

# **State of San Francisco Bay 2011 Appendix K**

## **STEWARDSHIP – Recycled Water Use Technical Appendix**

Peter Vorster, The Bay Institute

## TECHNICAL APPENDIX: RECYCLED WATER USE

### Background and rationale

Most of the water that Bay Area communities consume is used once, treated, and discharged from 34 publicly owned treatment works (POTW) into the Bay and its tidal sloughs and streams (see Figure 1).<sup>1</sup> The Bay Area is fortunate to receive high quality surface water directly from relatively pristine Sierran watersheds and from the local watersheds draining the Coast Ranges. Supplies from the Delta are usually of good quality although they may have been “recycled” several times by upstream users before being pumped from the Delta. There has been a small amount of intentional recycling or reuse of the water from wastewater treatment plants for over 50 years, but the amount and uses of recycled water have grown substantially in the past several decades.<sup>2</sup>

In the Bay Area, recycled water from POTW’s is used to irrigate landscapes, golf courses, and crops; for process water, including power plant and refinery cooling water and washdown water at commercial and industrial facilities; and to augment freshwater flow to wetlands. Proposed new uses of recycled water in the region include toilet flushing in commercial buildings, heating and cooling, and for groundwater recharge.

Water recycling demonstrates good stewardship because it uses the limited local and imported water supplies more efficiently, with the potential of reducing the need for new water diversions from the Bay’s watershed. Compared to existing supplies, recycled water is much less sensitive to climate-induced supply variation and often consumes less energy than pumping water from the Delta or pumping groundwater (BACWA, 2007).<sup>3</sup> Water recycling supports the region’s sustainability by providing a local and available source of water and because the wastewater is primarily discharged into or near the Bay, and not part of a downstream supply, it is a “new” source of water for the region and the State. Water recycling also reduces the amount of treated wastewater that is discharged into the Bay. In sum water recycling can meet multiple resource management and protection objectives.<sup>4</sup>

---

<sup>1</sup> Nearly all of the urban Bay Area is “sewered” and connected to publicly owned treatment works (POTW). The rural fringes of the Bay still rely on individual septic tanks or small facilities that discharge into groundwater. Some industrial users such as refineries, chemical companies, and shoreline businesses such as C&H Sugar discharge their wastewater directly into the Bay. Wastewater can be discharged into North Bay streams during the winter wet season when runoff is higher.

<sup>2</sup> Water recycling can refer to recycling of water from any source such as wastewater, irrigation water, gray water, or storm water but this analysis is specific to wastewater recycling from treatment plants. There is a very small but growing effort by residents and businesses to recycle greywater on-site to meet irrigation and plumbing needs.

<sup>3</sup> Energy consumption for recycled water depends on the distance and elevational difference of the end user and treatment plant.

<sup>4</sup> Recycling is not without its critics who note its high capital costs, water quality risks, and growth-inducing aspects.

Recycled water is quantified as either the recycled water produced at the POTW's, or the water supply that it replaces or creates. Recycled water that replaces water that otherwise would be delivered by a municipal supplier is considered a "potable offset." Recycled water can also be used in a way that does not offset potable water, such as for creating and enhancing freshwater marsh habitat at Hayward Marsh, Peyton Slough, Palo Alto Marsh and several North Bay streams.

Vineyards and dairies can also use recycled water from a POTW instead of pumping groundwater or withdrawing surface water from a nearby stream. A POTW may also treat its wastewater to recyclable standards but not have a market for the water and will apply it to formerly non-irrigated land to grow grass or forage crops instead of discharging it into the Bay. In all of these cases, the recycled water is providing a local water resource, expanding our region's available water portfolio, and providing economic, environmental or social benefits. For POTW's that normally discharge effluent to the Bay, any reuse will reduce the amount of that discharge.

### **Data sources**

There is no consistent, reliable, and regularly reported data for recycled water use. State agencies including the State Water Resources Control Board, the Department of Water Resources and the Regional Water Quality Control Board periodically compile recycled water use but the data is not always consistent with data obtained directly from or reported by the wastewater recyclers and the water agencies that distribute the water. The data inconsistencies are due in part to the differing definitions of what is classified as recycled water with some agencies quantifying only the portion that offsets potable uses and other agencies quantifying all wastewater that is used for any beneficial use including in-plant use and land irrigation used for wastewater disposal. There is also not a consistent delineation between the different categories (commercial, industrial, irrigation) of recycled water use.

Multiple sources were consulted to obtain the most up-to-date information (generally 2010) on the quantity of recycled water used for the different types of end use including landscape irrigation, commercial, industrial, and agricultural water use as well as for wetland and wildlife habitat use (termed environmental enhancement in some delineations). The most reliable source of data is to obtain it directly from the wastewater treatment plant operator (e.g. Napa Sanitation District) or from the distributor or consumer of the water, either a water agency (e.g. SFPUC) or the direct consumer (e.g. turf farm). The most recent (2010) urban water management plans (UWMPs) were also consulted. The UWMP's reviewed in April or May 2011 were typically in a draft form, but included the mandated set of information on production and use of recycled water (Water Code Section 10633), and on projections for the recycled water production/use until the year 2035.<sup>5</sup> Lastly the "96-011" reports to the San Francisco Bay Regional Water Quality Control Board (Regional Board) were consulted where data for 2010 was available to fill in gaps and to corroborate previously obtained data.<sup>6</sup> The data

---

<sup>5</sup> Some of the UWMPs in the region were still being drafted and were unavailable.

<sup>6</sup> Order 96-011 from the San Francisco Bay Regional Board is the master recycled water permit for Region 2 (SF Bay) and is the name given to the reports that wastewater recyclers submit to the Regional Board.

compilation shown in Table 1 was derived from 18 contacts with treatment plant operators or water agencies, eight UWMPs, and two data points were derived from 96-011 reports.

Recycled water use from 2001 was compiled for The Bay Institute's 2003 Ecological Scorecard (TBI 2003). That data was obtained from the treatment plant operators and water agencies and from the 2001 State Water Board Recycled Water Survey. The 2001 data was reanalyzed for this report to insure consistency with the current assessment and thus includes data from the North Bay counties (Marin, Sonoma, Napa, Solano) whereas the 2003 report only included data from the five counties covered by the Bay Area Regional Water Recycling Program (San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa).

### **Methods and calculations**

In order to quantify the contribution by recycled water to reducing regional water demand, the recycled water volume used to offset (i.e., reduce by the same amount) the consumption of potable water or groundwater is distinguished from the recycled water used in ways for which potable water would not or was not being used. In the latter category ("non-offset recycled water") recycled water is quantified that is (a) directly discharged to a (restored) wetland or wildlife habitat (e.g., a duck pond), (b) has been used to irrigate previously dry-farmed land or irrigate pasture for forage and grazing. In addition where data was available, wastewater was quantified that was (c) "land applied" (instead of being discharged to a waterbody) but not providing any agricultural value, (d) used "internally" for the wastewater plant operations that would not normally replace potable water.<sup>7</sup> The latter two quantities are not included in the total recycled water use shown in Table 1 since they are not consistently quantified.

### **Goals, targets, and reference conditions**

There are no standardized benchmarks or targets for assessing progress on recycled water use, however the following are approaches that have been used or could be used:

1. Comparing recycled water used to the total amount of water flowing into or out of wastewater treatment plants, usually expressed as a percentage. Regional Board records indicate that the 2009 inflow to the POTW's is nearly 615,000 ac-ft.
2. Comparing recycled water used to the amount of water treated to recyclable (Title 22) standards at the treatment plants (i.e. the amount potentially available for use). Depending on the end-use, recycled water often needs additional treatment above and beyond what is required for normal receiving water discharge. The amount of recycled water used can be less than the amount treated to the recyclable standards because demand for the water is reduced use due to seasonal and unusual variations in climate or reduced demand from businesses because of economic factors. The amount treated to recycled standards is not routinely reported but should be available from treatment plant operators.

---

<sup>7</sup> Wastewater treatment plants use treated wastewater for various in-plant functions and processes including cooling and filter flushing.

3. Comparing the recycled water used to published planning targets and projections. There are many plans and projections for recycled water use in the Bay Region, some of which include targets for recycled water use. In 1999 the Bay Area Regional Water Recycling Program projected that for the five county region (San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa) Water recycling projects in the Bay Area could produce as much as 125,000 acre feet a year by 2010 and 240,000 acre feet a year by 2025 if funding were available and institutional constraints were reduced (BARWMP, 1999 and BACWA 2006). The North Bay Water Reuse program projects a recycled water potential of 36,500 ac-ft in Marin, Sonoma, and Napa Counties although the three alternatives analyzed for implementation project smaller amounts available for reuse (BACWA 2006, North Bay Water Reuse web-site project description <http://nbwra.org/projects/3alternatives.html>). The 2006 Bay Area Integrated Regional Water Management Plan identifies 27 projects that could produce up to 120 TAF/YR of recycled water by the year 2020 (BACWA 2006). The individual water agencies that prepare 2010 UWMP's are required to produce projections for the recycled water production and use through the year 2035. The plans and projections are based upon an assessment of future supply and demand for recycled water and, depending on the projection, a greater or lesser evaluation of the economic viability and funding availability. For this assessment the BARWRP projection for 2010 is the most viable to use, recognizing that many of the assumptions made in 1999 about demand and funding availability have not been realized.

## Results

Results of this assessment are displayed in Table 1 and Figure 2. The data in Table 1 are listed by each “recycler” or producer of recycled water, i.e., a wastewater treatment plant, or a wastewater district –on a separate line. The recyclers are grouped by region (East Bay, South Bay, Peninsula, and North Bay) and by county (color code). The recycled water production in acre-feet (AF) is shown by-plant for 2010, and as total for the San Francisco Bay Area in 2001. Both 2010 and 2001 totals are further divided into use categories (shown in columns), with the categories grouped into those that offset water demand (summed in the “Potable offset” column), and those that do not. Also compiled but not shown on this table is the (2010) data source for each recycler, and a name and contact information of a person who provided the data or information specific to the plant.

Total recycled use in the Bay Area increased more than 50 percent from 2001 to 2010 to 46.1 thousand acre-feet (TAF), with the most significant increase in the use by refineries and power plants for process and cooling water. Nearly 36 TAF replaces potable use and stream and groundwater use, representing nearly 4 percent of the total urban and agricultural water demand in the Bay Area and more than doubling the potable offset in 2001. Most of the 36 TAF offsets potable supplies previously used for landscape irrigation and industrial uses, with around 3 TAF offsetting groundwater and surface water use by North Bay agriculture. The remaining recycled use does not offset potable

uses but is used to sustain freshwater marshes around the Bay and to grow forage crops in the North Bay.

Recycled water use in 2010 was only about 30% of the 2010 target of 125 TAF established for the five counties in 1999 by the Bay Area Regional Water Recycling Program (BARWRP). This is primarily due to the cost of recycled water projects and funding limitations, reduced market demand, and customer/public acceptance. Currently, proposals for 27 projects with 120 TAF/YR of yield are in different phases of planning or funding procurement although this is still short of the 276 TAF of the potential market for recycled water that the BARWRP and North Bay Reuse Study identified for the year 2025. The 46.1 TAF of recycled water comprises about 7 percent of wastewater production from the POTW's. There is plenty of potential supply, although a portion of the wastewater stream may never be economically feasible to develop for recycling given the mismatch between wastewater discharge locations and recycled water market locations. This discrepancy results in a high conveyance cost for the recycled water product.

Significant expansion of recycled water use in the Bay region will depend on acquiring the necessary funding and overcoming the perceived and actual risks of using it for indirect potable use by recharging it in groundwater basins. These basins in the Santa Clara Valley, Alameda County, Sonoma Creek and Napa River Valleys supply groundwater for urban and agricultural uses. The use of recycled water in new development should also be maximized since it is generally less expensive to install the needed infrastructure compared to retrofitting it in an existing development.

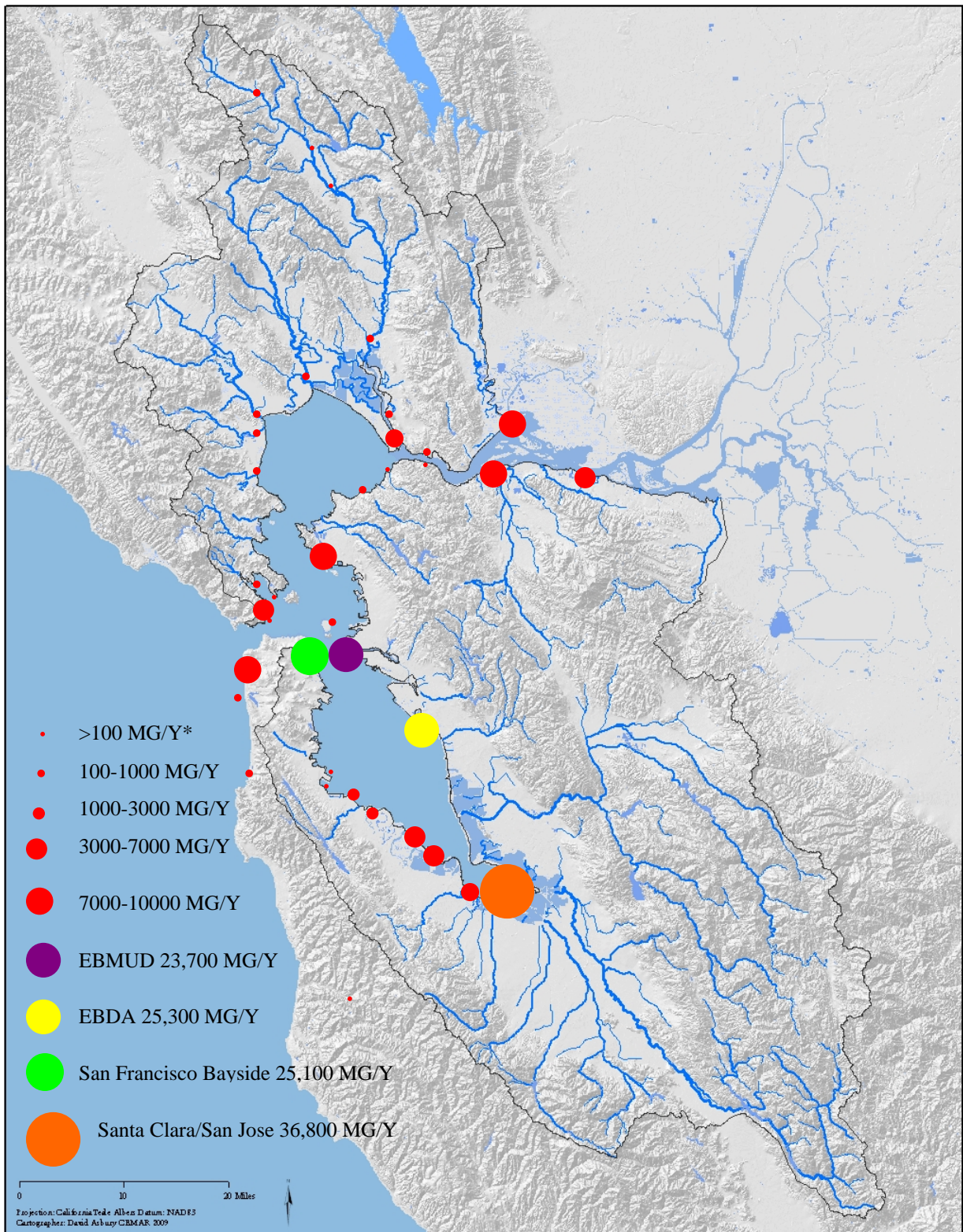
Recycled water use is becoming an increasingly important part of the Bay Area's water portfolio and will help offset increased potable uses and hopefully replace enough existing potable uses to reduce our reliance on imported supplies and increase freshwater outflows to the Bay from the Delta. If the potential market for recycled water is fully realized, demand for imported water could be significantly reduced and the region's water supply would be far more reliable. To fully realize this potential, Bay Area residents and businesses will need to overcome their concerns about the perceived risks of recycled water and embrace it as one of the most viable means of achieving a more sustainable water future for the region.

## References

- [BARWRP] Bay Area Regional Water Recycling Program. 1999. San Francisco Bay Area Regional Water Recycling Program Recycled Water Master Plan. Lafayette, CA.
- [BAWAC] Bay Area Clean Water Agencies. 2006. Wastewater and Recycled Water. Functional Area Document. 125 pp. Available at <http://bairwmp.org/docs/functional-area-documents/bay-area-clean-water-agencies-resolution-to-adopt>
- [BAWAC] Bay Area Clean Water Agencies. 2007. Importance of Recycled Water to the San Francisco Bay Area. Prepared for Bay Area Clean Water Agencies by M.Cubed, Oakland, CA. 34 pp. Available at <http://bacwa.org/LinkClick.aspx?fileticket=3A7XYG3Bwyo%3d&tabid=105&mid=463>
- The Bay Institute (TBI) 2003 San Francisco Bay Index. 84 pp. Novato, CA. Available at [www.bay.org](http://www.bay.org)



**Figure 1. Locations of Region 2 POTW Discharges**

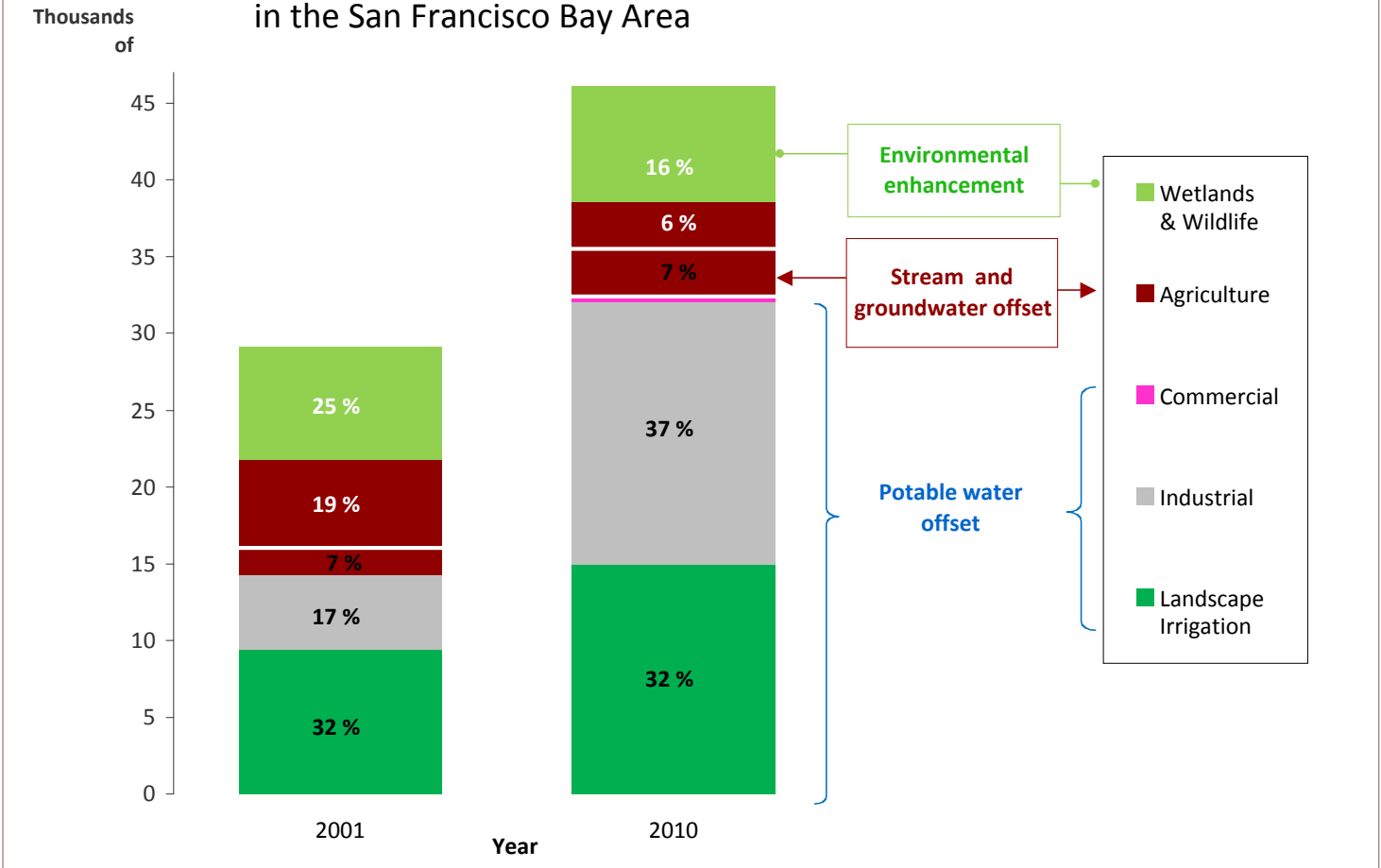


\* MG/Y = million gallons per year

From Region 2 draft staff report on Water Recycling in the SF Bay Area



Figure 2: Recycled water use in the San Francisco Bay Area



**TABLE 1: RECYCLED WATER USE IN THE SAN FRANCISCO BAY REGION IN 2010 AND 2001**

All values in acre-feet for 2010 except where noted

| Region            | County       | Distributor / Customer | POTW Operator                      | Total  | Potable Offset | Landscape Irrigation | Industrial | Commercial | Agriculture | Agriculture non-offset | Wetlands & Wildlife |
|-------------------|--------------|------------------------|------------------------------------|--------|----------------|----------------------|------------|------------|-------------|------------------------|---------------------|
| East Bay          | Alameda      | EBMUD                  | EBMUD Main WWTP                    | 560    | 560            | 549                  | 0          | 11         | 0           | 0                      | 0                   |
| East Bay          | Alameda      | EBMUD                  | San Leandro WPCP                   | 448    | 448            | 448                  | 0          | 0          | 0           | 0                      | 0                   |
| East Bay          | Alameda      | Hayward                | Oro Loma/Castro Valley             | 258    | 258            | 258                  | 0          | 0          | 0           | 0                      | 0                   |
| East Bay          | Alameda      | Livermore              | Livermore, City of                 | 800    | 800            | 773                  | 24         | 1          | 3           | 0                      | 0                   |
| East Bay          | Alameda      | Hayward Marsh          | Union Sanitary District            | 3,362  | 0              | 0                    | 0          | 0          | 0           | 0                      | 3,362               |
| East Bay          | Contra Costa | CCWD                   | Central Contra Costa SD            | 614    | 614            | 614                  | 0          | 0          | 0           | 0                      | 0                   |
| East Bay          | Contra Costa | CCWD                   | Delta Diablo Sanitation District   | 6,269  | 6,269          | 449                  | 5,821      | 0          | 0           | 0                      | 0                   |
| East Bay          | Contra Costa | Peyton Slough          | Mt. View Sanitation District       | 2,240  | 0              | 0                    | 0          | 0          | 0           | 0                      | 2,240               |
| East Bay          | Contra Costa | DSRSD                  | Dublin San Ramon Services District | 1,729  | 1,729          | 1,675                | 54         | 0          | 0           | 0                      | 0                   |
| East Bay          | Contra Costa | EBMUD-R.A.R. E.        | West County Wastewater District    | 4,124  | 4,124          | 202                  | 3,922      | 0          | 0           | 0                      | 0                   |
| East Bay          | Contra Costa | EBMUD-Chevron          | West County Wastewater District    | 4,482  | 4,482          | 0                    | 4,482      | 0          | 0           | 0                      | 0                   |
| East Bay          | Contra Costa | EBMUD                  | from Dublin San Ramon              | 491    | 491            | 491                  | 0          | 0          | 0           | 0                      | 0                   |
| Peninsula         | San Mateo    | Redwood City           | South Bayside System Authority     | 490    | 490            | 490                  | 0          | 0          | 0           | 0                      | 0                   |
| Peninsula         | San Mateo    | SFPUC                  | Daly City                          | 547    | 547            | 547                  | 0          | 0          | 0           | 0                      | 0                   |
| South Bay         | Santa Clara  | San Jose etc.          | San Jose/Santa Clara WPCP          | 7,767  | 7,767          | 5,030                | 2,277      | 460        | 0           | 0                      | 0                   |
| South Bay         | Santa Clara  | Sunnyvale              | Sunnyvale WPCP                     | 776    | 776            | 762                  | 8          | 6          | 0           | 0                      | 0                   |
| South Bay         | Santa Clara  | Palo Alto              | Palo Alto Regional WQCP            | 2,147  | 767            | 431                  | 336        | 0          | 0           | 0                      | 1,380               |
| North Bay         | Marin        | MMWD                   | Las Gallinas SD                    | 600    | 600            | 570                  | 0          | 30         | 0           | 0                      | 0                   |
| North Bay         | Marin        | North Marin WD         | Novato SD                          | 1,680  | 168            | 168                  | 0          | 0          | 0           | 951                    | 560                 |
| North Bay         | Napa         | American Canyon        | American Canyon                    | 68     | 68             | 27                   | 0          | 0          | 41          | 0                      | 0                   |
| North Bay         | Napa         | Napa and Ag            | Napa Sanitation District           | 1,679  | 915            | 905                  | 0          | 3          | 6           | 764                    | 0                   |
| North Bay         | Napa         | Calistoga              | Calistoga                          | 211    | 153            | 153                  | 0          | 0          | 0           | 58                     | 0                   |
| North Bay         | Napa         | Yountville and Ag      | Yountville                         | 284    | 284            | 47                   | 0          | 1          | 235         | 0                      | 0                   |
| North Bay         | Solano       | Turf farm              | Fairfield Suisun Sewer District    | 1,304  | 1,304          | 0                    | 0          | 0          | 1,304       | 0                      | 0                   |
| North Bay         | Sonoma       | Petaluma               | Petaluma WR Facility               | 1,677  | 493            | 356                  | 131        | 0          | 6           | 1,184                  | 0                   |
| North Bay         | Sonoma       | Agriculture            | Sonoma Valley County SD            | 1,500  | 1,500          | 0                    | 0          | 0          | 1,500       | 0                      | 0                   |
| East Bay          |              |                        |                                    | 25,378 | 19,776         | 5,459                | 14,303     | 12         | 3           | 0                      | 5,602               |
| Peninsula         |              |                        |                                    | 1,037  | 1,037          | 1,037                | 0          | 0          | 0           | 0                      | 0                   |
| South Bay         |              |                        |                                    | 10,690 | 9,310          | 6,223                | 2,621      | 466        | 0           | 0                      | 1,380               |
| North Bay         |              |                        |                                    | 9,003  | 5,485          | 2,226                | 131        | 34         | 3,093       | 0                      | 560                 |
| 2010 total        | 9 counties   |                        |                                    | 46,108 | 35,608         | 14,945               | 17,055     | 512        | 3,096       | 2,958                  | 7,542               |
| 2010 minus N. Bay | 5 counties   |                        |                                    | 37,105 | 30,124         | 12,719               | 16,924     | 478        | 3           | 0                      | 6,982               |
| 2001 total        | 9 counties   |                        |                                    | 29,094 | 16,219         | 9,392                | 4,865      | 32         | 1,930       | 5,559                  | 7,317               |