APPENDIX B

WATER INFRASTRUCTURE INVESTIGATION

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Memorandum

To:	Gene Abella, PE, City of Clovis
From:	Nick Jacobson, PE
Subject:	Water Infrastructure Investigation for Tentative Tract Map 6343
Date:	December 19, 2022

Provost and Pritchard Consulting Group ("P&P") has prepared this memorandum summarizing the findings of our investigation into the water system infrastructure required to serve a proposed single-family residential development generally located along the east side of Clovis Avenue between Perrin and Behymer Avenues.

Project Information

It is our understanding that Tentative Tract Map (Tract) 6343 (Project) will have a land use designation of medium high density residential (7.1 to 15.0 dwelling units per acre [du/ac]), which differs from the original designation of medium density (4.1 to 7.0 du/ac), originally considered for this area in the City of Clovis Water Master Plan (WMP) Update – Phase III (Provost & Pritchard, 2018). The Project covers an area of approximately 71.54 gross acres (64.36 net acres), encompassing two parcels entirely, and a portion of a third parcel (APNs 556-040-08, 07, and 556-030-14) within the Northwest Village planning area.

There is no existing infrastructure adjacent to the project footprint. It is understood that before the Project is built several master planned water mains will be constructed near or adjacent to the Project as part of the buildout of Tract 6200 including:

- *a 12-inch main in Marion Avenue from Perrin Avenue to Heirloom (Pryor) Avenue*
- *a 12-inch main in Heirloom (Pryor) Avenue from Marion Avenue to Sunnyside Avenue*
- *a 16-inch main in Baron Avenue from Clovis Avenue to Perrin Avenue*

Additionally, an added transmission water main is anticipated with Tract 6205, east of Sunnyside Avenue but it is not anticipated to be constructed prior to Tract 6343:

- *a 12-inch main in Heirloom (Pryor) Avenue from Sunnyside Avenue and continuing south through the Tract, to Shepherd Avenue.*

There are master planned water mains that will be constructed as part of the Tract 6343 improvements, including:

- *a 24-inch main in Behymer Avenue from the west limits of Tract 6343 to Baron Avenue*
- *a 24-inch main in Baron Avenue from Behymer Avenue to Perrin Avenue*

Mains internal to and along the frontage of Tract 6343 will be constructed as part of the Project. It is anticipated that the 12-inch main in Clovis Avenue from Baron Way to Behymer Avenue along with the portion of the 24-inch mains in Behymer Avenue between Baron Way and Clovis Avenue not along the frontage of Tract 6343 may also be constructed with this Project. Collectively these mains would connect to infrastructure associated with Tract 6200 to the southeast of the Project. Collectively, these existing and planned facilities convey or will convey water from the surface water treatment plant which is located approximately 5.5 miles to the southeast of the Project. This portion of Clovis' potable water system is within the pressure zone called "Zone 2." Figure 1 shows the existing and proposed infrastructure in the area.

The Project straddles the Kings River service area boundary for Fresno Irrigation District (FID) therefore approximately half of the Project is within the Kings River service area and the remaining half is outside the Kings River service area for FID. The portion of the project within the service area has access to water from the Kings River as its source of supply, while the portion outside of the service area does not. The existing project site consists of a residential dwelling, fallow land, and various row crop plantings. The proposed use will consist of a new 590-unit single family residential development on 71.54 gross acres

Assumptions

The following assumptions apply to this investigation:

- The City requires a minimum of two points of connection to the existing water system.
- Developer is responsible for sizing all water mains and other water related infrastructure internal to the Project.
- The Clovis Fire Department (CFD) requires a minimum fire flow of 1,800 gallons per minute (gpm) and a minimum residual pressure of 35 pounds per square inch (psi), per CFD Standard #2.3.
- Existing infrastructure sizes based on GIS data from the City (see Figure 1).
- Recycled water will not be applied to public landscaping surrounding the Project.
- Infrastructure conditioned on Tract 6200 will be constructed prior to development of Tract 6343.
- Tract 6200 is modeled as medium density residential.
- Tract 6343 is modeled as medium high density residential (MHDR).
- Existing and proposed Water system demands will be based on unit demand from the *Water Master Plan Update Phase III - Facilities Plan* (Provost & Pritchard, 2018).
- The analysis will reflect the demands associated with existing developments in the area based on actual land use; undeveloped areas are modeled utilizing land use designations specified in the General Plan. Proposed demands will be modeled using the above referenced land use designations rather than that shown in the General Plan.
- Figure 1 shows the existing and master planned water mains and facilities in the vicinity of the Project, including those conditioned with Tract 6200 shown as existing.
- For Alternative 1 the analysis assumed the transmission grid main infrastructure shown as existing and future (See Figures 2, and 3) as well as the proposed tank, booster pump

station, and tank fill valve, have been constructed and are operational or are under construction and are assumed to be operational for the purposes of this modeling effort.

- For Alternative 2 the analysis assumed the transmission grid main infrastructure shown as existing and future (See Figures 4 and 5) have been constructed and are operational or are under construction and are assumed to be operational for the purposes of this modeling effort.
- For Alternative 3 the analysis assumed the transmission grid main infrastructure shown as existing and future (See Figures 6 and 7), have been constructed and are operational or are under construction and are assumed to be operational for the purposes of this modeling effort.
- For Alternative 4, (See Figures 8 and 9), the analysis assumed the transmission grid main infrastructure shown as existing have been constructed and are operational or are under construction and are assumed to be operational for the purposes of this modeling effort. No future infrastructure is assumed.
- The system is operating with all valves open.
- System velocities should not exceed 10 feet per second (fps).

This investigation will include analysis of whether the existing (or soon to be existing) water system, as described above and shown on the attached figures, will be sufficient to provide up to maximum day demand and also meet Maximum Day Demand (MDD) plus Fire Flow (MDD+FF) demands per the WMP requirements both with and without the City's Surface Water Treatment Plant (SWTP) in operation. The analyses without the SWTP are modeled with a reduced demand consistent with that historically experienced in the autumn months when the SWTP is not operational due to canal maintenance activities.

Water Demand

Potable water demands for the Project were estimated using land-use-based unit water demand factors from the WMP. Table LU-2 in the Land Use Element of the City General Plan (GP) states that MHDR has an allowable density ranging from 7.1 – 15.0 du/ac. The proposed use equates to a dwelling unit density of approximately 8.25 du/ac, consistent with MHDR land use. A separate water supply assessment (WSA) was prepared by P&P in September 2022. The WSA estimated water demands for the Project. For consistency, the demand estimates stated in the WSA were used for this analysis. For specifics surrounding Project water demands refer to the WSA.

Infrastructure

The Project is comprised of three (3) parcels of mostly row crop agricultural land a residential dwelling generally located along the east side of Clovis Avenue between Perrin and Behymer Avenues. Because of the limited existing backbone infrastructure in the area, this development will depend on the construction of infrastructure planned to be built with Tract 6200. The other transmission mains near the Project are understood to be existing, as shown on Figure 1. Design

of the required water mains internal to the Project will be the responsibility of the Project developer.

Water Supply

Urbanization within Clovis occurs both inside and outside the Kings River service area for Fresno Irrigation District (FID), therefore not all lands have access to this water source. Lands generally located south and west of the Enterprise Canal are within the Kings River service area and as such are entitled to an average annual allotment of approximately 2.24 acre-feet per acre (AF/ac). The MHDR land use has a unit demand greater than the 2.24 AF/ac supply available. The City adopted an ordinance requiring new development with demands exceeding the allotment to pay fees, so the City can acquire additional water supply to serve the development. The Project will need to pay for supplies for demands over and above the FID available supply for the Project area within FID[1] and for all demands for the Project area outside FID, as shown below. For additional details on water supply for the Project, refer to the WSA (Provost & Pritchard, September 2022) prepared for the Project.

Table 1. Reconciliation of Surface Water Supply and Demand

Land Use Category	Area (ac)	Land Use Demand Factor (AFY/ac)	Annual Average Demand (AFY)	FID Entitlement (AFY)	Additional Supply Required (AFY)
Proposed					
Medium-High Density Residential – within FID	38.6	3.3	127.4	86.5	(40.9)
Medium-High Density Residential – outside FID	32.9	3.3	108.6	0.0	(108.6)
Proposed Total	71.5	3.3	236.0	86.5	(149.5)

Evaluation

The City has requested an investigation, utilizing the current City hydraulic model, to determine whether the proposed infrastructure in the vicinity of the Project (Figure 1) will provide adequate service during MDD and MDD+FF for several infrastructure scenarios including:

- Alternative 1: with 3.5 million gallons of storage capacity at the T-9 site[2].
- Alternative 2: with no storage capacity at the T-9 site and construction of water mains south of Shepherd Avenue and along Sunnyside and Nees Avenues, connecting to the existing water system in Nees Avenue (WMP designated mains P-3, P-4, and P-7).
- Alternative 3: with no storage capacity at the T-9 site and construction of water mains south of Shepherd Avenue and along Sunnyside and Teague Avenues, connecting to the existing water system at Fowler Avenue (WMP designated mains P-3, and P-6).

[1] Approximately 54 percent of the Project Area lies within the FID King River service area boundary.
[2] The T-9 water storage tank and booster pump site is at the northwest corner of Perrin and Sunnyside Avenues.

- Alternative 4: no storage capacity at the T-9 site, and only utilizing existing infrastructure and previously constructed infrastructure associated with Tract 6200.

As shown on Figure 1, infrastructure associated with Tract 6343, was modeled with 8-inch mains internal to the Project. Also, the results of this evaluation rely on the infrastructure that has been conditioned on Tract 6200 being constructed and operational.

Maximum Day Demand Analyses

Alternative 1

With an Operational SWTP

The hydraulic model analysis results with the SWTP operational indicates no pressure deficiencies internal to the Project. Minimum pressures during the MDD scenario are all above 40 psi.

Without an Operational SWTP

The hydraulic model analysis results with the SWTP not operational indicates no pressure deficiencies in Tracts 6343. The model results did show a portion of the system with minimum pressures below 40 psi in the Harlan Ranch portion of the system, mainly east of Sanders Avenue. Minimum pressures in Harlan Ranch dropped in places to approximately 31 psi during the peak demand hour of the MDD scenario without the SWTP operational. As stated above, while typically during MDD the distribution system pressures should be over 40 psi, the results of the analysis are not below minimum required pressure of the system of 20 psi (Title 22 requirement). The deficiencies identified in the model only last for a short duration during the morning hour from 6:00 AM until about 7:00 AM. Average pressures throughout the time duration in this scenario were all over 40 psi for the analysis.

Alternative 2

With an Operational SWTP

The hydraulic model analysis results with the SWTP operational indicates no pressure deficiencies internal to the Project. Minimum pressures during the MDD scenario are all above 40 psi.

Without an Operational SWTP

The hydraulic model analysis results with the SWTP not operational indicates no pressure deficiencies in Tracts 6343. The model results did show a portion of the system with minimum pressures below 40 psi in the Harlan Ranch portion of the system. The area that shows minimum pressures below 40 psi has a larger footprint than the area identified in Alternative 1. For Alternative 2, the general area showing minimum pressures below 40 psi is in Harlan Ranch east of Locan Avenue. Minimum pressures in this area dropped in places to approximately 27 psi during the peak demand hours of the MDD scenario without the SWTP operational. As stated above, while typically during MDD the distribution system pressures should be over 40 psi, the results of the analysis are not below minimum required 20 psi pressure (Title 22) of the system.

The deficiencies identified in the model only last for a short duration during the morning hours from 5:45 AM until about 8:00 AM. Average pressures throughout the time duration in this scenario were all over 40 psi for the analysis.

Alternative 3

With an Operational SWTP

The hydraulic model analysis results with the SWTP operational indicates no pressure deficiencies internal to the Project. System wide, minimum pressures during the MDD scenario are all above 40 psi.

Without an Operational SWTP

The hydraulic model analysis results with the SWTP not operational indicates no pressure deficiencies in Tracts 6343. The model results did show a portion of the system with minimum pressures below 40 psi in the Harlan Ranch portion of the system. The area that shows minimum pressures below 40 psi has a larger footprint than the area identified in Alternative 1. For Alternative 3, the general area showing minimum pressures below 40 psi is in Harlan Ranch east of Locan Avenue, similar to the footprint identified in Alternative 2. Minimum pressures in this area dropped in places to approximately 27 psi during the peak demand hours of the MDD scenario without the SWTP operational. As stated above, while typically during MDD the distribution system pressures should be over 40 psi, the results of the analysis are not below minimum required pressure of the system. The deficiencies identified in the model only last for a short duration during the morning hours from 5:45 AM until about 8:00 AM. Average pressures throughout the time duration in this scenario were all over 40 psi for the analysis.

Maximum Day Demand Plus Fire Flow

Alternative 1

With an Operational SWTP

The minimum pressure required during fire flow conditions (1,800 gpm) is 35 psi with a maximum velocity of 10 fps. The MDD+FF hydraulic model analysis results show available pressures internal to the Project range from approximately 35 psi to approximately 58 psi (see Figure 2). Available fire flow at the hydrants internal to the Project ranged from 1,920 gpm to as much as 4,365 gpm.

Without an Operational SWTP

The minimum pressure required during fire flow conditions (1,800 gpm) is 35 psi with a maximum velocity of 10 fps. The MDD+FF hydraulic model analysis results show available pressures internal to the Project range from approximately 35 psi to approximately 64 psi (see Figure 3). Available fire flow at the hydrants internal to the Project ranged from 1,920 gpm to as much as 4,365 gpm. The available pressures are slightly higher under this scenario than when the SWTP is online under alternative 1 because this analysis assumes that the SWTP is not operational during a lower demand period described on Page 2. Should the SWTP go offline during a typically high demand period like summer, the analysis would yield different results with potential for pressure drops below 20 psi.

Alternative 2

With an Operational SWTP

The minimum pressure required during fire flow conditions (1,800 gpm) is 35 psi with a maximum velocity of 10 fps. The MDD+FF hydraulic model analysis results show available pressures internal to the Project range from approximately 35 psi to approximately 54 psi (see Figure 4). Available fire flow at the hydrants internal to the Project ranged from 1,920 gpm to as much as 4,366 gpm.

Without an Operational SWTP

The minimum pressure required during fire flow conditions (1,800 gpm) is 35 psi with a maximum velocity of 10 fps. The MDD+FF hydraulic model analysis results show available pressures internal to the Project range from approximately 35 psi to approximately 58 psi (see Figure 5). Available fire flow at the hydrants internal to the Project ranged from 1,920 gpm to as much as 4,360 gpm. The available pressures are slightly higher under this scenario than when the SWTP is online under alternative 2 because this analysis assumes that the SWTP is not operational during a lower demand period described on Page 2. Should the SWTP go offline during a typically high demand period like summer, the analysis would yield different results with potential for pressure drops below 20 psi.

Alternative 3

With an Operational SWTP

The minimum pressure required during fire flow conditions (1,800 gpm) is 35 psi with a maximum velocity of 10 fps. The MDD+FF hydraulic model analysis results show available pressures internal to the Project range from approximately 35 psi to approximately 56 psi (see Figure 6). Available fire flow at the hydrants internal to the Project ranged from 1,920 gpm to as much as 4,366 gpm.

Without an Operational SWTP

The minimum pressure required during fire flow conditions (1,800 gpm) is 35 psi with a maximum velocity of 10 fps. The MDD+FF hydraulic model analysis results show available pressures internal to the Project range from approximately 35 psi to approximately 60 psi (see Figure 7). Available fire flow at the hydrants internal to the Project ranged from 1,920 gpm to as much as 4,356 gpm. The available pressures are slightly higher under this scenario than when the SWTP is online under alternative 3 because this analysis assumes that the SWTP is not operational during a lower demand period described on Page 2. Should the SWTP go offline during a typically high demand period like summer, the analysis would yield different results with potential for pressure drops below 20 psi.

Alternative 4

With an Operational SWTP

The minimum pressure required during fire flow conditions (1,800 gpm) is 35 psi with a maximum velocity of 10 fps. The MDD+FF hydraulic model analysis results show available pressures

internal to the Project range from approximately 35 psi to approximately 52 psi (see Figure 8). Available fire flow at the hydrants internal to the Project ranged from 1,920 gpm to as much as 3,970 gpm.

Without an Operational SWTP

The minimum pressure required during fire flow conditions (1,800 gpm) is 35 psi with a maximum velocity of 10 fps. The MDD+FF hydraulic model analysis results show available pressures internal to the Project range from approximately 35 psi to approximately 58 psi (see Figure 9). Available fire flow at the hydrants internal to the Project ranged from 1,920 gpm to as much as 4,350 gpm. The available pressures are slightly higher under this scenario than when the SWTP is online under alternative 4 because this analysis assumes that the SWTP is not operational during a lower demand period as described on Page 2. Should the SWTP go offline during a typically high demand period like summer, the analysis would yield different results with potential for pressure drops below 20 psi.

Conclusion

The modeling analysis indicates that the proposed infrastructure within the Project, as shown on the attached figures, along with the proposed connections points should be able to receive adequate flow and pressure during an MDD scenario and during an MDD+FF scenario with the SWTP operational. With the SWTP not in operation, the analysis shows that the system should be able to deliver MDD and MDD+FF scenarios as well. The City should note that the ability to deliver water to satisfy fire flow requirements without the aid of the SWTP is applicable to lower demand periods such as those experience during the autumn timeframe.

Based on information collected during this investigation and the City's adherence to recommendations from prior water supply planning efforts, the existing and planned water distribution system and recommended connections should be adequate to convey water supply to the Project to support anticipated demands from the Project. The Project may proceed with the existing infrastructure and the planned infrastructure along the Project frontage as shown in Alternative 4. Additional master planned infrastructure, discussed in Alternatives 1, 2 and 3 are not required to deliver adequate flow and provide sufficient pressure to the Project, but are recommended, in part, to provide system redundancy to the Project area.

Serving this Project should not negatively impact the City's ability to provide a supply and delivery of water to reasonably foreseeable users within the City assuming adherence to recommendations from prior water resources planning efforts. However, to understand the cumulative impacts to supplies and other major water infrastructure, the City should be tracking changes in demand as part of the development process in order to determine when projects with greater demand are offset by projects with demands lower than originally planned.

Respectfully,

Nicholas Jacobson

Enclosures:

- Figure 1 – Potable Water Infrastructure
- Figure 2 – Alternative 1 – Maximum Day Demand plus Fire Flow with Operational SWTP
- Figure 3 – Alternative 1 – Maximum Day Demand plus Fire Flow without Operational SWTP
- Figure 4 – Alternative 2 – Maximum Day Demand plus Fire Flow with Operational SWTP
- Figure 5 – Alternative 2 – Maximum Day Demand plus Fire Flow without Operational SWTP
- Figure 6 – Alternative 3 – Maximum Day Demand plus Fire Flow with Operational SWTP
- Figure 7 – Alternative 3 – Maximum Day Demand plus Fire Flow without Operational SWTP
- Figure 8 – Alternative 4 – Maximum Day Demand plus Fire Flow with Operational SWTP
- Figure 9 – Alternative 4 – Maximum Day Demand plus Fire Flow without Operational SWTP

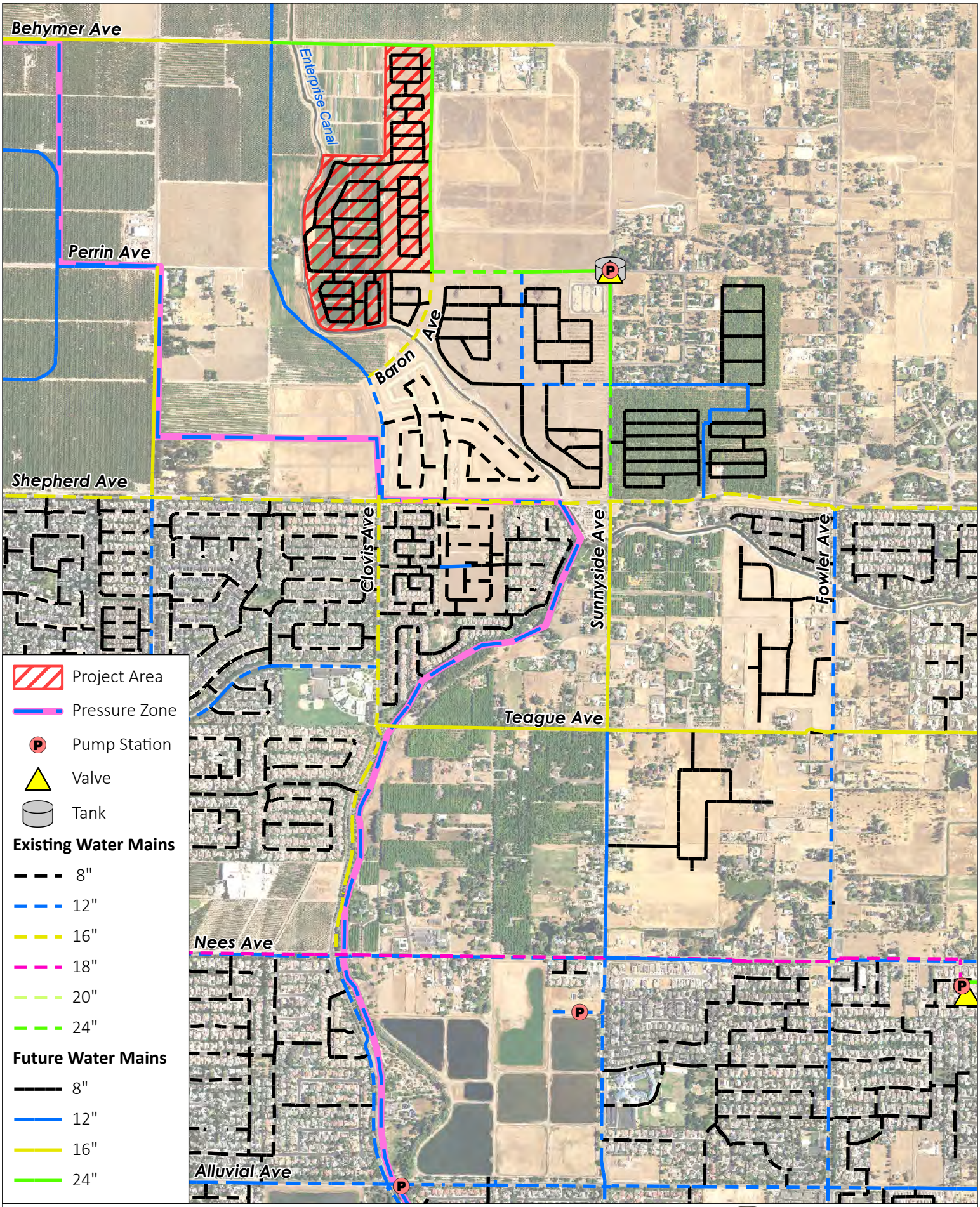

Figure 1: Existing Infrastructure

Water Supply Assessment

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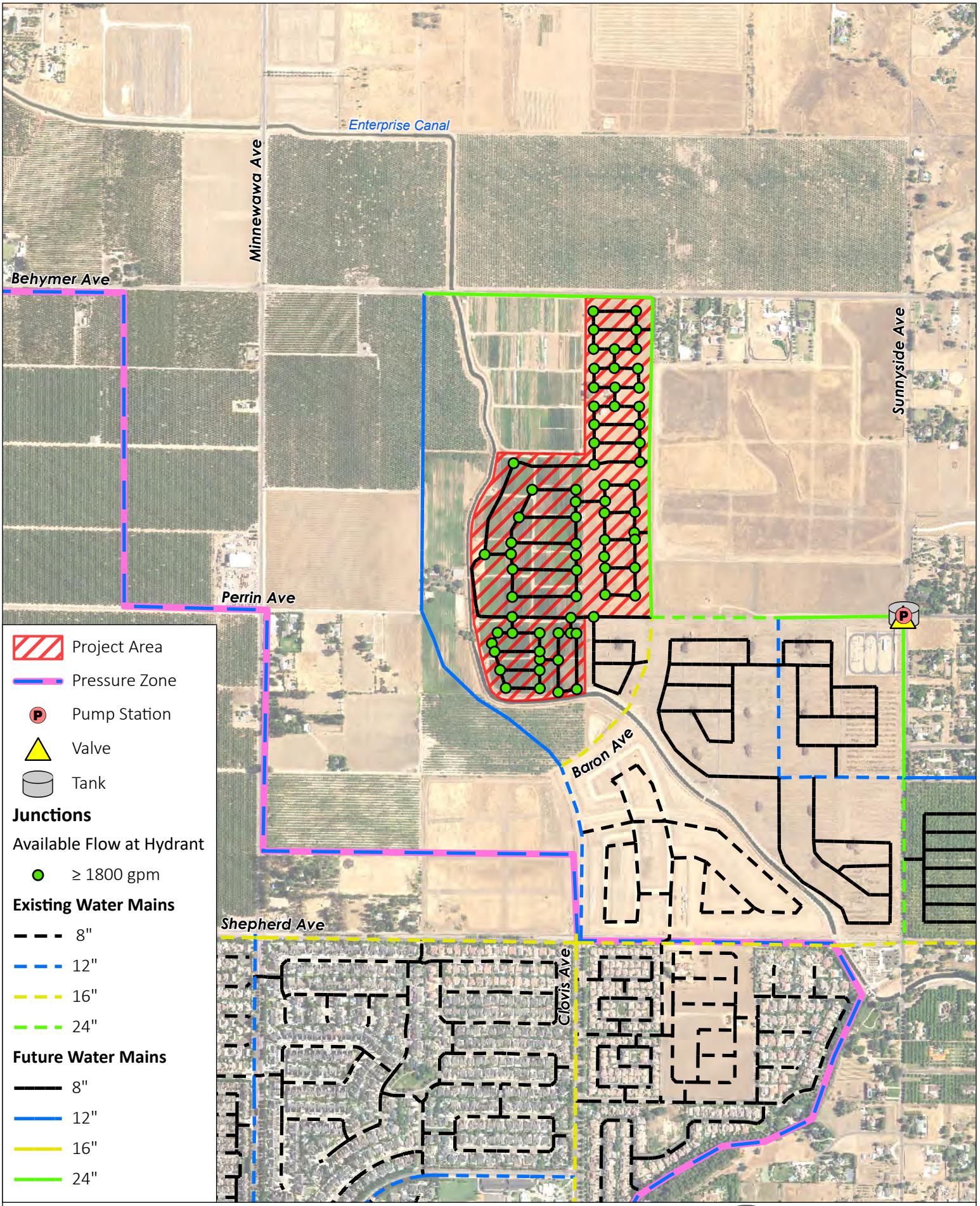

Figure 2: Alternative 1 Maximum Day Demand Plus Fire Flow with Operational SWTP

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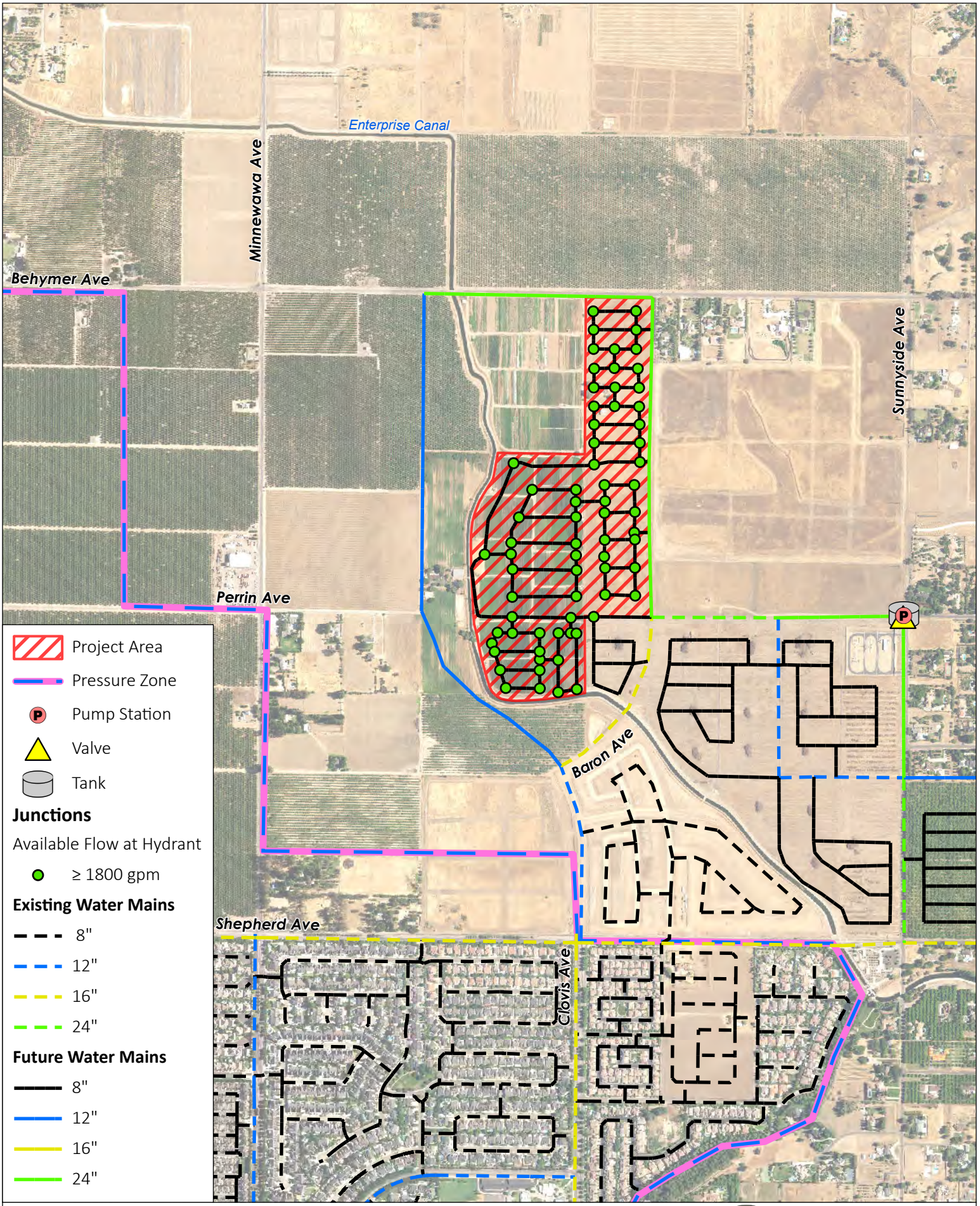

Figure 3: Alternative 1 Maximum Day Demand Plus Fire Flow without Operational SWTP

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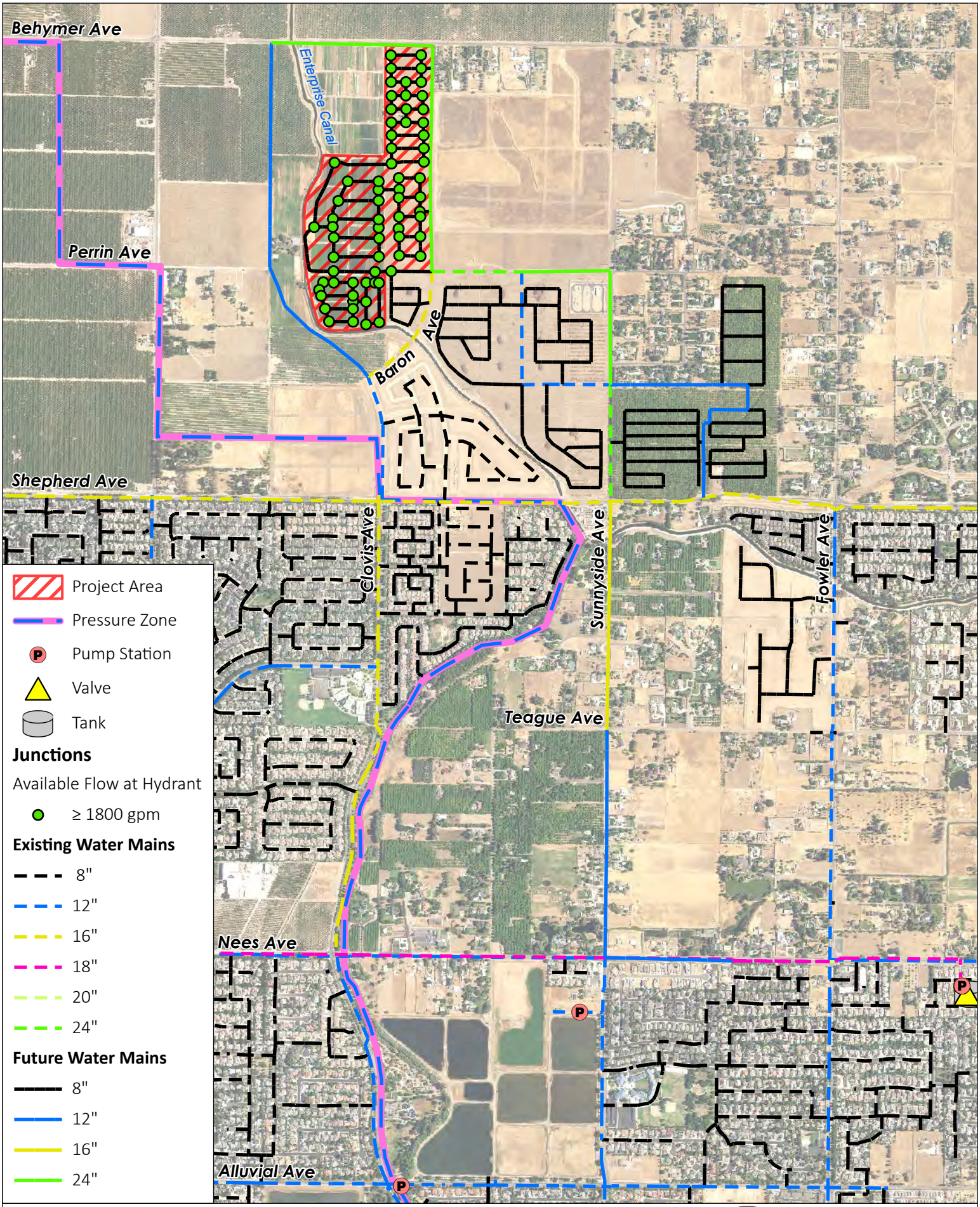

Figure 4: Alternative 2 Maximum Day Demand Plus Fire Flow with Operational SWTP

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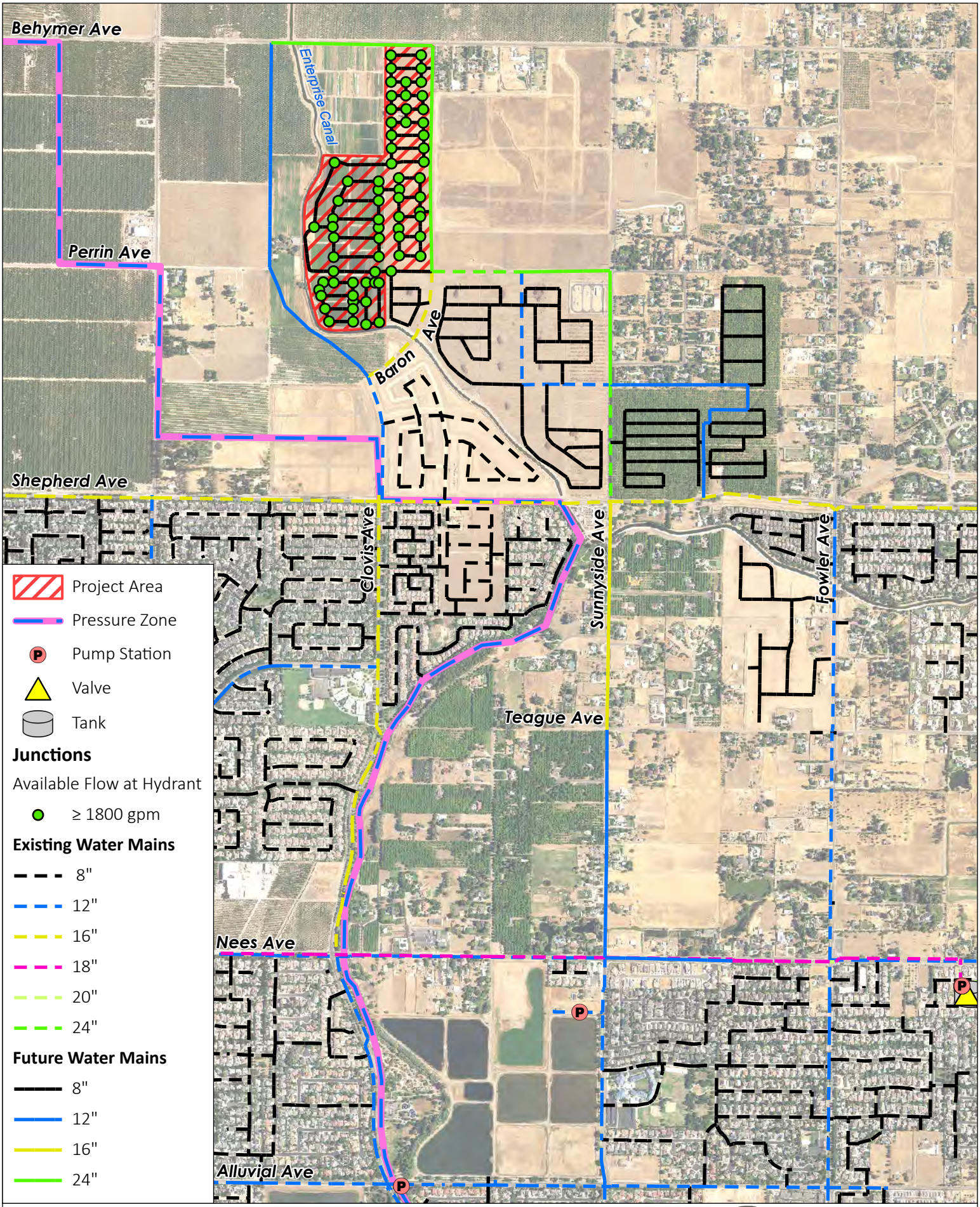

Figure 5: Alternative 2 Maximum Day Demand Plus Fire Flow without Operational SWTP

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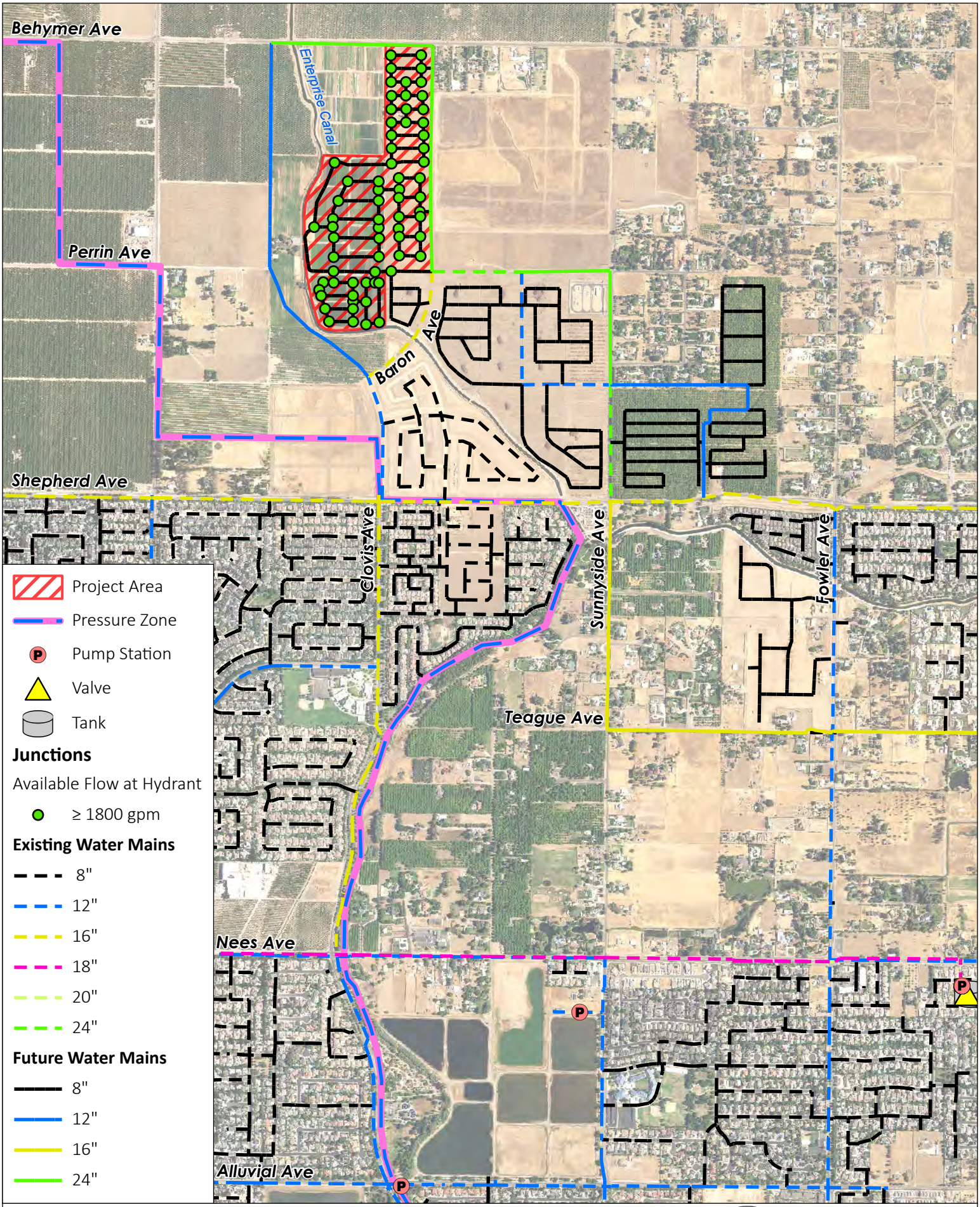

Figure 6: Alternative 3 Maximum Day Demand Plus Fire Flow with Operational SWTP

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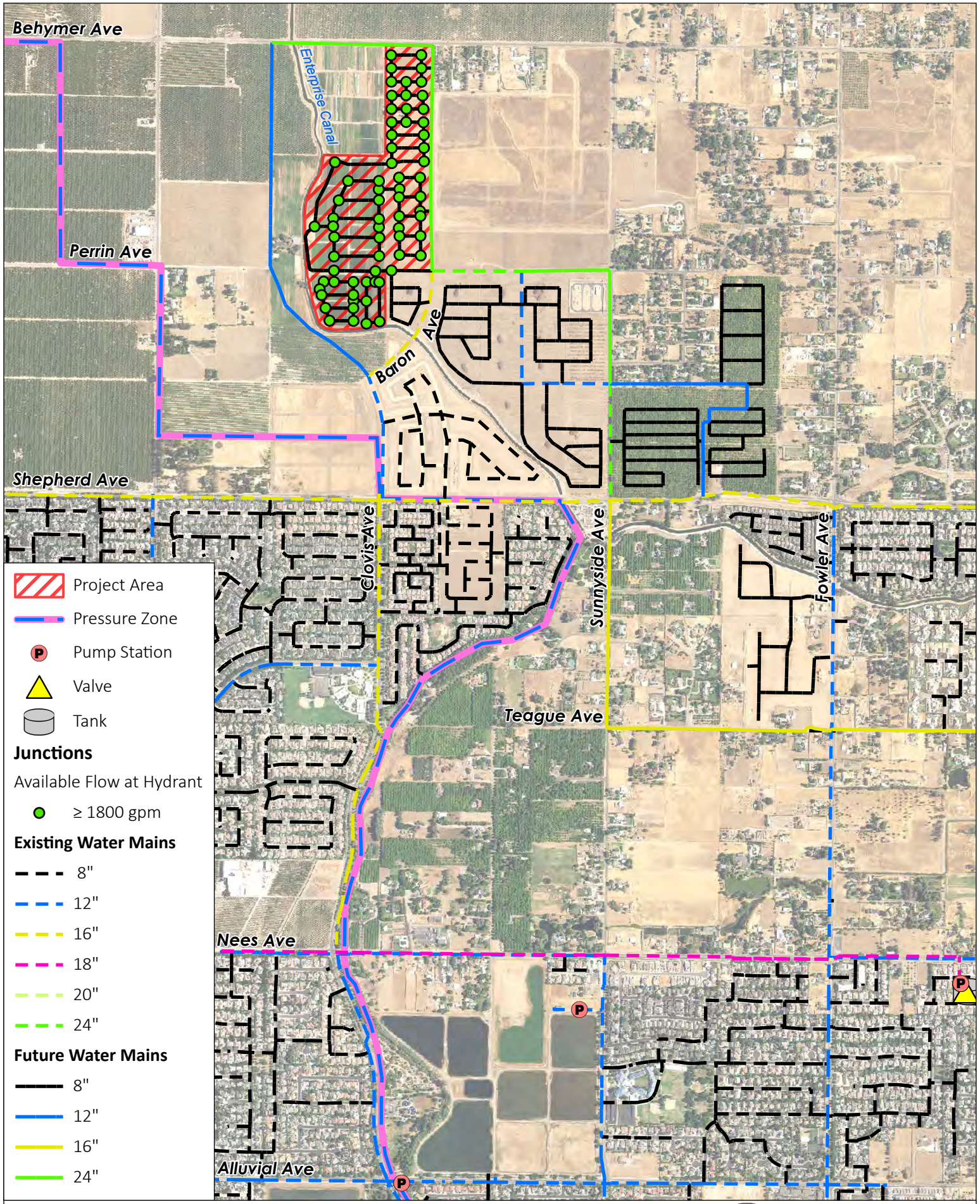

Figure 7: Alternative 3 Maximum Day Demand Plus Fire Flow without Operational SWTP

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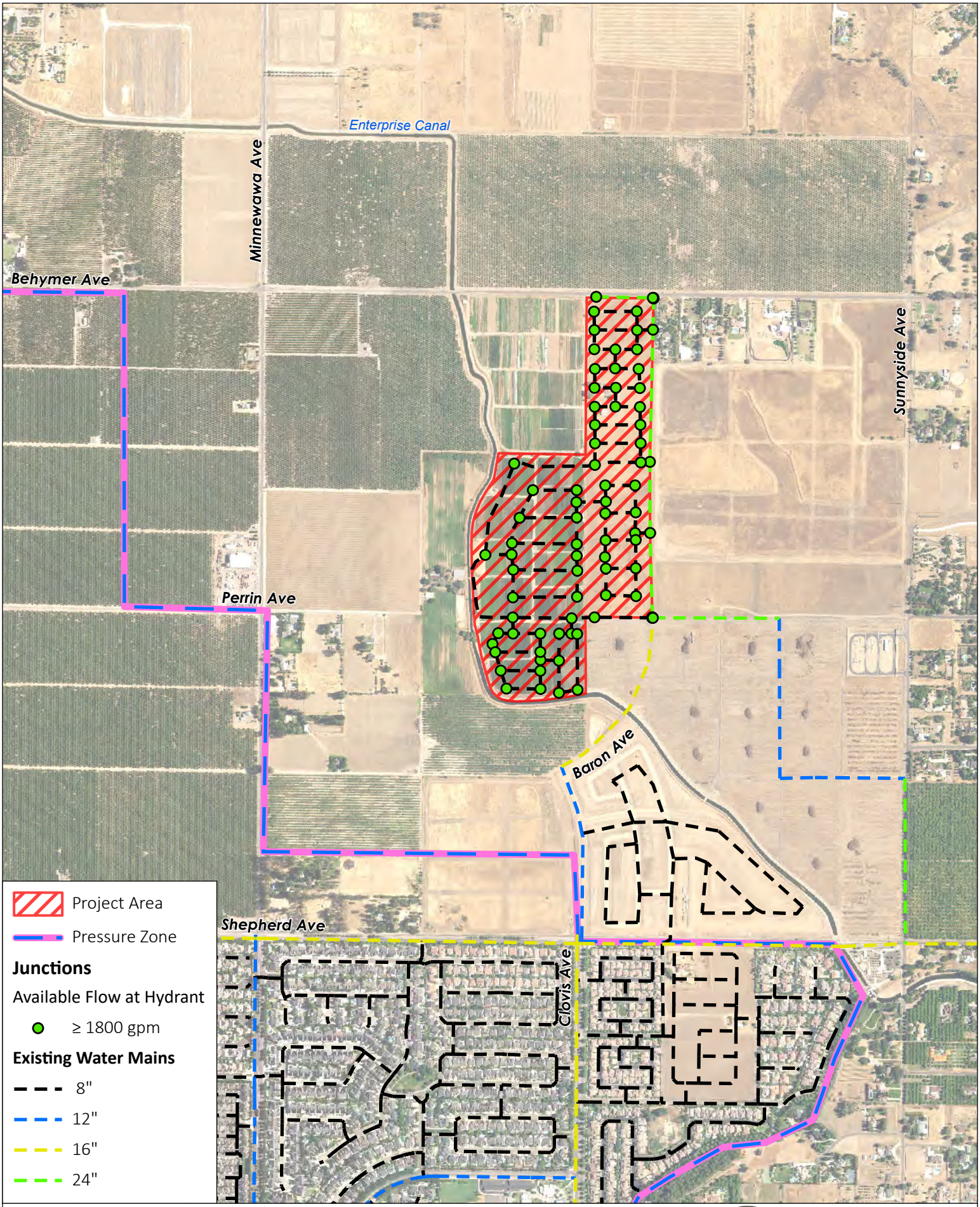

Figure 8: Alternative 4 Maximum Day Demand Plus Fire Flow With Operational SWTP

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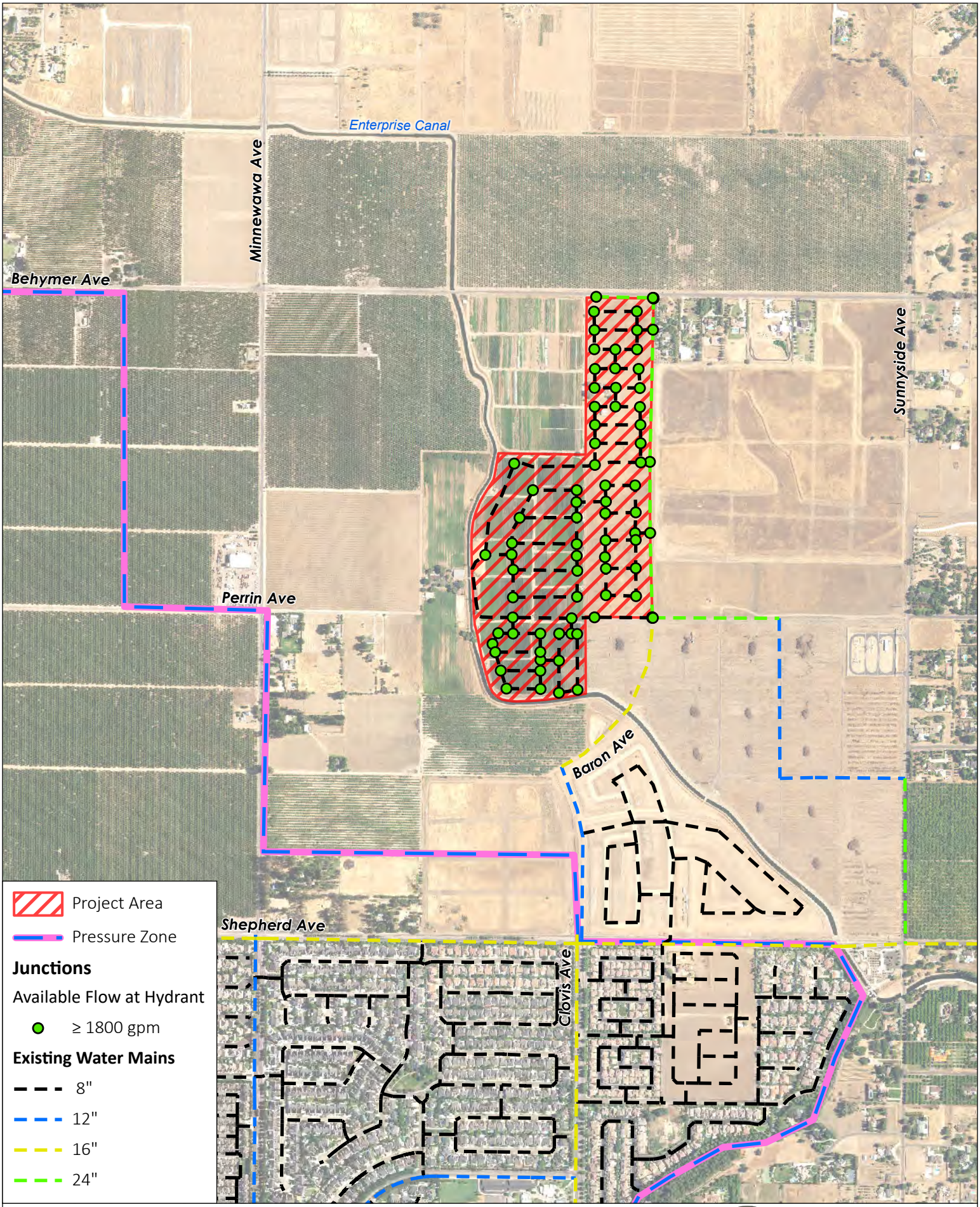

Figure 9: Alternative 4 Maximum Day Demand Plus Fire Flow Without Operational SWTP

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