RECORDING REQUESTED BY

City of Cupertino

WHEN RECORDED MAIL TO

City of Cupertino
10300 Torre Avenue
Cupertino, CA 95014

(Exempt from recording fees per Govt. Code § 27383.)

(SPACE ABOVE THIS LINE FOR RECORDER'S USE)

AGREEMENT FOR LEASE OF REAL PROPERTY (WATER SYSTEM)

TABLE OF CONTENTS

CITY OF CUPERTINO
AGREEMENT FOR LEASE OF
REAL PROPERTY (WATER SYSTEM)

This Agreement for Lease of Real Property (Water System) ("**Lease**") is entered into on _____, by and between the City of Cupertino ("**City**"), and San Jose Water Company, a California Corporation ("**Lessee**") (individually, a "**Party**" and collectively, the "**Parties**").

RECITALS

A. Prior to City's incorporation in 1955, and continuing thereafter, the Cupertino area was provided with water service by investor-owned private utility companies.

B. From about 1960 until October 1, 1997, in the areas not already served by the private water companies, City provided water service to approximately 4,200 (currently approximately 4,600) metered customers in the service area described in **Exhibit A** attached hereto ("**Service Area**").

C. As a result, Cupertino has been served by three roughly equal-size water systems: a City-owned system within the Service Area and two other systems owned and operated by investor-owned utilities.

D. Within the Service Area, City is the owner of certain real property, easements and rights of way and those certain reservoirs, pipes, wells, pumps and appurtenant facilities (including without limitation buildings, pump houses, sheds and other structures) constituting all of City's water system ("**Water System**") as generally depicted in the Water System Map attached as **Exhibit B** hereto.

E. City has no legal obligation to provide public water service to its residents and desires to allow those services to be provided City-wide exclusively by investor-owned utilities.

F. The Lessee has been operating the Water System since 1997 pursuant to a lease agreement with the City ("**1997 Lease**"). The term of the 1997 Lease will expire on September 30, 2024.

G. Pursuant to the requirements of Public Utilities Code section 10061, the City issued a Request for Proposals on **July 31, 2023** ("**RFP**") and received one responsive proposal from qualified water system operators. During a public hearing on July 16, 2024, which was scheduled and noticed pursuant to Public Utilities Code section 10061 and Government Code section 6066, the City Council examined the proposals and staff recommendations, and found that Lessee was the best qualified operator to continue to provide equal or better service to the customers of the Water System for just compensation as specified herein.

H. Following expiration of the 1997 Lease and as of the Effective Date, the Lessee will continue operating the Water System in accordance with the terms of this Lease.

I. As consideration for the valuable property, rights, and privileges granted under this Lease by the City, acting in its proprietary capacity, to Lessee, the Parties mutually agree that the reasonable just compensation will be comprised of the one-time Concession Fee, the Annual Investment Rent, and the annual Franchise Fee, as further specified herein.

NOW, THEREFORE, in consideration of the mutual promises and covenants contained herein and for good and valuable consideration, the receipt of which is hereby acknowledged, the Parties agree as follows:

TERMS AND CONDITIONS

Article 1 – Definitions

The following definitions apply to capitalized terms used in the Lease, including the recitals and exhibits hereto, unless otherwise specified:

1997 Lease has the meaning given in the Recitals.

Annual Investment Rent means the annual rent for the Water System to be paid by Lessee to the City, the proceeds of which will be allocated by the City to fund Capital Improvement Projects. The initial Annual Investment Rent shall be $1,800,000, and shall be adjusted annually as described in Section 2.5(B) (Annual Investment Rent).

Asset Management Plan means the 2019 Water Distribution System Asset Management

Plan, as updated by the memorandum dated December 8, 2021 ("**2021 Memorandum**"), prepared by Kayuga Solution, attached as **Exhibit C** to this Lease, as may be amended from time to time.

AWWA Handbook means the most current version of the *Water Distribution Systems Handbook* as published by the American Water Works Association.

Capital Improvement means any physical addition, betterment, replacement, or improvement to the Water System, excluding Maintenance or Repair, which will either enhance the Water System's overall value, increase its useful life, improve its performance or adapt it to new uses.

Capital Improvement Plan means the plan developed by the Parties and approved by the City for Capital Improvement Projects to be implemented by Lessee, attached hereto as **Exhibit D**, and which may be amended from time to time by the Parties as further specified in Section 3.4 (Capital Improvements), herein.

Capital Improvement Project means a project for construction of a Capital Improvement pursuant to a City-approved design, and includes all physical requirements for the project, including, as applicable, related demolition and removal of existing components in accordance with Laws, and which is subject to City reimbursement for Project Costs as more particularly described in Section 3.4 (Capital Improvements).

City means the City of Cupertino.

Concession Fee means the one-time fee more particularly described in Section 2.5 (Compensation) herein.

Consequential Damages means any special, indirect, consequential, or incidental damages arising out of or relating to this Lease that do not flow directly and immediately from an injurious act but that result indirectly from an action or failure to act, such as revenue losses, loss of use, cost of capital, debt service, loss of profit on related contracts, administrative costs, loss of bonding capacity, lost opportunity, claims of taxpayers and other indirect damage, whether arising out of breach of this Lease, tort (including negligence) or any other theory of liability.

Construction Cost Index means the most current version of the Construction Cost Index for San Francisco published by *Engineering News Record.*

County means Santa Clara County.

CPUC means the California Public Utilities Commission.

Customer means a retail customer of the Water System served by a physical connection to the Water System.

Director means the Director of the City's Public Works Department, unless otherwise indicated by the context.

Effective Date means the date that the Lease becomes effective as more particularly described in Section 2.2 (Term) herein.

Environmental Laws means any Federal, State or local laws or any regulations promulgated pursuant to such laws, as such laws or regulations may from time to time be amended, applicable to the Water System, groundwater or the utility services, regulating or imposing liability or standards of conduct concerning or relating to (1) the protection of human health or the environment, (2) the regulation, use or exposure to Hazardous Substances or (3) the operation, Maintenance, construction, Repair or rehabilitation of the Water System.

Force Majeure Event has the meaning set forth in Section 7.5 (Force Majeure) herein.

Franchise Fee means the annual fee more particularly described in Section 2.5 (Compensation) herein.

Hard Costs mean the reasonable direct costs for construction of a Capital Improvement Project, including but not limited to labor, equipment, materials, permitting, traffic control and inspection, but excluding costs for planning, design, project management, administration, or other such "soft" costs.

Hazardous Substance means any solid, liquid, gas, odor, heat, sound, vibration, radiation or other substance, material or waste which is defined as contaminant, pollutant, dangerous substance, toxic substance, hazardous waste, hazardous material, hazardous substance, extremely hazardous waste, restricted hazardous waste, residual waste, solid waste or similar term which is or becomes regulated by applicable Environmental Laws (as defined herein) or which is classified as hazardous or toxic under applicable Environmental Laws (including, without limitation, hydrocarbons, petroleum,

gasoline, diesel fuel, crude oil or any products, other petroleum hydrocarbons, polychlorinated biphenyls, asbestos, and urea formaldehyde foam insulation, or their by-products or fractions thereof).

Indemnified Person has the meaning given Section 3.11(B) (Indemnity).

Laws means all applicable laws, rules, regulations, ordinances, directives, covenants, easements and restrictions of record, permits, and requirements of any applicable fire insurance underwriter or rating bureau, relating in any manner to the Water System or the groundwater, including, but not limited to, SWRCB Permit; the SCVWD Contract and any amendments thereto; and the foregoing items pertaining to: (1) industrial hygiene, (2) environmental conditions on, in, under or about the Water System or the groundwater, including soil and groundwater conditions, (3) the use, generation, manufacture, production, installation, maintenance, removal, transportation, storage, spill or release of any Hazardous Substance or storage tank, and (4) prevailing wage requirements, payment bond requirements, working hours and workers compensation insurance, unemployment insurance benefits, Federal Insurance Contributions Act laws, and business license requirements now in effect or which may hereafter come into effect, and whether or not reflecting a change in policy from any previously existing policy.

Lease means this Agreement for Lease of Real Property (Water System), including all exhibits attached hereto or incorporated herein, and as amended by any duly executed amendments, if any.

Lessee has the meaning given in the Recital and includes its officers, assigns, and successors.

Maintain or Maintenance means routine maintenance activities or actions, other than Capital Improvements, to keep an asset in good working order so that it will operate as required under this Lease.

Maintenance Plan means the Maintenance Plan attached as **Exhibit E** hereto, as may be amended from time to time.

Operating Standards means, collectively, the operation-related requirements in this Lease, including the exhibits hereto, the applicable standards in the most current AWWA Handbook or other applicable water operation standards, and requirements of Laws.

Project Costs means all Hard Costs and Soft Costs, as defined, in connection with Capital Improvement Projects.

Rates means the rates, surcharges, surcredits, and other service charges or fees and penalties that Lessee may impose on Customers for the water services provided pursuant to this Lease.

Regulatory Cap means the maximum benchmark for rates charged to Customers as more particularly described in Section 4.1 (Customer Rates) herein.

Repair means activities or actions, other than Capital Improvements, to restore an asset to the condition and level of service required by this Lease after an asset has failed or has been damaged.

RFP means the Request for Proposals issued by the City on or about July 31, 2023, for leasing the Water System pursuant to Public Utilities Code section 10061.

SCVWD means the Santa Clara Valley Water District (also known as "Valley Water").

SCVWD Contract means the contract between the City and SCVWD for a supply of treated water, a copy of which is attached hereto as **Exhibit F**.

Section means a numbered section of this Lease, unless otherwise indicated by the context.

Service Area has the meaning given in the Recitals.

Soft Costs means all other costs and expenses paid or incurred in connection with Capital Improvement Projects which are not Hard Costs, including costs for planning, design, project management, administration, and construction management. Except as set out in Section 3.4(J) (Lessee's Responsibilities), the City will pay for all soft costs up to 24% of the total Hard Costs.

State means the State of California.

SWRCB means the State Water Resources Control Board.

SWRCB Permit means the SWRCB Domestic Water Supply Permit 68-43, as amended, which is incorporated herein by reference.

Term means the existing term of this Lease as more particularly described in Section 2.2 (Term) herein, including any duly authorized and executed extensions thereto, if any.

Water System has the meaning given in the Recitals.

Article 2 – Lease of Water System

2.1 **Lease.** City hereby leases to Lessee, and Lessee hereby leases from City, the Water System as described in Exhibit B. Except as specifically set forth in this Lease, the Water System is leased in an "as is" condition. City also grants a concession to Lessee to provide water service within the Service Area, and in connection therewith, to use, possess, operate, manage, Maintain, Repair, rehabilitate, expand, and improve the Water System in exchange for those Rates Lessee establishes in accordance with and pursuant to this Lease. In conveying this interest in governmental property to a private party, neither City nor any of its agents has made any representation or warranties with respect to the Water System except as specifically set forth in this Lease.

2.2 **Term.** The term of this Lease will commence on October 1, 2024_ ("**Effective Date**") and will continue for a period of 12 years, unless terminated earlier as otherwise provided in Article 6 herein ("**Term**"). Notwithstanding the foregoing, if mutually agreed, the Parties may extend the Term for an additional period of up to eight years, for a total Term of up to twenty years. For the Term to be extended, one of the Parties must provide written notice to the other Party requesting extension of the original Term no later than 180 days prior to expiration of the original Term, and subject to mutual agreement on the duration and conditions for any such extension, the Lease will be amended to so extend the Term.

2.3 **Use of Water System.** At all times during the Term, Lessee will use the Water System for the purpose of furnishing potable water service, including water service for fire protection, to all Customers in accordance with the applicable Operating Standards relating to service, subject to the provisions of this Lease. Provision of water from the Water System outside of the Service Area is prohibited unless authorized in writing in advance by the Director.

(A) *Property*. Lessee will not retire, sell, transfer, convey, dispose of, or encumber

any real property or personal property of the Water System without City's duly authorized prior written permission.

(B) *City's Right to Use*. City retains the full right to use or continue to use any portion(s) of the Water System, including easements, tanks, pump station, wells, buildings, and appurtenances, for any legal purpose which does not interfere with Lessee's use of the Water System to furnish water service to Customers.

(C) *Development.* City reserves the right to approve future developments to be served by the Water System subject to available water supply and applicable Laws, including the requirements of the SWRCB Permit and provisions of the SCVWD Contract. Notwithstanding the foregoing, all connections to the Water System required for future developments shall be performed by Lessee or by a contractor approved by Lessee at the sole expense of the developer. Lessee shall not be responsible or liable for any cost associated with such connections.

2.4 Title. City retains title to the Water System. Lessee will not own the Water System or any part thereof or any interest therein during the Term of this Lease, including ownership of any Capital Improvements made during the Term. Title to all Capital Improvements, improvements from Maintenance or Repair, or improvements installed for City-approved development made during the Term will vest in City upon acceptance by or beneficial use by City, whichever occurs first. No such vesting of title of any improvement will alter or limit Lessee's obligations for Repair and Maintenance of the Water System as set forth herein.

2.5 Compensation. As bargained-for consideration for the benefits it derives from this Lease, Lessee will pay the City the amounts set forth below. The Parties agree and acknowledge that the following payments to City are not levies imposed by City on Lessee in its governmental capacity, but rather voluntary payments as fair and reasonable compensation for a valuable interest in the Water System and the use of City's property and resources related to the Water System. The Parties further agree and acknowledge that the amounts to be paid pursuant to this Section were determined by a fair and competitive procurement process and good faith negotiation. The following payments will be legally incident on Lessee and the legal duty to pay will remain with Lessee regardless of how Lessee opts, in its sole discretion, to fund the payments.

(A) *Concession Fee*. Lessee will pay the City a one-time Concession Fee of $22,100,000 within 30 days following the Effective Date of this Lease. The

Concession Fee is consideration for Lessee's right to sell water from the Water System. Except as set out in Section 6.2 (Termination of Lease for Convenience), the Concession Fee is not a security deposit and is not refundable. The Concession Fee may be used to fund Capital Improvement Projects or for any other legal purposes the City desires.

(B) *Annual Investment Rent*. Upon the Effective Date and on each anniversary of the Effective Date each year thereafter during the Term, Lessee will pay to City as Annual Investment Rent, the sum of $1,800,000, subject to an annual adjustment based on the Construction Cost Index for the San Francisco Bay Area, applied on a cumulative basis (i.e., after the Effective Date, by adjusting the prior year's Annual Investment Rent). City will notify Lessee in writing at least 30 days prior to the date that the Annual Investment Rent is due of the adjusted amount pursuant to the Construction Cost Index, along with a calculation evidencing the adjusted amount. The Annual Investment Rent will be used, up to the amount recommended in the approved Capital Improvement Plan, to reimburse Lessee for the completion of City-approved Capital Improvement Projects, and excess amounts which have not been reimbursed to Lessee in any year will be carried forward to reimburse Capital Improvement Projects in the following year, in each case as further specified in Section 3.4 (Capital Improvements) and the Capital Improvements Plan. In the event that Lessee is due reimbursements to which the City agreed (in writing), were undisputed, due and payable, for Capital Improvement Projects from the previous year, the Annual Investment Rent will be reduced by any amount owing to Lessee for such Capital Improvement Projects in satisfaction of the amounts owing to Lessee and any remaining amount will be a debt due and payable from the City to Lessee.

(C) *Franchise Fee.* As consideration for the City's costs to administer this Lease, including the concession and franchise rights granted herein, Lessee will pay City an annual Franchise Fee, due the first year by November 1, 2025, and annually thereafter during the Term. The amount of the Franchise Fee will be equal to two percent of Lessee's annual gross receipts from Customers for the preceding year from the use, operation and possession of the Water System (with the total prorated for the final year of the Term if less than a 12-month period). The Parties agree that this constitutes fair and reasonable compensation for City administration of this Lease and the franchise conferred herein.

2.6 Net Lease. This Lease will be deemed and construed to be a "net lease" and Lessee

hereby agrees that the Annual Investment Rent is an absolute net return to City free and clear of any expenses, charges or setoffs other than as set forth in this Lease.

2.7 Taxes and Assessments. Lessee will pay all taxes, assessments, fees, levies, charges, license or permit fees and other governmental charges of any kind or nature which are levied, charged, assessed or imposed during the Term of this Lease upon or against the Water System or the groundwater or the leasehold estate created hereby or which may be imposed upon any taxable interest of Lessee acquired pursuant to the Lease. Without limiting the generality of the foregoing, Lessee acknowledges that this Lease may create a possessory interest which may be subject to property taxation and that Lessee may be subject to the payment of property taxes levied on such interest. Any such tax will be the sole responsibility of Lessee.

2.8 Liens and Encumbrances. Lessee agrees to keep the Water System free and clear of all liens, security interests and encumbrances except for those consented to in writing and duly authorized by City. Lessee agrees to promptly pay all amounts due for materials, parts, labor, water, power and other consumables and supplies furnished at Lessee's instance or request upon or to the Water System and to keep the Water System free and clear of all liens resulting from such payment obligations. Lessee agrees to require that any contractor performing work on City-owned property pursuant to a contract in excess of $25,000, will provide a payment bond in conformance with the requirements of Civil Code section 9550, as may be amended from time to time.

Article 3 – Operation of Water System

3.1 General. In addition to the requirements of this Lease, Lessee will operate the Water System in accordance with the Operating Standards. Lessee will, at its own expense, manage and operate the Water System and pay all costs and expenses of operating the Water System as specified herein, including, but not limited to, the costs of all water, utilities, Maintenance, Repair, and Capital Improvements, and all public charges, taxes and assessments of any nature whatsoever. City is not responsible for payment of any costs or expenses of any kind or character in connection with or related to the operation of or improvements to the Water System except and only to the extent as expressly set forth in this Lease (including,

but not limited to, City's payment and reimbursement obligations set forth in this Lease).

3.2 Maintenance. At all times during the Term, Lessee will Maintain the assets of the Water System in good working order consistent with the requirements of the current Maintenance Plan, and consistent with the Operating Standards. Within 10 days of the anniversary of the Effective Date each year, Lessee will submit proposed revisions, if any, to the Maintenance Plan for City's review and approval. If requested by City, Lessee must revise and resubmit the proposed revised Maintenance Plan within a reasonable time period after request, such period to be no less than 3 weeks, but not more than 6 weeks, unless mutually agreed upon otherwise. Upon approval by the Director, the revised Maintenance Plan will supersede any prior version. All Maintenance will be provided in accordance with the approved Maintenance Plan to ensure the Water System remains in good condition and at Lessee's sole expense. Maintenance work is not subject to reimbursement by City pursuant to Section 3.4 (Capital Improvements), below. However, Maintenance work is subject to the requirements of Section 3.4(F) (True-Up of Capital Improvement Reimbursements) pertaining to contractors.

3.3 Repair. Lessee is solely responsible at Lessee's sole expense for the prompt Repair of any assets of the Water System during the Term to ensure safe and effective operation of the Water System. If Lessee fails to effectuate any Repair on a timely basis, City reserves the right, but not the obligation, to have the Repair made at Lessee's expense, such amount to be based on the documented costs incurred by City. Repair work is not subject to reimbursement by City pursuant to Section 3.4 (Capital Improvements), below. However, Repair work is subject to the requirements of Section 3.4(G) (Contractors) pertaining to contractors.

3.4 Capital Improvements. Lessee will be responsible for Capital Improvements to be designed, constructed, and completed during the Term in accordance with the terms of this Lease and the Asset Management Plan, and as further specified in the current Capital Improvement Plan and as required by Laws. The parties may update the Asset Management Plan on an annual basis to reflect Capital Improvement Projects completed during the prior year and to reflect the current needs of the Water System or as otherwise set out in clause (B) below.

(A) *Capital Improvement Plan*. The Capital Improvement Plan in effect on the Effective Date of this Lease will include a five-year Capital Improvement Plan

approved by City, which also includes a list of Capital Improvement Projects which are to be prioritized for completion during the first three years of the Term. Within 10 days of the anniversary of the Effective Date each year, Lessee will submit proposed revisions (including in accordance with clause (B) below), if any, to the current five-year Capital Improvement Plan for City's review and approval, which approval shall not be withheld. Subject to clause (B) below, proposed revisions must be consistent with the current needs of the Water System, the Asset Management Plan, and the Operating Standards. If requested by City, Lessee must revise and resubmit the proposed revised Capital Improvement Plan within a reasonable time period after request, such period to be no less than 3 weeks, but not more than 6 weeks, unless mutually agreed upon otherwise.

(B) *Revisions to Capital Improvement Plan*. In the event that (i) unexpected Capital Improvement Projects become necessary or the required Capital Improvement Projects, which in either case, result in investments beyond the Annual Investment Rent being required, or (ii) Capital Improvement Projects are delayed due to an uninsurable Force Majeure Event, the existence of Hazardous Substances (other than caused by the negligence of Lessee) or City fault; or (iii) an uninsurable Force Majeure Event, the existence of Hazardous Substances or City fault occurs that has a material impact on the performance of Capital Improvements, then Lessee shall submit proposed revisions to the five-year Capital Improvement Plan together with adjustments to the Annual Investment Rent for City's review and approval, in its reasonable discretion. Upon approval by City, the revised Capital Improvement Plan will supersede any prior version. If the City does not approve, Section 6.6 (Dispute Resolution) will apply to resolve the form of Capital Improvement Plan to be complied with by Lessee. .

(C) *Minimum Annual Investment Rent.* Subject to reimbursement under Section 3.4(D) (Reimbursable Costs), each year during the Term, Lessee is solely responsible for investing a minimum of the Annual Investment Rent in construction of Capital Improvement Projects consistent with the requirements of the current Capital Improvement Plan.

(D) *Reimbursable Costs*. Lessee will be solely responsible for the cost to design, bid, and manage any Capital Improvement Project. However, provided that Lessee has fully complied with the requirements of this Lease as it relates to the Capital Improvement Project, including this Section, City will reimburse Lessee for Project Costs expended on approved Capital Improvement Projects as set forth below,

with the total annual reimbursement capped at the amount of the Annual Investment Rent paid by Lessee for that one-year period. City's reimbursement obligation will not exceed the amount recommended in the 2021 Memorandum with the Asset Management Plan and based on documented Project Costs for construction of the Capital Improvement Projects. In addition, City's reimbursement obligation is limited to City-approved Capital Improvement Projects that are completed in accordance with the requirements of this Lease and accepted by City.

(E) *Standards*. The design and construction of Capital Improvement Projects must be consistent with the requirements of this Lease, the Asset Management Plan, the Operating Standards, and Laws (in effect at the time of the Capital Improvement Project), and will provide a minimum design life of ten years for pumps, mechanical and electrical equipment, 40 years for above-ground buildings and structures, and 50 years for underground pipes and lines, measured, in each case, from City acceptance of the relevant Capital Improvement Project. The plans or design for any Capital Improvement Project is subject to the timely and reasonable review and approval by the Director pursuant to the authority set forth in Section 2.28.040 of the Cupertino Municipal Code, or as otherwise required for purposes of design immunity pursuant to Government Code section 830.6.

(F) *True-Up of Capital Improvement Reimbursements*. Following the completion of each Capital Improvement Project, Lessee and City will confer in good faith regarding any true-up of City's reimbursement obligation that may be necessary or appropriate based on the total Project Costs for each project, including for any increase in Project Costs due to City directed-change or City fault, the existence of Hazardous Substances (other than caused by the negligence of Lessee) impacting a Capital Improvement Project or uninsurable Force Majeure Events.

(G) *Contractors.* Lessee may contract with qualified, licensed design professionals or contractors for design and construction of Capital Improvement Projects or for Maintenance or Repairs. Lessee's contracts for construction must require that the contractor comply with Laws and must warranty its work for a period of at least one year following City's acceptance of the work. Lessee's contracts with design professionals and contractors must include requirements for insurance and indemnity that are satisfactory to the City's risk manager, which may include naming the City as an additional insured. Lessee is solely responsible for any such contracts, and any default by a contracting party will not relieve the

Lessee of its obligation to complete the Capital Improvements in accordance with this Lease.

(H) *Cost Estimates*. A minimum of 30 days prior to beginning any work on a Capital Improvement Project, Lessee will submit to the City an itemized schedule of anticipated Project Costs for each Capital Improvement Project for City review and approval.

(I) *Progress Meetings and Reports.* During construction of any Capital Improvement Projects, designated representatives for Lessee and City will participate in regularly scheduled construction progress meetings, as agreed upon between the Parties. At least five days before each such progress meeting, Lessee will provide City with a summary report for each such Capital Improvement Project regarding progress of construction, including payments to date as a percentage of the total project, the percentage of the project that is complete, and the following:

(1) updates regarding estimated and actual Project Costs;

(2) update and narrative with respect to progress schedules;

(3) overview of the work currently being performed;

(4) narrative of any expected upcoming issues or changes in the design; and

(5) an updated list of any outstanding issues and action items.

(J) *Lessee's Responsibilities*. Lessee is solely responsible for obtaining or providing all necessary services in connection with planning, design, direction, inspection, and supervision for each Capital Improvement Project, all necessary permits from applicable regulatory agencies (including City permits), for providing all materials, supplies, and equipment required for the completion, start-up, testing, commissioning, and performance of each Capital Improvement Project. Lessee is solely responsible for ensuring that all Capital Improvement Projects are constructed in compliance with applicable Laws, including prevailing wage and payment bond requirements. CEQA and NEPA approval documentation will be prepared by the Lessee. All Soft Costs for preparation of CEQA / NEPA

documentation shall be reimbursable and not subject to the 24% cap of Hard Costs as provided in the definition of Soft Costs.

(K) *Documents*. Within 30 days following completion of each Capital Improvement Project, Lessee will provide to City, in electronic form, and make available for review by City, a set of "as-built" plans for each Capital Improvement Project completed; all manuals required for operation and maintenance of the components of the Capital Improvement Project; and copies of warranties issued by the manufacturer of the equipment and materials installed as part of the Capital Improvement Project.

(L) *Invoicing*. Lessee must submit detailed monthly invoices to City for reimbursement for eligible Project Costs it has incurred for work completed during the preceding month on Capital Improvement Projects pursuant to this Section. Upon request by City, Lessee will promptly provide documentation to substantiate any of the costs for which it seeks reimbursement. The City will make payments on all undisputed amounts within 30 days after receiving a detailed invoice and any requested documentation. Within such 30 days period after receipt of a detailed invoice, if City disputes all or any portion of the invoice, City shall promptly provide Lessee reasonably detailed reason(s) for any disputed portions of such invoice and withhold the disputed amount, and Section 6.6 (Dispute Resolution) shall apply.

3.5 SWRCB Permit. Lessee is responsible for compliance with the terms of the SWRCB Permit and administration of the SWRCB Permit.

3.6 Customer Services. Lessee is solely responsible for satisfying all Customer service obligations associated with Lessee's provision of water service as set forth herein and consistent with the Operating Standards.

(A) *General Requirements.* Lessee's Customer service obligations include, but are not limited to, issuing detailed billing statements to all Customers for services provided; payment processing; responding to Customer inquiries on water service, bills, leaks or other concerns; collecting payments; processing applications for new or transfer of service; collection of Customer deposits for new service; collection of construction meter deposits; and investigation of Customer complaints.

(B) *Drought Education.* Lessee will provide ongoing drought education, by providing billing inserts about water conservation during drought, holding water conservation workshops and any other mutually agreed upon activities, to Customers consistent with Lessee's standard drought education programs provided to similarly situated customers and will enforce drought-related restrictions on water use as required by Laws or recommendations of SCVWD, including any City-wide requirements imposed by the City acting in its governmental capacity. Lessee will submit an annual written report on drought education to City within 10 days of the anniversary of the Effective Date for each year during the Term. The report must summarize Lessee's efforts to educate Customers and to enforce any applicable drought- related restrictions. The annual report must illustrate the effectiveness of Lessee's efforts in one or more summary tables or graphs showing the change in annual water use by residential and by commercial Customers.

(C) *Confidentiality.* Lessee will use all commercially reasonable efforts to keep all Customer information confidential, whether received from City or developed during the Term, and in compliance with Laws.

3.7 Emergency Services. Lessee is solely responsible for maintaining 24-hour on-call responses to emergency calls or Customer inquiries; providing an emergency or natural disaster operations plan; maintaining an emergency communications system; providing or having immediate access to equipment required to perform emergency repair work to vital Water System equipment and water mains, including providing emergency backup generator at the Mann Pumping station or anywhere else that may be needed to ensure uninterrupted delivery of potable water to Customers.

3.8 Water Quality Testing. Lessee is solely responsible for performing or causing to be performed by a laboratory certified by the State, any and all water sampling, analysis, testing and reporting as required by Laws governing water sources, distribution mains or Customer premises, including Laws of the U.S. Environmental Protection Agency, State Department of Health Services and Office of Drinking Water, and the County Environmental Health Department. This obligation includes, but is not limited to: scheduling and collecting water samples to test for microbiological, inorganic and organic constituents; transportation to certified lab; preparation of monitoring plans; sample collection training; reporting to appropriate regulator(s); record keeping; analysis interpretation; special or

emergency sample collection and analysis; emergency notification to affected Customers, if required; preparation and distribution of any and all published and distributed Customer reports on water quality; management of a cross-control program; new well or water source sampling and analysis; response to Customer inquiries on water quality issues; conducting annual system survey with State Department of Health Services; obtaining permits and compliance with any air district with jurisdiction over the Water System; providing hazardous materials control program, and ensuring any required operator certification is in compliance with Laws.

3.9 Other Services. Lessee is solely responsible, at its own expense, for implementing any City, County, SCVWD, State or federal water conservation program as established by mandate or law during the term; maintaining distribution system maps and plat maps; preparing any required urban water management plans; and in general, doing all such acts and performing all such services as required to operate the Water System as required by this Lease. All maps, plans and records required by this Section and/or through the operation, Maintenance and improvement of the Water System will be transmitted to City at a minimum frequency as specified in Section 3.10 (Reports).

3.10 Reports. In addition to the reporting requirements specified elsewhere in this Lease, including for Capital Improvement Projects set forth in Section 3.4 (Capital Improvements), Lessee will provide City with written reports related to Lessee's operation of the Water System, as specified herein.

(A) *Annual Summaries.* Each year during the Term, within 10 days of the anniversary of the Effective Date, Lessee will submit summary reports regarding activities during the preceding year, for the following:

(1) Annual Operations Report: General status of overall operation, expenditures and revenue of the Water System including priority needs and concerns.

(2) Annual Maintenance Report: Maintenance completed, in progress, and scheduled, including compliance with the current Maintenance Plan.

(3) Annual Repair Report: Repairs completed, in progress, and needed.

(4) Annual Report on Capital Improvement Projects: Capital Improvement Projects planned, in progress, and completed, including compliance with the current Capital Improvement Plan.

(5) Annual Report on Developer-funded Expansions to Water System: Summarize status of all developer-funded expansions to the Water System, including percentage of completion and pertinent comments relative to the project.

(6) Annual Customer Service Report: List Customer service requests and complaints, including the number of calls received by issue (e.g., general, lack of water, billing, water quality, etc.) and resolution of each such Customer request or complaint.

(7) Annual Water Quality Report: Water quality analysis of microbiological testing, including quantity of water delivered to all Customer types, quantity of water delivered from SCVWD, quantity of water delivered from each well site, estimated annual amount of Water System loss, number of water quality tests completed, number of water quality samples testing positive for coliform and action taken, results of annual water quality tests for all constituents tested and action taken for any constituent testing out of range.

(B) *Periodically*. In addition to any other reporting requirement set forth herein, Lessee will provide any additional report or information that is reasonably requested by City to ensure operation and Maintenance of the Water System in compliance with this Lease. Any water quality testing positive for coliform or constituent exceeding testing range is to be immediately reported to the City.

(C) *End of Term.* Within 30 days following expiration of the Term or early termination of the Lease, whichever occurs first, Lessee will provide City with an updated version of all of the annual reports specified above. This provision will survive expiration or termination of the Lease.

3.11 Hazardous Substances.

(A) *Release of Hazardous Substances.* Lessee will not cause or permit to occur any release, generation, manufacture, storage, treatment, transportation, or disposal

of Hazardous Substance on, in, under, or from the Water System or the groundwater or any portion of it in violation of Laws. If Lessee does cause any release or disposal of any Hazardous Substance on, in, or under the Water System or any portion of it, Lessee, at its own cost and expense, will immediately take such action as is necessary to detain the spread of and remove the Hazardous Substance as required by applicable Law. Lessee will promptly notify City of any release or disposal (of which Lessee has knowledge) of any Hazardous Substance on, in, under or from the Water System or the groundwater. If Hazardous Substances other than those caused or released by Lessee exist or occur on, in, under or from the Water System or the groundwater, Lessee shall not be responsible for the costs of any action to address, remediate, characterize, remove, treat, dispose, transport or handle such Hazardous Substances and the costs thereof shall be reimbursed to Lessee from City or deducted from any amounts owing from Lessee to City. Lessee is responsible for ensuring all water delivered from the water system is free of Hazardous Substances

(B) *Indemnity*. Lessee will indemnify, defend with counsel acceptable to City and hold harmless City and its officers, agents and employees (each such person and entity being referred to as an "Indemnified Person") from and against all losses, liabilities, obligations, penalties, claims, litigation, demands, defenses, costs, judgments, suits, proceedings, damages (including consequential damages), disbursements or expenses of any kind (including attorneys' and experts' fees and expenses and fees and expenses incurred in investigating, defending, or prosecuting any litigation, claims, or proceeding) that may at any time be imposed upon, incurred by, asserted, or awarded against City in connection with or arising from or out of: (1) any Hazardous Substance, on, in, under, or affecting all or any portion of the Water System or the groundwater caused or released by Lessee, excluding any unknown pre-existing Hazardous Substance or any Hazardous Substance released, generated or disposed by City; (2) any material breach of any covenant or agreement of Lessee contained or referred to in this Section relating to Hazardous Substances for which Lessee is responsible under this Lease; (3) any violation or claim of violation by Lessee of any Laws; or (4) the imposition of any lien for the recovery of any costs for environmental cleanup or other response costs relating to the release or threatened release of Hazardous Substance, excluding any unknown pre-existing Hazardous Substance or any Hazardous Substance released, generated or disposed by City. The expiration or termination of this Lease and/or the termination of Lessee's right to possession will not relieve Lessee from liability under any indemnity provisions of this Lease as to matters occurring

or accruing during the Term by reason of Lessee's occupancy of the Water System and the groundwater.

3.12 Water Supply. The Water System is supplied with water pursuant to the SCVWD Contract. Lessee will not modify or take water supply wells serving the Water System out of permanent service without the express written permission of the Director. Lessee will purchase water pursuant to and comply with requirements of the SCVWD Contract and will immediately notify City if any provision of the SCVWD Contract is violated by Lessee.

3.13 City Access. City and City's agents have the right to enter the Water System at any time in the case of an emergency, and otherwise at reasonable times and on reasonable prior notice for the following purposes: (i) to determine whether the Water System is in the condition as required by this Lease and whether Lessee is complying with its obligations under this Lease, (ii) to serve, post, or keep posted any notices required or allowed by Laws or under this Lease, and (iii) as City may otherwise reasonably deem necessary. In connection with any City access, City shall (i) comply with Lessee's reasonable safety rules, (ii) not unreasonably interfere with or adversely impact Lessee's operations, Maintenance, Repair or Capital Improvement Project activities; and (iii) be liable for any damage to the Water System arising out of such access or City actions.

3.14 City Inspection and Oversight. Lessee, upon written request of City or City's agent providing reasonable notice, will permit City or City's agent to conduct a comprehensive inspection of the Water System, including, but not limited to, field inspections; Maintenance and Repair records and reports; Customer complaint records; and Capital Improvement Projects, schedules, and plans, in order to assess the condition of the Water System. In connection with any City inspection and oversight, City shall (i) comply with Lessee's reasonable safety rules, (ii) not unreasonably interfere with or adversely impact Lessee's operations, Maintenance, Repair or Capital Improvement Project activities; and (iii) be liable for any damage to the Water System arising out of such access or City actions.

Article 4 – Customer Rates and Billing

4.1 Customer Rates. Lessee, in its sole and exclusive discretion, will be responsible for setting, levying, and providing notice of any and all of the Rates that Lessee will require for water service to be delivered to the Customers. Notwithstanding

the foregoing, City reserves the right to impose and collect fees for new or expanded water service connections on the Water System, including connection fees and development impact fees.

(A) *Regulatory Cap*. The Rates levied by Lessee on Customers must not exceed the lowest cumulative rates, surcharges, surcredits and other service charges or fees and penalties approved and/or authorized by the CPUC and in effect on Lessee's CPUC regulated water system located in the City ("**Regulatory Cap**"). The Parties agree that this Regulatory Cap affords Lessee with sufficient flexibility to establish Rates while ensuring the Customers are subject to just, reasonable, and nondiscriminatory Rates. The Regulatory Cap does not include the "Surcharge to Fund Public Utilities Commission Reimbursement Fee," an administrative fee imposed by the CPUC tariffed systems.

(B) *Modifications*. Lessee will notify City of any proposed modifications to Lessee's Rates at least 30 days prior to their effective date and provide documentation to demonstrate that the proposed Rates will be at or below the Regulatory Cap.

(C) *Compliance*. City, acting in its regulatory capacity, may confirm that Lessee is in compliance with this Article. In the event of a discrepancy, City may request additional information for clarification, which Lessee must provide within 15 business days. If, in City's reasonable determination, Lessee's Rates exceed the Regulatory Cap and Lessee cannot demonstrate that its Rates are in compliance, City may direct Lessee to revise its Rates to achieve compliance with this Article, and to further require that Lessee provide a refund and/or credit to Customers equal to the difference between the Rates charged and the revised Rates.

(D) *City's Rights*. Provided that Lessee is in material compliance with this Article, City will have no authority or obligation to impose, set, modify, approve, or provide notice of the Rates levied by Lessee on Customers. Notwithstanding the foregoing, the City reserves the right to impose and collect fees for new or expanded water service connections on the Water System such as connection fees and development impact fees.

(E) *CPUC Orders*. If the rates used to establish the Regulatory Cap are reduced or increased by order of the CPUC, Lessee will reduce or increase its Rates consistent with the CPUC order.

(F) *City's Facilities*. No charge will be made for water delivered to fire department facilities or for firefighting activities in the City. All other City properties using water service will be charged the same Rates as other Customers.

(G) *Water Rationing*. In the event of mandatory water rationing imposed by Laws, Lessee will impose water conservation measures or mandatory water rationing on its Customers and, if required by Laws, will provide timely education and if needed, proactively assess penalties on Customers that violate such Laws.

4.2 Customer Billing and Collections. Lessee is solely responsible for submitting billing statements to and collecting all Rates and taxes from Customers for water received through the Water System. Lessee may propose payment and credit rules substantially similar to those imposed on customers of its CPUC-regulated tariffed water system in the City. City will have no responsibility for billing or collecting Rates from Customers. Lessee will retain the proceeds from all Rates for water services provided during the Term of the Lease.

(A) *Utility Users Tax*. Notwithstanding the foregoing, at all times during the Term, Lessee will, at its sole expense, bill and collect from Customers on behalf of City any additional amounts which City, in its regulatory capacity, may assess as a utility users tax on any Customers and will promptly pay all such amounts to City.

(B) *Unpaid or Delinquent Accounts*. Lessee is solely responsible for the collection of unpaid or delinquent Customer accounts, at Lessee's sole expense. City will have no responsibility for collection of unpaid or delinquent Customer accounts.

(C) *Transition Periods.* With respect to Customer payments for water services provided prior to the Effective Date of the Lease, Lessee will cooperate with City to determine the amount payable to the prior lessee pursuant to the 1997 Lease and will promptly tender payment of that amount as specified by the Director. With respect to payments due for water services provided prior to expiration or termination of the Lease, Lessee will cooperate with City to determine the amount payable for such services prior to expiration or termination of the Lease, and the Director will arrange for payment of that sum to Lessee.

(D) *Survival.* The provisions of this Section will survive expiration or

termination of the Lease.

Article 5 – Insurance and Indemnity

5.1 Insurance. During the Term of this Lease, Lessee, at its own cost and expense, will maintain insurance, issued by a carrier or carriers acceptable to City, as set forth in this Section.

(A) *Policies and Limits.* The following insurance policies and limits are required for this Lease:

(1) *Commercial General Liability ("**CGL**").* Commercial general liability insurance in the single limit amount of not less than $10,000,000 which amount may be satisfied by any excess liability insurance carried by Lessee, written on an occurrence basis. Such insurance shall include coverage for injury (including death) or damage to persons and/or property arising out of the operations of Lessee pursuant to this Lease. The policy will include coverage for liability assumed under this Lease for personal injury, property damage and all other insurable claims as an "insured contract" for the performance of Lessee's indemnity obligations under this Lease.

(2) *Workers' Compensation Insurance*. Workers' compensation insurance, or a certificate of self-insurance, insuring against liability under the Workers' Compensation Insurance and Safety Act now in force in the State, or any act hereafter enacted as an amendment or supplement thereto or in lieu thereof. Such insurance will fully cover all persons employed by Lessee in connection with its operations under this Lease for claims of death or bodily injury arising in connection with their employment by Lessee pursuant to its operations under this Lease.

(3) *Automobile Liability Insurance*. Automobile (vehicle) liability insurance on an occurrence basis for bodily injury and/or property damage in a single limit amount of not less than $2,000,000.

(4) *Pollution Liability Insurance*. Pollution liability insurance on a claims made basis, providing coverage of at least $2,000,000 for all liability arising out of sudden, accidental and gradual pollution and remediation, and loss

arising out of claims for bodily injury, death, property damage, or environmental damage caused by pollution conditions.

(5) *Cyber Liability Insurance*. Cyber liability insurance with limits of at least $2,000,000 per occurrence. Coverage must be sufficiently broad to respond to the duties and obligations of Lessee under this Lease, including, but not limited to, claims involving infringement of intellectual property, including infringement of copyright, trademark, trade dress, invasion of privacy violations, information theft, damage to or destruction of electronic information, release of private information, alteration of electronic information, extortion, and network security. The policy must provide coverage for breach response costs as well as regulatory fines and penalties, and credit monitoring expenses with limits sufficient to respond to these obligations.

(B) *Endorsement*. Lessee's CGL policy, automobile liability policy, pollution liability policy, and cyber liability policy must contain an endorsement in favor of City and its officers, agents and employees listing them as additional insureds.

(C) *Review*. The Parties will periodically review the required insurance for the purpose of mutually agreeing on increases in the minimum limits, which may be reasonable and customary for similar facilities of like size and operation.

(D) *Insurers*. All insurance must be affected under policies issued by insurers of recognized responsibility, licensed or permitted to do business in the State, and with an AM Best rating of A.VII or otherwise as mutually agreed between the parties.

(E) *Cancellation or Changes*. All policies of insurance issued by the respective insurers must provide that such policies will not be canceled or materially changed without at least 30 days' prior written notice to Lessee and to City. Evidence of all renewed or new policies, together with evidence of payment, will likewise be deposited with City prior to expiration dates of expiring or non- renewed policies.

(F) *Minimum Limits*. The limits of insurance required by this Lease or as carried by Lessee will not limit the liability of Lessee nor relieve Lessee of any obligation under this Lease.

(G) *Waiver of Subrogation*. Lessee will cause the general liability and worker's compensation insurance policies obtained by it to provide that the insurance company waives all rights of recovery by way of subrogation against City in connection with any damage covered by any policy.

5.2 Indemnity. To the full extent permitted by Laws, Lessee will indemnify, defend with counsel proposed by Lessee and acceptable to City, and hold harmless the Indemnified Parties from and against all liability, loss, claims, obligations, penalties, demands, suits, litigation, legal or administrative proceedings, defenses, proceedings, judgments, damages (including consequential damages), expenses, costs (including, without limitation, reasonable attorneys' fees and all costs and fees of litigation and its threat) of any kind or nature, including any challenge to the validity of this Lease or any portions thereof (collectively, "**Liability**") to the extent arising out of or in connection with Lessee's negligent acts or omissions or willful breach of this Lease during the Term in relation to this Lease, including, but not limited to, Liability arising from any failure by Lessee to comply with Laws or the requirements of this Lease. In the event that Liability is caused in whole or in part by the concurrent negligent or intentional wrongful acts or omissions of an Indemnified Party, then this obligation to indemnify shall be comparative and each Party shall indemnify the other to the extent that such Party's negligent or intentional wrongful acts or omissions were the cause of such Liability. The obligations in this Section will survive expiration or termination of this Lease with respect to any Liability arising during the Term of the Lease. If this Lease or any portion hereof is declared invalid, each Party waives any claim it may have against the other in connection therewith.

Article 6 – Default, Termination, and Expiration

6.1 Default. If City determines that Lessee is in default of any of the material provisions of this Lease, City will notify Lessee in writing of the default and afford Lessee a reasonable opportunity to cure the default unless immediate action is required due to an emergency that threatens imminent danger or injury or death to persons or damage or destruction of property.

(A) *Default*. The occurrence of any of the following constitute a default by Lessee:

(1) If Lessee fails to operate, Maintain, or Repair the Water System or any portions thereof in accordance with this Lease, where such failure continues, or Lessee has not diligently commenced reasonable steps to cure such failure for 14 days following receipt of written notice from City specifying the failure or such other time specified in the written notice.

(2) If Lessee fails to make any payment to City or to any third party required by this Lease as and when due, where such failure continues for 60 days following receipt of written notice from City specifying the failure.

(3) If Lessee fails to obtain and maintain any insurance coverage required by this Lease, where such failure continues for seven days following receipt of written notice from City specifying the failure.

(4) If Lessee materially breaches or fails to perform any of its other covenants or agreements in this Lease, where such breach or failure continues, or Lessee has not diligently commenced reasonable steps to cure such failure, for 14 days following receipt of written notice from City specifying the failure or such other time specified in the written notice.

(5) Lessee's financial capacity to operate the Water system is impaired in any of the following manners: (a) Lessee is or becomes bankrupt or insolvent or makes any general arrangement or assignment for the benefit of creditors; (b) Lessee becomes a "debtor" as defined in 11 U.S.C. section 101 or any successor statute thereto (unless, in the case of a petition filed against Lessee, the same is dismissed within 90 days); (c) a trustee or receiver is appointed to take possession of substantially all of Lessee's assets or of Lessee's interest in this Lease and possession is not restored to Lessee within 60 days; or (d) if a writ of attachment or execution is levied on, or there is a judicial seizure of, substantially all of Lessee's assets or of Lessee's interest in this Lease and such seizure is not discharged within 60 days.

(B) *Notice and Cure*. Upon receipt of written notice of default from City, if Lessee's default is not cured or Lessee has not diligently commenced reasonable steps to cure the default within the time period specified in such written notice of default, then City may at its option, avail itself of any remedies listed below, which are non-exclusive and cumulative with any remedies now or later allowed by Laws or provided for elsewhere in this Lease:

(1) *City's Right to Cure Lessee's Default*. In the event of a default by Lessee, if Lessee is not taking prompt and reasonable efforts to cure the default, following the time specified in the written notice to Lessee, City may elect to cure the default at Lessee's cost, provided that Lessee has not provided City notice that it will need additional time to cure the default, unless immediate action is necessary to ensure uninterrupted operation of the Water System. Lessee will promptly reimburse City for its costs.

(2) *Emergency Corrective Action*. Notwithstanding any provision of this Section to the contrary, if a default or failure to perform by Lessee poses an immediate threat to public health, safety, or property, City will notify Lessee, and if Lessee fails to take corrective action within the time specified in such notice, City may take all necessary action at Lessee's expense, including Maintenance of or Repairs to the Water System or portions thereof. Lessee will promptly reimburse City for its costs.

(3) *Lessee's Right to Possession Not Terminated*. In the event of a default by Lessee, if Lessee is not taking prompt and reasonable efforts to cure the default, following the time specified in the written notice to Lessee (which shall be no less than the time periods set forth in Section 6.1(A) (Default)), City may take control of the Water System and relet the Water System and the groundwater, or any part of it, to third parties on Lessee's account. Lessee will be liable immediately to City for all reasonable costs City incurs in reletting the Water System and the groundwater. Reletting may be for a period shorter or longer than the remaining Term of this Lease. Lessee will pay to City any amounts due under this Lease on the dates such amounts are due, less the rent or other amounts City receives from any reletting. No act by City allowed by this paragraph will terminate this Lease unless City notifies Lessee that City elects to terminate this Lease.

(4) *Termination of Lessee's Right to Possession*. In the event of a default by Lessee, if Lessee is not taking prompt and reasonable efforts to cure the default, following the time specified in the written notice to Lessee (which shall be no less than the time periods set forth in Section 6.1(A) (Default)), City may elect to terminate Lessee's right to possession of the Water System and the groundwater. No act by City other than giving formal written notice to Lessee pursuant to this paragraph will terminate this Lease. Acts of Maintenance, efforts to relet the Water System and the groundwater or

the appointment of a receiver on City's initiative to protect City's interest under this Lease (other than the appointment of a receiver to perform all of Lessee's obligations hereunder) will not constitute a termination of Lessee's right to possession. On termination, City has the right to recover from Lessee any amount necessary to compensate City for all actual damages directly caused by Lessee's default.

(5) *Interest on Past Due Amounts.*

(i) If City, at any time, by reason of Lessee's default, pays any sum or does any act that requires the payment of any sum, the sum paid by City will be due immediately from Lessee to City at the time the sum is paid, and if not paid within 15 days of notice, will bear interest at the rate of the 90-Day AA Financial Commercial Paper Interest Rate, from the date the sum is paid by City until City is reimbursed by Lessee.

(ii) If payment of any undisputed amount from City to Lessee is made after the 30th day following the proper submission of an undisputed and properly completed invoice, then payment shall include interest on the amount owing, at the rate of the 90-Day AA Financial Commercial Paper Interest Rate, from the 30th day after the payment was due until the date of payment.

(6) *Survival.* The provisions of this Section will survive expiration or termination of the Lease.

(7) *Consequential Damages*. To the fullest extent permitted by applicable laws, except as otherwise specified in this Lease and excluding claims associated with patent infringement or intentional breach of confidentiality requirements, neither Party shall be liable to the other Party for punitive damages or Consequential Damages.

(8) *Limitation of Liability*. Notwithstanding anything else to the contrary herein, Lessee's aggregate liability under this Lease to the City shall not exceed an amount equal to the Annual Investment Rent in the prior 12 month period.

6.2 Termination of Lease for Convenience. The City may terminate the Lease for convenience prior to the expiration of the Lease upon ninety (90) days written notice to the Lessee. The amount of Lessee's payment obligations with respect to the Annual Investment Rent, pursuant to Section 2.5(B) (Annual Investment Rent), and Franchise Fee, pursuant to Section 2.5(C) (Franchise Fee) will be prorated based on the effective date of the termination for convenience. Following a termination of the Lease for convenience, City shall pay to Lessee all pro-rated amounts (including a pro-rated reimbursement of the Concession Fee based on the remaining term of the 12-year initial term of the Lease) owing under the Lease at the time of such termination for convenience. Lessee shall also be entitled to compensation for all work performed on or prior to the effective date of the termination for convenience, including work on Capital Improvement Projects. Lessee's obligations under the terms of this Lease, including any amendments hereto, will remain in full force and effect through the effective date of the termination, unless otherwise specified in the termination notice.

6.3 Termination by Lessee. Lessee shall have the right to terminate this Lease for cause, by declaring a breach should City fail to comply with any material provisions of this Lease. City shall be deemed in breach of this Lease if it fails to comply with any material provision of the Lease, including but not limited to failure to make payments in accordance with the Lease. Lessee shall provide City with reasonably prompt written notice setting forth in sufficient detail the reasons for the written notice declaring it believes that a breach has occurred. City shall have thirty (30) calendar days from receipt of the written notice declaring the breach (or such longer period as the Lessee may grant in writing) within which to cure the alleged breach or such longer period determined by Lessee if the breach is not curable within that time period. Upon such termination, Lessee shall be entitled to receive payment for work executed, and reasonable costs incurred by reason of such termination on the same basis as for a termination for convenience.

6.4 Surrender Upon Expiration or Termination. Upon expiration or termination of the Lease, Lessee agrees that it will surrender to City the Water System in in a state of repair that is consistent with the applicable Operating Standards. Within 30 days following expiration or termination of the Lease, Lessee will provide City with an updated Water System map (ArcGIS or equivalent), the accuracy of which Lessee cannot provide verification to the extent information was or is provided by City or third parties or to the extent of changes of such information with the passage of time, showing spatial location of all surface and subsurface assets

including all asset types, age, diameter and to the extent known by Lessee. This Section will survive expiration or termination of the Lease.

6.5 Transition Period. Lessee will reasonably cooperate with, and not take any affirmative actions to hinder in any way, City's efforts to operate, lease, or sell the Water System. All records required under this Lease will be made current by the Lessee at the frequency previously defined or as reasonably requested by City. All Customer billing information will be kept current and provided to City during the last 12 months of the Term.

6.6 Dispute Resolution. If a dispute, controversy, or claim arising out of or relating to this Lease, including its formation, validity, binding effect, interpretation, performance, breach, or termination (a "**Dispute**") arises between the Parties regarding interpretation or implementation of the terms and conditions of this Lease, including the exhibits hereto, the representatives of the Parties who have primary responsibility for operation of the Water System and administration of this Lease will engage in best efforts to resolve the Dispute informally. If the Parties are unable to resolve a Dispute informally, the Party seeking redress may submit an informal written claim to the City, specifying the nature of the claim, the applicable Lease provisions, a summary narrative of the events leading to the claim, and the remedy sought to resolve the claim. Within 30 days thereafter, the Director will arrange to meet and confer in person or by videoconference with Lessee, in a further attempt to informally resolve the claim. If, within 30 days following the initial attempt to meet and confer, the claim is not resolved, the Parties agree to submit the Dispute to mediation with an experienced third-party neutral in an effort to resolve the claim by compromise, with each Party to share equally in the mediator's fees and each Party to bear its own legal fees, if any. City and Lessee will mutually agree to a mediator selected in accordance with the Commercial Mediation Rules of the American Arbitration Association ("AAA"). Mediation will be scheduled to ensure the mutual availability of the selected mediator and all of the individuals that each Party requires to represent its interests. The Parties will share the costs of the mediation equally. Good faith compliance with the informal Dispute resolution provisions set forth in this Section is a condition precedent to filing a claim pursuant to the California Government Code or to otherwise initiating legal proceedings with regard to the Dispute. The provisions of this Section will survive expiration or termination of the Lease.

Article 7 – Miscellaneous Provisions

7.1 Recitals. The Parties agree that the recitals to this Lease are true and correct and are hereby made part of this Lease.

7.2 Notice. Any notice required by or given pursuant to the Lease, including notice of any changes to the contact information in this Section, must be in writing and sent to the other Party by U.S. Mail or a reliable overnight delivery service, with postage prepaid and return receipt requested. For the convenience of the Parties, copies of Notices may also be given by email to the email address given below. Notice is deemed effective on the date of delivery shown on the receipt or date of delivery of the email. A copy of any notice given to the City must also include simultaneous transmission of a PDF copy of the notice to the Director. Notice for each Party must be given as follows, unless a different address is later designated for such purpose by written notice to the other Party:

City: City of Cupertino, City Clerk
10300 Torre Avenue
Cupertino, CA 95014
Email: cityclerk@cupertino.gov

Copy to: Director of Public Works (via email)

Lessee: San Jose Water Company
Attention: John Tang
110 W. Taylor Street
San Jose, CA 95110
408-279-7933
Email: John.tang@sjwater.com

7.3 Compliance with Laws. Except as otherwise provided in this Lease, Lessee will, at Lessee's sole cost and expense, diligently and in a timely manner, comply in all material respects with all Laws. Lessee shall notify City in writing (with copies of any documents involved) of any threatened or actual claim, notice, inquiry, citation, warning, complaint or report with respect to which it obtains knowledge pertaining to or involving any alleged failure by Lessee to comply with any Laws in its operation of the Water System.

7.4 Nondiscrimination. Discrimination against or segregation of any person or group of persons in the leasing, transferring, use, or enjoyment of the Water System, on account of sex, race, color, creed, national origin, ancestry, religion, citizenship status, age, marital status, medical condition, mental or physical disability, sexual orientation, veteran status or any other characteristic protected by Laws is strictly prohibited. Lessee must comply with all applicable Laws prohibiting discrimination. Lessee cannot establish or permit any practice of discrimination or segregation.

7.5 Force Majeure.

(A) *Force Majeure Event*. Lessee's obligations under this Lease will be suspended only to the extent that and only for the duration in which the performance of its obligations is prevented or hindered by acts of nature; war; epidemic or pandemic; riots; civil insurrection; acts of civil or military authority taken to protect public health and safety; fires; floods; earthquakes or other natural phenomena; labor strikes, accidents or incidents; change in law or standards; or other cause of the same or other character which are beyond the reasonable control of Lessee ("**Force Majeure Event**").

(B) *Notice*. In the event of a suspension due to a Force Majeure Event, Lessee will promptly notify the City in writing of such suspension and the cause and estimated duration of such suspension. Lessee will be excused from fulfilling its obligations under the Lease only to the extent that the Force Majeure Event has prevented Lessee from fulfilling its obligations, and only until such time that the Force Majeure Event has ceased to prevent performance or other remedial action is taken, at which time Lessee will promptly notify City in writing of the resumption of its obligations under this Lease. If Lessee is unable to fulfill any of its obligations by reason of a Force Majeure Event, Lessee will exercise due diligence to reasonably remove such inability within a reasonable time period and to mitigate the effects of the Force Majeure Event. The relief from performance will be of no greater scope and of no longer duration than is required by the Force Majeure Event.

7.6 Assignment. Lessee may not assign its rights or obligations under this Lease, in part or in whole, or sublet the Water System or any portion thereof, without City's written consent. City agrees to provide consent where such assignment relates to an upstream reorganization or transfer of direct or indirect interests in Lessee so

long as no change occurs in the entity with ultimate power to direct or control or cause the direction or control of the management of Lessee.

7.7 Governing Law and Venue. This Lease will be governed by California law and venue will be in the Santa Clara County Superior Court, and no other place. Lessee waives any right it may have pursuant to Code of Civil Procedure section 394, to file a motion to transfer any action arising from or relating to this Lease to a venue outside of the County.

7.8 Waiver. City's waiver of a breach by Lessee of any term, covenant or condition contained in or granted by this Lease will not operate as a waiver of any subsequent breach of the same or any other term, covenant or condition hereof.

7.9 Integration. This Lease, including the exhibits hereto, which are incorporated by this reference, constitute the final, complete, and exclusive terms of the agreement between the Parties with respect to the Lease of the Water System, and supersede all other oral or written provisions.

7.10 Amendment. No amendment or modification of this Lease or any of the exhibits hereto will be binding unless it is in a writing duly authorized and signed by the Parties. Any amendment to the Term or to the provisions of Section 2.5 (Compensation) are subject to City Council approval, with the exception of annual adjustments to the Annual Investment Rent. Amendments to the Capital Improvement Plan, Maintenance Plan, and update of Asset Management Plan are subject to approval by the City's Director without further City Council approval.

7.11 Interpretation. The terms of this Lease have been negotiated by the Parties and the language used in this Lease will be deemed to be the language chosen by the Parties to express their mutual intent. This Lease will be construed without regard to any presumption or rule requiring construction against the Party causing such instrument or any portion thereof to be drafted, or in favor of the Party receiving a particular benefit under this Lease.

7.12 Severability. If any provision of this Lease is held to be illegal, invalid, or unenforceable, in part or in whole, such provision or portion thereof will be excluded from the Lease and the remaining provisions of the Lease will remain in full force and effect.

7.13 Execution in Counterparts. This Lease may be executed in any number of counterparts, each of which will be an original, but all of which together will constitute one instrument.

7.14 Authorization. Each individual signing below warrants that he or she is authorized to do so by the Party that he or she represents, and that this Lease is legally binding on that Party. If Lessee is a corporation, signatures from two officers of the corporation are required pursuant to Corporations Code section 313.

[*Signature page follows*]

The Parties agree to this Lease as witnessed by the signatures below.

CITY OF CUPERTINO

By: _____ Date: _____
Pamela Wu, City Manager

ATTEST:

By: _____ Date: _____
Kirsten Squarcia, MMC, City Clerk

APPROVED AS TO FORM:

By: _____ Date: _____
Christopher Jensen, City Attorney

LESSEE: _____

By: _____ Date: _____
<Name>, <Title>

By: _____ Date: _____
<Name>, <Title>

List of Exhibits:

Exhibit A – Service Area
Exhibit B – Water System
Map
Exhibit C – Asset Management Plan
Exhibit D – Capital Improvement Plan
Exhibit E – Maintenance Plan
Exhibit F – SCVWD Contract

EXHIBIT A
Service Area

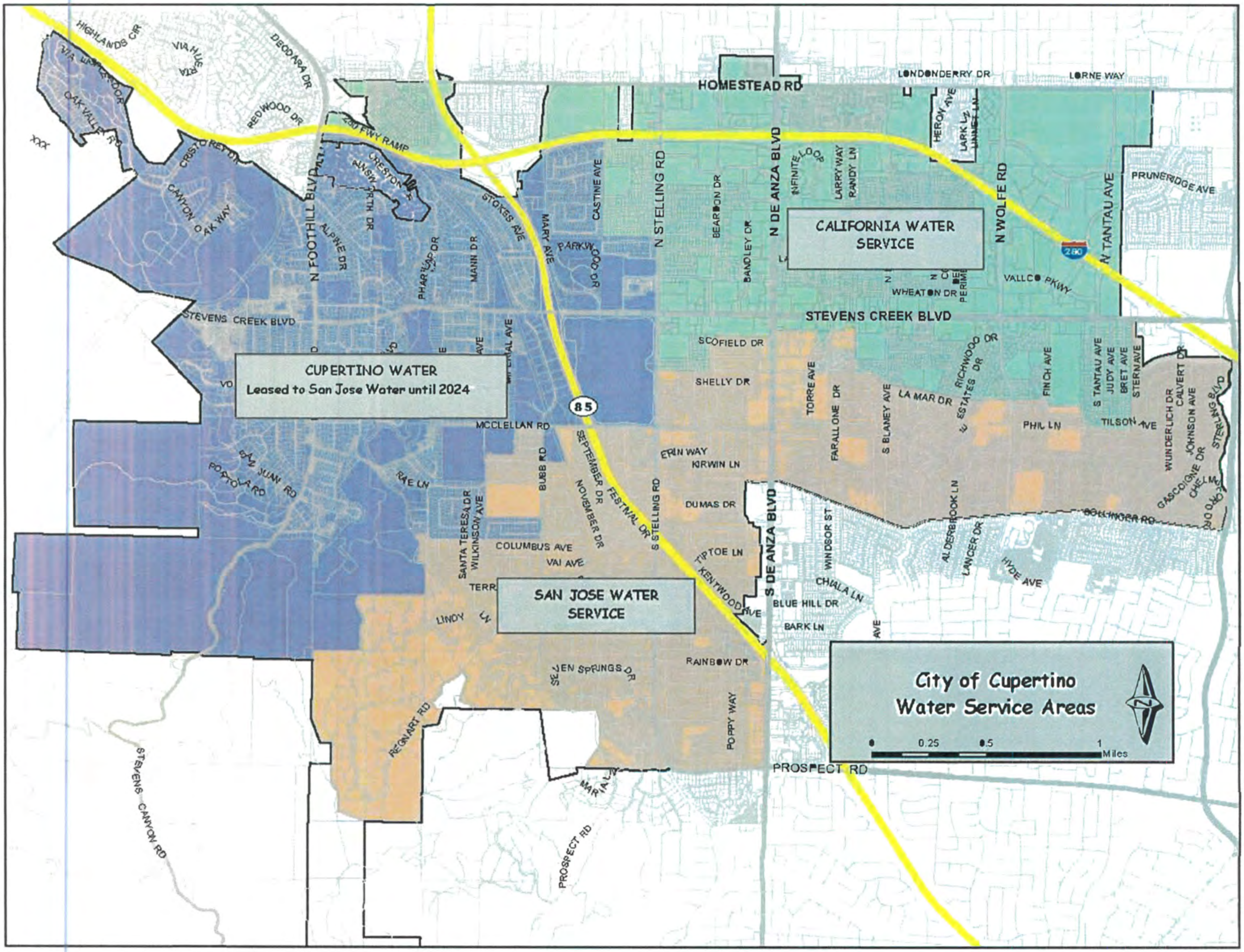

CUPERTINO WATER
Leased to San Jose Water until 2024
CALIFORNIA WATER SERVICE
SAN JOSE WATER SERVICE
City of Cupertino
Water Service Areas
0
0.25
0.5
1
Miles
HOMESTEAD RD
STEVENS CREEK BLVD
N DE ANZA BLVD
S DE ANZA BLVD
N STELLING RD
S STELLING RD
N FOOTHILL BLVD
N WOLFE RD
N TANTAU AVE
MCCLELLAN RD
BOLLINGER RD
PROSPECT RD
VALLCO PKWY
280 FWY RAMP
85
280

EXHIBIT B
Water System Map

EXHIBIT 1

System Map

EXHIBIT C
Asset Management Plan

CITY OF CUPERTINO

WATER DISTRIBUTION SYSTEM ASSET MANAGEMENT PLAN

2019

Table of Contents

Figures

Tables

Appendices

1 Introduction

The City of Cupertino (City) is working to investigate its water system. The City is served by three different systems: one owned and managed by California Water Service Company, one owned and managed by San Jose Water Company (SJWC), and one owned by the City. The City's water system is currently being operated and maintained by SJWC. This service is part of a 25-year concession between the City and SJWC that began in 1997.

The City's water system covers approximately 3.7 square miles and has nearly 60 miles of pipelines, 3 storage tanks, and just under 4,400 water services. Before the end of the concession agreement with SJWC in 2022, the City will need to gain a thorough understanding of its water system to assist them in the decision in the following business cases:

- The City takes over the operations, maintenance, management and customer interactions of the water system
- The City negotiates and renews the concession agreement with the lessee responsible for all operation and customer interaction responsibilities, and the City establishes a defined capital expenditure schedule for system improvements that is paid by lessee
- The City negotiates and renews the concession agreement with a lessee that is responsible for all operation and customer interactions, and the City establishes a defined capital expenditure schedule for system improvements to be paid by City
- The City sells the City-owned water system

In an effort to help the City make an informed business decision, the City has contracted Kayuga Solution and its team (i.e., Hanson Associates, Charles Marr Consulting, MR Valuation Consulting) to perform comprehensive water system asset planning and valuation. The goal of the project is to develop an asset management plan that provides a comprehensive understanding of the current and future asset needs, asset risk profile, appropriate levels of service, cost to provide that level of service, and financial and resource requirements to sustain the delivery of those services. The asset management plan will provide an understanding of the City's current and future infrastructure needs for the water system assets. As system conditions change in the future, a periodic re-inspection and update of this asset management plan is recommended.

1.1 What is an Asset Management Plan?

An asset management plan is a long-range planning document that provides a framework for understanding the assets owned by the City, services it provides, risks it assumes, and financial investments it requires. Development of an asset management plan requires answers to the following questions:

- What does the City own and manage?
- What is the current state of the assets?
- What are the immediate asset maintenance, rehabilitation, and replacement needs?
- What are longer-term asset investment needs with respect to aging assets, capacity, level of service, etc.?
- What is the risk associated with asset failure?
- What are the appropriate levels of service?
- What is required to sustain the delivery of service?
    - Financial requirements
    - Resource requirements

    - Risk vs. investment analysis
- What is the cost of service?

An asset management plan is a living document. It is meant to grow and change with the organization and system for which it is written. With new and/or replaced assets, an asset management plan should be updated periodically to reflect the asset risk profile and continually monitor the financial plan required to sustain the delivery of services.

1.2 Key Components of an Asset Management Plan

The following section introduces and defines the key components and methodology used to develop the asset management plan.

Asset Register

The asset register establishes the data foundation of the asset management plan by consolidating and documenting all assets owned and managed. The development of the asset register required establishing the following key elements:

- *Asset Definition* – Helps to define what is an asset versus what is not an asset. With the asset definition established, the City is able to separate assets from components and manage them accordingly.
- *Asset Hierarchy* – Organizes the thousands of assets in the asset register. With the asset hierarchy, the City is able to easily find assets and support asset management decisions at any level within the asset hierarchy.
- *Asset Classes* – Groups the assets to allow the City to characterize the life-cycle behavior of the assets in the register. An asset class is developed by grouping assets with similar characteristics, such as type, function, useful life, material, and size. Asset classes are used to help model the life-cycle costs of the assets.
- *Asset Data Standards* – Identifies the data attributes required to support asset management decisions.

Asset Definition

An asset was established as something that is owned and managed by the City, has a value, and is critical for the delivery of water distribution services. An asset is identified at a level at which a work order is typically generated.

The initial step in developing an asset register was to consolidate all previously existing asset data in the various information systems (e.g., Geographic Information System (GIS), Excel spreadsheets, engineering drawings). Once the data was consolidated, a data gap analysis was performed to determine which assets or asset attributes (e.g., size, material) were missing. This data gap analysis provided the foundation for the data collection and correction part of the project. The data gap was filled by visiting the assets and collecting missing assets and missing attributes.

Asset Class

Assets are grouped into classes to more efficiently model and manage the assets. An asset class generally refers to a group of assets that behave similarly. Grouping the assets into these classes allows easier modeling of life-cycle behavior. The following table lists the City's asset classes.

Table 1-1 Asset Classes

Asset Classes			
Building	HVAC	Main Casing	Service Line
Control Panel	Hydrant	Meter	Tank
Driveway	Instrumentation	Motor	Valve
Fencing	Lifting Equipment	Pavement	Vault Structure
Filter	Lighting	Pump	Well Casing
Generator	Main	SCADA	

Asset Hierarchy

The hierarchy for the organization of the assets is presented in the Figure 1-1. The assets are organized by City, Water System, and Sub-Systems.

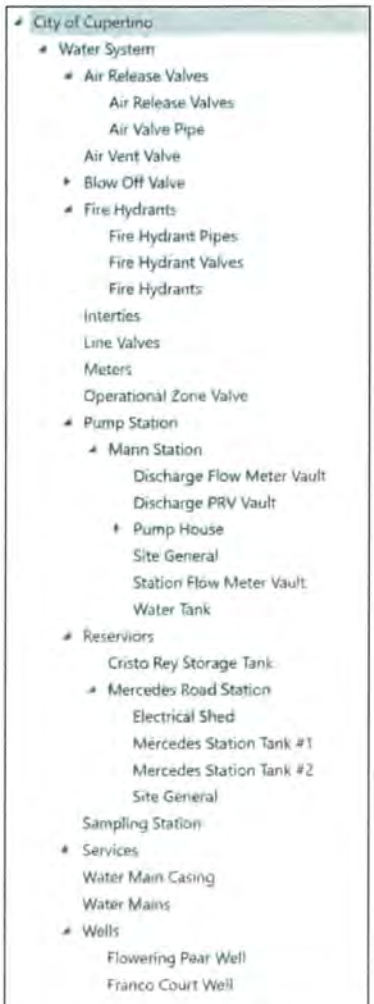


Figure 1-1 Asset Hierarchy

Replacement Cost

Asset management best practice estimates the future financial needs based on current-year asset replacement cost. In many cases, escalation of the initial purchase cost does not properly reflect the replacement cost. As such, each asset in the asset register was assigned a replacement cost in 2019 dollars. This replacement cost estimates the budget required to replace the asset with a like, in-kind asset. The replacement cost incorporates material, labor, removal, and other costs associated with replacing the asset. It should be noted that the replacement cost does not include any changes to capacity or level of service. In addition, the replacement cost does not represent costs associated with delivering a CIP project, which typically include the following:

- Engineering/design/project management
- Demolition and removal
- Permit
- Contractor overhead/profit
- Contingency
- Traffic control
- General conditions

Typically, an additional 30% to 50% is added to the replacement cost to represent CIP project costs. In the asset management plan, all costs are represented as replacement cost. The individual replacement costs for the assets are then summed to create a total estimated replacement cost for the management system.

Condition

Condition is one of the best indicators for estimation of immediate and/or future maintenance, repair, and replacement work. General condition assessment (e.g., visual, touch, sound) was performed for accessible assets. For inaccessible assets, condition was estimated based on age. No forensic or detailed condition assessment work was involved.

A condition scale of 1 to 5 (Table 1-2) was utilized to represent the general condition of the asset. Compared to a more complex scale (e.g., 1 to 10, 1 to 100), this simple scale greatly limits the subjectivity associated with the assessment of the condition score from one inspector to another.

Table 1-2 Condition Assessment Score and Description

Condition Score	Description
1	**Excellent**: New or nearly new
2	**Very Good**: Not new, but in very good condition
3	**Good**: Good or as expected based on age
4	**Poor**: Poor or recommended replacement in near-term
5	**Failed/Critical**: Failed or nearing failure, needs immediate attention

In many cases where the asset was not visible (e.g., buried assets) or the condition could not be determined (e.g., pipes, electrical), age was used as the main indicator of the condition of the asset. Utilizing age and decay curve, the condition of an asset is estimated. The figure below illustrates the various decay curves available to represent the deterioration of assets. It is expected that decaying characteristics of most assets can best be represented by an exponential curve. Kayuga utilized the Late Decay (1.5) curve to estimate asset condition in the City's asset management plan. This curve is widely used by many utilities and municipalities in this geographic area (i.e., Santa Clara Valley Water District, City of Livermore) as it represents a more conservative view of an asset's decay. For example, a linear decay curve of an asset with a condition rating of 3 is estimated to have 63% life consumed. The same asset with the same condition utilizing the Late Decay (2) curve is estimated to have 78% life consumed.

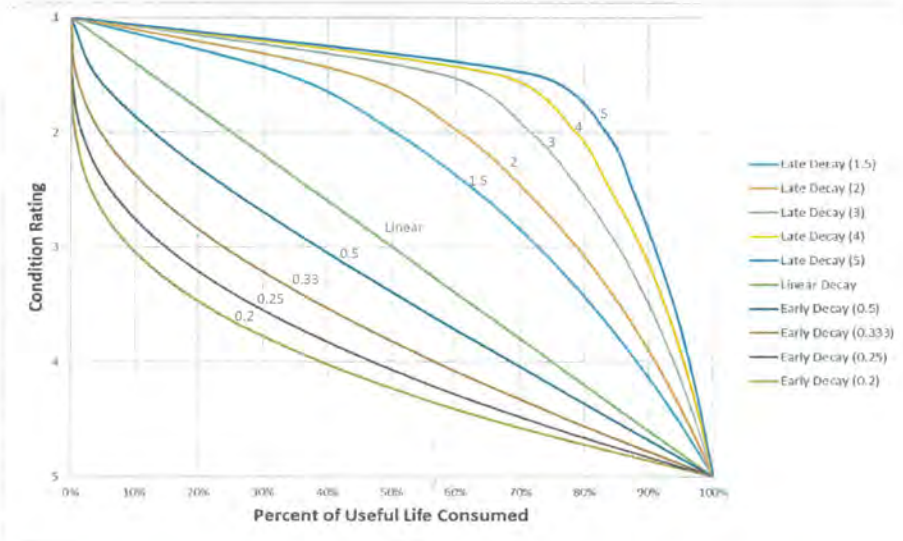


Figure 1-2 Decay Curve

Risk

Risk is used for effective, transparent prioritization of limited resources (e.g., budget, availability of staff). Under limited resources, the City should address the assets with the highest risk scores before addressing the lower-risk assets. The two main components of risk are Probability of Failure (PoF) and Consequence of Failure (CoF). PoF indicates the estimated time until the asset fails to function at the established levels of service. CoF provides an indication of the impact of the asset failure considering the triple bottom line factors of sustainability: economic, social, and environmental. Every asset in the asset register is assigned a risk score. For some assets, redundancy was considered to offset the risk.

The following formula is used to calculate the risk score:

With each asset's risk score calculated, assets were plotted in the following risk matrix. The risk-based strategy should be to manage the high-risk zone (red zone) before moving down to medium (yellow zone) and low risk zones (green zone).

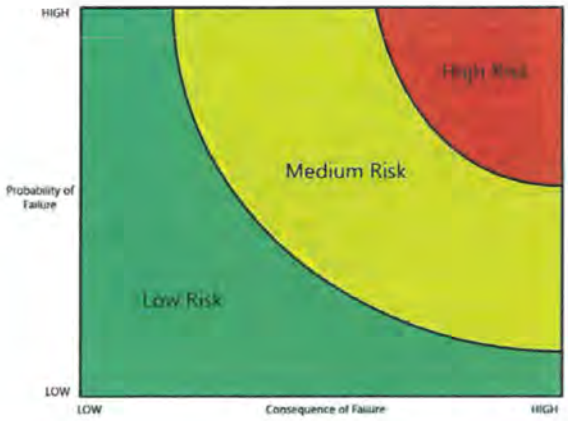


Figure 1-3 Risk Matrix

Life-Cycle Cost

In order to predict the future replacement and rehabilitation need of all assets, a life-cycle cost analysis is performed. The life-cycle cost analysis is a calculation of costs required to support the set of activities (e.g., rehabilitation, replacement) that are needed to sustain the delivery of an asset's services during the life of an asset or for the planning horizon (e.g., 10, 20, or 100 years). The useful life (e.g., 10, 20, 30 years) was estimated for each asset. Life-cycle cost analysis is performed for each asset in the asset register. For every year of the planning horizon, the life-cycle analysis will calculate which asset needs a refurbishment or replacement activity and how much it will cost to perform the needed activity. As noted previously, replacement costs do not include costs associated with delivering a CIP project (e.g., engineering, project management, contingency, insurance). When all the activity costs are

summed for each year, the overall replacement and rehabilitation budget for the year will be established. The life-cycle cost analysis drives the estimation of the future financial needs to sustain the delivery of the assets. Comparing and contrasting the life-cycle cost results against the current asset replacement and rehabilitation spending, sustainability of the future financial plan can be assessed.

Life-cycle cost calculation takes place in the form of a life cycle cost logic or management strategy. A management strategy characterizes the life-cycle behavior of an asset (e.g., how it will decay, how long it will last, necessary refurbishment during the life of the asset, when refurbishment is needed, how much refurbishment will cost). Every asset is assigned a management strategy. The following figure illustrates the relationship between asset condition, management activities, and life-cycle cost. After the installation, asset condition will deteriorate with time. In order to raise the condition to an acceptable level, an investment in the form of maintenance or rehabilitation will be required. At the end of its useful life, the asset will need to be replaced, and the cycle will repeat.

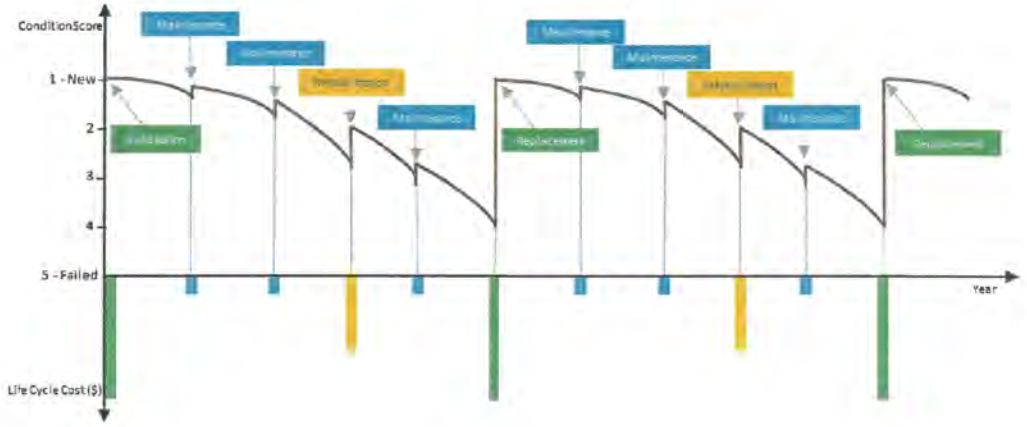


Figure 1-4 Life Cycle Cost Logic Illustration

The life-cycle cost assessment allows the City to proactively manage the assets. The City will be able to predict which assets are nearing the end of useful life and proactively plan for replacement of high-risk assets to prevent failure. Reacting to a high-risk asset failure after they have occurred typically results in the highest expense. With life-cycle cost analysis, the City will also have an understanding of the work and investment required for future years and proactively plan ahead to minimize risk and costs. These estimations will be used to prepare the budget and resources required to sustain the delivery of services. When budget and resource limitations exist, the City will be able to prioritize the needs by risk to ensure the budget is first spent on high-risk assets. In essence, the City will be able to ensure that minimum funds are spent to maximize risk reduction.

IRIS (Infrastructure Reinvestment Intelligence System)

Life-cycle cost calculation can be very tedious and time consuming. It is especially difficult when the calculations need to be performed for thousands of assets, year-by-year, asset-by-asset. For this reason, the City utilized Kayuga Solution's asset management planning tool, IRIS (Infrastructure Reinvestment Intelligence System), which incorporates the developed asset register and performs the life cycle cost and risk assessment work.

IRIS is an asset management dashboard that utilizes the asset data and performs asset management calculations and analyses presented in the City's asset management plan. It is a planning tool the City can use to project the

future maintenance, rehabilitation, and replacement needs, understand its high-risk assets, understand the cost of ownership, calculate the appropriate budget required to mitigate the high-risk assets, and identify assets estimated to require rehabilitation or replacement year-by-year, asset-by-asset. The figure below illustrates a sample view of the IRIS dashboard.

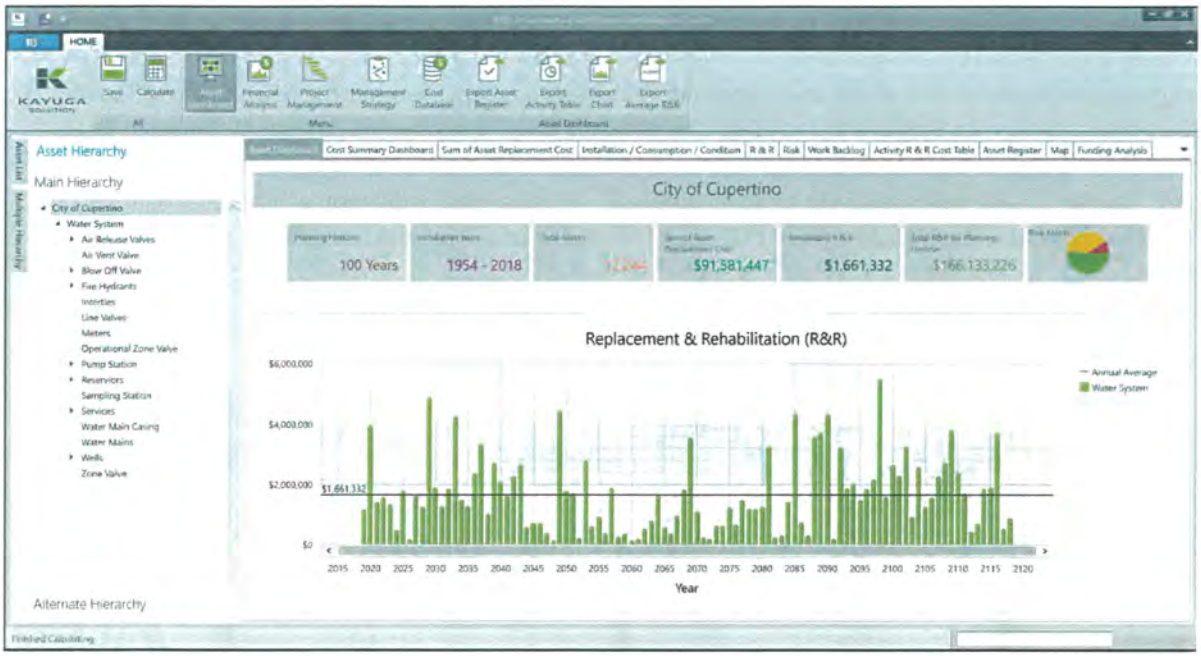


Figure 1-5 IRIS (Infrastructure Reinvestment Intelligence System)

Long-Range Planning of Asset Replacement and Rehabilitation Needs

Based on the life cycle cost analysis, the long-range financial needs of asset replacement and rehabilitation profile is generated. Life cycle cost analyses were performed for a 100-year, 20-year, and 10-year horizon to evaluate the replacement and rehabilitation needs of the assets. A 100-year planning horizon provides a comprehensive view of asset replacement; by the 100th year, each asset (e.g., main, valve, pump) will be replaced at least once within the 100-year planning horizon. Every year, those assets requiring replacement or rehabilitation are identified and summed to generate the replacement profile.

2 What Does the City Own?

As part of the asset management plan development process, a comprehensive asset inventory was performed. All facilities (e.g., pump station, storage tanks, wells) were visited and their assets inventoried. Hydrants and system valves were visited and their location (i.e., GPS coordinate) was recorded. Where assets are not visible (i.e., mains, services, valves), a thorough analysis of as-built drawings and available GIS data was performed. Water main, valve, service, and meter data were initially provided by SJWC. Where the initial GIS data did not match the as-built drawing or on-site verification, Kayuga updated the initial GIS data to provide the City with a more comprehensive and current water distribution asset database.

Asset Inventory

The City owns 12,244 assets including nearly 60 miles of pipelines and just under 4,400 services. The water system also includes 3 water storage tanks, 2 wells, and a pump station. The following tables summarize the water distribution assets for the Cupertino Leased Area water system. The provided GIS data also included pipes from water main to hydrants and small sections of pipes to blow off and air release valves all identified in the table below.

Table 2-1 Water Distribution Asset Inventory

Asset Class	Number of Assets	Length (miles)
Hydrants	399	
Mains (4" to 20" diameter)	1,094	57.6
Main Casing	1	
Air Release/Vent Valves	30	
Blow Off Valves	86	
Interties	4	
Line Valves	810	
Zone Valves	12	
Hydrant & Service Valves	455	
Hydrant Pipe	400	1.5
Blow Off Pipe	8	> 1
Air Release Pipe	9	> 1
Services	4,382	11.5
Fire Services	29	
Meters	4,382	
Sampling Stations	8	
Interties	4	
Total	**12,113**	**70.6**

Table 2-2 Water Main Inventory by Material

Diameter (in)	Length (mi)	Percent of Total
AC	33.7	59%
CI	1	2%
CIP	0.5	>1%
DICL	15.4	27%
DICLZ	0.4	>1%
FKCL	2.7	5%
PVC	0.1	>1%
S	1.2	2%
WS	0.8	1%
WSCL	1.7	3%
Total	**57.6**	**100%**

Table 2-3 Water Main Inventory by Size

Diameter (in)	Length (mi)	Percent of Total
2	0.6	1%
3	0.1	>1%
4	3.1	5%
6	19.1	33%
8	21	37%
10	5.8	10%
12	3.1	5%
14	1.5	3%
16	0.9	2%
18	1.4	2%
20	0.9	2%
Total	**57.6**	**100%**

A summary of the facility assets at the pump station, reservoirs, and wells is shown in the following tables. A comprehensive list of assets in each facility can be found in **Appendix A**. Piping to the facilities is accounted for in the water mains. Note that the PRV at the pump station is accounted for with the valves.

Table 2-4 Mann Pump Station Asset Inventory

Pump Station	Asset Class	Number of Assets
Mann Pump Station		**74**
	Building	1
	Control Panel	8
	Fencing	1
	Generator	2
	HVAC	1
	Instrumentation	6
	Lifting Equipment	1
	Motor	5
	Pavement	2
	Pump	5
	SCADA	1
	Sump Pump	2
	Tank	1
	Valve	35
	Vault Structure	3

Table 2-5 Storage Tank Asset Inventory

Storage Tank	Asset Class	Number of Assets
Mercedes Road Storage Tanks		**23**
	Building	1
	Control Panel	3
	Fencing	1
	Generator	1
	Instrumentation	2
	Pavement	1
	SCADA	1
	Site	1
	Tank	2
	Valve	10
Cristo Rey Storage Tank		**13**
	Driveway	1
	Fencing	1
	Pavement	1
	SCADA	1
	Tank	1
	Valve	7
	Vault Structure	1

Table 2-6 Well Asset Inventory

Well	Asset Class	Number of Assets
Flowering Pear Well		**13**
	Control Panel	2
	Fencing	1
	Filter	1
	Instrumentation	1
	Motor	1
	Pavement	1
	Pump	1
	SCADA	1
	Valve	3
	Well Casing	1
Franco Court Well		**12**
	Control Panel	1
	Fencing	1
	Instrumentation	1
	Lighting	1
	Motor	1
	Pavement	1
	Pump	1
	SCADA	1
	Valve	3
	VFD	1
	Well Casing	1

3 What is the Replacement Cost of the Assets?

In total, there are 12,224 assets in the water system. The replacement cost for each asset was estimated. The replacement cost does not represent a project cost that includes engineering, management, insurance, contingency, etc., costs. In many cases, project costs can add an extra 30% to 50% to the replacement cost. The sum of all individual asset replacement costs for the City's water distribution system is approximately $91.6 million in 2019 dollars.

The assets were further distributed into categories based on the asset hierarchy. The sum of all replacement costs for mains, services, interties, valves, hydrants, meters, is approximately $79.0 million.

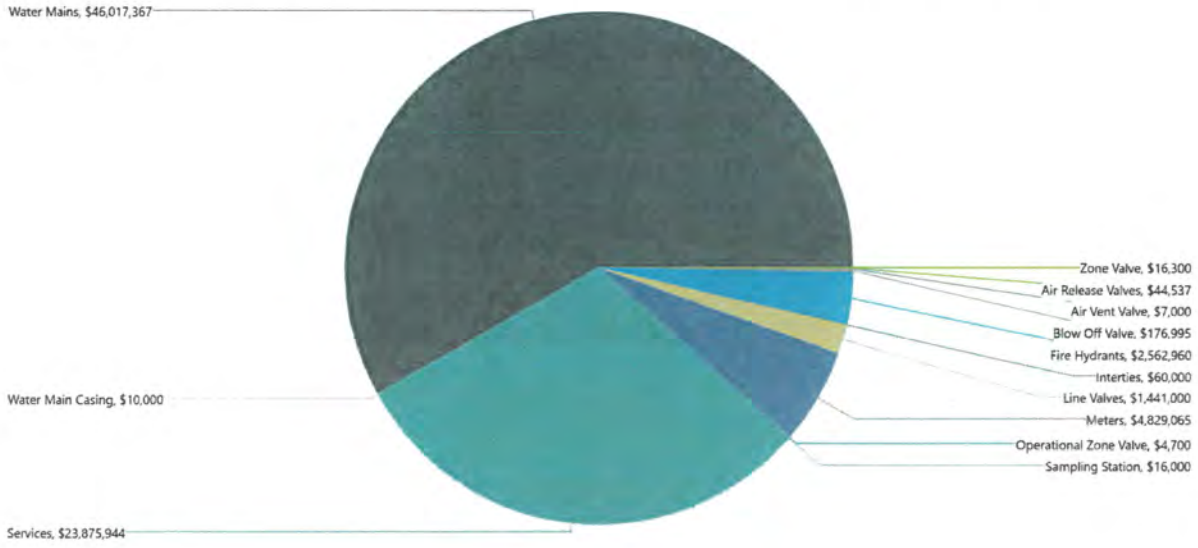


Figure 3-1 Replacement Cost of Mains, Valves, Hydrants, and Meters

The sum of all asset replacement costs (Figure 3-2) in the pump station, storage tanks, and wells totaled $13.0 million. Table 3-1 provides a summary of replacement costs by facility. It should be noted that a replacement cost does not equal CIP project cost. CIP projects cost can typically be 30 to 50 percent more than replacement cost estimate.

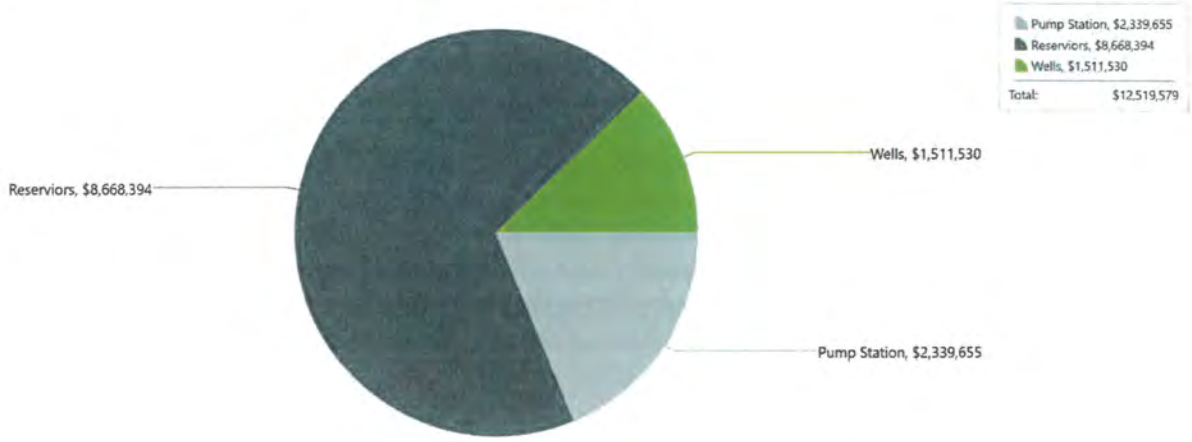


Figure 3-2 Water Distribution Facilities Replacement Cost

Table 3-1 Water Facility Total Asset Replacement Cost

Facility	Replacement Cost
Cristo Rey Storage Tank	$ 3,182,190
Mercedes Road Station	$ 5,486,204
Mann Pump Station	$ 2,339,655
Flowering Pear Well	$ 746,275
Franco Court Well	$ 765,255

4 What is the Current Condition of the Assets?

Condition is one of the best indicators for estimation of immediate and/or future maintenance, repair, and replacement work. During the asset inventory process, the condition of each visible asset was assessed and recorded utilizing the condition assessment scale introduced in Table 1-2. It should be noted that main objective of the condition assessment process is to highlight assets in poor and failed condition (i.e., Poor, Failed/Critical). These poor-condition assets will be included in the 20-year CIP recommendations (Chapter 7).

Where assets are not visible, age was used as the main indicator of the condition of the asset. When installation information was not available, assumptions were made based on neighboring assets or nearby developments (e.g., construction year of neighboring houses). There is a possibility that the mains were installed long before parcel development; however, the actual installation year was unknown. In some cases, the historical record of water main break data was utilized. Where the work report indicated the cause of the main break was due to corrosion, aging pipe, or poor condition, the condition score of the pipe segment where the water break occurred was updated to reflect the poor condition.

4.1 System Level Condition Profile

High-level condition profiles are provided below. These high-level profiles will be followed by specific asset analysis in the following sections.

Water System (Total)

Figure 4-1 provides an overview of the estimated current condition of the water system. This condition profile includes all assets. It is estimated that about 6% of all assets fall under Poor to Failed/Critical condition. The sum of replacement cost of these assets equates to about $12.6 million.

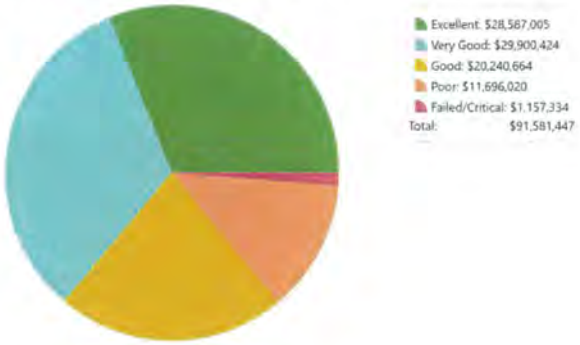


Figure 4-1 Condition Profile for the Water System Condition Profile

Water System (Water Mains, Water Services, Meters, Hydrants, Interties, and Others)

The estimated current condition profile for water mains, water services, valves, hydrants, meters, interties, and others assets are shown in Figure 4-2. Approximately 6% of the assets are identified in poor and failed/critical condition. The total replacement cost of these assets is about $8.8 million.

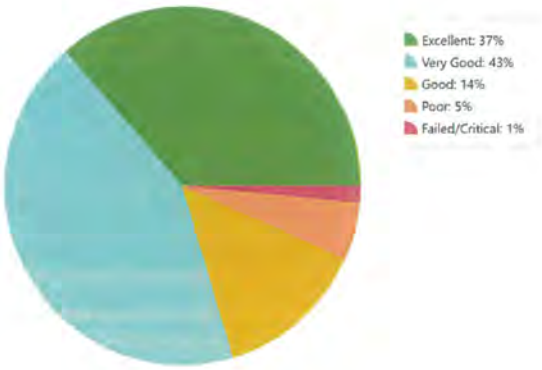


Figure 4-2 Condition Profile for Water Mains, Water Services, Meters, Hydrants, Interties, and Others

Water System (Pump Station, Reservoirs, Wells)

Figure 4-3 provides an overall condition profile for pump station, reservoir, and well assets. At these facilities, approximately 23% of the assets are identified as Poor or Failed/Critical condition. The total replacement cost of these assets is about $4 million. Details of assets in need of replacement or rehabilitation will be discussed in the following sections.

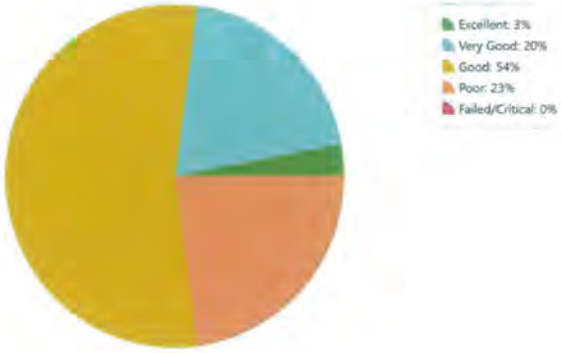


Figure 4-3 2019 Pump Station, Reservoirs, and Wells Condition Profile

4.2 Asset Level Condition Profile

Key representative asset level condition profiles are presented in the following sections. The condition profiles are either represented as current percentage of Poor and/or Failed/Critical assets or as replacement needs for the next 10 years.

Water Mains

The following installation profile shows the decade the water mains were installed or last replaced. When installation information was not available, assumptions were made based on neighboring assets or nearby developments (e.g., construction year of neighboring houses). The oldest water mains were estimated to have been installed in the 1950s and 1960s. The following figure presents the age by decade of the water mains with respect to total length. It is estimated that about 38% of the water mains are now over 50 years old. It should be noted that older pipes may potentially exist in the City. According the City's Lease Water System Inspection Technical Report[1], the City has a logbook that dates the water mains back to 1916. It stated that the City's water system was originally constructed in 1916 and then expanded in 1938 and 1950s. Unfortunately, no historical as-built drawings could be found to verify this claim. The oldest pipe in the GIS data showed to be constructed in the 1950s.

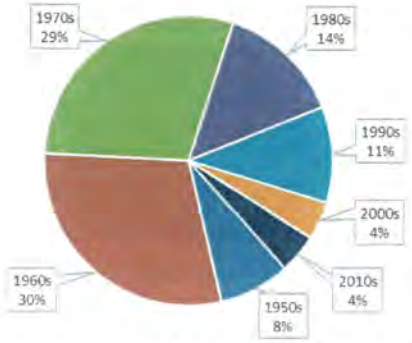


Figure 4-4 Water Main Installation by Decade

[1] SPF Water Engineering, "Final Technical Report: Leased Water System Inspection," 2017.

The figure below provides a map of the water main installation profile by decade.

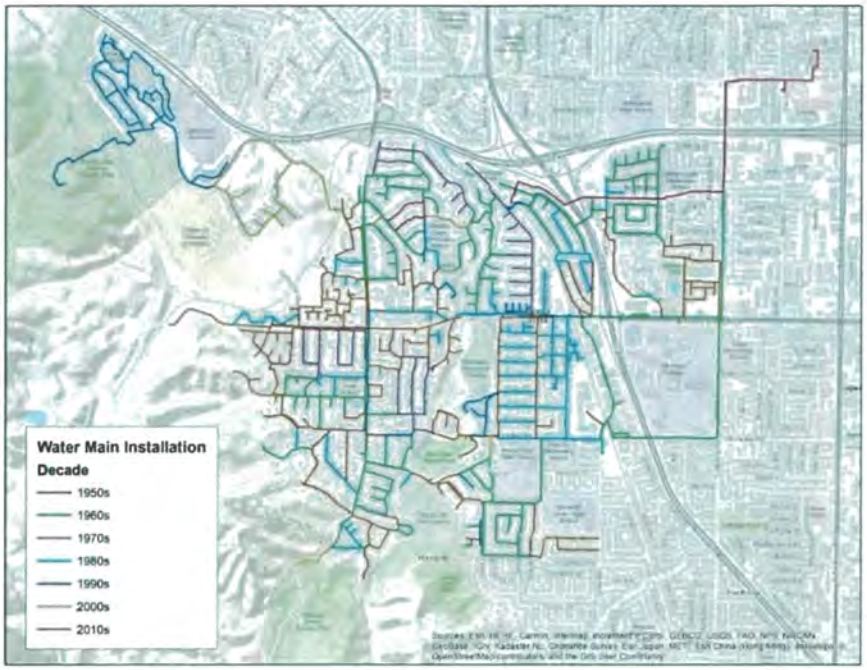


Figure 4-5 Water Main Installation History by Decade

Estimates of pipe useful life play a key role in the asset management analysis for underground pipelines. According to a comprehensive study conducted by Utah State University[2] on water main break rates in the USA, the average age of failing water mains is approximately 50 years old. This number is well below what is usually recommended by most of the pipe manufacturers. The study also found that the break rate of asbestos cement (AC) pipe significantly increased by 43% after reaching 50 years of age. The study concluded that AC pipe installed in the 1960's may be near its end of life. In addition, the study indicated that an average expected life of a newly installed pipe is 84 years. Typical new installation pipe materials included ductile iron (DI), PVC, HDPE, concrete steel cylinder (CSC), polyvinyl chloride (PVCO), and steel.

A similar study conducted by the US EPA[3] stated that post World War II cast iron (CI) pipe average service life is about 75 years. The US EPA study provided the following expected service lives for different pipe materials:

- AC pipe 15 inch or greater – 85 years
- AC pipe 4 inch or smaller – 40 years
- DI pipe – 87 years
- Reinforced concrete pipe – 140 years
- Concrete – 130 years
- CI pipe – 75 years

[2] Folkman, Steven. "Water Main Break Rates in the USA and Canada: A Comprehensive Study." Utah State University Buried Structures Laboratory (2018).

[3] "Primer on Condition Curves for Water Mains." US Environmental Protection Agency. EPA/600/R-13/080 (2013).

In addition, a recent study by the Sustainable Solutions[4] stated that the following useful lives:

- PVC pipe -100 years
- DI – 50 years
- HDPE – 50 years

Multiple water main useful life scenarios were developed and modeled to gain understanding of anticipated water main replacement needs for the next 10 years. Careful analysis of the scenario results can yield a better understanding of future water main replacements.

Scenario 1 – US EPA Useful Lives

A simulation of expected water main replacements was performed utilizing the US EPA pipe useful life presented above. For those pipe materials not identified by US EPA, a useful life of 84 years was used. This number is based on the Utah State University research presented above. Based on this analysis, it is expected that 10-year water main replacement will be about $1.4 million or about 3% of the total water mains. This value represents the pipes currently identified in the leak data to be in poor condition.

Scenario 2 – Conservative (100-Year Useful Life)

This scenario provides a conservative look at the water main pipe replacement needs. All pipes were assigned a 100-year useful life. From the water main data, the earliest water main installation recorded in the City was 1954. With a 100-year analysis, the earliest water main replacement will in the mid-2050's, out of the 10-year water main replacement window. Similar to Scenario 1, the 10-year water main replacement is expected to be about $1.4 million (3%) for the replacement of identified poor condition pipes.

Scenario 3 – Aggressive (65-Year Useful Life)

This scenario is developed to represent the worst-case scenario. All pipes were assigned a useful life of 65 years. In reviewing the water leak work data, the representative age of all pipes identified as structurally in poor condition was about 65 years. Based on this analysis, it is expected that the city has to replace about 17% of the total water mains worth $7 million.

Scenario 4 – Hybrid (65-Year Useful Life for AC Pipes and US EPA Useful Lives for Other Pipe Materials)

This hybrid scenario was designed to provide a more representative view of the City's water main replacement needs. As indicated in Scenario 3, the representative age of water mains identified to be poor condition was 65 years. Closer review of poor condition water mains revealed that they are mostly asbestos cement (AC) pipes. In this scenario, all AC pipes were assigned a 65-year useful life while other pipe materials were assigned useful life identified by the US EPA. This assumption is supported by the Utah State University study[5]. The study revealed that, for AC pipes, the frequency of leaks increased by 43% after 50 years. In another words, after the 50th year, the AC pipe decay curve (Figure 1-2) rapidly falls, indicating that there is little service life left before failure. A majority of AC pipes in the City were installed in the 1950's, 1960's, and 1970's. Based on this analysis, it is projected that the City will need to spend

[4] "Life Cycle Assessment of PVC Water and Sewer Pipe and Comparative Sustainability Analysis of Pipe Materials." Sustainable Solutions Corporation (2017).

[5] Folkman, Steven. "Water Main Break Rates in the USA and Canada: A Comprehensive Study." Utah State University Buried Structures Laboratory (2018).

about $6.6 million in the next 10 years. This equates to about 16% of the total water mains.

Scenario 5 – San Jose Water Company Useful Life

This scenario uses water main useful lives recommended by SJWC. According to SJWC, life expectancy is 85 years for AC, 110 years for CI and 70 to 85 years for WS mains. The remaining mains are estimated conservatively to have a 100-year useful life. Based on this analysis, it is expected that the City has to replace about 4% of the total water mains worth $2.9 million within the next 10 years.

Water Main Useful Life Scenario Summary

The summary of scenario results is provided in table below. Although it is difficult to predict exactly when the water mains will fail and how much budget is required to replace them, the scenarios provide an expectation between the worst-case and the best-case scenarios. The conservative and aggressive scenarios establish the two extreme numbers. From there, both the hybrid and SJWC numbers incorporate system knowledge in the analysis. From the scenarios, the City may expect to spend about $3 to $6.6 million for water main replacement in the next 10 years.

Table 4-1 Water Main Useful Life Scenario Summary

Scenarios		Assumption	10-Year Projection
1	US EPA Useful Lives	Water main useful life based on US EPA study	$1.4 million
2	Conservative	All water main useful life set to 100 years	$1.4 million
3	Aggressive	All water main useful life set to 65 years	$7.0 million
4	Hybrid	65-year useful life for AC pipes and US EPA useful lives for other pipe materials	$6.6 million
5	San Jose Water Company	Useful life and replacement cost based on SJWC recommendation	$2.9 million

Valves

Similar profiles were constructed for valves. The following figure shows the installation profile of the water valves by decade. Like with the mains, assumptions were made based on neighboring assets when installation information was not available. Similar to water mains, 31% of valves are over 50 years old.

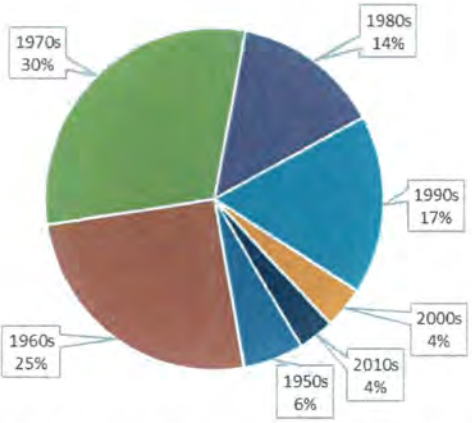


Figure 4-6 Valve Installation Profile by Decade

The figure below presents the condition profile for water system valves (i.e., air release, air vent, blow off, line, zone). It was assumed that the water system line valves would be replaced when the main is replaced. As such, the installation year and useful life were set to be the same as the nearest main. Valves on AC pipes were set to 65 years and valves on other pipe materials were set to US EPA recommended years. Data analysis show that about 10% of the valves are in Poor and Failed/Critical condition. In the next 10 years, it is anticipated that the City will need to spend about $160,000 to replace aging valves.

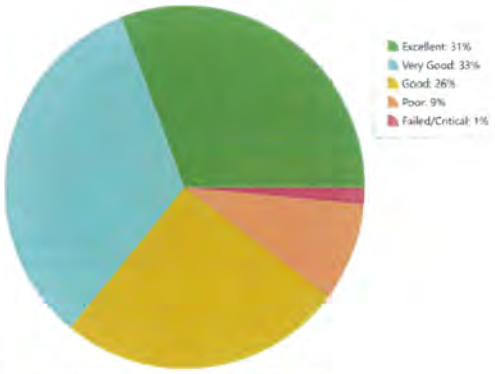


Figure 4-7 Valve Condition Profile

Hydrants

The following figure presents the installation profile of the hydrants by decade. Like the water mains and valves, some of the oldest hydrants were installed in the 1950s and 1960s. Currently, about 11% of hydrants are expected to be 50 years or older.

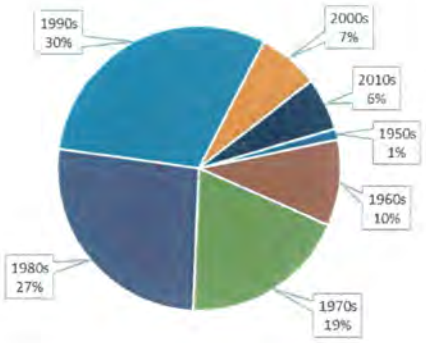


Figure 4-8 Hydrant Installation Profile by Decade

The figure below presents the condition profile of the hydrants. Useful lives of hydrants have been stated to be anywhere between 40 years to 100 years. A 100-year useful life was used in this analysis as the previous condition assessment work (Technical Report of the Leased Water System Inspection, 2017) revealed the hydrants to be in good condition. In general, hydrants are visible and regularly tested and exercised; as such, hydrant condition tends to be more updated and managed compared to other buried assets. Cities and water providers near Cupertino (e.g., City of Livermore, Santa Clara Valley Water District) also utilized a 100-year life for hydrants. The following condition profile reveals the hydrants to be in good condition or better.

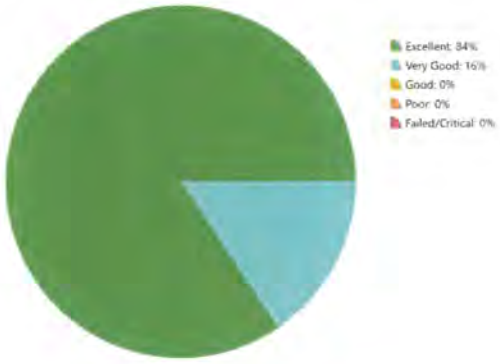


Figure 4-9 Hydrant Condition Profile

In the next 10 years, fire hydrant needs were limited to maintenance activities (i.e., testing and paint). During our field visit, numerous fire hydrants that are in need of repaint were identified. It was assumed that a typical per unit cost to sand blast, prime, and paint a fire hydrant is $125. At this rate, the total need for next 10 years was $44,500. No fire hydrant replacement needs were identified.

Water Services

The following figure presents the installation profile of the water services by decade. Like the mains, there were many services for which the installation year was not available. As such, age assumptions were made based on neighboring assets or nearby developments (i.e., construction year of neighboring homes). Based on these assumptions, approximately 28% of services are estimated to be 50 years old or older.

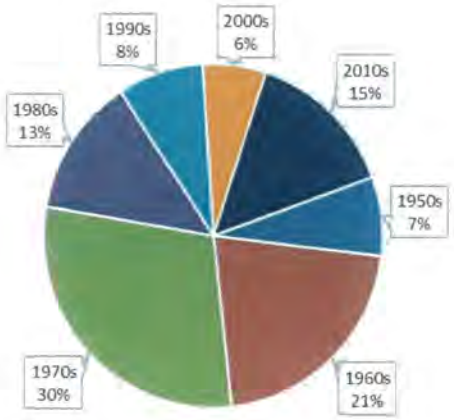


Figure 4-10 Water Service Installation Profile by Decade

Due to a thinner pipe wall, water services typically have shorter service life when compared to water mains. Multiple analyses were performed using varying water service life (i.e., 50-years, 65-years, 80-years) to gain understanding of the expected condition and their resulting budget for replacement. These scenarios were developed based available data analytics and from similar projects from nearby areas (e.g., Livermore).

It is important to note that, due to lack of available data, the installation year of water services were estimated to be equal to neighboring assets (i.e., water main) or nearby developments (e.g., construction year of neighboring homes). It should also be noted that, as mentioned in the water main analysis section, that some water mains could be older than shown in the database.

According to water service installation data from the past 20 years, over 450 services were replaced since 1997. This equates to about 10% of water services in the City. Further examination of the data revealed that the 53% of the replaced water services were connected to AC water mains where the average age was 43 years old. If water services were installed at the time of water main construction, it can be deduced that useful life of water services is about 43 years. However, since the City is not experiencing daily water service breaks, the scenario analyses of the water service useful life were represented as 50-years, 65-years, and 80-years.

Scenario 1 – 50-Year Water Service Life

An expected useful life of 50 years was used to model the condition of water services. Using a 50-year useful life, it is estimated that about 44% of water services are in Poor to Failed/Critical condition. The total replacement cost of these water services equates to approximately $10.3 million. The Failed/Critical condition water services alone summed to approximately $6.9 million. Failed/Critical condition water services are estimated to have exceeded their expected lives.

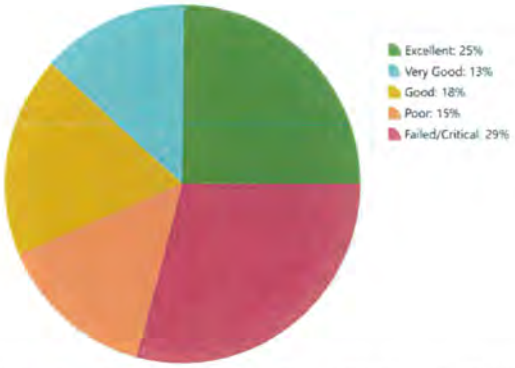


Figure 4-11 Water Service Condition Profile at 50-Year Useful Life

Scenario 2 – 65-Year Water Service Life

An alternative analysis was performed using a 65-year useful life. In this analysis, it is assumed that water services will be replaced at the same time water mains are replaced. In the water main discussion above, it was concluded that reasonable expected useful life of an AC pipe is 65 years. As approximately 60% of the City's water mains are AC (Table 2-2), water service useful life was set to 65 years to assume that water services will be replaced at the same time. The following figure shows the water service condition profile based on 65-year life. In this scenario, services in Poor or Failed/Critical condition equated to 12% or approximately $2.7 million dollars.

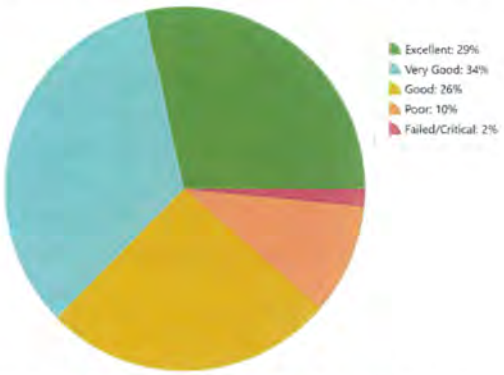


Figure 4-12 Water Service Condition Profile at 65-Year Useful Life

Scenario 3 – 80-Year Water Service Life

Another scenario was developed simulating 80-year useful life for water services. With the earliest water service installation taking place in the 1950's, an 80-year useful life scenario will push any replacement need for the water services out of the 10-year planning window. As expected, no water services were identified to be in Poor or Failed/Critical condition.

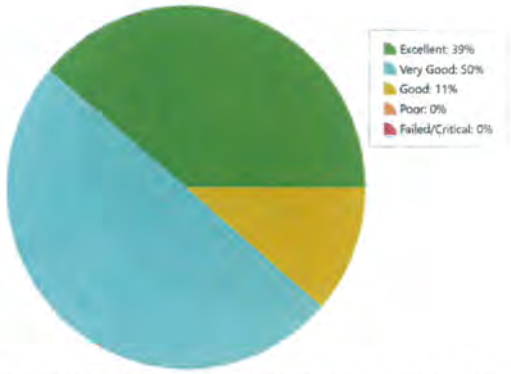


Figure 4-13 Water Service Condition Profile at 80-Year Useful Life

Water Service Useful Life Scenario Summary

The following table summarizes the water service scenarios. Water service data revealed the average life of the services that have been replaced was 43 years. In addition, the data showed that many services that were replaced were connected to AC pipes, the oldest pipes in the City. As water service pipe walls are thinner, it will be tough for water services to match the life of the water mains. Given this fact, if a reasonable useful life approximation of an AC pipe is 65 years, it will be realistic to assume that water service replacements may reach about $3 million within the next 10 years.

Table 4-2 Water Service Useful Life Scenario Summary

Scenarios		10-Year Projection
1	50-Year	$10.3 million
2	65-Year	$2.7 million
3	80-Year	$0

Water Meters

The following figure presents the water meter profile of the services by decade. SJWC practices a 20-year water meter replacement program. In 2009, many of the meters (66%) were replaced. As such, water meters in the leased area are in very good condition. The average age the water meter is 8 years.

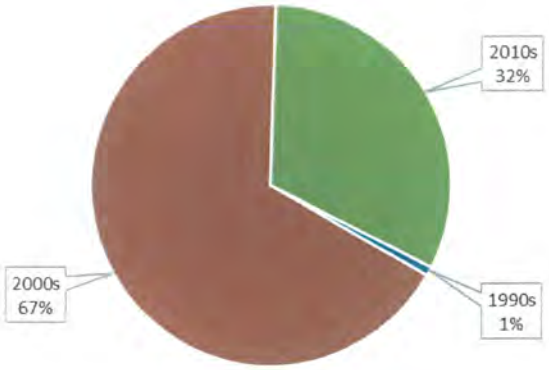


Figure 4-14 Water Meter Installation Profile by Decade

The water meter condition profile is provided below. As expected, overall, the water meters are in excellent to very good condition. However, the analysis indicates that there is $36,000 worth of water meters requiring replacement. According to data, these are water meters that were those not replaced in the recent replacement projects.

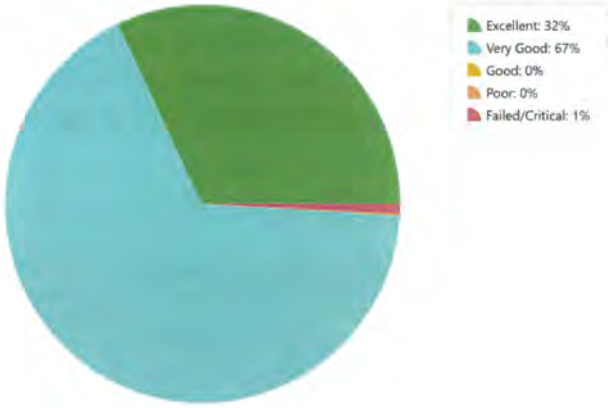


Figure 4-15 Water Meter Condition Profile

Facility Condition Profiles

The following figures give an overview of the condition of the assets at the pump station, storage tanks, and wells. On-site inspection of the facility assets took place. All visible and accessible asset condition is based on visual inspection. For those assets not visible or accessible, the condition of the asset was estimated based on age.

Mann Pump Station

The following figure provides an overall asset condition profile for the Mann Pump Station. It was noted during inspections that the pump station is aging; original construction is estimated to have taken place in the 1980's. As shown in the figure, many assets have been replaced since original installation and were in good condition. About 18% of the assets, however, were noted to be in Poor or Failed/Critical condition. In particular, the emergency generators and electrical controls were noted to have likely exceeded their useful lives, and the ability of the generators to provide power when needed was questionable. In addition, pump number 3 is aging and is in need of replacement. The estimated total replacement cost of these assets is about $1.1 million.

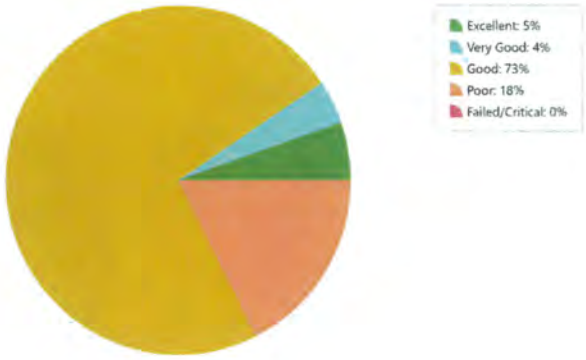


Figure 4-16 Mann Pump Station Condition Profile

A comprehensive list of assets requiring replacement or rehabilitation is provided in Table 4-4 below.

Table 4-3 Mann Station Assets in Need of Replacement or Rehabilitation

Asset Name	Condition	Replacement Cost
Engine-Generator Set, Bus B	Poor	$360,000
Engine-Generator Set, Bus A (Trailer Mounted)	Poor	$360,000
Main Switch Board	Poor	$100,000
Automatic Transfer Switch. Bus B	Poor	$30,000
Motor Control/Disconnect - Motor 1	Poor	$30,000
Motor Control/Disconnect - Motor 2	Poor	$30,000
Motor Control/Disconnect - Motor 3	Poor	$30,000
Motor Control/Disconnect - Motor 4	Poor	$30,000
Motor Control/Disconnect - Motor 5	Poor	$30,000
Booster Pump #3	Poor	$100,000
Booster Pump #3 Motor	Poor	$30,000
Flow Meter Vault Sump Pump	Poor	$500
Security fence	Poor	$11,375

Reservoirs

Figure 4-17 provides the condition profile for the storage tanks. It should be noted that this condition profile looks only at structural condition; any level of service recommendations (e.g., regulatory, seismic, water demand) will be included in the recommended CIP and future replacement and rehabilitation sections. As shown in the figures, the Cristo Rey Storage Tank is in very good condition as it was constructed in 2000. Mercedes Station Tank #2 was recently rehabilitated in 2018. Mercedes Station Tank #1 is currently out of service as the current water demand

does not require it. However, if the water demand increases, Tank #1 will be required again. A full rehabilitation will be required if Tank #1 is to come back on line. In 2018, Tank #2 was rehabilitated for $1.5 million. Rehabilitation of Tank #1 should cost about the same.

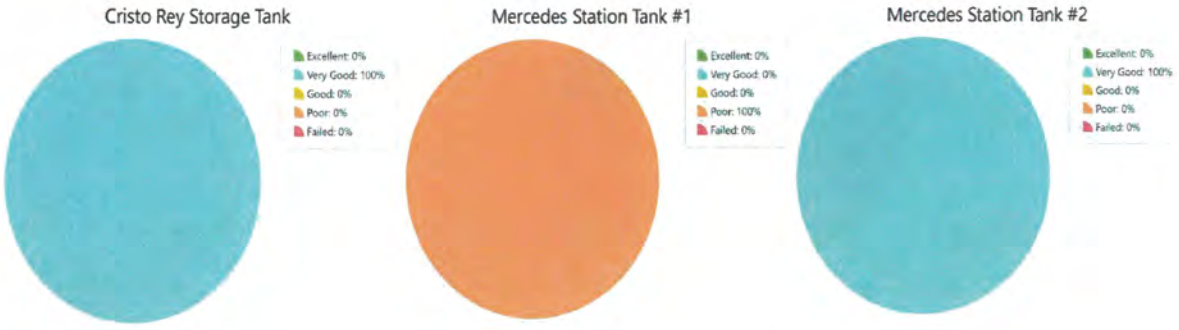


Figure 4-17 Storage Tanks Condition Profile

Wells

The condition profile of both Flowering Pear Well and Franco Court Well is presented in Figure 4-18 below. The overall condition of the wells is good as both wells were rehabilitated in 2015. At both wells, assets in need of update or replacement are electrical assets and fencing. The total replacement cost of assets in need is estimated to be about $51,000.

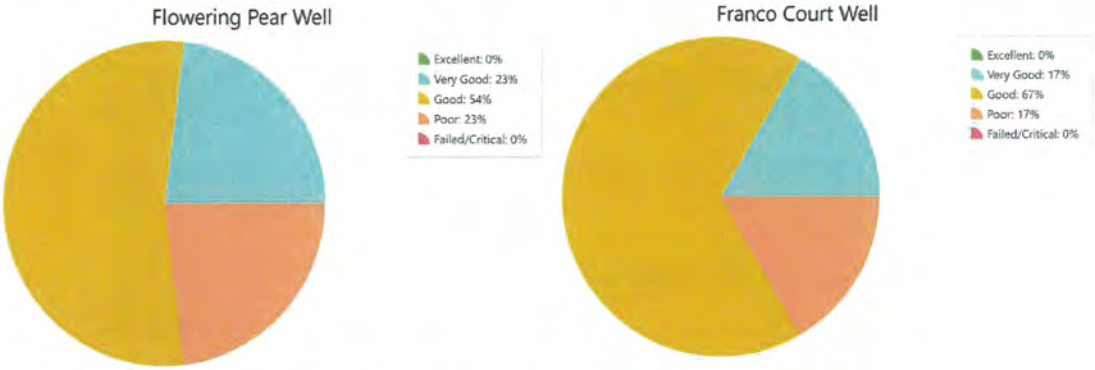


Figure 4-18 Flowering Pear Well and Franco Court Well Condition Profile

A comprehensive list of assets identified at the wells to be in poor condition is provided below. The list is categorized based on on-site visual inspection and age-based estimation. These poor-condition assets will be included in the 20-year CIP recommendations (Chapter 7).

Table 4-4 Flowering Pear Well and Franco Court Well Assets in Poor Condition

Well	Asset Name	Condition	Replacement Cost
Flowering Pear			
	Fencing		$7,875
	Control panel		$10,000
	Transfer switch		$15,000
Franco Court			
	Fencing		$3,150
	Motor controller		$15,000

5 How Should the Assets be Prioritized?

In order to prioritize the future needs for the water assets, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized.

5.1 Probability of Failure

The PoF score indicates the projected time until the asset fails to function as intended. PoF was represented by a score of 0 (new or very low probability of failure) to 1 (failed or very high probability of failure). An asset failure is represented by different failure modes (i.e., mortality, capacity, level of service, financial efficiency).

For the mortality failure mode, asset condition score or age was the key factor in determination of the PoF score. For water mains, historical main breaks were also incorporated.

For the capacity failure mode, hydraulic modeling work was performed to identify any capacity issues in the water system. The results of the hydraulic modeling indicate that the current system is capable of meeting current and future demand. However, field sample testing was lower than the hydraulic modeling capacity. The field results could be due to valve issues, leakage, or other issues; more investigation is required. For more information on the hydraulic modeling, refer to **Appendix B**.

For the level of service failure mode, the need for changes to the system to support the service demand were incorporated in the asset failure. These included water pressure, water quality, regulatory, safety, and emergency concerns.

For the efficiency failure mode, low efficiency (e.g., financial, energy) was the key factor for identifying asset failure.

5.2 Consequence of Failure

The CoF is a numerical measurement of the criticality of the asset, that is, the impact of the asset failure. Where applicable, the impact of failure was assessed with respect to the triple bottom line factors of sustainability: economic, social, and environmental. CoF scores were assigned on a scale of 1 (low criticality) to 5 (high criticality). The CoF is used to help prioritize the asset under limited budget and resources.

Prior to the asset management project, SJWC conducted a CoF analysis as documented in the 2015 Pipeline Consequence of Failure Study (**Appendix C**). The goal of the study was to rank each segment of the water pipeline from the highest to lowest consequence of failure.

The following consequences were considered during the CoF evaluation:

- Health and Safety
    - Potential water quality hazards due to contamination infiltration
    - Potential for injury due to flooding
    - Disruption to critical facility operations
- Transportation
    - Disruption to traffic along high traffic volume roads
- Business
    - Disruption to businesses
- Systems Operations

- Water supply shortage due to transmission main damage
- Water system facility disruption due to critical pipeline damage

Based on the principles of asset management, the CoF methodology was concluded to be sound. The CoF scores for the water mains were incorporated into the asset management study. In some cases, the water main IDs had changed since the 2015 study. These changes are likely due to water main replacement. Where possible, the score from the study was applied to the new pipe ID; where the new and old pipe IDs could not be reconciled, the score from the neighboring pipe was applied.

In order to make the main CoF scores consistent with facility asset CoF scores, the scores and ranking from the 2015 study were normalized to the 1 to 5 scale as summarized in the following table.

Table 5-1 Water Main CoF Scoring

Pipe Rank	% of Total Pipe Quantity	% of Total Pipe Length	CoF Score
1 to 106	10%	8%	5
107 to 212	10%	22%	4
213 to 530	32%	33%	3
531 to 760	22%	27%	2
761 - 1061	27%	26%	1

The following figure illustrates the CoF scores for the water mains. Valves along the water mains (e.g., line valves, blow off valves, air release valves) were given the same CoF score as the highest-CoF main to which it is attached.

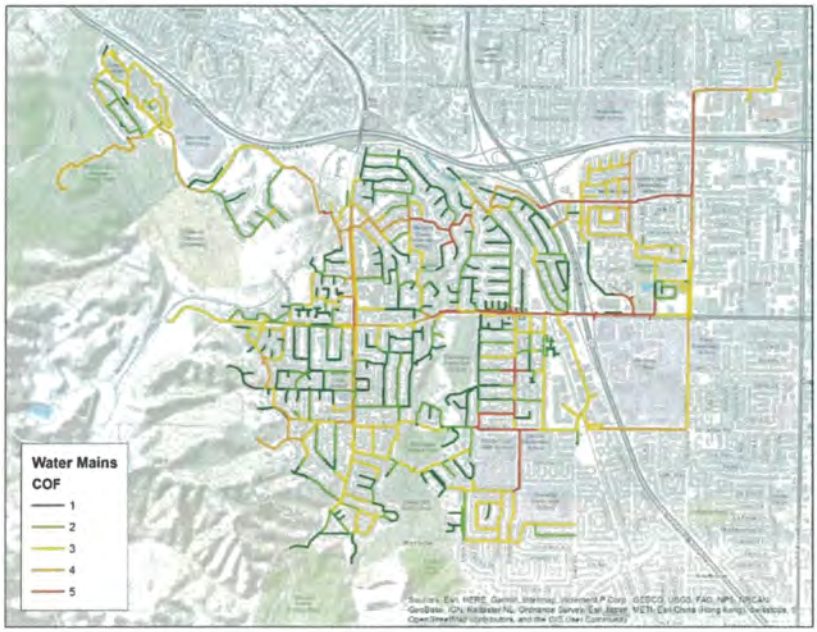


Figure 5-1 Water Main CoF Scores

The remaining water distribution asset CoF scores are shown in the table below. As hydrants provide critical emergency services, they were given a CoF score of 5. Water meters and services were given scores based on size. The greater the disruption a water service failure would cause, the greater the economic consequence of a failure.

Table 5-2 Water Distribution CoF by Asset Class

Asset Class	CoF
Hydrant	5
Hydrant Valves and Pipe	5
Interties	5
Meters and Services ≥ 4 in	4
Meters and Services between 1.5 and 3 in	2
Meters and Services ≤ 1 in	1

The following table shows the CoF scores for the water facility assets. Facility assets were given CoF scores based on their importance to the overall facility's ability to function. As such, many of the major mechanical and electrical assets (e.g., pumps, motors, emergency generator, MCC) were given high CoF scores.

Table 5-3 Water Facilities CoF by Asset Class

Asset Class	CoF	Asset Class	CoF
Tank	5	Flow Meter	4
Motor	5	Level Sensor	4
Pump	5	Pressure Transmitter	4
Generator	5	Intrusion Alarm	4
SCADA	5	Sump Pump	4
Vault Structure	5	Building	3
Well Casing	5	Strainer	3
Level Switch	5	Gantry Crane	3
Level Transmitter	5	Driveway/Pavement	2
Local Control Panel	4	Exhaust Fan	2
Transfer Switch	4	Valve	2
Breaker Panel	4	Fencing	1
Main Switch Board	4	Lighting	1
Disconnect Switch	4		

The following figure summarizes the percentage of critical assets. Figure 5-2 represents the asset criticality profile for all assets. Using the CoF assessment methodology summarized above, about 14% of all water system assets are considered to be critical (CoF ≥ 4).

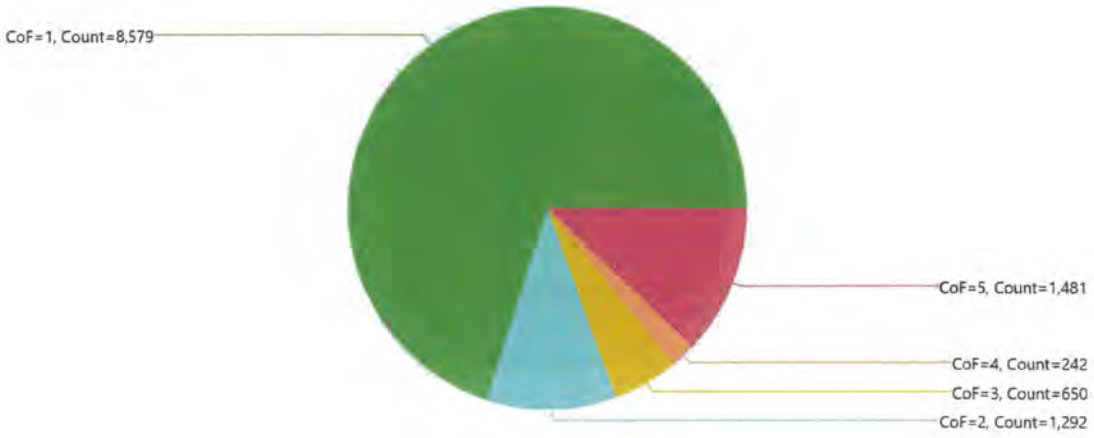


Figure 5-2 Asset Criticality Profile

5.3 Risk

The following figures show the resulting overall risk profiles for the water system. This profile incorporates both the Probability of Failure (PoF) and Consequence of Failure (CoF) scores to prioritize the assets. The assets in the red zone of the risk matrix are the highest risk assets. Under limited resources, assets in the red zone should take priority over others in terms of being replaced.

There are 26 high-risk assets with a total estimated replacement or rehabilitation cost of approximately $3.8 million. These assets are composed of water mains, water distribution system valves, water services, emergency generators, and tank rehabilitation at Mercedes Road. It should be noted that, as mentioned in Section 4.3, that Mercedes Station Tank #1 is currently not operating as the current water demand does not require it. However, if the water demand returns to historical level (3 MGD), Tank #1 will need to be operating again. More discussion on the need of Tank #1 will be provided in the CIP section (Chapter 7) of this report. The high-risk assets will be included in the 20-year CIP recommendations. The 148 assets in the medium risk (yellow zone) include water mains, water services, fire hydrants, and others. Under ideal conditions, all assets would be replaced as they reach PoF 1 at the top of the matrix; the replacement should be prioritized based on risk (red, yellow, and green).

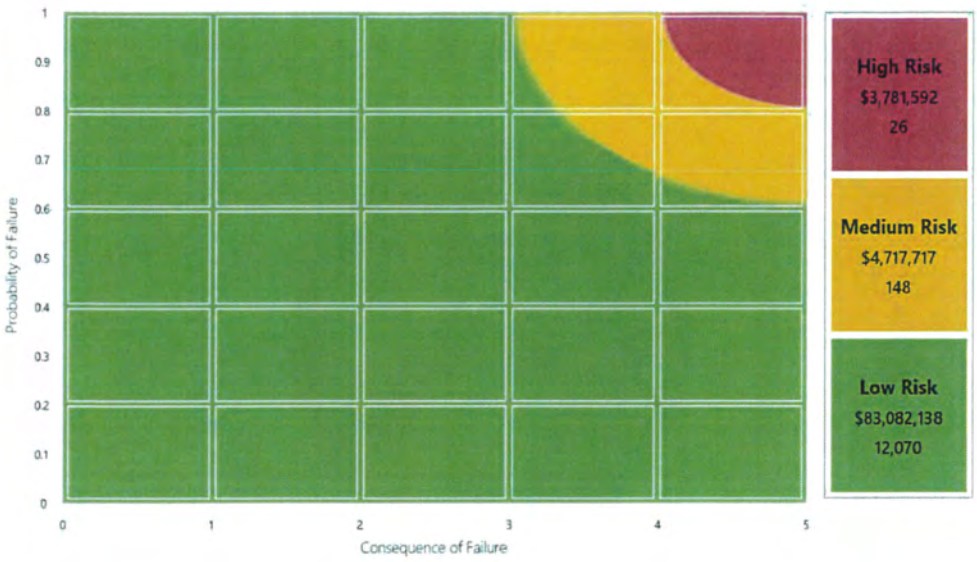


Figure 5-3 Risk Matrix

6 What are the Recommended Levels of Service?

Levels of service are performance indicators expressed as specific, measurable outcomes with defined time constraints. Service levels support priorities expressed in strategic plans, budget objectives, and policy-maker direction. The City should use levels of service to describe a commitment to service delivery, sustainability and risk management, asset performance, and regulatory compliance. Service levels are measured on a regular basis to learn where the organization is meeting or exceeding its goals and where improvement is needed. Service levels also indicate the level of effort and likely costs the agency must incur to meet its goals. The International Organization for Standardization in its Asset Management Guidelines (ISO 55002:2014(E)) note that defining service levels help ensure that the organization's assets are meeting the needs of customers and other stakeholders.

In order to develop levels of service for the City's water distribution system, four categories of indicators should be considered:

1. **Sustainability** - Sustainability topics will include minimizing the environmental impact of water operations, providing adequate financial resources for operations and capital needs, and maintaining a data-driven, effective organization.
2. **Asset Performance** - The asset performance section will identify actions required to obtain maximum performance and value from the community's investment in infrastructure.
3. **Customer Service** - The customer service category will address rate payers' expectations for product quality and reliability and for responsive, effective assistance from water organization employees.
4. **Regulatory Compliance** - Regulatory compliance will call out the responsibilities of the water agency to remain in compliance with the elements of the California Water Resources Control Board (WRCB) permit, state laws, and water regulations.

The tables below contain 51 level of service measurements recommended for the City. The indicator's level of importance is ranked on the following scale.

Table 6-1 Level of Service Importance Ranking

Rank	Description
3	Critical
2	Important
1	Useful

The measurements that matched AWWA "Benchmarking Performance Indicators for Water and Wastewater (2016 Edition)" are accompanied by the AWWA's benchmark numbers represented as high, median, and low percentiles of performance. Management and policy-makers often use these indicators to monitor performance and track the movement in the set direction.

6.1 Environmental, Organizational, and Financial Sustainability Levels of Service

The following table presents the recommended sustainability level of service to ensure stability by minimizing impact on the environment, maintaining an effective, productive organization, and ensuring that current and future financial obligations will be met.

Table 6-2 Environment, Organization, and Financial Sustainability Levels of Service

What We Do	What's Our Standard	How We Measure	Criticality Level	AWWA Performance Indicators		
				75th Percentile	Median	25th Percentile
Capital expenditures or funds reserved for pump station and storage rehabilitation / replacement	2.8% of NPV of pump station rehabilitation / replacement cost	Auditor attests annually	3	2.80%	1.50%	0.60%
Capital expenditures or funds reserved for well rehabilitation / replacement	2.5% of NPV of well rehabilitation / replacement cost	Auditor attests annually	3	2.5%	1.5%	0.3%
Capital expenditures or funds reserved for main and service line rehabilitation / replacement	2.1% of NPV of distribution piping rehabilitation / replacement cost	Auditor attests annually	3	2.1%	0.9%	0.5%
Set billing rates at levels that support both routine operations and planned capital replacement and rehabilitation. Adjust rates annually.	Rates provide adequate funding for operations, current capital projects, and reserve funds as established by system policy-makers	Auditor attests annually	3			
Employees maintain required certification levels	100%	Quarterly review of training and testing records	3			
Monitor and reduce water loss	≤ 4%	AWWA water audit software	2	3.3	5.9	14.3
Keep employee turnover rate low	≤ 5%	Human resources director attests	2	5.8%	6.8%	9.6%
Maintain at least a 2-day supply in storage based on average production for the previous 5 years	4.86 MG	System records annually and adjusted by the UWMP	2			
High risk assets receive priority funding in replacement and rehabilitation program	Funding for high risk asset replacement /rehabilitation not less than 85% of planned work	Biennial policy-maker review of asset risk assessment and CIP	2			
Adopt and regularly revise standard operating procedures	Management reviews and approves	Annually	2			
Increase annually use of recycled water for irrigation and other non-potable uses year over year	5% increase year over year	System records annually	1			

What We Do	What's Our Standard	How We Measure	Criticality Level	AWWA Performance Indicators 75th Percentile	Median	25th Percentile
Reduce electrical power costs year over year and increase alternative energy sources and fuels.	≥ 2%	Power bills and records of local power generation quarterly. Fuel consumption records quarterly	1			
Per capita water use steady to declining	Per capita use does not exceed a rolling two-year average	Customer billing records	1			
Make maximum use of grants and zero interest rate loans to support the water system	1 successful application every 3 years	Application history	1			
Maintain at least a high-grade bond rating	Annual review	Rating agency	1			
Employees rate workplace as excellent or good	≥ 85%	Biennial survey	1			

6.2 Asset Performance Levels of Service

From piping to pumps, a distribution system is asset-centric. The ability of underground and above ground assets to function properly facilitates delivery of potable water to customers. Establishing asset performance measurements will give management and policy-makers the guideposts needed to keep the organization's physical assets functioning at desired levels. A complete asset inventory, including criticality, will be instrumental in planning and executing preventive and corrective maintenance. Identification of critical assets and careful assessment of risk, updated routinely, will assure that limited resources are directed toward assets with the highest impact and probability of failure.

Table 6-3 Asset Performance Levels of Service

What We Do	What's Our Standard	How We Measure	Level	AWWA Performance Indicators 75th Percentile	Median	25th Percentile
High risk system valves exercised annually	≥ 99%	Maintenance records quarterly review	3			
Low risk system valves exercised annually	≥ 20%	Maintenance records quarterly review	2			
Hydrants tested	20% per year	Maintenance records semi-annual review	3			
Asset inventory and criticality database up to date	100% of assets identified and criticality assessed	Capital purchase and maintenance records reviewed annually	3			
Asset failures analyzed, and follow up actions completed	≥ 99%	Maintenance records annual review	2			

What We Do	What's Our Standard	How We Measure	Level	AWWA Performance Indicators		
				75th Percentile	Median	25th Percentile
Asset operation and maintenance costs fully tracked	≥ 99%	Maintenance records annual review	1			
Operate a mechanical, electrical, instrumentation and structural preventive maintenance program for all assets valued at $5,000 or critical to system operation	Failures and impaired performance decline year over year. Non-compliant equipment replaced	Report performance and replacement of equipment in program semi-annually	3			
Tank cleaning and inspection every 5 years including corrosion control	100%	Maintenance records	3			
Main or service line breaks repaired within 6 hours	≥ 95%	Maintenance records	1			
Adopt and revise a five-year capital improvement plan that reflects asset criticality	Policy-makers approve plan and revisions. Review progress.	Annually	2			
Testing of large meters or aging meter groups	Large meters – annually Aging meters – 20% annually	Maintenance records	2			
Conduct a leak detection program to reduce water loss and identify failing pipe sections	Water loss declines year over year by at least 5%. Failing segments identified and prioritized for repair or replacement	Management report to policy-maker annually.	3			
Breaks or leaks per 100 miles distribution pipe	≤ 6	Maintenance records	3	6	13	25
Maintain and update system risk assessment	Biennially	Management reports to policy-makers	2			

6.3 Customer Service Levels of Service

Customer service indicators describe the actions the organization will take to ensure the satisfaction of the rate payers and consumers. These levels of service set out markers for staff and decision-makers to guide individual interactions, community outreach and information availability, and the quality and reliability of the product.

Table 6-4 Customer Service Levels of Service

What We Do	What's Our Standard	How We Measure	Level	AWWA Performance Indicators		
				75th Percentile	Median	25th Percentile
Answer phone calls promptly	90% of calls answered within 20 seconds	Phone system records monthly	1			
Total hold time	≥ 1 minute	Phone system records monthly/ annual customer survey	3	0.6	1	2
Percent of calls abandoned	3.6%	Phone system records monthly	2	3.6	6.5%	10.6%
Water quality complaints per 1,000 customers	3	Customer records		1.7	4.1	10.5
Customer requests resolved within 1 business day	≥ 98%	Customer management software monthly/annual customer survey	2			
Minimum notice of 24 hours for all planned shutdowns	≥ 98%	Notice and outage records quarterly	2			
Minimum notice of 15 minutes for all unplanned shutdowns	≥ 85%	Notice and outage records quarterly	1			
Amount of time water is available to all customers	99.90%	Outage records quarterly	3			
Unplanned outages per year per 1,000 customers	1.38	Outage records quarterly	3	0.51	1.38	2.89
Customers able to use desired payment methods for water bills	≥ 90%	Annual customer survey	2			
Customers able to use desired tools to learn about water system activities and issues	≥ 95%	Annual customer survey	2			
Customers rate water service excellent or good	≥ 90%	Annual customer survey	3			
AWWA stakeholder outreach program checklist	≥ 90%	Management review	2	92%	67%	42%

6.4 Regulatory Compliance Levels of Service

Regulatory compliance is required by provisions of federal and California law and by orders and resolutions of the

State Water Resources Control Board, California's primary water regulator. The indicators in this section highlight the actions necessary to reliably deliver high-quality and safe drinking water, meet community fire flow demands, and secure future water supplies.

Table 6-5 Regulatory Compliance Levels of Service

What We Do	What's Our Standard	How We Measure	Level	AWWA Performance Indicators		
				75th Percentile	Median	25th Percentile
Remain in compliance with all permit requirements	100%	WRCB	3	100%	100%	100%
Provide fire flows required by SCCFD	100%	Annual testing in conjunction with flushing program	3			
Urban Water Master Plan completed	Every 5 years	Management presents results to policy-makers	3			
Maintain backflow prevention program in compliance with Title 17, Code of Regulations	All devices tested and in compliance. All program requirements met	Test records. Location and required improvement reports. Annually.	3			
Maintain 0.2 free chlorine in distribution system	100%	Sample testing records	3			
Complete sanitary survey for well sites	Every 5 years	Management presents results to policy-makers,	3			
Maintain system pressure between 40 and 70 PSI	≥ 95 %	Maintenance records	2			
Flush system annually to maintain water quality	100% of dead ends and low flow areas; 33% of other mains	Maintenance records	2			

7 What is Needed to Sustain the Delivery of Services?

The next step in the asset management analysis is to investigate the current and future asset replacement and rehabilitation needs. The future needs of the water system were evaluated based on the following methods:

- Condition and Age
- Level of Service
- Efficiency

The condition and age-based analysis focuses on the physical mortality of the assets, including when the assets need replacement and how much it will cost. The level of service analysis investigates the current system's ability to continue delivery of services, including capacity and safety. The efficiency analysis evaluates the system for any efficiency recommendations.

7.1 Condition and Age Based Analysis

In order to estimate the long-term asset replacement and rehabilitation needs in terms of physical mortality, a life-cycle cost analysis was performed for each asset. As described in Section 1.2 of this report, each asset class was assigned a life cycle cost logic or management strategy (e.g., useful life, decay curve, rehabilitation activities) that includes the rehabilitation and replacement activities to best characterize the life cycle investment needs for the asset. The estimated useful life is based on industry standards/reference documents (e.g., AWWA, Water Research Foundation, US EPA, Utah State University) or similar projects nearby the City (e.g., City of Livermore, Santa Clara Valley Water District). Assets in condition 4 or 5 that fail within the planning horizon are included in the long-term replacement needs. The following table summarizes the management strategies.

Table 7-1 Management Strategies

Asset Class	Useful Life (Years)	Rehabilitation Activity	Frequency (Years)	Cost	Rehabilitation Activity	Frequency (Years)	Cost
Air Release Valve	40						
Blow Off Valve	40						
Water Main - AC	65						
Water Main - DI	87						
Water Main - CI	75						
Water Main - FCKL, PVC, or WS	84						
Water Main Casing	84						
Line Valve, Connected Main	Same as Main						
Water Service	65						
Meter	20						
Sampling Station	100						
Fire Hydrant	100	Rehabilitation (Paint)	15	$300			

Asset Class	Useful Life (Years)	Rehabilitation Activity	Frequency (Years)	Cost	Rehabilitation Activity	Frequency (Years)	Cost
Mann Pump Station Building		Major rehabilitation	30	30% of cost	Replace roofing	15	$21,000
Breaker Panel	30						
Control Panel	30						
Disconnect Switch	15						
VFD	15						
Exhaust Fan	20						
Fence	20						
Flowmeter	20						
Gantry Crane	15						
Generator	30						
Intertie	100						
Intrusion Alarm	15						
Level Sensor	10						
Level Switch	10						
Level Transmitter	10						
Lighting	30						
Motor	20	Rehabilitation	10	25% of replacement cost			
Pavement - Asphalt	80	Rehabilitation	20	25% of replacement cost			
Pavement - Concrete	80	Rehabilitation	20	25% of replacement cost			
Unpaved Road		Rehabilitation	2	25% of replacement cost			
Pressure Transmitter	10						
Pump	40	Rehabilitation	20	25% of replacement cost			
SCADA	15						
Strainer	15						
Sump Pump	10						

Asset Class	Useful Life (Years)	Rehabilitation Activity	Frequency (Years)	Cost	Rehabilitation Activity	Frequency (Years)	Cost
Mann Suction Tank	125	Drain and inspection	7	$10,000			
Reservoir Tank	125	Rehabilitation (e.g., paint)	35	$ 500,000	Drain and inspection	7	$10,000
Transfer Switch	30						
Facility Isolation Valve	50						
Facility Check Valve	35						
Facility Air Release Valve	25						
Vault Structure	100						

The following figures show the long-range asset replacement and rehabilitation needs for the water system assets. Three planning horizons were utilized: 100 years, 20 years, and 10 years. A 100-year analysis provides a visualization of full replacement of all assets in the water distribution system (e.g., water main with 100-year life). For planning, a 20-year view provides a closer outlook of any upcoming spikes. A 10-year horizon will provide a more detailed information on what assets are anticipated to fail in the near future.

100-Year R&R Analysis

The result of a 100-year life cycle analysis is provided below. The total asset replacement and rehabilitation needs for the next 100 years is estimated to be $164.9 million. The average annual asset replacement and rehabilitation need is approximately $1.6 million in 2019 dollars. Inflated costs were not calculated as the long, 100-year, horizon exponentially increases the total replacement and rehabilitation sum. In addition, the City will never plan based on a 100-year planning horizon.

In the first couple of years, most replacement and rehabilitation needs are for water mains, valves, services, and meters; the overdue replacements include water services that are estimated to need replacement and recommended replacements at the facilities (e.g., emergency generators).

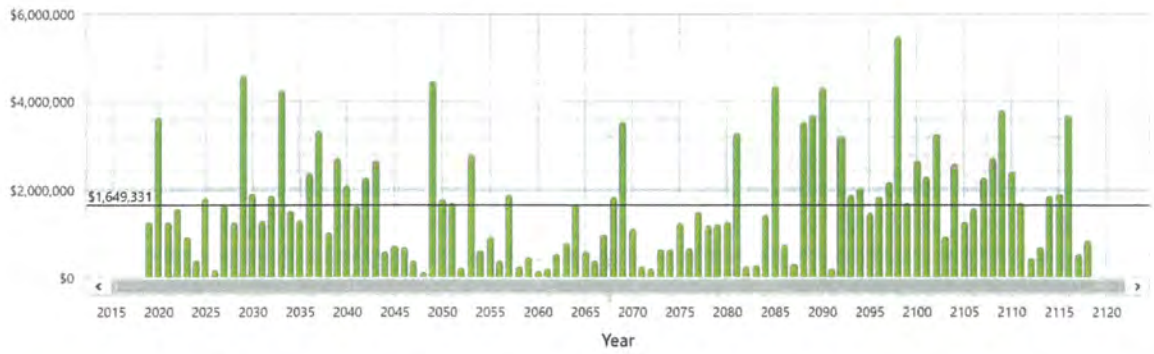


Figure 7-1 Water Distribution Asset Replacement and Rehabilitation Profile (100 Years)

20-Year R&R Analysis

In addition, a 20-year replacement and rehabilitation analysis was conducted. The total replacement and rehabilitation need for the next 20 years is $37.1 million. The average annual needs over a 20-year horizon is approximately $1.9 million per year.

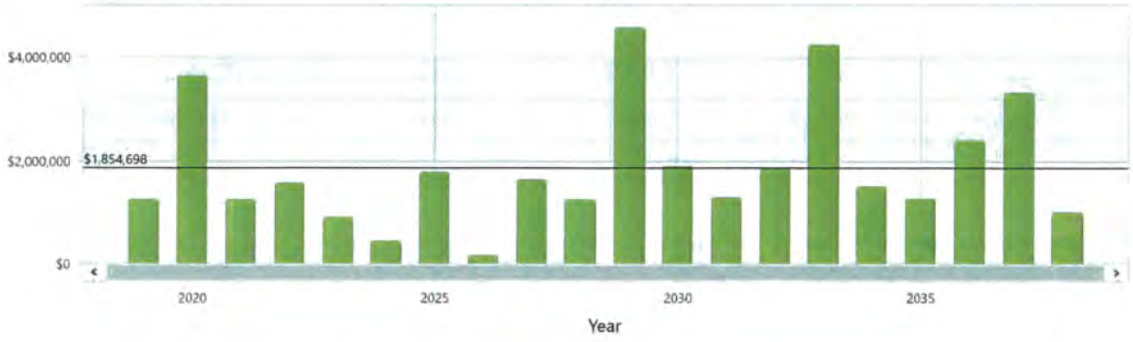


Figure 7-2 Water Distribution Asset Replacement and Rehabilitation Profile (20 Years)

The following graph provides a closer look at Figure 7-3 by summarizing the 20-year age and condition-based needs by asset class or location. Note that level of service recommendations will be covered in the next section. Over the next 20 years, it is anticipated that water mains ($17.3 million), water services ($9.2 million), Mercedes Road and Cristo Rey reservoirs ($2.1 million), and Mann pump station ($2.4 million) will be the biggest needs.

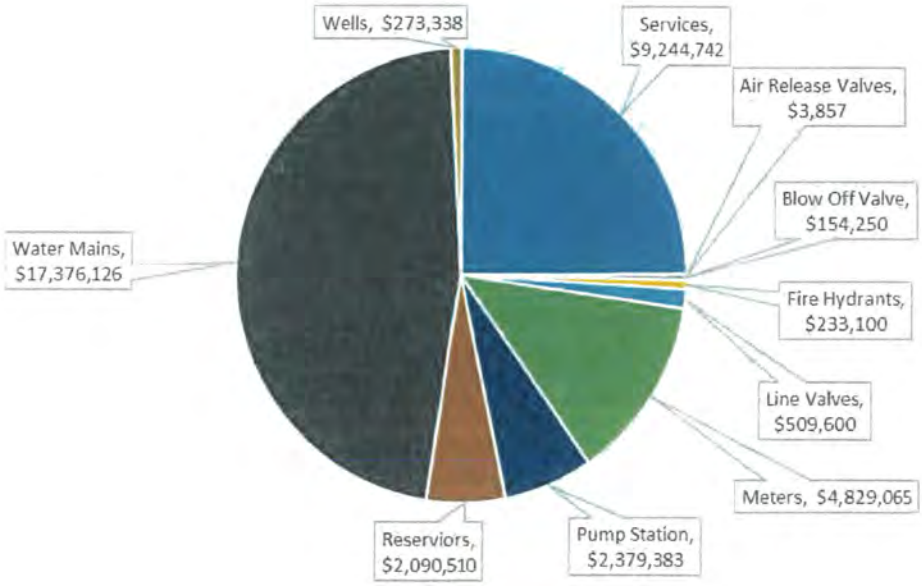


Figure 7-3 Total 20-Year Condition-Based Replacement and Rehabilitation Profile by Asset Type

The bulk of the R&R needs over the 20-year horizon for reservoirs is for Mercedes Road Station. These activities include the electrical building and system replacement, generator installation, tank rehabilitation/inspection, site rehabilitation, and replacement of various instruments and valves.

The future R&R over the 20-year horizon for Mann Pump Station includes generator replacement, pump and motor assembly replacements, tank rehabilitation/inspection, and building and site rehabilitation.

10-Year R&R Analysis

The analysis was repeated using a 10-year horizon to project the short-term needs. The total replacement and rehabilitation need for the next 10 years is $13.8 million. The average annual needs over a 10-year horizon is approximately $1.4 million per year.

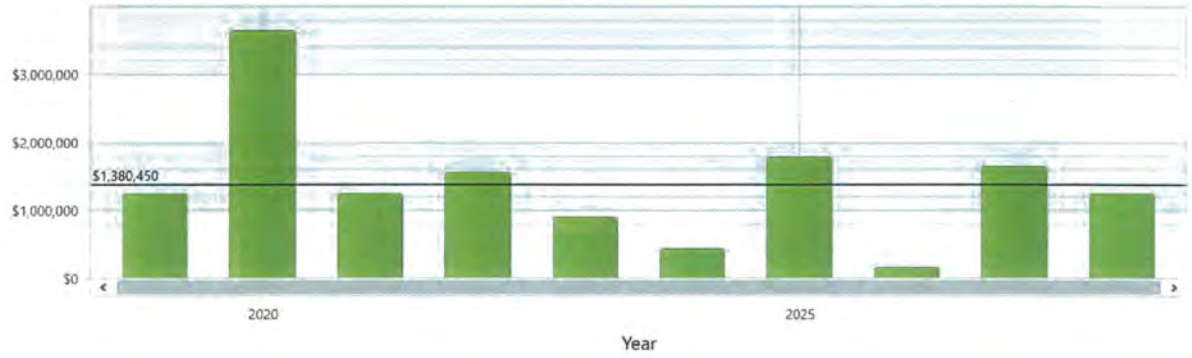


Figure 7-4 Water Distribution Asset Replacement and Rehabilitation Profile (10 Years)

The following figure presents a more detailed look of Figure 7-5 by summarizing the 10-year age and condition-based needs by asset class or location. Note that level of service recommendations will be covered in the next section. Over the next 10 years, it is anticipated that water mains ($6.7 million), water services ($3.0 million), Mercedes Road and Cristo Rey reservoirs ($1.9 million), and Mann pump station ($1.6 million) will be the biggest needs.

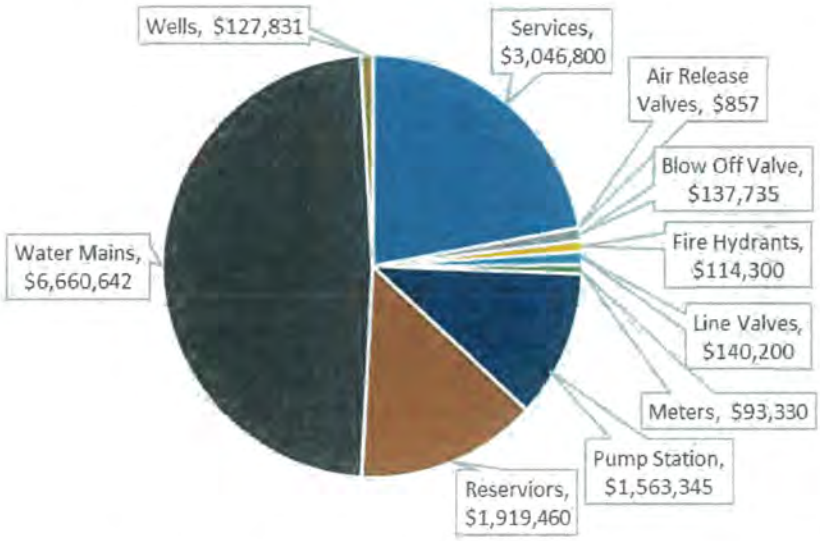


Figure 7-5 Total 10-Year Condition-Based Replacement and Rehabilitation Profile by Asset Type

The bulk of the R&R needs over the 10-year horizon for reservoirs is for Mercedes Road Station. These activities include the electrical building and system replacement, generator installation, tank rehabilitation/inspection, site rehabilitation, and replacement of various instruments and valves.

The future R&R over the 10-year horizon for Mann Pump Station includes generator replacement, pump and motor assembly replacements, tank rehabilitation/inspection, and building and site rehabilitation.

R&R Analysis Summary

The following table summarizes the annual average for the different replacement and rehabilitation analyses.

Table 7-2 Water Management System R&R Summary

Analysis Type	Total R&R	Annual Average
100-Year	$165 million	$1.6 million
20-Year	$37.1 million	$1.9 million
20-Year with 3% Inflation	$50.9 million	$2.5 million
10-Year	$13.7 million	$1.4 million
10-Year with 3% Inflation	$15.5 million	$1.5 million

The following figures provide a closer look at when major replacement needs are projected for the water mains, water services, and water meters.

Water Mains

The following figure presents the projected water main replacement for the next 20 years. As discussed previously, a large portion of the water mains are aging and are estimated to need replacement in the near future. In particular, AC mains estimated to have been installed in the 1950's and 1960's will are estimated to need replacement. In the next 20 years, approximately $17.4 million worth of mains are estimated to need replacement, with an annual average need of approximately $869,000.

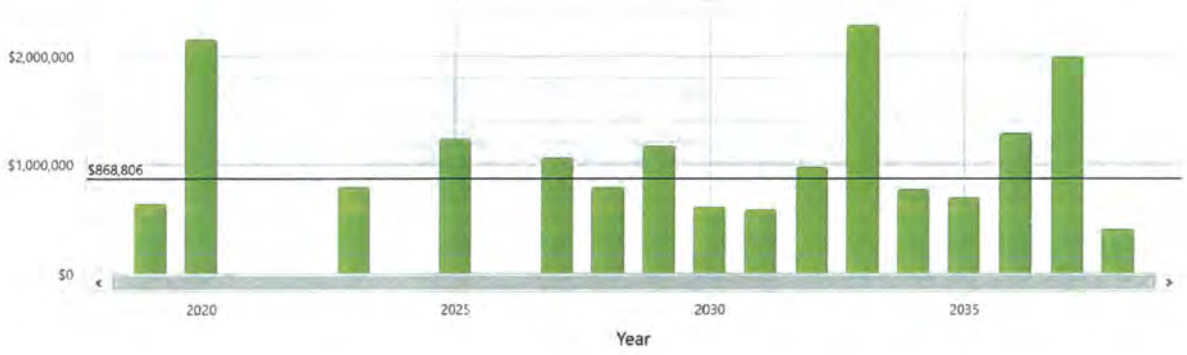


Figure 7-6 20-Year Replacement Profile for Water Mains

An additional analysis was conducted on the future main replacement needs using a probabilistic method. In this analysis, some mains are projected to fail earlier than their expected useful lives, while others are expected to fail later. Using this projection method, $9.4 million worth of mains are estimated to need replacement in the next 20 years, with an annual average of $468,000.

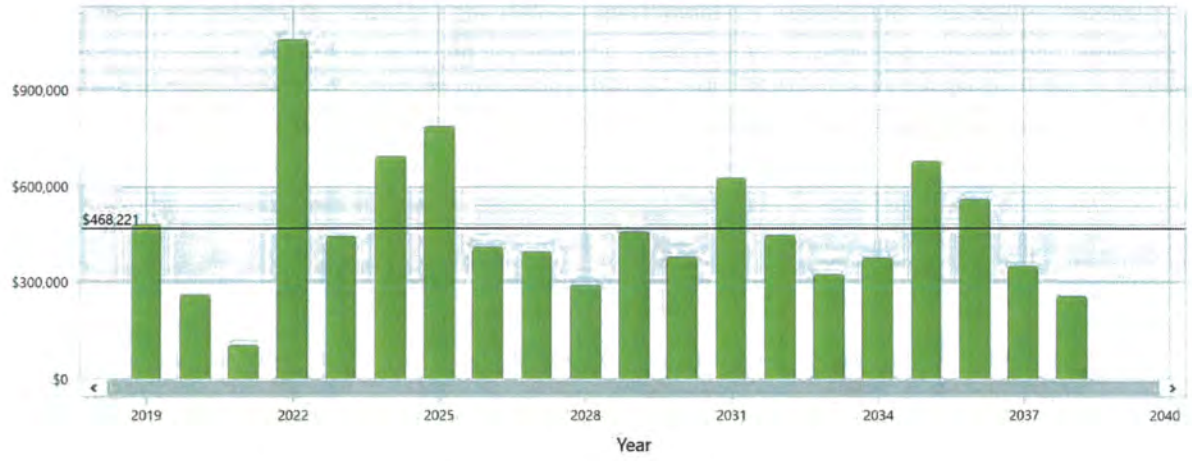


Figure 7-7 20-Year Replacement Profile for Water Mains – Probabilistic

The following table compares the water main replacement analyses. The actual water main replacement needs will likely fall between the two analyses.

Table 7-3 20-Year Water Main R&R Summary

Analysis Type	Total R&R	Annual Average
20-Year	$17.4 million	$869,000
20-Year, Probabilistic	$9.4 million	$468,000

Water Services and Water Meters

Replacement profiles of water services and water meters are presented below. Due to their shorter lives, it is projected that the greatest near future asset replacement needs will be water services and water meters. As shown in the figure below, approximately $14.1 million worth of services and meters will need replacement in the next 20 years, with an annual average of $704,000.

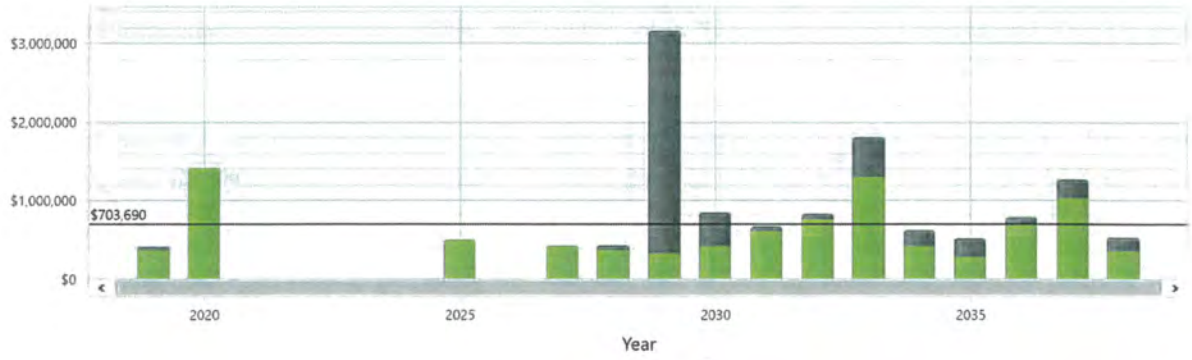


Figure 7-8 20-Year Replacement Profile for Water Services and Meters

An additional analysis was conducted on the future water services and water meters replacement needs using a probabilistic method. In this analysis, some services and meters are projected to fail earlier than their expected useful lives, while others are expected to fail later. Using this projection method, $7.4 million worth of meters and services are estimated to need replacement in the next 20 years, with an annual average of $371,000.

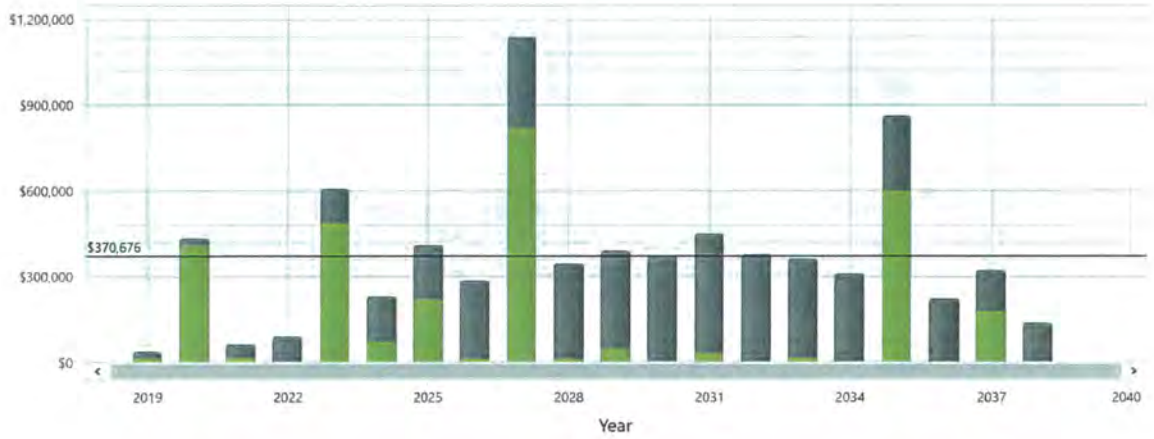


Figure 7-9 20-Year Replacement Profile for Water Services and Water Meters – Probabilistic

The following table compares the water services and water meters replacement analysis. The actual replacement needs may fall between the two analyses.

Table 7-4 20-Year Water Services and Water Meter R&R Summary

Analysis Type	Total R&R	Annual Average
20-Year	$14.1 million	$704,000
20-Year, Probabilistic	$7.4 million	$371,000

Backlog Analysis

Analysis was performed to compare and contrast the projected asset replacement and rehabilitation work since the start of SJWC's operation in 1997 to actual work performed by SJWC. A life-cycle cost analysis was performed with start year of analysis set to 1997. A planning horizon of 21 years was used to project the asset replacement and rehabilitation needs from 1997 to 2018. According to the analysis, an estimated asset replacement and rehabilitation needs for the 21-year period was $10.3 million. From this value, assets identified with known install year between 1997 and 2018 were removed. This assumes that those assets were installed under SJWC's management. The sum of all assets installed between 1997 to 2018 equated to $8.8 million. Taking $8.8 million from the projected $10.3 million reveals a value of $1.5 million. In theory, $1.5 million should be the amount of backlog not addressed from 1997 to 2018. However, the confidence level of $1.5 million is low. According to the City, SJWC reported having spent $5.73 million on asset rehabilitation and replacements since 1997. Based on this fact, the actual backlog of work could range from $1.5 million to $4.57 million.

7.2 Level of Service Analysis

The Level of Service analysis investigates the need for changes to the system to support the service demand. A capacity analysis considering both the current and future demand for water services in the water system was performed as part of the asset management study. The demand includes fire flow demands. As identified in the Cupertino Leased Water System Capacity Analysis (2018), no excessive capacity issues were identified under current demand.

The future demand analysis shows that the system demand trend has been decreasing in recent years due to the state-wide drought. In addition, limited or no growth is expected in the service area. As such, the system has the capacity to support future water demand. For more information about the water demand and capacity analysis, refer to the Cupertino Leased Water System Capacity Analysis (2018).

If the water demand rises, it is recommended that the City bring the Mercedes Road Storage Tank #1 back in service. Figure 7-10 shows a 10-year history of average water consumption. Since 2008, the average water consumption in Cupertino has steadily declined due to drought and water conservation programs. However, after recent wet winters, the graph reveals the average water consumption rising again. In 2008, the average water consumption was 3 MGD. In 2017, this value dropped to 2 MGD. At 2 MGD, the total capacity required is 3.3 MGD, using a design factor (maximum daily demand) of 1.5 and fire flow requirement of 0.3 MGD. Even with Mercedes Road Storage Tank #1 out of service, there is enough storage (4 MG) in the system to handle this load. However, as the graph shows, starting 2018 there is a bit of upward trend in water consumption. If this trend continues, when the average water consumption reaches 2.5 MGD, the total required storage capacity will reach over 4 MG. In 2018, the average water consumption was 2.26 MGD. The estimated cost to bring Mercedes Road Storage back in operation is approximately $1.92 million. This estimate includes rehabilitation, seismic upgrades, adding mixers, and other safety upgrades. This cost is reflected in Table 7-9.

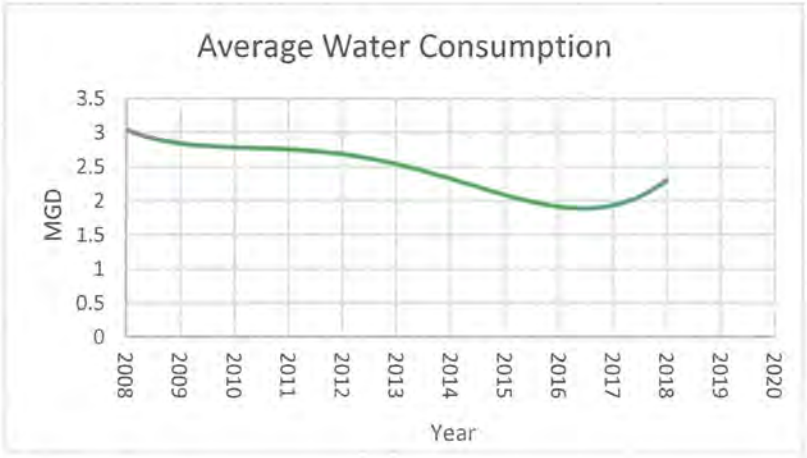


Figure 7-10 10-Year Water Consumption Trend

An additional recommended level of service is to develop an Urban Water Master Plan at an estimated cost of $250,000 every 5 years.

Another recommended project is related to the chronic low service pressure at Inspiration Heights. During the project and capacity investigation, it was found that 22 service locations have low pressure concerns. A closed water

service pressure zone should be investigated as a solution. This project includes the assessment and design, as well as the installation of a hydropneumatic tank, a small 24-hour pumping system and standby fire pumps, and a separate distribution piping system for an estimated $500,000. This project is recommended to be implemented within 5 years.

The connection/development of a SCADA monitoring system for the City is another recommended project. The priority of this recommendation varies based on whether the City chooses to operate the system or not. Even if the City does not operate the system, it will be helpful for the City to have the ability to monitor the status of the Leased Water System. This project is estimated to cost $300,000. This project is recommended to be implemented within 10 years, or earlier if the City decides to operate the system.

In addition, level of service includes the investigation of upgrades for regulatory, safety, and emergency concerns at the facilities. Seismic and emergency power upgrades for the storage tanks and wells were identified. The following table shows the recommended level of service upgrades for the facilities.

Table 7-5 Level of Service CIP Recommendations

Year	Asset / Location	Activity	Estimated Cost
2019	Mercedes Road Station Site	Thin foliage and create fire break	$45,000
2020	Mercedes Tank #2	Improve seismic stability with anchoring, foundation repair, flexible piping and other reinforcement	$ 308,000
2023	Flowering Pear Well	Install emergency generator	$ 200,000
2023	Franco Court Well	Install emergency generator	$ 200,000
2024	Mann Pump Station Suction Tank	Improve seismic stability with anchoring, foundation repair, flexible piping and other reinforcement	$92,400
2025	SCADA Monitoring Office		$300,000
2029	Mercedes Tank #1	Improve seismic stability with anchoring, foundation repair, flexible piping and other reinforcement	$ 308,000

7.3 Efficiency Analysis

The efficiency analysis examined opportunities for increased efficiency (e.g., financial, energy) in the system. In the Recommended Levels of Service, reduce electrical power costs year over year and increase alternative energy sources and fuels was one of the recommendations. The following projects will also help to address this level of service. The following table includes the specific recommendations for the VFD/soft start CIP recommendations for energy efficiency.

Table 7-6 Efficiency CIP Recommendations

Year	Asset	Activity	Estimated Cost
2021	Mann Pump Station	Install VFDs/Soft starts	$150,000
2023	Flowering Pear Well	Install VFD/Soft start	$ 15,000
2023	Franco Court Well	Install VFD/Soft start	$ 15,000

7.4 Analysis Summary

The following table summarizes the total water system needs, including the condition/age, level of service, and efficiency analyses.

Table 7-7 Long Range Water System Needs Summary

Analysis Type	Total R&R	Annual Average
100-Year	$166.8 million	$1.7 million
20-Year	$38.8 million	$1.9 million
20-Year with 3% Inflation	$54.4 million	$2.7 million
10-Year	$15.3 million	$1.5 million
10-Year with 3% Inflation	$17.6 million	$1.8 million

The following figures show the long-range replacement and rehabilitation profiles including the condition and age analysis, the level of service analysis, and the efficiency analysis.

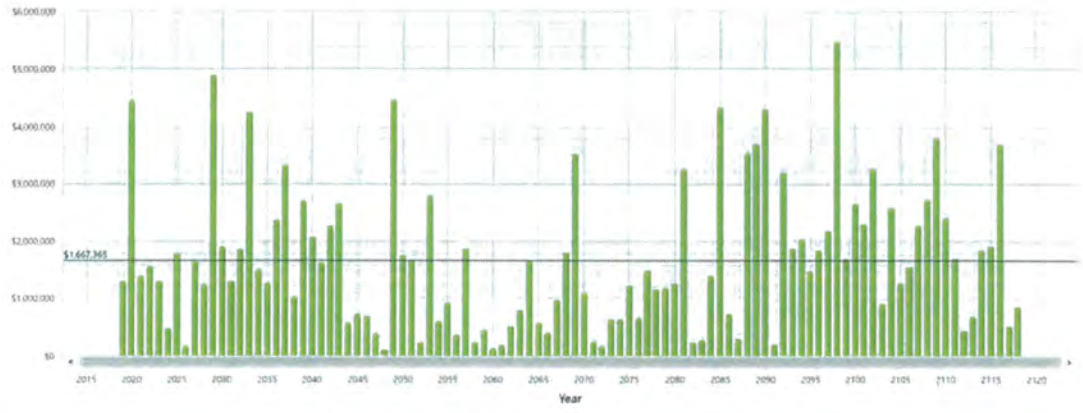


Figure 7-11 Long-Range Water System Needs - Condition/Age, Level of Service, and Efficiency – 100 Years

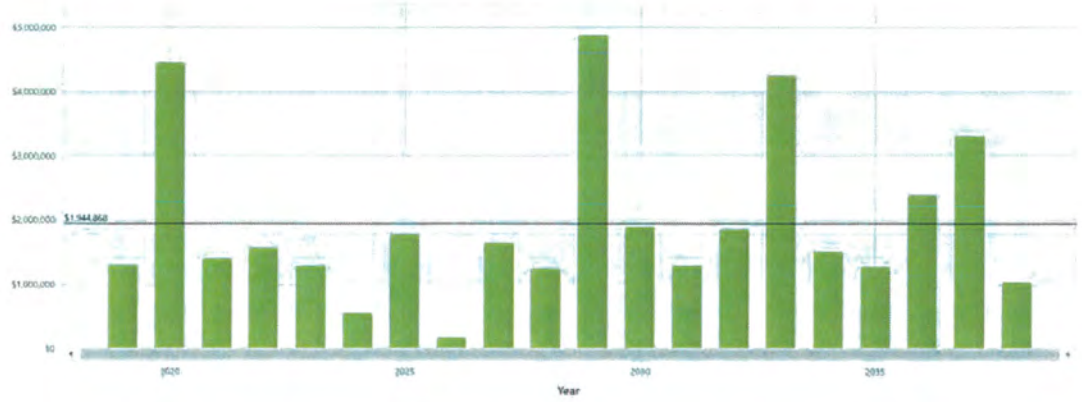


Figure 7-12 Long-Range Water System Needs - Condition/Age, Level of Service, and Efficiency – 20 Years

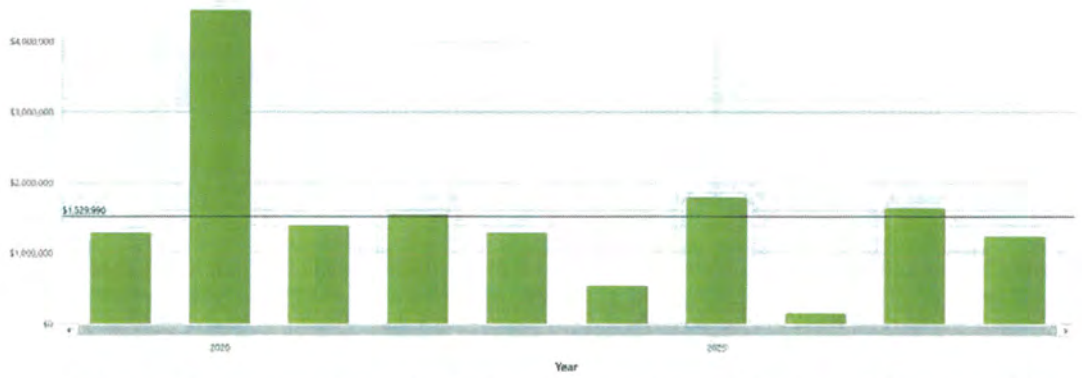


Figure 7-13 Long-Range Water System Needs - Condition/Age, Level of Service, and Efficiency – 10 Years

7.5 10-Year and 20-Year CIP Summary

The following tables summarize the recommended CIP for the next 20 years considering the condition, level of service, and efficiency analyses.

Table 7-8 2019 to 2028 CIP Summary

Asset Class/ Location	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Water Mains		$2,791,800					$2,024,000			$1,844,900
Valves		$176,200					$37,700			$64,900
Meters	$35,600								$57,600	
Service Line	$1,771,200								$1,275,600	
Fire Hydrants			$114,300							
Cristo Rey Storage Tank				$50,600						
Mercedes Station		$1,910,900						$231,000		
Mann Pump Station			$1,274,400			$531,400				
Flowering Pear Well					$288,300					
Franco Court Well					$270,100					
SCADA							$300,000			$70,000
Master Plan	$250,000					$250,000				
Low Pressure Project			$500,000							
Valve Location Project					$50,000					
Total	$2,056,800	$4,878,900	$1,888,700	$50,600	$608,400	$781,400	$2,361,700	$231,000	$1,333,200	$1,979,800

Table 7-9 2029 to 2038 CIP Summary

Asset Class/ Location	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Water Mains				$3,313,100			$3,732,500			$3,669,900
Line Valve				$109,000			$163,600			$116,300
Meters		$3,292,800				$1,442,900				
Service Line		$1,355,700				$2,470,500			$2,371,700	
Fire Hydrants	$118,800									
Cristo Rey Storage Tank			$52,700							
Mercedes Station			$426,400							
Mann Pump Station	$816,100									
Franco Court Well					$62,000					
Flowering Pear Well					$84,000					
Master Plan	$250,000					$250,000				
Total	$1,184,900	$4,648,500	$479,100	$3,422,100	$146,000	$4,163,400	$3,896,100		$2,371,700	$3,786,200

Appendix A

Asset Inventory of Pump Station, Storage Tanks, and Wells

Cristo Rey Storage Tank

Class	Name	Size
Driveway	Access Road	3360 SQFT
Fencing	Security Fencing	790 FT (LENGTH)
Pavement	Yard Pavement	4320 SQFT
Vault Structure	Vault Structure, Level Control Valve	12 FT (LENGTH)
Tank	Cristo Rey Storage Tank	2.051 MG
Valve	Tank Drain Valve #1	4 IN (DIA)
Valve	Tank Drain Valve #2	6 IN (DIA)
Valve	Tank Isolation Valve #1	12 IN (DIA)
Valve	Tank Isolation Valve #2	12 IN (DIA)

Mann Pump Station

Class	Name	Size
Fencing	Security fence	325 FT (LENGTH)
Pavement	Concrete Pavement	702 SQFT
Pavement	Crushed Gravel Pavement	8550 SQFT
Tank	Suction Tank	0.4 MG
Valve	Tank Isolation Valve (Emergency Connection)	6 IN (DIA)
Valve	Tank Inlet Air Release Valve	2 IN (DIA)
Valve	Tank Main Inlet Check Valve	12 IN (DIA)
Valve	Tank Main Inlet Isolation Valve	12 IN (DIA)
Valve	Tank Bypass Upstream Isolation Valve	8 IN (DIA)
Valve	Tank Bypass Check Valve	8 IN (DIA)
Valve	Tank Bypass Upstream Isolation Valve	8 IN (DIA)
Instrumentation	Pressure transmitter	
Instrumentation	Tank level alarm	
Instrumentation	Controller, suction tank level	
Building	Pump House	1400 SQFT
Lifting Equipment	Gantry Crane	0.75 TON (LOAD)
Instrumentation	Intrusion Alarm	
HVAC	Ventilation Fan	
Generator	Engine-Generator Set, Bus B	
Generator	Engine-Generator Set, Bus A	

Class	Name	Size
Control Panel	Main Switch Board	
Control Panel	Automatic Transfer Switch. Bus B	
Control Panel	Motor Control/Disconnect - Motor 1	
Control Panel	Motor Control/Disconnect - Motor 2	
Control Panel	Motor Control/Disconnect - Motor 3	
Control Panel	Motor Control/Disconnect - Motor 4	460 VOLTS
Control Panel	Motor Control/Disconnect - Motor 5	460 VOLTS
Control Panel	Main Panel	460 VOLTS
SCADA	SCADA Controller and RTU	
Valve	Pump Suction/Tank Outlet Isolation Valve	14 IN
Valve	Pump #3&4 Suction Supply Isolation Valve	14 IN
Valve	Booster Pump #1 Suction Isolation Valve	10 IN
Pump	Booster Pump #1	1,262 / 1,150 GPM
Motor	Booster Pump #1 Motor	100 HP
Valve	Booster Pump #1 Air Release Valve	0.5 IN
Valve	Booster Pump #1 Check Valve	8 IN
Valve	Booster Pump #1 Discharge Isolation Valve	8 IN
Valve	Booster Pump #2 Suction Isolation Valve	10 IN
Pump	Booster Pump #2	1,262 / 1,150 GPM
Motor	Booster Pump #2 Motor	100 HP
Valve	Booster Pump #2 Air Release Valve	0.5 IN
Valve	Booster Pump #2 Check Valve	8 IN
Valve	Booster Pump #2 Discharge Isolation Valve	8 IN
Valve	Booster Pump #3 Suction Isolation Valve	8 IN
Pump	Booster Pump #3	1050 GPM
Motor	Booster Pump #3 Motor	75 HP
Valve	Booster Pump #3 Air Release Valve	0.5 IN
Valve	Booster Pump #3 Check Valve	8 IN
Valve	Booster Pump #3 Discharge Isolation Valve	8 IN
Valve	Booster Pump #4 Suction Isolation Valve	8 IN
Pump	Booster Pump #4	1262 / 1150 GPM
Motor	Booster Pump #4 Motor	100 HP
Valve	Booster Pump #4 Air Release Valve	0.5 IN

Class	Name	Size
Valve	Booster Pump #4 Check Valve	8 IN
Valve	Booster Pump #4 Discharge Isolation Valve	8 IN
Valve	Booster Pump #5 Suction Isolation Valve	8 IN
Pump	Booster Pump #5	1600 GPM
Motor	Booster Pump #5 Motor	100 HP
Valve	Booster Pump #5 Air Release Valve	0.5 IN
Valve	Booster Pump #5 Check Valve	8 IN
Valve	Booster Pump #5 Discharge Isolation Valve	8 IN
Vault Structure	PRV Vault	6 FT (LENGTH)
Sump Pump	PRV Vault Sump Pump	1.5 IN
Valve	Pressure Regulating Valve #1 Upstream Isolation Valve	8 IN
Valve	Pressure Regulating Valve #1	10 IN
Valve	Pressure Regulating Valve #1 Downstream Isolation Valve	8 IN
Valve	Pressure Regulating Valve #2 Upstream Isolation Valve	4 IN
Valve	Pressure Regulating Valve #2	4 IN
Valve	Pressure Regulating Valve #2 Downstream Isolation Valve	4 IN
Vault Structure	Flow Meter Vault	5 FT (LENGTH)
Sump Pump	Flow Meter Vault Sump Pump	1.5 IN
Instrumentation	Flow Meter	8 IN
Vault Structure	Station Flow Meter Vault	5 FT (LENGTH)
Instrumentation	Station Flow Meter	IN

Mercedes Road Storage Tanks

Class	Name	Size
Fencing	Fencing	700 FT (LENGTH)
Pavement	Yard Paving	16092 SQFT
Site	Site	
Tank	Tank #1	2 MG
Instrumentation	Tank #1 Level Sensor	
Valve	Tank #1 Isolation Valve	20 IN
Valve	Tank #1 Altitude Valve	20 IN
Valve	Tank #1 Inlet Isolation Valve	
Valve	Tank #1 Outlet Isolation Valve	

Class	Name	Size
Valve	Tank #1 Bypass Isolation Valve	
Valve	Tank #1 Air Release Valve	2 IN
Tank	Tank #2 (Undergoing Rehabilitation)	2 MG
Instrumentation	Tank #2 Level Sensor	
Valve	Tank #2 Isolation Valve	6 IN
Valve	Tank #2 Outlet Isolation Valve	6 IN
Valve	Tank #2 Altitude Valve	20 IN
Valve	Tank #2 Air Release Valve	IN
Building	Mercedes Station Electrical Shed	70 SQFT
Control Panel	Controller, Emergency Generator	
Generator	Emergency Generator	
Control Panel	Main Electrical Panel	240 VOLTS
Control Panel	Electrical Sub-Panel	
SCADA	Remote Terminal Unit, Mercedes Tank Sensor	

Flowering Pear Well

Class	Name	Size
Fencing	Fencing	225 FT (LENGTH)
Pavement	Yard Paving	1800 SQFT
Well Casing	Flowering Pear Well	6 IN
Pump	Pump, Flowering Pear Well	550 GPM
Motor	Motor, Pump	75 HP
Valve	Air Release Valve	2 IN
Valve	Isolation Valve, Auxiliary Line	8 IN
Valve	Isolation Valve, Well	8 IN
Filter	Sand Trap	8 IN
Instrumentation	Flow Meter	
Control Panel	Motor Controller	
Control Panel	Manual Transfer Switch	
SCADA	SCADA Controller and RTU	

Franco Court Well

Class	Name	Size
Fencing	Fencing	90 FT (LENGTH)
Pavement	Yard Paving	441 SQFT
Lighting	Lighting	
Well Casing	Franco Court Well	8 IN
Pump	Well Pump	700 GPM
Motor	Pump Motor	75 HP
Valve	Air Release Valve	2 IN
Instrumentation	Flow Meter	8 IN
Valve	Check Valve	8 IN
Valve	Isolation Valve	8 IN
Control Panel	Motor Controller	
SCADA	SCADA Controller and RTU	

Appendix B

Hydraulic Analysis Report

KAYUGA
SOLUTION

City of Cupertino

Cupertino Leased Water System Capacity Analysis

Prepared by Charlie Marr Consulting

2018

Table of Contents

List of Exhibits

Appendices

1 Introduction and Purpose

The Cupertino Leased Water System Capacity Analysis was performed to support the Asset Management and Valuation investigation for the City of Cupertino. Cupertino owns a public water supply and distribution system, the operation and maintenance of which has been leased to the San Jose Water Company (SJWC) since 1997. The lease is for 25 years, and will end in 2022. The San Jose Water Company Service area and Cupertino's leased water system service area are shown in **Exhibit 1**.

The City is performing its due diligence to determine system integrity and capacity. As part of the City's due diligence investigation, it contracted with consultants in recent years to begin the process of affirming the water system operation and maintenance activities meet the lease agreement requirements, and that operation of the system is in accordance with customary utility practice and within the Operator's standards of the other water systems it owns and operates.

The capacity analysis is a recommendation in the *Final Technical Report Leased Water System Inspection*, by SPF Water Engineering (January 12, 2017).

2 Leased Water System

The City of Cupertino's leased system serves the northwest third of its City boundary, as shown in Exhibit 2. The City has leased out its operation and maintenance to San Jose Water Company, which owns a separate water system serving the southern portion of the City. California Water Service Company serves the remainder of the City in the northeastern area of the city.

The water system operates in a supply zone and two separate distribution pressure zones, and consists of City-owned groundwater well supply and imported water supply from the Santa Clara Valley Water District (SCVWD). SCVWD is a wholesaler for retail water utilities including SJWC and the City of Cupertino. The system serves 3.7 square miles of the City and consists of approximately 60 miles of water pipelines (ranging in diameter from 2-inch to 20-inch); 4,554 customer service connections (as of 2017); three 2.0 million-gallon (MG) reservoirs at two reservoir sites (Mercedes and Cristo Rey); a forebay, five parallel booster pumps and imported water supply source at the Mann Drive Pump Station site with total rated capacity of approximately 6,000 gpm capacity; two off-site wells and Homestead Road/Stelling Road transmission system; and two regional pressure-reducing stations at the Mann Drive Pump Station site. These facilities serve, on average, 800 to 1,000 million gallons per year, and represent about two percent of the total water served by San Jose Water Company.

2.1 Service Area and Applied Loading

The leased system service area is virtually built-out and consists predominantly of residential land uses. The City's Community Vision 2040 general plan defines the following Special Areas and residential communities within the water service area of the leased system:

- Bubb Road (low-rise industrial and research)
- Monte Vista Village (residential, neighborhood commercial, public and industrial)
- Oak Valley Neighborhood (residential)
- Creston-Pharlap Neighborhood (residential, includes school)
- Inspiration Heights (residential, includes institution and Mercedes reservoirs)
- Monte Vista North (residential, schools)
- Garden Gate (residential)

According to the general plan, limited or no growth is expected from these areas except for 42 acres of vacant privately-held land that could develop homes on a portion. This would still represent minimal increased demands in the future and not be significant for the model analysis.

2.2 System Demands

The Annual Reports SJWC produces for the Cupertino Municipal Water System identifies average annual demands of the leased water system as follows:

Table 2-1 – Average Annual Water Demands

Land Use	Year (million gallons per day)				
	2013	2014	2015	2016	2017
Residential	1.69	1.46	0.98	1.04	1.11
Commercial	0.80	0.77	0.63	0.54	0.58
Industrial	0.25	0.38	0.22	0.17	0.21
Public	0.24	0.19	0.15	0.15	0.14
Other	0.00	0.00	0.00	0.00	0.00
Total MGD	2.99	2.80	1.98	1.91	2.04
Total gpm	***2,077***	***1,945***	***1,377***	***1,324***	***1,419***

The trend seen here with lower demands in recent years is typical of what the industry has observed due to the persistent state-wide drought. Since 2011, California has been in one of the most severe extended droughts on record.

Peaking of demands is an important consideration in water model simulations for two reasons – fire flow analysis and peak demand analysis. Peaking information for the leased system was requested but not provided for the modeling investigation.

First, fire flow simulation is standardized by the California Fire Code (CFC) and required to be analyzed during maximum-day normal demands. 'Maximum-day' represents the largest volume of water demanded by a water system over a 24-hour period. Typical for public municipal water systems, the maximum daily volume occurs in the summer time when irrigation demands are at their highest. Second, peak normal demands for public water systems occur for much shorter periods. For public municipal water systems, these peaks, commonly referred to as "peak-hour", occur during the early morning and early evening hours just before the work day begins and just after the work day ends, as people shower in the morning and use dishwashers and clothes washers in the evening. Depending on the size of the public water system and land use make-up, maximum-day demand factors could range from 1.5 to 3.0 times average demand flow; and peak-hour factors could range from 2.5 to 5.0 times average demand flow. Considering the size of Cupertino's leased system, with a usage that can exceed 2.0 million gallons per day on average, the modeling study adopted 2.0 for the maximum-day factor and 4.0 for the peak-hour factor.

2.3 General System Operation

A current water master plan outlining system operation, including water supply and distribution characteristics, was not available for this study. The general operation was gleaned from provided documents, a phone interview, and e-mail correspondence with San Jose Water Company staff.

The leased water system is supplied by imported water from the Santa Clara Valley Water District and groundwater from City-owned wells outside of the leased system service area. The Franco and Flowering Pear Wells are located within the City of Cupertino but outside the leased system service area adjacent to Homestead Road and Forge Way.

Recent major improvements were done to the well systems' conveyance system, and should be capable of supporting any improvements to well operation and production capacity. The imported water supply is from a Santa Clara Valley Water District connection and meter at the Mann Drive Pump Station (MDPS) site. Both supply sources are designed to fill the Mann Drive Pump Station 400,000-gallon forebay.

The forebay acts to supply stable suction hydraulics for the MDPS pumps. The leased water system operates in an "open" system with reservoirs at elevation to supply system pressure by gravity. MDPS pumps operate to maintain water levels in the reservoirs at approximate pad elevation of 600 feet, namely the Mercedes and Cristo Rey tanks, which have a total capacity of 6.0 million gallons (MG). Considering the total demands of the leased system and fire flow volume requirements, the leased system storage capacity should be adequate for "time-of-use" operation. Time-of-use refers to avoiding the need to operate system facilities like pumps and wells during peak electrical power costs. Pumping only during off-peak hours is the preferred operation of water utilities in order to minimize operating costs. However, SJWC staff indicated that in order to maintain water service pressures at the highest elevations of the system, the reservoir levels must be maintained at or near high water level at all times (approximately 630 feet elevation). Staff indicated that the pumps must turn on every two- to four- hours in order to maintain the water levels, depending on the time of year. This requires short and frequent pumping periods that could also significantly reduce pump life.

SJWC staff also indicated that the primary source of supply is from Santa Clara Valley Water District imported water. Typically, local groundwater production that is not brackish (very low quality requiring reverse osmosis treatment) is more cost effective than paying for imported water. The City should investigate the cost of the two sources, considering water quality, conveyance, well improvements and pumping rights, and control of its own water supply.

The lowest elevations at the northeast end of the service area are pressure-reduced to manageable pressures because static pressures at elevations below about 280 feet (elevation above mean sea level) are excessive and could be dangerous for maintenance and upkeep. Lowering pressures is also a very effective way of reducing water loss. The "Mann Regulated Zone" consists of approximately 250 residential connections.

3 Hydraulic Model and Field Testing

The computer water model provided by SJWC staff was pre-loaded with 'average' demands totaling 1,682 gallons per minute (gpm), which is consistent with system demands from the Annual Reports.

Another component of water demand and sizing of distribution facilities is fire flow. Standardized fire flows for different types of land uses are typically provided in Water Master Plans or other hydraulic analysis reports that were not available for this modeling study. Current fire flow requirements are listed in the California Fire Code (CFC) as high as 8,000 gpm at 20 psi, with reductions allowed when fire sprinkler systems are included in building construction. Invariably, large structures are conditioned for fire sprinklers regardless of construction materials used. The CFC allows for a reduction in fire flow requirements of up to 75 percent. Also, fire flow requirements for the purposes of the model analysis should consider that many of the structures within the City's service area were likely constructed at a time when the fire flow requirements were lower. With these considerations, and the limited expected development or redevelopment that could occur, it is reasonable to evaluate the leased system capacities at various locations based on land use with the fire flow requirements as stated in the Final Technical Report, and summarized in **Table 3-1:**

Table 3-1 – Capacity Requirements

Zoning	Minimum Flow Rate (gpm)	Minimum Duration of Flow (hours)	Total Fire Storage (gallons)
Single-family Residential	1,500	2	180,000
Multi-family Residential	2,000	2	240,000
All other zoning	2,500	2	300,000

The following is a summary of system demand loadings used for the computer model analysis:

Table 3-2 – System Demand Loadings

Average Demand System-wide	Max-Day Demand System-wide	Peak-Hour Demand System-wide
1,682 gpm	3,364 gpm	6,728 gpm

Note: 2*Avg = Max-day; 4.0*Avg = Peak-hour

The Innovyze modeling software (formerly MWH Soft) InfoWater was used in a stand-alone version (no AutoCAD or Arcview platform) in instantaneous analysis mode. The scenarios selected were designed to analyze system capacity at different land uses throughout the service area. These scenarios were then field tested to validate system performance. Appendix A includes a graphic of the leased system water model.

The computer model includes the complete distribution system from the Mann Drive Pump Station to the Mercedes and Cristo Rey tanks. In all, nine simulation scenarios were performed for the purposes of hydraulic model analysis and establishing hydraulic bases for comparing with field flow testing:

Scenario 1: Supply scenario, zero system demand, Mann Drive PS operating
Scenario 2: Max-day system demand (3,364 gpm), normal operation, MDPS off
Scenario 3: Peak-hour system demand (6,728 gpm), normal operation, MDPS off
Scenario 4: Max-day plus FF #1 (Exhibit 3), 2500 gpm at Alves Street (J23992), MDPS off
Scenario 5: Max-day plus FF #2 (Exhibit 3), 2500 gpm at Mary Avenue (J23440), MDPS off
Scenario 6: Max-day plus FF #3 (Exhibit 3), 2500 gpm at Scenic Circle (J44068), MDPS off
Scenario 7: Max-day plus FF #4 (Exhibit 3), 2500 gpm at Alcalde Drive (J63366), MDPS off
Scenario 8: Max-day plus FF #5 (Exhibit 3), 2500 gpm at Ainsworth Drive (J65056), MDPS off
Scenario 9: Max-day plus FF #6 (Exhibit 3), 1500 gpm at Voss Avenue (J65056), MDPS off

Simulation Scenarios 1, 2 and 3 provide hydraulic characteristics under normal conditions. Scenarios 4 through 9 simulate foreseeable emergency fire events at critical locations. InfoWater includes a fire flow tool that, for each fire flow simulation, evaluates the entire system for deficient pressures in addition to meeting the minimum 20 psi at the fire flow location. This analysis uses the minimum pressure criteria for the fire flow junction of 20 psi (based on Uniform Fire Code), and maintains positive pressure everywhere else in the system.

Table 3-3 summarizes the hydraulic analysis results for the fire flow scenarios.

Table 3-3 – Fire Flow Hydraulic Analysis Results

Simulation Scenario	Modeling Parameter					Calculated Flow at 20 psi	Designated Fire Flow at 20 psi for Planning Purposes[2]
	Node	Elevation (ft amsl)	Normal Pressure[1]	Fire Flow	Residual Pressure		
1	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	J23992	269	82.77 psi	1,090 gpm	25.63 psi	1,147 gpm	1,500 gpm
5	J23440	296	139.83 psi	2,104 gpm	112.26 psi	4,652 gpm	2,500 gpm
6	J44068	323	128.38 psi	2,005 gpm	117.39 psi	6,900 gpm	2,500 gpm
7	J63366	446	75.28 psi	2,077 gpm	71.65 psi	9,038 gpm	2,500 gpm
8	J65056	314	132.33 psi	2,192 gpm	125.39 psi	9,858 gpm	2,500 gpm
9	J65152	542	33.69 psi	1,399 gpm	20.00 psi	1,399 gpm	1,500 gpm

[1] Normal (static) pressure is taken from the Max-day system demand Scenario 2.
[2] As designated for the Final Technical Report (SPF Water, January, 2017)

Other parameters important for hydraulic analysis evaluation are maximum flow velocity and minimum system pressure. Typical maximum velocities for design of public water systems are 3 to 5 feet per second (fps) for normal operation, and 10 to 17 feet per second for emergency fire flow conditions. The typical standard for minimum pressures during normal operation is 40 psi to ensure adequate pressure for second floors of residential structures. Although the velocities resulting from the analysis are within these criteria, the minimum system pressures are not. **Table 3-4** is a summary of the maximum velocities and minimum pressures observed for each scenario.

Table 3-4 – Maximum System Velocities and Minimum System Pressures

Simulation Scenario	1 (No Demands)	2 (Max-day)	3 (Peak-hour)	4 (Alves St FF)	5 (May Ave FF)	6 (Scenic Cir. FF)	7 (Alcalde St FF)	8 (Ainsworth St FF)	9 (Voss Ave FF)
Maximum System Velocity	5.93 fps (14" Mann Dr PS discharge)	2.69 fps, 2.40 fps	5.56 fps, 2.41 fps	8.20 fps	6.66 fps	6.06 fps	4.30 fps	4.17 fps	8.96 fps
@ Pipe ID	T602760	D531051 (8") D531151 (20")	D531051 (8") D531151 (20")	D531800 (8") D532110 (8")	D531682 (12") D531675 (12")	D531845 (8")	D531151 (20") D531156 (10")	D531151 (20")	D532154 (8")
Minimum System Pressure	10-24 psi (Inspiration Hts)	9-24 psi (Inspiration Hts)	6-24 psi (Inspiration Hts)	11-24 psi (Inspiration Hts)	10-24 psi (Inspiration Hts)	10-24 psi (Inspiration Hts)	10-24 psi (Inspiration Hts)	9-24 psi (Inspiration Hts)	-4 - 24 psi (Inspiration Hts)
@ Junction ID	J56126, 76014, -016, -022, et al.	J56126, 76014, -016, -022, et al.	J56126, 76014, -016, -022, et al.	J56126, 76014, -016, -022, et al.	J56126, 76014, -016, -022, et al.	J56126, 76014, -016, -022, et al.	J56126, 76014, -016, -022, et al.	J56126, 76014, -016, -022, et al.	J56126, 76014, -016, -022, et al., & FF Node

fps = feet per second
psi = pounds per square inch
ID = identification number used in the computer model.

As outlined in the table, model nodes with service to several estate lots in the hills of southwest Cupertino (namely Inspiration Heights residential community) are at elevations too high to comply with normal water service pressure standards. SJWC addresses this in a January 4, 2017 fire flow analysis memorandum and identifies these service areas as customer services with 'less than 20 psi' or 'no water' with a boil-water-advisory should a fire event occur. Even under normal conditions, as indicated in Table 5, service pressures can be less than 10 psi during normal conditions. It is assumed these services incorporate private pumping for adequate shower pressure, as well as dishwasher and clothes washer appliance pressure. The SJWC memorandum is included in **Appendix B**.

Scenarios 4 through 9 indicate adequate fire flow capacity for all locations except Garden Gates and Inspiration Heights. Scenarios 4 through 8 were field tested on November 20, 2018 by J&C Fire Protection. Field flow testing was recommended as a result of the findings of a series of technical memorandums of the Final Technical Report study (SPF, 2017). The flow testing crew, supported by SJWC and City of Cupertino staff, locate the desired hydrant to flow and a separate location for reading system pressures (normal operating pressure prior to flowing the hydrant, often called 'static'; and dynamic pressure during flow typically referred to as 'residual') and performed the proper flow testing procedure at each site. These field measurements should be taken periodically to confirm model results. The results of the field flow tests performed are included in **Appendix C**.

Table 3-5 includes a comparison of the fire flow analysis between model results and field flow testing results, and shows a distinct difference in all but the Alves Street location.

Table 3-5 – Fire Flow Analysis Comparison – Model vs. Field Flow Testing

Field Flow Tests										Flow at 20 psi from Computer Model	
Fire Hydrant Location	Normal Pressure		Observed Flow		Residual Pressure		Calculated Flow at 20 psi				
Alves St	55	psi	1,083	gpm	40	psi	1,180	gpm	1,147	gpm	
Mary Ave	145	psi	2,059	gpm	100	psi	3,575	gpm	4,652	gpm	
Scenic Circle	135	psi	2,293	gpm	98	psi	4,230	gpm	6,900	gpm	
Alcalde Rd	80	psi	1,595	gpm	55	psi	2,559	gpm	9,038	gpm	
Ainsworth Dr	130	psi	2,059	gpm	100	psi	4,153	gpm	9,858	gpm	

[1] Alves Street is in Mann Regulated Zone; therefore, calculation at 20 psi uses normal pressure that would be generated without pressure reduction. Estimated elevation of flow test at Alves Street is 270 feet, 630 HWL - 270 = 360 ft = 156 psi.

Assuming the geometry of the model provided by SJWC was confirmed for accuracy – i.e. elevations, pipe lengths, and pipe diameters – this could be an indication that pipe connections thought to have been constructed were actually not constructed (adversely affecting circulation and system capacity), or pipe roughness factors should be much lower in the model, or both. In addition, old or broken valves not properly abandoned, or thought to be removed, could also reduce system capacity. In any event, these major differences in field and modeling data should be corrected to acceptable tolerances before relying on modeling data for any further system analysis.

The apparent deficient fire flow at Alves Street could be a settings error in the model that needs further investigation. Review of the results reports indicate twice the flow as necessary flowing through the Mann regulation valves causing erroneously high headloss readings. Reducing the headloss will result in higher available flow to Alves Street and the entire Mann Regulated Zone service area.

4 Capital Improvements

Evaluation of the water system capacity using computer modeling shows that the system should be capable of operating within time-of-use and normally accepted criteria, with the exception of the highest residential services in Inspiration Heights. Adequate interconnection locations exist, and could be improved for automatic operation (actively connected). In addition, a SCADA headquarters office should be constructed and implemented for the ability to monitor all major water system functions – Well operation, Mann Drive PS operation and forebay water levels, SCVWD service connection flows, pressure-reducing valve operation, reservoir water levels at Mercedes and Cristo Rey sites, and interconnection flows. Water systems operation should incorporate digital readouts, electronic maps and signals to a single operator (dispatcher) at any hour of the day to alert on-call field staff in the event of ruptured mains, pumping failure, power outage, water supply outage, low reservoir water levels, etc. The Department of Public Health has strict guidelines for publicly-owned water utilities, in addition to operator registration requirements, for specific capacities within the organizational structure of a utility operation.

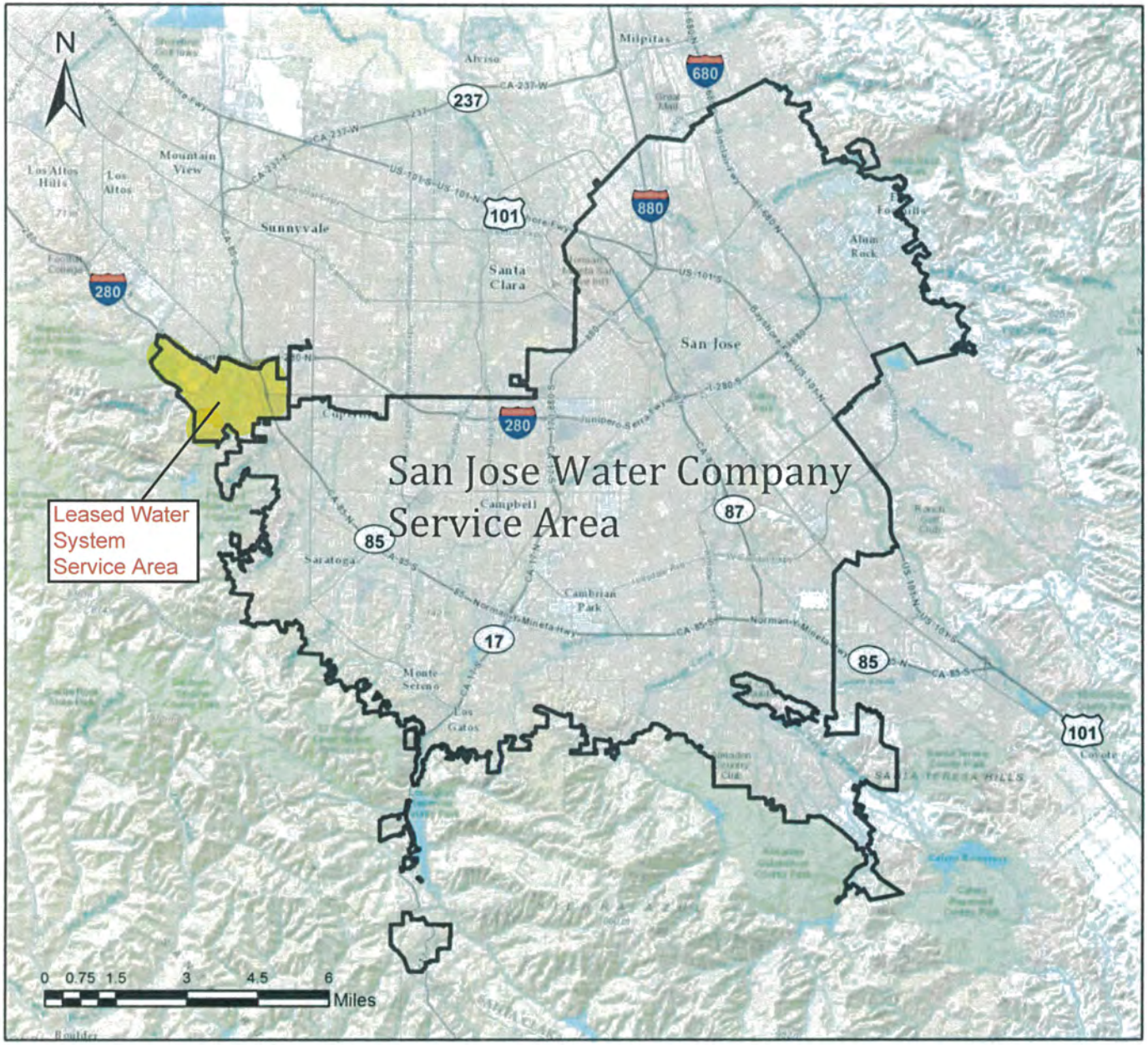
The following is a list of capital improvement projects gathered from the research of recent documentation provided for the hydraulic analysis study that should be prioritized for the City of Cupertino's leased water system:

1. Evaluate all options to remove/reduce the City's liability associated with the low service pressures in Inspiration Heights. Potential liability could arise with water quality degradation due to the low pressures, or lack of water capacity during normal operation, and lack of fire flow capacity during emergency operations. Options could include legal agreements with each homeowner, construction of a hydropnuematic pressure zone or other closed system operation, or City purchase and maintenance of individual private pumping units.
2. Based on the Final Technical Report (SPF, January 2017), the capacity and efficiency of the Mann Drive Pump Station needs major upgrades, and may require a redesign for time-of-use operation. This should include an evaluation of the adequacy of its backup power supply.
3. Perform a complete well inspection of both Franco and Flowering Pear wells, including mechanical/material inspection, efficiency testing, and downhole video to assess the level of needed rehabilitation.
4. Investigate the cost of the two sources of City water – local groundwater and imported water from SCVWD. This should consider issues such as water quality and on-going treatment requirements of each; operation and upkeep of the conveyance systems for each; well maintenance, improvements and pumping rights; and control of its own water supply. Curiously, SJWC does not emphasize maximizing local groundwater production despite the State of California's efforts to incentivize water suppliers to use local water supplies.
5. Prepare a Water Master Plan. Water Master Plans should be the cornerstone for funding a water system. A thorough water master plan includes analysis to justify capital improvement and replacement projects that should be reviewed on an annual basis. The Water Master Plan itself should be updated at least every 10 years, or when a major update to the general plan is made. Municipal finance departments rely heavily on a water master plan to perform the necessary updates to keep its capital Improvement and replacement programs current.
6. Investigate the water quality concerns at the Mercedes Reservoir site. One of the Mercedes Reservoir site tanks was reportedly emptied approximately two years ago due to "considerations of water age and

quality". Water quality would be the primary concern for the method of operation currently employed by the SJWC.

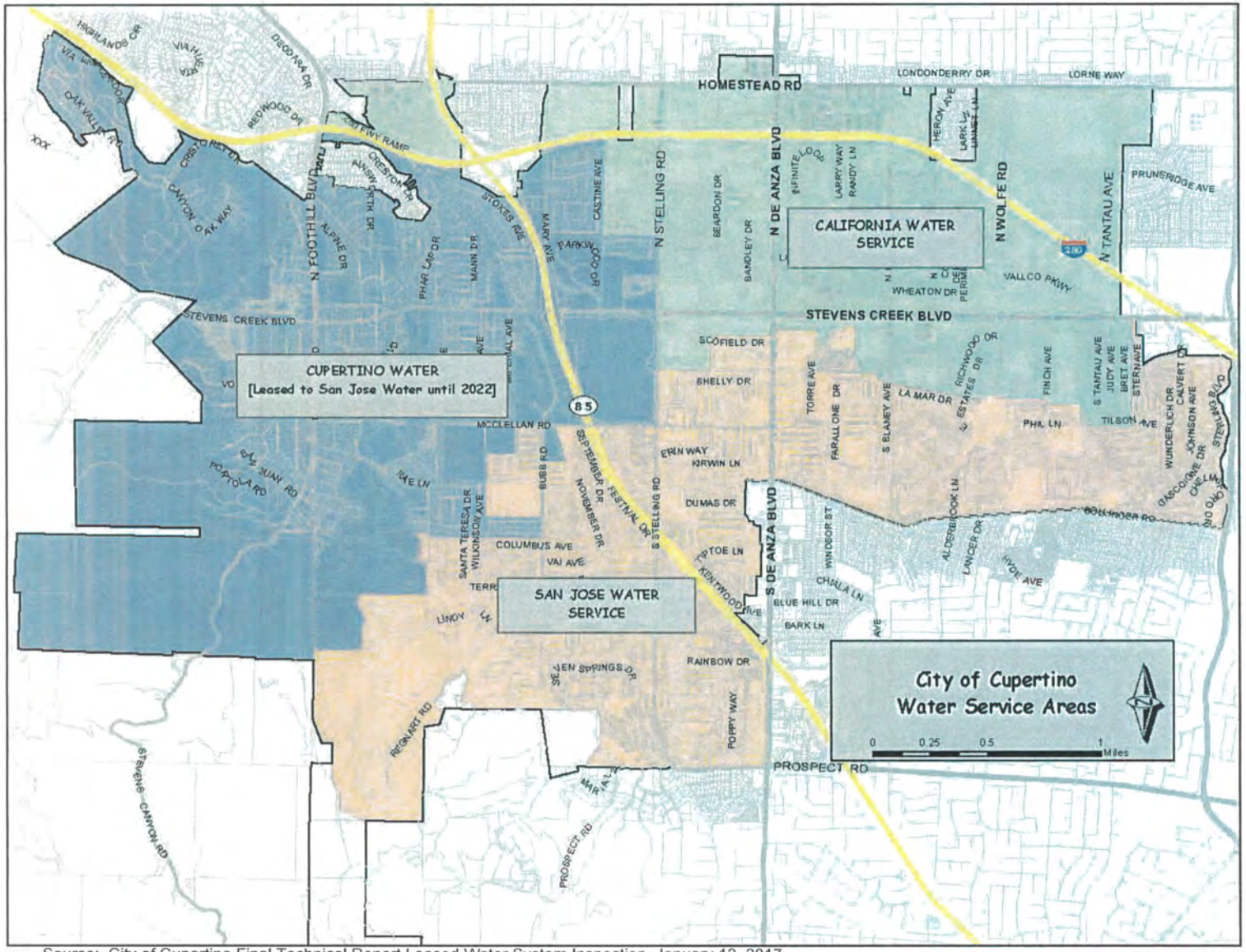
7. Update the Mercedes tanks to current seismic code. According to the SPF report, both tanks may be out of compliance with seismic construction requirements. Ironically, the "General Cupertino Leased Area Description" report describes the operational practice of minimizing the water level in the tanks (maximizing Freeboard) in order to "minimize damage from sloshing during a seismic event". This is inconsistent with SJWC staff assertion that the Mercedes tank water levels are maintained between 29.5 and 32 feet, which is at or near the high water level at all times to improve service pressures for nearby residents. This represents conflicting operational goals that could be detrimental to valuable storage capacity. Additionally, operating a 2.0 million-gallon reservoir with a water level band at the highest 2.5 feet is not prudent reservoir operation and negates many of the advantages of incorporating storage within a distribution system.
8. Investigate as-built plans and the reported existence of a "logbook" that could have records of system improvements since 1916, according to the SPF report. This could provide clues to lost and paved-over old valves that have broken and fallen into the flow path of old pipelines still in operation. Such debris would be a capacity and water quality detriment to a water system, and could be a reason for the difference in computer model results and field-tested capacity.
9. Start a hydrant flushing and valve maintenance program. Hydrant flushing should include gathering hydraulic data for field verification of the computer model. Valve maintenance program should include exercising each valve, documenting turns, and inventory type, location, and size.
10. Pave the access road to Cristo Rey tank site.

These capital projects represent top priority within a comprehensive Capital Improvement/Replacement Program. Additional projects should be identified through further cooperation from San Jose Water Company and candid descriptions of chronic operational challenges from staff. Otherwise, the oldest 4-inch (and smaller) "system" pipelines dating back to the 1930's and before should be prioritized for immediate replacement. If a logbook, as indicated in Item 8 above, exists it can be a very good resource for prioritization.



Source: San Jose Water Company 2015 Urban Water Management Plan, Figure 3.1

Exhibit 1



Source: City of Cupertino Final Technical Report Leased Water System Inspection, January 12, 2017.

Exhibit 2

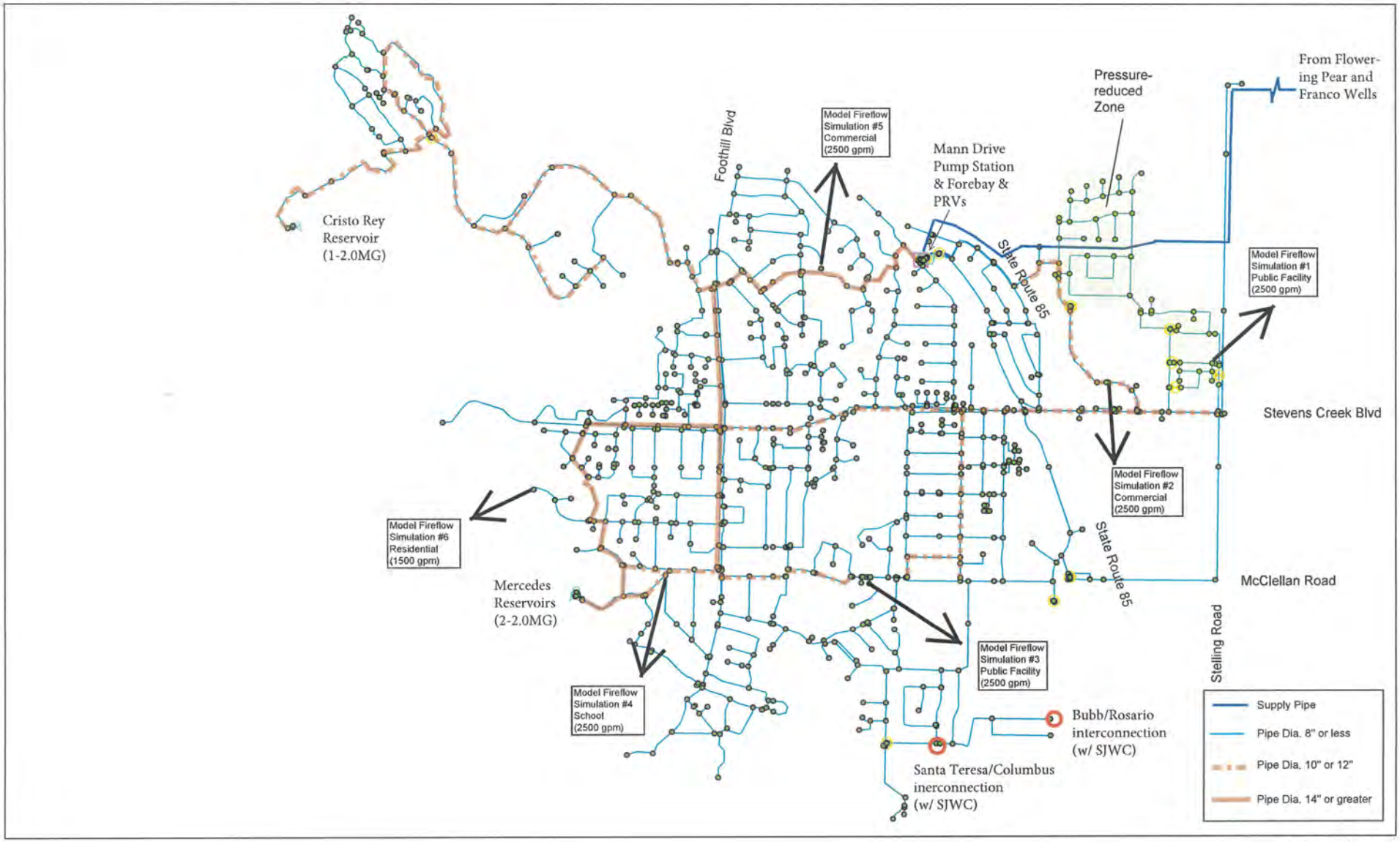
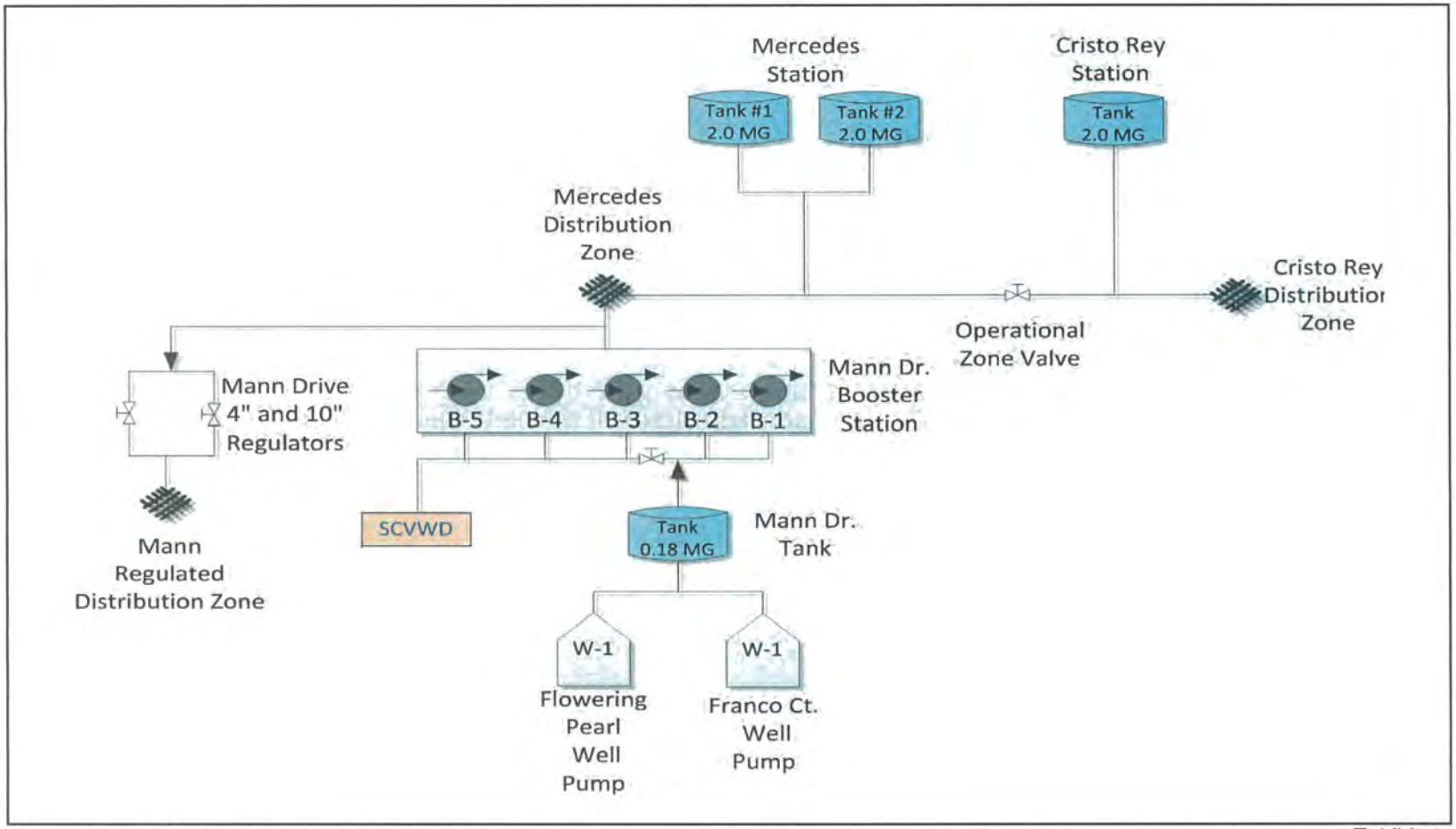

From Flowering Pear and Franco Wells
Pressure-reduced Zone
Foothill Blvd
Model Fireflow Simulation #5 Commercial (2500 gpm)
Mann Drive Pump Station & Forebay & PRVs
State Route 85
Model Fireflow Simulation #1 Public Facility (2500 gpm)
Cristo Rey Reservoir (1-2.0MG)
Stevens Creek Blvd
Model Fireflow Simulation #2 Commercial (2500 gpm)
Model Fireflow Simulation #6 Residential (1500 gpm)
State Route 85
McClellan Road
Mercedes Reservoirs (2-2.0MG)
Stelling Road
Model Fireflow Simulation #3 Public Facility (2500 gpm)
Model Fireflow Simulation #4 School (2500 gpm)
Bubb/Rosario interconnection (w/ SJWC)
Santa Teresa/Columbus inerconnection (w/ SJWC)
Supply Pipe
Pipe Dia. 8" or less
Pipe Dia. 10" or 12"
Pipe Dia. 14" or greater

Exhibit 3

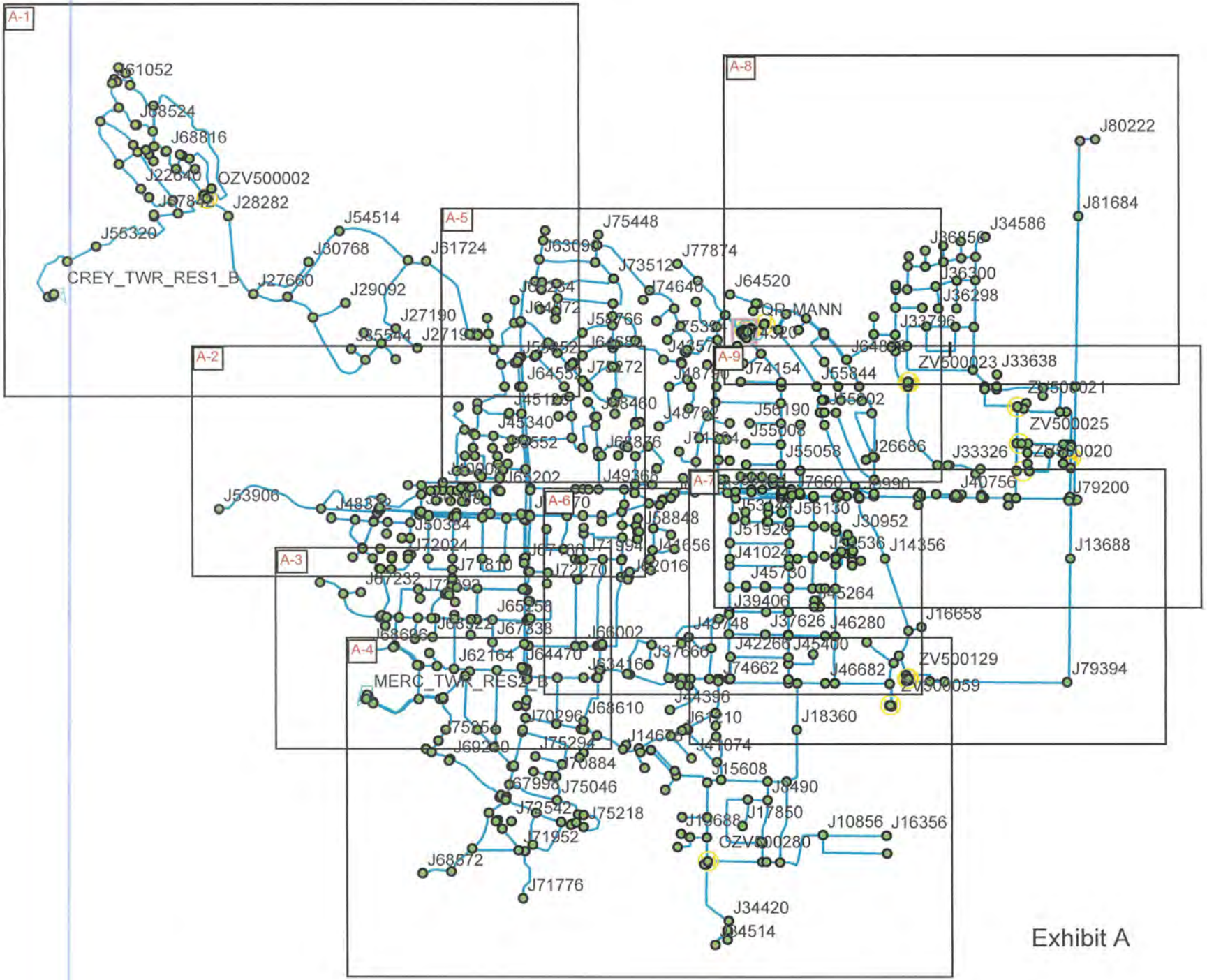


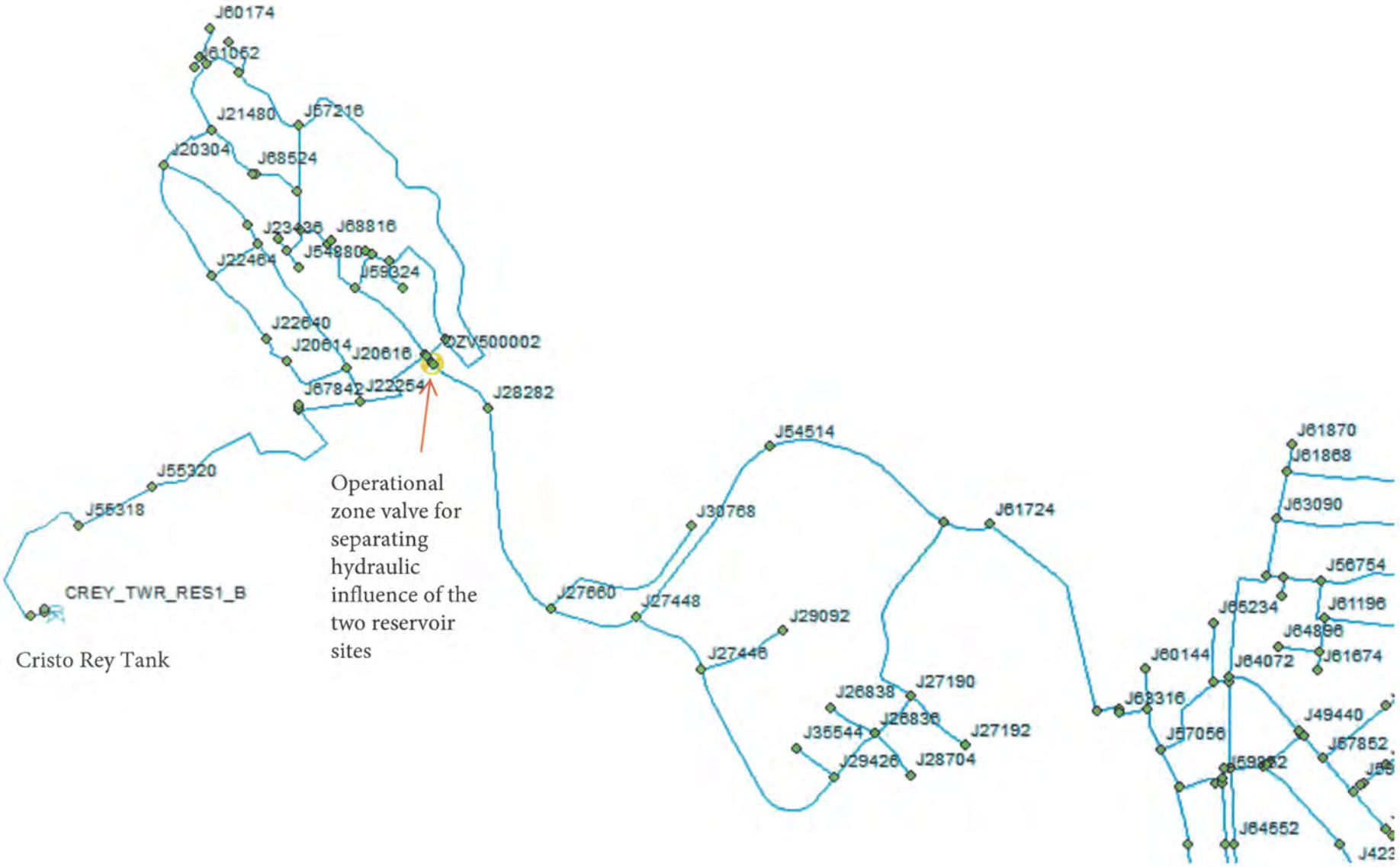
Source: City of Cupertino Final Technical Report Leased Water System Inspection, January 12, 2017.

Exhibit 4

APPENDIX A

Computer Model


A-1
A-2
A-3
A-4
A-5
A-6
A-7
A-8
A-9
J61052
J68524
J68816
J22640
OZV500002
J28282
J55320
CREY_TWR_RES1_B
J27660
J54514
J80768
J61724
J29092
J27190
J75448
J77874
J73512
J74648
J64520
J53766
J74154
J55844
J80222
J81684
J34586
J36856
J36300
J36298
J33796
QR_MANN
ZV500023
J33638
ZV500021
ZV500025
ZV500020
J33326
J26686
J55058
J56190
J40756
J79200
J13688
J53906
J50364
J58848
J72024
J71994
J41656
J41024
J45730
J45264
J39406
J30952
J14356
J56130
J51926
J16658
J37626
J46280
J42266
J45400
J74662
J46682
ZV500129
ZV500059
J79394
J62164
J64470
J64416
MERC_TWR_RES2_B
J68610
J70296
J75294
J70884
J67998
J75046
J73542
J75218
J71952
J68572
J71776
J18360
J15608
J8490
J17850
J19688
J10856
J16356
OZV500280
J34420
J34514
Exhibit A



Cristo Rey Tank

Exhibit A-1

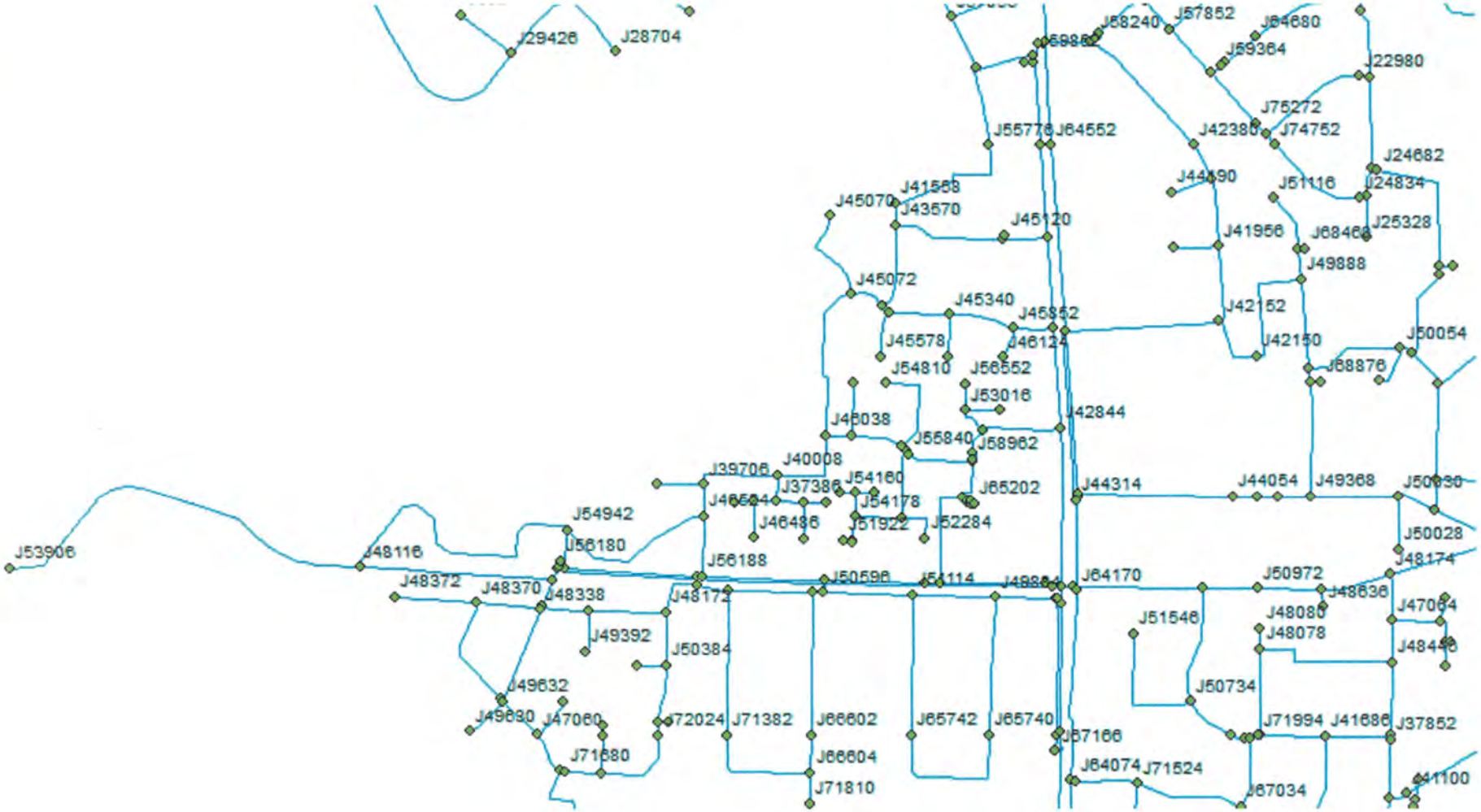

J29426
J28704
J57852
J64680
J58240
J59364
J22980
J75272
J74752
J42380
J55776
J64552
J24682
J44490
J51116
J24834
J41558
J45070
J43570
J45120
J41956
J68466
J25328
J49888
J45072
J45340
J45852
J42152
J45578
J46124
J42150
J50054
J54810
J56552
J68876
J53016
J42844
J46038
J55840
J58962
J40008
J39706
J54160
J37386
J65202
J44314
J44054
J49368
J50630
J46544
J54178
J46486
J51922
J52284
J54942
J50028
J53906
J48116
J56180
J48174
J56188
J48372
J48370
J48338
J48172
J64170
J50972
J48636
J51546
J48080
J47064
J49392
J48078
J50384
J48456
J49632
J50734
J49630
J47060
J72024
J71382
J66602
J65742
J65740
J71994
J41686
J37852
J67166
J71680
J66604
J64074
J71524
J41100
J71810
J67034

Exhibit A-2

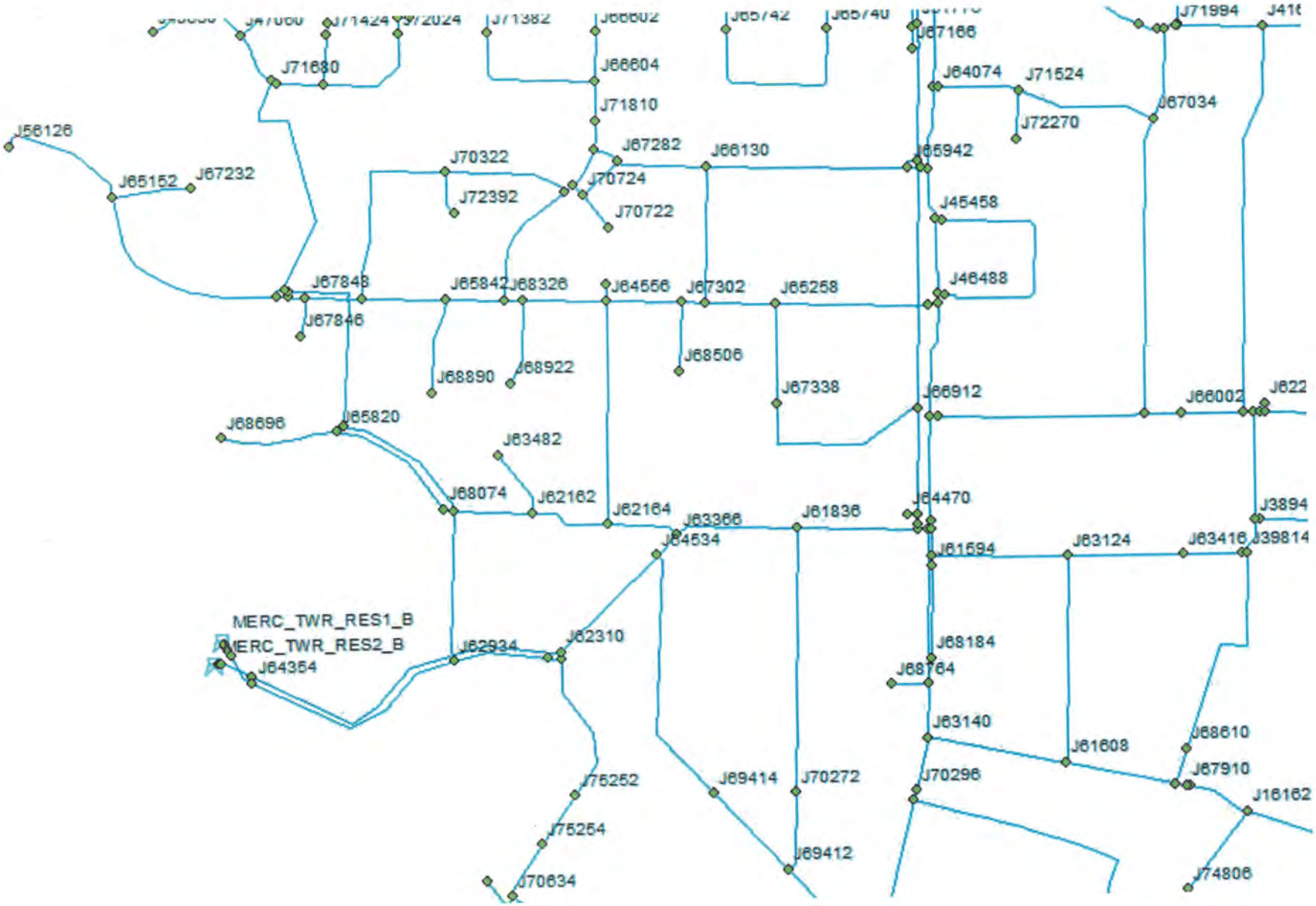

J71994
J67166
J71630
J66604
J64074
J71524
J71810
J67034
J72270
J56126
J67282
J66130
J70322
J65942
J65152
J67232
J70724
J72392
J70722
J45458
J67848
J65842
J68326
J64566
J67302
J65258
J46488
J67846
J68506
J68890
J68922
J67338
J66912
J66002
J68696
J65820
J63482
J68074
J62162
J62164
J63366
J61836
J64470
J64534
J61594
J63124
J63416
MERC_TWR_RES1_B
MERC_TWR_RES2_B
J62934
J62310
J68184
J64354
J68764
J63140
J61608
J68610
J67910
J75252
J69414
J70272
J70296
J16162
J75254
J69412
J70634
J74806

Exhibit A-3

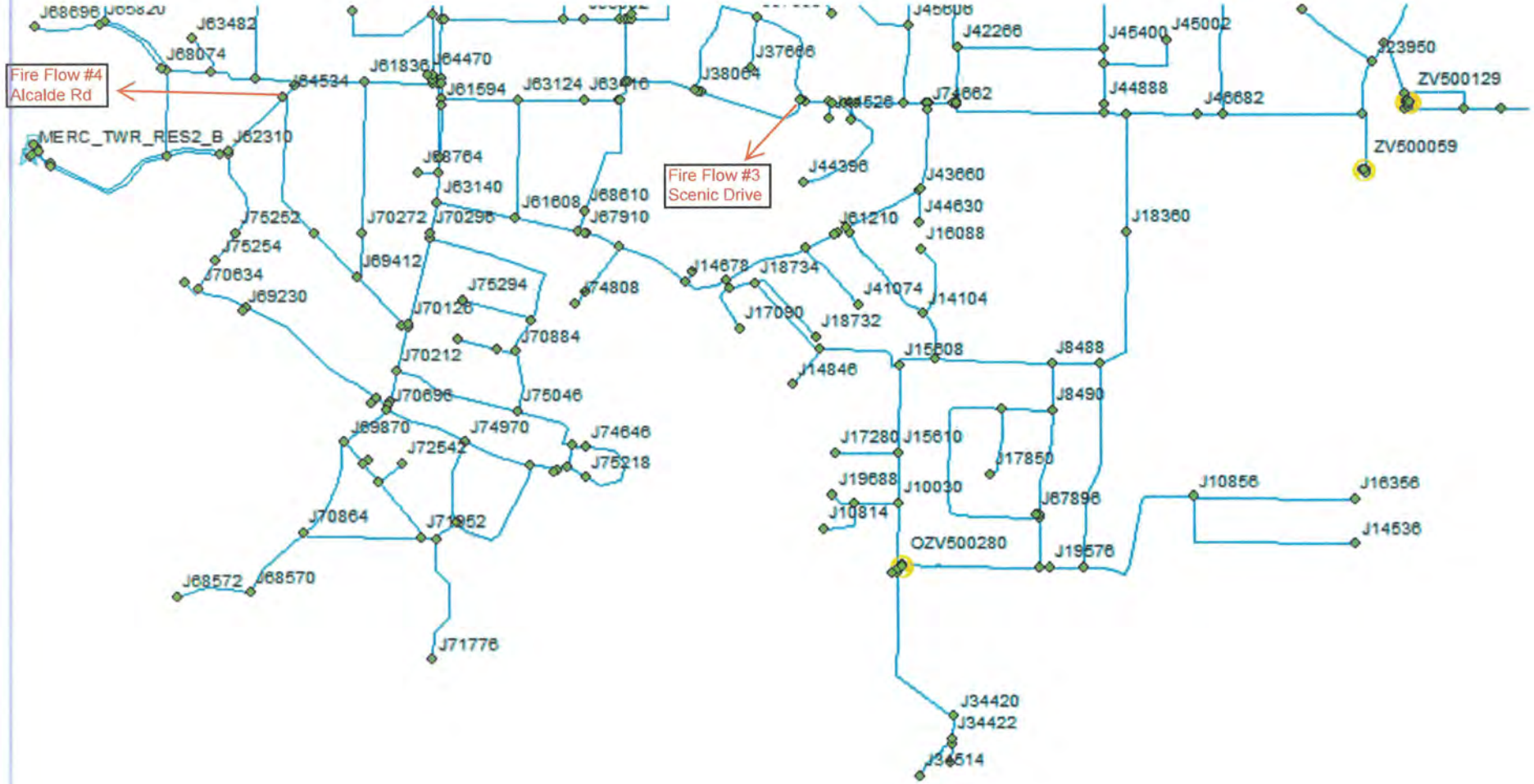

Fire Flow #4
Alcalde Rd
Fire Flow #3
Scenic Drive
MERC_TWR_RES2_B
J68696
J63482
J68074
J64534
J61836
J64470
J61594
J63124
J63416
J38064
J37666
J42266
J45400
J45002
J23950
ZV500129
J44888
J46682
ZV500059
J62310
J68764
J63140
J61608
J68610
J67910
J44396
J43660
J44630
J61210
J16088
J18360
J75252
J75254
J70634
J69230
J70272
J70296
J69412
J75294
J74808
J14678
J18734
J41074
J14104
J17090
J18732
J70126
J70884
J70212
J15808
J8488
J14846
J8490
J70696
J75046
J69870
J74970
J74646
J72542
J75218
J17280
J15610
J17850
J19688
J10030
J67896
J10856
J16356
J10814
J14536
J70864
J71952
OZV500280
J19576
J68572
J68570
J71776
J34420
J34422
J34514

Exhibit A-4

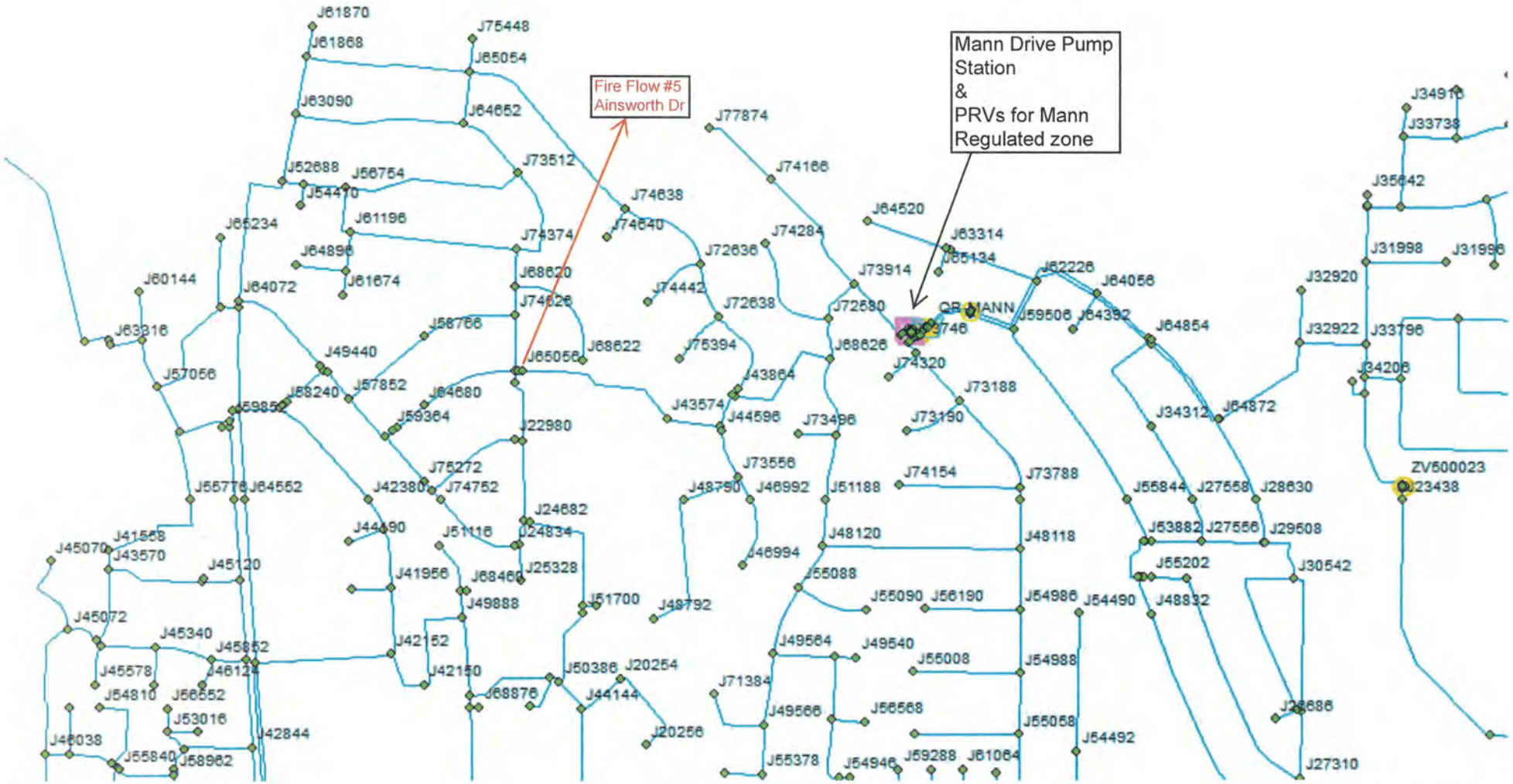

Fire Flow #5
Ainsworth Dr
Mann Drive Pump
Station
&
PRVs for Mann
Regulated zone
J61870
J61868
J75448
J65054
J63090
J64652
J73512
J52688
J56754
J54470
J61196
J74638
J74640
J74374
J65234
J64896
J61674
J60144
J64072
J68620
J74026
J63316
J58766
J49440
J57056
J68240
J57852
J64680
J59364
J65056
J68622
J22980
J75272
J55776
J64552
J42380
J74752
J24682
J41568
J45070
J43570
J44690
J51116
J24834
J45120
J41956
J68466
J25328
J49888
J51700
J45072
J45340
J45852
J42152
J45578
J46124
J42150
J50386
J20254
J54810
J56552
J68876
J44144
J53016
J46038
J42844
J55840
J58962
J20256
J77874
J74166
J74284
J72636
J74442
J72638
J75394
J43864
J43574
J44596
J73496
J73556
J48790
J46992
J51188
J46994
J48120
J55088
J55090
J56190
J48792
J49564
J49540
J55008
J71384
J49566
J56568
J55058
J55378
J54946
J59288
J61064
J54492
J64520
J63314
J65134
J73914
J62226
J64056
J72580
J59506
J64392
J64854
J68626
J74320
J73188
J73190
J34312
J64872
J73788
J74154
J48118
J55202
J48832
J54986
J54490
J54988
J55844
J27558
J28630
J63882
J27556
J29508
J30542
J28686
J27310
J34916
J33738
J35642
J31998
J31996
J32920
J32922
J33796
J34206
ZV500023
J23438

Exhibit A-5

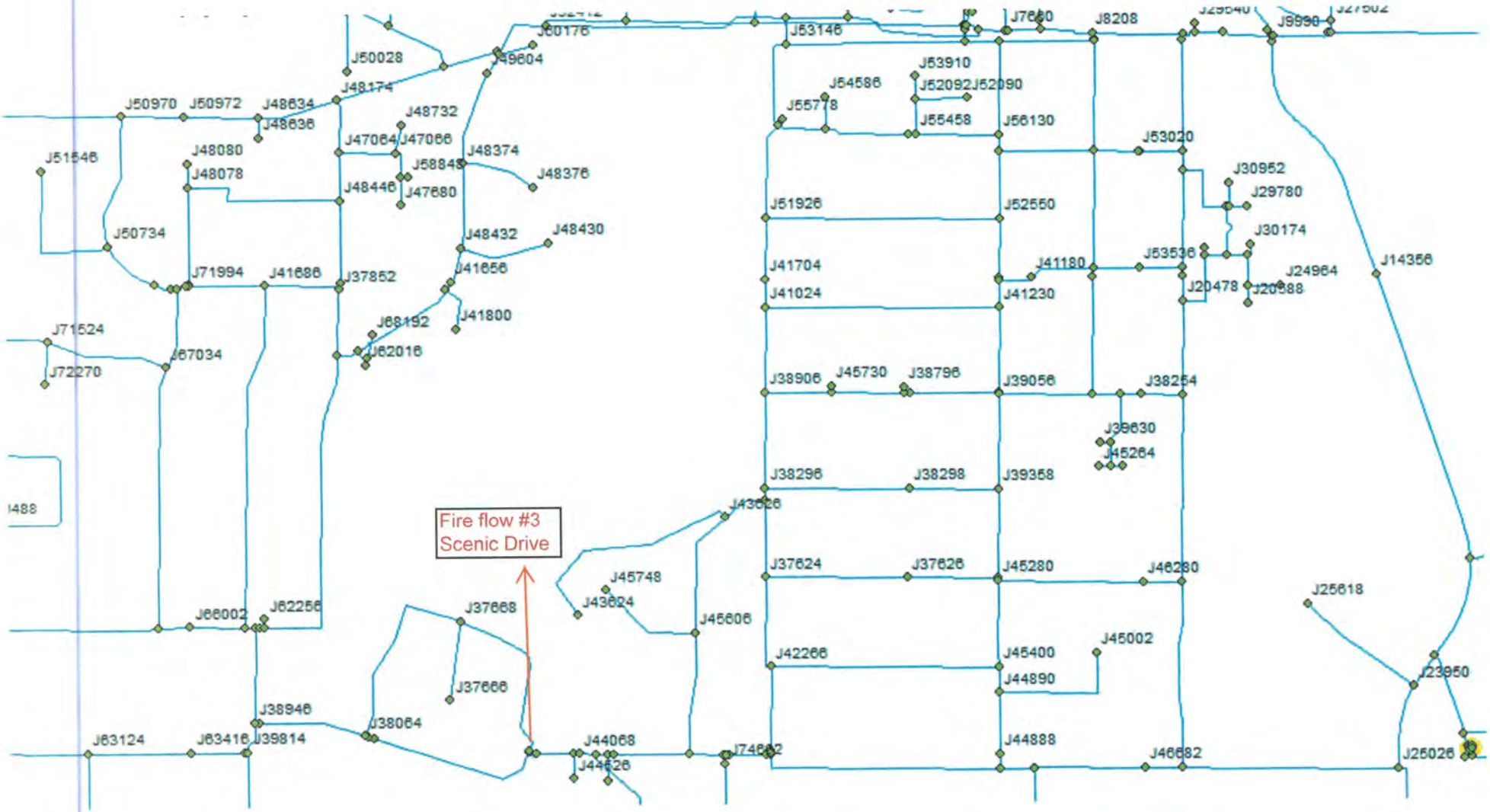

Fire flow #3
Scenic Drive
J50176
J49604
J50028
J48174
J50970
J50972
J48634
J48636
J48732
J47064
J47066
J48374
J48376
J58848
J47680
J48446
J48080
J48078
J51546
J50734
J71994
J41686
J37852
J48432
J48430
J41656
J41800
J68192
J62016
J71524
J67034
J72270
J66002
J62256
J38946
J63124
J63416
J39814
J38064
J37668
J37666
J44068
J44626
J74882
J43626
J45748
J43624
J45606
J53146
J53910
J54586
J52092
J52090
J55778
J55458
J56130
J53020
J51926
J52550
J41704
J41024
J41230
J41180
J53536
J30952
J29780
J30174
J24964
J20478
J20588
J14356
J38906
J45730
J38796
J39056
J38254
J39630
J45264
J38296
J38298
J39358
J37624
J37626
J45280
J46280
J42266
J45400
J45002
J44890
J44888
J46682
J25618
J23950
J25026
J8208
J9990

Exhibit A-6

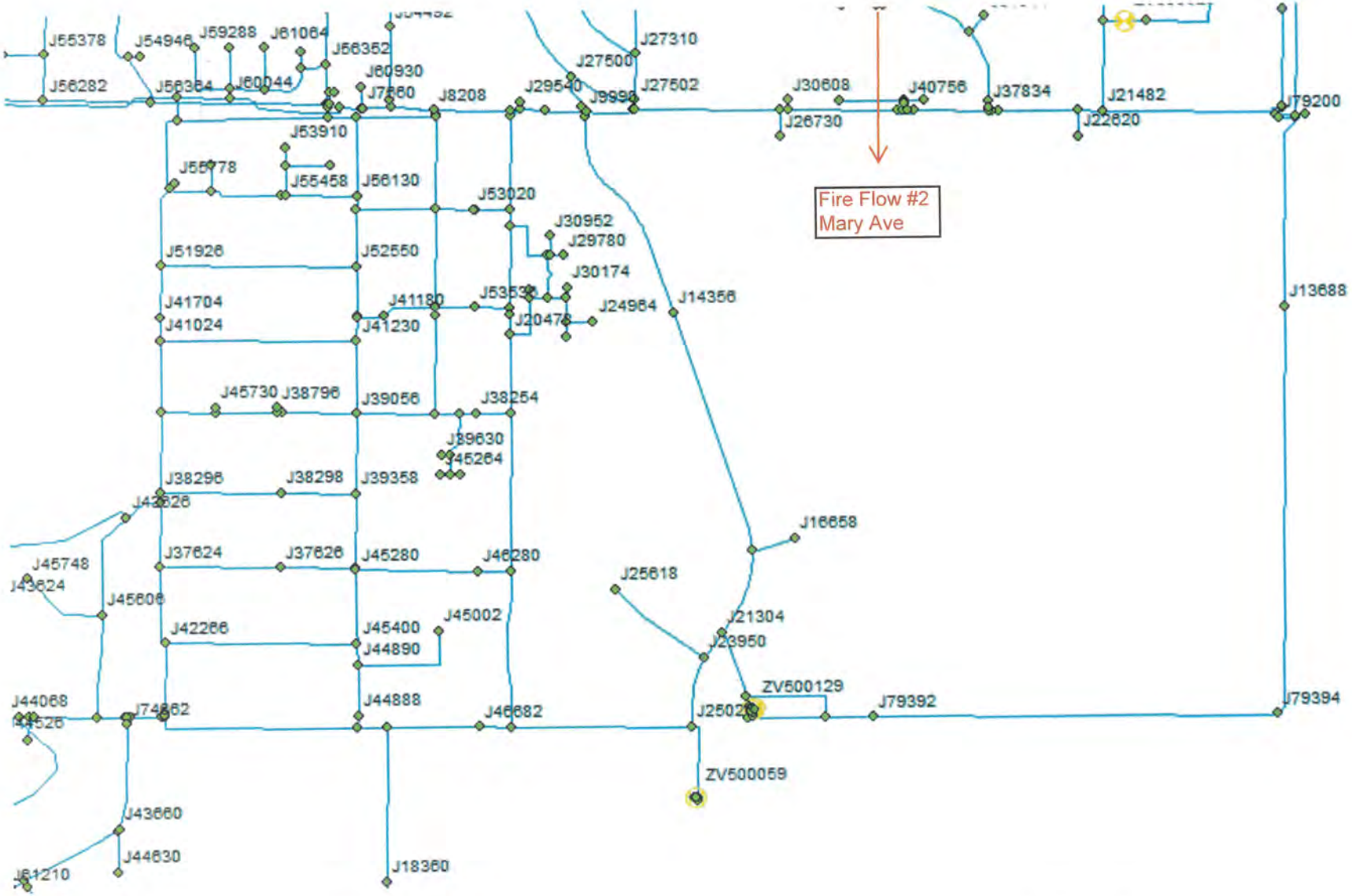

Fire Flow #2
Mary Ave
J55378
J54946
J59288
J61064
J56352
J56282
J56364
J60044
J60930
J7560
J8208
J27310
J27500
J29540
J27502
J30608
J40756
J37834
J21482
J79200
J26730
J22620
J53910
J55778
J55458
J56130
J53020
J30952
J29780
J30174
J51926
J52550
J41704
J41024
J41180
J41230
J24964
J14356
J13688
J45730
J38796
J39056
J38254
J39630
J45264
J38296
J38298
J39358
J16658
J37624
J37626
J45280
J46280
J45748
J25618
J45606
J45002
J21304
J42266
J45400
J44890
J23950
ZV500129
J44068
J44888
J79392
J79394
J46682
ZV500059
J43660
J44630
J18360

Exhibit A-7

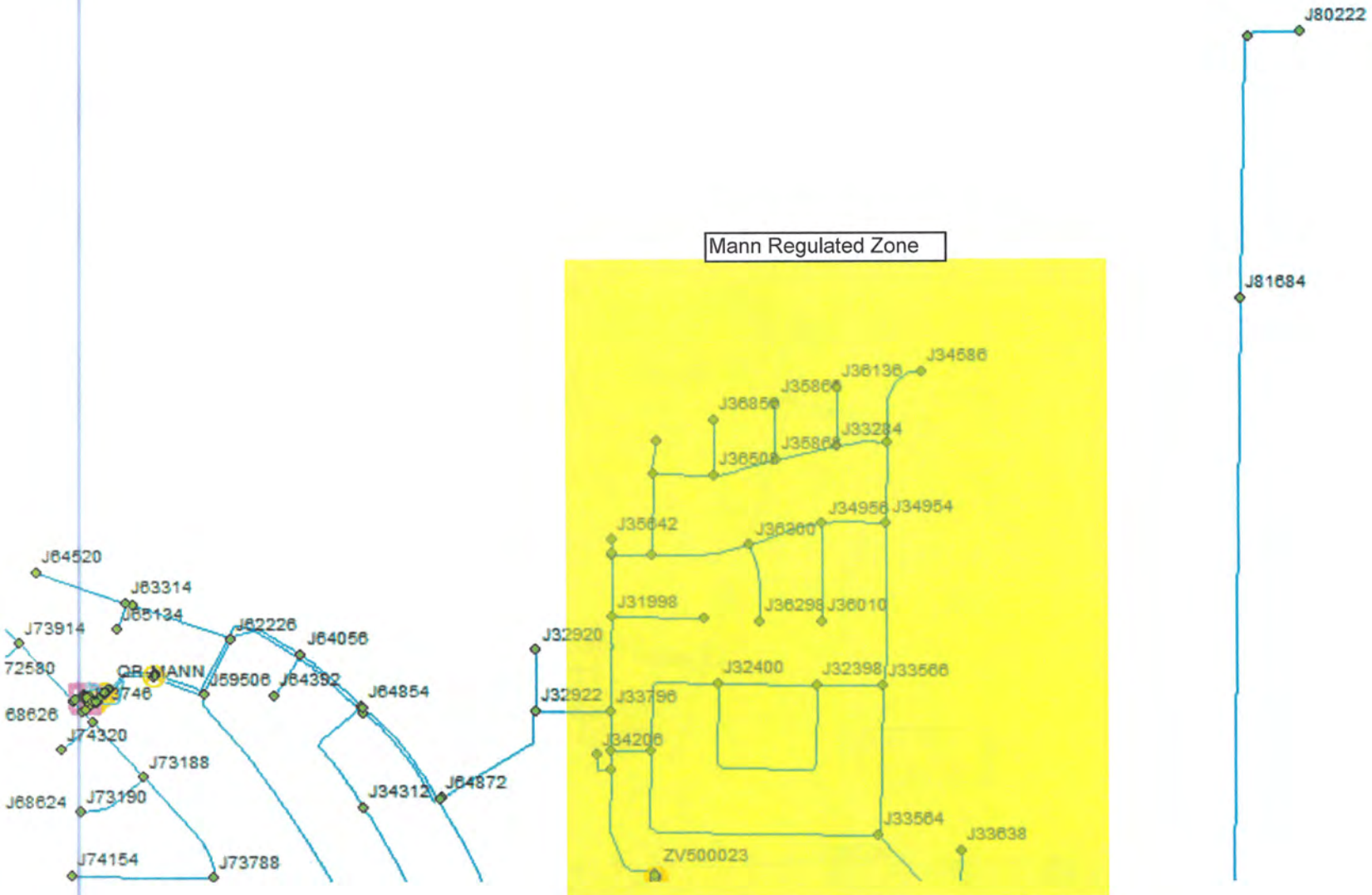

Mann Regulated Zone
J80222
J81684
J34686
J36136
J35864
J36858
J33284
J35868
J36508
J34956
J34954
J35642
J36360
J64520
J63314
J65134
J73914
J62226
J64056
J31998
J36298
J36010
J32920
72580
QR-MANN
J59506
J64392
J64854
J32400
J32398
J33566
J32922
J33796
68626
J74320
J34206
J73188
J64872
J34312
J68624
J73190
J33564
J33638
J74154
J73788
ZV500023

Exhibit A-8

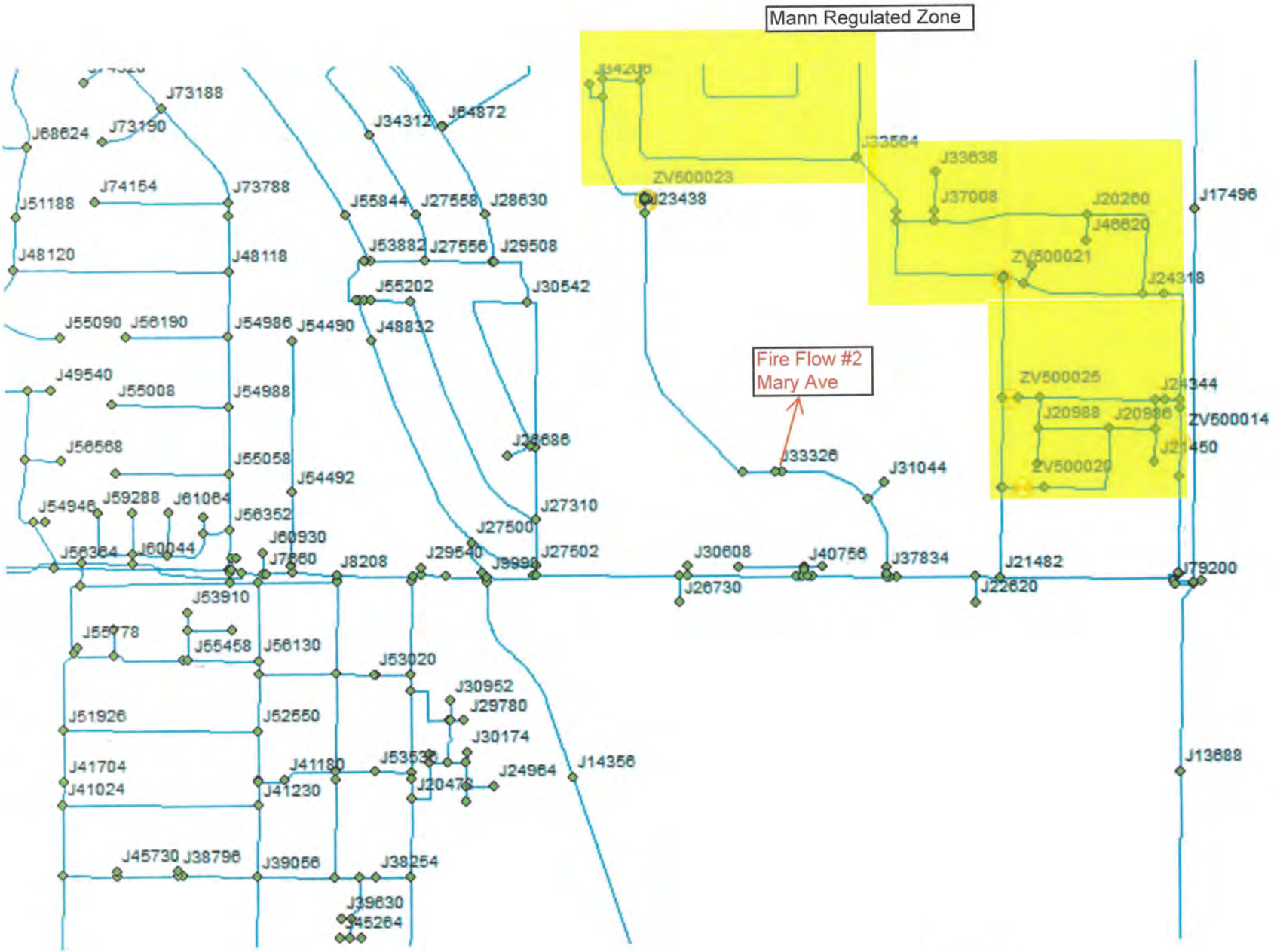

Mann Regulated Zone
Fire Flow #2
Mary Ave
J73188
J68624
J73190
J74154
J73788
J51188
J48120
J48118
J34312
J64872
J55844
J27558
J28630
J53882
J27556
J29508
J55202
J30542
J55090
J56190
J54986
J54490
J48832
J49540
J55008
J54988
J56568
J55058
J54492
J54946
J59288
J61064
J56352
J60930
J56364
J60044
J7660
J8208
J29540
J9996
J27502
J27500
J27310
J26686
J53910
J55778
J55458
J56130
J53020
J30952
J29780
J30174
J51926
J52550
J41704
J41024
J41180
J41230
J53530
J20478
J24964
J14356
J45730
J38796
J39056
J38254
J39630
J45264
J23438
ZV500023
J33638
J37008
J20260
J46620
J17496
ZV500021
J24318
ZV500025
J24344
J20988
J20986
ZV500014
J21450
ZV500020
J33326
J31044
J30608
J40756
J37834
J21482
J79200
J26730
J22620
J13688

Exhibit A-9

APPENDIX B

Cupertino Municipal Water System Fire Flow Analysis (SJWC)

CUPERTINO MUNICIPAL WATER SYSTEM FIRE FLOW ANALYSIS

Background

San Jose Water Company (SJWC) provides residents of the Cupertino Municipal Water System (MWS) with high quality water and exceptional customer service. SJWC maintains and operates the MWS based on a 25-year Lease agreement, which is set to expire in less than six years on October 1, 2022.

The Cupertino MWS consists of 4,183 service connections, about 58 miles of pipe, four welded steel storage tanks, five booster pumps, two wells and one regulator station. The system is comprised of three hydraulic pressure zones: Mercedes Zone, Cristo Rey Zone and Mann Regulated Zone. Imported surface water supply from Santa Clara Valley Water District (District) is the primary source of water for this system. In addition, there are two groundwater wells named Franco and Flowering Pear both located near Homestead Rd., east of Stelling Rd. District water and groundwater are both blended together at Mann Drive Station, which acts as the central hub for all three pressure zones.

The City of Cupertino (City) requested from SJWC a fire flow evaluation to demonstrate that the MWS can adequately respond to a simulated fire flow event. The following sections describe SJWC's analysis and results.

Analysis

The Santa Clara County Fire Department has indicated that for planning purposes fire flow requirements will vary from 1,500 gpm for two hours to 2,500 gpm for two hours based on zoning. In the Cupertino MWS, the highest fire flow requirement is 2,500 gpm in proximity to schools and public facilities. Residential neighborhoods have a fire flow requirement of 1,500 gpm for two hours.

Based on zoning within the Cupertino MWS and the distribution system network, SJWC determined that the area near Monte Vista High School is most appropriate to perform the requested fire flow evaluation. Should the City determine that an alternate location is preferred, SJWC will rerun the analysis. Santa Clara County Fire Department has accepted hydraulic simulations in lieu of field flows from SJWC for more than twenty years.

To further demonstrate to the City the resiliency of their water system, SJWC simulated a fire flow event under normal operating conditions and a worst case hydraulic analysis based on a fire event following an earthquake.

Assumptions

For the fire flow simulation based on normal operating conditions, the following assumptions were made:

- All tanks were assumed to be online
- Maximum day demand conditions
- The emergency pumper connection between SJWC and the MWS is offline

For the fire flow simulation based on a worst case scenario, the following assumptions were made:

- Both Mercedes Station tanks are offline
- Mann Station tank is offline
- Flowering Pear and Franco Court wells are offline
- Maximum day demand conditions
- The emergency pumper connection between SJWC and Cupertino MWS is offline

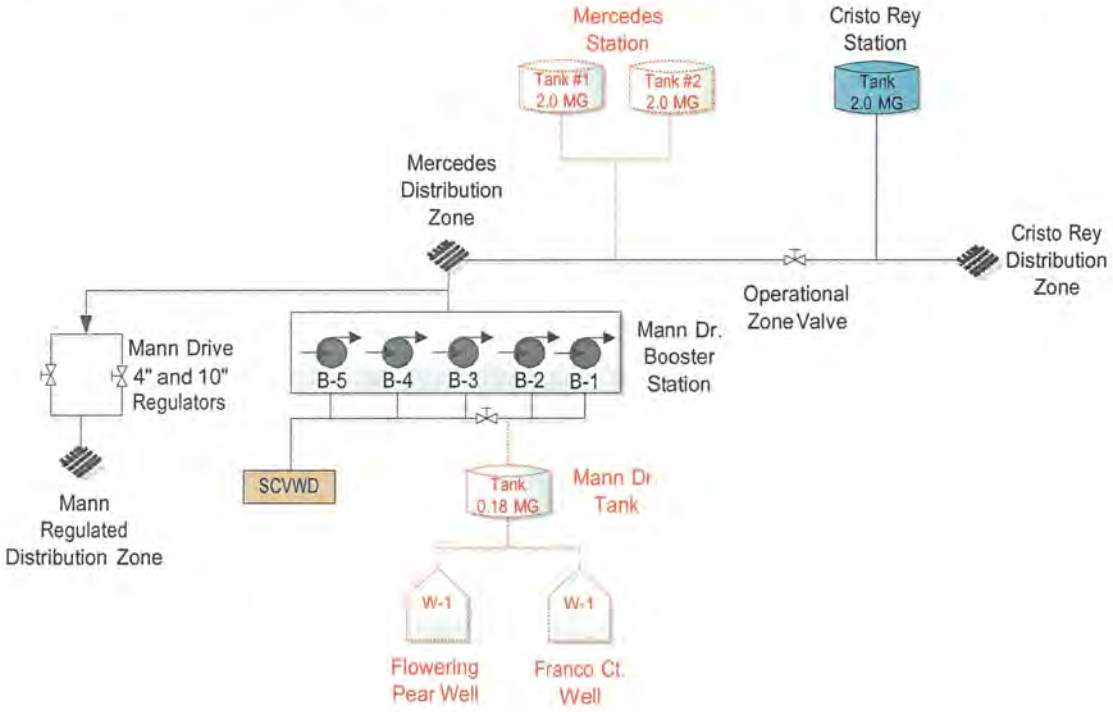


Figure 1. System Schematic for Simulated Worst Case Scenario

For the worst case scenario, two hydraulic model runs were analyzed: 1) three pumps at Mann Drive Booster Station online; and 2) all five pumps at Mann Drive Booster Station online.

Results

There are 11 services on the southwest side of the Cupertino MWS that have static pressure below 20 psi. These homes are situated at an elevation that is very high when compared to the base elevation of Mercedes Tanks.

When a fire flow event occurs near Monte Vista High School under normal operating conditions residual pressures are not significantly impacted at these high elevation homes or anywhere within in the distribution system because of the redundancy in storage and boosting facilities in the MWS.

When simulating the worst case scenario with both Mercedes Tanks taken out of service, more customers on the southwest side of the leased area would either have no water or have pressure between 3 and 20 psi. To minimize the impact to customer's water pressure following this simulated event, boosters at Mann Station must be continuously operating. If all five pumps at Mann Drive Booster Station are in service, there are 15 services with no water and 19 services with system pressure below 20 psi.

Due to the location of these low pressure services on a cul-de-sac, there is no potential for pipe looping. Under the simulated worst case scenario, a boil water advisory will be required for services with no water. Simulated system results during a fire flow event under normal operating conditions and a worst case scenario are presented in Table 1 and Figures 1, 2 and 3.

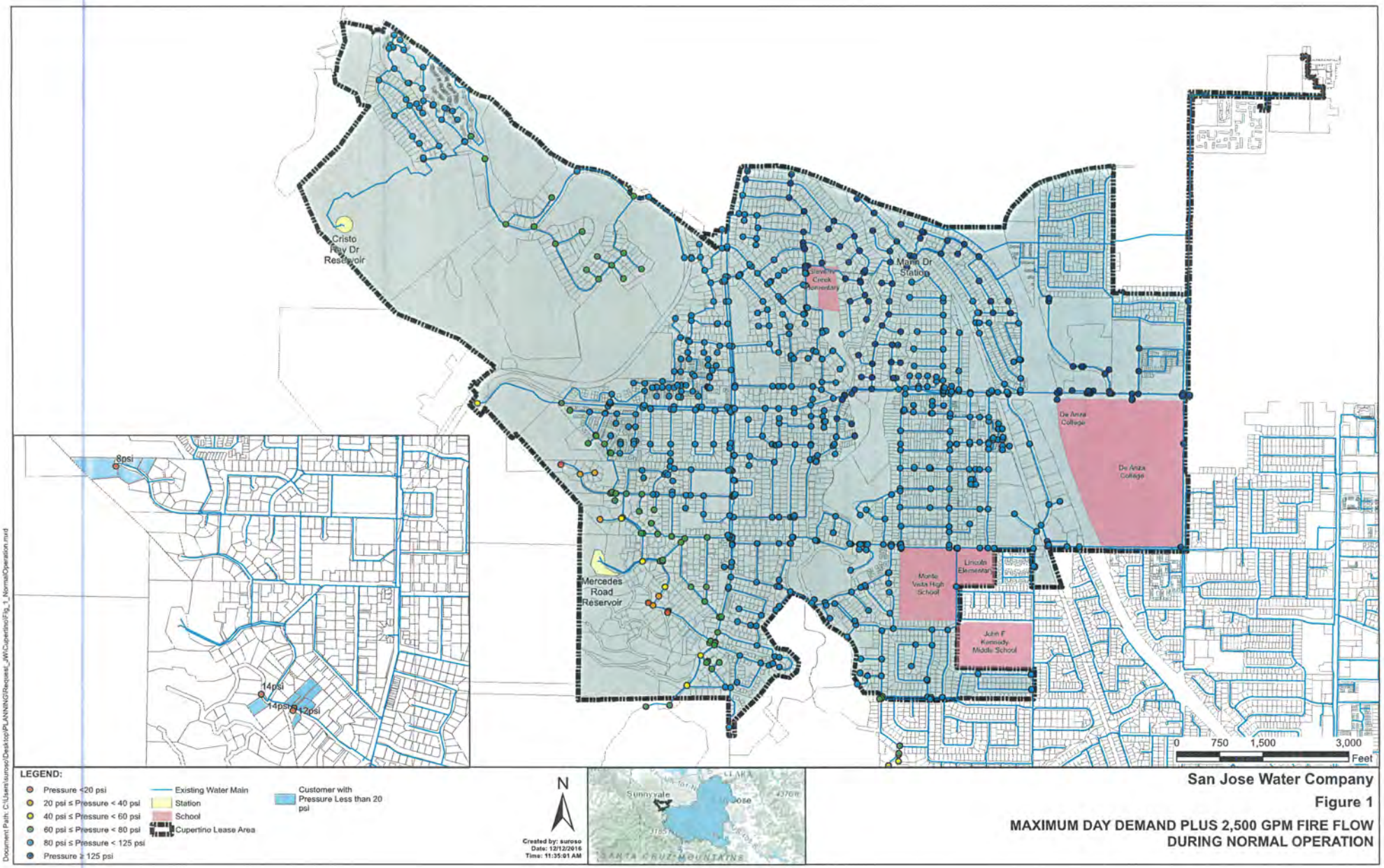
Table 1. Number of Services with No Water or Pressure Less than 20 psi[(a)]

System Condition	Facility in Service	Number of Services with No Water	Number of Services with Pressure Less than 20 psi
• 2,500 gpm fire flow • Max Day Demand • All tanks online • Pumper connection with SJWC offline	Mercedes Tanks; Cristo Rey Tank; Mann Drive Booster Station	-	11
• 2,500 gpm fire flow • Max Day Demand • Both Mercedes tanks offline • Pumper connection with SJWC offline	Cristo Rey Tank; Mann Drive Booster Station (operating 3 pumps)	68	33
	Cristo Rey Tank; Mann Drive Booster Station (operating 5 pumps)	15	19

(a) Under maximum day demand conditions with a 2,500 gpm fire flow demand near Monte Vista High School

Summary

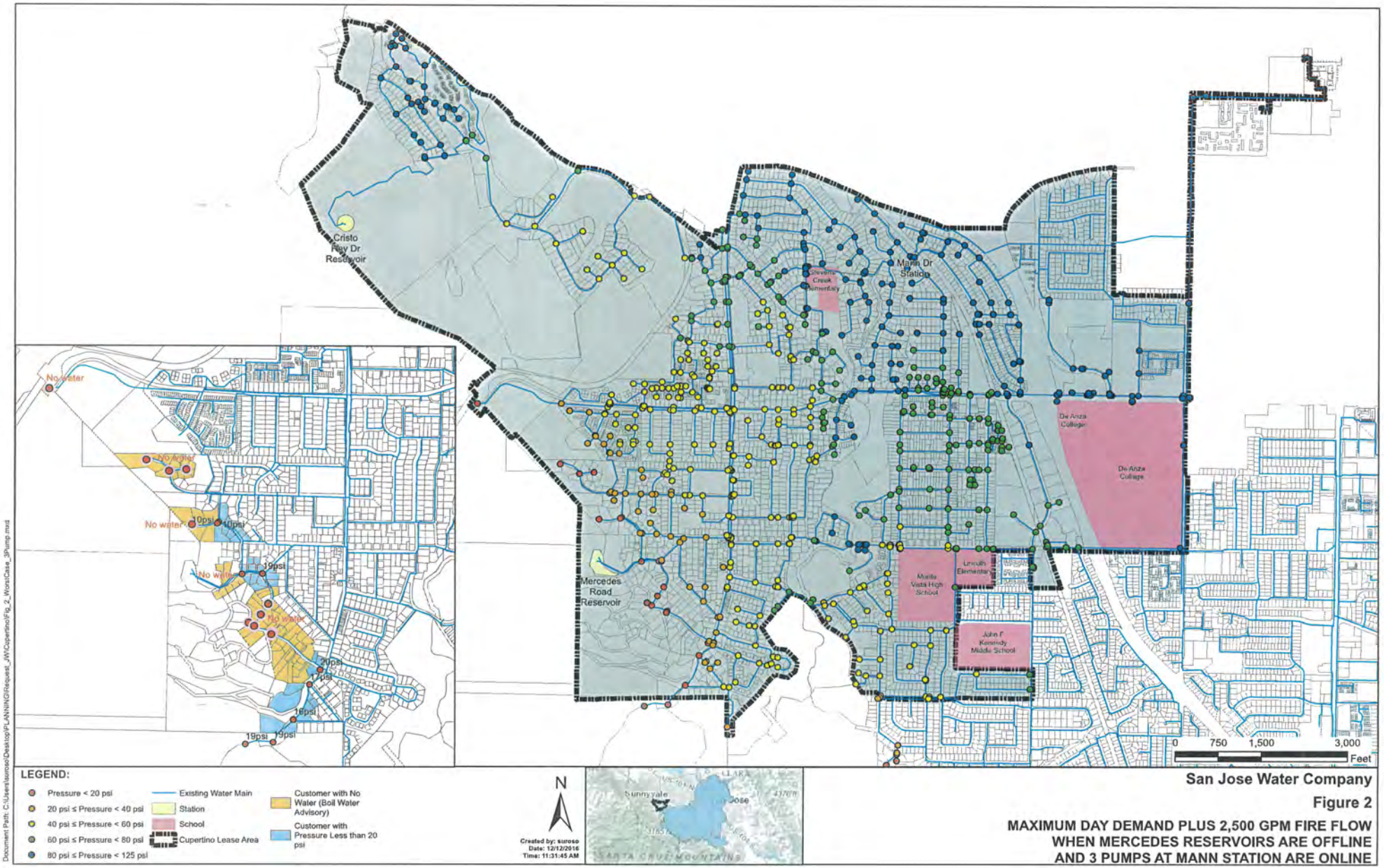
SJWC has a long history of providing high quality water and exceptional customer service to residents in the MWS. The system is well prepared to provide adequate water supplies to the Santa Clara County Fire Department during a fire flow event under both normal operating conditions and following a catastrophic event.



San Jose Water Company

Figure 1

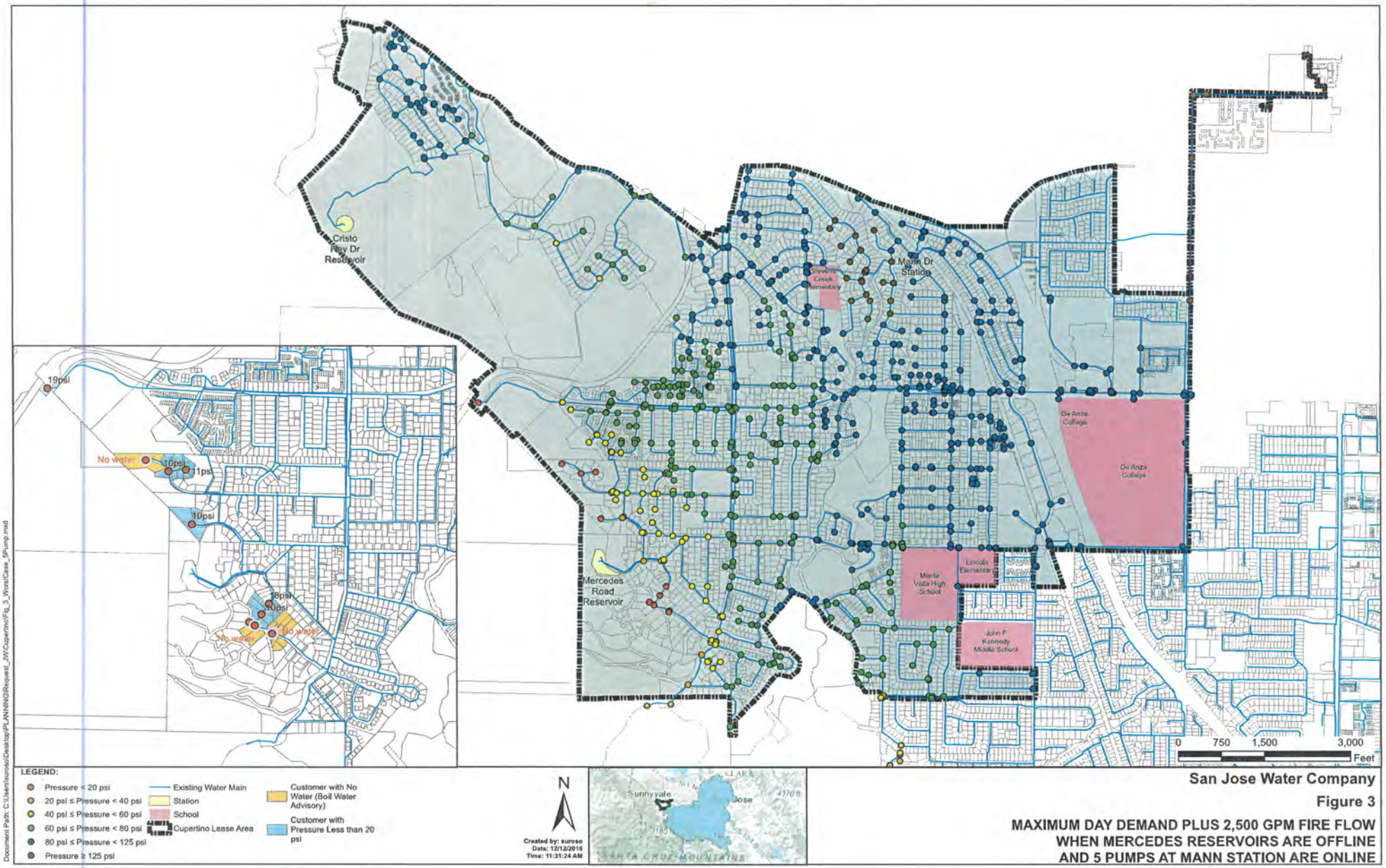
MAXIMUM DAY DEMAND PLUS 2,500 GPM FIRE FLOW DURING NORMAL OPERATION



San Jose Water Company

Figure 2

MAXIMUM DAY DEMAND PLUS 2,500 GPM FIRE FLOW WHEN MERCEDES RESERVOIRS ARE OFFLINE AND 3 PUMPS AT MANN STATION ARE ONLINE



San Jose Water Company

Figure 3

MAXIMUM DAY DEMAND PLUS 2,500 GPM FIRE FLOW WHEN MERCEDES RESERVOIRS ARE OFFLINE AND 5 PUMPS AT MANN STATION ARE ONLINE

APPENDIX C

J&C Fire Protection Field Flow Test Results


Alves St
Write a description for your map.
Legend
Congress Pl
Patriot Way
Freedom Dr
United Pl
Alves Dr
Memorial Park
Senate Way
Google Earth
© 2018 Google
N
200 ft

Location of test: Alves St Cupertino, CA 95014 Hydrant Z-00129

The follow available flow and pressure information is bases on a maximum day demand hydraulic model analysi J&C Safety 1st Fire Protection, Inc. This information should be used as a guidance of the approximate available recommended that a design allowance be made for possible reduction in pressure and/ or flow that could occur possible scenarios. Applicate understands that J&C Safety 1st Fire Protection Inc can not guarantee any specific pressure and flow. If you have any questions, please contact us at jcfireprotection@gmail.com or call us at (510)

Possible fire service connection #1

Connection Point Static 55 PSI

Residual Pressure 40 PSI

Pitot Reading 8 PSI (1083GPM)

LICENSED PROTECTION CONTRACTOR
J&C Safety 1st Fire Protection Inc.
CLASSIFACTION
C-16
LICENSE NO.
964500
STATE OF CALIFORNIA

X


Mary Ave
Write a description for your map.
Legend
W Valley Fwy
Glen Pl
285'el
Parkwood Dr
293'el
Mary Ave
Google Earth
© 2018 Google
600 ft
N

Location of test: Mary Ave Cupertino, CA 95014 Hydrant Z-00074

The follow available flow and pressure information is bases on a maximum day demand hydraulic model analysi J&C Safety 1st Fire Protection, Inc. This information should be used as a guidance of the approximate available recommended that a design allowance be made for possible reduction in pressure and/ or flow that could occur possible scenarios. Applicate understands that J&C Safety 1st Fire Protection Inc can not guarantee any specific pressure and flow. If you have any questions, please contact us at jcfireprotection@gmail.com or call us at (510)

Possible fire service connection #1

Connection Point Static 145 PSI

Residual Pressure 100 PSI

Pitot Reading 30 PSI (2059GPM)

LICENSED PROTECTION CONTRACTOR
J&C Safety 1st Fire Protection Inc.
CLASSIFACTION
C-16
LICENSE NO.
964500
STATE OF CALIFORNIA

X


Scenic Circle
Write a description for your map.
Legend
Palm Ave
Scenic Blvd
Riviera Rd
Scenic Ct
Scenic Cir
Stevens Creek Trail
San Fernando Ct
San Fernando Ave
N
600 ft
Google Earth
© 2018 Google

Location of test: Scenic Cir Cupertino, CA 95014 Hydrant Z-00211

The follow available flow and pressure information is bases on a maximum day demand hydraulic model analysi J&C Safety 1st Fire Protection, Inc. This information should be used as a guidance of the approximate available recommended that a design allowance be made for possible reduction in pressure and/ or flow that could occur possible scenarios. Applicate understands that J&C Safety 1st Fire Protection Inc can not guarantee any specific pressure and flow. If you have any questions, please contact us at jcfireprotection@gmail.com or call us at (510)

Possible fire service connection #1

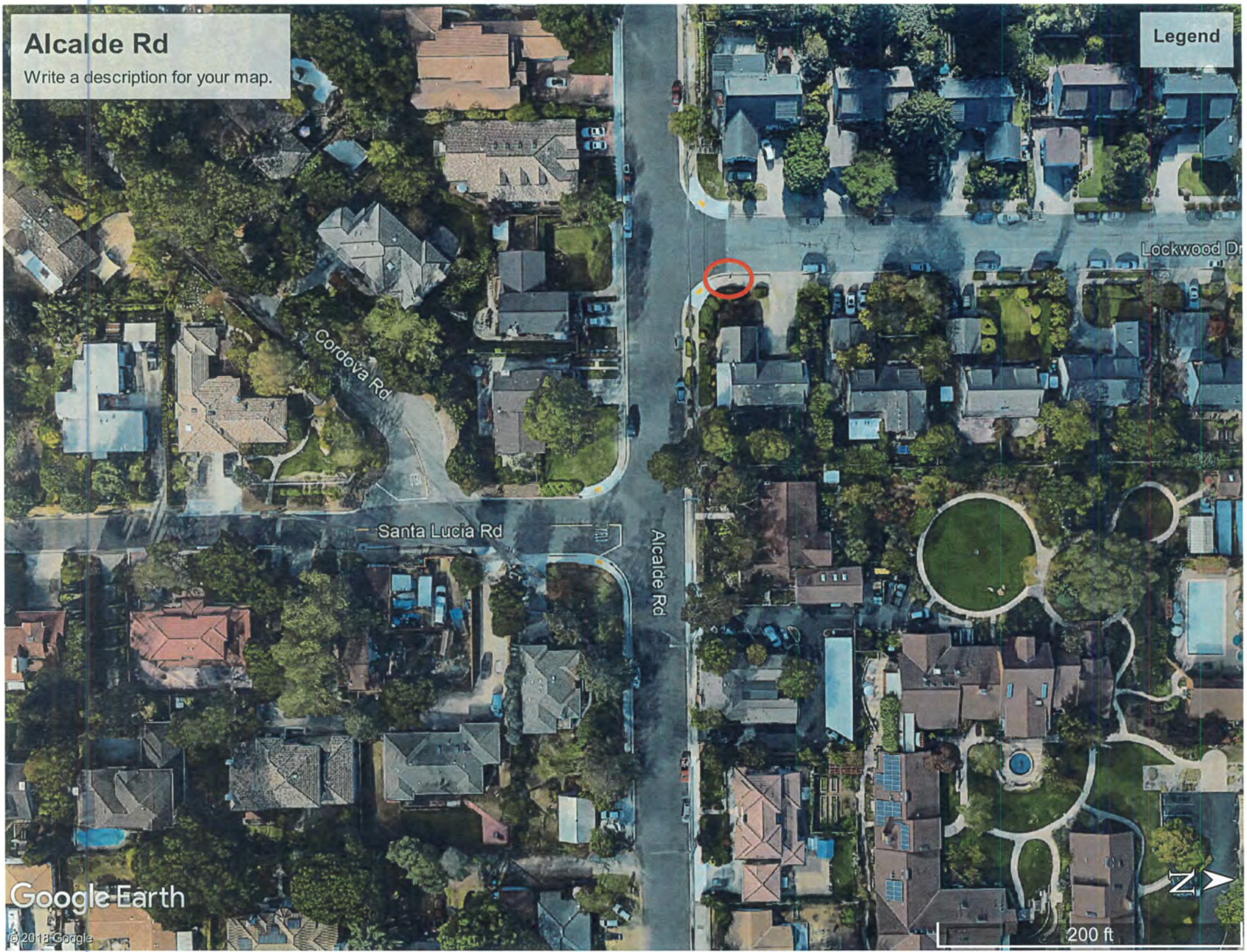
Connection Point Static 135 PSI

Residual Pressure 98 PSI

Pitot Reading 38 PSI (2293GPM)

LICENSED PROTECTION CONTRACTOR
J&C Safety 1st Fire Protection Inc.
CLASSIFACTION C-16
LICENSE NO. 964500
STATE OF CALIFORNIA

X


Alcalde Rd
Write a description for your map.
Legend
Lockwood Dr
Cordova Rd
Santa Lucia Rd
Alcalde Rd
Google Earth
© 2018 Google
200 ft
N

Location of test: Alcalde Rd Cupertino, CA 95014 Hydrant Z-00062

The follow available flow and pressure information is bases on a maximum day demand hydraulic model analysi J&C Safety 1st Fire Protection, Inc. This information should be used as a guidance of the approximate available recommended that a design allowance be made for possible reduction in pressure and/ or flow that could occur possible scenarios. Applicate understands that J&C Safety 1st Fire Protection Inc can not guarantee any specific pressure and flow. If you have any questions, please contact us at jcfireprotection@gmail.com or call us at (510)

Possible fire service connection #1

Connection Point Static 80 PSI

Residual Pressure 55 PSI

Pitot Reading 18 PSI (1595GPM)

LICENSED PROTECTION CONTRACTOR
J&C Safety 1st Fire Protection Inc.
CLASSIFACTION
C-16
LICENSE NO.
964500
STATE OF CALIFORNIA

X


Ainsworth Dr
Write a description for your map.
Legend
Carta Blanca St
Bahl St
Kendle St
Hartman Dr
Starling Dr
305'el
Ainsworth Dr
Via Camino Ct
Varian Way
Aldemey Ct
2
Google Earth
© 2018 Google
N
500 ft

Location of test: Ainsworth Dr Cupertino, CA 95014 Hydrant Z-00379

The follow available flow and pressure information is bases on a maximum day demand hydraulic model analysi J&C Safety 1st Fire Protection, Inc. This information should be used as a guidance of the approximate available recommended that a design allowance be made for possible reduction in pressure and/ or flow that could occur possible scenarios. Applicate understands that J&C Safety 1st Fire Protection Inc can not guarantee any specific pressure and flow. If you have any questions, please contact us at jcfireprotection@gmail.com or call us at (510)

Possible fire service connection #1

Connection Point Static 130 PSI

Residual Pressure 100 PSI

Pitot Reading 30 PSI (2059GPM)

LICENSED PROTECTION CONTRACTOR
J&C Safety 1st Fire Protection Inc.
CLASSIFACTION C-16
LICENSE NO. 964500
STATE OF CALIFORNIA

X

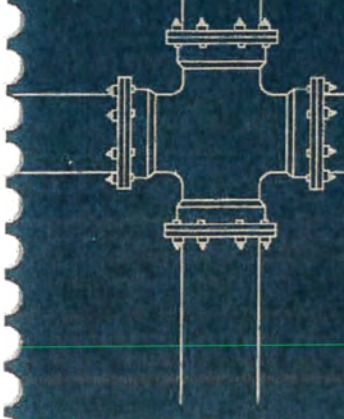
Appendix C

SJWC 2015 Pipeline Consequence of Failure Study

Pipeline Consequence of Failure Study

Cupertino Lease Area

October 2015



San Jose Water Company

Pipeline Consequence of Failure Study

October 2015

Prepared by

San Jose Water Company
Planning Group

Andy Yang, P.E.
Senior Civil Engineer

Damaris Villalobos-Galindo, P.E.
Associate Civil Engineer

Reviewed by

Jake Walsh, P.E.
Engineering Unit Manager

Bill Tuttle, P.E.
Director of Engineering

Executive Summary

Introduction and Purpose

Water System Overview

The Cupertino Lease Area is located in the northwestern region of the City of Cupertino. The water system includes:

- 4,200 water services
- 2.4 MGD Average Day Demand
- Nearly 60 miles of pipeline
- 4 water storage tanks
- 5 booster pumps
- 2 wells
- 1 SCVWD turnout

Pipelines are one of the most important assets of any water system and their continual operation is critical to San Jose Water Company (SJWC) delivering reliable water supply to its customers. With the purpose of identifying the criticality of each pipeline, the Planning Group conducted a Pipeline Consequence of Failure Study for the Cupertino Lease Area water system. This study provides a framework to strategically identify pipeline improvement projects within the Cupertino Lease Area. To this end, a methodology was developed which primarily used hydraulic modeling and flooding analysis results to quantify the criticality of all pipelines in the water system.

Consequence of Failure Evaluation

Pipeline failures have a multi-faceted impact on society. In order to quantify the amount of impact a pipeline failure has on society as a whole, it was necessary to identify the primary facets affected by pipeline failures. The following four impact categories summarized in Figure ES-1 were considered to be the primary impacts.

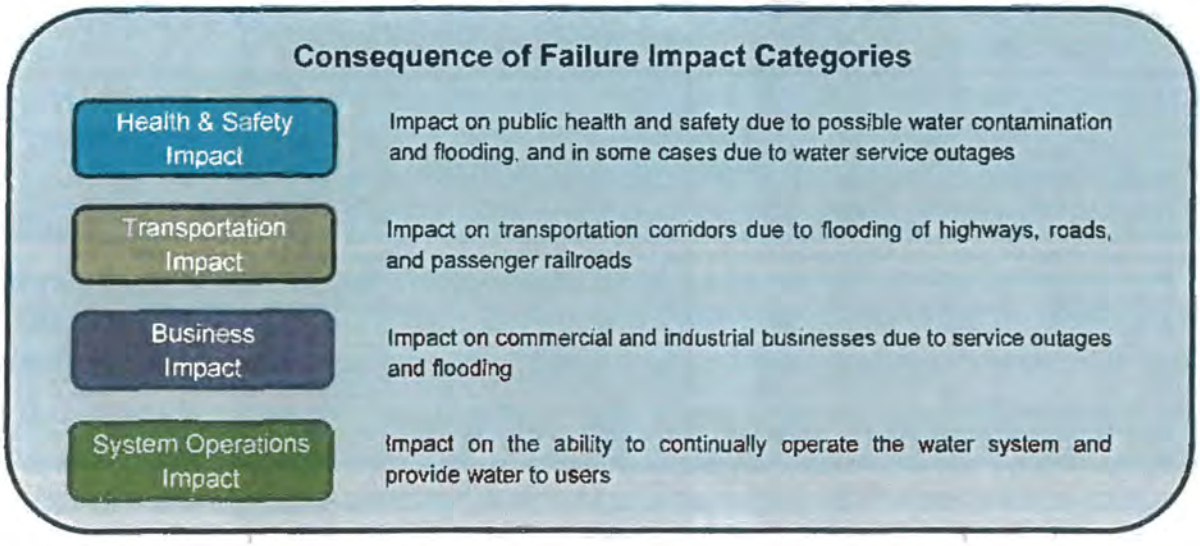


Figure ES-1. Consequence of Failure Impact Categories

Hydraulic Modeling

Extensive hydraulic modeling was conducted in order to simulate catastrophic break scenarios for every pipe in the Cupertino Lease Area water system. The hydraulic model measured the leak discharge rate out of each failed pipe, potential for water contamination due to low pressures, amount of consumer water demand inhibited due to isolation of the failed pipe, and number of valves needing to be operated to achieve hydraulic isolation for each pipe.

Critical Facilities and Key Features

The consequence of failure evaluation methodology was developed such that pipelines affecting critical facilities and key features received higher consequence of failure scores. Critical facilities and key features include:

- Hospitals
- Acute health care facilities
- Commercial or residential units with dialysis / life-support equipment
- Schools
- Freeways and major highways
- Railroads

Geographic Information System Mapping

Spatial analysis played a significant part in the consequence of failure analysis. Geographic Information System (GIS) mapping was used as a tool to identify the types of properties, facilities, roads, and railroads within the potential flooding region for each pipe. In addition, GIS spatial tools were used to help identify pipelines crossing critical transmission mains and those essential for water system operations.

Results from hydraulic modeling and GIS spatial analyses were input into the consequence of failure evaluation methodology, which ultimately yielded a final consequence of failure score for each pipeline. Figure ES-2 outlines the overall consequence of failure evaluation process.

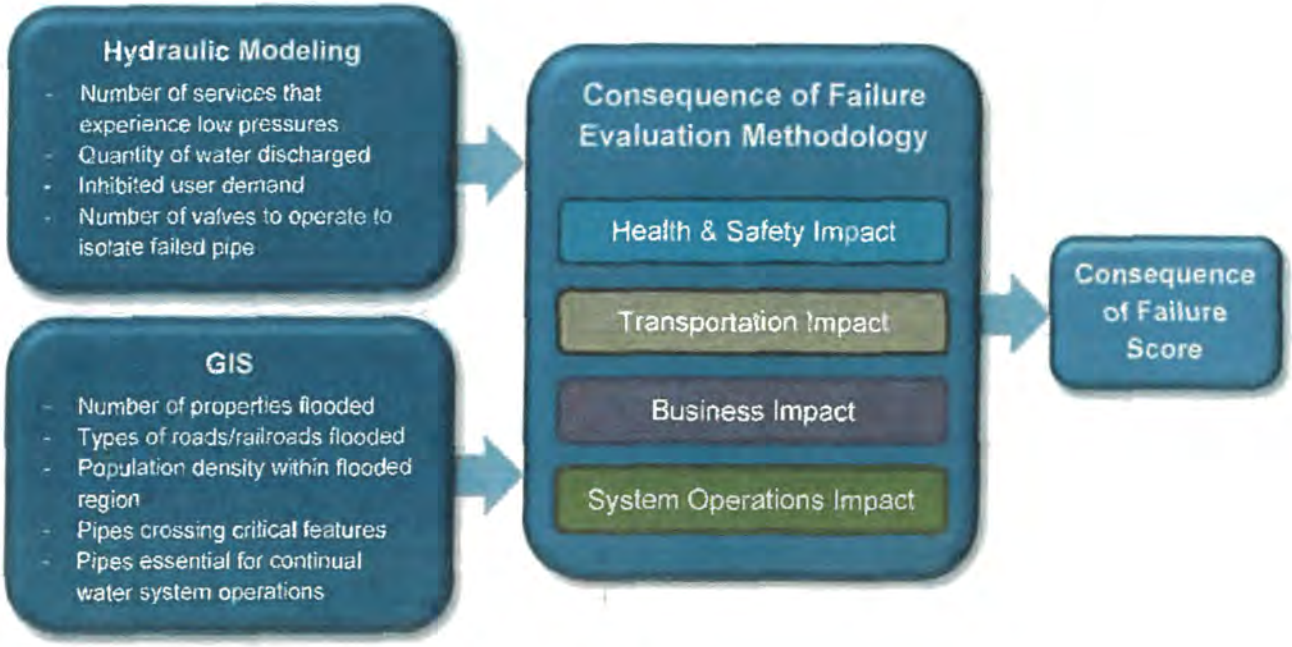


Figure ES-2. Consequence of Failure Score Evaluation Process

Consequence of Failure Evaluation Results

After the consequence of failure score was generated, all GIS defined pipe segments in Cupertino Lease Area were uniquely ranked from 1 to 1061 and divided into four criticality categories: High (Top 10%), Medium-High (10-20%), Medium (20-50%), and Low (50-100%). Map ES-1 provides a visual representation of the final results for all pipes by criticality category.

Recommended Improvements and Actions

Findings of the consequence of failure evaluation provide a baseline for future efforts to identify and prioritize capital improvement projects. Main replacement and rehabilitation project recommendations take into consideration both the consequence of failure as well as the probability of failure, so those recommendations are not included in the scope of this study. However, results of this study did bring to surface the need for a regulator installation, a valve installation, and easement documentation. As previously communicated with the City, SJWC requests that the City provide more data relating to pipe type and age of installation before a comprehensive probability of failure analysis is conducted.

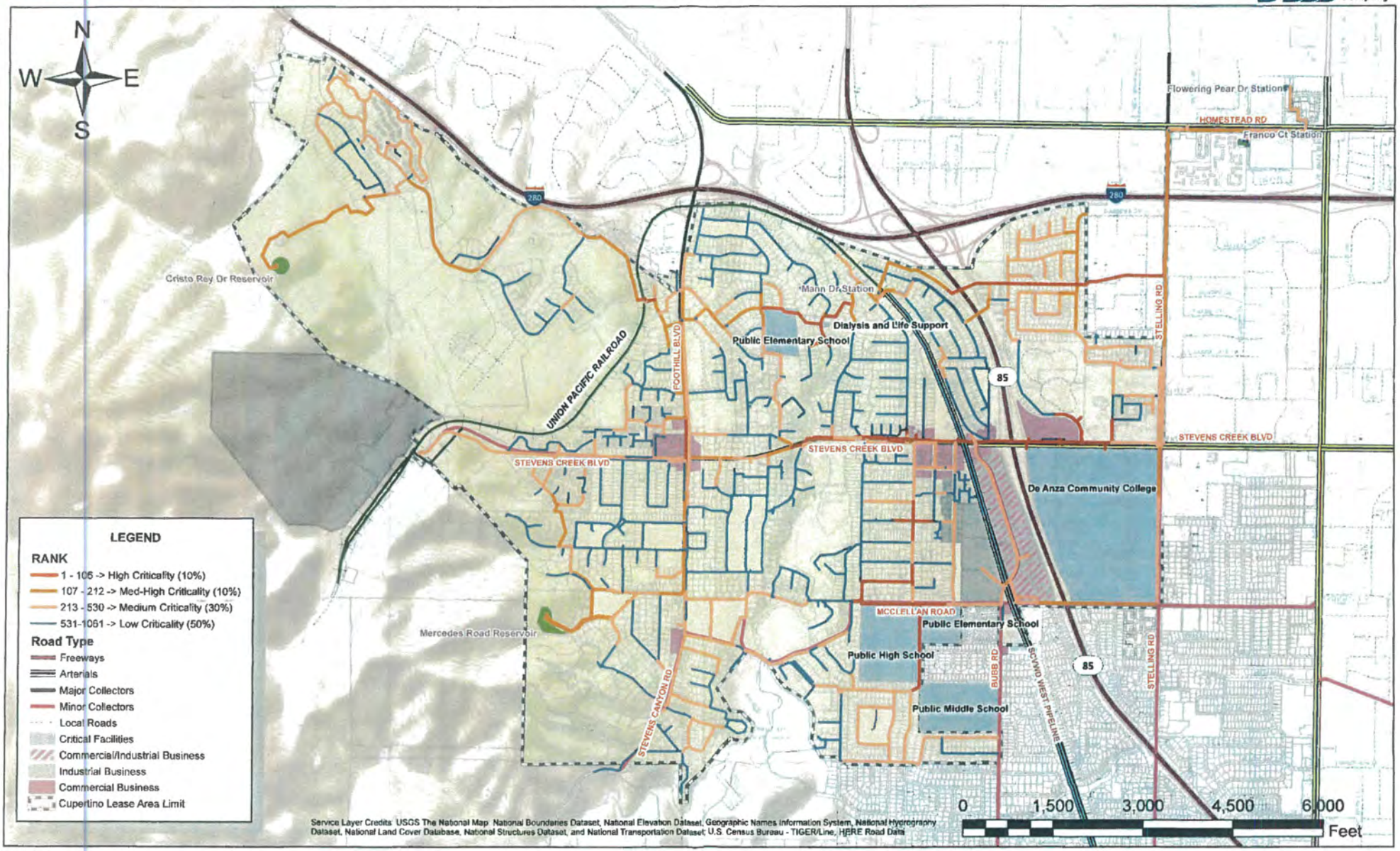
Regulator Installation

Based on the consequence of failure evaluation results, it is recommended that an 8-inch pressure regulator be installed on the northern border of Cupertino Memorial Park, near the intersection of Christensen Drive and Fenway Court, as shown in Figure ES-3. This improvement will prevent many services from dropping to low (often subatmospheric) pressures during a catastrophic pipe break and will increase fire-flow capacity. It is recommended that this improvement be implemented in 2017. The estimated cost for this improvement is $117,600.

Figure ES-3. Recommended 8-inch Pressure Regulator Installation

MAP ES-1. CONSEQUENCE OF FAILURE ANALYSIS - Results by Rank

San Jose Water Company



NOTE:
Industrial business parcels shown in this map that reside outside of the Cupertino Lease Area were included as part of the Consequence of Failure Analysis because they are served by the Cupertino Lease Area water system.

11/3/15

Comments:

1) No input re. condition of existing mains / probability of failure.

   Q - Is this a separate study?

2) Report states regulator, valve installation & easement documentation is needed.

   - Regulator is near memorial park.
   - Valve is at foothill / SCB.

   Q. - With 10% of 60 miles shown as High Criticality seems odd that so few improvements are recommended.

3) Report states that City is to provide more data relating to pipe type, age of install for probability of failure study.

   Q - SQW has operation system for 18 yrs. What has SQW learned?

4) Vicinity of line relative sanitary sewer not mentioned.

Valve Installation

It is recommended that a 14-inch valve be installed at the intersection of Stevens Creek Boulevard and South Foothill Boulevard, as illustrated in Figure ES-4. This recommendation will decrease the number of large diameter valves needing to be closed to hydraulically isolate the 14-inch diameter pipe alignment on South Foothill Boulevard between Stevens Creek Boulevard and Alcalde Road to the south. Currently, in the event of a catastrophic break along this alignment, it is estimated that approximately 2 million gallons may be discharged into the surrounding area. However, with the implementation of this recommendation, the failed pipe will be hydraulically isolated within a shorter time frame and the volume discharged will be reduced by up to 400,000 gallons. This improvement is recommended for implementation in 2017 and is estimated to cost $21,900.

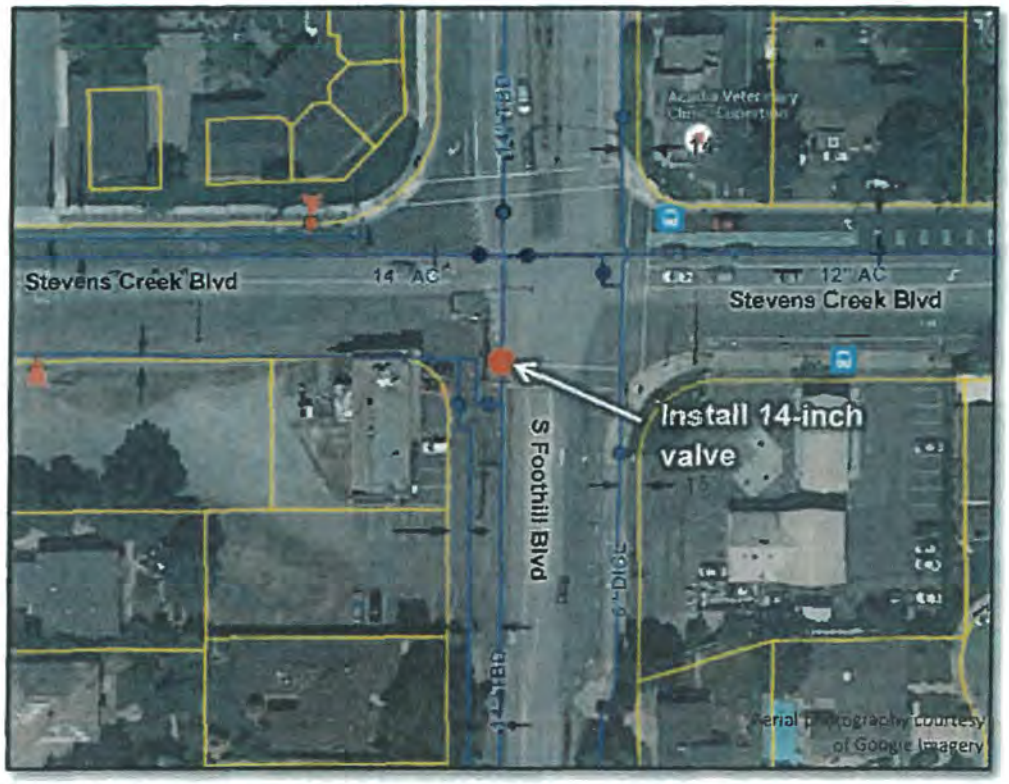


Figure ES-4. Recommended 14-inch Valve Installation

Easement Documentation

A number of pipes in the Cupertino Lease Area water system are installed within private yards and streets, see Table ES-1. SJWC requests that the City provide plat and legal descriptions, tract, parcel or utility maps identifying easement type and limits as well as water main location within each easement. This documentation would be necessary for any potential pipeline improvements in these areas.

Table ES-1. Easement Documentation Request List

APN	Address
326-12-049	10420 CRESTON DR
326-12-051	10440 CRESTON DR
326-12-052	10450 CRESTON DR
326-13-035	10407 VISTA KNOLL BLVD
326-15-076	10370 ALPINE DR
326-15-076	10370 ALPINE DR
326-15-076	10370 ALPINE DR
326-15-076	10370 ALPINE DR
326-15-103	22364 SALEM AVE
326-15-130	22445 CUPERTINO RD
326-15-130	22445 CUPERTINO RD
326-16-045	10130 CRESCENT RD
326-16-047	10151 HILLCREST RD
326-16-050	10181 HILLCREST RD
326-16-052	10161 HILLCREST RD
326-16-053	10143 HILLCREST RD
326-16-055	10133 HILLCREST RD
326-16-061	10191 HILLCREST RD
326-16-080	10171 HILLCREST RD
326-17-013	10168 AMELIA CT
326-17-019	10201 AMELIA CT
326-17-020	10185 AMELIA CT
326-17-026	10171 AMELIA CT
326-17-053	10151 AMELIA CT
326-18-057	10019 OAKLEAF PL
326-27-037	10145 PARKWOOD DR
326-27-037	10145 PARKWOOD DR
326-27-037	10145 PARKWOOD DR
326-27-037	10145 PARKWOOD DR
326-27-037	10145 PARKWOOD DR
326-35-063	10451 PHAR LAP DR
326-35-068	SOUTHERN PACIFIC TRANS.
326-37-004	10391 RIVERCREST CT
326-37-047	CRESTON DR
326-39-060	SANTA CLARA VALLEY WATER
326-41-033	10500 CASTINE AVE
326-41-095	21291 MILFORD DR
326-41-096	21301 MILFORD DR
326-41-097	21311 MILFORD DR
326-41-098	21321 MILFORD DR
326-41-099	21331 MILFORD DR
326-41-100	21341 MILFORD DR
326-41-101	21361 MILFORD DR
326-41-102	21371 MILFORD DR
326-41-103	21381 MILFORD DR

APN	Address
326-41-104	21391 MILFORD DR
326-41-105	21401 MILFORD DR
326-41-106	21421 MILFORD DR
326-41-107	21431 MILFORD DR
326-41-108	21451 MILFORD DR
326-41-109	21461 MILFORD DR
326-41-114	CITY OF CUPERTINO
326-47-019	10410 STOKES AVE
326-49-007	10650 STOKES AVE
326-49-018	21887 WILSON CT
326-49-034	STOKES AVE
326-55-023	10315 ANN ARBOR AVE
342-12-063	22615 SALEM AVE
342-12-064	22625 SALEM AVE
342-12-064	22625 SALEM AVE
342-12-064	22625 SALEM AVE
342-12-090	22611 POPPY DR
342-29-057	10495 MERRIMAN RD
342-44-017	10500 SAN FELIPE RD
342-44-020	10530 SAN FELIPE RD
342-45-007	22864 VOSS AVE
342-45-035	10396 AVENIDA LN
342-48-006	22654 OAKCREST CT
342-48-018	10439 HENEY CREEK PL
342-48-030	10350 HENEY CREEK PL
342-48-030	10350 HENEY CREEK PL
342-57-009	10799 JUNIPER CT
342-57-030	10829 SYCAMORE CT
342-58-003	22238 HAMMOND WAY
356-01-021	10980 MIRAMONTE RD
356-05-005	MC CLELLAN RD
356-06-030	22044 BAXLEY CT
357-01-027	22288 BELLEVUE AVE
357-01-033	10168 CASS PL
357-04-029	10494 MIRA VISTA RD
357-06-016	10489 SCENIC BLVD
357-09-053	22120 STEVENS CREEK BLVD
357-10-006	21975 SAN FERNANDO AVE
357-10-008	21979 SAN FERNANDO AVE
357-12-055	10485 SAN FERNANDO AVE
357-20-019	10340 BUBB RD
357-22-006	10106 IMPERIAL AVE
357-22-007	10104 IMPERIAL AVE
357-22-035	10118 IMPERIAL AVE

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF MAPS

LIST OF TABLES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

AADT	Annual Average Daily Traffic
DDW	Division of Drinking Water
ft	Feet
GIS	Geographic Information System
gpm	Gallons per minute
psi	Pounds per square inch
SCVWD	Santa Clara Valley Water District
SJWC	San Jose Water Company

1. Introduction

1.1 Background

Pipelines are a critical water distribution system asset and fundamental to virtually every facet of reliable water system operations. Given the magnitude of their importance, it is imperative that excellent pipeline asset management studies and programs be implemented to assure the safety and reliability of water systems for the overall benefit of the customers. This Pipeline Consequence of Failure study will serve as a baseline upon which San Jose Water Company (SJWC) will develop a refined pipeline asset management program.

1.2 Objectives

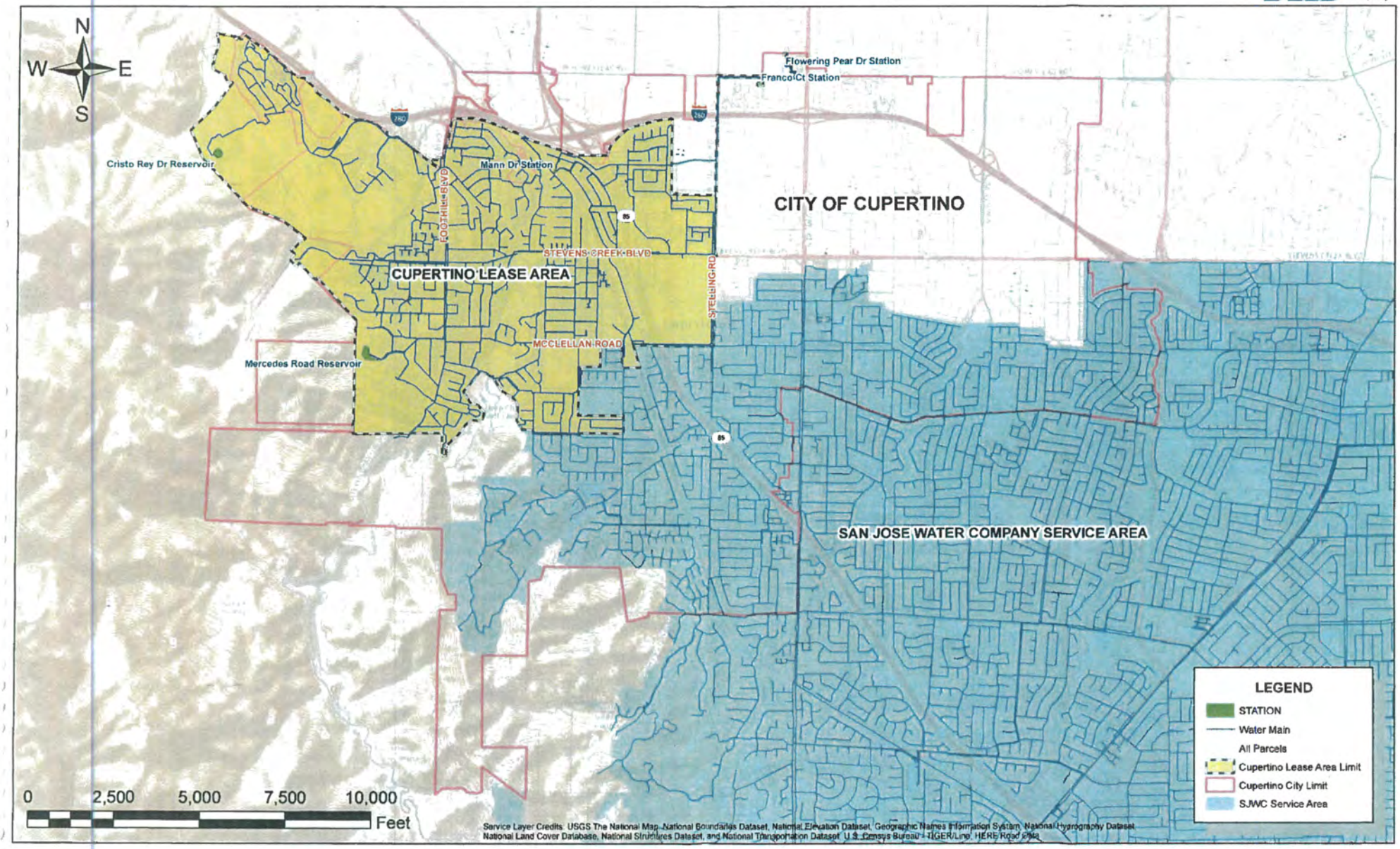
The objectives of the Consequence of Failure Study are summarized below:

- Establish an approach for evaluating the consequence of failure for each pipeline
- Locate critical facilities, features, and areas of concern
- Generate results measuring the consequence of failure for each pipeline by rank
- Develop a baseline to help strategically identify capital improvement projects that would yield the greatest ratepayer benefit

1.3 System Overview

The Cupertino Lease Area is located in the northwest region of the City of Cupertino, encompassing 3.7 square miles which is equivalent to approximately one-third of the city's total area. SJWC has been providing water service to the Cupertino Lease Area for the past 18 years as part of a 25 year agreement. The Cupertino Lease Area water system is composed of nearly 60 miles of pipelines, 4 water storage tanks with a total design storage capacity of nearly 8 million gallons, 5 booster pumps with a total design capacity of 6,300 gallons per minute (gpm), and 2 wells with a combined capacity of 1,100 gpm. The majority of water supply served to the Cupertino Lease Area comes through a Santa Clara Valley Water District (SCVWD) turnout at Mann Drive Station. There are approximately 4,200 water services within the Cupertino Lease Area, totaling an average day demand of over 2 million gallons. Map 1 provides a visual summary of the Cupertino Lease Area water system.

MAP 1. CONSEQUENCE OF FAILURE ANALYSIS - Cupertino Lease Area Boundary



2. Pipeline Failure Event Characterization, Effects, and Mode

Pipeline failure events can occur in many different fashions and magnitudes. Some failures may be as small as a minor leak, but some are catastrophic in nature causing a major disruption to the water distribution system and to the public as depicted in Figures 1 and 2. Before any system-wide analysis on the consequence of pipeline failure could be performed, it was first necessary to clearly define the characterization, effects, and mode of pipeline failures that would be considered for the purposes of this study.

Figure 1. Damage observed due to main break located on Pensacola Drive in the eastern side of San Jose.

Figure 2. Workers diverting traffic on Bascom Avenue while attempting to fix a main break on a 12" water main.

2.1 Pipeline Failure Event Characterization

Pipeline failure events and their impacts can be characterized by two stages. The first stage (break stage) is the affected condition of the distribution system immediately after the pipeline break, when water is being discharged from the failed pipe into the surrounding environment. The second stage (isolation stage) is the affected condition of the system while the failed pipe is hydraulically isolated and being repaired. Both stages were considered in this study to capture the entire impact of a pipeline failure event. Figure 3 includes photographs illustrating the two stages.

Figure 3. Picture on the left illustrates the Break Stage of a main break; picture on the right illustrates a repair during the Isolation Stage of a main break.

2.2 Pipeline Failure Hydraulic Effects (Impact Causes)

When a pipeline fails, there are a few primary hydraulic effects which cause impact to the public that must be considered. During the first stage of the failure event, the additional demand (i.e. water being discharged into its surroundings) creates higher velocities and lower pressures in the distribution system. Another major failure effect during the first stage is the flooding of the surrounding vicinity. The societal impacts of low pressures and flooding that were considered in this study are explained in Section 3 *Pipeline Consequence of Failure Evaluation Methodology*.

During the second stage of the failure event, various valves must be closed (or at least pinched down) in order to isolate the failed pipe for repair. This operation will hydraulically isolate the region contained within the closed valves and will put all of the users within this region out of service. In addition, once the isolation valves are closed, the rest of the water system outside of the isolated region may also be affected due to the change in overall system dynamics. Users outside of the isolated region may experience low pressures and reduced water flow as well. Table 1 summarizes the failure effects that were considered in this study. The societal impacts of hydraulic isolation that were considered in this study are explained in Section 3 *Pipeline Consequence of Failure Evaluation Methodology*.

Table 1. Hydraulic Effects of Pipeline Failure Event

Stage	Occurrence	Hydraulic Effects (Impact Causes)
Stage 1	Immediately following pipe break	• Low pressures • Flooding
Stage 2	Immediately following isolation for pipe repair	• Low pressures • Out of service

2.3 Pipeline Failure Mode

There are numerous ways in which pipelines can fail. Failure modes include blowouts, longitudinal splits, wall ruptures/tears, circumferential breaks, joint leaks, perforations, and more. It was assumed for the purposes of this study that all pipes would fail in a catastrophic fashion resulting in complete pipe separation such that there are two points at which water is discharged at atmospheric pressure, as illustrated in Figure 4. Although the vast majority of pipeline failures in the SJWC distribution system are not of this nature or magnitude, it was appropriate to analyze a worst-case scenario for each pipeline.

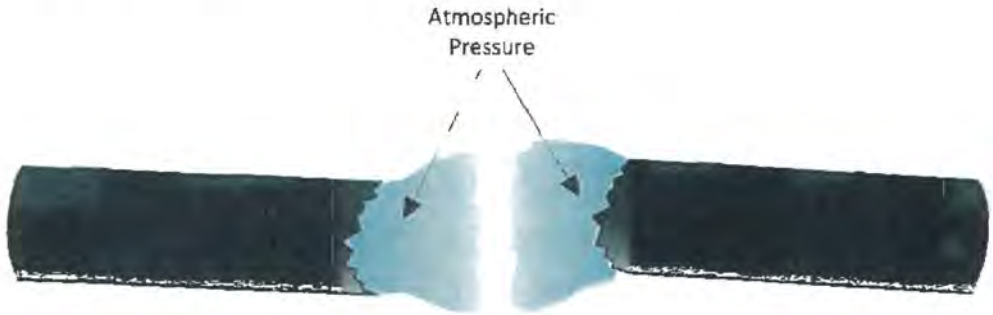


Figure 4. Pipeline Failure Mode - Complete Separation

3. Pipeline Consequence of Failure Evaluation Methodology

Establishing the methodology for evaluating each pipeline's consequence of failure is the most involved and pivotal portion of this study because, in the end, methodology will determine results. Therefore, it is imperative that the methodology is developed such that it captures all key consequences or impacts that result from pipeline failures and accurately measures them. Various consequence of failure evaluation methodologies have been developed for different water utilities and for research purposes. However, upon review of various studies, it was found that a new and customized methodology was necessary to more specifically evaluate and address the particular needs within the Cupertino Lease Area. This section presents SJWC's customized methodology which is intended to provide an objective and systematized process that will yield quantifiable and justifiable consequence of failure results. The section is structured as follows:

- ***Section 3.1 Impact Categories*** – Introduction to key impacts that result from pipeline failures
- ***Section 3.2 Impact Category Measurement Parameters and Tools*** – Discussion of parameters and tools used to measure impacts
- ***Section 3.3 Pipeline Consequence of Failure Scoring Methodology*** – Explanation of scoring methodology used to develop final rankings

3.1 Impact Categories

The following four impact categories encompass what SJWC believes to be the primary societal impacts when a pipeline fails:

- Health & Safety Impact
- Transportation Impact
- Business Impact
- System Operations Impact

The following subsections provide explanations as to why and how pipeline failures play a role in these four impact categories.

3.1.1 Health & Safety Impact

The most critical societal impact of pipeline failures is related to public health and safety. Pipeline failures often create a major drop in pipeline pressures, potentially allowing contamination infiltration into pipes. According to the California Division of Drinking Water (DDW) *Waterworks Standards*, distribution systems are required to "assure that the minimum operating pressure in the water main at the user service line connection throughout the distribution system is not less than 20 pounds per square inch (psi) at all times" (Chapter 16, Section 64602). However, in the event of a pipeline failure, pressures often drop below 20 psi, and sometimes even below 0 psi (atmospheric pressure) giving rise to potential contamination

of the water system. In addition to water quality concerns, pipeline failures can also compromise public safety due to flooding. Depending on the extent of flooding, conditions may be such that the general public is more prone to injuries. Lastly, public health and safety may be impacted due to users being put out of water service while the failed pipe is hydraulically isolated for repair. Pipeline failures can also negatively affect firefighting capabilities. However, due to the momentary nature of pipeline failures and the infrequency of fire events, fire-flow impacts during a pipeline failure were not included as part of this study.

3.1.2 Transportation Impact

In densely populated areas such as the San Francisco Bay Area, transportation is a critical component of public life and is heavily intertwined with numerous societal functions. Therefore, it is essential that all corridors related to public transportation such as highways, roads, and passenger railroads be minimally disrupted. Pipeline failures, depending on magnitude and location, can cause major disturbances to transportation corridors due to flooding.

3.1.3 Business Impact

Pipeline failures also negatively impact commercial and industrial businesses, possibly resulting in economic loss. When flooding occurs due to a pipe failure, all businesses that require customer or worker access may be temporarily inaccessible, thereby halting or impeding business operations. For example, potential customers of restaurants and shopping centers would be deterred from entering due to flooded conditions in parking lots, walkways, and building interiors. In addition to flooding, service shutdowns due to hydraulic isolation may also negatively affect businesses. While heavy water-consuming businesses such as restaurants, car wash stations, and certain heavy industries will be most affected, nearly all businesses will be affected as customers and workers will temporarily have only limited or no access to water.

3.1.4 System Operations Impact

There are specific pipelines that must remain in service for SJWC to maintain safe and reliable system operations. These pipelines include SCVWD transmission mains and critical pathway pipes that keep important water system facilities operational and hydraulically connected to the system.

SJWC relies heavily on SCVWD for its water supply. On an average water demand day, the District treats and delivers approximately 70 million gallons of wholesale water per day to SJWC through their large transmission mains which range from 20-inches to 6.5-feet in diameter in SJWC's service area (20-inches to 48-inches within the Cupertino Lease Area). A catastrophic break in an SJWC main that crosses a District transmission main could potentially result in significant damage to SCVWD's pipeline. This could cause flooding damage and result in water supply shortages to Cupertino and other surrounding communities. Therefore, SJWC pipelines crossing SCVWD transmission mains are considered critical to system operations.

Critical pathway pipes are defined as pipelines without redundancy that keep major facilities such as tanks and pumps in operation. These pipelines typically include tank inlet/outlet pipes as well as transmission mains located upstream and downstream of pump stations.

3.1.5 Impact Categories Summary

Table 2 summarizes the hydraulic effects and practical impacts which were considered in this study that correspond to the four impact categories.

Table 2. Impacts Categories Impact Summary

Impact Category	Impact Cause	Impacts
Health & Safety	Low Pressures	• Public exposure to potential water quality hazards due to contamination infiltration
	Flooding	• Public more prone to injuries due to hazardous conditions • Disruption to critical facility operations
	Out of Service	• Disruption to critical facility operations
Transportation	Flooding	• High traffic volume roads/highways and railroads disrupted
Business	Flooding	• Customer access to business prevented • Business operations disrupted
	Out of Service	• Business operations disrupted
System Operations	SCVWD Transmission Main Damage	• Water supply shortage
	Critical Pathway Pipeline Outage	• Inability to operate important water system facilities

3.2 Impact Category Measurement Parameters and Tools

Quantifiable parameters were established to measure the amount of impact every individual pipeline failure event has on each impact category. Table 3 provides all of the parameters used for this study, as well as the primary tools used to obtain these measurements for each parameter.

Table 3. Quantifiable Parameters Used to Measure Impact Categories

Parameter	Impact Cause	Primary Tool
Number of users (by type) that experience less than 20 psi during pipe break stage [1]	Low Pressure	Hydraulic Model
Number of users (by type) that experience less than or equal to 0 psi during pipe break stage [1]	Low Pressure	Hydraulic Model
Quantity of water lost in gallons per minute	Flooding	Hydraulic Model
Number of valves (by type and size) needing to be closed to isolate pipe segment for repair	Out of Service	Hydraulic Model
Number of users (by type) hydraulically isolated after valves are closed for pipe segment repair [1]	Out of Service	Hydraulic Model
Quantity of water inhibited due to hydraulic isolation when valves are closed for pipe segment repair	Out of Service	Hydraulic Model
Number of non-isolated users (by type) that experience less than 20 psi during isolation stage [1]	Low Pressure	Hydraulic Model
Number of non-isolated users (by type) that experience less than or equal to 0 psi during isolation stage [1]	Low Pressure	Hydraulic Model
Number of properties (by type) within flooding region [1]	Flooding	GIS
Road types within flooding regions [1]	Flooding	GIS
Population density within flooding region	Flooding	GIS
Pipes that cross SCVWD transmission mains	Damage to SCVWD Main	GIS
Critical pathway pipelines essential for water system operations	Critical Pathway Pipeline Outage	GIS

Notes:

(1) Certain user types, facility/property types, and roads types are more critical than others. Therefore, all users that would experience low pressures and all properties or roads that would be flooded due to pipeline failure were accounted for according to their type. See Section 3.3 *Pipeline Consequence of Failure Scoring Methodology* for detail on how these critical users and facilities contributed to the overall consequence of failure score for each pipe.

As indicated in Table 3, all parameters required in this study for evaluating the consequence of failure of each pipeline could be obtained through the use of the hydraulic model and Geographic Information System (GIS) mapping system. Synergi Water™ was the tool used to measure parameters related to services experiencing low pressures following pipe breaks and outages due to isolation, while ArcGIS® was the tool used to measure parameters related to geographic location such as flooding or proximity to other features. The following subsections explain in detail how these two software tools were used to obtain measurable parameters.

3.2.1 Hydraulic Model

In order to obtain results required for the consequence of failure evaluation, SJWC created an all pipes and valves hydraulic model based on GIS data. Pipe segments are assigned a unique ID in GIS and defined as a continuously drawn pipe with the same diameter and work order ID. A pipe segment is only broken by GIS at water main tees, changes in diameter, or when the work order ID changes. Pipe segments are not broken in GIS at valves, hydrants, elbows, or service taps.

After importing all facilities into the hydraulic model from GIS, 1-ft resolution elevation contours were obtained from Santa Clara County and assigned to each node. Annual service demand data from SJWC's Billing Department was then geospatially plotted and assigned to the nearest node of the appropriate pipeline. Creating this hydraulic model allowed SJWC to simulate the effect caused by catastrophically breaking and then isolating each pipe segment.

3.2.2 Geographic Information System (GIS)

ArcGIS® software can perform various spatial analyses and yield useful information tied to the geographic location of a specific feature. In this study, ArcGIS® was used to tie locations and attributes of each failed pipe to other external spatial data such as parcels, transportation corridors, SCVWD facilities, and population density.

Flooding Buffers

Following a catastrophic main break, water may inundate the surrounding area, possibly impacting critical facilities, roads, transportation corridors, businesses, and residential properties. SJWC's Distribution Systems Department identified 50-ft as the inundation limit for most pipe breaks. Therefore, 50-ft buffers surrounding each pipe were developed as potential flooding areas. When flooding intensity (see Section 3.3.1 *Health & Safety Impact Category Scoring* for an explanation of flooding intensity) was simulated to be greater than twice the average flooding intensity, a 100-ft flooding buffer surrounding the pipe was used as the potential flooding area. Map 2 shows the flooding buffers created around each water main.

GIS Spatial Data

Spatial data related to parcels, railroads, roads and population density was needed for this study and obtained via external sources as summarized in Table 4 and illustrated in Maps 3, 4

and 5. Map 3 contains parcel, road, railroad, and SCVWD pipeline data, while Map 4 shows the population density distribution. Map 5 identifies critical facilities, commercial parcels and industrial parcels. Parcels were flagged as critical in GIS if they contained hospitals, acute health care facilities, schools, and residential or commercial units where users require uninterrupted water service for dialysis or other life-support equipment.

Table 4. Type and Source of External Spatial Data

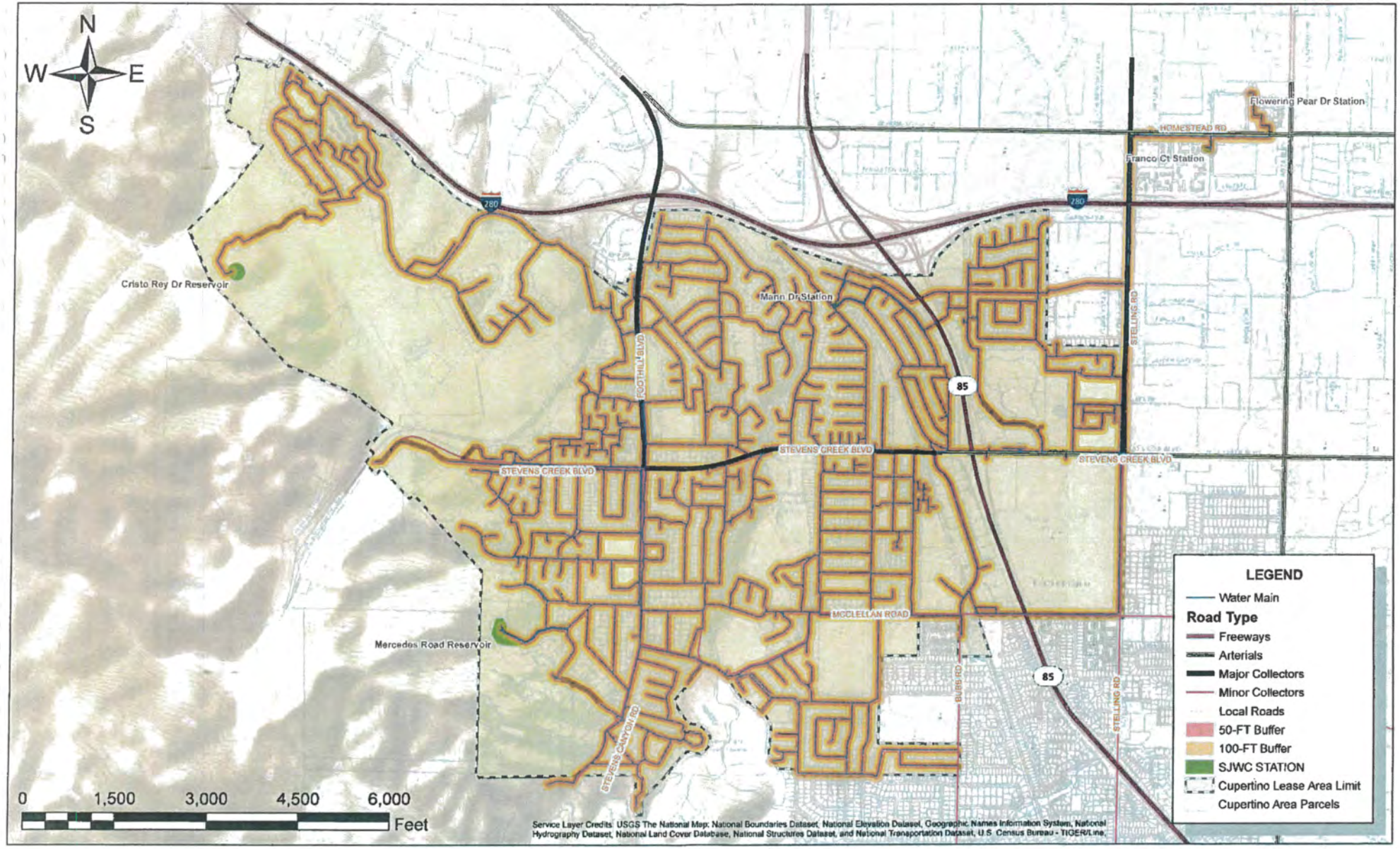
Spatial Feature Name	Type	Source
Santa Clara County Parcels	Polygon	Santa Clara County
Cupertino Roads	Line	City of Cupertino
Railroads	Line	United States Census Bureau
Population Density	Polygon	Bay Area Census / Metropolitan Transportation Commission
SCVWD West Pipeline	Line	SCVWD

Using GIS to Measure Parameters

Spatial intersection analyses were performed using the flooding buffer surrounding each pipe segment and the feature of interest (e.g. parcels, roads, population density polygons, etc.) in order to obtain a quantifiable value that would ultimately be used to determine the consequence of failure score. Figure 5 provides samples of the data obtained from ArcGIS® by using a 50-ft flooding buffer as an example. GIS was also used to identify water mains considered critical to SJWC's operations, as illustrated in Map 6.

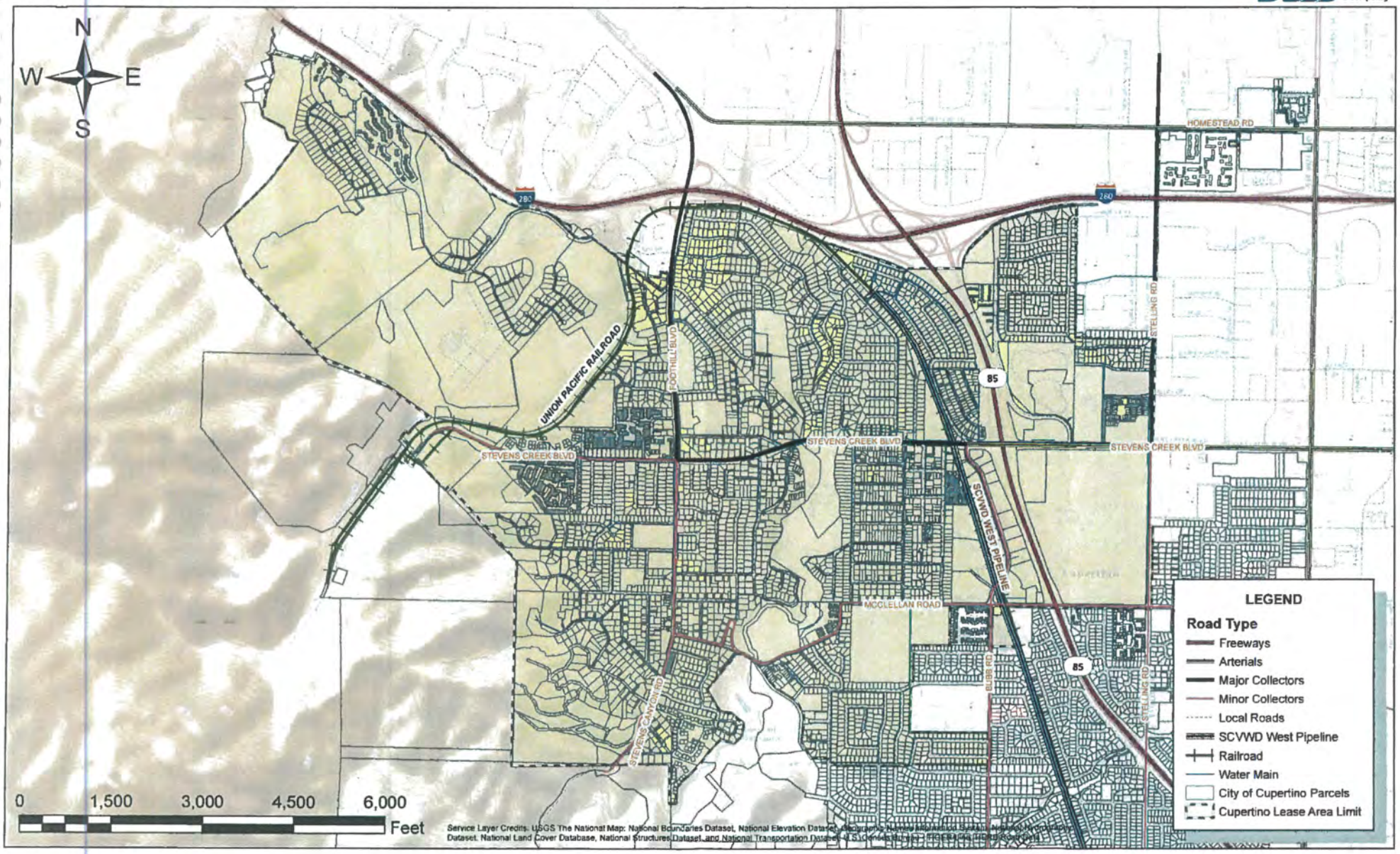
MAP 2. CONSEQUENCE OF FAILURE ANALYSIS - Flooding Buffers

San Jose Water Company



MAP 3. CONSEQUENCE OF FAILURE ANALYSIS - All Spatial Feature Data

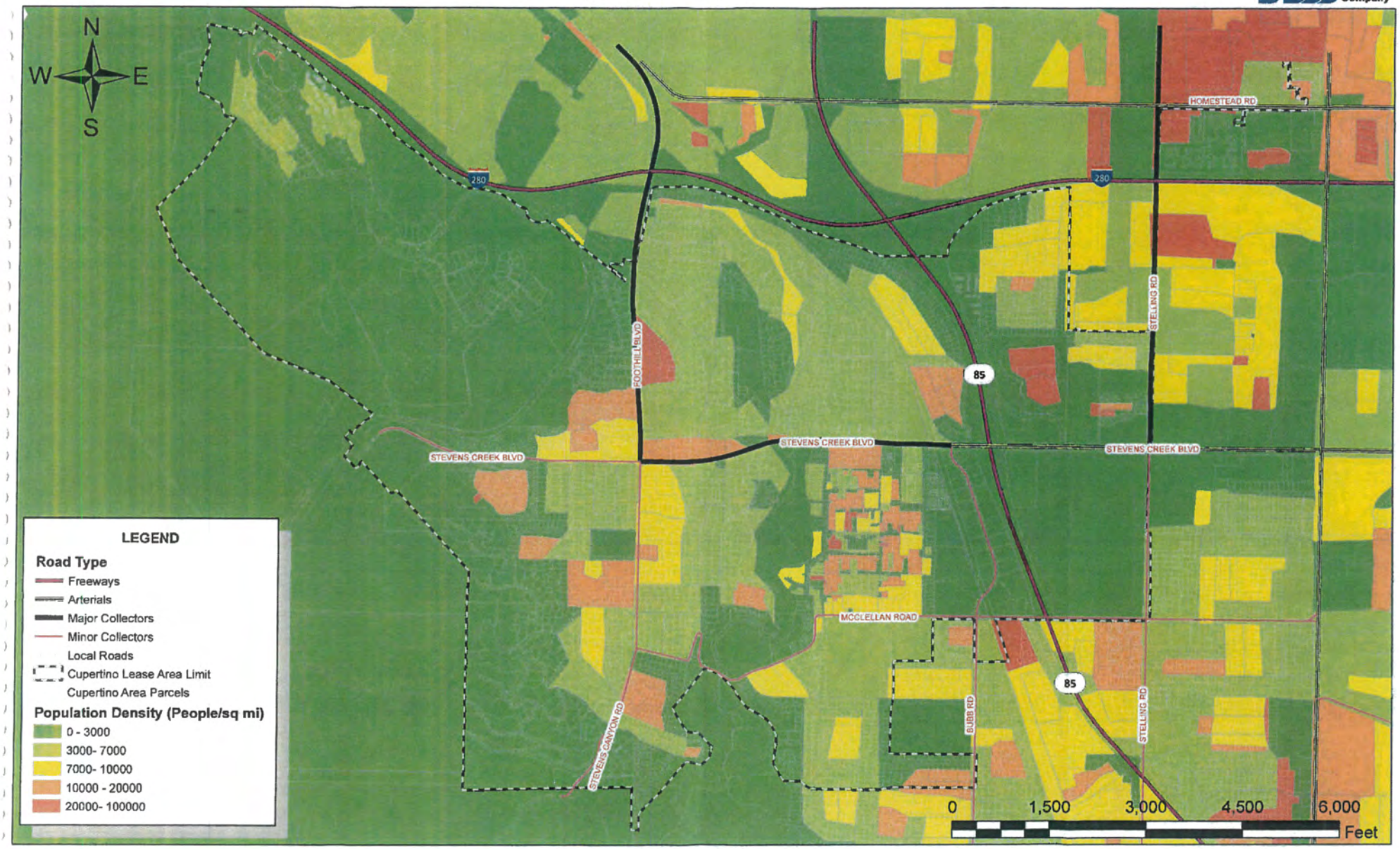
San Jose Water Company



Service Layer Credits: USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Wetlands and Riparian Mapping; ESRI

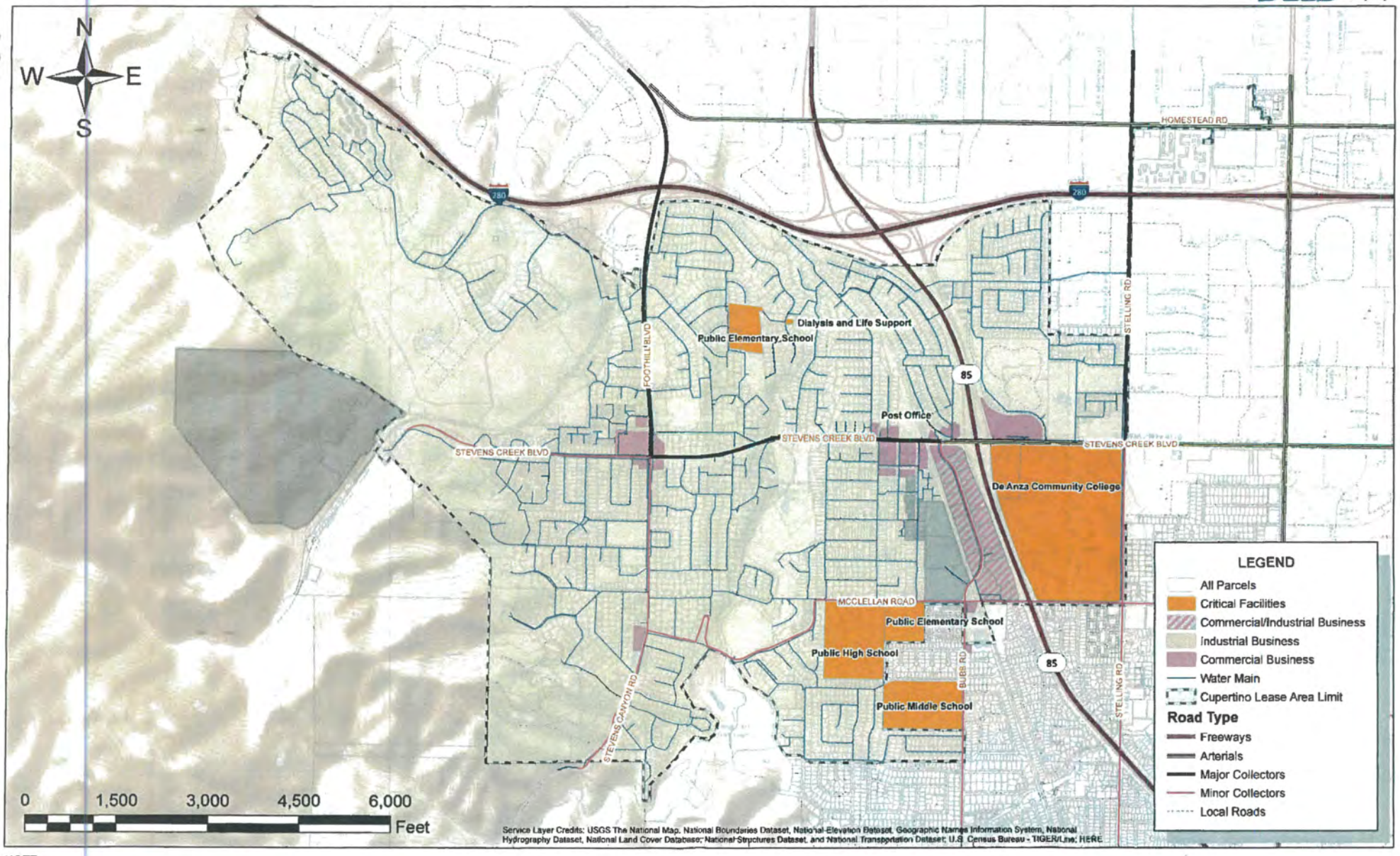
MAP 4. CONSEQUENCE OF FAILURE ANALYSIS - Population Density

San Jose Water Company



MAP 5. CONSEQUENCE OF FAILURE ANALYSIS - Critical Facilities, Commercial and Industrial Businesses

San Jose Water Company



NOTE:
Industrial business parcels shown in this map that reside outside of the Cupertino Lease Area were included as part of the Consequence of Failure Analysis because they are served by the Cupertino Lease Area water system.

FIGURE 5. Sample of GIS Results Obtained Using Flooding Buffers and Various Spatial Features

Flooding Buffer Interaction with various Features	Description of Measurable Parameters Obtained

50-ft Buffer/Population Density Intersect

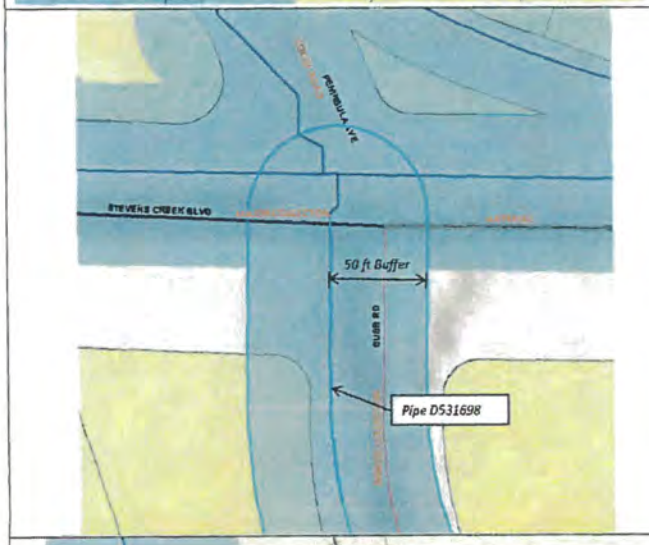
A spatial intersect between the 50-ft buffer of pipe D531828[1] and the population density layer is observed. Because five population density blocks intersect the highlighted 50-ft buffer, five polygons are created as a result of the spatial intersects. Each of these polygons contains the attributes of pipe D531828 as well as the attributes of each specific density block as illustrated in the summary table below. For the population density spatial feature the measurable value selected for pipe D531828 is the weighted arithmetic mean of the population density by area.

Pipe ID	Density Block ID Code	Population Density (total population/sq mi)	Total Density Block Area (ft^2)	Area Intersected (ft^2)
D531828	60855077012032	7328.33537	6715	9558.122074
D531828	60855077012034	14452.2091	3403	1028.015925
D531828	60855077012035	0	2612	8958.94872
D531828	60855077012036	0	805	1598.092461
D531828	60855077012037	4592.1773	1692	4011.44406

50-ft Buffer/Parcels Intersect

A spatial intersect between the 50-ft buffer of pipe D531828 and the Santa Clara County parcels layer is observed. Because nine parcels intersect the highlighted 50-ft buffer, nine polygons are created as a result of the spatial intersects. Each of these polygons contains the attributes of pipe D531828 as well as the attributes of each specific parcel as illustrated in the summary table below. For the parcels spatial feature the measurable value selected for pipe D531828 is the number and type of parcels affected by the flooding buffer.

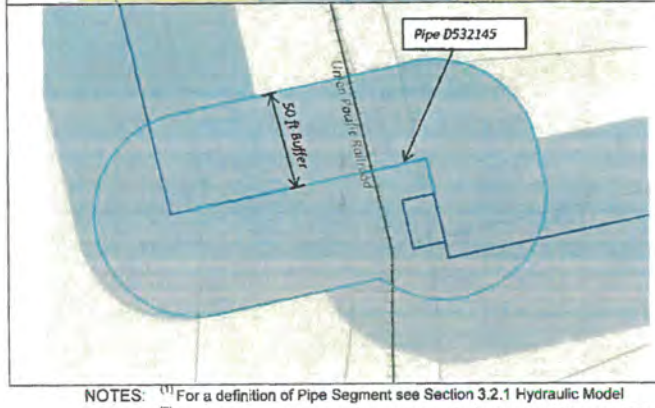
Pipe ID	APN	Section Area of Intersected Parcel (ft^2)	Total Parcel Area (ft^2)
D531828	357-16-059	452.61	6490
D531828	357-16-149	699.79	8455
D531828	357-17-099	666.01	5054
D531828	357-17-100	336.72	4850
D531828	357-17-101	221.44	5026
D531828	357-17-111	55.27	6668
D531828	357-18-002	378.70	13471
D531828	357-18-039	3064.27	7033
D531828	357-18-040	2548.50	6313



50-ft Buffer/Road Type Intersect

A spatial intersect between the 50-ft buffer of pipe D531698 and the Cupertino Roads layer is observed. Four different road types are found within the highlighted 50-ft buffer. As a result, the intersect tool reports on each of these 4 road types and ties their attributes with those of pipe D531698 as illustrated in the summary table below. For the Cupertino Roads spatial feature the measurable value selected for pipe D531828 is the Annual Average Daily Traffic (AADT)[2] of the highest traveled road affected by the pipe.

Pipe ID	Road Type	Road Name	Total Length Intersected (ft)
D531698	Arterials	STEVENS CREEK BLVD	23.91
D531698	Local Roads	PENINSULA AVE	59.98
D531698	Major Collectors	STEVENS CREEK BLVD	76.13
D531698	Minor Collectors	BUBB RD	1005.65



50-ft Buffer/Railroad Intersect

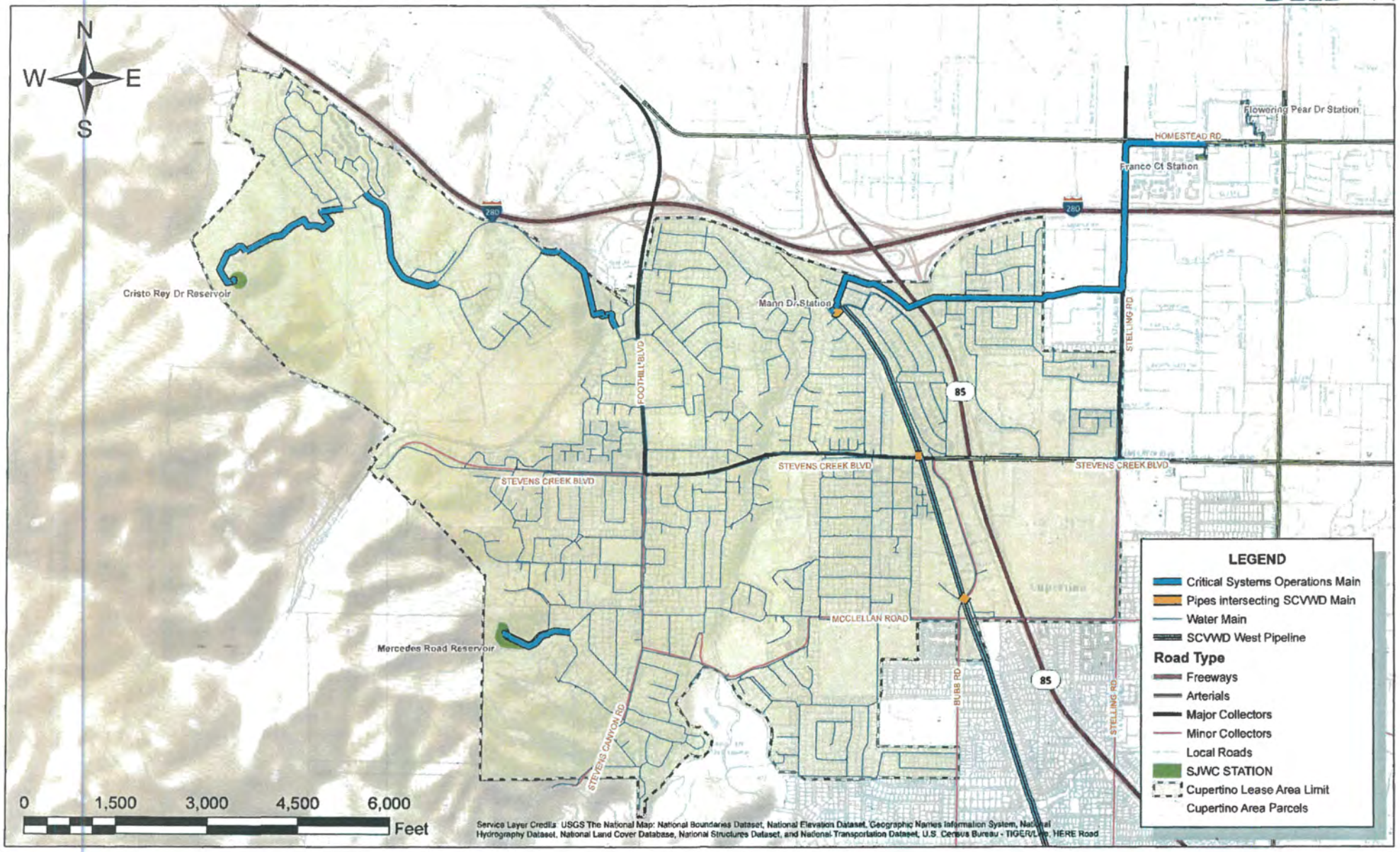
A spatial intersect between the 50-ft buffer of pipe D532145 and the Cupertino Railroads layer is observed. Four different road types are found within the highlighted 50-ft buffer. As it is illustrated, a segment of the Union Pacific Railroad is contained within the 50-ft flooding buffer for pipe D532145. The final measurable value selected for pipe D532145 would be a 1 indicating pipe D532145 does affect the railroad.

NOTES: [1] For a definition of Pipe Segment see Section 3.2.1 Hydraulic Model

[2] Annual Average Daily Traffic is explained in Section 3.3.2 Transportation Impact Category Scoring

MAP 6. CONSEQUENCE OF FAILURE ANALYSIS - Critical System Operations Mains and Pipes Intersecting SCVWD Main

San Jose Water Company



3.3 Pipeline Consequence of Failure Scoring Methodology

A two-step process was used to obtain consequence of failure scores for each pipeline. First, the parameters listed in Table 3 were used to calculate scores for each impact category for every pipeline. Then scores for each impact category were weighted and combined to yield the consequence of failure score for all pipes. Figure 6 illustrates the overall scoring process. The following subsections provide explanations of the scoring process for each impact category and for the overall consequence of failure score.

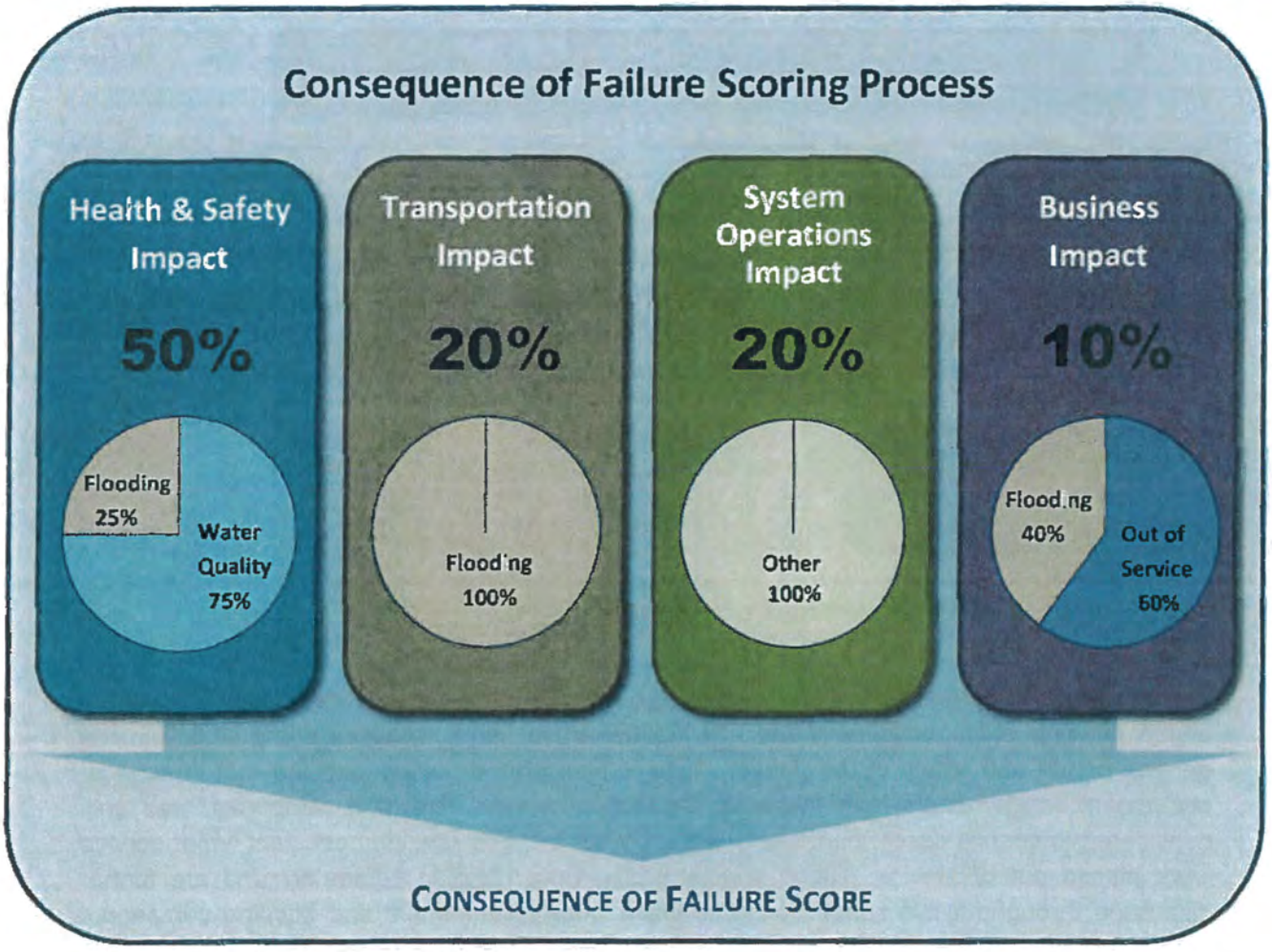


Figure 6. Overview of Consequence of Failure Scoring Process

3.3.1 Health & Safety Impact Category Scoring

The Health & Safety impact category is the largest contributor to the overall consequence of failure score, accounting for 50 percent of the total weight. The overall process and methodology for calculating the Health & Safety impact category score is presented in a flow chart in Figure 7. Following the flow chart is the discussion and rationale for the methodology.

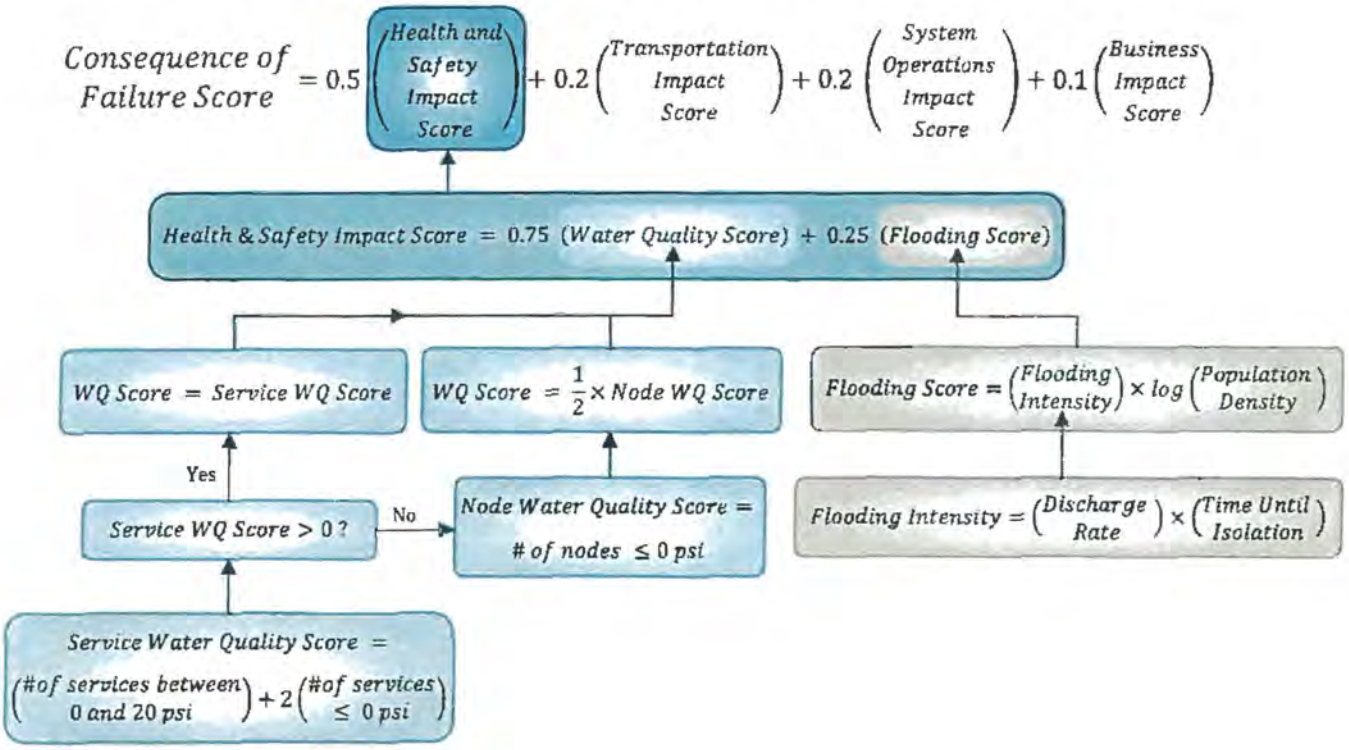


Figure 7. Health and Safety Category Scoring Process and Equations

The Health & Safety impact category score can be separated into a water quality component and a flooding component, as these are the two major impact causes associated with the general health and safety of the public. There is also a third component, the "out of service" component which results from hydraulic isolation. However, this third component was only considered in special cases, particularly when critical facilities requiring constant water service were placed out of service. These special cases were handled separately and are further discussed throughout this subsection. The water quality component and flooding component contributed 75 percent and 25 percent, respectively, to the total weight of Health & Safety impact category score, as shown in Equation 3.1. The methodologies used to obtain water quality and flooding scores are described in the following subsections.

$$\text{Health \& Safety Impact Score} = 0.75\,(\text{Water Quality Score}) + 0.25\,(\text{Flooding Score}) \qquad (3.1)$$

Water Quality Score

Service Water Quality Score

For each pipe, the water quality score was determined based on the number of services that would experience between 0 psi and 20 psi, and the number of services that would experience less than or equal to 0 psi during the break or isolation stage of a pipeline failure event. Each service experiencing between 0 psi and 20 psi contributed one point to the water quality score, and each experiencing less than or equal to 0 psi contributed two points to the service water quality score, as shown in Equation 3.2 below.

$$Service\ Water\ Quality\ Score = \binom{\#of\ services\ between}{0\ psi\ and\ 20\ psi} + 2\binom{\#of\ services}{\leq\ 0\ psi} \quad (3.2)$$

Hydraulically isolated services that did not drop below 20 psi after the pipe break (i.e. before isolation) do not contribute to the water quality score. The rationale behind this was that hydraulic isolation does not negatively affect water quality because, although isolated services drop to 0 psi, isolation is a controlled event. Before an isolated pipeline is put back into service, the necessary protocols (e.g. flushing) will be taken to ensure only high quality water is provided to users. However, if a service elsewhere in the system that is not hydraulically isolated drops below 20 psi or 0 psi as a result of the isolation of the failed pipe, it will contribute to the water quality score.

If no services dropped below 20 psi in both the break and isolation stages, the service water quality score was equal to 0. In these cases the node water quality score was considered.

Node Water Quality Score

In some cases, areas of the water system without services may experience low pressures due to a pipeline failure. Should there be contamination infiltration into these parts of the system, it is still possible for contaminated water to be conveyed toward users' services. In order to account for these potential cases, the number of hydraulic model nodes that would experience less than or equal to 0 psi were considered for the node water quality score, as shown in Equation 3.3. Only nodes with pressures at or below atmospheric pressure were included as part of the node water quality score because of the unlikelihood of water quality at a service being negatively affected due to pressures below 20 psi but above atmospheric pressure in a remote area. Any minor contamination infiltration would likely be disinfected by chlorine residual before the water reaches any service.

$$Node\ Water\ Quality\ Score = \#\ of\ nodes \leq 0\ psi \quad (3.3)$$

Water Quality Score

In cases where the service water quality score was greater than 0, the service water quality score was used as the water quality score. When the service water quality score was equal to 0 (i.e. no services were affected by low pressures), one-half of the node water quality score was used. Only a half of the node water quality score was used because, although contaminated water may be introduced into the system at atmospheric or sub-atmospheric conditions, the chlorine residual may disinfect the contaminated water in the time it would take to reach users services. Equation 3.4 shows the process for determining the water quality score. After a water quality score was calculated for all pipes, the scores were scaled such that the maximum score was equivalent to a value of 1.

$$Water\ Quality\ Score = \begin{cases} Service\ WQ\ Score & ,\ Service\ WQ\ Score > 0 \\ \frac{1}{2} \times (Node\ WQ\ Score), & Service\ WQ\ Score = 0 \end{cases} \quad (3.4)$$

Critical Facilities

Pipes affecting critical facilities by lowering their service pressures below 20 psi due to a pipe break had their scores elevated to the maximum water quality score of 1. In addition, pipes that took critical facilities out of service during the isolation stage were also given the maximum water quality score of 1. Although isolation is not typically a water quality concern, because it is a serious overall health concern for critical facilities requiring constant water service, it was considered a reasonable cause for score inflation.

Flooding Score

For each pipe, the flooding score was determined based on estimated flooding intensity and population density of the estimated flooded area.

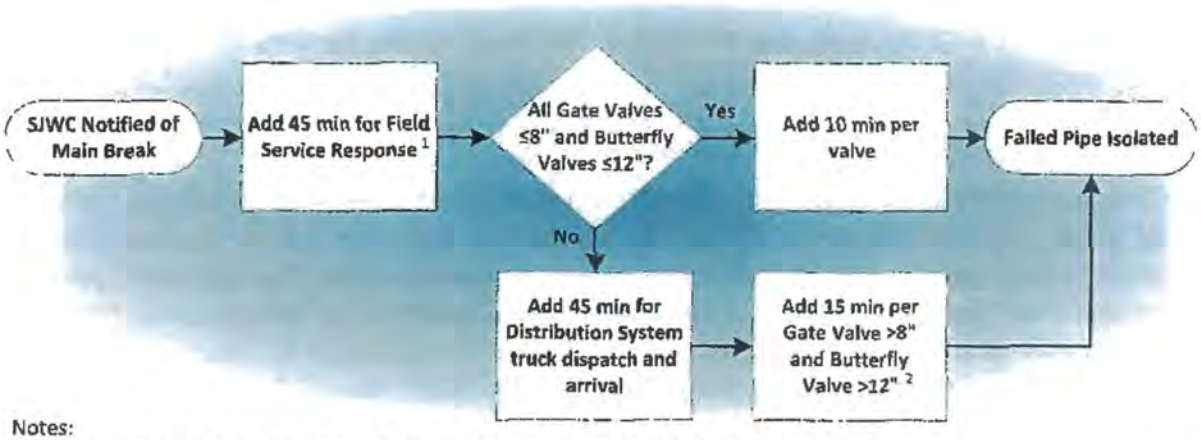
Estimated Flooding Intensity

Flooding intensity resulting from a pipe break is difficult to approximate as it is dependent on numerous factors. However, it can be roughly approximated as a function of the discharge rate of the pipe break and the time it takes to isolate the failed pipe, as shown in Equation 3.5.

$$Flooding\ Intensity = (Discharge\ Rate) \times (Time\ Until\ Isolation) \quad (3.5)$$

The discharge rate for each pipe break was attained from the hydraulic model (see Section 3.2.1 *Hydraulic Model*), and the time required to respond to and isolate each failed pipe was approximated based on the pipeline emergency response procedures and practices of SJWC's Field Service and Distribution Systems Departments.

Typically, when SJWC is notified of a water leak, it may take a Field Service worker up to 45 minutes to respond and arrive at the site of the break for investigation. If the Field Service worker is able to close the valves by hand (i.e. when valves are not larger than 8-inch gate valves or 12-inch butterfly valves), then it will usually take up to 10 minutes to close each valve. However, if valves cannot be closed by hand (e.g. larger valves) the Field Service worker will contact the Distribution Systems Department to have a truck dispatched. It may take up to 45 minutes for the truck to arrive onsite, and it may take up to 15 minutes to close each of the remaining valves. The flow chart used for deciding the approximate required time for isolation is shown in Figure 8.



Notes:
(1) Field Service response time of 45 min assumes SJWC is notified outside of working hours.
(2) This pathway assumes that all gate valves ≤8" and butterfly valves ≤12" in diameter are closed by Field Service by the time the Distribution System truck finishes its work. However, if takes longer for Field Service to close the smaller valves than it does for the Distribution System truck to be dispatched and close the larger valves, then the time it takes to close the smaller valves should be used.

Figure 8. Estimated Time Required for Isolation Flow Chart

Population Density

Flooding occurrences in densely populated areas will have a greater impact on general public safety. The average population density associated with each pipe was estimated based on the intersection of the population polygons and the flooding buffer of each pipe. See Section 3.2.2 *Geographic Information System (GIS)* for more detail on how the population density for each pipe was estimated.

Flooding Score

The flooding score for each pipe was calculated by multiplying estimated flooding intensity by the logarithm of the estimated average population density in the vicinity of the pipe, as shown in Equation 3.6. The logarithm of the population density was used for a more even distribution. After the flooding scores were calculated for each pipe, they were scaled such that the maximum flooding score was equivalent to a value of 1.

$$Flooding\ Score = (Flooding\ Intensity) \times log(Population\ Density) \quad (3.6)$$

Critical Facilities

Pipes affecting critical facilities due to flooding had their scores elevated to the maximum flooding score of 1.

3.3.2 Transportation Impact Category Scoring

The Transportation impact category is a large contributor to the overall consequence of failure score, accounting for 20 percent of the total weight. The score for this impact category is calculated solely based on flooding of public transportation corridors. The City of Cupertino categorizes their road types similarly to the United States Department of Transportation Federal Highway Administration's classifications. Table 5 tabulates the City of Cupertino road types along with their estimated Annual Average Daily Traffic (AADT). The AADT is defined as the total volume of vehicle traffic in a year divided by the number of days in a year, in units of vehicles. A map provided by the City of Cupertino with the AADT values for major roads is included in Appendix B.

Table 5. Transportation Corridor Annual Average Daily Traffic

Transportation Corridor Classification	Annual Average Daily Traffic			Source
	Lower	Upper	Average	
Freeway	N/A	N/A	265,000 (Route 280) 222,000 (Route 85)	California Department of Transportation 2009 Traffic Census[1]
Arterial	34,860	36,800	35,800	City of Cupertino
Major Collector	10,850	20,640	15,700	City of Cupertino
Minor Collector	3,300	14,580	8,900	City of Cupertino
Local	80	700	400	US Department of Transportation Federal Highway Administration[2]

Notes:

(1) 2009 Traffic Census data was used because the AADT data from the City of Cupertino for arterials, major collectors, and minor collectors are primarily from 2009. This allows for a fair comparison between the two datasets and more representative relative values.

(2) The United States Department of Transportation Federal Highway Administration provides general AADT ranges for various road classifications.

In order to determine the amount of impact each pipeline failure would have on public transportation, flooding areas for each pipeline were geospatially plotted and overlaid with roads and railroads (see Section 3.2.2 *Geographic Information System (GIS)* for more detail on flooding areas). Each pipe was given a score equivalent to the AADT value of the highest traveled road affected by the pipe. For example, a pipe affecting both an arterial and a major collector would receive a score of 35,800. One exception, however, was that only half of the AADT value for freeways was taken into account because of the unlikelihood of flooding both sides of freeways with center dividers. After the transportation corridor scores for all pipelines were assigned, scores were scaled so that the maximum score was equivalent to a value of 1.

Passenger Railroads

Pipes that affected passenger railroads due to flooding were given the maximum score of 1. Although passenger railroads would likely not affect as many people as freeways, the impact would be great because trains are typically unable to take alternate routes to get to their destinations, and any railroad damage could require extended repair times.

3.3.3 System Operations Impact Category Scoring

The System Operations impact category accounts for 20 percent of the total consequence of failure scoring weight. This impact category score takes into account pipelines that are necessary for the continual operation of the water system. Pipes that cross SCVWD transmission mains were considered critical to the overall operations of the water system, as SJWC relies heavily on these transmission mains for water supply; these pipes were given a score of 1. In addition, critical pathway pipes without redundancy that are essential for the operation of pumps or tanks were also given a score of 1. Table 6 presents the scoring summary for the system operations impact category. See Section 3.1.5 *System Operations Impact Category Scoring* for more information on the System Operations impact category.

Table 6. System Operations Impact Scoring Summary

Parameter	System Operations Impact Score
Pipe crosses SCVWD transmission main and/or is a critical pathway pipe	1
Pipe does not cross SCVWD transmission main and is not a critical pathway pipe	0

3.3.4 Business Impact Category Scoring

The Business impact category accounts for 10 percent of the total consequence of failure score weight. The overall process and methodology for calculating the Business impact category score is presented in a flow chart in Figure 9. Following the flow chart is the discussion and rationale for the methodology.

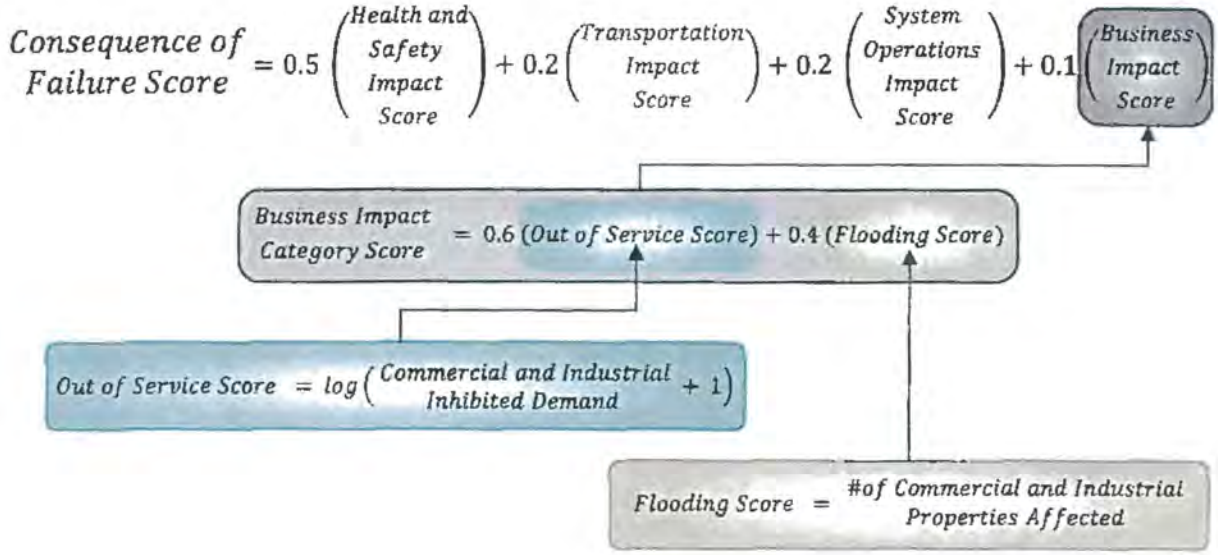


Figure 9. Business Impact Category Scoring Process and Equations

Out of Service Score

The Out of Service score, which is a measure of business impact due to a water service outage, was based on inhibited demand. The inhibited demand is equivalent to the average day demand (in gpm) of the services placed out of service, which can also be understood as the amount of water that would have been used by businesses had there been no service outage. The equation used for the Out of Service score is as follows, in Equation 3.7:

$$Out\ of\ Service\ Score = log\left(\begin{matrix}Commercial\ and\ Industrial\\ Inhibited\ Demand\end{matrix} + 1\right) \qquad (3.7)$$

A small number of commercial and industrial services with very high demands create a skewed and uneven demand distribution. Therefore, the logarithm of the demands was used for a more even distribution. A value of 1 was added to the demand before the logarithm was taken in order to avoid negative Out of Service scores and also to ensure that pipes which did not affect

commercial or industrial demands would receive a score of 0 (i.e. $log(0+1)=0$). After the scores were obtained for each pipe, the results were scaled such that the maximum value was equal to a value of 1.

Flooding Score

The flooding score for the business impact category was equivalent to the number of commercial and industrial parcels affected. A parcel was considered affected if it was at least partially within the flooding region of the pipe. Equation 3.8 presents the equation used to calculate the flooding score.

$$Flooding\ Score = \begin{matrix} \#of\ Commercial\ and\ Industrial \\ Properties\ Affected \end{matrix} \quad (3.8)$$

After the flooding scores were obtained for each pipe, results were scaled such that the maximum score was equivalent to a value of 1.

Business Impact Category Score

The overall Business impact category score is equivalent to the weighted sum of the Out of Service score and the flooding score for each pipe. The Out of Service score was given a 60% weight, and the flooding score was given a 40% weight. The flooding score was given a lower weight than the Out of Service score because of the higher degree of uncertainty with flooding. In the event of a pipe break, there is uncertainty as to where the break will occur along the pipe, and there is also uncertainty as to the exact destination of the discharged water. Nevertheless, because a large flooding scenario would leave a relatively long-term negative impact on businesses, a weight no lower than 40% was considered appropriate. Equation 3.9 is the equation used to obtain the overall Business impact category score for each pipe.

$$\begin{matrix} Business\ Impact \\ Category\ Score \end{matrix} = 0.6\ (Out\ of\ Service\ Score) + 0.4\ (Flooding\ Score) \quad (3.9)$$

After the scores for each pipe were calculated, they were scaled such that the maximum score was equivalent to a value of 1.

Freight Railroads

Railroads exclusively used for freight transport are critical to numerous industries requiring the transport of goods. Because pipes that impact freight railroads due to flooding would have a large impact on many businesses, they were given the maximum business impact category score of 1.

4. Pipeline Consequence of Failure Evaluation Results

4.1 Results for Overall System

Every pipeline in the Cupertino Lease area was evaluated according to the methodology explained in Section 3.3 *Pipeline Consequence of Failure Scoring Methodology* and ranked based on the calculated consequence of failure scores. Pipes with identical final scores were prioritized according to their flooding intensities. Results were grouped into four criticality categories as shown in Table 7. Figure 10 shows the breakdown of the four criticality categories by pipe count and by pipe segment length.

Table 7. Criticality Categories by Rank

Criticality	Rank	Rank by Percent
High	1 - 106	Top 10%
Medium-High	107 - 212	10 - 20%
Medium	213 - 530	20 - 50%
Low	531 - 1061	50 - 100%

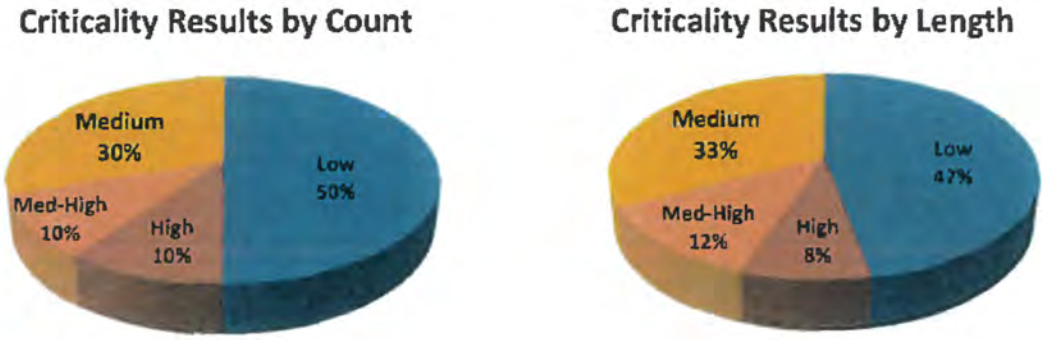
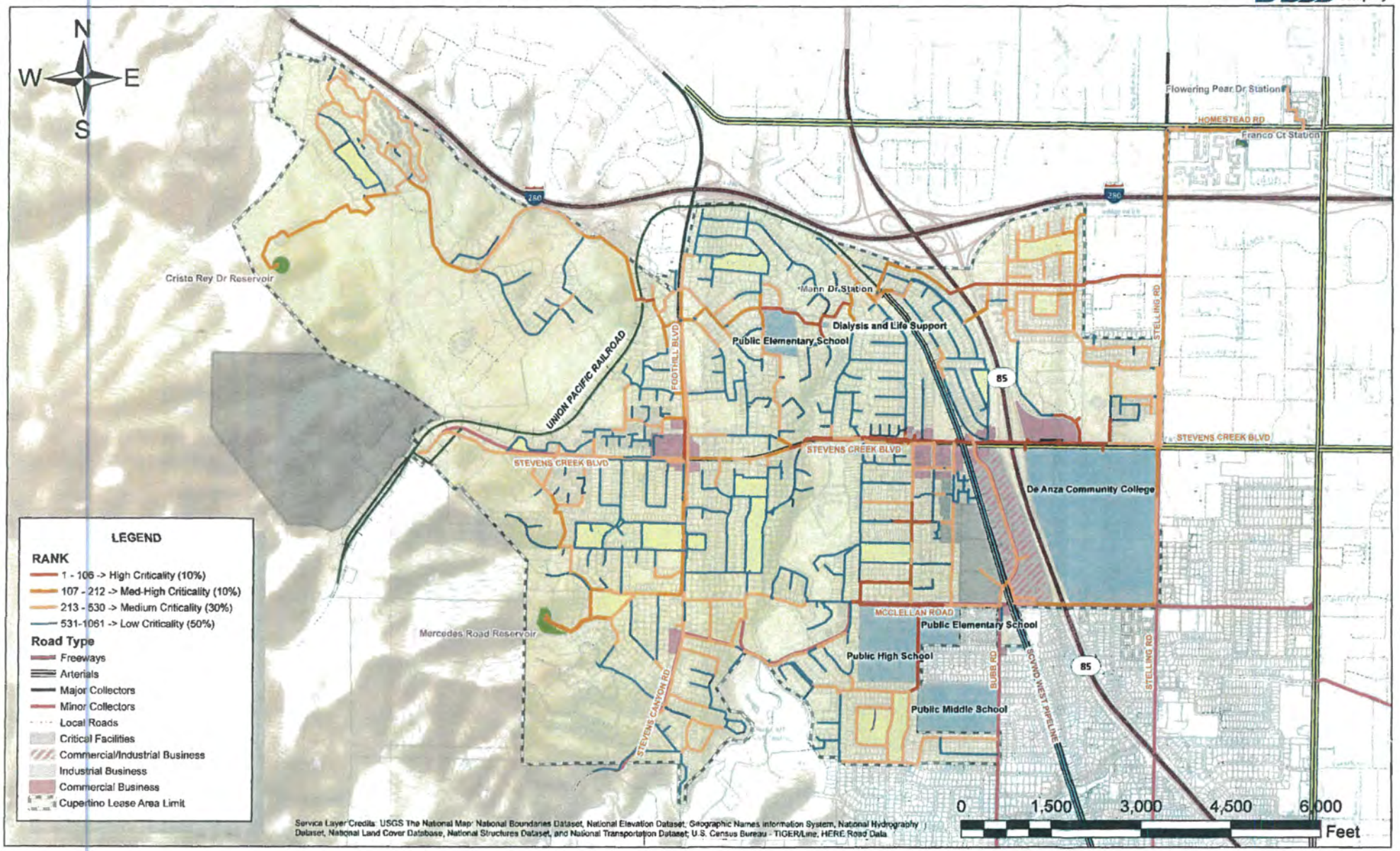


Figure 10. Percent Distribution of Criticality Results by Count and by Length

A compiled summary of the impact category scores, final consequence of failure scores, and final rankings for all pipes in the Cupertino Lease Area is included in Appendix C. Final results for all pipes by rank are geospatially presented in Map 7.

MAP 7. CONSEQUENCE OF FAILURE ANALYSIS - Results by Rank

San Jose Water Company



NOTE:
Industrial business parcels shown in this map that reside outside of the Cupertino Lease Area were included as part of the Consequence of Failure Analysis because they are served by the Cupertino Lease Area water system.

4.2 Results for Pipes Affecting Critical Facilities, Key Features, and System Operations

The following results summarize the number of pipes affecting critical facilities, key features, and system operations due to water quality impact, flooding, or placing services, tanks, or pumps out of service. Results indicate that 9 pipes affected a critical residential unit requiring constant water service for life support, 103 pipes affected schools, 8 pipes affected freeways, 22 pipes affected freight railroads, and 39 pipes affected system operations. No hospitals, acute health care facilities, or passenger railroads were found within the Cupertino Lease Area. See Figure 11 for a visual breakdown of the number of pipes affecting these key features and operations.

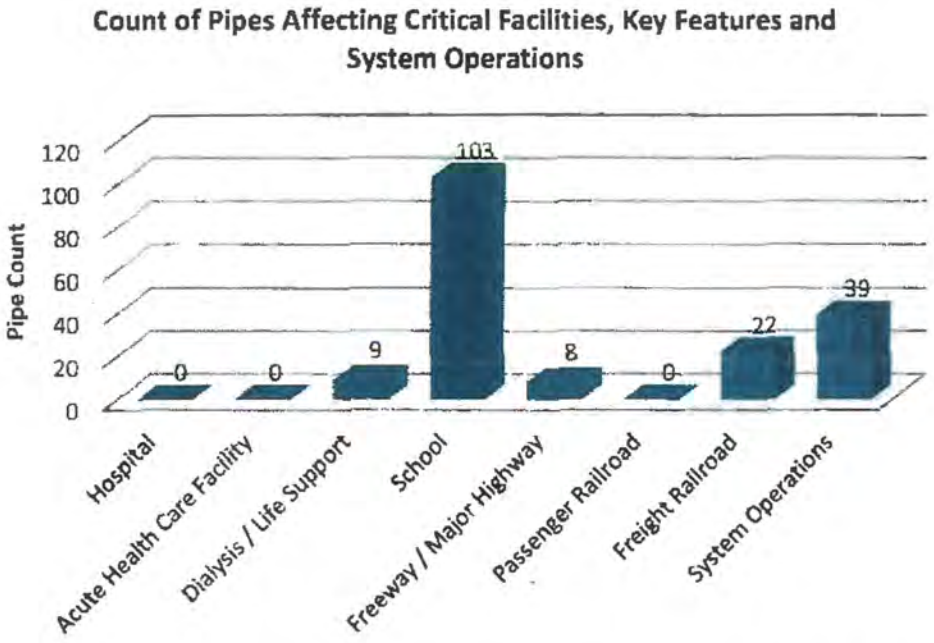


Figure 11. Breakdown of Pipes Affecting Critical Facilities, Key Features, and System Operations

Pipes affecting critical facilities, key features, and system operations predominantly fell within the high or medium-high criticality categories. Figure 12 shows the breakdown of criticality categories for pipes affecting critical facilities, key features, and system operations.

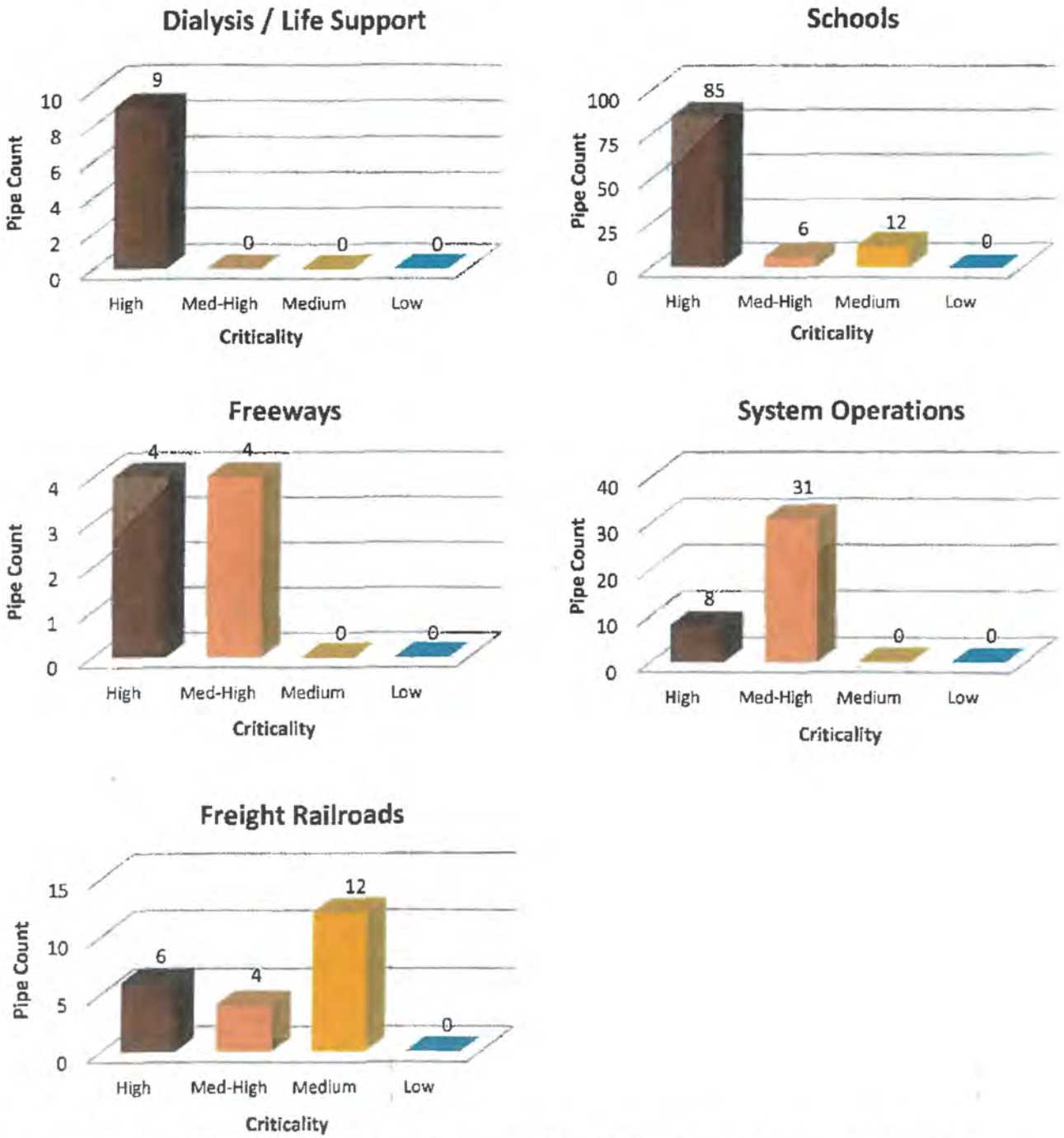


Figure 12. Number of Pipes by Criticality Affecting Critical Facilities, Key Features, and System Operations

5. Recommended Improvements and Actions

The results and findings of this study are intended to provide a baseline to help with future efforts to identify and prioritize pipeline capital improvement projects. Definitive main replacement and rehabilitation projects are not included as part of this study. SJWC requests that the City of Cupertino provide more pipe type and age of installation data before a comprehensive probability of failure analysis is conducted for the development of definitive pipeline improvement projects. However, the results of this study did bring to surface the need for a regulator installation, a valve installation, and easement documentation.

5.1 Regulator Installation for Mann Regulated Zone

Mann Regulated Zone is located within the northeast portion of the Cupertino Lease Area. Although most pipes within Mann Regulated Zone do not affect any critical facilities, key features, or businesses, nearly all of them fell within Medium-High and Medium criticality categories. The cause of these results is that Mann Regulated Zone was designed with only one regulator station as the sole input into the zone. Therefore, when there is high demand in the zone due to fire flows or a pipeline failure, nearly all services in the regulated zone drop to very low pressures, often to subatmoepheric pressures, regardless of which pipe fails.

Therefore, SJWC recommends an 8-inch pressure regulator be installed on the northern border of Cupertino Memorial Park, near the intersection of Christensen Drive and Fenway Court. This improvement will prevent many services from dropping to low pressures in the event of a pipeline failure and will also increase fire-flow capacity to help meet current fire department flow requirements. Figure 13 shows the location of the proposed 8-inch regulator in relation to Mann Regulated Zone, and Figure 14 shows the regulator in relation to its immediate vicinity. This improvement is recommended for implementation in 2017 and is estimated to cost $117,600.

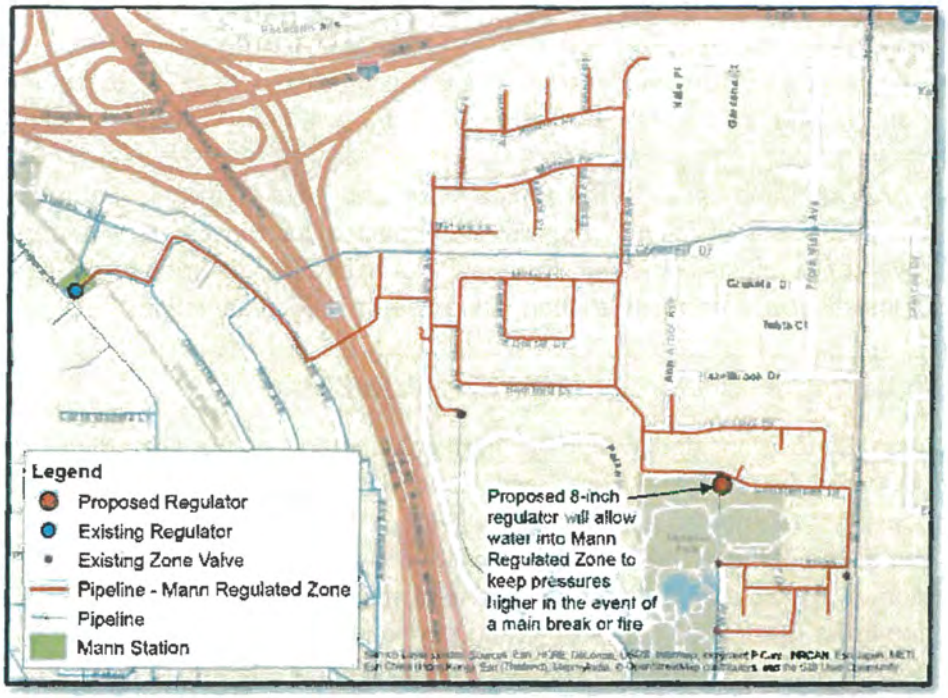


Figure 13. Recommended 8-inch Pressure Regulator and Mann Regulated Zone

Figure 14. Recommended 8-inch Pressure Regulator and Immediate Vicinity

5.2 Valve Installation

A 2,200-ft long, 14-inch diameter pipe alignment on South Foothill Boulevard between Stevens Creek Boulevard and Alcalde Road requires 7 valves to be closed to achieve hydraulic isolation, 4 of which are greater than or equal to 12 inches in diameter. In the event of a catastrophic break anywhere along this alignment, it is estimated that approximately 2 million gallons could be discharged into the surrounding area. However, with the installation of a 14-inch valve at the intersection of South Foothill Boulevard and Stevens Creek Boulevard, only two valves greater than or equal to 12 inches in diameter will need to be closed, thereby decreasing the time required to hydraulically isolate the alignment and reducing the volume discharged by up to 400,000 gallons. Therefore, it is recommended that a 14-inch valve be installed as illustrated in Figure 15. This improvement is recommended for implementation in 2017 and is estimated to cost $21,900.

Figure 15. Recommended 14-inch Valve Installation

5.3 Easement Documentation

It was found that a number pipelines within the Cupertino Lease Area cross through private property yards and streets. SJWC requests the City of Cupertino provide documentation defining the limits of the easements, as they would be necessary for any potential pipeline improvements in these areas. Map 8 highlights the location of these pipelines and Table 8 lists APN's and addresses of parcels that intersect these pipelines.

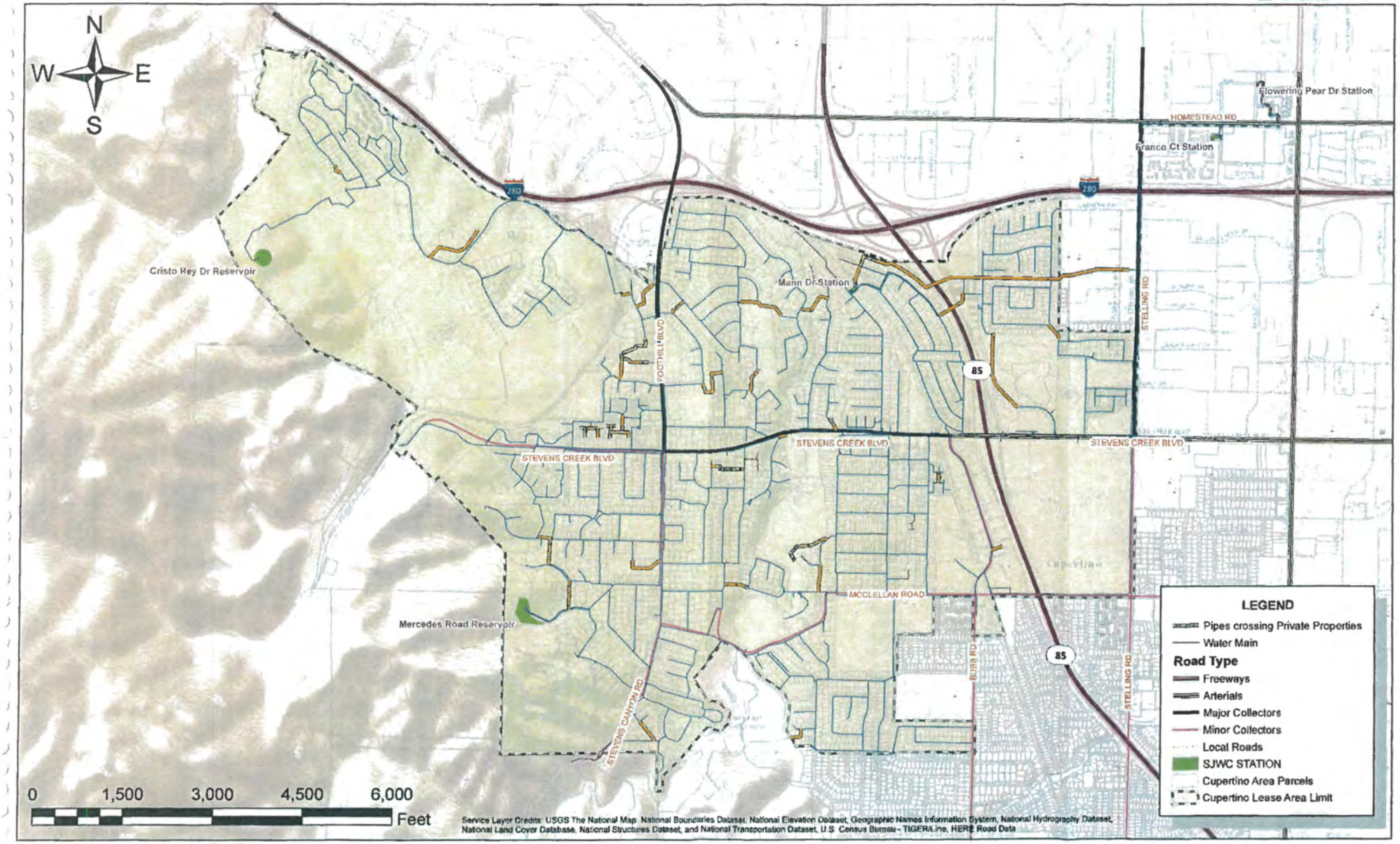
Table 8. Easement Documentation Request List

APN	Address
326-12-049	10420 CRESTON DR
326-12-051	10440 CRESTON DR
326-12-052	10450 CRESTON DR
326-13-035	10407 VISTA KNOLL BLVD
326-15-076	10370 ALPINE DR
326-15-076	10370 ALPINE DR
326-15-076	10370 ALPINE DR
326-15-076	10370 ALPINE DR
326-15-103	22364 SALEM AVE
326-15-130	22445 CUPERTINO RD
326-15-130	22445 CUPERTINO RD
326-16-045	10130 CRESCENT RD
326-16-047	10151 HILLCREST RD
326-16-050	10181 HILLCREST RD
326-16-052	10161 HILLCREST RD
326-16-053	10143 HILLCREST RD
326-16-055	10133 HILLCREST RD
326-16-061	10191 HILLCREST RD
326-16-080	10171 HILLCREST RD
326-17-013	10168 AMELIA CT
326-17-019	10201 AMELIA CT
326-17-020	10185 AMELIA CT
326-17-026	10171 AMELIA CT
326-17-053	10151 AMELIA CT
326-18-057	10019 OAKLEAF PL
326-27-037	10145 PARKWOOD DR
326-27-037	10145 PARKWOOD DR
326-27-037	10145 PARKWOOD DR
326-27-037	10145 PARKWOOD DR
326-27-037	10145 PARKWOOD DR
326-35-063	10451 PHAR LAP DR
326-35-068	SOUTHERN PACIFIC TRANS.
326-37-004	10391 RIVERCREST CT
326-37-047	CRESTON DR
326-39-060	SANTA CLARA VALLEY WATER
326-41-033	10500 CASTINE AVE
326-41-095	21291 MILFORD DR
326-41-096	21301 MILFORD DR
326-41-097	21311 MILFORD DR
326-41-098	21321 MILFORD DR
326-41-099	21331 MILFORD DR
326-41-100	21341 MILFORD DR
326-41-101	21361 MILFORD DR
326-41-102	21371 MILFORD DR
326-41-103	21381 MILFORD DR

APN	Address
326-41-104	21391 MILFORD DR
326-41-105	21401 MILFORD DR
326-41-106	21421 MILFORD DR
326-41-107	21431 MILFORD DR
326-41-108	21451 MILFORD DR
326-41-109	21461 MILFORD DR
326-41-114	CITY OF CUPERTINO
326-47-019	10410 STOKES AVE
326-49-007	10650 STOKES AVE
326-49-018	21887 WILSON CT
326-49-034	STOKES AVE
326-55-023	10315 ANN ARBOR AVE
342-12-063	22615 SALEM AVE
342-12-064	22625 SALEM AVE
342-12-064	22625 SALEM AVE
342-12-064	22625 SALEM AVE
342-12-090	22611 POPPY DR
342-29-057	10495 MERRIMAN RD
342-44-017	10500 SAN FELIPE RD
342-44-020	10530 SAN FELIPE RD
342-45-007	22864 VOSS AVE
342-45-035	10396 AVENIDA LN
342-48-006	22654 OAKCREST CT
342-48-018	10439 HENEY CREEK PL
342-48-030	10350 HENEY CREEK PL
342-48-030	10350 HENEY CREEK PL
342-57-009	10799 JUNIPER CT
342-57-030	10829 SYCAMORE CT
342-58-003	22238 HAMMOND WAY
356-01-021	10980 MIRAMONTE RD
356-05-005	MC CLELLAN RD
356-06-030	22044 BAXLEY CT
357-01-027	22288 BELLEVUE AVE
357-01-033	10168 CASS PL
357-04-029	10494 MIRA VISTA RD
357-06-016	10489 SCENIC BLVD
357-09-053	22120 STEVENS CREEK BLVD
357-10-006	21975 SAN FERNANDO AVE
357-10-008	21979 SAN FERNANDO AVE
357-12-055	10485 SAN FERNANDO AVE
357-20-019	10340 BUBB RD
357-22-006	10106 IMPERIAL AVE
357-22-007	10104 IMPERIAL AVE
357-22-035	10118 IMPERIAL AVE

MAP 8. CONSEQUENCE OF FAILURE ANALYSIS - Water Mains Crossing Private Properties

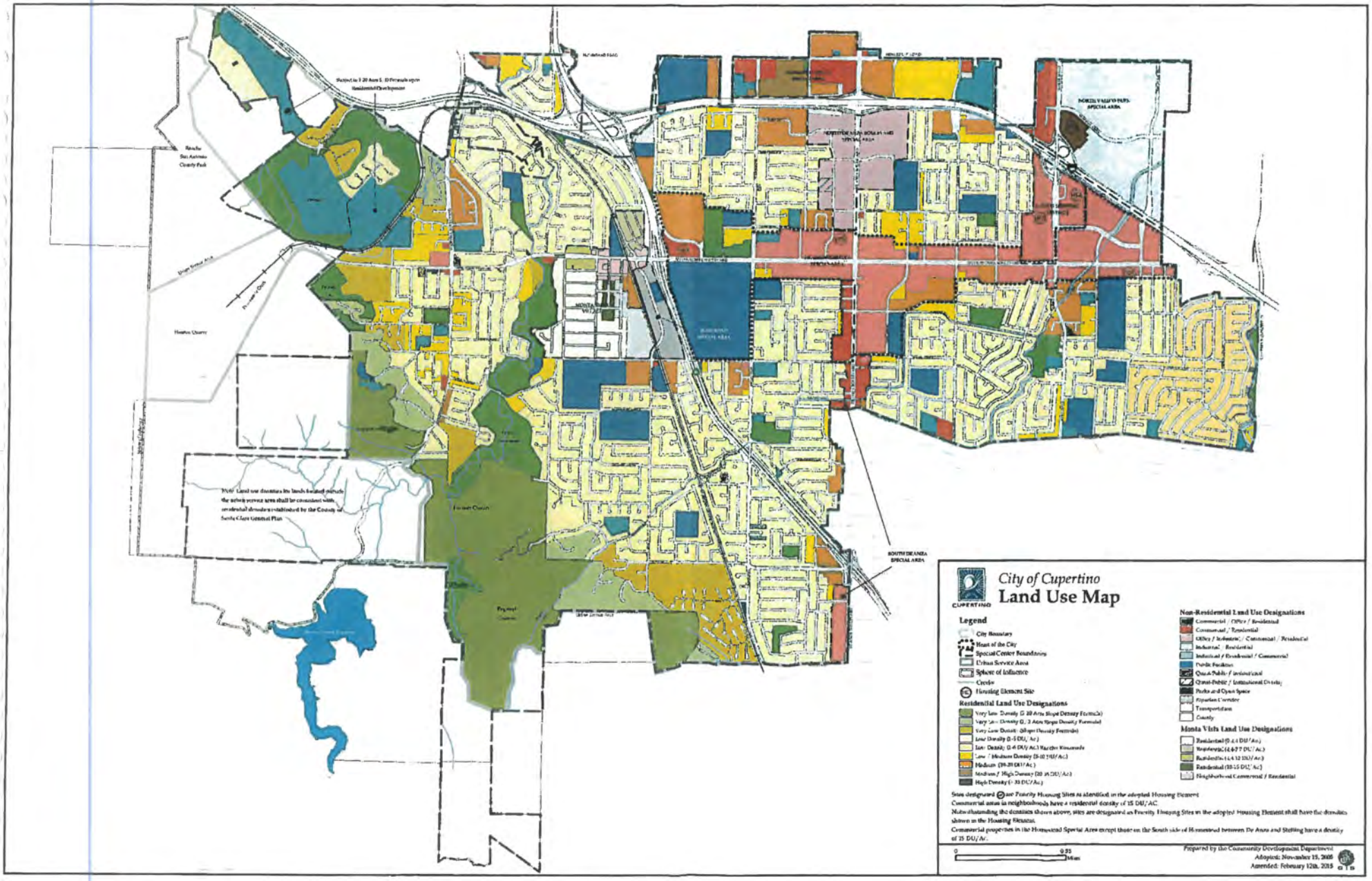
San Jose Water Company



Appendices

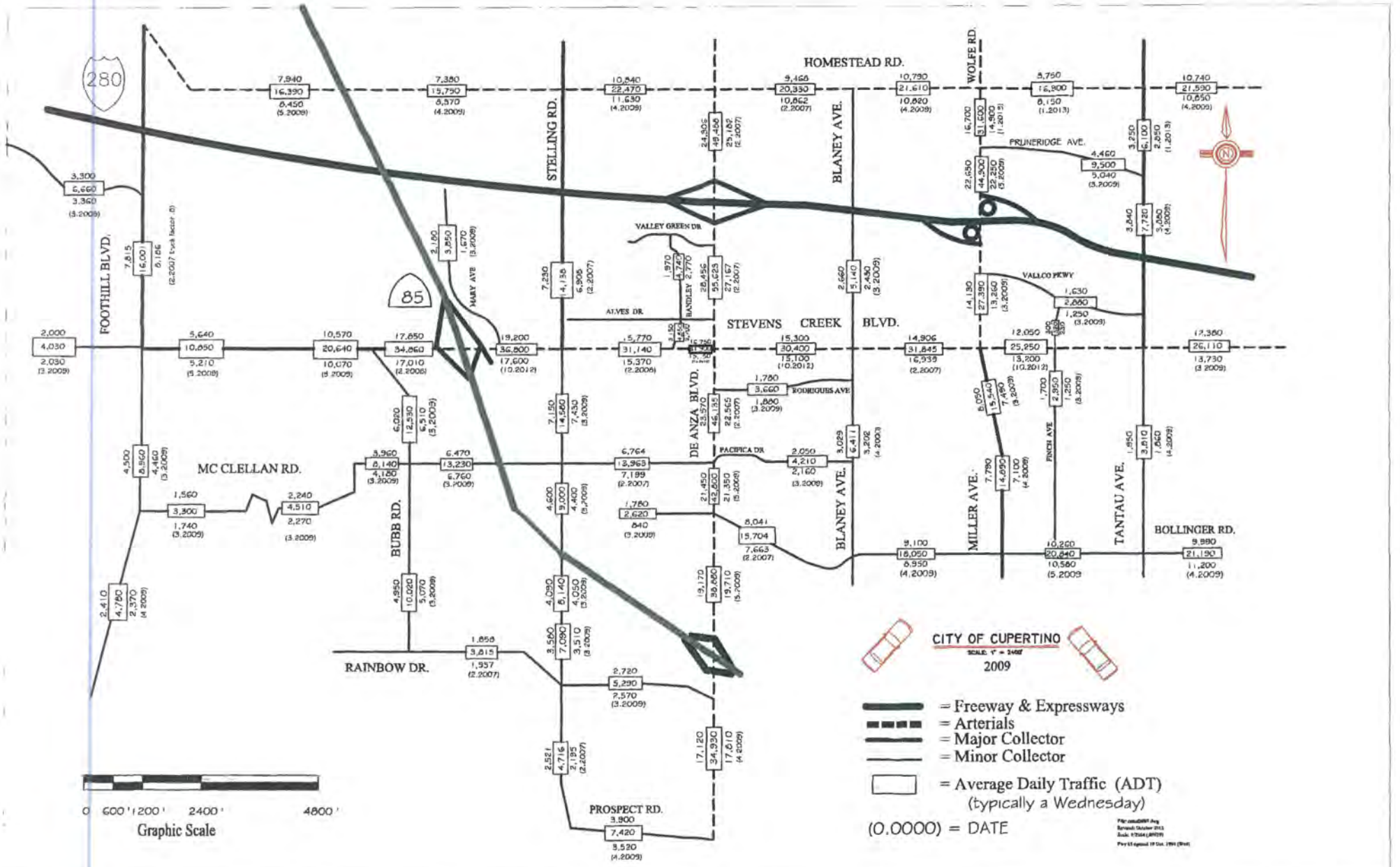
APPENDIX A

City of Cupertino Land Use Map


City of Cupertino
Land Use Map
Legend
City Boundary
Heart of the City
Special Center Boundary
Urban Service Area
Sphere of Influence
Creeks
Housing Element Site
Residential Land Use Designations
Non-Residential Land Use Designations
Commercial / Office / Residential
Commercial / Residential
Office / Industrial / Commercial / Residential
Industrial / Residential
Industrial / Residential / Commercial
Public Facilities
Quasi-Public / Institutional
Quasi-Public / Institutional Overlay
Parks and Open Space
Riparian Corridor
Transportation
County
Monta Vista Land Use Designations
Neighborhood Commercial / Residential
Sites designated are Priority Housing Sites as identified in the adopted Housing Element
Commercial areas in neighborhoods have a residential density of 15 DU/AC.
Notwithstanding the densities shown above, sites are designated as Priority Housing Sites in the adopted Housing Element shall have the densities shown in the Housing Element.
Commercial properties in the Homestead Special Area except those on the South side of Homestead between De Anza and Stelling have a density of 35 DU/Ac.
Prepared by the Community Development Department
Adopted: November 15, 2005
Amended: February 12th, 2019

APPENDIX B

City of Cupertino Annual Average Daily Traffic


HOMESTEAD RD.
STELLING RD.
BLANEY AVE.
WOLFE RD.
PRUNERIDGE AVE.
VALLCO PKWY
VALLEY GREEN DR
ALVES DR.
STEVENS CREEK BLVD.
FOOTHILL BLVD.
MARY AVE
DE ANZA BLVD.
RODRIGUES AVE
PACIFICA DR.
MC CLELLAN RD.
BUBB RD.
RAINBOW DR.
PROSPECT RD.
MILLER AVE.
FINCH AVE
TANTAU AVE.
BOLLINGER RD.
280
85
CITY OF CUPERTINO
2009
= Freeway & Expressways
= Arterials
= Major Collector
= Minor Collector
= Average Daily Traffic (ADT)
(typically a Wednesday)
(0.0000) = DATE
0 600' 1200' 2400' 4800'
Graphic Scale

APPENDIX C

Pipeline Consequence of Failure Scores and Rankings Table

Pipeline Consequence of Failure Scores and Rankings Table

Note: Pipes with identical Consequence of Failure Scores were prioritized according to their flooding intensities.

Pipe Information			Consequence of Failure Evaluation Results						
				Impact Category					
Pipe ID	Diameter (in)	Length (ft)	Flooding Intensity (gal)	Health & Safety	Transportation	Business	System Operations	Consequence of Failure Impact Score	FINAL RANK
D532520	12	107	1,268,042	0.8756	0.1414	1.0000	1.0000	0.7661	1
D531685	12	637	803,565	0.8134	1.0000	0.0956	0.0000	0.6162	2
D532529	12	181	779,586	0.8283	0.3225	1.0000	0.0000	0.5787	3
D531717	12	120	792,816	1.0000	0.3225	0.0000	0.0000	0.5645	4
D531672	10	111	649,809	1.0000	0.3225	0.0000	0.0000	0.5645	5
D531689	10	31	1,230,701	0.8719	0.1414	1.0000	0.0000	0.5642	6
D533109	12	52	1,985,310	0.9572	0.1414	0.3780	0.0000	0.5447	7
D530938	14	667	1,847,805	0.9350	0.1414	0.2817	0.0000	0.5240	8
D542751	14	77	2,038,245	0.9263	0.1414	0.2817	0.0000	0.5196	9
D530939	12	35	1,969,425	0.9399	0.1414	0.1878	0.0000	0.5170	10
D531889	10	8	615,731	1.0000	0.0802	0.0000	0.0000	0.5160	11
D531890	6	36	605,441	1.0000	0.0802	0.0000	0.0000	0.5160	12
D531896	6	53	494,360	1.0000	0.0802	0.0000	0.0000	0.5160	13
D531895	6	127	456,025	1.0000	0.0802	0.0000	0.0000	0.5160	14
D531892	6	16	417,053	1.0000	0.0802	0.0000	0.0000	0.5160	15
D531916	6	135	414,540	1.0000	0.0802	0.0000	0.0000	0.5160	16
D531897	8	680	389,632	1.0000	0.0802	0.0000	0.0000	0.5160	17
D531898	6	411	363,936	1.0000	0.0802	0.0000	0.0000	0.5160	18
D531894	6	895	291,278	1.0000	0.0802	0.0000	0.0000	0.5160	19
D540881	16	161	1,577,040	1.0000	0.0036	0.0000	0.0000	0.5007	20
D540878	16	264	1,572,204	1.0000	0.0036	0.0000	0.0000	0.5007	21
D531369	15	788	1,524,780	1.0000	0.0036	0.0000	0.0000	0.5007	22
D540879	6	28	1,000,812	1.0000	0.0036	0.0000	0.0000	0.5007	23
D531368	6	242	598,776	1.0000	0.0036	0.0000	0.0000	0.5007	24
D531563	8	850	353,269	1.0000	0.0036	0.0000	0.0000	0.5007	25
D531687	12	10	915,474	0.8311	0.3225	0.0956	0.0000	0.4896	26
D532531	12	211	743,266	0.8204	0.3225	0.0956	0.0000	0.4842	27
D532060	12	97	1,374,908	0.8843	0.1414	0.0939	0.0000	0.4798	28
D532530	8	24	711,119	0.8206	0.3225	0.0482	0.0000	0.4796	29
D532527	12	8	776,246	0.8280	0.3225	0.0000	0.0000	0.4785	30
D531686	6	39	613,947	0.8044	0.3225	0.1071	0.0000	0.4774	31
D532528	8	31	721,667	0.8222	0.3225	0.0047	0.0000	0.4761	32
D532070	12	233	1,420,860	0.8941	0.1414	0.0000	0.0000	0.4753	33
D542774	12	24	768,893	0.8198	0.3225	0.0000	0.0000	0.4744	34
D535814	12	326	767,151	0.8191	0.3225	0.0000	0.0000	0.4741	35
D531682	12	479	765,504	0.8182	0.3225	0.0000	0.0000	0.4736	36
D532176	12	6	1,404,297	0.8900	0.1414	0.0000	0.0000	0.4733	37
D532177	12	6	1,405,580	0.8899	0.1414	0.0000	0.0000	0.4732	38
D532127	12	50	1,406,619	0.8895	0.1414	0.0000	0.0000	0.4730	39
D532062	20	20	1,377,513	0.8884	0.1414	0.0000	0.0000	0.4725	40
D542773	12	6	716,436	0.8150	0.3225	0.0000	0.0000	0.4720	41
D542775	12	15	711,996	0.8146	0.3225	0.0000	0.0000	0.4718	42
D542784	12	15	740,421	0.8144	0.3225	0.0000	0.0000	0.4717	43
D542772	12	24	694,728	0.8130	0.3225	0.0000	0.0000	0.4710	44
D542777	12	20	726,017	0.8130	0.3225	0.0000	0.0000	0.4710	45
D531680	8	6	692,244	0.8128	0.3225	0.0000	0.0000	0.4709	46
D532058	12	10	1,221,264	0.8662	0.1414	0.0939	0.0000	0.4708	47
D531974	12	203	1,399,236	0.8841	0.1414	0.0000	0.0000	0.4704	48
D542776	12	24	714,137	0.8114	0.3225	0.0000	0.0000	0.4702	49
D532128	12	46	1,345,181	0.8831	0.1414	0.0000	0.0000	0.4698	50
D531673	12	350	678,659	0.8093	0.3225	0.0000	0.0000	0.4692	51
D542780	8	24	650,556	0.8090	0.3225	0.0000	0.0000	0.4690	52
D531671	12	108	664,119	0.8088	0.3225	0.0000	0.0000	0.4689	53
D532071	12	906	1,321,392	0.8804	0.1414	0.0000	0.0000	0.4685	54
D531684	12	42	787,992	0.8074	0.3225	0.0000	0.0000	0.4682	55
D532059	12	91	1,154,220	0.8603	0.1414	0.0939	0.0000	0.4678	56
D532178	12	228	1,270,188	0.8775	0.1414	0.0000	0.0000	0.4671	57
D532512	6	24	865,641	0.8331	0.1414	0.2213	0.0000	0.4670	58
D532065	12	519	1,242,708	0.8761	0.1414	0.0000	0.0000	0.4664	59
D531683	12	38	816,684	0.8002	0.3225	0.0000	0.0000	0.4646	60
D532513	12	120	958,398	0.8420	0.1414	0.1275	0.0000	0.4620	61
D532522	12	199	953,639	0.8416	0.1414	0.1275	0.0000	0.4618	62
D532069	8	316	1,156,476	0.8667	0.1414	0.0000	0.0000	0.4616	63
D532523	12	334	940,320	0.8407	0.1414	0.1275	0.0000	0.4614	64
D531668	8	396	479,796	0.7928	0.3225	0.0000	0.0000	0.4609	65
D532020	8	171	1,150,295	0.8632	0.1414	0.0000	0.0000	0.4599	66
D532525	8	23	862,410	0.8346	0.1414	0.1275	0.0000	0.4583	67
D540880	16	19	1,577,868	0.9117	0.0036	0.0000	0.0000	0.4566	68
D532066	8	776	1,041,984	0.8531	0.1414	0.0000	0.0000	0.4548	69
D531388	16	590	1,558,992	0.9036	0.0036	0.0000	0.0000	0.4525	70
D532526	12	52	908,913	0.8402	0.1414	0.0336	0.0000	0.4518	71

Note: Pipes with identical Consequence of Failure Scores were prioritized according to their flooding intensities.

Pipe Information			Consequence of Failure Evaluation Results						
				Impact Category					
Pipe ID	Diameter (in)	Length (ft)	Flooding Intensity (gal)	Health & Safety	Transportation	Business	System Operations	Consequence of Failure Impact Score	FINAL RANK
DS32511	8	32	692,493	0.8165	0.1414	0.1275	0.0000	0.4493	72
DS32191	2	48	185,976	0.7669	0.3225	0.0000	0.0000	0.4479	73
DS32194	2	48	186,543	0.7661	0.3225	0.0000	0.0000	0.4475	74
DS32192	2	48	165,312	0.7650	0.3225	0.0000	0.0000	0.4470	75
DS32190	2	48	165,264	0.7650	0.3225	0.0000	0.0000	0.4470	76
DS31976	8	14	892,441	0.8364	0.1414	0.0000	0.0000	0.4465	77
DS32147	16	24	1,251,348	0.2730	0.0000	1.0000	1.0000	0.4365	78
DS43109	16	12	1,522,824	0.8570	0.0036	0.0000	0.0000	0.4292	79
DS32187	10	6	973,032	0.8553	0.0036	0.0000	0.0000	0.4284	80
DS31833	10	315	952,104	0.8519	0.0036	0.0166	0.0000	0.4283	81
DS43108	16	24	1,518,012	0.8535	0.0036	0.0000	0.0000	0.4275	82
DS32146	16	163	1,301,040	0.2509	0.0036	1.0000	1.0000	0.4262	83
DS31873	10	350	916,908	0.8489	0.0036	0.0000	0.0000	0.4252	84
DS31888	10	311	632,121	0.8155	0.0802	0.0000	0.0000	0.4238	85
DS31885	10	93	904,527	0.8450	0.0036	0.0000	0.0000	0.4232	86
DS31861	8	344	821,232	0.8373	0.0036	0.0000	0.0000	0.4194	87
DS31879	10	838	851,756	0.8364	0.0036	0.0000	0.0000	0.4189	88
DS31881	10	322	839,592	0.8359	0.0036	0.0000	0.0000	0.4187	89
DS31860	8	327	801,012	0.8346	0.0036	0.0000	0.0000	0.4180	90
DS31882	10	10	880,908	0.8304	0.0036	0.0000	0.0000	0.4159	91
D600356	17	1,094	99,677	0.0188	1.0000	0.0000	1.0000	0.4094	92
DS42783	12	24	714,380	0.8120	0.0036	0.0000	0.0000	0.4067	93
D600337	17	1,477	51,887	0.0078	1.0000	0.0000	1.0000	0.4039	94
DS31676	12	329	641,172	0.8055	0.0036	0.0000	0.0000	0.4035	95
DS31675	12	415	617,520	0.8054	0.0036	0.0000	0.0000	0.4034	96
D600384	17	3,600	48,928	0.0065	1.0000	0.0000	1.0000	0.4033	97
DS31367	6	126	424,656	0.7933	0.0036	0.0000	0.0000	0.3974	98
DS31677	6	100	470,700	0.7908	0.0036	0.0000	0.0000	0.3961	99
DS31366	6	283	385,332	0.7859	0.0036	0.0000	0.0000	0.3937	100
DS42781	8	4	351,618	0.7819	0.0000	0.0000	0.0000	0.3910	101
DS31382	14	12	1,455,276	0.3693	0.0036	0.0000	1.0000	0.3854	102
DS32195	2	48	186,476	0.7662	0.0036	0.0000	0.0000	0.3838	103
DS32145	16	136	1,187,544	0.1249	0.0000	1.0000	1.0000	0.3624	104
DS33110	8	27	1,356,924	0.5826	0.1414	0.3780	0.0000	0.3574	105
DS32144	16	74	1,651,415	0.6439	0.1414	0.0000	0.0000	0.3503	106
DS32117	8	210	887,712	0.0912	0.0036	1.0000	1.0000	0.3463	107
DS31620	8	1,988	137,700	0.2514	1.0000	0.1970	0.0000	0.3454	108
DS34685	16	6	1,470,816	0.6234	0.1414	0.0000	0.0000	0.3400	109
DS34684	16	24	1,470,288	0.6222	0.1414	0.0000	0.0000	0.3394	110
DS32152	14	27	1,639,670	0.6140	0.1414	0.0000	0.0000	0.3353	111
DS31345	16	485	1,457,436	0.6671	0.0036	0.0000	0.0000	0.3342	112
T602760	10	38	1,256,703	0.2663	0.0036	0.0000	1.0000	0.3339	113
DS31151	20	763	2,594,940	0.2635	0.0036	0.0000	1.0000	0.3325	114
DS31095	16	248	1,357,824	0.2567	0.0036	0.0000	1.0000	0.3291	115
DS31637	8	132	428,820	0.0247	0.0802	1.0000	1.0000	0.3284	116
DS32170	8	227	537,453	0.0547	0.0036	1.0000	1.0000	0.3280	117
DS31387	14	199	1,536,312	0.6247	0.0036	0.0000	0.0000	0.3130	118
DS30942	14	539	1,932,660	0.5213	0.1414	0.1878	0.0000	0.3077	119
DS31346	8	270	1,056,108	0.6061	0.0036	0.0000	0.0000	0.3038	120
D600412	17	1,601	46,706	0.0055	0.0036	1.0000	1.0000	0.3035	121
DS31102	14	38	1,599,075	0.5471	0.1414	0.0000	0.0000	0.3018	122
DS31105	16	194	1,438,404	0.5231	0.1414	0.0000	0.0000	0.2898	123
DS31103	14	353	1,614,168	0.5146	0.1414	0.0000	0.0000	0.2856	124
D600351	17	1,007	100,790	0.0188	0.3225	0.0000	1.0000	0.2739	125
D602851	17	308	99,939	0.0175	0.3225	0.0000	1.0000	0.2732	126
DS30923	14	394	1,588,829	0.4733	0.1414	0.0000	0.0000	0.2650	127
DS31100	16	253	1,580,904	0.4716	0.1414	0.0000	0.0000	0.2641	128
T603403	20	6	1,623,720	0.1178	0.0000	0.0000	1.0000	0.2589	129
T603399	20	120	1,884,924	0.1142	0.0000	0.0000	1.0000	0.2571	130
T603393	20	14	1,603,056	0.1130	0.0000	0.0000	1.0000	0.2565	131
T603396	20	22	1,632,936	0.1085	0.0000	0.0000	1.0000	0.2542	132
DS31385	14	223	1,483,092	0.5033	0.0036	0.0000	0.0000	0.2524	133
DS32168	8	396	982,980	0.5012	0.0036	0.0000	0.0000	0.2513	134
DS31344	8	57	1,364,448	0.5002	0.0036	0.0000	0.0000	0.2508	135
DS30905	14	384	1,586,777	0.4421	0.1414	0.0000	0.0000	0.2493	136
DS30936	14	429	1,620,068	0.4247	0.1414	0.0000	0.0000	0.2406	137
DS31061	10	471	277,215	0.0762	0.0036	0.0000	1.0000	0.2388	138
DS31786	8	698	126,650	0.4646	0.0036	0.0000	0.0000	0.2330	139
DS31108	8	499	922,860	0.4077	0.1414	0.0000	0.0000	0.2321	140
DS42702	10	522	321,000	0.0603	0.0036	0.0000	1.0000	0.2309	141
DS31150	6	1,132	285,890	0.0527	0.0036	0.0000	1.0000	0.2271	142
DS30945	12	543	1,454,604	0.3367	0.1414	0.2841	0.0000	0.2250	143
DS31381	8	56	1,293,264	0.4478	0.0036	0.0000	0.0000	0.2246	144

Note: Pipes with identical Consequence of Failure Scores were prioritized according to their flooding intensities.

Pipe Information			Consequence of Failure Evaluation Results						
				Impact Category					
Pipe ID	Diameter (in)	Length (ft)	Flooding Intensity (gal)	Health & Safety	Transportation	Business	System Operations	Consequence of Failure Impact Score	FINAL RANK
D531147	10	1,309	576,612	0.0477	0.0036	0.0000	1.0000	0.2246	145
D531044	10	330	1,323,459	0.3923	0.1414	0.0000	0.0000	0.2244	146
D544257	10	279	491,970	0.0393	0.0036	0.0000	1.0000	0.2204	147
D531193	20	482	2,128,824	0.4372	0.0036	0.0000	0.0000	0.2193	148
D530903	8	167	1,212,368	0.3808	0.1414	0.0000	0.0000	0.2187	149
D531771	8	342	127,160	0.4356	0.0036	0.0000	0.0000	0.2185	150
D534683	10	1,253	225,612	0.0354	0.0036	0.0000	1.0000	0.2184	151
D531128	16	22	1,396,572	0.4319	0.0036	0.0000	0.0000	0.2167	152
D531275	20	827	1,966,968	0.4314	0.0036	0.0000	0.0000	0.2164	153
D532987	16	27	1,397,760	0.4265	0.0036	0.0000	0.0000	0.2140	154
D531799	10	590	195,228	0.0253	1.0000	0.0000	0.0000	0.2127	155
D531119	16	161	1,392,396	0.4234	0.0036	0.0000	0.0000	0.2124	156
D532161	20	16	2,124,576	0.4228	0.0036	0.0000	0.0000	0.2121	157
D532986	16	233	1,391,400	0.4221	0.0036	0.0000	0.0000	0.2118	158
D602870	12	12	109,400	0.0207	0.0000	0.0000	1.0000	0.2104	159
D531129	16	24	1,383,084	0.4159	0.0036	0.0000	0.0000	0.2087	160
D532999	16	4	1,382,892	0.4151	0.0036	0.0000	0.0000	0.2083	161
D531602	8	1,106	63,317	0.0144	1.0000	0.0000	0.0000	0.2072	162
D531378	12	12	1,091,507	0.4123	0.0036	0.0000	0.0000	0.2069	163
D531279	20	20	2,188,661	0.4089	0.0036	0.0000	0.0000	0.2052	164
D602868	12	11	87,896	0.0088	0.0000	0.0000	1.0000	0.2044	165
D531384	14	340	1,464,576	0.4068	0.0036	0.0000	0.0000	0.2041	166
D531596	8	2,500	65,468	0.0069	1.0000	0.0000	0.0000	0.2035	167
D531123	16	166	1,381,836	0.4052	0.0036	0.0000	0.0000	0.2033	168
D602872	12	13	46,123	0.0055	0.0000	0.0000	1.0000	0.2028	169
D532988	8	27	1,218,288	0.4027	0.0036	0.0000	0.0000	0.2021	170
D536144	12	347	469,296	0.0014	0.0036	0.0000	1.0000	0.2014	171
D531785	8	271	110,010	0.4006	0.0036	0.0000	0.0000	0.2010	172
D531054	12	1,440	493,776	0.0014	0.0000	0.0000	1.0000	0.2007	173
D531052	12	471	559,020	0.0007	0.0000	0.0000	1.0000	0.2004	174
D535147	12	957	287,184	0.0004	0.0000	0.0000	1.0000	0.2002	175
T603407	6	8	418,088	0.0000	0.0000	0.0000	1.0000	0.2000	176
T603410	6	3	290,692	0.0000	0.0000	0.0000	1.0000	0.2000	177
T602321	12	76	220,320	0.0000	0.0000	0.0000	1.0000	0.2000	178
T602326	12	34	192,780	0.0000	0.0000	0.0000	1.0000	0.2000	179
T603416	6	113	149,279	0.0000	0.0000	0.0000	1.0000	0.2000	180
D531159	20	492	2,860,320	0.3979	0.0036	0.0000	0.0000	0.1997	181
D531787	8	630	107,100	0.3973	0.0036	0.0000	0.0000	0.1994	182
D531121	16	261	1,374,516	0.3953	0.0036	0.0000	0.0000	0.1984	183
D531972	12	411	1,280,316	0.3369	0.1414	0.0000	0.0000	0.1967	184
D531098	16	240	1,516,644	0.3910	0.0036	0.0000	0.0000	0.1962	185
D531232	14	453	1,862,760	0.3548	0.0802	0.0000	0.0000	0.1934	186
D531172	10	17	1,811,070	0.3514	0.0802	0.0000	0.0000	0.1918	187
D532158	10	34	1,795,470	0.3490	0.0802	0.0000	0.0000	0.1905	188
D531593	8	853	69,531	0.2518	0.3225	0.0000	0.0000	0.1904	189
D531126	16	52	1,364,436	0.3790	0.0036	0.0000	0.0000	0.1902	190
D531127	16	24	1,364,700	0.3788	0.0036	0.0000	0.0000	0.1901	191
T602842	8	31	1,046,357	0.3751	0.0036	0.0000	0.0000	0.1883	192
D531278	10	183	1,863,257	0.3747	0.0036	0.0000	0.0000	0.1881	193
T602845	8	11	1,135,560	0.3694	0.0036	0.0000	0.0000	0.1854	194
D531166	10	389	1,549,110	0.3315	0.0802	0.0000	0.0000	0.1818	195
D532160	14	32	1,791,840	0.3312	0.0802	0.0000	0.0000	0.1816	196
D530940	6	36	1,085,205	0.2570	0.1414	0.1885	0.0000	0.1756	197
D532159	10	12	1,762,560	0.3189	0.0802	0.0000	0.0000	0.1755	198
D530944	12	233	1,338,084	0.2920	0.1414	0.0025	0.0000	0.1745	199
D531153	20	311	2,832,390	0.3467	0.0036	0.0000	0.0000	0.1741	200
D532629	8	299	1,081,464	0.3467	0.0036	0.0000	0.0000	0.1741	201
D531772	8	269	126,557	0.3467	0.0036	0.0000	0.0000	0.1741	202
D531769	8	211	109,695	0.3456	0.0036	0.0000	0.0000	0.1735	203
T602854	8	6	926,373	0.3457	0.0000	0.0000	0.0000	0.1729	204
D531770	6	383	101,070	0.3426	0.0036	0.0000	0.0000	0.1720	205
D531160	10	255	1,817,940	0.3421	0.0036	0.0000	0.0000	0.1718	206
D531973	8	273	940,236	0.2842	0.1414	0.0000	0.0000	0.1704	207
D540882	6	45	979,620	0.3268	0.0036	0.0000	0.0000	0.1641	208
D531230	14	347	1,778,790	0.2959	0.0802	0.0000	0.0000	0.1640	209
T602863	8	7	797,601	0.3255	0.0000	0.0000	0.0000	0.1627	210
D531231	14	812	1,790,325	0.2902	0.0802	0.0000	0.0000	0.1611	211
D531099	8	350	1,044,077	0.3202	0.0036	0.0000	0.0000	0.1608	212
D532111	8	20	466,200	0.3181	0.0036	0.0000	0.0000	0.1598	213
D531784	6	1,107	99,870	0.3151	0.0036	0.0000	0.0000	0.1582	214
D531146	4	56	600,156	0.1160	0.0000	1.0000	0.0000	0.1580	215
D532022	10	258	657,552	0.1140	0.0036	1.0000	0.0000	0.1577	216
D531200	20	638	2,045,064	0.3107	0.0036	0.0000	0.0000	0.1561	217

Note: Pipes with Identical Consequence of Failure Scores were prioritized according to their flooding intensities.

Pipe Information			Consequence of Failure Evaluation Results						
				Impact Category					
Pipe ID	Diameter (in)	Length (ft)	Flooding Intensity (gal)	Health & Safety	Transportation	Business	System Operations	Consequence of Failure Impact Score	FINAL RANK
DS31774	8	319	122,655	0.3092	0.0036	0.0000	0.0000	0.1553	218
DS31610	8	688	384,180	0.2759	0.0802	0.0000	0.0000	0.1540	219
DS31790	8	1,285	105,203	0.3054	0.0036	0.0000	0.0000	0.1534	220
DS31783	8	417	106,538	0.3043	0.0036	0.0000	0.0000	0.1529	221
DS31760	8	164	175,824	0.3031	0.0036	0.0000	0.0000	0.1523	222
DS31182	10	508	1,371,885	0.2711	0.0802	0.0000	0.0000	0.1516	223
DS32630	8	46	618,803	0.3012	0.0036	0.0000	0.0000	0.1513	224
DS31612	8	795	457,842	0.2577	0.0802	0.0601	0.0000	0.1509	225
DS32189	10	8	177,540	0.3000	0.0036	0.0000	0.0000	0.1507	226
DS31777	10.5	265	177,120	0.2993	0.0036	0.0000	0.0000	0.1504	227
DS31886	10	228	677,492	0.2668	0.0802	0.0000	0.0000	0.1494	228
DS31779	10	405	176,520	0.2950	0.0036	0.0000	0.0000	0.1482	229
DS31759	8	53	176,244	0.2930	0.0036	0.0000	0.0000	0.1472	230
DS31780	10	162	174,216	0.2929	0.0036	0.0000	0.0000	0.1472	231
DS31773	6	410	110,203	0.2897	0.0036	0.0000	0.0000	0.1456	232
DS31778	8	386	170,904	0.2890	0.0036	0.0000	0.0000	0.1452	233
DS31611	8	138	363,773	0.2577	0.0802	0.0000	0.0000	0.1449	234
DS31154	10	45	2,278,005	0.2871	0.0036	0.0000	0.0000	0.1443	235
DS31767	8	262	107,175	0.2856	0.0036	0.0000	0.0000	0.1435	236
DS31584	6	1,817	83,818	0.2518	0.0802	0.0000	0.0000	0.1419	237
DS43089	10	6	164,483	0.2823	0.0036	0.0000	0.0000	0.1419	238
DS31776	8	417	108,015	0.2810	0.0036	0.0000	0.0000	0.1412	239
DS31768	6	250	101,588	0.2796	0.0036	0.0000	0.0000	0.1405	240
DS31178	10	90	1,540,710	0.2461	0.0802	0.0000	0.0000	0.1391	241
DS31781	8	168	149,688	0.2763	0.0036	0.0000	0.0000	0.1389	242
DS31796	6	256	157,764	0.2772	0.0000	0.0000	0.0000	0.1386	243
DS31792	10	81	149,520	0.2757	0.0036	0.0000	0.0000	0.1386	244
DS31791	6	119	138,275	0.2750	0.0036	0.0000	0.0000	0.1382	245
DS31782	8	563	105,878	0.2736	0.0036	0.0000	0.0000	0.1375	246
DS31761	6	341	105,435	0.2736	0.0036	0.0000	0.0000	0.1375	247
DS31766	8	270	105,983	0.2734	0.0036	0.0000	0.0000	0.1374	248
DS31763	8	254	105,503	0.2732	0.0036	0.0000	0.0000	0.1373	249
DS31106	6	621	519,420	0.2732	0.0036	0.0000	0.0000	0.1373	250
DS31762	6	149	100,463	0.2693	0.0036	0.0000	0.0000	0.1354	251
DS31793	10	561	143,000	0.2689	0.0036	0.0000	0.0000	0.1352	252
DS31765	6	240	99,615	0.2684	0.0036	0.0000	0.0000	0.1349	253
DS31775	6	330	97,305	0.2680	0.0036	0.0000	0.0000	0.1347	254
DS31764	6	233	98,805	0.2672	0.0036	0.0000	0.0000	0.1343	255
DS32631	8	384	647,632	0.2668	0.0036	0.0000	0.0000	0.1341	256
DS31110	6	563	594,240	0.2107	0.1414	0.0000	0.0000	0.1336	257
DS32635	6	28	573,317	0.2638	0.0036	0.0000	0.0000	0.1324	258
DS31698	8	971	378,781	0.0322	0.3225	0.5176	0.0000	0.1324	259
DS32166	6	573	205,811	0.2605	0.0036	0.0000	0.0000	0.1310	260
DS32633	8	123	616,786	0.2598	0.0036	0.0000	0.0000	0.1306	261
DS31969	12	271	1,434,186	0.2037	0.1414	0.0000	0.0000	0.1301	262
DS31968	12	298	1,414,274	0.2009	0.1414	0.0000	0.0000	0.1287	263
DS31638	8	395	430,826	0.0243	0.0802	1.0000	0.0000	0.1282	264
DS31650	8	713	87,645	0.2549	0.0036	0.0000	0.0000	0.1282	265
DS31251	6	52	1,321,005	0.2220	0.0802	0.0000	0.0000	0.1270	266
DS31945	6	615	385,378	0.2521	0.0036	0.0000	0.0000	0.1268	267
DS31617	8	1,111	435,782	0.0214	0.0802	1.0000	0.0000	0.1268	268
DS32167	2	48	167,136	0.2500	0.0036	0.0000	0.0000	0.1257	269
DS31621	8	307	372,204	0.0178	0.0802	1.0000	0.0000	0.1249	270
DS30978	10	120	1,443,708	0.2170	0.0802	0.0000	0.0000	0.1246	271
DS31556	8	1,189	392,627	0.2476	0.0036	0.0000	0.0000	0.1245	272
DS31623	8	441	213,248	0.0111	0.0802	1.0000	0.0000	0.1216	273
DS31802	10	24	137,792	0.2432	0.0000	0.0000	0.0000	0.1216	274
DS31005	10	2,088	1,128,948	0.1671	0.1414	0.0939	0.0000	0.1212	275
DS31642	6	172	87,983	0.2395	0.0036	0.0000	0.0000	0.1205	276
DS31622	8	319	182,700	0.0084	0.0802	1.0000	0.0000	0.1202	277
DS31051	8	1,690	124,066	0.0082	0.0802	1.0000	0.0000	0.1201	278
DS42765	8	18	171,848	0.0072	0.0802	1.0000	0.0000	0.1197	279
DS31616	8	25	170,513	0.0072	0.0802	1.0000	0.0000	0.1196	280
DS32139	20	9	1,431,948	0.2060	0.0802	0.0000	0.0000	0.1190	281
DS31002	10	53	1,437,012	0.2055	0.0802	0.0000	0.0000	0.1188	282
DS32197	2	48	66,660	0.0028	0.0802	1.0000	0.0000	0.1174	283
DS32052	10	346	940,080	0.1158	0.1414	0.3071	0.0000	0.1169	284
DS31118	8	520	619,710	0.1736	0.1414	0.0000	0.0000	0.1151	285
DS30985	10	201	1,386,396	0.2254	0.0036	0.0000	0.0000	0.1134	286
DS30979	10	17	1,450,224	0.2222	0.0036	0.0000	0.0000	0.1118	287
DS32923	8	34	405,594	0.2182	0.0036	0.0000	0.0000	0.1098	288
DS32157	10	21	1,975,685	0.2180	0.0036	0.0000	0.0000	0.1097	289
DS32921	8	59	403,431	0.2178	0.0036	0.0000	0.0000	0.1096	290

Note. Pipes with identical Consequence of Failure Scores were prioritized according to their flooding intensities.

Pipe Information			Consequence of Failure Evaluation Results						
				Impact Categogry					
Pipe ID	Diameter (in)	Length (ft)	Flooding Intensity (gal)	Health & Safety	Transportation	Business	System Operations	Consequence of Failure Impact Score	FINAL RANK
D530947	8	498	703,956	0.1614	0.1414	0.0025	0.0000	0.1092	291
D531544	8	790	374,084	0.2152	0.0036	0.0000	0.0000	0.1083	292
D530983	10	411	1,362,840	0.2144	0.0036	0.0000	0.0000	0.1079	293
D532039	6	407	532,896	0.0601	0.1414	0.4949	0.0000	0.1079	294
D531992	12	76	1,296,675	0.1587	0.1414	0.0000	0.0000	0.1076	295
D531003	10	26	1,402,728	0.1825	0.0802	0.0000	0.0000	0.1073	296
T602763	10	6	1,239,158	0.2103	0.0036	0.0000	0.0000	0.1059	297
D542763	8	47	206,278	0.0108	0.0000	1.0000	0.0000	0.1054	298
D532138	20	18	1,383,804	0.2081	0.0036	0.0000	0.0000	0.1048	299
D542764	8	24	171,210	0.0093	0.0000	1.0000	0.0000	0.1047	300
D531377	8	60	953,967	0.2078	0.0036	0.0000	0.0000	0.1046	301
D531001	8	24	1,287,432	0.1768	0.0802	0.0000	0.0000	0.1044	302
D531163	10	240	1,510,353	0.2065	0.0036	0.0000	0.0000	0.1040	303
D532162	6	14	1,298,700	0.2057	0.0036	0.0000	0.0000	0.1036	304
D531554	8	612	379,250	0.2055	0.0036	0.0000	0.0000	0.1034	305
D531550	8	279	395,934	0.2053	0.0036	0.0000	0.0000	0.1034	306
D531322	10	30	958,092	0.1730	0.0802	0.0000	0.0000	0.1025	307
D531321	10	508	743,568	0.1727	0.0802	0.0000	0.0000	0.1024	308
D531158	10	94	1,562,247	0.2029	0.0036	0.0000	0.0000	0.1022	309
D531094	6	230	533,112	0.2017	0.0036	0.0000	0.0000	0.1016	310
D531697	8	414	553,680	0.0687	0.1414	0.3861	0.0000	0.1013	311
D531545	8	198	396,900	0.2003	0.0036	0.0000	0.0000	0.1009	312
D542754	8	19	390,863	0.1997	0.0036	0.0000	0.0000	0.1006	313
D531164	10	403	1,354,523	0.1994	0.0036	0.0000	0.0000	0.1004	314
T602767	10	8	1,231,041	0.1993	0.0036	0.0000	0.0000	0.1004	315
T602803	8	6	1,226,946	0.1989	0.0036	0.0000	0.0000	0.1002	316
T602771	10	6	1,220,898	0.1987	0.0036	0.0000	0.0000	0.1001	317
T602811	8	6	1,227,272	0.1986	0.0036	0.0000	0.0000	0.1000	318
D532188	8	15	379,271	0.1985	0.0036	0.0000	0.0000	0.1000	319
T602775	10	6	1,212,498	0.1981	0.0036	0.0000	0.0000	0.0998	320
D533111	8	382	649,528	0.1017	0.1414	0.2057	0.0000	0.0997	321
D531186	10	178	993,048	0.1662	0.0802	0.0000	0.0000	0.0991	322
T602806	8	7	1,207,868	0.1968	0.0036	0.0000	0.0000	0.0991	323
D531608	8	696	422,310	0.0788	0.0036	0.5754	0.0000	0.0977	324
D531180	10	437	1,161,959	0.1629	0.0802	0.0000	0.0000	0.0975	325
T602817	8	6	1,200,024	0.1930	0.0036	0.0000	0.0000	0.0972	326
T602815	8	6	1,200,644	0.1928	0.0036	0.0000	0.0000	0.0971	327
T602779	10	3	1,205,442	0.1927	0.0036	0.0000	0.0000	0.0971	328
D531187	8	455	897,696	0.1620	0.0802	0.0000	0.0000	0.0971	329
D531185	10	177	1,053,840	0.1619	0.0802	0.0000	0.0000	0.0970	330
D531229	8	629	673,980	0.1618	0.0802	0.0000	0.0000	0.0970	331
D531560	8	236	421,629	0.1911	0.0036	0.0000	0.0000	0.0963	332
D532040	6	347	623,088	0.0701	0.0036	0.5820	0.0000	0.0940	333
D531788	8	310	105,713	0.1838	0.0036	0.0000	0.0000	0.0926	334
D531587	8	768	111,636	0.1281	0.1414	0.0000	0.0000	0.0924	335
D531826	10	9	969,792	0.1794	0.0036	0.0166	0.0000	0.0921	336
D531555	8	271	335,861	0.1820	0.0036	0.0000	0.0000	0.0917	337
D531551	6	1,412	291,701	0.1810	0.0036	0.0000	0.0000	0.0912	338
D531827	10	103	965,700	0.1776	0.0036	0.0166	0.0000	0.0912	339
D531575	8	257	533,682	0.1482	0.0802	0.0000	0.0000	0.0901	340
D532073	6	38	879,084	0.1233	0.1414	0.0000	0.0000	0.0899	341
D531562	8	275	358,607	0.1777	0.0036	0.0000	0.0000	0.0896	342
D531201	8	46	1,395,060	0.1777	0.0036	0.0000	0.0000	0.0896	343
D531561	8	671	350,685	0.1767	0.0036	0.0000	0.0000	0.0891	344
D531669	12	796	535,092	0.0487	0.3225	0.0000	0.0000	0.0888	345
D532051	10	252	962,856	0.1345	0.0036	0.2044	0.0000	0.0884	346
D532053	10	60	973,668	0.1336	0.0036	0.2044	0.0000	0.0880	347
D531574	8	503	380,175	0.1433	0.0802	0.0000	0.0000	0.0877	348
D531179	10	30	1,193,508	0.1429	0.0802	0.0000	0.0000	0.0875	349
D531122	8	285	916,404	0.1731	0.0036	0.0000	0.0000	0.0873	350
D531175	6	28	1,192,785	0.1422	0.0802	0.0000	0.0000	0.0872	351
D531156	10	449	1,480,221	0.1722	0.0036	0.0000	0.0000	0.0868	352
D531000	8	815	489,192	0.1115	0.0802	0.1408	0.0000	0.0859	353
D532041	6	9	836,934	0.0908	0.1414	0.1193	0.0000	0.0856	354
D531120	8	470	835,596	0.1654	0.0036	0.0000	0.0000	0.0834	355
D531607	8	152	510,930	0.0687	0.0036	0.4788	0.0000	0.0829	356
D531280	8	153	1,189,881	0.1644	0.0036	0.0000	0.0000	0.0829	357
D531572	8	56	398,415	0.1318	0.0802	0.0000	0.0000	0.0819	358
D531564	8	283	327,075	0.1620	0.0036	0.0000	0.0000	0.0817	359
D531878	10	329	882,888	0.1617	0.0036	0.0000	0.0000	0.0816	360
D531081	10	230	415,536	0.1612	0.0036	0.0000	0.0000	0.0813	361
D531317	8	18	705,054	0.1295	0.0802	0.0000	0.0000	0.0808	362
D531641	8	38	100,950	0.1601	0.0036	0.0000	0.0000	0.0808	363

Note: Pipes with identical Consequence of Failure Scores were prioritized according to their flooding intensities.

Pipe Information			Consequence of Failure Evaluation Results						
				Impact Categgry					
Pipe ID	Diameter (in)	Length (ft)	Flooding Intensity (gal)	Health & Safety	Transportation	Business	System Operations	Consequence of Failure Impact Score	FINAL RANK
DS31083	10	484	469,044	0.1597	0.0036	0.0000	0.0000	0.0806	364
DS31084	10	377	472,284	0.1589	0.0036	0.0000	0.0000	0.0802	365
DS31016	8	20	987,294	0.1276	0.0802	0.0000	0.0000	0.0798	366
DS32061	6	47	812,669	0.0978	0.1414	0.0254	0.0000	0.0798	367
DS31085	10	2,451	415,193	0.1566	0.0036	0.0000	0.0000	0.0790	368
DS31148	10	1,148	435,405	0.1561	0.0036	0.0000	0.0000	0.0788	369
DS31071	10	231	474,836	0.1556	0.0036	0.0000	0.0000	0.0785	370
DS30977	6	200	854,508	0.1539	0.0036	0.0000	0.0000	0.0776	371
DS32136	8	252	926,426	0.1232	0.0802	0.0000	0.0000	0.0776	372
DS32054	6	348	580,493	0.0556	0.1414	0.2132	0.0000	0.0774	373
DS32156	6	31	1,055,400	0.1226	0.0802	0.0000	0.0000	0.0773	374
DS36145	8	433	414,312	0.1531	0.0036	0.0000	0.0000	0.0773	375
DS32057	6	126	733,950	0.0741	0.1414	0.1193	0.0000	0.0773	376
DS31162	10	261	1,298,772	0.1531	0.0036	0.0000	0.0000	0.0773	377
DS32033	10	218	960,768	0.1485	0.0036	0.0166	0.0000	0.0766	378
DS31091	10	222	465,710	0.1501	0.0036	0.0000	0.0000	0.0758	379
DS30873	8	44	926,545	0.1192	0.0802	0.0000	0.0000	0.0756	380
DS33665	8	372	415,608	0.1490	0.0036	0.0000	0.0000	0.0752	381
DS42752	6	185	752,261	0.0923	0.1414	0.0000	0.0000	0.0745	382
DS31567	8	523	386,261	0.1471	0.0036	0.0000	0.0000	0.0743	383
DS31064	10	326	468,113	0.1470	0.0036	0.0000	0.0000	0.0742	384
DS31043	10	117	1,061,280	0.1459	0.0036	0.0000	0.0000	0.0737	385
DS31699	8	153	549,810	0.0710	0.1414	0.0986	0.0000	0.0736	386
DS31063	10	555	493,425	0.1457	0.0036	0.0000	0.0000	0.0736	387
DS31601	12	56	100,181	0.0177	0.3225	0.0000	0.0000	0.0733	388
D600342	10	1,997	101,220	0.0174	0.3225	0.0000	0.0000	0.0732	389
D600347	8	183	101,042	0.0168	0.3225	0.0000	0.0000	0.0729	390
DS30937	8	19	646,170	0.0700	0.1414	0.0939	0.0000	0.0727	391
DS31316	8	264	600,212	0.1120	0.0802	0.0000	0.0000	0.0720	392
DS32201	10	21	462,524	0.1423	0.0036	0.0000	0.0000	0.0719	393
DS30932	6	12	636,370	0.0682	0.1414	0.0939	0.0000	0.0718	394
DS32143	10	24	1,040,100	0.1419	0.0036	0.0000	0.0000	0.0717	395
DS31072	8	270	412,080	0.1416	0.0036	0.0000	0.0000	0.0715	396
DS32067	6	105	765,744	0.0862	0.1414	0.0000	0.0000	0.0714	397
DS33117	6	820	336,728	0.0470	0.1414	0.1939	0.0000	0.0712	398
DS30963	8	291	887,661	0.1103	0.0802	0.0000	0.0000	0.0712	399
DS42750	10	193	469,679	0.1407	0.0036	0.0000	0.0000	0.0711	400
DS32142	10	6	1,038,960	0.1404	0.0036	0.0000	0.0000	0.0709	401
DS31065	10	153	456,840	0.1391	0.0036	0.0000	0.0000	0.0703	402
DS31306	10	177	531,510	0.1073	0.0802	0.0000	0.0000	0.0697	403
DS30975	8	328	687,629	0.1377	0.0036	0.0000	0.0000	0.0696	404
DS31645	6	605	79,500	0.1375	0.0036	0.0000	0.0000	0.0695	405
DS31073	8	375	415,056	0.1374	0.0036	0.0000	0.0000	0.0694	406
DS31024	10	274	1,006,908	0.1371	0.0036	0.0000	0.0000	0.0693	407
DS31600	8	232	52,135	0.0086	0.3225	0.0000	0.0000	0.0688	408
DS31585	8	1,659	67,574	0.0082	0.3225	0.0000	0.0000	0.0686	409
DS31092	10	110	400,308	0.1357	0.0036	0.0000	0.0000	0.0686	410
DS31111	8	28	672,665	0.0806	0.1414	0.0000	0.0000	0.0686	411
DS31647	8	528	85,238	0.1356	0.0036	0.0000	0.0000	0.0685	412
DS31982	6	197	617,868	0.0804	0.1414	0.0000	0.0000	0.0685	413
DS32251	8	9	109,158	0.0079	0.3225	0.0000	0.0000	0.0684	414
DS31547	8	983	287,291	0.1351	0.0036	0.0000	0.0000	0.0683	415
DS31059	10	1,238	365,775	0.1344	0.0036	0.0000	0.0000	0.0679	416
DS31304	8	18	516,212	0.1031	0.0802	0.0000	0.0000	0.0676	417
DS30980	6	272	656,736	0.1336	0.0036	0.0000	0.0000	0.0675	418
DS31323	6	971	292,706	0.1027	0.0802	0.0000	0.0000	0.0674	419
DS30962	8	134	816,943	0.1027	0.0802	0.0000	0.0000	0.0674	420
DS31589	2	92	34,671	0.0056	0.3225	0.0000	0.0000	0.0673	421
DS32038	6	165	455,184	0.0527	0.0036	0.4009	0.0000	0.0672	422
DS32013	8	203	581,033	0.0775	0.1414	0.0000	0.0000	0.0670	423
DS31167	10	377	1,012,428	0.1325	0.0036	0.0000	0.0000	0.0670	424
DS31276	8	372	840,032	0.1324	0.0036	0.0000	0.0000	0.0669	425
DS30964	8	224	788,880	0.1318	0.0036	0.0000	0.0000	0.0666	426
DS31337	8	706	376,457	0.1316	0.0036	0.0000	0.0000	0.0665	427
DS31693	6	155	417,915	0.0513	0.0036	0.4009	0.0000	0.0665	428
DS31334	8	391	388,714	0.1308	0.0036	0.0000	0.0000	0.0661	429
DS30933	8	694	550,834	0.0564	0.1414	0.0939	0.0000	0.0659	430
DS31305	8	37	499,454	0.0984	0.0802	0.0000	0.0000	0.0652	431
DS32164	6	32	563,210	0.0981	0.0802	0.0000	0.0000	0.0651	432
DS31336	8	491	336,600	0.1287	0.0036	0.0000	0.0000	0.0651	433
DS31590	2	131	13,233	0.0010	0.3225	0.0000	0.0000	0.0650	434
DS31592	2	105	13,129	0.0010	0.3225	0.0000	0.0000	0.0650	435
DS31320	6	401	488,124	0.0976	0.0802	0.0000	0.0000	0.0649	436

Note: Pipes with identical Consequence of Failure Scores were prioritized according to their flooding intensities.

Pipe Information			Consequence of Failure Evaluation Results						FINAL RANK
				Impact Category				Consequence of Failure Impact Score	
Pipe ID	Diameter (in)	Length (ft)	Flooding Intensity (gal)	Health & Safety	Transportation	Business	System Operations		
DS31083	10	484	469,044	0.1597	0.0036	0.0000	0.0000	0.0806	364
DS31084	10	377	472,284	0.1589	0.0036	0.0000	0.0000	0.0802	365
DS31016	8	20	987,294	0.1276	0.0802	0.0000	0.0000	0.0798	366
DS32061	6	47	812,669	0.0978	0.1414	0.0254	0.0000	0.0798	367
DS31085	10	2,451	415,193	0.1566	0.0036	0.0000	0.0000	0.0790	368
DS31148	10	1,148	435,405	0.1561	0.0036	0.0000	0.0000	0.0788	369
DS31071	10	231	474,836	0.1556	0.0036	0.0000	0.0000	0.0785	370
DS30977	6	200	854,508	0.1539	0.0036	0.0000	0.0000	0.0776	371
DS32136	8	252	926,426	0.1232	0.0802	0.0000	0.0000	0.0776	372
DS32054	6	348	580,493	0.0556	0.1414	0.2132	0.0000	0.0774	373
DS32156	6	31	1,055,400	0.1226	0.0802	0.0000	0.0000	0.0773	374
DS36145	8	433	414,312	0.1531	0.0036	0.0000	0.0000	0.0773	375
DS32057	6	126	733,950	0.0741	0.1414	0.1193	0.0000	0.0773	376
DS31162	10	261	1,298,772	0.1531	0.0036	0.0000	0.0000	0.0773	377
DS32033	10	218	960,768	0.1485	0.0036	0.0166	0.0000	0.0766	378
DS31091	10	222	465,710	0.1501	0.0036	0.0000	0.0000	0.0758	379
DS30873	8	44	926,545	0.1192	0.0802	0.0000	0.0000	0.0756	380
DS33665	8	372	415,608	0.1490	0.0036	0.0000	0.0000	0.0752	381
DS42752	6	185	752,261	0.0923	0.1414	0.0000	0.0000	0.0745	382
DS31567	8	523	386,261	0.1471	0.0036	0.0000	0.0000	0.0743	383
DS31064	10	326	468,113	0.1470	0.0036	0.0000	0.0000	0.0742	384
DS31043	10	117	1,061,280	0.1459	0.0036	0.0000	0.0000	0.0737	385
DS31699	8	153	549,810	0.0710	0.1414	0.0986	0.0000	0.0736	386
DS31063	10	555	493,425	0.1457	0.0036	0.0000	0.0000	0.0736	387
DS31601	12	56	100,181	0.0177	0.3225	0.0000	0.0000	0.0733	388
D600342	10	1,997	101,220	0.0174	0.3225	0.0000	0.0000	0.0732	389
D600347	8	183	101,042	0.0168	0.3225	0.0000	0.0000	0.0729	390
DS30937	8	19	646,170	0.0700	0.1414	0.0939	0.0000	0.0727	391
DS31316	8	264	600,212	0.1120	0.0802	0.0000	0.0000	0.0720	392
DS32201	10	21	462,524	0.1423	0.0036	0.0000	0.0000	0.0719	393
DS30932	6	12	636,370	0.0682	0.1414	0.0939	0.0000	0.0718	394
DS32143	10	24	1,040,100	0.1419	0.0036	0.0000	0.0000	0.0717	395
DS31072	8	270	412,080	0.1416	0.0036	0.0000	0.0000	0.0715	396
DS32067	6	105	765,744	0.0862	0.1414	0.0000	0.0000	0.0714	397
DS33117	6	820	336,728	0.0470	0.1414	0.1939	0.0000	0.0712	398
DS30963	8	231	887,661	0.1103	0.0802	0.0000	0.0000	0.0712	399
DS42750	10	193	469,679	0.1407	0.0036	0.0000	0.0000	0.0711	400
DS32142	10	6	1,038,960	0.1404	0.0036	0.0000	0.0000	0.0709	401
DS31065	10	153	456,840	0.1391	0.0036	0.0000	0.0000	0.0703	402
DS31306	10	177	531,510	0.1073	0.0802	0.0000	0.0000	0.0697	403
DS30975	8	328	687,629	0.1377	0.0036	0.0000	0.0000	0.0696	404
DS31645	6	605	79,500	0.1375	0.0036	0.0000	0.0000	0.0695	405
DS31073	8	375	415,056	0.1374	0.0036	0.0000	0.0000	0.0694	406
DS31024	10	274	1,006,908	0.1371	0.0036	0.0000	0.0000	0.0693	407
DS31600	8	232	52,135	0.0086	0.3225	0.0000	0.0000	0.0688	408
DS31585	8	1,659	67,574	0.0082	0.3225	0.0000	0.0000	0.0686	409
DS31092	10	110	400,308	0.1357	0.0036	0.0000	0.0000	0.0686	410
DS31111	8	28	672,665	0.0806	0.1414	0.0000	0.0000	0.0686	411
DS31647	8	528	85,238	0.1356	0.0036	0.0000	0.0000	0.0685	412
DS31982	6	197	617,868	0.0804	0.1414	0.0000	0.0000	0.0685	413
DS32251	8	9	109,158	0.0079	0.3225	0.0000	0.0000	0.0684	414
DS31547	8	983	287,291	0.1351	0.0036	0.0000	0.0000	0.0683	415
DS31059	10	1,238	365,775	0.1344	0.0036	0.0000	0.0000	0.0679	416
DS31304	8	18	516,212	0.1031	0.0802	0.0000	0.0000	0.0676	417
DS30980	6	272	656,736	0.1336	0.0036	0.0000	0.0000	0.0675	418
DS31323	6	971	292,706	0.1027	0.0802	0.0000	0.0000	0.0674	419
DS30962	8	134	816,943	0.1027	0.0802	0.0000	0.0000	0.0674	420
DS31589	2	92	34,671	0.0056	0.3225	0.0000	0.0000	0.0673	421
DS32038	6	165	455,184	0.0527	0.0036	0.4009	0.0000	0.0672	422
DS32013	8	203	581,033	0.0775	0.1414	0.0000	0.0000	0.0670	423
DS31167	10	377	1,012,428	0.1325	0.0036	0.0000	0.0000	0.0670	424
DS31276	8	372	840,032	0.1324	0.0036	0.0000	0.0000	0.0669	425
DS30964	8	224	788,880	0.1318	0.0036	0.0000	0.0000	0.0666	426
DS31337	8	706	376,457	0.1316	0.0036	0.0000	0.0000	0.0665	427
DS31693	6	155	417,915	0.0513	0.0036	0.4009	0.0000	0.0665	428
DS31334	8	391	388,714	0.1308	0.0036	0.0000	0.0000	0.0661	429
DS30933	8	694	550,834	0.0564	0.1414	0.0939	0.0000	0.0659	430
DS31305	8	37	499,454	0.0984	0.0802	0.0000	0.0000	0.0652	431
DS32164	6	32	563,210	0.0981	0.0802	0.0000	0.0000	0.0651	432
DS31336	8	491	336,600	0.1287	0.0036	0.0000	0.0000	0.0651	433
DS31590	2	131	13,233	0.0010	0.3225	0.0000	0.0000	0.0650	434
DS31592	2	105	13,129	0.0010	0.3225	0.0000	0.0000	0.0650	435
DS31320	6	401	488,124	0.0976	0.0802	0.0000	0.0000	0.0649	436

Note. Pipes with identical Consequence of Failure Scores were prioritized according to their flooding intensities.

Pipe Information			Consequence of Failure Evaluation Results						
				Impact Category					
Pipe ID	Diameter (in)	Length (ft)	Flooding Intensity (gal)	Health & Safety	Transportation	Business	System Operations	Consequence of Failure Impact Score	FINAL RANK
D531083	10	484	469,044	0.1597	0.0036	0.0000	0.0000	0.0806	364
D531084	10	377	472,284	0.1589	0.0036	0.0000	0.0000	0.0802	365
D531016	8	20	987,294	0.1276	0.0802	0.0000	0.0000	0.0798	366
D532061	6	47	812,669	0.0978	0.1414	0.0254	0.0000	0.0798	367
D531085	10	2,451	415,193	0.1566	0.0036	0.0000	0.0000	0.0790	368
D531148	10	1,148	435,405	0.1561	0.0036	0.0000	0.0000	0.0788	369
D531071	10	231	474,836	0.1556	0.0036	0.0000	0.0000	0.0785	370
D530977	6	200	854,508	0.1539	0.0036	0.0000	0.0000	0.0776	371
D532136	8	252	926,426	0.1232	0.0802	0.0000	0.0000	0.0776	372
D532054	6	348	580,493	0.0556	0.1414	0.2132	0.0000	0.0774	373
D532156	6	31	1,055,400	0.1226	0.0802	0.0000	0.0000	0.0773	374
D536145	8	433	414,312	0.1531	0.0036	0.0000	0.0000	0.0773	375
D532057	6	126	733,950	0.0741	0.1414	0.1193	0.0000	0.0773	376
D531162	10	261	1,298,772	0.1531	0.0036	0.0000	0.0000	0.0773	377
D532033	10	218	960,768	0.1485	0.0036	0.0166	0.0000	0.0766	378
D531091	10	222	465,710	0.1501	0.0036	0.0000	0.0000	0.0758	379
D530873	8	44	926,545	0.1192	0.0802	0.0000	0.0000	0.0756	380
D533665	8	372	415,608	0.1490	0.0036	0.0000	0.0000	0.0752	381
D542752	6	185	752,261	0.0923	0.1414	0.0000	0.0000	0.0745	382
D531567	8	523	386,261	0.1471	0.0036	0.0000	0.0000	0.0743	383
D531064	10	326	468,113	0.1470	0.0036	0.0000	0.0000	0.0742	384
D531043	10	117	1,061,280	0.1459	0.0036	0.0000	0.0000	0.0737	385
D531699	8	153	549,810	0.0710	0.1414	0.0986	0.0000	0.0736	386
D531063	10	555	493,425	0.1457	0.0036	0.0000	0.0000	0.0736	387
D531601	12	56	100,181	0.0177	0.3225	0.0000	0.0000	0.0733	388
D600342	10	1,997	101,220	0.0174	0.3225	0.0000	0.0000	0.0732	389
D600347	8	183	101,042	0.0168	0.3225	0.0000	0.0000	0.0729	390
D530937	8	19	646,170	0.0700	0.1414	0.0939	0.0000	0.0727	391
D531316	8	264	600,212	0.1120	0.0802	0.0000	0.0000	0.0720	392
D532201	10	21	462,524	0.1423	0.0036	0.0000	0.0000	0.0719	393
D530932	6	12	636,370	0.0682	0.1414	0.0939	0.0000	0.0718	394
D532143	10	24	1,040,100	0.1419	0.0036	0.0000	0.0000	0.0717	395
D531072	8	270	412,080	0.1416	0.0036	0.0000	0.0000	0.0715	396
D532067	6	105	765,744	0.0862	0.1414	0.0000	0.0000	0.0714	397
D533117	6	820	336,728	0.0470	0.1414	0.1939	0.0000	0.0712	398
D530963	8	231	887,661	0.1103	0.0802	0.0000	0.0000	0.0712	399
D542750	10	193	469,679	0.1407	0.0036	0.0000	0.0000	0.0711	400
D532142	10	6	1,038,960	0.1404	0.0036	0.0000	0.0000	0.0709	401
D531065	10	153	456,840	0.1391	0.0036	0.0000	0.0000	0.0703	402
D531306	10	177	531,510	0.1073	0.0802	0.0000	0.0000	0.0697	403
D530975	8	328	687,629	0.1377	0.0036	0.0000	0.0000	0.0696	404
D531645	6	605	79,500	0.1375	0.0036	0.0000	0.0000	0.0695	405
D531073	8	375	415,056	0.1374	0.0036	0.0000	0.0000	0.0694	406
D531024	10	274	1,006,908	0.1371	0.0036	0.0000	0.0000	0.0693	407
D531600	8	232	52,135	0.0086	0.3225	0.0000	0.0000	0.0688	408
D531585	8	1,659	67,574	0.0082	0.3225	0.0000	0.0000	0.0686	409
D531092	10	110	400,308	0.1357	0.0036	0.0000	0.0000	0.0686	410
D531111	8	28	672,665	0.0806	0.1414	0.0000	0.0000	0.0686	411
D531647	8	528	85,238	0.1356	0.0036	0.0000	0.0000	0.0685	412
D531982	6	197	617,868	0.0804	0.1414	0.0000	0.0000	0.0685	413
D532251	8	9	109,158	0.0079	0.3225	0.0000	0.0000	0.0684	414
D531547	8	983	287,291	0.1351	0.0036	0.0000	0.0000	0.0683	415
D531059	10	1,238	365,775	0.1344	0.0036	0.0000	0.0000	0.0679	416
D531304	8	18	516,212	0.1031	0.0802	0.0000	0.0000	0.0676	417
D530980	6	272	656,736	0.1336	0.0036	0.0000	0.0000	0.0675	418
D531323	6	971	292,706	0.1027	0.0802	0.0000	0.0000	0.0674	419
D530962	8	134	816,943	0.1027	0.0802	0.0000	0.0000	0.0674	420
D531589	2	92	34,671	0.0056	0.3225	0.0000	0.0000	0.0673	421
D532038	6	165	455,184	0.0527	0.0036	0.4009	0.0000	0.0672	422
D532013	8	203	581,033	0.0775	0.1414	0.0000	0.0000	0.0670	423
D531167	10	377	1,012,428	0.1325	0.0036	0.0000	0.0000	0.0670	424
D531276	8	372	840,032	0.1324	0.0036	0.0000	0.0000	0.0669	425
D530964	8	224	788,880	0.1318	0.0036	0.0000	0.0000	0.0666	426
D531337	8	706	376,457	0.1316	0.0036	0.0000	0.0000	0.0665	427
D531693	6	155	417,915	0.0513	0.0036	0.4009	0.0000	0.0665	428
D531334	8	391	388,714	0.1308	0.0036	0.0000	0.0000	0.0661	429
D530933	8	694	550,834	0.0564	0.1414	0.0939	0.0000	0.0659	430
D531305	8	37	499,454	0.0984	0.0802	0.0000	0.0000	0.0652	431
D532164	6	32	563,210	0.0981	0.0802	0.0000	0.0000	0.0651	432
D531336	8	491	336,600	0.1287	0.0036	0.0000	0.0000	0.0651	433
D531590	2	131	13,233	0.0010	0.3225	0.0000	0.0000	0.0650	434
D531592	2	105	13,129	0.0010	0.3225	0.0000	0.0000	0.0650	435
D531320	6	401	488,124	0.0976	0.0802	0.0000	0.0000	0.0649	436

Note: Pipes with Identical Consequence of Failure Scores were prioritized according to their flooding intensities.

Pipe Information			Consequence of Failure Evaluation Results						
				Impact Category					
Pipe ID	Diameter (in)	Length (ft)	Flooding Intensity (gal)	Health & Safety	Transportation	Business	System Operations	Consequence of Failure Impact Score	FINAL RANK
DS31914	8	65	389,880	0.0718	0.0802	0.0000	0.0000	0.0519	510
DS36143	8	790	405,059	0.0471	0.1414	0.0000	0.0000	0.0519	511
DS32169	8	257	501,857	0.1022	0.0036	0.0000	0.0000	0.0518	512
DS32025	8	12	657,552	0.1021	0.0036	0.0000	0.0000	0.0518	513
DS31192	8	39	629,423	0.0712	0.0802	0.0000	0.0000	0.0516	514
DS31654	8	509	87,355	0.1014	0.0036	0.0000	0.0000	0.0514	515
DS31303	8	305	353,462	0.0708	0.0802	0.0000	0.0000	0.0514	516
DS32163	6	38	846,651	0.1011	0.0036	0.0000	0.0000	0.0513	517
DS31553	8	285	255,818	0.1009	0.0036	0.0000	0.0000	0.0512	518
DS31930	8	10	615,429	0.0695	0.0802	0.0000	0.0000	0.0508	519
DS32026	8	20	632,289	0.0996	0.0036	0.0027	0.0000	0.0508	520
DS31191	8	119	603,697	0.0695	0.0802	0.0000	0.0000	0.0508	521
DS31966	8	407	662,008	0.0991	0.0036	0.0000	0.0000	0.0503	522
DS31947	8	382	602,034	0.0985	0.0036	0.0000	0.0000	0.0500	523
DS30883	8	373	555,128	0.0984	0.0036	0.0000	0.0000	0.0499	524
DS32280	8	18	385,455	0.0677	0.0802	0.0000	0.0000	0.0499	525
DS32035	6	172	441,252	0.0587	0.0036	0.1959	0.0000	0.0496	526
DS31962	8	56	663,642	0.0976	0.0036	0.0000	0.0000	0.0495	527
T602850	8	2	941,525	0.0989	0.0000	0.0000	0.0000	0.0495	528
DS31023	8	195	782,988	0.0974	0.0036	0.0000	0.0000	0.0494	529
DS33666	8	714	378,276	0.0974	0.0036	0.0000	0.0000	0.0494	530
DS31333	8	479	475,220	0.0972	0.0036	0.0000	0.0000	0.0493	531
DS32193	6	6	343,317	0.0357	0.0036	0.3070	0.0000	0.0493	532
DS31262	6	48	573,203	0.0665	0.0802	0.0000	0.0000	0.0493	533
DS30924	6	654	371,735	0.0413	0.1414	0.0000	0.0000	0.0489	534
DS42707	10	339	343,335	0.0964	0.0036	0.0000	0.0000	0.0489	535
DS33676	8	203	417,396	0.0962	0.0036	0.0000	0.0000	0.0488	536
DS31586	8	65	90,636	0.0409	0.1414	0.0000	0.0000	0.0487	537
DS32875	6	24	612,476	0.0653	0.0802	0.0000	0.0000	0.0487	538
DS31923	12	140	759,423	0.0972	0.0000	0.0000	0.0000	0.0486	539
T602856	8	20	922,194	0.0971	0.0000	0.0000	0.0000	0.0485	540
DS31868	8	105	502,703	0.0747	0.0036	0.1033	0.0000	0.0484	541
DS32888	6	376	433,237	0.0646	0.0802	0.0000	0.0000	0.0483	542
DS31664	6	314	74,993	0.0944	0.0036	0.0000	0.0000	0.0479	543
DS30897	8	35	736,649	0.0940	0.0036	0.0000	0.0000	0.0477	544
DS32129	6	20	870,240	0.0942	0.0000	0.0000	0.0000	0.0471	545
DS30896	8	156	712,567	0.0925	0.0036	0.0000	0.0000	0.0470	546
DS31842	8	36	732,228	0.0925	0.0036	0.0000	0.0000	0.0470	547
DS31004	8	566	640,229	0.0618	0.0802	0.0000	0.0000	0.0469	548
DS32887	6	33	479,324	0.0613	0.0802	0.0000	0.0000	0.0467	549
DS31583	8	1,183	177,068	0.0610	0.0802	0.0000	0.0000	0.0465	550
DS32885	6	175	511,658	0.0608	0.0802	0.0000	0.0000	0.0464	551
DS33667	8	596	374,160	0.0911	0.0036	0.0000	0.0000	0.0463	552
DS31591	12	10	466,830	0.0356	0.1414	0.0000	0.0000	0.0461	553
DS42711	8	1,215	374,475	0.0904	0.0036	0.0000	0.0000	0.0459	554
DS31700	6	305	471,045	0.0501	0.0036	0.2010	0.0000	0.0459	555
DS31957	8	420	576,954	0.0902	0.0036	0.0000	0.0000	0.0458	556
DS31010	8	1,265	304,620	0.0312	0.0802	0.1408	0.0000	0.0457	557
DS32032	6	859	537,084	0.0866	0.0036	0.0166	0.0000	0.0457	558
DS34824	8	91	520,913	0.0696	0.0036	0.1006	0.0000	0.0456	559
DS31977	8	353	592,416	0.0896	0.0036	0.0000	0.0000	0.0455	560
DS31843	8	17	722,841	0.0895	0.0036	0.0000	0.0000	0.0455	561
DS31347	8	464	583,831	0.0895	0.0036	0.0000	0.0000	0.0455	562
DS32008	6	227	282,465	0.0342	0.1414	0.0000	0.0000	0.0454	563
DS31696	8	359	515,415	0.0684	0.0036	0.1031	0.0000	0.0452	564
DS31819	8	201	678,426	0.0890	0.0036	0.0000	0.0000	0.0452	565
DS31653	8	166	84,575	0.0886	0.0036	0.0000	0.0000	0.0450	566
DS31665	6	137	84,898	0.0885	0.0036	0.0000	0.0000	0.0450	567
DS33671	8	321	375,792	0.0885	0.0036	0.0000	0.0000	0.0450	568
DS31711	8	298	422,700	0.0884	0.0036	0.0000	0.0000	0.0449	569
DS31234	8	672	420,743	0.0576	0.0802	0.0000	0.0000	0.0448	570
DS30908	8	363	668,914	0.0879	0.0036	0.0000	0.0000	0.0447	571
DS42704	10	501	340,920	0.0878	0.0036	0.0000	0.0000	0.0446	572
DS31849	8	18	827,474	0.0876	0.0036	0.0000	0.0000	0.0445	573
DS32871	6	30	442,536	0.0570	0.0802	0.0000	0.0000	0.0445	574
DS31058	6	8	463,824	0.0890	0.0000	0.0000	0.0000	0.0445	575
DS35869	6	118	75,098	0.0875	0.0036	0.0000	0.0000	0.0445	576
DS30882	8	136	711,212	0.0874	0.0036	0.0000	0.0000	0.0444	577
DS42705	10	1,321	335,145	0.0873	0.0036	0.0000	0.0000	0.0444	578
DS30971	8	246	571,440	0.0872	0.0036	0.0000	0.0000	0.0443	579
DS31844	8	354	736,197	0.0869	0.0036	0.0000	0.0000	0.0442	580
DS36147	8	177	379,740	0.0562	0.0802	0.0000	0.0000	0.0442	581
DS30959	8	55	458,115	0.0562	0.0802	0.0000	0.0000	0.0442	582

Note: Pipes with identical Consequence of Failure Scores were prioritized according to their flooding intensities.

Pipe Information			Consequence of Failure Evaluation Results						FINAL RANK
				Impact Category					
Pipe ID	Diameter (in)	Length (ft)	Flooding Intensity (gal)	Health & Safety	Transportation	Business	System Operations	Consequence of Failure Impact Score	
D531104	8	435	621,852	0.0721	0.1414	0.0000	0.0000	0.0643	437
D531074	6	61	316,649	0.1270	0.0036	0.0000	0.0000	0.0642	438
D530931	8	652	441,201	0.0526	0.1414	0.0939	0.0000	0.0640	439
D536149	12	4	1,032,402	0.1275	0.0000	0.0000	0.0000	0.0637	440
D531649	8	99	86,985	0.1260	0.0036	0.0000	0.0000	0.0637	441
D531310	8	83	479,892	0.0944	0.0802	0.0000	0.0000	0.0632	442
D532199	8	22	408,864	0.1244	0.0036	0.0000	0.0000	0.0629	443
D531661	8	129	88,587	0.1240	0.0036	0.0000	0.0000	0.0627	444
D530982	6	490	558,888	0.1239	0.0036	0.0000	0.0000	0.0627	445
D543110	8	12	867,395	0.1233	0.0036	0.0000	0.0000	0.0623	446
D533108	6	9	610,879	0.0736	0.0802	0.0946	0.0000	0.0623	447
D531009	8	169	713,788	0.0923	0.0802	0.0000	0.0000	0.0622	448
D531155	10	507	934,659	0.1225	0.0036	0.0000	0.0000	0.0620	449
D531335	8	167	386,206	0.1221	0.0036	0.0000	0.0000	0.0618	450
D531975	8	84	773,917	0.1234	0.0000	0.0000	0.0000	0.0617	451
D531606	8	349	512,828	0.0640	0.0036	0.2884	0.0000	0.0616	452
D531651	8	544	75,966	0.1214	0.0036	0.0000	0.0000	0.0614	453
D532072	8	128	585,897	0.0661	0.1414	0.0000	0.0000	0.0613	454
D532068	8	476	579,338	0.0656	0.1414	0.0000	0.0000	0.0611	455
D531847	10	191	889,508	0.1203	0.0036	0.0000	0.0000	0.0609	456
D532116	8	223	782,075	0.1200	0.0036	0.0000	0.0000	0.0607	457
D542760	12	13	940,776	0.1190	0.0036	0.0000	0.0000	0.0602	458
D542757	12	4	913,068	0.1186	0.0036	0.0000	0.0000	0.0600	459
D531082	6	231	299,556	0.1185	0.0036	0.0000	0.0000	0.0600	460
D542759	12	24	932,220	0.1182	0.0036	0.0000	0.0000	0.0598	461
D542756	12	24	911,040	0.1180	0.0000	0.0000	0.0000	0.0590	462
D542758	12	644	917,988	0.1165	0.0036	0.0000	0.0000	0.0590	463
D531846	8	749	626,262	0.0848	0.0802	0.0000	0.0000	0.0585	464
D531314	6	730	373,842	0.0846	0.0802	0.0000	0.0000	0.0583	465
D531025	8	36	862,124	0.1149	0.0036	0.0000	0.0000	0.0582	466
D531109	6	89	496,562	0.0597	0.1414	0.0000	0.0000	0.0581	467
D532027	8	8	663,831	0.1146	0.0036	0.0000	0.0000	0.0580	468
D531089	10	758	418,811	0.1145	0.0036	0.0000	0.0000	0.0580	469
D531663	8	203	77,070	0.1145	0.0036	0.0000	0.0000	0.0580	470
D532028	8	23	651,431	0.1140	0.0036	0.0000	0.0000	0.0577	471
D531848	8	16	899,798	0.1130	0.0036	0.0000	0.0000	0.0572	472
D531188	8	361	636,557	0.0816	0.0802	0.0000	0.0000	0.0569	473
D531060	12	588	395,004	0.1118	0.0036	0.0000	0.0000	0.0566	474
D531184	6	117	486,312	0.0807	0.0802	0.0000	0.0000	0.0564	475
D531662	8	151	77,108	0.1113	0.0036	0.0000	0.0000	0.0564	476
D531576	8	428	574,114	0.0805	0.0802	0.0000	0.0000	0.0563	477
D531181	6	679	467,208	0.0805	0.0802	0.0000	0.0000	0.0563	478
D532064	6	659	449,831	0.0508	0.1414	0.0254	0.0000	0.0562	479
D531619	8	495	344,285	0.0306	0.0802	0.2478	0.0000	0.0561	480
T602848	10	7	1,162,044	0.1106	0.0036	0.0000	0.0000	0.0560	481
T603302	8	102	1,042,128	0.1117	0.0000	0.0000	0.0000	0.0559	482
D531643	6	673	79,500	0.1095	0.0036	0.0000	0.0000	0.0555	483
D532198	8	313	430,920	0.0292	0.0802	0.2478	0.0000	0.0554	484
D531038	8	216	846,626	0.1092	0.0036	0.0000	0.0000	0.0553	485
D532021	8	221	603,309	0.1086	0.0036	0.0000	0.0000	0.0550	486
D531582	8	921	169,095	0.0775	0.0802	0.0000	0.0000	0.0548	487
D530885	8	113	856,947	0.1080	0.0036	0.0000	0.0000	0.0547	488
D531380	6	658	310,644	0.1080	0.0036	0.0000	0.0000	0.0547	489
T600006	10	7	921,480	0.1095	0.0000	0.0000	0.0000	0.0547	490
D531289	6	151	296,730	0.1070	0.0036	0.0000	0.0000	0.0542	491
D534823	8	74	543,053	0.0860	0.0036	0.1031	0.0000	0.0540	492
D530934	6	735	278,401	0.0319	0.1414	0.0939	0.0000	0.0536	493
D531829	6	859	519,396	0.1024	0.0036	0.0166	0.0000	0.0536	494
D531910	8	463	376,403	0.0748	0.0802	0.0000	0.0000	0.0534	495
D535813	6	42	85,493	0.1051	0.0036	0.0000	0.0000	0.0533	496
D531588	8	548	69,752	0.0497	0.1414	0.0000	0.0000	0.0531	497
D531850	12	391	928,464	0.1046	0.0036	0.0000	0.0000	0.0530	498
D531648	6	85	82,710	0.1046	0.0036	0.0000	0.0000	0.0530	499
D531845	8	121	850,941	0.1045	0.0036	0.0000	0.0000	0.0530	500
D531869	8	75	501,885	0.0648	0.0036	0.1971	0.0000	0.0529	501
D542708	10	301	352,755	0.1041	0.0036	0.0000	0.0000	0.0528	502
D530950	6	256	402,259	0.0545	0.0802	0.0946	0.0000	0.0527	503
D530894	8	670	662,359	0.1034	0.0036	0.0000	0.0000	0.0524	504
D531963	8	173	665,865	0.1034	0.0036	0.0000	0.0000	0.0524	505
D531915	8	30	382,080	0.0726	0.0802	0.0000	0.0000	0.0524	506
D531618	8	200	392,133	0.0230	0.0802	0.2478	0.0000	0.0523	507
D532023	8	192	636,437	0.1026	0.0036	0.0000	0.0000	0.0520	508
D531132	8	752	391,417	0.0473	0.1414	0.0000	0.0000	0.0519	509

Note: Pipes with identical Consequence of Failure Scores were prioritized according to their flooding intensities.

Pipe Information			Consequence of Failure Evaluation Results						
				Impact Category					
Pipe ID	Diameter (in)	Length (ft)	Flooding Intensity (gal)	Health & Safety	Transportation	Business	System Operations	Consequence of Failure Impact Score	FINAL RANK
DS32869	8	27	450,893	0.0559	0.0802	0.0000	0.0000	0.0440	583
DS32872	6	26	425,502	0.0558	0.0802	0.0000	0.0000	0.0440	584
DS35329	6	10	449,288	0.0556	0.0802	0.0000	0.0000	0.0439	585
DS35330	6	13	448,110	0.0556	0.0802	0.0000	0.0000	0.0438	586
DS32886	6	247	428,562	0.0554	0.0802	0.0000	0.0000	0.0437	587
DS35331	6	31	440,918	0.0553	0.0802	0.0000	0.0000	0.0437	588
DS30874	8	353	628,754	0.0859	0.0036	0.0000	0.0000	0.0437	589
DS32884	6	269	470,841	0.0551	0.0802	0.0000	0.0000	0.0436	590
DS31578	8	209	599,355	0.0548	0.0802	0.0000	0.0000	0.0434	591
DS30900	8	262	679,953	0.0854	0.0036	0.0000	0.0000	0.0434	592
DS31389	8	317	712,257	0.0850	0.0036	0.0000	0.0000	0.0432	593
DS33669	8	874	369,000	0.0848	0.0036	0.0000	0.0000	0.0431	594
DS32011	8	239	692,927	0.0845	0.0036	0.0000	0.0000	0.0430	595
DS41507	6	36	509,954	0.0845	0.0036	0.0000	0.0000	0.0430	596
DS32873	6	22	430,525	0.0525	0.0802	0.0000	0.0000	0.0423	597
DS31088	10	144	475,170	0.0830	0.0036	0.0000	0.0000	0.0422	598
DS31022	8	459	436,548	0.0523	0.0802	0.0000	0.0000	0.0422	599
T602860	8	34	855,341	0.0841	0.0000	0.0000	0.0000	0.0420	600
DS32882	6	347	423,848	0.0519	0.0802	0.0000	0.0000	0.0420	601
DS31694	6	157	404,678	0.0428	0.0036	0.1959	0.0000	0.0417	602
DS31701	6	205	460,972	0.0415	0.0036	0.2010	0.0000	0.0416	603
DS32050	6	308	518,460	0.0596	0.0036	0.1105	0.0000	0.0416	604
DS32037	6	433	399,832	0.0629	0.0036	0.0939	0.0000	0.0415	605
DS35332	8	470	396,368	0.0504	0.0802	0.0000	0.0000	0.0413	606
DS31222	8	730	496,409	0.0810	0.0036	0.0000	0.0000	0.0412	607
DS31998	8	240	548,331	0.0808	0.0036	0.0000	0.0000	0.0411	608
DS32000	8	233	693,977	0.0804	0.0036	0.0000	0.0000	0.0409	609
DS31090	6	193	291,072	0.0803	0.0036	0.0000	0.0000	0.0409	610
DS30960	6	357	423,491	0.0495	0.0802	0.0000	0.0000	0.0408	611
DS31011	8	687	564,154	0.0801	0.0036	0.0000	0.0000	0.0408	612
DS31349	6	185	400,482	0.0800	0.0036	0.0000	0.0000	0.0407	613
DS31613	8	335	368,708	0.0366	0.0802	0.0601	0.0000	0.0404	614
DS30957	6	46	379,670	0.0481	0.0802	0.0000	0.0000	0.0401	615
DS31062	10	11	492,060	0.0785	0.0036	0.0000	0.0000	0.0400	616
DS31911	8	11	380,010	0.0470	0.0802	0.0000	0.0000	0.0395	617
DS31996	8	226	705,716	0.0775	0.0036	0.0000	0.0000	0.0395	618
T602866	8	24	787,532	0.0788	0.0000	0.0000	0.0000	0.0394	619
DS31667	8	726	73,523	0.0770	0.0036	0.0000	0.0000	0.0392	620
DS42710	8	313	327,120	0.0769	0.0036	0.0000	0.0000	0.0392	621
DS35654	6	294	287,925	0.0562	0.0036	0.1031	0.0000	0.0391	622
DS32076	6	115	539,427	0.0766	0.0036	0.0000	0.0000	0.0390	623
DS31967	8	131	555,728	0.0763	0.0036	0.0000	0.0000	0.0389	624
DS31851	6	738	435,048	0.0762	0.0036	0.0000	0.0000	0.0388	625
DS33105	6	19	391,283	0.0454	0.0802	0.0000	0.0000	0.0387	626
DS31979	8	317	473,399	0.0759	0.0036	0.0000	0.0000	0.0387	627
DS31828	6	124	672,660	0.0726	0.0036	0.0166	0.0000	0.0387	628
DS42709	8	298	325,875	0.0754	0.0036	0.0000	0.0000	0.0384	629
DS31157	6	866	420,696	0.0751	0.0036	0.0000	0.0000	0.0383	630
DS31020	6	60	358,019	0.0442	0.0802	0.0000	0.0000	0.0381	631
DS31918	6	123	421,635	0.0439	0.0802	0.0000	0.0000	0.0380	632
DS31929	12	20	757,575	0.0758	0.0000	0.0000	0.0000	0.0379	633
DS42706	8	263	319,305	0.0741	0.0036	0.0000	0.0000	0.0378	634
DS30955	6	376	332,415	0.0432	0.0802	0.0008	0.0000	0.0377	635
DS32016	8	307	532,399	0.0738	0.0036	0.0000	0.0000	0.0376	636
DS31559	8	503	386,745	0.0738	0.0036	0.0000	0.0000	0.0376	637
DS42712	8	420	321,795	0.0736	0.0036	0.0000	0.0000	0.0375	638
DS35639	6	248	312,323	0.0525	0.0036	0.1006	0.0000	0.0370	639
DS31695	8	29	522,615	0.0711	0.0036	0.0067	0.0000	0.0369	640
DS32151	2	48	156,300	0.0171	0.1414	0.0000	0.0000	0.0368	641
DS32137	8	55	567,323	0.0720	0.0036	0.0000	0.0000	0.0367	642
DS31841	6	18	664,052	0.0719	0.0036	0.0000	0.0000	0.0367	643
DS32001	8	351	676,904	0.0717	0.0036	0.0000	0.0000	0.0366	644
DS32112	8	1,009	388,073	0.0713	0.0036	0.0000	0.0000	0.0364	645
DS42755	6	18	360,910	0.0712	0.0036	0.0000	0.0000	0.0363	646
DS33668	6	122	362,580	0.0708	0.0036	0.0000	0.0000	0.0361	647
DS31714	6	1,155	316,855	0.0489	0.0036	0.1071	0.0000	0.0359	648
DS31603	12	20	99,677	0.0148	0.1414	0.0000	0.0000	0.0357	649
DS31857	8	22	519,767	0.0698	0.0036	0.0000	0.0000	0.0356	650
DS31249	6	265	297,382	0.0391	0.0802	0.0000	0.0000	0.0356	651
DS32018	8	298	541,310	0.0697	0.0036	0.0000	0.0000	0.0356	652
DS30902	8	279	629,655	0.0696	0.0036	0.0000	0.0000	0.0355	653
DS31864	6	194	272,190	0.0297	0.0036	0.1971	0.0000	0.0353	654
DS32175	8	251	586,755	0.0685	0.0036	0.0000	0.0000	0.0350	655

Note: Pipes with identical Consequence of Failure Scores were prioritized according to their flooding intensities.

Pipe Information			Consequence of Failure Evaluation Results						
				Impact Category					
Pipe ID	Diameter (in)	Length (ft)	Flooding Intensity (gal)	Health & Safety	Transportation	Business	System Operations	Consequence of Failure Impact Score	FINAL RANK
D531702	6	324	347,854	0.0468	0.0036	0.1071	0.0000	0.0348	656
D532109	8	339	484,891	0.0680	0.0036	0.0000	0.0000	0.0347	657
D532009	8	350	680,558	0.0679	0.0036	0.0000	0.0000	0.0347	658
D531952	8	62	509,116	0.0675	0.0036	0.0000	0.0000	0.0345	659
D533675	8	427	365,856	0.0670	0.0036	0.0000	0.0000	0.0342	660
T602878	4	10	536,220	0.0680	0.0000	0.0000	0.0000	0.0340	661
D531287	6	93	273,848	0.0661	0.0036	0.0000	0.0000	0.0338	662
D531858	8	20	482,741	0.0660	0.0036	0.0000	0.0000	0.0337	663
D532106	8	330	468,274	0.0660	0.0036	0.0000	0.0000	0.0337	664
D531375	8	313	546,083	0.0658	0.0036	0.0000	0.0000	0.0336	665
D531338	6	65	359,210	0.0656	0.0036	0.0000	0.0000	0.0335	666
D531273	6	409	391,409	0.0656	0.0036	0.0000	0.0000	0.0335	667
D531853	6	648	435,444	0.0656	0.0036	0.0000	0.0000	0.0335	668
D531364	6	430	413,018	0.0654	0.0036	0.0000	0.0000	0.0334	669
D531872	6	326	497,988	0.0651	0.0036	0.0000	0.0000	0.0333	670
D531883	6	533	486,720	0.0650	0.0036	0.0000	0.0000	0.0332	671
D532196	8	1,007	436,170	0.0650	0.0036	0.0000	0.0000	0.0332	672
D531348	6	139	496,026	0.0646	0.0036	0.0000	0.0000	0.0330	673
D531202	6	61	596,709	0.0646	0.0036	0.0000	0.0000	0.0330	674
D532014	8	296	543,391	0.0644	0.0036	0.0000	0.0000	0.0329	675
D531925	12	92	729,467	0.0658	0.0000	0.0000	0.0000	0.0329	676
D531311	8	919	264,019	0.0334	0.0802	0.0000	0.0000	0.0327	677
D531710	8	8	420,968	0.0639	0.0036	0.0000	0.0000	0.0327	678
D531028	8	287	438,648	0.0638	0.0036	0.0000	0.0000	0.0326	679
D531577	6	321	341,744	0.0330	0.0802	0.0000	0.0000	0.0325	680
D531579	6	75	368,524	0.0328	0.0802	0.0000	0.0000	0.0325	681
D532107	8	12	412,200	0.0633	0.0036	0.0000	0.0000	0.0324	682
D531302	6	161	232,605	0.0327	0.0802	0.0000	0.0000	0.0324	683
D531093	6	48	381,612	0.0631	0.0036	0.0000	0.0000	0.0323	684
D530952	6	345	311,648	0.0321	0.0802	0.0000	0.0000	0.0322	685
D531840	6	1,280	300,878	0.0627	0.0036	0.0000	0.0000	0.0320	686
D531341	8	61	545,078	0.0626	0.0036	0.0000	0.0000	0.0320	687
D531712	8	240	450,795	0.0624	0.0036	0.0000	0.0000	0.0319	688
D532174	8	46	456,212	0.0622	0.0036	0.0000	0.0000	0.0318	689
D531371	8	63	485,299	0.0620	0.0036	0.0000	0.0000	0.0317	690
D531235	8	118	469,613	0.0618	0.0036	0.0000	0.0000	0.0316	691
D532079	6	154	497,361	0.0617	0.0036	0.0000	0.0000	0.0316	692
D530948	8	224	433,643	0.0616	0.0036	0.0000	0.0000	0.0315	693
D531210	6	58	388,323	0.0616	0.0036	0.0000	0.0000	0.0315	694
D531920	8	61	738,539	0.0630	0.0000	0.0000	0.0000	0.0315	695
D531571	8	157	355,965	0.0615	0.0036	0.0000	0.0000	0.0315	696
D531855	8	243	469,379	0.0615	0.0036	0.0000	0.0000	0.0315	697
D532634	8	32	580,695	0.0614	0.0036	0.0000	0.0000	0.0314	698
D531557	8	291	358,036	0.0612	0.0036	0.0000	0.0000	0.0313	699
D532036	6	33	469,583	0.0608	0.0036	0.0000	0.0000	0.0311	700
D531789	6	176	59,175	0.0606	0.0036	0.0000	0.0000	0.0310	701
D531228	6	500	296,445	0.0298	0.0802	0.0000	0.0000	0.0309	702
D530951	4	587	105,032	0.0287	0.0802	0.0000	0.0000	0.0305	703
D531921	8	43	712,971	0.0609	0.0000	0.0000	0.0000	0.0304	704
D531880	6	357	421,867	0.0594	0.0036	0.0000	0.0000	0.0304	705
D531798	8	937	393,098	0.0594	0.0036	0.0000	0.0000	0.0304	706
D531165	6	869	350,268	0.0592	0.0036	0.0000	0.0000	0.0303	707
D531856	8	267	485,325	0.0589	0.0036	0.0000	0.0000	0.0301	708
D531209	6	194	346,834	0.0588	0.0036	0.0000	0.0000	0.0301	709
D531340	8	61	505,598	0.0587	0.0036	0.0000	0.0000	0.0301	710
D531237	6	22	559,731	0.0583	0.0036	0.0000	0.0000	0.0299	711
D531922	8	23	699,636	0.0597	0.0000	0.0000	0.0000	0.0299	712
D530943	4	583	78,071	0.0085	0.0802	0.0946	0.0000	0.0297	713
D532165	4	40	197,557	0.0274	0.0802	0.0000	0.0000	0.0297	714
D531342	8.3	481	485,145	0.0580	0.0036	0.0000	0.0000	0.0297	715
D530925	8	264	477,280	0.0580	0.0036	0.0000	0.0000	0.0297	716
D531292	6	401	239,745	0.0579	0.0036	0.0000	0.0000	0.0297	717
D533673	8	480	353,724	0.0578	0.0036	0.0000	0.0000	0.0296	718
D532034	6	240	430,610	0.0577	0.0036	0.0000	0.0000	0.0296	719
D531877	6	333	481,680	0.0577	0.0036	0.0000	0.0000	0.0296	720
D531161	6	228	427,188	0.0576	0.0036	0.0000	0.0000	0.0295	721
D531238	6	47	558,971	0.0575	0.0036	0.0000	0.0000	0.0295	722
D531909	6	181	238,230	0.0266	0.0802	0.0000	0.0000	0.0294	723
D531265	6	134	452,498	0.0572	0.0036	0.0000	0.0000	0.0293	724
D531263	6	437	364,931	0.0571	0.0036	0.0000	0.0000	0.0293	725
D531350	6	800	283,385	0.0571	0.0036	0.0000	0.0000	0.0293	726
D531331	6	127	289,315	0.0570	0.0036	0.0000	0.0000	0.0292	727
T600009	4	10	352,643	0.0583	0.0000	0.0000	0.0000	0.0291	728

Note: Pipes with identical Consequence of Failure Scores were prioritized according to their flooding intensities.

Pipe Information			Consequence of Failure Evaluation Results						FINAL RANK
			Flooding Intensity	Impact Category				Consequence of Failure Impact Score	
Pipe ID	Diameter (in)	Length (ft)	(gal)	Health & Safety	Transportation	Business	System Operations		
D532115	6	395	135,885	0.0127	0.0036	0.0000	0.0000	0.0071	1021
D531034	6	41	110,044	0.0125	0.0036	0.0000	0.0000	0.0070	1022
D531053	6	439	85,774	0.0124	0.0036	0.0000	0.0000	0.0069	1023
D544652	6	5	111,436	0.0123	0.0036	0.0000	0.0000	0.0069	1024
D530987	4	40	73,508	0.0123	0.0036	0.0000	0.0000	0.0069	1025
D531964	4	184	122,626	0.0123	0.0036	0.0000	0.0000	0.0069	1026
D531206	6	257	130,484	0.0121	0.0036	0.0000	0.0000	0.0068	1027
D531373	4	305	112,889	0.0117	0.0036	0.0000	0.0000	0.0066	1028
D531852	4	295	104,948	0.0117	0.0036	0.0000	0.0000	0.0066	1029
D603112	8	8	100,695	0.0116	0.0036	0.0000	0.0000	0.0065	1030
D603109	8	30	100,664	0.0116	0.0036	0.0000	0.0000	0.0065	1031
D603115	8	65	100,527	0.0116	0.0036	0.0000	0.0000	0.0065	1032
D539619	6	462	122,232	0.0112	0.0036	0.0000	0.0000	0.0063	1033
D531037	4	101	108,540	0.0121	0.0000	0.0000	0.0000	0.0060	1034
D531248	4	160	102,356	0.0106	0.0036	0.0000	0.0000	0.0060	1035
D531288	6	766	113,568	0.0106	0.0036	0.0000	0.0000	0.0060	1036
D531135	3	210	105,613	0.0103	0.0036	0.0000	0.0000	0.0059	1037
D533075	4	107	92,174	0.0103	0.0036	0.0000	0.0000	0.0059	1038
D532017	4	513	94,620	0.0100	0.0036	0.0000	0.0000	0.0057	1039
D531224	4	227	88,118	0.0099	0.0036	0.0000	0.0000	0.0057	1040
D530877	4	82	94,452	0.0095	0.0036	0.0000	0.0000	0.0055	1041
D531137	4	239	99,294	0.0095	0.0036	0.0000	0.0000	0.0055	1042
D531196	6	449	107,399	0.0094	0.0036	0.0000	0.0000	0.0054	1043
D532114	4	120	96,743	0.0093	0.0036	0.0000	0.0000	0.0054	1044
D531965	4	244	84,015	0.0091	0.0036	0.0000	0.0000	0.0053	1045
D532019	4	501	85,468	0.0091	0.0036	0.0000	0.0000	0.0053	1046
D530878	4	155	81,751	0.0104	0.0000	0.0000	0.0000	0.0052	1047
D531035	4	70	78,998	0.0088	0.0036	0.0000	0.0000	0.0051	1048
D531372	4	586	81,915	0.0087	0.0036	0.0000	0.0000	0.0051	1049
D531327	4	234	79,970	0.0086	0.0036	0.0000	0.0000	0.0050	1050
D531197	6	379	97,818	0.0085	0.0036	0.0000	0.0000	0.0050	1051
D532108	4	207	86,607	0.0081	0.0036	0.0000	0.0000	0.0048	1052
D531040	4	113	68,757	0.0077	0.0036	0.0000	0.0000	0.0046	1053
D531309	4	30	82,391	0.0077	0.0036	0.0000	0.0000	0.0046	1054
D531036	4	80	77,963	0.0087	0.0000	0.0000	0.0000	0.0043	1055
D531041	4	144	64,552	0.0069	0.0036	0.0000	0.0000	0.0042	1056
D531924	4	767	87,528	0.0081	0.0000	0.0000	0.0000	0.0040	1057
D531801	2	48	56,637	0.0052	0.0000	0.0000	0.0000	0.0026	1058
D531308	2	128	13,188	0.0019	0.0036	0.0000	0.0000	0.0016	1059
D531570	2	499	11,400	0.0012	0.0036	0.0000	0.0000	0.0013	1060
D531379	2	397	11,110	0.0010	0.0036	0.0000	0.0000	0.0012	1061

EXHIBIT D
Capital Improvement Plan

Asset Class/ Location	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Water Mains		$894,900		$1,392,400		$1,196,500	$888,300	$1,313,400	$683,900	$655,300
Air Release, Vent, & Blow Off Valves	$2,600		$2,600	$21,400	$4,700	$2,800		$5,100	$2,300	
Fire Hydrants	$700	$1,000	$1,000	$1,000	$1,400	$3,400	$1,700	$2,700	$2,700	$3,100
Line Valves				$7,800		$47,000	$18,800	$37,400	$22,400	$30,900
Meters		$1,400	$2,100	$1,000		$1,000	$59,600	$3,189,900	$483,600	$47,600
Mann Station	$42,000	$36,200	$381,600		$19,300	$3,400	$12,100	$62,200	$476,000	$8,500
Cristo Rey Storage Tank					$39,600			$31,200		
Mercedes Road Station	$1,696,700	$17,000	$3,400	$28,300	$93,800	$118,700		$28,300	$3,400	$1,600
Services				$555,300		$471,200	$415,000	$371,000	$465,400	$695,700
Flowering Pear Well	$8,200	$33,900	$11,000		$15,400		$2,500	$48,000	$2,500	
Franco Court Well	$6,300	$28,300	$14,700		$2,200	$5,700	$600	$76,300	$600	
Interties										
Total	**$1,756,500**	**$1,012,700**	**$416,400**	**$2,007,200**	**$176,400**	**$1,849,700**	**$1,398,600**	**$5,165,500**	**$2,142,800**	**$1,442,700**

Asset Class/ Location	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Water Mains	$1,091,400	$2,571,100	$866,200	$780,800	$1,452,300	$2,242,100	$452,700	$1,740,400	$882,700	$755,000
Air Release, Vent, & Blow Off Valves			$6,300	$2,400	$5,800		$100	$41,200	$25,300	$2,400
Fire Hydrants	$3,400	$2,700	$21,000	$3,700	$85,800	$700	$1,000	$1,000	$1,000	$1,400
Line Valves	$25,200	$110,900	$20,700	$44,600	$40,200	$75,500	$9,700	$72,900	$14,800	$29,800
Meters	$61,400	$570,100	$223,000	$248,900	$84,100	$255,700	$189,600	$35,200	$3,100	
Mann Station	$19,400	$42,400	$52,200	$31,800	$181,600	$11,300	$36,900	$183,600	$12,600	$58,700
Cristo Rey Storage Tank		$28,300						$28,900	$932,300	$11,300
Mercedes Road Station	$28,300		$3,400		$28,300		$17,000	$28,300	$3,400	$27,700
Services	$860,200	$1,461,700	$469,900	$316,900	$787,200	$1,167,200	$408,900	$744,500	$457,700	$842,100
Flowering Pear Well	$2,500	$3,400	$2,500		$2,500		$8,200	$65,000	$2,500	$20,200
Franco Court Well	$600	$4,000	$600		$600		$11,900	$93,200	$600	$3,600
Interties										$67,800
Total	**$2,092,400**	**$4,794,600**	**$1,665,800**	**$1,429,100**	**$2,668,400**	**$3,752,500**	**$1,136,000**	**$3,034,200**	**$2,336,000**	**$1,820,000**

EXHIBIT E
Maintenance Plan

- ✓ Measure source pump capacity in gallons per minute (GPM) to detect pump output problems.
- ✓ Calibrate pressure gauges and flow meters monitoring pump performance and capacity.

Storage Facilities

Weekly

- ✓ Check any warning lights or alarms – low water level, high water level, intrusion, power outage, etc. Correct issues or write work order for follow up corrective action.
- ✓ Check storage tank for signs of security breaches – damaged fences, open gates, graffiti, vandalism, etc. Report security violations.
- ✓ Check the overflow line, vents, ladder access locks, roof access hatches, and controls that are readily visible from the ground for damage, vandalism, or other conditions. Correct issues or write work order for follow up corrective action.
- ✓ Check storage tank and site after any adverse event (i.e., heavy rain, high wind, earthquake). Correct issues or write work order for follow up corrective action.

Monthly

- ✓ Check water level indicator and record information.
- ✓ Verify all openings are protected from surface runoff, windblown contaminants, insects, birds and animals. Correct issues or write work order for follow up corrective action.
- ✓ Check tank overflow lines for signs of damage, such as, screens, flapper valves, check valves, splash plate, etc. Correct issues or write work order for follow up corrective action.
- ✓ Check area for excessive vegetation or dangerous conditions – uncut grass, brush, dead trees, fire hazard, ponding water, etc. Correct issues or write work order for follow up corrective action.
- ✓ Check control valves for proper positions, open or closed. Reposition as needed.
- ✓ Check control valves for damage or leaks. Correct issues or write work order for follow up corrective action.
- ✓ Check earth embankments for erosion, burrowing animals, improper drainage, and leakage.

Annually

- ✓ Check storage tank structural, seismic, and sanitary integrity – leaks, corrosion, cracks, supports, warping, etc.
- ✓ Exercise valves and make repairs as needed.
- ✓ Document inspection and maintenance activity as part of the annual maintenance program.
- ✓ Evaluate stored water for clarity, sediments, floating materials or films, unusual odors, insects, birds or animals.

Five Year Inspection

- ✓ Inspect storage tank interior for pitting, concrete spalling, rot, corrosion, rust, water level sensors, biofilm build-up, etc.
- ✓ Inspect tank indicator every three years for steel storage tanks without corrosion protection or every five years for storage tanks other than steel without corrosion protection.
- ✓ Drain, inspect, clean, and disinfect storage tank or use a diving maintenance service without draining tank.
- ✓ Respond to any evidence of storage tank problems or deficiencies and report them.

Instrumentation

Daily

- ✓ Perform corrective maintenance on any malfunctioning sensor loop.

Annual

- ✓ Calibrate each sensor loop and document results in work order. Write follow up work orders to correct each unresolvable sensor issue.

O&M Planning & Record Keeping

- ✓ Develop/update Water Master Plan and Water Rate Study every five years
- ✓ Develop an Asset Management Plan to manage risk and ensure financial capacity to deliver safe and reliable water. Report to City annually on progress in meeting objectives.
- ✓ Develop a five-year annual maintenance plan. Update annually. Report actual to planned accomplishment to City yearly.
- ✓ Maintain logs of water main and service line repairs.
- ✓ Maintain logs of safety equipment repairs.
- ✓ Maintain records of valve exercising programs and associated logs.
- ✓ Maintain employee training log.
- ✓ Maintain the customer complaint and system telephone threat checklist/logs.
- ✓ Review emergency response plans and update as needed.
- ✓ Review O&M manual and update as necessary.
- ✓ Consider installation of soft-starters/VFDs for well submersible and system pressure pump motors.
- ✓ Consider installation of an EAMS/CMMS to manage assets and maintenance.
- ✓ Consider backup power at Mercedes, Flowering Pear, and Franco Stations.
- ✓ Consider solar power installation with battery at Cristo Rey Station.

- ✓ Review the adequacy, reliability, and redundancy of the current pumping facilities and plan for improvements.

EXHIBIT F
SCVWD Contract

RESOLUTION NO. 5408

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF CUPERTINO AUTHORIZING EXECUTION OF CONTRACT BETWEEN THE CITY OF CUPERTINO AND THE SANTA CLARA VALLEY WATER DISTRICT FOR A SUPPLY OF TREATED WATER

WHEREAS, the City of Cupertino currently has a contract to purchase water from the Santa Clara Valley Water District which was executed on December 5, 1967; and

WHEREAS, there have been amendments to this original contract over the past years; and

WHEREAS, the Water District has submitted a new contract to the City which clarifies and simplifies the original contract and incorporates the amendments and changes which the City has requested; and

WHEREAS, the new contract is in proper and sufficient form and is acceptable to the City of Cupertino;

NOW, THEREFORE, BE IT RESOLVED that the City Clerk and the Mayor be and are hereby authorized to execute said contract in behalf of the City of Cupertino.

PASSED AND ADOPTED at a regular meeting of the City Council of the City of Cupertino this 2nd day of September, 1980 by the following vote:

Vote	Members of the City Council
AYES:	Gatto, Plungy, Sparks, Rogers
NOES:	None
ABSENT:	None
ABSTAIN:	None

APPROVED:

/s/ Barbara A. Rogers
Mayor, City of Cupertino

ATTEST:

/s/ Dorothy Cornelius
City Clerk

CONTRACT BETWEEN SANTA CLARA VALLEY WATER DISTRICT AND CITY OF CUPERTINO FOR A SUPPLY OF TREATED WATER

THIS CONTRACT is made and entered into on January 27, 1981, between the SANTA CLARA VALLEY WATER DISTRICT, hereinafter referred to as "District", and CITY OF CUPERTINO, hereinafter referred to as "Contractor" and supersedes previous water service contracts between District and Contractor.

RECITALS:

A. District has executed contracts with the State of California Department of Water Resources and the United States Bureau of Reclamation, whereby District is and will be entitled to receive imported water and District intends to continue construction of a system within the boundaries of District to distribute water so received.

B. Included within said system are facilities to treat and filter such water; and Contractor is desirous of obtaining a supply of treated water from District.

AGREEMENT: For and in consideration of the mutual promises and covenants herein contained, the parties hereto agree as follows:

ARTICLE A. INTRODUCTORY PROVISIONS

1. Definitions - When used in this contract, the following terms shall have the meanings hereinafter set forth:

   a) "Fiscal Year" shall mean each 12-month period during the term hereof commencing July 1 of one year and terminating June 30 of the next succeeding year, both dates inclusive.

   b) "Each Contractor", or "Other Contractor", shall mean any entity, public or private, contracting with District for a supply of treated water.

   c) The "Act" shall mean the Santa Clara Valley Water District Act, as amended.

   d) "Board" shall mean the Board of Directors of the Santa Clara Valley Water District.

2. Term of Contract

   a) This contract shall become effective on the date first above written and shall remain in effect for a period of 70 years or until all loans and all bonds, the proceeds of sale of which have been used for the construction of water treatment and distribution facilities have been retired, whichever period shall be longer, provided, however, that in no event shall the term of this contract be deemed to extend beyond the period authorized by law.

b) The term of this contract may be extended for an additional term of years upon such terms and conditions as may be set forth in a written agreement of the parties hereto executed at least eighteen (18) months prior to expiration of the terms specified in the preceding Subsection 2a. If no such agreement shall be so executed, this contract shall terminate as specified in said Subsection 2a unless at least one year prior to said termination date Contractor shall notify District in writing that Contractor desires to extend the term hereof; in such event, said term shall be extended for an addtional period of five years upon the covenants, agreements and conditions herein contained.

3. Successors and Assigns - Subject to the provisions of the succeeding Section 4 hereof, this contract and all the terms, covenants, agreements and conditions herein contained shall inure to the benefit of and be binding upon the successors and assigns of the parties hereto.

4. Assignment - No assignment or transfer by Contractor of this contract or any part hereof, or of any rights hereunder or interest herein of Contractor, shall be valid unless approved by District, which approval District agrees shall not be unreasonably withheld. The foregoing provisions of this Section 4 to the contrary notwithstanding, no consent shall be required on an assignment to a Public Agency with the power of eminent domain; provided, such Public Agency expressly assumes the obligations of this contract and provided, further, that if said Public Agency assumes only a portion of the obligations of this contract, Contractor shall remain obligated for the remainder, or in the event Contractor shall sell, transfer, or convey any part or parts or its water system to any entity, public or private, Contractor may assign to the purchaser thereof a portion of Contractor's rights, privileges and obligations hereunder and, in the event of any such assignment Contractor shall be relieved of such portion of such obligations of Contractor so assigned if, following such sale, transfer or conveyance, District shall commence to furnish treated water to such entity, or District under a contract with such entity existing prior to such sale, transfer or conveyance increases the amount of treated water delivered to such entity in order to meet in part the increased water requirements of such entity resulting from such sale, transfer or conveyance.

5. Adjustment of Schedule Purchases upon Other Water Service to Projected Service Area - Where Contractor has prepared and submitted a proposed water delivery schedule to District for an ensuing three-year period in accordance with Article B hereof in reasonable anticipation of and reliance upon projected water service by Contractor to its existing or future customers who receive or would receive service within a service area which shall be defined and may be amended from time to time by Contractor and attached hereto, as Exhibit A, and the schedule has been approved and made binding upon Contractor in accordance with Article B hereof, and where, in lieu of Contractor, any agency, public or private shall thereafter provide treated water service to any such customers and the existence of such circumstance and the necessity of Contractor to reduce its delivery schedule being shown to District and acknowledged by District to be facts (such acknowledgment to be in no case unreasonably withheld), then Contractor's said delivery schedule shall at its option be amended promptly in such manner as to reduce Contractor's scheduled water purchases from District hereunder by an amount fairly commensurate with such reduction of Contractor's anticipated or projected water service.

ARTICLE B. WATER SERVICE PROVISIONS

1. Water Delivery Schedules

a) On October 15, 1980, and every three years thereafter, Contractor shall submit in writing a proposed delivery schedule for the ensuing three-year period beginning July 1 of the following year. The proposed delivery schedule shall be submitted on a form provided by the District and shall indicate the amounts of treated water desired by Contractor during each year of the ensuing three-year period. Except as provided in Subsection c of this section, Contractor agrees that in submitting a proposed water delivery schedule it will not request an amount of water for each year which shall be less in total than 95 percent of the amount for the fiscal year containing the maximum amount in the then current three-year schedule unless Contractor shall have assigned or agreed to assign a portion of its rights, privileges, and obligations hereunder pursuant to the provisions of Article A, Section 4, hereof and i) District has consented to such assignment, or ii) Contractor otherwise shall have been relieved of a portion of its obligations hereunder pursuant to the provisions of said Article A, Section 4; that following occurrence of either event specified in the preceding clauses i) and ii), the foregoing provisions of this Subsection a) shall apply only to the unassigned portion of the Contractor's rights and obligations hereunder.

b) Upon receipt of such delivery schedule, District shall review same, and after consultation with Contractor and Other Contractors receiving treated water from District, shall approve such schedule or make such reductions therein as are consistent with District's ability to deliver water to Contractor and Other Contractors; provided, however, that subject to availability of funds, financing policies, construction schedules, and operating schedules, District will make every reasonable effort to approve each proposed delivery schedule submitted by Contractor and Other Contractors. Except as provided in Subsection c of this section, District agrees that it will approve a delivery schedule for said ensuing schedule period which will not be less in total amount for each fiscal year of said schedule period than 95 percent of the maximum fiscal year set forth in the then current schedule period.

c) Notwithstanding the provisions of Subsections a and b of this section, either Contractor or District may request that the minimum amount of water for each fiscal year in the ensuing three-year schedule period be reduced to a lesser minimum amount than prescribed in Subsections a and b. Upon written agreement by both Contractor and District, based on a showing of extraordinary circumstances, the delivery schedule may be approved at such lesser amount.

d) The approved delivery schedule shall be transmitted to Contractor prior to December 31 of the year in which the proposed delivery schedule is submitted. The approved delivery schedule for fiscal years 1976-77 through 1980-81 is set forth in Exhibit B, attached hereto and by this reference made a part hereof.

e) For operating and planning purposes, Contractor shall, on forms provided by District, annually supply District with Contractor's anticipated monthly delivery schedules for the ensuing year and such information reasonably needed by District to determine projected annual deliveries for the next ensuing five years. Contractor's anticipated monthly delivery schedules shall not constitute a committment by Contractor to receive the amounts of water set forth therein but shall establish the monthly schedule amounts of treated water to be delivered to Contractor for certain purposes under Article C hereof.

2. Amounts of Water - Rates of Flow

(a) District agrees to deliver to Contractor during each fiscal year or fractional fiscal year of this Contract, as the case may be, the amounts of treated water set forth on the approved delivery schedule for each year or fractional fiscal year, as the case may be.

(b) District agrees to deliver to Contractor on demand in any month during the term of this contract at least 15 percent of the total amount of treated water which District has theretofore agreed to deliver to Contractor during the applicable fiscal year as shown on the approved delivery schedule.

(c) District further agrees to provide facilities capable of delivering and will deliver the amounts of water prescribed by Subsections a and b of this section on demand of Contractor at rates of flow up to an instantaneous maximum flow rate equivalent to 205 percent of the then current annual volume shown on the approved delivery schedule expressed as an equivalent uniform flow rate over the full year for an aggregate of 72 hours in any month and for such additional hours in any month as District has the capability to deliver at said rate, provided that District, at such times during the remainder of such month when District does not have the capability to deliver at said rate, may reduce such rate to an instantaneous maximum flow rate not to exceed 180 percent of said annual volume expressed as an equivalent uniform flow rate over the full year.

d) Notwithstanding the foregoing, during the period July 1, 1979 to June 30, 1990, District may limit the maximum flow rate for each Contractor to 180 percent of the then current annual volume of that Contractor shown on the approved water delivery schedule expressed as an equivalent uniform rate over the full year. District will give Contractor reasonable prior notice of any such proposed limit of maximum flow rate.

3. Delivery Structures

a) Water delivered to Contractor pursuant to this contract shall be provided from District facilities through delivery structures to be located at such locations as may be mutually agreed upon. Such delivery structures shall be designed and constructed or caused to be constructed by District. Design and bid costs shall be subject to favorable review and approval by the Contractor prior to award of

construction contract for the delivery structure. District shall pay for the cost of the land, automated controls and reporting systems, nozzle turnout and shutoff valve portion of each of said structures, and Contractor shall pay the total cost of acquiring and installing the measuring devices, the vault or housing and the flow regulating devices, if any, of each of said structures as said devices and facilities are shown on Exhibit C attached hereto and by this reference made a part hereof. Upon thirty (30) days' written notice by District, Contractor shall deposit with District prior to such acquisition and installation an amount of money estimated by District to be sufficient to cover such cost to be borne by Contractor. In the event such estimate proves to be low, Contractor shall pay to District upon written demand therefor the difference between District's estimate and the actual cost to be borne by Contractor. In the event such estimate proves to be high, District shall refund to Contractor promptly the difference between the actual cost to be so borne by Contractor and the amount of said deposit.

b) Title to all delivery structures and to all appurtenances up to and including the control valve shall be in District and Contractor shall have no obligations or responsibilities with respect thereto and shall be under no obligation to operate, maintain, repair, replace or relocate the same.

4. Measurement of Water Delivered - District shall measure all water delivered to Contractor and shall keep and maintain accurate and complete records thereof. For such purpose, District shall install, operate and maintain at all delivery structures such measuring devices and equipment as are satisfactory and acceptable to both parties.

5. Curtailment of Delivery During Maintenance Periods - District will make all reasonable effort to provide continuous service to Contractor but may temporarily discontinue or reduce the delivery of water to Contractor for the purpose of necessary investigation, inspection, maintenance, repair or replacement of any of the facilities necessary for the delivery of treated water to Contractor. District shall notify Contractor as far in advance as possible of any discontinuance or reduction and the estimated duration of such discontinuance or reduction. Recognizing that Contractor will rely on District for uninterrupted deliveries of water particularly during the high water consumption months each year, District agrees to use its best efforts throughout the term of this contract to make any such discontinuance or reduction in the delivery of water only during the period of November through March in any fiscal year. In the event of any discontinuance of or reduction in delivery of water, Contractor may elect to receive the amount of water which otherwise would have been delivered to it during such period under the approved water delivery schedule for that fiscal year at other times during such year, consistent with District's delivery ability considering the then current delivery schedules of all Other Contractors.

6. Suspension of Service Upon Default - In the event of any default by Contractor in the payment of any money required to be paid to District hereunder, District may, upon not less than three months' written notice to Contractor, suspend deliveries of water under this contract for so long as such default shall continue, provided, however, that during such period Contractor shall remain obligated to make all payments required under this contract and provided, further, that such delinquent amount shall accrue interest at the rate of one-half of one percent per month commencing on the

due date of such delinquent amount and continuing until both the principal amount of such charges and the interest thereon are paid in full. Such suspension of delivery taken pursuant to this Section 6 shall not deprive District of or limit any remedy provided by this contract or by law for the recovery of money due or which may become due under this contract. In the event of any disagreement between Contractor and District as to the amount of any bill rendered to Contractor by District, water service shall not be discontinued if the disputed amount thereof is placed on deposit with District. Such deposit shall not preclude review and adjustment of any water bill as set forth in Article C, Section 8, hereof.

7. Water Quality - District agrees that all water to be delivered by it to Contractor pursuant to the terms of this contract will be pure, palatable, wholesome, potable and healthful and that all such water will be of such quality that the same may be used for domestic purposes at the points of delivery thereof to Contractor without further treatment. District understands that Contractor is a public utility furnishing water to its customers for domestic purposes and that water to be delivered by it to Contractor hereunder will be delivered by Contractor to said customers. District agrees that its system shall be constructed and operated during the term hereof in accordance with a permit or permits, including temporary permits, to be issued by the State Department of Health Services, copies of which will be furnished to Contractor upon receipt by District. District agrees that the treated water to be delivered to Contractor pursuant to this contract shall conform to the quality requirements set forth in the then current primary and secondary standards for domestic water quality and monitoring regulations adopted by the California State Department of Health. Should the need arise, District and Contractor will cooperate fully in adjusting their respective processes to the extent reasonably practicable, and provided such adjustments do not affect other Contractors, to aid the Contractor in conforming to such law within the Contractor's distribution system.

ARTICLE C. PAYMENT PROVISIONS

1. The payments to be made by Contractor and Each Contractor for delivery of treated water shall be a price per acre-foot based upon the pricing policy adopted by the Board, dated January 18, 1971, as from time to time amended, which is set forth in Exhibit D, attached hereto and by this reference made a part hereof, and shall be the total of the basic water charges and treated water surcharge as determined by the District Board for each period for which a rate schedule is effective.

2. In determining the above charges, the basic water charge shall be equal to District's groundwater charge for water other than agricultural water (said words "agricultural water" being defined in the Act) in Zone W-2, which shall be determined annually by the Board in accordance with the legal provisions and requirements of the Act; provided, however, that during each rate period the District will consider all anticipated costs for each such rate period and will endeavor to establish during the first year of such rate period a groundwater charge that is intended to remain constant for the full rate period.

3. District shall charge for the delivery of treated water in accordance with the rate schedule for water service as such rate schedule is established by the Board. The Board of Directors shall review said rate schedule every three years to determine whether the schedule is in accordance with the most recent and anticipated costs and revenues of District. Accordingly, the Board shall, on or about the second Tuesday in March 1981, but not later than April 15, 1981, establish a rate schedule for the rate period commencing July 1, 1981 through June 30, 1984, and shall follow said procedure

for each ensuing three-year period. Each such rate schedule shall be prospective in operation, but shall provide for the recovery of expenditures to be recovered by the basic water charge and the treated water surcharge during the period said rates are in effect and any shortages of revenue for said expenditures that may have been experienced during the preceding rate periods. It is agreed that the rates to be so established shall not be unreasonable or arbitrary, shall be based upon reasonable estimates of costs and water deliveries and shall be the same for Contractor and Other Contractors and all other persons, public or private, purchasing treated water from District, regardless of the point of delivery of such water by District; District agrees to use its best efforts throughout the term of this contract to collect from Other Contractors, and such other persons in accordance with such rate schedules, the appropriate sums of money without deduction or offset according to the respective amounts of treated water delivered by the District.

4. Contractor shall pay District the rate or rates set forth on the rate schedules during the period said rate schedules are effective for all water delivered to the Contractor; provided, however, that Contractor shall pay District at least a minimum charge each year applicable to water scheduled to be delivered in such year, which minimum charge shall be based upon an amount of treated water equal to 90 percent of the total amount of treated water to be delivered to Contractor during that fiscal year as shown on the approved delivery schedule; provided, however, that if Contractor during any other year of the current rate schedule period has purchased water in excess of 90 percent of the water scheduled to be delivered to Contractor during such other year, such delivery in excess of 90 percent for such other year may be used as a credit against years in such rate schedule period in which Contractor received less than 90 percent of the treated water as shown on the approved delivery schedule, and if Contractor has paid, pursuant to such annual minimum charge, for water not delivered to it, Contractor shall have the right to receive such undelivered water without additional payment during the remainder of the then current rate schedule period at times when District has the delivery capability provided further, however, that:

a) If in any day of any year during the term hereof, District, for any reason, including reduced deliveries pursuant to the provisions of Article D hereof, shall be unable to deliver treated water to Contractor in an amount equal to 1/30 of the then current monthly scheduled amount as set forth in Article B, Section 1(e) as expressed as a uniform daily volume, the then minimum charge for that year shall be based upon an amount of water as calculated above in Section 4 reduced by an amount equal to the reduction required by District for each day a reduced delivery is required.

b) If in any day of any year during the term hereof District shall offer to deliver to Contractor water which shall fail to meet the quality requirements set forth in Article B, Section 7, hereof, then Contractor shall have the right to refuse to accept or reduce deliveries of water from District until such time as such water shall meet said quality requirements. In such event Contractor shall immediately notify District, and confirm in writing within 5 days of the beginning of any such period. In any such year the then minimum charge shall be reduced by an amount equal to the volume of water reduced by the Contractor up to an amount equal to 1/30 of the then current monthly scheduled amount as set forth in Article B, Section 1(e), as expressed as a uniform daily volume for each day that water service is so refused or reduced by the Contractor. If Contractor at

any time, or from time to time during the term hereof, should have the right to refuse to accept water from District by reason of the foregoing provisions of this Subsection 4b, but should nevertheless fail to exercise such right, such failure shall in no event be deemed to waive or limit exercise of such right by Contractor. Except as set forth by the foregoing provisions of this Section 4, Contractor shall not be obligated to pay for any water not accepted by it. Nothing contained in this Section 4 shall in any way be deemed to limit Contractor's obligation to pay for all water accepted by it from District in accordance with the appropriate rate set forth from time to time in District's then applicable rate schedule.

c) If in any year during the term hereof, the Board of Directors of District shall by Resolution place in effect a water reduction program in excess of 10 percent of normal usage, the monthly scheduled amounts or portions thereof, as set forth in Article B, Section 1e, for that portion of the year when such water reduction program is in effect shall be reduced by the same percentage as required by the water reduction program less 10 percent. The Contractor shall be notified in writing of such water reduction program.

5. Surplus - If District shall determine, in accordance with sound accounting practice, that the aggregate of the revenues received by it in any fiscal year, or any rate period, during the term hereof a) from the sale of treated water to Contractor and Other Contractors, b) from the sale of raw water, and c) through collection of the groundwater charges referred to in Article E hereof, has exceeded District's costs and expenses during such year, or rate period, District shall retain such excess and reserve the same for purchases of raw water, construction, maintenance or operation of existing or additional facilities for the importation, conservation, treatment or wholesale distribution of water, reduce its scheduled price of treated water or, subject to the provisions of the Act, reduce said groundwater charges. It is understood that the object in computing rates under this contract is to cover the costs related to the importation, conservation, treatment or wholesale distribution of water.

6. Non-Contract Water - The term "non-contract water" refers to treated water found by District to be available for delivery to the treated water contractors in addition to the scheduled amounts. Non-contract water may be available only at such times and such prices as determined by the District. District will notify Contractor in writing thereof. Deliveries of non-contract water to Contractor will only be made after Contractor has purchased 100 percent of the monthly scheduled amount as set forth in Article B, Section 1(e). Further, at the end of each fiscal year an adjustment in billing will be made and Contractor will be required to have paid for 100 percent of the approved delivery scheduled amount, less any other adjustments before the purchase of non-contract water is allowed. During any period in which non-contract water is not available and Contractor takes water in excess of its scheduled amount, such water will not be reclassified and will be charged for at the full contract price. Water taken in excess of scheduled amounts during periods when non-contract water is not available may be credited as a part of Contractor's minimum annual charge.

7. Billings - Billings shall be made monthly as follows: On or about the first of each month District will send to Contractor a bill calculated in accordance with the provisions of Article C hereof for all treated water accepted by Contractor from District during the preceding month. The final bill for each fiscal year shall include any sums due for the minimum charge required by Article C, Section 4, hereof. District shall make

every effort to make required meter readings on the last day of each calendar month, but District shall be entitled to make such readings three days prior to the close of any calendar month or within five days after the beginning of any calendar month.

8. Time and Method of Payment - Payments shall be made by Contractor to District within twenty (20) days after billing by District. In the event that Contractor in good faith contests the accuracy of any bill submitted to it pursuant to this contract, it shall give District notice thereof at least five (5) days prior to the day upon which payment of the stated amount is due. To the extent that District finds Contractor's contentions regarding the statement to be correct, it shall revise the statement accordingly and Contractor shall make payment of the amounts on or before the due date. To the extent that District does not find Contractor's contentions to be correct or where time is not available for a review of such contentions prior to the due date, Contractor shall pay the billed amount on or before the due date and may make the contested part of such payment under protest and seek to recover the amount in question from District.

ARTICLE 0. AVAILABILITY OF WATER

1. In any year in which there may occur a water shortage by reason of drought or other temporary cause in the supply of water available for delivery to all users, District shall, before reducing other deliveries of water, reduce, or if necessary cease, to the extent permitted by the operation of District's facilities consistent with its obligations to receive water pursuant to the State and/or Federal Contract, all deliveries of untreated water for recharge of groundwaters.

2. If, despite such reduction or cessation of such deliveries of untreated water for groundwater recharge pursuant to the provisions of the preceding Section 1, a further reduction in deliveries shall become necessary if the treated water requirements set forth on the approved delivery schedule of Contractor and Other Contractors are to be met, District shall, before reducing deliveries to Contractor and Other Contractors, reduce the total amount of agricultural water (as defined in the Act) released to others for surface delivery during such fiscal year by an amount equal to the following: namely, the average of the releases of such surface-delivered agricultural water during the preceding three fiscal years multiplied by the percentage by which District's total receipt of water from State and Federal sources for agricultural use (as such use is defined in the State and Federal Contracts) is reduced in such year pursuant to provisions of said contracts.

3. If any reduction in deliveries of treated water shall become necessary following reductions in untreated water pursuant to the provisions of the preceding Sections 1 and 2, District shall reduce deliveries of treated water to Contractor and Other Contractors in an amount which bears the same proportion to the total amount of such reduction that the amount included in such treated water user's approved delivery schedule bears to the total of the amount included in the approved delivery schedule of Contractor and Other Contractors for that fiscal year, all as determined by District; provided that District may apportion on some other basis if such is required to meet minimum demands for domestic supply, fire protection, or sanitation during the year. District agrees to notify Contractor in writing promptly in the event any such reduction in deliveries to Contractor and Other Contractors shall be decided upon and concurrently of the amount of such reduction and of any changes in Contractor's approved delivery schedule.

4. District shall not be liable for failure to deliver water to Contractor hereunder in the amounts hereinabove provided if such failure shall be caused by drought or any other reason beyond the reasonable control of District.

5. District shall give Contractor written notice as far in advance as possible of any reduction in deliveries of treated water which may be necessary because of a shortage in water supply.

ARTICLE E. GROUNDWATER CHARGE

District agrees that in establishing or modifying the boundaries of any zone pursuant to the provisions of the Act, it will not act in an unreasonable, arbitrary, capricious or discriminatory manner. District further agrees that it will use its best efforts throughout the term of this contract to collect, without deduction or offset, from all persons operating groundwater-producing facilities (as said words are defined in Section 26.1 of the Act) the groundwater charges at the rates per acre-foot of water then applicable in the zone of the District in which each such facility is located.

ARTICLE F. REMEDIES

By reason of the specialized nature of the water service to be rendered, and for the further reason that the extent of any damage caused to either party by the other by reason of any breach of this contract may be extremely difficult to determine, it is agreed by the parties hereto that an action for damages is an inadequate remedy for any breach, and that specific performance, without precluding any other remedy available in equity or at law, will be necessary to furnish either party hereto with an adequate remedy for the breach hereof.

ARTICLE G. GENERAL PROVISIONS

1. Amendments - This Contract may be amended at any time by mutual agreement of the parties, except insofar as any proposed amendments are in any way contrary to applicable law. District agrees that in the event of legally enforceable action by a cognizant governmental body, either a) producing a prospective change in the volume of use of water by Contractor's customers, as by the imposition of an order suspending new services, or b) requiring reuse of wastewater or forbidding or limiting the discharge of wastewater into San Francisco Bay, District will make such amendments to Exhibit B of this contract as the circumstances may reasonably and equitably require.

2. Challenge of Laws - Nothing herein contained shall be construed as stopping or otherwise preventing Contractor or District from contesting by litigation or other lawful means the validity, constitutionality, construction, or application of any law of this State, any ordinance of District, or any rule, regulation or practice of District or Contractor.

3. Waiver of Rights - Any waiver at any time by either party hereto of its rights with respect to a default or any other matter arising in connection with this contract shall not be deemed to be a waiver with respect to any other default or matter. None of the covenants or agreements herein contained can be waived except by the written consent of the waiving party.

4. Notices - All notices or other writings in this contract provided to be given or made or sent, or which may be given or made or sent, by either party hereto to the other, shall be deemed to have been fully given or made or sent when made in writing and deposited in the United States mail, registered, or certified, postage prepaid, and addressed as follows:

To District:	Santa Clara Valley Water District 5750 Almaden Expressway San Jose, California 95118
To Contractor:	City of Cupertino 10300 Torre Avenue Cupertino, California 95014

The address to which any notice or other writing may be given or made or sent to either party may be changed upon written notice given by such party as above provided.

5. Separability - If any one or more of the covenants or agreements set forth in this contract on the part of District or Contractor, or either of them, to be performed should be contrary to any provision of law or contrary to the policy of law to such extent as to be unenforceable in any court of competent jurisdiction, then such covenant or covenants, agreement or agreements, shall be null and void and shall be deemed separable from the remaining covenants and agreements and shall in nowise affect the validity of this contract.

6. Paragraph Headings - Paragraph headings in this contract are for convenience only and are not to be construed as a part of this contract or in any way limiting or amplifying th provisions hereof.

7. Other Contracts - District agrees that each contract for the supply of treated water hereafter entered into by District with any Other Contractor shall contain provisions substantially similar to those herein set forth and shall not contain any provisions of a material nature more favorable to the Other Contractor than the provisions herein applicable to the Contractor.

////

////

////

////

////

////

////

////

////

//.//

IN WITNESS WHEREOF, District has caused this contract to be executed by the Chairman of its Board of Directors and caused its Official Seal to be hereunto affixed and Contractor has caused these presents to be executed on 19 , by its duly authorized officer.

ATTEST: SUSAN A. EKSTRAND

Doris Maconick
Clerk of the Board of Directors
CLERK AND EX-OFFICIO OF THE BOARD OF DIRECTORS

SANTA CLARA VALLEY WATER DISTRICT

By _____
Chairman of the Board of Directors
"District"

Approved as to form:

_____
General Counsel, Santa Clara
Valley Water District

ATTEST:

_____

CITY OF CUPERTINO

By Barbara A. Rogers
Its Mayor
"Contractor"

Approved as to form:

_____
Attorney for Contractor

FIVE YEAR DELIVERY SCHEDULE

Quantity of Water Requested in Acre-Feet

Fiscal Year 1976-77	Fiscal Year 1977-78	Fiscal Year 1978-79	Fiscal Year 1979-80	Fiscal Year 1980-81
1,850	2,000	2,050	2,150	2,200

Submitted By:

Robert Rummel

Contractor's Representative

Oct 10, 1975

Date

City of Cupertino
10300 Torre Avenue
Cupertino, California 95014

District Approval:

District's Representative

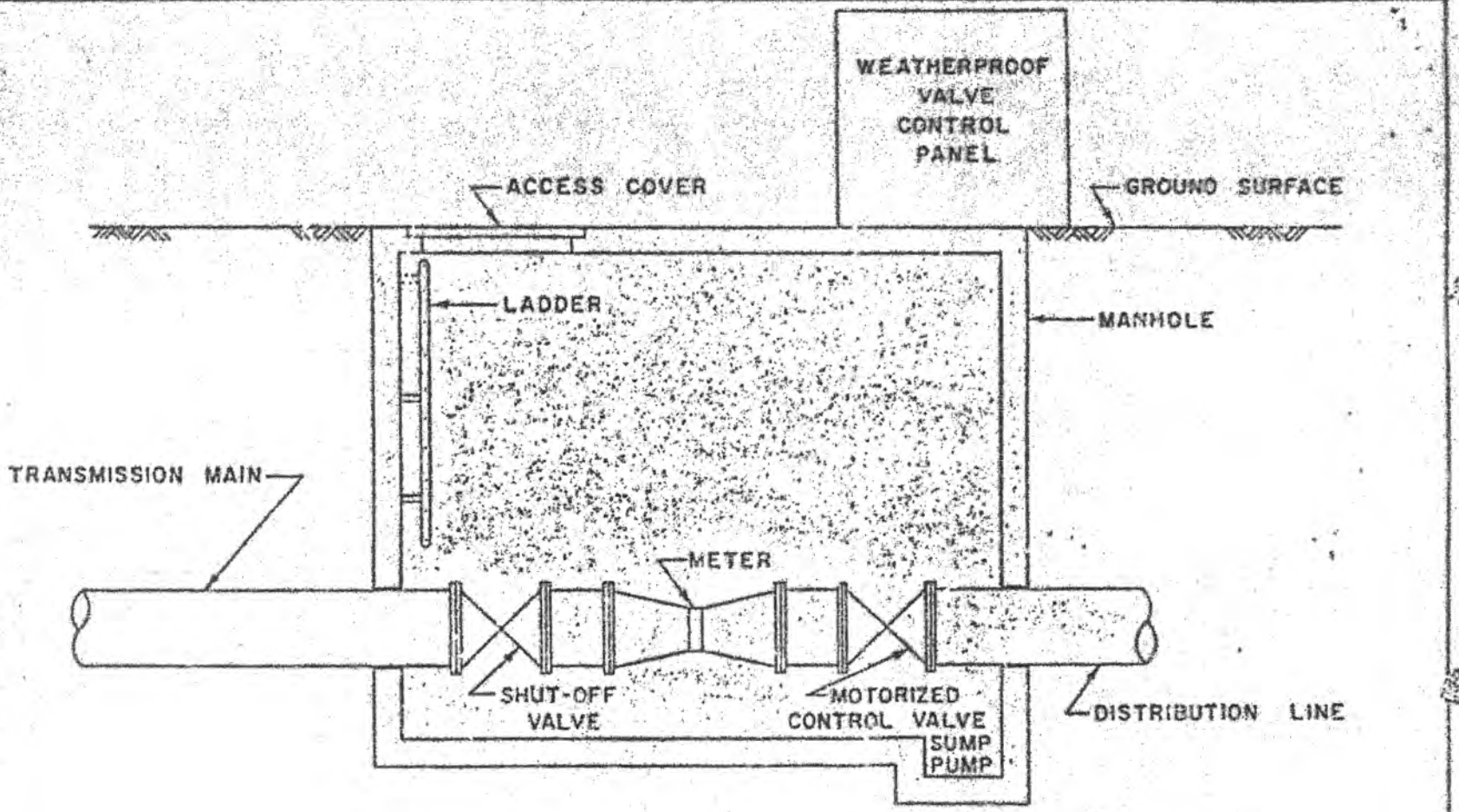
December 18, 1975

Date

NOTE: Please review Article B, Sections a and c, of the "Contract for a Supply of Treated Water" dated September 1971.

September 1975

EXHIBIT "B"



Note:
Shaded features paid for in advance of construction by Contractor

Open or unshaded features paid for by District

EXHIBIT "C"

TYPICAL TURNOUT STRUCTURE

No Scale

MARCH 1965

SANTA CLARA COUNTY FLOOD CONTROL AND WATER DISTRICT
TAXING AND PRICING POLICY

Objectives of a Water Pricing Policy

The broad objective of a proper pricing policy should be to charge the recipients of the various benefits for the benefits received.

There are several types of benefits which result from a comprehensive water program. The primary benefit is that of providing a water supply to the District so that we can optimize the methods of using the water resources available to the area. All of the facilities constructed or to be constructed should and do provide this benefit, whether the facilities are source of supply facilities such as reservoirs and import facilities; transmission facilities such as aqueducts, canals, pipelines, and percolation ponds; or the water treatment plants. Some of these facilities provide special and distinct benefits. The reservoirs provide flood control benefits in the watersheds in which they are located and provide recreational benefits such as fishing, boating, picnicking, camping, hiking, swimming, etc., to the entire County. Some of the percolation ponds also support similar recreational activities and provide a county-wide recreational benefit.

In addition to the water supply, flood control, and recreational benefits resulting from the water program, there is also a general economic benefit to either the County as a whole or the area of service of the facilities to be constructed. These benefits result from the mere construction of the facilities such as reservoirs, import lines, transmission mains and treatment plants which provide an availability for water even though such facilities are not put to use. In the construction of such facilities, excess capacity should be provided to insure the capability for a growing economy.

A final and important benefit resulting from the water program, closely allied to the general economic benefit, is the ability to retard and eliminate subsidence.

It is possible to ascertain the costs associated with some of these benefits, for example--the share of costs allocated to flood control resulting from construction and operation of the reservoirs and to recreation associated with the reservoirs, and the percolation ponds can be ascertained through application of

EXHIBIT "D"

recognized cost allocation formulas. Some aspects of cost related to the elimination of subsidence such as the cost of water used to replace the accumulated overdraft can be easily measured. It becomes more difficult, however, to allocate the remaining costs between water supply benefits and the economic benefits.

Whenever costs associated with specific benefits are clearly and easily measurable they should be charged to the beneficiaries. Those beneficiaries who receive a supply of water for consumptive use (use of water for private recreational purposes is considered a consumptive use) should pay for such benefits on the basis of a properly allocated water user charge. Those who receive benefits from the other elements of the water program should be charged on the basis of taxes in the areas of benefit. Where there is a question as to the identity of the beneficiary or the method of measuring the benefit, the allocation of costs should remain flexible and be determined in accordance with accepted practices and sound judgments.

As a means of accomplishing the aforementioned objectives, the pricing policy should embody the following concepts:

1. A Water Pooling Concept -- The water pooling concept is, to a limited extent, embodied in the present pricing policy. Under this concept water is considered to be mixed irrespective of its source and cost. The water is considered as a single commodity whether it be (a) water provided without benefit of local conservation facilities or importation, (b) water made available through our local conservation reservoirs, (c) water which is imported from the South Bay Aqueduct at present and will be imported through the Pacheco Aqueduct upon completion of the San Felipe Project, or (d) water from other sources such as reclaimed water, desalinized water, or weather modification.

   The concept should be retained, but the configuration of the groundwater basin which constitutes the common pool should be re-examined and more accurately described. From a geological and hydrological standpoint, the groundwater basin receiving runoff from streams in Northwest, North Central, Central and East Zones of the District is a common pooling basin. Local conservation and distribution facilities and the importation of water have in the past, and will in the future, aid in equalizing the benefits within this geographic area.

2. A Water Facilities Cost Pooling Concept - This concept is considered a basic requirement of optimum water resources management, since all facilities contribute to the common benefit.

To illustrate this point, there is a possibility that the Central Pipeline now transmitting raw water will in the future be used for the transmission of treated water; that treated water could be served to the Evergreen area by construction of a southern loop rather than the Peninsula Treatment Plant and the Evergreen Pipeline; and that the District could build percolation ponds and raw water pipelines instead of treatment plants and treated water pipelines for service to various areas and to relieve the overdraft on the underground. It seems obvious that any transmission facility, whether it be canal or pipeline, or whether it be carrying raw water or treated water, is constructed to deliver water to the point of use and thereby augment facilities provided by nature for the transmission of water. The same is true of treatment plants which are a substitute for the filtering process provided by the underground basin. Any aqueduct or treatment plant is constructed to augment or supplement the natural transmission and filtration capability of our underground basin. The location of treatment plants along those pipelines is, or should be, determined by the least expensive overall cost in providing adequate water service. The "pooling of costs of facilities" concept would eliminate from present practices the reference to named facilities and would charge instead on the basis of common benefit.

3. A Water Resources Management Concept - This concept would allow the District to manage its total water supplies whether underground or surface delivered, to obtain the maximum utilization of the water resources of the area to the advantage of the present and future populations of the County. From an external standpoint, it is desirable that our taxes and charges be competitive with those of other agencies performing similar services. This end result is desirable to attract various types of commercial and industrial activity to provide a diversified employment force and a well-balanced economy. This concept would, through taxing and pricing, provide management tools to establish competitive rates and to optimize the benefits received by the use of the water resources of the area.

The Implementation of the Proposed Water Taxing and Pricing Policy

To meet the objectives of a proper taxing and pricing policy, the following actions should be taken:

1. Establish zones encompassing the common groundwater basins benefited by conservation, import, and recharge of water. Such area would include the basins of all watersheds feeding into a common underground basin by natural means or as aided by construction of importation, distribution and recharge facilities.

   This zone would be a water charge zone in which charges should be levied on all groundwater extractions. The measure of this charge is determined in recommendations 6 and 7.

2. Establish a taxing zone or zones to reflect the areas presently capable of being served or which will, in the near future, be served by District-constructed water facilities. As new water facilities are added to serve new areas, the boundaries of the zones would, of necessity, be amended accordingly.

   NOTE: If the present practice of levying ad valorem taxes instead of groundwater charges in the area south of Metcalf Road is to be continued, a taxing zone should be established to encompass the area south of Metcalf Road and such area should not be subject to a groundwater charge.

3. Levy a county-wide importation tax to pay for the economic benefits to the County as a whole for water availability. The measure of this tax would be the same measure as being applied under the present policy for the capital cost of the water importation facilities except that it would not be limited. Water importation facilities related to this tax would be the South Bay Aqueduct (State of California), the San Felipe Project (Bureau of Reclamation), and the Hetch Hetchy System (San Francisco).

The philosophy of this tax is that these facilities assure to the County an adequate supply of water simply by their existence and availability.

Capital costs of the South Bay Aqueduct are determinable from bills of the Department of Water Resources and present no problem in projecting costs.

The Bureau of Reclamation, in its San Felipe contract negotiations, is proposing a per-acre-foot cost for conveyance (equivalent to capital, maintenance and operating cost of the South Bay Aqueduct), for storage (equivalent to the State's Delta Water Charge) and for power as it relates to both conveyance and storage. The Bureau of Reclamation will be able to designate the portion of the conveyance cost attributable to capital expenditures. The Bureau's method of charging will provide an easily determinable method for accurately projecting the capital cost component of the Federal importation facilities.

The method of measuring the capital cost component of the Hetch Hetchy System is much more difficult. The Hetch Hetchy Aqueduct may not have the same degree of permanent availability as is found in the South Bay or Pacheco Aqueducts. Hetch Hetchy contracts terminate in the early 1980's while the State and Federal contracts do not terminate until after year 2020 and contain provisions for renewal. Furthermore, there is no firm capacity reserved for Santa Clara County in the Hetch Hetchy System, and a recent report to the San Francisco Water Department recommends deleting Santa Clara County, except for the City of Palo Alto, from the service area of the Hetch Hetchy System. The San Francisco system imports water from three sources - Calaveras Reservoir, the Sunol Filter Gallery and Yosemite Park. Some of the system has been completely paid for while other parts are being paid off on a twenty-year amortization schedule. Expenditures have been made in the Hetch Hetchy Aqueduct System to enhance power generation and for other uses which should be but are not easily separated from the water supply costs. In view of the above, an accurate and equitable method of computing the capital cost component seems uncertain - as does the availability of the aqueduct to Santa Clara County. Even though such uncertainties exist, the present existence and use of the Hetch Hetchy Aqueduct

does provide an economic benefit to the District and should be paid for by a county-wide tax which would equate to the tax rebate to those public agencies importing water through the Hetch Hetchy System. Since the capital costs of the Hetch Hetchy System, and the economic benefits resulting therefrom, are not easily determined and are subject to question, it is recommended that the tax rebate be determined in accordance with the presently accepted practice embodied in the pricing policy adopted March 4, 1963 and the amount of such rebate be added to the annual capital cost payments of the South Bay and Pacheco Aqueducts to determine the total county-wide tax levy for construction of import facilities.

4. Levy a county-wide tax to pay for the recreation benefits which are available from use by all County residents of the District's reservoirs and percolation ponds. This tax would be determined by appropriate allocations of the capital costs and maintenance and operations costs of all District-owned reservoirs and percolation ponds opened for recreation activities.

5. Levy a tax within the flood control zones for the flood control benefits resulting from the construction, operation and maintenance of the District's reservoirs. This tax would also be determined by following the same cost allocation procedure used for allocating costs to recreation.

6. Levy a basic water user charge to recover costs incurred for the benefit of current water users, i.e., costs related to consumptive use of water which costs include:

   a) Water purchased from the State of California or the Bureau of Reclamation. This cost would be measured by the State's Delta Water Charge and the Bureau's prospective Storage Charge.

   b) Maintenance and operating costs of import facilities. This cost would be measured by cost data supplied by the State and Federal Governments.

c) Maintenance and operating costs of all District-owned and constructed facilities - determined by actual expenditures for such purposes from the District's accounting records.

This user charge would be applied to all groundwater extractions in the water charge zone and to all surface diversions of water conserved or imported by the District. The costs recovered by the user charge are made necessary because of the actual use of facilities constructed whether they be import or local conservation and distribution. Therefore, they should be paid for by the current water users.

7. The remaining expenditures that would be made in providing a supply of water result from construction of local facilities and consist of the capital cost of such items as local conservation reservoirs, aqueducts, regulating reservoirs, percolation ponds, and treatment plants. In such facilities some are deemed to contain excess capacity, while others are not. For example, the conservation reservoirs, our existing raw water aqueducts, and the percolation ponds are constructed to provide capacity for large flows required in years of heavy local rainfall. The capacity constructed into such facilities to handle these peak loads is necessary for the conservation and use of local water on a current basis. The cost of these facilities should, therefore, be charged to water users.

On the other hand, additional capacity built into treated water aqueducts, regulating reservoirs, and treatment plants is provided to assure availability of a water supply to undeveloped land in future years. Such excess capacity provides an economic benefit to such lands. Therefore, the excess capacity provided in facilities which produce or transmit a supply of treated water could, as an economic benefit, be properly charged to taxes within the service area for which excess capacity will be provided. The resulting recommendation is that the cost of such facilities be allocated between excess capacity and current use--with the costs allocated to current use being charged to the water users and the costs of excess capacity being charged to taxes within the service area. The combination of user charges and tax revenues would

provide flexibility for the construction of needed facilities which presently cannot be supported with reasonable user charges during the early years of use. Tax revenues for such purposes would be limited to that required to fund the repayment of the capital costs of any excess capacity provided in such facilities.

8. Levy a tax in the service area zone to pay the actual costs of water purchased to replenish our depleted underground supply - to retard and eliminate subsidence as well as provide an emergency supply in the underground reservoir for use during any unforeseen emergency. As stated earlier, the elimination of subsidence is of economic benefit to the area of service; and, as an economic benefit, taxes should be levied to pay for this cost. The same reasoning applies to the providing of an emergency supply of water. This cost would be measured by the State's Delta Water Charge and the Bureau's prospective Storage Charge, together with the related power costs.

9. Levy a treated water surcharge, which, when added to the basic water-user charge, would constitute the price of potable water delivered by the District from any of its facilities supplying potable water. This recommendation adopts the water resources management concept, and provides the necessary economic tool to obtain maximum utilization of our available water resources. The charge should be established at an amount that would prevent an overuse or under use of the groundwater basin. For any given rate period the charge could be lowered to discourage the use of groundwater supplies--or raised to encourage such use--while at the same time maintaining an approximate equality of total prices to the wholesale customers for groundwater and treated water.

Since the treated water surcharge is primarily an economic balancing tool, such revenue should be used to provide a proper balance between service area taxes and user charges, as well as establishing the proper relationship between treated water and groundwater charges.

Since the revenues derived from the treated water surcharge would be generated within the service area these sums could be used to lower the basic water charge or to reduce the service area taxes. Such revenues could

also be used to create or maintain a reserve to level the tax rates within a given rate period and to provide for unforeseen contingencies, or for minor construction.

10. Set water charges based on the above recommendations at a stable rate for 5-year rate periods.

Santa Clara Valley Water District

ALBERT THOMAS HENLEY
GENERAL COUNSEL

5750 ALMADEN EXPRESSWAY
SAN JOSE, CALIFORNIA 95118
TELEPHONE (408) 265-2600

September 25, 1980

CITY OF CUPERTINO
PUBLIC WORKS

SEP 2 5 1980

RECEIVED

TO: Treated Water Contractors

The form of contract for a treated water supply sent you recently, which contained certain amendments for your approval also contained one typographical error. How it got there I can't imagine, can't explain and don't want to think about.

On page ten in the last line of paragraph 1 of Article G, the word "equitably" somehow got changed to "equitability", making the sentence senseless as a matter of English composition. I enclose a new page ten with the proper word restored; please simply substitute it as representing an obvious correction not of substance.

Yours faithfully,

Albert Thomas Henley
General Counsel

Enclosure

4. District shall not be liable for failure to deliver water to Contractor hereunder in the amounts hereinabove provided if such failure shall be caused by drought or any other reason beyond the reasonable control of District.

5. District shall give Contractor written notice as far in advance as possible of any reduction in deliveries of treated water which may be necessary because of a shortage in water supply.

ARTICLE E. GROUNDWATER CHARGE

District agrees that in establishing or modifying the boundaries of any zone pursuant to the provisions of the Act, it will not act in an unreasonable, arbitrary, capricious or discriminatory manner. District further agrees that it will use its best efforts throughout the term of this contract to collect, without deduction or offset, from all persons operating groundwater-producing facilities (as said words are defined in Section 26.1 of the Act) the groundwater charges at the rates per acre-foot of water then applicable in the zone of the District in which each such facility is located.

ARTICLE F. REMEDIES

By reason of the specialized nature of the water service to be rendered, and for the further reason that the extent of any damage caused to either party by the other by reason of any breach of this contract may be extremely difficult to determine, it is agreed by the parties hereto that an action for damages is an inadequate remedy for any breach, and that specific performance, without precluding any other remedy available in equity or at law, will be necessary to furnish either party hereto with an adequate remedy for the breach hereof.

ARTICLE G. GENERAL PROVISIONS

1. Amendments - This Contract may be amended at any time by mutual agreement of the parties, except insofar as any proposed amendments are in any way contrary to applicable law. District agrees that in the event of legally enforceable action by a cognizant governmental body, either a) producing a prospective change in the volume of use of water by Contractor's customers, as by the imposition of an order suspending new services, or b) requiring reuse of wastewater or forbidding or limiting the discharge of wastewater into San Francisco Bay, District will make such amendments to Exhibit B of this contract as the circumstances may reasonably and equitability require.

2. Challenge of Laws - Nothing herein contained shall be construed as stopping or otherwise preventing Contractor or District from contesting by litigation or other lawful means the validity, constitutionality, construction, or application of any law of this State, any ordinance of District, or any rule, regulation or practice of District or Contractor.

3. Waiver of Rights - Any waiver at any time by either party hereto of its rights with respect to a default or any other matter arising in connection with this contract shall not be deemed to be a waiver with respect to any other default or matter. None of the covenants or agreements herein contained can be waived except by the written consent of the waiving party.