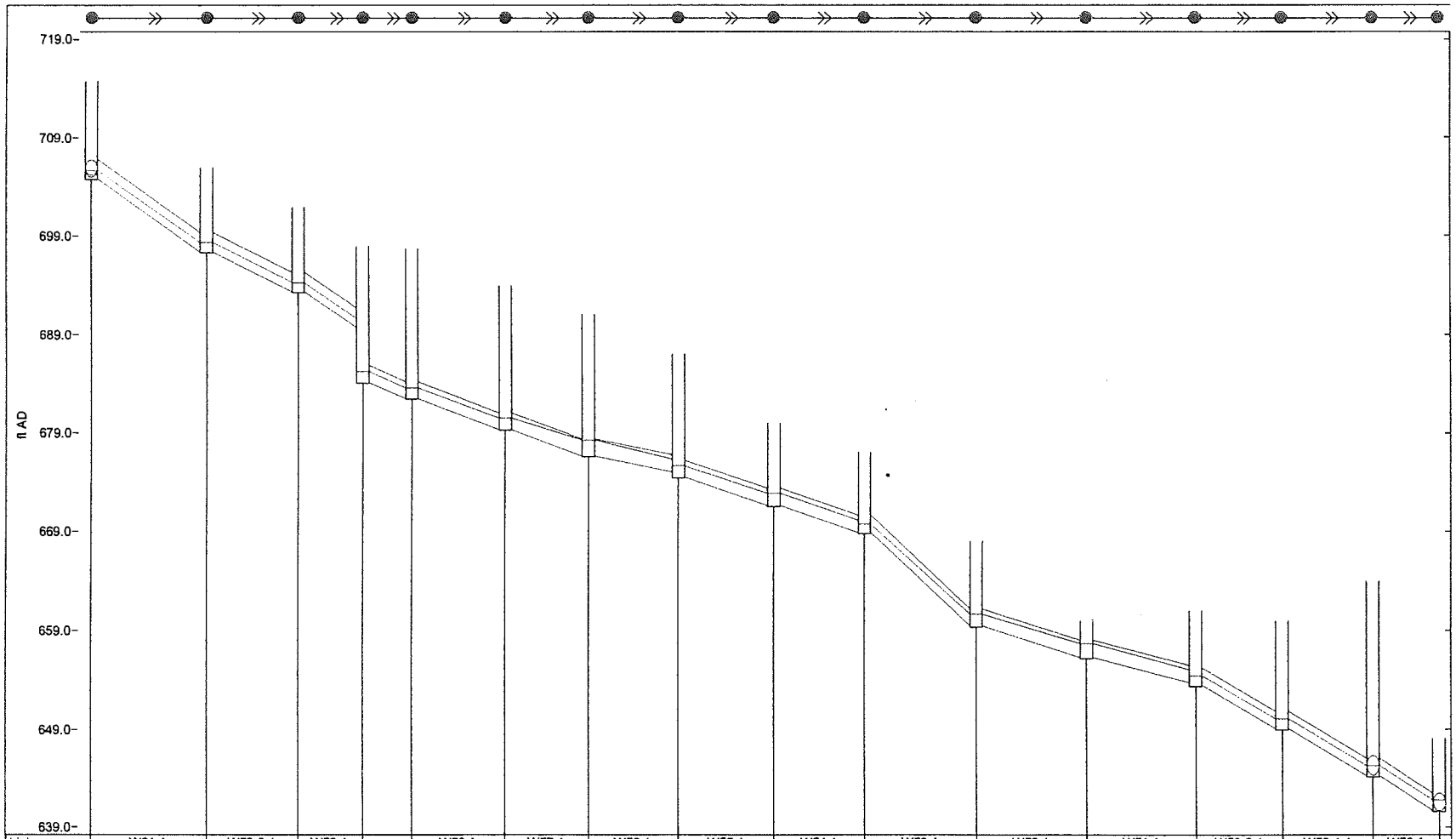
Capital Improvement Project W1

Project Description	Construct a new splitter manhole and 415 feet of new 21-inch pipe in the easement south of Hillcrest Drive and east of Wilbur Road, between Manhole W59 and W50-14.
Planning-Level Cost Estimate	$200,000
Implementation Phase	Short-Term
Project Basis	Capacity. The 21-inch Unit W interceptor between Manholes W58-1 and W50-2 is a minor capacity bottleneck (see hydraulic profiles). The existing dry and wet weather peak flows in this reach of Unit W are 6.5 mgd and 7.7 mgd, increasing to 7.3 mgd and 8.3 mgd at buildout. During buildout peak wet weather flow conditions, flows would exceed the capacity of two pipe segments (up to 115 percent of capacity) and would just surcharge Manholes W56 and W51. Of most concern is the depth of cover of only 2.1 feet over the crown at Manhole W51.
Project Issues	The project would divert a portion of the flow at Manhole W59 into an existing 21-inch sewer (Manholes W50-14 to W50-3) that runs parallel to and north of the main Unit W. The northern parallel sewer carries only about 0.2 mgd, but has a capacity ranging between 10.6 and 18.9 mgd, which is more than the capacity of the existing Unit W. The two pipes join downstream at Manhole W50 prior to the junction with Unit U. After construction of this diversion project, the buildout peak wet weather flow in this reach of the main Unit W would be lowered to less than 75 percent of capacity in all pipes. A gate frame in the splitter manhole will allow the percentage of flow diverted to be adjusted with stop logs The main Unit W is AC pipe built in 1963 and was last inspected in 2000. Although it was found to be in good condition overall, the segment between Manholes W58-1 and W58 had a major collapsed pipe that was replaced with PVC pipe in 2001, and a 15-foot spot repair of a crack is required between Manholes W56 and W55. Under this project, the existing main Unit W sewer will remain in service with reduced flows. The existing northern parallel sewer is VC pipe built in 1978 and was last inspected in 2000. It was found to be in good condition.
Alternatives	All flow could be diverted into the northern parallel sewer, and the older main Unit W sewer could be abandoned. The newer northern sewer would then flow at up to 73 percent of capacity under buildout peak wet weather flow. This alternative is not recommended at this time, but could be implemented in the future if the condition of the older AC pipe deteriorates significantly.

Capital Improvement Project W1

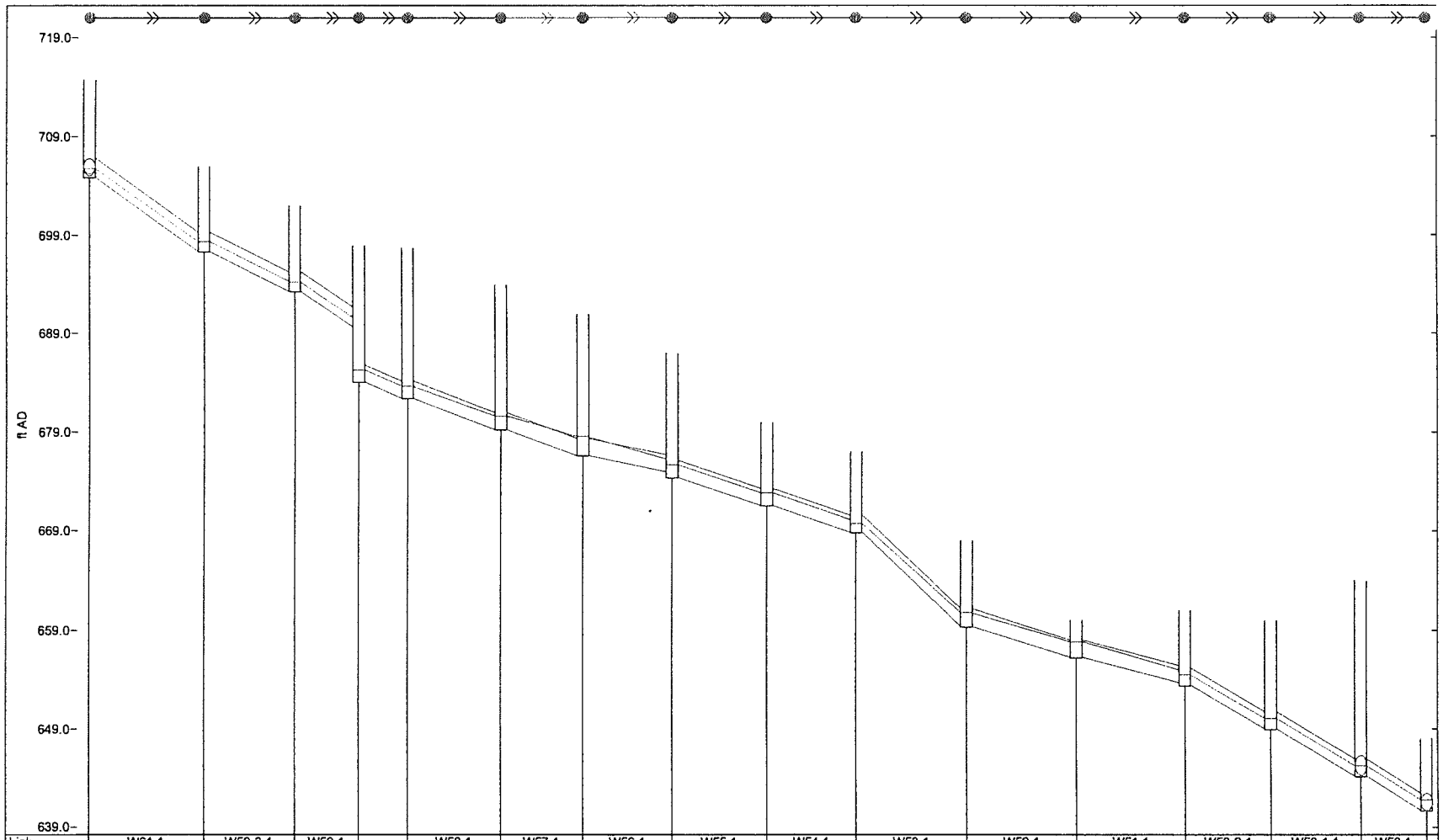


Capital Improvement Project W1 - Existing WWF, Southern 21" Line



Link	W61.1	W59-3.1	W59.1	-	W58.1	W57.1	W56.1	W55.1	W54.1	W53.1	W52.1	W51.1	W50-2.1	W50-1.1	W50.1
Cap	19.515	16.023	18.100	9.746	9.746	9.563	7.144	9.175	9.244	15.566	8.993	8.171	12.006	12.302	12.325
VelUs	8.728	7.509	8.177	6.962	6.955	6.769	5.269	6.556	6.616	9.755	6.487	5.986	8.065	8.225	8.273
FloUs	7.58988	7.59015	7.59020	-	7.58990	7.58889	7.58709	7.58710	7.69848	7.69839	7.69820	7.69768	7.69686	7.69618	7.87432
Node	W61	W59-3	W59	W58-1	W58	W57	W56	W55	W54	W53	W52	W51	W50-2	W50-1	W50	W49-

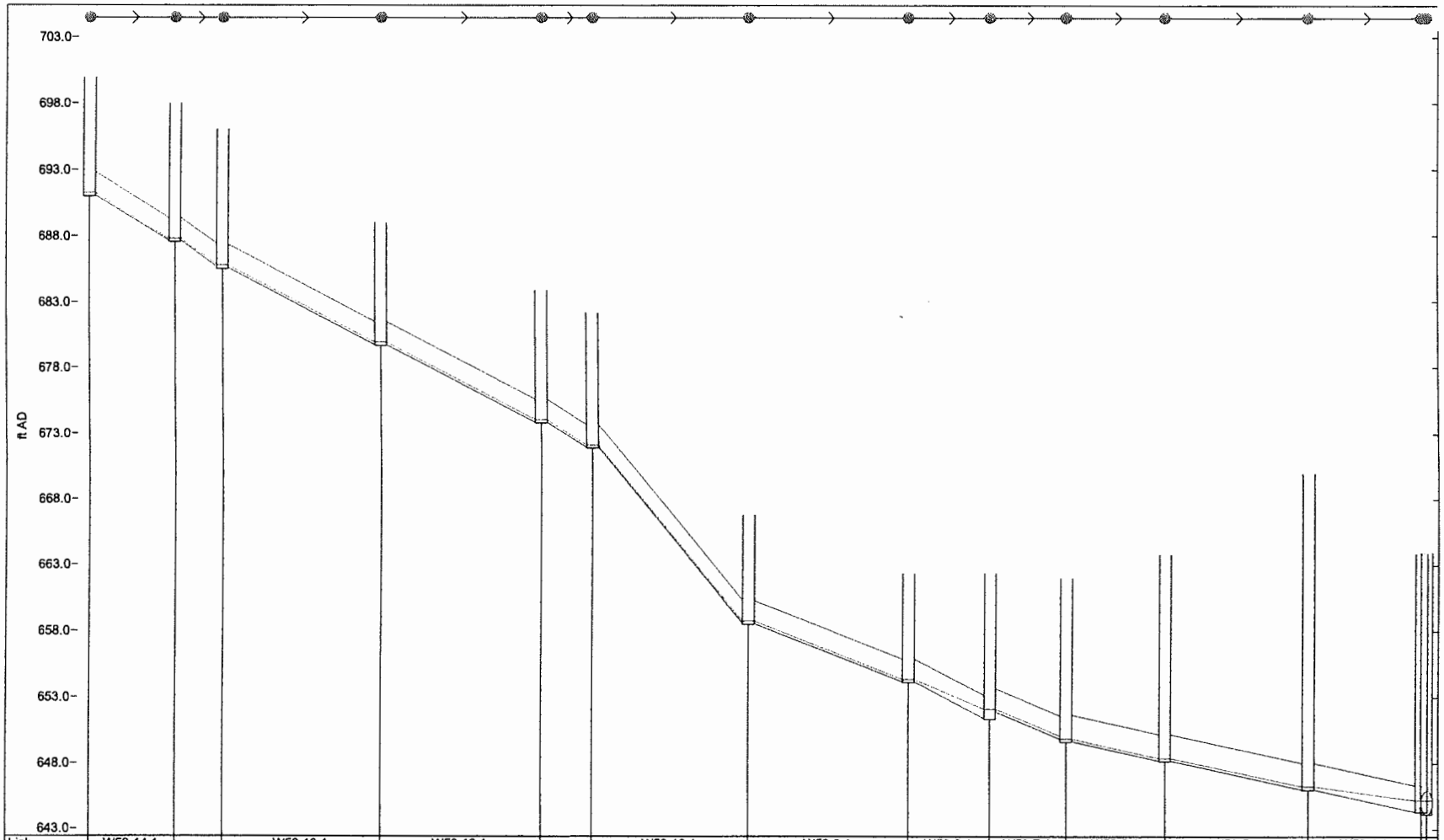
Capital Improvement Project W1 - Buildout WWF, Southern 21" Line



Link	W61.1	W59-3.1	W59.1	-	W58.1	W57.1	W56.1	W55.1	W54.1	W53.1	W52.1	W51.1	W50-2.1	W50-1.1	W50.1
Cap	19.515	16.023	18.100	9.746	9.746	9.563	7.144	9.175	9.244	15.566	8.993	8.171	12.006	12.302	12.325
VelUs	8.821	7.758	8.318	6.967	6.960	6.772	5.280	6.713	6.774	9.897	6.571	5.993	8.071	8.278	8.278
FloUs	8.21255	8.21117	8.21140	-	8.21175	8.20978	8.20439	8.20481	8.25473	8.25399	8.25284	8.24788	8.24605	8.24495	8.40446

Node	W61	W59-3	W59	W58-1	W58	W57	W56	W55	W54	W53	W52	W51	W50-2	W50-1	W50	W49

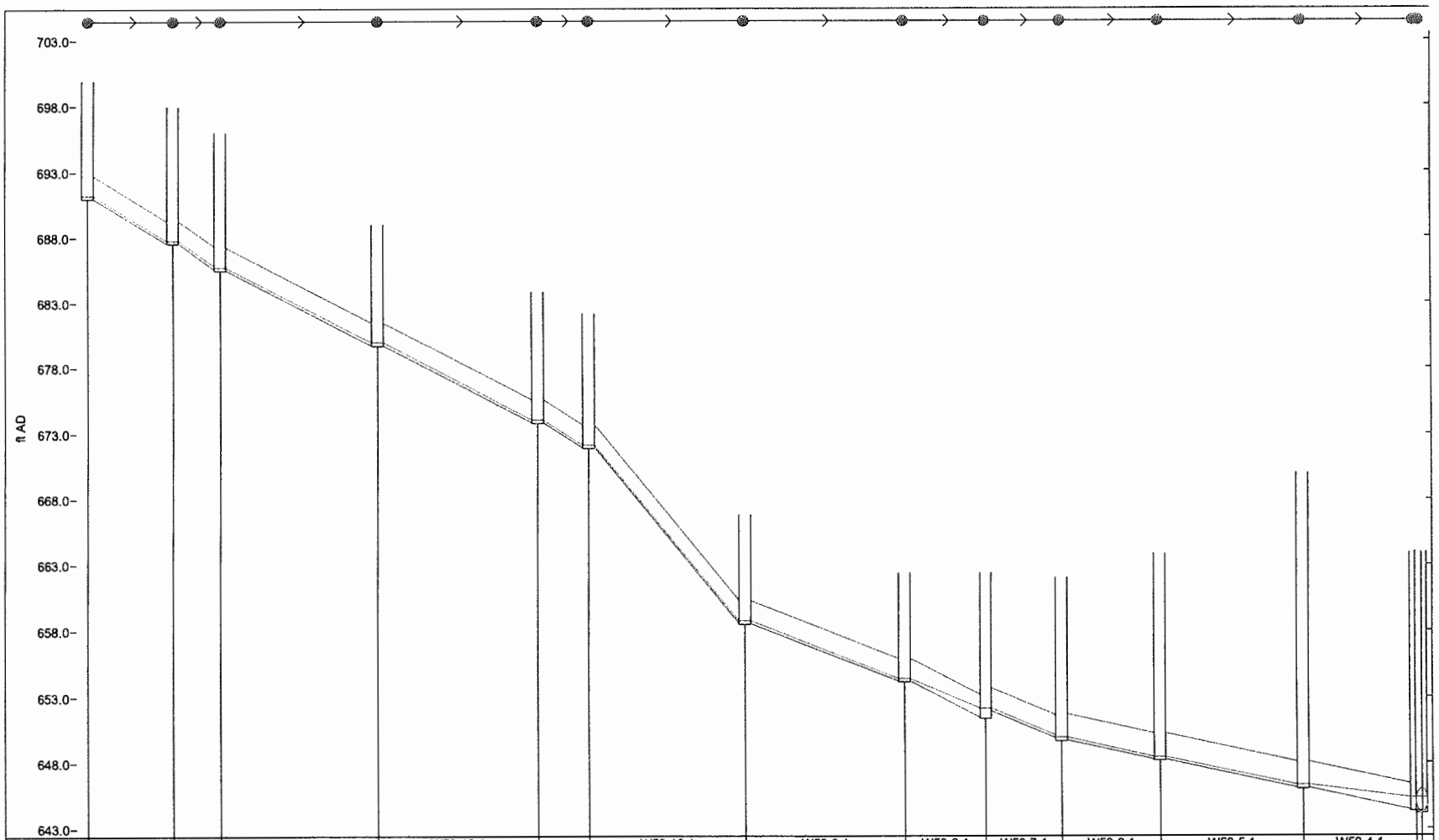
Capital Improvement Project W1 - Exisiting WWF, Northern 21" Line



Link	W50-14.1	-	W50-13.1	W50-12.1	-	W50-10.1	W50-9.1	W50-8.1	W50-7.1	W50-6.1	W50-5.1	W50-4.1
Cap	13.056	-	12.394	12.439	-	18.922	10.728	11.914	10.613	11.321	11.367	11.367
VelUs	1.661	1.661	1.638	1.639	1.642	1.822	1.572	1.619	1.567	1.794	1.797	1.798
FloUs	0.19976	-	0.19979	0.19973	-	0.19965	0.19961	0.19957	0.19955	0.19953	0.19950	0.19950

Node	-	W50-13A	W50-13	W50-12	W50-11	W50-10	W50-9	W50-8	W50-7	W50-6	W50-5	W50-4	W50-3

Capital Improvement Project W1 - Buildout WWF, Northern 21" Line



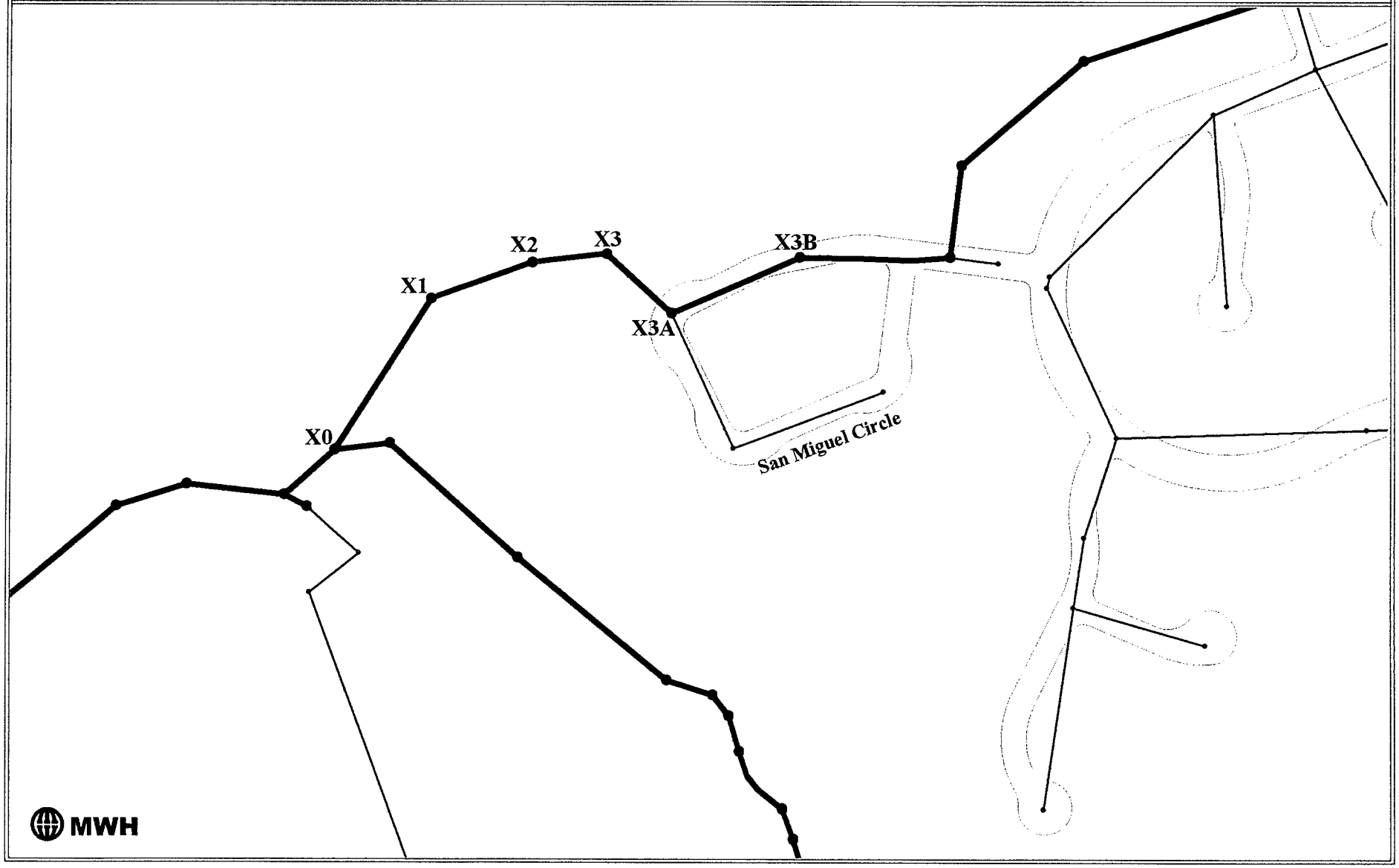
Link	W50-14.1	-	W50-13.1	W50-12.1	-	W50-10.1	W50-9.1	W50-8.1	W50-7.1	W50-6.1	W50-5.1	W50-4.1
Cap	13.056	-	12.394	12.439	-	18.922	10.728	11.914	10.613	11.321	11.367	11.367
VelUs	1.868	1.868	1.841	1.842	1.846	2.063	1.763	1.819	1.758	1.909	1.913	1.913
FloUs	0.23514	-	0.23507	0.23507	-	0.23504	0.23503	0.23503	0.23503	0.23504	0.23504	0.23499

Node	-	W50-13A	W50-13	W50-12	W50-11	W50-10	W50-9	W50-8	W50-7	W50-6	W50-5	W50-4	W50-3

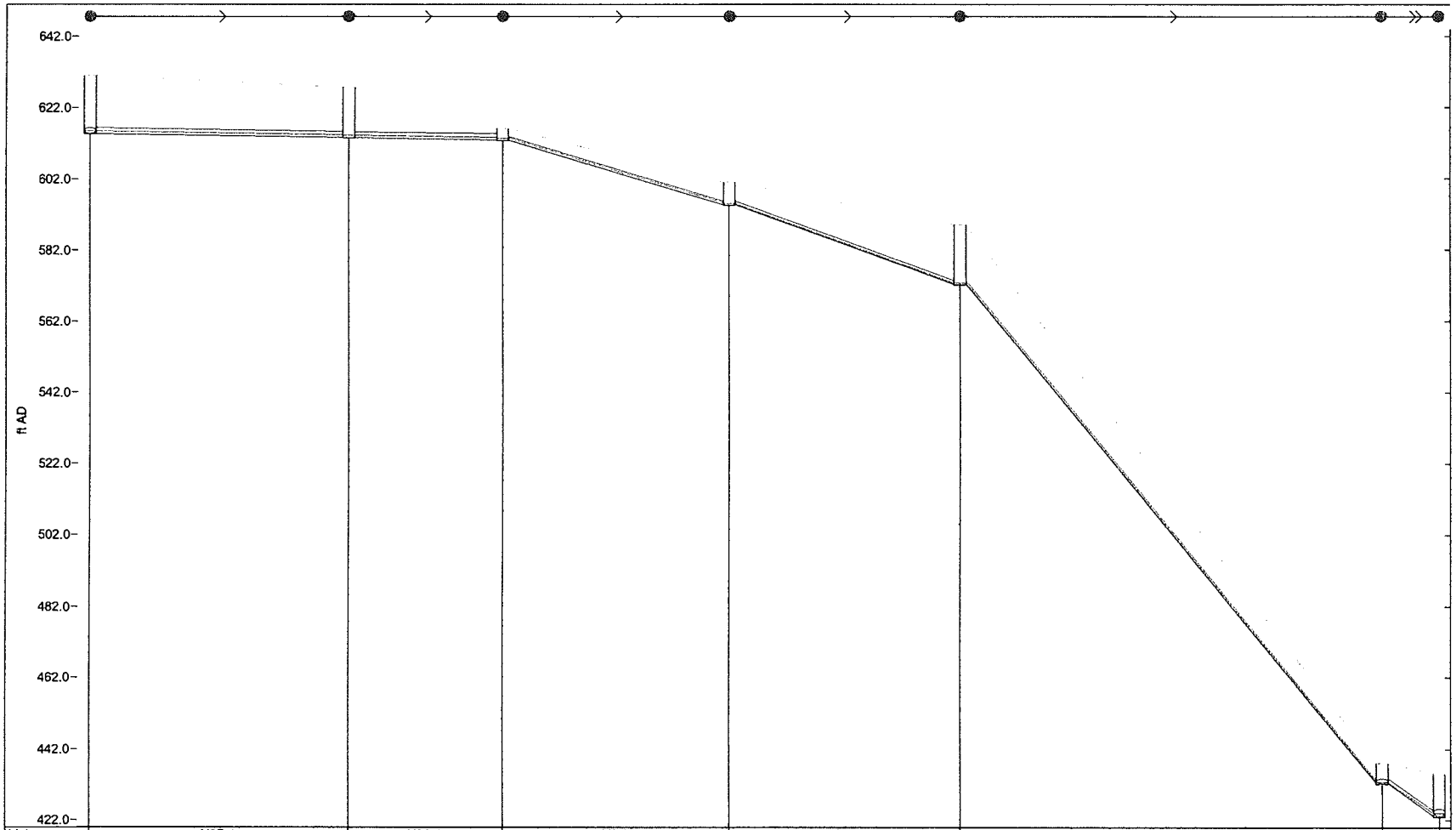
Capital Improvement Project X1

Project Description	Line 455 feet of 12-inch diameter AC pipe between Manholes X3 and X1 in easements below San Miguel Circle.
Planning-Level Cost Estimate	$90,000
Implementation Phase	Short-Term
Project Basis	Condition. This reach was built in 1961 and is in poor condition based on CCTV inspection in 2001. The structural score of the pipe segments from Manholes X3 to X2 is 331, and from Manhole X2 to X1 is 181. These are among the ten worst segments in the interceptor system based on structural scores from City television inspection. Major roots at joints and deteriorated pipe occur throughout. The next segment downstream (Manhole X1 to X0) was in worse condition, with broken pipe sections, and was replaced in 2001 on an emergency basis. Capacity is adequate. The buildout peak wet weather flow of 3.4 mgd is 53 percent of the nominal full-pipe capacity of 6.4 mgd.
Project Issues	Lining of this reach should be feasible and recommended in order to minimize impacts to this natural open space area. Lining should also be faster and less costly than replacement due to the steep slope and limited access. Chemical root treatment will be required prior to lining.
Alternatives	Replacement should be considered only if lining is not feasible.

Capital Improvement Project X1



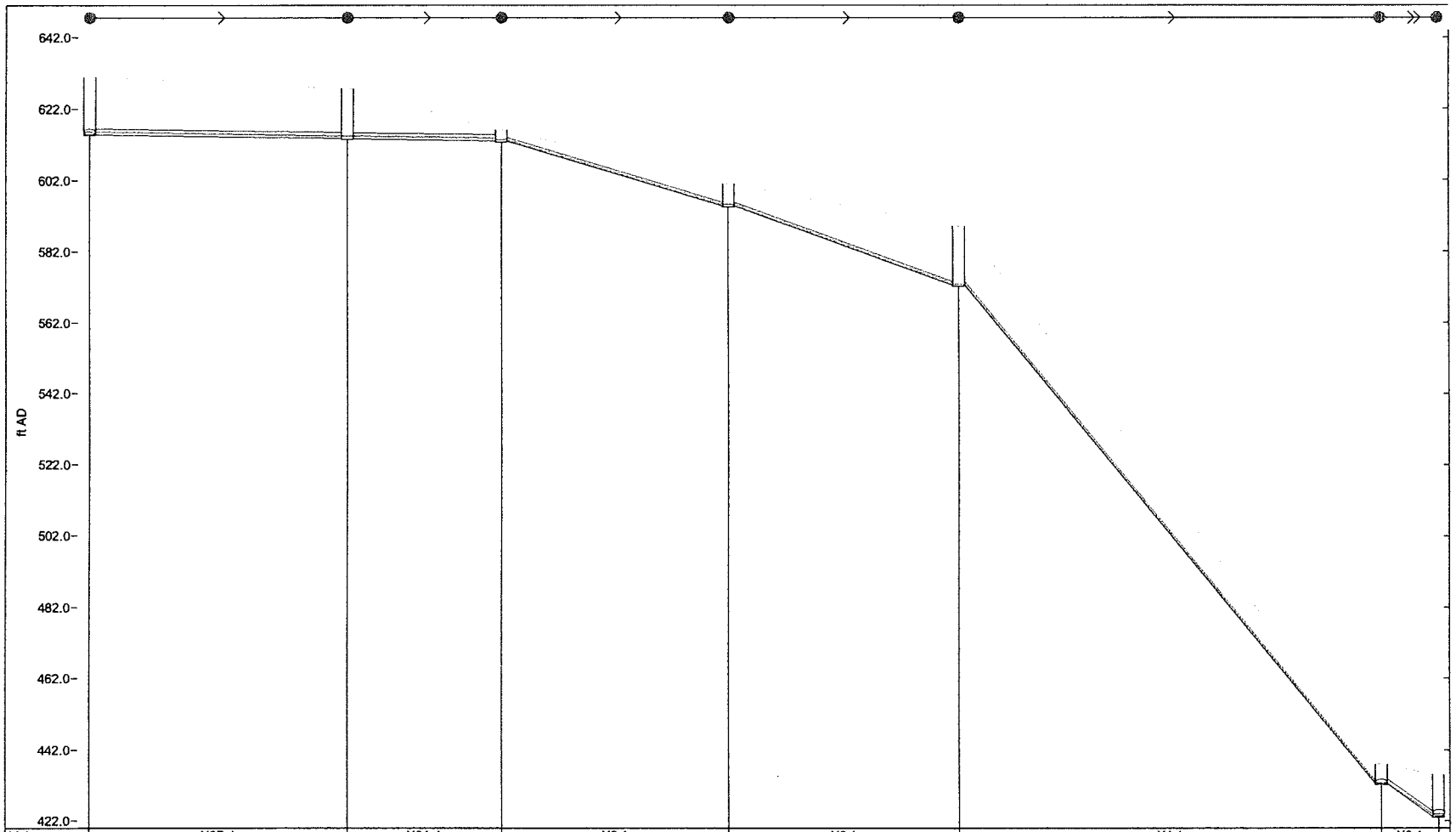
Capital Improvement Project X1 - Existing WWF



Link	X3B.1	X3A.1	X3.1	X2.1	X1.1	X0.1
Cap	6.756	6.391	6.596	7.235	13.444	27.252
DepUs	0.793	0.815	0.474	0.445	0.330	0.547
VelUs	4.147	3.996	11.944	12.983	19.417	19.277
FloUs	2.83608	2.83585	2.83568	2.83557	2.83548	-

Node	X3B	X3A	X3	X2	X1	X0	A37

Capital Improvement Project X1 - Buildout WWF



Link	X3B.1	X3A.1	X3.1	X2.1	X1.1	X0.1
Cap	6.756	6.391	6.596	7.235	13.444	27.252
DepUs	0.877	0.894	0.516	0.494	0.356	0.554
VelUs	4.325	4.222	12.753	13.459	20.748	19.478
FloUs	3.36853	3.36900	3.36910	3.36910	3.36908	-

Node	X3B	X3A	X3	X2	X1	X0	A37

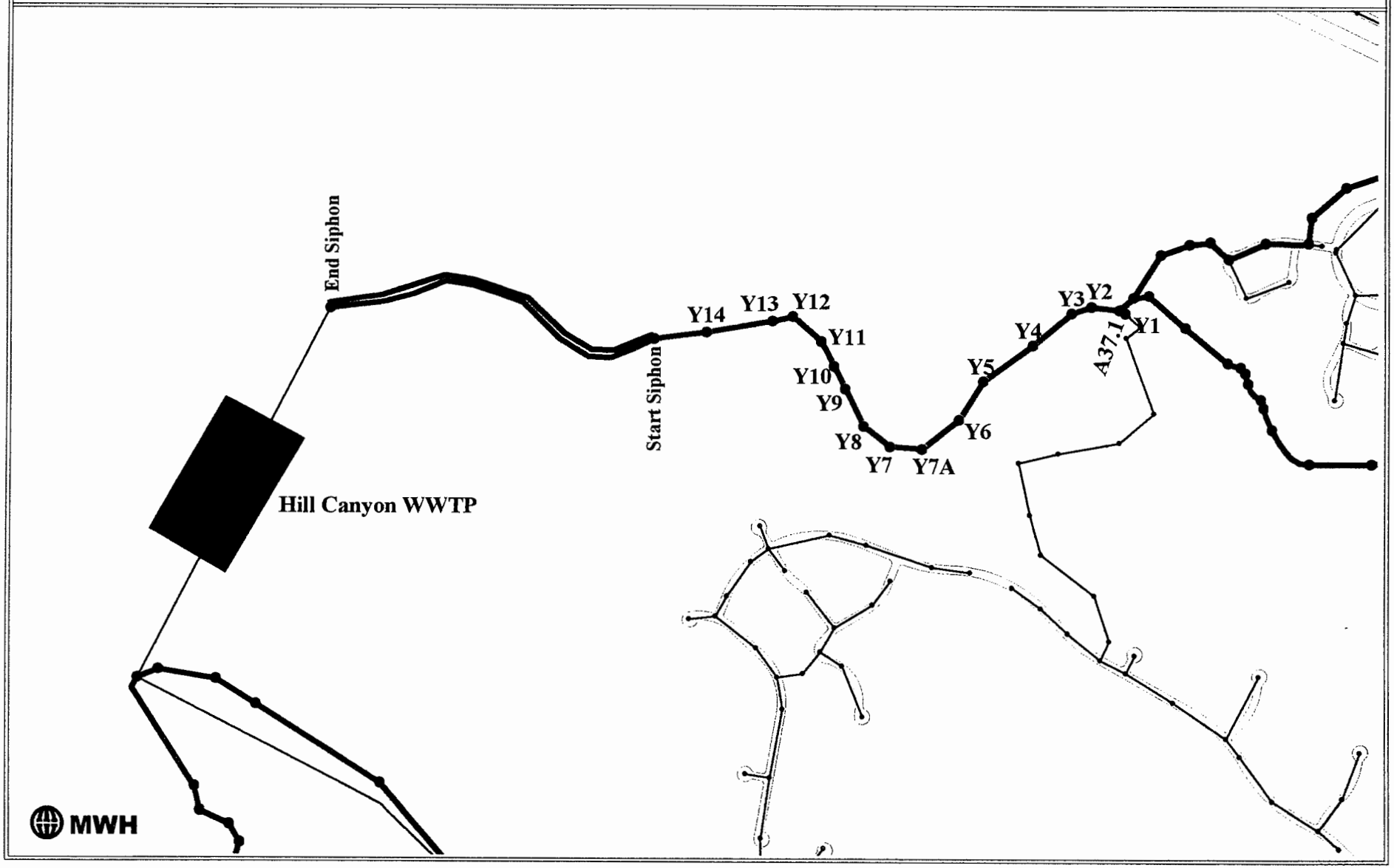
Capital Improvement Project Y1

Project Description	Creek bank erosion protection at several locations along the North Branch Arroyo Conejo along the alignment of the Unit Y interceptor. Appendix D is a technical memorandum that includes a map and photographs of the observed conditions, including the specific areas that require bank protection.
Planning-Level Cost Estimate	$250,000
Implementation Phase	Short-Term
Project Basis	Erosion. Unit Y follows the course of the North Branch Arroyo Conejo, and past experiences with creek bank erosion have exposed the sewer and made it susceptible to structural failure due to loss of earth burial cover or impact of debris (trees, rocks, etc.) carried by the high creek flows which periodically occur. The Unit Y interceptor material is Techite, which is a fiberglass resin composite material which is relatively thin-walled and therefore more susceptible than rigid pipe from damage due to impact from objects or from the loss of uniform support from surrounding earth cover. A walk-over inspection by MWH identified several areas along the Unit Y interceptor where the creek bank is eroding. Installation of rock gabions and other measures are recommended to protect the pipe in these areas.
Project Issues	This project should proceed with high priority to reduce the risk of pipe exposure and a major spill. Project Y2 would replace the entire Unit Y interceptor as part of a goal of eliminating all Techite pipe. Because Project Y2 is a long-term project, the City should proceed with Project Y1 in the short-term.
Alternatives	None identified.

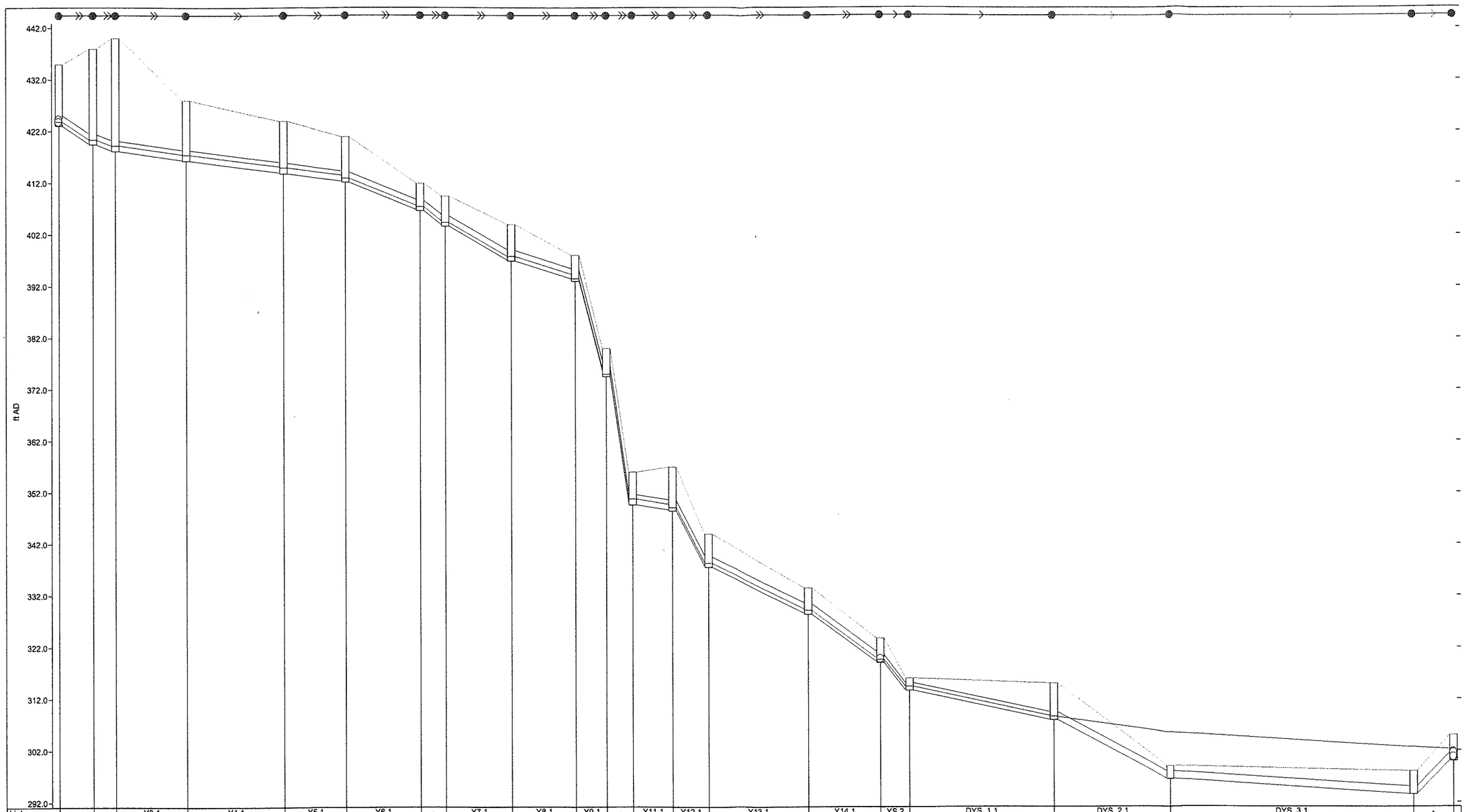
Capital Improvement Project Y2

Project Description	Replace 3119 feet of 24-inch diameter Techite pipe with same diameter pipe between Manholes Y1 and Y12 and between Manholes Y13 and the siphon inlet in open space easements. Replace 4536 feet (total footage of pipe in twin-barrel siphon) of 18-inch diameter Techite pipe with same diameter pipe between the siphon inlet and Hill Canyon Treatment Plant in open space easements.
Planning-Level Cost Estimate	$2,700,000 (gravity sewers) $3,800,000 (siphons)
Implementation Phase	Long-Term
Project Basis	Techite Pipe. Capacity is adequate (see hydraulic profiles). Unit Y is constructed of Techite pipe material installed in 1976. Techite is a fiberglass resin composite material that is relatively thin-walled and has had high failure rates in other installations throughout the country. The City had a failure of a Techite pipe segment on Unit Y in 1998 (Manhole Y12 to Y13), and has been concerned about the possibility of future failures for some time. Failures can occur even when internal inspection does not detect major defects prior to failure.
Project Issues	The gravity portion of Unit Y was inspected in 2000 and found to be in good condition. One of the siphon barrels was partially inspected in 2001 and found to be in good condition. Inspection of the remainder of the siphon is not possible. Unit Y is being included for future replacement because of the history of failures associated with Techite pipes. When this project is designed, consideration should be given to extending the pressurized siphon section upstream to allow single-barrel operation under a some flow conditions to minimize deposition and to facilitate flushing. See Section 6.6.3 of this report for details.
Alternatives	Alternatives to replacement include lining or encasement. If feasible, lining would minimize disruption to habitat. Some digging may still be required on the siphon section to limit the length of runs. Encasement would eliminate the need to bypass flows, and would utilize the existing pipe as an inert liner.

Capital Improvement Project Y2

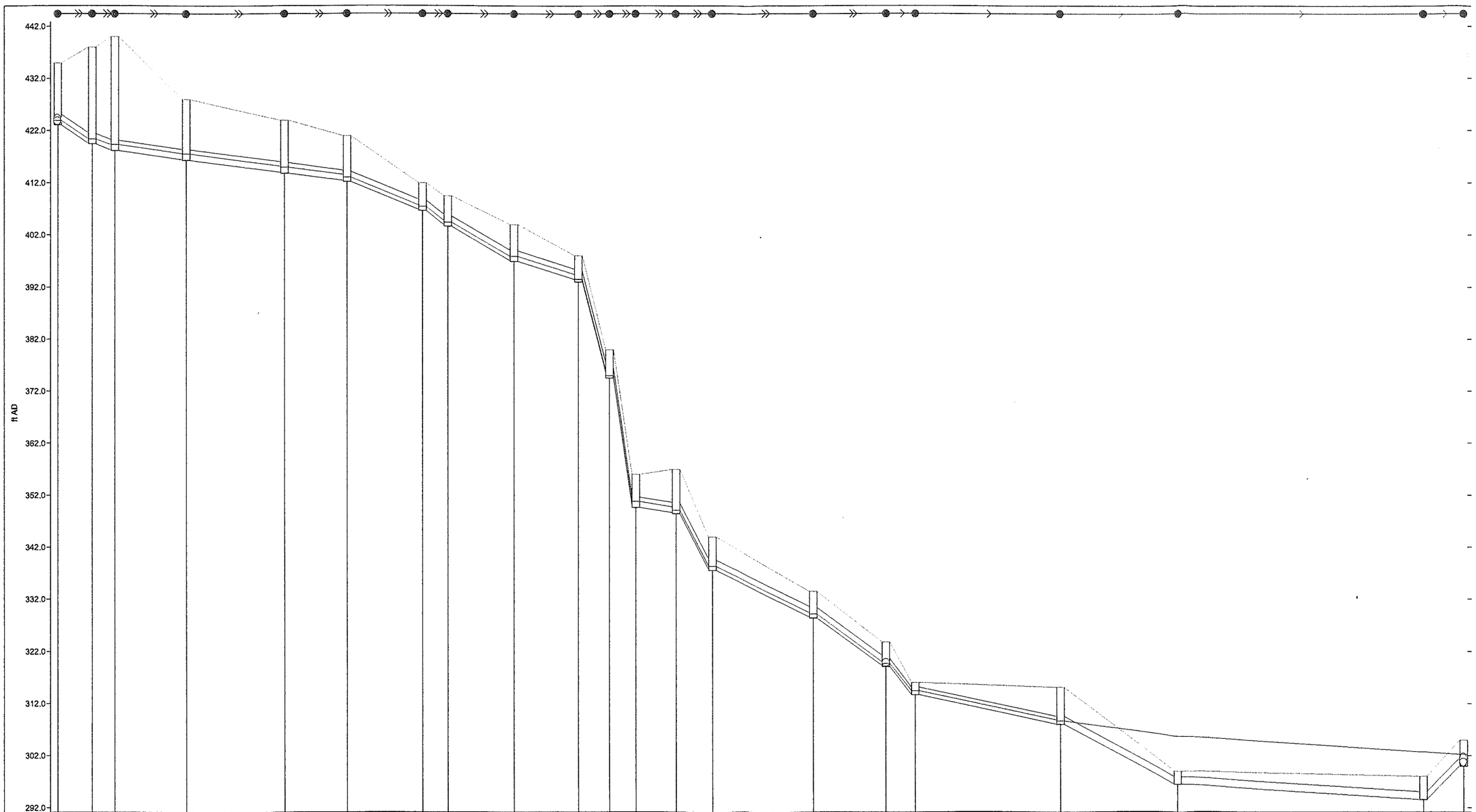


Capital Improvement Project Y2 - Existing WWF



Node	-	Y2	Y3	Y4	Y5	Y6	Y7A	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	YS	DYS_1	DYS_2	DYS_3	DYS_4	YD
Link	-	-	Y3.1	Y4.1	Y5.1	Y6.1	-	Y7.1	Y8.1	Y9.1	-	Y11.1	Y12.1	Y13.1	Y14.1	YS.2	DYS_1.1	DYS_2.1	DYS_3.1	-	
Cap	23.486	-	11.367	11.344	11.367	19.629	-	23.372	17.278	-	-	11.732	40.240	21.934	26.340	-	6.779	10.682	3.720	-13.718	
DepUs	0.795	-	1.160	1.161	1.163	0.867	-	0.799	0.936	0.533	-	1.146	0.607	0.828	0.744	0.531	0.802	0.631	8.998	9.076	
VelUs	9.650	-	5.943	5.933	5.949	8.635	-	9.618	7.813	-	-	6.059	14.012	9.176	10.600	-	5.875	7.996	2.748	2.745	
FloUs	-	-	7.25902	7.25865	7.29029	7.29046	-	7.29058	7.29062	-	-	7.29060	-	7.29054	7.29041	-	3.64510	3.64454	3.64435	3.64429	

Capital Improvement Project Y2 - Buildout WWF

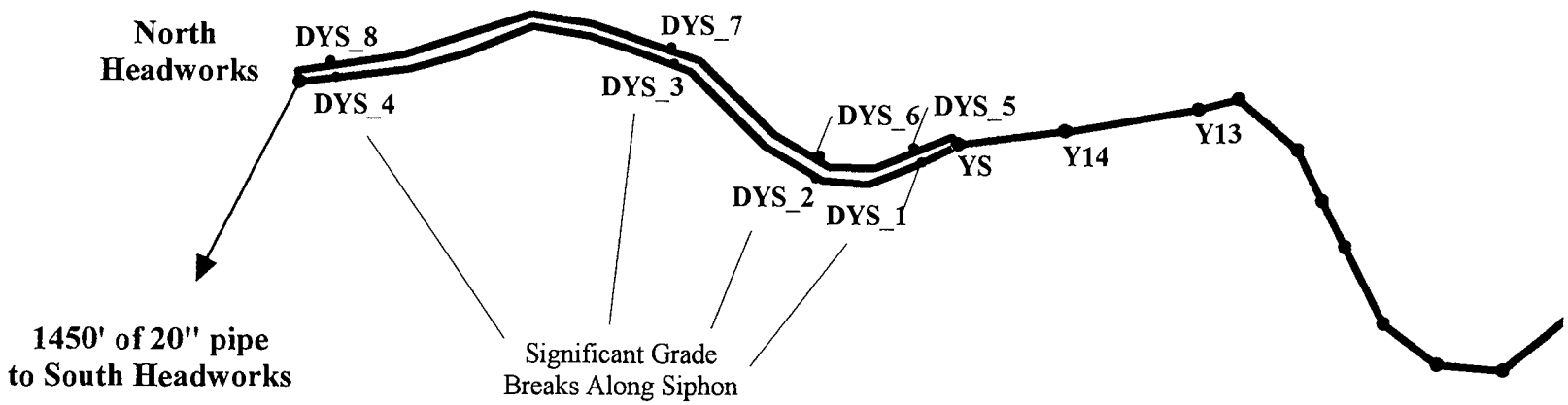


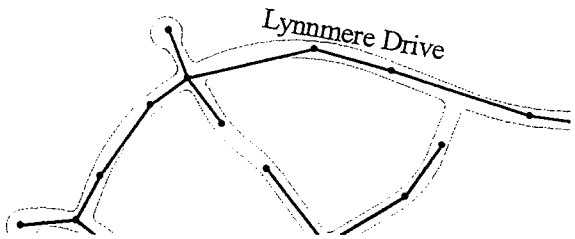
Link	-	-	Y3.1	Y4.1	Y5.1	Y6.1	-	Y7.1	Y8.1	Y9.1	-	Y11.1	Y12.1	Y13.1	Y14.1	YS.2	DYS_1.1	DYS_2.1	DYS_3.1	-
Cap	23.486	-	11.367	11.344	11.367	19.629	-	23.372	17.278	-	-	11.732	40.240	21.934	26.340	-	6.779	10.682	3.720	-13.718
DepUs	0.809	-	1.180	1.182	1.184	0.878	-	0.813	0.954	0.539	-	1.160	0.615	0.839	0.755	0.536	0.819	0.641	9.211	9.139
VelUs	9.704	-	5.985	5.971	5.983	8.731	-	9.876	7.842	-	-	6.135	14.121	9.272	10.677	-	5.876	8.049	2.812	2.814
FloUs	-	-	7.46708	7.46442	7.49413	7.49507	-	7.49533	7.49524	-	-	7.49456	-	7.49372	7.49262	-	3.74539	3.74352	3.74048	3.73939
Node	-	Y2	Y3	Y4	Y5	Y6	Y7A	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	YS	DYS_1	DYS_2	DYS_3	DYS_4	YD

Capital Improvement Project Y3

Project Description	Seal the gate structure at the siphon inlet (Manhole YS) and line 280 feet of 24-inch sewer between Manholes Y14 and YS.
Planning-Level Cost Estimate	$100,000
Implementation Phase	Short-Term
Project Basis	Capacity. A hydraulic analysis of the Unit Y siphon hydraulics (see Section 6.6.3) identified that water levels at Manhole YS could approach the ground surface at existing peak dry weather flows when Unit Y is routed to the south headworks of the Hill Canyon Plant. Sealing the gate structure and lining the upstream sewer would address this potential problem and would allow one-barrel operation to the north headworks during certain flow conditions.
Project Issues	Sealing the gate structure will allow water levels to rise into the gravity sewer segment between Manholes Y14 and YS under certain operating and flow conditions. Lining of this segment is recommended to eliminate the possibility of leakage under pressure. The ability of the siphons to accept higher pressures should also be verified. This project may be useful for assessing the condition of the Techite gravity sewer, and also to assess the feasibility of lining the entire Unit Y in the future (Project Y2).
Alternatives	Modify current operating procedures to never send Unit Y flows to the south headworks, nor use one-barrel operation to the north headworks.

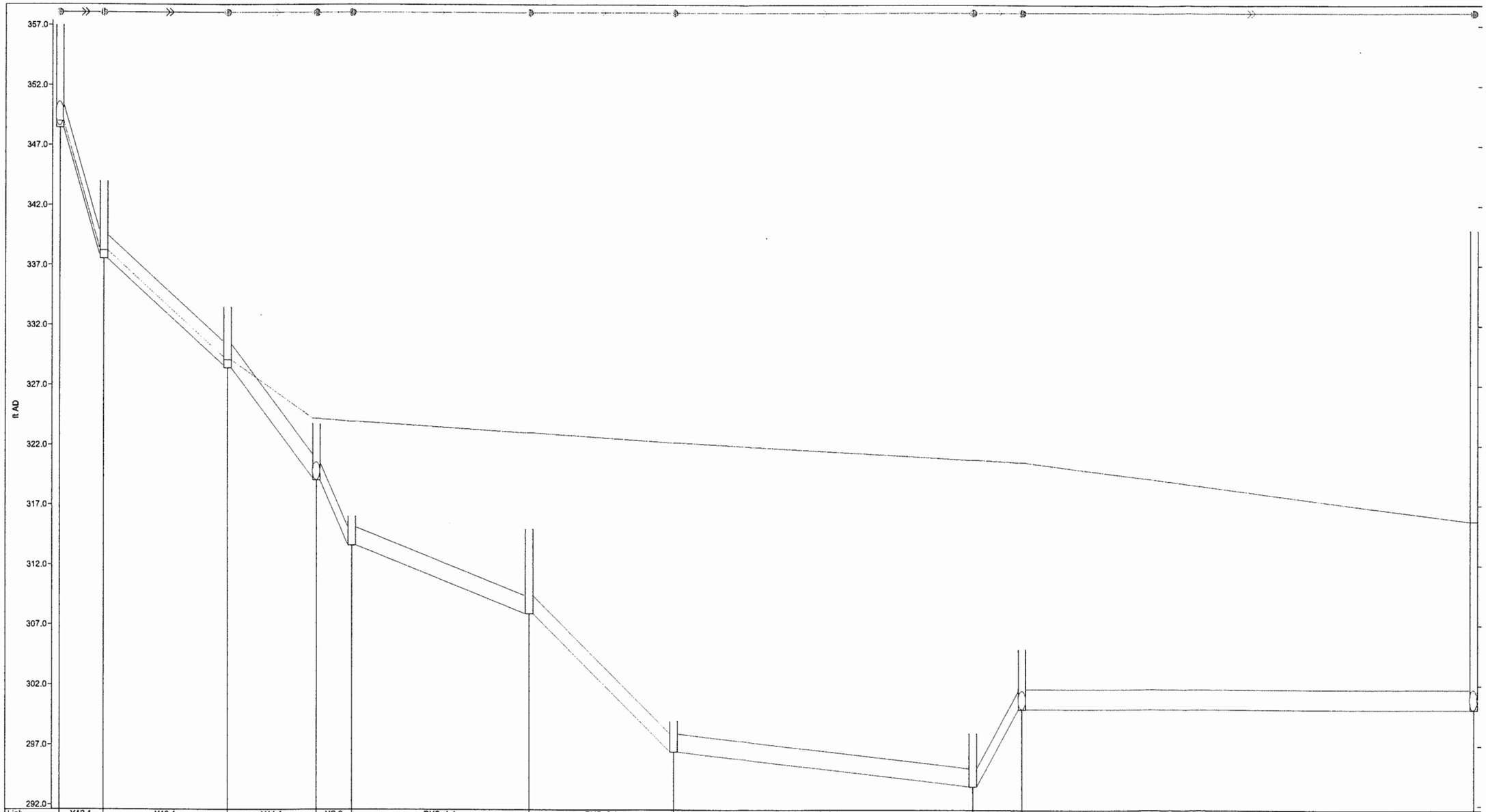
Capital Improvement Project Y3





MWH

Capital Improvement Project Y3 - Two Barrel Operation, Existing PDWF (Flows to South Headworks)



Link	Y12.1	Y13.1	Y14.1	YS.2	DYS_1.1	DYS_2.1	DYS_3.1	DYS_4.1	YD.1
Cap	40.240	21.934	26.340	14.790	6.779	10.682	3.720	-13.718	0.000
DepUs	0.531	0.701	0.640	5.118	10.344	15.083	25.739	27.197	20.539
VelUs	12.162	8.285	9.392	7.054	1.933	1.806	1.577	1.550	2.789
FloUs	5.25893	5.25883	5.25838	-	2.61176	2.60719	2.60316	2.60183	5.20300

Node	Y12	Y13	Y14	YS	DYS_1	DYS_2	DYS_3	DYS_4	YD	UNITY
GLev	-	344.00	333.50	323.79	316.01	314.99	299.02	298.00	304.99	339.99

Spot Repairs and Manhole Rehabilitation

Project Description	1. Spot repair of 20 feet of 24-inch diameter PVC pipe 90 feet downstream from Manhole Y3 in Wildwood Park next to the creek. Pipe is cracked and sagged. 2. Spot repair of hole in 20-inch diameter AC pipe 16 feet downstream from Manhole V27 in Thousand Oaks Boulevard near Erbes Road. There is a hole in side of pipe. 3. Spot repair of 15 feet of 21-inch diameter AC pipe 240 feet downstream from Manhole W56 in easement north of Highway 101 near Wilbur Road. Pipe is cracked. 4. Rehabilitation or repair of the following manholes: F22-15.6 (60) U23 (32) X27 (30) E2 (58) X12B (32) V45 (30) E40-18 (48) X24 (32) V28 (30) U14 (43) V40 (32) E47-128 (30) V41 (40) E40-19 (32)
Planning-Level Cost Estimate	$85,000 (spot repairs) $84,000 (manhole rehabilitations)
Implementation Phase	Short-Term
Project Basis	Condition. The review and assessment of CCTV logs and videotapes, as well as the manhole inspections performed during the study, identified several spot repair and manhole rehabilitation projects on various interceptors. These repairs are grouped together in this project. The manholes in this project are those that had structural scores over 30 and included moderate or severe breaks in the wall or bench. Manholes with only root defects are not included, but should be added to a maintenance list. Details and photographs of all defects are contained in Appendix B and in the GBA database.
Project Issues	The spot repair on Unit Y should be used as an opportunity to assess the condition of the Techite sewers. Other manholes and pipes requiring repair or rehabilitation are not included in the project if they are included in another CIP project scheduled for either the short-term or medium-term implementation phase.
Alternatives	Manhole rehabilitation will generally consist of lining the manhole wall and repairing the bench, but coating may be adequate in less severe cases.

7.4 Project Implementation

As noted earlier, the goal is to complete all high priority projects in the next 2 years, all medium priority projects in the 2 to 5 year horizon, and all low priority projects in the 5 to 10 year horizon. Based on the capital costs of projects in each of the priority categories, the capital requirements to meet this goal are as follows:

High Priority Projects:	$4,539,000 ($2.3 million per year for 2 years)
Medium Priority Projects:	$4,095,000 ($1.4 million per year for 3 years)
Low Priority Projects:	$12,070,000 ($2.4 million per year for 5 years)
All Projects:	$20,704,000 ($2.1 million per year for 10 years)

These numbers suggest that the City should budget for annual capital expenditures of about $2 million for interceptor improvements.

It is important to note that the 6 projects on Unit E total $10.6 million, which is 50 percent of the cost of all projects. Projects to replace the Techite pipe on Units A and Y total $7.8 million, which is 37 percent of the cost of all projects.

The following are the immediate steps that the City should take to begin implementation of the interceptor capital improvement program:

- Ensure that capital budgets are sufficient to cover $2 million per year for interceptor capital improvements.

- Perform a pre-design study for improvements to Unit E, covering projects E1 through E5. The study should examine alternative routes for the new sewers, and how to most effectively stage the projects considering construction issues as well as their relative priorities. Project E3, a short-term project, should proceed as soon as possible following the study.

- Move forward with design and construction on the other high-priority projects, which are relatively straightforward. These include Projects C1, E6, G1, W1, X1, Y1, Y3 and the spot repairs and manhole rehabilitation projects.

- Consider combining multiple projects into a single contract if that would reduce costs and if budgets allow. Example candidates include the projects on Unit E, Projects G1 and W1, spot repairs, and manhole rehabilitation projects.

- Monitoring of wet weather flows on Unit C should be performed to verify the modeled flows and confirm that lining is an appropriate solution.

7.5 Long-term Rehabilitation/Replacement Strategy

The Wastewater Interceptor Master Plan has assessed the condition and capacity of all the interceptor sewers, which constitutes about 9 percent of the sewers by length. The City should develop a strategy for dealing with the assessment and long-term rehabilitation and replacement of the other 91 percent of the sewers. The following points should be considered in the development of such a strategy.

- The entire collection system consists of 382 miles of sewer. If the average lifetime of a pipe is assumed to be 50 years, an average of 7.6 miles of pipe would need to be rehabilitated or replaced each year. At an average cost of $100 per foot, the annual cost would be about $4 million. Assuming a generous 75-year life expectancy, an average of 5 miles of pipe would need to be replaced per year, at a cost of $2.6 million.

- As shown on Figure 2-2, the age distribution of the City's sewers is far from uniform. Of most concern is the large group of pipes (92 miles) that were constructed between 1958 and 1965 and are now about 40 years old. These pipes will reach an age of 50 years during the 10-year planning horizon covered in this Master Plan. If all of those pipes had to be replaced over the next 10 years, that would be an average of 9.2 miles per year and an annual cost of $4.9 million. If that work were spread over 20 years instead of 10 years, 4.6 miles would be replaced at an annual cost of $2.5 million.

- Based on these facts, a reasonable goal at this point might be to replace 5 miles of pipe per year at an annual cost of $2.6 million. Such a program would go a long ways toward preventing future sewer spills and keeping I/I from increasing. However, it is not known now whether this goal is appropriate, because pipes should only be replaced when needed. A process must be in place to rate the condition of all pipes and to identify pipes that need replacement. A condition assessment process similar to that used for the interceptors is recommended.

- Television inspection is the best way to determine the condition of the sewers and prioritize them for replacement. The City should adopt a scoring system for defects such as that used in this study in order to have a highly quantitative method of categorizing pipes for replacement. This approach will also require that City staff receive training on identifying and scoring defects and using a computerized system for capturing and analyzing the results. An industry-based training and certification program for CCTV operators is now under development and should be utilized. The City will soon receive a new CCTV truck with the software that will allow capturing the needed information and transferring it to the GBA database of all sewers that was created in this study.

- A goal for the amount of CCTV inspection and condition assessment that is performed in each year should be established. If the average inspection interval were set at 10 years, approximately 38 miles of sewer would be inspected per year. Not all sewers should be inspected at the same interval, however. Inspection frequencies

should set by sewer class and adjusted based on the findings from initial inspections. For example, newer PVC sewers could have an inspection interval set as high as 20 years, while older AC sewers could have a 5-year interval. A group of sewers on a 10-year frequency could be moved to a 5-year frequency if a certain level of deterioration were observed. Likewise, sewers on a 5-year interval could be moved to a 10-year interval if no defects were observed. Once the overall goal and frequencies by category are established, resources required to implement the program should be obtained and dedicated.

- The GBA software should be used to automate and track the inspection program, similar to the preventive maintenance program. Preparatory work required for establishing the program includes populating the entire GBA database for year of construction and pipe material. This can be done through researching as-built drawings as was done for the interceptors, although it may be possible to fast-track the process by simply estimating the year of construction and materials based on local knowledge and spot inspections. These estimated data could then be refined over time.

- Near-term inspections should focus on the high-risk sewers most likely to require replacement soon. Age, material, maintenance history, and local knowledge should provide a solid basis for identifying these sewers. Assuming there are about 100 miles of high-risk sewers, it would take less than three years to inspect and rate all of them. At that point, the City would be in a good position to establish realistic annual goals for sewer replacement miles and budgets.

- Over time, the City will gather an increasing amount of information on their sewer assets. This information will include basic physical parameters, maintenance history, inspection frequency, latest inspection date, inspection results and condition ratings, schedules for rehabilitation and replacement, and (for interceptors) modeled flows and capacities. Most of this information will be stored and maintained in the GBA database, linked to GIS. Since some of this information will be of increasing interest to a range of City staff and not just GBA users, the City should develop a web browser-based GIS application that would allow staff to view selected sewer data without having to be trained in the use of GBA or GIS software. This application should be coordinated with the City's GIS group, which has adopted a similar approach of developing browser-based GIS applications.

- These rehabilitation/replacement strategy elements comprise major components of a comprehensive sewer asset management program. Implementing the strategy will contribute significantly to complying with the upcoming SSO/CMOM regulations, as well as the GASB34 financial reporting requirements. Therefore, the City's Public Works staff should coordinate these efforts with other City staff responsible for complying with the GASB34 requirements.

Appendix A

MWH
MONTGOMERY WATSON HARZA

APPENDIX A

CCTV INSPECTION FORMS AND REPORTS

Typical City CCTV Log Sheet
GBA Observations/Defects and Structural Scores
City-to-GBA Defect Conversion Guide
CCTV Reports for Sewers with High Structural Scores

CITY OF THOUSAND OAKS-UTILITIES DEPARTMENT

4 | 1
3 | 2 QUADRANT

WASTEWATER LINE T.V. INSPECTIO

SHEET NO. 4G:4H

STREET	DATE	INSPECTOR
Moorpark Rd	10-24-95	Noblitt

TAPE NO.	MANHOLE NO.	TO MANHOLE NO.	SECTION LENGTH	PIPE SIZE
1.04.35 27A 1.16.19	C6 to	C5 to C4	5Ft	12"

DISTANCE READING	QUAD.	CODE	RATING	DISTANCE READING	QUAD.	CODE	RATING	DISTANCE READING	QUAD.	CODE	RATING	REMARKS
76	4/1	II	2+									165-185 CP
104	1/2	CP	II									Light to heavy
105	CJ	CP	II									calcium build
110	J	II										up at every
119	CP	II										joint.
149	CP	II										
165	1/2 3/4	CP										
220	1/2	CP										
342	C/O	MH	C5									
38		II										
48		II										
59	CP	II										
183	4/1	CP										
238	1/2	C/P										
247	1/2	CP										
262	1/2 3/4	CP										
308	3/4	CP										
328-333	3/4	CP										
370-516	1/2 3/4	CP	Major									
520-560	1/2 3/4	CP										
595	C/O	MH	C4									

SPECIAL NOTES:	CODE:	REASON FOR INSPECTION:
CLEANLINESS	LATERAL-L	EXONERATION
LINE	BROKEN PIPE-BP	FIELD ACCEPTANCE
GRADE	OFFSET JOINT-OJ	TV OF REPAIR
MANHOLE CONDITIONS	PROTRUDING LATERAL-PL	RE-TV OF REPAIR
TYPE OF PIPE VC	CENTER OF-C/O	ROUTINE INSPECTION ✓
WHEEL ROLL DISTANCE	ROOTS-R HEAVY -3 MEDIUM-2 LIGHT -1	OTHER

C6 MANHOLE NO. — 342 Ft — C5 — 595 Ft. — C4 MANHOLE NO.

DIRECTION OF MEASURE → FLOW →

GBA Observations/Defects and Structural Scores

TV/Lamp Infilt | TV/Lamp Struc | TV/Lamp Clean | MH Flow | MH Cover | MH Struc | Smk/Dye/Bldg | Bldg Sumps

Code	Defect	Structure Rating 1	Structure Rating 2	Structure Rating 3	Structure Rating 4	Structure Rating 5
1	Crack-Radial	1	2	5	10	20
2	Crack-Horizontal	1	2	5	10	20
3	Broken Pipe	30	50	70	100	130
4	Collapsed Pipe	0	0	0	200	400
5	Wye Service	0	5	10	75	400
6	Break-in Conn	0	5	10	75	400
7	Extended Tap	1	5	10	75	400
8	Offset	0	0	25	70	120
9	Gapped Joint	0	0	25	70	120
10	Roots	1	2	5	10	20
11	Debris	0	0	0	0	0
12	Grease	0	0	0	0	0
13	Corrosion	3	6	10	25	75
14	Scaling	3	6	10	25	75
15	Sag	1	2	5	10	25
16	Infiltration	0	0	0	0	0
17	New Manhole	0	0	0	0	0
18	30' Horizontal Crack	10	20	50	100	200
31	Pipe Seal	5	10	20	60	100

TotalStructural Number = Sum of the structral numbers of all the TV inspection observations for each line

City-to-GBA Defect Conversion Guide

Defect	CTO Rating	GBA Rating
Grease	1	3
	2	4
	3	5
Cracked Pipe, Roots, Broken Pipe	1	1
	1+	2
	2	3
	2+	4
	3 or 3+	5
Inflow/Infiltration	slight	2
	medium	3
	heavy	4
	major	5

*If no rating was specified by city,
a GBA rating of 1 was assigned

Television Inspection Master Report

CCTV Reports for Sewers with High Structural Scores

5/16/2002
3:49:58PM

US Manhole: C2 **Date Insp:** 10/24/1995 **Basin:** C
DS Manhole: C1 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 12 12 Material: VC Index:
Length: 464.0 Slope: 0.194 Surface:
Pipe Sec Length: Comment: light to heavy calcium build-up at every joint

Inspection Information

Crew: Noblitt Percent Full: Tape ID: 27A
Weather: Purpose: TV Existing Line Counter Start: 2.16.19
Surface Cond: Flow: Counter Stop:
Dyed Test:

Mainentance Prior to TV:

Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 16
Max Obs Length: 464.0
Comment:

	Total	Remaining	Rating
Structural:	1025	1025	220.9
Flow:	1.566	1.566	0.338
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		0.0	unknown	Crack-Horizontal	1		0.002	1	0	0.002
2		0.0	unknown	Infiltration	1		0.002	0	0	0.002
3		14.0	unknown	30' Horizontal Crack	5		0.300	200	0	0.300
4		14.0	unknown	Infiltration	1		0.002	0	0	0.002
5		138.0	unknown	30' Horizontal Crack	5		0.300	200	0	0.300
6		138.0	unknown	Infiltration	1		0.002	0	0	0.002
7		168.0	unknown	30' Horizontal Crack	5		0.300	200	0	0.300
8		168.0	unknown	Infiltration	3		0.010	0	0	0.010
9		274.0	unknown	30' Horizontal Crack	1		0.020	10	0	0.020
10		295.0	unknown	30' Horizontal Crack	5		0.300	200	0	0.300
11		422.0	Crown	Crack-Horizontal	1		0.002	1	0	0.002
12		425.0	unknown	30' Horizontal Crack	1		0.020	10	0	0.020
13		457.0	unknown	Crack-Horizontal	1		0.002	1	0	0.002
14		462.0	Crown	Crack-Horizontal	1		0.002	1	0	0.002
15		464.0	DS Manhole	Crack-Horizontal	1		0.002	1	0	0.002
16		325.0	unknown	30' Horizontal Crack	5		0.300	200	0	0.300

US Manhole: C5 **Date Insp:** 10/24/1995 **Basin:** C
DS Manhole: C4 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 12 12 Material: VC Index:
Length: 595.0 Slope: 0.194 Surface:
Pipe Sec Length: Comment: light to heavy calcium build-up at every joint

Television Inspection Master Report

CCTV Reports for Sewers with High Structural Scores

5/16/2002
3:49:58PM

Inspection Information

Crew:	Noblitt	Percent Full:		Tape ID:	27A
Weather:		Purpose:	TV Existing Line	Counter Start:	1.04.35
Surface Cond:		Flow:		Counter Stop:	1.16.19
Dyed Test:					

Mainentance Prior to TV:

Cleaned:	False	Degrease:	False	Point Repair:	False	Manhole Replace:	False
Root Cut:	False	Root Chem:	False	Other:			

Overall Cond:
Collapsed/Blk: N
Max Obs #: 17
Max Obs Length: 520.0
Comment:

	Total	Remaining	Rating
Structural:	1018	1018	195.8
Flow:	1.542	1.542	0.297
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		38.0	unknown	Infiltration	1		0.002	0	0	0.002
2		48.0	unknown	Infiltration	1		0.002	0	0	0.002
3		59.0	unknown	Crack-Horizontal	1		0.002	1	0	0.002
4		59.0	unknown	Infiltration	1		0.002	0	0	0.002
5		183.0	Crown	Crack-Horizontal	1		0.002	1	0	0.002
6		238.0	Upper Right	Crack-Horizontal	1		0.002	1	0	0.002
7		247.0	Upper Right	Crack-Horizontal	1		0.002	1	0	0.002
8		262.0	Circumference	Crack-Radial	1		0.002	1	0	0.002
9		308.0	Upper Left	Crack-Horizontal	1		0.002	1	0	0.002
10		328.0	Upper Left	Crack-Horizontal	1		0.002	1	0	0.002
11		370.0	Circumference	30' Horizontal Crack	5		0.300	200	0	0.300
12		520.0	Circumference	Crack-Horizontal	1		0.002	1	0	0.002
13		400.0	Circumference	30' Horizontal Crack	5		0.300	200	0	0.300
14		430.0	Circumference	30' Horizontal Crack	5		0.300	200	0	0.300
15		460.0	Circumference	30' Horizontal Crack	5		0.300	200	0	0.300
16		490.0	Circumference	30' Horizontal Crack	5		0.300	200	0	0.300
17		520.0	Circumference	30' Horizontal Crack	1		0.020	10	0	0.020

US Manhole: C1 **Date Insp:** 10/24/1995 **Basin:** C
DS Manhole: A1 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape:		Length Status:	TV Inspections	Project No.:	
Dia/Ht Width:	12 12	Material:	VC	Index:	
Length:	430.0	Slope:	0.194	Surface:	
Pipe Sec Length:		Comment:	light to heavy calcium build-up at every joint		

Inspection Information

Crew:	Noblitt	Percent Full:		Tape ID:	27A
Weather:		Purpose:	TV Existing Line	Counter Start:	2.16.19
Surface Cond:		Flow:		Counter Stop:	
Dyed Test:					

Mainentance Prior to TV:

Cleaned:	False	Degrease:	False	Point Repair:	False	Manhole Replace:	False
Root Cut:	False	Root Chem:	False	Other:			

Overall Cond:
Collapsed/Blk: N
Max Obs #: 8
Max Obs Length: 110.0
Comment:

	Total	Remaining	Rating
Structural:	620	620	563.6
Flow:	0.940	0.940	0.855
Cleaning:	0	0	0.0

Television Inspection Master Report

CCTV Reports for Sewers with High Structural Scores

5/16/2002
3:49:58PM

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		20.0	Upper Right	30' Horizontal Crack	1		0.020	10	0	0.020
5		3.0	Upper Right	30' Horizontal Crack	1		0.020	10	0	0.020
6		50.0	unknown	30' Horizontal Crack	5		0.300	200	0	0.300
7		80.0	unknown	30' Horizontal Crack	5		0.300	200	0	0.300
8		110.0	unknown	30' Horizontal Crack	5		0.300	200	0	0.300

US Manhole: W58-1 **Date Insp:** 1/20/2000 **Basin:** W
DS Manhole: W58 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 21 21 Material: PVC Index:
Length: 180.0 Slope: 0.092 Surface:
Pipe Sec Length: Comment:

Inspection Information

Crew: Noblitt Percent Full: Tape ID: Unit W
Weather: Purpose: TV Existing Line Counter Start: 37.35
Surface Cond: Flow: Counter Stop: 58.25
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 5
Max Obs Length: 89.0
Comment:

	Total	Remaining	Rating
Structural:	600	600	674.2
Flow:	0.302	0.302	0.339
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		8.5	Crown	Wye Service			0.000	0	0	0.000
2		20.0	Crown	Collapsed Pipe	4		0.100	200	0	0.100
3		89.0	unknown	Infiltration	1		0.002	0	0	0.002
4		30.0	Crown	Collapsed Pipe	4		0.100	200	0	0.100
5		36.0	Crown	Collapsed Pipe	4		0.100	200	0	0.100

US Manhole: C4 **Date Insp:** 10/24/1995 **Basin:** C
DS Manhole: C3 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 12 12 Material: VC Index:
Length: 378.0 Slope: 0.194 Surface:
Pipe Sec Length: Comment:

Television Inspection Master Report

CCTV Reports for Sewers with High Structural Scores

5/16/2002
3:49:58PM

Inspection Information

Crew:	Noblitt	Percent Full:		Tape ID:	27A
Weather:		Purpose:	TV Existing Line	Counter Start:	1.04.35
Surface Cond:		Flow:		Counter Stop:	2.16.19
Dyed Test:					

Mainentance Prior to TV:

Cleaned:	False	Degrease:	False	Point Repair:	False	Manhole Replace:	False
Root Cut:	False	Root Chem:	False	Other:			

Overall Cond:
Collapsed/Blk: N
Max Obs #: 22
Max Obs Length: 333.0
Comment:

	Total	Remaining	Rating
Structural:	551	551	165.5
Flow:	0.294	0.294	0.088
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		5.0	Circumference	Crack-Horizontal	1		0.002	1	0	0.002
2		75.0	Crown	Crack-Horizontal	1		0.002	1	0	0.002
3		82.0	Circumference	Crack-Horizontal	1		0.002	1	0	0.002
4		100.0	unknown	Infiltration	3		0.010	0	0	0.010
5		105.0	Circumference	Crack-Horizontal	1		0.002	1	0	0.002
6		105.0	Circumference	Infiltration	3		0.010	0	0	0.010
7		125.0	Crown	Crack-Horizontal	5		0.030	20	0	0.030
8		160.0	Upper Right	Crack-Horizontal	1		0.002	1	0	0.002
9		160.0	Upper Right	Infiltration	3		0.010	0	0	0.010
10		250.0	unknown	Infiltration	2		0.004	0	0	0.004
11		274.0	unknown	Infiltration	2		0.004	0	0	0.004
12		333.0	unknown	Infiltration	2		0.004	0	0	0.004
13		8.0	Circumference	Crack-Horizontal	1		0.002	1	0	0.002
14		11.0	Circumference	Crack-Horizontal	1		0.002	1	0	0.002
15		14.0	Circumference	Crack-Horizontal	1		0.002	1	0	0.002
16		17.0	Circumference	Crack-Horizontal	1		0.002	1	0	0.002
17		85.0	Circumference	Crack-Horizontal	1		0.002	1	0	0.002
18		88.0	Circumference	Crack-Horizontal	1		0.002	1	0	0.002
19		100.0	unknown	Broken Pipe	5		0.050	130	0	0.050
20		130.0	unknown	Broken Pipe	5		0.050	130	0	0.050
21		190.0	unknown	Broken Pipe	5		0.050	130	0	0.050
22		220.0	unknown	Broken Pipe	5		0.050	130	0	0.050

US Manhole: X1 **Date Insp:** 10/26/2000 **Basin:** X
DS Manhole: X0 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape:			Length Status:	TV Inspections	Project No.:
Dia/Ht	Width: 12	12	Material:	PVC	Index:
Length:	465.0		Slope:	0.194	Surface:
Pipe Sec Length:		Comment:	10'-25',56'-61', 88-465' "MAJOR PROBLEMS"		

Television Inspection Master Report

CCTV Reports for Sewers with High Structural Scores

5/16/2002
3:49:58PM

Inspection Information

Crew:	Noblitt	Percent Full:		Tape ID:	48A
Weather:		Purpose:	TV Existing Line	Counter Start:	1.20.40
Surface Cond:		Flow:		Counter Stop:	2.09.40
Dyed Test:					

Mainentance Prior to TV:

Cleaned:	False	Degrease:	False	Point Repair:	False	Manhole Replace:	False
Root Cut:	False	Root Chem:	False	Other:			

Overall Cond:
Collapsed/Blk: N
Max Obs #: 4
Max Obs Length: 388.0
Comment:

	Total	Remaining	Rating
Structural:	440	440	113.4
Flow:	0.162	0.162	0.042
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		46.0	Crown	Broken Pipe	2		0.012	50	0	0.012
2		10.0	unknown	Broken Pipe	5		0.050	130	0	0.050
3		56.0	unknown	Broken Pipe	5		0.050	130	0	0.050
4		388.0	unknown	Broken Pipe	5		0.050	130	0	0.050

US Manhole: W24-3 **Date Insp:** 12/20/2001 **Basin:** E
DS Manhole: W24-2 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape:		Length Status:	TV Inspections	Project No.:	
Dia/Ht Width:	24 24	Material:	RCP	Index:	
Length:	266.0	Slope:	0.989	Surface:	
Pipe Sec Length:	12.0	Comment:	Heavy steam present.		

Inspection Information

Crew:	Nat.Plant	Percent Full:		Tape ID:	03
Weather:	Cloudy	Purpose:	TV Existing Line	Counter Start:	00.07.24
Surface Cond:		Flow:		Counter Stop:	00.13.23
Dyed Test:					

Mainentance Prior to TV:

Cleaned:	False	Degrease:	False	Point Repair:	False	Manhole Replace:	False
Root Cut:	False	Root Chem:	False	Other:			

Overall Cond:
Collapsed/Blk: N
Max Obs #: 29
Max Obs Length: 266.3
Comment:

	Total	Remaining	Rating
Structural:	335	335	125.8
Flow:	0.200	0.200	0.075
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		20.0	Unknown	Scaling	3		0.000	10	0	0.000
2		20.0	Crown	Corrosion	3		0.000	10	0	0.000
3		40.0	Unknown	Scaling	3		0.000	10	0	0.000
4		40.0	Crown	Corrosion	3		0.000	10	0	0.000
5		60.0	Unknown	Scaling	3		0.000	10	0	0.000
6		60.0	Crown	Corrosion	3		0.000	10	0	0.000
7		80.0	Unknown	Scaling	3		0.000	10	0	0.000
8		80.0	Crown	Corrosion	3		0.000	10	0	0.000
9		100.0	Unknown	Scaling	3		0.000	10	0	0.000
10		100.0	Crown	Corrosion	3		0.000	10	0	0.000
11		120.0	Unknown	Scaling	3		0.000	10	0	0.000
12		120.0	Crown	Corrosion	3		0.000	10	0	0.000

13	140.0	Unknown	Scaling	3	0.000	10	0	0.000
14	140.0	Crown	Corrosion	3	0.000	10	0	0.000
15	160.0	Unknown	Scaling	3	0.000	10	0	0.000
16	160.0	Crown	Corrosion	3	0.000	10	0	0.000
17	180.0	Unknown	Scaling	3	0.000	10	0	0.000
18	180.0	Crown	Corrosion	3	0.000	10	0	0.000
19	200.0	Unknown	Scaling	3	0.000	10	0	0.000
20	200.0	Crown	Corrosion	3	0.000	10	0	0.000
21	220.0	Unknown	Scaling	3	0.000	10	0	0.000
22	220.0	Crown	Corrosion	3	0.000	10	0	0.000
23	240.0	Unknown	Scaling	3	0.000	10	0	0.000
24	240.0	Crown	Corrosion	3	0.000	10	0	0.000
25	260.0	Unknown	Scaling	3	0.000	10	0	0.000
26	260.0	Crown	Corrosion	3	0.000	10	0	0.000
27	266.3	DS Manhole	Corrosion	4	0.100	25	0	0.100
28	193.0	Crown	Corrosion	4	0.100	25	0	0.100
29	193.0	Lower Right	Scaling	4	0.000	25	0	0.000

US Manhole: W24-2 **Date Insp:** 12/20/2001 **Basin:** E
DS Manhole: W24-1 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: As-Built Drawings Project No.:
Dia/Ht Width: 21 21 Material: RCP Index:
Length: 489.0 Slope: 4.000 Surface:
Pipe Sec Length: Comment: Inspection abandoned due to heavy flow. Suspect moderate corrosion and scaling based on upstream pipe conditions.

Inspection Information

Crew: Nat.Plant Percent Full: Tape ID: 03
Weather: Cloudy Purpose: TV Existing Line Counter Start: 00.13.23
Surface Cond: Flow: Counter Stop: 00.23.31
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 29
Max Obs Length: 266.3
Comment:

	Total	Remaining	Rating
Structural:	335	335	125.8
Flow:	0.200	0.200	0.075
Cleaning:	0	0	0.0

US Manhole: X3 **Date Insp:** 10/26/2000 **Basin:** X
DS Manhole: X2 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 12 12 Material: AC Index:
Length: 230.0 Slope: 0.194 Surface:
Pipe Sec Length: Comment:

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Inspection Information

Crew: Noblitt | Percent Full: | Tape ID: 48A
Weather: | Purpose: TV Existing Line | Counter Start: 1.20.40
Surface Cond: | Flow: | Counter Stop: 2.09.40
Dyed Test:

Mainentance Prior to TV:
Cleaned: False | Degrease: False | Point Repair: False | Manhole Replace: False
Root Cut: False | Root Chem: False | Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 14
Max Obs Length: 230.0
Comment:

	Total	Remaining	Rating
Structural:	331	331	143.9
Flow:	0.062	0.062	0.027
Cleaning:	58	58	25.2

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		47.5	Joint	Roots	3		0.010	5	8	0.010
3		60.0	Joint	Roots	3		0.010	5	8	0.010
5		72.0	Joint	Roots	4		0.020	10	25	0.020
7		173.0	Joint	Roots	3		0.010	5	8	0.010
9		223.0	Joint	Roots	3		0.010	5	8	0.010
10		230.0	DS Manhole	Roots	1		0.002	1	1	0.002
11		47.5	Joint	Scaling	5		0.000	75	0	0.000
12		60.0	Joint	Scaling	5		0.000	75	0	0.000
13		72.0	Joint	Scaling	5		0.000	75	0	0.000
14		173.0	Joint	Scaling	5		0.000	75	0	0.000

US Manhole: X2 | **Date Insp:** 10/26/2000 | **Basin:** X
DS Manhole: X1 | **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: | Length Status: TV Inspections | Project No.:
Dia/Ht Width: 12 12 | Material: AC | Index:
Length: 223.0 | Slope: 0.194 | Surface:
Pipe Sec Length: | Comment:

Inspection Information

Crew: Noblitt | Percent Full: | Tape ID: 48A
Weather: | Purpose: TV Existing Line | Counter Start: 1.20.40
Surface Cond: | Flow: | Counter Stop: 2.09.40
Dyed Test:

Mainentance Prior to TV:
Cleaned: False | Degrease: False | Point Repair: False | Manhole Replace: False
Root Cut: False | Root Chem: False | Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 9
Max Obs Length: 76.0
Comment:

	Total	Remaining	Rating
Structural:	181	181	238.2
Flow:	0.062	0.062	0.082
Cleaning:	67	67	88.2

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		0.0	US Manhole	Roots	1		0.002	1	1	0.002
2		13.0	Joint	Roots	4		0.020	10	25	0.020
3		13.0	Joint	Scaling	5		0.000	75	0	0.000
4		13.0	Joint	Rubber Out			0.000	0	0	0.000
5		26.0	Joint	Roots	3		0.010	5	8	0.010
6		26.0	Joint	Scaling	5		0.000	75	0	0.000

7	26.0	Joint	Rubber Out		0.000	0	0	0.000
8	64.0	Joint	Roots	3	0.010	5	8	0.010
9	76.0	Joint	Roots	4	0.020	10	25	0.020

US Manhole: W24-11 **Date Insp:** 12/20/2001 **Basin:** E
DS Manhole: W24-10 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 33 33 Material: RCP Index:
Length: 400.0 Slope: 0.183 Surface:
Pipe Sec Length: 13.0 Comment:

Inspection Information

Crew: Nat. Plant Percent Full: Tape ID: 02
Weather: Cloudy Purpose: TV Existing Line Counter Start: 01.37.39
Surface Cond: Flow: Counter Stop: 01.48.54
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 6
Max Obs Length: 365.0
Comment:

	Total	Remaining	Rating
Structural:	150	150	41.1
Flow:	0.020	0.020	0.005
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		155.0	Joint	Offset	3		0.020	25	0	0.020
2		166.0	Camera Submerged	Sag	5		0.000	25	0	0.000
3		215.0	Crown	Sag	5		0.000	25	0	0.000
4		265.0	Crown	Sag	5		0.000	25	0	0.000
5		315.0	Crown	Sag	5		0.000	25	0	0.000
6		365.0	Crown	Sag	5		0.000	25	0	0.000

US Manhole: C3 **Date Insp:** 10/24/1995 **Basin:** C
DS Manhole: C2 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 12 12 Material: VC Index:
Length: 490.0 Slope: 0.194 Surface:
Pipe Sec Length: Comment: light to heavy calcium build-up at every joint

Inspection Information

Crew: Noblitt Percent Full: Tape ID: 27A
Weather: Purpose: TV Existing Line Counter Start: 2.16.19
Surface Cond: Flow: Counter Stop:
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 57
Max Obs Length: 480.0
Comment:

	Total	Remaining	Rating
Structural:	148	148	30.8
Flow:	0.018	0.018	0.004
Cleaning:	0	0	0.0

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Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		210.0	unknown		1		0.002	1	0	0.002
2		210.0	unknown	Infiltration	1		0.002	0	0	0.002
3		215.0	Upper Right	Crack-Horizontal	1		0.002	1	0	0.002
4		215.0	Upper Right	Infiltration	1		0.002	0	0	0.002
5		230.0	Upper Left	Crack-Horizontal	1		0.002	1	0	0.002
6		230.0	Upper Left	Infiltration	1		0.002	0	0	0.002
7		244.0	unknown	Infiltration	1		0.002	0	0	0.002
8		250.0	unknown	Crack-Horizontal	1		0.002	1	0	0.002
9		250.0	unknown	Infiltration	1		0.002	0	0	0.002
10		10.0	Joint	Scaling	1		0.000	3	0	0.000
11		20.0	Joint	Scaling	1		0.000	3	0	0.000
12		30.0	Joint	Scaling	1		0.000	3	0	0.000
13		40.0	Joint	Scaling	1		0.000	3	0	0.000
14		50.0	Joint	Scaling	1		0.000	3	0	0.000
15		60.0	Joint	Scaling	1		0.000	3	0	0.000
16		70.0	Joint	Scaling	1		0.000	3	0	0.000
17		80.0	Joint	Scaling	1		0.000	3	0	0.000
18		90.0	Joint	Scaling	1		0.000	3	0	0.000
19		100.0	Joint	Scaling	1		0.000	3	0	0.000
20		110.0	Joint	Scaling	1		0.000	3	0	0.000
21		120.0	Joint	Scaling	1		0.000	3	0	0.000
22		130.0	Joint	Scaling	1		0.000	3	0	0.000
23		140.0	Joint	Scaling	1		0.000	3	0	0.000
24		150.0	Joint	Scaling	1		0.000	3	0	0.000
25		160.0	Joint	Scaling	1		0.000	3	0	0.000
26		170.0	Joint	Scaling	1		0.000	3	0	0.000
27		180.0	Joint	Scaling	1		0.000	3	0	0.000
28		190.0	Joint	Scaling	1		0.000	3	0	0.000
29		200.0	Joint	Scaling	1		0.000	3	0	0.000
30		210.0	Joint	Scaling	1		0.000	3	0	0.000
31		220.0	Joint	Scaling	1		0.000	3	0	0.000
32		230.0	Joint	Scaling	1		0.000	3	0	0.000
33		240.0	Joint	Scaling	1		0.000	3	0	0.000
34		250.0	Joint	Scaling	1		0.000	3	0	0.000
35		260.0	Joint	Scaling	1		0.000	3	0	0.000
36		270.0	Joint	Scaling	1		0.000	3	0	0.000
37		280.0	Joint	Scaling	1		0.000	3	0	0.000
38		290.0	Joint	Scaling	1		0.000	3	0	0.000
39		300.0	Joint	Scaling	1		0.000	3	0	0.000
40		310.0	Joint	Scaling	1		0.000	3	0	0.000
41		320.0	Joint	Scaling	1		0.000	3	0	0.000
42		330.0	Joint	Scaling	1		0.000	3	0	0.000
43		340.0	Joint	Scaling	1		0.000	3	0	0.000
44		350.0	Joint	Scaling	1		0.000	3	0	0.000
45		360.0	Joint	Scaling	1		0.000	3	0	0.000
46		370.0	Joint	Scaling	1		0.000	3	0	0.000
47		380.0	Joint	Scaling	1		0.000	3	0	0.000
48		390.0	Joint	Scaling	1		0.000	3	0	0.000
49		400.0	Joint	Scaling	1		0.000	3	0	0.000
50		410.0	Joint	Scaling	1		0.000	3	0	0.000
51		420.0	Joint	Scaling	1		0.000	3	0	0.000
52		430.0	Joint	Scaling	1		0.000	3	0	0.000
53		440.0	Joint	Scaling	1		0.000	3	0	0.000
54		450.0	Joint	Scaling	1		0.000	3	0	0.000
55		460.0	Joint	Scaling	1		0.000	3	0	0.000
56		470.0	Joint	Scaling	1		0.000	3	0	0.000
57		480.0	Joint	Scaling	1		0.000	3	0	0.000

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US Manhole: G3 **Date Insp:** 12/21/2001 **Basin:** G
DS Manhole: G2 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 15 15 Material: VC Index:
Length: 285.0 Slope: Surface:
Pipe Sec Length: 6.0 Comment: G3 is a brick manhole. Offset joint may be intentional to avoid another utility? Inspection abandoned when camera blocked at 99.40'

Inspection Information

Crew: Nat.Plant Percent Full: Tape ID: 03
Weather: Cloudy Purpose: TV Existing Line Counter Start: 00.23.31
Surface Cond: Flow: Counter Stop: 00.29.46
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 3
Max Obs Length: 95.8
Comment:

	Total	Remaining	Rating
Structural:	130	130	135.7
Flow:	0.070	0.070	0.073
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		0.0	Joint	Crack-Radial	4		0.020	10	0	0.020
2		93.1	Joint	Offset	5		0.050	120	0	0.050
3		95.8	Camera Submerged							0.000

US Manhole: G3 **Date Insp:** 12/21/2001 **Basin:** G
DS Manhole: G2 **Dir Televised:** Downstream to Upstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 15 15 Material: VC Index:
Length: 285.0 Slope: Surface:
Pipe Sec Length: 6.0 Comment: G3 is a brick manhole. Offset joint may be intentional to avoid another utility? Inspection abandoned when camera blocked at 99.40'

Inspection Information

Crew: Nat.Plant Percent Full: Tape ID: 03
Weather: Cloudy Purpose: TV Existing Line Counter Start: 00.29.49
Surface Cond: Flow: Counter Stop: 00.31.36
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 3
Max Obs Length: 95.8
Comment:

	Total	Remaining	Rating
Structural:	130	130	135.7
Flow:	0.070	0.070	0.073
Cleaning:	0	0	0.0

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US Manhole: C6 **Date Insp:** 10/24/1995 **Basin:** C
DS Manhole: C5 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 12 12 Material: VC Index:
Length: 342.0 Slope: 0.194 Surface:
Pipe Sec Length: Comment: light to heavy calcium build-up at every joint

Inspection Information

Crew: Noblitt Percent Full: Tape ID: 27A
Weather: Purpose: TV Existing Line Counter Start: 1.04.35
Surface Cond: Flow: Counter Stop: 1.16.19
Dyed Test:

Mainentance Prior to TV:

Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 46
Max Obs Length: 330.0
Comment:

	Total	Remaining	Rating
Structural:	117	117	35.5
Flow:	0.050	0.050	0.015
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		76.0	Crown	Infiltration	3		0.010	0	0	0.010
2		104.0	Upper Right	Crack-Horizontal	1		0.002	1	0	0.002
3		104.0	Upper Right	Infiltration	1		0.002	0	0	0.002
4		105.0	Joint	Crack-Horizontal	1		0.002	1	0	0.002
5		105.0	Joint	Infiltration	1		0.002	0	0	0.002
6		110.0	Joint	Infiltration	1		0.002	0	0	0.002
7		119.0	unknown	Crack-Horizontal	1		0.002	1	0	0.002
8		119.0	unknown	Infiltration	1		0.002	0	0	0.002
9		149.0	unknown	Crack-Horizontal	1		0.002	1	0	0.002
10		149.0	unknown	Infiltration	1		0.002	0	0	0.002
11		165.0	Circumference	30' Horizontal Crack	1		0.020	10	0	0.020
12		220.0	Upper Right	Crack-Horizontal	1		0.002	1	0	0.002
13		100.0	Joint	Scaling	1		0.000	3	0	0.000
14		20.0	Joint	Scaling	1		0.000	3	0	0.000
15		120.0	Joint	Scaling	1		0.000	3	0	0.000
16		80.0	Joint	Scaling	1		0.000	3	0	0.000
17		50.0	Joint	Scaling	1		0.000	3	0	0.000
18		30.0	Joint	Scaling	1		0.000	3	0	0.000
19		60.0	Joint	Scaling	1		0.000	3	0	0.000
20		40.0	Joint	Scaling	1		0.000	3	0	0.000
21		20.0	Joint	Scaling	1		0.000	3	0	0.000
22		90.0	Joint	Scaling	1		0.000	3	0	0.000
23		10.0	Joint	Scaling	1		0.000	3	0	0.000
24		110.0	Joint	Scaling	1		0.000	3	0	0.000
25		70.0	Joint	Scaling	1		0.000	3	0	0.000
26		130.0	Joint	Scaling	1		0.000	3	0	0.000
27		140.0	Joint	Scaling	1		0.000	3	0	0.000
28		150.0	Joint	Scaling	1		0.000	3	0	0.000
29		160.0	Joint	Scaling	1		0.000	3	0	0.000
30		170.0	Joint	Scaling	1		0.000	3	0	0.000
31		180.0	Joint	Scaling	1		0.000	3	0	0.000
32		190.0	Joint	Scaling	1		0.000	3	0	0.000
33		200.0	Joint	Scaling	1		0.000	3	0	0.000
34		210.0	Joint	Scaling	1		0.000	3	0	0.000

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35	220.0	Joint	Scaling	1	0.000	3	0	0.000
36	230.0	Joint	Scaling	1	0.000	3	0	0.000
37	240.0	Joint	Scaling	1	0.000	3	0	0.000
38	250.0	Joint	Scaling	1	0.000	3	0	0.000
39	260.0	Joint	Scaling	1	0.000	3	0	0.000
40	270.0	Joint	Scaling	1	0.000	3	0	0.000
41	280.0	Joint	Scaling	1	0.000	3	0	0.000
42	290.0	Joint	Scaling	1	0.000	3	0	0.000
43	300.0	Joint	Scaling	1	0.000	3	0	0.000
44	310.0	Joint	Scaling	1	0.000	3	0	0.000
45	320.0	Joint	Scaling	1	0.000	3	0	0.000
46	330.0	Joint	Scaling	1	0.000	3	0	0.000

US Manhole: C7 **Date Insp:** 10/23/1995 **Basin:** C
DS Manhole: C6 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 12 12 Material: VC Index:
Length: 495.0 Slope: 0.194 Surface:
Pipe Sec Length: Comment:

Inspection Information

Crew: Noblitt Percent Full: Tape ID: 27A
Weather: Purpose: TV Existing Line Counter Start: 9.42
Surface Cond: Flow: Counter Stop: 1.04.35
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 36
Max Obs Length: 470.0
Comment:

	Total	Remaining	Rating
Structural:	113	113	24.0
Flow:	0.248	0.248	0.053
Cleaning:	11	11	2.3

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
3		70.0	unknown	Infiltration	1		0.002	0	0	0.002
4		70.0	unknown	Roots	1		0.002	1	1	0.002
5		190.0	unknown	Roots	1		0.002	1	1	0.002
6		190.0	unknown	Infiltration	1		0.002	0	0	0.002
7		0.0	unknown	30' Horizontal Crack	1		0.020	10	0	0.020
8		30.0	unknown	Crack-Horizontal	1		0.002	1	0	0.002
9		190.0	unknown	Crack-Horizontal	1		0.002	1	0	0.002
10		220.0	unknown	30' Horizontal Crack	1		0.020	10	0	0.020
11		250.0	unknown	30' Horizontal Crack	1		0.020	10	0	0.020
12		280.0	unknown	30' Horizontal Crack	1		0.020	10	0	0.020
13		310.0	unknown	30' Horizontal Crack	1		0.020	10	0	0.020
14		340.0	unknown	30' Horizontal Crack	1		0.020	10	0	0.020
15		370.0	unknown	30' Horizontal Crack	1		0.020	10	0	0.020
16		400.0	unknown	30' Horizontal Crack	1		0.020	10	0	0.020
17		430.0	unknown	30' Horizontal Crack	1		0.020	10	0	0.020
18		470.0	unknown	30' Horizontal Crack	1		0.020	10	0	0.020
19		220.0	unknown	Roots	1		0.002	1	1	0.002
20		250.0	unknown	Roots	1		0.002	1	1	0.002
21		220.0	unknown	Infiltration	1		0.002	0	0	0.002
22		250.0	unknown	Infiltration	1		0.002	0	0	0.002
23		280.0	unknown	Roots	1		0.002	1	1	0.002
24		310.0	unknown	Roots	1		0.002	1	1	0.002

25	340.0	unknown	Roots	1	0.002	1	1	0.002
26	370.0	unknown	Roots	1	0.002	1	1	0.002
27	400.0	unknown	Roots	1	0.002	1	1	0.002
28	430.0	unknown	Roots	1	0.002	1	1	0.002
29	470.0	unknown	Roots	1	0.002	1	1	0.002
30	280.0	unknown	Infiltration	1	0.002	0	0	0.002
31	310.0	unknown	Infiltration	1	0.002	0	0	0.002
32	340.0	unknown	Infiltration	1	0.002	0	0	0.002
33	370.0	unknown	Infiltration	1	0.002	0	0	0.002
34	400.0	unknown	Infiltration	1	0.002	0	0	0.002
35	430.0	unknown	Infiltration	1	0.002	0	0	0.002
36	470.0	unknown	Infiltration	1	0.002	0	0	0.002

US Manhole: W56 **Date Insp:** 1/23/2000 **Basin:** W
DS Manhole: W55 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 21 21 Material: AC Index:
Length: 325.0 Slope: 0.092 Surface:
Pipe Sec Length: Comment:

Inspection Information

Crew: Noblitt Percent Full: Tape ID: Unit W
Weather: Purpose: TV Existing Line Counter Start: 3.42
Surface Cond: Flow: Counter Stop: 29.10
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 10
Max Obs Length: 252.0
Comment:

	Total	Remaining	Rating
Structural:	105	105	41.7
Flow:	0.160	0.160	0.063
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		0.0	US Manhole	Crack-Horizontal	1		0.002	1	0	0.002
2		240.0	unknown	Crack-Horizontal	5		0.030	20	0	0.030
3		3.0	Crown	Crack-Horizontal	1		0.002	1	0	0.002
4		6.0	Crown	Crack-Horizontal	1		0.002	1	0	0.002
5		9.0	Crown	Crack-Horizontal	1		0.002	1	0	0.002
6		12.0	Crown	Crack-Horizontal	1		0.002	1	0	0.002
7		243.0	unknown	Crack-Horizontal	5		0.030	20	0	0.030
8		246.0	unknown	Crack-Horizontal	5		0.030	20	0	0.030
9		249.0	unknown	Crack-Horizontal	5		0.030	20	0	0.030
10		252.0	unknown	Crack-Horizontal	5		0.030	20	0	0.030

US Manhole: W24-10 **Date Insp:** 12/20/2001 **Basin:** E
DS Manhole: W24-9 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 33 33 Material: RCP Index:
Length: 204.0 Slope: 0.181 Surface:
Pipe Sec Length: 12.0 Comment: Camera submerged 80% of the pipe.

Television Inspection Master Report

CCTV Reports for Sewers with High Structural Scores

5/16/2002
3:49:58PM

Inspection Information

Crew:	Nat. Plant	Percent Full:		Tape ID:	02
Weather:	Cloudy	Purpose:	TV Existing Line	Counter Start:	01.49.23
Surface Cond:		Flow:		Counter Stop:	01.56.52
Dyed Test:					

Mainentance Prior to TV:

Cleaned:	False	Degrease:	False	Point Repair:	False	Manhole Replace:	False
Root Cut:	False	Root Chem:	False	Other:			

Overall Cond:
Collapsed/Blk: N
Max Obs #: 4
Max Obs Length: 203.0
Comment:

	Total	Remaining	Rating
Structural:	100	100	49.3
Flow:	0.000	0.000	0.000
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		0.1	Camera Submerged	Sag	5		0.000	25	0	0.000
2		103.0	Crown	Sag	5		0.000	25	0	0.000
3		153.0	Crown	Sag	5		0.000	25	0	0.000
4		203.0	Crown	Sag	5		0.000	25	0	0.000

US Manhole: B11 **Date Insp:** 3/9/2000 **Basin:** B
DS Manhole: B10A **Dir Televised:** Upstream to Downstream

Pipe Information

Shape:			Length Status:	TV Inspections	Project No.:
Dia/Ht	Width: 10	10	Material:	VC	Index:
Length:	285.0		Slope:	0.248	Surface:
Pipe Sec Length:		Comment:	53'-94' sag, 105'-140' sag, 190'-225' sag, 240'-sag		

Inspection Information

Crew:	Noblitt	Percent Full:		Tape ID:	
Weather:		Purpose:	TV Existing Line	Counter Start:	00.00
Surface Cond:		Flow:		Counter Stop:	44.20
Dyed Test:					

Mainentance Prior to TV:

Cleaned:	False	Degrease:	False	Point Repair:	False	Manhole Replace:	False
Root Cut:	False	Root Chem:	False	Other:			

Overall Cond:
Collapsed/Blk: N
Max Obs #: 11
Max Obs Length: 254.0
Comment:

	Total	Remaining	Rating
Structural:	96	96	37.8
Flow:	0.054	0.054	0.021
Cleaning:	9	9	3.5

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		51.0	Upper Right	Wye Service			0.000	0	0	0.000
2		51.0	Wye Service	Roots	1		0.002	1	1	0.002
3		53.0	Upper Left	Wye Service			0.000	0	0	0.000
4		53.0	Wye Service	Roots	3		0.010	5	8	0.010
5		127.0	Upper Left	Wye Service			0.000	0	0	0.000
6		214.0	Upper Right	Wye Service			0.000	0	0	0.000
7		247.0	Crown	Broken Pipe	1		0.006	30	0	0.006
8		252.0	Crown	Broken Pipe	1		0.006	30	0	0.006
9		254.0	unknown	Crack-Horizontal	5		0.030	20	0	0.030
10		60.0	Crown	Sag	3		0.000	5	0	0.000
11		110.0	Crown	Sag	3		0.000	5	0	0.000

Television Inspection Master Report

CCTV Reports for Sewers with High Structural Scores

5/16/2002
3:49:58PM

US Manhole: F14 **Date Insp:** 11/19/2001 **Basin:** E
DS Manhole: F15 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape:
Dia/Ht Width: 8 8
Length: 343.0
Pipe Sec Length: 3.0 Comment:

Length Status: As-Built Drawings
Material: VC
Slope:

Project No.:
Index:
Surface:

Inspection Information

Crew: Wilson
Weather:
Surface Cond:
Dyed Test:

Percent Full:
Purpose: TV Existing Line
Flow:

Tape ID: UF
Counter Start: 00.00
Counter Stop: 30.40

Mainentance Prior to TV:

Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 42
Max Obs Length: 331.0
Comment:

	Total	Remaining	Rating
Structural:	89	89	26.9
Flow:	0.118	0.118	0.036
Cleaning:	48	48	14.5

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		3.0	Joint	Roots	1		0.002	1	1	0.002
2		21.0	Joint	Roots	1		0.002	1	1	0.002
3		46.0	Joint	Roots	1		0.002	1	1	0.002
4		56.0	Joint	Roots	1		0.002	1	1	0.002
5		66.0	Joint	Offset	3		0.020	25	0	0.020
6		67.0	Upper Right	Wye Service						0.000
7		68.0	Joint	Offset	3		0.020	25	0	0.020
8		93.0	Joint	Roots	1		0.002	1	1	0.002
9		136.0	Joint	Roots	1		0.002	1	1	0.002
10		141.0	unknown	Crack-Horizontal	1		0.002	1	0	0.002
11		143.0	Joint	Roots	1		0.002	1	1	0.002
12		152.0	Joint	Roots	1		0.002	1	1	0.002
13		156.0	Joint	Roots	1		0.002	1	1	0.002
14		157.0	unknown	Hole	1		0.000	0	0	0.000
15		159.0	Joint	Roots	1		0.002	1	1	0.002
16		162.0	Joint	Roots	1		0.002	1	1	0.002
17		166.0	Joint	Roots	2		0.004	2	4	0.004
18		168.0	Upper Left	Wye Service						0.000
19		169.0	Joint	Roots	2		0.004	2	4	0.004
20		176.0	Joint	Roots	1		0.002	1	1	0.002
21		181.0	Joint	Roots	1		0.002	1	1	0.002
22		186.0	Joint	Roots	1		0.002	1	1	0.002
23		192.0	Joint	Roots	1		0.002	1	1	0.002
24		206.0	Joint	Roots	1		0.002	1	1	0.002
25		249.0	Joint	Roots	2		0.004	2	4	0.004
26		261.0	Upper Left	Wye Service						0.000
27		262.0	Joint	Roots	1		0.002	1	1	0.002
28		265.0	Joint	Roots	1		0.002	1	1	0.002
29		278.0	Joint	Roots	2		0.004	2	4	0.004
30		282.0	Joint	Roots	1		0.002	1	1	0.002
31		285.0	Joint	Roots	1		0.002	1	1	0.002
32		288.0	Joint	Roots	1		0.002	1	1	0.002
33		292.0	Joint	Roots	1		0.002	1	1	0.002
34		299.0	Joint	Roots	2		0.004	2	4	0.004

35	302.0	Joint	Roots	1	0.002	1	1	0.002
36	305.0	Joint	Roots	1	0.002	1	1	0.002
37	308.0	Joint	Roots	1	0.002	1	1	0.002
38	311.0	Joint	Roots	1	0.002	1	1	0.002
39	315.0	Joint	Roots	1	0.002	1	1	0.002
40	317.0	Joint	Offset	2	0.000	0	0	0.000
41	319.0	Upper Left	Wye Service					0.000
42	331.0	Joint	Roots	1	0.002	1	1	0.002

US Manhole: V11 **Date Insp:** 8/2/2000 **Basin:** V
DS Manhole: V10-1 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 18 18 Material: AC Index:
Length: 393.0 Slope: 0.114 Surface:
Pipe Sec Length: Comment:

Inspection Information

Crew: Stidham Percent Full: Tape ID: T0B/TOB2
Weather: Purpose: TV Existing Line Counter Start: 6.02.39
Surface Cond: Flow: Counter Stop: 0.41.59
Dyed Test:

Mainentance Prior to TV:

Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 10
Max Obs Length: 385.0
Comment:

	Total	Remaining	Rating
Structural:	85	85	22.1
Flow:	0.004	0.004	0.001
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		33.0	Upper Left	Wye Service			0.000	0	0	0.000
2		104.0	Upper Left	Wye Service			0.000	0	0	0.000
3		109.0	Upper Right	Wye Service			0.000	0	0	0.000
4		164.0	Upper Right	Wye Service			0.000	0	0	0.000
5		177.0	Upper Left	Wye Service			0.000	0	0	0.000
6		177.0	Wye Service	Scaling	5		0.000	75	0	0.000
7		211.0	Wye Service	Extended Tap	3		0.004	10	0	0.004
8		236.0	Upper Right	Wye Service			0.000	0	0	0.000
9		385.0	Upper Left	Wye Service			0.000	0	0	0.000
10		211.0	Upper Left	Wye Service			0.000	0	0	0.000

US Manhole: W24-4B **Date Insp:** 12/20/2001 **Basin:** E
DS Manhole: W24-4 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 8 30 Material: RCP Index:
Length: 177.0 Slope: 0.341 Surface:
Pipe Sec Length: 12.0 Comment: Heavy steam present.

Television Inspection Master Report

CCTV Reports for Sewers with High Structural Scores

5/16/2002
3:49:58PM

Inspection Information

Crew:	Nat.Plant	Percent Full:		Tape ID:	02
Weather:	Cloudy	Purpose:	TV Existing Line	Counter Start:	01.23.59
Surface Cond:		Flow:		Counter Stop:	01.30.08
Dyed Test:					

Mainentance Prior to TV:

Cleaned:	False	Degrease:	False	Point Repair:	False	Manhole Replace:	False
Root Cut:	False	Root Chem:	False	Other:			

Overall Cond:
Collapsed/Blk: N
Max Obs #: 10
Max Obs Length: 245.5
Comment:

	Total	Remaining	Rating
Structural:	84	84	34.2
Flow:	0.000	0.000	0.000
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		20.0	Crown	Corrosion	3		0.000	10	0	0.000
2		82.0	Crown	Corrosion	3		0.000	10	0	0.000
3		95.0	Crown	Corrosion	3		0.000	10	0	0.000
4		117.0	Crown	Corrosion	3		0.000	10	0	0.000
5		130.0	Crown	Corrosion	3		0.000	10	0	0.000
6		150.0	Crown	Corrosion	2		0.000	6	0	0.000
7		162.0	Crown	Corrosion	2		0.000	6	0	0.000
8		190.0	Upper Right	Corrosion	2		0.000	6	0	0.000
9		196.0	Upper Left	Corrosion	2		0.000	6	0	0.000
10		245.5	DS Manhole	Corrosion	3		0.000	10	0	0.000

US Manhole: X1 **Date Insp:** 3/19/2001 **Basin:** X
DS Manhole: X0 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape:			Length Status:	TV Inspections	Project No.:
Dia/Ht	Width: 12	12	Material:	PVC	Index:
Length:	465.0		Slope:	0.194	Surface:
Pipe Sec Length:		Comment:	10'-25',56'-61', 88-465' "MAJOR PROBLEMS"		

Inspection Information

Crew:	Noblitt	Percent Full:		Tape ID:	SPEC
Weather:		Purpose:	TV Existing Line	Counter Start:	0
Surface Cond:		Flow:		Counter Stop:	53.20
Dyed Test:					

Mainentance Prior to TV:

Cleaned:	False	Degrease:	False	Point Repair:	False	Manhole Replace:	False
Root Cut:	False	Root Chem:	False	Other:			

Overall Cond:
Collapsed/Blk: N
Max Obs #: 26
Max Obs Length: 440.0
Comment:

	Total	Remaining	Rating
Structural:	68	68	15.5
Flow:	0.004	0.004	0.001
Cleaning:	2	2	0.5

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		12.0	Joint	Roots	1		0.002	1	1	0.002
2		12.0	Joint	Pipe Seal			0.000	0	0	0.000
3		17.0	Joint	Roots	1		0.002	1	1	0.002
4		17.0	Joint	Pipe Seal			0.000	0	0	0.000
5		20.0	Joint	Scaling	1		0.000	3	0	0.000
6		40.0	Joint	Scaling	1		0.000	3	0	0.000

7	60.0	Joint	Scaling	1	0.000	3	0	0.000
8	80.0	Joint	Scaling	1	0.000	3	0	0.000
9	100.0	Joint	Scaling	1	0.000	3	0	0.000
10	120.0	Joint	Scaling	1	0.000	3	0	0.000
11	140.0	Joint	Scaling	1	0.000	3	0	0.000
12	160.0	Joint	Scaling	1	0.000	3	0	0.000
13	180.0	Joint	Scaling	1	0.000	3	0	0.000
14	200.0	Joint	Scaling	1	0.000	3	0	0.000
15	220.0	Joint	Scaling	1	0.000	3	0	0.000
16	240.0	Joint	Scaling	1	0.000	3	0	0.000
17	260.0	Joint	Scaling	1	0.000	3	0	0.000
18	280.0	Joint	Scaling	1	0.000	3	0	0.000
19	300.0	Joint	Scaling	1	0.000	3	0	0.000
20	320.0	Joint	Scaling	1	0.000	3	0	0.000
21	340.0	Joint	Scaling	1	0.000	3	0	0.000
22	360.0	Joint	Scaling	1	0.000	3	0	0.000
23	380.0	Joint	Scaling	1	0.000	3	0	0.000
24	400.0	Joint	Scaling	1	0.000	3	0	0.000
25	420.0	Joint	Scaling	1	0.000	3	0	0.000
26	440.0	Joint	Scaling	1	0.000	3	0	0.000

US Manhole: A13 **Date Insp:** 10/21/1998 **Basin:** A
DS Manhole: A14 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 18 18 Material: AC Index:
Length: 410.0 Slope: 0.114 Surface:
Pipe Sec Length: Comment: Pipe appears to be deteriorating

Inspection Information

Crew: Noblitt Percent Full: Tape ID:
Weather: Purpose: TV Existing Line Counter Start:
Surface Cond: Flow: Counter Stop:
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond: Poor
Collapsed/Blk: N
Max Obs #: 19
Max Obs Length: 380.0
Comment:

	Total	Remaining	Rating
Structural:	57	57	15.0
Flow:	0.000	0.000	0.000
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		20.0	unknown	Corrosion	1		0.000	3	0	0.000
2		40.0	unknown	Corrosion	1		0.000	3	0	0.000
3		60.0	unknown	Corrosion	1		0.000	3	0	0.000
4		80.0	unknown	Corrosion	1		0.000	3	0	0.000
5		100.0	unknown	Corrosion	1		0.000	3	0	0.000
6		120.0	unknown	Corrosion	1		0.000	3	0	0.000
7		140.0	unknown	Corrosion	1		0.000	3	0	0.000
8		160.0	unknown	Corrosion	1		0.000	3	0	0.000
9		180.0	unknown	Corrosion	1		0.000	3	0	0.000
10		200.0	unknown	Corrosion	1		0.000	3	0	0.000
11		220.0	unknown	Corrosion	1		0.000	3	0	0.000
12		240.0	unknown	Corrosion	1		0.000	3	0	0.000
13		260.0	unknown	Corrosion	1		0.000	3	0	0.000
14		280.0	unknown	Corrosion	1		0.000	3	0	0.000

15	300.0	unknown	Corrosion	1	0.000	3	0	0.000
16	320.0	unknown	Corrosion	1	0.000	3	0	0.000
17	340.0	unknown	Corrosion	1	0.000	3	0	0.000
18	360.0	unknown	Corrosion	1	0.000	3	0	0.000
19	380.0	unknown	Corrosion	1	0.000	3	0	0.000

US Manhole: V27 **Date Insp:** 8/1/2000 **Basin:** V
DS Manhole: V26 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 20 20 Material: AC Index:
Length: 289.0 Slope: 0.092 Surface:
Pipe Sec Length: Comment:

Inspection Information

Crew: Noblitt Percent Full: Tape ID: TOB
Weather: Purpose: Counter Start: 3.47.40
Surface Cond: Flow: Counter Stop: 4.02.08
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 6
Max Obs Length: 303.0
Comment:

	Total	Remaining	Rating
Structural:	55	55	18.2
Flow:	0.012	0.012	0.004
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		10.0	Upper Right	Wye Service			0.000	0	0	0.000
2		15.4	Upper Left	Broken Pipe	2		0.012	50	0	0.012
	Hole in Side of Pipe									
3		250.0	Upper Left	Wye Service			0.000	0	0	0.000
	118-140 Sag									
5		303.0	Upper Right	Wye Service			0.000	0	0	0.000
6		118.0	Crown	Sag	3		0.000	5	0	0.000

US Manhole: W24-4 **Date Insp:** 12/20/2001 **Basin:** E
DS Manhole: W24-3 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 24 24 Material: RCP Index:
Length: 196.0 Slope: 10.985 Surface:
Pipe Sec Length: 12.0 Comment:

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Inspection Information

Crew:	Nat.Plant	Percent Full:		Tape ID:	02
Weather:	Cloudy	Purpose:	TV Existing Line	Counter Start:	01.30.13
Surface Cond:		Flow:		Counter Stop:	01.37.35
Dyed Test:					

Mainentance Prior to TV:

Cleaned:	False	Degrease:	False	Point Repair:	False	Manhole Replace:	False
Root Cut:	False	Root Chem:	False	Other:			

			Total	Remaining	Rating
Overall Cond:		Structural:	54	54	28.1
Collapsed/Blk:	N	Flow:	0.000	0.000	0.000
Max Obs #:	11	Cleaning:	25	25	13.0
Max Obs Length:	192.0				
Comment:					

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		20.0	Unknown	Corrosion	2		0.000	6	0	0.000
2		40.0	Unknown	Corrosion	2		0.000	6	0	0.000
3		60.0	Unknown	Corrosion	2		0.000	6	0	0.000
4		80.0	Unknown	Corrosion	2		0.000	6	0	0.000
5		100.0	Unknown	Corrosion	2		0.000	6	0	0.000
6		120.0	Unknown	Corrosion	2		0.000	6	0	0.000
7		140.0	Unknown	Corrosion	2		0.000	6	0	0.000
8		160.0	Unknown	Corrosion	2		0.000	6	0	0.000
9		180.0	Unknown	Corrosion	2		0.000	6	0	0.000
10		192.0	Joint	Offset			0.000	0	0	0.000
11		192.0	Joint	Debris	4		0.000	0	25	0.000

US Manhole: E21 **Date Insp:** 4/3/2000 **Basin:** E
DS Manhole: E20 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape:			Length Status:	TV Inspections	Project No.:
Dia/Ht	Width: 18	18	Material:	VC	Index:
Length:	305.0		Slope:	0.114	Surface:
Pipe Sec Length:		Comment:			

Inspection Information

Crew:	Noblitt	Percent Full:		Tape ID:	
Weather:		Purpose:	TV Existing Line	Counter Start:	4.58.50
Surface Cond:		Flow:		Counter Stop:	5.25.45
Dyed Test:					

Mainentance Prior to TV:

Cleaned:	False	Degrease:	False	Point Repair:	False	Manhole Replace:	False
Root Cut:	False	Root Chem:	False	Other:			

			Total	Remaining	Rating
Overall Cond:		Structural:	50	50	20.0
Collapsed/Blk:	N	Flow:	0.080	0.080	0.032
Max Obs #:	12	Cleaning:	225	225	90.0
Max Obs Length:	250.0				
Comment:					

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		6.0	Upper Right	Wye Service			0.000	0	0	0.000
2		6.0	Wye Service	Roots	5		0.030	20	100	0.030
3		17.0	Upper Left	Wye Service			0.000	0	0	0.000
4		17.0	Wye Service	Roots	5		0.030	20	100	0.030
5		52.0	Upper Left	Wye Service			0.000	0	0	0.000

6	63.0	Upper Right	Wye Service		0.000	0	0	0.000
7	63.0	Wye Service	Roots	4	0.020	10	25	0.020
8	116.0	Upper Left	Wye Service		0.000	0	0	0.000
9	181.0	Upper Right	Wye Service		0.000	0	0	0.000
10	204.0	Upper Left	Wye Service		0.000	0	0	0.000
11	233.0	Upper Right	Wye Service		0.000	0	0	0.000
12	250.0	Upper Left	Wye Service		0.000	0	0	0.000

US Manhole: W24-9 **Date Insp:** 12/20/2001 **Basin:** E
DS Manhole: W24-8 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 33 33 Material: RCP Index:
Length: 394.0 Slope: 0.183 Surface:
Pipe Sec Length: 13.0 Comment:

Inspection Information

Crew: Nat. Plant Percent Full: Tape ID: 03
Weather: Cloudy Purpose: TV Existing Line Counter Start: 00.01.04
Surface Cond: Flow: Counter Stop: 00.07.24
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 3
Max Obs Length: 103.0
Comment:

	Total	Remaining	Rating
Structural:	50	50	48.5
Flow:	0.000	0.000	0.000
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		0.0	Camera Submerged	Sag	5		0.000	25	0	0.000
2		50.0	Crown	Sag	5		0.000	25	0	0.000
3		103.0	Camera Emerged							0.000

US Manhole: W24-5 **Date Insp:** 12/20/2001 **Basin:** E
DS Manhole: W24-4A **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 30 30 Material: RCP Index:
Length: 157.0 Slope: 0.344 Surface:
Pipe Sec Length: 12.0 Comment: Heavy steam present.

Inspection Information

Crew: Nat.Plant Percent Full: Tape ID: 02
Weather: Cloudy Purpose: TV Existing Line Counter Start: 01.16.23
Surface Cond: Flow: Counter Stop: 01.20.27
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 9
Max Obs Length: 156.8
Comment:

	Total	Remaining	Rating
Structural:	49	49	31.3
Flow:	0.100	0.100	0.064
Cleaning:	0	0	0.0

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Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		0.0	Crown	Corrosion	1		0.000	3	0	0.000
2		20.0	Crown	Corrosion	1		0.000	3	0	0.000
3		40.0	Crown	Corrosion	1		0.000	3	0	0.000
4		60.0	Crown	Corrosion	1		0.000	3	0	0.000
5		80.0	Crown	Corrosion	1		0.000	3	0	0.000
6		100.0	Crown	Corrosion	4		0.100	25	0	0.100
7		120.0	Crown	Corrosion	1		0.000	3	0	0.000
8		140.0	Crown	Corrosion	1		0.000	3	0	0.000
9		156.8	DS Manhole	Corrosion	1		0.000	3	0	0.000

US Manhole: B12 **Date Insp:** 3/9/2000 **Basin:** B
DS Manhole: B11 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 10 10 Material: VC Index:
Length: 315.0 Slope: 0.248 Surface:
Pipe Sec Length: Comment:

Inspection Information

Crew: Noblitt Percent Full: Tape ID:
Weather: Purpose: TV Existing Line Counter Start: 00.00
Surface Cond: Flow: Counter Stop: 44.20
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 9
Max Obs Length: 276.0
Comment:

	Total	Remaining	Rating
Structural:	48	48	17.4
Flow:	0.076	0.076	0.028
Cleaning:	113	113	40.9

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		34.0	Joint	Roots	2		0.004	2	4	0.004
2		92.0	Joint	Roots	3		0.010	5	8	0.010
3		115.0	Circumference	Crack-Radial	5		0.030	20	0	0.030
4		121.0	Upper Right	Wye Service			0.000	0	0	0.000
5		121.0	Wye Service	Roots	5		0.030	20	100	0.030
6		227.0	Crown	Wye Service			0.000	0	0	0.000
7		264.0	Upper Left	Wye Service			0.000	0	0	0.000
8		276.0	Upper Right	Wye Service			0.000	0	0	0.000
9		276.0	Wye Service	Roots	1		0.002	1	1	0.002

US Manhole: X3 **Date Insp:** 3/19/2001 **Basin:** X
DS Manhole: X2 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 12 12 Material: AC Index:
Length: 230.0 Slope: 0.194 Surface:
Pipe Sec Length: Comment:

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Inspection Information

Crew:	Noblitt	Percent Full:		Tape ID:	SPEC
Weather:		Purpose:	TV Existing Line	Counter Start:	0
Surface Cond:		Flow:		Counter Stop:	53.20
Dyed Test:					

Mainentance Prior to TV:

Cleaned:	False	Degrease:	False	Point Repair:	False	Manhole Replace:	False
Root Cut:	False	Root Chem:	False	Other:			

Overall Cond:			Total	Remaining	Rating
Collapsed/Blk:	N	Structural:	45	45	20.2
Max Obs #:	6	Flow:	0.090	0.090	0.040
Max Obs Length:	223.0	Cleaning:	108	108	48.4
Comment:					

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		47.0	Joint	Roots	3		0.010	5	8	0.010
2		60.0	Joint	Roots	4		0.020	10	25	0.020
3		73.0	Joint	Roots	4		0.020	10	25	0.020
4		73.0	Joint	Pipe Seal			0.000	0	0	0.000
5		86.0	Joint	Roots	4		0.020	10	25	0.020
6		223.0	Joint	Roots	4		0.020	10	25	0.020

US Manhole: W24-7 **Date Insp:** 12/20/2001 **Basin:** E
DS Manhole: W24-6 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape:		Length Status:	TV Inspections	Project No.:	
Dia/Ht Width:	30 30	Material:	RCP	Index:	
Length:	270.0	Slope:	4.741	Surface:	
Pipe Sec Length:	12.0 Comment:				

Inspection Information

Crew:	Nat.Plant	Percent Full:		Tape ID:	02
Weather:	Cloudy	Purpose:	TV Existing Line	Counter Start:	01.02.50
Surface Cond:		Flow:		Counter Stop:	01.11.12
Dyed Test:					

Mainentance Prior to TV:

Cleaned:	False	Degrease:	False	Point Repair:	False	Manhole Replace:	False
Root Cut:	False	Root Chem:	False	Other:			

Overall Cond:			Total	Remaining	Rating
Collapsed/Blk:	N	Structural:	45	45	16.7
Max Obs #:	14	Flow:	0.000	0.000	0.000
Max Obs Length:	270.3	Cleaning:	0	0	0.0
Comment:					

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		20.0	Unknown	Corrosion	1		0.000	3	0	0.000
2		40.0	Unknown	Corrosion	1		0.000	3	0	0.000
3		60.0	Unknown	Corrosion	1		0.000	3	0	0.000
4		80.0	Unknown	Corrosion	1		0.000	3	0	0.000
5		100.0	Unknown	Corrosion	1		0.000	3	0	0.000
6		120.0	Unknown	Corrosion	1		0.000	3	0	0.000
7		140.0	Unknown	Corrosion	1		0.000	3	0	0.000
8		160.0	Unknown	Corrosion	1		0.000	3	0	0.000
9		180.0	Unknown	Corrosion	1		0.000	3	0	0.000
10		200.0	Unknown	Corrosion	1		0.000	3	0	0.000

11	220.0	Unknown	Corrosion	1	0.000	3	0	0.000
12	240.0	Unknown	Corrosion	1	0.000	3	0	0.000
13	260.0	Unknown	Corrosion	1	0.000	3	0	0.000
14	270.3	DS Manhole	Corrosion	2	0.000	6	0	0.000

US Manhole: G2 **Date Insp:** 12/21/2001 **Basin:** G
DS Manhole: G1 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 15 15 Material: VC Index:
Length: 389.0 Slope: 0.483 Surface:
Pipe Sec Length: 5.0 Comment:

Inspection Information

Crew: Nat.Plant Percent Full: Tape ID: 03
Weather: Cloudy Purpose: TV Existing Line Counter Start: 00.31.39
Surface Cond: Flow: Counter Stop: 00.48.32
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 6
Max Obs Length: 331.6
Comment:

	Total	Remaining	Rating
Structural:	45	45	13.6
Flow:	0.010	0.010	0.003
Cleaning:	8	8	2.4

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		35.1	Crown	Sag	4		0.000	10	0	0.000
2		181.7	Crown	Sag	4		0.000	10	0	0.000
3		249.4	Upper Left	Wye Service						0.000
4		256.4	Unknown	Roots	3		0.010	5	8	0.010
5		279.4	Crown	Sag	4		0.000	10	0	0.000
6		331.7	Crown	Sag	4		0.000	10	0	0.000

US Manhole: F21 **Date Insp:** 3/13/2001 **Basin:** E
DS Manhole: F22 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 8 8 Material: VC Index:
Length: 355.0 Slope: 0.400 Surface:
Pipe Sec Length: Comment:

Inspection Information

Crew: Noblitt Percent Full: Tape ID:
Weather: Purpose: TV Existing Line Counter Start:
Surface Cond: Flow: Counter Stop:
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 4
Max Obs Length: 294.0
Comment:

	Total	Remaining	Rating
Structural:	35	35	11.9
Flow:	0.016	0.016	0.005
Cleaning:	8	8	2.7

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Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		14.0	Upper Left	Wye Service			0.000	0	0	0.000
2		90.0	Joint	Roots	3		0.010	5	8	0.010
3		294.0	Joint	Offset	1		0.000	0	0	0.000
4		294.0	Joint	Broken Pipe	1		0.006	30	0	0.006

US Manhole: X2 **Date Insp:** 3/19/2001 **Basin:** X
DS Manhole: X1 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 12 12 Material: AC Index:
Length: 223.0 Slope: 0.194 Surface:
Pipe Sec Length: Comment:

Inspection Information

Crew: Noblitt Percent Full: Tape ID: SPEC
Weather: Purpose: TV Existing Line Counter Start: 0
Surface Cond: Flow: Counter Stop: 53.20
Dyed Test:

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 5
Max Obs Length: 75.0
Comment:

	Total	Remaining	Rating
Structural:	35	35	46.7
Flow:	0.070	0.070	0.093
Cleaning:	83	83	110.7

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		14.0	Joint	Roots	4		0.020	10	25	0.020
2		25.0	Joint	Roots	4		0.020	10	25	0.020
3		14.0	Joint	Pipe Seal			0.000	0	0	0.000
4		63.0	Joint	Roots	3		0.010	5	8	0.010
5		75.0	Joint	Roots	4		0.020	10	25	0.020

US Manhole: B13 **Date Insp:** 3/9/2000 **Basin:** B
DS Manhole: B12 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape: Length Status: TV Inspections Project No.:
Dia/Ht Width: 10 10 Material: VC Index:
Length: 322.0 Slope: 0.248 Surface:
Pipe Sec Length: Comment:

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Inspection Information

Crew: Noblitt
Weather:
Surface Cond:
Dyed Test:

Percent Full:
Purpose: TV Existing Line
Flow:

Tape ID:
Counter Start: 00.00
Counter Stop: 44.20

Mainentance Prior to TV:

Cleaned: False | Degrease: False | Point Repair: False | Manhole Replace: False
Root Cut: False | Root Chem: False | Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 11
Max Obs Length: 276.0
Comment:

	Total	Remaining	Rating
Structural:	32	32	11.6
Flow:	0.064	0.064	0.023
Cleaning:	59	59	21.4

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		156.0	Joint	Roots	1		0.002	1	1	0.002
2		181.0	Joint	Roots	1		0.002	1	1	0.002
3		186.0	Joint	Roots	4		0.020	10	25	0.020
4		191.0	Joint	Roots	3		0.010	5	8	0.010
5		211.0	Joint	Roots	2		0.004	2	4	0.004
6		231.0	Joint	Roots	2		0.004	2	4	0.004
7		236.0	Joint	Roots	2		0.004	2	4	0.004
8		271.0	Joint	Roots	2		0.004	2	4	0.004
9		276.0	Joint	Roots	3		0.010	5	8	0.010
10		38.0	unknown	Crack-Horizontal	1		0.002	1	0	0.002
11		41.0	unknown	Crack-Horizontal	1		0.002	1	0	0.002

US Manhole: F13
DS Manhole: F12

Date Insp: 4/3/1989
Dir Televised: Upstream to Downstream

Basin: F

Pipe Information

Shape:
Dia/Ht Width: 12 12
Length: 401.0
Pipe Sec Length: 5.0

Length Status: TV Inspections
Material: VC
Slope: 1.855
Comment: manhole never installed properly (old)

Project No.:
Index:
Surface:

Inspection Information

Crew: Troy
Weather:
Surface Cond:
Dyed Test:

Percent Full:
Purpose: TV Existing Line
Flow:

Tape ID:
Counter Start: 1399
Counter Stop: 1441

Mainentance Prior to TV:

Cleaned: False | Degrease: False | Point Repair: False | Manhole Replace: False
Root Cut: False | Root Chem: False | Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 1
Max Obs Length: 410.0
Comment:

	Total	Remaining	Rating
Structural:	30	30	7.3
Flow:	0.006	0.006	0.001
Cleaning:	0	0	0.0

Obs. #	VTR Counter Comment	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1		410.0	DS Manhole	Broken Pipe	1		0.006	30	0	0.006

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US Manhole: G1 **Date Insp:** 11/5/1981 **Basin:** W
DS Manhole: W62 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape:
Dia/Ht Width: 18 18
Length: 118.0
Pipe Sec Length: 6.0 Comment:

Length Status: TV Inspections
Material: VC
Slope:

Project No.:
Index:
Surface:

Inspection Information

Crew: Troy
Weather:
Surface Cond:
Dyed Test:

Percent Full:
Purpose: TV Existing Line
Flow:

Tape ID:
Counter Start: 821
Counter Stop: 890

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 1
Max Obs Length: 23.6
Comment:

	Total	Remaining	Rating
Structural:	30	30	127.1
Flow:	0.006	0.006	0.025
Cleaning:	0	0	0.0

Obs. #	VTR Counter	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
	Comment									
1		23.6	Joint	Broken Pipe	1		0.006	30	0	0.006

US Manhole: W62 **Date Insp:** 11/5/1981 **Basin:** W
DS Manhole: W61 **Dir Televised:** Upstream to Downstream

Pipe Information

Shape:
Dia/Ht Width: 18 18
Length: 86.0
Pipe Sec Length: 6.0 Comment:

Length Status: TV Inspections
Material: VC
Slope:

Project No.:
Index:
Surface:

Inspection Information

Crew: Troy
Weather:
Surface Cond:
Dyed Test:

Percent Full:
Purpose: TV Existing Line
Flow:

Tape ID:
Counter Start: 821
Counter Stop: 890

Mainentance Prior to TV:
Cleaned: False Degrease: False Point Repair: False Manhole Replace: False
Root Cut: False Root Chem: False Other:

Overall Cond:
Collapsed/Blk: N
Max Obs #: 1
Max Obs Length: 56.0
Comment:

	Total	Remaining	Rating
Structural:	30	30	53.6
Flow:	0.006	0.006	0.011
Cleaning:	0	0	0.0

Obs. #	VTR Counter	Distance	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
	Comment									
1		56.0	Joint	Broken Pipe	1		0.006	30	0	0.006

Appendix B

MWH
MONTGOMERY WATSON HARZA

APPENDIX B

MANHOLE INSPECTION FORMS AND REPORTS

GBA Manhole Inspection Form
Typical Manhole Inspection Photographs
GBA Manhole Structural Scores
Inspection Reports for Manholes with High Structural Scores

MANHOLE INSPECTION FORM

1. INSPECTION CREW: DATE:___/___/___ MANHOLE # :

2. GEN. LOCATION:

3. ADDRESS: LOT LOCATION:

	OBSERVATION	CODE NO.	CODE
3.	INSPECTION TYPE	| ___ |	1–INTERNAL 2–SURFACE 3–NOT INSPECTED 4–BURIED 5–NOT FOUND
4.	STRUCTURE TYPE	| ___ |	1-STND 2-CLN OUT 3-IN DROP 4-OUT DROP 5-CTCH BASIN 6-FIELD IN 7-TEE
5.	LOCATION		
6.	SURFACE TYPE	| ___ |	1-ASPHALT 2-CONCRETE 3-GRAVEL 4-DIRT/GRASS
7.	COVER A. TYPE	| ___ |	1-PICK 2-CONCEALED PICK 3-GASKETED 4-VENTED 5-STORM 6-BOLT DOWN
	B. FIT	| ___ |	1-GOOD 2-TIGHT 3-LOOSE 4-ROCKING 5-BOLTS MISSING 6-GASKET BAD/GONE
	C. # OF HOLES	| ___ |	
	D. PONDING DEPTH (IN)	| ___ |	
	E. PONDING TYPE	| ___ |	1-SHEET FLOW 2-LOW POINT
	F. GRADE +/- (IN)	| ___ |	
	G. SIZE	| ___ |	
	H. INFLOW DISH	| ___ |	1-YES 2-NO
8.	FRAME A. OFFSET (IN)	| ___ |	FRAME SIZE ___ - ___ - ___ - ___
	B. RISER HEIGHT (IN)	| ___ |	(CLR.OPN'G.) (COVER DEPTH) (COVER OPN'G) (FRAME DEPTH)
9.	GRADE ADJ. A. TYPE	| ___ |	1-NONE 2-PRECAST 3-BRICK 4-BLOCK 5-POURED
	B. DEPTH (IN)	| ___ |	
	C. MIN. DIA. (IN)	| ___ |	
10.	CONE/TOP A. TYPE	| ___ |	1-NONE 2-PRECST 3-BRK 4-BLK 5-PORD 6-BRK&CON 7-CLAY 8-PVC 9-RCK
	B. SHAPE	| ___ |	1-CONCENTRIC 2-ECCENTRIC 3-FLAT TOP
11.	WALL A. MATERIAL	| ___ |	1-NONE 2-PRECST 3-BRK 4-BLK 5-PORD 6-BRK&CON 7-CLAY 8-PVC
	B. LINING TYPE	| ___ |	1-CEMENTITIOUS 2-CAST-IN-PLACE 3-CURED-IN-PLACE 4-EPOXY
	C. DIA. (IN)	| ___ |	
12.	BENCH TYPE	| ___ |	1-NONE 2-PRECAST 3-BRICK 4-BLOCK 5-POURED
13.	TROUGH TYPE	| ___ |	1-NONE 2-PRECAST 3-POURED 4-VCP 5-PVC
14.	PIPE SEAL TYPE	| ___ |	1-NONE 2-MORTAR 3-GASKET
15.	STEPS A. TYPE	| ___ |	1-NONE 2-BAR 3-CAST IRON 4-PLASTIC
	B. CONDITION	| ___ |	1-GOOD 2-CORRODED 3-MISALIGNED 4-BROKEN 5-MISSING
17.	MANHOLE DEPTH (FT)	| ___ |	
18.	EVIDENCE OF SURCHARGE (FT)	| ___ |	

	DEFECTS	FLOW CODE	OBS. (GPM)	BROKEN S	BROKEN D	CORROSION S	CORROSION D	ROOTS S	ROOTS D	I/I CODE	NUMBER OF HOLES	NUMBER OF CRACKS	NUMBER OF JOINTS
19.	COVER												
20.	FRAME												
21.	FRAME SEAL												
22.	GRADE ADJUSTMENT												
23.	CONE												
24.	WALL												
25.	BENCH												
26.	TROUGH												

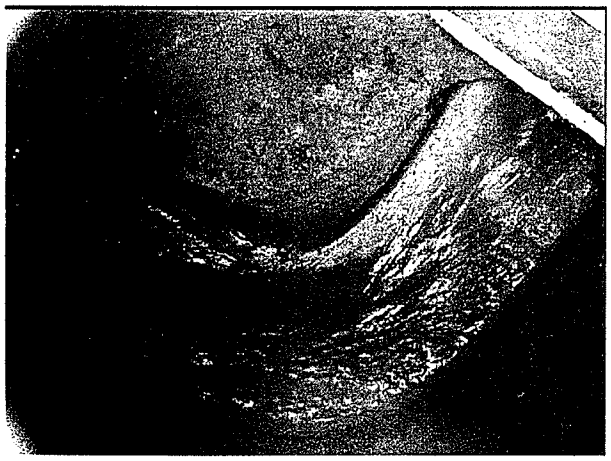
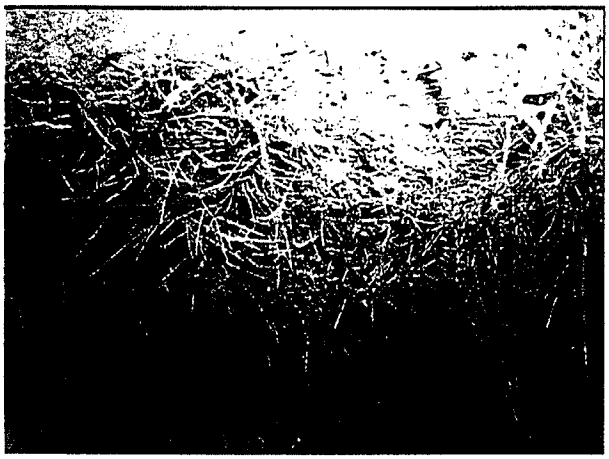
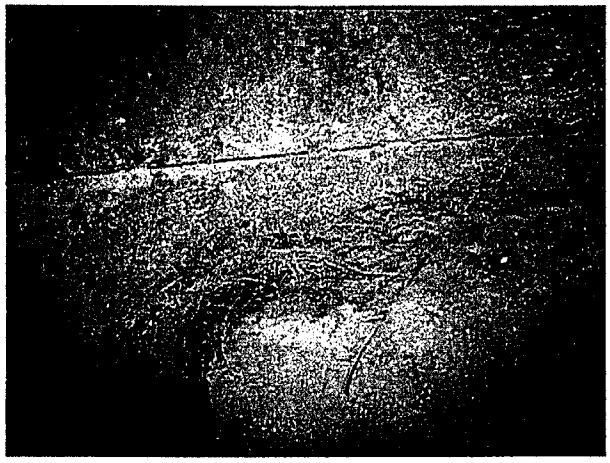
FLOW CODE	SEVERITY CODE	DENSITY CODE	I/I CODE
1 – LIGHT	1 – MILD	1 - <10%	1 - INFLOW
2 – MODERATE	2 – MODERATE	2 – 10% - 25%	2 - INFILTRATION
3 – HEAVY	3 – SEVERE	3 – 25% - 50%	
		4 - >50%	

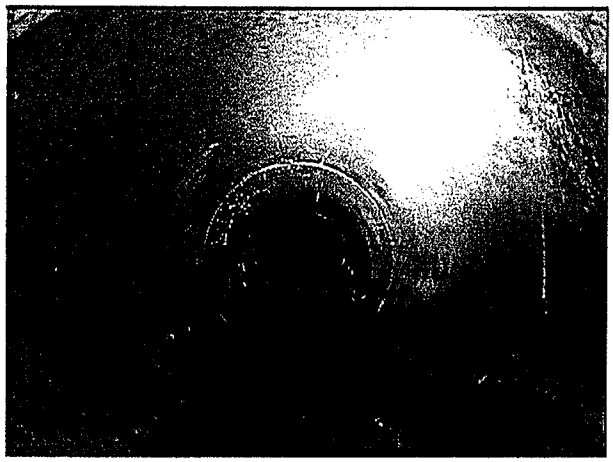
ROLL NUMBER(S):_____

PICTURE NUMBER(S):_____

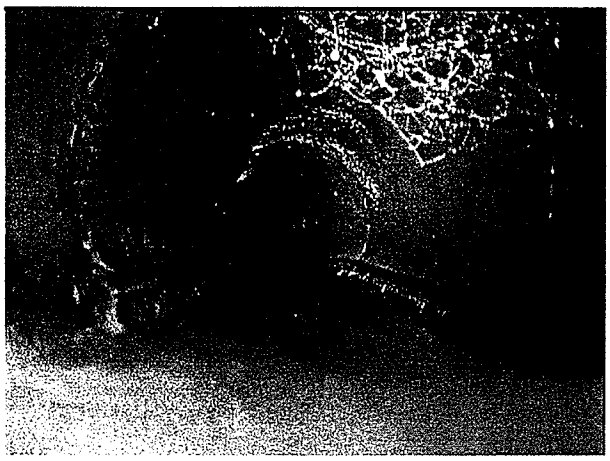
COMMENTS: _____

GBA Report Master® Sewer Manhole Inspection Image Data.

Images	Data
	**Manhole:** V55-28 **Inspection Date:** 4/9/01 **Flow Basin:** **Gen Location:** **Address:** **Inspection Text:** Internal **Location Text:** Sidewalk **Total Structural Val:** 10 **Total Flow (gpm):** 0 **Description:** Manhole Topside **File Name:** file://F:/CTO/GBA/GBAMastr/Pict/Sewer/V55-28M1.jpg
	**Manhole:** V55-28 **Inspection Date:** 4/9/01 **Flow Basin:** **Gen Location:** **Address:** **Inspection Text:** Internal **Location Text:** Sidewalk **Total Structural Val:** 10 **Total Flow (gpm):** 0 **Description:** Roots at cone and wall joint **File Name:** file://F:/CTO/GBA/GBAMastr/Pict/Sewer/V55-28M1A.jpg
	**Manhole:** V55-28 **Inspection Date:** 4/9/01 **Flow Basin:** **Gen Location:** **Address:** **Inspection Text:** Internal **Location Text:** Sidewalk **Total Structural Val:** 10 **Total Flow (gpm):** 0 **Description:** Roots at wall and bench joint **File Name:** file://F:/CTO/GBA/GBAMastr/Pict/Sewer/V55-28M1B.jpg



Description: Outgoing Line to V55-27
File Name:
file://F:/CTO/GBA/GBAMastr/Pict/Sewer/V55-28L1.jpg



Manhole: V55-28
Inspection Date: 4/9/01
Flow Basin:
Gen Location:
Address:
Inspection Text: Internal
Location Text: Sidewalk
Total Structural Val: 10
Total Flow (gpm): 0
Description: Incoming Line from V55-29
File Name:
file://F:/CTO/GBA/GBAMastr/Pict/Sewer/V55-28L2.jpg

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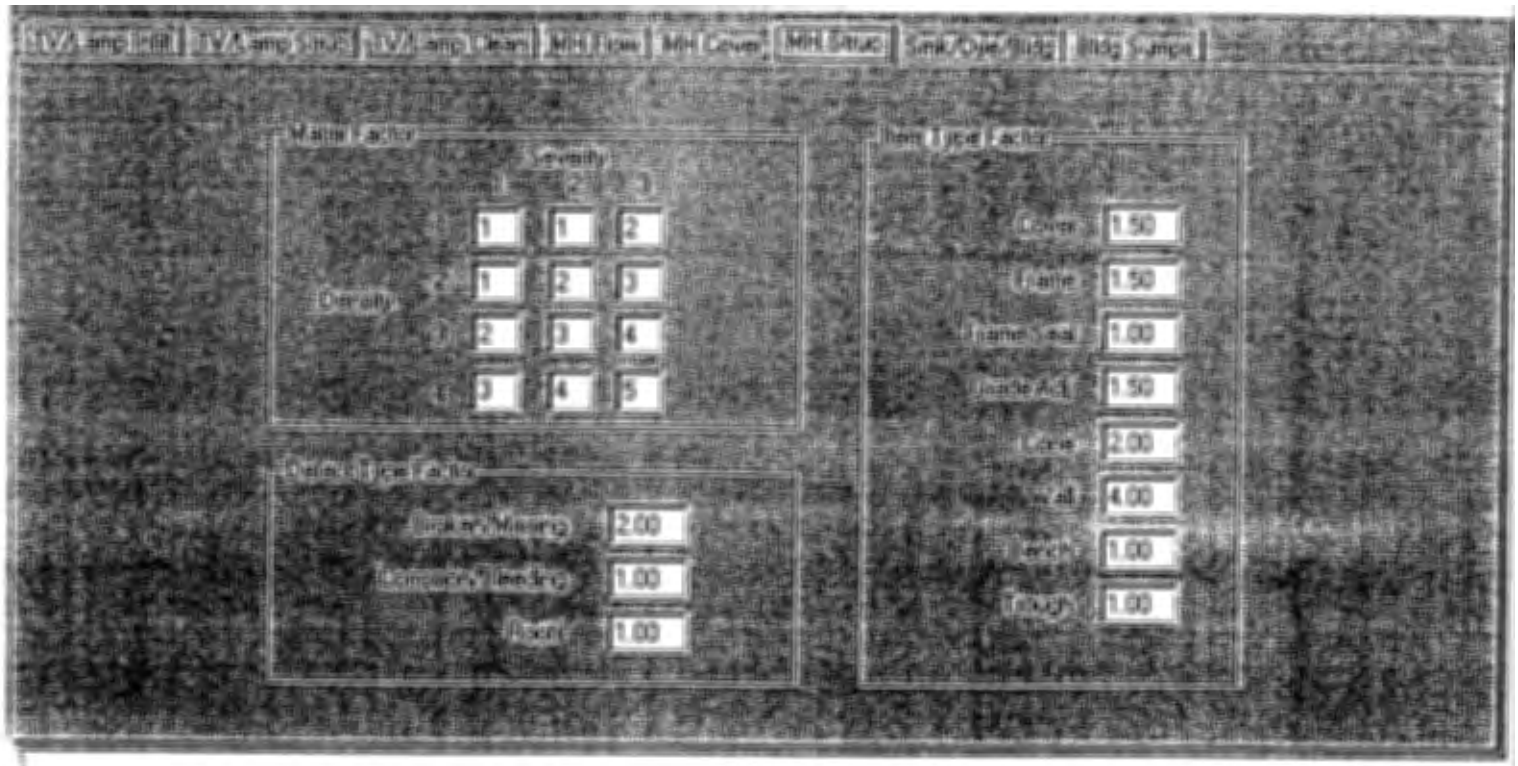
GBA Manhole Structural Scores



$$StructuralNumber = MatrixFactor \times DefectTypeFactor \times ItemTypeFactor$$

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: F22-15.6 **Gen Location:**
Insp. Date: 4/17/2001 **Facility:** **Basin:**
Address: **Lot Loc:**

Crew: BG, JM
Location: Storm Ditch
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 0
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 16
Minimum Dia.: 30

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Brick
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	2	0.05	2	4			3	4	Infiltration				0.40	0.40	False
Bench:	2	0.05	2	4					-----	--	--	--	0.20	0.20	False
Trough:									-----	--	--	--	0.00	0.00	False
	4				**Total Structural:**		60						0.60	0.60	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: E2
Insp. Date: 4/18/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, JM
Location: Storm Ditch
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 16
Minimum Dia.: 30

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:							2	3	Infiltration				0.00	0.00	False
Wall:	2	0.05	2	4			2	3	Infiltration				0.40	0.40	False
Bench:	2	0.50	2	4					-----	--	--	--	0.50	0.50	False
Trough:									-----	--	--	--	0.00	0.00	False
	4				**Total Structural:**		58						0.90	0.90	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: E40-18 **Gen Location:**
Insp. Date: 5/1/2001 **Facility:** **Basin:**
Address: **Lot Loc:**

Crew: RW, BG
Location: Street
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Tight
# of Holes: 2
Pond. Depth: 0
Ponding Type: Sheet Flow
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 5
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Plastic
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	3	0.35	3	3	3	3			Infiltration				0.60	0.60	False
Bench:									-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	3				**Total Structural:**		48						0.60	0.60	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: U14
Insp. Date: 3/15/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Grass
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Grade Adj: Type: Precast
Depth: 70
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:							3	2	-----	--	--	--	0.00	0.00	False
Grade Adj:							3	2	Infiltration	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	2	0.10	2	4			1	1	Infiltration				0.40	0.40	False
Bench:									-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		43						0.40	0.40	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: E3
Insp. Date: 4/18/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, JM
Location: Storm Ditch
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Grade Adj: Type: None
Depth: 0
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Bench Type: Poured
Trough Type: VCP
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	1	0.01	1	4			1	4	Infiltration				0.20	0.20	False
Bench:	1	0.01	1	2					-----	--	--	--	0.10	0.10	False
Trough:							3	3	-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**			42					0.30	0.30	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: U15
Insp. Date: 3/15/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Grass
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 1
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Poured
Depth: 1
Minimum Dia.: 23

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:							2	4	-----	--	--	--	0.00	0.00	False
Frame Seal:							2	4	-----	--	--	--	0.00	0.00	False
Grade Adj:							2	4	Inflow	--	--	--	0.00	0.00	False
Cone:							2	4	Infiltration				0.00	0.00	False
Wall:							2	4	Infiltration				0.00	0.00	False
Bench:							1	1	-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	0				**Total Structural:**		41						0.00	0.00	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: V41 **Gen Location:**
Insp. Date: 4/24/2001 **Facility:** **Basin:**
Address: **Lot Loc:**

Crew: BG, SJ
Location: Street
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: Sheet Flow
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 18
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	3	0.30	3	4					Infiltration				0.60	0.60	False
Bench:									-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	3				**Total Structural:**		40						0.60	0.60	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: B8-1
Insp. Date: 4/18/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Grass
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 2
Riser Height: 0

Grade Adj: Type: None
Depth: 0
Minimum Dia.: 0

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:							1	3	-----	--	--	--	0.00	0.00	False
Grade Adj:							1	3	Inflow	--	--	--	0.00	0.00	False
Cone:							2	4	Infiltration				0.00	0.00	False
Wall:	1	0.00	1	1			2	4	Infiltration				0.20	0.20	False
Bench:	1	0.00	1	1					-----	--	--	--	0.10	0.10	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		39						0.30	0.30	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: GIII23
Insp. Date: 3/22/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Grass
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Grade Adj: Type: Precast
Depth: 52
Minimum Dia.: 29

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Cover: Type:
Fit: Good
# of Holes: 1
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:							2	4	-----	--	--	--	0.00	0.00	False
Grade Adj:							3	4	Infiltration	--	--	--	0.00	0.00	False
Cone:							2	4	Infiltration				0.00	0.00	False
Wall:							2	4	Infiltration				0.00	0.00	False
Bench:							2	2	-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	0				**Total Structural:**		37						0.00	0.00	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: V55-70.27
Insp. Date: 3/30/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, JM
Location: Grass
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: None
Depth: 0
Minimum Dia.: 0

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:							1	4	-----	--	--	--	0.00	0.00	False
Grade Adj:							1	4	Inflow	--	--	--	0.00	0.00	False
Cone:							2	4	Infiltration				0.00	0.00	False
Wall:							2	4	Infiltration				0.00	0.00	False
Bench:							3	4	-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	0				**Total Structural:**		36						0.00	0.00	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: F22-15.5 **Gen Location:**
Insp. Date: 4/19/2001 **Facility:** **Basin:**
Address: **Lot Loc:**

Crew: BG, JM
Location: Storm Ditch
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 7
Minimum Dia.: 30

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	1	0.00	1	4			1	4	Infiltration				0.20	0.20	False
Bench:									-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	1				**Total Structural:**		36						0.20	0.20	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: X30 **Gen Location:**
Insp. Date: 3/30/2001 **Facility:** **Basin:**
Address: **Lot Loc:**

Crew: BG, SB
Location: Grass
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Tight
# of Holes: 1
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 28
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 1.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:							2	4	Infiltration	--	--	--	0.00	0.00	False
Cone:							2	4	Infiltration				0.00	0.00	False
Wall:							2	4	Infiltration				0.00	0.00	False
Bench:							2	2	-----	--	--	--	0.00	0.00	False
Trough:							3	2	-----	--	--	--	0.00	0.00	False
	0				**Total Structural:**			35					0.00	0.00	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: GIV1.1
Insp. Date: 5/9/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: RW, DC
Location: Grass
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: Sheet Flow
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 26
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth:
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:							3	3	Inflow	--	--	--	0.00	0.00	False
Cone:							3	3	Inflow				0.00	0.00	False
Wall:							3	3	Infiltration				0.00	0.00	False
Bench:							3	3	-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	0				**Total Structural:**		34						0.00	0.00	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: U23
Insp. Date: 3/14/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Grass
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Grade Adj: Type: None
Depth: 0
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	1		2	4					Infiltration				0.20	0.20	False
Bench:									-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	1				**Total Structural:**		32						0.20	0.20	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: V55-69.9
Insp. Date: 4/4/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, JM
Location: Grass
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: None
Depth: 0
Minimum Dia.: 0

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:							2	4	Infiltration	--	--	--	0.00	0.00	False
Cone:							2	4	Infiltration				0.00	0.00	False
Wall:							2	4	Infiltration				0.00	0.00	False
Bench:							1	3	-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	0				**Total Structural:**		32						0.00	0.00	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: X12B
Insp. Date: 3/14/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Storm Ditch
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 1
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 0
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	1	0.00	2	4					Infiltration				0.20	0.20	False
Bench:									-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	1				**Total Structural:**		32						0.20	0.20	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: X24
Insp. Date: 4/9/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Grass
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Grade Adj: Type: None
Depth: 0
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Cover: Type:
Fit: Tight
# of Holes: 7
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	2	0.00	2	4					Infiltration				0.40	0.40	False
Bench:									-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		32						0.40	0.40	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: V40
Insp. Date: 4/24/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SJ
Location: Street
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: Sheet Flow
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 18
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	2	0.25	2	4					Infiltration				0.40	0.40	False
Bench:									-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		32						0.40	0.40	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: E40-19
Insp. Date: 5/1/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: RW, BG
Location: Street
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Tight
# of Holes: 2
Pond. Depth: 0
Ponding Type: Sheet Flow
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 11
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Plastic
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	3	0.75	3	3					Infiltration				0.75	0.75	False
Bench:									-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	3				**Total Structural:**		32						0.75	0.75	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: U22
Insp. Date: 3/14/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Grass
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: None
Depth: 0
Minimum Dia.: 23

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:	1		1	3			1	1	Infiltration				0.20	0.20	False
Wall:	1		1	3			1	1	Infiltration				0.20	0.20	False
Bench:									-----	--	--	--	0.00	0.00	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		30						0.40	0.40	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: V55-70.26 **Gen Location:**
Insp. Date: 3/30/2001 **Facility:** **Basin:**
Address: **Lot Loc:**

Crew: BG, JM
Location: Street
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 17
Minimum Dia.: 33

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	1		1	4					Infiltration				0.20	0.20	False
Bench:	1		1	4					-----	--	--	--	0.10	0.10	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		30						0.30	0.30	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: C2
Insp. Date: 4/4/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Sidewalk
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 1
Pond. Depth: 0
Ponding Type: Sheet Flow
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 20
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: VCP
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	1	0.00	1	4					Infiltration				0.20	0.20	False
Bench:	1	0.00	1	4					-----	--	--	--	0.10	0.10	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		30						0.30	0.30	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: C3
Insp. Date: 4/4/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Sidewalk
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Grade Adj: Type: Precast
Depth: 6
Minimum Dia.: 25

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Cover: Type:
Fit: Good
# of Holes: 1
Pond. Depth: 0
Ponding Type: Sheet Flow
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Bench Type: Poured
Trough Type: VCP
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	1	0.00	1	4					Infiltration				0.20	0.20	False
Bench:	1	0.00	1	4					-----	--	--	--	0.10	0.10	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		30						0.30	0.30	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: E9
Insp. Date: 4/18/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, JM
Location: Storm Ditch
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Brick
Depth: 38
Minimum Dia.: 24

Cone/Top: Type: Brick
Shape: Concentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	1	0.00	1	4					Infiltration				0.20	0.20	False
Bench:	1	0.00	1	4					-----	--	--	--	0.10	0.10	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		30						0.30	0.30	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: X27
Insp. Date: 4/9/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Grass
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Grade Adj: Type: None
Depth: 0
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	2	0.10	2	3					Infiltration				0.40	0.40	False
Bench:	2	0.10	2	3					-----	--	--	--	0.20	0.20	False
Trough:									-----	--	--	--	0.00	0.00	False
	4				**Total Structural:**		30						0.60	0.60	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: X23
Insp. Date: 4/9/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Grass
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 6
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: None
Depth: 0
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	1	0.00	1	4					Infiltration				0.20	0.20	False
Bench:	1	0.00	1	4					-----	--	--	--	0.10	0.10	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		30						0.30	0.30	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: X29
Insp. Date: 4/9/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Storm Ditch
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 32
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:							3	4	Infiltration				0.00	0.00	False
Bench:							3	4	-----	--	--	--	0.00	0.00	False
Trough:							3	4	-----	--	--	--	0.00	0.00	False
	0				**Total Structural:**			30					0.00	0.00	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: Y7A
Insp. Date: 3/29/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Grass
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 0
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 4
Riser Height: 0

Grade Adj: Type: Precast
Depth: 7
Minimum Dia.: 30

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	1	0.00	1	4					Infiltration				0.20	0.20	False
Bench:	1	0.00	1	4					-----	--	--	--	0.10	0.10	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		30						0.30	0.30	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: V45
Insp. Date: 4/24/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SJ
Location: Street
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: Sheet Flow
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 11
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:			2	3					Infiltration				0.00	0.00	False
Bench:	2	0.50	2	3					-----	--	--	--	0.50	0.50	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		30						0.50	0.50	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: V28
Insp. Date: 4/24/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SJ
Location: Street
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 4
Pond. Depth: 0
Ponding Type: Sheet Flow
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 12
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	1	0.00	2	3					Infiltration				0.20	0.20	False
Bench:	1	0.00	2	3					-----	--	--	--	0.10	0.10	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		30						0.30	0.30	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: E47-128
Insp. Date: 3/23/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: BG, SB
Location: Street
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 17
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	2	0.20	2	3					Infiltration				0.40	0.40	False
Bench:	2	0.20	2	3					-----	--	--	--	0.20	0.20	False
Trough:									-----	--	--	--	0.00	0.00	False
	4				**Total Structural:**		30						0.60	0.60	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: E31 **Gen Location:**
Insp. Date: 5/15/2001 **Facility:** **Basin:**
Address: **Lot Loc:**

Crew: RW, BG
Location: Street
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 18
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: VCP
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 8.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	1	0.00	1	4					Infiltration				0.20	0.20	False
Bench:	1	0.00	1	4					-----	--	--	--	0.10	0.10	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		30						0.30	0.30	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: E29
Insp. Date: 5/15/2001

Gen Location:
Facility:
Address:

Basin:
Lot Loc:

Crew: RW, BG
Location: Street
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Grade Adj: Type: Precast
Depth: 14
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Cover: Type:
Fit: Good
# of Holes: 2
Pond. Depth: 0
Ponding Type: None
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Bench Type: Poured
Trough Type: VCP
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Good
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	1	0.05	1	4					Infiltration				0.20	0.20	False
Bench:	1	0.00	1	4					-----	--	--	--	0.10	0.10	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		30						0.30	0.30	

Manhole Inspection Master Report

Inspection Reports for Manholes with High Structural Scores

9/12/2001
8:21:56PM

Manhole: V14 **Gen Location:**
Insp. Date: 5/17/2001 **Facility:** **Basin:**
Address: **Lot Loc:**

Crew: RW, BG
Location: Street
Dye Test: False
Surface Type:
Inspect Type: Internal
Cleaning:
Struct. Type:

Cover: Type:
Fit: Tight
# of Holes: 4
Pond. Depth: 0
Ponding Type: Sheet Flow
Grade +/-:
Size:
Inflow Dish:

Frame: Offset: 0
Riser Height: 0

Grade Adj: Type: Precast
Depth: 22
Minimum Dia.: 24

Cone/Top: Type: Precast
Shape: Eccentric

Wall: Material:
Lining Type:
Dia/Length:
Width:

Bench Type: Poured
Trough Type: Poured
Pipe Seal Type: Mortar
Steps: Cast Iron
Steps Condition: Corroded
Manhole Depth: 0.00
Evidence of Surchrg: 0.0

Defect Information

	Flow Code	Obs. (gpm)	Broken S	Broken D	Corrosion S	Corrosion D	Roots S	Roots D	I/I Code Type	Number of Holes	Number of Crcks	Number of Joint	GPM	Remain GPM	Structure Repaired
Cover:							--	--	-----	--	--	--	0.00	0.00	False
Frame:									-----	--	--	--	0.00	0.00	False
Frame Seal:									-----	--	--	--	0.00	0.00	False
Grade Adj:									Inflow	--	--	--	0.00	0.00	False
Cone:									Inflow				0.00	0.00	False
Wall:	1	0.00	1	4					Infiltration				0.20	0.20	False
Bench:	1	0.00	1	4					-----	--	--	--	0.10	0.10	False
Trough:									-----	--	--	--	0.00	0.00	False
	2				**Total Structural:**		30						0.30	0.30	

Appendix C

MWH
MONTGOMERY WATSON HARZA

APPENDIX C

LINE LAMPING FORMS AND REPORTS

GBA Line Lamping Form
Typical Line Lamping Photographs
GBA Line Lamping Structural Scores
Line Lamping Reports for Lines with High Structural Scores

LAMPING DATA FORM

	PIPE #	(1)	(2)	(3)	(4)	
1.	UPSTREAM MANHOLE #					ENTER APPROPRIATE NUMBER OR "SERV" OR "STUB"
2.	DOWNSTREAM MANHOLE #					
3.	INSPECTED MANHOLE					1–UPSTREAM 2–DOWNSTREAM
4.	PIPE DIRECTION					1-12 CLOCK POSITION 21-N 22-S 23-E 24-W
5.	SHAPE OF PIPE					1–ROUND 2–ELLIPTICAL 3–BOX 4–DOUBLE BOX 5–TRIPLE BOX 6–HORSESHOE
6.	PIPE DIAMETER/HEIGHT (IN)					
7.	PIPE WIDTH (IN)					
8.	PIPE LENGTH (FT)					
9.	LENGTH STATUS					
10.	PIPE MATERIAL					1-VCP 2-PVC 3-CONCRETE 4-RCP 5-DIP 6-CIP 7-CMP 8-TILE 9-BRICK
10.	PIPE LINER MATERIAL					1-CIPP 2-FOLD&FORM 3-SLIPLINED 4-SPIRAL WOUND
11.	RIM TO CROWN (FT)					
12.	ANGLED RIM TO INVRT (FT)					FOR SURFACE INSPECTIONS
13.	OFFSET DISTANCE (IN)					FOR SURFACE INSPECTIONS – INCREMENTS OF 3 IN.
14.	FLOW DEPTH (IN)					INCLUDES DEPOSITION AT PIPE MOUTH
15.	DEPOSITION: INCHES					
	TYPE					1-SLUDGE 2-MUD 3-ROCKS 4-DEBRIS
16.	FLOW VELOCITY (FPS)					ESTIMATED OR MEASURED (CIRCLE)
17.	RECOMMENDED CLEAN					1-NO 2-YES
18.	RECOMMENDED TV					1-NO 2-YES
19.	ROLL #					
20.	PICTURE #					

PIPE #	FOOTGE	LOC.	DEF	RATNG	INFLT(gpm)	COMMENTS

PIPE #	FOOTGE	LOC.	DEF	RATNG	INFLT(gpm)	COMMENTS

COMMENTS: _____

PIPE SKETCH

LOCATION SKETCH (SHOW TWO TIES FOR FUTURE LOCATION)

N

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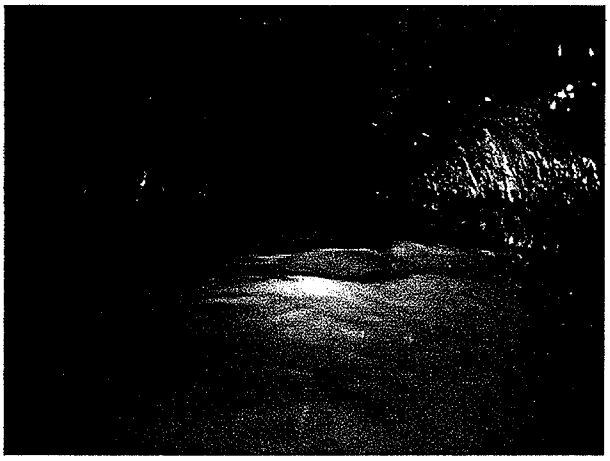
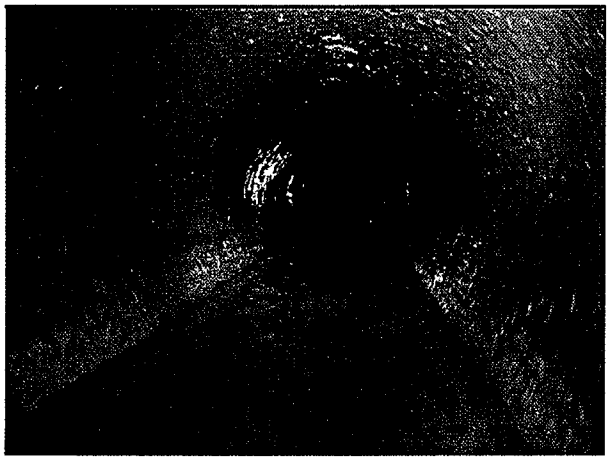
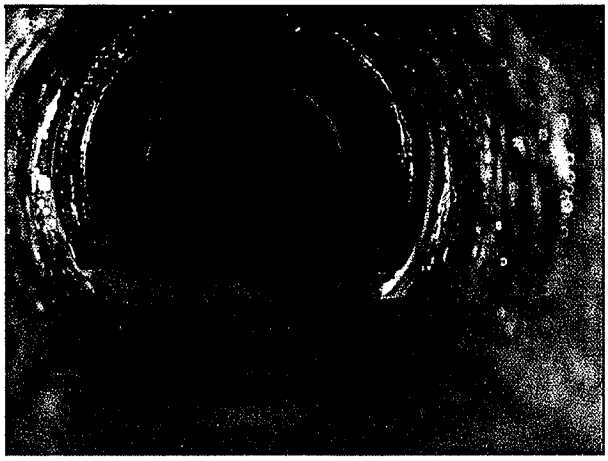
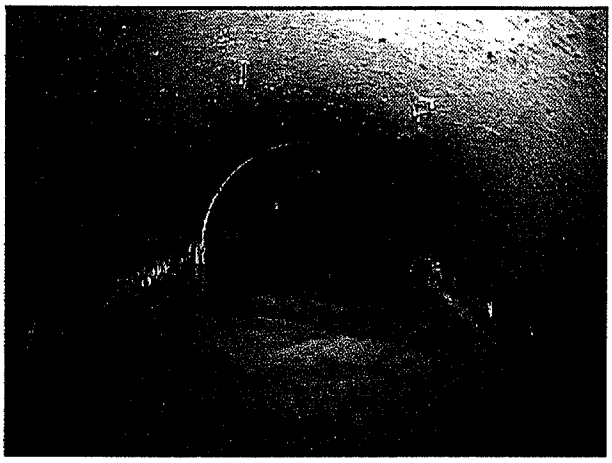
GBA Report Master® Sewer Manhole Inspection Image Data.

Images	Data
	**Manhole:** E16 **Inspection Date:** 3/20/01 **Flow Basin:** **Gen Location:** **Address:** **Inspection Text:** Internal **Location Text:** Street **Total Structural Val:** 0 **Total Flow (gpm):** 0 **Description:** outgoing line to E15 **File Name:** file://F:/CTO/GBA/GBAMastr/Pict/Sewer/E16L1.jpg
	**Manhole:** E16 **Inspection Date:** 3/20/01 **Flow Basin:** **Gen Location:** **Address:** **Inspection Text:** Internal **Location Text:** Street **Total Structural Val:** 0 **Total Flow (gpm):** 0 **Description:** incoming line from E16-1 **File Name:** file://F:/CTO/GBA/GBAMastr/Pict/Sewer/E16L2.jpg
	**Manhole:** E16 **Inspection Date:** 3/20/01 **Flow Basin:** **Gen Location:** **Address:** **Inspection Text:** Internal **Location Text:** Street **Total Structural Val:** 0 **Total Flow (gpm):** 0 **Description:** offset joint in incoming line from E16-1 **File Name:** file://F:/CTO/GBA/GBAMastr/Pict/Sewer/E16L2A.jpg



Manhole: E16
Inspection Date: 3/20/01
Flow Basin:
Gen Location:
Address:
Inspection Text: Internal
Location Text: Street
Total Structural Val: 0
Total Flow (gpm): 0
Description: incoming line from E16-1.1
File Name:
file://F:/CTO/GBA/GBAMastr/Pict/Sewer/E16L3.jpg

Manhole: E16
Inspection Date: 3/20/01
Flow Basin:
Gen Location:
Address:
Inspection Text: Internal
Location Text: Street
Total Structural Val: 0
Total Flow (gpm): 0
Description: inflow from hole in incoming line from E16-1.1
File Name:
file://F:/CTO/GBA/GBAMastr/Pict/Sewer/E16L3A.jpg

Manhole: E16
Inspection Date: 3/20/01
Flow Basin:
Gen Location:
Address:
Inspection Text: Internal
Location Text: Street
Total Structural Val: 0
Total Flow (gpm): 0
Description: manhole topside
File Name:
file://F:/CTO/GBA/GBAMastr/Pict/Sewer/E16M1.jpg

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GBA Observations/Defects and Structural Scores

TV/Lamp Infilt | TV/Lamp Struc | TV/Lamp Clean | MH Flow | MH Cover | MH Struc | Smk/Dye/Bldg | Bldg Sumps

Code	Defect	Structure Rating 1	Structure Rating 2	Structure Rating 3	Structure Rating 4	Structure Rating 5
1	Crack-Radial	1	2	5	10	20
2	Crack-Horizontal	1	2	5	10	20
3	Broken Pipe	30	50	70	100	130
4	Collapsed Pipe	0	0	0	200	400
5	Wye Service	0	5	10	75	400
6	Break-in Conn	0	5	10	75	400
7	Extended Tap	1	5	10	75	400
8	Offset	0	0	25	70	120
9	Gapped Joint	0	0	25	70	120
10	Roots	1	2	5	10	20
11	Debris	0	0	0	0	0
12	Grease	0	0	0	0	0
13	Corrosion	3	6	10	25	75
14	Scaling	3	6	10	25	75
15	Sag	1	2	5	10	25
16	Infiltration	0	0	0	0	0
17	New Manhole	0	0	0	0	0
18	30' Horizontal Crack	10	20	50	100	200
31	Pipe Seal	5	10	20	60	100

TotalStructural Number = Sum of the structral numbers of all the Line Lamping observations for each line

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Sewers with Line Lamping Structural Scores > 1

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US Manhole / DS Manhole	US Address / DS Address	Length / Length Status	Rim to Crown / Angled Rim/Inv	Depos.Depth / Deposition	Totals / Structural
Insp.Date	Direction	Material	Angled Offset	Flow Velocity	Cleaning
Flow Basin	Shape	Liner	Rim to Invert	Cleaning	GPM
	Dia/Ht Width		Flow Depth	TV	Remain GPM
Comments					

A7			263.0			0.00			
* A8			As-Built Drawings	12.80		N/A			400
4/2/2001	3 O'Clock		VC			4.50			0
A				12.80					0.050
	18	18		8.00					0.050

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Est. (gpm)	Ratings Struct	Clean	Remain (gpm)
1	3.0	Joint	Break-in Conn	5	0.050	0.030	400	0	0.050

* V55-72.37			356.0						
V55-72.38			As-Built Drawings	8.00					120
4/4/2001	7 O'Clock		VC			2.00			0
V				8.00					0.050
	10	10		1.00					0.050

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Est. (gpm)	Ratings Struct	Clean	Remain (gpm)
1	2.0	Joint	Offset	5	0.000	0.050	120	0	0.050

* W58-1			180.0			0.00			
W58			TV Inspections	19.00		N/A			120
3/21/2001	8 O'Clock		PVC			8.50			0
W				19.00					2.000
	21	21		6.00					2.000

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Est. (gpm)	Ratings Struct	Clean	Remain (gpm)
1	10.0	Joint	Offset	5	2.000	0.050	120	0	2.000
	Possible Service Connect?								

E47-138A						0.00			
* E47-138				12.90		N/A			120
3/23/2001	4 O'Clock					3.00			0
E				12.90					0.050
				0.75					0.500

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Est. (gpm)	Ratings Struct	Clean	Remain (gpm)
1	2.0	Joint	Offset	5	0.050	0.050	120	0	0.500

V29-1						0.00			
* V29				8.00		N/A			120
4/24/2001	1 O'Clock					2.00			0
V				8.00					0.050
				0.50					0.050

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Est. (gpm)	Ratings Struct	Clean	Remain (gpm)
1	0.0	US Manhole	Grease	2	0.000	0.000	0	0	0.000
2	10.0	US Manhole	Grease	2	0.000	0.000	0	0	0.000
3	5.0	Joint	Offset	5	0.000	0.050	120	0	0.050

* - Inspected Manhole

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Sewers with Line Lamping Structural Scores > 1

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US Manhole / DS Manhole	US Address / DS Address	Length / Length Status	Rim to Crown / Angled Rim/Inv	Depos.Depth / Deposition	Totals: Structural
Insp.Date	Direction	Material	Angled Offset	Flow Velocity	Cleaning
Flow Basin	Shape	Liner	Rim to Invert	Cleaning	GPM
	Dia/Ht Width		Flow Depth	TV	Remain GPM
Comments					

A6		317.0		0.00				
* A7		TV Inspections	12.10	N/A				75
4/2/2001	3 O'Clock	VC		7.00				5
A			12.10					0.060
	18 18		6.00					0.060

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	8.0	Joint	Offset	3	0.000	0.020	25	0	0.020
2	16.0	Joint	Offset	3	0.000	0.020	25	0	0.020
3	24.0	Joint	Offset	3	0.000	0.020	25	0	0.020
4	8.0	Joint	Grease	3	0.000	0.000	0	5	0.000

E40-24.4		44.0		0.00				
* E40-24.3		As-Built Drawings	17.60	N/A				70
5/15/2001	8 O'Clock	PVC		2.00				0
E			17.60					0.050
	12 12		0.25					0.050

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	25.0	Joint	Gapped Joint	4	0.050	0.035	70	0	0.050

F3-3				0.00				
* F3-2			14.70	N/A				70
5/17/2001	11 O'Clock			3.00				0
F			14.70					0.035
			1.00					0.040

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	5.0	Joint	Offset	4	0.000	0.035	70	0	0.035

B11		285.0		0.00				
* B10A		TV Inspections	18.90	N/A				25
4/18/2001	1 O'Clock	VC		8.00				0
B			18.90					0.020
	10 10		1.00					0.020

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	10.0	Joint	Offset	3	0.000	0.020	25	0	0.020

E31		372.0		0.00				
* E30		TV Inspections	13.70	N/A				25
5/15/2001	6 O'Clock	VC		4.50				0
E			13.70					0.050
	18 18		6.00					0.050

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	25.0	Joint	Offset	3	0.050	0.020	25	0	0.050

* - Inspected Manhole

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Sewers with Line Lamping Structural Scores > 1

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US Manhole / DS Manhole	Insp.Date / Flow Basin / Comments	US Address / DS Address	Direction / Shape / Dia/Ht	Width	Length / Length Status / Material / Liner	Rim to Crown / Angled Rim/Inv / Angled Offset / Rim to Invert / Flow Depth	Depos.Depth / Deposition / Flow Velocity / Cleaning / TV	Totals: Structural / Cleaning / GPM / Remain GPM
E40-8					374.0		0.00	
* E40-7					As-Built Drawings	9.90	N/A	25
	5/1/2001		11 O'Clock		AC		3.00	0
	E					9.90		0.050
			16	16		3.00		0.050

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings: Est. (gpm)	Struct	Clean	Remain (gpm)
1	20.0	Joint	Offset	3	0.050	0.020	25	0	0.050

US Manhole / DS Manhole	Insp.Date / Flow Basin / Comments	US Address / DS Address	Direction / Shape / Dia/Ht	Width	Length / Length Status / Material / Liner	Rim to Crown / Angled Rim/Inv / Angled Offset / Rim to Invert / Flow Depth	Depos.Depth / Deposition / Flow Velocity / Cleaning / TV	Totals: Structural / Cleaning / GPM / Remain GPM
E47-141					244.0		2.00	
* E47-140					As-Built Drawings	8.90	Mud	25
	3/23/2001		8 O'Clock		UNKN		1.50	0
	E					8.90		0.050
			15	15		3.00		0.050

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings: Est. (gpm)	Struct	Clean	Remain (gpm)
1	15.0	Joint	Offset	3	0.050	0.020	25	0	0.050

US Manhole / DS Manhole	Insp.Date / Flow Basin / Comments	US Address / DS Address	Direction / Shape / Dia/Ht	Width	Length / Length Status / Material / Liner	Rim to Crown / Angled Rim/Inv / Angled Offset / Rim to Invert / Flow Depth	Depos.Depth / Deposition / Flow Velocity / Cleaning / TV	Totals: Structural / Cleaning / GPM / Remain GPM
U24					113.0		0.00	
* U23					TV Inspections	16.90	N/A	25
	3/14/2001		1 O'Clock		AC		3.50	0
	U					16.90		0.050
			10	10		3.00		0.050

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings: Est. (gpm)	Struct	Clean	Remain (gpm)
1	5.0	Joint	Offset	3	0.050	0.020	25	0	0.050

US Manhole / DS Manhole	Insp.Date / Flow Basin / Comments	US Address / DS Address	Direction / Shape / Dia/Ht	Width	Length / Length Status / Material / Liner	Rim to Crown / Angled Rim/Inv / Angled Offset / Rim to Invert / Flow Depth	Depos.Depth / Deposition / Flow Velocity / Cleaning / TV	Totals: Structural / Cleaning / GPM / Remain GPM
V55-73.10					154.0		0.00	
* V55-73.9					As-Built Drawings	17.10	N/A	25
	4/18/2001		10 O'Clock		PVC		4.00	0
	V					17.10		0.020
			10	10		1.00		0.020

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings: Est. (gpm)	Struct	Clean	Remain (gpm)
1	5.0	Joint	Offset	3	0.000	0.020	25	0	0.020

US Manhole / DS Manhole	Insp.Date / Flow Basin / Comments	US Address / DS Address	Direction / Shape / Dia/Ht	Width	Length / Length Status / Material / Liner	Rim to Crown / Angled Rim/Inv / Angled Offset / Rim to Invert / Flow Depth	Depos.Depth / Deposition / Flow Velocity / Cleaning / TV	Totals: Structural / Cleaning / GPM / Remain GPM
E40-4					114.0		0.00	
* E40-1					As-Built Drawings	11.30	N/A	25
	5/1/2001		8 O'Clock		PVC		4.00	0
	E					11.30		0.020
			15	15		3.00		0.020

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings: Est. (gpm)	Struct	Clean	Remain (gpm)
1	20.0	Joint	Offset	3	0.000	0.020	25	0	0.020

US Manhole / DS Manhole	Insp.Date / Flow Basin / Comments	US Address / DS Address	Direction / Shape / Dia/Ht	Width	Length / Length Status / Material / Liner	Rim to Crown / Angled Rim/Inv / Angled Offset / Rim to Invert / Flow Depth	Depos.Depth / Deposition / Flow Velocity / Cleaning / TV	Totals: Structural / Cleaning / GPM / Remain GPM
Y14-1							0.00	
* A29.2						4.60	N/A	25
	4/2/2001		1 O'Clock				2.00	0
	Y					4.60		0.020
						0.25		0.020

* - Inspected Manhole

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Sewers with Line Lamping Structural Scores > 1

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US Manhole	US Address	Length	Rim to Crown	Depos.Depth	Totals
DS Manhole	DS Address	Length Status	Angled Rim/Inv	Deposition	Structural
Insp.Date	Direction	Material	Angled Offset	Flow Velocity	Cleaning
Flow Basin	Shape	Liner	Rim to Invert	Cleaning	GPM
	Dia/Ht Width		Flow Depth	TV	Remain GPM
Comments					

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	1.0	Joint	Offset	3	0.000	0.020	25	0	0.020

F14			343.0				0.00		
* F15			As-Built Drawings		7.50	N/A			20
	4/17/2001	12 O'Clock	VC				2.50		50
	E				7.50				0.040
		8	8		2.00				0.040

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	8.0	Joint	Roots	4	0.000	0.020	10	25	0.020
2	16.0	Joint	Roots	4	0.000	0.020	10	25	0.020

V55-30			256.0				0.00		
* V55-29			As-Built Drawings		12.60	N/A			20
	4/5/2001	1 O'Clock	VC				6.00		100
	V				12.60				0.030
		15	15		3.50				0.030

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	10.0	Joint	Roots	5	0.000	0.030	20	100	0.030

* V55-63			256.0				0.00		
V55-41			As-Built Drawings		12.50	N/A			20
	4/5/2001	8 O'Clock	VC				4.00		100
	V				12.50				0.030
		15	15		5.00				0.030

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	5.0	Joint	Offset	5	0.000	0.050	120	0	0.050
	Creating a backup in the flow.								

* V55-70.27			208.0				0.00		
V55-70.26			As-Built Drawings		26.00	N/A			20
	3/28/2001	5 O'Clock	VC				5.50		100
	V				26.00				0.030
		12	12		3.00				0.030

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	0.0	DS Manhole	Roots	5	0.000	0.030	20	100	0.030
	Could not image line due to root growth.								

V55-71.1			202.0				0.00		
* V55-70.27			As-Built Drawings		25.90	N/A			20
	3/28/2001	12 O'Clock	VC				5.50		100
	V				25.90				0.030
		12	12		3.00				0.030

* - Inspected Manhole

Lamping Inspection Master Report

Sewers with Line Lamping Structural Scores > 1

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US Manhole / DS Manhole	US Address / DS Address	Length / Length Status	Rim to Crown / Angled Rim/Inv	Depos.Depth / Deposition	Totals: Structural
Insp.Date	Direction	Material	Angled Offset	Flow Velocity	Cleaning
Flow Basin	Shape	Liner	Rim to Invert	Cleaning	GPM
	Dia/Ht Width		Flow Depth	TV	Remain GPM
Comments					

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings: Est. (gpm)	Struct	Clean	Remain (gpm)
1	0.0	US Manhole	Roots	5	0.000	0.030	20	100	0.030
	Could not image line because of root growth.								

* X30			298.0				0.00		
X29			TV Inspections		11.10	N/A			20
	3/30/2001	9 O'Clock	AC				3.00		100
	X				11.10				0.030
		10 10			8.00				0.030

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings: Est. (gpm)	Struct	Clean	Remain (gpm)
1	0.0	US Manhole	Roots	5	0.000	0.030	20	100	0.030

GIII6-1							0.00		
* GIII6					14.40	N/A			20
	3/27/2001	2 O'Clock					0.00		100
	G				14.40				0.030
					0.00				0.030

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings: Est. (gpm)	Struct	Clean	Remain (gpm)
1	0.0	Invert	Roots	5	0.000	0.030	20	100	0.030

V55-44							0.00		
* V55-29					12.00	N/A			20
	4/5/2001	3 O'Clock					2.50		100
	V				12.00				0.030
					0.75				0.030

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings: Est. (gpm)	Struct	Clean	Remain (gpm)
1	1.0	Joint	Roots	5	0.000	0.030	20	100	0.030

* V55-69.7			399.0				0.00		
V55-69.6			As-Built Drawings		11.70	N/A			10
	3/28/2001	6 O'Clock	VC				5.50		25
	V				11.70				0.020
		12 12			2.50				0.020

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings: Est. (gpm)	Struct	Clean	Remain (gpm)
1	0.0	DS Manhole	Roots	4	0.000	0.020	10	25	0.020
	Could not image line due to root growth.								

* W58			345.0				0.00		
W57			TV Inspections		20.00	N/A			10
	3/21/2001	9 O'Clock	AC				6.00		16
	W				20.00				0.020
		21 21			18.00				0.020

Lamping Inspection Master Report

Sewers with Line Lamping Structural Scores > 1

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US Manhole	US Address	Length	Rim to Crown	Depos.Depth	Totals
DS Manhole	DS Address	Length Status	Angled Rim/Inv	Deposition	Structural
Insp.Date	Direction	Material	Angled Offset	Flow Velocity	Cleaning
Flow Basin	Shape	Liner	Rim to Invert	Cleaning	GPM
	Dia/Ht Width		Flow Depth	TV	Remain GPM
Comments					

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	0.0	Crown	Roots	3	0.000	0.010	5	8	0.010
2	10.0	Crown	Roots	3	0.000	0.010	5	8	0.010

GIV1.2							0.00		
* GIV1.1					12.20	N/A			10
5/9/2001		2 O'Clock					2.00		25
G					12.20				0.020
					1.00				0.020

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	5.0	Crown	Roots	4	0.000	0.020	10	25	0.020

GIII8-1							0.00		
* GIII8					14.50	N/A			10
3/22/2001		2 O'Clock					2.00		25
G					14.50				0.020
					0.50				0.020

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	0.0	Invert	Roots	4	0.000	0.020	10	25	0.020

* W24-4A			38.0				0.00		
W24-4B			As-Built Drawings		10.20	N/A			10
4/20/2001		11 O'Clock	UNKN				5.00		0
E					10.20				0.000
		30			7.00				0.000

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	10.0	Crown	Scaling	3	0.000	0.000	10	0	0.000

W24-5							0.00		
* W24-4A					10.10	N/A			10
4/20/2001		5 O'Clock	UNKN				5.00		0
E					10.10				0.000
		30			6.00				0.000

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	10.0	Crown	Scaling	3	0.000	0.000	10	0	0.000

A-31.2			130.0				0.00		
* A-31.3			As-Built Drawings		5.40	N/A			9
4/3/2001		2 O'Clock	UNKN				9.00		0
A					5.40				0.000
		18	18		4.00				0.000

* - Inspected Manhole

Lamping Inspection Master Report

Sewers with Line Lamping Structural Scores > 1

9/26/2001
12:37:11PM

US Manhole	US Address	Length	Rim to Crown	Depos.Depth	Totals
DS Manhole	DS Address	Length Status	Angled Rim/Inv	Deposition	Structural
Insp.Date	Direction	Material	Angled Offset	Flow Velocity	Cleaning
Flow Basin	Shape	Liner	Rim to Invert	Cleaning	GPM
	Dia/Ht Width		Flow Depth	TV	Remain GPM
Comments					

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	8.0	Joint	Corrosion	1	0.000	0.000	3	0	0.000
2	16.0	Joint	Corrosion	1	0.000	0.000	3	0	0.000
3	24.0	Joint	Corrosion	1	0.000	0.000	3	0	0.000

* A-31.3			340.0			0.00			
A32			As-Built Drawings		5.50	N/A			9
	4/3/2001	8 O'Clock	UNKN			9.00			0
	A				5.50				0.000
		18 18			4.00				0.000

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	8.0	Joint	Corrosion	1	0.000	0.000	3	0	0.000
2	16.0	Joint	Corrosion	1	0.000	0.000	3	0	0.000
3	24.0	Joint	Corrosion	1	0.000	0.000	3	0	0.000

V55-24						0.00			
* V55-22					10.10	N/A			6
	4/24/2001	12 O'Clock				1.00			0
	V				10.10				0.000
					0.25				0.000

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	10.0	Joint	Scaling	2	0.000	0.000	6	0	0.000

B3			592.0			1.00			
* B2			TV Inspections		27.10	Mud			5
	4/18/2001	12 O'Clock	PVC			2.00			0
	B				27.10				0.002
		15 15			7.00				0.000

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	15.0	Crown	Pipe Seal	1	0.000	0.002	5	0	0.002

* B6			106.0			0.00			
B5			TV Inspections		20.90	N/A			5
	4/18/2001	8 O'Clock	VC			4.50			8
	B				20.90				0.010
		15 15			5.00				0.010

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	8.0	Joint	Roots	3	0.010	0.010	5	8	0.010

* A-31.2			130.0			0.00			
A-31.3			As-Built Drawings		4.70	N/A			3
	4/3/2001	8 O'Clock	UNKN			4.50			0
	A				4.70				0.000
		18 18			5.00				0.000

* - Inspected Manhole

Lamping Inspection Master Report

Sewers with Line Lamping Structural Scores > 1

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12:37:11PM

US Manhole	US Address	Length	Rim to Crown	Depos.Depth	Totals
DS Manhole	DS Address	Length Status	Angled Rim/Inv	Deposition	Structural
Insp.Date	Direction	Material	Angled Offset	Flow Velocity	Cleaning
Flow Basin	Shape	Liner	Rim to Invert	Cleaning	GPM
	Dia/Ht Width		Flow Depth	TV	Remain GPM
Comments					

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	1.0	Joint	Corrosion	1	0.000	0.000	3	0	0.000

* E40-8			374.0			0.00			
E40-7			As-Built Drawings		9.00	N/A			2
5/1/2001		4 O'Clock	AC			3.00			0
E					9.00				0.000
		16 16			3.00				0.000

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	20.0	Invert	Sag	2	0.000	0.000	2	0	0.000

* F14			343.0			0.00			
F15			As-Built Drawings		8.00	N/A			2
4/17/2001		6 O'Clock	VC			2.00			4
E					8.00				0.004
		8 8			3.00				0.000

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	2.0	Joint	Roots	2	0.000	0.004	2	4	0.004

* F22-15.5			270.0			0.00			
F22-15.4			TV Inspections		14.00	N/A			2
4/17/2001		2 O'Clock	VC			4.50			2
E					14.00				0.004
		30 30			7.00				0.000

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	5.0	Joint	Roots	1	0.000	0.002	1	1	0.002
2	10.0	Joint	Roots	1	0.000	0.002	1	1	0.002

* G10A			386.0			0.00			
G8A			TV Inspections		5.80	N/A			2
5/10/2001		6 O'Clock	UNKN			3.00			4
G					5.80				0.004
		18 18			5.00				0.000

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	20.0	Crown	Roots	2	0.000	0.004	2	4	0.004

* U11			172.0			0.00			
U10			TV Inspections		5.00	N/A			2
3/15/2001		5 O'Clock	AC			3.50			4
U					5.00				0.004
		10 10			2.50				0.000

Obs. #	Distance Comment	Location	Description	Rating	Obsrvd (gpm)	Ratings Est. (gpm)	Struct	Clean	Remain (gpm)
1	15.0	Joint	Roots	2	0.000	0.004	2	4	0.004

* - Inspected Manhole

Lamping Inspection Master Report

Sewers with Line Lamping Structural Scores > 1

9/26/2001
12:37:11PM

US Manhole / DS Manhole	US Address / DS Address	Length / Length Status	Rim to Crown / Angled Rim/Inv	Depos.Depth / Deposition	Totals / Structural
Insp.Date	Direction	Material	Angled Offset	Flow Velocity	Cleaning
Flow Basin	Shape	Liner	Rim to Invert	Cleaning	GPM
	Dia/Ht Width		Flow Depth	TV	Remain GPM
Comments					

V55-69.18				97.0			0.00			
* V55-69.17				As-Built Drawings		10.20	N/A			2
	3/28/2001	2 O'Clock		VC			5.50			4
	V					10.20				0.004
		12	12			3.50				0.000

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Est. (gpm)	Ratings Struct	Ratings Clean	Remain (gpm)
1	4.0	Joint	Roots	2	0.000	0.004	2	4	0.004

V56				112.0			0.00			
* V55				TV Inspections		23.00	N/A			2
	4/24/2001	3 O'Clock		VC			3.50			0
	V					23.00				0.050
		12	12			0.50				0.050

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Est. (gpm)	Ratings Struct	Ratings Clean	Remain (gpm)
1	1.0	Upper Left	Crack-Horizontal	2	0.050	0.004	2	0	0.050
2	5.0	Joint	Offset	2	0.000	0.000	0	0	0.000

* W50-9				392.0			0.00			
W50-8				TV Inspections		9.10	N/A			2
	3/22/2001	10 O'Clock		VC			1.00			2
	W					9.10				0.004
		21	21			1.00				0.000

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Est. (gpm)	Ratings Struct	Ratings Clean	Remain (gpm)
1	0.0	Upper Left	Roots	1	0.000	0.002	1	1	0.002
2	5.0	Upper Left	Roots	1	0.000	0.002	1	1	0.002

X3				230.0			0.00			
* X2				TV Inspections		6.60	N/A			2
	3/29/2001	2 O'Clock		AC			6.00			4
	X					6.60				0.004
		12	12			4.00				0.000

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Est. (gpm)	Ratings Struct	Ratings Clean	Remain (gpm)
1	4.0	Joint	Roots	2	0.000	0.004	2	4	0.004

GIII1A				41.0			0.00			
* GIII1				As-Built Drawings		10.80	N/A			2
	5/9/2001	12 O'Clock		AC			4.00			4
	G					10.80				0.004
		21	21			4.00				0.000

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Est. (gpm)	Ratings Struct	Ratings Clean	Remain (gpm)
1	10.0	Crown	Roots	2	0.000	0.004	2	4	0.004

* - Inspected Manhole

Lamping Inspection Master Report

Sewers with Line Lamping Structural Scores > 1

9/26/2001
12:37:11PM

US Manhole / DS Manhole	US Address / DS Address	Length / Length Status	Rim to Crown / Angled Rim/Inv	Depos.Depth / Deposition	Totals / Structural
Insp.Date	Direction	Material	Angled Offset	Flow Velocity	Cleaning
Flow Basin	Shape	Liner	Rim to Invert	Cleaning	GPM
	Dia/Ht Width		Flow Depth	TV	Remain GPM
Comments					

GIV1-1							0.00			
* GIV1						7.10	N/A			2
	5/9/2001	11 O'Clock					2.50			0
	G					7.10				0.000
						2.00				0.000

Obs. #	Distance / Comment	Location	Description	Rating	Obsrvd (gpm)	Est. (gpm)	Ratings: Struct	Ratings: Clean	Remain (gpm)
1	20.0	Crown	Sag	2	0.000	0.000	2	0	0.000

Appendix D

MWH
MONTGOMERY WATSON HARZA

APPENDIX D

UNIT Y EXTERNAL INSPECTION

MEMORANDUM

MONTGOMERY WATSON

To:	Dean Morales	**Date:**	June 5, 2001
From:	Paul Giguere and David Bouck	**Reference:**	City of Thousand Oaks
Subject:	Unit Y Trunk Sewer Physical Conditions Assessment		

Description of Investigation

The City staff has requested MY to perform an inspection of the visible ground features along the route of the Unit Y sewer and to review recently-performed videotapes of the sewer's interior. The MW staff conducted a walk-over and photographed the observed conditions in both February and May of this year. Areas of particular concern were those which are experiencing erosion of the side bank and the creek bed on the North Branch Arroyo Conejo Creek through Wildwood Park, because the Unit Y sewer parallels the meandering creek. Past experiences with creek bank erosion have exposed the sewer pipe or made it susceptible to structural failure due to loss of earth burial cover, impact of debris (trees, rocks, etc.) carried by the high creek flows which periodically occur. The Unit Y sewer pipe material is Techite™, which is a fiberglass resin composite material which is relatively thin-wall and therefore more susceptible than rigid pipe (such as concrete or steel or iron) from damage due to impact from objects or from the loss of uniform support from surrounding earth cover.

The following pages are an 11" x 17" Key Plan and color photographs used to illustrate the general alignment and topography along the creek. The Key Plan has photo numbers showing the viewer the location of the photos which are captioned on the following 13 pages. The photo survey begins at the upstream Manhole Y1, where Unit A sewer joins Unit X sewer and both flow into Unit Y sewer. The overall Unit Y sewer length observed, downstream to the reach at Manhole Y1 to the twin-pipe siphon, is a total distance of about 3,400 feet.

Areas of Concern and Recommendations

From the internal TV inspection, there are two areas of concern:

(1) A cracked pipe section exists near the upgrade end of the sewer between Manholes A37-1 and Y2. This area should be further investigated for a point repair, possibly by concrete

encasement or "sleeving" the Techite™ pipe. If the pipe structural integrity is very damaged, then the repair method should be to replace the pipe.

It is recommended that this work be completed this summer, by the same construction crew that is replacing the Unit X sewer from San Miguel Circle to this location down near the creek.

(2) A second area is a length of sewer about 20 feet long, which is located about 90 to 110 ft downstream of Manhole Y3, between Y3 and Y4 along the dirt road on the north side of the creek. The internal inspection shows cracked pipe and a pipe sag or partial blockage causing the water to deepen sufficiently to submerge the camera inside the sewer. Downstream of this location, the gravity sewer condition appears acceptable (no surcharging).

Based on the visible conditions at the ground surface, this reach between Manholes Y3 and Y4 could potentially be impacted soon by a section of collapsing creek bank, which is about 160 ft south of Manhole Y3. Reference the photographs, #32 and #35. These conditions need to be corrected this summer, also.

These conditions are not as severe as the condition described in the Manhole Y3 to Y4 reach at the collapsing creek bank area. However, they should be corrected during the dry weather, low stream flow period.

Action Plan to Correct Deficiencies

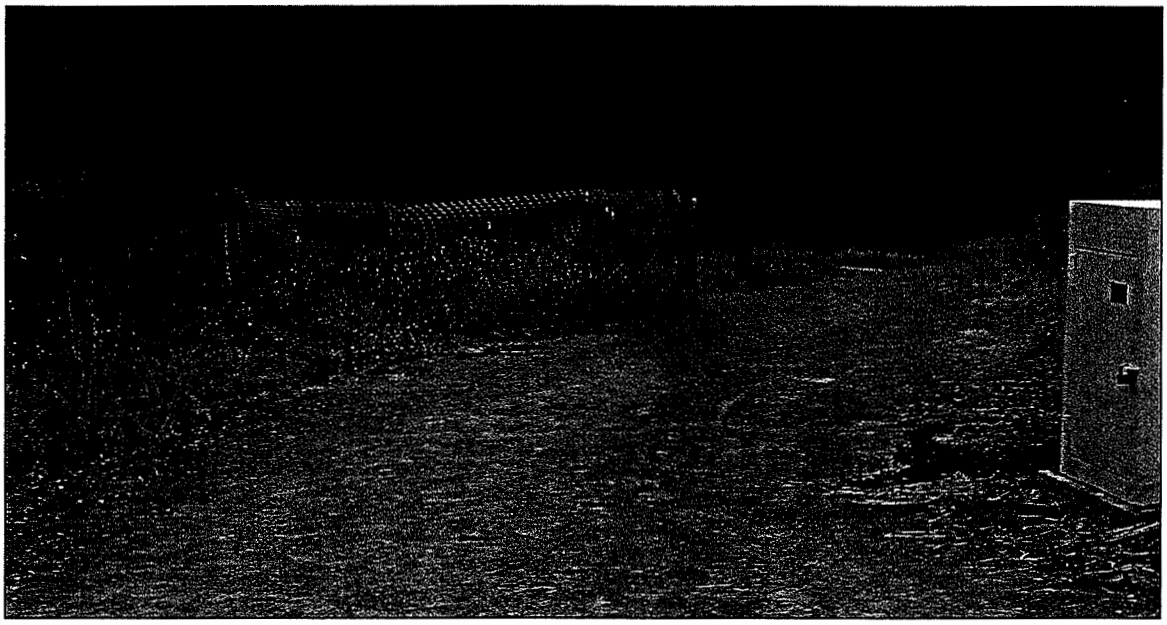
With the City's acceptance of these recommendations and direction to proceed, MW will engage the services of a soils engineer to assist in the design of corrections, at the earliest possible date. The reconstruction/repair work is general earthwork and drainage improvements and should not involve service interruption of the Unit ^ sewer. MW could proceed to secure competitive bids from general grading contractors and perform the work as a "turn-key" project, or the City may opt to publicly advertise and bid the creek bank repairs. Another contracting option may be to involve the Parks Department to see if they have an ongoing contract with a contractor for clearing, road grading, and general ground improvement activities within Wildwood Park. If this is the case, it may be the cheaper and faster route to contract for the "lower priority" repairs.

#27 Unit Y - Southeast of creek bridge, from Manhole Y1 area looking toward C.T.O. Manhole Y2, (The manhole cover is visible 3 ft of the marker post)

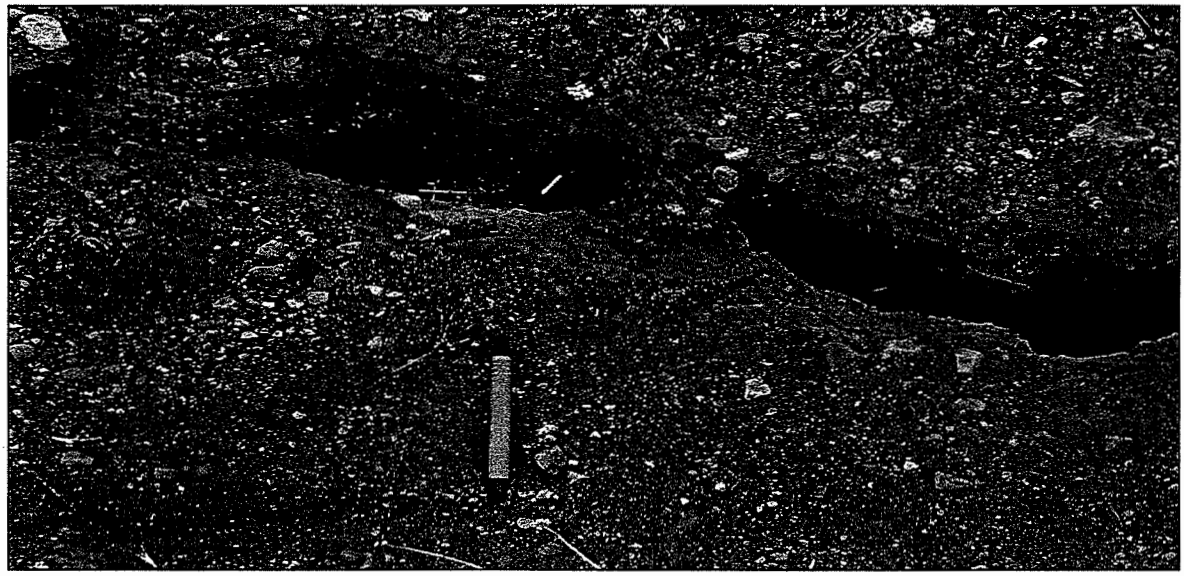
#28 Unit Y - Southeast of creek bridge at C.T.O. Manhole Y2, looking west toward manhole cover in the opposite creek bank, about 15 ft down. Could be a water main pump-out?

#29 Unit Y - Southwest of creek bridge, on the dirt road paralleling the west (north) bank of the creek. Looking northeast toward C.T.O. Manhole Y3 (manhole cover is visible). No work is required here; but possibly at bank collapse 160 ft downstream.

#31 Unit Y - Weir dam in creek about 75 ft south of CTO Manhole Y3. Foreground bank is the dirt road/trail along the Unit Y8 sewer route.



#32 Unit Y - Fence and area for park pedestrian safety along the eroding north creek bank. The collapsed bank is about 30 ft long, and is about 160 ft downstream between Manholes Y3 and Y4; Calleguas water line is exposed in bank side; Unit Y sewer is not exposed.
ACTION NEEDED: Notify Calleguas Water District of potential for water main damage. Coordinate erosion control measures with CWD, because their water main runs parallel to and between the creek and the Unit Y sewer. Reconstruction of drainage stabilization (as a minimum) needs to be done this summer (2001).



#35 Unit Y - Surface crack along collapsing creek bank. The ink pen shows the crack size in true scale.

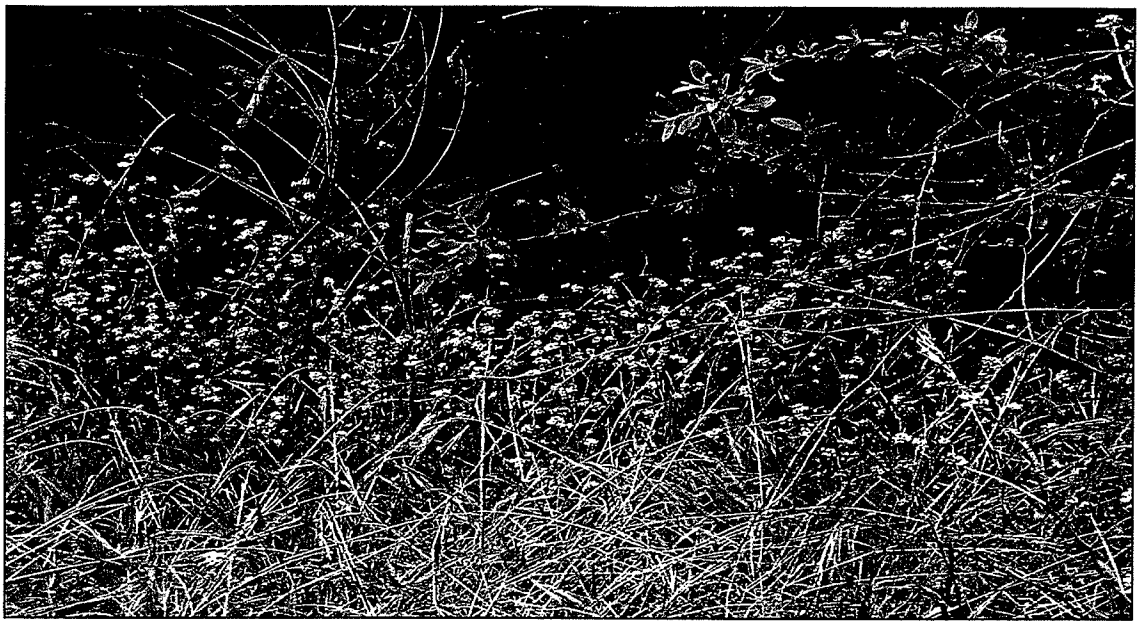
#36 Unit Y - C.T.O. Manhole Y4 in middle of dirt road, 15 ft from west bank of creek

#37 Unit Y - West of manhole Y4, the up-land creek drainage across dirt road is causing washout and erosion above C.T.O. Unit Y sewer which parallels the west bank of the creek.

ACTION NEEDED: Repair erosion and provide drainage inlet and pipe or swale to the creek over the City sewer to protect pipe cover in west bank.

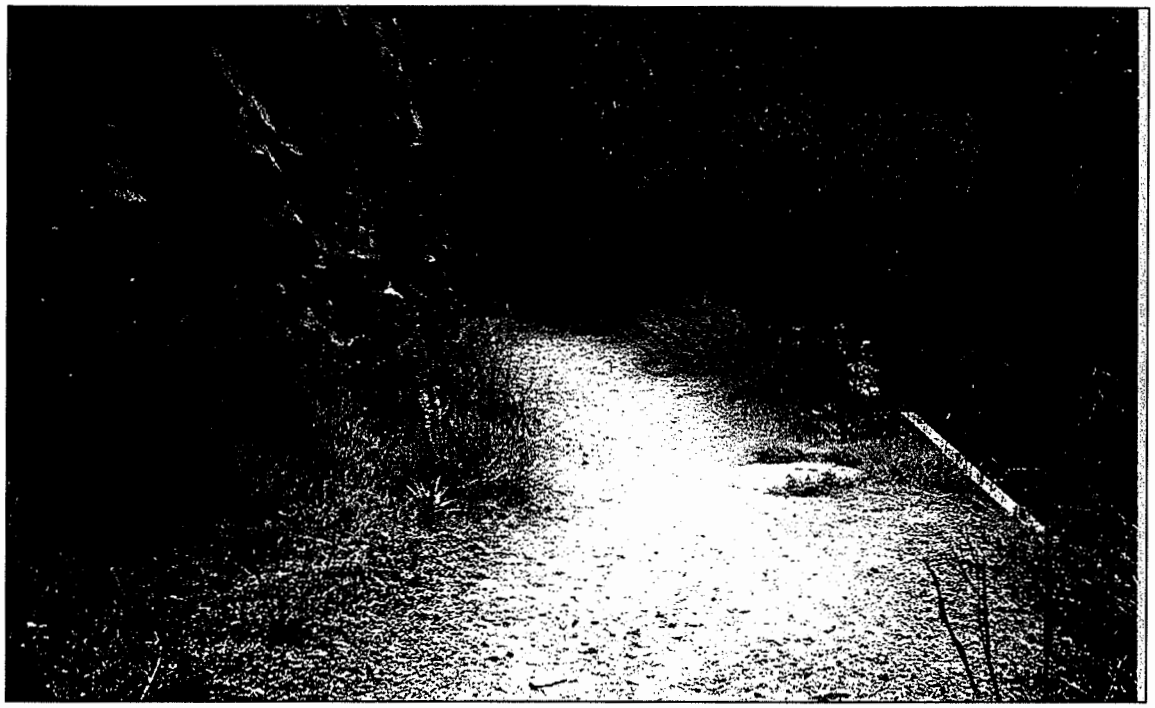
#38 Unit Y - C.T.O. Manhole Y7A next to north bank of creek with rip-rap stone and chain-link fence stabilization (previous repair)

#39 Unit Y - Close-up of creek bank erosion repair/stabilization at Manhole Y7A to show a successful, previous method of erosion control



#41 Unit Y - About 100 ft west of Manhole Y7A, a wall of rock-filled gabions along north bank have been eroded at high creek flow. They no longer provide erosion protection for the creek bank or C.T.O. Unit Y sewer. The sewer has a ±2 ft horizontal burial "cover" and a vertical cover of _?_ ft below the top of bank.

#1A Unit Y -Eroded creek bank area has destroyed a rock-filled gabion "wall" that was constructed to prevent bank erosion and exposure of the City's sewer. ACTION NEEDED: Reconstruct a gabion revetment with drilled bar dowels to anchor the base of the wall for slope stabilization

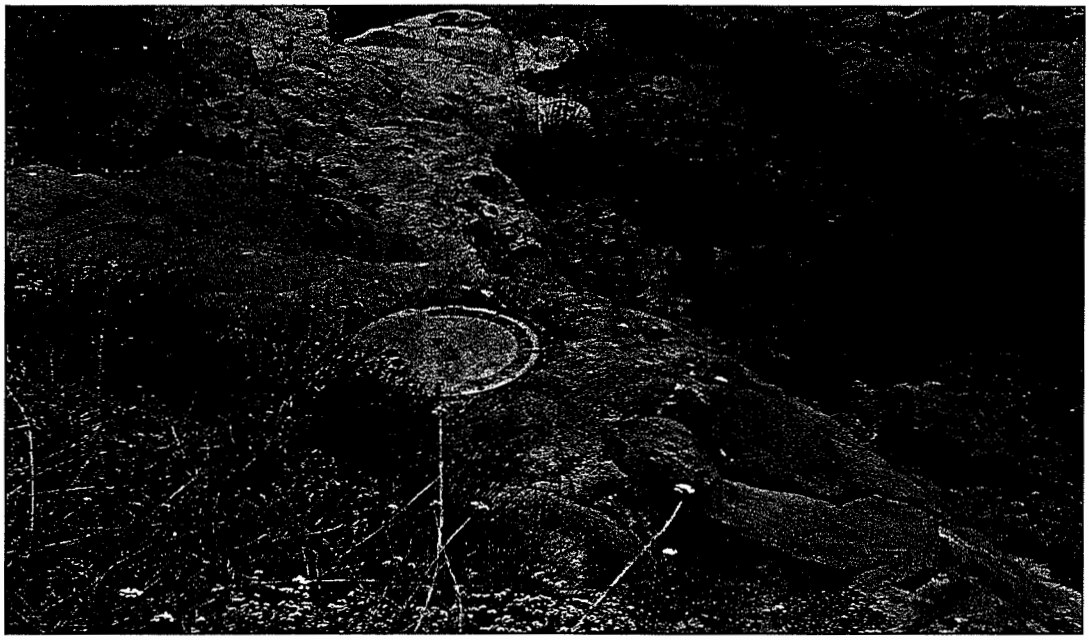


#3A Unit Y - Downstream of Manhole Y8 looking back at dirt path along sewer route which parallels the creek bank. Note the close-by wood timber retaining wall to prevent back erosion from exposing the manhole or sewer.

#44 Unit Y - Downstream of Manhole Y7, looking at sewer alignment along left edge of dirt path toward Manhole Y8.

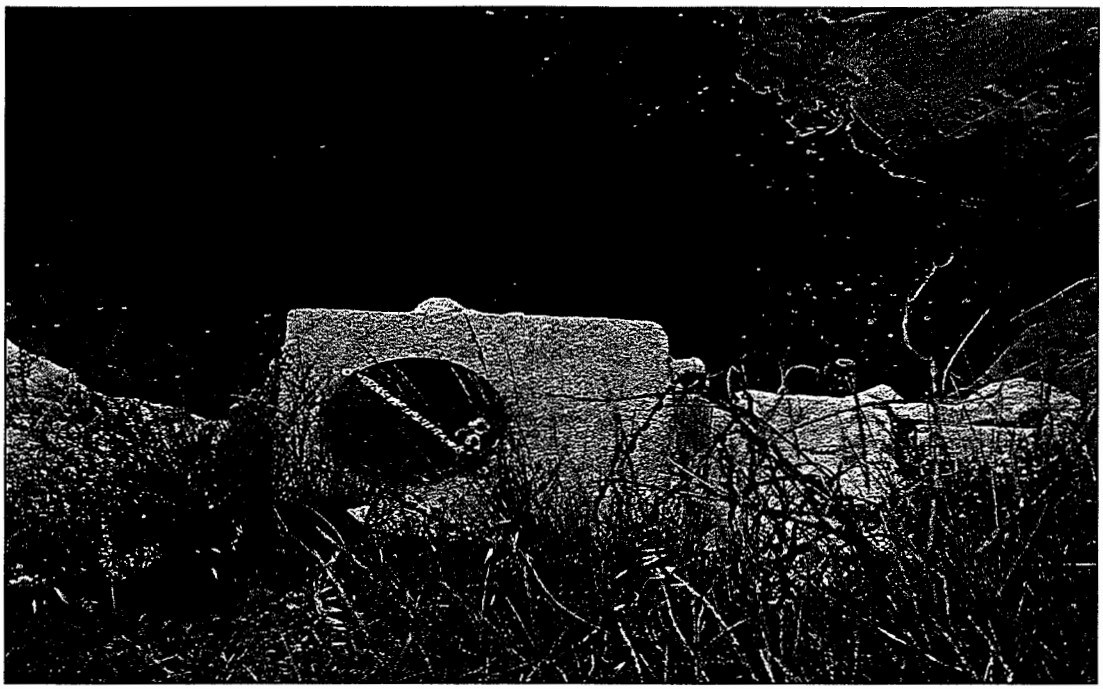
#45 Unit Y - North creek bank near C.T.O. manhole Y8, exposed rebar dowels and rock foundation for gabion wall which has been lost due to erosion. Unit Y sewer is next to bank slope without erosion protection.
ACTION NEEDED: Install drilled rebar anchorage for rock-filled gabion "crib wall" and rock rip-rap protection for the slope bank over the City's sewer.

#46 Unit Y - Between Manholes Y8 and Y9, looking back toward Manhole Y8 in southeasterly direction at creek bed. Unit Y sewer is buried along left side of creek bed below dirt path/road along the north side of the creek..



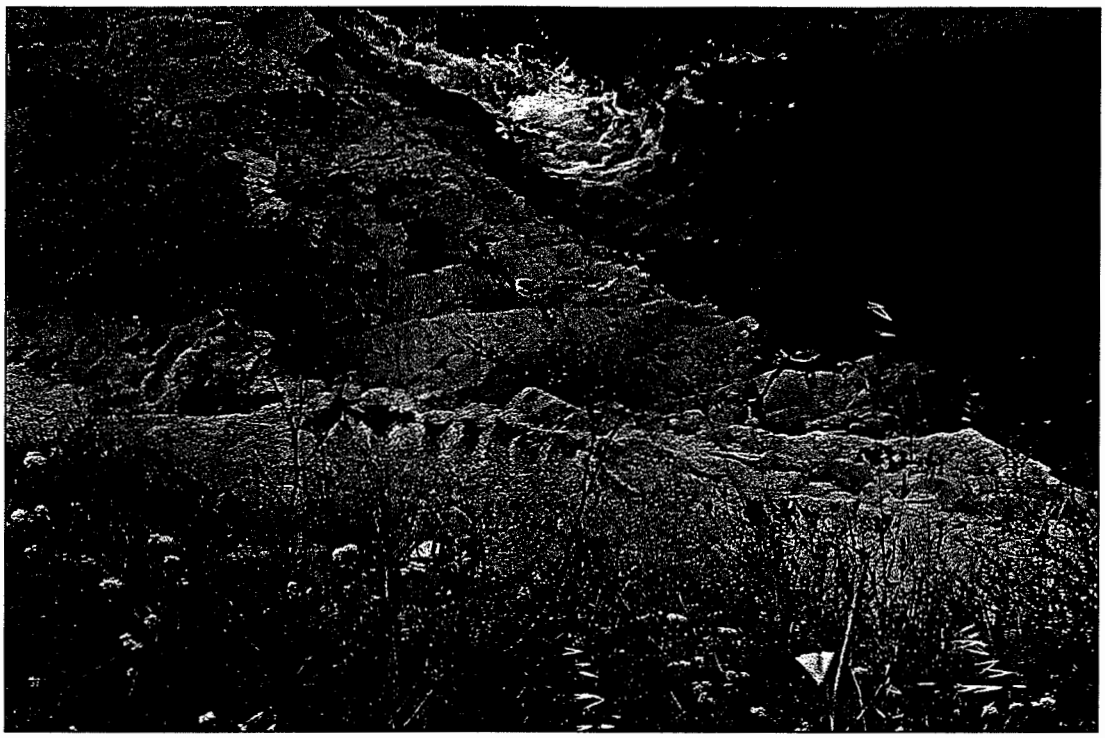
#47 Unit Y - Close-up of CTO Manhole Y9. Note poured concrete fill for erosion protection along the sewer alignment, from top left of photo continuing around manhole cover and to the lower right corner of the photo.

#48 Unit Y - Looking southeasterly at a wide panorama of creek. Looking down at Manhole Y9 and concrete cover backfill next to the creek. Near where fenced foot path was built farther back from rocky, steep bank for Park pedestrian safety purposes.

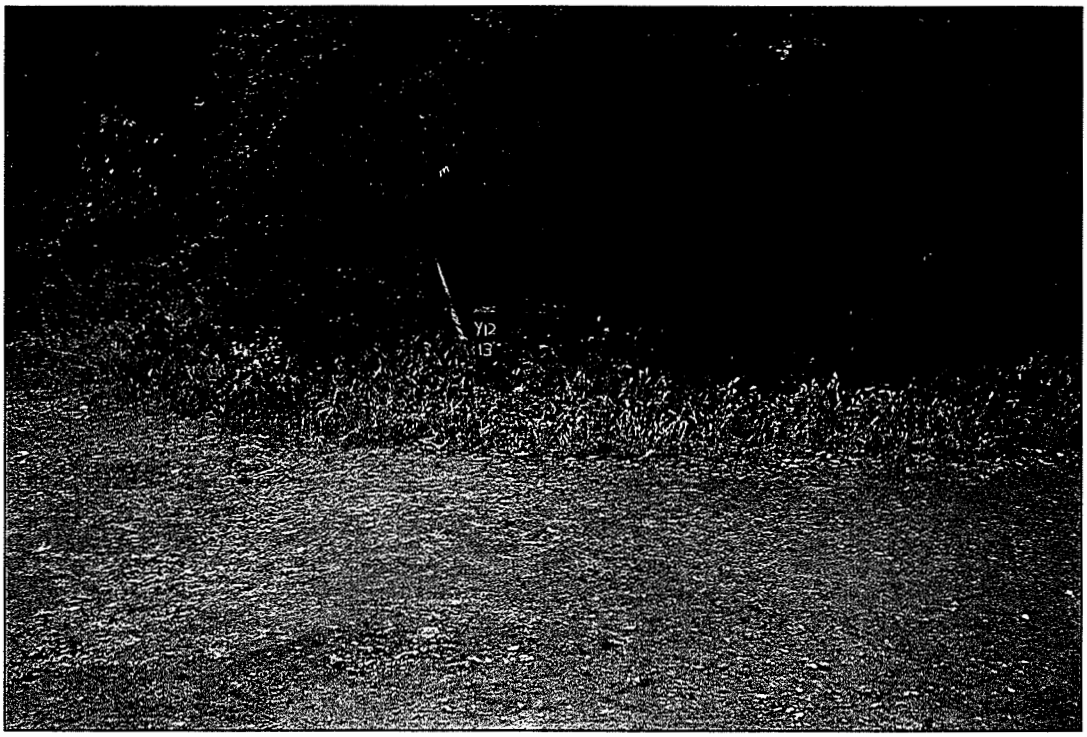


#50 Unit Y - From above on north side of creek, looking down on C.T.O. Manhole Y10 along creek bed with concrete backfill.

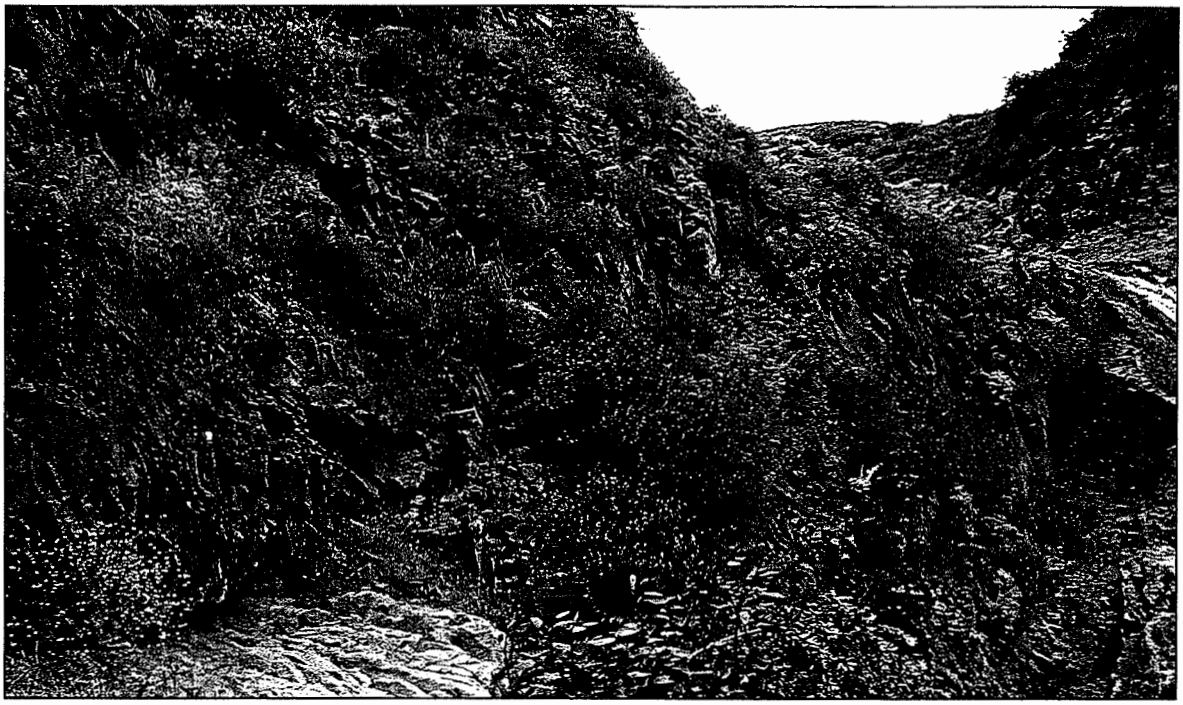
#2A Unit Y - Looking down at Manhole Y10 which is constructed with a square concrete riser. Note that manhole and concrete backfill is in the flowing creek, even at low flow period.



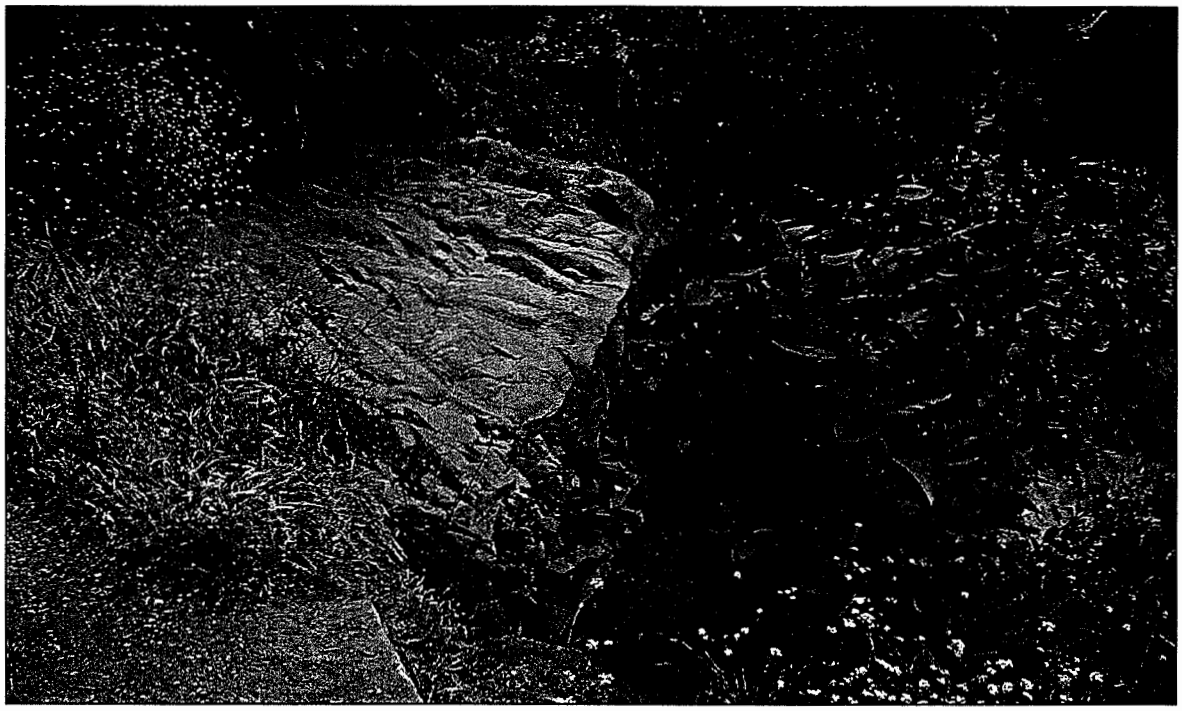
#51 Unit Y - Looking upstream from Manhole Y10 at continuous concrete backfill covering the Unit Y sewer



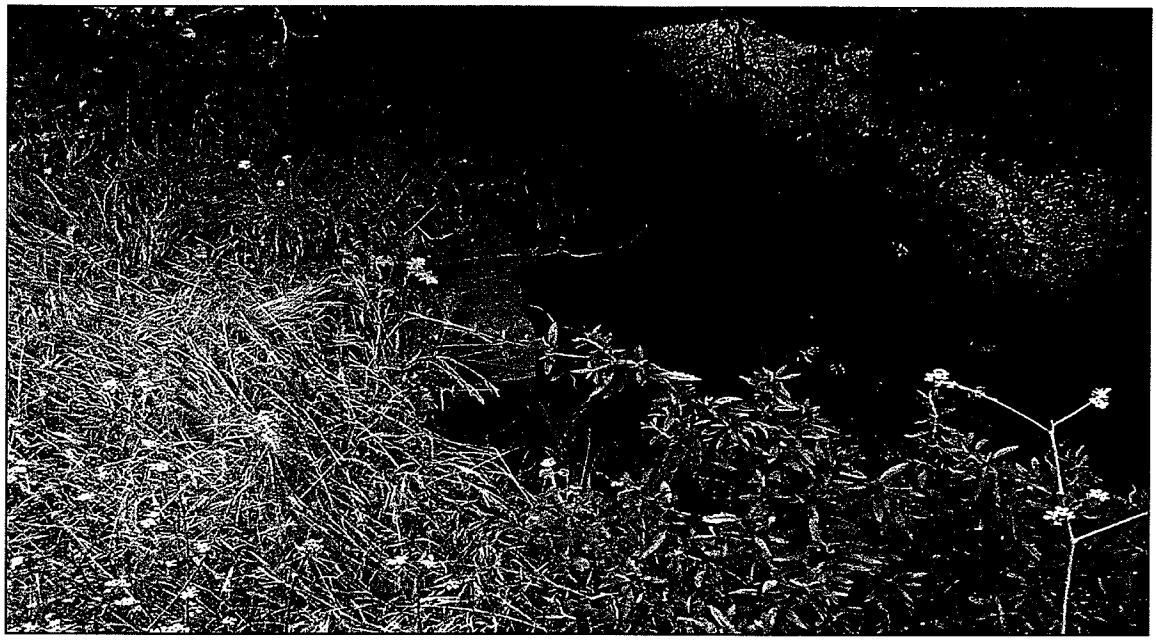
#53 Unit Y - C.T.O. Manhole Y12, 13 ft into dirt road from marker; about 50 ft from creek downstream of Paradise Falls



#59 Unit Y - At Manhole Y11, looking upstream along north rock bank of Paradise Falls where Unit Y sewer is tunneled through the bank.

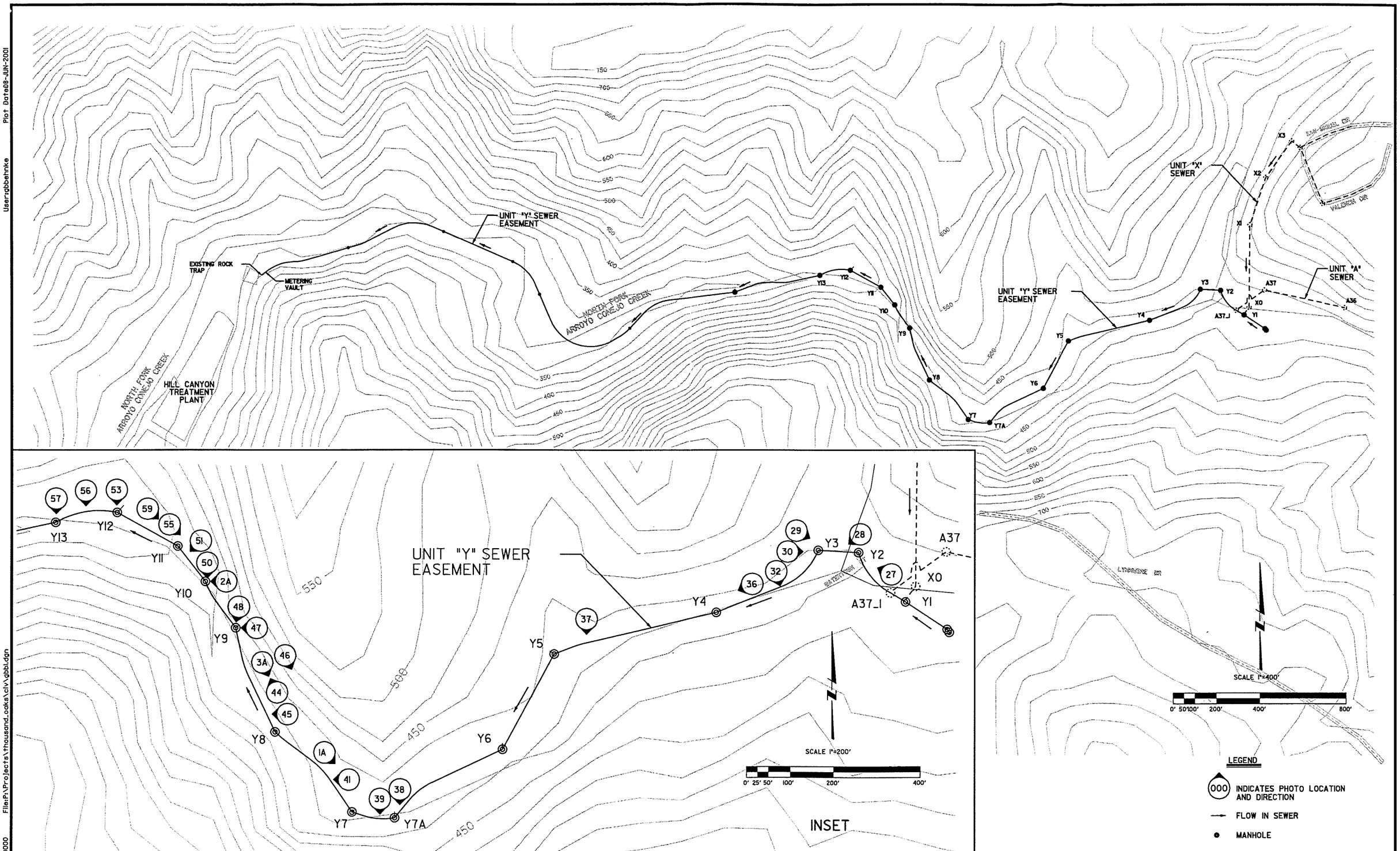


#55 Unit Y - At C.T.O. Manhole Y11, looking upstream with Paradise Falls to the right of the photo. The rock bank/face has been repaired with concrete (which is finished to resemble natural rock).



#56 Unit Y - North bank of creek about 30 ft (downstream) of Manhole Y12, looking at wood timbers shoring which is failing along eroded creek bank.
ACTION NEEDED: Investigate drainage area and wood timber shoring stability. Possibly replace/restore and backfill to protect CTO sewer.

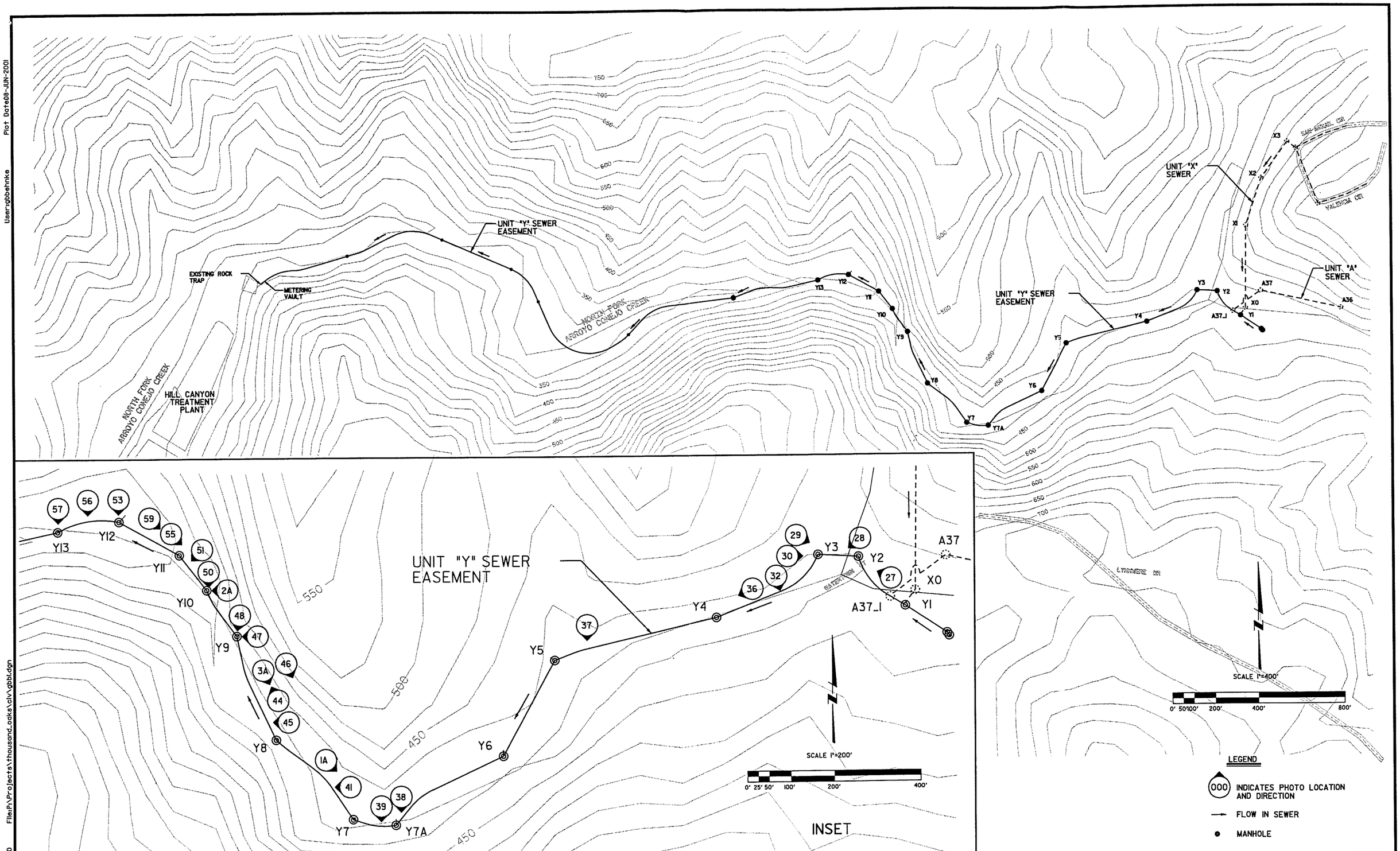
#57 Unit Y - At C.T.O. Manhole Y13, location of Unit Y sewer is OK relative to creek. However, the ground elevation along north dirt road declines about 10 ft from Manhole Y12 to Manhole Y13 which reduces burial "cover" on Unit Y sewer)
ACTION NEEDED: Verify depth of cover on City record drawings and check depths at Manholes Y12 and Y13 to verify the current burial depth for pipe protection from vehicles on road.



REV	DATE	BY	DESCRIPTION	SCALE		DESIGNED	SUBMITTED BY			MONTGOMERY WATSON Pasadena, California	CITY OF THOUSAND OAKS UNIT "Y" SEWER	PHOTO KEY PLAN In Wildwood Park along North Fork Arroyo Conejo Creek	SHEET
				AS NOTED		DRAWN	(PROJECT MANAGER'S NAME)	LICENSE NO.	DATE				
						CHECKED	(COMPANY OFFICER'S NAME)	LICENSE NO.	DATE				

Job No: 0000000 File:P:\Projects\thousand_oaks\civ\gbbl.dgn User:gbbehnke Plot Date08-JUN-2001

Plot Date08-JUN-2001
User:gbbehnke
File:P:\Projects\thousand_oaks\civ\gbbl.dgn
Job No: 0000000



REV	DATE	BY	DESCRIPTION

SCALE: AS NOTED

DESIGNED ____
DRAWN ____
CHECKED ____

SUBMITTED BY
(PROJECT MANAGER'S NAME) LICENSE NO. DATE
(COMPANY OFFICER'S NAME) LICENSE NO. DATE

MONTGOMERY WATSON
Pasadena, California

CITY OF THOUSAND OAKS
UNIT "Y" SEWER

PHOTO KEY PLAN
In Wildwood Park along
North Fork Arroyo Conejo Creek

SHEET

Appendix E

MWH
MONTGOMERY WATSON HARZA

APPENDIX E

CMOM PROGRAM ASSESSMENT

M E M O R A N D U M

MONTGOMERY WATSON

To:	Dean Morales, Mel Henson and Moe Norby	**Date:** June 28, 2001	
From:	Paul Giguere and Ken Kerri	**Reference:** Interceptor Master Plan	
Subject:	CMOM Program Assessment		

City of Thousand Oaks, CA

CMOM Program Assessment

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EXECUTIVE SUMMARY

Wastewater collection system agencies need to cost-effectively manage, operate, and maintain their systems in a manner that minimizes sanitary sewer overflows (SSOs), which can have negative impacts on public health, the local economy, and the environment. Agencies throughout the nation vary widely in their success at controlling SSOs, and regulatory requirements and enforcement actions have not been uniform.

To address this situation, the U.S. Environmental Protection Agency (EPA) has worked for several years with a broad-based advisory committee to formulate a Federal SSO policy. The EPA Administrator signed the resulting SSO Rule on January 18, 2001. However, the SSO Rule is affected by the Bush Administration's hold on all new and unpublished regulations. It is possible that the new Administration's review could affect the SSO Rule's requirements or implementation schedule. However, staff of the California State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCB) have informally indicated that they intend to enforce the concepts of the SSO Rule, regardless of the outcome of the Bush Administration's review.

The core of the proposed SSO Rule is a comprehensive capacity, management, operations, and maintenance (CMOM) program designed to ensure that collection systems avoid SSOs. In addition to being a useful self-assessment and self-improvement tool for wastewater agencies, a well-documented and implemented CMOM program is expected to be a consideration in an affirmative defense against regulatory action which could be taken in the event of a major spill.

This report is a summary and assessment of those aspects of the City of Thousand Oaks' wastewater collection system program that would constitute the City's CMOM program. The report describes the City's collection system administration program in terms of organizational structure, financial planning, personnel training and safety, equipment and tools, sewer ordinances, engineering, water quality monitoring, information systems, complaints, public relations, emergency maintenance, emergency preparedness, and spare parts inventory. The operation and maintenance program is described in terms of maintenance scheduling, sewer cleaning, inspection and cleaning equipment, root control, hydrogen sulfide control, sewer system evaluation, sewer rehabilitation, service laterals, maintenance of right-of-way, and regulatory compliance.

The City of Thousand Oaks' collection system performance was compared with other high-performing agencies on the basis of several performance measures:

(1) annual SSOs per 100 miles of sewer
(2) percent of system inspected annually by CCTV
(3) percent of system cleaned annually
(4) annual O&M cost per capita
(5) annual O&M cost per mile
(6) average annual rate for residential users
(7) annual complaints per 100,000 population, and

(8) annual number of lost time injuries.

Analysis of the City's program and comparisons with other programs reveals that the City's performance is very high, which indicates an effective and efficient program. The number of SSOs and complaints in the City are low when compared with other collection system agencies. The safety program is very effective. The level of funding and staffing are adequate. A Capital Improvement Program (CIP) and an equipment replacement program are in place and funded. Staff have indicated that their efforts are productive and appreciated.

While the City's performance is very good, a number of areas relating to information management systems and facility planning have been identified as requiring improvement. Several recommendations are included in this report, dealing with development and population of databases, GIS mapping, computerized maintenance and inspection data management, hydraulic modeling, and CIP master planning. These improvements will not only better prepare the City to satisfy the intent of the SSO Rule and CMOM Program, but will also improve work efficiency, further reduce the risk of SSOs, and protect the public's investment in the collection system assets.

Many of these recommended improvements are already being addressed during the development of the City's Wastewater Interceptor Master Plan, of which this report is a part. Implementing these recommended improvements and further documenting the City's CMOM program will put the City in a good position to satisfy the expected requirements of the SSO Rule and will constitute a strong defense against possible future regulatory action following an SSO.

SSO REGULATIONS

The SSO Problem

Wastewater collection system agencies need to manage, operate, and maintain their systems in a manner that minimizes sanitary sewer overflows (SSOs), which can have negative impacts on public health, the local economy, and the environment. Agencies throughout the nation vary widely in their success at controlling SSOs, and regulatory requirements and enforcement actions have not been uniform.

The SSO Rule

To address this situation, the U.S. Environmental Protection Agency (EPA) has worked for several years with a broad-based advisory committee to formulate a Federal SSO policy. The EPA Administrator signed the resulting SSO Rule on January 18, 2001. However, the SSO Rule is affected by the Bush Administration's hold on all new and unpublished regulations. It is possible that the new Administration's review could affect the SSO Rule's requirements or implementation schedule. However, staff of the California State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCB) have informally indicated that they intend to enforce the concepts of the SSO Rule, regardless of the outcome of the Bush Administration's review.

The proposed SSO Rule has three basic parts:

1. The prohibition provision,
2. Record-keeping, reporting, and public notification requirements, and
3. The capacity, management, operations, and maintenance (CMOM) program.

The SSO Rule begins with a provision that SSOs are an unpermitted discharge under the Clean Water Act (CWA). The prohibition provision will apply to all municipal satellite collection systems, which will need to be included under an existing NPDES permit or will need to have separate permits.

The SSO Rule's record-keeping and reporting requirements include:

1. 24-hour and follow-up reports,
2. An annual report of all collection system overflows, and
3. Public notice of municipal SSOs (so public can avoid exposure).

The core of the SSO Rule is the CMOM program, which is described in the following section.

The CMOM Program

The four main elements of the CMOM program are described below.

Management Program. The SSO Rule requires that each municipal collection system manager develop a management program that is "appropriate and applicable to the system." Important elements of the program include:

1. Establishing relevant legal authority,
2. Assessing current system capacity,
3. Identifying and prioritizing structural deficiencies, and
4. Training staff.

Overflow Response Plan. To mitigate the effect of SSOs, utilities are expected to create and implement overflow response plans that:

1. Describe the appropriate response to an overflow,
2. List appropriate steps for notifying Regional Board, health, drinking water, recreational water, and other relevant officials, and
3. Address how to notify the public promptly.

System Evaluation and Capacity Assurance Plan (SECAP). If peak flow conditions are contributing to an SSO discharge and it has not been addressed, the agency must prepare and implement a SECAP. This plan must include "capacity enhancement measures" to address the system's hydraulic capacity constraints.

Program Audits. The next time an agency's National Pollutant Discharge Elimination System (NPDES) permit is due for renewal (over the next five years), the collection system manager will be required to present a baseline self-audit assessing the system's existing management and capital needs and what actions are needed to meet SSO Rule requirements. Then, every time the permit is renewed, the manager will need to submit subsequent self-audits that track progress and revise goals as necessary. As self-audits, they are not conducted by a regulator, but they can be performed by a consultant retained by the permitee.

In addition to being a useful self-assessment and self-improvement tool for wastewater agencies, a well-documented and followed CMOM program is expected to be a consideration in an affirmative defense against regulatory actions which could be taken in the event of a major spill.

CMOM Program Assessment

In advance of the adoption of the SSO Rule, some forward-looking collection system agencies are assessing their preparedness to meet potential CMOM requirements. As a task in its Wastewater Interceptor Master Plan, the City included an inventory and assessment of its current

administration and operation and maintenance programs, identifying both strengths and weaknesses, and recommending ways to improve performance. This report describes the results of this task. The report is divided into the following main sections:

- Collection System Administration
- Operation and Maintenance Program
- Performance Comparison with Other Agencies
- Conclusions and Recommendations

COLLECTION SYSTEM ADMINISTRATION

Organizational Structure

A Public Works Superintendent reporting to the City's Public Works Director is responsible for field operations related to streets, landscape, sewer, and water facilities. A wastewater system maintenance supervisor reports to this Superintendent, and oversees collection system maintenance and repair.

Other divisions within the Public Works Department that are involved with the collection system include Resource Management (Environmental Programs - industrial waste control/inspections), Capital Projects (engineering and management of collection system capital improvement projects), and Development (approval and management of sewers in new developments, sewer map maintenance).

The organization chart in the Appendix illustrates the overall organizational structure and staffing of the Public Works Department. Current job descriptions are available for these employees. Based on a review of staff and overall performance, staffing appears to be adequate.

Financial Planning

Funding for the collection system comes from user service charges and connection fees. The current (2001) service charge for a single-family residence is $20.65 per month. Commercial and industrial service charges are based on flow and strength. The connection fee is $7,199 per service unit, set to recover new development's share of the Capital Improvement Program.

Service charges are comprised of the following components:

- Charge to recover collection system operation and maintenance (O&M) costs, plus a five percent reserve
- Capital Equipment Replacement charge (for major equipment replacement and minor capital projects)
- Capital Improvement charge (existing user's share of the Capital Improvement Program (CIP)
- "Agency Liability Allowance" which is being collected to pay the RWQCB fine for the Unit W washout in 1998

The City has a Wastewater Financial Plan, which is updated every two years in conjunction with the preparation of the City budget. At this time rates are evaluated and any adjustments are recommended to the City Council. Connection fees are escalated by the change in the ENR Construction Cost Index on an annual basis. Public hearings are held before rate changes are implemented.

The operating cost budget is prepared annually. The budget includes line items for labor,

materials, and equipment. A fund also is maintained for future equipment and infrastructure replacement. Budget priorities are determined by the supervisor and the public works superintendent on the basis of a review of prior budgets and field findings by maintenance staff. This process also develops short-term and long-term capital improvement projects. O&M staff are involved in budget preparation and have indicated that the budget provides sufficient funding.

The City tracks and controls maintenance costs using monthly reports that list each line item in the budget.

Personnel Training and Safety

O&M Policies and Procedures. The City has an O&M Manual that contains policies and procedures. The policies and procedures are developed, reviewed, and updated on a regular basis. Employees are kept informed during their annual training program.

Operator Training. There is a documented formal operator training program. Training begins during employee orientation, which covers the collection system's mission, goals, and policies. On-the-job training includes Standard Operating Procedures (SOPs) and Standard Maintenance Procedures (SMPs). Employee progress and performance are measured during regular performance evaluations. A system is in place to track and document employee training.

Certification is required only at the supervisory level at this time. The California Water Environment Association (CWEA) offers a voluntary Technical Certification Program (TCP) for collection system operators. Other voluntary certification programs offered by CWEA include Maintenance (mechanical and electrical/instrumentation) and also Environmental Compliance Inspector (industrial pretreatment facility inspection).

Safety Training. The City has a "Safety Policy Statement" that is available in the Public Works Department's OPERATIONS AND SAFETY MANUAL. This manual contains information on injury and incident reporting, first aid guidelines, operation of motor vehicles and other mobile equipment (including forklifts), technical applications (including confined space procedures, excavation procedures, lockout/tagout procedures, and traffic safety).

There is a City-wide Safety Committee under the leadership of the Human Resources Office. This Safety Committee provides training, equipment, and evaluation procedures. All O&M staff are required to follow safe work procedures, including the use of personal protective equipment (PPE). Safety training regulations include confined space, forklifts, hazardous materials, APR, CPR, first aid, defensive driving, DOT training for commercial license holders, and defibulator training. There is a recordkeeping system which documents that staff have received and comprehended the safety training. The City is in compliance with all pertinent safety training regulations.

Safety procedures are reviewed and revised on a continuous basis. The Cal-OSHA consultation service is invited twice a year to evaluate field staff and facilities. Safety training is an on-going

activity by memos, direct communications, tailgate safety sessions, classrooms, hands-on workshops, vendor demonstrations, and safety videos.

An accident review board investigates workplace accidents.

Equipment and Tools

Lists are available of the equipment and tools used for collection system operation and maintenance. Staff has access to the necessary equipment and tools to perform all aspects of the operation and maintenance of the collection system. If a particular piece of equipment is down for repair, alternative suitable equipment can become available. Portable generators are available when needed. All equipment is stored at the Municipal Service Center.

Written equipment maintenance procedures are available and used. Vehicles and equipment are maintained in-house. Turnaround time for maintenance is acceptable and depends on the equipment type and the work that must be performed.

A procedure is in place for equipment replacement. Each piece of equipment is given a life cycle time and money is budgeted each year for replacement until the equipment reaches the end of its' life cycle. At this time the equipment is replaced.

Sewer Ordinances

Title 10 of the City of Thousand Oaks Municipal Code represents the "Sewer-Use Ordinance." There is a grease ordinance with a discharge limitation of 175 mg/L animal/vegetable and 25 mg/L petroleum. The Environmental Programs Administrator and the Inspectors (Industrial Waste Control Program, Public Works Department) are responsible for enforcing the sewer-use and grease ordinances. Grease traps are inspected annually and more often if necessary. There are significant industrial dischargers to the collection system, but none of them discharge significant concentrations of oil and grease.

All sewer laterals connected to the City's wastewater collection system are considered private service laterals and the responsibility of the property owner. There is an ordinance prohibiting the connection of stormwater drains or the discharge of storm water to the sanitary wastewater collection system.

Engineering

System Mapping. Currently the City is using a manual mapping system (Atlas maps). A procedure is in-place for recording changes and for updating the mapping system. Maps and as-built plans are available for use by crews in the field and in the office. Information shown on the Atlas maps is limited to manhole identifiers, pipe sizes and pipe material. More detailed information (e.g., invert elevations, year built) is found on the as-built maps. The City is

investigating moving to a GIS-based mapping system in the future.

Capacity Analysis/Modeling. A certification is required that the sewer system is adequate to carry additional flows from new connections. Currently, standard hydraulic engineering calculations are used to determine whether the capacity of the existing gravity sewer system is adequate for the existing and new service connections. Occasionally metering has been performed prior to allowing new connections.

The City is currently developing a computerized hydraulic model of the wastewater interceptor sewers. The model will be capable of estimating current and future peak dry and wet weather flows, and determining the location and severity of any capacity deficiencies along the interceptors. The model is being calibrated using wet weather flow monitoring data, and will be used to plan future capital improvements to assure adequate capacity.

The City's most recent Sewer Master Plan is over ten years old and is currently being updated. As noted above, a computerized hydraulic model of the interceptor sewers is under development, and will be used in the Master Plan update. It is expected that the Master Plan may identify reaches of certain interceptors requiring additional capacity in the future due to development (e.g., Unit E), but most of the interceptors serve built-out areas and are not likely to experience any increases in dry weather flow due to development.

Condition Assessment and Rehabilitation. Sewer System Evaluation Surveys (SSES) have been performed in the past. Within the past 15 years sewer rehabilitation work has been performed using slip lining, manhole coatings, and open cut replacement techniques.

As part of the Interceptor Sewer Master Plan project, the City is currently performing an evaluation of the condition of the entire interceptor system, using CCTV inspections performed in recent years by staff, as well as new manhole inspections of all interceptor manholes. In addition, wet weather flow monitoring data will be used to identify areas of the collection system having excessive infiltration/inflow that may be indicative of sewers in poor condition. The Master Plan is expected to identify additional projects to be included in the CIP, as well as a long-term sewer replacement program.

The City has a multi-year Capital Improvement Program (CIP) that includes rehabilitation, replacement, and repair. Priorities for CIP funding are established with a combination of inputs from field staff, management, superintendent, engineering, and outside consulting engineers. Priorities are based on degree of structural deficiency and lack of capacity. Funding has been approved for the recommended program.

Design. CITY OF THOUSAND OAKS WASTEWATER DESIGN AND CONSTRUCTION STANDARDS is the document which details design criteria and standard construction details for gravity sewers, force mains, and pump stations. Life cycle cost analysis is performed as part of the design process. This "STANDARDS" document describes the procedures and standard forms followed in conducting design review. The document also has detailed requirements for O&M manuals, training and staffing needs, as well as established protocol for start-up, testing, and acceptance.

Construction. New construction is built to standard specifications established by both the City of Thousand Oaks and the State of California. There is a warranty for new construction and a warranty inspection is performed at the end of the warranty period.

The CITY OF THOUSAND OAKS WASTEWATER DESIGN AND CONSTRUCTION STANDARDS describes the procedures and standard forms followed when conducting construction inspection and testing programs. New construction is inspected by the Department of Public Works "Utilities" inspectors. These inspectors are qualified on the basis of on-the-job training, job knowledge, and on-going inspection classes. The percentage of time that an inspector is on the site will depend on tasks being performed by the contractor.

New gravity sewers are air-tested before acceptance. Also new gravity sewers are televised and a mandrel is used as part of the acceptance process. New manholes are tested for inflow and infiltration using negative air pressure. Should the manhole not be air-tight, the leaks are repaired prior to backfilling.

Water Quality Monitoring

After an SSO event, creek waters are sampled for four continuous days after the spill.

Information Systems

A hardcopy card system is in use with information on every manhole in the collection system, including a sketch of the manhole location. The data on the cards has recently been updated and input into the City's mainframe computer system. CCTV tapes and hardcopy observation logs are currently kept in central files in the office. Maintenance work records are also kept in hardcopy files.

In conjunction with the Interceptor Sewer Master Plan, the City is currently implementing a computerized maintenance management system using the GBA Master Series Software. This software will be used to computerize the manhole and sewer inventory and automate the maintenance work order system, including preventive maintenance activities. The new computerized system will include the manhole data records (including scanned versions of the manhole sketches) and the manhole inspection and CCTV records for the interceptors (initially). The GBA database will be linked to a GIS map of the interceptor system. Scanned as-built drawings are being linked to the GIS map to facilitate access to the maps (also initially for the interceptors only). In the future, the GBA and GIS systems will be expanded to include the entire collection system, and be used daily for maintenance management.

The GIS implementation will also integrate modeling results with CCTV and manhole inspection data for use in CIP project planning. It is anticipated that the GIS will be expanded in the future to include parcel-based information and other utility systems (e.g., water, stormwater, streets, landscaping).

Complaint Handling

When public complaints are received, the dispatcher creates a work order. A crew is then dispatched to investigate and resolve the complaint. If a complaint is received after hours, the standby person is contacted to investigate the call. A work order is generated the next work day.

Public Relations

The City has a public relations program. The program consists of distributing information booklets when responding to complaint calls and other requests for assistance or information. Informational flyers are inserted in utility bills.

Whenever there is a collection system overflow, signs are posted in the area to notify the public. Also the public is notified prior to major construction or maintenance work. The City communicates with other municipal departments during monthly committee meetings and also on an as needed basis.

Emergency Maintenance

The City has written emergency maintenance plans for sewer overflows and spills as well as a city-wide emergency plan. If an emergency occurs, crews can access and mobilize pumps, generators, hydro cleaners, backhoes, dump trucks, service trucks, arrow boards, shoring, pipes, and other essential supplies within an hour. Written procedures are available to minimize overflows and contain overflows once they occur. Causes of overflows are investigated by video inspection after the overflow. Procedures are established to immediately contact appropriate agencies after an overflow and to notify the public by posting signs in at affected area.

Emergency Preparedness

The City has an emergency response plan and a contingency plan in place. The City tracks and reports emergencies. A list of critical contacts, their telephone numbers and cell phone numbers are easily accessible in an emergency.

A hazard classification system has been established. Material Safety Data Sheets (MSDSs) are available in the warehouse and the fleet shop. Vulnerability analyses are conducted through the wastewater maintenance programs. Risk assessments are performed annually by a consultant. Staff are trained and drilled to respond to emergency situations. Responsibilities are detailed for all personnel who respond to emergencies. Work crews have immediate access to tools and equipment during emergencies.

Spare Parts Inventory

Spare parts are stored at a central location in the warehouse. Critical spare parts have been identified and a stock of spare parts is kept on maintenance vehicles. The warehouse computer system keeps track of the location and usage of spare parts as well as ordering of spare parts when appropriate. Parts are logged out when taken by maintenance personnel for use. Monthly checks and a yearly audit are performed to ensure that the spare parts inventory tracking system is working. The warehouse staff and supervisor are responsible for tracking the spare parts inventory. O&M staff may procure non-stock materials (1) by the use of procurement cards, (2) by purchasing small items and being reimbursed, and (3) by using accounts established at several local stores with approved signature lists.

OPERATION AND MAINTENANCE PROGRAM

Maintenance Scheduling

Preventive and corrective maintenance are planned and scheduled by the City. Maintenance priorities are determined in a cooperative atmosphere with input from the field staff, the wastewater supervisor, and the public works superintendent. Strong effort is made to keep maintenance on schedule. Action is taken if a backlog develops. O&M performance is tracked and measured on the basis of weekly footage by hydro flush and CCTV crews and also by the number of complaints and overflows per year.

Sewer Cleaning

The entire collection system is cleaned at least every 24 months. Segments of the sewer lines that have chronic problems are on a one, three, or six-month cleaning schedule to prevent SSOs. All SSOs are diagnosed to determine the cause, evaluate the problem, and select the appropriate preventive action.

Sewers are usually cleaned prior to CCTV inspection, especially if the sewer is a trouble spot. Debris and grit are removed from the sewer during the cleaning operation.

Inspection and Cleaning Equipment

The City's sewer inspection and cleaning equipment consists of one CCTV inspection unit, two hydro flush cleaners, two balling machines, one 6-inch pump, one 10-ton dump with backhoe, and four service trucks. All of the equipment is stationed at the Municipal Service Center. The CCTV unit and hydro cleaners are in a life-cycle replacement program, and a new modern CCTV truck is currently under order. Cleaning crews consist of two crew leaders and eight utility maintenance workers. All of these people are dedicated to preventive maintenance cleaning and also are assigned corrective maintenance work as discovered during preventive maintenance activities. These people also respond to emergencies when needed.

Root Control

Severe root problem areas are identified and placed on a "root scraping list" and scheduled for regular preventive maintenance.

Hydrogen Sulfide Control

The City receives from two to five odor complaints per year. Sewers are designed to minimize

hydrogen sulfide production and corrosion damage. Hydrogen sulfide is a problem in some interceptors. A chemical (bioxide) is injected in the interceptors at two locations and the effectiveness is monitored at two downstream locations.

Lift Stations

The City of Thousand Oaks does not have any lift stations at this time.

Sewer System Evaluation

Flow Monitoring. Currently flows are measured on an as-needed basis (for capacity determinations or bypass flow requirements) using four temporary Sigma 950 open channel meters. Permanent flow monitors have been purchased and will be installed in 2001 at locations recommended in the Wastewater Master Plan. These permanent monitors consist of nine Sigma 950 open-channel meters, two Sigma 920 open-channel meters, and one Polysonics ultrasonic meter. North and South influents to the Hill Canyon Treatment Plant are monitored using three mag meters.

As part of the Wastewater Interceptor Master Plan, 14 ADS temporary flow monitors were installed over a six-week wet weather period in early 2001. The results will be used to calibrate a hydraulic model and to assess I/I in the collection system. A series of 56 wet weather flow isolation measurements were also made during the temporary monitoring period. A previous temporary flow monitoring program and I/I assessment was performed in 1988. Where I/I is considered excessive, recommendations are made for rehabilitation capital projects.

There is one cone type rain gage at the wastewater treatment plant and one tipping-bucket recording rain gage at the Municipal Service Center. There are also several rain gauges in the area maintained by Ventura County. Recently, gauge-adjusted radar rainfall data was obtained over some 140 2-km cells for use in I/I wet weather flow assessments.

Manhole Inspection. The City has a regular manhole inspection and assessment program. The program evaluates overall manhole condition, access, root intrusion, I/I, and hydrogen sulfide deterioration. Manholes susceptible to inflow are identified and added to a master list for correction. As part of the Wastewater Interceptor Master Plan, approximately 550 manholes on the interceptor sewers were inspected in early 2001. The results of these inspection and future inspections will be loaded into the City's new GBA Master Series computerized maintenance management system.

City crews also perform external inspections of sewers in remote canyon areas following every major storm event, to verify that no spills are occurring, to inspect any damage that may have occurred, and to identify any creek erosion that might threaten manholes and pipes.

Manholes are rehabilitated when inspection reveals conditions requiring rehabilitation. A multi-year Capital Improvement Program (CIP) is in place for the rehabilitation, replacement, and

repair of manholes. Priorities for this work are established on the basis of field inspections, input from the wastewater supervisor, the Public Works Superintendent, and the Engineering Division. The City has established schedules for performing both short-term and long-term rehabilitation of manholes, and funding has been approved for the rehabilitation of manholes.

CCTV Inspection. The City uses CCTV inspection of new sewers for field acceptance and again prior to final exoneration. Approximately seven percent of the system is inspected annually with potential trouble spots inspected on a more frequent schedule as deemed appropriate. Conditions that could contribute to SSOs are identified, such as structural defects, debris, roots, grease, offset joints, deterioration of pipe, type of pipe, and lateral locations. A rating system is used to classify the defects. Preventive maintenance tasks and frequencies are established on the basis of detrimental conditions revealing roots, grease, and debris. In the future, the results of CCTV inspections will be loaded into the City's new GBA Master Series computerized maintenance management system (currently, hardcopy logs are kept as well as the tapes).

Smoke Testing and Dyed Water Flooding. The City has not used smoke testing or dyed water flooding to identify sources of inflow and infiltration (I/I). In the future, these techniques may be used in areas which are identified as having high I/I.

Sewer Rehabilitation

In the past, the City has repaired mainlines using CIPP, full replacement, and spot repairs. These techniques are still being used for mainline repairs. Manholes are repaired using spray linings, cured in-place linings and full replacement. The City does not use manhole inserts.

Service Laterals

Service laterals are the sole responsibility of the property owner. The City has a written procedure for the approval and inspection of new construction service laterals. Service laterals must comply with City standard and specifications.

Maintenance of Right-of-Way

The City performs scheduled maintenance on Rights-of-Way and Easements, including a program for maintaining access along sewers in canyons. The City monitors street paving projects and has a program to locate and adjust manhole covers as needed.

Regulatory Compliance

No violations have been issued in the past three years. All spills are reported immediately. The Hill Canyon Treatment Plant experiences between one and two NPDES permit violations per year due to the effects of wet weather flows.

PERFORMANCE COMPARISONS WITH OTHER AGENCIES

The performance of the City's collection system can be assessed using measures such as number of SSOs and sewer cave-ins. For example, the City experienced two SSOs in 1999 and ten in 2000 (however, only four of the ten reached "waters of the US"). Roots, grease, and vandalism caused these SSOs. There were no cave-ins.

An analysis of the performance of the City in these and other collection system performance criteria was performed, using information in the report: COLLECTION SYSTEMS: METHODS FOR EVALUATING AND IMPROVING PERFORMANCE. This report, prepared by Kenneth D. Kerri and Rick Arbour for the U.S. Environmental Protection Agency, contains the results of a research project which evaluated the adequacy and effectiveness of collection system O&M programs throughout the United States. Detailed system and operations performance data from 13 high-performing collection system agencies were thoroughly analyzed. The results provide benchmark data that can be used for developing comparisons between agencies.

City of Thousand Oaks' collection system performance was compared with these high-performing agencies on the basis of:

1. SSOs per 100 miles of gravity sewer (Figure 4.1),
2. Percent of system inspected annually by CCTV (Figure 4.3),
3. Percent of system cleaned annually (Figure 4.4),
4. Annual O&M cost per capita (Figure 4.6),
5. Annual O&M cost per mile of sewer (Figure 4.7),
6. Average annual rate for residential users (Figure 4.8),
7. Complaints per 100,000 population (Figure 4.9), and
8. Number of lost time injuries (Figure 4.10).

Analysis of these figures reveals that the City of Thousand Oaks' performance is high (low numbers of SSOs, complaints, and lost time injuries) and the costs of O&M are relatively low. This indicates an effective and efficient program when compared with other "best-of-class" collection system agencies.

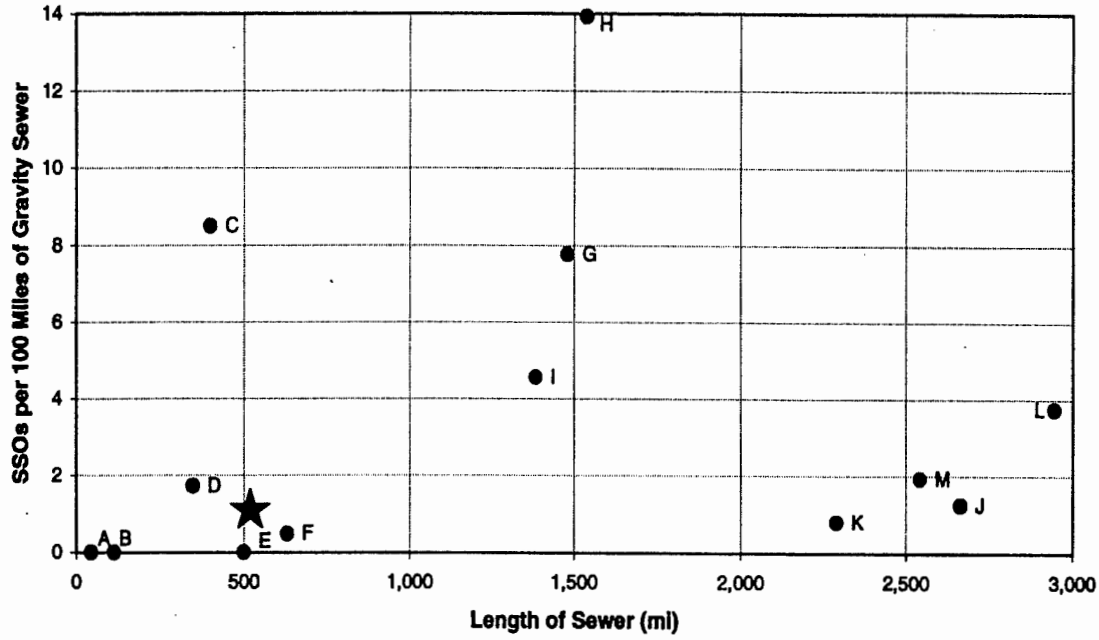


Figure 4-1. SSOs per 100 Miles of Gravity Sewer

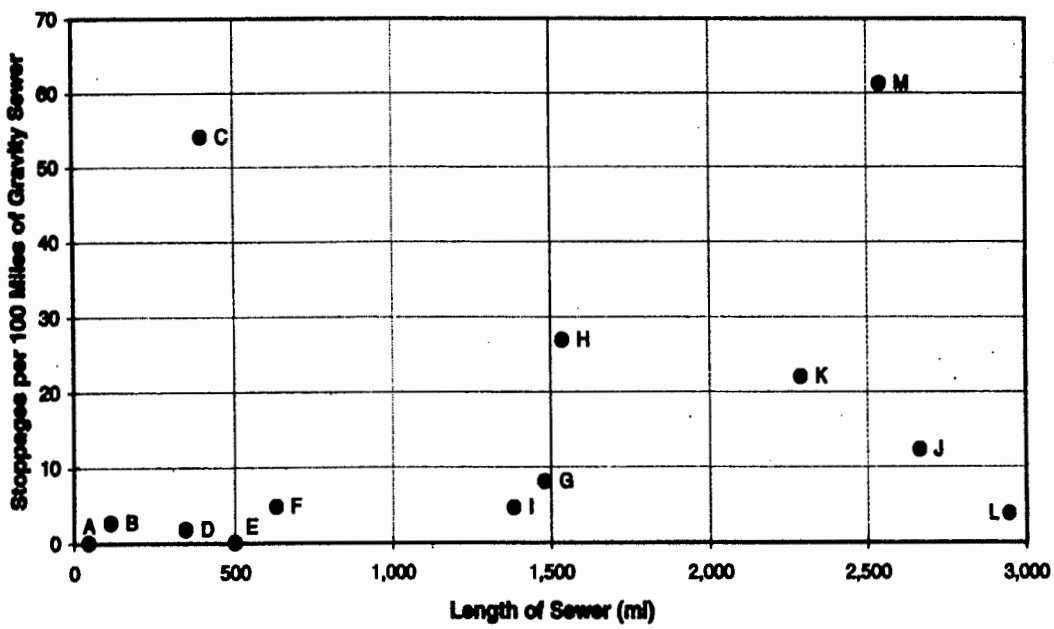


Figure 4-2. Stoppages per 100 Miles of Gravity Sewer

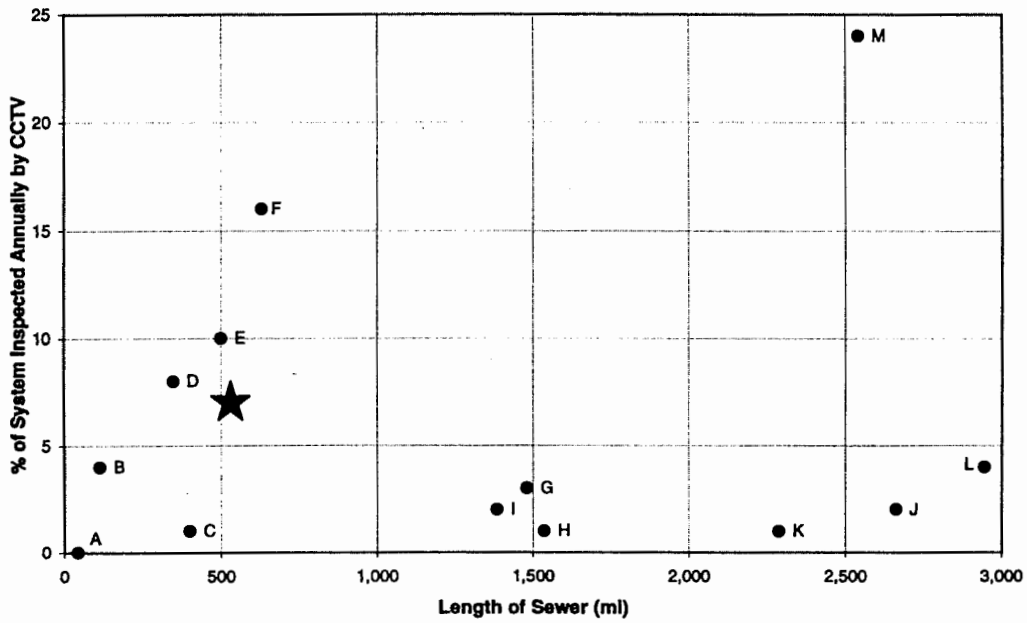


Figure 4-3. Percent of System Inspected Annually by CCTV

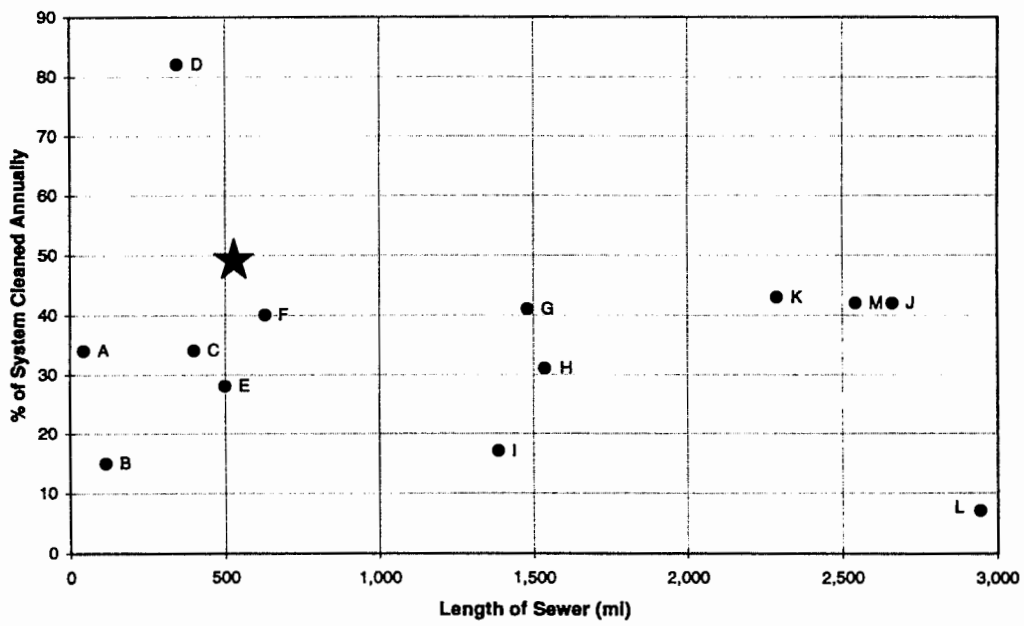


Figure 4-4. Percent of System Cleaned Annually

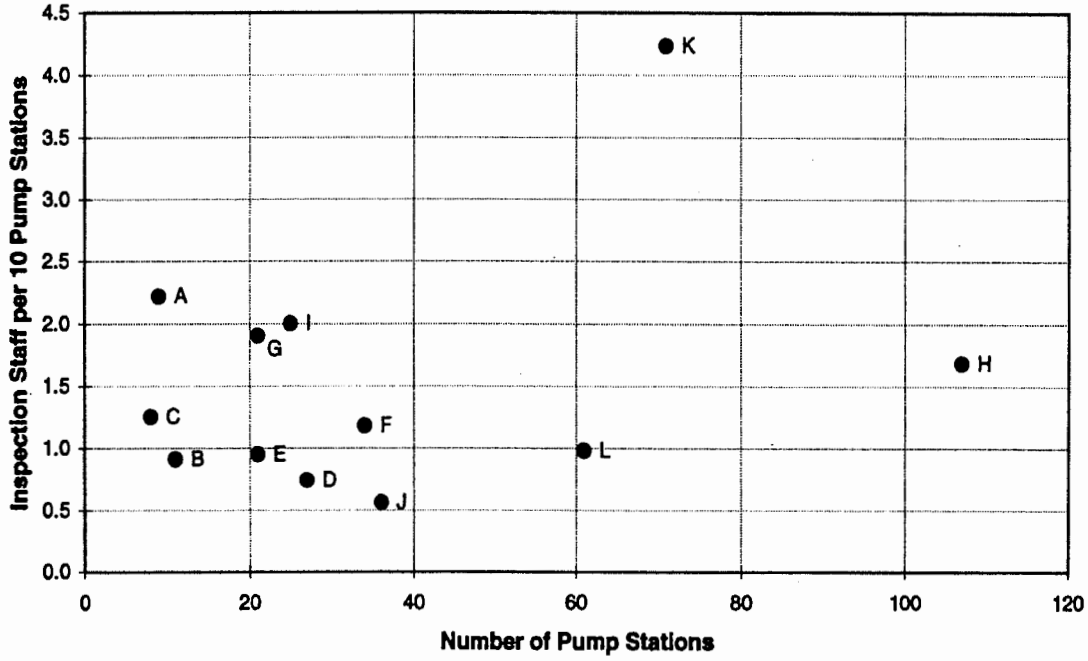


Figure 4-5. Inspection Staff per 10 Pump Stations

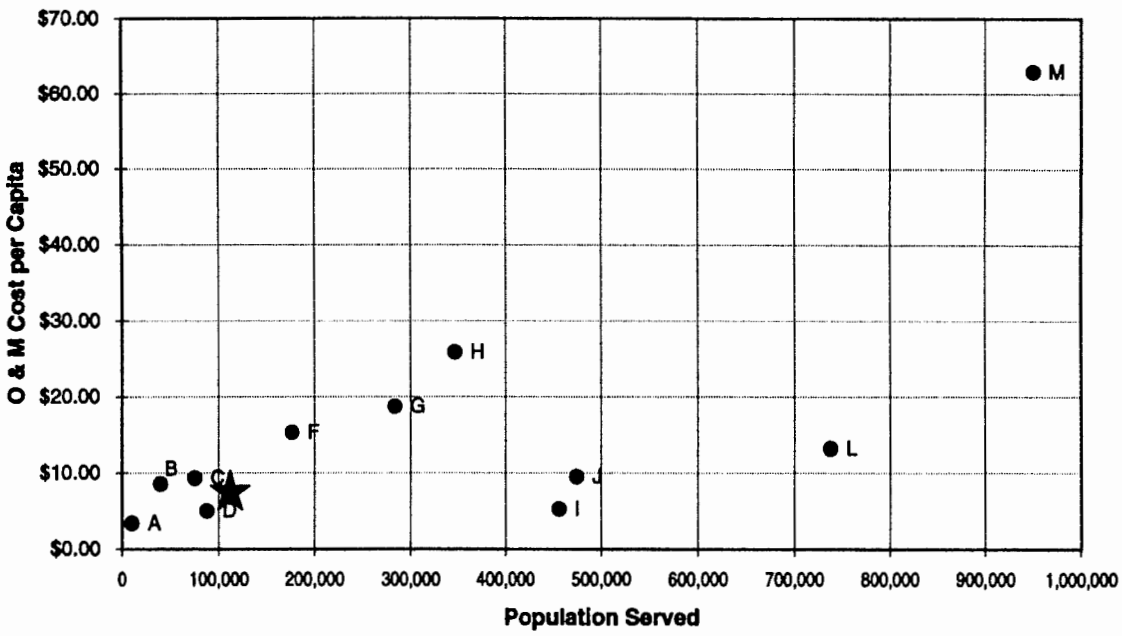


Figure 4-6. Annual O & M Cost per Capita

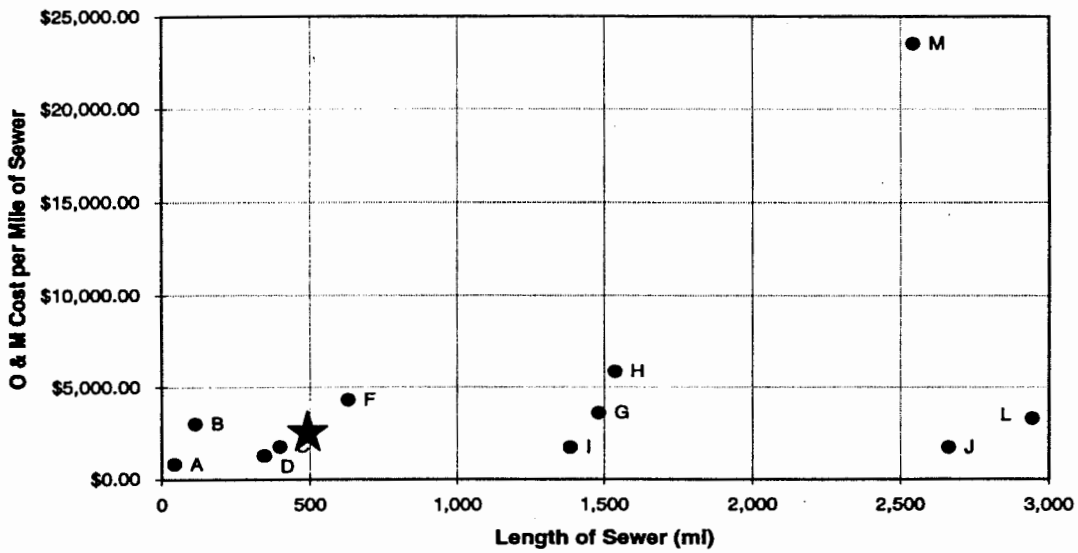


Figure 4-7. Annual O & M Cost per Mile of Sewer

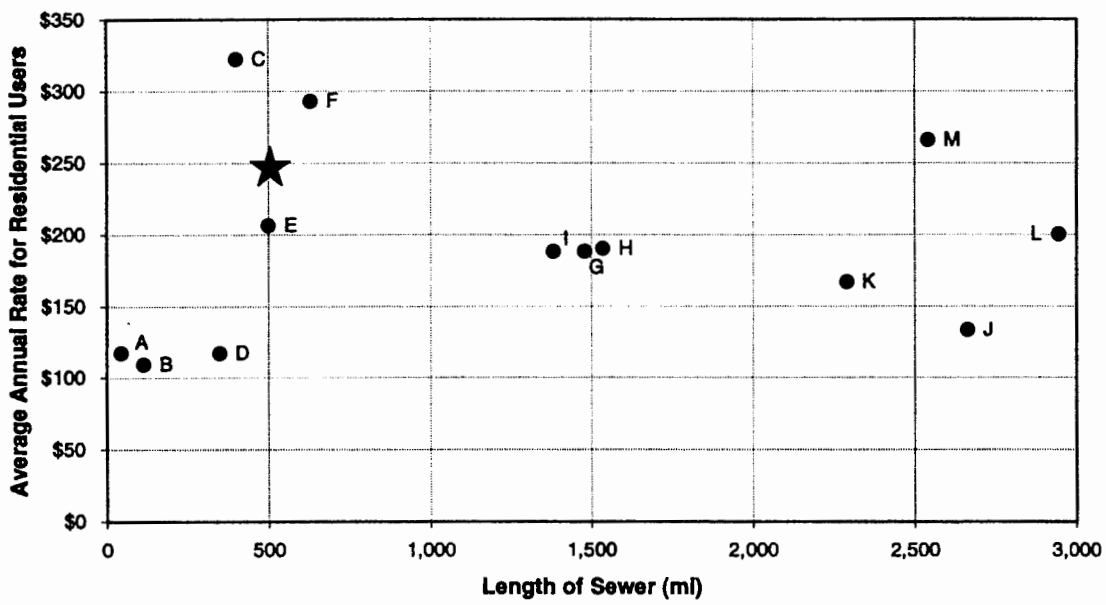


Figure 4-8. Average Annual Rate for Residential Users

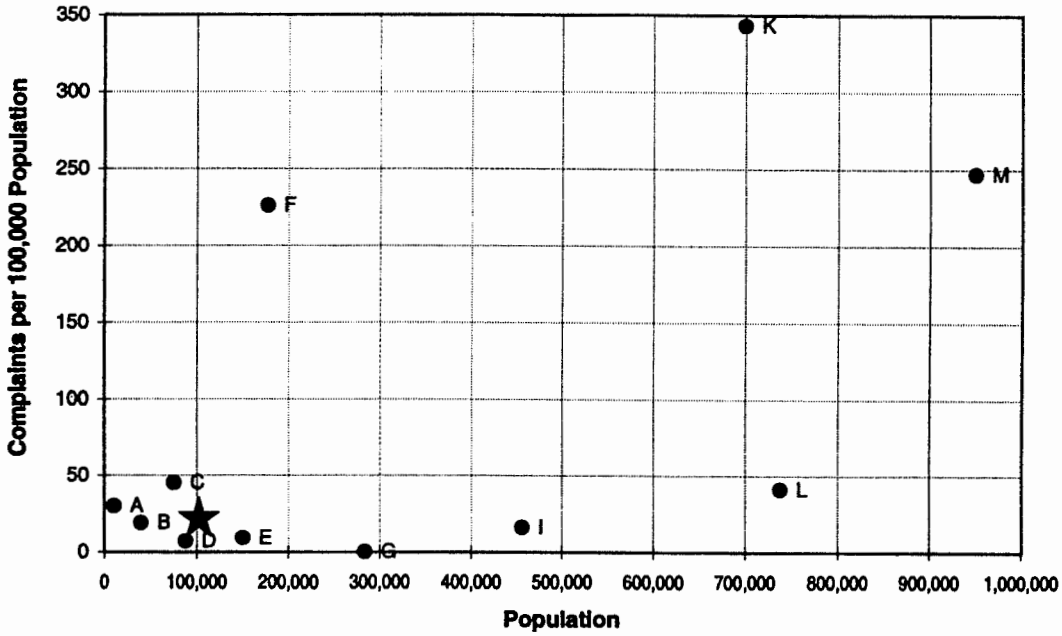


Figure 4-9. Complaints per 100,000 Population

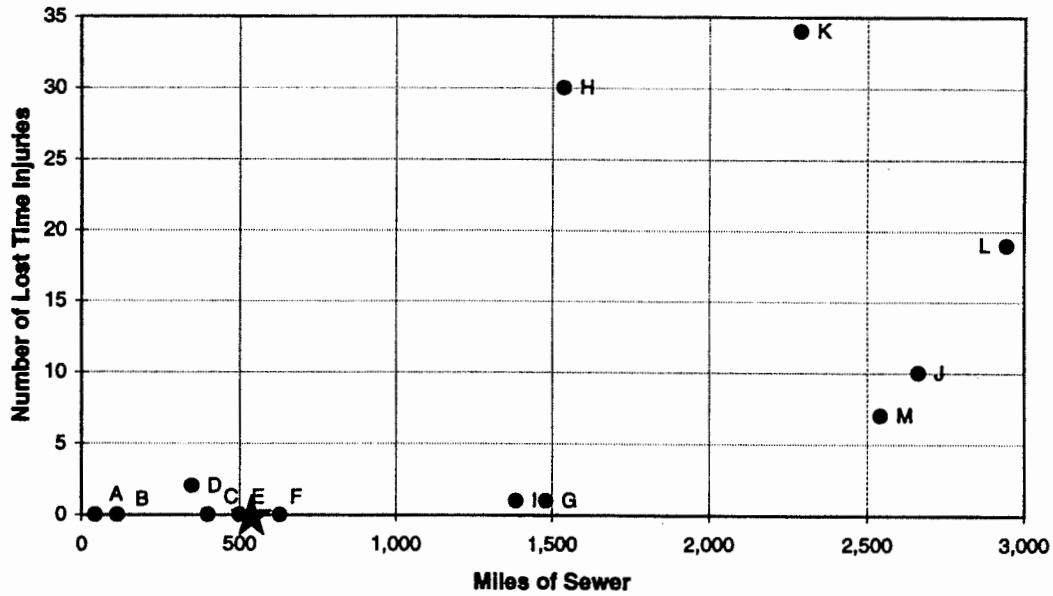


Figure 4-10. Number of Lost Time Injuries

CONCLUSIONS AND RECOMMENDATIONS

Program Strengths

A review and analysis of the City of Thousand Oaks' collection system program reveals an efficient, cost effective, and high performing program. The number of SSOs and complaints are low when compared with other collection system agencies. The safety program is very effective. The level of funding and staffing are adequate. Key maintenance and inspection activities are carried out regularly. A Capital Improvement Program (CIP) and an equipment replacement program are in place and funded. Staff have indicated that their efforts are productive and appreciated.

Areas for Improvement

The main area in which the City's collection system program could be improved is the implementation of computerized tools for information management and analysis, and updating the Master Plan and CIP. This need was recognized by the City and addressed to a large extent in the scope of the ongoing Wastewater Interceptor Master Plan. For example, the Master Plan includes:

- A computer-based hydraulic model/capacity analysis to identify potential future interceptor capacity needs for inclusion in an updated Master Plan and CIP. The Plan should satisfy the CMOM requirement for a System Evaluation and Capacity Assurance Plan (SECAP).

- A computerized maintenance management system to store and retrieve system inventory information, to manage complaints and work orders for preventing and corrective maintenance activities, and to store and analyze CCTV and manhole inspection findings.

- A GIS system to provide improved access to collection system maps and records, and to perform spatial analysis and mapping of system capacity, condition, maintenance requirements, and CIP projects.

- An updated Interceptor Sewer Master Plan recommending CIP projects to satisfy both flow capacity and condition needs, including a long-term rehabilitation/replacement strategy for all collection system assets.

Implementation of these information systems will further improve staff efficiency and effectiveness. These tools to analyze the capacity, structural condition, and maintenance needs of the system will lead to identification of capital projects and highly focused O&M activities that will minimize the risk of SSOs and protect the public's investment in the collection system.

Recommendations

To realize the full benefits of the information systems currently under development, additional work must be performed beyond that currently in the scope of the Wastewater Interceptor Master Plan. Specifically, the following actions are recommended.

- Populate the GIS and maintenance management system with data on the entire collection system, using the methods developed for interceptor system (which is less than 20 percent of the total system). This task includes digitizing all non-interceptor manholes and sewers, entering of basic inventory data shown on the Atlas maps and manhole cards, and scanning and linking manhole sketches. This high-priority work must be done before the maintenance management software can be effectively used to manage daily maintenance work.

- Implement the maintenance management system for everyday use. This will require configuring the software for the City's maintenance activities, inputting the preventive maintenance activities and schedules for all sewers, and receiving software training.

- Expand the system on an as-needed basis, as justified by cost-effectiveness analysis. For example: scanning and linking all as-built drawings to the GIS map, inputting additional data from as-built drawings of all sewers (invert elevations, year built, etc.), adding GIS themes such as street centerlines and county parcels with APNs, and implementing a computer-based Atlas mapping system.

- Store future CCTV and manhole inspection data in the maintenance management system, including captured digital still images. Transition to digital video files stored on CD or hard disk as a replacement for VHS tapes.

- Stay abreast of and evaluate emerging technologies that may improve the efficiency of data access and data capture in the field, including the use of handheld wireless devices.

- Install and maintain the recently-purchased permanent flow monitors at key locations in the interceptor system. The monitors should be located so as to measure flows in interceptor reaches that may need additional capacity in the future and where infiltration/inflow is of concern (based on Master Plan recommendations). In addition, monitors should be located near the downstream end of interceptors in remote areas and be used to detect sudden reductions in flow that could provide early detection of a major upstream blockage and SSO. Additionally, a program for periodic surface water quality monitoring to detect evidence of sewage should be developed and implemented.

- Document and report to the Regional Board both the cause of any SSO and the actions taken to prevent future SSOs of this type.

- The City of Thousand Oaks, Public Works Department's, "Policy for Wastewater Related Spills and Overflows" is similar to the CMOM "Overflow Response Plan". This document should be expanded to include details regarding how the utility will respond and what action will be taken after each SSO to prevent the SSO from occurring again.

- Continue monitoring the status of the SSO regulations and continue documenting and improving the City's existing CMOM program so that it conforms to requirements. A strong CMOM program will not only help the City improve performance and avoid SSOs, but will also provide a defense against possible regulatory action following an SSO. Elements of a CMOM program that will need further work in the future include establishing formal CMOM goals, public participation in the CMOM program, more detailed documentation of the CMOM program, and periodic self-audits.

REFERENCES

City of Thousand Oaks

O&M MANUAL
- Year Maintenance Plan
- Hydro Cleaning
- Balling Operations
- Manhole Root Scraping List
- Cockroach Spraying List
- Confined Space
- Toilet List (overflows due to hydro cleaning)
- Calle Brusca Plan
- Canyon Inspection
- Unit Y Maintenance Plan
- Unit W Maintenance Plan

INDUSTRIAL WASTE REGULATIONS

POLICY FOR WASTEWATER RELATED SPILLS AND OVERFLOWS

OPERATIONS AND SAFETY MANUAL

California State University, Sacramento, Office of Water Programs

OPERATION AND MAINTENANCE OF WASTEWATER COLLECTION SYSTEMS
Volumes I and II

COLLECTION SYSTEMS: METHODS FOR EVALUATING AND IMPROVING PERFORMANCE

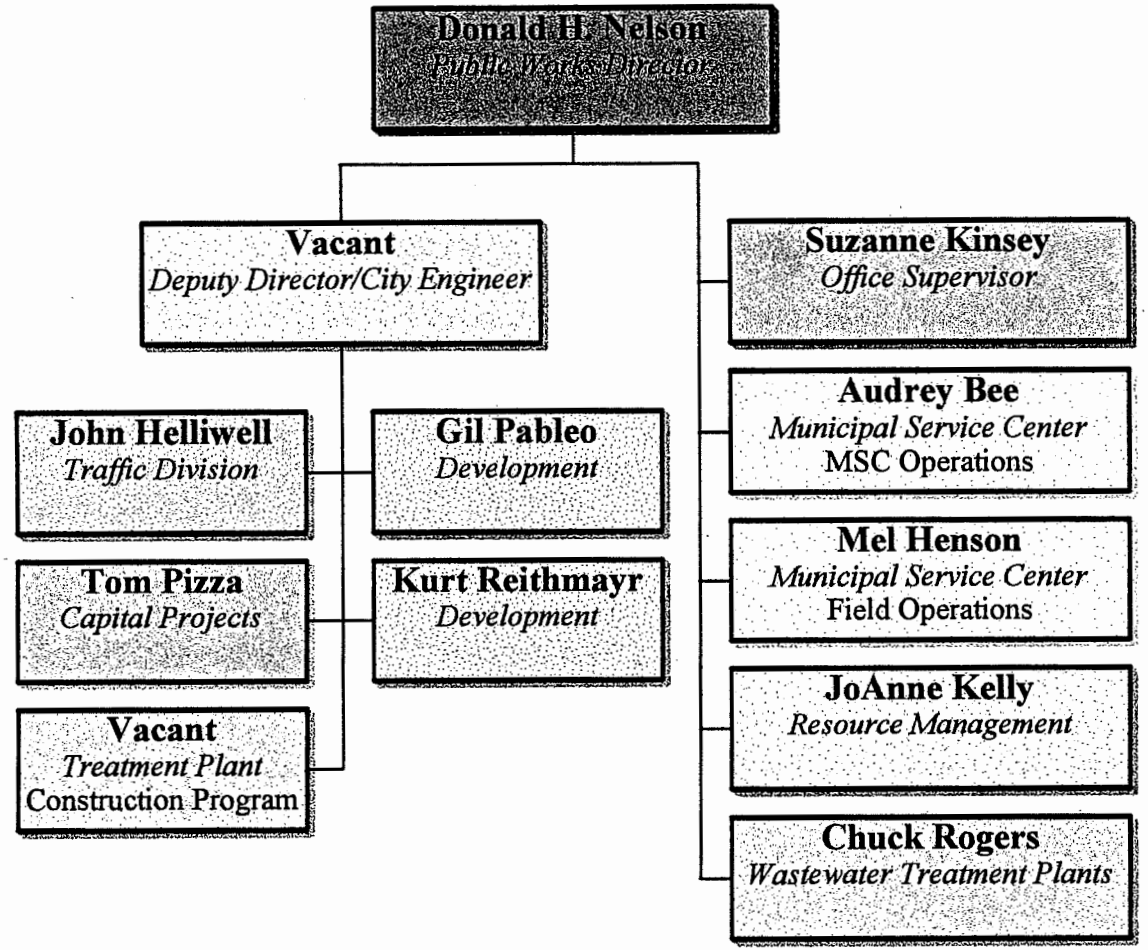
U. S. Environmental Protection Agency

PROPOSED SSO RULE AND CMOM PROGRAM

APPENDIX

Public Works Department Organization Charts

PUBLIC WORKS DEPARTMENT



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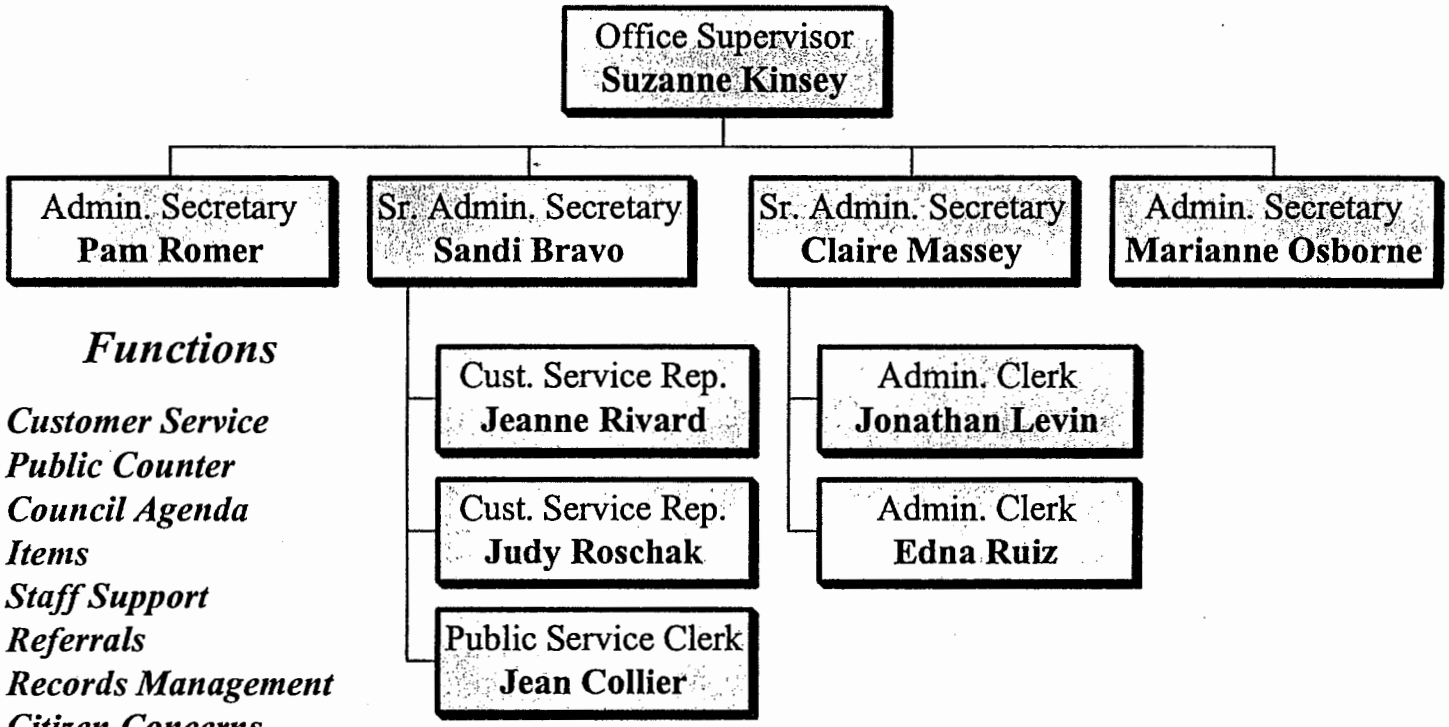
Administrative Support



Functions

Customer Service
Public Counter
Council Agenda Items
Staff Support
Referrals
Records Management
Citizen Concerns
Personnel
Scheduling

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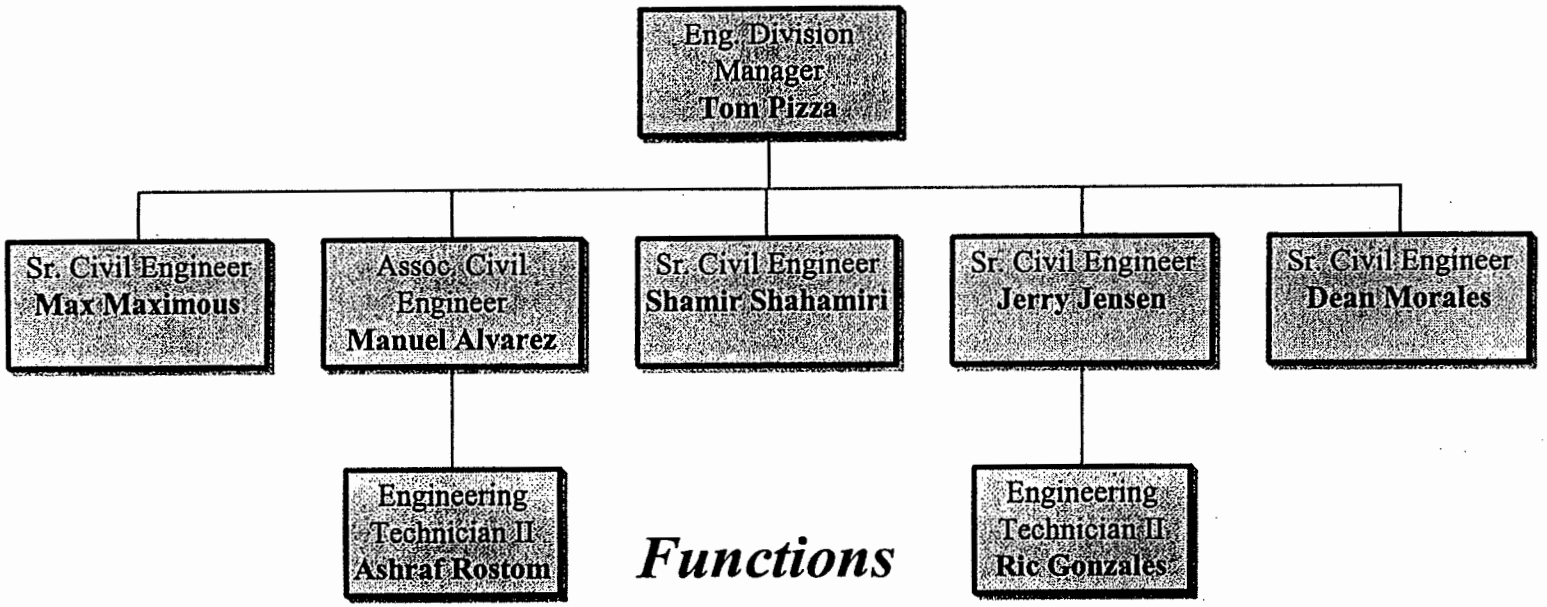
Capital Projects



Functions

Accessibility
Capital Projects Design
Contracts & Specs.
Pavement Mgmt.
Disaster Mitigation (Long Term)
Construction Management
Groundwater/Wells
Reclaimed Water
State & Federal Trans. Funding
Contract Administ.
RDA Projects

Soundwalls
Caltrans
Wastewater Interceptor Improvements
HCTP & ORWRP Capital Projects
Water Utility Capital Projects
Stormdrain Capital Projects
Freeway Interchange Capital Projects
Citywide Capital Projects Budget
Landscape Capital Projects
Transportation Facilities

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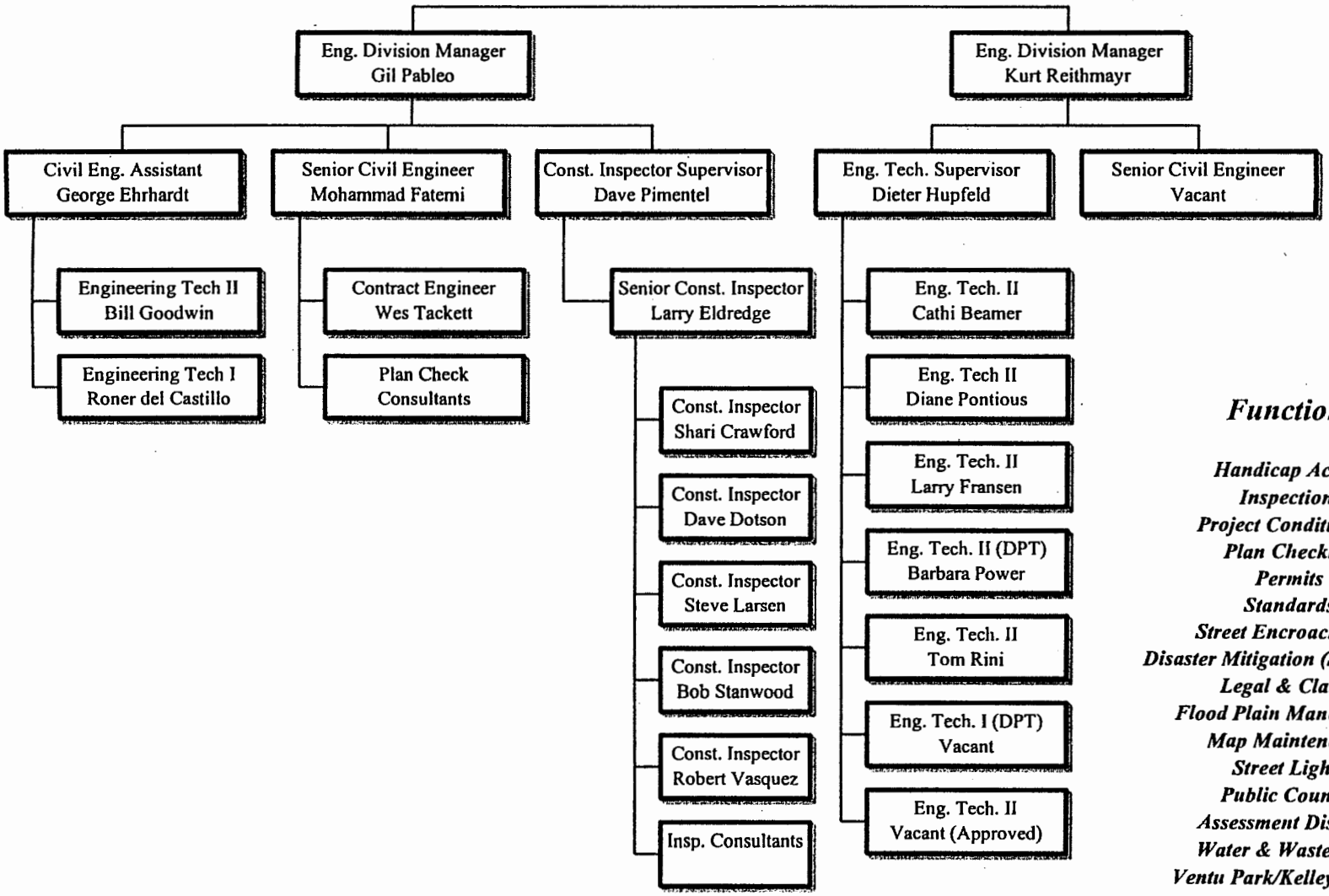
Development



Functions

Handicap Access
Inspections
Project Conditioning
Plan Checking
Permits
Standards
Street Encroachment
Disaster Mitigation (Short Term)
Legal & Claims
Flood Plain Management
Map Maintenance
Street Lights
Public Counter
Assessment Districts
Water & Wastewater
Ventu Park/Kelley Estates
Grading
Cross Connection Control
Maintenance Projects
Utility Billing
Utility Underground District
Refuse Enclosure Approvals

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Municipal Service Center

PW Superintendent
Mel Henson
Field Operations

Mgmt. Assist.
Vacant

MSC Manager
Audrey Bee
MSC Operations

Street Maint. Supv.
Joe Bravo

St. Sweeper Crwldr.
B. Garrick

St. Sweeper Operator
L. Herrera
T. Ranallo

St. Maint. Crwldr.
L Bolinger
E. Randall
P. Smith
T. Ulaszek

Hvy. Equip. Oper.
R. Lucchese
M. Summers
G. Taylor

St. Maint. Wkr. I, II
L. Aguilar
S. Appleton
A. Barrera
M. Barrera
B. Boyd
K. Boyle
J. Burton
J. Cuarda
J. Fisher
L. Garcia
R. Gonzales
R. Johnston
J. Klopman
G. Lopez
M. Parrotta
J. Pave
T. Reveles
J. Snyder
P. Tiffin
Wagner, R.
R.Williamson
D. Zarate
Vacant*
Vacant*

Landscape Maint. Supv.
Hans Faber

Land. Maint. Crwldr.
R. Campbell
G. Kennaley
F. Lepold
L. Lopez
S. McKnight
J. Pisciotta
S. Schultz

Land. Maint. Wkr. I, II
I. Bonds
M. Campbell
J. Ceja
P.Christianson
J. Colwell
L. Dumas
S. Garcia
F. Gessler
T. King
D. Lowman
J. Meza
J. Miller
M. Montelth
M. Murray
J. O'Grady
N. Perreault
K. Reister
E. Roberts
A. Rojo
J. Roman
B. Rotondo
D. Williams
K. Wilson
D. Yost
Vacant*

Utilities Maint. Supv.
Emil Norby
Wastewater Division

Utilities Maint. Crwldr.
J. Nelson
M. Noblitt

Hvy. Equip. Oper.
J. Tregaskis

Utilities Maint. Wkr. I, II
J. Mabry
N. Magana
S. Steiert
B. Stidham
S. Underwood
B. Wilson
Vacant*

Utilities Maint. Supv.
Ed Dusablon
Water Division

Utilities Maint. Crwldr.
R. Bratcher
B. Funfar

Water Systems Operator
T. Hartin

Hvy. Equip. Oper.
D. Diggs

Utilities Maint. Wkr.I, II
J. Castaneda
G. Frost
J. Garcia
C. Heimann
H. Magdaleno
J. Scarpa
R. S. Thomas
K. Witt

Fleet Services Supv.
Bob Miller

Fleet Serv. Crwldr.
L. Carpenter

Fleet Mech. I, II
W. Bates
P. Boxley
K. Hayes
G. Kempher
K. Lundgren
L. McKinney
J. Mueller
Vacant

Fleet Mech. Welder I, II
S. Richmond

Fleet Services Assistant
T. Keagy

Bldg. Maint. Tech.
S. Clark

Purchasing & Stores Worker
Vacant

Field Support Supv.
Christy Keagy

Sr. Admin. Secretary
B. Balfour

Admin. Clerk
C. Dahlstrom
B. Dalrymple
L. Lange
Vacant*

Accounting Specialist
N. Arrieta

Field Service Rep.
M. Kirkpatrick
B. Reiser
M. VanDeusen

Sr. Purchasing & Stores Worker
B. Lewis

Purchasing & Stores Worker
J. LaRue

Field Operations Functions

Wastewater Collection
Water Distribution
Street Maintenance
Landscaping
Graffiti
Special Projects
Stormwater Quality
Citizen Concerns

* Approved to be filled

MSC Operation Functions

Customer Service
Dispatch
Materials Purchasing
Inventory Management
Accounts Payable
Staff Support
Special Events
Meter Reading
Vehicle Maintenance
Equipment Repair
CNG Refueling Station
Welding & Fabrication
Facilities Maintenance

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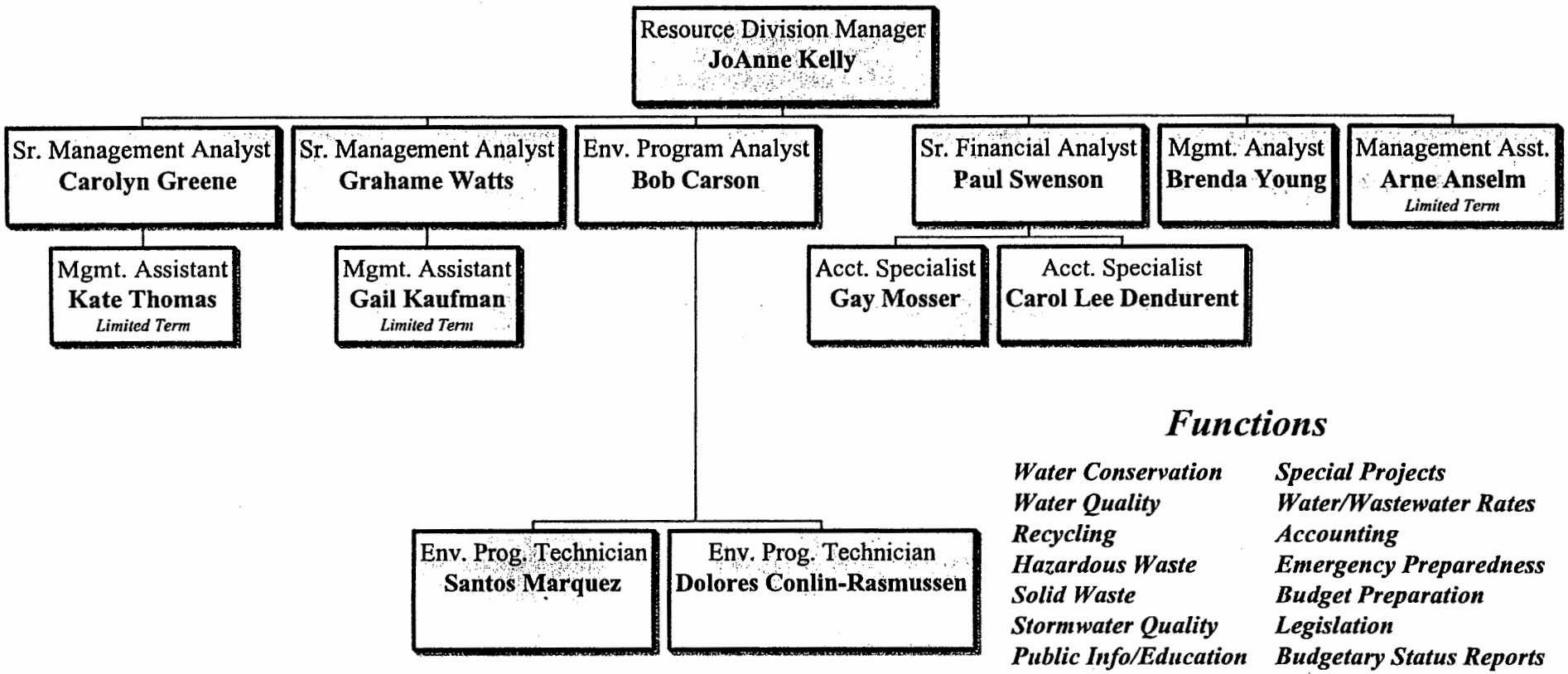
Resource Management



Functions

Water Conservation	*Special Projects*
Water Quality	*Water/Wastewater Rates*
Recycling	*Accounting*
Hazardous Waste	*Emergency Preparedness*
Solid Waste	*Budget Preparation*
Stormwater Quality	*Legislation*
Public Info/Education	*Budgetary Status Reports*
Industrial Waste	*Animal Control*

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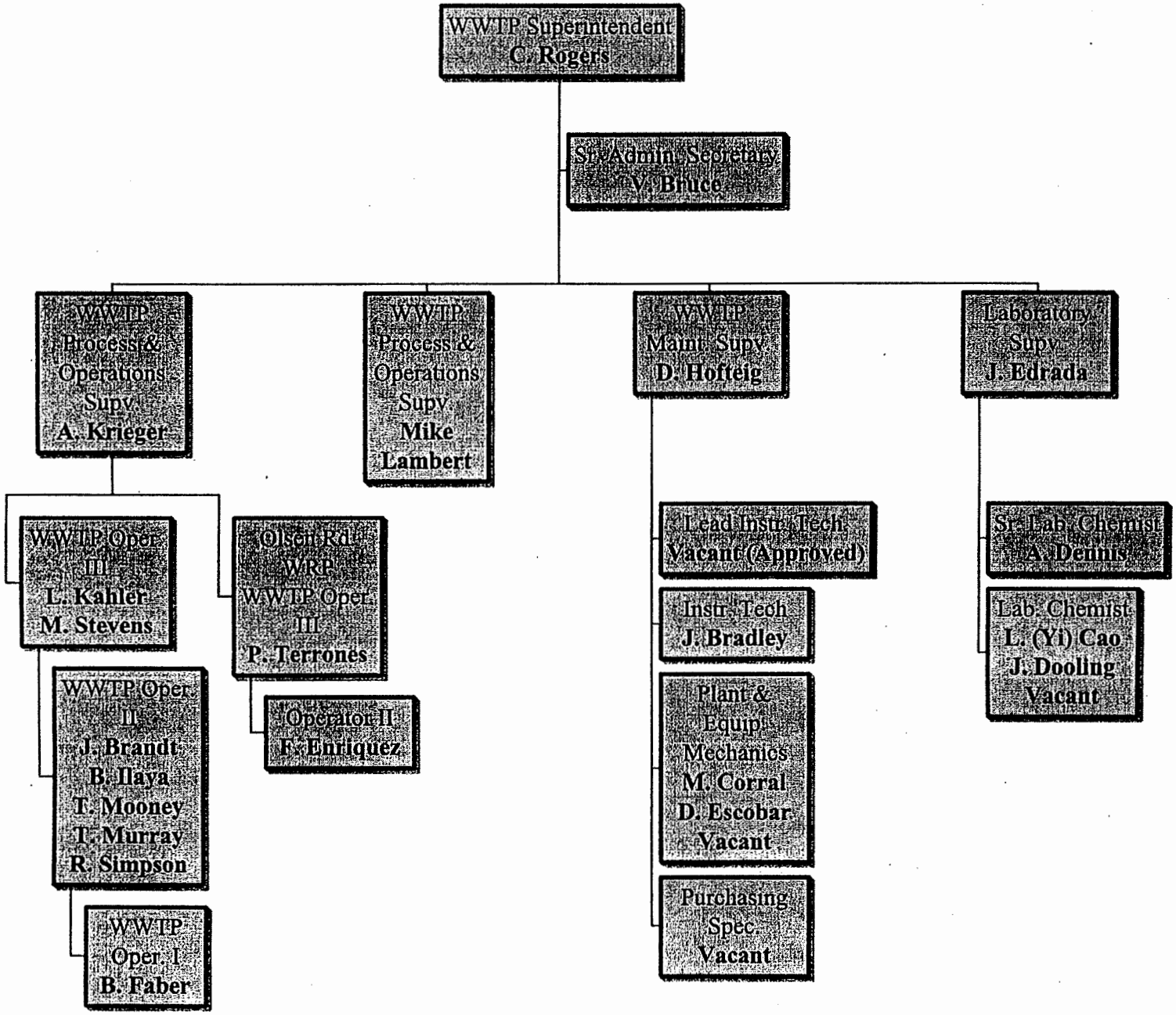
Wastewater Treatment Plants



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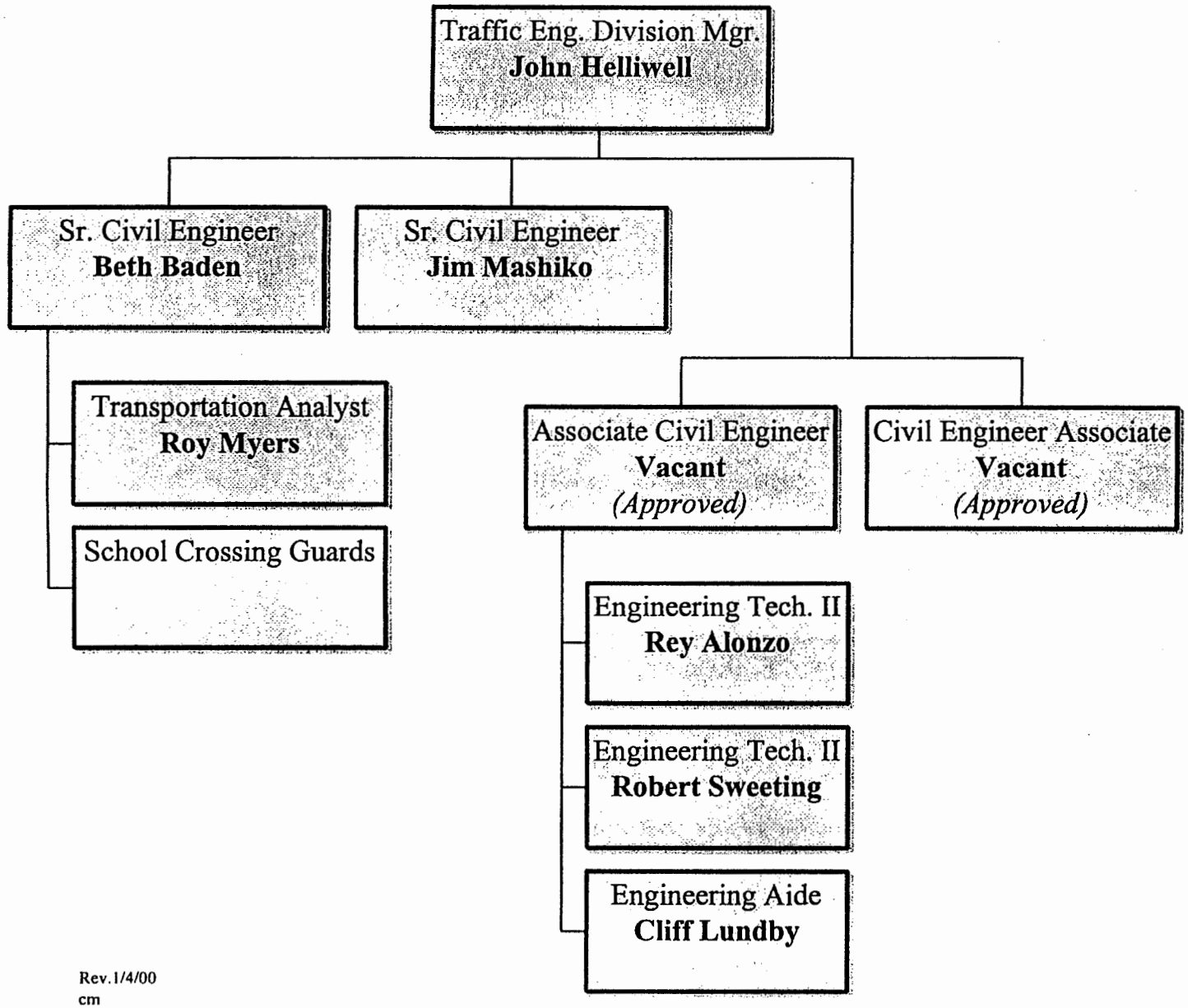
Traffic Engineering Division



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Functions

Congestion Mgmt. Plan
Special Events
Traffic Commission
Plan Checking
Transp. Demand Mgmt.
T.O. Transit
Traffic Signals
Crossing Guards
Permits (film, load)
Proj. Conditioning
Transit Contracts
Grants Processing
Trans. Cont. Measures
Fed. Trans. Funding
Subsidized Taxi
Traffic Control Plans
Circulation Element

Appendix F

MWH
MONTGOMERY WATSON HARZA

APPENDIX F

RAINFALL-DEPENDENT I/I ANALYSIS PLOTS FOR EVENT 5

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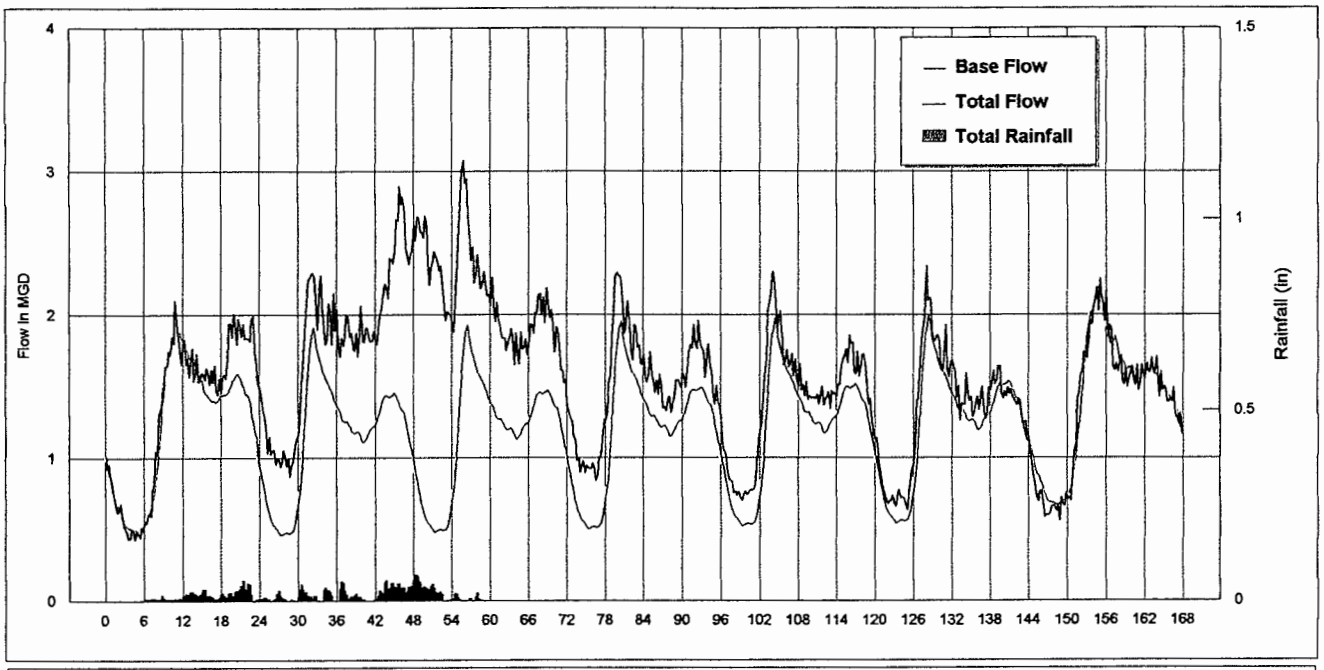

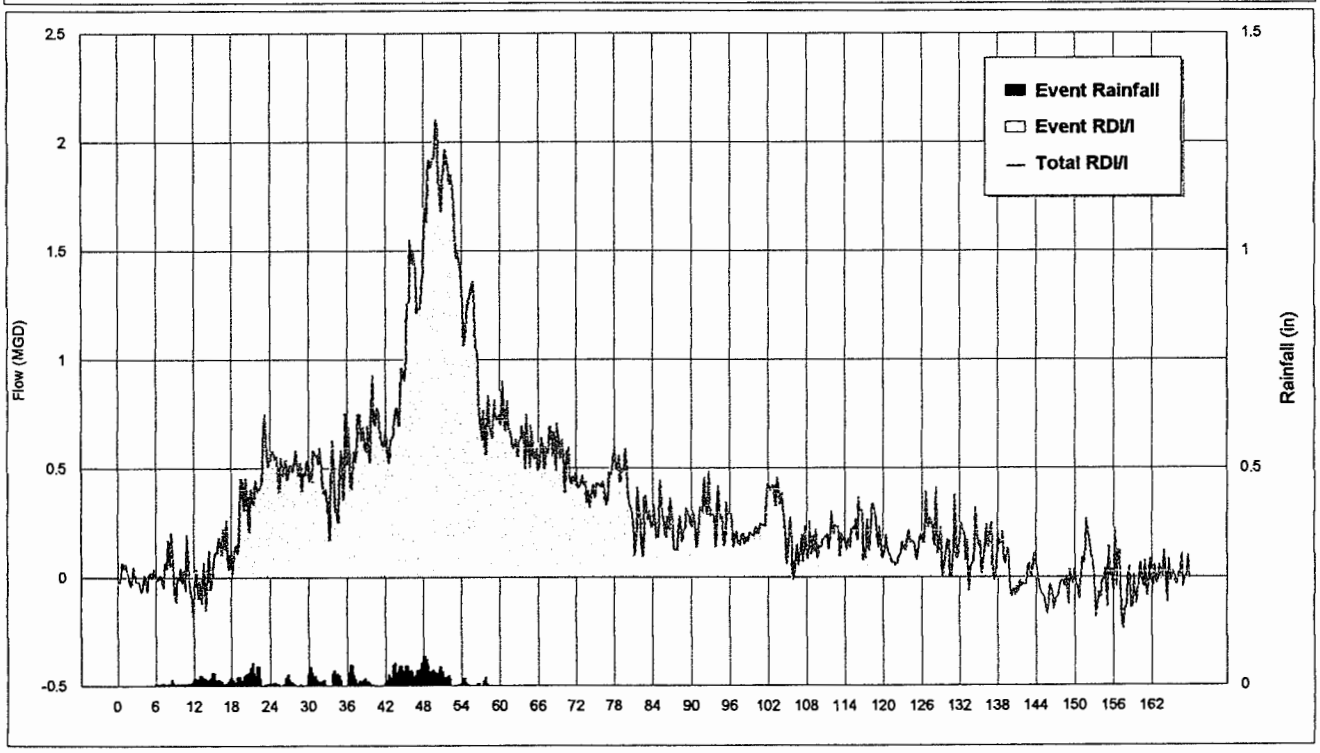

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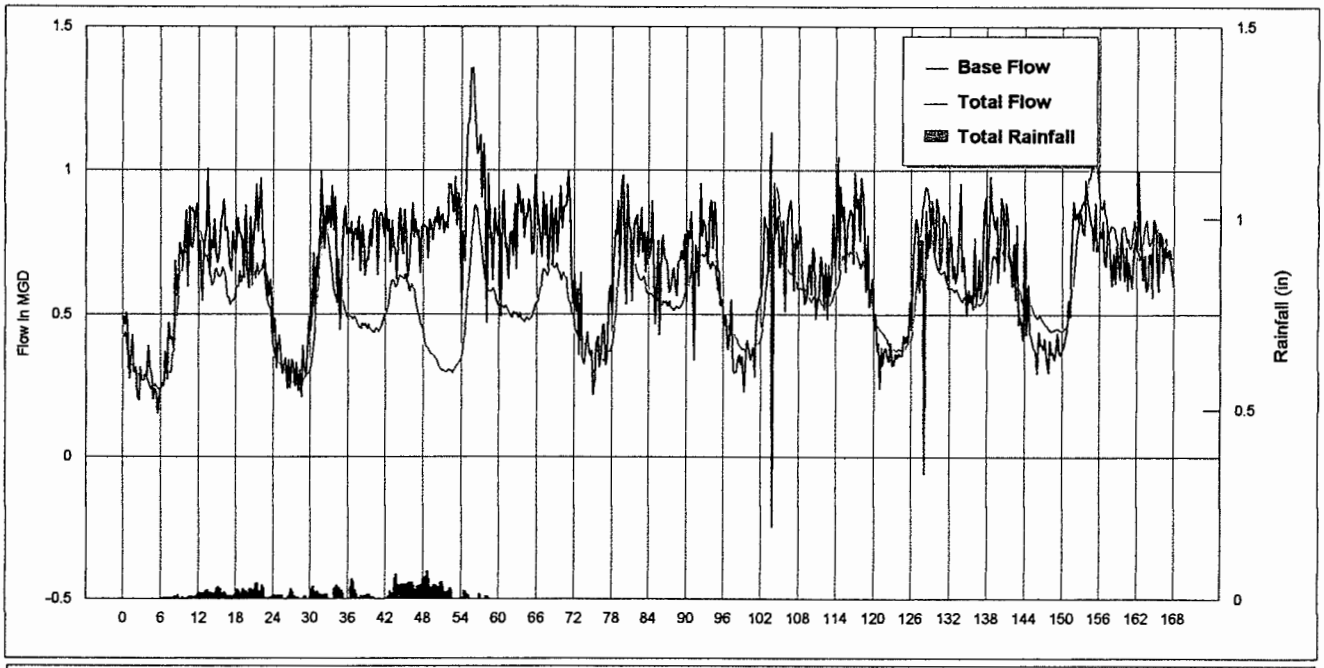

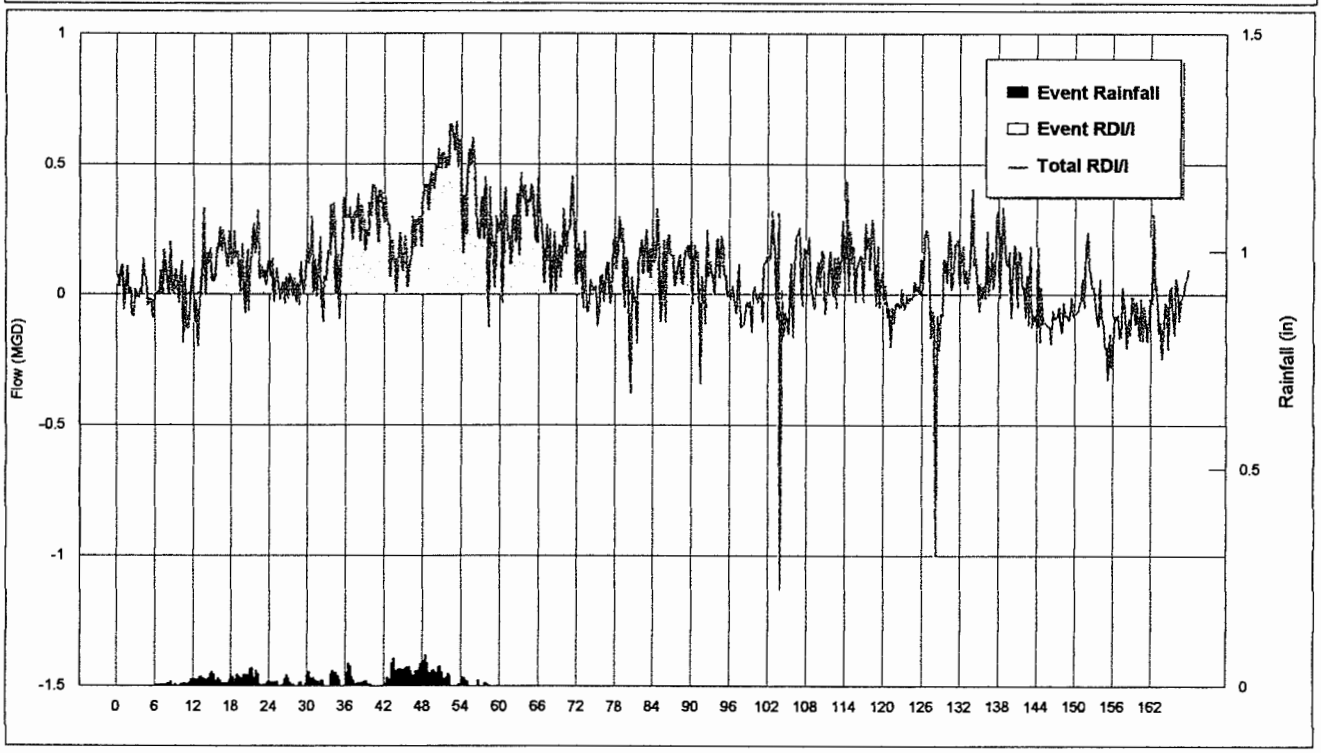

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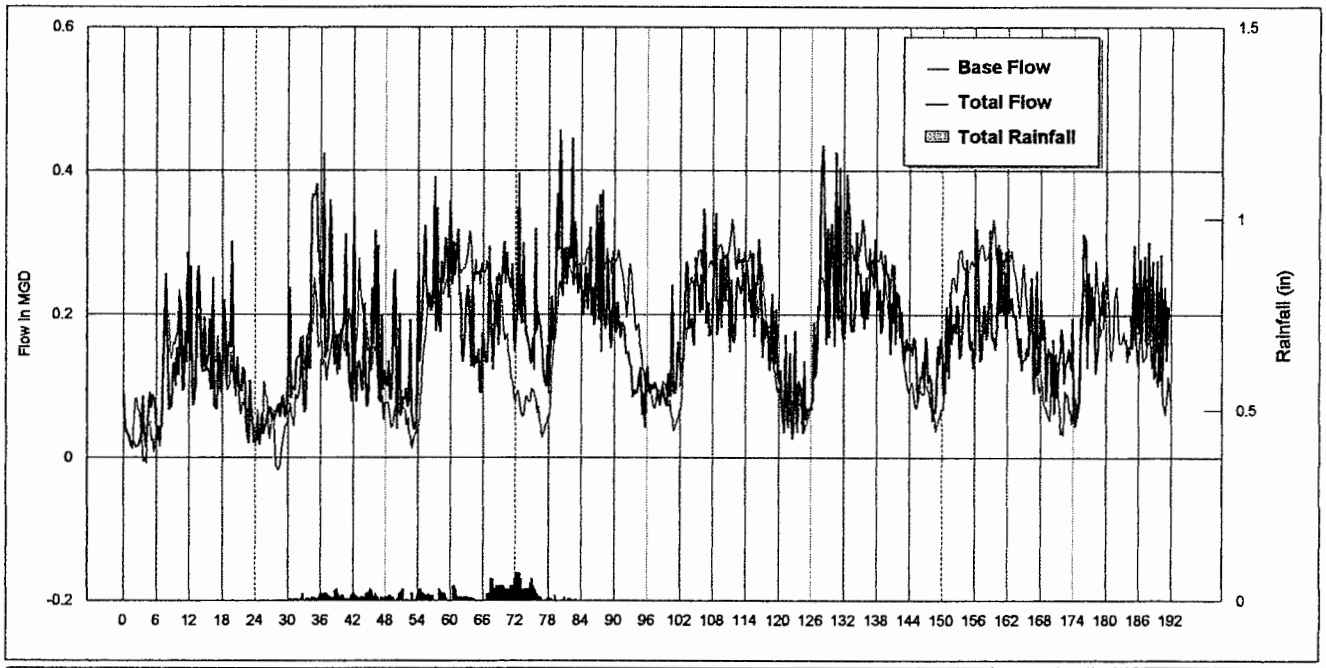

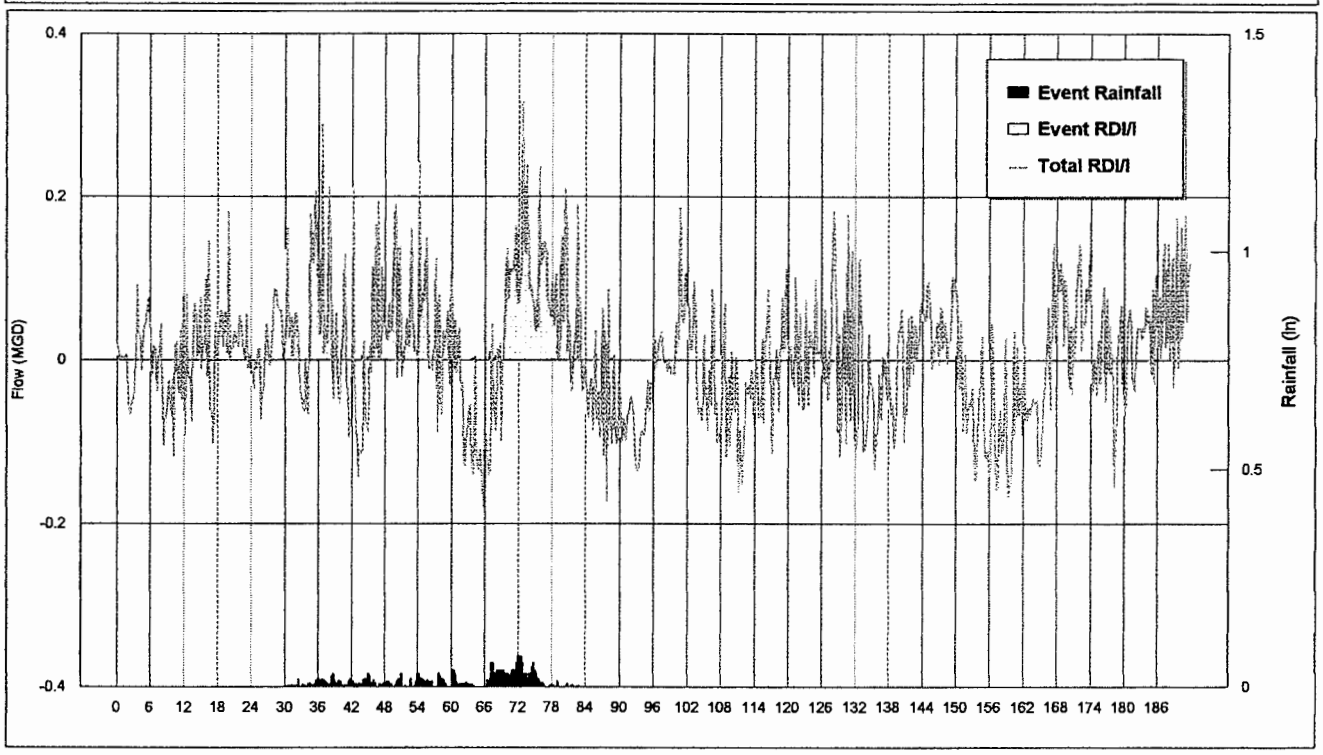

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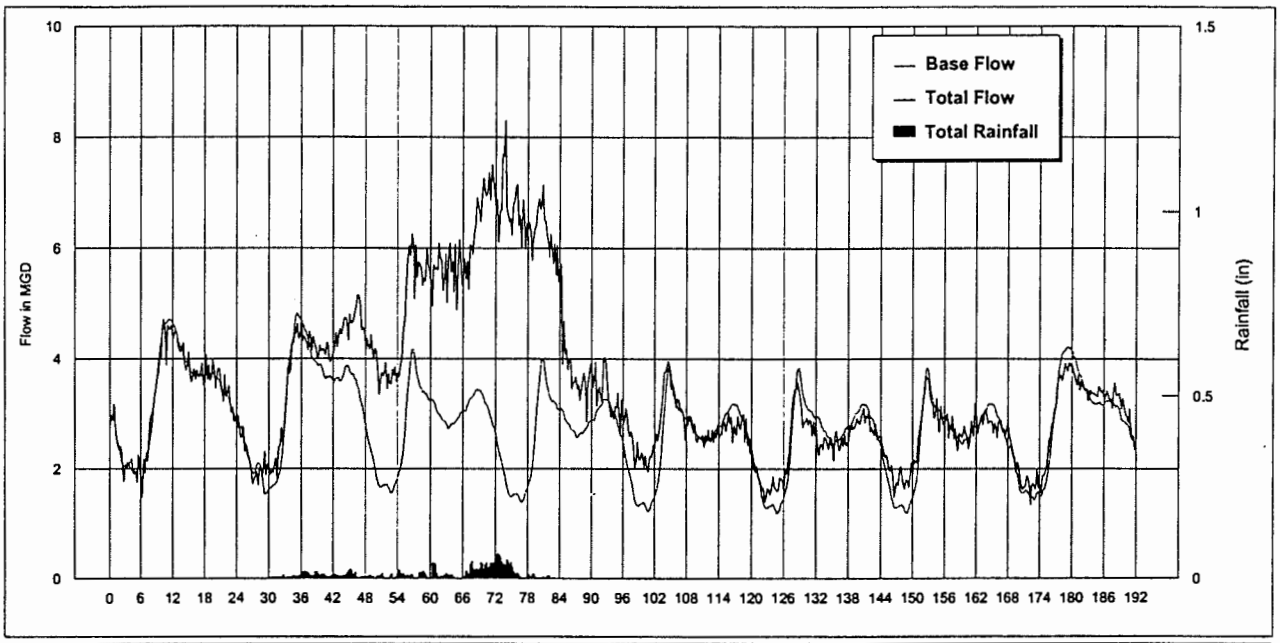

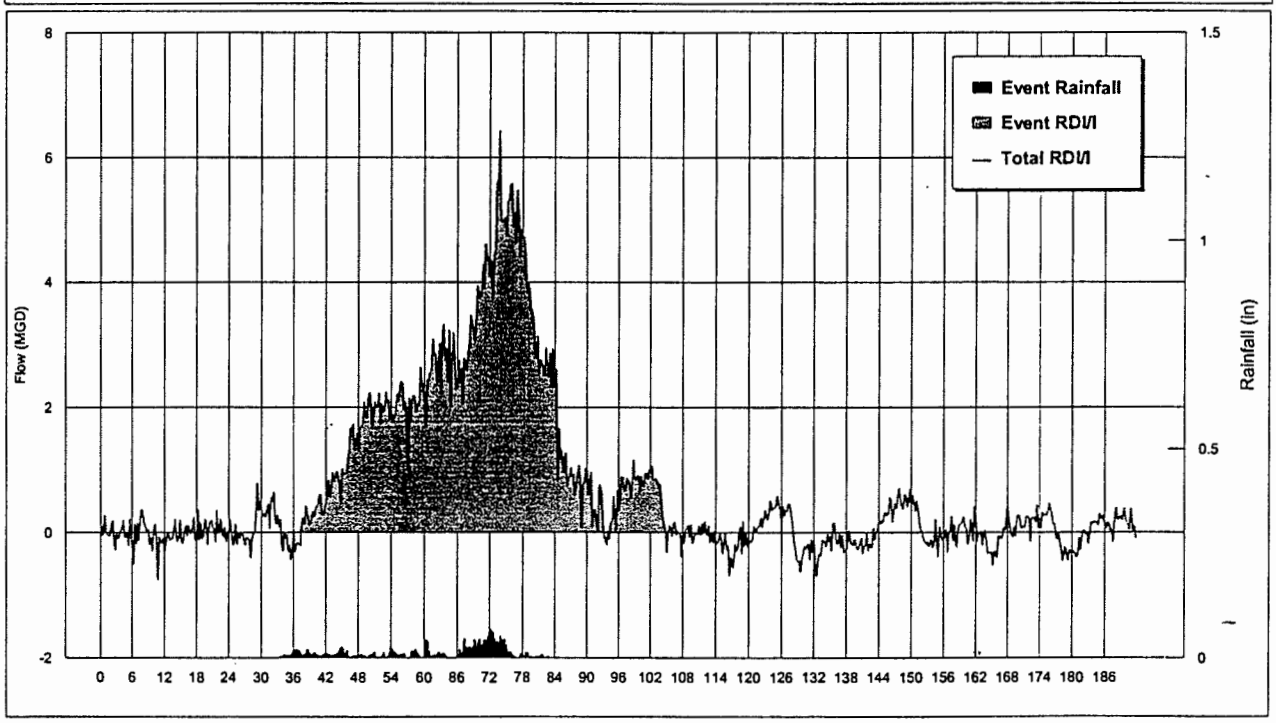

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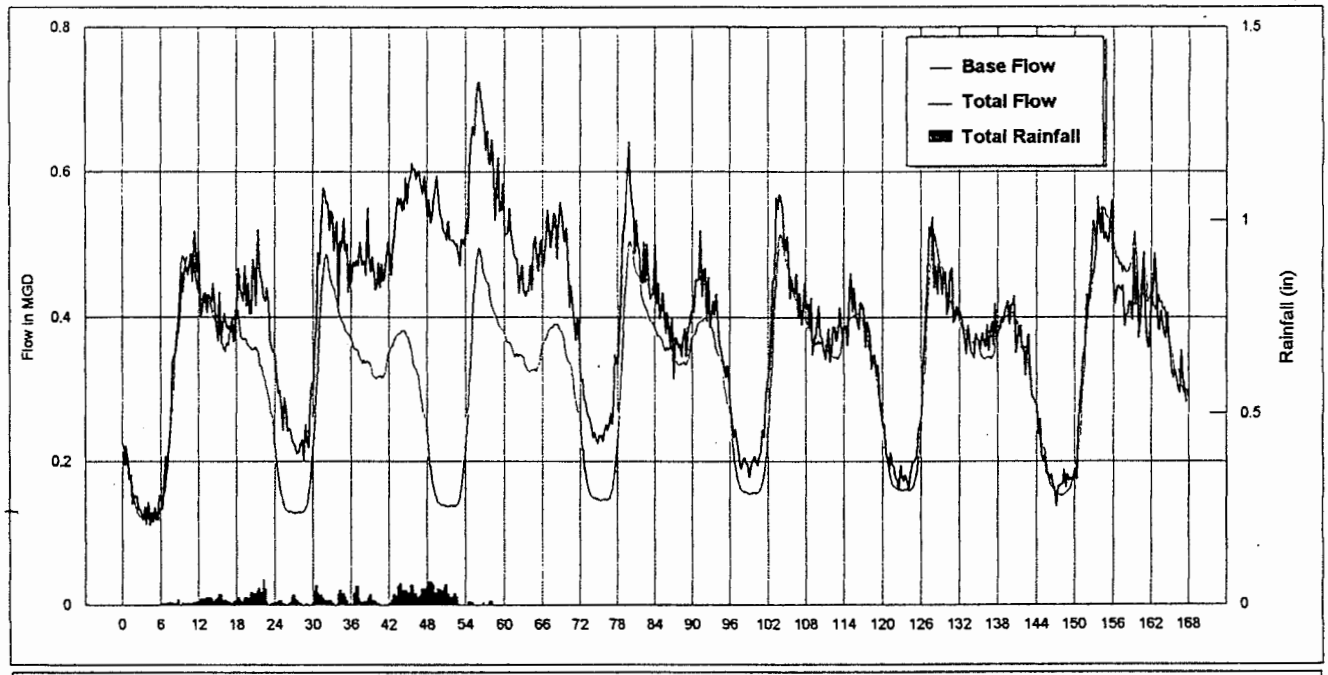

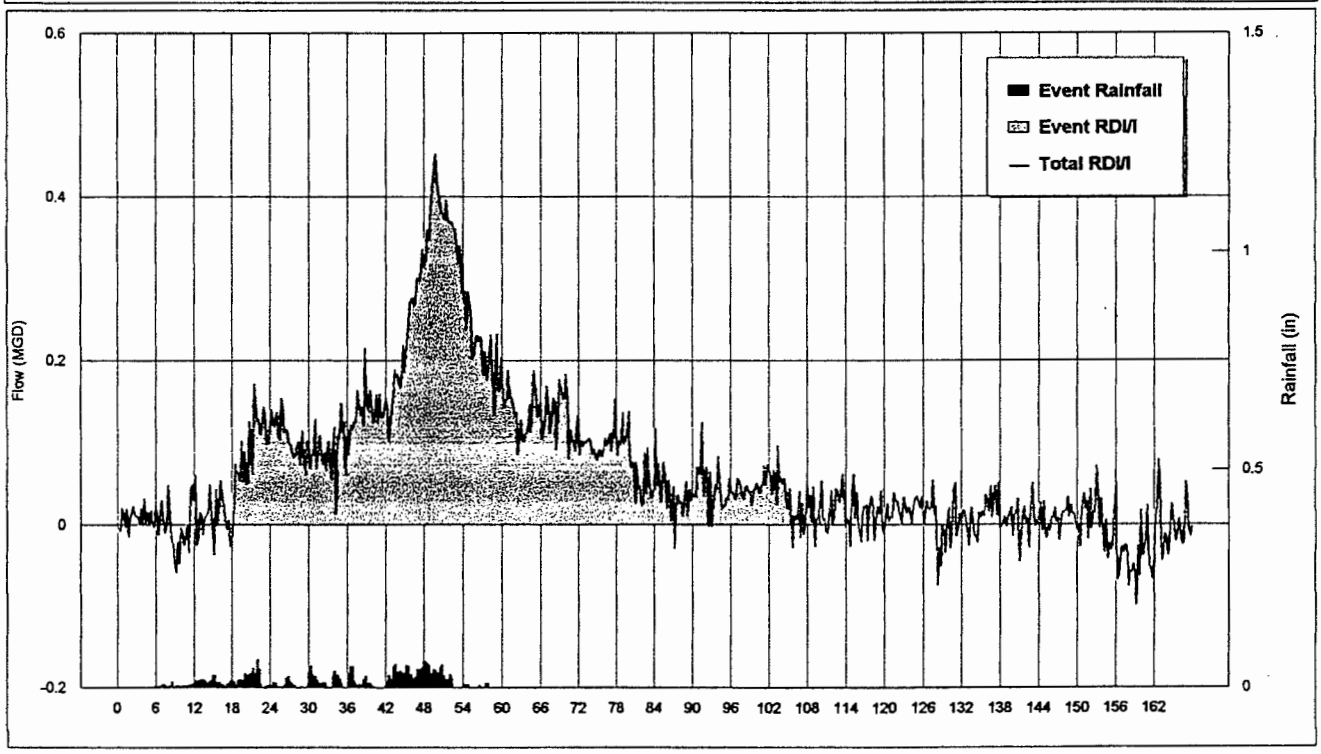

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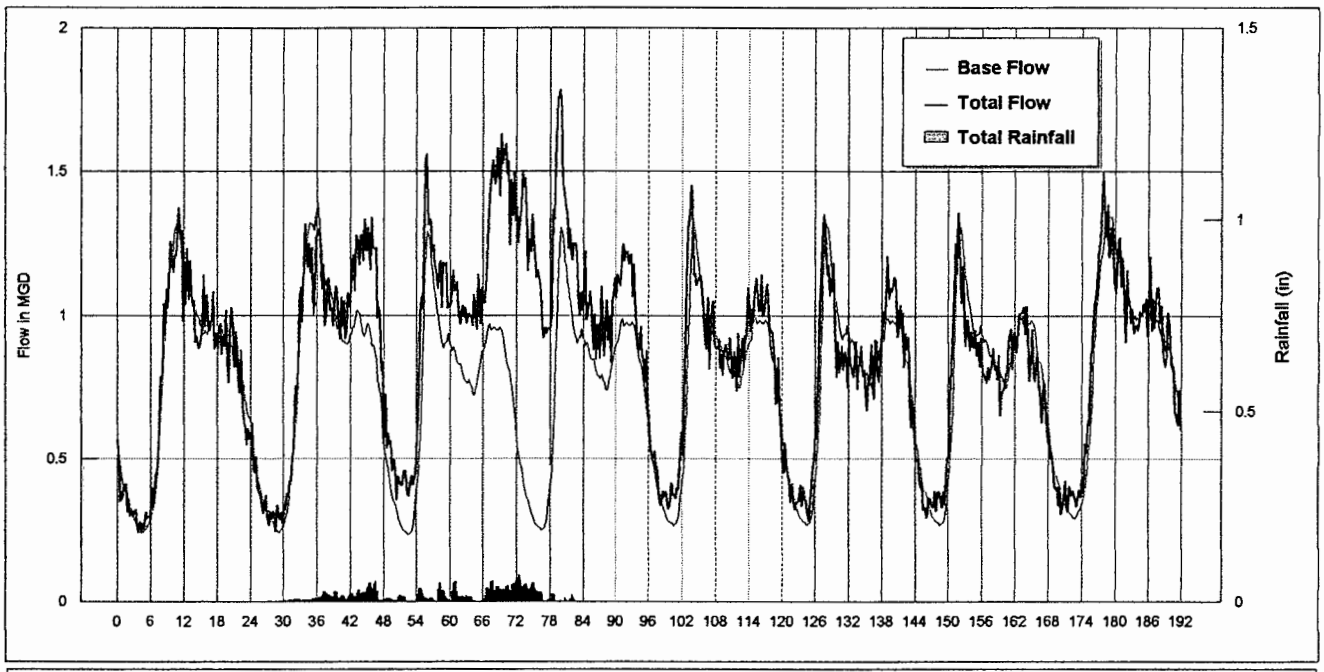

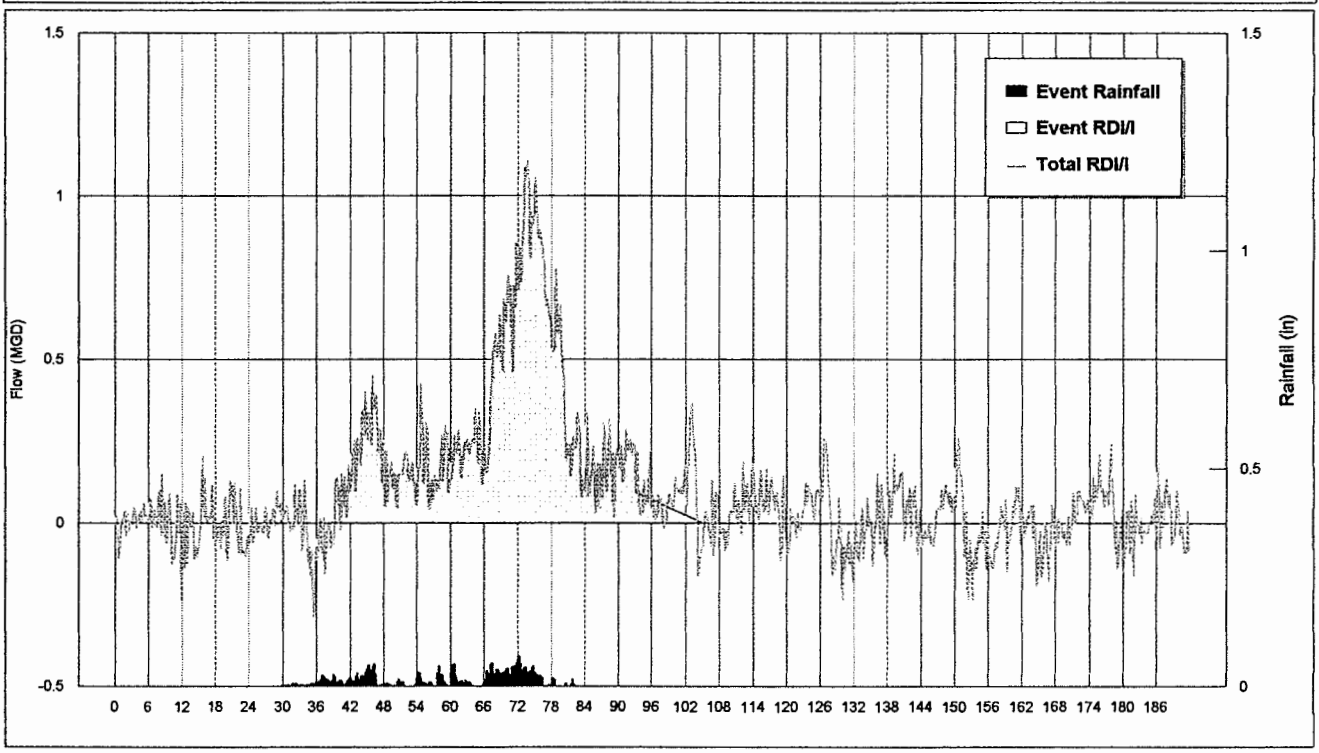

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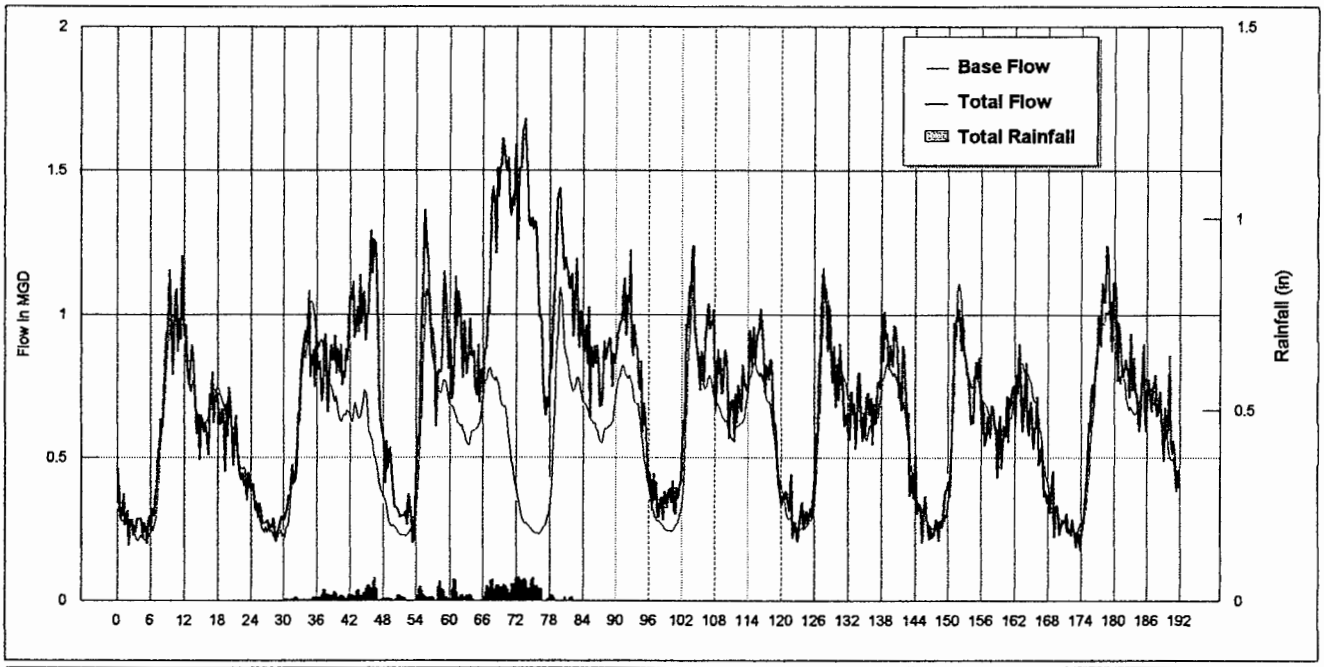

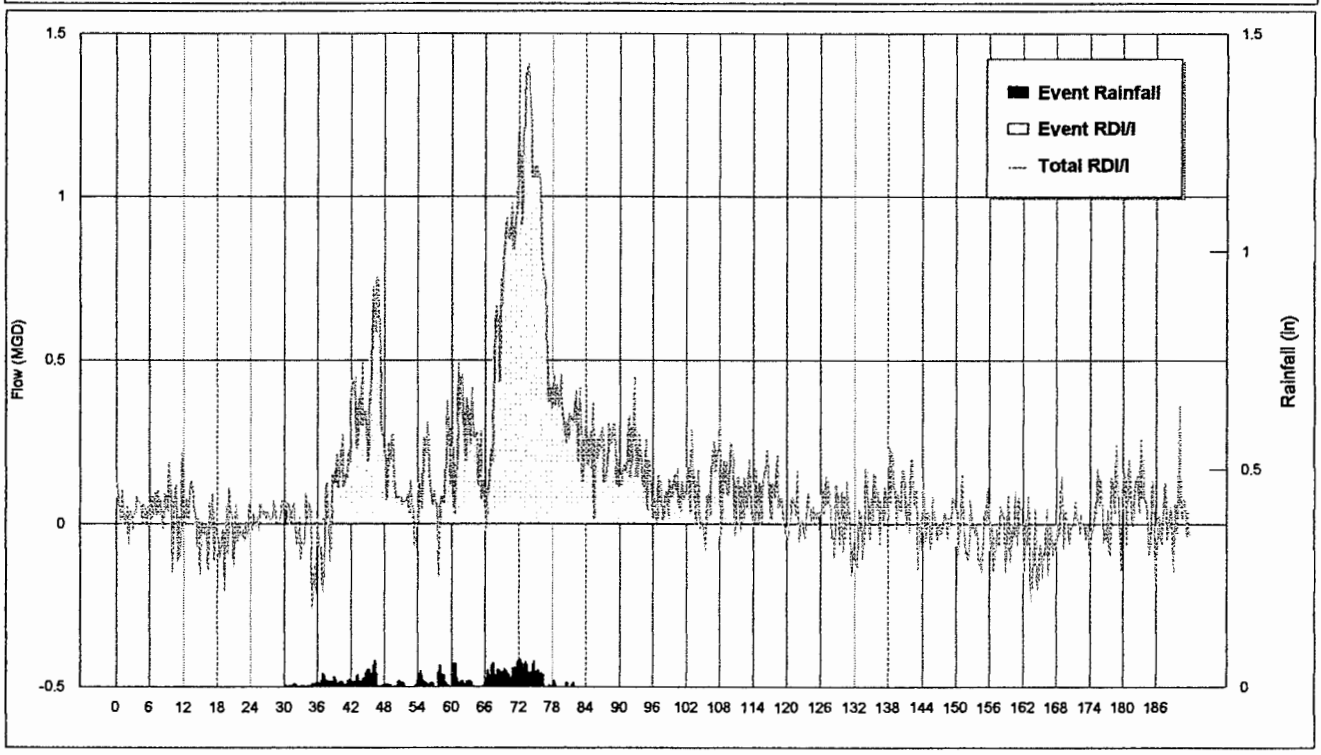

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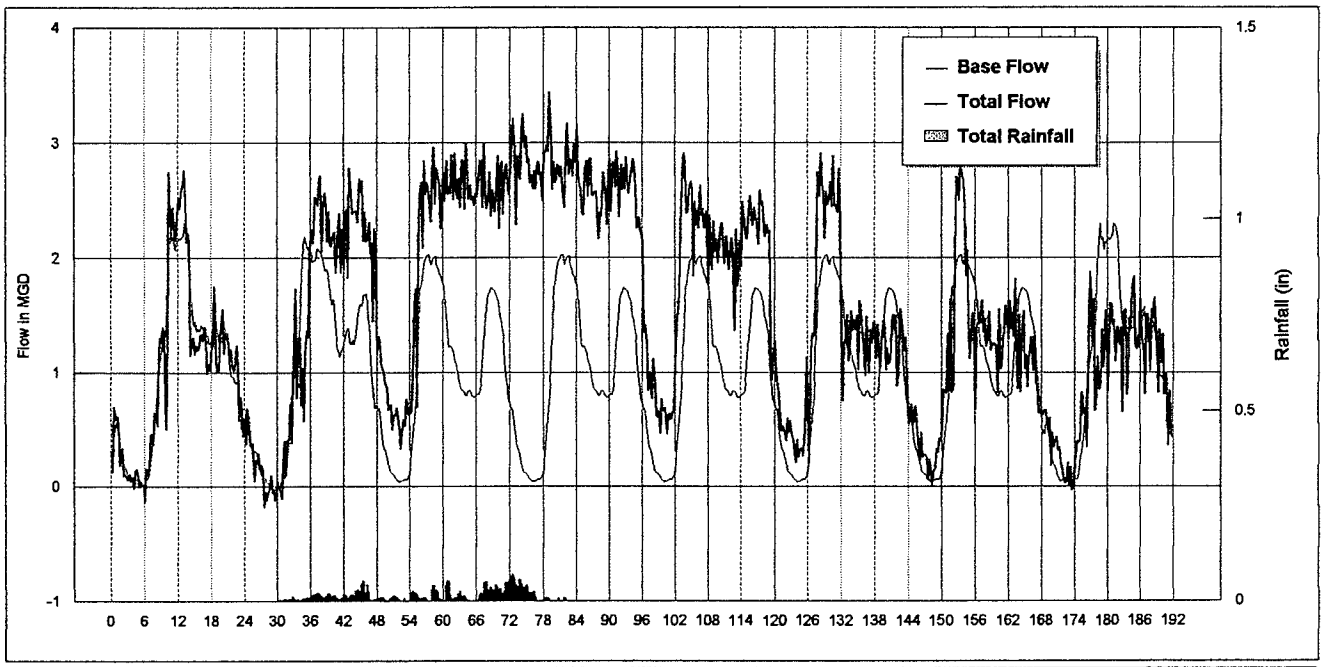

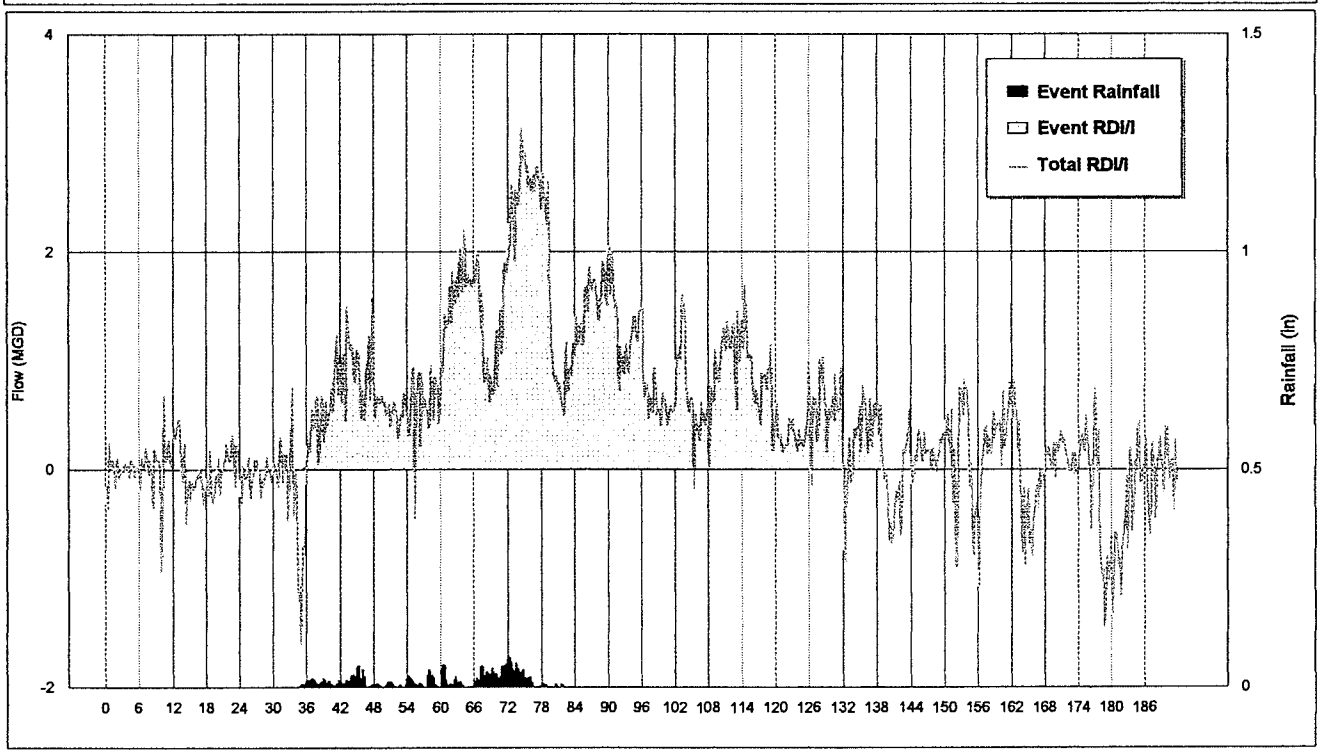

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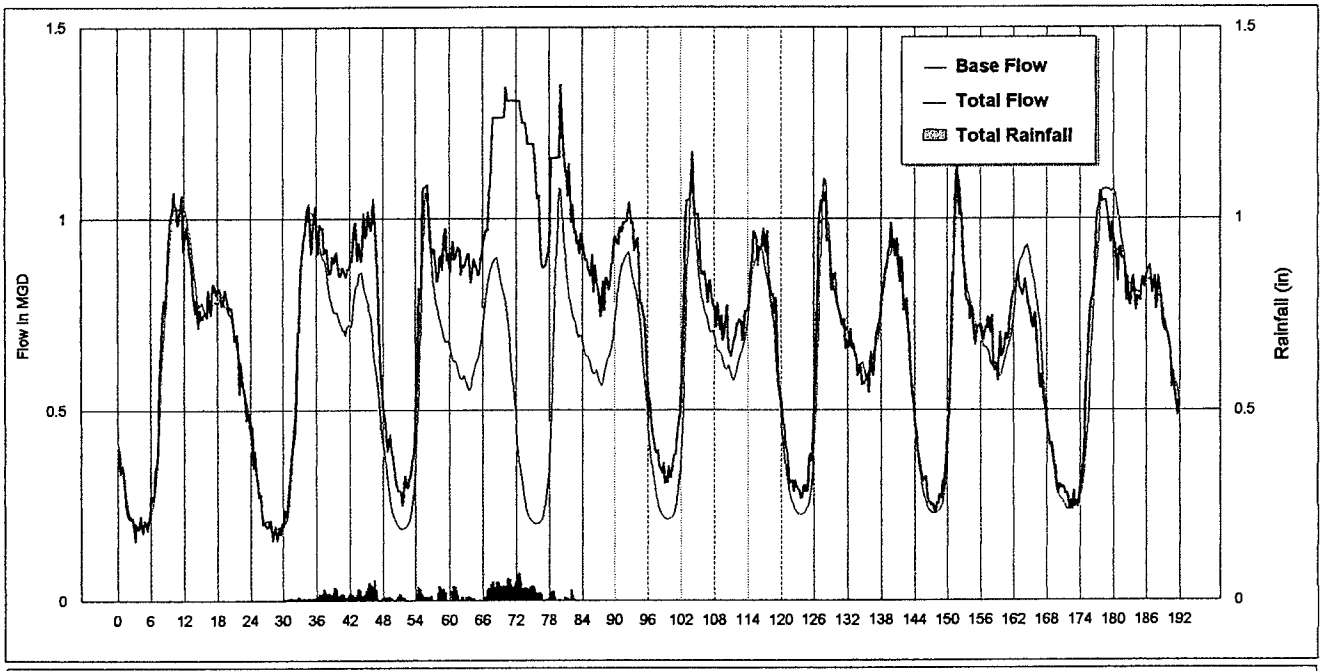

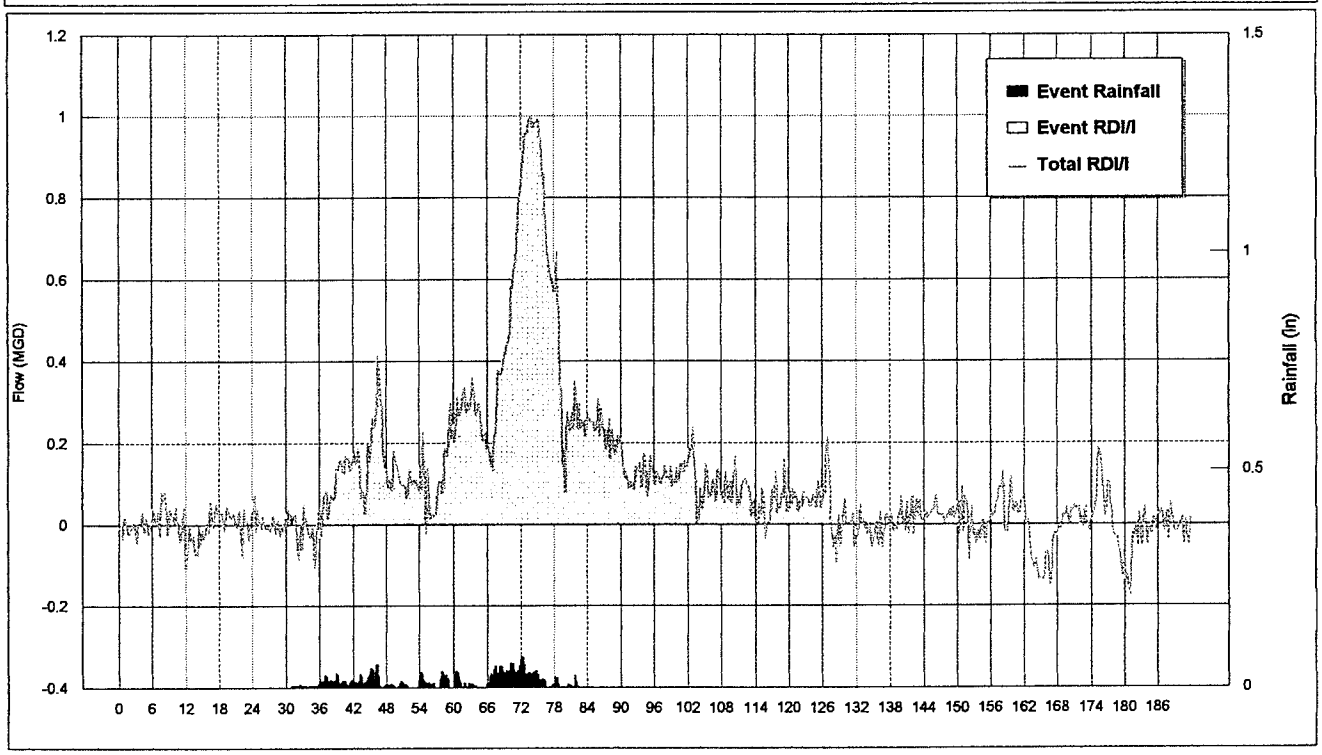

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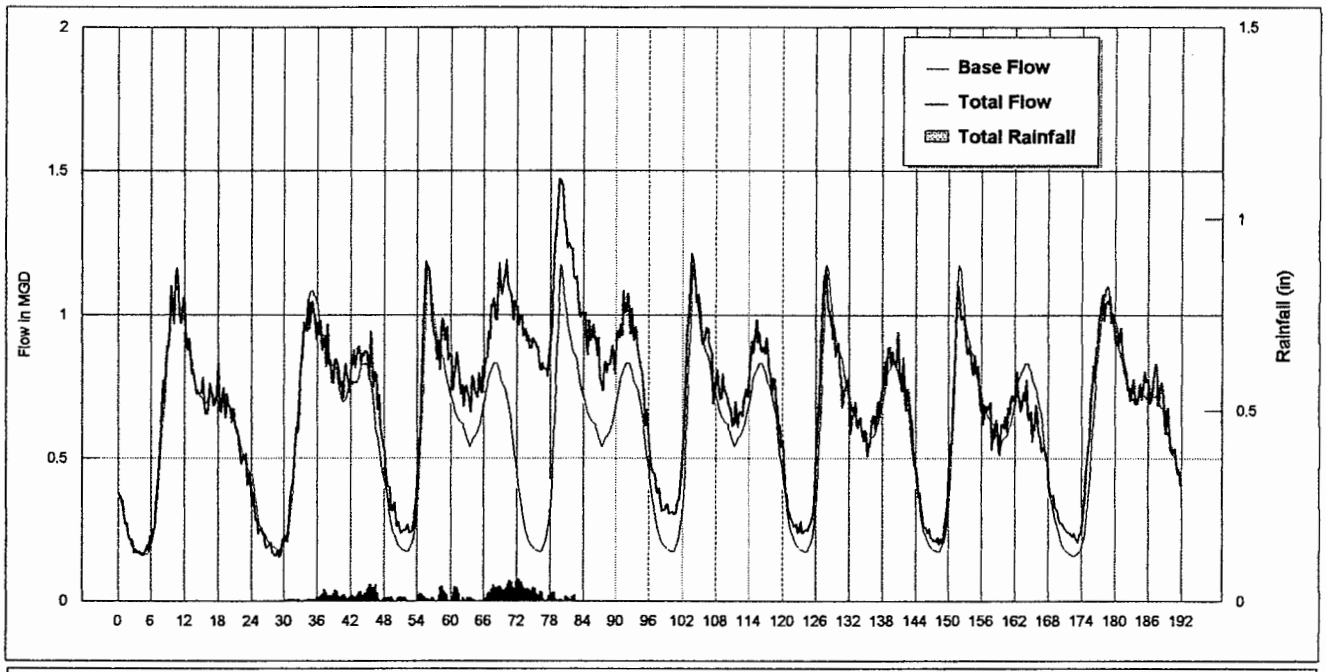

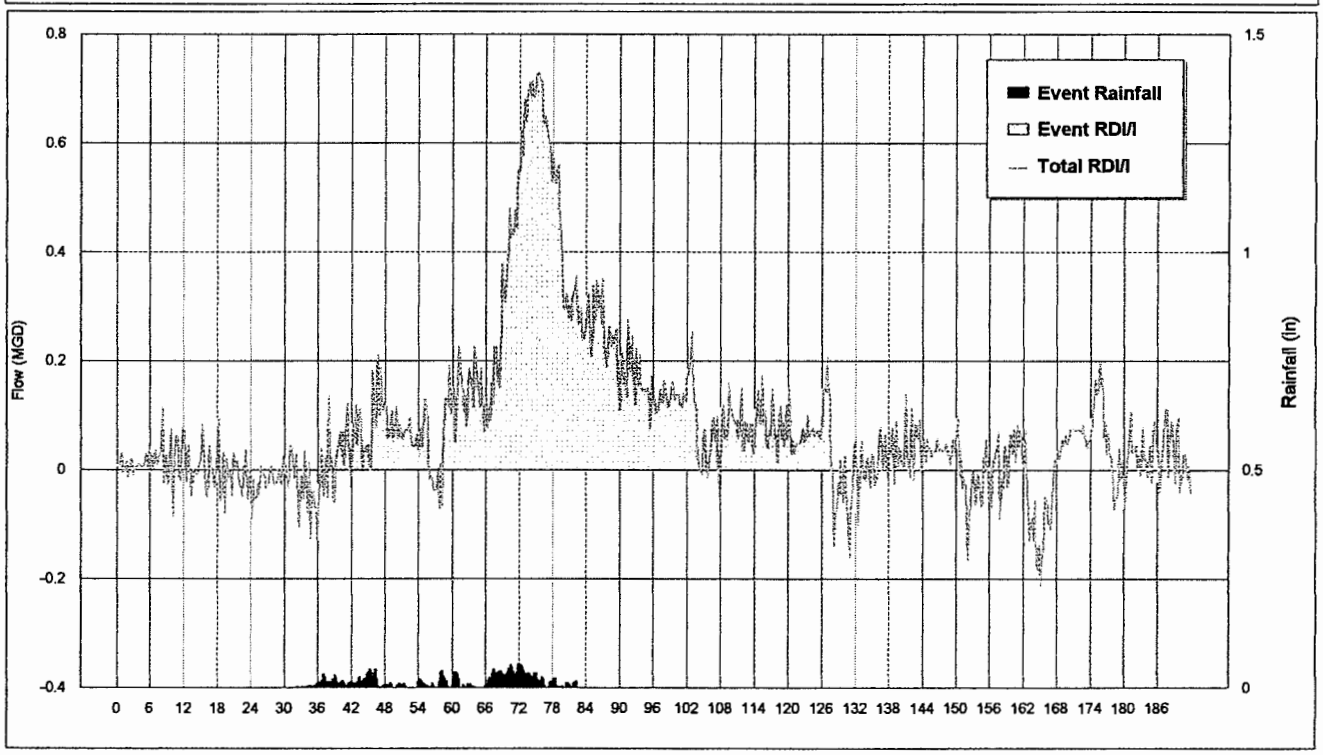

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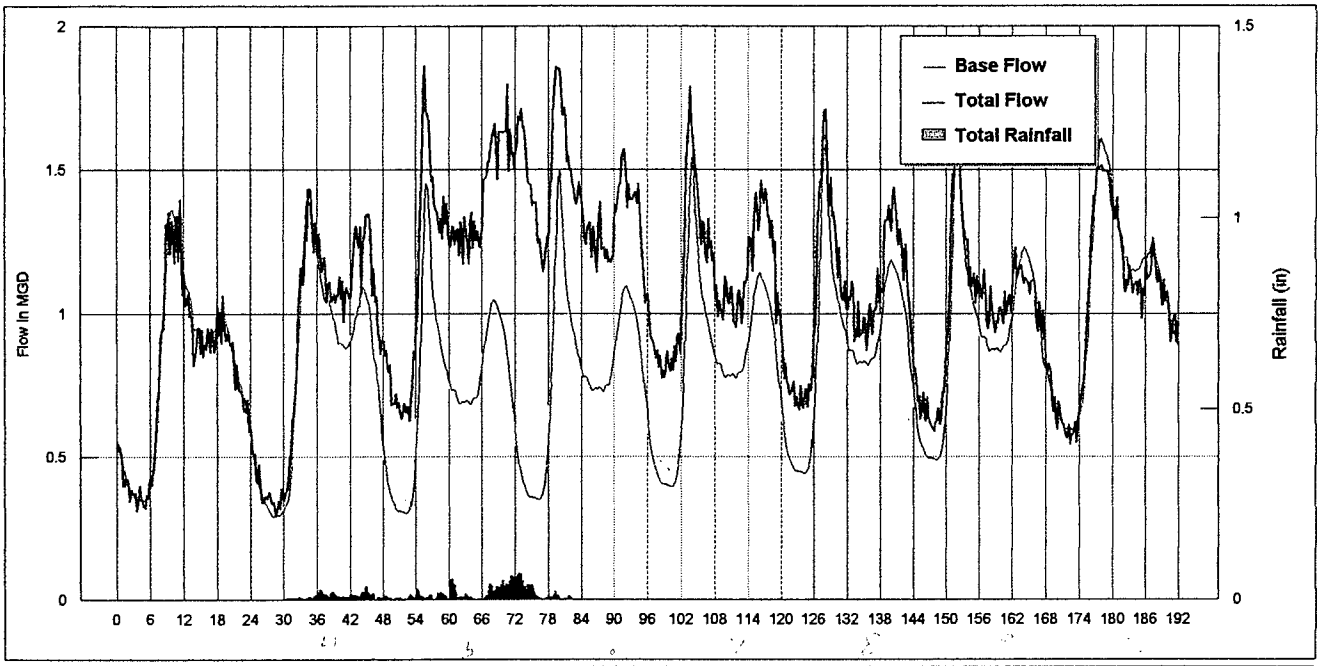
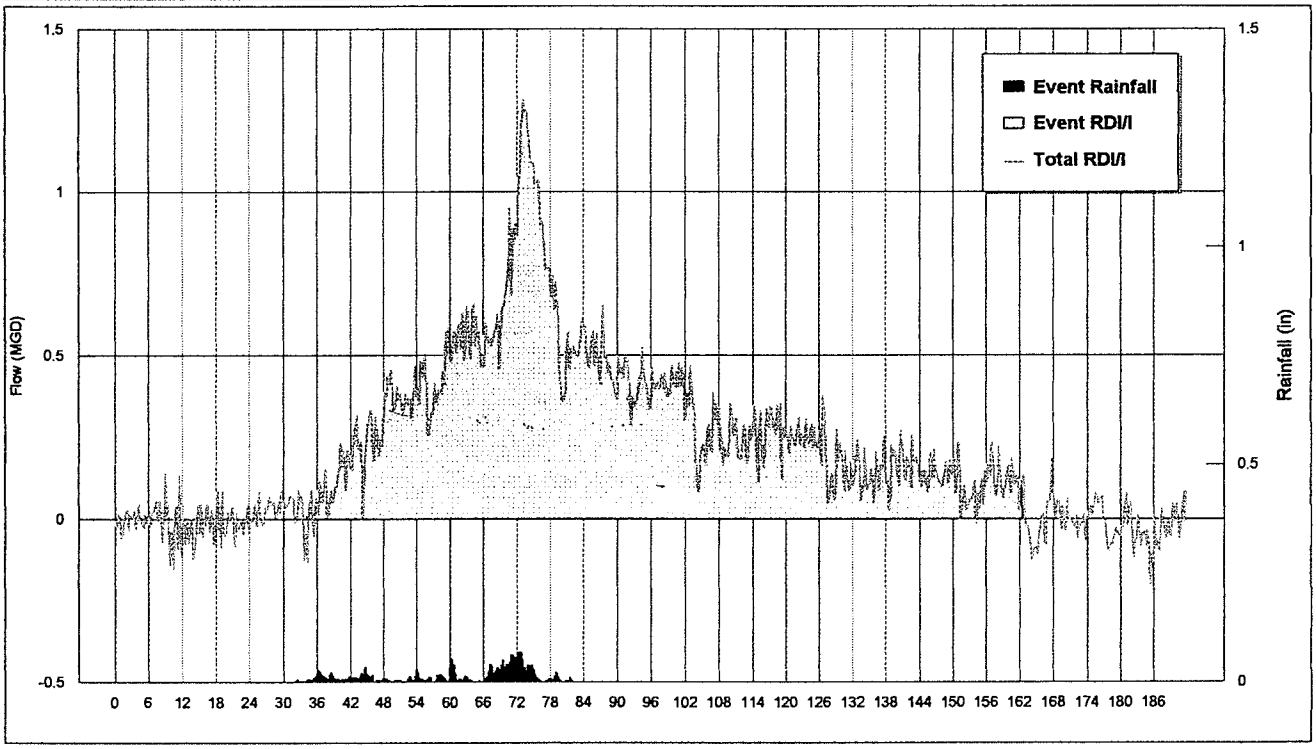
Meter FM012-5 Event 00





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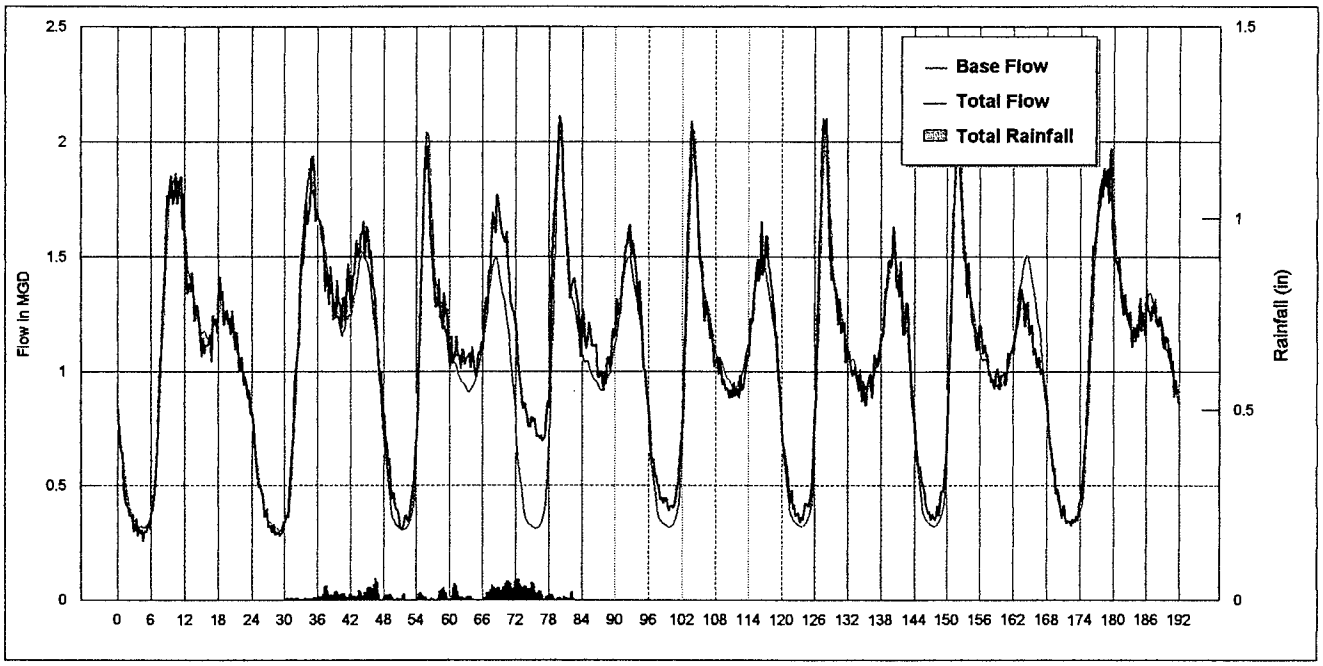

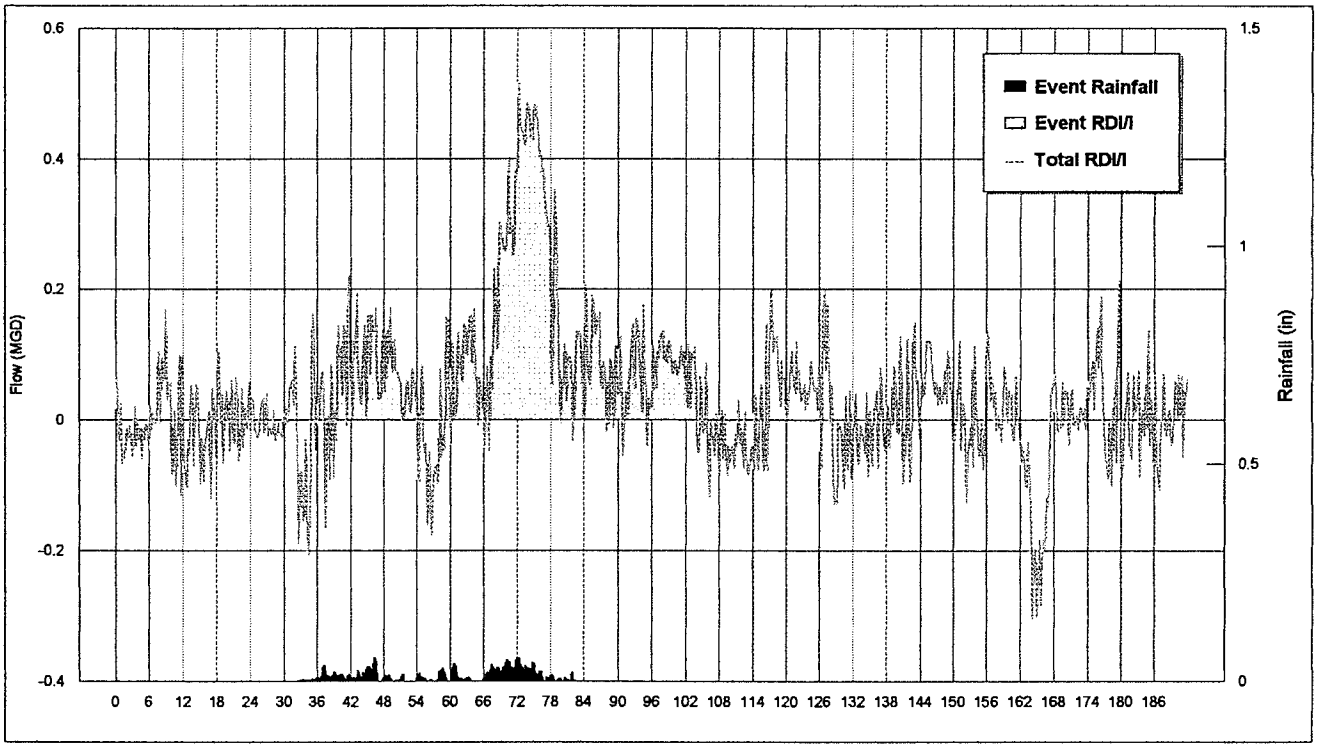

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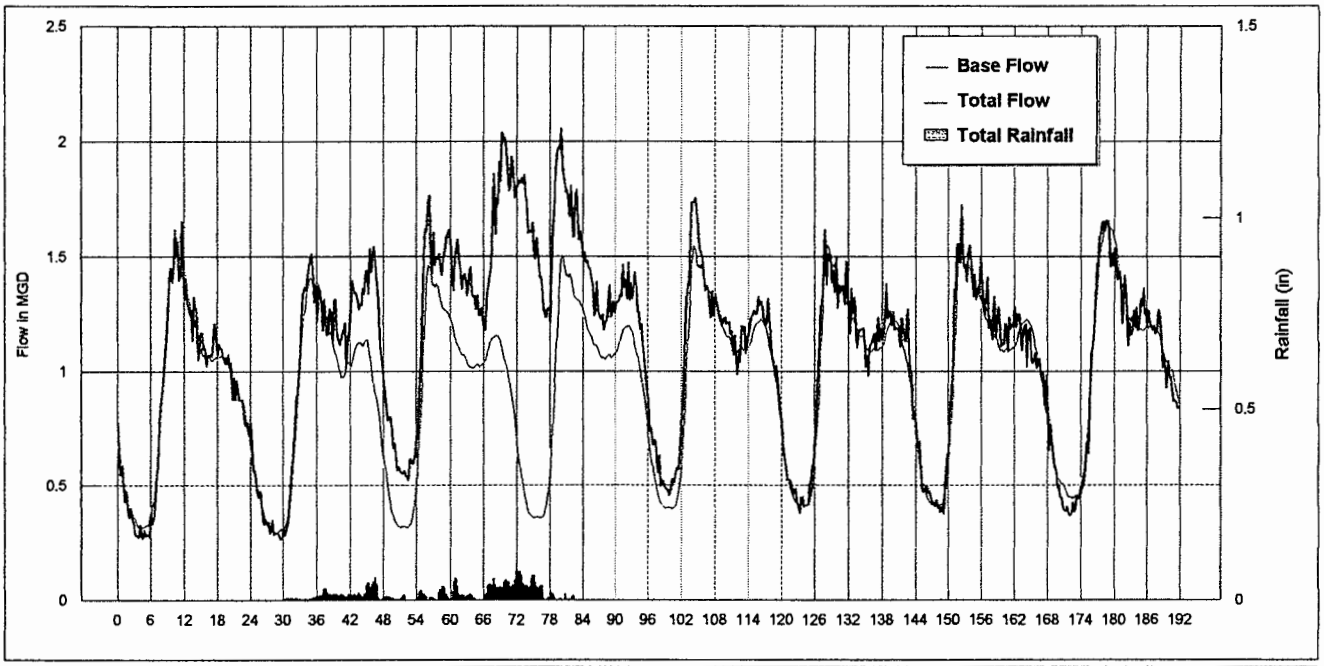

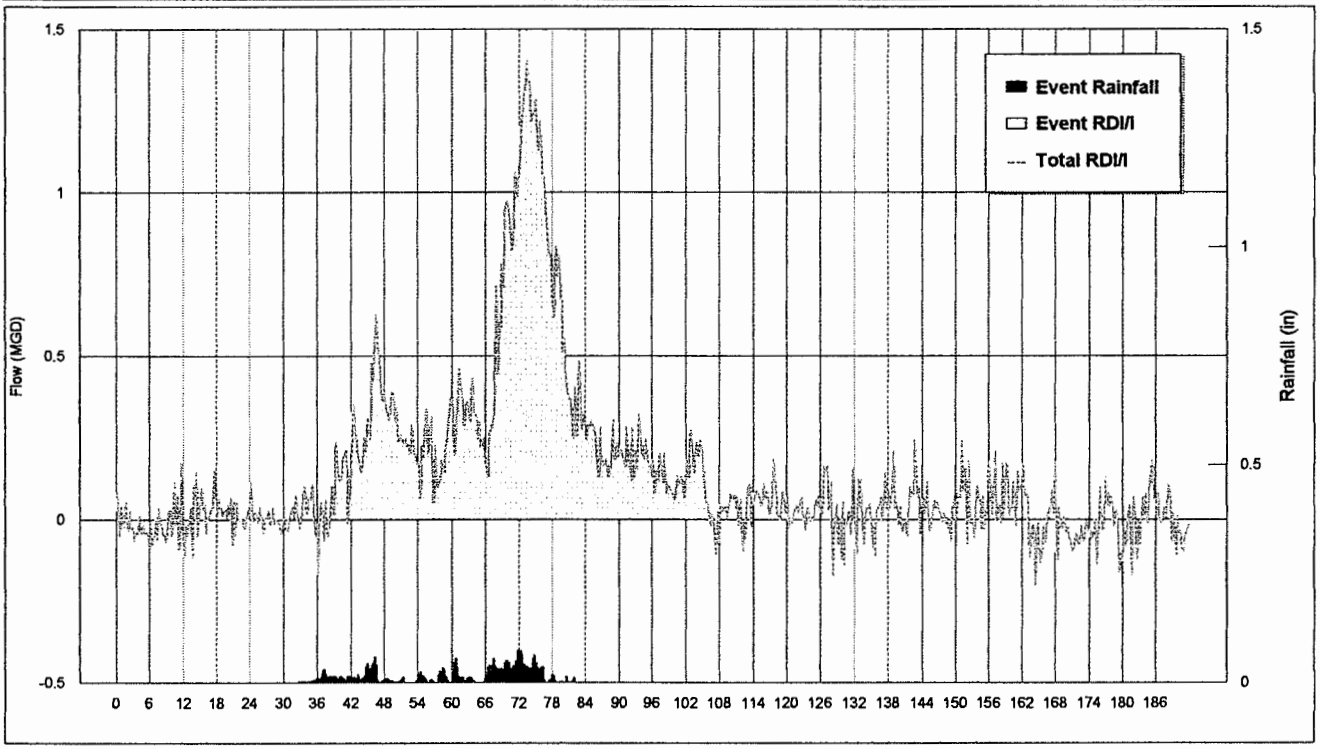

HOUR

Base: 0 Event: 0

Appendix G

MWH
MONTGOMERY WATSON HARZA

APPENDIX G

FLOW ISOLATION REPORT

ADS
Environmental Services

City of Thousand Oaks

California

Flow Isolation Study

Final Data Submission

Prepared for:

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Prepared by:

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April 2001

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Flow Isolation Data

The information provided herein has been produced by systems of ADS Environmental Services, Inc. which are protected by one or more of the following United States patents:

4,070,563 / 4,116,061 / 4,211,111 / 4,295,197 / 4,344,329 / 4,386,409
4,397,191 / 4,407,158 / 4,530,045 / 4,630,474 / 4,791,547 / 5,020,374

I. INTRODUCTION

Montgomery Watson contracted with ADS Environmental Services to provide flow isolation services in Thousand Oaks, California as part of a sewer interceptor analysis. Night time flow was isolated at 56 locations in areas that the City of Thousand Oaks had a history of inflow and infiltration. This report presents the results of the flow isolation study.

II. EXECUTIVE SUMMARY

Flow isolation work was initiated on March 5, 2001 when sufficient precipitation elevated groundwater levels and infiltration was evident. ADS performed 56 flow isolations in the City of Thousand Oaks which were completed by March 8, 2001. The flow isolation target areas were determined by a combination of historical information provided by the City of Thousand Oaks and preliminary analysis of flow monitoring data.

A. FLOW ISOLATIONS

Flow isolation is the process through which groundwater infiltration is isolated into smaller portions (micro-basin) within the basin in which it is located. Micro-basin infiltration may be further isolated to individual line segments. The process consists of recording flows through instantaneous weir readings taken during periods of minimum sewage contribution - normally between 12:00 midnight and 6:00 AM. By subtracting upstream contribution, net flows may be derived. Due to the time frame and minimum sewage contribution, the bulk of measured flow may be considered infiltration. Considering acceptable infiltration rates established for a particular job, a determination of *Excessive* or *Non - Excessive* may be applied to the measured infiltration rates and subsequent line cleaning and TV inspection justified.

Flow isolations were performed with calibrated volumetric V-Notch weirs and completed between the hours of 12:00 midnight and 6:00 AM to record infiltration. Pipe size, flow clarity, active leaks and other manhole or line observations were recorded by field crews. Flow isolations start at the furthest micro-basin upstream and continue downstream to the last dependent micro-basin. Manual depth and peak velocity readings were taken to generate a quantity when pipe size or flow conditions prevented accurate weir readings.

From the maps provided by Montgomery Watson, the study area was divided into micro-basins of approximately 2000 to 3000 linear feet (l/f). The map was scaled to determine the linear footage for each micro-basin.

Micro-basins were identified as dependent or independent. The flow quantities generated for an independent micro-basin are based on one flow isolation location independent of all other locations, while the flow quantities generated by a dependent micro-basin include flow from upstream micro-basins.

Upstream flow, derived from flow isolations, must be subtracted from dependent flow quantities to calculate net flow for the dependent micro-basins.

The number of inch - miles is determined by multiplying the length of each size pipe by diameter to obtain inch - feet; then divide the total inch - feet of all sizes by 5280 ft to obtain inch - miles.

Example:	Weir reading	=	27,000 GPD (gallons per day)
	6 inch pipe	=	2,300 feet
	8 inch pipe	=	1,000 feet
	10 inch pipe	=	345 feet
	6 inch x 2,300	=	13,800 inch - feet
	8 inch x 1,000	=	8,000 inch - feet
	10 inch x 345	=	+ 3,450 inch - feet
	Total	=	25,250 inch - feet
	25,250 inch - feet / 5280 feet/mile	=	4.78 inch - mile
	27,000 GPD / 4.78 inch - mile	=	5,648.5 GPD per IDM

27,000 GPD / 4.78 inch - miles = 5,648.5 gallons per day per inch diameter (GPD per IDM) of sewer. In this case the rate of infiltration is 5,648.5 (GPD per IDM).

Weirs are available for standard pipe sizes from 6 inch up to 18 inch pipe diameter. Weirs were placed in the input of selected sewer lines and checked for level by the field crew. Readings in gallons per day (GPD) were recorded off the face of the weir. Once the weir was installed, the flow was allowed to stabilize for at least five minutes before the first reading was taken. The weir reading was recorded only after the flow stabilized for the same reading to be repeated two consecutive times, two minutes apart.

When the weir does not fit because of odd shaped pipes, root intrusion, broken pipes or large dimensions, quantity must be calculated using depth and velocity measurements. Accurate pipe measurements are necessary for this type of flow quantification. The depth of the flow is manually measured with a folding carpenter ruler and velocity is obtained with a portable peak velocity meter.

Flow quantities in open channels are typically calculated using the continuity equation, ***Q(MGD)=A*V.***

Q = Quantity (MGD)
A = Wetted Area (ft^2)
V = Average Velocity (f/s)

Total Wetted Area is calculated in radian angles.

r = radius
d = depth flow
$A = (r^2 (\cos^{-1} ((r-d)/r)-(0.5\sin(2\cos^{-1}((r-d)/r)))))0.0069$

Average Velocity is calculated using standard 0.9 average / peak ratio

MGD conversion = 0.6464

Example: Diameter: 21.25" Radius: 10.63"
Depth: 4.63" Peak Velocity: 1.93 ft/sec

Total wetted area: 0.3963 (ft^2)

V_{peak} = 1.93 ft/sec
V_{avg} = 1.74 ft/sec

$Q = A_{(wetted)} \times V_{avg} \times MGD$ conversion
Q = 0.3963 ft^2 x 1.74 ft/sec x 0.6464
Q = 0.446 MGD

INFILTRATION FLOW ISOLATION

CITY OF THOUSAND OAKS

 actual

MICRO-SYSTEM	SYSTEM FOOTAGE	MH NO.	LINE NO.	DATE	TIME	DEPTH IN.	VELOCITY F/S	TOTAL MEASURED FLOW (GPD)	ACTUAL MEASURED FLOW (GPD)	INCH DIAM. MILE	GPD PER IN. MILE	PIPE SIZE (IN) HEIGHT
1	2425	W24-121	7:00	~~3/5/01~~ 3/4/01	23:46			4690	4690	3.67	1276	8
EXPLANATION Independent Basin												
2	3306	W24-116	9:00	3/5/01	12:13			37550	32860	5.01	6560	8
EXPLANATION Dependent on Basin 1												
3	4606	W24-38	9:00	3/5/01	12:37			37550	37550	6.98	5381	8
EXPLANATION Independent Basin												
4	3550	W24-34	3:00	3/5/01	12:58			61410	23860	5.38	4436	8
EXPLANATION Dependent on Basin 3												
5	3625	W24-34	9:00	3/5/01	1:07			40710	3160	5.49	575	8
EXPLANATION Dependent on Basin 2												
6	4156	W24-29.5	1:00	3/5/01	1:32			18110	18110	6.30	2876	8
EXPLANATION Independent Basin												
7	3787	W24-29A	3:00	3/5/01	1:51			40710	22600	5.74	3939	8
EXPLANATION Dependent on Basin 6												
8	3206	W24-29A	6:00	3/5/01	1:54	3.0"	8.0'	521700	419580	4.86	86376	8
EXPLANATION Dependent on Basins 4 and 5. Velocity too fast to perform weir calculation.												
9	3112	W24-85	6:00	3/5/01	2:18			37550	37550	4.72	7964	8
EXPLANATION Independent Basin												
10	4362	W24-40.1	6:00	3/5/01	2:33			57760	20210	6.61	3058	8
EXPLANATION Dependent on Basin 9												

INFILTRATION FLOW ISOLATION

CITY OF THOUSAND OAKS

MICRO-SYSTEM	SYSTEM FOOTAGE	MH NO.	LINE NO.	DATE	TIME	DEPTH IN.	VELOCITY F/S	TOTAL MEASURED FLOW (GPD)	ACTUAL MEASURED FLOW (GPD)	INCH DIAM. MILE	GPD PER IN. MILE	PIPE SIZE (IN) HEIGHT
11	2512	E16-51	8:00	3/5/01	3:12			11290	11290	3.81	2966	8
EXPLANATION Independent Basin												
12	3212	E16-94	6:00	3/5/01	3:31			9243	9243	4.87	1899	8
EXPLANATION Independent Basin												
13	4500	E16-9	9:00	3/5/01	3:48			25860	11290	6.82	1656	8
EXPLANATION Dependent on Basin 11												
14	2768	E16-37	3:00	3/5/01	4:02			15730	15730	4.19	3751	8
EXPLANATION Independent Basin												
15	2556	E16-8	9:00	3/5/01	4:22			31560	15830	3.87	4088	8
EXPLANATION Dependent on Basin 14												
16	3047	E16-8	6:00	3/5/01	4:25			49660	14557	4.62	3153	8
EXPLANATION Dependent on Basins 12 and 13												
17	4675	E36-2	3:00	3/5/01	4:46			13460	13460	7.08	1900	8
EXPLANATION Independent Basin												
18	3712	E36-1	3:00	3/5/01	5:07			38450	24990	5.62	4443	8
EXPLANATION Dependent on Basin 17												
19		E40	5:00	3/5/01	5:29	3.00"	8.54'	851400	851400	15.19	56235	14.5
EXPLANATION Trunk Line dependent on basins 56, 57												

INFILTRATION FLOW ISOLATION

CITY OF THOUSAND OAKS

MICRO-SYSTEM	SYSTEM FOOTAGE	MH NO.	LINE NO.	DATE	TIME	DEPTH IN.	VELOCITY F/S	TOTAL MEASURED FLOW (GPD)	ACTUAL MEASURED FLOW (GPD)	INCH DIAM. MILE	GPD PER IN. MILE	PIPE SIZE (IN) HEIGHT
20	5575	E16-28.1	5:00	~~3/6/01~~ 3/5/01	23:39			54180	54180	8.45	6414	8
EXPLANATION Independent Basin												
21	4494	E16-19	6:00	3/6/01	12:07			106160	51980	6.81	7634	8
EXPLANATION Dependent on Basin 20												
22	2691	E16	6:00	3/6/01	12:24	3.00"	3.38'	235100	128940	4.08	31624	8
EXPLANATION Dependent on Basin 21												
23	3659	E16-1.1	6:00	3/6/01	12:36	6.50"	0.83	206400	125220	8.14	15378	11.75
EXPLANATION Dependent on Basins 15 and 16												
24	4475	E11-15	6:00	3/6/01	1:05			76760	76760	6.78	11321	8
EXPLANATION Independent Basin												
25	3759	E11-1	6:00	3/6/01	1:29			88990	12230	5.70	2147	8
EXPLANATION Dependent on Basin 24												
26	3290	E10-67	10:00	3/8/01	11:38			40710	40710	4.98	8167	8
EXPLANATION Independent Basin - clear flow - Could not flow isolate on 3/6 due to downstream surcharge												
[redacted]												
28	6375	X33-14E		3/6/01				23170	23170	9.66	2399	8
EXPLANATION Independent Basin												
29	3138	X33-B	3:00	3/6/01	3:52			50690	27520	4.75	5788	8
EXPLANATION Dependent on Basin 28												

INFILTRATION FLOW ISOLATION

CITY OF THOUSAND OAKS

MICRO-SYSTEM	SYSTEM FOOTAGE	MH NO.	LINE NO.	DATE	TIME	DEPTH IN.	VELOCITY F/S	TOTAL MEASURED FLOW (GPD)	ACTUAL MEASURED FLOW (GPD)	INCH DIAM. MILE	GPD PER IN. MILE	PIPE SIZE (IN) HEIGHT
30	3850	X33-7	3:00	3/6/01	4:13			124600	73910	5.83	12670	8
EXPLANATION Dependent on Basin 29												
31	4706	X33-7	12:00	3/6/01	4:16			47280	47280	7.13	6631	8
EXPLANATION Independent Basin												
32	2518	X33	12:00	3/6/01	4:26	3.0"	2.78'	193400	21520	3.82	5641	8
EXPLANATION Dependent on Basin 21												
33		X32-1	3:00	3/6/01	4:57	5.0"	2.42'	504100	504100	83.7	6022	11.75
EXPLANATION Subtraction Basin												
34	20083	X27	6:00	3/6/01	5:37	5.5"	.8'	141310	141310	38.04	3715	10
EXPLANATION Independent Basin												

INFILTRATION FLOW ISOLATION

CITY OF THOUSAND OAKS

MICRO-SYSTEM	SYSTEM FOOTAGE	MH NO.	LINE NO.	DATE	TIME	DEPTH IN.	VELOCITY F/S	TOTAL MEASURED FLOW (GPD)	ACTUAL MEASURED FLOW (GPD)	INCH DIAM. MILE	GPD PER IN. MILE	PIPE SIZE (IN) HEIGHT
35	3419	E10-81	9:00	3/8/01	12:00			34490	34490	5.18	6658	8
EXPLANATION Independent Basin												
36	3138	E10-64	8:00	3/8/01	12:28			47280	12790	4.75	2690	8
EXPLANATION Dependent on Basin 35												
37	3037	E10-63	10:00	3/8/01	12:48			88990	1000	4.60	217	8
EXPLANATION Dependent on Basins 26 and 36												
38	3240	E10-31	12:00	3/8/01	1:10			97460	8470	4.91	1725	8
EXPLANATION Dependent on Basin 37												
39	2400	E10-46	11:00	3/8/01	1:20	3.75"	1.90'	177600	177600	3.64	48840	8
EXPLANATION Independent Basin												
40	2606	E10-34	8:00	3/8/01	1:34	2.38"	4.35'	251700	74100	4.94	15013	10
EXPLANATION Dependent on Basin 39												
41	4209	E10-31	6:00	3/8/01	1:02	3.63"	4.32'	449300	197600	7.97	24788	10
EXPLANATION Dependent on Basin 40												
42	3097	E10-26	12:00	3/8/01	1:45			23170	23170	4.69	4938	8
EXPLANATION Independent Basin												
43	3131	E10-10	9:00	3/8/01	2:05	7.25"	2.38'	586400	16470	5.93	2777	10
EXPLANATION Dependent on Basins 38, 41 and 42												
44	4506	E10-10	12:00	3/8/01	2:24	7.38"	2.35'	589900	3500	8.53	410	10
EXPLANATION Dependent on Basin 43 - Measurement taken at downstream line.												

INFILTRATION FLOW ISOLATION

CITY OF THOUSAND OAKS

Sheet 6 and 7

MICRO-SYSTEM	SYSTEM FOOTAGE	MH NO.	LINE NO.	DATE	TIME	DEPTH IN.	VELOCITY F/S	TOTAL MEASURED FLOW (GPD)	ACTUAL MEASURED FLOW (GPD)	INCH DIAM. MILE	GPD PER IN. MILE	PIPE SIZE (IN) HEIGHT
45	6331	Y20-46	3:00	~~3/7/01~~ 3/6/01	11:46			18110	18110	9.59	1888	8
EXPLANATION Independent Basin												
46	6318	Y20-23	3:00	3/7/01	12:09			49660	31550	11.97	2637	10
EXPLANATION Dependent on Basin 45												
47	3750	A14-22	2:00	3/7/01	12:40			13460	13460	5.68	2369	8
EXPLANATION Independent Basin												
48	4512	A14-5	4:00	3/7/01	1:11			18110	4650	6.84	680	8
EXPLANATION Dependent on Basin 47												
49	3987	A14	1:00	3/7/01	1:39			25860	7750	6.04	1283	8
EXPLANATION Dependent on Basin 48												
50	3493	A18-2	2:00	3/7/01	1:58			25860	25860	5.29	4886	8
EXPLANATION Independent Basin												
51	4556	A18-1	2:00	3/7/01	2:22			42100	16240	6.90	2353	8
EXPLANATION Dependent on Basin 50 - Measurement taken at downstream line.												
52	3800	E28-20	7:00	3/7/01	3:01			47280	47280	5.76	8212	8
EXPLANATION Independent Basin												
53	4487	E28-17	7:00	3/7/01	3:18			65140	17860	6.80	2627	8
EXPLANATION Dependent on Basin 52												
54	3918	E28-10	9:00	3/7/01	3:35			84850	19710	5.94	3320	8
EXPLANATION Dependent on Basin CJ												
55	3262	E28-3	7:00	3/7/01	4:13			110590	25740	4.94	5208	8
EXPLANATION Dependent on Basin 54												

INFILTRATION FLOW ISOLATION

CITY OF THOUSAND OAKS

MICRO-SYSTEM	SYSTEM FOOTAGE	MH NO.	LINE NO.	DATE	TIME	DEPTH IN.	VELOCITY F/S	TOTAL MEASURED FLOW (GPD)	ACTUAL MEASURED FLOW (GPD)	INCH DIAM. MILE	GPD PER IN. MILE	PIPE SIZE (IN) HEIGHT
56		E47-119	3:00	3/8/01	2:56	3.38"	1.72'	180500	180500	94.23	1916	11.88
EXPLANATION Trunk Line												
57		E47-119	6:00	3/8/01	2:50	3.38"	1.45'	174700	174700	104.96	28660	15
EXPLANATION Trunk Line												

Appendix H

MWH
MONTGOMERY WATSON HARZA

APPENDIX H

SMOKE TESTING REPORT

City of Thousand Oaks
California

Smoke Testing Study
November 2001

Prepared for:
Montgomery Watson
1230 Columbia Street
Suite 750
San Diego, CA 92101-8536

Prepared by:
ADS
ENVIRONMENTAL SERVICES

INTRODUCTION

ADS Environmental Services was contracted by Montgomery Watson to perform sanitary sewer smoke testing for the City of Thousand Oaks. The purpose of the SSES work described herein was to determine the location of defects in the areas of the sanitary sewer system pre-selected for this study.

This smoke testing 24,426 LF in flow Micro Systems: 8, 26, 35, 39, 40, 41, and 42. Smoke testing was used as a rainfall simulation technique to identify potential inflow sources/ defects.

Basin 8 included the Ventu Estates/Villa Trailer park. 3,691 feet of service laterals were tested in the trailer park. Sewer maps of the trailer park were not available, so ADS recorded line information discovered during the smoke testing onto the trailer park site map. The trailer park site map can be found in Appendix B. Line segments in the trailer park were named by putting a "SL" (Service Line) in front of the known downstream manhole number.

STUDY AREA

Micro Systems: 8, 26, 35, 39, 40, 41, and 42

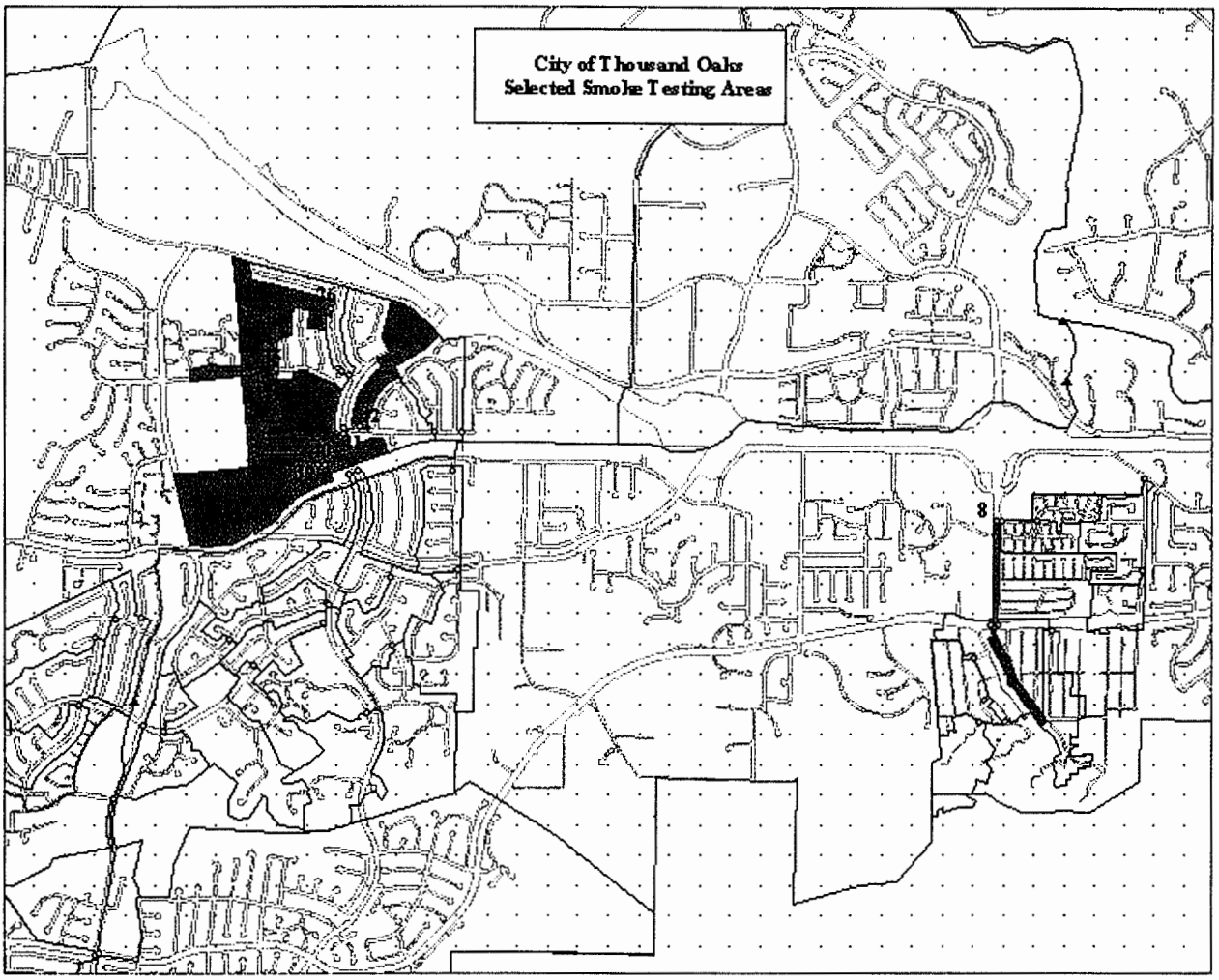


Figure 1 – Study Areas for Smoke Testing

DATA COLLECTION AND ENTRY

Data collection and entry are integral parts of a successful SSES project. ADS utilized the *GBA Master Series®* Infrastructure Management Software to record and analyze all defect observation data. All field defect observations noted during smoke testing were entered into the Sewer Master software module for analysis. The software utilizes the Microsoft ACCESS engine to manipulate data and output reports that categorize and quantify (in terms of estimated I/I potential) each type of defect within each basin.

SMOKE TESTING

Smoke testing identifies defects that allow rainwater to enter into the sewer system from the surface. Smoke testing is intended to detect inflow such as storm sewer cross-connections and point source inflow leaks in drainage paths or ponding areas, roof leaders, cellar, yard, area drains, fountain drains, abandoned building sewers, and faulty service connections.

PROCEDURE

Smoke testing was conducted with a two-person crew using a 4,000 cfm blower and consecutive three-minute non-toxic, odorless, and non-staining smoke candles. Smoke testing was limited to not more than four line segments or about 900 linear feet per test.

All observations regarding each identified leak were documented. Information includes location, personnel, date, and a schematic layout of the manhole and sewer line under testing. As a minimum, the following information is included:

- Numbered digital photo
- Description of leak including address
- Distance and offset from either the upstream or downstream manhole
- Area and type of surface drained by the leak

Digital photographs of all smoke leaks discovered were taken to document the leak location. The digital photographs are associated with the respective smoke defect. The photos are numbered according to the pipe segment and leak number (i.e. E10-101 – E10-98LK1.jpg).

The photographs were taken of smoke coming out of the ground, catch basins, pipes and other sources during the test. The photographs include the location of the smoke with reference to some recognizable topographic feature (i.e., house).

SMOKE TESTING
NOTICE TO RESIDENTS

SMOKE TESTING NOTIFICATIONS

Prior to smoke testing, ADS personnel distributed "Notice to Residents", to all affected areas. Commercial properties were notified in person to ensure that all necessary parties were informed of the pending activities.

ADS maintained communication with the local fire and police departments as well as a list of pre-determined contacts established at the job onset on a daily basis to ensure the proper authorities were aware of the smoke testing activities.

DEFECT LOCATION METHODOLOGY

ADS utilized a laser range finder to define the location of defects found during the smoke testing process. The laser range finder enabled highly accurate measurements to be taken in the field. A prism was utilized to assure a 90-degree relationship between the mainline distance and the offset to the defect. The field data was utilized to produce the necessary sketches.

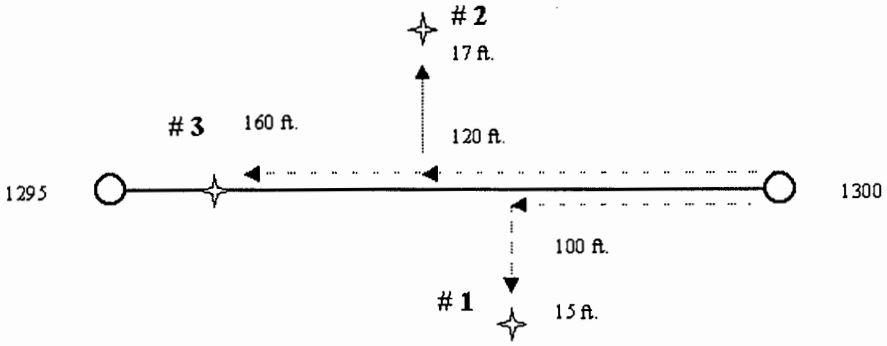


Figure 2 - Defect Location Methodology

Identified manholes were used as the reference point from which defect locations were measured. On each segment, each defect was measured along the mainline to a point 90 degrees adjacent to the defect, and then a separate offset measurement was taken from that point to the defect either left or right as depicted in Figure 2.

Standard forms were utilized to record all I/I defect data. Each smoke form identifies the type of defect (manhole, mainline, municipal service, or private service), leak location (grass, pavement, etc.), severity of the leak, and line segment on which the leak was identified.

ANALYSIS

Smoke testing observations were entered into the *GBA Sewer Master®* computer database for archiving and reporting purposes. *Sewer Master®* stores data on the collection system including a comprehensive manhole and pipe inventory. The system inventory is used by the inspection module of *Sewer Master®* to report smoke testing activities. Pictures taken on smoke test observations are linked to smoke test inspection records. The results can then be viewed, queried, exported and reported. The database was used to generate the reports found in the Appendices.

The severity of inflow defects in the collection system was estimated using the Rational Formula

$$Q = C \times I \times A$$

and an assumed rain event of 1.25" per hour.

Q = flow in cubic feet per second

C = runoff coefficient based on surface type

I = rainfall intensity in inches per hour

A = surface area in acres

A rainfall intensity (I) was assumed of 1.25 inches per hour. To calculate the surface area, field crews measured the extent of the area that would drain into the defect during a rain event. The severity of the inflow defects was estimated based on the quantity of smoke observed and the particular typed of defect.

SMOKE TESTING RESULTS

Eight (8) defects and one (1) suspect defects were identified during the smoke testing process. The majority of these defects were found along private laterals, cleanouts, and manholes. A summary of defects is located below.

Inflow Source	Smoke Density	US Manhole	DS Manhole	Address			General Location/ Comments	Gallons Per Minute
Cleanout	Light	E10-99	E10-90	758	Jenny	Drive	Clean Out in Landscaped in Front Yard	0.00
Cleanout	Medium	SLE10-39	E10-39	594	Dena	Drive	Clean Out in Landscaped in Front Yard	0.02
Cleanout	Light	E10-38	E10-37	512	Dena	Drive	Clean Out in Landscaped in Front Yard	0.02
Cleanout	Light	E10-28	E10-27	566	Dorena	Drive	Clean Out in Landscaped in Front Yard	0.05
Cleanout	Light	E10-98	E10-97	3480	Gloria	Drive	Clean Out in Front Yard Next to House	0.00
Cleanout	Light	SLW24-33	W24-33	105	Madona	Drive	Clean Out Next to Trailer Near Park Bench	0.23
Other	Light	E10-89	E10-88	3458	Ethel	Court	Mobile Camper Unit Appears to be Tied to Sewer	1.00
Service Lateral	Light	E10-101	E10-98	851	Jenny	Drive		1.23
Service Lateral	Light	SLW24-33	W24-33	105	Madona	Drive	Exposed Service Lateral Next to Trailer Near Park Bench	0.39
Manhole		E10-96	E10-95					0.21

Figure 3 - Summary of Defects

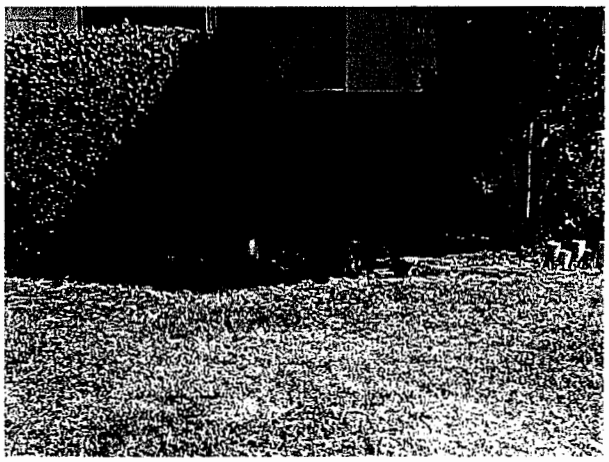
Locations of the defects are identified in Appendix A. It contains a list of the distances from upstream or downstream manholes and offset directions. In order to assist in identifying the locations of the defects, site sketches with addresses, locations of defects, a picture of the defect, and City manhole numbers have been included in Appendix A.

CONCLUSIONS AND RECOMMENDATIONS

ADS recommends repairing all identified smoke testing defects. These defects typically represent some of the most significant inflow sources to the sewer collection system and are often easily remediated. The City of Thousand Oaks should first consider addressing all defects that are simple repairs, because these defects can remove a significant portion of inflow in the sewer lines tested.

The smoke testing attempted to locate sewer line defects which cause significant sewer inflow problems within the study area. It should be noted that this study can only be used as a guide to rank the sewers that should provide the largest amount of Inflow reduction per rehabilitation dollar spent. It is difficult to give precise estimates of the effects of rehabilitating a particular defect because of the complex and dynamic nature of the defect's response to rainfall and its effect on the sewer system. In some cases, fixing a defect in one area will simply transfer the problem to another area. Because of this, the preferred method of sewer system rehabilitation is to break the system into many manageable sub-basins and to measure basin response to rehabilitative actions by quantifying the flow before and after repairs. In this manner, the net response to sewer repairs can be quantified for each basin and it can be demonstrated whether or not a rehabilitative effort was effective.

GBA Report Master® Sewer Smoke Testing and Observation Image Data.

Images	Data
	**Smoke Test Line** **US Manhole:** E10-99 **DS Manhole:** E10-90 **Date Inspected:** 11/1/2001 **Inspection Crew:** S.J. **Total GPM:** 0 **Comments:** **Description:** LK1 **File Name:** file://C:/GBAMastr/Pict/Sewer/E10-99 - E10-90 LK1.jpg
	Smoke Test Line **US Manhole:** E10-99 **DS Manhole:** E10-90 **Date Inspected:** 11/1/2001 **Inspection Crew:** S.J. **Total GPM:** 0 **Comments:** **Description:** LK1A **File Name:** file://C:/GBAMastr/Pict/Sewer/E10-99 - E10-90 LK1A.jpg

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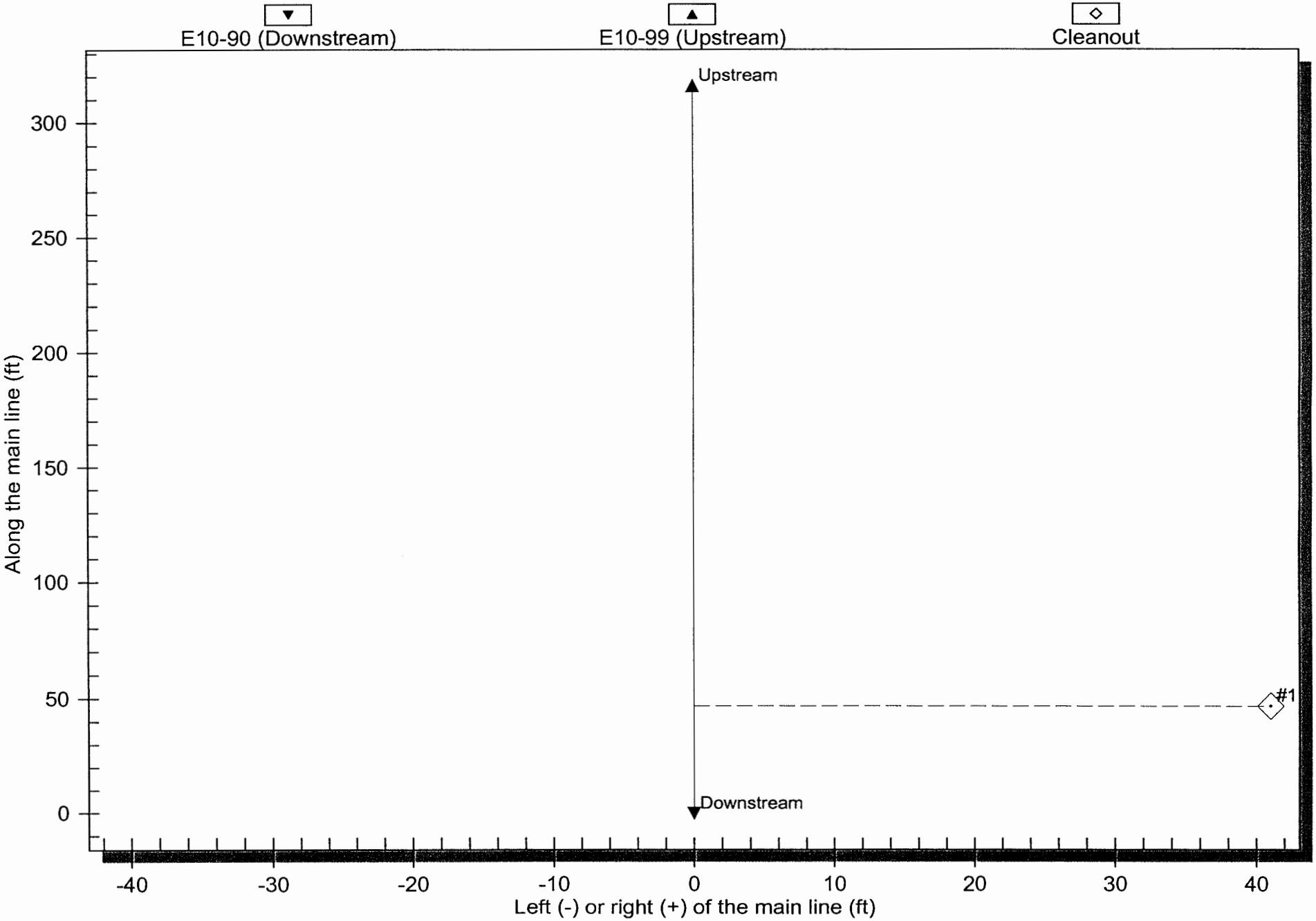
ADS Environmental Services

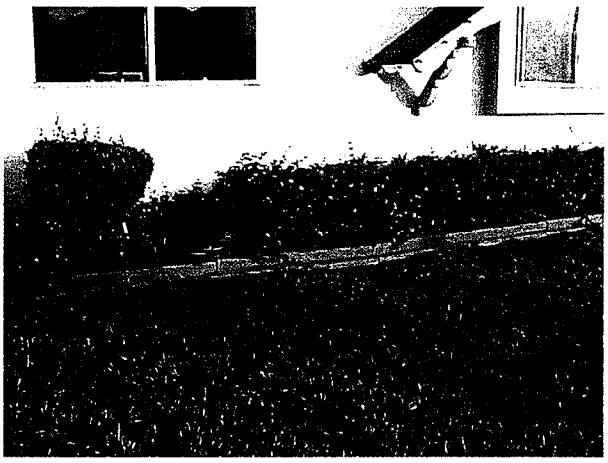
Date: 11/1/2001, Crew: S.J.

#	Address	Source Type	Severity	Owner	Distance (ft)	Offset (ft)	Side
1:	758 Jenny Dr.	Cleanout	Light	Private	47.00	41.00	Right



GBA Report Master® Sewer Smoke Testing and Observation Image Data.

Images | **Data**



Smoke Test Line
US Manhole: SLE10-39
DS Manhole: E10-39
Date Inspected: 11/1/2001
Inspection Crew: SJ
Total GPM: 0.02
Comments:
Description: LK1
File Name: file://C:/GBAMastr/Pict/Sewer/SLE10-39 - E10-39 LK1.jpg

Smoke Test Line
US Manhole: SLE10-39
DS Manhole: E10-39
Date Inspected: 11/1/2001
Inspection Crew: SJ
Total GPM: 0.02
Comments:
Description: LK1A
File Name: file://C:/GBAMastr/Pict/Sewer/SLE10-39 - E10-39 LK1A.jpg

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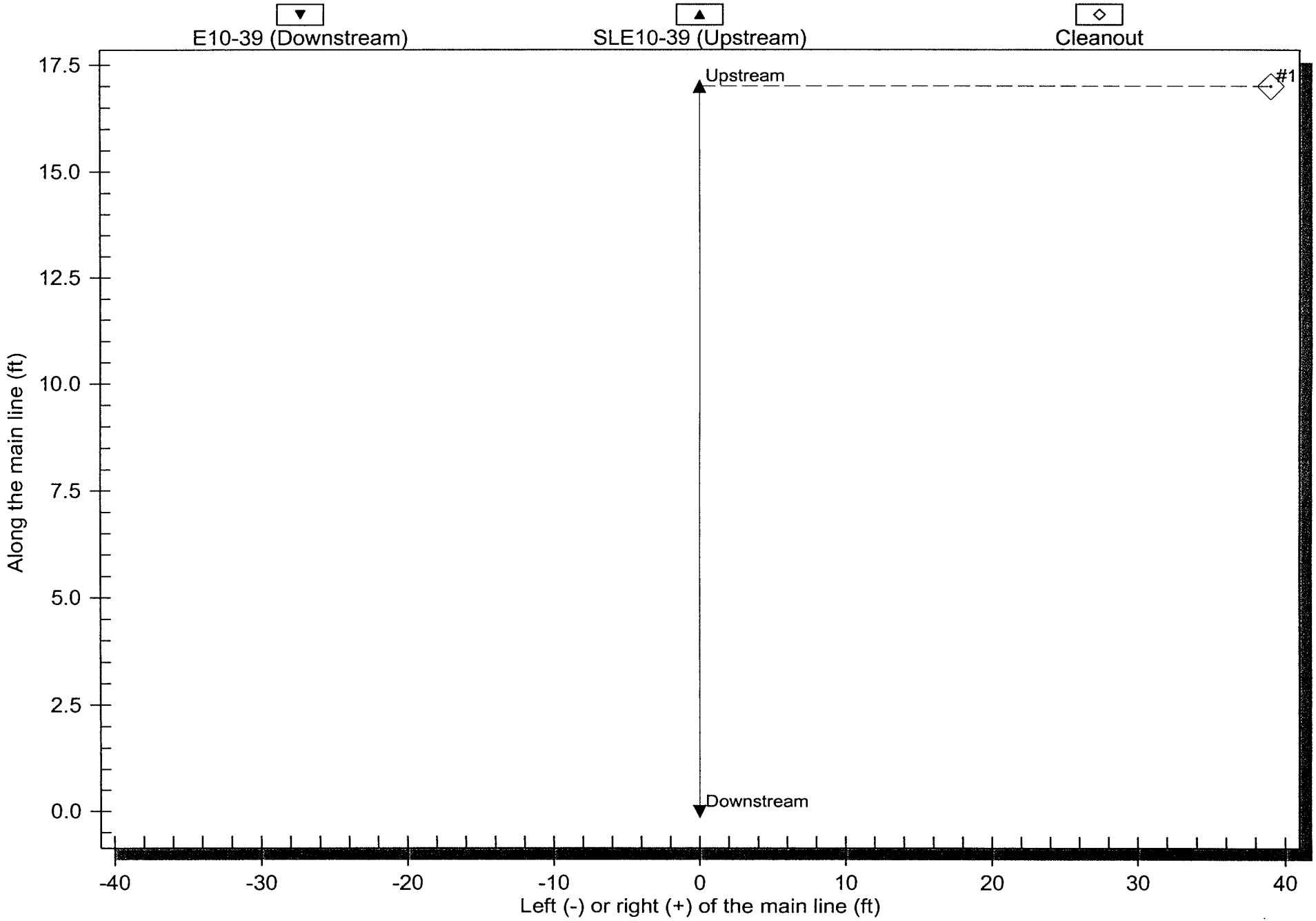
ADS Environmental Services

Date: 11/1/2001, Crew: SJ

#	Address	Source Type	Severity	Owner	Distance (ft)	Offset (ft)	Side
1:	594 Dena Dr.	Cleanout	Light	Private	17.00	39.00	Right

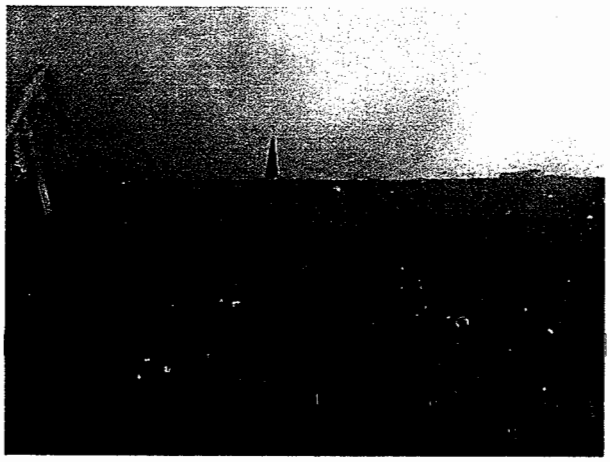


GBA Report Master® Sewer Smoke Testing and Observation Image Data.

Images

Data

Smoke Test Line
US Manhole: E10-38
DS Manhole: E10-37
Date Inspected: 11/1/2001
Inspection Crew: SJ
Total GPM: 0.02
Comments:
Description: LK1
File Name: file://C:/GBAMastr/Pict/Sewer/E10-38 - E10-37 LK1.jpg



Smoke Test Line
US Manhole: E10-38
DS Manhole: E10-37
Date Inspected: 11/1/2001
Inspection Crew: SJ
Total GPM: 0.02
Comments:
Description: LK1A
File Name: file://C:/GBAMastr/Pict/Sewer/E10-38 - E10-37 LK1A.jpg

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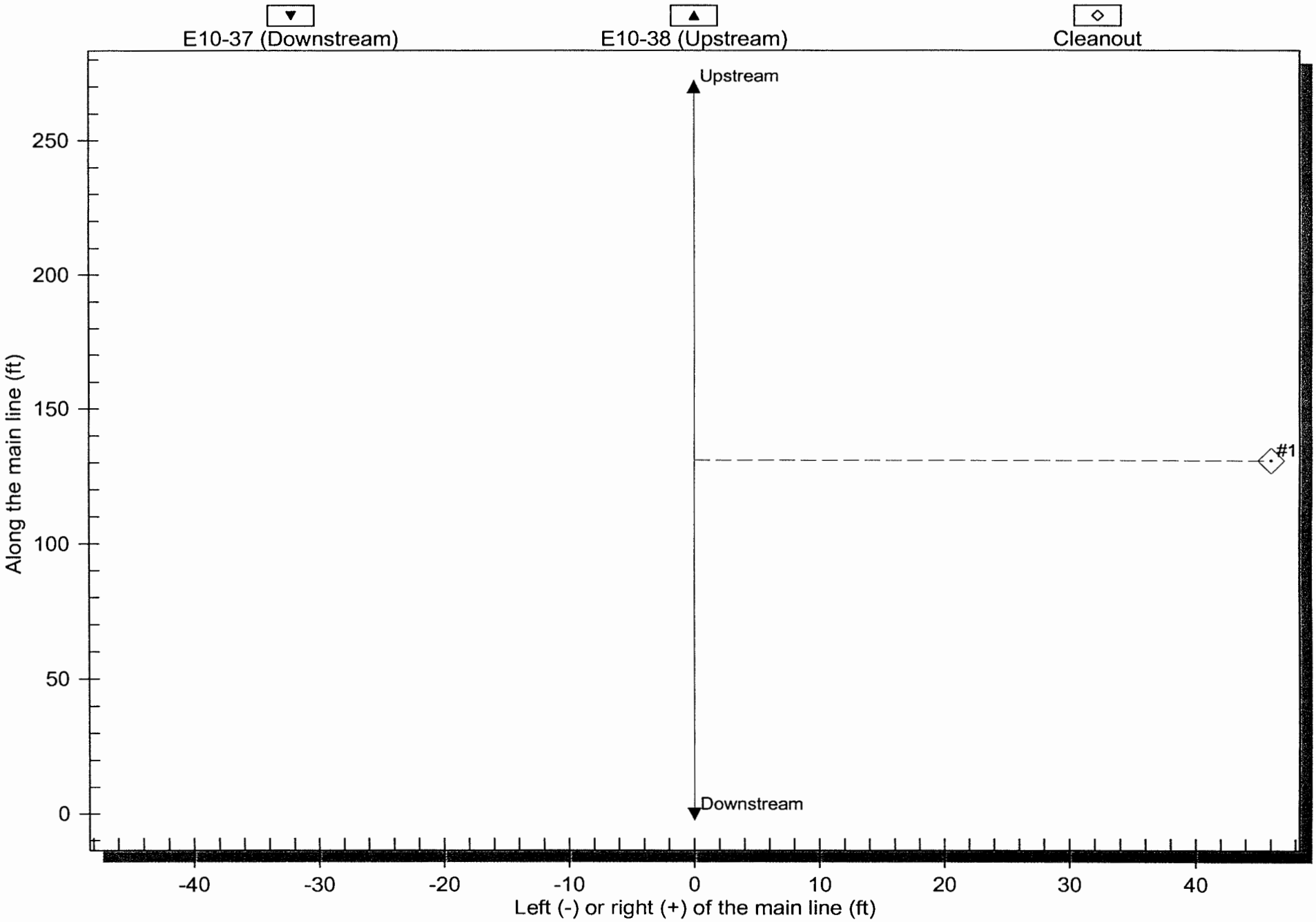
ADS Environmental Services

Date: 11/1/2001, Crew: SJ

#	Address	Source Type	Severity	Owner	Distance (ft)	Offset (ft)	Side
1:	512 Dena Dr.	Cleanout	Medium	Private	131.00	46.00	Right



GBA Report Master® Sewer Smoke Testing and Observation Image Data.

Images	Data
	Smoke Test Line **US Manhole:** E10-28 **DS Manhole:** E10-27 **Date Inspected:** 10/31/2001 **Inspection Crew:** SJ **Total GPM:** 0.05 **Comments:** **Description:** LK1 **File Name:** file://C:/GBAMastr/Pict/Sewer/E10-28 - E10-27 LK1.jpg
	Smoke Test Line **US Manhole:** E10-28 **DS Manhole:** E10-27 **Date Inspected:** 10/31/2001 **Inspection Crew:** SJ **Total GPM:** 0.05 **Comments:** **Description:** LK1A **File Name:** file://C:/GBAMastr/Pict/Sewer/E10-28 - E10-27 LK1A.jpg

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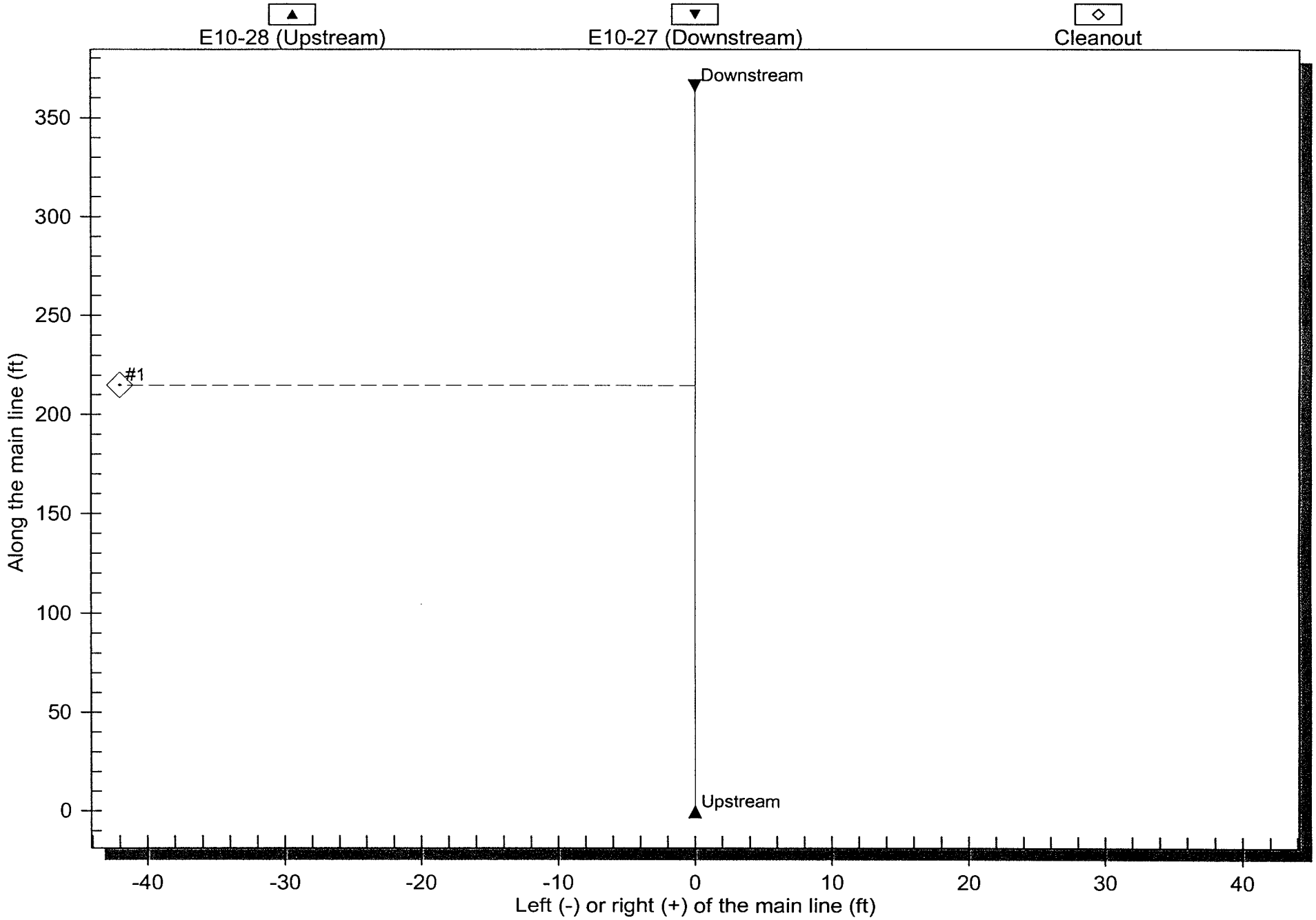
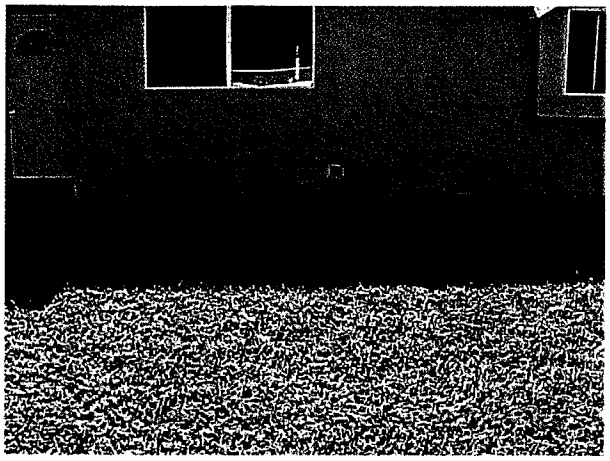
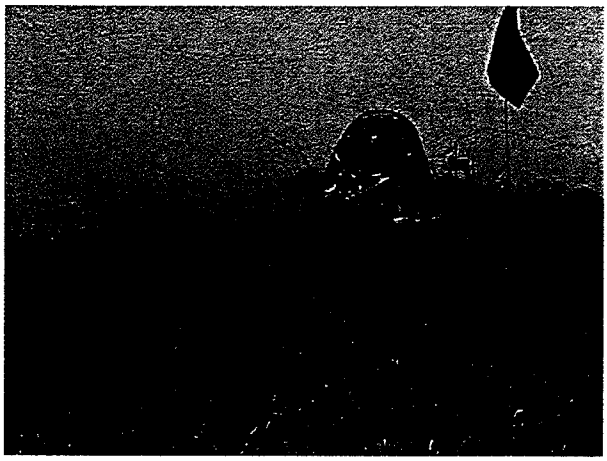
ADS Environmental Services

Date: 10/31/2001, Crew: SJ

#	Address	Source Type	Severity	Owner	Distance (ft)	Offset (ft)	Side
1:	566 Dorena Dr.	Cleanout	Light	Private	215.00	42.00	Left



GBA Report Master® Sewer Smoke Testing and Observation Image Data.

Images	Data
	**Smoke Test Line** **US Manhole:** E10-98 **DS Manhole:** E10-97 **Date Inspected:** 10/31/2001 **Inspection Crew:** SJ **Total GPM:** 0 **Comments:** **Description:** LK1 **File Name:** file://C:/GBAMastr/Pict/Sewer/E10-98 - E10-97 LK1.jpg
	**Smoke Test Line** **US Manhole:** E10-98 **DS Manhole:** E10-97 **Date Inspected:** 10/31/2001 **Inspection Crew:** SJ **Total GPM:** 0 **Comments:** **Description:** LK1A **File Name:** file://C:/GBAMastr/Pict/Sewer/E10-98 - E10-97 LK1A.jpg

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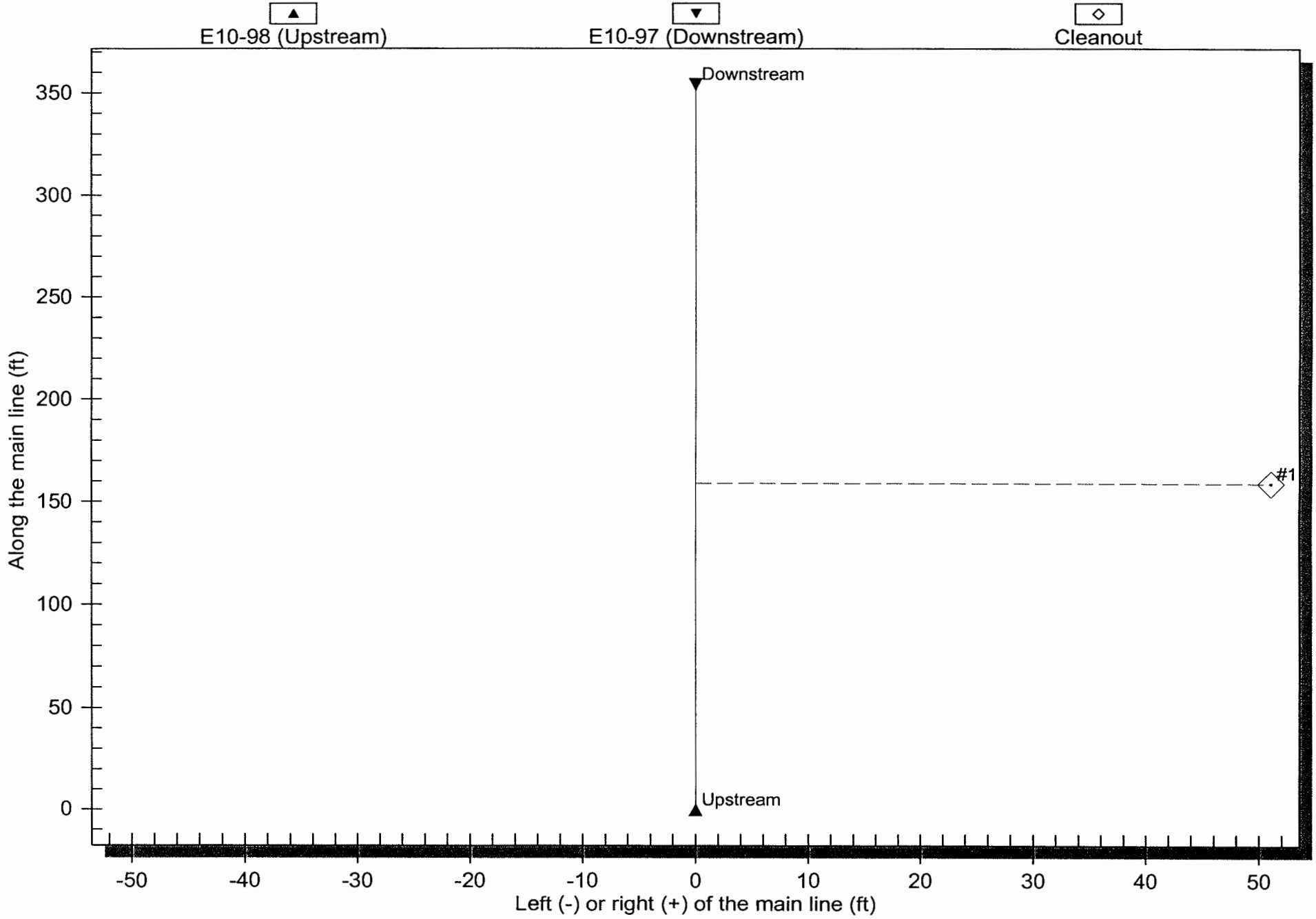
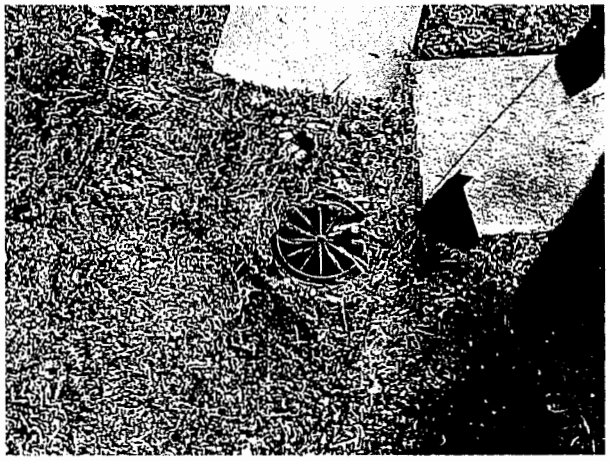
ADS Environmental Services

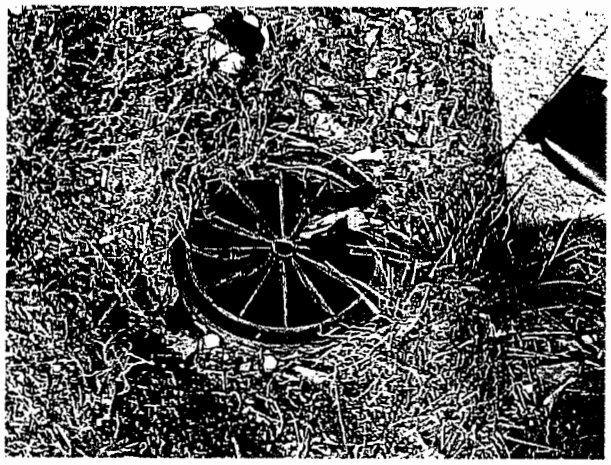
Date: 10/31/2001, Crew: SJ

#	Address	Source Type	Severity	Owner	Distance (ft)	Offset (ft)	Side
1:	3480 Gloria Dr.	Cleanout	Light	Private	159.00	51.00	Right



GBA Report Master® Sewer Smoke Testing and Observation Image Data.

Images	Data
	Smoke Test Line **US Manhole:** SLW24-33 **DS Manhole:** W24-33 **Date Inspected:** 10/31/2001 **Inspection Crew:** S.J. **Total GPM:** 1.23 **Comments:** **Description:** LK1 **File Name:** file://C:/GBAMastr/Pict/Sewer/SLW24-33 - W24-33 LK1.jpg
	Smoke Test Line **US Manhole:** SLW24-33 **DS Manhole:** W24-33 **Date Inspected:** 10/31/2001 **Inspection Crew:** S.J. **Total GPM:** 1.23 **Comments:** **Description:** LK1A **File Name:** file://C:/GBAMastr/Pict/Sewer/SLW24-33 - W24-33 LK1A.jpg
	**Smoke Test Line** **US Manhole:** SLW24-33 **DS Manhole:** W24-33 **Date Inspected:** 10/31/2001 **Inspection Crew:** S.J. **Total GPM:** 1.23 **Comments:** **Description:** LK2 **File Name:** file://C:/GBAMastr/Pict/Sewer/SLW24-33 - W24-33 LK2.jpg



Smoke Test Line
US Manhole: SLW24-33
DS Manhole: W24-33
Date Inspected: 10/31/2001
Inspection Crew: S.J.
Total GPM: 1.23
Comments:
Description: LK2A
File Name: file://C:/GBAMastr/Pict/Sewer/SLW24-33 - W24-33 LK2A.jpg

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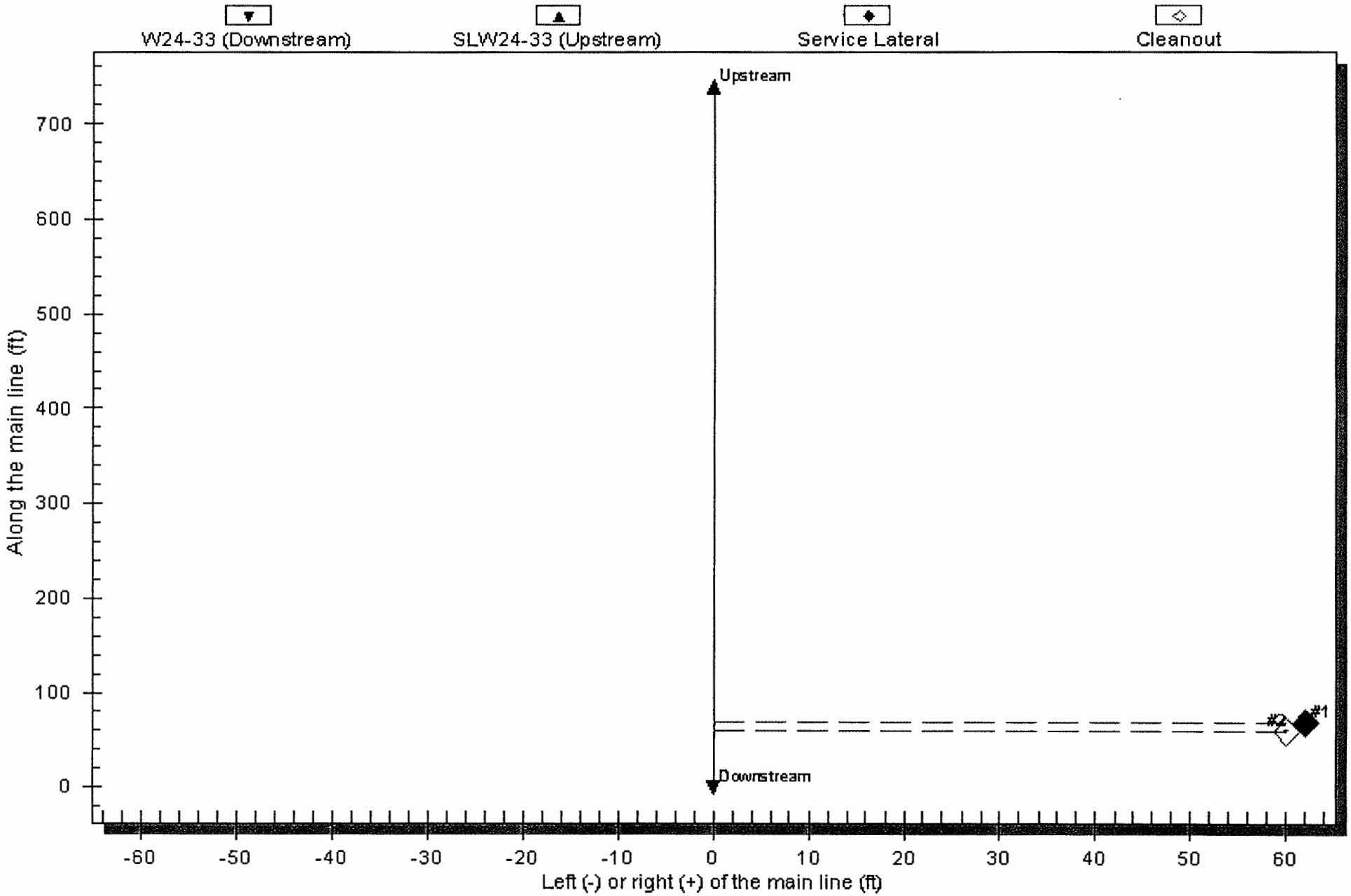
ADS Environmental Services

Date: 10/31/2001, Crew: S.J.

#	Address	Source Type	Severity	Owner	Distance (ft)	Offset (ft)	Side
1:	105 Madona Dr.	Service Lateral	Light	Private	70.00	62.00	Right
2:	105 Madona Dr.	Cleanout	Light	Private	61.00	60.00	Right



GBA Report Master® Sewer Smoke Testing and Observation Image Data.

Images	Data
	Smoke Test Line **US Manhole:** E10-89 **DS Manhole:** E10-88 **Date Inspected:** 11/1/2001 **Inspection Crew:** SJ **Total GPM:** 0 **Comments:** **Description:** LK1 **File Name:** file://C:/GBAMastr/Pict/Sewer/E10-89 - E10-88 LK1.jpg
	Smoke Test Line **US Manhole:** E10-89 **DS Manhole:** E10-88 **Date Inspected:** 11/1/2001 **Inspection Crew:** SJ **Total GPM:** 0 **Comments:** **Description:** LK1A **File Name:** file://C:/GBAMastr/Pict/Sewer/E10-89 - E10-88 LK1A.jpg

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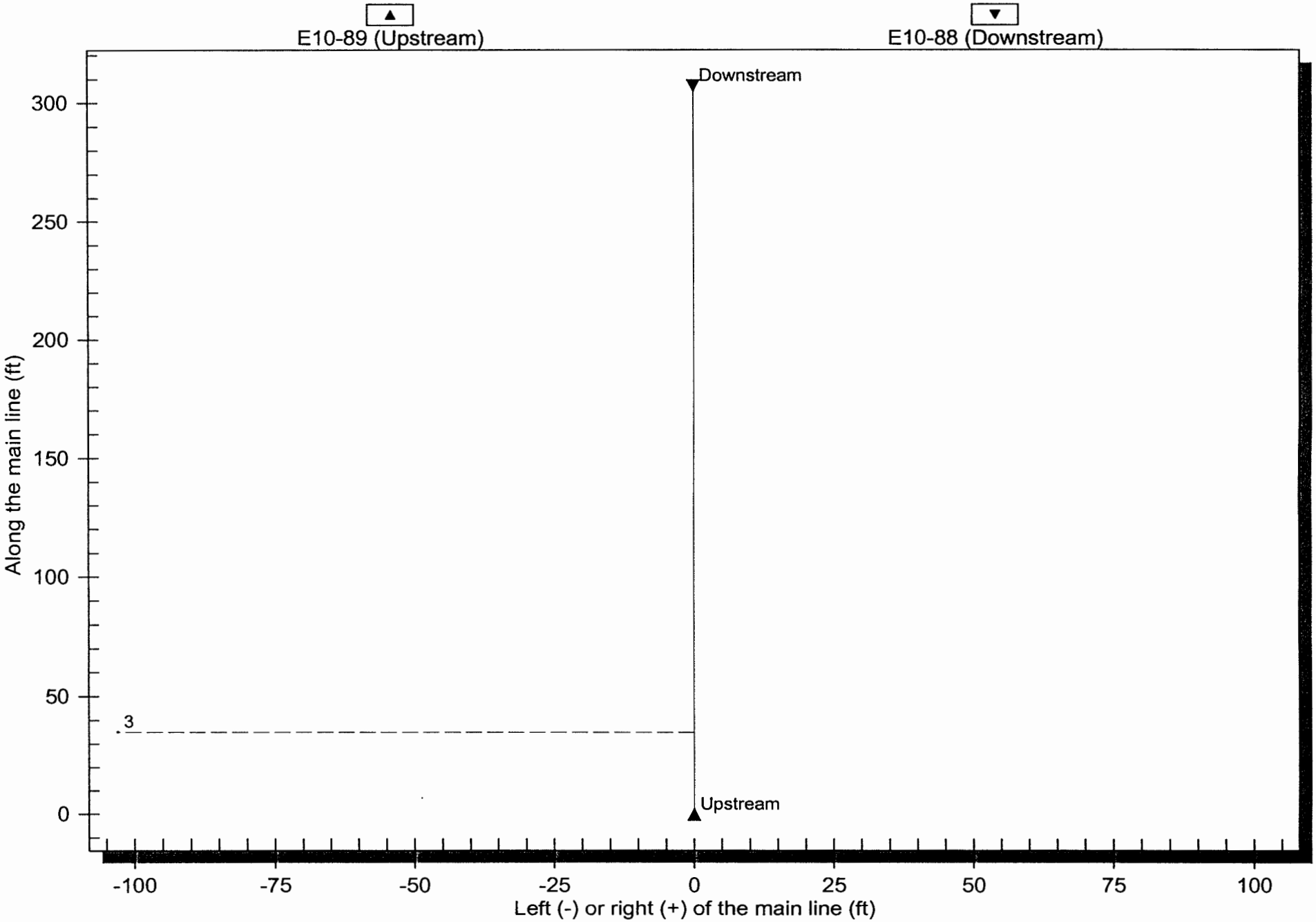
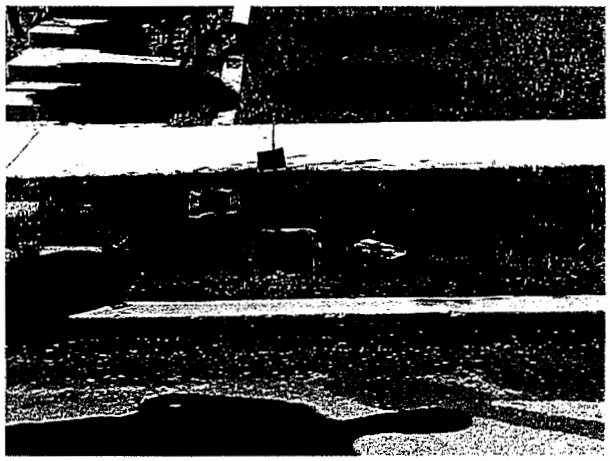
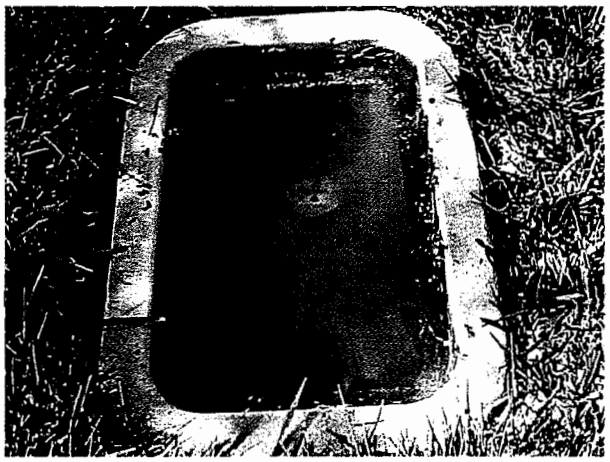
Date: 11/1/2001, Crew: SJ

#	Address	Source Type	Severity	Owner	Distance (ft)	Offset (ft)	Side
1:	3458 Ethel Ct.	Other	Medium	Private	35.00	103.00	Left



GBA Report Master® Sewer Smoke Testing and Observation Image Data.

Images	Data
	**Smoke Test Line** **US Manhole:** E10-101 **DS Manhole:** E10-98 **Date Inspected:** 10/31/2001 **Inspection Crew:** SJ **Total GPM:** 1 **Comments:** **Description:** LK1 **File Name:** file://C:/GBAMastr/Pict/Sewer/E10-101 - E10-98 LK1.jpg
	**Smoke Test Line** **US Manhole:** E10-101 **DS Manhole:** E10-98 **Date Inspected:** 10/31/2001 **Inspection Crew:** SJ **Total GPM:** 1 **Comments:** **Description:** LK1A **File Name:** file://C:/GBAMastr/Pict/Sewer/E10-101 - E10-98 LK1A.jpg

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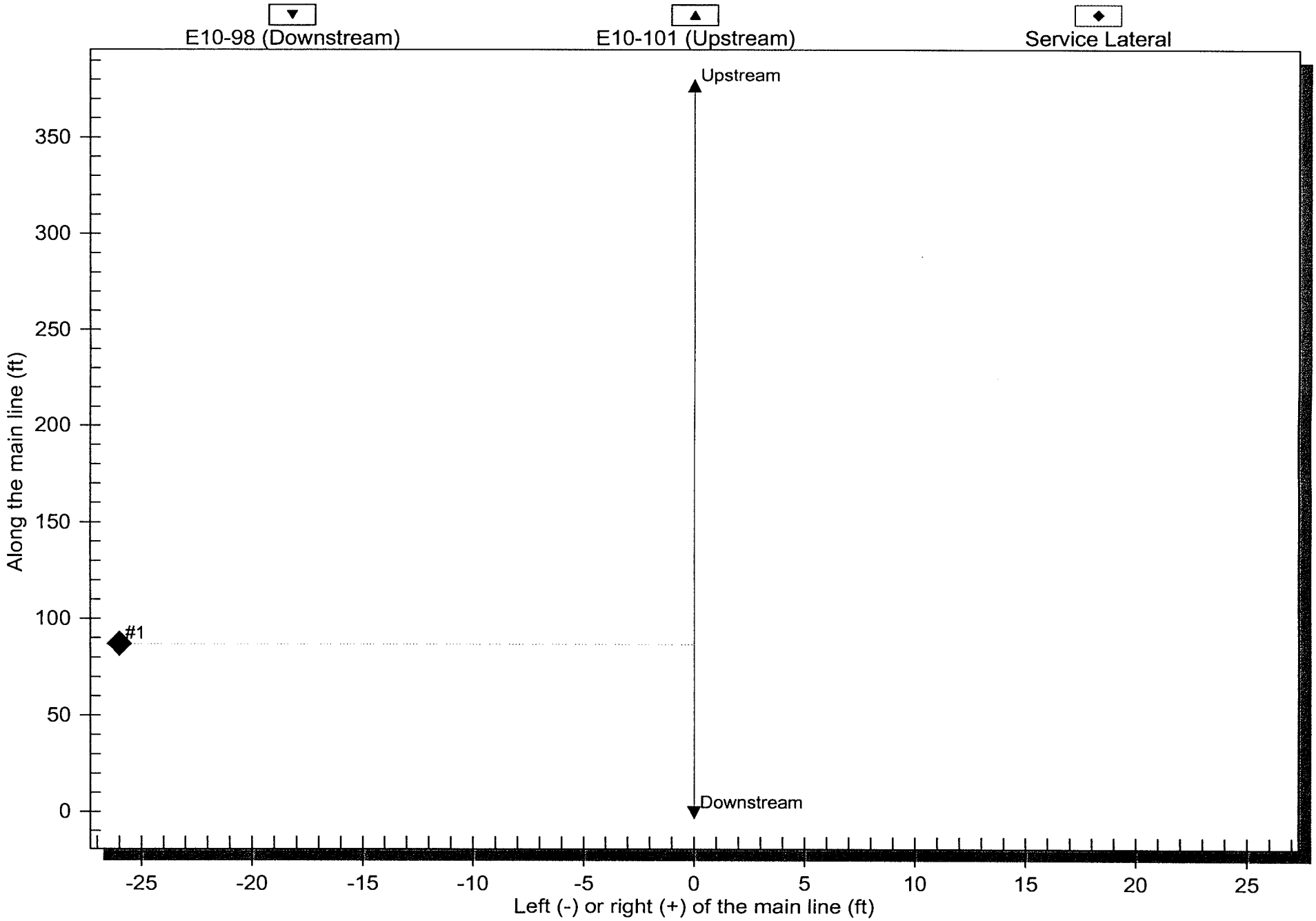
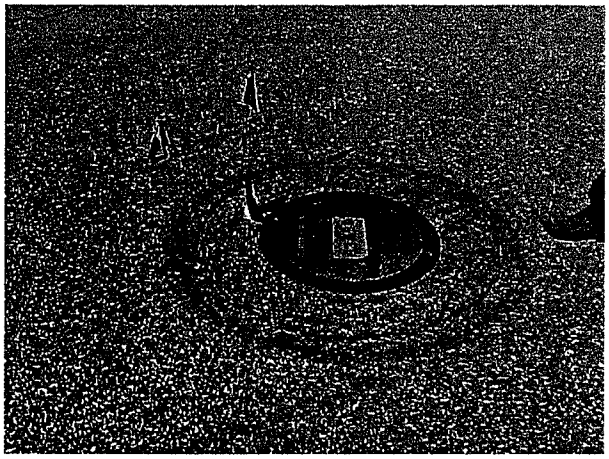
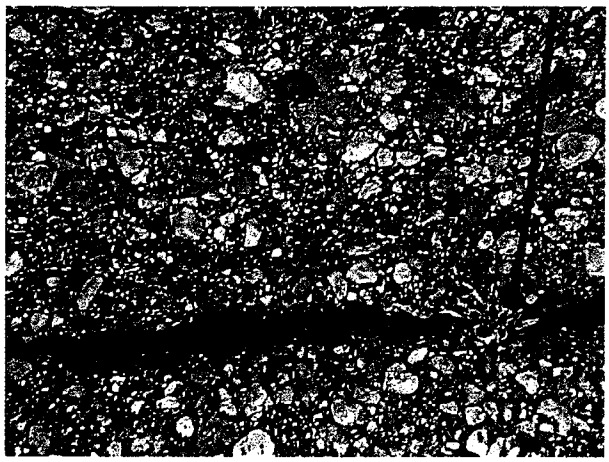
ADS Environmental Services

Date: 10/31/2001, Crew: SJ

#	Address	Source Type	Severity	Owner	Distance (ft)	Offset (ft)	Side
1:	851 Jenny Dr.	Service Lateral	Light	Private	87.00	26.00	Left



GBA Report Master® Sewer Smoke Testing and Observation Image Data.

Images	Data
	**Smoke Test Line** **US Manhole:** E10-96 **DS Manhole:** E10-95 **Date Inspected:** 10/31/2001 **Inspection Crew:** SJ **Total GPM:** 0.21 **Comments:** **Description:** LK1 **File Name:** file://C:/GBAMastr/Pict/Sewer/E10-96 - E10-95 LK1.jpg
	**Smoke Test Line** **US Manhole:** E10-96 **DS Manhole:** E10-95 **Date Inspected:** 10/31/2001 **Inspection Crew:** SJ **Total GPM:** 0.21 **Comments:** **Description:** LK1A **File Name:** file://C:/GBAMastr/Pict/Sewer/E10-96 - E10-95 LK1A.jpg

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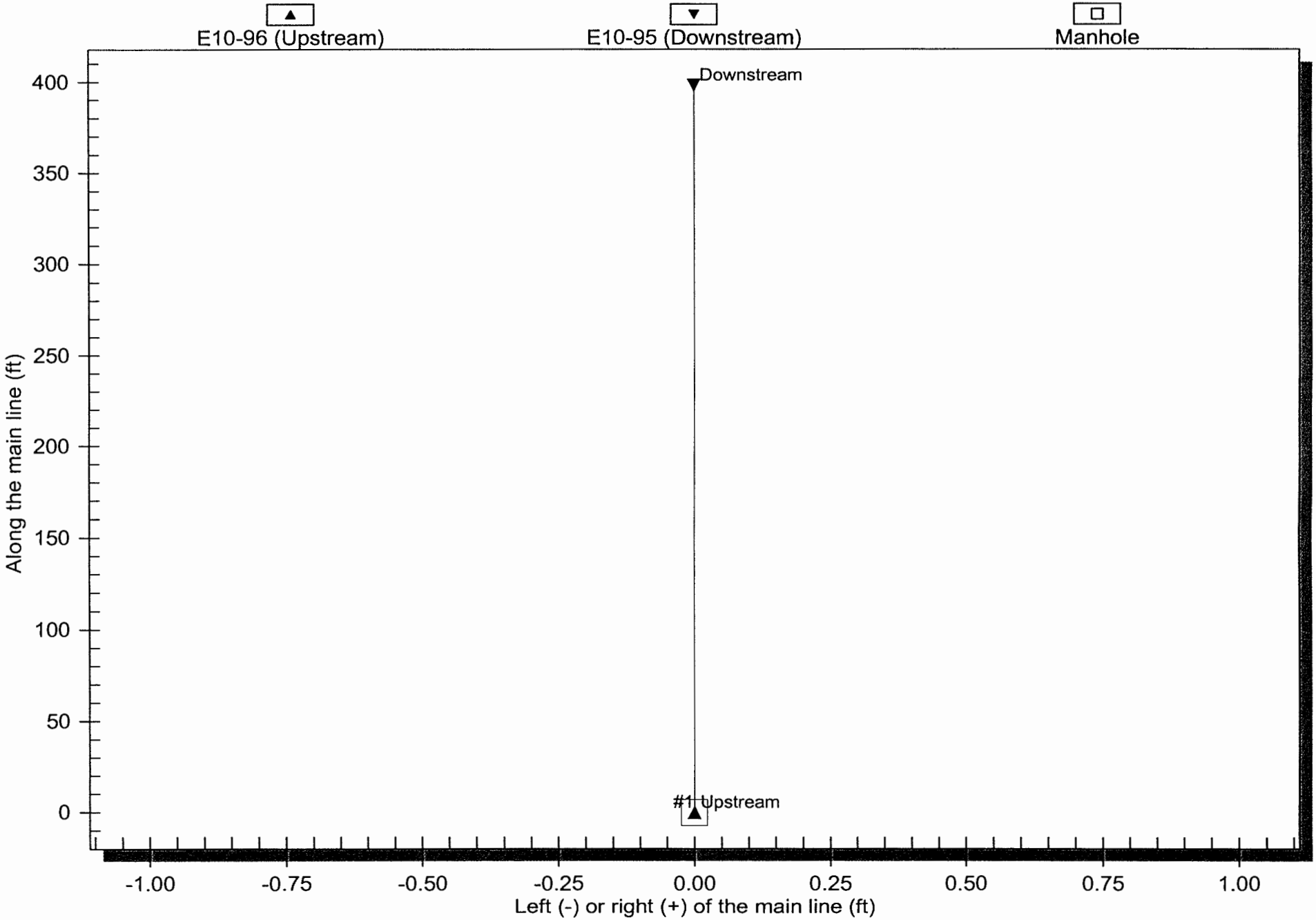
ADS Environmental Services

Date: 10/31/2001, Crew: SJ

#	Address	Source Type	Severity	Owner	Distance (ft)	Offset (ft)	Side
1:	No address	US Manhole	Light	Public	0.00	0.00	None



Smoke Testing Segment Summary Report

City of Thousand Oaks

12/11/2001
11:11:35AM

US Manhole US Manhole Address	DS Manhole DS Manhole Address	Basin	Results	Length	GPM Total	GPM Remain
E10-108	E10-107		Negative	246.0	0.00	0.00
E10-107	E10-106		Negative	244.0	0.00	0.00
E10-106	E10-103		Negative	203.0	0.00	0.00
E10-105	E10-104		Negative	293.0	0.00	0.00
E10-104	E10-103		Negative	370.0	0.00	0.00
E10-103	E10-102		Negative	200.0	0.00	0.00
E10-102	E10-29		Negative	272.0	0.00	0.00
E10-29	E10-28		Negative	342.0	0.00	0.00
E10-27	E10-26		Negative	360.0	0.00	0.00
E10-100	E10-99		Negative	255.0	0.00	0.00
E10-97	E10-95		Negative	352.0	0.00	0.00
E10-95	E10-94		Negative	259.0	0.00	0.00
E10-94	E10-92		Negative	259.0	0.00	0.00
E10-93	E10-92		Negative	311.0	0.00	0.00
E10-92	E10-67		Negative	261.0	0.00	0.00
E10-91	E10-90		Negative	317.0	0.00	0.00
E10-90	E10-88		Negative	253.0	0.00	0.00
E10-88	E10-86		Negative	251.0	0.00	0.00
COE10-85.3	E10-85.3		Negative	200.0	0.00	0.00
W24-33	W24-32		Negative	346.0	0.00	0.00
E10-87	E10-86		Negative	308.0	0.00	0.00
E10-86	E10-85		Negative	352.0	0.00	0.00
E10-85.3	E10-85.1		Negative	405.0	0.00	0.00
E10-85.1	E10-85		Negative	267.0	0.00	0.00
E10-85	E10-84		Negative	287.0	0.00	0.00
E10-84	E10-81		Negative	287.0	0.00	0.00
E10-83	E10-82		Negative	260.0	0.00	0.00

Smoke Testing Segment Summary Report

City of Thousand Oaks

12/11/2001
11:11:35AM

US Manhole US Manhole Address	DS Manhole DS Manhole Address	Basin	Results	Length	GPM Total	GPM Remain
E10-82	E10-81		Negative	347.0	0.00	0.00
E10-53	E10-52		Negative	148.0	0.00	0.00
E10-52	E10-51		Negative	307.0	0.00	0.00
E10-51.1	E10-51		Negative	244.0	0.00	0.00
E10-51	E10-50.2		Negative	101.0	0.00	0.00
E10-50.2	E10-50.1		Negative	129.0	0.00	0.00
E10-50.1	E10-50		Negative	278.0	0.00	0.00
E10-50	E10-49		Negative	285.0	0.00	0.00
E10-49	E10-48		Negative	281.0	0.00	0.00
E10-48	E10-47		Negative	276.0	0.00	0.00
E10-47	E10-46		Negative	331.0	0.00	0.00
E10-58.1	E10-58		Negative	291.0	0.00	0.00
E10-99	E10-90		Positive	316.0	0.00	0.00
E10-60	E10-59		Negative	322.0	0.00	0.00
E10-59	E10-58		Negative	330.0	0.00	0.00
E10-58	E10-56		Negative	302.0	0.00	0.00
E10-57	E10-56		Negative	354.0	0.00	0.00
E10-56	E10-54		Negative	247.0	0.00	0.00
E10-55	E10-54		Negative	204.0	0.00	0.00
E10-54	E10-46		Negative	376.0	0.00	0.00
E10-46	E10-34		Negative	252.0	0.00	0.00
E10-45	E10-44		Negative	337.0	0.00	0.00
E10-44	E10-43		Negative	325.0	0.00	0.00
E10-43	E10-41		Negative	330.0	0.00	0.00
E10-41	E10-40		Negative	301.0	0.00	0.00
E10-40	E10-37		Negative	310.0	0.00	0.00
E10-37	E10-36		Negative	259.0	0.00	0.00

Smoke Testing Segment Summary Report

City of Thousand Oaks

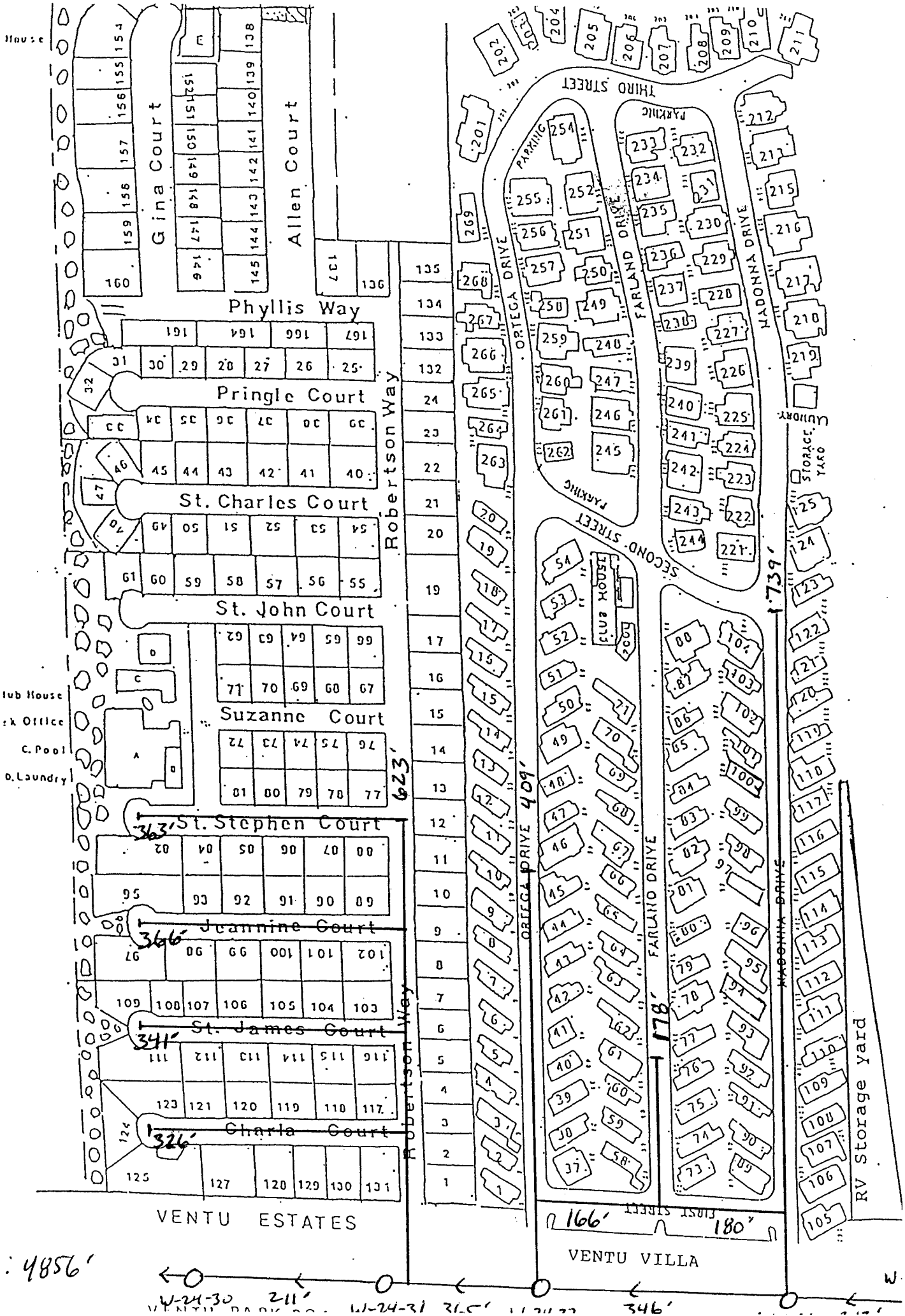
12/11/2001
11:11:35AM

US Manhole US Manhole Address	DS Manhole DS Manhole Address	Basin	Results	Length	GPM Total	GPM Remain
E10-36	E10-34		Negative	263.0	0.00	0.00
E10-34	E10-33		Negative	270.0	0.00	0.00
E10-32	E10-33		Negative	424.0	0.00	0.00
E10-33	E10-31		Negative	385.0	0.00	0.00
E10-42	E10-41		Negative	386.0	0.00	0.00
SLE10-39	E10-39		Positive	17.0	0.02	0.02
COE10-29	E10-29		Negative	144.0	0.00	0.00
E10-39	E10-38		Negative	352.0	0.00	0.00
E10-89	E10-88		Suspect	307.0	0.00	0.00
E10-38	E10-37		Positive	270.0	0.02	0.02
E10-28	E10-27		Positive	366.0	0.05	0.05
E10-101	E10-98		Positive	377.0	1.00	1.00
E10-98	E10-97		Positive	354.0	0.00	0.00
E10-96	E10-95		Positive	398.0	0.21	0.21
W24-34	W24-33		Negative	243.0	1.23	1.23
E10-98	E10-99		Negative	260.0	0.00	0.00
W24-32	W24-31		Negative	365.0	0.00	0.00
W24-31	W24-30		Negative	211.0	0.00	0.00
SLW24-33	W24-33		Positive	739.0	1.23	1.23
SLW24-32	W24-32		Negative	933.0	0.00	0.00
SLW24-31	W24-31		Negative	019.0	0.00	0.00
				24,426.0	3.76	3.76

Trailer Park

- SLW-24-33 – W-24-33 739'
- SLW-24-32 – W-24-32 933'
  (409+166+178+180=933)
- SLW-24-31 – W-24-31 2019'
  (623+363+366+341+326=2019)

SL= Service Line



Gina Court
Allen Court
Phyllis Way
Pringle Court
St. Charles Court
St. John Court
Suzanne Court
St. Stephen Court
Jeannine Court
St. James Court
Charla Court
Robertson Way
THIRD STREET
SECOND STREET
ORTEGA DRIVE
FARLAND DRIVE
MADONNA DRIVE
PARKING
CLUB HOUSE
STORAGE YARD
LAUNDRY
RV Storage yard
VENTU ESTATES
VENTU VILLA
Club House
C. Pool
D. Laundry
363'
366'
341'
326'
623'
409'
178'
739'
166'
180'
W-24-30
211'
W-24-31
346'

Total: 4856'

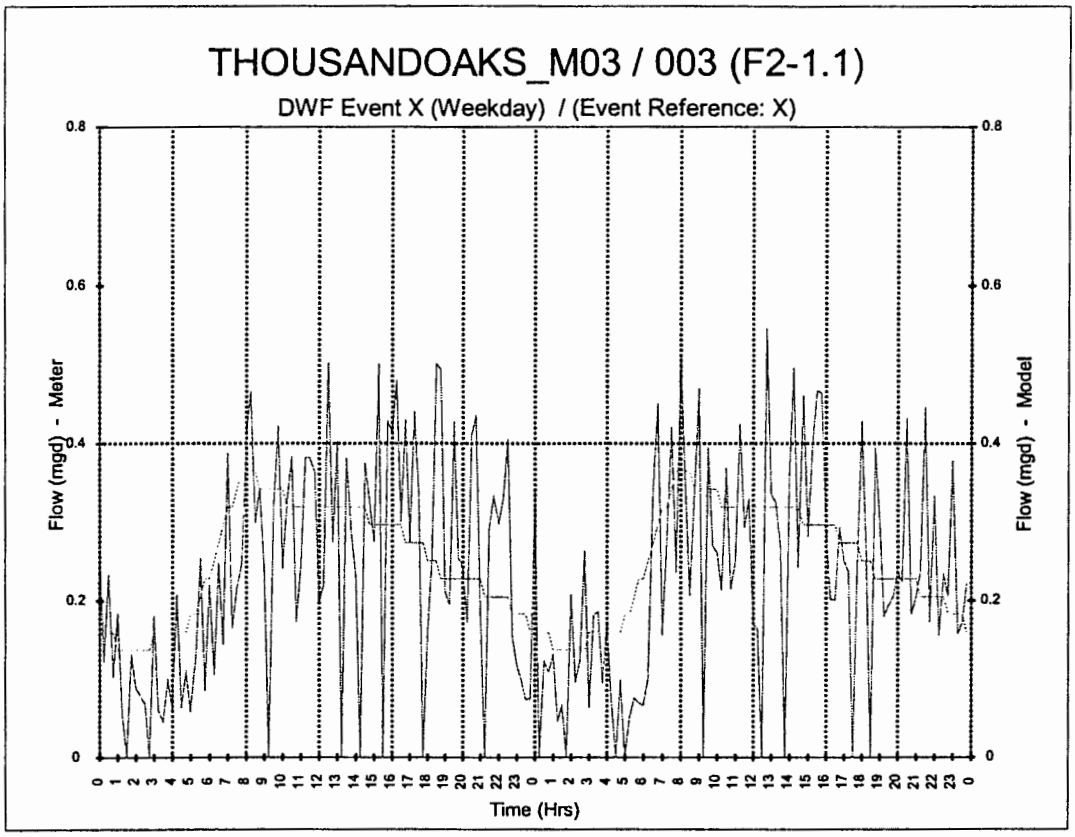
Appendix I

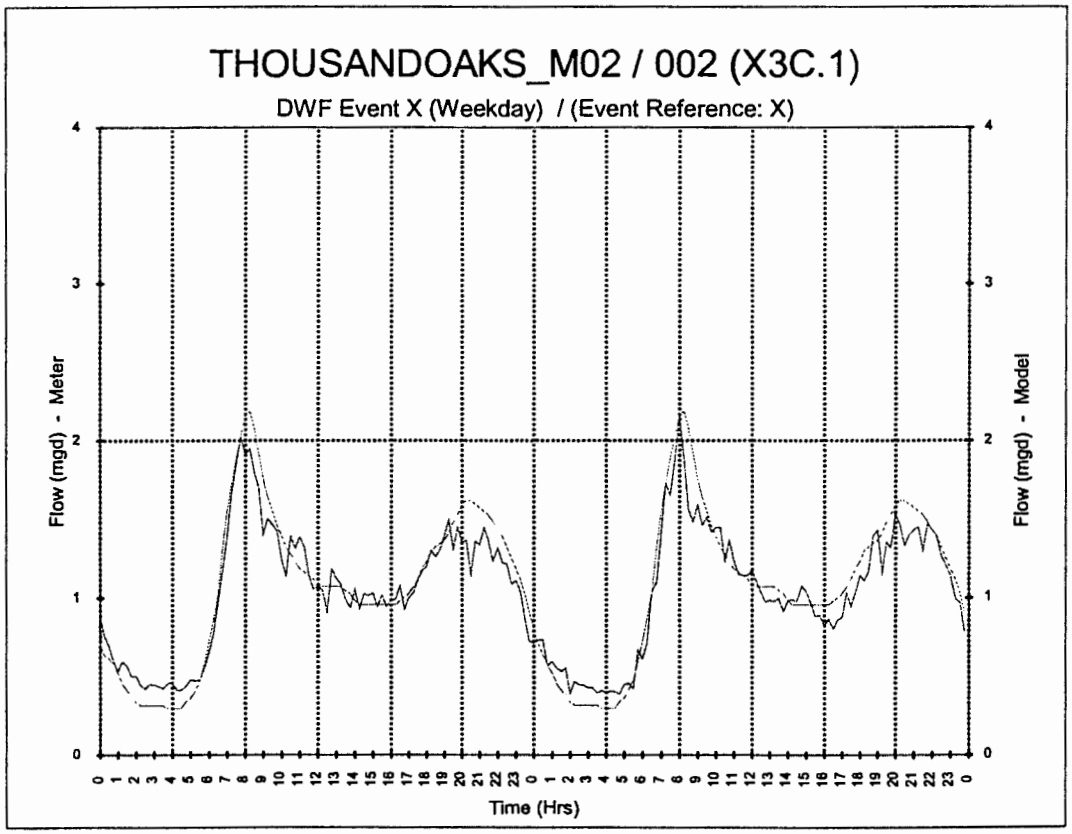
MWH
MONTGOMERY WATSON HARZA

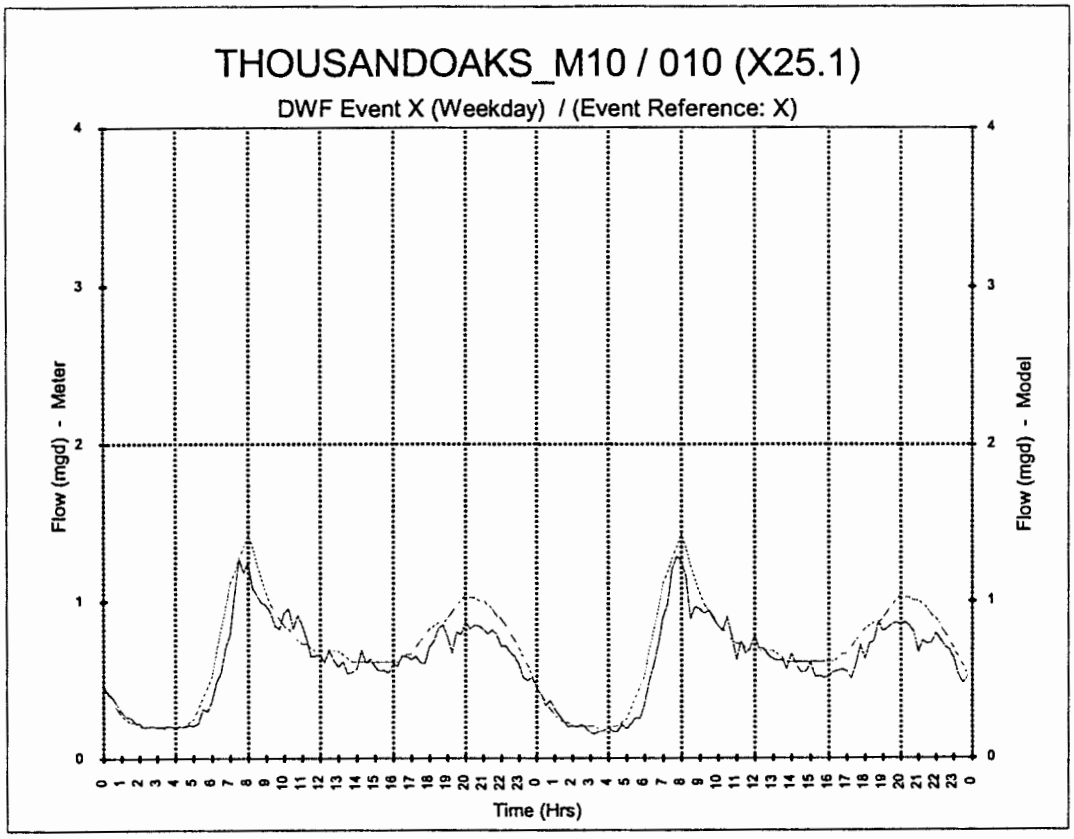
APPENDIX I

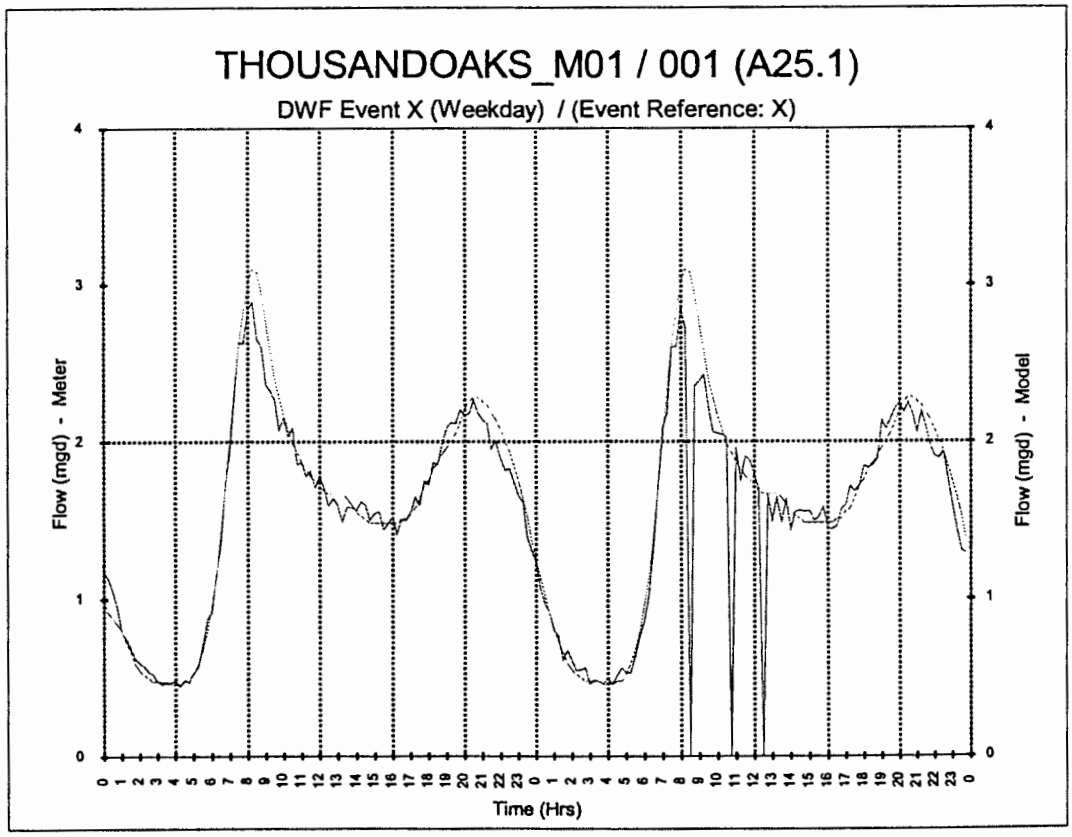
DRY AND WET WEATHER MODEL CALIBRATION PLOTS

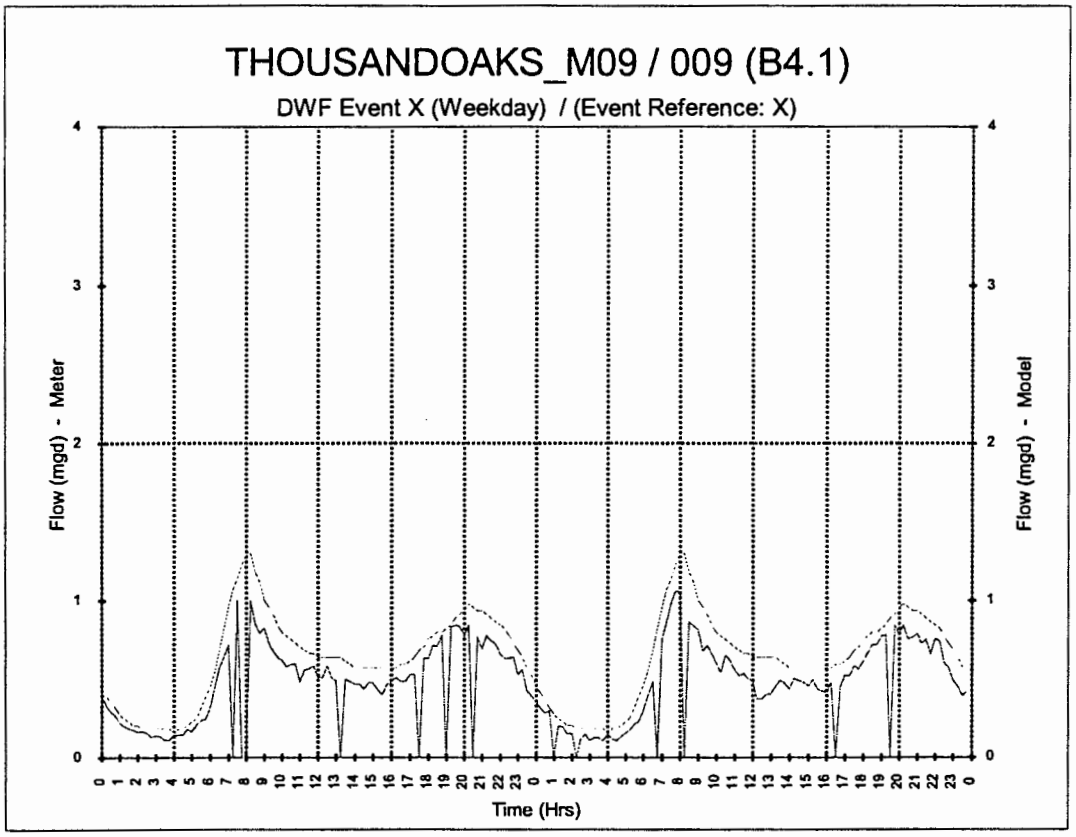
DRY WEATHER FLOW

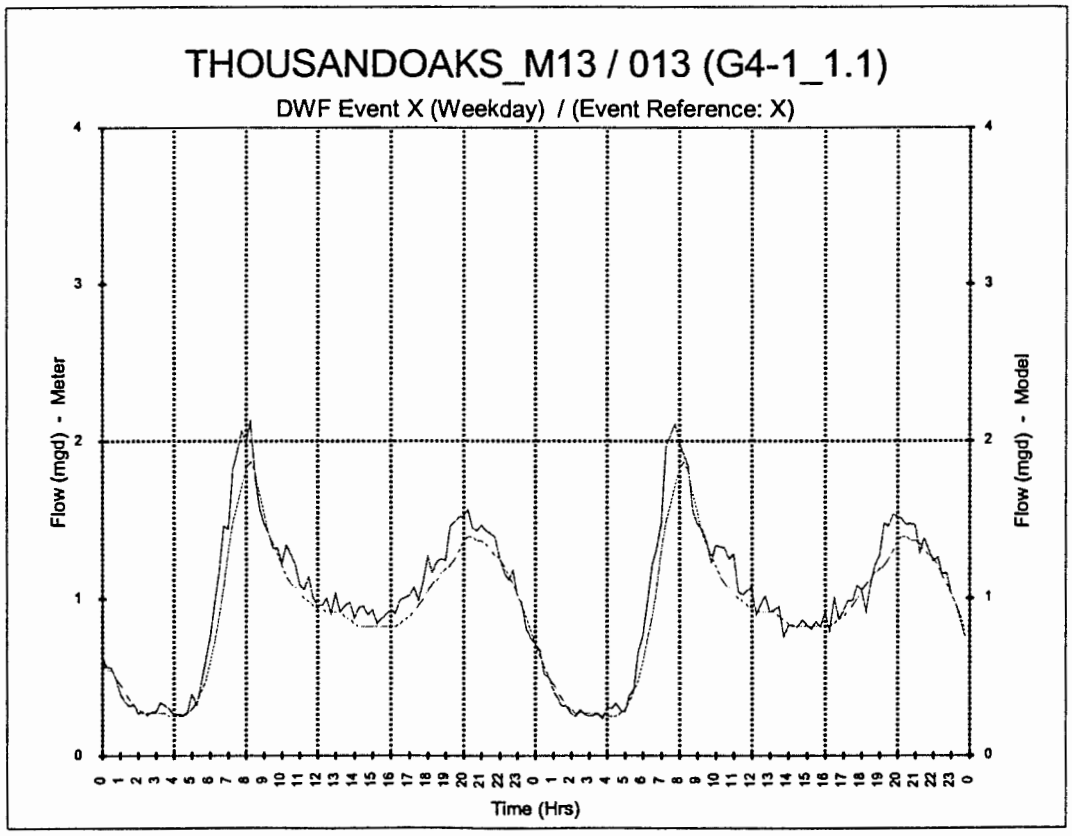

THOUSANDOAKS_M03 / 003 (F2-1.1)
DWF Event X (Weekday) / (Event Reference: X)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Hrs)

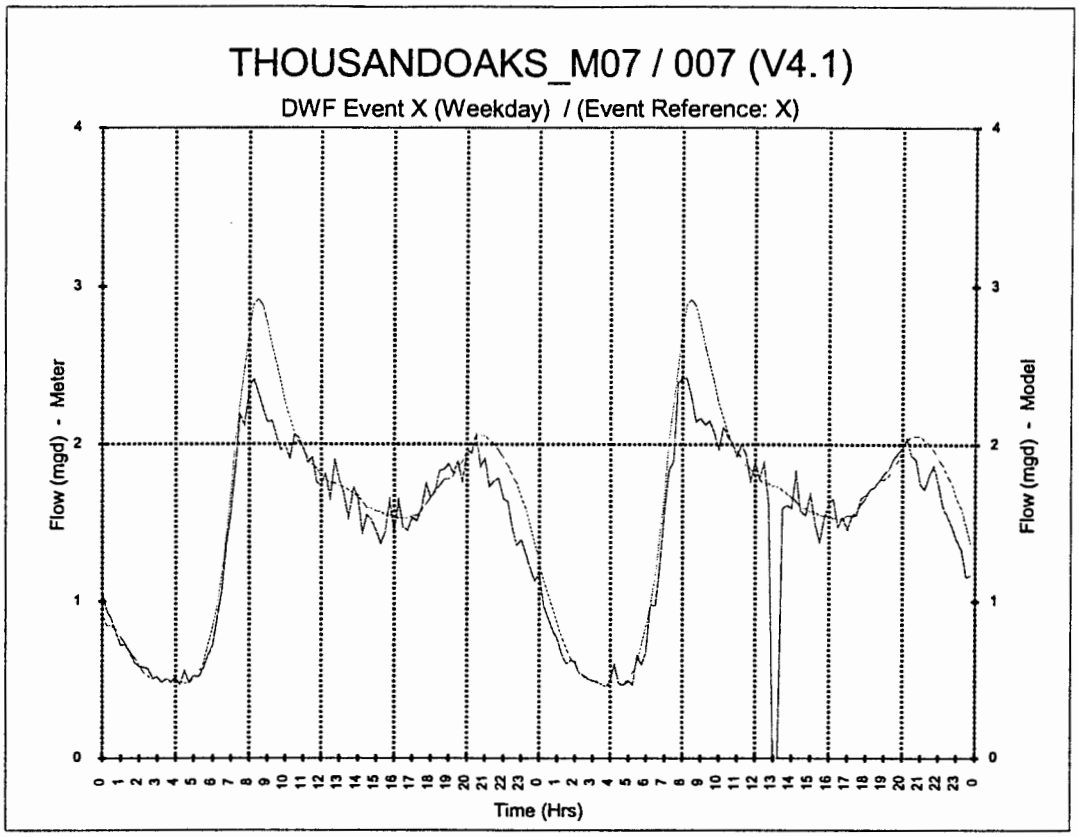

THOUSANDOAKS_M02 / 002 (X3C.1)
DWF Event X (Weekday) / (Event Reference: X)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Hrs)

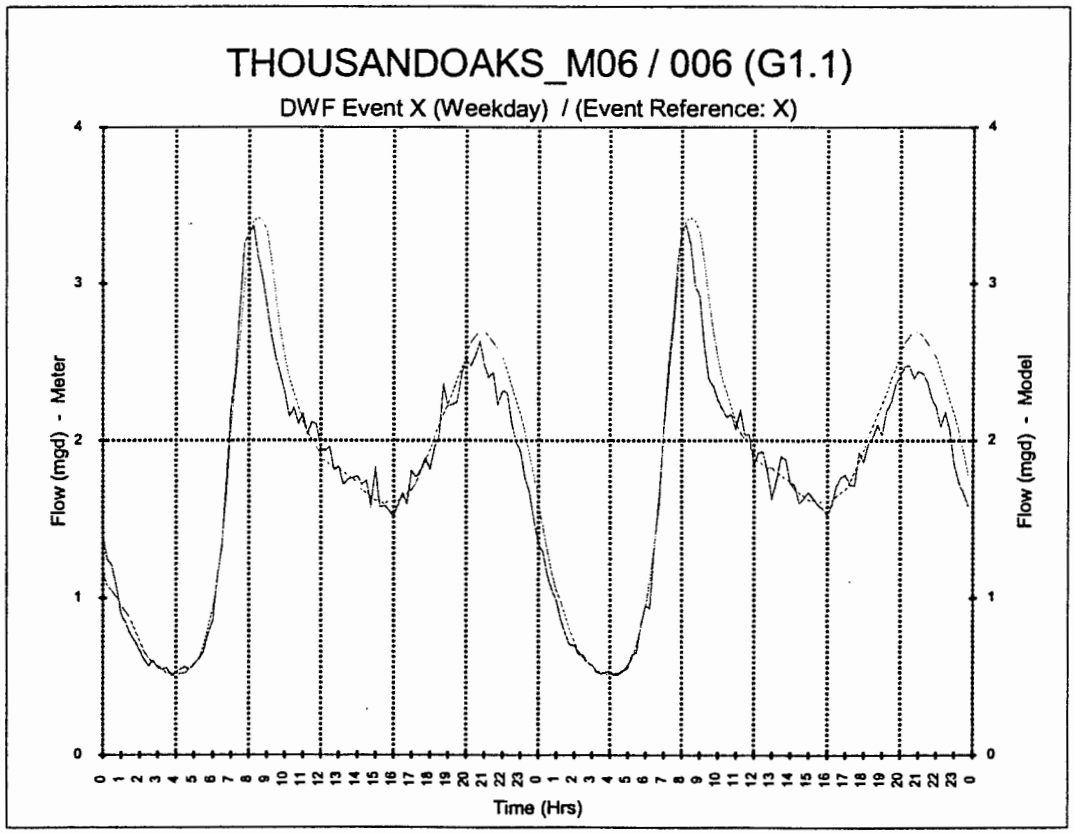

THOUSANDOAKS_M10 / 010 (X25.1)
DWF Event X (Weekday) / (Event Reference: X)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Hrs)

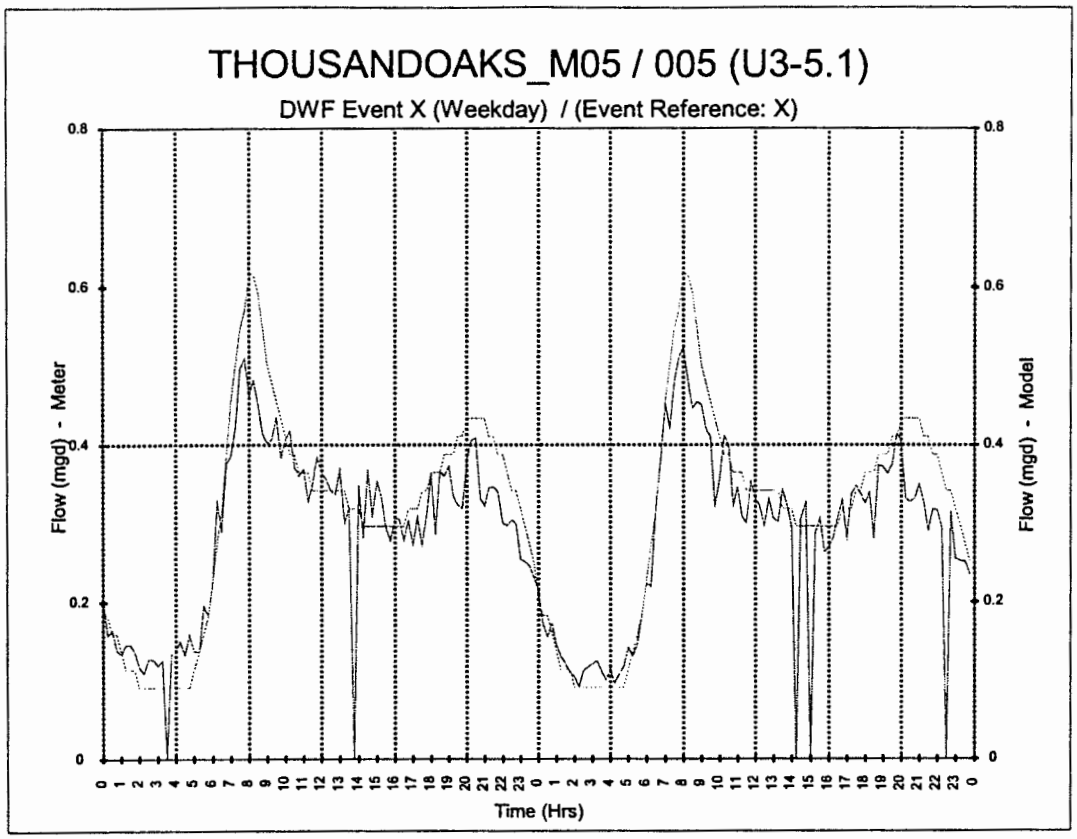

THOUSANDOAKS_M01 / 001 (A25.1)
DWF Event X (Weekday) / (Event Reference: X)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Hrs)

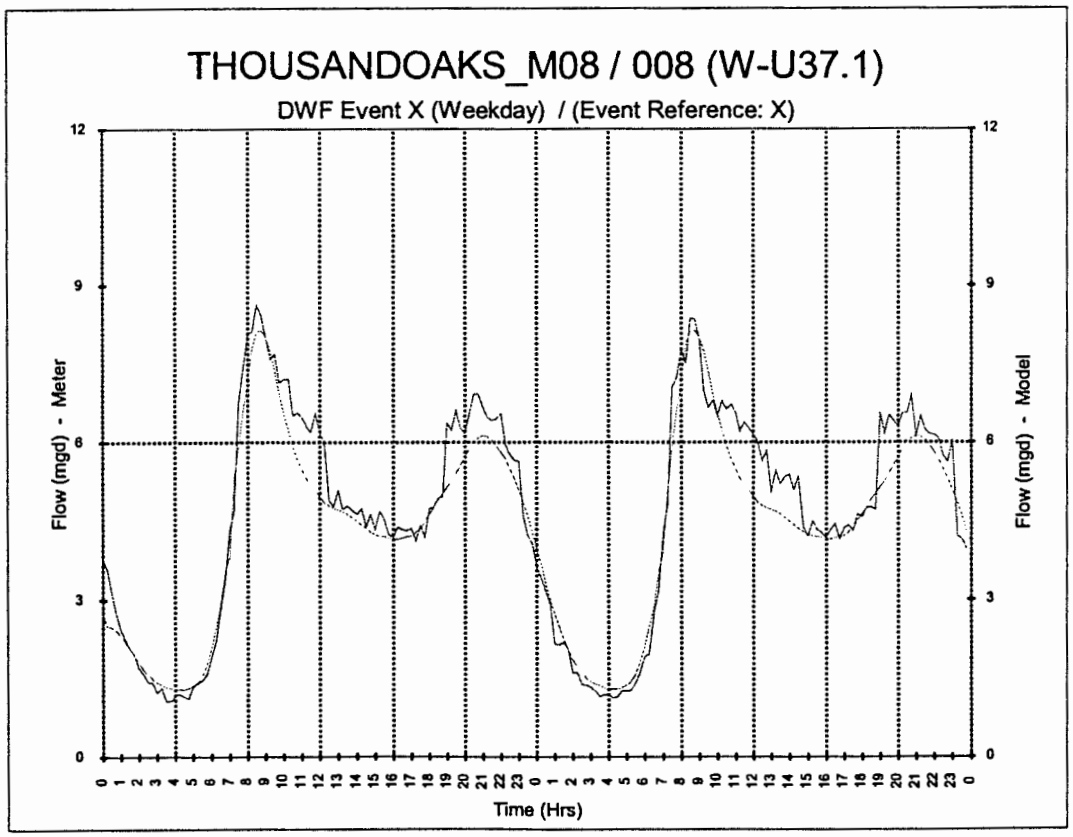

THOUSANDOAKS_M09 / 009 (B4.1)
DWF Event X (Weekday) / (Event Reference: X)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Hrs)

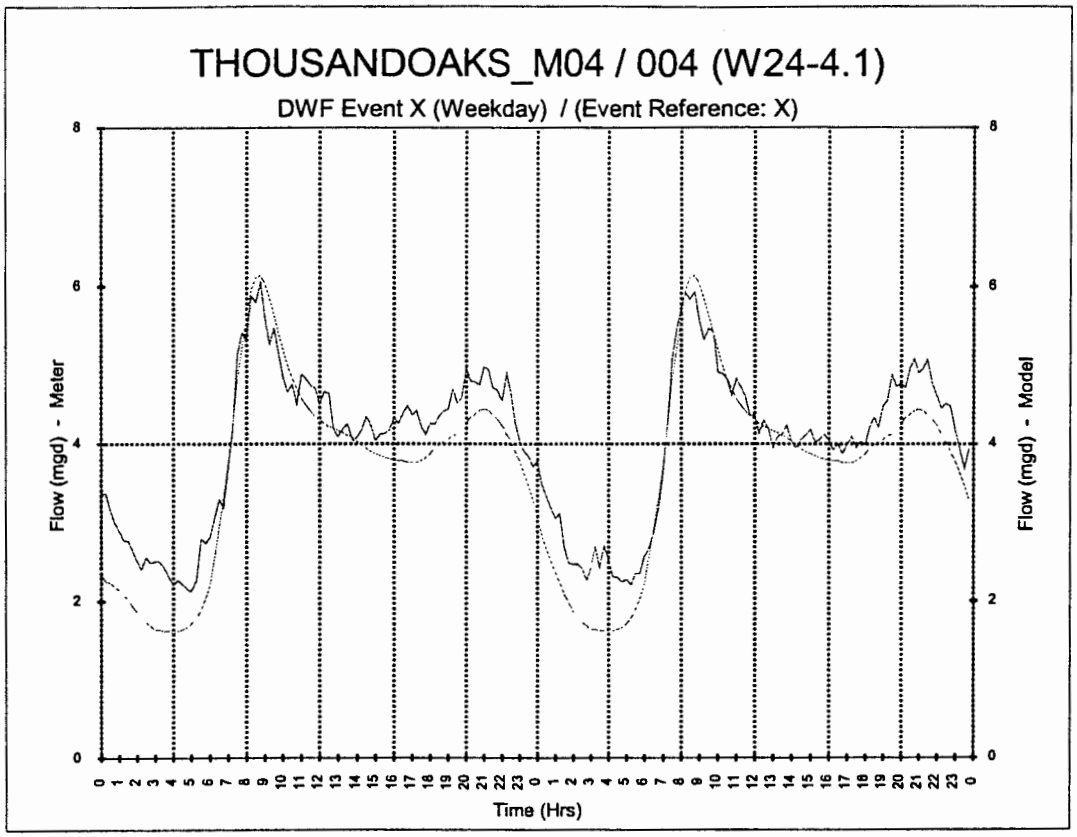

THOUSANDOAKS_M13 / 013 (G4-1_1.1)
DWF Event X (Weekday) / (Event Reference: X)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Hrs)

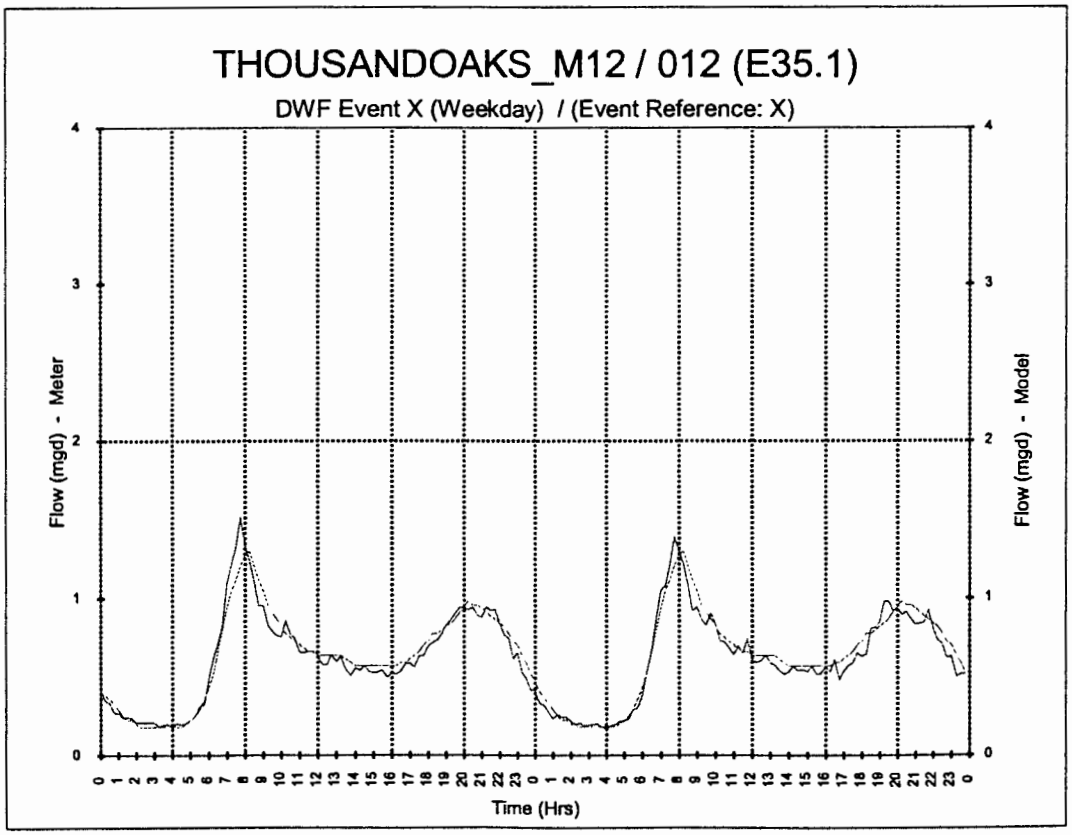

THOUSANDOAKS_M07 / 007 (V4.1)
DWF Event X (Weekday) / (Event Reference: X)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Hrs)

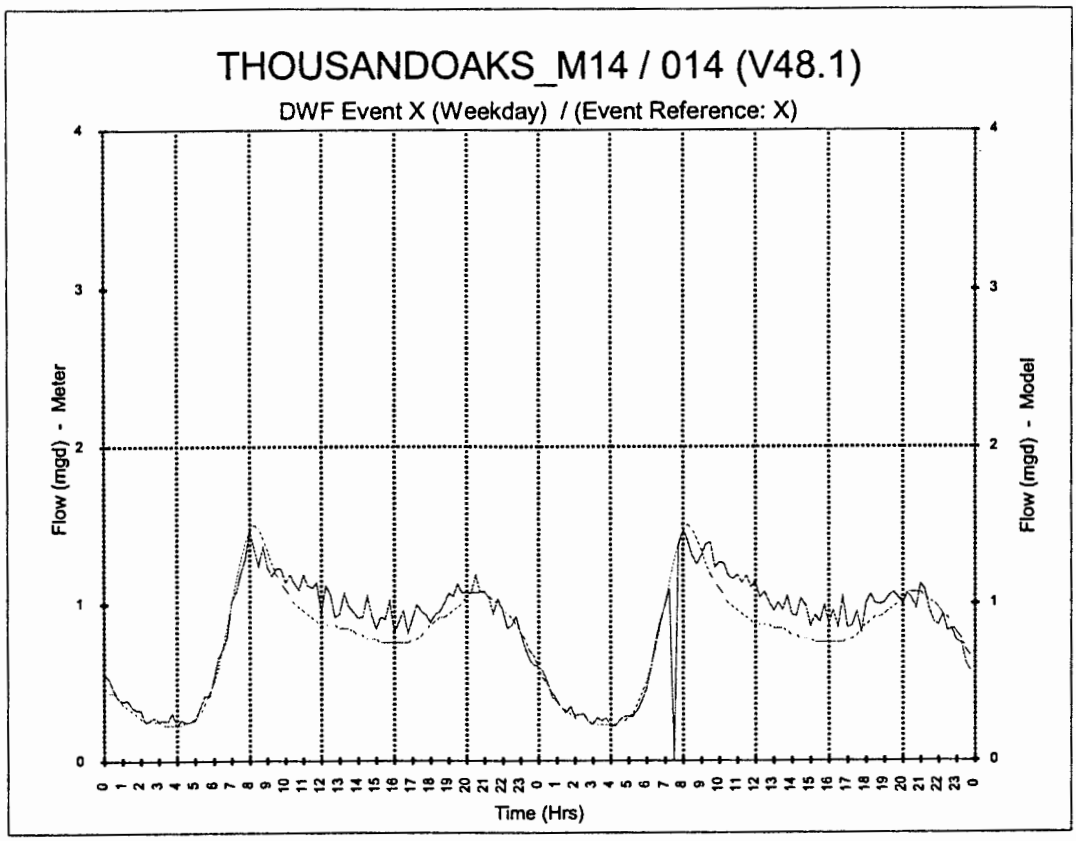

THOUSANDOAKS_M06 / 006 (G1.1)
DWF Event X (Weekday) / (Event Reference: X)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Hrs)


THOUSANDOAKS_M05 / 005 (U3-5.1)
DWF Event X (Weekday) / (Event Reference: X)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Hrs)

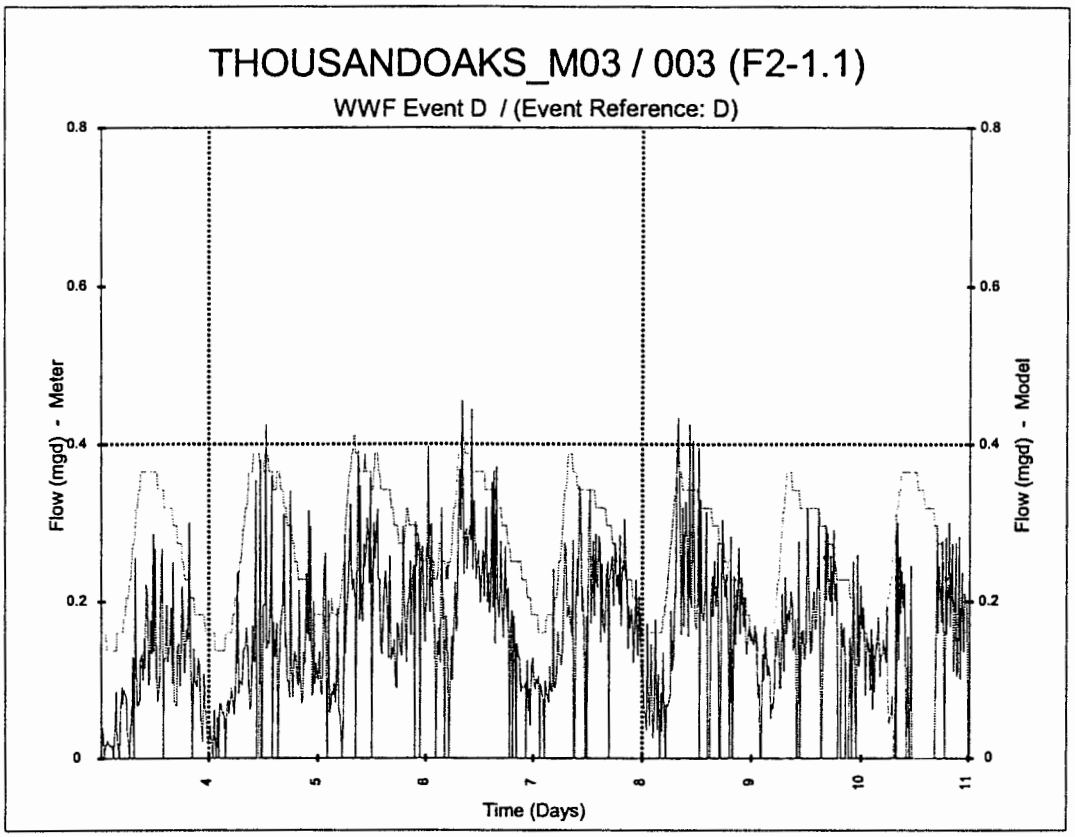

THOUSANDOAKS_M08 / 008 (W-U37.1)
DWF Event X (Weekday) / (Event Reference: X)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Hrs)

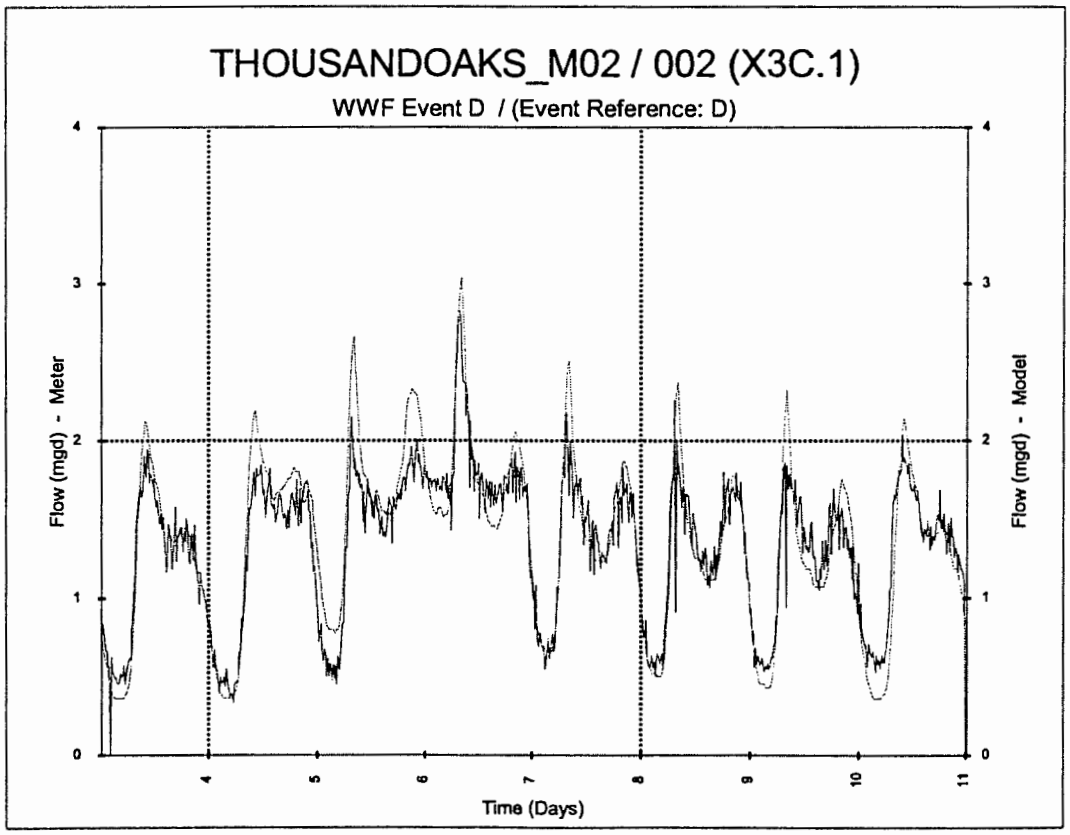

THOUSANDOAKS_M04 / 004 (W24-4.1)
DWF Event X (Weekday) / (Event Reference: X)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Hrs)

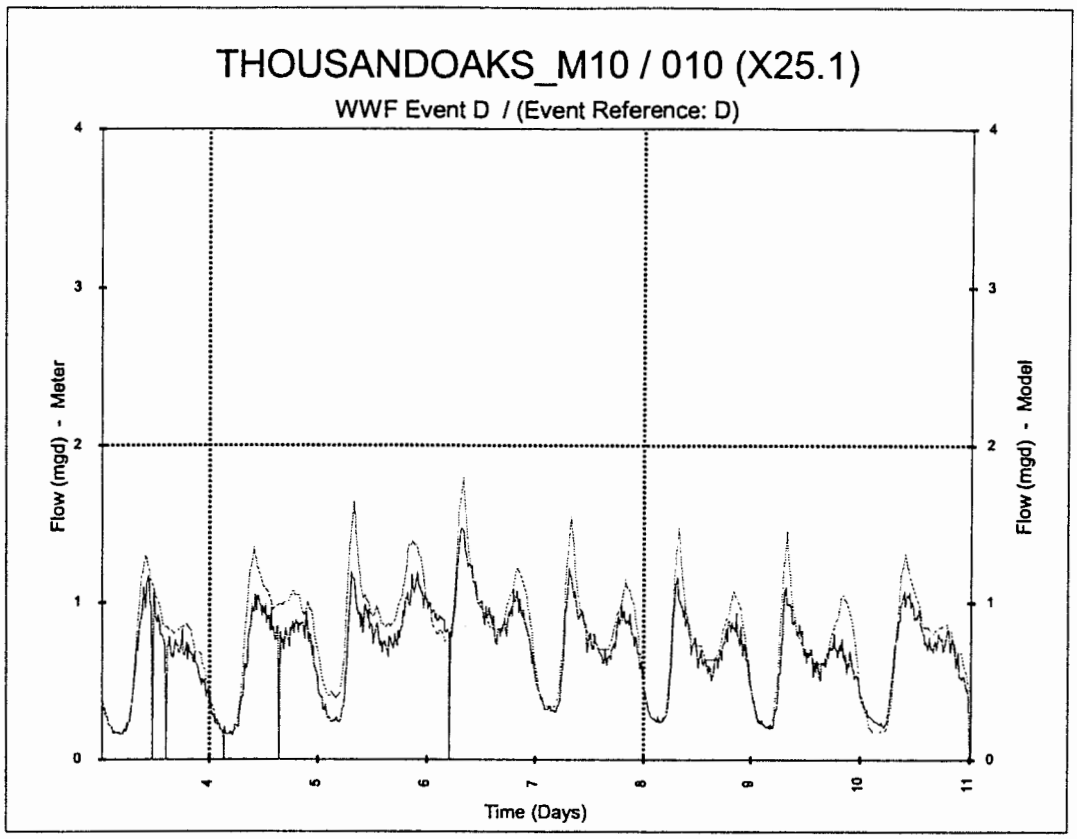

THOUSANDOAKS_M12 / 012 (E35.1)
DWF Event X (Weekday) / (Event Reference: X)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Hrs)

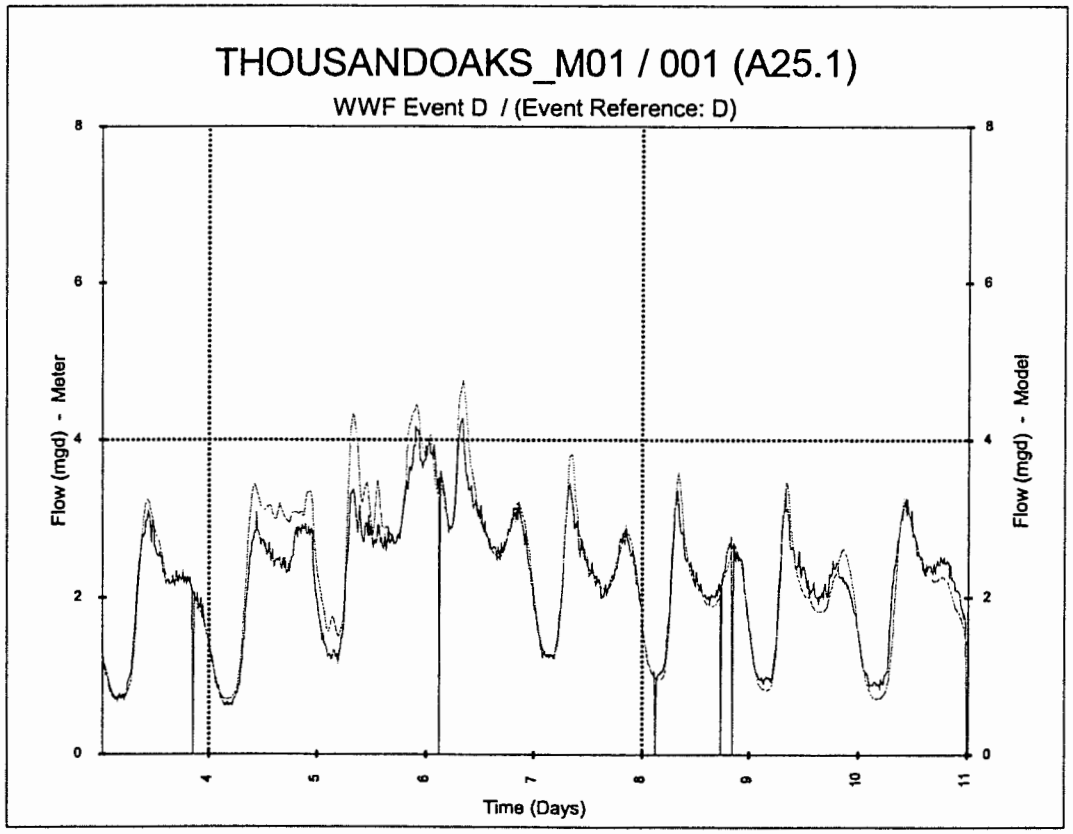

THOUSANDOAKS_M14 / 014 (V48.1)
DWF Event X (Weekday) / (Event Reference: X)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Hrs)

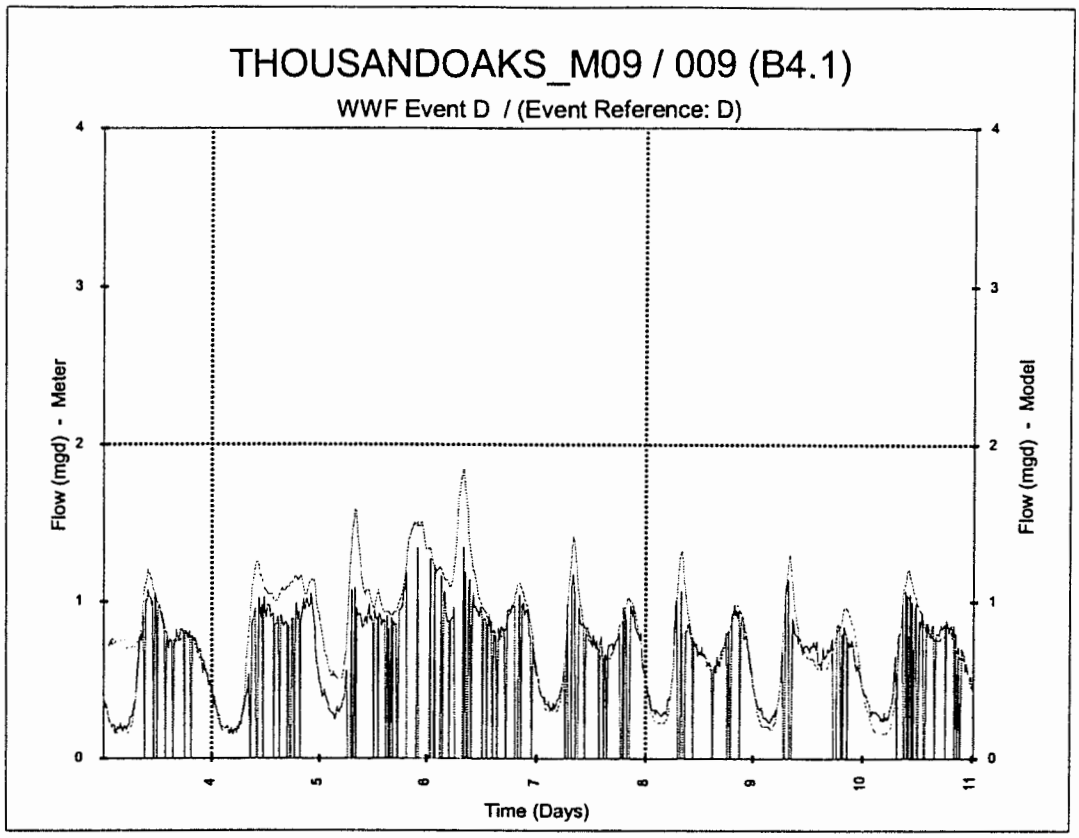
WET WEATHER FLOW (EVENT 5)

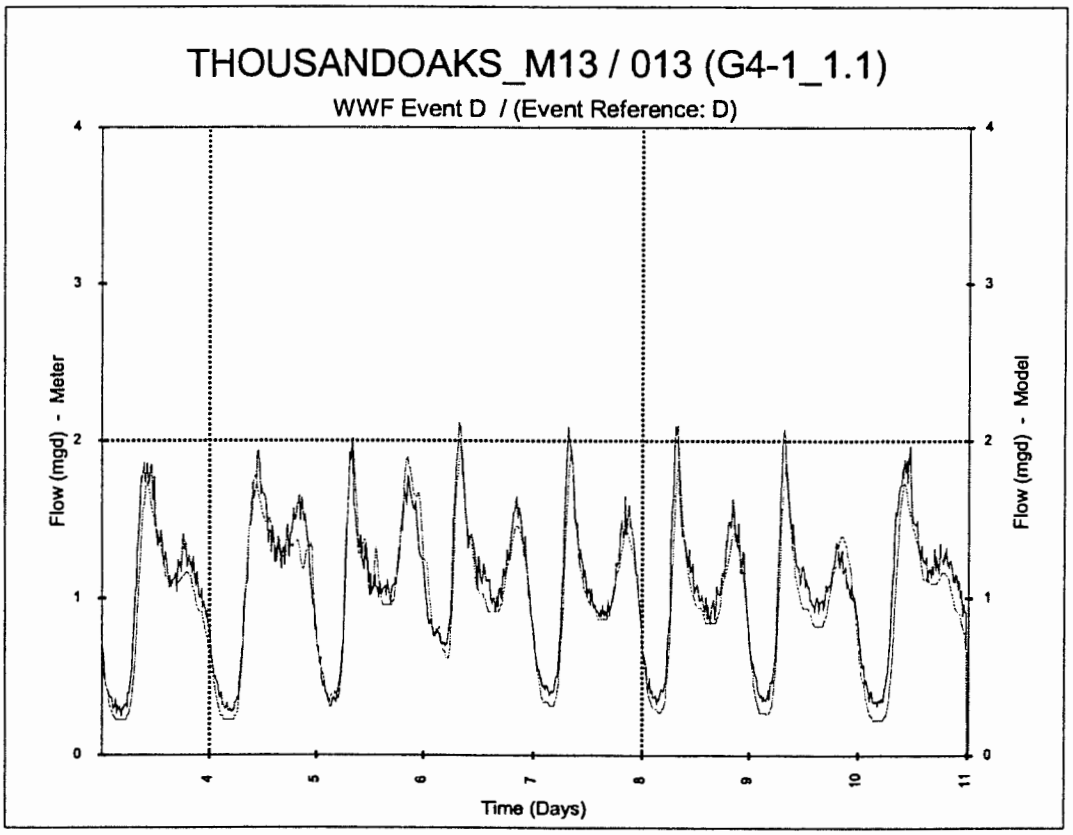

THOUSANDOAKS_M03 / 003 (F2-1.1)
WWF Event D / (Event Reference: D)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Days)
0.8
0.6
0.4
0.2
0
4
5
6
7
8
9
10
11

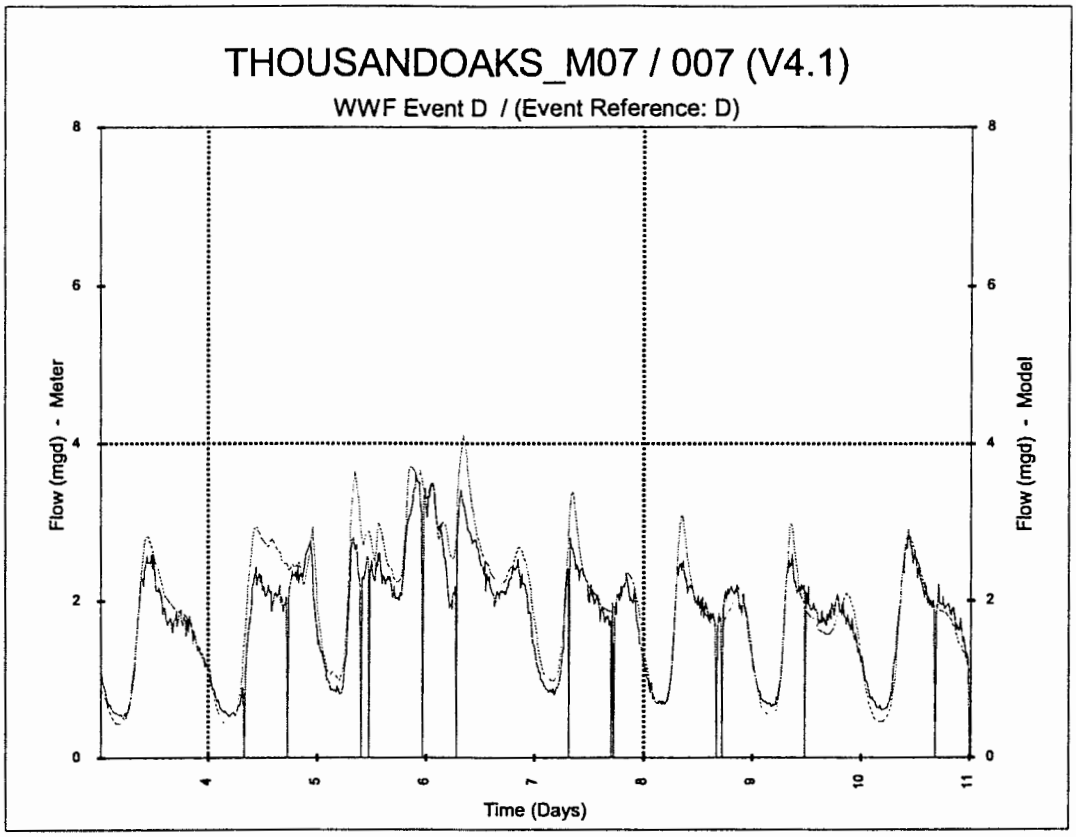

THOUSANDOAKS_M02 / 002 (X3C.1)
WWF Event D / (Event Reference: D)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Days)
4
3
2
1
0
4
5
6
7
8
9
10
11

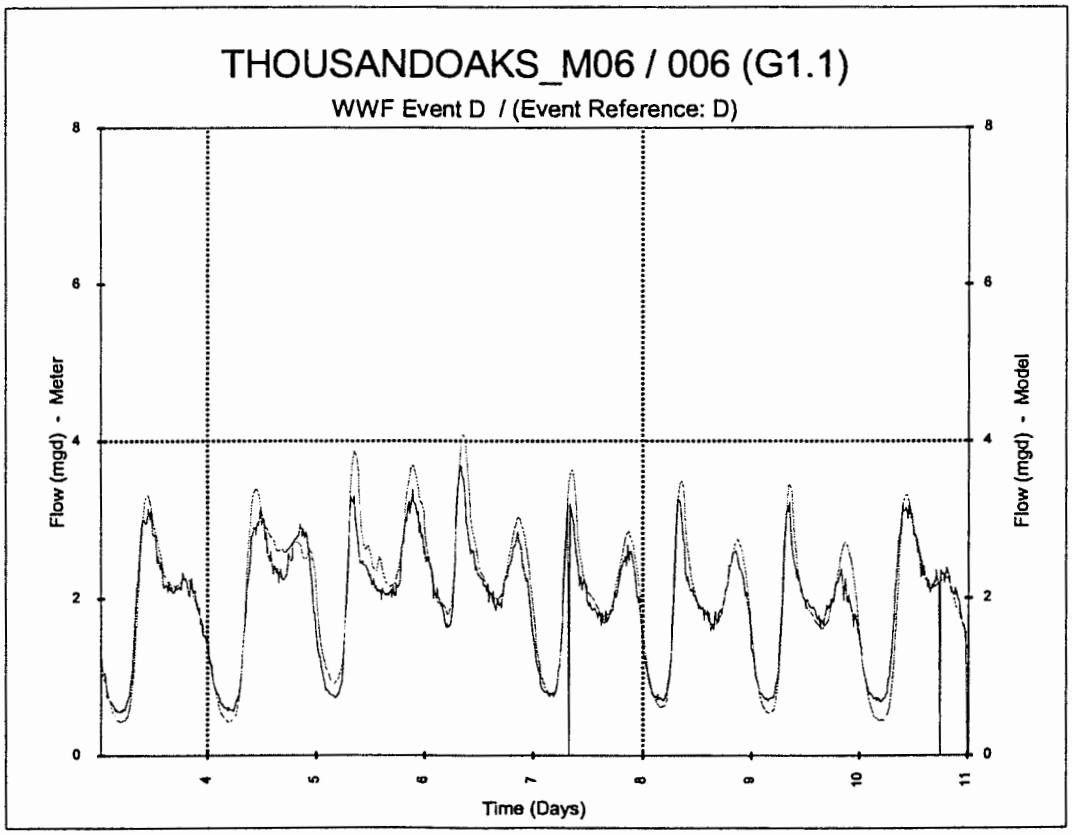

THOUSANDOAKS_M10 / 010 (X25.1)
WWF Event D / (Event Reference: D)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Days)
0
1
2
3
4
4
5
6
7
8
9
10
11

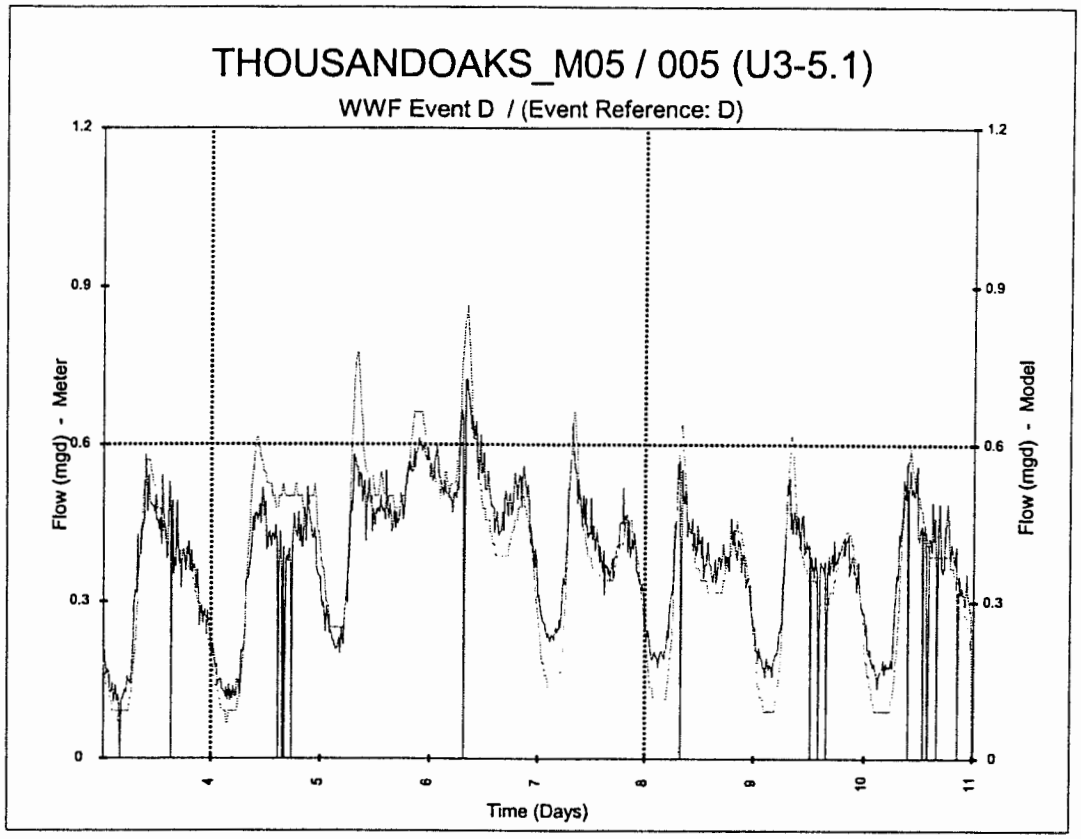

THOUSANDOAKS_M01 / 001 (A25.1)
WWF Event D / (Event Reference: D)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Days)
0
2
4
6
8
4
5
6
7
8
9
10
11

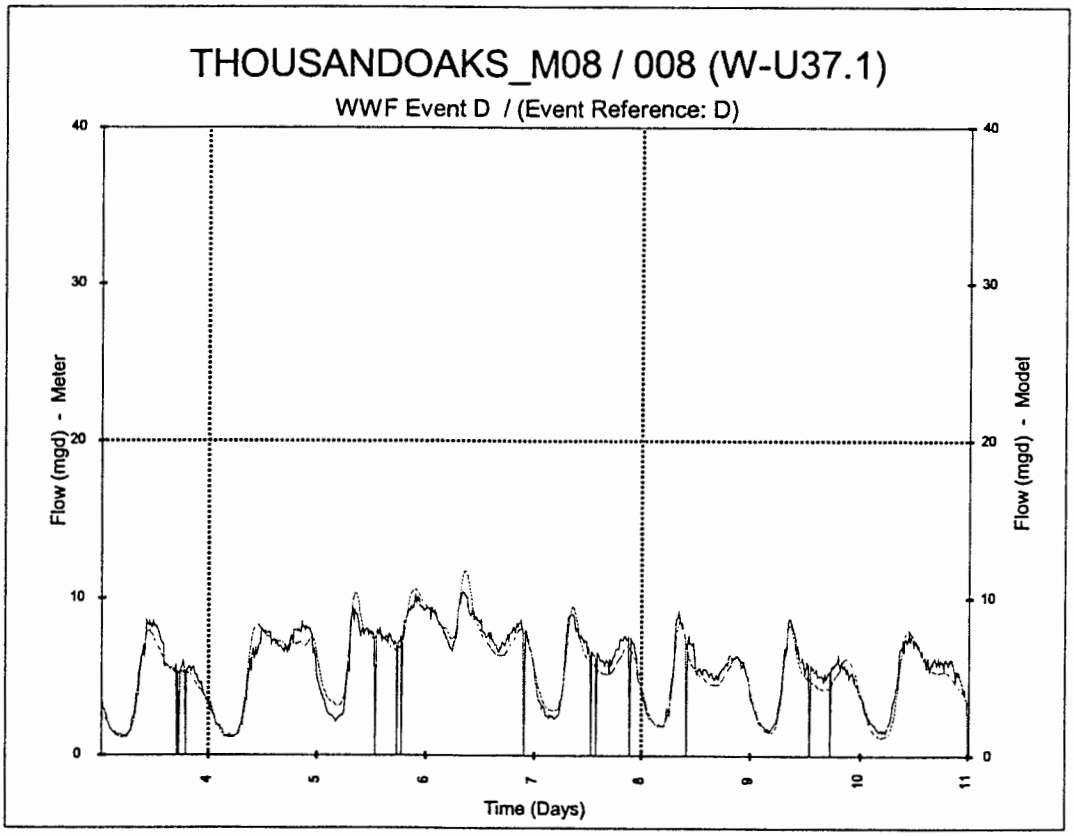

THOUSANDOAKS_M09 / 009 (B4.1)
WWF Event D / (Event Reference: D)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Days)
0
1
2
3
4
4
5
6
7
8
9
10
11

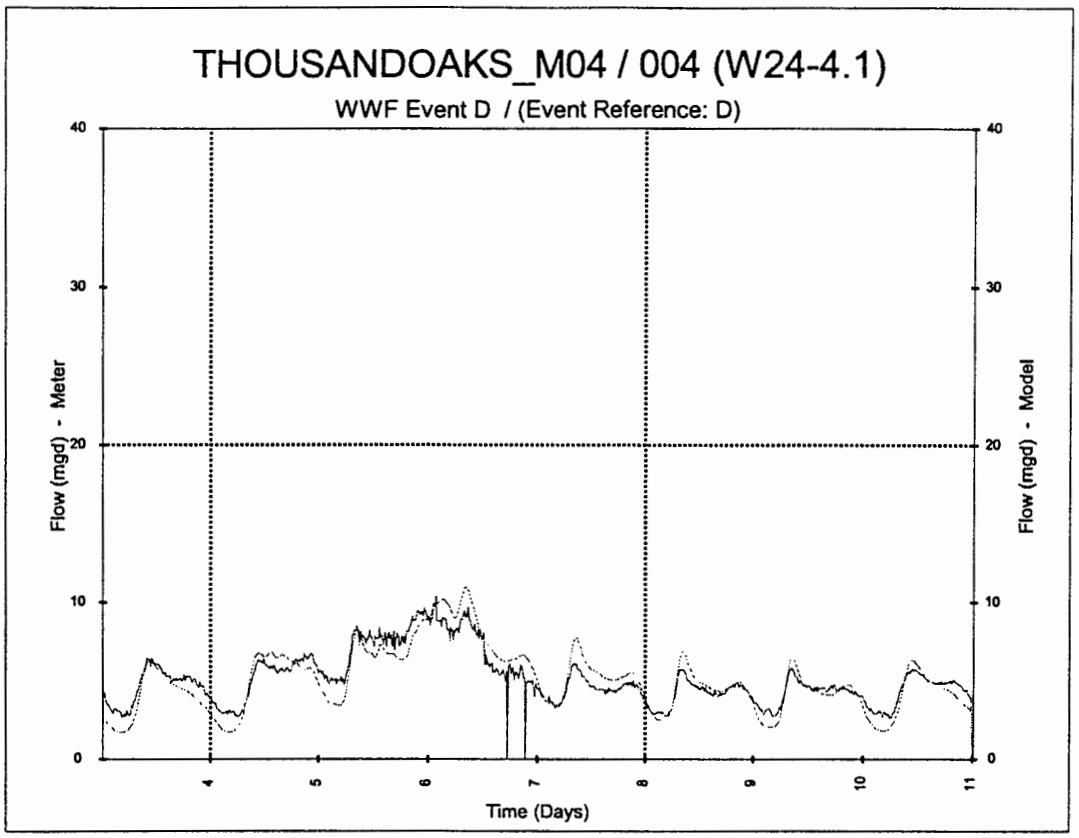

THOUSANDOAKS_M13 / 013 (G4-1_1.1)
WWF Event D / (Event Reference: D)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Days)
0
1
2
3
4
4
5
6
7
8
9
10
11

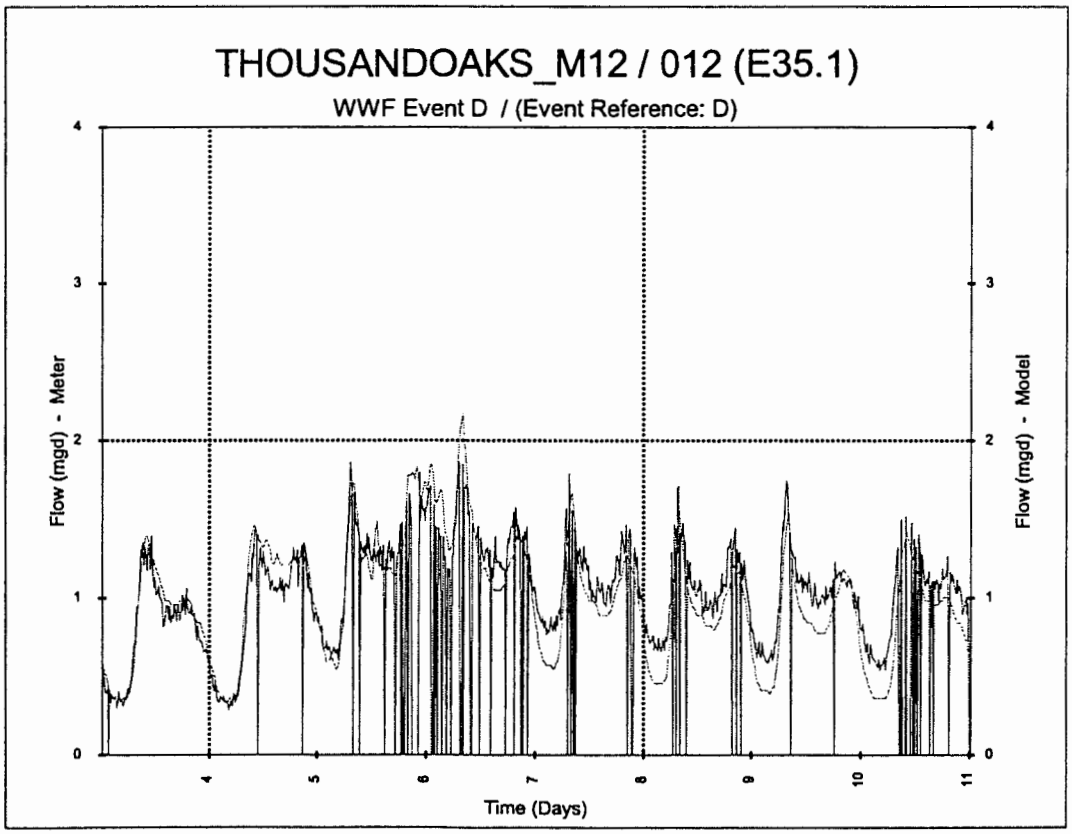

THOUSANDOAKS_M07 / 007 (V4.1)
WWF Event D / (Event Reference: D)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Days)
0
2
4
6
8
4
5
6
7
8
9
10
11


THOUSANDOAKS_M06 / 006 (G1.1)
WWF Event D / (Event Reference: D)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Days)
0
2
4
6
8
4
5
6
7
8
9
10
11


THOUSANDOAKS_M05 / 005 (U3-5.1)
WWF Event D / (Event Reference: D)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Days)
1.2
0.9
0.6
0.3
0
4
5
6
7
8
9
10
11


THOUSANDOAKS_M08 / 008 (W-U37.1)
WWF Event D / (Event Reference: D)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Days)
40
30
20
10
0
4
5
6
7
8
9
10
11


THOUSANDOAKS_M04 / 004 (W24-4.1)
WWF Event D / (Event Reference: D)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Days)
0
10
20
30
40
4
5
6
7
8
9
10
11


THOUSANDOAKS_M12 / 012 (E35.1)
WWF Event D / (Event Reference: D)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Days)
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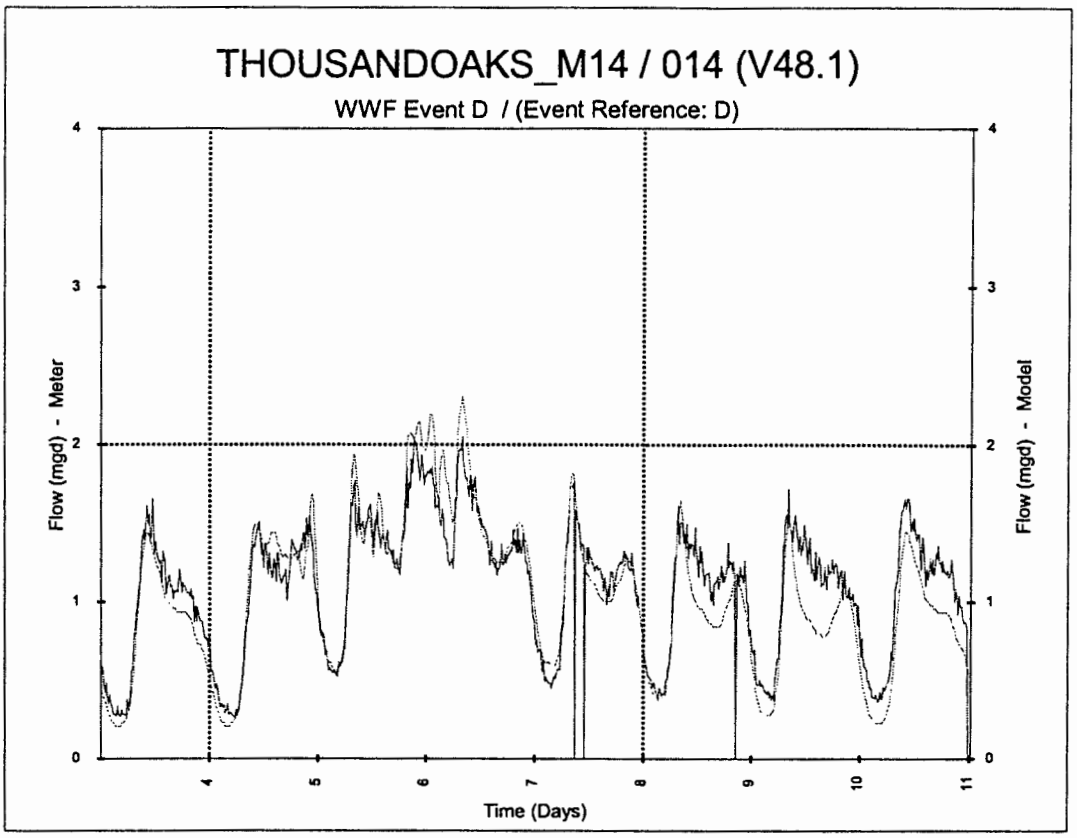
6
7
8
9
10
11


THOUSANDOAKS_M14 / 014 (V48.1)
WWF Event D / (Event Reference: D)
Flow (mgd) - Meter
Flow (mgd) - Model
Time (Days)
0
1
2
3
4
4
5
6
7
8
9
10
11

Appendix J

MWH
MONTGOMERY WATSON HARZA

APPENDIX J

GBA MASTER SERIES AND ARCVIEW REFERENCE MANUAL

CITY OF THOUSAND OAKS
WASTEWATER MASTER PLAN

GBA MASTER SERIES AND ARCVIEW
REFERENCE MANUAL

Prepared by MWH Global,

February 2002

VIEWING ASSET DATA WITH GBA MASTER SERIES

Getting Started

1. Double-click on the GBA Master Series icon located on the desktop.
2. When prompted, enter your login and password. "City of Thousand Oaks" should be showing in the "Client" field.
3. If you do not have a login and password, use login = GBA (all caps) and password = GBA (all caps). You will not be able to make changes to the database.

The following table lists the modules that are currently populated. You can access them by clicking on the word "Sewer" and navigating through the drop-down menus. Look through each of the modules and become familiar with the data that is available.

Module	Description
Pipe Inventory	A catalog of the city's collectors and interceptors.
Manhole Inventory	A catalog of the city's manholes and cleanouts. Contains scanned as-built drawings, atlas maps, and manhole card sketches.
Television Inspections	Digital version of inspections performed by the city and National Plant Services. Defects observed during inspections are assigned point values for analysis and work order management.
Manhole Inspections	Inspections performed by ADS Environmental for the Wastewater Interceptor Master Plan, 2001. Contains photographs of manholes and line lamping. Defects observed during inspection are assigned point values for analysis and work order management.
Line Lamping	Performed by ADS Environmental in conjunction with manhole inspections. Defects observed during line lamping are assigned point values for analysis and work order management.
Smoke Testing	Performed by ADS Environmental for the Wastewater Interceptor Master Plan, 2001. Displays results for 75 pipe sections that were tested for improper connections. Contains photographs and sketches.
Smoke Testing Observations	Gives details about possible improper connections identified during smoke testing.

Finding Data and Creating Reports

1. Open the module that contains the data in which you are interested.
2. If you are looking for data relating to one record only, click on the Locate button. A window will appear where you can scroll down and look for a specific record or type the record you are looking for in the empty box. Click "Open" when you find the record.
3. In some modules, you can move upstream and downstream using the Next Manhole Upstream and Next Manhole Downstream buttons. You can also link to all the modules that relate to the record you are viewing using the Relationships button.
4. If you are looking for a set of data that can be grouped by an attribute (i.e. pipe diameter), click on the Filter button. A new window will appear listing all the fields contained in the module. Find the field you would like to group the data by and select a condition for filtering (i.e. Dia/Height greater than 15). You can save your filter by clicking "save" and giving it a name. Your saved filter will be listed in the window next time you go to it. Check the box next to "My Filter Only" and click "Go". The program will present only the records that meet this condition.
5. Click on the Report button. A window will appear with several different pre-defined reports. Choose one, select "Current Filter", and then click "Preview". Enter a name for the report when prompted.
6. Your report will appear in a new window. You can look through the report using the Page-through button, print it with the Print button, or just cancel it.

DATABASE MAINTENANCE

While looking through the database, you may notice that a change has occurred in the sewer system that is not reflected in the database. In many cases, you can update the database using the following procedures. Only users with maintenance rights can update the database.

Adding Records

1. Open the module to which you would like to add a record. Click on the Add button . A blank record will appear.
2. Each module has "key fields" that must be populated before entering any other information. For the inventory modules, it is the name of the manhole or the upstream and downstream manholes of a pipe. For the inspection modules, you will also need the date of inspection. Fill in the "key fields".
3. If you get an error message, you may be trying to enter inspection data for a pipe or manhole that does not exist in the inventory database. You must add it to the inventory before adding the record in the inspection module. BE VERY CAREFUL WHEN ADDING A NEW PIPE OR MANHOLE TO THE INVENTORY DATABASE. Many manholes can have slightly different IDs depending on the information source. Do a thorough search of the inventory module using the Locate button before making additions. Having two records for the same manhole detriments important relationships in the database.
4. Enter all the data you have for the record. When you are finished, click on the Save button .

Editing Records Editing records (change length and status)

1. Open the module in which you would like to edit a record. Use the Locate button to find the record that you would like to edit. Open the record.

2. Click on the Edit button . Make changes to the record, keeping in mind that "key fields" and fields that are grayed out can not be edited.
3. When you are finished editing, click on the Save button.

Deleting Records Delete link V55-71.1 to V55-71

1. Open the module in which you would like to delete a record. Use the Locate button to find the record that you would like to delete. Open the record.
2. Click on the Delete button . Be sure of what you are doing! It is better to have an extra record than a missing one.

Renaming a Manhole Renaming a manhole (X5000 = CO100)

1. Go to Sewer / System Tools / Sewer Tools / Renumber a Manhole.
2. A new window will appear. Enter the name of the manhole as it exists in the database under "Old MH Number" and the correct manhole name under "New MH Number". Click "Add".
3. The names you entered will appear in a box below. You can renumber several manholes at a time.
4. When you are finished, click "Update" and "Exit".

Attaching Photos, Scanned Manhole Cards and other Files to a Record

1. Scan the image using the scanner software and save the file. Try to use a filename that describes the image and you can remember. Store the file on the hard drive in its appropriate folder, if possible.
2. In GBA, go to the module where you would like to store the image. For scanned manhole cards, as-builts, or atlas maps, go to the manhole inventory module. Use the Locate button to find the record that the image refers to.
3. If you are adding a file with a "jpeg" extension, click on the Image Control button . A window will appear listing all the images that are associated with that record. Click "Add". Click "Browse" to find the image file. Give the file a "Description"

and click "Save". The image will now be available by clicking on the Images button .

4. If you are adding a file with a "tiff" or "doc" extension, click on the Document Control button . A window will appear listing all the documents that are associated with that record. Click "Add". Click "Browse" to find the file. Give the file a "Description" and click "Save". The image will now be available by clicking on the Open Document button .

VIEWING GBA DATA IN THE GIS ENVIRONMENT

Opening the project

1. Double-click on the Arcview icon located on the desktop.
2. Check "Open an Existing Project" and use the browser to locate "H:\Common\Gbamastr\GIS\gbagis.apr".
3. When the main project window opens, click on the view named "View Images and Data".
4. The new view produces a city map with a list of "themes" on the left. Each one of these themes can be added or removed from the map by checking the box to the left of the theme name. Select the themes that help you understand how the sewer system is organized on the screen.

Viewing Manhole Inspection Photos and Manhole Cards

1. Use the zoom tools to hone in on the manhole in which you are interested. Please refer to Arcview manual to find out how to zoom to different views of the map.
2. To view images associated with a manhole, you must first activate the manhole theme. Click on the theme named "Manholes" to make it active. Active themes have a raised appearance in the theme list.
3. Click on the image button and then the manhole. A window will appear giving you two choices: "Manhole Inv" and "Manhole Insp". Click on "Manhole Inv", then double-click on "Manhole Sketch" if you would like to see the manhole card sketch. Click on "Manhole Insp", then the date of inspection that appears below. Click on a photo description to see manhole inspection photos.

Viewing Information Stored in the GBA Database

Information from the television inspection, smoke testing, and manhole inspection modules can be viewed in the GIS environment. GBA has selected some information from each module that can be viewed automatically using the **purple** identity tool .

Data that was not selected for automatic viewing can be viewed using advanced SQL queries. Both procedures are listed below.

GBA GIS Master provides many features in addition to the standard features of Arcview 3.2. Features unique to *GIS Master* are distinguished by the purple color of their buttons, which are shown to the right of the black Arcview buttons. Refer to the *GIS Master* Reference Manual to learn more about these buttons.

Viewing Pre-Selected GBA Data

1. Use the zoom tools to hone in on the manhole or pipe in which you are interested.
2. To view manhole inspection data, make the "Manholes" theme active. To view television inspection or smoke testing data, make the "Pipes" them active.
3. Click on the GBA identity tool and then the manhole or pipe in which you are interested. A window will pop up listing different modules. Click on a module. If there is a record for the manhole or pipe you selected, a date will appear in the window. Click on the date. All the available pre-selected data will appear in the right-hand side of the window.

Using Advanced SQL Queries to View Other Data

This procedure can be used to view any data stored in the GBA database but requires a basic understanding of database management logic.

1. Locate the field name of the data in which you are interested (i.e. "total structural number based on television inspections") in the SWFIELDS list provided in Appendix A. Be sure that the field name you select corresponds to the correct module, as some modules have similar fields.
2. In Arcview, close the view to return to the main project window.
3. Go to Project / SQL Connect. In the SQL Connect window, select GBASewer001 from the drop-down list next to "Connection". A list of tables will appear. Select the

table, defined in the "TableName" column of the SWFIELDS list, in which your data resides.

4. A list of columns will appear. Double-click on the field, defined in the "FieldName" column of the SWFIELDS list, which describes the data you are looking for. You may select several fields at once.
5. In addition, you must select the identification field for that particular module. The field will contain the letters "ID" in its name.
6. Click in the empty space next to the word "from:" and then double-click on the "TableName" again.
7. Click "Query". A new table containing the fields that you selected will appear in the project. Open the "Attributes of swman" or "Attributes of swline" tables using the button available in the "View Images and Data" view.
8. Go to Window / Tile to view both of the tables at once.
9. Click on the name of the "ID" field in the new table, then do the same with the "Attributes of swman" or "Attributes of swline" table. Click on the link button. The tables should now be merged together into one table. The Arcview manual discusses merging in further detail.
10. Return to the "View Images and Data" view. Double-click on either the "pipes" or the "manholes" theme, depending on the data you merged.
11. A legend editor window will appear. You can now create a color-coded legend to view the data you have merged. Please refer to the Arcview manual to learn how to create a legend that best illustrates your data.

<u>Using the GIS Toolkit to Update Shapefiles from the Database</u>

After adding, editing, or deleting data in the GBA database, you will want to update GBA shapefiles to reflect these changes.

1. Close GBA Master Series and Arcview.
2. Go to Start / Programs / GBA Master Series / GBA Tools / GBA GIS Toolkit. Enter "GBA" (all caps) in the "Initial" field and "GBAGTK" (all caps) in the "Password" field. Select "City of Thousand Oaks" in the "Client" box.
3. Go to Sewer / Recreate Maps and Drawings / Recreate Shapefiles from Databases.

4. Select the features you would like. Most likely, you will just want to check "Create a flow arrow shapefile" and leave everything else unchecked.
5. The program will create new shapefiles from the GBA database and store them in C:\GBAMastr\GISTolKit\Update.
6. Copy the new shapefiles into H:\Common\Gbamastr\GIS\Avdata\Covers\Sewer. Open the GBA GIS project in Arcview to view the updated shapefiles.

File Management

Files associated with this project are stored in the folders C:\Gisdata and H:\Common\Gbamastr\GIS\Avdata\Covers\Sewer. The filename of a theme can be found by making the theme active and going to Theme/Properties. The filename is listed as the "Source" in the Definition menu. Do not move or delete these files without understanding the implications of doing so!

VIEWING MODELING RESULTS IN THE GIS ENVIRONMENT

Opening the project

1. Double-click on the Arcview icon located on the desktop.
2. Check "Open an Existing Project" and use the browser to locate "C:\Modeling\modeling.apr".

Navigating

1. The main window of the project lists several model scenarios. Double-click on the scenario in which you are interested.
2. The new view produces a city map with a list of "themes" on the left. Each one of these themes can be added or removed from the map by checking the box to the left of the theme name. Select the themes that help you understand how the sewer system is organized on the screen. Always keep the "Interceptor" theme checked.
3. Use the zoom tools to look at a specific area in detail. Please refer to Arcview manual to find out how to zoom to different views of the map.
4. To view assets associated with a theme, you must first activate the theme in which you are interested. Click on the theme name to make it active. Active themes have a raised appearance in the theme list.
5. Click on the identity tool , then on an active theme graphic to view assets of the active theme. Please refer to Arcview manual for more instructions on using the identity tool.
6. If you would like to see the results for a different scenario, click the "X" in the right-hand corner to return to the main window.

Understanding the Model Results

The modeled interceptor system is color-coded using the legend shown below the "Interceptor" theme. The color-coding summarizes flow or velocity characteristics for each pipe section (depending on the view you chose).

1. Make the "Interceptor" theme active. Click on the identity tool , then click on any interceptor section to view the modeling data for that pipe. The following list defines relevant model variables listed in the identity box. These variables are dependent on the weather (dry vs. wet) and planning stage (existing vs. buildout) conditions that you have selected.

List of Interceptor Attributes Relevant to Model Results

Attribute	Description
Link_ref	Pipe reference in model, named using upstream manhole
Ds_node	Downstream manhole of pipe segment
Length	Pipe length
Hgt	Pipe diameter
Full_flow	Pipe capacity
Us_invert	Invert elevation at upstream end of pipe
Us_depth	Wastewater depth at upstream end of pipe during maximum flow
Us_mflow	Maximum flow at upstream end of pipe
Us_vel	Velocity at upstream end of pipe during maximum flow
Us_aflow	Average flow at upstream end of pipe
Us_pkfac	Peaking factor at upstream end, equals maximum flow / average flow.
	* For wet weather simulations, this is NOT the wet weather peaking
	factor. The wet weather peaking factor can be calculated by dividing
	the maximum wet weather flow by the average dry weather flow.
Us_surch	If field is blank, there was no surcharging at upstream end
	If field is "x", there was surcharging related to back-up at upstream end
	If field is "+", there was surcharging related to insufficient capacity at upstream end
Ds_invert	Invert elevation at downstream end of pipe
Ds_depth	Wastewater depth at downstream end of pipe during maximum flow
Ds_mflow	Maximum flow at downstream end of pipe
Ds_vel	Velocity at downstream end of pipe during maximum flow
Ds_aflow	Average flow at downstream end of pipe

Ds_pkfac	Peaking factor at downstream end, equals maximum flow / average flow.
	* For wet weather simulations, this is NOT the wet weather peaking
	factor. The wet weather peaking factor can be calculated by dividing
	the maximum wet weather flow by the average dry weather flow.
Ds_surch	If field is blank, there was no surcharging at downstream end
	If field is "x", there was surcharging related to back-up at downstream end
	If field is "+", there was surcharging related to insufficient capacity at downstream end
Ds_dd	Maximum depth / diameter at downstream end
Ds_qq	Maximum flow / capacity at downstream end

Model flows were derived using spreadsheets provided by the city planner. The spreadsheets contain information about the number of dwelling units and total non-residential square footage within specified zoning areas. Each zoning area has been assigned to one of the sewer drainage basins in the model.

1. Make the "Drainage Basins" theme active. Click on the identity tool , then click on the drainage basin in which you are interested. A window will pop up listing information stored in the drainage basin theme. The following list defines relevant model variables listed in the identity box.

List of Interceptor Attributes Relevant to Model Results

Attribute	Description
Node_ref	Name of the manhole into which the drainage basin feeds
Insewer_id	The reference ID of the drainage basin

2. Open the planning spreadsheets "C:\modeling\planning\res3.xls" and "C:\modeling\planning\nonres3.xls". Sort the data by "Wastewater Sub-Area", then scroll down to find the reference ID of the drainage basin you were looking at in Arcview. NEVER SAVE CHANGES you have made to these spreadsheets, as it will ruin their integrity.

3. In "res3.xls" you will find a list of all the residential developments that are incorporated in that drainage basin. The values under "Units Existing" were used for existing condition model runs, while the values under "Holding Capacity" were used for buildout condition model runs. In "nonres3.xls" you will find a list of all the non-residential developments that are incorporated in that drainage basin. The values under "AREA EX" were used for existing condition model runs, while the values under "AREAB" were used for buildout condition model runs.
4. Refer to the document *City of Thousand Oaks Wastewater Interceptor Master Plan: Summary of Hydraulic Modeling Assumptions* provided in Appendix B to calculate flows for each development that is included in the drainage basin.
5. In Arcview, make the "Manholes" theme active and find the manhole referenced above using the identity tool.
6. Make the "Interceptor" theme active and click on the pipes upstream and downstream of the referenced manhole. The difference in average flow between these two pipes is approximately equal to the total flow you have calculated from the planning spreadsheets.

Printing

Each view has a corresponding layout that is ready to print in 11'x 17' color format. The following instructions will guide you in printing map views and results.

1. Return to the main project window and click the "Layouts" picture. A list matching the view list appears. Click on the layout that corresponds to the results you would like to print.
2. A new window appears that acts as a live link to the view with the same name. If you have zoomed in to an area in that view, the same area will appear in the layout.
3. Go to File/Print Setup and select your printer. Then select 11'x 17' paper size and the "landscape" printing format. Click 'OK'.
4. Go to File/Print and click 'OK'.

File Management

All files associated with this project are stored in the folders C:\Gisdata and C:\Modeling\Arcade\Master. The filename of a theme can be found by making the theme

active and going to Theme/Properties. The filename is listed as the Source in the Definition menu. Do not move or delete these files without understanding the implications of doing so!

APPENDIX A:

GBA DATABASE FIELD DESCRIPTIONS

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2622	AD_ADR_APT	CMADDR	Apartment Number		☑	8x	5
2617	AD_ADR_BDG	CMADDR	Address		☑	nnnnnn	0
2618	AD_ADR_DIR	CMADDR	Address - Direction		☑	2x	5
2621	AD_ADR_SFX	CMADDR	Address - Suffix		☑	5X	5
2619	AD_ADR_STR	CMADDR	Address - Street Nam		☑	25x	5
2620	AD_ADR_TY	CMADDR	Address - Street Typ		☑	4x	5
2615	AD_BLDG_CD	CMADDR	Building Type		☑	nnn	1
2616	AD_BLDG_TY	CMADDR	Building Type Descri		☑	25x	5
2857	AD_CITY_CD	CMADDR	Facility		☑	nnn	1
2858	AD_CITY_TY	CMADDR	Facility Text		☑	50x	5
2691	AD_ID	CMADDR			☑		0
2692	AD_NETID	CMADDR	Pipe ID		☑		0
2363	NOTE1_CD	OBSNOTES	Location		☑	nnn	
2364	NOTE2_CD	OBSNOTES	Defect		☑	nnn	
2852	NOTE2_TY	OBSNOTES	Defect Text		☑	25x	5
153	BS_BASIN	SWBASIN	Flow Basin		☑	10x	5
2365	BS_BASINID	SWBASIN	Link to Outlets and		☑		0
2373	BS_BASNFLT	SWBASIN	Base Infilt (gpd)		☑	nnnnnnnnn	0
2374	BS_HINFLT	SWBASIN	High GW Infilt (gpd)		☑	nnnnnnnnn	0
2850	BS_MOD_BY	SWBASIN	Modified By		☑	3x	5
2851	BS_MOD_DT	SWBASIN	Modified Date		☑	mm/dd/yyyy	6
2375	BS_NFLO	SWBASIN	Inflow (gpd)		☑	nnnnnnnnn	0
2371	BS_NFLOADJ	SWBASIN	Inflow Adj Factor		☑	nn.nn	4
2369	BS_NFLOCST	SWBASIN	Inflow T&&T Cost		☑	nnn.nnn	4
2367	BS_NFLODAY	SWBASIN	Inflow Days		☑	nnn	0
2370	BS_NFLTADJ	SWBASIN	Infilt Adj Factor		☑	nn.nn	4
2368	BS_NFLTCST	SWBASIN	Infilt T&&T Cost		☑	nnn.nnn	4
2366	BS_NFLTDAY	SWBASIN	Infiltration Days		☑	nnn	0
2372	BS_PWF	SWBASIN	Pres Worth Factor		☑	nnn.nnn	4
2996	BA_BASIN	SWBASINOUT	Flow Basin		☐	10x	5
2376	BA_BASINID	SWBASINOUT	Link to Flow Basin		☑		
2378	BA_MOD_BY	SWBASINOUT	Modified By		☑	3x	5
2379	BA_MOD_DT	SWBASINOUT	Modified Date		☑	mm/dd/yyyy	6
2377	BA_NETID	SWBASINOUT	Pipe Link		☑		0
1575	BD_ADDID	SWBLDG	Address Link		☑		0
161	BD_BFIN_CD	SWBLDG	Basement Finished		☑	nnn	1
162	BD_BFIN_TY	SWBLDG	Basmnt Finished Text		☑	25x	5
1576	BD_BLDGID	SWBLDG	Building Child Link		☑		0
165	BD_BRPT_CD	SWBLDG	Backup Reported		☑	nnn	1
166	BD_BRPT_TY	SWBLDG	Backup Reported Text		☑	25x	5
167	BD_COMMENT	SWBLDG	Comments		☑		5
888	BD_CREW	SWBLDG	Inspection Crew		☑	10x	5
3042	BD_DOC_FLG	SWBLDG	Document Available		☐		2
889	BD_DT_INSP	SWBLDG	Inspection Date		☑	mm/dd/yyyy	6
177	BD_ELVS_CD	SWBLDG	Elev of Serv Pipe		☑	nnn	1
178	BD_ELVS_TY	SWBLDG	Elv of Srv Pipe Text		☑	25x	5

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
179	BD_FLDL_CD	SWBLDG	Flooding Source		☑	nnn	1
180	BD_FLDL_TY	SWBLDG	Flooding Source Text		☑	25x	5
181	BD_FLDR_CD	SWBLDG	Exist Floor Drains		☑	nnn	1
182	BD_FLDR_TY	SWBLDG	Exist Flr Drns Text		☑	25x	5
183	BD_FND_CD	SWBLDG	Foundation Type		☑	nnn	1
184	BD_FND_TY	SWBLDG	Foundation Type Text		☑	25x	5
2834	BD_GPM	SWBLDG	Total GPM		☐	nnnn.nn	4
2835	BD_GPM_REM	SWBLDG	Remaining GPM		☐	nnnn.nn	4
1578	BD_IMG_FLG	SWBLDG	Image Available		☑		2
187	BD_INSP_CD	SWBLDG	Inspection Status		☑	nnn	1
188	BD_INSP_TY	SWBLDG	Inspect Status Text		☑	25x	5
1580	BD_MOD_BY	SWBLDG	Modified By		☑	3x	5
1581	BD_MOD_DT	SWBLDG	Modified Date		☑	mm/dd/yyyy	6
1579	BD_MOV_FLG	SWBLDG	Movie Available		☑		2
2998	BD_OBSSTAT	SWBLDG	Exterior Source Stat		☐	nnn	1
192	BD_PFLD_CD	SWBLDG	Previous Flooding		☑	nnn	1
193	BD_PFLD_TY	SWBLDG	Previous Flood Text		☑	25x	5
2997	BD_SMPSTAT	SWBLDG	Sump Status		☐	nnn	1
204	BD_STAT_TY	SWBLDG	Building Status		☑	25x	5
890	BD_USER1CD	SWBLDG	User 1		☑	nnn	1
891	BD_USER1TY	SWBLDG	User 1 Text		☑	25x	5
892	BD_USER2CD	SWBLDG	User 2		☑	nnn	1
893	BD_USER2TY	SWBLDG	User 2 Text		☑	25x	5
894	BD_USER3CD	SWBLDG	User 3		☑	nnn	1
895	BD_USER3TY	SWBLDG	User 3 Text		☑	25x	5
896	BD_USER4	SWBLDG	User 4		☑	nnnnnnnnn.n	4
897	BD_USER5	SWBLDG	User 5		☑	30x	5
1582	BD_USER6	SWBLDG	User 6		☑		2
1583	BD_USER7	SWBLDG	User 7		☑		2
1584	BD_USER8	SWBLDG	User 8		☑		2
922	BO_BLDGID	SWBLDGOB	Observ Link to Bldg		☑		0
926	BO_COMMENT	SWBLDGOB	Comments		☑		5
2949	BO_DIR_CD	SWBLDGOB	Turn Direction		☑	nnn	1
2950	BO_DIR_TY	SWBLDGOB	Turn Direction Text		☑	25x	5
3050	BO_DOC_FLG	SWBLDGOB	Document Available		☐		2
2381	BO_DY_CREW	SWBLDGOB	Dye Test Crew		☑	10x	5
2380	BO_DY_DATE	SWBLDGOB	Dye Test Date		☑	mm/dd/yyyy	6
2385	BO_DYEND	SWBLDGOB	Dye End Time		☑	hh:mm am	6
2387	BO_DYPICT	SWBLDGOB	Dye Test Pict # (s)		☑	8x	5
2382	BO_DYRESCD	SWBLDGOB	Dye Test Results		☑	nnn	1
2383	BO_DYRESTY	SWBLDGOB	Dye Test Res Text		☑	25x	5
2386	BO_DYROLL	SWBLDGOB	Dye Test Roll #		☑	5x	5
2384	BO_DYSTART	SWBLDGOB	Dye Start Time		☑	hh:mm am	6
925	BO_FLO_LCK	SWBLDGOB	Flow Rate Lock		☑		2
2972	BO_FRM_CD	SWBLDGOB	Measured From		☑	nnn	1
2973	BO_FRM_TY	SWBLDGOB	Measured From Type		☑	25x	5

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
215	BO_FT1	SWBLDGOB	Length (ft)		☑	nnnn.n	4
216	BO_FT2	SWBLDGOB	Width (ft)		☑	nnnn.n	4
217	BO_GPM	SWBLDGOB	Flow Rate (gpm)		☑	nnn.nn	4
2839	BO_GPM_REM	SWBLDGOB	Remaining GPM		☑	nnnn.nn	4
1585	BO_IMG_FLG	SWBLDGOB	Image Available		☑		2
2948	BO_MNDIST	SWBLDGOB	Distance		☑	nnnn.n	4
923	BO_MOD_BY	SWBLDGOB	Modified By		☑	3x	5
924	BO_MOD_DT	SWBLDGOB	Modified Date		☑	mm/dd/yyyy	6
1586	BO_MOV_FLG	SWBLDGOB	Movie Available		☑		2
2999	BO_OBS_ID	SWBLDGOB			☐		0
218	BO_OBS_NO	SWBLDGOB	Observation #		☑	nnn	1
2951	BO_OFFDIST	SWBLDGOB	Turn Distance		☑	nnnn.n	4
2838	BO_PER_REM	SWBLDGOB	% I/I Removed		☑	nnn	1
2550	BO_PICT	SWBLDGOB	Pict # (s)		☑	8x	5
2549	BO_ROLL	SWBLDGOB	Roll #		☑	5x	5
219	BO_RUNOFF	SWBLDGOB	Runoff Factor		☑	nn	1
220	BO_SRCE_CD	SWBLDGOB	Source		☑	nnn	1
221	BO_SRCE_TY	SWBLDGOB	Source Text		☑	25x	5
222	BO_STAT_CD	SWBLDGOB	Results		☑	nnn	1
223	BO_STAT_TY	SWBLDGOB	Results Text		☑	25x	5
2572	BO_USER1CD	SWBLDGOB	User 1		☑	nnn	1
2573	BO_USER1TY	SWBLDGOB	User 1 Text		☑	25x	5
2574	BO_USER2CD	SWBLDGOB	User 2		☑	nnn	1
2575	BO_USER2TY	SWBLDGOB	User 2 Text		☑	25x	5
2576	BO_USER3CD	SWBLDGOB	User 3		☑	nnn	1
2577	BO_USER3TY	SWBLDGOB	User 3 Text		☑	25x	5
2578	BO_USER4	SWBLDGOB	User 4		☑	nnnnnnnnn.n	4
2579	BO_USER5	SWBLDGOB	User 5		☑	30x	5
2580	BO_USER6	SWBLDGOB	User 6		☑		2
2581	BO_USER7	SWBLDGOB	User 7		☑		2
2582	BO_USER8	SWBLDGOB	User 8		☑		2
2952	BO_X	SWBLDGOB	X Coordinate		☑	-nnnnnnnnn.	4
2953	BO_Y	SWBLDGOB	Y Coordinate		☑	-nnnnnnnnn.	4
2624	BB_BLDGID	SWBLDGSUM	Sump Link to Buildin		☑		0
3052	BB_DOC_FLG	SWBLDGSUM	Document Available		☐		2
2630	BB_DPNT_CD	SWBLDGSUM	Discharge Point		☑	nnn	1
2631	BB_DPNT_TY	SWBLDGSUM	Discharge Point Text		☑	25x	5
2626	BB_DRNB_CD	SWBLDGSUM	Drains Basement		☑	nnn	1
2627	BB_DRNB_TY	SWBLDGSUM	Drains Basement Text		☑	25x	5
2628	BB_DRNL_CD	SWBLDGSUM	Drains Laundry		☑	nnn	1
2629	BB_DRNL_TY	SWBLDGSUM	Drains Laundry Text		☑	25x	5
2632	BB_DVLV_CD	SWBLDGSUM	Diverter Valve		☑	nnn	1
2633	BB_DVLV_TY	SWBLDGSUM	Diverter Value Text		☑	25x	5
185	BB_FNDC_CD	SWBLDGSUM	Foundation Conn		☑	nnn	1
186	BB_FNDC_TY	SWBLDGSUM	Fndation Conn Text		☑	25x	5
2636	BB_GPM	SWBLDGSUM	Flow Rate (gpm)		☑	nnn.nn	4

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2836	BB_GPM_REM	SWBLDGSUM	Remaining GPM		☐	nnnn.nn	4
2639	BB_IMG_FLG	SWBLDGSUM	Image Available		☑		2
2641	BB_MOD_BY	SWBLDGSUM	Modified By		☑	3x	5
2642	BB_MOD_DT	SWBLDGSUM	Modified Date		☑	mm/dd/yyyy	6
2640	BB_MOV_FLG	SWBLDGSUM	Movie Available		☑		2
190	BB_PACT_CD	SWBLDGSUM	Pump Active		☑	nnn	1
191	BB_PACT_TY	SWBLDGSUM	Pump Active Text		☑	25x	5
2837	BB_PER_REM	SWBLDGSUM	% I/I Removed		☐	nnn	1
194	BB_PXST_CD	SWBLDGSUM	Pump Exists		☑	nnn	1
195	BB_PXST_TY	SWBLDGSUM	Pump Exists Text		☑	25x	5
196	BB_SCND_CD	SWBLDGSUM	Sump Pit Cond		☑	nnn	1
197	BB_SCND_TY	SWBLDGSUM	Sump Pit Cond Text		☑	25x	5
198	BB_SDRN_CD	SWBLDGSUM	Sump Pit Drain		☑	nnn	1
199	BB_SDRN_TY	SWBLDGSUM	Sump Pit Drain Text		☑	25x	5
201	BB_SSEL_CD	SWBLDGSUM	Sump Pit Sealed		☑	nnn	1
202	BB_SSEL_TY	SWBLDGSUM	Sump Pit Sealed Text		☑	25x	5
3000	BB_STAT_CD	SWBLDGSUM	Sump Status		☐	nnn	1
2635	BB_STAT_TY	SWBLDGSUM	Sump Status		☑	25x	5
205	BB_STYP_CD	SWBLDGSUM	Sump Pit Type		☑	nnn	1
206	BB_STYP_TY	SWBLDGSUM	Sump Pit Type Text		☑	25x	5
2625	BB_SUMP_NO	SWBLDGSUM	Sump #		☑	nn	1
2637	BB_USER1	SWBLDGSUM	User 1		☑	nnnnnnnnn.n	4
2638	BB_USER2	SWBLDGSUM	User 2		☑	30x	5
2979	CO_ID	SWCOMMENT	:Unique Comment ID		☑		0
2980	CO_MOD_BY	SWCOMMENT	:Last user to modify		☑	3x	5
2981	CO_MOD_DT	SWCOMMENT	:Date record last mo		☑	mm/dd/yyyy	6
2974	CO_SB	SWCOMMENT	Comment		☑		5
2968	CO_SS	SWCOMMENT	Comment		☑		5
2982	CO_TEXT	SWCOMMENT	:Comment text string		☑		3
3001	CCV_NETID	SWCONNCUR	Link to Swnetconn		☐		0
3002	CCV_VX_NUM	SWCONNCUR	Vertex Number		☐	nnnnn	0
3003	CCV_X	SWCONNCUR	X Offset		☐	-nnnn.nn	4
3004	CCV_Y	SWCONNCUR	Y Offset		☐	-nnnn.nn	4
3005	CV_NETID	SWCURVE	Link to Swnet		☐		0
3006	CV_VX_NUM	SWCURVE	Vertex Number		☐	nnnnn	0
3007	CV_X	SWCURVE	X Coordinate		☐	-nnnnnnnnn.	4
3008	CV_Y	SWCURVE	Y Coordinate		☐	-nnnnnnnnn.	4
2795	DI_CST_FCT	SWDIA	Diameter Cost Factor		☑	nnn.nn	4
2788	DI_DIA	SWDIA	Diameter (in)		☑	nnnn	1
3009	DI_MOD_BY	SWDIA	Modified By		☐	3x	5
3010	DI_MOD_DT	SWDIA	Modified Date		☐	mm/dd/yyyy	6
2794	DI_REHAB	SWDIA	Rehabilitation Cost		☑	nnnn.nn	4
2792	DI_REP_10	SWDIA	Replace Cost less th		☑	nnnn.nn	4
2793	DI_REP_11	SWDIA	Replace Cost each ad		☑	nnnn.nn	4
2789	DI_SLOPE	SWDIA	Min Slope (%)		☑	nn.nnn	4
2345	Code	SWFIELDSDES			☑	nnn	1

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2609	Descriptio	SWFIELDSDES			☑	25x	
2344	ID	SWFIELDSDES			☑		0
2442	FC_BASINID	SWFLOCOVER	Link to Flow Setup T		☑		0
2443	FC_DEPTH	SWFLOCOVER	Ponding Depth		☑	nnn	1
2444	FC_FLOW	SWFLOCOVER	Flow Rate per Hole		☑	nn.nn	4
2445	FM_BASINID	SWFLOMH	Link to Flow Setup T		☑		0
2608	FM_CODEID	SWFLOMH	Popup Codes		☑	nnn	1
2447	FM_FACTOR	SWFLOMH	Flow Rate Factor		☑	nn.nn	4
2446	FM_FIELDID	SWFLOMH	ID Link to Swfields		☑		0
3011	FM_ID	SWFLOMH			☐		0
2449	FS_BASINID	SWFLOSETUP	Link to Flow Basins		☑		0
2491	FS_COMDRN	SWFLOSETUP	Combo Sump - Drain		☑	nnn.nn	4
2490	FS_COMSAN	SWFLOSETUP	Combo Sump - Sanita		☑	nnn.nn	4
2498	FS_COMSUSP	SWFLOSETUP	Combo Sump - Suspe		☑	nnn.nn	4
2512	FS_DEF_BM	SWFLOSETUP	Defct Fact Brkn/Miss		☑	nn.nn	4
2513	FS_DEF_CB	SWFLOSETUP	Defct Fact Corrs/Bld		☑	nn.nn	4
2514	FS_DEF_R	SWFLOSETUP	Defect Factor Roots		☑	nn.nn	4
2492	FS_DIVVALV	SWFLOSETUP	Diverter Valve		☑	nnn.nn	4
2493	FS_FLDRHOL	SWFLOSETUP	Floor Drain Hole		☑	nnn.nn	4
2521	FS_ITM_BE	SWFLOSETUP	Item Factor Bench		☑	nn.nn	4
2519	FS_ITM_CN	SWFLOSETUP	Item Factor Cone		☑	nn.nn	4
2515	FS_ITM_CV	SWFLOSETUP	Item Factor Cover		☑	nn.nn	4
2516	FS_ITM_FR	SWFLOSETUP	Item Factor Frame		☑	nn.nn	4
2517	FS_ITM_FS	SWFLOSETUP	Item Fact Frame Seal		☑	nn.nn	4
2518	FS_ITM_GA	SWFLOSETUP	Item Factor Grade Ad		☑	nn.nn	4
2522	FS_ITM_TR	SWFLOSETUP	Item Factor Trough		☑	nn.nn	4
2520	FS_ITM_WL	SWFLOSETUP	Item Factor Wall		☑	nn.nn	4
2500	FS_MAT_1_1	SWFLOSETUP	Density 1 Severity 1		☑	nn	1
2504	FS_MAT_1_2	SWFLOSETUP	Density 1 Severity 2		☑	nn	1
2508	FS_MAT_1_3	SWFLOSETUP	Density 1 Severity 3		☑	nn	1
2501	FS_MAT_2_1	SWFLOSETUP	Density 2 Severity 1		☑	nn	1
2505	FS_MAT_2_2	SWFLOSETUP	Density 2 Severity 2		☑	nn	1
2509	FS_MAT_2_3	SWFLOSETUP	Density 2 Severity 3		☑	nn	1
2502	FS_MAT_3_1	SWFLOSETUP	Density 3 Severity 1		☑	nn	1
2506	FS_MAT_3_2	SWFLOSETUP	Density 3 Severity 2		☑	nn	1
2510	FS_MAT_3_3	SWFLOSETUP	Density 3 Severity 3		☑	nn	1
2503	FS_MAT_4_1	SWFLOSETUP	Density 4 Severity 1		☑	nn	1
2507	FS_MAT_4_2	SWFLOSETUP	Density 4 Severity 2		☑	nn	1
2511	FS_MAT_4_3	SWFLOSETUP	Density 4 Severity 3		☑	nn	1
2478	FS_NFLOCN1	SWFLOSETUP	Inflow Cone Rating 1		☑	nn.nn	4
2479	FS_NFLOCN2	SWFLOSETUP	Inflow Cone Rating 2		☑	nn.nn	4
2480	FS_NFLOCN3	SWFLOSETUP	Inflow Cone Rating 3		☑	nn.nn	4
2466	FS_NFLOCV1	SWFLOSETUP	Inflow Cover Ratng 1		☑	nn.nn	4
2467	FS_NFLOCV2	SWFLOSETUP	Inflow Cover Ratng 2		☑	nn.nn	4
2468	FS_NFLOCV3	SWFLOSETUP	Inflow Cover Ratng 3		☑	nn.nn	4
2469	FS_NFLOFR1	SWFLOSETUP	Inflow Frame Ratng 1		☑	nn.nn	4

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2470	FS_NFLOFR2	SWFLOSETUP	Inflow Frame Ratng 2		☑	nn.nn	4
2471	FS_NFLOFR3	SWFLOSETUP	Inflow Frame Ratng 3		☑	nn.nn	4
2472	FS_NFLOFS1	SWFLOSETUP	Inflow Fram Seal Rat		☑	nn.nn	4
2473	FS_NFLOFS2	SWFLOSETUP	Inflow Fram Seal Rat		☑	nn.nn	4
2474	FS_NFLOFS3	SWFLOSETUP	Inflow Fram Seal Rat		☑	nn.nn	4
2475	FS_NFLOGA1	SWFLOSETUP	Inflow Grade Adj Rat		☑	nn.nn	4
2476	FS_NFLOGA2	SWFLOSETUP	Inflow Grade Adj Rat		☑	nn.nn	4
2477	FS_NFLOGA3	SWFLOSETUP	Inflow Grade Adj Rat		☑	nn.nn	4
2481	FS_NFLOWL1	SWFLOSETUP	Inflow Wall Rating 1		☑	nn.nn	4
2482	FS_NFLOWL2	SWFLOSETUP	Inflow Wall Rating 2		☑	nn.nn	4
2483	FS_NFLOWL3	SWFLOSETUP	Inflow Wall Rating 3		☑	nn.nn	4
2460	FS_NFLTBN1	SWFLOSETUP	Infilt Bench Ratng 1		☑	nn.nn	4
2461	FS_NFLTBN2	SWFLOSETUP	Infilt Bench Ratng 2		☑	nn.nn	4
2462	FS_NFLTBN3	SWFLOSETUP	Infilt Bench Ratng 3		☑	nn.nn	4
2454	FS_NFLTCN1	SWFLOSETUP	Infilt Cone Rating 1		☑	nn.nn	4
2455	FS_NFLTCN2	SWFLOSETUP	Infilt Cone Rating 2		☑	nn.nn	4
2456	FS_NFLTCN3	SWFLOSETUP	Infilt Cone Rating 2		☑	nn.nn	4
2451	FS_NFLTGA1	SWFLOSETUP	Infilt Grade Adj Rat		☑	nn.nn	4
2452	FS_NFLTGA2	SWFLOSETUP	Infilt Grade Adj Rat		☑	nn.nn	4
2453	FS_NFLTGA3	SWFLOSETUP	Infilt Grade Adj Rat		☑	nn.nn	4
2463	FS_NFLTTR1	SWFLOSETUP	Infilt Trough Rat 1		☑	nn.nn	4
2464	FS_NFLTTR2	SWFLOSETUP	Infilt Trough Rat 2		☑	nn.nn	4
2465	FS_NFLTTR3	SWFLOSETUP	Infilt Trough Rat 3		☑	nn.nn	4
2457	FS_NFLTWL1	SWFLOSETUP	Infilt Wall Rating 1		☑	nn.nn	4
2458	FS_NFLTWL2	SWFLOSETUP	Infilt Wall Rating 2		☑	nn.nn	4
2459	FS_NFLTWL3	SWFLOSETUP	Infilt Wall Rating 3		☑	nn.nn	4
2484	FS_RAIN	SWFLOSETUP	Rainfall In/Hr		☑	nn.nn	4
2485	FS_RUNOFF1	SWFLOSETUP	Runoff Factor 1		☑	n.nn	4
2486	FS_RUNOFF2	SWFLOSETUP	Runoff Factor 2		☑	n.nn	4
2487	FS_RUNOFF3	SWFLOSETUP	Runoff Factor 3		☑	n.nn	4
2488	FS_RUNOFF4	SWFLOSETUP	Runoff Factor 4		☑	n.nn	4
2489	FS_RUNOFF5	SWFLOSETUP	Runoff Factor 5		☑	n.nn	4
2494	FS_SANUSEA	SWFLOSETUP	Sanitary Sump Unseal		☑	nnn.nn	4
2495	FS_STMDRN	SWFLOSETUP	Storm Sump - Drain		☑	nnn.nn	4
2496	FS_STMSAN	SWFLOSETUP	Storm Sump - Sanitar		☑	nnn.nn	4
2497	FS_STMSUSP	SWFLOSETUP	Storm Sump - Suspect		☑	nnn.nn	4
2499	FS_SUSPSMP	SWFLOSETUP	Suspect Sump		☑	nnn.nn	4
2450	FS_UNITS	SWFLOSETUP	ALL FLOWS IN GPM		☑	1x	5
2523	FK_BASINID	SWFLOSMK	Link to Flow Setup T		☑		0
2527	FK_CALCULA	SWFLOSMK	Calculate?		☑		2
2587	FK_CODEID	SWFLOSMK	Link to Swfields Tab		☑		1
2586	FK_FIELDID	SWFLOSMK	Link to Swfields Tab		☑		0
2530	FK_HEAVY	SWFLOSMK	Heavy		☑	nnn.nn	4
2525	FK_II_CD	SWFLOSMK	Flow Type		☑	nnn	1
2526	FK_II_TY	SWFLOSMK	Flow Type Text		☑	25x	5
2528	FK_LIGHT	SWFLOSMK	Light		☑	nnn.nn	4

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2529	FK_MEDIUM	SWFLOSMK	Medium		☑	nnn.nn	4
2524	FK_NOTEID	SWFLOSMK	Link to Observ Notes		☑		
3012	SU_UNIT_CD	SWFREQ	Frequency/Duration C		☐	nn	1
3013	SU_UNIT_TY	SWFREQ	Frequency/Duration T		☐	10x	5
2696	Descriptio	SWIMAGE	Description		☑	50x	
2697	Display	SWIMAGE	Display		☑	50x	5
1605	FileName	SWIMAGE	File Name		☑	12x	5
1603	KeyID	SWIMAGE	Key ID		☑		0
1604	Module	SWIMAGE	Module		☑	8x	
2670	FI_CLCFLOW	SWISOLAT	Calc Flow Diff (gpd)		☑	-nnnnnnnnn	0
2669	FI_CLMFLOW	SWISOLAT	Meas Flo Diff (gpd)		☑	-nnnnnnnnn	0
2698	FI_COMMENT	SWISOLAT	Comments		☑		5
2644	FI_CREW	SWISOLAT	Testing Crew		☑	10x	5
2668	FI_DSCFLOW	SWISOLAT	DS Calc Flow (gpd)		☑	nnnnnnnnn	0
2664	FI_DSDEPTH	SWISOLAT	DS Flow Depth (in)		☑	nnn.nn	4
2665	FI_DSDIA	SWISOLAT	DS Diameter (in)		☑	nnnn	1
2661	FI_DSDV_CD	SWISOLAT	DS Device		☑	nnn	1
2662	FI_DSDV_TY	SWISOLAT	DS Device Text		☑	25x	5
2667	FI_DSMANN	SWISOLAT	DS Mannings		☑	n.nnn	4
2663	FI_DSMFLOW	SWISOLAT	DS Meas Flo (gpd)		☑	nnnnnnnnn	0
2666	FI_DSSLOPE	SWISOLAT	DS Slope %		☑	nn.nnn	4
2660	FI_DSTIME	SWISOLAT	DS Time		☑	hh:mm am	6
2645	FI_DT_TEST	SWISOLAT	Testing Date		☑	mm/dd/yyyy	6
2648	FI_HOUS	SWISOLAT	# Houses Connctd		☑	nnnn	1
2683	FI_IMG_FLG	SWISOLAT	Image Available		☑		2
2646	FI_INTER	SWISOLAT	Interceptor		☑	25x	5
2643	FI_ISOID	SWISOLAT	Link to Pipe List Ta		☑		0
2671	FI_MFLOIDM	SWISOLAT	Meas Flow per IDM		☑	-nnnnnn.nn	4
2647	FI_MICRO	SWISOLAT	Micro Flow Basin #		☑	10x	5
2685	FI_MOD_BY	SWISOLAT	Modified By		☑	3x	5
2686	FI_MOD_DT	SWISOLAT	Modified Date		☑	mm/dd/yyyy	6
2684	FI_MOV_FLG	SWISOLAT	Movie Available		☑		2
2650	FI_TOTIDM	SWISOLAT	Total IDM		☑	nnnn.nn	4
2649	FI_TOTLEN	SWISOLAT	Total Length (ft)		☑	nnnnnn.n	4
2659	FI_USCFLOW	SWISOLAT	US Calc Flow (gpd)		☑	nnnnnnnnn	0
2655	FI_USDEPTH	SWISOLAT	US Flow Depth (in)		☑	nnn.nn	4
2656	FI_USDIA	SWISOLAT	US Diameter (in)		☑	nnnn	1
2652	FI_USDV_CD	SWISOLAT	US Device		☑	nnn	1
2653	FI_USDV_TY	SWISOLAT	US Device Text		☑	25x	5
2672	FI_USER1CD	SWISOLAT	User 1		☑	nnn	1
2673	FI_USER1TY	SWISOLAT	User 1 Text		☑	25x	5
2674	FI_USER2CD	SWISOLAT	User 2		☑	nnn	1
2675	FI_USER2TY	SWISOLAT	User 2 Text		☑	25x	5
2676	FI_USER3CD	SWISOLAT	User 3		☑	nnn	1
2677	FI_USER3TY	SWISOLAT	User 3 Text		☑	25x	5
2678	FI_USER4	SWISOLAT	User 4		☑	nnnnnnnnn.n	4

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2679	FI_USER5	SWISOLAT	User 5		☑	30x	5
2680	FI_USER6	SWISOLAT	User 6		☑		2
2681	FI_USER7	SWISOLAT	User 7		☑		2
2682	FI_USER8	SWISOLAT	User 8		☑		2
2658	FI_USMANN	SWISOLAT	US Mannings		☑	n.nnn	4
2654	FI_USMFLOW	SWISOLAT	US Meas Flo (gpd)		☑	nnnnnnnnn	0
2657	FI_USSLOPE	SWISOLAT	US Slope %		☑	nn.nnn	4
2651	FI_USTIME	SWISOLAT	US Time		☑	hh:mm am	6
2687	FN_ISOID	SWISONET	Link to Flow Isolati		☑		0
2688	FN_NETID	SWISONET	Link to Pipe Table		☑		0
2787	FN_PIPE_NO	SWISONET	Pipe #		☑	nnn	0
245	JO_COMMENT	SWJNTOBS	Comments		☑		5
248	JO_FOOTAGE	SWJNTOBS	Distance (ft)		☑	nnnn.n	4
2689	JO_IMG_FLG	SWJNTOBS	Image Available		☑		2
1608	JO_JTID	SWJNTOBS	Link to Jt Test Line		☑		0
1611	JO_MOD_BY	SWJNTOBS	Modified By		☑	3x	5
1612	JO_MOD_DT	SWJNTOBS	Modified Date		☑	mm/dd/yyyy	6
2690	JO_MOV_FLG	SWJNTOBS	Movie Available		☑		2
249	JO_NOT1_CD	SWJNTOBS	Pass/Fail		☑	nnn	1
1609	JO_NOT1_TY	SWJNTOBS	Pass/Fail Text		☑	25x	5
250	JO_NOT2_CD	SWJNTOBS	Seal/Non-Seal		☑	nnn	1
1610	JO_NOT2_TY	SWJNTOBS	Seal/Non-Seal Text		☑	25x	5
251	JO_OBS_NO	SWJNTOBS	Observation #		☑	nnn	1
252	JO_RATING	SWJNTOBS	Rating		☑	n	1
258	JT_COMMENT	SWJOINTS	Comments		☑		5
259	JT_DATA_DT	SWJOINTS	Inspection Date		☑	mm/dd/yyyy	6
1621	JT_IMG_FLG	SWJOINTS	Image Available		☑		2
905	JT_JTID	SWJOINTS	Unique Number		☑		0
261	JT_LATEST	SWJOINTS	Latest Test		☑		2
262	JT_MAX_FT	SWJOINTS	Max Distance (ft)		☑	nnnn.n	4
263	JT_MAX_OBS	SWJOINTS	Max Obs #		☑	nnn	1
914	JT_MOD_BY	SWJOINTS	Modified By		☑	3x	5
915	JT_MOD_DT	SWJOINTS	Modified Date		☑	mm/dd/yyyy	6
1622	JT_MOV_FLG	SWJOINTS	Movie Available		☑		2
904	JT_NETID	SWJOINTS	Pipe Link		☑		0
1616	JT_START	SWJOINTS	Start Counter		☑	15x	5
1617	JT_STOP	SWJOINTS	Stop Counter		☑	15x	5
266	JT_TAPE_ID	SWJOINTS	Tape ID		☑	15x	5
1613	JT_TVDR_CD	SWJOINTS	TV Direction		☑	nnn	1
1614	JT_TVDR_TY	SWJOINTS	TV Direction Text		☑	25x	5
906	JT_USER1CD	SWJOINTS	User 1		☑	nnn	1
907	JT_USER1TY	SWJOINTS	User 1 Text		☑	25x	5
908	JT_USER2CD	SWJOINTS	User 2		☑	nnn	1
909	JT_USER2TY	SWJOINTS	User 2 Text		☑	25x	5
910	JT_USER3CD	SWJOINTS	User 3		☑	nnn	1
911	JT_USER3TY	SWJOINTS	User 3 Text		☑	25x	5

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
912	JT_USER4	SWJOINTS	User 4		☑	nnnnnnnnn.n	4
913	JT_USER5	SWJOINTS	User 5		☑	30x	5
1618	JT_USER6	SWJOINTS	User 6		☑		2
1619	JT_USER7	SWJOINTS	User 7		☑		2
1620	JT_USER8	SWJOINTS	User 8		☑		2
268	JT_WORK_BY	SWJOINTS	Inspection Crew		☑	25x	5
269	LP_ANG_INV	SWLAMP	Angled Rim/Inv (ft)		☑	nn.nn	4
270	LP_CLN_CD	SWLAMP	Cleaning		☑	nnn	1
271	LP_CLN_TY	SWLAMP	Cleaning Text		☑	25x	5
272	LP_COMMENT	SWLAMP	Comments		☑		5
273	LP_CROWN	SWLAMP	Rim to Crown (ft)		☑	nnn.nn	4
274	LP_DIR_CD	SWLAMP	Pipe Direction		☑	nnn	1
275	LP_DIR_TY	SWLAMP	Pipe Direction Text		☑	25x	5
3043	LP_DOC_FLG	SWLAMP	Document Available		☐		2
276	LP_DPO_CD	SWLAMP	Deposition		☑	nnn	1
277	LP_DPO_DEP	SWLAMP	Depos Depth (in)		☑	nnn.nn	4
278	LP_DPO_TY	SWLAMP	Deposition Text		☑	25x	5
2323	LP_DSMAN	SWLAMP	DS Manhole		☑	20x	
280	LP_DT_INSP	SWLAMP	Date Inspected		☑	mm/dd/yyyy	6
282	LP_FLO_DEP	SWLAMP	Flow Depth (in)		☑	nnn.nn	4
283	LP_FLO_VEL	SWLAMP	Flow Velocity (fps)		☑	nn.nn	4
2804	LP_GPM_REM	SWLAMP	Remaining GPM		☑	nnnn.nn	4
1623	LP_IMG_FLG	SWLAMP	Images Available		☑		2
284	LP_INMH_CD	SWLAMP	Inspected MH		☑	nnn	1
285	LP_INMH_TY	SWLAMP	US or DS Text		☑	4x	5
286	LP_INVERT	SWLAMP	Rim to Invert (ft)		☑	nnn.nn	4
898	LP_LAMP_ID	SWLAMP	Child Link		☑		0
287	LP_LINK_MH	SWLAMP	Inspected Manhole		☑	20x	5
900	LP_MOD_BY	SWLAMP	Modified By		☑	3x	5
901	LP_MOD_DT	SWLAMP	Modified Date		☑	mm/dd/yyyy	6
1624	LP_MOV_FLG	SWLAMP	Movies Available		☑		2
899	LP_NETID	SWLAMP	Pipe Link		☑		0
288	LP_OFFSET	SWLAMP	Angled Offset (in)		☑	nn.n	4
921	LP_TOT_CLN	SWLAMP	Total Cleaning		☑	nnnn.nnn	4
779	LP_TOT_INF	SWLAMP	Total Infiltration		☑	nnnn.nnn	4
920	LP_TOT_STR	SWLAMP	Total Structure		☑	nnnn.nnn	4
289	LP_TV_CD	SWLAMP	TV		☑	nnn	1
290	LP_TV_TY	SWLAMP	TV Text		☑	25x	5
292	LP_USER1CD	SWLAMP	User 1		☑	nnn	1
293	LP_USER1TY	SWLAMP	User 1 Text		☑	25x	5
294	LP_USER2CD	SWLAMP	User 2		☑	nnn	1
295	LP_USER2TY	SWLAMP	User 2 Text		☑	25x	5
296	LP_USER3CD	SWLAMP	User 3		☑	nnn	1
297	LP_USER3TY	SWLAMP	User 3 Text		☑	25x	5
298	LP_USER4	SWLAMP	User 4		☑	nnnnnnnnn.n	4
299	LP_USER5	SWLAMP	User 5		☑	30x	5

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
1565	LP_USER6	SWLAMP	User 6		☑		2
1566	LP_USER7	SWLAMP	User 7		☑		2
1567	LP_USER8	SWLAMP	User 8		☑		2
2322	LP_USMAN	SWLAMP	US Manhole		☑	20x	
701	LO_CLN_RAT	SWLAMPOB	Cleaning #		☑	nnnn	1
702	LO_COMMENT	SWLAMPOB	Comments		☑		5
780	LO_FLO_ACT	SWLAMPOB	Observed (gpm)		☑	nn.nnn	4
699	LO_FLO_RAT	SWLAMPOB	Estimated (gpm)		☑	nn.nnn	4
695	LO_FOOTAGE	SWLAMPOB	Distance (ft)		☑	nnnn.n	4
2806	LO_GPM_REM	SWLAMPOB	Remaining GPM		☑	nn.nnn	4
1626	LO_IMG_FLG	SWLAMPOB	Image Available		☑		2
1625	LO_LPID	SWLAMPOB	Link to Parent		☑		0
1627	LO_MOV_FLG	SWLAMPOB	Movie Available		☑		2
696	LO_NOT1_CD	SWLAMPOB	Location		☑	nnn	1
782	LO_NOT1_TY	SWLAMPOB	Location Text		☑	25x	5
697	LO_NOT2_CD	SWLAMPOB	Description		☑	nnn	1
783	LO_NOT2_TY	SWLAMPOB	Description Text		☑	25x	5
2589	LO_OBS_ID	SWLAMPOB	Unique Number for th		☑		0
694	LO_OBS_NO	SWLAMPOB	Observation #		☑	nnn	1
2805	LO_PER_REM	SWLAMPOB	% I/I Removed		☑	nnn	1
698	LO_RATING	SWLAMPOB	Rating		☑	n	1
2807	LO_REPR_CD	SWLAMPOB	Repaired		☑	nnn	1
2808	LO_REPR_TY	SWLAMPOB	Repaired Text		☑	25x	5
700	LO_STR_RAT	SWLAMPOB	Structure #		☑	nnn	1
39	MH_BN_BM_D	SWMAN	Bench Broken D		☑	n	1
40	MH_BN_BM_S	SWMAN	Bench Broken S		☑	n	1
41	MH_BN_CB_D	SWMAN	Bench Corrosion D		☑	n	1
42	MH_BN_CB_S	SWMAN	Bench Corrosion S		☑	n	1
2783	MH_BN_REM	SWMAN	Bench % I/I Rem		☑	nnn	1
43	MH_BN_RT_D	SWMAN	Bench Root D		☑	n	1
44	MH_BN_RT_S	SWMAN	Bench Root S		☑	n	1
2802	MH_BN_STRP	SWMAN	Bench Struct Rep		☑		2
733	MH_BNCH_AF	SWMAN	Bench Act Flw (gpm)		☑	nn.nn	4
37	MH_BNCH_CD	SWMAN	Bench		☑	nnn	1
36	MH_BNCH_F	SWMAN	Bench Flow Rating		☑	n	1
38	MH_BNCH_TY	SWMAN	Bench Text		☑	25x	5
45	MH_CFIT_CD	SWMAN	Cover Fit		☑	nnn	1
46	MH_CFIT_TY	SWMAN	Cover Fit Text		☑	25x	5
723	MH_CLN_CD	SWMAN	Cleaning		☑	nnn	1
724	MH_CLN_TY	SWMAN	Cleaning Text		☑	25x	5
47	MH_CN_BM_D	SWMAN	Cone Broken D		☑	n	1
48	MH_CN_BM_S	SWMAN	Cone Broken S		☑	n	1
49	MH_CN_CB_D	SWMAN	Cone Corrosion D		☑	n	1
50	MH_CN_CB_S	SWMAN	Cone Corrosion S		☑	n	1
718	MH_CN_CRK	SWMAN	Cone Cracks		☑	nn	1
2326	MH_CN_FCD	SWMAN	Cone I/I		☑	nnn	1

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
712	MH_CN_FTY	SWMAN	Cone I/I Text		☑	25x	5
715	MH_CN_HOL	SWMAN	Cone Holes		☑	nn	1
721	MH_CN_JNT	SWMAN	Cone Joints		☑	nn	1
2781	MH_CN_REM	SWMAN	Cone % I/I Rem		☑	nnn	1
51	MH_CN_RT_D	SWMAN	Cone Root D		☑	n	1
52	MH_CN_RT_S	SWMAN	Cone Root S		☑	n	1
2800	MH_CN_STRP	SWMAN	Cone Struct Rep		☑		2
53	MH_COMMEN	SWMAN	Comments		☑		5
2859	MH_COND_CD	SWMAN	General MH Condition		☑	nnn	1
2860	MH_COND_TY	SWMAN	General MH Cond Tex		☑	25x	5
731	MH_CONE_AF	SWMAN	Cone Act Flw (gpm)		☑	nn.nn	4
56	MH_CONE_CD	SWMAN	Cone/Top		☑	nnn	1
57	MH_CONE_F	SWMAN	Cone Flow Rating		☑	n	1
58	MH_CONE_TY	SWMAN	Cone/Top Text		☑	25x	5
59	MH_COR_FLO	SWMAN	Remaining Inflow		☑	nnnn.nn	4
60	MH_COR_GPM	SWMAN	Remaining Flow (gpm)		☑	nnnn.nn	4
61	MH_COR_INF	SWMAN	Remaining Infiltrati		☑	nnnn.nn	4
727	MH_COVR_AF	SWMAN	Cover Act Flw (gpm)		☑	nn.nn	4
62	MH_COVR_F	SWMAN	Cover Flow Rating		☑	n	1
104	MH_CREW	SWMAN	Inspection Crew		☑	10x	5
63	MH_CSIZ_CD	SWMAN	Cover Size		☑	nnn	1
64	MH_CSIZ_TY	SWMAN	Cover Size Text		☑	25x	5
65	MH_CV_BM_D	SWMAN	Cover Broken D		☑	n	1
66	MH_CV_BM_S	SWMAN	Cover Broken S		☑	n	1
67	MH_CV_CB_D	SWMAN	Cover Corrosion D		☑	n	1
68	MH_CV_CB_S	SWMAN	Cover Corrosion S		☑	n	1
69	MH_CV_GRAD	SWMAN	Cover Grade		☑	nn	1
139	MH_CV_HOLE	SWMAN	# Holes in Cover		☑	nnn	1
2777	MH_CV_REM	SWMAN	Cover % I/I Rem		☑	nnn	1
2796	MH_CV_STRP	SWMAN	Cover Struct Rep		☑		2
3044	MH_DOC_FLG	SWMAN	Document Available		☐		2
70	MH_DT_INSP	SWMAN	Inspection Date		☑	mm/dd/yyyy	6
71	MH_DT_REHB	SWMAN	Rehab Date		☑	mm/dd/yyyy	6
72	MH_FR_BM_D	SWMAN	Frame Broken D		☑	n	1
73	MH_FR_BM_S	SWMAN	Frame Broken S		☑	n	1
74	MH_FR_CB_D	SWMAN	Frame Corrosion D		☑	n	1
75	MH_FR_CB_S	SWMAN	Frame Corrosion S		☑	n	1
2778	MH_FR_REM	SWMAN	Frame % I/I Rem		☑	nnn	1
76	MH_FR_RT_D	SWMAN	Frame Root D		☑	n	1
77	MH_FR_RT_S	SWMAN	Frame Root S		☑	n	1
2797	MH_FR_STRP	SWMAN	Frame Struct Rep		☑		2
728	MH_FRAM_AF	SWMAN	Frame Act Flw (gpm)		☑	nn.nn	4
78	MH_FRAM_F	SWMAN	Frame Flow Rating		☑	n	1
79	MH_FRM_OFF	SWMAN	Frame Offset (in)		☑	nn	1
80	MH_FS_BM_D	SWMAN	Frame Seal Broken D		☑	n	1
81	MH_FS_BM_S	SWMAN	Frame Seal Broken S		☑	n	1

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
82	MH_FS_CB_D	SWMAN	Frame Seal Corr D		☑	n	1
83	MH_FS_CB_S	SWMAN	Frame Seal Corr S		☑	n	1
2779	MH_FS_REM	SWMAN	Fr Seal % I/I Rem		☑	nnn	1
84	MH_FS_RT_D	SWMAN	Frame Seal Root D		☑	n	1
85	MH_FS_RT_S	SWMAN	Frame Seal Root S		☑	n	1
2798	MH_FS_STRP	SWMAN	Fr Seal Struct Rep		☑		2
729	MH_FSEA_AF	SWMAN	FS Actual Flow (gpm)		☑	nn.nn	4
86	MH_FSEA_F	SWMAN	FS Flow Rating		☑	n	1
717	MH_GA_CRK	SWMAN	Grade Adj Cracks		☑	nn	1
2325	MH_GA_FCD	SWMAN	Grade Adj I/I		☑	nnn	1
711	MH_GA_FTY	SWMAN	Grade Adj I/I Text		☑	25x	5
714	MH_GA_HOL	SWMAN	Grade Adj Holes		☑	nn	1
720	MH_GA_JNT	SWMAN	Grade Adj Joints		☑	nn	1
87	MH_GPM_FLO	SWMAN	Total Inflow		☑	nnnn.nn	4
88	MH_GPM_INF	SWMAN	Total Infiltration		☑	nnnn.nn	4
89	MH_GR_BM_D	SWMAN	Grade Adj Broken D		☑	n	1
90	MH_GR_BM_S	SWMAN	Grade Adj Broken S		☑	n	1
91	MH_GR_CB_D	SWMAN	Grade Adj Corr D		☑	n	1
92	MH_GR_CB_S	SWMAN	Grade Adj Corr S		☑	n	1
2780	MH_GR_REM	SWMAN	Grade % I/I Rem		☑	nnn	1
93	MH_GR_RT_D	SWMAN	Grade Adj Root D		☑	n	1
94	MH_GR_RT_S	SWMAN	Grade Adj Root S		☑	n	1
2799	MH_GR_STRP	SWMAN	Grade Struct Rep		☑		2
730	MH_GRAD_AF	SWMAN	GA Actual Flow (gpm)		☑	nn.nn	4
95	MH_GRAD_CD	SWMAN	Grade Adjustment		☑	nnn	1
97	MH_GRAD_F	SWMAN	GA Flow Rating		☑	n	1
96	MH_GRAD_TY	SWMAN	Grade Adj Text		☑	25x	5
98	MH_GRD_DEP	SWMAN	Grade Adj Depth (in)		☑	nnn	1
99	MH_GRD_DIA	SWMAN	Grd Adj Min Dia (in)		☑	nnn	1
100	MH_H2S	SWMAN	H2S		☑	nnn	1
916	MH_IMG_FLG	SWMAN	Image Available		☑		2
775	MH_INSP_CD	SWMAN	Inspection		☑	nnn	1
102	MH_INSP_TY	SWMAN	Inspection Text		☑	25x	5
141	MH_LOC_CD	SWMAN	Location		☑	nnn	1
142	MH_LOC_TY	SWMAN	Location Text		☑	25x	5
103	MH_MHID	SWMAN	Number from SWNET		☑		0
2324	MH_MHINSP	SWMAN	Inspection Record ID		☑		0
918	MH_MOD_BY	SWMAN	Modified By		☑	3x	5
919	MH_MOD_DT	SWMAN	Modified Date		☑	mm/dd/yyyy	6
917	MH_MOV_FLG	SWMAN	Movie Available		☑		2
107	MH_PND_CD	SWMAN	Ponding Type		☑	nnn	1
108	MH_PND_DEP	SWMAN	Ponding Depth (in)		☑	nnn	1
109	MH_PND_TY	SWMAN	Cover Ponding Text		☑	25x	5
126	MH_RISR_HT	SWMAN	Riser Height (in)		☑	nn	1
127	MH_SEAL_CD	SWMAN	Pipe Seal		☑	nnn	1
128	MH_SEAL_TY	SWMAN	Pipe Seal Text		☑	25x	5

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
129	MH_SHAP_CD	SWMAN	Cone/Top Shape		☑	nnn	1
130	MH_SHAP_TY	SWMAN	Cone/Top Shape Text		☑	25x	5
725	MH_SMK_CD	SWMAN	Smoke		☑	nnn	1
726	MH_SMK_TY	SWMAN	Smoke Text		☑	25x	5
131	MH_ST_C_CD	SWMAN	Steps Condition		☑	nnn	1
132	MH_ST_C_TY	SWMAN	Step Condition Text		☑	25x	5
133	MH_STEP_CD	SWMAN	Steps		☑	nnn	1
134	MH_STEP_TY	SWMAN	Steps Text		☑	25x	5
135	MH_SUM_FLO	SWMAN	Total Flow Value		☑	nn	1
136	MH_SUM_STR	SWMAN	Total Structural Val		☑	nnn	1
137	MH_SURCHG	SWMAN	Surchange Evid (ft)		☑	nn.n	4
138	MH_TESTED	SWMAN	Dye Testing		☑		2
140	MH_TOT_GPM	SWMAN	Total Flow (gpm)		☑	nnnn.nn	4
110	MH_TR_BM_D	SWMAN	Trough Broken D		☑	n	1
111	MH_TR_BM_S	SWMAN	Trough Broken S		☑	n	1
112	MH_TR_CB_D	SWMAN	Trough Corrison D		☑	n	1
113	MH_TR_CB_S	SWMAN	Trough Corrison S		☑	n	1
2784	MH_TR_REM	SWMAN	Trough % I/I Rem		☑	nnn	1
114	MH_TR_RT_D	SWMAN	Trough Root D		☑	n	1
115	MH_TR_RT_S	SWMAN	Trough Root S		☑	n	1
2803	MH_TR_STRP	SWMAN	Trough Struct Rep		☑		2
143	MH_TRGH_CD	SWMAN	Trough		☑	nnn	1
144	MH_TRGH_TY	SWMAN	Trough Text		☑	25x	5
734	MH_TROF_AF	SWMAN	Trough Act Flw (gpm)		☑	nn.nn	4
116	MH_TROF_F	SWMAN	Trough Flow Rating		☑	n	1
703	MH_USER1CD	SWMAN	User 1		☑	nnn	1
704	MH_USER1TY	SWMAN	User 1 Text		☑	25x	5
705	MH_USER2CD	SWMAN	User 2		☑	nnn	1
706	MH_USER2TY	SWMAN	User 2 Text		☑	25x	5
707	MH_USER3CD	SWMAN	User 3		☑	nnn	1
708	MH_USER3TY	SWMAN	User 3 Text		☑	25x	5
709	MH_USER4	SWMAN	User 4		☑	nnnnnnnnn.n	4
710	MH_USER5	SWMAN	User 5		☑	30x	5
1628	MH_USER6	SWMAN	User 6		☑		2
1629	MH_USER7	SWMAN	User 7		☑		2
1630	MH_USER8	SWMAN	User 8		☑		2
732	MH_WALL_AF	SWMAN	Wall Act Flw (gpm)		☑	nn.nn	4
146	MH_WALL_F	SWMAN	Wall Flow Rating		☑	n	1
147	MH_WL_BM_D	SWMAN	Wall Broken D		☑	n	1
148	MH_WL_BM_S	SWMAN	Wall Broken S		☑	n	1
149	MH_WL_CB_D	SWMAN	Wall Corrosion D		☑	n	1
150	MH_WL_CB_S	SWMAN	Wall Corrosion S		☑	n	1
719	MH_WL_CRK	SWMAN	Wall Cracks		☑	nn	1
2327	MH_WL_FCD	SWMAN	Wall I/I		☑	n	1
713	MH_WL_FTY	SWMAN	Wall I/I Text		☑	25x	5
716	MH_WL_HOL	SWMAN	Wall Holes		☑	nn	1

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
722	MH_WL_JNT	SWMAN	Wall Joints		☑	nn	1
2782	MH_WL_REM	SWMAN	Wall % I/I Rem		☑	nnn	1
151	MH_WL_RT_D	SWMAN	Wall Root D		☑	n	1
152	MH_WL_RT_S	SWMAN	Wall Root S		☑	n	1
2801	MH_WL_STRP	SWMAN	Wall Struct Rep		☑		2
2826	MG_BN_GPM	SWMANGPM	Bench GPM		☑	nnnn.nn	4
2827	MG_BN_REM	SWMANGPM	Bench Remaining GP		☑	nnnn.nn	4
2822	MG_CN_GPM	SWMANGPM	Cone GPM		☑	nnnn.nn	4
2823	MG_CN_REM	SWMANGPM	Cone Remaining GPM		☑	nnnn.nn	4
2814	MG_CV_GPM	SWMANGPM	Cover GPM		☑	nnnn.nn	4
2815	MG_CV_REM	SWMANGPM	Cover Remaining GP		☑	nnnn.nn	4
2816	MG_FR_GPM	SWMANGPM	Frame GPM		☑	nnnn.nn	4
2817	MG_FR_REM	SWMANGPM	Frame Remaining GP		☑	nnnn.nn	4
2818	MG_FS_GPM	SWMANGPM	Fr Seal GPM		☑	nnnn.nn	4
2819	MG_FS_REM	SWMANGPM	Fr Seal Remainng GP		☑	nnnn.nn	4
2820	MG_GR_GPM	SWMANGPM	Grade Adj GPM		☑	nnnn.nn	4
2821	MG_GR_REM	SWMANGPM	Grade Adj Remain GP		☑	nnnn.nn	4
2813	MG_MHID	SWMANGPM	Number from SWMAN		☑		0
2828	MG_TR_GPM	SWMANGPM	Trough GPM		☑	nnnn.nn	4
2829	MG_TR_REM	SWMANGPM	Trough Remaining GP		☑	nnnn.nn	4
2824	MG_WL_GPM	SWMANGPM	Wall GPM		☑	nnnn.nn	4
2825	MG_WL_REM	SWMANGPM	Wall Remaining GPM		☑	nnnn.nn	4
2699	Descriptio	SWMOVIE			☑	50x	
2700	Display	SWMOVIE			☑	50x	5
1635	FileName	SWMOVIE			☑	12x	5
1633	KeyID	SWMOVIE			☑		0
1634	Module	SWMOVIE			☑	8x	
300	NT_ACADED	SWNET	Record Drawn on Map		☑		2
301	NT_BASIN	SWNET	Flow Basin		☑	10x	5
302	NT_BED_CD	SWNET	Bedding		☑	nnn	1
303	NT_BED_TY	SWNET	Bedding Text		☑	25x	5
304	NT_CAPAC	SWNET	Capacity (cfs)		☑	nnnn.nn	4
305	NT_CF_DINV	SWNET	Adj DS Inv Elev		☑	nnnn.nn	4
306	NT_CF_DRIM	SWNET	Adj DS Rim Elev		☑	nnnn.nn	4
307	NT_CF_UINV	SWNET	Adj US Inv Elev		☑	nnnn.nn	4
308	NT_CF_URIM	SWNET	Adj US Rim Elev		☑	nnnn.nn	4
309	NT_CLN_CD	SWNET	Cleaning Area		☑	nnn	1
310	NT_CLN_TY	SWNET	Cleaning Area Text		☑	25x	5
754	NT_CREW	SWNET	Collected By		☑	10x	5
313	NT_DIA	SWNET	Dia/Height (in)		☑	nnnn	1
2349	NT_DIST_CD	SWNET	District		☑	nnn	1
2350	NT_DIST_TY	SWNET	District Text		☑	25x	5
3024	NT_DOC_FLG	SWNET	Document Available		☐		2
315	NT_DS_INV	SWNET	DS Invert		☑	nnnn.nn	4
316	NT_DS_RIM	SWNET	DS Rim		☑	nnnn.nn	4
317	NT_DS_STA	SWNET	DS Station		☑	nnnnnn.nn	4

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
342	NT_DSID	SWNET	DS MH Link to MH Inv		☑		0
318	NT_DSINVO	SWNET	Record DS Invert		☑	nnnn.nn	4
319	NT_DSMAN	SWNET	DS Manhole		☑	20x	5
320	NT_DSRIMO	SWNET	Record DS Rim		☑	nnnn.nn	4
321	NT_DT_CONS	SWNET	Date Constructed		☑	mm/dd/yyyy	6
322	NT_FLOW_CD	SWNET	Flow Type		☑	nnn	1
323	NT_FLOW_TY	SWNET	Flow Type Text		☑	25x	5
324	NT_GOVT_CD	SWNET	Benefit District		☑	nnn	1
325	NT_GOVT_TY	SWNET	Benefit Distrct Text		☑	25x	5
1638	NT_ID	SWNET	Unique Number		☑		0
327	NT_IDM	SWNET	IDM		☑	nnnn.nn	4
1639	NT_IMG_FLG	SWNET	Image Available		☑		2
328	NT_INDX_CD	SWNET	Index		☑	10x	5
755	NT_LEN_CD	SWNET	Length Status		☑	nnn	1
756	NT_LEN_TY	SWNET	Length Status Text		☑	25x	5
329	NT_LENGTH	SWNET	Length (ft)		☑	nnnn.n	4
330	NT_LINE_CD	SWNET	Line Type		☑	nnn	1
331	NT_LINE_TY	SWNET	Line Type Text		☑	25x	5
332	NT_LINR_CD	SWNET	Liner		☑	nnn	1
333	NT_LINR_TY	SWNET	Liner Text		☑	25x	5
334	NT_LOC_CD	SWNET	Location		☑	nnn	1
335	NT_LOC_TY	SWNET	Location Text		☑	25x	5
336	NT_LOCK	SWNET	Elevation Lock		☑		2
337	NT_MANNING	SWNET	Mannings		☑	n.nnn	4
338	NT_MAT_CD	SWNET	Material		☑	nnn	1
339	NT_MAT_TY	SWNET	Material Text		☑	25x	5
1641	NT_MOD_BY	SWNET	Modified By		☑	3x	5
1642	NT_MOD_DT	SWNET	Modified Date		☑	mm/dd/yyyy	6
1640	NT_MOV_FLG	SWNET	Movie Available		☑		2
340	NT_NOTES	SWNET	Comments		☑		5
343	NT_OWN_CD	SWNET	Owner		☑	nnn	1
344	NT_OWN_TY	SWNET	Owner Text		☑	25x	5
345	NT_PROJ_NO	SWNET	Project Number		☑	10x	5
2933	NT_PSECLTH	SWNET	Pipe Sec Length (ft)		☑	nnnn.n	4
346	NT_S_T_R	SWNET	Sec-Twn-Rng		☑	10x	5
347	NT_SHAP_CD	SWNET	Shape		☑	nnn	1
348	NT_SHAP_TY	SWNET	Shape Text		☑	25x	5
349	NT_SLOPE	SWNET	Slope %		☑	-nn.nnn	4
311	NT_SLP_LCK	SWNET	Slope Lock		☑		2
350	NT_ST_DINV	SWNET	DS Invert Status		☑	1x	5
351	NT_ST_DRIM	SWNET	DS Rim Status		☑	1x	5
352	NT_ST_UINV	SWNET	US Invert Status		☑	1x	5
353	NT_ST_URIM	SWNET	US Rim Status		☑	1x	5
354	NT_SURF_CD	SWNET	Surface		☑	nnn	1
355	NT_SURF_TY	SWNET	Surface Text		☑	25x	5
356	NT_TAG	SWNET	Record Tag for Progr		☑		2

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2830	NT_TRAP_CD	SWNET	Trap Area		☑	nnn	1
2831	NT_TRAP_TY	SWNET	Trap Area Text		☑	25x	5
357	NT_US_INV	SWNET	US Invert		☑	nnnn.nn	4
358	NT_US_RIM	SWNET	US Rim		☑	nnnn.nn	4
359	NT_US_STA	SWNET	US Station		☑	nnnnnn.nn	4
3029	NT_USER10	SWNET	User 10		☑	mm/dd/yyyy	6
3030	NT_USER11	SWNET	User 11		☑	mm/dd/yyyy	6
3031	NT_USER12	SWNET	User 12		☑	-nnnnnnnnn.	4
3032	NT_USER13	SWNET	User 13		☑	-nnnnnnnnn.	4
3033	NT_USER14	SWNET	User 14		☑	30x	5
3034	NT_USER15	SWNET	User 15		☑	30x	5
757	NT_USER1CD	SWNET	User 1		☑	nnn	1
758	NT_USER1TY	SWNET	User 1 Text		☑	25x	5
759	NT_USER2CD	SWNET	User 2		☑	nnn	1
760	NT_USER2TY	SWNET	User 2 Text		☑	25x	5
761	NT_USER3CD	SWNET	User 3		☑	nnn	1
762	NT_USER3TY	SWNET	User 3 Text		☑	25x	5
763	NT_USER4	SWNET	User 4		☑	nnnnnnnnn.n	4
764	NT_USER5	SWNET	User 5		☑	30x	5
1568	NT_USER6	SWNET	User 6		☑		2
1569	NT_USER7	SWNET	User 7		☑		2
1570	NT_USER8	SWNET	User 8		☑		2
3028	NT_USER9	SWNET	User 9		☑	mm/dd/yyyy	6
341	NT_USID	SWNET	US MH Link to MH Inv		☑		0
360	NT_USINVO	SWNET	Record US Invert		☑	nnnn.nn	4
361	NT_USMAN	SWNET	US Manhole		☑	20x	5
362	NT_USRIMO	SWNET	Record US Rim		☑	nnnn.nn	4
363	NT_WIDTH	SWNET	Pipe Width (in)		☑	nnnn	1
3025	NT_WO_COM	SWNET	Short Comment		☐	75x	5
2710	NC_CDIR_CD	SWNETCONN	Direction from Main		☑	nn	1
2711	NC_CDIR_TY	SWNETCONN	Dir from Main Text		☑	25x	5
2722	NC_COMMENT	SWNETCONN	Comments		☑		5
2706	NC_CON_DST	SWNETCONN	Dist from Manhole		☑	nnnn.n	4
2703	NC_CON_NO	SWNETCONN	Connection #		☑	nn	1
2702	NC_CONNID	SWNETCONN	Link into Service La		☑	nnnn	0
2712	NC_DIA	SWNETCONN	Diameter (in)		☑	nnnnn.n	4
3014	NC_DIR	SWNETCONN	Conn Dir from Main		☐	nnn	1
2707	NC_DIR_CD	SWNETCONN	Dist Measrd From		☑	nnn	1
2708	NC_DIR_TY	SWNETCONN	Dist Measrd From Tex		☑	25x	5
2718	NC_DPTH_EN	SWNETCONN	Depth at End		☑	nnnn.n	4
2716	NC_DPTH_MN	SWNETCONN	Depth at Main		☑	nnnn.n	4
2717	NC_DPTH_PL	SWNETCONN	Depth at PL		☑	nnnn.n	4
2709	NC_DS_DIST	SWNETCONN	Dist from DS MH		☑	-nnnn.n	4
2727	NC_IMG_FLG	SWNETCONN	Image Available		☑		2
2719	NC_INSTALL	SWNETCONN	Date Installed		☑	mm/dd/yyyy	6
2713	NC_LENGTH	SWNETCONN	Length (ft)		☑	nnnn.n	4

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2714	NC_MAT_CD	SWNETCONN	Connection Materl		☑	nnn	1
2715	NC_MAT_TY	SWNETCONN	Conn Material Text		☑	25x	5
2725	NC_MOD_BY	SWNETCONN	Modified By		☑	3x	5
2726	NC_MOD_DT	SWNETCONN	Modified Date		☑	mm/dd/yyyy	6
2728	NC_MOV_FLG	SWNETCONN	Movie Available		☑		2
2701	NC_NETID	SWNETCONN	Network Link		☑		0
2720	NC_STAT_CD	SWNETCONN	Status		☑	nnn	1
2721	NC_STAT_TY	SWNETCONN	Status Text		☑	25x	5
2704	NC_TYPE_CD	SWNETCONN	Connection Type		☑	nnn	1
2705	NC_TYPE_TY	SWNETCONN	Connection Type Text		☑	25x	5
2723	NC_USER1	SWNETCONN	User 1		☑	nnnnnnnnn.n	4
2724	NC_USER2	SWNETCONN	User 2		☑	30x	5
1	MA_ABVSURF	SWNETMH	Grade +/- (in)		☑	-nn	1
2	MA_ADR_BDG	SWNETMH	Address		☑	nnnnnn	0
3	MA_ADR_DIR	SWNETMH	Street Direction		☑	2x	5
13	MA_ADR_SFX	SWNETMH	Street Suffix		☑	5x	5
4	MA_ADR_STR	SWNETMH	Street Name		☑	25x	5
5	MA_ADR_TY	SWNETMH	Street Type		☑	4x	5
742	MA_ATT_SIZ	SWNETMH	Attribute Size		☑	nnnn	1
743	MA_ATT_TYP	SWNETMH	Attribute Type		☑	n	1
740	MA_ATT_X	SWNETMH	Attri X Offset (ft)		☑	-nnnn.nn	4
741	MA_ATT_Y	SWNETMH	Attri Y Offset (ft)		☑	-nnnn.nn	4
6	MA_BASIN	SWNETMH	Flow Basin		☑	10x	5
2853	MA_CITY_CD	SWNETMH	Facility		☑	nnn	1
2854	MA_CITY_TY	SWNETMH	Facility Text		☑	50x	5
8	MA_COMMENT	SWNETMH	Comments		☑		5
9	MA_COVR_CD	SWNETMH	Cover Type		☑	nnn	1
10	MA_COVR_TY	SWNETMH	Cover Type Text		☑	25x	5
17	MA_CREW	SWNETMH	Collected By		☑	10x	5
11	MA_DEPTH	SWNETMH	Manhole Depth (ft)		☑	nnn.nn	4
12	MA_DIA	SWNETMH	Dia/Length (in)	Man	☑	nnn.n	4
738	MA_DISH_CD	SWNETMH	Inflow Dish		☑	nnn	1
739	MA_DISH_TY	SWNETMH	Inflow Dish Text		☑	25x	5
3026	MA_DOC_FLG	SWNETMH	Document Available		☐		2
14	MA_GPS	SWNETMH	GPS Flag		☑		2
784	MA_IMG_FLG	SWNETMH	Image Available		☑		2
15	MA_IN	SWNETMH	# of In Pipes		☑	nn	1
16	MA_INDROP	SWNETMH	# of In Drops		☑	nn	1
736	MA_LINR_CD	SWNETMH	Liner		☑	nnn	1
737	MA_LINR_TY	SWNETMH	Liner Text		☑	25x	5
2351	MA_LOCATIO	SWNETMH	Gen Location		☑	50x	5
32	MA_MANHOLE	SWNETMH	Manhole		☑	20x	5
2954	MA_MAPPAGE	SWNETMH	Map Page No.		☑	15x	5
18	MA_MATR_CD	SWNETMH	Wall Material		☑	nnn	1
19	MA_MATR_TY	SWNETMH	Wall Material Text		☑	25x	5
7	MA_MHID	SWNETMH	Unique Number		☑		0

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
1643	MA_MOD_BY	SWNETMH	Modified By		☑	3x	5
1644	MA_MOD_DT	SWNETMH	Modified Date		☑	mm/dd/yyyy	6
785	MA_MOV_FLG	SWNETMH	Movie Available		☑		2
3022	MA_MPST_CD	SWNETMH	Map Status		☑	nnn	1
3023	MA_MPST_TY	SWNETMH	Map Status Text		☑	25x	5
21	MA_OUT	SWNETMH	# of Out Pipes		☑	nn	1
22	MA_OUTDROP	SWNETMH	# of Out Drops		☑	nn	1
2352	MA_RIM_CD	SWNETMH	Rim Status		☑	nnn	1
23	MA_RIM_ELE	SWNETMH	Rim Elevation		☑	nnnn.nn	4
2342	MA_RIM_TY	SWNETMH	Rim Status Text		☑	25x	5
2848	MA_STAT_CD	SWNETMH	Status		☑	nnn	1
2849	MA_STAT_TY	SWNETMH	Status Text		☑	25x	5
25	MA_STRC_CD	SWNETMH	Structure Type		☑	nnn	1
26	MA_STRC_TY	SWNETMH	Structure Type Text		☑	25x	5
27	MA_SURF_CD	SWNETMH	Surface Type		☑	nnn	1
28	MA_SURF_TY	SWNETMH	Surface Type Text		☑	25x	5
29	MA_TYPE_CD	SWNETMH	Manhole Type		☑	nnn	1
30	MA_TYPE_TY	SWNETMH	Manhole Type Text		☑	25x	5
31	MA_US_LOC	SWNETMH	Lot Location		☑	2x	5
3036	MA_USER10	SWNETMH	User 10		☑	mm/dd/yyyy	6
3037	MA_USER11	SWNETMH	User 11		☑	mm/dd/yyyy	6
3038	MA_USER12	SWNETMH	User 12		☑	-nnnnnnnnn.	4
3039	MA_USER13	SWNETMH	User 13		☑	-nnnnnnnnn.	4
3040	MA_USER14	SWNETMH	User 14		☑	30x	5
3041	MA_USER15	SWNETMH	User 15		☑	30x	5
744	MA_USER1CD	SWNETMH	User 1	Sew	☑	nnn	1
745	MA_USER1TY	SWNETMH	User 1 Text		☑	25x	5
746	MA_USER2CD	SWNETMH	User 2		☑	nnn	1
747	MA_USER2TY	SWNETMH	User 2 Text		☑	25x	5
748	MA_USER3CD	SWNETMH	User 3		☑	nnn	1
749	MA_USER3TY	SWNETMH	User 3 Text		☑	25x	5
750	MA_USER4	SWNETMH	User 4		☑	nnnnnnnnn.n	4
751	MA_USER5	SWNETMH	User 5	Shaf	☑	5x	5
1645	MA_USER6	SWNETMH	User 6		☑		2
1646	MA_USER7	SWNETMH	User 7		☑		2
1647	MA_USER8	SWNETMH	User 8		☑		2
3035	MA_USER9	SWNETMH	User 9		☑	mm/dd/yyyy	6
33	MA_WIDTH	SWNETMH	Width (in)	Shaf	☑	5x	5
3027	MA_WO_COM	SWNETMH	Short Comment		☐	75x	5
34	MA_X	SWNETMH	X Coordinate		☑	-nnnnnnnnn.	4
35	MA_Y	SWNETMH	Y Coordinate		☑	-nnnnnnnnn.	4
2355	OM_DIST	SWOBSMAN	Dist from DS MH (ft)		☑	nnnn.n	4
2354	OM_NETID	SWOBSMAN	Link to Pipe		☑		0
2353	OM_OBSID	SWOBSMAN	Unique Number		☑		0
2356	OM_X	SWOBSMAN	X Coordinate		☑	nnnnnnnnn.n	4
2357	OM_Y	SWOBSMAN	Y Coordinate		☑	nnnnnnnnn.n	4

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
1651	ON_FIELDID	SWOBSNOTES	ID link to SWFIELDS		☑		
1650	ON_ID	SWOBSNOTES	ID to link to Rating		☑		
1652	ON_NOTE_CD	SWOBSNOTES	Location/Description		☑	nnn	
1653	ON_NOTE_TY	SWOBSNOTES	Location/Description		☑	25x	
1654	ON_USERDEF	SWOBSNOTES	Can user change the		☑		
2533	OR_BASINID	SWOBSRATIN	Link to Flow Setup T		☑		0
1666	OR_CLN_1	SWOBSRATIN	Cleaning Rating 1		☑	nnn	1
1667	OR_CLN_2	SWOBSRATIN	Cleaning Rating 2		☑	nnn	1
1668	OR_CLN_3	SWOBSRATIN	Cleaning Rating 3		☑	nnn	1
1669	OR_CLN_4	SWOBSRATIN	Cleaning Rating 4		☑	nnn	1
1670	OR_CLN_5	SWOBSRATIN	Cleaning Rating 5		☑	nnn	1
1656	OR_FLO_1	SWOBSRATIN	Flow Rating 1		☑	nn.nnn	4
1657	OR_FLO_2	SWOBSRATIN	Flow Rating 2		☑	nn.nnn	4
1658	OR_FLO_3	SWOBSRATIN	Flow Rating 3		☑	nn.nnn	4
1659	OR_FLO_4	SWOBSRATIN	Flow Rating 4		☑	nn.nnn	4
1660	OR_FLO_5	SWOBSRATIN	Flow Rating 5		☑	nn.nnn	4
2591	OR_NOTECD	SWOBSRATIN	Field Code		☑		0
1655	OR_NOTEID	SWOBSRATIN	Popup Field ID		☑		0
1661	OR_STR_1	SWOBSRATIN	Structure Rating 1		☑	nnn	1
1662	OR_STR_2	SWOBSRATIN	Structure Rating 2		☑	nnn	1
1663	OR_STR_3	SWOBSRATIN	Structure Rating 3		☑	nnn	1
1664	OR_STR_4	SWOBSRATIN	Structure Rating 4		☑	nnn	1
1665	OR_STR_5	SWOBSRATIN	Structure Rating 5		☑	nnn	1
2106	PI_BRG_TMP	SWPINSP	TM Bearing (F)		☑	nnn	1
2095	PI_CNDM_CD	SWPINSP	Motor Condition		☑	nnn	1
2096	PI_CNDM_TY	SWPINSP	Motor Condition Text		☑	25x	5
2093	PI_CNDP_CD	SWPINSP	Pump Condition		☑	nnn	1
2094	PI_CNDP_TY	SWPINSP	Pump Condition Text		☑	25x	5
2097	PI_CNDS_CD	SWPINSP	Seal Condition		☑	nnn	1
2098	PI_CNDS_TY	SWPINSP	Seal Condition Text		☑	25x	5
2146	PI_COMMENT	SWPINSP	Comments		☑		5
2103	PI_FRM_VM	SWPINSP	VM Frame (ips)		☑	n.nnnn	4
2144	PI_IMG_FLG	SWPINSP	Image Available		☑		2
2092	PI_INSP_BY	SWPINSP	Inspected By		☑	25x	5
2091	PI_INSP_DT	SWPINSP	Date Inspected		☑	mm/dd/yyyy	6
2108	PI_LG1_VLT	SWPINSP	Voltage Leg1		☑	nnnn	1
2111	PI_LG2_VLT	SWPINSP	Voltage Leg2		☑	nnnn	1
2114	PI_LG3_VLT	SWPINSP	Voltage Leg3		☑	nnnn	1
2107	PI_LGT_TMP	SWPINSP	TM Lighting (F)		☑	nnn	1
2109	PI_LR_AMP1	SWPINSP	Lock rotor amps Leg		☑	nnnn	1
2112	PI_LR_AMP2	SWPINSP	Lock rotor amps Leg		☑	nnnn	1
2115	PI_LR_AMP3	SWPINSP	Lock rotor amps Leg		☑	nnnn	1
2104	PI_MCC_TMP	SWPINSP	TM MCC (F)		☑	nnn	1
2125	PI_MFREQ	SWPINSP	Insp Frequency		☑	nnn	1
2124	PI_MFRN	SWPINSP	Insp Freq Units		☑	25x	5
2126	PI_MNMT_DT	SWPINSP	Next Motor Insp		☑	mm/dd/yyyy	6

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2142	PI_MOD_BY	SWPINSP	Modified By		☑	3x	5
2143	PI_MOD_DT	SWPINSP	Modified Date		☑	mm/dd/yyyy	6
2145	PI_MOV_FLG	SWPINSP	Movie Available		☑		2
2105	PI_MTR_TMP	SWPINSP	TM Motor (F)		☑	nnn	1
2100	PI_MTR_VM	SWPINSP	VM Motor (ips)		☑	n.nnnn	4
2121	PI_PFREQ	SWPINSP	Insp Frequency		☑	nnn	1
2120	PI_PFRN	SWPINSP	Insp Freq Units		☑	25x	5
2122	PI_PNMT_DT	SWPINSP	Next Pump Insp		☑	mm/dd/yyyy	6
2090	PI_PUMP_ID	SWPINSP	Link to Pump		☑	10x	0
3015	PI_PUMP_NO	SWPINSP			☐		0
2099	PI_PUMP_VM	SWPINSP	VM Pump (ips)		☑	n.nnnn	4
2102	PI_RDCR_VM	SWPINSP	VM Reducer (ips)		☑	n.nnnn	4
2110	PI_RN_AMP1	SWPINSP	Running amps Leg1		☑	nnnn	1
2113	PI_RN_AMP2	SWPINSP	Running amps Leg2		☑	nnnn	1
2116	PI_RN_AMP3	SWPINSP	Running amps Leg3		☑	nnnn	1
2117	PI_ROTSPD1	SWPINSP	1st Speed (rpm)		☑	nnnn	1
2118	PI_ROTSPD2	SWPINSP	2nd Speed (rpm)		☑	nnnn	1
2129	PI_SFREQ	SWPINSP	Insp Frequency		☑	nnn	1
2128	PI_SFRN	SWPINSP	Insp Freq Units		☑	25x	5
2101	PI_SHFT_VM	SWPINSP	VM Shaft (ips)		☑	n.nnnn	4
2130	PI_SNMT_DT	SWPINSP	Next Seal Insp		☑	mm/dd/yyyy	6
2131	PI_USER1CD	SWPINSP	User 1		☑	nnn	1
2132	PI_USER1TY	SWPINSP	User 1 Text		☑	25x	5
2133	PI_USER2CD	SWPINSP	User 2		☑	nnn	1
2134	PI_USER2TY	SWPINSP	User 2 Text		☑	25x	5
2135	PI_USER3CD	SWPINSP	User 3		☑	nnn	1
2136	PI_USER3TY	SWPINSP	User 3 Text		☑	25x	5
2137	PI_USER4	SWPINSP	User 4		☑	nnnnnnnnn.n	4
2138	PI_USER5	SWPINSP	User 5		☑	30x	5
2139	PI_USER6	SWPINSP	User 6		☑		2
2140	PI_USER7	SWPINSP	User 7		☑		2
2141	PI_USER8	SWPINSP	User 8		☑		2
2159	PM_CAPCITY	SWPUMPS	Pump Capacity (gpm)		☑	nnnnn.n	4
2157	PM_CLSS_CD	SWPUMPS	Pump Classification		☑	nnn	1
2158	PM_CLSS_TY	SWPUMPS	Pump Classification		☑	25x	5
2175	PM_CNTL_CD	SWPUMPS	Pump Controller		☑	nnn	1
2176	PM_CNTL_TY	SWPUMPS	Pump Controller Text		☑	25x	5
2238	PM_COMMENT	SWPUMPS	Comments		☑		5
2151	PM_CONSTR	SWPUMPS	Project Number		☑	20x	5
2171	PM_DSC_DIA	SWPUMPS	DS End Dia (in)		☑	nnnn.nn	4
2169	PM_DSCH_CD	SWPUMPS	DS End Type		☑	nnn	1
2170	PM_DSCH_TY	SWPUMPS	DS End Type Text		☑	25x	5
2172	PM_DSCL_EL	SWPUMPS	DS C/L Elev (ft)		☑	nnnnn.nn	4
2163	PM_DYNM_HD	SWPUMPS	Total Dyn Head (ft)		☑	nnnnn.nn	4
2190	PM_H1_H	SWPUMPS	High H 1 (ft)		☑	nnnnn.nn	4
2178	PM_H1_L	SWPUMPS	Low H 1 (ft)		☑	nnnnn.nn	4

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2192	PM_H2_H	SWPUMPS	High H 2 (ft)		☑	nnnnn.nn	4
2180	PM_H2_L	SWPUMPS	Low H 2 (ft)		☑	nnnnn.nn	4
2194	PM_H3_H	SWPUMPS	High H 3 (ft)		☑	nnnnn.nn	4
2182	PM_H3_L	SWPUMPS	Low H 3 (ft)		☑	nnnnn.nn	4
2196	PM_H4_H	SWPUMPS	High H 4 (ft)		☑	nnnnn.nn	4
2184	PM_H4_L	SWPUMPS	Low H 4 (ft)		☑	nnnnn.nn	4
2198	PM_H5_H	SWPUMPS	High H 5 (ft)		☑	nnnnn.nn	4
2186	PM_H5_L	SWPUMPS	Low H 5 (ft)		☑	nnnnn.nn	4
2200	PM_H6_H	SWPUMPS	High H 6 (ft)		☑	nnnnn.nn	4
2188	PM_H6_L	SWPUMPS	Low H 6 (ft)		☑	nnnnn.nn	4
2162	PM_HIGH_SP	SWPUMPS	Pump High Speed		☑	nnnn	1
2206	PM_HORSPW	SWPUMPS	Horsepower		☑	nnnnn.n	4
2236	PM_IMG_FLG	SWPUMPS	Image Available		☑		2
2164	PM_IMP_DIA	SWPUMPS	Impeller Dia (in)		☑	nnnn.nn	4
2774	PM_IMP_MOD	SWPUMPS	Impeller Model #		☑	25x	5
2203	PM_INS_MTR	SWPUMPS	Motor Installed		☑	mm/dd/yyyy	6
2150	PM_INST_DT	SWPUMPS	Pump Installed		☑	mm/dd/yyyy	6
2152	PM_LOCATE	SWPUMPS	Pump Location		☑	100x	5
2209	PM_LOK_RTR	SWPUMPS	Lock Rotor Amps		☑	nnnn.nn	4
2161	PM_LOW_SP	SWPUMPS	Pump Low Speed		☑	nnnn	1
2221	PM_LUB_CD	SWPUMPS	Seal Lubrication		☑	nnn	1
2222	PM_LUB_TY	SWPUMPS	Seal Lubrication Tex		☑	25x	5
2202	PM_MAN_MTR	SWPUMPS	Motor Manufacturer		☑	25x	5
2149	PM_MAN_PMP	SWPUMPS	Pump Manufacturer		☑	25x	5
2215	PM_MAN_SEL	SWPUMPS	Seal Manufacturer		☑	25x	5
2204	PM_MDL_MTR	SWPUMPS	Motor Model #		☑	25x	5
2153	PM_MDL_PMP	SWPUMPS	Pump Model #		☑	25x	5
2217	PM_MDL_SEL	SWPUMPS	Seal Model #		☑	25x	5
2845	PM_MLOC_CD	SWPUMPS	Motor Location		☑	nnn	1
2846	PM_MLOC_TY	SWPUMPS	Motor Location Text		☑	25x	5
2234	PM_MOD_BY	SWPUMPS	Modified By		☑	3x	5
2235	PM_MOD_DT	SWPUMPS	Modified Date		☑	mm/dd/yyyy	6
2237	PM_MOV_FLG	SWPUMPS	Movie Available		☑		2
2776	PM_MTR_EFF	SWPUMPS	Motor Efficiency		☑	nn.n	0
2207	PM_PHAS_CD	SWPUMPS	Phase		☑	nnn	1
2208	PM_PHAS_TY	SWPUMPS	Phase Text		☑	25x	5
2773	PM_PMP_SZ	SWPUMPS	Pump Size (in.)		☑	25x	5
2173	PM_PRIM_CD	SWPUMPS	Priming Type		☑	nnn	1
2174	PM_PRIM_TY	SWPUMPS	Priming Type Text		☑	25x	5
2147	PM_PUMP_NO	SWPUMPS	Pump Number		☑	10x	5
2592	PM_PUMPID	SWPUMPS	Unique Number		☑		0
2191	PM_Q1_H	SWPUMPS	High Q 1 (gpm)		☑	nnnnn.nn	4
2179	PM_Q1_L	SWPUMPS	Low Q 1 (gpm)		☑	nnnnn.nn	4
2193	PM_Q2_H	SWPUMPS	High Q 2 (gpm)		☑	nnnnn.nn	4
2181	PM_Q2_L	SWPUMPS	Low Q 2 (gpm)		☑	nnnnn.nn	4
2195	PM_Q3_H	SWPUMPS	High Q 3 (gpm)		☑	nnnnn.nn	4

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2183	PM_Q3_L	SWPUMPS	Low Q 3 (gpm)		☑	nnnnn.nn	4
2197	PM_Q4_H	SWPUMPS	High Q 4 (gpm)		☑	nnnnn.nn	4
2185	PM_Q4_L	SWPUMPS	Low Q 4 (gpm)		☑	nnnnn.nn	4
2199	PM_Q5_H	SWPUMPS	High Q 5 (gpm)		☑	nnnnn.nn	4
2187	PM_Q5_L	SWPUMPS	Low Q 5 (gpm)		☑	nnnnn.nn	4
2201	PM_Q6_H	SWPUMPS	High Q 6 (gpm)		☑	nnnnn.nn	4
2189	PM_Q6_L	SWPUMPS	Low Q 6 (gpm)		☑	nnnnn.nn	4
2211	PM_RPM_MTR	SWPUMPS	Motor Speed (rpm)		☑	nnnnn	4
2595	PM_SBY_CD	SWPUMPS	Standby Power		☑	nnn	1
2596	PM_SBY_TY	SWPUMPS	Standby Power Text		☑	25x	5
2216	PM_SEAL_DT	SWPUMPS	Seal Installed		☑	mm/dd/yyyy	6
2730	PM_SHT_OFH	SWPUMPS	Shut Off Head H(ft)		☑	nnnnn.nn	4
2177	PM_SHT_OFL	SWPUMPS	Shut Off Head L(ft)		☑	nnnnn.nn	4
2205	PM_SRL_MTR	SWPUMPS	Motor Serial #		☑	25x	5
2154	PM_SRL_PMP	SWPUMPS	Pump Serial #		☑	25x	5
2218	PM_SRL_SEL	SWPUMPS	Seal Serial #		☑	25x	5
2775	PM_STAGES	SWPUMPS	Number of Stages		☑	nnn	0
2148	PM_STN_ID	SWPUMPS	Link to Pump Station		☑	10x	0
2213	PM_STRT_CD	SWPUMPS	Starter Type		☑	nnn	1
2214	PM_STRT_TY	SWPUMPS	Starter Type Text		☑	25x	5
2167	PM_SUC_DIA	SWPUMPS	SS End Dia (in)		☑	nnnn.nn	4
2165	PM_SUCD_CD	SWPUMPS	SS End Type		☑	nnn	1
2166	PM_SUCD_TY	SWPUMPS	SS End Type Text		☑	25x	5
2168	PM_SUCL_EL	SWPUMPS	SS C/L Elev (ft)		☑	nnnnn.nn	4
2219	PM_TSEL_CD	SWPUMPS	Seal Type		☑	nnn	1
2220	PM_TSEL_TY	SWPUMPS	Seal Type Text		☑	25x	5
2155	PM_TYPE_CD	SWPUMPS	Pump Type		☑	nnn	1
2156	PM_TYPE_TY	SWPUMPS	Pump Type Text		☑	25x	5
2223	PM_USER1CD	SWPUMPS	User 1		☑	nnn	1
2224	PM_USER1TY	SWPUMPS	User 1 Text		☑	25x	5
2225	PM_USER2CD	SWPUMPS	User 2		☑	nnn	1
2226	PM_USER2TY	SWPUMPS	User 2 Text		☑	25x	5
2227	PM_USER3CD	SWPUMPS	User 3		☑	nnn	1
2228	PM_USER3TY	SWPUMPS	User 3 Text		☑	25x	5
2229	PM_USER4	SWPUMPS	User 4		☑	nnnnnnnnn.n	4
2230	PM_USER5	SWPUMPS	User 5		☑	30x	5
2231	PM_USER6	SWPUMPS	User 6		☑		2
2232	PM_USER7	SWPUMPS	User 7		☑		2
2233	PM_USER8	SWPUMPS	User 8		☑		2
2593	PM_VAR_CD	SWPUMPS	Variable Speed		☑	nnn	1
2594	PM_VAR_TY	SWPUMPS	Variable Speed Text		☑	25x	5
2210	PM_VLT_MTR	SWPUMPS	Voltage		☑	nnnn.nn	4
1672	SV_ADDID	SWSERV	Address Link		☑		0
1711	SV_ALCT_CD	SWSERV	Alley Cut		☑	nnn	1
1712	SV_ALCT_TY	SWSERV	Alley Cut Text		☑	25x	5
538	SV_COMMENT	SWSERV	Comments		☑		5

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
539	SV_CON_CD	SWSERV	Connection Type		☑	nnn	1
1673	SV_CON_NO	SWSERV	Lateral No.		☑	nnn	1
542	SV_CON_TY	SWSERV	Connection Text		☑	25x	5
2731	SV_CONNID	SWSERV	Link to Service Conn		☑		0
543	SV_DIA	SWSERV	Diameter (in)		☑	nnnn.n	4
3045	SV_DOC_FLG	SWSERV	Document Available		☐		2
2734	SV_DRN_CD	SWSERV	Drains		☑	nnn	1
2735	SV_DRN_TY	SWSERV	Drains Text		☑	25x	5
1686	SV_DT_INSP	SWSERV	Date Inspected		☑	mm/dd/yyyy	6
1719	SV_GREASE	SWSERV	Grease Interceptor		☑	nnnnnnn	0
1717	SV_GWCL_CD	SWSERV	Groundwtr Cleanup		☑	nnn	1
1718	SV_GWCL_TY	SWSERV	GW Cleanup Text		☑	25x	5
2606	SV_IMG_FLG	SWSERV	Image Available		☑		2
2732	SV_INSP_CD	SWSERV	Inspected By		☑	nnn	1
1687	SV_INSP_NO	SWSERV	Inspection Number		☑	10x	5
2733	SV_INSP_TY	SWSERV	Inspected By Text		☑	25x	5
546	SV_INSTALL	SWSERV	Date Installed		☑	mm/dd/yyyy	6
1682	SV_LENGTH	SWSERV	Length (ft)		☑	nnnn.n	4
2843	SV_LOCATIO	SWSERV	Gen Location		☑	50x	5
547	SV_MAT_CD	SWSERV	Pipe Material		☑	nnn	1
548	SV_MAT_TY	SWSERV	Pipe Material Text		☑	25x	5
1699	SV_MOD_BY	SWSERV	Modified By		☑	3x	5
1700	SV_MOD_DT	SWSERV	Modified Date		☑	mm/dd/yyyy	6
2607	SV_MOV_FLG	SWSERV	Movie Available		☑		2
1704	SV_PRETRCD	SWSERV	Pretreatment		☑	nnn	1
1705	SV_PRETRTY	SWSERV	Pretreatment Text		☑	25x	5
1702	SV_RESN_CD	SWSERV	Connection Reason		☑	nnn	1
1703	SV_RESN_TY	SWSERV	Connect Reason Text		☑	25x	5
550	SV_RSLT_CD	SWSERV	Insp Results		☑	nnn	1
551	SV_RSLT_TY	SWSERV	Insp Results Text		☑	25x	5
2841	SV_SEPA_CD	SWSERV	Separator		☑	nnn	1
2842	SV_SEPA_TY	SWSERV	Separator Text		☑	25x	5
1715	SV_SEPT_CD	SWSERV	Septic Tank Filled		☑	nnn	1
2736	SV_SEPT_FL	SWSERV	Date Septic Filled		☑	mm/dd/yyyy	6
1716	SV_SEPT_TY	SWSERV	Sptic Tank Fill Text		☑	25x	5
2534	SV_SERVID	SWSERV	Link into Service Ma		☑		0
1706	SV_SLOPE	SWSERV	Slope / Fall %		☑	nn.nnn	4
553	SV_STAT_CD	SWSERV	Source of Data		☑	nnn	1
554	SV_STAT_TY	SWSERV	Source of Data Text		☑	25x	5
1709	SV_STCT_CD	SWSERV	Street Cut		☑	nnn	1
1710	SV_STCT_TY	SWSERV	Street Cut Text		☑	25x	5
2928	SV_STRC_CD	SWSERV	Structure Type		☑	nnn	1
2927	SV_STRC_ID	SWSERV	Structure		☑	20x	5
2929	SV_STRC_TY	SWSERV	Structure Type Text		☑	25x	5
2931	SV_STRC_X	SWSERV	X Coordinate		☑	-nnnnnnnnn.	4
2932	SV_STRC_Y	SWSERV	Y Coordinate		☑	-nnnnnnnnn.	4

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2930	SV_STRCDST	SWSERV	Dist from DSMH (ft)		☑	nnnn.n	4
2535	SV_SVST_CD	SWSERV	Service Status		☑	nnn	1
2536	SV_SVST_TY	SWSERV	Service Stat Text		☑	25x	5
1713	SV_SWCT_CD	SWSERV	Sidewalk Cut		☑	nnn	1
1714	SV_SWCT_TY	SWSERV	Sidewalk Cut Text		☑	25x	5
1707	SV_TRAP_CD	SWSERV	Trap Size		☑	nnn	1
1708	SV_TRAP_TY	SWSERV	Trap Size Text		☑	25x	5
1688	SV_USER1CD	SWSERV	User 1		☑	nnn	1
1689	SV_USER1TY	SWSERV	User 1 Text		☑	25x	5
1690	SV_USER2CD	SWSERV	User 2		☑	nnn	1
1691	SV_USER2TY	SWSERV	User 2 Text		☑	25x	5
1692	SV_USER3CD	SWSERV	User 3		☑	nnn	1
1693	SV_USER3TY	SWSERV	User 3 Text		☑	25x	5
1694	SV_USER4	SWSERV	User 4		☑	nnnnnnnnn.n	4
1695	SV_USER5	SWSERV	User 5		☑	30x	5
1696	SV_USER6	SWSERV	User 6		☑		2
1697	SV_USER7	SWSERV	User 7		☑		2
1698	SV_USER8	SWSERV	User 8		☑		2
2863	SS_ADDID	SWSERVINS	Address link		☑		0
2873	SS_ANG_INV	SWSERVINS	Angled Rim/Inv (ft)		☑	nnn.nn	4
2881	SS_CLN_CD	SWSERVINS	Cleaning		☑	nnn	1
3020	SS_CLN_RTG	SWSERVINS	Total Clean Rating		☑	nnnnn.n	4
2882	SS_CLN_TY	SWSERVINS	Cleaning Text		☑	25x	5
2885	SS_COMMENT	SWSERVINS	Comments		☑		0
2958	SS_CONDCD	SWSERVINS	Struct Condition		☑	nnn	1
2959	SS_CONDTY	SWSERVINS	Structure Cond Text		☑	25x	5
2865	SS_CREW	SWSERVINS	Inspection Crew		☑	3x	5
2872	SS_CROWN	SWSERVINS	Rim to Crown (ft)		☑	nnn.nn	4
3046	SS_DOC_FLG	SWSERVINS	Document Available		☐		2
2878	SS_DPO_CD	SWSERVINS	Deposition		☑	nnn	1
2877	SS_DPO_DEP	SWSERVINS	Depos Depth (in)		☑	nnn.nn	4
2879	SS_DPO_TY	SWSERVINS	Deposition Text		☑	25x	5
2864	SS_DT_INSP	SWSERVINS	Inspection Date		☑	mm/dd/yyyy	6
2876	SS_FLO_DEP	SWSERVINS	Flow Depth (in)		☑	nnn.nn	4
2880	SS_FLO_VEL	SWSERVINS	Flow Velocity (fps)		☑	nn.nn	4
2983	SS_GPM_REM	SWSERVINS	Remaining GPM		☑	nnn.nnn	4
2861	SS_ID	SWSERVINS	Unique ID		☑		0
2984	SS_IMG_FLG	SWSERVINS	Images Available		☑		2
2868	SS_INDR_CD	SWSERVINS	Inspect Direction		☑	nnn	1
2869	SS_INDR_TY	SWSERVINS	Inspec. Dir. Text		☑	25x	5
3019	SS_INF_RTG	SWSERVINS	Total Flow Rating		☑	nnn.nnn	4
2866	SS_INSP_CD	SWSERVINS	Inspection Type		☑	nnn	1
2867	SS_INSP_TY	SWSERVINS	Inspection Type Text		☑	25x	5
2875	SS_INVERT	SWSERVINS	Rim to Inv (ft)		☑	nnn.nn	4
2883	SS_MNTP_CD	SWSERVINS	Maintance Prior		☑	nnn	1
2884	SS_MNTP_TY	SWSERVINS	Maint. Prior Text		☑	25x	5

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2985	SS_MOD_BY	SWSERVINS	Modified By		☑	3x	5
2986	SS_MOD_DT	SWSERVINS	Modified Date		☑	mm/dd/yyyy	6
2987	SS_MOV_FLG	SWSERVINS	Movies Available		☑		2
2874	SS_OFFSET	SWSERVINS	Angled Offset (in)		☑	nnnn.n	4
2862	SS_SERVID	SWSERVINS	Link to Service Lat.		☑		0
3021	SS_STR_RTG	SWSERVINS	Total Struc Rating		☑	nnnnn.n	4
2957	SS_STRCDEP	SWSERVINS	Struct Depth (ft)		☑	nnn.n	4
2870	SS_SVDR_CD	SWSERVINS	Service Direction		☑	nnn	1
2871	SS_SVDR_TY	SWSERVINS	Service Dir. Text		☑	25x	5
2988	SS_TOT_CLN	SWSERVINS	Total Cleaning		☑	nnnn	1
2989	SS_TOT_INF	SWSERVINS	Total Infiltration		☑	nnnn.nnn	4
2990	SS_TOT_STR	SWSERVINS	Total Structure		☑	nnnn	1
2961	SS_USER10	SWSERVINS	User 10		☑	mm/dd/yyyy	6
2962	SS_USER11	SWSERVINS	User 11		☑	mm/dd/yyyy	6
2963	SS_USER12	SWSERVINS	User 12		☑	mm/dd/yyyy	6
2964	SS_USER13	SWSERVINS	User 13		☑		2
2965	SS_USER14	SWSERVINS	User 14		☑		2
2966	SS_USER15	SWSERVINS	User 15		☑		2
2886	SS_USER1CD	SWSERVINS	User 1		☑	nnn	1
2887	SS_USER1TY	SWSERVINS	User 1 Text		☑	25x	5
2888	SS_USER2CD	SWSERVINS	User 2		☑	nnn	1
2889	SS_USER2TY	SWSERVINS	User 2 Text		☑	25x	5
2890	SS_USER3CD	SWSERVINS	User 3		☑	nnn	1
2891	SS_USER3TY	SWSERVINS	User 3 Text		☑	25x	5
2892	SS_USER4	SWSERVINS	User 4		☑	30x	5
2893	SS_USER5	SWSERVINS	User 5		☑	30x	5
2894	SS_USER6	SWSERVINS	User 6		☑	30x	5
2895	SS_USER7	SWSERVINS	User 7		☑	nnnnnnnnn.n	4
2896	SS_USER8	SWSERVINS	User 8		☑	nnnnnnnnn.n	4
2960	SS_USER9	SWSERVINS	User 9		☑	nnnnnnnnn.n	4
2737	SR_ID	SWSERVMTR	Unique ID for Servic		☑		0
1722	SR_ITEM_CD	SWSERVMTR	Item		☑	nnn	0
1723	SR_ITEM_TY	SWSERVMTR	Item Text		☑	25x	5
1721	SR_QUANT	SWSERVMTR	Quantity		☑	nnn	0
1720	SR_SERVID	SWSERVMTR	Link to Service Lat		☑		0
2566	SR_SIZE	SWSERVMTR	Size (in)		☑	nnnn.n	4
2738	SR_UNITS	SWSERVMTR	Units		☑	10x	5
2908	SB_CLN_RAT	SWSERVOBS	Cleaning #		☑	nnn	1
2909	SB_COMMENT	SWSERVOBS	Comment		☑		0
2906	SB_FLO_ACT	SWSERVOBS	Observed (gpm)		☑	nn.nnn	4
2907	SB_FLO_RAT	SWSERVOBS	Estimated (gpm)		☑	nn.nnn	4
2900	SB_FOOTAGE	SWSERVOBS	Distance		☑	nnnnn.nn	4
2913	SB_GPM_REM	SWSERVOBS	Remaining GPM		☑	nn.nnn	4
2897	SB_ID	SWSERVOBS	Unique ID		☑		0
2910	SB_IMG_FLG	SWSERVOBS	Image Available		☑		2
2991	SB_MOD_BY	SWSERVOBS	Modified By		☑	3x	5

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2992	SB_MOD_DT	SWSERVOBS	Modified Date		☑	mm/dd/yyyy	6
2911	SB_MOV_FLG	SWSERVOBS	Movie Available		☑		2
2901	SB_NOT1_CD	SWSERVOBS	Location		☑	nnn	1
2902	SB_NOT1_TY	SWSERVOBS	Location		☑	25x	5
2903	SB_NOT2_CD	SWSERVOBS	Description		☑	nnn	1
2904	SB_NOT2_TY	SWSERVOBS	Description		☑	25x	5
2899	SB_OBS_NO	SWSERVOBS	Observation No.		☑	nnn	1
2912	SB_PER_REM	SWSERVOBS	% I/I Removed		☑	nnn	1
2905	SB_RATING	SWSERVOBS	Rating		☑	n	1
2914	SB_REPR_CD	SWSERVOBS	Repaired		☑	nnn	1
2915	SB_REPR_TY	SWSERVOBS	Repaired Text		☑	25x	5
2898	SB_SSID	SWSERVOBS	Link to SWSERVINS		☑		0
2969	SB_STR_RAT	SWSERVOBS	Structure #		☑	nnn	1
2916	SB_USER1CD	SWSERVOBS	User 1		☑	nnn	1
2917	SB_USER1TY	SWSERVOBS	User 1 Text		☑	25x	5
2918	SB_USER2	SWSERVOBS	User 2		☑	nnnnnnnnn.n	4
2919	SB_USER3	SWSERVOBS	User 3		☑	30x	5
2920	SB_USER4	SWSERVOBS	User 4		☑		2
2977	SB_XCOORD	SWSERVOBS	X Coordinate		☑	-nnnnnnnnn.	4
2978	SB_YCOORD	SWSERVOBS	Y Coordinate		☑	-nnnnnnnnn.	4
2755	SP_ANNX_CD	SWSERVPRMT	Annex Applied for		☑	nnn	1
2756	SP_ANNX_TY	SWSERVPRMT	Annex Appld for Text		☑	25x	5
2739	SP_CONNID	SWSERVPRMT	Link into Service La		☑		0
2750	SP_DT_EXPD	SWSERVPRMT	Date Permit Expired		☑	mm/dd/yyyy	6
2758	SP_DT_FEPD	SWSERVPRMT	Date Fee Paid		☑	mm/dd/yyyy	6
2752	SP_DT_FINL	SWSERVPRMT	Date Permit Finaled		☑	mm/dd/yyyy	6
2749	SP_DT_ISSU	SWSERVPRMT	Date Permit Issued		☑	mm/dd/yyyy	6
2748	SP_DT_RECV	SWSERVPRMT	Date Permit Reqstd		☑	mm/dd/yyyy	6
2751	SP_DT_VOID	SWSERVPRMT	Date Permit Voided		☑	mm/dd/yyyy	6
2759	SP_EQPD_CD	SWSERVPRMT	Equity Paid		☑	nnn	1
2760	SP_EQPD_TY	SWSERVPRMT	Equity Paid Text		☑	25x	5
2741	SP_EXV_NO	SWSERVPRMT	Excavate Permit #		☑	15x	5
2757	SP_FEES	SWSERVPRMT	Fees in Lieu of		☑	nnnnnnnnn.n	4
2771	SP_IMG_FLG	SWSERVPRMT	Image Available		☑		2
2763	SP_INSP_CD	SWSERVPRMT	Plumbing Inspector		☑	nnn	1
2764	SP_INSP_TY	SWSERVPRMT	Plumbing Inspct Text		☑	25x	5
2742	SP_ISSU_CD	SWSERVPRMT	Issued By		☑	nnn	1
2743	SP_ISSU_TY	SWSERVPRMT	Issued By Text		☑	25x	5
2769	SP_MOD_BY	SWSERVPRMT	Modified By		☑	3x	5
2770	SP_MOD_DT	SWSERVPRMT	Modified Date		☑	mm/dd/yyyy	6
2772	SP_MOV_FLG	SWSERVPRMT	Movie Available		☑		2
2740	SP_PER_NO	SWSERVPRMT	Permit #		☑	15x	5
2754	SP_PLMLCNS	SWSERVPRMT	Plumber License #		☑	15x	5
2761	SP_PLOK_CD	SWSERVPRMT	Plumbing OKed		☑	nnn	1
2762	SP_PLOK_TY	SWSERVPRMT	Plumbing OKed Text		☑	25x	5
2840	SP_PLUM_CD	SWSERVPRMT	Plumber		☑	nnn	1

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2753	SP_PLUM_TY	SWSERVPRMT	Plumber Text		☑	25x	5
2765	SP_PTOK_CD	SWSERVPRMT	Pretreatment OKed		☑	nnn	1
2766	SP_PTOK_TY	SWSERVPRMT	Pretreatment OK Text		☑	25x	5
2744	SP_PTYP_CD	SWSERVPRMT	Permit Type		☑	nnn	1
2745	SP_PTYP_TY	SWSERVPRMT	Permit Type Text		☑	25x	5
2767	SP_STOK_CD	SWSERVPRMT	Storm Discharge OK		☑	nnn	1
2768	SP_STOK_TY	SWSERVPRMT	Storm Dschrg OK Text		☑	25x	5
2746	SP_WTYP_CD	SWSERVPRMT	Work Type		☑	nnn	1
2747	SP_WTYP_TY	SWSERVPRMT	Work Type Text		☑	25x	5
2360	SO_ADR_BDG	SWSMKOB	Address		☑	nnnnnn	0
560	SO_ADR_DIR	SWSMKOB	Dir		☑	2x	5
1725	SO_ADR_SFX	SWSMKOB	Suffix		☑	5x	5
561	SO_ADR_STR	SWSMKOB	Street Name		☑	25x	5
562	SO_ADR_TY	SWSMKOB	Type		☑	4x	5
2855	SO_CITY_CD	SWSMKOB	Facility		☑	nnn	1
2856	SO_CITY_TY	SWSMKOB	Facility Text		☑	50x	5
867	SO_COMMENT	SWSMKOB	Comments		☑		5
2943	SO_DIR_CD	SWSMKOB	Turn Direction		☑	nnn	1
2944	SO_DIR_TY	SWSMKOB	Turn Direction Text		☑	25x	5
3051	SO_DOC_FLG	SWSMKOB	Document Available		☐		2
2538	SO_DY_CREW	SWSMKOB	Dye Test Crew		☑	10x	5
2537	SO_DY_DATE	SWSMKOB	Dye Test Date		☑	mm/dd/yyyy	6
2542	SO_DYEND	SWSMKOB	Dye End Time		☑	hh:mm am	6
2544	SO_DYPICT	SWSMKOB	Dye Test Pict # (s)		☑	8x	5
2539	SO_DYRESCD	SWSMKOB	Dye Test Results		☑	nnn	1
2540	SO_DYRESTY	SWSMKOB	Dye Test Res Text		☑	25x	5
2543	SO_DYROLL	SWSMKOB	Dye Test Roll #		☑	5x	5
2541	SO_DYSTART	SWSMKOB	Dye Start Time		☑	hh:mm am	6
866	SO_FLO_LCK	SWSMKOB	Flow Rate Lock		☑		2
2970	SO_FRM_CD	SWSMKOB	Measured From		☑	nnn	1
2971	SO_FRM_TY	SWSMKOB	Measured From Type		☑	25x	5
565	SO_FT1	SWSMKOB	Length (ft)		☑	nnnn.n	4
566	SO_FT2	SWSMKOB	Width (ft)		☑	nnnn.n	4
567	SO_GPM	SWSMKOB	Flow Rate (gpm)		☑	nnn.nn	4
2786	SO_GPM_REM	SWSMKOB	Remaining GPM		☑	nnn.nn	4
3016	SO_ID	SWSMKOB			☐		0
1726	SO_IMG_FLG	SWSMKOB	Image Available		☑		2
2597	SO_LOCATIO	SWSMKOB	Gen Location		☑	50x	5
2942	SO_MNDIST	SWSMKOB	Distance		☑	nnnn.n	4
868	SO_MOD_BY	SWSMKOB	Modified By		☑	3x	5
869	SO_MOD_DT	SWSMKOB	Modified Date		☑	mm/dd/yyyy	6
1727	SO_MOV_FLG	SWSMKOB	Movie Available		☑		2
887	SO_OBV_NO	SWSMKOB	Observation #		☑	nnn	0
2945	SO_OFFDIST	SWSMKOB	Turn Distance		☑	nnnn.n	4
2785	SO_PER_REM	SWSMKOB	% I/I Removed		☑	nnn	1
568	SO_PICTURE	SWSMKOB	Picture No (s)		☑	8x	5

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
569	SO_ROLL	SWSMKOB	Roll Number		☑	5x	5
570	SO_RSLT_CD	SWSMKOB	Result		☑	nnn	1
571	SO_RSLT_TY	SWSMKOB	Result Text		☑	25x	5
572	SO_RUNOFF	SWSMKOB	Runoff Factor		☑	n	1
864	SO_SMK_CD	SWSMKOB	Smoke Quantity		☑	nnn	1
865	SO_SMK_TY	SWSMKOB	Smoke Quantity Text		☑	25x	5
1724	SO_SMKID	SWSMKOB	Link to Parent		☑		0
573	SO_SRCE_CD	SWSMKOB	Source		☑	nnn	1
574	SO_SRCE_TY	SWSMKOB	Source Text		☑	25x	5
575	SO_STAT_CD	SWSMKOB	Status		☑	nnn	1
576	SO_STAT_TY	SWSMKOB	Status Text		☑	25x	5
578	SO_TV	SWSMKOB	TV		☑		2
2555	SO_USER1CD	SWSMKOB	User 1		☑	nnn	1
2556	SO_USER1TY	SWSMKOB	User 1 Text		☑	25x	5
2557	SO_USER2CD	SWSMKOB	User 2		☑	nnn	1
2558	SO_USER2TY	SWSMKOB	User 2 Text		☑	25x	5
2559	SO_USER3CD	SWSMKOB	User 3		☑	nnn	1
2560	SO_USER3TY	SWSMKOB	User 3 Text		☑	25x	5
2561	SO_USER4	SWSMKOB	User 4		☑	nnnnnnnnn.n	4
2562	SO_USER5	SWSMKOB	User 5		☑	30x	5
2563	SO_USER6	SWSMKOB	User 6		☑		2
2564	SO_USER7	SWSMKOB	User 7		☑		2
2565	SO_USER8	SWSMKOB	User 8		☑		2
2946	SO_X	SWSMKOB	X Coordinate		☑	-nnnnnnnnn.	4
2947	SO_Y	SWSMKOB	Y Coordinate		☑	-nnnnnnnnn.	4
884	SM_COMMENT	SWSMKTST	Comments		☑		5
872	SM_CREW	SWSMKTST	Inspection Crew		☑	10x	5
3047	SM_DOC_FLG	SWSMKTST	Document Available		☐		2
563	SM_DS_MAN	SWSMKTST	DS Manhole		☑	20x	
564	SM_DT_INSP	SWSMKTST	Date Inspected		☑	mm/dd/yyyy	6
875	SM_GPM	SWSMKTST	Total GPM		☑	nnnn.nn	4
876	SM_GPM_REM	SWSMKTST	Remaining GPM		☑	nnnn.nn	4
1729	SM_IMG_FLG	SWSMKTST	Image Available		☑		2
885	SM_MOD_BY	SWSMKTST	Modified By		☑	3x	5
886	SM_MOD_DT	SWSMKTST	Modified Date		☑	mm/dd/yyyy	6
1730	SM_MOV_FLG	SWSMKTST	Movie Available		☑		2
871	SM_NETID	SWSMKTST	Pipe Link		☑		0
873	SM_RSLT_CD	SWSMKTST	Result		☑	nnn	1
874	SM_RSLT_TY	SWSMKTST	Result Text		☑	25x	5
1728	SM_SMKID	SWSMKTST	Link to Child		☑		0
579	SM_US_MAN	SWSMKTST	US Manhole		☑	20x	
877	SM_USER1CD	SWSMKTST	User 1		☑	nnn	1
878	SM_USER1TY	SWSMKTST	User 1 Text		☑	25x	5
879	SM_USER2CD	SWSMKTST	User 2		☑	nnn	1
880	SM_USER2TY	SWSMKTST	User 2 Text		☑	25x	5
881	SM_USER3CD	SWSMKTST	User 3		☑	nnn	1

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
882	SM_USER3TY	SWSMKTST	User 3 Text		☑	25x	5
870	SM_USER4	SWSMKTST	User 4		☑	nnnnnnnnn.n	4
883	SM_USER5	SWSMKTST	User 5		☑	30x	5
1731	SM_USER6	SWSMKTST	User 6		☑		2
1732	SM_USER7	SWSMKTST	User 7		☑		2
1733	SM_USER8	SWSMKTST	User 8		☑		2
2547	Browse	SWSORT			☑		
2548	Filter	SWSORT			☑		1
2546	ID	SWSORT			☑		0
2545	ModuleName	SWSORT			☑	255x	5
2339	SN_COMMENT	SWSTATN	Comments		☑		5
2245	SN_CONSTR	SWSTATN	Project Number		☑	20x	5
2246	SN_CONTRCT	SWSTATN	Constructed By		☑	30x	5
2248	SN_DATE	SWSTATN	Date Completed		☑	mm/dd/yyyy	6
2337	SN_DESIGN	SWSTATN	Designed By		☑	30x	5
3048	SN_DOC_FLG	SWSTATN	Document Available		☐		2
2338	SN_FLO_CAP	SWSTATN	Stn Capacity (gpm)		☑	nnnnnnnn.n	4
2273	SN_IMG_FLG	SWSTATN	Image Available		☑		2
2259	SN_MHID	SWSTATN	Manhole ID		☑		0
2271	SN_MOD_BY	SWSTATN	Modified By		☑	3x	5
2272	SN_MOD_DT	SWSTATN	Modified Date		☑	mm/dd/yyyy	6
2274	SN_MOV_FLG	SWSTATN	Movie Available		☑		2
2241	SN_NODE_NO	SWSTATN	Pump Station ID		☑	20x	5
2598	SN_STN_ID	SWSTATN	Unique Number		☑		0
2242	SN_STN_NAM	SWSTATN	Station Name		☑	30x	5
2247	SN_TOTAL_C	SWSTATN	Construction Cost		☑	nnnnnnnnn.n	4
2257	SN_TYPE_CD	SWSTATN	Station Type		☑	nnn	1
2258	SN_TYPE_TY	SWSTATN	Station Type Text		☑	25x	5
2260	SN_USER1CD	SWSTATN	User 1		☑	nnn	1
2261	SN_USER1TY	SWSTATN	User 1 Text		☑	25x	5
2262	SN_USER2CD	SWSTATN	User 2		☑	nnn	1
2263	SN_USER2TY	SWSTATN	User 2 Text		☑	25x	5
2264	SN_USER3CD	SWSTATN	User 3		☑	nnn	1
2265	SN_USER3TY	SWSTATN	User 3 Text		☑	25x	5
2266	SN_USER4	SWSTATN	User 4		☑	nnnnnnnnn.n	4
2267	SN_USER5	SWSTATN	User 5		☑	30x	5
2268	SN_USER6	SWSTATN	User 6		☑		2
2269	SN_USER7	SWSTATN	User 7		☑		2
2270	SN_USER8	SWSTATN	User 8		☑		2
2303	SI_COMMENT	SWSTNINSP	Comments		☑		5
2280	SI_ELEC_CD	SWSTNINSP	Electrical Condition		☑	nnn	1
2281	SI_ELEC_TY	SWSTNINSP	Electrical Cond Text		☑	25x	5
2286	SI_FREQ	SWSTNINSP	Insp Frequency		☑	nnn	1
2285	SI_FRUN	SWSTNINSP	Insp Freq Units		☑	25x	5
2301	SI_IMG_FLG	SWSTNINSP	Image Available		☑		2
2277	SI_INSP_BY	SWSTNINSP	Inspected By		☑	15x	5

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
2276	SI_INSP_DT	SWSTNINSP	Date Inspected		☑	mm/dd/yyyy	6
2282	SI_MECH_CD	SWSTNINSP	Mechanical Condition		☑	nnn	1
2283	SI_MECH_TY	SWSTNINSP	Mechanical Cond Text		☑	25x	5
2299	SI_MOD_BY	SWSTNINSP	Modified By		☑	3x	5
2300	SI_MOD_DT	SWSTNINSP	Modified Date		☑	mm/dd/yyyy	6
2302	SI_MOV_FLG	SWSTNINSP	Movie Available		☑		2
2287	SI_NMNT	SWSTNINSP	Next Station Insp		☑	mm/dd/yyyy	6
2275	SI_NODE_ID	SWSTNINSP	Link to Pump Station		☑	10x	
2600	SI_STN_ID	SWSTNINSP	Link to Pump Station		☑		0
3017	SI_STN_NO	SWSTNINSP			☐		0
2340	SI_STRT_CD	SWSTNINSP	Structural Condition		☑	nnn	1
2341	SI_STRT_TY	SWSTNINSP	Structural Cond Text		☑	25x	5
2288	SI_USER1CD	SWSTNINSP	User 1		☑	nnn	1
2289	SI_USER1TY	SWSTNINSP	User 1 Text		☑	25x	5
2290	SI_USER2CD	SWSTNINSP	User 2		☑	nnn	1
2291	SI_USER2TY	SWSTNINSP	User 2 Text		☑	25x	5
2292	SI_USER3CD	SWSTNINSP	User 3		☑	nnn	1
2293	SI_USER3TY	SWSTNINSP	User 3 Text		☑	25x	5
2993	SI_ID	SWSUBSETIN	Unique Subset ID		☑		0
2994	SI_INFR_ID	SWSUBSETIN	Infrastructure ID		☑		0
2995	SI_SB_ID	SWSUBSETIN	Subset Number		☑		0
610	TL_CLN_NUM	SWTVLINE	Remain Cleaning #		☑	nnnn	1
611	TL_CLN_RTG	SWTVLINE	Cleaning Rating		☑	nnnnn.n	4
612	TL_CLN_TOT	SWTVLINE	Total Cleaning #		☑	nnnn	1
613	TL_COL_BLK	SWTVLINE	Collapsed/Blocked		☑	1x	5
614	TL_COMMENT	SWTVLINE	Comments		☑		5
616	TL_COND_CD	SWTVLINE	Surface Condition		☑	nnn	1
617	TL_COND_TY	SWTVLINE	Surface Cond Text		☑	25x	5
669	TL_CREW	SWTVLINE	Inspection Crew		☑	20x	5
3049	TL_DOC_FLG	SWTVLINE	Document Available		☐		2
618	TL_DT_INSP	SWTVLINE	Date Televised		☑	mm/dd/yyyy	6
620	TL_DYED_CD	SWTVLINE	Dyed Water		☑	nnn	1
621	TL_DYED_TY	SWTVLINE	Dyed Water Text		☑	25x	5
622	TL_FLO_NUM	SWTVLINE	Remain Flow (gpm)		☑	nnnn.nnn	4
623	TL_FLO_RTG	SWTVLINE	Flow Rating		☑	nnn.nnn	4
624	TL_FLO_TOT	SWTVLINE	Total Flow # (gpm)		☑	nnnn.nnn	4
625	TL_FLOW_CD	SWTVLINE	Flow Type		☑	nnn	1
2362	TL_FLOW_TY	SWTVLINE	Flow Type Text		☑	25x	5
931	TL_IMG_FLG	SWTVLINE	Image Available		☑		2
627	TL_LATEST	SWTVLINE	Ltst TV Rec For Line		☑		2
631	TL_MAX_FT	SWTVLINE	Max Obs Len (ft)		☑	nnnn.n	4
632	TL_MAX_OBS	SWTVLINE	Max Obs #		☑	nnn	1
933	TL_MOD_BY	SWTVLINE	Modified By		☑	3x	5
934	TL_MOD_DT	SWTVLINE	Modified Date		☑	mm/dd/yyyy	6
932	TL_MOV_FLG	SWTVLINE	Movie Available		☑		2
662	TL_NETID	SWTVLINE	Link to Pipe		☑		0

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
634	TL_OBS_FLT	SWTVLINE	Observation Filter		☑		2
615	TL_OCND_CD	SWTVLINE	Overall Condition		☑	nnn	4
1571	TL_OCND_TY	SWTVLINE	Overall Cond Text		☑	25x	5
636	TL_PCT_FUL	SWTVLINE	Percent Full		☑	nnn	1
646	TL_PRCLND	SWTVLINE	Clean Prior		☑		2
647	TL_PRDBCTR	SWTVLINE	Degrease Prior		☑		2
648	TL_PRKNIFE	SWTVLINE	Root Cut Prior		☑		2
649	TL_PRMANHL	SWTVLINE	MH Replace Prior		☑		2
650	TL_PROTHER	SWTVLINE	Other Maint Prior		☑	25x	5
651	TL_PRPOINT	SWTVLINE	Point Repair Prior		☑		2
652	TL_PRVAPOR	SWTVLINE	Root Chem Prior		☑		2
653	TL_PURP_CD	SWTVLINE	Purpose		☑	nnn	1
2361	TL_PURP_TY	SWTVLINE	Purpose Text		☑	25x	5
659	TL_START	SWTVLINE	Counter Start		☑	15x	5
660	TL_STOP	SWTVLINE	Counter Stop		☑	15x	5
663	TL_STR_NUM	SWTVLINE	Remain Structural #		☑	nnnn	1
664	TL_STR_RTG	SWTVLINE	Structural Rating		☑	nnnnn.n	4
665	TL_STR_TOT	SWTVLINE	Total Structural #		☑	nnnn	1
668	TL_TAPE_ID	SWTVLINE	Tape ID Number		☑	15x	5
670	TL_TVDR_CD	SWTVLINE	TV Direction		☑	nnn	1
671	TL_TVDR_TY	SWTVLINE	TV Direction Text		☑	25x	5
655	TL_TVID	SWTVLINE	Unique Number		☑		0
765	TL_USER1CD	SWTVLINE	User 1		☑	nnn	1
766	TL_USER1TY	SWTVLINE	User 1 Text		☑	25x	5
767	TL_USER2CD	SWTVLINE	User 2		☑	nnn	1
768	TL_USER2TY	SWTVLINE	User 2 Text		☑	25x	5
769	TL_USER3CD	SWTVLINE	User 3		☑	nnn	1
770	TL_USER3TY	SWTVLINE	User 3 Text		☑	25x	5
771	TL_USER4	SWTVLINE	User 4		☑	nnnnnnnnn.n	4
772	TL_USER5	SWTVLINE	User 5		☑	30x	5
1734	TL_USER6	SWTVLINE	User 6		☑		2
1735	TL_USER7	SWTVLINE	User 7		☑		2
1736	TL_USER8	SWTVLINE	User 8		☑		2
2934	TL_WTHR_CD	SWTVLINE	Weather		☑	nnn	1
2935	TL_WTHR_TY	SWTVLINE	Weather Text		☑	25x	5
673	TO_CLN_RAT	SWTVOBSR	Cleaning #		☑	nnn	1
674	TO_COMMENT	SWTVOBSR	Comments		☑		5
685	TO_FLO_ACT	SWTVOBSR	Observed (gpm)		☑	nn.nnn	4
677	TO_FLO_RAT	SWTVOBSR	Estimated (gpm)		☑	nn.nnn	4
678	TO_FOOTAGE	SWTVOBSR	Distance (ft)		☑	nnnn.nn	4
2812	TO_GPM_REM	SWTVOBSR	Remaining GPM		☑	nn.nnn	4
1739	TO_IMG_FLG	SWTVOBSR	Image Available		☑		2
929	TO_MOD_BY	SWTVOBSR	Modified By		☑	3x	5
1738	TO_MOD_DT	SWTVOBSR	Modified Date		☑	mm/dd/yyyy	6
1740	TO_MOV_FLG	SWTVOBSR	Movie Available		☑		2
683	TO_NETID	SWTVOBSR			☐		

ID	FieldName	TableName	DefaultName	User	AllwSort	Mask	FldType
679	TO_NOT1_CD	SWTVOBSR	Location		☑	nnn	1
675	TO_NOT1_TY	SWTVOBSR	Location Text		☑	25x	5
680	TO_NOT2_CD	SWTVOBSR	Description		☑	nnn	1
676	TO_NOT2_TY	SWTVOBSR	Description Text		☑	25x	5
3018	TO_OBS_ID	SWTVOBSR			☐		0
681	TO_OBS_NO	SWTVOBSR	Observation #		☑	nnn	1
2811	TO_PER_REM	SWTVOBSR	% I/I Removed		☑	nnn	1
682	TO_RATING	SWTVOBSR	Rating		☐	n	1
2809	TO_REPR_CD	SWTVOBSR	Repaired		☑	nnn	1
2810	TO_REPR_TY	SWTVOBSR	Repaired Text		☑	25x	5
684	TO_STR_RAT	SWTVOBSR	Structure #		☑	nnn	1
1737	TO_TVID	SWTVOBSR	Link to Parent		☑		0
2937	TO_USER1CD	SWTVOBSR	User 1		☑	nnn	1
2938	TO_USER1TY	SWTVOBSR	User 1 Text		☑	25x	5
2939	TO_USER4	SWTVOBSR	User 2		☑	nnnnnnnnn.n	4
2940	TO_USER5	SWTVOBSR	User 3		☑	30x	5
2941	TO_USER6	SWTVOBSR	User 4		☑		2
2936	TO_VTR_NO	SWTVOBSR	VCR Counter		☑	10x	5
2975	TO_XCOORD	SWTVOBSR	X Coordinate		☑	-nnnnnnnnn.	4
2976	TO_YCOORD	SWTVOBSR	Y Coordinate		☑	-nnnnnnnnn.	4
940	TW_COMP_CD	SWTVWORK	Completed		☑	nnn	0
941	TW_COMP_TY	SWTVWORK	Completed Text		☑	25x	5
1742	TW_MOD_BY	SWTVWORK	Modified By		☑	3x	5
1743	TW_MOD_DT	SWTVWORK	Modified Date		☑	mm/dd/yyyy	6
942	TW_NOTES	SWTVWORK	Comments		☐		5
935	TW_NUMBER	SWTVWORK	Task #		☑	nnn	0
936	TW_TASK_CD	SWTVWORK	Additional Task		☑	nnn	0
937	TW_TASK_TY	SWTVWORK	Additional Task Text		☑	25x	5
1741	TW_TVID	SWTVWORK	Link to TV Line		☑		0
938	TW_WHO_CD	SWTVWORK	Assigned To		☑	nnn	0
939	TW_WHO_TY	SWTVWORK	Assigned To Text		☑	25x	5

APPENDIX B:

SUMMARY OF HYDRAULIC MODELING ASSUMPTIONS

City of Thousand Oaks Wastewater Interceptor Master Plan
Summary of Hydraulic Modeling Assumptions

Calibrated Dry Weather Unit Flow Rates:

Residential:	269 gpd/single family dwelling unit
	186 gpd/multiple family dwelling unit
	128 gpd/group quarter dwelling unit

Above rates are equivalent to 85 gpd/capita using City's capita/dwelling unit estimates.

Commercial:	0.1 gpd/developed square foot (equivalent to an average of 1220 gpd/net acre)
Schools:	12 gpd/student
Hotels:	40 gpd/room
Industrial:	0.1 gpd/developed square foot (equivalent to an average of 610 gpd/net acre), plus process flow for major dischargers

Dry Weather Peak Flows:

Based on 24-hour diurnal flow profiles developed for weekdays and weekends. Hydrographs dynamically routed to attenuate peaks.

Peak Wet Weather Flows:

Existing I/I volume and hydrograph shape parameters calibrated based on data from the temporary flow monitors and radar grid for the event of March 4-6, 2001. Storm of March 4-6 produced relatively uniform rainfall over city (about 3 inches), and occurred on saturated soils. It generated I/I at the treatment plant similar to the Feb. 23, 1998 storm (peak day flow of 22 mgd). For analysis, shifted storm in time so that I/I peak occurs during time of average flow rather than minimum flow.

Future Flows:

Future residential and non-residential development at buildout was based on Planning Department projections. Existing unit flow rates were applied. AMGEN flows were increased in proportion to the projected increase in square footage. Recommend increasing general industrial unit flow rate to 0.2 gpd/sq.ft. to allow for possible future major dischargers.

Future I/I assumed to be the same as existing I/I. No allowances made for deterioration, rehabilitation, or I/I from new sewers.

Appendix K

MWH
MONTGOMERY WATSON HARZA

APPENDIX K

UNIT E SEWER AND ILS AREA ALTERNATIVES (PROJECT E6)

CITY OF THOUSAND OAKS

UNIT E SEWER & I.L.S. AREA ALTERNATIVES

APRIL, 2002
(REVISED)

ALTERNATIVE 1 - PARTIALLY FILL THE I.L.S. WET WELL WITH CONCRETE AND APPLY COATING

-COST IS APPROX. $ 50,000
-APPROX DEPTH OF SEWAGE IS 12'; WATER SURFACE EL.=631
-TEMPORARILY BYPASS FLOWS FROM MANHOLES F22 AND F23 ON HILLCREST DR (1WEEK).
-CLEAN & HYDROBLAST WET WELL INTERIOR
-PARTIAL CONCRETE FILL AND FORM FLOW CHANNELS TO DEPTH OF THE LOWEST INCOMING SEWER (ABOUT 45 CY OF CONCRETE)
-RENOVATE WET WELL INTERIOR WITH 100 MIL THICK CORROSION-RESISTANT COATING.

ADVANTAGES:
-LOWEST COST ALTERNATIVE
-FAST CONSTRUCTION REDUCES FLOW BYPASSING TIME AND COST
-NO CALTRANS PERMIT IS REQUIRED
-CORRECTS SEPTIC SETTLING SOLIDS IN WET WELL, BUT DOES NOT REMEDY THE EXISTING FLOW SURCHARGING (AND GREASE /SCUM/FLOATABLES ACCUMULATION)

ALTERNATIVE 2 - INSTALL NEW MANHOLE F23 INSIDE THE I.L.S. WET WELL

-COST IS APPROX. $ 60,000
-TEMPORARILY BYPASS FLOWS FROM MANHOLES F22 AND F23 (2 WEEKS)
-CLEAN AND PUMP OUT WET WELL INTERIOR
-PARTIAL CONCRETE FILL IN WET WELL TO SUPPORT NEW MANHOLE
-SET 6' DIAMETER PVC-LINED MANHOLE INTO 12'x12' WET WELL
-BACKFILL WITH CONCRETE AROUND MANHOLE (INSIDE WET WELL)

ADVANTAGES:
-LOW COST FOR NEW JUNCTION MANHOLE
-REMOVES TROUBLESOME WET WELL FROM SERVICE
-NO EXCAVATION BECAUSE WET WELL ACTS AS SHORING TO SET NEW MANHOLE F23
-NO CALTRANS PERMIT IS REQUIRED
-CORRECTS SEPTIC SETTLING SOLIDS IN WET WELL, BUT DOES NOT REMEDY THE EXISTING FLOW SURCHARGING (AND GREASE/SCUM/FLOATABLES ACCUMULATION)

ALTERNATIVE 3 - NEW JUNCTION MANHOLE AND NEW SEWER CROSSING THE 101 FREEWAY

-COST IS APPROX. $ 450,000
-MAINTAIN SEWER FLOW AS-IS (NO BYPASS NEEDED TO START)
-CONSTRUCT JACKING PITS AND JACK & BORE A STEEL CASING NEXT TO I.L.S. AND MH E-1 (SOUTH OF FWY)
-INSTALL A NEW 21 OR 24-INCH PVC GRAVITY SEWER IN CASING PIPE ON-GRADE, SLOPE FOR
-CALTRANS PERMIT IS REQUIRED
-GRAVITY FLOW (NO SURCHARGE)
-INSTALL 2 MANHOLES AND CONNECT TO MH E-1 ON THE UNIT E SEWER
-TEMP BYPASS FLOW AND RECONSTRUCT 650' OF SEWER WEST OF I.L.S. IN WEST HILLCREST DRIVE
TEMP BYPASS FLOW AND RECONSTRUCT 800' OF SEWER EAST OF I.L.S. IN WEST HILLCREST DRIVE

ADVANTAGES:
-PROVIDES GRAVITY FLOW (NO SURCHARGING) FOR A LONG-TERM SOLUTION
-EXISTING SEWER CAN REMAIN IN SERVICE, SO MAJOR CONSTRUCTION ITEMS AT 101 FWY
-CAN BE BUILT WITHOUT TEMP BYPASS (IMPROVES RELIABILITY & MAINTENANCE; LOWERS THE COST)

ALTERNATIVE 4 - NEW LOW FLOW SUBMERSIBLE PUMPS OR SELF PRIMING PUMPS IN THE EXISTING I.L.S. WET WELL

-COST IS APPROX. $ 150,000
-LOW FLOW (200 GPM±) PUMP TO EVACUATE WET WELL TWICE DAILY AND PREVENT SEPTIC CONDITIONS.
-TEMPORARILY BYPASS FLOWS FROM MANHOLES F 22 AND F 23 (1 MONTH)
-CLEAN AND HYDROBLAST WET WELL INTERIOR
-PARTIAL REMOVAL OF EXIST CONCRETE FILL IN WET WELL
-REMOVAL OF EXIST CONCRETE WET WELL TOP SLAB
-CONSTRUCT SITE IMPROVEMENTS FOR ACCESS AND SECURING THE SITE WITH NEW
-PAVEMENT, GATES AND FENCES
-CONSTRUCT NEW 450 LF PVC FORCE MAIN TO MANHOLE E1-2.1, INSIDE THE EXIST 21" SEWER
-CONSTRUCT NEW WET WELL TOP WITH ALUMINUM ACCESS HATCH
-RENOVATE EXIST WET WELL INTERIOR WITH 100 MILL THICK CORROSION RESISTANT COATING
-(OPTIONAL) PROVIDE FOR PORTABLE GENERATOR HOOK-UP OR 25 KW ONSITE ENGINE GENERATOR.
-CALTRANS PERMIT REQUIRED FOR INSTALLING 4" FORCEMAIN INSIDE THE EXIST 21" SEWER

ADVANTAGES:
-PROVIDES A DAILY TURNOVER OF EXISTING WASTEWATER WITH LOW COST PUMP STATION TO REDUCE SEPTICITY & SCUM ACCUMULATION
-EXISTING SEWER PIPING REMAINS IN SERVICE
-DAILY FLOW CONTINUES TO FILL THE WET WELL AND SURCHARGES TO FLOW OUT TO THE SOUTH TO MANHOLES E-1 AND E-2
-MINIMAL EXCAVATION NEEDED
-NEW JACK AND BORED CASING FOR THE FORCE MAIN IS NOT NEEDED; (LOWERS THE COST $200K)

ALTERNATIVE 5 - NEW FULL FLOW SUBMERSIBLE PUMPS OR SELF-PRIMING PUMPS IN THE EXISTING I.L.S. WET WELL

-COST IS $ 230,000
-FULL FLOW (750 GPM±) PUMP TO CYCLE ON/OF AND PUMP FLOWS FROM I.L.S. RANGING FROM LOW OF 0.4 MGD (EXISTING) TO HIGH OF 1.1 MGD (FUTURE).
-TEMPORARILY BYPASS FLOW FROM MANHOLES F 22 AND F 23 (2 MONTS)
-CLEAN AND HYDROBLAST WET WELL INTERIOR
-PARTIAL REMOVAL OF EXIST CONCRETE FILL IN WET WELL
-REMOVAL OF EXIST CONCRETE WET WELL TOP SLAB
-CONSTRUCT SITE IMPROVEMENTS FOR ACCESS AND SECURING THE SITE WITH NEW
-PAVEMENT, GATES AND FENCES
-CONSTRUCT NEW 450 LF 8" PVC FORCE MAIN TO MANHOLE E1-2.1, INSIDE THE EXIST 21" SEWER
-CONSTRUCT NEW WET WELL TOP WITH ALUMINUM ACCESS HATCH
-RENOVATE EXIST WET WELL INTERIOR WITH 100 MILL THICK CORROSION RESISTANT COATING
-(OPTIONAL) PROVIDE FOR PORTABLE GENERATOR HOOK-UP OR 25 KW ONSITE ENGINE GENERATOR
-CALTRANS PERMIT REQUIRED FOR INSTALLING 8" FORCEMAIN INSIDE THE EXIST 21" SEWER

ADVANTAGES:
-PROVIDES A DAILY TURNOVER OF EXISTING WASTEWATER WITH LOW COST PUMP STATION TO REDUCE SEPTICITY & SCUM ACCUMULATION
-EXISTING SEWER PIPING REMAINS IN SERVICE
-ENTIRE DAILY FLOW IS PUMPED FROM THE WET WELL; WET WELL WON'T SURCHARGE TO FLOW SOUTH TO MANHOLES E-1 AND E-2
-MINIMAL EXCAVATION NEEDED
-NEW JACK AND BORED CASING FOR THE FORCE MAIN IS NOT NEEDED; (LOWERS THE COST $ 200K)
-EASY ACCESS TO PUMPS, MOTORS AND PIPING
-NO EQUIPMENT IN THE WET WELL EXCEPT THE SUCTION PIPING AND SEWER FORCE MAIN
-COVERED PUMP STATION WILL REDUCE CORROSION ON THE EQUIPMENT

PRELIMINARY
DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION
1	3-21-02	CJG	FIELD VERIFIED & REVISED CALTRANS FLOOD CHANNEL
2	4-5-02	CJG	ADDED ALT 4 AND 5

SCALE: NONE
WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE
DESIGNED P.BOGDANOFF
DRAWN G. BEHNKE
CHECKED J. GANTNEY
SUBMITTED BY
(PROJECT MANAGER'S NAME) LICENSE NO. DATE
(COMPANY OFFICER'S NAME) LICENSE NO. DATE

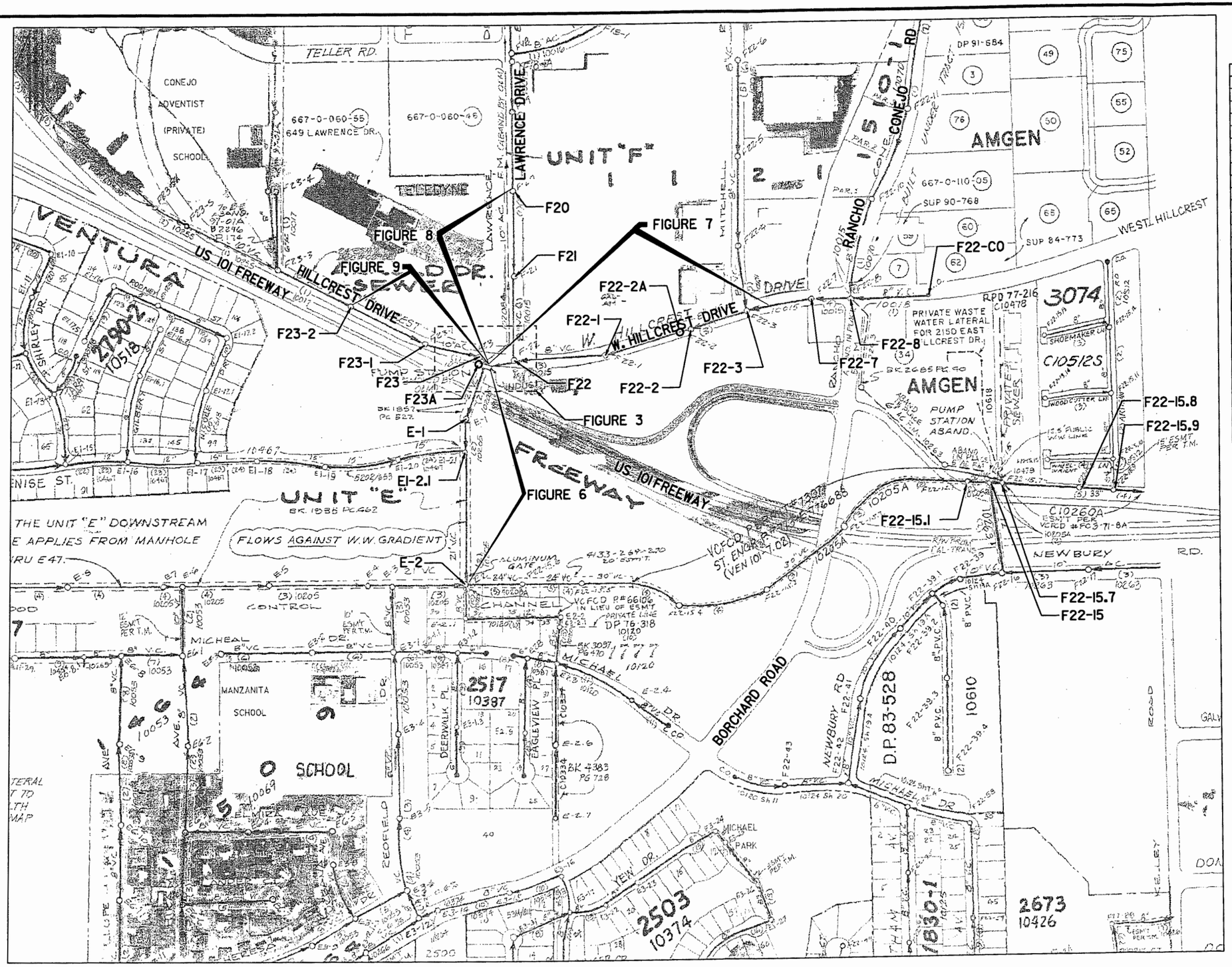
MWH
MONTGOMERY WATSON HARZA
Pasadena California

CITY OF THOUSAND OAKS
INTERCEPTOR SEWER STUDY

FEBRUARY 2002
PROJECT NO. 13411311.011205

FIGURE 1 of 20

Job No: 0000000 File:P:\Projects\thousand.oaks\unit-e_sewer\civ\Fig01.div User:nolsic Plot Date:17-APR-2002



MH NO.	FLOWLINE	RIM ELEV.	COMMENTS
	628.9±		INVERT TO I.L.S WETWELL
F22	631.32	642.51	DROP MH OUTLET WEST
F22-1	632.83	641.01	
F22-2A	636.04	643.79	
F22-2	636.22	644.00	
F22-3	643.70	649.75	
F22-7	644.94	651.91	
F22-8	646.04	650.44	
F22-CO	647.37	652.49	
	628.9±		INVERT TO I.L.S WETWELL
F22	635.0±	642.51	DROP MH INLET NORTH
F21	637.47	644.82	
F20	636.96	645.66	STANDING LIQUID
	628.3±		INVERT TO I.L.S WETWELL
F23	628.40	643.05	
F23A	620.90	642.90	DRY WELL (ABANDONED)
F23-1	630.10	643.88	
F23-2	632.73	643.20	
	628.5±		INVERT TO I.L.S WETWELL
E-1	630.49	641.66	
E1-21	630.61	641.29	
E-2	629.96	640.67	
LIFT STA	620.3±	643.03	WL EL=631.0±
F22-15.1	620.98	641.70	
F22-15	620.15	638.38	
F22-15.7	620.05	638.15	
F22-15.8	———	637.95	SEALED
F22-15.9	619.16	636.64	

EXISTING SEWER DATA
DECEMBER 2001

N

CITY BENCH MARK:

ELEVATIONS SHOWN ARE CITY OF THOUSAND OAKS DATUM BASED ON CITY OF THOUSAND OAKS BENCH MARK 56-B-74 BRONZE DISC SET IN SOUTHERLY CURB OF CAMINO DOS RIOS APPROXIMATLY 160 FEET EASTERLY OF THE WENDY DRIVE OFF RAMP 2 FEET NORTH OF A FIRE HYDRANT IN FRONT OF A SERVICE STATION (2870 CAMINO DOS RIOS) ELEV 664.62

TEMPORARY BENCHMARKS

1. SET CHISELED + AT NORTHEASTERLY CORNER OF CONCRETE SLAB OF PUMP STATION
   N 10,032.43
   E 9866.23
   ELEV. 643.03
2. SET NAIL AND WASHER IN NORTHERLY CURB AT WEST EDGE OF CONCRETE DRIVEWAY 480' +/- EAST OF LAWRENCE DR 6' WEST OF A HYDRANT
   N 10168.05
   E 9955.30
   ELEV. 641.30

PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED P.BOGDANOFF
DRAWN G. BEHNKE
CHECKED J. GANTNEY

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(COMPANY OFFICER'S NAME) LICENSE NO. DATE

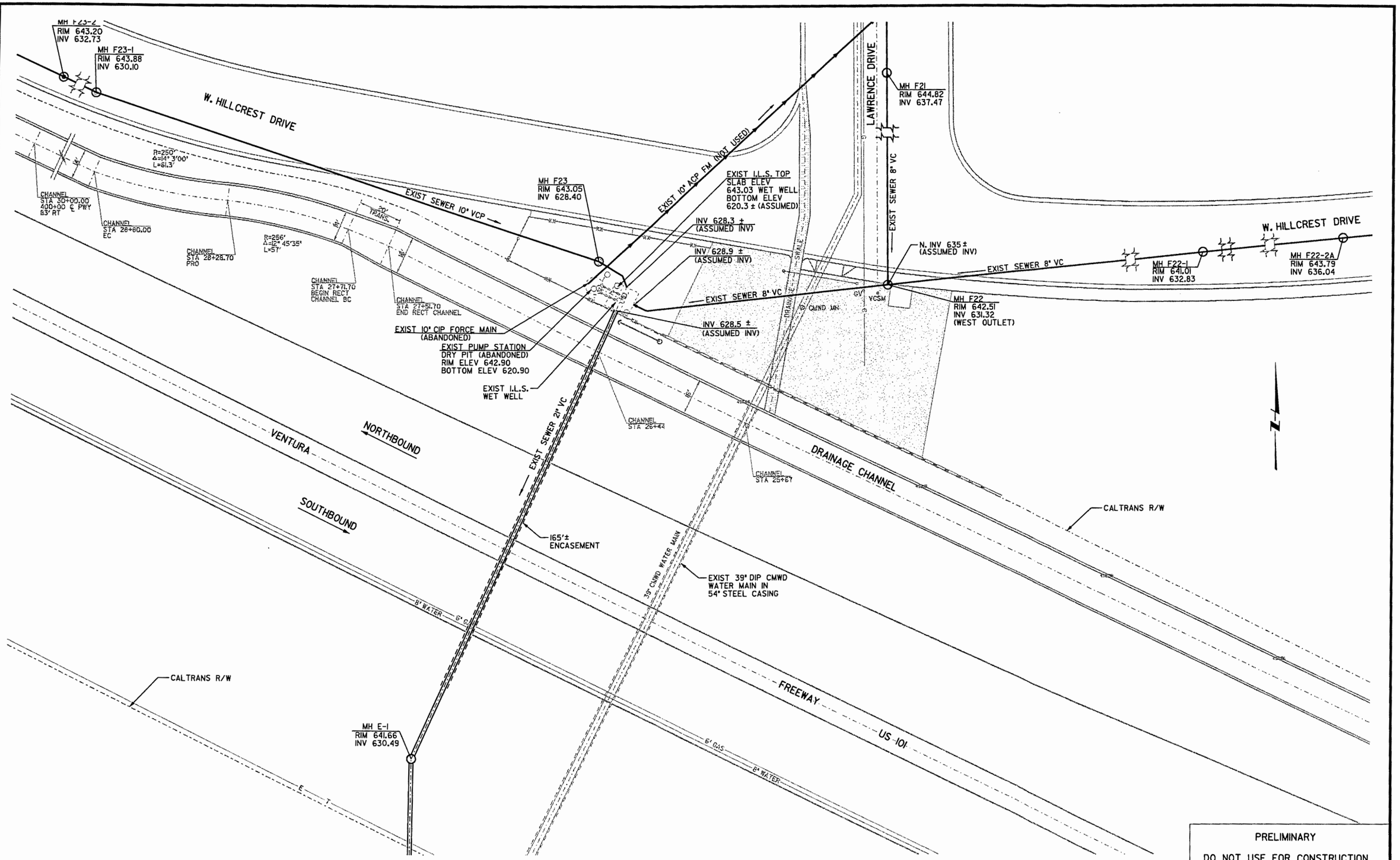
MWH
MONTGOMERY WATSON HARZA
Pasadena California

CITY OF THOUSAND OAKS
INTERCEPTOR SEWER STUDY

UNIT E SEWER & UNIT F SEWER
EXISTING AREA MAP

FIGURE 2 of 20

Job No: 0000000 File:P:\Projects\thousand_oaks\unit_e_sewer\civ\Fig02.dlv User:nclalo Plot Date:17-APR-2002



PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE 1" = 20'

WARNING 0 ½ 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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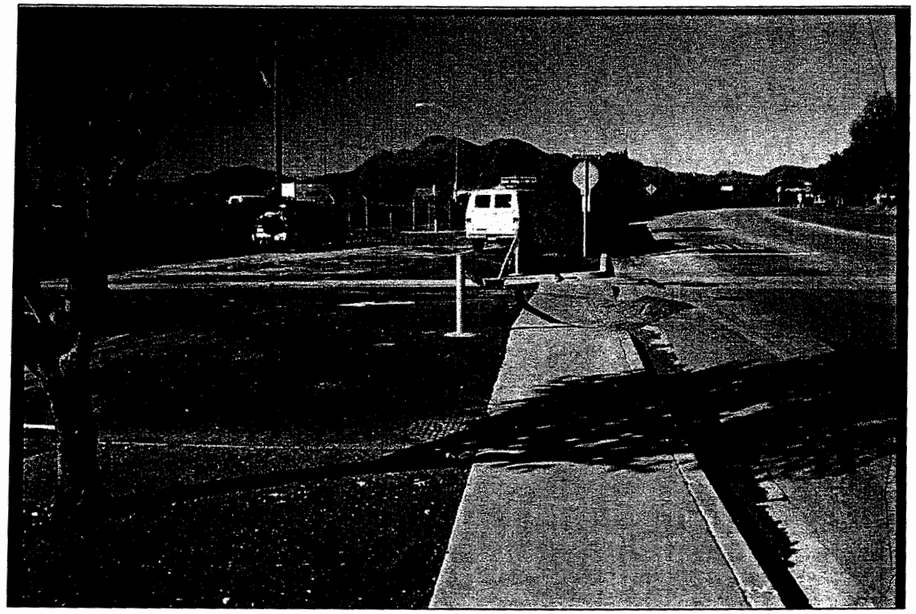
CITY OF THOUSAND OAKS
INTERCEPTOR SEWER STUDY

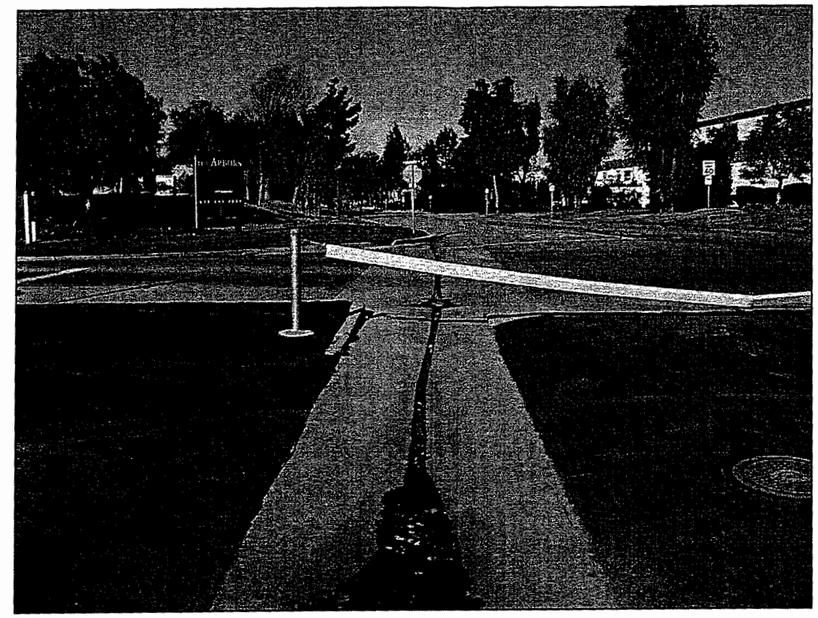
EXISTING INDUSTRIAL LIFT STATION
PARTIAL PLAN

FIGURE 3 of 20

Plot Date17-APR-2002
Userncisic
File:P:\Projects\thousand_oaks\unit_e_sewer\civ\Fig03.dlv
Job No: 0000000

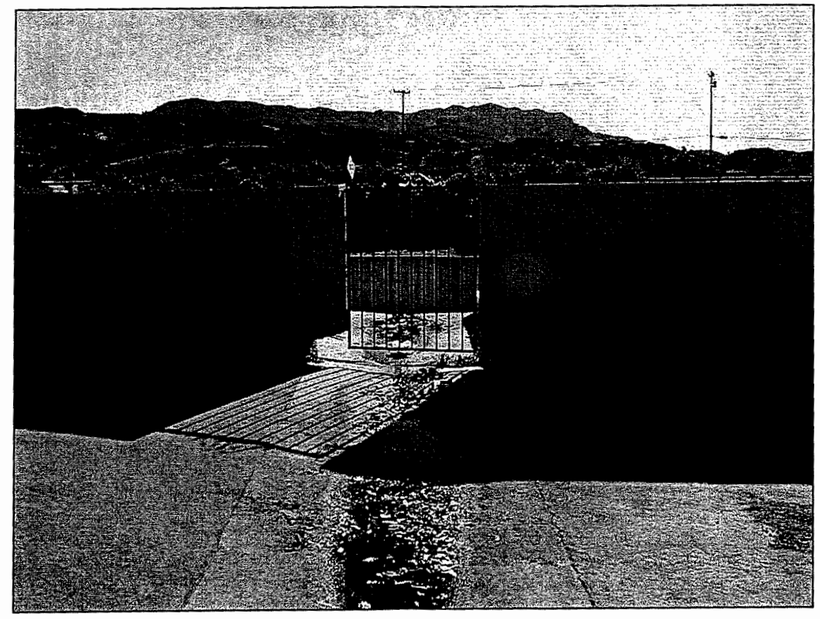


AT ILS LOOKING WEST ALONG HILLCREST DR
MANHOLE F22 BACK OF SIDEWALK AT TREE SHADOW



EAST OF ILS LOOKING NORTH TOWARDS LAWRENCE DR DRAINAGE SWALE
CALLEGAS WATER MAIN MH AT RIGHT

AT ILS LOOKING WEST
FENCE AT RIGHT IS ALONG W. HILLCREST DRIVE
FLOOD CHANNEL AND 101FWY AT LEFT (OFF-SITE)



PAVEMENT DRAINAGE SWALE LOOKING SOUTH
AS IT EMPTIES INTO FLOOD CHANNEL

PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED P. BOGDANOFF
DRAWN N. CISIC
CHECKED J. GANTNEY

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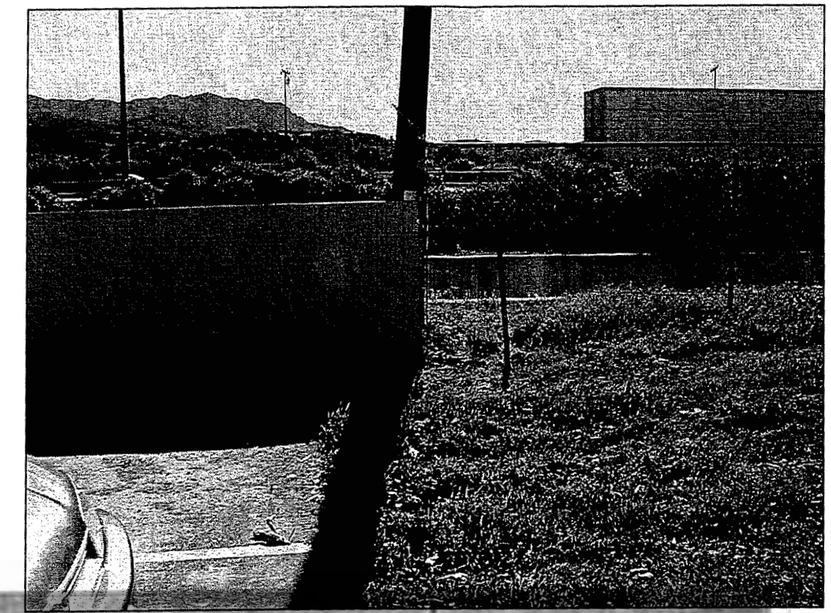
CITY OF THOUSAND OAKS
INTERCEPTOR SEWER STUDY

PHOTOS AT THE OLD
INDUSTRIAL LIFT STATION SITE

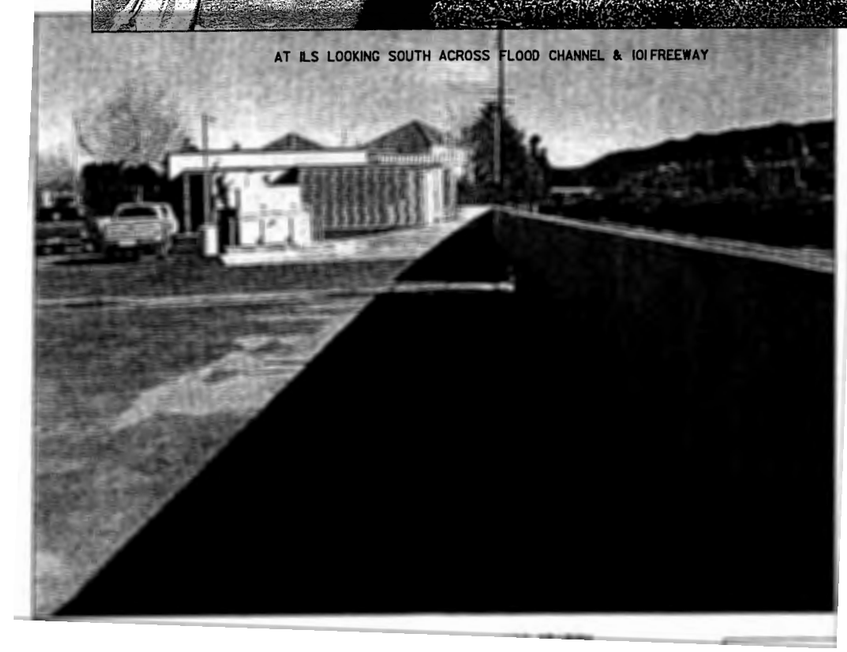
FIGURE 4 of 20

Job No: 0000000 File:P:\Projects\thousand_oaks\unit-e_sewer\civ\Fig04.div Plot Date17-APR-2002 User:nclsic

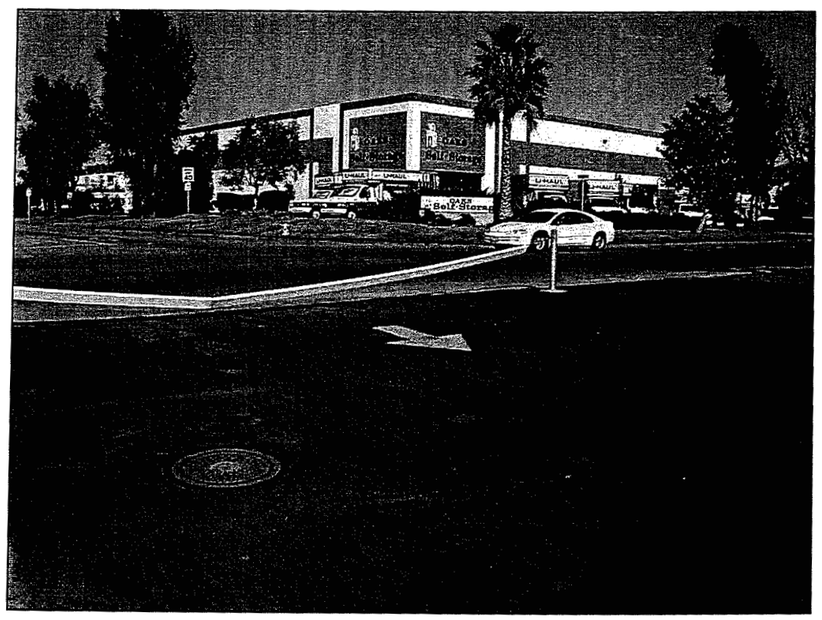
AT ILS LOOKING EAST TOWARDS FIRE STATION



AT ILS LOOKING SOUTH ACROSS FLOOD CHANNEL & 101 FREEWAY



AT ILS LOOKING EAST TOWARDS FIRE STATION



AT ILS LOOKING NORTHEAST TOWARDS LAWRENCE DR AND HILLCREST DR

PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED P. BOGDANOFF
DRAWN N. CISIC
CHECKED J. GANTNEY

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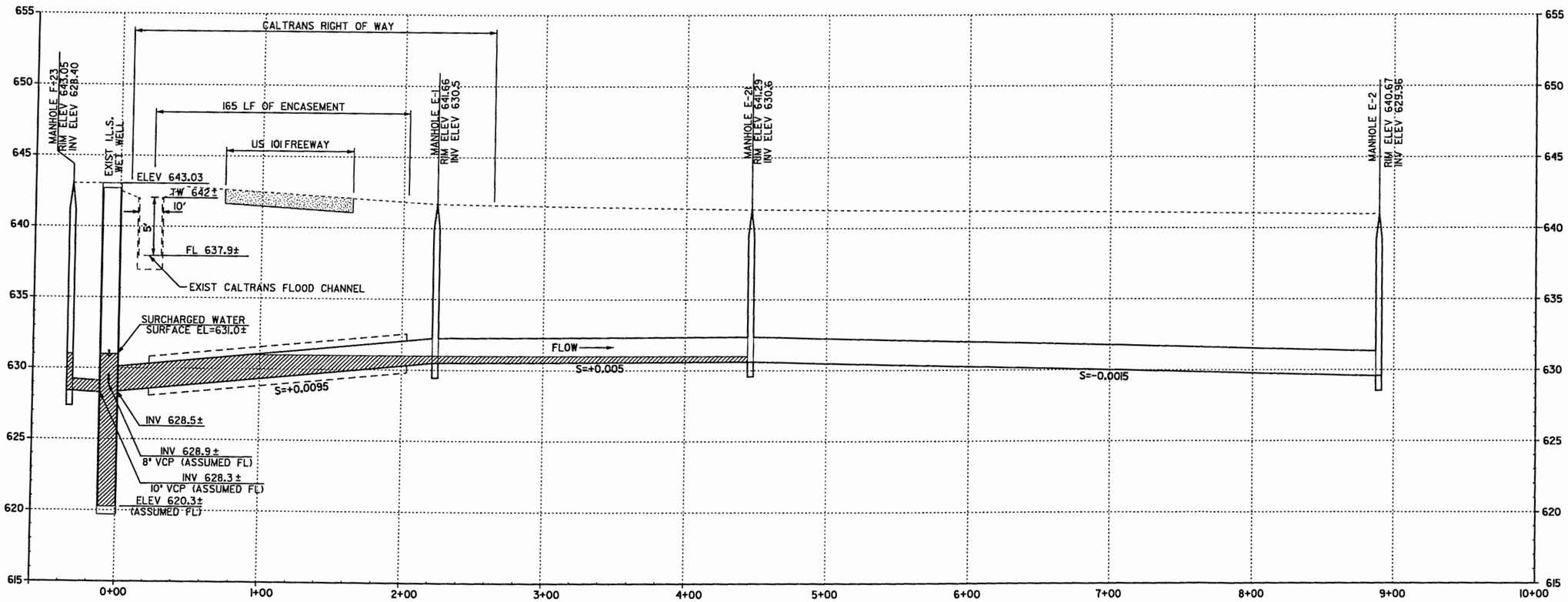
CITY OF THOUSAND OAKS
INTERCEPTOR SEWER STUDY

PHOTOS AT THE OLD
INDUSTRIAL LIFT STATION SITE

FIGURE 5 of 20

Job No: 0000000 File:P:\Projects\thousand_oaks\unit_e_sewer\civ\Fig05.div Plot Date17-APR-2002 User:nicisic



21" VCP UNIT E SEWER SOUTH OF I.L.S. BENEATH THE 101 FREEWAY

LEGEND

SURCHARGED SEWER

PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE: HORIZ 1"=40' VERT 1"=4'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED G. BEHNKE
DRAWN P. BOGDANOFF
CHECKED J. GANTNEY

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(PROJECT MANAGER'S NAME) LICENSE NO. DATE
(COMPANY OFFICER'S NAME) LICENSE NO. DATE

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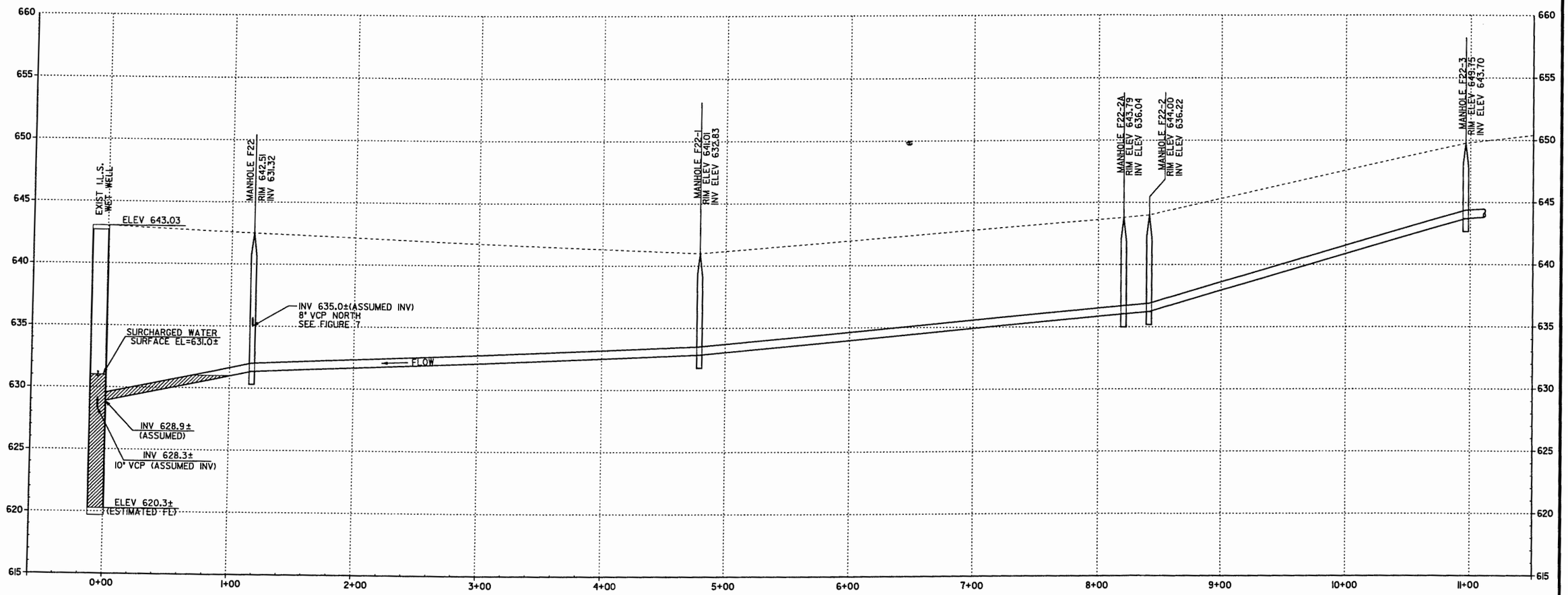
CITY OF THOUSAND OAKS
INTERCEPTOR SEWER STUDY

EXIST PROFILE OF UNIT E SEWER
ILS WET WELL TO MANHOLE E-2

FIGURE 6 of 20

Job No: 0000000 File:P:\Projects\thousand_oaks\unit_e_sewer\civ\fig06.dlv Plot Date17-APR-2002 Userincisic



PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE: HORIZ 1"=40' VERT 1"=4'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED G. BEHNKE
DRAWN P. BOGDANOFF
CHECKED J. GANTNEY

SUBMITTED BY
(PROJECT MANAGER'S NAME) LICENSE NO. DATE
(COMPANY OFFICER'S NAME) LICENSE NO. DATE

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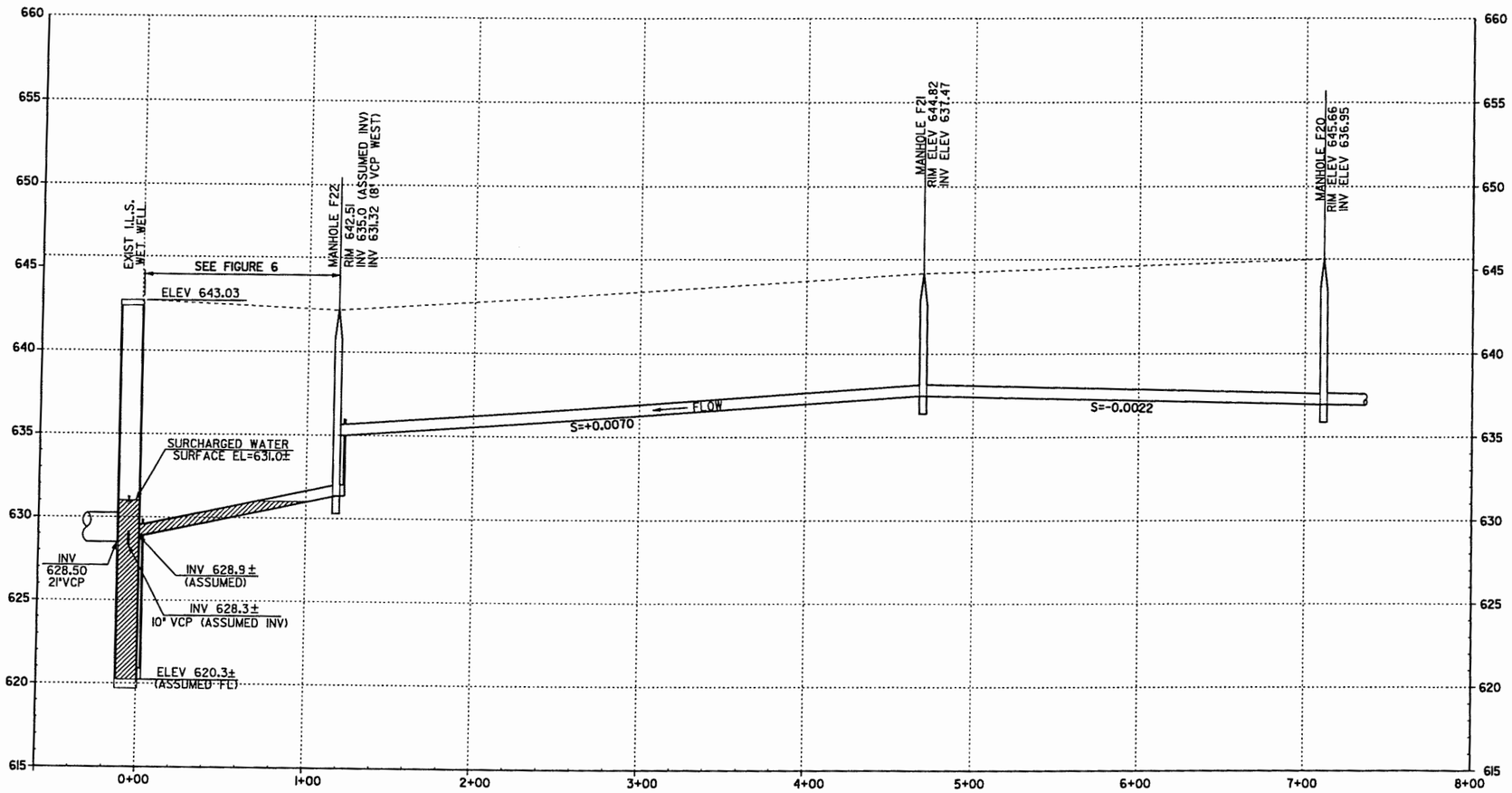
CITY OF THOUSAND OAKS
INTERCEPTOR SEWER STUDY

EXISTING PROFILE OF UNIT F SEWER
ILS WET WELL TO MANHOLE F22-3

FIGURE 7 of 20

Job No: 0000000 File:P:\Projects\thousand_oaks\unit_e_sewer\olv\fig07.dlv Plot Date17-APR-2002 User:nclsic



8" VCP IN LAWRENCE DRIVE TO MANHOLE F22

LEGEND

SURCHARGED SEWER

PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE: HORIZ 1"=40' VERT 1"=4'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED G. BEHNKE
DRAWN P. BOGDANOFF
CHECKED J. GANTNEY

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(COMPANY OFFICER'S NAME) LICENSE NO. DATE

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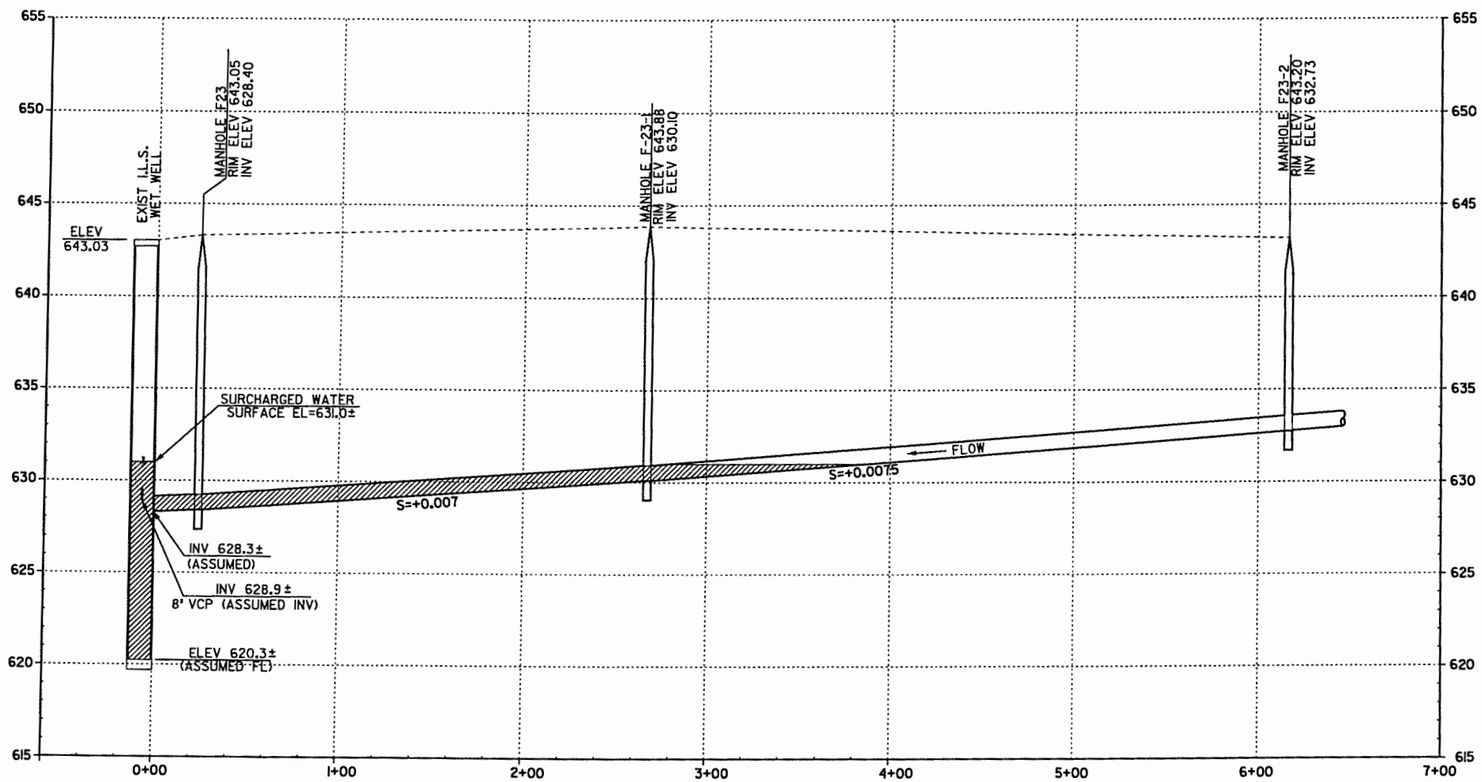
INTERCEPTOR SEWER STUDY

EXISTING PROFILE OF UNIT F SEWER
ILS WET WELL TO MANHOLE F20

FIGURE 8 of 20

Job No: 0000000 File:P:\Projects\thousand_oaks\unit_e_sewer\civ\fig08.div Plot Date17-APR-2002 Userinclsic



10" VCP IN W. HILLCREST DRIVE (WEST OF I.L.S.)

LEGEND

SURCHARGED SEWER

PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE: HORIZ 1"=40' VERT 1"=4'

WARNING: 0 ½ 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED G. BEHNKE
DRAWN P. BOGDANOFF
CHECKED J. GANTNEY

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(PROJECT MANAGER'S NAME) LICENSE NO. DATE
(COMPANY OFFICER'S NAME) LICENSE NO. DATE

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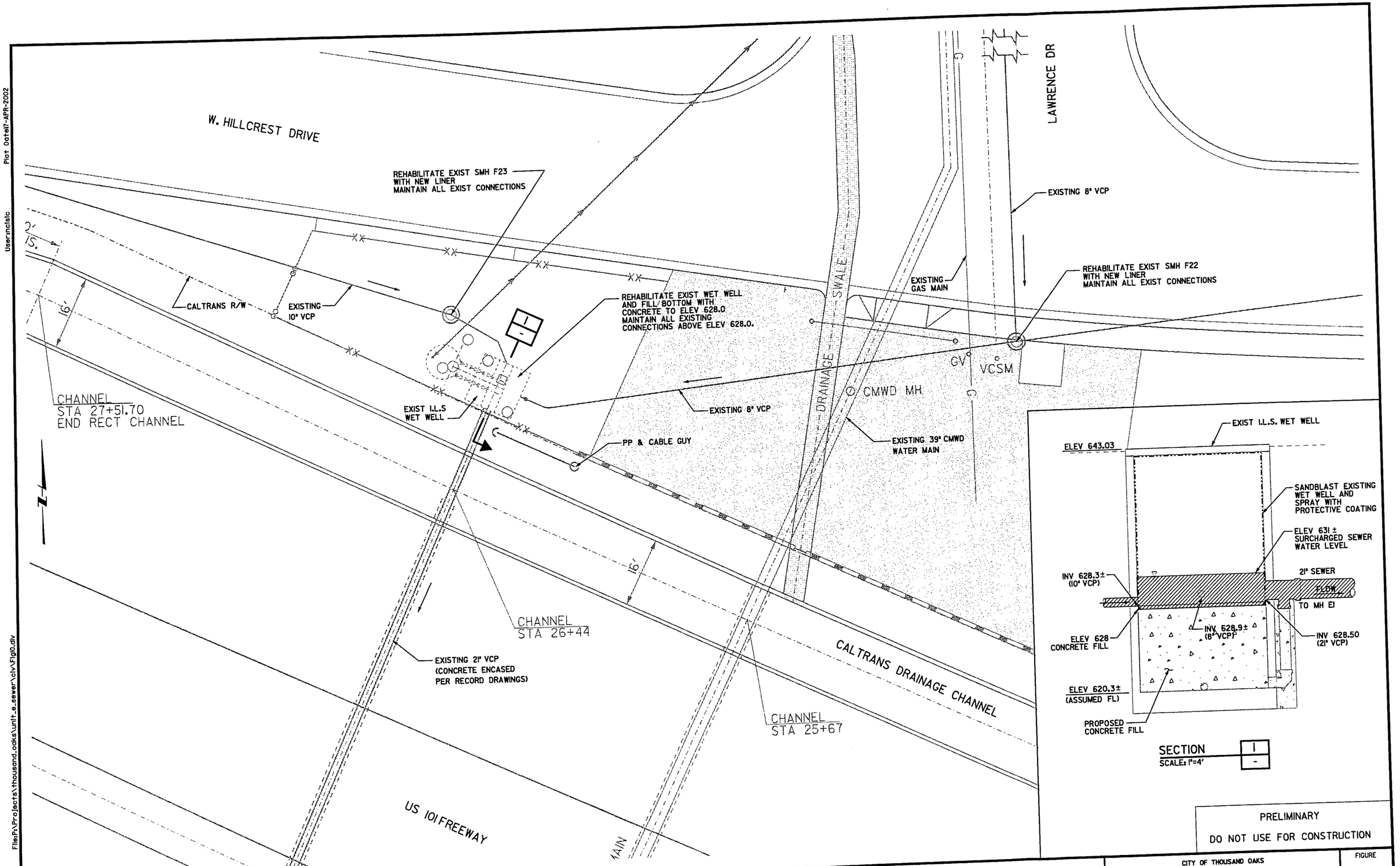
CITY OF THOUSAND OAKS INTERCEPTOR SEWER STUDY

EXISTING PROFILE OF UNIT F SEWER ILS WET WELL TO MANHOLE F23-2

FIGURE 9 of 20

Job No: 0000000 File:P:\Projects\thousand_oaks\unit_e_sewer\civ\fig09.div Plot Date:17-APR-2002 User:nclelc



PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE 1" = 10'

WARNING 0 ½ 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DRAWN N. CISIC
CHECKED J. GANTNEY

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(PROJECT MANAGER'S NAME) LICENSE NO. DATE
(COMPANY OFFICER'S NAME) LICENSE NO. DATE

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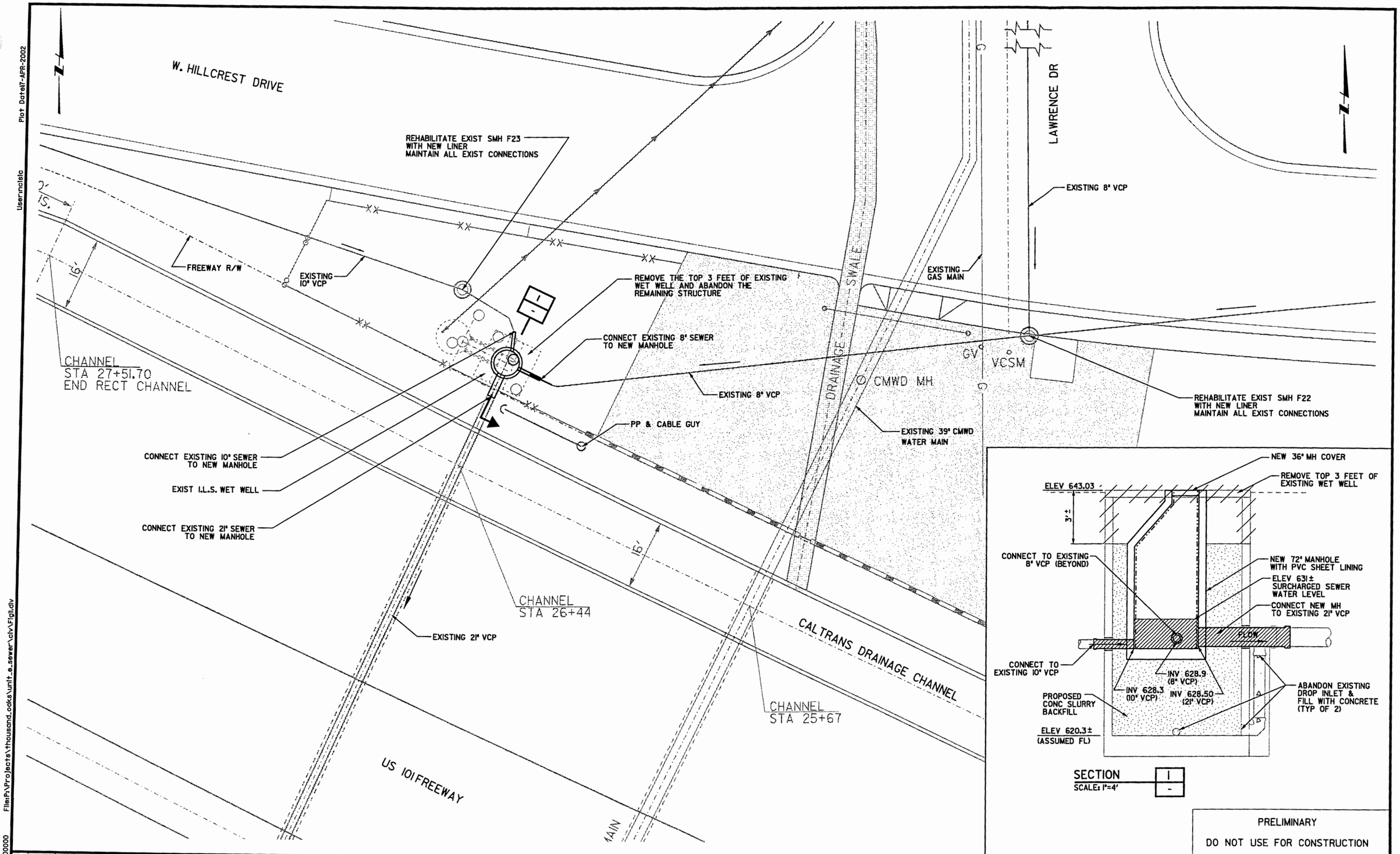
CITY OF THOUSAND OAKS
INTERCEPTOR SEWER STUDY

CITY OF THOUSAND OAKS
ALTERNATIVE I
PARTIALLY FILL AND IMPROVE
FLOW THROUGH I.L.S.

FIGURE 10 of 20

Plot Date17-APR-2002
User:ncisic
File:P:\Projects\thousand_oaks\unit_e_sewer\civ\Fig10.div
Job No: 0000000



PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE: 1" = 10'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DRAWN N. CISIC
CHECKED J. GANTNEY

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(COMPANY OFFICER'S NAME) LICENSE NO. DATE

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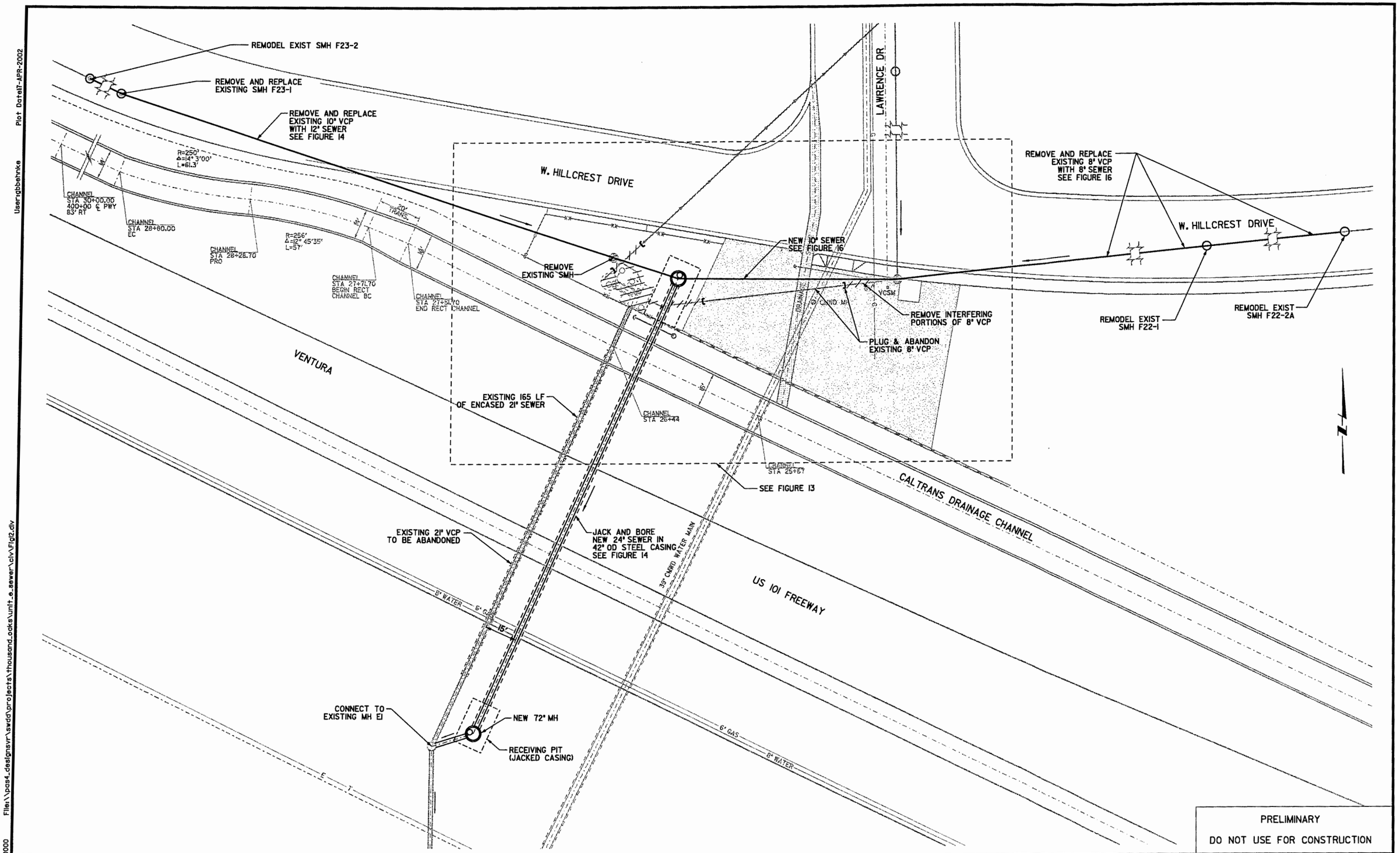
Pasadena California

CITY OF THOUSAND OAKS
INTERCEPTOR SEWER STUDY

ALTERNATIVE 2
NEW MH IN I.L.S. WET WELL

FIGURE
11
of 20

Job No: 0000000 File:P:\Projects\thousand_oaks\unit_a_sewer\civ\Fig11.div Plot Date:17-APR-2002 Username:cisic



PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE 1" = 20'

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J. GANTNEY
DRAWN N. CISIC
CHECKED J. GANTNEY

SUBMITTED BY
(PROJECT MANAGER'S NAME) LICENSE NO. DATE
(COMPANY OFFICER'S NAME) LICENSE NO. DATE

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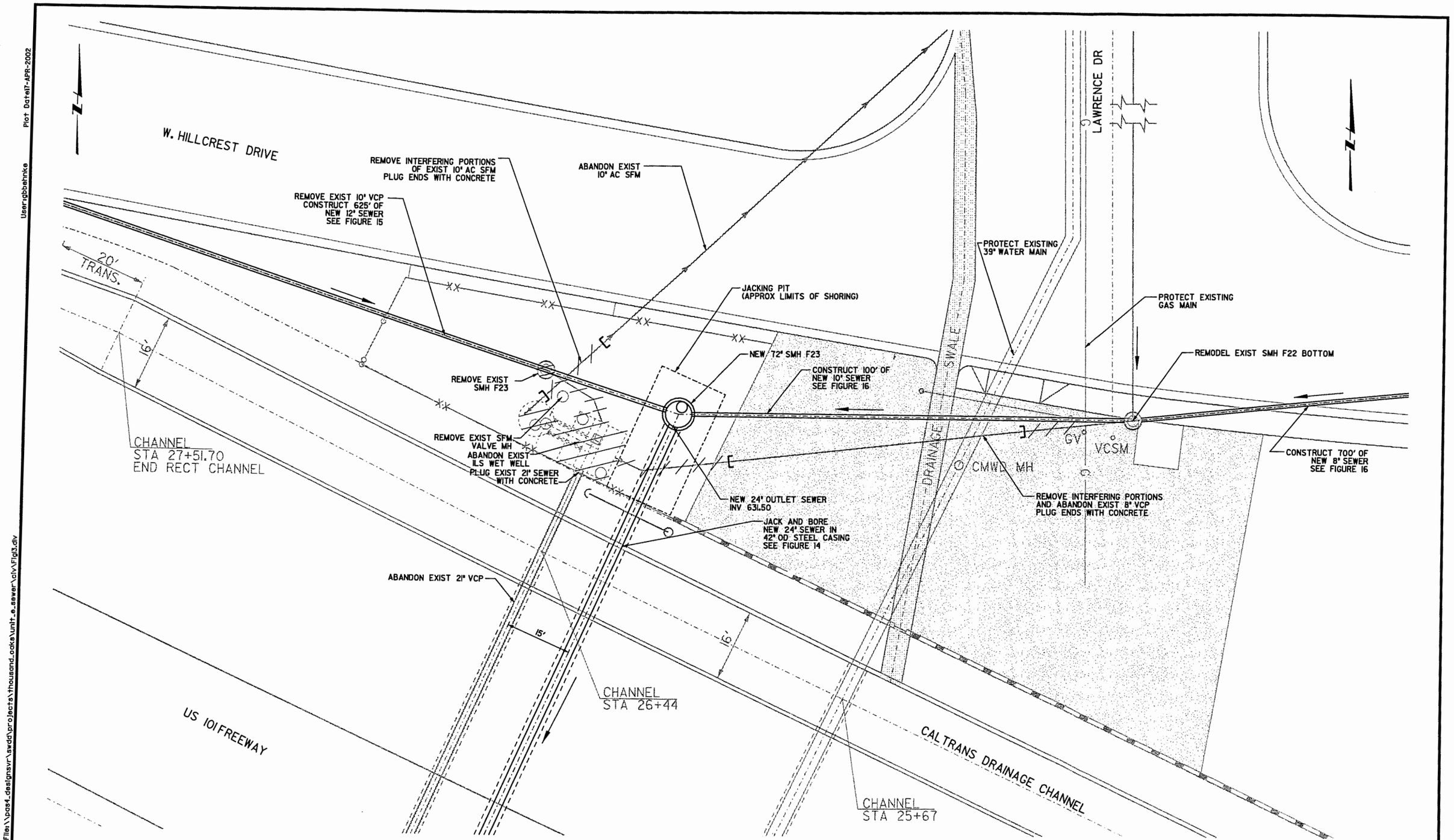
CITY OF THOUSAND OAKS INTERCEPTOR SEWER STUDY

ALTERNATIVE 3 SITE PLAN

FIGURE 12 of 20

Job No: 0000000 File:\\pas4_designsvr\swdd\projects\thousand_oaks\unit_e_sewer\civ\Fig12.div Plot Date17-APR-2002 User:gbbehnke



PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE 1" = 10'

WARNING 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J. GANTNEY
DRAWN N. CISIC
CHECKED J. GANTNEY

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(COMPANY OFFICER'S NAME) LICENSE NO. DATE

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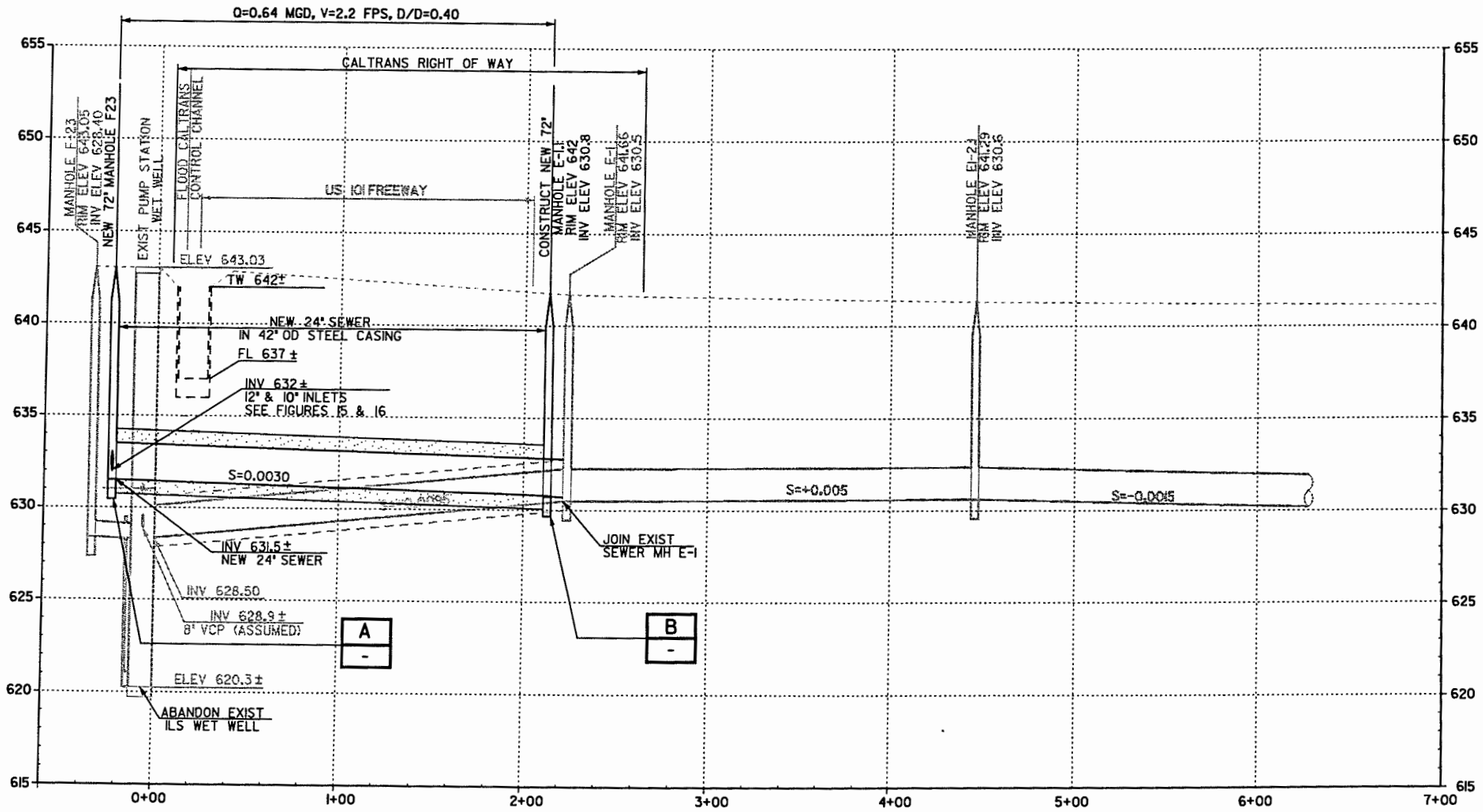
CITY OF THOUSAND OAKS INTERCEPTOR SEWER STUDY

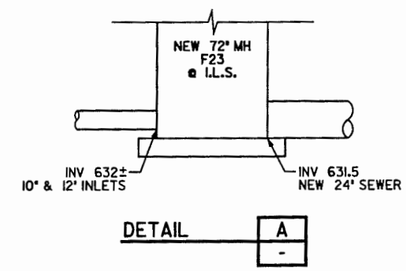
ALTERNATIVE 3 EXPANDED I.L.S. SITE PLAN

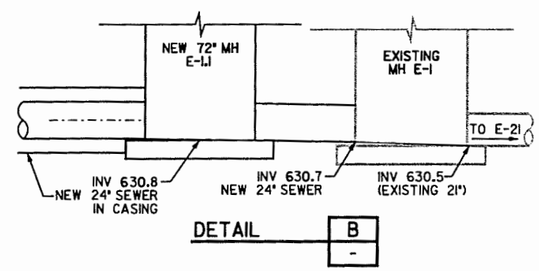
FIGURE 13 of 20

Job No: 0000000 File:\\pas4_designsvr\swdd\projects\thousand_oaks\unit_e_sewer\civ\Fig13.div User:gbehnke Plot Date:17-APR-2002

Usergbbehnke Plot Date17-APR-2002
Job No: 0000000 File:\\pas4_designsvr\awdd\projects\thousand_oaks\unit_e_sewer\civ\fig14.dwg







PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE: HORIZ 1"=40' VERT 1"=4'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J. GANTNEY
DRAWN J.JESSEY
CHECKED J. GANTNEY

SUBMITTED BY
(PROJECT MANAGER'S NAME) LICENSE NO. DATE
(COMPANY OFFICER'S NAME) LICENSE NO. DATE

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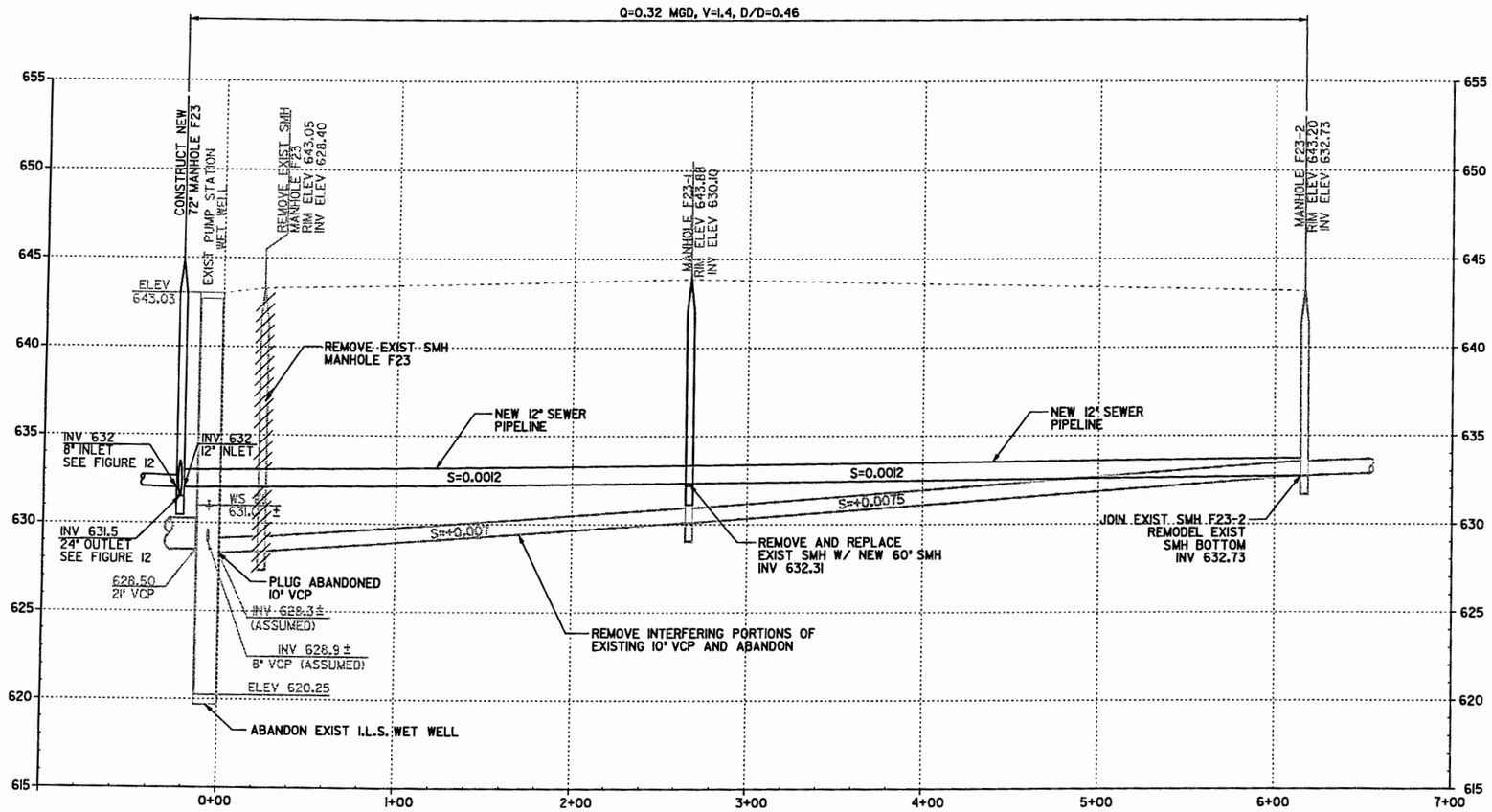
CITY OF THOUSAND OAKS
INTERCEPTOR SEWER STUDY

ALTERNATIVE 3
PROFILE OF NEW UNIT E SEWER
TO CROSS THE 101 FREEWAY

FIGURE 14 of 20



PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE: HORIZ 1"=40' VERT 1"=4'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J. GANTNEY
DRAWN J.JESSEY
CHECKED J. GANTNEY

SUBMITTED BY
(PROJECT MANAGER'S NAME) LICENSE NO. DATE
(COMPANY OFFICER'S NAME) LICENSE NO. DATE

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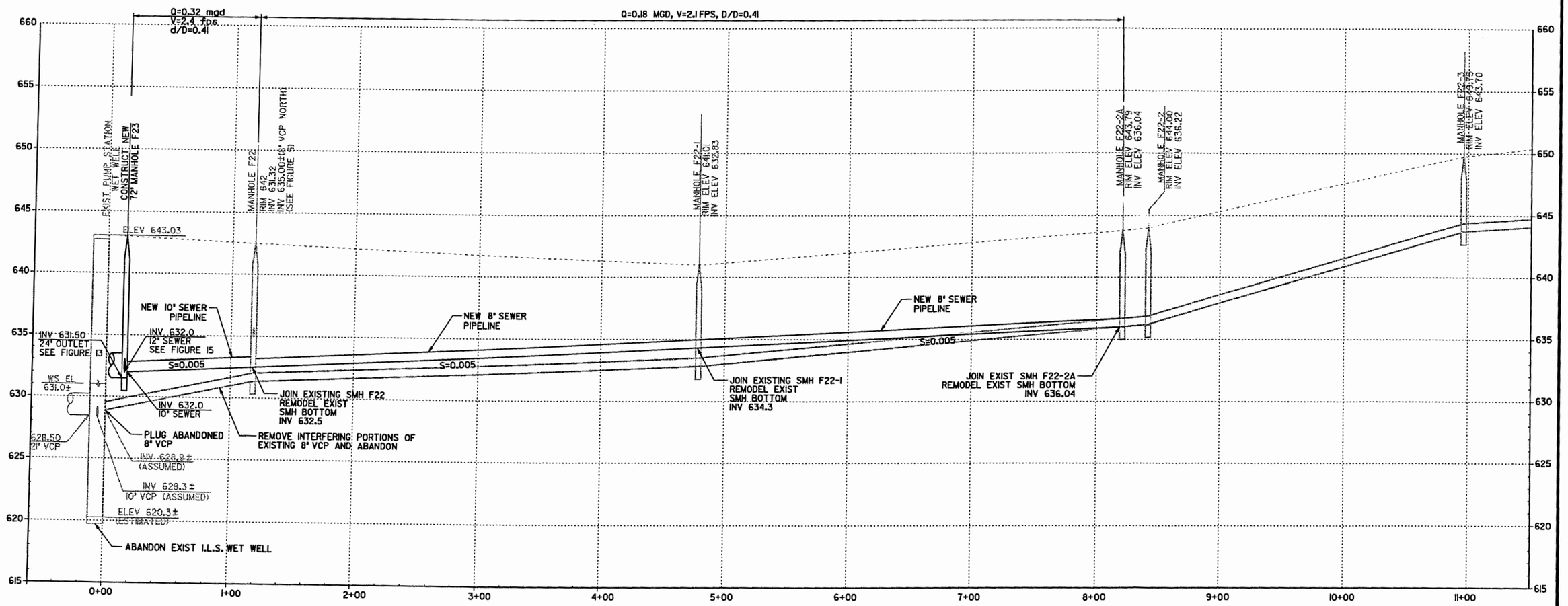
CITY OF THOUSAND OAKS
INTERCEPTOR SEWER STUDY

ALTERNATIVE 3
REPLACEMENT 12" SEWER IN W. HILLCREST DR
ILS WET WELL TO MANHOLE F23-2

FIGURE 15 of 20

Plot Date17-APR-2002
Username
File:P:\Projects\thousand_oaks\unit_e_sewer\alv\fig15.dlv
Job No: 0000000



PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE: HORIZ 1"=40' VERT 1"=4'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J. GANTNEY
DRAWN J. JESSEY
CHECKED J. GANTNEY

SUBMITTED BY
(PROJECT MANAGER'S NAME) LICENSE NO. DATE
(COMPANY OFFICER'S NAME) LICENSE NO. DATE

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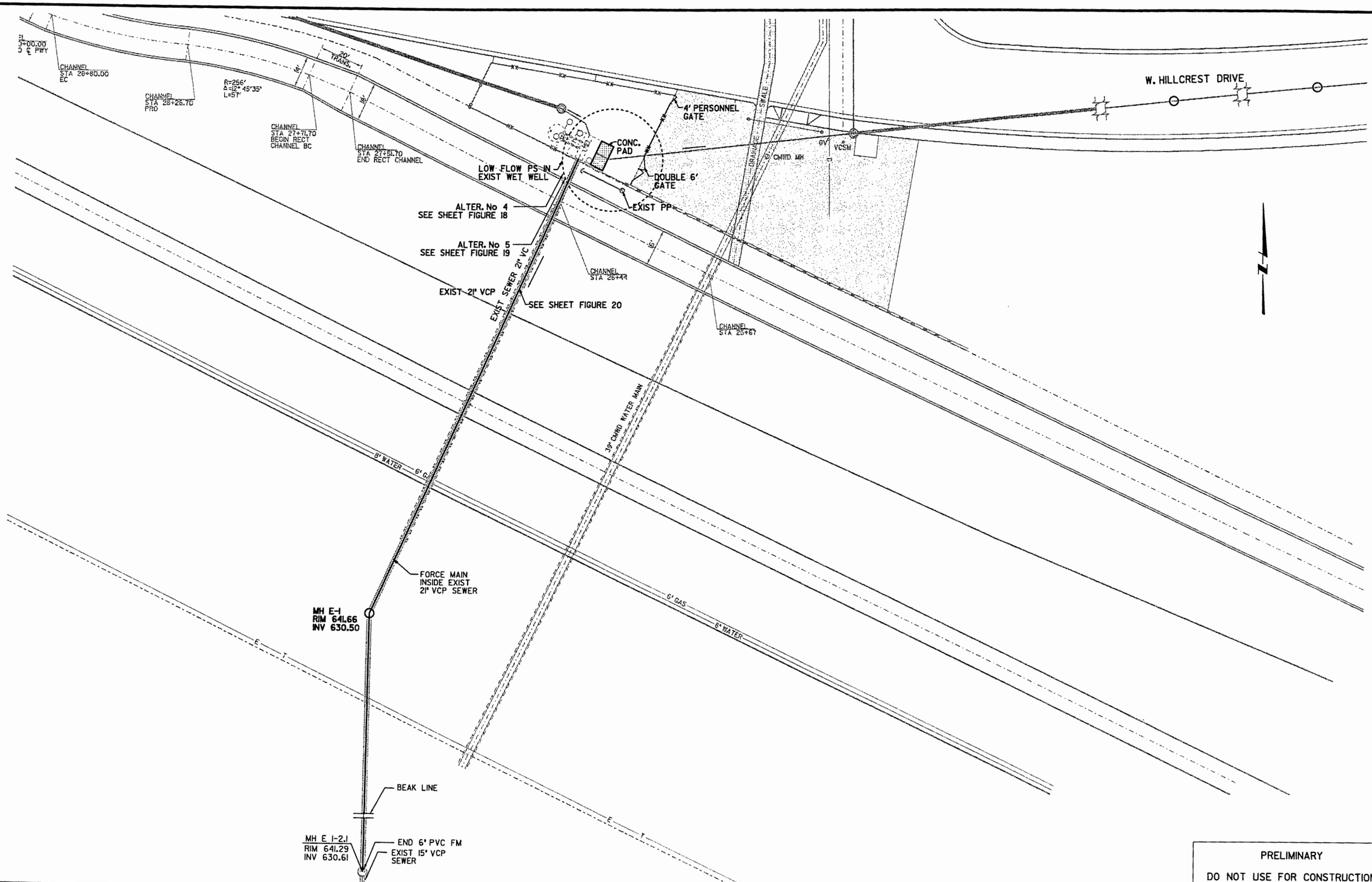
MONTGOMERY WATSON HARZA
Pasadena California

CITY OF THOUSAND OAKS
INTERCEPTOR SEWER STUDY

ALTERNATIVE 3
REPLACEMENT 8" & 10" SEWERS IN HILLCREST
ILS WET WELL TO MANHOLE F22-2A

FIGURE 16 of 20

Plot Date17-APR-2002
Userigbbehnke
File:\\pas4_designsvr\swdd\projects\thousand_oaks\unit_e_sewer\civ\fig16.dlv
Job No: 0000000



PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE 1" = 20'

WARNING 0 ½ 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J. GANTNEY
DRAWN N. CISIC
CHECKED J. GANTNEY

SUBMITTED BY
(PROJECT MANAGER'S NAME) LICENSE NO. DATE
(COMPANY OFFICER'S NAME) LICENSE NO. DATE

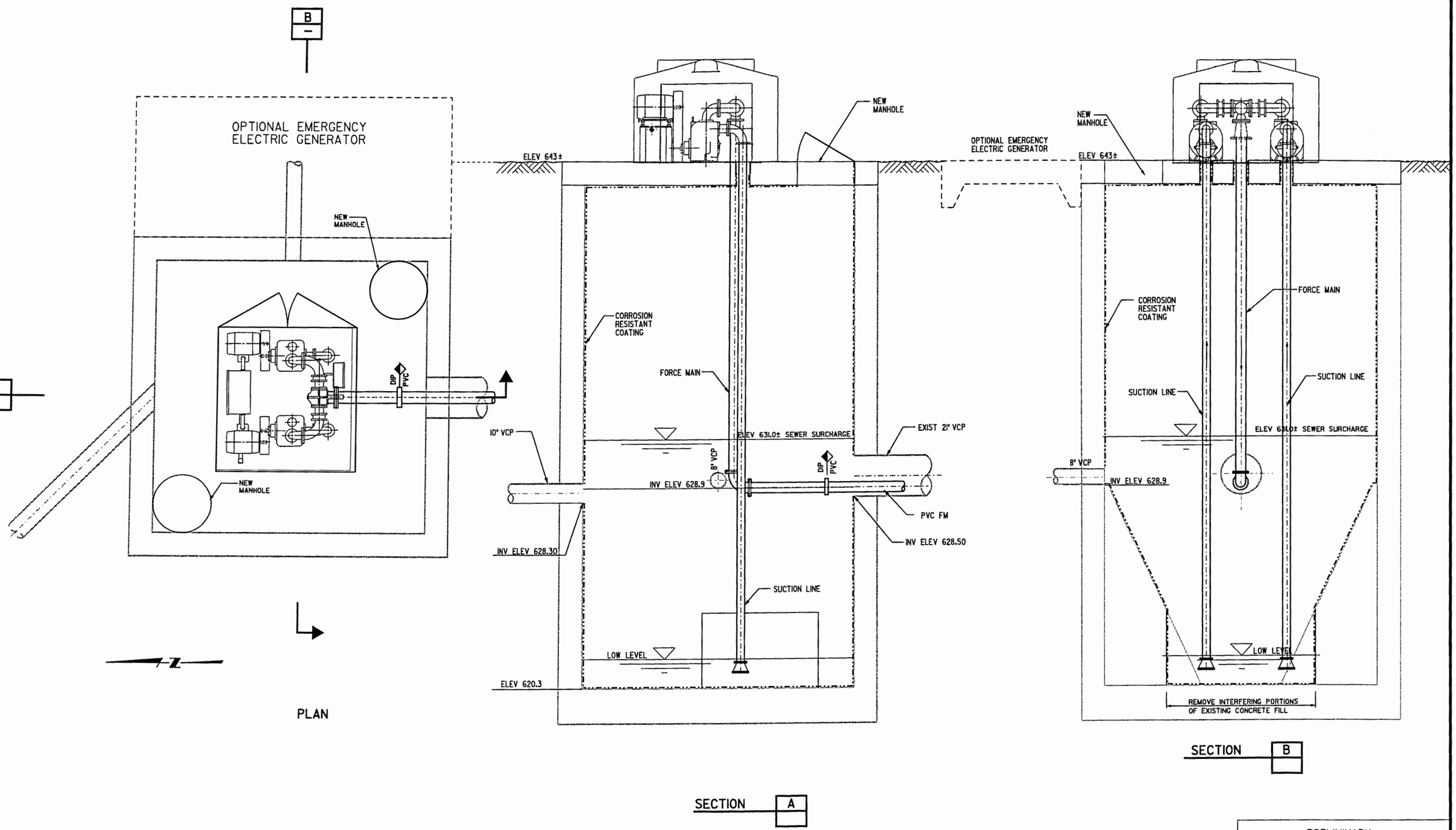
MWH MONTGOMERY WATSON HARZA Pasadena California

CITY OF THOUSAND OAKS INTERCEPTOR SEWER STUDY

ALTERNATIVES 4 AND 5 SITE PLAN

FIGURE 17 of 20

Job No: 0000000 File:P:\Projects\thousand_oaks\unit_e_sewer\civ\Fig17.div Plot Date:17-APR-2002 User:ncisic



PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE 1"=2'

WARNING 0 ½ 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED ____ DRAWN ____ CHECKED ____

SUBMITTED BY

(PROJECT MANAGER'S NAME) LICENSE NO. DATE

(COMPANY OFFICER'S NAME) LICENSE NO. DATE

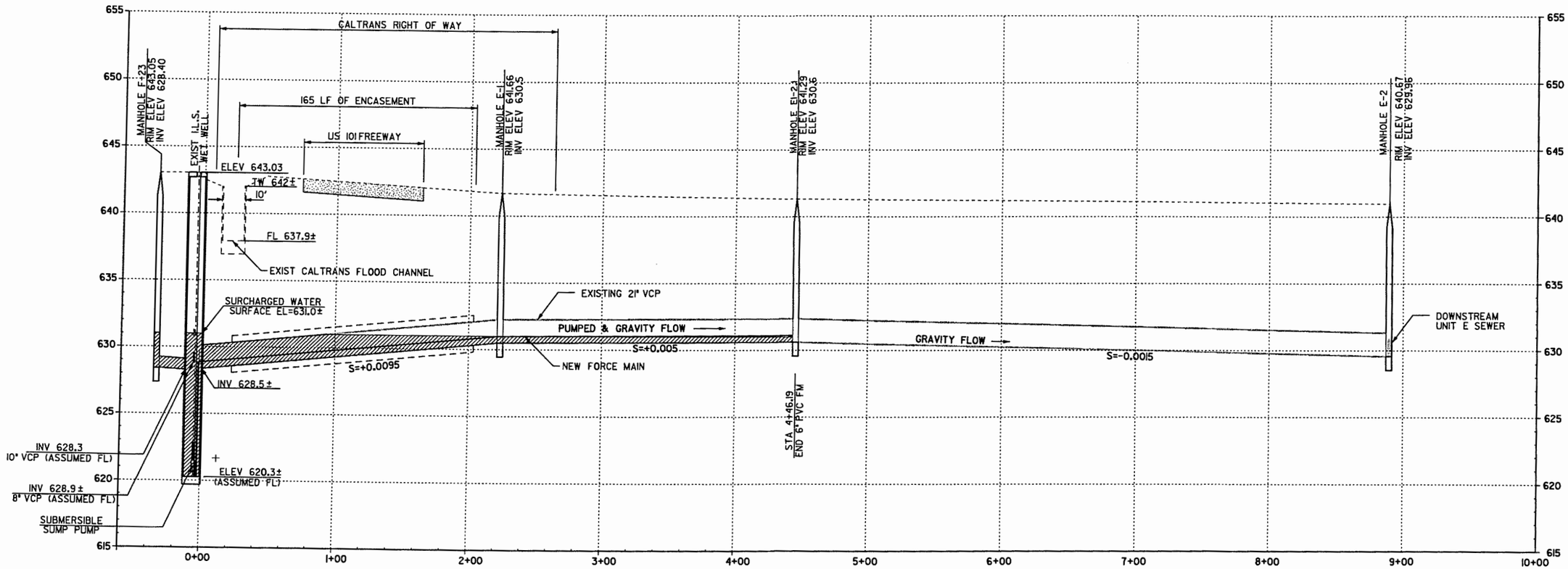
MWH MONTGOMERY WATSON HARZA Pasadena California

CITY OF THOUSAND OAKS INTERCEPTOR SEWER STUDY

ALTERNATIVS 4 AND 5 SELF-PRIMING PUMP STATION IN EXISTING WET WELL

FIGURE 19 of 20

Job No: 0000000 File:P:\Projects\thousand_oaks\unit_e_sewer\civ\fig19.div User:nclsic Plot Date:17-APR-2002



21" VCP UNIT E SEWER FROM I.L.S. TO MH E2

PRELIMINARY

DO NOT USE FOR CONSTRUCTION

REV	DATE	BY	DESCRIPTION

SCALE: HORIZ 1"=40' VERT 1"=4'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED G. BEHNKE
DRAWN P. BOGDANOFF
CHECKED J. GANTNEY

SUBMITTED BY
(PROJECT MANAGER'S NAME) LICENSE NO. DATE
(COMPANY OFFICER'S NAME) LICENSE NO. DATE

MWH MONTGOMERY WATSON HARZA — Pasadena California

CITY OF THOUSAND OAKS
INTERCEPTOR SEWER STUDY

PROFILE OF UNIT E SEWER
ILS WET WELL TO MANHOLE E-2

FIGURE 20 of 20

Job No: 0000000 File:P:\Projects\thousand_oaks\unit_e_sewer\civ\fig20.dlv User:mclsic Plot Date:7-APR-2002