Public Version

California Water Service Company

Water Supply and Facilities Master Plan

Dixon District

FINAL REPORT

2009

TABLE OF CONTENTS

EXECUTIVE SUMMARY ES-1

INTRODUCTION ES-1
OVERVIEW OF THE DIXON DISTRICT SERVICE AREA ES-1
Dixon District Service Area ES-1
Service Connections and Population Served ES-2
EXISTING AND FUTURE WATER DEMANDS ES-2
Existing Water Demands ES-2
Future Water Demands ES-2
EXISTING AND FUTURE WATER SUPPLIES ES-3
Existing Water Supply ES-3
Future Water Supply ES-4
Other Potential Water Supply Concepts ES-4
Recommended Water Supply Option ES-5
HYDRAULIC MODEL ES-5
Hydraulic Model Development ES-5
Hydraulic Model C-factor Tests ES-5
Hydraulic Model Verification ES-5
DIXON DISTRICT FACILITIES ES-6
Facility Assessments ES-6
EXISTING WATER SYSTEM ES-6
Existing Water System Evaluation and Recommended Improvements ES-7
FUTURE WATER SYSTEM EVALUATION ES-7
Future Water System Evaluation and Recommended Improvements ES-7
RECOMMENDED CAPITAL IMPROVEMENT PROGRAM ES-8
Recommended Capital Improvements ES-8
2009-2010 Renewal and Replacement Improvements ES-9
Future System Improvements and 2011-2035 Renewal and Replacement Improvements ES-9
Recommended Cost and Timing of Capital Improvements ES-10
REFERENCES ES-20

CHAPTER 1. INTRODUCTION 1-1

MASTER PLAN PURPOSE 1-1
MASTER PLAN OBJECTIVES 1-1
AUTHORIZATION 1-1
REPORT ORGANIZATION 1-2
ACRONYMS AND ABBREVIATIONS 1-3
ACKNOWLEDGEMENTS 1-5

CHAPTER 2. EXISTING WATER SYSTEM 2-1

EXISTING SERVICE AREA 2-1
EXISTING SERVICE CONNECTIONS AND POPULATION SERVED 2-1
Existing Service Connections in 2007 2-2
Existing Population in 2007 2-2
EXISTING WATER SUPPLIES 2-2
EXISTING WATER SYSTEM FACILITIES 2-3
Well Facilities 2-3
Water Storage Facilities 2-3
Distribution System and Pipelines 2-5
Telemetry/SCADA System 2-5
Emergency Interties 2-5

CHAPTER 3. WATER DEMANDS 3-1

DESCRIPTION OF THE DIXON DISTRICT 3-1
Historical Number of Services by Revenue Class 3-1
Historical Population Served 3-2
Estimated Historical Housing Density 3-4
Estimated Population Served 3-5
Existing and Projected Land Use Served Water 3-5
HISTORICAL WATER PRODUCTION AND CONSUMPTION 3-8
Historical Water Production 3-8
Historical Water Consumption 3-8
Historical Unaccounted-for Water 3-11
Historical Per Capita Water Demand 3-11
Water Conservation 3-11
ADOPTED PEAKING FACTORS 3-13
PROJECTED WATER DEMANDS 3-15
Unit Demand Factors Adopted for this Water Supply and Facilities Master Plan Update 3-15
Unit Demand Factor: Very Low Density 3-16
Unit Demand Factor: Low Density 3-16
Unit Demand Factor: Medium Low Density 3-17
Unit Demand Factor: Medium High Density 3-17
Unit Demand Factor: High Density 3-17
Unit Demand Factor: General Industrial 3-18
Unit Demand Factor: Downtown 3-18
Unit Demand Factor: Neighborhood Commercial 3-18
Unit Demand Factor: Commercial Services 3-19
Unit Demand Factor: Professional/Administrative Offices 3-19
Unit Demand Factor: Core Area Mixed Use 3-19
Unit Demand Factor: Governmental/Institutional 3-19
Unit Demand Factor: Parks 3-20
Unit Demand Factor: School Buildings/Play Areas 3-20
Summary of Adopted Unit Demand Factors 3-20

Estimated Timing of Future Development 3-21
Projected Water Demands 3-22
Projected UWMP Demands (2006 UWMP Scenario 2 and 3) and Historical Water Demands 3-22
Projected Water Demands for this WSFMP 3-24
PROJECTED NUMBER OF SERVICES 3-26
Service Factors for Projecting Number of Services 3-26
Service Factor for Single Family Residential 3-26
Service Factor for Multi Family Residential 3-26
Service Factor for Commercial 3-26
Service Factor for Government 3-28
Service Factor for Industrial 3-28
Service Factor for Other 3-28
Future Service Connections 3-30
PROJECTED POPULATION SERVED 3-30
General Plan Maximum 3-30
General Plan Minimum Population 3-31
Projected Future Population for the WSFMP 3-31
Projected Future Population Using GPCD 3-31

CHAPTER 4. INTEGRATED WATER SUPPLY PLAN 4-1

EXISTING GROUNDWATER FACILITIES AND WELL CONDITION ASSESSMENT 4-1
GROUNDWATER BASIN DESCRIPTION 4-2
Subbasin Description 4-2
Hydrogeology 4-4
Tehama Formation 4-5
Older Alluvium 4-5
Stream Channel and Basin Deposits 4-5
Flood Basin Deposits 4-6
INELASTIC LAND SUBSIDENCE POTENTIAL 4-6
GROUNDWATER MANAGEMENT 4-7
GROUNDWATER LEVEL TRENDS 4-8
Groundwater Elevations 4-8
Groundwater Level Data per DWR Bulletin 118 4-8
Criteria for Evaluation Historical Groundwater Levels 4-8
Groundwater Trends in the Solano Subbasin 4-9
Summary of Groundwater Level Trends in DWR Monitoring Wells 4-9
GROUNDWATER FLOW TRENDS 4-11
Summary of Groundwater Level and Flow Trends in the Dixon District Wells 4-11
Overall Summary of Groundwater Level Trends 4-12
GROUNDWATER QUALITY 4-12
Water Quality per DWR Bulletin 118 4-12
Active Groundwater Contamination Cases in the Area 4-12
USGS GAMA Study 4-13
Water Quality in Dixon District Wells 4-15

Nitrate Trends 4-16
Potential Point Sources 4-18
Well Sanitary Seals 4-19
Intrawell Flow During Non-pumping Conditions 4-19
Aquifer Stratification 4-19
Abandoned Wells 4-20
Intrawell Volumetric Distribution of Pumping 4-20
Production Rate and Schedule 4-21
Variations in Hydrologic Conditions 4-22
EC and TDS Trends 4-23
Trends in Trace Constituent Concentrations 4-23
Possible Water Quality Mitigations 4-23
Summary of Potential Water Quality Concerns 4-24
COST OF GROUNDWATER 4-25
Cost of Maintaining Existing Groundwater Production Capacity 4-25
Cost of Future Groundwater Production Requirements 4-26
Unit Cost Components of Groundwater 4-26
OTHER POTENTIAL WATER SUPPLY CONCEPTS 4-27
Potential Surface Water Supply Options 4-28
State Water Project Contract Supplies 4-28
Federal Solano Project Supplies 4-28
Water Transfers 4-28
Conveyance/Wheeling 4-29
Water Treatment 4-30
Potential Recycled Water Supplies 4-30
RECOMMENDED WATER SUPPLY OPTIONS 4-30
REFERENCES 4-49

CHAPTER 5. PLANNING AND DESIGN CRITERIA 5-1

FIRE FLOW REQUIREMENTS 5-1
WATER SUPPLY CAPACITY DURING HIGH DEMAND PERIODS 5-3
Maximum Day Demand plus Fire Flow 5-3
Peak Hour Demand 5-5
PUMPING FACILITY CAPACITY 5-5
CRITICAL SUPPLY FACILITIES 5-5
WATER STORAGE CAPACITY 5-6
Operational Storage 5-6
Fire Storage 5-7
Emergency Storage 5-7
Credit for Existing Groundwater Supply 5-8
Total Storage Capacity 5-9
WATER TRANSMISSION AND DISTRIBUTION PIPELINE SIZING 5-9
Water Transmission System 5-10
Average Day Demand 5-10
Maximum Day Demand 5-10
Peak Hour Demand 5-10

Water Distribution System 5-10
Average Day Demand 5-10
Maximum Day Demand plus Fire Flow 5-11
Peak Hour Demand 5-11

CHAPTER 6. HYDRAULIC MODEL DEVELOPMENT 6-1

DEVELOPMENT OF THE HYDRAULIC MODEL 6-2
Description of the Model and Element Definitions 6-2
Pipelines, Nodes, and Junctions Imported into InfoWater 6-3
Roughness Factors Assigned in InfoWater 6-3
Elevations Allocated in H_2OMAP 6-4
Accounts Spatially Located in GIS 6-4
Water Demands Allocated in H_2OMAP 6-6
Station Elements Incorporated into InfoWater 6-7
Naming Scheme Applied in InfoWater 6-7
DIURNAL CURVE DEVELOPMENT 6-7
HYDRAULIC MODEL CALIBRATION 6-9
Development of Hydrant (C-Factor) Tests 6-9
Hydrant (C-factor) Test Results 6-11
Development of the Verification Process 6-11
Verification Results 6-12
Hydraulic Model Calibration Findings and Conclusions 6-13

CHAPTER 7. FACILITY ASSESSMENTS 7-1

DIXON DISTRICT WATER SUPPLY WELLS 7-1
Desktop and Field Assessments of Existing Well Facilities 7-1
Well Facilities Evaluation Criteria 7-2
Findings, Conclusions and Recommendations for Well Facilities 7-2
Backup Power Provisions for Wells 7-7
DIXON DISTRICT TREATMENT AND DISINFECTION FACILITIES 7-8
DIXON DISTRICT STORAGE FACILITY 7-9
Storage Facility Evaluation Criteria 7-9
Desktop Assessment of Existing Storage Facility 7-9
DIXON DISTRICT TELEMETRY SYSTEM 7-10
PLANNED NEW FACILITIES 7-10
New Well 09-01 7-10
New Storage Tank 7-10

CHAPTER 8. EVALUATION OF EXISTING WATER SYSTEM 8-1

EXISTING WATER DEMANDS 8-1
EXISTING WATER SYSTEM FACILITY EVALUATION 8-2
Water Storage Capacity 8-2
Pumping Capacity 8-3
Critical Supply Facilities 8-7
EXISTING WATER SYSTEM PERFORMANCE EVALUATION 8-7
Existing Water System Performance Criteria 8-7

Peak Hour Demand Scenario 8-7
Maximum Day Demand plus Fire Flow Scenario 8-8
Recommended Improvements Criteria 8-8
Existing Water System Evaluation Results 8-8
Peak Hour Demand Scenario 8-8
Maximum Day Demand plus Fire Flow Scenario 8-10
SUMMARY OF RECOMMENDED IMPROVEMENTS FOR THE EXISTING WATER SYSTEM 8-10
Storage Facilities 8-10
Pumping Facilities 8-11
Backup Power 8-11

CHAPTER 9. EVALUATION OF FUTURE WATER SYSTEM 9-1

BUILDOUT WATER DEMANDS 9-1
BUILDOUT WATER SYSTEM FACILITY EVALUATION 9-2
Water Storage Capacity 9-2
Pumping Capacity 9-5
Critical Supply Facilities 9-6
BUILDOUT WATER SYSTEM PERFORMANCE EVALUATION 9-8
Buildout Water System Performance Criteria 9-8
Peak Hour Demand Scenario 9-8
Maximum Day Demand plus Fire Flow Scenario 9-8
Recommended Improvements Criteria 9-9
Buildout Water System Evaluation Results 9-10
Peak Hour Demand Scenario 9-10
Maximum Day Demand plus Fire Flow Scenario 9-10
SUMMARY OF RECOMMENDED IMPROVEMENTS FOR THE BUILDOUT WATER SYSTEM 9-11
Storage Facilities 9-12
Pumping Facilities 9-12
Pipelines 9-12
Backup Power 9-12

CHAPTER 10. RECOMMENDED CAPITAL IMPROVEMENT PROGRAM 10-1

RECOMMENDED CAPITAL IMPROVEMENT PROGRAM 10-1
Existing Water System Improvements 10-1
Existing System Improvements 10-2
2009-2010 Renewal and Replacement Improvements 10-2
Buildout Water System Improvements 10-3
Buildout System Improvements 10-4
2011-2035 Renewal and Replacement Improvements 10-4
Recommended CIP Costs 10-4
Recommended CIP Costs by Project Type 10-5
CAPITAL IMPROVEMENT PROGRAM IMPLEMENTATION 10-5

LIST OF APPENDICES[1]

APPENDIX A: **Cal Water Census Block Data**

APPENDIX B: **Cal Water Best Management Practices**

APPENDIX C: **Peak Hour Diurnal Curves**

APPENDIX D: **Geologic Map**

APPENDIX E: **Groundwater Management Technical Memorandum**

APPENDIX F: **Spring Hydrographs for DWR Monitoring Wells**

APPENDIX G: **Historical Spring Groundwater Levels**

APPENDIX H: **ENVIROSTOR Search Results**

APPENDIX I: **Plots of Historical Concentration Trends for Al, COND, total Cr, Fe, NO_3, and TDS, Plots of Historical Monthly Production versus Historical NO_3 Concentrations**

APPENDIX J: **Detail Cost Estimates for Groundwater Supply**

APPENDIX K: **Technical Memorandum Hydraulic Model Development and Calibration for California Water Service Company's Dixon District – IDModeling**

APPENDIX L: **Facility Assessments**

APPENDIX M: **Cal Water Simulated Available Fire Flow to Meet the Maximum Day Demand plus Fire Flow Performance Criteria**

APPENDIX N: **Cal Water Simulated Available Fire Flow to Meet the Maximum Day Demand plus Fire Flow Performance Criteria (For Residential Pressure and Velocity)**

APPENDIX O: **Cal Water Simulated Available Fire Flow to Meet the Maximum Day Demand plus Fire Flow Performance Criteria (For Residential Pressure Only)**

APPENDIX P: **Cost Estimating Assumptions**

[1] Appendices are on CD in PDF format at the end of the report.

LIST OF TABLES

Table ES-1. Estimated Cost of Recommended CIP by Project Type ES-11
Table 2-1. Existing 2007 Service Connections by Revenue Class 2-2
Table 2-2. Dixon District Well Facilities 2-4
Table 2-3. Dixon District Storage Facilities 2-5
Table 2-4. Dixon District Pipeline Material Types 2-6
Table 3-1. Historical Services by Revenue Class 3-3
Table 3-2. Historical Population Served 3-6
Table 3-3. Land Use Served Water by Cal Water Within the 2035 Sphere of Influence 3-7
Table 3-4. Historical Water Production in the Dixon District 3-9
Table 3-5. Historical Water Consumption by Revenue Class, acre-feet 3-10
Table 3-6. Historical Per Capita Demand and Rainfall Comparison 3-12
Table 3-7. Historical Maximum Day Peaking Factors 3-14
Table 3-8. Adopted Peaking Factors 3-15
Table 3-9. Adopted Unit Demand Factors 3-21
Table 3-10. Projected Water Demands 3-23
Table 3-11. Revenue Class Assignment 3-24
Table 3-12. Projected Water Demands for the Dixon District, acre-feet 3-25
Table 3-13. Revenue Class Conversion Factors for Projecting the Number of Services, af/service 3-27
Table 3-14. Projected Services for the Dixon District 3-29
Table 4-1. Summary of Production Well Information 4-3
Table 4-2. Characteristics of the Solano Subbasin 4-4
Table 4-3. Water-Bearing Formations within the Solano Subbasin 4-4
Table 4-4. Groundwater Level Trends in DWR Monitoring Wells 4-10
Table 4-5. Historic Groundwater Level Trends 4-12
Table 4-6. Potential Responsible Parties in the Dixon District with Known Groundwater Contamination 4-14
Table 4-7. Summary of Wells with Water Quality Data Exceeding 75% MCL (2003-2007) 4-17
Table 4-8. Replacement Schedule for Dixon District Groundwater Wells 4-25
Table 4-9. Future Unit Costs of Existing Groundwater Capacity (in 2008 dollars) 4-26

Table 4-10. Summary of the Unit Cost Components of Groundwater (in 2008 dollars)..... 4-27

Table 4-11. Projected Cost of the Recommended Water Supply Scenario (in 2008 dollars).... 4-31

Table 5-1. California Water Service Company's Dixon District Planning and Design Criteria 5-2

Table 5-2. Recommended Fire Flow Requirements 5-4

Table 6-1. Preliminary C-Factors Assigned in the Model 6-4

Table 6-2. Spatially Located Results for the Dixon District..... 6-5

Table 6-3. Revenue Class Assignment 6-7

Table 6-4. Naming Scheme for Network Elements 6-8

Table 6-5. Available Telemetry Chart Data from Cal Water Stations (August 20, 2008 through August 29, 2008) 6-10

Table 7-1. Summary of Well Facilities Assessment Findings and Recommendations: Cal Water Dixon District Wells..... 7-3

Table 7-2. Summary of Well Facilities Assessment Recommended Improvements: Cal Water Dixon District Wells..... 7-5

Table 7-3. Dixon District Pump Efficiency Test Results 7-7

Table 8-1. Existing Water Demands for the Dixon District 8-1

Table 8-2. Comparison of Available and Required Storage Capacity..... 8-3

Table 8-3. Summary of Existing Storage Requirements 8-4

Table 8-4. Evaluation of Total Firm Pumping Capacity and Peak Hour Demand 8-5

Table 8-5. Summary of Existing Pumping Facilities..... 8-6

Table 9-1. Buildout Water Demands for the Dixon District..... 9-1

Table 9-2. Comparison of Available and Required Storage Capacity..... 9-3

Table 9-3. Summary of Buildout Storage Requirements..... 9-4

Table 9-4. Recommended Flow for Well Being Replaced..... 9-5

Table 9-5. Evaluation of Total Firm Pumping Capacity and Maximum Day Demand plus Fire Flow..... 9-6

Table 9-6. Summary of Buildout Pumping Facilities 9-7

Table 9-7. Dixon District Buildout Water System Fire Flow Demand Requirements 9-9

Table 10-1. Recommended Pipeline Improvements for the Buildout Water System to Meet Fire Flow Requirements 10-3

Table 10-2. Summary of Probable Construction Costs for Existing System CIP 10-6

Table 10-3. Summary of Probable Construction Costs for Renewal and Replacement CIP..... 10-7

Table 10-4. Summary of Probable Construction Costs for Buildout (2035) System CIP 10-8

Table 10-5. Estimated Cost of Recommended CIP by Project Type..... 10-9

LIST OF FIGURES

Figure ES-1. Service Area ES-12
Figure ES-2. Timing of Developments ES-13
Figure ES-3. Projected Demands over Time for the Dixon District ES-14
Figure ES-4. Existing Water System ES-15
Figure ES-5. Assessment Recommendations for Cal Water Wells ES-16
Figure ES-6. Existing System Improvements and 2009 - 2010 R&R ES-17
Figure ES-7. Buildout System Improvements and 2011-2035 R&R ES-18
Figure ES-8. Timing of Major Water Supply and Distribution Facilities ES-19
Figure 2-1. Service Area 2-7
Figure 2-2. Existing Water System 2-8
Figure 3-8. Illustration of Unit Demand Factor Methodology 3-16
Figure 3-1. Service Area 3-33
Figure 3-2. Historical Housing Density 3-34
Figure 3-3. Historical Population Served 3-35
Figure 3-4. General Plan 3-36
Figure 3-5. Comparison of Existing Land Use with Future Land Use 3-37
Figure 3-6. Historical Water Production 3-38
Figure 3-7. Comparison of Historical Per Capita Demand, Production and Population 3-39
Figure 3-9. Historical Unit Demand Factor: Very Low Density 3-40
Figure 3-10. Historical Unit Demand Factor: Low Density 3-41
Figure 3-11. Historical Unit Demand Factor: Medium Low Density 3-42
Figure 3-12. Historical Unit Demand Factor: Medium High Density 3-43
Figure 3-13. Historical Unit Demand Factor: High Density 3-44
Figure 3-14. Historical Unit Demand Factor: General Industrial 3-45
Figure 3-15. Historical Unit Demand Factor: Downtown 3-46
Figure 3-16. Historical Unit Demand Factor: Neighborhood Commercial 3-47
Figure 3-17. Historical Unit Demand Factor: Commercial Services 3-48
Figure 3-18. Historical Unit Demand Factor: Professional/Administrative Services 3-49
Figure 3-19. Historical Unit Demand Factor: Core Area Mixed Use 3-50
Figure 3-20. Historical Unit Demand Factor: Governmental/Institutional 3-51

Figure 3-21. Historical Unit Demand Factor: Parks 3-52
Figure 3-22. Historical Unit Demand Factor: School Buildings/Play Area 3-53
Figure 3-23. Timing of Developments 3-54
Figure 3-24. Projected Demands over Time for the Dixon District 3-55
Figure 3-25. Service Factor for Single Family Residential and Multifamily 3-56
Figure 3-26. Service Factor for Commercial and Government 3-57
Figure 3-27. Service Factor for Industrial 3-58
Figure 3-28. Total Projected Services for the Dixon District 3-59
Figure 3-29. Projected Population Served Water for the Dixon District 3-60
Figure 4-5. Sacramento Valley Geologic Cross Section 4-4
Figure 4-6. Example of Overdraft Conditions in Bulletin 118 (Source: DWR Bulletin 118 (2003), Chapter 6, Figure 18, pg 97) 4-9
Figure 4-1. Service Area and Well Locations 4-32
Figure 4-2. Historical Groundwater Production (1980 to 2007) 4-33
Figure 4-3. Existing Well Profiles 4-34
Figure 4-4. Solano Subbasin Location Map 4-35
Figure 4-7. Dixon District Well and DWR Monitoring Well Locations 4-36
Figure 4-8. Dixon District and DWR Monitoring Well Trends 4-37
Figure 4-9. DWR Monitoring Wells – Annual Average Spring Groundwater Levels 4-38
Figure 4-10. 1997 Spring Groundwater Level Contours 4-39
Figure 4-11. 2007 Spring Groundwater Level Contours 4-40
Figure 4-12. Cal Water Wells – Annual Average Spring Groundwater Levels 4-41
Figure 4-13. Known Point Sources of Groundwater Contamination (Active Sites) 4-42
Figure 4-14. Relationship between Intake Elevations and Historical Nitrate Concentrations 4-43
Figure 4-15. Solano County Water Agencies and Districts Location Map 4-44
Figure 4-16. Location of Potential Recycled Water Supply and WWTP 4-45
Figure 4-17. Comparison of Available Existing Groundwater Supply and Projected Annual Demand 4-46
Figure 4-18. Projected Maximum Day Demand and Groundwater Production Capacity 4-47
Figure 4-19. Projected Future Costs of Recommended Water Supply Option 4-48
Figure 6-1. Illustration of Methodology for Spatially Locating Metered Accounts 6-6
Figure 6-2. Spatially Located Demands 6-14
Figure 6-3. Hydrant Test Locations 6-15

Figure 6-4. HPR Locations 6-16
Figure 7-1. Locations of Existing Stations and Facilities 7-11
Figure 7-2. Assessment Recommendations for Cal Water Wells 7-12
Figure 8-1. Existing Water System 8-12
Figure 8-2. Existing System Peak Hour Demand Analysis 8-13
Figure 8-3. Existing System Peak Hour Demand Analysis with Station 09-01 8-14
Figure 8-4. Existing System Available Fire Flow (Residual Pressure 20 psi & Velocity < 10 fps) 8-15
Figure 9-1. Future Water System 9-13
Figure 9-2. Future Land Use Parcels 9-14
Figure 9-3. Proposed Future Distribution System Improvements 9-15
Figure 9-4. Buildout System Fire Flow Demands 9-16
Figure 9-5. Buildout System Peak Hour Demand Analysis 9-17
Figure 9-6. Buildout System Available Fire Flow (Residential Pressure > 20 psi & Velocity < 10 fps) 9-18
Figure 9-7. Buildout System Available Fire Flow (Residual Pressure > 20 psi) 9-19
Figure 9-8. Future System Fire Flow Improvements 9-20
Figure 10-1. Existing System Improvements 2009-2010 R&R 10-10
Figure 10-2. Buildout System Improvements and 2011-2035 R&R 10-10
Figure 10-3. Timing of Major Water Supply and Distribution Facilities 10-10

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EXECUTIVE SUMMARY

This Water Supply and Facilities Master Plan for the California Water Service Company's (Cal Water) Dixon District evaluates the Dixon District's water supply and distribution facilities, existing and projected future water demands, and existing and potential future water supplies. In order to evaluate the Dixon District water system, West Yost Associates (WYA) developed a hydraulic model of the Dixon District water system and conducted a condition assessment of the Dixon District water system facilities.

The following are the three major work products that resulted from this master planning effort:

- An evaluation of potential future water supplies;
- A desktop and field assessment of the Dixon District water system facilities; and
- A recommended Capital Improvement Program (CIP) for the Dixon District's existing and future water system.

Renewal and Replacement (R&R) Program

Well facility assessments were performed using a combination of desktop assessments (based on review of available data received from Cal Water and discussions with Cal water staff), and field assessments (involving visiting each site and identifying potential issues and deficiencies). The assessments for the other Dixon District facilities were conducted using desktop assessments only.

Recommended CIP Components and Costs:

Recommended facilities to address identified existing system or future system deficiencies are discussed in Chapters 8 and 9. Costs for these recommended improvements are discussed in Chapter 10.

ESTIMATED COST OF RECOMMENDED CIP BY PROJECT TYPE			
CIP PROJECT TYPE	2009-2010 CIP, $M	2011-2035 CIP, M$	TOTAL CIP COST, $M
R&R Water Lube Conversion	0.37	-	0.37
R&R SCADA	0.06	-	0.06
R&R Replace Well	5.53	9.22	14.75
Storage Facility	1.77	2.18	3.95
Pump Station	2.00	0.05	2.05
New Pipeline	-	4.17	4.17
Bore and Jack	-	0.53	0.53
Backup Power	0.29	0.29	0.58
Totals	**$10.02**	**$16.44**	**$26.46**

EXECUTIVE SUMMARY

INTRODUCTION

This Water Supply and Facilities Master Plan (WSFMP) for the California Water Service Company's (Cal Water) Dixon District evaluates the Dixon District's water supply and distribution facilities, existing and projected future water demands, and existing and potential future water supplies. In order to evaluate the Dixon District water system, West Yost Associates (WYA) developed a hydraulic model of the Dixon District water system and conducted a condition assessment of the Dixon District water system facilities.

The following are the three major work products that resulted from this master planning effort:

- An evaluation of potential future water supplies;
- A desktop and field assessment of the Dixon District water system facilities; and
- A recommended Capital Improvement Program (CIP) for the Dixon District's existing and future water system.

The associated analyses and assessments related to these work products are briefly summarized below. Complete descriptions of the analyses and assessments are provided in the following chapters and appendices of this WSFMP.

OVERVIEW OF THE DIXON DISTRICT SERVICE AREA

A detailed description of the Dixon District's existing service area and water distribution system is provided in Chapter 2. The following subsections present a brief overview of the Dixon District service area.

Dixon District Service Area

Cal Water's Dixon District currently provides potable water service to most of the City of Dixon (City) and adjacent unincorporated territory in Solano County. The Dixon District is located in the Sacramento Valley approximately 20 miles west of the City of Sacramento and the Sacramento River. As shown on Figure ES-1, the Dixon District service area is approximately 1,044 acres, or about 1.6 square miles.

The Dixon District serves the central portions of the City. Areas within the City limits not served by Cal Water are served by the Dixon-Solano Municipal Water Service (DSMWS), which is operated and maintained by the Solano Irrigation District. Land to the east of the Dixon District is available for potential development. Currently, no development plans exist. Therefore, potential growth for the Dixon District in the near future includes infill and redevelopment.

Service Connections and Population Served

The Dixon District currently has six different revenue classes which make up its 2,854 service connections. This total does not include the 31 flat accounts for fire protection. Approximately 94 percent of the Dixon District's connections are either Single Family or Multi Family Residential.

The Dixon District serves adjacent unincorporated territory in Solano County; therefore, the use of traditional sources of the City's historical population data was not possible to determine the existing population served by the Dixon District. Consequently, the population served was estimated using housing densities developed by the California Department of Finance (CDOF) and the number of dwelling units as provided by Cal Water staff, and then calibrated using 2000 Census Block data that was also provided by Cal Water staff. Based on this methodology, the estimated population served by the Dixon District in 2007 was 8,144 people.

EXISTING AND FUTURE WATER DEMANDS

A detailed description of the Dixon District's existing and projected future water demands is provided in Chapter 3. The following subsections present a brief overview of existing and future water demands in the Dixon District.

Existing Water Demands

Existing water demands for the Dixon District were determined based on historical water production, historical consumption data and an estimation of unaccounted-for water. Peaking factors for maximum day and peak hour demand were developed based on historical production records.

Future Water Demands

As shown previously on Figure ES-1, the Dixon District is bounded by the Solano Irrigation District in the east and by the city limits in the north, west, and south. Land to the east of the Dixon District is available for potential development; however no development plans currently exist. Therefore, potential growth for the Dixon District in the near future includes infill and redevelopment.

Water demands were projected through buildout of the Dixon District using a unit demand methodology based on land uses in the City of Dixon's General Plan. Individual water use (by meter) was linked to individual parcels using addresses. The unit demand factor for each land use designation was then calculated by dividing the total water use by the total parcel area for which it was linked.

Total projected water demands at ultimate buildout for the Dixon District were calculated by multiplying the adopted unit demand factors by the additional developed acreage projected to occur. The resulting projection was added to existing 2007 water demands, followed by adjustments for unaccounted-for water.

The projected water demands adopted for this WSFMP are based on the timing associated with Figure ES-2, in which 19 percent of the future developments will be built-out by 2035. The projected water demands were calculated by multiplying the adopted unit demand factors by the future acreage shown on Figure ES-2. Consequently, the water demand projections for the Dixon District by 2035 are approximately equal to 2,406 af/yr, and the demand projection over time is shown as the solid blue line on Figure ES-3.

EXISTING AND FUTURE WATER SUPPLIES

Detailed descriptions of the Dixon District's existing and potential future water supplies are provided in Chapter 4. In addition, a recommended future integrated water supply plan was developed for the Dixon District as discussed in Chapter 4. The following subsections present a brief overview of existing and potential future water supplies for the Dixon District.

Existing Water Supply

Cal Water's Dixon District currently relies solely on groundwater to meet the potable water demands of its existing customers. The Dixon District overlies the Sacramento Valley Groundwater Basin, which has been divided into several smaller subbasins using institutional boundaries established by the California Department of Water Resources (DWR). The Sacramento Valley Groundwater Basin is located in north central California, and is bounded on the east by the Sierra Nevada and Cascade Ranges and on the west by the North Coast Range.[i] The Sacramento Valley Groundwater Basin also extends from about five miles north of Red Bluff southward for 150 miles to the Sacramento-San Joaquin Delta and covers an area of approximately 6,000 square miles.[ii]

The Dixon District has a total of eight wells located throughout the Dixon District's service area as shown on Figure ES-4. All eight wells are active. The total current combined pumping capacity of these active wells is about 4,000 gallons per minute (gpm), or about 5.8 million gallons per day (mgd).

Based on available groundwater level data, average groundwater level trends from DWR-monitored wells located around the Dixon District service area, as well as the Dixon District wells, have been stable. Overdraft conditions are not present based on the data reviewed.

A number of sites with groundwater contamination were identified within the Dixon District service area. Most of these active groundwater contamination cases involving one or more constituents related to gasoline and diesel fuels, petroleum hydrocarbons, volatile organic compounds (VOCs), solvents, fertilizers, pesticides and herbicides. Although the potential exists for groundwater contamination at these sites to impact adjacent or nearby municipal supply wells, it should not be inferred that the presence of these contaminants at these sites has impacted Dixon District wells. In the future, Cal Water can avoid these areas through careful site selection of future groundwater wells.

Early discussions with Cal Water staff indicated that potential nitrate contamination is of concern for the Dixon District. Of the eight wells observed by Cal Water, recent data (2003-2007) show that four (4) wells (Stations 02-01, 03-01, 04-01 and 05-01) have nitrate concentrations near or

above the MCL. Comparison of historical nitrate and the well construction information indicates that wells with shallow intakes generally have the highest nitrate concentrations. The regression statistics result indicates that most of the variation in median historical nitrate concentrations can be explained by the elevation of the well intakes. Higher (shallower) intakes lead to higher nitrate concentrations, because shallower intakes are more likely to draw in water from the shallower part of the aquifer system where nitrate concentrations resulting from nonpoint agricultural sources are highest.

Currently, Cal Water has equipped Stations 02-01, 03-01, and 05-01 with nitrate analyzers to provide an extensive safeguard to these wells when the nitrate level increases. In addition, nitrate treatment system options are currently being studied to identify the best treatment methodology for Stations 03-01 and 05-01, where data showed that nitrate exceeded MCL.

Future Water Supply

Evaluations of existing groundwater level trends and groundwater quality in the Dixon District conclude that Cal Water can plan to use groundwater to meet future water demands. However, Cal Water should closely monitor groundwater levels in the Dixon District wells and other wells (as monitored by DWR) to ensure that increased annual demands (by Cal Water or other groundwater basin users) do not induce overdraft conditions on a long-term basis.

Other Potential Water Supply Concepts

For long-term planning purposes and supply diversification, the need for other water supplies (e.g., surface water and recycled water) in conjunction with groundwater was reviewed. For the Dixon District, there is sufficient groundwater supply, and associated costs of these alternative supplies are not currently justified. However, these alternative supply options are described for future reference, in the case regulations become more stringent and regional water resources become scarcer causing integration of alternative water supply sources to become desirable.

Regarding potential future water supply options, the Solano Irrigation District (SID) receives a portion of surface water from the Solano Project, and its boundaries nearly enclose the City of Dixon. Due to this geographical proximity, Cal Water would have to negotiate a water purchase from the SID to the Dixon District to have the right of diverting this surface water through recharge to the groundwater basin and subsequent extraction or direct use through the design and construction of a surface water treatment facility. In addition, the City of Dixon currently has future surface water rights from the North Bay Aqueduct (NBA) through the State Water Project (SWP). However, there are no infrastructure or treatment facilities available. WYA recommends that Cal Water conduct a separate, more focused feasibility level evaluation to assess: available water quantities; required conveyance facilities; wheeling requirements, recharge locations, and other technical and institutional issues associated with water transfers.

Regarding potential future recycled water options, the City of Dixon's wastewater treatment plant (WWTP) is located approximately 2.5 miles south of the City, and all of the schools and parks are scattered throughout the City. Implementation of a recycled water program would require new distribution infrastructure between the WWTP and potential customers. The cost of

this infrastructure is not justified at the present time. Furthermore, due to the high TDS of the groundwater basin, it may be a problem to irrigate with recycled water.

Recommended Water Supply Option

For the future timeframe that was reviewed for this WSFMP, groundwater is a reliable supply source, and the most cost effective option for future water supply to meet projected water demands. Consequently, for planning purposes in this WSFMP, it was assumed that Cal Water will meet all future demands in the Dixon District with groundwater.

HYDRAULIC MODEL

A detailed description of the Dixon District's hydraulic model development is provided in Chapter 6. The following subsections present a brief overview of the development of the hydraulic model for the Dixon District.

Hydraulic Model Development

A hydraulic model of the Dixon District water system was developed using a series of steps that included the following:

- Description of the Model and Element Definitions
- Pipelines, Nodes, and Junctions Imported into InfoWater
- Roughness Factors Assigned in InfoWater
- Elevations Allocated in H_2OMAP
- Accounts Spatially Located in GIS
- Water Demands Allocated in H_2OMAP
- Station Elements Incorporated into InfoWater
- Naming Scheme Applied in InfoWater

Hydraulic Model C-factor Tests

The results from the hydrant tests that were performed in the field indicated that eighty-two percent (82%) of all C-factor comparison points were found to be within 5 percent or 5 psi of the field data, while the remaining 18 percent were all within 10 psi of the field observed values. There were three specific adjustments to the model were found to be necessary in order to achieve the desired calibration goals. These specific calibration adjustments were made to: groundwater depths, system demands and assumed valve configuration. The detailed results of the individual calibration tests that were performed are provided in Chapter 6.

Hydraulic Model Verification

The goal of the EPS calibration for this project was to match model tank levels by 2 ft or 10 percent to the available SCADA data and to achieve a consistent pattern of operation which

produces drain/fill and pump on/off status. In addition to the tank levels, the model was also calibrated to match all well pump station flow values to within 10 gpm or 10 percent, and all well pump station discharge pressures and data logger pressures to within 5 psi or 5 percent during calibration. The Root Mean Square (RMS) method is applied to measure the calibration accuracy of each location investigated during EPS Calibration.

Based on the results of the verification, it can be concluded that the hydraulic model provides an accurate operational representation of the Dixon District water distribution system, and is more than adequate for use as a planning and operational tool.

DIXON DISTRICT FACILITIES

A detailed description of the desktop and field assessments of the Dixon District water system facilities is provided in Chapter 7. The following subsection presents a brief overview of the facility assessments for the Dixon District.

Facility Assessments

Water system facilities assessed for this WSFMP included the following:

- Water Supply Wells;
- Treatment and Disinfection Facilities;
- Storage Facility; and
- Telemetry System.

Well facilities and treatment and disinfection facilities assessments were performed using a combination of desktop assessments (based on review of available data received from Cal Water and discussions with Cal Water staff) and field assessments (involving visiting each site and identifying potential issues and deficiencies). The assessment of the Dixon District storage facilities was based on a desktop assessment only.

Overall recommendations for each station are shown on Figure ES-5, and discussed further in Chapter 7.

EXISTING WATER SYSTEM

A detailed description of the evaluation the existing water system is provided in Chapter 8. The following subsection presents a brief overview of the evaluation for the existing water system.

Existing Water System Evaluation and Recommended Improvements

The Dixon District currently has a surplus operational water storage capacity of 0.1 million gallons (MG) in the existing water system[1].

The Dixon District's firm groundwater pumping capacity is adequate to meet the pumping capacity criterion for the entire service area during the peak hour flow.

During a peak hour demand scenario, results indicate that the existing water system could not adequately deliver peak hour demands to meet the Dixon District's minimum pressure criterion of 40 psi. A large area of low pressures ranging from 34 to 40 psi was identified during the simulation in the northwestern part of the California Northern Railroad, and a small area of low pressure ranging from 39 to 40 psi was identified in the southeastern part of the California Northern Railroad. Based on the location of this area of low pressures, it appears that the low pressures are caused by insufficient supply sources. Both critical wells, Station 06-01 and 07-01, are located in the northwestern part of the California Northern Railroad. Under a peak hour demand scenario, these critical wells were assumed to be offline.

Per discussions with Cal Water, a new well, Station 09-01, is currently planned to be constructed. This well has a proposed capacity up to 2,000 gpm, and is planned to be drilled down into the deeper aquifer to alleviate groundwater quality issues due to nitrates (see Chapter 4 for water quality discussion). In addition, a new 16-inch diameter pipeline is planned for construction along with Station 09-01. These planned facilities will improve the operation of the existing water system and address the area of low pressures during peak hour demand condition.

As discussed with Cal Water staff, any additional fire flow capacity will be provided as part of the future system. The required upgrades in the existing system are extensive, and completion of pipeline upgrades for the sole purpose of improving fire flow, or pumping and storage upgrades for the sole purpose of meeting the demands of a few large users would be cost prohibitive to the existing customers of the Dixon District.

FUTURE WATER SYSTEM EVALUATION

A detailed description of the evaluation of the future water system is provided in Chapter 9. The following subsection presents a brief overview of the evaluation and recommended improvements for the future water system.

Future Water System Evaluation and Recommended Improvements

The Dixon District has a projected water storage capacity deficit of 0.6 MG in the future water system. One of the near term project that Cal Water planned for Dixon District is to add storage capacity to meet fire flow storage requirement. A new ground level storage reservoir (Station 10)

[1] As discussed with Cal Water staff, increasing fire flow storage for the sole purpose of meeting the requirements of only a few large buildings would be cost prohibitive to the existing customers of the Dixon District. Consequently, the fire flow storage component is not considered until the future water storage capacity evaluation.

is planned to be constructed near 210 West F Street. This new storage reservoir will be a pumped storage reservoir, and it will alleviate the water storage capacity deficit in the future water system.

The Dixon District has a projected pumping capacity deficit of 1,885 gpm (2.7 mgd) during a maximum day demand plus fire flow scenario. However, if the District decides to construct the additional storage improvement recommended in the water storage capacity evaluation, these combined improvements will be sufficient to provide a solution for the pumping capacity deficit in the future water system.

During a peak hour demand scenario, results indicate that the future water system will adequately deliver peak hour demands to meet the Dixon District's minimum pressure criteria of 40 psi. Under this scenario, system pressures ranged from 43 to 52 psi.

Maximum day demand plus fire flow simulation results indicate that there are numerous areas where the available fire flow, evaluated using the maximum day demand plus fire flow performance criteria, was less than the minimum required fire flow of 1,500 gpm[2]. At most of these locations, the *existing* pipelines are undersized and would need to be replaced by larger diameter pipelines to supply a minimum fire flow of 1,500 gpm while meeting the maximum day demand plus fire flow performance criteria. Cal Water is not required to upgrade the Dixon District's *existing* water system to meet current or future fire flow requirements. The cost to implement these upgrades solely for the purpose of improved fire flow would be cost prohibitive to the existing customers. Therefore, it is not recommended that the improvements necessary to fix these fire flow deficiencies be identified as projects in the Dixon District's CIP. However, it is recommended that Cal Water staff consider these fire flow deficiencies as a factor for sizing future main replacement projects.

Also, pumping and storage upgrades, while recommended, are included as future projects in the Dixon District's CIP, to be paid by new development or otherwise triggered by any upgrades to the City's larger facilities.

RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

A detailed description of the Dixon District's CIP is provided in Chapter 10. The following subsections present a brief overview of the recommended CIP for the Dixon District.

Recommended Capital Improvements

The existing water system is adequate to meet the operational and design criteria; therefore, no improvement is required. Recommendations for improvements to the future water system are described in Chapter 9. In addition, Chapters 4 and 7 provide descriptions of renewal and replacement (R&R) improvements for many of the existing facilities. A summary of the recommended capital improvements is listed below.

[2] Public Utilities Commission. *General Order 103*, page 27.

2009-2010 Renewal and Replacement Improvements

- R&R Well Replacement[3]
  - Replace wells 01-03, 02-01 and 03-01.
- R&R Well Pump
  - Convert pumps from oil-lube to water-lube at Wells 01-03, 02-01, 04-01, 06-01, 07-01 and 08-01.
  - Install new well pump at Well 05-01 (Cost is included in 2010 Preliminary Advance Budget)[4]
- R&R Treatment Facility
  - Install ion-exchange treatment for nitrate removal at Well 03-01 (Cost is included in 2008 Capital Budget)
- R&R Control Panel
  - Install control panel at Well 01-03 (Cost is included in 2008 Capital Budget)
  - R&R Emergency Generator
  - Install emergency generator at Well 01-03 (Cost is included in 2008 Capital Budget)
- R&R SCADA
  - Install SCADA at Wells 01-03, 03-01, 04-01, 06-01 and 08-01 (Costs for SCADA installation for Wells 04-01, 06-01 and 08-01 are included in 2010 Preliminary Advance Budget)

The locations of the recommended 2009-2010 R&R projects are shown on Figure ES-6.

Future System Improvements and 2011-2035 Renewal and Replacement Improvements

- Storage Facility
  - Construct a new 0.6 MG pumped storage reservoir located [redacted].
- Pump Station[5]
  - Add 1.5 mgd of pumping capacity to existing Station 10 located [redacted]

[3] Assumes a conservative planning criterion where wells are replaced after a 50 year service life. However, the replacement of wells should be reviewed on case-by-case basis to determine if the well can be rehabilitated in lieu of replacement.

[4] CIP Information for Dixon District (provided by Tom Salzano, Cal Water, on August 12, 2008)

[5] Cost estimate was based on the additional firm pumping capacity required.

- Pipeline Improvement
  - Install a new 12-inch diameter pipeline from [redacted]
- New Pipeline plus Bore and Jack
  - Install approximately 17,800 linear feet of proposed pipelines ranging from 8 to 12 inches, and one bore and jack crossings under the California Northern Railroad as shown on Figure 10-2 in Chapter 10.
- Backup Power
  - Install backup power at Well 02-01.
  - Install backup power for any proposed groundwater pumping facility to provide the Dixon District with additional supply reliability.
- R&R Well Replacement[6]
  - Wells 04-01, 05-01, 06-01, 07-01 and 08-01

The locations of the recommended future system and 2011-2035 R&R CIP projects are shown on Figure ES-7.

Recommended Cost and Timing of Capital Improvements

Costs are presented in June 2009 dollars based on an Engineering News Record Construction Cost Index (ENR CCI) of 8578 (20 Cities Average). Total CIP costs include the following construction contingency and project cost allowances:

- Construction Contingency: 20 percent
- Project Cost Allowances:
  - Design: 10 percent
  - Construction Management: 10 percent
  - Administration: 8 percent

A summary of the costs for the recommended CIP by project type is provided in Table ES-1. As shown in Table ES-1, the total estimated recommended CIP cost for the Dixon District water system is estimated to be $26.46 million. Additional details of the probable construction costs of each individual project are provided in Chapter 10.

The construction of the improvements for the future system should be coordinated with the proposed schedules of future development to ensure that the required infrastructure will be in place to serve future customers. However, if the future system improvements are based on

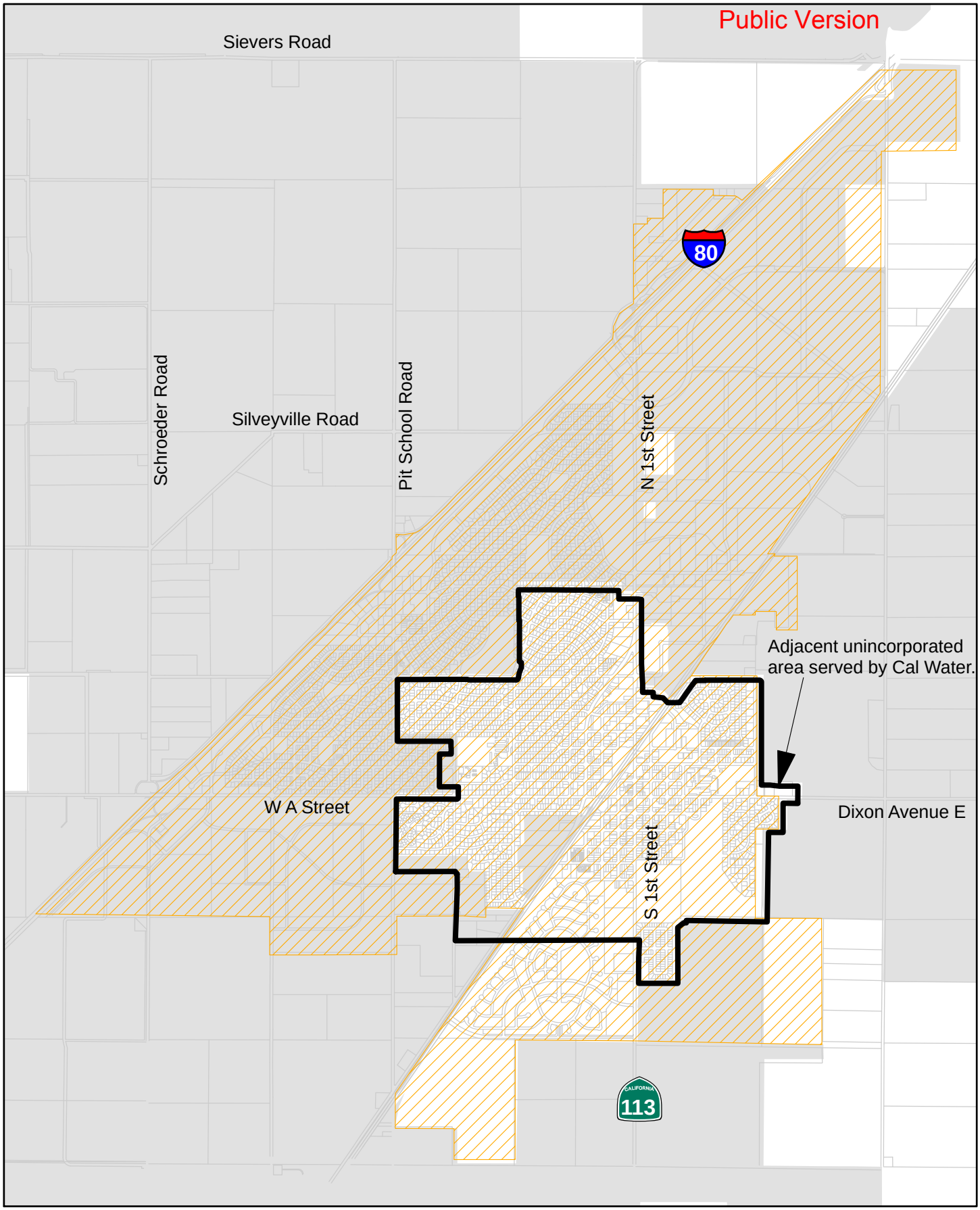
[6] Assumes a conservative planning criterion where wells are replaced after a 50 year service life. However, the replacement of wells should be reviewed on a case-by-case basis to determine if the well can be rehabilitated in lieu of replacement.

addressing deficiency in fire flow pumping or storage, emergency storage, or reliability issues, they should be the District's first priority. Figure ES-8 presents a schedule starting in 2010 for the construction of the recommended capital improvement projects to eliminate deficiencies in the existing and future water system.

Table ES-1. Estimated Cost of Recommended CIP by Project Type

CIP Project Type	2009-2010 CIP[a], million dollars	2011-2035 CIP [b,c,d], million dollars	Total CIP Cost[a,b], million dollars
R&R Water Lube Conversion	0.37	-	0.37
R&R SCADA	0.06	-	0.06
R&R Replace Well	5.53	9.22	14.75
Storage Facility[e]	1.77	2.18	3.95
Pump Station	2.00	0.05	2.05
New Pipeline	-	4.17[f]	4.17
Bore and Jack	-	0.53[f]	0.53
Backup Power	0.29	0.29	0.58
Total[g]	$10.02	$16.44	$26.46

(a) Includes 2009-2010 R&R projects.
(b) Includes 2011-2035 R&R projects.
(c) Timing of buildout system improvements will be triggered by specific developments and increase in system demands.
(d) Buildout system CIP costs are in current dollars and have not been escalated by the CPI of 3 to 5 percent.
(e) Cost based on welded steel storage tanks to provide a more conservative cost estimate; however, a more economic option may be to use a bolted steel tank.
(f) Cost typically funded by developers.
(g) Total cost based on the June 2009 ENR index of 8578 and includes construction contingency and project cost allowances.



LEGEND:

- Dixon District
- City of Dixon
- Solano Irrigation District
- Parcels

N

0 700 1,400 2,800

S

FIGURE ES-1

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

SERVICE AREA

WEST YOST ASSOCIATES Consulting Engineers

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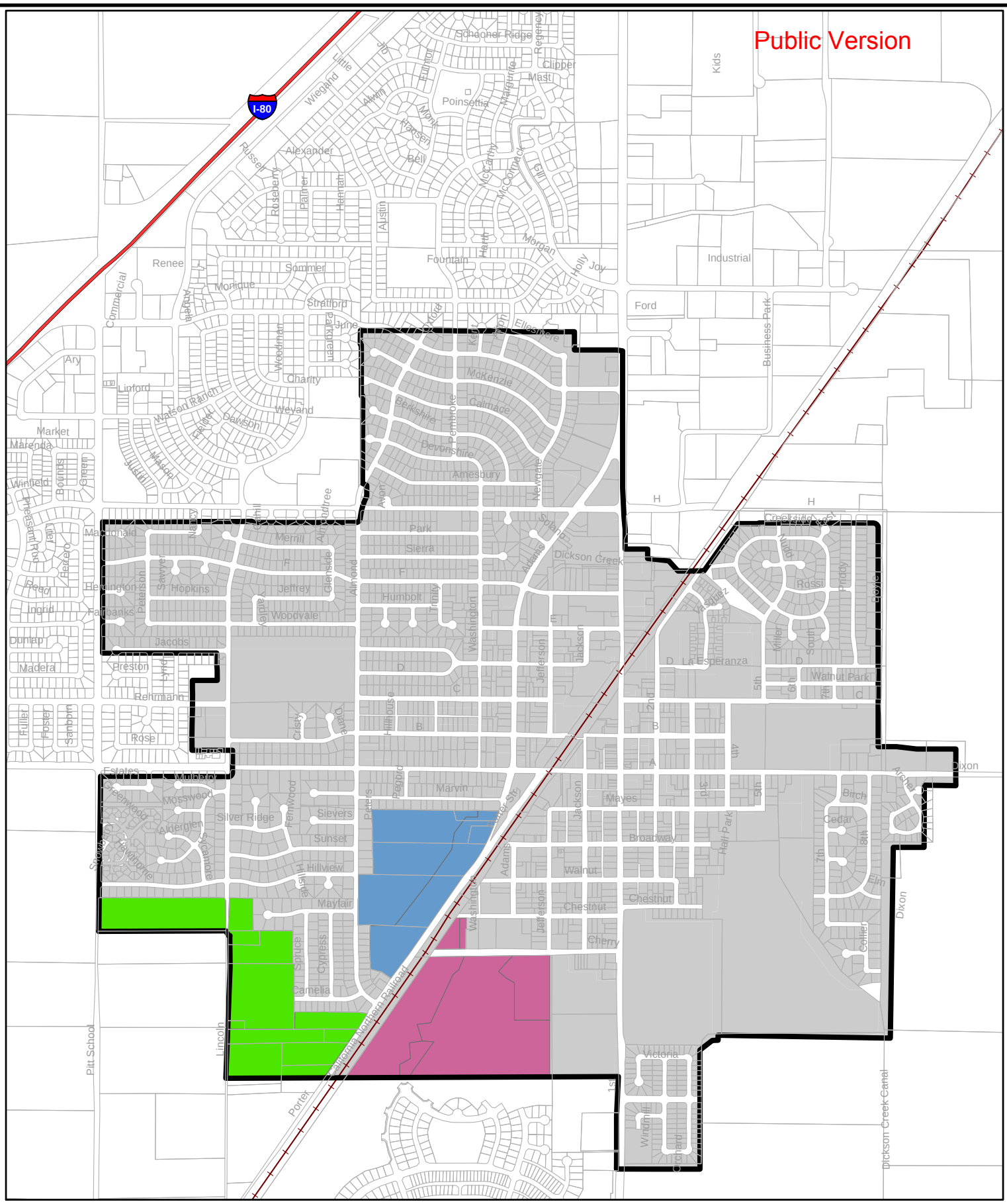

Legend

- Existing Developments
- Buildout in 2015
- Buildout in 2025
- Buildout in 2035
- CalWater_Parcels
- Cal Water Dixon District Boundary
- Highway
- California Northern Railroad

FIGURE ES-2

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

TIMING OF DEVELOPMENTS

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Consulting Engineers

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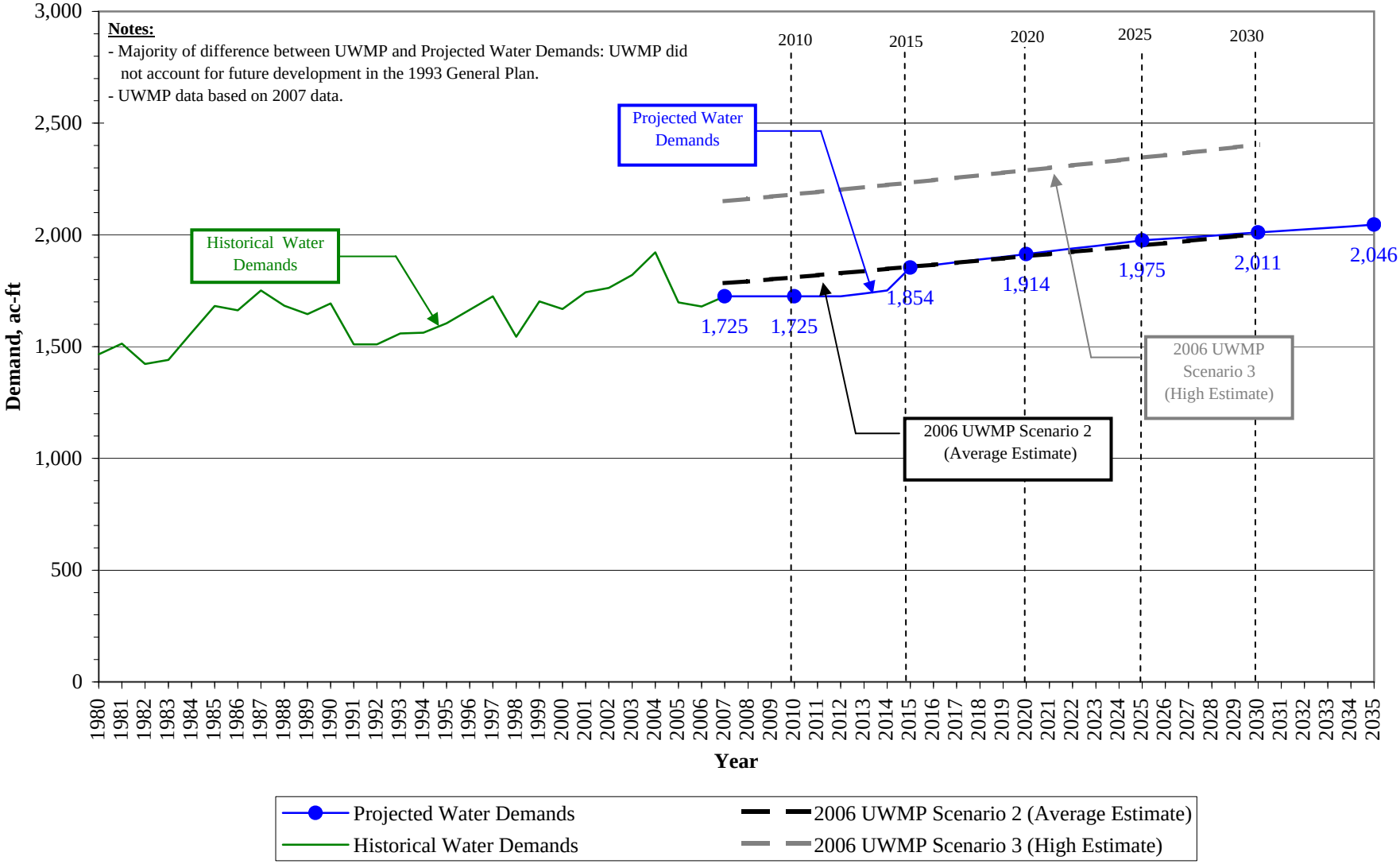
Figure ES-3. Projected Demands over Time for the Dixon District



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Last Revised: 11/17/2008

California Water Service Company
Dixon District
Water Supply and Facilities Master Plan

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Public Version

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LEGEND:

- Dixon District
- Active Well
- Potable Water Storage
- Pipeline
- Street
- Railroad

N

0 400 800 1,600

Scale in Feet

FIGURE ES-4

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

EXISTING WATER SYSTEM

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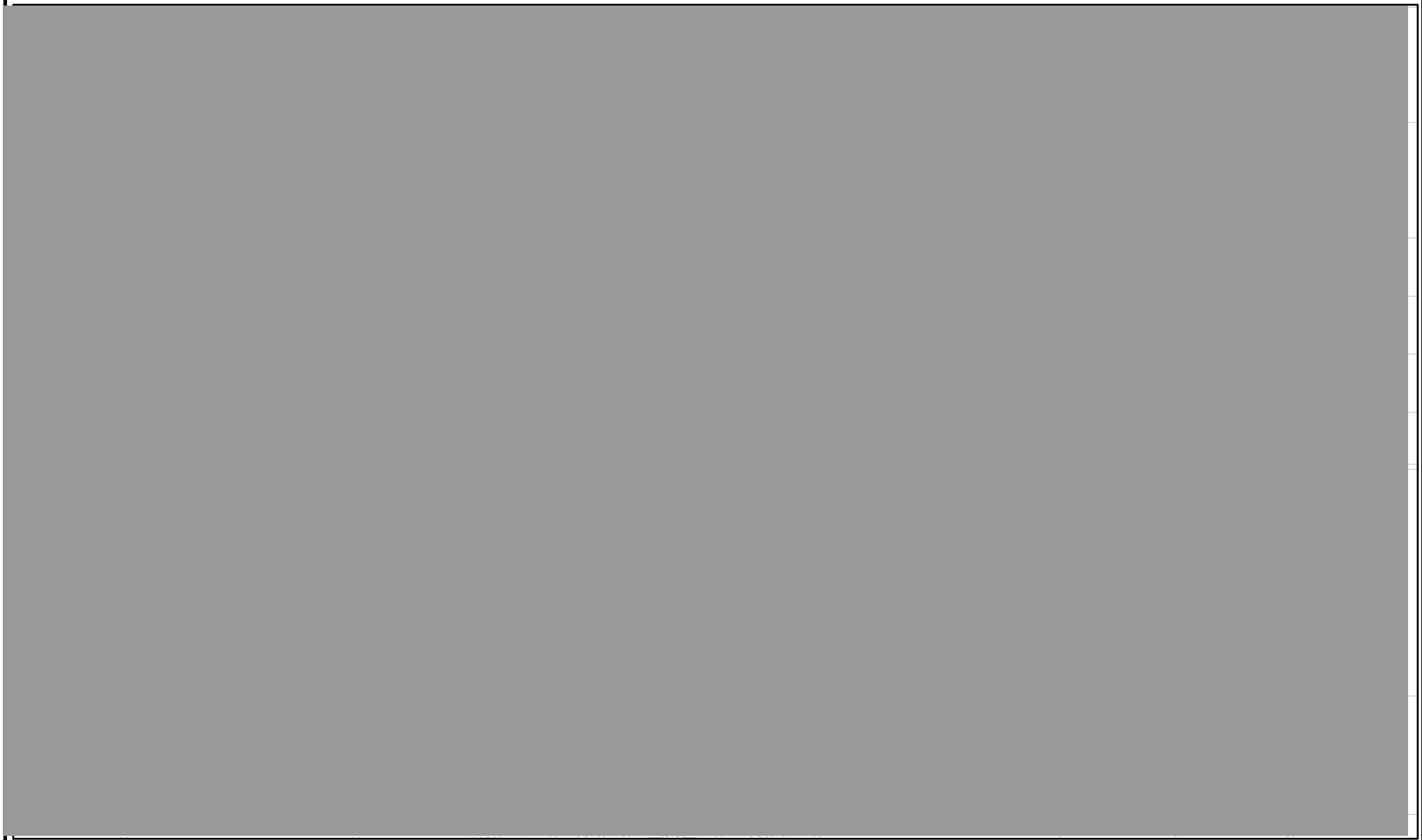

LEGEND:

- Active Well
- Potable Water Storage
- Pipeline
- Dixon District Service Boundary

N

0 400 800 1,600

Scale in Feet

FIGURE ES-5

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

ASSESSMENT RECOMMENDATIONS FOR CAL WATER WELLS

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LEGEND:

- Proposed Near Term Station 9
- Recommended Pumped Storage
- 2009 - 2010 Renewal and Replacement
- Proposed Near Term Pipeline
- Pipeline
- Dixon District Service Boundary

N

0 400 800 1,600

Scale in Feet

FIGURE ES-6

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

EXISTING SYSTEM IMPROVEMENTS AND 2009 - 2010 R&R

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Public Version

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LEGEND:

- Existing Pipeline
- Recommended Fire Flow Improvement
- Recommended Future Pipeline
- Recommended Pumped Storage
- Add Backup Power
- 2011-2035 Renewal and Replacement
- Dixon District
- CIP Group A
- CIP Group B
- CIP Group C

N

0 395 790 1,580

Scale in Feet

FIGURE ES-7

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

BUILDOUT SYSTEM IMPROVEMENTS AND 2011-2035 R&R

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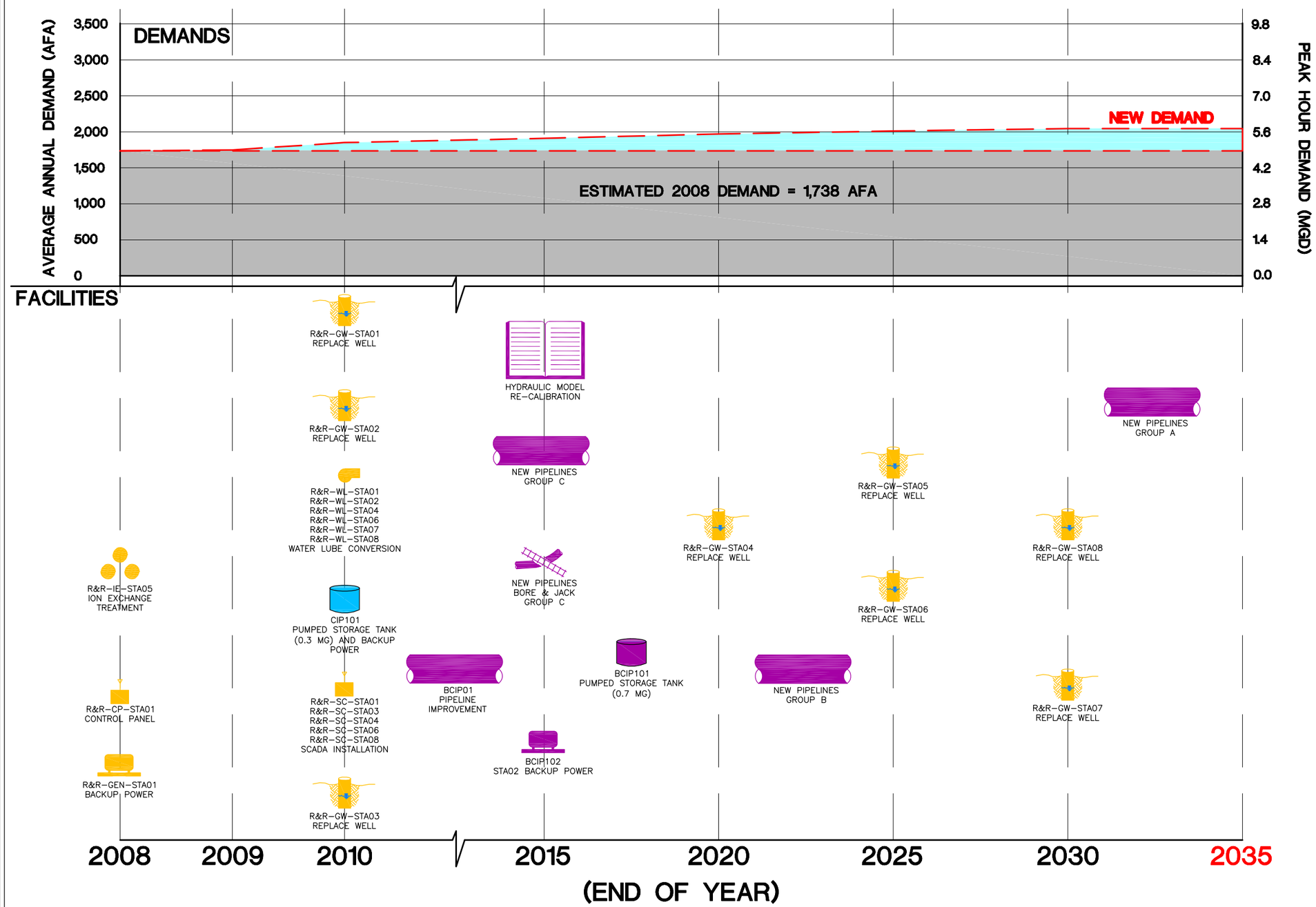
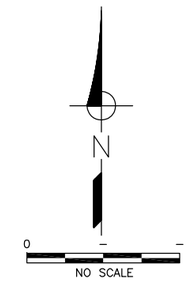


FIGURE ES-8

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

TIMING OF MAJOR WATER SUPPLY AND DISTRIBUTION FACILITIES



NOTES:

- Proposed timing of recommended improvements shown is preliminary and is subject to change as individual projects are further studied and refined.

LEGEND:

- EXISTING SYSTEM IMPROVEMENT
- RENEWAL AND REPLACEMENT IMPROVEMENT
- BUILDOUT SYSTEM IMPROVEMENT

CALIFORNIA WATER SERVICE CO.

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Consulting Engineers

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REFERENCES

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[i] Department of Water Resources (DWR), U.S. Geological Survey (USGS). *Bulletin 118-6-Evaluation of Ground Water Resources: Sacramento Valley*. August 1978.

[ii] Department of Water Resources (DWR), U.S. Geological Survey (USGS). *Bulletin 118-6-Evaluation of Ground Water Resources: Sacramento Valley*. August 1978.

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CHAPTER 1: INTRODUCTION

Chapter Highlights:

Master Plan Purpose:

The intent of this Water Supply and Facilities Master Plan is to identify existing system deficiencies and required system improvements, based on updated demand estimates and system evaluations, and to formulate a comprehensive Capital Improvement Program which meets the needs of existing and future customers.

Master Plan Objectives:

- Develop operational and design criteria under which the existing system will be analyzed and future facilities will be formulated;
- Evaluate existing water demands and project future water demands;
- Analyze the existing capacity and operation of pump stations, and water storage facilities to meet existing and 2035 water demands;
- Identify potential new water storage facilities;
- Evaluate water service to new development areas;
- Evaluate the effect of operating limitations placed on wells (due to water quality issues);
- Evaluate potential new supply delivery points (e.g., wells); and
- Address the question: "What triggers the timing of construction of specific infrastructure improvements?"

Chapter Contents:

- Master Plan Purpose
- Master Plan Objectives
- Authorization
- Report Organization
- Acronyms and Abbreviations
- Acknowledgements

Chapter 2. Existing Water System
Chapter 3. Water Demands
Chapter 4. Integrated Water Supply Plan
Chapter 5. Planning and Design Criteria
Chapter 6. Hydraulic Model Development
Chapter 7. Facility Assessments
Chapter 8. Evaluation of Existing Water System
Chapter 9. Evaluation of Future Water System
Chapter 10. Recommended Capital Improvement Program

CHAPTER 1. INTRODUCTION

MASTER PLAN PURPOSE

California Water Service Company (Cal Water) has an ongoing capital improvement program to upgrade the Dixon District's water distribution system. However, with the recent development, calibration and verification of a hydraulic model for the Dixon District water system, Cal Water has the perfect opportunity to refine, further define, and prioritize a plan for capital improvement projects for the next 25+ years. The intent of this Water Supply and Facilities Master Plan (WSFMP) is to identify existing system deficiencies and required system improvements, based on updated demand estimates and system evaluations, and to formulate a comprehensive Capital Improvement Program (CIP) which meets the needs of existing and future customers.

MASTER PLAN OBJECTIVES

The objectives of this WSFMP are to:

- Develop operational and design criteria under which the existing system will be analyzed and future facilities will be formulated;
- Evaluate existing water demands and project future water demands;
- Analyze the existing capacity and operation of pump stations, and water storage facilities to meet existing and 2035 water demands;
- Identify potential new water storage facilities;
- Evaluate water service to new development areas;
- Evaluate the effect of operating limitations placed on wells (due to water quality issues);
- Evaluate potential new supply delivery points (e.g., wells); and
- Address the question: "What triggers the timing of construction of specific infrastructure improvements?"

AUTHORIZATION

West Yost Associates (WYA) was authorized to prepare this WSFMP by Cal Water on June 3, 2008

REPORT ORGANIZATION

This WSFMP is organized into the following chapters:

- Chapter 2: Existing Water System
- Chapter 3: Water Demands
- Chapter 4: Integrated Water Supply Plan
- Chapter 5: Planning and Design Criteria
- Chapter 6: Hydraulic Model Development
- Chapter 7: Facility Assessments
- Chapter 8: Evaluation of Existing Water System
- Chapter 9: Evaluation of Future Water System
- Chapter 10: Recommended Capital Improvement Program

The following appendices to this WSFMP contain additional technical information and assumptions:

- APPENDIX A: Cal Water Census Block Data
- APPENDIX B: Cal Water Best Management Practices
- APPENDIX C: Geologic Cross-Section
- APPENDIX D: Basin Management Objective
- APPENDIX E: DWR Groundwater Elevation Maps
- APPENDIX F: Groundwater Elevation Maps from Preliminary Plan
- APPENDIX G: DWR Bulletin 118 – Chapter 6 (Overdraft)
- APPENDIX H: Spring Groundwater Level Hydrographs for Cal Water Wells
- APPENDIX I: Historical Nitrate Concentrations for Cal Water Wells
- APPENDIX J: Email to CDPH (Dan Cikuth) Regarding Private Well System
- APPENDIX K: Detailed Cost Estimates for Groundwater Supply
- APPENDIX L: Diurnal Curve
- APPENDIX M: Hydraulic Model Calibration – Hydrant Tests
- APPENDIX N: Hydraulic Model Calibration – Optional Fire Flow Tests
- APPENDIX O: Hydraulic Model Calibration – HPR Data
- APPENDIX P: Facility Assessments
- APPENDIX Q: Cal Water Simulated Available Fire Flow to Meet the Maximum Day Demand Plus Fire Flow Performance Criteria

- APPENDIX R: Cal Water Simulated Available Fire flow to Meet the Maximum Day Demand plus Fire Flow Performance Criteria
- APPENDIX S: Cost Estimating Assumptions

ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations have been used throughout this WSFMP to improve document clarity and readability.

AC	Asbestos Cement
ADD	Average Day Demand
af	Acre-Feet
af/service/yr	Acre-Feet Per Service Per Year
af/yr	Acre-Feet Per Year
bgs	below ground surface
BMPs	Best Management Practices
Cal Water	California Water Service Company
ccf	Hundred Cubic Feet
CCI	Construction Cost Index
CDOF	California Department of Finance
CDPH	California Department of Public Health
CFC	California Fire Code
CI	Cast Iron
CIP	Capital Improvement Program
City	City of Dixon
CL&C	Concrete Pressure Pipe
COP	Copper
CR Total	Total Chromium
CUWCC	California Urban Water Conservation Council
CWC	California Water Code
DI	Ductile Iron
DOC	Dissolved Organic Compounds
DPH	Department of Public Health
DSMWS	Dixon-Solano Municipal Water Service
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
EC or COND	Electrical Conductivity
ENR	Engineering News Record
EPS	Extended Period Simulation
fps	Feet Per Second
ft	Feet
ft/kft	Feet Per Thousand Feet
ft/yr	Feet Per Year
GALV	Galvanized Pipe
GAMA	Groundwater Ambient Monitoring and Assessment
GCWAC	Glenn County Water Advisory Committee

GEIMS	Geographic Environmental Information Management System
General Plan	City of Dixon 1999 General Plan
GIS	Geographical Information System
gpcd	Gallons Per Capita Per Day
gpm	Gallons Per Minute
GPS	Global Positioning System
GSE	Ground Surface Elevation
HD	High Density
HPR	Hydrant Pressure Recorders
IDM	IDModeling Incorporated
LD	Low Density
LUFT	Leaking Underground Fuel Tanks
LUST	leaking underground storage tanks
MCL	Maximum Contaminant Levels
MDD	Maximum Day Demand
mg/L	Milligrams Per Liter
mgd	Million Gallons Per Day
MHD	Medium High Density
MLD	Medium Low Density
MOU	Memorandum of Understanding
msl	Mean Sea Level
my	Million Years
NBA	North Bay Aqueduct
NED DEM	National Elevation Database Digital Elevation Model
NFPA	National Fire Protection Association
NO_3	Nitrate
O&M	Operations and Maintenance
PHD	Peak Hour Demand
psi	Pounds Per Square Inch
PUC	Public Utilities Commission
PVC	polyvinyl chloride
R&R	Replacement and Renewal
RMS	Root Mean Square
RNVWD	Rural North Vacaville Water District
SC	Specific Conductance
SCADA	Supervisory Control and Data Acquisition
SID	Solano Irrigation District
SMCL	Secondary Maximum Contaminant Level
SOI	Sphere of Influence
SS	Stainless Steel
SSACV	Southern Sacramento Valley
STD STL	Standard Steel
SWP	State Water Project
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
total Cr	Total Chromium

TRANS	Transite
UAFW	Unaccounted-for Water
UCI	Unlined Cast Iron
USBR	United States Bureau of Reclamation
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan
VLD	Very Low Density
VOC	Volatile Organic Chemical
WI	Steel Lined
WSFMP	Water Supply and Facilities Master Plan
WWTP	Waste Water Treatment Plant
WYA	West Yost Associates

ACKNOWLEDGEMENTS

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- Richard Shults, Dixon District Field Operations
- Tom Salzano, Water Resources Planning Supervisor
- Tarrah Henrie, Water Quality Manager
- Erin McCauley, Acting Bear Gulch District Manager
- Ted Coughlin, Acting Design Manager
- Jim Simunovich, Engineering Operations Manager
- Jonathan Keck, Engineer
- Shyamala Raveendran, Engineer
- Ting He, Manager of Distribution
- Jeff Yarne, Project/Consulting Manager

CHAPTER 10: RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

Chapter Highlights:

Chapter Contents:

- Recommended Capital Improvement Program
- Capital Improvement Program Implementation

This chapter presents the recommended capital improvement program (CIP) for the Dixon District's existing and buildout water system. Recommendations for improvements to the existing and buildout water system were described previously in Chapters 8 and 9, respectively. In addition, Chapters 4 and 7 provided renewal and replacement (R&R) improvements for the existing facilities. This chapter provides a summary of all the recommended improvement projects, along with estimates of probable construction costs. It should be noted that the recommended CIP only identifies improvements at a master plan level and does not constitute a design of such improvements. Subsequent detailed design is required to determine the exact sizes and locations of these proposed improvements.

Costs are presented in June 2009 dollars based on an Engineering News Record Construction Cost Index (ENR CCI) of 8578 (20 Cities Average). Total CIP costs include the following construction contingency and project cost allowances:

- Construction Contingency: 20 percent
- Project Cost Allowances:
  - Design: 10 percent
  - Construction Management: 10 percent
  - Administration: 8 percent

ESTIMATED COST OF RECOMMENDED CIP BY PROJECT TYPE			
CIP PROJECT TYPE	2009-2010 CIP, $M	2011-2035 CIP, M$	TOTAL CIP COST, $M
R&R Water Lube Conversion	0.37	-	0.37
R&R SCADA	0.06	-	0.06
R&R Replace Well	5.53	9.22	14.75
Storage Facility	1.77	2.18	3.95
Pump Station	2.00	0.05	2.05
New Pipeline	-	4.17	4.17
Bore and Jack	-	0.53	0.53
Backup Power	0.29	0.29	0.58
Totals	**$10.02**	**$16.44**	**$26.46**

CHAPTER 10. RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

This chapter presents the recommended CIP for the Dixon District's existing and buildout water system. Recommendations for improvements to the existing and buildout water system were described previously in Chapters 8 and 9, respectively. In addition, Chapters 4 and 7 provided renewal and replacement (R&R) improvements for the existing facilities. This chapter provides a summary of all the recommended improvement projects, along with estimates of probable construction costs. It should be noted that the recommended CIP only identifies improvements at a master plan level and does not constitute a design of such improvements. Subsequent detailed design is required to determine the exact sizes and locations of these proposed improvements.

Costs are presented in June 2009 dollars based on an Engineering News Record Construction Cost Index (ENR CCI) of 8578 (20 Cities Average). Total CIP costs include the following construction contingency and project cost allowances:

- Construction Contingency: 20 percent
- Project Cost Allowances:
  - Design: 10 percent
  - Construction Management: 10 percent
  - Administration: 8 percent

A complete description of the assumptions used in developing the estimates of probable construction cost is provided in Appendix P.

RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

Existing Water System Improvements

Chapter 8 provided a summary of the evaluation of the Dixon District's existing water system and its ability to meet the recommended operational and design criteria described in Chapter 5. In Chapter 8 evaluation, WYA assumed the new Station 09-01 and the 16-inch diameter pipeline are constructed (detailed map of facilities are provided in Chapter 8, Figure 8-4). Based on this assumption, additional improvements to the existing water system were recommended to eliminate existing deficiencies, as listed in the following section.

As discussed in Chapter 8, improvements to address fire flow requirements will be included in the future system evaluation because upsizing existing facilities for the sole purpose of increasing fire flow capacity to meet fire flow storage requirements would be cost prohibitive to the existing customers of the Dixon District. However, the fire flow capacity will be addressed in the future water system evaluation where system improvements are triggered when future users increase overall demands.

Based on evaluations in Chapters 4 and 7, there are several R&R recommendations for the existing facilities to be implemented in the 2009-2010 timeframe. The R&R recommendations in this chapter do not include the recommended improvement for O&M purposes, i.e. paint building, lighting, "tune up" or pump efficiency test as listed in Chapter 7.

Consequently, the existing system improvements and the 2009-2010 R&R improvements have been grouped into several recommended CIP projects, and include the following:

Existing System Improvements

- Storage Facility
  - Construct a new 0.3 MG pumped storage reservoir located at Station 10 [redacted] to provide additional storage capacity.
- Pump Station[1]
  - Construct a new 5.18 mgd booster pump station (3.02 mgd firm capacity) located [redacted] to increase pumping capacity and convey water from the proposed 0.3 MG storage reservoir.
- Backup Power
  - Install backup power for any proposed groundwater pumping facility to provide the Dixon District with additional supply reliability.

2009-2010 Renewal and Replacement Improvements

- R&R Well Replacement[2]
  - Replace wells 01-03, 02-01 and 03-01.
- R&R Well Pump
  - Convert pumps from oil-lube to water-lube at Wells 01-03, 02-01, 04-01, 06-01, 07-01 and 08-01.
  - Install new well pump at Well 05-01 (Cost is included in 2010 Preliminary Advance Budget)[3]
- R&R Treatment Facility
  - Install ion-exchange treatment for nitrate removal at Well 03-01 (Cost is included in 2008 Capital Budget)

[1] Cost estimate was based on the additional firm pumping capacity required.

[2] Assumes a conservative planning criterion where wells are replaced after a 50 year service life. However, the replacement of wells should be reviewed on case-by-case basis to determine if the well can be rehabilitated in lieu of replacement.

[3] CIP Information for Dixon District (provided by Tom Salzano, Cal Water, on August 12, 2008)

- R&R Control Panel
  - Install control panel at Well 01-03 (Cost is included in 2008 Capital Budget)
- R&R Emergency Generator
  - Install emergency generator at Well 01-03 (Cost is included in 2008 Capital Budget)
- R&R SCADA
  - Install SCADA at Wells 01-03, 03-01, 04-01, 06-01 and 08-01 (Costs for SCADA installation for Wells 04-01, 06-01 and 08-01 are included in 2010 Preliminary Advance Budget)

The locations of the recommended existing system and the 2009-2010 R&R CIP projects are shown on Figure 10-1. Details of the recommended existing system CIP projects are provided in Chapter 8. Details of the recommended R&R CIP projects are provided in Chapters 4 and 7.

Buildout Water System Improvements

Chapter 9 provided a summary of the evaluation of the Dixon District's buildout water system and its ability to meet the recommended operational and design criteria described in Chapter 5. Based on this evaluation, improvements to the buildout water system were recommended to meet projected demands. It should be noted that the timing of buildout system improvements will be triggered by specific developments and increase in system demands. Specific improvements required to meet maximum day plus fire flow demands at buildout are listed in Table 10-1.

Table 10-1. Recommended Pipeline Improvements for the Buildout Water System to Meet Fire Flow Requirements[a]

CIP ID[b]	Description	Length, feet	Diameter, inches
			Recommended
BFF01	Install new pipeline from [redacted]	1,133	12

[a] Improvements are illustrated on Figure 10-2.
[b] The "BFF" designation in the CIP ID indicates an improvement that is required to meet buildout fire flow requirements.

Additional specific buildout system improvements are needed to serve future customers as described below. Also, Chapters 4 and 7 provided R&R recommendations for the existing facilities to be implemented in the 2011-2035 timeframe. These additional buildout system and 2011-2035 R&R improvements have been grouped into several recommended CIP projects, and include the following:

Buildout System Improvements

- Storage Facility
  - Construct a new 0.7 MG pumped storage reservoir located [redacted].
- Pump Station[4]
  - Add 1.5 mgd of pumping capacity to existing Station 10 located [redacted].
- New Pipeline plus Bore and Jack
  - Install approximately 17,800 linear feet of proposed pipelines ranging from 8 to 12 inches, and one bore and jack crossings under the California Northern Railroad as shown on Figure 10-2.
- Backup Power
  - Install backup power at Well 02-01.

2011-2035 Renewal and Replacement Improvements

- R&R Well Replacement[5]
  - Wells 04-01, 05-01, 06-01, 07-01 and 08-01

The locations of the recommended buildout system and 2011-2035 R&R CIP projects are shown on Figure 10-2. Details of the recommended buildout system CIP projects are provided in Chapter 9, and details of the recommended R&R CIP projects for implementation from 2011 through 2035 are provided in Chapter 4.

Recommended CIP Costs

The recommended existing system and R&R CIP projects are presented in Table 10-2 and Table 10-3, respectively, along with their probable construction costs. The buildout system CIP projects are presented in Table 10-4 along with their probable construction costs. As shown, the existing system CIP cost is estimated to be approximately $ 4.1 million and the R&R CIP cost is estimated to be approximately $15.2 million. The buildout system CIP cost is estimated to be approximately $7.2 million. Buildout water system improvement cost should be appropriately allocated to existing and/or future users as shown in Table 10-4.

[4] Cost estimate was based on the additional firm pumping capacity required.

[5] Assumes a conservative planning criterion where wells are replaced after a 50 year service life. However, the replacement of wells should be reviewed on a case-by-case basis to determine if the well can be rehabilitated in lieu of replacement.

Recommended CIP Costs by Project Type

A summary of the costs for the recommended CIP by project type is provided in Table 10-5. As shown in Table 10-5, the total estimated recommended CIP cost for the Dixon District water system is estimated to be approximately $26.45 million.

CAPITAL IMPROVEMENT PROGRAM IMPLEMENTATION

As shown in Table 10-4, several improvement projects have been recommended for the buildout water system. The construction of the improvements for the buildout system should be coordinated with the proposed schedules of future development to ensure that the required infrastructure will be in place to serve future customers. However, if the buildout improvements are based on addressing deficiency in fire flows, emergency storage, or reliability issues, they should be the District's first priority. Figure 10-3 presents a schedule starting in 2009 for the construction of the recommended improvement projects to eliminate deficiencies in the existing and buildout water system.

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Table 10-2. Summary of Probable Construction Costs for Existing System CIP[a,b]

Improvement Type[c]	Improvement Description	CIP ID	Quantity	2009-2010 Estimated Construction Cost	2009-2010 CIP Cost[d] (including contingency and cost allowances)	2011 - 2015 Estimated Construction Cost	2011 - 2015 CIP Cost[d] (including contingency and cost allowances)	2016 - 2020 Estimated Construction Cost	2016 - 2020 CIP Cost[d] (including contingency and cost allowances)	2021 - 2025 Estimated Construction Cost	2021 - 2025 CIP Cost[d] (including contingency and cost allowances)	2026- 2030 Estimated Construction Cost	2026- 2030 CIP Cost[d] (including contingency and cost allowances)	2031 - 2035 Estimated Construction Cost	2031 - 2035 CIP Cost[d] (including contingency and cost allowances)	Cost for Future CIP by Project Type
EXISTING CAPITAL IMPROVEMENTS																
Storage Tank	New 0.3 MG Storage Tank[e,f]	CIP100	0.3 MG	$ 1,150,000	$ 1,766,400		$ -									$ 1,766,400
Pump Station	New 5.18 mgd Pump Station[f,g]	CIP100	5.2 mgd	$ 1,302,000	$ 1,999,872		$ -									$ 1,999,872
Backup Power	Install Backup Power for New 5.18 mgd Pump[h]	CIP100	each	190,000	$ 291,840		$ -									$ 291,840
	Total[d]			**$ 2,642,000**	**$ 4,058,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 4,058,000**
	Construction Contingency (20%)			$ 528,400		$ -		$ -		$ -		$ -		$ -		
	Total Construction Cost			**$ 3,170,400**		**$ -**		**$ -**		**$ -**		**$ -**		**$ -**		
	Engineering (10%)			$ 317,040		$ -		$ -		$ -		$ -		$ -		
	Construction Management (10%)			$ 317,040		$ -		$ -		$ -		$ -		$ -		
	Program Implementation (8%)			$ 253,632		$ -		$ -		$ -		$ -		$ -		
	Total Buildout System CIP Cost[d,i]			**$ 4,058,000**		**$ -**		**$ -**		**$ -**		**$ -**		**$ -**		

[a] Costs shown are based on June 2009 dollars and an ENR CCI of 8578 (20 Cities Average).
[b] Timing of buildout system improvements will be triggered by specific developments and increase in system demands.
[c] Cal Water funds all water supply related improvements. All other improvements are typically funded by the development community.
[d] Total cost rounded to nearest $1,000.
[e] Cost based on welded steel storage tanks to provide a more conservative cost estimate; however, a more economic option may be to use a bolted steel tank.
[f] Partial costs included in the Dixon Draft Preliminary Advance Budget (2008-2012); however, the estimated construction cost shown does not include the budgeted cost and reflects the cost assumptions presented in Appendix P.
[g] Cost determined using firm pumping capacity of 3.0 mgd.
[h] Based on cost developed from the Livermore District WSFMP.
[i] Cost is in current dollars and have not been escalated by the CPI of 3 to 5 percent.

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Table 10-3. Summary of Probable Construction Costs for Renewal and Replacement CIP[a]

Improvement Type	Improvement Description	CIP ID	Quantity	Cost Included in Cal Water CIP Budget	2009-2010		2011 - 2015		2016 - 2020		2021 - 2025		2026 - 2030		2031 - 2035		Cost for R&R CIP by Project Type
					Estimated Construction Cost	CIP Cost[b] (including contingency and cost allowances)	Estimated Construction Cost	CIP Cost[b] (including contingency and cost allowances)	Estimated Construction Cost	CIP Cost[b] (including contingency and cost allowances)	Estimated Construction Cost	CIP Cost[b] (including contingency and cost allowances)	Estimated Construction Cost	CIP Cost[b] (including contingency and cost allowances)	Estimated Construction Cost	CIP Cost[b] (including contingency and cost allowances)	
RENEWAL AND REPLACEMENT IMPROVEMENTS																	
Renewal and Replacement	Convert Station 01-03 Well Pump from Oil-Lube to Water-Lube [c]	R&R-WL-STA01	each		$ 40,000	$ 61,440											
Renewal and Replacement	Convert Station 02-01 Well Pump from Oil-Lube to Water-Lube [c]	R&R-WL-STA02	each		$ 40,000	$ 61,440											
Renewal and Replacement	Convert Station 04-01 Well Pump from Oil-Lube to Water-Lube [c]	R&R-WL-STA04	each		$ 40,000	$ 61,440											
Renewal and Replacement	Convert Station 06-01 Well Pump from Oil-Lube to Water-Lube [c]	R&R-WL-STA06	each		$ 40,000	$ 61,440											$ 368,640
Renewal and Replacement	Convert Station 07-01 Well Pump from Oil-Lube to Water-Lube [c]	R&R-WL-STA07	each		$ 40,000	$ 61,440											
Renewal and Replacement	Convert Station 08-01 Well Pump from Oil-Lube to Water-Lube [c]	R&R-WL-STA08	each		$ 40,000	$ 61,440											
Renewal and Replacement	Install New Pump at Station 05-01 Well	R&R-PMP-STA05	each	$ 69,800 [d, i]													$ -
Renewal and Replacement	Install Ion-exchange for Nitrate Removal at Station 03-01 Well	R&R-IE-STA03	each	$ 216,000 [e, i]													$ -
Renewal and Replacement	Install Contro Panel at Station 01-03 Well	R&R-CP-STA01	each	$ 12,600 [f, i]													$ -
Renewal and Replacement	Install Emergency Generator at Station 01-03 Well	R&R-GEN-STA01	each	$ 59,400 [g, i]													$ -
Renewal and Replacement	Install SCADA at Station 01-03 Well	R&R-SC-STA01	each		$ 18,000	$ 27,648											
Renewal and Replacement	Install SCADA at Station 03-01Well	R&R-SC-STA03	each		$ 18,000	$ 27,648											
Renewal and Replacement	Install SCADA at Station 04-01Well	R&R-SC-STA04	each	$ 18,000 [h, i]													$ 55,296
Renewal and Replacement	Install SCADA at Station 06-01Well	R&R-SC-STA06	each	$ 18,000 [h, i]													
Renewal and Replacement	Install SCADA at Station 08-01 Well	R&R-SC-STA08	each	$ 18,000 [h, i]													
Renewal and Replacement	Replace Groundwater Well	R&R-GW-STA01	each		$ 1,200,000	$ 1,843,200											
Renewal and Replacement	Replace Groundwater Well	R&R-GW-STA02	each		$ 1,200,000	$ 1,843,200											
Renewal and Replacement	Replace Groundwater Well	R&R-GW-STA03	each		$ 1,200,000	$ 1,843,200											
Renewal and Replacement	Replace Groundwater Well	R&R-GW-STA04	each						$ 1,200,000	$ 1,843,200							
Renewal and Replacement	Replace Groundwater Well	R&R-GW-STA05	each								$ 1,200,000	$ 1,843,200					$ 14,745,600
Renewal and Replacement	Replace Groundwater Well	R&R-GW-STA06	each								$ 1,200,000	$ 1,843,200					
Renewal and Replacement	Replace Groundwater Well	R&R-GW-STA07	each										$ 1,200,000	$ 1,843,200			
Renewal and Replacement	Replace Groundwater Well	R&R-GW-STA08	each										$ 1,200,000	$ 1,843,200			
		Total[b]		**NA**	**$ 3,876,000**	**$ 5,954,000**	**$ -**	**$ -**	**$ 1,200,000**	**$ 1,843,000**	**$ 2,400,000**	**$ 3,686,000**	**$ 2,400,000**	**$ 3,686,000**	**$ -**	**$ -**	**$ 15,169,500**
		Construction Contingency (20%)			$ 775,200		$ -		$ 240,000		$ 480,000		$ 480,000		$ -		
		Total Construction Cost			**$ 4,651,200**		**$ -**		**$ 1,440,000**		**$ 2,880,000**		**$ 2,880,000**		**$ -**		
		Total Construction Cost			$ 465,120		$ -		$ 144,000		$ 288,000		$ 288,000		$ -		
		Construction Management (10%)			$ 465,120		$ -		$ 144,000		$ 288,000		$ 288,000		$ -		
		Program Implementation (8%)			$ 372,096		$ -		$ 115,200		$ 230,400		$ 230,400		$ -		
		Total R&R CIP Cost[b,e]			**$ 5,954,000**		**$ -**		**$ 1,843,000**		**$ 3,686,000**		**$ 3,686,000**		**$ -**		

[a] Costs shown are based on May 2009 dollars and an ENR CCI of 8574 (20 Cities Average).
[b] Total cost rounded to nearest $1,000.
[c] Based on cost estimation for Dixon Station 03-01 Water Lube Conversion from Durham Pump, Inc. (dated February 22, 2008).
[d] Pump cost was included in 2010 Preliminary Advance Budget for Dixon District (Information was received from Tom Salzano, Cal Water, on August 12, 2008).
[e] Ion-exchange treatment facility cost was included in 2008 Preliminary Advance Budget for Dixon District (Information was received from Tom Salzano, Cal Water, on August 12, 2008).
[f] Control panel cost was included in 2008 Preliminary Advance Budget for Dixon District (Information was received from Tom Salzano, Cal Water, on August 12, 2008).
[g] Emergency generator cost was included in 2008 Preliminary Advance Budget for Dixon District (Information was received from Tom Salzano, Cal Water, on August 12, 2008).
[h] SCADA cost was included in 2010 Preliminary Advance Budget for Dixon District (Information was received from Tom Salzano, Cal Water, on August 12, 2008).
[i] Since improvement cost is already included in Cal Water Budget, no CIP cost is allocated for this facility in the development of the WSFMP.

Table 10-4. Summary of Probable Construction Costs for Buildout (2035) System CIP [a,b]

Improvement Type[c]	Improvement Description	CIP ID	Quantity	2009-2010		2011 - 2015		2016 - 2020		2021 - 2025		2026- 2030		2031 - 2035		Cost for Future CIP by Project Type
				Estimated Construction Cost	CIP Cost[d] (including contingency and cost allowances)	Estimated Construction Cost	CIP Cost[d] (including contingency and cost allowances)	Estimated Construction Cost	CIP Cost[d] (including contingency and cost allowances)	Estimated Construction Cost	CIP Cost[d] (including contingency and cost allowances)	Estimated Construction Cost	CIP Cost[d] (including contingency and cost allowances)	Estimated Construction Cost	CIP Cost[d] (including contingency and cost allowances)	
BUILDOUT (2035) CAPITAL IMPROVEMENTS																
New Pipeline	12-inch diameter, 1,133 lf	BFF01	1,133 lf			$ 226,515	$ 347,928									
New Pipeline	8-inch diameter, 7,626 lf	Group A	7,626 lf											$ 1,067,618	$ 1,639,862	
New Pipeline	8-inch diameter, 2,395 lf	Group B	2,395 lf							$ 335,287	$ 515,000					$ 4,173,333
New Pipeline	8-inch diameter, 4,636 lf	Group C	4,636 lf			$ 649,039	$ 996,924									
New Pipeline	12-inch diameter, 3,133 lf	Group C	3,133 lf			$ 438,554	$ 673,620									
Storage Tank	New 0.7 MG Storage Tank[e,f]	BCIP101	0.7 MG					$ 1,420,000	$ 2,181,120							$ 2,181,120
Pump Station	New Additional 1.5 mgd Pump [f,g]	BCIP101	1.5 mgd					$ 30,000	$ 46,080							$ 46,080
Backup Power	Install Backup Power for Station 02-01[h]	BCIP102	each			$ 190,000	$ 291,840									$ 291,840
Bore and Jack	Bore and Jack Pipeline, 12-inch diameter	Group C	763 lf							$ 343,445	$ 527,532					$ 527,532
	Total[d]			**$ -**	**$ -**	**$ 1,504,109**	**$ 2,310,000**	**$ 1,450,000**	**$ 2,227,000**	**$ 678,732**	**$ 1,043,000**	**$ -**	**$ -**	**$ 1,067,618**	**$ 1,640,000**	**$ 7,219,000**
	Construction Contingency (20%)			$ -		$ 300,822		$ 290,000		$ 135,746		$ -		$ 213,524		
	Total Construction Cost			**$ -**		**$ 1,804,931**		**$ 1,740,000**		**$ 814,478**		**$ -**		**$ 1,281,142**		
	Engineering (10%)			$ -		$ 180,493		$ 174,000		$ 81,448		$ -		$ 128,114		
	Construction Management (10%)			$ -		$ 180,493		$ 174,000		$ 81,448		$ -		$ 128,114		
	Program Implementation (8%)			$ -		$ 144,394		$ 139,200		$ 65,158		$ -		$ 102,491		
	Total Buildout System CIP Cost[d,i]			**$ -**		**$ 2,310,000**		**$ 2,227,000**		**$ 1,043,000**		**$ -**		**$ 1,640,000**		

[a] Costs shown are based on June 2009 dollars and an ENR CCI of 8578 (20 Cities Average).
[b] Timing of buildout system improvements will be triggered by specific developments and increase in system demands.
[c] Cal Water funds all water supply related improvements. All other improvements are typically funded by the development community.
[d] Total cost rounded to nearest $1,000.
[e] Cost based on welded steel storage tanks to provide a more conservative cost estimate; however, a more economic option may be to use a bolted steel tank.
[f] Partial costs included in the Dixon Draft Preliminary Advance Budget (2008-2012); however, the estimated construction cost shown does not include the budgeted cost and reflects the cost assumptions presented in Appendix P.
[g] Cost determined using firm pumping capacity of 1.5 mgd.
[h] Based on cost developed from the Livermore District WSFMP.
[i] Cost is in current dollars and have not been escalated by the CPI of 3 to 5 percent.

Table 10-5. Estimated Cost of Recommended CIP by Project Type

CIP Project Type	2009-2010 CIP[a], million dollars	2011-2035 CIP [b,c,d], million dollars	Total CIP Cost[a,b], million dollars
R&R Water Lube Conversion	0.37	-	0.37
R&R SCADA	0.06	-	0.06
R&R Replace Well	5.53	9.22	14.75
Storage Facility[e]	1.77	2.18	3.95
Pump Station	2.00	0.05	2.05
New Pipeline	-	4.17[f]	4.17
Bore and Jack	-	0.53[f]	0.53
Backup Power	0.29	0.29	0.58
Total[g]	$10.02	$16.44	$26.46

(a) Includes 2009-2010 R&R projects.
(b) Includes 2011-2035 R&R projects.
(c) Timing of buildout system improvements will be triggered by specific developments and increase in system demands.
(d) Buildout system CIP costs are in current dollars and have not been escalated by the CPI of 3 to 5 percent.
(e) Cost based on welded steel storage tanks to provide a more conservative cost estimate; however, a more economic option may be to use a bolted steel tank.
(f) Cost typically funded by developers, except for CIP BFF01 at $0.35 million of the total $4.17 million which is a recommended new pipeline to alleviate fire flow deficiency.
(g) Total cost based on the June 2009 ENR index of 8578 and includes construction contingency and project cost allowances.

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LEGEND:

- Proposed Near Term Station 9
- Recommended Pumped Storage
- 2009 - 2010 Renewal and Replacement
- Proposed Near Term Pipeline
- Pipeline
- Dixon District Service Boundary

N

0 400 800 1,600

Scale in Feet

FIGURE 10-1

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

EXISTING SYSTEM IMPROVEMENTS AND 2009 - 2010 R&R

WEST YOST ASSOCIATES
Consulting Engineers

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LEGEND:

- Existing Pipeline
- Recommended Fire Flow Improvement
- Recommended Future Pipeline
- Recommended Pumped Storage
- Add Backup Power
- 2011-2035 Renewal and Replacement
- Dixon District
- CIP Group A
- CIP Group B
- CIP Group C

N

0 395 790 1,580

Scale in Feet

FIGURE 10-2

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

BUILDOUT SYSTEM
IMPROVEMENTS AND 2011-2035 R&R

WEST YOST ASSOCIATES
Consulting Engineers

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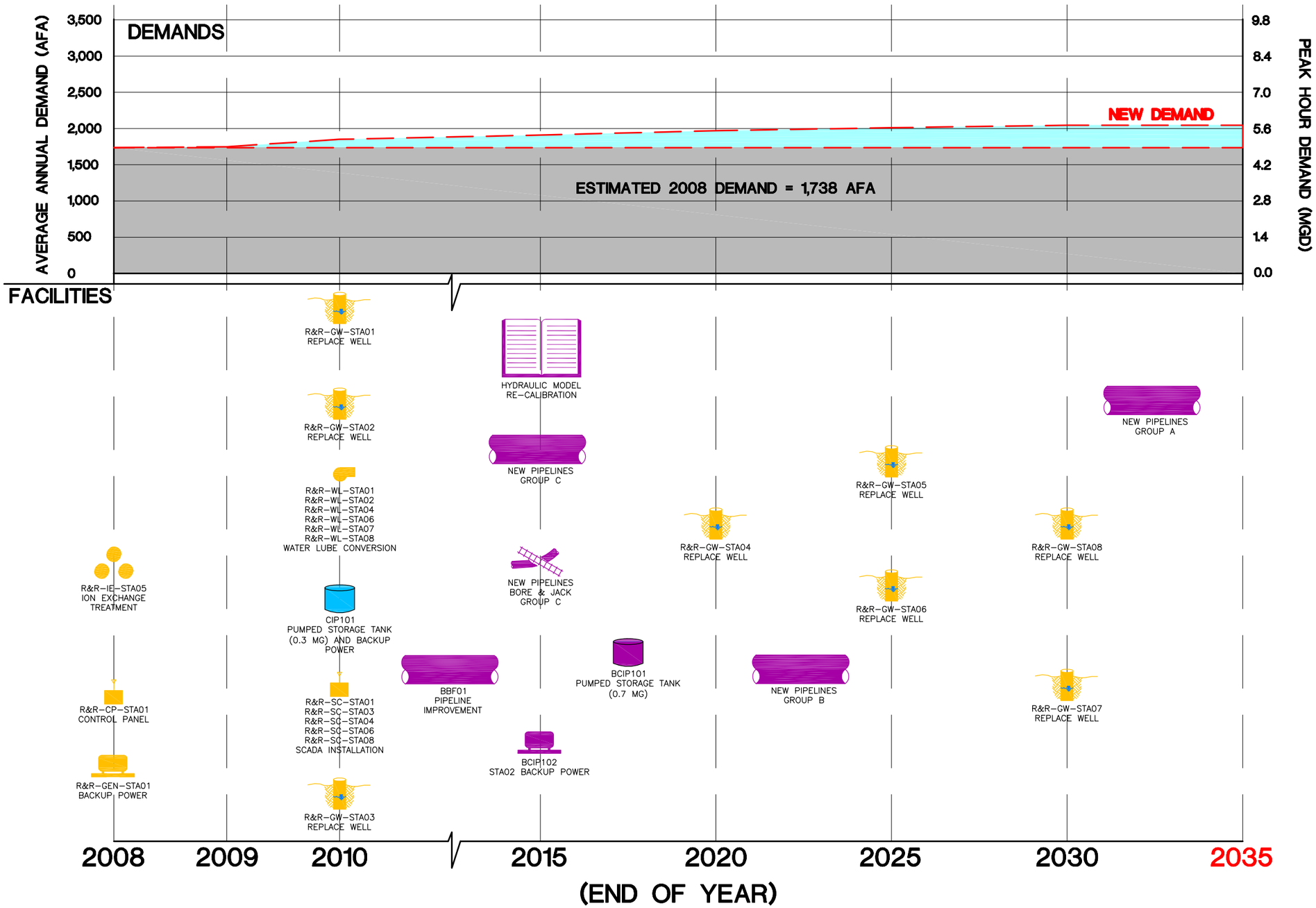
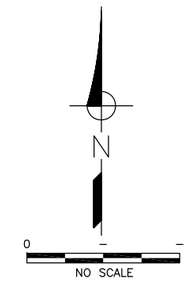
FIGURE 10-3

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

TIMING OF MAJOR WATER SUPPLY AND DISTRIBUTION FACILITIES





NOTES:

- Proposed timing of recommended improvements shown is preliminary and is subject to change as individual projects are further studied and refined.

LEGEND:

- EXISTING SYSTEM IMPROVEMENT
- RENEWAL AND REPLACEMENT IMPROVEMENT
- BUILDOUT SYSTEM IMPROVEMENT

CALIFORNIA WATER SERVICE CO.

WEST YOST ASSOCIATES Consulting Engineers

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CHAPTER 2: EXISTING WATER SYSTEM

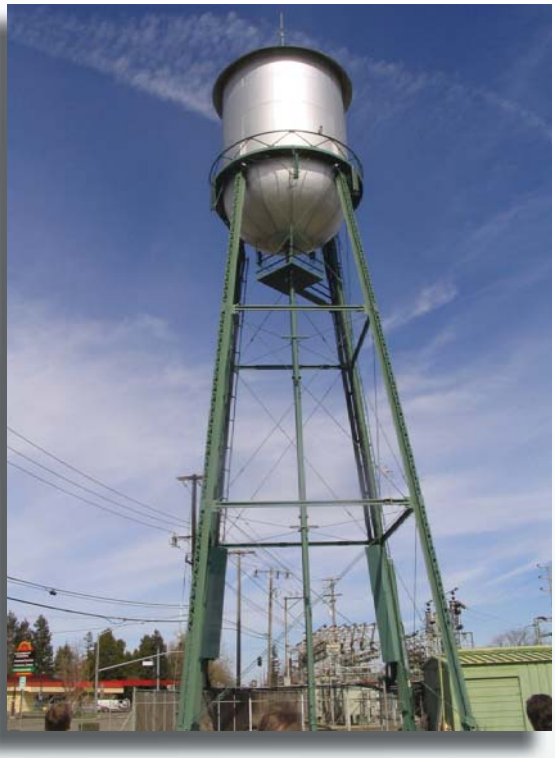
Chapter Highlights:

Cal Water's Dixon District currently provides potable water service to a portion of the City of Dixon and adjacent unincorporated territory in Solano County; this District is located in the Sacramento Valley about 20 miles west of the City of Sacramento and the Sacramento River. The Dixon District service area is approximately 1,044 acres, or about 2 square miles.

Chapter Contents:

- Existing Service Area
- Existing Service Connections and Population Served
- Existing Water Supplies
- Existing Water System Facilities

The purpose of this chapter is to describe Cal Water's Dixon District existing (2008) water distribution system. System information was obtained through the review of previous reports, maps, plans, operating records, and other available data provided to WYA by Cal Water.



CHAPTER 2. EXISTING WATER SYSTEM

The purpose of this chapter is to describe Cal Water's Dixon District (Dixon District) existing 2008 water distribution system. System information was obtained through the review of previous reports, maps, plans, operating records, and other available data provided to WYA by Cal Water. The following sections of this chapter describe the components of the Dixon District existing water distribution system:

- Existing Service Area
- Existing Service Connections and Population Served
- Existing Water Supplies
- Existing Water System Facilities

EXISTING SERVICE AREA

Cal Water's Dixon District currently provides potable water service to a portion of the City of Dixon (City) and adjacent unincorporated territory in Solano County. The Dixon District is located in the Sacramento Valley approximately 20 miles west of the City of Sacramento and the Sacramento River. As shown on Figure 2-1, the Dixon District service area is approximately 1,044 acres, or about 1.6 square miles.

The Dixon District serves the central portions of the City. Areas within the City limits not served by Cal Water are served by the Dixon-Solano Municipal Water Service (DSMWS), which is operated and maintained by the Solano Irrigation District.

Figure 2-1 also shows that the Dixon District is bounded by the City limits in the north, west, and south and by the Solano Irrigation District in the east. Land to the east of the Dixon District is available for potential development. Currently, no development plans exist. Therefore, potential growth for the Dixon District in the near future includes infill and redevelopment.

EXISTING SERVICE CONNECTIONS AND POPULATION SERVED

The purpose of this section is to describe the existing number of services and population served, as of 2007, within the Dixon District. A more complete description of the historical number of services and population estimation methodology, and how it was used to estimate the population to be served in the future, is provided in *Chapter 3 Water Demands*.

The following is discussed in this section:

- Existing Service Connections in 2007
- Existing Population in 2007

Existing Service Connections in 2007

The Dixon District currently has six different revenue classes which make up its 2,854 service connections. This total does not include the 31 flat accounts for fire protection. A breakdown of the number of connections by revenue class is provided in Table 2-1. As shown in Table 2-1, approximately 94 percent of the Dixon District's connections are either Single Family or Multi Family Residential.

Table 2-1. Existing 2007 Service Connections by Revenue Class[(a)]

Revenue Class	Number of Connections in 2007	Percent of Total Connections
Single Family Residential	2,653	93.0
Multi Family Residential	16	0.6
Commercial	152	5.3
Industrial	4	0.1
Government	25	0.9
Other	4	0.1
Total	2,854	100.0

[(a)] Data provided by Cal Water (05DIX.xls) on 5/12/08.

Existing Population in 2007

The Dixon District serves adjacent unincorporated territory in Solano County; therefore, the use of traditional sources of the City's historical population data was not possible to determine the existing population served by the Dixon District. Consequently, the population served was estimated using housing densities developed by the California Department of Finance (CDOF) and the number of dwelling units as provided by Cal Water staff, and then calibrated using 2000 Census Block data that was also provided by Cal Water staff. Based on this methodology, the estimated population served by the Dixon District in 2007 was 8,144 people. As mentioned previously, a more thorough discussion of the historical population is provided in *Chapter 3 Water Demands*.

EXISTING WATER SUPPLIES

The Dixon District relies entirely on groundwater for its water supply. Groundwater from eight Cal Water owned wells is pumped directly into the distribution system and one elevated steel tank to serve the Dixon District. All wells are active. Two new wells and a storage tank are currently in design and are anticipated to be completed by 2010.

A complete description of the Dixon District's existing water supply is provided in *Chapter 4 Integrated Water Supply Plan* of this report.

EXISTING WATER SYSTEM FACILITIES

The Dixon District's water system facilities (including groundwater wells and storage facility) are located at numbered "stations" positioned throughout the service area. The components of the existing water system facilities are discussed in Chapters 7 through 9. Facility assessments are discussed in *Chapter 7 Facility Assessment* of this report. The evaluation of facility capacities and their ability to meet existing and future potable water demands is described in *Chapter 8 Evaluation of Existing Water System* and *Chapter 9 Evaluation of Future Water System*, respectively.

Provided below is a description of the following existing facilities:

- Well Facilities
- Water Storage Facilities
- Distribution System and Pipelines
- Telemetry/SCADA System
- Emergency Interties

Well Facilities

The Dixon District currently has eight active groundwater wells (see Figure 2-2) that are all currently chlorinated using either sodium hypochlorite or calcium hypochlorite methods. Wells 003-01 and 005-01 also have high nitrate levels and will be treated at Station 5 with ion exchange to reduce the nitrate levels to below the Maximum Contaminant Level (MCL). The ion exchange treatment facility is under design and is currently being reviewed by Cal Water staff.

Well 009-01 is a new well that is currently under design for completion in 2010. The property for Well 009-01 has been acquired; however the well has not yet been drilled. Another new well and storage tank is also under design for completion in 2010. Potential property for the site has been identified but has not yet been acquired.

Table 2-2 presents a summary of the existing well facilities, well status, and key characteristics. A review of Table 2-2 also indicates that the current design pumping capacity of the Dixon District's active wells is approximately 4,000 gallons per minute (gpm), or 5.76 million gallons per day (mgd).

Water Storage Facilities

The Dixon District currently operates one elevated steel tank (see Figure 2-2). Table 2-3 presents a summary of the tank type, age, and capacity. As shown in Table 2-3, the Dixon District currently has a total above-ground storage capacity of 0.075 million gallons (75,000 gallons). A complete evaluation of Tank 1 is provided in *Chapter 7 Facility Assessments*.

Table 2-2. Dixon District Well Facilities[a]

Well Number (Station Number)	Current Status	Year of Well Construction	Total Depth, feet	Year of Pump Installation	Design Flow Capacity, gpm[b]	Total Dynamic Head, ft
Active Wells						
001-03	Active	1954	538	1954	500	238
002-01[c]	Active	1950	578	1988	700	180
003-01[c]	Active	1956	602	1956	600	210
004-01	Active	1966	665	1966	650	200
005-01[c]	Active	1973	650	2003	600	320
006-01	Active	1976	648	1998	850	220
007-01	Active	1979	820	2000	800	245
008-01	Active	1979	860	1979	500	379

(a) Data provided by Cal Water's Station Equipment Profile sheets provided by Cal Water on 6/20/08.

(b) Flow capacity for the wells based on design capacity. Due to the age and efficiencies of the Dixon wells, most of the listed design flows have decreased. The adjusted values are described further in Chapters 6 and 7.

(c) Historically, these wells have high nitrates and are not operated as frequently as the other wells. Station 002-01 currently has a nitrate analyzer, which is why DPH has allowed Cal Water to operate this well.

Table 2-3. Dixon District Storage Facilities[(a)]

Storage Facility Name/Number	Station Number	Storage Type	Material	Year Constructed	Overflow Elevation, ft[(b)]	Storage Capacity, MG
Tank 1	001	Elevated Tank	Steel	1924	105.5	0.075
Total Storage Capacity, million gallons						0.075

(a) Data provided by Cal Water's Station Equipment Profile Sheets provided by Cal Water on 6/20/08.
(b) Data provided by Dixon Station Schematic provided by Cal Water on 6/20/08.

Distribution System and Pipelines

The Dixon District water distribution system is operated as one single pressure zone. There are approximately 32 miles (167,931 feet) of pipeline in the Dixon District service area that range in size from 2 to 12 inches in diameter. Pipeline materials consist mainly of asbestos cement (AC), cast iron (CI), and polyvinyl chloride (PVC). Table 2-4 provides a summary of pipeline material type within the service area. Figure 2-2 provides a layout of the Dixon District water distribution system.

Telemetry/SCADA System

Pressure and flow data at each station are currently recorded using telemetry chart recorders for all stations in the system and Supervisory Control and Data Acquisition (SCADA) for four stations in the system. Cal Water currently has plans to complete SCADA installation at all its active facilities by 2010. Analyses in this Water Supply and Facilities Master Plan are based on the available telemetry and SCADA data.

Emergency Interties

For emergency purposes, the Dixon District maintains three emergency interties with DSMWS which serves the City of Dixon. As illustrated Figure 2-2, these interties are located at the following location:

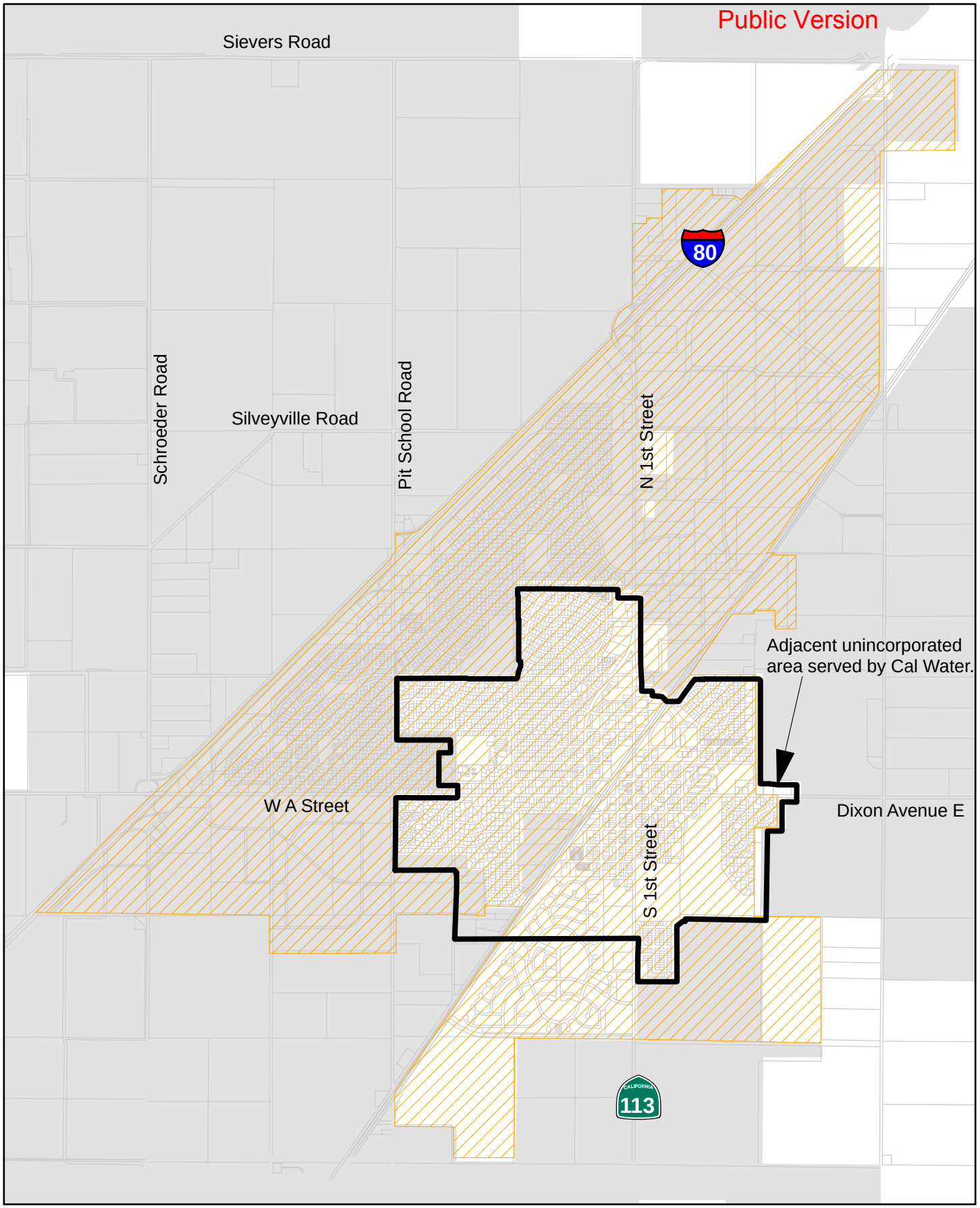
- Two 6-inch standard meters located [redacted];
- One 2-way 6-inch meter located [redacted]; and
- One 2-way 8-inch meter located [redacted].

These interties are designed for short-term demand shortage assistance.

Table 2-4. Dixon District Pipeline Material Types[(a)]

Material	Acronym	Length of Pipelines, ft	Percent in Water System
Asbestos Cement	AC	126,906	75.6
Cast Iron	CI	15,772	9.4
Polyvinyl Chloride	PVC	12,365	7.4
Ductile Iron	DI	3,821	2.3
Wrought Iron	WI	3,786	2.3
Transite (AC)	TRANS	2,142	1.3
Unlined Cast Iron	UCI	2,056	1.2
Steel	STL	722	0.4
Cement Line & Coated	CL&C	213	0.1
Stainless Steel	SS	76	0.0
Copper	COP	42	0.0
Galvanized Steel	GALV	27	0.0
Standard Steel	STD STL	3	0.0
Total		167,931	100.0

(a) Data includes all active pipelines in the PressurizedMain feature class provided by Cal Water in the Dixon District geodatabase provided on 6/20/08.



LEGEND:

- Dixon District
- City of Dixon
- Solano Irrigation District
- Parcels

N

0 700 1,400 2,800

S

FIGURE 2-1

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

SERVICE AREA

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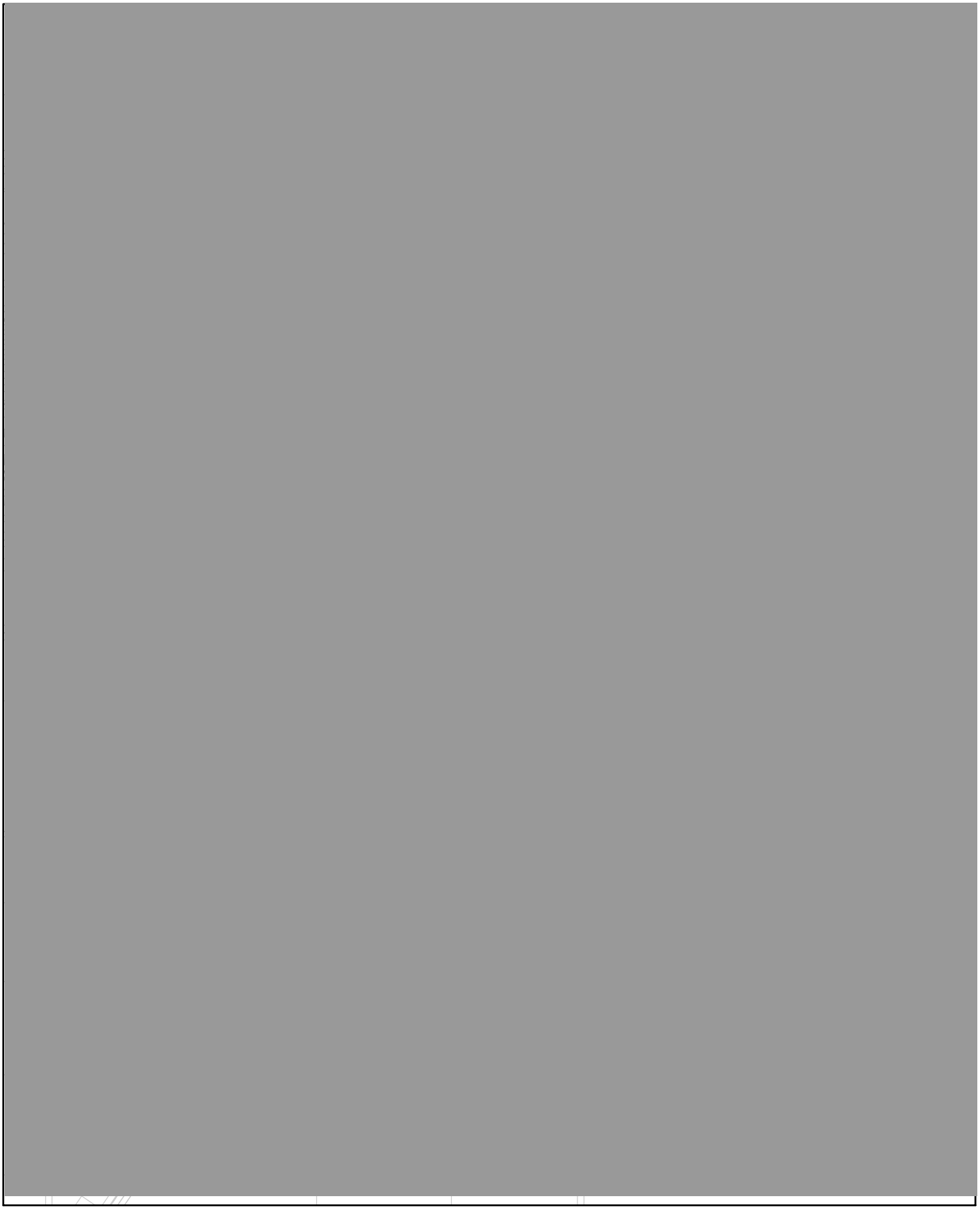

LEGEND:

- Active Well
- Potable Water Storage
- Pipeline
- Dixon District
- Parcels

Emergency Connection (D.S.M.W.S.)

- Standard Connection
- 2-Way Connection

N

0 325 650 1,300

FIGURE 2-2

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

EXISTING WATER SYSTEM

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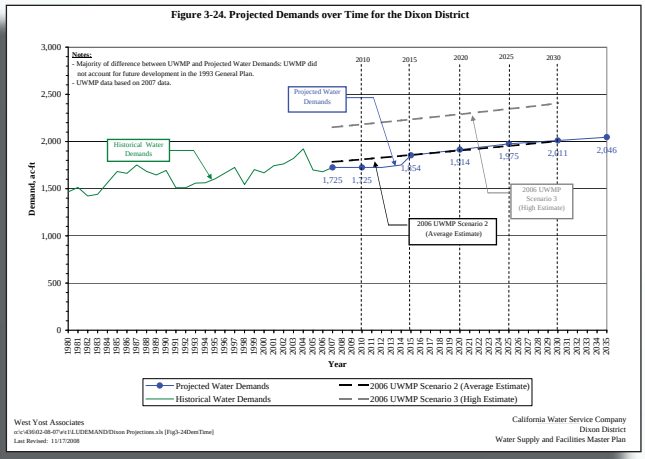
CHAPTER 3: WATER DEMANDS

Chapter Highlights:



Chapter Contents:

- Description of the Dixon District
- Historical Water Production and Consumption
- Adopted Peaking Factors
- Projected Water Demands
- Projected Number of Services
- Projected Population Served

The purpose of this chapter is to present the current and projected potable water demands served by Cal Water in its Dixon District. Accurate and detailed potable water demand estimates are required to develop and calibrate the potable water system hydraulic model, help identify deficiencies in the existing potable water system, and assist in the assessment of future system capacity and future capital improvement projects based on planned development. Future water demand projections also play a key role in helping Cal Water identify and secure sufficient water supplies to serve their Dixon District customers under various hydrologic conditions.

TABLE 3-10. PROJECTED WATER DEMANDS

LAND USE DESIGNATION	UNIT DEMAND FACTOR, AF/AC/YR	ADDITIONAL ACREAGE	ADDITIONAL CONSUMPTION, AF/YEAR
Very Low Density	0.59	12.2	7.16
Low Density	2.70	62.3	168.50
Medium Low Density	2.89	27.2	78.62
Medium High Density	5.02	5.9	29.67
High Density	2.86	0.0	0.00
General Industrial	0.36	0.4	0.39
Downtown	2.17	0.0	0.00
Neighborhood Commercial	1.21	0.0	0.00
Commercial Services	1.05	13.3	14.06
Professional/Administrative Offices	3.52	0.0	0.00
Core Area Mixed Use	1.58	0.0	0.00
Governmental/Institutional	0.70	0.0	0.00
Parks	0.91	0.0	0.00
School Buildings/Play Areas	2.57	0.0	0.00
Subtotal		121	298
UAFW (7%)[(a)]			*22*
Total Additional Production Added from 2007 to Buildout			321
Existing 2007 Production[(d)]			1,725
Total Future Water Demand			2,046
Percentage Increase			*19%*

[(a)] *7% UAFW is based on the 10 year historical UAFW average.*

CHAPTER 3. WATER DEMANDS

The purpose of this chapter is to present the current and projected potable water demands served by Cal Water in its Dixon District. Accurate and detailed potable water demand estimates are required to develop and calibrate the potable water system hydraulic model, help identify deficiencies in the existing potable water system, and assist in the assessment of future system capacity and future CIPs based on planned development. Future water demand projections also play a key role in helping Cal Water identify and secure sufficient water supplies to serve their Dixon District customers under various hydrologic conditions.

The following sections of this chapter describe the data and methodology utilized to determine the Dixon District's potable water system demands:

- Description of the Dixon District
- Historical Water Production and Consumption
- Adopted Peaking Factors
- Projected Water Demands
- Projected Number of Services
- Projected Population Served

DESCRIPTION OF THE DIXON DISTRICT

The Dixon District is located in Solano County approximately 20 miles west of the City of Sacramento and the Sacramento River. The Dixon District service area is approximately 1,044 acres or about 1.6 square miles. The Dixon District serves the central portions of the City of Dixon. Areas within the City limits not served by Cal Water are served by the DSMWS, which is operated and maintained by the Solano Irrigation District. Figure 3-1 presents the location of the Dixon District along with the areas served by the City of Dixon.

Figure 3-1 also shows that the Dixon District is bounded by the Solano Irrigation District in the east and by the city limits in the north, west, and south. Land to the east of the Dixon District is available for potential development, however no development plans currently exist. Therefore, potential growth for the Dixon District in the near future includes infill and redevelopment.

Subsequent sections describe the historical number of services by revenue class, estimated population served, and the existing and projected land uses within the Dixon District.

Historical Number of Services by Revenue Class

Cal Water tracks the number of services within the Dixon District using six different revenue classes: Single Family Residential Metered, Multi Family Residential, Commercial, Industrial, Government, and Other. The Single Family Residential class usually designates a service

typically served by an individual meter and an individual account, while the Multi Family Residential class usually designates an individual meter with more than one account.[1]

The Commercial and Industrial classes designate typical commercial and industrial uses, such as a store for commercial or a manufacturing company for industrial.[2] The Government class includes all uses operated by a governing body (e.g., City Hall); however, it also includes schools, parks, and cemeteries.[3] The Other class includes all construction or "other" metered water uses that do not fit within the other six categories.[4]

Table 3-1 summarizes the historical number of services within the Dixon District by revenue class between years 1980 and 2007. All classes have little or no growth throughout the 28-year span. The Single Family Residential class experienced low growth during this span and plateaus from 1999 to 2007. The Multi-Family Residential class registered growth between 1980 and 1989, and was unchanged between 1990 and 2007. Although Commercial class service did not significantly vary between 1980 and 2006, between 2006 and 2007 Commercial class services increased 6.30 percent. The Industrial class ranges from 3 to 5 service connections for the last 28 years. The Other class fluctuates between 1 to 3 service connections between years 1980 and 1987, but it was inactive between 1988 and 2003 with 0 service connections, and within the last four years the service connections fluctuated between 3 and 4. Very little or no growth of the historical number of service for each of the six revenue classes indicate that the Dixon District has reached or is nearing buildout.

Historical Population Served

As discussed previously, the Dixon District serves adjacent unincorporated areas in Solano County and therefore, the use of traditional sources of the City's historical population data was not possible to determine the existing population served by the Dixon District. Consequently, the population served by the Dixon District was estimated using historical housing densities (i.e., people per dwelling unit) developed by the California Department of Finance (CDOF) and the number of dwelling units as provided by Cal Water staff. The historical housing densities were first calibrated to reflect the conditions in the Dixon District by using 2000 Census Block data and the number of dwelling units determined by Cal Water staff in the year 2000.

[1] Definitions of each revenue class obtained from "Operating Revenue 5010" sheet and discussions with Cal Water Staff.

[2] Definitions of each revenue class obtained from "Operating Revenue 5010" sheet and discussions with Cal Water Staff.

[3] Definitions of each revenue class obtained from "Operating Revenue 5010" sheet and discussions with Cal Water Staff.

[4] Definitions of each revenue class obtained from "Operating Revenue 5010" sheet and discussions with Cal Water Staff.

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Table 3-1. Historical Services by Revenue Class, af[a]

Year	Single Family Residential	Multi-Family Residential	Commercial	Industrial	Government	Other	Total Services
1980	2,156	3	134	4	19	2	2,318
1981	2,207	8	138	4	22	1	2,380
1982	2,216	11	138	4	23	1	2,393
1983	2,241	11	140	4	23	1	2,420
1984	2,292	13	140	3	24	1	2,473
1985	2,329	14	139	4	25	2	2,513
1986	2,345	16	142	3	25	1	2,532
1987	2,370	16	142	4	25	1	2,558
1988	2,386	16	142	4	24	0	2,572
1989	2,391	16	141	4	24	0	2,576
1990	2,394	17	142	4	26	0	2,583
1991	2,420	17	139	4	26	0	2,606
1992	2,429	17	138	4	26	0	2,614
1993	2,459	17	138	4	26	0	2,644
1994	2,486	17	137	4	27	0	2,671
1995	2,505	17	137	4	27	0	2,690
1996	2,519	17	136	4	28	0	2,704
1997	2,539	17	135	4	27	0	2,722
1998	2,587	17	136	3	25	0	2,768
1999	2,628	17	138	3	25	0	2,811
2000	2,635	17	136	4	23	0	2,815
2001	2,634	17	134	4	22	0	2,812
2002	2,640	17	136	5	24	0	2,822
2003	2,637	17	136	5	25	0	2,820
2004	2,636	17	139	5	24	3	2,824
2005	2,657	17	141	4	24	3	2,846
2006	2,666	17	143	4	25	4	2,859
2007[b]	2,653	16	152	4	25	4	2,854
Historical Average	2,466	15	139	4	25	1	2,650
20-Year Average[c]	2,545	17	139	4	25	1	2,731
10 Year Average[d]	2,637	17	139	4	24	1	2,823
5-Year Average[e]	2,650	17	142	4	25	3	2,841
Average Annual % Growth	0.77%	9.12%	0.48%	1.34%	1.06%	12.35%	0.78%

[a] Data provided by Cal Water (Dixon UWMP.xls)
[b] Data for 2007 is from Cal Water (05DIX.xls)
[c] 20-Year Average: 1988-2007
[d] 10-Year Average: 1998-2007
[e] 5-Year Average: 2003-2007
af = Acre-Feet

Estimated Historical Housing Density

The CDOF estimates historical housing densities for the area within the City's limits. The Dixon District serves approximately half of the City and therefore, the CDOF estimates provide a good approximation of changes in housing densities within the Dixon District over time.

Historical housing densities from 1990 to 2007 were downloaded from the CDOF website[5], and plotted on Figure 3-2. Housing densities from the CDOF website are not available prior to 1990. Because these historical housing densities were developed for the area within the City limits, they had to be adjusted to reflect the conditions in the Dixon District service area. Consequently, the historical housing densities were calibrated by using 2000 Census Block data and the number of dwelling units determined by Cal Water staff in the year 2000.

Cal Water staff was able to estimate the population served for calendar year 2000 by using GIS Census Block data determined from the location of the Dixon District service area and the 2000 Census data. Appendix A presents the Census Block data used by Cal Water. Because the total housing units in the 2000 Census Block data includes dwelling units without an active service connection, it could not be used to calculate the actual housing density in the year 2000. Consequently, the actual housing density was calculated using the 2000 Census Block population (9,102) and dividing that by the total number of dwelling units (2,898) in year 2000 as indicated in the Dixon District's Urban Water Management Plan (UWMP). This equates to an actual housing density of 3.141 people per dwelling unit in the year 2000.

Subsequently, the historical housing density in 2000 was calibrated by first setting the year 2000 housing density estimate equal to the actual housing density based on Cal Water data (3.141), then adjusting the housing densities from all previous and subsequent years by the same percentage increase or decrease observed in the historical CDOF housing densities.

For example, the CDOF historical housing density data showed a 0.66 percent increase from 2000 to 2001 (from 3.166 to 3.187); hence, the adjusted 2001 housing density was determined by increasing the 2000 actual housing density estimate (3.141) by the same percentage, to 3.16 (1.0066 times 3.141). Conversely, the historical housing density data showed a 1.00 percent decrease from 2000 to 1999 (from 3.166 to 3.134); hence, the adjusted 1999 housing density was determined by decreasing the 2000 actual housing density estimate (3.141) by the same percentage, to 3.11 (0.99 times 3.141). Figure 3-2 also illustrates the adjusted historical housing density.

As shown on Figure 3-2, the revised and calibrated estimates show that the housing density fluctuated over the last 18 years. The housing density increased between 1990 and 1994, and 1997 and 2001, and it decreased between 1995-1996 and 2002-2007.

[5] Historical housing densities for the City of Dixon were downloaded from the California Department of Finance (CDOF) reports E-5 and E-8 on July 17, 2008. These housing densities do not include the population in Group Quarters.

Estimated Population Served

The housing density based population for Cal Water's Dixon District was calculated by multiplying the adjusted historical housing densities previously presented in Figure 3-2 by an estimate of the number of dwelling units provided by Cal Water staff. Table 3-2 presents the adjusted historical housing densities, estimated number of dwelling units, and the population estimates based on adjusted housing densities.

As shown on Figure 3-3, the estimated population served by the Dixon District has increased, at a relatively stable growth rate (12 percent between 1990 and 2007). The population released by the CDOF is shown in blue. It illustrates that the City of Dixon increased nearly 70 percent since 1990. However, this population growth includes the area outside of Dixon District, inside the confines of the city's sphere of influence.

In comparison, the population estimate in the UWMP also increased, but at a slower growth rate of 10 percent between 1990 and 2007. The difference in estimates comes from the methodology. The UWMP calculated population based on a constant housing density derived from the 2000 population census and Cal Water dwelling unit information, whereas the WYA estimate calculated population based on adjusted housing densities which varied, and gradually increased, over time. Therefore, the WYA estimate of the population shows a greater increase over time than the UWMP estimate of the population.

Existing and Projected Land Use Served Water

WYA obtained the 1993 City of Dixon General Plan and 2008 City of Dixon General Plan Update from the City of Dixon website. The General Plan Update provides a summary of the issues that will be addressed in an updated General Plan, currently in the works. The General Plan Update designates buildout land uses and includes amendments made in 1995, 1996, 2005, and 2006. The amendments were included in this Water Supply and Facilities Master Plan Update so that future demand and supply projections would reflect the most current data available. Figure 3-4 illustrates designated land uses contained in the General Plan and within the City's SOI.

Existing land use served water was estimated by spatially locating metered water demand data by either linking the data to individual parcels using an address or by geocoding; this data was augmented by a review of aerial photographs. A detailed discussion of this process is provided in subsequent sections of this chapter.

For planning purposes in this Water Supply and Facilities Master Plan, it was assumed that any parcel receiving water from either Cal Water or the City of Dixon was classified as developed from a water supply planning perspective (i.e., currently using water). Table 3-3 summarizes existing and projected land use served water by Cal Water within the City's SOI. As shown in Table 3-3, the Dixon District is approximately 82 percent developed.

Figure 3-5 compares existing and projected land use served water by Cal Water within the SOI. As shown in Figure 3-5, a majority of future development is located inside the Dixon District service area with developments to the south.

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Table 3-2. Historical Population Served

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8] = [6] + [7]	[9] = [5] x [8]
					Estimate of Dwelling Units[d]			
Year[a]	Actual Housing Density Based on Cal Water Data[a]	CDOF Housing Density[b]	Annual Percentage Change in CDOF Housing Density	Adjusted Housing Density[c]	Single Family Residential	Multifamily [f]	Total	Population Estimate Based on Adjusted Housing Density[e]
1990		3.04	-0.45%	3.02	2,394	263	2,657	8,012
1991		3.05	-1.93%	3.03	2,420	263	2,683	8,127
1992		3.11	-0.66%	3.09	2,429	263	2,692	8,315
1993		3.13	-0.38%	3.11	2,459	264	2,723	8,466
1994		3.15	1.70%	3.12	2,486	263	2,749	8,580
1995		3.09	0.75%	3.07	2,505	260	2,765	8,485
1996		3.07	-0.52%	3.05	2,519	264	2,783	8,477
1997		3.09	-0.33%	3.06	2,539	266	2,805	8,589
1998		3.10	-1.19%	3.07	2,587	263	2,850	8,756
1999		3.13	-1.00%	3.11	2,628	263	2,891	8,989
2000	3.141	3.17	--	3.14	2,635	263	2,898	9,102
2001		3.19	0.66%	3.16	2,634	262	2,896	9,156
2002		3.19	0.03%	3.16	2,640	263	2,903	9,181
2003		3.17	-0.44%	3.15	2,637	267	2,904	9,144
2004		3.16	-0.41%	3.14	2,636	281	2,917	9,147
2005		3.12	-1.30%	3.09	2,657	280	2,937	9,090
2006		3.08	-1.25%	3.06	2,666	280	2,946	9,004
2007		3.08	-0.16%	3.05	2,653	280	2,933	8,950

[a] Data provided in Cal Water's UWMP and 2000 Census Block Data (Dixon UWMP Data.xls). Because the total housing units in the 2000 Census Block includes units without an active service connection, it could not be used to calculate the actual housing density. Consequently, the actual housing density was calculated using the 2000 Census Block population (9,102) and dividing that by the total number of service connections (2,898) in year 2000 as indicated in the UWMP. (9,102/2,898=3.141)

[b] Historical housing densities for the City of Dixon were downloaded from the California Department of Finance (CDOF) reports E-5 and E-8 on July 16, 2008. Historical housing densities were not available prior to 1990. These housing densities do not include the population in Group Quarters.

[c] The historical CDOF housing densities were calibrated to the actual housing density in the year 2000 [2], which was calculated using Cal Water's UWMP and 2000 Census Block data.

[d] Data provided by Cal Water (Dixon UWMP.xls).

[e] Population served estimated by multiplying the adjusted housing density by the estimated number of dwelling units.

[f] The number of dwelling units for Multi Family in 2007 was omitted in Dixon UWMP.xls and was assumed to be 280 based on previous years.

Table 3-3. Land Use Served Water by Cal Water Within the 2035 Sphere of Influence

Land Use Designation[a]	Existing Acreage Served Water[b]	Additional Acreage Served Water	Total Future Acreage Served Water	% of Existing Acreage Served Water
Very Low Density	2	12	14	11%
Low Density	355	62	418	85%
Medium Low Density	70	27	97	72%
Medium High Density	9	6	15	60%
High Density	4	0	4	100%
General Industrial	4	1	5	80%
Downtown	9	0	9	100%
Neighborhood Commercial	8	0	8	100%
Commercial Services	24	13	38	64%
Professional/Administrative Offices	2	0	2	100%
Core Area Mixed Use	7	0	7	100%
Governmental/Institutional	40	0	40	100%
Parks	11	0	11	100%
School Buildings/Play Areas	4	0	4	100%
Total	549	122	672	82%

[a] Land Use Designations obtained from the City of Dixon adopted 1993 General Plan and 2008 City of Dixon General Plan Update.

[b] Based on spatially located demand data, review of aerial photographs, comments from Cal Water Staff, and City of Dixon Planning Department.

HISTORICAL WATER PRODUCTION AND CONSUMPTION

Water production is the combined quantity of water produced by Cal Water's groundwater wells, while water consumption is the quantity of water actually consumed or used by its customers. As will be discussed later, the difference between production and consumption is unaccounted-for water (UAFW).

Cal Water currently tracks all of the water produced by its wells and meters all of its customers within the Dixon District. Consequently, Cal Water tracks water use in two ways: production records and meter (consumption) records. Both are discussed in more detail below, along with a discussion on UAFW.

Historical Water Production

Cal Water meets its customers water demands within the Dixon District with groundwater pumped from its own groundwater wells; the Dixon District does not have an existing surface water supply used to meet potable water demands. Table 3-4 presents the historical water production from 1980 to 2007.[6]

As shown in Table 3-4, groundwater production has increased by approximately 18 percent (from 1,466 af in 1980 to 1,725 af in 2007) over the past 28 years, with an average annual increase of 1.00 percent. This trend indicates that as demands have increased within the Dixon District, Cal Water has increased groundwater pumping to meet the potable water demands of its customers.

Figure 3-6 compares total historical water production and historical average annual rainfall. As shown in Figure 3-6, Dixon District water demands increased at a relatively stable growth rate over the past 28 years, with only a few low demand periods in 1982 to 1983, 1998, 2003, and 2005 to 2007. The low demand periods appear to correlate with above average rainfall.

Historical Water Consumption

Historical water consumed between 1980 and 2007, within each of Cal Water's revenue classes, is summarized in Table 3-5.

A review of the data from 1998 to 2007 (past 10 years) indicates that every revenue class, except Multi Family Residential, Industrial, and Other revenue classes, experienced an increase in water consumption. The increased consumption is due to the increase number of services throughout the years. However, the Government class registered doubled its consumption during 2003 to 2007 without an increase in services.

[6] California Water Services Company (Cal Water), 2006. Urban Water Management Plan for the Dixon District. December.

Table 3-4. Historical Water Production in the Dixon District [a]

Year	Groundwater, af	Groundwater, MG
1980	1,466	478
1981	1,513	493
1982	1,422	463
1983	1,441	470
1984	1,562	509
1985	1,682	548
1986	1,662	542
1987	1,752	571
1988	1,683	548
1989	1,646	536
1990	1,693	552
1991	1,510	492
1992	1,510	492
1993	1,560	508
1994	1,563	509
1995	1,605	523
1996	1,665	543
1997	1,725	562
1998	1,545	503
1999	1,702	555
2000	1,669	544
2001	1,743	568
2002	1,763	575
2003	1,821	593
2004	1,922	626
2005	1,698	553
2006	1,680	547
2007	1,725	562
Historical Average	1,640	535
20-Year Average[b]	1,671	545
10-Year Average[c]	1,727	563
5-Year Average[d]	1,769	577

[a] Data provided by Cal Water (Dixon UWMP Data.xls).
[b] 20-Year Average: 1988-2007
[c] 10-Year Average: 1998-2007
[d] 5-Year Average: 2003-2007
af = Acre-Feet
MG = Million Gallons

Public Version

Table 3-5. Historical Water Consumption by Revenue Class, af[a]

Year	Single Family Residential	Multi-Family Residential	Commercial	Industrial	Government	Other	Unaccounted For Water (UAFW)	Total Production	Total % of UAFW
1980	1,149	38	171	2	37	0	70	1,466	5%
1981	1,214	58	153	2	36	1	49	1,513	3%
1982	1,112	63	142	2	31	1	72	1,422	5%
1983	1,133	75	148	1	37	0	47	1,441	3%
1984	1,258	90	172	1	47	0	-5	1,562	0%
1985	1,261	85	175	1	35	3	123	1,682	7%
1986	1,264	95	170	1	40	2	90	1,662	5%
1987	1,321	104	175	1	42	1	109	1,752	6%
1988	1,301	114	175	1	34	0	58	1,683	3%
1989	1,252	94	189	1	31	0	78	1,646	5%
1990	1,280	93	189	2	34	0	95	1,693	6%
1991	1,152	80	164	2	35	0	77	1,510	5%
1992	1,210	86	160	3	27	0	24	1,510	2%
1993	1,209	90	169	2	25	0	64	1,560	4%
1994	1,267	94	150	1	32	0	18	1,563	1%
1995	1,273	89	145	0	36	0	61	1,605	4%
1996	1,295	100	138	2	33	0	98	1,665	6%
1997	1,365	95	132	1	34	0	98	1,725	6%
1998	1,191	93	121	1	30	0	109	1,545	7%
1999	1,347	96	135	0	34	0	90	1,702	5%
2000	1,342	85	130	1	39	0	72	1,669	4%
2001	1,386	89	127	1	43	0	98	1,743	6%
2002	1,405	85	130	1	44	0	98	1,763	6%
2003	1,329	85	129	1	85	11	180	1,821	10%
2004	1,376	87	128	1	88	6	236	1,922	12%
2005	1,301	86	115	0	79	6	111	1,698	7%
2006	1,293	73	118	1	78	3	115	1,680	7%
2007	1,333	65	134	0	83	13	96	1,725	6%
Historical Average	1,272	85	149	1	44	2	87	1,640	5%
20-Year Average[b]	1,295	89	144	1	46	2	94	1,671	6%
10-Year Average[c]	1,330	85	127	1	60	4	120	1,727	7%
5-Year Average[d]	1,327	80	125	1	83	8	148	1,769	8%

[a] Data provided by Cal Water (Dixon UWMP Data.xls)
[b] 20-Year Average: 1988-2007
[c] 10-Year Average: 1998-2007
[d] 5-Year Average: 2003-2007
af = Acre-Feet

Historical Unaccounted-for Water

UAFW in the Dixon District is the difference between the recorded production from Cal Water's groundwater wells and metered consumption.

UAFW is typically caused by uses such as: hydrant testing, fires, system flushing, system leaks, and water main breaks. Construction water use is normally captured in the Other revenue class. UAFW increases over time and the total percentage of UAFW per year ranges between 1 percent and 12 percent. For planning purposes in this water supply and facilities master plan, UAFW for the Dixon District utilized the 7 percent from the 10-year average (2003 to 2007) which is also consistent with Cal Water's 2006 UWMP.

Historical Per Capita Water Demand

Historical per capita water demands were calculated by dividing the total water production previously presented in Table 3-4 by the estimated historical population previously presented in Figure 3-3. Table 3-6 summarizes historical per capita water demands for the Dixon District between 1990 and 2007. As shown in Table 3-6, the historical average per capita water demand has remained relatively stable, averaging about 171 gallons per capita per day (gpcd) over the past 28 years. Increases and decreases in the per capita demand appear to be associated with drier and wetter years, respectively, as noted by the varying quantities of annual average rainfall in Table 3-6. The average per capita demand of 171 gpcd will be used in subsequent sections to project future population served; demand projections are based on a different database used to develop land use based unit demand factors.

Figure 3-7 compares the historical per capita demand, historical production, and historical population. As shown in Figure 3-7, the historical population has increased at a relatively constant rate from 1990 to 2007, whereas the per capita demand has hovered at around 171 gpcd. The majority of the variation observed in the per capita demand is tied to total water production, which appears to vary based on hydrologic conditions as discussed previously (i.e. quantity of rainfall).

Figure 3-7 also indicates that the per capita demand decreased significantly in 1998. As discussed previously, the sharp decrease in 1998 is likely the result of a large amount of rainfall during that year.

Water Conservation

Cal Water is committed to preserving California's water resources through water conservation, and is currently a signatory of the California Urban Water Conservation Council's (CUWCC) Memorandum of Understanding (MOU)[7]. As a signatory of the CUWCC MOU, Cal Water has agreed to implement the Best Management Practices (BMPs) defined in Exhibit 1 of the MOU

[7] California Water Services Company (Cal Water), 2006. Urban Water Management Plan for the Dixon District. December.

Table 3-6. Historical Per Capita Demand and Rainfall Comparison

Year	Production, (af)	Production, MG	Estimated Population Served	GPCD[a]	Annual Average Rainfall, inches
1990	1,693	552	8,012	189	12.51
1991	1,510	492	8,127	166	15.22
1992	1,510	492	8,315	162	22.54
1993	1,560	508	8,466	164	25.79
1994	1,563	509	8,580	163	15.15
1995	1,605	523	8,485	169	30.41
1996	1,665	543	8,477	175	27.31
1997	1,725	562	8,589	179	17.86
1998	1,545	503	8,756	157	24.11
1999	1,702	555	8,989	169	10.53
2000	1,669	544	9,102	164	19.51
2001	1,743	568	9,156	170	21.66
2002	1,763	575	9,181	171	16.70
2003	1,821	593	9,144	178	17.42
2004	1,922	626	9,147	188	18.97
2005	1,698	553	9,090	167	18.64
2006	1,680	547	9,004	167	18.52
2007	1,725	562	8,950	172	10.86
Historical Average				171	19.10
10-Year Average[c]				170	17.69
5-Year Average[d]				174	16.88

[a] Based on Table 3-2. Historical Population Served

[b] 10-Year Average: 1998-2007

[c] 5-Year Average: 2002-2007

af = Acre-Feet

MG = Million Gallons

GPCD = Gallons Per Capita Per Day

that are cost beneficial, and submits a report to the CUWCC every two years describing BMP implementation.[8] A list of each BMP is provided in Appendix B.

ADOPTED PEAKING FACTORS

Peaking factors are used to calculate water demands expected under high demand conditions (i.e., maximum day and peak hour demand). The resulting demand conditions for maximum day and peak hour periods are then used to evaluate and size transmission/distribution pipelines and storage facilities, and to define water supply needs and capacity requirements. This section describes the methodology used to develop the peaking factors for the maximum day and peak hour demand conditions within the Dixon District.

Table 3-7 summarizes the historical maximum day and corresponding maximum day peaking factors, between 1980 and 2007. As shown in Table 3-7, the maximum day peaking factor for the Dixon District has ranged from a high of 2.4 in 1981 to a low of 1.6 in 2005. For planning purposes in this Water Supply and Facilities Master Plan, a maximum day peaking factor of 1.9 was adopted. A peaking factor of 1.9 represents the average over the historical period from 1980 to 2007.

Insufficient data was available to determine a historical peak hour demand factor over time; however, as part of the recent hydraulic model development work completed for the Dixon District, WYA used SCADA data, both in electronic and circular chart format, to develop diurnal curves for a peak day in July 2007. The diurnal curves from this work were used to estimate the peak hour demand in 2007 (see Appendix C).

The July 01, 2007 peak hour demand in the system was 3,375 gpm. The peak hour factor for 2007 was ascertained by dividing the estimated peak hour demand (3,375 gpm or 4.86 mgd) by the average day demand (1.54 mgd). This method results in a peak hour factor of approximately 3.16.

Table 3-8 summarizes the maximum day and peak hour peaking factors adopted for this Water Supply and Facilities Master Plan.

[8] California Water Services Company (Cal Water), 2006. Urban Water Management Plan for the Dixon District. December.

Table 3-7. Historical Maximum Day Peaking Factors

Year	Average Day, mgd[a]	Maximum Day, mgd[a]	Average Day to Maximum Day Peaking Factor
1980	1.3	2.7	2.1
1981	1.4	3.3	2.4
1982	1.3	2.6	2.0
1983	1.3	2.7	2.1
1984	1.4	2.7	1.9
1985	1.5	2.9	1.9
1986	1.5	2.8	1.9
1987	1.6	2.9	1.9
1988	1.5	3.0	2.0
1989	1.5	2.9	2.0
1990	1.5	2.6	1.7
1991	1.3	2.4	1.8
1992	1.3	2.4	1.8
1993	1.4	2.6	1.9
1994	1.4	2.5	1.8
1995	1.4	3.0	2.1
1996	1.5	2.7	1.8
1997	1.5	2.7	1.7
1998	1.4	3.2	2.3
1999	1.5	2.7	1.8
2000	1.5	2.9	2.0
2001	1.6	3.0	1.9
2002	1.6	2.9	1.8
2003	1.5	2.9	2.0
2004	1.7	3.2	1.9
2005	1.5	2.4	1.6
2006	1.5	3.4	2.2
2007	1.5	2.8	1.9
Historical Average			1.9
5-Year Average[b]			1.9

[a] Data provided by Cal Water (Dixon UWMP Data.xls).
[b] 5-Year Average: 2002-2006
mgd = Million Gallons Per Day

Table 3-8. Adopted Peaking Factors

Type of Factor	Adopted Factor
Average Day (ADD) to Maximum Day Demand (MDD)	1.9
Maximum Day Demand to Peak Hour Demand (PHD)	1.7

PROJECTED WATER DEMANDS

Water demands were projected through partial buildout of the Dixon District using a unit demand methodology based on land uses in the General Plan. As will be discussed below, full buildout was not considered realistic or practical for the Dixon District within the 2035 planning horizon used for this WSFMP. A land use based methodology was used instead of a per capita demand methodology because per capita water demand projections uniformly distribute water use over the entire water service area and therefore, do not account for specific land uses and associated water demands in specific locations.

Subsequent sections describe the land use based methodology used, followed by a discussion of total projected water demands.

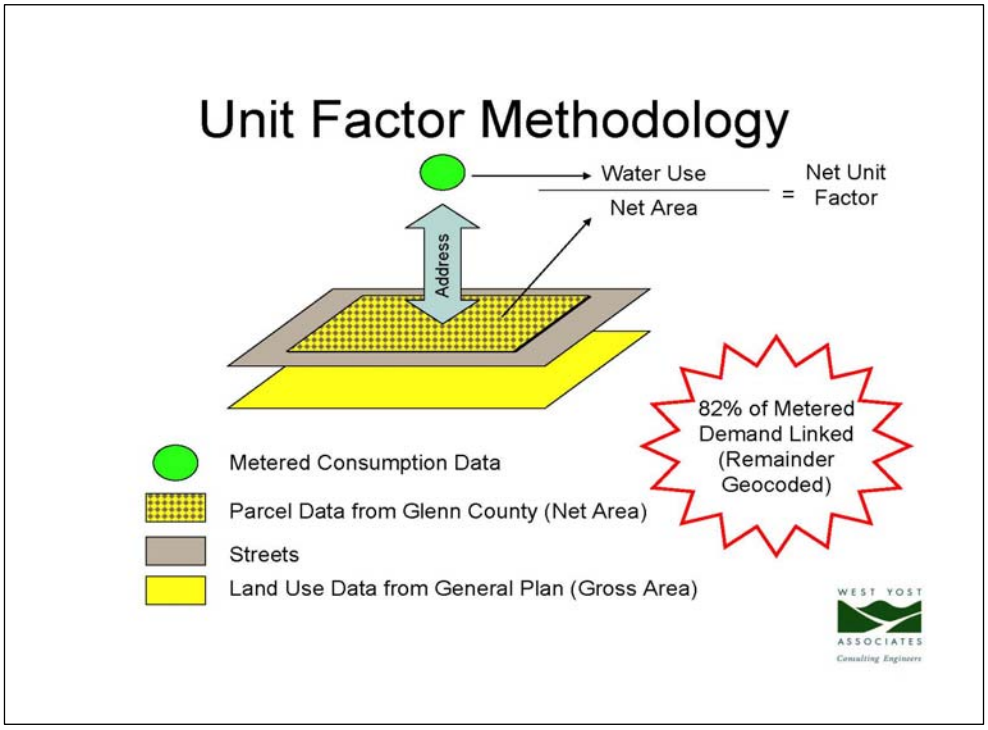
Unit Demand Factors Adopted for this Water Supply and Facilities Master Plan Update

Unit demand factors from 2004 to 2007 were determined using meter data obtained from Cal Water, parcel data obtained from Solano County, and land use data obtained from the City's Planning Department. Individual water use (by meter) was linked to individual parcels using addresses (see green dot on Figure 3-8); 82 percent of all available water meter data was linked to a parcel. An additional 17 percent had addresses that did not link with a parcel address; therefore, they were spatially located near a parcel in a process called geocoding. Ultimately, 99 percent (82 percent plus 17 percent) of metered demands will be allocated in the hydraulic model (see Chapter 6). The geocoded meters were not used to develop unit demand factors because they were not linked to an individual parcel.

The unit demand factor for each land use designation was calculated by dividing the total water use by the total parcel area for which it was linked; however, the parcel area used in this initial calculation did not include streets (see grey area on Figure 3-8) and therefore, represented net area. Accordingly, the unit demand factors calculated were net unit demand factors.

The net unit demand factors were used to project future demands by multiplying the appropriate net unit demand factor by the future acreage. However, acreage for future developments is gross area and therefore, includes the streets. Typically, the net unit demand factor would not be used to calculate demands for gross areas. In order to be consistent with the use of the same unit demand factor for existing and future developments and to provide additional conservatism for planning level purposes in this water system, the net unit demands factors were used to project future demands.

Figure 3-8. Illustration of Unit Demand Factor Methodology



Subsequent sections present the calculated unit demand factors for each land use designation.

Unit Demand Factor: Very Low Density

The Very Low Density (VLD) land use designation, per 1993 General Plan, specifies that one housing unit is allowed in a minimum site area of 20,000 square feet. There is only one Very Low Density designation in the Dixon District's SOI. The property is located in the southern section of the City at the corner of S. Porter Road and W. Chestnut Street.

Figure 3-9 illustrates the calculated Very Low Density unit demand factor between 2004 and 2007 for the Dixon District. The Very Low Density unit demand factor ranged between 1.14 and 0.30 af/ac/yr. The decreasing trend in unit demand factor over the years of 2004 to 2007 is due to a decrease in demand from 757 hundred cubic feet (ccf) to 197 ccf.

For planning purposes, it was assumed that all future Very Low Density development would use the average unit demand factor of 0.59 af/ac/yr and that water use for this designation would not increase.

Unit Demand Factor: Low Density

The Low Density (LD) land use designation, per 1993 General Plan, allows one housing unit in a site ranging from 7,000 to 19,999 square feet. This land use designation accounts for a majority of the services in the Dixon District.

Figure 3-10 illustrates the calculated Low Density unit demand factor between 2004 and 2007 for the Dixon District. As shown in Figure 3-10, the Low Density unit demand factor remained steady as it ranged from 2.81 to 2.61 af/ac/yr during this time period.

For planning purposes, it was assumed that all future Low Density development would use the average unit demand factor of 2.70 af/ac/yr.

Unit Demand Factor: Medium Low Density

The Medium Low Density (MDL) land use designation per 1993 General Plan, allows one housing unit in a site ranging from 3,000 to 6,999 square feet.

Figure 3-11 illustrates the calculated Medium Low Density unit demand factor between 2004 and 2007 for the Dixon District. The Medium Low Density remains relatively stable as it ranges from 3.09 and 2.80 af/ac/yr.

For planning purposes, it was assumed that all future Medium Low Density development would use the average unit demand factor of 2.89 af/ac/yr.

Unit Demand Factor: Medium High Density

The Medium High Density (MHD) land use designation, per 1993 General Plan, allows one housing unit in a site ranging from 2,000 to 2,999 square feet.

Figure 3-12 illustrates the calculated Medium High Density unit demand factor between 2004 and 2007 for the Dixon District. The range of unit demand factor in this designation is 5.61 to 4.63. The unit demand decrease as the water use decreases every year.

For planning purposes, the average Medium High Density unit demand factor of 5.02 af/ac/yr will be used with no expected increases in the future.

Unit Demand Factor: High Density

The High Density (HD) land use designation, per 1993 General Plan, is intended solely for construction of housing facilities for senior citizens. The ordinance allows for one housing unit in a site ranging from 1,500 to 1,999 square feet.

Figure 3-13 illustrates the calculated High Density unit demand factor between 2004 and 2007 for the Dixon District. The High Density unit demand factor fluctuates between 3.78 and 0.23 af/ac/yr. Between years 2004 and 2005, a sudden drop in unit demand factor from 3.78 to 0.28 af/ac/yr occurs. This is due to new service connections during December of 2005. The water usage does not vary significantly but the acreage, which is used to calculate the unit demand factor, dramatically increases. The low 2005 unit demand factor drives down the average unit demand to 2.24 af/ac/yr.

To remedy the diverging 2005 unit demand, the unit demand is recalculated without incorporating the new service connections. The revised water demand without new services for

2005 is 315 ccf and the acreage is 0.27. As shown in Figure 3-13, this yields a new unit demand factor of 2.68 af/ac/yr for 2005, and new average demand for 2004 to 2007 will be 2.86 af/ac/yr.

For planning purposes, the adjusted High Density unit demand factor of 2.86 af/ac/yr will be used.

Unit Demand Factor: General Industrial

Establishments located in the General Industrial land use designation characteristically require large parcels of land with good truck or rail access. This designation includes a mix of light and heavy industrial uses such as manufacturing, research institutions, and administrative facilities. Properties with this land use designation in the Dixon District are clustered on Porter Street along the California Northern Railroad line.

Figure 3-14 illustrates the calculated General Industrial unit demand factor between 2004 and 2007. It remains stable within this time period and ranges from a low of 0.34 and high of 0.41 af/ac/yr.

Average General Industrial unit demand factor of 0.36 af/ac/yr will be used for planning purposes.

Unit Demand Factor: Downtown

The Downtown land use designation includes businesses in the Downtown area along Porter Street south of Dickson Creek and north of Mayes.

Figure 3-15 illustrates the calculated Downtown unit demand factor between 2004 and 2007 for the Dixon District. As shown in Figure 3-15, the Downtown unit demand factor ranged between 2.25 and 2.09 af/ac/yr. The unit demand factor remained stable within this four year period.

For planning purposes, it was assumed that all future Downtown development would use the average unit demand factor of 2.17 af/ac/yr.

Unit Demand Factor: Neighborhood Commercial

The Neighborhood Commercial land use designation include establishments that require larger sites and more floor area than establishments in the Downtown designation. Typical uses of this designation include retail stores, drugstores, bakeries, banks, grocery stores, and other retail or service industry that meet the day to day needs of local residents.

Figure 3-16 illustrates the calculated Neigborhood Commercial unit demand factor between 2004 and 2007 for the Dixon District. As shown in Figure 3-16, the Neighborhood Commercial unit demand factor ranged from 1.40 to 1.01 af/ac/yr. The decreased trend of the unit demand factor is due to decreased demand. The total demands were 4,872 ccf in 2004 and 3,519 ccf in 2007. The number of service connections remained constant in the four year period.

The average Neighborhood Commercial unit demand factor of 1.21 af/ac/yr will be used for planning purposes.

Unit Demand Factor: Commercial Services

The Commercial Services land use designation include establishments that cater to heavy commercial and light industry uses, which might include automobile repair, glass shops, plumbing shops, and cleaning and dyeing establishments.

Figure 3-17 illustrates the calculated Commercial Services unit demand factor between 2004 and 2007 for the Dixon District. As shown in Figure 3-17, the Commercial Services unit demand factor is stable within the four year period and ranges from a low of 0.92 and a high of 1.15 af/ac/yr.

For planning purposes, it was assumed that all future Commercial Services development will use the average unit demand factor of 1.05 af/ac/yr.

Unit Demand Factor: Professional/Administrative Offices

The Professional/Administrative Offices land use designation include establishments that provide professional services to the surrounding residential areas. Typical establishments include and are not limited to offices of physicians, engineers, dentist, architects, attorney, and planners.

Figure 3-18 illustrates the Professional/Administrative Services unit demand factor between 2004 and 2007 for the Dixon District. As the figure illustrates the range of unit demand factors are from a low of 3.17 and a high of 3.81 af/ac/yr. The unit demand factor remains stable within this four year time period.

For planning purposes, it was assumed that future Professional/Administrative Office development will use the average unit demand factor of 3.52 af/ac/yr.

Unit Demand Factor: Core Area Mixed Use

The Core Area Mixed Use land use designation encourages adaptive reuse of older residential structures of older residential structures adjacent to the Downtown area as offices and retail uses.

Figure 3-19 illustrates the Core Area Mixed Use unit demand factor between 2004 and 2007 for the Dixon District. As the figure illustrates the range of unit demand factors are from a low of 1.45 to a high of 1.72 af/ac/yr. The unit demand factor is stable within the four year period.

For planning purposes, it was assumed that future Core Area Mixed Use development will use the average unit demand factor of 1.58 af/ac/yr.

Unit Demand Factor: Governmental/Institutional

The Governmental/Institutional land use designation is applicable to property owned and operated by the City, County, State and Federal agencies, special districts, and public utilities.

Figure 3-20 illustrates the Governmental/Institutional unit demand factor between 2004 and 2007 for the Dixon District. As illustrated in the figure, the unit demands ranges from 0.75 to 0.64 af/ac/yr. The unit demand factors for all four years are relatively stable.

For planning purposes, the average unit demand factor for Governmental/Institutional land use designation will be 0.70 af/ac/yr for all future developments.

Unit Demand Factor: Parks

The Parks land use designation is applicable to all City-owned property that are intended for recreational use.

Figure 3-21 shows the Parks unit demand factor for years 2004 to 2007. As shown in the figure, the unit demands are increasing over this four year period from 0.90 af/ac/yr in 2004 to 1.14 af/ac/yr in 2005. The increase in unit demands is due to an increase in water use.

For planning purposes, the average unit demand factor for the Parks land use designation will be 0.91 af/ac/yr for all future developments.

Unit Demand Factor: School Buildings/Play Areas

The School Buildings/Play Areas land use designation is applicable to all property owned and operated by Dixon Unified School District.

Figure 3-22 shows that the School Buildings/Play Area unit demand factors range from a low of 2.27 af/ac/yr in 2006 to a high of 2.89 af/ac/yr in 2005. The unit demand factors are relatively stable, and any variances are attributed to a decrease in water usage.

For planning purposes, the average unit demand factor for School Buildings/Play Areas land use designation will be 2.57 af/ac/yr.

Summary of Adopted Unit Demand Factors

Table 3-9 summarizes the unit demand factors adopted in this Water Supply and Facilities Master Plan for projecting future water demands. These unit demand factors are based on 82 percent of the meter data from 2004 to 2007 for Cal Water's Dixon District.

Table 3-9. Adopted Unit Demand Factors

Land Use Designation	Unit Demand Factor, af/ac/yr
Very Low Density	0.59
Low Density	2.70
Medium Low Density	2.89
Medium High Density	5.02
High Density	2.86
General Industrial	0.36
Downtown	2.17
Neighborhood Commercial	1.21
Commercial Services	1.05
Professional/Administrative Offices	3.52
Core Area Mixed Use	1.58
Governmental/Institutional	0.70
Parks	0.91
School Buildings/Play Areas	2.57

Estimated Timing of Future Development

On July 31, 2008, WYA staff met with the Cal Water Dixon District Manager, Jack Caldwell, to discuss the timing of future development. Mr. Caldwell located on a map what parcels will be developed in the future within the Dixon District. In addition, WYA staff contacted the City of Dixon Planning Department to discuss the development of these parcels identified by Mr. Caldwell.

The identified parcels have the following land use designations: Very Low Density, Low Density, Medium Low Density, Medium High Density, General Industrial, and Commercial Services. All future developments are in the southwestern portion of Dixon District's boundary.

Figure 3-23 presents the timing used based on the timing of the remaining future developments in the City with priority to current construction development, planning review status, and the recent economic hardships. The development, Valley Glen (Buildout 2013), has been approved by the Planning Commission as of 04/18/2006. The infrastructure has been built but because of the unstable economy, further construction has been put on hold. Another development, Orchard Estates (Buildout 2025), in the southern portion of the Dixon District, is under planning review at this time. City Planners are uncertain of when this project will be constructed as future plans are put on hold as a result of the unstable economy. The City of Dixon City Planner was not informed of any development activity on the remaining parcels (Buildout 2035), which was identified by Cal Water.

In order to ensure that the necessary infrastructure is provided for areas within the City before expansion occurs outside the City, the planning-level analysis in this WSFMP assumes that infill would be built out within the next 27 years.

The timing illustrated on Figure 3-23 is based on the most recent and readily available information provided by the City of Dixon and Cal Water Staff. The timing represents projections that were used for planning future water system infrastructure. Actual timing of developments may change as political, environmental, or other conditions change. Actual demand projections are discussed in the following section of this chapter.

Projected Water Demands

Total projected water demands at buildout for the Dixon District were calculated by multiplying the adopted unit demand factors (see Table 3-9) by the additional developed acreage projected to occur (see Table 3-11). The resulting projection was added to existing 2007 water demands, followed by adjustments for unaccounted-for water and resulted in a projected buildout water demand of 2,046 af/yr.

The existing 2007 water demands were used as a reference point for representing existing demands. The historical water production trendline from 1980 to 2007 (see Figure 3-6) passed through the 2007 water demand point, indicating that the existing 2007 water demands adequately represent the historical trend. Therefore, projected water demands were added to the 2007 water demands to calculate the projected buildout water demands.

Table 3-10 illustrates the projected buildout demand discussed above for the Dixon District. As shown in Table 3-10, the maximum Dixon District water demands are projected to increase by 19 percent (from 1,725 af/yr to 2,046 af/yr). All of the increase in water demand is associated with developments inside the service area.

Two water demand scenarios were developed for the Dixon District and illustrated on Figure 3-24:

- Projected UWMP Demands (2006 UWMP Scenario 2 and 3) and Historical Water Demands
- Projected Water Demands for this WSFMP

<u>Projected UWMP Demands (2006 UWMP Scenario 2 and 3) and Historical Water Demands</u>

The projected low demands are the 2006 UWMP Scenario 2 average demand projections, which are shown as a dashed black line on Figure 3-24. The projected low demands totaled to 2,004 af/yr in 2030. These demand projections are based on the historical average growth, which is shown as the green line on Figure 3-24. The 2006 UWMP Scenario 3 high demand projections are shown as the dashed grey line on Figure 3-24. These demands are included for comparison with the 2006 UWMP Scenario 2 demand projections. The 2006 UWMP Scenario 3 demand projections totaled to 2,404 af/yr in 2030.

Table 3-10. Projected Water Demands

Land Use Designation	Unit Demand Factor, af/ac/yr	Additional Acreage	Additional Consumption, af/yr
Very Low Density	0.59	12.2	7.16
Low Density	2.70	62.3	168.50
Medium Low Density	2.89	27.2	78.62
Medium High Density	5.02	5.9	29.67
High Density	2.86	0.0	0.00
General Industrial	0.36	0.4	0.39
Downtown	2.17	0.0	0.00
Neighborhood Commercial	1.21	0.0	0.00
Commercial Services	1.05	13.3	14.06
Professional/Administrative Offices	3.52	0.0	0.00
Core Area Mixed Use	1.58	0.0	0.00
Governmental/Institutional	0.70	0.0	0.00
Parks	0.91	0.0	0.00
School Buildings/Play Areas	2.57	0.0	0.00
Subtotal		121	298
UAFW (7%) [(a)]			*22*
Total Additional Production Added from 2007 to Buildout			321
Existing 2007 Production			1,725
Total Future Water Demand			**2,046**
Percentage Increase			*19%*

[(a)] 7% UAFW is based on the 10 year historical UAFW average.

Projected Water Demands for this WSFMP

The projected water demands for the WSFMP are based on the timing associated with Figure 3-23, in which 100 percent of the future developments will be built-out by 2035. The projected water demands were calculated by multiplying the adopted unit demand factors (see Table 3-9) by the future acreage shown in Figure 3-23. The projected water demands associated with the Land Use Designations in Table 3-10 were then assigned to a Cal Water revenue class using the definitions previously provided by Cal Water staff.

Table 3-11 presents the revenue class assigned to each land use designation. Table 3-12 presents the projected water demands, by revenue class, over time. The water demand projections for the Dixon District by 2035 are, therefore, approximately equal to 2,046 af/yr, and the projections over time are shown as the solid blue line in Figure 3-24.

Table 3-11. Revenue Class Assignment

Revenue Service Class	Land Use Designation
Single Family Residential	Very Low Density Low Density
Multi Family Residential	Medium Low Density Medium High Density High Density
Commercial	Downtown Neighborhood Commercial Commercial Services Professional/Administrative Offices Core Area Mixed Use
Industrial	General Industrial
Government	Governmental/Institutional Parks School Buildings/Play Areas
Other	Construction

The projected water demands in 2035 of 2,046 af/yr are approximately 40 af/yr more than the 2006 UWMP Scenario 2 (projected average demands) of 2,004 af/yr and are approximately 358 af/yr less than the 2006 UWMP Scenario 3 (projected high demands) of 2,404 af/yr.

Table 3-12. Projected Water Demands for the Dixon District, acre-feet

Year	Single Family Residential	Multi Family Residential	Commercial	Industrial	Government	Other[a]	UAFW[b]	Production
2007	1,333	65	134	0	83	13	96	1,725
2008	1,333	65	134	0	83	13	96	1,725
2009	1,333	65	134	0	83	13	96	1,725
2010	1,333	65	134	0	83	13	96	1,725
2011	1,333	65	134	0	83	13	96	1,725
2012	1,333	65	134	0	83	13	96	1,725
2013	1,334	76	134	0	83	13	97	1,738
2014	1,335	87	134	0	83	13	98	1,751
2015	1,344	174	134	0	83	13	105	1,854
2016	1,355	174	134	0	83	13	106	1,866
2017	1,366	174	134	0	83	13	107	1,878
2018	1,378	174	134	0	83	13	108	1,890
2019	1,389	174	134	0	83	13	108	1,902
2020	1,400	174	134	0	83	13	109	1,914
2021	1,412	174	134	0	83	13	110	1,927
2022	1,423	174	134	0	83	13	111	1,939
2023	1,434	174	134	0	83	13	112	1,951
2024	1,446	174	134	0	83	13	113	1,963
2025	1,457	174	134	0	83	13	114	1,975
2026	1,462	174	136	0	83	13	114	1,982
2027	1,467	174	137	0	83	13	115	1,990
2028	1,473	174	138	0	83	13	115	1,997
2029	1,478	174	140	0	83	13	116	2,004
2030	1,483	174	141	0	83	13	116	2,011
2031	1,488	174	143	0	83	13	116	2,018
2032	1,493	174	144	0	83	13	117	2,025
2033	1,498	174	146	0	83	13	117	2,032
2034	1,503	174	147	0	83	13	118	2,039
2035	1,509	174	148	0	83	13	118	2,046

[a] Future demand of Other accounts assumed equal to largest historical value between 1980 and 2007 (see Table 3-5).

[b] Future demand of UAFW is based on 10-year Average of 7%.

PROJECTED NUMBER OF SERVICES

This water supply and facilities master plan provides an alternative methodology for projecting the number of future services by revenue class to help facilitate Cal Water staff in producing an UWMP for the Dixon District. The methodology used involves developing another service factor in af/service/yr that can then be used with the projected demand, by revenue class, to predict the number of services in a particular year.

The subsequent sections describe the development of a service based unit factor for each revenue class.

Service Factors for Projecting Number of Services

Service factors for each revenue class were calculated by dividing the historical consumption (see Table 3-5) by the historical number of services (see Table 3-1). All historical service factors except for Industrial and Other are summarized in Table 3-13 from 1980 to 2007, and illustrated on Figures 3-25, 3-26, and 3-27, respectively. Each factor is discussed in more detail below.

Service Factor for Single Family Residential

Table 3-13 indicates that the average factor over the past 28 years, 20 and 10 years is 0.52 af/service/yr, 0.51 af/service/yr, and 0.50 af/service/yr. The average service factor for the past five years remained the same as the ten year span. Since the service factor remained steady over the past 28 years, the historical average of 0.52 af/service/yr was adopted for projecting future services.

Service Factor for Multi Family Residential

As shown in Table 3-13, the Multi Family Residential service factor has varied widely in the past 28 years, ranging from 4.03 to 12.54 af/service/yr. A review of Figure 3-25 shows decreasing trends occurring from 1980 to 1982, 1988 to 1991, and 1999 to 2007. Increasing trends occurred from 1982 to 1984 and from 1986 to 1988.

The historical average service factor of 5.59 af/service/yr was adopted for projecting future services because it also captures the fluctuations observed in the past 27 years. The data for 1980 was not included in the historical average, because the 1980 service factor (12.54 af/service/yr) seems to be anomaly in comparison to service factors for the remaining year. The 5-year average would likely over predict the number of future Multi Family Residential services.

Service Factor for Commercial

Table 3-13 indicates that the average service factor over the past 20 years, 10 years, and 5 years is approximately 1.04 af/service/yr, 0.91 af/service/yr, and 0.88 af/service/yr, respectively, implying a decreasing trend in water use per Commercial service. A review of Figure 3-26 indicates that the decreasing trend is likely the result of a decrease in water use per Commercial service between 1989 to 2007.

Table 3-13. Revenue Class Conversion Factors for Projecting the Number of Services, af/service [a]

Year	Single Family Residential	Multifamily[b]	Commercial	Industrial	Government
1980	0.53	12.54	1.28	0.46	1.95
1981	0.55	7.30	1.11	0.44	1.64
1982	0.50	5.75	1.03	0.39	1.34
1983	0.51	6.80	1.06	0.23	1.61
1984	0.55	6.89	1.23	0.18	1.97
1985	0.54	6.04	1.26	0.24	1.38
1986	0.54	5.92	1.20	0.33	1.60
1987	0.56	6.48	1.23	0.34	1.69
1988	0.55	7.11	1.23	0.34	1.43
1989	0.52	5.88	1.34	0.36	1.31
1990	0.53	5.50	1.33	0.44	1.29
1991	0.48	4.72	1.18	0.42	1.34
1992	0.50	5.08	1.16	0.65	1.05
1993	0.49	5.30	1.23	0.61	0.97
1994	0.51	5.53	1.10	0.28	1.19
1995	0.51	5.21	1.06	0.12	1.33
1996	0.51	5.87	1.01	0.40	1.18
1997	0.54	5.58	0.98	0.36	1.27
1998	0.46	5.48	0.89	0.24	1.21
1999	0.51	5.64	0.98	0.13	1.38
2000	0.51	5.03	0.96	0.20	1.69
2001	0.53	5.21	0.94	0.30	1.91
2002	0.53	5.03	0.96	0.20	1.86
2003	0.50	5.02	0.95	0.15	3.41
2004	0.52	5.13	0.92	0.20	3.66
2005	0.49	5.08	0.82	0.10	3.27
2006	0.48	4.31	0.83	0.15	3.11
2007	0.50	4.03	0.88	0.11	3.38
Historical Average	0.52	5.59	1.08	0.30	1.80
20-Year Average	0.51	5.29	1.04	0.29	1.86
10-Year Average	0.50	5.00	0.91	0.18	2.49
5-Year Average	0.50	4.71	0.88	0.14	3.37
Average Annual % Growth	-0.06%	-3.28%	-1.13%	6.28%	3.92%

[a] Based on data provided by Cal Water (Dixon UWMP Data.xls).

[b] Historical average for Multi Family does not include 1980 data of 12.54 because it varies greatly from subsequent factors.

20-Year Average is from 1988-2007

10-Year Average is from 1998-2007

5-Year Average is from 2003-2007

Adopting the historical average (1.08 af/service/yr) captures the decrease observed between 1989 and 2007, and provides additional conservatism (i.e., projects fewer services) than if the 20, 10, or 5 year average was adopted. Consequently, a 1.08 af/service/yr service factor for Commercial was adopted for projecting future services.

Service Factor for Government

Table 3-13 indicates that the average service factor over the past 20 years, 10 years, and 5 years is approximately 1.86 af/service/yr, 2.49 af/service/yr, and 3.37 af/service/yr, respectively, implying an increasing trend in water use per Government service. However, a review of Figure 3-26 indicates that unit factor has varied widely in the past 5 years, and the increasing trend is likely the result of the large increase in water use per Government service between 2003 and 2007.

The highest service factor value occurs in 2004, and is likely the result of increased demands at the Dixon Fairground (Account 7785277777), Hall Park (Account 2408277777) and Dixon Chamber of Commerce (Account 2408277777), as discussed previously. The demands of these entities likely remain at this rate in the future. Therefore, the historical average (3.37 af/service/yr) was adopted to capture the large increase observed between 2003 and 2007 and to provide additional conservatism (i.e., projects fewer services) than if the historical average (1980 to 2007) was adopted. Consequently, a 3.37 af/service/yr unit factor for Government was adopted for projecting future services.

Service Factor for Industrial

Table 3-13 indicates that the average service factor over the past 20 years, 10 years, and 5 years is approximately 0.29 af/service/yr, 0.18 af/service/yr, and 0.14 af/service/yr, respectively, implying a decreasing trend in water use per Industrial service. The decreasing trend is likely the result of decreasing water use.

Adopting the historical average (0.30 af/service/yr) captures the recent decrease observed between 1989 and 2007, and provides additional conservatism (i.e., projects fewer services) than if the 20 year, 10 year, or 5 year average (1980 to 2007) was adopted. Consequently, a 0.30 af/service/yr service factor for Industrial was adopted for projecting future services.

Service Factor for Other

The Other service factor was not shown on Table 3-14 because it represented the occasional use of one construction meter, and did not represent the actual growth of the Other services. For planning purposes, the numbers of services for the Other revenue class was assumed equal to the highest number of services between 1980 and 2007 (one service, see Table 3-1). It is not anticipated that Other services will increase beyond one service.

Table 3-14. Projected Services for the Dixon District

Year	Single Family Residential	Multifamily	Commercial	Industrial	Government	Other[a]	Total Services
2007	2,653	16	152	4	25	4	2,854
2008	2,653	16	152	4	25	4	2,854
2009	2,653	16	152	4	25	4	2,854
2010	2,653	16	152	4	25	4	2,854
2011	2,653	16	152	4	25	4	2,854
2012	2,653	16	152	4	25	4	2,854
2013	2,655	18	152	4	25	4	2,858
2014	2,657	20	152	4	25	4	2,862
2015	2,674	22	152	4	25	4	2,881
2016	2,696	38	152	4	25	4	2,918
2017	2,718	38	152	4	25	4	2,940
2018	2,740	38	152	4	25	4	2,962
2019	2,762	38	152	4	25	4	2,984
2020	2,784	38	152	4	25	4	3,006
2021	2,806	38	152	4	25	4	3,028
2022	2,828	38	152	4	25	4	3,050
2023	2,850	38	152	4	25	4	3,072
2024	2,871	38	152	4	25	4	3,094
2025	2,893	38	152	4	25	4	3,116
2026	2,903	38	152	4	25	4	3,126
2027	2,913	38	153	4	25	4	3,137
2028	2,923	38	155	4	25	4	3,148
2029	2,933	38	156	4	25	4	3,160
2030	2,943	38	157	4	25	4	3,171
2031	2,953	38	159	4	25	4	3,182
2032	2,963	38	160	4	25	4	3,193
2033	2,973	38	161	4	25	4	3,205
2034	2,983	38	162	4	25	4	3,216
2035	2,993	38	164	4	25	4	3,227
% Increase from 2007 to 2035	13%	131%	8%	0%	0%	0%	13%
UWMP in 2030[b]							3,300

[a] The number of services for the Other revenue service class is the maximum historical value between 1980 and 2007.

[b] Data based on demand scenario 2 of 2006 UWMP

Future Service Connections

Future services were projected by adding the incremental number of services due to an increase in water demand to the previous year's number of services. For example, the projected incremental increase in water use for the Single Family Residential revenue class between 2007 and 2008 is approximately 1 af (1,333 af in 2008, per Table 3-12, minus 1,334 af in 2007, per Table 3-5). Therefore, the projected number of additional Single Family Residential services is approximately 1.923 services in 2008 (1 af/yr divided by 0.52 af/service/yr). The total number of Single Family Residential services is therefore 2,655 services in 2008 (2,653 in 2007, per Table 3-14, plus an additional 2 services). Table 3-14 summarizes projected services by revenue class between 2007 and 2035. Figure 3-28 illustrates the projected services over time. The projected services are 3,227 services in 2035.

Most revenue classes, such as Commercial, Industrial and Government, increased by very few service connections over the next 30 years compared to Single Family and Multi Family Residential revenue classes. The smaller increase is due in part to the timing of developments. The smaller increase is also due to the smaller quantity of future or open land dedicated to Commercial, Industrial or Government land use.

As discussed above, the numbers of services for the Other revenue class was assumed equal to the highest number of services between 1980 and 2007 (one service, see Table 3-1).

PROJECTED POPULATION SERVED

The population served by the Dixon District is projected to increase to 11,405 by 2035, or an increase of approximately 23 percent over the estimated population of 9,250 in 2006. The population was calculated using population density information from the General Plan, adjusted housing densities from Table 3-2, and land use acreage associated with the timing in Figure 3-23. Four population scenarios were developed for the Dixon District as illustrated on Figure 3-26:

- General Plan Maximum Population
- General Plan Minimum Population
- Projected Future Population for the WSFMP
- Projected Future Population Using GPCD

<u>General Plan Maximum</u>

The projected maximum population is the General Plan maximum population, illustrated as the dark purple line on Figure 3-29. The maximum population density listed in the General Plan for Single Family Residential (listed as Very Low and Low Density) and Multi Family Residential (listed as Medium Low and Medium High Density) is 5 and 14 persons/acre for Very Low and Low Density, respectively, and 33 and 49 persons/acre for Medium Low and Medium High Density, respectively. These population densities were multiplied by future acreages associated with the timing in Figure 3-23 and added to the existing population.

For example, the projected General Plan Maximum population in 2015 is 10,518 people. The projected population was calculated by adding the additional population of 1,268 (5 persons/acre times 12.2 acres plus 14 persons/acre times 1.3 acres of Single Family Residential plus 33 persons/acre times 26.7 acres plus 49 persons/acre times 5.9 acres of Multi Family) to the existing 2006 population of 9,250. Consequently, the projected maximum population is 10,518 people in 2015 (1,268 plus 9,250). The projected maximum population is 11,372 people in 2035.

General Plan Minimum Population

The projected minimum population is the General Plan minimum population, illustrated as the light purple line on Figure 3-29. The maximum population density listed in the General Plan for Single Family Residential (listed as Very Low and Low Density) and Multi Family Residential (listed as Medium Low and Medium High Density) is 5 persons/acre for Very Low/Low Density, and 14 and 33 persons/acre for Medium Low and Medium High Density, respectively. These population densities were multiplied by future acreages associated with the timing in Figure 3-23, as discussed previously. The projected minimum population is 10,199 people in 2035.

Projected Future Population for the WSFMP

The projected future population is shown as the dark blue line on Figure 3-29 and represents the recommended estimate of the future population. Single Family Residential and Multi Family Residential population densities were developed using existing 2007 acreages (shown in Table 3-3), existing 2007 dwelling units (shown in Table 3-2), and existing 2007 adjusted housing densities (shown in Table 3-2).[9] The resulting population densities for Single Family Residential and Multi Family Residential are 22.89 persons/acre and 10.39 persons/acre, respectively. These population densities were multiplied by the future Single Family Residential and Multi Family Residential acreages associated with the timing in Figure 3-23, as discussed in the previous section, to yield a population of 11,405 people in 2035.

Projected Future Population Using GPCD

The future population can also be calculated using the same methodology for services, except that the adopted per capita demand, 171 gpcd, was used instead of a service based unit demand factor. The projected future population calculated using the gpcd is shown as the light blue line on Figure 3-29.

For example, the incremental increase in projected water demands between 2007 and 2008 is approximately 13 af (1,738 af in 2008 minus 1,725 af in 2007, per Table 3-12). Therefore, the additional population served is approximately 67 people (13 af/yr converted to gallons per day divided by 171 gpcd). The total projected population is 9,317 people in 2008 (9,250 people in 2007, per Table 3-6, plus additional 67 people).

[9] The 2008 adjusted housing densities were based on information from the CDOF and do not include populations from group quarters. The Dixon group quarters population is approximately 41 people, and represents only a small percentage of the existing population. Therefore, it was not necessary to include the group quarters populations in the future population estimate.

Calculating the population using gpcd poses some uncertainty because the gpcd can change in the future based on additional conservation measures pursued by the Dixon District. Therefore, the recommended WSFMP future population estimate does not use the gpcd but instead uses area and housing densities as discussed in the previous section.

The projected population using the gpcd is 10,923 people in 2035 which is approximately 482 people less than the recommended WSFMP projected future population of 11,405 people.

Public Version

Sievers Road

I-80

Schroeder Road

Silveyville Road

Pitt School Road

N 1st Street

Adjacent unincorporated area served by Cal Water.

W A Street

California Water Service Company Dixon District

Dixon Avenue E

S 1st Street

Adjacent unincorporated area served by Cal Water.

CALIFORNIA 113

LEGEND:

Cal Water Dixon District

City of Dixon

Parcels

N

0 700 1,400 2,800

S

FIGURE 3-1

California Water Service Company Dixon District Water Supply and Facilities Master Plan

SERVICE AREA

WEST YOST ASSOCIATES Consulting Engineers

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Public Version

Figure 3-2. Historical Housing Density

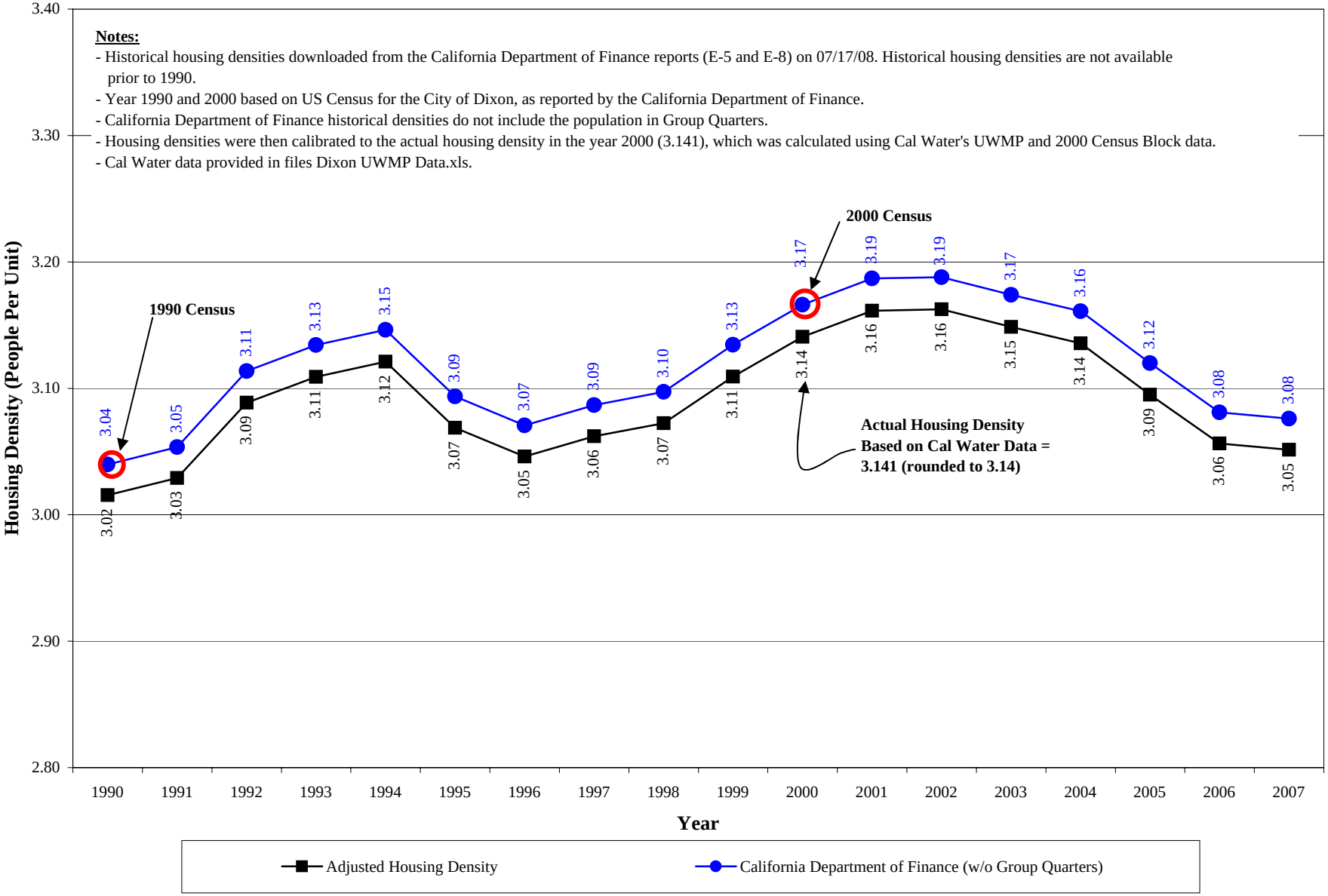
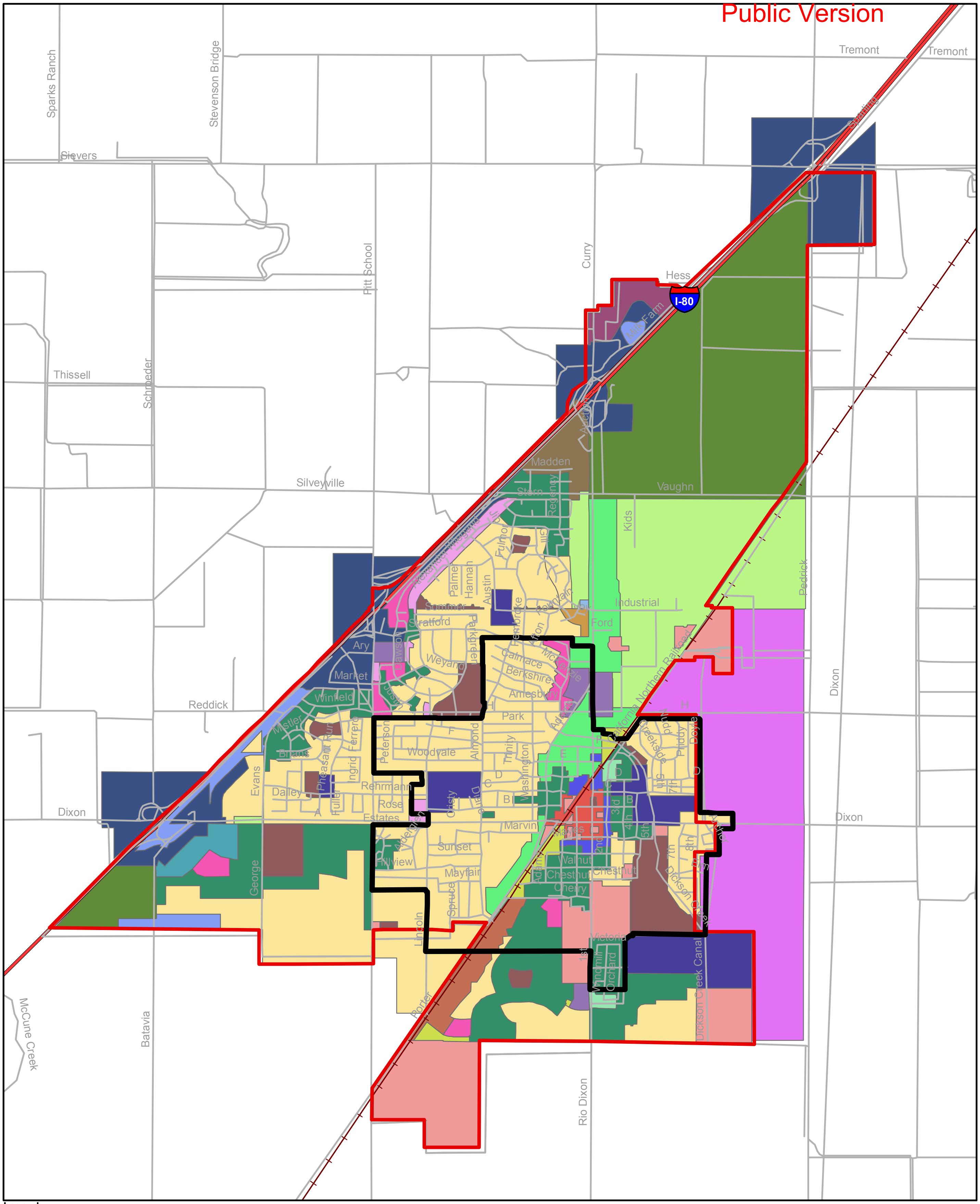


Figure 3-3. Historical Population Served



Legend

- Agriculture
- Commercial Service
- Commercial Service/Prof Admin Office
- Community Commercial
- Core Area Mixed Use
- Downtown
- Employment Center
- Functional/Buffer
- Future Residential
- General Industrial
- Government/Industrial
- High Density
- Highway Commercial
- Hwy Commercial/ProfAdminOffice
- Low Density
- Medium High Density
- Medium Low Density
- Neighborhood Commercial
- Parks
- Planned Business/Industrial
- Planned Business/Industrial Commercial Service
- Professional/Administrative Office
- School
- Very Low Density Residential
- Cal Water Dixon District Boundary
- City of Dixon Sphere of Influence
- Streets
- I-80
- California Northern Railroad

FIGURE 3-4

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

GENERAL PLAN

WEST YOST ASSOCIATES
Consulting Engineers

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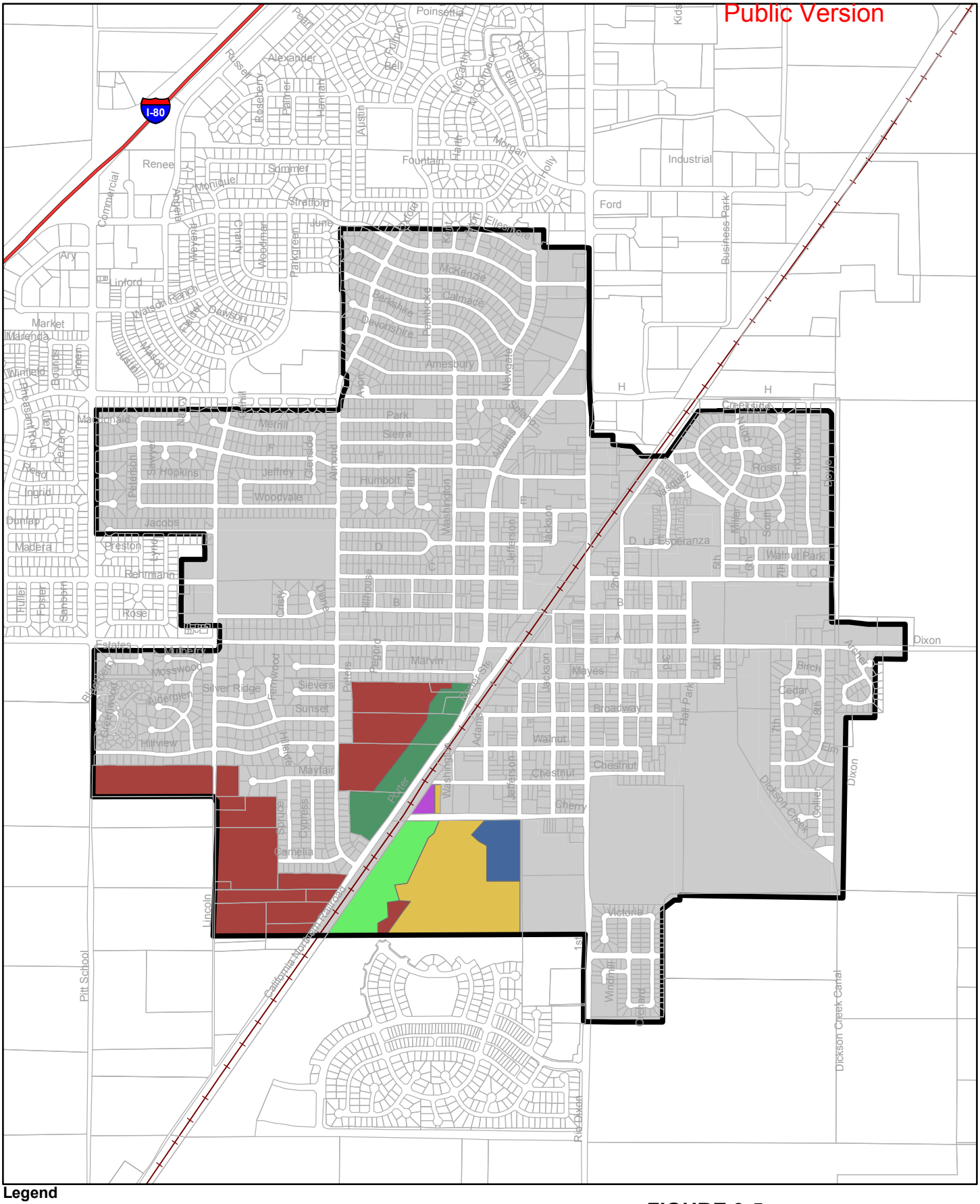

FIGURE 3-5

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

COMPARISON OF EXISTING LAND USE WITH FUTURE LAND USE

WEST YOST ASSOCIATES
Consulting Engineers

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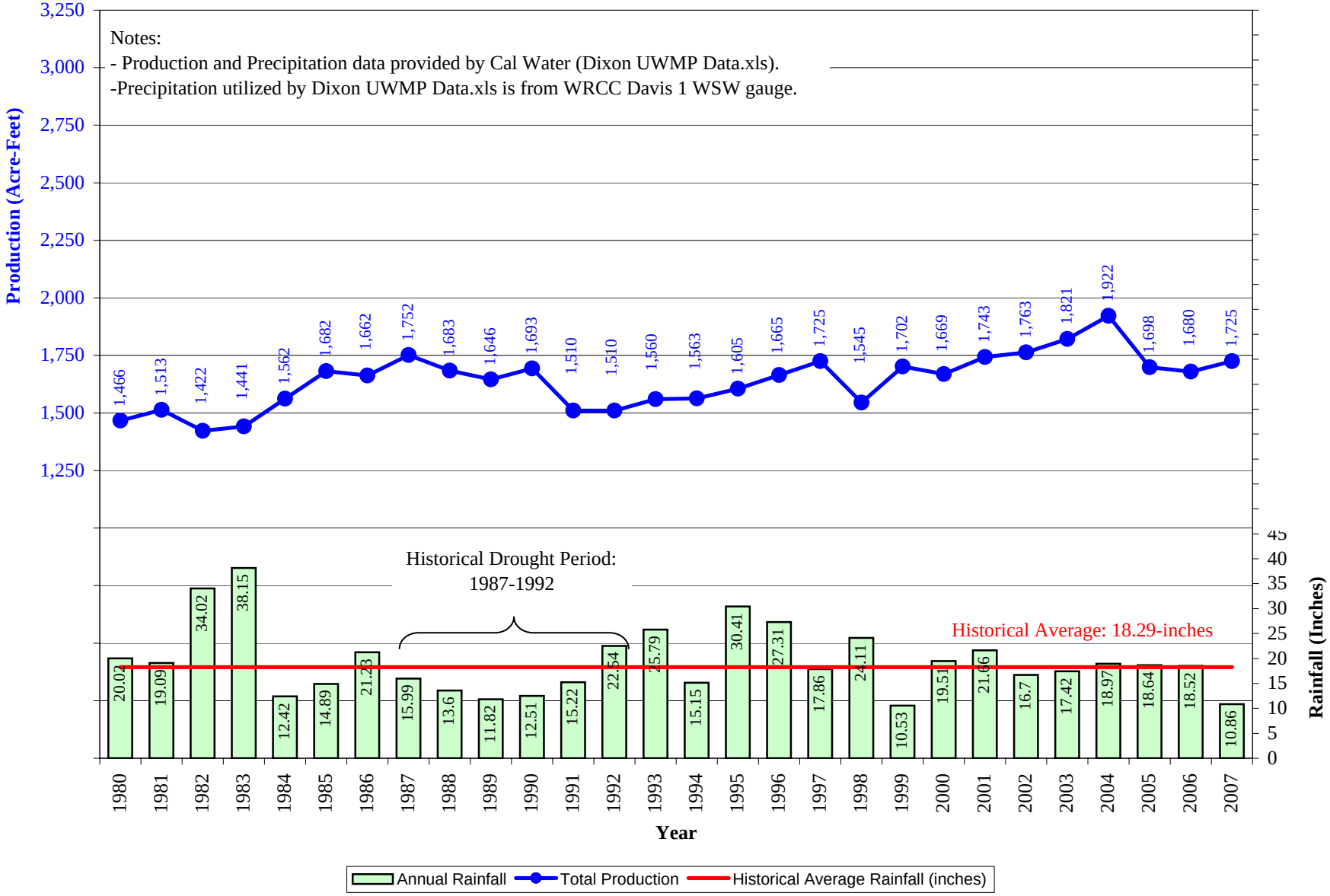
Figure 3-6. Historical Water Production



Public Version

Figure 3-7. Comparison of Historical Per Capita Demand, Production, & Population

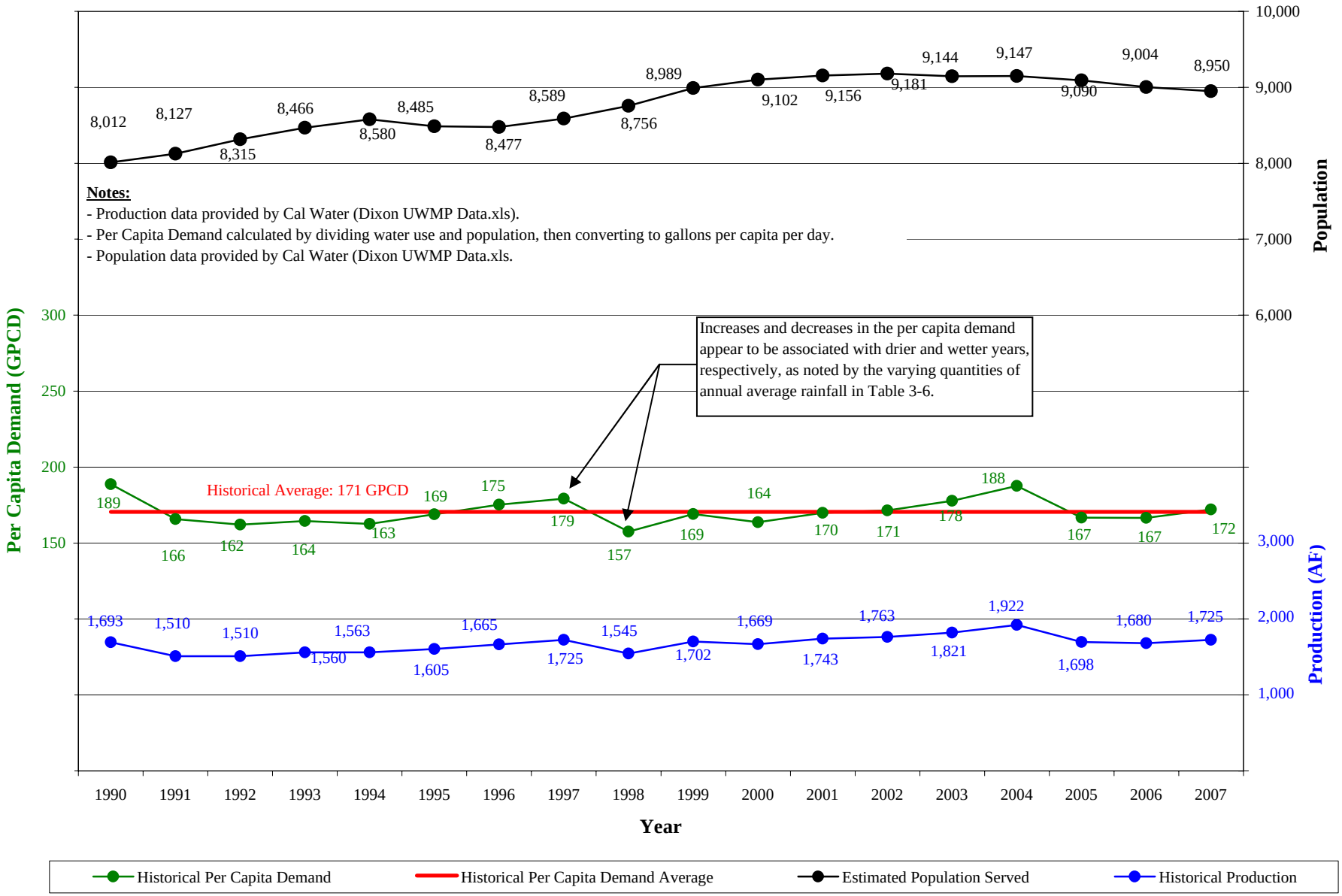


Figure 3-9. Historical Unit Demand Factor: Very Low Density

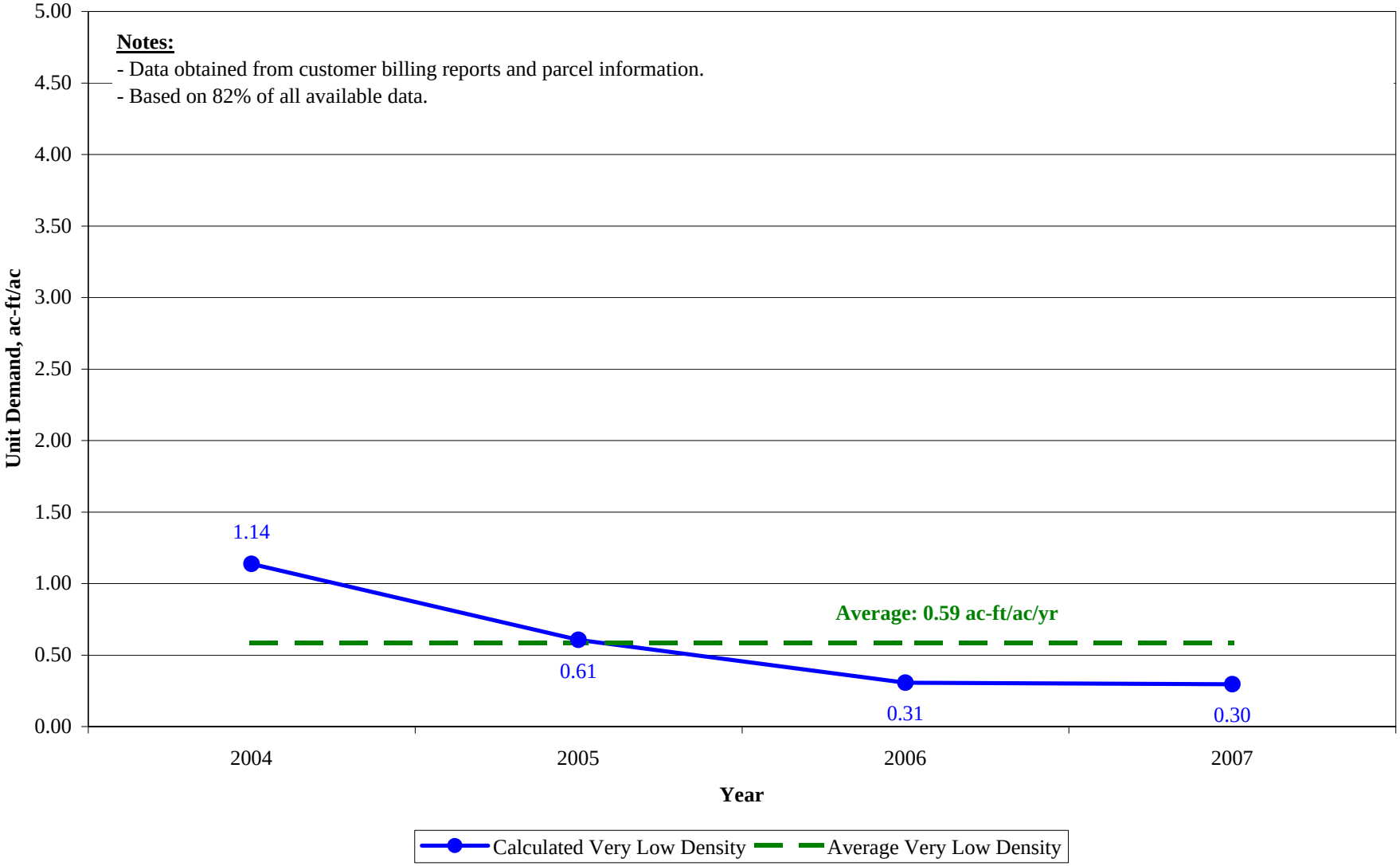


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Figure 3-10. Historical Unit Demand Factor: Low Density

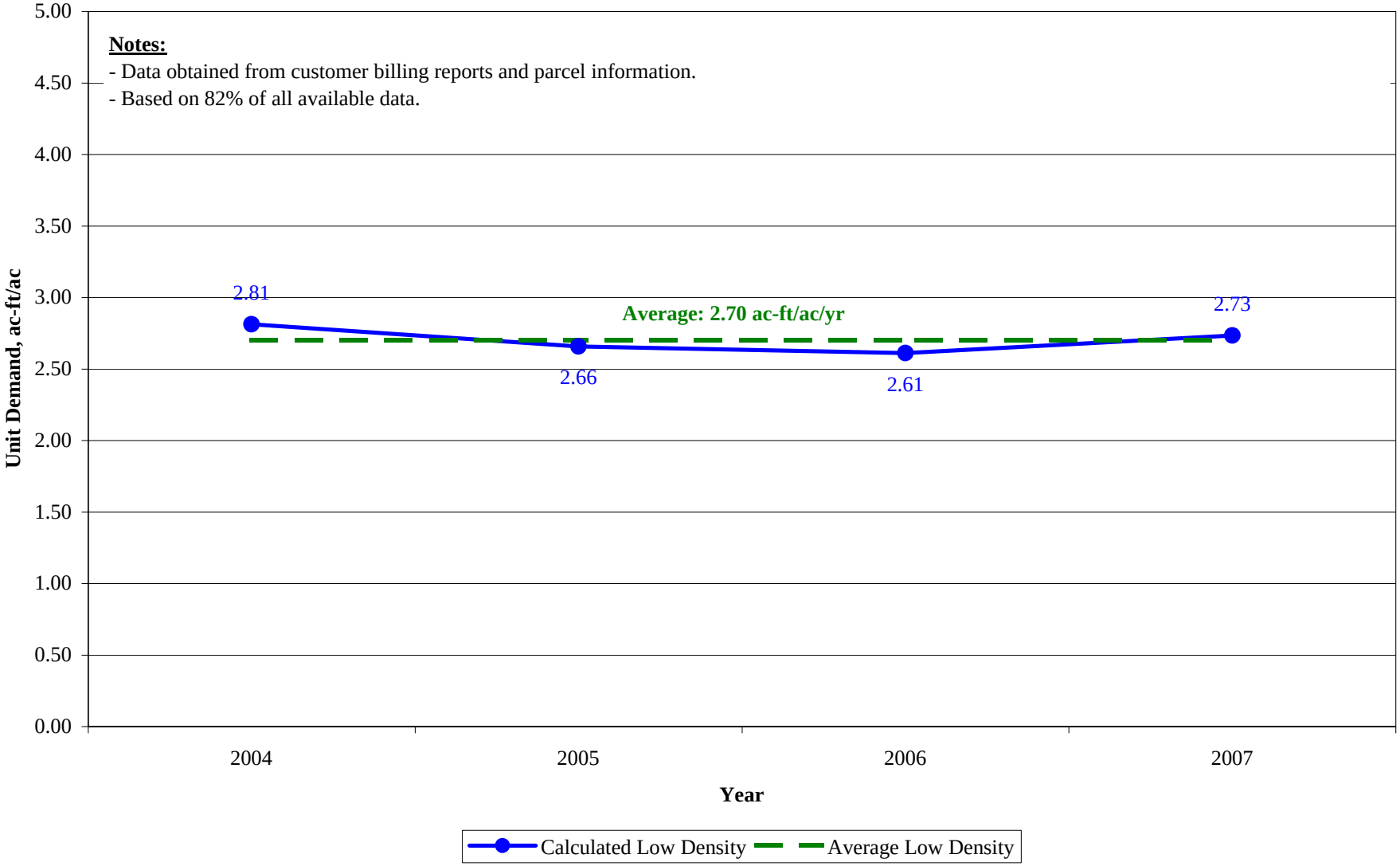

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Figure 3-11. Historical Unit Demand Factor: Medium Low Density

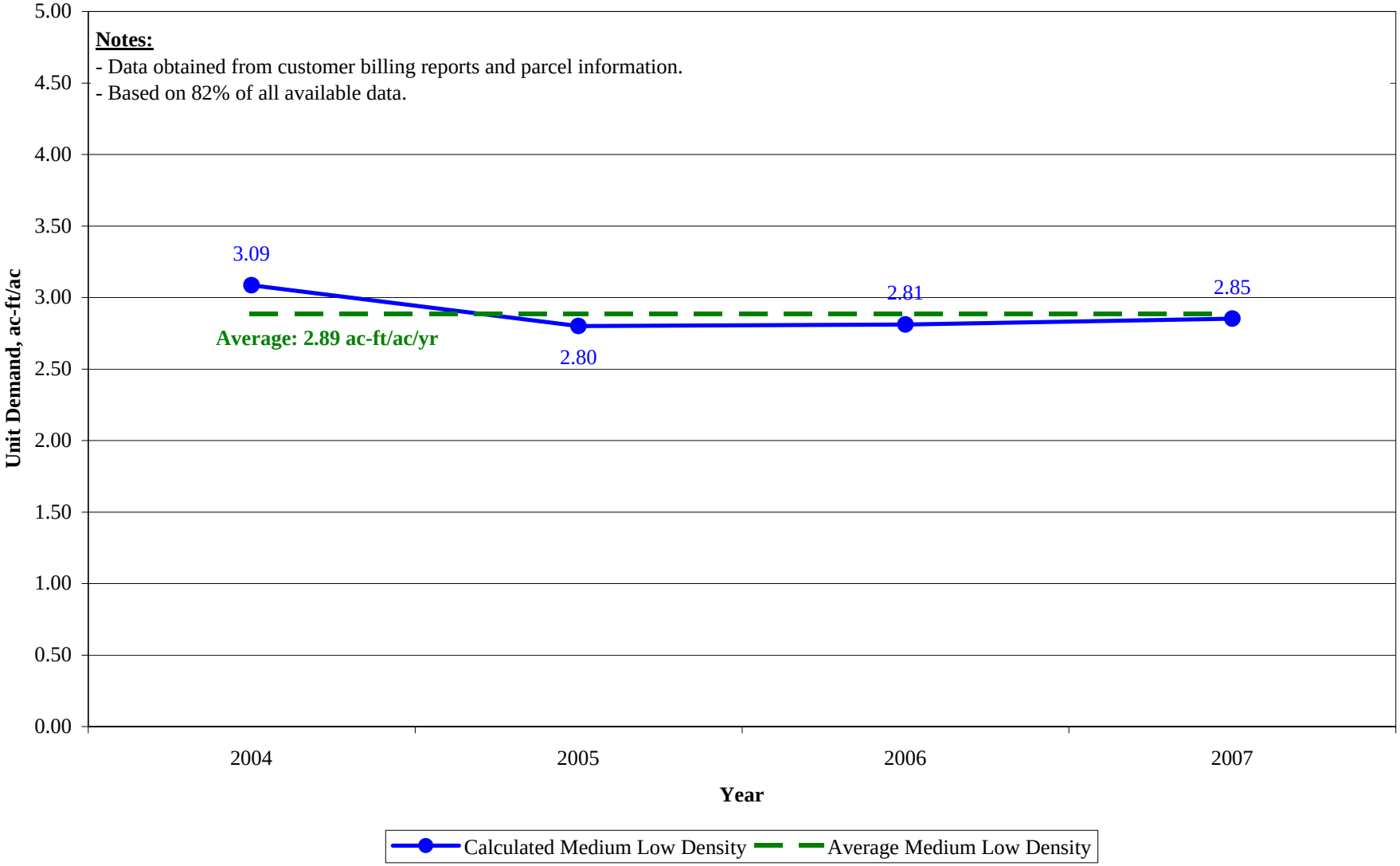

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Figure 3-12. Historical Unit Demand Factor: Medium High Density

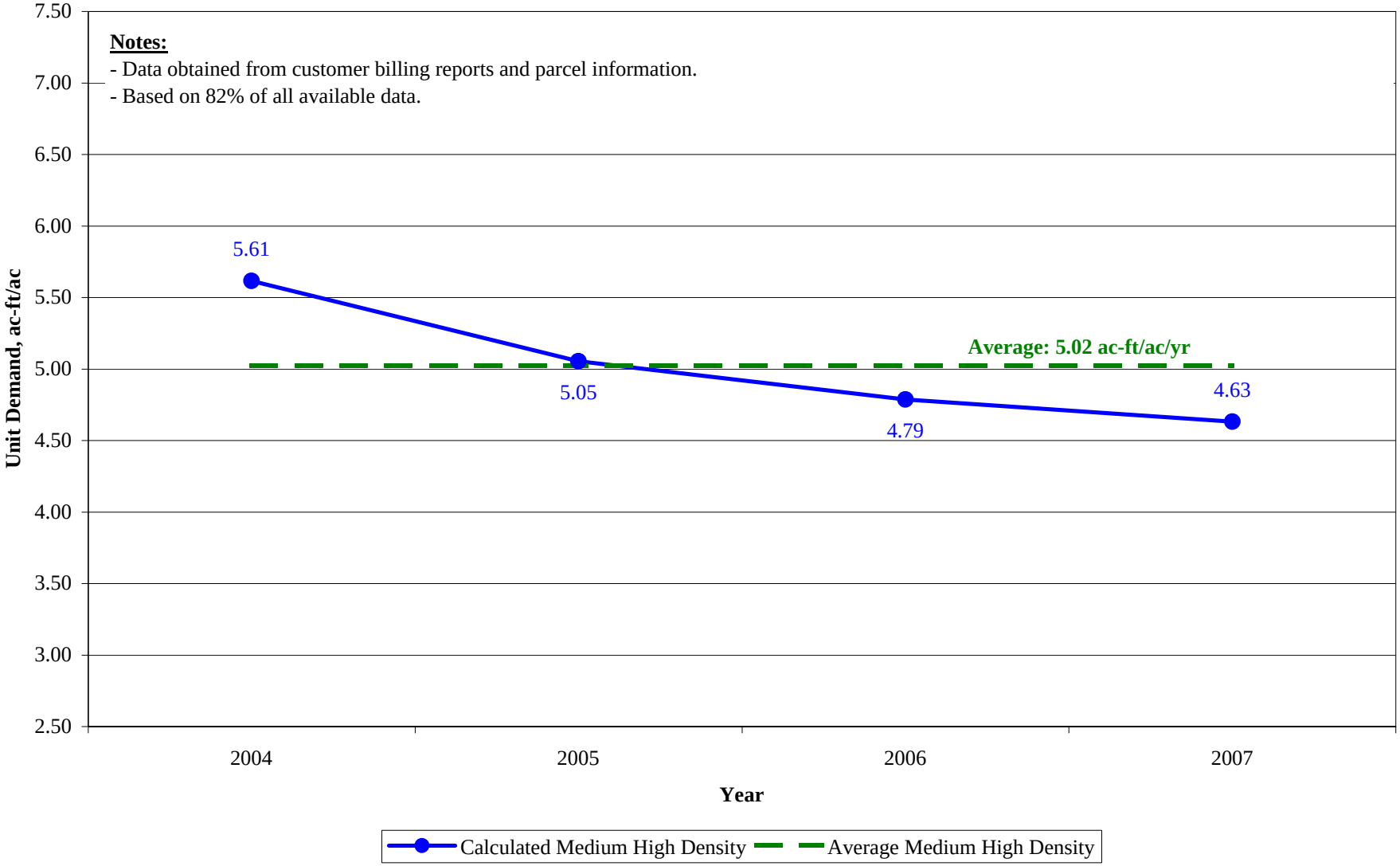

Figure 3-13. Historical Unit Demand Factor: High Density

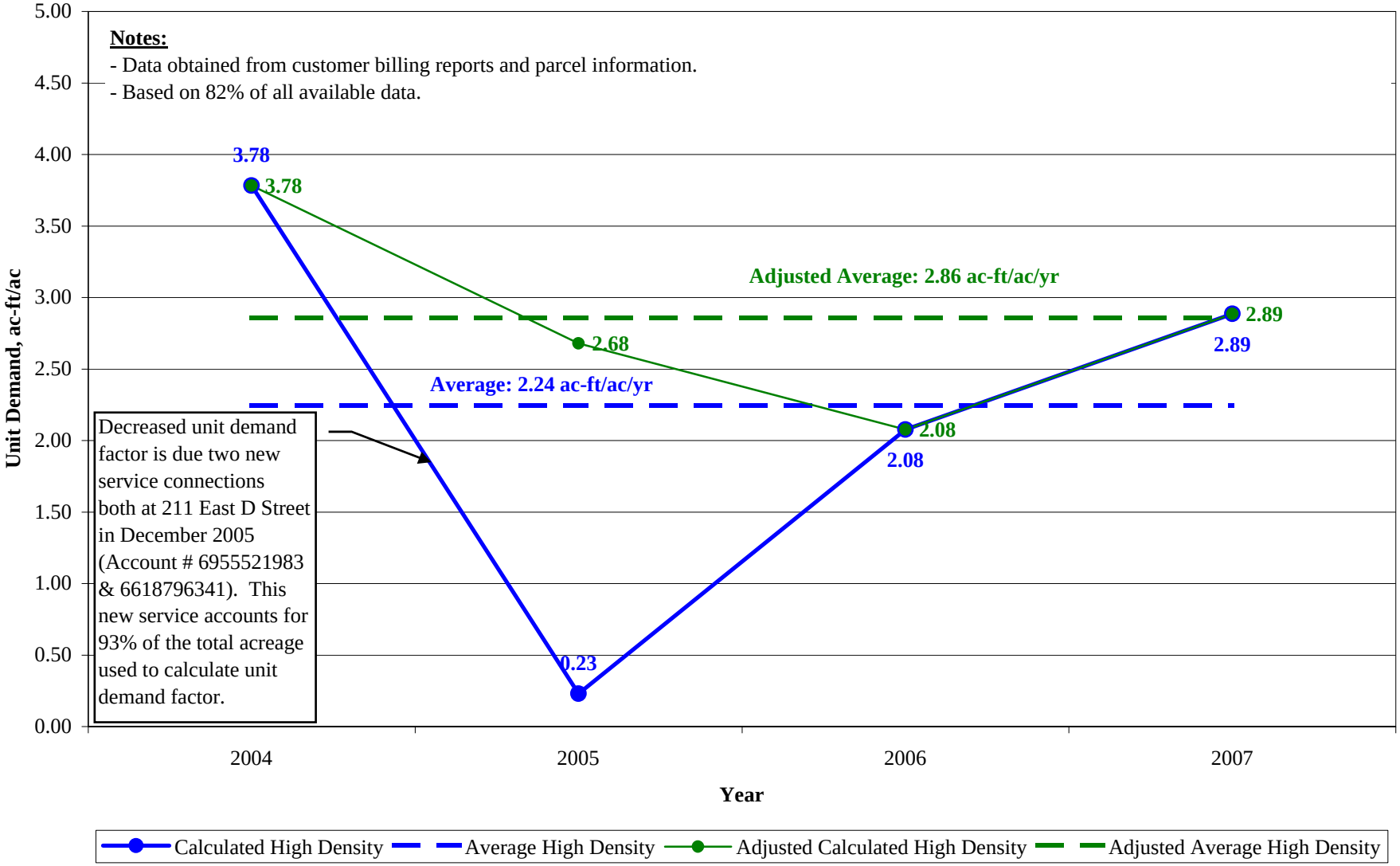

Figure 3-14. Historical Unit Demand Factor: General Industrial

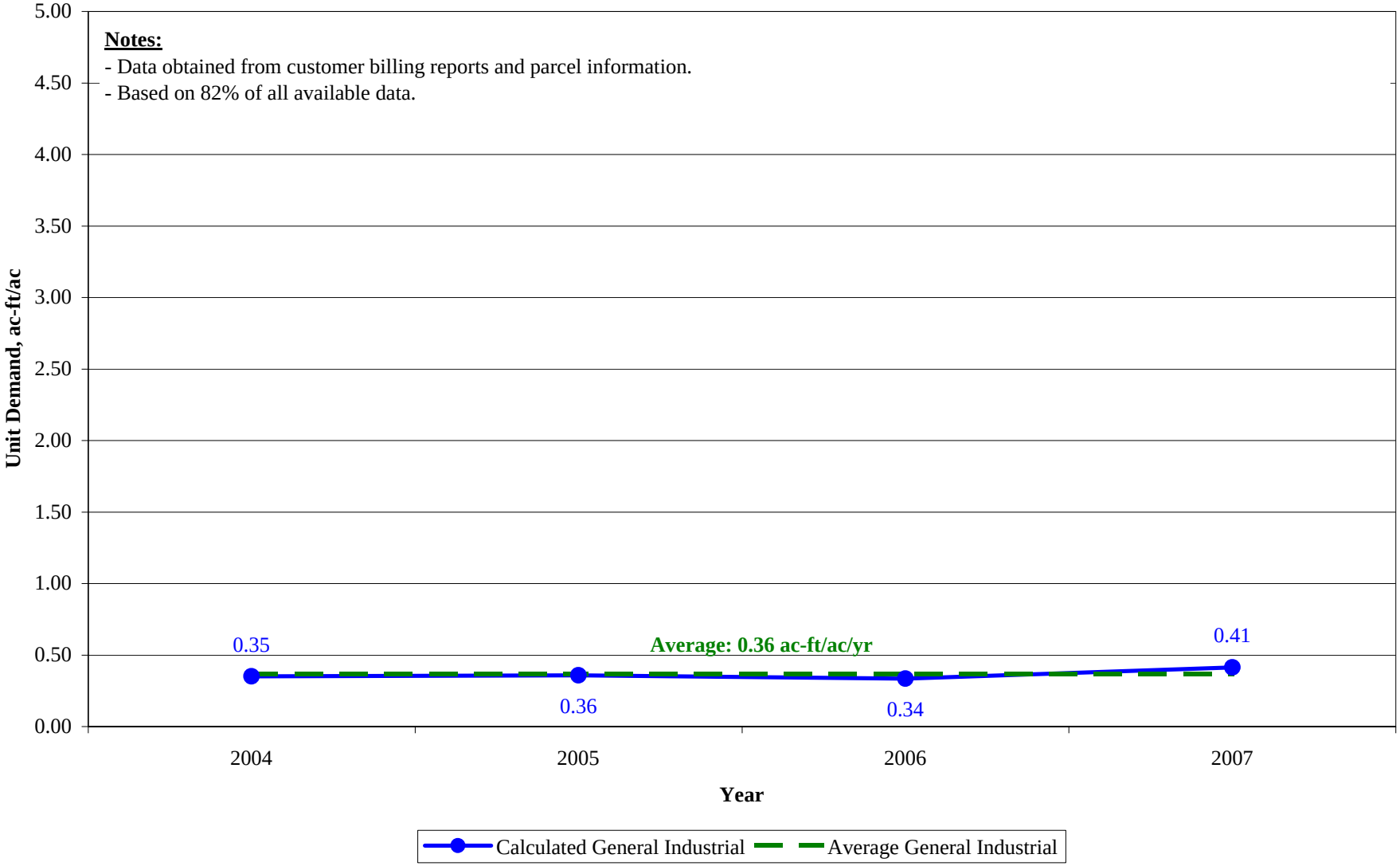

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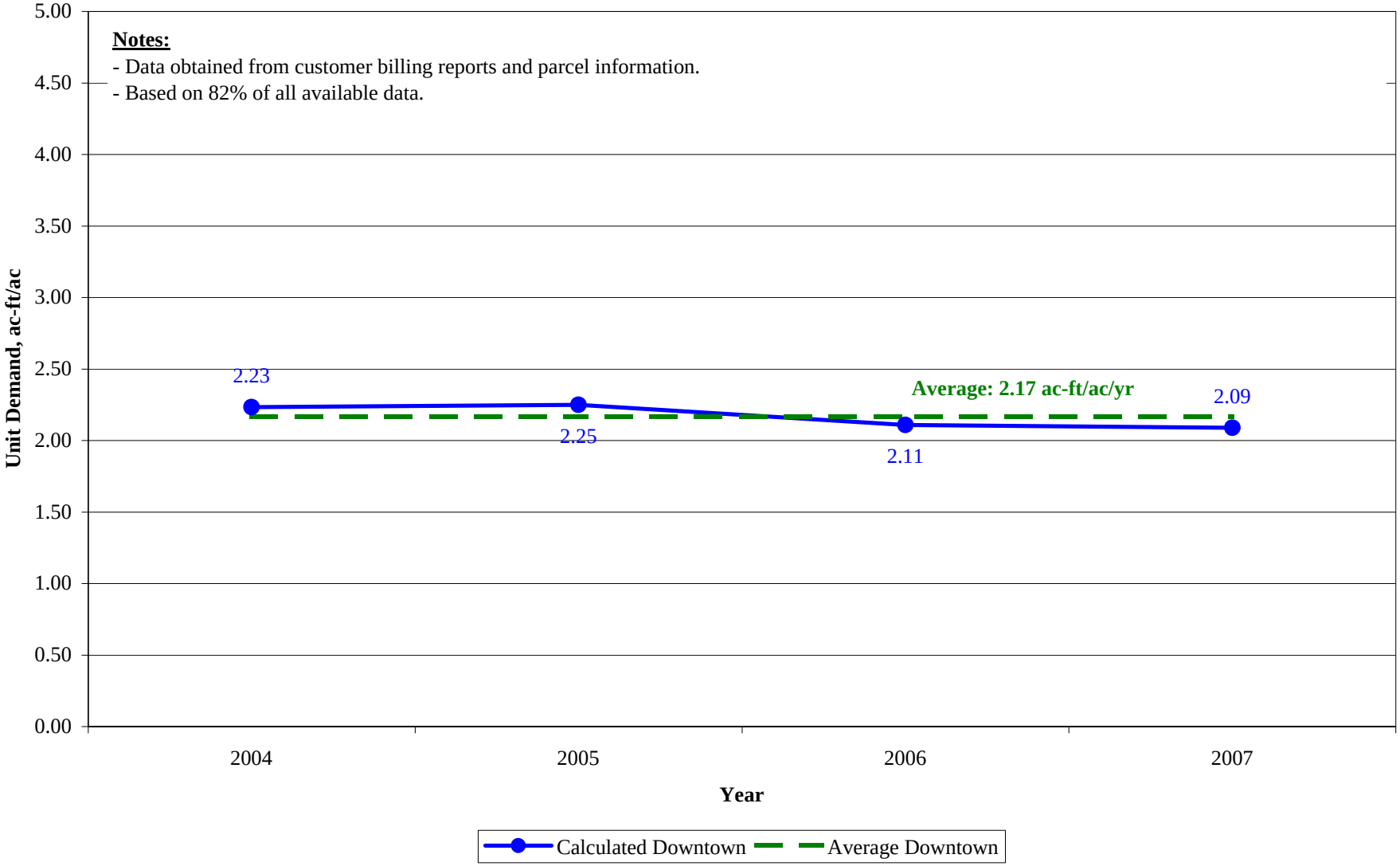
Figure 3-15. Historical Unit Demand Factor: Downtown



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Last Revised: 10/08/2008

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Water Supply and Facilities Master Plan

Figure 3-16. Historical Unit Demand Factor: Neighborhood Commercial

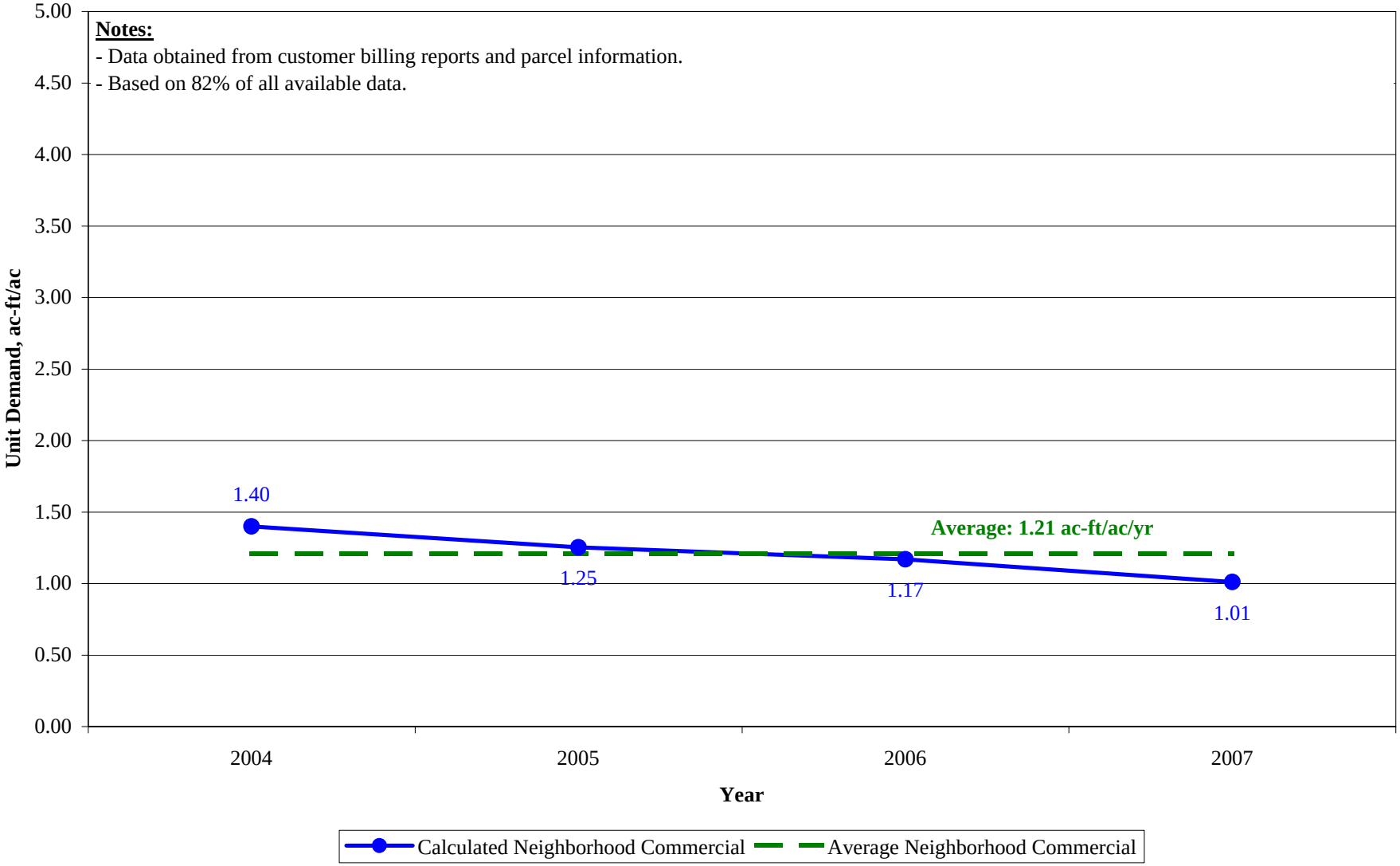

Figure 3-17. Historical Unit Demand Factor: Commercial Services

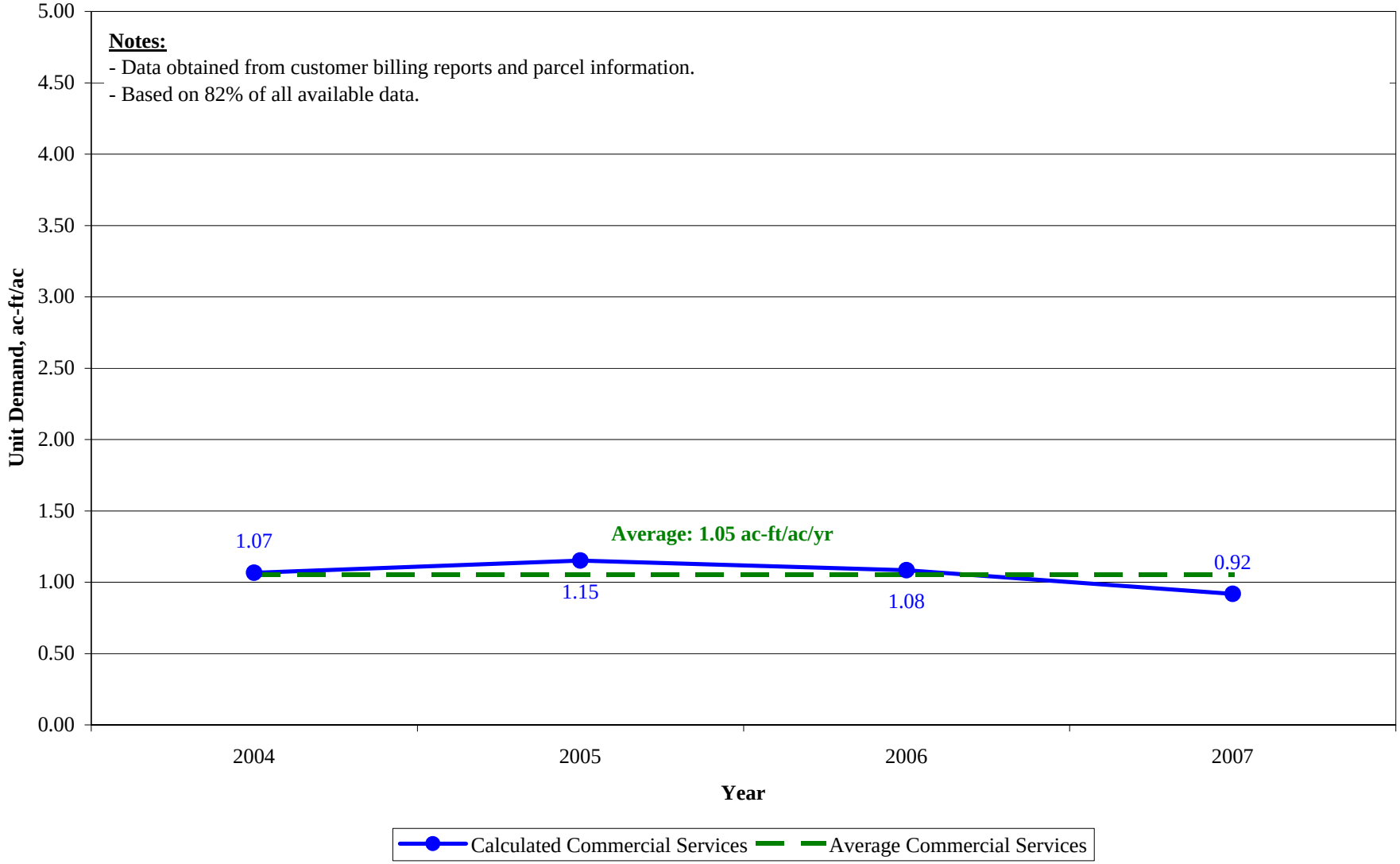

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Figure 3-18. Historical Unit Demand Factor: Professional/Administrative Services

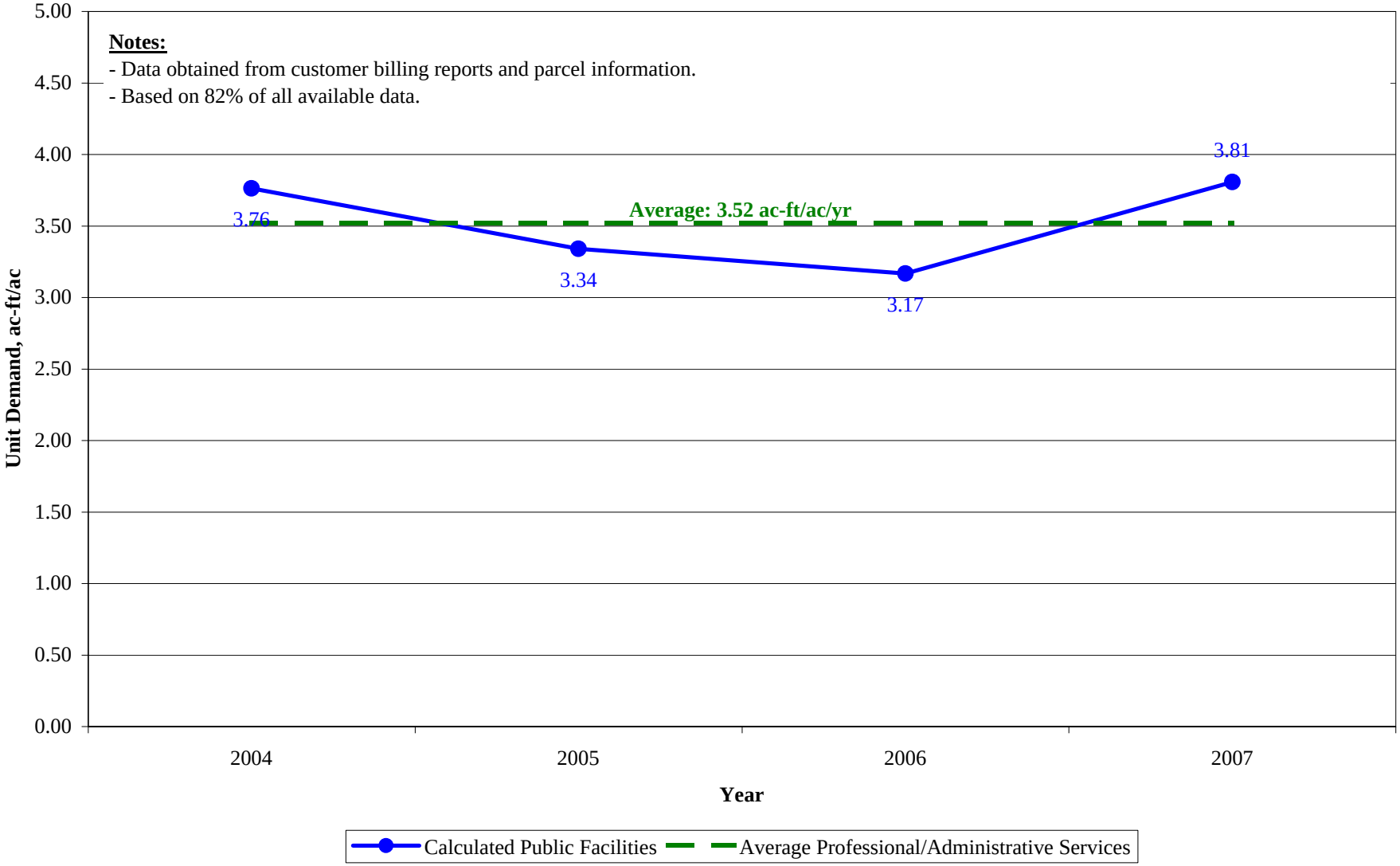

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Figure 3-19. Historical Unit Demand Factor: Core Area Mixed Use

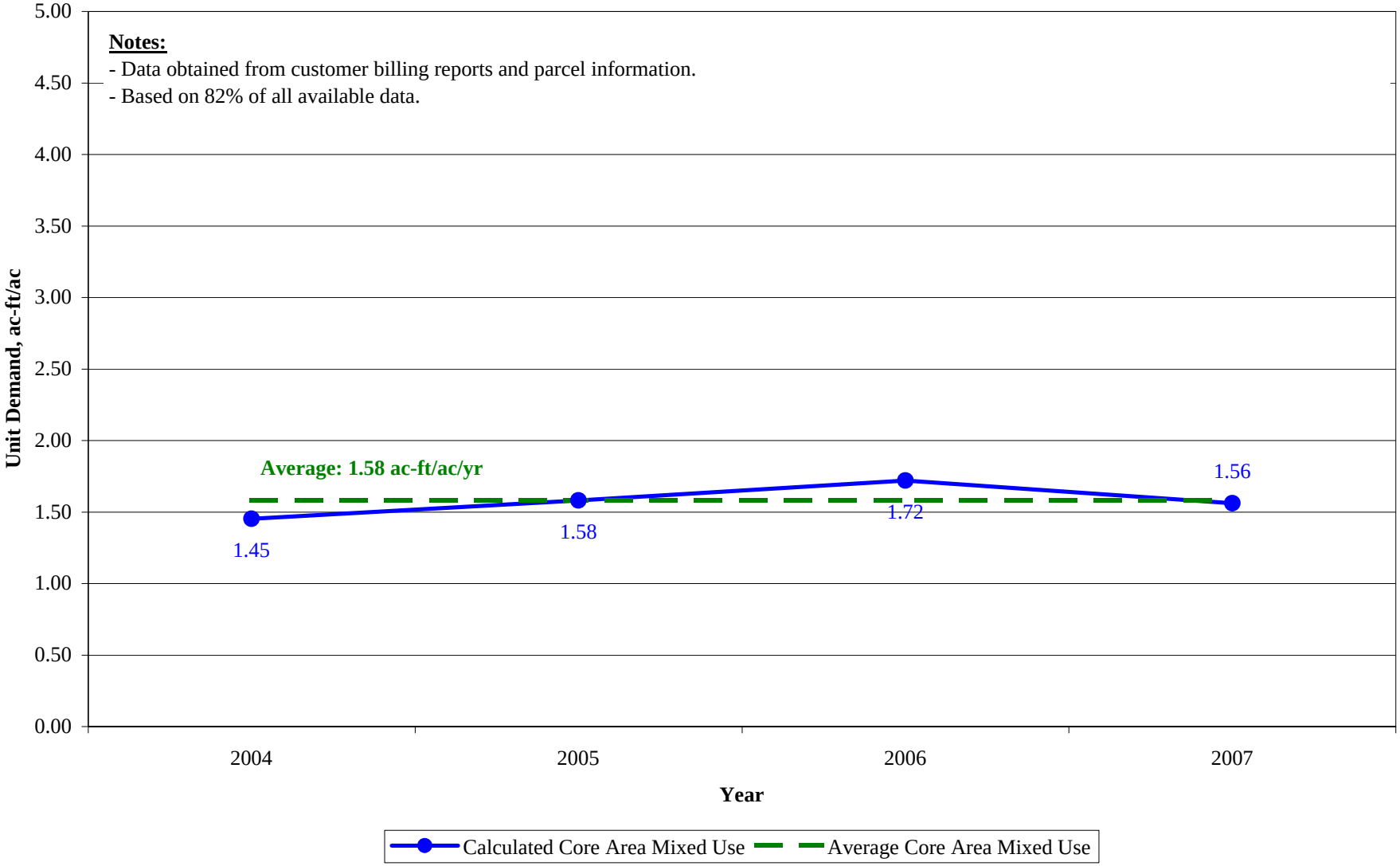


Figure 3-20. Historical Unit Demand Factor: Governmental/Institutional

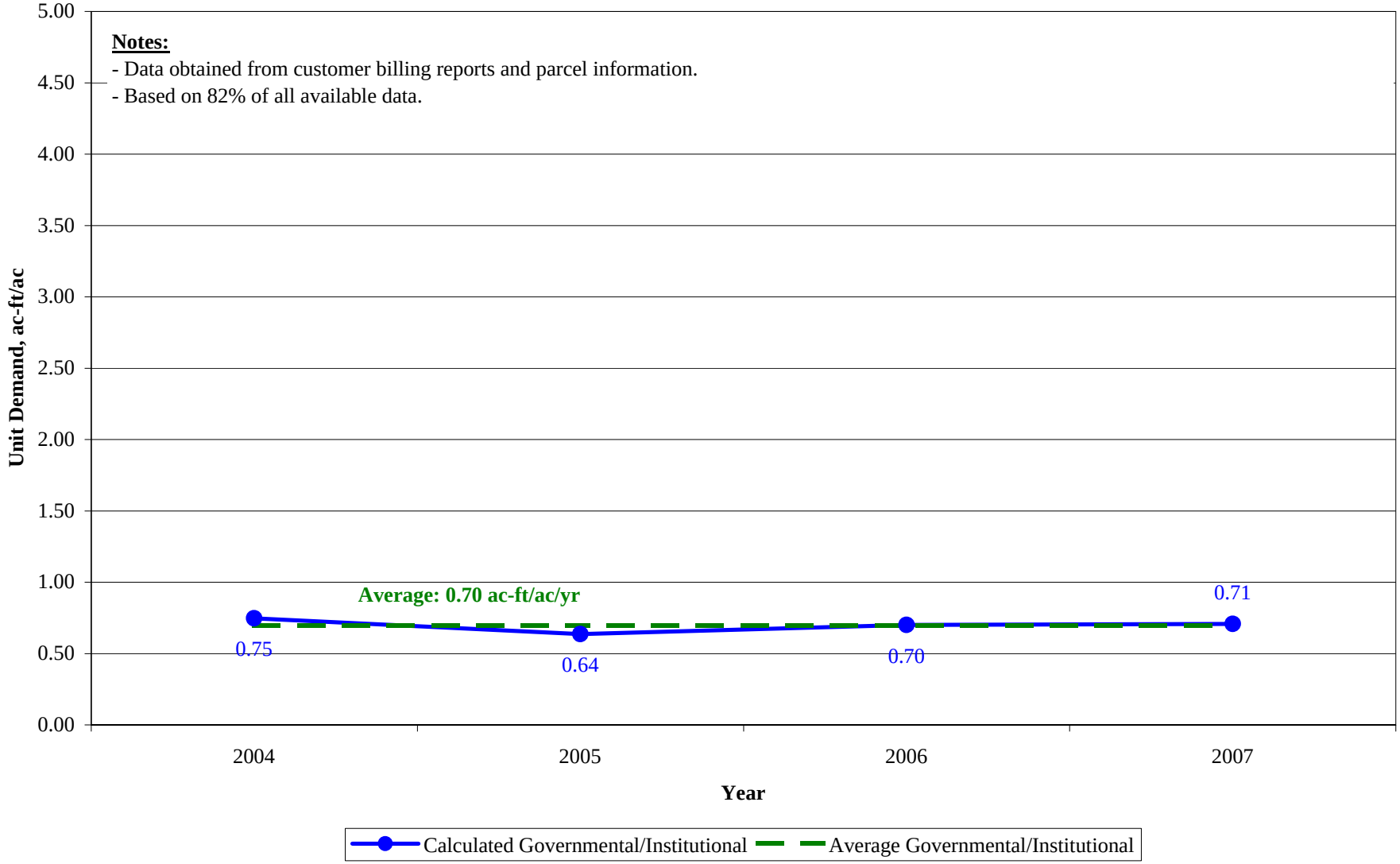


Figure 3-21. Historical Unit Demand Factor: Parks

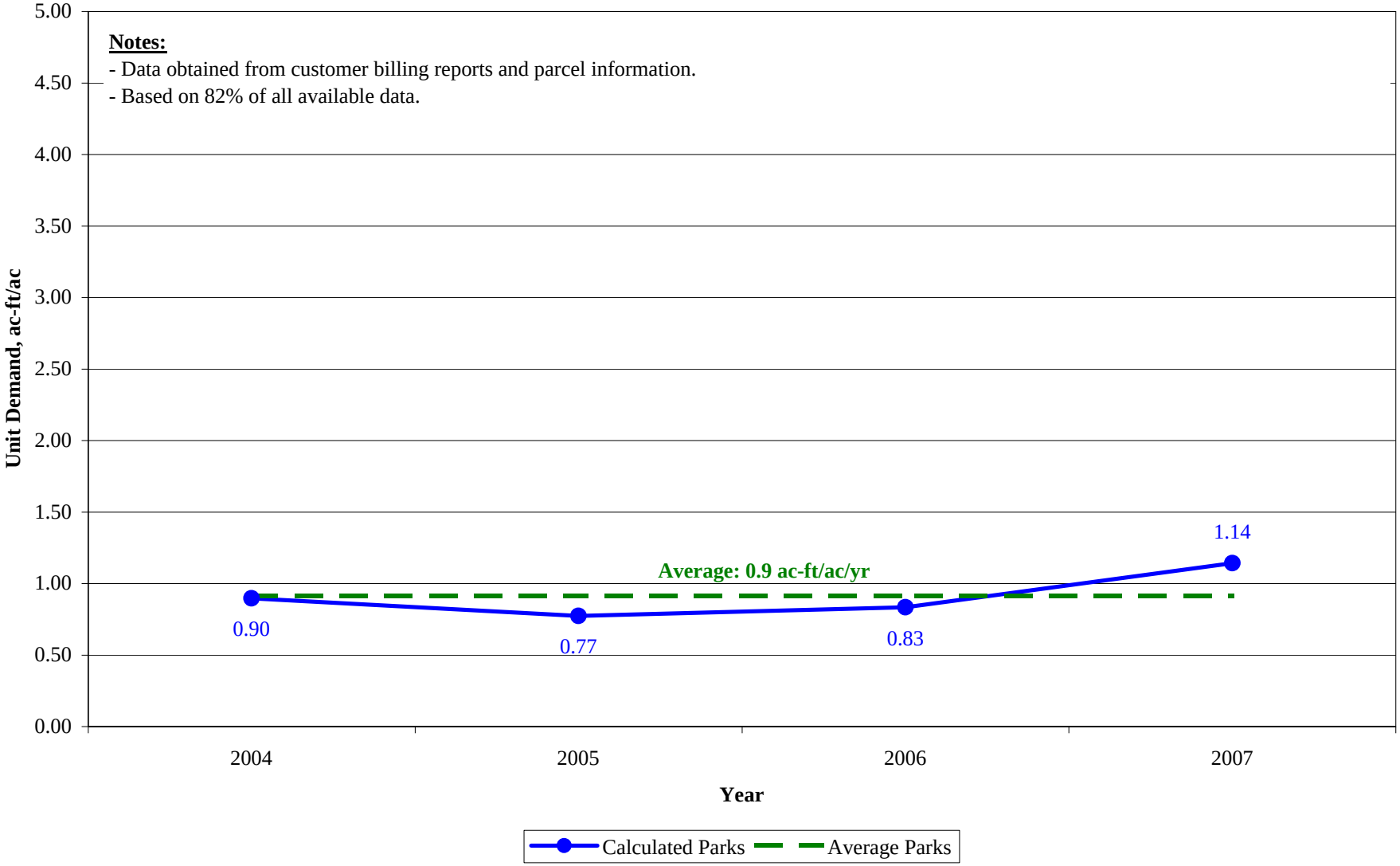
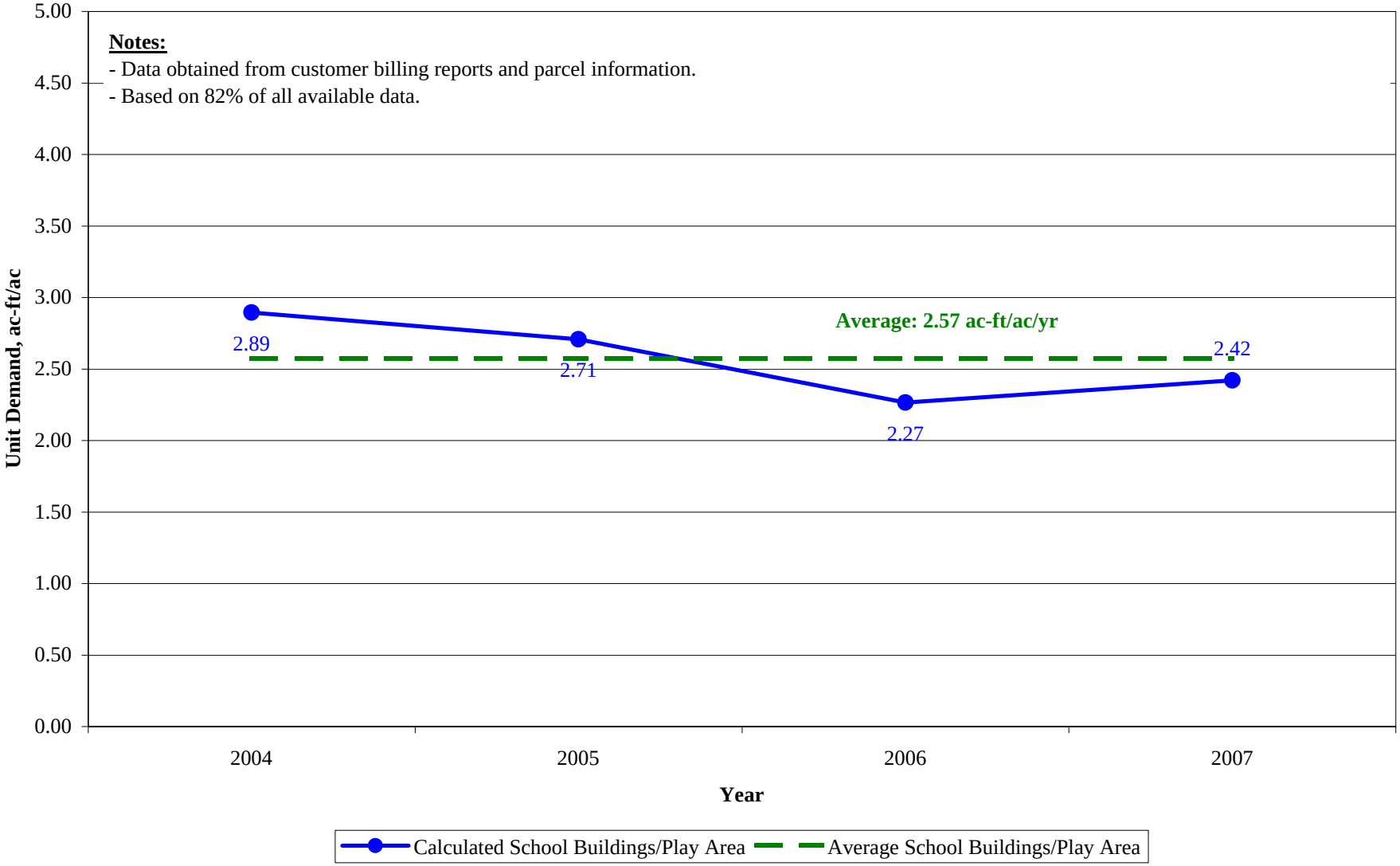
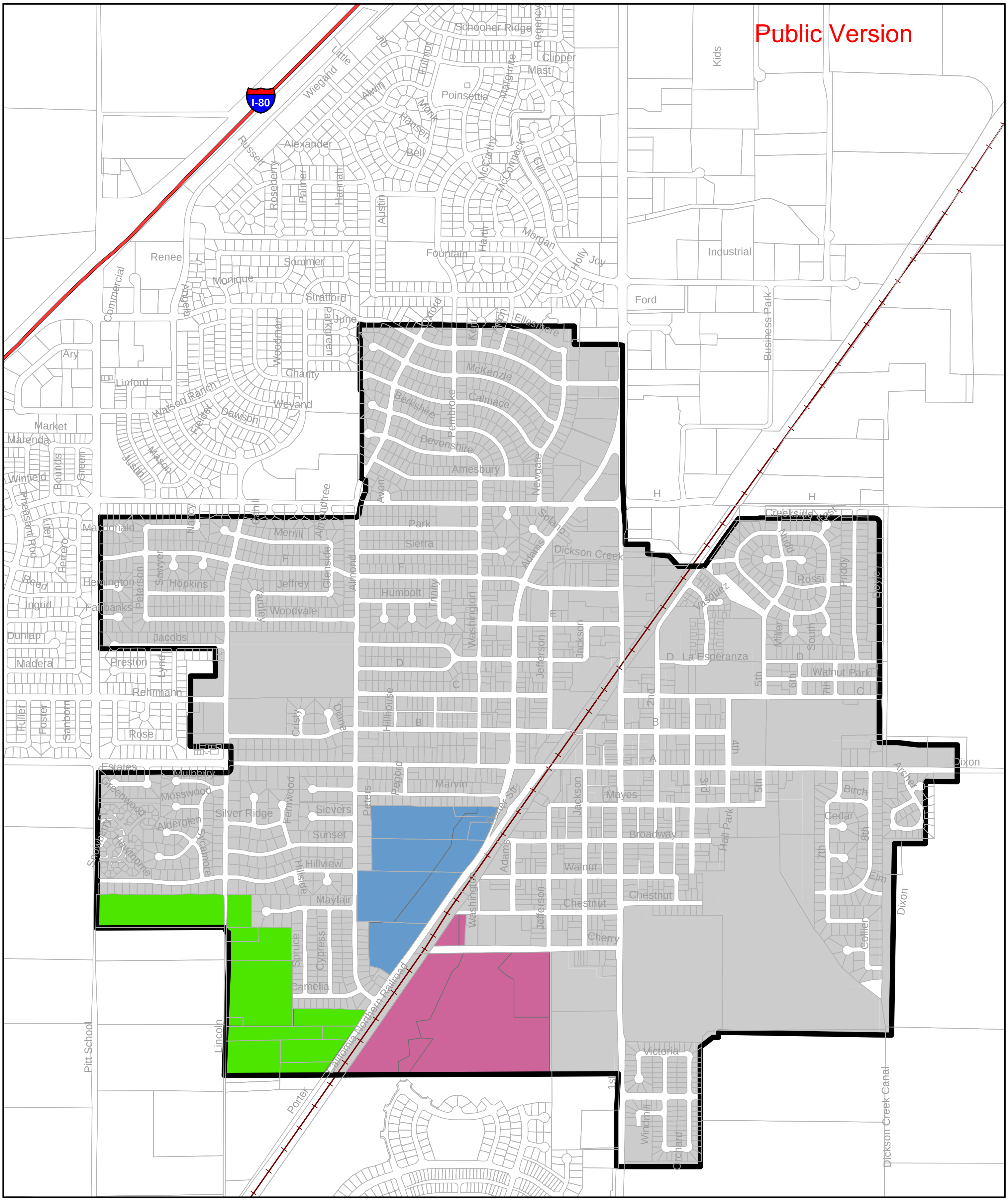


Figure 3-22. Historical Unit Demand Factor: School Buildings/Play Area





Legend

Existing Developments	CalWater_Parcels
Buildout in 2015	Cal Water Dixon District Boundary
Buildout in 2025	Highway
Buildout in 2035	California Northern Railroad

FIGURE 3-23

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Dixon District Water Supply
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TIMING OF DEVELOPMENTS

WEST YOST ASSOCIATES
Consulting Engineers

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Figure 3-24. Projected Demands over Time for the Dixon District

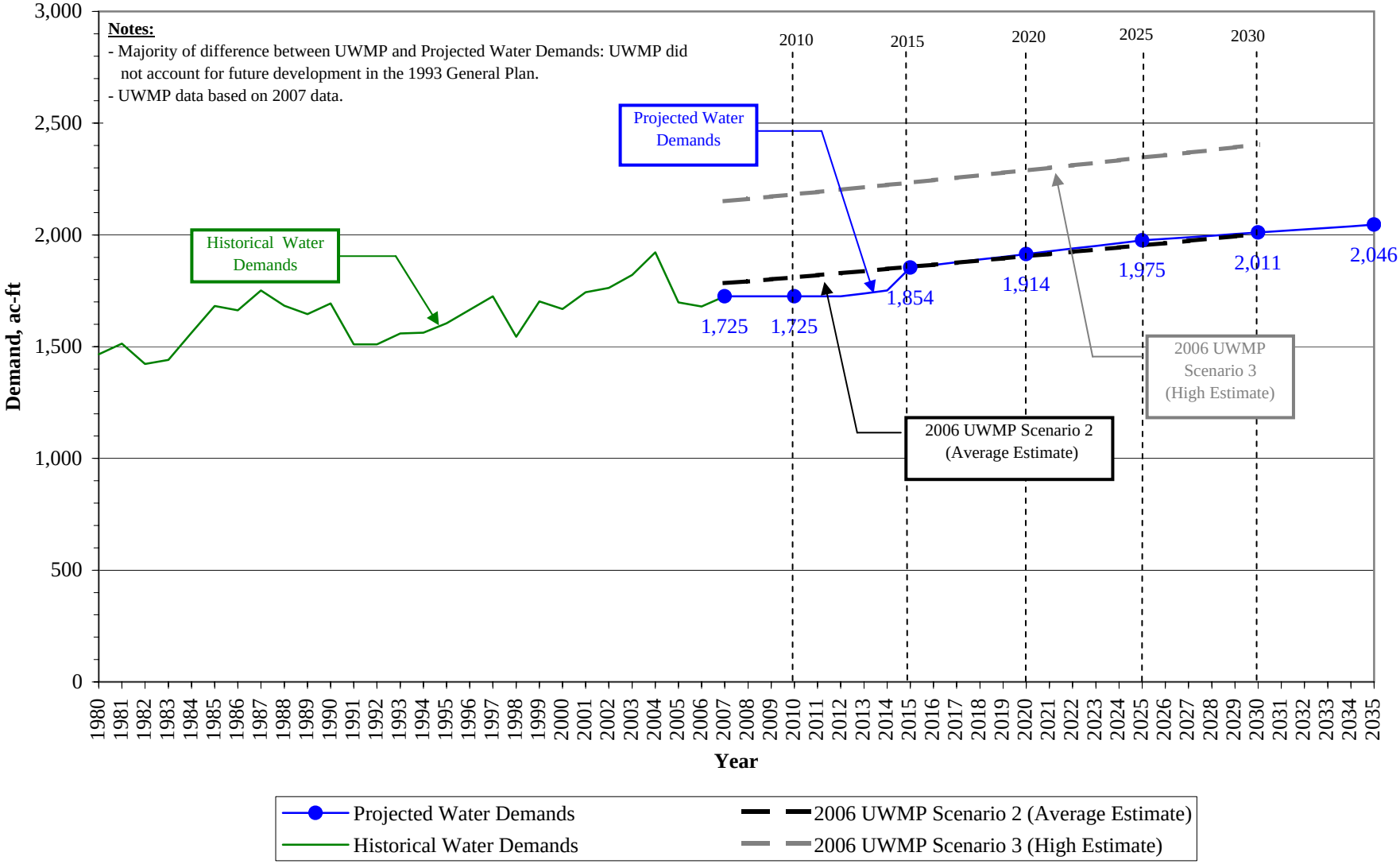

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Figure 3-25. Service Factor for Single Family Residential and Multifamily

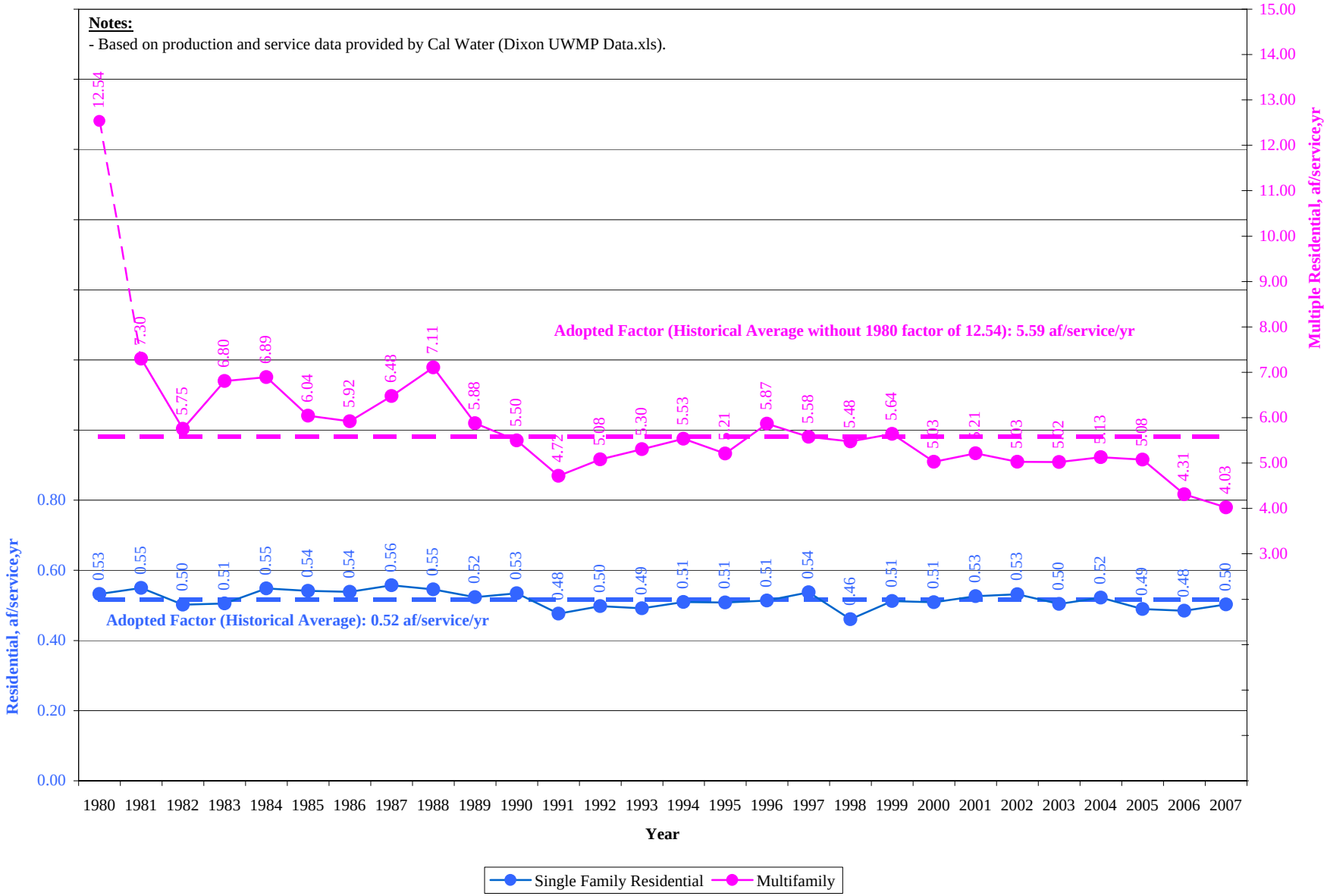

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Figure 3-26. Service Factor for Commercial and Government

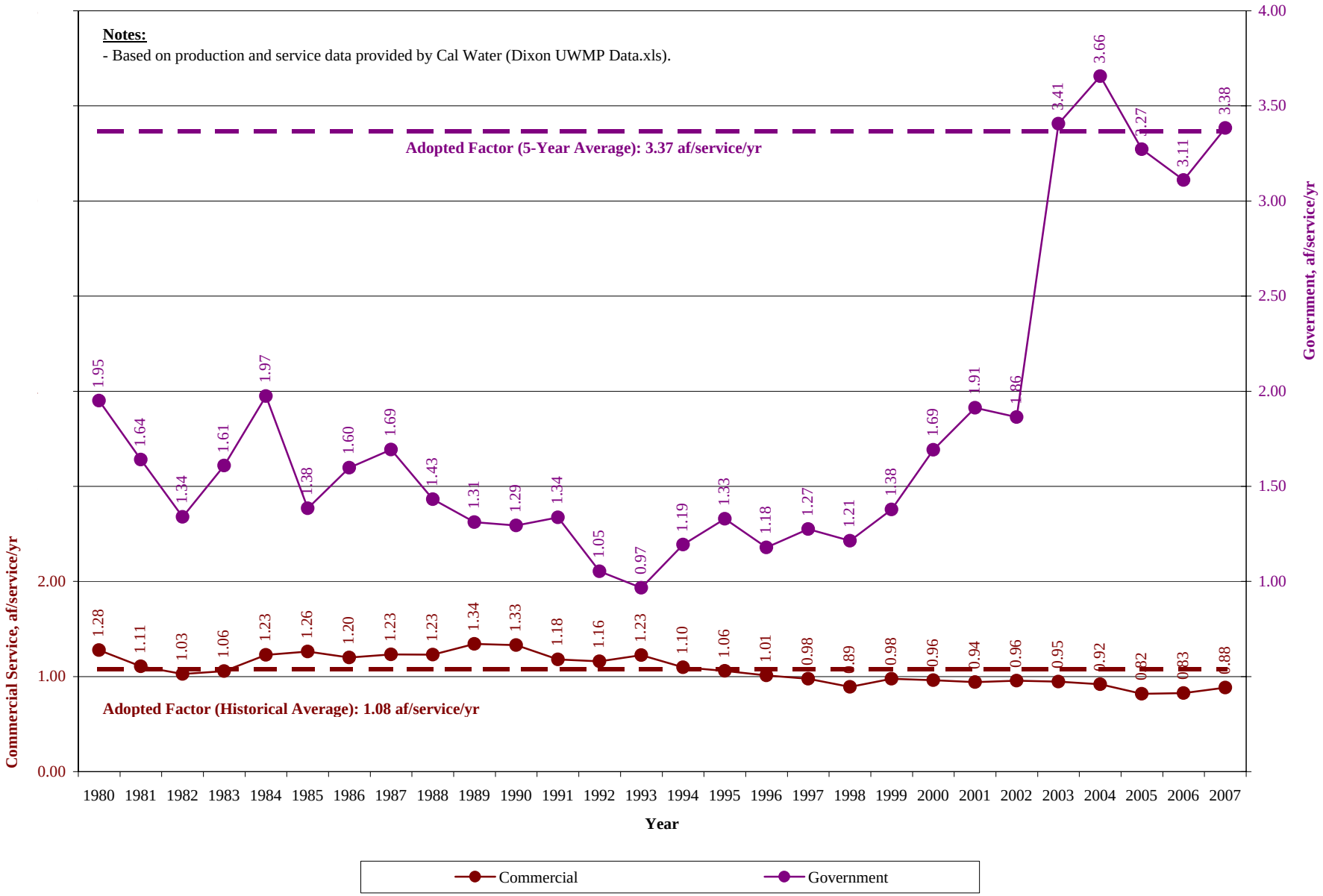

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Figure 3-27. Service Factor for Industrial

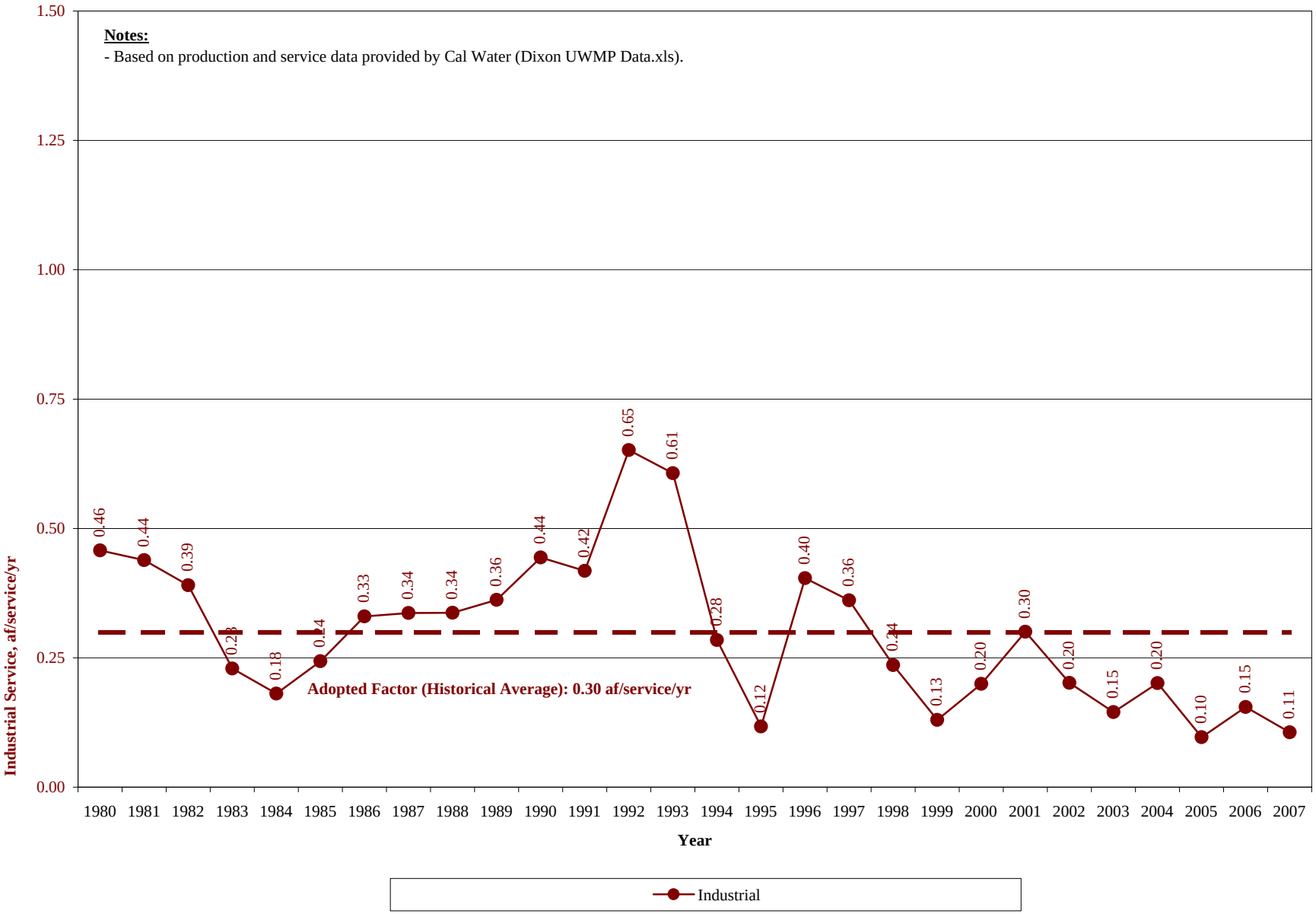

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Figure 3-28. Total Projected Services for the Dixon District

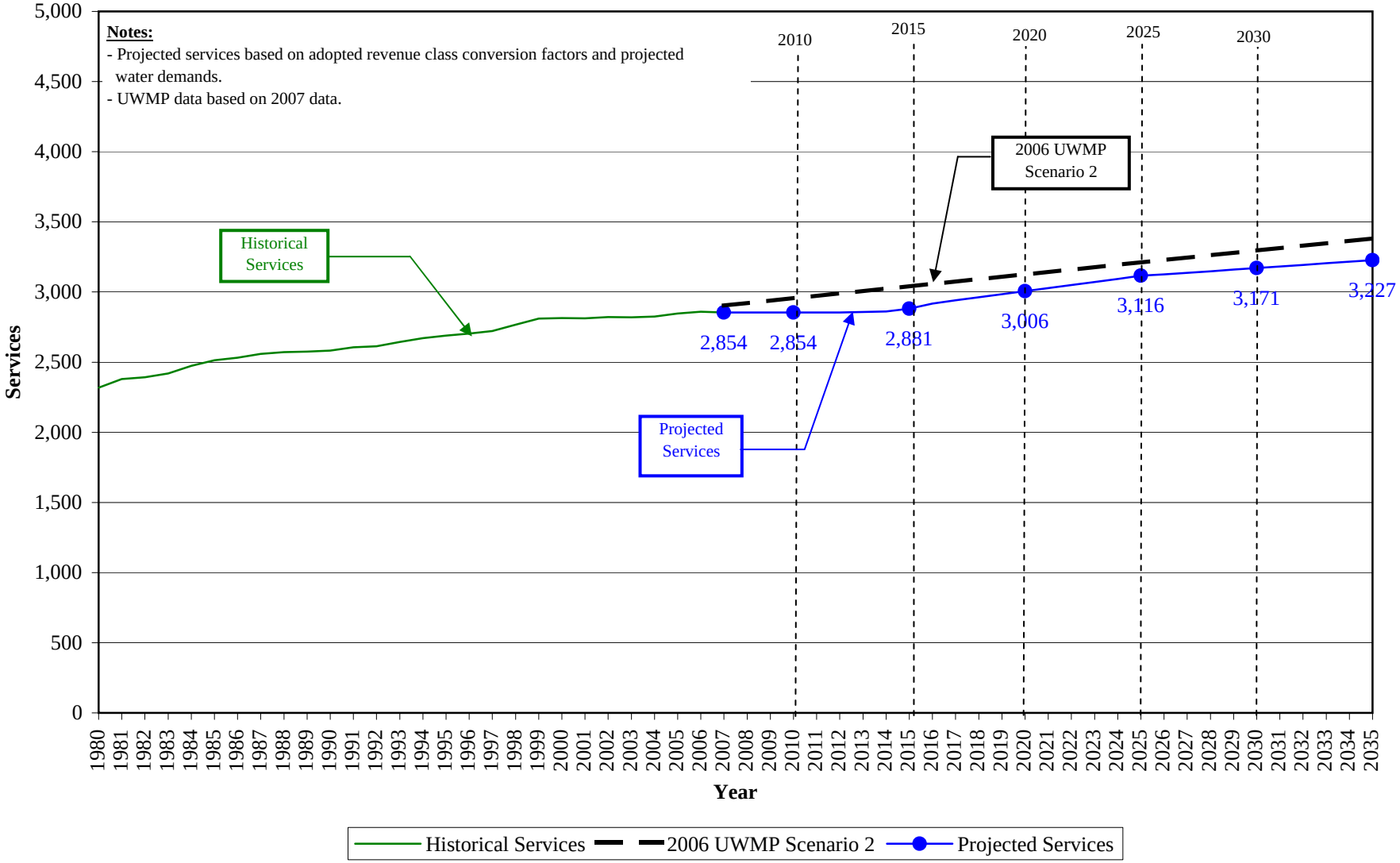

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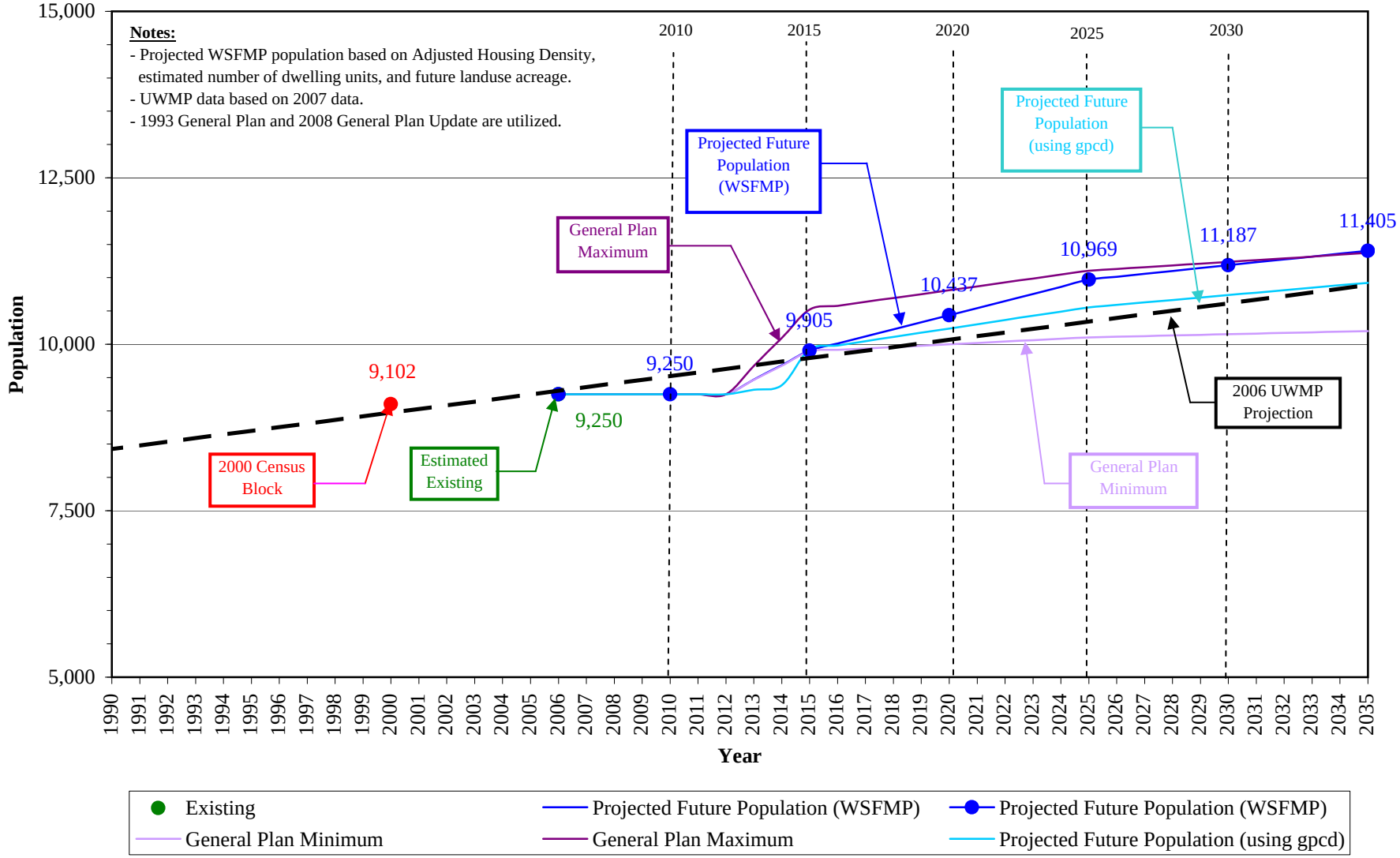
Figure 3-29. Projected Population Served Water for the Dixon District



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Last Revised: 11/17/2008

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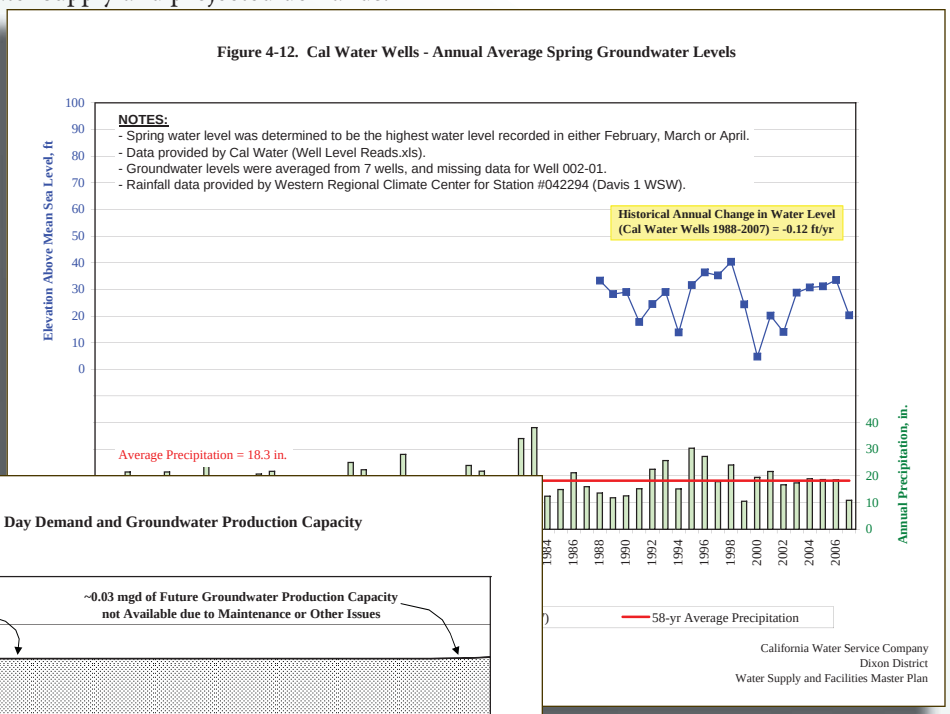
CHAPTER 4: INTEGRATED WATER SUPPLY PLAN

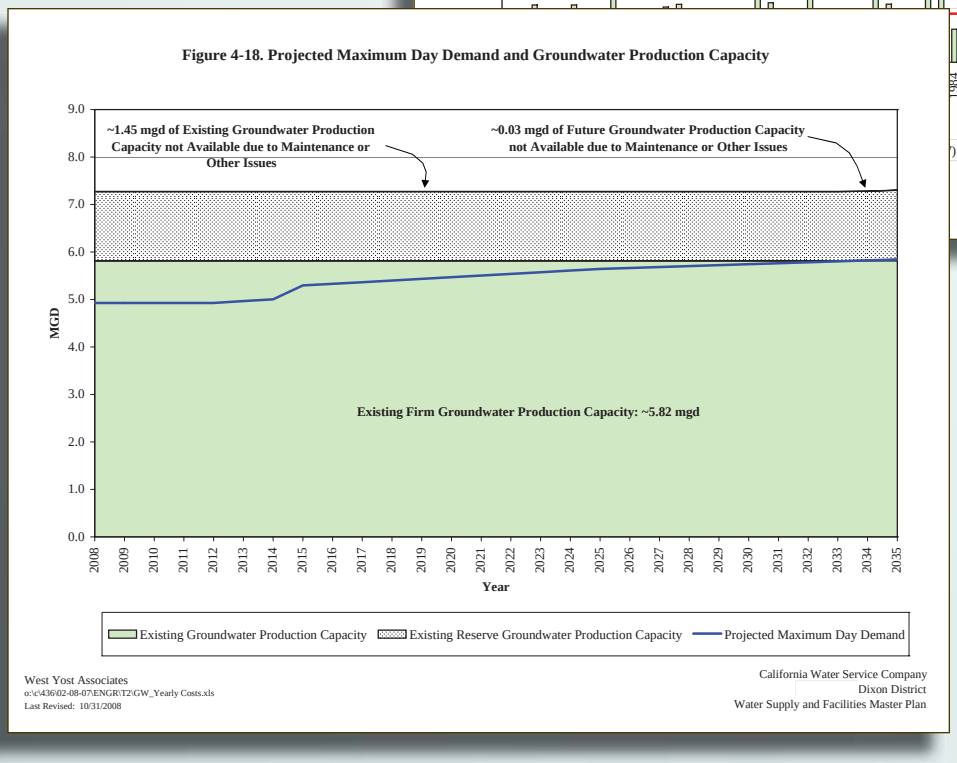
Chapter Highlights:

Cal Water's Dixon District currently relies solely on groundwater to meet the potable water demands of its existing customers. The purpose of this chapter is to describe the quantity and reliability of groundwater pumped by Cal Water. This chapter also describes other potential future water supply concepts (surface water and recycled water) that Cal Water can further explore to increase supply reliability as demands increase in the future and if groundwater conditions change. After identifying these potential water supplies for the Dixon District, this chapter then presents the most plausible future water supply scenario available to Cal Water, and associated cost, including a comparison of future water supply and projected demands.

Chapter Contents:

- Existing Groundwater Facilities
- Groundwater Basin Description
- Groundwater Management
- Groundwater Flow Trends
- Groundwater Level Trends
- Groundwater Quality
- Cost of Groundwater
- Other Potential Water Supply Concepts
- Recommended Water Supply Option





CHAPTER 4. INTEGRATED WATER SUPPLY PLAN

Cal Water's Dixon District currently relies solely on groundwater to meet the potable water demands of its existing customers. The purpose of this chapter is to describe the quantity and reliability of groundwater pumped by Cal Water. This chapter also describes other potential future water supply concepts (surface water and recycled water) that Cal Water can further explore to increase supply reliability as demands increase in the future and if groundwater conditions change.

After identifying these potential water supplies for the Dixon District, this Chapter then presents the most plausible future water supply scenario available to Cal Water, and associated cost, including a comparison of future water supply and projected demands. The following sections describe the methodology used to develop the water supply options recommended for the Dixon District.

- Existing Groundwater Facilities and Well Condition Assessment
- Groundwater Basin Description
- Inelastic Land Subsidence Potential
- Groundwater Management
- Groundwater Level Trends
- Groundwater Flow Trends
- Groundwater Quality
- Cost of Groundwater
- Other Potential Water Supply Concepts
- Recommended Water Supply Options

EXISTING GROUNDWATER FACILITIES AND WELL CONDITION ASSESSMENT

The Dixon District has a total of eight active wells located throughout Dixon District's service area (see Figure 4-1). The total current combined pumping capacity of the eight active wells is about 5,050 gpm, or about 7.272 mgd.[a]

The Dixon District pumped approximately 1,725 acre-feet (af) of groundwater for potable water consumption in 2007. As shown on Figure 4-2, groundwater pumpage over the past five years has been relatively stable, averaging about 1,770 acre-feet per year (af/yr), which is approximately 35 percent of the groundwater pumping capacity.

[a] Pumping capacity calculated from the flow capacity of the active groundwater wells as shown previously on Table 2-2 in Chapter 2.

Figure 4-2 also provides a summary of historical groundwater production and historical average annual rainfall from 1980 to 2007. As shown on Figure 4-2, water production in the Dixon District has increased at a relatively stable rate over the past 28 years, with only a few low production periods in 1982 to 1983, 1991 to 1995, 1998, and 2005 to 2007. These low production periods appear to correlate with the above average rainfall, except for 2005 to 2007, which may be due to ongoing conservation effort and/or water quality issues.

A summary of all Dixon District active wells is provided in Table 4-1 and graphically illustrated on Figure 4-3. All active Dixon District wells are listed as drilled between the years of 1950 and 1979. The total depths below ground surface (bgs) range from 538 feet to 900 feet. All wells except for Stations 001-03 and 003-01 are reported to have sanitary seals made of cement grout surrounding the conductor casing. In addition, a lining was documented on Station 008-01 from 405-425 feet. Cal Water documents and as built drawing for Stations 001-03 and 003-01 did not include any details for sanitary seals. Figure 4-3 illustrates the depths of the screened interval and pump settings for all of the production wells. The ground surface elevation (GSE) of all wells is also displayed.

The conditions of above ground facilities are assessed in Chapter 7 of this WSFMP.

GROUNDWATER BASIN DESCRIPTION

The Dixon District overlies the Sacramento Valley Groundwater Basin, which has been divided into several smaller subbasins using institutional boundaries established by the California Department of Water Resources (DWR). The Sacramento Valley Groundwater Basin is located in the north central California, and is bounded on the east by the Sierra Nevada and Cascade Ranges, and on the west by the North Coast Range.[1] The Sacramento Valley Groundwater Basin also extends from about five miles north of Red Bluff southward for 150 miles to the Sacramento-San Joaquin Delta and covers an area of approximately 6,000 square miles.[2]

Subbasin Description

Dixon is located in the Solano Subbasin (Subbasin 5-21.66) of the Sacramento Valley Groundwater Basin as defined in the California DWR Bulletin 118 update.[3] Characteristics of the Solano Subbasin are provided in Table 4-2.

Figure 4-4 shows the location of the groundwater subbasin. The subbasin is bounded by Putah Creek on the north; the Sacramento River on the east; Delta channels to the southeast and south; and a hydrologic divide on the west.[4] The western hydrologic divide corresponds to the crest of the English Hills and Montezuma Hills, and separates the Solano Subbasin from the Suisun-Fairfield Groundwater Basin.

Table 4-1. Summary of Production Well Information

Well ID	State Well Number	Date Drilled	Total Depth, bgs[a]	Cased Depth, bgs[1]	Casing Type	Casing Diameter, bgs[a]	Screen Type	Screen Size	Screen Zones, feet, bgs					Gravel Pack	Sanitary Seal, bgs[a]	Well Pump Test Result	Location
									100-200	200-300	300-400	400-500	500 +				
001-03	07N/01E-23A04 M	10/20/1954	538’	538’	CONDUCTOR 20” X 1/4” INNER 16” X 10 GA Double Nord Red	CONDUCTOR 0-50’ 20” INNER 0-538’ 16”	NA	3/8” X 3”			317-324	465-484	498-503	NA	0-50’[b]	412 gpm (2006)	EAST SIDE OF PORTER STREET @ MARVIN WAY
002-01	07N/01E-24C02 M	5/1/1950	600’	578’	CONDUCTOR 20” X 3/4” INNER 16” X 10 GA	CONDUCTOR 0-52’ 20” INNER 0-578’ 16”	NA	1/4” X 1-3/4”	185-218				495-503	NA	CEMENT GROUT 0-52’	638 gpm (2003)	SOUTH SIDE OF EAST “A” ST. +/- 200’ E/O 5TH ST.
003-01	07N/01E-14J01 M	1/1/1956	602’	602’	CONDUCTOR 30” X 1/4” INNER 16” X 1/4”	CONDUCTOR 0-48’ 30” INNER 0-602’ 16”	NA	5/32” X 1-1/2”	156-336		384-576			88 TONS 5/16 X 3/16	0-48’[b]	590 gpm (2006)	EAST SIDE OF ADAMS ST. +/- 350’ S/O WEST “H” ST.
004-01	07N/01E-23G02 M	2/10/1966	668’	668’	CONDUCTOR 20” X 1/4” INNER 16” X 10GA	CONDUCTOR 0-66’ 20” INNER 0-668’ 16”	NA	5/32” X 2-1/2”	130-145	215-225 260-285		400-410 430-440 470-480		8 TONS	GROUT SEAL 0-66’	635 gpm (2006)	NORTH SIDE OF PORTER ST. +/- 100’ N/O ALMOND ST.
005-01	07N/01E-14G02 M	5/1/1973	650’	650’	CONDUCTOR 30” X 1/4” INNER 16” X 5/16”	CONDUCTOR 0-60’ 30” INNER 0-650’ 16”	HORIZONTAL LOUVER	3/32”			330-630			70 YARDS OF MIXED #3, #4, #8, & #16	CEMENT GROUT 0-60’	320 gpm (2006)	NORTH SIDE OF WEST “H” ST. +/- 125’ E/O AVON CT.
006-01	07N/01E-14N03 M	2/10/1976	648	540’	CONDUCTOR 30” X 1/4” INNER 16” X 5/16”	CONDUCTOR 0-64’ 30” INNER 0-540’ 16”	HORIZONTAL LOUVER	2-3/8” X 3/32”		235-385		410-520		85 TONS OF #21 MIX	CEMENT GROUT 0-64’	395 gpm (2006)	S/W CORNER OF WOODVALE DR. & LINCOLN ST.
007-01	07N/01E-23D02 M	11/1/1979	822’	820’	CONDUCTOR 30” X 1/14” INNER 14” X 5/16”	CONDUCTOR 0-55’ 30” INNER 0-420’ 14” 800-820’ 14”	HORIZONTAL LOUVER	2-3/8” X 3/32”				420-800		150 TONS	CEMENT GROUT 0-55’	667 gpm (2006)	SOUTH SIDE OF HILLVIEW DR. +/- 200’ E/O PITT SCH. RD.
008-01	07N/01E-13M01 M	7/18/1979	900’	860’	CONDUCTOR 30” X 1/4” INNER 14” X 5/16” 12” X 3/32”	CONDUCTOR 0-60’ 30” INNER 0-399’ 14” 399-400’ REDUCER 850-860’ 12”	HORIZONTAL LOUVER	2-3/8” X 3/32”				400-850		193 TONS OF #21 MIX	CEMENT GROUT 0-60’ LINER 405-425’	312 gpm (2006)	SOUTH SIDE OF NO. 2ND ST. +/- 200’ W/O W. CREEKSIDE CIR.

[a] BGS = Below Ground Surface
[b] Drill reports are not available for wells 001-03 and 003-01.

Table 4-2. Characteristics of the Solano Subbasin[5]

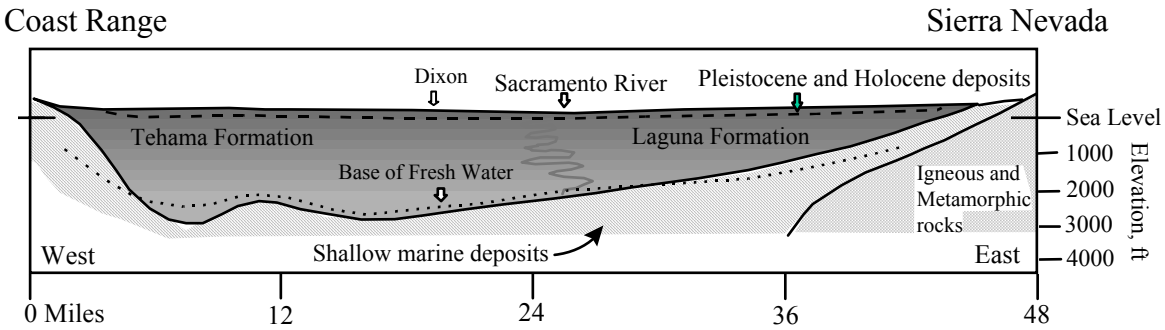
Groundwater Basin Name	Subbasin Name	DWR Basin Number	Surface Area
Sacramento Valley	Solano	5-21.66	425,000 acres (664 square miles)

Hydrogeology

The Sacramento Valley in the vicinity of Dixon is filled by a thick sequence of marine sedimentary rock of Late Jurassic (159 million years [my] before present) to Eocene (34 my) age, unconformably overlain by a relatively thin sequence of continental sedimentary deposits of Pliocene (5 my) and younger age.[6]

A generalized geologic cross section for the Sacramento Valley is shown in Figure 4-5.

Figure 4-5. Sacramento Valley Geologic Cross Section[7]



The older, deeper marine rocks contain saline water. The freshwater aquifers in the vicinity of Dixon occur in the overlying continental sedimentary deposits, which are presented from oldest to youngest in the following discussion. Table 4-3 summarizes the major water-bearing formations within the Solano Subbasin. Appendix D presents a geologic map encompassing Dixon and vicinity.[5]

Table 4-3. Water-Bearing Formations within the Solano Subbasin

Formation[(a)]	Typical Thickness, feet	Well Characteristics
Tehama Formation	1,500 to 2,500	Well Depth Range (varies by type of formation): Domestic 38 to 1,070 Municipal/Irrigation 62 to 2,275 Well Yield Range: NA
Older Alluvium	60 to 130	
Stream Channel and Basin Deposits	0 to 40	
Flood Basin Deposits	0 to 150	

(a) California DWR Bulletin 118.

Tehama Formation

The Tehama Formation forms the oldest, deepest and thickest part of the freshwater aquifer in the vicinity of Dixon. The Tehama Formation consists of up to nearly 2,500 feet of moderately compacted silt, clay, and silty fine sand enclosing thin, discontinuous lenses of sand and gravel, silt and gravel deposited in a fluvial (river-borne) environment. Based on the mineralogy of surface exposures, the sediments were derived from erosion of the Coast Ranges and Klamath Mountains.[8, 9, 10]

The Tehama Formation is exposed at the land surface to the west of Dixon, in the English Hills and the eastern flank of the Vaca Mountains (Figure 4-4). The Tehama Formation is buried beneath younger sediments to the east of the English Hills.

The regional hydrostratigraphic framework for the Tehama Formation is defined in U. S. Geological Survey Water-Supply Paper 1464, *Geology and Usable Ground-Water Storage Capacity of Part of Solano County, California.*[11] Thomasson, et al (1960) shows three broad hydrostratigraphic zones within the Tehama Formation and related continental sediments:

- A relatively coarse-grained zone extending to a depth of approximately 1,500 feet
- A predominantly fine-grained zone between depths of approximately 1,500 and 1,800 feet
- A predominantly coarse-grained zone between depths of approximately 1,700 and 2,700 feet.

The permeability of the Tehama Formation varies but is generally less than in the overlying unconsolidated alluvial deposits. Because of the thickness of the producing zones, production from the Tehama Formation can be up to several thousand gpm per well.[12] The majority of irrigation and municipal wells in the Solano Subbasin are completed in the Tehama Formation.[13, 14] Based on their depths, the Dixon District's wells are screened in the Tehama Formation (see Table 4-1 and Figure 4-3).

Older Alluvium

Older Alluvium consists of loose to moderately compacted silt, silty clay, sand and gravel deposited in alluvial fans during the Pliocene and Pleistocene ages.[15] Thicknesses range from approximately 60 to 130 feet. Wells penetrating the sand and gravel units produce between 300 and 1,000 gpm.[16] The majority of the domestic wells in the vicinity of Dixon produce water from the Older Alluvium. The upper screened zones in Dixon District Wells 002-01, 003-01 and 004-01 may draw water from the older Alluvium.

Stream Channel and Basin Deposits

Holocene stream channel and basin deposits are the youngest sediments in Dixon, with ages of roughly 10,000 years or less.[17] The stream channel and basin deposits consist of up to 40-foot sections of unconsolidated clay, silt, sand and gravel reworked from older formations by streams. According to DWR,[18] which also refers to these deposits as younger alluvium, these deposits

form a shallow unconfined aquifer of moderate to high permeability but with limited capacity due to the relatively restricted lateral and vertical extents of the deposits.

Flood Basin Deposits

Holocene flood basin deposits are very young surficial deposits formed during flood events when streams overtopped their natural levees flooding the surrounding area. These deposits are primarily found to the east of Dixon in the Yolo Flood Basin of the Sacramento River (see Figure 4-4). As the flood water spread, the current velocity and stream competency decreased, resulting in deposition of silts, clays and fine sands. Flood basin deposits reach thicknesses up to 150 feet and may be interbedded with stream channel deposits.[19] Because of their low permeability, limited extent, and generally poor water quality, flood basin deposits are typically not used for groundwater production.[20]

INELASTIC LAND SUBSIDENCE POTENTIAL

Significant land subsidence has been documented in areas of Solano and Yolo Counties north of Dixon, but adverse impacts associated with land subsidence have not been identified within the Dixon District or its immediate vicinity. Land subsidence due to groundwater withdrawal is triggered by decreases in pore pressure in a confined aquifer system containing clay layers (typically, montmorillonite clay). The decrease in pore pressure increases the effective stress on the aquifer skeleton. If this effective stress exceeds the maximum stress to which the aquifer skeleton has been subjected in the past, the clay layers will undergo permanent compaction.

Differential land subsidence and associated earth fissuring resulting from groundwater withdrawal have had significant consequences in several California groundwater basins. The risk of significant impacts depends on a complex array of variables including: the degree of new groundwater development, especially in areas or at depths not previously exploited; changing land use, which could bring to light an impact that would otherwise go unnoticed; and the mineral composition and consolidation history of the aquifer skeleton.

Land subsidence of up to 5.4 feet is documented over the past few decades in a north-south trending zone in the southwestern Sacramento Valley that extends from Zamora to Dixon.[21] Down-well television surveys have been used to document well casings damaged by land subsidence over this same zone, at the Yolo/Colusa County line, and northward into central Colusa County. Of 81 wells found to be damaged, the substantial damage was in the sections of the well casings penetrating the Tehama Formation. A comparison of damaged and undamaged wells in the main area of subsidence showed similar amounts of compressible sediments and that the damaged wells were those in which the greatest declines in head had occurred after well installation.[22] Recent studies have verified that subsidence is continuing to occur in the Yolo County portion of this zone.[23]

The 1976-1977 droughts were the first time that more groundwater than surface water was used for agricultural irrigation in the Sacramento Valley. Drilling and pump contractors reported that in the summer of 1977 many wells were discovered to have broken casings, and the demand for new and replacement wells could barely be met.[24]

The Yolo County GPS Subsidence Network has six and the Delta Land Subsidence Monitoring Network has three land subsidence benchmarks in the vicinity of Dixon. Continued monitoring of these benchmarks and groundwater levels will provide a means of evaluating future land subsidence risks.

GROUNDWATER MANAGEMENT

The Solano Subbasin is not adjudicated. A "water master" is not appointed to resolve groundwater pumping issues, nor are there established limits on groundwater pumping by individuals or agencies within the basin. However, neighboring water agencies sharing the Solano Subbasin have adopted groundwater management plans. Those agencies include the City of Vacaville, Reclamation District #2068, Maine Prairie Water District, and Solano Irrigation District.

In the City of Dixon, domestic water is supplied by Cal Water and the Dixon-Solano Municipal Water Service (DSMWS). As previously discussed, Cal Water operates eight wells that produced 1,725 af in 2007 and DSMWS operates four wells that produced approximately 1,850 af. Together, the water produced in the City of Dixon area is approximately 3,575 af/yr. Outside of the City of Dixon's Sphere of Influence (SOI), the Solano Irrigation District operates nine wells drawing approximately, on average, 6,000 af/yr from the same aquifer.

Prior to the completion of the Solano Project in 1959, groundwater was extensively used in Solano County for municipal and agricultural supplies. The Solano Project refers to United States Bureau of Reclamation project to store surface water in Lake Berryessa for potable and non-potable uses primarily in Solano County. One of the primary reasons behind the Solano Project was to correct the overdraft of groundwater, which was occurring in agricultural areas. Since then, the Solano Project has halted the overdraft of groundwater, and the groundwater levels have rebounded in most areas of the Solano Subbasin. Groundwater level data presented in the North Central Solano County Groundwater Resources Report and additional data published by DWR, show that the subbasin is in a state of equilibrium. The groundwater levels are not permanently impacted by multiple dry years and data also shows slight variations in response to climatic conditions. Over the last twenty years the basin levels are stable despite increased water demand.

Solano County Water Agency is making efforts to assist water agencies to update their existing groundwater management plans to be compliant with recent amendments to the California Water Code (CWC) resulting from Senate Bill No. 1938, Machado. Agencies involved share a common groundwater basin and are seeking to manage the basin to the benefit of all stakeholders, while maintaining their individual groundwater management plans. Stakeholders in the groundwater basin include Solano County, the Rural North Vacaville Water District (RNVWD), the City of Dixon, DSMWS, and Cal Water. These plans have not been adopted at the time of this WSFMP. Appendix E provides additional information on Groundwater Management Technical Memorandum prepared by WYA in 2006.

GROUNDWATER LEVEL TRENDS

Groundwater Elevations

To evaluate historic groundwater levels and trends in the Dixon District service area, WYA reviewed DWR Bulletin 118 to define criteria necessary to evaluate groundwater level data. Groundwater level data from DWR monitoring wells and the Dixon District wells were analyzed to indentify groundwater level trends and existing conditions within the subbasin underlying the Dixon District service area.

Groundwater Level Data per DWR Bulletin 118

The DWR Bulletin 118 reports that the groundwater elevations prior to 1912 represent the groundwater basin in its natural state. Between the years 1912 and 1932, precipitation was below average, which resulted in lower groundwater levels. In 1932 to 1941 groundwater levels recovered slightly because of above average precipitation. After 1941, groundwater levels declined due to increasing agricultural and urban development and the levels reached their lowest in the 1950s. After 1959, when the Solano Project began to supply surface water to Solano County, groundwater levels began to rise. Since the 1980s, the groundwater levels have been stable with low levels in the dry season and high levels in the wet season of each year.

Criteria for Evaluation Historical Groundwater Levels

DWR Bulletin 118 defines overdraft as follows:

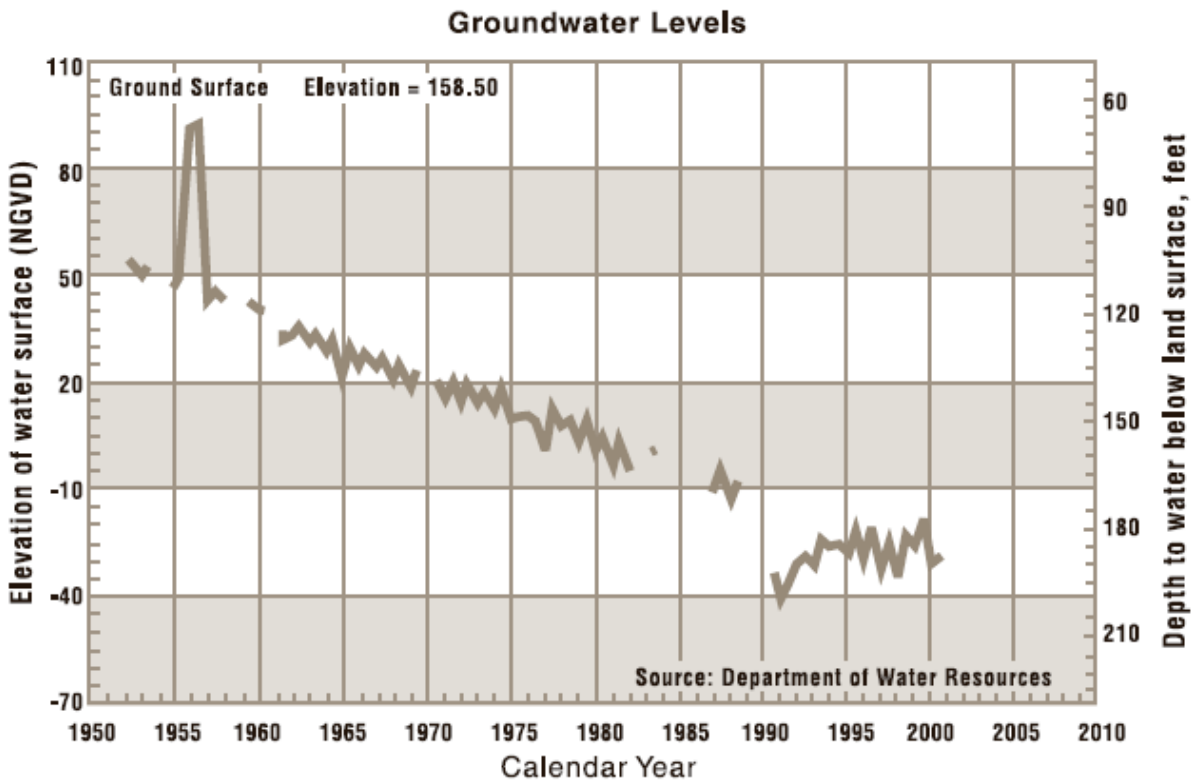
> *"Groundwater overdraft is defined as the condition of a groundwater basin or subbasin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions. Overdraft can be characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years."*

This definition implies that overdraft conditions exist if pumping exceeds recharge, and that declining water levels over an unspecified but operationally representative period is an attribute of overdraft conditions. As shown in Figure 4-6, DWR Bulletin 118 also provides an example of overdraft conditions. This example reflects declining groundwater levels at a rate of about 2.5 feet per year (ft/year).

Historical annual water level trends fluctuate (declining or increasing by small amounts) depending on annual hydrologic conditions. These natural fluctuations do not necessarily indicate the presence of overdraft conditions; instead, the long-term trend over many years is more indicative of whether overdraft conditions exist or not. The geology, historical hydrologic conditions (e.g., dry or wet year), and historical management practices vary from subbasin to subbasin; consequently, the actual level of decline that would be indicative of overdraft conditions will also vary from subbasin to subbasin.

The rate of water level decline within the Dixon District that would be indicative of overdraft conditions would probably be more than 1 to 2 ft/year. For planning purposes in this Water Supply and Facilities Master Plan, this range (more than 1 to 2 ft/year) was used to evaluate historical water level trends within the portion of the subbasin used by Cal Water.

Figure 4-6. Example of Overdraft Conditions in Bulletin 118
(Source: DWR Bulletin 118 (2003), Chapter 6, Figure 18, pg 97)



Groundwater Trends in the Solano Subbasin

For this WSFMP, WYA evaluated historic groundwater levels for DWR monitoring wells located around the Dixon District service area, and for Dixon District wells.

The following average annual groundwater level change criteria were used to evaluate historical groundwater level trends over multiyear periods:

- Decreasing groundwater levels - Groundwater level decline greater than 0.75 ft/yr
- Stable groundwater levels - Groundwater level decline less than 0.75 ft/yr and groundwater level increase less than 0.75 ft/yr
- Increasing groundwater levels - Groundwater level increase greater than 0.75 ft/yr

Findings of this evaluation are discussed below.

Summary of Groundwater Level Trends in DWR Monitoring Wells

DWR monitors groundwater levels on the either a semi-annual or monthly basis for thousands of groundwater wells located throughout California. Groundwater level data is available on DWR's Water Data Library website (http://wdl.water.ca.gov). For this evaluation, WYA selected twelve

(12) DWR monitoring wells located around the Dixon District service area that had long periods of record and relatively complete data sets. Unfortunately, DWR monitoring wells do not reside inside the Dixon District boundary. Figure 4-7 illustrates the location of Dixon District wells and DWR monitoring well locations.

The DWR monitoring wells are located in the 07N01E and 07N02E townships. In the 07N01E Township, 9 out of 35 wells were selected and in the 07N02E Township 3 out of 39 wells were selected. Depending on the annual precipitation pattern, the highest annual Spring groundwater level would tend to occur during a month that experiences the greatest amount of precipitation. Therefore, evaluating the highest annual groundwater level recorded between the months of February, March, and April would help account for annual variations in precipitation patterns. Consequently, WYA evaluated the highest groundwater levels recorded in February, March or April from 1950 to 2007 to ascertain Spring groundwater level trends.

Hydrographs for the DWR monitoring wells are provided in Appendix F. DWR wells (07N02E30N003M, 07N01E10E001M, 07N01E03G001M, 07N01E11M001M, 07N01E12N002M, 07N02E19E001M, and 07N01E26Q002M) have long histories of data that recorded declining groundwater levels in the 1950's through the early 1960s. These same wells recovered as surface water from the Solano Project replaced some groundwater use and recharged the groundwater subbasin. The remaining DWR monitoring wells reflect groundwater conditions from the early 1980s to present. All 12 wells show that groundwater levels stabilized by the early 1980s at depths ranging from roughly 0 to 95 feet below land surface. Typical Fall to Spring fluctuations in groundwater elevations in the monitored wells were roughly 40 feet or less.

Table 4-4 provides a summary of groundwater level trends of DWR monitoring wells located near Dixon District services area based on the criteria discussed above. As shown in Table 4-4, the groundwater level trends were decreasing from 1951 to 1969, and increasing from 1970 to the early 1980s, and have been stable from the early 1980s to the present. Figure 4-8 illustrates the groundwater level trend for each individual DWR monitoring well.

Table 4-4. Groundwater Level Trends in DWR Monitoring Wells

DWR Monitoring Well	Average Groundwater Level Trends[a]		
	Average Trend from 1950 to 1960	Average Trend from 1960 to early 1980s	Early 1980s to Present[b]
12 DWR Monitoring Wells Located Near Dixon District	**-3.89**	**1.34**	**-0.06**

(a) Data provided by DWR's Water Data Library website (http://wdl.water.ca.gov).
(b) Well Status as of October 2008.
(c) Green = Increasing groundwater levels (Slope > 0.75 ft/yr)
Yellow = Stable Groundwater levels (Slope ≤ 0.75 ft/yr or Slope is ≥-0.75 ft/yr)
Red = Decreasing Groundwater levels (Slope < -0.75 ft/yr)
Figure 4-8 shows Mape Code colors for each DWR monitoring well.

Figure 4-9 shows the average of groundwater levels for all twelve (12) DWR monitoring wells discussed above. Figure 4-9 also indicates that from 1950 to 1960, the historical annual average change in groundwater level was -3.89 ft/yr, which is considered to be decreasing according to the specified criterion. From 1961 to early 1980s, the historical annual average change in groundwater level was 1.34 ft/yr, which is greater than the criterion identified above. Groundwater levels have been stable since the early 1980s.

GROUNDWATER FLOW TRENDS

Groundwater flow directions were analyzed by reviewing Spring groundwater level contours from all DWR monitoring wells in the Solano Subbasin. Two sets of contours were generated for comparison: 1997 Spring contours and 2007 Spring contours.

Figures 4-10 and 4-11 show groundwater elevation contours in the vicinity of Dixon for the Spring 1997 and Spring 2007. Groundwater flows from northwest to southeast direction for both Spring contours as per 1912 conditions. The comparison between 1997 very wet Spring contours and 2007 very dry Spring contours show that at Station 001-03, the groundwater level decreased by fifteen (15) feet. This change in groundwater levels may be due to below average rainfall within the last six years (see Figure 4-12).

Summary of Groundwater Level and Flow Trends in the Dixon District Wells

As discussed above, the Dixon District has a total of eight (8) active wells located throughout the service area (see Figure 4-1). Cal Water provided historical groundwater levels from 1988 to 2007 in electronic format for all of eight wells. Historical Spring groundwater levels for Dixon District production wells between years 1988 to 2007 are provided in Appendix G. For each corresponding year, the highest groundwater elevation of February, March, or April was utilized as the Spring groundwater level. For example, in 1988, Station 001-03 had Spring groundwater levels of 27 feet, 32 feet, and 17 feet for February, March, and April, respectively. The highest groundwater elevation of 32 feet was chosen as the Spring groundwater level. This value represents the largest recovery for Spring 1988. Figure 4-12 displays the average Spring groundwater levels of all production wells in the Dixon District compared with historical rainfall data. This figure illustrates that lower average Spring groundwater levels correlate with drier years. Increases in production between 2000 and 2004 may account for the lower groundwater levels seen in Station 001-03, 005-01, and 008-01 (Appendix G). Groundwater levels are considered to be stable per the criteria used for the WSFMP.

Table 4-5 shows that the groundwater level trends for the Dixon District production wells. All wells with the exception of Well 001-03, exhibit stable trends. Well 001-03 has a slight decreasing trend that is attributable to increase in groundwater production and below average rainfall within the last six years. Figure 4-8 illustrates the trends for Dixon District Cal Water wells.

Groundwater flow directions have been stable in a northwesterly to southeasterly direction for many years.

Table 4-5. Historic Groundwater Level Trends

Well	Map ID	Well Status[(b)]	Elevation, ft	Data Range	Slope	Map Code[(c)]
DIX-W-001-03	STA 1	Active	67	1988-2007	-0.88	
DIX-W-002-01	STA 2	Active	55	1988-2007	0.47	
DIX-W-003-01	STA 3	Active	63	1988-2007	0.40	
DIX-W-004-01	STA 4	Active	61	1988-2007	0.12	
DIX-W-005-01	STA 5	Active	65	1988-2007	-0.53	
DIX-W-006-01	STA 6	Active	66	1988-2007	0.12	
DIX-W-007-01	STA 7	Active	64	1988-2007	-0.22	
DIX-W-008-01	STA 8	Active	55	1988-2007	-0.20	

(a) Data provided by Cal Water (Well Level Reads.xls) and Dixon Schematic Diagram.
(b) Well Status as of October 2008.
(c) Green = Increasing groundwater levels (Slope > 0.75 ft/yr)
Yellow = Stable Groundwater levels (Slope ≤ 0.75 ft/yr or Slope is ≥-0.75 ft/yr)
Red = Decreasing Groundwater levels (Slope < -0.75 ft/yr)
Figure 4-8 shows Map Code colors for each Dixon District Well.

Overall Summary of Groundwater Level Trends

As shown on Figure 4-8, since 1980, groundwater levels in the DWR-monitored wells located around the Dixon District service area and the Dixon District wells, have on average, been stable except Station 001-03. Overdraft conditions are not present based on the data reviewed.

GROUNDWATER QUALITY

The quality of groundwater underlying the Dixon District was evaluated by consulting DWR Bulletin 118, locating active groundwater contamination cases in the area, reviewing each municipal well operated by Cal Water, and reviewing historical water quality data from each municipal well operated by Cal Water.

Water Quality per DWR Bulletin 118

According to DWR[25], groundwater in the Solano Subbasin is good quality and is suitable for domestic and agricultural purposes. Total dissolved solids (TDS) concentrations generally range from 250 to 500 milligrams per liter (mg/L) and are comprised predominantly of calcium, magnesium and sodium cations and bicarbonate anions.[26] The groundwater is hard to very hard.[27]

Active Groundwater Contamination Cases in the Area

To identify and evaluate existing groundwater contamination sites within the Dixon District, WYA consulted two primary sources: Geo Tracker and Envirostor websites. GeoTracker is a geographic information system (GIS) that provides online access to environmental data and is an interface to the Geographic Environmental Information Management System (GEIMS), a data

warehouse that tracks regulatory data from the State Water Resources Control Board (SWRCB) that includes underground fuel tanks, fuel pipelines, and public drinking water supplies. Envirostor is a similar type of database that contains information on contaminated sites based on data from the State of California Department of Toxic Substances Control's (DTSC) ongoing and past cases, including spills, leaks, leaking underground fuel tanks (LUFT), leaking underground storage tanks (LUST), and other environmental concerns.

Based on these sources of information, 40 active cases were identified within the Dixon District service area where groundwater has been potentially impacted by one or more contaminants. These active cases are listed in Table 4-6. As shown in Table 4-6, the majority of the cases are either related to LUFTs, LUSTs, spills, leaks, investigations, and/or cleanups. Groundwater contaminants detected at these sites include one or more constituents related to gasoline and diesel fuels, petroleum hydrocarbons, volatile organic compounds (VOCs), solvents, fertilizers, metals, pesticides, and herbicides. Queries performed on Envirostor revealed that groundwater was not affected by any of the known contamination sites in the City of Dixon. Appendix H contains the search results for the queries performed on November 2, 2008.

Figure 4-13 displays all active point contamination sources located in the City of Dixon per GeoTracker and Envirostor databases. A majority of the point sources are located along Highway 80 and Route 113.

Although the potential exists for groundwater contamination from the sites illustrated on Figure 4-13 to impact adjacent or nearby municipal supply wells, it should not be inferred that the presence of these contaminants at these sites has impacted the Dixon District wells. The Dixon District samples it wells regularly in accordance with State requirements, to ensure that water produced from the wells does not contain contaminants above maximum contaminant levels. A complete discussion of water quality within the Dixon District is provided below. Nonetheless, information available regarding these sites is useful in identifying potential water quality problem areas when conducting siting studies for potential new groundwater wells or estimating the costs of treatment when selecting future groundwater well locations.

USGS GAMA Study

Growing concern over the closure of public water supply wells because of groundwater contamination has led the SWRCB to establish the Groundwater Ambient Monitoring and Assessment (GAMA) Program. With the aid of the U.S. Geological Survey (USGS) and Lawrence Livermore National Laboratory, the program goals are to enhance understanding and provide a current assessment of groundwater quality in areas where groundwater is an important source of drinking water. The GAMA study will accomplish this by sampling selected wells for a wide-range of chemical constituents and analytically testing for the presence of these chemicals at levels that are significantly below currently accepted health or advisory standards.

The Southern Sacramento Valley (SSACV) study unit covers an estimated 2,100 square miles across six hydrologic study areas in the counties of Placer, Sacramento, Solano, Sutter, and Yolo. The study areas are situated on the North American Subbasin, South American Subbasin, Solano

Public Version

Table 4-6. Potential Responsible Parties in the Dixon District with Known Groundwater Contamination [a]

ID	Site Name	Subbasin	Type	TPH[b]	BTEX	VOC[c]	MTBE	Other Oxygenates[d]	Fertilizers/ Pesticides[e]	PCE	NAP	NO3
01	7-11 STORE #23584	SOLANO	LUST CLEANUP SITE	X	X		X	X				
02	B.C. STOCKING DISTRIBUTION	SOLANO	LUST CLEANUP SITE	X	X		X					
03	BC STOCKING DISTRIBUTING	SOLANO	CLEANUP PROGRAM SITE									
04	BEACON # 3682 (FORMER)	SOLANO	LUST CLEANUP SITE	X			X					
05	BP #11245	SOLANO	LUST CLEANUP SITE		X		X	X				
06	CAMPBELLS SOUP	SOLANO	CLEANUP PROGRAM SITE	X								
07	CITY CORPORATION YARD	SOLANO	LUST CLEANUP SITE	X	X		X					
08	DIXON BUSINESS PARK	SOLANO	CLEANUP PROGRAM SITE									
09	DIXON DOWNS, FORMER MISTLER TRUCKING CO	SOLANO	CLEANUP PROGRAM SITE	X	X							
10	DIXON LAUNDRY	SOLANO	LUST CLEANUP SITE	X	X	X						
11	DIXON NAVAL RESERVE TRAINING FACILITY - BASEWIDE GROUNDWATER - FACILITY WIDE	SOLANO	MILITARY CLEANUP SITE									
12	DIXON NAVAL RESERVE TRAINING FACILITY - IR SITE 1-WASTE BLOWDOWN AREA	SOLANO	MILITARY CLEANUP SITE									
13	DIXON NAVAL RESERVE TRAINING FACILITY - IR SITE 2- LANDFILL AREA A	SOLANO	MILITARY CLEANUP SITE									
14	DIXON NAVAL RESERVE TRAINING FACILITY - IR SITE 3-LANDFILL AREA B	SOLANO	MILITARY CLEANUP SITE									
15	DIXON NAVAL RESERVE TRAINING FACILITY - IR SITE 4-AUTOMOBILE LANDFILL	SOLANO	MILITARY CLEANUP SITE									
16	DIXON NAVAL RESERVE TRAINING FACILITY - SHOOTING RANGE	SOLANO	MILITARY CLEANUP SITE									
17	DIXON NRTF (C/R ONLY) - DIXON NAVAL RESERVE TRAINING FACILITY	SOLANO	MILITARY CLEANUP SITE									
18	DIXON SANITARY SERVICE	SOLANO	CLEANUP PROGRAM SITE									
19	DOW BUNKER DEHYDRATION STN	SOLANO	CLEANUP PROGRAM SITE									
20	FLORIN TALLOW	SOLANO	LUST CLEANUP SITE									
21	FLORIN TALLOW, FORMER	SOLANO	CLEANUP PROGRAM SITE							X		
22	FORMER EXXON 7-6237	SOLANO	LUST CLEANUP SITE	X			X	X				
23	FORMER TEXACO	SOLANO	LUST CLEANUP SITE	X	X		X					
24	GROWERS AG SERVICE	SOLANO	CLEANUP PROGRAM SITE						X			
25	J & J CHEMICALS	SOLANO	CLEANUP PROGRAM SITE					X	X			
26	JACK MONSON AG CHEMICALS INC.	SOLANO	CLEANUP PROGRAM SITE					X	X			
27	JOHN TAYLOR FERTILIZERS - DIXON	SOLANO	CLEANUP PROGRAM SITE						X			
28	MORGAN'S FRUIT STAND	SOLANO	LUST CLEANUP SITE	X	X	X					X	
29	NAVY RADIO FACILITY - DIXON	SOLANO	LAND DISPOSAL SITE									
30	PG&E BUNKER FIELD DEHYDRATOR STATION	SOLANO	CLEANUP PROGRAM SITE	X	X							
31	PG&E MILLAR METER DEHYDRATOR STATION	SOLANO	CLEANUP PROGRAM SITE	X	X							
32	SANDERS PROPERTY	SOLANO	CLEANUP PROGRAM SITE				X	X				
33	SANDERS PROPERTY	SOLANO	CLEANUP PROGRAM SITE									
34	SHELL - RAMOS OIL - DIXON	SOLANO	LUST CLEANUP SITE	X	X		X	X				
35	TOWER MART STORE #18	SOLANO	LUST CLEANUP SITE	X	X		X					
36	TSI (PESTICIDES)	SOLANO	CLEANUP PROGRAM SITE			X			X			X
37	TSI (SPILL)	SOLANO	CLEANUP PROGRAM SITE						X			X
38	UNOCAL BULK PLANT #0161	SOLANO	LUST CLEANUP SITE	X	X		X					
39	WILLIAM D. JOSLIN, INC.	SOLANO	CLEANUP PROGRAM SITE					X				
40	WILLIS PROPERTY	SOLANO	LUST CLEANUP SITE	X	X							

[a] Data obtained from Geotracker, EnviroStor, and DTSC
[b] TPH contaminants includes: TPHg, TPHd, and TPH, mo.
[c] VOCs include: C12DCA, DICHLORETHANE, CHLOROBENZENE, and CHLOROFORM.
[c] Other Oxygenates include: C12DCA, DIPE, ETBE, TAME, TBA, GRO, and PHC.
[d] Fertilizers/Pesticides include: TON, NH3, 12DCP, 123TCP, DIACAMBA, 112TCA, 11DCA, DBCP, AND PHOSOPHORUS.

BTEX, CHLOROBENZENE, and CHLOROFORM are mobile in groundwater.
MTBE is very mobile in groundwater.
LUST = Leaking Underground Storage Tank (AKA LUFT = Leaking Underground Fuel Tank)
VOC = Volatile Organic Compounds
PCE - Tetrachloroethene
TCE - Trichloroethene
DCE - Dichloroethene (both *cis* and *trans*)
TPH - Total Petroleum Hydrocarbons
MTBE - Methyl Tertiary Butyl Ether
BTEX - Benzene, Toluene, Ethylbenzene, Xylene
PCP - Pentachlorophenol
TCP - Trichloropropane
PAH - Polycyclic Aromatic Hydrocarbons
NAP - Naphthalene

Subbasin, Yolo Subbasin, the upland area on the eastern sides of the North and South American Subbasins, and the DWR-defined Suisan-Fairfield groundwater basin. Groundwater quality data collected as part of the GAMA program were documented in the USGS report titled "Ground-Water Quality Data in the Southern Sacramento Valley, California 2005 - Results from the California GAMA Program" (USGS Data Series 285).

From March 2005 to June 2005, 87 samples were collected from 83 wells in the SSACV study area and analyzed for a number of constituents including: 88 VOCs, 118 pesticides, 5 nutrients, dissolved organic compounds (DOC), 9 major ions, 25 trace elements, 4 constituents of special interest (N-nitrosodimethylamine, 1,2,3-trichloropropane, chromium(VI), perchlorate), 8 isotopic constituents, 5 dissolved noble gases, and the microbial constituents coliform and coliphage. Detections of these constituents in samples do not represent quality of water delivered to consumers as samples are from raw groundwater.

Only samples collected from wells in Solano Subbasin were assessed, for this evaluation. On Table 2 of the GAMA study, thirteen (13) wells are listed as being located in the Solano Subbasin.

The SSACV study produced the following findings[28]:

- VOCs, including gasoline oxygenates, were collected at all wells sampled, but concentrations were not greater than an MCL or threshold value.
- Cyclopentane and sulfur dioxide were found in the Solano Subbasin.
- Pesticide concentrations were found in the Solano Subbasin, but there were not greater than an MCL or threshold values.
- Nutrients such as ammonia, nitrates, and orthophosphates were found in the Solano Subbasin, but were lower than an MCL or threshold value.
- Major ions were detected in Solano Subbasin wells, but concentrations did not exceed the Secondary MCL (SMCL).
- Trace inorganic elements were detected in Solano Subbasin wells. In Well SOL-06, boron and iron were found to be in concentrations higher than the threshold.
- Total chromium, chromium(VI), total arsenic, arsenic(III), and total iron, and iron(II) were found in two Solano study area wells, but concentrations did not exceed MCL or threshold values.
- Naturally occurring isotopic constituents and dissolved noble gases were found in various wells in Solano Subbasin, but they did not exceed MCL or threshold.
- Microbial constituents were not detected in groundwater samples collected for study area wells in Solano Subbasin.

Water Quality in Dixon District Wells

To evaluate the current water quality status of each of the Dixon District wells, WYA evaluated recent water quality data provided by the Dixon District from 2003 to 2007. Water quality data

reviewed included water quality results from the Dixon District California Department of Public Health (CDPH)-required annual sampling and included analytical results for inorganic chemicals, organic chemicals, radiological constituents, disinfection by-products, microbiological constituents, and other regulated substances.

Table 4-7 provides a summary of water quality findings for the Dixon District wells. For purposes of this evaluation, only constituents exceeding 75 percent of MCL within the last five years are identified in Table 4-7.[b] This 75 percent threshold was intended to highlight wells in which constituents might be close to their respective MCLs and might become issues in the future should the regulated MCL be further reduced, and/or if the concentration of the constituent of concern were to rise over time, for whatever reason. As shown in Table 4-7, recent water quality data shows that seven (7) out of eight (8) wells have constituent concentrations exceeding the MCL or 75 percent of the MCL. These constituents include specific conductance (SC), or equivalently, electrical conductivity (EC), TDS, total chromium (total Cr), and nitrate (NO_3).

WYA evaluated the historical EC, TDS total Cr, and NO_3, concentration trends for the Dixon District wells to determine if the concentrations of the constituents discussed in the preceding paragraph have increased over time. Plots of historical concentrations by well are provided in Appendix I. Detailed concentration trends are discussed below.

Nitrate Trends

Discussions with Cal Water staff indicated that potential nitrate contamination is of concern for the Dixon District.[c] Of the eight wells observed by Cal Water, recent data (2003-2007) show that four (4) wells (Stations 002-01, 003-01, 004-01 and 005-01) have nitrate concentrations near or above the MCL (Appendix I).

Evaluation of historical data for the period January 1980 through December 2007 provides additional information on the temporal trends in nitrate concentrations. Comparison of the nitrate results to: 1) the well construction information listed in Table 4-1 and shown schematically on Figure 4-3, and 2) the map of identified nitrate points sources provides insight into the spatial trends in nitrate concentrations.

Elevated nitrate concentrations are widespread in the vicinity of Dixon District and result from agricultural practices. There are two factors that drive these agricultural nonpoint sources of nitrate. The first factor is the application of nitrate fertilizer that leads to loading of nitrogen compounds in the soil column above the groundwater system. The second factor is irrigation of agricultural lands that leads to significant deep percolation and groundwater recharge over wide areas. In the Central Valley, groundwater modeling studies indicate that irrigation returns account for about 80 percent of the groundwater recharge on average[29]. Recent unpublished studies funded

[b] Cal Water Staff reported that sampling errors occurred in DIX-W-06-01 for Al at 0.9 mg/L in 2007 and Fe at 1.5 mg/L in 2007. As a result, these constituents were not listed in Table 4-7.

[c] Identified during discussion with Cal Water Staff at the Project Kick-off Meeting on June 20, 2008.

Table 4-7. Summary of Wells with Water Quality Data Exceeding 75 Percent MCL (2003-2007) [a]

Well	Current Well Status	Constituent[b]	Result	Year of Result	MCL/SMCL[c]	75% of MCL/SMCL
DIX-W-01-03	Active	EC	680 µs/cm	2003	900 µs/cm	675 µs/cm
DIX-W-02-01	Active	EC	842 µs/cm	2005	900 µs/cm	675 µs/cm
DIX-W-02-01	Active	CR TOTAL	0.03997 mg/L	2005	.05 mg/L	0.0375 mg/L
DIX-W-02-01	Active	NO3	38.466 mg/L	2007	45 mg/L	33.75 mg/L
DIX-W-02-01	Active	TDS	462 mg/L	2005	500 mg/L	375 mg/L
DIX-W-03-01	Active	EC	840 µs/cm	2006	900 µs/cm	675 µs/cm
DIX-W-03-01	Active	NO3	66 mg/L	2007	45 mg/L	33.75 mg/L
DIX-W-03-01	Active	TDS	500 mg/L	2006	500 mg/L	375 mg/L
DIX-W-04-01	Active	EC	744 µs/cm	2006	900 µs/cm	675 µs/cm
DIX-W-04-01	Active	NO3	34 mg/L	2006	45 mg/L	33.75 mg/L
DIX-W-04-01	Active	TDS	424 mg/L	2006	500 mg/L	375 mg/L
DIX-W-05-01	Active	NO3	46.846 mg/L	2007	45 mg/L	33.75 mg/L
DIX-W-06-01	Active	TDS	400 mg/L	2007	500 mg/L	375 mg/L
DIX-W-08-01	Active	EC	716 µs/cm	2004	900 µs/cm	675 µs/cm
DIX-W-08-01	Active	TDS	378 mg/L	2004	500 mg/L	375 mg/L

[a] Data provided by Cal Water (WIL 3-18-08.XLS).
[b] EC = Electrical Conductivity (Secondary MCL)
CR TOTAL = Total Chromium (Primary MCL)
NO3 = Nitrate (Primary MCL)
TDS = Total Dissolved Solids (Secondary MCL)
[c] Criteria based on MCL set by California Deparment of Public Health (CDPH)
[d] Yellow = Water Quality Data at MCL/SMCL level
Red = Water Quality Data above MCL/SMCL level

by the Central Valley Regional Water Control Board indicate that nitrate concentrations in the soil moisture of Yolo County can be up to the low hundreds of mg/L.[30]

Comparison of historical nitrate and the well construction information indicates that wells with shallow intakes generally have the highest nitrate concentrations. Figure 4-14 shows the correlation between the highest elevation intake and the median historical nitrate concentration detected in each well. The regression statistics included a coefficient of determination (R^2) of 0.74. The R^2 result indicates that most of the variation in median historical nitrate concentrations can be explained by the elevation of the well intakes. Higher (shallower) intakes lead to higher nitrate concentrations, because shallower intakes are more likely to draw in water from the shallower part of the aquifer system where nitrate concentrations resulting from nonpoint agricultural sources are highest.

Although the elevation of the well intakes has a major influence on nitrate concentration in the wells, other influences can also be identified. These other influences include:

- Proximity to point sources of nitrate contamination;
- Degree to which the well is sealed from shallow nitrate contamination;
- Degree to which head differences in aquifer production zones cause flow from shallow zones into a well when it is not being pumped;
- Degree to which permeable zones are vertically interconnected within the aquifer system;
- Presence of inactive or abandoned wells;
- Volumetric distribution of flow through the various intakes in each well during pumping;
- Production rate, duration and schedule, and dimensions of hydraulic capture; and
- Multi-year variations in hydrologic conditions.

Each potential influence is discussed in the subsequent section.

Potential Point Sources

Figure 4-13 shows the location of each of the District's well stations and identified point sources of nitrate contamination. Four potential point sources of nitrate contamination were identified near Dixon District wells, and they were (Table 4-6):

- Site 24, Growers Ag Service
- Site 25, J&J Chemicals
- Site 26, Jack Monson Ag Chemicals
- Site 37, TCI Spill Site.

These potential point sources of nitrate contamination are clustered in the central Dixon area, and Site 24, the Growers Ag Service, is located within approximately 500 feet of Station 005-01. Figure 4-14 shows that the median nitrate concentrations at Station 005-01 are not anomalously high given the elevation of the well perforations and the agricultural land use in the Dixon area. However, the proximity of the potential point sources of nitrate may warrant a well-head protection study to fully assess risks to Station 005-01. Several relatively recent results from Station 005-01 have exceeded the MCL for nitrate, and there is no obvious explanation for the significant increases in nitrate concentrations in this well since 2006.

Well Sanitary Seals

Well construction was discussed in a previous section. However, sanitary seals are also important in the context of potential sources of nitrate. Inadequate seals can lead to nitrate contamination under pumping and non-pumping conditions. During pumping, the hydraulic gradients induced between the permeable zones in the aquifer and in the annular space of the well can cause groundwater from shallow depths to flow into the annular space of the well, downward to the well intakes. Under non-pumping conditions, residual drawdown from the earlier pumping, natural vertical gradients or vertical gradients induced by other pumping wells can cause flow through the same pathways into the well. The expected pattern of nitrate concentrations is a gradual increase in nitrate concentrations to an asymptotic limit after the well is turned off. The pattern is a more rapid decrease in nitrate concentrations to an asymptotic limit when the well is turned on. With discrete, as opposed to continuous, sampling of nitrate concentrations, concentrations will appear to spike when the well is turned on.

Intrawell Flow During Non-pumping Conditions

The pattern of nitrate concentrations described above will result when flow occurs from shallow zones through shallow intakes, down the well bore and out through deeper zones. This condition will occur when the well is off. Vertical gradients exist between the shallow and deep aquifer zones. These vertical gradients result from the superposition of all of the pumping in the area. Much of the aquifer system is semiconfined or confined, and changes in hydraulic head propagate over relatively large distances. This means that downward hydraulic gradients probably exist due to agricultural pumping through the irrigation season (approximately April through October) even without considering municipal pumping in Dixon.

Aquifer Stratification

The lateral and vertical distribution of high permeability zones within the aquifer system and the degree to which these zones are vertically interconnected is an important consideration in the transport of nitrate from shallow source areas to deeper parts of the aquifer system and then to production wells. Vertical gradients and the resulting capture zones induced by pumping will drive groundwater flow downwards if interconnected pathways exist.

At present, the only detailed information available on the distribution of aquifer materials near the Dixon District groundwater wells is contained in the DWR Drillers Reports for the wells. This information is not adequate for accurately assessing aquifer properties. To rectify this, Cal Water should consider specifying and performing geophysical and lithologic logging by

qualified contractors and professional geologists during drilling of future test holes and construction of future wells. Cal Water should also consider specifying and conducting aquifer tests at each new test or production well. This should include a step test to assess well efficiency and an optimum pumping rate, and a constant discharge rate test to estimate aquifer hydraulic properties and aid in selection of permanent pumping equipment. Evaluation of the geophysical and lithologic logs in conjunction with the aquifer testing will provide valuable information on the long-term risks for downward movement of nitrate – and other constituent of concern – through the aquifer system.

Abandoned Wells

The presence of inactive or abandoned wells provides a direct vertical connection between aquifer zones and conduits for the movement of nitrate and other contaminants. Flow through any such wells is activated by the natural and induced head differences described above.

Intrawell Volumetric Distribution of Pumping

Nitrates – and the concentrations of other constituents – are affected by the percentage of flow entering the well from each perforated zone. The concentrations measured at the wellhead are the volume-weighted averages of the concentrations measured at each intake of the well. In other words, measurements of flow rate and concentration taken during pumping can be used to assess which zones have the greatest effect on water quality and yield. Yield of the individual zones depends on:

- Thickness and hydraulic conductivity of each aquifer production zone
- Thoroughness of well development at each zone
- Current condition of the well screen and filter pack at each zone
- Head distribution during pumping.

In many areas of the southern Sacramento Valley, nitrate concentrations are greatly reduced at depths beginning at roughly 300 feet. In the Dixon area, this is equivalent to an elevation of approximately -250 feet below mean sea level (msl). This elevation was used to screen the eight Dixon District wells based on whether the bulk of their production may be from above or below this elevation, based on the assumption that most nitrate contamination is above -250 feet msl. The following wells have approximately 50 percent or greater of their intake footage at -250 feet mean sea level or higher (as illustrated on Figure 4-3):

- Station 002-01
- Station 003-01
- Station 004-01
- Station 006-01

It is not possible to estimate the percentage flow from the portions of the intakes above and below -250 feet in these wells, because the hydraulic conductivity and thickness of the aquifer zones is not well known. However, Figure 4-14 shows that the -250 foot elevation provides a dividing line between those wells with and without high median historical nitrate concentrations. Station 005-01 shows signs of deviation from this guideline. Most of the screen section of the well is below an elevation of -250 feet, and it is true that the median historical concentration fits the pattern described above; i.e., the median concentration is relatively low, as expected for deeper well intakes. However, nitrate concentrations in this well have increased significantly in Station 005-01 since 2006 and have exceeded the MCL.

Production Rate and Schedule

The correlation between monthly production and nitrate concentration were graphed in Appendix I. These graphs illustrates monthly production and nitrate concentration as a function of time for each Dixon District wells from January 2000 through December 2007 period. When multiple nitrate samples were analyzed in a given month the results were averaged for this analysis.

For all wells, the scatter plots show that the correlation between monthly production and nitrate concentration is weak; with R^2 ranging from 0.05 to 0.4 (the R^2 of 0.7 for Station 008-01 is not considered representative because of the limited production data available for correlation). Although the correlation between monthly production and nitrate concentrations is weak, the plots show nitrate concentrations tend to be more variable for lower monthly production. This occurrence is expected when nitrates enters the wells when they are not pumping, except for Station 005-01. At Station 005-01, the variation in nitrate concentrations is relatively high throughout the range of production rates.

In addition, the correlation between monthly production and nitrate concentrations show fluctuations of nitrate concentration in response to pumping rate in the wells. As illustrated on figures in Appendix I, the following stations showed decreasing nitrate concentrations with increased pumping:

- Station 001-03
- Station 005-01
- Station 006-01
- Station 008-01

Increasing trends in nitrate concentration with increasing monthly pumping volume are indicated for these following stations:

- Station 002-01
- Station 003-01
- Station 004-01
- Station 007-01

The graphs of monthly production and nitrate concentration (see Appendix I) as a function of time in each of the wells confirm that the relationship between monthly production and nitrate concentrations is weak. However, they provide additional insight into possible relationships between production and nitrate concentrations. Notable trends are as follow.

1. Nitrate concentrations increased at Station 003-01 after a very large increase in production in 2007. It is possibly due to capture of shallow nitrate-bearing groundwater.
2. Although variable, the nitrate concentrations in Station 005-01 show a steadily increasing trend beginning in early 2000. The trend has accelerated since early 2006. Review of production data for the well indicates that the acceleration beginning in 2006 is associated with lower production rates. However, the large increasing nitrate concentration through late 2006 occurred when the well was still being pumped at a relatively high, stable rate. Evaluation of the pumping volumes in the other Dixon District wells showed no obvious relationship between pumping and nitrate trends at Station 005-01. This implies that the cause of the increase is not related to the pumping volumes of the Dixon District wells.
3. Nitrate concentrations at Stations 006-01 and 007-01 show an increasing trends associated with an overall reduction in pumping volumes in 2006. This could be due to increased percentage of shallow groundwater entering the well during inactive periods.
4. Based on limited data, nitrate concentrations at Station 008-01 appeared to decline with increasing production in 2006.

Variations in Hydrologic Conditions

Wet and dry climatic cycles taking place over single or multiple year periods have influence on the nitrate concentrations in the wells. Under dry conditions, natural and agricultural recharge decreases and agricultural groundwater pumping increases. This causes the depth to groundwater to increase bringing the shallower nitrate-bearing groundwater closer to well intakes. Recent dry periods included 1986 through 1992, 2001 and 2007. Because of the reliability of the Solano Project, these dry periods did not affect groundwater levels in the Dixon District area as much as other parts of the state. Elevated nitrate concentrations from 1986 to 1992 are evident at Stations 002-01, 003-01, 004-01, and 006-01. No data are available for Station 001-003 for this time period. There was no obvious increase in nitrate concentrations in dry year 2001, possibly because there was only a minimal change in the depth to groundwater. Nitrate concentration increases in 2007 at Stations 002-01 and 003-01 may be related to the 2007 dry conditions. Both Stations share relatively shallow intakes.

Currently, Cal Water has equipped Stations 002-01, 003-01, and 005-01 with nitrate analyzers to provide an extensive safeguard to these wells when the nitrate level increases. In addition, nitrate treatment system options are currently being studied to identify the best treatment methodology for Stations 003-01 and 005-01, where data showed that nitrate exceeded MCL.

EC and TDS Trends

Salinity in the Central Valley (Sacramento River, San Joaquin River, and Tulare Lake Basins) is an issue that has received greater attention in the past few years. Salinity is a measure of the dissolved salt concentration in water. Typical measurements of salinity include TDS and EC. Cal Water monitors TDS concentration on all eight wells in the Dixon District. Water quality data from 2003 to 2007 indicate Stations 002-01, 003-01, 004-01, 006-01, and 008-01 have TDS and EC levels at or approaching the SMCL (Appendix I).

The historical results for the Dixon District wells are consistent with results from other municipal wells in southern Sacramento Valley. Although very high levels of salinity exist in the shallowest parts of the aquifer, generally EC and TDS concentrations do not vary widely with depths ranging from roughly 150 feet to 1,500 feet. However, the concentrations of the major ions that comprise TDS and control EC levels do change significantly with depth, and this affects source water quality. Typically, shallower groundwater contains relatively high proportions of calcium (common groundwater quality types are calcium bicarbonate and calcium-magnesium bicarbonate waters). With increasing depth, calcium is replaced by sodium from the aquifer matrix, and the two water types transition to a sodium bicarbonate type water with similar EC and TDS but lower hardness than the shallow groundwater.

Trends in Trace Constituent Concentrations

A number of constituents naturally occur at low, or trace concentrations in groundwater. Cal Water monitors these trace element concentrations in all Dixon District wells. Based on recent water quality data for Dixon District from 2003 to 2007, Station 002-01 has total chromium level near but below the MCL. The historical results in Appendix I show no trends in the total chromium concentrations. Total chromium is a naturally-occurring constituent derived from weathering of chromium-bearing minerals in the aquifer matrix. These minerals are derived from erosion of serpentinite and related rocks of the Coast Range.

Possible Water Quality Mitigations

Nitrate can be removed from drinking water by three methods: distillation, reverse osmosis, and ion exchange. The distillation process involves a distillation unit that boils raw water, collects steam, and condenses it. Nearly 100 percent of nitrate-nitrogen can be removed by this process since the minerals do not evaporate and remains concentrated in the boiling tank. In the reverse osmosis process, water is passed through a semipermeable membrane, which filters out most of the impurities. 85 to 95 percent of nitrates can be removed through the reverse osmosis process. An ion-exchange process operates on the same principle as a household water softener. Special anion exchange resins are used to exchange chloride ions for nitrate and sulfate ion in the water through the resin. All three of these methods described to remove nitrate from water are relatively expensive. Operating costs normally include the energy needed to operate the system, additional water that may be needed for system flushing, consumable supplies and filters, repairs, and general maintenance.

Well rehabilitation and construction of new wells can be considered for nitrate reduction. Several of the existing wells, including Stations 001-03, 002-01, 003-01, 004-01 and 006-01 have intakes at relatively shallow depths. Spinner logging to measure the volumetric contribution to flow from the individual intakes and discrete water quality sampling in these well could be used to assess the effects on water quality and yield of sealing off the upper portions of the well.

It may be possible to avoid nitrate treatment by drilling a new well in a different location or a deeper well in a different aquifer. The general trends in groundwater quality with depth in the vicinity of Dixon District are from very hard, calcium-magnesium bicarbonate water containing nitrate and other oxidized chemical species to less hard, sodium bicarbonate water with low nitrate concentrations but higher concentrations of reduced chemical species, such as arsenic, iron and manganese. Arsenic, iron and manganese concentrations may exceed MCLs in deeper wells. Concentrations can be reduced through design and construction of a well that blends water from a range of depths, thus avoiding wellhead treatment. Such a design would require specification of a test drilling project at the proposed site, which would include geophysical logging by a qualified contractor, collection of cuttings samples by the drilling contractor, lithologic description of the cuttings by a professional geologist and groundwater quality sampling. Groundwater quality sampling can be conducted by zone sampling or installing monitoring wells.

In zone sampling, groundwater samples are collected from the test hole after drilling is completed. Sampling equipment is installed at the deepest zone of interest in the aquifer, the zone is purged by airlifting and a water quality sample is collected. The sampling equipment is then withdrawn to the next deepest zone of interest and the process is repeated until the shallowest zone of interest is sampled. The resulting water quality information provides a one-time characterization of the groundwater quality with depth. The main advantage of the technique is the relatively large number of zones that can be sampled. Disadvantages are that no permanent monitoring system exists, and temporal trends can not be assessed. Also, zone sampling results from discrete zones may not correlate well with samples from wells with intakes encompassing several aquifer zones.

Multiple completion monitoring wells provide a second option for testing groundwater quality. In a typical installation, multiple casing and well screen assemblies are installed in a single boring to monitor selected aquifer zones. The boring is sealed to prevent movement of groundwater between zones. Advantages of multiple monitoring wells include the ability to conduct the long-term monitoring needs to assess temporal trends, and possibly more representative sample results. The main disadvantage is the inability to monitor a large number of zones. The costs for both approaches are comparable.

Summary of Potential Water Quality Concerns

Elevated and increasing nitrate concentrations in groundwater are the chief water quality concern for the Dixon District area. EC and TDS levels are in normal ranges for the southern Sacramento Valley and do not appear to be increasing. Although there are 40 active groundwater contamination sites within the Dixon District, most of these sites do not appear to pose an immediate threat to Cal Water's existing groundwater supply. Most of the contaminant sources have been identified, and are currently being regulated by either DTSC or SWRCB. In the future,

Cal Water can avoid these areas through careful site selection of future groundwater wells. However, a cluster of identified sites in the central Dixon District area are potential point sources of nitrate contamination. Station 005-01 is located in the vicinity of these sites. The concentrations of nitrate in this well have been increasing since 2006. These increases are not correlated with well operations and are inconsistent with the construction of the well, which has relatively deep intakes. Based on this, a wellhead protection study may be warranted for Station 005-01.

In general, groundwater contamination locations will not likely limit Cal Water's existing groundwater supplies or prevent Cal Water from relying on the groundwater basin in the future. Cal Water staff should continue to monitor nitrate and TDS concentrations due to recent increasing concentration trends that have been observed.

COST OF GROUNDWATER

The cost for Cal Water to provide groundwater in the future will consist of the cost to maintain its existing capacity, the cost to increase its groundwater production capacity as demands increase, and the costs for operation and maintenance (O&M). Comparisons of existing supply and projected demand, along with the recommended water supply scenario, are discussed in subsequent sections of this Chapter.

Cost of Maintaining Existing Groundwater Production Capacity

Cal Water will need to replace older wells to maintain its existing groundwater production capacity. Table 4-8 below presents the replacement schedule assumed in this WSFMP. This replacement schedule was based on the age of the existing groundwater wells and typical replacement schedules in the industry. As shown in Table 4-8 it is recommended that Cal Water replace all eight of its operating wells by 2030.

Table 4-8. Replacement Schedule for Dixon District Groundwater Wells

Asset Type	Station	Year Built	Replacement Schedule					
			2008 - 2010	2011 - 2015	2016 - 2020	2021 - 2025	2026 - 2030	2031 - 2035
Well	001-03	1954	Replace					
Well	002-01	1950	Replace					
Well	003-01	1956	Replace					
Well	004-01	1966			Replace			
Well	005-01	1973				Replace		
Well	006-01	1976				Replace		
Well	007-01	1979					Replace	
Well	008-01	1979					Replace	

Table 4-9 presents the future unit cost of maintaining the existing groundwater production capacity assuming the replacement schedule previously presented in Table 4-8 is followed, and that each new well costs approximately $1.4 million[d]. The capital costs were annualized using the depreciation methodology adopted by Cal Water for its capital projects. This methodology, developed by Cal Water, accounts for depreciation over 40 years, and revenue requirement to cover debt, annual rate of return (13 percent), and taxes. The detailed tables used to develop the costs presented in Table 4-9 are included in Appendix J.

Table 4-9. Future Unit Costs of Existing Groundwater Capacity (in 2008 dollars)

Component	2008	2010	2015	2020	2025	2030	2035
Annualized Capital Cost, $	651,000	623,700	555,450	686,000	992,600	1,253,700	1,071,700
Groundwater, af[(a)]	1,725	1,725	1,725	1,725	1,725	1,725	1,725
Unit Capital Cost, $/af[(b)]	380	360	320	400	580	730	620

(a) Based on existing 2007 groundwater pumpage of approximately 1,725 af.
(b) Unit capital costs rounded to the nearest $10.

Cost of Future Groundwater Production Requirements

Dixon District primarily relies on the groundwater wells (and storage in the groundwater basin) to meet peak hour demands. The projected maximum day demand at buildout (2030) was previously presented in Chapter 3 as 1.9 times the 2030 annual average day demand (2,046 af), or approximately 2,415 gpm.

Based on data provided by Cal Water, the existing design capacity of all the active groundwater wells within the Dixon District is approximately 5,050 gpm. Assuming that 20 percent of Cal Water's groundwater production capacity could be out of service at any given time (i.e., maintenance, water quality or other issues), only 4,040 gpm should be considered as reliable firm groundwater production capacity. Consequently, Cal Water will not require any additional new groundwater production capacity by 2030.

Unit Cost Components of Groundwater

In addition to the unit capital costs associated with existing and future groundwater production capacity, Cal Water will also have associated unit O&M costs. Discussions with Cal Water staff indicated that the current (2007) O&M cost is approximately $299,399 per year or approximately $174 per af based on 2007 pumpage of approximately 1,725 af. This cost is the value per acre-foot of groundwater delivered, and therefore, includes pipeline repair, chemicals, power, and replacement of equipment.

[d] Cost of new wells provided by Cal Water staff and does not include the cost of land. Email of provided information included in Appendix J.

In the future, O&M costs will likely increase due to inflation of material, labor, and equipment costs. Consequently, future O&M costs were projected assuming an increase of 4 percent per year (based on work previously completed in Cal Water's Livermore and Chico-Hamilton City Districts).

Table 4-10 summarizes the unit cost components of groundwater, which includes the unit capital costs associated with maintaining existing production capacity, unit capital costs associated with increasing production capacity, and unit O&M costs.

Table 4-10. Summary of the Unit Cost Components of Groundwater (in 2008 dollars)

Unit Cost Component	2008	2010	2015	2020	2025	2030	2035
Existing Capacity, $/af[(a)]	380	360	320	400	580	730	620
Future Capacity, $/af	0	0	0	0	0	0	0
O&M, $/af[(b)]	180	200	240	290	350	430	520

(a) Obtained from Table 4-9.
(b) Based on $174/af (2007), and then increased at a rate of 4% per year.

OTHER POTENTIAL WATER SUPPLY CONCEPTS

Evaluations of groundwater level trends and groundwater quality in the Dixon District (performed in the previous sections of this Chapter) conclude that Cal Water can plan to use groundwater to meet future water demands; however, Cal Water should closely monitor groundwater levels in the Dixon District wells and other wells (as monitored by DWR) to ensure that increased annual demands (by Cal Water or other groundwater basin users) do not induce overdraft conditions on a long-term basis. Although the planning horizon for this WSFMP is 2035, it will most likely require an update every 5 to 10 years.

For long-term planning purposes and supply diversification, it is recommended that Cal Water begin exploring the possibility of using other water supplies (e.g., surface water and recycled water) in conjunction with groundwater. As regulations become more stringent and regional water resources become scarcer, integration of alternative water supply sources may be desirable to assure adequate management and sustainability of groundwater resources, and to provide the Dixon District with additional supply reliability.

The purpose of this section is to present Cal Water staff with other potential water supply options that can be further explored. Integration of these other supplies (surface water and recycled water) would strengthen the long-term management of groundwater resources and diversify the Dixon District's water supply portfolio.

Potential Surface Water Supply Options

State Water Project Contract Supplies

The City of Dixon currently has future surface water rights from the North Bay Aqueduct (NBA) through the State Water Project (SWP). The City of Dixon can start taking 300 af of surface water from the NBA starting in 2016 with yearly increases of 300 af until a maximum allotment of 1,500 af is met. Although the City of Dixon has the right to obtain a specified amount of NBA water in the future, there are no infrastructure or treatment facilities available. Infrastructure and treatment of NBA water must be constructed to utilize the surface water allotment.

Federal Solano Project Supplies

Figure 4-15 illustrates Dixon District's proximity to various water agencies and districts. Solano Irrigation District (SID) boundaries nearly enclose the City of Dixon and due to this geographical proximity, potential surface water supply from SID could be acquired by Cal Water Dixon District.

SID currently receives a portion of surface water from the Solano Project. SID serves four (4) cities, Maine Prairie Water District and SID customers. Cal Water would have to negotiate a water purchase from the SID to the Dixon District to have the right of diverting this surface water through recharge to the groundwater basin and subsequent extraction or direct use through the design and construction of a surface water treatment facility.

If Cal Water decides to explore the specific option of acquiring additional surface water through water purchases, WYA recommends that Cal Water conduct a separate, more focused feasibility level evaluation to assess: available water quantities; required conveyance facilities; wheeling requirements, recharge locations, and other technical and institutional issues associated with water transfers.

Water Transfers

California has an active water transfers market, whereby a willing water user sells water to another willing water buyer under terms and conditions negotiated by the parties. California surface water rights law allows such transfers on both a short-term and a long-term or permanent basis. In general, water can be made available for transfer if there is a history of prior use, and the transfer is based on a decrease in actual use by the seller (i.e., crop fallowing, conservation, etc.).

Based on experience developed in water marketing beginning with the 1991 State Drought Water Bank, DWR, the U.S. Bureau of Reclamation (USBR) and the SWRCB have oversight and a regulatory role in approving water transfers. Such roles and authorities depend on details of the specific water rights of the proposed transfer, and the involved parties.

Water made available by sellers for sale to others can be developed by:

- Selling surface water supplies and replacing with a like amount of additional groundwater pumping (this is called a groundwater substitution transfer, which is coming under more regulatory scrutiny and becoming more difficult to implement);
- Selling surface water supplies and foregoing irrigation that was supported by such supplies (historically described as land fallowing);
- Releasing previously stored water from reservoirs owned or controlled by the sellers;
- Implementing land use or cropping pattern changes to reduce the net amount of water historically diverted and used (for example, shifting from a high water use crop to a low water use crop); and
- Pumping and selling groundwater (in some areas, the pumping and export of groundwater supply is prohibited or severely restricted by local ordinances).

There is little history of permanent water transfers from agricultural to urban use in the Sacramento Valley; however, there are several clear examples of such transfers in southern California. The most recent example is the transfer of water from the Imperial Irrigation District to San Diego County Water Authority. However, Sacramento Valley transfers for urban use may be considered in the future as urban areas expand due to increases in population in the region.

Temporary or short-term water transfers have occurred in the past from agricultural water districts in the Sacramento Valley. For example, SID has sold water in the past on a short-term basis; however, it is unknown whether they would be interested in selling water on a long-term basis. Figure 4-15 illustrates the location of the SID service area and its proximity to Cal Water's Dixon District service area.

Water transfers – whether short or long-term – have generated a great deal of local interest and opposition. Any successful transfer will need to be accomplished within a local and regional policy and political context, in addition to complying with environmental laws and regulatory processes. Local ordinances in each county establish specific approval details and processes for water transfers. Solano County Water Agency does not account for exchanges or transfers on its own but does facilitate and assist cities and districts in water transfers and exchanges.

Conveyance/Wheeling

Delivery of surface water to the Dixon District depends on the location of existing or potential canals or pipelines, and the location of potential recharge areas. In general, potential sellers of surface water have a water right which entitles the agency to divert a certain quantity of flow during a certain period of time from a particular location of a stream or river. Therefore, inherent in this water right is the ability to convey this quantity of flow to the point of diversion. If the proposed diversion point of the water to be transferred to the new buyer is located upstream of the diversion point of the seller, then conveyance of this transferred water is "built-in" to the water transfer. However, if the potential buyer is located downstream of the seller's diversion point, a conveyance or wheeling study would need to occur to determine if and how this transferred water could be conveyed to the new buyer's diversion location.

Water Treatment

If Cal Water acquires a reliable surface water supply and the treatment of that supply is the preferred option, then the construction of a new water treatment plant will be required. In addition, construction of a water conveyance system from the North Bay Aqueduct and/or Solano Irrigation District to this water treatment plant near or in the City of Dixon will also be necessary.

Constructing a new water treatment plant to treat and deliver any surface water supplies may be cost prohibitive.

Potential Recycled Water Supplies

Recycled water projects normally arise due to a need to offset potable water use or to dispose of wastewater that cannot be discharged through normal practices. Schools and parks are normally the first customers to use recycled water due to their landscape irrigation needs.

The City of Dixon's wastewater treatment plant (WWTP) is located approximately 2.5 miles south of the City. Figure 4-16 illustrates the location of the WWTP and potential future school and park customers. Implementation of a recycled water program would require new distribution infrastructure between the WWTP and potential customers. The cost of this infrastructure is not justified at the present time. Furthermore, due to the high TDS of the groundwater basin, it may be a problem to irrigate with recycled water.

Based on these conditions, a recycled water system in the Dixon District is not recommended at this time, and should only be considered if:

- Future wastewater disposal and discharge requirements cannot be addressed through treatment facility improvements at the WWTP.
- Cal Water is unable to secure surface water supplies, and groundwater overdraft conditions occur.
- Cal Water needs to offset private pumping to secure long-term groundwater pumping rights.

Consequently, it is recommended that Cal Water should consider exploring the use of recycled water only after it has further evaluated (1) the potential surface water supply option (i.e., water transfers) previously discussed in this Chapter or (2) changes to recycled water distribution options that improve the economics for recycled water use.

RECOMMENDED WATER SUPPLY OPTIONS

In the future, Cal Water can rely on continued use of groundwater to meet projected water demands. Consequently, for planning purposes in this WSFMP, it was assumed that Cal Water will meet all future demands in the Dixon District with groundwater.

Cal Water may want to begin exploring the possibility of using surface water supplies in conjunction with groundwater. As regulations become more stringent and regional water resources become scarcer, integration of other water supply sources could be desirable to strengthen management and sustainability of the groundwater resources, and provide Cal Water's Dixon District with additional supply reliability. However, costs for a surface water feasibility study have not been included because it was assumed that the Dixon District will rely on groundwater only to meet future demands.

Figure 4-17 compares Cal Water's projected annual water demands to the existing groundwater supply. As shown on Figure 4-17, all of Cal Water's future annual water demands can be met from the groundwater basin using existing wells. Additionally, unlike surface water supplies, groundwater supplies are inherently resistant to drought conditions due to the relatively large volume of water in basin storage. For planning purposes, it was assumed that the Dixon District's groundwater supplies would be available during all hydrologic water year types.

Figure 4-18 compares the projected annual maximum day demands to existing groundwater production capacity. As shown on Figure 4-18, the Dixon District will not require additional groundwater production capacity by 2035 to meet projected maximum day demands.

The total cost of the recommended water supply scenario was determined by the sum of the following components:

- Cost of Maintaining Existing Groundwater Capacity – The total cost was determined by multiplying the total existing groundwater production (1,725 af) by the unit capital cost for maintaining existing groundwater production capacity, as summarized in Table 4-10.
- Cost of O&M – The total cost was determined by multiplying the total projected groundwater production by the unit O&M cost.

Table 4-11 presents the projected cost of the recommended scenario in approximately five year intervals, while Figure 4-19 illustrates the projected costs on an annual basis. As shown in Table 4-11 and Figure 4-19, the total cost of meeting future water demands with groundwater is projected to reach approximately $2.13 million by 2035.

Table 4-11. Projected Cost of the Recommended Water Supply Scenario (in 2008 dollars)

Cost Component[(a)]	2008	2010	2015	2020	2025	2030	2035
Existing Capacity, $	656,000	621,000	552,000	690,000	1,001,000	1,259,000	1,069,000
Future Capacity, $	0	0	41,000	76,000	145,000	208,500	0
O&M, $	310,000	345,000	445,000	555,000	691,000	864,500	1,064,000
Total Cost, $	966,000	966,000	1,038,000	1,321,000	1,837,000	2,332,000	2,133,000

(a) Unit costs obtained from Table 4-10.

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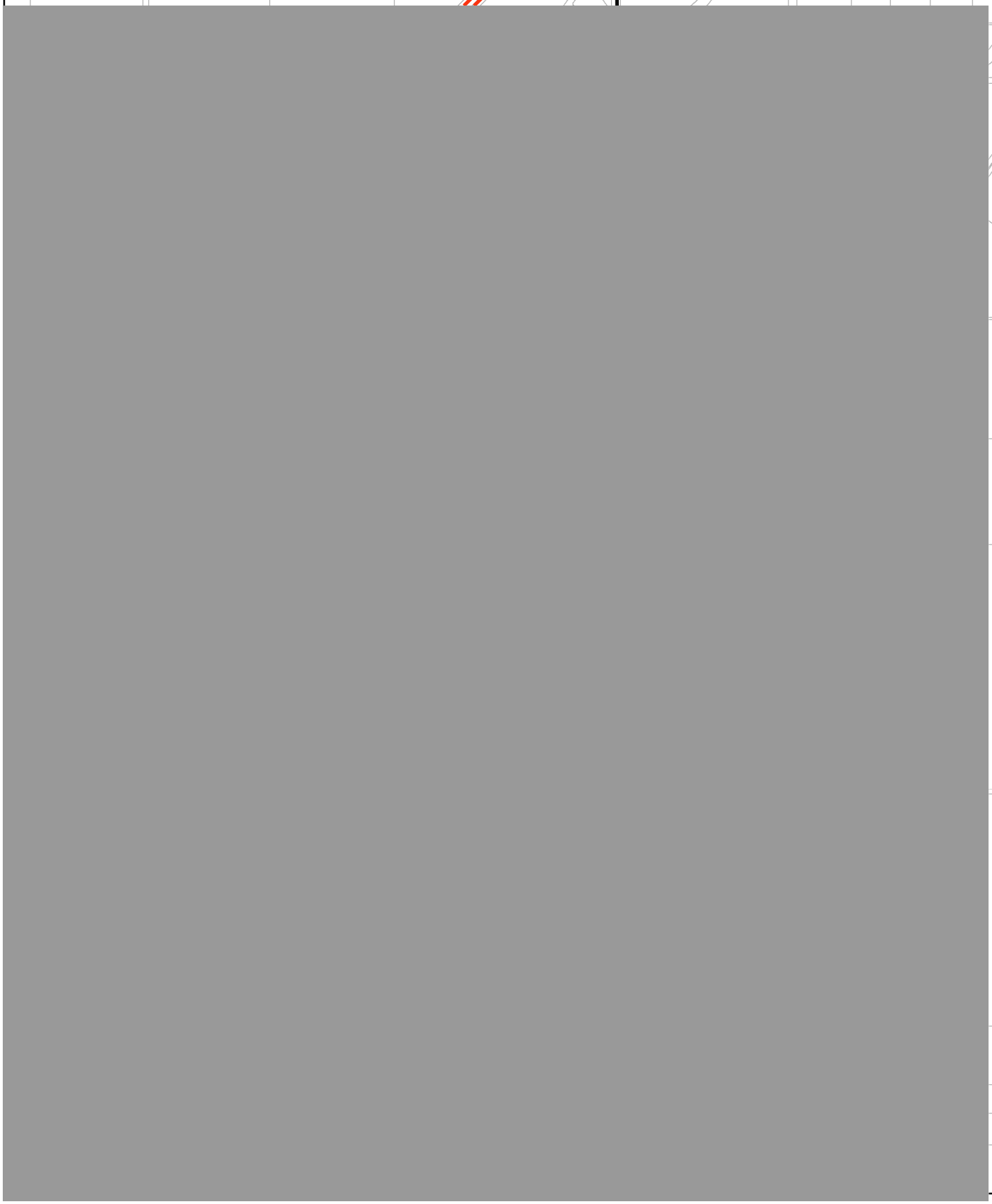

Active Well
Potable Water Storage
Dixon District
Parcels
Highway
Route
Hydrologic Features

0 305 610 1,220
S

FIGURE 4-1

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

SERVICE AREA AND WELL LOCATIONS

WEST YOST ASSOCIATES
Consulting Engineers

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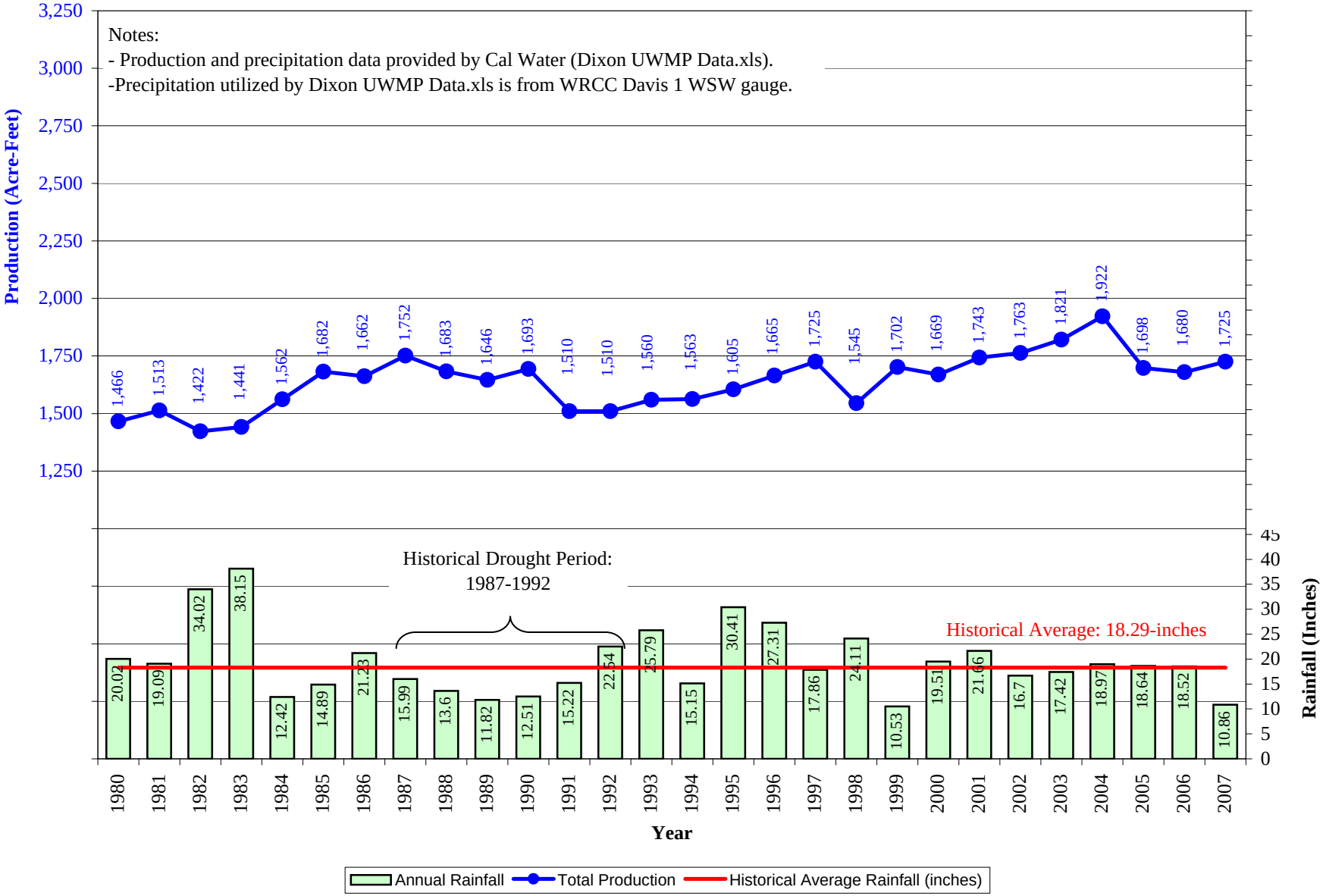
Public Version

Figure 4-2. Historical Groundwater Production (1980-2007)



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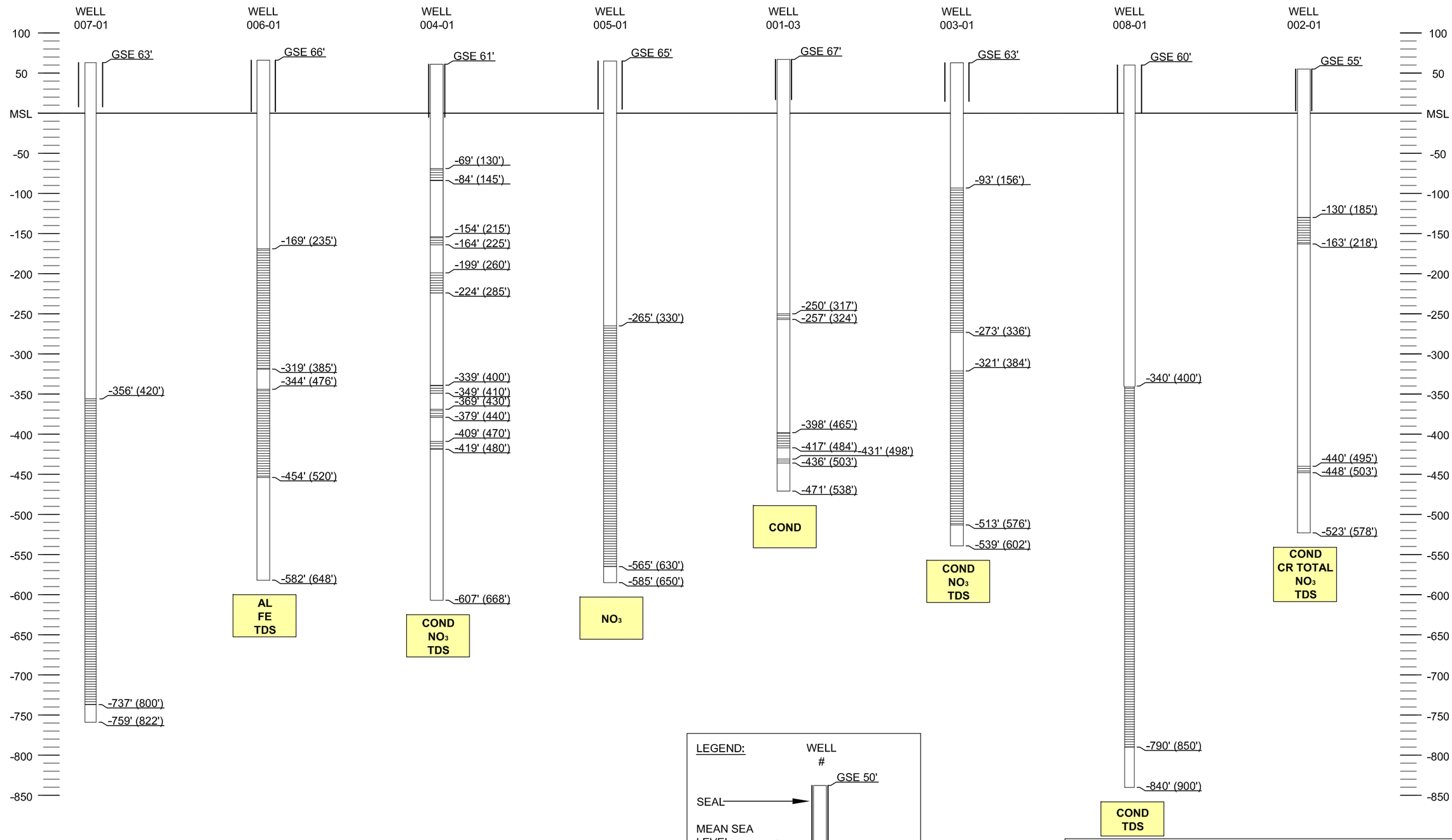
Last Revised: 10/24/2008

California Water Service Company
Dixon District
Water Supply and Facilities Master Plan

Public Version



NOTES:

1. GSE = GROUND SURFACE ELEVATION
2. ELEVATIONS RELATIVE TO MEAN SEA LEVEL; DEPTHS RELATIVE TO GROUND SURFACE SHOWN IN PARENTHESES
3. SANITARY SEAL INFORMATION UNKNOWN FOR WELLS 001-03 AND 003-01
4. CONSTIUENTS THAT ARE OVER 75 PERCENT OF MCL/SMCL ARE CALLED OUT IN YELLOW BOXES. PLEASE REFER TO TABLE 4-7.

FIGURE 4-3
California Water Service Company
Dixon District Water Supply
and Facilities Master Plan
EXISTING WELL PROFILES

WEST YOST ASSOCIATES
Consulting Engineers

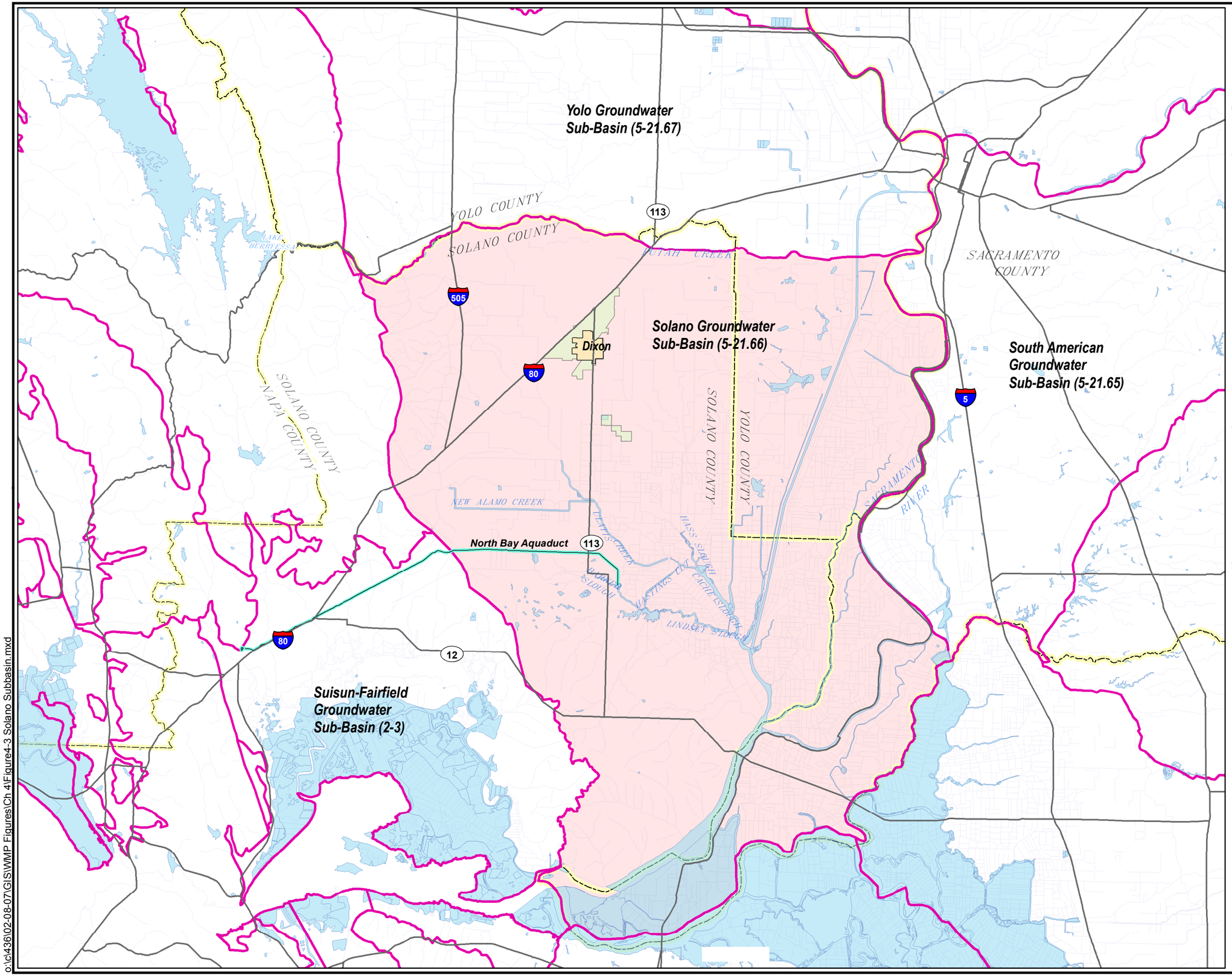
O:\Clients\436 California Water Service Company\02-08-07 Dixon District WS&FMP\CAD\Figures\Well Construction\FIG 4-3_Well Profiles.dwg 5/20/2009 1:24 PM Siuroso

Public Version

FIGURE 4-4

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

SOLANO SUBBASIN LOCATION MAP



0 1.25 2.5 5
Miles

NOTES:

LEGEND:

- DWR Groundwater Subbasin Boundaries
- Solano Subbasin
- Cal Water Dixon District
- City of Dixon
- County Boudary
- North Bay Aqueduct

WEST YOST ASSOCIATES
Consulting Engineers

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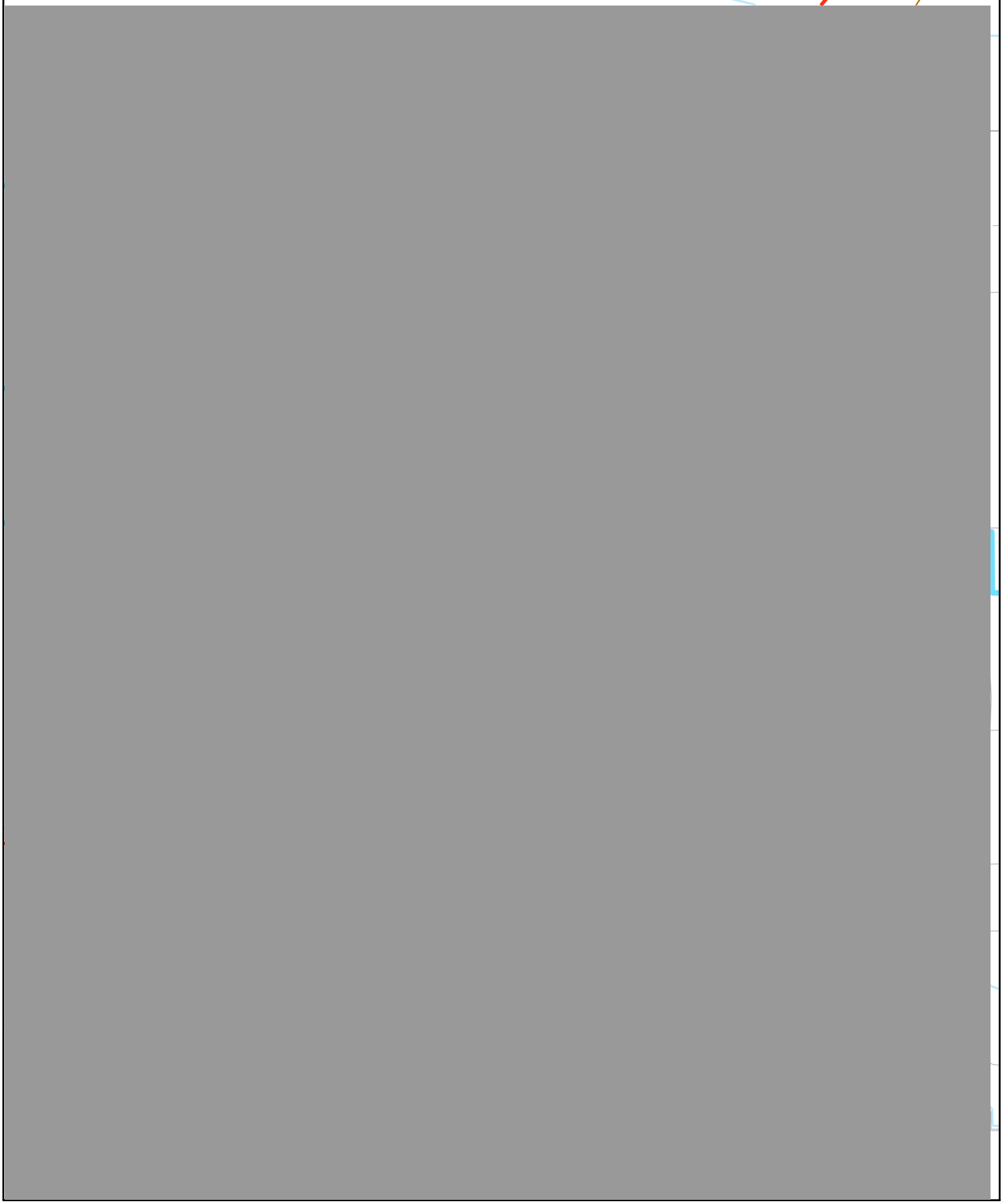

LEGEND:

- Dixon District Wells
- DWR Monitoring Wells
- Dixon District Service Area
- City of Dixon
- Route
- Highway
- Streets
- Canal
- Hydrologic Features

N

0 1,350 2,700 5,400

FIGURE 4-7

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

DIXON DISTRICT WELL AND DWR MONITORING WELL LOCATIONS

WEST YOST ASSOCIATES Consulting Engineers

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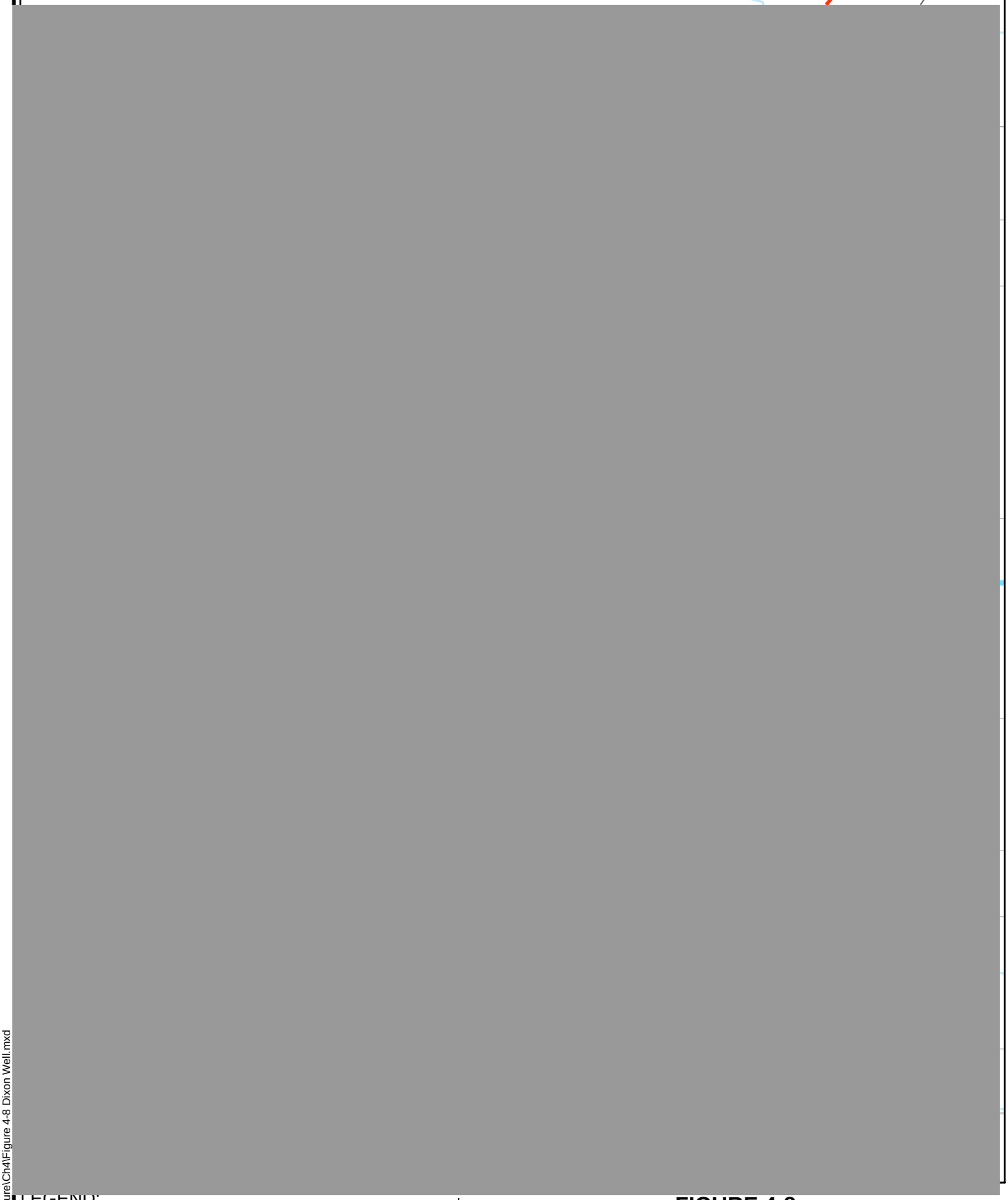
Public Version



LEGEND:

Dixon District Wells

- Decreasing Trend
- Stable Trend

DWR Monitoring Wells

- Increasing Trend
- Stable Trend

- Highway
- Route
- Streets
- Canal
- Dixon District Service Area
- City of Dixon
- Water Feature

N

0 1,350 2,700 5,400

S

FIGURE 4-8

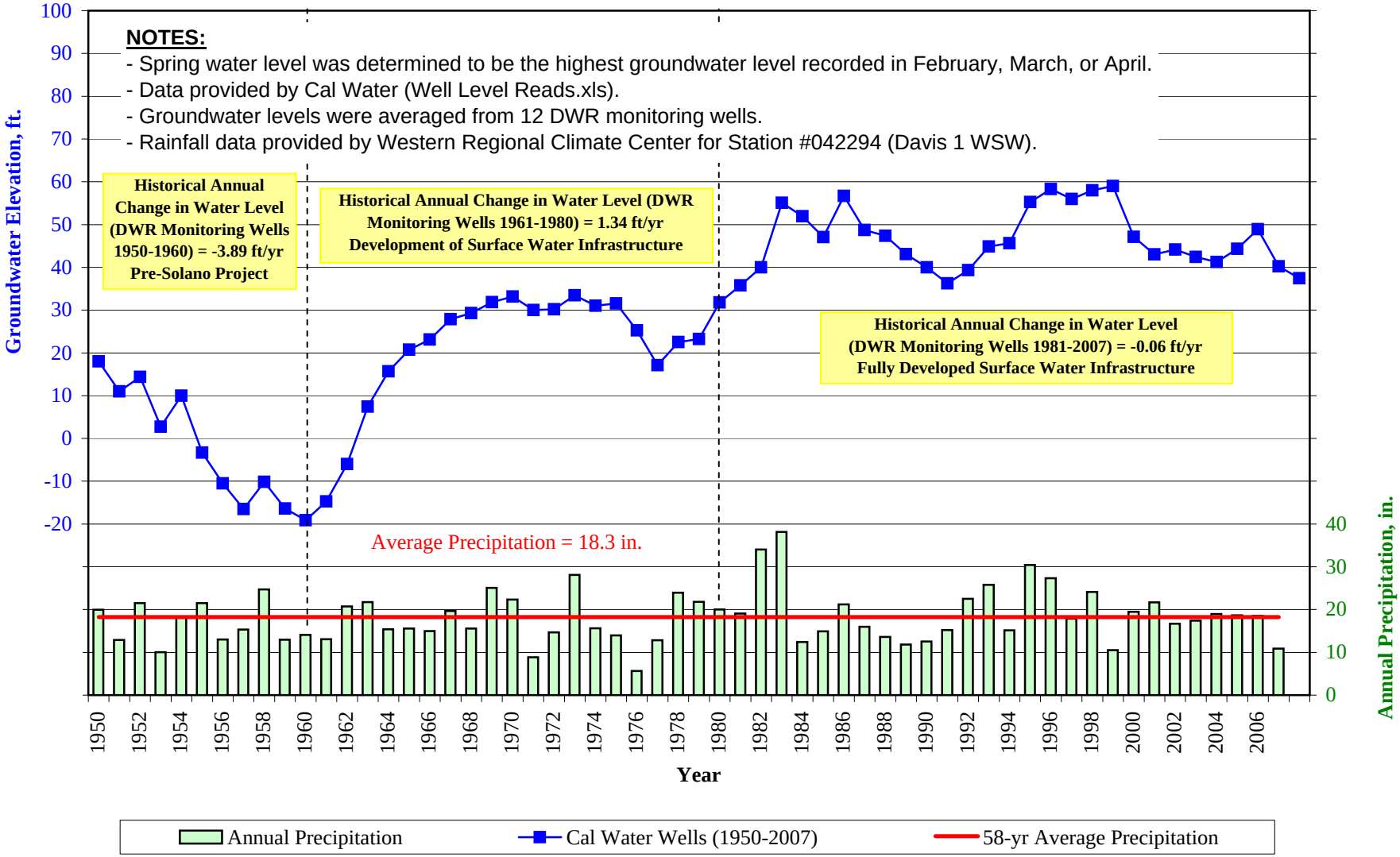
California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

DIXON DISTRICT AND DWR MONITORING WELL TRENDS

WEST YOST ASSOCIATES Consulting Engineers

o:\c\436\020807\GIS\WMP Figure\Ch4\Figure 4-8 Dixon Well.mxd

Figure 4-9. DWR Monitoring Wells - Annual Average Spring Groundwater Levels



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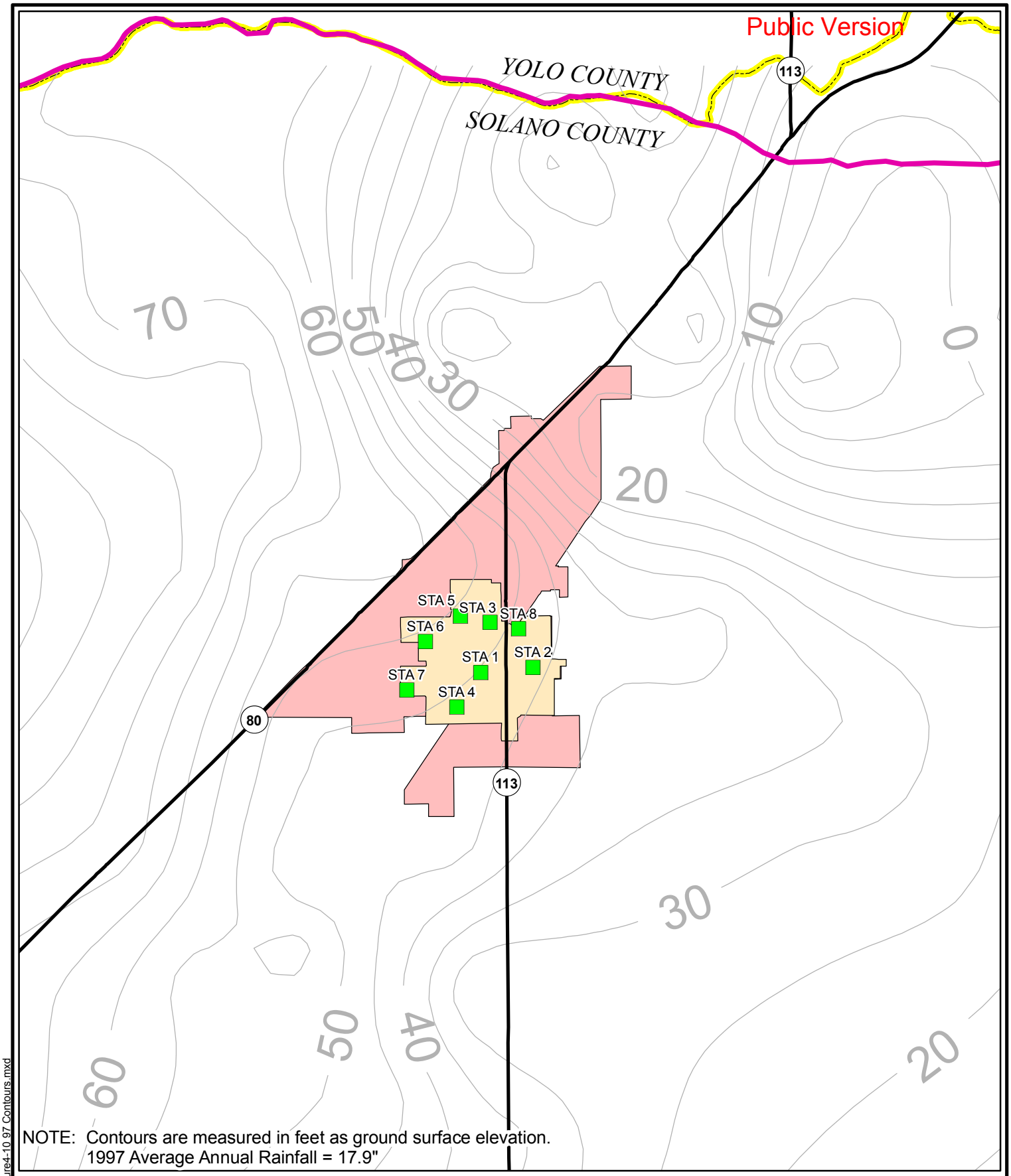
Last Revised: 10/28/2008

California Water Service Company
Dixon District
Water Supply and Facilities Master Plan



LEGEND

- 1997 Spring Groundwater Contours
- Cal Water Dixon District Wells
- Cal Water Dixon District
- County Boudary
- Solano Subbasin Boundary
- City of Dixon
- Highway
- Route

N

0 1,200 2,400 4,800

FIGURE 4-10

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

1997 SPRING GROUNDWATER LEVEL CONTOURS

WEST YOST ASSOCIATES
Consulting Engineers

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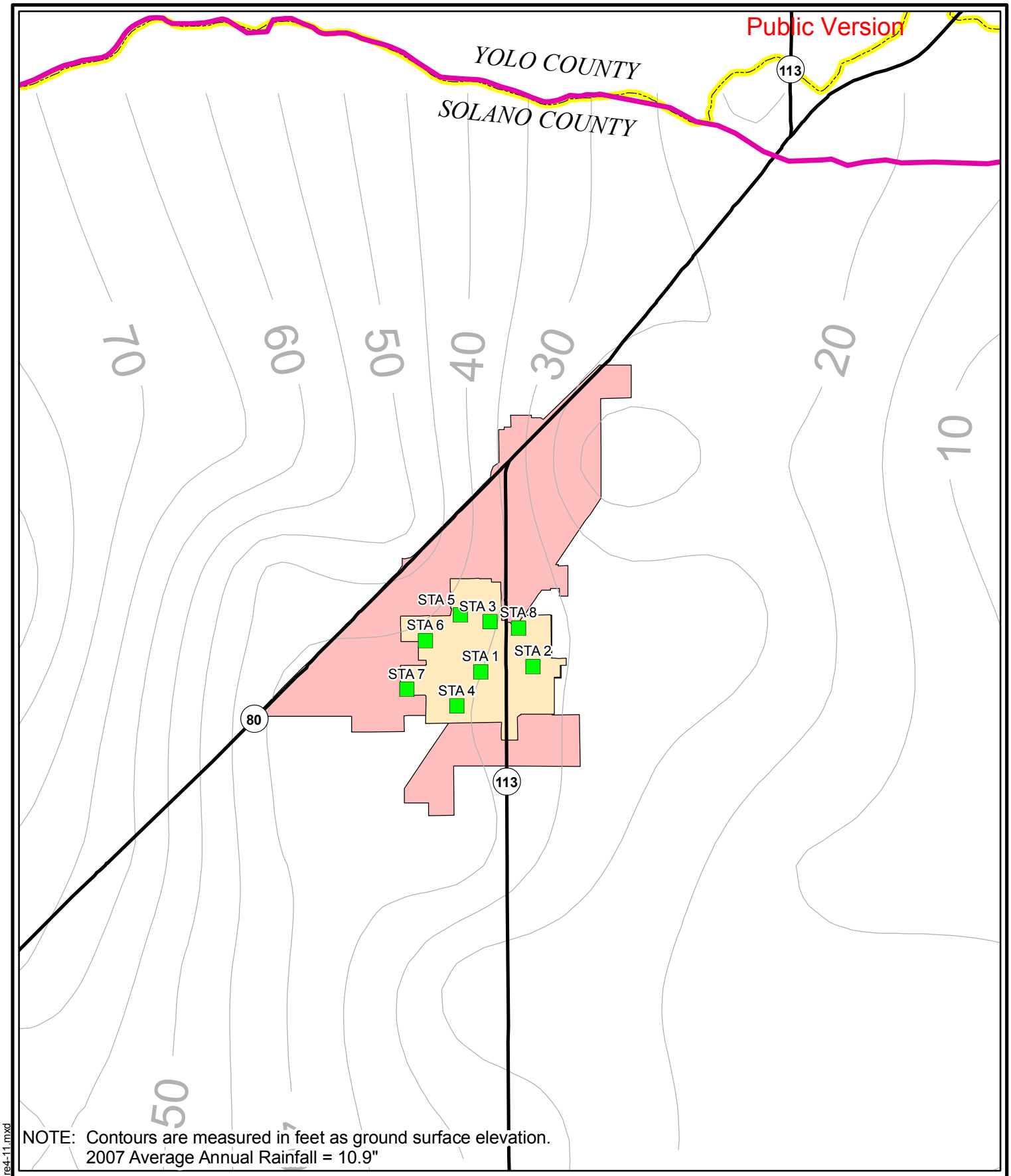

LEGEND

- 2007 Spring Groundwater Contours
- Cal Water Dixon District Wells
- Cal Water Dixon District
- County Boundary
- Solano Subbasin Boundary
- City of Dixon
- Highway
- Route

N

0 1,200 2,400 4,800

FIGURE 4-11

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

2007 SPRING GROUNDWATER LEVEL CONTOURS

WEST YOST ASSOCIATES
Consulting Engineers

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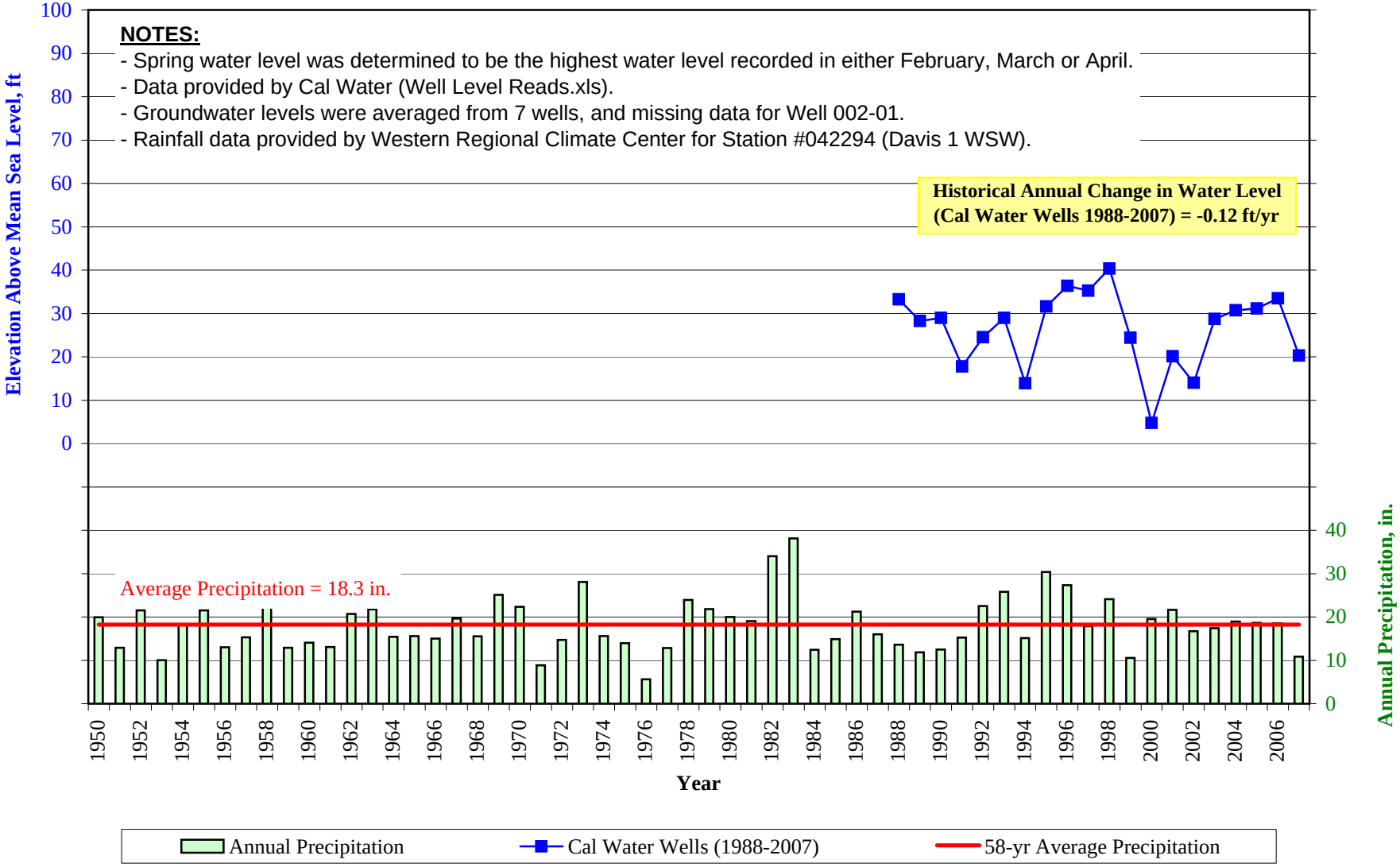
Public Version

Figure 4-12. Cal Water Wells - Annual Average Spring Groundwater Levels



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Last Revised: 05/12/08

California Water Service Company
Dixon District
Water Supply and Facilities Master Plan

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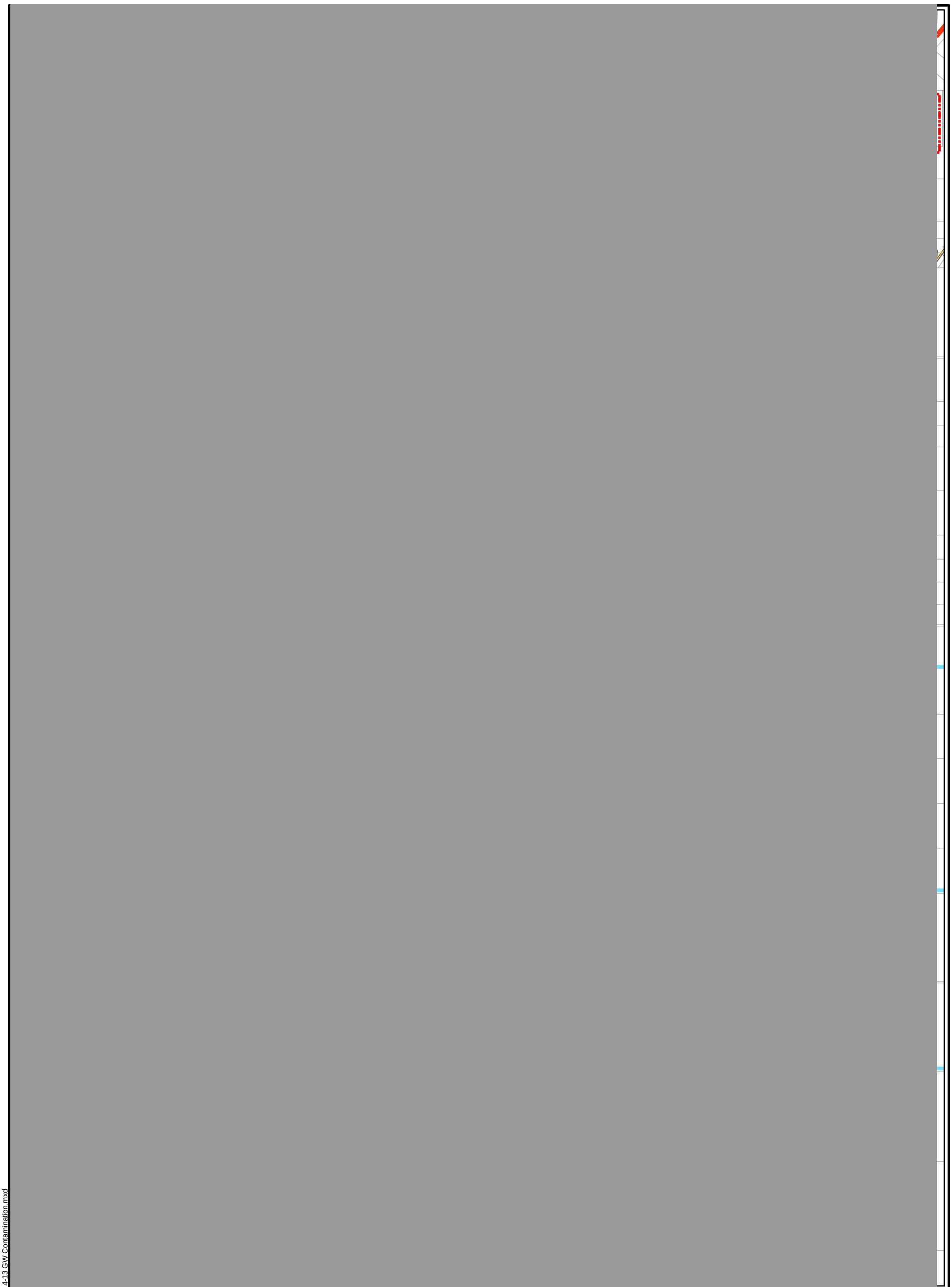

LEGEND:

GeoTracker Sites

- TPH
- BTEX
- VOC
- MTBE
- OXYGENATES
- Pesticides
- PCE
- NAP
- NO3
- No Data
- Dixon District Wells
- City of Dixon
- Dixon District Service Area
- Highway
- Route
- Railroad
- Hydrologic Features
- Parcels

N

0 650 1,300 2,600

Scale in Feet

FIGURE 4-13

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

KNOWN POINT SOURCES OF GW CONTAMINATION (ACTIVE SITES)

WEST YOST ASSOCIATES Consulting Engineers

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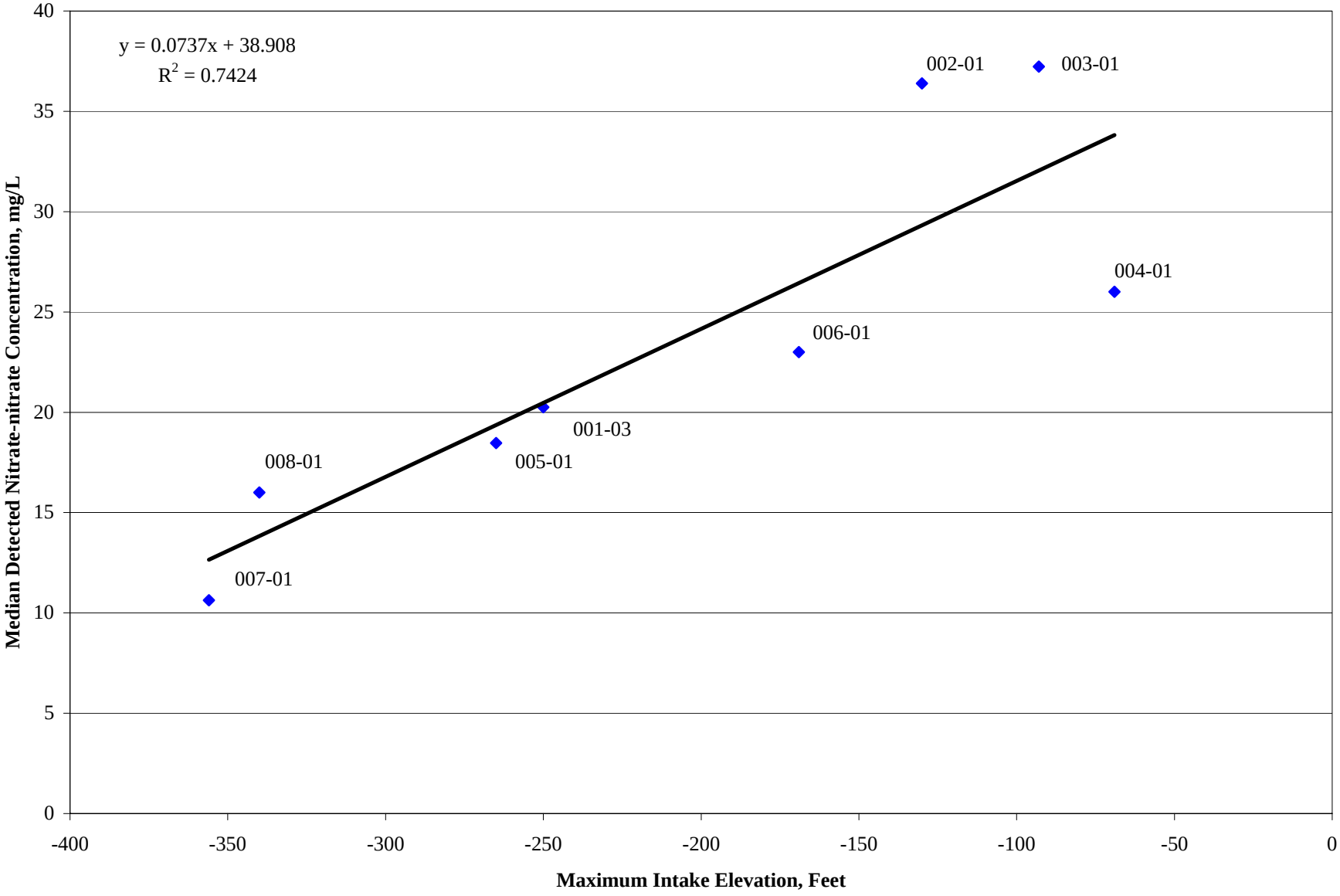
Public Version

Figure 4-14. Relationship between Intake Elevations and Historical Nitrate Concentrations



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Last Revised: 0512/2009

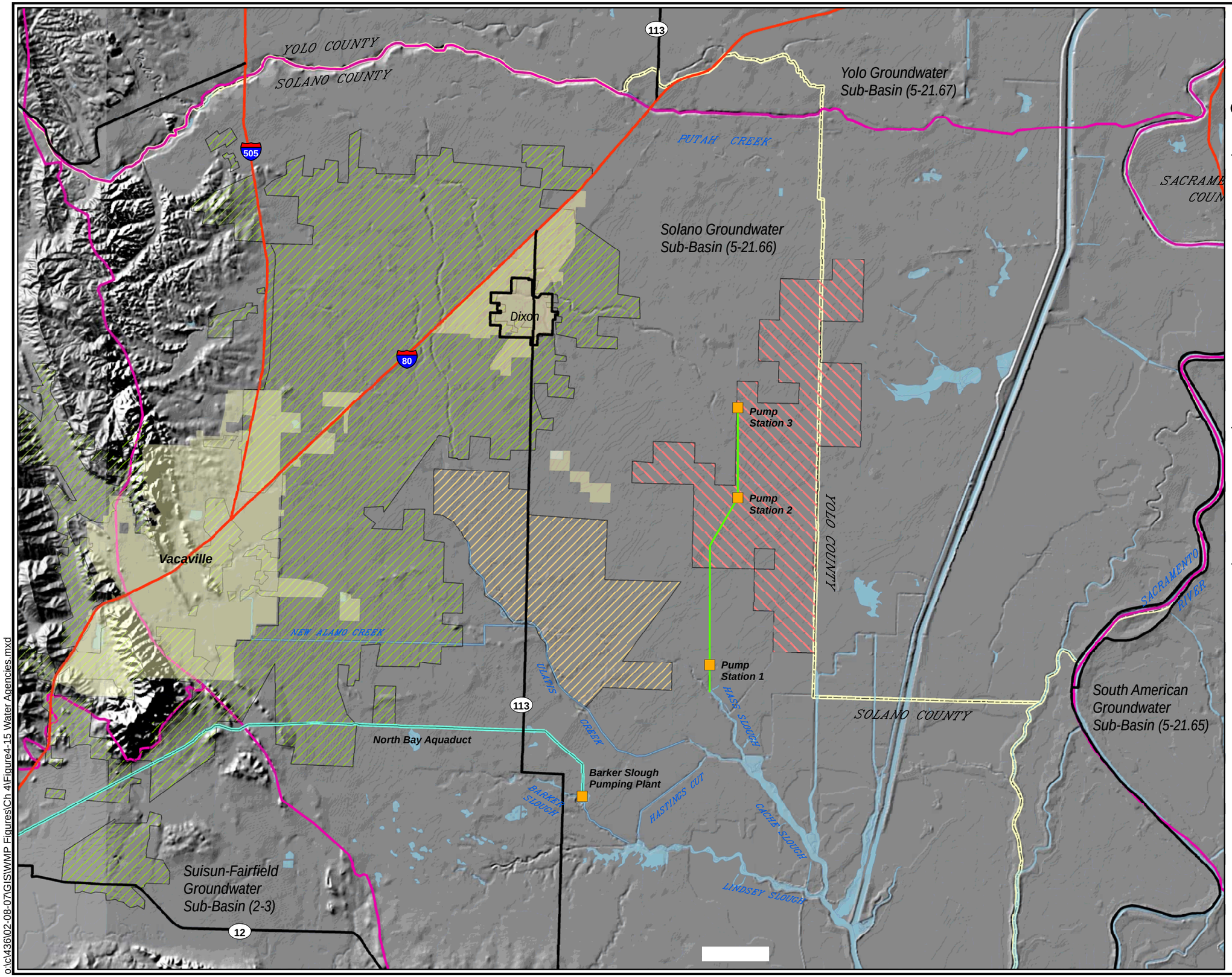
California Water Service Company
Dixon District
Water Supply and Facilities Master Plan

Public Version

FIGURE 4-15

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

SOLANO COUNTY WATER AGENCIES AND DISTRICTS LOCATION MAP



N

0 0.5 1 2
Miles

NOTES:

LEGEND:

- Reclamation District No. 2068
- Solano Irrigation District
- Maine Prairie Water District
- Cal Water Dixon District Boundary
- County Boundary
- North Bay Aqueduct
- RD 2068 Main Canal
- DWR Groundwater Basin
- Highway
- Route
- Hydrologic Features

WEST YOST ASSOCIATES Consulting Engineers

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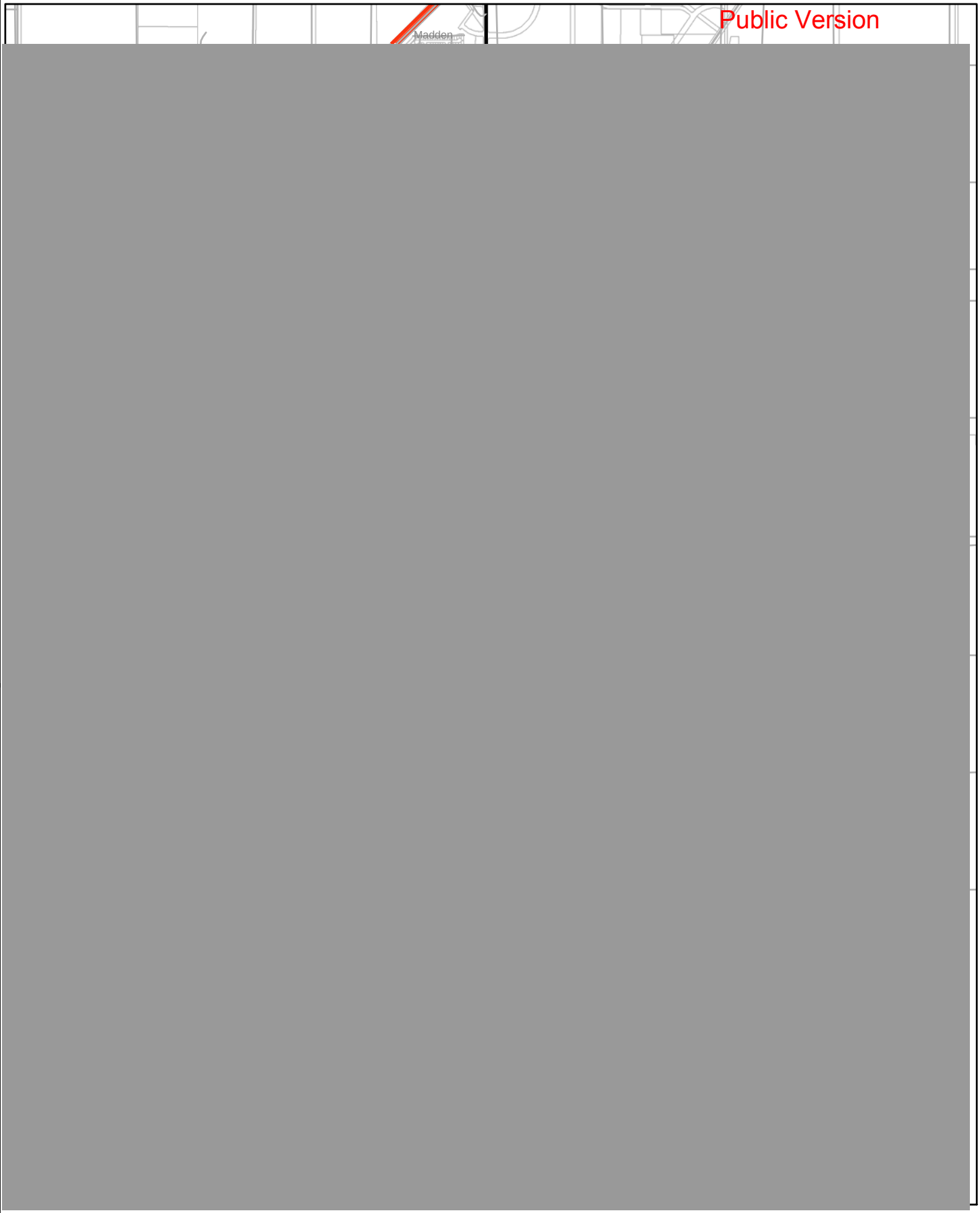

LEGEND

- Waste Water Treatment Plant (WWTP)
- Active Well
- Potable Water Storage
- Existing Schools, Parks, & Landscaped Areas
- Dixon District
- Streets
- Highway
- Route
- Hydrologic Features
- Parcels

N

0 550 1,100 2,200

FIGURE 4-16

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

LOCATION OF POTENTIAL RECYCLED WATER SUPPLY AND WWTP

WEST YOST ASSOCIATES
Consulting Engineers

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Figure 4-17. Comparison of Available Existing Groundwater Supply and Projected Annual Demand

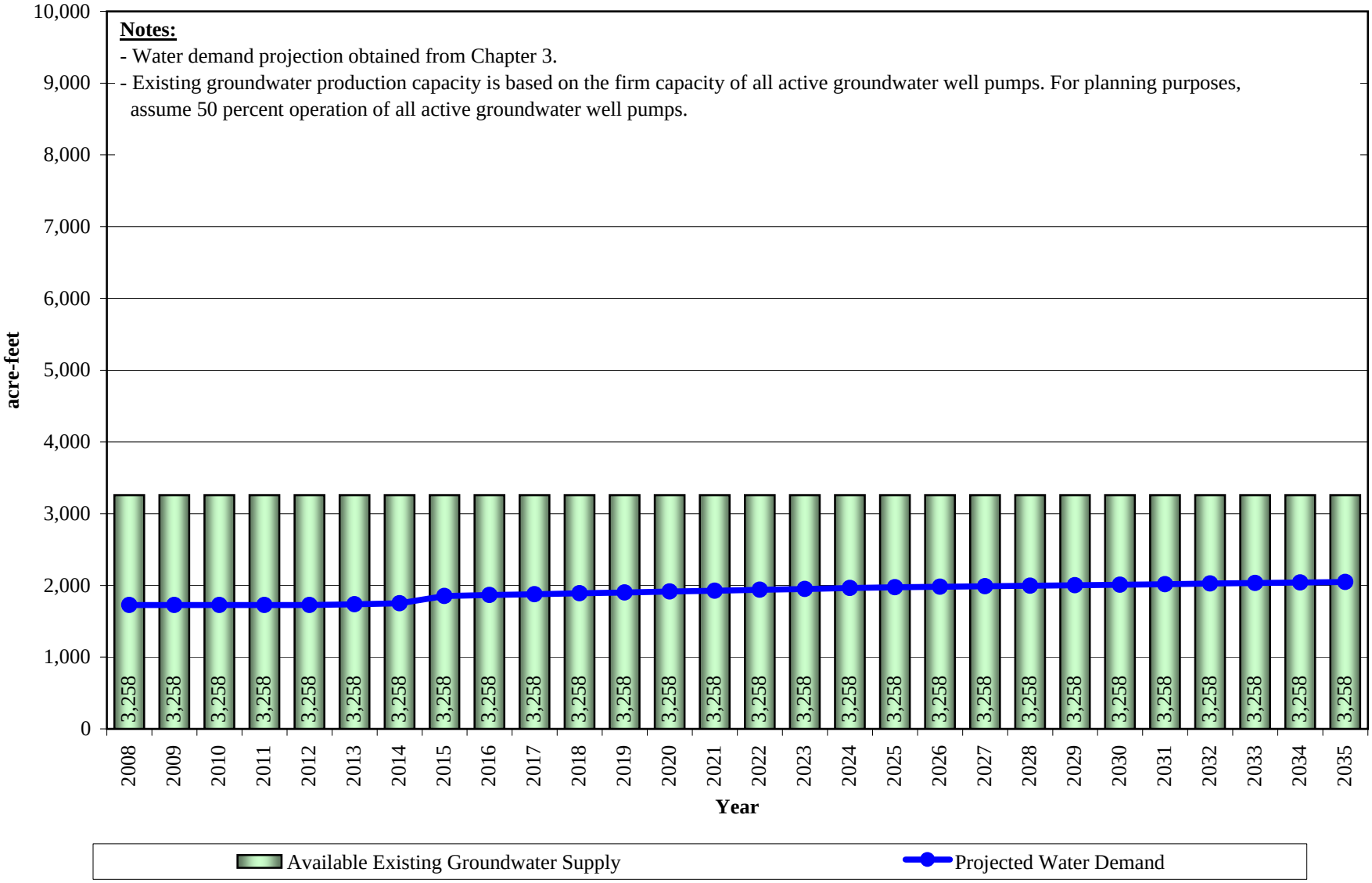

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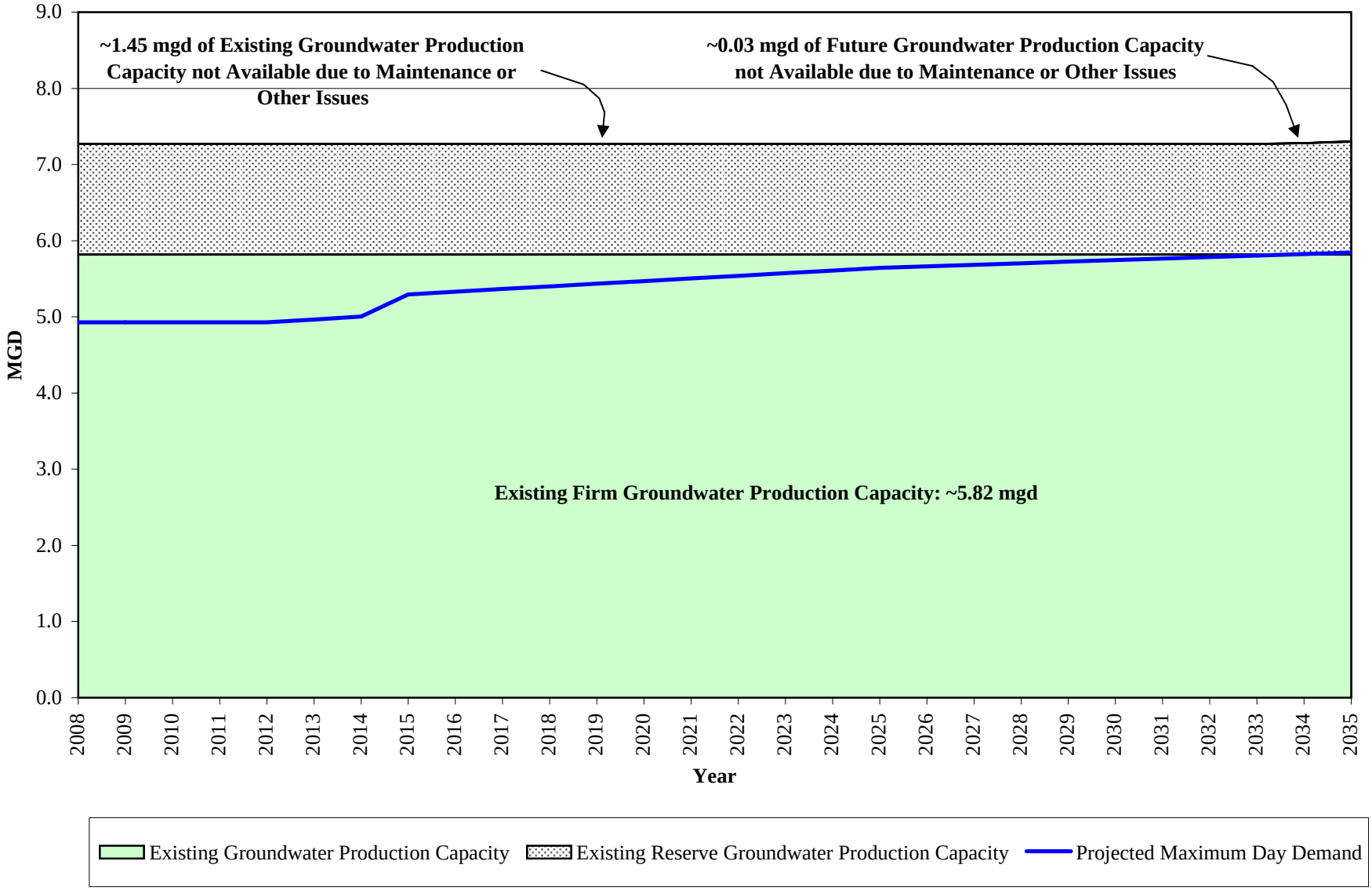
Figure 4-18. Projected Maximum Day Demand and Groundwater Production Capacity



West Yost Associates
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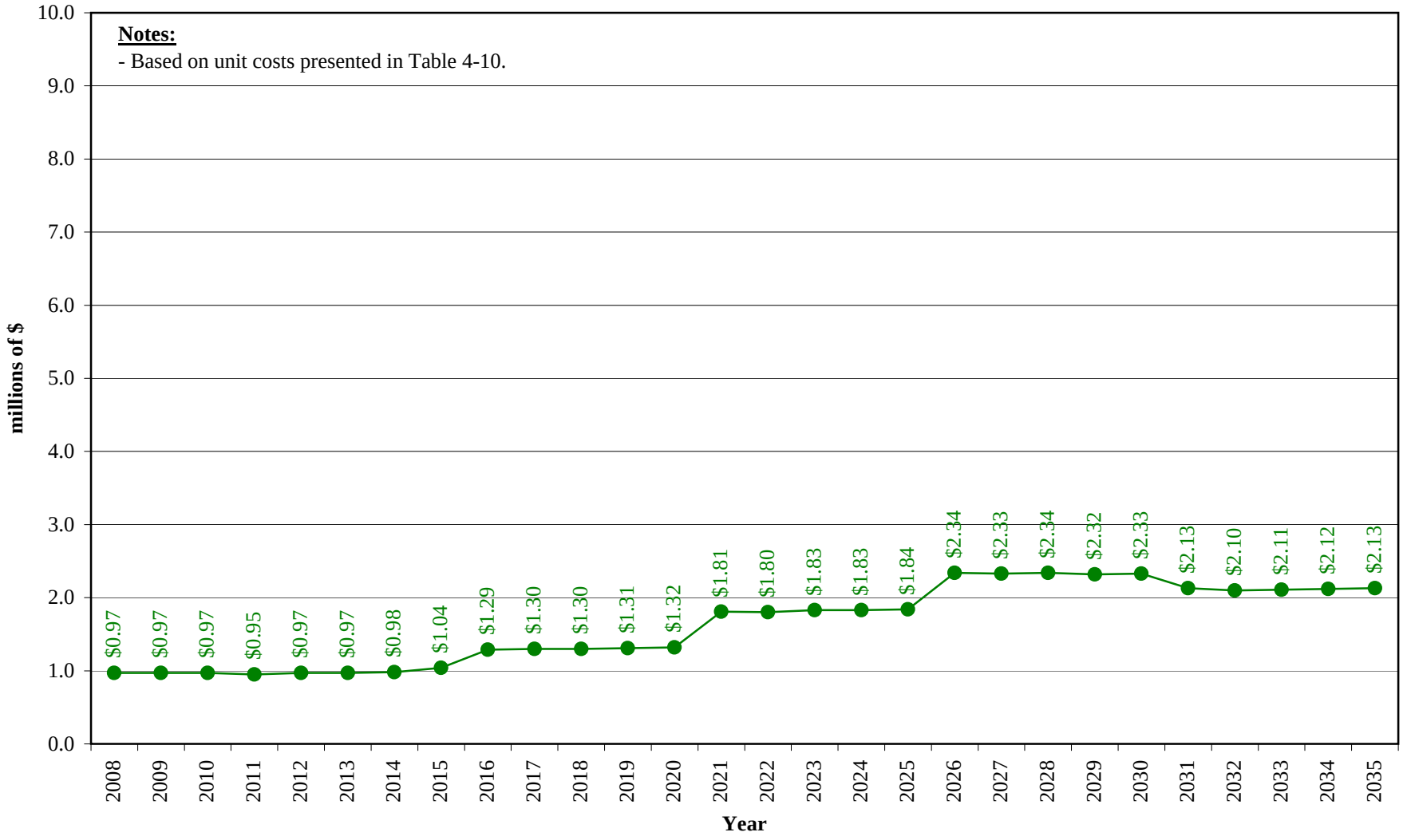
Last Revised: 10/31/2008

California Water Service Company
Dixon District
Water Supply and Facilities Master Plan

Figure 4-19. Projected Future Costs of Recommended Water Supply Option



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[19] DWR, 2004, California's Groundwater, Bulletin 118, Sacramento Valley Groundwater Basin, Solano Subbasin, February 27.

[20] DWR, 2004, California's Groundwater, Bulletin 118, Sacramento Valley Groundwater Basin, Solano Subbasin, February 27.

[21] (Ikehara, 1994)

[22] (Borchers, et. al., 1998)

[23] (Frame, 2005)

[24] (Borchers, et. al., 1998)

[25] DWR, 2004, California's Groundwater, Bulletin 118, Sacramento Valley Groundwater Basin, Solano Subbasin, February 27.

[26] DWR, 2004, California's Groundwater, Bulletin 118, Sacramento Valley Groundwater Basin, Solano Subbasin, February 27.

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CHAPTER 5: PLANNING AND DESIGN CRITERIA

Chapter Highlights:

The purpose of this chapter is to define the planning and design criteria for analyzing the performance of Cal Water's potable water distribution system in its Dixon District. These criteria include the desired fire flow and flow duration, definition of "emergency events", pumping capacity, storage capacity components (including operational, fire flow and emergency), minimum and maximum system pressures, and maximum pipeline velocity and head loss.

Chapter Contents:

- Fire Flow Requirements
- Water Supply Capacity During High Demand Periods
- Pumping Facility Capacity
- Critical Supply Facilities
- Water Storage Capacity
- Water Transmission and Distribution Pipeline Sizing

Total Storage Capacity

The Dixon District's water storage capacity should be the sum of the following components:

- Operational: Volume of water necessary to meet diurnal peaks observed throughout the day, usually designed to be equivalent to at least 25 percent of the maximum day demand.
- Fire Flow: Volume of water necessary to provide the maximum fire flow in the service area multiplied by the duration the flow rate that must be maintained. (For the Dixon District, this fire flow storage criteria is considered in the future system evaluation only; the cost to upgrade fire flow storage in the existing system to accommodate fire flow demands from a few large buildings would create an unreasonable burden on the District's existing customers.)
- Emergency: Volume of water necessary to provide an average day demand
- Emergency Storage Credit: Equal to the groundwater supply of potable water that can be reliably accessed (wells are equipped with auxiliary power) up to the required emergency storage capacity
- Operational Storage Credit: Equal to 38 percent of the difference between the firm groundwater pumping capacity and a maximum day demand up to the required operational storage capacity

CHAPTER 5. PLANNING AND DESIGN CRITERIA

The purpose of this chapter is to define the planning and design criteria for analyzing the performance of Cal Water's potable water distribution system in its Dixon District. These criteria include the desired fire flow and flow duration, definition of "emergency events", pumping capacity, storage capacity components (including operational, fire flow and emergency), minimum and maximum system pressures, and maximum pipeline velocity and head loss. The planning and design criteria used for this WSFMP are summarized in the following sections:

- Fire Flow Requirements
- Water Supply Capacity During High Demand Periods
- Pumping Facility Capacity
- Critical Supply Facilities
- Water Storage Capacity
- Water Transmission and Distribution Pipeline Sizing

These criteria, summarized in Table 5-1, reflect typical water system industry standards, including the California Safe Drinking Water Act and related laws, California Public Utilities Commission's General Order 103, American Water Works Association and the California Fire Code standards.

FIRE FLOW REQUIREMENTS

As purveyor of water for the Dixon District, Cal Water is responsible for providing a realistic water supply to meet fire flow requirements in the City. The City's Fire Department (Fire Department) establishes minimum water flows and pressures required for fire fighting purposes. The Fire Department uses the 2007 California Fire Code (CFC) Table B105.1 *Minimum Required Fire-Flow and Flow Duration for Buildings* to assist them in establishing minimum fire flows and durations for individual structures.

Fire protection is one of the factors considered when planning improvements to the distribution system as part of the District's annual CIP. In the Dixon District, fire flow pumping and storage requirements are driven by fire flow demands of several large buildings. Upsizing existing facilities for the purpose of increasing fire flow capacity for specific buildings would be cost prohibitive to the existing customers of the Dixon District. Following discussions with Cal Water staff, CIP recommendations are based on the philosophy that additional pumping capacity and pipeline replacements[1] needed to meet fire flow criteria based on Table B105.1 of the 2007 CFC will be installed as part of the future system, and will be triggered by upgrades to existing facilities or by new development.

[1] In addition, Cal Water is not required to replace existing pipelines to provide additional fire flow capacity to meet fire flow requirements as stated in the Public Utilities Commission's *General Order 103* (page 27).

Table 5-1. California Water Service Company's Dixon District Planning and Design Criteria

Component	Criteria	Remarks / Issues
PERFORMANCE CRITERIA FOR PLANNING & DESIGN		
Fire Flow Requirements (flow [gpm] @ duration [hours])		
Single-Family Residential	1,500 gpm @ 2 hrs	Fire flows based on new development requirements. As discussed with Cal Water staff, improvements to address fire flow requirements will be included in the future system evaluation.
Multi-Family Residential	2,500 gpm @ 2 hrs	
Commercial	4,000 gpm @ 4 hrs (with approved automatic sprinkler system)	
Government (schools, hospitals, etc.)	4,000 gpm @ 4 hrs (with approved automatic sprinkler system)	
Industrial	4,000 gpm @ 4 hrs (with approved automatic sprinkler system)	
Water Supply Capacity		
Maximum Day Demand Plus Fire Flow	Provide capacity equal to maximum day demand plus fire flow	As discussed with Cal Water staff, improvements to address fire flow requirements will be included in the future system evaluation.
Peak Hour Demand	Provide capacity equal to peak hour demand	
Pumping Facility Capacity		
Booster Pump Capacity	Equal to the maximum day demand for the service area the facility is serving	Design for maximum day plus fire flow or peak hour (whichever is larger), only if no gravity storage is available within the service area.
Backup Power	Equal to the firm capacity of the pumping facility	On-site generator for critical stations.[a] Plug in portable generator for less critical stations.
Water Storage and System Peaking Capacity		
Operational	25 percent of Maximum day demand (MDD)	
Fire	Varies (see requirements listed in remarks column)	Varies depending on required fire flow duration. See Table 5-2. 1,500 gpm @ 3 hrs = 0.27 MG 2,500 gpm @ 3 hrs = 0.45 MG 4,000 gpm @ 3 hrs = 0.96 MG[c]
Emergency	Average day demand	Based on DPH recommendations.
Emergency Storage Credit (ESC)	Equal to pumping capacity of wells with backup power	Minimum credit is equal to zero, and the maximum credit is equal to the recommended emergency storage capacity.
Operational Storage Credit (OSC)	38 percent of (firm groundwater pumping capacity - MDD)	Minimum credit is equal to zero, and the maximum credit is equal to the recommended operational storage capacity.
Total Water Storage Capacity	Operational + Fire + Emergency - ESC - OSC	As discussed with Cal Water staff, improvements to address fire flow requirements will be included in the future system evaluation.
Water Transmission Line Sizing[b]		
Diameter	18-inches in diameter or larger	Criteria based on requirements for new development, existing transmission mains will be evaluated on case-by-case basis. Evaluation will include age, material type, velocity, head loss, and pressure.
Average Day Demand Condition		
Minimum Pressure [psi]	50 psi	
Maximum Pressure [psi]	125 psi	
Maximum Velocity [ft/sec]	3 fps	
Maximum Day Demand Condition		
Minimum Pressure [psi]	40 psi	
Maximum Head loss [ft/1000 ft]	3 ft/kft	
Maximum Velocity [ft/sec]	5 fps	
Peak Hour Demand Condition		
Minimum Pressure [psi]	40 psi	
Maximum Head loss [ft/1000 ft]	3 ft/kft	
Maximum Velocity [ft/sec]	5 fps	
Hazen Williams "C" Factor	130	For consistency in hydraulic modeling.
Pipeline Material	Ductile Iron, Concrete Cylinder or Steel	
Water Distribution Line Sizing		
Diameter	Less than 18-inches in diameter	Must verify pipeline size with maximum day plus fire flow analysis.
Average Day Demand Condition		Criteria based on requirements for new development, existing distribution mains will be evaluated on case-by-case basis. Evaluation will include age, material type, velocity, head loss, and pressure.
Minimum Pressure [psi]	50 psi	
Maximum Pressure [psi]	125 psi	
Maximum Velocity [ft/sec]	3 - 5 fps	
Maximum Day w/ Fire Flow Demand Condition		
Minimum Pressure [psi] (at fire node)	20 psi	
Maximum Head loss [ft/1000 ft]	10 ft/kft	
Maximum Velocity [ft/sec]	10 fps	
Peak Hour Demand Condition		
Minimum Pressure [psi]	40 psi	
Maximum Head loss [ft/1000 ft]	10 ft/kft	
Maximum Velocity [ft/sec]	7 fps	
Minimum Pipeline Sizes		
Low Density Residential	12" [sq mi grid], 8" [1/4 mi grid], 6" [other]	
Commercial	8" + 12" [sq mi grid]	
Industrial	12"	
Distribution to cul-de-sac / dead end street	8"	
Distribution to fire hydrants	8"	
Hazen Williams "C" Factor	120 (Ductile, Iron, Steel); 130 (PVC)	For consistency in hydraulic modeling.
Pipeline Material	PVC, Ductile Iron or Steel	
OTHER CRITERIA		
Maximum Number of residential lots that can be served by a non-looped water pipeline	25 lots	If a non-looped water line goes out-of-service, all associated residences lose water service.

[a] A pumping facility is defined as critical if it provides service to pressure zones and/or service areas without sufficient emergency storage and that meet the following criterion:
- The largest facility that provides water to a particular pressure zone and/or service area; and
- A facility that provides water from key (depends on capacity, quality and location) groundwater supply wells into a pressure zone and/or service area.

[b] See comments in Chapter 5.

[c] Storage requirement is based on CFC recommended duration of 4 hours

The recommended fire flow requirements in the future water system (based on land use types within the City) are presented in Table 5-2. The maximum fire flow requirement recommended for the future water system in the Dixon District is 4,000 gpm for the duration of four hours (see sprinklered industrial and governmental land uses). This criterion assumes that buildings are either fully sprinklered or non-sprinklered (Type V-B) up to 23,300 square feet. Non-sprinklered (Type V-B) buildings greater than 23,300 square feet may require a fire flow demand greater than 4,000 gpm. Building owners with fire flow demands above 4,000 gpm will require further discussions with Cal Water staff and the City's Fire Chief to determine how the fire flow deficiency will be addressed.

The recommended fire flow criteria presented in Table 5-2 will be used for the evaluation of Cal Water's future potable water distribution system in the Dixon District. For planning purposes, fire flows are assumed to be met concurrently with a maximum day demand condition, while maintaining a minimum residual system pressure of 20 pounds per square inch (psi) throughout the Dixon District. Additionally, as discussed in subsequent sections of this chapter, fire flows presented in Table 5-2, and their expected duration, are also used to establish storage capacity requirements for the future water system.

WATER SUPPLY CAPACITY DURING HIGH DEMAND PERIODS

The following criteria should be used to assess the adequacy of the Dixon District's water supply during high demand periods.

Maximum Day Demand plus Fire Flow

In accordance with typical industry standards, the Dixon District's water supply system should have the capability to meet a system demand condition equal to the occurrence of a maximum day demand concurrent with a fire flow event. For planning purposes, it is assumed that the maximum day plus fire flow demand scenario will consist of a single fire flow event, and that specific fire flow evaluations will be conducted assuming the largest booster pump[2] at each station is offline (i.e., firm booster pumping capacity). In addition, well pumps are assumed to pump at a firm capacity (i.e., firm groundwater pumping capacity) during a specific fire flow evaluation.

Based on data provided by Cal Water, the current active groundwater well pumping capacity within the Dixon District's service area is approximately 7.5 mgd (see Chapter 2). To account for pumps that are out of service at any given time due to mechanical breakdowns, maintenance, water quality, or other operational issues, *firm groundwater pumping capacity* is defined as the total active well capacity minus the two most critical wells or 90 percent of the total active well capacity, whichever is less. The most critical well (07-01) was determined based on well pumping records, frequency of use, and input from Cal Water staff. The second most critical well (06-01) was determined using this criteria followed by an evaluation of the overall effect on

[2] Currently, there are no booster pumps within the Dixon District water system; however, for future planning purposes, the planning and design criteria will include booster pump(s) that may be installed in the future.

Table 5-2. Recommended Fire Flow Requirements[a,b,c]

Designation	Non-Sprinklered			Sprinklered[d,e]		
	Fire Flow, gpm	Duration, hours	Recommended Storage, MG	Fire Flow, gpm	Duration, hours	Recommended Storage, MG
Single-Family Residential[f]	1,500	3	0.27	--	--	--
Multi-Family Residential	2,500	3	0.45	--	--	--
Commercial[g]	6,000	3	1.1	4,000	3	1.0
Industrial[g]	6,000	3	1.1	4,000	3	1.0
Government[g]	6,000	3	1.1	4,000	3	1.0

(a) Construction type and fire area are not generally known during the development of a master plan; consequently, fire flow requirements set forth in this table are based on previous estimates for these land use types and similar communities.

(b) Unique projects or projects with alternate materials may require higher fire flows and will be reviewed by the City's Fire Chief on a case-by-case basis (e.g., proposed commercial/industrial areas and schools).

(c) Any new developments proposed to be served by the Dixon District were assumed to be annexed by the City and subject to the City's fire flow requirements as shown on this table. Any new developments served by the Dixon District were also assumed to be sprinklered.

(d) The City Fire Marshal normally allows up to a 30 percent reduction in fire flows if a building is sprinklered. The Fire Code also requires that no fire flow be less than 1,000 gpm for single family residential or 1,500 gpm for all other building types. For a more conservative fire flow estimate, Single Family and Multiple Family buildings were considered non-sprinklered for this Water Supply and Facilities Master Plan.

(e) Specific fire flows were determined from Table B105.1 of the 2007 CFC, and depend on construction type and fire area. These fire flow requirements are based on buildings being fully sprinklered.

(f) Per City Standards – the minimum size for a new well is 1,500 gpm at a minimum pressure of 20 psi for a 3 hour period.

(g) Recommended storage is based on CFC recommended duration of 4 hours.

water system pressures with the well removed from service. Consequently, the Dixon District can assume a *firm groundwater pumping capacity* of up to approximately 5.1 mgd (assuming Wells 07-01 and 06-01 are out of service) from the active groundwater wells.

These conservative assumptions ensure the reliability of the system to provide sufficient supply during emergency fire flow conditions. For future system improvement analyses, pump stations with only one booster pump will not be considered to be available during a fire flow analysis. In addition, the selection of an existing well for the installation of a backup power supply will be based on the capacity, quality, and location of the well.

Peak Hour Demand

If feasible, peak hour demand should be met from a combination of supply sources, such as groundwater wells and water storage reservoirs.

PUMPING FACILITY CAPACITY

Sufficient water system pumping capacity should be provided to meet the greater of these two demand scenarios:

(1) A maximum day demand concurrent with a maximum fire flow event with the largest pump at each booster pump station in standby mode, while other well pumps are assumed to operate at their firm groundwater pumping capacity.

(2) A peak hour demand with the largest pump at each booster pump station in standby mode, while other well pumps are assumed to operate at their firm groundwater pumping capacity.

Consequently, the maximum demand requirement sets the pumping capacity requirement. Per Cal Water's request, and as discussed earlier in this Chapter, the fire flow capacity currently available in the existing water system is not intended to increase for the purposes of this WSFMP. Therefore, the existing water system's pumping capacity will only be evaluated during a peak hour demand scenario.

CRITICAL SUPPLY FACILITIES

Critical pumping facilities are defined as those facilities that provide service to service area(s) without sufficient emergency storage (see emergency storage section) and that meet the following criteria:

- The largest pumping facility that provides water, and
- A pumping facility that provides water from key (depends on capacity, quality and location) groundwater supply wells.

All critical pumping facilities should be equipped with an on-site, backup power generator to provide pumping capacity during a power outage. At less critical facilities, a plug-in adapter will be used to allow interconnection to a portable generator, which will be brought to the site by Dixon District staff during a prolonged power outage. In addition, portable generator booster connections will be configured at all tank/booster pump locations.

If unavailable by gravity storage, the fire flow should be supplied with a National Fire Protection Association (NFPA) rated fire pump. If an NFPA rated fire pump is not used, then a pump(s) and motor(s) combination with a backup power source of sufficient capacity to meet the required maximum fire flow and minimum residual pressure requirements, as determined by the City's Fire Chief, will be required.

WATER STORAGE CAPACITY

The total treated water storage capacity requirements are evaluated based on the following three components:

- Operational Storage,
- Fire Storage, and
- Emergency Storage.

A discussion of these three components, along with a discussion of the groundwater supply credit, follows.

Operational Storage

Over any 24-hour period, water demands will vary. Typically, higher water demands will occur during the early morning hours when people are irrigating landscape and getting ready to go to work or school. Water demands will then decline to some nominal baseline level (depending on the proximity to water use patterns of adjacent commercial/industrial areas), and will then begin to increase again depending on outside water needs (and corresponding temperature), until it reaches a higher water demand in the early evening hours as people return home from work or school. Throughout the year, the peaks of this cycle will vary according to customer needs; thereby, creating maximum day and peak hour demands.

Typically, water treatment plants, supply turnouts, and/or wells are operated at a constant rate over a 24-hour period (baseline), augmented by additional flow from storage tanks, supply turnouts and/or wells during peak demand periods. Storage tanks are normally refilled when demands drop below the baseline water production flow rate. The storage volume used to meet these peak demand periods is called operational storage.

The operational storage requirements will be calculated based on the diurnal demand in a pressure zone or service area. If sufficient data is not available to develop a diurnal demand, then the recommended volume of water to be held in reserve for operational storage should be at least equal to 25 percent of the total volume of water used on a maximum day.

Fire Storage

Flow requirements for fighting fires are identified in the CFC. These requirements are based on flow (in gpm) for the building use type (i.e., commercial. residential, school, industrial etc.), size of building (in square feet), and type of construction (wood frame, metal, masonry, installation of sprinklers, etc.). After a fire flow requirement is established, it is multiplied by the required fire fighting duration to produce an estimate of the total volume of fire flow storage required.

As discussed previously, in the Dixon District, fire flow pumping and storage requirements are driven by fire flow demands of several large buildings. Upsizing existing facilities for the purpose of increasing fire flow capacity for specific buildings would be cost prohibitive to the existing customers of the Dixon District. Therefore, following discussions with Cal Water staff, this WSFMP reflects the philosophy that fire flow storage needed to meet fire flow criteria based on Table B105.1 of the 2007 CFC will be installed as part of the future system, and will be triggered by upgrades to existing facilities or by new development.

In the future water system, the required fire flow storage will be calculated using the highest recommended fire flow requirement (i.e., 4,000 gpm for the duration of four hours). Consequently, the resulting volume required for fire flow storage in the future water system is 0.96 MG as shown previously in Table 5-2.

Emergency Storage

A reserve of stored water is also required to meet demands during an emergency. An emergency is defined as an unforeseen or unplanned event that may degrade the quality or quantity of potable water supplies available to serve customers. There are three types of emergency events that a water utility typically prepares for:

- Minor emergency. A fairly routine, normal, or localized event that affects few customers, such as a pipeline break, malfunctioning valve, hydrant break, or a brief power loss. Utilities plan for minor emergencies and typically have staff and materials available to correct them.
- Major emergency. A disaster that affects an entire, and/or large, portion of a water system, lowers the quality and quantity of the water, or places the health and safety of a community at risk. Examples include water treatment plant failures, raw water contamination, or major power grid outages. Water utilities infrequently experience major emergencies.
- Natural disaster. A disaster caused by natural forces or events that create water utility emergencies. Examples include earthquakes, forest or brush fires, hurricanes, tornados or high winds, floods, and other severe weather conditions such as freezing or drought.

Determination of the required volume of emergency storage is a policy decision based on the assessment of the risk of failures and the desired degree of system reliability. The amount of required emergency storage is a function of several factors, including the diversity of the supply sources, redundancy and reliability of the production facilities, and the anticipated length of the

emergency outage. In developing an emergency storage requirement for the Dixon District, typical industry standards were used and the recommended criteria and assumptions are described in the following paragraphs.

The treated water emergency supply requirements, as published by the State Department of Public Health (DPH) in Title 22 Chapter 16, call for a minimum emergency supply in each pressure zone equivalent to the average day demand. AWWA states, however, that no formula exists for determining the amount of emergency storage required, and that the decision will be made by the utility based on a judgment about the perceived vulnerability of the system.

For this WSFMP, it has been assumed that the emergency storage requirement will be based on minor emergencies and *specific* major emergency criteria. It is recommended that the Dixon District use DPH's suggested guideline of having a minimum quantity of emergency storage volume equivalent to the Dixon District's average day demand.

Credit for Existing Groundwater Supply

Because the Dixon District water supply includes wells, the groundwater basin can account for a portion of the recommended water storage and system peaking capacity. Sufficient water transmission facilities, however, must be available to distribute this water to demand areas.

Groundwater credit can be defined using the following two categories:

- Emergency Storage Credit – Equal to the groundwater supply of potable water that can be reliably accessed in the event of a power outage or any other emergency that would interrupt system-wide operations. In the case of the Dixon District, these facilities would include wells that are equipped with auxiliary power. The minimum credit is equal to zero, and the maximum credit is equal to the required emergency storage capacity or an ADD.
- Operational Storage Credit – Equal to a percentage of the groundwater supply that can be accessed in excess of that which is required to meet a MDD. The supply used for this calculation assumes that either the two most critical active wells or 10 percent of the total active well capacity, whichever is greater, are out of service for maintenance or other issues (firm groundwater supply). For the Dixon District, the Operational Storage Credit is equal to 38 percent of the difference between the firm groundwater pumping capacity and a maximum day demand. The estimated Operational Storage Credit is based on the Dixon District's peaking factors (MDD = 1.9 x ADD and PHD = 1.66 x MDD) and can vary between Cal Water Districts. The minimum credit is equal to zero, and the maximum credit is equal to the required operational storage capacity or 25 percent of a maximum day demand.

Total Storage Capacity

The Dixon District's water storage capacity should be the sum of the following components:

- Operational: Volume of water necessary to meet diurnal peaks observed throughout the day, usually designed to be equivalent to at least 25 percent of the maximum day demand.
- Fire Flow: Volume of water necessary to provide the maximum fire flow in the service area multiplied by the duration of the flow rate that must be maintained. However, following discussions with Cal Water staff, this WSFMP reflects the philosophy that fire flow storage currently available in the existing water system should not be increased to accommodate fire flow demands from a few large buildings; the resulting improvements would create an unreasonable burden on the District's customers..
- Emergency: Volume of water necessary to provide an average day demand.
- Emergency Storage Credit: Equal to the groundwater supply of potable water that can be reliably accessed (wells are equipped with auxiliary power) up to the required emergency storage capacity.
- Operational Storage Credit: Equal to 38 percent of the difference between the firm groundwater pumping capacity and a maximum day demand up to the required operational storage capacity.

The amount of total system storage and system peaking capacity required to meet these criteria will change over time as the Dixon District continues to grow and demands increase.

WATER TRANSMISSION AND DISTRIBUTION PIPELINE SIZING

The following criteria are used as guidelines for new transmission and distribution pipeline sizing. The Dixon District's existing system, however, should be evaluated on a case–by-case basis. For example, if an existing pipeline experiences head loss in excess of the criteria described below during a maximum day plus fire flow event, this does not necessarily indicate a problem as long as the minimum pressure criterion is satisfied. Also, other conditions (e.g., age, material type, and location in the system) should be considered.

Although these criteria and guidelines have been established, and used to size new pipelines, the Dixon District's existing system should be evaluated using pressure as the primary criterion. Secondary criteria, such as velocity, head loss, age, and material type, are used as indicators for areas of the water system that also may need improvements.

Water Transmission System

Transmission pipelines are generally 18[3] inches in diameter or larger, and should be designed based on the criteria described below for average day, maximum day and peak hour demand scenarios. The criteria reflect industry standards and WYA's experience working in other Cal Water Districts.

Average Day Demand

- Pressures should be maintained between a maximum of 125 psi and a minimum of 50 psi.
- Maximum velocity within transmission pipelines should be 3 feet per second (fps).

Maximum Day Demand

- The minimum allowable service pressure should be 40 psi.
- The maximum velocity within the transmission system pipelines should be 5 fps.
- Head losses within the transmission system pipelines should be limited to 3 ft/kft of pipeline.

Peak Hour Demand

- The minimum allowable service pressure should be 40 psi.
- The maximum velocity within the transmission system pipelines should be 5 fps.
- Head losses within the transmission system pipelines should be limited to 3 ft/kft of pipeline.

Water Distribution System

Distribution pipelines are generally less than 18 inches in diameter, and should be sized based on the criteria described below for average day, maximum day plus fire flow, and peak hour demand scenarios. The criteria reflect industry standards and WYA's experience working in other Cal Water Districts.

Average Day Demand

- Pressures should be maintained between a maximum of 125 psi and a minimum of 50 psi.
- The maximum velocity within the distribution system pipelines should be 3 to 5 fps.

[3] Currently, there are no pipelines greater than 14-inches in diameter within the Dixon District water system; however, for future planning purposes, the planning and design criteria will include transmission main(s) that may be installed in the future.

Maximum Day Demand plus Fire Flow

- The minimum allowable residual pressure should be 20 psi at the flowing fire hydrant.
- The maximum velocity within the distribution system pipelines should be 10 fps.
- Head losses within the distribution system pipelines should be limited to 10 ft/kft of pipeline.

Peak Hour Demand

- The minimum allowable service pressure should be 40 psi.
- The maximum velocity within the distribution system pipelines should be 7 fps.
- Head losses within the distribution system pipelines should be limited to 10 ft/kft of pipeline.

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CHAPTER 6: HYDRAULIC MODEL DEVELOPMENT

Chapter Highlights:

Chapter Contents:

- Development of the Hydraulic Model
- Diurnal Curve Development
- Hydraulic Model Calibration

This chapter describes the development, calibration, and verification of Cal Water's Dixon District water system hydraulic model. To develop Cal Water's Dixon District hydraulic network model, the following steps were completed:

- Used Cal Water's existing water distribution system maps (exported from Cal Water's geographical information system (GIS)) to create the hydraulic model,
- Verified that the hydraulic model system configuration (pipeline sizes, alignments, connections, and other facility sizes and locations) was representative of the current Dixon District water system,
- Allocated existing water demands by using Cal Water's spatially located account information to properly distribute demands within the hydraulic model, and
- Calibrated the Dixon District water system hydraulic model to simulate pressures and flows observed in the field.

To accomplish these tasks, staff worked closely with Cal Water's Engineering and Operations staff to obtain and review:

- Available information regarding existing transmission and distribution mains, storage tanks, groundwater wells, pump stations and other water facilities,
- As-built drawings and maps detailing sections of the system to confirm pipeline sizes, material type, age, locations and alignments, and
- Available metered and residential flat account data.

The water distribution system model was then further calibrated and verified using tank level, flow, and pressure data observed in the field during July 2008.

CHAPTER 6. HYDRAULIC MODEL DEVELOPMENT

This chapter describes the development, calibration, and verification of Cal Water's Dixon District water system hydraulic model.

The development of the hydraulic model for the Dixon District was a collaboration between WYA and IDModeling, Inc. (IDM). As part of this collaboration, IDM developed a technical memorandum for WYA and Cal Water (Appendix K) to discuss the processes involved and assumptions made during the project. IDM's technical memorandum included discussions on model construction from GIS, model facility creation, demand development and loading, steady state calibration, diurnal curve creation, and 72-hour extended period calibration. The following sections provide a summary of the IDM *Hydraulic Model Development and Calibration* technical memorandum.

To develop Cal Water's Dixon District hydraulic network model, WYA and IDM (the Team) completed the following steps:

- Used Cal Water's existing water distribution system maps (exported from Cal Water's GIS) to create the hydraulic model,
- Verified that the hydraulic model system configuration (pipeline sizes, alignments, connections, and other facility sizes and locations) was representative of the current Dixon District water system,
- Allocated existing water demands by using Cal Water's spatially located account information to properly distribute demands within the hydraulic model, and
- Calibrated the Dixon District water system hydraulic model to simulate pressures and flows observed in the field.

To accomplish these tasks, the Team worked closely with Cal Water's Engineering and Operations staff to obtain and review:

- Available information regarding existing transmission and distribution mains, storage tanks, groundwater wells, pump stations and other water facilities,
- As-built drawings and maps detailing sections of the system to confirm pipeline sizes, material type, age, locations and alignments, and
- Available metered data.

The water distribution system model was then further calibrated and verified using tank level, flow, and pressure data observed in the field during August 2008. The hydraulic model development, calibration, and verification are described below.

DEVELOPMENT OF THE HYDRAULIC MODEL

The Team developed a hydraulic model of Cal Water's Dixon District potable water system using a series of steps that included the following:

- Description of the Model and Element Definitions
- Pipelines, Nodes, and Junctions Imported into InfoWater
- Roughness Factors Assigned in InfoWater
- Elevations Allocated in H_2OMAP
- Accounts Spatially Located in GIS
- Water Demands Allocated in H_2OMAP
- Station Elements Incorporated into InfoWater
- Naming Scheme Applied in InfoWater

Each of these steps is discussed in more detail below.

Description of the Model and Element Definitions

MWH Soft's InfoWater was the hydraulic modeling software used to represent the Dixon District water system. This computer simulation model transforms information about the physical system into a mathematical model that solves for various flow conditions, and for each set of specified demands. The computer model then generates information on pressure, flow, velocity and head loss that is used to analyze system performance and identify system deficiencies. The model can also be used to verify the adequacy of recommended or proposed system improvements.

The hydraulic model is represented as a skeletonized network of nodes (e.g., location of a tank, location where pressure is monitored), and node-connecting elements (e.g., pipes). However, because nodes are representative of various actual facilities (e.g., tanks, pump stations, or wells) and physical locations, a definition of each element was created during the development of the hydraulic model. The description of nodes and node-connecting elements, as used in the development of the Dixon District model, is described as follows:

<u>Node:</u> Nodes, as defined for the Dixon District model, represent transitions in pipeline characteristics (e.g., diameter) or points in the system where pressure or water quality is monitored. Nodes also represent locations in the system where metered water demands do not exist, such as at stations (i.e., wells, pump station, tanks). Elevation and physical facility location were the data requirements for nodes.

<u>Junction:</u> Junctions, as defined for the Dixon District model, represent locations in the system where water is subtracted from the system, and were used in the model to mark the locations in the system where a water demand exists. Junctions can also include transitions in pipeline characteristics (e.g., diameter). The demand at each junction, in addition to elevation and location, were the data requirements for junctions.

Pipe: Pipes (i.e., links), as defined for the Dixon District model, represent facilities that convey water from one point in the system to another, and were used to represent pipelines or check valves in the model. Diameter, from/to node or junction, length and pipeline roughness factor were the input data required.

Reservoir: Reservoirs, as defined for the Dixon District model, represent external sources of water for the model (e.g., groundwater basin), and remain at a constant level irrespective of the flow unless they are specified as variable-head reservoirs. Reservoirs were used to represent the source (groundwater basin) for each of the groundwater wells in the Dixon District model. Location and water surface elevation were the input data required.

Tank: Tanks, as defined for the Dixon District model, are distinguished from reservoirs by having known finite volumes and water surface elevations that change with time as water flows into or out of the facility. This element was used to represent the District's single storage tank. Diameter, bottom elevation, overflow elevation, and location were the input data required.

Pump: Pumps, as defined for the Dixon District model, represent locations in the model where the hydraulic grade line is raised to overcome elevation differences and friction losses, and were used to represent pump stations. Elevation, diameter, number of pumps, pump test results, pump curves, sequencing, and location were the input data required.

Pipelines, Nodes, and Junctions Imported into InfoWater

Cal Water staff provided the Team with a GIS geodatabase file containing the geospatial location of existing pipelines, fittings, system valves, and control valves for the Dixon District water system. The Team used the GIS Exchange Gateway available within InfoWater to import the pipelines and junctions into the model.

Roughness Factors Assigned in InfoWater

The original geodatabase layer for existing water pipelines did not include roughness factors. However, the geodatabase did include material type, which is an attribute that can be used as a surrogate for roughness factor. Consequently, The Team assigned a preliminary roughness factor (i.e., C-factor), based on experience and professional judgment, to each pipeline by using its material type as a surrogate in the hydraulic model. Table 6-1 presents the preliminary C-factors assigned to each of the different material types within the Dixon District water system. These C-factors were then validated during calibration of the hydraulic model (see subsequent sections below).

Table 6-1. Preliminary C-Factors Assigned in the Model

Pipeline Material Acronym[(a)]	Pipeline Material Type	C-factor Value
AC	Asbestos Cement	130
CI	Cast Iron	110
CL&C	Concrete Pressure Pipe	130
COP	Copper	140
DI	Ductile Iron	120
GALV	Galvanized Pipe	125
PVC	Polyvinyl Chloride	140
SS	Stainless Steel	130
STD STL	Standard Steel	120
STL	Steel	110
TRANS	Transite (AC)	130
UCI	Unlined Cast Iron	110
WI	Steel Lined	120

[(a)] Acronym obtained from geodatabase layer, Pressurized Main, for the Dixon District.

Elevations Allocated in H_2OMAP

Digital topology information for the Dixon District was extracted as a GIS shapefile using the software program TopoDepot®. TopoDepot® provides elevation contours generated from the USGS National Elevation Database Digital Elevation Model (NED DEM). NED DEM consists of a grid of elevation values posted approximately every 30 meters. TopoDepot® runs this grid of elevations through a Surface Contouring Program to generate the elevation contours; the resulting shapefile was imported into the hydraulic model and service elevations assigned to each node using H_2OMAP's[1] Elevation Interpolation feature. Certain service elevations (at the existing stations) were later confirmed during calibration.

Accounts Spatially Located in GIS

This section describes the methodology used to spatially locate water consumption for Metered Accounts (Residential Metered, Multiple Residential Metered, Business Metered, Public Authority Metered, Other Sales & Services).

Cal Water provided WYA with billing spreadsheets containing metered accounts and their corresponding metered consumption data by address (including zip code) and revenue class for each month of the year from 2003 through 2007. The most recent data set from 2007 was used to

[1] MWH Soft's H_2OMAP program was used to allocate elevations. Consequently, this information was then imported into the Dixon District model in InfoWater.

develop the existing water demands for the hydraulic model and was the baseline for projecting future demands (see Chapter 3).

The consumption data from metered accounts was spatially located using two separate methods: 1) linking the consumption data by address to a separate GIS parcel file[2], and 2) geocoding any remaining consumption data using a GIS street file. Figure 6-1 illustrates the methodology used to link the addresses associated with the consumption data to the addresses in the GIS parcel file and street file.

WYA was able to spatially locate 90 percent of the metered accounts (2,858 out of 3,184) present in the 2007 billing spreadsheet provided by Cal Water. This amounts to 99 percent of the total 2007 metered consumption within the Dixon District. The remaining consumption in the Dixon District was either from irrigation meters located in areas that did not have an address, construction meters without proper addresses, or meters with addresses that did not match up with either the GIS parcel file or the GIS street file. Table 6-2 presents the percentage of total metered accounts and metered consumption spatially located for the Dixon District.

Table 6-2. Spatially Located Results for the Dixon District

Category	Number of Metered Accounts	Total "Metered" Demand, afa	Average Day Demand, gpm
Actual 2007[(a)]	3,184	1,633	1,012
Spatially Located using Parcel file[(b)]	2,523	1,346	834
Spatially Located using Street file	335	266	165
Spatially Located Total[(c)]	2,858	1,612	999
Percent of Actual 2007	90%	99%	99%

(a) Data provided by Cal Water in March and May 2008 and does not include unaccounted-for water.
(b) Provided by Solano County.
(c) Based on WYA's GIS.

[2] GIS parcel file was provided by Solano County.

Figure 6-1. Illustration of Methodology for Spatially Locating Metered Accounts

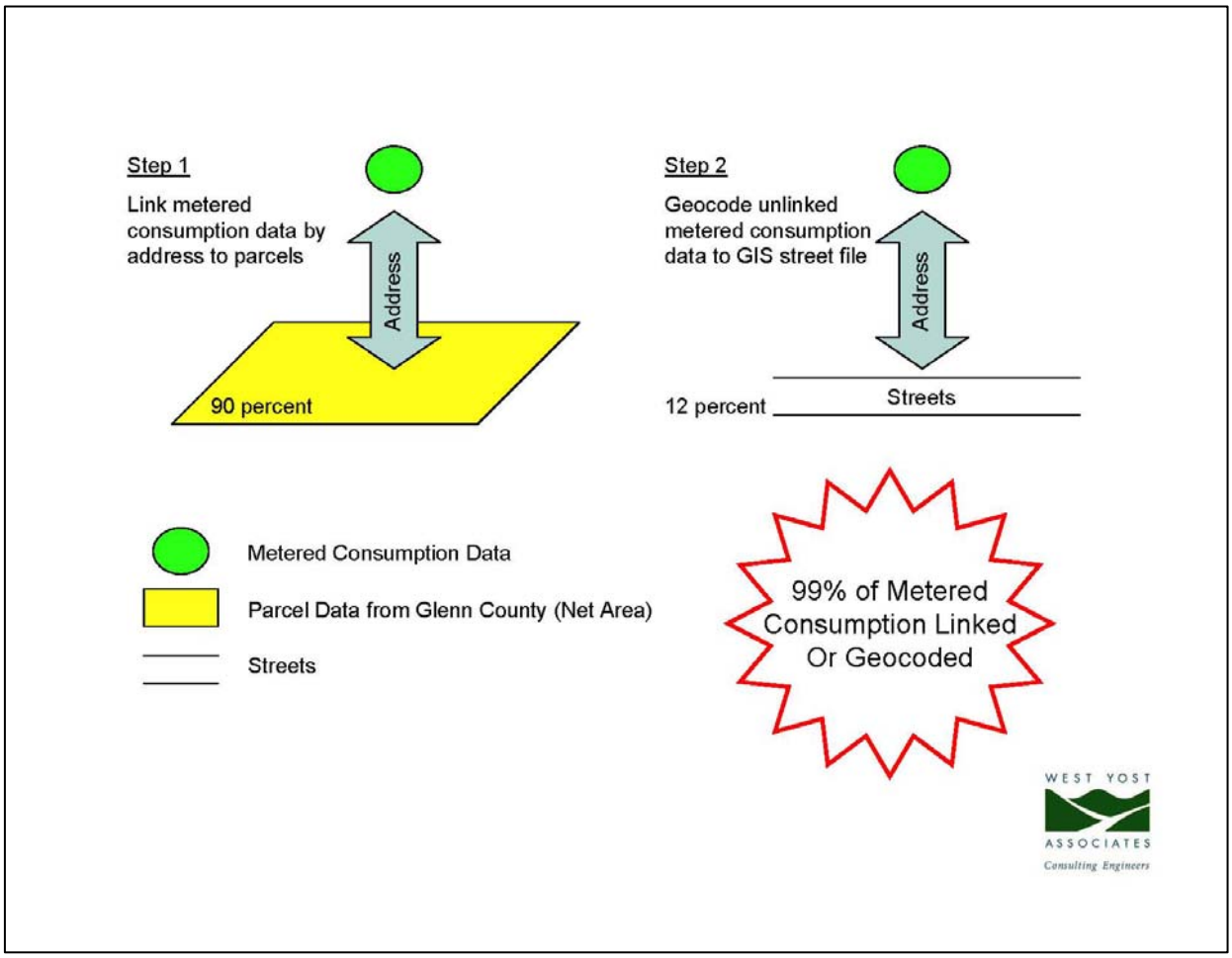


Figure 6-2 compares the spatially located water demand data with existing pipelines imported into InfoWater for the Dixon District. As shown on Figure 6-2, most areas with spatially located demands also had an existing pipeline. This correlation indicates that the geodatabase layer used as the basis for the hydraulic model includes most, if not all of the existing pipelines.

Water Demands Allocated in H_2OMAP

For the Dixon District water system, water demands were allocated into the hydraulic model using the spatially located demand data developed in the previous section and the Demand Allocation/Pro module of H_2OMAP[3] (Allocation Module). The Allocation Module automatically assigned the spatially located demand point to the closest pipeline to its position in the system. The Team reviewed the model after running the Allocation Module to confirm that the demands were allocated to the correct pipeline.

[3] MWH Soft's H_2OMAP program was used to allocate water demands. Consequently, this information was then imported into the Dixon District model in InfoWater.

Table 6-3 below presents the demand column assigned to each revenue class within the hydraulic model.

Table 6-3. Revenue Class Assignment

Revenue Class Description[a,b]	Demand Column in Model[c]
Residential Flat, All Metered (Residential Multiple, Business, Public Authority), Other Sales & Services	1

[a] Revenue class description provided by Cal Water in March 2008.
[b] No demands for the "Other Sales & Services" revenue class or construction meter were allocated into the model because the construction meter does not have a specific location. The demands will be included when the model is scaled for production values.
[c] Column number corresponds to Demand # Column in Junction database in the InfoWater model.

Station Elements Incorporated into InfoWater

After the nodes and pipelines were imported into the hydraulic model, major system facilities (e.g., groundwater wells, pump stations, and storage tanks) were then digitized into the model. Each of these facilities was entered into the model by hand based on actual construction or "as-built" drawings provided by Cal Water staff.

Naming Scheme Applied in InfoWater

After the major facilities were digitized into the model, each model element was assigned a label, which identifies the type of model element, the element's purpose, and the element's location. Assigning each model element a specific label allows the modeler to easily locate specific elements or more readily identify potential problems during the calibration and verification process.

Based on WYA's experience and discussion with Cal Water staff, the Dixon District model was populated using the naming scheme presented in Table 6-4. As shown in Table 6-4, this naming scheme utilized Cal Water's existing labeling scheme for the Dixon District water system.

DIURNAL CURVE DEVELOPMENT

To add the time variable to the Dixon District hydraulic model and create an extended period simulation (EPS) model to compare to the collected telemetry chart/SCADA data, the Team developed a representative 24-hour diurnal pattern for the Dixon District service area.

The Team collected station data, in circular chart format, on tank level, flows, and pump discharge pressures for Cal Water's tank and wells in the Dixon District. This information was collected during the period from August 20, 2008 to August 29, 2008 to develop the diurnal curve. After an initial review of the data, the Team identified August 20th – 22nd, 2008 as the date when recorded flow characteristics most accurately represented system operations. Consequently, hourly production data from the tank and wells were summed using individual

Table 6-4. Naming Scheme for Network Elements

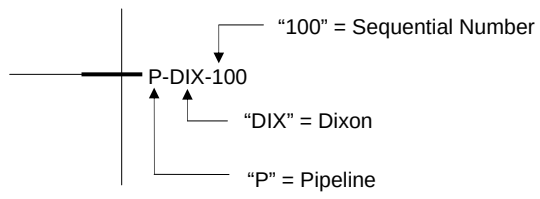
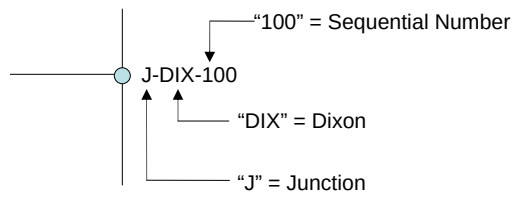
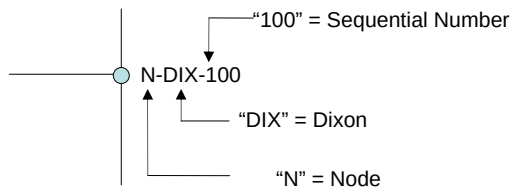
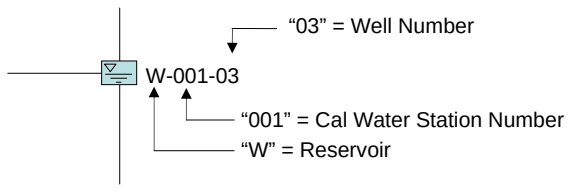
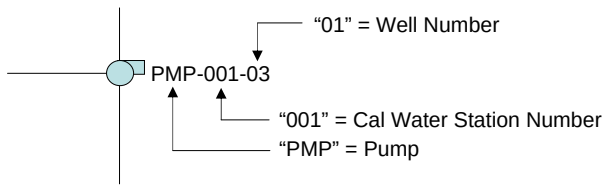
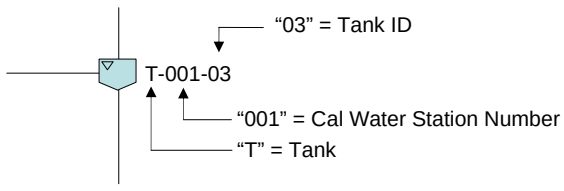
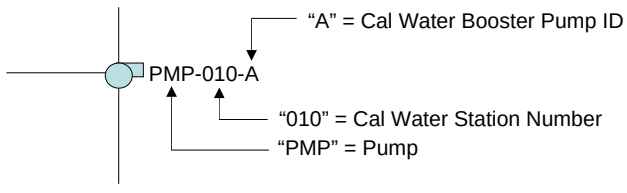
Model Component	Naming Scheme
Pipelines	
Junctions	
Nodes	
Wells	
Well Pumps	
Tanks	
Booster Pumps	

chart flow recordings and SCADA information to represent the total demand in the Dixon District water system on this date. By using a 72-hour demand pattern, the model can more accurately represent fluctuations in demand over the indicated time period.

In order to develop a representative diurnal flow pattern, certain adjustments to available chart data were required. These adjustments corrected what appeared to be chart recorder delays that occurred between the flow and pressure recordings. Table 6-5 presents a summary of the available data for each facility in the Dixon District. The following paragraphs provide the methodology used in the development of the diurnal curve in the Dixon District.

The Dixon District water system is predominantly supplied water from groundwater wells. Flow information from all of the active groundwater wells is available from charts and SCADA information. Flow information from charts was read at hour increments over a period of 72 consecutive hours for August 20th – 22nd, 2008.

The Dixon District water system receives additional water supply from an elevated tank located at Station 1. Tank level information from the elevated tank is available from SCADA information, and was read at hour increments over a period of 72 consecutive hours for August 20th – 22nd, 2008; the tank level information was then converted to flow data by using the volume of the elevated tank.

To create the diurnal curve, the flow from the elevated tank was either added or subtracted, depending on if the tank was emptying or filling, respectively, from the total production from all the active groundwater wells at hour increments over a period of 72 consecutive hours for August 20th – 22nd, 2008. The resulting normalized diurnal pattern is provided in Appendix K[4].

HYDRAULIC MODEL CALIBRATION

The Dixon District hydraulic model was calibrated to confirm that the computer simulation model can accurately represent the operation of the water distribution system under varying conditions. Calibration of the hydraulic model used data gathered through hydrant tests, optional fire flow tests, and hydrant pressure recorders, as described in the following sections.

Development of Hydrant (C-Factor) Tests

After developing the hydraulic model, six sets of hydrant tests were chosen for possible hydrant flow testing (see Figure 6-3). Since no age information was available on these pipelines, selection of these hydrant test sites was based only on specific pipeline size and material type. These hydrant tests were used to evaluate pipeline friction factors (C-factors) and to calibrate the model to ensure that the hydraulic model closely represented actual observed pressure conditions in the field.

[4] See Appendix K, Chapter 5, Figure 3 – System-Wide 72-Hour Diurnal Curve, page 13.

Table 6-5. Available Telemetry Chart Data from Cal Water Stations (August 20, 2008 through August 29, 2008)[a]

Station	Facility	Tank Level	Flow	Pressure	Notes
01	Tank 03	Yes	--	--	Tank level was recorded in both SCADA and seven-day tank level charts.
	01-03	--	Yes	Yes	Flow and pressure were recorded on telemetry charts.
02	02-01	--	Yes	Yes	Flow and pressure were recorded on telemetry charts. Pressure and nitrate concentration were recorded in SCADA.
03	03-01	--	Yes	Yes	Flow and pressure were recorded on telemetry charts.
04	04-01	--	Yes	Yes	Flow and pressure were recorded on telemetry charts.
05	05-01	--	Yes	Yes	Flow and pressure were recorded on telemetry charts. Flow, pressure and nitrate concentration were recorded in SCADA.
06	06-01	--	Yes	Yes	Flow and pressure were recorded on telemetry charts.
07	07-01	--	Yes	Yes	Flow and pressure were recorded on telemetry charts. Flow and pressure were recorded in SCADA.
08	08-01	--	Yes	Yes	Flow and pressure were recorded on telemetry charts.

[a] Pen delay at most stations was confirmed through Cal Water staff.

Hydrant flow testing was scheduled and performed on August 12, 2008. Each hydrant test involved flowing water through pipelines of a specific size and material type, and then measuring the pressure drops along the pipelines to determine friction losses. The hydrant test procedure consisted of monitoring discharge and pressure at the key flowing hydrant, and pressures at other hydrants along the supply routes to that key hydrant. Static pressures were measured while the key hydrant was closed, and residual pressures were measured while the key hydrant was flowing.

Pipelines in the Dixon District water system range in size from 2-inch to 14-inches in diameter. Pipeline materials consist mainly of AC and CI. Other pipeline materials as listed in Table 6-1 are also found in the Dixon District water system.

Prior to any model runs, each pipeline was assigned a preliminary C-factor based on the pipeline size and material type as presented in Table 6-1. Consequently, each hydrant flow test was then simulated using the hydraulic model of the Dixon District water system. Results were compared to the field data to determine the accuracy of the model. The differences between observed static and residual pressures for the field hydrant test, compared to readings predicted by the model, were calculated. The goal of the calibration effort was to achieve no greater than a 5 psi differential between the field hydrant test data and model-simulated results. Results from the hydrant tests are discussed in more detail in the following section.

Hydrant (C-factor) Test Results

The results of the simulated hydrant flow tests generally validated the system pipeline configuration and confirmed the preliminary C-factors presented in Table 6-1. Eighty-two percent (82%) of all C-factor comparison points were found to be within 5 percent or 5 psi of the field data, while the remaining 18 percent were all within 10 psi of the field observed values. A summary of the calibration results can be found in Appendix K. However, based on the comparison of the collected hydrant flow test data and model simulation results, three specific adjustments to the model were found to be necessary in order to achieve the desired calibration goals. These specific calibration adjustments were made to: groundwater depths, system demands and assumed valve configuration. Details of each of these adjustments are further described in Appendix K[5,6].

Development of the Verification Process

Verifying that a hydraulic model replicates field conditions requires thorough knowledge of how the system performs over a wide range of operating conditions. To ensure that the hydraulic model was correctly configured and capable of producing results that are consistent with those observed in the field, a verification process was conducted. Hydrant pressure recorders (HPRs) were used to record pressures in the field. The data was then compared with model-predicted pressures at the same system locations. Other pressure points monitored by Cal Water were also

[5] See Appendix K, Chapter 4, Table 5 – Steady State Calibration Groundwater Levels, page 11.

[6] See Appendix K, Appendix C, Figures 1, 2 and 3, page 24 and 25.

used in the verification process. A brief description of the verification process is discussed below.

Six hydrant pressure recorders were placed in different locations within the Dixon District water distribution system. Each HPR collected field-pressure data for approximately two weeks (from August 20, 2008 to August 29, 2008). The locations were selected based on their proximity to the transmission mains and to extreme elevations (low and high) in the water distribution system. Figure 6-4 shows the location of each HPR.

Following the integration of the diurnal pattern into the hydraulic model, an EPS modeling run was performed and the resulting pressures at each of the HPRs, the flows and pressures at each well, and the tank level were graphed. To verify whether the Dixon District hydraulic model was accurately predicting field-observed tank level, flows, and pressures, model-predicted tank level, flows, and pressures were compared to actual field data. Results from the verification process are discussed below.

Verification Results

Graphs of representative comparisons between model-simulated and field-observed tank level, flows, and pressures are provided in Appendix K[7].

The goal of the EPS calibration for this project was to match model tank levels by 2 ft or 10 percent to the available SCADA data and to achieve a consistent pattern of operation which produces drain/fill and pump on/off status matching the August 20th to 22nd, 2008 operation. In addition to the tank levels, the model was also calibrated to match all well pump station flow values to within 10 gpm or 10 percent, and all well pump station discharge pressures and data logger pressures to within 5 psi or 5 percent during calibration. The Team used the Root Mean Square (RMS) method for measuring the calibration accuracy of each location investigated during EPS Calibration.

The RMS method is a way of analyzing the average error observed for all data points compared for a specific location. RMS is calculated by taking the difference between the model and field value at every hour in the simulation. The hourly error values are then squared (so that all values are positive). The average of all the squared values is taken to determine the average squared error seen. Lastly, the square root of the average error for the results at that location is calculated to determine the average error at that location during the course of the extended period simulation.

Cal Water's Dixon District water system was found to achieve the acceptable criteria for tank level, pump discharge flow and pressure and data logger pressure described above for the EPS Calibration. Individual graphs of comparisons between model-simulated and field-observed pressures for each HPR are provided in Appendix K[8]. These results indicate that the water

[7] See Appendix K, Appendix D – EPS Calibration Graphs, page 26 to 34.

[8] See Appendix K, Appendix D – EPS Calibration Graphs, page 34 to 36.

demands are properly allocated in the model and that the modeled pipeline network is accurately configured.

Hydraulic Model Calibration Findings and Conclusions

In summary, the results from the hydrant tests indicate that the hydraulic model is fairly well calibrated using the preliminary pipeline C-factors assigned as shown in Table 6-1, and can accurately simulate a fire flow or other large demand conditions within the Dixon District.

Overall, the results from the verification process validated the system configuration and demand allocation in the hydraulic model. Pump station flow rate comparisons at each of Cal Water's operated facilities trended well with chart readings. Comparisons of HPR and model-simulated pressure data also trended fair. Most of the trends, though not exact, follow closely with the recorded HPR pressures. It is recommended that Cal Water continue to update/verify pipeline system configurations in the model as new facilities are constructed. It is also recommended to calibrate and confirm that the current telemetry chart system is tracking accurate system information.[9]

Based on the results of the hydraulic model calibration, it can be concluded that the hydraulic model provides an accurate operational representation of the Dixon District water distribution system, and is more than adequate for use as a planning and operational tool.

[9] Similarly, as the proposed SCADA system is installed, the system should be re-calibrated to verify that the SCADA system is recording accurate information.

Public Version

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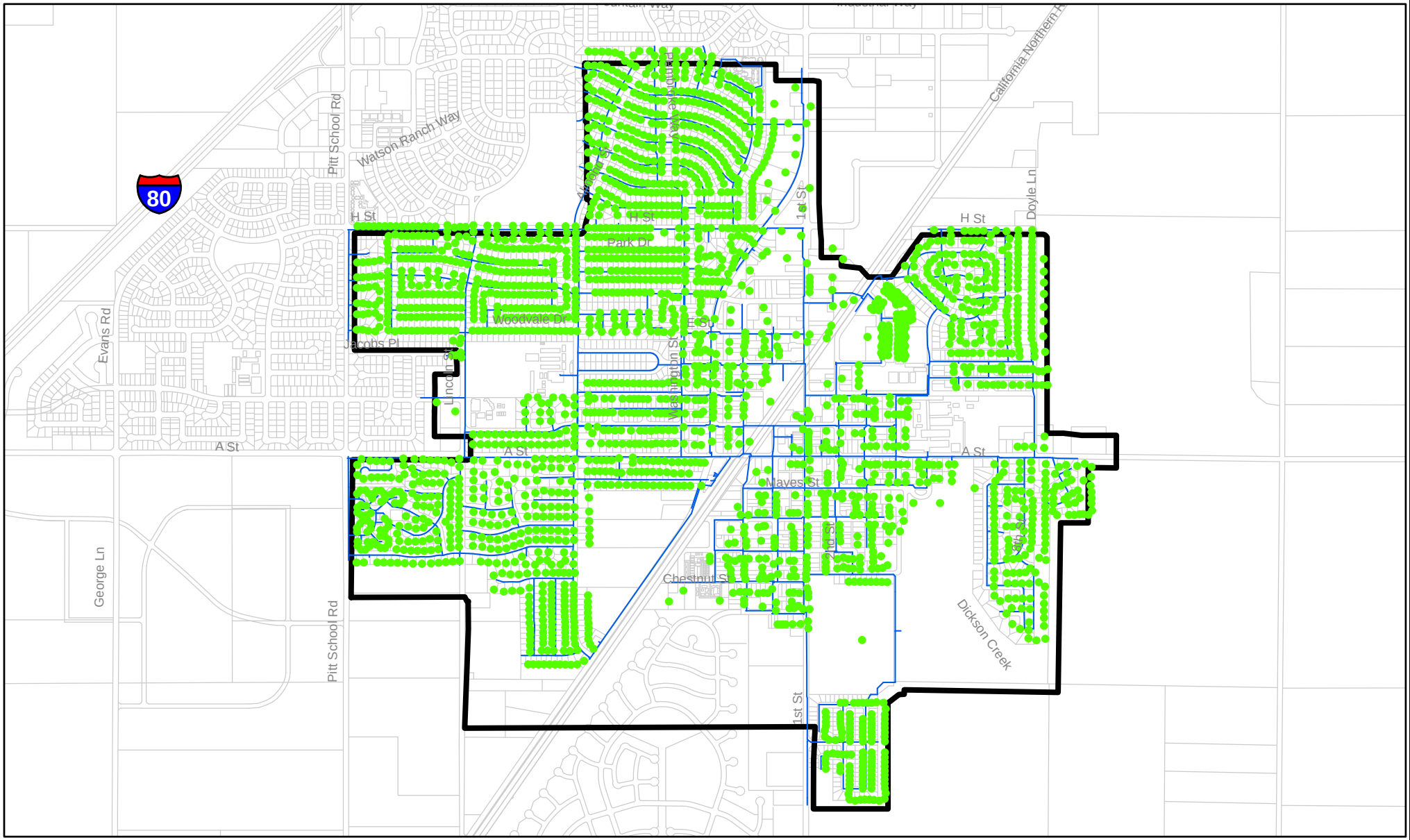

LEGEND:

- Spatially Located Demand
- Existing Pipeline
- Dixon District Service Area

N

0 405 810 1,620

Scale in Feet

FIGURE 6-2

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

SPATIALLY LOCATED DEMANDS

WEST YOST ASSOCIATES Consulting Engineers

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Public Version

LEGEND:

- Active Well
- Water Tank
- Pipeline
- IDModeling Test Location - Completed
- Test Location - Completed, Not Used For Steady State Calibration
- Test Location
- Alternate Test Location

N

0 300 600 1,200

Scale in Feet

FIGURE 6-3

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

HYDRANT TEST LOCATIONS

WEST YOST ASSOCIATES
Consulting Engineers

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Public Version

LEGEND:

- HPR Location
- HPR Location (Missing Data)
- Active Well
- Water Tank
- Pipeline
- Dixon District Service Area

N

0 305 610 1,220

Scale in Feet

FIGURE 6-4

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

HPR LOCATIONS

WEST YOST ASSOCIATES Consulting Engineers

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Public Version

CHAPTER 7: FACILITY ASSESSMENTS

Chapter Highlights:

This chapter presents the findings and conclusions resulting from WYA's desktop and field assessments of Cal Water's Dixon District water system facilities. Water system facilities assessed included the following:

- Water Supply Wells;
- Treatment and Disinfection Facilities;
- Storage Facility; and
- Telemetry System

Chapter Contents:

- Dixon District Water Supply Wells
- Dixon District Treatment and Disinfection Facilities
- Dixon District Storage Facility
- Dixon District Telemetry System
- City of Dixon Water Supply Wells

Well facilities and treatment and disinfection facilities assessments were performed using a combination of desktop assessments (based on review of available data received from Cal Water and discussions with Cal Water staff) and field assessments (involving visiting each site and identifying potential issues and deficiencies). The assessment of the Dixon District storage facility was based on a desktop assessment only.

Cal Water has begun installing a Supervisory Control and Data Acquisition (SCADA) system at the Dixon District. SCADA is currently installed at Tank 1 and Wells 02-01, 05-01 and 07-01, and is currently planned for installation at Wells 04-01, 06-01, and 07-01 in the 2010 Preliminary Advance Budget. It is recommended that the installation of the SCADA facilities at the remaining Dixon District wells proceed as quickly as possible to improve system operational efficiency and flexibility.

CHAPTER 7. FACILITY ASSESSMENTS

This chapter presents the findings and conclusions resulting from WYA's desktop and field assessments of the Cal Water Dixon District water system facilities. Water system facilities assessed for this WSFMP included the following:

- Water Supply Wells;
- Treatment and Disinfection Facilities;
- Storage Facility; and
- Telemetry System.

The Dixon District facilities are located at numbered "stations" located throughout the service area. Figure 7-1 shows the locations of the stations and facilities.

Well facilities and treatment and disinfection facilities assessments were performed using a combination of desktop assessments (based on review of available data received from Cal Water and discussions with Cal Water staff) and field assessments (involving visiting each site and identifying potential issues and deficiencies). The assessment of the Dixon District storage facilities was based on a desktop assessment only.

Descriptions of the assessments and resulting findings and conclusions are described below. The recommended improvements from these assessments are included in the recommended CIP discussed in Chapter 10.

DIXON DISTRICT WATER SUPPLY WELLS

As described in Chapter 2, the Dixon District currently has eight active groundwater wells. Figure 7-1 shows the locations of the Dixon District wells. Subsequent sections of this chapter describe the assessment findings, conclusions, and recommendations with regard to the Dixon District water supply wells.

Desktop and Field Assessments of Existing Well Facilities

Both desktop and field assessments for the Dixon District well facilities were conducted by WYA for this Water Supply and Facilities Master Plan. The desktop assessments were conducted in July 2008, and consisted of a review of available data, including construction plans, inspection reports, water quality data, and recent and planned maintenance activities. The field assessments were conducted on July 31, 2008, and consisted of visiting each facility to confirm information collected during the desktop assessment, evaluate the general condition of the facility, identify needed improvements, and determine the adequacy of the site to accommodate additional facilities (i.e., treatment facilities, if required).

A detailed checklist was used to record the information collected during the desktop and field assessments. Copies of the completed checklists for the Dixon District well facilities are provided in Appendix L.

Well Facilities Evaluation Criteria

The evaluation of the Dixon District well facilities was based on the following criteria:

- Age,
- Current and historic production capacity,
- Pump efficiency,
- Available water quality data,
- Disinfection method,
- Facility condition, and
- Personnel safety and operational issues.

The evaluation of each site for suitability of additional facilities (such as wellhead treatment facilities) was based on the following criteria:

- Overall size of the lot and remaining available space on lot,
- Specific site characteristics (e.g., uneven slope, existing trees),
- Configuration of the lot (e.g., locations of existing facilities, accessibility for construction and maintenance of facilities)
- Adjacent land uses and compatibility with current and/or additional facilities, and
- Location of the site in relation to known areas with water quality problems.

Findings, Conclusions and Recommendations for Well Facilities

The following describes the findings, conclusions, and recommendations from the desktop and field assessments for the Dixon District wells. Overall recommendations are summarized on Figure 7-2.

Table 7-1 provides a detailed description of the findings and recommendations regarding each of the Dixon District wells. Table 7-2 provides a summary of the recommended improvements by improvement type. Some of the recommended improvements have already been planned by Cal Water staff and are included in the CIP for the Dixon District[1]. These planned improvements are so noted on Tables 7-1 and 7-2. Those improvements which have not yet been planned or budgeted will be included in the recommended CIP discussed in Chapter 10, and should be incorporated into Cal Water's future CIPs as appropriate.

[1] CIP information for Dixon District (provided by Tom Salzano (Cal Water) on August 12, 2008).

Table 7-1. Summary of Well Facilities Assessment Findings and Recommendations: Cal Water Dixon District Wells

Well Number (Station Number)	Year Constructed Total Depth Design Flow Capacity[a]	Assessment Findings	Assessment Recommendations
01-03 *2007: 12% of Total Production*	1954 538 feet 500 gpm	• Current water quality issues[b]: Nitrates – between 20 and 32 mg/L; TDS – 453 mg/L (2000) • Disinfection method: Calcium hypochlorite tablets • SCADA installed for tank, but not for Well 01-03 • No backup power • Pump is old, but is in good condition; oil-lube • New electrical panel and emergency generator have been requested, but have been delayed due to other District needs • Latest pump efficiency test was October 2006: Overall Pump Efficiency 53.1% at a flow rate of 414 gpm; PUC Rating: FAIR	• Convert pump from oil-lube to water-lube • Install SCADA for Well 01-03 • Install new control panel (included in 2007 Capital Budget) • Install emergency generator (included in 2008 Capital Budget, the need for backup power at this station will be evaluated as part of the existing system evaluation in Chapter 8) • Conduct pump efficiency test; install new well pump if pump efficiency continues to decrease
02-01 *2007: 0% of Total Production*	1950 578 feet 700 gpm	• Current water quality issues[b]: Nitrates – 35.5 mg/L (2008); Total Chromium – 0.04 mg/L (2005); TDS – 462 mg/L (2005) • Disinfection method: Calcium hypochlorite tablets • Nitrate analyzer installed • SCADA available • No backup power; not much space for new facilities • Interior/exterior paint is peeling • Well has a sand tester installed; sand production is not bad • Well has not been operated recently; just for sampling • Pump is oil-lube • Latest pump efficiency test was May 2003: Overall Pump Efficiency 62.8% at a flow rate of 638 gpm; PUC Rating: EXCELLENT	• Paint building exterior and interior • Provide exterior lighting for security and operator convenience for evening work • Convert pump from oil-lube to water-lube • Conduct pump efficiency test • The need for backup power at this station will be evaluated as part of the existing system evaluation in Chapter 8
03-01 *2007: 28% of Total Production*	1956 602 feet 600 gpm	• Current water quality issues[b]: Nitrates – 37 mg/L (2007); Total Chromium – 24-34 µg/L; TDS – 500 mg/L (2006) • Disinfection method: Calcium hypochlorite tablets • Nitrate analyzer installed • Sand separator installed; sand production is not bad • No SCADA available • No backup power • Interior/exterior paint is peeling • Latest pump efficiency test was September 2008: Overall Pump Efficiency 38.6% at a flow rate of 419 gpm; PUC Rating: VERY LOW • A new pump was installed in May 2008; water-lube • Ion-exchange treatment system for nitrate removal planned and currently pending approval	• Paint building exterior and interior • Provide exterior lighting for security and operator convenience for evening work • Install ion-exchange treatment system for nitrate removal (included in 2008 Capital Budget) • Install SCADA • The need for backup power at this station will be evaluated as part of the existing system evaluation in Chapter 8
04-01 *2007: 8% of Total Production*	1966 665 feet 650 gpm	• Current water quality issues[b]: Nitrates – 34 mg/L (2006); TDS – 424 mg/L (2006) • Disinfection method: Calcium hypochlorite tablets • Well was recently redeveloped; has had sanding problem • Has backup power provisions (auxiliary engine—gasoline); could use a "tune up"; new generator included in 2010 Preliminary Advance Budget • Exterior paint is peeling • No SCADA available • Pump is oil-lube • Latest pump efficiency test was September 2008: Overall Pump Efficiency 54.5% at a flow rate of 467 gpm; PUC Rating: LOW	• Paint building exterior • Provide exterior lighting for security and operator convenience for evening work • Provide "tune up" for auxiliary engine • Convert pump from oil-lube to water-lube • Install SCADA (included in 2010 Preliminary Advance Budget) • Install new well pump if pump efficiency continues to decrease • Install new larger sander
05-01 *2007: 3% of Total Production*	1973 650 feet 400 gpm	• Current water quality issues[b]: Nitrates – 45.1 mg/L (2007); nitrate concentrations have decreased recently • Disinfection method: Calcium hypochlorite tablets • Nitrate analyzer installed • Sand separator installed; sand production is not bad • Has backup power provisions (aux natural gas) • Pump scheduled to be replaced in fall 2008; pump is water lube • SCADA available • Latest pump efficiency test was September 2008: Overall Pump Efficiency 26.1% at a flow rate of 531 gpm; PUC Rating: VERY LOW	• Provide exterior lighting for security and operator convenience for evening work • Install new well pump (scheduled for fall 2008) (included in 2010 Preliminary Advance Budget)

Table 7-1. Summary of Well Facilities Assessment Findings and Recommendations: Cal Water Dixon District Wells

Well Number (Station Number)	Year Constructed Total Depth Design Flow Capacity[a]	Assessment Findings	Assessment Recommendations
06-01 *2007: 7% of Total Production*	1976 648 feet 850 gpm	• Current water quality issues[b]: TDS – 400 mg/L (2007) • Disinfection method: Calcium hypochlorite tablets • Has backup power provisions (auxiliary engine—diesel) • No SCADA available • Pump is oil-lube • Latest pump efficiency test was September 2008: Overall Pump Efficiency 52.3% at a flow rate of 430 gpm; PUC Rating: LOW	• Provide exterior lighting for security and operator convenience for evening work • Convert pump from oil-lube to water-lube • Install SCADA (included in 2010 Preliminary Advance Budget) • Install new well pump if pump efficiency continues to decrease; new pump included in 2010 Preliminary Advance Budget
07-01 *2007: 34% of Total Production*	1979 820 feet 800 gpm	• Current water quality issues[b]: None • Disinfection method: Calcium hypochlorite tablets • SCADA available • Has emergency generator (diesel) with automatic transfer switch • Pump is oil-lube • No sanding problems • Latest pump efficiency test was September 2008: Overall Pump Efficiency 50.2% at a flow rate of 560 gpm; PUC Rating: LOW	• Provide exterior lighting for security and operator convenience for evening work • Convert pump from oil-lube to water-lube • Conduct pump efficiency test (new pump included in 2011 Preliminary Advance Budget)
8-01 *2007: 8% of Total Production*	1979 860 feet 500 gpm	• Current water quality issues[b]: TDS – 378 mg/L (2004); purple bacteria • Disinfection method: Liquid sodium hypochlorite (25-gallon automatic feed system) • Rosedale Bag filter for removal of Streptomyces bacteria (purple color in water) • Newest well in Cal Water Dixon system • Has backup power provisions (auxiliary engine—diesel); could use a "tune up" • Site is small; no space for additional facilities • No SCADA • Pump is oil-lube • Latest pump efficiency test was November 2006: Overall Pump Efficiency 42.3% at a flow rate of 338 gpm; PUC Rating: VERY LOW • New motor installed in March 2008 • No fire extinguisher at station	• Provide exterior lighting for security and operator convenience for evening work • Provide "tune up" for auxiliary engine • Convert pump from oil-lube to water-lube • Install SCADA (included in 2010 Preliminary Advance Budget) • Provide fire extinguisher at station • Install a higher capacity Rosedale filter • Well rehabilitation to remove purple bacteria and switch bag filter

[a] Design flow capacity as reported in February 2008 DHS Annual Report.
[b] See Chapter 4 for complete discussion of water quality issues.

Table 7-2. Summary of Well Facilities Assessment Recommended Improvements: Cal Water Dixon District Wells

Well Number	Recommended Repairs and Improvements					Treatment Improvements	New Equipment					Additional Studies	Comments
	Paint building exterior	Paint building interior	Provide exterior lighting	Conduct "tune ups" for auxiliary engines	Convert pumps from oil-lube to water-lube	Install ion-exchange treatment system for nitrate removal	Install SCADA	Install New Control Panel	Install New Emergency Generator	Install New Well Pump	Provide Fire Extinguisher	Pump Efficiency Test[a]	
01-03					✔		✔	✔ Included in 2007 Capital Budget	✔ Included in 2008 Capital Budget See comments	See comments		✔	Consider pump replacement if overall pump efficiency continues to decrease Although a new emergency generator is included in the 2008 Capital Budget, the need for backup power at this station will be evaluated as part of the existing system evaluation in Chapter 8
02-01	✔	✔	✔		✔				See comments			✔	The need for backup power at this station will be evaluated as part of the existing system evaluation in Chapter 8
03-01	✔	✔	✔			✔ Included in 2008 Capital Budget	✔		See comments				Consider pump replacement if overall pump efficiency continues to decrease The need for backup power at this station will be evaluated as part of the existing system evaluation in Chapter 8
04-01	✔		✔	✔	✔		✔ Included in 2010 Preliminary Advance Budget		See comments	See comments			Consider pump replacement if overall pump efficiency continues to decrease New generator included in 2010 Preliminary Advance Budget
05-01			✔							✔ Included in 2010 Preliminary Advance Budget (scheduled for Fall 2008)			Consider pump replacement if overall pump efficiency continues to decrease
06-01			✔		✔		✔ Included in 2010 Preliminary Advance Budget			See comments			Consider pump replacement if overall pump efficiency continues to decrease (new pump included in 2010 Preliminary Advance Budget)
07-01			✔		✔					See comments			Consider pump replacement if overall pump efficiency continues to decrease (new pump included in 2011 Preliminary Advance Budget)
08-01			✔	✔	✔		✔ Included in 2010 Preliminary Advance Budget				✔		Consider pump replacement if overall pump efficiency continues to decrease

[a] Based on Industry Standards, pumps with efficiency test results under 70% require additional monitoring and testing with possible rehabilitation or replacement. Pump efficiency test should be performed approximately every three (3) years and repair history reviewed to determine future improvements.

As summarized in Tables 7-1 and 7-2, the Dixon District wells appear to be in good condition. Only minor equipment and operational issues were identified. Recommended improvements for the Dixon District wells include the following:

Recommended Repairs and Improvements:

- Paint building exterior (Stations 2, 3, and 4)
- Paint building interior (Station 2 and 3)
- Provide exterior lighting for security and operator convenience when working at night (Stations 2, 3, 4, 5, 6, 7, and 8)
- Conduct "tune ups" for auxiliary engines for more efficient operation (Stations 4 and 8)
- Convert pumps from oil-lube to water-lube (Stations 1, 2, 4, 6, 7, and 8)

Recommended Treatment Improvements:

- Install ion-exchange treatment system for nitrate removal (Station 3) (included in 2008 Capital Budget for Station 5)
- Rehabilitation to remove purple bacteria and switch bag filter (Station 8)

Recommended New Equipment:

- Install SCADA (Well 01-03 and Stations 3, 4, 6, and 8) (SCADA for Stations 4, 6 and 8 included in 2010 Preliminary Advance Budget)
- Install new control panel (Station 1) (included in 2007 Capital Budget)
- Install new emergency generator (Station 1) (included in 2008 Capital Budget)
- Install new well pump (Station 5) (included in 2010 Preliminary Advance Budget)
- Provide fire extinguisher (Station 8)
- Install higher capacity Rosedale filter (Station 8)

Recommended Additional Studies:

- Conduct pump efficiency tests for Stations 01-03 and 02-01

In addition, pump efficiency test data was reviewed for the Dixon District wells. Table 7-3 provides a summary of the latest pump efficiency test data for the Dixon District wells, including the Public Utilities Commission (PUC) rating as included in Cal Water's test data summary. Pump efficiency tests should be performed approximately every three years and repair history reviewed to determine future improvements.

Table 7-3. Dixon District Pump Efficiency Test Results[a]

Well Number	Test Date	Static Water Level, depth in feet	Pumping Water Level, depth in feet	Flow Rate, gpm	Overall Pump Efficiency	PUC Rating
01-03	October 2006	0	132	414	53.1%	Fair
02-01	May 2003	24	42	638	62.8%	Excellent
03-01	September 2008[b]	37	51	419	38.6%	Very Low
04-01	September 2008	66	103	467	54.5%	Low
05-01	September 2008[c]	28	30	531	26.1%	Very Low
06-01	September 2008	61	93	430	52.3%	Low
07-01	September 2008	62	132	560	50.2%	Low
08-01	September 2008[d]	120	205	338	42.3%	Very Low

(a) Based on information contained in DIX PUMP TEST DATA.xls received on June 20, 2008.
(b) A new pump was installed at Well 03-01 in May 2008.
(c) A new pump is planned to be installed at Well 05-01 in the fall of 2008.
(d) A new motor was installed at Well 08-01 in March 2008.

As shown in Table 7-3, the most recent pump efficiency tests for the Dixon District wells were performed in September 2008. Based on the most recent test results, overall pump efficiencies for Wells 01-03, 03-01, 04-01, 05-01, 06-01, 07-01 and 08-01 were below 60 percent, with PUC ratings of “Fair”, “Low” or “Very Low”. As noted above, a new pump was installed at Well 03-01 in May 2008, a new pump is planned to be installed at Well 05-01 in fall 2008, and a new motor was installed at Well 08-01 in March 2008.

WYA recommends that pump efficiency tests be performed on Dixon District wells 01-03 and 02-01 in 2009 to determine the current efficiency of the well pumps. If current pump efficiencies for Wells 03-01, 04-01, 05-01, 06-01, 07-01 and 08-01 continue to be low or decrease even further, Cal Water should consider future pump replacement for these wells.

Backup Power Provisions for Wells

Several of the Dixon District stations have backup power provisions in the form of auxiliary engines or emergency generators. These stations are listed below:

- Station 4: Gasoline auxiliary engine
- Station 5: Natural gas auxiliary engine
- Station 6: Diesel auxiliary engine
- Station 7: Diesel emergency generator
- Station 8: Diesel auxiliary engine

The Dixon District backup power provisions appear to be in generally good condition; however, Dixon District operations staff indicate that the auxiliary engines at Stations 4 and 8 could use a "tune up" in the near future. The auxiliary engines and emergency generators are tested regularly to ensure proper starting and operation. The engines and generators are inspected regularly and are permitted by the Yolo-Solano Air Quality Management District.

New emergency generators are planned in the coming years for Station 1 (included in 2008 Capital Budget) and Station 4 (included in 2010 Preliminary Advance Budget). In addition, an emergency generator will be provided at the new well planned at Station 9 (included in 2010 Preliminary Advance Budget) (see additional discussion at the end of this chapter).

There are no current recommendations for the existing backup power provisions based on this facilities assessment. The need for additional backup power provisions to provide for additional supply reliability is evaluated in Chapters 8 and 9 of this Water Supply and Facilities Master Plan.

DIXON DISTRICT TREATMENT AND DISINFECTION FACILITIES

Both desktop and field assessments of the Dixon District treatment and disinfection facilities were conducted for the Dixon District wells. The assessment consisted of a review of available facility data, discussions with Cal Water staff, and on-site field confirmation.

Treatment for the Dixon District wells currently consists of wellhead chlorination only. Well 08-01 utilizes liquid sodium hypochlorite tablets for disinfection (using a 25-gallon-capacity automated feed system), and the other wells use calcium hypochlorite tablets. For the stations which utilize calcium hypochlorite tablets, each station has a device into which calcium hypochlorite tablets are manually inserted by the operator. The tablets are then dissolved into solution and the solution is dripped into the well. The operators refill the device with calcium hypochlorite tablets as needed based on the well production and usage rate.

Some other Cal Water districts have reported that the calcium hypochlorite tablet feed systems can be problematic due to the tablets not dissolving properly and clogging the chlorination feed system. The Dixon District, however, does not appear to have any issues with their tablet feed systems.

As described in Chapter 4, some of the Dixon District wells have increasing nitrate concentrations which are approaching the MCL for nitrate. None of the Dixon District wells currently have treatment systems for nitrate removal; however, Wells 02-01, 03-01, and 05-01 have nitrate analyzers installed to continuously monitor nitrate concentrations. An ion exchange treatment system is currently planned for Well 03-01[2].

[2] An ion exchange treatment system was included in the 2008 Capital Budget for Station 5; this treatment system is currently planned for installation at Station 3. However, this treatment system is pending approval from the City of Dixon.

Cal Water should continue to closely monitor nitrate concentrations at its wells to determine if additional treatment systems are needed in the future.

DIXON DISTRICT STORAGE FACILITY

As discussed in Chapter 2, the Dixon District currently has one storage reservoir, a 75,000-gallon elevated steel tank (Tank 1) located at Station 1. The location of the storage facility is shown on Figure 7-1.

Storage Facility Evaluation Criteria

The evaluation of the Dixon District storage facility was based on the following criteria:

- Tank age,
- Tank material,
- Tank type,
- Recent improvements,
- Recent and/or planned maintenance activities, and
- Recent inspection findings.

Desktop Assessment of Existing Storage Facility

A desktop assessment of the Dixon District elevated tank was conducted in July 2008. The assessment consisted of a review of available data that included construction plans and maintenance records and discussions with Cal Water staff regarding future planned maintenance activities.

The Dixon District Tank 1 was constructed in 1924 and is located at Station 1. The tank height is approximately 31 feet; the tank diameter is 21 feet.

Steel reservoirs and tanks are typically designed for a service life of 40 to 60 years with periodic maintenance including painting. The Dixon District tank is currently 84 years old, which is well beyond the typical service life of a steel tank. However, based on this facilities assessment and data provided by Cal Water, the Dixon District tank appears to be in generally good condition.

The tank exterior was last painted in 1995 and a portion of the interior was painted in 1986. The tank interior is currently scheduled for repainting in October 2008 (included in 2008 Capital Budget). The cathodic protection system was originally installed in 1956 and was last inspected in September 2007. The entire cathodic protection system is due for replacement in 2008 (included in 2008 Capital Budget). During the field assessment, Dixon District operations staff indicated that the replacement of the cathodic protection system will likely occur at the same time that the tank interior is painted (currently scheduled for October 2008).

Additional recommendations related to the Dixon District storage facility, resulting from WYA's hydraulic system modeling and evaluation of operational issues are discussed in Chapters 8 and 9, and are included in the recommended CIP discussed in Chapter 10.

DIXON DISTRICT TELEMETRY SYSTEM

The Dixon District has an existing telemetry system based at Station 1 wherein water levels in the District's storage tank are monitored by electrodes installed at various levels in the tank. The system turns on the District's wells as water levels in the tank drop, which indicates a pressure drop within the system. The existing telemetry system, although functional, is fairly antiquated and does not provide adequate operational flexibility, control capability, or monitoring or reporting capability.

Cal Water has begun installing a SCADA system at the Dixon District. SCADA is currently installed at Tank 1 and Wells 02-01, 05-01 and 07-01, and is currently planned for installation at Wells 04-01, 06-01, and 07-01 in the 2010 Preliminary Advance Budget. Such a system enables remote monitoring and operational control of system facilities, and will assist operations staff in developing and implementing operational strategies to meet customers' needs. It is recommended that the installation of the SCADA facilities at the remaining Dixon District wells proceed as quickly as possible to improve system operational efficiency and flexibility.

PLANNED NEW FACILITIES

The Dixon District is currently planning to construct a new well (Well 09-01) and possibly a new storage tank in the next few years. These are discussed below.

New Well 09-01

Cal Water recently purchased a property for a proposed new well (Well 09-01) in the Dixon District. The property is located [redacted]. The property has an empty building (previously used as a contractor's office) which the Dixon District may consider converting to a future customer service office. Well 09-01 is scheduled to be constructed in 2009 (included in 2008 Capital Budget), with completion anticipated by late summer 2009. The Dixon District is also planning to install an emergency generator at this new well site (included in 2010 Preliminary Advance Budget).

New Storage Tank

Cal Water is considering the future purchase of a new property for the construction new water storage facilities for the Dixon District. Cal Water plans to purchase the new property by 2010 and construct the first storage tank in 2011 (acquisition of land included in 2009 Preliminary Advance Budget; tank construction included in 2010 Preliminary Advance Budget; pumping equipment included in 2011 Preliminary Advance Budget).

Further discussion of these proposed future facilities is provided in Chapter 8.

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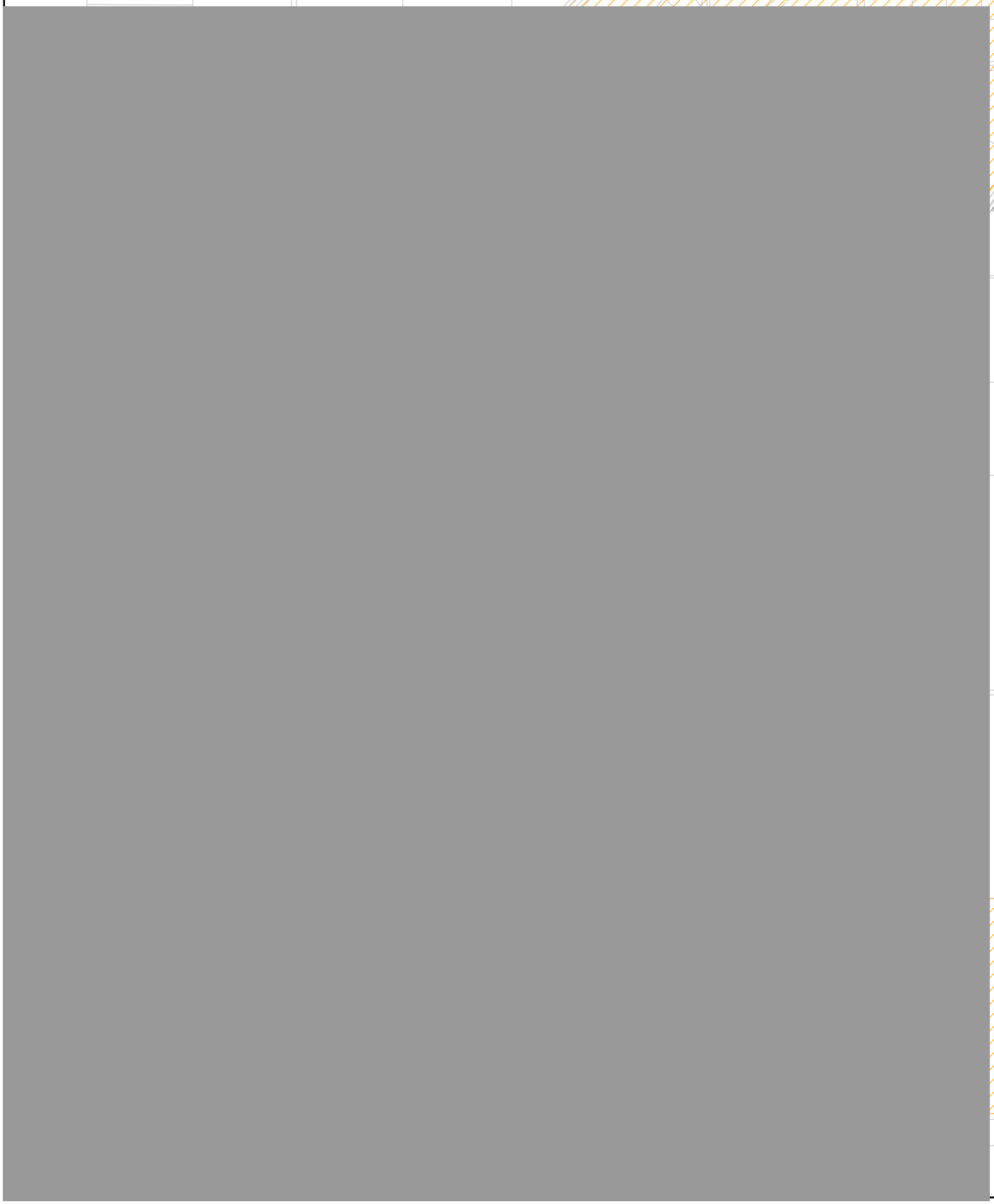
Public Version



LEGEND:

- Dixon District Service Boundary
- Dixon_City_Lim
- Active Well
- Potable Water Storage
- Pipeline
- Parcels

N

0 480 960 1,920

FIGURE 7-1

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

LOCATIONS OF EXISTING STATION AND FACILITIES

WEST YOST ASSOCIATES Consulting Engineers

o:\c\436\020807\GIS\WMP\Ch7\Fig7-1_Locations.mxd

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Public Version

o:\c\436\020807\GIS\WMPFigures\Ch7\Fig7-2_Recommendations.mxd

LEGEND:

- Active Well
- Potable Water Storage
- Pipeline
- Dixon District Service Boundary

N

0 400 800 1,600

Scale in Feet

FIGURE 7-2

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

ASSESSMENT RECOMMENDATIONS FOR CAL WATER WELLS

WEST YOST ASSOCIATES
Consulting Engineers

CHAPTER 8: EVALUATION OF EXISTING WATER SYSTEM

Chapter Highlights:

This chapter presents an overview evaluation of the Dixon District's existing water distribution system and its ability to meet the Dixon District's recommended performance and planning criteria under existing demand conditions. This evaluation includes an analysis of water storage capacity, pumping capacity, and the existing water system's ability to meet recommended operational and design criteria under maximum day demand plus fire flow and peak hour demand scenarios.

Chapter Contents:

- Existing Water Demands
- Existing Water System Facility Evaluation
- Existing Water System Performance Evaluation
- Summary of Recommended Improvements tor the Existing Water System

Summary of Recommended Improvements for the Existing Water System:

With the construction of the new Station 09-01. Well and the 16-inch diameter pipeline as illustrated on Figure 8-4, there are only few recommended improvements needed to eliminate deficiencies identified in the evaluation of the existing water distribution system. These improvements are summarized below.

Storage Facilities

- To alleviate the storage capacity deficit, a new 0.3 MG ground level storage reservoir with booster pump station will be constructed [redacted] (future site of Station 10).

Pumping Facilities

- To convey water from the new 0.3 MG storage reservoir located [redacted] (future site of Station 10), a new 5.18 mgd pump station will be constructed.

Backup Power

- Install backup power to any proposed existing system improvements to improve supply reliability.

AVAILABLE STORAGE CAPACITY, MG			REQUIRED STORAGE CAPACITY, MG			TOTAL STORAGE CAPACITY SURPLUS, MG
Reservoir Capacity	Groundwater Credit	Total	Operational	Emergency	Total	
0.1	2.3	2.4	0.7	1.5	2.3	0.1

[redacted]

[redacted]

CHAPTER 8. EVALUATION OF EXISTING WATER SYSTEM

This chapter presents an overview evaluation of the Dixon District's existing water distribution system (see Figure 8-1) and its ability to meet the Dixon District's recommended performance and planning criteria under existing demand conditions. This evaluation includes an analysis of water storage capacity, pumping capacity, and the existing water system's ability to meet recommended operational and design criteria under maximum day demand plus fire flow and peak hour demand scenarios.

WYA conducted this evaluation using the updated hydraulic model described in Chapter 6. Evaluations, findings, and recommendations for addressing the identified existing water distribution system deficiencies are included. Any recommendation was then used to develop a CIP, including an estimate of probable construction costs. The recommended CIP is described further in Chapter 10.

EXISTING WATER DEMANDS

The existing water demands for the Dixon District's water system were spatially located using meter data provided by Cal Water (see Chapter 3 for more detail). These existing water demands were then scaled up (using 2007 production data) to represent an average day demand, maximum day demand, and peak hour demand. The 2007 production data was the latest data received from Cal Water. Table 8-1 summarizes the existing water demands for the Dixon District.

Table 8-1. Existing Water Demands for the Dixon District

Demand Scenario	Demand	
	gpm	mgd
Average Day[(a)]	1,069	1.54
Maximum Day[(b)]	2,032	2.93
Peak Hour[(c)]	3,379	4.87

(a) Average day demand is based on 2007 production data (Dixon UWMP Data.xls).
(b) Maximum day demand is based on 2007 production data (Dixon UWMP Data.xls). The average day to maximum day peaking factor for 2007 is 1.9. This peaking factor is also the historical average and the 5-year average.
(c) Peak hour demand is 1.66 times the maximum day demand.

EXISTING WATER SYSTEM FACILITY EVALUATION

To evaluate the existing water system, analyses addressing the following system facilities were conducted:

- Water Storage Capacity,
- Pumping Capacity, and
- Critical Supply Facilities.

The results of the existing water system facility analyses are discussed below.

Water Storage Capacity

The principal advantages that storage provides for the water system are the ability to equalize demands on supply sources, production facilities, and transmission mains; to provide emergency storage in case of supply failure; and to provide water to fight fires. As discussed with Cal Water staff, increasing fire flow storage for the sole purpose of meeting the requirements of only a few large buildings would be cost prohibitive to the existing customers of the Dixon District. Consequently, the fire flow storage component is not considered until the future water storage capacity evaluation. System improvements are triggered when future users increase overall demands, or when large buildings undergo a remodel.

The Dixon District service area has two sources of available storage: one elevated storage tank and the groundwater basin. Together, these two sources of storage must be sufficient to meet the Dixon District's storage criteria for the existing water system. The volume required for each storage component is detailed below:

- Operational Storage: 25 percent of maximum day demand; and
- Emergency Storage: Average day demand.

Because the Dixon District water supply includes wells, the groundwater basin can account for a portion of the recommended water storage and system peaking capacity, in the form of a groundwater credit. Sufficient water transmission facilities must be available to distribute this water to demand areas.

Groundwater credit can be defined using the following two categories:

- Emergency Storage Credit – Equal to the groundwater supply of potable water that can be reliably accessed in the event of a power outage or any other emergency that would interrupt system-wide operations. In the case of the Dixon District, these facilities would include wells that are equipped with auxiliary power. The minimum credit is equal to zero, and the maximum credit is equal to the required emergency storage capacity or an average day demand.

- Operational Storage Credit – Equal to a percentage of the groundwater supply that can be accessed in excess of that which is required to meet a maximum day demand. For the Dixon District, the Operational Storage Credit is equal to 38 percent of the difference between the firm groundwater pumping capacity and a maximum day demand. The minimum credit is equal to zero, and the maximum credit is equal to the required operational storage capacity or 25 percent of a maximum day demand.

The existing storage tank, in conjunction with available groundwater credit, was evaluated to determine whether the Dixon District's existing water system has sufficient capacity to provide the required system storage. Currently, the Dixon District has a water storage capacity deficit of 0.3 MG as summarized in Table 8-2. Table 8-3 provides additional detail on existing available storage capacity, groundwater credit, and required storage capacity.

Table 8-2. Comparison of Available and Required Storage Capacity

Available Storage Capacity, MG			Required Storage Capacity[(a)], MG			
Reservoir Capacity	Groundwater Credit[(b)]	Total	Operational	Emergency	Total	Additional Storage Capacity Required, MG[(c)]
0.1	1.9	2.0	0.7	1.5	2.3	0.3

(a) As requested by Cal Water, the Required Storage Capacity does not include a fire flow storage component. Increasing storage to meet fire flow requirements for a few large buildings would be cost prohibitive to the ratepayers. Consequently, the fire flow storage component is not considered until the future water storage capacity evaluation.

(b) Equal to the sum of the Emergency Storage Credit and the Operational Storage Credit (see Table 8-3).

(c) Equal to required storage minus available storage.

Cal Water is currently planning a new ground level storage reservoir in the Dixon District water system. This new ground level storage (Station 10) site is located at 620 North Jackson Street. The primary purpose for this new storage reservoir will be to meet fire flow storage requirement. The construction of this new storage reservoir will be completed in 2010. This proposed storage reservoir will provide a solution for the water storage capacity deficit of 0.3 MG in the existing system.

The recommended storage reservoir will require a new 5.18 mgd booster pump station to supply stored water to the distribution system. These new storage and pumping facilities were added to the Dixon District hydraulic model, to determine requirements for associated supply infrastructure, as discussed in the following sections.

Pumping Capacity

The Dixon District's pumping capacity was evaluated to assess its ability to deliver a reliable firm capacity to the existing service area. Firm capacity assumes a reduction in total pumping

Table 8-3. Summary of Existing Storage Requirements

[A]	[B]	[C]	[D]	[E] = [C] + [D]	[F]	[G]	[H]	[I]	[J] = [F] + [H] + [I]	[K] = [J] - [E]
		Required Storage Capacity, MG								
Station	Status	Operational[a]	Emergency[b]	Total Required Storage[c], MG	Reservoir Capacity, MG	Well Pump Capacity[d], MG	Emergency Storage Credit[e], MG	Operational Storage Credit[f], MG	Total Available Storage, MG	Storage Surplus (Deficit), MG
Tank 1	Active	0.7	1.5	2.3	0.1	--	1.5	0.4	2.0	(0.3)
Well 01-03	Active				--	--				
Well 02-01	Active				--	--				
Well 03-01	Active				--	--				
Well 04-01	Active				--	0.8				
Well 05-01	Active				--	0.6				
Well 06-01	Active				--	0.5				
Well07-01	Active				--	0.8				
Well08-01	Active				--	0.4				
Total	--	--	--	--	0.1	3.1	--	--	--	--

[a] Based on 25 percent of a maximum day demand of 2.93 mgd (see Table 8-1).

[b] Based on average day demand (see Table 8-1).

[c] As requested by Cal Water, the Total Required Storage does not include a fire flow storage component because the fire flow storage currently available in the existing water system is assumed to be sufficient for the purposes of this WSFMP.

[d] Pump capacity of wells with backup power.

[e] Equal to the minimum of either the sum of the total groundwater pumping capacity of active wells with backup power or the required emergency storage capacity.

[f] Equal to the minimum of either 38 percent of the difference between the firm groundwater pumping capacity (see Table 8-5) and maximum day demand (see Table 8-1) or the required operational storage capacity.

capacity to account for pumps that are out of service at any given time due to mechanical breakdowns, maintenance, water quality, or other operational issues. For groundwater well pumps, the firm groundwater pumping capacity was defined as the total active well capacity minus the two most critical wells or 90 percent of the total active well capacity, whichever is less. The most critical well (07-01) was determined based on well pumping records, frequency of use, water quality, and input from Cal Water staff. The second most critical well (06-01) was determined using this criteria followed by an evaluation of the overall effect on water system pressures with the well removed from service.

The pumping capacity criterion for the Dixon District, described in additional detail in Chapter 5, requires the Dixon District's existing water system to have sufficient pumping capacity to meet a peak hour demand[1]. The results of the pumping capacity evaluation are summarized in Table 8-4. Table 8-5 summarizes the pumping capacity of each station.

As requested by Cal Water, the supply from the elevated storage tank was not considered in the pumping capacity analysis because the supply from the tank is small relative to the peak hour demand requirement; therefore, the incremental supply provided by this tank throughout the duration of the peak hour event would be negligible.

The pumping capacity analysis indicated that the Dixon District's existing firm groundwater pumping capacity does not meet the pumping capacity criterion for the entire service area during the governing flow scenario, which uses a peak hour flow. As shown on Table 8-4, the Dixon District has a pumping capacity deficit of 604 gpm (0.87 mgd) during peak hour demand condition. However, this pumping capacity deficit is supplemented by the gravity flow available from the elevated storage tank during a peak hour demand scenario. Therefore, no improvements are recommended to address this pumping capacity deficit in the existing water system. The combination of flows from the various pump stations and the elevated storage tank is sufficient to meet demands during a peak hour.

Table 8-4. Evaluation of Total Firm Pumping Capacity and Peak Hour Demand

Station	Existing Firm Pumping Capacity, gpm	Existing Peak Hour Demand, gpm[(a)]
Groundwater Wells	2,775[b)]	3,379
Pumping Capacity Surplus, gpm	604	

(a) Peak hour demand is 1.66 times the maximum day demand.

(b) Defined as the total active well capacity minus the two most critical wells or 90 percent of the total active well capacity, whichever is less. Well status is defined in Chapter 2.

[1] As requested by Cal Water, the fire flow capacity currently available in the existing water system is assumed to be sufficient for the purposes of this WSFMP. Therefore, the existing water system's pumping facility capacity will only be evaluated during a peak hour demand scenario.

Table 8-5. Summary of Existing Pumping Facilities

Pump Station	Backup Power	Status	Pump 1[a], gpm	Pump 2, gpm	Pump 3, gpm	Total Capacity, gpm	Firm Capacity[b], gpm
Well 01-03		Active	425	--	--	425	2,775
Well 02-01		Active	550	--	--	550	
Well 03-01		Active	550	--	--	550	
Well 04-01	✓	Active	550	--	--	550	
Well 05-01	✓	Active	450	--	--	450	
Well 06-01	✓	Active	340	--	--	340	
Well 07-01	✓	Active	550	--	--	550	
Well 08-01	✓	Active	250	--	--	250	
						Total	2,775

[a] Pump capacity are based on measured capacity from historical field data (2005 to 2009) provided by Cal Water on June 5, 2009.

[b] Firm capacity is defined as the total active well capacity minus the two most critical wells or 90 percent of the total active well capacity, whichever is less. The most critical well (07-01) was determined based on well pumping records, frequency of use, water quality and input from Cal Water staff. The second most critical well (06-01) was determined using this criteria followed by an evaluation of the overall effect on water system pressures with the well removed from service.

Critical Supply Facilities

All critical pumping facilities should be equipped with an on-site, backup power generator to provide pumping capacity during a power outage. Critical pumping facilities are defined as those facilities that provide service to service area(s) without sufficient emergency storage and that meet the following criteria:

- The largest pumping facility that provides water; and
- A pumping facility that provides water from key (depends on capacity, quality and location) groundwater supply wells.

As indicated in Table 8-5, Wells 06-01 and 07-01 in the Dixon District generally address the criteria listed above and are currently equipped with backup power generators to provide pumping capacity during a power outage.

EXISTING WATER SYSTEM PERFORMANCE EVALUATION

This section discusses the performance criteria for and results of the existing water distribution system evaluation.

Existing Water System Performance Criteria

Steady state hydraulic analyses using the updated model were conducted to identify areas of the existing water system that do not meet the recommended system performance criteria as presented previously in Chapter 5. The results of the evaluation of the existing water system are presented below for the following demand scenarios:

- Peak Hour Demand—A peak hour flow condition was simulated for the existing distribution facilities to evaluate their capability to meet a peak hour demand scenario. Peak hour demands are met by the combined flows from the groundwater (firm groundwater pumping capacity) and elevated storage tank.
- Maximum Day Demand plus Fire Flow—To evaluate the existing water system under the maximum day demand plus fire flow scenario, InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow while meeting the maximum day demand plus fire flow performance criteria within the existing water system. Maximum day plus fire flow demands are met by the combined flows from the groundwater (firm groundwater pumping capacity) and elevated storage tank.

<u>Peak Hour Demand Scenario</u>

As shown in Table 8-1, the peak hour demand for the existing Dixon District service area was calculated to be 3,379 gpm (4.87 mgd). This peak hour demand represents a peaking factor of 1.66 times the maximum day demand. During a peak hour demand scenario, a minimum pressure of 40 psi must be maintained throughout the water system. In addition, maximum head loss per thousand feet of distribution main should not exceed 10 feet per thousand feet (ft/kft) and maximum velocities should not exceed 7 fps. Details of the system pressures as simulated in the model under the peak hour demand scenario are discussed below.

Maximum Day Demand plus Fire Flow Scenario

As discussed with Cal Water, any fire flow improvements are considered part of the future system analysis. Therefore, additional pumping capacity and pipeline replacements[2] are not recommended to improve the fire flow capacity in the existing water system.

Consequently, the existing system was evaluated during a maximum day demand plus fire flow scenario only to determine the available fire flow while meeting the maximum day demand within the existing water system. The results from this evaluation will assist Cal Water staff in identifying areas within the Dixon District where they may want to improve fire flow as future main replacement projects are developed.

As shown in Table 8-1, the maximum day demand for the existing Dixon District service area was 2,032 gpm (2.93 mgd) in 2007. InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow in the existing water system while meeting the minimum residual pressure criterion of 20 psi and maximum pipeline velocity criterion of 10 fps.

Recommended Improvements Criteria

The existing water system is expected to deliver peak hour flows and maximum day demand plus fire flow within the acceptable pressure, velocity and head loss ranges as identified in the performance criteria presented in Chapter 5. However, the existing system was evaluated using pressure as the primary criterion. The evaluation results are discussed below. Recommended improvements needed to comply with the performance criteria were added to the existing water system to fix any deficiencies found and are also described below.

Existing Water System Evaluation Results

This section addresses the results of the peak hour demand and maximum day demand plus fire flow analyses.

Peak Hour Demand Scenario

During a peak hour demand scenario, results indicate that the existing water system could not adequately deliver peak hour demands to meet the Dixon District's minimum pressure criterion of 40 psi as illustrated on Figure 8-2. Under this scenario, system pressures ranged from 34 to 47 psi. A large area of low pressures ranging from 34 to 40 psi was identified during the simulation in the northwestern part of the California Northern Railroad, and a small area of low pressure ranging from 39 to 40 psi was identified in the southeastern part of the California Northern Railroad. Based on the location of this area of low pressures, it appears that the low pressures are caused by insufficient supply sources. Both critical wells, Station 06-01 and 07-01, are located in the northwestern part of the California Northern Railroad. Under a peak hour demand scenario, these critical wells were assumed to be offline.

[2] In addition, Cal Water is not required to replace existing pipelines to provide additional fire flow capacity to meet fire flow requirements as stated in the Public Utilities Commission's *General Order 103* (page 27).

Per discussions with Cal Water, a new well, Station 09-01, is currently planned to be constructed. This well has a proposed capacity up to 2,000 gpm, and is planned to be drilled down into the deeper aquifer to alleviate groundwater quality issues due to nitrates (see Chapter 4 for water quality discussion). In addition, a new 16-inch diameter pipeline is planned for construction along with Station 09-01. Figure 8-3 illustrates this new pipeline configuration, which includes the following:

- Approximately 48 lineal feet of 16-inch diameter pipeline along Adam Street from downstream of Station 09-01 to H Street;
- Approximately 800 lineal feet of 16-inch diameter pipeline along Adam Street from downstream of Station 09-01 to F Street; and
- Approximately 920 lineal feet of 16-inch diameter pipeline along F Street from Adam Street to 1st Street.

The construction of Station 09-01 and the 16-inch diameter pipeline will improve the operation of the existing water system and address the area of low pressures. Figure 8-3 illustrates existing system pressure under a peak hour demand scenario with the addition of Station 09-01. Under this system configuration, existing system pressures ranged from 44 to 58 psi.

As illustrated on Figure 8-2, all the pipelines in the existing water system met the maximum velocity criterion during a peak hour demand scenario. However, some pipelines, primarily those located downstream of a pump station, did not meet the maximum head loss criterion. The following list details pipelines in the existing water system that exceeded the maximum head loss criterion of 10 ft/kft.

- The 8-inch diameter pipelines along Porter Road, north of downstream of the Station 01-03 had head losses between 12.1 ft/kft to 43.7 ft/kft. The pipeline with head loss of 43.7 ft/kft was assigned with a pipeline minor loss in addition to the pipeline roughness coefficient for cast iron pipe by IDModeling.
- The 4-inch diameter pipeline along Pegord Avenue (approximately 424 lineal feet) had head loss of 13.4 ft/kft.
- The 8-inch diameter pipeline near the intersection of North 2nd Street and West Creekside Circle had head loss of 10.1 ft/kft.
- The 6-inch diameter pipeline along A Street, near the intersection of A Street and 4th Street had head loss of 12.7 ft/kft.
- The 4-inch diameter pipeline along 5th Street, near the intersection of A Street and 5th Street had head loss of 11.7 ft/kft.
- The 8-inch diameter pipeline downstream of the pump at Station 02-01 had head loss of 18.1 ft /kft.

Because head loss is a secondary criterion, no improvements for pipelines exceeding the head loss criterion in the existing water system are recommended unless the primary criterion (pressure) is not met. Based on results of the peak hour simulation, none of the above pipelines

are in the vicinity of the low pressure areas. Therefore, no mitigation is recommended at this time.

Maximum Day Demand plus Fire Flow Scenario

InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow (while meeting the maximum day demand plus fire flow performance criteria) at each junction within the existing water system under a maximum day demand scenario. Figure 8-4 illustrates the available fire flow at each junction within the existing water system.

Although the ability of the existing water system to meet fire flow is shown on Figure 8-4, any additional fire flow capacity will be provided as part of the future system. The required upgrades in the existing system are extensive, and completion of pipeline upgrades for the sole purpose of improving fire flow, or pumping and storage upgrades for the sole purpose of meeting the demands of a few large users would be cost prohibitive to the existing customers of the Dixon District.

Therefore, it is not recommended that the improvements necessary to increase fire flow capacity in the existing water system be identified as projects in the Dixon District's CIP. However, it is recommended that Cal Water staff consider improving fire flow capacity as a factor for sizing future main replacement projects. Consequently, WYA has provided Appendix M to list the simulated available fire flow to meet the maximum day demand plus fire flow performance criteria (residual pressure of 20 psi and maximum pipeline velocity of 10 fps) within the Dixon District's existing water system. Appendix M would allow Cal Water staff to locate areas within the existing water system where they may want to improve fire flow as future main replacement projects are developed.

It should be noted that the majority of junctions located in the Dixon District had an available fire flow less than 1,500 gpm while meeting the maximum day demand plus fire flow performance criteria.

SUMMARY OF RECOMMENDED IMPROVEMENTS FOR THE EXISTING WATER SYSTEM

With the construction of the new Station 09-01 Well and the 16-inch diameter pipeline as illustrated on Figure 8-4, there are only few recommended improvements needed to eliminate deficiencies identified in the evaluation of the existing water distribution system. These improvements are summarized below.

Storage Facilities

- To alleviate the storage capacity deficit, a new 0.3 MG ground level storage reservoir with booster pump station will be constructed at 620 North Jackson Street (future site of Station 10).

Pumping Facilities

- To convey water from the new 0.3 MG storage reservoir located at 620 North Jackson Street (future site of Station 10), a new 5.18 mgd pump station will be constructed.

Backup Power

- Install backup power to any proposed existing system improvements to improve supply reliability.

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LEGEND:

- Dixon District
- Active Well
- Potable Water Storage
- Pipeline
- Street
- Railroad

N

0 400 800 1,600

Scale in Feet

FIGURE 8-1

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

EXISTING WATER SYSTEM

WEST YOST ASSOCIATES
Consulting Engineers

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Public Version

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LEGEND:

- Dixon District
- Active Well
- Potable Water Storage
- Pressure < 40 psi
- 40 psi ≤ Pressure ≤ 45
- 45 < Pressure ≤ 50 psi
- 50 psi < Pressure ≤ 55 psi
- Velocity ≤ 7 fps
- Velocity > 7 fps
- Street
- Railroad

N

0 405 810 1,620

Scale in Feet

FIGURE 8-2

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

EXISTING SYSTEM PEAK HOUR DEMAND ANALYSIS

WEST YOST ASSOCIATES Consulting Engineers

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Public Version

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LEGEND:

- Dixon District
- Active Well
- Planned Future Well
- Potable Water Storage
- 40 psi < Pressure ≤ 45
- 45 psi < Pressure ≤ 50
- 50 psi < Pressure ≤ 55
- 55 psi < Pressure ≤ 60
- Velocity ≤ 7 fps
- Velocity > 7 fps
- Street
- Railroad

N

0 405 810 1,620

Scale in Feet

FIGURE 8-3

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

EXISTING SYSTEM PEAK HOUR DEMAND ANALYSIS WITH STATION 09-01

WEST YOST ASSOCIATES Consulting Engineers

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Public Version

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LEGEND:

- Available Fire Flow ≤ 1,500 gpm
- 1,500 gpm < Available Fire Flow ≤ 2,500 gpm
- 2,500 gpm < Available Fire Flow ≤ 3,500 gpm
- 3,500 gpm < Available Fire Flow ≤ 4,000 gpm
- Available Fire Flow > 4,000 gpm
- Existing Pipeline
- Dixon District
- Active Well
- Potable Water Storage
- Street
- Railroad

N

0 405 810 1,620

Scale in Feet

FIGURE 8-4

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

EXISTING SYSTEM
AVAILABLE FIRE FLOW
(Residual Pressure ≥ 20 psi & Velocity ≤ 10 fps)

WEST YOST ASSOCIATES Consulting Engineers

CHAPTER 9: EVALUATION OF FUTURE WATER SYSTEM

Chapter Highlights:

This chapter presents an overview evaluation of the Dixon District's future (2035) water distribution system and its ability to meet the Dixon District's recommended performance and planning criteria under future demand conditions.

Chapter Contents:

- Future Water Demands
- Future Water System Facility Evaluation
- Future Water System Performance Evaluation
- Summary of Recommended Improvements for the Future Water System

This chapter identifies the improvements to existing water system infrastructure that will be required to support the projected future water demands generated by the buildout of the existing water system. The evaluation includes an analysis of water storage capacity, pumping capacity and the future system's ability to meet recommended operational and design criteria under future maximum day demand plus fire flow and peak hour demand scenarios.

Summary of Recommended Improvements for the Buildout Water System:

The recommended improvements needed to eliminate deficiencies identified in the evaluation of the future water distribution system are summarized below.

Storage Facilities

- To alleviate the storage capacity deficit, a new 0.7 MG ground level storage reservoir should be constructed at Station 10, [redacted]

Pumping Facilities

- To alleviate the pumping capacity deficit, an additional 1.5 mgd of pump capacity should be added to Station 10 booster pump station.

Pipelines

- To meet the minimum residual pressure during a maximum day demand plus fire flow scenario, install a new 12-inch diameter pipeline near Hall Park, from [redacted] as shown on Figure 9-8.

Backup Power

- Install backup power at Station 02-01.

Install backup power for any proposed buildout system improvement supply or booster pumping facility to improve supply reliability.

CHAPTER 9. EVALUATION OF FUTURE WATER SYSTEM

This chapter presents an overview evaluation of the Dixon District's buildout (2035) water distribution system and its ability to meet the Dixon District's recommended performance and planning criteria under buildout demand conditions.

This chapter identifies the improvements to existing water system infrastructure that will be required to support the water demands generated by the buildout of the existing water system. The evaluation includes an analysis of water storage capacity, pumping capacity and the buildout system's ability to meet recommended operational and design criteria under future maximum day demand plus fire flow and peak hour demand scenarios.

WYA conducted this evaluation using an updated hydraulic model that incorporated the new planned groundwater well (Well 09-01) in the existing water system (see Chapter 8), as well as distribution pipelines required to serve projected buildout. These facilities are shown on Figure 9-1. Evaluations, findings, and recommendations for addressing the identified buildout water distribution system deficiencies are included in this chapter. Recommendations were then used to develop a CIP, including an estimate of probable construction costs. The recommended CIP is described further in Chapter 10.

BUILDOUT WATER DEMANDS

The buildout water demands for the Dixon District were developed based on the additional projected buildout land use information provided by the City as shown on Figure 9-2, and the adopted water duty factors as described in Chapter 3. These additional projected buildout demands were allocated into the buildout hydraulic model using H_2OMAP[1] Demand Allocation/Pro™. Table 9-1 summarizes the buildout water demands for the Dixon District.

Table 9-1. Buildout Water Demands for the Dixon District[(a)]

Demand Scenario	Demand	
	gpm	mgd
Average Day	1,255	1.81
Maximum Day[(b)]	2,385	3.43
Peak Hour[(c)]	3,966	5.71

(a) Demand includes the existing demand and accounts for UAFW (see Table 3-12).
(b) Maximum day demand is 1.9 times the average day demand.
(c) Peak hour demand is 1.66 times the maximum day demand. This peaking factor has not yet been adopted by Cal Water.

[1] MWH Soft's H_2OMAP program was used to allocate water demands. Consequently, this information was then imported into the Dixon District model in InfoWater.

BUILDOUT WATER SYSTEM FACILITY EVALUATION

To evaluate the buildout water system, analyses addressing the following system facilities were conducted:

- Water Storage Capacity,
- Pumping Capacity, and
- Critical Supply Facilities.

The results of the buildout water system facility analyses are discussed below.

Water Storage Capacity

The principal advantages that storage provides for the water system are the ability to equalize demands on supply sources, production facilities, and transmission mains; to provide emergency storage in case of supply failure; and to provide water to fight fires. The Dixon District service area has two sources of available storage: an existing elevated storage tank and the groundwater basin. Together, these two sources of storage must be sufficient to meet the Dixon District's future operational, emergency, and fire flow storage criteria. The volume required for each storage component is detailed below:

- Operational Storage: 25 percent of maximum day demand;
- Emergency Storage: Average day demand; and
- Fire Flow Storage: The required fire flow demand multiplied by the fire flow duration period, as required by the City's Fire Department. Fire flow demands range from 1,500 to 4,000 gpm. The highest Dixon District fire flow of 4,000 gpm for the duration of 3 hours was assumed for the storage analysis.

Because the Dixon District water supply includes wells, the groundwater basin can account for a portion of the recommended water storage and system peaking capacity, in the form of a groundwater credit. Sufficient water transmission facilities must be available to distribute this water to demand areas.

Groundwater credit can be defined using the following two categories:

- Emergency Storage Credit – Equal to the groundwater supply of potable water that can be reliably accessed in the event of a power outage or any other emergency that would interrupt system-wide operations. In the case of the Dixon District, these facilities would include wells that are equipped with auxiliary power. The minimum credit is equal to zero, and the maximum credit is equal to the required emergency storage capacity or an average day demand.

- Operational Storage Credit – Equal to a percentage of the groundwater supply that can be accessed in excess of that which is required to meet a maximum day demand. For the Dixon District, the Operational Storage Credit is equal to 38 percent of the difference between the firm groundwater pumping capacity and a maximum day demand. The minimum credit is equal to zero, and the maximum credit is equal to the required operational storage capacity or 25 percent of a maximum day demand.

The existing and proposed storage reservoirs, in conjunction with available groundwater credit, were evaluated to determine whether the Dixon District's buildout water system has sufficient capacity to provide the required operational, emergency, and fire flow storage. As summarized in Table 9-2, the Dixon District is projected to have a water storage capacity deficit of 1.0 MG at buildout. Table 9-3 provides additional detail on buildout available storage capacity, groundwater credit, and required storage capacity.

Table 9-2. Comparison of Available and Required Storage Capacity

Available Storage Capacity, MG			Required Storage Capacity, MG				
Reservoir Capacity	Groundwater Credit[(a)]	Total	Operational	Emergency	Fire Flow	Total	Additional Storage Capacity Required[(b)], MG
0.4	2.3	2.7	0.9	1.8	1.0	3.7	1.0

(a) Equal to the sum of the Emergency Storage Credit and the Operational Storage Credit (see Table 9-3).
(b) Equal to required storage minus available storage.

The Station 10 site, one of the near term storage project that Cal Water planned for the Dixon District at 210 West F Street, could accommodate a 1 MG storage tank. Based on the existing system evaluation, a 0.3 MG was recommended to be located at Station 10 to improve the storage capacity deficit in the existing system. Consequently, the Station 10 site will only be able to provide space for an additional 0.7 MG storage tank, which is 0.3 MG less than what is required for the buildout system's water storage capacity.

To alleviate the remaining 0.3 MG storage capacity deficit for the buildout system, rehabilitation and/or replacement is recommended for Stations 4, 5, 6, 7 and 8. This recommendation is consistent with Chapter 4 based on the age of the existing wells and typical replacement schedules in the industry. At a minimum, the new flow capacity for each well that is being replaced will need to be near its original design flow capacity as indicated in Table 9-4.

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Table 9-3. Summary of Buildout Storage Requirements

[A]	[B]	[C]	[D]	[E]	[F] = [C] + [D] + [E]	[G]	[H]	[I]	[J]	[K] = [G] + [I] + [J]	[L] = [K] - [F]
		Required Storage Capacity, MG									
Station	Status	Operational[a]	Fire Flow[b]	Emergency[c]	Total Required Storage, MG	Reservoir Capacity, MG	Well Pump Capacity[d], MG	Emergency Storage Credit[e], MG	Operational Storage Credit[f], MG	Total Available Storage, MG	Storage Surplus (Deficit), MG
Station 1 Tank 1	Active					0.1	--				
Well 01-03	Active					--	0.7				
Well 02-01	Active					--	1.0				
Well 03-01	Active					--	0.9				
Well 04-01	Active					--	0.8				
Well 05-01	Active	0.9	1.0	1.8	3.7	--	0.6	1.8	0.5	2.7	(1.0)
Well 06-01	Active					--	0.5				
Well 07-01	Active					--	0.8				
Well 08-01	Active					--	0.4				
Well 09-01	Active					--	2.9				
Station 10 Tank 1	Active					0.3	--				
Total	--	--	--	--	--	0.4	8.6	--	--	--	--

[a] Based on 25 percent of a maximum day demand of 3.43 mgd (see Table 9-1).
[b] Based on Cal Water's fire flow criteria of 4,000 gpm multiplied by a 3 hour duration.
[c] Based on average day demand of 1.8 mgd (see Table 9-1).
[d] Pump capacity of wells with backup power.
[e] Equal to the minimum of either the sum of the total groundwater pumping capacity of active and proposed wells with backup power or the required emergency storage capacity.
[f] Equal to the minimum of either 38 percent of the difference between the firm groundwater pumping capacity (see Table 9-5) and maximum day demand (see Table 9-1) or the required operational storage capacity.

Table 9-4. Recommended Flow for Well Being Replaced

Pump Station	Existing Flow[(a)], gpm	Recommended Flow, gpm
Well 04-01	550	650
Well 05-01	450	600
Well 06-01	340	850
Well 07-01	550	800
Well 08-01	250	500

[(a)] Flow was based on historical production and field data provided by Cal Water on June 5, 2009.

No booster pump station is required for this recommended additional storage capacity for buildout demand condition. Based on the existing system evaluation (Chapter 8), a 5.18 mgd booster pump station was recommended to supply stored water to the distribution system. By adding additional storage, this improvement will alleviate the water storage capacity deficit in the buildout water system. Consequently, this improvement was added to the Dixon District buildout hydraulic model, to determine requirements for associated supply infrastructure, as discussed in the following sections.

Pumping Capacity

The Dixon District's pumping capacity was evaluated to assess its ability to deliver a reliable firm capacity at buildout of the service area. Firm capacity assumes a reduction in total pumping capacity to account for pumps that are out of service at any given time due to mechanical breakdowns, maintenance, water quality, or other operational issues. At each booster pump station, firm booster pumping capacity was defined as the total booster pump station capacity with the largest pump out of service. For groundwater well pumps, the firm groundwater pumping capacity was defined as the total active well capacity minus the two most critical wells or 90 percent of the total active well capacity, whichever is less. The two most critical wells under buildout conditions are Wells 09-01 and 02-01. Although Well 09-01 is not yet constructed, it is planned to have capacity up to 2,000 gpm, and to be drilled down into the deeper aquifer to alleviate groundwater quality issues due to nitrates. Consequently, this well is considered to be the most critical in the Dixon District. The second most critical well (Well 02-01) was determined using this criteria followed by an evaluation of the overall effect on water system pressures with the well removed from service.

The pumping capacity criterion for the Dixon District, described in additional detail in Chapter 5, requires the Dixon District's water system to have sufficient pumping capacity to meet the greater of either a maximum day demand concurrent with fire flow or a peak hour demand. The results of the pumping capacity evaluation are summarized in Table 9-5. Table 9-6 summarizes the pumping capacity of each station.

Table 9-5. Evaluation of Total Firm Pumping Capacity and Maximum Day Demand plus Fire Flow

Pump Station	Buildout Firm Pumping Capacity, gpm	Buildout Maximum Day Demand plus Fire Flow[a,b], gpm
Groundwater Wells	3,240[c]	6,385
Booster Pumps	2,100[d]	
Total, gpm	5,340	6,385
Pumping Capacity Deficit, gpm	1,045	

(a) Maximum day demand is equal to 1.9 times the average day demand.
(b) Fire flow demand = 4,000 gpm; this is the highest fire flow demand requirement recommended in the buildout water system.
(c) Defined as the total active well capacity minus the two most critical wells or 90 percent of the total active well capacity, whichever is less (see Table 9-5). Well status is defined in Chapter 2.
(d) Defined as the total booster pump station capacity with the largest pump out of service, however, the District currently has no booster pumps in the water distribution system.

The pumping capacity analysis indicates that the Dixon District's firm groundwater capacity does not meet the pumping capacity criterion for the entire service area during the governing flow scenario of maximum day demand plus fire flow. The Dixon District has a pumping capacity deficit of 1,045 gpm (1.5 mgd) during a maximum day demand plus fire flow scenario. To alleviate the pumping capacity deficit for buildout demand condition under the governing flow scenario of maximum day demand plus fire flow, an additional 1.5 mgd of pump capacity is recommended to be installed at Station 10. This improvement will be sufficient to provide a solution for the pumping capacity deficit in the buildout water system.

Critical Supply Facilities

All critical pumping facilities should be equipped with an on-site, backup power generator to provide pumping capacity during a power outage. Critical pumping facilities are defined as those facilities that provide service to service area(s) without sufficient emergency storage and that meet the following criteria:

- The largest pumping facility that provides water; and
- A pumping facility that provides water from key (depends on capacity, quality and location) groundwater supply wells.

As indicated in Table 9-6, Well 09-01 in the Dixon District address the criteria listed above and are proposed to be equipped with backup power generators to provide pumping capacity during a power outage. Since Well 02-01 is one of the most critical facilities, it is recommended that a backup power generator is provided at this station. In addition, any proposed pumping facilities for the buildout water system are assumed to have a backup power generator installed to improve supply reliability.

Table 9-6. Summary of Buildout Pumping Facilities

Pump Station	Backup Power	Status	Pump 1[a], gpm	Pump 2, gpm	Pump 3, gpm	Total Capacity, gpm	Firm Capacity[b], gpm
CIP 100	✓	Active	600	1,500	1,500	3,600	2,100
Well 01-03	✓[c]	Active	500	--	--	500	3,240
Well 02-01	✓[c]	Active	700	--	--	700	
Well 03-01	✓[c]	Active	600	--	--	600	
Well 04-01	✓	Active	550	--	--	550	
Well 05-01	✓	Active	450	--	--	450	
Well 06-01	✓	Active	340	--	--	340	
Well 07-01	✓	Active	550			550	
Well 08-01	✓	Active	250	--	--	250	
Well 09-01	✓[d]	Active	2,000	--	--	2,000	
						Total	5,340

[a] Flow capacity for Wells 01-03, 02-01 and 03-01 are based on design capacity assuming that R&R Well Replacement recommended in Chapter 7 for these wells are completed. Flow capacity for Wells 04-01-, 05-01, 06-01, 07-01 and 08-01 are based on measured capacity from historical production and field data from 2005 to 2009 provided by Cal Water on June 5, 2009.

[b] Firm capacity is defined as the total booster pumping capacity with the largest pump out of service. For groundwater well pumps, firm capacity is defined as the total active well capacity minus the two most critical wells or 90 percent of the total active well capacity, whichever is less. During the development of their WSFMP, Station 09-01 is under construction, and it is planned to supply groundwater from the deeper aquifer.

[c] When well is replaced, it is assumed that a backup power will be provided.

[d] Station is currently under construction, and it is assumed that a backup power will be provided at this station.

BUILDOUT WATER SYSTEM PERFORMANCE EVALUATION

This section discusses the performance criteria for and results of the buildout water distribution system evaluation. The proposed buildout water system, which includes improvements recommended from the buildout water system facility evaluation, is illustrated on Figure 9-3.

Buildout Water System Performance Criteria

Steady state hydraulic analyses using the updated model were conducted to identify areas of the buildout water system that do not meet the recommended system performance criteria as presented previously in Chapter 5. The results of the evaluation of the buildout water system are presented for the two demand scenarios listed below. For both scenarios, groundwater flow is defined by the firm groundwater pumping capacity, as discussed previously.

- Peak Hour Demand—A peak hour flow condition was simulated for the buildout distribution facilities to evaluate their capability to meet a peak hour demand scenario. Peak hour demands are met by the combined flows from groundwater and ground level storage reservoirs.
- Maximum Day Demand plus Fire Flow—To evaluate the buildout water system under the maximum day demand plus fire flow scenario, InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow while meeting the maximum day demand plus fire flow performance criteria within the buildout water system. Maximum day plus fire flow demands are met by the combined flows from groundwater and ground level storage reservoirs.

<u>Peak Hour Demand Scenario</u>

As shown in Table 9-1, the peak hour demand for the buildout Dixon District service area was calculated to be 3,966 gpm (5.71 mgd). This peak hour demand represents a peaking factor of 1.66 times the maximum day demand. During a peak hour demand scenario, a minimum pressure of 40 psi must be maintained throughout the water system. In addition, maximum head loss per thousand feet of distribution main should not exceed 10 ft/kft and maximum velocities should not exceed 7 fps. Details of the system pressures as simulated in the model under the peak hour demand scenario are discussed below.

<u>Maximum Day Demand plus Fire Flow Scenario</u>

As shown in Table 9-1, the maximum day demand for the buildout Dixon District service area was calculated to be 2,385 gpm (3.43 mgd). Fire flow demands were simulated at various locations within the Dixon District service area to determine if the minimum residual pressure criterion of 20 psi and maximum pipeline velocity criterion of 10 fps could be met during a maximum day demand plus fire flow scenario. The fire flow demands were assigned based on land use designations, and are listed below in Table 9-7. The recommended fire flow demands for the Dixon District are illustrated on Figure 9-4.

The maximum fire flow requirement evaluated in the buildout water system was 4,000 gpm for a duration of 3 hours. This criterion assumes that buildings are either fully sprinklered or non-sprinklered (Type V-B) up to 23,300 square feet. Non-sprinklered (Type V-B) buildings greater than 23,300 square feet may require a fire flow demand greater than 4,000 gpm. Building owners with fire flow demands above 4,000 gpm will require further discussions with Cal Water staff and the City's Fire Chief to determine how the fire flow deficiency will be addressed.

Table 9-7. Dixon District Buildout Water System Fire Flow Demand Requirements

Revenue Class[(a)]	Fire Flow, gpm[(b)]	Duration, hours[(b,c)]
Single Family Residential	1,500	3
Multi Family Residential	2,500	3
Commercial	3,000	3
Industrial	4,000	3
Government	4,000	3

(a) Revenue class assignment based on land use designations presented in Table 3-11.

(b) Specific fire flow demand requirements were determined from Table B105.1 of the 2007 CFC, and depend on construction type and fire area. These fire flow requirements are based on buildings being fully sprinklered under the Commercial, Industrial and Government revenue classes. See Table 5-2 for further explanation on how the fire flow demand requirements were developed.

(c) Fire flow duration was based on discussions with the local Fire Marshal.

Recommended Improvements Criteria

The buildout water system is expected to deliver peak hour flows and maximum day demand plus fire flow within the acceptable pressure, velocity and head loss ranges as identified in the performance criteria presented in Chapter 5. However, the system was evaluated using pressure as the primary criterion. Recommended improvements needed to comply with the performance criteria were added to the buildout water system to fix any deficiencies found and are also described below.

As discussed in the following section, a large number of the existing system junctions within the model failed to meet the maximum day demand plus fire flow performance criteria. Recommended improvements to meet the residual pressure requirement of 20 psi and maximum pipeline velocity requirement of 10 fps during a maximum day demand plus fire flow scenario would require the replacement of a substantial amount of the existing water distribution system. Cal Water is not required to address existing system deficiencies associated with fire flow requirements[2]. Therefore, in lieu of including these projects in the CIP for this WSFMP, it is recommended that the District consider fire flow requirements when sizing pipelines that are otherwise scheduled to be replaced. Evaluation results are discussed below.

[2] Public Utilities Commission. *General Order 103*, page 27.

Buildout Water System Evaluation Results

This section addresses the results of the peak hour demand and maximum day demand plus fire flow analyses.

Peak Hour Demand Scenario

During a peak hour demand scenario, results indicate that the buildout water system can adequately deliver peak hour demands to meet the Dixon District's minimum pressure criterion of 40 psi as illustrated on Figure 9-5. Under this scenario, system pressures ranged from approximately 43 to 52 psi.

As illustrated on Figure 9-5, all the pipelines in the buildout water system met the maximum velocity criterion during a peak hour demand scenario. However, some pipelines, primarily those located downstream of a pump station, did not meet the maximum head loss criterion. The following list details pipelines in the buildout water system that exceeded the maximum head loss criterion of 10 ft/kft.

- The existing 8-inch diameter pipeline downstream of the pump at Station 7 had head loss of 10.7 ft/kft.
- The existing 8-inch diameter pipeline along 2nd Street, northeast of downstream of the Station 02-01 had head loss of 21.3 ft/kft. The pipeline was assigned with a pipeline minor loss in addition to the pipeline roughness coefficient for Asbestos Cement pipe by IDModeling.
- The existing 4-inch diameter pipeline along Mayes Street between 4th Street and 5th Street had head loss of 10.3 ft/kft.

Because pipeline head loss is a secondary criterion, no improvements for pipelines exceeding the head loss criterion in the buildout water system are recommended unless the primary criterion (pressure) is not met.

Maximum Day Demand plus Fire Flow Scenario

Fire flow demands were assigned based on the proximity of the fire flow junction to the recommended fire flow demands as shown on Figure 9-4. Fire flow demands at these junctions were then simulated at various locations within the hydraulic model. Results indicate that a large number of the junctions failed to meet the performance criteria for a maximum day demand plus fire flow scenario. Consequently, InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow (while meeting the maximum day demand plus fire flow performance criteria) at each junction within the buildout water system under a maximum day demand scenario.

Figure 9-6 illustrates the available fire flow at each junction within the buildout water system. These available fire flows were simulated to meet Cal Water's performance criteria under maximum day demand plus fire flow where minimum residual pressure criteria is 20 psi and the maximum velocity in the pipelines is 10 fps. As shown on Figure 9-6, results indicate that there are numerous areas where the available fire flow while meeting the maximum day demand plus

fire flow performance criteria was less than the minimum required fire flow of 1,500 gpm as shown in Table 9-7. At most of these locations, the pipelines are undersized and would need to be replaced by larger diameter pipelines to supply a minimum fire flow of 1,500 gpm while meeting the maximum day demand plus fire flow performance criteria.

Cal Water is not required to upgrade the Dixon District's existing water system to meet the fire flow requirements as shown in Table 9-7. The required upgrades are extensive, and completion of the upgrades solely to meet fire flow requirements would be cost prohibitive. Therefore, it is not recommended that the improvements necessary to fix these fire flow deficiencies be identified as projects in the Dixon District's CIP. However, it is recommended that Cal Water staff should consider these fire flow deficiencies as a factor for sizing future main replacement projects. Consequently, WYA has provided Appendix N to list the simulated available fire flow to meet the maximum day demand plus fire flow performance criteria (residual pressure of 20 psi and maximum pipeline velocity of 10 fps) within the Dixon District's buildout water system. Appendix N would allow Cal Water staff to locate areas within the buildout water system that have simulated deficient fire flows within the hydraulic model.

Because the overall available fire flows in the Dixon District while meeting both performance criteria of 20 psi minimum residual pressure and 10 fps of maximum velocity in the pipeline are less than 1,500 gpm, as illustrated on Figure 9-6, WYA also simulated the maximum day demand plus fire flow condition using the Dixon District's buildout demand scenario to only meet the minimum residual criteria of 20 psi. Figure 9-7 presents the available fire flows within the Dixon District's buildout service area while only meeting the minimum residual pressure of 20 psi. These results provide Cal Water a range of available fire flow under two different performance criteria, and they also provide Cal Water the flexibility to determine the priority of pipeline replacement in near future. WYA has provided Appendix O to list the simulated available fire flow to meet the maximum day demand plus fire flow performance criteria (residual pressure of 20 psi) within the Dixon District's buildout water system.

As shown on Figure 9-7, the available fire flow on the eastside of the Hall Park area is less than 1,500 gpm. The residual pressures in this area during maximum day demand plus fire flow conditions are less than 20 psi. This area is mainly served through two distribution mains: an existing 6-inch diameter pipeline on East A Street; and an existing 8-inch diameter pipeline on Doyle Lane. The nearest supply source into this area is Well 02-01. To provide a fire flow of 1,500 gpm while meeting the minimum 20 psi residual pressure criteria, a new 12-inch diameter pipeline (approximately 1,133 feet) is recommended. As shown on Figure 9-8, this pipeline extends from the existing 8-inch diameter pipeline at the intersection of Chestnut Street and Hall Park Drive to the intersection of 7th and 8th Street.

SUMMARY OF RECOMMENDED IMPROVEMENTS FOR THE BUILDOUT WATER SYSTEM

The recommended improvements needed to eliminate deficiencies identified in the evaluation of the buildout water distribution system are summarized below and shown on Figure 9-3.

Storage Facilities

- To alleviate the storage capacity deficit, a new 0.7 MG ground level storage reservoir should be constructed at Station 10 near 210 West F Street.

Pumping Facilities

- To alleviate the pumping capacity deficit, an additional 1.5 mgd of pump capacity should be added to Station 10 booster pump station.

Pipelines

- To meet the minimum residual pressure during a maximum day demand plus fire flow scenario, install a new 12-inch diameter pipeline near Hall Park, from intersection of Chestnut Street and Hall Park Drive to the intersection of 7th and 8th Street as shown on Figure 9-8.

Backup Power

- Install backup power at Station 02-01.

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LEGEND:

- Active Well
- Active Well Currently Under Construction
- Potable Water Storage
- Existing Pipeline
- Existing Pipeline Currently Under Construction
- Proposed Future Pipeline
- Dixon District
- Street
- Railroad

N

0 400 800 1,600

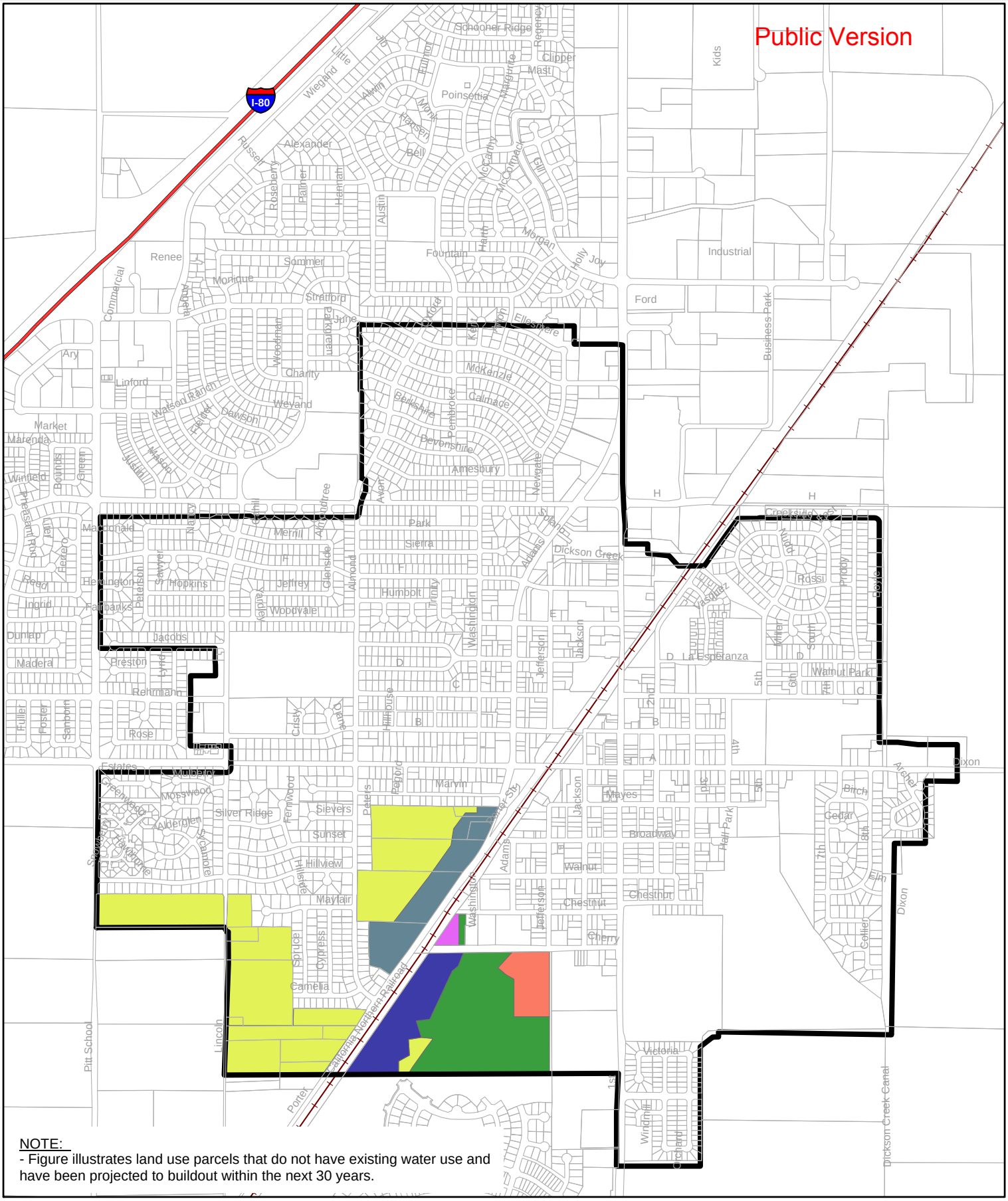
Scale in Feet

FIGURE 9-1

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

FUTURE WATER SYSTEM

WEST YOST ASSOCIATES
Consulting Engineers



NOTE:
- Figure illustrates land use parcels that do not have existing water use and have been projected to buildout within the next 30 years.

LEGEND:

- Commercial Service
- General Industrial
- Low Density
- Medium High Density
- Medium Low Density
- Very Low Density Residential
- Cal Water Dixon District Boundary
- Highway
- California Northern Railroad

FIGURE 9-2

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

FUTURE LAND USE PARCELS

WEST YOST ASSOCIATES
Consulting Engineers

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LEGEND:

- Potable Water Storage
- Active Well
- Active Well Currently Under Construction
- Proposed Future Pumped Storage
- Existing Pipeline
- Existing Pipeline Currently Under Construction
- Proposed Future Pipeline
- Dixon District
- Street
- Railroad

N

0 400 800 1,600

Scale in Feet

FIGURE 9-3

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

PROPOSED FUTURE DISTRIBUTION SYSTEM IMPROVEMENTS

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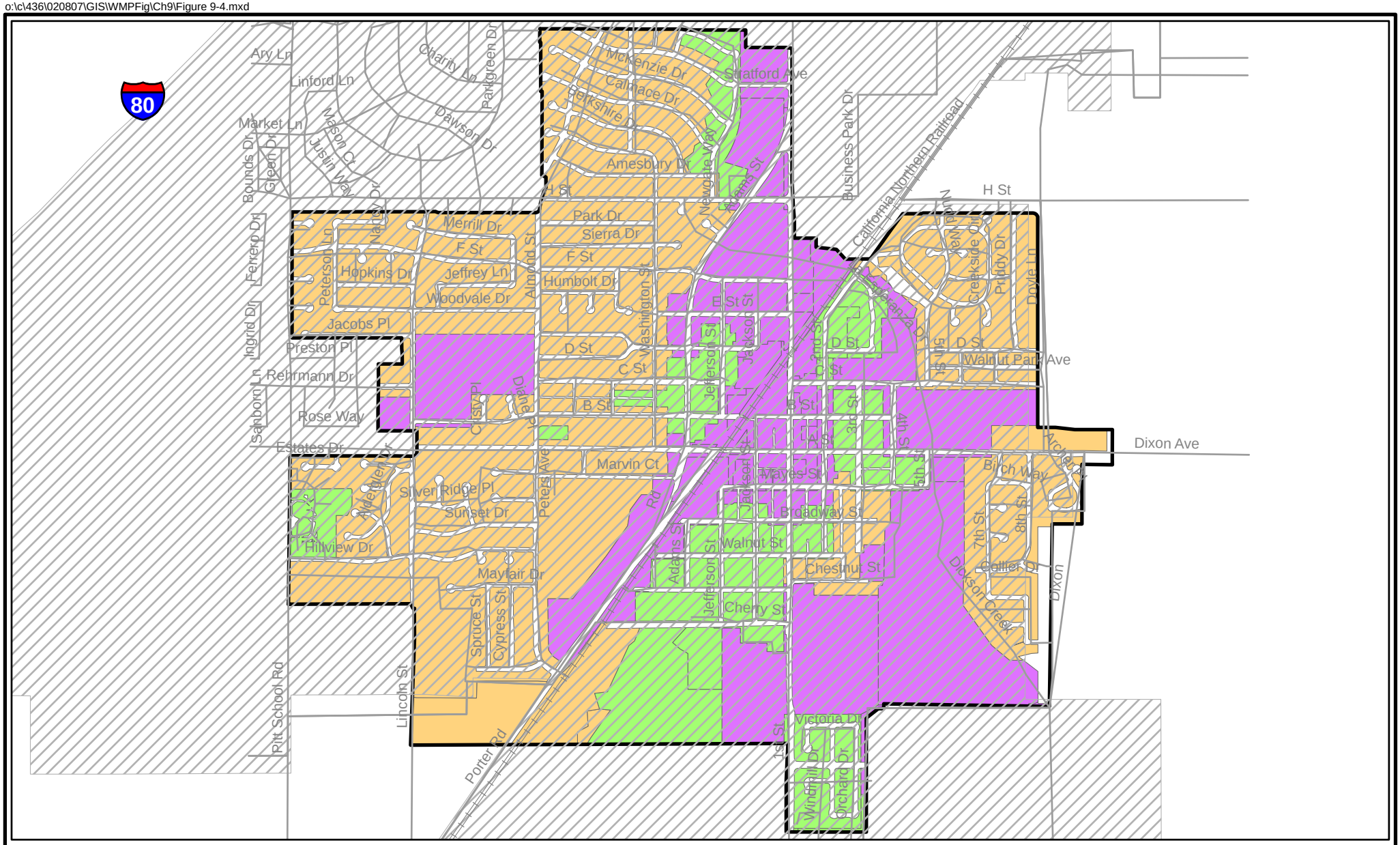

LEGEND:

- 1,500 gpm for 3 hours
- 2,500 gpm for 3 hours
- 4,000 gpm for 3 hours
- Street
- Railroad
- City of Dixon
- Dixon District

N

0 405 810 1,620

Scale in Feet

FIGURE 9-4

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

BUILDOUT SYSTEM
FIRE FLOW DEMANDS

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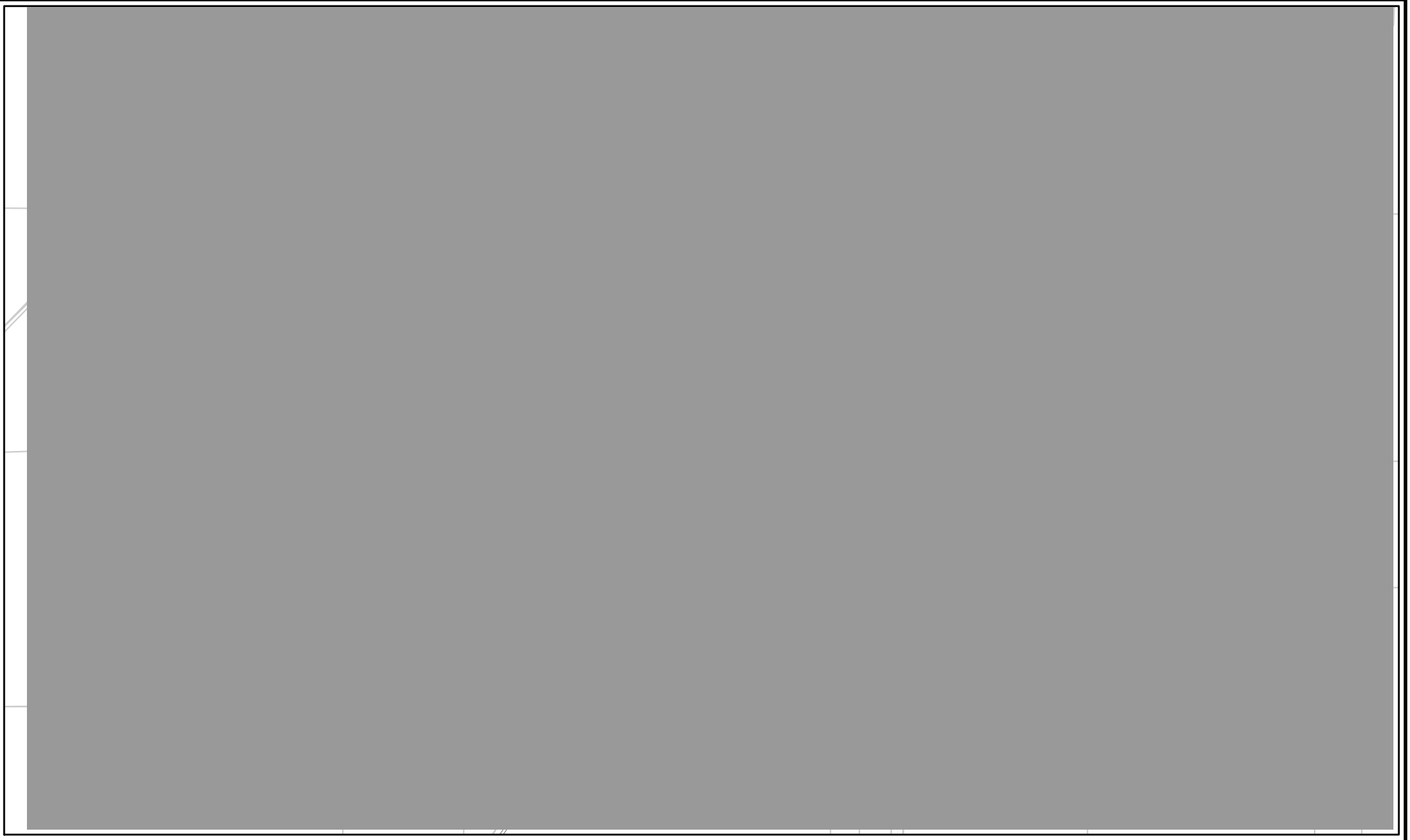

LEGEND:

- Storage with Pump Station
- Dixon District
- Active Well
- Potable Water Storage
- Pressure < 40 psi
- 40 psi ≤ Pressure ≤ 45
- 45 psi < Pressure ≤ 50
- 50 psi < Pressure ≤ 55
- Velocity ≤ 7 fps
- Velocity > 7 fps
- Street
- Railroad

N

0 405 810 1,620

Scale in Feet

FIGURE 9-5

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

BUILDOUT SYSTEM PEAK HOUR DEMAND ANALYSIS

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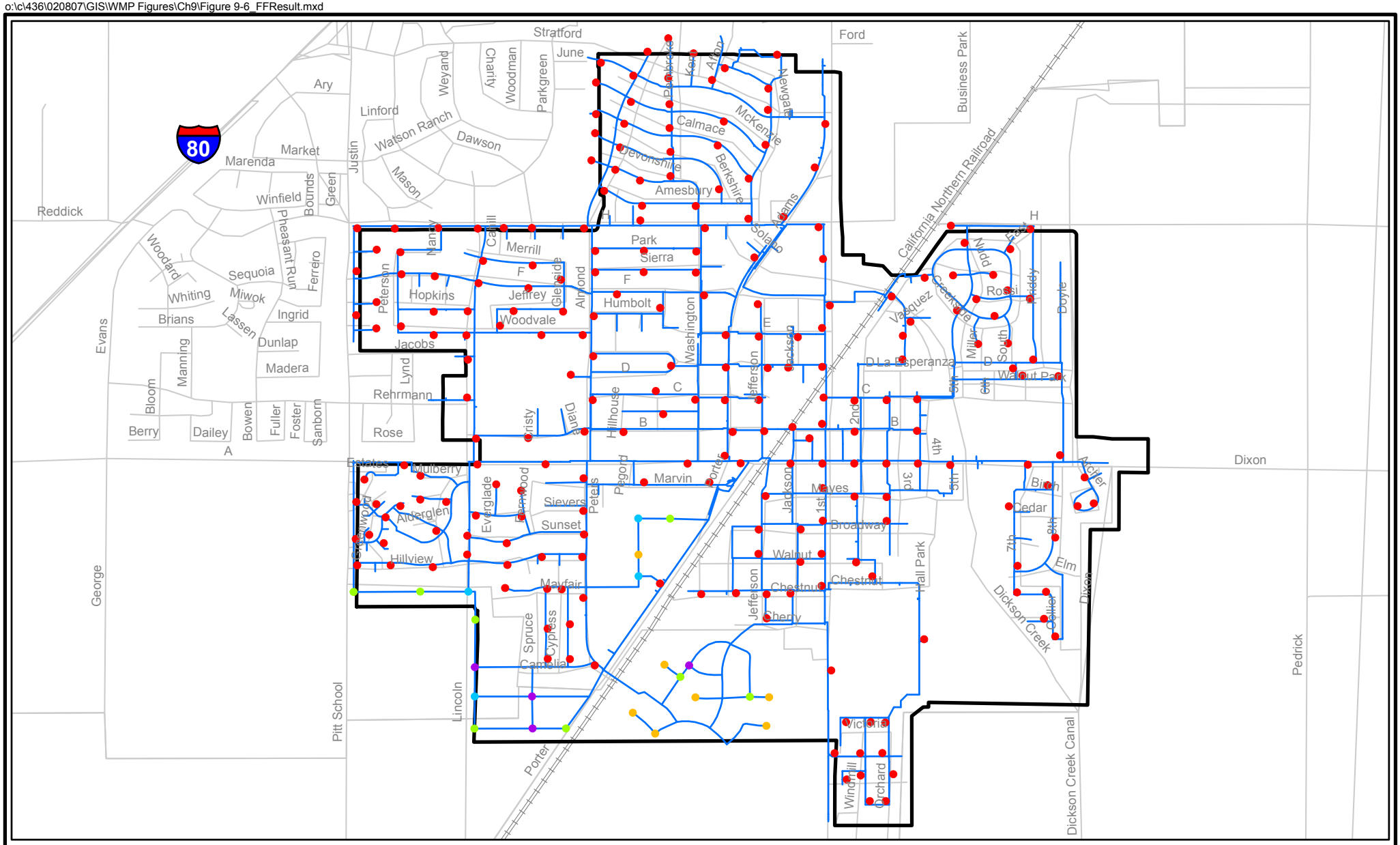

LEGEND:

- Dixon District
- Pipelines
- Street
- Railroad

- Available Fire Flow < 1,500 gpm
- 1,500 gpm ≤ Available Fire Flow ≤ 2,500 gpm
- 2,500 gpm < Available Fire Flow ≤ 3,000 gpm
- 3,000 gpm < Available Fire Flow ≤ 4,000 gpm
- Available Fire Flow > 4,000 gpm

N

0 410 820 1,640

Scale in Feet

FIGURE 9-6

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

BUILDOUT SYSTEM AVAILABLE FIRE FLOW
(Residual Pressure ≥ 20 psi & Velocity ≤ 10 fps)

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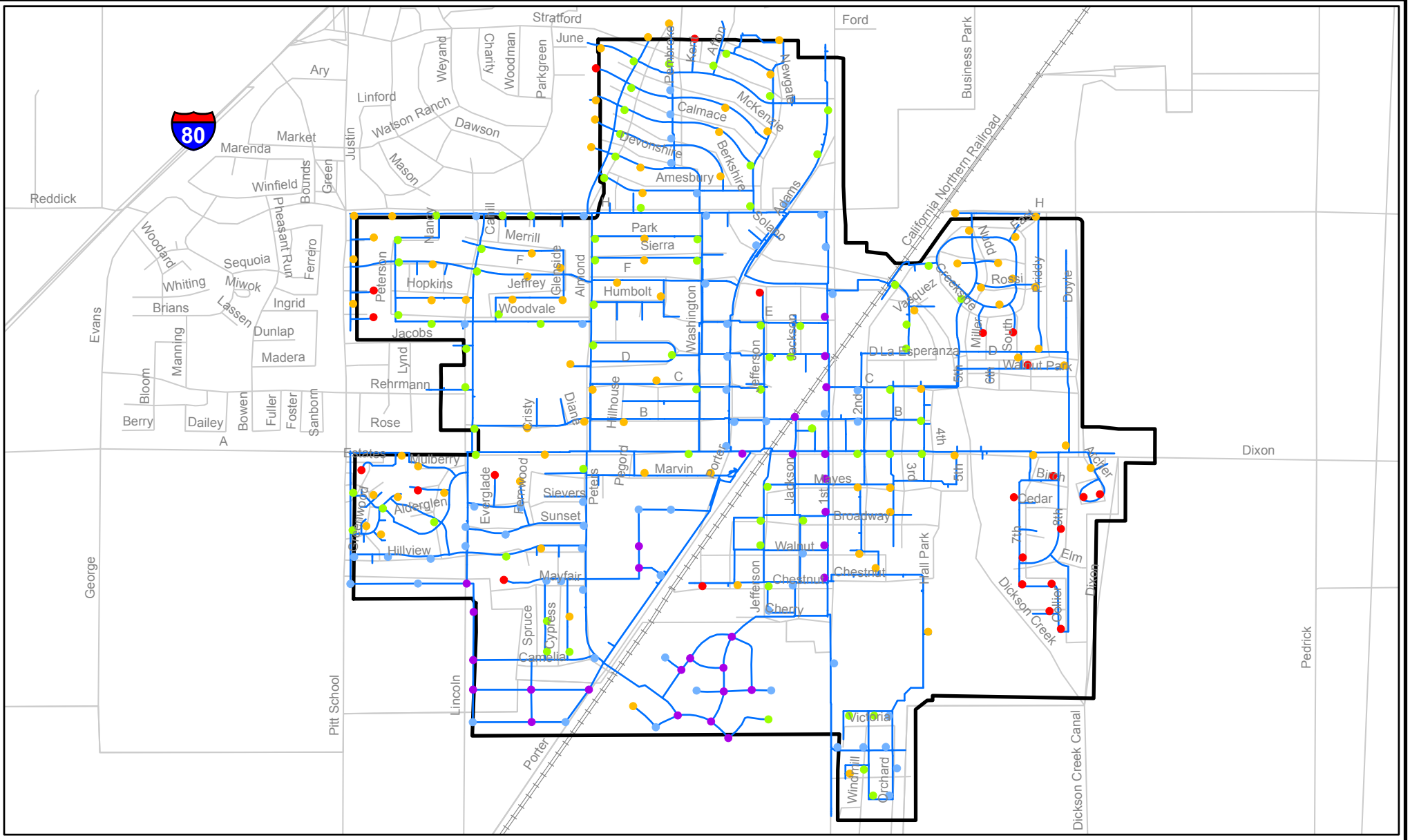

LEGEND:

- Dixon District
- Pipeline
- Street
- Railroad

- Available Fire Flow < 1,500 gpm
- 1,500 gpm ≤ Available Fire Flow ≤ 2,500 gpm
- 2,500 gpm < Available Fire Flow ≤ 3,000 gpm
- 3,000 gpm < Available Fire Flow ≤ 4,000 gpm
- Available Fire Flow > 4,000 gpm

N

0 412.5 825 1,650

Scale in Feet

FIGURE 9-7

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

BUILDOUT SYSTEM AVAILABLE FIRE FLOW
(Residual Pressure ≥ 20 psi)

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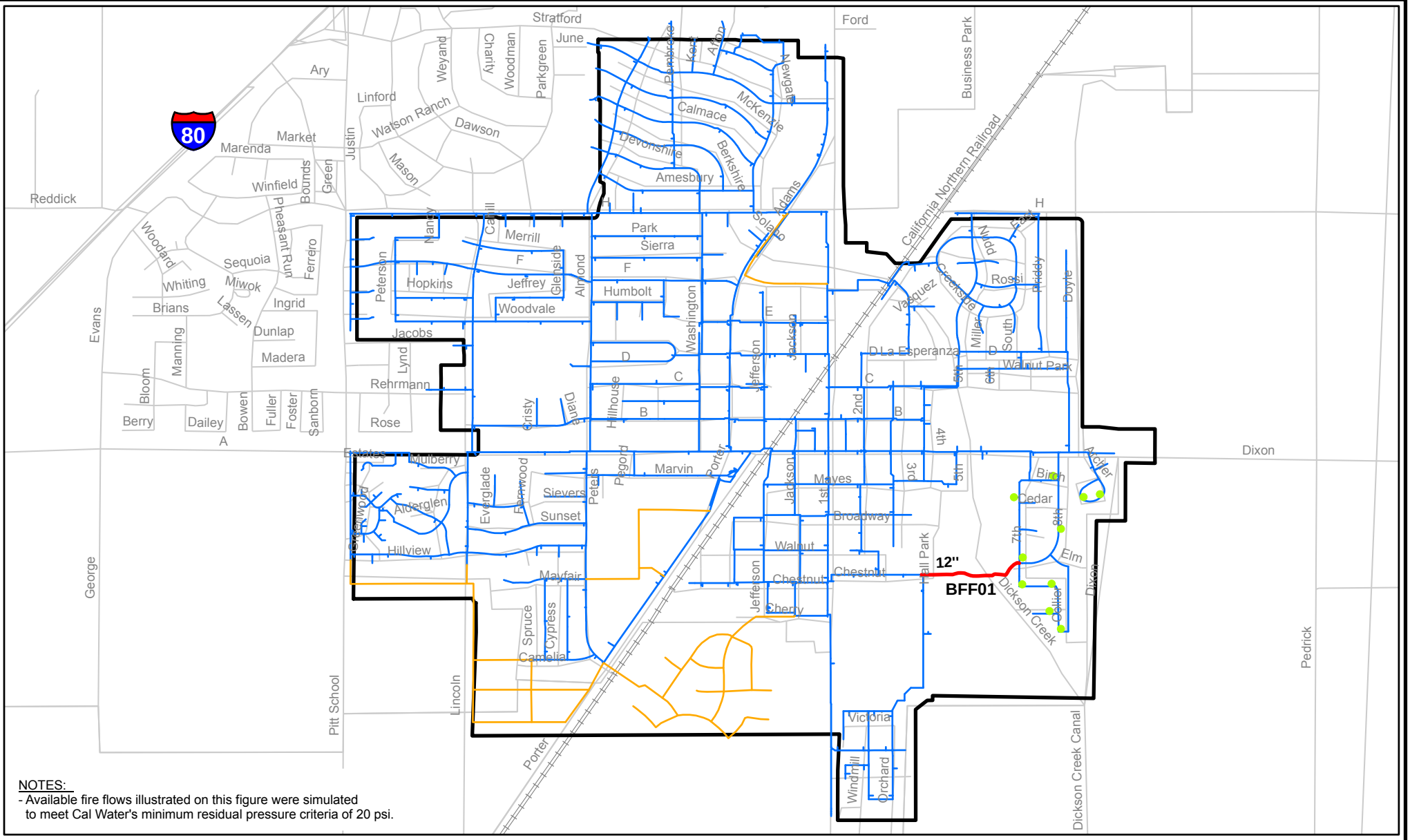

NOTES:
- Available fire flows illustrated on this figure were simulated to meet Cal Water's minimum residual pressure criteria of 20 psi.

LEGEND:

- Available Fire Flow < 1,500 gpm
- 1,500 gpm ≤ Available Fire Flow ≤ 2,500 gpm
- Proposed Fire Flow Improvement - New Pipeline
- Existing Pipelines
- Future Pipelines
- Dixon District
- Street
- Railroad

N

0 412.5 825 1,650

Scale in Feet

FIGURE 9-8

California Water Service Company
Dixon District Water Supply
and Facilities Master Plan

FUTURE SYSTEM FIRE FLOW IMPROVEMENTS

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APPENDIX A

Cal Water Census Block Data

2.2 Service Area Population

Cal Water's Dixon District is growing at a measured rate. Growth in total services has averaged 0.21% in the past five years.

The land within the Dixon District service area that can sustain development is limited, and the Solano Irrigation District, which has taken on municipal and industrial service in its designated service area, surrounds the district. Therefore, Cal Water does not anticipate any significant growth.

The housing development for the City of Dixon is projected to grow at a slow rate of 0.5%. Some developments are slated by the City of Dixon's planning division (Dixon Downs, Brookfield Project, and Valley Glen); however, these projects are outside of Cal Water's Service Area. A major segment of land is available for development which is adjacent to Cal Water's eastern boundary, but currently no development plans exist. Any growth potential for near future in the District will be limited to redevelopment.

Based on 2000 U.S. Census data, considering actual service connection growth and assuming that density has remained unchanged since the census was conducted, Cal Water estimates that, as of December 2005, the district's population is approximately 9,278. A density of 3.145 persons per residential service (single family services plus multifamily units) was used for this estimate.

Estimate of the population serviced by Cal Water is based on overlaying the U.S. Census 2000 Block data with the service area map (SAM), as shown in Figure 2.2-1. A summary of the census data for the Year 2000 is shown in Table 2.2-1. LandView 5 and MARPLOT ® software were used to generate the data[2].

Cal Water estimates the service area's population could reach 10,650 by 2030. Table 2.2-2 lists the population growth in 5 year increments.

Table 2.2-1: Summary of Census 2000 Data

	Census Blocks	Population	Housing Units
Dixon Service Area	118	9,102	2,906

APPENDIX B

Cal Water Best Management Practices

Table 7.2-1: Water Conservation Best Management Practices	
No.	**BMP Name**
1	Water survey programs for single-family residential and multifamily residential connections
2	Residential plumbing retrofit
3	System water audits, leak detection and repair
4	Metering with commodity rates for all new connections and retrofit of existing connections
5	Large landscape conservation programs and incentives
6	High-efficiency washing machine rebate programs
7	Public information programs
8	School education programs
9	Conservation programs for commercial, industrial, and institutional accounts
10	Wholesale agency assistance programs
11	Conservation pricing
12	Conservation coordinator
13	Water waste prohibition
14	Residential Ultra Low Flush Toilet (ULFT) replacement programs

7.3 Economic Analysis Methodology and Assumptions

An economic analysis was conducted for six of the 14 BMPs that are described in the MOU (i.e. BMP nos. 1, 2, 5, 6, 9, and 14). Economic analyses were not done for BMPs 3, 7, 8, 10, 11, and 13 because they are essentially non-quantifiable, but essential to the success of those BMPs that are quantifiable. An economic analysis was not done for BMP 4 since this BMP has been fully implemented.

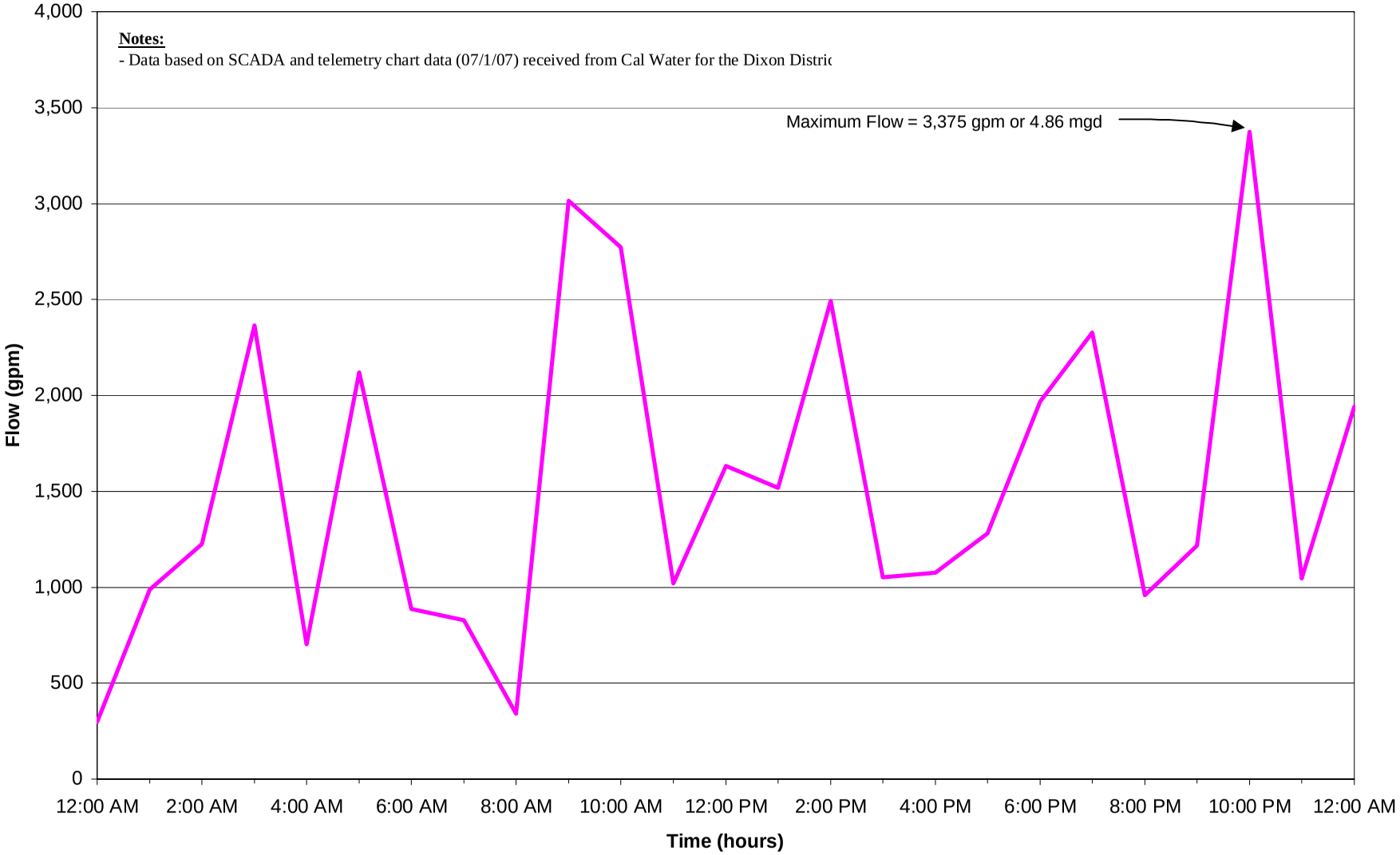
Assumptions used in the economic analysis for each BMP are described in Table E-1 (Appendix H). Directly beneath each assumption is a brief description of the rationale and/or supporting evidence for that assumption. Common assumptions for all BMPs are the value of conserved water ($479/ac-ft), the real discount rate (6.15%), and the overhead rate (13%). The real discount rate is calculated from the assumed real cost of money (8.82%) and the assumed long-term inflation rate (2.52%) using the precise conversion method [9](page A-2 of Ref.). Housing information and a breakdown of the number of connections for each connection category used for the economic analysis are presented in Table 7.3-1 and 7.3-2.

Table 7.3-1: Housing Estimates and Projections (1997)		
Year	Single family dwelling units	Multifamily dwelling units
1991	2,420	263
1997	2,539	266
2000	2,635	--
2005	2,763	--
2010	2,897	--
2015	3,037	--
2020	3,184	--
2030		

APPENDIX C

Peak Hour Diurnal Curves

Dixon District Diurnal for July 1, 2007



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Last Revised: 10/24/08

California Water Service Company
Dixon District
Water Supply and Facilities Master Plan

Public Version

APPENDIX D

Geologic Map

Public Version

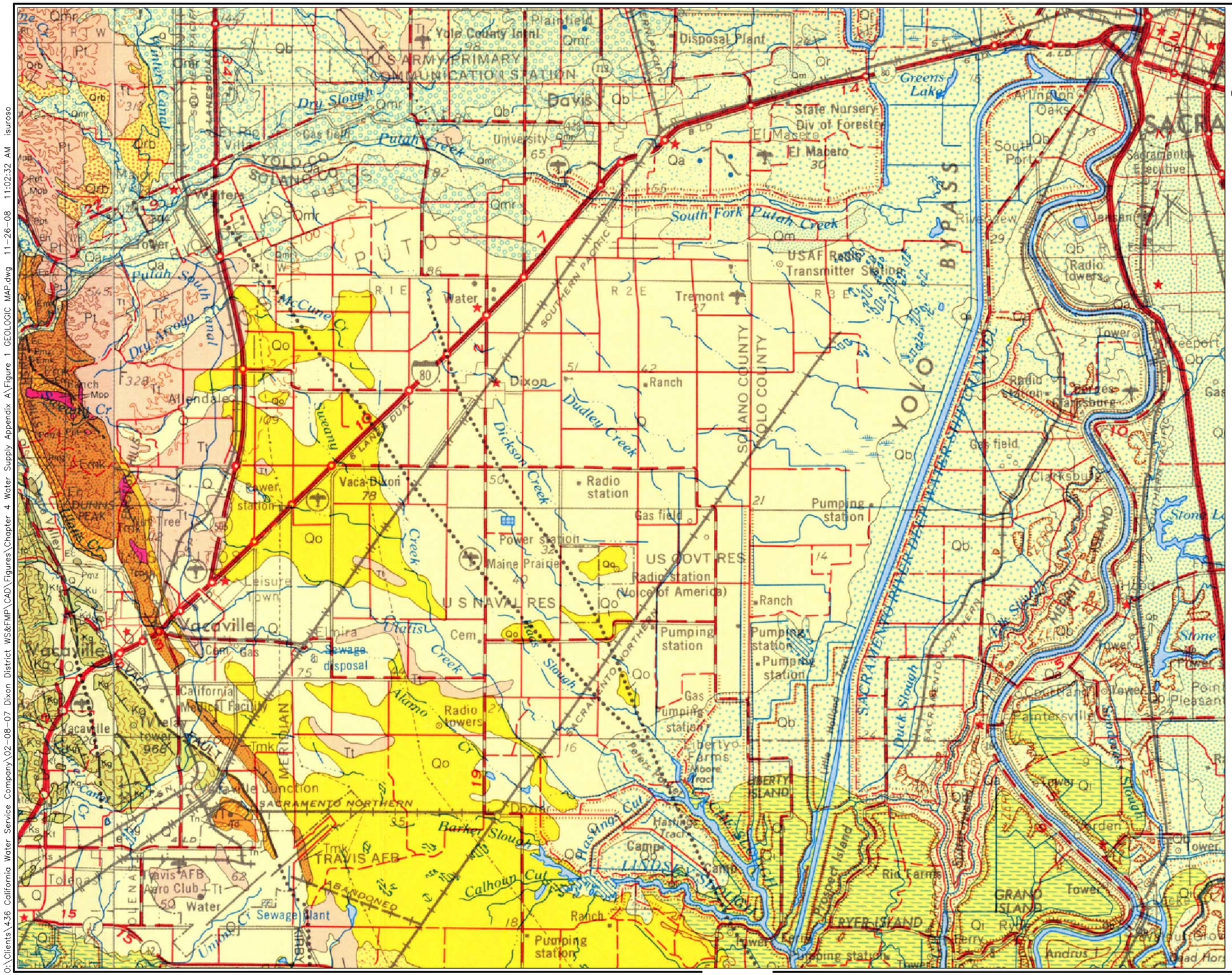
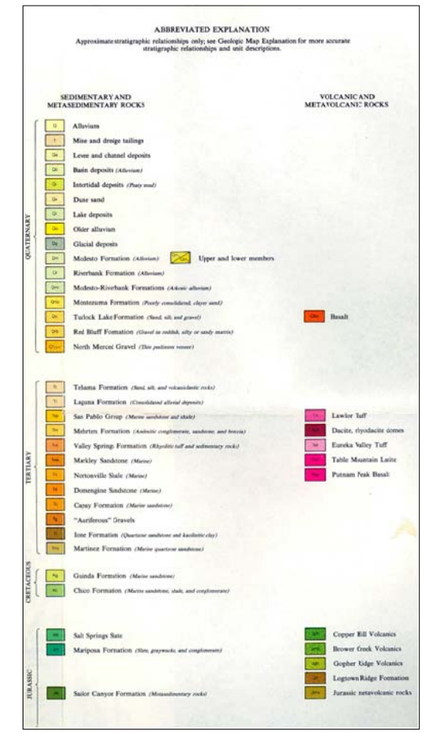


FIGURE 1
California Water Service Company Dixon District Water Supply and Facilities Master Plan
GEOLOGIC MAP

LEGEND



REFERENCE

California Geological Survey, 1981, Geologic Map of the Sacramento Quadrangle, compiled by D.L. Wagner, C.W. Jennings, T.L. Bedrossian and E.J. Bortugno, 1:250,000, second printing 1987.

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WEST YOST & ASSOCIATES

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APPENDIX E

Groundwater Management Technical Memorandum

Public Version

WEST YOST ASSOCIATES
Consulting Engineers

TECHNICAL MEMORANDUM NO. 1

DATE: February 22, 2006 Project No.: 074-00-04-06

TO: Thomas Pate

FROM: Kenneth Loy

SUBJECT: Assessment of AB 3030 Plans for SB 1938 Compliance

INTRODUCTION

This technical memorandum (TM) was prepared by West Yost Associates (WYA) in support of the Solano County Water Agency's (SCWA) efforts to assist Solano Irrigation District (SID), Maine Prairie Water District (MPWD), Reclamation District 2068 (RD 2068) and the City of Vacaville in updating their existing groundwater management plans to be compliant with recent amendments to the California Water Code (CWC) resulting from Senate Bill No. 1938 (SB 1938), Machado. These agencies share a common groundwater basin and are seeking to manage the basin to the benefit of all stakeholders, while maintaining their individual groundwater management plans. Stakeholders in the groundwater basin include Solano County, the Rural North Vacaville Water District (RNVWD), the City of Dixon, Dixon-Solano Municipal Water Service (DSMWS), and California Water Service Company (CWSC). These stakeholders do not have their own groundwater management plans.

Much of the groundwater management information contained in this TM was obtained from California Department of Water Resources (DWR) *Bulletin 118 – Update 2003: California's Groundwater* (DWR, 2003). Additional detailed information can be found in Bulletin 118 and in *California Groundwater Management, A Resource for Future Generations*, Second Edition (Groundwater Resource Association of California, 2005).

PURPOSE AND SCOPE

The purpose of this TM is to document basin management objectives (BMOs) that the agencies hold in common, provide recommendations for updating each agency's existing groundwater management plan to be consistent with SB 1938, and to provide recommendations for involving other basin stakeholders in groundwater management activities. The scope of the effort included: reviewing the four agencies' groundwater management plans and supporting documents to determine the currently documented objectives and existing institutional agreements that could be used to promote cooperative management of the groundwater basin; and meeting with the

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agencies on June 2, 2004 and November 23, 2004 to discuss the needs and priorities of the individual agencies, and the objectives that they have in common.

SCWA AND STAKEHOLDER BACKGROUND

SCWA was established in 1951 as the Solano County Flood Control and Water Conservation District (SCFC&WCD) under the governance of the Solano County Board of Supervisors. The governing board was expanded in 1988 to include:

- Solano County Board of Supervisors
- Mayors of the Cities of Vallejo, Benicia, Suisun City, Dixon, Rio Vista, Fairfield and Vacaville
- SID
- MPWD
- RD 2068

In 1989 the name of SCFC&WCD was changed to SCWA.

The Solano Water Authority (SWA) was established in 1987 as a joint exercise of powers agency comprised of the SCWA members. SCWA and SWA are legally separate entities but have close coordination. The SWA conducts its work through project agreements. One such project agreement, known as SWA Project 4 (SWA-4), the Coordinated Groundwater Data Analysis Project, is a study of the shared groundwater basin. The study is supported by the entire stakeholder group. The active participants are:

- SID
- City of Vacaville
- City of Dixon
- MPWD
- RD 2068
- Solano County
- SCWA

The purpose of SWA-4 has been to provide data for groundwater management. Data collection activities have been performed by the participating agencies, DWR and the U.S. Bureau of Reclamation. SCWA compiles and manages the data, and SWA-4 member agencies periodically confer on the status of the groundwater basin to determine the need for future actions.

Goals, objectives and accomplishments to date under SWA-4 include:

- Development of a DWR-format database allowing the filing of all relevant, publicly available groundwater data collected to date in Solano County
- Coordination of monthly, semiannual and annual water level monitoring
- Preparation of groundwater monitoring reports documenting the historical and prevailing groundwater conditions
- Support to the member agencies in the development of groundwater management plans.

DWR developed an initial database for the groundwater basin in 1992. SCWA began management of the local groundwater database in 1994, under the auspices of the SWA-4.

Coordinated groundwater monitoring was also initiated through SWA in 1994. SWA issued the first annual groundwater monitoring report in 1996.

Other groundwater basin stakeholders include the RNVWD, DSMWS, and CWSC. RNVWD delivers groundwater to rural Solano County residents. RNVWD is directed by members of the Solano County Board of Supervisors and is, therefore, represented in the SWA-4 stakeholder group. DSMWS supplies groundwater to the City of Dixon as a joint exercise of powers agency operated by SID and administered by the City of Dixon. These two agencies provide the DSMWS with representation in the SWA-4 stakeholder group. CWSC also operates wells that are used for public drinking water supply within the City of Dixon.

The North Central Solano County Groundwater Resources Report, dated May 16, 1995, recommended that the Cities of Vacaville and Dixon, SID, and Solano County jointly prepare an acceptable monitoring program to allow the groundwater resources of the North Central Solano County area to be safely managed and maintained into the future. The recommended principles of a "staged mitigation" monitoring plan are:

1. Conduct a monitoring period of at least five years to establish a baseline condition of the aquifer.
2. If during this five year period static groundwater levels are observed to be dropping relative to historical levels or set thresholds, then a two year cautionary period should be invoked and monitoring increased.
3. If water levels do not recover or continue to drop during the cautionary period, then groundwater dependency should be reduced until groundwater levels stabilize

The Master Water Agreement between SID and the City of Vacaville, dated May 25, 1995, incorporates the staged mitigation monitoring methodology. Solano County and the City of Dixon have incorporated the recommended principles into CEQA documents where relevant. Solano County, upon formation of the Rural North Vacaville Water District, agreed to enter into a Memorandum of Understanding with the City of Dixon, City of Vacaville and SID.

REQUIREMENTS UNDER SB 1938

SB 1938 establishes a revised framework for groundwater management plans with the intent of encouraging local agencies to work cooperatively to manage groundwater resources. SB 1938 became effective on January 1, 2003 through amendments to CWC Section 10750 *et. seq*. To be eligible for funding administered by the DWR, the CWC revisions require local agencies to:

1. Make available to the public a written statement describing the manner in which interested parties may participate in development of the plan, which may include appointing a technical advisory committee.
2. Prepare and implement a groundwater management plan that includes BMOs for the groundwater basin that is subject to the plan.
3. Include components relating to the monitoring and management of groundwater levels within the groundwater basin, groundwater quality degradation, inelastic land

subsidence, and changes in surface water flow and quality that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin. Consider additional components listed in CWC Section 10753.8 (a) through (l).

4. Prepare a plan that involves other agencies and enables the local agency to work cooperatively with other public entities whose service areas or boundaries overlie the groundwater basin.
5. Adopt monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic subsidence in basins for which subsidence has been identified as a potential problem and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin. The monitoring protocols should be designed to generate information that promotes efficient and effective groundwater management and supports attainment of the BMOs.
6. Prepare a map that details the areas of the groundwater basin, as defined in DWR Bulletin 118, the area that will be subject to the plan, and the boundaries of the local agencies overlying the basin.

A seventh component requires agencies not overlying groundwater basins to prepare plans incorporating items 1 through 6 using geologic and hydrologic principles appropriate to those areas. Appendix A contains the complete list of required and recommended components of local groundwater management plans from the 2003 update of DWR Bulletin 118.

The listed requirements apply to DWR-administered funding authorized or appropriated after September 1, 2002 and do not apply to grants from the Local Groundwater Assistance Fund (AB303).

DEFINITION OF BASIN MANAGEMENT OBJECTIVES (BMOS)

BMOs are the objectives that groundwater managers set to support the overall goal of maintaining a long-term, sustainable, reliable supply of acceptable quality water for beneficial use in their local area. BMOs are the local agency's means of identifying and prioritizing the most important issues in meeting their water resources needs. BMOs can range from being entirely qualitative to entirely quantitative. Each BMO should have a criterion or threshold, which can be used to assess progress towards the BMO and trigger management actions. Complying with the groundwater management plan components required under SB 1938 results in the establishment of BMOs for the management of:

- Groundwater elevations
- Groundwater quality degradation
- Inelastic land subsidence
- Changes in surface water flow and quality that directly affect groundwater levels or quality, or are caused by groundwater pumping in the basin.

The thresholds for each BMO may be established based on evaluation of historical monitoring data or a monitoring program designed to establish the thresholds. The staged mitigation methodology

described in the Master Water Agreement between SID and the City of Vacaville, dated May 25, 1995, is a procedure for developing groundwater level thresholds based on monitoring of pumping volumes and groundwater levels. Analogous staged mitigation methodologies could also be developed for the BMOs relating to groundwater quality, inelastic land subsidence and groundwater/surface water interactions.

Land subsidence due to groundwater withdrawal is triggered by decreases in pore pressure in a confined aquifer system containing clay layers (typically, montmorillonite clay). The decrease in pore pressure increases the effective stress on the aquifer skeleton. If this effective stress exceeds the maximum stress to which the aquifer skeleton has been subjected in the past, the clay layers will undergo permanent compaction. Unacceptable levels of land subsidence have not occurred in Solano County or southern Yolo County. Therefore, the historical minimum groundwater elevations may provide thresholds below which the risk of land subsidence increases. In areas in which groundwater development is occurring in deeper aquifer zones with relatively sparse histories of groundwater elevation monitoring, alternative thresholds may be needed, because the reduction in pore pressure associated with groundwater withdrawal in these zones are unprecedented. In these areas, initial thresholds may need to be established based on repeat surveys of land subsidence benchmarks, or a combination of groundwater elevations and repeat surveys.

Other useful examples may be found in adopted groundwater management plans. Glenn County and the Sacramento Groundwater Authority (SGA) have adopted groundwater management plans that are SB 1938 compliant. Glenn County adopted BMOs on August 21, 2001. The Glenn County plan is implemented by county ordinance and can be found at http://www.countyofglenn.net/common/countycode. SGA adopted its groundwater management plan on December 11, 2003. These plans encompass multiple agencies and allow the agencies to establish their own BMOs, as in the case of Glenn County, or implement independent management actions under a set of over-arching BMOs established collaboratively, as in the SGA plan. Groundwater monitoring is conducted on a regular basis. Meetings are also held on a regular basis to review BMOs and plan management actions. The plans may be considered starting points for basin management and may be modified over time as needs and conditions change.

SUMMARY OF MEMBER AGENCY OBJECTIVES DOCUMENTED IN EXISTING AB 3030 GROUNDWATER MANAGEMENT PLANS

Each of the agencies in Solano County has individually adopted an AB 3030 groundwater management plan. Table 1 summarizes the management goal, or objective, documented in each of the existing plans.

Table 1. Primary Goal or Objective of Existing Groundwater Management Plans

Agency	Plan Adoption Date	Primary Goal or Objective of Existing GMP
City of Vacaville	February 28, 1995	To preserve the capacity of the basin to yield high quality water without excessive drawdown.
Maine Prairie Water District	January 21, 1997	Work cooperatively with landowners to most efficiently manage and monitor groundwater resources (to maintain a reliable water supply for potential future emergency water supply needs).
Reclamation District 2068	January 9, 1997	Work cooperatively with landowners to most effectively manage and monitor groundwater resources (to maintain a reliable water supply for potential future emergency water supply needs).
Solano Irrigation District	February 28, 1995	To monitor and analyze groundwater use and trends and recommend any necessary actions for the wise use of groundwater resources.

BMOs COMMON TO ALL AGENCIES

It is recommended that each agency's updated groundwater management plan contain a statement of the agency's overall purpose or goal in adopting the plan. This statement of purpose or overall goal should include language pertaining to:

> "maintaining a long-term, sustainable, reliable supply of high quality water for beneficial use in their local area."

Each plan should then present the BMOs in the context of meeting the agency's overall goal. Figure 1 illustrates the relationship between the agency's overall goal, BMOs and resulting management actions. The BMOs that the agencies hold in common are those associated with managing groundwater elevations, groundwater quality, and land subsidence. As described above, these represent three of the four required groundwater management components under CWC Section 10750 *et. seq.* The fourth required component, changes in surface water flow and quality that directly affect groundwater levels or quality, or are caused by groundwater pumping in the basin, have not been identified as priority issues by all agencies. It appears likely that any BMOs developed to address this required component of groundwater management plans will be based on the needs of the individual agencies.

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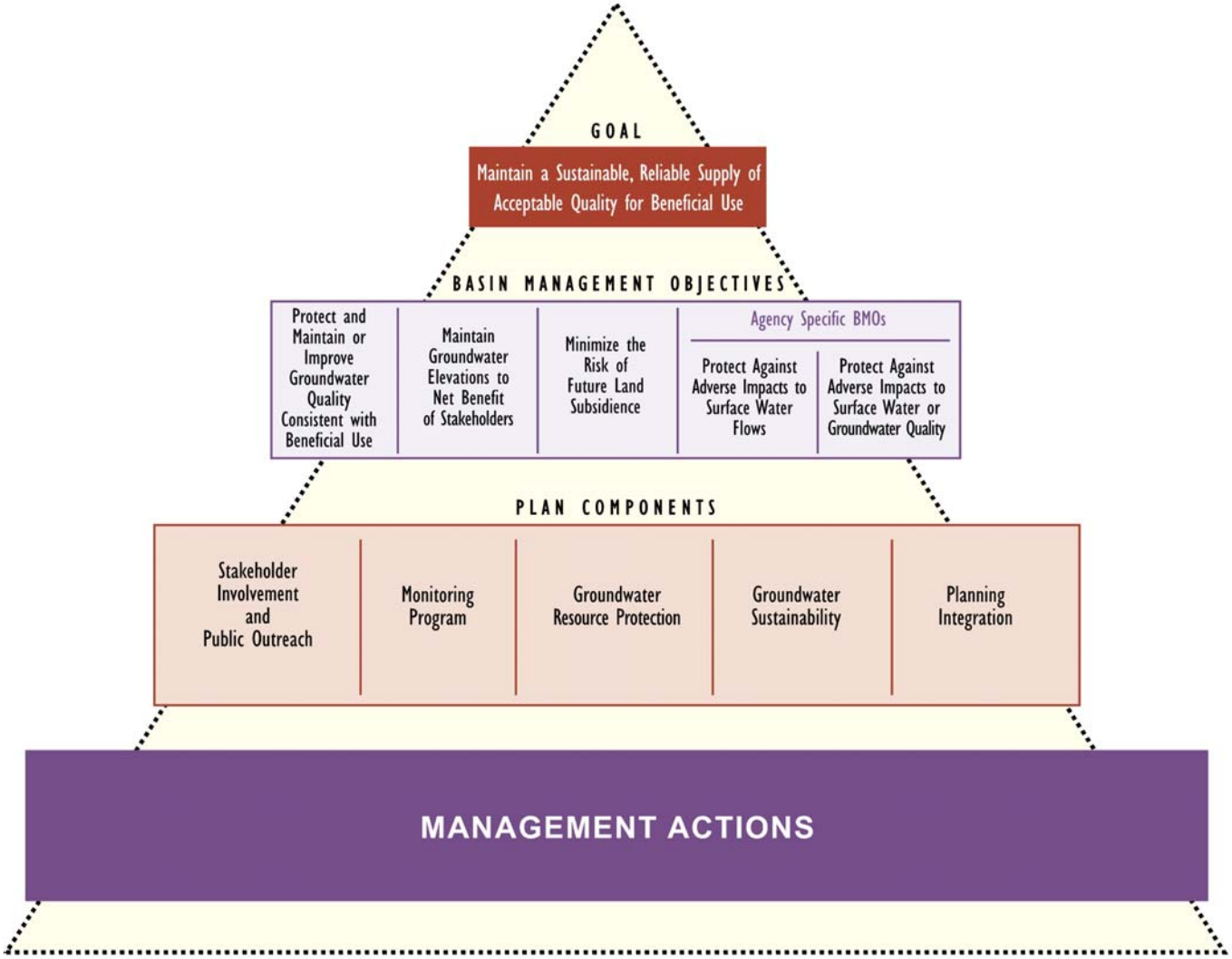

Figure 1

Solano County Water Agency
Groundwater Management Planning Assistance

Relationship of Management Goal, Basin Management Objectives and Management Actions

The three BMOs held in common by the agencies are as follows.

1. **Maintain groundwater elevations that result in a net benefit to basin groundwater users.** The individual agencies may choose to elaborate on this BMO to define net benefits and costs within their institutional boundaries or within management subareas contained within their boundaries. Example definitions of net benefit include:

   - Maintaining an affordable, reliable supply for irrigation or municipal and industrial use
   - Maintaining a reliable emergency or dry-year supplemental supply
   - Mitigating high groundwater table conditions to the benefit of agricultural or other interests.

   The costs associated with declining groundwater elevations include energy costs and capital cost for deepening or replacing wells.

   The agencies may also choose to tailor the BMO to add greater specificity, as required to meet individual agency or subarea management needs. For example, agencies that plan to use groundwater conjunctively with surface and/or recycled water may want to specify that groundwater elevations will be maintained at varying levels, depending on hydrologic and economic conditions and that the impact of short-term declines will be offset over time by the conjunctive use program.

2. **Protect and maintain or improve groundwater quality, consistent with its beneficial use, for the benefit of basin groundwater users.** The individual agencies may choose to elaborate on this BMO in regards to the types of sources (point and nonpoint) that could degrade groundwater quality and the beneficial uses of groundwater (agricultural, municipal and industrial) within their boundaries or management subareas, since these are the primary factors influencing the scope of management activities and associated monitoring. County, state and federal agencies are responsible for most management and oversight functions associated with point sources.

3. **Minimize the risk of future significant impact due to inelastic land subsidence.** Differential land subsidence and associated earth fissuring resulting from groundwater withdrawal have had significant consequences in several California groundwater basins. Significant impacts have not been reported in Solano County or southern Yolo County. However, the risk of future significant impacts depends on a complex array of variables including: the degree of new groundwater development, especially in areas or at depths not previously exploited; changing land use, which could bring to light an impact that would otherwise go unnoticed; and the mineral composition of the aquifer skeleton, and its consolidation history. In light of these uncertainties, all of the agencies may choose to state that they plan to monitor groundwater levels as a factor indicative of an increased risk of land subsidence and take appropriate actions if groundwater elevations fall to critical thresholds, as described above. Agencies developing groundwater in new or deeper zones, or increasing production in deeper zones, may also choose to state that they will regularly perform level surveys of subsidence benchmarks established at key locations within their service areas.

The BMOs should be linked to management actions that are planned or triggered to attain the BMOs and the overall groundwater management goal (Figure 1).

RECOMMENDATIONS FOR GROUNDWATER MANAGEMENT PLAN UPDATES

Appendix B contains a proposed outline for groundwater management plans based on the CWC Section 10750 *et. seq.* requirements. The proposed outline is intended as a template that can be tailored to the specific needs of each agency, while maintaining overall consistency across plans. It should be noted that not all of the items in the outline are required to maintain funding eligibility under CWC Section 10750 *et. seq*. Some of the items are voluntary under CWC Section 10750 *et. seq*., and others are recommended by DWR. Table 2 lists the required and voluntary components of CWC Section 10750 *et. seq.*, and components recommended by DWR, indexed to the sections of the outline that are recommended for each agency.

It is anticipated that SID and Vacaville will have more comprehensive groundwater management plans than the other agricultural water agencies, because the former have a wider range of supplies, are actively engaged in integrated water management and are using water from deeper aquifer zones. Vacaville also requires higher water quality for public drinking water supply. Although SID is an agricultural water agency, it manages and maintains groundwater supply and distribution facilities for the City of Dixon through the DSMWS joint exercise of powers authority. SID's updated groundwater management plan could include the DSMWS service area as a management area, or a separate groundwater management plan could be developed for DSMWS.

It is recommended that the agencies use the proposed outline as a guide to developing their respective groundwater management plans and for identifying the plan sections that can be developed jointly and applied in all of the individual plans. This will help to facilitate mutual involvement in development of the individual plans, as required by CWC Section 10750 *et. seq.* (item 5 in Table 2). Further recommendations are as follows.

SWA-4 Role. The SWA-4 group should consider becoming the coordinator and facilitator of the groundwater management planning activities within the basin. In this role, SWA-4 could provide a forum for the agencies to coordinate the groundwater management planning process. After updated plans are adopted, the SWA-4 member agencies could meet periodically to facilitate review and discussion of groundwater management efforts, if requested.

The SWA-4 coordination efforts currently include SID, the Cities of Dixon and Vacaville, MPWD, RD 2068, Solano County and SCWA. The SWA-4 coordination should be expanded to include the RNVWD, DSMWS, and CWSC. Including all basin stakeholders will provide a wide variety of perspectives in the planning process, and SWA-4 could provide a mechanism for fostering cooperation between the stakeholders. The SWA-4 focus should remain on local groundwater management.

Table 2. Summary of Recommended Groundwater Management Plan Components

Description	Plan Sections			
	Solano Irrigation District	Maine Prairie Water District	Reclamation District 2068	City of Vacaville
A. CWC § 10750 *et seq*., Mandatory Components				
1. Documentation of public involvement statement	3.3.1.3	3.3.1.3	3.3.1.3	3.3.1.3
2. Basin Management Objectives (BMOs)	3.2	3.2	3.2	3.2
3. Monitoring and management of groundwater elevations, groundwater quality, inelastic land surface subsidence, and changes in surface water flows and quality that directly affect groundwater levels or quality or are caused by pumping	3.3.2	3.3.2	3.3.2	3.3.2
4. Plan to involve other agencies located within groundwater basin	3.3.1.2	3.3.1.2	3.3.1.2	3.3.1.2
5. Adoption of monitoring protocols by basin stakeholders	3.3.2, 6.0	3.3.2, 6.0	3.3.2, 6.0	3.3.2, 6.0
6. Map of groundwater basin showing area of agency subject to GMP, other local agency boundary as defined in DWR bulletin 118	Figure 1	Figure 1	Figure 1	Figure 1
7. For agencies not overlying groundwater basins, prepare GMP using appropriate geologic and hydrogeologic principals	NA	NA	NA	NA
B. DWR's Suggested Components				
1. Manage with guidance of advisory committee	3.3.5.2	3.3.5.2	3.3.5.2	3.3.5.2
2. Describe area to be managed under GMP	2.0	2.0	2.0	2.0
3. Create link between BMOs and goals and actions of GMP	Figure 3	Figure 3	Figure 3	Figure 3
4. Describe GMP monitoring program	3.3.2, Figure 2	3.3.2, Figure 2	3.3.2, Figure 2	3.3.2, Figure 2
5. Describe integrated water management planning efforts	3.3.5	3.3.5	3.3.5	3.3.5
6. Report on implementation of GMP	4.1	4.1	4.1	4.1
7. Evaluate GMP periodically	4.2	4.2	4.2	4.2
C. CWC § 10750 *et seq*., Voluntary Components				
1. Control of saline water intrusion	3.3.4.5	NA	NA	3.3.4.5
2. Identification and management of wellhead protection areas and recharge areas	3.3.4	NA	NA	3.3.4
3. Regulation of the migration of contaminated groundwater	3.3.4.4	NA	NA	3.3.4.4
4. Administration of well abandonment and well destruction program	3.3.4.1	NA	NA	3.3.4.1
5. Mitigation of conditions of overdraft	3.3.3	NA	3.3.3.1, 3.3.3.3	3.3.3
6. Replenishment of groundwater extracted by water producers	3.3.3	NA	3.3.3.1, 3.3.3.3	3.3.3
7. Monitoring of groundwater levels and storage	3.3.2	3.3.2	3.3.2	3.3.2
8. Facilitating conjunctive use operations	3.3.3.1	NA	3.3.3.1	3.3.3.1
9. Identification of well construction policies	3.3.4.1	NA	NA	3.3.4.1
10. Construction and operation by local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects	3.3.4.4, 3.3.3	NA	3.3.3.1	3.3.4.4, 3.3.3
11. Development of relationships with state and federal regulatory agencies	3.3.1.4	3.3.1.4	3.3.1.4	3.3.1.4
12. Review of land use plans and coordination with land use planning agencies to assess activities that create reasonable risk of groundwater contamination	3.3.5.1.5	3.3.5.1.5	3.3.5.1.5	3.3.5.1.5

Management Area Definitions. The individual agencies should consider identifying management areas and sub-areas within their service areas. Management areas and sub-areas should be defined based on physical, institutional and legal boundaries. BMOs should be developed down to the level of the individual management areas using a process that accounts for overlapping spheres of influence and the cumulative effects of groundwater production by multiple stakeholders.

Clear Linkage of Goals, BMOs and Actions. Each groundwater management plan should clearly state the goals of the agency and provide links between these goals, the supporting BMOs and actions that are planned or triggered to attain the BMOs. This linkage is illustrated on Figure 1. The plan components should include consideration of:

- Well spacing
- Wellhead protection
- Groundwater monitoring protocols
- Mitigation measures for declining groundwater elevations
- Protocols for monitoring inelastic land subsidence.

Appendix B outlines all of the groundwater management plan components.

Integration of Water Management Planning Efforts. Groundwater is the focus of the groundwater management plan updates. However, the individual agencies should consider describing any current or planned actions to coordinate with other land use, zoning or integrated water resources planning efforts in their local area or affecting their local area. This could include, for example, plans for conjunctive use of surface water and groundwater, use of recycled water, and protection of recharge areas.

Reports on Implementation. Although not required, reports on implementation should be prepared by the individual agencies to address groundwater conditions within their respective service areas. These periodic reports should summarize the condition of the portion of the groundwater basin within each agency's service area, the results of any management actions, and provide recommendations for future actions. SW-4 may provide a useful forum for reviewing the implementation reports and coordinating management actions.

Periodic Evaluation of the Plans. SWA-4 should consider developing a schedule and procedures for updating other stakeholders within the groundwater basin of issues or hydrogeologic conditions that would or could impact the effectiveness of existing groundwater management plans. This could also include evaluation of the management actions taken by the agencies to determine whether similar actions could be expected to be successful in the future.

Seek Grant Funding for an Expanded Monitoring Program. The SWA-4 member agencies should consider submitting a grant application to fund an expanded groundwater monitoring network. Possible funding sources include the Local Groundwater Assistance Grant Program (AB 303) administered by DWR, and the Integrated Regional Water Management Grant Program under Proposition 50, administered jointly by DWR and the State Water Resources Control Board.

APPENDIX A

Required and Recommended Components of Local Groundwater Management Plans

Appendix A
Required and Recommended Components of Local Groundwater Management Plans

From the 2003 Update of DWR Bulletin 118

Section 71050 et seq. of the Water Code, commonly referred to as Assembly Bill 3030, stipulates certain procedures that must be followed in adopting a groundwater management plan under this section.

Amendments to Section 10750 et seq. added the requirement that new groundwater management plans prepared under Section 10750 et seq. must include component 1 below (SB1938 (Stats 2002, Ch 603)).

In addition, the amendments mandate that if the agency preparing the groundwater management plan intends to apply for funding administered by the California Department of Water Resources (DWR) for groundwater or groundwater quality projects, the agency must prepare and implement a groundwater management plan that includes components 2, 3, 6, 7 and 9 below. DWR recommends that all the components below be included in any groundwater management plan to be adopted and implemented by a local managing entity.

Consideration and development of these components for the specific conditions of the basin to be managed under the plan will help to ensure effective groundwater management. In developing these criteria, DWR recognizes that the goal of a groundwater management plan and the goal of an ordinance to manage groundwater should be the same—assurance of a long-term, sustainable, reliable, good quality groundwater supply. Such efforts can benefit greatly from cooperative management within the basin or region.

None of the suggested data reporting in the components below should be construed as recommending disclosure of information that is under State law.

1. Include documentation that a written statement was provided to the public "describing the manner in which interested parties may participate in developing the groundwater management plan," which may include appointing a technical advisory committee (Water Code § 10753.4 (b)).
2. Include a plan by the managing entity to "involve other agencies that enables the local agency to work cooperatively with other public entities whose service area or boundary overlies the groundwater basin." (Water Code § 10753.7 (a) (2)). A local agency includes "any local public agency that provides water service to all or a portion of its service area" (Water Code § 10752 (g)).
3. Provide a map showing the area of the groundwater basin, as defined by DWR Bulletin 118, with the area of the local agency subject to the plan as well as the boundaries of other local agencies that overlie the basin in which the agency is developing a groundwater management plan (Water Code § 10753.7 (a) (3)).
4. Establish an advisory committee of stakeholders (interested parties) within the plan area that will help guide the development and implementation of the plan and provide a forum for resolution of controversial issues.
5. Describe the area to be managed under the plan, including:
    a. The physical structure and characteristics of the aquifer system underlying the plan area in the context of the overall basin.
    b. A summary of the availability of historical data including, but not limited to, the components in Section 7 below.

c. Issues of concern including, but not limited to, issues related to the components in Section 7 below.

d. A general discussion of historical and projected water demands and supplies.

6. Establish management objectives (MOs) for the groundwater basin that is subject to the plan. (Water Code § 10753.7 (a)(1)).

7. Include components relating to the monitoring and management of groundwater levels, groundwater quality, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping. (Water Code § 10753.7 (a)(1)). Consider additional components listed in Water Code § 10753.8 (a) through (l).

8. For each MO, describe how meeting the MO will contribute to a more reliable supply for long-term beneficial uses of groundwater in the plan area, and describe existing or planned management actions to achieve MOs.

9. Adopt monitoring protocols for the components in Section 7 (Water Code § 10753.7 (a) (4)). Monitoring protocols are not defined in the Water Code, but the section is interpreted to mean developing a monitoring program capable of tracking changes in conditions for the purpose of meeting MOs.

10. Describe the monitoring program, including:

    a. A map indicating the general locations of any applicable monitoring sites for groundwater levels, groundwater quality, subsidence stations, or stream gages.

    b. A summary of monitoring sites indicating the type (groundwater level, groundwater quality, subsidence, stream gage) and frequency of monitoring. For groundwater level and groundwater quality wells, indicate the depth interval(s) or aquifer zone monitored and the type of well (public, irrigation, domestic, industrial, monitoring).

11. Describe any current or planned actions by the local managing entity to coordinate with other land use, zoning, or water management planning agencies or activities (Water Code § 10753.8 (k), (l)).

12. Provide for periodic report(s) summarizing groundwater basin conditions and groundwater management activities. The report(s), prepared annually or at other frequencies as determined by the local management agency, should include:

    a. Summary of monitoring results, including a discussion of historical trends.

    b. Summary of management actions during the period covered by the report.

    c. A discussion, supported by monitoring results, of whether management actions are achieving progress in meeting MOs.

    d. Summary of proposed management actions for the future.

    e. Summary of any plan component changes, including addition or modification of MOs, during the period covered by the report.

    f. Summary of actions taken to coordinate with other water management and land use agencies, and other government agencies.

13. Provide for the periodic re-evaluation of the entire plan by the managing entity.

14. For local agencies not overlaying groundwater basins, plans should be prepared including the above listed components and using geologic and hydrologic principals appropriate to those area (Water Code § 10753.7 (a)(5)).

APPENDIX B

Proposed Outline for SB-1938 Groundwater Management Plans

Appendix B
Proposed Outline for SB-1938 Groundwater Management Plans

Note: Table B-1 is an index of the required and voluntary components of CWC Section 10750 *et. seq.*, and components recommended by DWR.

1.0 Introduction

- 1.1 Agency Description and Overview
- 1.2 Authority
- 1.3 Overview of Regional Planning Efforts
- 1.4 Purpose of the Agency Groundwater Management Plan
- 1.5 Organization of the Groundwater Management Plan

2.0 Basin Description and Agency Water Supplies

- 2.1 Summary Basin Description
  - 2.1.1 Location
  - 2.1.2 Summary Hydrogeologic Description
- 2.2 Water Supplies
  - 2.2.1 Current Supplies
  - 2.2.2 Planned or Potential Future Supplies
- 2.3 Known Groundwater Management Issues

3.0 Groundwater Management Goal and Plan Structure

- 3.1 Overall Groundwater Management Goal
- 3.2 Basin Management Objectives
- 3.3 Groundwater Management Plan Components
  - 3.3.1 Agency Coordination, Stakeholder Involvement and Public Outreach
    - 3.3.1.1 Agency Coordination through SWA
    - 3.3.1.2 Involvement of Other Agencies within and near the Plan Area
    - 3.3.1.3 Public Involvement Process
    - 3.3.1.4 Relationships to State and Federal Regulatory Agencies
  - 3.3.2 Monitoring Program
    - 3.3.2.1 Groundwater Elevation Monitoring
    - 3.3.2.2 Groundwater Quality Monitoring
    - 3.3.2.3 Land Subsidence Monitoring
    - 3.3.2.4 Groundwater-Surface Water Interaction Monitoring
    - 3.3.2.5 Data Management
    - 3.3.2.6 Data Quality Assurance and Quality Control
  - 3.3.3 Groundwater Sustainability
    - 3.3.3.1 Conjunctive Use
    - 3.3.3.2 Water Recycling

3.3.3.3 Water Conservation

3.3.4 Groundwater Protection

3.3.4.1 Well Construction and Destruction Policies
3.3.4.2 Wellhead Protection Policies
3.3.4.3 Protection of Recharge Areas
3.3.4.4 Management of Sources of Groundwater Contamination
3.3.4.5 Control of Saline Water Intrusion

3.3.5 Planning Integration

3.3.5.1 Existing Integrated Planning Efforts

3.3.5.1.1 SCWA Groundwater Management Planning Efforts
3.3.5.1.2 SWA Projects
3.3.5.1.3 Urban Water Management Planning
3.3.5.1.4 DWSAP Program
3.3.5.1.5 Land Use Planning

3.3.5.2 SWA Advisory Committee

4.0 Plan Implementation

4.1 Annual Groundwater Management Report
4.2 Future Groundwater Management Plan Updates
4.3 Financing

5.0 References

6.0 Appendices

Appendix A. Standard Operating Procedure for Conducting Manual Groundwater Level Measurements

List of Figures

Figure	Title
1	Map of the Groundwater Sub-basin and Agency Boundaries
2	Groundwater Monitoring and Land Subsidence Monitoring Locations
3	Plan Goal, BMOs and Management Actions

Table B-1. Summary of Recommended Groundwater Management Plan Components

Description	Plan Sections			
	Solano Irrigation District	Maine Prairie Water District	Reclamation District 2068	City of Vacaville
A. CWC § 10750 *et seq*., Mandatory Components				
1. Documentation of public involvement statement	3.3.1.3	3.3.1.3	3.3.1.3	3.3.1.3
2. Basin Management Objectives (BMOs)	3.2	3.2	3.2	3.2
3. Monitoring and management of groundwater elevations, groundwater quality, inelastic land surface subsidence, and changes in surface water flows and quality that directly affect groundwater levels or quality or are caused by pumping	3.3.2	3.3.2	3.3.2	3.3.2
4. Plan to involve other agencies located within groundwater basin	3.3.1.2	3.3.1.2	3.3.1.2	3.3.1.2
5. Adoption of monitoring protocols by basin stakeholders	3.3.2, 6.0	3.3.2, 6.0	3.3.2, 6.0	3.3.2, 6.0
6. Map of groundwater basin showing area of agency subject to GMP, other local agency boundary as defined in DWR bulletin 118	Figure 1	Figure 1	Figure 1	Figure 1
7. For agencies not overlying groundwater basins, prepare GMP using appropriate geologic and hydrogeologic principals	NA	NA	NA	NA
B. DWR's Suggested Components				
1. Manage with guidance of advisory committee	3.3.5.2	3.3.5.2	3.3.5.2	3.3.5.2
2. Describe area to be managed under GMP	2.0	2.0	2.0	2.0
3. Create link between BMOs and goals and actions of GMP	Figure 3	Figure 3	Figure 3	Figure 3
4. Describe GMP monitoring program	3.3.2, Figure 2	3.3.2, Figure 2	3.3.2, Figure 2	3.3.2, Figure 2
5. Describe integrated water management planning efforts	3.3.5	3.3.5	3.3.5	3.3.5
6. Report on implementation of GMP	4.1	4.1	4.1	4.1
7. Evaluate GMP periodically	4.2	4.2	4.2	4.2
C. CWC § 10750 *et seq*., Voluntary Components				
1. Control of saline water intrusion	3.3.4.5	NA	NA	3.3.4.5
2. Identification and management of wellhead protection areas and recharge areas	3.3.4	NA	NA	3.3.4
3. Regulation of the migration of contaminated groundwater	3.3.4.4	NA	NA	3.3.4.4
4. Administration of well abandonment and well destruction program	3.3.4.1	NA	NA	3.3.4.1
5. Mitigation of conditions of overdraft	3.3.3	NA	3.3.3.1, 3.3.3.3	3.3.3
6. Replenishment of groundwater extracted by water producers	3.3.3	NA	3.3.3.1, 3.3.3.3	3.3.3
7. Monitoring of groundwater levels and storage	3.3.2	3.3.2	3.3.2	3.3.2
8. Facilitating conjunctive use operations	3.3.3.1	NA	3.3.3.1	3.3.3.1
9. Identification of well construction policies	3.3.4.1	NA	NA	3.3.4.1
10. Construction and operation by local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects	3.3.4.4, 3.3.3	NA	3.3.3.1	3.3.4.4, 3.3.3
11. Development of relationships with state and federal regulatory agencies	3.3.1.4	3.3.1.4	3.3.1.4	3.3.1.4
12. Review of land use plans and coordination with land use planning agencies to assess activities that create reasonable risk of groundwater contamination	3.3.5.1.5	3.3.5.1.5	3.3.5.1.5	3.3.5.1.5

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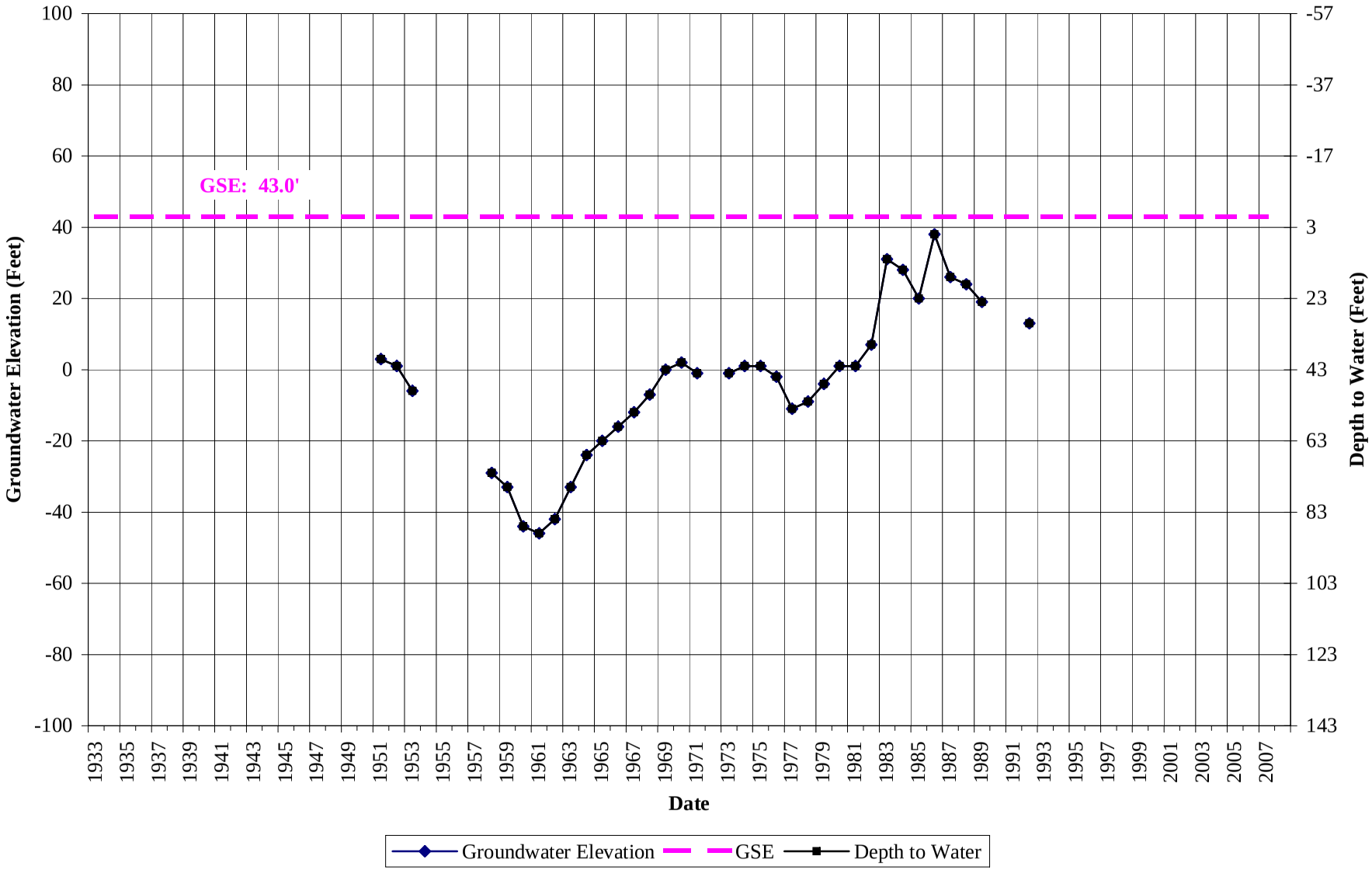
APPENDIX F

Spring Hydrographs for DWR Monitoring Wells

Figure 1. Spring Hydrograph of 07N02E30N003M



West Yost Associates
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Figure 2. Spring Hydrograph of 07N01E16D002M

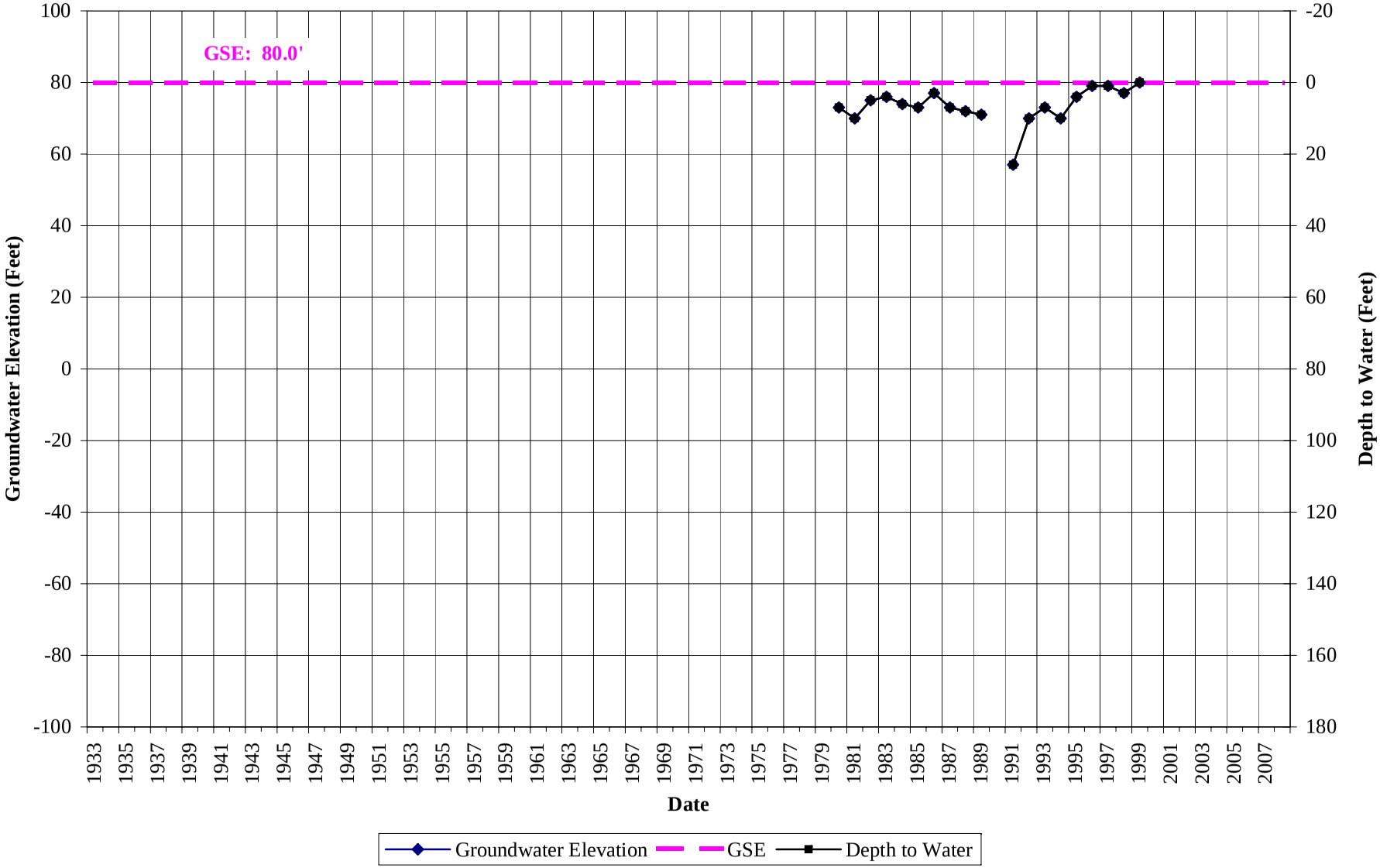

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Figure 3. Spring Hydrograph of 07N01E16B002M

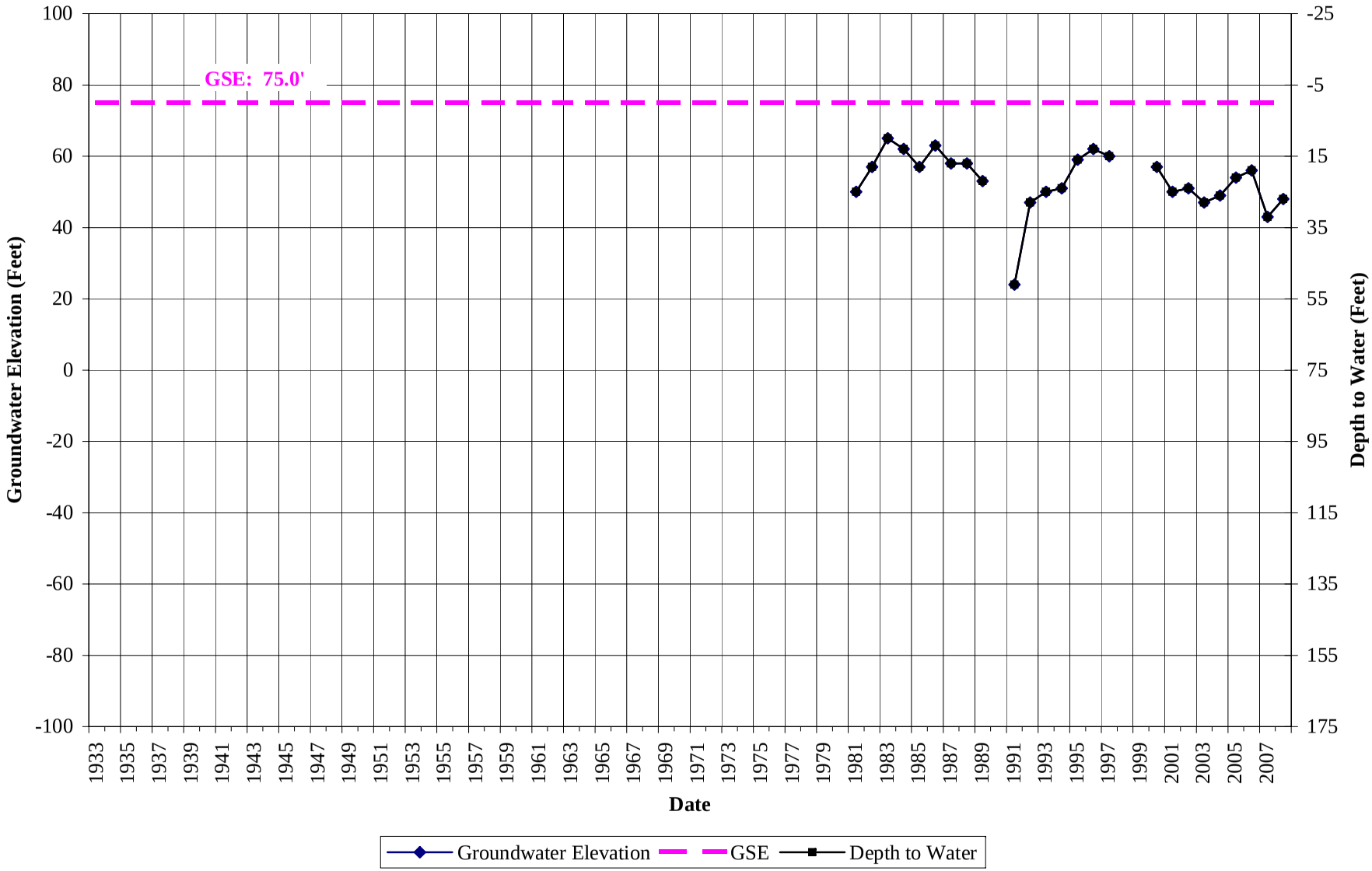

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Figure 4. Spring Hydrograph of 07N01E10E001M

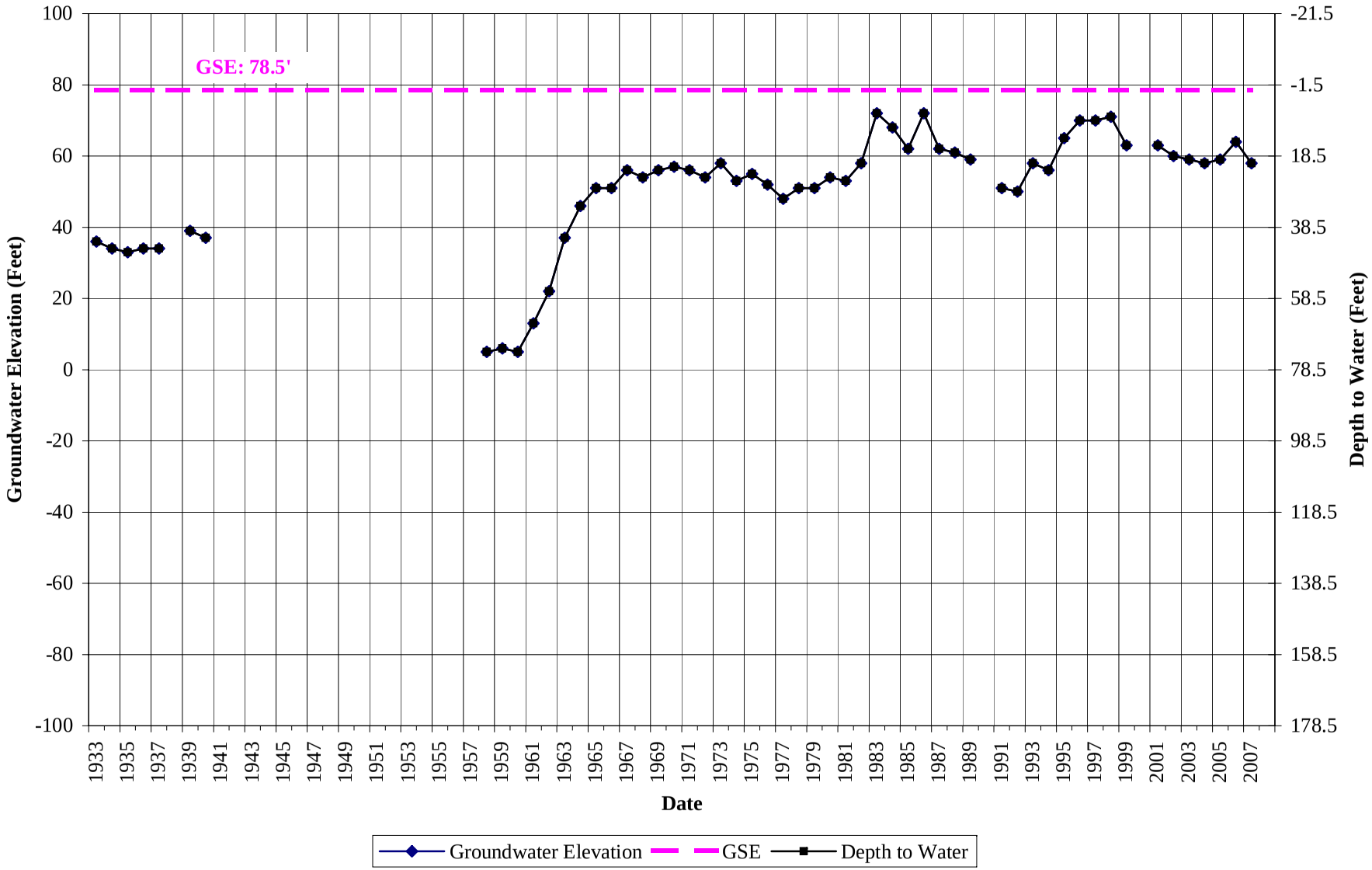

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Figure 5. Spring Hydrograph of 07N01E03G001M

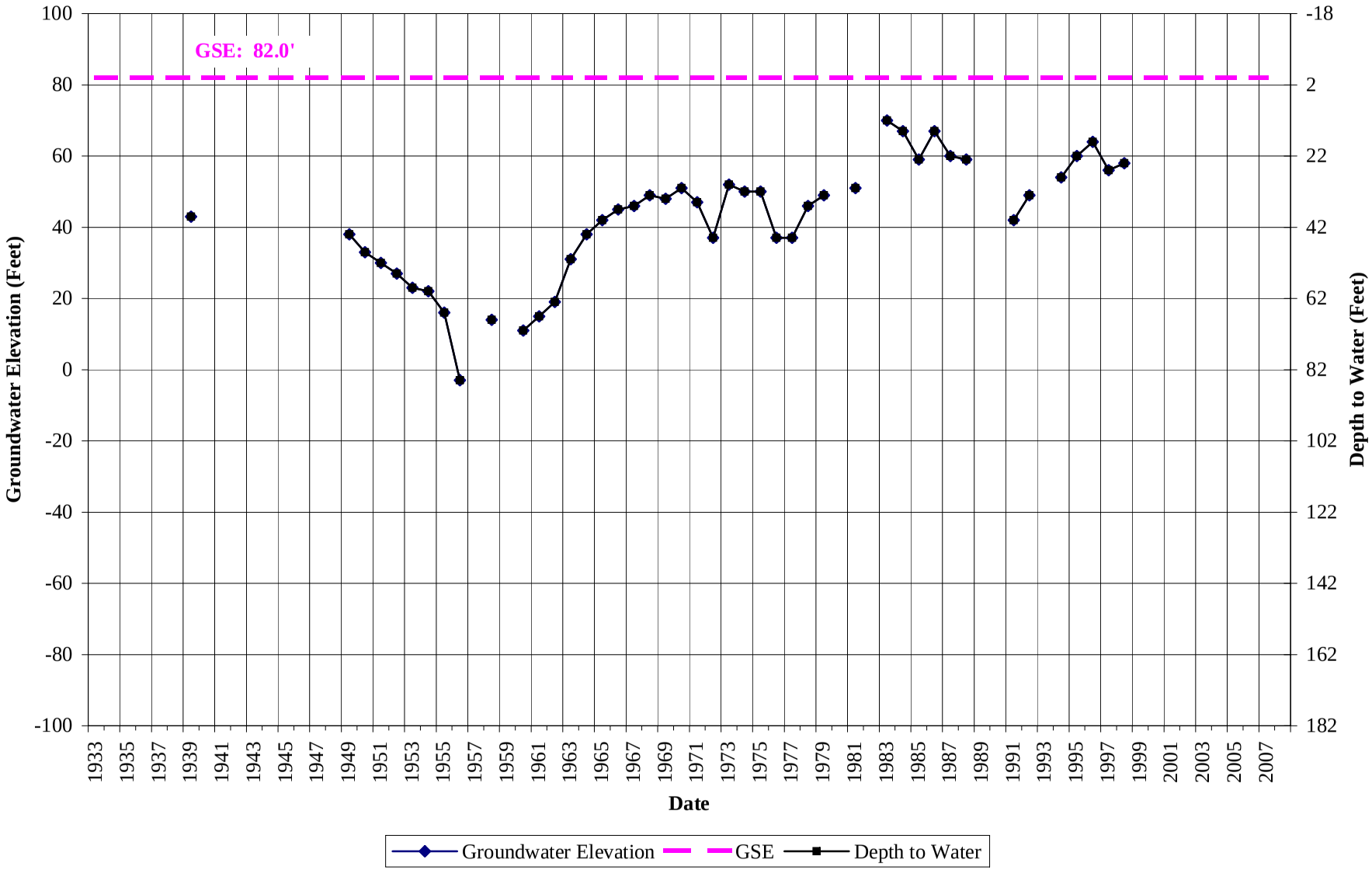

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Figure 6. Hydrograph of 07N01E27M004M

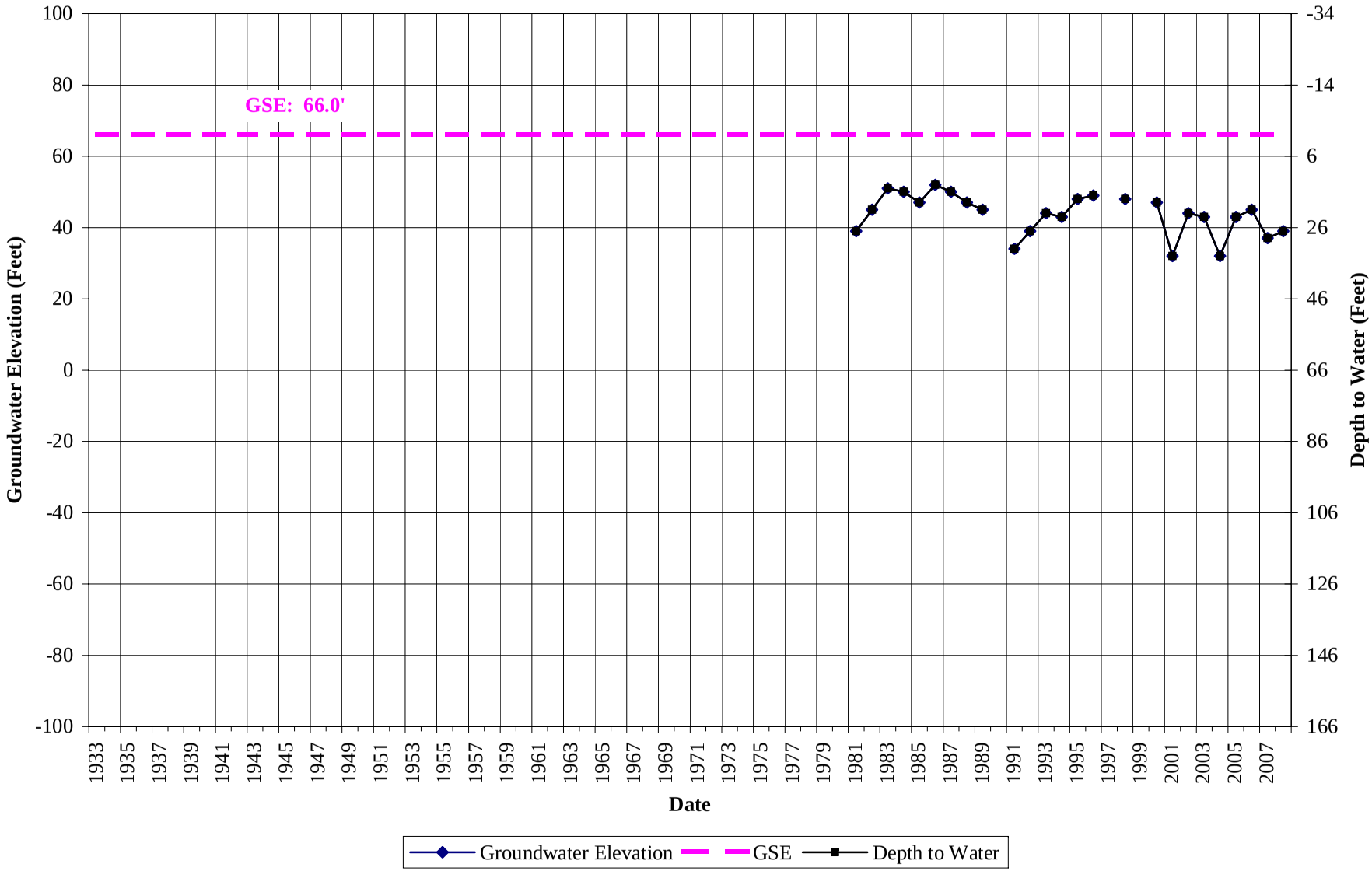

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Figure 7. Spring Hydrograph of 07N02E17E002M

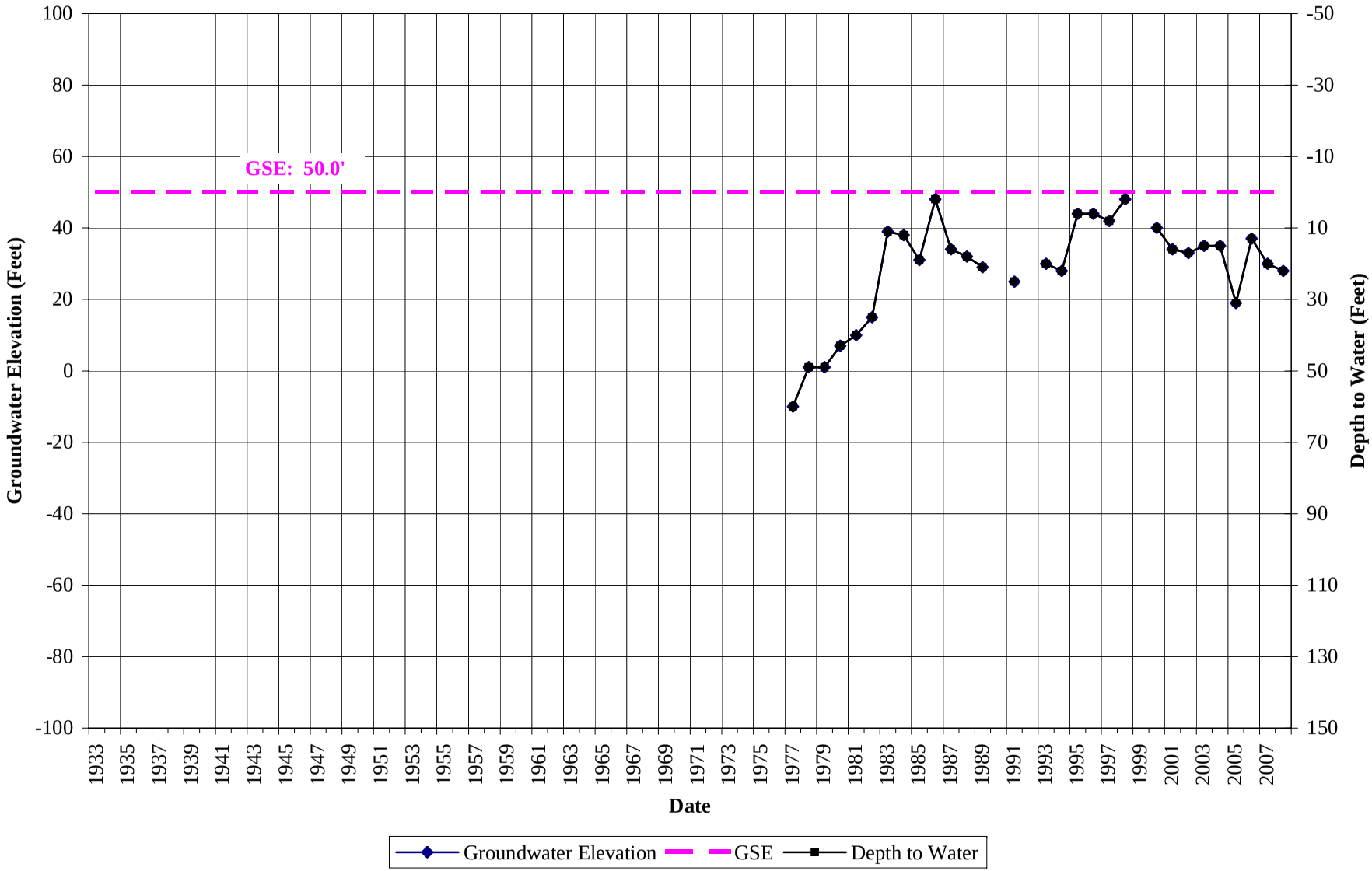

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Figure 8. Spring Hydrograph of 07N01E21H003M

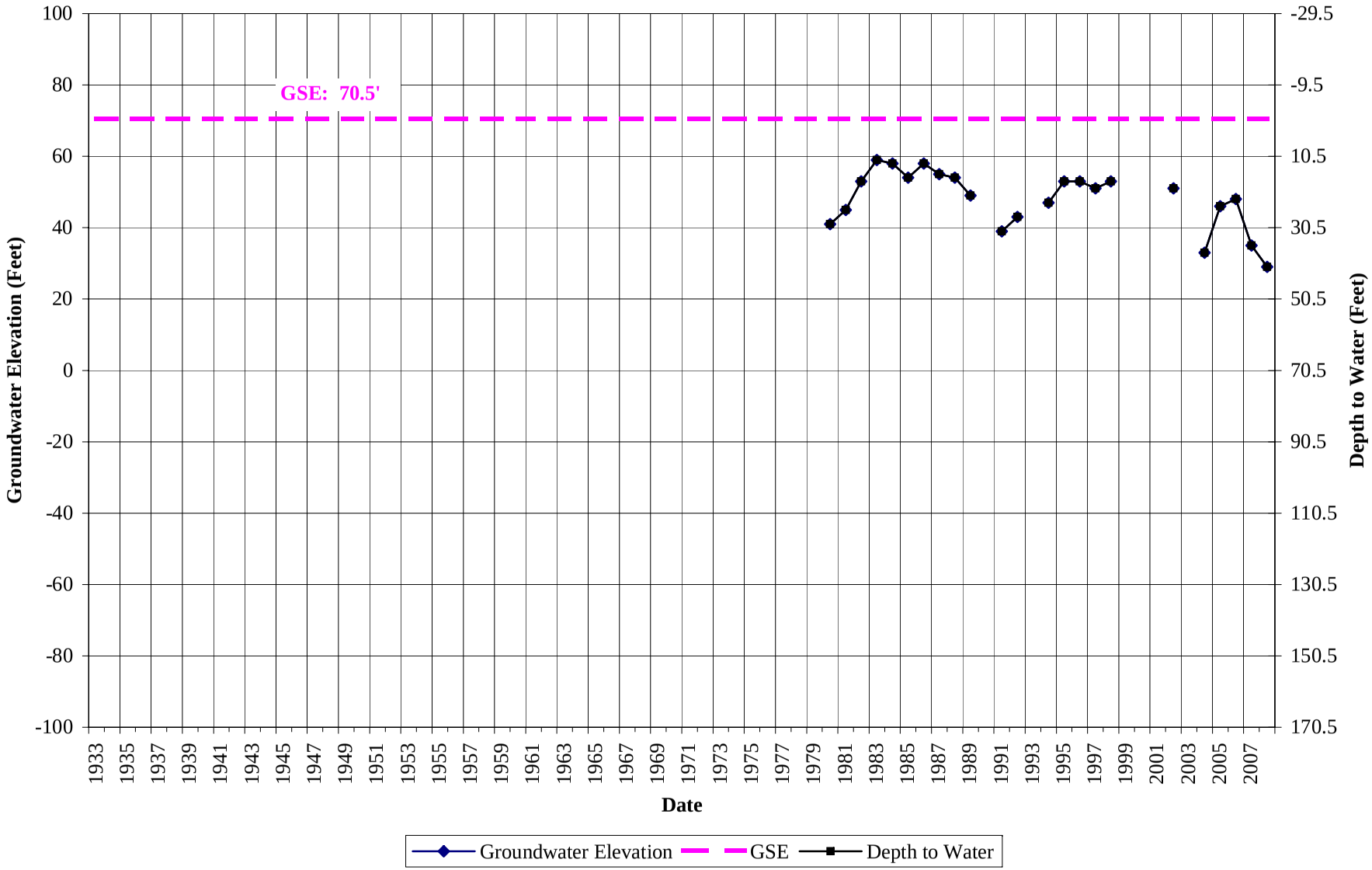

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Figure 9. Spring Hydrograph of 07N01E11M001M

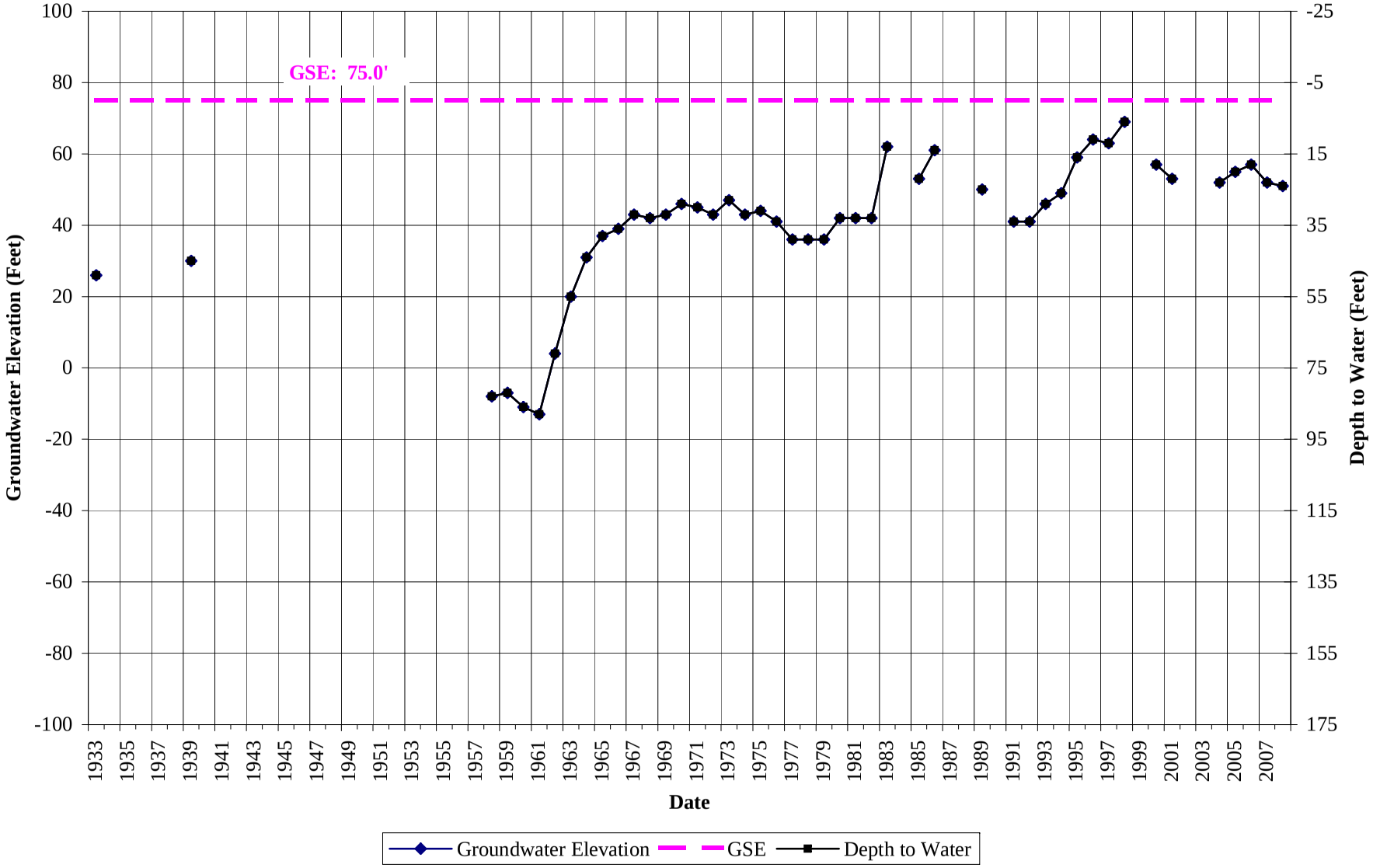

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Figure 10. Spring Hydrograph of 07N01E12N002M

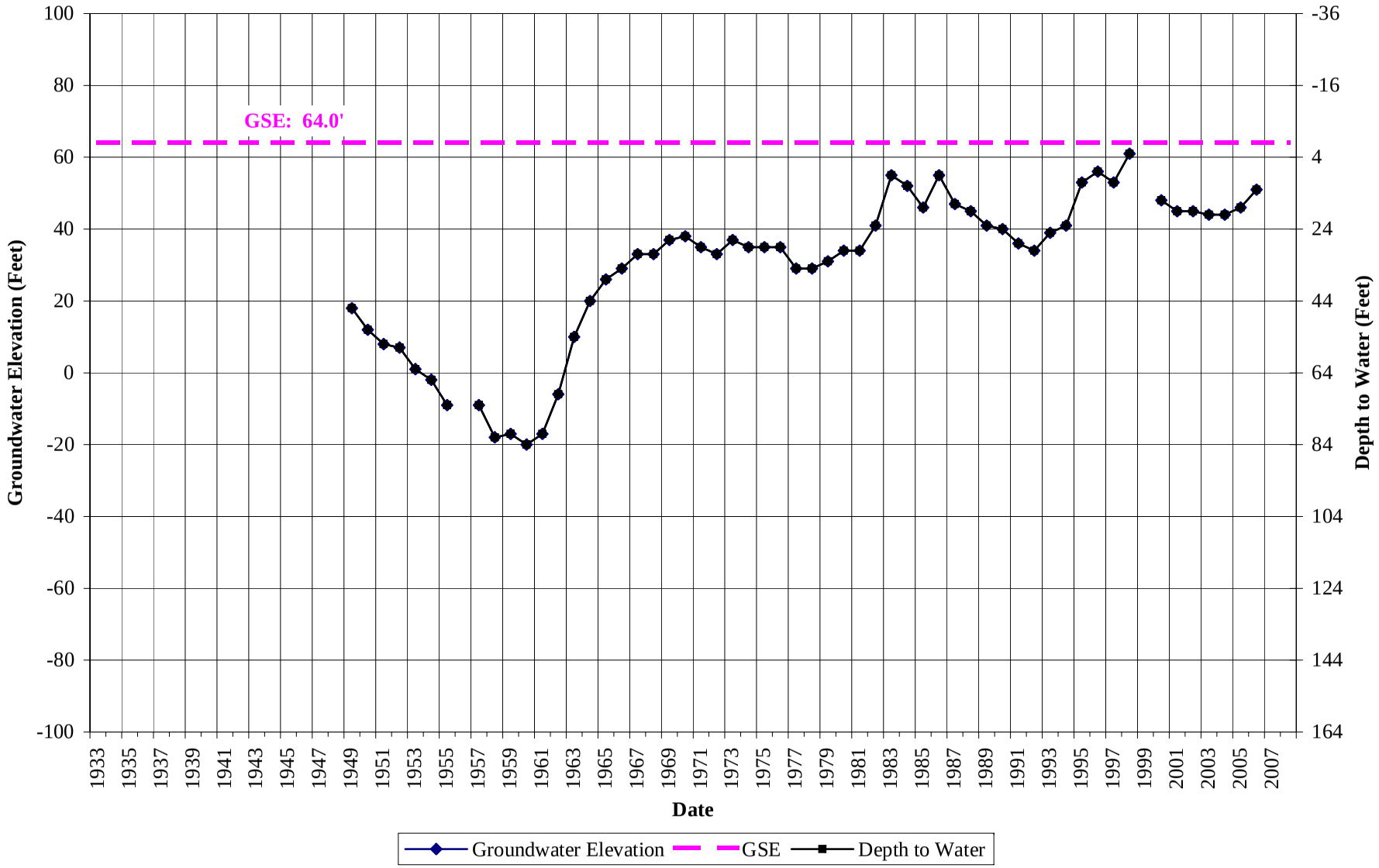

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Figure 11. Spring Hydrograph of 07N02E19E001M

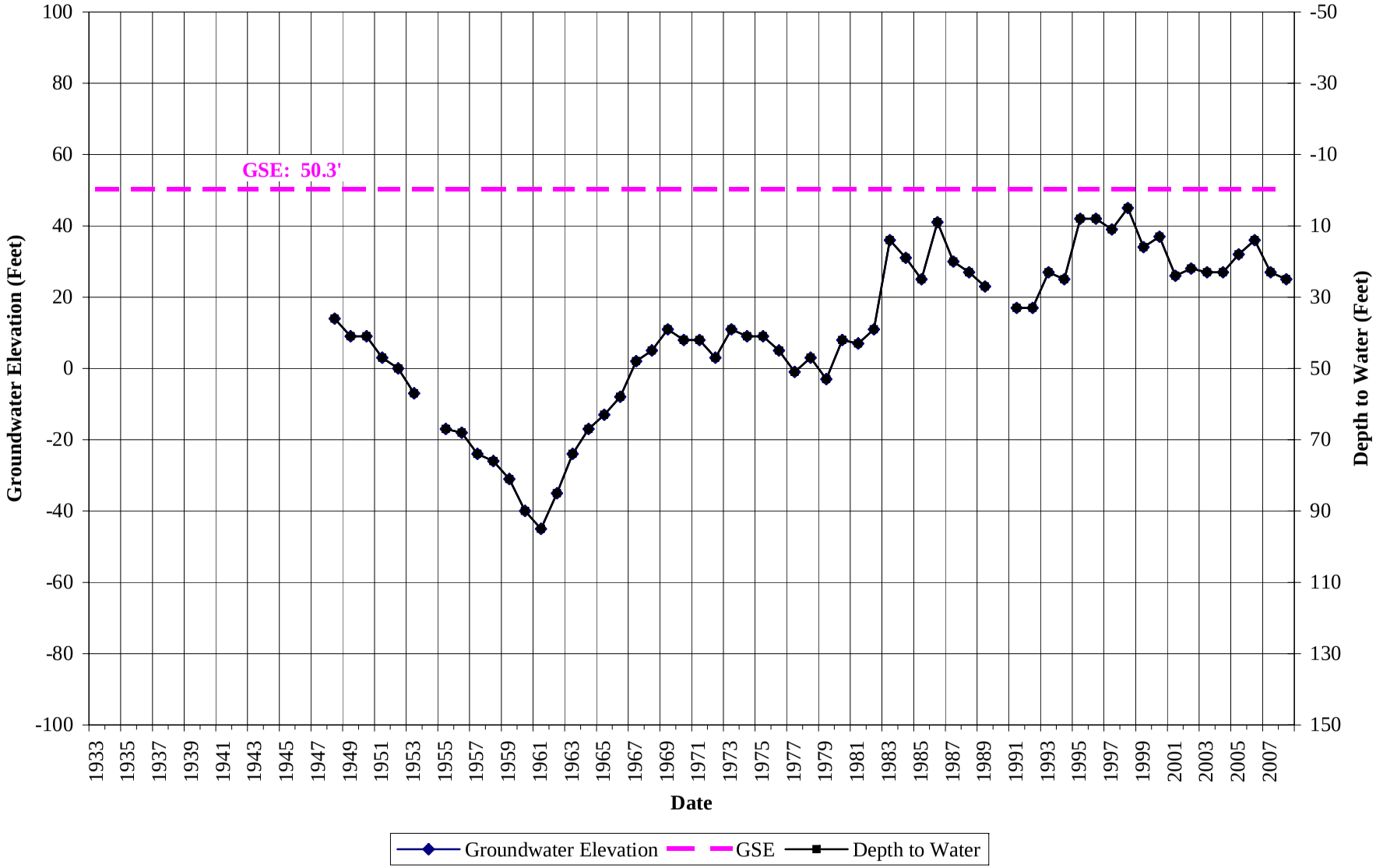

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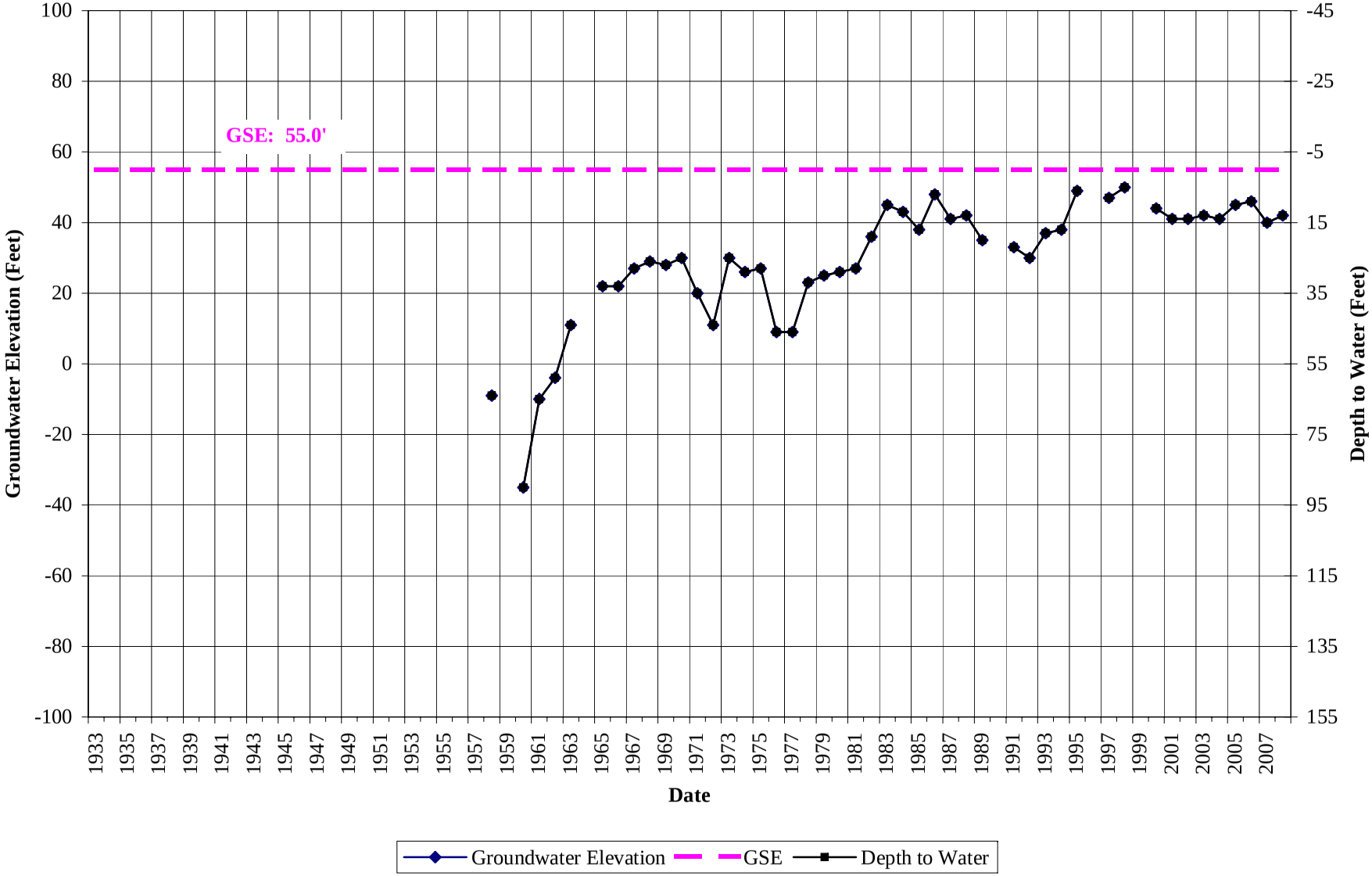
Figure 12. Spring Hydrograph of 07N01E26Q002M



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APPENDIX G

Historical Spring Groundwater Levels

Figure 1. Station 001-03 - Spring Groundwater Level Hydrograph

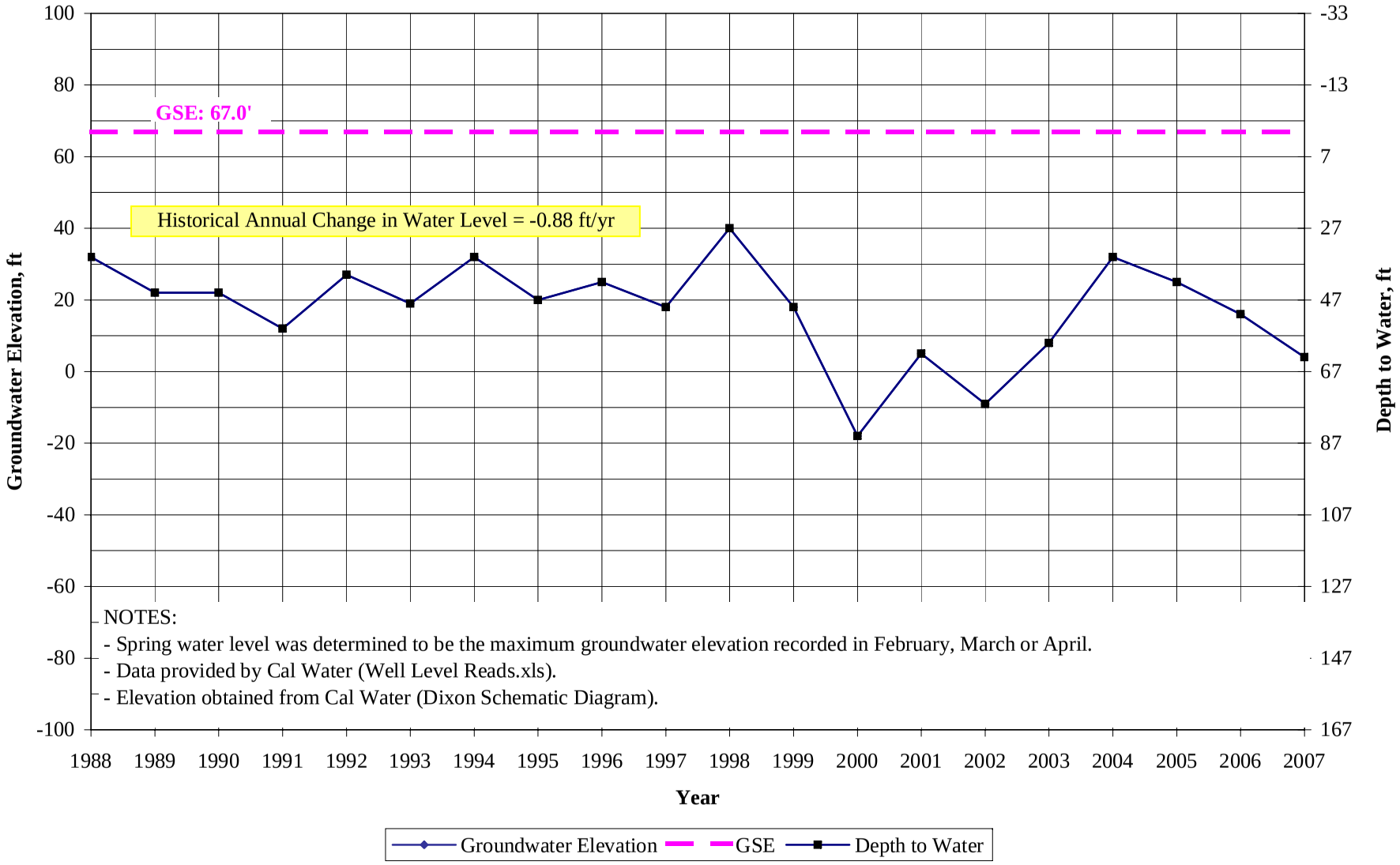

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Figure 2. Station 002-01 - Spring Groundwater Level Hydrograph

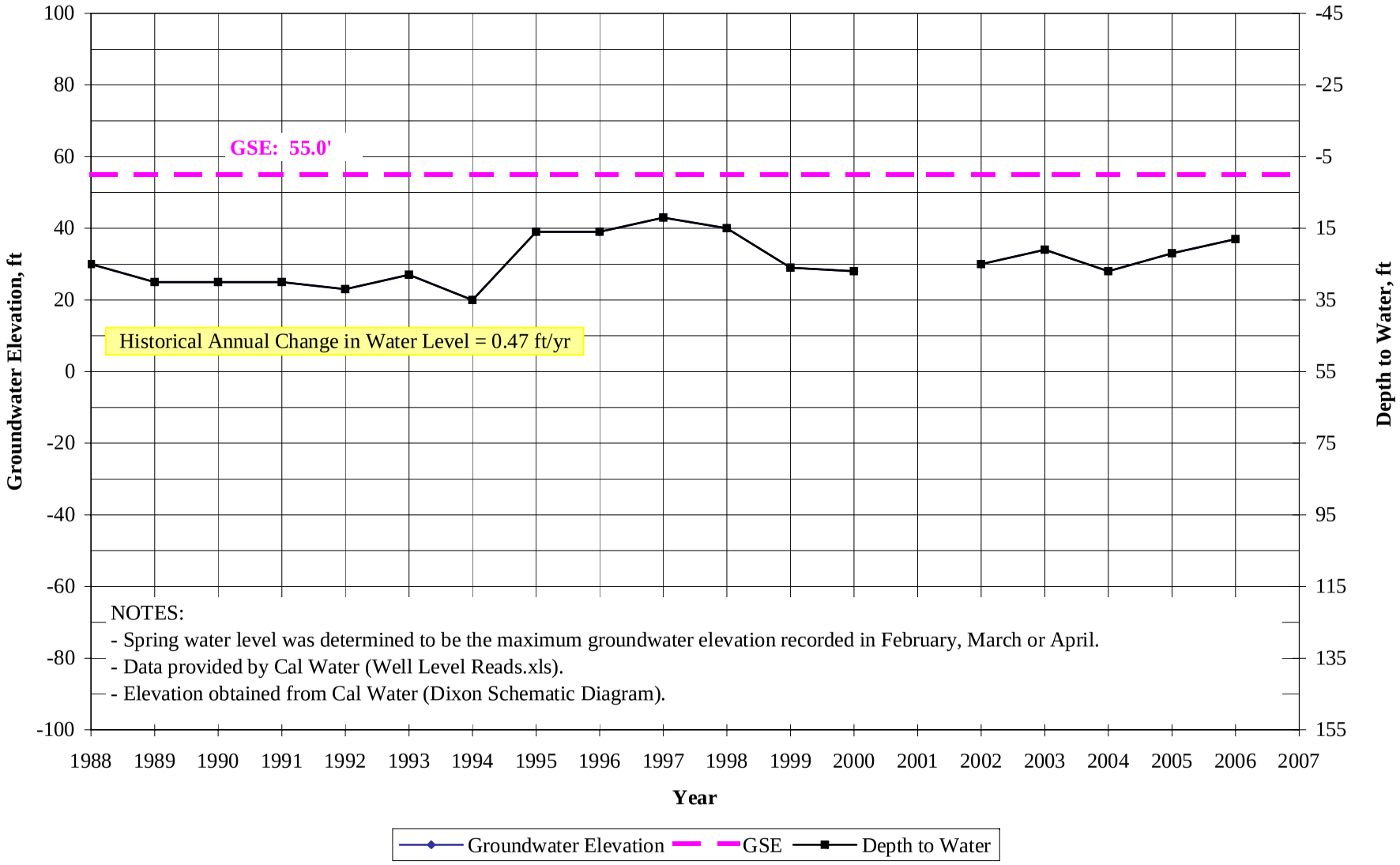

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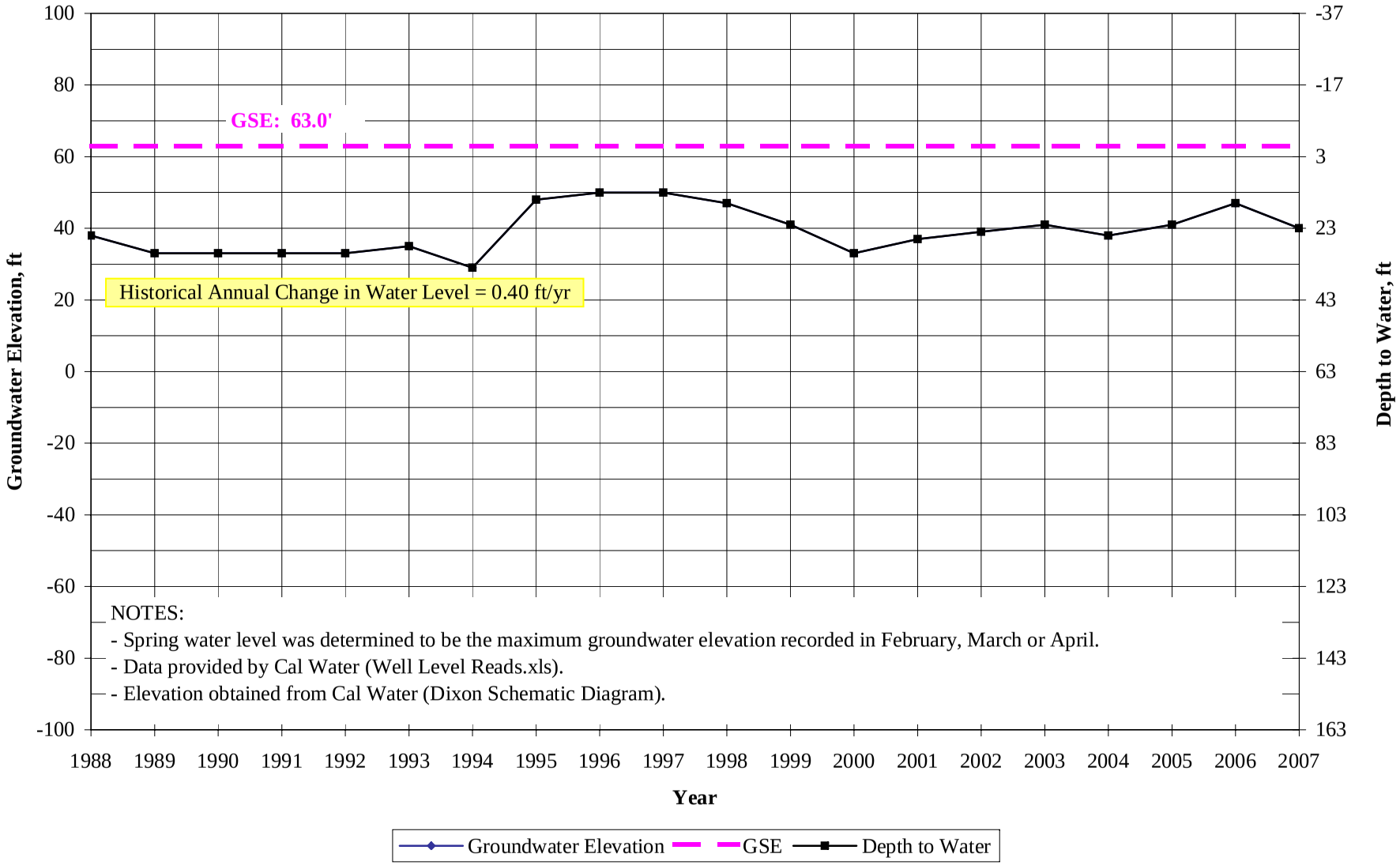
Figure 3. Station 003-01 - Spring Groundwater Level Hydrograph



NOTES:
- Spring water level was determined to be the maximum groundwater elevation recorded in February, March or April.
- Data provided by Cal Water (Well Level Reads.xls).
- Elevation obtained from Cal Water (Dixon Schematic Diagram).

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o:\C\436\02-08-07\E\T2\GW\Dixon Well Level [Figure 4D-3 STA. 003]
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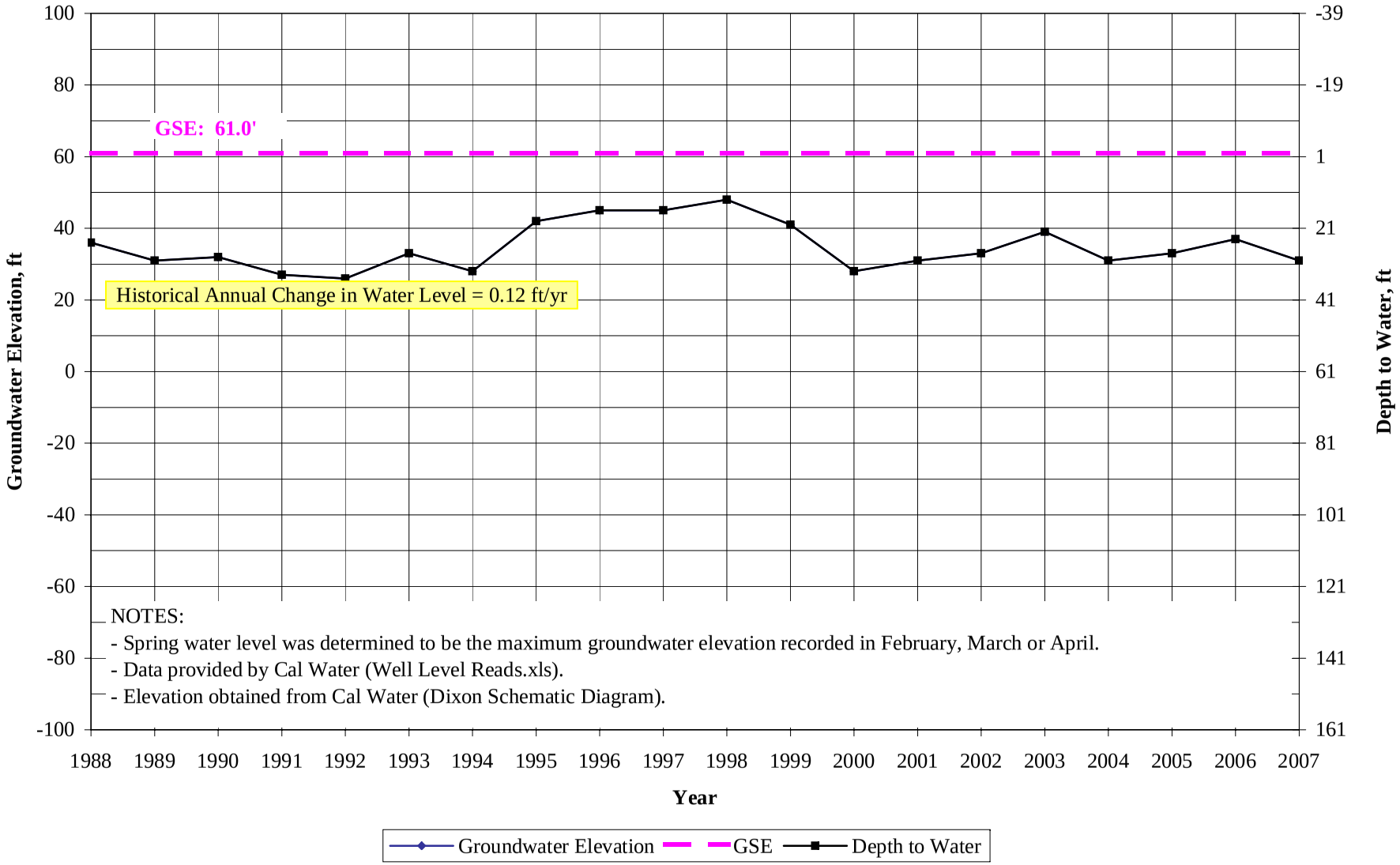
Figure 4. Station 004-01 - Spring Groundwater Level Hydrograph



NOTES:
- Spring water level was determined to be the maximum groundwater elevation recorded in February, March or April.
- Data provided by Cal Water (Well Level Reads.xls).
- Elevation obtained from Cal Water (Dixon Schematic Diagram).

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o:\C\436\02-08-07\E\T2\GW\Dixon Well Level [Figure 4D-4 STA. 004]
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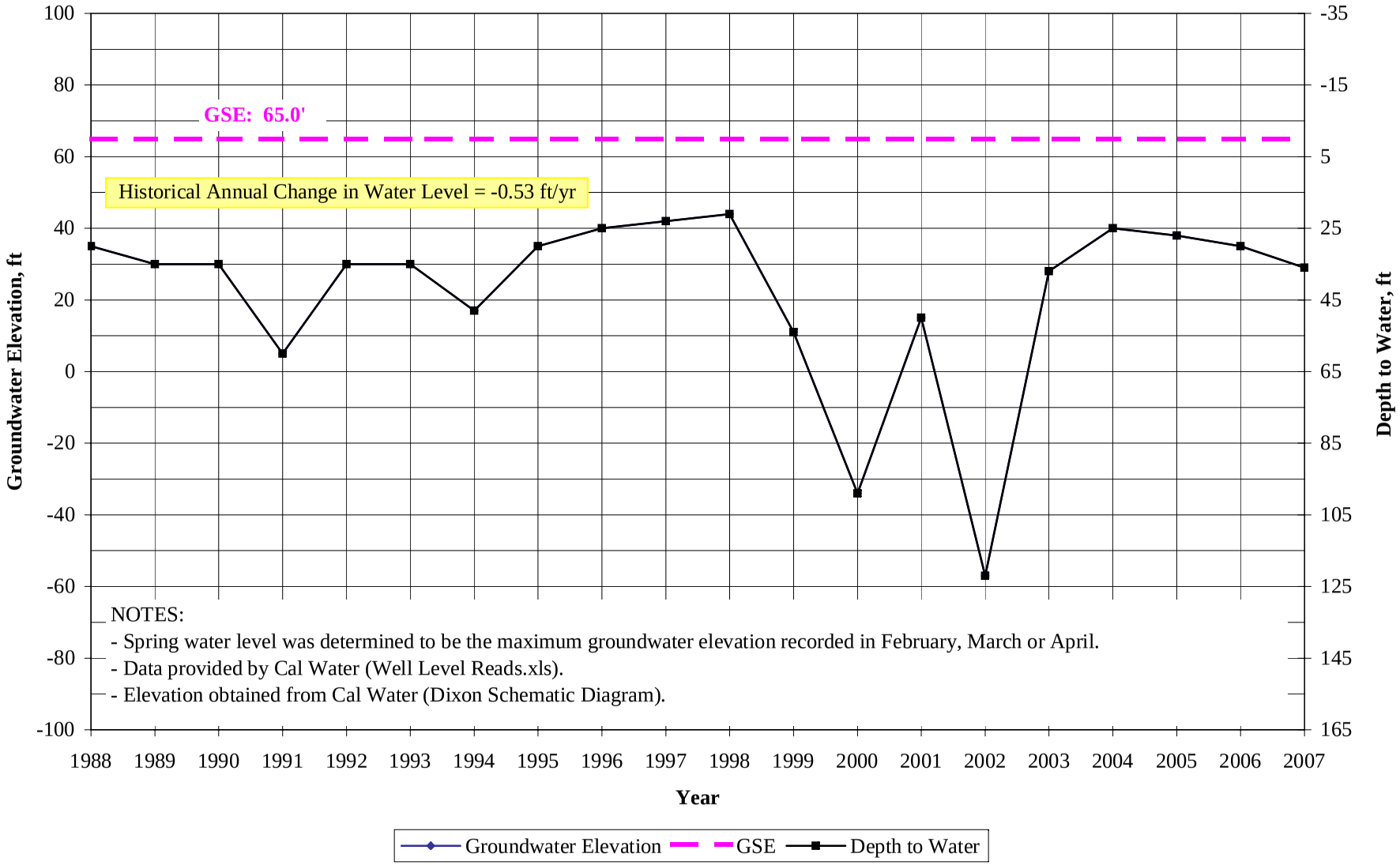
Figure 5. Station 005-01 - Spring Groundwater Level Hydrograph



NOTES:
- Spring water level was determined to be the maximum groundwater elevation recorded in February, March or April.
- Data provided by Cal Water (Well Level Reads.xls).
- Elevation obtained from Cal Water (Dixon Schematic Diagram).

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o:\C\436\02-08-07\E\T2\GW\Dixon Well Level [Figure 4D-5 STA. 005]
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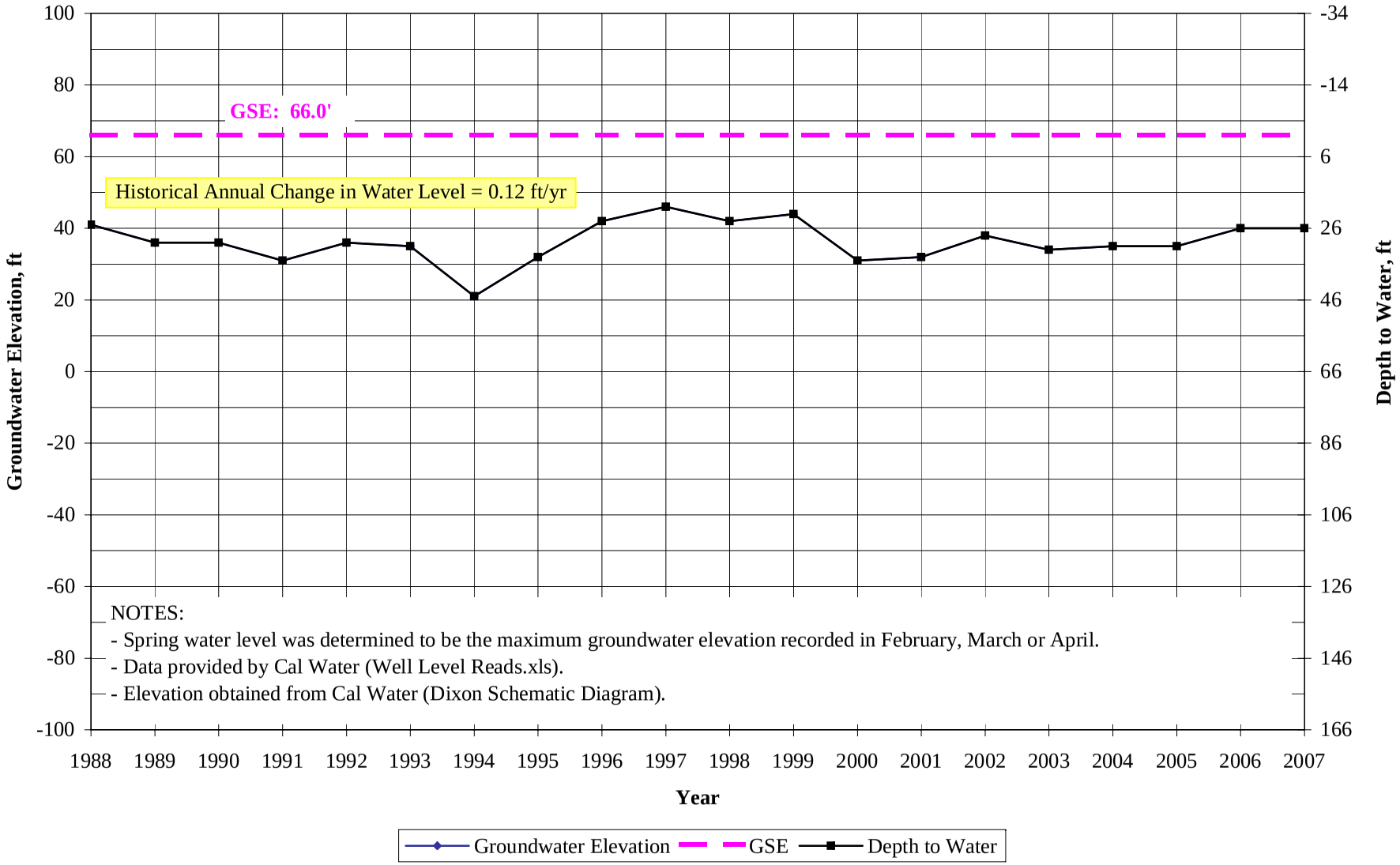
Figure 6. Station 006-01 - Spring Groundwater Level Hydrograph



West Yost Associates
o:\C\436\02-08-07\E\T2\GW\Dixon Well Level [Figure 4D-6 STA. 006]
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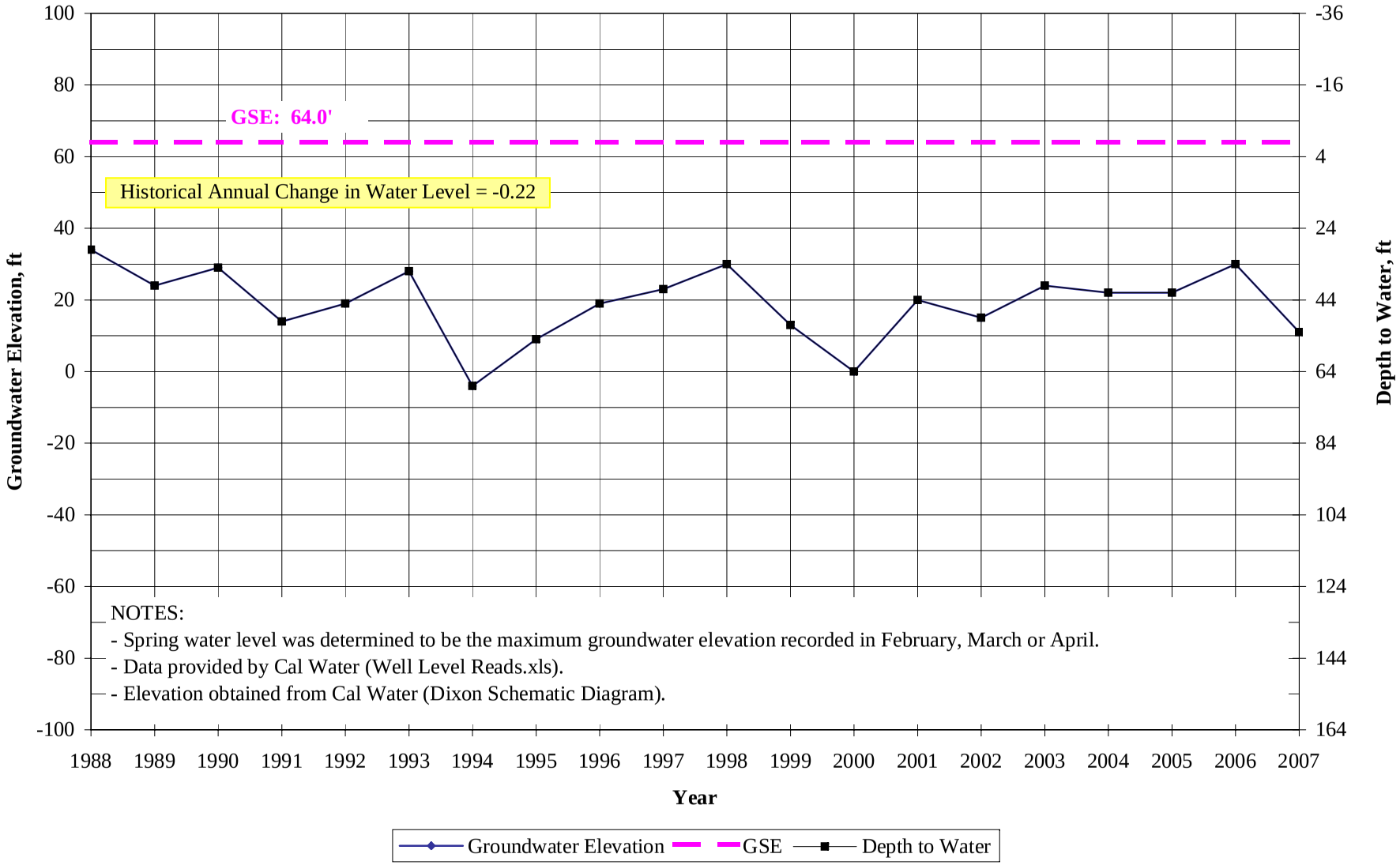
Figure 7. Station 007-01 - Spring Groundwater Level Hydrograph



NOTES:
- Spring water level was determined to be the maximum groundwater elevation recorded in February, March or April.
- Data provided by Cal Water (Well Level Reads.xls).
- Elevation obtained from Cal Water (Dixon Schematic Diagram).

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o:\C\436\02-08-07\E\T2\GW\Dixon Well Level [Figure 4D-7 STA. 007]
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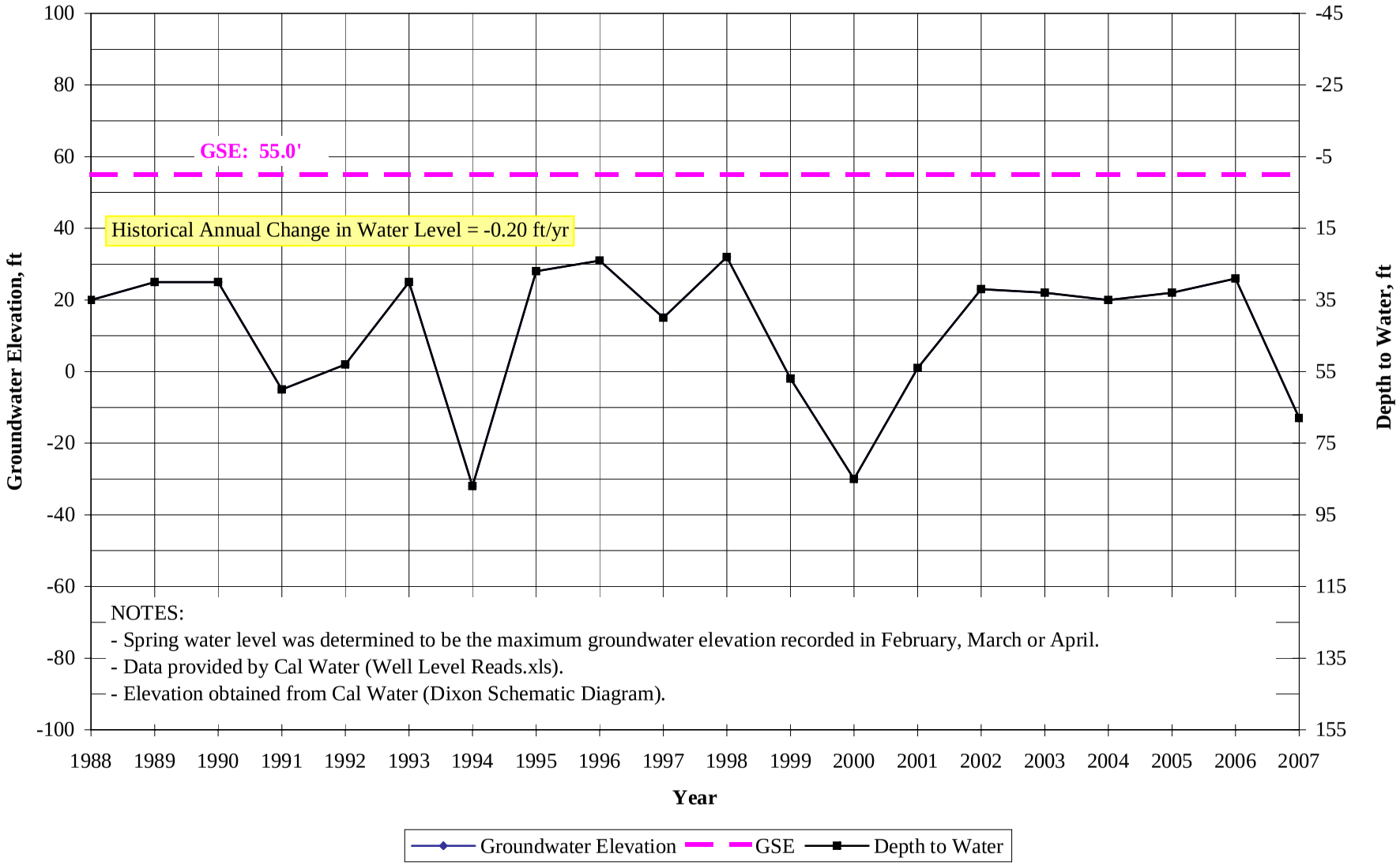
Figure 8. Station 008-01 - Spring Groundwater Level Hydrograph



West Yost Associates
o:\C\436\02-08-07\E\T2\GW\Dixon Well Level [Figure 4D-8 STA. 008]
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APPENDIX H

ENVIROSTOR Search Results

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

ENVIROSTOR

PROJECT SEARCH RESULTS

CLEANUP STATUS: All Statuses GO

SEARCH CRITERIA: DIXON, WELL USED FOR DRINKING WATER SUPPLY AFFECTED, WELL USED FOR DRINKING WATER SUPPLY AFFECTED

0 RECORDS FOUND

EXPORT TO EXCEL

PAGE 1 OF 1

NO PROJECTS FOUND WITH THOSE SEARCH PARAMETERS.

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1.3125 seconds

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DEPARTMENT OF TOXIC SUBSTANCES CONTROL

ENVIROSTOR

PROJECT SEARCH RESULTS

CLEANUP STATUS: All Statuses GO

SEARCH CRITERIA: DIXON, OTHER GROUNDWATER AFFECTED (USES OTHER THAN DRINKING WATER), OTHER GROUNDWATER AFFECTED (USES OTHER THAN DRINKING WATER)

0 RECORDS FOUND

EXPORT TO EXCEL

PAGE 1 OF 1

NO PROJECTS FOUND WITH THOSE SEARCH PARAMETERS.

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1.28125 seconds

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DEPARTMENT OF TOXIC SUBSTANCES CONTROL

ENVIROSTOR

PROJECT SEARCH RESULTS

CLEANUP STATUS: All Statuses GO

SEARCH CRITERIA: DIXON, AQUIFER USED FOR DRINKING WATER SUPPLY AFFECTED, AQUIFER USED FOR DRINKING WATER SUPPLY AFFECTED

0 RECORDS FOUND

EXPORT TO EXCEL

PAGE 1 OF 1

NO PROJECTS FOUND WITH THOSE SEARCH PARAMETERS.

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1.328125 seconds

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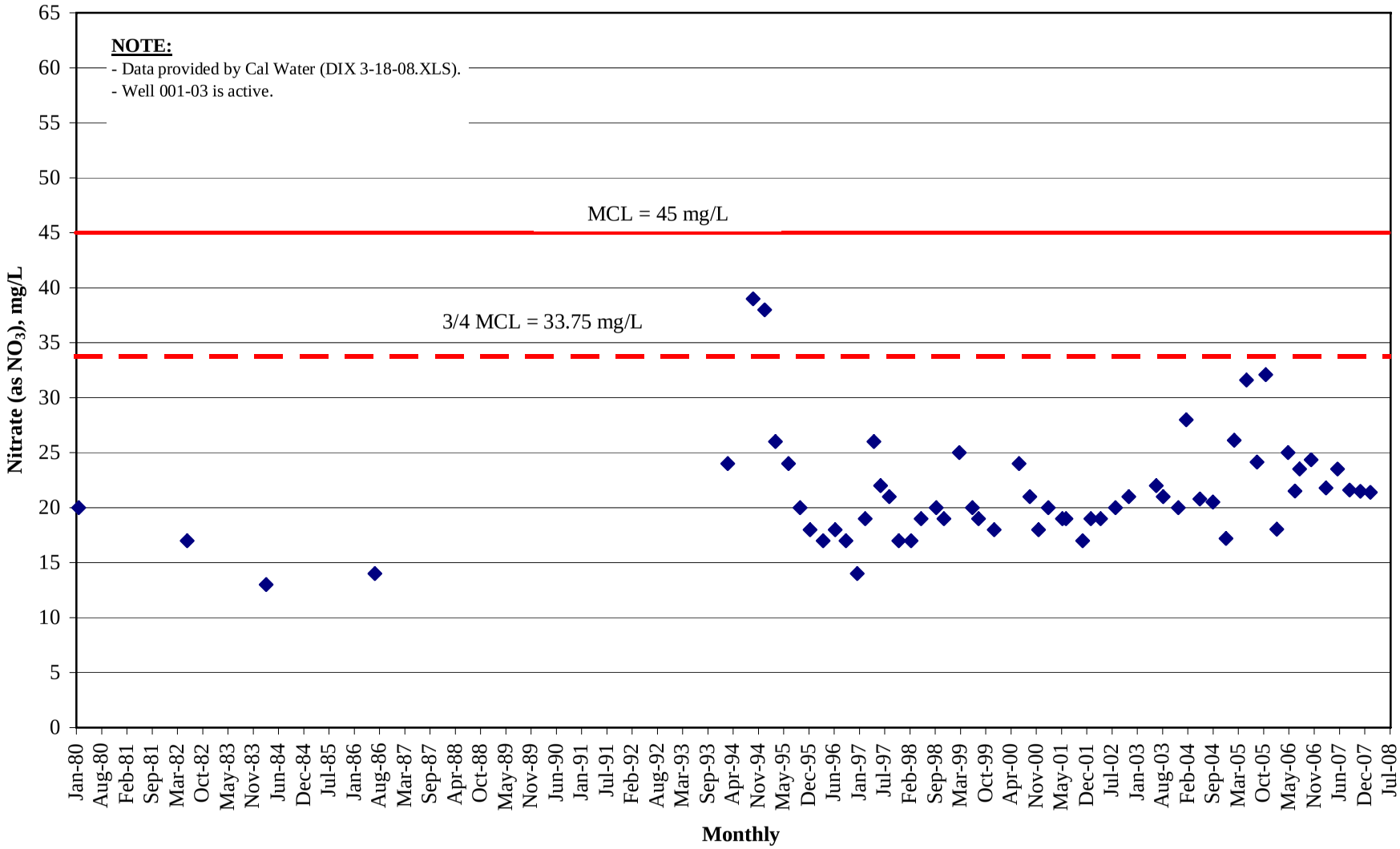
APPENDIX I

Plots of Historical Concentration Trends for Al, COND, total C_r, F_e, NO^3, and TDS
Plots of Historical Monthly Production versus Historical NO^3 Concentrations

Figure 1. Station 001-03 - Historical Nitrate Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-1 STA. 001-03_NO3
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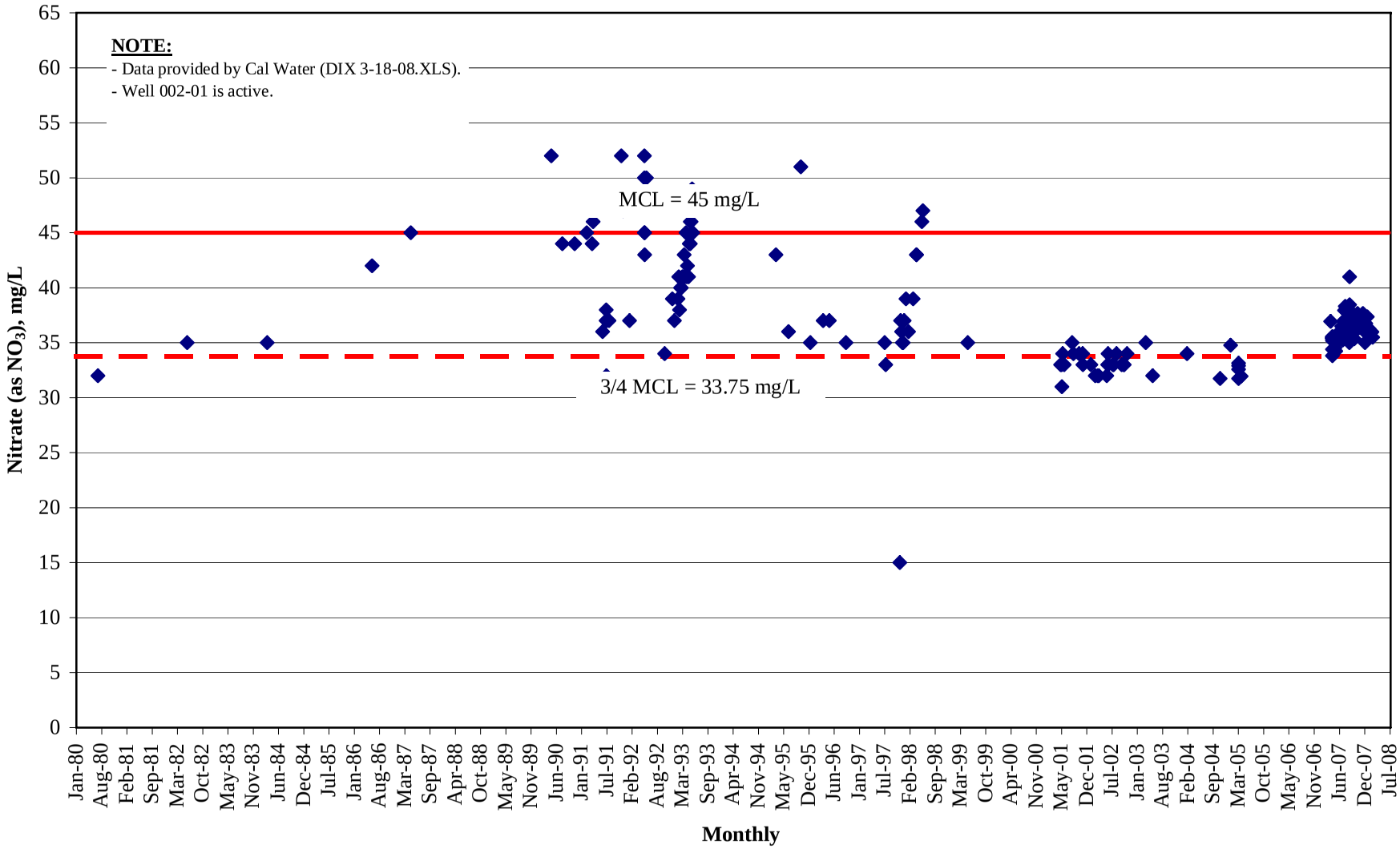
Figure 2. Station 002-01 - Historical Nitrate Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-2 STA. 002-01_NO3
Last Revised: 08/15/2008

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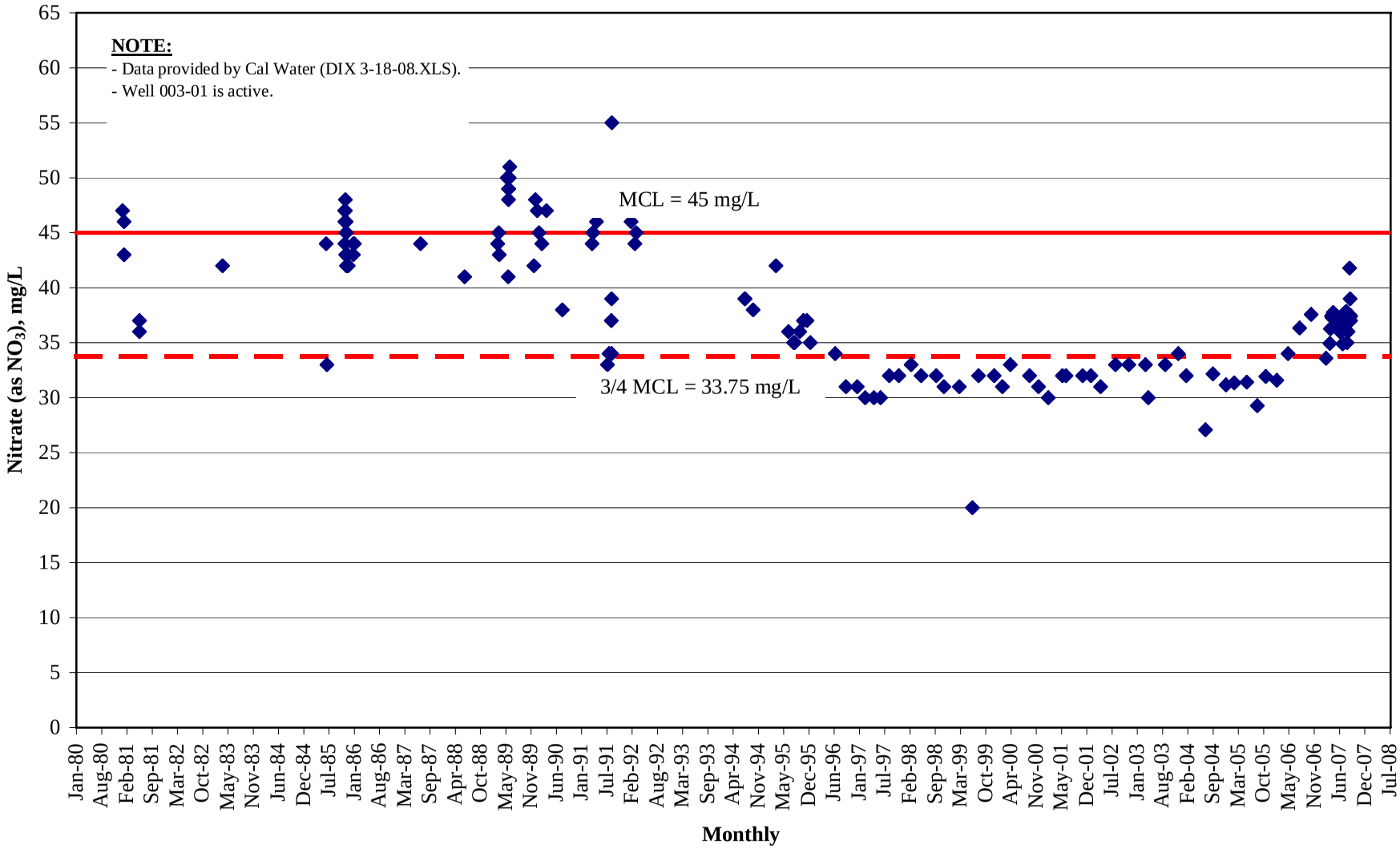
Figure 3. Station 003-01 - Historical Nitrate Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-3 STA. 003-01_NO3
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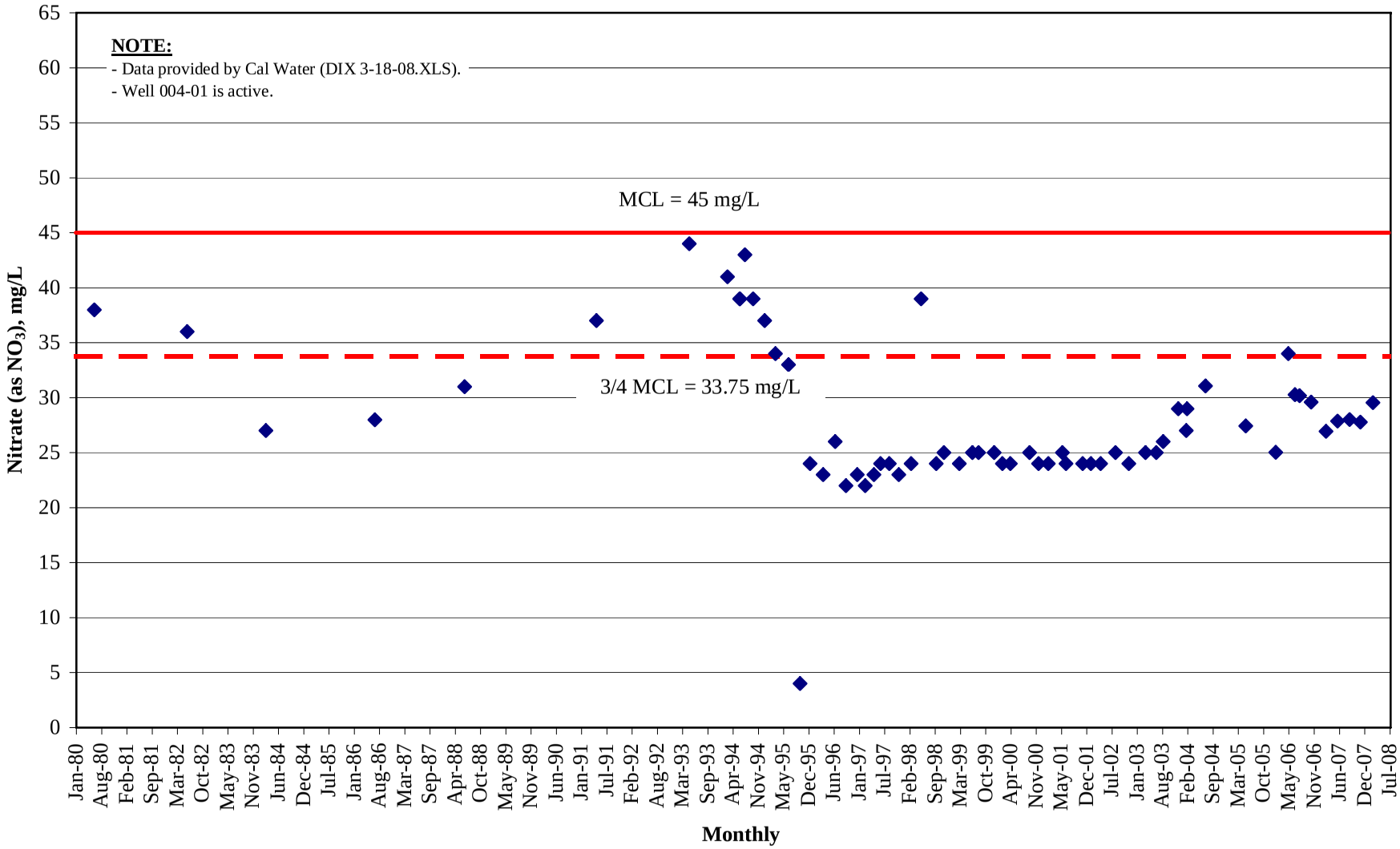
Figure 4. Station 004-01 - Historical Nitrate Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-4 STA. 004-01_NO3
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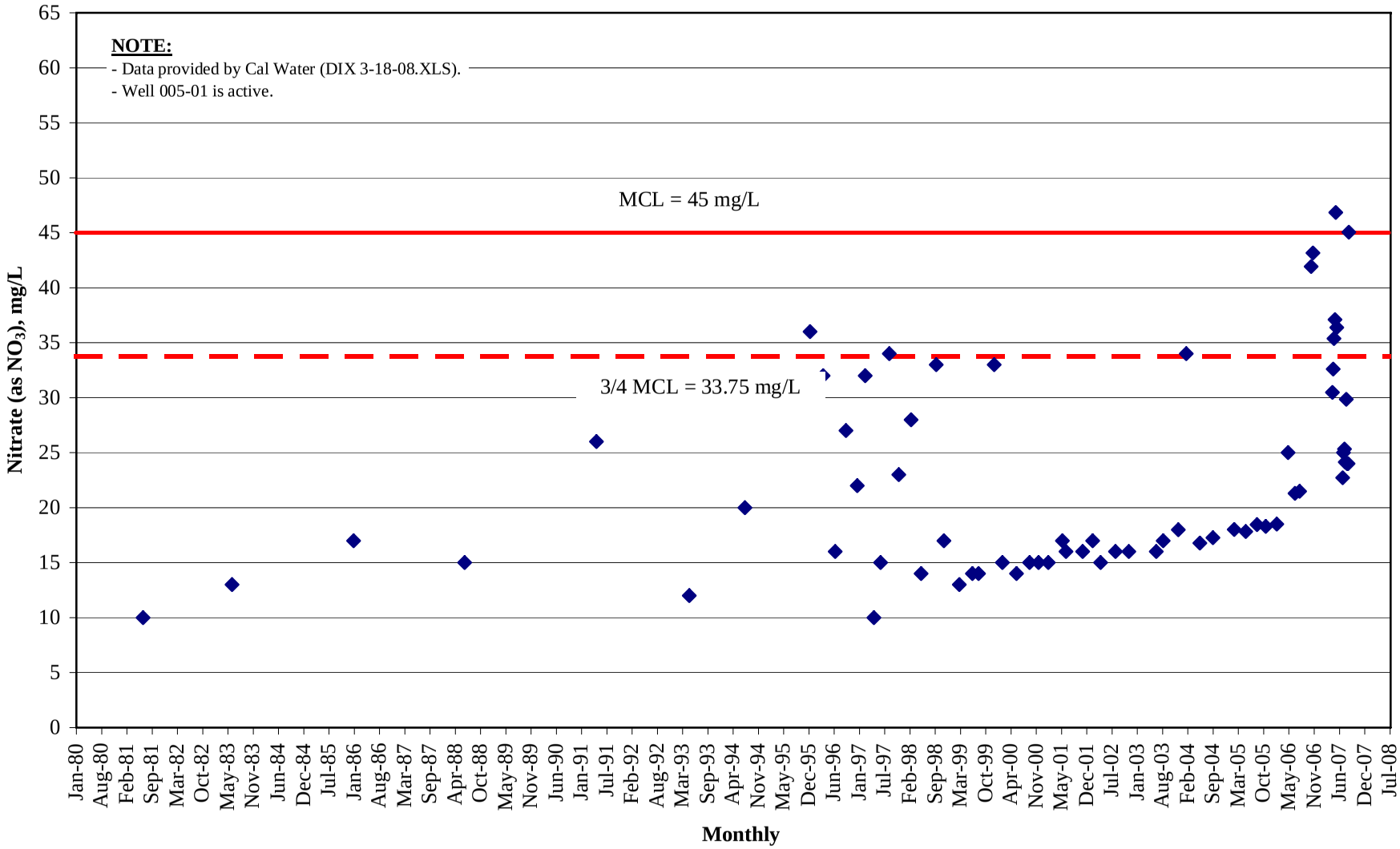
Figure 5. Station 005-01 - Historical Nitrate Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-5 STA. 005-01_NO3
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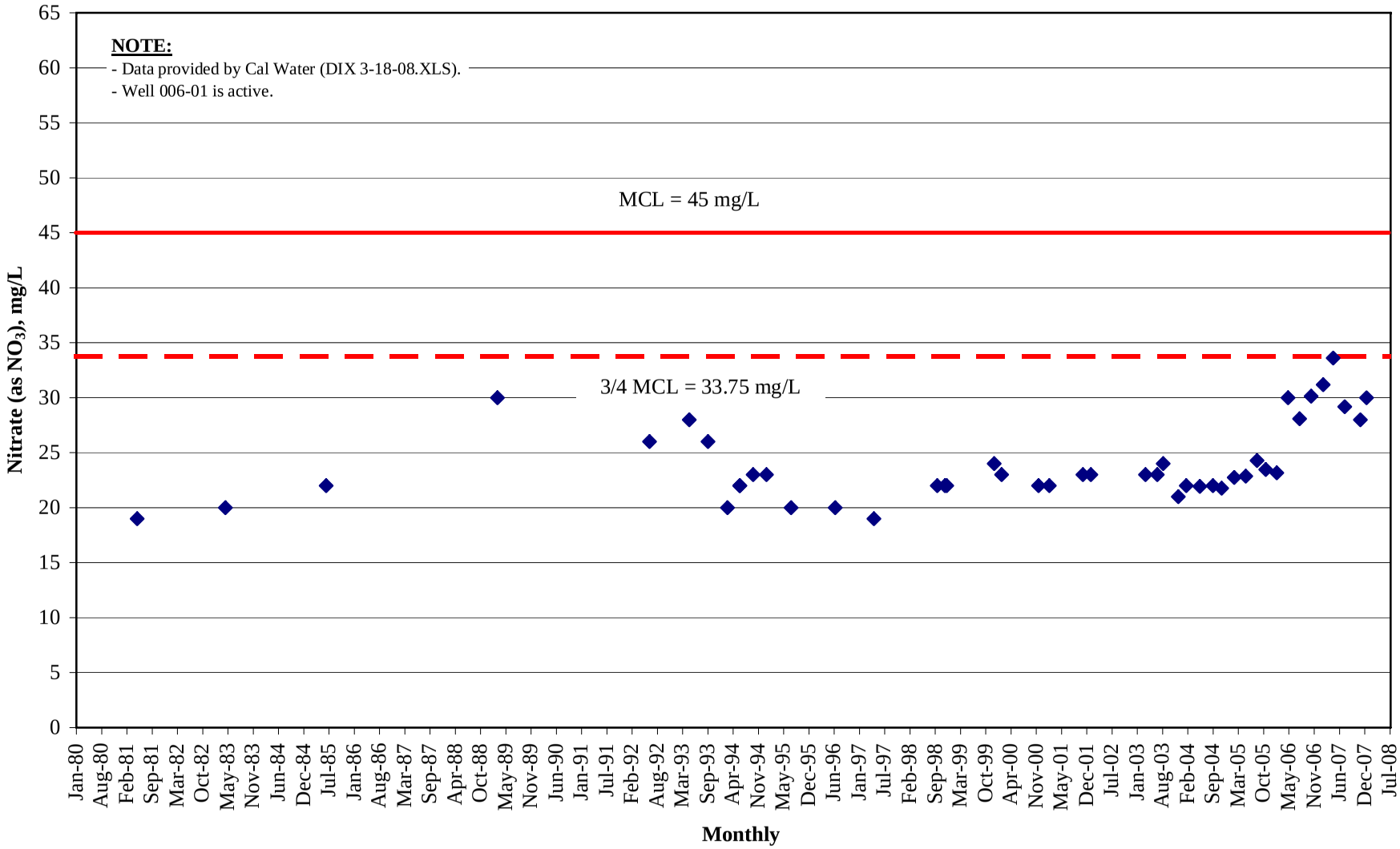
Figure 6. Station 06-01 - Historical Nitrate Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-6 STA. 006-01_NO3
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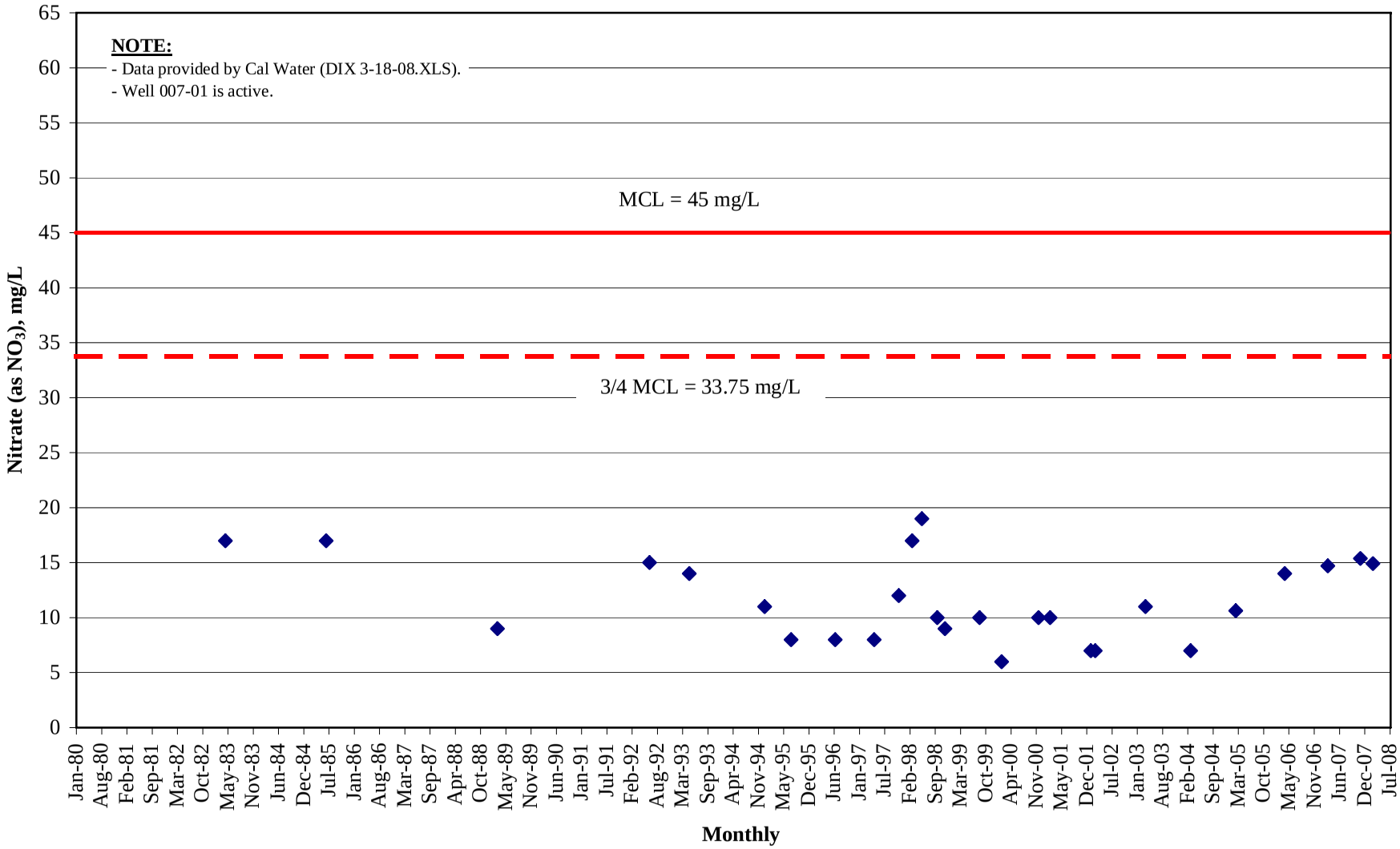
Figure 7. Station 007-01 - Historical Nitrate Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-7 STA. 007-01_NO3
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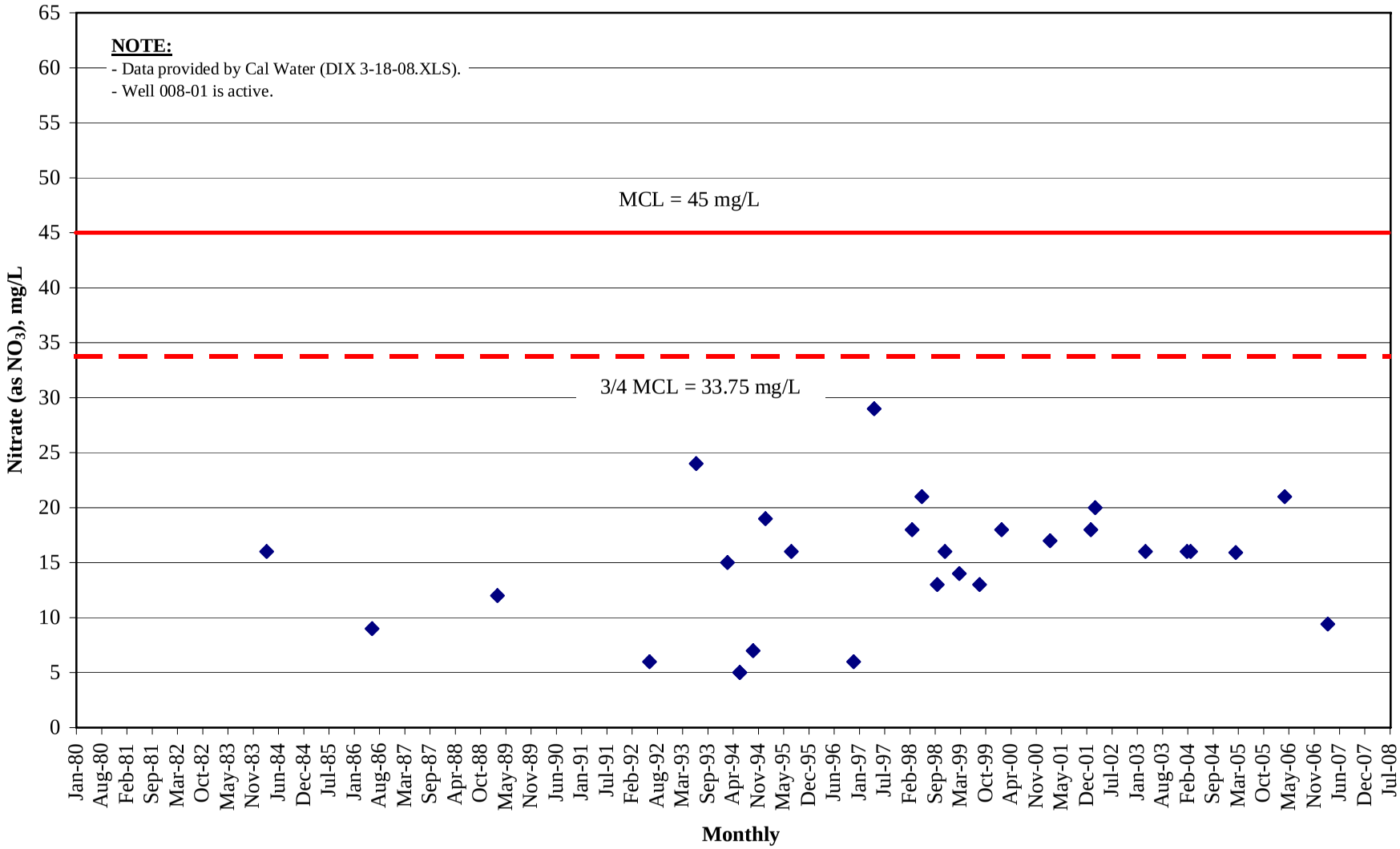
Figure 8. Station 008-01 - Historical Nitrate Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-8 STA. 008-01_NO3
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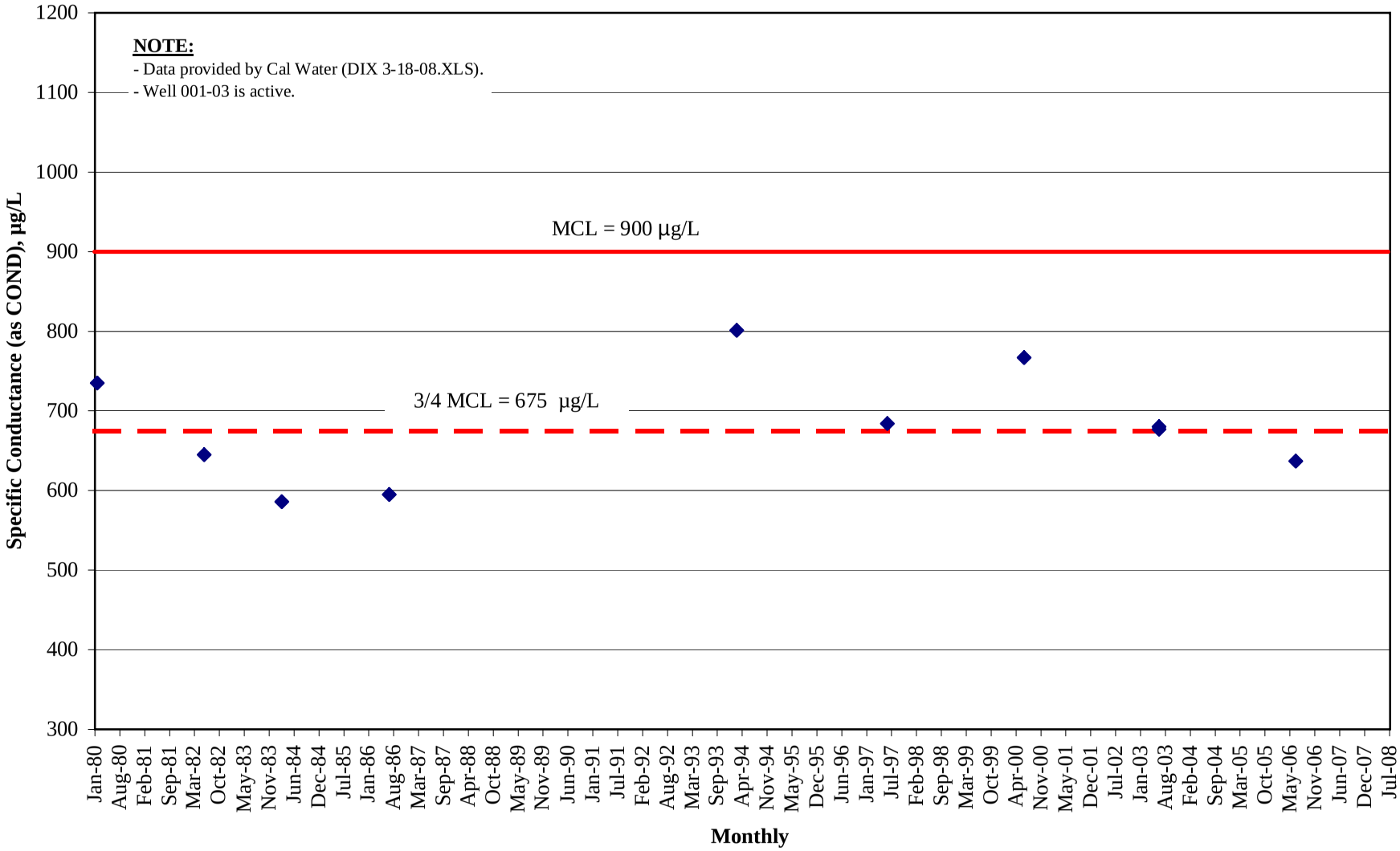
Figure 9. Station 001-03 - Historical Specific Conductance Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-9 STA. 001-03_COND
Last Revised: 08/15/2008

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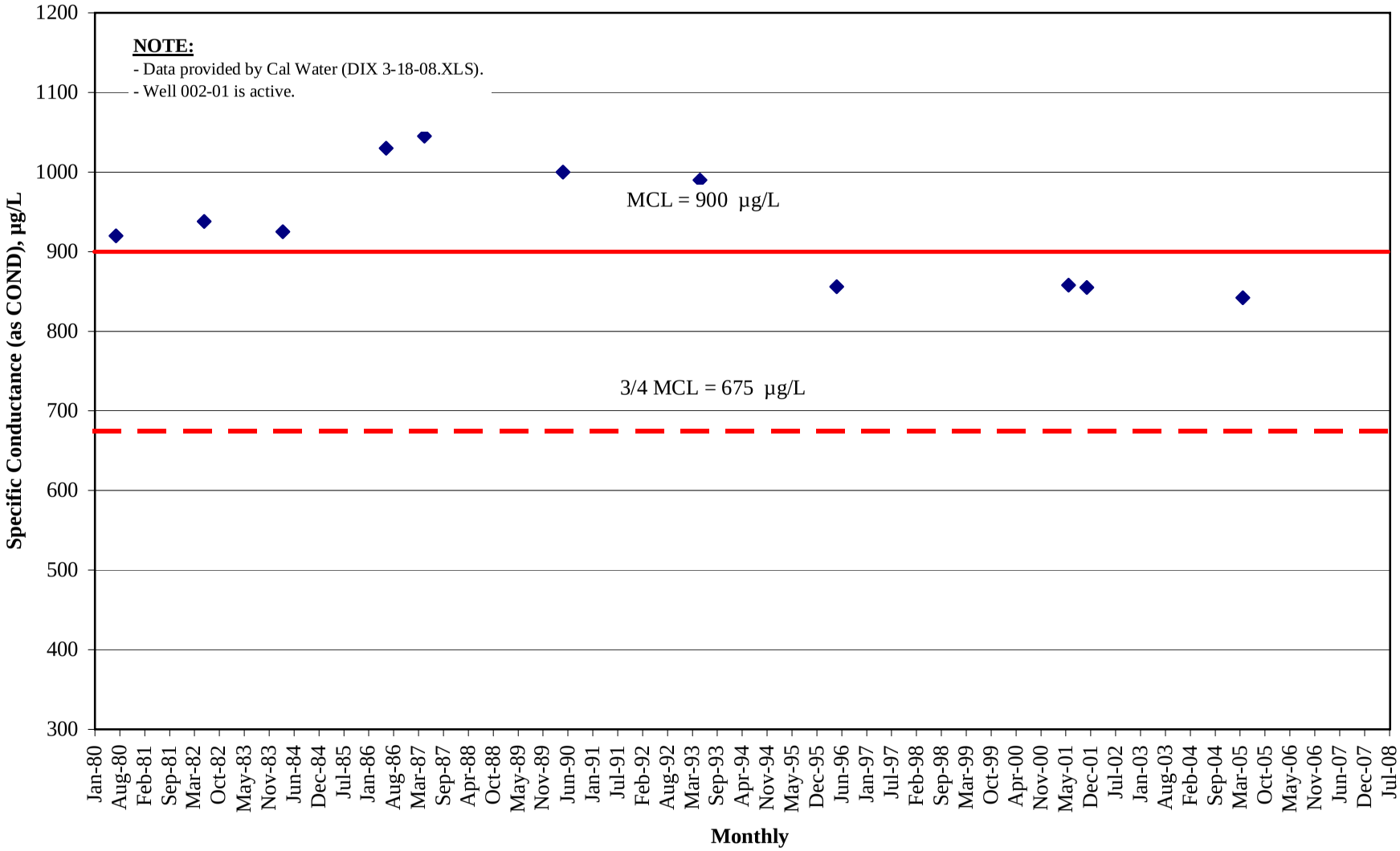
Figure 10. Station 002-01 - Historical Specific Conductance Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-10 STA. 002-01_COND
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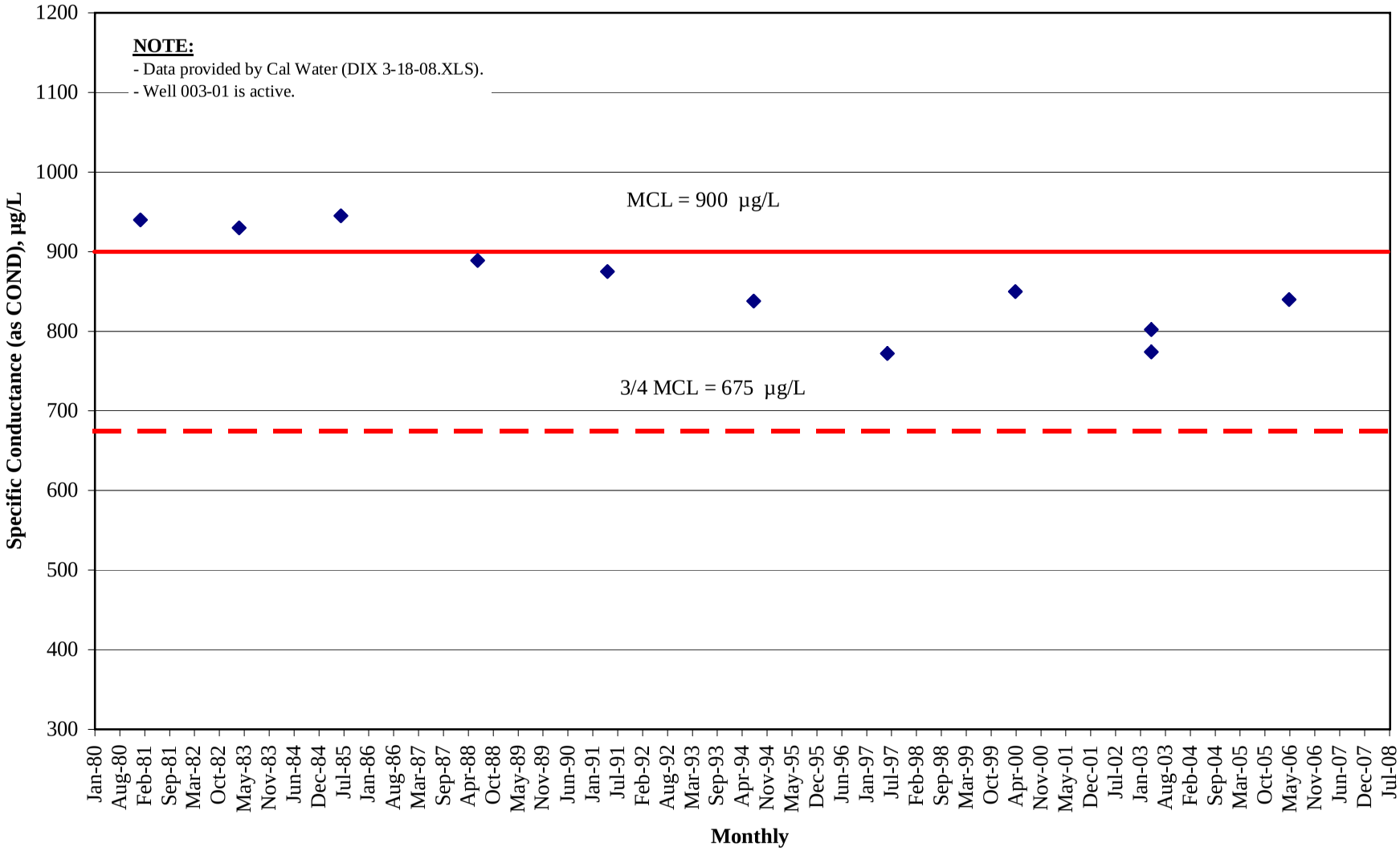
Figure 11. Station 003-01 - Historical Specific Conductance Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-11 STA. 003-01_COND
Last Revised: 08/15/2008

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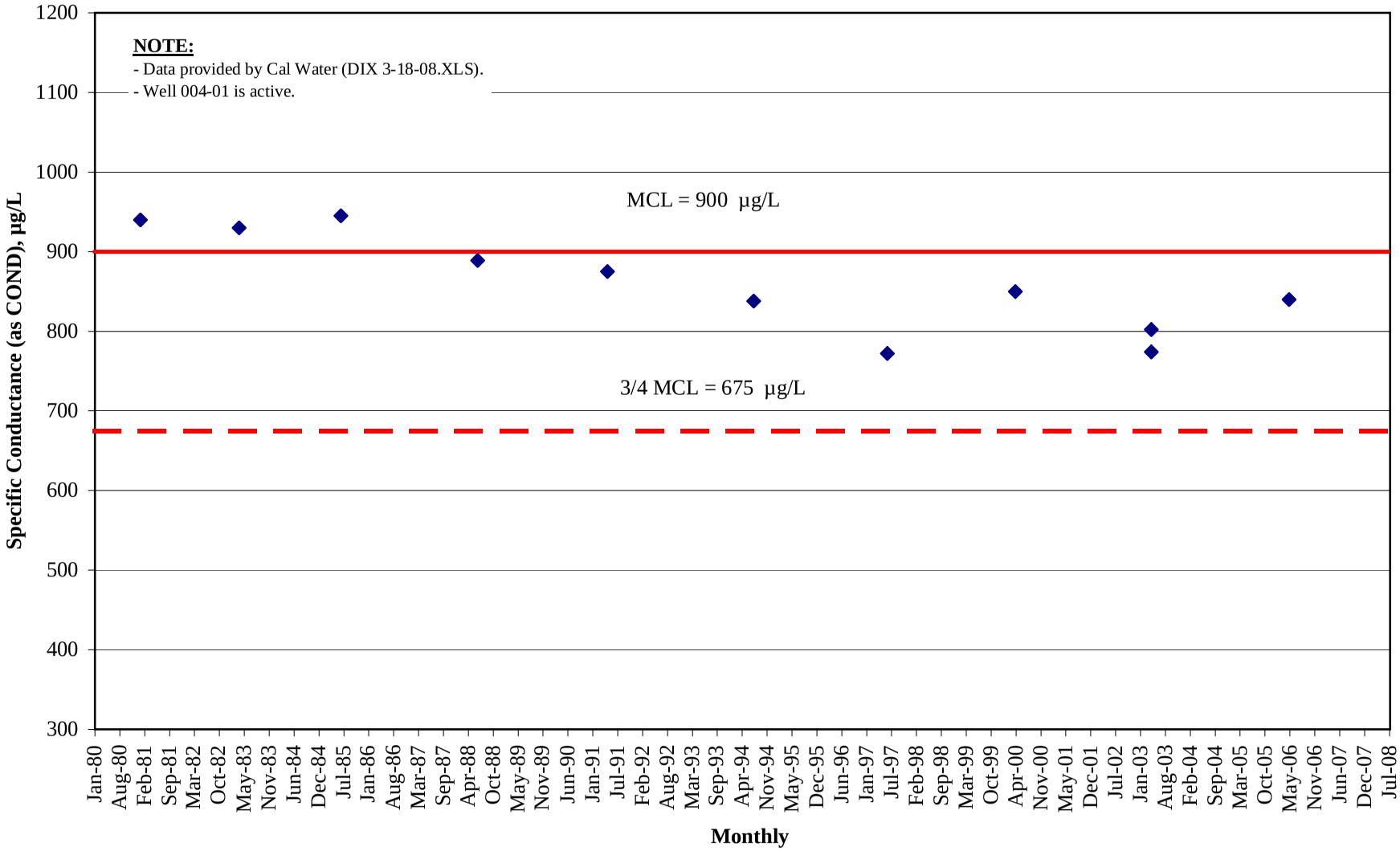
Figure 12. Station 004-01 - Historical Specific Conductance Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-12 STA. 004-01_COND
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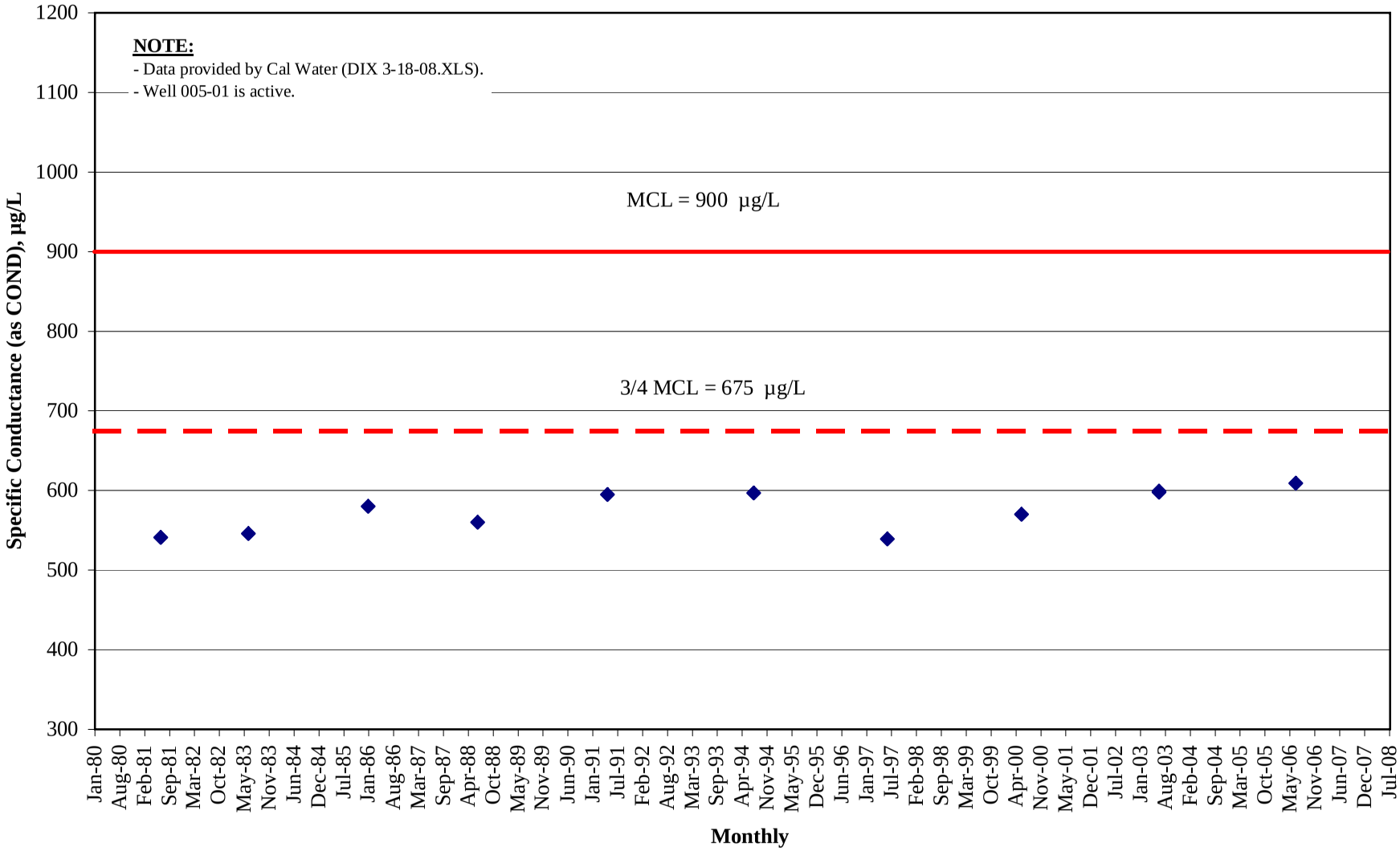
Figure 13. Station 005-01 - Historical Specific Conductance Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-13 STA. 005-01_COND
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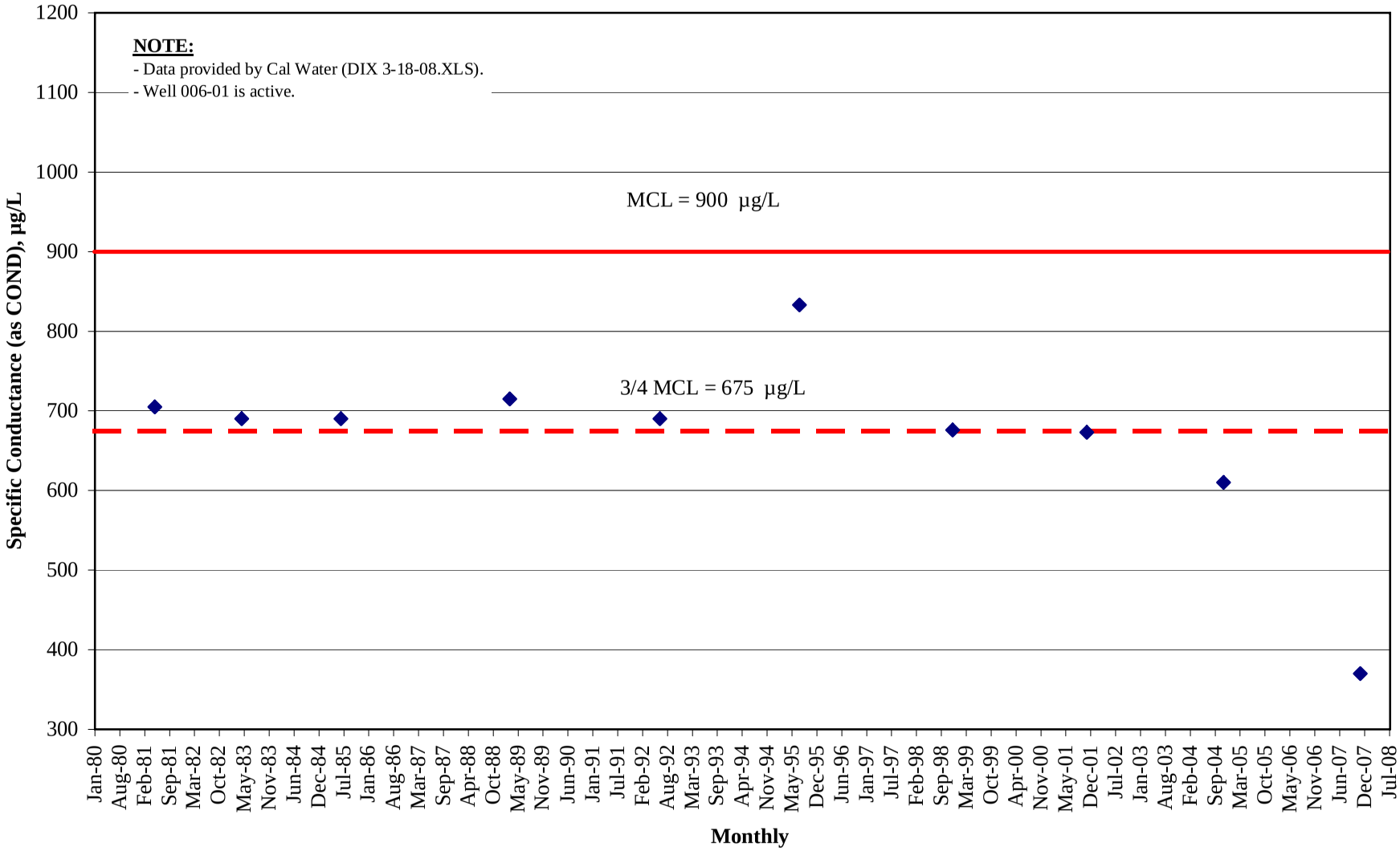
Figure 14. Station 06-01 - Historical Specific Conductance Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-14 STA. 006-01_COND
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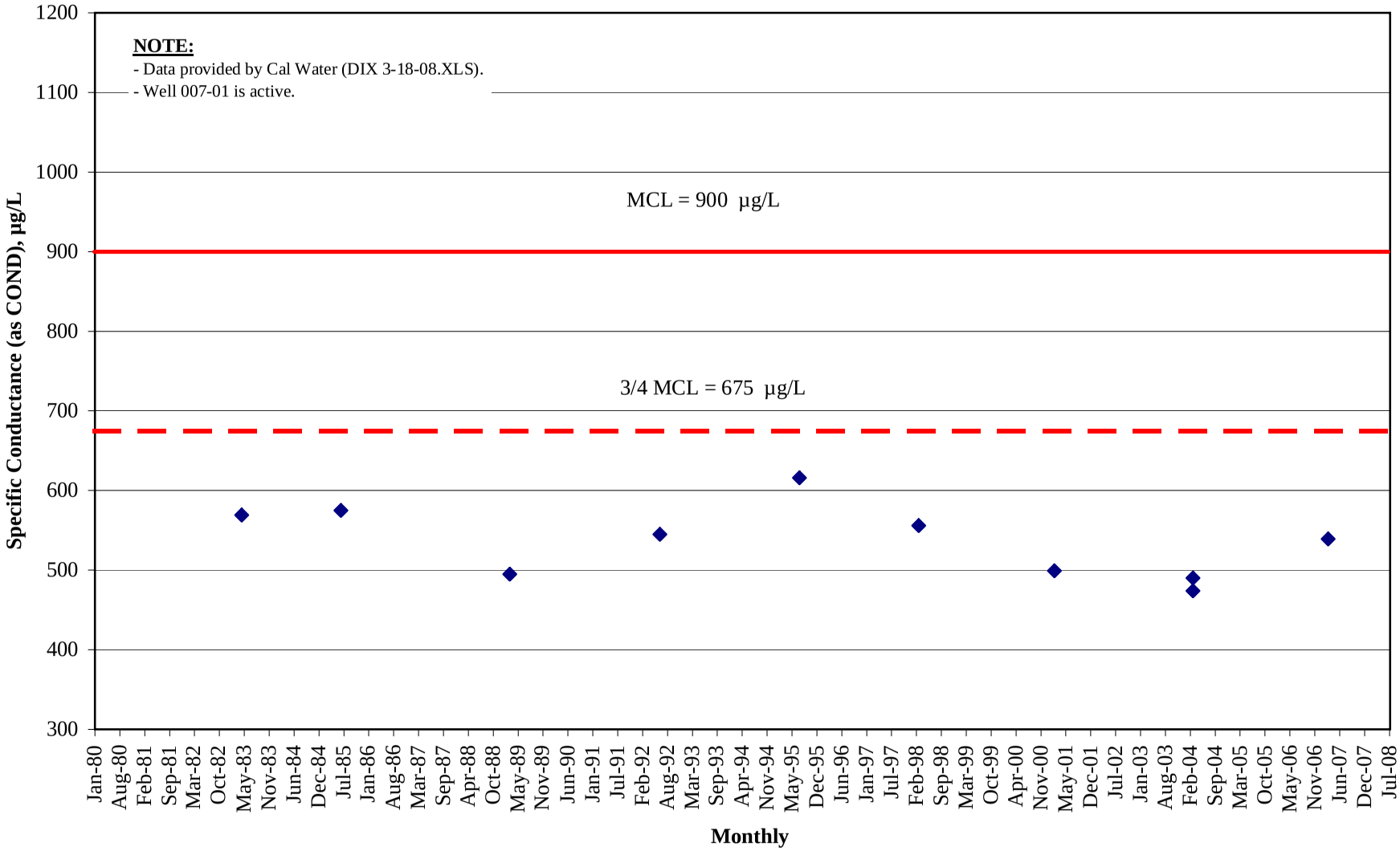
Figure 15. Station 007-01 - Historical Specific Conductance Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-15 STA. 007-01_COND
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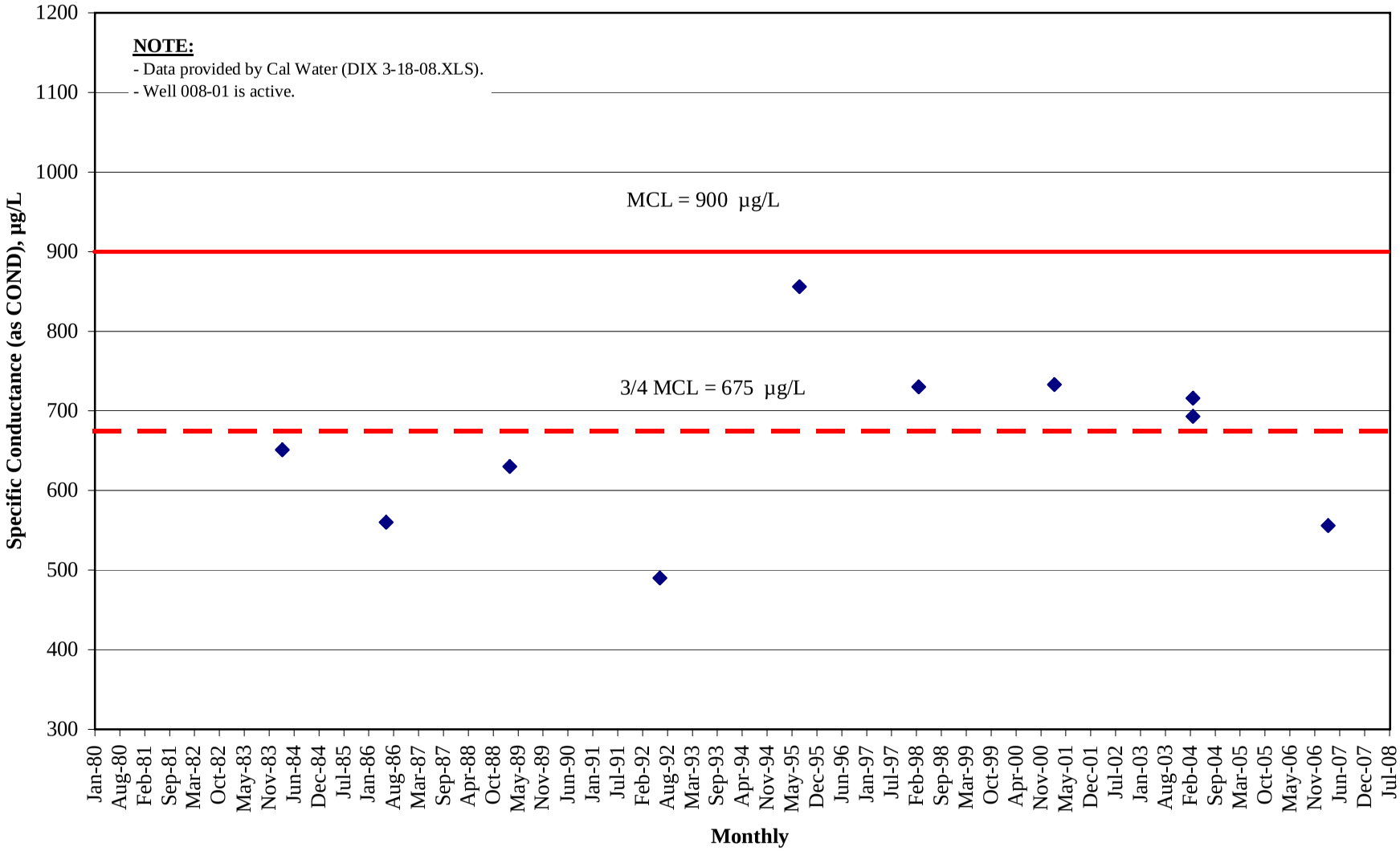
Figure 16. Station 008-01 - Historical Specific Conductance Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-16 STA. 008-01_COND
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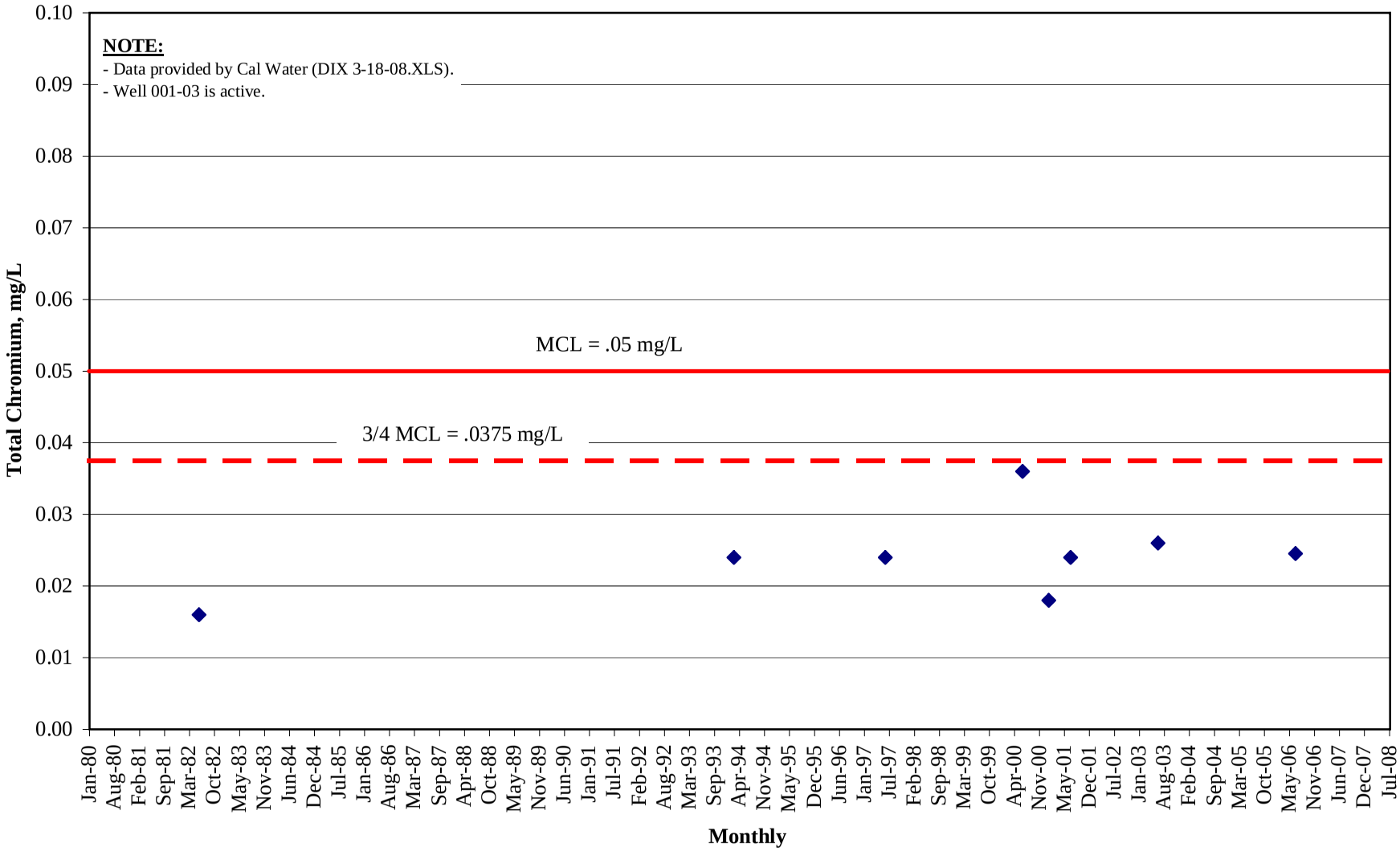
Figure 17. Station 001-03 - Historical Total Chromium Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-17 STA. 001-03_CR TOTAL
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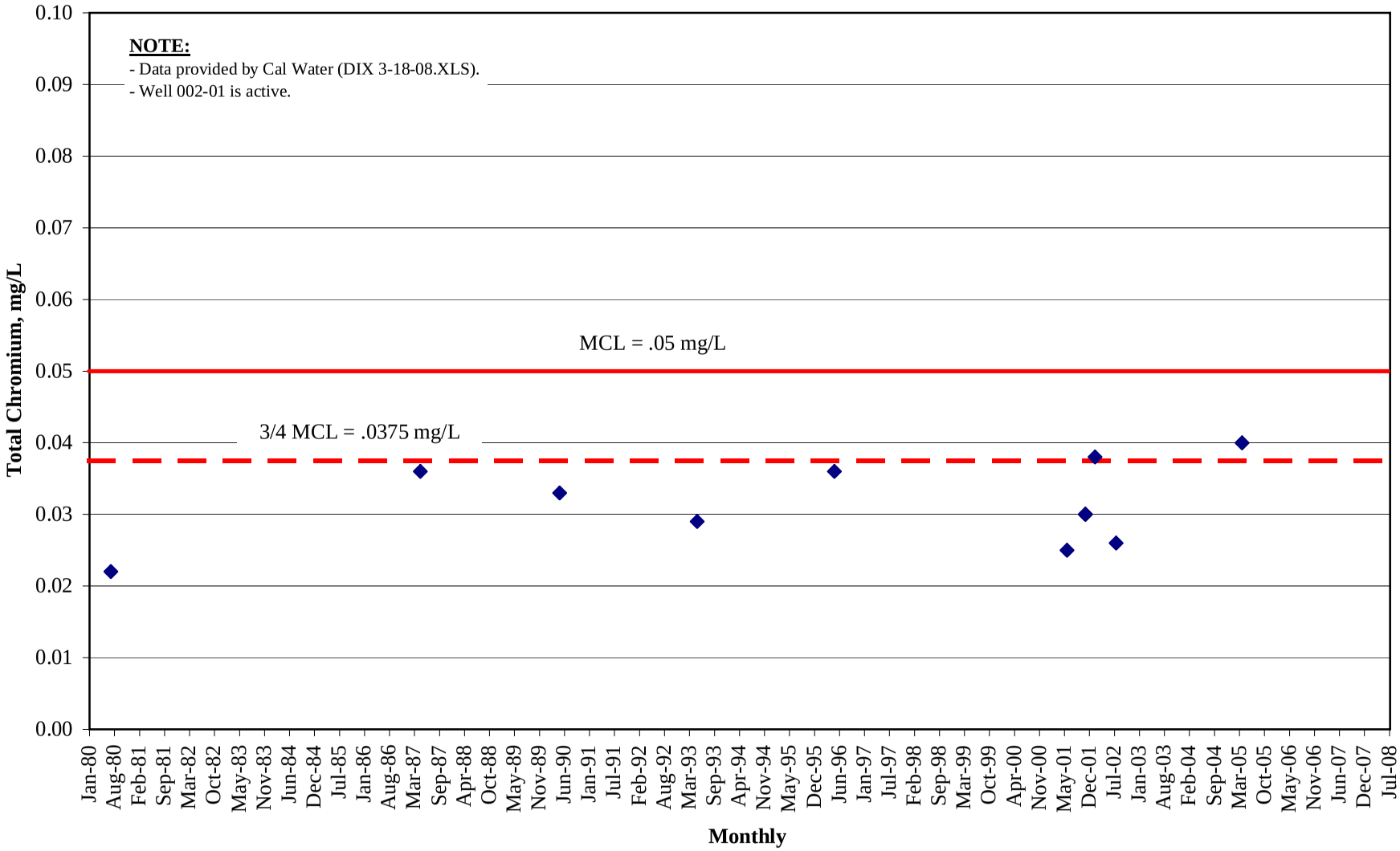
Figure 18. Station 002-01 - Historical Total Chromium Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-18 STA. 002-01_CR TOTAL
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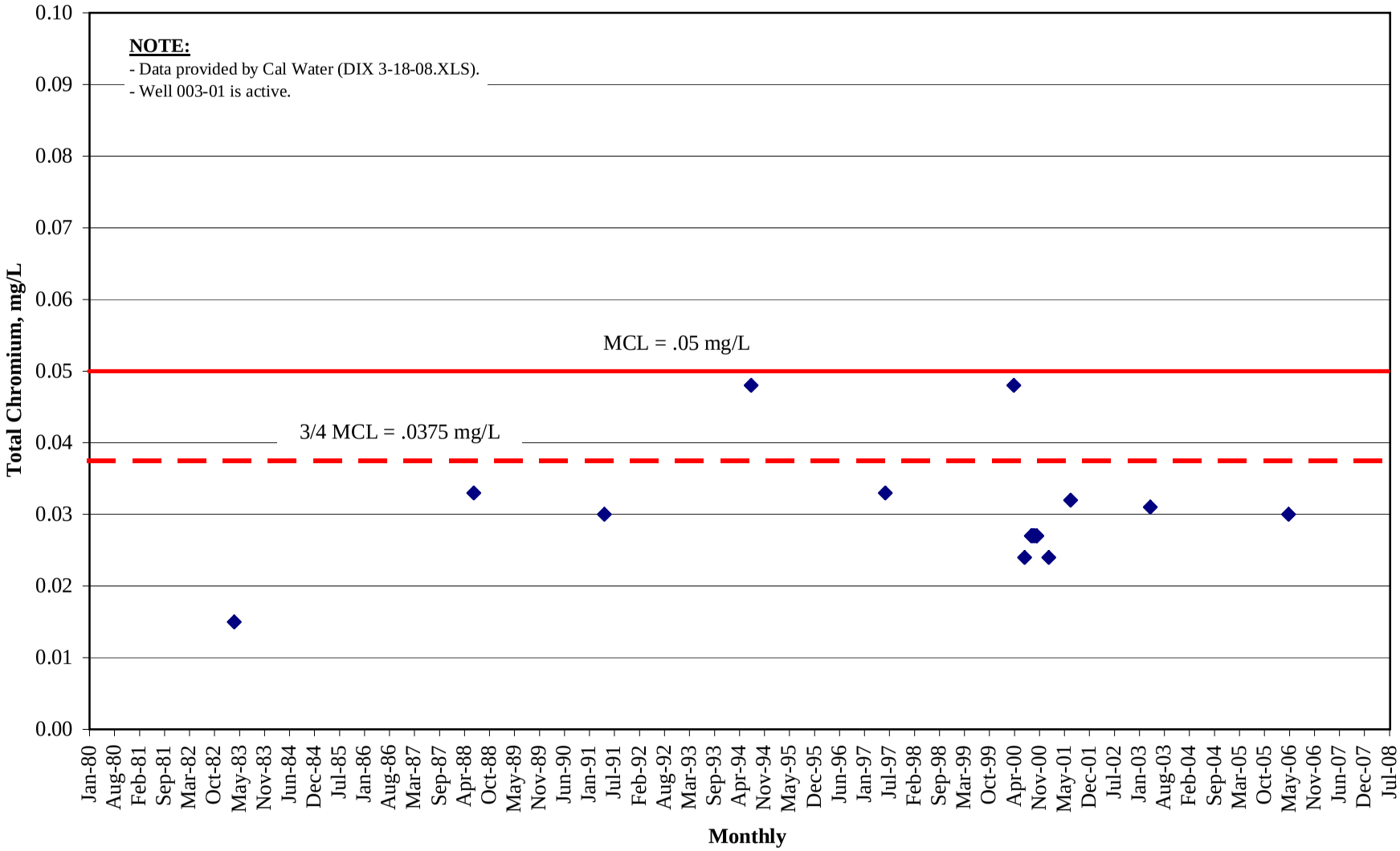
Figure 19. Station 003-01 - Historical Total Chromium Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-19 STA. 003-01_CR TOTAL
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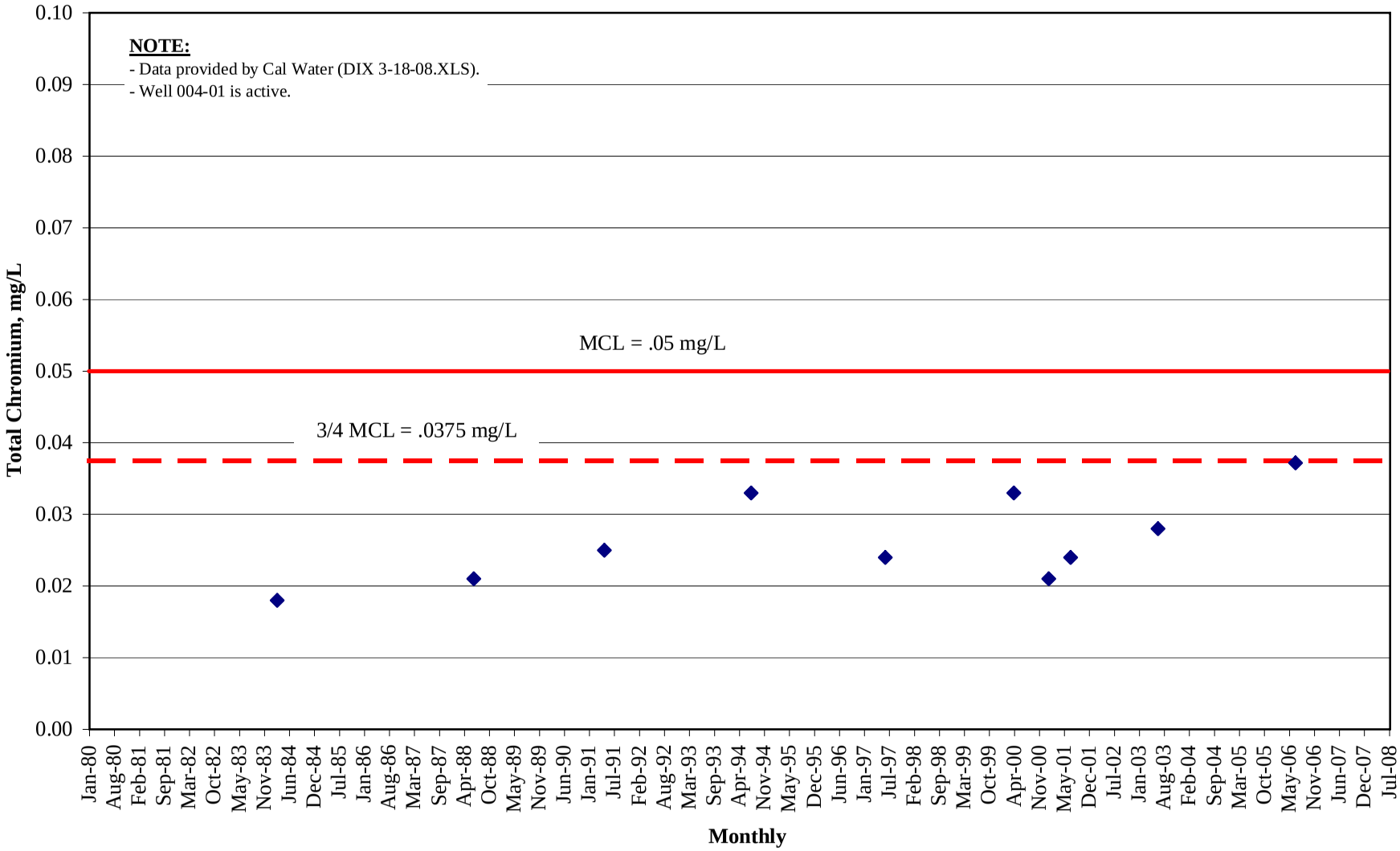
Figure 20. Station 004-01 - Historical Total Chromium Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-20 STA. 004-01_CR TOTAL
Last Revised: 08/15/2008

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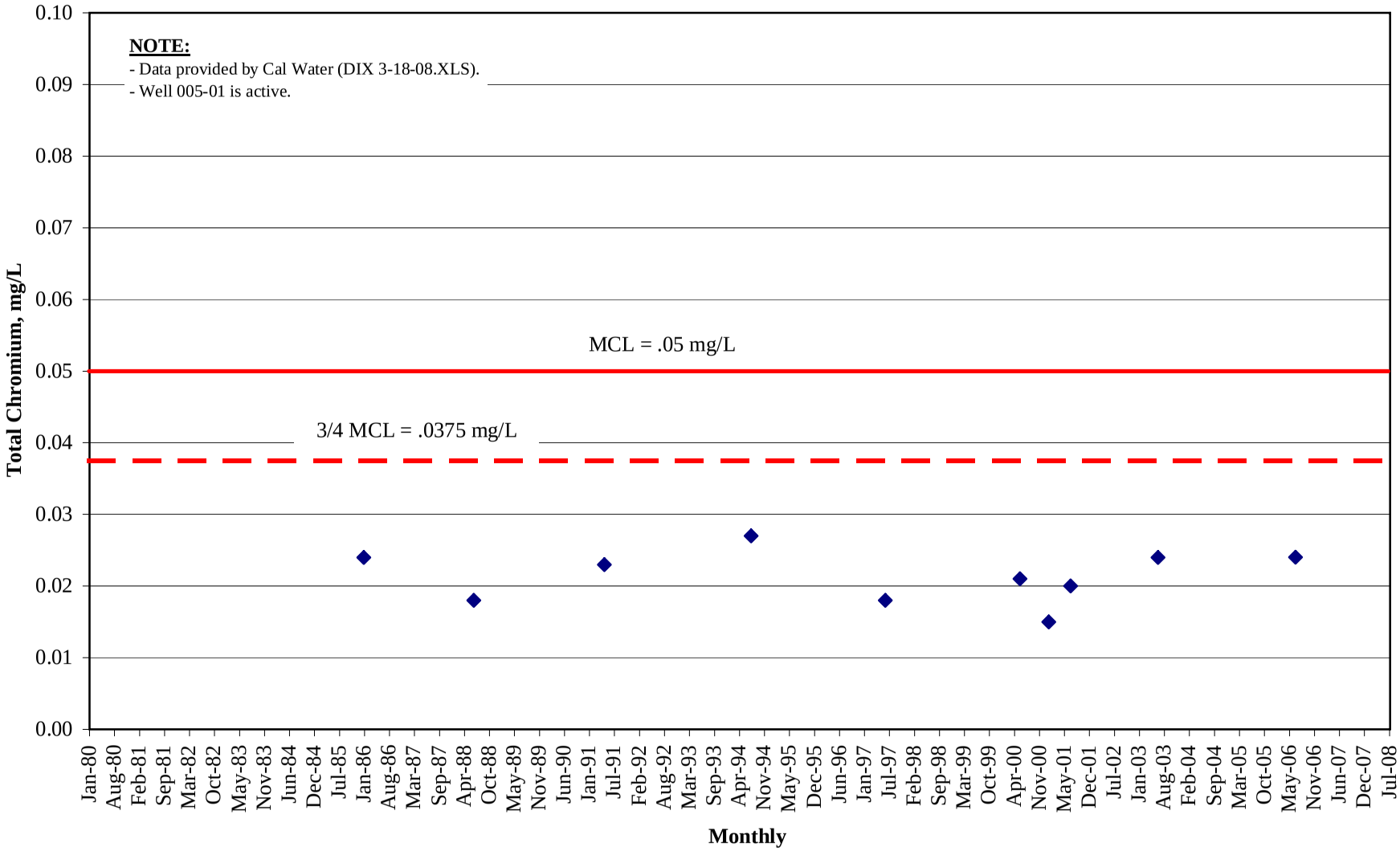
Figure 21. Station 005-01 - Historical Total Chromium Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-21 STA. 005-01_CR TOTAL
Last Revised: 08/15/2008

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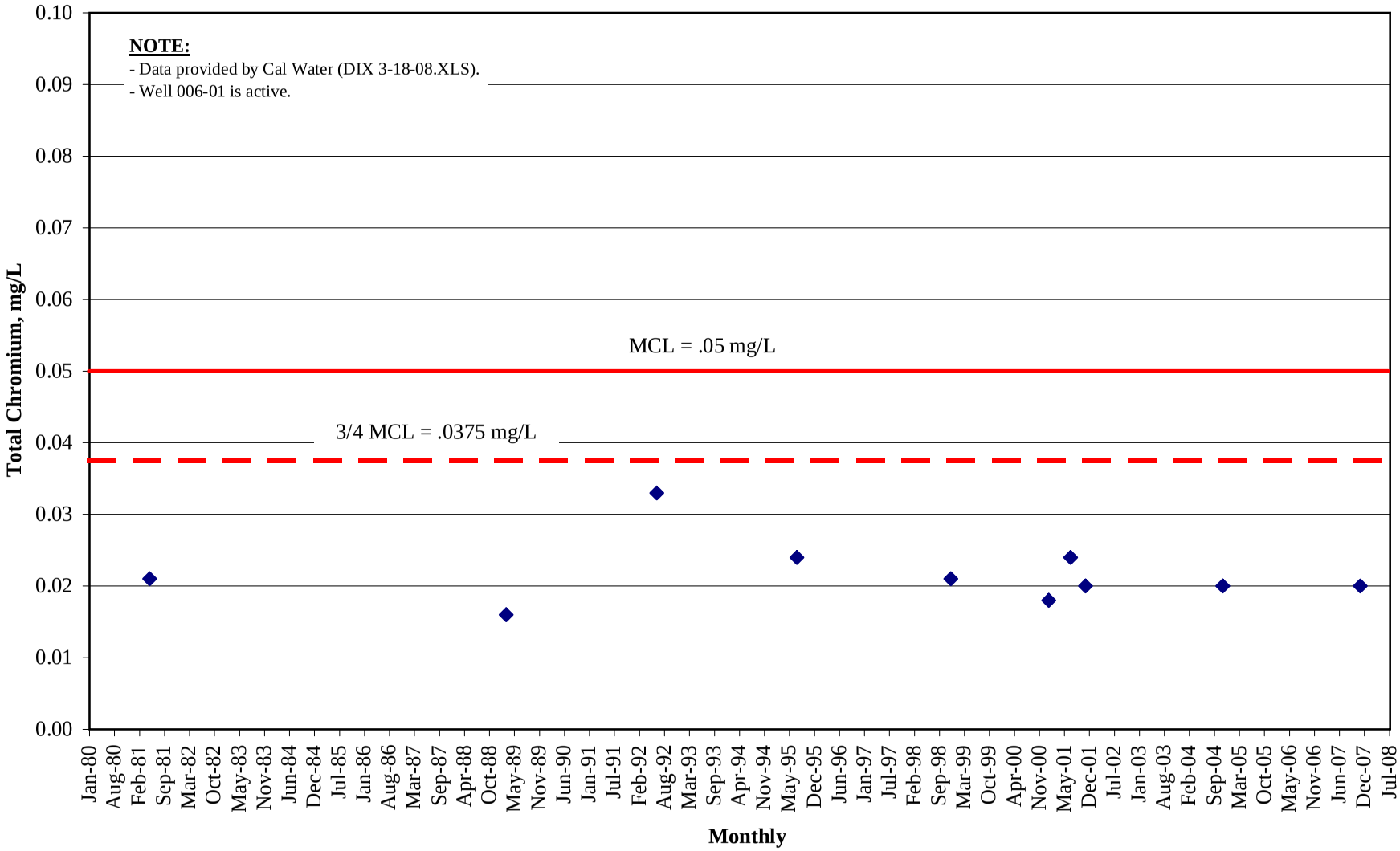
Figure 22. Station 06-01 - Historical Total Chromium Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-22 STA. 006-01_CR TOTAL
Last Revised: 08/15/2008

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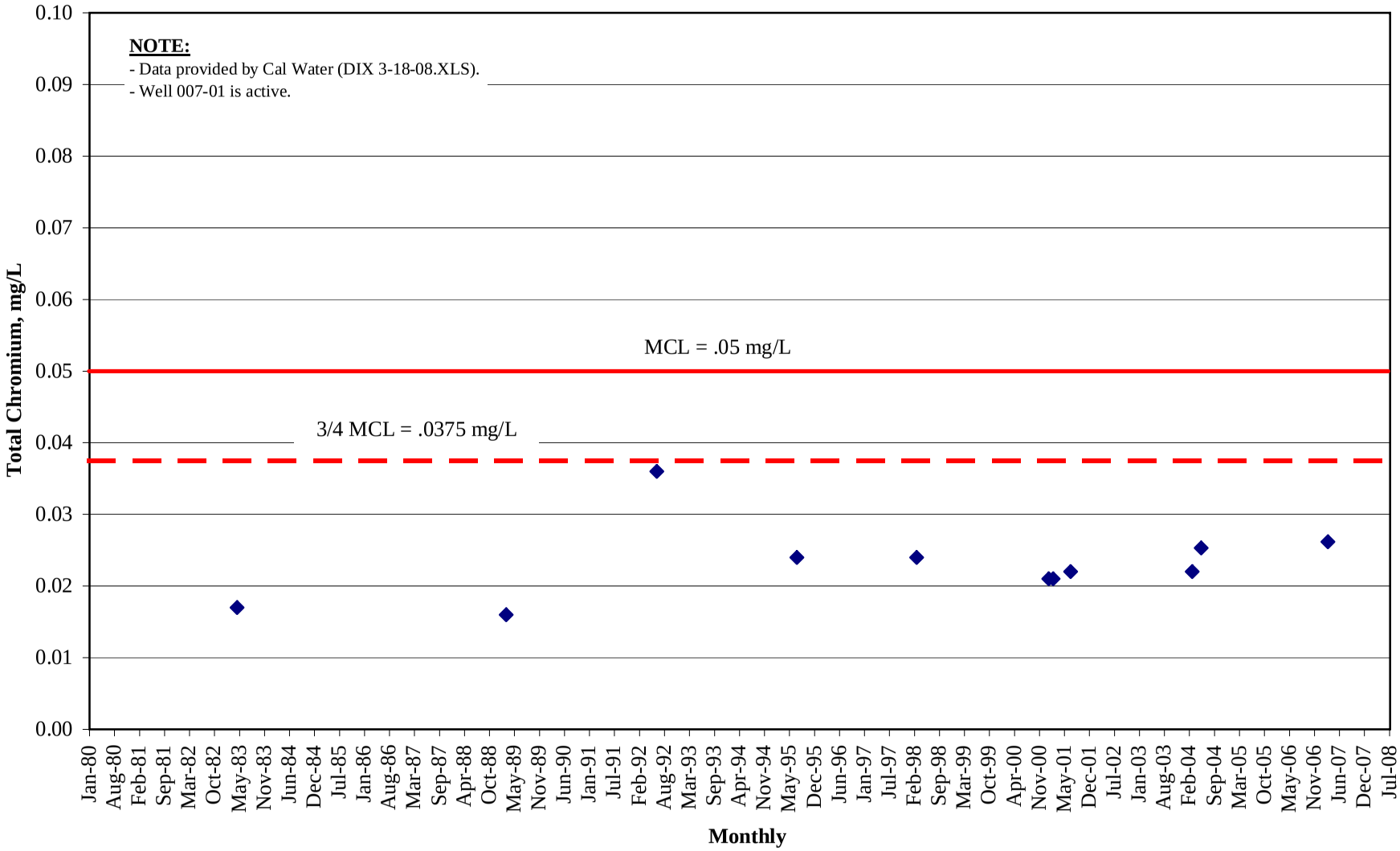
Figure 23. Station 007-01 - Historical Total Chromium Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-23 STA. 007-01_CR TOTAL
Last Revised: 08/15/2008

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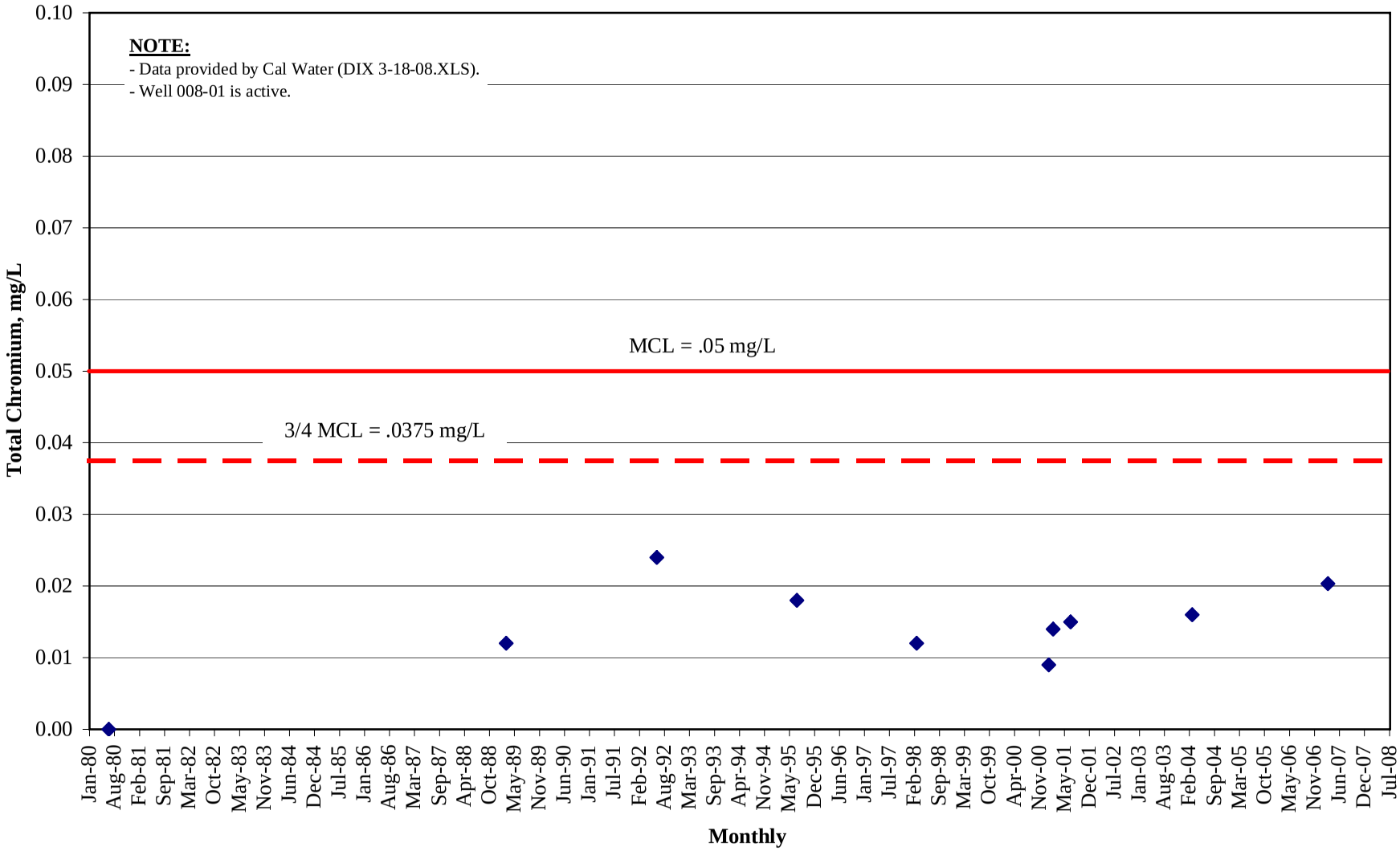
Figure 24. Station 008-01 - Historical Total Chromium Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-24 STA. 008-01_CR TOTAL
Last Revised: 08/15/2008

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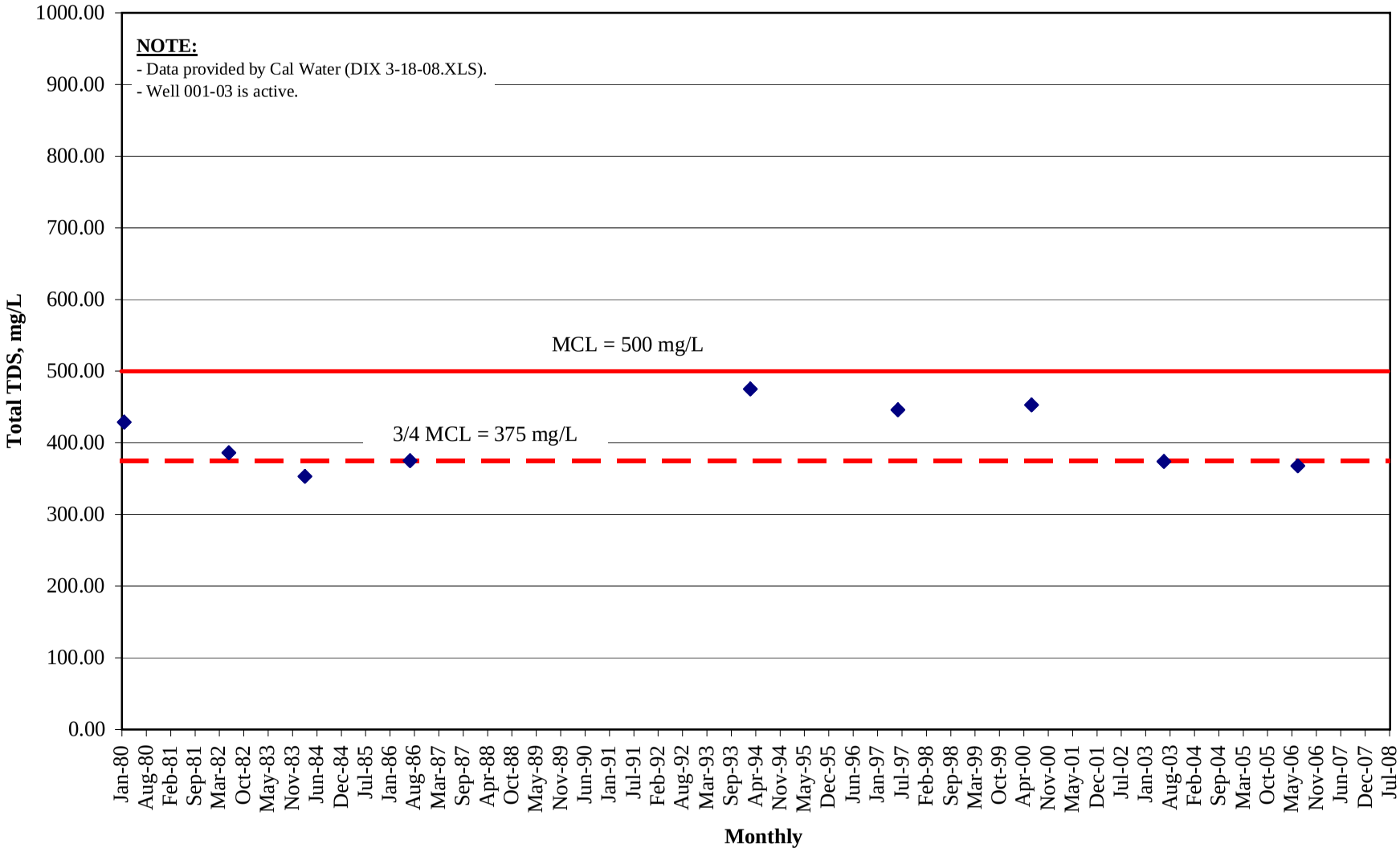
Figure 25. Station 001-03 - Historical TDS Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-25 STA. 001-03_TDS
Last Revised: 08/15/2008

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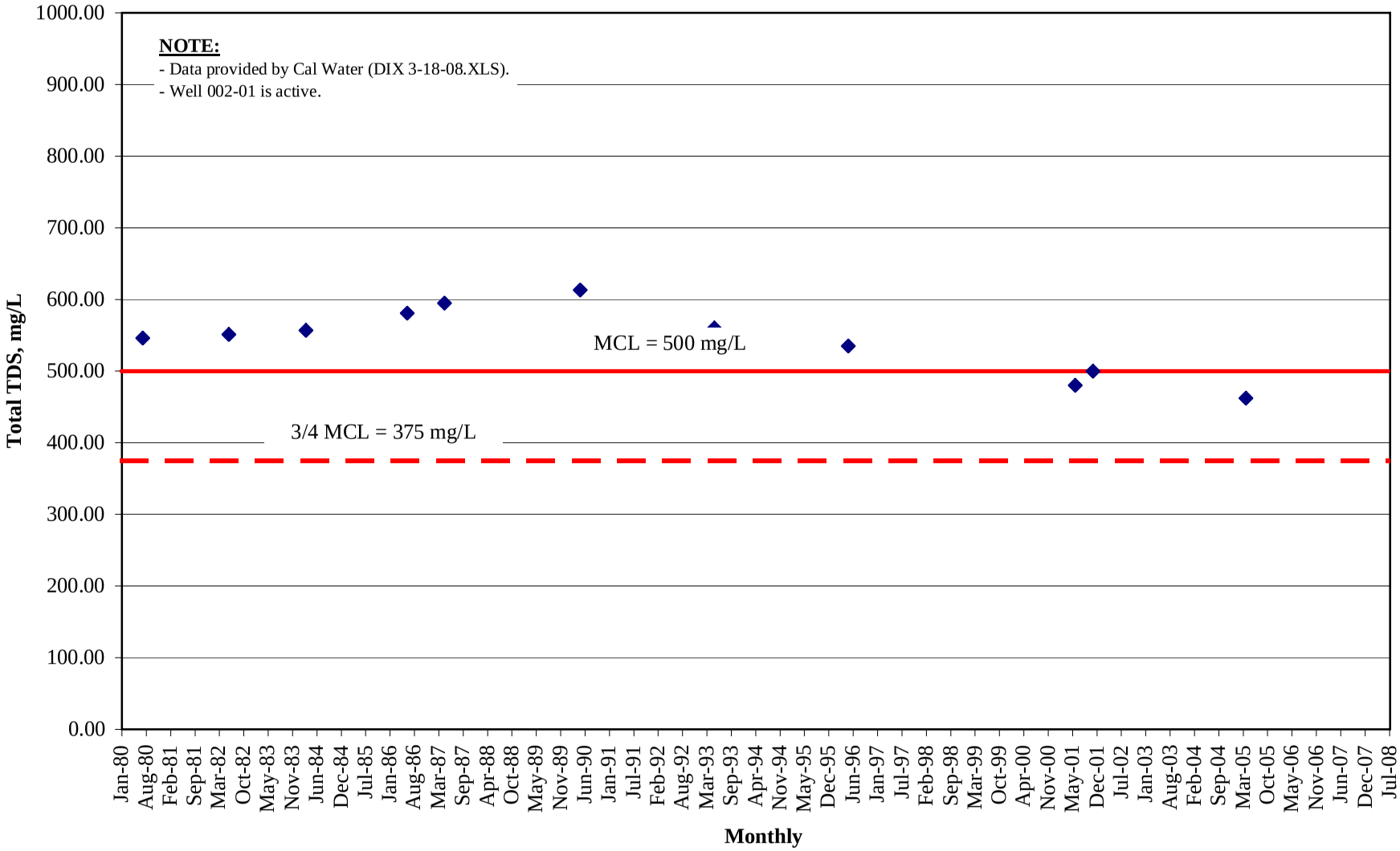
Figure 26. Station 002-01 - Historical TDS Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-26 STA. 002-01_TDS
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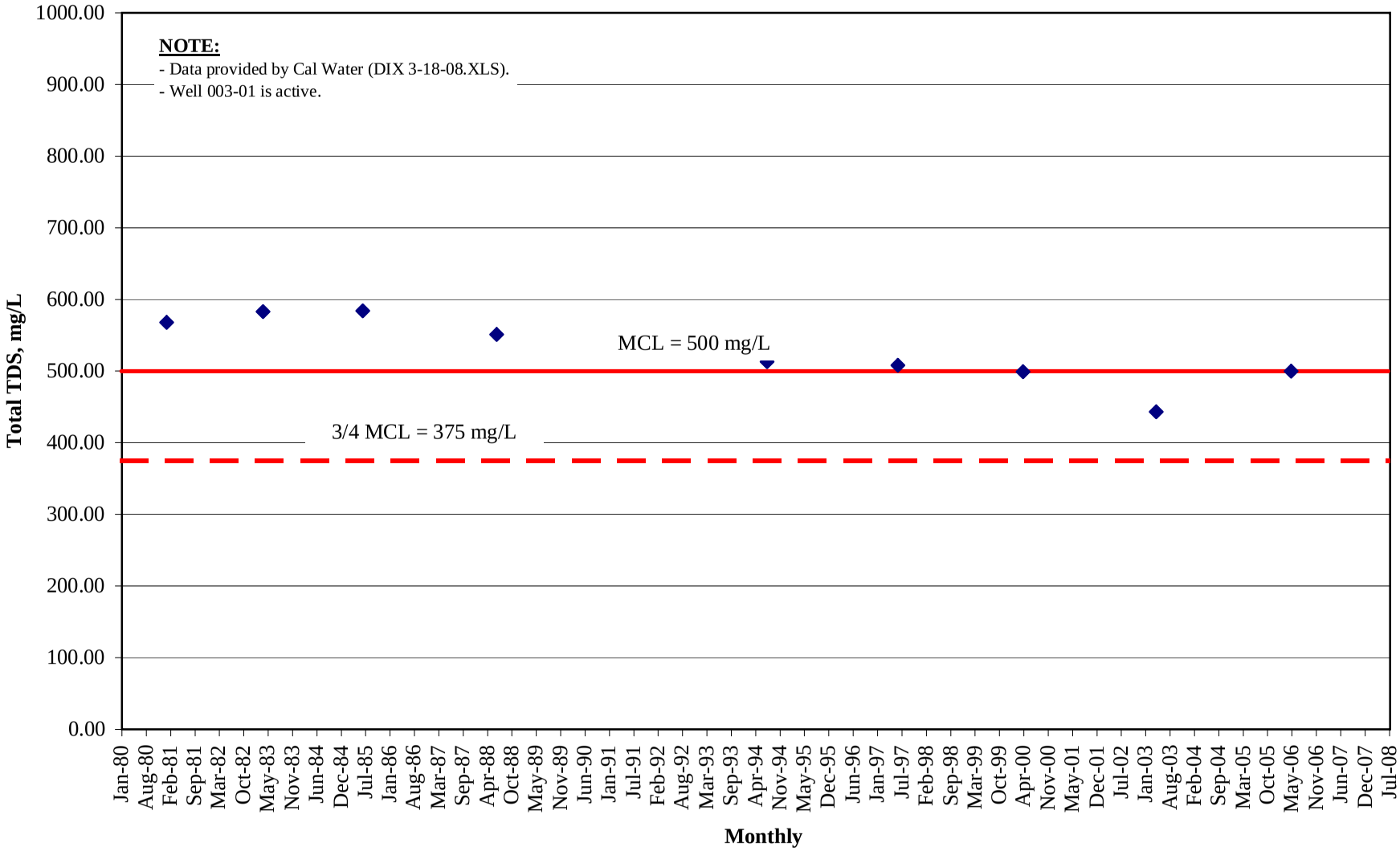
Figure 27. Station 003-01 - Historical TDS Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-27 STA. 003-01_TDS
Last Revised: 08/15/2008

California Water Service Company
Dixon District
Water Supply and Facilities Master Plan

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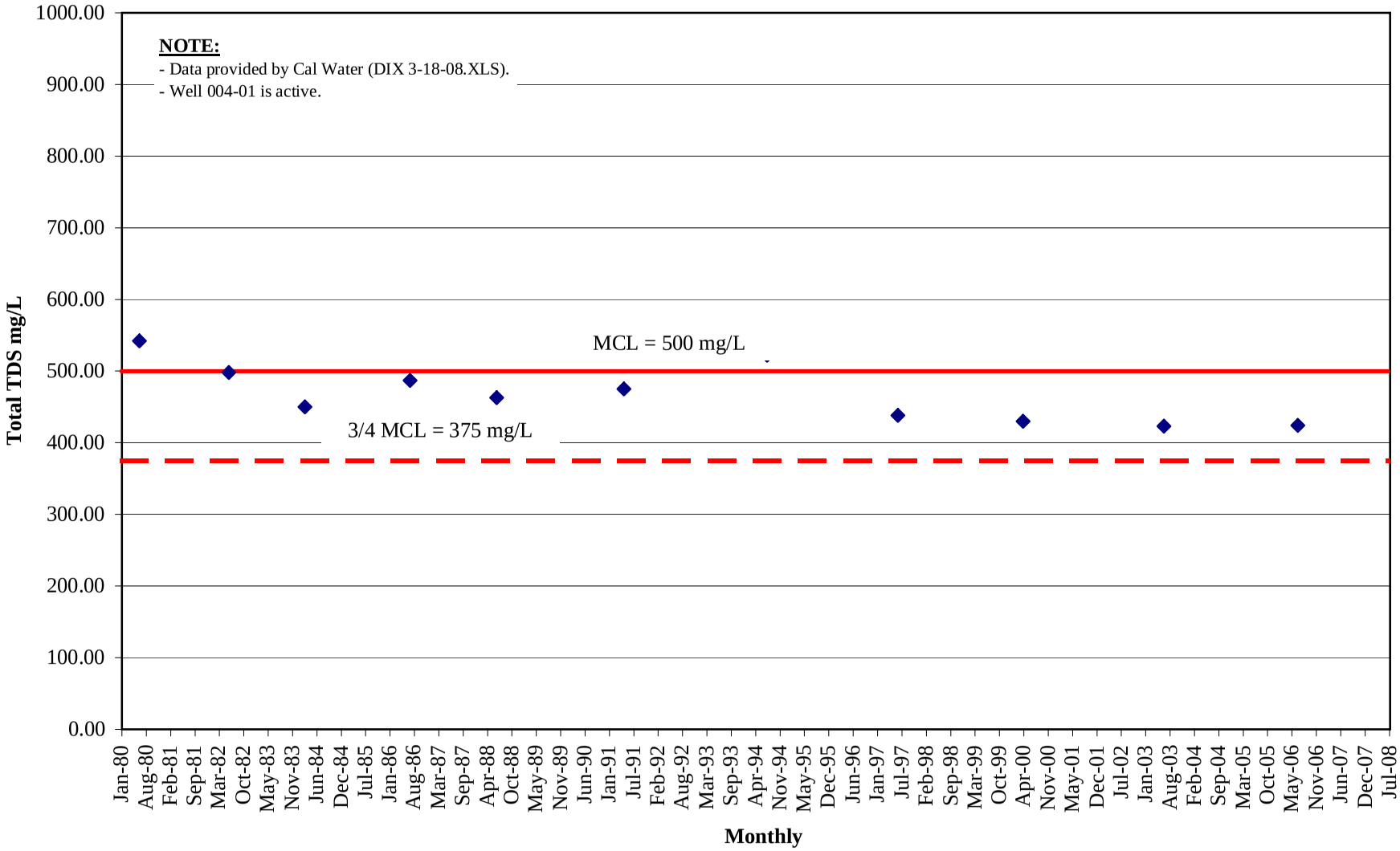
Figure 28. Station 004-01 - Historical TDS Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-28 STA. 004-01_TDS
Last Revised: 08/15/2008

California Water Service Company
Dixon District
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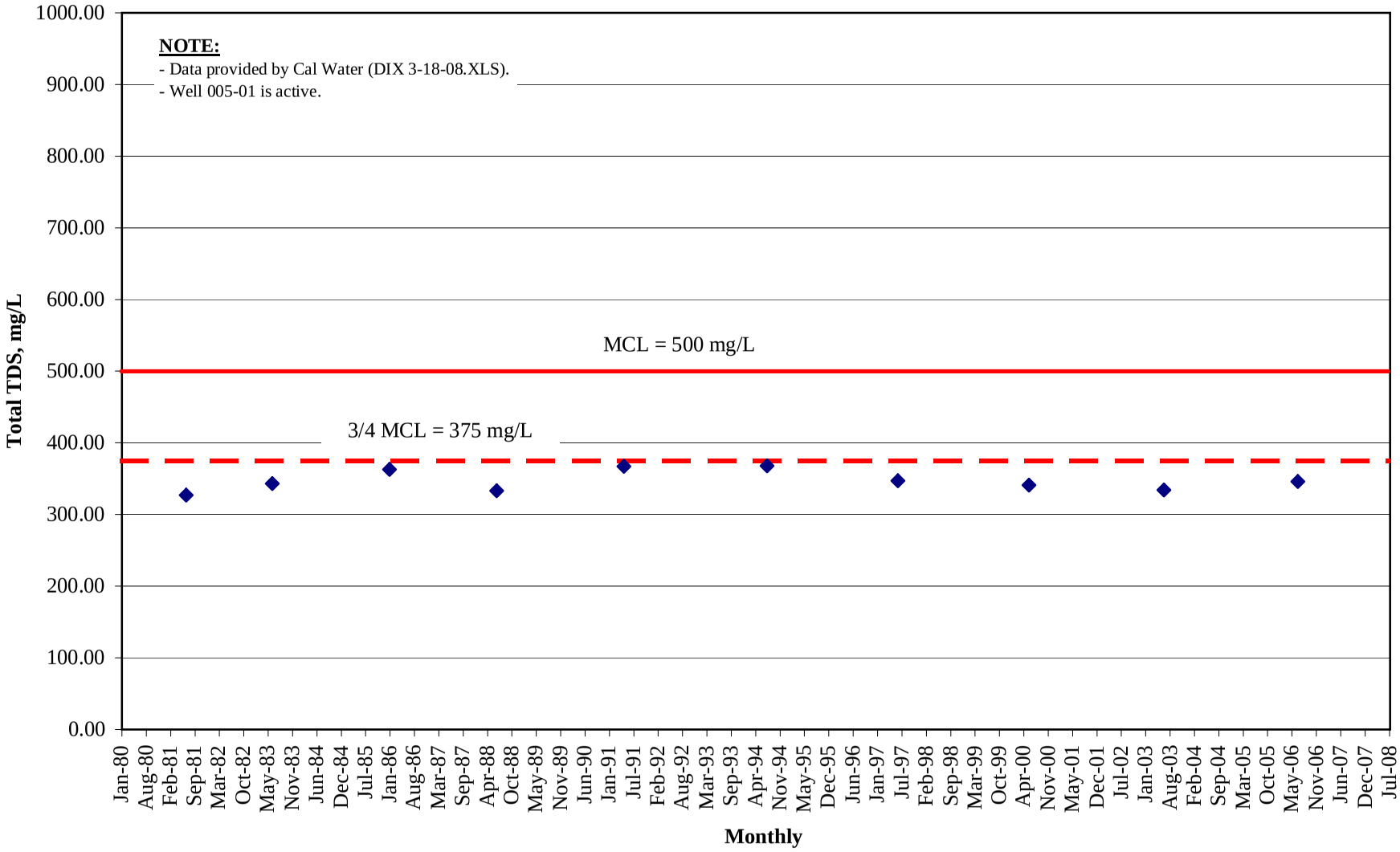
Figure 29. Station 005-01 - Historical TDS Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-29 STA. 005-01_TDS
Last Revised: 08/15/2008

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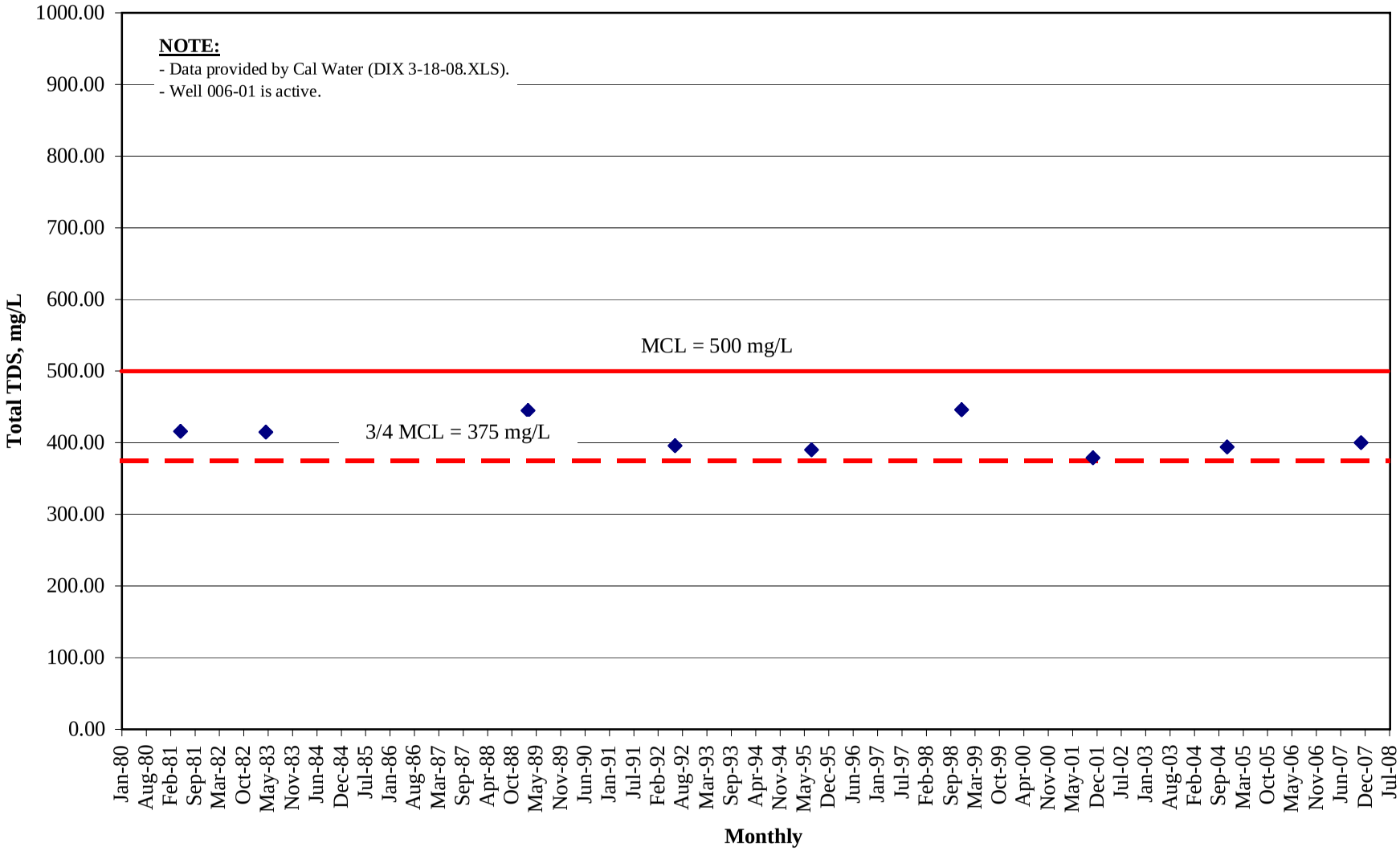
Figure 30. Station 06-01 - Historical TDS Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-30 STA. 006-01_TDS
Last Revised: 08/15/2008

California Water Service Company
Dixon District
Water Supply and Facilities Master Plan

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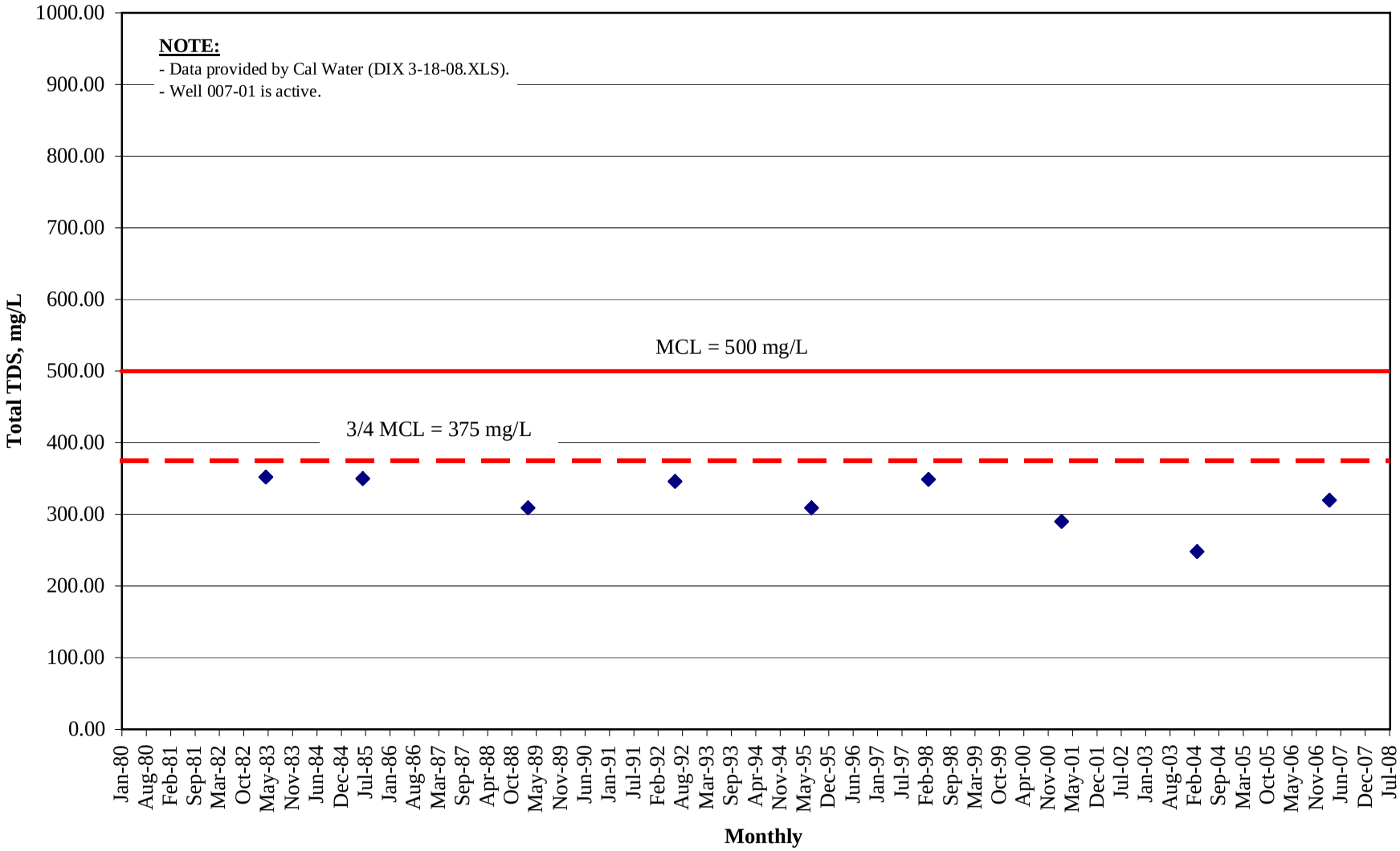
Figure 31. Station 007-01 - Historical TDS Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-31 STA. 007-01_TDS
Last Revised: 08/15/2008

California Water Service Company
Dixon District
Water Supply and Facilities Master Plan

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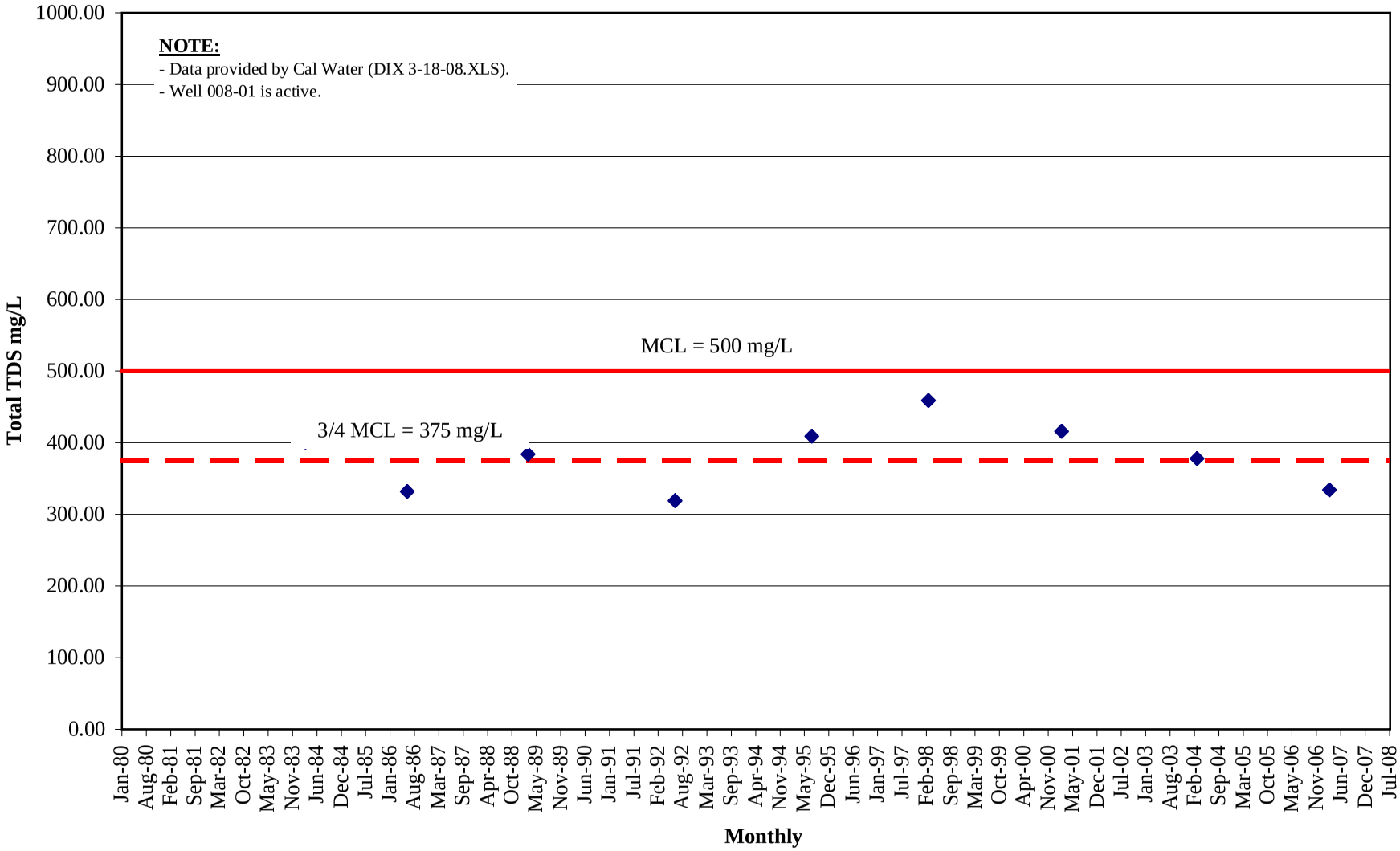
Figure 32. Station 008-01 - Historical TDS Concentrations



West Yost Associates
o:\c\436\02-08-07\e\T2\WQ\DIX_WellQuality\FIG 4F-32 STA. 008-01_TDS
Last Revised: 08/15/2008

California Water Service Company
Dixon District
Water Supply and Facilities Master Plan

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APPENDIX J

Detail Cost Estimates for Groundwater Supply

Table 1. Summary of Total Customer Expenditure for Maintaining Existing Groundwater Production Capacity

Year	Total Annual Customer Expenditure by Capital Improvement Phase[a]						Total Annual Customer Expenditure	Existing Groundwater Production, af	Unit Cost
	2008 to 2010	2011 to 2015	2016 to 2020	2021 to 2025	2026 to 2030	2030 to 2035			
2008	$651,000	$0	$0	$0	$0	$0	$651,000	1,725	$377.39
2009	$637,350	$0	$0	$0	$0	$0	$637,350	1,725	$369.48
2010	$623,700	$0	$0	$0	$0	$0	$623,700	1,725	$361.57
2011	$610,050	$0	$0	$0	$0	$0	$610,050	1,725	$353.65
2012	$596,400	$0	$0	$0	$0	$0	$596,400	1,725	$345.74
2013	$582,750	$0	$0	$0	$0	$0	$582,750	1,725	$337.83
2014	$569,100	$0	$0	$0	$0	$0	$569,100	1,725	$329.91
2015	$555,450	$0	$0	$0	$0	$0	$555,450	1,725	$322.00
2016	$541,800	$0	$217,000	$0	$0	$0	$758,800	1,725	$439.88
2017	$528,150	$0	$212,450	$0	$0	$0	$740,600	1,725	$429.33
2018	$514,500	$0	$207,900	$0	$0	$0	$722,400	1,725	$418.78
2019	$500,850	$0	$203,350	$0	$0	$0	$704,200	1,725	$408.23
2020	$487,200	$0	$198,800	$0	$0	$0	$686,000	1,725	$397.68
2021	$473,550	$0	$194,250	$434,000	$0	$0	$1,101,800	1,725	$638.72
2022	$459,900	$0	$189,700	$424,900	$0	$0	$1,074,500	1,725	$622.90
2023	$446,250	$0	$185,150	$415,800	$0	$0	$1,047,200	1,725	$607.07
2024	$432,600	$0	$180,600	$406,700	$0	$0	$1,019,900	1,725	$591.25
2025	$418,950	$0	$176,050	$397,600	$0	$0	$992,600	1,725	$575.42
2026	$405,300	$0	$171,500	$388,500	$434,000	$0	$1,399,300	1,725	$811.19
2027	$391,650	$0	$166,950	$379,400	$424,900	$0	$1,362,900	1,725	$790.09
2028	$378,000	$0	$162,400	$370,300	$415,800	$0	$1,326,500	1,725	$768.99
2029	$364,350	$0	$157,850	$361,200	$406,700	$0	$1,290,100	1,725	$747.88
2030	$350,700	$0	$153,300	$352,100	$397,600	$0	$1,253,700	1,725	$726.78
2031	$337,050	$0	$148,750	$343,000	$388,500	$0	$1,217,300	1,725	$705.68
2032	$323,400	$0	$144,200	$333,900	$379,400	$0	$1,180,900	1,725	$684.58
2033	$309,750	$0	$139,650	$324,800	$370,300	$0	$1,144,500	1,725	$663.48
2034	$296,100	$0	$135,100	$315,700	$361,200	$0	$1,108,100	1,725	$642.38
2035	$282,450	$0	$130,550	$306,600	$352,100	$0	$1,071,700	1,725	$621.28

[a] Data obtained from Appendix 4G, Table 2.

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Table 2. Annualized Groundwater Supply Costs: Existing Capacity Needs

Year
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

2008 to 2010

Capital Cost $1,400,000 per Project
Depreciation Period 40 Years
Quantity 3
Revenue Requirement Rate 13.0%

Depreciation Year	Rate Base Value	Revenue Requirement	Depreciation Cost	Total Annual Customer Expenditure
1	$4,200,000	$546,000	$105,000	$651,000
2	$4,095,000	$532,350	$105,000	$637,350
3	$3,990,000	$518,700	$105,000	$623,700
4	$3,885,000	$505,050	$105,000	$610,050
5	$3,780,000	$491,400	$105,000	$596,400
6	$3,675,000	$477,750	$105,000	$582,750
7	$3,570,000	$464,100	$105,000	$569,100
8	$3,465,000	$450,450	$105,000	$555,450
9	$3,360,000	$436,800	$105,000	$541,800
10	$3,255,000	$423,150	$105,000	$528,150
11	$3,150,000	$409,500	$105,000	$514,500
12	$3,045,000	$395,850	$105,000	$500,850
13	$2,940,000	$382,200	$105,000	$487,200
14	$2,835,000	$368,550	$105,000	$473,550
15	$2,730,000	$354,900	$105,000	$459,900
16	$2,625,000	$341,250	$105,000	$446,250
17	$2,520,000	$327,600	$105,000	$432,600
18	$2,415,000	$313,950	$105,000	$418,950
19	$2,310,000	$300,300	$105,000	$405,300
20	$2,205,000	$286,650	$105,000	$391,650
21	$2,100,000	$273,000	$105,000	$378,000
22	$1,995,000	$259,350	$105,000	$364,350
23	$1,890,000	$245,700	$105,000	$350,700
24	$1,785,000	$232,050	$105,000	$337,050
25	$1,680,000	$218,400	$105,000	$323,400
26	$1,575,000	$204,750	$105,000	$309,750
27	$1,470,000	$191,100	$105,000	$296,100
28	$1,365,000	$177,450	$105,000	$282,450
29	$1,260,000	$163,800	$105,000	$268,800
30	$1,155,000	$150,150	$105,000	$255,150
31	$1,050,000	$136,500	$105,000	$241,500
32	$945,000	$122,850	$105,000	$227,850
33	$840,000	$109,200	$105,000	$214,200
34	$735,000	$95,550	$105,000	$200,550
35	$630,000	$81,900	$105,000	$186,900
36	$525,000	$68,250	$105,000	$173,250
37	$420,000	$54,600	$105,000	$159,600
38	$315,000	$40,950	$105,000	$145,950
39	$210,000	$27,300	$105,000	$132,300
40	$105,000	$13,650	$105,000	$118,650
Total Expenditure		$11,193,000	$4,200,000	$15,393,000
Average Annual Expenditure				$384,825

2011 to 2015

Capital Cost $1,400,000 per Project
Depreciation Period 40 Years
Quantity 0
Revenue Requirement Rate 13.0%

Depreciation Year	Rate Base Value	Revenue Requirement	Depreciation Cost	Total Annual Customer Expenditure
1	$0	$0	$0	$0
2	$0	$0	$0	$0
3	$0	$0	$0	$0
4	$0	$0	$0	$0
5	$0	$0	$0	$0
6	$0	$0	$0	$0
7	$0	$0	$0	$0
8	$0	$0	$0	$0
9	$0	$0	$0	$0
10	$0	$0	$0	$0
11	$0	$0	$0	$0
12	$0	$0	$0	$0
13	$0	$0	$0	$0
14	$0	$0	$0	$0
15	$0	$0	$0	$0
16	$0	$0	$0	$0
17	$0	$0	$0	$0
18	$0	$0	$0	$0
19	$0	$0	$0	$0
20	$0	$0	$0	$0
21	$0	$0	$0	$0
22	$0	$0	$0	$0
23	$0	$0	$0	$0
24	$0	$0	$0	$0
25	$0	$0	$0	$0
26	$0	$0	$0	$0
27	$0	$0	$0	$0
28	$0	$0	$0	$0
29	$0	$0	$0	$0
30	$0	$0	$0	$0
31	$0	$0	$0	$0
32	$0	$0	$0	$0
33	$0	$0	$0	$0
34	$0	$0	$0	$0
35	$0	$0	$0	$0
36	$0	$0	$0	$0
37	$0	$0	$0	$0
38	$0	$0	$0	$0
39	$0	$0	$0	$0
40	$0	$0	$0	$0
Total Expenditure		$0	$0	$0
Average Annual Expenditure				$0

2016 to 2020

Capital Cost $1,400,000 per Project
Depreciation Period 40 Years
Quantity 1
Revenue Requirement Rate 13.0%

Depreciation Year	Rate Base Value	Revenue Requirement	Depreciation Cost	Total Annual Customer Expenditure
1	$1,400,000	$182,000	$35,000	$217,000
2	$1,365,000	$177,450	$35,000	$212,450
3	$1,330,000	$172,900	$35,000	$207,900
4	$1,295,000	$168,350	$35,000	$203,350
5	$1,260,000	$163,800	$35,000	$198,800
6	$1,225,000	$159,250	$35,000	$194,250
7	$1,190,000	$154,700	$35,000	$189,700
8	$1,155,000	$150,150	$35,000	$185,150
9	$1,120,000	$145,600	$35,000	$180,600
10	$1,085,000	$141,050	$35,000	$176,050
11	$1,050,000	$136,500	$35,000	$171,500
12	$1,015,000	$131,950	$35,000	$166,950
13	$980,000	$127,400	$35,000	$162,400
14	$945,000	$122,850	$35,000	$157,850
15	$910,000	$118,300	$35,000	$153,300
16	$875,000	$113,750	$35,000	$148,750
17	$840,000	$109,200	$35,000	$144,200
18	$805,000	$104,650	$35,000	$139,650
19	$770,000	$100,100	$35,000	$135,100
20	$735,000	$95,550	$35,000	$130,550
21	$700,000	$91,000	$35,000	$126,000
22	$665,000	$86,450	$35,000	$121,450
23	$630,000	$81,900	$35,000	$116,900
24	$595,000	$77,350	$35,000	$112,350
25	$560,000	$72,800	$35,000	$107,800
26	$525,000	$68,250	$35,000	$103,250
27	$490,000	$63,700	$35,000	$98,700
28	$455,000	$59,150	$35,000	$94,150
29	$420,000	$54,600	$35,000	$89,600
30	$385,000	$50,050	$35,000	$85,050
31	$350,000	$45,500	$35,000	$80,500
32	$315,000	$40,950	$35,000	$75,950
33	$280,000	$36,400	$35,000	$71,400
34	$245,000	$31,850	$35,000	$66,850
35	$210,000	$27,300	$35,000	$62,300
36	$175,000	$22,750	$35,000	$57,750
37	$140,000	$18,200	$35,000	$53,200
38	$105,000	$13,650	$35,000	$48,650
39	$70,000	$9,100	$35,000	$44,100
40	$35,000	$4,550	$35,000	$39,550
Total Expenditure		$3,731,000	$1,400,000	$5,131,000
Average Annual Expenditure				$128,275

2021 to 2025

Capital Cost $1,400,000 per Project
Depreciation Period 40 Years
Quantity 2
Revenue Requirement Rate 13.0%

Depreciation Year	Rate Base Value	Revenue Requirement	Depreciation Cost	Total Annual Customer Expenditure
1	$2,800,000	$364,000	$70,000	$434,000
2	$2,730,000	$354,900	$70,000	$424,900
3	$2,660,000	$345,800	$70,000	$415,800
4	$2,590,000	$336,700	$70,000	$406,700
5	$2,520,000	$327,600	$70,000	$397,600
6	$2,450,000	$318,500	$70,000	$388,500
7	$2,380,000	$309,400	$70,000	$379,400
8	$2,310,000	$300,300	$70,000	$370,300
9	$2,240,000	$291,200	$70,000	$361,200
10	$2,170,000	$282,100	$70,000	$352,100
11	$2,100,000	$273,000	$70,000	$343,000
12	$2,030,000	$263,900	$70,000	$333,900
13	$1,960,000	$254,800	$70,000	$324,800
14	$1,890,000	$245,700	$70,000	$315,700
15	$1,820,000	$236,600	$70,000	$306,600
16	$1,750,000	$227,500	$70,000	$297,500
17	$1,680,000	$218,400	$70,000	$288,400
18	$1,610,000	$209,300	$70,000	$279,300
19	$1,540,000	$200,200	$70,000	$270,200
20	$1,470,000	$191,100	$70,000	$261,100
21	$1,400,000	$182,000	$70,000	$252,000
22	$1,330,000	$172,900	$70,000	$242,900
23	$1,260,000	$163,800	$70,000	$233,800
24	$1,190,000	$154,700	$70,000	$224,700
25	$1,120,000	$145,600	$70,000	$215,600
26	$1,050,000	$136,500	$70,000	$206,500
27	$980,000	$127,400	$70,000	$197,400
28	$910,000	$118,300	$70,000	$188,300
29	$840,000	$109,200	$70,000	$179,200
30	$770,000	$100,100	$70,000	$170,100
31	$700,000	$91,000	$70,000	$161,000
32	$630,000	$81,900	$70,000	$151,900
33	$560,000	$72,800	$70,000	$142,800
34	$490,000	$63,700	$70,000	$133,700
35	$420,000	$54,600	$70,000	$124,600
36	$350,000	$45,500	$70,000	$115,500
37	$280,000	$36,400	$70,000	$106,400
38	$210,000	$27,300	$70,000	$97,300
39	$140,000	$18,200	$70,000	$88,200
40	$70,000	$9,100	$70,000	$79,100
Total Expenditure		$7,462,000	$2,800,000	$10,262,000
Average Annual Expenditure				$256,550

2026 to 2030

Capital Cost $1,400,000 per Project
Depreciation Period 40 Years
Quantity 2
Revenue Requirement Rate 13.0%

Depreciation Year	Rate Base Value	Revenue Requirement	Depreciation Cost	Total Annual Customer Expenditure
1	$2,800,000	$364,000	$70,000	$434,000
2	$2,730,000	$354,900	$70,000	$424,900
3	$2,660,000	$345,800	$70,000	$415,800
4	$2,590,000	$336,700	$70,000	$406,700
5	$2,520,000	$327,600	$70,000	$397,600
6	$2,450,000	$318,500	$70,000	$388,500
7	$2,380,000	$309,400	$70,000	$379,400
8	$2,310,000	$300,300	$70,000	$370,300
9	$2,240,000	$291,200	$70,000	$361,200
10	$2,170,000	$282,100	$70,000	$352,100
11	$2,100,000	$273,000	$70,000	$343,000
12	$2,030,000	$263,900	$70,000	$333,900
13	$1,960,000	$254,800	$70,000	$324,800
14	$1,890,000	$245,700	$70,000	$315,700
15	$1,820,000	$236,600	$70,000	$306,600
16	$1,750,000	$227,500	$70,000	$297,500
17	$1,680,000	$218,400	$70,000	$288,400
18	$1,610,000	$209,300	$70,000	$279,300
19	$1,540,000	$200,200	$70,000	$270,200
20	$1,470,000	$191,100	$70,000	$261,100
21	$1,400,000	$182,000	$70,000	$252,000
22	$1,330,000	$172,900	$70,000	$242,900
23	$1,260,000	$163,800	$70,000	$233,800
24	$1,190,000	$154,700	$70,000	$224,700
25	$1,120,000	$145,600	$70,000	$215,600
26	$1,050,000	$136,500	$70,000	$206,500
27	$980,000	$127,400	$70,000	$197,400
28	$910,000	$118,300	$70,000	$188,300
29	$840,000	$109,200	$70,000	$179,200
30	$770,000	$100,100	$70,000	$170,100
31	$700,000	$91,000	$70,000	$161,000
32	$630,000	$81,900	$70,000	$151,900
33	$560,000	$72,800	$70,000	$142,800
34	$490,000	$63,700	$70,000	$133,700
35	$420,000	$54,600	$70,000	$124,600
36	$350,000	$45,500	$70,000	$115,500
37	$280,000	$36,400	$70,000	$106,400
38	$210,000	$27,300	$70,000	$97,300
39	$140,000	$18,200	$70,000	$88,200
40	$70,000	$9,100	$70,000	$79,100
Total Expenditure		$7,462,000	$2,800,000	$10,262,000
Average Annual Expenditure				$256,550

APPENDIX K

Technical Memorandum
Hydraulic Model Development and Calibration for California Water Service Company's Dixon District – IDModeling

Draft Technical Memorandum

Hydraulic Model Development and Calibration for California Water Service Company's Dixon District

West Yost Associates

IDModeling, Inc.
May 21, 2009

Chapter 1

1.0 Introduction

In support of the Water Supply and Facility Master Plan for Distribution System Hydraulic Model Development and Calibration for the California Water Service Company's (Cal Water) Dixon District project, IDModeling, Inc. (IDM) has developed this technical memorandum for West Yost Associates (WYA) to discuss the processes involved and assumptions made during the project. This technical memorandum presents the following items:

- Model Construction from GIS
- Model Facility Creation
- Demand Development and Loading
- Steady-State Calibration
- Diurnal Curve Creation
- 72-Hour Extended Period Calibration

The project's main objective is to develop and calibrate a hydraulic model of the Dixon District's water system which can be used to assist with demand planning, analyze what-if situations and plan for the future growth of the system.

The hydraulic model was developed using MWHSoft's InfoWater version 6.0 software, Cal Water's GIS files, and information obtained during discussions with WYA, Cal Water and Dixon District staff.

Chapter 2
Model Construction

2.0 Building The Model From GIS

Cal Water developed a GIS geodatabase for its Dixon District water system piping network which assisted in the creation of the hydraulic model. IDM worked closely with WYA to create pipelines that had model junctions strategically located at the following locations:

- Change in pipeline diameter
- Change in pipeline age (where applicable)
- Pipeline intersections (tee, crosses, etc.)
- All hydrant locations
- Locations of large users
- Dead ends (cul-de-sacs, for example)

The GIS Exchange Gateway available within InfoWater was used to import the pipelines and junctions into the model. Elements were named using the currently accepted Cal Water naming conventions provided by Cal Water. This naming convention can be found in **Appendix A**. For instance, when pipelines were imported, they were given a prefix of 'P-DIX-' and junctions were given a prefix of 'J-DIX-'. The prefix was followed by a sequential number to complete the element ID. **Table 1** displays a summary of the GIS data available for the Dixon District system.

Table 1 – Cal Water's Dixon District GIS Data Summary

SHAPEFILE	NO. OF ENTRIES IN GIS	MODEL ELEMENT TYPE	MODEL - SPECIFIC DATA INCLUDED
FITTINGS	1088	JUNCTION	COORDINATES
METER	10	JUNCTION	COORDINATES
HYDRANT	239	JUNCTION	COORDINATES
LATERAL POINT	25	JUNCTION	COORDINATES
SAMPLING STATION	9	JUNCTION	COORDINATES
SYSTEM VALVES	773	JUNCTION	COORDINATES
PRESSURIZED MAIN	1443	PIPELINE	DIAMETER
			MATERIAL
			LINE LENGTH
LATERAL LINES	547	PIPELINE	DIAMETER
			MATERIAL
			LINE LENGTH

2.1 Pipeline Data

The pipeline diameter and material attributes were imported from the geodatabase attribute tables. A year of installation is not currently tracked in the geodatabase; therefore, the pipeline age was not determined at this time. The pipeline roughness coefficient assignments (C-factors) within the model were assigned based on pipeline material using industry standard values as can be seen in **Table 2**.

Table 2 – Industry Standard C-Factor's

Pipeline Material	Pipeline Material Description	C-Factor Value
AC	Asbestos Cement	130
CI	Cast Iron Pipe	110
CL&C	Concrete Pressure Pipe	130
COP	Copper	140
DI	Ductile Iron Pipe	120
GALV	Galvanized Pipe	125
PVC	Polyvinyl Chloride Pipe	140
SS	Stainless Steel Pipe	130
STD STL	Standard Steel	120
STL	Steel Pipe	110
TRANS	Transite Pipe	130
UCI	Unlined Cast Iron Pipe	110
WI	Steel Lined	120

2.2 Junctions and Hydrants

Elevations were assigned to all model junctions after the topological and attribute checks were completed. The elevations for each junction in the model were provided by WYA in a delimited text file. InfoWater's Exchange Manager was used to import the file and populate the elevations for junctions in the model. Elevations are an important data source used to establish model pressures. During calibration, elevations for selected locations were confirmed based on static pressures.

The GIS files provided by Cal Water for the Dixon District system also contained hydrant features in the hydrant layer. All the hydrant elements in the hydrant layer were imported into the model and are represented as junctions.

2.3 Well Pumps

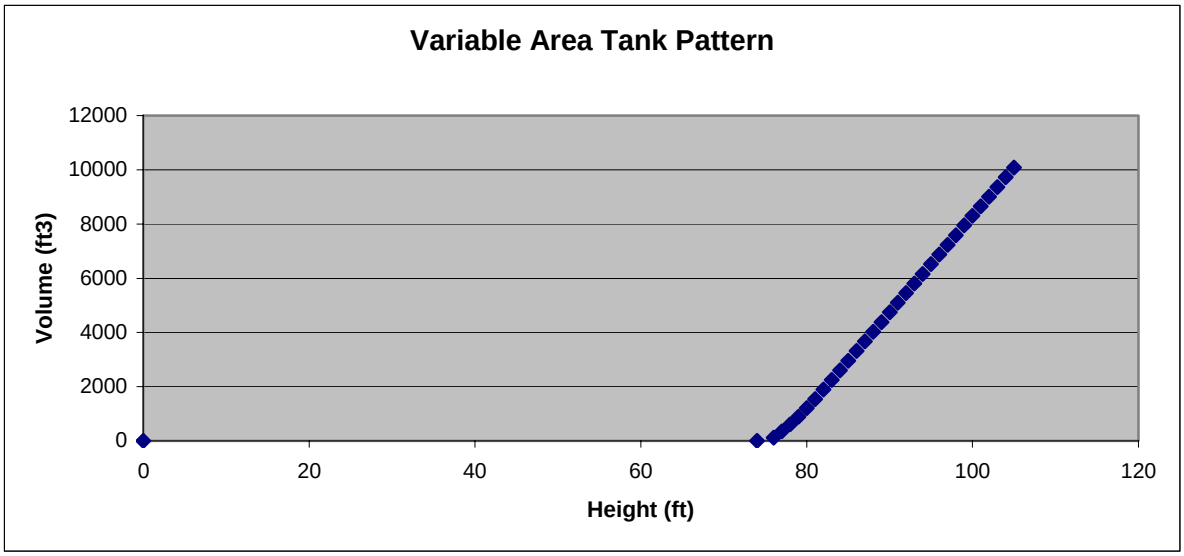
WYA provided IDM with a parcel shapefile to identify the locations of the facilities in the Dixon District system. IDM used schematics of the facilities provided by Cal Water to create the pump station, well, and tank elements within the model.

Pumps in the hydraulic model require pump curves to determine pump flow and delivered head. Cal Water provided multiple-point manufacturer's curves for all well pumps in the system. The pump curves can be found in **Appendix B**.

2.4 Tanks

Station 001-T1 is the only tank in the Dixon District system. It is labeled as T-001-03 in the hydraulic model. This tank represents an elevated water tank and is a variable area tank. Model tanks with variable areas require specific attributes to define the geometry and calculate volume. Model attributes required for tank facilities include ground elevation, maximum water level, minimum water level, initial water level (assumed or known starting point), and a height vs. volume curve. **Figure 1**, provided below, summarizes the tank height vs. volume curve applied to the Dixon District model for the Station 001-T1 tank. The SCADA data for the elevated tank records the height of water in the tank from ground elevation. To compare the SCADA tank data with the model results the variable area tank pattern in **Figure 1** was adjusted per Cal Water direction so that the bottom elevation of the tank (74 feet above MSL) represented 0 feet and the top of the tank (105 feet above MSL) represented 31 feet.

Figure 1 – Station 001-T1 Variable Area Tank Pattern



2.5 Model Topology and Attribute Verification

The model element topology or system connectivity for all node and pipeline elements was verified by using the Network Review/Fix Tools within InfoWater. To maintain the integrity of the system, a series of topology and attribute checks were performed. Any identified issues were documented in the construction questions model data field labeled (CNST_QUES).

Point features from the geodatabase were imported into the hydraulic model as junctions. Several topological and attribute checks were performed to verify the integrity of the system as shown below:

- Nodes in Close Proximity, and
- Disconnected Nodes

These topological and attribute checks were necessary for the hydraulic model because the model topology directly affects the hydraulics of the model and its results. Any junctions identified while performing the topological and attribute checks were noted in the model data field labeled QA_QC_CODE.

The following InfoWater software tools were used to identify the following connectivity and data issues for pipeline elements:

- Pipeline Split Candidates,
- Crossing/Intersecting Pipelines,
- Trace Network,
- Diameter Discrepancies, and
- Parallel Pipelines

The only connectivity issues identified using the Network Review/Fix Tools were pipeline split candidates. Pipeline split candidates are pipeline sections that should be connected by a common node. All of the pipeline split candidates were checked one by one and split accordingly. The junctions which split the pipelines were given a 'PSC' code in the QA_QC_CODE field.

Chapter 3
Demand Allocation

3.0 Demand Allocation

Before the model was loaded IDM identified the service and non-service junctions in the model. Service junctions, or demand junctions, are those junctions that are allowed to be loaded with demand. Non-service junctions are those junctions which are not allowed to be loaded with demand. The following criteria were considered in assigning non-service nodes in the model:

- Junctions immediately upstream and downstream of a pump station (suction and discharge sides) – these junctions are typically on the low-end or high-end of the pressure criteria due to close proximity of a booster pump and typically do not represent a service lateral location.
- Junctions which are downstream of a tank and only used to denote a change in pipeline diameter.

All junctions which did not meet the criteria above were attributed with a “YES” in the DMD_JCT field. The junctions with a “YES” attribute are defined in this model as demand junctions. These are the junctions which were eligible to be loaded during demand allocation.

The Dixon District demand allocation was performed using InfoWater’s Demand Allocator module. IDM allocated the 2007 geocoded meter shapefile provided by Cal Water. This demand was allocated to all service nodes using the “closest pipeline” method. The total system demand allocated was 702,051 CCF (i.e. 100 cubic feet) per year. This demand was equal to 999 gallons per minute (gpm) and was adjusting in the model using InfoWater’s block editing features to multiply all demand values by the appropriate conversion factor. The allocated demand represents the Dixon District’s 2007 average day demand (ADD). This demand was allocated to the model under the ‘EX_ADM_ALLOC’ scenario and ‘EX_ADM_ALLOC’ demand data set.

Chapter 4

Steady State Calibration

4.0 Steady State Calibration Background

Steady State Calibration was based on 6 sets of hydrant tests performed and recorded by Cal Water, WYA and IDM staff on August 12, 2008. **Figure 2** illustrates the locations where the hydrant tests were performed in Cal Water's Dixon District system.

To represent the flow tests in the model, twelve unique model scenarios were created, two for each of the six field hydrant tests (one representing static conditions, one representing dynamic (flowing) conditions). The goal calibration tolerance for this project was to have the model results compare to the field observations within +/- 5 percent or +/- 5 psi for 90% of all static points and within +/- 10 percent or +/- 10 psi for 90% of all dynamic points. Where this tolerance is not met (if applicable), IDM provided a summary and recommendation of how to address this within the field, model, or both, as appropriate.

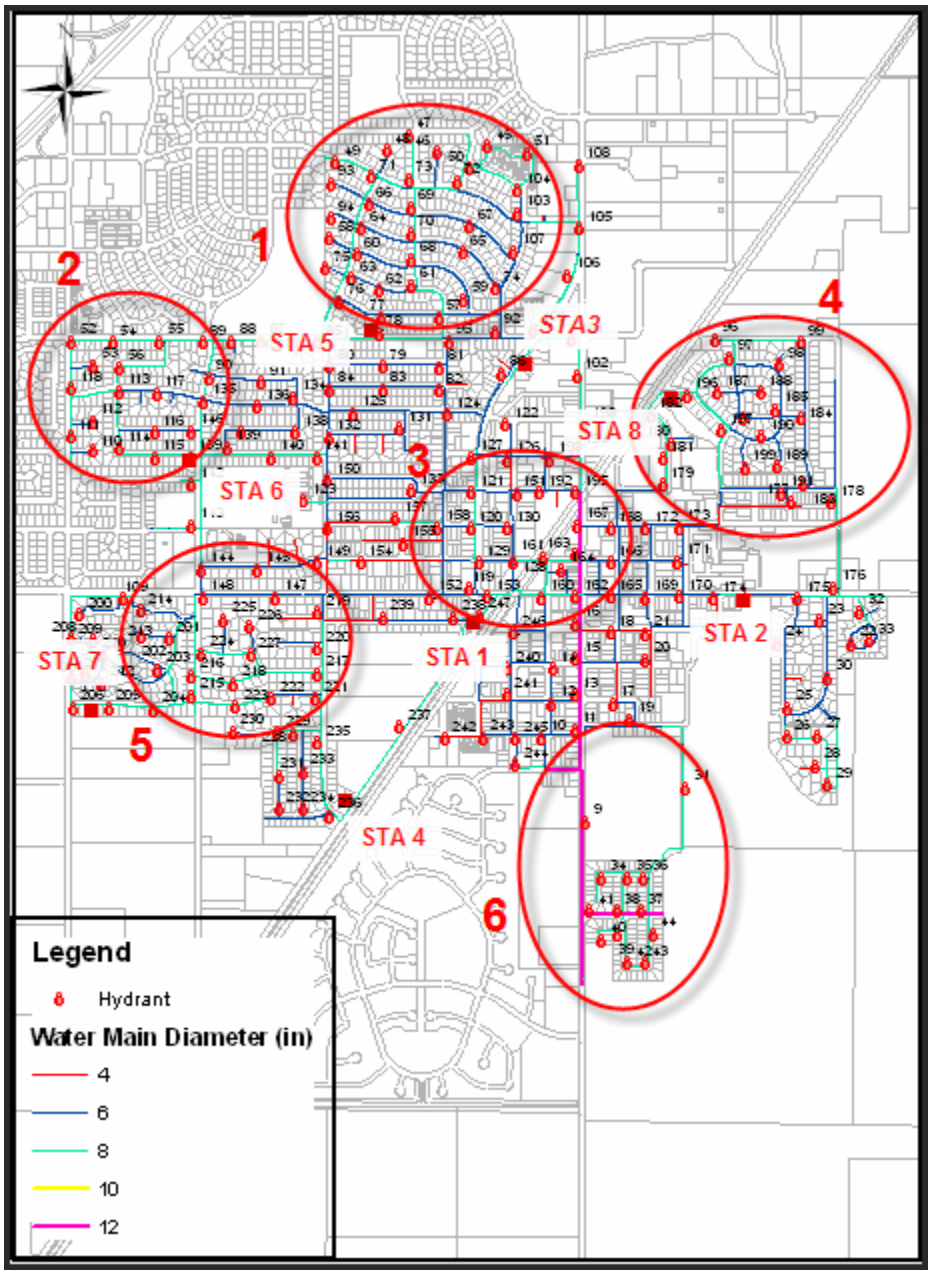
The boundary conditions (well discharge pressure and flow) for each Steady State Calibration scenario were recorded on telemetry charts during the hydrant testing and used to populate model boundary condition information for each scenario within the model. **Table 3** displays the pump status and tank water level for each of the 12 calibration scenarios (6 static and 6 dynamic).

Table 3 – Steady State Model Boundary Conditions

Scenario Name	Scenario Description	Well Pump Status								Elevated Tank Water Level (%)
		Station #1	Station #2	Station #3	Station #4	Station #5	Station #6	Station #7	Station #8	
SFT01	Static Hydrant Test #1	Closed	Inactive	Closed	Open	Closed	Open	Open	Closed	94.8
DFTO1	Dynamic Hydrant Test #1	Closed	Inactive	Closed	Open	Closed	Open	Open	Closed	94.8
SFT02	Static Hydrant Test #2	Closed	Inactive	Closed	Open	Closed	Open	Open	Closed	94.4
DFTO2	Dynamic Hydrant Test #2	Closed	Inactive	Closed	Open	Closed	Open	Open	Closed	94.4
SFT03	Static Hydrant Test #3	Closed	Inactive	Closed	Open	Closed	Open	Open	Open	94.1

Table 3 – Steady State Model Boundary Conditions										
Scenario Name	Scenario Description	Well Pump Status								Elevated Tank Water Level (%)
		Station #1	Station #2	Station #3	Station #4	Station #5	Station #6	Station #7	Station #8	
DFTO3	Dynamic Hydrant Test #3	Closed	Inactive	Closed	Open	Closed	Open	Open	Open	94.1
SFT04	Static Hydrant Test #4	Closed	Inactive	Closed	Open	Closed	Open	Closed	Closed	93.5
DFTO4	Dynamic Hydrant Test #4	Closed	Inactive	Closed	Open	Closed	Open	Closed	Open	93.5
SFT05	Static Hydrant Test #5	Closed	Inactive	Closed	Open	Closed	Open	Closed	Closed	93.6
DFTO5	Dynamic Hydrant Test #5	Closed	Inactive	Closed	Open	Closed	Open	Open	Open	93.6
SFT06	Static Hydrant Test #6	Closed	Inactive	Closed	Open	Closed	Open	Open	Open	94.2
DFTO6	Dynamic Hydrant Test #6	Closed	Inactive	Closed	Open	Closed	Open	Open	Open	94.2

Figure 2 – Dixon District Hydrant Test Location Map



4.1 Steady State Calibration Results

The model was analyzed for each of the twelve scenarios with the boundary conditions described above for each scenario. 91% of the static comparison points were found to be within 5 percent or 5 psi of the field data and thus achieving the acceptable Steady State Calibration tolerance for static conditions. 82% of the dynamic comparison points were found to be within 10 percent or 10 psi of the field data and due to the uncertainty of the closed or partially closed valves in the system this was considered to be acceptable for the Steady State Calibration dynamic conditions. A summary of the calibration results can be seen in **Table 4**. The detailed results for the Steady State Calibration with notes can be found in **Appendix C**.

Table 4 – Steady State Calibration Results Summary								
Calibration Criteria	Static Number	Static %	Dynamic Number	Dynamic %	Pressure Drop Number	Pressure Drop %	Overall Number	Overall %
Number of Sites	33		33		33		99	
Within 5 units	30	90.9%	14	42.4%	17	51.5%	61	61.6%
Within 10 units	33	100%	27	81.8%	33	100%	93	93.9%
Greater than 10 units	0	0%	6	18.2%	0	0%	6	6.1%

4.2 Model Adjustments for Steady State Calibration

Three specific adjustments to the model were found to be necessary in order to achieve the desired calibration goals of model pressures within +/- 5 percent or +/- 5 psi of field observed pressures. Satisfying either criterion was considered to satisfy the calibration goals. Specific calibration adjustments were made to:

- Groundwater Depths
- System Demands
- Possible Closed and Partially Closed Valves

Groundwater levels will set the suction pressure of well pumps and will directly impact where the well pump operates on its curve. As such the groundwater levels will control how much flow is supplied by each well. IDM took an average of the latest well drawdown readings for the summer of 2006 and 2007 provided by Cal Water to assign initial groundwater levels to the model. The groundwater levels for each well were then calculated to equal the ground elevation minus the average pumping read for that well. IDM then compared the field flows and pressures for each well recorded during the hydrant testing against the pump curves supplied by Cal Water and made adjustments to the groundwater levels for each well to better correlate with the pump flow observed in the field. The final values used were selected to provide the best fit for all 6 field tests. **Table 5** displays the groundwater levels adjusted and applied to the model during the Steady State Calibration.

Table 5 – Steady State Calibration Groundwater Levels			
Well	Calculated Ground Water Levels (ft)	Adjusted Ground Water Level (ft)	Difference
W-001-03*	-	-88	-
W-004-01	-39	-90	-51
W-006-01	-34	-94	-60
W-007-01	-88	-90	-2
W-008-01	-221	-310	-89

*Pumping readings were not available for W-001-03

4.3 Steady State Calibration Demand Adjustments

A separate demand set was created for each of the twelve Steady State Calibration scenarios. These demand sets were based on the original 2007 ADD loading of 999 gpm as provided by Cal Water and were scaled to reflect the estimated demand occurring on August 12, 2008. The factors used to scale demands can be seen below in **Table 6.**

Table 6- Hydrant Test Scenario Demands

Test Number	Time of Test	Adjusted Demand (gpm)	Factor	Flow (gpm)
Test 1	10:30 AM	1,350	1.35	1,930
Test 2	10:50 AM	1,350	1.35	1,160
Test 3	9:50 AM	1,350	1.35	2,110
Test 4	3:30 PM	1,350	1.35	1,220
Test 5	1:30 PM	1,350	1.35	2,250
Test 6	8:50 AM	1,350	1.35	920

The Dixon District system demand is supplied by the water in the elevated tank and what well pumps are operating. Thus, the system demand is essentially equal to the sum of all well discharge flows plus or minus the flow in or out of the tank. While the telemetry charts identify the well flows and the tank level, reading the chart data to determine system demand for a given test was difficult to perform with a high degree of accuracy. Therefore, base system demands were scaled to achieve closer pressure comparisons for the static condition scenarios. Since the static and dynamic test runs occurred within minutes of each other; the base system demand for both the static and dynamic conditions was assumed to be the same. **Table 6** above displays the base demand used within the model and the fire flows recorded during the tests.

4.4 Steady State Calibration Potentially Closed System Valves

Steady State field pressure readings indicated that there may be some closed and partially closed valves in the system. This was due to the higher amount of pressure drop observed in the field for certain tests than was observed in the model that could not occur unless the system had valves in the field that were closed or partially closed. Partially closed valves are simulated by applying a minor loss to the pipeline where a partially closed valve is suspected of being located. Closed valves are simulated by applying an initial setting of “closed” to the pipeline where a closed valve is suspected of being located. IDM identified potential partially closed and/or closed valves in the vicinity of the following locations:

- On the 8-inch diameter pipeline north of Tank 1 on Porter Street (partially closed valve – a minor loss of 25 was added to this pipeline in the model)
- On the 8-inch diameter pipeline east of Well #8 on Second Street (partially closed valve– a minor loss of 30 was added to this pipeline in the model)

- On the 12-inch diameter pipeline north of County Fair Drive on South First Street (partially closed valve – a minor loss of 100 was added to this pipeline in the model)
- On 8-inch diameter pipeline south of Victoria Drive on Orhard Drive (closed valve – this pipeline was closed in the model)
- On 8-inch diameter pipeline south of Victoria Drive on Windmill Drive (closed valve – this pipeline was closed in the model)

Screen shots of the suspected partially closed valves described above can be found in **Appendix D**. Cal Water's Dixon District staff has attempted to field locate the closed valves in these areas but has not found any closed valves as this time. IDM suspects there are still closed and/or partially closed valves in these areas or that the valves were closed or partially closed during the test but were subsequently opened. Additional field work and/or hydrant testing may be required by Cal Water and/or the Dixon District's staff to locate and correct the closed and/or partially closed valves in these areas.

It is recommended that Cal Water's Dixon District staff verify field valve status at these locations. It is also recommended that the analysis runs assume that any closed or partially closed valves identified during calibration be assumed open for existing and future system evaluations. With this assumed system configuration, all static and dynamic Steady State Calibration scenarios, the model shows results comparable to the field results.

Chapter 5

Extended Period Calibration

5.0 Extended Period Simulations Background

The goal of Extended Period Simulation (EPS) Calibration is to verify the diurnal curves, system demands, and automatic controls used in the model and to demonstrate that the model pressures generally agree with field observations under similar operating conditions. EPS Calibration is completed by comparing SCADA data for tank levels, station pressures, and station flow data against model data. The goal of the EPS Calibration for this project was to obtain general agreement between model tank levels and SCADA tank levels within 2 ft or 10% and to achieve a consistent pattern of operation which produces drain/fill and pump on/off status for the August 20th-22nd, 2008 operation.

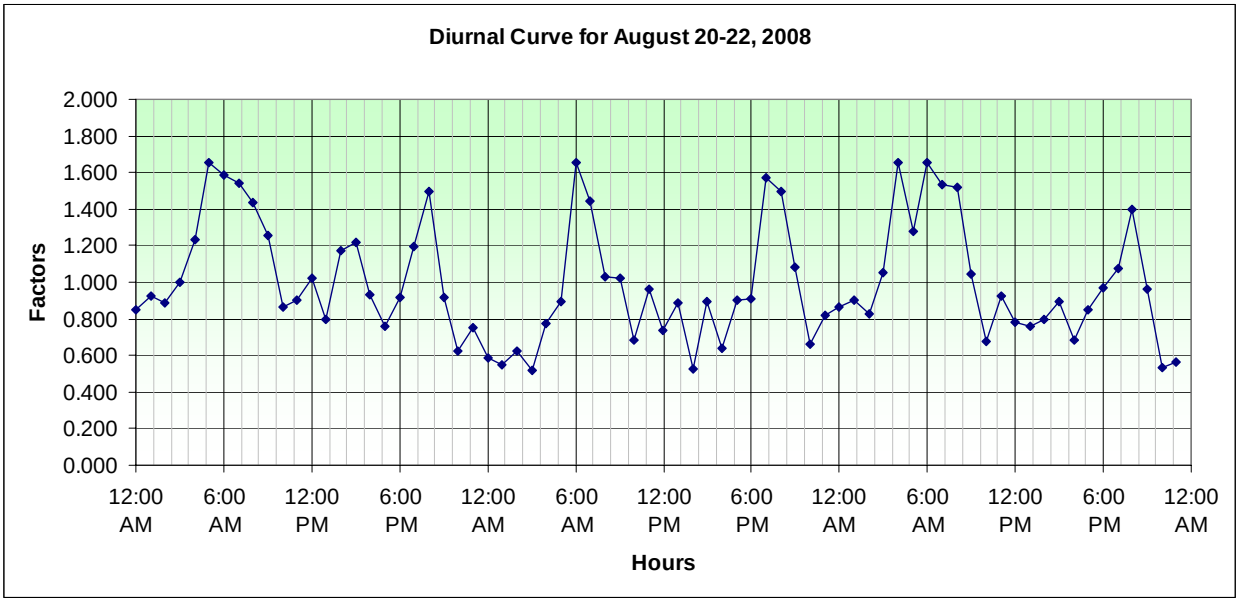
Extended Period Simulations require two key element attributes to move beyond a Steady-State hydraulic model: 1) a diurnal curve which applies hourly peaking factors to the base demand, emulating the change in water use over the course of a day, and 2) system operational controls which actuate a pump, valve, or pipeline based on another facility's status (such as a tank level or system pressure).

5.1 Diurnal Curve Creation

Diurnal curve development typically involves a system-wide mass balance. This data shows the flows into (supply) and out of (demand) the system, as well as the amount of water stored in or drained from storage tanks. The remaining water in the mass balance represents the system demand. The variation in system demand over a specified period of time represents the system diurnal curve. Hourly diurnal factors are calculated by dividing the hourly demand by the average system demand for that period. In this manner, the diurnal curve can be used for any model demand node in the system.

The diurnal curve for the Dixon District system was developed using 72-hour SCADA data and telemetry readings that were digitized and translated for use in the diurnal curve development. This data was provided by Cal Water. Diurnal Curve data developed for the Dixon District system can be found below in **Figure 3**.

Figure 3 - System-Wide 72-Hour Diurnal Curve



The Dixon District diurnal curve is based on an average system demand of 1,363 gpm. The base 2007 demands in the Dixon District model of 999 gpm used for the Steady State Calibration were globally scaled up by a factor of 1.36 to correlate with the average demands observed during the EPS Calibration period.

5.2 Initial Settings and System Operational Controls

For Extended Period Simulations, initial settings of "on" or "off" were applied to each pump within the model. Pumps that have an initial status "off" were initially off during the simulation period. Pumps have an initial status "on" if the SCADA data shows that the pump was on at the start of the calibration day. **Table 7** displays the initial status of each pump specified in the hydraulic model.

Table 7 – Pump Initial Settings

Well Pump	Initial Status
PMP-001-03	Closed
PMP-002-01	Closed
PMP-003-01	Closed
PMP-004-01	Open
PMP-005-01	Closed
PMP-006-01	Open
PMP-007-01	Closed
PMP-008-01	Open

Automatic system controls were developed in the model to represent typical operation of the system under the simulation period demand conditions. Control information was used to create controls for all well pumps that operate automatically based on tank level controls. IDM used the operational control information provided by WYA for the pumps in the Dixon District system as the basis of the control data included in the model. These operational controls are displayed in **Table 8.**

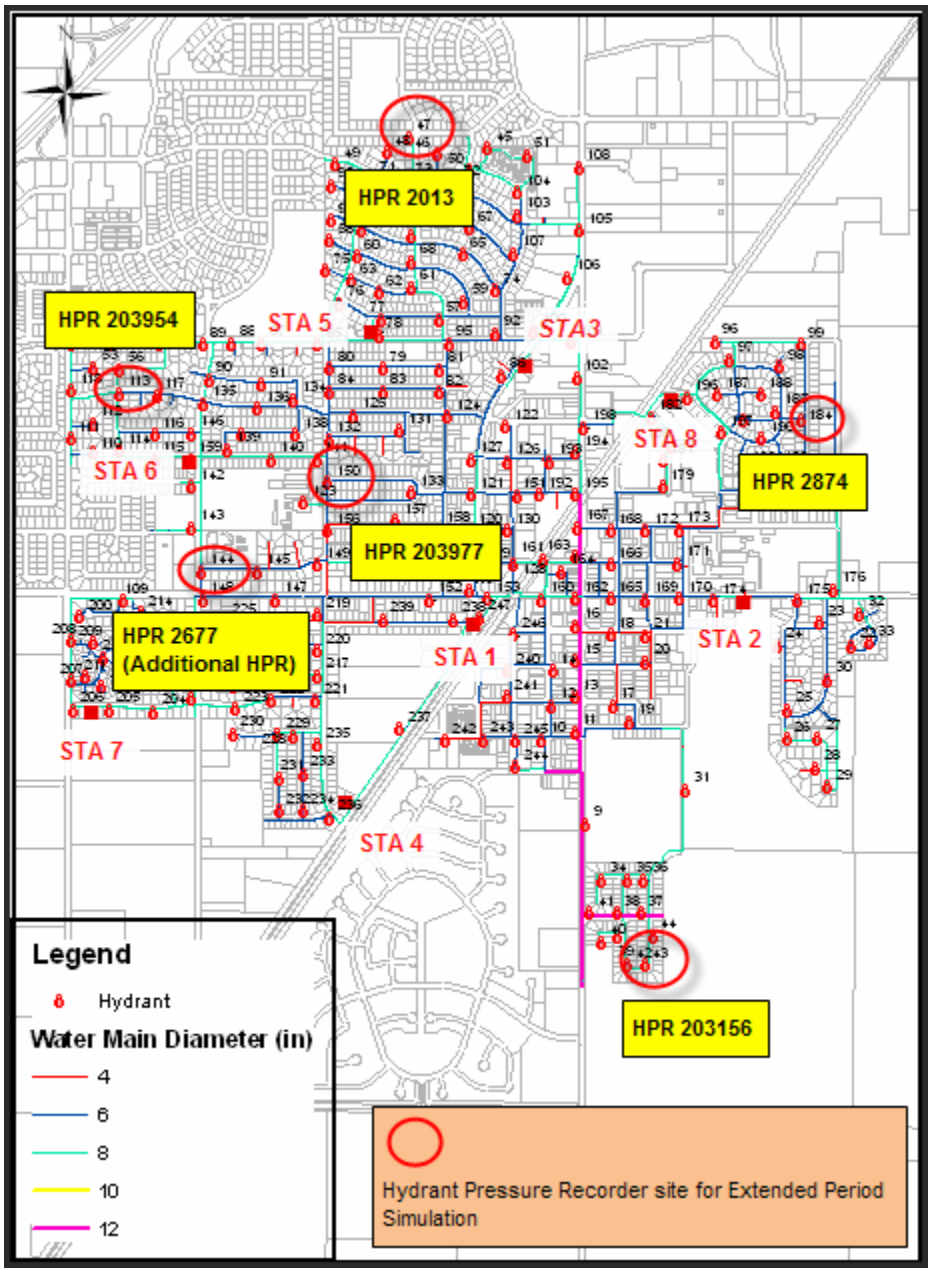
Table 8 – Pump Operational Controls

Station	Pump On		Pump Off		Controlled Tank
	Relative Level from Top of Tank (ft)	Relative % from Top of Tank	Relative Level from Top of Tank (ft)	Relative % from Top of Tank	
001-03	4.5	95.7	1.5	98.6	001-T1
002-01	15.7	85	8.4	92	001-T1
003-01	8	92.4	5.5	94.8	001-T1
004-01	24-hours				
005-01	12.6	88	5.2	95	001-T1
006-01	4	96.2	1	99	001-T1
007-01	10.5	90	1	99	001-T1
003-01	5	95.2	2.5	97.6	001-T1

5.3 Field Data Loggers

There were six pressure data loggers placed in the field by WYA during the days of the calibration period, August 20th-29th, 2008. These data loggers recorded system pressures at various locations in the field to assist with the EPS Calibration. **Figure 4** displays the locations these data loggers were placed in the Dixon District system.

Figure 4 – Dixon District Data Logger Placement (August 12th-29th, 2008)



Data loggers HPR203957 and HPR203168 were unable to gather useable calibration data and therefore were not used for calibration.

5.4 Extended Period Calibration Results

As noted previously, the goal of the EPS Calibration for this project was to show general agreement between the model tank levels and tank levels from SCADA within 2 ft or 10% and to achieve a consistent pattern of operation which produces drain/fill and pump on/off status for the August 20th-22nd, 2008 operation. In addition to the tank levels IDM also calibrated the model to

the pump station flow values to within 50 gpm or 10% and the pump discharge pressures and field pressure loggers to within 10 percent or 10 psi, for 90% of all points.

IDM used the Root Mean Square (RMS) method for measuring the calibration accuracy of each location investigated during EPS Calibration. The RMS method is a way of analyzing the average error observed for all data points compared for a specific location. RMS is calculated by taking the difference between the model and field value at every hour in the simulation. The hourly error values are then squared (so that all values are positive). The average of all the squared values is taken to determine the average squared error seen. Lastly, the square root of the average error for the results at that location is calculated to determine the average error at that location during the course of the extended period simulation.

Modifications to the pump level controls were required for EPS Calibration due to differences between the SCADA data collected, control information collected and conversations with operational staff for the EPS Calibration. According to the pump controls provided by Cal Water for the Steady State Calibration, well pump #8 was the 6th pump to turn on whereas the SCADA data shows this pump remains on during the entire calibration period. The pump controls provided by Cal Water were modified to reflect pump operations observed in the SCADA data. A summary of the control set-points for the EPS Calibration in the model can be found in **Table 9**.

Table 9 – Well Pump Controls Based on Tank 1 Water Level

Well Pump	On Water Level (ft)	Off Water Level (ft)
PMP-001-03	96.20	104.15
PMP-002-01	*Never on	
PMP-003-01	*Never on	
PMP-004-01	Always on	
PMP-005-01	*Never on	
PMP-006-01	100.87	104.20
PMP-007-01	95.25	103.80
PMP-008-01	99.82	104.85

*According to the SCADA data and operational staff, these pumps came on for 1 or 2 hours during the entire 72-hour simulation because of water quality sampling at these pump stations.

During the EPS Calibration a few anomalies were uncovered with regards to the telemetry charts and SCADA data that impacted the diurnal curve and calibration efforts. The specific anomalies identified include:

- The telemetry chart pressure and flow pins for a few of the stations appear to have a lead/lag offset at varying times rather than the uniform offset of 15-20 minutes per WYA staff
- Based on the tank SCADA data and control information it looks as though Well Station 7 had manual control for approximately an hour during the first 24-hours of the 72-hour EPS Calibration.

- There appears to be an error in the tank level % SCADA data at hour 15 of the 24-hours of the 72-hour EPS Calibration. The SCADA data shows the percent full of the tank equal to 100.61%.
- The telemetry chart discharge pressure for well pump #4 is approximately 12 psi higher than the model discharge pressure for the entire EPS simulation. This higher telemetry chart pressure does not match the system HGL. This could occur if there is a closed valve on the discharge on the pump downstream of the telemetry chart prior to discharging to the system. Another possible reason could be an inaccurate telemetry chart scale. For model calibration purposes IDM assumed the telemetry chart values for this well pump were off by 12 psi. With this assumption the model results and telemetry chart results have more comparable results. It is recommended that Cal Water investigate in the field to confirm.

In addition, during the EPS Calibration IDM found that due to the Dixon District's water system being relatively small, minor differences in flow rates and/or control settings can have a noticeable impact on the tank levels and system pressures. For example, a well running for only 15 minutes longer between the 1 hour time steps used in the model, resulted in a tank level difference of 2 feet.

Cal Water's Dixon District water system was found to achieve the acceptable calibration tolerance for tank level, pump flow and pump discharge pressure as described above. **Table 10** displays the EPS Calibration results summary and **Appendix E** contains figures representing a comparison of SCADA data and model results.

Table 10 – Cal Water's Dixon District EPS Calibration Summary

EPS Calibration Summary

Criteria	Tank Level		Pump Flow		Junction Pressure	
	Within	Unit	Within	Unit	Within	Unit
	2	ft	50	gpm	10	psi
	5	%	10	%	10	%

Tank Summary	ID	Difference RMS (ft)	Percent RMS (%)	Criteria Satisfied	NOTES
	TANK 1	2.62	2.71%	YES	

Pump Summary	ID	Difference RMS (gpm)	Percent RMS (%)	Criteria Satisfied	The RMS comparison show is compared when the pumps are on both in the field and in the model for validating the pump curves.
	WELL #1 PUMP	200.58	1.18%	YES	
	WELL #2 PUMP			N/A	Pump did not run except for part of 2 hours for water quality sampling
	WELL #3 PUMP			N/A	Pump did not run
	WELL #4 PUMP	14.43	2.92%	YES	
	WELL #5 PUMP			N/A	Pump did not run except for part of 2 hours for water quality sampling
	WELL #6 PUMP	119.97	6.66%	YES	
	WELL #7 PUMP	261.78	4.44%	YES	
	WELL #8 PUMP	18.35	7.34%	YES	

Junction Summary	ID	Difference RMS (psi)	Percent RMS (%)	Criteria Satisfied	
	WELL #1 DIS PRESS	2.97	7.00%	YES	
	WELL #2 DIS PRESS	3.34	7.98%	YES	
	WELL #3 DIS PRESS	4.83	12.23%	YES	
	WELL #4 DIS PRESS	2.70	6.03%	YES	Pump discharge on SCADA runs 12 psi higher than model for entire simulation. The higher SCADA pressures do not match the system HGL and are considered suspect. Assumed SCADA values off by 12 psi and appear to have a nearly perfect agreement.
	WELL #5 DIS PRESS	6.74	18.11%	YES	
	WELL #6 DIS PRESS	3.66	7.78%	YES	
	WELL #7 DIS PRESS	7.52	20.72%	YES	
	WELL #8 DIS PRESS	7.60	19.15%	YES	
	LOGGER 2013	6.28	17.08%	YES	
	LOGGER 2877	4.62	12.35%	YES	
	LOGGER 2874	5.54	14.18%	YES	
	LOGGER 203977	4.11	11.55%	YES	

IDModeling
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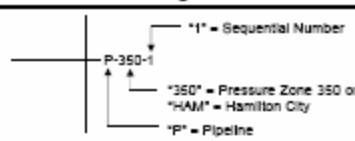
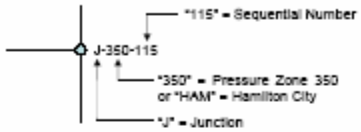
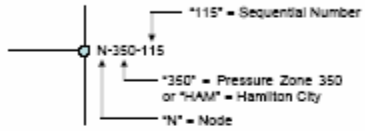
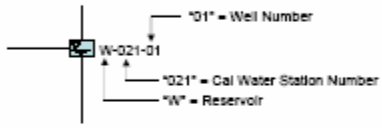
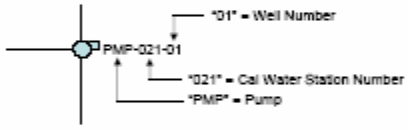
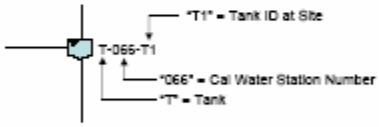
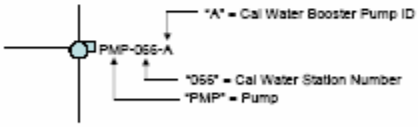
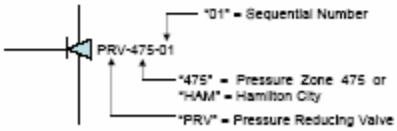
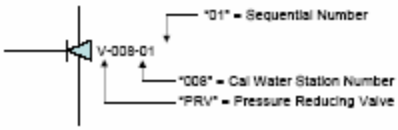
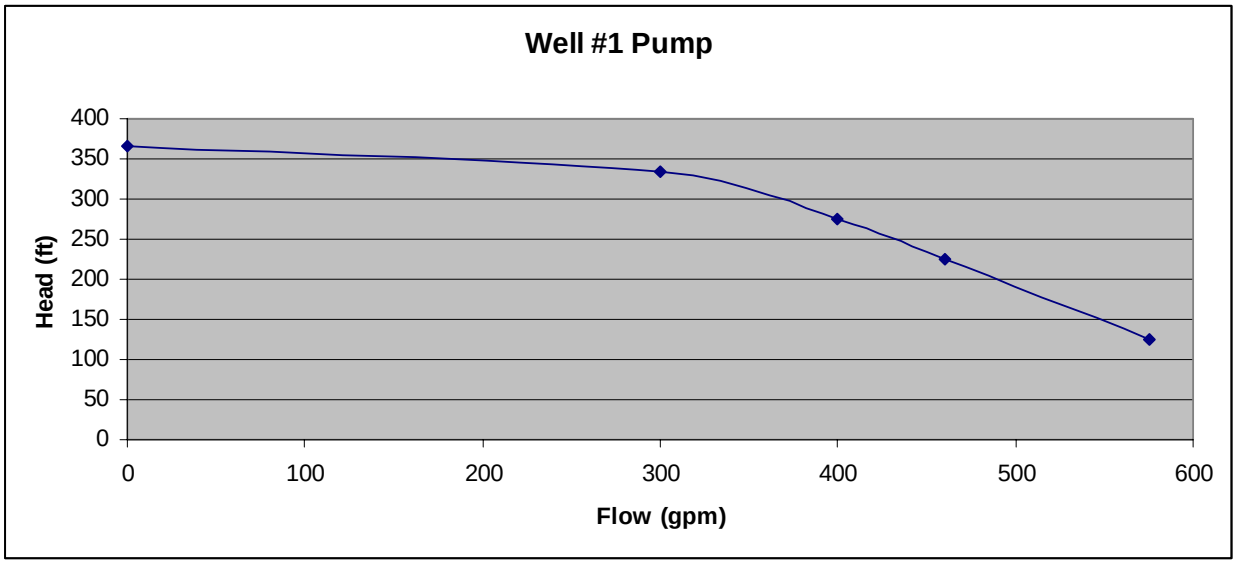
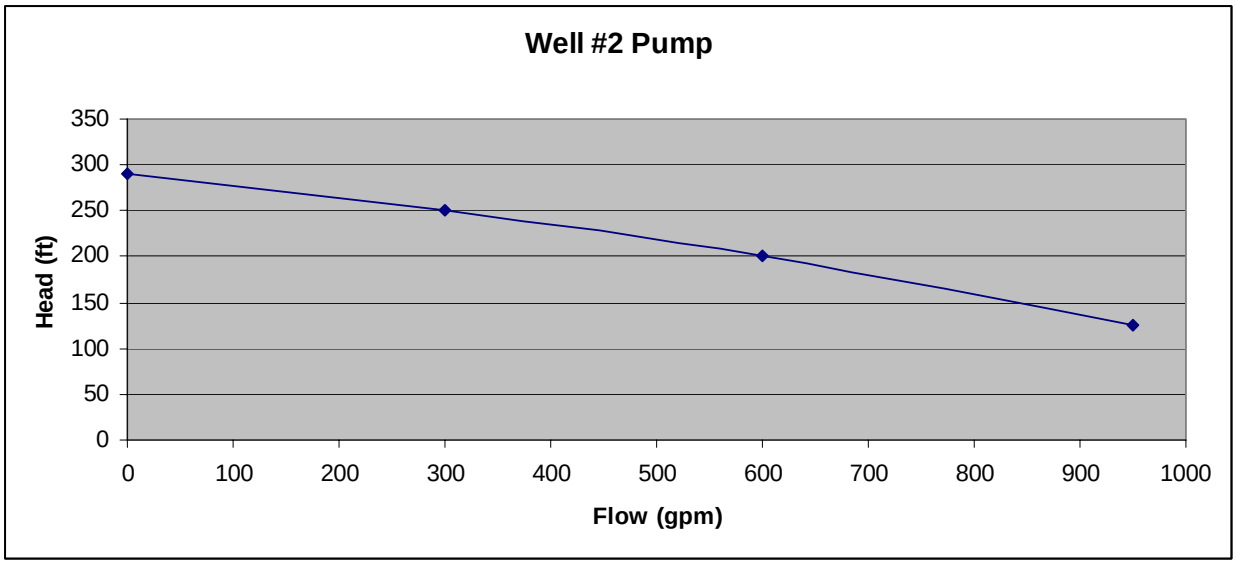
APPENDIX A – Cal Water's Naming Scheme for Network Elements

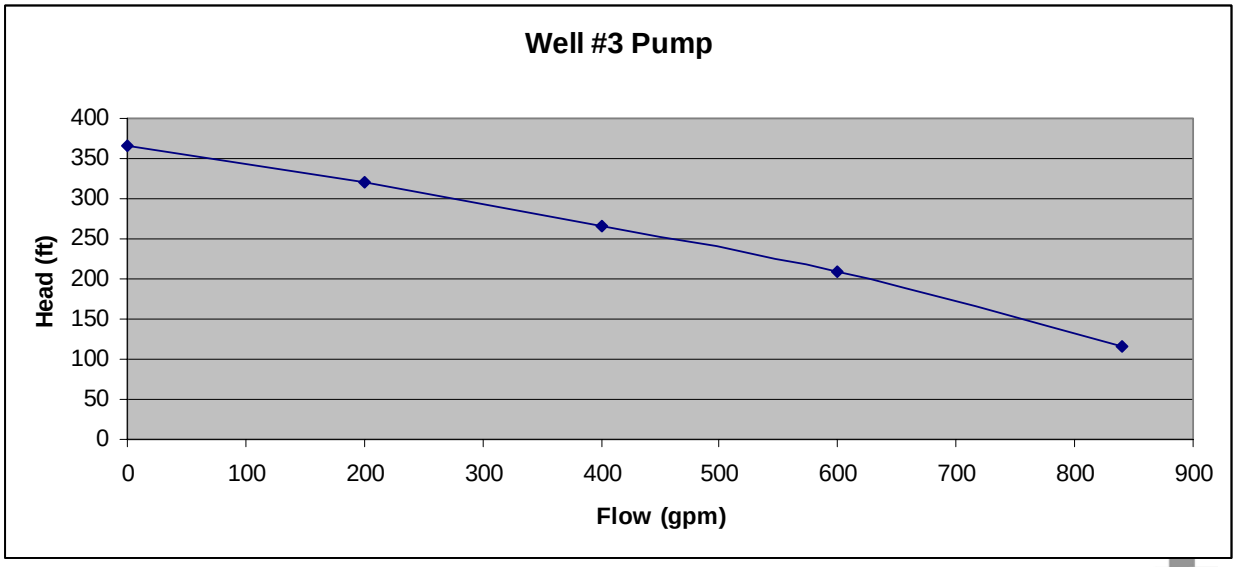
Model Component	Naming Scheme
Pipelines	
Junctions	
Nodes	
Wells	
Well Pumps	
Tanks	
Booster Pumps	
Control Valves	 

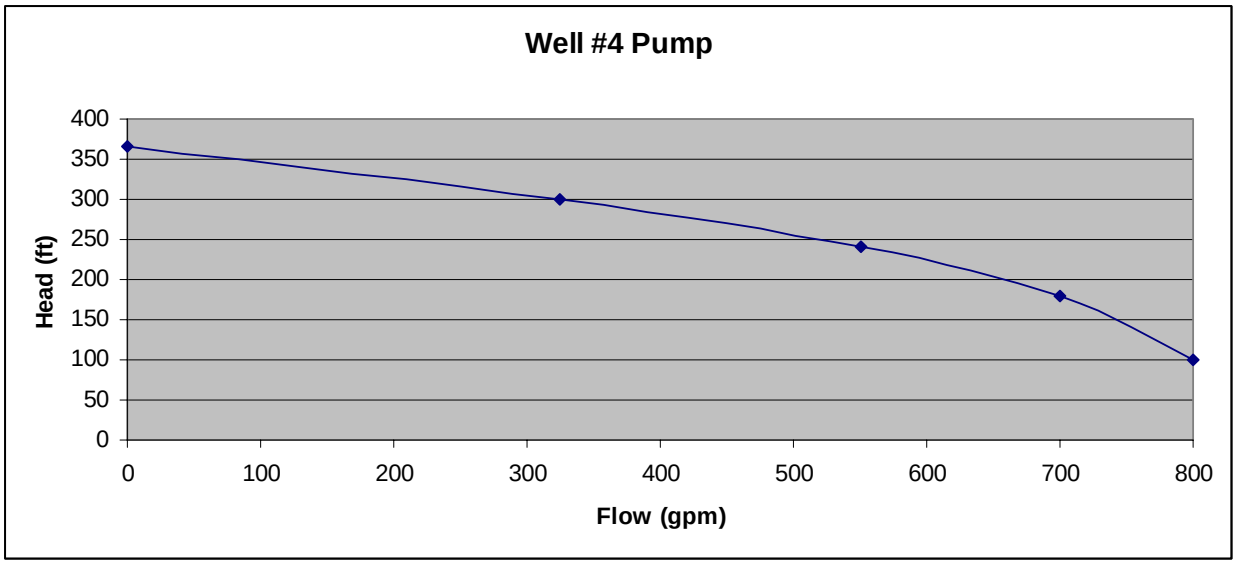
IDModeling
observe . model . improve ™

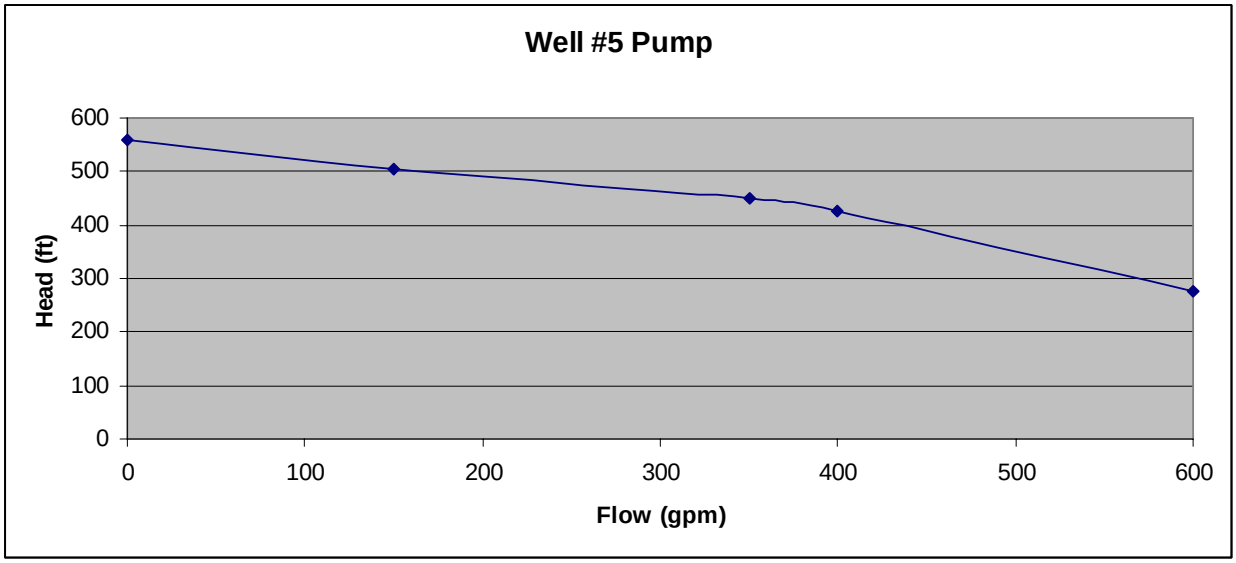
APPENDIX B – Dixon District Well Pump Curves

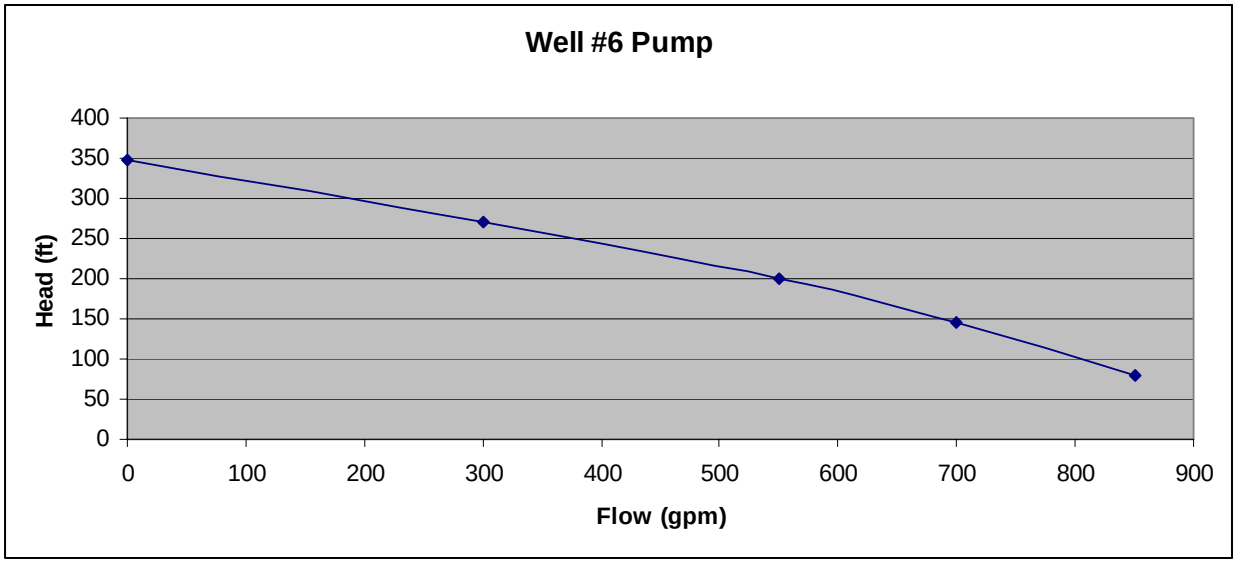


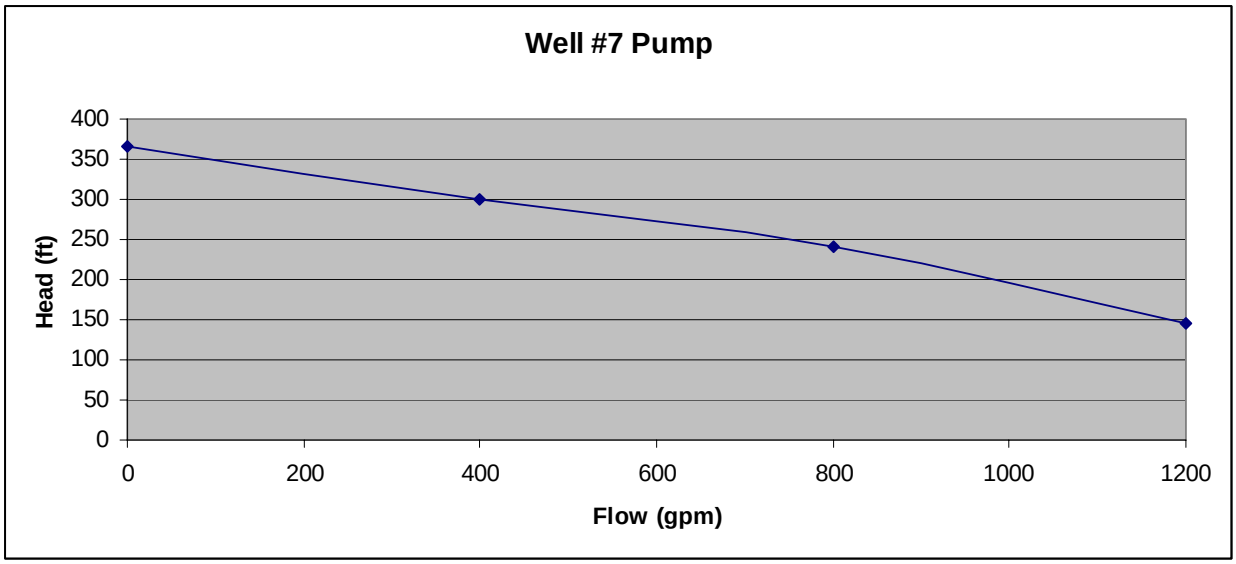


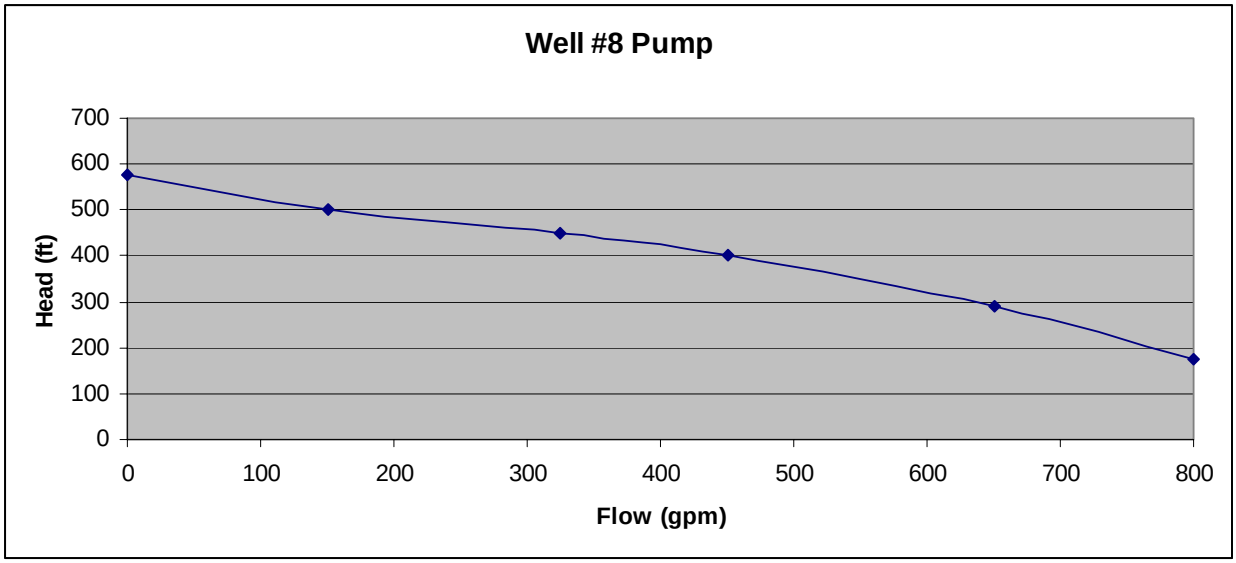



Well #4 Pump
Head (ft)
400
350
300
250
200
150
100
50
0
0
100
200
300
400
500
600
700
800
Flow (gpm)


Well #5 Pump
Head (ft)
600
500
400
300
200
100
0
0
100
200
300
400
500
600
Flow (gpm)


Well #6 Pump
Head (ft)
400
350
300
250
200
150
100
50
0
0
100
200
300
400
500
600
700
800
900
Flow (gpm)


Well #7 Pump
Head (ft)
400
350
300
250
200
150
100
50
0
0
200
400
600
800
1000
1200
Flow (gpm)


Well #8 Pump
Head (ft)
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
800
Flow (gpm)

APPENDIX C - DETAILED STEADY STATE CALIBRATION RESULTS

HYDRANT TEST ID	TEST NO.	HYDRANT DESIGNATION	MODEL JUNCTION ID	FLOW RATE (GPM)	FIELD STATIC PRESSURE (PSI)	MODEL STATIC PRESSURE (PSI)	STATIC VALUE DIFF.	STATIC % DIFF.	MODEL RESULTS	FIELD DYNAMIC PRESSURE (PSI)	MODEL DYNAMIC PRESSURE (PSI)	DYNAMIC VALUE DIFF.	DYNAMIC % DIFF.	MODEL RESULTS	MODEL PRESS DROP (PSI)	FIELD PRESS DROP (PSI)	DIFFERENCE IN DROP (PSI)	MODEL RESULTS	STATIC NOTES	DYNAMIC NOTES
Q1	Test 1	0	J-DIX-154	710	42	42.91	0.91	2.2		18 pitot										
Q2	Test 1	0	J-DIX-156	1220		44.04				8 pitot										
R1	Test 1	0	J-DIX-138	0	41	42.64	1.64	4	Great	18	23.58	5.58	31	Good	19.06	23	-3.94	Great		
R2	Test 1	73, Gauge #2	J-DIX-158	0	42	43.08	1.08	2.6	Great	17	20.8	3.8	22.4	Great	22.28	25	-2.72	Great		
R3	Test 1	0	J-DIX-126	0	42	44.65	2.65	6.3	Great	20	26.43	6.43	32.2	Good	18.22	22	-3.78	Great		
R4	Test 1	0	J-DIX-668	0	42	46.17	4.17	9.9	Great	19	26.44	7.44	39.2	Good	19.73	23	-3.27	Great		
R5	Test 1	70, Gauge #13	J-DIX-152	0	42	44.24	2.24	5.3	Great	17	23.51	6.51	38.3	Good	20.73	25	-4.27	Great		
R6	Test 1	0	J-DIX-226	0	42	44.77	2.77	6.6	Great	18	23.61	5.61	31.2	Good	21.16	24	-2.84	Great		
Q1	Test 2	0	not used																	
Q2	Test 2	0	J-DIX-248	1160	42	42.31	0.31	0.7		28	29.59	1.59	5.7							
R1	Test 2	113, Gauge #13	J-DIX-238	0	42	43.23	1.23	2.9	Great	33	34.52	1.52	4.6	Great	8.71	9	-0.29	Great		
R2	Test 2	0	J-DIX-182	0	42	42.19	0.19	0.5	Great	39	35.52	-3.48	8.9	Great	6.67	3	3.67	Great		
R3	Test 2	88, Gauge # 2	J-DIX-188	0	44	44.48	0.48	1.1	Great	38	37.09	-0.91	2.4	Great	7.39	6	1.39	Great		
R4	Test 2	0	J-DIX-240	0	40	42.47	2.47	6.2	Great	25	34.77	9.77	39.1	Good	7.7	15	-7.3	Good		
R5	Test 2	0	J-DIX-280	0	not recorded	41.48									41.48					
R6	Test 2	0	J-DIX-292	0	40	43.55	3.55	8.9	Great	36	37.17	1.17	3.3	Great	6.38	4	2.38	Great		
Q1	Test 3	Gauge # 11	J-DIX-252	750	41	43.45	2.45	6		20 pitot										
Q2	Test 3	Gauge # 11	J-DIX-254	1360	41	43.81	2.81	6.9		10 pitot										
R1	Test 3	0	J-DIX-260	0	41	42.59	1.59	3.9	Great	22	31.87	9.87	44.9	Good	10.72	19	-8.28	Good		
R2	Test 3	0	J-DIX-266	0	40	42.08	2.08	5.2	Great	19	30.22	11.22	59.1	Bad	11.86	21	-9.14	Good		
R3	Test 3	0	J-DIX-400	0	41	43.69	2.69	6.6	Great	22	33.28	11.28	51.3	Bad	10.41	19	-8.59	Good		
R4	Test 3	129, Gauge # 4	J-DIX-270	0	40	42.91	2.91	7.3	Great	20	32.38	12.38	61.9	Bad	10.53	20	-9.47	Good		Suspected Closed or Partially Closed Valve in this test area
R5	Test 3	158, Gauge # 2	J-DIX-326	0	41	42.93	1.93	4.7	Great	22	32	10	45.5	Good	10.93	19	-8.07	Good		
R6	Test 3	0	J-DIX-330	0	41	42.87	1.87	4.6	Great	23	32.97	9.97	43.3	Good	9.9	18	-8.1	Good		
Q1	Test 4	0	J-DIX-366	1220	42	45.6	3.6	8.6		8 pitot										
Q2	Test 4	0	not used																	
R1	Test 4	184	J-DIX-378	0	44	44.93	0.93	2.1	Great	26	34.3	8.3	31.9	Good	10.63	18	-7.37	Good		
R2	Test 4	0	J-DIX-356	0	41	43.64	2.64	6.4	Great	25	34.99	9.99	40	Good	8.65	16	-7.35	Good		Suspected Closed or Partially Closed Valve in this test area
R3	Test 4	0	J-DIX-362	0	41	44.12	3.12	7.6	Great	14	25.41	11.41	81.5	Bad	18.71	27	-8.29	Good		
R4	Test 4	0	J-DIX-392	0	45	45.94	0.94	2.1	Great	24	32.97	8.97	37.4	Good	12.97	21	-8.03	Good		
R5	Test 4	0	J-DIX-206		not recorded					not recorded										
R6	Test 4	0	J-DIX-404	0	43	45.65	2.65	6.2	Great	26	35.93	9.93	38.2	Good	9.72	17	-7.28	Good		
Q1	Test 5	0	J-DIX-444	890	42	45.52	3.52	8.4		28 pitot										
Q2	Test 5	0	J-DIX-462	1360	42	45.8	3.8	9		10 pitot										
R1	Test 5	223, Gauge #2	J-DIX-454	0	42	46.15	4.15	9.9	Great	33	34.01	1.01	3.1	Great	12.14	9	3.14	Great		
R2	Test 5	0	J-DIX-298	0	40	44.15	4.15	10.4	Great	35	35.73	0.73	2.1	Great	8.42	5	3.42	Great		
R3	Test 5	0	J-DIX-418	0	40	46.14	6.14	15.4	Good	34	34.18	0.18	0.5	Great	11.96	6	5.96	Good		
R4	Test 5	224 Gauge 13	J-DIX-456	0	44	44.88	0.88	2	Great	32	31.29	-0.71	2.2	Great	13.59	12	1.59	Great		
R5	Test 5	0	J-DIX-450	0	41	45.73	4.73	11.5	Great	33	34.9	1.9	5.8	Great	10.83	8	2.83	Great		
R6	Test 5	0	J-DIX-446	0	40	44.98	4.98	12.5	Great	35	34.92	-0.08	0.2	Great	10.06	5	5.06	Good		
Q1	Test 6	0	J-DIX-96	920	42	46.53	4.53	10.8		30	38.12	8.12	27.1							
Q2	Test 6	0	not used																	
R1	Test 6	0	J-DIX-30	0	40	46.05	6.05	15.1	Good	37	41.08	4.08	11	Great	4.97	3	1.97	Great		
R2	Test 6	0	J-DIX-34	0	41	44.85	3.85	9.4	Great	39	40.47	1.47	3.8	Great	4.38	2	2.38	Great		
R3	Test 6	0	inaccessible hydrant									0								
R4	Test 6	0	J-DIX-84	0	42	46.96	4.96	11.8	Great	39	41.16	2.16	5.5	Great	5.8	3	2.8	Great		
R5	Test 6	44, Gauge #2	J-DIX-100	0	43	46.31	3.31	7.7	Great	27.5	40.22	12.72	46.3	Bad	6.09	15.5	-9.41	Good		Suspected Closed or Partially Closed Valve in this test area
R6	Test 6	41, Gauge 44	J-DIX-94	0	40	45.93	5.93	14.8	Good	25	40.32	15.32	61.3	Bad	5.61	15	-9.39	Good		

APPENDIX D – Potentially Closed or Partially Closed Valves

Figure 1

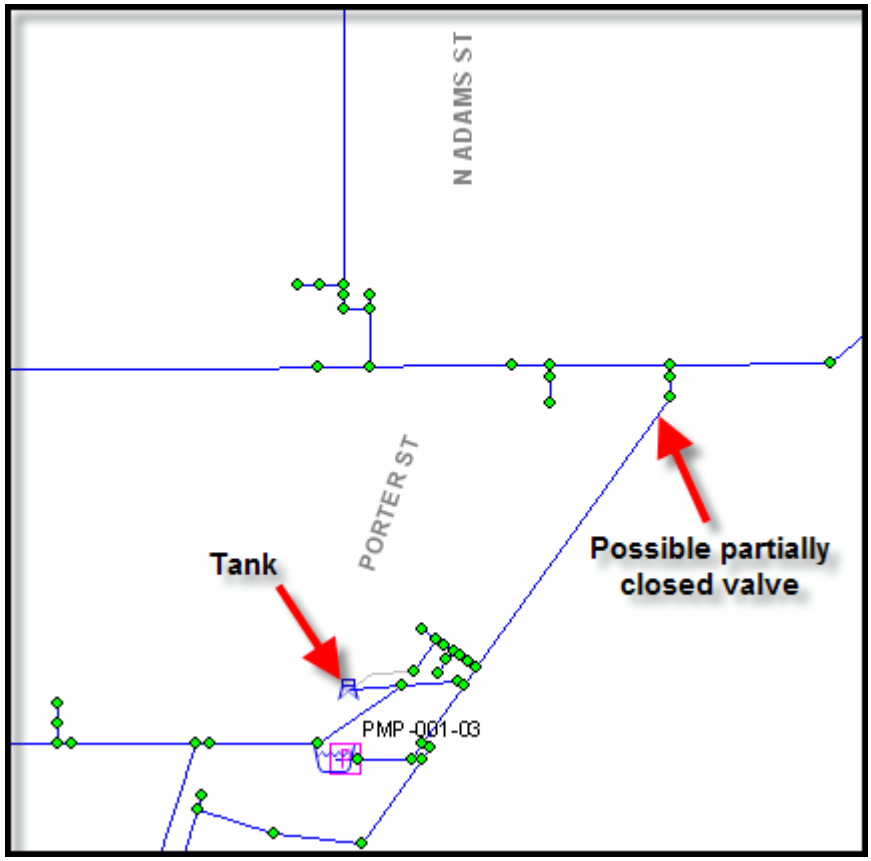


Figure 2

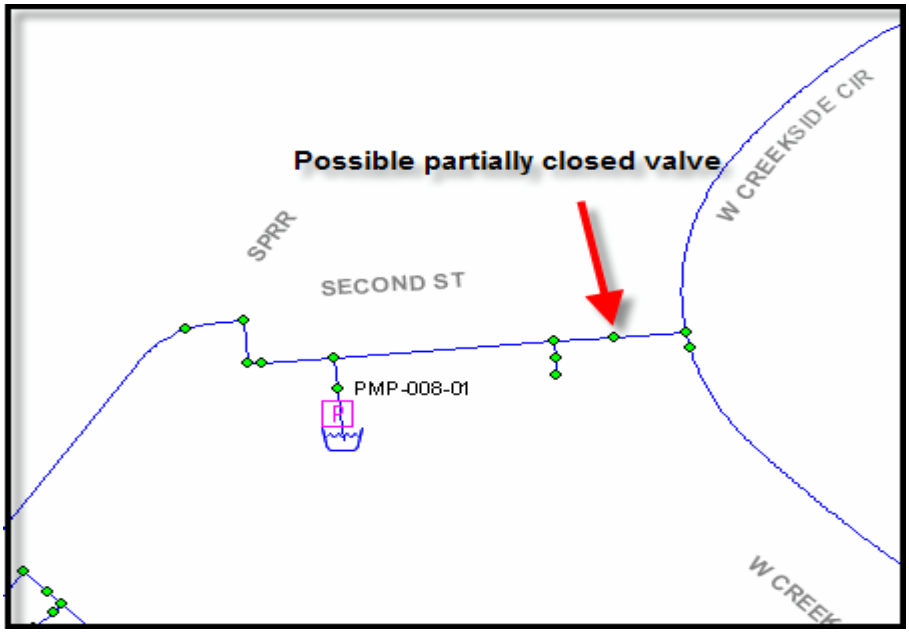
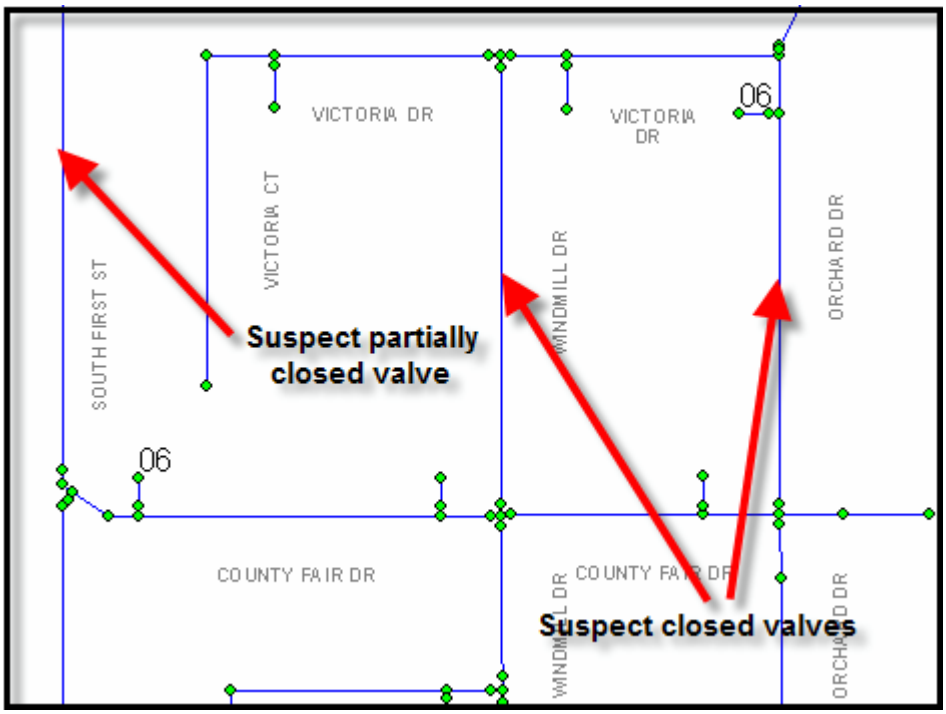
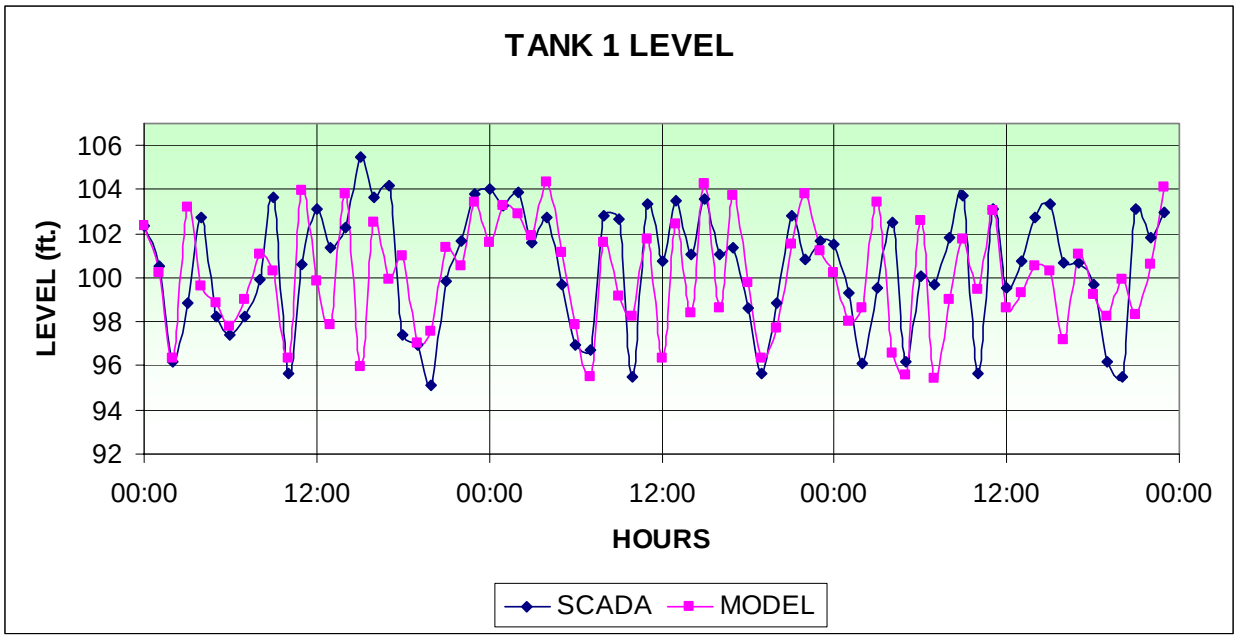
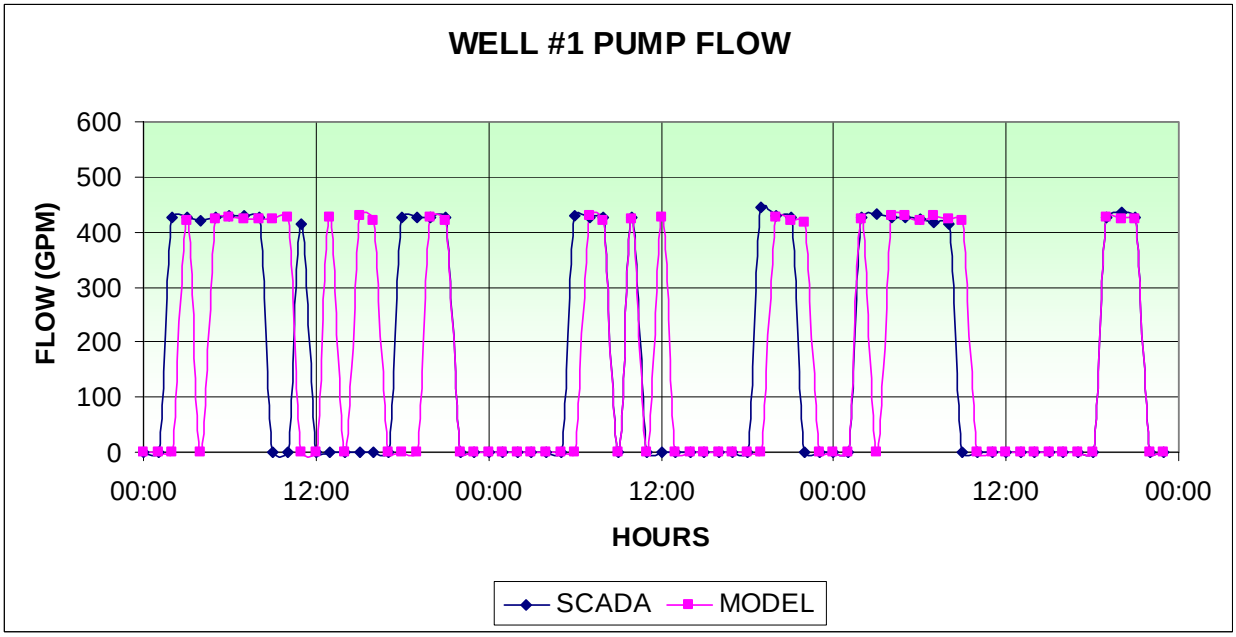


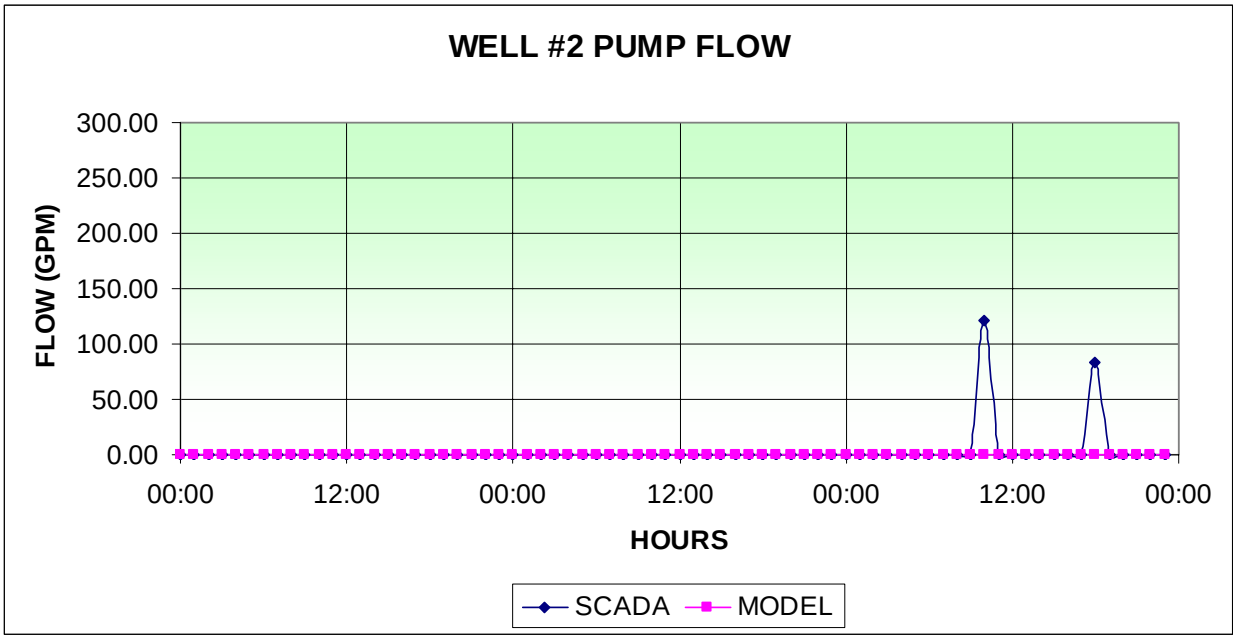
Figure 3

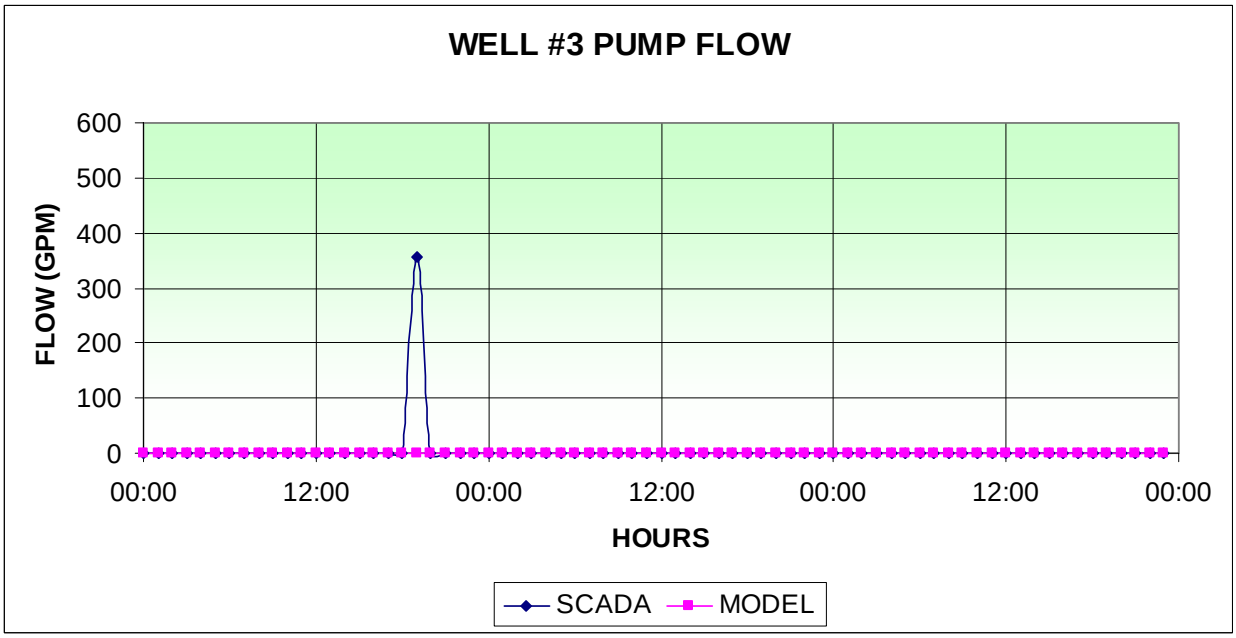

VICTORIA DR
VICTORIA DR
06
VICTORIA CT
SOUTH FIRST ST
WINDMILL DR
ORCHARD DR
Suspect partially closed valve
06
COUNTY FAIR DR
COUNTY FAIR DR
Suspect closed valves

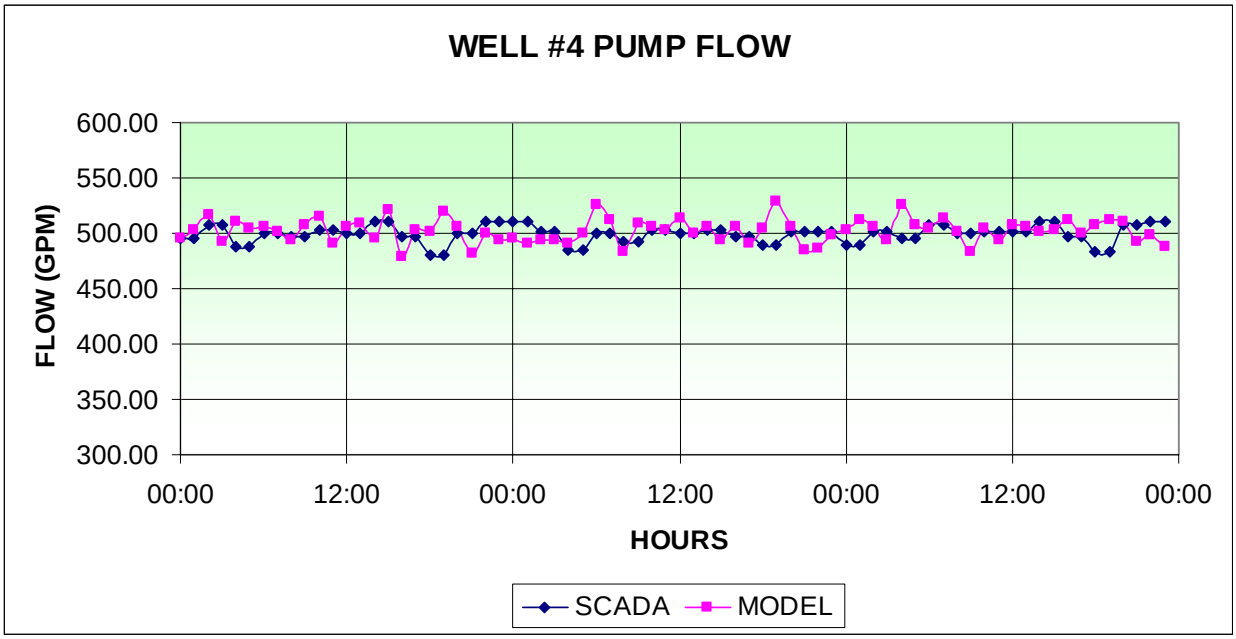
APPENDIX E – EPS Calibration Graphs

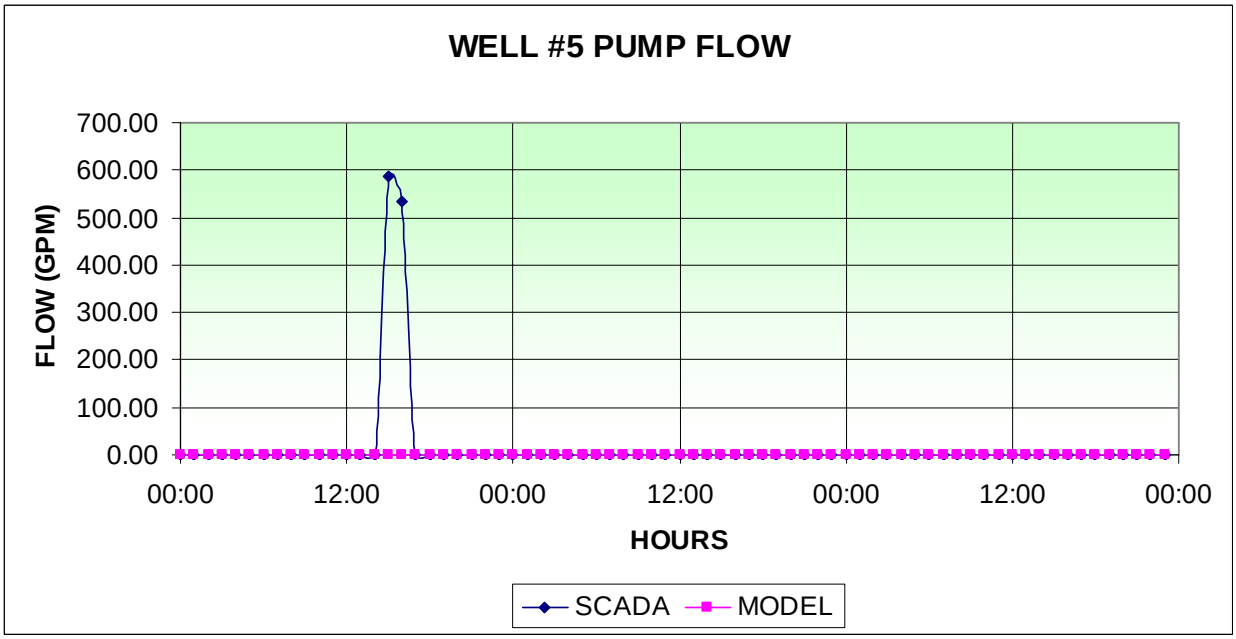


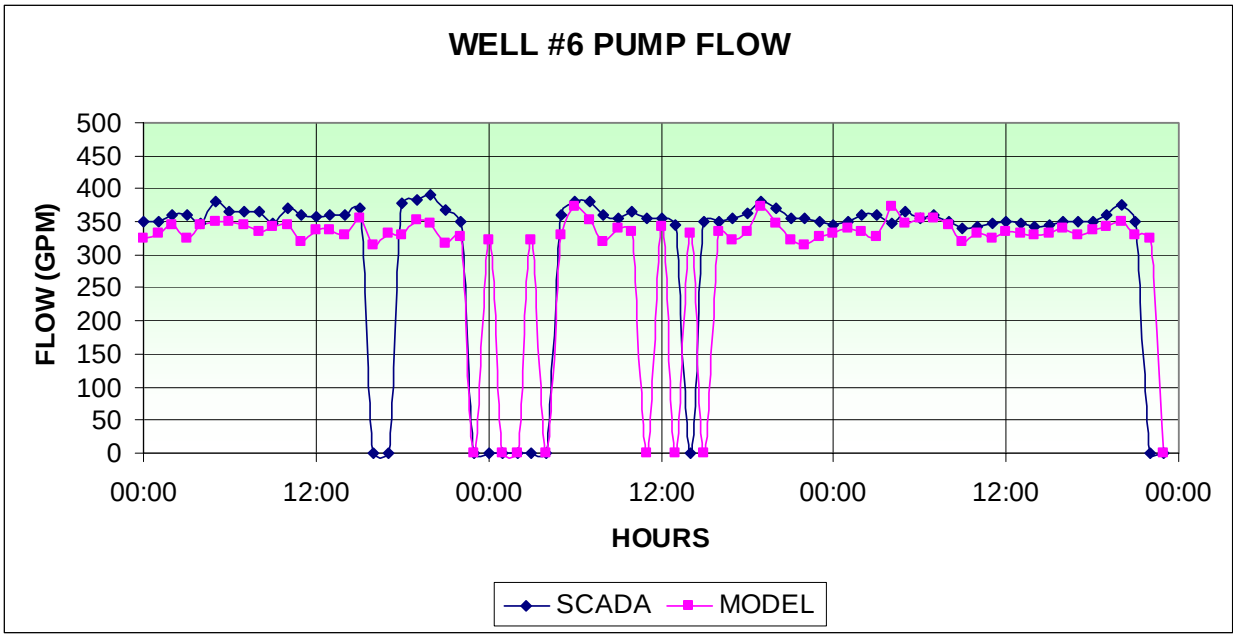


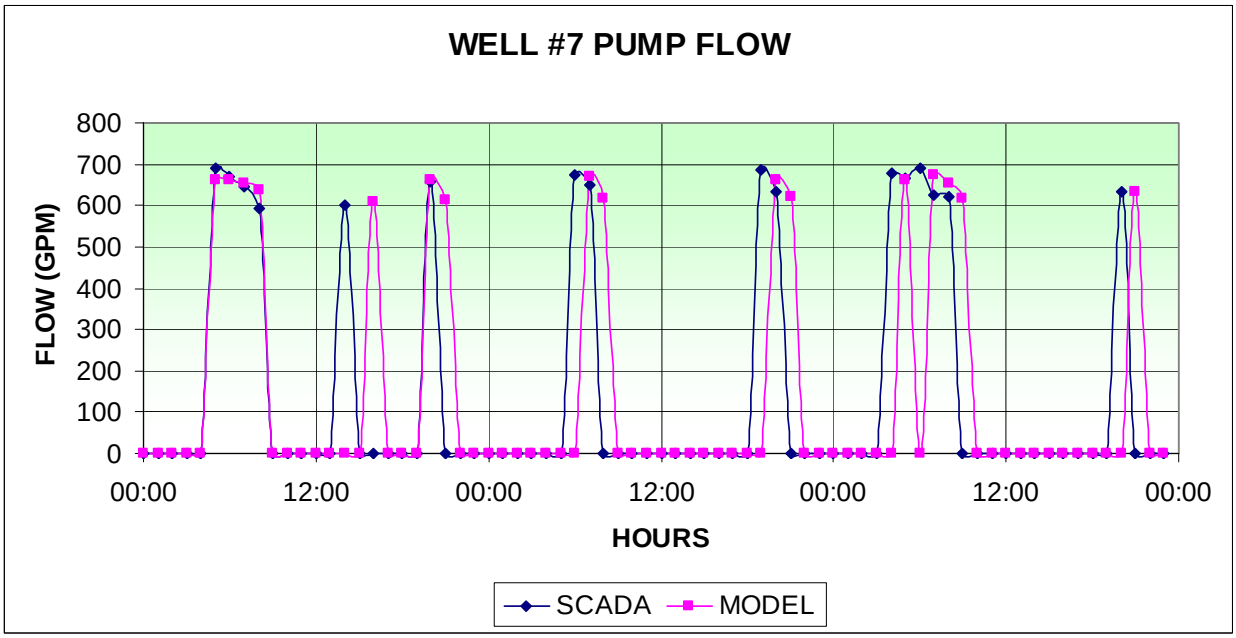

WELL #2 PUMP FLOW
FLOW (GPM)
300.00
250.00
200.00
150.00
100.00
50.00
0.00
00:00
12:00
00:00
12:00
00:00
12:00
00:00
HOURS
SCADA
MODEL

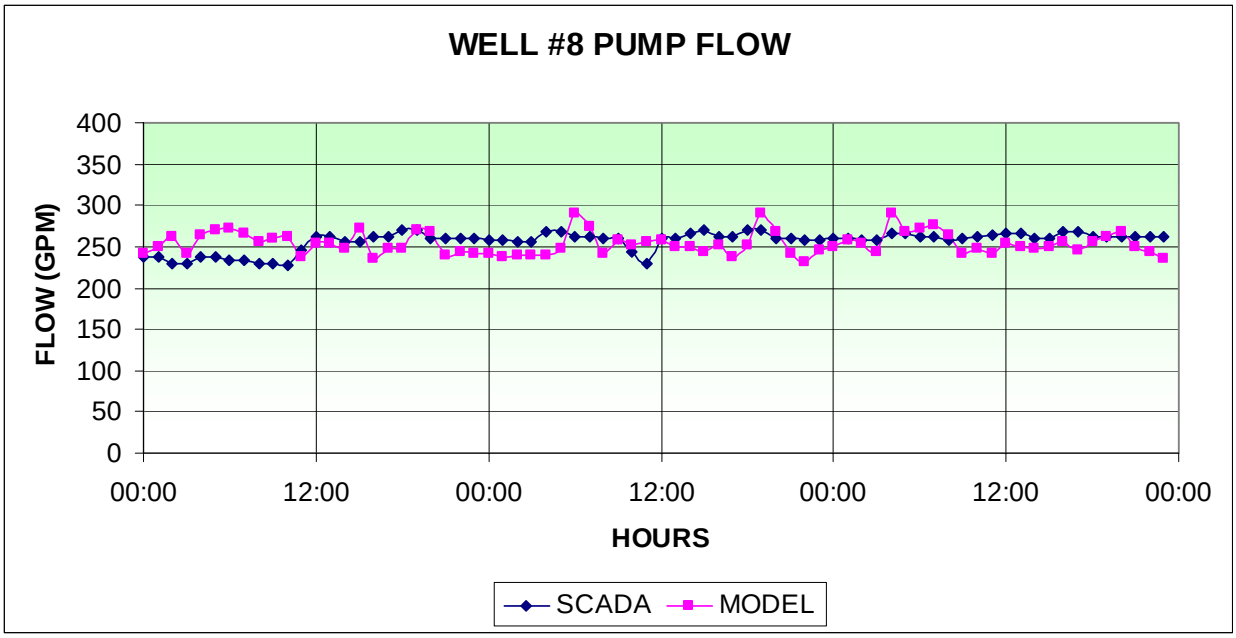

WELL #3 PUMP FLOW
FLOW (GPM)
600
500
400
300
200
100
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
HOURS
SCADA
MODEL

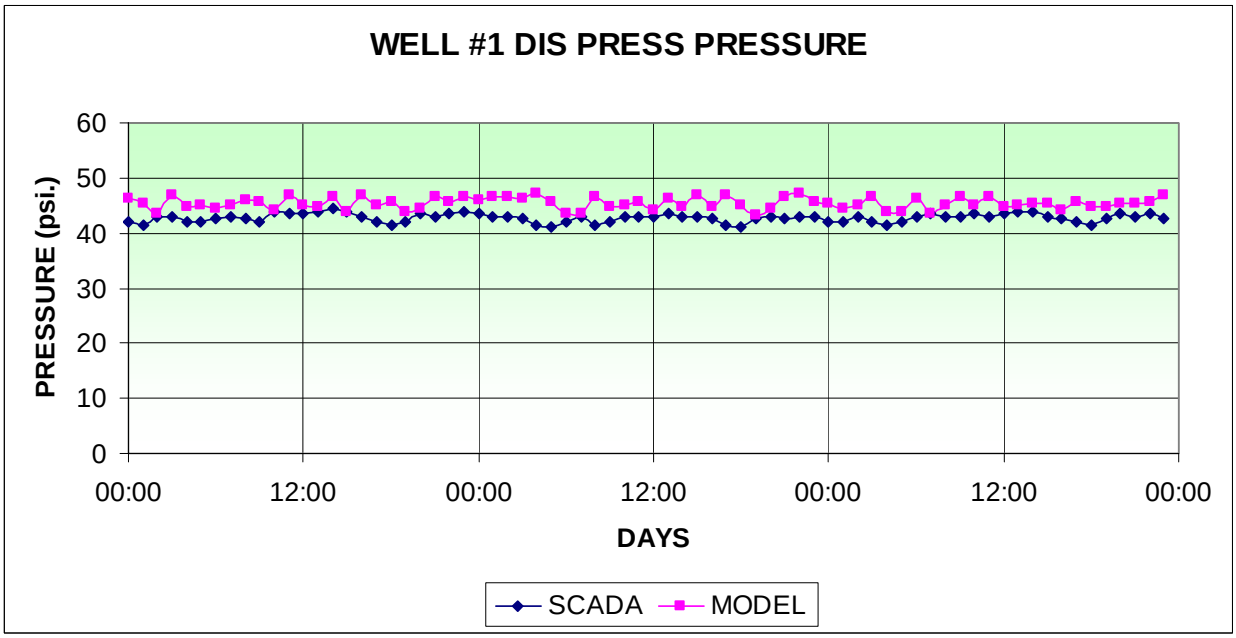

WELL #4 PUMP FLOW
FLOW (GPM)
600.00
550.00
500.00
450.00
400.00
350.00
300.00
00:00
12:00
00:00
12:00
00:00
12:00
00:00
HOURS
SCADA
MODEL

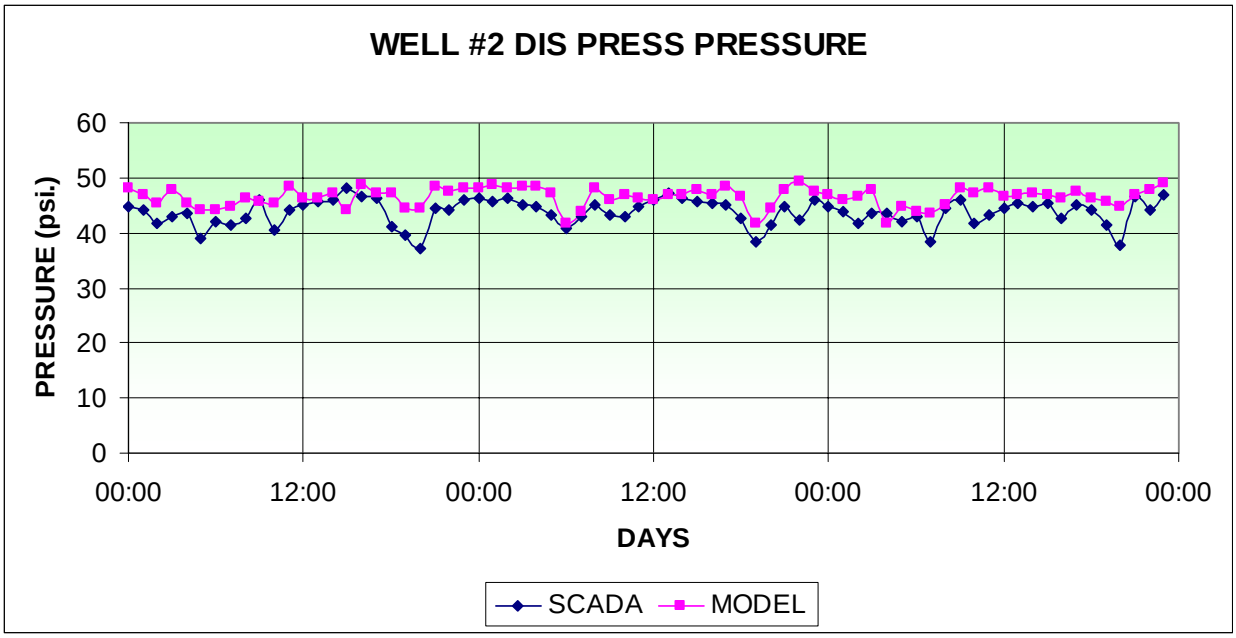

WELL #5 PUMP FLOW
FLOW (GPM)
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
00:00
12:00
00:00
12:00
00:00
12:00
00:00
HOURS
SCADA
MODEL


WELL #6 PUMP FLOW
FLOW (GPM)
500
450
400
350
300
250
200
150
100
50
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
HOURS
SCADA
MODEL


WELL #7 PUMP FLOW
FLOW (GPM)
800
700
600
500
400
300
200
100
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
HOURS
SCADA
MODEL


WELL #8 PUMP FLOW
FLOW (GPM)
400
350
300
250
200
150
100
50
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
HOURS
SCADA
MODEL


WELL #1 DIS PRESS PRESSURE
PRESSURE (psi.)
60
50
40
30
20
10
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
DAYS
SCADA
MODEL


WELL #2 DIS PRESS PRESSURE
PRESSURE (psi.)
60
50
40
30
20
10
0
00:00
12:00
00:00
12:00
00:00
12:00
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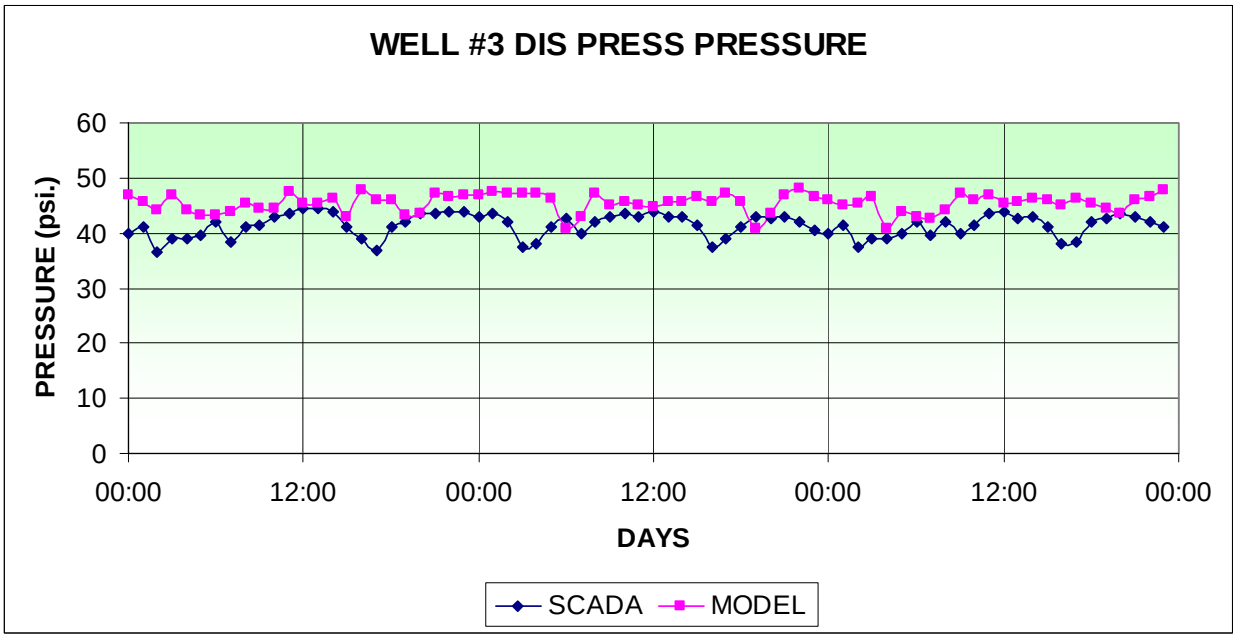
DAYS
SCADA
MODEL


WELL #3 DIS PRESS PRESSURE
PRESSURE (psi.)
60
50
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30
20
10
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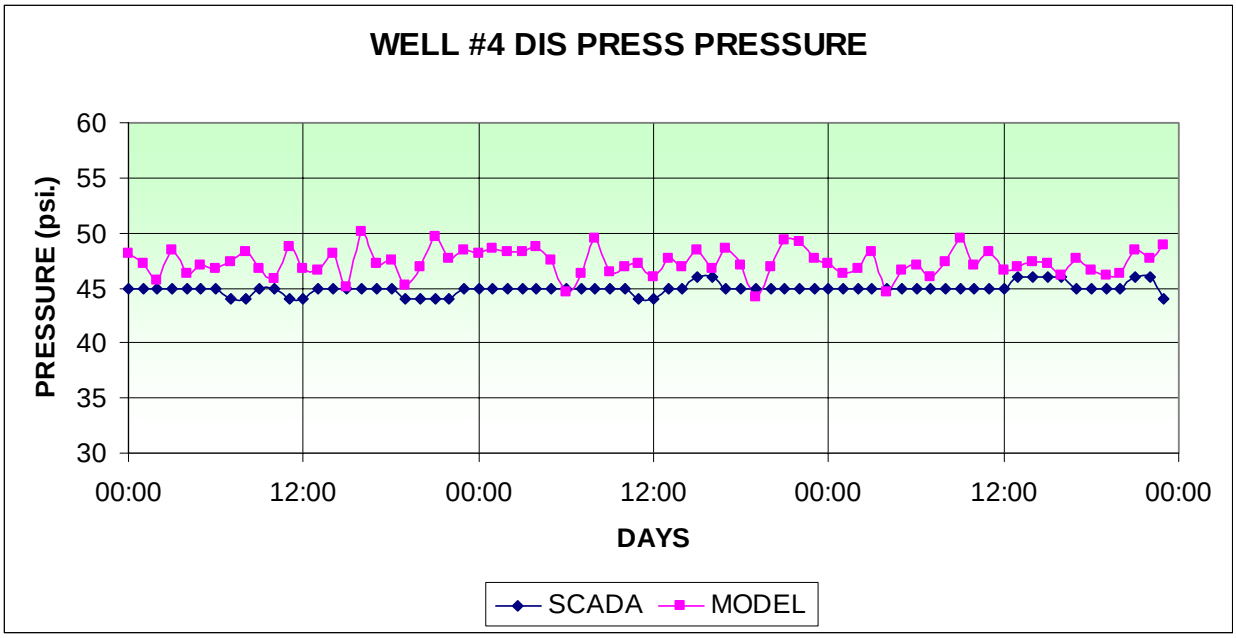
DAYS
SCADA
MODEL


WELL #4 DIS PRESS PRESSURE
PRESSURE (psi.)
60
55
50
45
40
35
30
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12:00
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12:00
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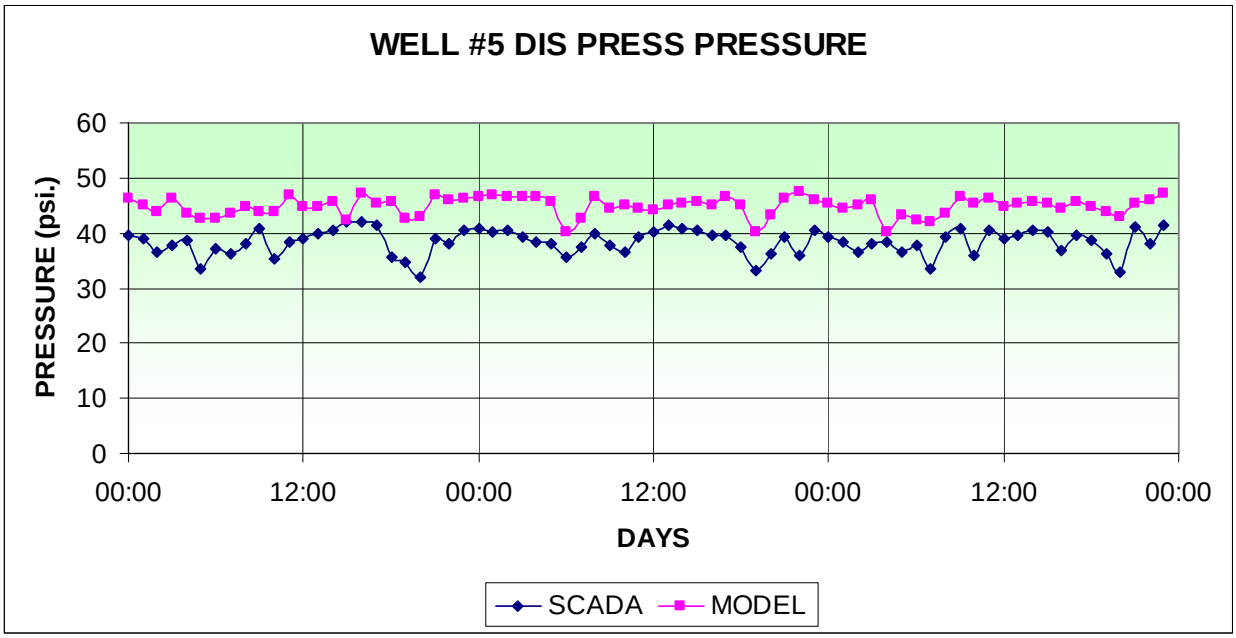
DAYS
SCADA
MODEL


WELL #5 DIS PRESS PRESSURE
PRESSURE (psi.)
60
50
40
30
20
10
0
00:00
12:00
00:00
12:00
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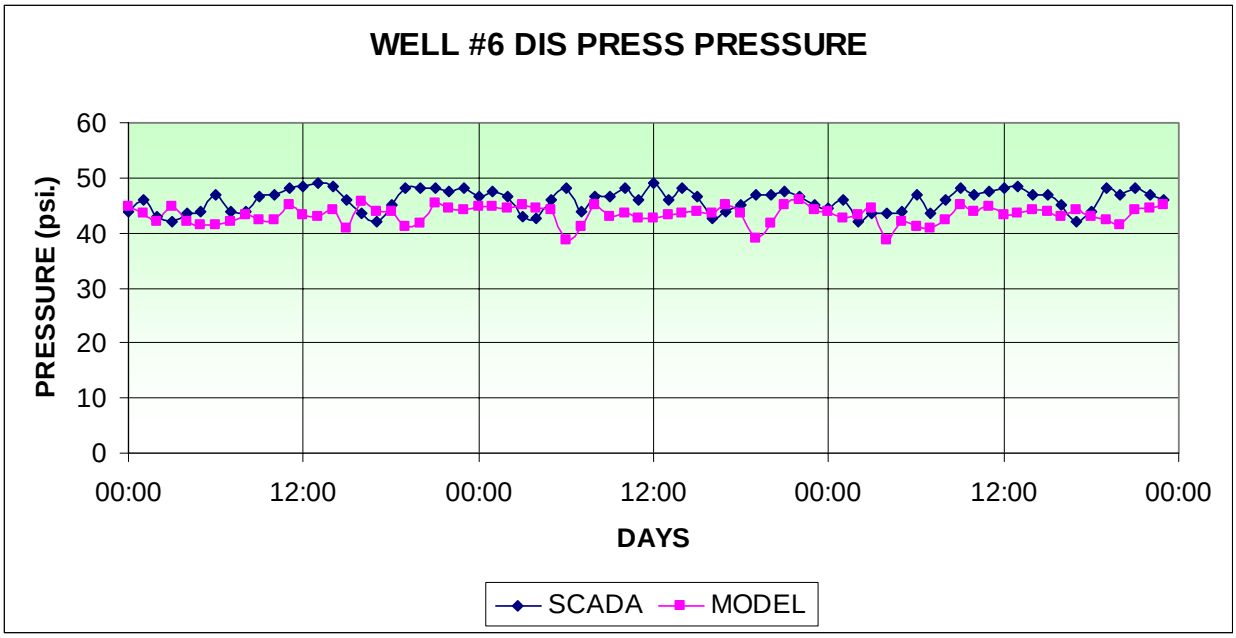
12:00
00:00
DAYS
SCADA
MODEL


WELL #6 DIS PRESS PRESSURE
PRESSURE (psi.)
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50
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20
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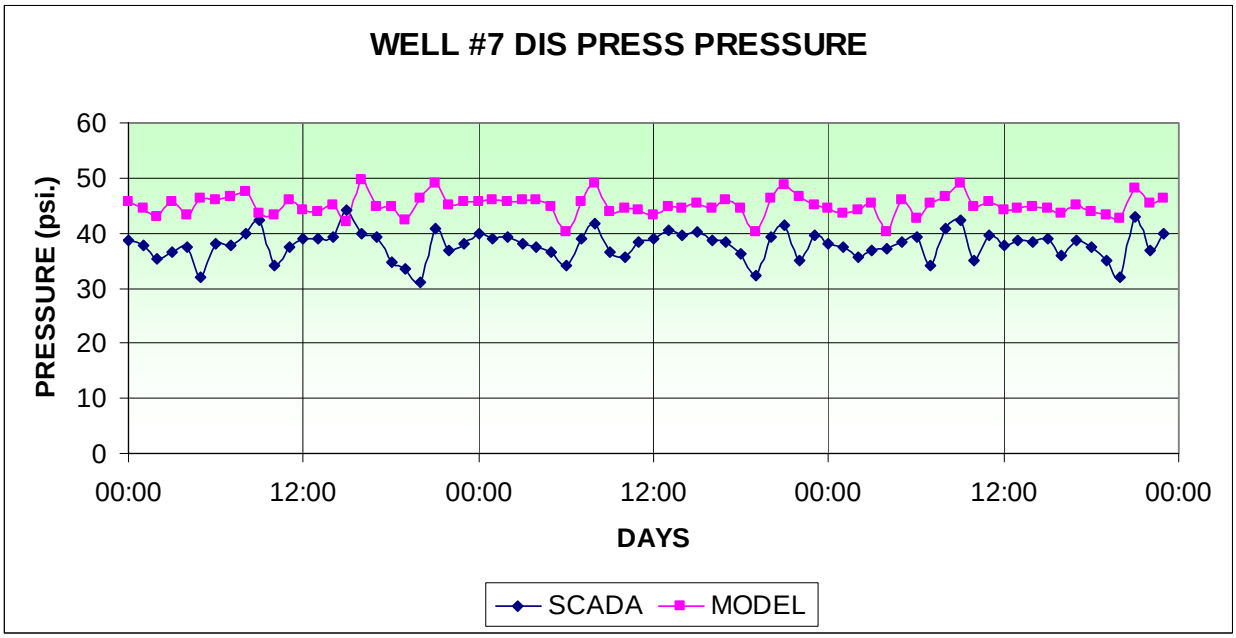
DAYS
SCADA
MODEL


WELL #7 DIS PRESS PRESSURE
PRESSURE (psi.)
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50
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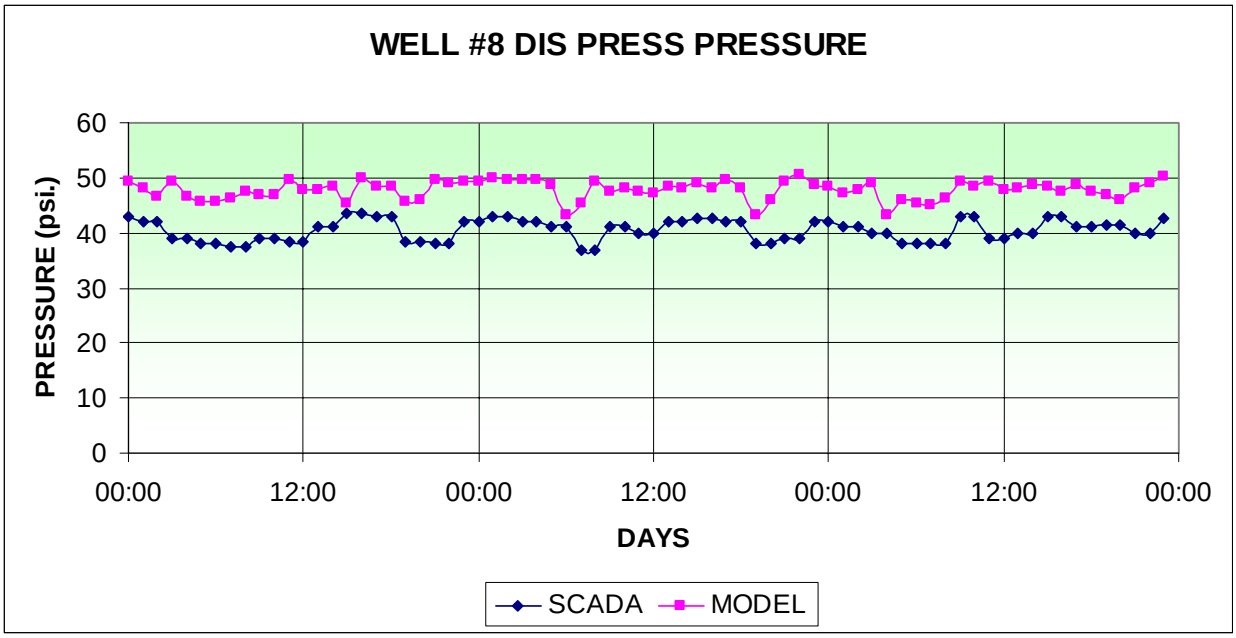
DAYS
SCADA
MODEL


WELL #8 DIS PRESS PRESSURE
PRESSURE (psi.)
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50
40
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00:00
12:00
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12:00
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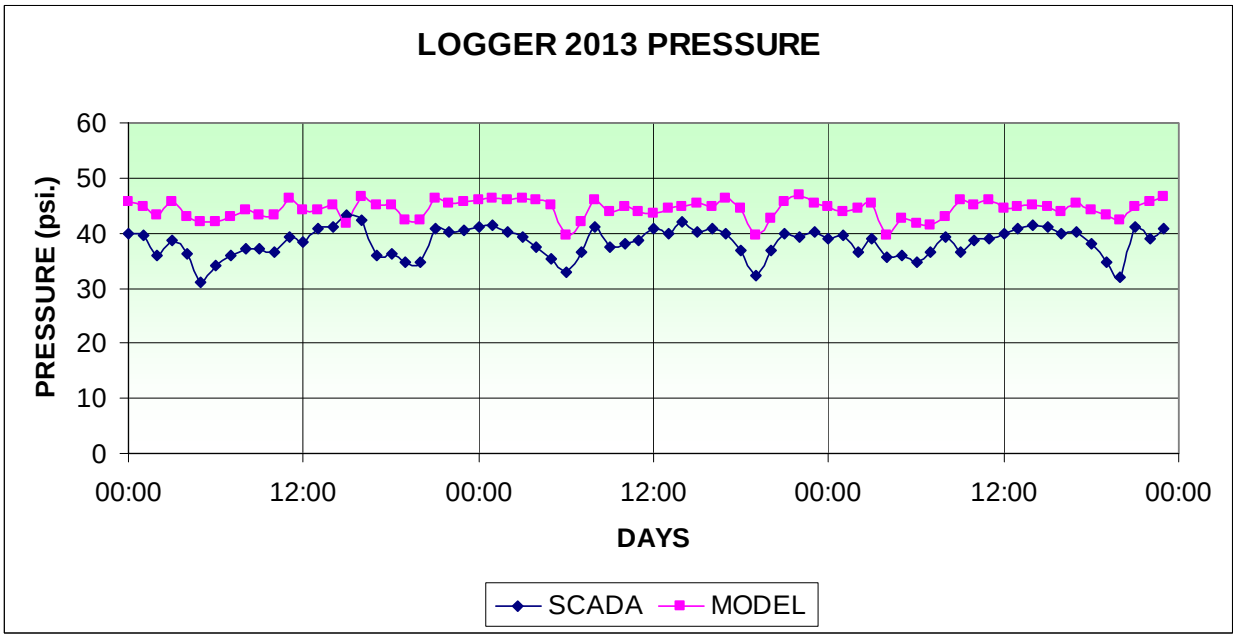
DAYS
SCADA
MODEL


LOGGER 2013 PRESSURE
PRESSURE (psi.)
60
50
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30
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12:00
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12:00
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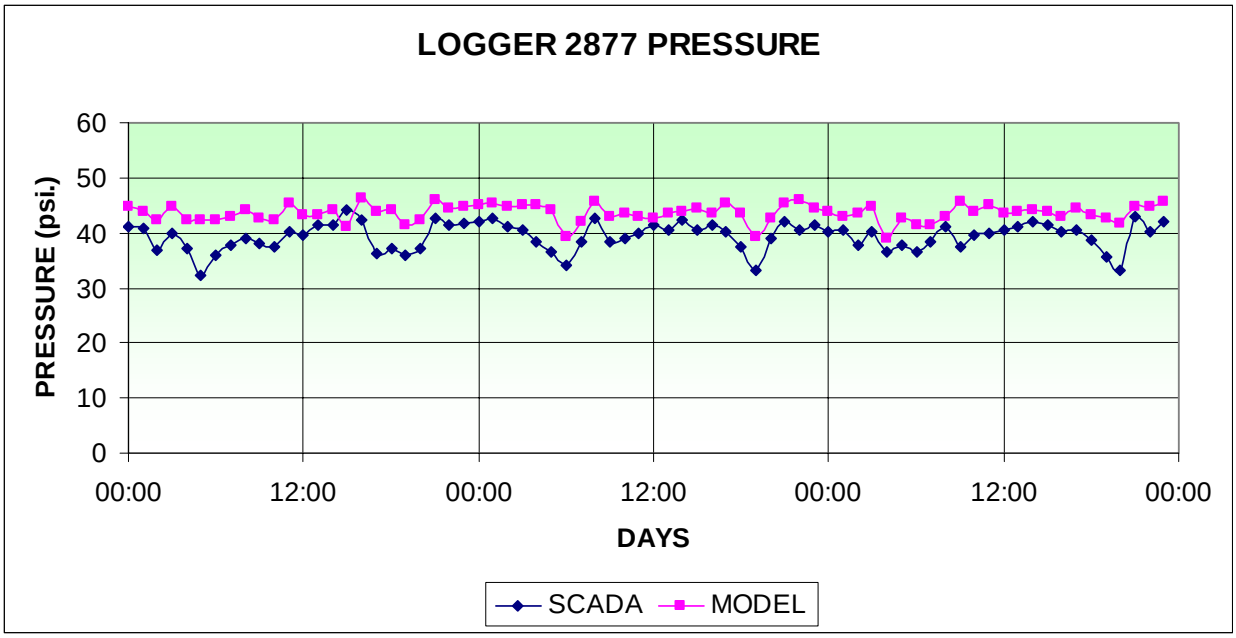
12:00
00:00
DAYS
SCADA
MODEL


LOGGER 2877 PRESSURE
PRESSURE (psi.)
60
50
40
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12:00
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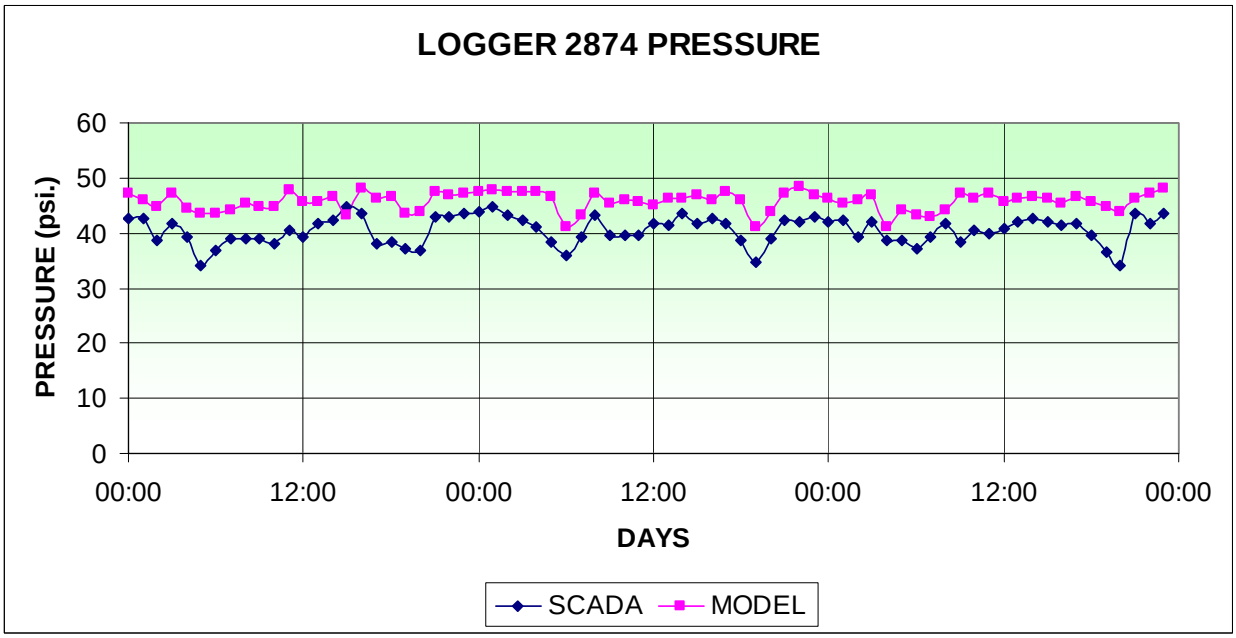
12:00
00:00
DAYS
SCADA
MODEL


LOGGER 2874 PRESSURE
PRESSURE (psi.)
60
50
40
30
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12:00
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12:00
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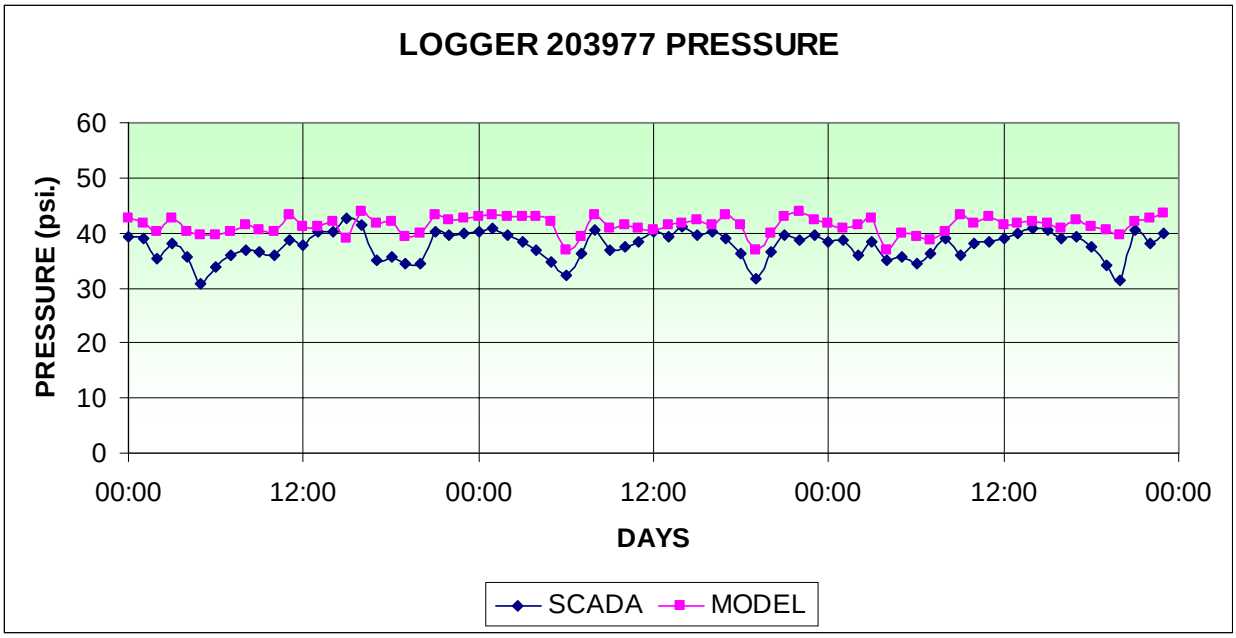
12:00
00:00
DAYS
SCADA
MODEL


LOGGER 203977 PRESSURE
PRESSURE (psi.)
60
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12:00
00:00
DAYS
SCADA
MODEL

Public Version

APPENDIX L

Facility Assessments

Public Version

Cal Water Dixon District

Facility Assessments

July 31, 2008

Station 01-03 (Active)

Tank 1 @ Station 01

Station 01 Control Building

Well 01-03 Panel

Station 01 Control Panel

Well 01-03 Pump & Motor

Station 01 Storage Building

Assessment Summary and Recommendations for Well No. 001-03

General Condition of Facilities & Recommendations	☒ Well facilities and site are in generally good condition Are there any recommended site improvements? - Genset/Panel would be nice (previously requested but delayed ☒ Yes; list recommended improvements: - convert to water lube? ☐ No, no site improvements needed - SCADA for well Is there space on-site for treatment facilities (for Fe & Mn, Nitrates and/or arsenic)? ☒ Yes; describe: maintenance yard ☐ No ☐ Well facilities and site are in generally bad condition Is the site favorable? (e.g. good water quality area, close to transmission pipelines, adequate space on site, compatible with adjacent land uses) ☐ Yes, site is favorable Are the existing facilities upgradeable? ☐ Yes, list recommended upgrades to existing facilities: ☐ No, recommend replacement of existing facilities with the following new facilities: ☐ No, site is not favorable ☐ Recommend that well site be decommissioned/relocated ☐ Recommend that site be used for other purposes ☐ Recommend that site be sold
Recommended Maintenance Program	☒ Routine (water level measurements, record production, annual pump efficiency test, water quality sampling, etc.) ☐ Special Requirements ☐ Pull Pump & conduct video survey of casing and perforations ☐ Clean casing and perforations/redevelop well ☐ Perform pump bowl/motor maintenance ☐ Other_____

Desktop Condition Assessment for Well No. 001-03

Facility Name	Station 001-03
Facility Address/Location	[redacted]
APN#	
Parcel Size	43' x 192' x 78' x 33' x 43' x 82' x 175'
Well Status	☒ Active ☐ Standby ☐ Inactive
Well Construction Data	Well Depth: 538 feet Design Flow Rate: 500 gpm Pump Horsepower: 40 hp
Facility Age	Year Constructed: 10/20/1954 or Age (years): 54
Recent Repairs/ Improvements/ Maintenance	List date and type of repair/improvement/maintenance: Flow meter (installed 2/17/1998)
Water Level Data	☐ Data Available; Historic Water Levels are: ☐ Increasing ☐ Stable ☐ Decreasing ☐ Data Not Available
Water Quality Data	☒ Data Available; Constituents of concern are: ☐ Fe & Mn ☐ PCE ☒ Nitrates ☐ Arsenic ☐ Other _____ ☐ None ☐ Current On-Site Wellhead Treatment for ☐ Fe & Mn ☐ Arsenic ☐ Other _____ ☐ Unknown ☐ Data Not Available
Well Testing Data	☐ No Testing Data Available ☐ Well Video (Date:_____) Results:_____ ☒ Pump Efficiency Test(s)—List Results Below:

Date (month/yr)	Static Water Level	Pumping Water Level	Flow (gpm)	Efficiency (%)
5/21/1998	53.00	68.00	545.00	53.11%
11/6/2000	70.00	82.00	556.00	55.61%
3/19/2002	104	116	500	60.9%
5/8/2003	70	84	540	56.4%
7/7/2004	142	162	405	58.3%
6/21/2005	106	112	474	52.0
10/26/2006	0	132	414	53.1

Cal Water Operations Staff Issues of Concern (or Items to Check in Field based on Desktop)	List any issues of concern or specific items to evaluate during field assessment:
Cal Water Operations Staff Facility Importance	☐ Critical to overall system operations ☐ Important ☐ Not so important

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Aerial Photo of Site
or Site Layout or Site
Sketch

[redacted]

Public Version

On-Site Condition Assessment for Well No. 001-03

Structural Assessment			
Building ☐ Not Applicable	Size: ____ ft by ____ ft ☐ Wood 5 x 5 ☒ Steel ☐ Concrete Masonry Block (CMU) ☐ Other_____	Year Constructed /Age	Condition: Exterior: ☒ Good ☐ Fair ☐ Poor Interior: ☐ Good ☐ Fair ☐ Poor Comments:
Roof ☐ Not Applicable	☐ Asphalt Shingle ☐ Wood Shingle ☐ Tile ☒ Other Steel	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Other Structure ☐ Not Applicable	☒ Above-Ground Tank ☒ Steel ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Tank ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Vault ☐ Other_____	Year Constructed /Age 1924/84	Condition: ☒ Good ☐ Fair ☐ Poor Comments: - Jose Mendez - maintenance records - store room - 7 5-gal containers bad iron hypo - no sand separator
Electrical/Back-Up Power Systems			
Motor Control Center/Control Panel ☐ Not Applicable	Type_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☒ Fair ☐ Poor Comments: New panel/genset in budget - but delayed
Emergency Generator/Auxiliary Engine ☐ Not Applicable	☐ On-Site Emergency Generator ☐ Diesel ☐ Gasoline ☐ Natural Gas ☐ Other_____ Manufacturer_____ Size (kW)_____ ☐ Auxiliary Engine ☐ Diesel ☐ Gasoline ☐ Natural Gas ☐ Other_____ Manufacturer_____ Size (hp)_____ ☐ Adaptor for "Plug In" Potable Unit	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments: No backup power - Genset in budget - but delayed

SCADA/Telemetry Systems			
SCADA/Telemetry ☐ Not Applicable	☒ Data Monitoring ☒ Pumping Rate ☒ Pressure ☐ Tank Level ☐ Other_____ ☐ Remote Control ☐ Booster Pump On/Off ☐ Well Pump On/Off ☐ Other_____ Manufacturer: Bristol Model: 433126D-061-111-130-000-220	Year Constructed /Age 2000/8	Condition: ☒ Good ☐ Fair ☐ Poor Comments: No SCADA for well Tank on SCADA
Mechanical Systems			
Booster Pumps ☐ Not Applicable	Type ☐ Vertical ☐ Horizontal Split Case Hp_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Well System: **Well No. 001-03** ☐ Not Applicable	Motor Type: CFU Hp: 40 Manufacturer: U.S. Back-Up Power (yes/no) Pump Type: 1-1/2 K2 RPM: 1750 Stages Manufacturer: Byron Jackson	Year Constructed /Age 1954/54	Condition: ☒ Good ☐ Fair ☐ Poor Comments: Oil lubed old pump but in good condition
Well System **Well No.____** (if more than one well at same site) ☒ Not Applicable	Motor Type_____ Hp_____ Manufacturer_____ Back-Up Power (yes/no) Pump Type_____ RPM_____ Stages_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:

Water Treatment System ☐ Not Applicable	Treatment Type ☒ Disinfection ☒ Calcium Hypochlorite ☐ Sodium Hypochlorite ☐ Other_____ ☐ Fe/Mn_____ ☐ Other_____ ☐ None Chemical Feed System ☐ 55-gallon drums ☐ Day Tank ☒ Other Tablets ☐ None Safety ☐ Emergency Eye Wash Station ☐ Emergency Shower ☒ None	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Discharge Piping Systems ☐ Not Applicable	Installation ☒ Above Ground ☐ Below Ground Materials ☒ Asbestos Cement ☐ Ductile Iron ☐ Steel ☐ PVC Diameter (inches): 8	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Heating, Ventilation and Cooling Systems ☒ Not Applicable	Type_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Fire Protection ☒ Not Applicable	☐ Automatic Sprinkler ☐ Fire Extinguisher ☐ Other_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Overall Site Issues	Concern	Comments or Not Applicable (N/A)	
Adjacent Land Use	☐ Residential ☐ Single Family Homes ☐ Apartments ☐ Condos ☒ Commercial ☒ Industrial ☐ Park ☐ School ☐ Other_____	Downtown Area	

Aesthetic Issues	Exterior Paint	Condition: ☒ Good ☐ Fair ☐ Poor
	Interior Paint	Condition: ☐ Good ☐ Fair ☐ Poor NA
	Site Landscaping	Condition: ☐ Good ☐ Fair ☐ Poor Yard Maintenance NA
	Site Drainage	Condition: ☒ Good ☐ Fair ☐ Poor
	Access Road	Condition: ☒ Good ☐ Fair ☐ Poor
	General Site Appearance	Condition: ☒ Good ☐ Fair ☐ Poor
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor NA
Security Issues	Security of Doors, Windows, & Locks	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A Deadbolt
	Security of Hatches & Vaults	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Perimeter Fences & Gates	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A 6' chain link barbed wire
	Interior Lighting	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A
	Exterior Lighting	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A
	Alarm Systems	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Health & Safety Equipment	☐ First Aid Kit ☐ Personal Protective Equipment ☐ MSDS ☐ Other_____ ☒ None
Potential Site Hazards	Overgrown Trees On/Adjacent to Site	☐ Yes; Describe_____ ☒ No
	Adjacent Fire Hazards	☐ Yes; Describe_____ ☒ No
	Adjacent Flood Hazards	☐ Yes; Describe_____ ☒ No
	Landslide Hazards	☐ Yes; Describe_____ ☒ No
	Other_____	☐ Yes; Describe_____ ☒ No

Other Comments	
Assessment Performed by	Suroso/Bruyer
Assessment Date	7/31/08

Public Version

Cal Water Dixon District

Facility Assessments

July 31, 2008

Station 02-01 (Active)

Station 02-01 Pump & Motor

Station 02-01 Building

Station 02-01 Pressure Tank

Station 02-01 Panel

Station 02-01 Nitrate Analyzer

Station 02-01 Disinfection

Assessment Summary and Recommendations for Well No. 002-01

General Condition of Facilities & Recommendations	☒ Well facilities and site are in generally good condition Are there any recommended site improvements? ☒ Yes; list recommended improvements: Exterior lighting Exterior paint/interior paint convert to water lube? ☐ No, no site improvements needed Is there space on-site for treatment facilities (for Fe & Mn and/or arsenic)? ☐ Yes; describe: ☒ No very small site ☐ Well facilities and site are in generally bad condition Is the site favorable? (e.g. good water quality area, close to transmission pipelines, adequate space on site, compatible with adjacent land uses) ☐ Yes, site is favorable Are the existing facilities upgradeable? ☐ Yes, list recommended upgrades to existing facilities: ☐ No, recommend replacement of existing facilities with the following new facilities: ☐ No, site is not favorable ☐ Recommend that well site be decommissioned/relocated ☐ Recommend that site be used for other purposes ☐ Recommend that site be sold
Recommended Maintenance Program	☒ Routine (water level measurements, record production, annual pump efficiency test, water quality sampling, etc.) Do pump test ☐ Special Requirements ☐ Pull Pump & conduct video survey of casing and perforations ☐ Clean casing and perforations/redevelop well ☐ Perform pump bowl/motor maintenance ☐ Other_____

Desktop Condition Assessment for Well No. 002-01

Facility Name	002-01
Facility Address/Location	[redacted]
APN#	
Parcel Size	137' x 65'
Well Status	☒ Active ☐ Standby ☐ Inactive
Well Construction Data	Well Depth: 578 feet Design Flow Rate: 700 gpm Pump Horsepower: 50 hp
Facility Age	Year Constructed: 5/1/1950 or Age (years): 58
Recent Repairs/ Improvements/ Maintenance	List date and type of repair/improvement/maintenance: Chlorinator
Water Level Data	☐ Data Available; Historic Water Levels are: ☐ Increasing ☐ Stable ☐ Decreasing ☐ Data Not Available
Water Quality Data	☒ Data Available; Constituents of concern are: ☐ Fe & Mn ☐ PCE ☒ Nitrates ☐ Arsenic ☒ Other : Total Chromium ☐ None ☐ Current On-Site Wellhead Treatment for ☐ Fe & Mn ☐ Arsenic ☐ Other _____ ☐ Unknown ☐ Data Not Available
Well Testing Data	☐ No Testing Data Available ☐ Well Video (Date:_____) Results:_____ ☒ Pump Efficiency Test(s)—List Results Below:

Date (month/yr)	Static Water Level	Pumping Water Level	Flow (gpm)	Efficiency (%)
4/19/1988	53.00	65.00	655.00	73.99%
11/4/1991	51.00	72.00	690.00	82.88%
3/19/2002	26	37	658	64.7%
5/8/2003	24	42	638	62.8%

Cal Water Operations Staff Issues of Concern (or Items to Check in Field based on Desktop)	List any issues of concern or specific items to evaluate during field assessment:
Cal Water Operations Staff Facility Importance	☐ Critical to overall system operations ☐ Important ☐ Not so important

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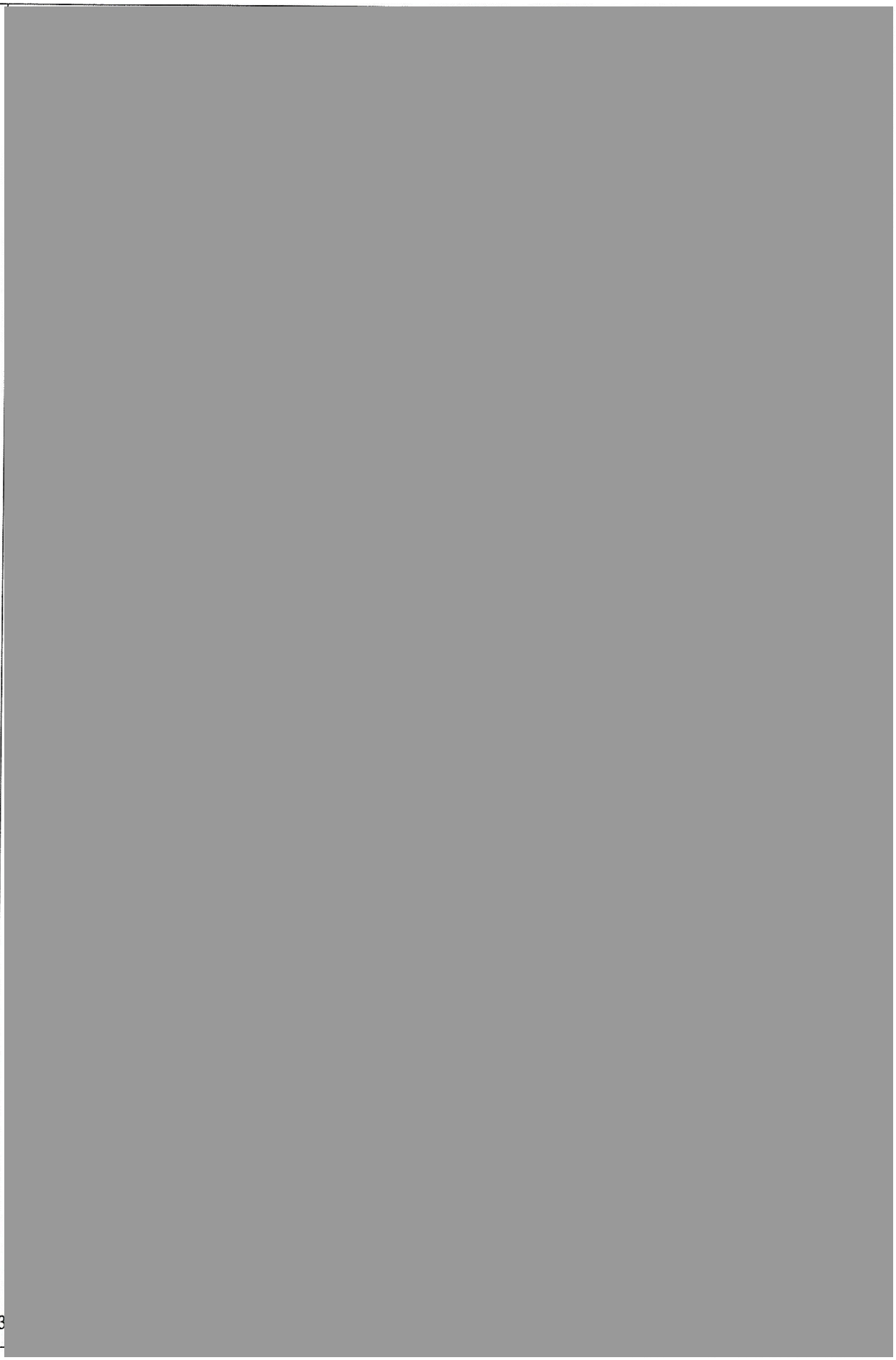
Aerial Photo of Site or Site Layout or Site Sketch



On-Site Condition Assessment for Well No. 002-01

Structural Assessment			
Building ☐ Not Applicable	Size: 10 ft by 15 ft ☐ Wood ☒ Steel ☐ Concrete Masonry Block (CMU) ☐ Other_____	Year Constructed /Age	Condition: Exterior: ☒ Good ☐ Fair ☐ Poor Interior: ☒ Good ☐ Fair ☐ Poor Comments:
Roof ☐ Not Applicable	☐ Asphalt Shingle ☐ Wood Shingle ☐ Tile ☒ Other metal	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Other Structure ☐ Not Applicable	☐ Above-Ground Tank ☐ Steel ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Tank ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Vault ☒ Other: Pressurized Tank	Year Constructed /Age	Condition: ☐ Good ☒ Fair ☐ Poor Comments: → Pressure tank not connected to system
Electrical/Back-Up Power Systems			
Motor Control Center/Control Panel ☐ Not Applicable	Type_____ Manufacturer_____ Columbia Electric	Year Constructed /Age	Condition: ☐ Good ☒ Fair ☐ Poor Comments:
Emergency Generator/Auxiliary Engine ☒ Not Applicable	☐ On-Site Emergency Generator ☐ Diesel ☐ Gasoline ☐ Natural Gas ☐ Other_____ Manufacturer_____ Size (kW)_____ ☐ Auxiliary Engine ☐ Diesel ☐ Gasoline ☐ Natural Gas ☐ Other_____ Manufacturer_____ Size (hp)_____ ☐ Adaptor for "Plug In" Potable Unit	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments: No backup power – not much space for it either Maybe space for portable – although would need to install transfer switch

SCADA/Telemetry Systems			
SCADA/Telemetry ☐ Not Applicable	☒ Data Monitoring ☒ Pumping Rate ☒ Pressure ☐ Tank Level ☐ Other_____ ☐ Remote Control ☐ Booster Pump On/Off ☐ Well Pump On/Off ☐ Other_____ Manufacturer: Bristol Model: 433126D-061-111-1HO-020-220	Year Constructed /Age 1995/13	Condition: ☒ Good ☐ Fair ☐ Poor Comments: SCADA – monitoring control
Mechanical Systems			
Booster Pumps ☐ Not Applicable	Type ☐ Vertical ☐ Horizontal Split Case Hp_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Well System: **Well No. 002-01** ☐ Not Applicable Layne Bowler	Motor Type: KS Hp: 50 Manufacturer: G.E. Back-Up Power (yes/no) Pump Type: 11HQL RPM: Stages: Manufacturer: Byron Jackson	Year Constructed /Age 1988/20 motor	Condition: ☒ Good ☐ Fair ☐ Poor Comments: Not running – Hasn't run in July – only for sampling Oil lube
Well System **Well No.____** (if more than one well at same site) ☒ Not Applicable	Motor Type_____ Hp_____ Manufacturer_____ Back-Up Power (yes/no) Pump Type_____ RPM_____ Stages_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:

Water Treatment System ☐ Not Applicable	Treatment Type ☐ Disinfection ☐ Calcium Hypochlorite ☒ Sodium Hypochlorite tablets ☐ Other_____ ☐ Fe/Mn_____ ☒ Other: Nitrates ☐ None Chemical Feed System ☐ 55-gallon drums ☐ Day Tank ☒ Other tablets ☐ None Safety ☐ Emergency Eye Wash Station ☐ Emergency Shower ☒ None	Year Constructed /Age 2007/1	Condition: ☒ Good ☐ Fair ☐ Poor Comments: Higher 30 mg/L nitrate Nitrate Analyzer (about 2 yrs old) Tablet system works fine
Discharge Piping Systems ☐ Not Applicable	Installation ☒ Above Ground ☐ Below Ground Materials ☐ Ductile Iron ☒ Steel ☐ PVC Diameter (inches)_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Heating, Ventilation and Cooling Systems ☒ Not Applicable	Type_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Fire Protection ☒ Not Applicable	☐ Automatic Sprinkler ☐ Fire Extinguisher ☐ Other_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Overall Site Issues	Concern	Comments or Not Applicable (N/A)	
Adjacent Land Use	☒ Residential ☒ Single Family Homes ☐ Apartments ☐ Condos ☐ Commercial ☐ Industrial ☒ Park Hall Memorial Park ☒ School ☒ Other: City Hall/Public		
Aesthetic Issues	Exterior Paint	Condition: ☐ Good ☒ Fair ☐ Poor	consider painting
	Interior Paint	Condition: ☐ Good ☒ Fair ☐ Poor	
	Site Landscaping	Condition: ☐ Good ☒ Fair ☐ Poor	Demonstration Garden City/Cal Water @ front

Weeds growing in yard

	Site Drainage	Condition: ☐ Good ☒ Fair ☐ Poor
	Access Road	Condition: ☒ Good ☐ Fair ☐ Poor
	General Site Appearance	Condition: ☒ Good ☐ Fair ☐ Poor
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor NA
Security Issues	Security of Doors, Windows, & Locks	Condition: ☐ Good ☒ Fair ☐ Poor ☐ N/A Padlock
	Security of Hatches & Vaults	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Perimeter Fences & Gates	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A 6' chainlink w/ slats
	Interior Lighting	Condition: ☐ Good ☒ Fair ☐ Poor ☐ N/A
	Exterior Lighting	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Alarm Systems	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Health & Safety Equipment	☐ First Aid Kit ☐ Personal Protective Equipment ☐ MSDS ☐ Other_____ ☒ None
Potential Site Hazards	Overgrown Trees On/Adjacent to Site	☐ Yes; Describe_____ ☒ No
	Adjacent Fire Hazards	☐ Yes; Describe_____ ☒ No
	Adjacent Flood Hazards	☐ Yes; Describe_____ ☒ No
	Landslide Hazards	☐ Yes; Describe_____ ☒ No
	Other_____	☐ Yes; Describe_____ ☒ No

Other Comments

Sand tester - on well - no sand separator - sand production not bad.

Well seal not very deep? 52 feet per well data.

Assessment Performed by	7/31/08
Assessment Date	Surosso / Drager

Public Version

Cal Water Dixon District

Facility Assessments

July 31, 2008

Station 03-01 (Active)

Station 03-01 Lot

Station 03-01 Panel

Station 03-01 Pump & Motor

Station 03-01 Nitrate Analyzer

Station 03-01 Sand Separator & Pressure Tank

Assessment Summary and Recommendations for Well No. 003-01

General Condition of Facilities & Recommendations	☒ Well facilities and site are in generally good condition Are there any recommended site improvements? ☒ Yes; list recommended improvements: - SCADA / treatment - Exterior lighting - Interior/exterior paint ☐ No, no site improvements needed Is there space on-site for treatment facilities (for Fe & Mn, Nitrates and/or arsenic)? ☒ Yes; describe: space behind building small but adequate ☐ No ☐ Well facilities and site are in generally bad condition Is the site favorable? (e.g. good water quality area, close to transmission pipelines, adequate space on site, compatible with adjacent land uses) ☐ Yes, site is favorable Are the existing facilities upgradeable? ☐ Yes, list recommended upgrades to existing facilities: ☐ No, recommend replacement of existing facilities with the following new facilities: ☐ No, site is not favorable ☐ Recommend that well site be decommissioned/relocated ☐ Recommend that site be used for other purposes ☐ Recommend that site be sold
Recommended Maintenance Program	☒ Routine (water level measurements, record production, annual pump efficiency test, water quality sampling, etc.) ☐ Special Requirements ☐ Pull Pump & conduct video survey of casing and perforations ☐ Clean casing and perforations/redevelop well ☐ Perform pump bowl/motor maintenance ☐ Other_____

Desktop Condition Assessment for Well No. 003-01

Facility Name	Station 003-01
Facility Address/Location	[redacted]
APN#	
Parcel Size	111' x 40'
Well Status	☒ Active ☐ Standby ☐ Inactive
Well Construction Data	Well Depth: 602 feet Design Flow Rate: ~~750~~ gpm 600 gpm (1989) Pump Horsepower: 50 hp New pump installed May 2008 600 gpm @ 210 ft TDH, Bowl @ 140 ft
Facility Age	Year Constructed: 1/1/1956 or Age (years): 52
Recent Repairs/ Improvements/ Maintenance	List date and type of repair/improvement/maintenance: Sand Separator, Pressurized Tank ✓ ✓
Water Level Data	☐ Data Available; Historic Water Levels are: ☐ Increasing ☐ Stable ☐ Decreasing ☐ Data Not Available
Water Quality Data	☒ Data Available; Constituents of concern are: ☐ Fe & Mn ☐ PCE ☒ Nitrates ☐ Arsenic ☒ Other: Chromium (Chromium 6) ☐ None ☐ Current On-Site Wellhead Treatment for ☐ Fe & Mn ☐ Arsenic ☐ Other _____ ☐ Unknown ☐ Data Not Available
Well Testing Data	☐ No Testing Data Available ☐ Well Video (Date:_____) Results:_____ ☒ Pump Efficiency Test(s)—List Results Below:

Date (month/yr)	Static Water Level	Pumping Water Level	Flow (gpm)	Efficiency (%)
11/4/1991	38.00	50.00	651.00	72.12%
7/24/1996	42.00	52.00	705.00	67.88%
5/21/1998	34.00	44.00	805.00	63.42%
11/6/2000	28.00	38.00	690.00	62.03%
3/19/2002	24	34	666	62.2%
5/8/2003	23	34	654	46.7%
11/22/2006	26	39	590	64.7

Cal Water Operations Staff Issues of Concern (or Items to Check in Field based on Desktop)	List any issues of concern or specific items to evaluate during field assessment: Sanding
Cal Water Operations Staff Facility Importance	☐ Critical to overall system operations ☐ Important ☐ Not so important

Aerial Photo of Site or Site Layout or Site Sketch	[redacted]

On-Site Condition Assessment for Well No. 001-03

Structural Assessment			
Building ☐ Not Applicable	Size: 10 ft by 12 ft ☐ Wood ☒ Steel ☐ Concrete Masonry Block (CMU) ☐ Other_____	Year Constructed /Age	Condition: Exterior: ☐ Good ☒ Fair ☐ Poor Interior: ☐ Good ☒ Fair ☐ Poor Comments: ceiling paint peeling bit
Roof ☐ Not Applicable	☐ Asphalt Shingle ☐ Wood Shingle ☐ Tile ☒ Other steel	Year Constructed /Age	Condition: ☐ Good ☒ Fair ☐ Poor Comments:
Other Structure ☐ Not Applicable	☐ Above-Ground Tank ☐ Steel ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Tank ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Vault ☒ Other: Pressurized Tank	Year Constructed /Age 1987/21	Condition: ☐ Good ☐ Fair ☐ Poor Comments: Capacity: 580 gal Sand separator - Pressure Tank Dorrclone - Desander - sand production not too bad
Electrical/Back-Up Power Systems			
Motor Control Center/Control Panel ☐ Not Applicable	Type_____ Manufacturer_____ Industrial Elect	Year Constructed /Age	Condition: ☐ Good ☒ Fair ☐ Poor Comments:
Emergency Generator/Auxiliary Engine ☒ Not Applicable	☐ On-Site Emergency Generator ☐ Diesel ☐ Gasoline ☐ Natural Gas ☐ Other_____ Manufacturer_____ Size (kW)_____ ☐ Auxiliary Engine ☐ Diesel ☐ Gasoline ☐ Natural Gas ☐ Other_____ Manufacturer_____ Size (hp)_____ ☐ Adaptor for "Plug In" Potable Unit	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments: No backup power - probably not needed

SCADA/Telemetry Systems			
SCADA/Telemetry ☐ Not Applicable	☒ Data Monitoring ☒ Pumping Rate ☒ Pressure ☐ Tank Level ☐ Other_____ ☐ Remote Control ☐ Booster Pump On/Off ☐ Well Pump On/Off ☐ Other_____ Manufacturer: Bristol Model: 433126D-061-111-1HO-020-220	Year Constructed /Age 1995/13	Condition: ☐ Good ☐ Fair ☐ Poor Comments: Planned for 2009 – possibly part of nitrate treatment project?
Mechanical Systems			
Booster Pumps ☐ Not Applicable	Type ☐ Vertical ☐ Horizontal Split Case Hp_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Well System: **Well No. 003-01** ☐ Not Applicable	Motor BF50A Type: ~~KS~~ 1989 Hp: 50 ✓ Manufacturer: G.E. Back-Up Power (yes/no) Pump May 2008 Type: ~~10RH~~ Vert. turbine RPM: ~~1765~~ 1770 Stages: 8 Manufacturer: Layne & Bowler	Year Constructed /Age 1956/	Condition: ☒ Good ☐ Fair ☐ Poor Comments: (1989) (May 2008) New motor / new pump ~~[illegible]~~ Active well water tube
Well System **Well No.____** (if more than one well at same site) ☒ Not Applicable	Motor Type_____ Hp_____ Manufacturer_____ Back-Up Power (yes/no) Pump Type_____ RPM_____ Stages_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:

Water Treatment System ☐ Not Applicable	Treatment Type ☒ Disinfection ☒ Calcium Hypochlorite ☐ Sodium Hypochlorite ☐ Other_____ ☐ Fe/Mn_____ ☐ Other_____ ☐ None Chemical Feed System ☐ 55-gallon drums ☐ Day Tank ☒ Other tablets ☐ None Safety ☐ Emergency Eye Wash Station ☐ Emergency Shower ☒ None	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments: Nitrate analyzer - 3.5 mg/L installed last summer just started using
Discharge Piping Systems ☐ Not Applicable	Installation ☐ Above Ground ☐ Below Ground Materials ☒ Asbestos Cement ☐ Ductile Iron ☐ Steel ☐ PVC Diameter (inches): 8	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Heating, Ventilation and Cooling Systems ☒ Not Applicable	Type_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Fire Protection ☒ Not Applicable	☐ Automatic Sprinkler ☐ Fire Extinguisher ☐ Other_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Overall Site Issues	Concern	Comments or Not Applicable (N/A)	
Adjacent Land Use	☒ Residential ☒ Single Family Homes ☐ Apartments ☐ Condos ☒ Commercial ☐ Industrial ☐ Park ☐ School ☐ Other_____		

Aesthetic Issues	Exterior Paint	Condition: ☒ Good ☐ Fair ☐ Poor
	Interior Paint	Condition: ☐ Good ☐ Fair ☒ Poor Ceiling Paint
	Site Landscaping	Condition: ☒ Good ☐ Fair ☐ Poor
	Site Drainage	Condition: ☒ Good ☐ Fair ☐ Poor
	Access Road	Condition: ☒ Good ☐ Fair ☐ Poor
	General Site Appearance	Condition: ☒ Good ☐ Fair ☐ Poor
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor
Security Issues	Security of Doors, Windows, & Locks	Condition: ☐ Good ☐ Fair ☐ Poor ☐ N/A Padlock
	Security of Hatches & Vaults	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Perimeter Fences & Gates	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A Chain link w/ 3 strands 6'
	Interior Lighting	Condition: ☐ Good ☒ Fair ☐ Poor ☐ N/A
	Exterior Lighting	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A No exterior lighting
	Alarm Systems	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Health & Safety Equipment	☐ First Aid Kit ☐ Personal Protective Equipment ☐ MSDS ☐ Other_____ ☒ None
Potential Site Hazards	Overgrown Trees On/Adjacent to Site	☐ Yes; Describe_____ ☒ No
	Adjacent Fire Hazards	☐ Yes; Describe_____ ☒ No
	Adjacent Flood Hazards	☐ Yes; Describe_____ ☒ No
	Landslide Hazards	☐ Yes; Describe_____ ☒ No
	Other_____	☐ Yes; Describe_____ ☒ No

Other Comments	
Nitrate treatment to be installed on site. Original thought was to bring well #5 here for treatment as well, now just thinking #3. (well 5 nitrate has gone down) Would be last to turn on - based on current nitrate levels.	
Assessment Performed by	Suroso/Drayer
Assessment Date	7/31/08

Site 9 across street already bought property
Late summer 2009 - scheduled to be on-line

Public Version

Cal Water Dixon District

Facility Assessments

July 31, 2008

Station 04-01 (Active)

Station 04-01 Panel

Station 04-01 Building

Station 04-01 Sand Separator

Station 04-01
Aux. Gasoline Engine

Station 04-01 Pump & Motor

Station 04-01 Convault
(500 gal. gasoline)

Assessment Summary and Recommendations for Well No. 004-01

General Condition of Facilities & Recommendations	☒ Well facilities and site are in generally good condition Are there any recommended site improvements? ☒ Yes; list recommended improvements: - convert to water lube? - Exterior lighting - SCADA - Exterior paint - Aux engine tune up ☐ No, no site improvements needed Is there space on-site for treatment facilities (for Fe & Mn, Nitrates and/or arsenic)? ☒ Yes; describe: Some space for treatment if needed ☐ No ☐ Well facilities and site are in generally bad condition Is the site favorable? (e.g. good water quality area, close to transmission pipelines, adequate space on site, compatible with adjacent land uses) ☐ Yes, site is favorable Are the existing facilities upgradeable? ☐ Yes, list recommended upgrades to existing facilities: ☐ No, recommend replacement of existing facilities with the following new facilities: ☐ No, site is not favorable ☐ Recommend that well site be decommissioned/relocated ☐ Recommend that site be used for other purposes ☐ Recommend that site be sold
Recommended Maintenance Program	☒ Routine (water level measurements, record production, annual pump efficiency test, water quality sampling, etc.) ☐ Special Requirements ☐ Pull Pump & conduct video survey of casing and perforations ☐ Clean casing and perforations/redevelop well ☐ Perform pump bowl/motor maintenance ☐ Other_____

Desktop Condition Assessment for Well No. 004-01

Facility Name	Station 004-01
Facility Address/Location	[redacted]
APN#	
Parcel Size	98' x 87'
Well Status	☒ Active ☐ Standby ☐ Inactive
Well Construction Data	Well Depth: 665 feet Design Flow Rate: 650 gpm Pump Horsepower: 60 hp
Facility Age	Year Constructed: 2/10/1966 or Age (years): 42
Recent Repairs/ Improvements/ Maintenance	List date and type of repair/improvement/maintenance: Chlorinator Desander ✓
Water Level Data	☐ Data Available; Historic Water Levels are: ☐ Increasing ☐ Stable ☐ Decreasing ☐ Data Not Available
Water Quality Data	☒ Data Available; Constituents of concern are: ☐ Fe & Mn ☐ PCE ☒ Nitrates ☐ Arsenic ☐ Other _____ ☐ None ☐ Current On-Site Wellhead Treatment for ☐ Fe & Mn ☐ Arsenic ☐ Other _____ ☐ Unknown ☐ Data Not Available
Well Testing Data	☐ No Testing Data Available ☐ Well Video (Date:_____) Results:_____ ☒ Pump Efficiency Test(s)—List Results Below:

Date (month/yr)	Static Water Level	Pumping Water Level	Flow (gpm)	Efficiency (%)
8/17/1994	65.00	75.00	372.00	65.39%
7/24/1996	67.00	84.00	636.00	67.27%
5/21/1998	27.00	46.00	700.00	59.28%
11/6/2000	37.00	62.00	690.00	57.69%
3/19/2002	28	51	678	58.6%
5/8/2003	27	52	670	43.8%
11/22/2006	38	68	0	58.9

Cal Water Operations Staff Issues of Concern (or Items to Check in Field based on Desktop)	List any issues of concern or specific items to evaluate during field assessment:
Cal Water Operations Staff Facility Importance	☐ Critical to overall system operations ☐ Important ☐ Not so important

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Public Version

Aerial Photo of Site or Site Layout or Site Sketch

On-Site Condition Assessment for Well No. 004-01

Structural Assessment			
Building ☐ Not Applicable	Size: 12 ft by 20 ft ☒ Wood ☐ Steel ☐ Concrete Masonry Block (CMU) ☐ Other_____	Year Constructed /Age	Condition: Exterior: ☒ Good ☐ Fair ☐ Poor Interior: ☒ Good ☐ Fair ☐ Poor Comments:
Roof ☐ Not Applicable	☒ Asphalt Shingle ☐ Wood Shingle ☐ Tile ☐ Other_____	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Other Structure ☐ Not Applicable	☐ Above-Ground Tank ☐ Steel ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Tank ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Vault ☐ Other_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments: - Con vault - gasoline - Sand separator Dorr Clone Desander
Electrical/Back-Up Power Systems			
Motor Control Center/Control Panel ☐ Not Applicable	Type_____ Manufacturer_____ Industrial Elect	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Emergency Generator/Auxiliary Engine ☐ Not Applicable	☐ On-Site Emergency Generator ☐ Diesel ☐ Gasoline ☐ Natural Gas ☐ Other_____ Manufacturer: Size (kW): ☒ Auxiliary Engine ☐ Diesel ☒ Gasoline ✓ ☐ Natural Gas ☐ Other_____ Manufacturer: WAUKESHA Size (hp): 2200 ☐ Adaptor for "Plug In" Potable Unit	Year Constructed /Age Engine: 1966/42 Fuel Tank: 1988/20	Condition: ☐ Good ☒ Fair ☐ Poor Comments: → could use tune up → Gen set in 2010 budget?

SCADA/Telemetry Systems			
SCADA/Telemetry ☐ Not Applicable	☒ Data Monitoring ☒ Pumping Rate ☒ Pressure ☐ Tank Level ☐ Other_____ ☐ Remote Control ☐ Booster Pump On/Off ☐ Well Pump On/Off ☐ Other_____ Manufacturer: Bristol Model: 2EPA500-45-14	Year Constructed /Age 2000/8	Condition: ☐ Good ☐ Fair ☐ Poor Comments: No SCADA (2010 budget ?)
Mechanical Systems			
Booster Pumps ☒ Not Applicable	Type ☐ Vertical ☐ Horizontal Split Case Hp_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Well System: **Well No. 004-01** ☐ Not Applicable	Motor Type: K Hp: 60 Manufacturer: G.E. Back-Up Power (yes/no) Pump Type: 10CKH RPM: 1750 Stages_____ Manufacturer: Byron Jackson	Year Constructed /Age 1966/42	Condition: ☒ Good ☐ Fair ☐ Poor Comments: Oil mix
Well System **Well No.____** (if more than one well at same site) ☒ Not Applicable	Motor Type_____ Hp_____ Manufacturer_____ Back-Up Power (yes/no) Pump Type_____ RPM_____ Stages_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:

Water Treatment System ☐ Not Applicable	Treatment Type ☒ Disinfection ☒ Calcium Hypochlorite ☐ Sodium Hypochlorite ☐ Other_____ ☐ Fe/Mn_____ ☐ Other_____ ☐ None Chemical Feed System ☐ 55-gallon drums ☐ Day Tank ☒ Other tablets ☐ None Safety ☐ Emergency Eye Wash Station ☐ Emergency Shower ☐ None Fire Extinguisher - yes	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments: good
Discharge Piping Systems ☐ Not Applicable	Installation ☒ Above Ground ☐ Below Ground Materials ☐ Ductile Iron ☐ Steel ☐ PVC Diameter (inches)_____	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Heating, Ventilation and Cooling Systems ☒ Not Applicable	Type_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Fire Protection ☐ Not Applicable	☐ Automatic Sprinkler ☒ Fire Extinguisher ☐ Other_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Overall Site Issues	Concern	Comments or Not Applicable (N/A)	
Adjacent Land Use	☒ Residential ☒ Single Family Homes ☐ Apartments ☐ Condos ☒ Commercial ☐ Industrial ☐ Park ☐ School ☐ Other_____	- Railroad across street - storage facility next door (contractor storage)	
Aesthetic Issues	Exterior Paint	Condition: ☐ Good ☒ Fair ☐ Poor some peeling paint	
	Interior Paint	Condition: ☒ Good ☐ Fair ☐ Poor	
	Site Landscaping	Condition: ☒ Good ☐ Fair ☐ Poor	

	Site Drainage	Condition: ☒ Good ☐ Fair ☐ Poor
	Access Road	Condition: ☒ Good ☐ Fair ☐ Poor
	General Site Appearance	Condition: ☒ Good ☐ Fair ☐ Poor
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor
Security Issues	Security of Doors, Windows, & Locks	Condition: ☐ Good ☒ Fair ☐ Poor ☐ N/A Padlock
	Security of Hatches & Vaults	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Perimeter Fences & Gates	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A Chainlink/wood 6" fence
	Interior Lighting	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A
	Exterior Lighting	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A No exterior lighting
	Alarm Systems	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Health & Safety Equipment	☐ First Aid Kit ☐ Personal Protective Equipment ☐ MSDS ☒ Other Fire Extinguisher ☐ None
Potential Site Hazards	Overgrown Trees On/Adjacent to Site	☐ Yes; Describe_____ ☒ No
	Adjacent Fire Hazards	☐ Yes; Describe_____ ☒ No
	Adjacent Flood Hazards	☐ Yes; Describe_____ ☒ No
	Landslide Hazards	☐ Yes; Describe_____ ☒ No
	Other_____	☐ Yes; Describe_____ ☒ No

Other Comments

Produces lots of sand

Assessment Performed by	Sur0307 Drayer
Assessment Date	7/31/08

Public Version

Cal Water Dixon District

Facility Assessments

July 31, 2008

Station 05-01 (Active)

Station 05-01 Panel

Station 05-01
Nitrate Analyzer

Station 05-01 Lot

Station 05-01 Pump &
Motor and Disinfection

Station 05-01
Sand Separator

Station 05-01
SCADA Panel

Station 05-01 Natural Gas
Auxiliary Engine

Assessment Summary and Recommendations for Well No. 005-01

General Condition of Facilities & Recommendations	☒ Well facilities and site are in generally good condition Are there any recommended site improvements? ☒ Yes; list recommended improvements: - Exterior lighting - New pump planned for fall 2008 ☐ No, no site improvements needed Is there space on-site for treatment facilities (for Fe & Mn, Nitrates and/or arsenic)? ☒ Yes; describe: But nice neighborhood - not ideal for maintenance activities - reason why station 3 was selected for treatment system instead of station 5 ☐ No ☐ Well facilities and site are in generally bad condition Is the site favorable? (e.g. good water quality area, close to transmission pipelines, adequate space on site, compatible with adjacent land uses) ☐ Yes, site is favorable Are the existing facilities upgradeable? ☐ Yes, list recommended upgrades to existing facilities: ☐ No, recommend replacement of existing facilities with the following new facilities: ☐ No, site is not favorable ☐ Recommend that well site be decommissioned/relocated ☐ Recommend that site be used for other purposes ☐ Recommend that site be sold
Recommended Maintenance Program	☒ Routine (water level measurements, record production, annual pump efficiency test, water quality sampling, etc.) ☐ Special Requirements ☐ Pull Pump & conduct video survey of casing and perforations ☐ Clean casing and perforations/redevelop well ☐ Perform pump bowl/motor maintenance ☐ Other_____

Desktop Condition Assessment for Well No. 005-01

Facility Name	Station 005-01
Facility Address/Location	[redacted]
APN#	
Parcel Size	107' x 61'
Well Status	☒ Active ☐ Standby ☐ Inactive
Well Construction Data	Well Depth: 650 feet Design Flow Rate: 600 gpm Pump Horsepower: 60 hp
Facility Age	Year Constructed: 5/1/1973 or Age (years): 35
Recent Repairs/ Improvements/ Maintenance	List date and type of repair/improvement/maintenance: Chlorinator Sand Separator
Water Level Data	☐ Data Available; Historic Water Levels are: ☐ Increasing ☐ Stable ☐ Decreasing ☐ Data Not Available
Water Quality Data	☒ Data Available; Constituents of concern are: ☐ Fe & Mn ☐ PCE ☒ Nitrates ☐ Arsenic ☐ Other _____ ☐ None ☐ Current On-Site Wellhead Treatment for ☐ Fe & Mn ☐ Arsenic ☐ Other _____ ☐ Unknown ☐ Data Not Available
Well Testing Data	☐ No Testing Data Available ☐ Well Video (Date:_____) Results:_____ ☒ Pump Efficiency Test(s)—List Results Below:

Date (month/yr)	Static Water Level	Pumping Water Level	Flow (gpm)	Efficiency (%)
5/21/1998	30.00	61.00	600.00	61.74%
11/6/2000	146.00	181.00	431.00	63.90%
3/19/2002	164	184	525	70.7%
5/8/2003	151	204	527	68.3%
7/7/2004	202	257	453	67.7%
6/20/2005	161	214	545	68.7%
10/26/2006	0	210	320	59.3%

Cal Water Operations Staff Issues of Concern (or Items to Check in Field based on Desktop)	List any issues of concern or specific items to evaluate during field assessment: new pump planned for Fall 2008
Cal Water Operations Staff Facility Importance	☐ Critical to overall system operations ☐ Important ☐ Not so important

Aerial Photo of Site or Site Layout or Site Sketch	[redacted]

On-Site Condition Assessment for Well No. 005-01

Structural Assessment			
Building ☐ Not Applicable	Size: 20 ft by 15 ft ☐ Wood ☐ Steel ☒ Concrete Masonry Block (CMU) ☐ Other_____	Year Constructed /Age	Condition: Exterior: ☒ Good ☐ Fair ☐ Poor Interior: ☒ Good ☐ Fair ☐ Poor Comments:
Roof ☐ Not Applicable	☐ Asphalt Shingle ☐ Wood Shingle ☐ Tile ☒ Other Steel	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Other Structure ☐ Not Applicable	☐ Above-Ground Tank ☐ Steel ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Tank ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Vault ☐ Other_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments: sand separator – not a bad sander
Electrical/Back-Up Power Systems			
Motor Control Center/Control Panel ☐ Not Applicable	Type_____ Manufacturer_____ Industrial Elect	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Emergency Generator/Auxiliary Engine ☐ Not Applicable	☐ On-Site Emergency Generator ☐ Diesel ☐ Gasoline ☐ Natural Gas ☐ Other_____ Manufacturer_____ Size (kW)_____ ☒ Auxiliary Engine ✓ ☐ Diesel ☐ Gasoline ☒ Natural Gas ✓ ☐ Other_____ Manufacturer: WAUKESHA Size (hp): 1800 ☐ Adaptor for "Plug In" Potable Unit	Year Constructed /Age Engine: 1973/35 Fuel Tank: 2000/8	Condition: ☒ Good ☐ Fair ☐ Poor Comments: – Pretty good aux engine. Has fire extinguisher

SCADA/Telemetry Systems			
SCADA/Telemetry ☐ Not Applicable	☒ Data Monitoring ☒ Pumping Rate ☒ Pressure ☐ Tank Level ☐ Other_____ ☐ Remote Control ☐ Booster Pump On/Off ☐ Well Pump On/Off ☐ Other_____ Manufacturer: Bristol Model: 2ERA500-45-14-R10-X3165	Year Constructed /Age 2000/8	Condition: ☐ Good ☐ Fair ☐ Poor Comments: ~~[illegible]~~ Has SCADA
Mechanical Systems			
Booster Pumps ☒ Not Applicable	Type ☐ Vertical ☐ Horizontal Split Case Hp_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Well System: **Well No. 005-01** ☐ Not Applicable	Motor Type: Hp: 60 ✓ Manufacturer: U.S. Motor Back-Up Power (yes/no) Pump Type: 9RCHC RPM: 320 Stages_____ Manufacturer: GOULDS	Year Constructed /Age 2001/7	Condition: ☒ Good ☐ Fair ☐ Poor Comments: - Water lubed - Planned to install new pump in Fall 2008
Well System **Well No.____** (if more than one well at same site) ☒ Not Applicable	Motor Type_____ Hp_____ Manufacturer_____ Back-Up Power (yes/no) Pump Type_____ RPM_____ Stages_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:

Water Treatment System ☐ Not Applicable	Treatment Type ☒ Disinfection ☒ Calcium Hypochlorite ☐ Sodium Hypochlorite ☐ Other_____ ☐ Fe/Mn_____ ☒ Other tablets ☐ None Chemical Feed System ☐ 55-gallon drums ☐ Day Tank ☐ Other_____ ☐ None Safety ☐ Emergency Eye Wash Station ☐ Emergency Shower ☐ None Fire Extinguisher	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments: Nitrates have gone down recently - no longer thinking about blended treatment @ station 3 - may reconsider if nitrate levels increase again Nitrate analyzer 35 mg/L
Discharge Piping Systems ☐ Not Applicable	Installation ☒ Above Ground ☐ Below Ground Materials ☒ Asbestos Cement ☐ Ductile Iron ☐ Steel ☐ PVC Diameter (inches): 8	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Heating, Ventilation and Cooling Systems ☒ Not Applicable	Type_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Fire Protection ☒ Not Applicable	☐ Automatic Sprinkler ☐ Fire Extinguisher ☐ Other_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Overall Site Issues	Concern	Comments or Not Applicable (N/A)	
Adjacent Land Use	☒ Residential ☒ Single Family Homes ☐ Apartments ☐ Condos ☐ Commercial ☐ Industrial ☒ Park ☐ School ☐ Other_____		

Aesthetic Issues	Exterior Paint	Condition: ☒ Good ☐ Fair ☐ Poor
	Interior Paint	Condition: ☒ Good ☐ Fair ☐ Poor
	Site Landscaping	Condition: ☒ Good ☐ Fair ☐ Poor
	Site Drainage	Condition: ☒ Good ☐ Fair ☐ Poor
	Access Road	Condition: ☒ Good ☐ Fair ☐ Poor
	General Site Appearance	Condition: ☒ Good ☐ Fair ☐ Poor
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor
Security Issues	Security of Doors, Windows, & Locks	Condition: ☐ Good ☒ Fair ☐ Poor ☐ N/A dead bolt
	Security of Hatches & Vaults	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Perimeter Fences & Gates	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A 6' chain link/slats
	Interior Lighting	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A
	Exterior Lighting	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A No exterior lighting
	Alarm Systems	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Health & Safety Equipment	☐ First Aid Kit ☐ Personal Protective Equipment ☐ MSDS ☒ Other Fire Extinguisher ☐ None
Potential Site Hazards	Overgrown Trees On/Adjacent to Site	☐ Yes; Describe_____ ☒ No
	Adjacent Fire Hazards	☐ Yes; Describe_____ ☒ No
	Adjacent Flood Hazards	☐ Yes; Describe_____ ☒ No
	Landslide Hazards	☐ Yes; Describe_____ ☒ No
	Other_____	☐ Yes; Describe_____ ☒ No

Public Version

Other Comments	
- New pump selected - ordered - Plan to install new pump Fall 2008	
Assessment Performed by	Suroso/Drayer
Assessment Date	7/31/08

Public Version

Cal Water Dixon District

Facility Assessments

July 31, 2008

Station 06-01 (Active)

Station 06-01 Panel

Station 06-01 Lot

Station 06-01 Aux. Diesel Engine

Station 06-01 Pump & Motor

Station 06-01 Disinfection

Station 06-01 Convault
(500 gal. diesel)

Assessment Summary and Recommendations for Well No. 006-01

General Condition of Facilities & Recommendations	☒ Well facilities and site are in generally good condition Are there any recommended site improvements? ☒ Yes; list recommended improvements: SCADA – 2010? Exterior lighting convert to water tube? ☐ No, no site improvements needed Is there space on-site for treatment facilities (for Fe & Mn, Nitrates and/or arsenic)? ☒ Yes; describe: average sized lot – not lots of extra space – corner lot ☐ No ☐ Well facilities and site are in generally bad condition Is the site favorable? (e.g. good water quality area, close to transmission pipelines, adequate space on site, compatible with adjacent land uses) ☐ Yes, site is favorable Are the existing facilities upgradeable? ☐ Yes, list recommended upgrades to existing facilities: ☐ No, recommend replacement of existing facilities with the following new facilities: ☐ No, site is not favorable ☐ Recommend that well site be decommissioned/relocated ☐ Recommend that site be used for other purposes ☐ Recommend that site be sold
Recommended Maintenance Program	☒ Routine (water level measurements, record production, annual pump efficiency test, water quality sampling, etc.) ☐ Special Requirements ☐ Pull Pump & conduct video survey of casing and perforations ☐ Clean casing and perforations/redevelop well ☐ Perform pump bowl/motor maintenance ☐ Other_____

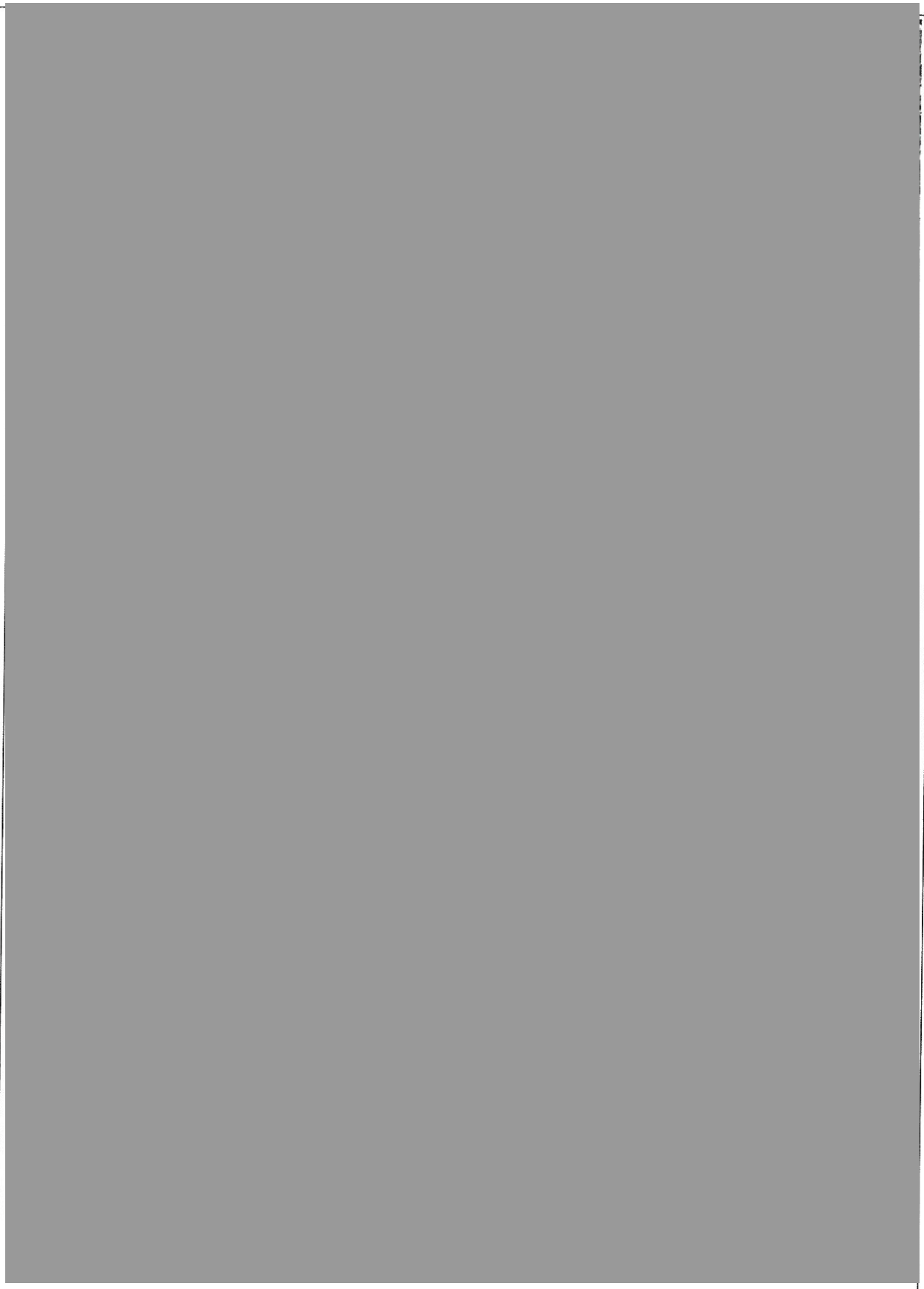
Desktop Condition Assessment for Well No. 006-01

Facility Name	Station 006-01
Facility Address/Location	[redacted]
APN#	
Parcel Size	108' x 72'
Well Status	☒ Active ☐ Standby ☐ Inactive
Well Construction Data	Well Depth: 648 feet Design Flow Rate: 550 gpm Pump Horsepower: 75 hp
Facility Age	Year Constructed: 2/10/1976 or Age (years): 32
Recent Repairs/ Improvements/ Maintenance	List date and type of repair/improvement/maintenance: Chlorinator
Water Level Data	☐ Data Available; Historic Water Levels are: ☐ Increasing ☐ Stable ☐ Decreasing ☐ Data Not Available
Water Quality Data	☒ Data Available; Constituents of concern are: ☐ Fe & Mn ☐ PCE ☒ Nitrates ☐ Arsenic ☐ Other _____ ☐ None ☐ Current On-Site Wellhead Treatment for ☐ Fe & Mn ☐ Arsenic ☐ Other _____ ☐ Unknown ☐ Data Not Available
Well Testing Data	☐ No Testing Data Available ☐ Well Video (Date:_____) Results:_____ ☒ Pump Efficiency Test(s)—List Results Below:

Date (month/yr)	Static Water Level	Pumping Water Level	Flow (gpm)	Efficiency (%)
8/17/1994	84.00	112.00	719.00	72.63%
7/24/1996	62.00	89.00	830.00	66.79%
8/3/1998	38.00	48.00	475.00	45.28%
11/6/2000	41.00	63.00	470.00	48.55%
3/19/2002	29	48	486	48.5%
5/8/2003	33	54	454	48.2%
10/26/2006	0	90	346	48.0%

Cal Water Operations Staff Issues of Concern (or Items to Check in Field based on Desktop)	List any issues of concern or specific items to evaluate during field assessment:
Cal Water Operations Staff Facility Importance	☐ Critical to overall system operations ☐ Important ☐ Not so important

Aerial Photo of Site or Site Layout or Site Sketch



Public Version

On-Site Condition Assessment for Well No. 001-03

Structural Assessment			
Building ☐ Not Applicable	Size: 15 ft by 20 ft ☐ Wood ☐ Steel ☒ Concrete Masonry Block (CMU) ☐ Other_____	Year Constructed /Age	Condition: Exterior: ☒ Good ☐ Fair ☐ Poor Interior: ☒ Good ☐ Fair ☐ Poor Comments:
Roof ☐ Not Applicable	☐ Asphalt Shingle ☐ Wood Shingle ☐ Tile ☒ Other Steel	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Other Structure ☐ Not Applicable	☐ Above-Ground Tank ☐ Steel ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Tank ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Vault ☐ Other_____	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments: PG"E Transformer Diesel convault
Electrical/Back-Up Power Systems			
Motor Control Center/Control Panel ☐ Not Applicable	Type_____ Manufacturer_____ Industrial Elect	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Emergency Generator/Auxiliary Engine ☐ Not Applicable	☐ On-Site Emergency Generator ☐ Diesel ☐ Gasoline ☐ Natural Gas ☐ Other_____ Manufacturer_____ Size (kW)_____ ☒ Auxiliary Engine ✓ ☒ Diesel ✓ ☐ Gasoline ☐ Natural Gas ☐ Other_____ Manufacturer: Cummins Size (hp): 116 ☐ Adaptor for "Plug In" Potable Unit	Year Constructed /Age 1995/13	Condition: ☒ Good ☐ Fair ☐ Poor Comments: Good aux engine – no issues

SCADA/Telemetry Systems			
SCADA/Telemetry ☐ Not Applicable	☒ Data Monitoring ☒ Pumping Rate ☒ Pressure ☐ Tank Level ☐ Other_____ ☐ Remote Control ☐ Booster Pump On/Off ☐ Well Pump On/Off ☐ Other_____ Manufacturer: Data Industrial Model:	Year Constructed /Age 2002/6	Condition: ☐ Good ☐ Fair ☐ Poor Comments: No SCADA – budget 2010?
Mechanical Systems			
Booster Pumps ☒ Not Applicable	Type ☐ Vertical ☐ Horizontal Split Case Hp_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Well System: **Well No. 006-01** ☐ Not Applicable	Motor Type: 5KS365DP6005 Hp: 75 Manufacturer: G.E. Back-Up Power (yes/no) Pump Type: 10RL RPM: 1770 Stages_____ Manufacturer: Vertiline	Year Constructed /Age Motor: 1986/22 Pump: 1998/10	Condition: ☒ Good ☐ Fair ☐ Poor Comments: Oil lube
Well System **Well No.____** (if more than one well at same site) ☒ Not Applicable	Motor Type_____ Hp_____ Manufacturer_____ Back-Up Power (yes/no) Pump Type_____ RPM_____ Stages_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:

Water Treatment System ☐ Not Applicable	Treatment Type ☒ Disinfection ☒ Calcium Hypochlorite ☐ Sodium Hypochlorite ☐ Other_____ ☐ Fe/Mn_____ ☐ Other_____ ☐ None Chemical Feed System ☐ 55-gallon drums ☐ Day Tank ☒ Other Tablets ☐ None Safety ☐ Emergency Eye Wash Station ☐ Emergency Shower ☒ None	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Discharge Piping Systems ☐ Not Applicable	Installation ☒ Above Ground ☐ Below Ground Materials ☐ Ductile Iron ☐ Steel ☐ PVC Diameter (inches) 8"	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Heating, Ventilation and Cooling Systems ☒ Not Applicable	Type_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Fire Protection ☐ Not Applicable	☐ Automatic Sprinkler ☒ Fire Extinguisher ☐ Other_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Overall Site Issues	Concern	Comments or Not Applicable (N/A)	
Adjacent Land Use	☒ Residential ☒ Single Family Homes ☐ Apartments ☐ Condos ☐ Commercial ☐ Industrial ☐ Park ☒ School ☒ Other: Office	Corner lot - nice neighborhood	
Aesthetic Issues	Exterior Paint	Condition: ☒ Good ☐ Fair ☐ Poor	
	Interior Paint	Condition: ☒ Good ☐ Fair ☐ Poor	
	Site Landscaping	Condition: ☒ Good ☐ Fair ☐ Poor	

	Site Drainage	Condition: ☒ Good ☐ Fair ☐ Poor
	Access Road	Condition: ☒ Good ☐ Fair ☐ Poor
	General Site Appearance	Condition: ☒ Good ☐ Fair ☐ Poor
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor NA
Security Issues	Security of Doors, Windows, & Locks	Condition: ☐ Good ☒ Fair ☐ Poor ☐ N/A Padlock
	Security of Hatches & Vaults	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Perimeter Fences & Gates	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A Wood gate / CMU-
	Interior Lighting	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A wood fence
	Exterior Lighting	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A No exterior
	Alarm Systems	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A lighting
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Health & Safety Equipment	☐ First Aid Kit ☐ Personal Protective Equipment ☐ MSDS ☒ Other Fire Extinguisher ☐ None
Potential Site Hazards	Overgrown Trees On/Adjacent to Site	☐ Yes; Describe_____ ☒ No
	Adjacent Fire Hazards	☐ Yes; Describe_____ ☒ No
	Adjacent Flood Hazards	☐ Yes; Describe_____ ☒ No
	Landslide Hazards	☐ Yes; Describe_____ ☒ No
	Other_____	☐ Yes; Describe_____ ☒ No

Other Comments

Assessment Performed by	Suroso / Drayer
Assessment Date	7/31/08

Public Version

Cal Water Dixon District

Facility Assessments

July 31, 2008

Station 07-01 (Active)

Station 07-01 Pump & Motor
And Disinfection System

Station 07-01 Building

Station 07-01 Panel

Station 07-01 Standby Diesel Generator

Station 07-01
Automatic Transfer Switch

Station 07-01 Sand Detection

Assessment Summary and Recommendations for Well No. 007-01

General Condition of Facilities & Recommendations	☒ Well facilities and site are in generally good condition Are there any recommended site improvements? ☒ Yes; list recommended improvements: Exterior lighting convert to water lube? ☐ No, no site improvements needed Is there space on-site for treatment facilities (for Fe & Mn, Nitrates and/or arsenic)? ☒ Yes; describe: some space back of lot ☐ No ☐ Well facilities and site are in generally bad condition Is the site favorable? (e.g. good water quality area, close to transmission pipelines, adequate space on site, compatible with adjacent land uses) ☐ Yes, site is favorable Are the existing facilities upgradeable? ☐ Yes, list recommended upgrades to existing facilities: ☐ No, recommend replacement of existing facilities with the following new facilities: ☐ No, site is not favorable ☐ Recommend that well site be decommissioned/relocated ☐ Recommend that site be used for other purposes ☐ Recommend that site be sold
Recommended Maintenance Program	☒ Routine (water level measurements, record production, annual pump efficiency test, water quality sampling, etc.) ☐ Special Requirements ☐ Pull Pump & conduct video survey of casing and perforations ☐ Clean casing and perforations/redevelop well ☐ Perform pump bowl/motor maintenance ☐ Other_____

Desktop Condition Assessment for Well No. 007-01

Facility Name	Station 007-01
Facility Address/Location	[redacted]
APN#	
Parcel Size	75' x 113'
Well Status	☒ Active ☐ Standby ☐ Inactive
Well Construction Data	Well Depth: 820 feet Design Flow Rate: 800 gpm Pump Horsepower: 75 hp
Facility Age	Year Constructed: 11/1/1979 or Age (years): 29
Recent Repairs/ Improvements/ Maintenance	List date and type of repair/improvement/maintenance: Chlorinator
Water Level Data	☐ Data Available; Historic Water Levels are: ☐ Increasing ☐ Stable ☐ Decreasing ☐ Data Not Available
Water Quality Data	☒ Data Available; Constituents of concern are: ☐ Fe & Mn ☐ PCE ☒ Nitrates ☐ Arsenic ☐ Other _____ ☐ None ☐ Current On-Site Wellhead Treatment for ☐ Fe & Mn ☐ Arsenic ☐ Other _____ ☐ Unknown ☐ Data Not Available
Well Testing Data	☐ No Testing Data Available ☐ Well Video (Date:_____) Results:_____ ☒ Pump Efficiency Test(s)—List Results Below:

Date (month/yr)	Static Water Level	Pumping Water Level	Flow (gpm)	Efficiency (%)
7/24/1996	122.00	159.00	729.00	71.09%
5/21/1998	45.00	88.00	965.00	69.23%
11/6/2000	61.00	90.00	878.00	65.72%
3/19/2002	43	67	674	56.6%
5/8/2003	38	72	820	61.7%
7/7/2004	131	156	583	57.7%
6/21/2005	104	134	670	63.3%

Cal Water Operations Staff Issues of Concern (or Items to Check in Field based on Desktop)	List any issues of concern or specific items to evaluate during field assessment:
Cal Water Operations Staff Facility Importance	☐ Critical to overall system operations ☐ Important ☐ Not so important

Aerial Photo of Site or Site Layout or Site Sketch	

On-Site Condition Assessment for Well No. 007-01

Structural Assessment			
Building ☐ Not Applicable	Size: 15 ft by 20 ft ☐ Wood ☐ Steel ☒ Concrete Masonry Block (CMU) ☐ Other_____	Year Constructed /Age	Condition: Exterior: ☒ Good ☐ Fair ☐ Poor Interior: ☒ Good ☐ Fair ☐ Poor Comments: some peeling paint exterior
Roof ☐ Not Applicable	☒ Asphalt Shingle ☐ Wood Shingle ☐ Tile ☐ Other_____	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Other Structure ☐ Not Applicable	☐ Above-Ground Tank ☐ Steel ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Tank ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Vault ☒ Other Genset	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Electrical/Back-Up Power Systems			
Motor Control Center/Control Panel ☐ Not Applicable	Type_____ Manufacturer_____ Industrial Elect	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Emergency Generator/Auxiliary Engine ☐ Not Applicable	☒ On-Site Emergency Generator ☒ Diesel Day tank ☐ Gasoline ☐ Natural Gas ☐ Other_____ Manufacturer Cummins Size (kW)_____ ☐ Auxiliary Engine ☒ Diesel ☐ Gasoline ☐ Natural Gas ☐ Other_____ Manufacturer_____ Size (hp)_____ ☐ Adaptor for "Plug In" Potable Unit	Year Constructed /Age About 2 yrs old	Condition: ☒ Good ☐ Fair ☐ Poor Comments: Has Automatic transfer switch

SCADA/Telemetry Systems			
SCADA/Telemetry ☐ Not Applicable	☒ Data Monitoring ☒ Pumping Rate ☒ Pressure ☐ Tank Level ☐ Other_____ ☐ Remote Control ☐ Booster Pump On/Off ☐ Well Pump On/Off ☐ Other_____ Manufacturer: Bristol Model: 2ERA500-45-14-R10-Z120	Year Constructed /Age 1979/29	Condition: ☐ Good ☐ Fair ☐ Poor Comments: Has SCADA
Mechanical Systems			
Booster Pumps ☒ Not Applicable	Type ☐ Vertical ☐ Horizontal Split Case Hp_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Well System: **Well No. 007-01** ☐ Not Applicable	Motor Type: 5K6255XM549A Hp: 75 Manufacturer: G.E. Back-Up Power (yes/no) Pump Type: 12RXL RPM: 1770 Stages_____ Manufacturer: Aurora	Year Constructed /Age 2000/8	Condition: ☒ Good ☐ Fair ☐ Poor Comments: Oil lube
Well System **Well No.____** (if more than one well at same site) ☒ Not Applicable	Motor Type_____ Hp_____ Manufacturer_____ Back-Up Power (yes/no) Pump Type_____ RPM_____ Stages_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:

Water Treatment System ☐ Not Applicable	Treatment Type ☒ Disinfection ☒ Calcium Hypochlorite ☐ Sodium Hypochlorite ☐ Other_____ ☐ Fe/Mn_____ ☐ Other_____ ☐ None Chemical Feed System ☐ 55-gallon drums ☐ Day Tank ☒ Other Tablets ☐ None Safety ☐ Emergency Eye Wash Station ☐ Emergency Shower ☒ None	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Discharge Piping Systems ☐ Not Applicable	Installation ☒ Above Ground ☐ Below Ground Materials ☒ Asbestos Cement ☐ Ductile Iron ☐ Steel ☐ PVC Diameter (inches): 8	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Heating, Ventilation and Cooling Systems ☒ Not Applicable	Type_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Fire Protection ☐ Not Applicable	☐ Automatic Sprinkler ☒ Fire Extinguisher ☐ Other_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Overall Site Issues	Concern	Comments or Not Applicable (N/A)	
Adjacent Land Use	☒ Residential ☐ Single Family Homes ☐ Apartments ☐ Condos ☐ Commercial ☐ Industrial ☐ Park ☐ School ☐ Other_____	Nice neighborhood	

Aesthetic Issues	Exterior Paint	Condition: ☐ Good ☒ Fair ☐ Poor some peeling paint
	Interior Paint	Condition: ☒ Good ☐ Fair ☐ Poor
	Site Landscaping	Condition: ☒ Good ☐ Fair ☐ Poor
	Site Drainage	Condition: ☒ Good ☐ Fair ☐ Poor
	Access Road	Condition: ☒ Good ☐ Fair ☐ Poor
	General Site Appearance	Condition: ☒ Good ☐ Fair ☐ Poor
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor
Security Issues	Security of Doors, Windows, & Locks	Condition: ☐ Good ☐ Fair ☐ Poor ☐ N/A Dead bolt
	Security of Hatches & Vaults	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Perimeter Fences & Gates	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A 6' chain link/slats
	Interior Lighting	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A
	Exterior Lighting	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A No exterior lighting
	Alarm Systems	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Health & Safety Equipment	☐ First Aid Kit - ☐ Personal Protective Equipment ☐ MSDS ☒ Other Fire extinguisher ☐ None
Potential Site Hazards	Overgrown Trees On/Adjacent to Site	☐ Yes; Describe_____ ☒ No
	Adjacent Fire Hazards	☐ Yes; Describe_____ ☒ No
	Adjacent Flood Hazards	☐ Yes; Describe_____ ☒ No
	Landslide Hazards	☐ Yes; Describe_____ ☒ No
	Other_____	☐ Yes; Describe_____ ☒ No

Other Comments	
Best well in system No WQ issues, good production SCADA / Gen set No sanding	
Assessment Performed by	Surobso / Drayer
Assessment Date	7/31/08

Public Version

Cal Water Dixon District

Facility Assessments

July 31, 2008

Station 08-01 (Active)

Station 08-01 Pump & Motor

Station 08-01 Panel

Station 08-01 Building

Station 08-01 Rosedale Bacterial Filter

Station 08-01 Aux. Diesel Engine

Station 08-01 Convault (500 gal. diesel)

Station 08-01 Disinfection

Assessment Summary and Recommendations for Well No. 008-01

General Condition of Facilities & Recommendations	☒ Well facilities and site are in generally good condition Are there any recommended site improvements? ☒ Yes; list recommended improvements: - Convert to water lube? - SCADA - Exterior lighting - Aux Engine tune up - Fire Extinguisher ☐ No, no site improvements needed Is there space on-site for treatment facilities (for Fe & Mn, Nitrates and/or arsenic)? ☒ Yes; describe: Fairly large site ☐ No ☐ Well facilities and site are in generally bad condition Is the site favorable? (e.g. good water quality area, close to transmission pipelines, adequate space on site, compatible with adjacent land uses) ☐ Yes, site is favorable Are the existing facilities upgradeable? ☐ Yes, list recommended upgrades to existing facilities: ☐ No, recommend replacement of existing facilities with the following new facilities: ☐ No, site is not favorable ☐ Recommend that well site be decommissioned/relocated ☐ Recommend that site be used for other purposes ☐ Recommend that site be sold
Recommended Maintenance Program	☒ Routine (water level measurements, record production, annual pump efficiency test, water quality sampling, etc.) ☐ Special Requirements ☐ Pull Pump & conduct video survey of casing and perforations ☐ Clean casing and perforations/redevelop well ☐ Perform pump bowl/motor maintenance ☐ Other_____

Desktop Condition Assessment for Well No. 008-01

Facility Name	Station 008-01
Facility Address/Location	[redacted]
APN#	
Parcel Size	108' x 62'
Well Status	☒ Active ☐ Standby ☐ Inactive
Well Construction Data	Well Depth: 860 feet Design Flow Rate: 500 gpm Pump Horsepower: 75 hp
Facility Age	Year Constructed: 7/18/1979 or Age (years): 29
Recent Repairs/ Improvements/ Maintenance	List date and type of repair/improvement/maintenance: ~~Sand Separator (installed 1996)~~ No.
Water Level Data	☐ Data Available; Historic Water Levels are: ☐ Increasing ☐ Stable ☐ Decreasing ☐ Data Not Available
Water Quality Data	☒ Data Available; Constituents of concern are: ☐ Fe & Mn ☐ PCE ☒ Nitrates ☐ Arsenic ☒ Other Purple Water Bacteria ☐ None ☐ Current On-Site Wellhead Treatment for ☐ Fe & Mn ☐ Arsenic ☐ Other _____ ☐ Unknown ☐ Data Not Available
Well Testing Data	☐ No Testing Data Available ☐ Well Video (Date:_____) Results:_____ ☒ Pump Efficiency Test(s)—List Results Below:

Date (month/yr)	Static Water Level	Pumping Water Level	Flow (gpm)	Efficiency (%)
8/17/1994	170.00	244.00	458.00	58.84%
7/24/1996	99.00	265.00	528.00	70.84%
6/2/1998	30.00	246.00	515.00	63.80%
11/6/2000	50.00	222.00	533.00	70.38%
3/19/2002	47	201	384	66.4%
5/8/2003	33	230	438	59.5%
11/22/2006	0	90	290	25.8

Cal Water Operations Staff Issues of Concern (or Items to Check in Field based on Desktop)	List any issues of concern or specific items to evaluate during field assessment: New motor installed 03/08
Cal Water Operations Staff Facility Importance	☐ Critical to overall system operations ☐ Important ☐ Not so important

Aerial Photo of Site or Site Layout or Site Sketch	[redacted]

On-Site Condition Assessment for Well No. 008-01

Structural Assessment			
Building ☐ Not Applicable	Size: 15 ft by 20 ft ☐ Wood ☐ Steel ☒ Concrete Masonry Block (CMU) ☐ Other_____	Year Constructed /Age	Condition: Exterior: ☒ Good ☐ Fair ☐ Poor Interior: ☒ Good ☐ Fair ☐ Poor Comments:
Roof ☐ Not Applicable	☒ Asphalt Shingle ☐ Wood Shingle ☐ Tile ☐ Other_____	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Other Structure ☐ Not Applicable	☐ Above-Ground Tank ☐ Steel ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Tank ☐ Reinforced Concrete ☐ Other_____ ☐ Below-Ground Vault ☐ Other_____	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments: -Bacteria Filter -Rosdale Bag Filter -Convault -Diesel - PG&E Transformer
Electrical/Back-Up Power Systems			
Motor Control Center/Control Panel ☐ Not Applicable	Type_____ Manufacturer_____ Industrial Electric	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments:
Emergency Generator/Auxiliary Engine ☐ Not Applicable	☒ On-Site Emergency Generator ☐ Diesel ☐ Gasoline ☐ Natural Gas ☒ Other: Standby Manufacturer: Onan Size (kW): 60 ☒ Auxiliary Engine ☒ Diesel Onan ☐ Gasoline ☐ Natural Gas ☐ Other_____ Manufacturer: Allis-Chalmers Size (hp)_____ ☐ Adaptor for "Plug In" Potable Unit	Year Constructed /Age Generator: 1980/28 Engine: 1979/29 Fuel Tank: 1990/18	Condition: ☒ Good ☐ Fair ☐ Poor Comments: Exercised ~ 1 time/month Permitted by Air Quality Board works OK Has been used during power outages General maintenance - needs "tune up"

SCADA/Telemetry Systems			
SCADA/Telemetry ☐ Not Applicable	☒ Data Monitoring ☒ Pumping Rate ☒ Pressure ☐ Tank Level ☐ Other_____ ☐ Remote Control ☐ Booster Pump On/Off ☐ Well Pump On/Off ☐ Other_____ Manufacturer: Bristol Model: 2ERA500-45-14-R10-Z120	Year Constructed /Age 1979/29	Condition: ☐ Good ☐ Fair ☐ Poor Comments: No SCADA Telemetry control
Mechanical Systems			
Booster Pumps ☒ Not Applicable	Type ☐ Vertical ☐ Horizontal Split Case Hp_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Well System: **Well No. 008-01** ☐ Not Applicable	Motor BF61A Type: 5KS365DP6005 Hp: 75 ✓ 1780 RPM Manufacturer: ~~G.E.~~ USMotor Back-Up Power (yes/no) Pump Type: RL10 RPM: 1770 Stages 9 Manufacturer: ~~Aurora~~ Vertiline 500 gpm	Year Constructed /Age Motor: ~~1986/22~~ → March 2008 new motor Pump: 1979/29	Condition: ☒ Good ☐ Fair ☐ Poor Comments: Oil lube
Well System **Well No.____** (if more than one well at same site) ☒ Not Applicable	Motor Type_____ Hp_____ Manufacturer_____ Back-Up Power (yes/no) Pump Type_____ RPM_____ Stages_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:

Water Treatment System ☐ Not Applicable	Treatment Type ☒ Disinfection ☐ Calcium Hypochlorite ☒ Sodium Hypochlorite 25 gallon tank feed system ☐ Other_____ ☐ Fe/Mn_____ ☐ Other_____ ☐ None Chemical Feed System ☐ 55-gallon drums ☐ Day Tank ☒ Other 5 gallon containers 25 gallon feed system ☐ None Safety ☐ Emergency Eye Wash Station Emergency Drench Hose ☐ Emergency Shower ☐ None	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments: Located outside building small utility shed @ back of bldg Only station with liquid sodium hypo all others calcium hypo tablets Bacterial Filter- Filter media not changed recently-
Discharge Piping Systems ☐ Not Applicable	Installation ☒ Above Ground ☐ Below Ground Materials ☒ Asbestos Cement ☐ Ductile Iron ☐ Steel ☐ PVC Diameter (inches): 8	Year Constructed /Age	Condition: ☒ Good ☐ Fair ☐ Poor Comments: indicator is headloss across filter - appears to be ok based on pressure guages
Heating, Ventilation and Cooling Systems ☒ Not Applicable	Type_____ Manufacturer_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments:
Fire Protection ☒ Not Applicable	☐ Automatic Sprinkler ☐ Fire Extinguisher NO ☐ Other_____	Year Constructed /Age	Condition: ☐ Good ☐ Fair ☐ Poor Comments: should have fire extinguisher
Overall Site Issues	Concern	Comments or Not Applicable (N/A)	
Adjacent Land Use	☒ Residential ✓ ☒ Single Family Homes ✓ ☐ Apartments ☐ Condos ☐ Commercial ☐ Industrial ☐ Park ☐ School ☐ Other_____		

Aesthetic Issues	Exterior Paint	Condition: ☒ Good ☐ Fair ☐ Poor
	Interior Paint	Condition: ☒ Good ☐ Fair ☐ Poor
	Site Landscaping	Condition: ☒ Good ☐ Fair ☐ Poor
	Site Drainage	Condition: ☒ Good ☐ Fair ☐ Poor
	Access Road	Condition: ☒ Good ☐ Fair ☐ Poor
	General Site Appearance	Condition: ☒ Good ☐ Fair ☐ Poor
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor
Security Issues	Security of Doors, Windows, & Locks	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A Deadbolt
	Security of Hatches & Vaults	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Perimeter Fences & Gates	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A 6' chain link w/ barb
	Interior Lighting	Condition: ☒ Good ☐ Fair ☐ Poor ☐ N/A
	Exterior Lighting	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A No exterior lighting
	Alarm Systems	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Other_____	Condition: ☐ Good ☐ Fair ☐ Poor ☒ N/A
	Health & Safety Equipment	☐ First Aid Kit ☐ Personal Protective Equipment ☐ MSDS ☒ Other Emergency Drench Hose ☐ None No fire extinguisher
Potential Site Hazards	Overgrown Trees On/Adjacent to Site	☐ Yes; Describe_____ ☒ No
	Adjacent Fire Hazards	☐ Yes; Describe_____ ☒ No
	Adjacent Flood Hazards	☐ Yes; Describe_____ ☒ No
	Landslide Hazards	☐ Yes; Describe_____ ☒ No
	Other_____	☐ Yes; Describe_____ ☒ No

Public Version

Other Comments	
Assessment Performed by	BURTON / DRAYER
Assessment Date	7/31/08

Public Version

Cal Water Dixon District

Facility Assessments

July 31, 2008

Station 09-01 (Future)

N. Adams Street
@West H Street

Future Station 09-01 Lot

Existing Building

APPENDIX M

Cal Water Simulated Available Fire Flow to Meet the Maximum Day Demand plus Fire Flow Performance Criteria

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-100	48.99	881	38.8	P-DIX-3041	10
J-DIX-1000	41.56	1,324	20.0		
J-DIX-1002	43.42	1,459	20.0		
J-DIX-1004	41.56	1,582	20.0		
J-DIX-1006	43.73	1,875	20.0		
J-DIX-1008	45.76	1,651	28.1	P-DIX-1771	10
J-DIX-101	49.46	392	44.6	P-DIX-3797	10
J-DIX-1010	46.66	2,384	24.5	P-DIX-747	10
J-DIX-1014	46.35	392	29.1	P-DIX-179	10
J-DIX-1016	45.13	881	39.4	P-DIX-2637	10
J-DIX-1018	47.01	2,385	20.1		
J-DIX-1020	47.19	2,852	20.1		
J-DIX-1022	46.24	1,216	20.0		
J-DIX-1024	47.74	1,408	20.0		
J-DIX-1026	48.33	1,836	20.0		
J-DIX-1028	48.79	1,865	20.0		
J-DIX-1030	41.82	1,885	20.0		
J-DIX-1032	45.71	2,105	20.0		
J-DIX-1034	43.55	1,811	20.0		
J-DIX-1036	44.01	1,872	20.0		
J-DIX-1038	43.28	1,894	20.0		
J-DIX-104	43.53	881	26.1	P-DIX-3047	10
J-DIX-1040	43.28	1,861	20.0		
J-DIX-1042	43.43	1,824	20.0		
J-DIX-1044	43.95	1,760	20.0		
J-DIX-1046	49.56	1,901	20.0		
J-DIX-1048	45.32	1,839	20.0		
J-DIX-1050	43.73	1,877	20.0		
J-DIX-1054	44.48	2,646	20.1		
J-DIX-1056	44.97	2,608	20.1		
J-DIX-1058	44.79	2,394	20.1		
J-DIX-106	45.17	881	33.6	P-DIX-3051	10
J-DIX-1060	42.85	2,096	20.0		
J-DIX-1062	45.57	2,056	20.2	P-DIX-927	10
J-DIX-1064	45.57	2,317	20.1		
J-DIX-1066	45.82	2,280	20.1		
J-DIX-1068	43.75	1,865	20.0		
J-DIX-1070	41.89	1,918	20.0		
J-DIX-1072	43.64	2,114	20.0		
J-DIX-1074	46.43	2,908	20.1		
J-DIX-1076	46.33	2,932	20.1		
J-DIX-1078	47.4	1,477	34.8	P-DIX-1237	10
J-DIX-108	45.05	881	29.6	P-DIX-3057	10
J-DIX-1080	47.06	2,584	20.1		
J-DIX-1082	48.06	2,447	20.1		
J-DIX-1084	47.58	2,475	20.1		
J-DIX-1086	49.6	2,416	20.1		
J-DIX-1088	47.46	2,214	20.5	P-DIX-1985	10
J-DIX-1090	51.03	772	25.5	P-DIX-523	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-1092	50.32	1,875	20.0		
J-DIX-1094	50.02	1,715	20.6	P-DIX-2611	10
J-DIX-1096	46.86	2,309	20.1		
J-DIX-1098	50.47	2,049	20.0		
J-DIX-110	43.85	881	32.1	P-DIX-3059	10
J-DIX-1100	43.96	1,934	20.0		
J-DIX-1102	43.87	1,508	22.5	P-DIX-1701	10
J-DIX-1104	44.45	2,131	20.1		
J-DIX-1106	50.1	1,291	32.4	P-DIX-2327	10
J-DIX-1108	50.57	1,430	28.3	P-DIX-2329	10
J-DIX-1110	47.19	401	45.3	P-DIX-123	10
J-DIX-1111	46.31	2,169	25.6	P-DIX-336	10
J-DIX-1112	46.65	874	33.9	P-DIX-171	10
J-DIX-1114	47.62	1,162	37.4	P-DIX-193	10
J-DIX-1116	49.04	1,539	20.0		
J-DIX-1118	51.9	1,067	20.0		
J-DIX-112	44.96	881	35.3	P-DIX-3063	10
J-DIX-1120	51.33	1,002	20.0		
J-DIX-1122	51.61	1,039	20.0		
J-DIX-1124	47.93	1,567	21.8	P-DIX-118	10
J-DIX-1126	48.41	1,665	20.0		
J-DIX-1128	50.91	1,364	20.0		
J-DIX-1136	44.04	1,679	21.7	P-DIX-2251	10
J-DIX-1138	44.05	1,561	24.1	P-DIX-2379	10
J-DIX-114	43.31	881	32.7	P-DIX-3067	10
J-DIX-1140	47.99	1,567	21.5	P-DIX-773	10
J-DIX-1142	49.74	1,852	21.3	P-DIX-783	10
J-DIX-1144	49.63	1,897	20.0		
J-DIX-1146	49.68	2,457	20.1		
J-DIX-1148	46.66	1,709	20.0		
J-DIX-1150	46.79	1,561	25.6	P-DIX-2789	10
J-DIX-1152	45.6	1,152	35.0	P-DIX-544	10
J-DIX-1154	45.32	1,532	25.5	P-DIX-2449	10
J-DIX-1156	42.49	1,492	20.0		
J-DIX-1158	44.03	1,507	20.0		
J-DIX-116	43	881	33.1	P-DIX-3071	10
J-DIX-1160	43.5	1,341	25.0	P-DIX-2857	10
J-DIX-1162	44.69	2,125	27.2	P-DIX-2481	10
J-DIX-1164	44.79	2,107	24.1	P-DIX-2503	10
J-DIX-1166	43.96	1,567	23.7	P-DIX-719	10
J-DIX-1168	45.52	1,047	37.1	P-DIX-543	10
J-DIX-1170	45.59	1,003	38.9	P-DIX-939	10
J-DIX-1172	45	2,148	26.2	P-DIX-471	10
J-DIX-1174	45.96	1,922	31.3	P-DIX-481	10
J-DIX-1176	43.96	1,510	29.1	P-DIX-323	10
J-DIX-1178	43.42	1,480	28.0	P-DIX-957	10
J-DIX-118	43.04	881	27.7	P-DIX-3085	10
J-DIX-1180	43.52	1,897	20.0		
J-DIX-1182	44.91	885	39.7	P-DIX-2543	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-1184	45.55	2,194	28.7	P-DIX-932	10
J-DIX-1186	43.19	1,707	20.0		
J-DIX-1188	44.01	446	32.1	P-DIX-1889	10
J-DIX-1190	44.27	1,960	28.8	P-DIX-2045	10
J-DIX-1192	44.39	1,882	30.3	P-DIX-2061	10
J-DIX-1194	45.6	1,839	32.6	P-DIX-667	10
J-DIX-1196	47.2	1,893	33.5	P-DIX-1201	10
J-DIX-1198	51.41	436	38.1	P-DIX-2003	10
J-DIX-12	46.67	392	42.9	P-DIX-3943	10
J-DIX-120	43.48	881	34.1	P-DIX-3075	10
J-DIX-1200	48.16	2,158	21.9	P-DIX-2291	10
J-DIX-1202	50.86	2,030	20.0		
J-DIX-1204	50.36	1,913	23.1	P-DIX-845	10
J-DIX-1206	50.47	1,740	27.1	P-DIX-847	10
J-DIX-1208	46.26	2,164	25.4	P-DIX-2313	10
J-DIX-1210	48.87	1,962	20.0		
J-DIX-1212	43.93	1,736	23.8	P-DIX-881	10
J-DIX-1214	44.03	1,730	24.0	P-DIX-879	10
J-DIX-1216	46.06	391	24.6	P-DIX-1568	10
J-DIX-1218	43.5	1,868	26.0	P-DIX-1779	10
J-DIX-122	44.16	881	35.8	P-DIX-3079	10
J-DIX-1220	45.51	1,906	20.0		
J-DIX-1222	44.4	1,558	29.1	P-DIX-2697	10
J-DIX-1224	45.81	1,871	20.0		
J-DIX-1226	42.91	1,150	28.4	P-DIX-1797	10
J-DIX-1228	47.24	804	38.3	P-DIX-801	10
J-DIX-1230	46.19	1,197	38.0	P-DIX-293	10
J-DIX-1232	48.64	2,478	20.1		
J-DIX-1234	46.44	2,481	20.1		
J-DIX-1236	47.41	2,444	20.1		
J-DIX-1238	47.47	1,474	35.2	P-DIX-2865	10
J-DIX-124	43.93	881	35.3	P-DIX-3083	10
J-DIX-1240	47.71	1,785	29.8	P-DIX-2875	10
J-DIX-1242	47.8	1,625	32.5	P-DIX-1891	10
J-DIX-1244	47.58	1,235	37.3	P-DIX-504	10
J-DIX-1246	48.07	2,327	20.9	P-DIX-1891	10
J-DIX-1248	46.27	2,545	20.1		
J-DIX-1250	46.27	2,543	20.1		
J-DIX-1252	46.24	1,025	39.2	P-DIX-1913	10
J-DIX-1254	46.27	2,548	20.1		
J-DIX-1256	46.27	2,557	20.1		
J-DIX-1258	46.67	2,651	20.1		
J-DIX-126	45.41	881	37.9	P-DIX-3087	10
J-DIX-1260	47.22	1,281	37.1	P-DIX-1570	10
J-DIX-1262	46.29	2,641	20.1		
J-DIX-1264	46.74	1,588	29.9	P-DIX-502	10
J-DIX-1266	46.82	1,538	31.2	P-DIX-75	10
J-DIX-1268	46.54	2,737	20.1		
J-DIX-1270	46.56	2,735	20.1		

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-1272	46.4	2,734	20.1		
J-DIX-1274	46.58	2,169	20.1		
J-DIX-1276	45.93	1,540	32.2	P-DIX-279	10
J-DIX-1278	46.12	2,129	22.4	P-DIX-105	10
J-DIX-128	42.42	881	29.2	P-DIX-3089	10
J-DIX-1280	46.37	2,814	20.1		
J-DIX-1282	46.26	1,690	20.0		
J-DIX-1284	46.37	1,217	21.9	P-DIX-131	10
J-DIX-1286	47.11	1,174	36.7	P-DIX-143	10
J-DIX-1288	47.11	2,090	20.0		
J-DIX-1290	46.92	726	32.1	P-DIX-358	10
J-DIX-1292	45.61	945	37.9	P-DIX-155	10
J-DIX-1294	45.58	1,720	24.0	P-DIX-153	10
J-DIX-1296	45.6	526	41.4	P-DIX-360	10
J-DIX-1298	45.78	1,096	36.2	P-DIX-155	10
J-DIX-130	43.85	881	33.9	P-DIX-3093	10
J-DIX-1300	47.99	1,078	34.5	P-DIX-169	10
J-DIX-1302	47.78	617	40.0	P-DIX-102	10
J-DIX-1304	47.6	628	42.6	P-DIX-191	10
J-DIX-1306	47.66	533	42.4	P-DIX-628	10
J-DIX-1308	47.58	2,082	20.6	P-DIX-187	10
J-DIX-1310	47.48	1,824	23.6	P-DIX-197	10
J-DIX-1312	49.53	508	42.9	P-DIX-104	10
J-DIX-1314	48.41	1,667	20.0		
J-DIX-1316	50.94	1,229	20.0		
J-DIX-1318	50.72	1,416	20.0		
J-DIX-132	43.11	881	34.3	P-DIX-3095	10
J-DIX-1320	51.9	1,412	20.0		
J-DIX-1322	51.64	1,446	20.0		
J-DIX-1324	51.01	1,428	20.4	P-DIX-231	10
J-DIX-1326	50.51	1,196	20.4	P-DIX-225	10
J-DIX-1328	50.54	1,183	20.0		
J-DIX-1330	50.74	1,118	20.0		
J-DIX-1332	51.18	1,098	20.0		
J-DIX-1334	50.94	1,093	20.0		
J-DIX-1336	53.22	1,087	20.0		
J-DIX-1338	50.09	1,005	20.0		
J-DIX-134	43.31	881	35.3	P-DIX-3099	10
J-DIX-1340	50.25	1,002	20.0		
J-DIX-1342	51.13	1,000	20.0		
J-DIX-1344	53.56	1,065	20.0		
J-DIX-1346	50.76	1,095	20.0		
J-DIX-1348	51.01	1,145	20.0		
J-DIX-1350	47.97	1,567	22.0	P-DIX-251	10
J-DIX-1352	48.09	1,670	20.0		
J-DIX-1354	48.18	1,656	20.0		
J-DIX-1356	47.46	1,448	28.4	P-DIX-269	10
J-DIX-1358	50.62	1,422	20.0		
J-DIX-136	43.62	881	33.6	P-DIX-3103	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-1360	50.68	1,406	20.0		
J-DIX-1362	50.88	1,368	20.0		
J-DIX-1364	50.94	1,255	20.0		
J-DIX-1366	48.27	1,563	22.3	P-DIX-1157	10
J-DIX-1368	47.74	1,756	20.0		
J-DIX-1370	47.53	1,754	20.0		
J-DIX-1372	49.1	1,842	20.0		
J-DIX-1374	49.5	1,851	20.0		
J-DIX-1376	48.02	1,827	20.0		
J-DIX-1378	48.35	1,852	20.0		
J-DIX-138	43.39	881	34.5	P-DIX-3107	10
J-DIX-1380	48.6	1,785	20.0		
J-DIX-1382	48.97	1,565	25.5	P-DIX-1556	10
J-DIX-1384	48.3	1,568	20.0		
J-DIX-1388	47.96	1,847	20.0		
J-DIX-1390	48.12	1,713	20.0		
J-DIX-1392	48.94	1,744	20.0		
J-DIX-1394	48.73	1,780	20.0		
J-DIX-1398	45.17	1,471	20.0		
J-DIX-140	43.69	881	34.6	P-DIX-3111	10
J-DIX-1400	45.12	877	30.7	P-DIX-1627	10
J-DIX-1402	44.01	1,440	20.0		
J-DIX-1404	44.76	1,690	20.0		
J-DIX-1406	43.74	1,517	20.0		
J-DIX-1408	43.02	1,598	20.0		
J-DIX-1410	42.61	1,580	20.0		
J-DIX-1412	42.57	1,587	20.0		
J-DIX-1414	43.35	1,659	20.0		
J-DIX-1416	44.16	1,874	20.0		
J-DIX-1418	44.23	1,867	20.0		
J-DIX-142	44.8	881	33.1	P-DIX-3115	10
J-DIX-1420	43.73	1,791	20.0		
J-DIX-1422	47.19	2,168	20.1		
J-DIX-1424	45.18	2,015	20.0		
J-DIX-1426	45.35	2,007	20.0		
J-DIX-1428	43.64	1,963	20.0		
J-DIX-1430	44.61	2,105	20.0		
J-DIX-1432	44.45	2,104	20.0		
J-DIX-1434	42.67	1,835	20.0		
J-DIX-1436	42.47	1,836	20.0		
J-DIX-1438	43.95	1,938	20.0		
J-DIX-144	43.23	881	33.8	P-DIX-3119	10
J-DIX-1440	44.97	1,430	30.0	P-DIX-1055	10
J-DIX-1442	46.03	1,998	20.0		
J-DIX-1444	46.35	1,699	28.4	P-DIX-453	10
J-DIX-1446	46.54	2,180	20.1		
J-DIX-1450	45.9	2,061	20.0		
J-DIX-1452	45.18	1,985	20.0		
J-DIX-1454	45.44	2,091	20.0		

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-1456	46.55	1,913	20.0		
J-DIX-1458	45.43	1,919	20.0		
J-DIX-146	44.72	881	32.4	P-DIX-3123	10
J-DIX-1460	45.51	1,785	20.0		
J-DIX-1462	47.31	2,203	20.5	P-DIX-2271	10
J-DIX-1464	47.74	2,167	22.2	P-DIX-2269	10
J-DIX-1466	47.99	2,186	20.1		
J-DIX-1468	42.87	1,907	20.0		
J-DIX-1470	44.47	1,963	20.0		
J-DIX-1472	42.71	1,842	20.0		
J-DIX-1474	42.9	1,854	20.0		
J-DIX-1476	43.39	1,907	20.0		
J-DIX-1478	43.38	1,910	20.0		
J-DIX-148	45.02	881	37.0	P-DIX-3127	10
J-DIX-1480	43.85	1,600	20.0		
J-DIX-1482	43.32	1,709	20.0		
J-DIX-1484	43.29	1,899	20.0		
J-DIX-1486	43.64	1,567	20.0		
J-DIX-1488	43.29	1,216	29.9	P-DIX-1669	10
J-DIX-1490	43.63	1,270	28.7	P-DIX-1671	10
J-DIX-1492	46.1	1,508	20.0		
J-DIX-1494	43.16	1,295	27.7	P-DIX-1675	10
J-DIX-1496	44.82	1,410	20.0		
J-DIX-1498	44.46	1,524	20.0		
J-DIX-150	43.28	881	35.1	P-DIX-3129	10
J-DIX-1500	43.28	1,835	20.0		
J-DIX-1502	45.01	1,955	20.0		
J-DIX-1504	43.82	1,759	20.0		
J-DIX-1506	44.58	1,770	20.0		
J-DIX-1508	44.83	1,743	20.0		
J-DIX-1510	44.59	1,810	20.0		
J-DIX-1512	43.8	1,563	23.9	P-DIX-162	10
J-DIX-1514	45.35	1,732	20.0		
J-DIX-1516	47.05	1,848	20.0		
J-DIX-1518	44.8	1,163	31.5	P-DIX-598	10
J-DIX-152	45.01	881	37.1	P-DIX-3133	10
J-DIX-1520	43.07	1,126	31.4	P-DIX-2285	10
J-DIX-1522	43.75	1,454	20.0		
J-DIX-1524	46.33	2,005	20.0		
J-DIX-1526	44.45	1,468	20.0		
J-DIX-1528	42.67	1,127	31.6	P-DIX-168	10
J-DIX-1530	45.93	1,868	20.0		
J-DIX-1532	45.22	1,137	34.1	P-DIX-170	10
J-DIX-1534	42.55	1,415	20.0		
J-DIX-1536	42.38	1,815	20.0		
J-DIX-1538	42.35	1,784	20.0		
J-DIX-154	43.69	881	34.6	P-DIX-3137	10
J-DIX-1540	43.1	1,847	20.0		
J-DIX-1542	43.76	1,561	20.0		

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-1544	43.94	1,524	21.7	P-DIX-1109	10
J-DIX-1546	44.16	1,450	23.7	P-DIX-2461	10
J-DIX-1548	43.48	1,530	20.0		
J-DIX-1550	42.96	1,490	21.2	P-DIX-1817	10
J-DIX-1552	42.61	1,614	20.0		
J-DIX-1554	45.17	1,332	36.1	P-DIX-2469	10
J-DIX-1556	45.6	1,444	34.8	P-DIX-590	10
J-DIX-1558	44.57	2,636	20.1		
J-DIX-156	44.83	881	35.7	P-DIX-3141	10
J-DIX-1560	45.01	2,465	20.1		
J-DIX-1562	45.04	2,068	26.3	P-DIX-180	10
J-DIX-1564	44.37	2,202	20.1		
J-DIX-1566	45.54	2,245	20.1		
J-DIX-1568	44.42	2,106	20.0		
J-DIX-1570	43.5	1,410	32.3	P-DIX-1447	10
J-DIX-1572	44.55	1,525	31.3	P-DIX-182	10
J-DIX-1574	43.5	1,700	28.6	P-DIX-1779	10
J-DIX-1576	46.48	2,403	20.1		
J-DIX-1578	46.11	2,401	20.1		
J-DIX-158	43.87	881	35.0	P-DIX-3145	10
J-DIX-1580	44.77	2,473	20.1		
J-DIX-1582	44.39	2,236	20.1		
J-DIX-1584	45.89	1,904	20.0		
J-DIX-1586	45.71	1,628	25.8	P-DIX-186	10
J-DIX-1588	45.55	1,897	20.0		
J-DIX-1590	44.65	1,950	20.0		
J-DIX-1592	43.99	2,145	20.1		
J-DIX-1594	43.82	2,115	20.0		
J-DIX-1596	43.98	2,168	20.1		
J-DIX-1598	44.21	2,067	20.0		
J-DIX-16	46.52	392	40.8	P-DIX-3951	10
J-DIX-160	46.55	881	37.1	P-DIX-3149	10
J-DIX-1600	44.6	2,101	20.0		
J-DIX-1602	44.54	2,104	20.0		
J-DIX-1604	44.83	2,230	20.1		
J-DIX-1606	44.87	1,572	28.3	P-DIX-2687	10
J-DIX-1608	44.06	2,606	20.1		
J-DIX-1610	44.34	2,583	20.1		
J-DIX-1612	45.59	2,635	20.9	P-DIX-192	10
J-DIX-1614	45.17	2,597	20.1		
J-DIX-1616	45.31	2,149	20.1		
J-DIX-1618	46.52	880	32.1	P-DIX-935	10
J-DIX-162	43.3	881	31.2	P-DIX-3153	10
J-DIX-1620	44.42	1,453	20.0		
J-DIX-1622	44.46	1,486	20.0		
J-DIX-1624	43.46	1,897	20.0		
J-DIX-1626	44.17	1,412	31.4	P-DIX-196	10
J-DIX-1628	41.77	1,682	20.0		
J-DIX-1630	43.78	1,658	26.7	P-DIX-959	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-1632	42.71	1,483	22.5	P-DIX-895	10
J-DIX-1634	44.13	130	20.0		
J-DIX-1636	45.81	1,585	29.3	P-DIX-198	10
J-DIX-1638	44.78	2,401	20.1		
J-DIX-164	43.29	881	34.6	P-DIX-3155	10
J-DIX-1640	44.27	1,565	33.9	P-DIX-547	10
J-DIX-1642	44.69	1,210	37.6	P-DIX-200	10
J-DIX-1644	44.18	2,224	25.9	P-DIX-547	10
J-DIX-1646	44.93	2,123	26.8	P-DIX-469	10
J-DIX-1648	46.07	1,343	34.8	P-DIX-1687	10
J-DIX-1650	45.67	1,438	33.4	P-DIX-202	10
J-DIX-1652	44.62	1,868	27.0	P-DIX-651	10
J-DIX-1654	42.94	1,373	24.3	P-DIX-835	10
J-DIX-1656	43.11	1,446	21.9	P-DIX-839	10
J-DIX-1658	42.18	1,438	20.0		
J-DIX-166	43.91	881	32.6	P-DIX-3159	10
J-DIX-1660	43.3	1,406	23.6	P-DIX-997	10
J-DIX-1662	43.79	1,101	33.9	P-DIX-204	10
J-DIX-1664	44.68	1,655	30.3	P-DIX-1005	10
J-DIX-1666	44.77	1,972	25.7	P-DIX-1005	10
J-DIX-1668	43.88	1,642	25.2	P-DIX-1007	10
J-DIX-1670	43.82	1,162	33.1	P-DIX-1935	10
J-DIX-1672	43.74	1,170	31.1	P-DIX-512	10
J-DIX-1674	42.59	1,112	32.3	P-DIX-576	10
J-DIX-1676	43.74	1,525	20.0		
J-DIX-1678	41.95	1,399	20.0		
J-DIX-168	46.24	881	37.4	P-DIX-3163	10
J-DIX-1680	44.18	1,373	24.4	P-DIX-210	10
J-DIX-1682	43.21	2,023	20.0		
J-DIX-1684	43.37	1,797	20.0		
J-DIX-1686	43.78	2,026	20.2	P-DIX-959	10
J-DIX-1688	43.4	1,944	20.0		
J-DIX-1690	43.91	2,037	20.0		
J-DIX-1694	45.12	2,105	20.0		
J-DIX-1696	44.86	1,566	28.1	P-DIX-1027	10
J-DIX-1698	44.95	2,045	20.0		
J-DIX-170	43	881	31.6	P-DIX-3167	10
J-DIX-1700	44.56	1,566	27.0	P-DIX-572	10
J-DIX-1702	44.31	2,013	20.0		
J-DIX-1704	44.01	1,957	22.4	P-DIX-329	10
J-DIX-1706	44.19	1,939	24.7	P-DIX-1821	10
J-DIX-1708	44.13	1,104	35.2	P-DIX-218	10
J-DIX-1710	43.99	1,458	20.0		
J-DIX-1712	43.13	1,999	20.0		
J-DIX-1714	43.34	1,181	31.1	P-DIX-220	10
J-DIX-1716	44.05	1,776	27.1	P-DIX-1821	10
J-DIX-1718	45.58	1,556	22.9	P-DIX-965	10
J-DIX-172	42.67	881	34.2	P-DIX-3171	10
J-DIX-1720	44.28	1,138	35.7	P-DIX-222	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-1722	44.3	1,006	35.7	P-DIX-2557	10
J-DIX-1724	42.73	821	24.9	P-DIX-2525	10
J-DIX-1726	42.66	1,068	30.5	P-DIX-947	10
J-DIX-1728	42.51	1,563	20.0		
J-DIX-1730	42.98	1,340	24.6	P-DIX-568	10
J-DIX-1732	44.35	2,098	20.0		
J-DIX-1734	41.89	1,894	20.0		
J-DIX-1736	43.23	1,932	20.0		
J-DIX-1738	43.79	1,959	20.0		
J-DIX-174	45.59	881	36.7	P-DIX-3175	10
J-DIX-1740	41.89	1,832	20.0		
J-DIX-1742	45.31	1,554	31.5	P-DIX-2539	10
J-DIX-1744	45.68	2,187	21.6	P-DIX-2539	10
J-DIX-1746	45.89	1,421	33.1	P-DIX-1562	10
J-DIX-1748	44.29	660	39.7	P-DIX-2557	10
J-DIX-1750	43.51	1,957	21.2	P-DIX-226	10
J-DIX-1752	44.25	1,773	24.0	P-DIX-1601	10
J-DIX-1754	44.55	1,331	32.8	P-DIX-228	10
J-DIX-1756	44.57	2,222	20.9	P-DIX-1859	10
J-DIX-1758	45.73	2,127	30.1	P-DIX-2031	10
J-DIX-176	44.16	881	35.6	P-DIX-3179	10
J-DIX-1760	46.15	3,060	20.4	P-DIX-1873	10
J-DIX-1762	46.38	2,945	20.1		
J-DIX-1764	44.81	507	40.3	P-DIX-1885	10
J-DIX-1766	45	1,494	20.0		
J-DIX-1768	44.88	1,498	20.0		
J-DIX-1770	44.34	694	40.6	P-DIX-1081	10
J-DIX-1772	44.38	1,026	37.9	P-DIX-1081	10
J-DIX-1774	44.03	1,697	26.1	P-DIX-373	10
J-DIX-1776	43.98	385	26.5	P-DIX-1093	10
J-DIX-1778	44.18	474	40.3	P-DIX-232	10
J-DIX-178	42.24	881	31.1	P-DIX-3183	10
J-DIX-1780	43.25	1,716	20.0		
J-DIX-1782	44.25	2,278	20.1		
J-DIX-1784	44.17	1,316	33.9	P-DIX-234	10
J-DIX-1786	44.36	1,476	32.1	P-DIX-2053	10
J-DIX-1788	44.73	1,844	30.5	P-DIX-1875	10
J-DIX-1790	46.97	2,901	20.1		
J-DIX-1792	46.7	2,529	25.2	P-DIX-683	10
J-DIX-1794	47.83	2,425	27.6	P-DIX-562	10
J-DIX-1796	45.82	1,231	37.5	P-DIX-236	10
J-DIX-1798	46.48	2,870	20.1		
J-DIX-18	42.4	881	32.7	P-DIX-1137	10
J-DIX-180	42.69	881	34.3	P-DIX-3187	10
J-DIX-1800	46.48	1,804	33.9	P-DIX-1525	10
J-DIX-1802	46.37	2,785	20.1		
J-DIX-1804	46.51	1,655	31.8	P-DIX-659	10
J-DIX-1806	45.64	2,773	20.1		
J-DIX-1808	45.33	2,787	20.1		

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-1810	45.4	2,292	27.0	P-DIX-934	10
J-DIX-1812	46.54	2,310	27.9	P-DIX-560	10
J-DIX-1814	46.16	2,910	20.1		
J-DIX-1816	46.07	2,150	24.6	P-DIX-1203	10
J-DIX-1818	47.01	1,662	31.2	P-DIX-3550	10
J-DIX-182	43.06	881	35.8	P-DIX-3191	10
J-DIX-1820	46.26	1,772	31.2	P-DIX-242	10
J-DIX-1822	47.44	1,499	35.7	P-DIX-558	10
J-DIX-1824	47.44	1,742	32.4	P-DIX-1235	10
J-DIX-1826	47.34	1,969	29.0	P-DIX-2401	10
J-DIX-1828	45.81	2,862	20.1		
J-DIX-1830	45.9	2,868	20.1		
J-DIX-1832	47.11	1,382	36.4	P-DIX-936	10
J-DIX-1834	47.53	1,553	27.0	P-DIX-1949	10
J-DIX-1836	46.8	1,939	29.1	P-DIX-1955	10
J-DIX-1838	47.99	1,234	38.9	P-DIX-246	10
J-DIX-184	48.68	881	40.8	P-DIX-3195	10
J-DIX-1840	47.82	2,194	20.1		
J-DIX-1842	49.58	1,200	39.9	P-DIX-556	10
J-DIX-1844	48.18	1,379	35.0	P-DIX-248	10
J-DIX-1846	47.56	1,505	33.3	P-DIX-1989	10
J-DIX-1848	48.61	1,280	35.8	P-DIX-2199	10
J-DIX-1850	48.61	2,093	20.0		
J-DIX-1852	47.84	905	39.4	P-DIX-252	10
J-DIX-1854	47.87	815	40.7	P-DIX-2883	10
J-DIX-1856	47.77	1,606	28.4	P-DIX-938	10
J-DIX-1858	48.52	1,480	33.1	P-DIX-254	10
J-DIX-186	45	881	36.5	P-DIX-3199	10
J-DIX-1860	50.69	1,405	35.9	P-DIX-2215	10
J-DIX-1862	50.76	1,273	37.8	P-DIX-552	10
J-DIX-1864	50.72	1,360	36.7	P-DIX-2223	10
J-DIX-1868	52.2	942	43.2	P-DIX-256	10
J-DIX-1870	50.89	1,383	27.7	P-DIX-2263	10
J-DIX-1872	50.89	1,447	25.4	P-DIX-1564	10
J-DIX-1874	51.03	1,643	20.0		
J-DIX-1876	49.43	1,587	20.0		
J-DIX-1878	49.42	1,586	20.0		
J-DIX-188	45.12	881	36.7	P-DIX-3203	10
J-DIX-1880	50.09	1,633	20.0		
J-DIX-1882	50.04	1,906	21.2	P-DIX-2319	10
J-DIX-1884	49.99	515	45.5	P-DIX-1995	10
J-DIX-1886	49.7	1,090	31.1	P-DIX-2617	10
J-DIX-1888	50.52	421	42.2	P-DIX-550	10
J-DIX-1890	49.94	1,629	20.0		
J-DIX-1892	49.28	2,003	20.0		
J-DIX-1894	49.43	2,145	20.2	P-DIX-855	10
J-DIX-1896	49.2	873	40.9	P-DIX-548	10
J-DIX-1898	49.22	2,110	20.0		
J-DIX-190	44.95	881	37.2	P-DIX-3235	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-1900	49.13	2,072	20.0		
J-DIX-1902	48.02	2,000	25.1	P-DIX-870	10
J-DIX-1904	48.21	1,936	27.8	P-DIX-2019	10
J-DIX-1906	46.94	1,761	31.8	P-DIX-1959	10
J-DIX-1908	49.66	1,626	20.0		
J-DIX-1910	49.83	1,782	20.0		
J-DIX-1912	49.91	1,324	30.9	P-DIX-266	10
J-DIX-1914	49.55	1,756	20.0		
J-DIX-1916	49.47	1,329	30.4	P-DIX-546	10
J-DIX-1918	50	1,189	34.1	P-DIX-268	10
J-DIX-192	41.78	881	34.2	P-DIX-3239	10
J-DIX-1920	50.69	1,791	23.0	P-DIX-2595	10
J-DIX-1922	50.79	1,362	31.7	P-DIX-942	10
J-DIX-1924	50.68	1,376	30.0	P-DIX-2613	10
J-DIX-1926	50.38	1,676	20.0		
J-DIX-1928	50.46	1,678	20.0		
J-DIX-1930	49.82	1,567	23.0	P-DIX-2829	10
J-DIX-1932	50.54	1,741	20.0		
J-DIX-1934	50.47	1,042	35.6	P-DIX-4130	10
J-DIX-1936	47.02	2,299	20.1		
J-DIX-1938	46.56	1,388	34.3	P-DIX-274	10
J-DIX-194	42.81	881	31.5	P-DIX-3243	10
J-DIX-1940	47.04	1,580	30.9	P-DIX-542	10
J-DIX-1942	47.65	1,576	32.7	P-DIX-276	10
J-DIX-1944	46.4	1,630	30.5	P-DIX-2825	10
J-DIX-1946	47.08	2,508	22.9	P-DIX-1511	10
J-DIX-1948	47.3	2,738	20.1		
J-DIX-1950	47.76	2,939	20.1		
J-DIX-1952	47.85	1,094	41.4	P-DIX-540	10
J-DIX-1954	47.77	1,753	28.8	P-DIX-421	10
J-DIX-1956	46.01	2,548	20.1		
J-DIX-1958	48.32	2,372	20.1		
J-DIX-196	45.39	881	36.9	P-DIX-3247	10
J-DIX-1962	50.62	2,077	20.0		
J-DIX-1964	50.7	2,081	20.0		
J-DIX-1966	50.86	2,033	20.0		
J-DIX-1968	51	1,509	31.5	P-DIX-2321	10
J-DIX-1970	51.17	1,601	23.2	P-DIX-2333	10
J-DIX-1972	51.21	2,065	20.0		
J-DIX-1974	46.49	1,422	35.2	P-DIX-538	10
J-DIX-1976	46.99	1,262	37.2	P-DIX-284	10
J-DIX-1978	50.91	1,512	20.0		
J-DIX-198	42.66	881	25.6	P-DIX-3251	10
J-DIX-1980	44.27	1,918	20.0		
J-DIX-1982	44.22	875	36.2	P-DIX-867	10
J-DIX-1984	44.01	879	28.7	P-DIX-871	10
J-DIX-1986	43.94	1,108	33.1	P-DIX-536	10
J-DIX-1988	44.32	2,024	20.0		
J-DIX-1990	44.37	1,887	20.0		

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-1992	45.52	1,802	20.0		
J-DIX-1996	44.25	1,727	20.0		
J-DIX-20	47.87	392	43.3	P-DIX-3959	10
J-DIX-200	44.15	881	29.1	P-DIX-3255	10
J-DIX-2002	44.07	1,165	31.4	P-DIX-534	10
J-DIX-2004	42.67	1,285	27.3	P-DIX-292	10
J-DIX-2008	43.06	1,553	20.5	P-DIX-2355	10
J-DIX-2010	43.44	869	33.0	P-DIX-294	10
J-DIX-2012	44.24	1,713	20.0		
J-DIX-2014	44.47	1,718	20.0		
J-DIX-2016	44.79	1,255	29.8	P-DIX-532	10
J-DIX-2018	44.6	1,378	26.0	P-DIX-2665	10
J-DIX-202	46.79	881	38.7	P-DIX-3259	10
J-DIX-2020	44.77	1,445	24.3	P-DIX-2667	10
J-DIX-2022	44.44	881	33.5	P-DIX-2673	10
J-DIX-2024	45.67	880	34.5	P-DIX-1713	10
J-DIX-2026	45.53	1,614	20.0		
J-DIX-2028	45.33	1,405	26.1	P-DIX-673	10
J-DIX-2030	43.53	1,446	22.7	P-DIX-1725	10
J-DIX-2032	43.04	881	31.9	P-DIX-1697	10
J-DIX-2034	44.22	1,506	20.0		
J-DIX-2036	44.66	2,147	20.1		
J-DIX-2038	44.35	2,177	20.1		
J-DIX-204	47.27	881	35.1	P-DIX-3265	10
J-DIX-2040	47.38	2,148	24.7	P-DIX-2701	10
J-DIX-2042	46.98	2,564	20.1		
J-DIX-2044	45.86	1,874	27.1	P-DIX-302	10
J-DIX-2046	43.96	1,997	20.5	P-DIX-2151	10
J-DIX-2048	43.79	1,996	20.0		
J-DIX-2050	45.92	1,896	20.0		
J-DIX-2052	45.8	1,701	21.9	P-DIX-306	10
J-DIX-2054	46.1	1,540	26.6	P-DIX-2725	10
J-DIX-2056	45.07	1,665	21.2	P-DIX-2733	10
J-DIX-2058	47.11	1,270	34.7	P-DIX-308	10
J-DIX-206	48.6	881	38.4	P-DIX-3269	10
J-DIX-2060	47.25	1,748	27.9	P-DIX-751	10
J-DIX-2062	45.91	2,442	20.1		
J-DIX-2064	44.57	2,327	20.1		
J-DIX-2066	46.71	2,371	24.9	P-DIX-753	10
J-DIX-2068	46.5	2,449	22.7	P-DIX-2161	10
J-DIX-2070	46.55	2,470	22.3	P-DIX-524	10
J-DIX-2074	46.8	2,683	20.1		
J-DIX-2076	46.49	2,686	20.1		
J-DIX-2078	46.37	2,695	20.1		
J-DIX-208	49.84	881	35.0	P-DIX-3273	10
J-DIX-2080	45.29	1,100	39.7	P-DIX-1813	10
J-DIX-2082	44.64	1,186	35.7	P-DIX-316	10
J-DIX-2084	43.11	1,487	20.0		
J-DIX-2086	44.62	616	36.6	P-DIX-759	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-2088	42.66	1,200	27.4	P-DIX-1603	10
J-DIX-2090	47.06	1,986	41.2	P-DIX-817	10
J-DIX-2092	45.79	2,271	42.8	P-DIX-2751	10
J-DIX-2096	46.88	1,075	37.8	P-DIX-318	10
J-DIX-2098	46.83	1,512	32.2	P-DIX-811	10
J-DIX-210	48.99	881	36.3	P-DIX-3277	10
J-DIX-2100	47.26	782	38.7	P-DIX-801	10
J-DIX-2102	46.23	1,456	32.2	P-DIX-809	10
J-DIX-2104	46.36	1,366	32.9	P-DIX-520	10
J-DIX-2106	46.68	1,163	29.1	P-DIX-518	10
J-DIX-2108	46.39	381	40.6	P-DIX-320	10
J-DIX-2110	45.8	391	27.2	P-DIX-322	10
J-DIX-2112	45.76	391	28.5	P-DIX-2149	10
J-DIX-2114	47.48	1,153	30.5	P-DIX-324	10
J-DIX-2116	47.43	1,139	31.1	P-DIX-1545	10
J-DIX-2118	46.39	1,541	30.4	P-DIX-1549	10
J-DIX-212	45.67	881	37.7	P-DIX-3281	10
J-DIX-2120	46.26	2,111	20.0		
J-DIX-2122	46.39	2,127	20.1		
J-DIX-2124	46.44	2,121	20.0		
J-DIX-2126	46.28	1,329	34.2	P-DIX-516	10
J-DIX-2128	46.43	1,419	32.3	P-DIX-1559	10
J-DIX-2130	46.43	1,445	31.7	P-DIX-878	10
J-DIX-2132	46.23	2,117	20.0		
J-DIX-2134	46.87	2,191	20.1		
J-DIX-2136	46.36	2,199	20.1		
J-DIX-2138	46.55	1,439	33.2	P-DIX-2769	10
J-DIX-214	45.86	881	39.1	P-DIX-3285	10
J-DIX-2146	45.99	881	40.6	P-DIX-295	10
J-DIX-2148	47.35	881	41.8	P-DIX-297	10
J-DIX-2150	47.82	881	41.8	P-DIX-305	10
J-DIX-2152	46.27	881	41.2	P-DIX-1897	10
J-DIX-2154	46.54	881	40.2	P-DIX-1909	10
J-DIX-2156	46.27	98	44.6	P-DIX-301	10
J-DIX-2158	42.42	1,565	20.0		
J-DIX-216	47.84	881	41.4	P-DIX-3401	10
J-DIX-2160	49.07	1,567	20.3	P-DIX-1391	10
J-DIX-2162	45.81	1,567	31.4	P-DIX-989	10
J-DIX-2168	45.27	881	40.3	P-DIX-933	10
J-DIX-2170	46.39	881	31.7	P-DIX-582	10
J-DIX-2172	45.98	881	39.4	P-DIX-645	10
J-DIX-2174	44.06	881	38.3	P-DIX-2565	10
J-DIX-2176	42.76	881	33.6	P-DIX-951	10
J-DIX-2178	45	1,489	20.0		
J-DIX-218	45.5	881	35.8	P-DIX-3405	10
J-DIX-2180	47.41	881	41.5	P-DIX-591	10
J-DIX-2182	47.4	881	41.5	P-DIX-1211	10
J-DIX-2184	47.46	881	39.0	P-DIX-589	10
J-DIX-2186	51.03	98	48.6	P-DIX-521	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-2188	48.91	1,567	30.9	P-DIX-975	10
J-DIX-2190	46.48	1,567	36.3	P-DIX-571	10
J-DIX-2192	51.17	881	39.7	P-DIX-2331	10
J-DIX-2194	46.71	1,567	36.5	P-DIX-2773	10
J-DIX-2196	45.94	1,567	42.0	P-DIX-2771	10
J-DIX-2198	46.47	1,567	30.5	P-DIX-803	10
J-DIX-22	48.83	220	43.7	P-DIX-3963	10
J-DIX-220	45.37	881	35.3	P-DIX-3409	10
J-DIX-2200	46.61	1,394	33.9	P-DIX-99	10
J-DIX-2202	46.24	1,271	36.2	P-DIX-107	10
J-DIX-2204	46.93	1,563	31.1	P-DIX-115	10
J-DIX-2206	45.92	92	33.2	P-DIX-175	10
J-DIX-2208	47.74	386	43.9	P-DIX-181	10
J-DIX-2210	50.55	1,160	20.0		
J-DIX-2212	51.62	1,218	20.0		
J-DIX-2214	51.63	1,196	21.5	P-DIX-227	10
J-DIX-2216	46.68	1,605	20.0		
J-DIX-2218	47.99	1,524	26.6	P-DIX-120	10
J-DIX-222	47.1	881	37.6	P-DIX-3415	10
J-DIX-2220	46.38	95	39.1	P-DIX-273	10
J-DIX-2222	47.24	1,423	33.3	P-DIX-2393	10
J-DIX-2224	48.43	1,765	20.0		
J-DIX-2226	48.41	1,809	20.0		
J-DIX-2230	44.54	1,575	20.0		
J-DIX-2232	44.97	1,712	20.0		
J-DIX-2234	44.6	2,029	20.0		
J-DIX-2236	42.6	1,410	20.0		
J-DIX-2238	45.46	1,552	28.3	P-DIX-501	10
J-DIX-224	46.48	881	37.4	P-DIX-3417	10
J-DIX-2240	43.7	1,449	20.0		
J-DIX-2242	45.27	1,206	31.7	P-DIX-1259	10
J-DIX-2244	45.43	2,066	20.0		
J-DIX-2246	43.28	1,716	20.0		
J-DIX-2248	44.95	1,242	30.9	P-DIX-2365	10
J-DIX-2250	44.82	1,466	20.0		
J-DIX-2252	43.28	1,195	30.3	P-DIX-1679	10
J-DIX-2254	44.81	1,410	20.0		
J-DIX-2256	44.67	1,239	27.9	P-DIX-2245	10
J-DIX-2258	44.97	1,277	28.0	P-DIX-2243	10
J-DIX-226	45.58	881	35.8	P-DIX-3421	10
J-DIX-2260	46.02	1,248	30.1	P-DIX-2253	10
J-DIX-2262	44.36	1,976	20.0		
J-DIX-2264	46.33	2,010	20.0		
J-DIX-2266	42.66	1,521	26.0	P-DIX-2193	10
J-DIX-2268	45.01	1,208	31.8	P-DIX-537	10
J-DIX-2270	44.22	1,610	22.6	P-DIX-2415	10
J-DIX-2272	47.21	881	40.6	P-DIX-2425	10
J-DIX-2274	45.26	1,419	30.7	P-DIX-1505	10
J-DIX-2276	47.09	1,563	22.0	P-DIX-1475	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-2278	43.04	1,749	20.0		
J-DIX-2280	43.45	1,855	20.0		
J-DIX-2282	44.82	1,286	36.7	P-DIX-2473	10
J-DIX-2284	45.04	1,286	34.9	P-DIX-681	10
J-DIX-2286	45.37	1,768	26.1	P-DIX-2507	10
J-DIX-2288	45.88	1,304	34.0	P-DIX-2073	10
J-DIX-2290	43.86	1,149	34.4	P-DIX-729	10
J-DIX-2292	42.28	1,550	20.0		
J-DIX-2294	43.77	1,473	28.3	P-DIX-899	10
J-DIX-2296	43.27	143	21.4	P-DIX-905	10
J-DIX-2298	43.59	132	20.0		
J-DIX-230	44.31	881	33.7	P-DIX-3487	10
J-DIX-2300	44.63	133	29.0	P-DIX-917	10
J-DIX-2302	44.58	319	20.0		
J-DIX-2304	45.33	1,442	32.0	P-DIX-921	10
J-DIX-2306	45.2	1,330	36.1	P-DIX-463	10
J-DIX-2308	45.7	1,341	35.2	P-DIX-553	10
J-DIX-2310	45.01	1,503	31.8	P-DIX-555	10
J-DIX-2312	43.88	1,462	31.4	P-DIX-565	10
J-DIX-2314	44.56	1,224	36.0	P-DIX-1183	10
J-DIX-2316	42.96	1,385	23.8	P-DIX-578	10
J-DIX-2318	44	98	30.4	P-DIX-2569	10
J-DIX-232	43.29	881	24.7	P-DIX-3489	10
J-DIX-2320	43.74	1,274	28.6	P-DIX-2021	10
J-DIX-2322	41.8	1,369	20.0		
J-DIX-2324	43.5	1,953	20.0		
J-DIX-2326	43.5	2,002	20.0		
J-DIX-2328	44.61	2,125	20.1		
J-DIX-2330	44.34	2,009	20.0		
J-DIX-2332	43.43	1,228	29.9	P-DIX-343	10
J-DIX-2334	41.13	1,271	26.1	P-DIX-1815	10
J-DIX-2336	44.27	1,605	20.0		
J-DIX-2338	45.6	1,390	28.5	P-DIX-961	10
J-DIX-234	41.56	881	29.7	P-DIX-3493	10
J-DIX-2340	46.19	1,643	20.8	P-DIX-930	10
J-DIX-2342	44.18	604	35.2	P-DIX-969	10
J-DIX-2344	44.83	667	32.9	P-DIX-2529	10
J-DIX-2346	45.61	1,297	31.6	P-DIX-2537	10
J-DIX-2348	43.57	1,770	25.5	P-DIX-2561	10
J-DIX-2350	43.65	1,557	29.4	P-DIX-2561	10
J-DIX-2352	44.26	1,418	30.3	P-DIX-1851	10
J-DIX-2354	44.09	682	24.4	P-DIX-1077	10
J-DIX-2356	44.93	740	21.1	P-DIX-1085	10
J-DIX-2358	44.34	1,206	36.6	P-DIX-1089	10
J-DIX-236	43.22	881	26.4	P-DIX-3495	10
J-DIX-2360	44.07	1,660	26.8	P-DIX-2057	10
J-DIX-2362	43.85	387	24.4	P-DIX-564	10
J-DIX-2364	43.88	527	37.2	P-DIX-2063	10
J-DIX-2366	44.25	1,478	32.1	P-DIX-1589	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-2368	44.39	1,189	36.8	P-DIX-1595	10
J-DIX-2370	42.33	153	33.8	P-DIX-2037	10
J-DIX-2372	43.59	346	20.0		
J-DIX-2374	46.51	881	41.0	P-DIX-657	10
J-DIX-2376	46.51	1,690	31.2	P-DIX-1535	10
J-DIX-2378	45.62	2,616	22.4	P-DIX-663	10
J-DIX-238	43.73	881	35.3	P-DIX-3499	10
J-DIX-2380	45.65	2,773	20.1		
J-DIX-2382	45.73	2,453	24.7	P-DIX-381	10
J-DIX-2384	46.48	2,759	20.1		
J-DIX-2386	46.1	2,905	20.1		
J-DIX-2388	47.28	1,392	37.1	P-DIX-1227	10
J-DIX-2390	46.93	1,247	38.4	P-DIX-1233	10
J-DIX-2392	47.17	1,240	38.5	P-DIX-2409	10
J-DIX-2394	46.85	1,651	33.3	P-DIX-1955	10
J-DIX-2396	46.75	1,203	38.5	P-DIX-2165	10
J-DIX-2398	50.68	609	35.8	P-DIX-1999	10
J-DIX-24	47.75	392	40.2	P-DIX-3973	10
J-DIX-240	42.88	881	34.6	P-DIX-3503	10
J-DIX-2400	50.25	411	44.4	P-DIX-2001	10
J-DIX-2402	50.32	414	44.0	P-DIX-2821	10
J-DIX-2404	50.57	139	41.9	P-DIX-2011	10
J-DIX-2406	47.14	2,915	20.1		
J-DIX-2408	48.37	1,914	28.8	P-DIX-569	10
J-DIX-2410	50.73	1,244	38.3	P-DIX-2217	10
J-DIX-2412	49.97	868	29.4	P-DIX-601	10
J-DIX-2414	48.96	871	20.7	P-DIX-603	10
J-DIX-2416	49.34	815	20.0		
J-DIX-2418	50.4	792	20.0		
J-DIX-242	42.99	881	35.0	P-DIX-3507	10
J-DIX-2420	50.32	1,404	28.4	P-DIX-2579	10
J-DIX-2422	47.23	1,402	35.5	P-DIX-411	10
J-DIX-2424	48.32	1,054	42.5	P-DIX-419	10
J-DIX-2426	48.47	2,340	20.1		
J-DIX-2428	48.15	2,302	21.2	P-DIX-861	10
J-DIX-2430	49.68	1,508	24.8	P-DIX-2645	10
J-DIX-2432	50.28	1,660	22.2	P-DIX-2575	10
J-DIX-2434	46.43	2,606	24.3	P-DIX-1879	10
J-DIX-2436	48.77	1,375	32.8	P-DIX-2127	10
J-DIX-2438	43.94	1,899	20.0		
J-DIX-244	44.17	881	34.0	P-DIX-3511	10
J-DIX-2440	44.45	1,919	20.7	P-DIX-1573	10
J-DIX-2444	45.05	1,560	20.2	P-DIX-675	10
J-DIX-2446	43.92	1,525	20.0		
J-DIX-2448	44.46	1,509	20.0		
J-DIX-2450	43.87	2,147	20.1		
J-DIX-2452	44.84	2,238	20.1		
J-DIX-2454	45.62	1,662	21.7	P-DIX-2729	10
J-DIX-2456	46.58	1,231	37.6	P-DIX-2155	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-2458	44.67	1,303	30.8	P-DIX-1807	10
J-DIX-246	42.25	881	31.9	P-DIX-3515	10
J-DIX-2460	44.8	1,402	26.8	P-DIX-1805	10
J-DIX-2462	43.55	1,502	20.0		
J-DIX-2464	43.11	1,489	20.0		
J-DIX-2466	43.86	587	37.0	P-DIX-1795	10
J-DIX-2468	46.87	756	34.0	P-DIX-791	10
J-DIX-2470	46.86	931	29.1	P-DIX-791	10
J-DIX-2472	46.43	1,472	31.2	P-DIX-328	10
J-DIX-2474	46.43	1,689	26.6	P-DIX-1557	10
J-DIX-2476	46.51	1,353	27.4	P-DIX-1543	10
J-DIX-2478	45.83	1,684	27.6	P-DIX-1773	10
J-DIX-248	42.82	881	33.3	P-DIX-3519	10
J-DIX-2494	46.13	1,007	43.5	P-DIX-9090	10
J-DIX-250	45.91	881	40.1	P-DIX-3293	10
J-DIX-2508	43.25	881	32.7	P-DIX-615	10
J-DIX-2510	46.44	98	31.0	P-DIX-139	10
J-DIX-2512	47.12	98	27.3	P-DIX-177	10
J-DIX-2514	50.58	98	28.4	P-DIX-13	10
J-DIX-2516	51.14	392	37.3	P-DIX-245	10
J-DIX-2518	53.77	392	38.3	P-DIX-241	10
J-DIX-252	44.54	881	39.0	P-DIX-3523	10
J-DIX-2520	49.52	881	30.7	P-DIX-311	10
J-DIX-2522	48	1,455	20.0		
J-DIX-2524	48.85	1,843	20.0		
J-DIX-2526	48.44	1,545	20.0		
J-DIX-2528	43.68	1,427	20.0		
J-DIX-2530	45.03	1,450	20.0		
J-DIX-2532	43.28	1,334	20.0		
J-DIX-2534	45.24	881	30.4	P-DIX-854	10
J-DIX-2536	43.29	881	31.8	P-DIX-2421	10
J-DIX-2538	43.7	881	33.3	P-DIX-1039	10
J-DIX-254	44.89	881	39.4	P-DIX-3529	10
J-DIX-2540	43.37	881	32.9	P-DIX-1035	10
J-DIX-2542	42.68	392	35.5	P-DIX-1031	10
J-DIX-2544	45.15	392	33.8	P-DIX-1059	10
J-DIX-2546	46.33	881	36.8	P-DIX-489	10
J-DIX-2548	47.03	98	28.2	P-DIX-2267	10
J-DIX-2550	46.35	881	38.0	P-DIX-2419	10
J-DIX-2552	46.66	1,567	28.0	P-DIX-2277	10
J-DIX-2554	41.98	881	26.1	P-DIX-2431	10
J-DIX-2556	49.23	881	32.1	P-DIX-1389	10
J-DIX-2558	50.26	750	20.0		
J-DIX-256	46.41	881	31.0	P-DIX-3553	10
J-DIX-2560	41.56	1,201	20.0		
J-DIX-2562	43.72	881	30.9	P-DIX-1113	10
J-DIX-2564	44.74	881	32.5	P-DIX-1119	10
J-DIX-2566	43.47	392	28.5	P-DIX-709	10
J-DIX-2568	42.6	392	28.3	P-DIX-713	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-2570	43.97	97	20.0		
J-DIX-2572	45.18	98	20.6	P-DIX-1845	10
J-DIX-2574	44.51	881	26.9	P-DIX-2571	10
J-DIX-2576	41.99	392	31.3	P-DIX-995	10
J-DIX-2578	43.28	392	32.8	P-DIX-1003	10
J-DIX-258	43.97	881	35.6	P-DIX-3535	10
J-DIX-2580	44	89	20.0		
J-DIX-2584	44.24	313	20.0		
J-DIX-2586	46.57	1,690	29.5	P-DIX-5031	10
J-DIX-2588	47.46	98	41.7	P-DIX-1983	10
J-DIX-2590	50.77	98	43.5	P-DIX-581	10
J-DIX-2592	50.54	98	32.1	P-DIX-583	10
J-DIX-2594	49.98	881	36.9	P-DIX-851	10
J-DIX-2596	49.14	1,567	32.2	P-DIX-2017	10
J-DIX-2598	46.41	392	35.4	P-DIX-2117	10
J-DIX-26	51.81	392	45.8	P-DIX-3987	10
J-DIX-260	44.12	881	37.0	P-DIX-3539	10
J-DIX-2600	50.19	881	40.7	P-DIX-1969	10
J-DIX-2602	51.22	1,397	20.0		
J-DIX-2604	43.92	881	26.2	P-DIX-286	10
J-DIX-2606	43.99	1,567	22.4	P-DIX-731	10
J-DIX-2608	42.66	881	32.3	P-DIX-1707	10
J-DIX-2610	43.59	881	31.6	P-DIX-2089	10
J-DIX-2612	42.75	881	30.2	P-DIX-1711	10
J-DIX-2614	44.79	881	33.6	P-DIX-2669	10
J-DIX-2616	44.53	881	31.2	P-DIX-2675	10
J-DIX-2618	46.13	881	32.6	P-DIX-2677	10
J-DIX-262	42.27	881	32.8	P-DIX-3543	10
J-DIX-2620	45.97	881	35.4	P-DIX-1715	10
J-DIX-2622	42.99	881	30.6	P-DIX-1841	10
J-DIX-2624	46.24	434	20.0		
J-DIX-2626	43.71	1,567	26.8	P-DIX-2139	10
J-DIX-2628	45.44	392	25.4	P-DIX-1445	10
J-DIX-2630	44.35	881	28.0	P-DIX-1451	10
J-DIX-2632	43.94	392	37.4	P-DIX-1459	10
J-DIX-2634	45.13	392	39.6	P-DIX-2777	10
J-DIX-2636	45.4	881	34.4	P-DIX-2775	10
J-DIX-2638	42.9	98	28.6	P-DIX-763	10
J-DIX-264	45.76	881	38.4	P-DIX-3547	10
J-DIX-2640	45.4	74	20.0		
J-DIX-2642	43.28	1,891	20.0		
J-DIX-2644	46.54	1,674	29.8	P-DIX-944	10
J-DIX-2646	46.55	392	36.8	P-DIX-2843	10
J-DIX-2648	43.39	1,896	20.0		
J-DIX-2650	45.61	1,355	34.2	P-DIX-2803	10
J-DIX-2652	45.02	2,004	20.0		
J-DIX-2654	45.73	1,139	35.6	P-DIX-511	10
J-DIX-2656	45.72	1,177	34.8	P-DIX-513	10
J-DIX-2658	44.54	1,762	20.0		

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-266	44.61	881	38.4	P-DIX-3551	10
J-DIX-2660	44.95	1,298	34.8	P-DIX-2555	10
J-DIX-2662	45.48	1,272	35.9	P-DIX-2553	10
J-DIX-2664	52.11	907	43.8	P-DIX-1251	10
J-DIX-2666	52.15	921	43.6	P-DIX-2259	10
J-DIX-2668	51.87	2,260	20.1		
J-DIX-2670	44.99	1,682	20.0		
J-DIX-2672	44.8	1,662	20.0		
J-DIX-2674	45.02	1,984	20.0		
J-DIX-2676	44.02	1,485	28.9	P-DIX-2805	10
J-DIX-2678	46.48	1,452	34.0	P-DIX-1509	10
J-DIX-268	45.26	881	40.2	P-DIX-3557	10
J-DIX-2680	46.27	1,142	36.4	P-DIX-1921	10
J-DIX-2682	46.82	1,509	31.8	P-DIX-103	10
J-DIX-2684	46.62	113	45.3	P-DIX-1255	10
J-DIX-2686	46.6	2,735	20.1		
J-DIX-2688	46.63	2,736	20.1		
J-DIX-2690	46.76	127	43.2	P-DIX-81	10
J-DIX-2692	46.04	1,525	32.6	P-DIX-105	10
J-DIX-2694	46.5	1,155	27.4	P-DIX-167	10
J-DIX-2696	46.5	1,244	20.0		
J-DIX-2698	47.99	880	37.5	P-DIX-2937	10
J-DIX-270	44.99	881	39.4	P-DIX-3561	10
J-DIX-2700	47.33	1,674	28.5	P-DIX-189	10
J-DIX-2702	47.33	1,748	26.9	P-DIX-1437	10
J-DIX-2704	49	686	34.8	P-DIX-205	10
J-DIX-2706	47.73	1,045	33.7	P-DIX-203	10
J-DIX-2708	48.93	1,057	33.8	P-DIX-201	10
J-DIX-2710	50.65	1,381	22.0	P-DIX-1827	10
J-DIX-2712	50.5	1,051	29.2	P-DIX-217	10
J-DIX-2714	50.54	1,078	27.8	P-DIX-219	10
J-DIX-2716	53.13	1,086	20.0		
J-DIX-2718	50.09	1,005	20.0		
J-DIX-272	42.81	881	32.7	P-DIX-3799	10
J-DIX-2720	50.09	1,003	20.0		
J-DIX-2722	51.88	1,033	20.0		
J-DIX-2724	51.88	1,033	20.0		
J-DIX-2726	51.61	1,042	20.0		
J-DIX-2728	46.36	1,202	40.0	P-DIX-1925	10
J-DIX-2730	50.74	2,172	20.5	P-DIX-1215	10
J-DIX-2732	52.07	1,852	29.1	P-DIX-1929	10
J-DIX-2734	50.95	1,625	20.2	P-DIX-1253	10
J-DIX-2736	46.59	890	41.9	P-DIX-1933	10
J-DIX-2738	44.87	1,354	31.8	P-DIX-2881	10
J-DIX-274	42.49	881	34.6	P-DIX-3803	10
J-DIX-2740	47.9	861	40.2	P-DIX-2883	10
J-DIX-2742	50.01	1,094	37.7	P-DIX-2885	10
J-DIX-2744	44.33	1,026	35.3	P-DIX-527	10
J-DIX-2746	44.63	881	39.1	P-DIX-971	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-2748	44.09	1,590	20.0		
J-DIX-2750	51.28	2,446	20.1		
J-DIX-2752	47.35	2,423	20.1		
J-DIX-2754	48.64	881	43.0	P-DIX-2897	10
J-DIX-2756	47.09	2,527	20.1		
J-DIX-2758	47.44	1,953	27.6	P-DIX-2867	10
J-DIX-276	43.82	881	36.0	P-DIX-3807	10
J-DIX-2760	47.58	1,197	38.4	P-DIX-2869	10
J-DIX-2762	47.83	1,309	36.6	P-DIX-2877	10
J-DIX-2764	47.58	881	41.3	P-DIX-2901	10
J-DIX-2766	48.07	1,304	37.6	P-DIX-1893	10
J-DIX-2768	46.27	2,541	20.1		
J-DIX-2770	46.27	1,039	39.9	P-DIX-1905	10
J-DIX-2772	46.36	881	40.5	P-DIX-1907	10
J-DIX-2774	45.98	996	39.5	P-DIX-1911	10
J-DIX-2776	46.27	2,552	20.1		
J-DIX-2778	46.27	881	40.8	P-DIX-2905	10
J-DIX-278	43.74	881	34.6	P-DIX-3809	10
J-DIX-2780	46.24	1,048	38.7	P-DIX-63	10
J-DIX-2782	46.67	1,063	40.3	P-DIX-67	10
J-DIX-2784	47.08	1,205	38.2	P-DIX-71	10
J-DIX-2786	46.96	1,174	38.5	P-DIX-69	10
J-DIX-2788	47.14	881	41.0	P-DIX-2909	10
J-DIX-2790	46.29	881	41.0	P-DIX-2913	10
J-DIX-2792	46.79	879	39.9	P-DIX-2917	10
J-DIX-2794	47.82	2,803	20.1		
J-DIX-2796	46.81	134	42.2	P-DIX-95	10
J-DIX-2798	46.42	881	41.8	P-DIX-2921	10
J-DIX-28	46.34	392	43.3	P-DIX-3989	10
J-DIX-280	41.99	881	33.5	P-DIX-3813	10
J-DIX-2800	46.65	1,416	33.5	P-DIX-101	10
J-DIX-2802	46.49	1,437	33.1	P-DIX-283	10
J-DIX-2804	46.51	1,291	35.1	P-DIX-285	10
J-DIX-2806	46.23	1,862	26.6	P-DIX-685	10
J-DIX-2808	46.36	1,291	36.0	P-DIX-109	10
J-DIX-2810	46.42	1,270	36.3	P-DIX-277	10
J-DIX-2812	47.19	112	45.8	P-DIX-121	10
J-DIX-2814	45.48	545	40.9	P-DIX-125	10
J-DIX-2816	47.19	2,861	20.1		
J-DIX-2818	47.19	881	42.8	P-DIX-2925	10
J-DIX-282	43.74	881	32.7	P-DIX-3823	10
J-DIX-2820	46.56	881	31.6	P-DIX-2929	10
J-DIX-2822	46.34	550	39.8	P-DIX-137	10
J-DIX-2824	46.39	95	40.3	P-DIX-303	10
J-DIX-2826	46.92	96	45.7	P-DIX-3693	10
J-DIX-2828	47.52	527	41.8	P-DIX-145	10
J-DIX-2830	47.09	1,402	33.1	P-DIX-149	10
J-DIX-2832	45.61	1,557	27.7	P-DIX-151	10
J-DIX-2834	45.6	881	35.6	P-DIX-2987	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-2836	47.12	501	43.8	P-DIX-157	10
J-DIX-2838	47.19	1,740	26.3	P-DIX-309	10
J-DIX-284	42.36	881	30.8	P-DIX-3291	10
J-DIX-2840	46.26	1,689	20.0		
J-DIX-2842	46.25	1,385	27.5	P-DIX-165	10
J-DIX-2844	47.99	880	37.8	P-DIX-2935	10
J-DIX-2846	47.99	1,085	34.2	P-DIX-900	10
J-DIX-2848	47.78	881	33.2	P-DIX-2939	10
J-DIX-2850	46.51	92	43.1	P-DIX-173	10
J-DIX-2852	47.71	881	35.4	P-DIX-2943	10
J-DIX-2854	47.53	1,561	31.0	P-DIX-187	10
J-DIX-2856	47.39	1,402	33.1	P-DIX-195	10
J-DIX-2858	47.4	1,746	25.2	P-DIX-197	10
J-DIX-286	44.15	881	33.7	P-DIX-3831	10
J-DIX-2860	48.28	993	38.5	P-DIX-199	10
J-DIX-2862	49.49	335	45.6	P-DIX-3795	10
J-DIX-2864	48.41	881	38.4	P-DIX-3697	10
J-DIX-2866	50.94	1,230	20.0		
J-DIX-2868	50.93	880	32.3	P-DIX-2947	10
J-DIX-2870	50.62	976	33.1	P-DIX-215	10
J-DIX-2872	51.65	1,413	20.0		
J-DIX-2874	51.64	879	36.8	P-DIX-2951	10
J-DIX-2876	50.53	881	31.7	P-DIX-2955	10
J-DIX-2878	50.48	96	45.9	P-DIX-11	10
J-DIX-288	43.02	881	34.5	P-DIX-3835	10
J-DIX-2880	50.98	389	43.5	P-DIX-247	10
J-DIX-2882	50.92	1,086	20.0		
J-DIX-2884	50.75	881	28.1	P-DIX-2959	10
J-DIX-2886	50.89	1,093	20.0		
J-DIX-2888	51.38	1,090	20.2	P-DIX-235	10
J-DIX-2890	51.74	1,063	20.0		
J-DIX-2892	52.62	881	28.4	P-DIX-2963	10
J-DIX-2894	50.09	880	25.4	P-DIX-2967	10
J-DIX-2896	50.09	1,007	20.0		
J-DIX-2898	51.02	881	25.2	P-DIX-2971	10
J-DIX-290	43.34	881	35.8	P-DIX-3839	10
J-DIX-2900	51.59	390	43.7	P-DIX-243	10
J-DIX-2902	52.5	881	27.2	P-DIX-2975	10
J-DIX-2904	51.75	1,035	20.0		
J-DIX-2906	51.61	1,044	20.0		
J-DIX-2908	50.83	1,028	20.0		
J-DIX-2910	50.75	1,081	20.0		
J-DIX-2912	50.04	1,084	20.0		
J-DIX-2914	51.1	878	30.2	P-DIX-2979	10
J-DIX-2916	47.98	881	37.9	P-DIX-2983	10
J-DIX-2918	48.08	1,681	20.0		
J-DIX-292	44.18	881	37.0	P-DIX-3843	10
J-DIX-2920	48.07	1,567	22.8	P-DIX-249	10
J-DIX-2922	47.91	392	44.8	P-DIX-3701	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-2924	47.78	1,643	20.0		
J-DIX-2926	46.67	392	43.6	P-DIX-3941	10
J-DIX-2928	48.41	1,664	20.0		
J-DIX-2930	47.33	881	38.7	P-DIX-3705	10
J-DIX-2932	50.69	880	35.7	P-DIX-2993	10
J-DIX-2934	50.59	878	35.3	P-DIX-313	10
J-DIX-2936	50.98	1,020	31.0	P-DIX-317	10
J-DIX-2938	50.94	981	32.3	P-DIX-321	10
J-DIX-294	44.86	881	37.0	P-DIX-3847	10
J-DIX-2940	50.37	881	32.1	P-DIX-2997	10
J-DIX-2942	48.32	879	38.3	P-DIX-2999	10
J-DIX-2944	47.78	1,563	25.0	P-DIX-1271	10
J-DIX-2946	47.74	1,759	20.0		
J-DIX-2948	47.71	1,755	20.0		
J-DIX-2950	47.58	881	38.7	P-DIX-3003	10
J-DIX-2952	49.03	1,837	20.0		
J-DIX-2954	49.26	881	40.5	P-DIX-3007	10
J-DIX-2956	48.33	1,835	20.0		
J-DIX-2958	48.33	1,758	21.9	P-DIX-1291	10
J-DIX-296	44.88	881	37.0	P-DIX-3851	10
J-DIX-2960	48.63	1,841	20.0		
J-DIX-2962	48.72	1,863	20.0		
J-DIX-2964	48.85	1,867	20.0		
J-DIX-2966	48.79	1,848	20.5	P-DIX-1303	10
J-DIX-2968	48.78	1,668	24.9	P-DIX-1301	10
J-DIX-2970	48.02	881	39.5	P-DIX-3011	10
J-DIX-2972	48.33	881	39.9	P-DIX-3015	10
J-DIX-2974	48.61	1,791	20.0		
J-DIX-2976	48.59	1,781	20.0		
J-DIX-2978	48.67	1,563	25.8	P-DIX-1317	10
J-DIX-298	44.13	881	36.8	P-DIX-3855	10
J-DIX-2980	48.91	881	39.7	P-DIX-3019	10
J-DIX-2982	48.36	881	37.5	P-DIX-3023	10
J-DIX-2986	47.96	881	39.6	P-DIX-3027	10
J-DIX-2990	47.4	2,335	20.1		
J-DIX-2996	48.74	1,729	20.0		
J-DIX-2998	48.08	880	38.7	P-DIX-3031	10
J-DIX-30	47.47	881	41.0	P-DIX-2899	10
J-DIX-300	45.26	881	34.1	P-DIX-3207	10
J-DIX-3000	48.89	881	39.5	P-DIX-3035	10
J-DIX-3002	48.78	878	39.8	P-DIX-3039	10
J-DIX-3004	48.23	1,728	20.0		
J-DIX-3006	48.33	1,772	20.0		
J-DIX-3010	44.57	1,549	20.0		
J-DIX-3012	43.61	880	26.9	P-DIX-1625	10
J-DIX-3014	45.17	881	34.0	P-DIX-3049	10
J-DIX-3016	45.09	878	30.1	P-DIX-3053	10
J-DIX-3018	43.93	881	32.6	P-DIX-3061	10
J-DIX-302	44.48	881	35.4	P-DIX-3213	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-3020	44.98	881	35.7	P-DIX-3977	10
J-DIX-3022	44.83	1,654	20.0		
J-DIX-3024	43.57	881	33.4	P-DIX-3065	10
J-DIX-3028	42.87	1,591	20.0		
J-DIX-3030	42.96	1,527	20.0		
J-DIX-3032	43.1	1,603	20.0		
J-DIX-3034	42.1	876	32.7	P-DIX-1373	10
J-DIX-3036	42.99	880	28.2	P-DIX-1377	10
J-DIX-3038	43.41	880	34.5	P-DIX-3073	10
J-DIX-304	46	881	36.6	P-DIX-3217	10
J-DIX-3040	44.2	1,860	20.0		
J-DIX-3042	44.38	1,871	20.0		
J-DIX-3044	44.16	881	36.2	P-DIX-3077	10
J-DIX-3046	43.89	881	35.7	P-DIX-3081	10
J-DIX-3048	43.24	1,821	20.0		
J-DIX-3050	45.03	2,019	20.0		
J-DIX-3052	47.19	2,159	20.1		
J-DIX-3054	45.59	2,081	20.0		
J-DIX-3056	41.57	1,067	32.1	P-DIX-1653	10
J-DIX-3058	42.31	877	33.9	P-DIX-2423	10
J-DIX-306	44.47	881	37.7	P-DIX-3221	10
J-DIX-3060	43.39	1,438	20.0		
J-DIX-3062	43.45	388	40.3	P-DIX-1667	10
J-DIX-3064	45.46	876	37.8	P-DIX-610	10
J-DIX-3066	46.54	878	38.9	P-DIX-150	10
J-DIX-3068	45.25	2,027	21.9	P-DIX-1045	10
J-DIX-3070	43.66	1,253	32.5	P-DIX-1047	10
J-DIX-3072	44.1	2,075	20.0		
J-DIX-3074	43.36	2,030	20.0		
J-DIX-3076	42.67	1,104	32.2	P-DIX-1051	10
J-DIX-3078	45.97	388	42.4	P-DIX-1057	10
J-DIX-308	43.25	881	33.0	P-DIX-3225	10
J-DIX-3080	44.71	1,108	34.3	P-DIX-1061	10
J-DIX-3082	44.77	1,478	20.0		
J-DIX-3084	42.49	1,414	20.0		
J-DIX-3086	46	1,901	20.0		
J-DIX-3088	44.56	1,088	38.4	P-DIX-1597	10
J-DIX-3090	44.21	1,943	29.1	P-DIX-2043	10
J-DIX-3092	43.59	1,989	20.0		
J-DIX-3094	43.54	881	36.6	P-DIX-3325	10
J-DIX-3096	45.57	2,619	22.3	P-DIX-689	10
J-DIX-3098	47.47	881	43.2	P-DIX-3329	10
J-DIX-310	42.13	881	34.5	P-DIX-3229	10
J-DIX-3100	45.55	2,282	27.1	P-DIX-1531	10
J-DIX-3102	45.72	1,075	39.9	P-DIX-687	10
J-DIX-3104	45.74	881	40.5	P-DIX-3741	10
J-DIX-3106	46.44	2,717	22.5	P-DIX-691	10
J-DIX-3108	46.48	1,783	34.3	P-DIX-1529	10
J-DIX-3110	46.44	1,621	32.2	P-DIX-695	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-3112	45.39	2,561	23.4	P-DIX-1537	10
J-DIX-3114	45.35	879	41.1	P-DIX-3333	10
J-DIX-3116	46.37	880	39.5	P-DIX-3663	10
J-DIX-3118	46.75	580	40.1	P-DIX-797	10
J-DIX-312	45.88	881	38.9	P-DIX-3289	10
J-DIX-3120	46.32	392	39.3	P-DIX-3971	10
J-DIX-3122	45.72	392	26.3	P-DIX-3781	10
J-DIX-3124	45.67	475	20.0		
J-DIX-3126	47.51	392	44.3	P-DIX-3785	10
J-DIX-3128	47.47	876	36.7	P-DIX-3671	10
J-DIX-3130	46.46	991	38.2	P-DIX-1547	10
J-DIX-3132	46.34	1,479	31.5	P-DIX-1551	10
J-DIX-3134	46.39	881	39.9	P-DIX-3675	10
J-DIX-3136	46.35	1,376	33.2	P-DIX-1553	10
J-DIX-3138	46.24	881	39.6	P-DIX-3679	10
J-DIX-314	44.59	881	37.8	P-DIX-3299	10
J-DIX-3140	46.44	1,325	34.3	P-DIX-1561	10
J-DIX-3142	46.39	1,657	20.0		
J-DIX-3144	46.39	392	44.0	P-DIX-3789	10
J-DIX-3146	45.6	1,463	31.0	P-DIX-805	10
J-DIX-3148	46.63	881	40.4	P-DIX-3685	10
J-DIX-3150	46.44	1,288	35.7	P-DIX-1767	10
J-DIX-316	45.89	881	41.4	P-DIX-3303	10
J-DIX-3160	46.59	1,465	32.7	P-DIX-330	10
J-DIX-3162	46.79	1,560	25.8	P-DIX-2787	10
J-DIX-3164	44.91	1,684	20.0		
J-DIX-3166	47.74	390	44.9	P-DIX-2841	10
J-DIX-3168	46.37	1,137	39.8	P-DIX-2809	10
J-DIX-3170	51.86	392	47.5	P-DIX-3985	10
J-DIX-3172	46.79	1,312	34.4	P-DIX-441	10
J-DIX-3174	46	2,137	20.1		
J-DIX-3176	46.69	2,082	22.0	P-DIX-451	10
J-DIX-3178	46.36	1,179	35.5	P-DIX-449	10
J-DIX-318	45	881	34.0	P-DIX-3307	10
J-DIX-3180	46.33	2,012	20.0		
J-DIX-3182	46.33	2,018	20.0		
J-DIX-3184	46.33	880	37.9	P-DIX-487	10
J-DIX-3186	45.35	1,393	30.5	P-DIX-497	10
J-DIX-3188	43.57	1,449	20.0		
J-DIX-3190	45.48	881	38.4	P-DIX-3091	10
J-DIX-3192	45.7	1,008	37.3	P-DIX-507	10
J-DIX-3194	45.69	1,240	33.5	P-DIX-509	10
J-DIX-3196	45.08	1,191	31.9	P-DIX-1257	10
J-DIX-3198	45.64	96	43.0	P-DIX-2265	10
J-DIX-32	47.67	881	40.4	P-DIX-2903	10
J-DIX-320	43.99	456	20.0		
J-DIX-3200	47.74	2,176	21.9	P-DIX-2273	10
J-DIX-3202	48.23	1,566	33.0	P-DIX-2275	10
J-DIX-3204	43.15	1,154	30.7	P-DIX-164	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-3206	45.42	1,300	31.6	P-DIX-2337	10
J-DIX-3208	45.5	2,014	20.0		
J-DIX-3210	44.34	1,053	34.9	P-DIX-2341	10
J-DIX-3212	44.29	1,950	20.0		
J-DIX-3214	45.58	2,076	20.0		
J-DIX-3216	43.61	879	35.4	P-DIX-699	10
J-DIX-3218	43.9	1,851	20.0		
J-DIX-322	44.32	881	31.8	P-DIX-3315	10
J-DIX-3220	44.22	879	36.2	P-DIX-2095	10
J-DIX-3222	44.22	1,883	20.0		
J-DIX-3224	42.42	881	29.7	P-DIX-2101	10
J-DIX-3226	42.9	880	35.0	P-DIX-2103	10
J-DIX-3228	43.56	881	35.6	P-DIX-2113	10
J-DIX-3230	43.38	1,895	20.0		
J-DIX-3232	45.01	1,041	35.6	P-DIX-1065	10
J-DIX-3234	45.02	1,041	35.8	P-DIX-2849	10
J-DIX-3236	43.28	1,074	33.5	P-DIX-2861	10
J-DIX-3238	43.85	881	34.3	P-DIX-3261	10
J-DIX-324	43.15	881	34.4	P-DIX-3319	10
J-DIX-3240	43.49	1,259	29.0	P-DIX-606	10
J-DIX-3242	43.26	881	34.8	P-DIX-3097	10
J-DIX-3244	43.64	881	34.0	P-DIX-3105	10
J-DIX-3246	43.32	881	34.9	P-DIX-3109	10
J-DIX-3248	43.26	1,250	29.0	P-DIX-604	10
J-DIX-3250	43.52	1,312	27.6	P-DIX-152	10
J-DIX-3252	43.65	880	35.0	P-DIX-3113	10
J-DIX-3254	45.01	1,141	32.5	P-DIX-1673	10
J-DIX-3256	46.1	881	34.8	P-DIX-3117	10
J-DIX-3258	43.53	1,660	20.0		
J-DIX-326	45.06	881	38.6	P-DIX-3323	10
J-DIX-3260	43.2	881	34.2	P-DIX-3121	10
J-DIX-3262	43.28	1,064	33.2	P-DIX-1681	10
J-DIX-3264	44.42	1,120	32.0	P-DIX-703	10
J-DIX-3266	44.78	881	32.8	P-DIX-3125	10
J-DIX-3268	45.02	881	37.5	P-DIX-3979	10
J-DIX-3270	44.17	1,829	20.0		
J-DIX-3272	43.54	1,260	30.2	P-DIX-2249	10
J-DIX-3274	43.4	1,822	20.0		
J-DIX-3276	43.28	881	35.5	P-DIX-3131	10
J-DIX-3278	45.01	881	37.5	P-DIX-3135	10
J-DIX-328	43.62	881	36.3	P-DIX-3327	10
J-DIX-3280	45.01	1,953	20.0		
J-DIX-3282	44.21	1,764	20.0		
J-DIX-3284	43.74	881	35.1	P-DIX-3139	10
J-DIX-3286	43.91	1,560	23.9	P-DIX-2417	10
J-DIX-3288	44.27	876	35.1	P-DIX-2381	10
J-DIX-3290	44.8	1,746	20.0		
J-DIX-3292	44.83	881	36.1	P-DIX-3143	10
J-DIX-3294	44.32	878	34.2	P-DIX-2385	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-3296	43.79	1,561	24.1	P-DIX-2387	10
J-DIX-3298	43.82	881	35.4	P-DIX-3147	10
J-DIX-330	45.28	881	40.3	P-DIX-3331	10
J-DIX-3300	45.29	1,139	32.1	P-DIX-2247	10
J-DIX-3302	46.55	1,148	33.7	P-DIX-541	10
J-DIX-3304	44.81	880	35.8	P-DIX-3151	10
J-DIX-3306	44.41	1,424	26.2	P-DIX-539	10
J-DIX-3308	44.07	881	32.6	P-DIX-2111	10
J-DIX-3310	43.15	881	34.9	P-DIX-3157	10
J-DIX-3312	44.14	881	33.2	P-DIX-3161	10
J-DIX-3314	46.33	881	38.8	P-DIX-3165	10
J-DIX-3316	43.89	880	32.9	P-DIX-3169	10
J-DIX-3318	42.67	881	34.6	P-DIX-3173	10
J-DIX-332	44.97	881	40.3	P-DIX-3335	10
J-DIX-3320	46.09	880	37.6	P-DIX-3177	10
J-DIX-3322	44.58	881	36.4	P-DIX-3181	10
J-DIX-3324	42.37	880	31.6	P-DIX-3185	10
J-DIX-3326	42.69	881	34.7	P-DIX-3189	10
J-DIX-3328	42.56	881	35.7	P-DIX-3193	10
J-DIX-3330	48.95	878	41.7	P-DIX-3197	10
J-DIX-3332	44.25	881	36.2	P-DIX-3201	10
J-DIX-3334	44.69	881	36.7	P-DIX-3233	10
J-DIX-3336	45.12	880	37.8	P-DIX-3237	10
J-DIX-3338	41.78	881	34.7	P-DIX-3241	10
J-DIX-334	46.55	881	41.6	P-DIX-3339	10
J-DIX-3340	42.77	880	31.9	P-DIX-3245	10
J-DIX-3342	45.42	881	37.4	P-DIX-3249	10
J-DIX-3344	42.41	881	26.0	P-DIX-2099	10
J-DIX-3346	45.24	2,004	20.0		
J-DIX-3348	43.24	881	28.6	P-DIX-3253	10
J-DIX-3350	42.92	881	35.3	P-DIX-3101	10
J-DIX-3352	46.5	881	38.9	P-DIX-3257	10
J-DIX-3354	49.14	1,763	20.0		
J-DIX-3356	49.41	1,750	20.0		
J-DIX-3358	47.88	881	36.7	P-DIX-775	10
J-DIX-336	46.33	881	41.1	P-DIX-3343	10
J-DIX-3360	47.77	392	43.7	P-DIX-3709	10
J-DIX-3362	47.53	881	35.8	P-DIX-3263	10
J-DIX-3364	48.72	881	38.9	P-DIX-3267	10
J-DIX-3366	49.04	1,847	20.0		
J-DIX-3368	49.32	1,894	20.0		
J-DIX-3370	49.8	1,870	20.0		
J-DIX-3372	49.71	1,570	20.0		
J-DIX-3374	49.95	879	36.7	P-DIX-1387	10
J-DIX-3376	49.85	879	35.5	P-DIX-3271	10
J-DIX-3378	49.07	1,379	25.5	P-DIX-1393	10
J-DIX-338	46.29	881	39.5	P-DIX-3347	10
J-DIX-3380	49.02	881	36.7	P-DIX-3275	10
J-DIX-3382	49.07	1,585	20.0		

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-3384	45.63	2,337	20.1		
J-DIX-3386	45.52	1,125	36.6	P-DIX-1507	10
J-DIX-3388	46.26	2,282	20.1		
J-DIX-3390	45.45	1,026	37.3	P-DIX-987	10
J-DIX-3392	45.62	881	38.1	P-DIX-3279	10
J-DIX-3394	45.69	2,236	20.1		
J-DIX-3396	45.86	881	39.5	P-DIX-3283	10
J-DIX-3398	48.71	2,398	20.1		
J-DIX-34	48.01	881	42.1	P-DIX-2907	10
J-DIX-340	47	881	40.4	P-DIX-3351	10
J-DIX-3400	47.96	881	42.0	P-DIX-3287	10
J-DIX-3402	47.09	1,813	20.0		
J-DIX-3404	47.1	1,813	20.0		
J-DIX-3406	45.3	1,238	31.8	P-DIX-1485	10
J-DIX-3408	45.38	1,063	34.6	P-DIX-1483	10
J-DIX-3410	45.34	1,234	30.9	P-DIX-1487	10
J-DIX-3412	45.21	1,511	26.0	P-DIX-1491	10
J-DIX-3414	46.51	387	43.5	P-DIX-3713	10
J-DIX-3416	46.57	391	43.6	P-DIX-3949	10
J-DIX-3418	45.43	881	36.2	P-DIX-3403	10
J-DIX-342	47.44	881	41.3	P-DIX-3355	10
J-DIX-3420	45.56	880	35.9	P-DIX-3407	10
J-DIX-3422	44.8	1,629	20.0		
J-DIX-3424	46.76	876	37.3	P-DIX-3717	10
J-DIX-3426	45.59	1,503	20.0		
J-DIX-3428	47.1	881	38.1	P-DIX-3413	10
J-DIX-3430	47.74	880	39.0	P-DIX-3719	10
J-DIX-3432	47.1	881	38.4	P-DIX-3723	10
J-DIX-3434	46.44	1,567	25.6	P-DIX-3729	10
J-DIX-3436	46.54	877	37.9	P-DIX-3427	10
J-DIX-3438	46.71	1,831	20.0		
J-DIX-344	46.01	881	41.2	P-DIX-3359	10
J-DIX-3440	45.62	880	36.2	P-DIX-3419	10
J-DIX-3444	42.53	1,612	20.0		
J-DIX-3446	43.72	1,833	20.0		
J-DIX-3448	43.73	1,139	32.5	P-DIX-1129	10
J-DIX-3450	42.57	1,501	20.0		
J-DIX-3452	43.98	1,506	20.0		
J-DIX-3454	44.26	881	34.1	P-DIX-3485	10
J-DIX-3456	44.49	1,539	20.0		
J-DIX-3458	44.64	1,606	20.0		
J-DIX-346	47.25	881	41.0	P-DIX-3363	10
J-DIX-3460	43.55	881	34.8	P-DIX-3733	10
J-DIX-3462	41.56	1,238	20.0		
J-DIX-3464	41.56	879	28.7	P-DIX-623	10
J-DIX-3466	43.29	880	25.2	P-DIX-627	10
J-DIX-3468	41.56	880	30.1	P-DIX-3491	10
J-DIX-3470	43.29	876	32.4	P-DIX-629	10
J-DIX-3472	43.34	878	27.1	P-DIX-633	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-3474	41.56	1,556	20.1	P-DIX-985	10
J-DIX-3476	41.56	1,589	20.0		
J-DIX-3478	43.73	881	35.7	P-DIX-3497	10
J-DIX-348	47.83	881	41.4	P-DIX-3367	10
J-DIX-3480	43.73	1,874	20.0		
J-DIX-3482	42.29	1,139	31.3	P-DIX-1101	10
J-DIX-3484	42.35	1,786	20.0		
J-DIX-3486	42.75	881	34.9	P-DIX-3501	10
J-DIX-3488	43.05	1,847	20.0		
J-DIX-3490	43.04	881	35.4	P-DIX-3505	10
J-DIX-3492	43.76	1,560	20.0		
J-DIX-3494	44.17	880	34.4	P-DIX-3509	10
J-DIX-3496	43.68	877	33.8	P-DIX-1111	10
J-DIX-3498	43.49	1,531	20.0		
J-DIX-350	49.58	881	42.6	P-DIX-3371	10
J-DIX-3500	43.54	881	33.6	P-DIX-3513	10
J-DIX-3502	44.69	877	34.7	P-DIX-1117	10
J-DIX-3504	42.62	881	33.5	P-DIX-3517	10
J-DIX-3506	45.5	1,420	35.1	P-DIX-2471	10
J-DIX-3508	45.77	881	40.4	P-DIX-3295	10
J-DIX-3510	44.64	2,109	27.5	P-DIX-2477	10
J-DIX-3512	44.18	2,589	20.1		
J-DIX-3514	44.44	2,376	23.5	P-DIX-2489	10
J-DIX-3516	45.59	2,600	21.5	P-DIX-2491	10
J-DIX-3518	44.6	881	39.9	P-DIX-3521	10
J-DIX-352	48.49	881	40.9	P-DIX-3375	10
J-DIX-3520	44.48	2,219	24.8	P-DIX-2497	10
J-DIX-3522	45.24	2,604	20.1		
J-DIX-3524	44.95	880	40.0	P-DIX-3525	10
J-DIX-3526	44.81	2,095	24.5	P-DIX-2505	10
J-DIX-3528	45.99	1,285	34.5	P-DIX-2069	10
J-DIX-3530	46.45	880	31.4	P-DIX-3531	10
J-DIX-3532	45.69	387	41.2	P-DIX-707	10
J-DIX-3534	44.24	388	39.7	P-DIX-711	10
J-DIX-3536	43.5	1,567	26.4	P-DIX-717	10
J-DIX-3538	45	881	37.0	P-DIX-3533	10
J-DIX-354	47.65	881	40.3	P-DIX-3379	10
J-DIX-3540	45.11	1,324	33.5	P-DIX-721	10
J-DIX-3542	43.84	1,391	31.5	P-DIX-725	10
J-DIX-3544	44.12	881	37.4	P-DIX-3537	10
J-DIX-3546	43.96	1,126	34.9	P-DIX-727	10
J-DIX-3548	43.78	1,123	33.9	P-DIX-891	10
J-DIX-3550	42.27	881	33.2	P-DIX-3541	10
J-DIX-3552	43.95	103	43.0	P-DIX-903	10
J-DIX-3554	44.21	131	20.0		
J-DIX-3556	44.84	100	43.8	P-DIX-2541	10
J-DIX-3558	45.76	881	38.8	P-DIX-3545	10
J-DIX-356	47.9	881	38.9	P-DIX-3383	10
J-DIX-3560	45.7	1,561	29.7	P-DIX-925	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-3562	45.58	1,677	27.3	P-DIX-927	10
J-DIX-3564	44.85	2,400	20.1		
J-DIX-3566	44.67	881	39.2	P-DIX-3549	10
J-DIX-3568	45.84	880	38.3	P-DIX-475	10
J-DIX-3570	45.69	1,390	34.4	P-DIX-643	10
J-DIX-3572	44.81	1,184	37.7	P-DIX-647	10
J-DIX-3574	44.35	881	39.7	P-DIX-3555	10
J-DIX-3576	44.47	2,636	20.1		
J-DIX-3578	44.96	881	40.3	P-DIX-3559	10
J-DIX-358	50.76	881	41.9	P-DIX-3387	10
J-DIX-3580	44.97	2,134	26.5	P-DIX-862	10
J-DIX-3582	45.58	881	39.7	P-DIX-3563	10
J-DIX-3584	46.41	1,448	34.0	P-DIX-559	10
J-DIX-3586	44.29	1,378	33.4	P-DIX-2495	10
J-DIX-3588	45.59	97	41.7	P-DIX-1847	10
J-DIX-3590	44.27	1,338	34.1	P-DIX-483	10
J-DIX-3592	42.83	1,220	32.9	P-DIX-1177	10
J-DIX-3594	44.97	1,124	38.0	P-DIX-1179	10
J-DIX-3596	44.95	1,146	36.2	P-DIX-1185	10
J-DIX-3598	42.02	1,189	29.4	P-DIX-833	10
J-DIX-36	47.15	881	40.6	P-DIX-2911	10
J-DIX-360	50.92	881	37.9	P-DIX-3391	10
J-DIX-3600	42.86	881	33.2	P-DIX-3567	10
J-DIX-3602	43.17	878	33.2	P-DIX-2079	10
J-DIX-3604	42.99	1,492	20.3	P-DIX-837	10
J-DIX-3606	42.19	389	38.6	P-DIX-993	10
J-DIX-3608	43.29	390	39.9	P-DIX-1001	10
J-DIX-3610	42.49	881	35.0	P-DIX-3801	10
J-DIX-3612	44.57	97	42.8	P-DIX-2889	10
J-DIX-3614	43.94	1,154	33.5	P-DIX-1009	10
J-DIX-3616	43.78	881	36.4	P-DIX-3805	10
J-DIX-3618	43.76	1,183	32.6	P-DIX-206	10
J-DIX-362	49.42	881	36.3	P-DIX-3395	10
J-DIX-3620	43.75	1,127	32.6	P-DIX-1943	10
J-DIX-3622	43.74	1,158	31.5	P-DIX-1941	10
J-DIX-3624	43.74	881	35.0	P-DIX-3811	10
J-DIX-3626	43.74	1,152	32.3	P-DIX-1945	10
J-DIX-3628	43.74	1,259	29.1	P-DIX-1947	10
J-DIX-3630	41.13	1,149	29.5	P-DIX-2081	10
J-DIX-3632	42.36	1,067	33.1	P-DIX-2027	10
J-DIX-3634	42.26	881	34.6	P-DIX-3815	10
J-DIX-3636	43.74	1,524	20.0		
J-DIX-3638	43.74	880	33.6	P-DIX-3819	10
J-DIX-364	50.62	881	21.3	P-DIX-3429	10
J-DIX-3640	42.2	880	31.5	P-DIX-3825	10
J-DIX-3642	41.8	1,368	20.0		
J-DIX-3644	44.17	879	34.1	P-DIX-3829	10
J-DIX-3646	43.12	881	35.0	P-DIX-3833	10
J-DIX-3648	43.28	1,828	20.0		

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-3650	43.77	1,355	30.2	P-DIX-1923	10
J-DIX-3652	43.38	881	36.3	P-DIX-3837	10
J-DIX-3654	43.52	1,957	20.0		
J-DIX-3656	44.12	881	37.3	P-DIX-3841	10
J-DIX-3658	43.95	2,042	20.0		
J-DIX-366	50.27	881	37.5	P-DIX-3433	10
J-DIX-3660	43.5	1,925	22.0	P-DIX-1523	10
J-DIX-3662	43.56	2,097	20.0		
J-DIX-3664	43.9	2,118	20.0		
J-DIX-3666	42.61	2,018	20.0		
J-DIX-3668	44.86	881	37.4	P-DIX-3845	10
J-DIX-3670	44.86	1,566	27.9	P-DIX-214	10
J-DIX-3672	44.71	881	37.2	P-DIX-3849	10
J-DIX-3674	44.66	1,566	27.5	P-DIX-1405	10
J-DIX-3676	44.37	1,567	28.1	P-DIX-3737	10
J-DIX-3678	43.94	2,011	20.0		
J-DIX-368	49.21	881	40.6	P-DIX-3871	10
J-DIX-3682	44.09	1,089	35.5	P-DIX-331	10
J-DIX-3684	44.13	881	37.2	P-DIX-3853	10
J-DIX-3686	44.66	1,463	20.0		
J-DIX-3688	45.39	879	34.7	P-DIX-3205	10
J-DIX-3690	44.76	1,466	20.0		
J-DIX-3692	44.27	881	36.1	P-DIX-3209	10
J-DIX-3694	43.34	1,141	32.2	P-DIX-341	10
J-DIX-3696	41.19	1,876	20.0		
J-DIX-3698	44.28	1,609	20.0		
J-DIX-370	49.1	881	39.4	P-DIX-3437	10
J-DIX-3700	46.12	881	37.1	P-DIX-3215	10
J-DIX-3702	44.5	881	38.1	P-DIX-3219	10
J-DIX-3704	44.46	517	39.7	P-DIX-2887	10
J-DIX-3706	44.83	657	33.3	P-DIX-973	10
J-DIX-3708	44.34	1,269	31.4	P-DIX-943	10
J-DIX-3710	42.9	1,330	24.9	P-DIX-1611	10
J-DIX-3712	43.03	881	33.6	P-DIX-3223	10
J-DIX-3714	43.79	1,619	20.0		
J-DIX-3716	43.42	1,592	25.6	P-DIX-1053	10
J-DIX-3718	42.02	881	34.8	P-DIX-3227	10
J-DIX-372	48.9	881	40.8	P-DIX-3875	10
J-DIX-3720	41.88	1,157	31.4	P-DIX-224	10
J-DIX-3722	43.16	1,541	27.1	P-DIX-2517	10
J-DIX-3724	44.91	491	41.0	P-DIX-2527	10
J-DIX-3726	45.81	1,103	37.9	P-DIX-2535	10
J-DIX-3728	45.91	881	39.8	P-DIX-3231	10
J-DIX-3730	44.87	1,359	34.3	P-DIX-2563	10
J-DIX-3732	45.12	1,338	34.2	P-DIX-2065	10
J-DIX-3734	44.27	1,434	30.0	P-DIX-1853	10
J-DIX-3736	44.22	542	40.7	P-DIX-1601	10
J-DIX-3738	44.56	881	38.3	P-DIX-3297	10
J-DIX-374	47.89	881	40.6	P-DIX-3879	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-3740	44.7	1,215	35.9	P-DIX-1855	10
J-DIX-3742	44.46	1,510	32.1	P-DIX-1859	10
J-DIX-3744	44.66	1,393	33.5	P-DIX-1861	10
J-DIX-3746	45.14	1,256	37.0	P-DIX-1865	10
J-DIX-3748	45.78	881	41.8	P-DIX-3301	10
J-DIX-3750	46.1	3,043	20.6	P-DIX-1871	10
J-DIX-3752	46.37	1,090	40.8	P-DIX-1877	10
J-DIX-3754	46.39	2,378	27.9	P-DIX-1881	10
J-DIX-3756	42.63	123	39.8	P-DIX-1609	10
J-DIX-3758	42.56	1,532	20.0		
J-DIX-376	49.78	881	38.6	P-DIX-3441	10
J-DIX-3760	45.01	497	39.7	P-DIX-1075	10
J-DIX-3762	44.86	1,493	20.0		
J-DIX-3764	44.99	881	34.4	P-DIX-3305	10
J-DIX-3766	44.24	428	41.9	P-DIX-1083	10
J-DIX-3768	44.35	1,247	35.3	P-DIX-369	10
J-DIX-3770	45.77	1,506	32.9	P-DIX-1087	10
J-DIX-3772	43.97	456	20.0		
J-DIX-3774	43.82	388	23.9	P-DIX-1095	10
J-DIX-3776	44.19	881	33.6	P-DIX-3313	10
J-DIX-3778	43.19	881	34.9	P-DIX-3317	10
J-DIX-378	49.34	881	38.0	P-DIX-3445	10
J-DIX-3780	44.2	1,288	34.5	P-DIX-2055	10
J-DIX-3782	44.16	881	38.4	P-DIX-3321	10
J-DIX-3784	44.36	1,681	28.9	P-DIX-375	10
J-DIX-3786	44.25	1,509	31.6	P-DIX-1591	10
J-DIX-3788	45.69	2,432	25.0	P-DIX-379	10
J-DIX-3790	46.47	2,757	20.1		
J-DIX-3792	46.41	2,900	20.1		
J-DIX-3794	46.55	880	42.2	P-DIX-3337	10
J-DIX-3796	46.41	2,912	20.1		
J-DIX-3798	46.21	2,916	20.1		
J-DIX-38	46.29	881	40.6	P-DIX-2915	10
J-DIX-380	50.26	881	39.0	P-DIX-3449	10
J-DIX-3800	46.3	2,238	28.7	P-DIX-1927	10
J-DIX-3802	46.17	1,260	38.5	P-DIX-1195	10
J-DIX-3804	46.19	881	42.0	P-DIX-3341	10
J-DIX-3806	46.39	881	40.0	P-DIX-3345	10
J-DIX-3808	46.3	1,162	39.8	P-DIX-1199	10
J-DIX-3810	46.23	1,332	35.9	P-DIX-1205	10
J-DIX-3812	47.01	881	41.1	P-DIX-3349	10
J-DIX-3814	46.27	387	44.4	P-DIX-3745	10
J-DIX-3816	47.33	1,426	36.6	P-DIX-1229	10
J-DIX-3818	47.44	2,391	20.1		
J-DIX-382	50.43	881	39.6	P-DIX-3453	10
J-DIX-3820	46.88	1,274	37.9	P-DIX-1231	10
J-DIX-3822	47.44	1,132	39.7	P-DIX-2395	10
J-DIX-3824	47.46	1,388	36.3	P-DIX-2397	10
J-DIX-3826	47.28	1,260	38.2	P-DIX-2399	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-3828	47.04	1,219	39.1	P-DIX-2405	10
J-DIX-3830	47.09	1,153	39.8	P-DIX-2403	10
J-DIX-3832	45.93	881	41.7	P-DIX-3357	10
J-DIX-3834	46.2	1,221	38.9	P-DIX-1763	10
J-DIX-3836	47.03	1,321	37.3	P-DIX-1765	10
J-DIX-3838	47.19	881	41.3	P-DIX-3361	10
J-DIX-384	49.92	881	34.6	P-DIX-3463	10
J-DIX-3840	46.9	1,135	39.2	P-DIX-399	10
J-DIX-3842	47.79	1,610	25.6	P-DIX-1951	10
J-DIX-3844	46.83	1,275	37.8	P-DIX-1961	10
J-DIX-3846	46.71	1,224	38.1	P-DIX-2167	10
J-DIX-3848	47.99	1,178	39.4	P-DIX-1971	10
J-DIX-3850	48.16	1,208	39.2	P-DIX-2171	10
J-DIX-3852	47.95	881	42.2	P-DIX-3365	10
J-DIX-3854	48.33	1,371	36.8	P-DIX-1973	10
J-DIX-3856	47.86	1,339	37.0	P-DIX-1421	10
J-DIX-3858	47.49	1,196	39.0	P-DIX-1423	10
J-DIX-386	49.95	881	32.9	P-DIX-3455	10
J-DIX-3860	47.88	1,430	34.3	P-DIX-1433	10
J-DIX-3862	49.58	881	43.3	P-DIX-3369	10
J-DIX-3864	49.29	1,406	36.1	P-DIX-2813	10
J-DIX-3866	49.57	1,248	39.0	P-DIX-2817	10
J-DIX-3868	48.26	880	41.4	P-DIX-3373	10
J-DIX-3870	47.51	1,478	33.8	P-DIX-1985	10
J-DIX-3872	47.6	1,533	32.8	P-DIX-250	10
J-DIX-3874	47.58	881	41.2	P-DIX-3377	10
J-DIX-3876	47.47	1,453	33.9	P-DIX-1993	10
J-DIX-3878	47.8	600	43.4	P-DIX-2199	10
J-DIX-388	50.39	881	31.0	P-DIX-3465	10
J-DIX-3880	48.61	1,423	33.5	P-DIX-2203	10
J-DIX-3882	48.89	506	43.3	P-DIX-2211	10
J-DIX-3884	48.89	1,255	35.9	P-DIX-2207	10
J-DIX-3886	47.85	881	39.5	P-DIX-3381	10
J-DIX-3888	47.87	392	45.0	P-DIX-3957	10
J-DIX-3890	47.77	219	46.0	P-DIX-3961	10
J-DIX-3892	48.44	391	45.8	P-DIX-3749	10
J-DIX-3894	50.76	881	42.3	P-DIX-3385	10
J-DIX-3896	50.64	378	46.7	P-DIX-2221	10
J-DIX-3898	52.22	392	47.9	P-DIX-3753	10
J-DIX-390	50.46	881	38.6	P-DIX-3461	10
J-DIX-3900	50.9	1,000	36.0	P-DIX-2261	10
J-DIX-3902	50.91	1,517	23.4	P-DIX-1245	10
J-DIX-3904	50.91	880	38.3	P-DIX-3389	10
J-DIX-3906	51.03	1,021	35.9	P-DIX-1249	10
J-DIX-3908	51	1,641	20.0		
J-DIX-3910	49.42	880	36.7	P-DIX-3393	10
J-DIX-3912	50.7	1,641	20.0		
J-DIX-3914	49.87	1,418	31.7	P-DIX-2233	10
J-DIX-3916	50.02	1,081	38.2	P-DIX-2237	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-3918	49.84	498	43.8	P-DIX-2241	10
J-DIX-392	50.33	881	37.9	P-DIX-3469	10
J-DIX-3920	51.03	98	45.1	P-DIX-585	10
J-DIX-3922	49.79	473.28	44.1	P-DIX-525	10
J-DIX-3924	50.54	880.69	22.2	P-DIX-3397	10
J-DIX-3926	50.19	118.49	47.2	P-DIX-2005	10
J-DIX-3928	50.16	111.39	47.9	P-DIX-2007	10
J-DIX-3930	50.14	881.28	37.8	P-DIX-3431	10
J-DIX-3932	49.36	881.28	41.3	P-DIX-3869	10
J-DIX-3934	49.43	2147.18	20.1		
J-DIX-3936	48.14	871.04	40.1	P-DIX-849	10
J-DIX-3938	49.19	880.54	40.5	P-DIX-3435	10
J-DIX-394	46.43	881.28	39.6	P-DIX-3473	10
J-DIX-3940	49.54	1566.72	31.8	P-DIX-977	10
J-DIX-3942	49.38	867.79	41.8	P-DIX-3873	10
J-DIX-3944	48	1991.59	25.3	P-DIX-853	10.01
J-DIX-3946	47.98	881.28	41.3	P-DIX-3877	10
J-DIX-3948	48.24	1566.72	33.8	P-DIX-2015	10
J-DIX-3950	47.62	2932.05	20.1		
J-DIX-3952	47.31	1047.08	41.8	P-DIX-575	10
J-DIX-3954	49.58	1565.76	21.7	P-DIX-2581	10
J-DIX-3956	49.72	1547.32	22.4	P-DIX-2581	10
J-DIX-3958	49.59	862.68	38.0	P-DIX-599	10
J-DIX-396	46.83	881.28	40.0	P-DIX-3477	10
J-DIX-3960	49.02	870.83	20.0		
J-DIX-3962	50.24	781.63	20.0		
J-DIX-3964	49.88	1307.32	31.3	P-DIX-2577	10
J-DIX-3966	49.85	881.28	39.0	P-DIX-3439	10
J-DIX-3968	49.39	881.28	38.4	P-DIX-3443	10
J-DIX-3970	48.66	1634.65	22.4	P-DIX-2583	10
J-DIX-3972	49.65	1231.23	32.0	P-DIX-2585	10
J-DIX-3974	50.25	1252.19	34.2	P-DIX-2591	10
J-DIX-3976	50.12	1163.58	34.9	P-DIX-2593	10
J-DIX-3978	50.16	880.55	39.3	P-DIX-3447	10
J-DIX-398	47.09	881.28	41.7	P-DIX-3481	10
J-DIX-3980	50.74	1314.5	32.9	P-DIX-2599	10
J-DIX-3982	50.59	881.28	40.1	P-DIX-3451	10
J-DIX-3984	49.97	879.46	39.2	P-DIX-2601	10
J-DIX-3986	49.9	1361.61	20.0		
J-DIX-3988	50.38	879.67	38.2	P-DIX-2605	10
J-DIX-3990	49.98	880.23	33.5	P-DIX-2607	10
J-DIX-3992	51.04	877.44	39.3	P-DIX-2609	10
J-DIX-3994	51.25	878.74	33.2	P-DIX-981	10
J-DIX-3996	50.49	881.1	31.8	P-DIX-983	10
J-DIX-3998	50.4	880.96	38.9	P-DIX-3459	10
J-DIX-40	46.82	881.28	39.5	P-DIX-2919	10
J-DIX-400	47.85	881.28	42.6	P-DIX-3399	10
J-DIX-4000	49.59	878.66	37.4	P-DIX-2119	10
J-DIX-4002	49.68	1079.62	31.9	P-DIX-2619	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-4004	50.37	880.17	38.3	P-DIX-3467	10
J-DIX-4006	50.53	2419.84	20.1		
J-DIX-4008	47.1	1354.68	36.0	P-DIX-2623	10
J-DIX-4010	46.8	1327.14	35.8	P-DIX-2627	10
J-DIX-4012	46.52	880.57	40.4	P-DIX-3471	10
J-DIX-4014	47.03	881.04	40.7	P-DIX-3757	10
J-DIX-4016	45.58	1378.49	34.0	P-DIX-2633	10
J-DIX-4018	46.91	880.89	39.1	P-DIX-3761	10
J-DIX-402	50.98	881.28	41.9	P-DIX-3865	10
J-DIX-4020	46.61	880.54	40.2	P-DIX-3475	10
J-DIX-4022	46.55	881.28	40.4	P-DIX-3765	10
J-DIX-4024	47.06	2526.28	22.5	P-DIX-278	10
J-DIX-4026	47.09	881.06	42.3	P-DIX-3479	10
J-DIX-4028	47.43	1102.28	40.9	P-DIX-1513	10
J-DIX-4030	47.78	1013.27	42.5	P-DIX-413	10.01
J-DIX-4032	47.65	2165.06	30.7	P-DIX-415	10
J-DIX-4034	47.85	881.28	43.0	P-DIX-3483	10
J-DIX-4036	46.38	1380.07	35.9	P-DIX-427	9.98
J-DIX-4038	48.14	2249.23	20.1		
J-DIX-404	51.2	881.28	41.9	P-DIX-3859	10
J-DIX-4040	48.1	2292.36	21.4	P-DIX-857	10
J-DIX-4042	48.38	2331.89	20.1		
J-DIX-4044	50.5	2071.52	20.0		
J-DIX-4046	50.84	879.21	42.2	P-DIX-3867	10
J-DIX-4048	46.3	2179.19	25.1	P-DIX-2315	10.01
J-DIX-4050	50.33	1146.69	37.1	P-DIX-2325	10
J-DIX-4052	51.17	1758.46	20.2	P-DIX-2335	10
J-DIX-4054	50.44	1430.83	28.1	P-DIX-2641	10
J-DIX-4056	50.69	2016.03	20.0		
J-DIX-4058	50.46	2046.13	20.0		
J-DIX-406	46.7	881.28	40.2	P-DIX-3863	10
J-DIX-4060	51.72	2116.29	20.0		
J-DIX-4062	50.88	2056.9	20.0		
J-DIX-4064	51.18	881.28	42.3	P-DIX-3857	10
J-DIX-4066	46.53	881.28	41.0	P-DIX-3861	10
J-DIX-4068	47.72	391.68	45.3	P-DIX-3769	10
J-DIX-4070	49.21	2008.91	20.0		
J-DIX-4072	51.16	1506.42	20.0		
J-DIX-4074	49.74	1446.38	20.0		
J-DIX-4076	50.48	1517.01	20.0		
J-DIX-4078	44.65	879.71	21.0	P-DIX-3881	10
J-DIX-408	51.25	881.28	32.6	P-DIX-3457	10
J-DIX-4080	44.18	880.97	35.5	P-DIX-3925	10
J-DIX-4082	44.87	876.22	36.6	P-DIX-946	10
J-DIX-4084	43.99	881.09	28.2	P-DIX-3929	10
J-DIX-4086	43.67	1906.1	20.0		
J-DIX-4088	44.09	1002.54	35.7	P-DIX-885	10
J-DIX-4090	43.95	1081.74	33.8	P-DIX-887	10
J-DIX-4092	44.08	881.28	35.9	P-DIX-3921	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-4094	44.39	1995.1	20.0		
J-DIX-4096	44.35	880.15	37.0	P-DIX-3917	10
J-DIX-4098	45.52	1819.62	20.0		
J-DIX-410	44.06	880.48	20.0		
J-DIX-4100	45.52	880.7	37.4	P-DIX-3913	10
J-DIX-4102	44.24	879.4	36.0	P-DIX-3909	10
J-DIX-4104	44.12	1721.59	20.0		
J-DIX-4108	43.99	1134.35	32.1	P-DIX-737	10
J-DIX-4110	44.06	881.28	35.7	P-DIX-3885	10
J-DIX-4112	42.61	881.28	34.1	P-DIX-3891	10
J-DIX-4114	42.63	1252.63	28.1	P-DIX-739	10
J-DIX-4118	43.96	1463.35	23.9	P-DIX-2357	10
J-DIX-412	44.14	881.28	35.1	P-DIX-3927	10
J-DIX-4120	43.36	881.14	32.4	P-DIX-3893	10
J-DIX-4122	44.35	1694.98	20.5	P-DIX-1695	10
J-DIX-4124	44.61	1224.89	30.5	P-DIX-2363	10
J-DIX-4126	44.71	881.28	36.1	P-DIX-3905	10
J-DIX-4128	44.58	880.33	35.4	P-DIX-2671	10
J-DIX-4130	44.49	881.28	33.3	P-DIX-3897	10
J-DIX-4132	45.76	879.46	34.3	P-DIX-1713	10
J-DIX-4134	45.37	879.46	35.7	P-DIX-2681	10
J-DIX-4136	43.66	1473.18	22.0	P-DIX-1727	10
J-DIX-414	43.97	881.28	27.7	P-DIX-3931	10
J-DIX-4140	44.3	880.41	34.0	P-DIX-3933	10
J-DIX-4142	44.65	879.12	22.0	P-DIX-1571	10
J-DIX-4144	45.09	2230.53	20.1		
J-DIX-4146	44.46	1565.52	29.9	P-DIX-2141	10
J-DIX-4148	44.45	2050.09	21.5	P-DIX-2145	10
J-DIX-4150	44.62	2142.41	20.1		
J-DIX-4152	44.67	881.11	38.7	P-DIX-3937	10
J-DIX-4154	44.35	2109.93	20.0		
J-DIX-4156	45.02	2032.7	27.0	P-DIX-1575	10
J-DIX-4158	45.02	881.28	40.2	P-DIX-3575	10
J-DIX-416	44.17	881.28	35.6	P-DIX-3923	10
J-DIX-4160	44.42	2205.23	20.1		
J-DIX-4162	44.07	2141.41	20.1		
J-DIX-4164	44.59	2153.37	20.1		
J-DIX-4166	44.39	880.56	38.3	P-DIX-3579	10
J-DIX-4168	43.85	2119.76	20.0		
J-DIX-4170	43.5	386.99	41.1	P-DIX-1443	10
J-DIX-4172	44.53	881.28	38.5	P-DIX-3583	10
J-DIX-4174	46.55	2328.48	20.1		
J-DIX-4176	46.11	880.65	40.9	P-DIX-3587	10
J-DIX-4178	46.11	2408.18	20.1		
J-DIX-418	44.32	881.28	36.6	P-DIX-3919	10
J-DIX-4180	44.62	881.28	39.0	P-DIX-3591	10
J-DIX-4182	43.94	1486.54	20.0		
J-DIX-4184	45.58	1922.33	20.0		
J-DIX-4186	45.76	881.28	38.1	P-DIX-3595	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-4188	45.57	1665.8	20.0		
J-DIX-4190	44.72	1899.64	20.0		
J-DIX-4192	44.38	2065.53	20.0		
J-DIX-4194	43.76	1988.1	20.0		
J-DIX-4196	43.98	1725.25	20.0		
J-DIX-4198	43.82	1186.45	20.0		
J-DIX-42	46.5	881.28	41.2	P-DIX-2923	10
J-DIX-420	45.52	881.28	37.0	P-DIX-3915	10
J-DIX-4200	44.43	1356.92	20.0		
J-DIX-4202	44.76	1761.5	20.0		
J-DIX-4204	44.6	1988.87	20.0		
J-DIX-4206	44.11	2137.61	20.1		
J-DIX-4208	45.01	2168.4	20.1		
J-DIX-4210	43.87	1095.2	33.6	P-DIX-1777	10
J-DIX-4212	46.98	1982.45	29.9	P-DIX-2703	10.01
J-DIX-4214	46.22	1856.82	28.1	P-DIX-2699	10
J-DIX-4216	46.08	2146.35	20.1		
J-DIX-4218	44.15	1972.05	20.0		
J-DIX-422	44.24	881.28	35.6	P-DIX-3911	10
J-DIX-4220	46.57	1146.39	20.0		
J-DIX-4222	44.4	875.05	36.8	P-DIX-2695	10
J-DIX-4224	44.08	2003.68	20.0		
J-DIX-4226	45.91	879.11	39.0	P-DIX-3623	10
J-DIX-4228	45.83	1871.82	20.0		
J-DIX-4230	45.84	880.03	38.1	P-DIX-3627	10
J-DIX-4232	45.89	1654.04	23.2	P-DIX-2717	10
J-DIX-4234	47.06	1068.09	40.2	P-DIX-2731	10.01
J-DIX-4236	45.12	880.82	37.1	P-DIX-3631	10
J-DIX-4238	47.03	881.05	40.2	P-DIX-3635	10
J-DIX-424	44.06	881.28	34.9	P-DIX-3887	10
J-DIX-4240	47.08	1238.64	35.5	P-DIX-2727	10
J-DIX-4242	45.94	880.72	41.0	P-DIX-3639	10
J-DIX-4244	44.87	2384.53	20.1		
J-DIX-4246	46.47	2687.78	20.1		
J-DIX-4248	46.62	2389.18	24.4	P-DIX-1783	10.04
J-DIX-4250	46.51	880.98	42.1	P-DIX-3643	10
J-DIX-4252	46.69	2118.67	27.8	P-DIX-2159	10.02
J-DIX-4254	46.56	978.81	41.7	P-DIX-2157	10.05
J-DIX-4256	46.79	2320.75	26.3	P-DIX-1787	10.06
J-DIX-4258	46.93	2692.68	20.7	P-DIX-1789	10
J-DIX-426	42.47	881.28	33.3	P-DIX-3889	10
J-DIX-4260	46.65	881.28	42.5	P-DIX-3773	10
J-DIX-4262	46.34	2461.41	20.1		
J-DIX-4264	46.21	881.28	42.2	P-DIX-3777	10
J-DIX-4266	45.33	1090.35	40.1	P-DIX-1811	10.01
J-DIX-4268	44.39	1176.97	35.8	P-DIX-1809	10.01
J-DIX-4270	45.06	880.81	39.4	P-DIX-3651	10
J-DIX-4272	43.11	880.81	33.5	P-DIX-3655	10
J-DIX-4274	43.5	527.82	39.1	P-DIX-757	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-4276	43.51	96.67	41.3	P-DIX-761	10
J-DIX-4278	45.68	1817.66	43.5	P-DIX-821	10.02
J-DIX-428	43.11	881.28	31.3	P-DIX-3895	10
J-DIX-4280	46.46	1382.65	26.2	P-DIX-2741	10
J-DIX-4282	47.37	1547.37	20.0		
J-DIX-4284	46.87	1059.28	38.3	P-DIX-2745	10
J-DIX-4286	46.87	881.28	40.0	P-DIX-3659	10
J-DIX-4288	46.79	1264.33	35.5	P-DIX-2743	10
J-DIX-4290	46.34	494.37	42.9	P-DIX-795	10
J-DIX-4292	47.42	1537.06	33.3	P-DIX-2823	10
J-DIX-4294	43.13	881.16	31.7	P-DIX-3981	10
J-DIX-4296	45.7	1333.09	34.8	P-DIX-2801	10.01
J-DIX-430	44.57	881.28	35.5	P-DIX-3907	10
J-DIX-432	44.77	881.28	32.2	P-DIX-3899	10
J-DIX-434	45.51	881.28	33.2	P-DIX-3903	10
J-DIX-436	44.37	881.28	33.7	P-DIX-3935	10
J-DIX-438	44.68	881.28	38.3	P-DIX-3569	10
J-DIX-44	47.19	881.28	42.1	P-DIX-2927	10
J-DIX-440	44.19	881.28	38.0	P-DIX-3573	10
J-DIX-442	44.99	881.28	39.6	P-DIX-3577	10
J-DIX-444	44.34	881.28	37.9	P-DIX-3581	10
J-DIX-446	44.52	881.28	38.1	P-DIX-3585	10
J-DIX-448	46.11	881.28	40.2	P-DIX-3589	10
J-DIX-450	44.79	881.28	38.7	P-DIX-3593	10
J-DIX-452	45.22	881.28	37.2	P-DIX-3597	10
J-DIX-454	44.83	881.28	37.6	P-DIX-3601	10
J-DIX-456	43.71	881.28	37.1	P-DIX-3605	10
J-DIX-458	43.85	881.28	29.1	P-DIX-3691	10
J-DIX-46	46.63	881.28	31.2	P-DIX-2931	10
J-DIX-460	44.53	881.28	32.4	P-DIX-3607	10
J-DIX-462	44.65	881.28	37.9	P-DIX-3611	10
J-DIX-464	46.19	881.28	40.3	P-DIX-3615	10
J-DIX-466	44.42	881.28	38.1	P-DIX-3619	10
J-DIX-468	47.01	881.28	29.8	P-DIX-3621	10
J-DIX-470	45.89	881.28	38.5	P-DIX-3625	10
J-DIX-472	45.9	881.28	37.8	P-DIX-3629	10
J-DIX-474	45.21	881.28	36.8	P-DIX-3633	10
J-DIX-476	47.15	881.28	39.9	P-DIX-3637	10
J-DIX-478	45.95	881.28	40.6	P-DIX-3641	10
J-DIX-48	45.6	881.28	34.9	P-DIX-2933	10
J-DIX-480	46.53	881.28	41.7	P-DIX-3645	10
J-DIX-482	46.23	881.28	41.6	P-DIX-3649	10
J-DIX-484	45.26	881.28	39.2	P-DIX-3653	10
J-DIX-486	43.11	881.28	33.1	P-DIX-3657	10
J-DIX-488	47.55	881.28	39.9	P-DIX-3661	10
J-DIX-490	46.41	881.28	38.7	P-DIX-3665	10
J-DIX-492	45.62	472.91	20.0		
J-DIX-494	47.55	881.28	36.2	P-DIX-3673	10
J-DIX-496	46.39	881.28	39.5	P-DIX-3677	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-498	46.37	881.28	38.6	P-DIX-3681	10
J-DIX-50	47.99	881.28	37.1	P-DIX-2989	10
J-DIX-500	46.77	881.28	40.1	P-DIX-3683	10
J-DIX-502	45.36	881.28	38.6	P-DIX-3565	10
J-DIX-504	43.37	881.28	31.3	P-DIX-3983	10
J-DIX-508	46.92	97.92	44.2	P-DIX-3695	10
J-DIX-510	46.68	881.28	36.5	P-DIX-3699	10
J-DIX-512	47.89	391.68	44.5	P-DIX-3703	10
J-DIX-514	47.24	881.28	38.4	P-DIX-3707	10
J-DIX-516	47.85	391.68	43.5	P-DIX-3711	10
J-DIX-518	46.51	391.68	43.2	P-DIX-3715	10
J-DIX-52	47.78	881.28	32.5	P-DIX-2941	10
J-DIX-520	46.61	881.28	37.0	P-DIX-3731	10
J-DIX-522	47.73	881.28	38.8	P-DIX-3721	10
J-DIX-524	47.17	881.28	38.3	P-DIX-3725	10
J-DIX-526	46.4	1566.72	25.5	P-DIX-3727	10
J-DIX-528	43.62	881.28	34.6	P-DIX-3735	10
J-DIX-530	44.41	1566.72	28.0	P-DIX-3739	10
J-DIX-532	45.73	881.28	40.3	P-DIX-3743	10
J-DIX-534	46.36	391.68	42.8	P-DIX-3747	10
J-DIX-536	48.06	391.68	43.5	P-DIX-3751	10
J-DIX-538	52.27	391.68	47.4	P-DIX-3755	10
J-DIX-54	47.88	881.28	34.8	P-DIX-2945	10
J-DIX-540	46.98	881.28	40.2	P-DIX-3759	10
J-DIX-542	46.93	881.28	38.8	P-DIX-3763	10
J-DIX-544	46.69	881.28	40.3	P-DIX-3767	10
J-DIX-546	46.36	391.68	43.6	P-DIX-3771	10
J-DIX-548	46.99	881.28	42.7	P-DIX-3775	10
J-DIX-550	46.14	881.28	42.0	P-DIX-3779	10
J-DIX-552	45.69	391.68	26.0	P-DIX-3783	10
J-DIX-554	47.59	391.68	43.8	P-DIX-3787	10
J-DIX-556	46.35	391.68	43.6	P-DIX-3791	10
J-DIX-558	45.58	97.92	43.8	P-DIX-3793	10
J-DIX-56	50.92	881.28	31.9	P-DIX-2949	10
J-DIX-560	52.07	97.92	50.0	P-DIX-3939	10
J-DIX-562	45.46	97.92	44.1	P-DIX-3947	10
J-DIX-564	43.89	97.92	42.5	P-DIX-3953	10
J-DIX-566	51.25	97.92	49.5	P-DIX-3965	10
J-DIX-568	43.97	97.92	42.6	P-DIX-3967	10
J-DIX-570	44.36	97.92	42.9	P-DIX-3945	10
J-DIX-572	44.44	97.92	43.3	P-DIX-3955	10
J-DIX-574	44.51	97.92	43.0	P-DIX-3969	10
J-DIX-576	45.96	2450.71	20.1		
J-DIX-578	47.79	1672.94	31.7	P-DIX-2875	10
J-DIX-58	51.64	881.28	35.4	P-DIX-2953	10
J-DIX-580	46.68	1603.28	20.0		
J-DIX-582	48.41	1663.78	20.0		
J-DIX-584	47.89	1565.23	20.9	P-DIX-618	10
J-DIX-586	48.95	1833.87	20.0		

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-588	47.94	1772.74	20.0		
J-DIX-590	48.46	1780.84	20.0		
J-DIX-592	47.81	1743.79	20.0		
J-DIX-594	47.78	1728.51	20.0		
J-DIX-596	48.27	1728.38	20.0		
J-DIX-598	47.96	1775.12	20.0		
J-DIX-60	50.57	881.28	30.2	P-DIX-2957	10
J-DIX-600	47.9	1565.94	21.2	P-DIX-1319	10
J-DIX-602	48	1706.06	20.0		
J-DIX-604	48.95	1741.36	20.0		
J-DIX-606	47.98	1848.55	20.0		
J-DIX-612	47.55	2344.15	20.1		
J-DIX-614	47.6	2350.1	20.1		
J-DIX-616	44.59	1551.58	20.0		
J-DIX-618	44.93	1637.59	20.0		
J-DIX-62	50.64	881.28	27.6	P-DIX-2961	10
J-DIX-620	44.94	1622.03	20.0		
J-DIX-626	45.08	877.38	30.5	P-DIX-3055	10
J-DIX-628	44.36	1546.25	20.0		
J-DIX-630	42.84	880.16	29.0	P-DIX-1375	10
J-DIX-632	43.72	1783.34	20.0		
J-DIX-634	44	1800.47	20.0		
J-DIX-636	44.39	1378.31	24.5	P-DIX-1939	10
J-DIX-638	45.45	1531.36	28.7	P-DIX-2429	10.01
J-DIX-64	52.69	881.28	28.0	P-DIX-2965	10
J-DIX-640	43.11	881.28	28.4	P-DIX-216	10
J-DIX-642	43.96	881.28	30.7	P-DIX-769	10
J-DIX-644	43.28	1155.1	31.2	P-DIX-1683	10
J-DIX-646	45.57	2127.15	23.2	P-DIX-1403	10.02
J-DIX-648	45.61	2333.87	20.1		
J-DIX-650	46.4	2289.04	20.1		
J-DIX-652	44.62	1557.56	29.7	P-DIX-1011	10
J-DIX-654	44.9	1640.5	20.0		
J-DIX-656	47.28	2328.12	20.1		
J-DIX-658	47.24	1563.14	21.5	P-DIX-1473	10
J-DIX-66	50.09	881.28	25.0	P-DIX-2969	10
J-DIX-660	47.09	1563.14	21.8	P-DIX-1477	10
J-DIX-662	45.06	1643.61	20.0		
J-DIX-664	43.91	1580.22	20.0		
J-DIX-666	43.58	1548.25	20.0		
J-DIX-668	47.1	881.28	38.3	P-DIX-3411	10
J-DIX-670	43.93	1505.64	20.0		
J-DIX-672	43.29	879.79	26.1	P-DIX-625	10
J-DIX-674	43.67	877.94	28.5	P-DIX-631	10
J-DIX-676	42.58	1791.14	20.0		
J-DIX-678	45.37	1389.58	35.4	P-DIX-1171	10
J-DIX-68	50.93	881.28	24.7	P-DIX-2973	10
J-DIX-680	44.77	1255.72	37.1	P-DIX-1173	10
J-DIX-682	44.74	1241.17	37.3	P-DIX-2483	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-684	44.82	880.64	39.6	P-DIX-3527	10
J-DIX-686	46.21	1259.37	36.6	P-DIX-1175	10.01
J-DIX-688	46.22	1185.5	38.0	P-DIX-2501	10.01
J-DIX-690	44.02	1566.72	23.9	P-DIX-715	10
J-DIX-692	43.88	106.29	42.4	P-DIX-901	10
J-DIX-694	44.17	97.06	28.6	P-DIX-2547	10
J-DIX-696	43.93	97.92	24.2	P-DIX-2551	10
J-DIX-698	44.66	107.02	41.8	P-DIX-2545	10.01
J-DIX-70	52.22	881.28	26.6	P-DIX-2977	10
J-DIX-700	44.78	102.49	43.2	P-DIX-919	10.02
J-DIX-702	45.53	1376.27	33.6	P-DIX-2799	10.01
J-DIX-704	45.44	1418.71	32.6	P-DIX-473	10
J-DIX-706	45.5	1425.06	33.6	P-DIX-641	10
J-DIX-708	45.48	1456.54	33.0	P-DIX-639	10
J-DIX-710	45.06	1269.15	37.0	P-DIX-467	10.02
J-DIX-712	45.13	1300.42	36.5	P-DIX-1169	10.01
J-DIX-714	45.68	1360.79	34.9	P-DIX-551	10
J-DIX-716	45.84	1420.4	33.9	P-DIX-937	10
J-DIX-718	44.88	1475.12	32.1	P-DIX-561	10
J-DIX-72	51.2	881.28	29.9	P-DIX-2981	10
J-DIX-720	44.55	1403.8	33.1	P-DIX-563	10
J-DIX-722	44.06	1366.45	33.4	P-DIX-485	10
J-DIX-724	43.64	1431.78	31.7	P-DIX-479	10
J-DIX-726	44.82	1158.53	37.3	P-DIX-1181	10.01
J-DIX-728	44.71	1191.44	36.6	P-DIX-653	10.01
J-DIX-730	43.31	879.5	30.0	P-DIX-2467	10
J-DIX-732	44.29	1359.23	24.9	P-DIX-1937	10
J-DIX-734	42.07	881.28	34.1	P-DIX-3817	10
J-DIX-736	43.74	880.77	33.4	P-DIX-3821	10
J-DIX-738	42.49	1309.5	25.0	P-DIX-1691	10
J-DIX-74	47.99	881.28	37.5	P-DIX-2985	10
J-DIX-740	42.36	1358.63	20.0		
J-DIX-742	44.18	881.28	35.7	P-DIX-3211	10
J-DIX-744	45.61	1276.01	32.3	P-DIX-2533	10
J-DIX-746	45.61	1286.84	32.0	P-DIX-967	10
J-DIX-748	46.02	3015.88	20.9	P-DIX-1867	10
J-DIX-750	46.36	2689.01	24.1	P-DIX-2033	10
J-DIX-752	44.3	1171.93	37.1	P-DIX-2039	10
J-DIX-754	44.3	1127.75	37.8	P-DIX-2041	10
J-DIX-756	44.5	1119.68	37.9	P-DIX-1599	10.01
J-DIX-758	44.44	1161.38	37.3	P-DIX-2059	10.01
J-DIX-76	50.76	881.28	35.4	P-DIX-2991	10
J-DIX-760	46.38	2945.21	20.1		
J-DIX-762	46.43	2661.11	23.4	P-DIX-2121	10
J-DIX-764	46.53	881.28	40.7	P-DIX-655	10
J-DIX-766	47.23	1359.65	37.5	P-DIX-1221	10.01
J-DIX-768	46.97	1223.76	38.9	P-DIX-1219	10.02
J-DIX-770	47.02	1204.2	39.3	P-DIX-1225	10.02
J-DIX-772	47.2	1332.67	37.8	P-DIX-1223	10.01

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-774	47.34	1638.64	33.8	P-DIX-2401	10
J-DIX-776	46.5	1532.39	26.6	P-DIX-1953	10
J-DIX-778	46.5	1526.03	26.7	P-DIX-401	10
J-DIX-78	50.36	881.28	31.7	P-DIX-2995	10
J-DIX-780	46.88	1704.79	32.5	P-DIX-1957	10
J-DIX-782	46.88	1681.93	32.9	P-DIX-573	10
J-DIX-784	46.87	1305.8	37.4	P-DIX-1965	10
J-DIX-786	47.64	1212.68	39.0	P-DIX-1417	10
J-DIX-788	47.89	1309.95	37.5	P-DIX-1419	10
J-DIX-790	47.37	1240.39	37.9	P-DIX-1425	10.01
J-DIX-792	47.41	1282.06	37.2	P-DIX-1427	10.01
J-DIX-794	47.94	1457.75	33.8	P-DIX-1435	10
J-DIX-796	48.33	1519.44	33.0	P-DIX-1431	10
J-DIX-798	47.76	1633.49	31.1	P-DIX-1981	10
J-DIX-80	48.52	881.28	37.3	P-DIX-3001	10
J-DIX-800	47.67	1568.79	32.2	P-DIX-1987	10
J-DIX-802	49.16	1750.65	21.8	P-DIX-2235	10
J-DIX-804	49.36	670.73	33.7	P-DIX-2239	10
J-DIX-806	50.7	1375.52	36.4	P-DIX-2255	10.08
J-DIX-808	50.73	1343.79	36.9	P-DIX-1215	10.09
J-DIX-810	50.77	97.92	48.9	P-DIX-587	10
J-DIX-812	50.91	1281.92	30.1	P-DIX-1241	10
J-DIX-814	50.87	1384.22	27.2	P-DIX-1243	10
J-DIX-816	49.92	1389.03	32.6	P-DIX-2231	10
J-DIX-818	47.99	1978.77	25.9	P-DIX-2013	10.01
J-DIX-82	47.75	881.28	37.6	P-DIX-3005	10
J-DIX-820	48.44	1919.47	28.7	P-DIX-567	10.01
J-DIX-822	47.77	2940.68	20.1		
J-DIX-824	49.57	1621.81	20.0		
J-DIX-826	50.99	2433.6	20.1		
J-DIX-828	51.56	2461.35	20.1		
J-DIX-830	46.92	1337.26	36.2	P-DIX-2635	10
J-DIX-832	46.08	1358.31	34.9	P-DIX-1967	10
J-DIX-834	45.13	880.89	37.5	P-DIX-2639	10
J-DIX-836	47.67	1454.19	34.1	P-DIX-2291	10.05
J-DIX-838	47.83	2248.58	20.1		
J-DIX-84	48.67	881.28	39.1	P-DIX-3009	10
J-DIX-840	48.31	2325.64	20.1		
J-DIX-842	46.22	2136.16	26.0	P-DIX-2309	10.01
J-DIX-844	46.22	2152.29	25.6	P-DIX-2311	10.01
J-DIX-846	50.96	1464.92	32.6	P-DIX-2317	10
J-DIX-848	50.89	1448.11	32.9	P-DIX-2659	10
J-DIX-850	49.26	1990.6	20.0		
J-DIX-852	44.65	879.12	21.4	P-DIX-1839	10
J-DIX-854	44.18	1476.41	21.6	P-DIX-1709	10
J-DIX-856	44.01	878.46	31.3	P-DIX-869	10
J-DIX-858	43.92	880.6	33.5	P-DIX-2091	10
J-DIX-86	48.03	881.28	38.7	P-DIX-3013	10
J-DIX-860	45.13	1315.88	28.2	P-DIX-2361	10

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-862	44.42	880.75	32.7	P-DIX-296	10
J-DIX-864	45.88	880.34	33.3	P-DIX-874	10
J-DIX-866	45.09	1482.23	22.7	P-DIX-1719	10
J-DIX-868	45.26	1542.6	20.9	P-DIX-1721	10
J-DIX-870	45.17	1558.49	20.0		
J-DIX-872	45.24	1452.89	23.9	P-DIX-883	10
J-DIX-874	44.25	1545.51	20.0		
J-DIX-876	42.98	881.02	31.6	P-DIX-298	10
J-DIX-878	44.05	1350.73	26.3	P-DIX-1731	10
J-DIX-88	48.32	881.28	39.1	P-DIX-3017	10
J-DIX-880	44.48	1511.62	20.0		
J-DIX-882	44.4	1506.47	20.0		
J-DIX-884	45.22	877.29	31.8	P-DIX-2093	10
J-DIX-886	44.99	875.8	32.5	P-DIX-351	10
J-DIX-888	44.65	878.79	25.5	P-DIX-1563	10
J-DIX-890	46.35	877.89	32.0	P-DIX-2693	10
J-DIX-892	46.59	2393.9	24.2	P-DIX-749	10.04
J-DIX-894	45.72	3268.29	20.1		
J-DIX-896	45.73	1808.99	43.8	P-DIX-825	10.03
J-DIX-90	48.67	881.28	38.3	P-DIX-3021	10
J-DIX-900	46.27	1937.38	41.5	P-DIX-819	10
J-DIX-902	45.65	1881.98	42.1	P-DIX-823	10.01
J-DIX-904	46.44	1362.22	27.0	P-DIX-1541	10
J-DIX-906	47.22	1541.22	20.0		
J-DIX-908	46.66	376.52	43.6	P-DIX-799	10.01
J-DIX-910	46.08	1471.75	32.2	P-DIX-1769	10
J-DIX-912	42.69	1138.98	31.6	P-DIX-106	10
J-DIX-914	43.09	2012.21	20.0		
J-DIX-916	49.16	1412.25	34.5	P-DIX-128	10
J-DIX-918	44.13	1845.17	20.0		
J-DIX-92	48.67	881.28	36.7	P-DIX-3025	10
J-DIX-920	43.67	1836	20.0		
J-DIX-922	45.9	2059.3	20.0		
J-DIX-924	41.62	1872.19	20.0		
J-DIX-926	43.3	1430.65	20.0		
J-DIX-928	45.47	1449.53	29.4	P-DIX-194	10.01
J-DIX-930	45.31	1403.25	24.4	P-DIX-926	10
J-DIX-932	43.21	881.28	28.8	P-DIX-533	10
J-DIX-934	46.36	2025.94	20.0		
J-DIX-936	48.98	1749.82	20.0		
J-DIX-938	47.68	1549.02	20.0		
J-DIX-94	48	881.28	38.9	P-DIX-3029	10
J-DIX-940	48.82	1831.1	20.0		
J-DIX-942	49.71	1572.01	20.0		
J-DIX-944	49.87	878.89	36.2	P-DIX-868	10
J-DIX-946	49.06	1566.39	20.0		
J-DIX-948	49.09	1578.17	20.0		
J-DIX-950	45.65	2345.36	20.1		
J-DIX-952	45.56	2304.03	20.1		

Appendix M

Model ID	Static Pressure (psi)	Available Flow, gpm	Residual Pressure, psi	Critical Pipe ID	Critical Pipe Velocity, ft/s
J-DIX-956	45.57	1990.24	20.0		
J-DIX-958	45.79	2242.4	20.1		
J-DIX-96	47.93	881.28	37.4	P-DIX-3033	10
J-DIX-960	45.9	2252.97	20.1		
J-DIX-962	48.01	2378	20.1		
J-DIX-964	47.09	1813.46	20.0		
J-DIX-966	46.51	1811.31	20.0		
J-DIX-968	46.57	1812.85	20.0		
J-DIX-970	45.34	1721.17	20.0		
J-DIX-972	45.73	1673.92	20.0		
J-DIX-974	45.12	1653.92	20.0		
J-DIX-976	46.79	1820.71	20.0		
J-DIX-978	47.1	1814.67	20.0		
J-DIX-98	48.74	881.28	38.5	P-DIX-3037	10
J-DIX-980	47.78	1853.85	20.0		
J-DIX-982	47.33	1843.65	20.0		
J-DIX-984	46.53	1836.71	20.0		
J-DIX-986	46.63	1829.38	20.0		
J-DIX-988	45.67	1704.13	20.0		
J-DIX-992	44.17	1519.42	20.0		
J-DIX-994	44.46	1535.7	20.0		
J-DIX-996	43.46	1636.18	20.0		
J-DIX-998	41.3	1240.77	20.0		

APPENDIX N

Cal Water Simulated Available Fire Flow to Meet the Maximum Day Demand plus Fire Flow Performance Criteria (For Residential Pressure and Velocity)

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-100	57.64	881	51.4	P-DIX-3041	10
J-DIX-1000	53.24	1,562	30.0	P-DIX-348	10
J-DIX-1002	55.11	1,556	34.2	P-DIX-1121	10
J-DIX-1004	53.24	2,415	22.8	P-DIX-637	10
J-DIX-1006	55.41	2,765	27.9	P-DIX-962	10
J-DIX-1008	54.25	1,576	41.4	P-DIX-1771	10
J-DIX-101	57.43	392	52.2	P-DIX-3797	10
J-DIX-1010	54.56	1,915	46.4	P-DIX-747	10
J-DIX-1014	55.07	392	37.5	P-DIX-179	10
J-DIX-1016	55.35	881	49.8	P-DIX-2637	10
J-DIX-1018	55.66	2,717	38.1	P-DIX-65	10
J-DIX-1020	56.06	6,060	28.0	P-DIX-127	10
J-DIX-1022	54.98	1,579	20.0		
J-DIX-1024	56.46	1,323	33.5	P-DIX-102	10
J-DIX-1026	56.98	5,247	20.3		
J-DIX-1028	57.43	4,188	33.4	P-DIX-1311	10
J-DIX-1030	53.54	3,531	20.1		
J-DIX-1032	58.74	4,275	20.2		
J-DIX-1034	56.56	3,305	20.1		
J-DIX-1036	57.01	3,241	23.9	P-DIX-2097	10
J-DIX-1038	56.31	3,573	21.9	P-DIX-2367	10
J-DIX-104	56.58	881	40.3	P-DIX-3047	10
J-DIX-1040	56.31	3,454	21.6	P-DIX-2375	10
J-DIX-1042	56.46	3,387	20.1		
J-DIX-1044	56.97	2,655	27.6	P-DIX-600	10
J-DIX-1046	58.99	3,041	20.5	P-DIX-785	10
J-DIX-1048	58.49	2,342	34.8	P-DIX-1491	10
J-DIX-1050	55.41	3,276	20.1		
J-DIX-1054	54.05	4,621	28.2	P-DIX-2489	10
J-DIX-1056	54.97	4,415	29.2	P-DIX-2499	10
J-DIX-1058	55.12	3,235	33.0	P-DIX-929	10
J-DIX-106	58.21	881	47.7	P-DIX-3051	10
J-DIX-1060	54.45	2,959	32.0	P-DIX-2805	10
J-DIX-1062	55.81	2,071	36.6	P-DIX-925	10
J-DIX-1064	55.47	2,663	34.9	P-DIX-553	10
J-DIX-1066	55.31	2,440	35.9	P-DIX-643	10
J-DIX-1068	55.41	2,187	34.9	P-DIX-429	10
J-DIX-1070	53.56	3,665	20.1		
J-DIX-1072	55.2	4,294	20.2		
J-DIX-1074	55.37	7,338	20.5		
J-DIX-1076	55.42	4,949	37.1	P-DIX-1925	10
J-DIX-1078	56.14	1,504	45.8	P-DIX-1237	10
J-DIX-108	58.07	881	43.7	P-DIX-3057	10
J-DIX-1080	55.83	2,847	38.1	P-DIX-1223	10
J-DIX-1082	56.45	2,848	33.0	P-DIX-246	10
J-DIX-1084	56.12	2,822	34.9	P-DIX-1415	10
J-DIX-1086	57.58	3,031	26.7	P-DIX-2817	10
J-DIX-1088	56.19	2,154	37.6	P-DIX-1985	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-1090	59.57	772	35.5	P-DIX-523	10
J-DIX-1092	59.59	2,914	20.1		
J-DIX-1094	59.38	1,730	38.2	P-DIX-2611	10
J-DIX-1096	57.08	2,321	38.7	P-DIX-1509	10
J-DIX-1098	59.77	3,435	20.1		
J-DIX-110	56.86	881	46.2	P-DIX-3059	10
J-DIX-1100	53.31	3,309	27.2	P-DIX-1757	10
J-DIX-1102	53.28	1,555	39.0	P-DIX-1701	10
J-DIX-1104	53.67	4,830	20.2		
J-DIX-1106	58.83	1,278	45.9	P-DIX-2327	10
J-DIX-1108	59.23	1,421	42.7	P-DIX-2329	10
J-DIX-1110	56.06	399	53.8	P-DIX-123	10
J-DIX-1111	55.23	2,121	42.4	P-DIX-336	10
J-DIX-1112	55.37	874	43.0	P-DIX-171	10
J-DIX-1114	55.95	1,200	46.1	P-DIX-193	10
J-DIX-1116	57.08	1,865	20.0		
J-DIX-1118	58.33	1,189	46.3	P-DIX-21	10
J-DIX-112	58.05	881	49.5	P-DIX-3063	10
J-DIX-1120	57.76	1,562	33.2	P-DIX-114	10
J-DIX-1122	58.05	1,518	36.7	P-DIX-41	10
J-DIX-1124	56.64	1,567	42.9	P-DIX-118	10
J-DIX-1126	57.16	2,359	34.3	P-DIX-263	10
J-DIX-1128	57.78	1,641	30.4	P-DIX-319	10
J-DIX-1136	57.06	1,666	41.7	P-DIX-2251	10
J-DIX-1138	57.06	1,561	42.9	P-DIX-2379	10
J-DIX-114	56.4	881	47.0	P-DIX-3067	10
J-DIX-1140	57.39	1,567	37.9	P-DIX-773	10
J-DIX-1142	59.16	1,837	41.1	P-DIX-783	10
J-DIX-1144	59.06	1,979	39.0	P-DIX-781	10
J-DIX-1146	63.75	2,736	44.0	P-DIX-948	10
J-DIX-1148	59.77	1,842	38.1	P-DIX-1493	10
J-DIX-1150	60.13	1,561	44.7	P-DIX-2789	10
J-DIX-1152	59.59	995	52.9	P-DIX-544	10
J-DIX-1154	58.61	1,620	43.3	P-DIX-2449	10
J-DIX-1156	53.33	1,567	33.0	P-DIX-1139	10
J-DIX-1158	53.42	2,112	25.0	P-DIX-355	10
J-DIX-116	54.7	881	45.8	P-DIX-3071	10
J-DIX-1160	56.59	1,353	41.9	P-DIX-2857	10
J-DIX-1162	53.78	1,962	43.6	P-DIX-2481	10
J-DIX-1164	55.15	2,320	40.0	P-DIX-2503	10
J-DIX-1166	54.38	1,567	37.5	P-DIX-719	10
J-DIX-1168	55.76	1,035	48.0	P-DIX-543	10
J-DIX-1170	55.49	1,024	49.0	P-DIX-939	10
J-DIX-1172	54.11	2,127	42.1	P-DIX-471	10
J-DIX-1174	55.53	1,911	46.1	P-DIX-481	10
J-DIX-1176	54.51	1,794	40.1	P-DIX-323	10
J-DIX-1178	53.84	1,386	42.4	P-DIX-957	10
J-DIX-118	54.74	881	40.4	P-DIX-3085	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-1180	53.94	2,303	30.1	P-DIX-2523	10
J-DIX-1182	55.24	892	50.2	P-DIX-2543	10
J-DIX-1184	52.8	2,440	42.3	P-DIX-932	10
J-DIX-1186	52.96	1,791	32.1	P-DIX-866	10
J-DIX-1188	54.14	444	41.9	P-DIX-1889	10
J-DIX-1190	53.4	1,950	43.1	P-DIX-2045	10
J-DIX-1192	53.97	1,894	44.7	P-DIX-2061	10
J-DIX-1194	54.44	1,856	46.1	P-DIX-667	10
J-DIX-1196	56.14	1,868	48.0	P-DIX-1201	10
J-DIX-1198	59.79	434	46.9	P-DIX-2003	10
J-DIX-12	55.41	392	52.2	P-DIX-3943	10
J-DIX-120	55.2	881	46.8	P-DIX-3075	10
J-DIX-1200	59.56	1,721	45.5	P-DIX-2291	10
J-DIX-1202	59.66	2,293	35.6	P-DIX-2323	10
J-DIX-1204	59.66	1,946	42.5	P-DIX-845	10
J-DIX-1206	59.77	1,751	44.9	P-DIX-847	10
J-DIX-1208	60.22	1,793	52.2	P-DIX-2313	10
J-DIX-1210	59.26	2,411	27.0	P-DIX-2125	10
J-DIX-1212	53.28	1,770	41.8	P-DIX-881	10
J-DIX-1214	53.38	1,762	41.9	P-DIX-879	10
J-DIX-1216	54.65	390	33.0	P-DIX-1568	10
J-DIX-1218	52.2	2,107	36.9	P-DIX-1779	10
J-DIX-122	55.88	881	48.5	P-DIX-3079	10
J-DIX-1220	54.58	2,428	29.9	P-DIX-2715	10
J-DIX-1222	52.62	1,558	41.8	P-DIX-2697	10
J-DIX-1224	54.05	2,067	35.1	P-DIX-2719	10
J-DIX-1226	49.02	1,215	32.9	P-DIX-1797	10
J-DIX-1228	55.84	800	47.5	P-DIX-801	10
J-DIX-1230	54.86	1,055	49.9	P-DIX-293	10
J-DIX-1232	57.3	6,015	21.6	P-DIX-350	10
J-DIX-1234	55.11	6,206	20.9	P-DIX-291	10
J-DIX-1236	56	3,406	39.0	P-DIX-2865	10
J-DIX-1238	56.06	1,396	48.8	P-DIX-2865	10
J-DIX-124	55.62	881	48.0	P-DIX-3083	10
J-DIX-1240	56.33	1,814	44.9	P-DIX-2875	10
J-DIX-1242	56.42	1,648	46.3	P-DIX-1891	10
J-DIX-1244	56.19	1,227	48.6	P-DIX-504	10
J-DIX-1246	56.71	2,285	42.1	P-DIX-1891	10
J-DIX-1248	54.97	6,242	22.8	P-DIX-1915	10
J-DIX-1250	54.97	6,280	22.5	P-DIX-1895	10
J-DIX-1252	54.95	1,060	49.4	P-DIX-1911	10
J-DIX-1254	54.97	6,521	20.4		
J-DIX-1256	54.98	6,522	20.4		
J-DIX-1258	55.41	6,672	20.4		
J-DIX-126	58.44	881	51.8	P-DIX-3087	10
J-DIX-1260	55.86	1,303	48.2	P-DIX-1570	10
J-DIX-1262	55.04	6,628	20.4		
J-DIX-1264	55.37	1,623	42.3	P-DIX-502	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-1266	55.45	1,573	43.2	P-DIX-75	10
J-DIX-1268	55.35	6,768	20.5		
J-DIX-1270	55.37	5,932	27.3	P-DIX-287	10
J-DIX-1272	55.22	6,722	20.8	P-DIX-79	10
J-DIX-1274	55.21	2,410	34.7	P-DIX-99	10
J-DIX-1276	54.56	1,502	44.4	P-DIX-279	10
J-DIX-1278	54.75	2,199	38.2	P-DIX-105	10
J-DIX-128	55.4	881	43.2	P-DIX-3089	10
J-DIX-1280	55.25	5,863	29.0	P-DIX-391	10
J-DIX-1282	54.99	1,897	35.3	P-DIX-165	10
J-DIX-1284	55.1	1,190	35.1	P-DIX-131	10
J-DIX-1286	55.85	1,170	46.8	P-DIX-143	10
J-DIX-1288	55.86	2,122	35.8	P-DIX-141	10
J-DIX-1290	55.66	736	40.9	P-DIX-358	10
J-DIX-1292	54.35	962	47.0	P-DIX-155	10
J-DIX-1294	54.32	1,706	37.3	P-DIX-153	10
J-DIX-1296	54.35	531	49.9	P-DIX-360	10
J-DIX-1298	54.45	1,082	46.0	P-DIX-155	10
J-DIX-130	56.9	881	47.9	P-DIX-3093	10
J-DIX-1300	56.72	1,043	47.1	P-DIX-169	10
J-DIX-1302	56.47	610	48.7	P-DIX-102	10
J-DIX-1304	56.04	656	50.6	P-DIX-191	10
J-DIX-1306	56.13	542	50.5	P-DIX-628	10
J-DIX-1308	55.91	2,072	34.9	P-DIX-187	10
J-DIX-1310	55.56	1,850	34.8	P-DIX-197	10
J-DIX-1312	57.49	477	51.1	P-DIX-104	10
J-DIX-1314	57.16	1,369	46.2	P-DIX-850	10
J-DIX-1316	57.81	1,617	23.1	P-DIX-211	10
J-DIX-1318	57.36	2,317	27.3	P-DIX-213	10
J-DIX-132	56.1	881	48.3	P-DIX-3095	10
J-DIX-1320	58.55	1,665	38.9	P-DIX-221	10
J-DIX-1322	58.31	2,271	29.3	P-DIX-231	10
J-DIX-1324	57.7	1,571	40.6	P-DIX-902	10
J-DIX-1326	57.09	1,511	36.7	P-DIX-225	10
J-DIX-1328	57.09	1,589	34.6	P-DIX-110	10
J-DIX-1330	57.24	1,508	37.1	P-DIX-239	10
J-DIX-1332	57.61	3,331	20.1		
J-DIX-1334	57.37	1,153	47.9	P-DIX-233	10
J-DIX-1336	59.65	2,201	27.4	P-DIX-19	10
J-DIX-1338	56.52	2,207	20.1		
J-DIX-134	56.34	881	49.3	P-DIX-3099	10
J-DIX-1340	56.68	2,132	20.1		
J-DIX-1342	57.57	1,562	33.2	P-DIX-33	10
J-DIX-1344	59.99	1,881	29.4	P-DIX-47	10
J-DIX-1346	57.21	1,993	31.5	P-DIX-53	10
J-DIX-1348	57.53	1,645	33.8	P-DIX-57	10
J-DIX-1350	56.67	1,567	43.1	P-DIX-251	10
J-DIX-1352	56.8	3,057	23.8	P-DIX-289	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-1354	56.92	2,729	29.8	P-DIX-257	10
J-DIX-1356	56.18	1,570	40.7	P-DIX-269	10
J-DIX-1358	57.49	1,543	35.5	P-DIX-1833	10
J-DIX-136	56.61	881	47.6	P-DIX-3103	10
J-DIX-1360	57.55	2,111	20.0		
J-DIX-1362	57.75	1,548	33.0	P-DIX-315	10
J-DIX-1364	57.81	1,380	32.3	P-DIX-122	10
J-DIX-1366	56.93	1,563	44.0	P-DIX-1157	10
J-DIX-1368	56.39	3,128	33.3	P-DIX-1275	10
J-DIX-1370	56.18	2,916	35.2	P-DIX-1277	10
J-DIX-1372	57.75	3,695	31.4	P-DIX-906	10
J-DIX-1374	58.15	2,912	38.5	P-DIX-906	10
J-DIX-1376	56.67	4,674	26.7	P-DIX-1305	10
J-DIX-1378	57	4,167	33.6	P-DIX-1309	10
J-DIX-138	56.35	881	48.5	P-DIX-3107	10
J-DIX-1380	57.25	2,089	43.8	P-DIX-1313	10
J-DIX-1382	57.62	4,132	20.2		
J-DIX-1384	56.94	2,881	20.1		
J-DIX-1388	56.6	4,049	36.4	P-DIX-614	10
J-DIX-1390	56.77	2,719	34.6	P-DIX-1321	10
J-DIX-1392	57.59	3,924	20.2		
J-DIX-1394	57.38	2,201	42.4	P-DIX-134	10
J-DIX-1398	58.21	1,566	36.0	P-DIX-1613	10
J-DIX-140	56.69	881	48.6	P-DIX-3111	10
J-DIX-1400	58.13	877	44.8	P-DIX-1627	10
J-DIX-1402	57.03	1,566	35.2	P-DIX-1163	10
J-DIX-1404	57.84	2,377	28.6	P-DIX-1629	10
J-DIX-1406	56.83	2,410	20.1		
J-DIX-1408	54.72	2,504	20.1		
J-DIX-1410	54.31	2,484	20.1		
J-DIX-1412	54.27	2,503	20.1		
J-DIX-1414	55.06	2,483	23.1	P-DIX-1379	10
J-DIX-1416	55.89	2,876	25.6	P-DIX-1649	10
J-DIX-1418	55.96	3,188	20.1		
J-DIX-142	57.87	881	47.2	P-DIX-3115	10
J-DIX-1420	55.42	2,460	29.0	P-DIX-1361	10
J-DIX-1422	59	3,968	20.2		
J-DIX-1424	57.18	2,904	30.4	P-DIX-1663	10
J-DIX-1426	57.6	2,822	31.6	P-DIX-2185	10
J-DIX-1428	56.16	2,358	37.5	P-DIX-2839	10
J-DIX-1430	57.39	3,285	33.3	P-DIX-1043	10
J-DIX-1432	57.22	3,237	33.7	P-DIX-1043	10
J-DIX-1434	55.09	1,931	38.9	P-DIX-529	10
J-DIX-1436	54.53	2,234	34.5	P-DIX-531	10
J-DIX-1438	55.97	2,087	38.3	P-DIX-2807	10
J-DIX-144	56.24	881	47.9	P-DIX-3119	10
J-DIX-1440	57.05	2,058	39.0	P-DIX-435	10
J-DIX-1442	58.47	1,949	42.1	P-DIX-443	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-1444	59.35	1,556	49.2	P-DIX-453	10
J-DIX-1446	59.57	2,474	42.5	P-DIX-453	10
J-DIX-1450	58.88	2,832	36.6	P-DIX-491	10
J-DIX-1452	58.53	1,840	44.6	P-DIX-499	10
J-DIX-1454	58.47	3,082	34.2	P-DIX-1810	10
J-DIX-1456	59.61	2,067	40.1	P-DIX-515	10
J-DIX-1458	58.59	2,960	28.2	P-DIX-2337	10
J-DIX-146	57.79	881	46.5	P-DIX-3123	10
J-DIX-1460	58.68	1,767	41.1	P-DIX-1261	10
J-DIX-1462	61.44	5,648	25.2	P-DIX-2279	10
J-DIX-1464	61.93	3,205	45.5	P-DIX-2275	10
J-DIX-1466	61.97	662	58.0	P-DIX-2279	10
J-DIX-1468	55.78	3,345	26.0	P-DIX-2281	10
J-DIX-1470	57.49	3,593	23.1	P-DIX-2343	10
J-DIX-1472	55.7	2,455	34.7	P-DIX-2107	10
J-DIX-1474	55.88	3,561	20.1		
J-DIX-1476	56.35	3,713	20.1		
J-DIX-1478	56.33	3,258	26.6	P-DIX-2115	10
J-DIX-148	58.04	881	51.1	P-DIX-3127	10
J-DIX-1480	56.9	1,360	42.7	P-DIX-146	10
J-DIX-1482	56.3	1,228	45.7	P-DIX-1071	10
J-DIX-1484	56.31	2,997	29.6	P-DIX-148	10
J-DIX-1486	56.62	1,748	35.7	P-DIX-912	10
J-DIX-1488	56.25	1,225	45.7	P-DIX-1669	10
J-DIX-1490	56.63	1,275	45.0	P-DIX-1671	10
J-DIX-1492	59.17	1,713	33.9	P-DIX-856	10
J-DIX-1494	56.17	1,301	44.3	P-DIX-1675	10
J-DIX-1496	57.89	1,715	30.4	P-DIX-602	10
J-DIX-1498	57.57	2,373	20.1		
J-DIX-150	56.31	881	49.3	P-DIX-3129	10
J-DIX-1500	56.31	2,528	33.2	P-DIX-914	10
J-DIX-1502	58.04	3,706	20.1		
J-DIX-1504	56.84	3,090	20.1		
J-DIX-1506	57.66	2,814	24.7	P-DIX-2391	10
J-DIX-1508	57.91	2,963	20.1		
J-DIX-1510	57.65	2,474	32.0	P-DIX-2389	10
J-DIX-1512	56.83	1,563	42.7	P-DIX-162	10
J-DIX-1514	58.48	2,208	32.7	P-DIX-2179	10
J-DIX-1516	60.17	2,005	39.2	P-DIX-2413	10
J-DIX-1518	57.92	1,160	47.2	P-DIX-598	10
J-DIX-152	58.04	881	51.2	P-DIX-3133	10
J-DIX-1520	55.99	1,136	46.6	P-DIX-2285	10
J-DIX-1522	56.7	1,827	30.0	P-DIX-505	10
J-DIX-1524	59.55	3,814	22.0	P-DIX-166	10
J-DIX-1526	56.88	1,802	29.4	P-DIX-596	10
J-DIX-1528	55.09	3,011	20.1		
J-DIX-1530	58.37	1,128	49.1	P-DIX-858	10
J-DIX-1532	57.25	1,140	48.0	P-DIX-170	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-1534	54.6	1,729	29.1	P-DIX-594	10
J-DIX-1536	54.04	3,203	20.1		
J-DIX-1538	54.01	2,890	23.5	P-DIX-918	10
J-DIX-154	56.7	881	48.7	P-DIX-3137	10
J-DIX-1540	54.75	2,510	31.2	P-DIX-174	10
J-DIX-1542	55.4	2,362	20.1		
J-DIX-1544	55.58	2,421	20.1		
J-DIX-1546	55.84	2,230	24.7	P-DIX-743	10
J-DIX-1548	55.16	1,746	32.5	P-DIX-743	10
J-DIX-1550	54.64	2,136	25.0	P-DIX-1115	10
J-DIX-1552	54.3	2,522	21.1	P-DIX-178	10
J-DIX-1554	53.42	1,524	44.5	P-DIX-2469	10
J-DIX-1556	53.95	2,026	40.4	P-DIX-2475	10
J-DIX-1558	53.69	2,685	39.9	P-DIX-2479	10
J-DIX-156	57.91	881	49.9	P-DIX-3141	10
J-DIX-1560	53.76	3,411	33.0	P-DIX-2735	10
J-DIX-1562	53.8	4,636	20.2		
J-DIX-1564	53.46	3,967	22.5	P-DIX-765	10
J-DIX-1566	54.75	3,419	32.6	P-DIX-1741	10
J-DIX-1568	53.56	3,203	28.2	P-DIX-2163	10
J-DIX-1570	52.2	2,398	32.8	P-DIX-182	10
J-DIX-1572	53.26	1,502	42.3	P-DIX-182	10
J-DIX-1574	52.2	1,509	42.1	P-DIX-1779	10
J-DIX-1576	55.2	3,976	20.2		
J-DIX-1578	54.83	4,052	20.2		
J-DIX-158	56.9	881	49.2	P-DIX-3145	10
J-DIX-1580	53.4	3,988	28.9	P-DIX-2735	10
J-DIX-1582	53.05	1,175	46.1	P-DIX-860	10
J-DIX-1584	54.76	1,611	39.7	P-DIX-2143	10
J-DIX-1586	54.73	1,491	41.5	P-DIX-186	10
J-DIX-1588	54.6	1,398	42.9	P-DIX-2715	10
J-DIX-1590	53.79	2,189	35.7	P-DIX-2779	10
J-DIX-1592	53.21	3,701	26.9	P-DIX-1743	10
J-DIX-1594	53.03	4,068	20.2		
J-DIX-1596	53.21	4,093	23.3	P-DIX-1747	10
J-DIX-1598	53.39	2,677	33.2	P-DIX-2709	10
J-DIX-16	59.86	392	53.9	P-DIX-3951	10
J-DIX-160	59.67	881	51.2	P-DIX-3149	10
J-DIX-1600	53.73	2,722	33.0	P-DIX-190	10
J-DIX-1602	53.67	2,661	33.8	P-DIX-1753	10
J-DIX-1604	54.17	3,253	32.8	P-DIX-2683	10
J-DIX-1606	54.22	1,884	41.3	P-DIX-2687	10
J-DIX-1608	53.19	3,744	32.5	P-DIX-2479	10
J-DIX-1610	53.58	2,995	37.3	P-DIX-584	10
J-DIX-1612	55.1	2,367	43.1	P-DIX-192	10
J-DIX-1614	55.11	2,525	41.7	P-DIX-1560	10
J-DIX-1616	56.78	2,693	34.7	P-DIX-2507	10
J-DIX-1618	56.76	880	42.4	P-DIX-935	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-162	56.26	881	45.2	P-DIX-3153	10
J-DIX-1620	54.64	1,664	27.8	P-DIX-335	10
J-DIX-1622	54.66	1,534	32.0	P-DIX-949	10
J-DIX-1624	53.89	2,539	26.4	P-DIX-2519	10
J-DIX-1626	55.75	1,354	46.4	P-DIX-196	10
J-DIX-1628	53.42	1,988	32.6	P-DIX-889	10
J-DIX-1630	55.49	3,744	20.1		
J-DIX-1632	54.4	1,469	38.5	P-DIX-895	10
J-DIX-1634	54.91	159	20.0		
J-DIX-1636	56.05	1,604	42.4	P-DIX-198	10
J-DIX-1638	55.06	3,094	34.3	P-DIX-931	10
J-DIX-164	56.2	881	48.5	P-DIX-3155	10
J-DIX-1640	53.21	1,396	46.4	P-DIX-547	10
J-DIX-1642	53.59	1,020	48.5	P-DIX-200	10
J-DIX-1644	53.13	2,425	41.3	P-DIX-547	10
J-DIX-1646	54.04	2,099	42.4	P-DIX-469	10
J-DIX-1648	55.59	1,410	45.3	P-DIX-1687	10
J-DIX-1650	55.12	1,370	45.5	P-DIX-202	10
J-DIX-1652	54.88	1,951	41.8	P-DIX-651	10
J-DIX-1654	54.57	1,371	39.1	P-DIX-835	10
J-DIX-1656	54.74	1,444	37.3	P-DIX-839	10
J-DIX-1658	53.78	1,754	28.8	P-DIX-991	10
J-DIX-166	56.86	881	46.5	P-DIX-3159	10
J-DIX-1660	54.88	1,411	38.5	P-DIX-997	10
J-DIX-1662	55.35	1,119	46.9	P-DIX-204	10
J-DIX-1664	54.93	1,735	43.6	P-DIX-1005	10
J-DIX-1666	55.01	1,884	42.6	P-DIX-1005	10
J-DIX-1668	54.28	1,709	38.6	P-DIX-1007	10
J-DIX-1670	54.22	1,182	44.7	P-DIX-1935	10
J-DIX-1672	55.42	1,179	45.0	P-DIX-512	10
J-DIX-1674	54.26	1,103	46.2	P-DIX-576	10
J-DIX-1676	55.41	1,688	33.2	P-DIX-208	10
J-DIX-1678	53.53	1,523	32.9	P-DIX-2085	10
J-DIX-168	59.46	881	51.9	P-DIX-3163	10
J-DIX-1680	55.82	1,370	39.6	P-DIX-210	10
J-DIX-1682	54.75	2,759	33.0	P-DIX-1015	10
J-DIX-1684	54.92	1,120	46.2	P-DIX-574	10
J-DIX-1686	55.47	3,332	26.1	P-DIX-1923	10
J-DIX-1688	54.86	2,980	26.0	P-DIX-212	10
J-DIX-1690	55.3	2,558	33.7	P-DIX-928	10
J-DIX-1694	56.43	2,290	38.4	P-DIX-1023	10
J-DIX-1696	56.16	1,566	44.1	P-DIX-1027	10
J-DIX-1698	55.79	2,817	28.2	P-DIX-1407	10
J-DIX-170	55.44	881	44.9	P-DIX-3167	10
J-DIX-1700	55.4	1,566	41.9	P-DIX-572	10
J-DIX-1702	55.08	2,920	25.8	P-DIX-864	10
J-DIX-1704	54.28	2,032	38.1	P-DIX-323	10
J-DIX-1706	53.64	1,845	41.7	P-DIX-1821	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-1708	54.4	1,085	47.0	P-DIX-218	10
J-DIX-1710	54.22	1,559	30.7	P-DIX-333	10
J-DIX-1712	54.75	3,060	29.5	P-DIX-345	10
J-DIX-1714	54.97	1,185	45.3	P-DIX-220	10
J-DIX-1716	53.45	1,987	40.8	P-DIX-1821	10
J-DIX-1718	54.58	1,625	33.0	P-DIX-965	10
J-DIX-172	55.09	881	47.4	P-DIX-3171	10
J-DIX-1720	53.72	1,037	47.4	P-DIX-222	10
J-DIX-1722	54.54	1,079	45.9	P-DIX-2557	10
J-DIX-1724	52.28	858	33.0	P-DIX-2525	10
J-DIX-1726	52.84	1,043	41.9	P-DIX-947	10
J-DIX-1728	52.68	1,688	31.0	P-DIX-953	10
J-DIX-1730	53.16	1,355	36.6	P-DIX-568	10
J-DIX-1732	55.71	2,629	34.2	P-DIX-2511	10
J-DIX-1734	52.63	1,853	37.2	P-DIX-955	10
J-DIX-1736	53.7	1,986	35.7	P-DIX-2517	10
J-DIX-1738	55.35	2,139	37.2	P-DIX-2511	10
J-DIX-174	58.03	881	50.1	P-DIX-3175	10
J-DIX-1740	52.62	1,086	44.6	P-DIX-2513	10
J-DIX-1742	54.06	1,481	42.9	P-DIX-2539	10
J-DIX-1744	54.43	2,170	36.6	P-DIX-2531	10
J-DIX-1746	55.79	1,444	44.9	P-DIX-1562	10
J-DIX-1748	54.51	602	50.4	P-DIX-2557	10
J-DIX-1750	55.13	2,394	37.9	P-DIX-226	10
J-DIX-1752	52.67	2,068	30.2	P-DIX-1601	10
J-DIX-1754	53.03	1,263	42.9	P-DIX-228	10
J-DIX-1756	53.05	2,275	35.2	P-DIX-1859	10
J-DIX-1758	52.93	2,385	43.2	P-DIX-2031	10
J-DIX-176	56.19	881	48.5	P-DIX-3179	10
J-DIX-1760	53.16	4,077	38.9	P-DIX-1873	10
J-DIX-1762	54.39	3,778	39.1	P-DIX-1605	10
J-DIX-1764	54.96	477	50.5	P-DIX-1885	10
J-DIX-1766	55.16	1,935	21.5	P-DIX-2047	10
J-DIX-1768	55.04	1,931	21.8	P-DIX-1887	10
J-DIX-1770	53.46	390	51.1	P-DIX-1081	10
J-DIX-1772	53.56	1,228	45.9	P-DIX-1081	10
J-DIX-1774	53.47	1,609	40.0	P-DIX-373	10
J-DIX-1776	53.43	385	35.4	P-DIX-1093	10
J-DIX-1778	54.39	463	50.3	P-DIX-232	10
J-DIX-178	54.29	881	44.0	P-DIX-3183	10
J-DIX-1780	53.02	1,781	32.5	P-DIX-377	10
J-DIX-1782	53.92	2,275	37.8	P-DIX-2053	10
J-DIX-1784	53.8	1,222	45.8	P-DIX-234	10
J-DIX-1786	54.13	1,642	42.8	P-DIX-2053	10
J-DIX-1788	52.85	2,172	40.9	P-DIX-1875	10
J-DIX-1790	55.69	3,995	39.2	P-DIX-683	10
J-DIX-1792	55.41	2,688	44.5	P-DIX-683	10
J-DIX-1794	56.51	2,108	47.6	P-DIX-562	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-1796	54.52	1,256	47.2	P-DIX-236	10
J-DIX-1798	54.76	3,352	40.5	P-DIX-693	10
J-DIX-18	53.24	2,069	20.0		
J-DIX-180	54.75	881	47.2	P-DIX-3187	10
J-DIX-1800	54.77	1,916	46.2	P-DIX-1525	10
J-DIX-1802	55.21	3,122	41.5	P-DIX-389	10
J-DIX-1804	55.35	1,661	44.1	P-DIX-659	10
J-DIX-1806	54.48	3,288	40.2	P-DIX-665	10
J-DIX-1808	54.23	4,188	36.3	P-DIX-1537	10
J-DIX-1810	54.3	2,207	44.8	P-DIX-934	10
J-DIX-1812	55.46	2,163	46.5	P-DIX-560	10
J-DIX-1814	55.3	5,838	31.3	P-DIX-240	10
J-DIX-1816	54.93	2,116	41.1	P-DIX-1203	10
J-DIX-1818	55.78	1,691	43.4	P-DIX-3550	10
J-DIX-182	55.79	881	49.4	P-DIX-3191	10
J-DIX-1820	55.23	1,744	44.8	P-DIX-242	10
J-DIX-1822	56.26	1,518	47.0	P-DIX-558	10
J-DIX-1824	56.13	1,768	45.0	P-DIX-1235	10
J-DIX-1826	56.02	1,944	43.6	P-DIX-2401	10
J-DIX-1828	55.19	6,752	22.8	P-DIX-244	10
J-DIX-1830	55.27	6,718	23.2	P-DIX-2411	10
J-DIX-1832	56.15	1,379	47.8	P-DIX-936	10
J-DIX-1834	57.15	1,612	38.6	P-DIX-1949	10
J-DIX-1836	55.74	1,762	45.1	P-DIX-1955	10
J-DIX-1838	56.39	1,307	47.9	P-DIX-246	10
J-DIX-184	62.33	881	55.3	P-DIX-3195	10
J-DIX-1840	56.1	2,293	34.3	P-DIX-1433	10
J-DIX-1842	57.58	1,298	47.7	P-DIX-556	10
J-DIX-1844	56.45	1,308	46.1	P-DIX-248	10
J-DIX-1846	56.3	1,551	44.3	P-DIX-1989	10
J-DIX-1848	57.13	1,324	46.0	P-DIX-2199	10
J-DIX-1850	57.13	2,371	31.5	P-DIX-2203	10
J-DIX-1852	56.43	681	51.2	P-DIX-554	10
J-DIX-1854	56.49	812	49.7	P-DIX-2883	10
J-DIX-1856	56.15	1,659	39.5	P-DIX-938	10
J-DIX-1858	56.75	1,408	44.7	P-DIX-254	10
J-DIX-186	57.26	881	49.7	P-DIX-3199	10
J-DIX-1860	56.68	1,888	32.3	P-DIX-2217	10
J-DIX-1862	56.85	1,701	36.1	P-DIX-552	10
J-DIX-1864	56.56	1,510	39.1	P-DIX-2255	10
J-DIX-1868	57.55	1,663	36.4	P-DIX-256	10
J-DIX-1870	57.51	2,085	34.5	P-DIX-1241	10
J-DIX-1872	57.57	1,684	40.6	P-DIX-1564	10
J-DIX-1874	57.83	2,915	20.1		
J-DIX-1876	56.31	2,425	26.5	P-DIX-2225	10
J-DIX-1878	56.34	2,526	23.9	P-DIX-258	10
J-DIX-188	57.12	881	49.7	P-DIX-3203	10
J-DIX-1880	57.55	2,537	20.1		

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-1882	58.7	1,698	41.2	P-DIX-2319	10
J-DIX-1884	58.64	504	54.5	P-DIX-1995	10
J-DIX-1886	58.09	1,086	43.3	P-DIX-2617	10
J-DIX-1888	58.91	419	51.0	P-DIX-550	10
J-DIX-1890	57.42	2,526	20.1		
J-DIX-1892	59.71	2,357	29.5	P-DIX-262	10
J-DIX-1894	60.04	2,093	38.4	P-DIX-855	10
J-DIX-1896	59.81	873	51.3	P-DIX-548	10
J-DIX-1898	59.79	2,150	36.4	P-DIX-2133	10
J-DIX-190	56.74	881	50.0	P-DIX-3235	10
J-DIX-1900	59.66	2,208	34.4	P-DIX-264	10
J-DIX-1902	58.76	1,937	42.2	P-DIX-870	10
J-DIX-1904	59	1,866	44.5	P-DIX-2019	10
J-DIX-1906	55.93	1,942	43.9	P-DIX-1959	10
J-DIX-1908	57.25	1,713	36.6	P-DIX-597	10
J-DIX-1910	58.11	2,531	24.1	P-DIX-2579	10
J-DIX-1912	58.22	1,360	44.4	P-DIX-266	10
J-DIX-1914	58.68	1,922	34.8	P-DIX-2583	10
J-DIX-1916	58.57	1,275	45.2	P-DIX-546	10
J-DIX-1918	59.28	1,200	47.2	P-DIX-268	10
J-DIX-192	53.49	881	46.9	P-DIX-3239	10
J-DIX-1920	60	1,811	41.3	P-DIX-2595	10
J-DIX-1922	60.08	1,360	46.3	P-DIX-942	10
J-DIX-1924	59.97	1,375	44.6	P-DIX-2613	10
J-DIX-1926	59.66	1,718	36.4	P-DIX-2615	10
J-DIX-1928	59.74	1,747	35.9	P-DIX-272	10
J-DIX-1930	59.1	1,567	39.2	P-DIX-2829	10
J-DIX-1932	58.94	1,753	37.0	P-DIX-2335	10
J-DIX-1934	58.87	1,037	47.4	P-DIX-4130	10
J-DIX-1936	56.92	2,576	35.3	P-DIX-421	10
J-DIX-1938	56.47	1,371	46.4	P-DIX-274	10
J-DIX-194	54.5	881	44.1	P-DIX-3243	10
J-DIX-1940	56.94	1,598	43.6	P-DIX-542	10
J-DIX-1942	58	1,653	45.3	P-DIX-276	10
J-DIX-1944	56.79	1,705	43.4	P-DIX-2825	10
J-DIX-1946	58.45	2,197	47.9	P-DIX-278	10
J-DIX-1948	58.23	2,543	46.4	P-DIX-1511	10
J-DIX-1950	57.42	4,649	37.7	P-DIX-415	10
J-DIX-1952	57.53	1,178	51.4	P-DIX-540	10
J-DIX-1954	57.59	1,719	43.3	P-DIX-421	10
J-DIX-1956	59.22	717	55.9	P-DIX-2309	10
J-DIX-1958	59.13	3,625	23.5	P-DIX-2299	10
J-DIX-196	58.68	881	51.2	P-DIX-3247	10
J-DIX-1962	60.33	2,302	40.2	P-DIX-2307	10
J-DIX-1964	60.63	2,194	42.2	P-DIX-2305	10
J-DIX-1966	59.66	3,190	20.1		
J-DIX-1968	59.77	1,333	48.2	P-DIX-2321	10
J-DIX-1970	59.76	1,597	38.9	P-DIX-2333	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-1972	60.45	2,316	38.1	P-DIX-872	10
J-DIX-1974	59.39	908	54.0	P-DIX-538	10
J-DIX-1976	57.22	1,241	49.0	P-DIX-284	10
J-DIX-1978	57.78	1,533	39.0	P-DIX-1837	10
J-DIX-198	55.67	881	39.7	P-DIX-3251	10
J-DIX-1980	53.63	3,041	27.8	P-DIX-83	10
J-DIX-1982	53.58	875	46.9	P-DIX-867	10
J-DIX-1984	53.36	879	39.4	P-DIX-871	10
J-DIX-1986	53.3	1,121	45.4	P-DIX-536	10
J-DIX-1988	53.66	3,076	33.8	P-DIX-2767	10
J-DIX-1990	53.8	2,509	35.8	P-DIX-288	10
J-DIX-1992	55.15	2,585	35.5	P-DIX-669	10
J-DIX-1996	53.79	3,023	31.1	P-DIX-290	10
J-DIX-20	56.49	392	51.8	P-DIX-3959	10
J-DIX-200	57.15	881	43.1	P-DIX-3255	10
J-DIX-2002	53.53	1,090	46.2	P-DIX-534	10
J-DIX-2004	52.09	1,280	42.2	P-DIX-292	10
J-DIX-2008	52.48	1,528	38.6	P-DIX-2355	10
J-DIX-2010	52.85	869	44.4	P-DIX-294	10
J-DIX-2012	53.65	1,912	37.0	P-DIX-1695	10
J-DIX-2014	53.87	1,801	38.4	P-DIX-2359	10
J-DIX-2016	54.19	1,210	44.4	P-DIX-532	10
J-DIX-2018	54.05	1,334	42.7	P-DIX-2665	10
J-DIX-202	59.82	881	52.7	P-DIX-3259	10
J-DIX-2020	54.21	1,400	41.7	P-DIX-2667	10
J-DIX-2022	53.89	2,178	20.1		
J-DIX-2024	55.11	880	46.1	P-DIX-1713	10
J-DIX-2026	54.96	1,693	37.6	P-DIX-2679	10
J-DIX-2028	54.75	1,459	41.3	P-DIX-673	10
J-DIX-2030	52.92	1,406	39.0	P-DIX-1725	10
J-DIX-2032	52.43	881	43.1	P-DIX-1697	10
J-DIX-2034	53.6	1,706	32.3	P-DIX-1569	10
J-DIX-2036	53.88	2,495	39.9	P-DIX-300	10
J-DIX-2038	53.57	2,413	39.5	P-DIX-950	10
J-DIX-204	56.67	881	46.7	P-DIX-3265	10
J-DIX-2040	55.6	2,337	42.0	P-DIX-2701	10
J-DIX-2042	55.19	5,133	26.3	P-DIX-2737	10
J-DIX-2044	54.08	2,002	41.8	P-DIX-302	10
J-DIX-2046	52.19	2,164	36.4	P-DIX-2151	10
J-DIX-2048	52.01	2,181	35.8	P-DIX-528	10
J-DIX-2050	54.15	2,634	27.7	P-DIX-1785	10
J-DIX-2052	54.06	1,334	44.2	P-DIX-306	10
J-DIX-2054	54.37	1,949	41.5	P-DIX-2775	10
J-DIX-2056	53.29	1,666	34.6	P-DIX-2733	10
J-DIX-2058	55.32	1,240	45.4	P-DIX-308	10
J-DIX-206	58.02	881	50.0	P-DIX-3269	10
J-DIX-2060	55.46	2,190	39.0	P-DIX-751	10
J-DIX-2062	54.09	2,341	41.8	P-DIX-2153	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-2064	52.71	2,797	35.5	P-DIX-310	10
J-DIX-2066	54.61	6,603	20.4		
J-DIX-2068	54.48	2,382	43.5	P-DIX-2161	10
J-DIX-2070	54.56	2,517	42.6	P-DIX-524	10
J-DIX-2074	53.66	2,666	38.8	P-DIX-312	10
J-DIX-2076	53.28	2,499	40.7	P-DIX-876	10
J-DIX-2078	53.1	2,110	42.6	P-DIX-314	10
J-DIX-208	59.19	881	46.6	P-DIX-3273	10
J-DIX-2080	47.29	1,275	40.3	P-DIX-1813	10
J-DIX-2082	47.05	2,221	20.1		
J-DIX-2084	48.69	1,511	25.2	P-DIX-954	10
J-DIX-2086	52.63	484	45.9	P-DIX-759	10
J-DIX-2088	48.75	996	37.4	P-DIX-1603	10
J-DIX-2090	51.49	2,734	42.3	P-DIX-817	10
J-DIX-2092	49.43	2,903	44.4	P-DIX-2751	10
J-DIX-2096	55.49	1,085	47.7	P-DIX-318	10
J-DIX-2098	55.43	1,568	43.9	P-DIX-811	10
J-DIX-210	58.32	881	47.8	P-DIX-3277	10
J-DIX-2100	55.87	786	47.8	P-DIX-801	10
J-DIX-2102	54.83	1,433	44.6	P-DIX-809	10
J-DIX-2104	54.97	1,351	44.6	P-DIX-520	10
J-DIX-2106	55.28	1,158	39.8	P-DIX-518	10
J-DIX-2108	54.99	379	49.0	P-DIX-320	10
J-DIX-2110	54.39	389	35.6	P-DIX-322	10
J-DIX-2112	54.35	389	36.9	P-DIX-2149	10
J-DIX-2114	56.08	1,148	41.2	P-DIX-324	10
J-DIX-2116	56.03	1,134	41.7	P-DIX-1545	10
J-DIX-2118	55	1,500	43.8	P-DIX-1549	10
J-DIX-212	59.68	881	53.0	P-DIX-3281	10
J-DIX-2120	54.86	2,524	33.7	P-DIX-1551	10
J-DIX-2122	54.98	2,237	38.1	P-DIX-307	10
J-DIX-2124	55.03	2,252	37.8	P-DIX-956	10
J-DIX-2126	54.88	1,341	45.7	P-DIX-516	10
J-DIX-2128	55.03	1,393	45.1	P-DIX-1559	10
J-DIX-2130	55.03	1,418	44.7	P-DIX-878	10
J-DIX-2132	54.84	2,377	34.6	P-DIX-809	10
J-DIX-2134	55.48	2,190	37.8	P-DIX-811	10
J-DIX-2136	54.92	2,567	33.0	P-DIX-2769	10
J-DIX-2138	55.12	1,460	44.3	P-DIX-2769	10
J-DIX-214	60.05	881	54.5	P-DIX-3285	10
J-DIX-2146	54.66	881	50.3	P-DIX-295	10
J-DIX-2148	55.93	881	51.6	P-DIX-297	10
J-DIX-2150	56.45	881	51.4	P-DIX-305	10
J-DIX-2152	54.97	881	50.9	P-DIX-1897	10
J-DIX-2154	55.24	881	50.0	P-DIX-1909	10
J-DIX-2156	55.01	98	53.1	P-DIX-301	10
J-DIX-2158	54.12	1,567	36.9	P-DIX-1639	10
J-DIX-216	61.91	881	56.4	P-DIX-3401	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-2160	58.41	1,567	36.6	P-DIX-1391	10
J-DIX-2162	59.99	1,567	50.2	P-DIX-989	10
J-DIX-2168	53.52	881	48.4	P-DIX-933	10
J-DIX-2170	56.63	881	42.0	P-DIX-582	10
J-DIX-2172	55.47	881	49.0	P-DIX-645	10
J-DIX-2174	53.46	881	48.4	P-DIX-2565	10
J-DIX-2176	52.93	881	44.1	P-DIX-951	10
J-DIX-2178	55.16	1,567	31.0	P-DIX-2067	10
J-DIX-218	58.66	881	50.1	P-DIX-3405	10
J-DIX-2180	56.14	881	50.6	P-DIX-591	10
J-DIX-2182	56.14	881	50.6	P-DIX-1211	10
J-DIX-2184	57.09	881	49.3	P-DIX-589	10
J-DIX-2186	59.57	98	57.1	P-DIX-521	10
J-DIX-2188	59.49	1,567	43.9	P-DIX-975	10
J-DIX-2190	54.76	1,567	47.4	P-DIX-571	10
J-DIX-2192	59.76	881	50.6	P-DIX-2331	10
J-DIX-2194	54.61	1,846	46.6	P-DIX-2773	10
J-DIX-2196	50.37	1,567	45.4	P-DIX-2771	10
J-DIX-2198	55.07	1,567	44.3	P-DIX-803	10
J-DIX-22	57.21	220	52.1	P-DIX-3963	10
J-DIX-220	58.47	881	49.6	P-DIX-3409	10
J-DIX-2200	55.24	1,430	45.0	P-DIX-99	10
J-DIX-2202	54.87	1,263	46.7	P-DIX-107	10
J-DIX-2204	55.54	1,553	43.3	P-DIX-115	10
J-DIX-2206	54.64	92	41.8	P-DIX-175	10
J-DIX-2208	56.46	386	52.2	P-DIX-181	10
J-DIX-2210	57.09	1,697	31.8	P-DIX-15	10
J-DIX-2212	58.2	1,556	36.7	P-DIX-227	10
J-DIX-2214	58.21	1,519	37.7	P-DIX-227	10
J-DIX-2216	55.42	1,354	44.7	P-DIX-265	10
J-DIX-2218	56.72	1,672	39.4	P-DIX-120	10
J-DIX-222	60.6	881	52.4	P-DIX-3415	10
J-DIX-2220	55.12	95	47.7	P-DIX-273	10
J-DIX-2222	55.92	1,422	44.3	P-DIX-2393	10
J-DIX-2224	57.08	2,211	42.0	P-DIX-1323	10
J-DIX-2226	57.06	1,910	45.9	P-DIX-1357	10
J-DIX-2230	57.63	2,313	24.6	P-DIX-1165	10
J-DIX-2232	58.05	2,310	30.7	P-DIX-2433	10
J-DIX-2234	56.29	2,901	31.1	P-DIX-2077	10
J-DIX-2236	54.29	1,666	30.1	P-DIX-1657	10
J-DIX-2238	59.15	1,317	49.7	P-DIX-501	10
J-DIX-224	60.19	881	52.4	P-DIX-3417	10
J-DIX-2240	56.65	1,683	33.1	P-DIX-503	10
J-DIX-2242	58.32	1,204	47.6	P-DIX-1259	10
J-DIX-2244	58.46	2,237	42.1	P-DIX-2347	10
J-DIX-2246	56.3	1,216	45.9	P-DIX-705	10
J-DIX-2248	57.96	1,241	47.0	P-DIX-2365	10
J-DIX-2250	57.89	1,876	28.9	P-DIX-856	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-2252	56.31	1,195	46.2	P-DIX-1679	10
J-DIX-2254	57.88	1,684	31.2	P-DIX-2183	10
J-DIX-2256	57.79	1,238	44.1	P-DIX-2245	10
J-DIX-2258	58.08	1,274	44.4	P-DIX-2243	10
J-DIX-226	58.71	881	50.0	P-DIX-3421	10
J-DIX-2260	59.18	1,239	46.7	P-DIX-2253	10
J-DIX-2262	56.77	2,551	35.0	P-DIX-2795	10
J-DIX-2264	59.55	2,606	38.3	P-DIX-166	10
J-DIX-2266	55.27	1,409	44.6	P-DIX-2193	10
J-DIX-2268	58.04	1,208	47.7	P-DIX-537	10
J-DIX-2270	57.35	1,615	41.7	P-DIX-2415	10
J-DIX-2272	61.34	881	56.4	P-DIX-2425	10
J-DIX-2274	59.07	1,169	51.1	P-DIX-1505	10
J-DIX-2276	60.57	1,563	41.3	P-DIX-1475	10
J-DIX-2278	54.72	2,061	34.1	P-DIX-2463	10
J-DIX-2280	55.13	2,070	36.8	P-DIX-1127	10
J-DIX-2282	53.84	1,019	48.4	P-DIX-2473	10
J-DIX-2284	55.57	1,517	45.5	P-DIX-681	10
J-DIX-2286	56.48	1,486	45.5	P-DIX-2507	10
J-DIX-2288	57.57	1,608	45.6	P-DIX-2073	10
J-DIX-2290	55.47	1,183	47.4	P-DIX-729	10
J-DIX-2292	53.96	1,562	36.0	P-DIX-924	10
J-DIX-2294	55.6	1,572	43.4	P-DIX-899	10
J-DIX-2296	54.75	141	33.0	P-DIX-905	10
J-DIX-2298	54.9	159	21.4	P-DIX-907	10
J-DIX-230	53.71	881	44.9	P-DIX-3487	10
J-DIX-2300	55.15	135	39.0	P-DIX-917	10
J-DIX-2302	54.95	113	50.9	P-DIX-915	10
J-DIX-2304	55.63	1,412	45.0	P-DIX-921	10
J-DIX-2306	54.29	1,307	46.6	P-DIX-463	10
J-DIX-2308	55.6	1,350	46.7	P-DIX-553	10
J-DIX-2310	54.97	1,487	44.4	P-DIX-555	10
J-DIX-2312	53.42	1,457	43.2	P-DIX-565	10
J-DIX-2314	54.6	1,272	46.9	P-DIX-1183	10
J-DIX-2316	54.59	1,384	38.8	P-DIX-578	10
J-DIX-2318	54.24	98	40.5	P-DIX-2569	10
J-DIX-232	54.98	881	37.4	P-DIX-3489	10
J-DIX-2320	55.41	1,282	43.1	P-DIX-2021	10
J-DIX-2322	53.4	1,741	26.9	P-DIX-2087	10
J-DIX-2324	54.98	2,766	29.5	P-DIX-1515	10
J-DIX-2326	55.14	1,959	41.6	P-DIX-1013	10
J-DIX-2328	56.07	2,124	41.3	P-DIX-1025	10
J-DIX-2330	55.12	2,903	26.1	P-DIX-1409	10
J-DIX-2332	55.06	1,232	44.4	P-DIX-343	10
J-DIX-2334	52.81	1,274	40.9	P-DIX-1815	10
J-DIX-2336	53.43	1,559	33.1	P-DIX-1825	10
J-DIX-2338	54.51	1,458	37.6	P-DIX-961	10
J-DIX-234	53.24	881	42.4	P-DIX-3493	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-2340	55.23	1,715	31.4	P-DIX-930	10
J-DIX-2342	54.16	573	45.7	P-DIX-969	10
J-DIX-2344	54.69	637	43.4	P-DIX-2529	10
J-DIX-2346	54.47	1,367	40.3	P-DIX-2537	10
J-DIX-2348	53.56	1,641	41.1	P-DIX-2559	10
J-DIX-2350	53.75	1,427	43.7	P-DIX-2561	10
J-DIX-2352	52.68	1,454	39.3	P-DIX-1851	10
J-DIX-2354	53.88	667	34.7	P-DIX-1077	10
J-DIX-2356	54.52	754	29.7	P-DIX-1085	10
J-DIX-2358	53.48	1,195	46.6	P-DIX-1089	10
J-DIX-236	54.91	881	39.1	P-DIX-3495	10
J-DIX-2360	53.53	1,573	40.5	P-DIX-2057	10
J-DIX-2362	53.3	518	20.0		
J-DIX-2364	54.06	518	47.2	P-DIX-2063	10
J-DIX-2366	53.92	1,426	44.5	P-DIX-1589	10
J-DIX-2368	53.97	1,204	47.2	P-DIX-1595	10
J-DIX-2370	52.04	157	42.7	P-DIX-2037	10
J-DIX-2372	53.03	390	23.3	P-DIX-2049	10
J-DIX-2374	55.36	881	49.9	P-DIX-657	10
J-DIX-2376	55.35	1,698	43.7	P-DIX-1535	10
J-DIX-2378	54.46	2,560	43.3	P-DIX-663	10
J-DIX-238	55.41	881	48.0	P-DIX-3499	10
J-DIX-2380	54.49	3,063	41.3	P-DIX-665	10
J-DIX-2382	54.64	2,384	43.9	P-DIX-381	10
J-DIX-2384	55.41	2,747	42.1	P-DIX-385	10
J-DIX-2386	55.25	5,896	30.7	P-DIX-1197	10
J-DIX-2388	56.09	1,413	47.9	P-DIX-1227	10
J-DIX-2390	55.69	1,207	49.0	P-DIX-1233	10
J-DIX-2392	55.93	1,222	48.8	P-DIX-2409	10
J-DIX-2394	55.81	1,811	44.8	P-DIX-1955	10
J-DIX-2396	55.69	1,136	49.4	P-DIX-2165	10
J-DIX-2398	59.14	611	45.1	P-DIX-1999	10
J-DIX-24	56.35	392	48.5	P-DIX-3973	10
J-DIX-240	54.53	881	47.3	P-DIX-3503	10
J-DIX-2400	58.65	409	53.1	P-DIX-2001	10
J-DIX-2402	58.71	411	52.6	P-DIX-2821	10
J-DIX-2404	58.19	142	49.6	P-DIX-2011	10
J-DIX-2406	56.69	6,080	27.7	P-DIX-407	10
J-DIX-2408	59.18	1,841	45.3	P-DIX-569	10
J-DIX-2410	56.77	1,677	36.5	P-DIX-2217	10
J-DIX-2412	57.55	868	40.6	P-DIX-601	10
J-DIX-2414	56.55	871	31.9	P-DIX-603	10
J-DIX-2416	56.92	875	27.5	P-DIX-607	10
J-DIX-2418	57.98	876	25.5	P-DIX-2573	10
J-DIX-242	54.63	881	47.7	P-DIX-3507	10
J-DIX-2420	58.31	1,455	42.6	P-DIX-2579	10
J-DIX-2422	57.93	1,333	48.7	P-DIX-411	10
J-DIX-2424	57.99	1,150	52.3	P-DIX-419	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-2426	59.42	2,651	36.0	P-DIX-865	10
J-DIX-2428	58.99	2,575	37.3	P-DIX-861	10
J-DIX-2430	58.11	1,509	39.8	P-DIX-2645	10
J-DIX-2432	58.64	1,629	39.4	P-DIX-2575	10
J-DIX-2434	54.59	3,085	41.9	P-DIX-1879	10
J-DIX-2436	59.15	1,328	45.4	P-DIX-2127	10
J-DIX-2438	53.3	2,784	31.0	P-DIX-877	10
J-DIX-244	55.81	881	46.6	P-DIX-3511	10
J-DIX-2440	53.83	2,281	39.0	P-DIX-1573	10
J-DIX-2444	54.43	1,522	37.6	P-DIX-675	10
J-DIX-2446	53.31	1,732	32.8	P-DIX-1699	10
J-DIX-2448	53.85	1,650	33.6	P-DIX-1565	10
J-DIX-2450	53.09	2,764	35.7	P-DIX-1747	10
J-DIX-2452	53.86	2,859	34.0	P-DIX-1441	10
J-DIX-2454	53.84	1,655	35.4	P-DIX-2729	10
J-DIX-2456	54.65	1,336	46.1	P-DIX-2155	10
J-DIX-2458	47.69	1,464	31.1	P-DIX-1807	10
J-DIX-246	53.93	881	44.6	P-DIX-3515	10
J-DIX-2460	48.33	1,555	27.2	P-DIX-1805	10
J-DIX-2462	48.5	1,657	20.9	P-DIX-954	10
J-DIX-2464	48.75	1,496	25.7	P-DIX-1799	10
J-DIX-2466	50.34	672	41.0	P-DIX-1795	10
J-DIX-2468	55.47	754	43.1	P-DIX-791	10
J-DIX-2470	55.46	676	45.5	P-DIX-793	10
J-DIX-2472	55.03	1,445	44.4	P-DIX-328	10
J-DIX-2474	55.02	1,881	38.8	P-DIX-1555	10
J-DIX-2476	55.11	1,359	38.7	P-DIX-1543	10
J-DIX-2478	54.31	1,608	41.0	P-DIX-1773	10
J-DIX-248	54.51	881	46.0	P-DIX-3519	10
J-DIX-2494	47.77	1,223	44.0	P-DIX-9090	10
J-DIX-250	54.26	881	48.4	P-DIX-3293	10
J-DIX-2508	54.09	881	44.3	P-DIX-615	10
J-DIX-2510	55.17	98	39.6	P-DIX-139	10
J-DIX-2512	55.84	98	35.9	P-DIX-177	10
J-DIX-2514	57.14	98	35.5	P-DIX-13	10
J-DIX-2516	57.64	392	47.3	P-DIX-245	10
J-DIX-2518	60.2	392	49.0	P-DIX-241	10
J-DIX-252	54.05	881	48.5	P-DIX-3523	10
J-DIX-2520	56.39	881	42.8	P-DIX-311	10
J-DIX-2522	56.65	1,567	37.8	P-DIX-1267	10
J-DIX-2524	57.5	3,525	35.6	P-DIX-1297	10
J-DIX-2526	57.09	1,567	41.3	P-DIX-130	10
J-DIX-2528	56.76	1,567	35.0	P-DIX-1615	10
J-DIX-2530	58.07	1,567	35.4	P-DIX-136	10
J-DIX-2532	56.29	1,567	31.6	P-DIX-138	10
J-DIX-2534	58.26	881	44.5	P-DIX-854	10
J-DIX-2536	55.01	881	44.4	P-DIX-2421	10
J-DIX-2538	55.7	881	46.2	P-DIX-1039	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-254	54.83	881	49.4	P-DIX-3529	10
J-DIX-2540	55.63	881	46.0	P-DIX-1035	10
J-DIX-2542	55.21	392	47.5	P-DIX-1031	10
J-DIX-2544	57.23	392	45.6	P-DIX-1059	10
J-DIX-2546	59.31	881	50.9	P-DIX-489	10
J-DIX-2548	60.2	98	41.1	P-DIX-2267	10
J-DIX-2550	60.49	881	53.8	P-DIX-2419	10
J-DIX-2552	60.95	1,685	53.3	P-DIX-5006	10
J-DIX-2554	54.98	881	40.2	P-DIX-2431	10
J-DIX-2556	58.58	881	43.6	P-DIX-1389	10
J-DIX-2558	57.84	881	21.6	P-DIX-1399	10
J-DIX-256	56.65	881	41.3	P-DIX-3553	10
J-DIX-2560	53.24	1,567	24.6	P-DIX-619	10
J-DIX-2562	55.41	881	43.6	P-DIX-1113	10
J-DIX-2564	56.42	881	45.1	P-DIX-1119	10
J-DIX-2566	53.69	392	38.4	P-DIX-709	10
J-DIX-2568	52.8	392	38.2	P-DIX-713	10
J-DIX-2570	54.74	98	30.2	P-DIX-909	10
J-DIX-2572	54.7	98	29.9	P-DIX-1845	10
J-DIX-2574	56.13	881	39.2	P-DIX-2571	10
J-DIX-2576	53.6	392	42.6	P-DIX-995	10
J-DIX-2578	54.86	392	44.0	P-DIX-1003	10
J-DIX-258	54.39	881	46.5	P-DIX-3535	10
J-DIX-2580	54.24	98	25.6	P-DIX-2567	10
J-DIX-2584	53.68	372	20.0		
J-DIX-2586	55.46	1,845	40.6	P-DIX-1207	10
J-DIX-2588	56.19	98	50.3	P-DIX-1983	10
J-DIX-2590	56.6	98	49.7	P-DIX-581	10
J-DIX-2592	59.09	98	40.6	P-DIX-583	10
J-DIX-2594	60.59	881	47.3	P-DIX-851	10
J-DIX-2596	59.93	1,567	45.5	P-DIX-2017	10
J-DIX-2598	56.23	392	44.9	P-DIX-2117	10
J-DIX-26	57.09	392	52.2	P-DIX-3987	10
J-DIX-260	55.71	881	49.1	P-DIX-3539	10
J-DIX-2600	58.96	881	51.5	P-DIX-1969	10
J-DIX-2602	58.09	1,567	33.6	P-DIX-1831	10
J-DIX-2604	53.28	881	37.0	P-DIX-286	10
J-DIX-2606	53.49	2,171	38.5	P-DIX-731	10
J-DIX-2608	52.08	881	43.9	P-DIX-1707	10
J-DIX-2610	53	881	43.1	P-DIX-2089	10
J-DIX-2612	52.16	881	41.6	P-DIX-1711	10
J-DIX-2614	54.23	881	45.3	P-DIX-2669	10
J-DIX-2616	53.98	881	42.9	P-DIX-2675	10
J-DIX-2618	55.57	881	44.2	P-DIX-2677	10
J-DIX-262	53.97	881	45.2	P-DIX-3543	10
J-DIX-2620	55.38	881	46.9	P-DIX-1715	10
J-DIX-2622	52.38	881	41.8	P-DIX-1841	10
J-DIX-2624	54.83	507	20.0		

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-2626	52.93	2,636	37.2	P-DIX-2139	10
J-DIX-2628	54.15	392	33.6	P-DIX-1445	10
J-DIX-2630	53.07	881	36.4	P-DIX-1451	10
J-DIX-2632	52.81	392	46.1	P-DIX-1459	10
J-DIX-2634	54.18	392	48.5	P-DIX-2777	10
J-DIX-2636	53.74	2,749	36.5	P-DIX-2775	10
J-DIX-2638	50.91	98	35.8	P-DIX-763	10
J-DIX-264	56.01	881	48.7	P-DIX-3547	10
J-DIX-2640	47.34	77	20.0		
J-DIX-2642	56.31	3,295	25.4	P-DIX-2367	10
J-DIX-2644	56.96	1,748	43.0	P-DIX-944	10
J-DIX-2646	60.52	392	50.6	P-DIX-2843	10
J-DIX-2648	56.35	2,622	34.0	P-DIX-2833	10
J-DIX-2650	55.91	1,318	46.8	P-DIX-2803	10
J-DIX-2652	58.04	3,912	20.2		
J-DIX-2654	58.76	1,165	50.8	P-DIX-511	10
J-DIX-2656	58.75	1,202	50.3	P-DIX-513	10
J-DIX-2658	57.62	1,963	38.1	P-DIX-2855	10
J-DIX-266	54.89	881	48.8	P-DIX-3551	10
J-DIX-2660	54.85	1,326	45.9	P-DIX-2555	10
J-DIX-2662	55.38	1,301	46.9	P-DIX-2553	10
J-DIX-2664	57.41	1,634	36.9	P-DIX-1251	10
J-DIX-2666	57.47	1,645	36.7	P-DIX-2259	10
J-DIX-2668	57.16	2,390	20.1		
J-DIX-2670	58.08	2,466	26.3	P-DIX-958	10
J-DIX-2672	57.88	2,552	23.8	P-DIX-2837	10
J-DIX-2674	58.04	2,702	35.0	P-DIX-2891	10
J-DIX-2676	55.83	1,661	42.8	P-DIX-2805	10
J-DIX-2678	56.75	1,536	45.8	P-DIX-1509	10
J-DIX-268	54.16	881	49.1	P-DIX-3557	10
J-DIX-2680	54.98	1,195	47.1	P-DIX-1921	10
J-DIX-2682	55.46	1,544	43.6	P-DIX-103	10
J-DIX-2684	55.42	111	53.9	P-DIX-1255	10
J-DIX-2686	55.41	5,890	27.6	P-DIX-85	10
J-DIX-2688	55.44	5,905	27.5	P-DIX-87	10
J-DIX-2690	55.55	126	51.8	P-DIX-81	10
J-DIX-2692	54.67	1,487	44.7	P-DIX-105	10
J-DIX-2694	55.23	1,126	40.3	P-DIX-167	10
J-DIX-2696	55.23	881	42.3	P-DIX-133	10
J-DIX-2698	56.72	880	48.3	P-DIX-2937	10
J-DIX-270	54.1	881	48.3	P-DIX-3561	10
J-DIX-2700	55.67	1,695	39.6	P-DIX-189	10
J-DIX-2702	55.67	1,724	39.2	P-DIX-1437	10
J-DIX-2704	56.61	661	43.2	P-DIX-205	10
J-DIX-2706	55.78	1,018	42.5	P-DIX-203	10
J-DIX-2708	56.97	1,032	42.6	P-DIX-201	10
J-DIX-2710	57.28	1,645	38.6	P-DIX-213	10
J-DIX-2712	57.11	1,290	43.2	P-DIX-217	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-2714	57.15	1,326	42.2	P-DIX-219	10
J-DIX-2716	59.55	2,220	26.7	P-DIX-112	10
J-DIX-2718	56.52	2,194	20.1		
J-DIX-272	54.44	881	45.1	P-DIX-3799	10
J-DIX-2720	56.52	2,181	20.1		
J-DIX-2722	58.32	2,165	20.1		
J-DIX-2724	58.31	1,842	28.7	P-DIX-49	10
J-DIX-2726	58.05	1,497	37.3	P-DIX-49	10
J-DIX-2728	55.43	1,038	50.9	P-DIX-1925	10
J-DIX-2730	56.43	1,536	38.4	P-DIX-1215	10
J-DIX-2732	57.33	1,937	30.7	P-DIX-1251	10
J-DIX-2734	57.65	1,794	38.9	P-DIX-1253	10
J-DIX-2736	55.4	889	51.3	P-DIX-1933	10
J-DIX-2738	54.22	1,491	44.4	P-DIX-2881	10
J-DIX-274	54.05	881	46.9	P-DIX-3803	10
J-DIX-2740	56.55	862	49.3	P-DIX-2883	10
J-DIX-2742	58.67	1,077	49.1	P-DIX-2885	10
J-DIX-2744	54.56	988	46.7	P-DIX-527	10
J-DIX-2746	54.88	881	49.7	P-DIX-971	10
J-DIX-2748	57.19	2,102	30.1	P-DIX-2197	10
J-DIX-2750	61.36	2,959	34.1	P-DIX-2895	10
J-DIX-2752	56.01	5,914	21.5	P-DIX-61	10
J-DIX-2754	57.3	881	53.1	P-DIX-2897	10
J-DIX-2756	55.77	6,349	20.4		
J-DIX-2758	56.03	1,906	45.5	P-DIX-2867	10
J-DIX-276	54.22	881	46.9	P-DIX-3807	10
J-DIX-2760	56.17	1,178	49.8	P-DIX-2869	10
J-DIX-2762	56.45	1,326	48.3	P-DIX-2877	10
J-DIX-2764	56.2	881	50.9	P-DIX-2901	10
J-DIX-2766	56.71	1,269	49.4	P-DIX-1893	10
J-DIX-2768	54.97	5,268	30.4	P-DIX-1901	10
J-DIX-2770	54.97	1,036	50.3	P-DIX-1905	10
J-DIX-2772	55.07	881	50.3	P-DIX-1907	10
J-DIX-2774	54.69	1,029	49.6	P-DIX-1911	10
J-DIX-2776	54.98	6,520	20.4		
J-DIX-2778	54.98	881	50.5	P-DIX-2905	10
J-DIX-278	55.42	881	47.1	P-DIX-3809	10
J-DIX-2780	54.95	1,087	49.0	P-DIX-63	10
J-DIX-2782	55.4	1,054	50.6	P-DIX-67	10
J-DIX-2784	55.72	1,228	48.9	P-DIX-71	10
J-DIX-2786	55.6	1,138	49.3	P-DIX-69	10
J-DIX-2788	55.79	881	50.5	P-DIX-2909	10
J-DIX-2790	55.04	881	50.6	P-DIX-2913	10
J-DIX-2792	55.42	879	49.1	P-DIX-2917	10
J-DIX-2794	56.62	5,994	27.9	P-DIX-89	10
J-DIX-2796	55.59	133	50.8	P-DIX-95	10
J-DIX-2798	55.24	881	51.2	P-DIX-2921	10
J-DIX-28	54.93	392	51.8	P-DIX-3989	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-280	53.66	881	46.1	P-DIX-3813	10
J-DIX-2800	55.28	1,452	44.7	P-DIX-101	10
J-DIX-2802	55.12	1,400	45.1	P-DIX-283	10
J-DIX-2804	55.14	1,291	45.9	P-DIX-285	10
J-DIX-2806	54.88	1,633	42.9	P-DIX-281	10
J-DIX-2808	54.99	1,282	46.6	P-DIX-109	10
J-DIX-2810	55.05	1,304	46.4	P-DIX-277	10
J-DIX-2812	56.05	111	54.5	P-DIX-121	10
J-DIX-2814	54.33	543	49.5	P-DIX-125	10
J-DIX-2816	56.07	5,924	29.2	P-DIX-964	10
J-DIX-2818	56.07	881	52.0	P-DIX-2925	10
J-DIX-282	55.41	881	45.3	P-DIX-3823	10
J-DIX-2820	55.29	881	42.0	P-DIX-2929	10
J-DIX-2822	55.08	538	49.1	P-DIX-137	10
J-DIX-2824	55.12	95	48.9	P-DIX-303	10
J-DIX-2826	55.66	96	54.3	P-DIX-3693	10
J-DIX-2828	56.26	532	50.3	P-DIX-145	10
J-DIX-2830	55.84	1,390	44.5	P-DIX-149	10
J-DIX-2832	54.35	1,569	39.5	P-DIX-151	10
J-DIX-2834	54.35	881	44.7	P-DIX-2987	10
J-DIX-2836	55.78	487	52.4	P-DIX-157	10
J-DIX-2838	55.86	1,742	39.1	P-DIX-309	10
J-DIX-284	53.94	881	43.3	P-DIX-3291	10
J-DIX-2840	54.99	1,488	41.1	P-DIX-163	10
J-DIX-2842	54.99	1,669	38.7	P-DIX-165	10
J-DIX-2844	56.72	880	48.6	P-DIX-2935	10
J-DIX-2846	56.72	1,050	46.8	P-DIX-900	10
J-DIX-2848	56.47	881	42.2	P-DIX-2939	10
J-DIX-2850	55.23	92	51.7	P-DIX-173	10
J-DIX-2852	56.18	881	44.2	P-DIX-2943	10
J-DIX-2854	55.86	1,576	41.6	P-DIX-187	10
J-DIX-2856	55.69	1,350	43.7	P-DIX-195	10
J-DIX-2858	55.48	1,725	36.8	P-DIX-197	10
J-DIX-286	55.79	881	46.2	P-DIX-3831	10
J-DIX-2860	56.36	955	47.4	P-DIX-199	10
J-DIX-2862	57.45	335	53.2	P-DIX-3795	10
J-DIX-2864	57.16	881	50.8	P-DIX-3697	10
J-DIX-2866	57.81	1,701	20.0		
J-DIX-2868	57.8	880	44.4	P-DIX-2947	10
J-DIX-2870	57.25	1,206	45.8	P-DIX-215	10
J-DIX-2872	58.31	1,548	41.0	P-DIX-223	10
J-DIX-2874	58.33	879	50.7	P-DIX-2951	10
J-DIX-2876	57.1	881	47.9	P-DIX-2955	10
J-DIX-2878	57.04	96	53.1	P-DIX-11	10
J-DIX-288	54.57	881	46.9	P-DIX-3835	10
J-DIX-2880	57.48	389	53.5	P-DIX-247	10
J-DIX-2882	57.35	1,125	48.5	P-DIX-17	10
J-DIX-2884	57.18	881	49.9	P-DIX-2959	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-2886	57.33	1,166	47.5	P-DIX-624	10
J-DIX-2888	57.8	976	50.7	P-DIX-235	10
J-DIX-2890	58.16	2,139	28.6	P-DIX-23	10
J-DIX-2892	59.04	881	50.4	P-DIX-2963	10
J-DIX-2894	56.52	880	47.3	P-DIX-2967	10
J-DIX-2896	56.52	2,212	20.1		
J-DIX-2898	57.45	881	47.1	P-DIX-2971	10
J-DIX-290	54.8	881	48.0	P-DIX-3839	10
J-DIX-2900	58.02	390	54.3	P-DIX-243	10
J-DIX-2902	58.93	881	49.0	P-DIX-2975	10
J-DIX-2904	58.18	2,156	20.1		
J-DIX-2906	58.05	1,523	36.7	P-DIX-51	10
J-DIX-2908	57.27	1,474	37.2	P-DIX-47	10
J-DIX-2910	57.2	1,216	44.6	P-DIX-47	10
J-DIX-2912	56.5	1,330	41.7	P-DIX-55	10
J-DIX-2914	57.62	878	48.2	P-DIX-2979	10
J-DIX-2916	56.68	881	50.3	P-DIX-2983	10
J-DIX-2918	56.79	3,036	24.3	P-DIX-253	10
J-DIX-292	55.56	881	49.0	P-DIX-3843	10
J-DIX-2920	56.78	1,567	43.9	P-DIX-249	10
J-DIX-2922	56.61	2,433	20.1		
J-DIX-2924	56.52	2,754	28.9	P-DIX-620	10
J-DIX-2926	55.41	392	53.0	P-DIX-3941	10
J-DIX-2928	57.16	1,339	46.7	P-DIX-267	10
J-DIX-2930	56.05	881	48.9	P-DIX-3705	10
J-DIX-2932	57.56	880	47.8	P-DIX-2993	10
J-DIX-2934	57.47	878	47.4	P-DIX-313	10
J-DIX-2936	57.85	1,020	44.4	P-DIX-317	10
J-DIX-2938	57.81	981	45.4	P-DIX-321	10
J-DIX-294	56.16	881	49.2	P-DIX-3847	10
J-DIX-2940	57.24	881	44.3	P-DIX-2997	10
J-DIX-2942	56.97	879	50.8	P-DIX-2999	10
J-DIX-2944	56.43	1,563	46.7	P-DIX-1271	10
J-DIX-2946	56.39	3,091	33.7	P-DIX-1299	10
J-DIX-2948	56.36	3,091	33.6	P-DIX-124	10
J-DIX-2950	56.23	881	51.2	P-DIX-3003	10
J-DIX-2952	57.68	2,073	44.7	P-DIX-1283	10
J-DIX-2954	57.91	881	53.0	P-DIX-3007	10
J-DIX-2956	56.98	1,991	46.1	P-DIX-1293	10
J-DIX-2958	56.98	1,765	47.4	P-DIX-1291	10
J-DIX-296	55.72	881	48.6	P-DIX-3851	10
J-DIX-2960	57.28	3,522	36.2	P-DIX-1295	10
J-DIX-2962	57.37	3,947	35.1	P-DIX-1307	10
J-DIX-2964	57.5	4,185	33.6	P-DIX-616	10
J-DIX-2966	57.44	1,756	48.3	P-DIX-1303	10
J-DIX-2968	57.43	1,665	48.8	P-DIX-1301	10
J-DIX-2970	56.67	881	52.1	P-DIX-3011	10
J-DIX-2972	56.98	881	52.5	P-DIX-3015	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-2974	57.26	2,064	44.2	P-DIX-1325	10
J-DIX-2976	57.23	2,117	43.4	P-DIX-1315	10
J-DIX-2978	57.32	1,563	47.8	P-DIX-1317	10
J-DIX-298	54.4	881	47.7	P-DIX-3855	10
J-DIX-2980	57.56	881	52.3	P-DIX-3019	10
J-DIX-2982	57.01	881	50.1	P-DIX-3023	10
J-DIX-2986	56.61	881	52.3	P-DIX-3027	10
J-DIX-2990	56.05	5,928	20.4		
J-DIX-2996	57.39	2,950	32.2	P-DIX-1355	10
J-DIX-2998	56.73	880	51.3	P-DIX-3031	10
J-DIX-30	56.12	881	51.0	P-DIX-2899	10
J-DIX-300	55.49	881	44.8	P-DIX-3207	10
J-DIX-3000	57.54	881	52.1	P-DIX-3035	10
J-DIX-3002	57.43	878	52.3	P-DIX-3039	10
J-DIX-3004	56.91	2,505	34.6	P-DIX-1151	10
J-DIX-3006	57	2,257	40.1	P-DIX-1153	10
J-DIX-3010	57.66	2,440	20.1		
J-DIX-3012	56.66	880	41.1	P-DIX-1625	10
J-DIX-3014	58.21	881	48.1	P-DIX-3049	10
J-DIX-3016	58.11	878	44.2	P-DIX-3053	10
J-DIX-3018	56.94	881	46.7	P-DIX-3061	10
J-DIX-302	56.1	881	48.1	P-DIX-3213	10
J-DIX-3020	58.07	881	50.0	P-DIX-3977	10
J-DIX-3022	57.92	1,868	36.3	P-DIX-2793	10
J-DIX-3024	56.67	881	47.7	P-DIX-3065	10
J-DIX-3028	54.57	2,496	20.1		
J-DIX-3030	54.66	881	46.2	P-DIX-3069	10
J-DIX-3032	54.8	2,510	20.1		
J-DIX-3034	53.8	876	45.4	P-DIX-1373	10
J-DIX-3036	54.69	880	40.9	P-DIX-1377	10
J-DIX-3038	55.13	880	47.2	P-DIX-3073	10
J-DIX-304	55	881	45.5	P-DIX-3217	10
J-DIX-3040	55.93	1,949	38.3	P-DIX-1381	10
J-DIX-3042	56.11	2,203	35.2	P-DIX-608	10
J-DIX-3044	55.88	881	48.9	P-DIX-3077	10
J-DIX-3046	55.58	881	48.4	P-DIX-3081	10
J-DIX-3048	54.93	2,165	34.6	P-DIX-1641	10
J-DIX-3050	56.82	2,172	39.3	P-DIX-1643	10
J-DIX-3052	59.02	2,612	37.4	P-DIX-1645	10
J-DIX-3054	57.39	2,554	36.5	P-DIX-1647	10
J-DIX-3056	53.29	1,053	45.8	P-DIX-1653	10
J-DIX-3058	54.03	877	46.5	P-DIX-2423	10
J-DIX-306	53.91	881	47.7	P-DIX-3221	10
J-DIX-3060	55.08	1,691	30.3	P-DIX-1659	10
J-DIX-3062	55.97	388	52.2	P-DIX-1667	10
J-DIX-3064	57.71	876	50.9	P-DIX-610	10
J-DIX-3066	58.54	878	51.9	P-DIX-150	10
J-DIX-3068	58.05	2,429	41.7	P-DIX-1045	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-3070	56.41	1,107	49.3	P-DIX-1047	10
J-DIX-3072	56.88	2,237	42.2	P-DIX-1049	10
J-DIX-3074	56.11	2,013	43.1	P-DIX-1041	10
J-DIX-3076	55.09	1,108	46.5	P-DIX-1051	10
J-DIX-3078	58.05	388	54.2	P-DIX-1057	10
J-DIX-308	53.44	881	43.6	P-DIX-3225	10
J-DIX-3080	56.73	1,111	48.1	P-DIX-1061	10
J-DIX-3082	57.2	1,744	31.1	P-DIX-596	10
J-DIX-3084	54.54	1,708	29.5	P-DIX-1843	10
J-DIX-3086	58.44	1,108	49.6	P-DIX-439	10
J-DIX-3088	54.13	1,105	48.5	P-DIX-1597	10
J-DIX-3090	53.34	1,933	43.3	P-DIX-2043	10
J-DIX-3092	55.28	2,634	33.7	P-DIX-2075	10
J-DIX-3094	55.16	881	49.4	P-DIX-3325	10
J-DIX-3096	54.32	2,701	42.7	P-DIX-689	10
J-DIX-3098	56.15	881	51.9	P-DIX-3329	10
J-DIX-310	52.86	881	45.8	P-DIX-3229	10
J-DIX-3100	54.28	2,426	43.9	P-DIX-1531	10
J-DIX-3102	54.43	1,091	49.1	P-DIX-687	10
J-DIX-3104	54.44	881	49.3	P-DIX-3741	10
J-DIX-3106	54.66	3,210	41.2	P-DIX-691	10
J-DIX-3108	54.76	1,900	46.4	P-DIX-1529	10
J-DIX-3110	55.28	1,625	44.3	P-DIX-695	10
J-DIX-3112	54.28	2,508	43.7	P-DIX-1537	10
J-DIX-3114	54.25	879	50.1	P-DIX-3333	10
J-DIX-3116	54.97	880	48.9	P-DIX-3663	10
J-DIX-3118	55.35	579	48.8	P-DIX-797	10
J-DIX-312	55.78	881	49.0	P-DIX-3289	10
J-DIX-3120	54.92	392	47.6	P-DIX-3971	10
J-DIX-3122	54.31	392	34.6	P-DIX-3781	10
J-DIX-3124	54.27	557	20.0		
J-DIX-3126	56.11	392	52.7	P-DIX-3785	10
J-DIX-3128	56.07	876	46.1	P-DIX-3671	10
J-DIX-3130	55.06	984	48.1	P-DIX-1547	10
J-DIX-3132	54.94	1,438	44.5	P-DIX-1551	10
J-DIX-3134	54.98	881	49.6	P-DIX-3675	10
J-DIX-3136	54.95	1,400	45.0	P-DIX-1553	10
J-DIX-3138	54.84	881	49.2	P-DIX-3679	10
J-DIX-314	53.06	881	45.8	P-DIX-3299	10
J-DIX-3140	55.03	1,301	46.5	P-DIX-1561	10
J-DIX-3142	54.98	392	52.4	P-DIX-3975	10
J-DIX-3144	54.98	392	52.4	P-DIX-3789	10
J-DIX-3146	54.21	1,468	43.1	P-DIX-805	10
J-DIX-3148	55.2	881	49.4	P-DIX-3685	10
J-DIX-3150	55.01	1,333	45.7	P-DIX-1767	10
J-DIX-316	53.09	881	48.3	P-DIX-3303	10
J-DIX-3160	55.16	1,484	44.0	P-DIX-330	10
J-DIX-3162	60.13	1,560	45.0	P-DIX-2787	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-3164	57.99	2,431	27.2	P-DIX-2835	10
J-DIX-3166	61.71	390	58.6	P-DIX-2841	10
J-DIX-3168	55.21	1,122	49.7	P-DIX-2809	10
J-DIX-3170	57.14	392	53.9	P-DIX-3985	10
J-DIX-3172	59.73	1,151	51.9	P-DIX-441	10
J-DIX-3174	59.03	2,601	40.3	P-DIX-447	10
J-DIX-3176	59.73	2,243	44.5	P-DIX-451	10
J-DIX-3178	59.38	1,243	50.5	P-DIX-449	10
J-DIX-318	55.16	881	44.4	P-DIX-3307	10
J-DIX-3180	59.57	2,425	40.9	P-DIX-457	10
J-DIX-3182	59.56	2,853	36.0	P-DIX-1239	10
J-DIX-3184	59.31	880	52.0	P-DIX-487	10
J-DIX-3186	58.66	1,331	48.6	P-DIX-497	10
J-DIX-3188	56.52	1,665	33.4	P-DIX-2283	10
J-DIX-3190	58.51	881	52.3	P-DIX-3091	10
J-DIX-3192	58.72	1,003	51.9	P-DIX-507	10
J-DIX-3194	58.73	1,262	49.4	P-DIX-509	10
J-DIX-3196	58.13	1,188	47.7	P-DIX-1257	10
J-DIX-3198	58.8	96	55.8	P-DIX-2265	10
J-DIX-32	56.28	881	50.1	P-DIX-2903	10
J-DIX-320	53.44	545	20.0		
J-DIX-3200	61.92	1,453	54.4	P-DIX-2273	10
J-DIX-3202	62.43	3,159	46.2	P-DIX-2275	10
J-DIX-3204	56.06	1,164	46.1	P-DIX-164	10
J-DIX-3206	58.57	1,286	48.3	P-DIX-2337	10
J-DIX-3208	58.52	2,757	34.9	P-DIX-2339	10
J-DIX-3210	57.36	1,052	49.8	P-DIX-2341	10
J-DIX-3212	57.31	2,911	31.7	P-DIX-2343	10
J-DIX-3214	58.61	2,207	42.6	P-DIX-2345	10
J-DIX-3216	56.62	879	49.4	P-DIX-699	10
J-DIX-3218	56.91	2,542	33.1	P-DIX-767	10
J-DIX-322	54.53	881	42.3	P-DIX-3315	10
J-DIX-3220	57.22	879	50.2	P-DIX-2095	10
J-DIX-3222	57.21	3,092	26.3	P-DIX-2097	10
J-DIX-3224	55.4	881	43.7	P-DIX-2101	10
J-DIX-3226	55.88	880	49.0	P-DIX-2103	10
J-DIX-3228	56.51	881	49.6	P-DIX-2113	10
J-DIX-3230	56.34	2,648	33.6	P-DIX-2845	10
J-DIX-3232	58.04	1,040	50.4	P-DIX-1065	10
J-DIX-3234	58.04	1,041	50.6	P-DIX-2849	10
J-DIX-3236	56.31	1,071	48.5	P-DIX-2861	10
J-DIX-3238	56.9	881	48.3	P-DIX-3261	10
J-DIX-324	52.92	881	44.4	P-DIX-3319	10
J-DIX-3240	56.48	1,265	45.2	P-DIX-606	10
J-DIX-3242	56.24	881	48.8	P-DIX-3097	10
J-DIX-3244	56.62	881	48.0	P-DIX-3105	10
J-DIX-3246	56.28	881	48.9	P-DIX-3109	10
J-DIX-3248	56.22	1,258	45.0	P-DIX-604	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-3250	56.53	1,317	44.2	P-DIX-152	10
J-DIX-3252	56.66	880	49.0	P-DIX-3113	10
J-DIX-3254	58.05	1,148	47.9	P-DIX-1673	10
J-DIX-3256	59.17	881	48.9	P-DIX-3117	10
J-DIX-3258	56.54	1,353	43.7	P-DIX-154	10
J-DIX-326	54.7	881	48.3	P-DIX-3323	10
J-DIX-3260	56.21	881	48.3	P-DIX-3121	10
J-DIX-3262	56.31	1,060	48.3	P-DIX-1681	10
J-DIX-3264	57.46	1,128	47.3	P-DIX-703	10
J-DIX-3266	57.85	881	47.0	P-DIX-3125	10
J-DIX-3268	58.04	881	51.5	P-DIX-3979	10
J-DIX-3270	57.21	2,290	35.6	P-DIX-2371	10
J-DIX-3272	56.58	1,248	46.6	P-DIX-2249	10
J-DIX-3274	56.43	3,059	25.1	P-DIX-2373	10
J-DIX-3276	56.31	881	49.7	P-DIX-3131	10
J-DIX-3278	58.04	881	51.6	P-DIX-3135	10
J-DIX-328	55.24	881	49.1	P-DIX-3327	10
J-DIX-3280	58.04	2,661	34.5	P-DIX-158	10
J-DIX-3282	57.22	2,834	24.3	P-DIX-2173	10
J-DIX-3284	56.75	881	49.1	P-DIX-3139	10
J-DIX-3286	56.93	1,560	42.6	P-DIX-2417	10
J-DIX-3288	57.28	876	49.2	P-DIX-2381	10
J-DIX-3290	57.87	2,173	34.3	P-DIX-2383	10
J-DIX-3292	57.91	881	50.4	P-DIX-3143	10
J-DIX-3294	57.38	878	48.4	P-DIX-2385	10
J-DIX-3296	56.83	1,561	42.9	P-DIX-2387	10
J-DIX-3298	56.86	881	49.5	P-DIX-3147	10
J-DIX-330	53.97	881	49.0	P-DIX-3331	10
J-DIX-3300	58.41	1,137	47.7	P-DIX-2247	10
J-DIX-3302	59.67	1,144	49.3	P-DIX-541	10
J-DIX-3304	57.93	880	49.9	P-DIX-3151	10
J-DIX-3306	57.53	1,428	43.7	P-DIX-539	10
J-DIX-3308	57.03	881	46.5	P-DIX-2111	10
J-DIX-3310	56.06	881	48.8	P-DIX-3157	10
J-DIX-3312	57.09	881	47.1	P-DIX-3161	10
J-DIX-3314	59.55	881	53.3	P-DIX-3165	10
J-DIX-3316	56.32	880	46.2	P-DIX-3169	10
J-DIX-3318	55.09	2,788	20.1		
J-DIX-332	53.87	881	49.3	P-DIX-3335	10
J-DIX-3320	58.53	880	51.0	P-DIX-3177	10
J-DIX-3322	56.6	881	49.3	P-DIX-3181	10
J-DIX-3324	54.41	880	44.5	P-DIX-3185	10
J-DIX-3326	54.75	881	47.6	P-DIX-3189	10
J-DIX-3328	55.3	881	49.3	P-DIX-3193	10
J-DIX-3330	62.6	878	56.2	P-DIX-3197	10
J-DIX-3332	56.51	881	49.4	P-DIX-3201	10
J-DIX-3334	56.69	881	49.7	P-DIX-3233	10
J-DIX-3336	56.91	880	50.6	P-DIX-3237	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-3338	53.49	881	47.4	P-DIX-3241	10
J-DIX-334	55.47	881	50.7	P-DIX-3339	10
J-DIX-3340	54.46	880	44.5	P-DIX-3245	10
J-DIX-3342	58.71	881	51.6	P-DIX-3249	10
J-DIX-3344	55.42	881	40.1	P-DIX-2099	10
J-DIX-3346	57.55	2,728	32.9	P-DIX-2187	10
J-DIX-3348	56.24	881	42.6	P-DIX-3253	10
J-DIX-3350	55.95	881	49.3	P-DIX-3101	10
J-DIX-3352	59.53	881	52.8	P-DIX-3257	10
J-DIX-3354	58.54	1,972	34.9	P-DIX-777	10
J-DIX-3356	58.81	2,021	33.4	P-DIX-771	10
J-DIX-3358	57.28	881	48.3	P-DIX-775	10
J-DIX-336	55.47	881	50.4	P-DIX-3343	10
J-DIX-3360	57.17	392	53.0	P-DIX-3709	10
J-DIX-3362	56.93	881	47.4	P-DIX-3263	10
J-DIX-3364	58.14	881	50.5	P-DIX-3267	10
J-DIX-3366	58.46	1,837	39.7	P-DIX-779	10
J-DIX-3368	58.76	2,977	21.6	P-DIX-347	10
J-DIX-3370	59.22	1,153	49.2	P-DIX-1581	10
J-DIX-3372	59.05	1,675	33.9	P-DIX-1385	10
J-DIX-3374	59.3	1,992	20.0		
J-DIX-3376	59.2	879	47.0	P-DIX-3271	10
J-DIX-3378	58.41	1,364	40.6	P-DIX-1393	10
J-DIX-338	55.13	881	48.4	P-DIX-3347	10
J-DIX-3380	58.35	881	48.3	P-DIX-3275	10
J-DIX-3382	58.41	2,263	20.1		
J-DIX-3384	59.91	1,882	51.3	P-DIX-2441	10
J-DIX-3386	59.61	738	55.4	P-DIX-1507	10
J-DIX-3388	60.47	2,945	44.9	P-DIX-2437	10
J-DIX-3390	59.54	778	54.9	P-DIX-987	10
J-DIX-3392	59.63	881	53.3	P-DIX-3279	10
J-DIX-3394	59.87	2,665	41.1	P-DIX-282	10
J-DIX-3396	60.05	881	54.9	P-DIX-3283	10
J-DIX-3398	62.8	2,867	41.5	P-DIX-1469	10
J-DIX-34	56.71	881	51.8	P-DIX-2907	10
J-DIX-340	55.77	881	49.5	P-DIX-3351	10
J-DIX-3400	62.04	881	57.0	P-DIX-3287	10
J-DIX-3402	60.55	3,017	20.1		
J-DIX-3404	60.6	3,016	20.1		
J-DIX-3406	58.48	1,199	48.6	P-DIX-1485	10
J-DIX-3408	58.55	1,043	50.1	P-DIX-1483	10
J-DIX-3410	58.5	1,215	47.5	P-DIX-1487	10
J-DIX-3412	58.48	1,599	43.5	P-DIX-1491	10
J-DIX-3414	59.85	387	56.5	P-DIX-3713	10
J-DIX-3416	59.9	391	56.6	P-DIX-3949	10
J-DIX-3418	58.59	881	50.5	P-DIX-3403	10
J-DIX-342	56.27	881	50.5	P-DIX-3355	10
J-DIX-3420	58.66	880	50.2	P-DIX-3407	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-3422	57.9	2,036	32.5	P-DIX-1501	10
J-DIX-3424	60.1	876	51.9	P-DIX-3717	10
J-DIX-3426	59.07	1,566	37.5	P-DIX-2457	10
J-DIX-3428	60.6	881	52.8	P-DIX-3413	10
J-DIX-3430	61.36	880	53.9	P-DIX-3719	10
J-DIX-3432	60.76	881	53.4	P-DIX-3723	10
J-DIX-3434	60.16	1,567	45.2	P-DIX-3729	10
J-DIX-3436	60.26	877	52.9	P-DIX-3427	10
J-DIX-3438	60.41	2,573	30.4	P-DIX-508	10
J-DIX-344	55.38	881	50.6	P-DIX-3359	10
J-DIX-3440	58.75	880	50.4	P-DIX-3419	10
J-DIX-3444	54.22	2,484	21.8	P-DIX-2465	10
J-DIX-3446	55.41	1,932	37.9	P-DIX-2465	10
J-DIX-3448	55.41	1,139	46.5	P-DIX-1129	10
J-DIX-3450	53.41	1,567	33.3	P-DIX-506	10
J-DIX-3452	53.38	2,342	20.1		
J-DIX-3454	53.65	881	45.3	P-DIX-3485	10
J-DIX-3456	53.89	2,413	20.1		
J-DIX-3458	54.05	2,287	26.9	P-DIX-611	10
J-DIX-346	56.28	881	50.4	P-DIX-3363	10
J-DIX-3460	54.39	881	46.4	P-DIX-3733	10
J-DIX-3462	53.24	1,567	26.4	P-DIX-621	10
J-DIX-3464	53.24	879	41.4	P-DIX-623	10
J-DIX-3466	54.98	880	37.9	P-DIX-627	10
J-DIX-3468	53.24	880	42.8	P-DIX-3491	10
J-DIX-3470	54.98	876	45.1	P-DIX-629	10
J-DIX-3472	55.03	878	39.8	P-DIX-633	10
J-DIX-3474	53.24	1,556	37.0	P-DIX-985	10
J-DIX-3476	53.24	2,383	23.8	P-DIX-1097	10
J-DIX-3478	55.41	881	48.4	P-DIX-3497	10
J-DIX-348	56.23	881	50.1	P-DIX-3367	10
J-DIX-3480	55.41	2,803	27.2	P-DIX-1125	10
J-DIX-3482	53.95	1,134	45.4	P-DIX-1101	10
J-DIX-3484	54.01	3,109	20.1		
J-DIX-3486	54.4	881	47.6	P-DIX-3501	10
J-DIX-3488	54.69	2,485	31.6	P-DIX-1131	10
J-DIX-3490	54.69	881	48.2	P-DIX-3505	10
J-DIX-3492	55.4	1,756	33.2	P-DIX-176	10
J-DIX-3494	55.81	880	47.1	P-DIX-3509	10
J-DIX-3496	55.36	877	46.5	P-DIX-1111	10
J-DIX-3498	55.17	1,754	32.4	P-DIX-1115	10
J-DIX-350	57.58	881	50.7	P-DIX-3371	10
J-DIX-3500	55.22	881	46.3	P-DIX-3513	10
J-DIX-3502	56.37	877	47.3	P-DIX-1117	10
J-DIX-3504	54.31	881	46.2	P-DIX-3517	10
J-DIX-3506	53.83	1,603	43.9	P-DIX-2471	10
J-DIX-3508	54.12	881	48.7	P-DIX-3295	10
J-DIX-3510	53.74	1,942	43.8	P-DIX-2477	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-3512	53.37	2,845	38.3	P-DIX-2485	10
J-DIX-3514	54.06	2,641	40.5	P-DIX-2489	10
J-DIX-3516	55.11	2,328	43.4	P-DIX-2491	10
J-DIX-3518	54.11	881	49.3	P-DIX-3521	10
J-DIX-352	56.75	881	49.7	P-DIX-3375	10
J-DIX-3520	54.52	2,423	41.4	P-DIX-2497	10
J-DIX-3522	55.19	2,483	42.1	P-DIX-2499	10
J-DIX-3524	54.89	880	50.0	P-DIX-3525	10
J-DIX-3526	55.16	2,310	40.2	P-DIX-2505	10
J-DIX-3528	57.64	1,589	46.0	P-DIX-2069	10
J-DIX-3530	56.69	880	41.7	P-DIX-3531	10
J-DIX-3532	55.92	387	51.0	P-DIX-707	10
J-DIX-3534	54.44	388	49.6	P-DIX-711	10
J-DIX-3536	53.93	1,567	40.2	P-DIX-717	10
J-DIX-3538	55.42	881	47.9	P-DIX-3533	10
J-DIX-354	56.4	881	49.4	P-DIX-3379	10
J-DIX-3540	56.58	1,282	48.0	P-DIX-721	10
J-DIX-3542	55.42	1,329	46.4	P-DIX-725	10
J-DIX-3544	55.71	881	49.5	P-DIX-3537	10
J-DIX-3546	55.56	1,161	47.8	P-DIX-727	10
J-DIX-3548	55.49	1,098	47.7	P-DIX-891	10
J-DIX-3550	53.97	881	45.6	P-DIX-3541	10
J-DIX-3552	55.75	91	54.7	P-DIX-903	10
J-DIX-3554	54.97	159	20.3	P-DIX-2541	10
J-DIX-3556	55.17	106	53.9	P-DIX-2541	10
J-DIX-3558	56.01	881	49.1	P-DIX-3545	10
J-DIX-356	56.49	881	48.1	P-DIX-3383	10
J-DIX-3560	55.94	1,580	42.7	P-DIX-925	10
J-DIX-3562	55.82	1,681	41.1	P-DIX-927	10
J-DIX-3564	55.14	3,131	34.0	P-DIX-580	10
J-DIX-3566	54.95	881	49.7	P-DIX-3549	10
J-DIX-3568	56.08	880	48.6	P-DIX-475	10
J-DIX-3570	55.18	1,390	45.7	P-DIX-643	10
J-DIX-3572	53.76	1,223	47.3	P-DIX-647	10
J-DIX-3574	53.25	881	48.6	P-DIX-3555	10
J-DIX-3576	53.42	2,852	39.5	P-DIX-461	10
J-DIX-3578	54.07	881	49.2	P-DIX-3559	10
J-DIX-358	56.85	881	47.9	P-DIX-3387	10
J-DIX-3580	54.08	2,112	42.3	P-DIX-862	10
J-DIX-3582	55.02	881	49.3	P-DIX-3563	10
J-DIX-3584	56.32	1,458	46.0	P-DIX-559	10
J-DIX-3586	54.27	1,358	45.4	P-DIX-2495	10
J-DIX-3588	55.12	97	51.0	P-DIX-1847	10
J-DIX-3590	53.82	1,332	45.3	P-DIX-483	10
J-DIX-3592	54.39	1,079	47.5	P-DIX-1177	10
J-DIX-3594	54.99	1,183	48.5	P-DIX-1179	10
J-DIX-3596	55.28	1,282	46.7	P-DIX-1185	10
J-DIX-3598	53.67	1,190	43.1	P-DIX-833	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-36	55.79	881	50.1	P-DIX-2911	10
J-DIX-360	57.6	881	50.0	P-DIX-3391	10
J-DIX-3600	54.5	881	45.5	P-DIX-3567	10
J-DIX-3602	54.8	878	45.5	P-DIX-2079	10
J-DIX-3604	54.61	1,490	36.0	P-DIX-837	10
J-DIX-3606	53.79	389	49.9	P-DIX-993	10
J-DIX-3608	54.87	390	51.2	P-DIX-1001	10
J-DIX-3610	54.05	881	47.3	P-DIX-3801	10
J-DIX-3612	54.81	97	52.9	P-DIX-2889	10
J-DIX-3614	54.34	1,185	44.8	P-DIX-1009	10
J-DIX-3616	54.18	881	47.3	P-DIX-3805	10
J-DIX-3618	54.16	1,202	44.3	P-DIX-206	10
J-DIX-362	56.34	881	48.3	P-DIX-3395	10
J-DIX-3620	55.41	1,121	46.4	P-DIX-1943	10
J-DIX-3622	55.42	1,166	45.3	P-DIX-1941	10
J-DIX-3624	55.42	881	47.5	P-DIX-3811	10
J-DIX-3626	55.41	1,161	46.1	P-DIX-1945	10
J-DIX-3628	55.41	1,267	43.5	P-DIX-1947	10
J-DIX-3630	52.81	1,151	43.6	P-DIX-2081	10
J-DIX-3632	54.03	1,055	46.8	P-DIX-2027	10
J-DIX-3634	53.93	881	47.2	P-DIX-3815	10
J-DIX-3636	55.41	1,666	33.6	P-DIX-2025	10
J-DIX-3638	55.41	880	46.2	P-DIX-3819	10
J-DIX-364	59.01	881	32.2	P-DIX-3429	10
J-DIX-3640	53.78	880	44.0	P-DIX-3825	10
J-DIX-3642	53.39	1,723	27.4	P-DIX-2970	10
J-DIX-3644	55.81	879	46.6	P-DIX-3829	10
J-DIX-3646	54.67	881	47.4	P-DIX-3833	10
J-DIX-3648	54.82	1,101	46.6	P-DIX-1693	10
J-DIX-3650	55.45	1,348	45.3	P-DIX-1923	10
J-DIX-3652	54.84	881	48.5	P-DIX-3837	10
J-DIX-3654	55.01	2,749	29.8	P-DIX-431	10
J-DIX-3656	55.51	881	49.4	P-DIX-3841	10
J-DIX-3658	55.33	2,542	33.9	P-DIX-1517	10
J-DIX-366	57.76	881	48.9	P-DIX-3433	10
J-DIX-3660	55.11	2,354	38.4	P-DIX-1523	10
J-DIX-3662	55.12	2,256	40.1	P-DIX-1017	10
J-DIX-3664	55.44	2,032	42.3	P-DIX-1019	10
J-DIX-3666	54.18	2,257	38.6	P-DIX-1021	10
J-DIX-3668	56.16	881	49.6	P-DIX-3845	10
J-DIX-3670	56.16	1,566	43.9	P-DIX-214	10
J-DIX-3672	55.55	881	48.9	P-DIX-3849	10
J-DIX-3674	55.5	1,566	42.4	P-DIX-1405	10
J-DIX-3676	55.14	1,567	42.9	P-DIX-3737	10
J-DIX-3678	54.5	3,041	23.6	P-DIX-325	10
J-DIX-368	59.64	881	51.1	P-DIX-3871	10
J-DIX-3682	54.36	1,070	47.2	P-DIX-331	10
J-DIX-3684	54.4	881	48.1	P-DIX-3853	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-3686	54.89	1,653	28.4	P-DIX-570	10
J-DIX-3688	55.62	879	45.3	P-DIX-3205	10
J-DIX-3690	54.98	1,712	26.9	P-DIX-337	10
J-DIX-3692	55.89	881	48.7	P-DIX-3209	10
J-DIX-3694	54.96	1,146	46.1	P-DIX-341	10
J-DIX-3696	52.86	2,737	30.5	P-DIX-843	10
J-DIX-3698	53.44	1,545	33.5	P-DIX-1823	10
J-DIX-370	59.71	881	49.8	P-DIX-3437	10
J-DIX-3700	55.12	881	46.0	P-DIX-3215	10
J-DIX-3702	53.94	881	48.1	P-DIX-3219	10
J-DIX-3704	54.61	475	50.2	P-DIX-2887	10
J-DIX-3706	54.71	627	43.9	P-DIX-973	10
J-DIX-3708	54.56	2,692	20.1		
J-DIX-3710	53.09	1,345	36.8	P-DIX-1611	10
J-DIX-3712	53.21	881	44.1	P-DIX-3223	10
J-DIX-3714	53.97	1,638	33.3	P-DIX-945	10
J-DIX-3716	55.47	1,492	43.8	P-DIX-1053	10
J-DIX-3718	52.75	881	46.1	P-DIX-3227	10
J-DIX-372	59.43	881	51.2	P-DIX-3875	10
J-DIX-3720	52.6	1,117	44.0	P-DIX-224	10
J-DIX-3722	53.64	1,656	39.5	P-DIX-2517	10
J-DIX-3724	53.75	542	48.8	P-DIX-2527	10
J-DIX-3726	54.57	1,190	45.9	P-DIX-2535	10
J-DIX-3728	55.81	881	49.8	P-DIX-3231	10
J-DIX-3730	55.09	1,217	47.6	P-DIX-2563	10
J-DIX-3732	53.86	1,193	44.9	P-DIX-2065	10
J-DIX-3734	52.68	1,471	39.0	P-DIX-1853	10
J-DIX-3736	52.48	275	50.0	P-DIX-1601	10
J-DIX-3738	53.03	881	46.3	P-DIX-3297	10
J-DIX-374	58.63	881	51.1	P-DIX-3879	10
J-DIX-3740	53.18	1,135	45.7	P-DIX-1855	10
J-DIX-3742	52.93	1,453	43.0	P-DIX-1859	10
J-DIX-3744	53.21	1,531	42.2	P-DIX-1861	10
J-DIX-3746	53.3	1,357	45.5	P-DIX-1865	10
J-DIX-3748	52.98	881	48.7	P-DIX-3301	10
J-DIX-3750	53	1,046	48.6	P-DIX-1873	10
J-DIX-3752	54.41	1,322	48.2	P-DIX-1877	10
J-DIX-3754	54.43	2,847	43.4	P-DIX-1881	10
J-DIX-3756	52.23	129	48.7	P-DIX-1609	10
J-DIX-3758	52.74	1,872	26.0	P-DIX-1883	10
J-DIX-376	58.1	881	49.5	P-DIX-3441	10
J-DIX-3760	55.13	475	49.8	P-DIX-1075	10
J-DIX-3762	55.02	1,933	21.6	P-DIX-230	10
J-DIX-3764	55.15	881	44.8	P-DIX-3305	10
J-DIX-3766	53.37	470	50.0	P-DIX-1083	10
J-DIX-3768	53.55	1,358	44.6	P-DIX-369	10
J-DIX-3770	54.94	1,492	44.3	P-DIX-1087	10
J-DIX-3772	53.42	545	20.0		

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-3774	53.27	388	32.9	P-DIX-1095	10
J-DIX-3776	54.41	881	44.1	P-DIX-3313	10
J-DIX-3778	52.96	881	44.8	P-DIX-3317	10
J-DIX-378	58.45	881	49.3	P-DIX-3445	10
J-DIX-3780	53.85	1,191	46.3	P-DIX-2055	10
J-DIX-3782	53.8	881	48.2	P-DIX-3321	10
J-DIX-3784	54.12	1,694	42.1	P-DIX-375	10
J-DIX-3786	53.91	1,457	44.2	P-DIX-1591	10
J-DIX-3788	54.6	2,362	44.0	P-DIX-379	10
J-DIX-3790	55.39	2,770	42.0	P-DIX-387	10
J-DIX-3792	55.35	4,945	36.7	P-DIX-393	10
J-DIX-3794	55.47	880	51.4	P-DIX-3337	10
J-DIX-3796	55.37	6,485	26.9	P-DIX-395	10
J-DIX-3798	55.33	5,790	31.8	P-DIX-1191	10
J-DIX-38	55.04	881	50.2	P-DIX-2915	10
J-DIX-380	59.54	881	50.5	P-DIX-3449	10
J-DIX-3800	55.37	2,115	46.4	P-DIX-1927	10
J-DIX-3802	55.22	1,231	49.2	P-DIX-1195	10
J-DIX-3804	55.33	881	51.3	P-DIX-3341	10
J-DIX-3806	55.23	881	49.0	P-DIX-3345	10
J-DIX-3808	55.23	1,152	49.9	P-DIX-1199	10
J-DIX-3810	55.1	1,341	46.5	P-DIX-1205	10
J-DIX-3812	55.78	881	50.2	P-DIX-3349	10
J-DIX-3814	55.24	387	53.0	P-DIX-3745	10
J-DIX-3816	56.14	1,446	47.6	P-DIX-1229	10
J-DIX-3818	56.26	881	51.2	P-DIX-3353	10
J-DIX-382	59.73	881	51.1	P-DIX-3453	10
J-DIX-3820	55.63	3,092	32.9	P-DIX-1415	10
J-DIX-3822	56.13	1,127	49.5	P-DIX-2395	10
J-DIX-3824	56.16	1,411	46.9	P-DIX-2397	10
J-DIX-3826	55.96	1,210	48.8	P-DIX-2399	10
J-DIX-3828	55.82	1,269	48.9	P-DIX-2405	10
J-DIX-3830	55.86	1,132	49.8	P-DIX-2403	10
J-DIX-3832	55.3	881	51.2	P-DIX-3357	10
J-DIX-3834	55.54	1,173	49.6	P-DIX-1763	10
J-DIX-3836	56.04	1,320	48.3	P-DIX-1765	10
J-DIX-3838	56.22	881	50.8	P-DIX-3361	10
J-DIX-384	59.27	881	46.1	P-DIX-3463	10
J-DIX-3840	55.91	1,238	48.8	P-DIX-399	10
J-DIX-3842	57.48	1,664	37.5	P-DIX-1951	10
J-DIX-3844	55.77	1,208	49.0	P-DIX-1961	10
J-DIX-3846	55.64	1,161	49.0	P-DIX-2167	10
J-DIX-3848	56.37	1,140	49.1	P-DIX-1971	10
J-DIX-3850	56.53	1,132	49.3	P-DIX-2171	10
J-DIX-3852	56.35	881	50.9	P-DIX-3365	10
J-DIX-3854	56.75	1,416	46.6	P-DIX-1973	10
J-DIX-3856	56.38	1,296	47.7	P-DIX-1421	10
J-DIX-3858	56.02	1,161	49.0	P-DIX-1423	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-386	59.31	881	44.4	P-DIX-3455	10
J-DIX-3860	56.17	1,449	44.7	P-DIX-1433	10
J-DIX-3862	57.58	881	51.4	P-DIX-3369	10
J-DIX-3864	57.03	1,203	47.4	P-DIX-2813	10
J-DIX-3866	57.57	1,365	46.7	P-DIX-2817	10
J-DIX-3868	56.52	880	50.2	P-DIX-3373	10
J-DIX-3870	56.24	1,523	44.6	P-DIX-1985	10
J-DIX-3872	56.35	1,579	44.0	P-DIX-250	10
J-DIX-3874	56.32	881	50.4	P-DIX-3377	10
J-DIX-3876	56.18	1,427	45.3	P-DIX-1993	10
J-DIX-3878	56.36	602	52.1	P-DIX-2199	10
J-DIX-388	59.67	881	42.5	P-DIX-3465	10
J-DIX-3880	57.13	1,419	45.0	P-DIX-2203	10
J-DIX-3882	57.42	511	51.9	P-DIX-2211	10
J-DIX-3884	57.41	1,313	45.8	P-DIX-2207	10
J-DIX-3886	56.44	881	48.7	P-DIX-3381	10
J-DIX-3888	56.49	392	53.4	P-DIX-3957	10
J-DIX-3890	56.15	219	54.3	P-DIX-3961	10
J-DIX-3892	56.67	391	54.1	P-DIX-3749	10
J-DIX-3894	56.85	881	48.3	P-DIX-3385	10
J-DIX-3896	56.68	459	52.9	P-DIX-2221	10
J-DIX-3898	57.57	392	54.5	P-DIX-3753	10
J-DIX-390	59.74	881	50.1	P-DIX-3461	10
J-DIX-3900	57.52	1,258	46.1	P-DIX-2261	10
J-DIX-3902	57.6	1,725	40.0	P-DIX-1245	10
J-DIX-3904	57.58	880	50.4	P-DIX-3389	10
J-DIX-3906	57.82	1,211	47.3	P-DIX-1249	10
J-DIX-3908	57.81	2,372	30.0	P-DIX-1247	10
J-DIX-3910	56.34	880	48.8	P-DIX-3393	10
J-DIX-3912	58.02	2,586	20.1		
J-DIX-3914	58.53	1,303	46.2	P-DIX-2233	10
J-DIX-3916	58.69	1,064	49.5	P-DIX-2237	10
J-DIX-3918	58.48	495	52.7	P-DIX-2241	10
J-DIX-392	58.73	881	48.7	P-DIX-3469	10
J-DIX-3920	59.57	98	53.6	P-DIX-585	10
J-DIX-3922	58.19	479	52.9	P-DIX-525	10
J-DIX-3924	58.93	881	33.0	P-DIX-3397	10
J-DIX-3926	58.54	114	55.7	P-DIX-2005	10
J-DIX-3928	57.65	117	55.5	P-DIX-2007	10
J-DIX-3930	57.63	881	49.2	P-DIX-3431	10
J-DIX-3932	59.79	881	51.7	P-DIX-3869	10
J-DIX-3934	60.04	2,112	38.0	P-DIX-2131	10
J-DIX-3936	58.76	871	50.5	P-DIX-849	10
J-DIX-3938	59.8	881	50.9	P-DIX-3435	10
J-DIX-394	56.33	881	49.8	P-DIX-3473	10
J-DIX-3940	60.12	1,567	44.8	P-DIX-977	10
J-DIX-3942	59.91	868	52.3	P-DIX-3873	10
J-DIX-3944	58.74	1,928	42.4	P-DIX-853	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-3946	58.72	881	51.7	P-DIX-3877	10
J-DIX-3948	59.03	1,567	47.1	P-DIX-2015	10
J-DIX-3950	57.26	6,280	26.0	P-DIX-409	10
J-DIX-3952	55.6	1,169	49.8	P-DIX-575	10
J-DIX-3954	57.15	1,726	36.4	P-DIX-2581	10
J-DIX-3956	57.33	1,693	37.1	P-DIX-2581	10
J-DIX-3958	57.17	863	49.2	P-DIX-599	10
J-DIX-396	57.18	881	50.5	P-DIX-3477	10
J-DIX-3960	56.61	872	31.2	P-DIX-605	10
J-DIX-3962	57.83	877	24.7	P-DIX-609	10
J-DIX-3964	58.19	1,344	44.7	P-DIX-2577	10
J-DIX-3966	58.16	881	50.0	P-DIX-3439	10
J-DIX-3968	58.5	881	49.7	P-DIX-3443	10
J-DIX-3970	57.8	1,671	38.4	P-DIX-2583	10
J-DIX-3972	58.81	1,253	45.1	P-DIX-2585	10
J-DIX-3974	59.52	1,265	47.7	P-DIX-2591	10
J-DIX-3976	59.4	1,176	47.9	P-DIX-2593	10
J-DIX-3978	59.44	881	50.8	P-DIX-3447	10
J-DIX-398	58.46	881	52.9	P-DIX-3481	10
J-DIX-3980	60.04	1,313	47.2	P-DIX-2599	10
J-DIX-3982	59.89	881	51.6	P-DIX-3451	10
J-DIX-3984	59.32	879	50.7	P-DIX-2601	10
J-DIX-3986	59.25	881	46.7	P-DIX-2603	10
J-DIX-3988	59.73	880	49.7	P-DIX-2605	10
J-DIX-3990	59.34	880	45.0	P-DIX-2607	10
J-DIX-3992	60.33	877	50.7	P-DIX-2609	10
J-DIX-3994	60.54	1,561	20.0		
J-DIX-3996	59.77	881	43.2	P-DIX-983	10
J-DIX-3998	59.68	881	50.4	P-DIX-3459	10
J-DIX-40	55.46	881	48.8	P-DIX-2919	10
J-DIX-400	57.53	881	52.3	P-DIX-3399	10
J-DIX-4000	58.87	879	48.9	P-DIX-2119	10
J-DIX-4002	58.08	1,076	44.0	P-DIX-2619	10
J-DIX-4004	58.77	880	49.2	P-DIX-3467	10
J-DIX-4006	60.77	3,182	30.2	P-DIX-2299	10
J-DIX-4008	57.01	1,412	47.2	P-DIX-2623	10
J-DIX-4010	56.7	1,311	47.6	P-DIX-2627	10
J-DIX-4012	56.42	881	50.5	P-DIX-3471	10
J-DIX-4014	56.94	881	50.8	P-DIX-3757	10
J-DIX-4016	55.78	1,322	46.7	P-DIX-2633	10
J-DIX-4018	57.17	881	49.6	P-DIX-3761	10
J-DIX-402	60.92	881	53.6	P-DIX-3865	10
J-DIX-4020	56.96	881	50.7	P-DIX-3475	10
J-DIX-4022	56.93	881	50.9	P-DIX-3765	10
J-DIX-4024	58.48	2,156	48.1	P-DIX-425	10
J-DIX-4026	58.46	881	53.5	P-DIX-3479	10
J-DIX-4028	58.34	959	53.2	P-DIX-1513	10
J-DIX-4030	57.44	1,115	52.2	P-DIX-413	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-4032	57.37	2,744	45.8	P-DIX-415	10
J-DIX-4034	57.53	881	52.8	P-DIX-3483	10
J-DIX-4036	59.35	866	54.4	P-DIX-427	10
J-DIX-4038	59.51	2,959	29.7	P-DIX-2295	10
J-DIX-404	60.44	881	53.2	P-DIX-3859	10
J-DIX-4040	58.93	2,566	37.4	P-DIX-857	10
J-DIX-4042	59.35	2,660	35.7	P-DIX-863	10
J-DIX-4044	60.33	2,244	41.1	P-DIX-280	10
J-DIX-4046	60.77	879	53.9	P-DIX-3867	10
J-DIX-4048	60.26	7,610	20.6		
J-DIX-4050	59.11	1,126	49.7	P-DIX-2325	10
J-DIX-4052	59.56	1,733	38.1	P-DIX-2647	10
J-DIX-4054	58.85	1,433	42.6	P-DIX-2641	10
J-DIX-4056	59.61	2,926	24.9	P-DIX-979	10
J-DIX-4058	59.77	2,695	32.5	P-DIX-2649	10
J-DIX-406	59.6	881	53.2	P-DIX-3863	10
J-DIX-4060	61.42	1,950	45.3	P-DIX-2651	10
J-DIX-4062	60.14	2,281	38.5	P-DIX-2655	10
J-DIX-4064	60.43	881	53.6	P-DIX-3857	10
J-DIX-4066	59.43	881	54.0	P-DIX-3861	10
J-DIX-4068	57.95	392	55.0	P-DIX-3769	10
J-DIX-4070	59.65	2,346	29.9	P-DIX-2135	10
J-DIX-4072	58.03	1,542	38.6	P-DIX-1835	10
J-DIX-4074	56.61	1,530	36.8	P-DIX-2227	10
J-DIX-4076	57.35	1,532	39.2	P-DIX-2227	10
J-DIX-4078	54.05	880	32.2	P-DIX-3881	10
J-DIX-408	60.54	881	44.0	P-DIX-3457	10
J-DIX-4080	53.53	881	46.3	P-DIX-3925	10
J-DIX-4082	54.22	876	47.3	P-DIX-946	10
J-DIX-4084	53.35	881	38.9	P-DIX-3929	10
J-DIX-4086	53.03	2,409	35.9	P-DIX-875	10
J-DIX-4088	53.45	1,023	47.2	P-DIX-885	10
J-DIX-4090	53.31	1,097	45.8	P-DIX-887	10
J-DIX-4092	53.44	881	46.9	P-DIX-3921	10
J-DIX-4094	53.74	2,312	39.3	P-DIX-1759	10
J-DIX-4096	53.78	880	48.3	P-DIX-3917	10
J-DIX-4098	55.11	2,813	32.4	P-DIX-1566	10
J-DIX-410	53.46	881	31.2	P-DIX-3883	10
J-DIX-4100	55.15	881	49.6	P-DIX-3913	10
J-DIX-4102	53.79	879	48.4	P-DIX-3909	10
J-DIX-4104	53.65	2,968	31.6	P-DIX-2663	10
J-DIX-4108	53.45	1,051	46.7	P-DIX-737	10
J-DIX-4110	53.53	881	47.6	P-DIX-3885	10
J-DIX-4112	52.04	881	45.7	P-DIX-3891	10
J-DIX-4114	52.05	1,246	42.7	P-DIX-739	10
J-DIX-4118	53.37	1,510	39.8	P-DIX-2357	10
J-DIX-412	53.5	881	45.8	P-DIX-3927	10
J-DIX-4120	52.77	881	43.9	P-DIX-3893	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-4122	53.75	1,708	39.4	P-DIX-1695	10
J-DIX-4124	54.01	1,178	44.9	P-DIX-2363	10
J-DIX-4126	54.11	881	47.4	P-DIX-3905	10
J-DIX-4128	54.03	880	47.2	P-DIX-2671	10
J-DIX-4130	53.94	881	45.1	P-DIX-3897	10
J-DIX-4132	55.19	879	45.9	P-DIX-1713	10
J-DIX-4134	54.8	879	47.4	P-DIX-2681	10
J-DIX-4136	53.05	1,433	38.5	P-DIX-1727	10
J-DIX-414	53.32	881	38.5	P-DIX-3931	10
J-DIX-4140	53.69	880	45.1	P-DIX-3933	10
J-DIX-4142	54.05	879	33.3	P-DIX-1571	10
J-DIX-4144	54.42	2,637	38.2	P-DIX-2685	10
J-DIX-4146	53.69	2,218	41.9	P-DIX-2141	10
J-DIX-4148	53.68	2,265	41.7	P-DIX-2145	10
J-DIX-4150	53.84	2,442	40.3	P-DIX-1739	10
J-DIX-4152	53.89	881	49.1	P-DIX-3937	10
J-DIX-4154	53.56	880	48.7	P-DIX-3571	10
J-DIX-4156	53.77	2,292	41.3	P-DIX-1575	10
J-DIX-4158	53.78	881	48.9	P-DIX-3575	10
J-DIX-416	53.52	881	46.5	P-DIX-3923	10
J-DIX-4160	53.5	3,909	23.0	P-DIX-1441	10
J-DIX-4162	53.17	2,528	36.0	P-DIX-1579	10
J-DIX-4164	53.78	2,239	39.9	P-DIX-1577	10
J-DIX-4166	53.53	881	48.2	P-DIX-3579	10
J-DIX-4168	53.06	2,147	39.7	P-DIX-1745	10
J-DIX-4170	52.2	387	49.2	P-DIX-1443	10
J-DIX-4172	53.24	881	46.7	P-DIX-3583	10
J-DIX-4174	55.26	874	49.8	P-DIX-1449	10
J-DIX-4176	54.83	881	49.4	P-DIX-3587	10
J-DIX-4178	54.84	2,329	39.4	P-DIX-1455	10
J-DIX-418	53.75	881	47.9	P-DIX-3919	10
J-DIX-4180	53.28	3,378	20.1		
J-DIX-4182	52.81	1,999	20.0		
J-DIX-4184	54.66	2,408	30.9	P-DIX-586	10
J-DIX-4186	54.78	881	47.7	P-DIX-3595	10
J-DIX-4188	54.63	2,380	20.1		
J-DIX-4190	53.85	3,157	20.1		
J-DIX-4192	53.58	4,165	20.2		
J-DIX-4194	52.98	3,501	20.1		
J-DIX-4196	53.16	2,618	20.1		
J-DIX-4198	53	1,530	20.0		
J-DIX-42	55.31	881	50.6	P-DIX-2923	10
J-DIX-420	55.15	881	49.2	P-DIX-3915	10
J-DIX-4200	53.56	1,796	20.0		
J-DIX-4202	53.89	2,642	20.1		
J-DIX-4204	53.72	881	48.1	P-DIX-3609	10
J-DIX-4206	53.21	3,936	20.2		
J-DIX-4208	54.35	1,283	47.0	P-DIX-2683	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-4210	53.22	3,112	20.1		
J-DIX-4212	55.19	1,999	46.1	P-DIX-2703	10
J-DIX-4214	54.44	4,278	20.2		
J-DIX-4216	54.29	3,714	20.1		
J-DIX-4218	52.37	881	46.7	P-DIX-3617	10
J-DIX-422	53.79	881	48.0	P-DIX-3911	10
J-DIX-4220	54.79	880	38.5	P-DIX-2691	10
J-DIX-4222	52.62	875	45.2	P-DIX-2695	10
J-DIX-4224	52.3	2,210	35.6	P-DIX-2723	10
J-DIX-4226	54.14	879	47.8	P-DIX-3623	10
J-DIX-4228	54.06	2,709	25.9	P-DIX-4710	10
J-DIX-4230	54.1	880	48.0	P-DIX-3627	10
J-DIX-4232	54.15	2,726	29.6	P-DIX-306	10
J-DIX-4234	55.28	1,088	49.0	P-DIX-2731	10
J-DIX-4236	53.34	881	45.5	P-DIX-3631	10
J-DIX-4238	55.24	881	48.7	P-DIX-3635	10
J-DIX-424	53.53	881	46.8	P-DIX-3887	10
J-DIX-4240	55.29	1,207	46.1	P-DIX-2727	10
J-DIX-4242	54.12	881	49.1	P-DIX-3639	10
J-DIX-4244	53.05	2,365	40.5	P-DIX-952	10
J-DIX-4246	53.24	3,807	30.9	P-DIX-4544	10
J-DIX-4248	54.53	1,960	46.1	P-DIX-1783	10
J-DIX-4250	54.49	881	49.9	P-DIX-3643	10
J-DIX-4252	54.72	2,175	43.7	P-DIX-2159	10
J-DIX-4254	54.57	1,054	49.3	P-DIX-2157	10
J-DIX-4256	54.6	2,473	43.7	P-DIX-753	10
J-DIX-4258	54.57	1,952	45.3	P-DIX-1789	10
J-DIX-426	51.89	881	44.9	P-DIX-3889	10
J-DIX-4260	53.52	879	48.3	P-DIX-3773	10
J-DIX-4262	53.13	881	47.8	P-DIX-3647	10
J-DIX-4264	52.93	880	47.7	P-DIX-3777	10
J-DIX-4266	47.28	1,268	40.7	P-DIX-1811	10
J-DIX-4268	46.75	1,341	36.4	P-DIX-1809	10
J-DIX-4270	47.47	881	42.1	P-DIX-3651	10
J-DIX-4272	48.69	881	38.7	P-DIX-3655	10
J-DIX-4274	51.94	337	48.3	P-DIX-757	10
J-DIX-4276	51.52	97	48.5	P-DIX-761	10
J-DIX-4278	49.38	2,472	44.5	P-DIX-821	10
J-DIX-428	52.51	881	42.8	P-DIX-3895	10
J-DIX-4280	55.06	1,389	37.6	P-DIX-2741	10
J-DIX-4282	55.97	1,702	28.9	P-DIX-1143	10
J-DIX-4284	55.47	1,070	48.1	P-DIX-2745	10
J-DIX-4286	55.47	881	49.3	P-DIX-3659	10
J-DIX-4288	55.39	1,288	46.1	P-DIX-2743	10
J-DIX-4290	54.95	493	51.4	P-DIX-795	10
J-DIX-4292	57.75	1,616	45.6	P-DIX-2823	10
J-DIX-4294	52.52	881	43.0	P-DIX-3981	10
J-DIX-4296	56.01	1,295	47.2	P-DIX-2801	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-430	53.97	881	46.8	P-DIX-3907	10
J-DIX-432	54.22	881	44.0	P-DIX-3899	10
J-DIX-434	54.95	881	44.8	P-DIX-3903	10
J-DIX-436	53.75	881	44.7	P-DIX-3935	10
J-DIX-438	53.9	881	48.7	P-DIX-3569	10
J-DIX-44	56.07	881	51.3	P-DIX-2927	10
J-DIX-440	53.4	881	48.1	P-DIX-3573	10
J-DIX-442	53.74	881	48.3	P-DIX-3577	10
J-DIX-444	53.48	881	47.7	P-DIX-3581	10
J-DIX-446	53.23	881	46.3	P-DIX-3585	10
J-DIX-448	54.83	881	48.7	P-DIX-3589	10
J-DIX-450	53.45	881	47.5	P-DIX-3593	10
J-DIX-4500	55.16	6,484	20.4		
J-DIX-4502	55.31	2,998	38.2	P-DIX-4506	10
J-DIX-4504	55.59	4,339	30.4	P-DIX-4514	10
J-DIX-4506	55.7	6,130	20.4		
J-DIX-4508	56.37	6,225	20.4		
J-DIX-4510	55.92	6,266	20.4		
J-DIX-4512	54.4	6,275	20.4		
J-DIX-4514	54.97	6,396	20.4		
J-DIX-4516	56	6,267	20.4		
J-DIX-4518	54.84	1,567	39.2	P-DIX-4524	10
J-DIX-452	54.24	881	46.8	P-DIX-3597	10
J-DIX-4520	55.08	2,549	39.1	P-DIX-4522	10
J-DIX-4522	54.59	1,567	42.3	P-DIX-4526	10
J-DIX-4524	55.9	1,567	44.1	P-DIX-4532	10
J-DIX-4526	53.16	2,287	39.6	P-DIX-4536	10
J-DIX-4528	53.16	3,957	30.0	P-DIX-4544	10
J-DIX-4530	51.5	3,310	25.0	P-DIX-4540	10
J-DIX-4532	52.69	2,703	34.5	P-DIX-4542	10
J-DIX-4536	53.89	3,388	31.3	P-DIX-4552	10
J-DIX-4538	52.67	2,677	29.6	P-DIX-4550	10
J-DIX-454	53.97	881	47.6	P-DIX-3601	10
J-DIX-4540	53.45	2,512	32.8	P-DIX-4546	10
J-DIX-4542	54.22	2,902	33.3	P-DIX-4554	10
J-DIX-4544	55.46	4,371	21.7	P-DIX-4556	10
J-DIX-4546	54.85	4,857	20.2		
J-DIX-4548	54.64	4,669	20.2		
J-DIX-4550	54.84	2,989	31.6	P-DIX-4576	10
J-DIX-4552	54.86	4,241	20.2		
J-DIX-4554	54.41	2,789	31.5	P-DIX-4564	10
J-DIX-4556	55.03	3,593	28.0	P-DIX-4558	10
J-DIX-4558	55.21	1,567	43.5	P-DIX-4580	10
J-DIX-456	52.92	881	47.1	P-DIX-3605	10
J-DIX-4560	56.46	1,562	44.6	P-DIX-4582	10
J-DIX-4562	54.82	1,567	37.5	P-DIX-4584	10
J-DIX-458	53.02	881	39.0	P-DIX-3691	10
J-DIX-46	55.36	881	41.7	P-DIX-2931	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-460	53.66	881	42.2	P-DIX-3607	10
J-DIX-462	53.77	881	47.7	P-DIX-3611	10
J-DIX-464	54.41	881	48.6	P-DIX-3615	10
J-DIX-466	52.64	881	46.6	P-DIX-3619	10
J-DIX-468	55.23	881	38.3	P-DIX-3621	10
J-DIX-470	54.12	881	47.4	P-DIX-3625	10
J-DIX-472	54.16	881	47.7	P-DIX-3629	10
J-DIX-474	53.43	881	45.2	P-DIX-3633	10
J-DIX-476	55.36	881	48.4	P-DIX-3637	10
J-DIX-478	54.14	881	48.7	P-DIX-3641	10
J-DIX-48	54.35	881	44.0	P-DIX-2933	10
J-DIX-480	54.51	881	49.5	P-DIX-3645	10
J-DIX-482	53.01	881	47.3	P-DIX-3649	10
J-DIX-484	47.67	881	41.9	P-DIX-3653	10
J-DIX-486	48.69	881	38.3	P-DIX-3657	10
J-DIX-488	56.15	881	49.2	P-DIX-3661	10
J-DIX-490	55.02	881	48.1	P-DIX-3665	10
J-DIX-492	54.21	555	20.0		
J-DIX-494	56.15	881	45.6	P-DIX-3673	10
J-DIX-496	54.98	881	49.2	P-DIX-3677	10
J-DIX-498	54.97	881	48.2	P-DIX-3681	10
J-DIX-50	56.72	881	47.9	P-DIX-2989	10
J-DIX-500	55.34	881	49.0	P-DIX-3683	10
J-DIX-502	54.81	881	48.2	P-DIX-3565	10
J-DIX-504	52.76	881	42.5	P-DIX-3983	10
J-DIX-508	55.65	98	52.8	P-DIX-3695	10
J-DIX-510	55.42	881	48.9	P-DIX-3699	10
J-DIX-512	56.6	392	53.7	P-DIX-3703	10
J-DIX-514	55.96	881	48.7	P-DIX-3707	10
J-DIX-516	57.25	392	52.8	P-DIX-3711	10
J-DIX-518	59.85	392	56.2	P-DIX-3715	10
J-DIX-52	56.47	881	41.5	P-DIX-2941	10
J-DIX-520	59.95	881	51.5	P-DIX-3731	10
J-DIX-522	61.34	881	53.7	P-DIX-3721	10
J-DIX-524	60.83	881	53.3	P-DIX-3725	10
J-DIX-526	60.12	1,567	45.0	P-DIX-3727	10
J-DIX-528	54.46	881	46.3	P-DIX-3735	10
J-DIX-530	55.18	1,567	42.8	P-DIX-3739	10
J-DIX-532	54.42	881	49.1	P-DIX-3743	10
J-DIX-534	55.33	392	51.4	P-DIX-3747	10
J-DIX-536	56.29	392	51.8	P-DIX-3751	10
J-DIX-538	57.62	392	53.9	P-DIX-3755	10
J-DIX-54	56.35	881	43.6	P-DIX-2945	10
J-DIX-540	56.88	881	50.3	P-DIX-3759	10
J-DIX-542	57.19	881	49.3	P-DIX-3763	10
J-DIX-544	57.08	881	50.9	P-DIX-3767	10
J-DIX-546	56.58	392	53.4	P-DIX-3771	10
J-DIX-548	53.85	881	48.4	P-DIX-3775	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-550	52.87	881	47.5	P-DIX-3779	10
J-DIX-552	54.28	392	34.2	P-DIX-3783	10
J-DIX-554	56.19	392	52.2	P-DIX-3787	10
J-DIX-556	54.95	392	52.1	P-DIX-3791	10
J-DIX-558	54.32	98	52.4	P-DIX-3793	10
J-DIX-56	57.79	881	44.0	P-DIX-2949	10
J-DIX-560	58.72	98	57.1	P-DIX-3939	10
J-DIX-562	57.9	98	56.3	P-DIX-3947	10
J-DIX-564	55.52	98	53.9	P-DIX-3953	10
J-DIX-566	60.53	98	58.7	P-DIX-3965	10
J-DIX-568	53.18	98	51.8	P-DIX-3967	10
J-DIX-570	57.47	98	55.8	P-DIX-3945	10
J-DIX-572	53.68	98	52.3	P-DIX-3955	10
J-DIX-574	52.64	98	51.1	P-DIX-3969	10
J-DIX-576	54.63	5,109	29.5	P-DIX-59	10
J-DIX-578	56.42	1,698	45.9	P-DIX-2875	10
J-DIX-58	58.33	881	49.3	P-DIX-2953	10
J-DIX-580	55.42	2,597	31.0	P-DIX-209	10
J-DIX-582	57.16	3,494	20.1		
J-DIX-584	56.54	1,565	42.6	P-DIX-618	10
J-DIX-586	57.61	2,079	44.6	P-DIX-1281	10
J-DIX-588	56.6	2,183	41.3	P-DIX-1287	10
J-DIX-590	57.12	2,248	40.5	P-DIX-1285	10
J-DIX-592	56.47	2,306	38.5	P-DIX-1151	10
J-DIX-594	56.45	3,693	20.1		
J-DIX-596	56.95	2,495	34.8	P-DIX-1145	10
J-DIX-598	56.62	2,177	41.5	P-DIX-1279	10
J-DIX-60	57.14	881	46.5	P-DIX-2957	10
J-DIX-600	56.55	1,566	43.1	P-DIX-1319	10
J-DIX-602	56.64	2,805	33.3	P-DIX-132	10
J-DIX-604	57.6	2,863	33.5	P-DIX-908	10
J-DIX-606	56.63	4,035	36.7	P-DIX-1327	10
J-DIX-612	56.19	5,943	20.4		
J-DIX-614	56.24	5,949	20.4		
J-DIX-616	57.68	2,443	20.1		
J-DIX-618	58.02	1,974	33.9	P-DIX-2689	10
J-DIX-62	57.07	881	49.4	P-DIX-2961	10
J-DIX-620	58.03	2,071	31.5	P-DIX-1623	10
J-DIX-626	58.09	877	44.6	P-DIX-3055	10
J-DIX-628	57.45	2,446	20.1		
J-DIX-630	54.53	880	41.7	P-DIX-1375	10
J-DIX-632	55.44	2,952	20.1		
J-DIX-634	55.7	2,515	28.2	P-DIX-144	10
J-DIX-636	56.07	1,386	39.7	P-DIX-1939	10
J-DIX-638	59.16	1,295	49.9	P-DIX-2429	10
J-DIX-64	59.12	881	50.1	P-DIX-2965	10
J-DIX-640	56.11	881	42.4	P-DIX-216	10
J-DIX-642	56.96	881	44.8	P-DIX-769	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-644	56.31	1,154	46.8	P-DIX-1683	10
J-DIX-646	59.76	1,268	53.5	P-DIX-1403	10
J-DIX-648	59.88	1,917	50.9	P-DIX-2443	10
J-DIX-650	60.48	2,756	40.5	P-DIX-1471	10
J-DIX-652	53.75	1,558	43.3	P-DIX-1011	10
J-DIX-654	57.98	1,950	34.5	P-DIX-2853	10
J-DIX-656	61.37	2,832	40.5	P-DIX-1465	10
J-DIX-658	60.72	1,563	40.8	P-DIX-1473	10
J-DIX-66	56.52	881	46.9	P-DIX-2969	10
J-DIX-660	60.57	1,563	41.1	P-DIX-1477	10
J-DIX-662	58.16	2,010	33.4	P-DIX-1499	10
J-DIX-664	57	2,119	29.5	P-DIX-2859	10
J-DIX-666	56.68	2,287	24.7	P-DIX-1495	10
J-DIX-668	60.6	881	53.1	P-DIX-3411	10
J-DIX-670	53.33	2,343	20.1		
J-DIX-672	54.98	880	38.8	P-DIX-625	10
J-DIX-674	55.36	878	41.1	P-DIX-631	10
J-DIX-676	54.23	3,022	21.4	P-DIX-1103	10
J-DIX-678	53.67	1,575	44.1	P-DIX-1171	10
J-DIX-68	57.36	881	46.6	P-DIX-2973	10
J-DIX-680	53.82	957	48.8	P-DIX-1173	10
J-DIX-682	53.81	927	49.0	P-DIX-2483	10
J-DIX-684	54.76	881	49.6	P-DIX-3527	10
J-DIX-686	56.7	1,492	47.0	P-DIX-1175	10
J-DIX-688	56.62	1,424	48.0	P-DIX-2501	10
J-DIX-690	54.44	1,567	37.7	P-DIX-715	10
J-DIX-692	55.66	100	54.1	P-DIX-901	10
J-DIX-694	54.94	97	39.3	P-DIX-2547	10
J-DIX-696	54.71	98	35.0	P-DIX-2551	10
J-DIX-698	55.02	111	51.8	P-DIX-2545	10
J-DIX-70	58.65	881	48.3	P-DIX-2977	10
J-DIX-700	55.12	108	53.2	P-DIX-919	10
J-DIX-702	55.83	1,342	46.3	P-DIX-2799	10
J-DIX-704	55.74	1,387	45.5	P-DIX-473	10
J-DIX-706	55	1,426	45.0	P-DIX-641	10
J-DIX-708	54.97	1,459	44.6	P-DIX-639	10
J-DIX-710	54.16	3,100	34.0	P-DIX-1169	10
J-DIX-712	54.23	1,277	47.0	P-DIX-1169	10
J-DIX-714	55.58	1,370	46.4	P-DIX-551	10
J-DIX-716	55.75	1,430	45.8	P-DIX-937	10
J-DIX-718	54.84	1,459	44.6	P-DIX-561	10
J-DIX-72	57.72	881	47.8	P-DIX-2981	10
J-DIX-720	54.52	1,385	45.3	P-DIX-563	10
J-DIX-722	53.6	1,361	44.7	P-DIX-485	10
J-DIX-724	53.18	1,427	43.3	P-DIX-479	10
J-DIX-726	54.85	1,212	47.9	P-DIX-1181	10
J-DIX-728	54.74	1,241	47.4	P-DIX-653	10
J-DIX-730	54.94	880	42.3	P-DIX-2467	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-732	55.92	1,357	40.1	P-DIX-1937	10
J-DIX-734	53.75	881	46.8	P-DIX-3817	10
J-DIX-736	55.41	881	45.9	P-DIX-3821	10
J-DIX-738	54.05	1,314	39.7	P-DIX-1691	10
J-DIX-74	56.7	881	49.9	P-DIX-2985	10
J-DIX-740	53.94	881	43.9	P-DIX-3827	10
J-DIX-742	55.81	881	48.4	P-DIX-3211	10
J-DIX-744	54.46	1,347	40.9	P-DIX-2533	10
J-DIX-746	54.47	1,357	40.6	P-DIX-967	10
J-DIX-748	52.73	1,122	48.1	P-DIX-1871	10
J-DIX-750	54.05	2,666	44.1	P-DIX-1869	10
J-DIX-752	53.44	1,159	47.0	P-DIX-2039	10
J-DIX-754	53.44	1,117	47.5	P-DIX-2041	10
J-DIX-756	54.08	1,132	48.1	P-DIX-1599	10
J-DIX-758	54.02	1,173	47.6	P-DIX-2059	10
J-DIX-76	57.63	881	47.5	P-DIX-2991	10
J-DIX-760	54.36	2,264	45.7	P-DIX-1605	10
J-DIX-762	54.63	3,146	41.6	P-DIX-2121	10
J-DIX-764	55.37	881	49.6	P-DIX-655	10
J-DIX-766	56.03	1,381	48.1	P-DIX-1221	10
J-DIX-768	55.74	1,181	49.3	P-DIX-1219	10
J-DIX-770	55.79	1,158	49.6	P-DIX-1225	10
J-DIX-772	56	1,354	48.3	P-DIX-1223	10
J-DIX-774	56.02	1,663	45.7	P-DIX-2401	10
J-DIX-776	56.1	1,594	38.0	P-DIX-1953	10
J-DIX-778	56.08	1,588	38.2	P-DIX-401	10
J-DIX-78	57.23	881	43.9	P-DIX-2995	10
J-DIX-780	55.86	1,655	46.0	P-DIX-1959	10
J-DIX-782	55.85	1,861	44.4	P-DIX-573	10
J-DIX-784	55.8	1,241	48.7	P-DIX-1965	10
J-DIX-786	56.18	1,163	49.2	P-DIX-1417	10
J-DIX-788	56.41	1,265	48.1	P-DIX-1419	10
J-DIX-790	55.89	1,214	48.1	P-DIX-1425	10
J-DIX-792	55.92	1,260	47.5	P-DIX-1427	10
J-DIX-794	56.24	1,477	44.4	P-DIX-1435	10
J-DIX-796	56.64	1,539	43.9	P-DIX-1431	10
J-DIX-798	56.53	1,683	42.8	P-DIX-1981	10
J-DIX-80	57.17	881	49.8	P-DIX-3001	10
J-DIX-800	56.43	1,617	43.6	P-DIX-1987	10
J-DIX-802	57.77	1,655	37.9	P-DIX-2235	10
J-DIX-804	57.97	669	42.8	P-DIX-2239	10
J-DIX-806	56.59	1,501	39.4	P-DIX-2215	10
J-DIX-808	56.52	1,518	38.9	P-DIX-2223	10
J-DIX-810	56.6	98	55.1	P-DIX-587	10
J-DIX-812	57.55	1,572	42.3	P-DIX-1241	10
J-DIX-814	57.53	1,647	41.1	P-DIX-1243	10
J-DIX-816	58.58	1,271	47.0	P-DIX-2231	10
J-DIX-818	58.74	1,914	42.8	P-DIX-2013	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-82	56.4	881	50.2	P-DIX-3005	10
J-DIX-820	59.24	1,847	45.2	P-DIX-567	10
J-DIX-822	57.42	6,297	25.9	P-DIX-405	10
J-DIX-824	57.14	2,497	20.1		
J-DIX-826	61.09	2,974	33.6	P-DIX-2893	10
J-DIX-828	61.72	3,026	33.4	P-DIX-2621	10
J-DIX-830	57.14	1,279	48.7	P-DIX-2635	10
J-DIX-832	56.29	1,301	47.5	P-DIX-1967	10
J-DIX-834	55.39	881	48.0	P-DIX-2639	10
J-DIX-836	59.13	1,813	44.1	P-DIX-2291	10
J-DIX-838	59.09	2,876	30.9	P-DIX-2297	10
J-DIX-84	57.32	881	51.6	P-DIX-3009	10
J-DIX-840	59.29	2,669	35.4	P-DIX-859	10
J-DIX-842	60.17	7,069	32.6	P-DIX-2309	10
J-DIX-844	60.17	1,758	52.4	P-DIX-2311	10
J-DIX-846	59.74	1,293	48.9	P-DIX-2317	10
J-DIX-848	59.68	1,279	49.1	P-DIX-2659	10
J-DIX-850	59.67	2,381	28.6	P-DIX-2129	10
J-DIX-852	54.05	879	32.6	P-DIX-1839	10
J-DIX-854	53.55	1,524	36.2	P-DIX-1709	10
J-DIX-856	53.37	878	42.0	P-DIX-869	10
J-DIX-858	53.33	881	45.0	P-DIX-2091	10
J-DIX-86	56.68	881	51.3	P-DIX-3013	10
J-DIX-860	54.53	1,274	43.3	P-DIX-2361	10
J-DIX-862	53.87	881	44.5	P-DIX-296	10
J-DIX-864	55.31	880	45.0	P-DIX-874	10
J-DIX-866	54.48	2,254	25.0	P-DIX-1721	10
J-DIX-868	54.65	2,122	27.1	P-DIX-675	10
J-DIX-870	54.55	1,811	32.1	P-DIX-1723	10
J-DIX-872	54.61	2,188	26.1	P-DIX-1703	10
J-DIX-874	53.64	2,031	28.1	P-DIX-1699	10
J-DIX-876	52.38	881	42.8	P-DIX-298	10
J-DIX-878	53.42	2,476	21.9	P-DIX-671	10
J-DIX-88	56.97	881	51.7	P-DIX-3017	10
J-DIX-880	53.87	1,913	28.6	P-DIX-1565	10
J-DIX-882	53.79	1,680	33.0	P-DIX-1567	10
J-DIX-884	54.62	1,740	20.0		
J-DIX-886	54.39	1,839	20.0		
J-DIX-888	54.05	1,317	20.0		
J-DIX-890	54.57	1,522	20.0		
J-DIX-892	54.5	6,305	20.4		
J-DIX-894	51.53	4,868	20.2		
J-DIX-896	49.39	7,836	23.4	P-DIX-821	10
J-DIX-90	57.32	881	50.9	P-DIX-3021	10
J-DIX-900	50.48	4,885	30.2	P-DIX-817	10
J-DIX-902	49.62	2,537	43.2	P-DIX-823	10
J-DIX-904	55.04	2,179	20.1		
J-DIX-906	55.82	1,800	26.1	P-DIX-1539	10

Appendix N

ID	Static Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)	Critical Pipe ID	Critical Pipe Velocity (ft/s)
J-DIX-908	55.26	375	52.0	P-DIX-799	10
J-DIX-910	54.62	2,299	34.2	P-DIX-1771	10
J-DIX-912	54.75	2,976	20.1		
J-DIX-914	55.83	4,205	20.2		
J-DIX-916	62.81	877	56.7	P-DIX-128	10
J-DIX-918	56.39	876	49.9	P-DIX-1033	10
J-DIX-92	57.32	881	49.3	P-DIX-3025	10
J-DIX-920	55.67	3,152	20.1		
J-DIX-922	57.69	3,690	20.1		
J-DIX-924	53.33	3,284	23.2	P-DIX-1655	10
J-DIX-926	55	2,091	20.0		
J-DIX-928	58.75	2,261	38.2	P-DIX-495	10
J-DIX-930	57.75	2,358	20.1	P-DIX-437	10
J-DIX-932	56.21	1,677	20.0		
J-DIX-934	59.39	1,260	50.2	P-DIX-566	10
J-DIX-936	58.38	2,666	20.1		
J-DIX-938	57.08	2,242	20.1		
J-DIX-94	56.65	881	51.6	P-DIX-3029	10
J-DIX-940	58.24	2,899	20.1		
J-DIX-942	59.06	1,637	34.9	P-DIX-1585	10
J-DIX-944	59.22	879	47.7	P-DIX-868	10
J-DIX-946	58.39	2,220	20.1		
J-DIX-948	58.43	2,253	20.1		
J-DIX-950	59.93	8,213	20.7		
J-DIX-952	59.73	6,969	20.5		
J-DIX-956	59.58	955	53.2	P-DIX-2459	10
J-DIX-958	59.96	4,782	20.2		
J-DIX-96	56.58	881	50.0	P-DIX-3033	10
J-DIX-960	60.09	4,025	29.4	P-DIX-282	10
J-DIX-962	62.08	3,708	33.2	P-DIX-948	10
J-DIX-964	60.57	3,016	20.1		
J-DIX-966	59.85	3,048	20.1		
J-DIX-968	59.9	3,049	20.1		
J-DIX-970	58.49	2,858	20.1		
J-DIX-972	58.83	2,701	20.1		
J-DIX-974	58.22	2,682	20.1		
J-DIX-976	60.13	2,857	24.0	P-DIX-338	10
J-DIX-978	60.6	3,018	20.1		
J-DIX-98	57.39	881	51.1	P-DIX-3037	10
J-DIX-980	61.39	2,754	26.9	P-DIX-340	10
J-DIX-982	60.99	3,105	20.1		
J-DIX-984	60.25	3,132	20.1		
J-DIX-986	60.34	2,559	30.6	P-DIX-342	10
J-DIX-988	58.8	2,766	20.1		
J-DIX-992	53.57	2,373	20.1		
J-DIX-994	53.86	2,406	20.1		
J-DIX-996	54.3	1,567	36.6	P-DIX-617	10
J-DIX-998	52.99	1,799	20.0		

APPENDIX O

Cal Water Simulated Available Fire Flow to Meet the Maximum Day Demand plus Fire Flow Performance Criteria (For Residential Pressure Only)

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-100	57.64	3,100	20.1
J-DIX-1000	53.24	1,955	20.0
J-DIX-1002	55.11	2,163	20.1
J-DIX-1004	53.24	2,557	20.1
J-DIX-1006	55.41	3,271	20.1
J-DIX-1008	54.25	3,097	20.1
J-DIX-101	57.43	1,251	20.0
J-DIX-1010	54.56	6,487	20.4
J-DIX-1014	55.07	577	20.0
J-DIX-1016	55.35	3,481	20.1
J-DIX-1018	55.66	4,549	20.2
J-DIX-1020	56.06	6,989	20.5
J-DIX-1022	54.98	1,579	20.0
J-DIX-1024	56.46	1,753	20.0
J-DIX-1026	56.98	5,247	20.3
J-DIX-1028	57.43	5,537	20.3
J-DIX-1030	53.54	3,531	20.1
J-DIX-1032	58.74	4,275	20.2
J-DIX-1034	56.56	3,305	20.1
J-DIX-1036	57.01	3,491	20.1
J-DIX-1038	56.31	3,695	20.1
J-DIX-104	56.58	1,462	20.0
J-DIX-1040	56.31	3,555	20.1
J-DIX-1042	56.46	3,387	20.1
J-DIX-1044	56.97	3,084	20.1
J-DIX-1046	58.99	3,061	20.1
J-DIX-1048	58.49	3,242	20.1
J-DIX-1050	55.41	3,276	20.1
J-DIX-1054	54.05	5,473	20.3
J-DIX-1056	54.97	5,347	20.3
J-DIX-1058	55.12	4,457	20.2
J-DIX-106	58.21	2,095	20.0
J-DIX-1060	54.45	4,004	20.2
J-DIX-1062	55.81	3,165	20.1
J-DIX-1064	55.47	3,911	20.2
J-DIX-1066	55.31	3,699	20.1
J-DIX-1068	55.41	3,164	20.1
J-DIX-1070	53.56	3,665	20.1
J-DIX-1072	55.2	4,294	20.2
J-DIX-1074	55.37	7,338	20.5
J-DIX-1076	55.42	7,401	20.6
J-DIX-1078	56.14	3,717	20.1
J-DIX-108	58.07	1,641	20.0
J-DIX-1080	55.83	4,675	20.2
J-DIX-1082	56.45	3,854	20.2
J-DIX-1084	56.12	4,072	20.2
J-DIX-1086	57.58	3,444	20.1
J-DIX-1088	56.19	3,383	20.1
J-DIX-1090	59.57	1,031	20.0
J-DIX-1092	59.59	2,914	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-1094	59.38	2,570	20.1
J-DIX-1096	57.08	3,838	20.2
J-DIX-1098	59.77	3,435	20.1
J-DIX-110	56.86	2,029	20.0
J-DIX-1100	53.31	3,860	20.2
J-DIX-1102	53.28	2,761	20.1
J-DIX-1104	53.67	4,830	20.2
J-DIX-1106	58.83	2,604	20.1
J-DIX-1108	59.23	2,453	20.1
J-DIX-1110	56.06	3,290	20.1
J-DIX-1111	55.23	4,512	20.2
J-DIX-1112	55.37	1,675	20.0
J-DIX-1114	55.95	2,912	20.1
J-DIX-1116	57.08	1,865	20.0
J-DIX-1118	58.33	2,529	20.1
J-DIX-112	58.05	2,523	20.1
J-DIX-1120	57.76	2,038	20.0
J-DIX-1122	58.05	2,179	20.1
J-DIX-1124	56.64	3,057	20.1
J-DIX-1126	57.16	3,290	20.1
J-DIX-1128	57.78	1,999	20.0
J-DIX-1136	57.06	3,044	20.1
J-DIX-1138	57.06	3,041	20.1
J-DIX-114	56.4	2,234	20.1
J-DIX-1140	57.39	2,389	20.1
J-DIX-1142	59.16	3,048	20.1
J-DIX-1144	59.06	3,046	20.1
J-DIX-1146	63.75	5,021	20.3
J-DIX-1148	59.77	2,735	20.1
J-DIX-1150	60.13	2,982	20.1
J-DIX-1152	59.59	3,837	20.2
J-DIX-1154	58.61	3,038	20.1
J-DIX-1156	53.33	2,135	20.1
J-DIX-1158	53.42	2,342	20.1
J-DIX-116	54.7	2,235	20.1
J-DIX-1160	56.59	2,493	20.1
J-DIX-1162	53.78	4,972	20.3
J-DIX-1164	55.15	4,271	20.2
J-DIX-1166	54.38	2,487	20.1
J-DIX-1168	55.76	3,068	20.1
J-DIX-1170	55.49	3,659	20.1
J-DIX-1172	54.11	4,644	20.2
J-DIX-1174	55.53	5,429	20.3
J-DIX-1176	54.51	3,264	20.1
J-DIX-1178	53.84	2,914	20.1
J-DIX-118	54.74	1,537	20.0
J-DIX-1180	53.94	2,907	20.1
J-DIX-1182	55.24	4,134	20.2
J-DIX-1184	52.8	5,360	20.3
J-DIX-1186	52.96	2,405	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-1188	54.14	808	20.0
J-DIX-1190	53.4	4,849	20.2
J-DIX-1192	53.97	5,349	20.3
J-DIX-1194	54.44	6,018	20.4
J-DIX-1196	56.14	6,512	20.4
J-DIX-1198	59.79	848	20.0
J-DIX-12	55.41	1,856	20.0
J-DIX-120	55.2	2,379	20.1
J-DIX-1200	59.56	3,549	20.1
J-DIX-1202	59.66	3,181	20.1
J-DIX-1204	59.66	3,407	20.1
J-DIX-1206	59.77	3,405	20.1
J-DIX-1208	60.22	7,927	20.6
J-DIX-1210	59.26	2,735	20.1
J-DIX-1212	53.28	3,796	20.1
J-DIX-1214	53.38	3,802	20.1
J-DIX-1216	54.65	511	20.0
J-DIX-1218	52.2	3,519	20.1
J-DIX-122	55.88	2,719	20.1
J-DIX-1220	54.58	3,017	20.1
J-DIX-1222	52.62	3,465	20.1
J-DIX-1224	54.05	3,053	20.1
J-DIX-1226	49.02	1,716	20.0
J-DIX-1228	55.84	2,018	20.0
J-DIX-1230	54.86	5,548	20.3
J-DIX-1232	57.3	6,134	20.4
J-DIX-1234	55.11	6,257	20.4
J-DIX-1236	56	5,755	20.3
J-DIX-1238	56.06	5,068	20.3
J-DIX-124	55.62	2,630	20.1
J-DIX-1240	56.33	4,340	20.2
J-DIX-1242	56.42	4,353	20.2
J-DIX-1244	56.19	3,912	20.2
J-DIX-1246	56.71	4,549	20.2
J-DIX-1248	54.97	6,515	20.4
J-DIX-1250	54.97	6,511	20.4
J-DIX-1252	54.95	4,601	20.2
J-DIX-1254	54.97	6,521	20.4
J-DIX-1256	54.98	6,522	20.4
J-DIX-1258	55.41	6,672	20.4
J-DIX-126	58.44	3,418	20.1
J-DIX-1260	55.86	4,180	20.2
J-DIX-1262	55.04	6,628	20.4
J-DIX-1264	55.37	3,237	20.1
J-DIX-1266	55.45	3,321	20.1
J-DIX-1268	55.35	6,768	20.5
J-DIX-1270	55.37	6,765	20.5
J-DIX-1272	55.22	6,755	20.5
J-DIX-1274	55.21	3,511	20.1
J-DIX-1276	54.56	3,681	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-1278	54.75	3,732	20.1
J-DIX-128	55.4	1,769	20.0
J-DIX-1280	55.25	6,935	20.5
J-DIX-1282	54.99	2,778	20.1
J-DIX-1284	55.1	1,675	20.0
J-DIX-1286	55.85	3,050	20.1
J-DIX-1288	55.86	3,148	20.1
J-DIX-1290	55.66	1,237	20.0
J-DIX-1292	54.35	2,773	20.1
J-DIX-1294	54.32	2,720	20.1
J-DIX-1296	54.35	2,018	20.0
J-DIX-1298	54.45	2,832	20.1
J-DIX-130	56.9	2,352	20.1
J-DIX-1300	56.72	2,517	20.1
J-DIX-1302	56.47	1,583	20.0
J-DIX-1304	56.04	2,323	20.1
J-DIX-1306	56.13	1,770	20.0
J-DIX-1308	55.91	2,959	20.1
J-DIX-1310	55.56	2,636	20.1
J-DIX-1312	57.49	1,491	20.0
J-DIX-1314	57.16	3,185	20.1
J-DIX-1316	57.81	1,700	20.0
J-DIX-1318	57.36	2,664	20.1
J-DIX-132	56.1	2,667	20.1
J-DIX-1320	58.55	2,569	20.1
J-DIX-1322	58.31	2,718	20.1
J-DIX-1324	57.7	2,628	20.1
J-DIX-1326	57.09	2,201	20.1
J-DIX-1328	57.09	2,170	20.1
J-DIX-1330	57.24	2,215	20.1
J-DIX-1332	57.61	3,331	20.1
J-DIX-1334	57.37	2,919	20.1
J-DIX-1336	59.65	2,509	20.1
J-DIX-1338	56.52	2,207	20.1
J-DIX-134	56.34	3,026	20.1
J-DIX-1340	56.68	2,132	20.1
J-DIX-1342	57.57	2,043	20.0
J-DIX-1344	59.99	2,219	20.1
J-DIX-1346	57.21	2,528	20.1
J-DIX-1348	57.53	2,189	20.1
J-DIX-1350	56.67	3,090	20.1
J-DIX-1352	56.8	3,282	20.1
J-DIX-1354	56.92	3,371	20.1
J-DIX-1356	56.18	2,756	20.1
J-DIX-1358	57.49	2,154	20.1
J-DIX-136	56.61	2,329	20.1
J-DIX-1360	57.55	2,111	20.0
J-DIX-1362	57.75	2,009	20.0
J-DIX-1364	57.81	1,748	20.0
J-DIX-1366	56.93	3,231	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-1368	56.39	4,296	20.2
J-DIX-1370	56.18	4,295	20.2
J-DIX-1372	57.75	4,668	20.2
J-DIX-1374	58.15	4,657	20.2
J-DIX-1376	56.67	5,271	20.3
J-DIX-1378	57	5,568	20.3
J-DIX-138	56.35	2,676	20.1
J-DIX-1380	57.25	4,487	20.2
J-DIX-1382	57.62	4,132	20.2
J-DIX-1384	56.94	2,881	20.1
J-DIX-1388	56.6	5,934	20.4
J-DIX-1390	56.77	3,879	20.2
J-DIX-1392	57.59	3,924	20.2
J-DIX-1394	57.38	4,327	20.2
J-DIX-1398	58.21	2,219	20.1
J-DIX-140	56.69	2,612	20.1
J-DIX-1400	58.13	1,728	20.0
J-DIX-1402	57.03	2,194	20.1
J-DIX-1404	57.84	2,807	20.1
J-DIX-1406	56.83	2,410	20.1
J-DIX-1408	54.72	2,504	20.1
J-DIX-1410	54.31	2,484	20.1
J-DIX-1412	54.27	2,503	20.1
J-DIX-1414	55.06	2,632	20.1
J-DIX-1416	55.89	3,215	20.1
J-DIX-1418	55.96	3,188	20.1
J-DIX-142	57.87	2,063	20.0
J-DIX-1420	55.42	2,986	20.1
J-DIX-1422	59	3,968	20.2
J-DIX-1424	57.18	3,626	20.1
J-DIX-1426	57.6	3,619	20.1
J-DIX-1428	56.16	3,753	20.1
J-DIX-1430	57.39	4,450	20.2
J-DIX-1432	57.22	4,453	20.2
J-DIX-1434	55.09	3,306	20.1
J-DIX-1436	54.53	3,241	20.1
J-DIX-1438	55.97	3,418	20.1
J-DIX-144	56.24	2,508	20.1
J-DIX-1440	57.05	3,374	20.1
J-DIX-1442	58.47	3,518	20.1
J-DIX-1444	59.35	4,332	20.2
J-DIX-1446	59.57	4,508	20.2
J-DIX-1450	58.88	4,114	20.2
J-DIX-1452	58.53	3,775	20.1
J-DIX-1454	58.47	4,247	20.2
J-DIX-1456	59.61	3,324	20.1
J-DIX-1458	58.59	3,467	20.1
J-DIX-146	57.79	1,966	20.0
J-DIX-1460	58.68	2,982	20.1
J-DIX-1462	61.44	6,130	20.4

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-1464	61.93	6,880	20.5
J-DIX-1466	61.97	4,985	20.3
J-DIX-1468	55.78	3,783	20.1
J-DIX-1470	57.49	3,803	20.1
J-DIX-1472	55.7	3,538	20.1
J-DIX-1474	55.88	3,561	20.1
J-DIX-1476	56.35	3,713	20.1
J-DIX-1478	56.33	3,726	20.1
J-DIX-148	58.04	3,166	20.1
J-DIX-1480	56.9	2,582	20.1
J-DIX-1482	56.3	2,960	20.1
J-DIX-1484	56.31	3,698	20.1
J-DIX-1486	56.62	2,512	20.1
J-DIX-1488	56.25	2,953	20.1
J-DIX-1490	56.63	2,866	20.1
J-DIX-1492	59.17	2,258	20.1
J-DIX-1494	56.17	2,838	20.1
J-DIX-1496	57.89	2,100	20.0
J-DIX-1498	57.57	2,373	20.1
J-DIX-150	56.31	3,013	20.1
J-DIX-1500	56.31	3,446	20.1
J-DIX-1502	58.04	3,706	20.1
J-DIX-1504	56.84	3,090	20.1
J-DIX-1506	57.66	3,068	20.1
J-DIX-1508	57.91	2,963	20.1
J-DIX-1510	57.65	3,196	20.1
J-DIX-1512	56.83	3,033	20.1
J-DIX-1514	58.48	2,864	20.1
J-DIX-1516	60.17	3,086	20.1
J-DIX-1518	57.92	2,830	20.1
J-DIX-152	58.04	3,205	20.1
J-DIX-1520	55.99	3,004	20.1
J-DIX-1522	56.7	2,230	20.1
J-DIX-1524	59.55	3,932	20.2
J-DIX-1526	56.88	2,170	20.1
J-DIX-1528	55.09	3,011	20.1
J-DIX-1530	58.37	3,095	20.1
J-DIX-1532	57.25	3,055	20.1
J-DIX-1534	54.6	2,092	20.0
J-DIX-1536	54.04	3,203	20.1
J-DIX-1538	54.01	3,103	20.1
J-DIX-154	56.7	2,629	20.1
J-DIX-1540	54.75	3,260	20.1
J-DIX-1542	55.4	2,362	20.1
J-DIX-1544	55.58	2,421	20.1
J-DIX-1546	55.84	2,438	20.1
J-DIX-1548	55.16	2,309	20.1
J-DIX-1550	54.64	2,354	20.1
J-DIX-1552	54.3	2,571	20.1
J-DIX-1554	53.42	4,002	20.2

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-1556	53.95	3,839	20.2
J-DIX-1558	53.69	5,166	20.3
J-DIX-156	57.91	2,689	20.1
J-DIX-1560	53.76	4,740	20.2
J-DIX-1562	53.8	4,636	20.2
J-DIX-1564	53.46	4,158	20.2
J-DIX-1566	54.75	4,603	20.2
J-DIX-1568	53.56	3,836	20.2
J-DIX-1570	52.2	3,366	20.1
J-DIX-1572	53.26	3,290	20.1
J-DIX-1574	52.2	3,493	20.1
J-DIX-1576	55.2	3,976	20.2
J-DIX-1578	54.83	4,052	20.2
J-DIX-158	56.9	2,734	20.1
J-DIX-1580	53.4	4,884	20.2
J-DIX-1582	53.05	3,887	20.2
J-DIX-1584	54.76	2,839	20.1
J-DIX-1586	54.73	2,890	20.1
J-DIX-1588	54.6	2,975	20.1
J-DIX-1590	53.79	3,330	20.1
J-DIX-1592	53.21	4,302	20.2
J-DIX-1594	53.03	4,068	20.2
J-DIX-1596	53.21	4,364	20.2
J-DIX-1598	53.39	3,735	20.1
J-DIX-16	59.86	1,286	20.0
J-DIX-160	59.67	2,615	20.1
J-DIX-1600	53.73	3,758	20.1
J-DIX-1602	53.67	3,775	20.1
J-DIX-1604	54.17	4,458	20.2
J-DIX-1606	54.22	3,768	20.1
J-DIX-1608	53.19	5,139	20.3
J-DIX-1610	53.58	4,998	20.3
J-DIX-1612	55.1	5,366	20.3
J-DIX-1614	55.11	5,203	20.3
J-DIX-1616	56.78	3,801	20.1
J-DIX-1618	56.76	1,564	20.0
J-DIX-162	56.26	1,943	20.0
J-DIX-1620	54.64	1,945	20.0
J-DIX-1622	54.66	1,993	20.0
J-DIX-1624	53.89	2,910	20.1
J-DIX-1626	55.75	3,706	20.1
J-DIX-1628	53.42	2,723	20.1
J-DIX-1630	55.49	3,744	20.1
J-DIX-1632	54.4	2,440	20.1
J-DIX-1634	54.91	159	20.0
J-DIX-1636	56.05	3,130	20.1
J-DIX-1638	55.06	4,471	20.2
J-DIX-164	56.2	2,718	20.1
J-DIX-1640	53.21	5,274	20.3
J-DIX-1642	53.59	4,871	20.2

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-1644	53.13	5,424	20.3
J-DIX-1646	54.04	4,736	20.2
J-DIX-1648	55.59	3,425	20.1
J-DIX-1650	55.12	3,485	20.1
J-DIX-1652	54.88	4,011	20.2
J-DIX-1654	54.57	2,329	20.1
J-DIX-1656	54.74	2,258	20.1
J-DIX-1658	53.78	2,119	20.0
J-DIX-166	56.86	2,079	20.0
J-DIX-1660	54.88	2,312	20.1
J-DIX-1662	55.35	3,156	20.1
J-DIX-1664	54.93	4,013	20.2
J-DIX-1666	55.01	4,046	20.2
J-DIX-1668	54.28	2,900	20.1
J-DIX-1670	54.22	2,843	20.1
J-DIX-1672	55.42	2,735	20.1
J-DIX-1674	54.26	3,114	20.1
J-DIX-1676	55.41	2,268	20.1
J-DIX-1678	53.53	2,068	20.0
J-DIX-168	59.46	2,884	20.1
J-DIX-1680	55.82	2,287	20.1
J-DIX-1682	54.75	3,826	20.2
J-DIX-1684	54.92	2,979	20.1
J-DIX-1686	55.47	3,777	20.1
J-DIX-1688	54.86	3,378	20.1
J-DIX-1690	55.3	3,589	20.1
J-DIX-1694	56.43	3,750	20.1
J-DIX-1696	56.16	3,355	20.1
J-DIX-1698	55.79	3,344	20.1
J-DIX-170	55.44	1,976	20.0
J-DIX-1700	55.4	3,005	20.1
J-DIX-1702	55.08	3,287	20.1
J-DIX-1704	54.28	3,404	20.1
J-DIX-1706	53.64	3,901	20.2
J-DIX-1708	54.4	3,191	20.1
J-DIX-1710	54.22	1,962	20.0
J-DIX-1712	54.75	3,810	20.1
J-DIX-1714	54.97	2,891	20.1
J-DIX-1716	53.45	4,003	20.2
J-DIX-1718	54.58	2,201	20.1
J-DIX-172	55.09	2,625	20.1
J-DIX-1720	53.72	3,590	20.1
J-DIX-1722	54.54	2,790	20.1
J-DIX-1724	52.28	1,162	20.0
J-DIX-1726	52.84	2,140	20.1
J-DIX-1728	52.68	2,186	20.1
J-DIX-1730	53.16	2,105	20.0
J-DIX-1732	55.71	3,745	20.1
J-DIX-1734	52.63	3,116	20.1
J-DIX-1736	53.7	3,029	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-1738	55.35	3,394	20.1
J-DIX-174	58.03	2,631	20.1
J-DIX-1740	52.62	2,928	20.1
J-DIX-1742	54.06	3,220	20.1
J-DIX-1744	54.43	3,362	20.1
J-DIX-1746	55.79	3,350	20.1
J-DIX-1748	54.51	2,741	20.1
J-DIX-1750	55.13	3,984	20.2
J-DIX-1752	52.67	2,610	20.1
J-DIX-1754	53.03	2,829	20.1
J-DIX-1756	53.05	3,437	20.1
J-DIX-1758	52.93	5,594	20.3
J-DIX-176	56.19	2,586	20.1
J-DIX-1760	53.16	6,873	20.5
J-DIX-1762	54.39	6,428	20.4
J-DIX-1764	54.96	1,879	20.0
J-DIX-1766	55.16	1,984	20.0
J-DIX-1768	55.04	1,993	20.0
J-DIX-1770	53.46	3,479	20.1
J-DIX-1772	53.56	3,689	20.1
J-DIX-1774	53.47	3,015	20.1
J-DIX-1776	53.43	549	20.0
J-DIX-1778	54.39	1,937	20.0
J-DIX-178	54.29	1,943	20.0
J-DIX-1780	53.02	2,426	20.1
J-DIX-1782	53.92	3,862	20.2
J-DIX-1784	53.8	3,552	20.1
J-DIX-1786	54.13	3,669	20.1
J-DIX-1788	52.85	4,458	20.2
J-DIX-1790	55.69	6,582	20.4
J-DIX-1792	55.41	6,521	20.4
J-DIX-1794	56.51	6,495	20.4
J-DIX-1796	54.52	4,221	20.2
J-DIX-1798	54.76	6,157	20.4
J-DIX-18	53.24	2,069	20.0
J-DIX-180	54.75	2,598	20.1
J-DIX-1800	54.77	5,772	20.3
J-DIX-1802	55.21	6,123	20.4
J-DIX-1804	55.35	3,837	20.2
J-DIX-1806	54.48	6,150	20.4
J-DIX-1808	54.23	6,339	20.4
J-DIX-1810	54.3	6,260	20.4
J-DIX-1812	55.46	6,712	20.5
J-DIX-1814	55.3	7,296	20.5
J-DIX-1816	54.93	4,185	20.2
J-DIX-1818	55.78	3,591	20.1
J-DIX-182	55.79	3,370	20.1
J-DIX-1820	55.23	4,410	20.2
J-DIX-1822	56.26	4,226	20.2
J-DIX-1824	56.13	4,221	20.2

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-1826	56.02	4,245	20.2
J-DIX-1828	55.19	7,033	20.5
J-DIX-1830	55.27	7,047	20.5
J-DIX-1832	56.15	4,039	20.2
J-DIX-1834	57.15	2,506	20.1
J-DIX-1836	55.74	4,310	20.2
J-DIX-1838	56.39	3,746	20.1
J-DIX-184	62.33	3,329	20.1
J-DIX-1840	56.1	3,202	20.1
J-DIX-1842	57.58	3,269	20.1
J-DIX-1844	56.45	3,083	20.1
J-DIX-1846	56.3	3,340	20.1
J-DIX-1848	57.13	2,967	20.1
J-DIX-1850	57.13	3,015	20.1
J-DIX-1852	56.43	2,509	20.1
J-DIX-1854	56.49	2,485	20.1
J-DIX-1856	56.15	2,746	20.1
J-DIX-1858	56.75	2,959	20.1
J-DIX-186	57.26	2,742	20.1
J-DIX-1860	56.68	2,448	20.1
J-DIX-1862	56.85	2,447	20.1
J-DIX-1864	56.56	2,421	20.1
J-DIX-1868	57.55	2,388	20.1
J-DIX-1870	57.51	2,876	20.1
J-DIX-1872	57.57	2,846	20.1
J-DIX-1874	57.83	2,915	20.1
J-DIX-1876	56.31	2,757	20.1
J-DIX-1878	56.34	2,716	20.1
J-DIX-188	57.12	2,750	20.1
J-DIX-1880	57.55	2,537	20.1
J-DIX-1882	58.7	2,832	20.1
J-DIX-1884	58.64	2,384	20.1
J-DIX-1886	58.09	1,948	20.0
J-DIX-1888	58.91	1,125	20.0
J-DIX-1890	57.42	2,526	20.1
J-DIX-1892	59.71	2,808	20.1
J-DIX-1894	60.04	3,144	20.1
J-DIX-1896	59.81	2,600	20.1
J-DIX-1898	59.79	3,053	20.1
J-DIX-190	56.74	3,044	20.1
J-DIX-1900	59.66	2,964	20.1
J-DIX-1902	58.76	3,463	20.1
J-DIX-1904	59	3,707	20.1
J-DIX-1906	55.93	4,305	20.2
J-DIX-1908	57.25	2,500	20.1
J-DIX-1910	58.11	2,721	20.1
J-DIX-1912	58.22	2,630	20.1
J-DIX-1914	58.68	2,626	20.1
J-DIX-1916	58.57	2,563	20.1
J-DIX-1918	59.28	2,623	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-192	53.49	2,944	20.1
J-DIX-1920	60	2,975	20.1
J-DIX-1922	60.08	2,746	20.1
J-DIX-1924	59.97	2,554	20.1
J-DIX-1926	59.66	2,411	20.1
J-DIX-1928	59.74	2,413	20.1
J-DIX-1930	59.1	2,418	20.1
J-DIX-1932	58.94	2,520	20.1
J-DIX-1934	58.87	2,262	20.1
J-DIX-1936	56.92	3,757	20.1
J-DIX-1938	56.47	3,416	20.1
J-DIX-194	54.5	1,940	20.0
J-DIX-1940	56.94	3,230	20.1
J-DIX-1942	58	3,632	20.1
J-DIX-1944	56.79	3,520	20.1
J-DIX-1946	58.45	6,201	20.4
J-DIX-1948	58.23	6,291	20.4
J-DIX-1950	57.42	6,912	20.5
J-DIX-1952	57.53	5,151	20.3
J-DIX-1954	57.59	3,362	20.1
J-DIX-1956	59.22	7,752	20.6
J-DIX-1958	59.13	3,841	20.2
J-DIX-196	58.68	2,870	20.1
J-DIX-1962	60.33	3,618	20.1
J-DIX-1964	60.63	3,684	20.1
J-DIX-1966	59.66	3,190	20.1
J-DIX-1968	59.77	3,048	20.1
J-DIX-1970	59.76	2,387	20.1
J-DIX-1972	60.45	3,405	20.1
J-DIX-1974	59.39	4,904	20.2
J-DIX-1976	57.22	3,765	20.1
J-DIX-1978	57.78	2,396	20.1
J-DIX-198	55.67	1,463	20.0
J-DIX-1980	53.63	3,597	20.1
J-DIX-1982	53.58	2,734	20.1
J-DIX-1984	53.36	1,502	20.0
J-DIX-1986	53.3	3,127	20.1
J-DIX-1988	53.66	4,361	20.2
J-DIX-1990	53.8	3,797	20.1
J-DIX-1992	55.15	3,741	20.1
J-DIX-1996	53.79	3,870	20.2
J-DIX-20	56.49	1,405	20.0
J-DIX-200	57.15	1,644	20.0
J-DIX-2002	53.53	3,308	20.1
J-DIX-2004	52.09	2,935	20.1
J-DIX-2008	52.48	2,733	20.1
J-DIX-2010	52.85	2,147	20.1
J-DIX-2012	53.65	3,077	20.1
J-DIX-2014	53.87	3,078	20.1
J-DIX-2016	54.19	2,876	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-2018	54.05	2,840	20.1
J-DIX-202	59.82	3,126	20.1
J-DIX-2020	54.21	2,781	20.1
J-DIX-2022	53.89	2,178	20.1
J-DIX-2024	55.11	2,141	20.1
J-DIX-2026	54.96	2,691	20.1
J-DIX-2028	54.75	2,776	20.1
J-DIX-2030	52.92	2,498	20.1
J-DIX-2032	52.43	1,986	20.0
J-DIX-2034	53.6	2,289	20.1
J-DIX-2036	53.88	4,642	20.2
J-DIX-2038	53.57	4,450	20.2
J-DIX-204	56.67	2,092	20.0
J-DIX-2040	55.6	4,630	20.2
J-DIX-2042	55.19	5,760	20.3
J-DIX-2044	54.08	4,161	20.2
J-DIX-2046	52.19	3,531	20.1
J-DIX-2048	52.01	3,479	20.1
J-DIX-2050	54.15	3,100	20.1
J-DIX-2052	54.06	3,266	20.1
J-DIX-2054	54.37	3,971	20.2
J-DIX-2056	53.29	2,441	20.1
J-DIX-2058	55.32	3,055	20.1
J-DIX-206	58.02	2,592	20.1
J-DIX-2060	55.46	3,700	20.1
J-DIX-2062	54.09	4,919	20.2
J-DIX-2064	52.71	4,363	20.2
J-DIX-2066	54.61	6,603	20.4
J-DIX-2068	54.48	5,701	20.3
J-DIX-2070	54.56	5,587	20.3
J-DIX-2074	53.66	4,595	20.2
J-DIX-2076	53.28	4,836	20.2
J-DIX-2078	53.1	4,664	20.2
J-DIX-208	59.19	1,806	20.0
J-DIX-2080	47.29	2,678	20.1
J-DIX-2082	47.05	2,221	20.1
J-DIX-2084	48.69	1,692	20.0
J-DIX-2086	52.63	1,412	20.0
J-DIX-2088	48.75	1,729	20.0
J-DIX-2090	51.49	5,780	20.3
J-DIX-2092	49.43	8,467	20.7
J-DIX-2096	55.49	3,144	20.1
J-DIX-2098	55.43	3,488	20.1
J-DIX-210	58.32	2,059	20.0
J-DIX-2100	55.87	2,020	20.0
J-DIX-2102	54.83	3,441	20.1
J-DIX-2104	54.97	3,156	20.1
J-DIX-2106	55.28	1,936	20.0
J-DIX-2108	54.99	1,100	20.0
J-DIX-2110	54.39	551	20.0

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-2112	54.35	570	20.0
J-DIX-2114	56.08	2,001	20.0
J-DIX-2116	56.03	2,025	20.0
J-DIX-2118	55	3,383	20.1
J-DIX-212	59.68	3,216	20.1
J-DIX-2120	54.86	3,610	20.1
J-DIX-2122	54.98	3,797	20.1
J-DIX-2124	55.03	3,770	20.1
J-DIX-2126	54.88	3,525	20.1
J-DIX-2128	55.03	3,443	20.1
J-DIX-2130	55.03	3,402	20.1
J-DIX-2132	54.84	3,488	20.1
J-DIX-2134	55.48	3,576	20.1
J-DIX-2136	54.92	3,517	20.1
J-DIX-2138	55.12	3,345	20.1
J-DIX-214	60.05	3,657	20.1
J-DIX-2146	54.66	4,902	20.2
J-DIX-2148	55.93	5,081	20.3
J-DIX-2150	56.45	3,917	20.2
J-DIX-2152	54.97	5,591	20.3
J-DIX-2154	55.24	3,642	20.1
J-DIX-2156	55.01	534	20.0
J-DIX-2158	54.12	2,456	20.1
J-DIX-216	61.91	3,847	20.2
J-DIX-2160	58.41	2,242	20.1
J-DIX-2162	59.99	4,668	20.2
J-DIX-2168	53.52	3,686	20.1
J-DIX-2170	56.63	1,543	20.0
J-DIX-2172	55.47	2,902	20.1
J-DIX-2174	53.46	3,708	20.1
J-DIX-2176	52.93	2,092	20.0
J-DIX-2178	55.16	1,975	20.0
J-DIX-218	58.66	2,532	20.1
J-DIX-2180	56.14	3,418	20.1
J-DIX-2182	56.14	3,418	20.1
J-DIX-2184	57.09	2,431	20.1
J-DIX-2186	59.57	515	20.0
J-DIX-2188	59.49	2,968	20.1
J-DIX-2190	54.76	5,602	20.3
J-DIX-2192	59.76	2,272	20.1
J-DIX-2194	54.61	6,439	20.4
J-DIX-2196	50.37	5,473	20.3
J-DIX-2198	55.07	3,708	20.1
J-DIX-22	57.21	697	20.0
J-DIX-220	58.47	2,440	20.1
J-DIX-2200	55.24	3,454	20.1
J-DIX-2202	54.87	3,679	20.1
J-DIX-2204	55.54	3,257	20.1
J-DIX-2206	54.64	162	20.0
J-DIX-2208	56.46	1,489	20.0

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-2210	57.09	2,153	20.1
J-DIX-2212	58.2	2,227	20.1
J-DIX-2214	58.21	2,244	20.1
J-DIX-2216	55.42	3,112	20.1
J-DIX-2218	56.72	2,740	20.1
J-DIX-222	60.6	2,650	20.1
J-DIX-2220	55.12	227	20.0
J-DIX-2222	55.92	3,074	20.1
J-DIX-2224	57.08	4,298	20.2
J-DIX-2226	57.06	4,822	20.2
J-DIX-2230	57.63	2,513	20.1
J-DIX-2232	58.05	2,860	20.1
J-DIX-2234	56.29	3,725	20.1
J-DIX-2236	54.29	2,072	20.0
J-DIX-2238	59.15	3,731	20.1
J-DIX-224	60.19	2,736	20.1
J-DIX-2240	56.65	2,225	20.1
J-DIX-2242	58.32	2,949	20.1
J-DIX-2244	58.46	4,115	20.2
J-DIX-2246	56.3	2,974	20.1
J-DIX-2248	57.96	2,975	20.1
J-DIX-2250	57.89	2,218	20.1
J-DIX-2252	56.31	3,004	20.1
J-DIX-2254	57.88	2,101	20.0
J-DIX-2256	57.79	2,470	20.1
J-DIX-2258	58.08	2,549	20.1
J-DIX-226	58.71	2,496	20.1
J-DIX-2260	59.18	2,703	20.1
J-DIX-2262	56.77	3,659	20.1
J-DIX-2264	59.55	3,930	20.2
J-DIX-2266	55.27	3,381	20.1
J-DIX-2268	58.04	3,064	20.1
J-DIX-2270	57.35	2,918	20.1
J-DIX-2272	61.34	5,384	20.3
J-DIX-2274	59.07	3,879	20.2
J-DIX-2276	60.57	2,533	20.1
J-DIX-2278	54.72	2,914	20.1
J-DIX-2280	55.13	3,230	20.1
J-DIX-2282	53.84	4,489	20.2
J-DIX-2284	55.57	3,771	20.1
J-DIX-2286	56.48	3,431	20.1
J-DIX-2288	57.57	3,534	20.1
J-DIX-2290	55.47	3,597	20.1
J-DIX-2292	53.96	2,366	20.1
J-DIX-2294	55.6	3,338	20.1
J-DIX-2296	54.75	183	20.0
J-DIX-2298	54.9	162	20.0
J-DIX-230	53.71	2,147	20.1
J-DIX-2300	55.15	207	20.0
J-DIX-2302	54.95	386	20.0

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-2304	55.63	3,307	20.1
J-DIX-2306	54.29	4,165	20.2
J-DIX-2308	55.6	3,785	20.1
J-DIX-2310	54.97	3,530	20.1
J-DIX-2312	53.42	3,447	20.1
J-DIX-2314	54.6	4,044	20.2
J-DIX-2316	54.59	2,314	20.1
J-DIX-2318	54.24	161	20.0
J-DIX-232	54.98	1,345	20.0
J-DIX-2320	55.41	2,614	20.1
J-DIX-2322	53.4	2,011	20.0
J-DIX-2324	54.98	3,426	20.1
J-DIX-2326	55.14	3,899	20.2
J-DIX-2328	56.07	4,033	20.2
J-DIX-2330	55.12	3,286	20.1
J-DIX-2332	55.06	2,775	20.1
J-DIX-2334	52.81	2,517	20.1
J-DIX-2336	53.43	2,154	20.1
J-DIX-2338	54.51	2,331	20.1
J-DIX-234	53.24	1,838	20.0
J-DIX-2340	55.23	2,202	20.1
J-DIX-2342	54.16	1,345	20.0
J-DIX-2344	54.69	1,249	20.0
J-DIX-2346	54.47	2,482	20.1
J-DIX-2348	53.56	3,301	20.1
J-DIX-2350	53.75	3,424	20.1
J-DIX-2352	52.68	2,588	20.1
J-DIX-2354	53.88	928	20.0
J-DIX-2356	54.52	913	20.0
J-DIX-2358	53.48	4,136	20.2
J-DIX-236	54.91	1,443	20.0
J-DIX-2360	53.53	3,026	20.1
J-DIX-2362	53.3	518	20.0
J-DIX-2364	54.06	1,397	20.0
J-DIX-2366	53.92	3,698	20.1
J-DIX-2368	53.97	4,384	20.2
J-DIX-2370	52.04	315	20.0
J-DIX-2372	53.03	414	20.0
J-DIX-2374	55.36	3,615	20.1
J-DIX-2376	55.35	3,827	20.2
J-DIX-2378	54.46	6,114	20.4
J-DIX-238	55.41	2,670	20.1
J-DIX-2380	54.49	6,143	20.4
J-DIX-2382	54.64	5,963	20.4
J-DIX-2384	55.41	5,664	20.3
J-DIX-2386	55.25	7,265	20.5
J-DIX-2388	56.09	4,324	20.2
J-DIX-2390	55.69	4,327	20.2
J-DIX-2392	55.93	4,140	20.2
J-DIX-2394	55.81	4,303	20.2

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-2396	55.69	4,193	20.2
J-DIX-2398	59.14	1,130	20.0
J-DIX-24	56.35	977	20.0
J-DIX-240	54.53	2,674	20.1
J-DIX-2400	58.65	1,444	20.0
J-DIX-2402	58.71	1,355	20.0
J-DIX-2404	58.19	328	20.0
J-DIX-2406	56.69	6,943	20.5
J-DIX-2408	59.18	3,815	20.2
J-DIX-2410	56.77	2,446	20.1
J-DIX-2412	57.55	1,397	20.0
J-DIX-2414	56.55	1,097	20.0
J-DIX-2416	56.92	998	20.0
J-DIX-2418	57.98	959	20.0
J-DIX-242	54.63	2,799	20.1
J-DIX-2420	58.31	2,584	20.1
J-DIX-2422	57.93	3,876	20.2
J-DIX-2424	57.99	5,634	20.3
J-DIX-2426	59.42	3,742	20.1
J-DIX-2428	58.99	3,807	20.1
J-DIX-2430	58.11	2,394	20.1
J-DIX-2432	58.64	2,533	20.1
J-DIX-2434	54.59	6,200	20.4
J-DIX-2436	59.15	2,714	20.1
J-DIX-2438	53.3	3,607	20.1
J-DIX-244	55.81	2,190	20.1
J-DIX-2440	53.83	4,015	20.2
J-DIX-2444	54.43	2,434	20.1
J-DIX-2446	53.31	2,369	20.1
J-DIX-2448	53.85	2,306	20.1
J-DIX-2450	53.09	4,282	20.2
J-DIX-2452	53.86	4,078	20.2
J-DIX-2454	53.84	2,466	20.1
J-DIX-2456	54.65	3,858	20.2
J-DIX-2458	47.69	1,937	20.0
J-DIX-246	53.93	2,086	20.0
J-DIX-2460	48.33	1,824	20.0
J-DIX-2462	48.5	1,685	20.0
J-DIX-2464	48.75	1,697	20.0
J-DIX-2466	50.34	1,380	20.0
J-DIX-2468	55.47	1,417	20.0
J-DIX-2470	55.46	1,461	20.0
J-DIX-2472	55.03	3,366	20.1
J-DIX-2474	55.02	3,213	20.1
J-DIX-2476	55.11	2,195	20.1
J-DIX-2478	54.31	3,089	20.1
J-DIX-248	54.51	2,314	20.1
J-DIX-2494	47.77	3,758	20.1
J-DIX-250	54.26	3,121	20.1
J-DIX-2508	54.09	1,956	20.0

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-2510	55.17	153	20.0
J-DIX-2512	55.84	135	20.0
J-DIX-2514	57.14	132	20.0
J-DIX-2516	57.64	819	20.0
J-DIX-2518	60.2	811	20.0
J-DIX-252	54.05	3,482	20.1
J-DIX-2520	56.39	1,606	20.0
J-DIX-2522	56.65	2,396	20.1
J-DIX-2524	57.5	5,060	20.3
J-DIX-2526	57.09	2,761	20.1
J-DIX-2528	56.76	2,193	20.1
J-DIX-2530	58.07	2,182	20.1
J-DIX-2532	56.29	2,000	20.0
J-DIX-2534	58.26	1,697	20.0
J-DIX-2536	55.01	1,925	20.0
J-DIX-2538	55.7	2,135	20.1
J-DIX-254	54.83	3,657	20.1
J-DIX-2540	55.63	2,125	20.0
J-DIX-2542	55.21	1,004	20.0
J-DIX-2544	57.23	770	20.0
J-DIX-2546	59.31	2,579	20.1
J-DIX-2548	60.2	147	20.0
J-DIX-2550	60.49	3,198	20.1
J-DIX-2552	60.95	8,208	20.7
J-DIX-2554	54.98	1,523	20.0
J-DIX-2556	58.58	1,587	20.0
J-DIX-2558	57.84	903	20.0
J-DIX-256	56.65	1,494	20.0
J-DIX-2560	53.24	1,716	20.0
J-DIX-2562	55.41	1,787	20.0
J-DIX-2564	56.42	1,877	20.0
J-DIX-2566	53.69	615	20.0
J-DIX-2568	52.8	622	20.0
J-DIX-2570	54.74	118	20.0
J-DIX-2572	54.7	118	20.0
J-DIX-2574	56.13	1,405	20.0
J-DIX-2576	53.6	755	20.0
J-DIX-2578	54.86	779	20.0
J-DIX-258	54.39	2,345	20.1
J-DIX-2580	54.24	108	20.0
J-DIX-2584	53.68	372	20.0
J-DIX-2586	55.46	3,385	20.1
J-DIX-2588	56.19	270	20.0
J-DIX-2590	56.6	248	20.0
J-DIX-2592	59.09	148	20.0
J-DIX-2594	60.59	1,803	20.0
J-DIX-2596	59.93	3,149	20.1
J-DIX-2598	56.23	760	20.0
J-DIX-26	57.09	1,370	20.0
J-DIX-260	55.71	3,026	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-2600	58.96	2,676	20.1
J-DIX-2602	58.09	2,056	20.0
J-DIX-2604	53.28	1,356	20.0
J-DIX-2606	53.49	3,740	20.1
J-DIX-2608	52.08	2,195	20.1
J-DIX-2610	53	1,911	20.0
J-DIX-2612	52.16	1,781	20.0
J-DIX-2614	54.23	2,127	20.1
J-DIX-2616	53.98	1,791	20.0
J-DIX-2618	55.57	1,808	20.0
J-DIX-262	53.97	2,212	20.1
J-DIX-2620	55.38	2,265	20.1
J-DIX-2622	52.38	1,801	20.0
J-DIX-2624	54.83	507	20.0
J-DIX-2626	52.93	4,388	20.2
J-DIX-2628	54.15	521	20.0
J-DIX-2630	53.07	1,339	20.0
J-DIX-2632	52.81	1,007	20.0
J-DIX-2634	54.18	1,162	20.0
J-DIX-2636	53.74	4,417	20.2
J-DIX-2638	50.91	146	20.0
J-DIX-264	56.01	2,651	20.1
J-DIX-2640	47.34	77	20.0
J-DIX-2642	56.31	3,674	20.1
J-DIX-2644	56.96	3,513	20.1
J-DIX-2646	60.52	889	20.0
J-DIX-2648	56.35	3,667	20.1
J-DIX-2650	55.91	3,535	20.1
J-DIX-2652	58.04	3,912	20.2
J-DIX-2654	58.76	3,957	20.2
J-DIX-2656	58.75	3,830	20.2
J-DIX-2658	57.62	3,047	20.1
J-DIX-266	54.89	3,160	20.1
J-DIX-2660	54.85	3,622	20.1
J-DIX-2662	55.38	3,769	20.1
J-DIX-2664	57.41	2,390	20.1
J-DIX-2666	57.47	2,389	20.1
J-DIX-2668	57.16	2,390	20.1
J-DIX-2670	58.08	2,770	20.1
J-DIX-2672	57.88	2,726	20.1
J-DIX-2674	58.04	3,826	20.2
J-DIX-2676	55.83	3,429	20.1
J-DIX-2678	56.75	3,712	20.1
J-DIX-268	54.16	3,877	20.2
J-DIX-2680	54.98	3,536	20.1
J-DIX-2682	55.46	3,340	20.1
J-DIX-2684	55.42	720	20.0
J-DIX-2686	55.41	6,764	20.5
J-DIX-2688	55.44	6,764	20.5
J-DIX-2690	55.55	453	20.0

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-2692	54.67	3,706	20.1
J-DIX-2694	55.23	1,918	20.0
J-DIX-2696	55.23	1,628	20.0
J-DIX-2698	56.72	2,287	20.1
J-DIX-270	54.1	3,341	20.1
J-DIX-2700	55.67	2,889	20.1
J-DIX-2702	55.67	2,882	20.1
J-DIX-2704	56.61	1,206	20.0
J-DIX-2706	55.78	1,918	20.0
J-DIX-2708	56.97	1,880	20.0
J-DIX-2710	57.28	2,571	20.1
J-DIX-2712	57.11	2,431	20.1
J-DIX-2714	57.15	2,375	20.1
J-DIX-2716	59.55	2,492	20.1
J-DIX-2718	56.52	2,194	20.1
J-DIX-272	54.44	2,115	20.0
J-DIX-2720	56.52	2,181	20.1
J-DIX-2722	58.32	2,165	20.1
J-DIX-2724	58.31	2,157	20.1
J-DIX-2726	58.05	2,189	20.1
J-DIX-2728	55.43	6,776	20.5
J-DIX-2730	56.43	2,398	20.1
J-DIX-2732	57.33	2,393	20.1
J-DIX-2734	57.65	2,847	20.1
J-DIX-2736	55.4	5,707	20.3
J-DIX-2738	54.22	3,721	20.1
J-DIX-274	54.05	2,670	20.1
J-DIX-2740	56.55	2,531	20.1
J-DIX-2742	58.67	2,700	20.1
J-DIX-2744	54.56	2,731	20.1
J-DIX-2746	54.88	3,776	20.1
J-DIX-2748	57.19	2,578	20.1
J-DIX-2750	61.36	3,845	20.2
J-DIX-2752	56.01	6,028	20.4
J-DIX-2754	57.3	5,389	20.3
J-DIX-2756	55.77	6,349	20.4
J-DIX-2758	56.03	4,968	20.3
J-DIX-276	54.22	2,523	20.1
J-DIX-2760	56.17	4,609	20.2
J-DIX-2762	56.45	4,043	20.2
J-DIX-2764	56.2	3,654	20.1
J-DIX-2766	56.71	4,385	20.2
J-DIX-2768	54.97	6,492	20.4
J-DIX-2770	54.97	5,871	20.3
J-DIX-2772	55.07	4,160	20.2
J-DIX-2774	54.69	4,966	20.3
J-DIX-2776	54.98	6,520	20.4
J-DIX-2778	54.98	4,660	20.2
J-DIX-278	55.42	2,411	20.1
J-DIX-2780	54.95	4,328	20.2

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-2782	55.4	5,755	20.3
J-DIX-2784	55.72	4,419	20.2
J-DIX-2786	55.6	4,375	20.2
J-DIX-2788	55.79	3,654	20.1
J-DIX-2790	55.04	4,674	20.2
J-DIX-2792	55.42	2,919	20.1
J-DIX-2794	56.62	6,880	20.5
J-DIX-2796	55.59	408	20.0
J-DIX-2798	55.24	5,762	20.3
J-DIX-28	54.93	1,874	20.0
J-DIX-280	53.66	2,528	20.1
J-DIX-2800	55.28	3,424	20.1
J-DIX-2802	55.12	3,411	20.1
J-DIX-2804	55.14	3,330	20.1
J-DIX-2806	54.88	3,516	20.1
J-DIX-2808	54.99	3,633	20.1
J-DIX-2810	55.05	3,638	20.1
J-DIX-2812	56.05	708	20.0
J-DIX-2814	54.33	1,957	20.0
J-DIX-2816	56.07	7,014	20.5
J-DIX-2818	56.07	5,966	20.4
J-DIX-282	55.41	2,014	20.0
J-DIX-2820	55.29	1,596	20.0
J-DIX-2822	55.08	1,624	20.0
J-DIX-2824	55.12	252	20.0
J-DIX-2826	55.66	658	20.0
J-DIX-2828	56.26	1,642	20.0
J-DIX-2830	55.84	3,079	20.1
J-DIX-2832	54.35	2,754	20.1
J-DIX-2834	54.35	1,977	20.0
J-DIX-2836	55.78	2,459	20.1
J-DIX-2838	55.86	2,897	20.1
J-DIX-284	53.94	1,883	20.0
J-DIX-2840	54.99	2,761	20.1
J-DIX-2842	54.99	2,774	20.1
J-DIX-2844	56.72	2,357	20.1
J-DIX-2846	56.72	2,473	20.1
J-DIX-2848	56.47	1,562	20.0
J-DIX-2850	55.23	347	20.0
J-DIX-2852	56.18	1,743	20.0
J-DIX-2854	55.86	2,938	20.1
J-DIX-2856	55.69	2,821	20.1
J-DIX-2858	55.48	2,627	20.1
J-DIX-286	55.79	2,117	20.0
J-DIX-2860	56.36	2,418	20.1
J-DIX-2862	57.45	1,393	20.0
J-DIX-2864	57.16	3,014	20.1
J-DIX-2866	57.81	1,701	20.0
J-DIX-2868	57.8	1,663	20.0
J-DIX-2870	57.25	2,627	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-2872	58.31	2,587	20.1
J-DIX-2874	58.33	2,573	20.1
J-DIX-2876	57.1	2,153	20.1
J-DIX-2878	57.04	342	20.0
J-DIX-288	54.57	2,534	20.1
J-DIX-2880	57.48	1,568	20.0
J-DIX-2882	57.35	3,015	20.1
J-DIX-2884	57.18	2,632	20.1
J-DIX-2886	57.33	2,863	20.1
J-DIX-2888	57.8	3,120	20.1
J-DIX-2890	58.16	2,514	20.1
J-DIX-2892	59.04	2,343	20.1
J-DIX-2894	56.52	2,129	20.1
J-DIX-2896	56.52	2,212	20.1
J-DIX-2898	57.45	1,978	20.0
J-DIX-290	54.8	2,876	20.1
J-DIX-2900	58.02	1,713	20.0
J-DIX-2902	58.93	2,102	20.0
J-DIX-2904	58.18	2,156	20.1
J-DIX-2906	58.05	2,183	20.1
J-DIX-2908	57.27	2,171	20.1
J-DIX-2910	57.2	2,454	20.1
J-DIX-2912	56.5	2,377	20.1
J-DIX-2914	57.62	2,113	20.0
J-DIX-2916	56.68	2,957	20.1
J-DIX-2918	56.79	3,293	20.1
J-DIX-292	55.56	3,018	20.1
J-DIX-2920	56.78	3,244	20.1
J-DIX-2922	56.61	2,433	20.1
J-DIX-2924	56.52	3,335	20.1
J-DIX-2926	55.41	2,531	20.1
J-DIX-2928	57.16	3,250	20.1
J-DIX-2930	56.05	2,633	20.1
J-DIX-2932	57.56	2,085	20.0
J-DIX-2934	57.47	2,024	20.0
J-DIX-2936	57.85	1,943	20.0
J-DIX-2938	57.81	1,967	20.0
J-DIX-294	56.16	2,785	20.1
J-DIX-2940	57.24	1,686	20.0
J-DIX-2942	56.97	3,084	20.1
J-DIX-2944	56.43	4,224	20.2
J-DIX-2946	56.39	4,299	20.2
J-DIX-2948	56.36	4,294	20.2
J-DIX-2950	56.23	3,975	20.2
J-DIX-2952	57.68	4,640	20.2
J-DIX-2954	57.91	4,268	20.2
J-DIX-2956	56.98	5,184	20.3
J-DIX-2958	56.98	5,157	20.3
J-DIX-296	55.72	2,653	20.1
J-DIX-2960	57.28	5,173	20.3

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-2962	57.37	5,517	20.3
J-DIX-2964	57.5	5,555	20.3
J-DIX-2966	57.44	5,432	20.3
J-DIX-2968	57.43	5,411	20.3
J-DIX-2970	56.67	4,748	20.2
J-DIX-2972	56.98	4,973	20.3
J-DIX-2974	57.26	4,532	20.2
J-DIX-2976	57.23	4,446	20.2
J-DIX-2978	57.32	4,410	20.2
J-DIX-298	54.4	2,687	20.1
J-DIX-2980	57.56	3,846	20.2
J-DIX-2982	57.01	2,777	20.1
J-DIX-2986	56.61	5,234	20.3
J-DIX-2990	56.05	5,928	20.4
J-DIX-2996	57.39	3,872	20.2
J-DIX-2998	56.73	3,628	20.1
J-DIX-30	56.12	3,897	20.2
J-DIX-300	55.49	1,887	20.0
J-DIX-3000	57.54	3,667	20.1
J-DIX-3002	57.43	4,009	20.2
J-DIX-3004	56.91	3,559	20.1
J-DIX-3006	57	3,991	20.2
J-DIX-3010	57.66	2,440	20.1
J-DIX-3012	56.66	1,509	20.0
J-DIX-3014	58.21	2,168	20.1
J-DIX-3016	58.11	1,674	20.0
J-DIX-3018	56.94	2,100	20.0
J-DIX-302	56.1	2,476	20.1
J-DIX-3020	58.07	2,653	20.1
J-DIX-3022	57.92	2,705	20.1
J-DIX-3024	56.67	2,339	20.1
J-DIX-3028	54.57	2,496	20.1
J-DIX-3030	54.66	2,333	20.1
J-DIX-3032	54.8	2,510	20.1
J-DIX-3034	53.8	2,283	20.1
J-DIX-3036	54.69	1,578	20.0
J-DIX-3038	55.13	2,495	20.1
J-DIX-304	55	2,060	20.0
J-DIX-3040	55.93	3,157	20.1
J-DIX-3042	56.11	3,184	20.1
J-DIX-3044	55.88	2,896	20.1
J-DIX-3046	55.58	2,789	20.1
J-DIX-3048	54.93	3,131	20.1
J-DIX-3050	56.82	3,650	20.1
J-DIX-3052	59.02	3,933	20.2
J-DIX-3054	57.39	3,823	20.2
J-DIX-3056	53.29	3,166	20.1
J-DIX-3058	54.03	2,557	20.1
J-DIX-306	53.91	2,902	20.1
J-DIX-3060	55.08	2,099	20.0

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-3062	55.97	2,016	20.0
J-DIX-3064	57.71	3,095	20.1
J-DIX-3066	58.54	3,162	20.1
J-DIX-3068	58.05	4,432	20.2
J-DIX-3070	56.41	4,066	20.2
J-DIX-3072	56.88	4,363	20.2
J-DIX-3074	56.11	4,258	20.2
J-DIX-3076	55.09	3,124	20.1
J-DIX-3078	58.05	1,825	20.0
J-DIX-308	53.44	1,938	20.0
J-DIX-3080	56.73	3,158	20.1
J-DIX-3082	57.2	2,179	20.1
J-DIX-3084	54.54	2,092	20.0
J-DIX-3086	58.44	3,197	20.1
J-DIX-3088	54.13	4,982	20.3
J-DIX-3090	53.34	4,926	20.2
J-DIX-3092	55.28	3,705	20.1
J-DIX-3094	55.16	3,501	20.1
J-DIX-3096	54.32	6,096	20.4
J-DIX-3098	56.15	5,600	20.3
J-DIX-310	52.86	2,537	20.1
J-DIX-3100	54.28	6,170	20.4
J-DIX-3102	54.43	5,307	20.3
J-DIX-3104	54.44	3,838	20.2
J-DIX-3106	54.66	6,164	20.4
J-DIX-3108	54.76	5,953	20.4
J-DIX-3110	55.28	3,846	20.2
J-DIX-3112	54.28	6,297	20.4
J-DIX-3114	54.25	5,417	20.3
J-DIX-3116	54.97	3,004	20.1
J-DIX-3118	55.35	1,667	20.0
J-DIX-312	55.78	2,767	20.1
J-DIX-3120	54.92	1,003	20.0
J-DIX-3122	54.31	538	20.0
J-DIX-3124	54.27	557	20.0
J-DIX-3126	56.11	1,819	20.0
J-DIX-3128	56.07	1,985	20.0
J-DIX-3130	55.06	3,107	20.1
J-DIX-3132	54.94	3,445	20.1
J-DIX-3134	54.98	3,547	20.1
J-DIX-3136	54.95	3,450	20.1
J-DIX-3138	54.84	3,308	20.1
J-DIX-314	53.06	2,520	20.1
J-DIX-3140	55.03	3,660	20.1
J-DIX-3142	54.98	2,323	20.1
J-DIX-3144	54.98	2,393	20.1
J-DIX-3146	54.21	3,246	20.1
J-DIX-3148	55.2	3,179	20.1
J-DIX-3150	55.01	3,451	20.1
J-DIX-316	53.09	4,077	20.2

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-3160	55.16	3,316	20.1
J-DIX-3162	60.13	3,018	20.1
J-DIX-3164	57.99	2,783	20.1
J-DIX-3166	61.71	2,507	20.1
J-DIX-3168	55.21	5,216	20.3
J-DIX-3170	57.14	1,955	20.0
J-DIX-3172	59.73	4,077	20.2
J-DIX-3174	59.03	4,378	20.2
J-DIX-3176	59.73	4,465	20.2
J-DIX-3178	59.38	3,836	20.2
J-DIX-318	55.16	1,871	20.0
J-DIX-3180	59.57	3,996	20.2
J-DIX-3182	59.56	4,008	20.2
J-DIX-3184	59.31	3,008	20.1
J-DIX-3186	58.66	3,523	20.1
J-DIX-3188	56.52	2,226	20.1
J-DIX-3190	58.51	3,765	20.1
J-DIX-3192	58.72	3,952	20.2
J-DIX-3194	58.73	3,659	20.1
J-DIX-3196	58.13	2,985	20.1
J-DIX-3198	58.8	433	20.0
J-DIX-32	56.28	3,023	20.1
J-DIX-320	53.44	545	20.0
J-DIX-3200	61.92	6,699	20.5
J-DIX-3202	62.43	6,922	20.5
J-DIX-3204	56.06	2,908	20.1
J-DIX-3206	58.57	3,356	20.1
J-DIX-3208	58.52	3,863	20.2
J-DIX-3210	57.36	3,625	20.1
J-DIX-3212	57.31	3,773	20.1
J-DIX-3214	58.61	4,149	20.2
J-DIX-3216	56.62	2,939	20.1
J-DIX-3218	56.91	3,416	20.1
J-DIX-322	54.53	1,678	20.0
J-DIX-3220	57.22	3,079	20.1
J-DIX-3222	57.21	3,503	20.1
J-DIX-3224	55.4	1,837	20.0
J-DIX-3226	55.88	3,095	20.1
J-DIX-3228	56.51	3,081	20.1
J-DIX-3230	56.34	3,658	20.1
J-DIX-3232	58.04	3,596	20.1
J-DIX-3234	58.04	3,687	20.1
J-DIX-3236	56.31	3,496	20.1
J-DIX-3238	56.9	2,459	20.1
J-DIX-324	52.92	2,147	20.1
J-DIX-3240	56.48	2,896	20.1
J-DIX-3242	56.24	2,839	20.1
J-DIX-3244	56.62	2,435	20.1
J-DIX-3246	56.28	2,838	20.1
J-DIX-3248	56.22	2,878	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-3250	56.53	2,805	20.1
J-DIX-3252	56.66	2,761	20.1
J-DIX-3254	58.05	2,938	20.1
J-DIX-3256	59.17	2,178	20.1
J-DIX-3258	56.54	2,794	20.1
J-DIX-326	54.7	2,938	20.1
J-DIX-3260	56.21	2,642	20.1
J-DIX-3262	56.31	3,348	20.1
J-DIX-3264	57.46	2,842	20.1
J-DIX-3266	57.85	2,029	20.0
J-DIX-3268	58.04	3,439	20.1
J-DIX-3270	57.21	3,316	20.1
J-DIX-3272	56.58	3,257	20.1
J-DIX-3274	56.43	3,383	20.1
J-DIX-3276	56.31	3,260	20.1
J-DIX-3278	58.04	3,490	20.1
J-DIX-328	55.24	3,199	20.1
J-DIX-3280	58.04	3,698	20.1
J-DIX-3282	57.22	3,069	20.1
J-DIX-3284	56.75	2,786	20.1
J-DIX-3286	56.93	3,004	20.1
J-DIX-3288	57.28	2,620	20.1
J-DIX-3290	57.87	2,975	20.1
J-DIX-3292	57.91	2,850	20.1
J-DIX-3294	57.38	2,352	20.1
J-DIX-3296	56.83	3,075	20.1
J-DIX-3298	56.86	2,907	20.1
J-DIX-330	53.97	4,060	20.2
J-DIX-3300	58.41	2,792	20.1
J-DIX-3302	59.67	2,971	20.1
J-DIX-3304	57.93	2,676	20.1
J-DIX-3306	57.53	2,840	20.1
J-DIX-3308	57.03	2,054	20.0
J-DIX-3310	56.06	2,885	20.1
J-DIX-3312	57.09	2,160	20.1
J-DIX-3314	59.55	3,699	20.1
J-DIX-3316	56.32	2,073	20.0
J-DIX-3318	55.09	2,788	20.1
J-DIX-332	53.87	4,494	20.2
J-DIX-3320	58.53	2,802	20.1
J-DIX-3322	56.6	2,757	20.1
J-DIX-3324	54.41	2,012	20.0
J-DIX-3326	54.75	2,757	20.1
J-DIX-3328	55.3	3,691	20.1
J-DIX-3330	62.6	3,791	20.1
J-DIX-3332	56.51	2,877	20.1
J-DIX-3334	56.69	2,904	20.1
J-DIX-3336	56.91	3,304	20.1
J-DIX-3338	53.49	3,199	20.1
J-DIX-334	55.47	4,299	20.2

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-3340	54.46	2,002	20.0
J-DIX-3342	58.71	3,062	20.1
J-DIX-3344	55.42	1,496	20.0
J-DIX-3346	57.55	3,635	20.1
J-DIX-3348	56.24	1,655	20.0
J-DIX-3350	55.95	3,251	20.1
J-DIX-3352	59.53	3,353	20.1
J-DIX-3354	58.54	2,691	20.1
J-DIX-3356	58.81	2,638	20.1
J-DIX-3358	57.28	2,314	20.1
J-DIX-336	55.47	3,993	20.2
J-DIX-3360	57.17	2,003	20.0
J-DIX-3362	56.93	2,177	20.1
J-DIX-3364	58.14	2,736	20.1
J-DIX-3366	58.46	2,934	20.1
J-DIX-3368	58.76	3,052	20.1
J-DIX-3370	59.22	2,949	20.1
J-DIX-3372	59.05	2,211	20.1
J-DIX-3374	59.3	1,992	20.0
J-DIX-3376	59.2	1,850	20.0
J-DIX-3378	58.41	2,227	20.1
J-DIX-338	55.13	2,797	20.1
J-DIX-3380	58.35	2,129	20.1
J-DIX-3382	58.41	2,263	20.1
J-DIX-3384	59.91	7,793	20.6
J-DIX-3386	59.61	5,238	20.3
J-DIX-3388	60.47	6,485	20.4
J-DIX-3390	59.54	4,742	20.2
J-DIX-3392	59.63	3,490	20.1
J-DIX-3394	59.87	4,792	20.2
J-DIX-3396	60.05	4,104	20.2
J-DIX-3398	62.8	4,884	20.2
J-DIX-34	56.71	4,168	20.2
J-DIX-340	55.77	2,973	20.1
J-DIX-3400	62.04	4,485	20.2
J-DIX-3402	60.55	3,017	20.1
J-DIX-3404	60.6	3,016	20.1
J-DIX-3406	58.48	3,178	20.1
J-DIX-3408	58.55	3,141	20.1
J-DIX-3410	58.5	2,933	20.1
J-DIX-3412	58.48	3,053	20.1
J-DIX-3414	59.85	2,341	20.1
J-DIX-3416	59.9	2,426	20.1
J-DIX-3418	58.59	2,658	20.1
J-DIX-342	56.27	3,281	20.1
J-DIX-3420	58.66	2,563	20.1
J-DIX-3422	57.9	2,638	20.1
J-DIX-3424	60.1	2,616	20.1
J-DIX-3426	59.07	2,287	20.1
J-DIX-3428	60.6	2,791	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-3430	61.36	2,952	20.1
J-DIX-3432	60.76	2,942	20.1
J-DIX-3434	60.16	3,071	20.1
J-DIX-3436	60.26	2,893	20.1
J-DIX-3438	60.41	3,120	20.1
J-DIX-344	55.38	4,548	20.2
J-DIX-3440	58.75	2,619	20.1
J-DIX-3444	54.22	2,571	20.1
J-DIX-3446	55.41	3,125	20.1
J-DIX-3448	55.41	3,035	20.1
J-DIX-3450	53.41	2,151	20.1
J-DIX-3452	53.38	2,342	20.1
J-DIX-3454	53.65	2,236	20.1
J-DIX-3456	53.89	2,413	20.1
J-DIX-3458	54.05	2,642	20.1
J-DIX-346	56.28	3,188	20.1
J-DIX-3460	54.39	2,315	20.1
J-DIX-3462	53.24	1,786	20.0
J-DIX-3464	53.24	1,719	20.0
J-DIX-3466	54.98	1,372	20.0
J-DIX-3468	53.24	1,894	20.0
J-DIX-3470	54.98	2,036	20.0
J-DIX-3472	55.03	1,480	20.0
J-DIX-3474	53.24	2,496	20.1
J-DIX-3476	53.24	2,574	20.1
J-DIX-3478	55.41	2,841	20.1
J-DIX-348	56.23	3,038	20.1
J-DIX-3480	55.41	3,264	20.1
J-DIX-3482	53.95	3,029	20.1
J-DIX-3484	54.01	3,109	20.1
J-DIX-3486	54.4	2,843	20.1
J-DIX-3488	54.69	3,269	20.1
J-DIX-3490	54.69	3,007	20.1
J-DIX-3492	55.4	2,360	20.1
J-DIX-3494	55.81	2,279	20.1
J-DIX-3496	55.36	2,227	20.1
J-DIX-3498	55.17	2,310	20.1
J-DIX-350	57.58	2,795	20.1
J-DIX-3500	55.22	2,219	20.1
J-DIX-3502	56.37	2,240	20.1
J-DIX-3504	54.31	2,418	20.1
J-DIX-3506	53.83	3,860	20.2
J-DIX-3508	54.12	3,391	20.1
J-DIX-3510	53.74	5,042	20.3
J-DIX-3512	53.37	5,047	20.3
J-DIX-3514	54.06	5,274	20.3
J-DIX-3516	55.11	5,406	20.3
J-DIX-3518	54.11	4,444	20.2
J-DIX-352	56.75	2,662	20.1
J-DIX-3520	54.52	5,049	20.3

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-3522	55.19	5,236	20.3
J-DIX-3524	54.89	4,333	20.2
J-DIX-3526	55.16	4,311	20.2
J-DIX-3528	57.64	3,587	20.1
J-DIX-3530	56.69	1,522	20.0
J-DIX-3532	55.92	1,378	20.0
J-DIX-3534	54.44	1,340	20.0
J-DIX-3536	53.93	2,885	20.1
J-DIX-3538	55.42	2,476	20.1
J-DIX-354	56.4	2,704	20.1
J-DIX-3540	56.58	3,667	20.1
J-DIX-3542	55.42	3,749	20.1
J-DIX-3544	55.71	3,280	20.1
J-DIX-3546	55.56	3,697	20.1
J-DIX-3548	55.49	3,374	20.1
J-DIX-3550	53.97	2,310	20.1
J-DIX-3552	55.75	946	20.0
J-DIX-3554	54.97	160	20.0
J-DIX-3556	55.17	793	20.0
J-DIX-3558	56.01	2,815	20.1
J-DIX-356	56.49	2,268	20.1
J-DIX-3560	55.94	3,136	20.1
J-DIX-3562	55.82	3,093	20.1
J-DIX-3564	55.14	4,468	20.2
J-DIX-3566	54.95	3,828	20.2
J-DIX-3568	56.08	2,573	20.1
J-DIX-3570	55.18	3,638	20.1
J-DIX-3572	53.76	4,597	20.2
J-DIX-3574	53.25	4,374	20.2
J-DIX-3576	53.42	5,433	20.3
J-DIX-3578	54.07	4,306	20.2
J-DIX-358	56.85	2,188	20.1
J-DIX-3580	54.08	4,695	20.2
J-DIX-3582	55.02	3,286	20.1
J-DIX-3584	56.32	3,639	20.1
J-DIX-3586	54.27	3,702	20.1
J-DIX-3588	55.12	324	20.0
J-DIX-3590	53.82	3,738	20.1
J-DIX-3592	54.39	3,723	20.1
J-DIX-3594	54.99	4,569	20.2
J-DIX-3596	55.28	3,566	20.1
J-DIX-3598	53.67	2,674	20.1
J-DIX-36	55.79	3,315	20.1
J-DIX-360	57.6	2,535	20.1
J-DIX-3600	54.5	2,202	20.1
J-DIX-3602	54.8	2,139	20.1
J-DIX-3604	54.61	2,225	20.1
J-DIX-3606	53.79	1,680	20.0
J-DIX-3608	54.87	1,808	20.0
J-DIX-3610	54.05	2,849	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-3612	54.81	527	20.0
J-DIX-3614	54.34	2,857	20.1
J-DIX-3616	54.18	2,669	20.1
J-DIX-3618	54.16	2,799	20.1
J-DIX-362	56.34	2,382	20.1
J-DIX-3620	55.41	2,946	20.1
J-DIX-3622	55.42	2,779	20.1
J-DIX-3624	55.42	2,531	20.1
J-DIX-3626	55.41	2,973	20.1
J-DIX-3628	55.41	2,642	20.1
J-DIX-3630	52.81	2,815	20.1
J-DIX-3632	54.03	3,344	20.1
J-DIX-3634	53.93	2,872	20.1
J-DIX-3636	55.41	2,267	20.1
J-DIX-3638	55.41	2,177	20.1
J-DIX-364	59.01	1,096	20.0
J-DIX-3640	53.78	2,005	20.0
J-DIX-3642	53.39	2,011	20.0
J-DIX-3644	55.81	2,196	20.1
J-DIX-3646	54.67	2,688	20.1
J-DIX-3648	54.82	3,085	20.1
J-DIX-3650	55.45	3,298	20.1
J-DIX-3652	54.84	3,102	20.1
J-DIX-3654	55.01	3,434	20.1
J-DIX-3656	55.51	3,268	20.1
J-DIX-3658	55.33	3,602	20.1
J-DIX-366	57.76	2,265	20.1
J-DIX-3660	55.11	4,025	20.2
J-DIX-3662	55.12	4,196	20.2
J-DIX-3664	55.44	4,223	20.2
J-DIX-3666	54.18	4,003	20.2
J-DIX-3668	56.16	2,976	20.1
J-DIX-3670	56.16	3,310	20.1
J-DIX-3672	55.55	2,811	20.1
J-DIX-3674	55.5	3,087	20.1
J-DIX-3676	55.14	3,235	20.1
J-DIX-3678	54.5	3,263	20.1
J-DIX-368	59.64	2,543	20.1
J-DIX-3682	54.36	3,264	20.1
J-DIX-3684	54.4	2,865	20.1
J-DIX-3686	54.89	1,956	20.0
J-DIX-3688	55.62	1,946	20.0
J-DIX-3690	54.98	1,956	20.0
J-DIX-3692	55.89	2,757	20.1
J-DIX-3694	54.96	3,021	20.1
J-DIX-3696	52.86	3,585	20.1
J-DIX-3698	53.44	2,161	20.1
J-DIX-370	59.71	2,275	20.1
J-DIX-3700	55.12	2,140	20.1
J-DIX-3702	53.94	3,128	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-3704	54.61	1,808	20.0
J-DIX-3706	54.71	1,260	20.0
J-DIX-3708	54.56	2,692	20.1
J-DIX-3710	53.09	2,113	20.0
J-DIX-3712	53.21	2,058	20.0
J-DIX-3714	53.97	2,248	20.1
J-DIX-3716	55.47	3,278	20.1
J-DIX-3718	52.75	2,691	20.1
J-DIX-372	59.43	2,651	20.1
J-DIX-3720	52.6	2,827	20.1
J-DIX-3722	53.64	2,999	20.1
J-DIX-3724	53.75	1,925	20.0
J-DIX-3726	54.57	3,251	20.1
J-DIX-3728	55.81	3,181	20.1
J-DIX-3730	55.09	3,936	20.2
J-DIX-3732	53.86	3,107	20.1
J-DIX-3734	52.68	2,576	20.1
J-DIX-3736	52.48	2,198	20.1
J-DIX-3738	53.03	2,715	20.1
J-DIX-374	58.63	2,984	20.1
J-DIX-3740	53.18	3,316	20.1
J-DIX-3742	52.93	3,387	20.1
J-DIX-3744	53.21	3,296	20.1
J-DIX-3746	53.3	3,993	20.2
J-DIX-3748	52.98	4,951	20.3
J-DIX-3750	53	6,832	20.5
J-DIX-3752	54.41	5,614	20.3
J-DIX-3754	54.43	6,374	20.4
J-DIX-3756	52.23	478	20.0
J-DIX-3758	52.74	2,123	20.1
J-DIX-376	58.1	2,362	20.1
J-DIX-3760	55.13	1,605	20.0
J-DIX-3762	55.02	1,986	20.0
J-DIX-3764	55.15	1,927	20.0
J-DIX-3766	53.37	2,491	20.1
J-DIX-3768	53.55	3,559	20.1
J-DIX-3770	54.94	3,491	20.1
J-DIX-3772	53.42	545	20.0
J-DIX-3774	53.27	513	20.0
J-DIX-3776	54.41	1,895	20.0
J-DIX-3778	52.96	2,242	20.1
J-DIX-378	58.45	2,292	20.1
J-DIX-3780	53.85	3,659	20.1
J-DIX-3782	53.8	3,342	20.1
J-DIX-3784	54.12	3,601	20.1
J-DIX-3786	53.91	3,657	20.1
J-DIX-3788	54.6	5,995	20.4
J-DIX-3790	55.39	5,650	20.3
J-DIX-3792	55.35	7,296	20.5
J-DIX-3794	55.47	5,749	20.3

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-3796	55.37	7,314	20.5
J-DIX-3798	55.33	7,324	20.5
J-DIX-38	55.04	4,053	20.2
J-DIX-380	59.54	2,366	20.1
J-DIX-3800	55.37	6,640	20.4
J-DIX-3802	55.22	5,298	20.3
J-DIX-3804	55.33	6,117	20.4
J-DIX-3806	55.23	3,000	20.1
J-DIX-3808	55.23	5,717	20.3
J-DIX-3810	55.1	3,792	20.1
J-DIX-3812	55.78	3,385	20.1
J-DIX-3814	55.24	2,861	20.1
J-DIX-3816	56.14	4,286	20.2
J-DIX-3818	56.26	3,918	20.2
J-DIX-382	59.73	2,462	20.1
J-DIX-3820	55.63	4,210	20.2
J-DIX-3822	56.13	4,038	20.2
J-DIX-3824	56.16	3,795	20.1
J-DIX-3826	55.96	4,059	20.2
J-DIX-3828	55.82	4,517	20.2
J-DIX-3830	55.86	4,505	20.2
J-DIX-3832	55.3	5,959	20.4
J-DIX-3834	55.54	5,210	20.3
J-DIX-3836	56.04	4,148	20.2
J-DIX-3838	56.22	3,472	20.1
J-DIX-384	59.27	1,753	20.0
J-DIX-3840	55.91	4,075	20.2
J-DIX-3842	57.48	2,483	20.1
J-DIX-3844	55.77	4,213	20.2
J-DIX-3846	55.64	4,075	20.2
J-DIX-3848	56.37	3,663	20.1
J-DIX-3850	56.53	3,640	20.1
J-DIX-3852	56.35	3,517	20.1
J-DIX-3854	56.75	3,507	20.1
J-DIX-3856	56.38	3,591	20.1
J-DIX-3858	56.02	3,880	20.2
J-DIX-386	59.31	1,610	20.0
J-DIX-3860	56.17	3,179	20.1
J-DIX-3862	57.58	3,119	20.1
J-DIX-3864	57.03	3,016	20.1
J-DIX-3866	57.57	3,187	20.1
J-DIX-3868	56.52	2,956	20.1
J-DIX-3870	56.24	3,359	20.1
J-DIX-3872	56.35	3,324	20.1
J-DIX-3874	56.32	3,177	20.1
J-DIX-3876	56.18	3,289	20.1
J-DIX-3878	56.36	2,630	20.1
J-DIX-388	59.67	1,470	20.0
J-DIX-3880	57.13	2,990	20.1
J-DIX-3882	57.42	1,702	20.0

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-3884	57.41	2,852	20.1
J-DIX-3886	56.44	2,438	20.1
J-DIX-3888	56.49	2,126	20.1
J-DIX-3890	56.15	1,632	20.0
J-DIX-3892	56.67	2,455	20.1
J-DIX-3894	56.85	2,275	20.1
J-DIX-3896	56.68	2,103	20.0
J-DIX-3898	57.57	2,107	20.0
J-DIX-390	59.74	2,238	20.1
J-DIX-3900	57.52	2,789	20.1
J-DIX-3902	57.6	2,845	20.1
J-DIX-3904	57.58	2,669	20.1
J-DIX-3906	57.82	2,870	20.1
J-DIX-3908	57.81	2,899	20.1
J-DIX-3910	56.34	2,497	20.1
J-DIX-3912	58.02	2,586	20.1
J-DIX-3914	58.53	2,738	20.1
J-DIX-3916	58.69	2,767	20.1
J-DIX-3918	58.48	1,677	20.0
J-DIX-392	58.73	2,090	20.0
J-DIX-3920	59.57	285	20.0
J-DIX-3922	58.19	1,781	20.0
J-DIX-3924	58.93	1,118	20.0
J-DIX-3926	58.54	546	20.0
J-DIX-3928	57.65	657	20.0
J-DIX-3930	57.63	2,354	20.1
J-DIX-3932	59.79	2,720	20.1
J-DIX-3934	60.04	3,133	20.1
J-DIX-3936	58.76	2,624	20.1
J-DIX-3938	59.8	2,525	20.1
J-DIX-394	56.33	2,872	20.1
J-DIX-3940	60.12	3,042	20.1
J-DIX-3942	59.91	2,863	20.1
J-DIX-3944	58.74	3,485	20.1
J-DIX-3946	58.72	3,292	20.1
J-DIX-3948	59.03	3,662	20.1
J-DIX-3950	57.26	6,910	20.5
J-DIX-3952	55.6	5,353	20.3
J-DIX-3954	57.15	2,499	20.1
J-DIX-3956	57.33	2,502	20.1
J-DIX-3958	57.17	2,387	20.1
J-DIX-396	57.18	2,919	20.1
J-DIX-3960	56.61	1,080	20.0
J-DIX-3962	57.83	947	20.0
J-DIX-3964	58.19	2,653	20.1
J-DIX-3966	58.16	2,471	20.1
J-DIX-3968	58.5	2,389	20.1
J-DIX-3970	57.8	2,582	20.1
J-DIX-3972	58.81	2,461	20.1
J-DIX-3974	59.52	2,854	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-3976	59.4	2,673	20.1
J-DIX-3978	59.44	2,462	20.1
J-DIX-398	58.46	4,335	20.2
J-DIX-3980	60.04	2,785	20.1
J-DIX-3982	59.89	2,581	20.1
J-DIX-3984	59.32	2,456	20.1
J-DIX-3986	59.25	1,811	20.0
J-DIX-3988	59.73	2,177	20.1
J-DIX-3990	59.34	1,653	20.0
J-DIX-3992	60.33	2,267	20.1
J-DIX-3994	60.54	1,561	20.0
J-DIX-3996	59.77	1,507	20.0
J-DIX-3998	59.68	2,319	20.1
J-DIX-40	55.46	2,736	20.1
J-DIX-400	57.53	4,083	20.2
J-DIX-4000	58.87	2,145	20.1
J-DIX-4002	58.08	2,001	20.0
J-DIX-4004	58.77	2,161	20.1
J-DIX-4006	60.77	3,814	20.2
J-DIX-4008	57.01	3,703	20.1
J-DIX-4010	56.7	3,565	20.1
J-DIX-4012	56.42	3,235	20.1
J-DIX-4014	56.94	3,115	20.1
J-DIX-4016	55.78	3,598	20.1
J-DIX-4018	57.17	2,541	20.1
J-DIX-402	60.92	3,176	20.1
J-DIX-4020	56.96	3,130	20.1
J-DIX-4022	56.93	3,273	20.1
J-DIX-4024	58.48	6,199	20.4
J-DIX-4026	58.46	5,444	20.3
J-DIX-4028	58.34	5,669	20.3
J-DIX-4030	57.44	6,116	20.4
J-DIX-4032	57.37	6,740	20.5
J-DIX-4034	57.53	4,670	20.2
J-DIX-4036	59.35	5,233	20.3
J-DIX-4038	59.51	3,553	20.1
J-DIX-404	60.44	2,958	20.1
J-DIX-4040	58.93	3,815	20.2
J-DIX-4042	59.35	3,727	20.1
J-DIX-4044	60.33	3,642	20.1
J-DIX-4046	60.77	3,402	20.1
J-DIX-4048	60.26	7,610	20.6
J-DIX-4050	59.11	2,944	20.1
J-DIX-4052	59.56	2,548	20.1
J-DIX-4054	58.85	2,492	20.1
J-DIX-4056	59.61	3,181	20.1
J-DIX-4058	59.77	3,424	20.1
J-DIX-406	59.6	3,478	20.1
J-DIX-4060	61.42	3,653	20.1
J-DIX-4062	60.14	3,413	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-4064	60.43	3,152	20.1
J-DIX-4066	59.43	4,467	20.2
J-DIX-4068	57.95	2,283	20.1
J-DIX-4070	59.65	2,818	20.1
J-DIX-4072	58.03	2,367	20.1
J-DIX-4074	56.61	2,260	20.1
J-DIX-4076	57.35	2,430	20.1
J-DIX-4078	54.05	1,144	20.0
J-DIX-408	60.54	1,527	20.0
J-DIX-4080	53.53	2,540	20.1
J-DIX-4082	54.22	2,666	20.1
J-DIX-4084	53.35	1,473	20.0
J-DIX-4086	53.03	3,745	20.1
J-DIX-4088	53.45	3,602	20.1
J-DIX-4090	53.31	3,227	20.1
J-DIX-4092	53.44	2,778	20.1
J-DIX-4094	53.74	4,165	20.2
J-DIX-4096	53.78	3,434	20.1
J-DIX-4098	55.11	3,695	20.1
J-DIX-410	53.46	1,121	20.0
J-DIX-4100	55.15	3,412	20.1
J-DIX-4102	53.79	3,494	20.1
J-DIX-4104	53.65	3,873	20.2
J-DIX-4108	53.45	3,436	20.1
J-DIX-4110	53.53	3,143	20.1
J-DIX-4112	52.04	2,806	20.1
J-DIX-4114	52.05	2,987	20.1
J-DIX-4118	53.37	2,785	20.1
J-DIX-412	53.5	2,409	20.1
J-DIX-4120	52.77	2,087	20.0
J-DIX-4122	53.75	3,073	20.1
J-DIX-4124	54.01	2,965	20.1
J-DIX-4126	54.11	2,760	20.1
J-DIX-4128	54.03	2,689	20.1
J-DIX-4130	53.94	2,127	20.1
J-DIX-4132	55.19	2,096	20.0
J-DIX-4134	54.8	2,524	20.1
J-DIX-4136	53.05	2,478	20.1
J-DIX-414	53.32	1,444	20.0
J-DIX-4140	53.69	2,181	20.1
J-DIX-4142	54.05	1,178	20.0
J-DIX-4144	54.42	4,423	20.2
J-DIX-4146	53.69	4,786	20.2
J-DIX-4148	53.68	4,779	20.2
J-DIX-4150	53.84	4,670	20.2
J-DIX-4152	53.89	4,169	20.2
J-DIX-4154	53.56	4,071	20.2
J-DIX-4156	53.77	4,695	20.2
J-DIX-4158	53.78	4,208	20.2
J-DIX-416	53.52	2,617	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-4160	53.5	4,146	20.2
J-DIX-4162	53.17	3,964	20.2
J-DIX-4164	53.78	4,188	20.2
J-DIX-4166	53.53	3,576	20.1
J-DIX-4168	53.06	4,099	20.2
J-DIX-4170	52.2	2,157	20.1
J-DIX-4172	53.24	2,923	20.1
J-DIX-4174	55.26	3,711	20.1
J-DIX-4176	54.83	3,767	20.1
J-DIX-4178	54.84	4,076	20.2
J-DIX-418	53.75	3,149	20.1
J-DIX-4180	53.28	3,378	20.1
J-DIX-4182	52.81	1,999	20.0
J-DIX-4184	54.66	3,072	20.1
J-DIX-4186	54.78	2,663	20.1
J-DIX-4188	54.63	2,380	20.1
J-DIX-4190	53.85	3,157	20.1
J-DIX-4192	53.58	4,165	20.2
J-DIX-4194	52.98	3,501	20.1
J-DIX-4196	53.16	2,618	20.1
J-DIX-4198	53	1,530	20.0
J-DIX-42	55.31	4,311	20.2
J-DIX-420	55.15	3,148	20.1
J-DIX-4200	53.56	1,796	20.0
J-DIX-4202	53.89	2,642	20.1
J-DIX-4204	53.72	3,323	20.1
J-DIX-4206	53.21	3,936	20.2
J-DIX-4208	54.35	4,201	20.2
J-DIX-4210	53.22	3,112	20.1
J-DIX-4212	55.19	5,656	20.3
J-DIX-4214	54.44	4,278	20.2
J-DIX-4216	54.29	3,714	20.1
J-DIX-4218	52.37	3,329	20.1
J-DIX-422	53.79	3,202	20.1
J-DIX-4220	54.79	1,392	20.0
J-DIX-4222	52.62	2,446	20.1
J-DIX-4224	52.3	3,475	20.1
J-DIX-4226	54.14	2,957	20.1
J-DIX-4228	54.06	3,057	20.1
J-DIX-4230	54.1	3,105	20.1
J-DIX-4232	54.15	3,388	20.1
J-DIX-4234	55.28	4,253	20.2
J-DIX-4236	53.34	2,369	20.1
J-DIX-4238	55.24	2,920	20.1
J-DIX-424	53.53	2,719	20.1
J-DIX-4240	55.29	3,167	20.1
J-DIX-4242	54.12	4,058	20.2
J-DIX-4244	53.05	4,786	20.2
J-DIX-4246	53.24	4,880	20.2
J-DIX-4248	54.53	6,392	20.4

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-4250	54.49	4,639	20.2
J-DIX-4252	54.72	5,198	20.3
J-DIX-4254	54.57	5,187	20.3
J-DIX-4256	54.6	5,848	20.3
J-DIX-4258	54.57	5,128	20.3
J-DIX-426	51.89	2,542	20.1
J-DIX-4260	53.52	3,947	20.2
J-DIX-4262	53.13	3,927	20.2
J-DIX-4264	52.93	3,996	20.2
J-DIX-4266	47.28	2,751	20.1
J-DIX-4268	46.75	2,240	20.1
J-DIX-4270	47.47	2,139	20.1
J-DIX-4272	48.69	1,645	20.0
J-DIX-4274	51.94	1,809	20.0
J-DIX-4276	51.52	418	20.0
J-DIX-4278	49.38	7,960	20.6
J-DIX-428	52.51	1,924	20.0
J-DIX-4280	55.06	2,155	20.1
J-DIX-4282	55.97	2,025	20.0
J-DIX-4284	55.47	3,252	20.1
J-DIX-4286	55.47	2,997	20.1
J-DIX-4288	55.39	3,321	20.1
J-DIX-4290	54.95	2,333	20.1
J-DIX-4292	57.75	3,653	20.1
J-DIX-4294	52.52	1,947	20.0
J-DIX-4296	56.01	3,614	20.1
J-DIX-430	53.97	2,594	20.1
J-DIX-432	54.22	1,906	20.0
J-DIX-434	54.95	1,949	20.0
J-DIX-436	53.75	2,100	20.0
J-DIX-438	53.9	3,688	20.1
J-DIX-44	56.07	4,375	20.2
J-DIX-440	53.4	3,599	20.1
J-DIX-442	53.74	3,557	20.1
J-DIX-444	53.48	3,247	20.1
J-DIX-446	53.23	2,730	20.1
J-DIX-448	54.83	3,187	20.1
J-DIX-450	53.45	3,107	20.1
J-DIX-4500	55.16	6,484	20.4
J-DIX-4502	55.31	5,060	20.3
J-DIX-4504	55.59	5,382	20.3
J-DIX-4506	55.7	6,130	20.4
J-DIX-4508	56.37	6,225	20.4
J-DIX-4510	55.92	6,266	20.4
J-DIX-4512	54.4	6,275	20.4
J-DIX-4514	54.97	6,396	20.4
J-DIX-4516	56	6,267	20.4
J-DIX-4518	54.84	2,661	20.1
J-DIX-452	54.24	2,496	20.1
J-DIX-4520	55.08	4,538	20.2

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-4522	54.59	3,237	20.1
J-DIX-4524	55.9	3,455	20.1
J-DIX-4526	53.16	4,140	20.2
J-DIX-4528	53.16	4,943	20.2
J-DIX-4530	51.5	3,677	20.1
J-DIX-4532	52.69	3,903	20.2
J-DIX-4536	53.89	4,425	20.2
J-DIX-4538	52.67	3,353	20.1
J-DIX-454	53.97	2,934	20.1
J-DIX-4540	53.45	3,438	20.1
J-DIX-4542	54.22	4,031	20.2
J-DIX-4544	55.46	4,498	20.2
J-DIX-4546	54.85	4,857	20.2
J-DIX-4548	54.64	4,669	20.2
J-DIX-4550	54.84	3,922	20.2
J-DIX-4552	54.86	4,241	20.2
J-DIX-4554	54.41	3,660	20.1
J-DIX-4556	55.03	4,263	20.2
J-DIX-4558	55.21	3,432	20.1
J-DIX-456	52.92	3,184	20.1
J-DIX-4560	56.46	3,456	20.1
J-DIX-4562	54.82	2,475	20.1
J-DIX-458	53.02	1,489	20.0
J-DIX-46	55.36	1,566	20.0
J-DIX-460	53.66	1,732	20.0
J-DIX-462	53.77	3,059	20.1
J-DIX-464	54.41	3,365	20.1
J-DIX-466	52.64	3,064	20.1
J-DIX-468	55.23	1,370	20.0
J-DIX-470	54.12	2,764	20.1
J-DIX-472	54.16	2,887	20.1
J-DIX-474	53.43	2,265	20.1
J-DIX-476	55.36	2,745	20.1
J-DIX-478	54.14	3,608	20.1
J-DIX-48	54.35	1,869	20.0
J-DIX-480	54.51	4,008	20.2
J-DIX-482	53.01	3,506	20.1
J-DIX-484	47.67	2,062	20.0
J-DIX-486	48.69	1,605	20.0
J-DIX-488	56.15	2,676	20.1
J-DIX-490	55.02	2,639	20.1
J-DIX-492	54.21	555	20.0
J-DIX-494	56.15	1,908	20.0
J-DIX-496	54.98	3,208	20.1
J-DIX-498	54.97	2,692	20.1
J-DIX-50	56.72	2,199	20.1
J-DIX-500	55.34	2,925	20.1
J-DIX-502	54.81	2,792	20.1
J-DIX-504	52.76	1,858	20.0
J-DIX-508	55.65	406	20.0

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-510	55.42	2,829	20.1
J-DIX-512	56.6	2,128	20.1
J-DIX-514	55.96	2,563	20.1
J-DIX-516	57.25	1,826	20.0
J-DIX-518	59.85	2,090	20.0
J-DIX-52	56.47	1,511	20.0
J-DIX-520	59.95	2,559	20.1
J-DIX-522	61.34	2,875	20.1
J-DIX-524	60.83	2,867	20.1
J-DIX-526	60.12	3,046	20.1
J-DIX-528	54.46	2,273	20.1
J-DIX-530	55.18	3,207	20.1
J-DIX-532	54.42	3,640	20.1
J-DIX-534	55.33	1,539	20.0
J-DIX-536	56.29	1,422	20.0
J-DIX-538	57.62	1,749	20.0
J-DIX-54	56.35	1,676	20.0
J-DIX-540	56.88	2,921	20.1
J-DIX-542	57.19	2,454	20.1
J-DIX-544	57.08	3,160	20.1
J-DIX-546	56.58	1,991	20.0
J-DIX-548	53.85	3,765	20.1
J-DIX-550	52.87	3,776	20.1
J-DIX-552	54.28	533	20.0
J-DIX-554	56.19	1,598	20.0
J-DIX-556	54.95	2,088	20.0
J-DIX-558	54.32	526	20.0
J-DIX-56	57.79	1,630	20.0
J-DIX-560	58.72	652	20.0
J-DIX-562	57.9	663	20.0
J-DIX-564	55.52	644	20.0
J-DIX-566	60.53	691	20.0
J-DIX-568	53.18	642	20.0
J-DIX-570	57.47	658	20.0
J-DIX-572	53.68	649	20.0
J-DIX-574	52.64	598	20.0
J-DIX-576	54.63	6,183	20.4
J-DIX-578	56.42	4,342	20.2
J-DIX-58	58.33	2,223	20.1
J-DIX-580	55.42	3,362	20.1
J-DIX-582	57.16	3,494	20.1
J-DIX-584	56.54	3,011	20.1
J-DIX-586	57.61	4,614	20.2
J-DIX-588	56.6	4,156	20.2
J-DIX-590	57.12	4,023	20.2
J-DIX-592	56.47	3,842	20.2
J-DIX-594	56.45	3,693	20.1
J-DIX-596	56.95	3,570	20.1
J-DIX-598	56.62	4,177	20.2
J-DIX-60	57.14	1,922	20.0

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-600	56.55	3,121	20.1
J-DIX-602	56.64	3,847	20.2
J-DIX-604	57.6	3,903	20.2
J-DIX-606	56.63	5,983	20.4
J-DIX-612	56.19	5,943	20.4
J-DIX-614	56.24	5,949	20.4
J-DIX-616	57.68	2,443	20.1
J-DIX-618	58.02	2,654	20.1
J-DIX-62	57.07	2,495	20.1
J-DIX-620	58.03	2,611	20.1
J-DIX-626	58.09	1,712	20.0
J-DIX-628	57.45	2,446	20.1
J-DIX-630	54.53	1,654	20.0
J-DIX-632	55.44	2,952	20.1
J-DIX-634	55.7	2,986	20.1
J-DIX-636	56.07	2,304	20.1
J-DIX-638	59.16	3,746	20.1
J-DIX-64	59.12	2,257	20.1
J-DIX-640	56.11	1,648	20.0
J-DIX-642	56.96	1,821	20.0
J-DIX-644	56.31	3,086	20.1
J-DIX-646	59.76	7,139	20.5
J-DIX-648	59.88	7,456	20.6
J-DIX-650	60.48	4,754	20.2
J-DIX-652	53.75	3,685	20.1
J-DIX-654	57.98	2,664	20.1
J-DIX-656	61.37	4,787	20.2
J-DIX-658	60.72	2,482	20.1
J-DIX-66	56.52	2,057	20.0
J-DIX-660	60.57	2,518	20.1
J-DIX-662	58.16	2,662	20.1
J-DIX-664	57	2,563	20.1
J-DIX-666	56.68	2,494	20.1
J-DIX-668	60.6	2,888	20.1
J-DIX-670	53.33	2,343	20.1
J-DIX-672	54.98	1,422	20.0
J-DIX-674	55.36	1,559	20.0
J-DIX-676	54.23	3,104	20.1
J-DIX-678	53.67	3,900	20.2
J-DIX-68	57.36	1,919	20.0
J-DIX-680	53.82	4,652	20.2
J-DIX-682	53.81	4,748	20.2
J-DIX-684	54.76	3,978	20.2
J-DIX-686	56.7	3,933	20.2
J-DIX-688	56.62	4,237	20.2
J-DIX-690	54.44	2,506	20.1
J-DIX-692	55.66	688	20.0
J-DIX-694	54.94	151	20.0
J-DIX-696	54.71	133	20.0
J-DIX-698	55.02	437	20.0

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-70	58.65	2,028	20.0
J-DIX-700	55.12	605	20.0
J-DIX-702	55.83	3,465	20.1
J-DIX-704	55.74	3,357	20.1
J-DIX-706	55	3,563	20.1
J-DIX-708	54.97	3,517	20.1
J-DIX-710	54.16	4,457	20.2
J-DIX-712	54.23	4,289	20.2
J-DIX-714	55.58	3,738	20.1
J-DIX-716	55.75	3,640	20.1
J-DIX-718	54.84	3,557	20.1
J-DIX-72	57.72	2,051	20.0
J-DIX-720	54.52	3,660	20.1
J-DIX-722	53.6	3,644	20.1
J-DIX-724	53.18	3,476	20.1
J-DIX-726	54.85	4,359	20.2
J-DIX-728	54.74	4,189	20.2
J-DIX-730	54.94	1,679	20.0
J-DIX-732	55.92	2,305	20.1
J-DIX-734	53.75	2,759	20.1
J-DIX-736	55.41	2,128	20.1
J-DIX-738	54.05	2,306	20.1
J-DIX-74	56.7	2,770	20.1
J-DIX-740	53.94	1,971	20.0
J-DIX-742	55.81	2,657	20.1
J-DIX-744	54.46	2,526	20.1
J-DIX-746	54.47	2,504	20.1
J-DIX-748	52.73	6,778	20.5
J-DIX-750	54.05	6,374	20.4
J-DIX-752	53.44	4,305	20.2
J-DIX-754	53.44	4,570	20.2
J-DIX-756	54.08	4,770	20.2
J-DIX-758	54.02	4,524	20.2
J-DIX-76	57.63	2,022	20.0
J-DIX-760	54.36	6,418	20.4
J-DIX-762	54.63	6,178	20.4
J-DIX-764	55.37	3,326	20.1
J-DIX-766	56.03	4,369	20.2
J-DIX-768	55.74	4,446	20.2
J-DIX-770	55.79	4,560	20.2
J-DIX-772	56	4,413	20.2
J-DIX-774	56.02	4,227	20.2
J-DIX-776	56.1	2,477	20.1
J-DIX-778	56.08	2,482	20.1
J-DIX-78	57.23	1,650	20.0
J-DIX-780	55.86	4,298	20.2
J-DIX-782	55.85	4,300	20.2
J-DIX-784	55.8	4,128	20.2
J-DIX-786	56.18	3,947	20.2
J-DIX-788	56.41	3,656	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-790	55.89	3,667	20.1
J-DIX-792	55.92	3,527	20.1
J-DIX-794	56.24	3,157	20.1
J-DIX-796	56.64	3,137	20.1
J-DIX-798	56.53	3,291	20.1
J-DIX-80	57.17	2,589	20.1
J-DIX-800	56.43	3,308	20.1
J-DIX-802	57.77	2,481	20.1
J-DIX-804	57.97	1,155	20.0
J-DIX-806	56.59	2,430	20.1
J-DIX-808	56.52	2,413	20.1
J-DIX-810	56.6	675	20.0
J-DIX-812	57.55	2,865	20.1
J-DIX-814	57.53	2,849	20.1
J-DIX-816	58.58	2,793	20.1
J-DIX-818	58.74	3,529	20.1
J-DIX-82	56.4	3,036	20.1
J-DIX-820	59.24	3,794	20.1
J-DIX-822	57.42	6,920	20.5
J-DIX-824	57.14	2,497	20.1
J-DIX-826	61.09	3,829	20.2
J-DIX-828	61.72	3,865	20.2
J-DIX-830	57.14	3,800	20.1
J-DIX-832	56.29	3,681	20.1
J-DIX-834	55.39	2,521	20.1
J-DIX-836	59.13	3,518	20.1
J-DIX-838	59.09	3,560	20.1
J-DIX-84	57.32	3,408	20.1
J-DIX-840	59.29	3,715	20.1
J-DIX-842	60.17	8,831	20.8
J-DIX-844	60.17	8,255	20.7
J-DIX-846	59.74	3,096	20.1
J-DIX-848	59.68	3,113	20.1
J-DIX-850	59.67	2,782	20.1
J-DIX-852	54.05	1,157	20.0
J-DIX-854	53.55	2,346	20.1
J-DIX-856	53.37	1,734	20.0
J-DIX-858	53.33	2,212	20.1
J-DIX-86	56.68	3,705	20.1
J-DIX-860	54.53	2,734	20.1
J-DIX-862	53.87	2,026	20.0
J-DIX-864	55.31	1,924	20.0
J-DIX-866	54.48	2,490	20.1
J-DIX-868	54.65	2,453	20.1
J-DIX-870	54.55	2,387	20.1
J-DIX-872	54.61	2,476	20.1
J-DIX-874	53.64	2,423	20.1
J-DIX-876	52.38	1,942	20.0
J-DIX-878	53.42	2,568	20.1
J-DIX-88	56.97	3,829	20.2

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-880	53.87	2,311	20.1
J-DIX-882	53.79	2,298	20.1
J-DIX-884	54.62	1,740	20.0
J-DIX-886	54.39	1,839	20.0
J-DIX-888	54.05	1,317	20.0
J-DIX-890	54.57	1,522	20.0
J-DIX-892	54.5	6,305	20.4
J-DIX-894	51.53	4,868	20.2
J-DIX-896	49.39	8,260	20.7
J-DIX-90	57.32	2,987	20.1
J-DIX-900	50.48	6,073	20.4
J-DIX-902	49.62	6,619	20.4
J-DIX-904	55.04	2,179	20.1
J-DIX-906	55.82	2,018	20.0
J-DIX-908	55.26	1,791	20.0
J-DIX-910	54.62	3,284	20.1
J-DIX-912	54.75	2,976	20.1
J-DIX-914	55.83	4,205	20.2
J-DIX-916	62.81	4,054	20.2
J-DIX-918	56.39	3,169	20.1
J-DIX-92	57.32	2,412	20.1
J-DIX-920	55.67	3,152	20.1
J-DIX-922	57.69	3,690	20.1
J-DIX-924	53.33	3,507	20.1
J-DIX-926	55	2,091	20.0
J-DIX-928	58.75	3,466	20.1
J-DIX-930	57.75	2,360	20.1
J-DIX-932	56.21	1,677	20.0
J-DIX-934	59.39	3,748	20.1
J-DIX-936	58.38	2,666	20.1
J-DIX-938	57.08	2,242	20.1
J-DIX-94	56.65	3,952	20.2
J-DIX-940	58.24	2,899	20.1
J-DIX-942	59.06	2,216	20.1
J-DIX-944	59.22	1,932	20.0
J-DIX-946	58.39	2,220	20.1
J-DIX-948	58.43	2,253	20.1
J-DIX-950	59.93	8,213	20.7
J-DIX-952	59.73	6,969	20.5
J-DIX-956	59.58	3,938	20.2
J-DIX-958	59.96	4,782	20.2
J-DIX-96	56.58	2,871	20.1
J-DIX-960	60.09	4,897	20.2
J-DIX-962	62.08	4,914	20.2
J-DIX-964	60.57	3,016	20.1
J-DIX-966	59.85	3,048	20.1
J-DIX-968	59.9	3,049	20.1
J-DIX-970	58.49	2,858	20.1
J-DIX-972	58.83	2,701	20.1
J-DIX-974	58.22	2,682	20.1

Appendix O

Model ID	Static Pressure (psi)	Available Flow @ Hydrant (gpm)	Available Flow Pressure (psi)
J-DIX-976	60.13	3,054	20.1
J-DIX-978	60.6	3,018	20.1
J-DIX-98	57.39	3,090	20.1
J-DIX-980	61.39	3,093	20.1
J-DIX-982	60.99	3,105	20.1
J-DIX-984	60.25	3,132	20.1
J-DIX-986	60.34	3,121	20.1
J-DIX-988	58.8	2,766	20.1
J-DIX-992	53.57	2,373	20.1
J-DIX-994	53.86	2,406	20.1
J-DIX-996	54.3	2,392	20.1
J-DIX-998	52.99	1,799	20.0

Public Version

APPENDIX P

Cost Estimating Assumptions

COST ESTIMATING ASSUMPTIONS

This appendix provides the assumptions used by WYA to estimate the construction costs for the planning and design of recommended water system facilities for Cal Water's Willows District. The costs were developed based on data supplied by manufacturers, published industry standard cost data and curves, construction costs for similar facilities built by Cal Water and/or other public agencies, and construction costs previously estimated by WYA for similar facilities with similar construction cost indexes.

Additionally, these costs are for construction only and do not include estimating uncertainties or unexpected construction costs (e.g., variations in final quantities) or cost estimates for land acquisition, engineering, legal costs, environmental review, inspections and/or contract administration. These additional cost items are referred to as construction contingency costs and project cost allowances, and are further described in the last section of this appendix.

All construction costs have been adjusted to reflect May 2009 costs at an Engineering News Record (ENR) Construction Cost Index (CCI) of 8574 (20 Cities Average). These costs are to be used for conceptual cost estimates only, and should be updated regularly. Construction costs presented in this appendix are not intended to represent the lowest prices in the industry for each type of construction; rather they are representative of average or typical construction costs. The planning level cost estimates have been prepared for guidance in evaluating various options, and are intended for budgetary purposes only, within the context of this master planning effort.

CONSTRUCTION COSTS

Pipelines

Unit construction costs for potable water pipelines 6 through 36 inches in diameter are provided in Table 1. These costs are to be used for typical pipeline construction in developed areas and for construction across open fields or areas that are not yet developed (undeveloped). These costs generally include pipeline materials, trenching, placing and jointing pipe, valves, fittings, hydrants, service connections, placing imported pipe bedding, native backfill material, and asphalt pavement replacement, if required. The costs presented in Table 1 do not include the cost of boring and jacking pipe. The costs shown in Table 2 should be added where required for this purpose.

Table 1. Unit Construction Costs for Pipelines[a]

Pipe Diameter, inches	Unit Construction Cost, $/linear foot	
	Developed Areas	Undeveloped Areas
6	110	100
8	140	120
10	160	140
12	200	160
14	220	180
16	250	210
18	280	230
20	300	260
24	350	290
30	420	360
36	490	410

[a] Based on the May 2009 ENR index of 8574.

Table 2. Unit Construction Costs for Jack & Boring[a]

Size	Unit Construction Cost, $/linear foot[b]
8-inch pipe (16-inch casing)	390
12-inch pipe (21-inch casing)	450
16-inch pipe (24-inch casing)	520
20-inch pipe (30-inch casing)	640
54-inch pipe (66-inch casing)	1,280
Tunnel	2,660

[a] Based on the May 2009 ENR index of 8574.
[b] Conductor pipe not included in cost.

Treated Water Storage Reservoirs

Table 3 lists the estimated construction costs for water storage reservoirs between the size ranges of 0.1 to 6.0 MG. These costs generally include the storage tank, site piping, earthwork, paving, instrumentation, and all related sitework. As previously stated, these costs are representative of construction conducted under normal excavation and foundation conditions, and would be significantly higher for special or difficult foundation requirements.

Table 3. Construction Costs for Treated Water Storage Reservoirs[a]

Capacity, MG	Estimated Construction Cost, million dollars	
	Partially Buried Pre-Stressed Concrete	Welded Steel
0.1	1.6	1.0
0.5	1.9	1.3
1.0	2.3	1.6
2.0	3.0	2.2
3.0	3.7	2.8
4.0	4.4	3.4
5.0	5.2	4.0
6.0	5.9	4.6

(a) Based on the May 2009 ENR index of 8574.

Treated Water Booster Pump Stations

Distribution pumping station costs vary considerably, depending on such factors as architectural design, pumping head, and station capacity. Estimated average construction costs for distribution pumping stations, as shown in Table 4, are based on enclosed stations with architectural and landscaping treatment suitable for residential areas. Booster pump station cost estimates include a chemical feed system (hypochlorite or fluoride), backup/standby generator plus SCADA, and are based on the typical Cal Water configuration, which includes 1 to 3 pumps at approximately 1 to 2 mgd.

Table 4. Construction Costs for Booster Pump Stations[a]

Firm Capacity[b], mgd	Estimated Construction Cost, million dollars
0.5	1.0
1	1.0
2	1.2
3	1.3
5	1.5
10	2.1

(a) Based on the May 2009 ENR index of 8574.
(b) The pumping capacity with the largest pump out of service or on standby.

Groundwater Production Wells

Well construction consists of pilot hole drilling, water quality/soil sampling, pilot hole reaming, well construction, well development and providing the necessary housing, pump, motor, automatic control equipment, discharge piping, SCADA, and disinfection equipment. Costs are estimated to be approximately $1,200,000 per well. These costs are representative of construction conducted under normal drilling conditions, and would be significantly higher for special or difficult locations.

CONTINGENCIES AND OTHER PROJECT COSTS

Contingency costs must be reviewed on a case-by-case basis because they will vary considerably with each project. However, to assist Cal Water with budgeting for these future construction projects, contingency costs have been added to the planning budget as percentages of the estimated construction cost using these two categories: Construction Contingency Costs and Other Project Cost Allowances.

Construction Contingency Costs

The construction costs presented above are representative of the construction of water system facilities under normal construction conditions and schedules; consequently, it is appropriate to allow for estimating and construction uncertainties unavoidably associated with the conceptual planning of projects. Factors such as unexpected construction conditions, the need for unforeseen mechanical items, and variations in final quantities are only a few of the items that can increase project costs for which it is wise to make allowances in these preliminary cost estimates. An allowance of 20 percent of the base construction cost will be included to cover such project related construction contingencies.

Other Project Cost Allowances

Other project cost allowances are divided into three subcategories, totaling 28 percent:

- Design services associated with new facilities include preliminary investigations and reports, right-of-way acquisition, foundation explorations, preparation of drawings and specifications for construction, surveying and staking, sampling of testing material, and start-up services. The cost of these items may vary, but for the purpose of this study, it is assumed that engineering design costs will equal 10 percent of the construction costs after construction contingencies have been applied.
- Construction management covers items such as contract management and inspection during construction. The cost of these items may vary, but for the purpose of this study, it is assumed that construction management costs will equal 10 percent of the construction costs after construction contingencies have been applied.
- Administration costs cover items such as legal fees, environmental/CEQA compliance requirements, financing expenses, and interest during construction. The cost of these items may vary, but for the purpose of this study, it is assumed that program implementation costs will equal 8 percent of the construction costs after construction contingencies have been applied.

An example application of these allowances to a project with an assumed base construction cost of $1.0 million is shown in Table 5. As shown, the total cost of all project construction contingencies (construction, design, construction management, and administration costs) is approximately 54 percent of the base construction cost for each project.

Table 5. Example Application of Construction Contingency Costs and Other Project Cost Allowances

Cost Component	Percent	Cost	Total Cost
Estimated Base Construction Cost before Contingencies		$1,000,000[a]	
Construction Contingency Costs	20%	200,000	
Estimated Construction Cost with Contingencies			*$1,200,000*
Other Project Cost Allowances:			
Design	10%	$120,000	
Construction Management	10%	120,000	
Administration	8%	96,000	
Total Project Cost Allowances			$336,000
Estimated Total Project Cost[b]			**$1,536,000**

(a) Assumed cost of example project.
(b) Revenue requirement rate of 13% is not included in estimated project cost. This rate is included when developing the annual project cost (see Chapter 4).