Specific Plan
Infrastructure Master Plan

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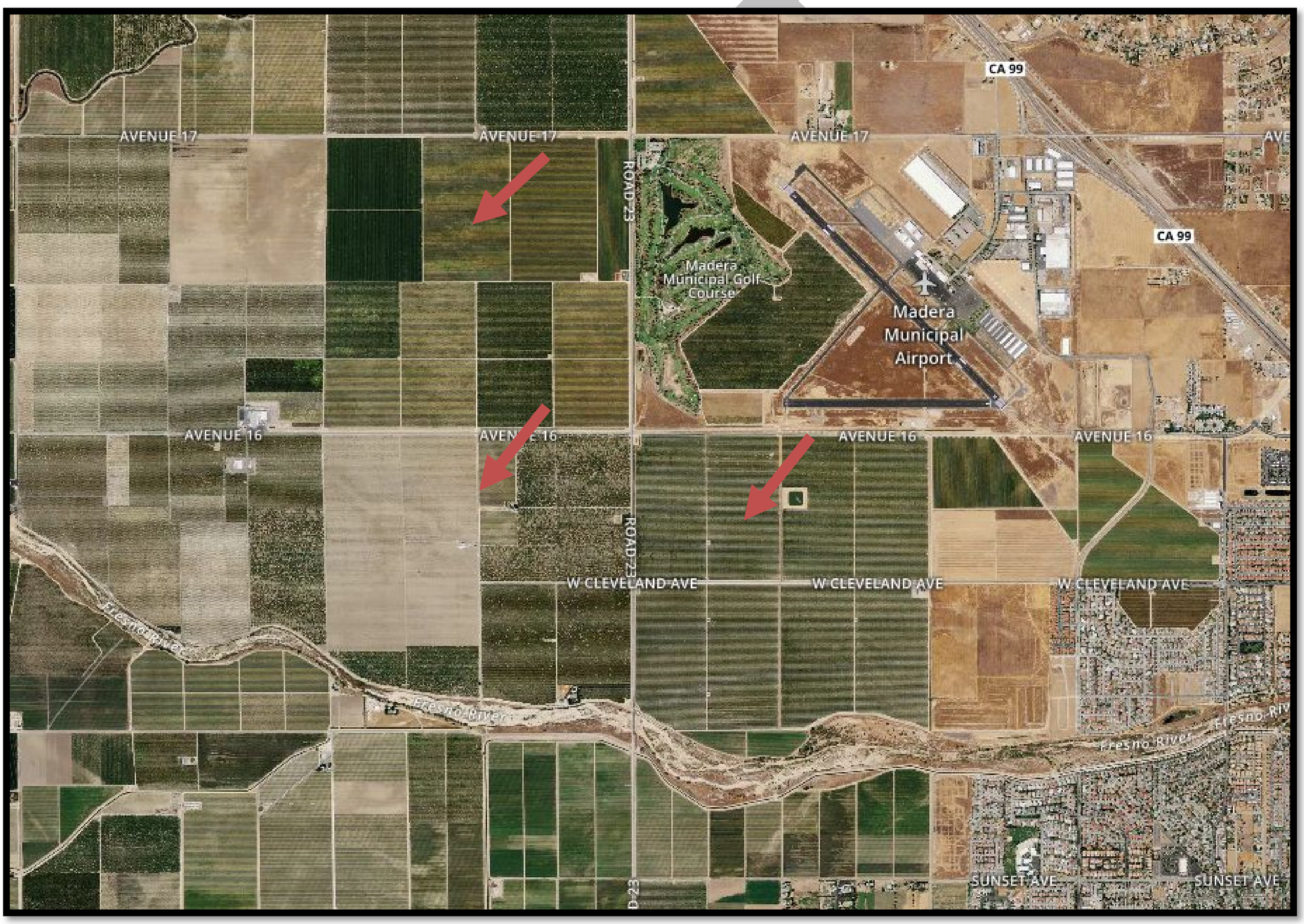
1 EXECUTIVE SUMMARY

The Villages at Almond Grove (The Villages) are located in Madera County, immediately adjacent to the western boundary of the City of Madera, California. This project (the Project) consists of approximately 1,860 acres and is designed to accommodate a population of approximately 36,500. It incorporates the necessary housing of approximately 10,783 units as well as, commercial and public facilities, recreational areas, and open space. The major cross streets for The Villages site location are Avenue 16 and Road 23, refer to Figure 1- 1.

Figure 1- 1 Site Location



This document has been divided into the following sections:

The plans and designs, presented are based upon the proposed land uses of the project, Madera City (City) Standards and the Infrastructure Master Plan (IMP). However, future changes in proposed land uses, field investigations, preliminary and final engineering design, and any requirements called for in the approved Environmental Impact Report (EIR) for the project may warrant future modifications to the IMP.

The Project includes a water distribution system, requiring California Division of Drinking Water ("DDW"), formerly California Department of Public Health ("CDPH"), approval. The Villages water supplies are met by the use of ground water obtained from wells that are to be newly constructed in conformance with the Madera Subbasin Groundwater Sustainability Plan (GSP). In order to reduce groundwater demand, the Project shall be utilizing groundwater only for indoor water supply, while using reclaimed water for outdoor irrigation.

The City of Madera Sanitary Sewer System Master Plan (SSSMP) identified the need for an additional sewer trunk line running down Road 23 to connect to the existing Waste Water Treatment Plant (WWTP).

To conserve water the Project intends to utilize reclaimed wastewater by constructing a non-potable water distribution (purple pipe) system for all outdoor use, including all open spaces and parks. Doing so allows for efficient disposal of treated water from the local waste water treatment plant as well as reducing the potable water demand; thus minimizing the impacts to the groundwater aquifer. In addition to meeting outdoor watering demands, reclaimed water shall also be used for groundwater recharge. The non-potable water system, irrigation system, and surface sprayer shall be constructed to be in compliance with Title 22 requirements.

The proposed storm water collection system will be comprised of roadway curb and gutter, inlets, pipelines, and retention basins. Grading shall be per the City of Madera standards. Storm water runoff will be stored in retention basins on-site.

Fire suppression will be provided by way of fire hydrants throughout the Project. The fire hydrants will be installed and spaced according to the City of Madera Standard Specifications. The City's Water System Master Plan has planned additional storage tanks to meet the supplemental operational storage and fire flow requirements of the City.

2 INTRODUCTION

2.1 Project Location

The Villages are located in Madera County, adjacent to the western boundary of the City of Madera, California. The Project consists of approximately 1,880 acres and 10,783 dwelling units designed to accommodate a population of approximately 38,000. The major cross streets for The Villages site location are Avenue 16 and Road 23.

2.2 Existing Plans and Surrounding Land Uses

The current planned land uses for the Project are Low Density Residential (VLDR), Medium Density Residential (VMDR), High Density Residential (VHDR), Mixed Use (VMU), Village Country Estates (VCE), Parks and Recreational Areas (VPR), Schools (VES), Village Business Park (VBP), and Open Space (VOS).

The Project is currently surrounded by lands primarily used for agricultural purposes and residential land uses. The Madera Municipal Airport and Madera Municipal Golf Course are located directly north and east of the site location.

2.3 Land Use

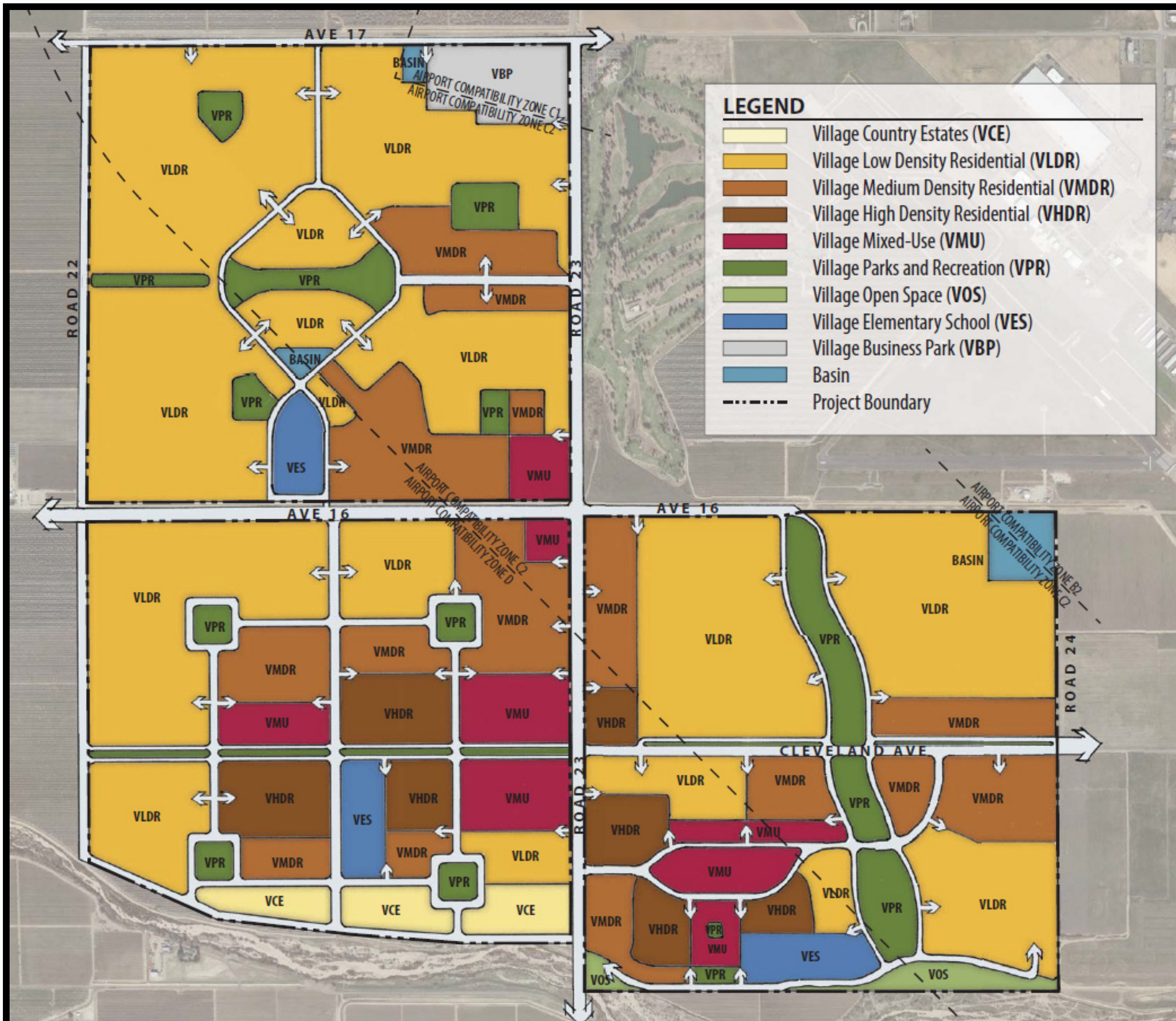
The Infrastructure design is based on the proposed land uses as shown in Table 2- 1 and Figure 2-1.

Table 2- 1 Land Use Summary

Land Use	Acres	Total DU[1]	DU[1] Density (DU/AC[2])
VCE	36	54	0.1 - 2
VLDR	911	4,784	2.1 - 7
VMDR	318	3,579	7.1 - 15
VHDR	105	2,366	15.1 - 50
VMU	120		
VPR	164		
VES	54		
VOP	17		
VBP	30		
MAJOR ROADWAYS	128		
TOTAL	1,883	10,783	

1 DU – Dwelling Unit
2 AC – Acres

Figure 2- 1 Land Use Map



2.4 Infrastructure Phasing

The primary intent of the phasing of the project is to ensure that complete and adequate public facilities and services are in place and available to the Project area as development occurs. While no specific sequencing is prescribed by the Villages at Almond Grove Specific Plan or the IMP, sub-areas of development within the Project area are permitted and shall meet the following objectives:

- Orderly build-out of the project based on market and economic conditions.
- Provision of adequate infrastructure and public facilities as determined and deemed necessary by the City concurrent with development of each sub-area.

- Protection of public health, safety and welfare.

3 POTABLE WATER SYSTEM AND DESIGN STANDARDS

3.1 Introduction

This section consists of the major water supply facilities plan and water design standards to provide for a safe and reliable water system and fire protection system for the Project. The Project's overall water demand was calculated by utilizing a number of sources, which can be found in Appendix C, and which are based on the assumption that the project shall comply with the mandated 20 percent reduction of indoor water usage. Reclaimed water will be used for groundwater recharge and irrigation of landscaped areas and open space areas to reduce groundwater demand. The water system master plan may be subject to modification pending approvals of more specific development entitlements over time.

3.2 Water Conservation and Demand Reduction

California approved the 2010 California Green Building Standards Code (CALGreen 2010), which required new buildings in California to become more efficient by mandating new construction to meet minimum standards. CALGreen 2010 required compliance effective January 1, 2011, as Part 11 of California Code of Regulations (CCR) Title 24.

When addressing residential water use, CALGreen 2010 required a 20 percent reduction in indoor water use from the 2008 Title 24 baseline, through either prescriptive or performance methods. The prescriptive method requires installation of ultra low flow fixtures for showerheads, bathroom and kitchen faucets, and toilets. The performance method requires a demonstrated 20 percent reduction in baseline water use, with options for compliance left to the builder. Other legislation and water conservation programs include the 20x2020 Water Conservation Plan, LEED, Senate Bill (SB) 407, and EPA WaterSense® Program, each of which have similar goals in water use reduction and efficiency to CALGreen.

The 20x2020 Water Conservation Plan (SB7 legislation) requires a statewide 20 percent per capita reduction in urban water demands by 2020, while LEED has a prerequisite to reduce indoor water usage 20 percent beyond 1992 standards. SB407 mandates retrofit of non-compliant plumbing fixtures in pre-1994 homes. Beginning in January 2014, all building alterations or improvements to single-family, multi-family, and commercial properties will require non- compliant fixtures to be replaced for final permit approval by local building departments. As of January 2017, a seller or transferor of a property must disclose to the purchaser the requirement for replacing plumbing fixtures. Furthermore, beginning in January 2019, all non-compliant plumbing fixtures in multi-family and commercial properties must be replaced.

The EPA WaterSense® program also requires a 20 percent reduction in water use. New homes may be labeled as EPA WaterSense® if specific criteria are met and the home is built by a WaterSense® building partner.

With the new CALGreen legislation and other water conservation programs, indoor water use (and wastewater flows) is expected to decrease significantly for new residential developments. Reduced indoor water use estimated from new water conservation legislation and programs is provided in Table 3- 1.

The Project will comply with the California Green Building Code standards, which requires residential and nonresidential water efficiency and conservation measures for new buildings and structures that will reduce the overall potable water use inside the building by 20 percent. The Project will install ultra low flow fixtures and appliances.

The Project will install water meters at all of the service connections. The service provider will assess service charges based on volumetric rates and/or tiered rates. The rate structure will encourage reasonable water use.

Table 3- 1 Projected Water Use with New Water Conservation Measures

Legislation/Program	Projected Indoor Water Use (gpcd)
CalGreen 2010[1]	40.0
EPA WaterSense® Program[2]	39.5
AWWA Guidance Report[3]	43.5

1 *California's Residential Indoor Water Use*, prepared by Con Sol March, 2014. Refer to Appendix V.
2 *Water-Efficient Single Family New Home Specification Supporting Statement*, Prepared by USEPA, Water Sense, May 2008. Refer to Appendix V.
3 *Water Conservation Measurement Metrics Guidance Report*, prepared by AWWA, January 2010. Refer to Appendix V.
4 Gallons per capita per day (gpcd).

3.3 Potable Water Demands

The 2017 Census data indicates an average household size of 3.47 people per dwelling unit (DU) for this area. For purposes of this report 3.5 persons per DU is used. Based on the projected water usages presented in Table 3- 1, water usages ranges from 39.5-43.5 gallons per capita per day (gpcd). For the purposes of this report and to be conservative 45 gpcd will be used for residential water demands. Therefore, estimated water demand for residential uses is approximately 157.5 gpd/DU. For purposes of this report it will be rounded up to 160 gpd/DU. For multi-family residential uses, such as the VHDR, a lower water demand of 134 gpd/DU is used; this reflects the generally lower per capita per dwelling unit (3.0 persons per DU) for multifamily residential uses, and respective lower water use. For Village Country Estates, 3.75 persons per DU and a higher water demand of approximately 170 gpd/DU shall be used. Table 3-2 summarizes the water demands for the various land uses. The estimated average daily demand (ADD) for the Project is 2.0 MGD. These demands specifically exclude demands associated with irrigation.

Table 3- 2 Potable Water Demands

Land Use	Total Units	Unit	gpd/Unit	ADD (gpd)
VCE	54	DU	170	9,180
VLDR	4,784	DU	160	765,467
VMDR	3,579	DU	160	572,706
VHDR	2,366	DU	134	317,027
VMU	120	AC	700	84,049
SCHOOL	3,656	Student	8	29,249
VBP	1,293,454	SQ. FT.	0.08	103,476
UFW[1]				131,681
Total				**2,012,835**

1 Unaccounted-For Water (UFW) assumed 7% of system demands

3.4 Water Use Peaking Factors

Peaking factors represent the increase above the average annual demand experienced during a specific period. The various peaking conditions are statistical concepts or numerical values obtained from a review of historical data and tempered by engineering judgment. The peaking conditions discussed in the following sections are of particular significance to hydraulic analysis for and determination of water supply needs.

ADD is the average daily demand for a year and is calculated by dividing the total water demand in a year by 365 days. This value is used as a base demand for a system to which various higher demand periods throughout the year are related for comparison.

The Maximum Month Demand (MMD) is the highest water demand during a calendar month of the year. The peaking factor used for MMD is expressed as a multiplier of average daily demand. The MMD peaking factor is used primarily in the evaluation of supply capabilities. Based on the analysis in the City of Madera Water System Master Plan (WSMP), the MMD peaking factor is 1.75 times greater than the average daily demand.

The Maximum Day Demand (MDD) is the highest water demand during a 24-hour period. The peaking factor used for MDD is expressed as a multiplier of average daily demand. Water system sources are typically sized to meet the anticipated MDD of a water system when there is adequate peaking storage or additional well supplies. At a minimum, a system's water supply capacity should be able to meet the MDD of the system. Based on the analysis in the WSMP, the MDD peaking factor is 2.0 times greater than the average daily demand.

The Peak Hour Demand (PHD) is the highest water demand during any 1-hour period in the year. The peaking factor used for PHD is expressed as a multiplier of average daily demand. Peak Hour Demand is primarily used in sizing storage tanks and booster pump facilities. Demand variations throughout a typical summer day are due to higher water use for activities such as food preparation, bathing, and certain restaurant and commercial uses. PHDs stress the entire system and show which areas of the water system experience low pressures. This condition is typically similar to MDD plus fire flow, only in this case the demand is distributed throughout the system. Based on the analysis in the WSMP, the PHD peaking factor is 3.0 times greater than the average daily demand. Table 3- 3 summarizes the Peaking Factors used for the water system.

Table 3- 3 Peaking Factors and Peak Demands

ADD	MMD		MDD		PHD	
gpm	Factor	gpm	Factor	gpm	Factor	gpm
1,398	1.75	2,446	2.0	2,796	3.0	4,193

3.5 Fire Protection

According to the 2016 California Fire Code, the minimum fire flow requirement in is 1,000 gpm at 20 psi for 1 hour for single- and two-family dwellings having a fire flow calculation area that does not exceed 3,600 square feet. For residential dwellings larger than 3,600 square feet, a fire flow of at least 1,750 gpm at 20 psi for 2 hours is required. For multi-family residential and nonresidential buildings fire sprinklers are required and specific fire flow requirements must be met based on construction material and square footages of individual buildings in accordance with the Fire Code. The Fire Marshall can allow fire flow reductions for installing fire sprinklers, etc.

As of January 1, 2011 California State Law requires all new one and two-family dwellings, and manufactured homes built in California to have a working fire sprinkler system. There are no alternatives or exceptions to this law. It's important to recognize this law is not retroactive. Fire flow shall comply with Appendix B of the California Fire Code. For purposes of this study, a 2,000-gpm fire flow will be used to determine supply requirements.

The potable water system shall be designed to supply the required fire flow of 2,000-gpm for a minimum of two hours, while concurrently supplying the Maximum Day Demand, with a minimum pressure of 20 psi. Fire hydrant spacing will be a maximum of 400 feet in residential areas and 300 feet in commercial districts. Onsite fire protection must comply with CFC Appendix C for fire hydrant distribution. Fire hydrants shall be dry-barrel with 4-1/2 inch and 2-1/2 inch outlets per City of Madera Fire standards. All fire hydrants shall be of common manufacture and of a brand acceptable to the City of Madera Fire Department.

3.6 Potable Water Supply

Potable water for existing developments within the City area is currently being supplied by groundwater through 18 active wells. These wells all pump from the regional groundwater supply from the Madera Subbasin of the San Joaquin groundwater basin directly into the distribution system to meet the City's demands. The future water needs of the Plan Area i.e., residential, commercial, fire fighting, shall be met through additional wells. These wells are to be constructed near the Villages area per the WSMP, refer to Figure 3- 1.

Due to groundwater constraints in the City, future well capacity in the southeast was estimated at 1,300 gpm per well, while the remainder of the City was estimated at 1,850 gpm per well (Akel

Engineering Group, Inc. 2014). While it was preferred to continue constructing groundwater supply wells throughout the City, review of groundwater conditions completed by Kenneth D. Schmidt and Associates, combined with 2014 groundwater test holes, indicate high probability for the presence of poor water quality as well as low well yields in the east and northeast part of the City. Therefore, it was determined by the City that new wells should be constructed in the western side of the City, with the intent of servicing the future developments throughout the Planning Area, including the northeast. The water quality shall be less than the Maximum Contaminant Levels of the Safe Drinking Water Quality Act.

A 24" water line is needed to connect the project along Avenue 17 to a storage tank constructed in the northeast quadrant of the city to help service the eastern side of the city, refer to Figure 3-1. The City shall provide accelerated fee credits to the developer of this water line.

Determination of the adequacy of the groundwater supply requires calculation of the aquifer's sustainable yield. The sustainable yield is the amount of water that is naturally and/or artificially recharged to the aquifer each year that may be extracted without reducing the remaining volume of the aquifer. The Madera Subbasin Groundwater Sustainability Plan (GSP) was used as a basis for determining the sustainable groundwater pumping for the study area acreage. Regional Sustainable Yield is calculated as follows:

Annual Pumpage – Annual Overdraft = Annual Sustainable Yield

The annual sustainable yield can be divided by the regional (basin, subbasin, or zone within a subbasin) aquifer area to determine the sustainable yield per acre.

Annual Sustainable Yield / Area of Regional Aquifer = Sustainable Yield per Acre

The project area can now be applied to determine the average annual yearly amount of groundwater that can be used by the project.

Project Acreage x Sustainable Yield per Acre = Total Sustainable Annual Use

The Project demand and annual sustainable use values are then subtracted to determine if the groundwater supply by itself is adequate or if there is a deficit.

This calculation must also account for imported surface water used for direct or in-lieu recharge, and for direct or in-lieu recharge of other waters within the groundwater subbasin, all of which directly offset groundwater pumping by the project. In the following equation "Total Recharge" means the average annual acre-feet (AF) of water recharged via any and all of these methods, including recharge and re-use of reclaimed wastewater, stormwater and irrigation water.

Total Groundwater Pumped – Total Recharge – Sustainable Annual Use = Annual Surplus (or Deficit) of Groundwater

Use of surface water or reclaimed wastewater supplies by the project will reduce the demand on groundwater to be pumped, but does not directly offset groundwater pumping, so it is not included in this calculation. Any beneficial recharge claimed shall be included in Total Recharge, which directly offsets groundwater pumping, as indicated above.

In order to help reduce the demand on groundwater pumping by the Project, reclaimed water shall be used to meet outdoor water demands for the project area.

Other options to help offset groundwater demands include:

- Purchasing surface water for outdoor use and recharge (instead of using reclaimed)
- Claim groundwater reductions in other properties owned by the developer within the Madera subbasin
    - Place a land conservation easement on properties currently utilizing groundwater
    - Or reduce the amount of water used in that area
- Fund other water demand reduction projects to obtain groundwater reduction credits
    - Purchase land conservation easements from other land owners
    - Purchase other land to be used for recharge projects
- Capture excess flood waters from MID on onsite basins to be used for recharge

Funding/purchasing land conservation easements from other land owner would mean essentially “buying" groundwater rights, or paying water users to forgo pumping or reduce their ground water extractions. This approach can be very effective in reducing groundwater overdraft, while avoiding the potential equity concerns associated with mandatory reductions in ground water extractions. However, monitoring and enforcement are critical for ensuring the success of the purchase of conservation easements/ground water rights. This is clearly required to ensure that water right or license holders do not continue to pump contrary to the program or agreement.

Figure 3- 1 City Water Master Plan

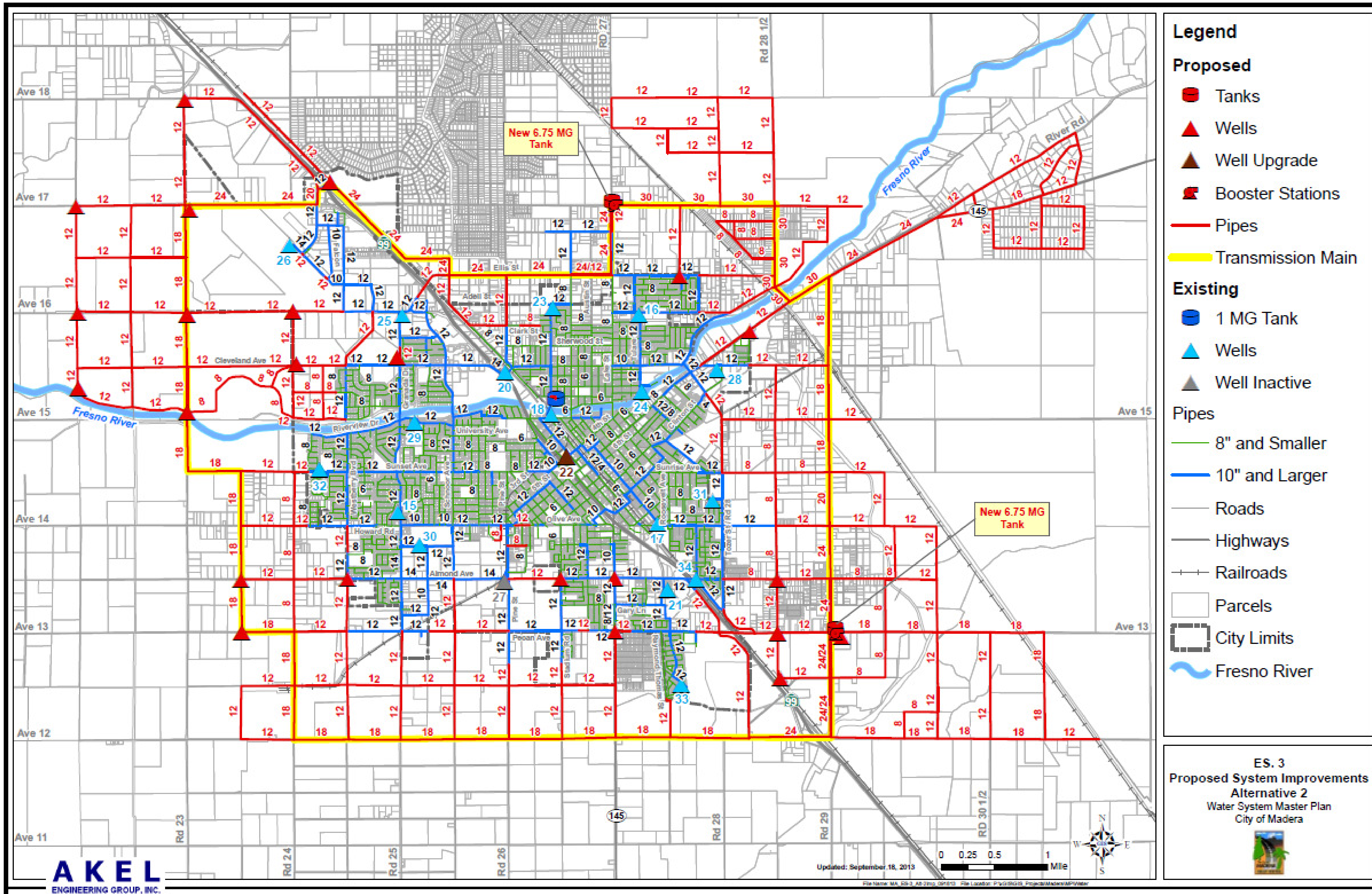


*Figure provided by Akel Engineering Group, Inc.

3.8 Potable Water System Master Plan

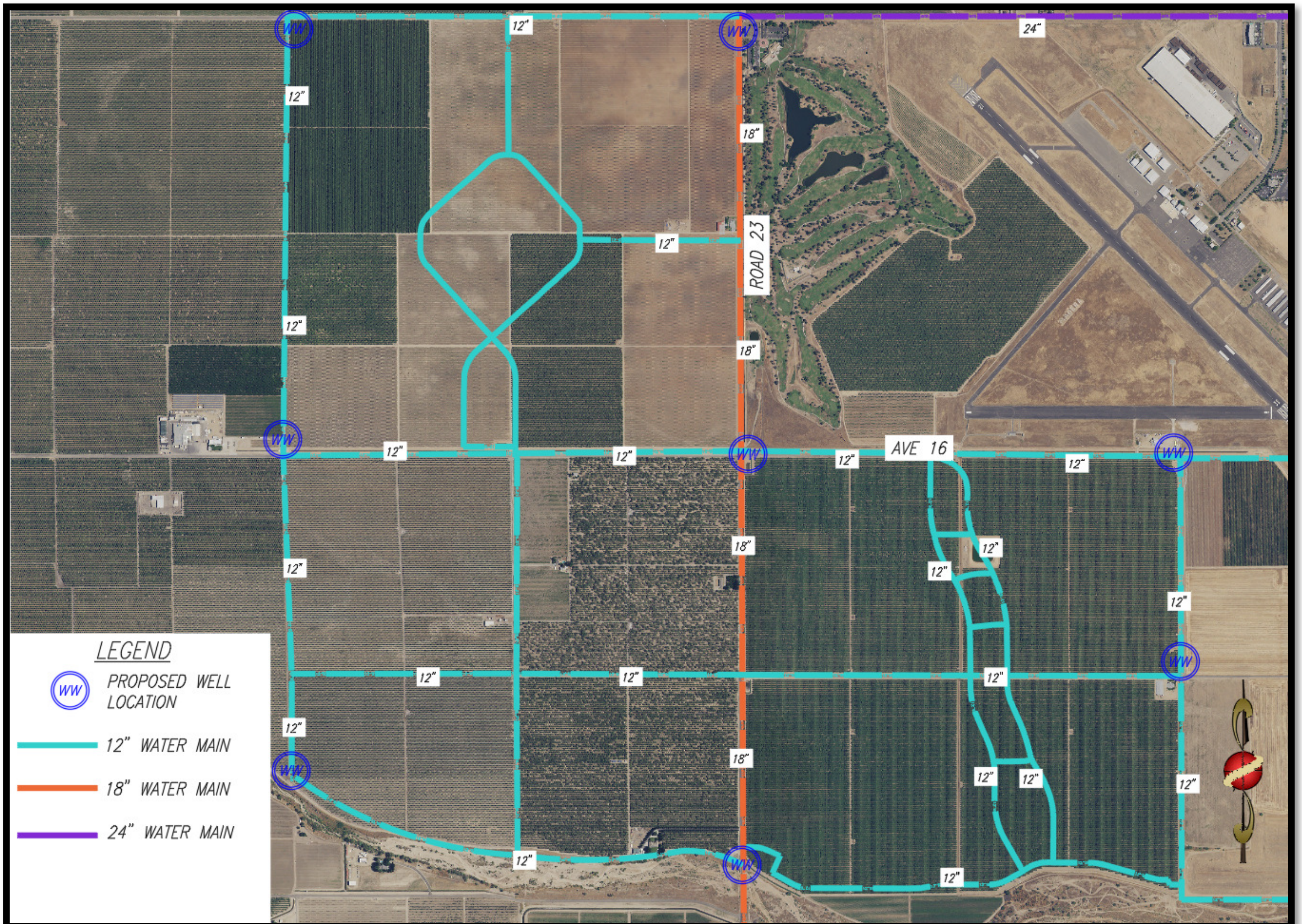
Figure 3- 2 illustrates the major water facilities proposed for the Project. The proposed master plan, distribution system, and pipe sizes, were developed based upon the proposed Land Use Plan in Table 2- 1 and the WSMP. Adjustments to the Land Uses will require modifications to the water system master plan based on approval of subsequent development entitlements that finalize residential densities, neighborhood commercial, recreational and office use.

3.8.1 Water Production and Distribution Standards

The current practice in Madera considers the groundwater aquifer as the available storage as long as the supply wells are designed to meet peak hour demands. During electrical outages, it is desired that emergency generators are installed on wells to meet the average day demand requirements. As groundwater supply is seen as a sustainable resource, the groundwater aquifer storage is adequate for meeting the existing storage requirements of the City. For supplemental operational storage and for meeting fire flow requirements, the City maintains an elevated reservoir with a 1.0 million gallons (MG) capacity.

The WSMP has planned additional storage tanks to meet the supplemental operational storage and fire flow requirements of the City; tank locations per the WSMP are provided in Figure 3-1. Average Day, Peak Hour and Fire Flow demands shall be calculated in accordance with the IMP. Master Planned water mains for the project area are shown in Figure 3- 2.

Figure 3- 2 Project Area Water System Master Plan



3.8.2 Water and Fire Flow Storage

Water storage requirements include three components: fire flow, peak demands, and contingency back-up. Water storage requirement will increase as the development progresses, with the general principles being that additional water supply redundancy reduces the requirement for back-up storage, and more-intensive land use increases the fire flow storage requirement. Fire flow storage must be sufficient to provide 120 minutes (two hours) of operation at the highest-required fire flow, while concurrently meeting the Maximum Day Demand of the City as developed at the time.

Many community water systems, including the one planned for The Villages, are designed to produce the MDD on a sustained basis over a number of days. This sustained capability makes it possible to meet the system's demand during a period of hot days, as typically experienced during the summer in the Valley. However, the MDD is the total water used in a 24-hour period, and does not represent the actual peak use during any day. Over the course of a maximum day, hourly water usage peaks and then declines. During low usages, such as during the evening, storage tanks for the City can be filled. Peak Demand Storage must be adequate to supplement the sustained water supply capacity and meet PHD for a minimum of six hours per day. Calculations demonstrating the need for Peak Demand Storage, and the required capacity thereof, shall be submitted with each application for subdivision improvement drawings, for approval by the City.

3.8.3 System Utilization and Redundancy

Backup power shall be provided for all reservoirs, and booster pumps to insure that power is maintained during power outages. City reservoirs producing at least the MDD for the City should be constructed to provide for system redundancy for maintenance and repairs.

3.8.4 Water Distribution Requirements

The water transmission and distribution mains shown on Figure 3- 2 have been sized to meet the water demands anticipated by the planned land uses for the Project.

The distribution system shall be of adequate size and designed in conjunction with related facilities to maintain normal operating pressures of no more than 65 psi and 100 psi at the service connection, except during periods of maximum hourly demand the pressures shall not be less than 35 psi and 40 psi during maximum day and no more than 125 psi. The computations for fire flow shall be based upon a minimum of 20 psi residual operating pressure at the hydrant.

All in-tract water facilities shall be designed at the time of subdivision approval, and shall be adequate to meet these pressure and fire flow requirements throughout each individual development.

3.8.5 Water System Construction Standards

Water main pipe shall be PVC Class 150 per AWWA C-900 for 12" and smaller. Water main pipe 14" and larger shall be Class 165 per AWWA C-905. Alternatively, water main pipe 16" and larger may be Ductile Iron Class 250. Water service pipe shall be Polyethylene CTS 200 psi SDR-9 PE 3408.

All valves 12" and smaller shall be gate valves with resilient seats per AWWA C-515. Valves 14" and larger may be butterfly design per AWWA C-504. Valves shall be installed at every street intersection and shall be configured to allow for isolation of individual blocks without affecting other parts of the system. All water services receiving surface treated or well water shall be metered.

Any private water service requires double detector checks. All commercial businesses shall be equipped with a reduced pressure (RP) device.

3.8.6 Phasing and Incremental Development

Incremental development of water system infrastructure shall be designed and constructed in accordance with the IMP as needed for each phase of the Project.

4 WASTEWATER SYSTEM AND DESIGN STANDARDS

4.1 Introduction

This section provides for the major wastewater facilities design and wastewater system design standards for the Project. The City of Madera Sanitary Sewer System Master Plan (SSSMP) identified the need for an additional sewer trunk line running down Road 23 (Road 23 Trunk) to connect to the existing Waste Water Treatment Plant (WWTP), refer to Figure 4- 2. The wastewater system master plan may be subject to modification pending approvals of more specific development entitlements over time.

4.2 Wastewater Master Plan

Figure 4- 1 illustrates the wastewater master planned sewer mains and preliminary elevations for Project. The Road 23 Trunk shall be a 30” line that shall connect to a 48” line running parallel to an existing 48” pipe that connects to the existing WWTP. The 30” line shall be approximately 15,900 linear feet (lf) and the parallel 48” pipe shall be approximately 8,000 lf. A lift station will be needed west of the Ave 16 and Road 23 intersection. A second lift station will be needed before the Fresno River crossing on Road 23. Refer to Figure 4- 1.

An analysis done by Akel suggested that the existing Westberry Trunk seems to have capacity to accommodate the first 100-200 lots of the development at this time. However, the capacity is already allocated per the SSSMP for future Northeast growth tributary to the Westberry Trunk and as such, the connection of the 100-200 lots shall only be permitted on a temporary basis. Provisions shall be made to reverse the flows for these 100-200 lots back to the future Road 23 Trunk.

4.3 Sewer Generation Rates

Sewer generations were calculated based on the water demands presented in Table 3- 2, with the assumption that all indoor water generated within the Project ends up in the wastewater collection system. The estimated sewer generation rate for single family residential land uses is 160 gpd per DU. For high-density residential units only, a lower per DU contribution of 134 gallons per day has been used. For VCE a higher rate of 170 gpd per DU was used. The planned Elementary Schools are expected to have approximately 3,656 students that will generate wastewater at a rate of 8 gpd, which will produce about 29,249 gpd. The inflow and infiltration (I&I) is the storm water flow entering the waste water system through manholes, and joints in the sewer collection system. The I&I is estimated to be approximately 7% of total flows, which is generally acceptable for new wastewater collection systems. Table 4- 1 below summarizes the sewer generation rates used for the proposed land uses in this Project and sewer system master planning. The Average Daily Flow is approximately 2.0 MGD.

Table 4- 1 Sewer Generation Rates

Land Use	Unit Count	Unit	gpd/unit	gpd
VCE	54	DU	170	9,180
VLDR	4784	DU	160	765,467
VMDR	3579	DU	160	572,706
VHDR	2366	DU	134	317,027
VMU	120	AC	700	84,049
VBP	1,293,454	SQ. FT.	0.08	103,476
VES	3,656	Student	8	29,249
Inflow and Infiltration[1]				131,681
			Total	**2,012,835**

1 Assumes 7% of the total sewer flows is Inflow and Infiltration.

4.4 Wastewater Treatment

The Project's wastewater will be conveyed to the existing WWTP located on Road 21 ½ and Avenue 13. Wastewater will be collected in a system of mains using primarily gravity flow. The collection system will generally follow topographical features or roads and require one or more lift stations. In addition, a separate distribution system will be constructed for delivery of treated effluent from the wastewater treatment plant for irrigation of landscaped areas.

The Madera WWTP shall be expanded to treat effluent that shall be used on this development to tertiary levels, consistent with Title 22 requirements for landscaping and irrigation uses. Funding for this upgrade as well as the distribution system that will deliver treated effluent shall be provided through a Community Facilities District (CFD).

4.5 Treatment Process

The existing WWTP consists of a headworks with two mechanical bar screens, an influent lift station, and two grit chambers; three rectangular primary clarifiers and primary effluent pump station; and biological treatment with three oxidation ditches, four circular secondary clarifiers, and a Return Activated Sludge (RAS)/ Waste Activated Sludge (WAS) splitter. The effluent disposal facilities consist of fourteen 20-acre evaporation/percolation ponds and one 40-acre evaporation/percolation pond. Solids handling includes three anaerobic sludge digesters (two primary and one secondary) and two sludge dewatering centrifuges. The original treatment plant and disposal facilities were constructed in 1972. The plant was expanded in 1990 with the addition of a third primary clarifier and then upgraded in 2007 with the installation of three oxidation ditches and four secondary clarifiers, which replaced the original trickling filters. The influent mechanical screens at the headworks were replaced in 2011.

The City of Madera WWTP operates under Waste Discharge Requirements (WDRs) Order No. 95-046 of the California Regional Water Quality Control Board (RWQCB), Central Valley Region, which was adopted in 1989. The treated effluent from the existing WWTP is discharged to existing evaporation/percolation ponds. Wastewater treatment for the project will achieve tertiary-quality effluent, meeting State Water Quality Standards (Title 22) for unrestricted reuse. A Waste Discharge Report shall be filed with the RWQCB for each Project phase.

The Waste Water Treatment Plant (WWTP) will be subject to the Waste Discharge Requirements promulgated by the Board subsequent to those applications.

4.6 Effluent Reclamation and Storage

Treated effluent will be used for irrigation of all parks and outdoor landscaped areas. While effluent disposed via reclamation can be expected to have moderately higher electro conductivity (EC) than the source water. In many valley communities, a large portion of the increase in EC is due to water softeners employed to mitigate the hardness of typical groundwater. Such water softeners will be prohibited within the development to assure that any rise in EC between the source water and the effluent is minimized.

The waste discharge requirements do not allow the irrigation of reclaimed water during and 12 hours before and after a rain event. To account for this limitation effluent storage shall be large enough to accommodate the treated effluent during this period. The design storm used for the effluent pond is a 48 hour 100 year storm event. Per NOAA Atlas 14 maps the 100 year rainfall amount is 3.9 inches, refer to Appendix B.

4.7 Biosolids Disposal

Disposal of biosolids generated by the WWTP in the Project will be in accordance with regulations contained in EPA 40 CFR 503, and State Water Resources Control Board Water Quality Order 2000-01-DWQ, "General Waste Discharge Requirements for the Discharge of Biosolids to Land for Use as a Soil Amendment in Agricultural, Silvicultural, Horticultural, and Land Reclamation Activities (General Order)." It is expected that biosolids will be trucked to and disposed of at an approved landfill and/or disposal site. In any case, all disposal operations will operate under the permitting authority of the RWQCB and the California Department of Public Health Services (CDPHS), and shall comply with any future Madera City ordinance which regulates land application of treated municipal sludge.

The Waste Discharge Requirements (ORDER NO. R5-2008-0127) issued by the RWQCB for the WWTP contain the following stipulations regarding biosolids:

"The United States Environmental Protection Agency (EPA) has promulgated biosolids reuse regulations in Title 40, Code of Federal Regulations, Part 503, Standards for the Use or Disposal of Sewage Sludge, which establishes management criteria for protection of ground and surface waters, sets application rates for heavy metals, and establishes stabilization and disinfection criteria. The Discharger may have separate and/or additional compliance, reporting, and permitting responsibilities to EPA. The RWD states that all biosolids will be hauled to a separate permitted facility."

"Residual sludge, biosolids, and solid waste shall be disposed of in a manner approved by the Executive Officer and consistent with Title 27. Removal for further treatment, disposal, or reuse at sites (i.e., landfill, composting sites, soil amendment sites) operated in accordance with valid waste discharge requirements issued by a regional water quality control board will satisfy this specification."

Figure 4- 1 Project Area Wastewater System Master Plan

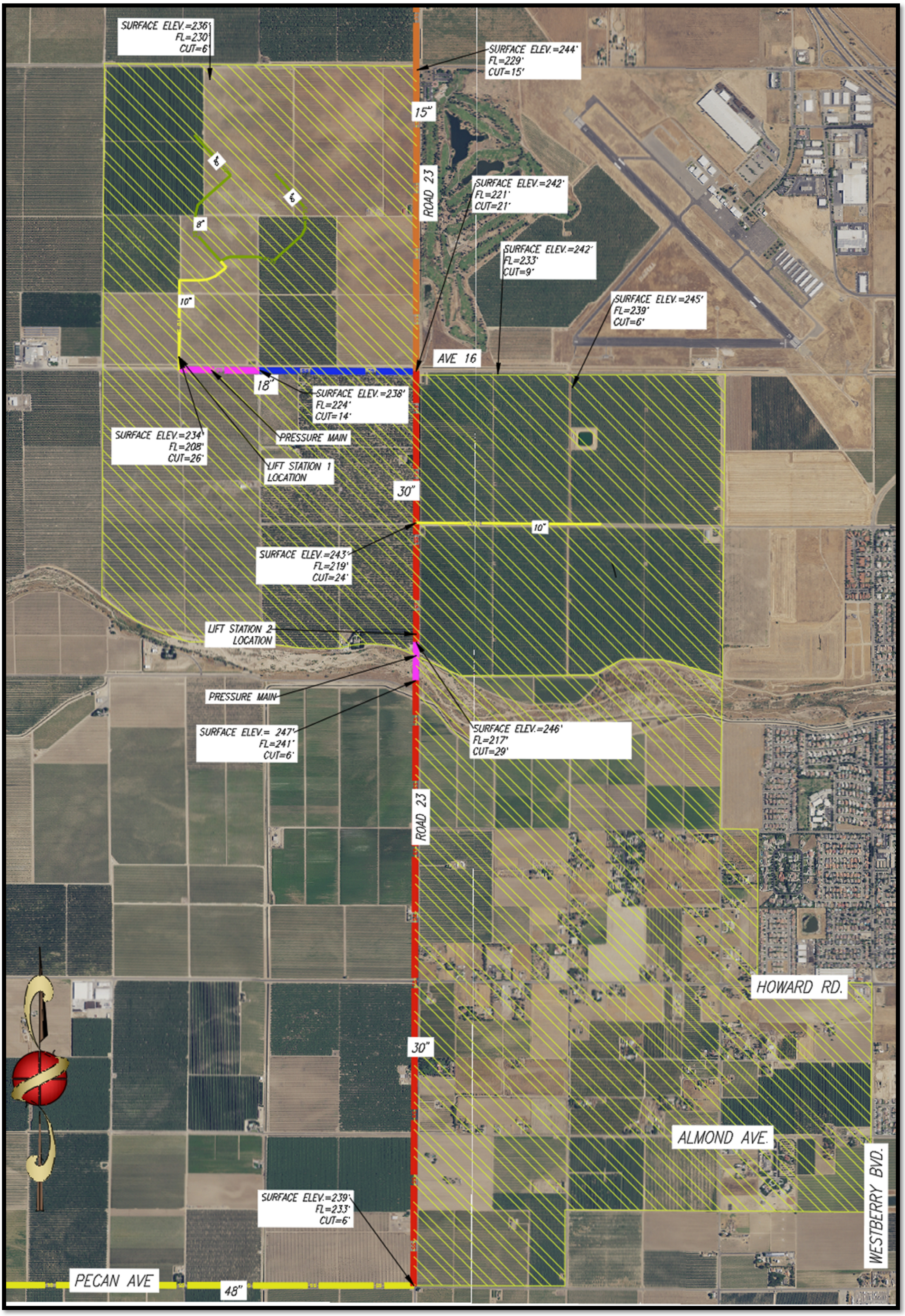
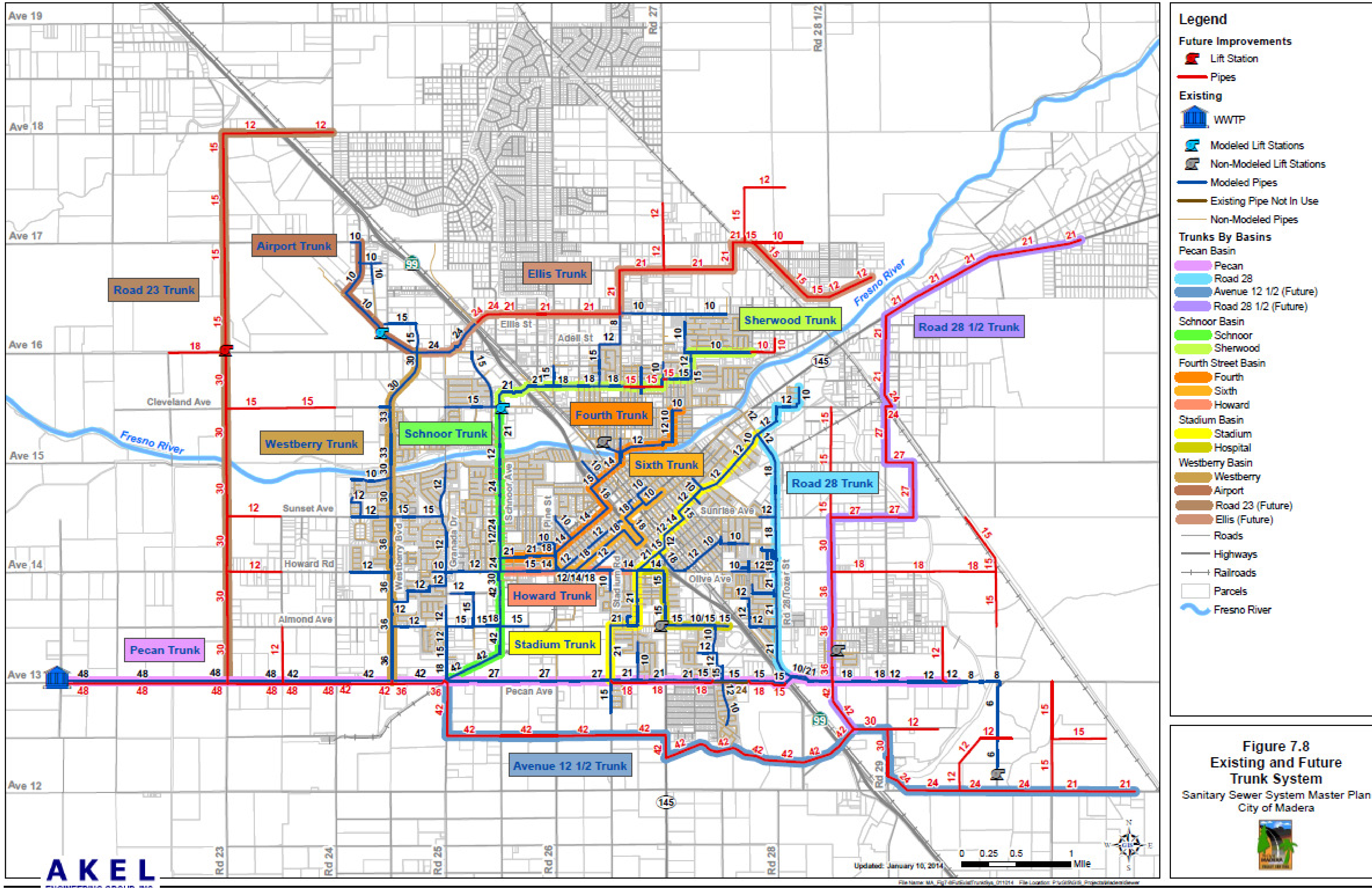


Figure 4- 2 City Sewer Master Plan



* Figure provided by Akel Engineering Group, Inc.

4.8 Wastewater Collection System Design Standards

The waste water collection system was designed to convey the sewer flows based on the land uses from Table 2-1, and sewer generation rates as shown on Table 4- 1. Adjustments to the sewer master plan will be made with development entitlements approving final street alignments and actual residential densities and specific commercial uses are identified.

4.8.1 Collection Facilities

Collector sewers should be designed for a minimum velocity at average daily flow of 2.0 fps and a maximum velocity at peak daily flow of 4.0 fps. Minimum velocity prevents suspended material from depositing in the pipe and the high velocity allows for flushing of the pipes each day during peak sewage flows. During this period, any deposited materials will be re-suspended and carried down the pipeline. Keeping velocity below 4.0 fps minimizes scour and abrasion caused by grit in the sewage. Pipe friction factors can vary depending on pipe material, size of pipe, depth of flow, and other factors. For purposes of this report the friction factor was based on a Manning's "n" of 0.010.

In addition to minimum and maximum velocity requirements, pipe sizes were selected to maintain a depth at peak flow of approximately 50 percent of the nominal pipe diameter for pipes 8 to 12 inches in diameter and 75 percent for pipes larger than 12 inches. This provides a "cushion" for any changes to wastewater discharge that we cannot quantify, such as changes in land use, inflow through manholes during storm events, etc.

Collection facilities include gravity sewer mains of a minimum of 8 inches in diameter. The collection system will be constructed in phases, designed to correspond with the service needs of the Project phases.

The Madera WWTP is a primary and secondary treatment facility. The City is currently seeking approval for 7 MGD with plans for 10.1 MGD within 20 years. The treatment facility is located on the corner of Road 21 ½ and Avenue 13. The original plant was completed in 1972 with a plant expansion occurring in 2007 to provide the plants current capacity and technology. The plant is currently operating at an average flow of 5.1 MGD.

4.8.2 Wastewater System Construction Standards

Gravity sewer mains will typically be of PVC (SDR 35) construction with rubber-gasket joints. Any future sewer force mains to connect to overall area master plan will typically be of PVC pressure pipe, C-900, Class 150. Exceptions may be made in cases of water/sewer crossings where CDPHS regulations require other materials.

Standard manholes, per City of Madera standards, shall be spaced no further than 500 feet apart on public main sewers and shall be placed at each change in alignment, grade, or pipe size. Construction practices shall follow the approved City of Madera standard specifications.

The lift station shall be wet-well designed employing submersible non-clog pumps or as determined through consultation with Public Works personnel during design of these facilities.

Each lift station shall have a minimum of two pumps. The station shall be capable of meeting the peak design flow with one pump out of service. Pumps shall be specifically designed for operation in a raw municipal wastewater environment. All miscellaneous metals inside the wet well, including steps and pump rails, shall be of stainless steel to resist corrosion. Pump electrical services shall generally be 480V, 3-phase for economical operation. Lift stations with individual pumps rated at 2 horsepower or less may be 240V, 1-phase. Detailed specifications for lift stations and equipment shall be subject to approval by the City of Madera Engineering Department.

4.8.3 Phasing and Incremental Development

Incremental development of wastewater collection facilities and infrastructure shall be designed in accordance with the IMP as needed for each phase of the Project. Wastewater collection pipes shall be constructed in conformance with the wastewater system master plan.

4.8.4 Pipe Slopes for Gravity Systems

Pipes shall be designed to achieve design flow velocity of at least 2.0 feet per second (fps), to allow for self-cleaning. Pipes shall be designed to flow at a maximum depth/diameter ratio of 50% (8”-12” pipes) or 75% (>12” pipes), to allow for flow peaks, unplanned land use changes and other non-predictable factors. The minimum slopes to maintain suggested velocities per the SSSMP are presented in Table 4- 2 below.

Table 4- 2 Pipe Slopes

Diameter (inch)	Minimum Slope (ft/ft)	Capacity	Velocity
8	0.0034	0.49	2.28
10	0.0025	0.76	2.26
12	0.0022	1.15	2.40
15	0.0015	1.73	2.30
18	0.0012	2.81	2.60
21	0.0010	3.46	2.35
24	0.0008	4.42	2.30
27	0.0008	6.05	2.48
30	0.0008	8.01	2.66
33	0.0008	10.33	2.84
36	0.0008	13.02	3.01
42	0.0008	19.65	3.33
48	0.0007	26.24	3.41

5 NON-POTABLE WATER SYSTEM AND DESIGN STANDARDS

5.1 Introduction

This section provides for the major non-potable water facilities and distribution system design standards for the Project plan area. The Project will utilize reclaimed water supply to irrigate all landscaped areas within the Project area. Doing so allows for efficient disposal of treated water from the local waste water treatment plant as well as reducing the potable water demand. The Project is designed to efficiently use the available water resources and minimize the impacts to the groundwater aquifer. The non-potable water system master plan may be subject to modification pending approvals of more specific development entitlements over time.

Per Title 7 of the Division of Drinking Water's Recycled Water-Related Statues, the waters of the state are of limited supply and are subject to ever-increasing demands. The continuation of California's economic prosperity is dependent on adequate supplies of water being available for future uses. It is in the policy of the state to promote the efficient use of water through the development of water recycling facilities. Landscape design, installation, and maintenance can and should be water efficient. The use of potable domestic water for landscaped areas is considered a waste or unreasonable use of water within the meaning of Section 2 of Article X of the California Constitution if recycled water is available and meets the conditions described in Section 13550 of the Water Code.

5.2 Non-Potable Water System Master Plan

The non-potable water system shall be designed to serve parks, commercial and residential landscape areas (front and back yard). The existing watstewater treatment facility shall need to be expanded to treat effluent to tertiary levels, consistent with Title 22 requirements for landscaping and irrigation uses. A reclaimed water main shall run from the WWTP to the Project location. Reclaimed water mains shall be installed throughout the project area to irrigate all landscaped areas. Funding for the expansion of the WWTP to accommodate for extra treatment of effluent, as well as funding for the distribution system that will deliver the treated effluent shall be provided through a CFD. Adjustments to the non-potable water master plan will be made with development entitlements approving street alignments, parks, outlots, and actual residential uses are identified.

5.3 Outdoor Irrigation Water Demands

The Project will comply with the Department of Water Resources to update the Model Water Efficient Landscape Ordinance (WELO). Landscaped areas include all of the planting areas, turf areas, and water features. These water demands shall be calculated based on the WELO's Maximum Applied Water Allowance (MAWA) requirements. Table 5- 1 summarizes the outdoor water demands for the Project. Open Space areas and trails will be planted with native drought tolerant plant species and therefore will not be irrigated. Stormwater retention basins will not be irrigated and therefore will not contribute to the Projects non-potable water demands.

Table 5- 1 Outdoor Irrigation Water Demands

Land Use	Total Units	Unit	gpd/DU or gpd/AC	ADID gpd	Annual AF[2]
VCE	54	DU	350	18,896	21
VLDR	4784	DU	131	627,753	703
VMDR	3579	DU	73	261,116	292
VHDR	2366	DU	13	31,046	35
VMU	120	AC	1,143	137,182	154
VPR	164	AC	3,055	499,951	560
VES	54	AC	2,293	123,464	138
VBP	30	AC	762	22,627	25
UFW[2]				120,542	135
			Total	**1,842,577**	**2,064**

1 Assumes 80% landscape area and 20% non-irrigated hardscape such as play structures, paths, parking areas, and restroom facilities.
2 Unaccounted For Water (UFW) assumed 7% of system demands

5.4 Outdoor Irrigation Water Use Peaking Factors

There are no established industry standard peaking factors for non-potable water systems. However, the City has adopted an outdoor water schedule that prohibits all outdoor watering during 10:00 am to 7:00 pm. The optimum times to perform outdoor watering are early morning and evening, which generally also follow the typical diurnal curve for residential uses. For the purposes of this report, similar peaking factors for the potable water system will used for the non-potable water system. Table 5- 2 summarizes the Peaking Factors that are to be used for the non-potable water system. The Maximum Day Irrigation Demand (MDID) shall be used to size the non-potable water pipes. The Projected Peak Hour Irrigation Demand (PHID) shall be used in sizing storage tanks and booster pump facilities.

Table 5- 2 Peaking Factors and Peak Demands

ADID	MMID[1]		MDID[2]		PHID[3]	
gpm	Factor	gpm	Factor	gpm	Factor	gpm
1,280	1.75	2,239	2.0	2,559	3.0	3,839

1 Maximum Month Irrigation Demand (MMID)
2 Maximum Day Irrigation Demand (MDID)
3 Peak Hour Irrigation Demand (PHID)

5.5 Non-Potable Water Supplies

The reclaimed wastewater produced by the sewer treatment plant will be used for outdoor irrigation purposes. In the early phases of development, quantities of effluent available for use as reclaimed water will be quite limited. Only as the number of completed dwelling units and non-residential increases will the quantity of reclaimed water become large enough to irrigate all proposed landscape areas.

Based on sewer generation rates presented in Table 4- 1, the Average Daily Flow is 2.0 MGD. Assuming approximately 7% of the total inflow is consumed through the treatment process and evaporation, approximately 1.9 MGD will be available for reclaimed uses.

5.6 Water Quality

The reclaimed wastewater shall be treated to tertiary levels to be used for outdoor irrigation purposes, pursuant to Title 22 requirements.

5.7 Non-Potable Water Production and Distribution Standards

Non-potable water shall only be distributed to irrigate landscaped areas within the project. Reclaimed water production capacity must be adequate to supply the MDID for the Project at full build out. Booster pumps shall be designed and constructed to adequately supply the PHID. Water distribution pumping capacity and redundancy must be adequate to meet Peak Hour flow demand with any single source supply out of service. Therefore a minimum of two booster pumps at the intake structure and WWTP shall be constructed to serve this Project. Pump design is beyond the scope of the IMP and will, therefore, be sized later within each phase of development.

5.7.1 System Utilization and Redundancy

Backup power shall be provided for all storage tanks, intake pumps, and booster pumps to ensure that power is maintained during power outages. A minimum of two pumps shall be designed and constructed, at all locations requiring pumps, to provide for system redundancy for maintenance and repairs.

5.7.2 Non-Potable Water Distribution Requirements

The water transmission and distribution mains shall be sized to meet the water demands anticipated by the planned land uses for the Project. All in-tract water facilities shall be designed at the time of subdivision approval, and shall be adequate to meet the pressure requirements throughout each individual development.

5.7.3 Non-Potable Water System Construction Standards

All pipes installed above or below the ground, and are designed to carry non-potable water, shall be colored purple or distinctively wrapped with purple tape. Water main pipe shall be PURPLE PIPE PVC Class 150 per AWWA C-900 for 12" and smaller. Water main pipe 14" and larger shall be Class 165 per AWWA C-905. Alternatively, water main pipe 16" and larger may be Ductile Iron Class 250 and wrapped with purple tape.

Irrigation services shall be Polyethylene CTS 200 psi SDR-9 PE 3408, and shall be equipped with a reduced pressure (RP) device.

All valves 12” and smaller shall be gate valves with resilient seats per AWWA C-515. Valves 14” and larger may be butterfly design per AWWA C-504. Valves shall be installed at every street intersection and shall be configured to allow for isolation of individual blocks without affecting other parts of the system.

5.7.4 Cross Connection Inspection Plan and Enforcement

The Project shall ensure that the non-potable water system within each facility and use area is inspected for possible cross connections with the potable water system. The Project shall develop a cross connection Inspection Plan and an enforcement process, consisting of routine inspections, potential fines and penalties. The enforcement process will help deter any potential cross connections.

The non-potable water system shall be inspected and tested for possible cross connections at least once every four years. The testing shall be conducted in accordance with the requirements of Title 22, California Code of Regulations. The inspections and the testing shall be performed by a cross connection control specialist certified by AWWA, or an organization with equivalent certification requirements. In addition, any backflow prevention device installed on the non-potable water system shall be inspected and maintained in accordance with Title 17, California Code of Regulations.

5.8 Non-Potable Water Rates and Service Charges

Water rates and service charges will be based on cost of maintaining and intake structures, booster pumps storage tanks, force mains, and non-potable water distribution system for a life span of 30 years. Water Code §525 requires water purveyors to install meters on all new service connections, and Water Code §527 requires water purveyors to charge for water based upon the actual volume of water delivered if a meter has been installed. The Project shall develop a Technical, Managerial and Financial report establishing the service charges and tiered metered rates and subject to approval by the City prior to acceptance of the facilities. The rates will be established to promote reasonable water uses, and penalize excessive water uses. The differential in rates of the non-potable water system and the potable water system should not vary significantly. This will assist in deterring non-approved interconnection of non-potable water system and the potable water system.

5.9 Phasing and Incremental Development

Incremental development of non-potable water infrastructure shall be designed in accordance with the IMP as needed for each phase of the Project.

6 STORM DRAINAGE SYSTEM AND DESIGN STANDARDS

6.1 Introduction

This section discusses the storm drainage system design and design standards that will provide flood protection to the Project. Figure 6- 1 illustrates the existing topographic drainage in the area. Currently, the site area all ultimately drains into the Fresno River. For stormwater master planned facilities and infrastructure, see the master plan specific to each of the project quadrants. The Storm Drain master plan may be subject to modification pending approvals of more specific development entitlements over time.

6.2 Grading and Drainage

Grading for the Project shall be in accordance with the City of Madera Grading Ordinance, the current building code, and the recommendations provided in the IMP and its appendices.

During Project design, detailed grading plans shall be prepared, in conformance with the overall drainage concept and the defined drainage area boundaries. Grading plans must be prepared for and reviewed by the City of Madera Engineering Department.

The design of storm drainage systems and grading shall meet existing conditions. Currently there is no storm water flow crossing through this property from any upstream adjacent property. New storm water runoff will be collected on site.

The minimum slope of curb and gutter shall be 0.0015. However, to the maximum extent feasible the Project shall be designed using the recommended maximum design slope of 0.0017.

6.3 Flood Protection

Building pad elevations for the individual subdivisions shall be designed to a minimum of one and a half (1.5) feet above the master-planned gutter flowline elevation in the corresponding inlet tributary area. These criteria will reduce flood risks to the building structures during an extreme storm event over and above the storm drain pipeline and inlet design criteria.

The grading and drainage plans shall be designed so that major storm breakovers and localized street flooding do not exceed a depth of one and a half (1.5) feet. Major storm breakovers shall be designed to direct major storm flows to onsite retention basins.

6.4 Design Criteria

6.4.1 Design Storm

Per the City of Madera Storm Drainage Master Plan (SDMP) all future conveyance facilities shall be designed to convey a design storm with a ten (10) percent probability of occurrence, which is also known as a ten (10) year return interval. A 100-year – 10 day (6.14 inches) design storm shall be used for all retention basins. Streets are to convey the difference in peak runoff volume generated between the 100-year 24-hour design storm and the 10-year 24-hour design storm (1.94 inches). Rainfall precipitation intensity for the design storm event shall be based upon data and graphs found in the National Oceanic and Atmospheric Administration (NOAA), per the SDMP.

The formula for the Intensity is as follows:

Equation 6- 1 IDF Formula

$I = P \times (TC)^{E}$

Where,
I = Intensity (in/hr); P = P factor; TC = Time of Concentration (minutes); E = E factor
The P and E factors for various storm events are presented in Table 6- 1.

Table 6- 1 IDF P and E Factors

Factors	Design Storm		
	2 yr	**10 yr**	**100 year**
P Factor [1]	2.8409	4.5457	8.4917
E Factor [1]	-0.534	-0.544	-0.560

1 Based on best fit trendline Power Regression formula of NOAA Atlas 14 Intensity Duration Frequency, refer to

Appendix A.

6.4.2 Runoff Coefficients and Time of Concentration

Most municipalities in the Central Valley make use of the Rational Formula to calculate storm drain runoff quantities. This formula is simpler than other methods used in other parts of the country, but provides reasonable answers and accuracy when used for small areas (less than several hundred acres per drainage zone). The Project development will be suited for use with the Rational Formula so long as drainage areas are kept relatively small. Final selection of calculation methodology is deferred to the design phase, when a higher level of design detail is available about both land use and grading.

In this case, the Rational Formula is applied and the following runoff coefficients (or "C" factors) and Roof to Gutter (R/G) travel time shall be used for various land uses, as identified in Table 6- 2.

Table 6- 2 Runoff Coefficients

Land Use	2 year	10 year	100 year	R/G (min)
VLDR	0.348	0.38	0.58	25
VMDR	0.384	0.42	0.64	20
VHDR	0.660	0.68	0.90	20
VMU	0.840	0.77	0.90	10
VES	0.340	0.44	0.68	10
VPR	0.240	0.26	0.40	*
VOS	0.240	0.26	0.40	*
ROADS	0.900	0.90	0.90	5

* Design Engineer shall use surface flow curve or other means to establish travel time.

6.4.3 Hydraulic Grade Line Tailwater Conditions

The initial Hydraulic Grade Line (HGL) for the outlet/outfall structure for the collection system in each drainage zone shall be equal to the elevation of the water surface in the basin at two-thirds of its depth.

6.4.4 Pipelines

Storm drain pipes shall be designed using a Manning roughness coefficient of 0.013. Pipeline soffits shall be designed a minimum of one (1) foot below the HGL. The design of the storm drain pipeline below the HGL ensures full pipe flow and reduces the chance of water seal breaks in the pipe and other hydraulic inefficiencies during pipeline use. Design of pipeline below the soffit control elevation ensures proper pipeline performance in sections of the pipe where flow is in the open channel condition due to steep grade construction. Pipelines shall be designed at the recommended design slope of 0.0015, to the maximum extent feasible. The minimum design slope is 0.0010. Storm drain pipes shall be designed to have a minimum 3.5 feet of cover over all pipes.

6.4.5 Overside Drains

The purpose of overside drains, sometimes called slope drains, is to protect slopes against erosion. They convey down the slope drainage which is collected from the roadbed, the tops of cuts or from benches in cut or fill slopes. They may be pipes, flumes or paved spillways. Overside Drains on site shall be designed per Caltrans Standard D87D. The design engineer shall be responsible to provide hydraulic calculations to ensure overside drains can accommodate flows, and intercept any bypass flows.

6.4.6 Inlets

Inlets shall be similar to Fresno Metropolitan Flood Control District (FMFCD) Type "D" Inlets. Inlets shall be designed to accommodate the peak flows of the 10 year design event. Inlets shall be designed under sag conditions. Exceptions may be accommodated where sag conditions are not feasible. Table 6- 3 summarizes the design inlet capacities under sag conditions and continuous slope conditions. If this inlet is not feasible the Caltrans D75A type OMP inlet should be used.

Table 6- 3 Inlet Conditions and Capacities

Inlet Type	Inlet Capacities	
	Sag (cfs)	Continuous Slope (cfs)
Type D	6	3*
Type DD	12	6*

*Assumes minimum gutter slope 0.0015. Design Engineer shall verify inlet capacities and spacing based on proposed design gutter slopes.

6.4.7 Watershed Boundaries

The Watershed for each inlet shall be designed to not exceed the maximum gutter flows and inlet capacities. The peak flows shall be maintained within the roadway top of curbs. The inlets, storm drain pipe, inlet boundaries may need to be modified with approvals of more specific development entitlements over time.

6.4.8 Permanent Retention Basins

Permanent retention basins shall be utilized to the maximum extent feasible, to reduce cost of temporary facilities. Cost of removing temporary facilities shall be borne by the project. Storage volume shall be calculated based on the following formula:

Equation 6- 2 Basin Volume (Required)

$$V = C_{comp} \times A \times I$$

Where;
V = Volume (acre feet)
C_{comp} = Composite C-Factor for watershed
A = Total area in watershed (acres)

I = total rainfall depth (feet) for 100 yr 10 day storm event: 0.51 feet (6.14 inches).

The highwater elevation of the retention basin shall be at a minimum of 1.0 foot below the lowest inlet elevation within the watershed of the retention basin. The Retention basins shall be designed with a minimum freeboard of 1.0 foot. The HGL in the basin shall be equal to the elevation of the water surface in the basin at two-thirds of the basin depth. The side slopes shall be designed not to exceed 4:1. To the extent feasible, permanent retention basins will be designed with dual levels. The low flow area shall be sized to accommodate nuisance flows to provide for potential recreational uses of the upper level. Basin design volumes shall be:

Equation 6- 3 Basin Design Volume (Provided)

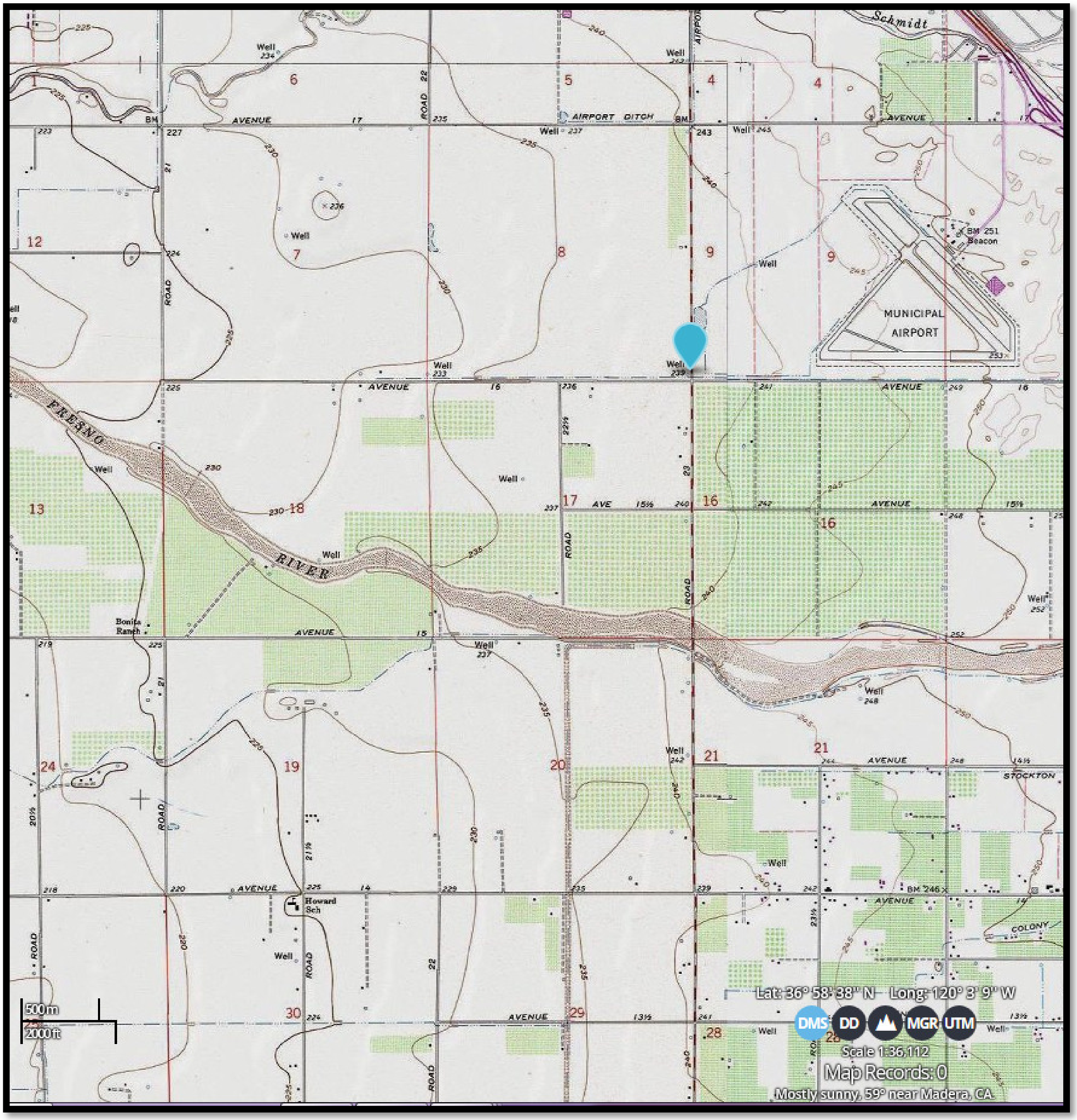
$$Vol = (A_{top} + A_{bot} + \sqrt{(A_{top} \times A_{bot})}) \times \left(\frac{D}{3}\right)$$

Where,

Atop = Average Area of Top water surface
Abot = Average Area of Bottom water surface
D = Average Basin depth

It is recommended that all future ponds consider multi-use if soil conditions are favorable for recharge.

Figure 6- 1 USGS Topo Map



6.5 Phasing and Incremental Development

Drainage facilities shall be designed in accordance with the IMP as needed for each phase of the Project. The drainage patterns and pipes shall be constructed in conformance with the master storm drainage plan. Use of permanent retention basins shall conform to the IMP.

6.6 Storm Drainage System Construction Standards

Storm drainage pipelines shall be constructed of PVC, HDPE, ADS, or Concrete. Construction standards shall conform to manufacturer specifications and City of Madera specifications. Manholes shall be constructed using City of Madera or Fresno Metropolitan Flood Control District (FMFCD) Standards at a maximum spacing of 500 feet. Outfall structures shall be constructed in accordance with the City of Madera or FMFCD standards, per the direction of the City Engineer.

6.7 National Pollution Discharge Elimination System (NPDES)

Storm water originating from the development of the Project site shall be treated utilizing Best Management Practices (BMPs) as permitted by the National Pollution Discharge Elimination System (NPDES) general permitting process of the Clean Water Act. BMPs for the Villages will be developed during the design phase, and may be drawn from local area authorities including the Fresno Metropolitan Flood Control District (FMFCD) and Caltrans, as appropriate.

BMPs may also be drawn from the California Stormwater Quality Association (CASQA) Storm Water Best Management Practice Handbook (Latest Version Adopted at the time of construction). BMPs shall be in accordance with the City's permit requirements and/or ordinance (if ordinance has been implemented at the time of development). The CASQA handbook series contains recommendations for New Development Planning, Construction, Municipal, Industrial and Commercial BMP applications. All BMPs used shall be selected for their suitability to Project requirements and shall be adapted to local conditions as necessary. BMPs shall be employed prior to the start of grading construction for the site and shall be adapted as necessary as the Project construction progresses. Permanent BMPs shall be maintained during the entire Project life cycle.

Pretreated storm water may be disposed of through sedimentation basins. Treated storm water will then be released through weirs or other applicable outlet facilities that work with the sedimentation basin design. The outlet feature of each sedimentation basin shall be at a maximum of pre-development peak runoff rates. Prior to the start of grading activities for site improvements, the developer shall file a Notice of Intent (NOI), which is a General Permit for Storm Water Discharges Associated with Construction Activity, with the Regional Water Quality Control Board (RWQCB).

The developer shall also prepare a Storm Water Pollution Prevention Plan (SWPPP) and provide a current copy of the SWPPP to remain on the construction site at all times. The SWPPP shall include construction and post construction BMPs. The developer shall pay an NOI fee to the SWRCB. At the end of the construction Project, the developer shall file a Notice of

Termination (NOT) with the RWQCB and provide documentation of substantial Project completion, to terminate the NPDES permit coverage.

6.8 Storm Drainage Best Management Practices

Storm water originating from the development of the Project site shall follow City of Madera Storm drainage Best Management Practices (BMPs) and Storm Drainage Management Plan. At minimum, sedimentation controls must be applied prior to discharge of storm water into Waters of the United States.

6.9 FEMA Flood Hazard

According to the Federal Emergency Management Agency (FEMA), the western portion of the project area is part of Flood Zone AO, refer to Figure 6- 2. Zone AO areas are subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply. Some Zone AOs have been designed in areas with high flood velocities such as alluvial fans and washes. Communities are encouraged to adopt more restrictive requirements for these areas, refer to the City's draft ordinance.

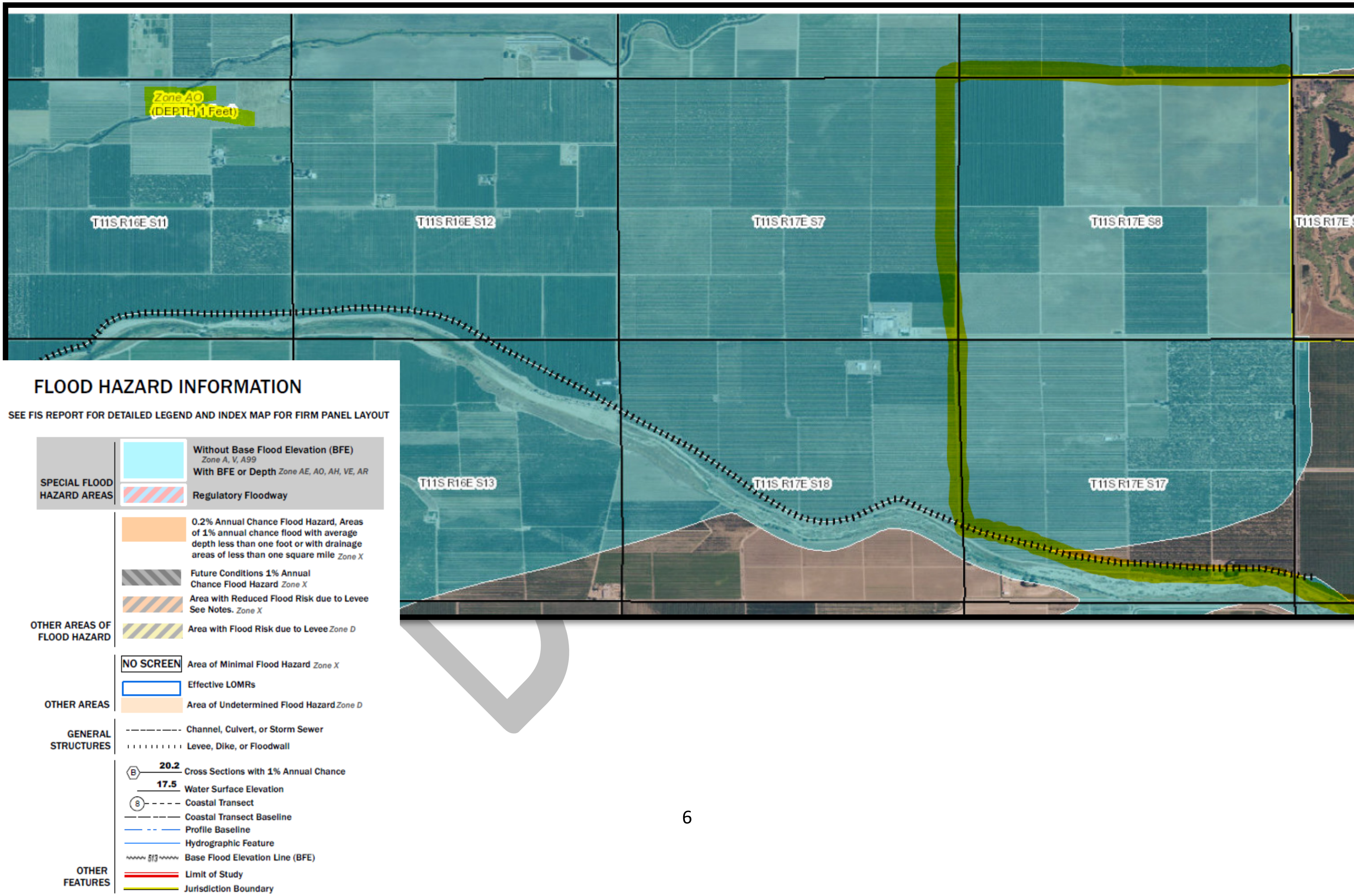
A Conditional Letter of Map Revision (CLOMR) and A Letter of Map Revision (LOMR) will need to be processed with FEMA for project areas that are part of Zone AO.

A CLOMR is FEMA's comment on a proposed project that would, upon construction, affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of the existing regulatory floodway, the effective Base Flood Elevations (BFEs), or the Special Flood Hazard Area (SFHA). The letter does not revise an effective National Flood Insurance Program (NFIP) map, it indicates whether the project, if built as proposed, would be recognized by FEMA. FEMA charges a fee for processing a CLOMR to recover the costs associated with the review.

A LOMR is FEMA's modification to an effective Flood Insurance Rate Map (FIRM), or Flood Boundary and Floodway Map (FBFM), or both. LOMRs are generally based on the implementation of physical measures that affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of the existing regulatory floodway, the effective Base Flood Elevations (BFEs), or the Special Flood Hazard Area (SFHA). The LOMR officially revises the Flood Insurance Rate Map (FIRM) or Flood Boundary and Floodway Map (FBFM), and sometimes the Flood Insurance Study (FIS) report, and when appropriate, includes a description of the modifications. The LOMR is generally accompanied by an annotated copy of the affected portions of the FIRM, FBFM, or FIS report.

All requests for changes to effective maps, other than those initiated by FEMA, must be made in writing by the Chief Executive Officer (CEO) of the community or an official designated by the CEO. Because a LOMR officially revises the effective NFIP map, it is a public record that the community must maintain. Any LOMR should be noted on the community's master flood map and filed by panel number in an accessible location.

Figure 6- 2 FEMA Flood Zone Map



7 PUBLIC FACILITIES FINANCING PLAN (PFFP)

7.1 Introduction

Development in the Specific Plan Area will require major investments in infrastructure and public facilities. This infrastructure required for buildout of the Specific Plan is detailed in the preceding sections of this Specific Plan Infrastructure Master Plan and the "Traffic Impact Analysis" (Appendix F) prepared for the Villages at Almond Grove (a.k.a. Village D). The City of Madera requires that new development pay its fair share of the cost of developing new facilities and services and upgrading existing public facilities and services. The City does have exceptions to this requirement if the new development generates significant public benefits (e.g., educational facilities, recreational facilities, etc.) and when alternative sources of funding can be identified. Relevant City of Madera General Plan policies are provided in Table 7- 1 below:

Table 7- 1 Madera General Plan Policies

Policy CI-47	All major development projects shall identify the size and cost of all infrastructure and public facilities and identify how the installation and long-term maintenance of infrastructure will be financed consistent with the policies in this General Plan.
Policy CI-51	Except when prohibited by state law, the City shall require that sufficient capacity in all public services and facilities will be available on time to maintain desired service levels and avoid capacity shortages, traffic congestion, or other negative effects on safety and quality of life.
Policy CI-52	All new residential development shall be required to annex into City of Madera Community Facilities District 2005-01, or any subsequent CFD created in its place. The purpose of the CFD is to collect special assessments from new residential development to offset the cost of providing eligible municipal services to that development.
Policy LU-14	All proposals to annex property into the City limits for the purpose of new development shall prepare a Public Facilities Financing Plan (PFFP) that articulates infrastructure and public facilities requirements, their costs, financing mechanisms, and the feasibility of the financial burden. The PFFP shall analyze backbone infrastructure and public service needs and funding capacity at the Village level, as defined in Figure LU-3 of the Land Use Element of this General Plan. (The Planning Process required for Village Reserve Areas in Policy LU-34 shall be sufficient to meet this requirement.) The cost of preparing the PFFP shall be shared proportionately among property owners in each Village, with the shares of any non-participating owner collected at the time of development and reimbursed to owner(s) who prepared the PFFP through a reimbursement agreement.

Policy LU-16	Funding mechanisms for major capital facilities which must be “oversized” to support future development shall be established to account for the full cost of the facility(ies) and provide for ultimate financing by the future development that will share in the benefit. A typical way of accomplishing this is for the initial project proponent to complete the required improvements and enter into a reimbursement agreement to be reimbursed for that portion beyond his fair share. Alternatively, a phased Community Facility District (CFD) or similar mechanism which can include all oversized facilities required for the Village can be established to finance these facilities over time.

Section 7 identifies how the specific plan infrastructure and improvements will be financed over time, in compliance with City of Madera General Plan policies. As noted above, the Madera General Plan requires the preparation of a Public Facilities Financing Plan (PFFP) for all proposals seeking to annex property into the city limits for the purpose of new development. Pursuant to General Plan Policy LU-14, the PFFP is required to articulate the following components: (1) infrastructure requirements, (2) public facilities requirements, (3) costs associated with such requirements, (4) financing mechanisms, and (5) the feasibility of the financial burden. The PFFP for the Villages at Almond Grove is provided in this Infrastructure Master Plan. The Infrastructure Master Plan meets the component requirements pursuant to General Plan Policy LU-14. The preceding plan includes items 1 and 2 noted above, Appendix E (TIA Cost estimate) and Appendix D (Master Plan Infrastructure Cost Estimate) address item 3, while items 4 and 5 noted above are addressed in Sections 7.2 and 7.3.

7.2 FUNDING MECHANISMS AND SOURCES

The funding for the Project infrastructure and public facilities are available through various funding mechanisms and sources. These include but are not limited to: Debt Financing, Dedications and Extractions, Development Agreements, Development Impact Fees, Mello-Roos Community Facilities Districts, Landscape Maintenance Districts, and Special Assessment Districts. This section discusses these mechanisms and sources.

1. **Debt Financing.** Public entities have the statutory authority to “issue debt,” or borrow bonds, for infrastructure spending. In this context, “debt” generally refers to a public entity’s obligation to make payments with respect to borrowed money. Debt may be payable from a General Fund or from special revenues such as an assessment or enterprise fund. Debt financing differs from pay-as-you-go (PAYGO) financing whereby the public entity has the financial resources available to pay for capital improvements. Instead, debt financing is “pay-as-you-use” funding that typically includes local General Obligation Bonds (i.e., voter-approval bonds), General Fund Obligations (e.g. Lease Revenue Bonds or Certificates of Participation), Enterprise Fund Debt Obligations, and Special Assessments (e.g. Mello-Roos Bonds, Special Assessment Bonds). This type of funding allows public entities to undertake large, long-term projects that cannot be paid for by existing resources. According to the City of Madera Debt Service Policies, the City will consider the issuance of long-term debt to purchase or construct capital assets that will serve as long-term community assets.

2. **Dedications and Exactions.** Under the Subdivision Map Act, developers, in return for receiving approval to develop land, may be required to dedicate land or construct or pay for all or a portion of costs to provide certain services and amenities necessitated by their project. This may include land, a portion of the value of the land, or money (e.g. mitigation fee, traffic signaling, etc.). A dedication is the physical appropriation of property (i.e., title, easement) as a condition of approval for the project; these typically are made for road and utility rights-of-way, parks, and land for other public facilities. In some cases, dedications and exactions are regulatory and are therefore imposed legislatively through a local ordinance or code requirement. Specifically, the Madera Development Code, Section 10-2.700, Subdivision Requirements, requires developers to construct all required improvements both on- and off-site for storm drainage, sanitary sewers, water supply, utilities, streetlights, curb and gutters, and sidewalks. Such improvements shall be completed, or the developer shall enter into an improvement agreement agreeing to do such work, before final approval is granted by the City.

3. **Development Agreement.** California Government Code Section 65864 declares that the lack of certainty in approving development projects can result in waste of resources, cost escalations for the consumer, and can discourage investment in comprehensive planning. The subsequent code provisions allow local agencies to enter into a development agreement with a developer in order to specify responsibilities and commitments by both parties. Development agreements typically include a commitment to vested rights, proceeding in accordance with existing policies, rules, regulations, and conditions of approval, installment or development of certain public facilities, and payments for such facilities. As stated in Government Code Section 65864: "The agreement may also include terms and conditions relating to applicant financing of necessary public facilities and subsequent reimbursement over time." The City of Madera Development Code Section 10-3.1700 establishes procedures and requirements for the consideration of development agreements.

4. **Development Impact Fees.** Development Impact Fees are fees collected from developers for off-site improvements that are needed to serve new development. Fees are typically charged for new residential, commercial, and industrial construction projects to pay for the cost of new and necessary public improvements. The City of Madera utilizes Development Impact Fees to construct necessary public improvements or to reimburse developers when they construct eligible improvements. Such fees are collected for improvements including arterial and collector streets, parks, sewer and water pipes, water wells, and fire stations in conjunction with development. The City of Madera defines impact fees as a local fee imposed on new development to fund the city's capital facilities. The City collects funds during the permitting process and deposits them into multiple assigned accounts, each with a specific purpose. The Madera General Plan indicates the following account types: administrative, fire, police, parks, public works, sewer, storm drain, streets transportation facility, traffic signal, water impact, and wastewater. In addition to the City Development Impact Fees, new residential and commercial/industrial development within the Madera Unified School District is subject to developer fees with the purposes of funding the construction or reconstruction of

school facilities.

5. **Landscape Maintenance Districts.** The Landscaping and Lighting Act of 1972 enables the creation of assessment districts to finance the installation and/or maintenance of landscaping, lighting facilities, and ornamental structures. Property owners within such districts are levied a special tax based on the benefits received to the real property. In 1991, the City of Madera formed the Citywide Landscape Maintenance District (LMD) that allows for individual LMDs to be formed for the purposes of levying assessments against new development for the maintenance of landscaped areas including median islands, certain park strips, frontage road islands, and certain landscaped out-lots. Parcels within the LMD are ultimately responsible for participating in the cost of maintaining existing and proposed landscaping additions. According to the Madera General Plan Policy CD-7, all new development projects that require site plan approval shall establish landscape and façade maintenance programs for the first three years in order to ensure that streetscapes and landscape areas are installed and maintained as approved. The City has 80 defined zones; special assessments for these zones are prepared in accordance with the California Streets and Highway Code.

6. **Mello-Roos Community Facilities Districts.** The Mello-Roos Community Facilities Act of 1982 came in response to the lack of adequate financing for public capital facilities and services. The Act authorizes any local agency including a county, city, special district, school district, or joint powers of authority to form a Community Facilities District (CFD) within a defined set of boundaries for the purpose of providing public facilities and services. A CFD is formed for financing purposes only and is governed by the agency that formed it. The City of Madera established CFD 2005-1 in 2005, which levies a special tax on property owners within the CFD each year for funding police protection services, fire protection and suppression services, park maintenance, and storm drainage system maintenance and operations. According to the Madera General Plan, Policy CI-52, "the purpose of the CFD is to collect special assessments from new residential development to offset the cost of providing eligible municipal services to that development." To implement the policy, all new development is required to be annexed into the CFD.

7. **Special Assessment Districts.** Special assessments are levies against real property to finance all or a portion of the cost of providing public improvements or services, typically after the project is completed. State law enables local governments to levy special assessments to obtain tax-exempt financing for costs of providing public improvements or services within an established "Special Assessment District"; improvements may include streets, storm drains, sewers, curbs, gutters, sidewalks, streetlights, or parks among other facilities. The maximum assessment on real property within the district is the increase in property value created by the improvement. When considering the formation of a district, local governments must consider the specific services or improvements to be funded, the special benefits that properties will receive from the services or improvements, the cost of services or improvements, and the proportionality between the costs and special benefits received. Examples of improvement types, units of measure to determine the assessment, and associated special

benefits are provided in Table 7- 2 below. The City of Madera has the following special assessment districts: Parking District Operations, Business Improvement District, Community Facilities Districts, and Landscape Maintenance Districts.

Table 7- 2 Methodologies for Special Assessment Districts

Improvement Type	Unit of Measure	Special Benefit
Landscaping	Equivalent Dwelling Units (EDUs), Frontage, Acreage	Specific Enhancement to Property Value, Landscaping
Street Lighting	EDUs, Frontage, Acreage	Safety, Character & Vitality, Economic Enhancement, Enhanced Illumination, Proximity
Streets	EDUs, Frontage	Access to Property, Safety
Storm Drain	Impervious Area	Storm and Flood Protection
Parks	EDUs, Employee Density	Proximity, Access to Green Spaces, Extension of Open Areas
Sewer	Connection, Peak Capacity	Occupancy, Health, Sanitation
Public Utilities	EDUs, Frontage	View, Aesthetics, Safety, Reliable Connection
Source: https://www.treasurer.ca.gov/cdiac/publications/opportunities.pdf		

7.3 FINANCING STRATEGY AND FEASIBILITY

The Plan Area financing strategy relies on a combination of funding mechanisms and sources previously discussed in the Funding Mechanisms and Sources section.

Traffic/Transportation Improvements

a. Capital Improvement Plan (CIP)

The CIP is a five-year plan prepared and maintained by the City staff and presented to the Planning Commission for conformity. The CIP for the fiscal years 2018–2019 to 2022–2023 was created based on the following criteria:

a. Projects represent improvements, studies, or tasks that may advance a physical development.
b. Projects cycle through a five-year timeframe.
c. Projects budget a minimum of $5,000.

The CIP comprises departmental needs focused on the City's objectives and fiscal capacity. It is a coordinated effort to increase efficiencies and serves as a source of information for the public. The CIP is a progressive and continuous plan that is updated annually and presented to Council for input, direction, and approval. It is a useful planning tool that matches projects with programmed funds and includes them in the annual budget proposals.

b. Development Impact Fee Program and Reimbursements

The funding for citywide public improvements to serve new developments is included in the development impact fees (DIF) for new residential, commercial, and industrial projects in the City. The DIF are used by the City to construct the new improvements, or to reimburse developers when they construct eligible improvements. For intersections where the project has a cumulative, significant impact that can be mitigated with improvements covered by the City's DIF program, the project shall pay toward those fees. Per the City Engineer, the following are the available reimbursements:

Streets

- Arterial - Center 3 travel lanes totaling 40 feet
  - 16 foot median, paved or landscaped depending on location
  - 12 foot travel lane on either side of the median

- Collector - Center 3 travel lanes totaling 36 feet
  - 12 foot median, paved
  - 12 foot travel lane on either side of the median

- Traffic Signal
  - This is based on a base intersection – no auxiliary lanes

Other Reimbursements

- Sanitary Sewer
  - Oversize component is reimbursed. This is the cost difference between the pipe installed and an 8-inch equivalent pipe.
  - There are no provisions for recycled water systems.

- Water Pipe
  - Oversize component is reimbursed. This is the cost difference between the pipe installed and an 8-inch equivalent pipe.
  - There are no provisions for recycled water systems

- Storm Pipe
  - 100% of the cost of all storm facilities are reimbursable within collector and arterial streets. Or, any portion that can be reasonably identified as a master plan facility as opposed to purely development related. Generally, this is well understood for most developments in the City. It is reasonable to assume that Village D will require additional review in some cases.
  - Storm pipe within subdivisions are not reimbursable unless oversized to collect runoff from adjacent developments

c. Measure "T" Program

The Madera County Transportation Authority (MCTA) was established to administer the proceeds of Measure "T," a ½ cent sales tax to be utilized for local transportation projects. The Measure "T" program is a 20-year program that funds highway and road capital projects including improvement of traffic safety, reduction of traffic congestion, and leverage of other state and federal funds. The program is projected to yield approximately $213 million for transportation projects in the County through 2027. The revenues from the Measure "T" tax are administered through a planning and programming process, including an Expenditure Plan and Annual Work Program (AWP). Per the policy of the MCTA, the AWP is prepared annually and serves as the annual funding authority for the Measure "T" program. The AWP determines the availability of funds for various projects according to the Measure "T" Investment Plan and outlines the Annual Expenditure Plan for each local jurisdiction on the basis of the available funds. *Given that this funding expires in 2027 and there are projects from other jurisdictions already in the queue, the Specific Plan Improvements will not rely on this funding.*

d. Development Agreement

Approval of statutory Development Agreements, is authorized pursuant to California Government Code Sections 65864 et seq. The Development Agreement will eliminate uncertainty in planning for and securing orderly development of the Project, provide the certainty necessary for the developers to make significant investments in public infrastructure and other improvements, assure the timely installation of necessary improvements, provide public services appropriate to each stage of development, ensure the orderly build-out of the Project consistent with market demand and provide significant permanent public benefits

In exchange for the permanent benefits to the City, the Developers desire to receive the assurance that they may proceed with the Project in accordance with the existing land use ordinances, subject to the terms and conditions contained in the Agreement and to secure the benefits afforded the Developers by Government Code §65864.

REFERENCES

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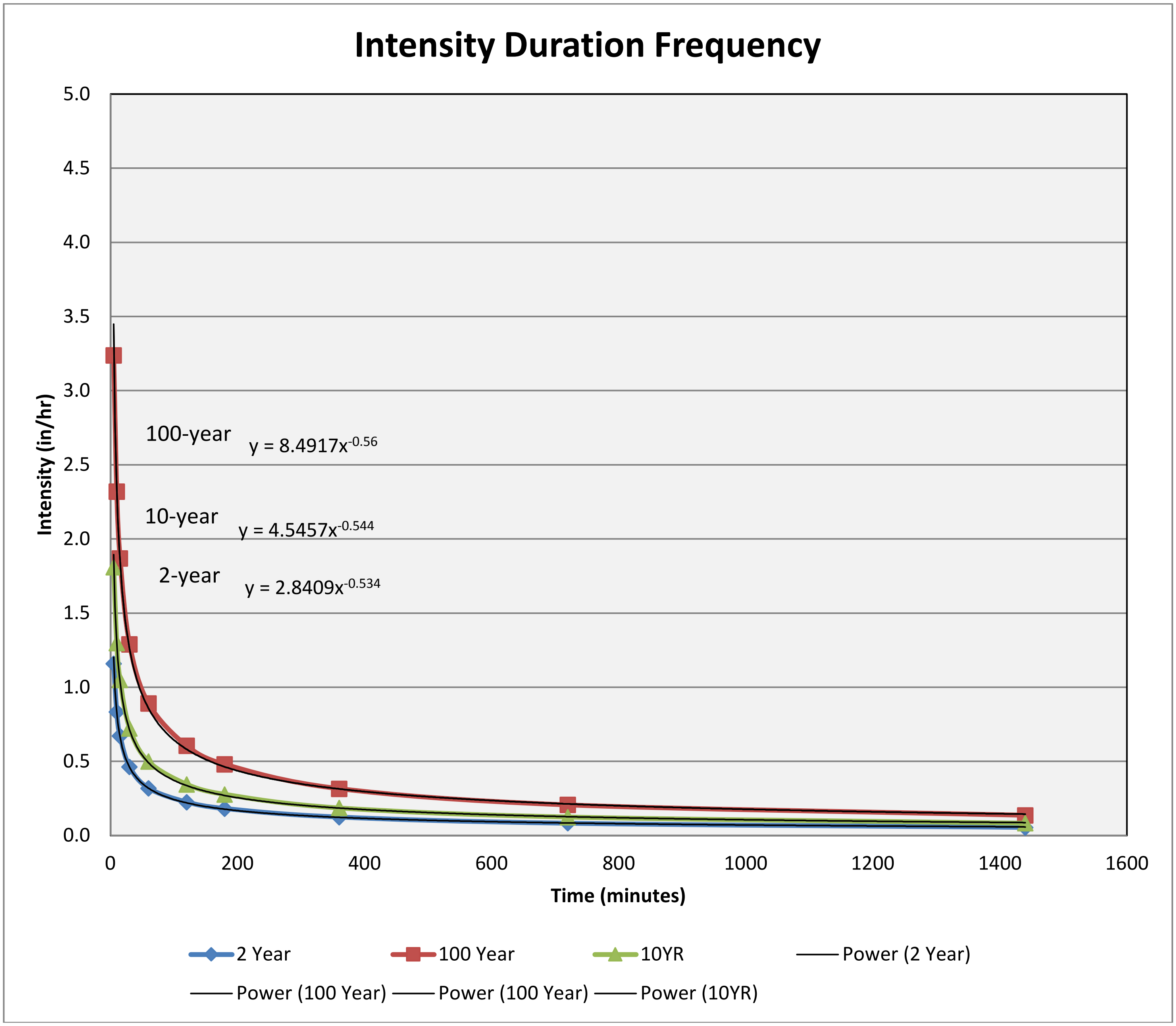
Appendix A - IDF Curve



Appendix B - NOAA Atlas 14

NOAA Atlas 14, Volume 6, Version 2
Location name: Madera, California, USA*
Latitude: 36.9814°, Longitude: -120.1287°
Elevation: 241.03 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.078 (0.069-0.088)	0.096 (0.086-0.109)	0.124 (0.110-0.141)	0.150 (0.132-0.172)	0.191 (0.159-0.230)	0.227 (0.184-0.283)	0.269 (0.211-0.347)	0.318 (0.240-0.427)	0.396 (0.282-0.563)	0.466 (0.316-0.695)
10-min	0.111 (0.100-0.126)	0.138 (0.123-0.156)	0.177 (0.158-0.202)	0.215 (0.189-0.247)	0.273 (0.229-0.330)	0.325 (0.264-0.405)	0.386 (0.302-0.497)	0.456 (0.344-0.612)	0.568 (0.404-0.807)	0.668 (0.453-0.996)
15-min	0.135 (0.120-0.152)	0.166 (0.149-0.188)	0.215 (0.191-0.244)	0.259 (0.228-0.298)	0.330 (0.276-0.399)	0.394 (0.320-0.490)	0.467 (0.366-0.601)	0.552 (0.416-0.740)	0.687 (0.488-0.976)	0.808 (0.548-1.20)
30-min	0.186 (0.167-0.210)	0.230 (0.205-0.260)	0.297 (0.264-0.337)	0.359 (0.315-0.413)	0.457 (0.382-0.552)	0.544 (0.442-0.677)	0.645 (0.506-0.832)	0.764 (0.575-1.02)	0.950 (0.675-1.35)	1.12 (0.758-1.67)
60-min	0.257 (0.230-0.290)	0.317 (0.283-0.359)	0.409 (0.364-0.465)	0.495 (0.435-0.569)	0.630 (0.527-0.761)	0.751 (0.609-0.934)	0.890 (0.698-1.15)	1.05 (0.793-1.41)	1.31 (0.931-1.86)	1.54 (1.05-2.30)
2-hr	0.368 (0.329-0.415)	0.449 (0.401-0.508)	0.573 (0.509-0.650)	0.687 (0.604-0.790)	0.867 (0.725-1.05)	1.03 (0.833-1.28)	1.21 (0.947-1.56)	1.42 (1.07-1.91)	1.75 (1.25-2.49)	2.05 (1.39-3.05)
3-hr	0.450 (0.402-0.507)	0.547 (0.489-0.619)	0.694 (0.617-0.788)	0.830 (0.729-0.954)	1.04 (0.871-1.26)	1.23 (0.997-1.53)	1.44 (1.13-1.86)	1.69 (1.27-2.26)	2.07 (1.47-2.94)	2.41 (1.64-3.60)
6-hr	0.615 (0.550-0.694)	0.745 (0.665-0.843)	0.939 (0.835-1.07)	1.12 (0.980-1.28)	1.39 (1.16-1.68)	1.63 (1.32-2.02)	1.90 (1.49-2.44)	2.21 (1.66-2.96)	2.68 (1.91-3.81)	3.10 (2.10-4.61)
12-hr	0.830 (0.743-0.938)	1.00 (0.897-1.14)	1.26 (1.12-1.43)	1.49 (1.31-1.72)	1.85 (1.55-2.23)	2.16 (1.75-2.68)	2.50 (1.96-3.22)	2.89 (2.18-3.88)	3.49 (2.48-4.96)	4.01 (2.72-5.98)
24-hr	1.11 (1.01-1.24)	1.34 (1.22-1.51)	1.69 (1.53-1.90)	1.99 (1.79-2.26)	2.45 (2.14-2.86)	2.84 (2.43-3.39)	3.28 (2.75-3.99)	3.77 (3.08-4.71)	4.51 (3.54-5.85)	5.14 (3.92-6.89)
2-day	1.34 (1.22-1.51)	1.65 (1.50-1.85)	2.07 (1.88-2.33)	2.44 (2.20-2.77)	2.98 (2.60-3.48)	3.42 (2.93-4.08)	3.90 (3.27-4.75)	4.42 (3.61-5.52)	5.18 (4.08-6.72)	5.82 (4.43-7.79)
3-day	1.50 (1.36-1.68)	1.85 (1.68-2.08)	2.34 (2.12-2.64)	2.76 (2.48-3.13)	3.35 (2.92-3.91)	3.82 (3.28-4.55)	4.33 (3.63-5.27)	4.87 (3.98-6.09)	5.65 (4.44-7.32)	6.28 (4.78-8.40)
4-day	1.64 (1.49-1.84)	2.04 (1.85-2.29)	2.58 (2.34-2.90)	3.03 (2.73-3.44)	3.67 (3.21-4.29)	4.18 (3.58-4.98)	4.72 (3.95-5.75)	5.29 (4.32-6.61)	6.09 (4.79-7.90)	6.74 (5.14-9.02)
7-day	1.97 (1.79-2.21)	2.46 (2.23-2.76)	3.12 (2.83-3.51)	3.67 (3.30-4.16)	4.43 (3.87-5.18)	5.03 (4.31-6.00)	5.66 (4.74-6.89)	6.31 (5.15-7.88)	7.22 (5.68-9.36)	7.94 (6.05-10.6)
10-day	2.18 (1.98-2.45)	2.73 (2.48-3.07)	3.47 (3.15-3.91)	4.09 (3.68-4.64)	4.94 (4.31-5.77)	5.60 (4.80-6.67)	6.28 (5.26-7.65)	6.99 (5.71-8.73)	7.97 (6.27-10.3)	8.74 (6.66-11.7)
20-day	2.81 (2.55-3.15)	3.55 (3.22-3.98)	4.53 (4.10-5.10)	5.33 (4.80-6.05)	6.43 (5.61-7.52)	7.28 (6.23-8.67)	8.14 (6.82-9.91)	9.02 (7.37-11.3)	10.2 (8.04-13.3)	11.1 (8.49-14.9)
30-day	3.40 (3.09-3.82)	4.32 (3.92-4.85)	5.53 (5.01-6.23)	6.51 (5.86-7.39)	7.85 (6.85-9.18)	8.88 (7.60-10.6)	9.91 (8.30-12.1)	11.0 (8.95-13.7)	12.4 (9.72-16.0)	13.4 (10.2-18.0)
45-day	4.18 (3.81-4.70)	5.34 (4.85-6.00)	6.85 (6.21-7.71)	8.07 (7.26-9.15)	9.72 (8.48-11.4)	11.0 (9.40-13.1)	12.2 (10.2-14.9)	13.5 (11.0-16.9)	15.2 (11.9-19.7)	16.4 (12.5-22.0)
60-day	4.96 (4.51-5.57)	6.35 (5.77-7.13)	8.15 (7.39-9.18)	9.60 (8.64-10.9)	11.5 (10.1-13.5)	13.0 (11.2-15.5)	14.5 (12.1-17.7)	16.0 (13.0-20.0)	17.9 (14.1-23.2)	19.4 (14.8-25.9)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Appendix C – Water Demand Sources

USEPA Water Sense – "Water-Efficient Single-Family New Home Specification Supporting Statement"

Water-Efficient Single-Family New Home Specification Supporting Statement

I. Introduction

The WaterSense® Program is developing criteria for water-efficient new homes. The intent of the Water-Efficient Single-Family New Home Specification (Specification) is to reduce indoor and outdoor water usage in new residential homes and encourage community infrastructure savings. The Specification is applicable to newly constructed single-family homes and townhomes, three stories or less in size.

II. Current Status of Water Use in Residential New Homes

The environmental impact of the residential sector is significant. There are more than 120 million homes in the United States and about 1.5 million new homes are constructed each year. On average for all homes, 70 percent of household water is used indoors and 30 percent is used outdoors; however, these percentages can easily flip during summer months in arid climates. Outdoor water use, especially for irrigation, can strongly affect a municipality's peak water use, upon which the sizing of water supply facilities is based. Table 1 presents the average indoor water consumption data for an existing American home.[1]

Table 1. Typical Indoor Household Water Use

Type of Use	Daily Use (gallons/person)	Approximate % of Total Indoor Use
Toilets	18.5	26.7
Clothes Washers	15.0	21.7
Showers	11.6	16.8
Faucets	10.9	15.7
Leaks	9.5	13.7
Other	1.6	2.2
Baths	1.2	1.7
Dishwashers	1.0	1.4
Total	**69.3**	**100.0**

Water use inside the home has been addressed nationally through two mechanisms. The Energy Policy Act of 1992 (EPAct) established the maximum flush volume of toilets typically installed in residential settings at 1.6 gallons per flush (gpf), and the maximum flow rate for bathroom sink faucets, kitchen faucets, and showerheads at 2.5 gallons per minute (gpm) at 80 pounds per square inch (psi) static pressure. In 1998, the Department of Energy adopted a maximum flow rate standard of 2.2 gpm at 60 psi for all faucets.[2] However, new standards have not been issued to mandate the more efficient plumbing products being manufactured today.

[1] AWWA Research Foundation, 1998. Residential End Uses of Water.
[2] 63 *Federal Register* 13307; March 18, 1998.

American Water Works Association – "Water Conservation Measurement Metrics Guidance Report"

Table 22. Example of Calculations for Toilet End Use

Symbol	Parameter Description	Current	Goal
M_1	Inefficient class 1 rate	5.00	5.00
S_1	Inefficient class 1 fraction	0.20	0.00
M_2	Standard class 2 rate	3.50	3.50
S_2	Standard class 2 fraction	0.50	0.00
M_3	Efficient class 3 rate	1.60	1.60
S_3	Efficient class 3 fraction	0.30	0.00
M_4	Efficient class 4 rate	1.28	1.28
S_4	Efficient class 4 fraction	0.00	1.00
U	Intensity (or frequency) of use, fpd	14.00	14.00
K	Leakage rate, gpd	20.00	20.00
F	Incidence of leaks	0.15	0.15
A	Presence of end use	1.00	1.00
EU	End use quantity, gpad	48.2	20.9

An efficiency goal for toilet flushing may be defined by a water utility by assuming that all non-conserving and standard toilets are replaced with the 1.28 gpf model that is recommended by WaterSense®. Then, at the same intensity of use (i.e., same number of flushes per day) and the same rate and intensity of leaks, the toilet end use that represents an efficiency goal would be 20.9 gallons per account per day.

Other end uses and their efficiency goals can be estimated using similar parameters and assumptions. Once all significant indoor end uses are estimated, the total value of the indoor efficiency goal can be calculated as:

$$IUM_{aG} = \sum_{1}^{n} EU^{i}_{aG} \qquad (10)$$

where, EU^{i}_{aG} is efficiency goal for end use i where $i = 1\ldots$n.

9.2.1 Single Family Indoor Use

Table 23 shows the results of the AWWA residential end use study of a sample of single-family homes (DeOreo et al, 1999). The table compares the average rates of use at the time of the study and the estimated usage with the most efficient fixtures and appliances (M_3) existing at that time. The actual average indoor use in the AWWA study was 69.3 gallons per person per day.

The efficiency goal in Table 23 represents a condition requiring the installation of water efficient fixtures and appliances and requires no change in water using behavior. For example, the average volume of water used to flush the toilet was measured to be 3.7 gallons. However, 13.9 percent of recorded flushes used approximately 1.6 gallons per flush, which was then the current efficiency standard in toilet design. If all toilet flushes would use 1.28 gallons per flush, then without changing the frequency of toilet flushing, the efficient usage goal would be 6.5 gpcd instead of the previous average of 18.5 gallons. Similar assumptions can be made for the remaining seven end uses. The efficient single-family sector indoor use goal in this example is 43.5 gpcd.

Using the average and the goal values of indoor use in Table 23, the calculated value of the ICI metric for single family indoor use can be calculated as:

$$ICI_a^{SF} = \frac{IUM_c^{SF}}{IUM_{cG}^{SF}} = \frac{69.3}{43.5} = 1.59 \quad (11)$$

Table 23. Examples of Average and Efficient Levels of Indoor Residential End Uses

Purpose of Use	Average Frequency of Use (U) (events/person/ day)	Average Usage (M_i*S_i) (gallons per event)	Average Use (EU^i) (gpcd)	Efficiency Assumption (M_3*1.0) (gallons per event)	Efficient Use Goal (EU^i_G) (gpcd)
Toilet flushing	5.05	3.7	18.5	1.28	6.5
Clothes washing	0.37	40.6	15.0	25.8	9.5
Showering	0.70	16.6	11.6	14.4	10.1
Bathing	0.05	23.8	1.2	18.6	0.9
Faucet use	17.60	0.6	10.9	0.5	9.3
Dishwashing	0.10	10.0	1.0	8.0	0.8
Leaks	0.46	20.7	9.5	20.7	4.8
Other domestic	--	--	1.6	--	1.6
Total indoor use	--	--	69.3	--	43.5

gpcd = gallons per person per day

It is important to note that each water utility would likely develop its own efficiency goal by selecting realistic assumptions about achieving the adoption of the efficient fixtures and appliances. Also, the intensity (U) and presence (A) of end uses may vary among different utilities.

9.2.2 Multifamily Indoor Use

The ICI^{MF} benchmark for multifamily use can also be developed for each utility. In absence of a locally derived efficiency benchmark, an approximate benchmark value for indoor use can be derived based on the AWWA end use study by assuming different rates of presence of washing machines and dishwashers in multifamily housing units.

The national submetering study (Mayer, 2004) found that only 52 percent of apartments had a washing machine. Eighteen percent of residents without a washing machine reported washing clothes at an off-site laundry (or through other arrangements). This implies that only about 85 percent of multifamily residences are expected to have the clothes washing end use. Also, 78.8 percent of respondents reported having a dishwasher.

Table 24 shows the adjusted average indoor use per person in multifamily housing based on the AWWA end use study. The estimates in the table indicate that the average indoor use in multifamily residences would be 62.2 gpcd and the efficiency goal would be 40.3 gpcd. Accordingly the value of the ICI_c^{MF} metric would be 62.2/40.3 or 1.54.

ConSol – California's Residential Indoor Water Use

California Indoor Water Use

The 2010 CALGreen Code[1] set new standards for the maximum flow rates of plumbing fixtures in new construction. Taking effect on January 1, 2011, this collection of construction requirements has resulted in the most significant reduction in indoor water use in the history of California building codes. The 2010 CALGreen Code called for a 20% reduction in indoor water use. CALGreen included guidance on how to calculate the "baseline" indoor water use for a current new single-family home. As an alternative to the 20% reduction performance standard, a builder could choose to use plumbing fixtures that comply with a prescriptive list of maximum water flow rates.

Table 1 lists the historical fixture flow rates and appliance standards required by code from 1975 to 2013. Nationally, water use codes have been very slow to change. In 1980, the national Energy Policy Act lowered the showerhead flow rates to 2.5 gallons per minute (gpm) and toilet flow rates to 3.6 gallons per flush (gpf). Before 1980, those values were typically 3.5 gpm and 5.0 gpf, respectively.

Fixture and Appliance Standards Over Time						
	1975	1980	1992	2009	2011	2013
Shower (gpm)	3.5	2.5	2.5	2.5	2.0	2.0
Toilets (gpf)	5.0	3.6	1.6	1.6	1.28	1.28
Faucets (gpm)	2.5	2.5	2.5	2.2	1.8	1.8/1.5
Clothes Washers (gal/cubic foot)	15.0	15.0	15.0	8.5	6.0	6.0

Table 1: Flow Rates of Fixtures over Time

The recent changes to the 2010 and 2013 CALGreen low-flow faucets and showerheads did not add significant costs to the home. The cost increase for low-flow showerheads fixtures is less than $15 per fixture; however, most builders were already using the faucets. The low-flow (1.28 gpf) toilet requirement has added approximately a $75 incremental cost per toilet.

The updated 2013 edition of CALGreen Code eliminated the 20% water reduction "performance option," leaving only the prescriptive list of maximum water flow rates for each of the indoor plumbing fixtures. This simplification has made enforcement much easier; however, it has resulted in a minimal decrease in water use compared to the initial 2010 CALGreen Code.

CALGreen only covers indoor water use from showers, faucets, and toilets. The code does not provide guidance for clothes-washing machines, which account for 4% of total annual water use. On average, a top-loading washing machine uses between 40 and 45 gallons per wash.[2] A horizontal axis washer can use between 15 and 30 gallons. Appliance standards effective in California before 2010 limited the

[1] http://www.bsc.ca.gov/Home/CALGreen.aspx

amount of water a washing machine could use to 8.5 gallons per cubic foot of capacity. In 2010, this number was dropped to 6 gallons per cubic foot. The average capacity for a clothes-washing machine is 3 cubic feet, meaning a new washing machine averages 18 gallons per wash. Studies have shown that the average household does between 300 and 400 loads of laundry per year.[3] To determine the current estimated indoor water use, Table 2 combines the CALGreen fixture and use assumptions with the washing machine usage to determine the estimated indoor water use for a new three-bedroom home. The total indoor water use for a new home with four occupants is approximately 46,500 gallons per year.

Total Indoor Water Use, New Three Bedroom Home					
Fixture Type	**Flow Rate (gpm or gpf)**	**Duration (mins.)**	**Daily Uses**	**# of Occupants**	**Gallons/Year**
Showerheads	2.0	8	1	4	23,360
Lavatory Faucets	1.5	0.25	3	4	1,643
Kitchen Faucets	1.8	4	1	4	10,512
Toilets	1.28	---	3	4	5,606
Fixture Water Use					41,121
	Loads per Year		Gallons per Load		
Clothes Washers	300		18		5,400
Total Indoor Water Use, New Three Bedroom Home					**46,521**

Table 2: Indoor Water Use for a New Three Bedroom Home

While there is limited water savings potential in new California homes, existing California homes represent a clear and significant conservation opportunity. Old toilets and showerheads can use up to three times more water than current required fixtures. The historical indoor water use of homes built to national and State codes is listed in Table 3 in gallons and percent reduction.

	1975	1990	2009	2011	2013
Shower	40,880	29,200	29,200	23,360	23,360
Toilets	21,900	15,768	7,008	5,606	5,606
Kitchen and Lavatory Faucets	17,338	17,338	15,257	12,483	12,155
Clothes Washer	12,000	12,000	7,650	5,400	5,400
Total Indoor Water Use	92,118	74,306	59,115	46,849	46,521
Reduction		19%	20%	21%	1%

Table 3: Annual Indoor Water Use over Time

Indoor water fixtures have significantly changed over the last forty years. As shown in Figure 1, there has been a 50% reduction in indoor water use due to the incorporation of low-flow fixtures and

[3] http://www.consumerenergycenter.org/residential/appliances/washers.html,

Appendix D – Master Plan Infrastructure Cost Estimate

PRECISION CIVIL ENGINEERING, INC

August 1, 2019

Engineer's Opinion of Probable Cost
Madera 1200 - Villages at Almond Grove
LOT COUNT =
6320

	Description	Estimated Quantity	Unit		Unit Price		Extension
	I. GENERAL CONSTRUCTION						
1	CLEARNING AND GRUBBING	1	LS	$	50,000.00	$	50,000
2	ROUGH GRADING	250000	CY	$	4.00	$	1,000,000
3	ASPHALT PAVEMENT	2898774	SF	$	5.00	$	14,493,870
4	CONCRETE CURB AND GUTTER	138148	LF	$	18.00	$	2,486,664
5	CONCRETE SIDEWALK	350000	SF	$	6.00	$	2,100,000
6	CONCRETE MEDIAN ISLAND CURB	50000	LF	$	16.00	$	800,000
7	CONCRETE CURB RAMPS	75	EA	$	2,500.00	$	187,500
8	STREET LIGHTS	230	EA	$	3,000.00	$	690,000
9	SIGNAGE AND STRIPING	1	LS	$	350,000.00	$	350,000
10	6' MASONRY WALL	27500	LF	$	60.00	$	1,650,000
11	MEDIAN LANDSCAPING & IRRIGATION	375000	SF	$	5.00	$	1,875,000
12	NEIGHBORHOOD & COMMUNITY PARK SPACE	3804530	SF	$	5.00	$	19,022,650
13	TRAIL	237402	SF	$	5.00	$	1,187,010
14	SIGNALIZED INTERSECTION	4	EA	$	300,000.00	$	1,200,000
14	BRIDGE CROSSING	1	EA	$	950,000.00	$	950,000
15	UTILITY UNDERGROUNDING	1	LS	$	5,000,000.00	$	5,000,000
					GENERAL CONSTRUCTION SUBTOTAL	**$**	**53,042,694**
	II. WATER CONSTRUCTION						
1	8" WATER MAIN	1834	LF	$	45.00	$	82,514
2	12" WATER MAIN	71822	LF	$	60.00	$	4,309,342
3	18" WATER MAIN	10323	LF	$	80.00	$	825,841
4	24" WATER MAIN	6550	LF	$	100.00	$	655,000
5	PRESSURE REDUCING VALVE	26	EA	$	7,000.00	$	182,000
6	FIRE HYDRANT	181	EA	$	3,500.00	$	633,703
7	WATER WELL	7	EA	$	1,250,000.00	$	8,750,000
					WATER CONSTRUCTION SUBTOTAL	**$**	**15,438,399**
	III. SEWER CONSTRUCTION						
1	10" SEWER MAIN	5,821	LF	$	45.00	$	261,942
2	12" SEWER MAIN	-	LF	$	60.00	$	-
3	15" SEWER MAIN	5,280	LF	$	75.00	$	396,000
4	18" SEWER MAIN	2,740	LF	$	80.00	$	219,182
5	30" SEWER MAIN	15,322	LF	$	125.00	$	1,915,257
6	48" SEWER MAIN	8,113	LF	$	150.00	$	1,216,891
7	48" SEWER MANHOLE	28	EA	$	4,000.00	$	110,726
8	60" SEWER MANHOLE	47	EA	$	6,000.00	$	281,216
9	LIFT STATION, PUMPS, CONTROLS, SCADA	2	LS	$	500,000.00	$	1,000,000
10	18" FORCE MAIN	1,411	LF	$	80.00	$	112,915
11	30" FORCE MAIN	673	LF	$	125.00	$	84,122
					SEWER CONSTRUCTION SUBTOTAL	**$**	**5,598,251**
	IV. STORM DRAIN CONSTRUCTION						
1	18" STORM DRAIN (RCP)	29,590	LF	$	70.00	$	2,071,307
2	24" STORM DRAIN (RCP)	13,890	LF	$	80.00	$	1,111,192
3	30" STORM DRAIN (RCP)	7,498	LF	$	100.00	$	749,800
4	36" STORM DRAIN (RCP)	3,106	LF	$	125.00	$	388,250
5	42" STORM DRAIN (RCP)	848	LF	$	150.00	$	127,200
6	48" STORM DRAIN (RCP)	100	LF	$	175.00	$	17,500
7	STORM DRAIN MANHOLE	110	EA	$	5,000.00	$	549,320
8	TYPE 'D' CURB INLET	107	EA	$	3,500.00	$	374,500
9	BASIN (SOME DUAL USE SOME STAND ALONE)	815,795	CY	$	4.00	$	3,263,181
10	BASIN OUTFALL STRUCTURE	11	EA	$	5,000.00	$	55,000
					STORM DRAIN CONSTRUCTION SUBTOTAL	**$**	**8,707,250**

August 1, 2019

V. RECLAIMED WATER CONSTRUCTION							
1	8" NON-POTABLE WATER MAIN	1,834	LF	$	40.00	$	73,345
2	10" NON-POTABLE WATER MAIN	86,251	LF	$	50.00	$	4,312,568
3	12" NON-POTABLE WATER MAIN	29,519	LF	$	60.00	$	1,771,140
	RECLAIMED WATER CONSTRUCTION SUBTOTAL					**$**	**6,157,054**
VI. MID FACILITIES CONSTRUCTION							
1	42" RCP (LAT 24.2-13.2 Undergrounding)	5,500	LF	$	150.00	$	825,000
2	FILL CANAL	20,000	CY	$	5.00	$	100,000
3	STANDPIPE	3	EA	$	10,000.00	$	30,000
4	TURNOUT	6	EA	$	2,000.00	$	12,000
	MID FACILITIES CONSTRUCTION SUBTOTAL					**$**	**967,000**
	SUBTOTAL CONSTRUCTION COST					**$**	**89,910,648**
VII. ENGINEERING COST AND CONTINGENCIES							
1	SOILS ENGINEERING AND TESTING	1	LS	$	100,000.00	$	100,000
2	ENGINEERING, CONSTRUCTION STAKING AND SURVEYING	1	LS	$	6,293,745.35	$	6,293,745
3	10% CONTINGENCY	1	LS	$	8,991,064.79	$	8,991,065
	ENGINEERING AND CONTINGENCIES COST SUBTOTAL					**$**	**15,384,810**
	TOTAL BACKBONE INFRUSTRUCTURE COST					**$**	**105,295,458**
	BACKBONE INFRUSTRUCTURE COST PER LOT					**$**	**16,661**

Notes:

1. UNIT COSTS ARE BASED ON CURRENT COST, UNIT COST MAY VARY AT TIME OF CONSTRUCTION.
2. THIS ESTIMATE DOES NOT INCLUDE ALL FEES, CREDITS OR REIMBURSEMENTS AND HAVE NOT BEEN CONFIRMED
3. MAJOR STREET IMPROVMENTS INCLUDE AVE 17, RD 23, AVE 16, AND CLEVELAND AVE., 60' COLLECTOR STREETS,
4.

Appendix E – Traffic Impact Analysis Cost Estimate

Appendix F – Traffic Impact Analysis