

Author: John Lambie, principal hydrogeologist

Site Name: Mustang Creek

Location: Merced County, CA

Operator(s): Eastside Water District

Permitting Agency(s): State Water Board and Merced County Department of Environmental Health

Current MAR Status: Pilot study

Year Constructed: 2020

Costs: Not available

Project Contact Information: John Lambie

Project Website/Publication Links: NA

Purpose of MAR:

- Water supply resilience

Source Water:

- Captured water

Water Quality:

- Pretreatment required

Recharge Technology(s):

- Dry well

Project Description

The Mustang Creek project is located near East Avenue and Oakdale Road in Merced County, California. It is a pilot study designed to establish whether dry wells can be cost-effective in introducing captured floodwater into the Turlock Subbasin Aquifer. Project data, including impacts to baseline water quality, infiltration and cost-effectiveness of dry wells, and the ability to introduce water to the subsurface into different geological strata, will be collected over a period of 2 years.

Three dry wells with flow meters are installed ([Figure 1](#)) at various depths and monitored for (1) surface water quality for mineralogy, (2) groundwater chemistry for changes in ions and inorganics in first groundwater, (3) the quantity of water infiltrated, and (4) groundwater hydraulic heads in the local and nearby region ([Figure 2](#)).

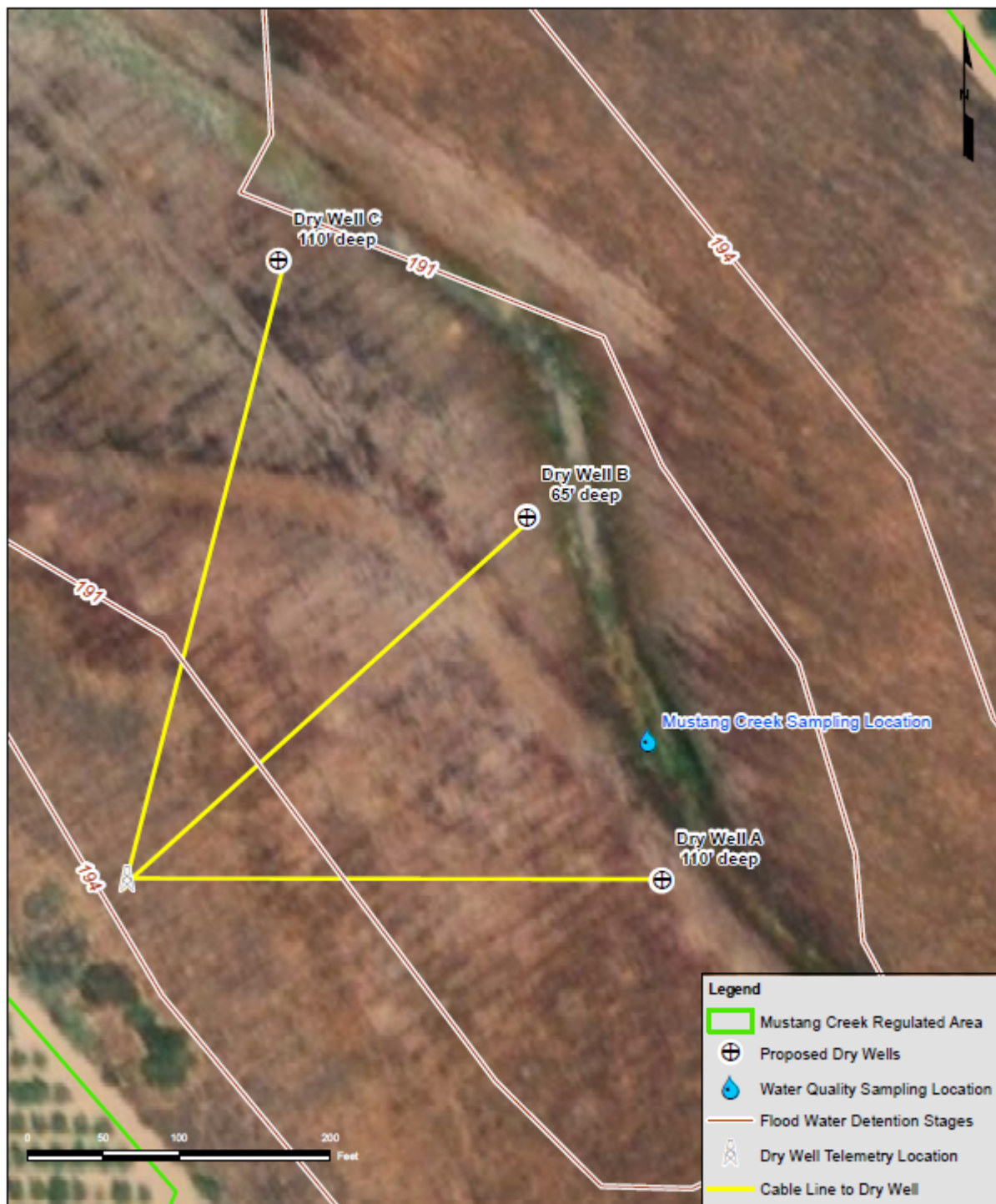


Figure 1. Installed dry well locations and depths.

Source: [Lambie \(2020\)](#)

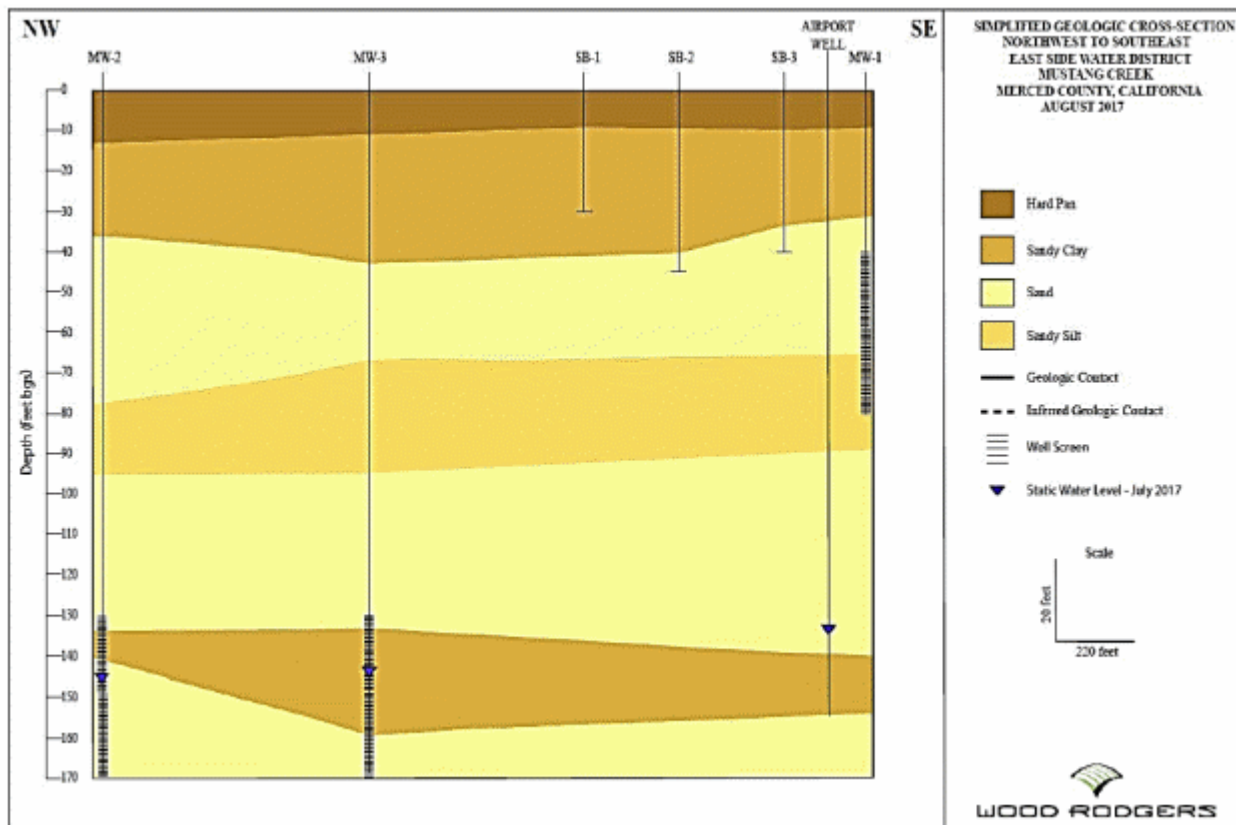


Figure 2. Geologic cross section at project site.

Source: [Lambie \(2020\)](#).

Receiving Aquifer

The Turlock Subbasin is defined and regulated under California's Sustainable Groundwater Management Act (SGMA) ([Figure 3](#)). The SGMA requires that groundwater sustainability plans (GSP) be developed by local groundwater sustainability agencies so that groundwater conditions are not adversely impacted in the Turlock Subbasin. Further, the SGMA requires that water supply and demand met by groundwater usage is sustainable over the long term. This pilot project for dry wells and the broader program of intentional and MAR projects will be important components in the GSP water budgets. This can help water users of all types better manage water resources within the area to withstand droughts and minimize the need to fallow land or alter land uses due to a lack of water supplies.

There are five relatively small watersheds within the basin where surface and near-surface conditions may be conducive to groundwater recharge above native or existing conditions of recharge. In these watersheds native surface water may be available as floodwater or diffused stormflow (water that does not and cannot reach a watercourse). These five watersheds range in size from 6.5 square miles to 21.5 square miles, with the largest of them being Mustang Creek.

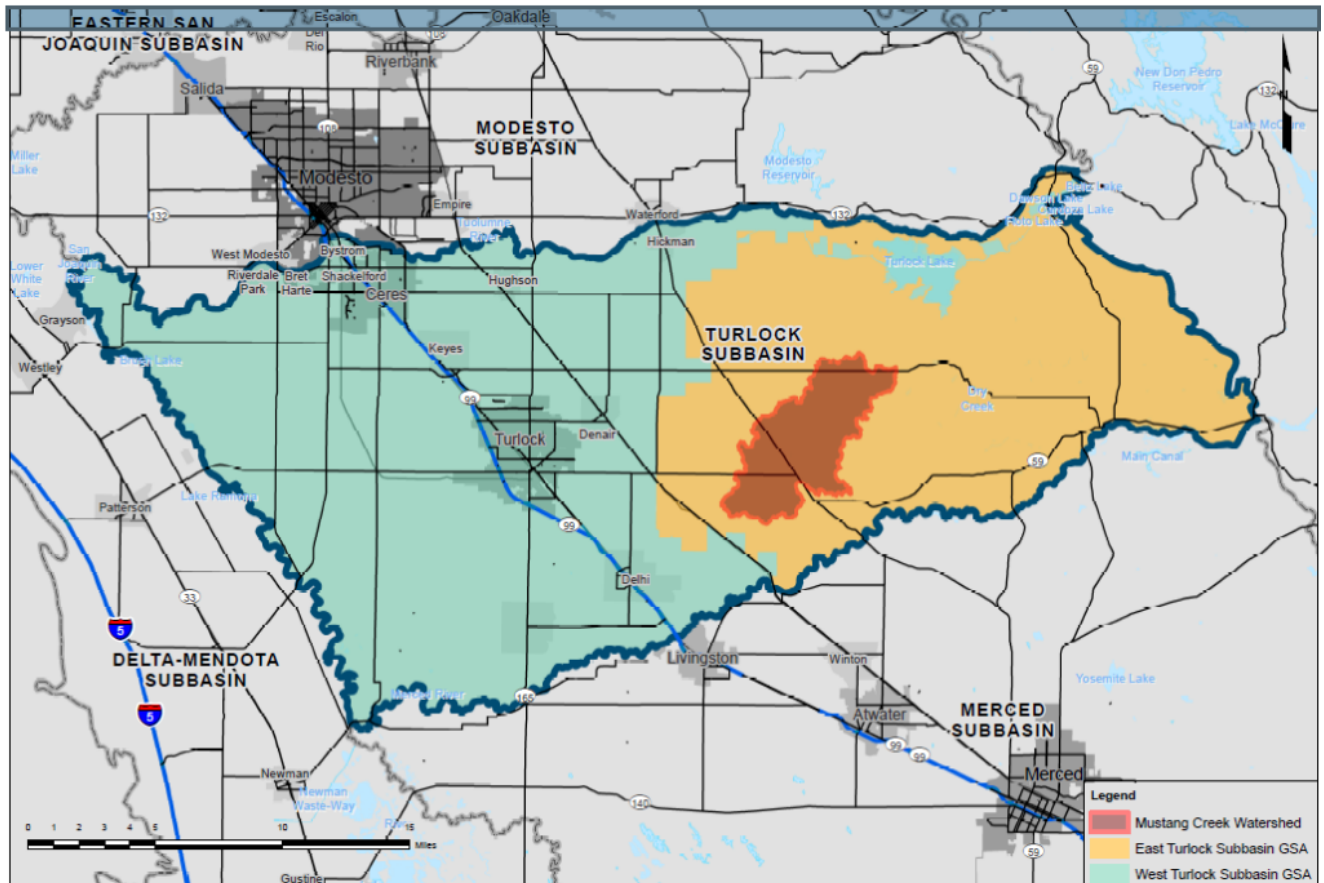


Figure 3. Location of receiving aquifer, Turlock Subbasin.

Source: [Lambie \(2020\)](#)

Water Quality

The USGS conducted extensive studies of groundwater and surface water in the region with a series of four or more focused on the water resources of Mustang Creek ([Figure 4](#)). The Eastern San Joaquin Water Quality Coalition has been conducting surface water quality testing of Mustang Creek since 2008. In 2014 the Eastside Water District (EWD) conducted investigations and preparatory work for some form of MAR at the secondary detention basin. Most recently, the East Turlock Subbasin Groundwater Sustainability Agency began a series of groundwater monitoring of their agency area, with three wells being monitored as of fall 2019 and another from the 2014 EWD work.

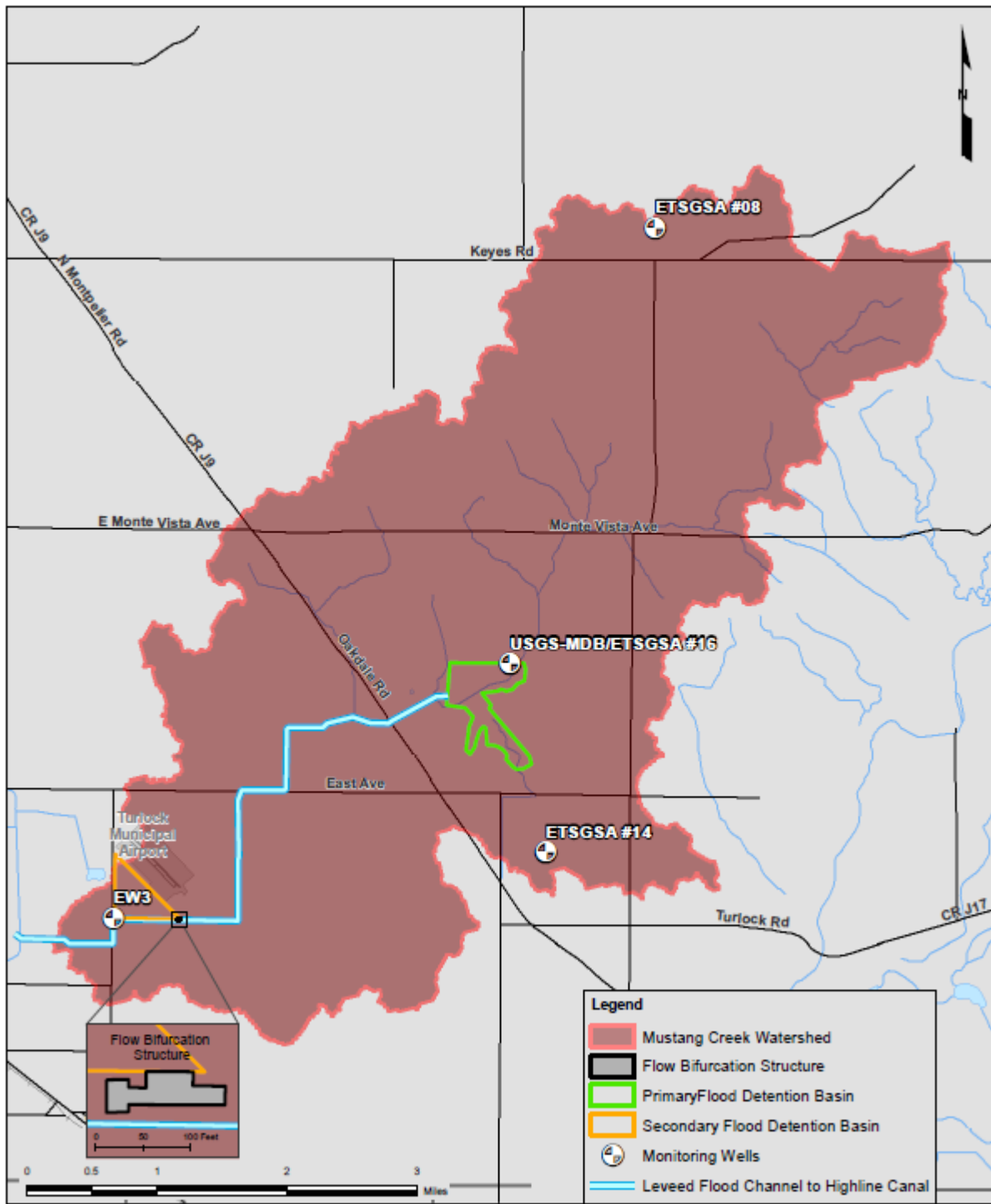


Figure 4. Mustang Creek watershed.

Source: [Lambie \(2020\)](#)

To provide the most relevant and recent assessment of water quality conditions in the detained waters of Mustang Creek, the engineer developed a baseline water-quality standard in 2020, taking samples from the surface as well as from the USGS well. A full description of the sampling methods and results (general chemistry, pesticides, nutrients) can be found in [Lambie \(2020\)](#).

The field sampling scope for February 2020 was to collect one set of surface water quality samples from the primary detention basin on Mustang Creek and one set of groundwater quality samples from the USGS monitoring well at the primary detention basin (USGS MDB). Samples were also collected for baseline analysis of dissolved organic carbon, select metals, nitrogen, orthophosphate, major ions, biochemical oxygen demand (BOD), pH, and total dissolved solids (TDS).

The installed dry wells include a pretreatment chamber ([Figure 5](#)). The pretreatment chambers are designed to provide for surficial removal of sediment and organic debris but also to provide vadose zone treatment to percolating water before it reaches the groundwater table. This additional vadose zone treatment is important to reduce or mitigate water quality

concerns associated with use of floodwater and other surface water.

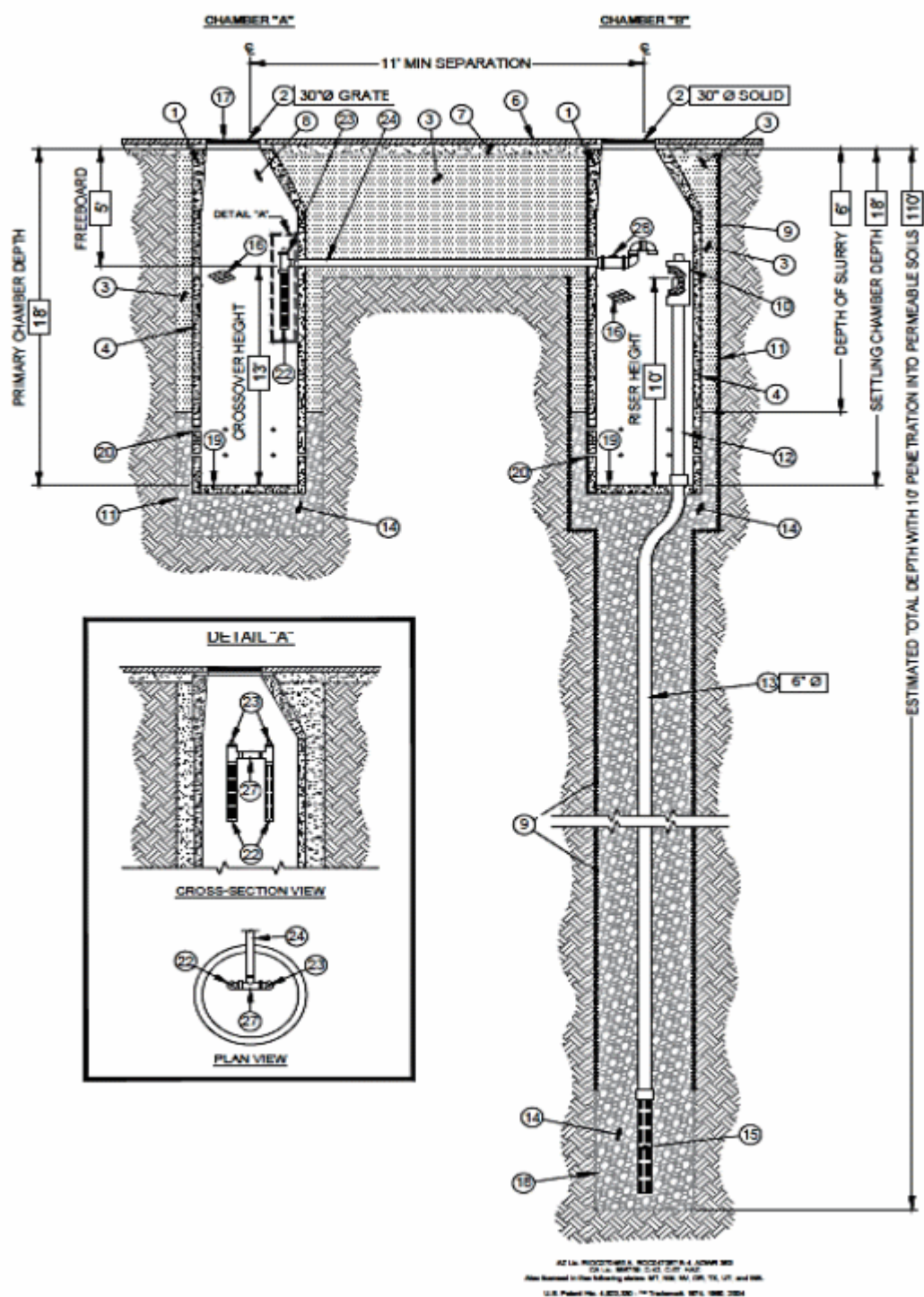


Figure 5. Detail of installed dry well.

Source: [Torrent Resources \(2019\)](#)

○ ITEM NUMBERS

1. MANHOLE CONE - MODIFIED FLAT BOTTOM.
2. BOLTED RING & GRATE/COVER - DIAMETER & TYPE AS SHOWN. CLEAN CAST IRON WITH WORDING "STORM WATER ONLY" IN RAISED LETTERS. BOLTED IN 2 LOCATIONS AND SECURED TO CONE WITH MORTAR. RIM ELEVATION $\pm 0.02'$ OF PLANS.
3. STABILIZED BACKFILL - TWO-SACK SLURRY MIX.
4. PRE-CAST LINER - 4000 PSI CONCRETE 48" ID. X 54" OD. CENTER IN HOLE AND ALIGN SECTIONS TO MAXIMIZE BEARING SURFACE.
5. NOT USED.
6. GRADED BASIN OR PAVING (BY OTHERS).
7. COMPACTED BASE MATERIAL, IF REQUIRED (BY OTHERS).
8. FREEBOARD DEPTH VARIES WITH INLET PIPE ELEVATION. INCREASE PRIMARY AND SECONDARY CHAMBER DEPTHS AS NEEDED TO MAINTAIN ALL INLET PIPE ELEVATIONS ABOVE RISER PIPE.
9. NON-WOVEN GEOTEXTILE SLEEVE - MIRAFI 140 NL. MIN. 6 FT Ø. HELD APPROX. 10 FEET OFF THE BOTTOM OF EXCAVATION.
10. PUREFLO® DEBRIS SHIELD - ROLLED 16 GA. STEEL X 24" LENGTH WITH VENTED ANTI-SIPHON AND INTERNAL 0.265" MAX. S.W.O. FLATTENED EXPANDED STEEL SCREEN X 12" LENGTH. FUSION BONDED EPOXY COATED.
11. MIN. 6" Ø DRILLED SHAFT.
12. RISER PIPE - SCH. 40 PVC MATED TO DRAINAGE PIPE AT BASE SEAL.
13. DRAINAGE PIPE - ADS HIGHWAY GRADE OR SCH. 40 PVC WITH TRI-A COUPLER. SUSPEND PIPE DURING BACKFILL OPERATIONS. DIAMETER AS NOTED.
14. ROCK - WASHED, SIZED BETWEEN 3/8" AND 1-1/2".
15. FLOFAST® DRAINAGE SCREEN - SCH. 40 PVC 0.120" SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT. WITH TRI-B COUPLER. OVERALL LENGTH VARIES, UP TO 120" WITH TRI-B COUPLER.
16. ABSORBENT - HYDROPHOBIC PETROCHEMICAL SPONGE. MIN. 128 OZ. CAPACITY. TYPICAL, 2 PER CHAMBER.
17. FABRIC SEAL - U.V. RESISTANT GEOTEXTILE - TO BE REMOVED BY CUSTOMER AT PROJECT COMPLETION. GRATED ONLY.
18. MIN. 4" Ø DRILLED SHAFT.
19. BASE SEAL - CONCRETE SLURRY.
20. 8 PERFORATIONS MINIMUM PER FOOT, 2 ROWS MINIMUM.
21. NOT USED.
22. DUAL INTAKE SCREEN - 4" Ø SCH. 40 PVC 0.120" MODIFIED SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/ FT. 48" OVERALL LENGTH WITH TRI-B COUPLER PER DETAIL. REFER TO "DETAIL A" HEREON. REFER TO TABLE FOR INFORMATION REGARDING ORIFICE.
23. VENTED ANTI-SIPHON INTAKE.
24. CONNECTOR PIPE - 6" Ø SCH. 40 PVC.
27. 6" Ø SCH. 40 PVC TEE WITH 4" REDUCERS.
28. 6" FLOW METER - PLUMBED TO FLOW FULL. METER PROVIDED BY OWNER AND CONNECTED BY TORRENT RESOURCES. IF METER IS NOT AVAILABLE AT THE TIME OF SCHEDULED DRYWELL INSTALLATION, IT WILL BE CONNECTED BY OWNER. FLOW METER TO BE STRAPPED AND/OR BRACED ACCORDINGLY IN THE FIELD.

Figure 5. Detail of installed dry well—cont'd.

Source: [Torrent Resources \(2019\)](#)

Regulatory Considerations/Issues

Current injection well regulations as defined by the U.S. Environmental Protection Agency require users to register dry wells as Class V injection facilities. Merced County Department of Environmental Health (MCDEH) as of September 2019 required that "recharge/injection wells" undergo a specific well construction/destruction permit process in accordance with Merced County Code (Chapters 9.27 and 9.28). The MCDEH permit process includes the establishment of and adherence to a monitoring and reporting program (MRP) as specified by the Central Valley Regional Water Quality Control Board (CVRWQCB). The CVRWQCB regards introduction of surface waters to dry wells as water and not waste or wastewater and develops appropriate MRPs to protect beneficial uses of groundwater.

Performance to Date

The dry wells are fed via gravity flow, and delivery of water is dependent upon rain events. Observed infiltration rates for a single dry well have exceeded 350 gallons per minute during significant rain events. Monitoring of infiltration rates is in real time.