CHAPTER 7
Climate Change Resiliency

This Chapter documents an analysis of the resiliency of the four WWTPs of interest and the unsewered parcels within the Study Area to flooding and associated climate change impacts. The topics addressed are as follows:

- Background
- Water Supply Resiliency
- Existing Federal Flood Mapping
- Climate Change Scenarios
- Impacts to Unsewered Parcels
- Impacts to Existing WWTP Infrastructure

7.1 BACKGROUND

This section presents relevant background information related to this analysis under the following topics:

- Evaluation Objectives
- Data Sources
- Methodology

7.1.1 Evaluation Objectives

Climate change is expected to impact both water supply and water demands within Sonoma County in various ways. For instance, climate change may increase the variability and reliability of Sonoma County's surface water supplies for production of potable water. Climate change may also lead to more frequent or longer droughts, hotter temperatures, and higher water demands. Therefore, expanded water supply through local production of recycled water generated from unsewered communities could play a role in mitigating these climate change conditions. This Chapter summarizes readily available information from Sonoma Water regarding water supply impacts under future climate change scenarios and potential benefits of increased recycled water supply.

Climate change also has the potential to cause increased flooding depths and extents in the Russian River and surrounding watersheds due to increased rainfall intensity. For the four West County WWTPs, increased flood levels may result in more frequent or extended inundation of critical infrastructure during flood conditions. OWTS leachate contains pathogens and other contaminants. Under flooding conditions, the leachate from any OWTS has the potential to enter the river and put public and environmental health at risk. Therefore, increased flooding depths expected to occur due to climate change impacts have the potential to increase the risks of impacts associated with OWTS. For these reasons, this evaluation assesses the impacts of the increased flooding associated with climate change on the OWTSs and the four existing WWTPs located in the Study Area.

To assess climate change impacts to OWTSs in the Russian River watershed, an evaluation of baseline flooding conditions and three projected climate change flooding scenarios was completed to quantify the number of unsewered parcels likely to be adversely impacted by partial or full inundation due to flooding, specifically unsewered parcels within both the project Study Area broadly and the identified community clusters defined in Chapter 5. The analysis also defines the increasing flooding extents that occur within the impacted community clusters. Parcels identified as vulnerable under the evaluated flooding scenarios may benefit from future connection to a centralized sewer system to reduce the risk of contamination, thereby protecting the water quality of the Russian River and supporting long-term regional resilience to climate change.

To assess climate change impacts to the WWTPs, baseline and projected flood level information was used in combination with Federal Emergency Management Agency (FEMA) mapping data to define potential future 100-year and 500-year flood elevations at each WWTP site and identify what infrastructure may become vulnerable under the future climate change conditions.

7.1.2 Data Sources

This study utilizes data from a variety of sources, including but not limited to the following:

1. **Water Supply and Climate Change Planning Documents**:
   - 2021 Sonoma Water *Climate Adaptation Plan*[1]
   - 2022 Sonoma Water Regional Water Supply Resiliency Study[2]
2. **FEMA Floodplain GIS Shapefile:** FEMA floodplain data for Sonoma County from the FEMA website. The 100-year baseline floodplain boundary was used to intersect with parcel data and identify impacted parcels under baseline conditions.
3. **Baseline Data:** Baseline data from Sonoma Water[3]. The data reflects a 1986 flooding event, which is approximately equivalent to a 50-year (2 percent annual chance) flood event. The file includes flood depth data (in feet) for the baseline flooding condition.
4. **Climate Change Data:** Three climate change scenarios (early_1986, mid_1986, and late_1986) data from Sonoma Water[1]. These datasets show flood depths (in feet) equivalent to a 50-year flood event, produced using climate model projections. These scenarios represent projections for Early Century (Years 2016 to 2045), Mid Century (Years 2046 to 2075) and Late Century (Years 2070 to 2099).
5. **GIS Data From Wastewater Regionalization Study:** Additional data have been used in the analysis from other parts of the project, such as GIS shapefiles for the Study Area boundary and locations of WWTPs and communities of unsewered parcels.

[1] Sonoma Water, 2021. Accessed at https://www.sonomawater.org/media/PDF/Environment/Climate%20Adaptation%20Planning/SW_CAP_Final_October_2021.pdf.

[2] Sonoma Water, 2022. Accessed at https://www.sonomawater.org/media/PDF/About/WAC/2022_05/7.2.%20Sonoma%20Water%20Resiliency%20Study%20-%20Drought%20Analysis%20TM%20FINAL%20DRAFT.pdf

[3] All data received from Sonoma Water were processed using the Raster Domain tool, which converted raster datasets to shapefiles while preserving the original geometry configuration. The raster corresponding to the 50-year flood event represented flood depth and was used as a proxy for the inundation boundary in the analysis.

7.1.3 Methodology

To quantify the number of impacted unsewered parcels, the GIS Intersect tool was applied to overlay parcel boundaries with the floodplain extent for each baseline and climate change scenario. This intersection identified parcels located within flood-impacted areas. Subsequently, the intersected parcels were overlaid with the identified community cluster boundaries, allowing determination of the number of impacted parcels within each defined community cluster. The projected flood levels were also defined within each impacted community cluster under the four scenarios evaluated. Following the completion of all GIS processing steps, the resulting datasets were exported to spreadsheets for further quantitative analysis and reporting.

In addition, the flood depths defined for the clusters located near the West County WWTPs were used in combination with the FEMA mapping information to estimate the potential increases in the 100-year and 500-year flood elevations near these facilities. This information was then used in combination with available LiDAR ground surface elevation data to identify potential areas within each facility that could be adversely impacted by the increased flood levels.

7.2 WATER SUPPLY RESILIENCY

The 2021 *Climate Adaptation Plan* lists several climate change vulnerabilities of Sonoma's water supply, including temperature, extreme precipitation, river flooding, drought and wildfire. Extreme drought within the Russian River watershed is specifically discussed as a major risk area, with the following projected changes listed:

- Increased variability in water supply due to greater variability in precipitation, combined with warming.
- Potential reduction in early and late wet season runoff by end of the century, leading toward extended summer dry season.

The *Climate Adaptation Plan* lists several possible water supply adaption concepts that could be implemented to address climate change vulnerabilities, including "Increase Production and Use of Recycled Water." In addition, "Expand Opportunities for Reuse" is one of five major actions identified as part of a sanitation adaptation strategy. The description of that action includes "expansion of partnerships with wineries and other irrigators…to increase the service area for recycled water" and that "opportunities exist for increased reuse opportunities in most sanitation entities [i.e., in the region]." "Expand recycled water supply" and "Increase recycled water storage" are also listed in the Sonoma Water's 2022 Regional Water Supply Resiliency Study report as drought mitigation option for increasing water supply and improving operations, respectively, and expanding recycled water supply as one of the longer-term actions offering potential for resiliency during prolonged, extreme droughts.

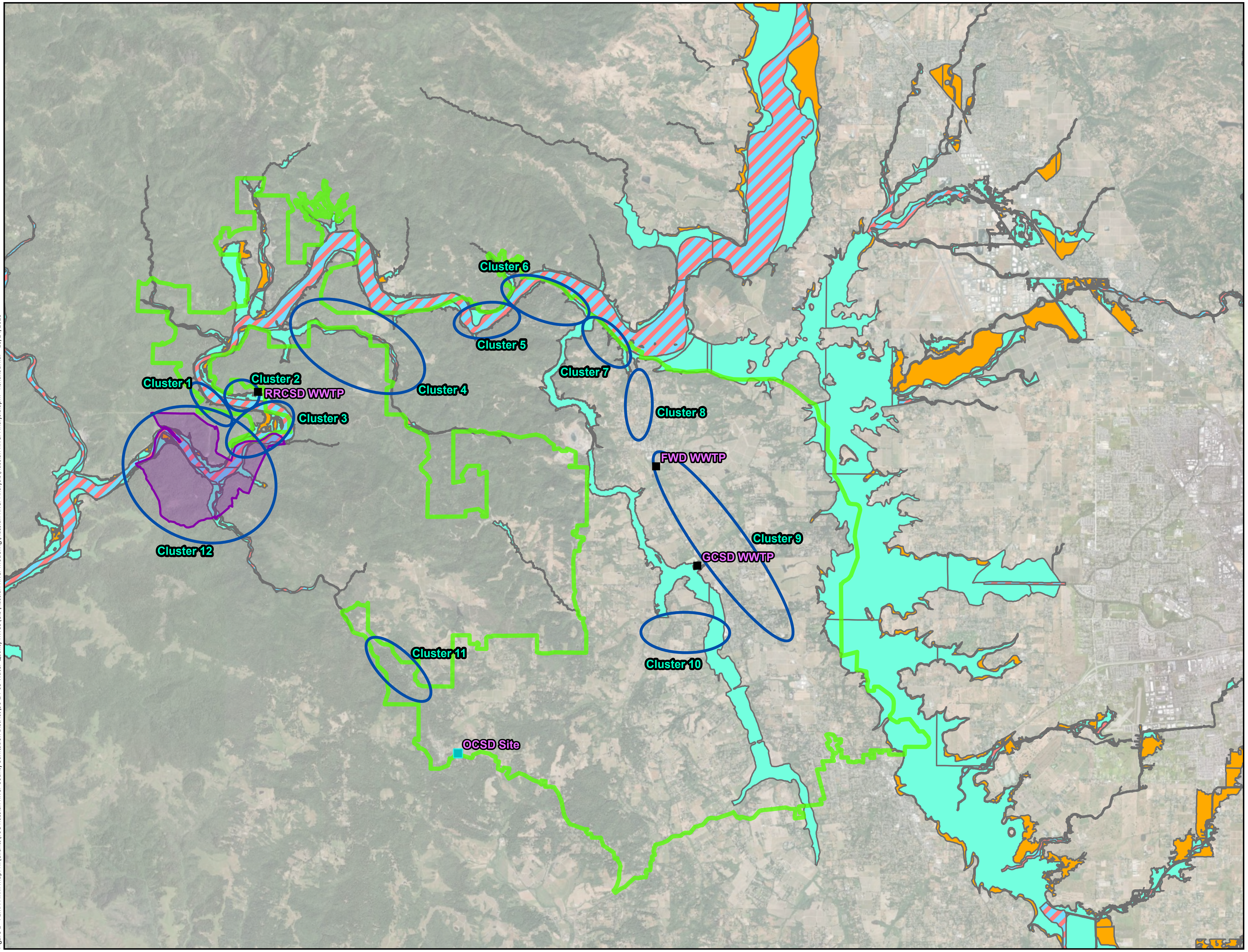
The 2021 plan also lists an adaptation concept of "Increase Regional Partnerships to Support Climate Resilience" as applying across various Sonoma Water water/wastewater systems, with a description that "[e]xpansion of existing, and development of new, regional partnerships will promote and enable greater climate resilience for Sonoma Water."

7.3 EXISTING FEDERAL FLOOD MAPPING

The Russian River is a FEMA-mapped river with a designated floodway in Zone AE. The Study Area is located within the unincorporated areas of Sonoma County (Community Number: 060375), as shown in Flood Insurance Rate Map panels 06097C0519F, 06097C0538F, 06097C0540F, 06097C0657F and 06097C0676F. FEMA flood hazard layers for the 100-year (1 percent annual chance) and 500-year (0.5 percent annual chance).

FEMA flood zones are shown on Figure 7-1, which also shows the Study Area, locations of the four West County WWTPs, and the locations of the unsewered community clusters established for this project. This mapping shows at least nine of the 12 clusters are impacted by flooding (Clusters 1 through 7, 10 and 12). In addition, only two of the WWTP sites are in/near mapped floodplain areas, the RRCSD WWTP and GCSD WWTP[4].

[4] The OCSD discharge pump station is located adjacent to a small creek. However, flood mapping is not available for this small waterway.



WWTP

Cluster Location

FEMA Flood Hazard Layer

0.2% Annual Chance Flood Hazard

1% Annual Chance Flood Hazard

Regulatory Floodway

Monte Rio & Villa Grande Study Area

Study Area

ID	Name
1	Guerneville South of River
2	Guerneville North of River
3	Northwood
4	Hwy 116 East of Guerneville
5	Summerhome Park Road
6	Hacienda and Hollydale
7	River Road North of Forestville
8	Forestville
9	Hwy 116 East of Graton
10	Graton West
11	Camp Meeker
12	*Monte Rio/Villa Grande*

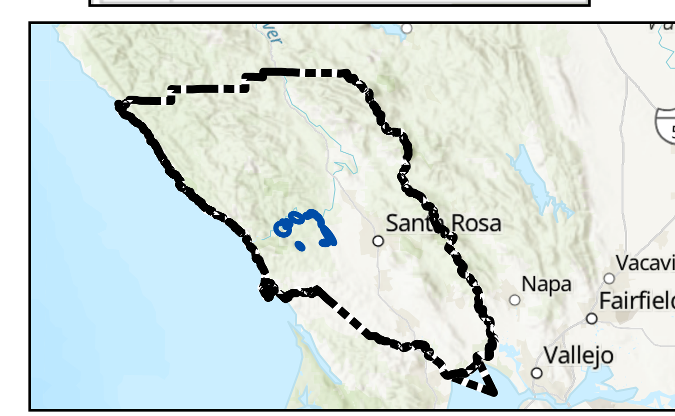


Figure 1 - FEMA FIRM Map: N:\Clients\798 Russian River County Sanitation District\50-24-05 Water Quality RWSS\GIS\Russian River Modeling\Russian River Analysis\Russian River Analysis.aprx - nshakourifar - 10/24/2025

Prepared by:

WEST YOST

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Prepared for:

Russian River County Sanitation District

Water Quality and Recycled
Water Supply Feasibility Study

Sonoma Water

Russian River Basin
FEMA Baseline Information

Russian River Basin FEMA Floodplain Mapping

Figure 7-1

7.4 CLIMATE CHANGE SCENARIOS

Sonoma Water conducted Risk Assessment Special Studies and published a report in October 2021 focusing on climate change impacts on water resources within Sonoma County. This report is included as Appendix E. Among several topics, that study primarily focused on the hydrologic impacts of climate change on water supply management, operations and flooding of the Russian River. The Russian River analysis in this study was generally limited to the main stem of the river and some primary tributaries to about 2 miles upstream along those reaches. That study extent thus does not represent all impacts to flooding within the Study Area. More specific to the current analysis, the study does not address impacts to flooding along Atascadero Creek south of around Forestville, which has the potential to cause flooding around the GCSD WWTP.

The Sonoma Water analysis used climate projections from the Coupled Model Intercomparison Project – Phase 5 model. A total of 20 individual daily climate projections were analyzed to support a quantitative risk assessment. The Localized Constructed Analogs statistical downscaling method was applied to downscale daily climate data from 10 General Circulation Models. These projections incorporated two Representative Concentration Pathways (RCPs), RCP 4.5 (moderate emissions) and RCP 8.5 (high emissions). The list of General Circulation Models used in that analysis is provided in Table C-1 of the Risk Assessment Special Study Report (Appendix E).

The Sonoma Water hydrologic and hydraulic analysis included the following efforts:

- After applying bias correction to the climate data, it was prepared for input into the U.S. Army Corps of Engineers' hydrology (HEC-HMS) model.
- The hydrology model was then used to develop hydrographs, which were then input into the Russian River hydraulics (HEC-RAS) model to evaluate the impacts on flooding.

To quantify the potential impacts of climate change over time, the analysis was divided into three future time periods (time horizons):

1. Early Century – Years 2016 to 2045
2. Mid Century – Years 2046 to 2075
3. Late Century – Years 2070 to 2099

The referenced study also included comparison of the hydrologic and hydraulic results from the three future time periods to the baseline flooding extent to quantify the changes and identify trends in peak flow, flood depth and water surface elevation under the three climate change scenarios. For more details, refer to the Climate Change Impact Analysis Report (Appendix E).

7.5 IMPACTS TO UNSEWERED PARCELS

This section describes the following results related to evaluation of impacts of increased flooding to unsewered parcels and associated OWTSs:

- Study Area Impacts of Flooding
- Community Cluster Inundation
- Community Cluster Flood Depths
- Summary

7.5.1 Study Area Impacts of Flooding

The baseline floodplain boundary and impacted unsewered parcels within the Sonoma Water Risk Assessment Special Studies area are presented on Figure 7-2, along with the community clusters that also fall within this area[5]. The floodplain boundary and impacted unsewered parcels for the Early, Mid, and Late Century climate change scenarios are shown on Figures F-1, F-2 and F-3, respectively, in Appendix F.

A comparison of inundation extents and impacted parcels in the Study Area across the baseline and climate change scenarios is provided in the Table 7-1 and Table 7-2 below. Compared to baseline conditions, the total inundated areas within the Study Area could increase by 6 percent to 30 percent under climate change conditions. The total number of impacted parcels could also increase by similar percentages, 8 to 30 percent.

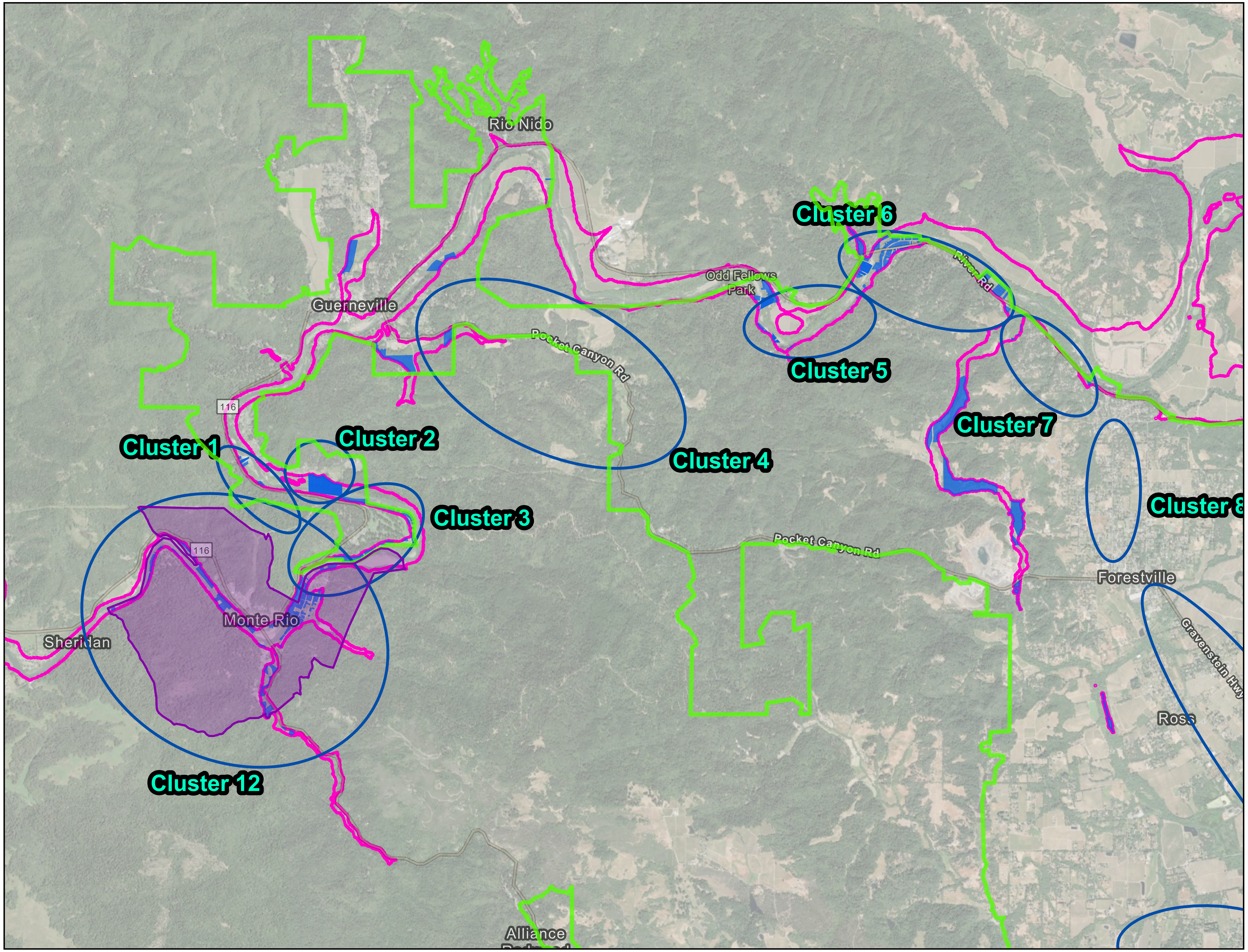
Table 7-1. Inundated Surface Areas under Baseline and Climate Change Scenarios

Scenario	Total Inundated Area, acres	Increased Inundated Area over Baseline, acres	Increased Inundated Area over Baseline, percent
Baseline	20,860	-	-
Early Century	22,190	1,330	6
Mid Century	23,360	2,500	12
Late Century	27,140	6,280	30

Table 7-2. Numbers of Impacted Parcels under Baseline and Climate Change Scenarios

Scenario	Number of Parcels Impacted	Increased Number	Increased, percent
Baseline	641	-	-
Early Century	690	49	8
Mid Century	729	88	14
Late Century	832	191	30

[5] As previously noted, Cluster 10 (Graton West) is potentially impacted by flooding in Atascadero Creek. However, the Risk Assessment Special Studies for the Russian River completed by Sonoma Water does not evaluate flooding impacts south of Forestville. Therefore, an assessment of climate change impacts on flooding within Cluster 10 could not be completed through this effort.



Cluster Location
Baseline Inundation Mapping
Impacted Parcels Under Baseline Conditions
Study Area
Monte Rio & Villa Grande Study Area

Notes:
1. The flood depth raster was received from the Sonoma County Water Agency (SCWA).
2. The total number of impacted parcels under baseline conditions is 641.
3. The parcel count does not quantify the inundated area of each parcel; it includes all parcels that are impacted, regardless of whether they are only slightly inundated or completely flooded.
4. Clusters that are not shown have not impacted parcels.

Figure 2 - Baseline Floodplain Inundation Map: N:\Clients\798 Russian River County Sanitation District\50-24-05 Water Quality RWSS\GIS\Russian River Modeling\Russian River Analysis\Russian River Analysis.aprx - nshakourifar - 10/24/2025

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WEST YOST

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Russian River County Sanitation District
Water Quality and Recycled
Water Supply Feasibility Study

Sonoma Water

Russian River Basin
Baseline Inundation Mapping

Figure 7-2

7.5.2 Community Cluster Inundation

Eight of the 12 community clusters within the area evaluated by Sonoma Water are impacted by the identified baseline and/or climate change flood conditions[6]. A summary of the impacted parcels in each cluster is provided in Table 7-3 for the baseline and three future climate change scenarios. The percentages of parcels within a cluster impacted are presented in Table 7-4.

Table 7-3. Numbers of Impacted Parcels by Community Cluster under Baseline and Climate Change Scenarios

ID	Cluster Name	Number of Impacted Parcels by Scenario			
		Baseline	Early Century	Mid Century	Late Century
1	Guerneville South of River	6	6	6	6
2	Guerneville North of River	16	16	17	19
3	Northwood	78	83	86	99
4	Hwy 116 East of Guerneville	4	4	4	5
5	Summerhome Park Road	41	43	45	50
6	Hacienda and Hollydale	153	160	170	195
7	River Road North of Forestville	17	19	22	35
12	Monte Rio/Villa Grande	227	241	248	259
	Total	542	572	598	668

Table 7-4. Percent of Impacted Parcels by Community Cluster under Baseline and Climate Change Scenarios

ID	Cluster Name	Percent of Impacted Parcels by Scenario			
		Baseline	Early Century	Mid Century	Late Century
1	Guerneville South of River	11	11	11	11
2	Guerneville North of River	28	28	29	33
3	Northwood	41	44	45	52
4	Hwy 116 East of Guerneville	6	6	6	7
5	Summerhome Park Road	41	43	45	50
6	Hacienda and Hollydale	35	37	39	45
7	River Road North of Forestville	4	4	5	8
12	Monte Rio/Villa Grande	29	31	32	33

[6] As previously noted, Cluster 10 (Graton West) is potentially impacted by flooding in Atascadero Creek. However, an assessment of climate change impacts on flooding within Cluster 10 could not be completed with the available information.

The results in Table 7-3 and Table 7-4 show a consistent increase in impacted parcels over time. The following observations are also made:

- The Hacienda and Hollydale cluster (Cluster 6) experiences the highest number of affected parcels in all scenarios, increasing from 153 (35 percent) under baseline conditions to 195 (45 percent) under the Late Century scenario.
- As a percentage of parcels, the Northwood and Summerhome Park Road clusters (Clusters 3 and 5, respectively) show the greatest impact under all scenarios, with about half their respective parcels impacted under the Early Century scenario.
- Clusters such as Northwood (Cluster 3) and River Road North of Forestville (Cluster 7) also show significant increases, while areas like Guerneville South of River (Cluster 1) and Hwy 116 East of Guerneville (Cluster 4) remain relatively stable and with relatively low percentages of parcels impacted.

7.5.3 Community Cluster Flood Depths

The absolute flood depths under baseline conditions and each of the three climate change scenarios in the eight impacted community clusters are summarized in Table 7-5, based on Sonoma Water's modeling. These results clearly demonstrate a constant increase in flood depth across the Early, Mid, and Late Century scenario. On average, flood depths increase by 1.8 feet in the Early Century scenario, 3.1 feet in the Mid Century, and 6.3 feet in the Late Century scenario, when compared to the baseline condition. This trend underscores the growing severity of flood events driven by climate change and highlights the increasing exposure of vulnerable communities to deeper and potentially more damaging inundation.

Table 7-5. Flood Depths under Baseline and Climate Change Scenarios, feet

Cluster ID	Name of Cluster	Baseline	Early Century	Mid Century	Late Century
1	Guerneville South of River	25.3	27.0	28.3	31.4
2	Guerneville North of River	27.6	29.3	30.7	33.8
3	Northwood	45.3	47.1	48.5	51.6
4	Hwy 116 East of Guerneville	18.1	20.0	21.4	24.6
5	Summerhome Park Road	32.2	34.0	35.4	38.5
6	Hacienda and Hollydale	46.5	48.3	49.6	52.7
7	River Road North of Forestville	28.2	29.9	31.3	34.5
12	Monte Rio/Villa Grande	38.4	40.2	41.6	44.7

7.5.4 Summary

Sonoma Water's hydrologic and hydraulic modeling that defines Russian River watershed flood levels under three future time periods (Early, Mid, and Late Century) as compared to a 1986 baseline flooding condition was used to assess current and potential future flooding impacts on the West County unsewered parcels. Results show substantial increases in both floodplain extent and flood depth, with the number of impacted parcels in the Study Area rising from 641 to 832 and inundated surface areas growing by over 30 percent by the Late Century climate change scenario. If converted to a centralized sewer system, currently unsewered parcels susceptible to flooding will have increased resilience.

7.6 IMPACTS TO EXISTING WWTP INFRASTRUCTURE

Of the West County WWTPs evaluated in this study, only the RRCSD WWTP and GCSD WWTP are near a FEMA designated floodplain boundary and therefore currently potentially susceptible to flooding, as noted earlier in this Chapter. Moreover, even with the increased flood levels projected under the climate change conditions, the remaining two facilities (OCSD WWTP and FWD WWTP) are not expected to be impacted by significant flooding. Therefore, the analysis presented below is limited to the two potentially impacted facilities.

7.6.1 RRCSD WWTP

FEMA flood mapping in and around the RRCSD WWTP is shown on Figure 7-3 along with relevant elevations taken from 2013 USGS LiDAR data and the RRCSD WWTP design drawings. The flood zone in this area is mapped as Zone AE, with 100-year flood elevations defined as being between 51.7 feet and 50.9 feet. On average, the FEMA 100-year flood elevation at the WWTP site is thus about 51.5 feet. The following information is noted from this figure:

- The entire WWTP site is outside the mapped 100-year floodplain (1 percent chance flood hazard).
- The Emergency Storage Pond on the south side of the site is within the 500-year floodplain (0.2 percent chance flood hazard).
- LiDAR elevation data shows the following:
  - The elevation of the road located on the south side of the Emergency Storage Pond is approximately 53 feet.
  - The elevation of the road between the Emergency Storage Pond and the Effluent Storage Pond is around 60 feet.
  - The elevation of the road on the north of the Effluent Storage Pond and aeration basins is approximately 63 feet.
  - The elevation of the area around the headworks, the Administration Building, and Filter Complex facilities are at or above approximately 70 feet. (Elevations north of these facilities are even higher.)
- Elevation data in the design drawings for the RRCSD WWTP indicates the following:
  - The elevation of the headworks is 73 feet at the top of the structure.
  - The elevation of the flow split structure is 64 feet at the top of the structure.
  - The elevation of the aeration basins is 62 feet at the top of the structure.
  - The elevation of the UV Disinfection facility is 67 feet at the top of the structure.
  - The elevation of the old chlorine contact basin (which is used for effluent flow transfer to the Effluent Storage Pond) is 61 feet at the top of the structure.
- Based on the elevation of the road located between the Emergency Storage Pond and the Effluent Storage Pond, the 500-year floodplain elevation in the area of the RRCSD WWTP is estimated to be slightly less than 60 feet.

The climate change modeling indicates Russian River flood depths near Clusters 1 and 2 could rise by about two feet in the Early Century condition and by six feet in the Late Century condition. Applying these depths to the FEMA flood elevation, the following findings are made:

- An Early Century rise of two feet could raise the 100-year flood depth to 53.5 feet. That is just above the elevation of the road located south side of the Emergency Storage Pond, but well below the 60 feet elevation of the road located between the Emergency Storage Pond and the Effluent Storage Pond.
- A Late Century rise of six feet could raise the 100-year flood elevation to 57.5 feet, which is still more than two feet below the 60-foot elevation of the road located between the Emergency Storage Pond and the Effluent Storage Pond but would clearly overtop the road south of the Emergency Storage Pond.
- An Early Century rise of two feet could raise the 500-year flood depth to approximately 62 feet, which would overtop the Emergency Storage Pond and potentially overtop the Effluent Storage Pond, aerations basins and the old chlorine contact basin.
- A Late Century rise of six feet could raise the 500-year flood elevation to approximately 66 feet, which would overtop the Emergency Storage Pond and Effluent Storage Pond and very likely overtop the aerations basins, old chlorine contact basin, and flow split structure.

Based on this information, the majority of RRCSD WWTP would maintain resiliency in a 100-year flood event under the projected climate change conditions. However, the Emergency Storage Pond would potentially be inundated under the Early Century Conditions and would very likely be inundated in the Mid to Late Century conditions. In addition, assuming the 500-year flood depth is currently 60 feet, increases in flood level could result in inundation of several facilities within the main WWTP site under the Early Century 500-year flood conditions.

FEMA Flood Hazard Layer

- 0.2% Annual Chance Flood Hazard
- 1% Annual Chance Flood Hazard
- LiDAR Elevation in feet
- Design Drawing Elevation in feet

Prepared by:

WEST YOST

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0 50 100
Feet

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Water Supply Feasibility Study

Sonoma Water

Russian River WWTP FEMA Flood Mapping

Figure 7-3

7.6.2 GCSD WWTP

FEMA flood mapping in and around the GCSD WWTP is shown on Figure 7-4. The flood area is mapped as a Zone A floodplain, which means the 100-year flood elevations are not established and the 500-year flooded area is not defined. Figure 7-4 also shows approximate elevations based on 1976 design drawings for the GCSP WWTP[7] and 2013 USGS LiDAR data. The following information is noted from this figure:

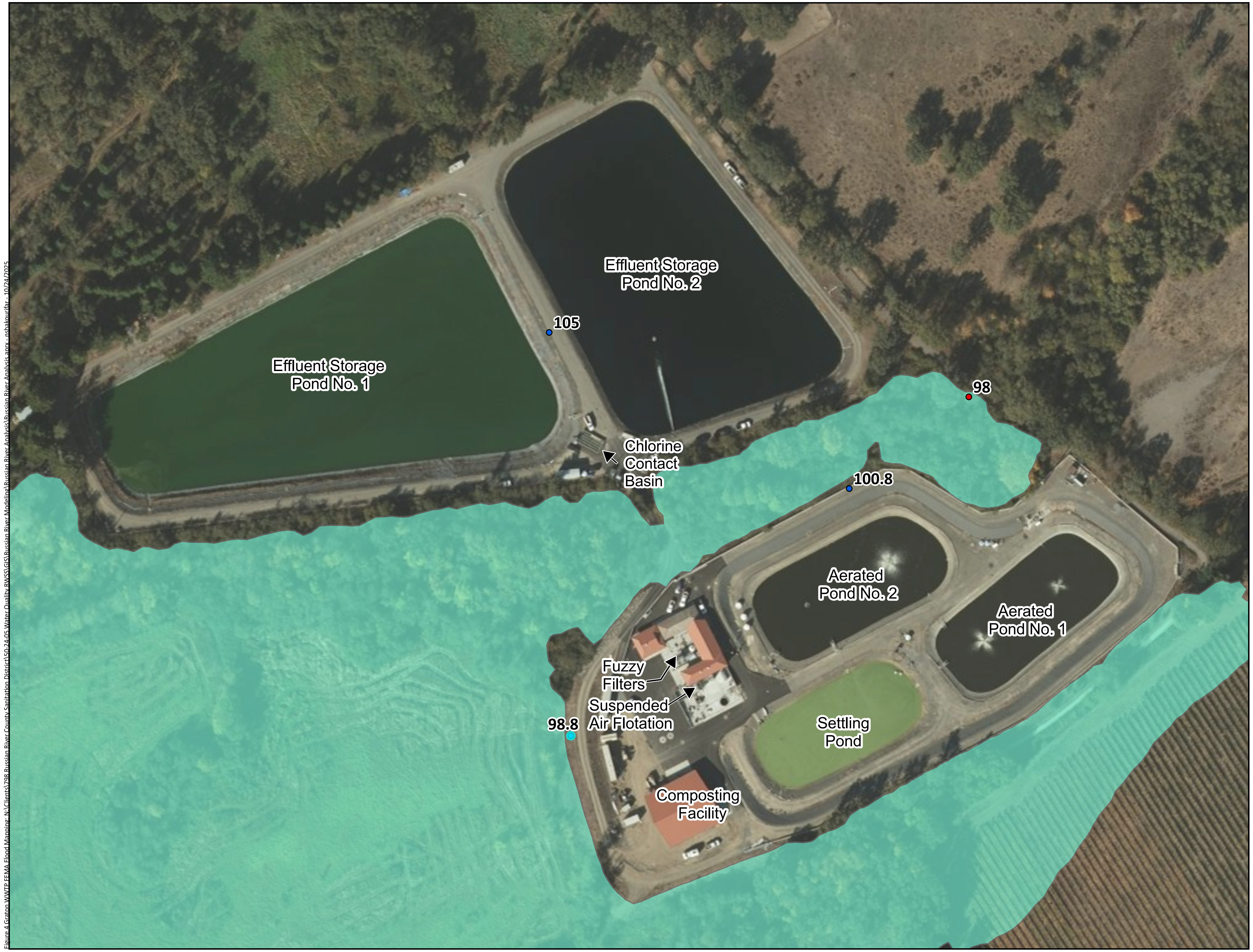
- The main treatment facilities at the GCSD WWTP are outside the 100-year floodplain due to the presence of an engineered floodwall.
- The flood wall around the WWTP is estimated to have an approximate top elevation of approximately 100.8 feet.
- The storage ponds, which are located adjacent to the flood-protected area, are constructed with levees that have elevations of approximately 105 feet.
- Based on ground surface LiDAR elevation data near the site, it is estimated that the 100-year flood elevation is approximately 98 feet, which is three feet below the flood wall elevation. Based on the WWTP design drawings, the 100-year flood elevation is defined as 98.8 feet, which is two feet below the flood wall elevation. Although the flood elevation derived from the LiDAR data is only an estimate, the observed differences could also be associated with a change in the flood map elevation that occurred since 1976.

The flooding source for the GCSD WWTP is the nearby Atascadero Creek, which was not evaluated as part of the Russian River climate change flood analysis. Nevertheless, the climate change analysis does show an increase in flood elevations between two and six feet in the Russian River near Cluster 7. Conservatively applying these flood elevation rises to the 100-year floodplain near the GCSD WWTP site leads to the following findings:

- A flood elevation rise of two feet would result in a 100-year flood elevation of 100 to 101 feet, significantly reducing/potentially eliminating the freeboard protection provided by the WWTP flood wall.
- The storage pond levees would continue to provide protection from flooding with a two-foot rise.
- A rise of six feet would result in an estimated elevation of 104 to 105 feet. These flood elevations would overtop the flood wall and would potentially overtop the storage pond levees.

Based on this information, the GCSD WWTP could be vulnerable to flooding under climate change scenarios. However, additional mapping and analysis of potential flooding impacts in the Atascadero Creek watershed is needed to confirm these findings. This analysis should include an investigation of the current mapped flood elevation near the WWTP.

[7] There is an approximate 3-foot difference in elevation between the LiDAR data and the elevation data included in the 1976 WWTP design drawings. This is likely due a different datum reference for these two sources. In the area of the Graton WWTP, the NAVD 88 datum is approximately 2.8 feet higher than NGVD 29 datum. For presentation in this Chapter, the elevations shown on the 1976 WWTP design drawings were adjusted by 2.8 feet.



FEMA Flood Hazard Layer

- 1% Annual Chance Flood Hazard
- Design Drawing Elevation in feet
- LiDAR Elevation in feet

Prepared by:

WEST YOST

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0 80 160 Feet

Prepared for:

Russian River County Sanitation District

Water Quality and Recycled

Water Supply Feasibility Study

Sonoma Water

Graton WWTP FEMA Flood Mapping

Figure 7-4

7.6.3 Summary

The analysis documented herein shows no existing flooding impacts on two of the West County WWTPs of interest. However, climate change impacts related to more severe flooding could increase the flooding risks, as follows:

- The RRCSD WWTP should generally remain resilient to flooding under the projected 100-year flood conditions, except for the Emergency Storage Pond.
- The RRCSD WWTP could experience more widespread flooding at 500-year flood conditions under the climate change scenarios evaluated.
- The GCSD WWTP would be vulnerable to flooding in a 100-year event under the Mid to Late Century climate change scenarios.
- Additional analysis of flooding potential in Atascadero Creek watershed is needed to better define potential impacts to the GCSD WWTP.

The FWD WWTP and existing OCSD WWTP sites do not have known impacts from flooding and are thus not evaluated as being further impacted under the climate change scenarios.

CHAPTER 8
Potential Unsewered Community Solutions

This Chapter presents further evaluation of the five feasible regionalization alternatives that were discussed in Chapter 3 and Chapter 4. This additional evaluation specifically identifies the infrastructure needs and total project costs to incorporate the wastewater generated from the twelve unsewered community clusters identified in Chapter 5 into the five alternatives. The Chapter is organized around the following sections:

- Unsewered Communities' Collection System Costs
- Alternative 1a
- Alternative 1c
- Alternative 2a
- Alternative 2b
- Alternative 3b
- Comparison of Alternatives

8.1 UNSEWERED COMMUNITIES' COLLECTION SYSTEM COSTS

This section presents the estimated capital and operating costs for new collection systems within each of the selected unsewered community clusters. The topics addressed are as follows:

- Cost Estimating Approach Overview
- Estimated Monte Rio/Villa Grande Area Collection System Costs
- Estimated Average Cost per Parcel[1] for Remaining Community Clusters
- Estimated Costs for Community Cluster Collection Systems
- Community Cluster Collection System Operating Cost

8.1.1 Cost Estimating Approach Overview

The cost estimates presented in this section are common to all five alternatives, as follows:

- For most of community clusters, the common costs include the community collection system infrastructure and the community pump stations used to convey wastewater flows to the regional system. However, the force main costs for conveying wastewater from the community collection systems to a potential regional system can vary for each alternative. Therefore, these transmission main costs are included in the alternative-specific discussions presented later in this Chapter.

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[1] For purposes of this analysis, it is assumed that each unsewered parcel within the community cluster areas would represent one new connection to a regional wastewater system. Additional analysis of each specific cluster area would be needed to confirm the actual number of connections.

- For the Monte Rio/Villa Grande area (Cluster 12), the common costs also include the community collection system infrastructure and the community pump stations used to convey wastewater flows to the regional system. In addition, the Monte Rio/Villa Grande wastewater flows would be directed to the RRCSD WWTP site along with flows from Clusters 1, 2 and 3 under all of the alternatives. Therefore, the associated transmission main costs is also common to all alternatives. Nerveless, to simplify the analysis, the costs associated with transmission for these four clusters is applied separately from the common costs.

As discussed in Chapter 1, the primary objective of this study is to assess the feasibility and costs for the wastewater infrastructure needed to support a regional wastewater system that provides service for existing sewered and unsewered communities within West County. However, to support this effort and provide a complete cost of each alternative, it is necessary to define the costs related to the removal of existing OWTS and construction of a new community collection system within the 12 community clusters.

The specific infrastructure required to provide wastewater collection within each community cluster will be unique to each area and this detailed level of analysis is beyond the scope of this current project. Therefore, readily available information was used to provide an estimate of these costs. For the Monte Rio/Vaille Grande area (Cluster 12) the estimated community collection system cost was developed directly from the information provided in the Monte Rio Study Report. For the remaining areas, cost information from Monte Rio Study Report and a recently bid septic-to-sewer conversion project located near Sacramento, California were used to define a range of average costs per connected parcel within each community cluster. To account for some of the unique features of each community, factors such as community size, flooding potential, parcel density, and access to major roadways were also considered in the development of the per parcel costs. Additional details regarding this approach are provided later in this section.

A detailed, community-specific evaluation will ultimately be needed to define the total collection system costs for each community. The site-specific average per parcel costs could vary significantly from the average per parcel costs identified herein. Moreover, site specific factors could result in the cost for an individual connection to a community system that ranges between 50 to 100 percent higher and 50 percent lower than the average per parcel costs defined for the community.

8.1.2 Estimated Monte Rio/Villa Grande Area Collection System Costs

The Monte Rio Study Report cost information has been used to define the common costs associated with the Monte Rio/Villa Grande area (Cluster 12)[2]. The Monte Rio Study Report defines the community collection system construction cost for this area, which also includes the transmission main to the RRCSD WWTP, as $64.1 million[3]. The Monte Rio Study Report further indicates that the estimated cost for this pressurized system would include the following elements[4]:

- Traffic control;
- Existing septic tank decommissioning for each connection;
- Grinder pump packages and electrical connection at each connection;
- Lateral installations for each connection;
- Various, 2-inch to 6-inch HDPE force mains that comprise the community collection system;
- Two community pump stations
- a 6-inch transmission main to convey collected flow the RRCSD WWTP;
- Caltrans road restorations for both the transmission main and service force mains;
- Pipeline appurtenances, including air release valves and cleanouts;
- Two Caltrans bridge crossings;
- Nine local bridge crossings;
- Estimated 361 potential utility conflicts; and
- Local road restorations.

As previously stated, the common costs applied for Monte Rio/Villa Grande area is assumed to only include the community collection system and the community pump station. Therefore, the cost associated with the transmission main presented in the Monte Rio report ($4.4) will need to be excluded from the common costs applied to all alternatives.

[2] Due to the potential for flooding in a significant portion of the community and this slope variation throughout the community, a pressurized collection system is planned for the Monte Rio/Villa Grande area.

[3] Shown in Table 17 of the Monte Rio Study Report.

[4] The Monte Rio Study Report notes that cost estimates are based on consultations with manufacturers and distributors.

The Monte Rio Study Report also defines the total project cost as including an additional cost for a connection fee to the RRCSD WWTP (approximately $15 million), engineering planning costs (20 percent of construction cost plus connection fee), legal and administrative costs (10 percent of construction cost plus connection fee), and construction administration and inspection costs (15 percent of construction cost plus connection fee). To ensure the Monte Rio Villa Grande community collection system costs are consistent with the other cost estimates provided in this report, a revised total project cost for the common collection system elements was developed by applying the estimating contingency, construction-related multipliers, and "soft" costs that are used for other estimates described herein to the construction cost information from the Monte Rio report. Additional information about these various cost elements is provided in the Basis of Cost Estimating TM included as Attachment A.

Table 8-1 provides the updated estimated total Project Cost for the common elements of Monte Rio and Villa Grande community collection system that will be used in this study. As noted previously, this cost includes all the infrastructure required to collect wastewater from 780 connections within the Monte Rio/Villa Grande study area at two community pump stations. Under this revised estimate, the average cost per connection for the new community collection system is $161,900.

Table 8-1. Estimated Total Project Cost for Monte Rio/Villa Grande Community Collection System

Cost Component		Cost, $ million
Community Collection System Cost Defined in Monte Rio Study Report		64.1
Exclude Transmission Main Costs		-4.4
Cost of Collection system Only		59.7
Contractor Costs		
Contractor's Overhead and Profit	15%	9.0
Mobilization/Demobilization	5%	3.0
Contractor's General Conditions	10%	6.0
	Subtotal	77.7
Additional Project Elements		
Estimating Contingency	30%	23.3
	Engineer's Preliminary OPCC	**101.0**
Engineering Design, Environmental Planning and Studies, Permitting, Construction Management, ESDC and Legal and Admin Costs, 25 percent of OPCC		25.3
	Engineer's Preliminary OPTCC	**126.3**
ESDC = engineering services during construction		

8.1.3 Estimated Average Cost Per Parcel for Remaining Community Clusters

For the remaining community clusters, three sources of cost information were used to define per parcel costs, as follows:

- The $59.7 million construction cost presented in the Monte Rio Study Report for the entire system was adjusted to remove the community pump stations ($1.5 million) so the remaining construction cost reflected only the community collection system elements. This resulted in an estimated cost of $58.2 million. Applying the same contractor costs and estimating contingency factors described in Table 8-1 then results in a calculated construction cost of $98.3 million (compared to the $101.0 million shown in Table 8-1). This equates to $126,000 per connection.
- The Monte Rio Study Report also defines a total project cost for a Phase 1 pressurized collection system project that encompasses 550 connections located in the flatter, higher-density areas of the Monte Rio/Villa Grande community[5]. The estimated construction cost of this smaller system was defined as approximately $44.1 million. This cost was then adjusted to remove the community pump stations and transmission main elements. This resulted in an estimated cost of $38.2 million. Applying the same contractor costs and estimating contingency factors described in Table 8-1 then results in a calculated Phase 1 construction cost of $64.5 million, or $117,200 per connection.
- The difference between the adjusted Phase 1 cost ($64.5 million as described above) and the similarly adjusted total Monte Rio/Villa Grande construction cost ($98.3 million as described above) defines the cost for a potential Phase 2 pressurized collection system project that would encompass the 230 connections located in the steeper-sloped, less dense areas of the Monte Rio/Villa Grande community. This estimated Phase 2 construction cost is $33.8 million, or $147,000 per connection.
- The construction cost for a septic-to-sewer gravity system project located in a flat, relatively densely populated area near Sacramento, California of $5.4 million for 51 connections, or $105,800 per connection. This project was bid in January 2025 and is currently under construction.

These average per-connection construction costs were further adjusted to account for some of the differences between the communities using the following approach:

- **Flood risk:** Clusters located in flood-prone areas were assigned a unit cost for a pressurized collection systems that were developed from the Monte Rio Study Report, while clusters that are not susceptible to flooding were assigned costs based on the Sacramento-area gravity system. Clusters with more than 30 percent of parcels in the floodplain[6] were assigned the flood risk cost category.

[5] See Table 24 of the Monte Rio Study Report.

[6] Approximately 30 percent of the parcels in the Monte Rio/Villa Grande area are in the floodplain.

- **Community size:** The two project examples used to define the community collection system costs represent the high end (550 connections) and low end (51 connections) of community sizes evaluated for this project. The smaller (51 connection) gravity system, which is in a flat area and has approximately 84 feet of lateral per connection, has a construction cost of $105,800 per connection. The larger (550 connection) Phase 1 pressure system from the Monte Rio Study Report, which is in a relatively flat area and has approximately 92 feet of lateral per connection, has a construction cost of $117,200 per connection.

  While a pressurized system would be expected to have a lower per connection construction cost, there are likely some opportunities for economy of scale savings between the larger and smaller systems[7]. To adjust for these savings, the "power law scaling" has been applied as follows:

  Cost Project A = Cost Project B x
  (Length of Pipeline in Project A / Length of Pipeline in Project B)^α

  where:
  α = 0.94 for gravity systems
  α = 0.95 for pressure systems

  Community clusters with more than 350 parcels were assigned the larger-sized community cost and the community clusters with less than 200 parcels were assigned the smaller-sized community cost[8].

- **Slope conditions and parcel density:** There is an approximate 21 percent difference between the estimated average Monte Rio Study Area Phase 1 and Phase 2 per connection construction cost (once the Phase 2 cost is adjusted for number of connections). This difference is assumed to represent the average difference in costs per parcel resulting from the higher construction difficulty for parcels that are in less dense areas and/or have steeper terrain[9]. Therefore, a 21 percent increase was applied to the average per parcel costs of the gravity system (which was in a flat sloped area) to define the cost of a gravity system in an area with higher slopes and/or less parcel density.

A summary of the average unit construction costs per parcel developed applying the methodology listed above is provided in Table 8-2.

[7] Economy of scale savings are realized due to factors like increased efficiency, bulk purchasing discounts, and better utilization of specialized equipment and expertise.

[8] The Monte Rio Phase 2 cost is based on 230 parcels and assumed to represent a cost for a system with less than 200 parcels. None of the community clusters defined in this report have a parcel count within the 200 and 350 parcel range.

[9] A review of the available parcel density and parcel slope information confirms that higher sloped parcels are strongly correlated to lower density areas in the West County region.

Table 8-2. Average Unit Construction Costs for Septic-to-Sewer Conversions			
System Type	Condition	Cost per Parcel, $	Basis
Larger Communities (350 to 800 parcels) [a]			
Gravity System	Flat slopes, no flood risk	99,700	Sized adjusted the average per parcel cost for the recently-bid, gravity system using the power law scaling equation
	High slopes, no flood risk	120,600	Adjusted the average per parcel cost for the flat-slope, no-flood-risk, larger-sized, gravity system defined above by the 21 percent factor derived from Monte Rio Study Report costs
Pressure System	Flat slopes, flood risk	117,200	Monte Rio Study Report Phase 1 cost, adjusted to remove Transmission Main and apply construction cost and estimating contingency factors described in Table 8-1[b]
	High slopes, flood risk	142,200	Size adjusted the smaller Monte Rio Study Report Phase 2 cost (which is based on 230 parcels) using the power law scaling equation.
Smaller Communities (50 to 200 parcels)[a]			
Gravity System	Flat slopes, no flood risk	105,800	Cost from recently bid project[c]
	High slopes, no flood risk	128,000	Adjusted the average per parcel cost for the flat-slope, no-flood-risk, smaller-sized, gravity system defined above by the 21 percent factor derived from Monte Rio Study Report costs.
Pressure System	Flat slopes, flood risk	121,400	Sized adjusted the larger Monte Rio Study Report Phase 1 cost shown above which is based on 550 parcels) using the power law scaling equation.
	High slopes, flood risk	147,000	Monte Rio Study Report Phase 2 cost, adjusted to apply construction cost and estimating contingency factors described in Table 8-1[d].

(a) No community clusters have a parcel count within the 200 and 350 parcel range.
(b) Phase 1 project cost with the transmission main removed and the construction cost and estimating contingency factors incorporated is estimated to be $64.5 million.
(c) Project bid in January 2025 was $5.4 million for 51 homes.
(d) Phase 2 project cost with the construction cost and estimating contingency factors incorporated from Table 8-1 is estimated to be $33.8 million.

8.1.4 Estimated Community Collection System Costs

Table 8-3 presents the percent of parcels within each cluster that were shown to be impacted by baseline flooding (see Chapter 7 for details), as well as the percent of high-slope parcels within each cluster. As noted previously, costs for the Monte Rio/Villa Grande area (Cluster 12) were prepared separately and presented in the Monte Rio Study Report. Therefore, the flooding and slope percentage vales shown in Table 8-3 for Cluster 12 are only provided for comparison purposes.

Table 8-3. Percent of Parcels Impacted by Baseline Flooding and with High Slopes

ID	Name	Percent of Parcels Impacted by Flood Risk under Baseline Conditions	Percent of Parcels with Slopes >25 percent
1	Guerneville South of River	11	32
2	Guerneville North of River	**29**	16
3	Northwood	**45**	3
4	Hwy 116 East of Guerneville	6	19
5	Summerhome Park Road	**45**	46
6	Hacienda and Hollydale	**39**	15
7	River Road North of Forestville	5	18
8	Forestville	1	1
9	Hwy 116 between Forestville and Graton	0	0
10	Graton West	0	0
11	Camp Meeker	0	11
12	Monte Rio/Villa Grande	**32**	21

Based on the information in Table 8-3, the following cost approach was applied related to flooding:

- Clusters 2, 3, 5, and 6 require pressurized systems, because they have similar percentage of parcels that are subject to flooding as the Monte Rio/Villa Grande system.
- The remaining systems are assumed to be predominantly gravity with smaller areas of pressured Septic Tank Effluent Pump systems (if needed).

The percent of high slope parcels value in Table 8-3 was also used to develop a weighted average cost per parcel for each cluster.

The average per parcel construction costs and total estimated collection system construction costs are presented in Table 8-4 for all twelve clusters. The table also includes construction costs for the dedicated pump stations for each cluster to provide a total construction costs for the community collection system infrastructure common to all alternatives. Finally, a 25 percent factor was used to define the engineering, environmental, legal and administrative costs related to these projects, to define a total project cost.

Table 8-4. Unsewered Cluster Collection System Project Costs

ID	Name	Number of Parcels[a]	Estimated Average Collection System Construction Cost per Parcel,[b] $	Estimated Total Collection System Construction Cost,[c] $ million	Estimated Pump Station Construction Cost,[d] $ million	Estimated Total Construction Costs, $ million	Estimated Total Project Costs[e], $million
1	Guerneville South of River	50	112,900	5.6	1.8	7.4	9.3
2	Guerneville North of River	60	125,500	7.5	1.7	9.2	11.5
3	Northwood	190	122,200	23.2	1.9	25.1	31.4
4	Hwy 116 East of Guerneville	110	110,000	12.1	1.9	14.0	17.5
5	Summerhome Park Road	100	133,200	13.3	1.9	15.2	19.0
6	Hacienda and Hollydale	440	121,000	53.2	1.9	55.1	68.9
7	River Road North of Forestville	450	103,500	46.6	1.9	48.5	60.6
8	Forestville	170	106,000	18.0	1.7	19.7	24.6
9	Hwy 116 between Forestville and Graton	140	105,800	14.8	1.7	16.5	20.6
10	Graton West	70	105,800	7.4	1.8	9.2	11.5
11	Camp Meeker	370	102,000	37.7	3.9[f]	41.6	52.0
12	Monte Rio/ Villa Grande	780	-	-	-	101.0[g]	126.3
	Total	**2,930**		**347.7**	**22.1**	**362.5**	**453.2**

(a) Number of parcels from Table 5-5.

(b) The relevant unit costs from Table 8-2 were selected based on the cluster size and percent of parcels impacted by flooding from Table 8-3. Unit costs are also weighted based on the relevant unit costs from Table 8-2 and percent of parcels with relatively high slopes from Table 8-3.

(c) Total cost = number of parcels x average cost per parcel.

(d) The base construction costs for pump stations are proportional to the respective unsewered flows (see Table 5-7), with additional costs for Camp Meeker and Monte Rio/Villa Grande as noted.

(e) Cost shown includes an assumed 25 percent of the construction cost for Engineering Design, Environmental Planning and Studies, Permitting, Construction Management, ESDC and Legal and Admin Costs.

(f) Pump station cost for Camp Meeker also includes $2 million for upsizing the previously planned OCSD to Graton pump station and pipeline to accommodate Camp Meeker and Graton West flows.

(g) The Monte Rio/Villa Grande unit cost includes two collection system community pump stations.

As previously discussed, the costs shown in Table 8-4 are feasibility-level estimates, based on readily available information and are intended to provide the order of magnitude range of costs for potential future community collection systems. Development of more detailed site-specific costs for these community cluster collection systems is outside the scope of the current study.

8.1.5 Collection System Operating Costs

Similar to the project costs discussed above, the specific operating costs for providing reliable wastewater collection within each community cluster will be unique to each area and this detailed level of analysis is beyond the scope of this current effort. Therefore, average per- parcel O&M estimates have been developed to support this evaluation based on the information available in the Monte Rio Study Report. While the average costs presented likely reflect the order of magnitude cost for collection system O&M, actual costs could vary significantly what is defined herein depending on the system complexity and operational strategies. It is also important to note that these collection system O&M costs do not include the cost associated with O&M of the treatment systems that would receive wastewater from these community systems. These treatment-based O&M costs are presented later in this Chapter.

The Monte Rio Study Report listed a collection system O&M cost estimate of $430,800 per year, which included costs associated with regular maintenance on low pressure collection mains, transmission force mains, individual grinder pump stations and main lift stations, equipment replacement costs, electricity and monitoring costs, and occasional emergency maintenance. No labor costs were included in this estimate. Instead, the analysis assumed inspections and maintenance would be the responsibility of the governing agency and applied the existing RRCSD monthly rates of $190 for collection and treatment system O&M plus an estimated $5 per month to cover the cost of electricity to run the grinder pump. This resulted in an estimated overall annual O&M cost of $2,340 ($195 per month) including treatment plant and collection system O&M.

Using the rates for current RRCSD customers is not representative of how rates would be established for the operations of collection systems in the unsewered communities. Moreover, some of the costs identified in the Monte Rio study would only apply to pressure systems. Therefore, the analysis presented herein relies on the $430,800 per year estimated cost presented in the Monte Rio Study Report plus an estimated cost of two, full-time equivalent (FTE) employees at an assumed rate of $200,000 a year per employee to define the annual collection system O&M cost for a 780-parcel sized pressure system. For gravity systems, the $430,800 per year estimated cost presented in the Monte Rio Study Report was adjusted to remove the costs associated with maintenance of the grinder pumps and other associated equipment. However, the same FTE count was applied.

Table 8-5 provides the estimated average O&M costs for the pressurized and gravity systems on a per parcel basis. As shown, the operating costs per parcel are $1,100 per year for a pressure system and $700 per year for a gravity system. For a total unsewered parcel count of 2,930, total collection system operating costs for the unsewered communities are estimated to be approximately $2.7 million.

Table 8-5. Collection System O&M Cost		
O&M Cost Component	Cost, $	
	Pressurized System	Gravity System
Scheduled Maintenance	24,000	24,000
Line Cleaning	13,000	13,000
Equipment Replacement	157,000	17,000
Grinder Pump Electricity Cost	36,000	-
Telemetry Monitoring	78,000	-
Emergency Maintenance	43,000	43,000
Transmission Pump Station O&M	73,000	73,000
Transmission Pump Station Electricity Cost	6,800	6,800
Labor	400,000	400,000
Total Annual Costs	**830,800**	**576,800**
Total Annual Cost per Parcel[(a)]	**1,100**	**700**
Number of Parcels	**1,570**	**1,360**
Total Annual O&M	**$1,730,000**	**$950,000**

(a) Cost per parcel based on 780 parcels and total cost shown.

8.2 ALTERNATIVE 1a

Alternative 1a involves providing treatment at two local facilities. Flows from FWD, GCSD, and OCSD would be treated at a combined FWD/GCSD WWTP and recycled water system that is sized to accommodate zero surface water discharge (i.e., in lieu of making treatment improvements to meet the nitrogen effluent limitations that have been prescribed for surface discharge). Flows from the RRCSD service area would continue to be treated at the existing RRCSD WWTP. This section presents a description of how the selected unsewered community clusters would be incorporated into this regional strategy, the associated basis of design for the facility improvements, a summary of the required facility improvements, site layout, project costs, O&M costs and total lifecycle costs.

8.2.1 Incorporation of Unsewered Clusters

Under Alternative 1a the selected unsewered community clusters would be incorporated into the regional facilities as follows:

- Clusters 1, 2, 3, and 12 would connect to the RRCSD WWTP for treatment at this site.
- Clusters 4[10] through 8 would connect to the FWD WWTP for treatment at this site.
- Clusters 9 through 10 would connect to the GCSD WWTP for secondary treatment and then be discharged, along with the GCSD flows, to the FWD WWTP for tertiary treatment.
- Cluster 11 would initially be conveyed via the OCSD pump station and force main before traveling to the GCSD WWTP site with flows from Cluster 10.

8.2.2 Basis of Design

The projected flows and loads to RRCSD and FWD/GCSD WWTPs under Alternative 1a with unsewered community flows added in are presented in Table 8-6. These flows and loads assume equalization of RRCSD, GCSD, and FWD flows based on the information presented in Chapters 2 through 4. Flows and loads for the unsewered communities are taken from Chapter 5.

[10] Although Cluster 4 is adjacent to a portion of the RRCSD service area, the RRCSD collection system is inadequate to receive an additional 48,000 gallons per day of peak flow. Therefore, so new conveyance would be needed to the RRCSD WWTP. Connecting to the force main that brings flow from Cluster 5 to the FWD WWTP is likely a more direct route. Additional evaluation of connection options for Cluster 4 is outside the scope of this effort.

Table 8-6. Alternative 1a Treatment Facilities Design Flows and Loads

Scenario	ADWF, mgd	Relevant Peak Flow Condition	Peak Design Flow, mgd	Maximum 30 Day BOD Load, lb/day
Design Flow for the RRCSD WWTP				
Projected RRCSD Flows and Load	--[a]	PDF	4.2[b]	2,620
Clusters 1-3 & 12			0.8	600
Total to RRCSD WWTP			**5.0**[b]	**3,220**
Design Flow for the GCSD Screening System				
Projected GCSD/OCSD Flows and Load	--[a]	PDF	1.5	--[a]
Design Flows and Loads to the GCSD Secondary Treatment Ponds				
Projected GCSD/OCSD Flows and Load	0.15	MWF	1.1[c]	680
Clusters 9-11	0.10	Peak Flow	0.38	300
Total to GCSD Ponds	**0.25**	--	**1.5**	**980**
Design Flows to the FWD Secondary Treatment Ponds				
Projected FWD Flows and Load	0.064	MMF	0.39[c]	270
Clusters 4-8	0.20	Peak Flow	0.80	600
Total to FWD Ponds	**0.26**	--	**1.2**	**870**
Design Flows to the Combined Tertiary Filtration and Disinfection Facilities				
Combined FWS/GCSD/OCSD and Clusters 4-11	**0.51**	--	**2.7**	--[a]

(a) Design condition is not relevant to the facility sizing.
(b) Equalized peak flow. The RRCSD Treatment Plant Master Plan indicates that Peak Day flows through the WWTP can be equalized to 5.0 mgd with use of existing Emergency Storage Pond. If 0.4 MG EQ basin is also available, flows can be equalized to 4.2 mgd. For this analysis, it is assumed flows can be equalized to 4.2 mgd. RRCSD Treatment Plant Master Plan indicates that un-equalized sustained peak flows are 5.2 mgd.
(c) Equalized peak flow. Chapter 4 discusses use of equalization storage to equalize peak flows to the treatment ponds.

8.2.3 Required Facility Improvements

This section addresses the required RRCSD treatment facility improvements, the required GSCD/FWD treatment facility improvements, and the required recycled water system improvements.

8.2.3.1 RRCSD Treatment Infrastructure Improvements

As discussed in Chapters 2 and 3, there are several condition and hydraulic capacity-related improvement projects that have been identified as necessary for continued long-term treatment at the RRCSD. In addition, based on the findings from the RRCSD Treatment Plant Master Plan summarized in Table 2-4, the RRCSD WWTP facilities should have adequate treatment capacity for up to 5.0 mgd peak flow[11][12] and 3,220 lb/day BOD load with two notable exceptions:

- The tertiary filters are listed with a firm capacity of 4.0 mgd. It is assumed that a third, 4.0 mgd filtration unit would be installed for this alternative to provide the necessary firm filtration capacity.
- Additional evaluation is needed of the RRCSD grit removal system performance to confirm expansion needs beyond the listed capacity of 4.1 mgd. No expansion of the grit removal is assumed for the current analysis.

Figure 8-1 shows the proposed layout of the RRCSD WWTP site.

[11] Assuming the 0.4 mgd EQ basin will be available and RRCSD flows can be equalized to 4.2 mgd.

[12] Additional analysis of the equalization storage needs and/or facilities necessary for processing peak flows at the RRCSD WWTP may be needed in light of the recent (January 2026) spill event. The findings of this report related to the costs for the RRCSD WWTP to accept additional flows and loads may need to be revisited.

8-1- RRCSD site modification for Alternative 1a: N:\Clients\798 Russian River County Sanitation District\50-24-05 Water Quality RWSS\GIS\RR CSD Water Quality RWSS.aprx - nshakourifar - 10/27/2025

Prepared by:

WEST YOST

Prepared for:

Russian River County Sanitation District
Water Quality and Recycled Water Supply Feasibility Study

Sonoma Water

RRCSD WWTP Site Layout for Alternative 1a

Figure 8-1

8.2.3.2 FWD/GCSD Treatment Infrastructure Improvements

For the FWD/GSCD treatment systems, significant treatment improvements are needed to accommodate the projected flows and loads for those systems. Needed treatment improvements at the GCSD WWTP would remain unchanged under Alternative 1a with the addition of the Clusters 9, 10, and 11 flows. These improvements were detailed in Chapter 4 and include upgrades to the headworks and conversion of partial mix ponds to a complete mix system. Proposed treatment upgrades at the GCSD WWTP are the same as those outlined in Chapter 4 and already provided on Figure 4-3.

With the addition of flows and loads from Clusters 4 through 8, the existing partial mix ponds at the FWD WWTP would require upgrades to a complete mix system to provide sufficient treatment capacity. In addition, the following major treatment facilities would be required to accommodate tertiary treatment of the combined flows:

- Two, 1.5 mgd SAFs,
- Two, 2.7 mgd cloth disk filter units, and
- Four additional CCBs.

Figure 8-2 shows the proposed new infrastructure and treatment systems at the FWD WWTP, along with the existing infrastructure that will be repurposed.

Prepared by:

WEST YOST

Prepared for:

Russian River County Sanitation District

Water Quality and Recycled Water Supply Feasibility Study

Sonoma Water

FWD WWTP Site Layout for Alternative 1a

Figure 8-2

8.2.3.3 Recycled Water Infrastructure Improvements at RRCSD

The RRCSD water balance was updated to include the wastewater flows generated by the community clusters that would discharge to the RRCSD WWTP. The analysis demonstrated that up to55 additional acres[13] of land application area would potentially be required to accommodate approximately 93 AFY of additional recycled water generated. However, no additional storage capacity would be needed.

It is assumed that RRCSD would be able to obtain the required additional land application area acreage through expansion of the existing 17-acre irrigation property wooded irrigation area and/or by creating a new application areas within ~~the~~ 394-acre forested property that was transferred to the RRCSD in August 2024[14].

RRCSD has not yet defined the acreage available for disposal area expansion. For the current analysis, expansion of irrigation/disposal facilities are assumed to cost $25,000 per acre.

8.2.3.4 Recycled Water Infrastructure Improvements at FWD/GCSD

Zero discharge water balances for the combined FWD/GCSD system have been updated from those discussed in Chapter 3 to account for the addition of unsewered flows, as well as to address the findings presented in Chapter 6 of relatively low vineyard irrigation demands and additional demands from quarries near the FWD WWTP. Updated FWD/GCSD 100-year water balance results are presented in Table 8-7 for projected West County flows with and without the unsewered clusters.

Table 8-7. FWD/GCSD Water Balance Results for Alternative 1a

Scenario	Storage Volume Required, acre feet	Irrigated/Disposal Area Required, acres
Existing Facilities		
FWD/GCSD	70[(a)]	325[(b)]
FWD/GCSD Water Balance Results (100-Year Rainfall 75 in/yr)		
Projected	335	1,385
Projected + Unsewered	690	3,365

(a) Existing 7 acre-feet of storage at FWD assumed to be filled to support new treatment facilities.
(b) Existing 20.5 acres of GCSD irrigation area assumed used for siting new recycled water storage.

[13] The estimated 55 additional acres is based on a conservative assumption that recycled water is applied at agronomic rates with no allowance for additional percolation. Only 17 additional acres would be needed if the 0.6 inch per day percolation rates identified for the upper portions of the existing irrigation area (as discussed in Chapter 3).

[14] It is noted that the 394-acre forested property has a conservation easement limiting uses of the site and has topography that presents challenges for installing new irrigation infrastructure, it is estimated that it may be possible to use about 3 percent of this site for recycled water applications.

The updated water balance analysis indicates a need for the following:

- 3,040 acres of additional land application area[15].
- 620 acre-feet of new recycled water storage, corresponding to a land acquisition need of about 52 acres[16].

Figure 8-3 shows a potential footprint for the effluent storage ponds at the GCSD WWTP.

[15] The parallel analysis in Chapter 3 included a conclusion that the existing irrigation FWD/GCSD reuse sites would be able to accommodate the combined recycled water flow generated (without unsewered flows). These updated results reveal that even with the additional quarry demands, more than 1,000 acres of additional land application area would be needed. The addition of the quarry demands did reduce the required additional recycled water storage without unsewered flows from 310 acre-feet to 265 acre-feet.

[16] A detailed real estate assessment was not completed. Land purchase cost of $100,000 per acre is assumed.

8-3-ReW storage needs at GCSD for Alternative 1a: N:\Clients\798 Russian River County Sanitation District\50-24-05 Water Quality RWSS\GIS\RR CSD Water Quality RWSS.aprx - nshakourifar - 10/24/2025

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Recycled Water Storage Needs at GCSD for Alternative 1a

Figure 8-3

8.2.4 Conveyance Infrastructure

Relevant conveyance infrastructure includes collection system conveyance for the unsewered parcels, raw wastewater and secondary effluent conveyance to and from the GCSD WWTP and recycled water conveyance.

8.2.4.1 Collection System Infrastructure for Unsewered Community Clusters

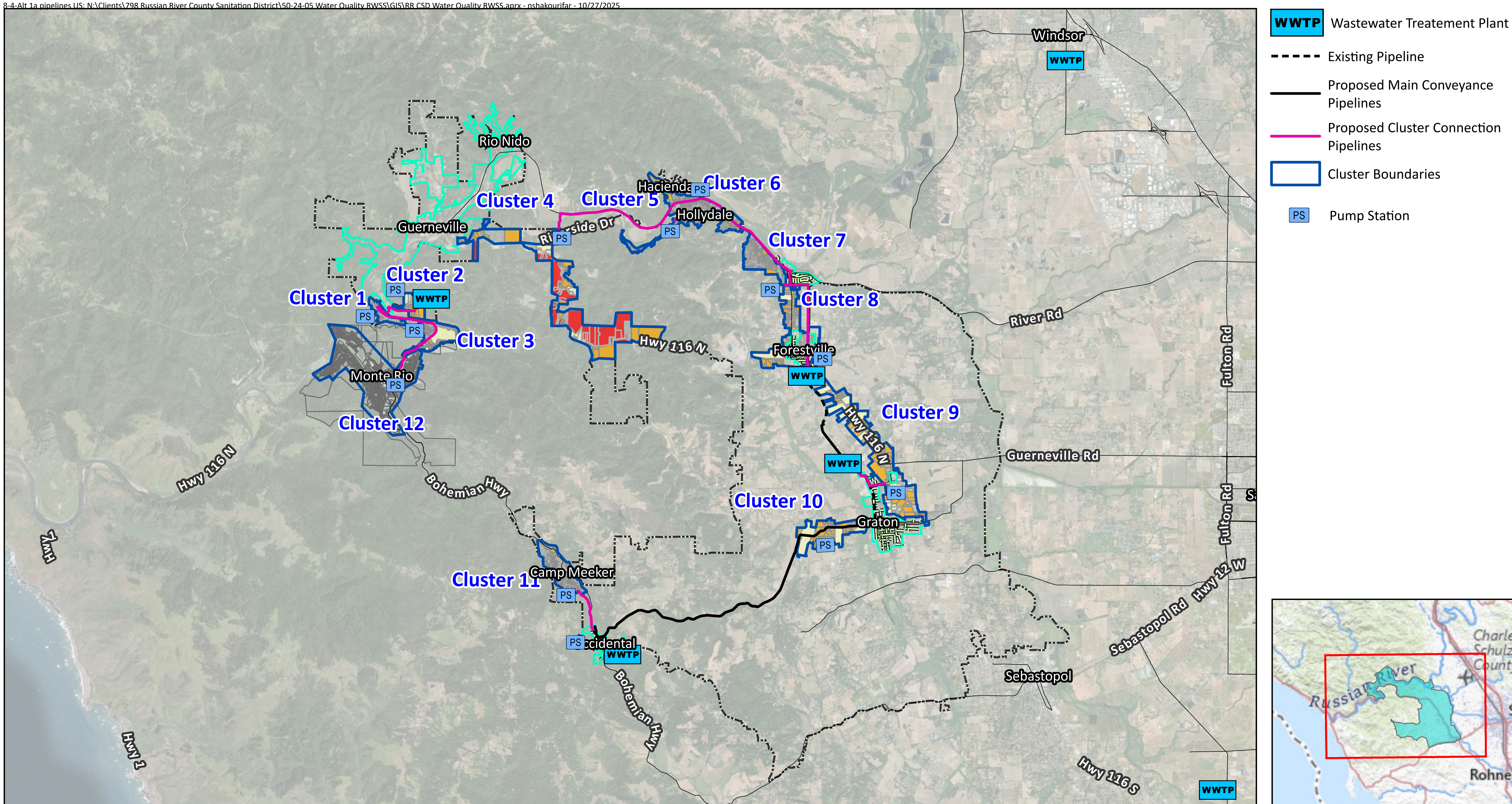
Figure 8-4 presents a conceptual alignment of the force main conveyance facilities required to connect the community clusters lift stations to the appropriate regional WWTPs under Alternative 1a. The distances and diameters of these conveyance pipelines are summarized in Table 8-8.

Table 8-8. Sizing of Conveyance Infrastructure from Unsewered Areas for Alternative 1a

Cluster(s)	Pipeline Distance, miles	Pipeline Diameter, inches
Connection to RRCSD		
2	0.1	4
3	1.2	6
1, 3 & 12	1.7	8
Connection to FWD/GSCD [(a)]		
4, 5, 9 & 11	4.0	4
6 to 8	4.0	8
Total Pipeline Length	**11.0**	

(a) Cluster 10 connects directly to the OCSD to GCSD pipeline.

8-4-Alt 1a pipelines US: N:\Clients\798 Russian River County Sanitation District\50-24-05 Water Quality RWSS\GIS\RR CSD Water Quality RWSS.aprx - nshakourifar - 10/27/2025



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0 1.5 3 Miles

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Proposed Pipeline Alignments for Alternative 1a

Figure 8-4

8.2.4.2 Conveyance from OCSD to GCSD WWTP

The Occidental to Graton Pipeline Feasibility Study identified the need for a 4-inch pipeline to convey wastewater from the OCSD site to the GCSD collection system. With addition of Camp Meeker (Cluster 11) to the OCSD flows, peak flows would increase by 0.24 mgd, resulting in combined peak flows of 0.37 mgd. A larger conveyance pipeline and corresponding pump station than Sonoma Water is currently planning for will be required to accommodate the higher flows. The pipeline would need to be increased from 4- inch to a 6-inch diameter size. Cluster 10 also connects near the downstream end of the proposed alignment and is estimated to result in total peak flows of 0.41 mgd but would not require additional upsized pipeline. Capital costs for the upsized conveyance facilities are common to all alternatives and included in all alternatives to allow for comparison with the capital costs without unsewered communities added in.

8.2.4.3 Conveyance Between GCSD WWTP and FWD WWTP

To accommodate the flow of water between the GCSD and FWD facilities the following pipelines and pump stations are needed:

- **Secondary Effluent from GCSD to FWD:**
  - An existing pipeline would be rehabilitated and a new, parallel pipeline constructed to allow for transfer of up to 1.5 mgd of GCSD/OCSD secondary effluent from the GCSD WWTP to the FWD WWTP. The existing 1.7-mile long, 8-inch diameter DI pipeline between the FWD and GCSD WWTPs would be rehabilitated, and a new, parallel 0.8-mile, 6-inch pipeline would be constructed between the GCSD WWTP and the existing 6-inch PVC pipe connecting to the FWD WWTP.
  - A new, 1.5 mgd effluent pump station to convey flow from the GCSD is also needed for secondary effluent transfer.[17]
- **Tertiary Effluent from FWD to GCSD Storage Ponds and Recycled Water Customers:**
  - A new, 1.7 mile 14-inch diameter pipeline would be constructed to allow for transfer of 2.7 mgd of tertiary effluent from the FWD WWTP to the storage ponds at the GCSD WWTP (and for distribution to recycled water customers).
  - The existing 0.7 mgd effluent pump station at the FWD WWTP needs to be expanded to 2.7 mgd to allow for transfer of flows from the FWD site to the ponds at the GCSD site.
- **Tertiary Effluent from GCSD Storage Ponds to Recycled Water Customers:**
  - A new, 5.0 mgd[18] recycled water pump station at the GCSD site is needed to distribute recycled water from the storage ponds to recycled water customers.

The new pipelines would parallel the existing inter-tie pipelines between the FWD and GCSD WWTPs (see Figure 8-4).

[17] GCSD has identified the need for a new effluent pump station. It is assumed that the facility would be sized to accommodate the proposed use. The new pump station is assumed to be adequately designed to accommodate the effluent flow detailed herein.

[18] The recycled water pump station has been sized based on the maximum month recycled water demand from the water balance, multiplied by an assumed peak day peaking factor of 1.5 to serve recycled customers.

8.2.4.4 Recycled Water Conveyance Infrastructure

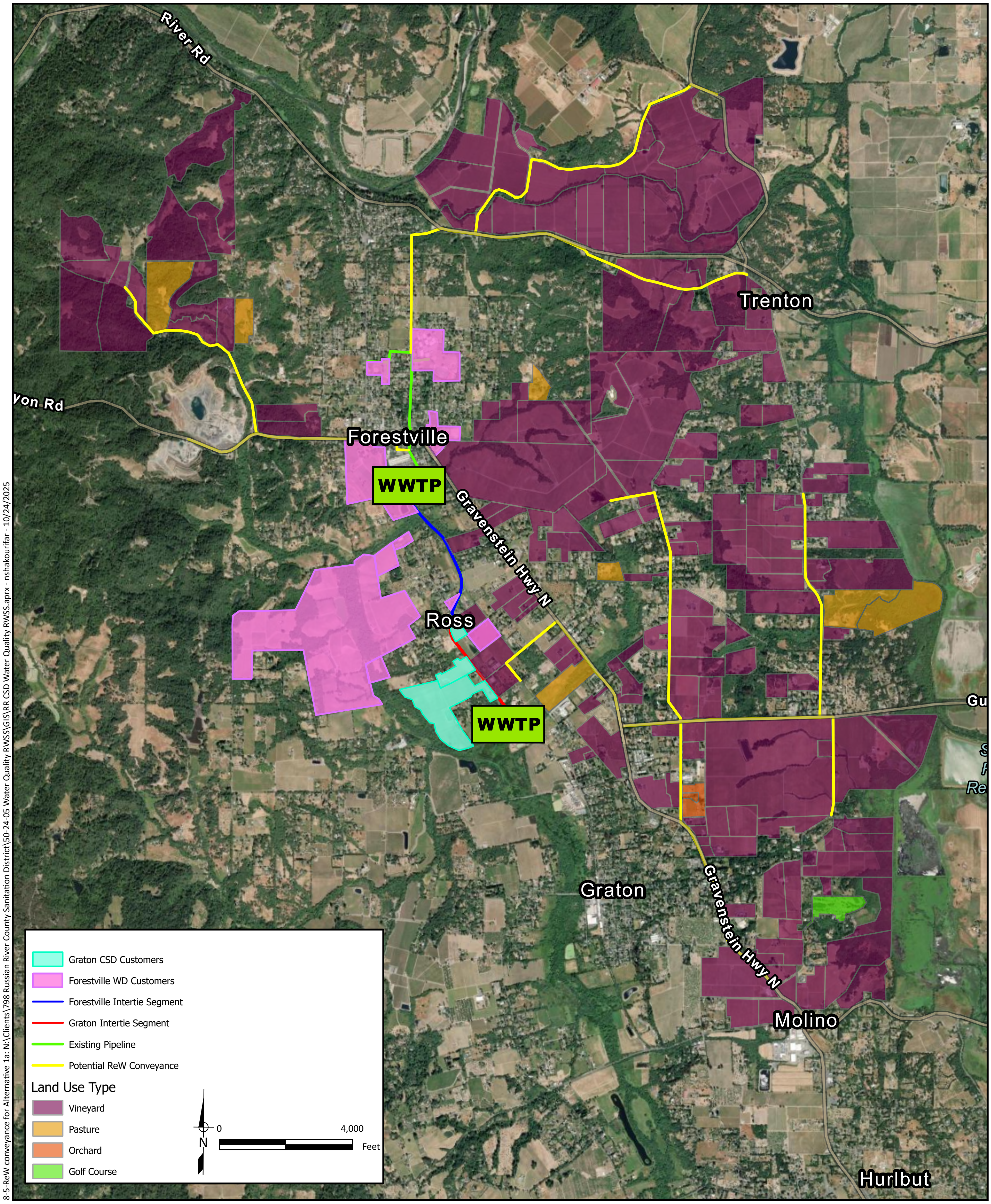
A potential expanded recycled water service area and associated recycled water main service pipelines are presented on Figure 8-5. At a feasibility level, these conveyances are assumed to be 12-inch diameter. A total of 16 miles of conveyance pipeline is estimated, including pipelines to serve the nearby quarries. In addition, $5,000 per acre is assumed to be needed to cover costs of additional piping and other required irrigation infrastructure on individual irrigated parcels.

8.2.5 Project Costs

The OPCC and OPTCC for Alternative 1a project elements are presented in Table 8-9, which also shows the estimated cost shares for RRCSD, FWD/GCSD (which also includes costs for processing flows from OCSD) and for unsewered communities. Additional details regarding these costs are provided in a Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendix G-1.

The following cost share approach was used:

- Costs of improvements needed to accommodate treatment/disposal of all anticipated flows and loads are split between existing users and new customers based on their respective portions of capacity provided.
- Costs of RRCSD condition-related improvements are split between existing users and new customers based on their respective average flows.
- New customers pay a wastewater system connection fee based on existing rate structures for use of existing facilities.
- Any improvements or costs associated with collection systems or raw wastewater conveyance (including existing systems) are only applied to users of those systems (proportional to peak flow).



8-5-ReW conveyance for Alternative 1a: N:\Clients\798 Russian River County Sanitation District\50-24-05 Water Quality RWSS\GIS\RR CSD Water Quality RWSS.aprx - nshakourifar - 10/24/2025

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Recycled Water Conveyance Infrastructure Needs for Alternative 1a

Figure 8-5

Table 8-9. OPCC and OPTCC for Alternative 1a						
Facility Component	Components	Cost, $ million			
		RRCSD	FWD/ GSCD	Un sewered	Total[(a)]
Treatment		**$16.6**	**$20.0**	**$30.4**	**$67.0**
RRCSD	Condition and hydraulic capacity improvements	15.5	--	8.1	23.6
	Tertiary filter expansion	1.1		0.6	1.7
FWD	SAF/cloth disk filtration and disinfection expansion	--	11.7	10.2	21.9
	Convert treatment ponds to complete mix system	--	3.8	5.7	9.5
GCSD	Headworks improvements	--	0.7	0.2	0.9
	Convert treatment ponds to complete mix system	--	3.8	5.6	9.4
Conveyance		**$0.0**	**$11.2**	**$24.3**	**$35.5**
New Pump Stations	1.5 mgd pump station at the GCSD WWTP for secondary effluent transfer to FWD	--	1.9	0.6	2.5
	5.0 mgd pump station at GCSD for distribution to customers	--	2.2	1.8	4.0
	2.7 mgd pump stations at the FWD WWTP for transfer to GCSD storage/local reuse	--	1.6	1.2	2.8
Pipeline	Pipeline Connections Between FWD/GCSD: • 0.8 mile, 6-inch pipeline extension of existing HDPE pipe • 1.7 mile, 14-inch pipeline • Rehab existing 1.7 mile, 8-inch ductile iron pipeline	--	5.5	4.0	9.5
	11 miles of 4-to–8-inch community conveyance lines	--	--	16.7	16.7
Recycled Water		**$0.2**	**$43.3**	**$64.0**	**$107.5**
Land Application Area	55 acres (RRCSD)[(b)]	0.2	--	1.2	1.4
	3,040 acres (FWD/GCSD)	--	6.2	9.0	15.2
Storage	620 acre-feet (GCSD)	--	13.9	20.2	34.1
	52 acres land purchase	--	2.1	3.1	5.2
Pipelines	16 miles of 12-inch conveyances to Use Areas	--	21.1	30.5	51.6
Unsewered Service Area Systems (Collection Systems and Dedicated Pump Stations)		**--**	**--**	**$362.5**	**$362.5**
	Engineer's Preliminary OPCC	**$17.0**	**$75**	**$481**	**$573**
	Engineering Design, Environmental Planning and Studies, Permitting, Construction Management, ESDC and Legal and Admin Costs, 25 percent of OPCC (*applied to all*)	4.0	19	120	143
	Engineer's Preliminary OPTCC	**$21.0**	**$94**	**$601**	**$716**
	Wastewater Agency's Treatment Plant Connection Fees	- $6	- $19	$25	
	OPTCC with Connection Fees Included	**$15.0**	**$75**	**$626**	

(a) Project Phase-Level OPCC estimating contingency of 30 percent applied to all elements.
(b) The estimated 55 additional acres is based on a conservative assumption that recycled water is applied at agronomic rates with no allowance for additional percolation. As documented in Chapter 3, RRCD alone only requires a 5-acre expansion.

8.2.6 Operations and Maintenance Costs

This section provides a summary of the O&M costs, focused on the following elements:

- Power costs
- Labor costs
- Chemical costs
- Equipment repair and replacement costs

Following this summary of the additional O&M elements, the total additional O&M costs are presented along with the 20-year, present-worth lifecycle O&M cost. Additional details regarding these O&M costs are provided in the Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendices H-1 and H-2.

8.2.6.1 Power Costs

The annual power costs for Alternative 1a are summarized in Table 8-10. These costs account for the energy demands of new treatment systems and conveyance infrastructure, as well as projected savings resulting from operational changes at the GCSD WWTP. Similar to the concepts presented in Chapter 4, an upgrade to a complete mix aeration system at the GCSD and FWD WWTPs increases power demands (reflected in the treatment pond power cost), but eliminating all tertiary treatment at the GCSD WWTP and eliminating membrane filtration at the FWD WWTP results in power savings.

Table 8-10. Annual Power Costs for Alternative 1a

Cost Element	Annual Cost, $
RRCSD Treatment[(a)]	34,200
Treatment Pond at GCSD and FWD WWTPs	303,200
GCSD and FWD WWTP Operation[(b)]	-173,400
Cloth Disk Filtration at FWD WWTP	900
SAF at FWD WWTP	12,800
Conveyance Pumps	100,500
Total	**$278,200**

(a) Assuming addition of 20 percent of RRCSD current treatment power costs corresponding to increased loads.
(b) Assuming elimination of 90 and 60 percent of GCSD and FWD current treatment power costs. A negative cost represents cost savings relative to existing costs.

8.2.6.2 Labor Costs

No change in labor costs was assumed in the analysis presented in Chapter 4. With unsewered flows included, it is assumed two additional full-time employees would be required for FWD/GCSD WWTP recycled water system O&M. The cost for one full-time employee is assumed to be $200,000, so a total labor cost of $400,000 per year is assumed.

8.2.6.3 Chemical Costs

Annual chemical costs for Alternative 1a are summarized in Table 8-11. The bases for these costs are provided in the footnotes to the table. The savings assumed at the GCSD WWTP are the same as those used in Chapter 4. Additional RRCSD treatment costs would be incurred to treat the unsewered flows, and additional SAF and chlorine chemical costs would be incurred for FWD/GCSD treatment proportional to the increased flows from the unsewered communities.

Table 8-11. Annual Chemical Costs for Alternative 1a

Cost Element	Annual Cost, $
RRCSD Treatment	12,500[(a)]
SAF floc aid	136,500[(b)]
CCB: chlorine gas and sulfur dioxide gas	53,800[(c)]
Current GCSD WWTP Operation	-69,700[(d)]
Total	**$133,100**

(a) Additional chemical usage at RRCSD WWTP based on current chemical usage, assuming usage increases proportional to average flow.
(b) Based on chemical usage at the existing GCSD SAF facility.
(c) Additional chlorine gas and sodium bisulfite required for the expanded CCB at the FWD WWTP are estimated using FWD current design criteria and the projected increase in annual average flow from GCSD.
(d) Assuming elimination of 100 percent of GCSD WWTP chemical costs. A negative cost represents cost savings relative to existing costs.

8.2.6.4 Equipment Repair and Replacement Costs

A summary of the estimated major equipment repair and replacement costs for Alternative 1a is provided in Table 8-12. As done with Chapter 4, replacement costs for equipment with replacement frequencies of more than 20 years were excluded from this analysis (e.g., pumps, which are assumed to need replacement after 25 years). These costs are higher than those used for Alternative 1a in Chapter 4, accounting most significantly for additional piping and valve maintenance and replacements.

Table 8-12. Equipment Repair and Replacement Costs for Alternative 1a			
Cost Element	Cost, $		Cost Basis Assumption
	Annual Basis	Cost Basis (if different)	
Filter Cloth Replacement	3,000	21,000	Every 7 years
Routine O&M[a]	15,500	-	Annual
Piping and Valve Maintenance and Replacement Cost	233,800	-	5 percent of mechanical and piping capital costs
Instrumentation Maintenance	4,000	83,000	5 percent of instrumentation and controls capital costs, Year 15
Pumps Rebuilds and Major Maintenance	5,000	53,000	30 percent of pump capital costs, Every 10 Years
10-Year Parts Replacement[b]	200	2,000	Every 10 Years
Major Parts Replacement[c]	4,000	84,000	Every 15 Years
Total Annual Costs	**$266,000**	**-**	--

(a) Includes cloth disk filtration routine lubrication of backwash pumps, drive motor and gear box, SAF parts replacement, pond cleaning and pond blower filter/belt/oil changes.
(b) Includes cloth disk filtration main "V-Ring" seal replacement.
(c) Includes aeration equipment replacement.

8.2.6.5 Total Additional Annual O&M Costs

Total additional annual O&M costs are provided in Table 8-13 based on the information presented in the previous sections. Also shown are estimated cost shares, using the following approach:

- For treatment and recycled water costs, costs are divided between RRCSD and FWD/GSCD based on the facility where the costs are incurred.
- For collection system costs, any new O&M is for the unsewered communities, so those are shown assigned solely to the unsewered communities.

Table 8-13. Additional Annual O&M Costs for Alternative 1a					
Service Area	RRCSD, $		FWD/GCSD, $		Total Annual OpEx, $
Treatment/Recycled Water					
Power	34,000		244,000		278,000
Labor	-		400,000		400,000
Chemicals	12,000		121,000		133,000
Major Parts Replacement[(a)]	-		13,200		13,200[(b)]
Routine O&M for Treatment[(a)]	-		218,000		218,000[(b)]
Total Treatment Annual OpEx	**$46,000**		**$996,200**		**$1,042,200**
Collection	RRCSD	Unsewered	FWD/GCSD	Unsewered	Total
Routine O&M for Conveyance[(a)]	-	8,000	-	26,800	34,800[(b)]
Collection System O&M[(c)]	-	1,150,000	-	1,529,000	2,679,000
Total Collection Annual OpEx	**-**	**$1,158,000**	**-**	**$1,555,800**	**$2,713,800**

(a) The equipment repair and replacement costs from Table 8-12 are shown where relevant under treatment or collection.
(b) These cost items comprise the total annual equipment repair and replacement cost in Table 8-12.
(c) Based on estimated costs shown in Table 8-5.

8.2.6.6 Total 20-Year Present Worth of O&M Costs

To calculate total lifecycle costs for the alternative, total costs over the project lifetime (20 years) are needed. The total 20-year, present-worth O&M costs for Alternative 1a are shown in Table 8-14. Additional details are provided in Appendices H-1 and H-2.

Table 8-14. Present Worth O&M Cost for Alternative 1a	
O&M Cost Component	Total 20 Year Cost, $ million
Power	5.8
Labor	8.4
Chemicals	2.8
Equipment Repair and Replacement	6.4
Unsewered Collection Systems	56.3
Total 20-Year, Present-Worth O&M Costs	**$80**

8.2.7 Total Lifecycle Costs

A total lifecycle cost for Alternative 1a is calculated as shown in Table 8-15 using the OPTCC from Table 8-9 and total 20-year O&M costs from Table 8-14.

Table 8-15. Lifecycle Cost for Alternative 1a

Cost Component	Cost, $ million
Total Project Capital Cost (CapEx)	716
Total Present Worth O&M Costs (OpEx)	80
Total Lifecycle Cost	**$796**

8.2.8 Potential Annual Operating Costs per ESD

The additional operating costs from Table 8-13 were combined with current operating costs to define potential operation costs per ESD under Alternative 1a[19]. The following methodology was used to develop these per ESD annual operating costs:

- For treatment:
  - Current treatment operating costs from recent West County annual budgets were taken and divided amongst all prospective future users proportional to the number of ESDs.
  - Additional operating costs were taken from Table 8-13 and were proportioned by the same ratios.
- For collection systems:
  - The recent West County annual budgets were retained specific to the RRCSD and FWD/GSCD and none of these costs were allocated to unsewered communities[20].
  - Additional operating costs (Table 8-13) were assigned only to the unsewered communities.
- The combined total operating costs values were divided by the respective number of ESDs.

These total annual operating costs and operating costs per ESD values are presented in Table 8-16. These per parcel costs include estimated operating costs only and do not include any costs related to debt that may arise from the implementation of a regional project. Therefore, the costs should not be interpreted as the annual charges paid by a sanitation district customer.

[19] Overall rates will include these annual operating costs in addition to any appropriate debt service as well as potential administrative fees.

[20] The unsewered community cluster collection system operating costs could potentially be consolidated amongst the system users, which would likely significantly reduce the collection system operating costs. Additional evaluation of governance and management options is recommended to better define these costs.

Table 8-16. Total Estimated Annual O&M Costs for Alternative 1a					
Category	RRCSD	RRCSD Unsewered	FWD/GCSD	FWD/GCSD Unsewered	Total Annual Operating costs
Current Annual O&M for Treatment	$4.1 M[(a)]	$1.4 M[(a)]	$0.8 M[(b)]	$0.8 M[(b)]	$7.1 M
Additional Annual O&M for Treatment	$0.03 M	$0.01 M	$0.5 M	$0.5 M	$1.0 M
Current Collection System O&M	$3.3 M[(a)]	-	$0.9 M	-	$4.2 M
Additional Collection System O&M[(c)]	-	$1.2 M	-	$1.6 M	$2.8 M
Total Annual Operating costs	**$7.4 M**	**$2.6 M**	**$2.2 M**	**$2.9 M**	**$15.1 M**
Total Annual Operating costs per ESD	**$2,100**	**$2,100**	**$1,200**	**$1,500**	

(a) Current annual O&M from RRCSD FY 24/25 budgets split amongst proposed future users (proportioned by ESDs).
(b) Current annual O&M from FWD/GSCSD FY 24/25 budgets split amongst proposed future users (proportioned by ESDs).
(c) Based on $49 per month per parcel from Monte Rio Study Report plus an assumed 2 new FTEs for collection system management. Totaling $89 per parcel.

8.3 ALTERNATIVE 1C

Alternative 1c involves treating all West County flows at new treatment facilities constructed at the existing FWD WWTP site that provides the level of treatment required to allow for seasonal discharge to the Russian River. The system would also rely on the expansion of the FWD/GCSD recycled water system to allow for beneficial reuse during the dry-season period.[21] This section presents a description of how the selected unsewered community clusters would be incorporated into this regional strategy, the associated basis of design for the facility improvements, a summary of the required facility improvements, site layout, project costs, O&M costs and total lifecycle costs.

8.3.1 Incorporation of Unsewered Clusters

Under Alternative 1c the selected unsewered community clusters would be incorporated into the regional facilities as follows:

- Clusters 1, 2, 3, and 12 would connect to a pump station at the RRCSD site. This station would convey the combined RRCSD/community cluster flows to the FWD WWTP.
- Clusters 4 through 8 would connect to the same force main between RRCSD and FWD, ultimately discharging to the FWD WWTP.
- A dedicated Cluster 9 lift station and force main would be constructed to convey flows from this area directly to the FWD WWTP.
- Flow from Cluster 11 would be conveyed to the OCSD pump station where it would be combined with OCSD flows and discharged to a new discharge pump station at the GCSD WWTP site. Cluster 10 would also discharge to the new force main between the OCSD pump station and GCSD pump station. This new GCSD pump station would convey the combined GCSD/OCD/community cluster flows to the FWD WWTP.

[21] Existing recycled water use from RRCSD on the Northwood Golf Course is assumed to cease.

8.3.2 Basis of Design

The projected flows and loads to the FWD WWTPs under Alternative 1c with unsewered community flows added in are presented in Table 8-17. These flows and loads are based on the information presented in Chapters 2 and 5 for the West County agencies and unsewered communities, respectively.

Table 8-17. Alternative 1c Treatment Facilities Design Flows and Loads

Scenario	ADWF, mgd	Relevant Peak Flow Condition	Peak Design Flow, mgd	Maximum 30 Day BOD Load, lb/day
Design Flow for the RRCSD Pump Station				
Projected RRCSD Flows and Load	0.38	MWF	3.5[(a)]	2,620
Clusters 1-3 & 12	0.20	Peak Flow	0.80	600
Total to RRCSD Pump Station	--[(b)]	--	**4.3**	--[(b)]
Design Flow to the GCSD Pump Station				
Projected GCSD/OCSD Flows and Loads	0.15	MMF	0.64[(c)]	680
Clusters 10-11	0.10	Peak Flow	0.28	300
Total to GCSD Pump Station	--[(b)]	--	**0.92**	--[(b)]
Design Flows to the FWD WWTP				
Projected FWD Flows and Loads	0.064	MMF	0.25[(c)]	270
Clusters 4-9	0.20	Peak Flow	0.92	2,760
Combined West County and Unsewered	**1.1**	--	**6.4**	**5,100**

(a) Equalized peak flow. Chapter 4 discusses use of existing storage to equalize peak flows to the new treatment system
(b) Design condition is not relevant to the facility sizing.
(c) Equalized peak flow. Chapter 4 discusses use of existing ponds to equalize peak flows to the new treatment system.

8.3.3 Required Facility Improvements

This section addresses the required RRCSD treatment facility improvements, the required GSCD/FWD treatment facility improvements, and the required recycled water system improvements.

8.3.3.1 RRCSD Treatment Infrastructure Improvements

Under this alternative, the following improvements will be required at the RRCSD WWTP site:

- The existing storage ponds and aeration basins at the RRCSD would be modified to provide equalization of RRCSD service area flows. It is assumed that flows could be equalized to 3.5 mgd. Unsewered flows would not be equalized. Required infrastructure for this conversion includes:
  - Influent control structures to allow flexible flow direction within each facility (e.g., directing flow to the ponds or pump station, or combining flows)
  - Additional internal pipelines within the facilities

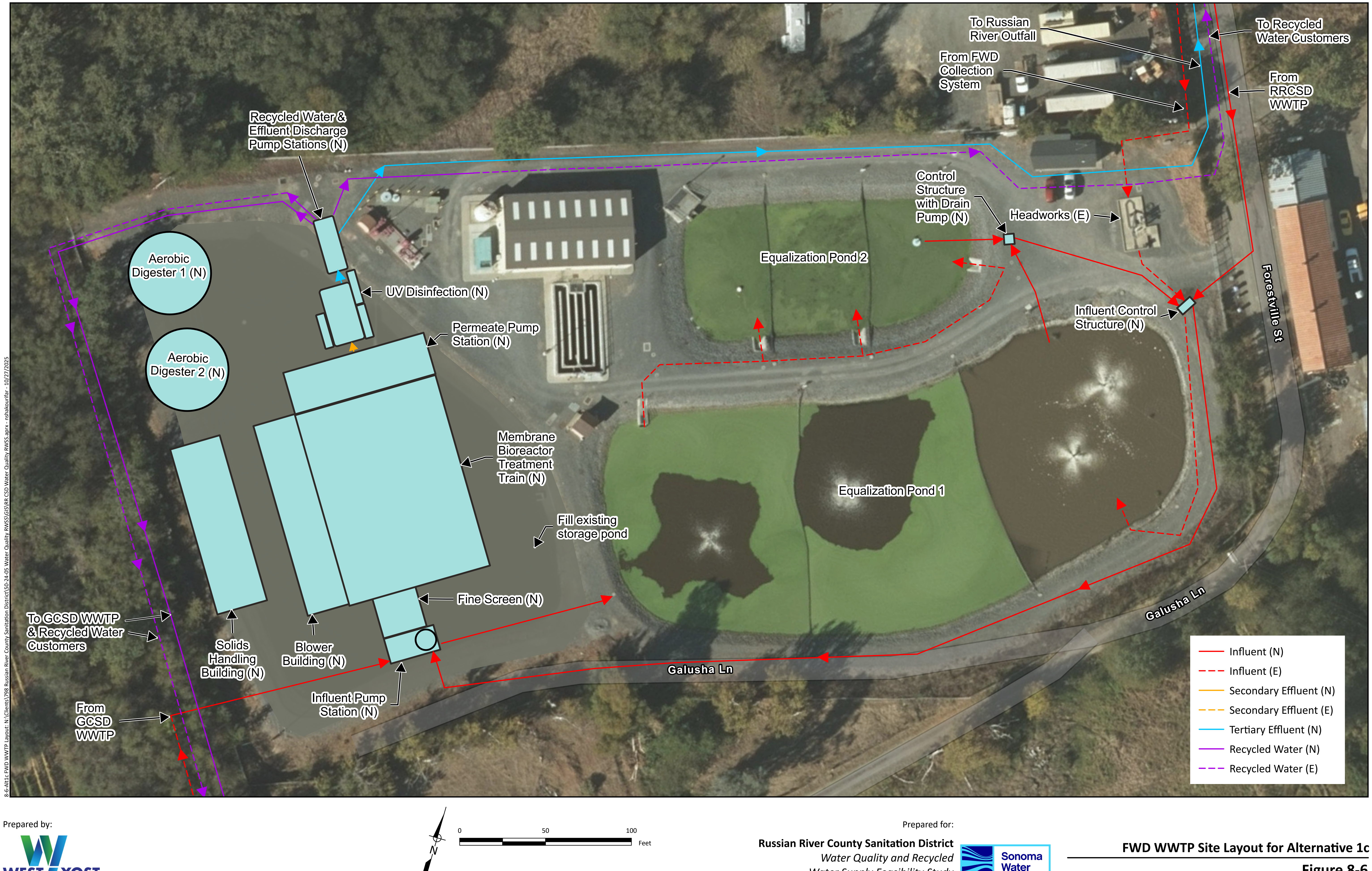
Proposed infrastructure improvements at the RRCSD WWTP to convert existing storage ponds to EQ ponds are the same as those outlined in Chapter 4 and were already provided on Figure 4-4.

8.3.3.2 FWD/GSCD Treatment Improvements

Under this alternative, the following improvements will be required at the GCSD WWTP site:

- The GCSD headworks will be upgraded with a new mechanical screening facility.
- The existing GCSD and FWD treatment ponds would be reconfigured so to provide EQ at each site. With this approach, the GCSD and FWD flows can likely be equalized to the maximum 30-day average values (0.9 mgd combined total) (Unsewered flows would not be equalized.) Required infrastructure for this conversion includes:
  - Influent control structures at the GCSD and FWD sites to allow flexible flow direction within each facility (e.g., directing flow to the ponds or pump station, or combining flows)
  - A drain pump for the FWD ponds
  - Additional internal pipelines within the facilities
- A new 6.75 mgd, three train MBR treatment system that provides biological nitrogen removal will be installed at the FWD WWTP, paired with a new 6.75 mgd, three channel UV disinfection to meet treatment requirements.
- Two, 7.5 mgd fine screening units (one duty and one standby) with 2-millimeter openings will need to be installed upstream of the MBR system, as required by membrane manufacturers to protect the membranes from damage.
- An aerobic solid digestion system with a capacity of handling 50,000 gallons per day of WAS will be constructed to treat WAS generated by the MBR process. A new solids handling building will house mechanical equipment, such as solids thickening and dewatering systems, blowers, and a cake storage room.

These improvements are the same as those presented in Chapter 4 for Alternative 1c, except capacities have been approximately doubled for account for the increased flows and loads from the unsewered communities. The site layout showing the proposed improvements at the FWD WWTP, along with the existing infrastructure that will be repurposed, is provided as Figure 8-6. Proposed infrastructure improvements at the GCSD WWTPs to convert existing treatment ponds to EQ ponds are the same as those outlined in Chapter 4 and were provided on Figure 4-5.



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WEST YOST

Prepared for:

Russian River County Sanitation District
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FWD WWTP Site Layout for Alternative 1c

Figure 8-6

8.3.3.3 Recycled Water Infrastructure Improvements

As with Alternative 1a, water balances for the combined FWD/GCSD system with all West County flows have been updated from those discussed in Chapter 3 to account for the addition of unsewered flows, as well as to address the findings presented in Chapter 6 of relatively low vineyard irrigation demands and additional demands from quarries near the FWD WWTP. Updated FWD/GCSD 100-year water balance results are presented in Table 8-18 for projected West County flows with and without the unsewered clusters.

Table 8-18. FWD/GCSD Water Balance Results for Alternative 1c

Scenario	Storage Volume Required, acre feet	Irrigated/Disposal Area Required, acres
Existing Facilities		
FWD/GCSD	70[a]	345
FWD/GCSD Water Balance Results (100-Year Rainfall 75 in/yr)		
Projected	44	345
Projected + Unsewered	255	325[b]

(a) Existing 7 acre-feet of storage at FWD assumed to be filled to support new treatment facilities.
(b) Existing 20.5 acres of GCSD irrigation area assumed used for siting new recycled water storage.

The updated water balance analysis indicates the following:

- No additional land application area required.
- 185 acre-feet of new recycled water storage needed, which could be sited on the available 20.5-acre GCSD land application site. The proposed locations of the recycled water facilities at GCSD for effluent storage are the same as that presented in Chapter 4 on Figure 4-3.
- Extension of the existing recycled water distribution system to the quarries near Forestville would also be required.

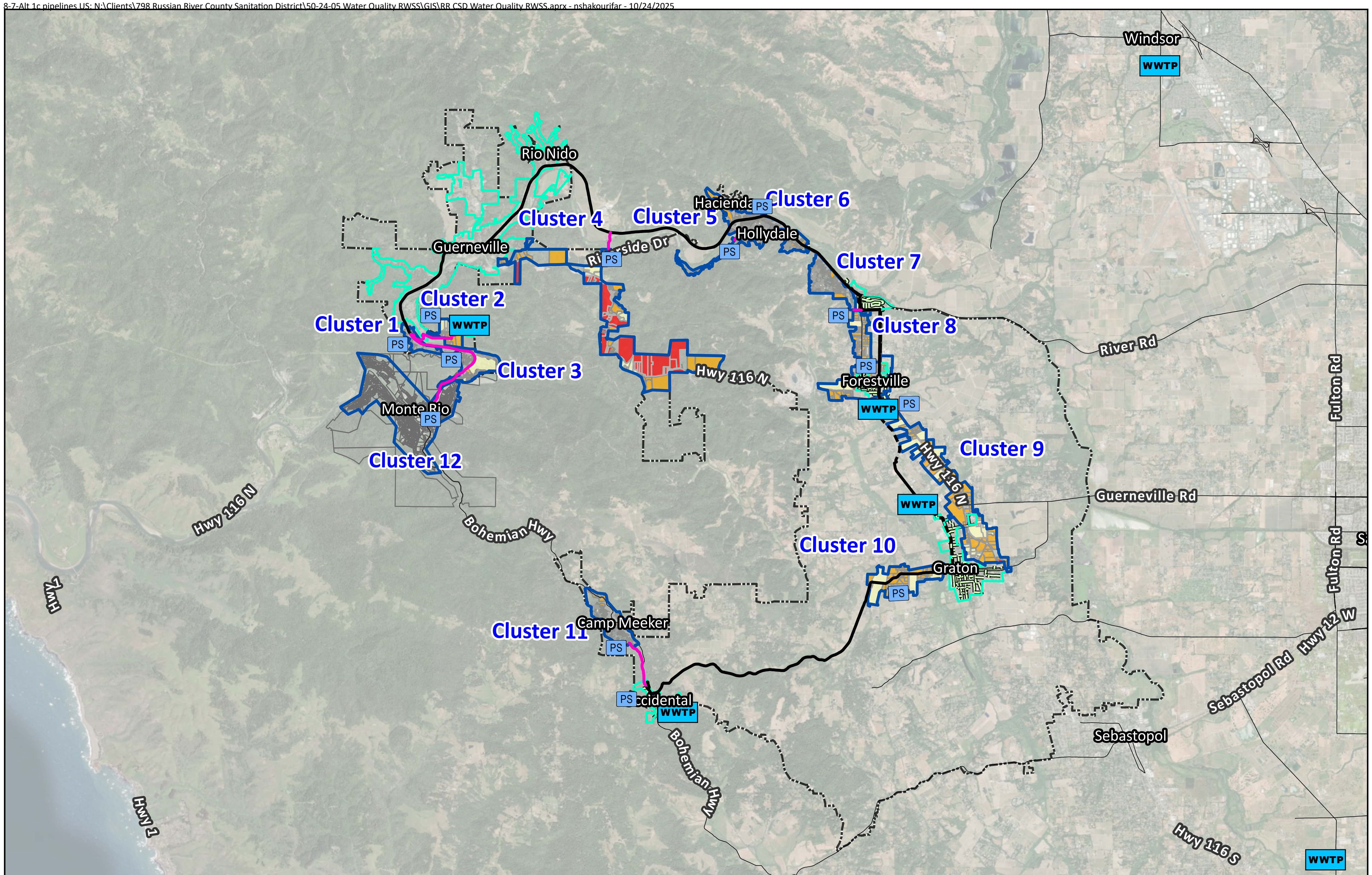
8.3.4 Conveyance Infrastructure

Relevant conveyance infrastructure includes collection system conveyance for the unsewered parcels, raw wastewater conveyance to the GCSD and FWD WWTPs, treated effluent conveyance between the GCSD and FWD WWTPs and conveyance to the Russian River and recycled water users.

8.3.4.1 Collection System Infrastructure for Unsewered Community Clusters

A new 10- to 24-inch, 13-miles of pipeline between the RRCSD and FWD WWTP sites would be constructed. This pipeline would be constructed along River Road and have two river crossings. A conceptual alignment is shown on Figure 8-7.

8-7-Alt 1c pipelines US: N:\Clients\798 Russian River County Sanitation District\50-24-05 Water Quality RWSS\GIS\RR CSD Water Quality RWSS.aprx - nshakourifar - 10/24/2025



WWTP Wastewater Treatement Plant

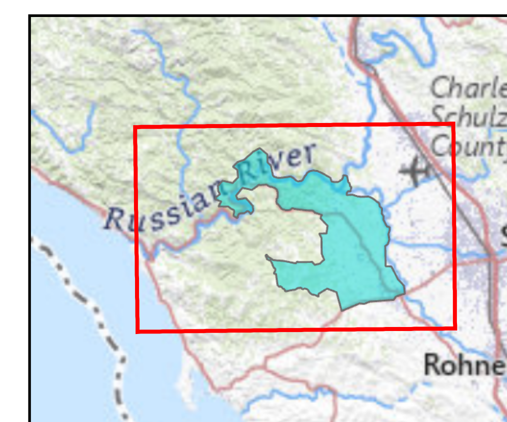
Existing Pipeline

Proposed Main Conveyance Pipelines

Proposed Cluster Connection Pipelines

Cluster Boundaries

PS Pump Station



0 1.5 3 Miles

N

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Russian River County Sanitation District
Water Quality and Recycled Water Supply Feasibility Study

Sonoma Water

Proposed Pipeline Alignments
Alternative 1c

Figure 8-7

In addition, each cluster would have a new pipeline connection as summarized in Table 8-19.

Table 8-19. Sizing of Conveyance Infrastructure from Unsewered Areas for Alternative 1c

Cluster(s)[(a)]	Pipeline Distance, miles	Pipeline Diameter, inches
2, 4, 5, 9 & 11	1.3	4
7	1.3	6
3 & 12	0.8	8
Total Pipeline Length	**3.4**	

(a) Clusters 1, 6 and 8 connect directly to the RRCSD to FWD pipeline, and Cluster 10 connects directly to the OCSD to GCSD pipeline.

8.3.4.1 Raw Wastewater Conveyance

To accommodate conveyance of raw wastewater between the RRCSD and GCSD facilities to the FWD WWTP, the following pipelines and pump stations are needed:

- A new 4.3 mgd pump station at the RRCSD WWTP and 13 miles of 10 to 24-inch pipeline to convey raw wastewater to the FWD WWTP site.
- The existing 1.7-mile long, 8-inch diameter DI pipeline between the FWD and GCSD WWTPs would be rehabilitated to allow for transfer of 0.64 mgd of equalized, raw OCSD/GCSD wastewater to the FWD site.
- A new 0.64 mgd effluent pump station for GCSD is needed for raw wastewater transfer to the FWD WWTP site.

8.3.4.2 Treated Effluent and Recycled Water Conveyance

The following major conveyances will be required for discharge or transfer of effluent and recycled water:

- A new 4.1-mile long, 30-inch diameter outfall from the FWD WWTP to the Russian River (The assumed alignment for the outfall was provided as Figure 3-6 in Chapter 3).[22] A new 6.4 mgd effluent pump station at the FWD site needs to be constructed to allow for discharge to surface waters via this outfall.
- New pipelines and pump stations will be constructed between the FWD and GCSD sites to convey flows to the treatment, storage, and recycled water facilities, as follows:
  - **Treated Water from FWD to GCSD:** A new, 1.7-mile, 16-inch pipeline between the GCSD WWTP and the FWD WWTP would be constructed to allow for transfer up to 6.4 mgd of tertiary effluent from the FWD WWTP to the GCSD storage ponds and/or the existing discharge location at the GCSD WWTP. A new 6.4 mgd effluent pump station at the FWD site needs to be constructed to allow for transfer to the GCSD ponds.

[22] Additional evaluation of the dilution available at the existing GCSD and FWD discharge locations is needed to confirm the need for a new outfall. It is also likely that the existing FWD and GCSD outfalls would be available to accommodate some of the discharge flow. A lower-cost supplemental discharge site may also be possible. Therefore, the new outfall could potentially be lower cost than what has been assumed for this study.

— **Recycled Water from GCSD to Existing Recycled Water Customers:** A new 0.8-mile, 6-inch pipeline between the GCSD WWTP and the existing 6-inch PVC pipe connecting to the FWD WWTP would be constructed to allow for transfer of 0.6 mgd of tertiary effluent from the storage ponds at the GCSD WWTP to existing recycled water customers. A new, 0.8 mgd[23] recycled water pump station at the GCSD site is needed to distribute recycled water from the storage ponds to recycled water customers.

— **Recycled Water to Quarries:** New 0.5 miles of 12-inch conveyance pipeline would be needed to connect the new Russian River outfall pipeline to the nearby quarries (the assumed alignment for the new Russian River outfall pipeline was provided as Figure 3-6 in Chapter 3 and is the same alignment of the northwest portion of the recycled water distribution pipeline shown on Figure 8-5)[24].

8.3.5 Project Costs

The OPCC and OPTCC for Alternative 1c project elements are presented in Table 8-20, which also shows the estimated cost shares for RRCSD, FWD/GCSD and for unsewered communities. Additional details regarding these costs are provided in a Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendix G-2.

The following cost share approach was used:

- Costs of improvements needed to accommodate treatment/disposal of all anticipated flows and loads are split between existing users and new customers based on their respective portions of capacity provided.
- Cost of EQ improvements are applied to each community (i.e., RRCSD, GCSD and FWD).
- No connection fee is assumed because basically all new treatment infrastructure is being constructed.
- Any improvements or costs associated with collection systems or raw wastewater conveyance (including existing systems) are only applied to users of those systems (proportional to peak flow).

[23] The recycled water pump station has been sized based on the maximum month recycled water demand from the water balance, multiplied by an assumed peak day peaking factor of 1.5 to serve recycled customers.

[24] Note that if an alternate discharge site is deemed unnecessary or if an alternative alignment or discharge site is identified, then this recycled water pipeline may need to be longer. This impact should be weighed when evaluating overall project costs.

Table 8-20. OPCC and OPTCC for Alternative 1c

Facility Component	Components	Cost, $ million RRCSD	FWD/ GCSD	Un sewe red	Total[(a)]
Treatment		**$43.7**	**$24.2**	**$32.3**	**$100.1**
RRCSD	Convert storage ponds to EQ facility	0.3	--	--	0.3
FWD	Convert treatment ponds to EQ ponds	--	3.8	--	3.8
	BNR/MBR + UV disinfection + Solids Processing	43.4	19.4	32.2	94.9
GCSD	Headworks improvements	--	0.8	0.1	0.9
	Convert treatment ponds to EQ facility	--	0.2	--	0.2
Conveyance		**$104.1**	**$13.8**	**$43.6**	**$161.5**
New Pump Stations	4.3-mgd pump station at RRCSD discharge to FWD site	3.1	--	0.8	3.9
	0.9-mgd pump station at GCSD for raw wastewater transfer and 0.8-mgd pump station for distribution to local reuse customers	--	3.3	1.5	4.8
	6.4 mgd pump station at FWD discharge to GCSD storage/local reuse	2.0	0.5	1.1	3.6
	6.4 mgd pump station at FWD for Russian River discharge and distribution to quarries	2.4	0.6	1.4	4.4
Pipeline	13-mile of 10 to 24-inch conveyance pipeline between RRCSD and FWD	70.6	--	18.5	89.1
	Pipelines connections between FWD/GCSD: • 1.7 mile, 20-inch pipeline for effluent transfer to GCSD • 0.8 mile, 6-inch pipeline extension of existing HDPE pipe (raw wastewater) • Rehab existing 1.7 mile, 8-inch pipeline between GCSD and FWD (recycled water)	4.7	3.9	4.4	13.0
	4.1-mile, 30-inch Outfall to Russian River[(b)]	21.3	5.5	12.2	39.0
	3.4 miles of 4–8-inch community conveyance lines	--	--	3.7	3.7
Recycled Water		**$6.7**	**$0.3**	**$9.0**	**$16.0**
Storage	185 acre-feet (GCSD)	6.2	--	8.3	14.5
Pipelines	0.5-mile, 12-inch pipeline extension to quarries	0.5	0.3	0.7	1.5
Unsewered Service Area Systems (Collection Systems and Dedicated Pump Stations)		**--**	**--**	**$362.5**	**$362.5**
	Engineer's Preliminary OPCC	**$154**	**$38**	**$447**	**$640**
Engineering Design, Environmental Planning and Studies, Permitting, Construction Management, ESDC and Legal and Admin Costs, 25 percent of OPCC[(c)]		42	10	114	166
	Engineer's Preliminary OPTCC	**$196**	**$48**	**$561**	**$806**

(a) Project Phase-Level OPCC estimating contingency of 30 percent applied to all elements.
(b) Additional evaluation of dilution available at existing GCSD and FWD discharge locations needed to confirm new outfall requirements. A study of potential new outfall locations/alignments is also warranted. If existing FWD and GCSD outfalls are available and can reliably accommodate all planned GCSD/FWD flows, costs applied to GCSD/FWD could be eliminated (an up to $9 million reduction).
(c) Engineering design, environmental planning and studies, permitting, construction management, ESDC and legal and administrative costs of 25 percent applied to all elements, except for the outfall to Russian River, which has a 40 percent factor applied due to possible permitting challenges.

8.3.6 Operations and Maintenance Costs

This section provides a summary of the O&M costs for Alternative 1c, focused on the following elements:

- Power costs
- Labor costs
- Chemical costs
- Equipment repair and replacement costs

Following this summary of the additional O&M elements, the total additional O&M costs are presented along with the 20-year, present-worth lifecycle O&M cost. Additional details regarding these O&M costs are provided in the Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendices H-3 and H-4.

8.3.6.1 Power Costs

The annual power costs for Alternative 1c are summarized in Table 8-21. These costs account for power for the new tertiary treatment facility, solids handling facility and conveyance infrastructure, as well as anticipated savings from operational changes at the RRCSD, FWD, and GCSD WWTPs. These costs are higher than those used in Chapter 4 for Alternative 1c because of increased treatment requirements with the unsewered flows.

Table 8-21. Annual Power Costs for Alternative 1c

Cost Element	Cost, $
Fine Screen	2,000
MBR Treatment System	242,200
Aerobic Digestion	86,600
UV	86,700
Conveyance Pumps	370,200
RRCSD, FWD and GCSD WWTPs Operation[a]	-576,600
Total	**$210,900**

(a) Assuming elimination of 95, 90 and 60 percent, respectively, of RRCSD, GCSD and FWD WWTP current treatment power costs. A negative cost represents cost savings relative to existing costs.

8.3.6.2 Labor Costs

The following labor cost reductions are assumed for this alternative, same as in Chapter 4:

- 100 percent increase in labor and administrative costs at the FWD WWTP
- 75 percent reduction in labor costs at the RRCSD WWTP
- 90 percent reduction in labor and a 50 percent reduction in administrative costs at the GCSD WWTP

Based on these assumptions, the estimated annual labor cost savings is $2.9 million.

In addition, the expanded recycled water storage needs are assumed to require 2 full-time employees, at a total cost of $400,000 per year.

8.3.6.3 Chemical Costs

Annual chemical costs for Alternative 1c are summarized in Table 8-22. The bases for these costs are provided in the footnotes to the table. The savings assumed at the RRCSD and GCSD WWTP are the same as those used in Chapter 4. Additional MBR and digestion chemical costs would be incurred to treat the unsewered flows, proportional to the increased flows.

Table 8-22. Annual Chemical Costs for Alternative 1c

Cost Element	Cost, $
MBR Treatment System	24,200[(a)]
Aerobic Digestion	32,800[(b)]
RRCSD and GCSD WWTPs Operation	-104,700[(c)]
Total	**-$47,700**

(a) Based on chemical doses provided by manufacturer for system cleaning after organic fouling events.
(b) Based on estimated polymer usage for dewatering and thickener units.
(c) Assuming elimination of 100 percent of RRCSD and GCSD WWTPs chemical costs. A negative cost represents cost savings relative to existing costs.

8.3.6.4 Equipment Repair and Replacement Costs

A summary of the estimated major equipment repair and replacement costs for Alternative 1c is provided in Table 8-23. Replacement costs for equipment with replacement frequencies of more than 20 years were excluded from this analysis (e.g., pumps). These costs are higher than those used for Alternative 1c in Chapter 4, with several categories estimated to require significantly higher costs.

Table 8-23. Equipment Repair and Replacement Costs for Alternative 1c			
Cost Element	Cost, $		Cost Basis Assumption
	Annual Basis	Cost Basis (if different)	
UV Equipment Replacement	36,000	-	Annual
Piping and Valve Maintenance and Replacement Cost	532,000	-	5 percent of mechanical and piping cost
MBR Membrane Cassette	69,000	-	Every 7 years
Instrumentation Maintenance	12,700	266,000	5 percent of instrumentation and controls cost, Year 15
Pumps Rebuild and Major Maintenance	22,000	230,800	30 percent of pump cost, Every 10 Years
15-Year MBR Replacements	18,300	384,000	Every 15 years
20-Year MBR Replacement	30,000	630,000	Every 20 years
20-Year Major Equipment Replacement (fine screens)	60,400	1,269,000	Every 20 years
RRCSD and GCSD Operations[(a)]	-948,600	-	Annual
Total Annual Costs	-$168,000	**-**	--

(a) Assumes a 90 percent cost reduction for parts replacement, permitting, and testing/analysis at the RRCSD WWTP; a 50 percent reduction in SCADA-related costs at RRCSD; and an 80 percent reduction in equipment maintenance costs at the existing GCSD WWTP.

8.3.6.5 Total Additional Annual O&M Costs

Total additional annual O&M costs are provided in Table 8-24 based on the information presented in the previous sections. Also shown are estimated cost shares, using the following approach:

- For treatment and recycled water costs, costs are divided between RRCSD and FWD/GSCD based on the facility where the costs are incurred.
- Routine O&M for conveyance refers to the major conveyance pipelines, and those costs are divided proportional to peak flows.
- For collection system costs, any new O&M is for the unsewered communities, so those are shown assigned solely to the unsewered communities.

Table 8-24. Additional Annual O&M Costs for Alternative 1c				
Service Area	RRCSD, $	FWD/GCSD, $		Total Annual OpEx, $
Treatment/Recycled Water				
Power	-218,000	429,000		211,000
Labor	-2,964,000	-16,000		-2,980,000
Chemicals	-35,000	-13,000		-48,000
Major Parts Replacement	5,000	138,000		143,000[(a)]
Routine O&M for Treatment	-847,000	511,000		-336,000[(a)]
Total Treatment Annual OpEx	**-$4,059,000**	**$1,049,000**		**-$3,010,000**
Collection	**RRCSD**	**FWD/GSCD**	**Unsewered**	**Total**
Routine O&M for Conveyance	126,000	8,000	78,000	212,000[(a)]
Collection System O&M	-	-	2,679,000	2,679,000
Total Collection Annual OpEx	**$126,000**	**$8,000**	**$2,757,000**	**$2,891,000**

(a) These cost items comprise the total annual equipment repair and replacement cost in Table 8-23 with the addition of $188,000 a year for solids handling.
(b) Based on estimated costs shown in Table 8-5

8.3.6.6 Total 20-Year Present Worth of O&M Costs

The total 20-year, present-worth O&M costs for Alternative 1c are shown in Table 8-25. Additional details are provided in Appendices H-3 and H-4.

Table 8-25. Present Worth O&M Cost for Alternative 1c	
O&M Cost Component	Total 20 Year Cost, $ million
Power	4.4
Labor	-62.6
Chemicals	-1.0
Equipment Repair and Replacement	-3.5
Dewatered Solids Hauling	4.0
Unsewered Collection Systems	56.3
Total 20-Year, Present-Worth O&M Costs	**-$2.4**

8.3.7 Total Lifecycle Costs

A total lifecycle cost for Alternative 1c is calculated as shown in Table 8-26 using the OPTCC from Table 8-20 and total 20-year O&M costs from Table 8-25.

Table 8-26. Lifecycle Cost for Alternative 1c	
Cost Component	Cost, $ million
Total Project Capital Cost (CapEx)	806
Total Present Worth O&M Costs (OpEx)	-2.4
Total Lifecycle Cost	**$804**

8.3.8 Potential Annual Operating Costs per ESD

As with Alternative 1a, the additional operating costs (Table 8-24) can be combined with current operating costs to define potential future annual operating costs per ESD. The same methodology used for Alternative 1a was applied for this alternative and the results are shown in Table 8-27. These per parcel costs include estimated operating costs only and do not include any costs related to debt that may arise from the implementation of a regional project. Therefore, the costs should not be interpreted as the annual charges paid by a sanitation district customer.

Table 8-27. Total Estimated Annual O&M Costs for Alternative 1c

Category	RRCSD, $	FWD/GSCD, $	Unsewered. $	Total Annual OpEx, $
Current Annual O&M for Treatment	5.5 M[(a)]+ 0.7 M[(b)]	0.3 M[(b)]	0.6 M[(b)]	7.1 M
Additional Annual O&M for Treatment	-4.1 M[(c)]+ 0.5 M[(d)]	0.2 M[(d)]	0.4 M[(d)]	-3.0 M
Current Collection System O&M	3.3 M[(e)]	0.9 M[(e)]	-	4.2 M
Additional Collection System O&M	0.1 M	-	2.8 M	2.9 M
Total Annual OpEx	**$6.0 M**	**$1.4 M**	**$3.8 M**	$11.2 M
Total Annual OpEx per ESD	**$1,700**	**$800**	**$1,200**	

(a) Current annual O&M from RRCSD FY 24/25 budget.
(b) Current FWD/GSCD annual O&M costs split amongst proposed future users (proportioned by ESDs).
(c) Savings from ceasing operations of RRCSD WWTP.
(d) Additional cost for operating new FWD system (above existing cost). Total cost to operate new FWD system is: $2.4 million.
(e) Current annual O&M from FY 24/25 budgets.

8.4 ALTERNATIVE 2A

Alternative 2a includes conveying untreated West County flows to the Windsor WWTP for treatment. This section presents a description of how the selected unsewered community clusters would be incorporated into this regional strategy, the associated basis of design for the facility improvements, a summary of the required facility improvements, site layout, project costs, O&M costs and total lifecycle costs.

8.4.1 Incorporation of Unsewered Clusters

Under Alternative 1c the selected unsewered community clusters would be incorporated into the regional facilities as follows:

- Clusters 1, 2, 3, and 12 would be directed to a pump station at the existing RRCSD WWTP site that also conveys the RRCSD flows to the Windsor WWTP.
- Clusters 4 through 7 would connect directly to the force main between the RRCSD WWTP site and the Windsor WWTP.
- Cluster 11 would initially be conveyed to the OCSD pump station, combined with OCSD flows, and directed to a new pump station at the GCSD WWTP site that also conveys GCSD flows to the FWD WWTP.
- Cluster 10 would connect directly to the force main between OCSD and GCSD.
- Clusters 8 and 9 would be directed to a new pump station at the FWD WWTP site that also conveys FWD/GCSD/OCSD/Cluster 10-11 flows to the Windsor WWTP.

8.4.2 Basis of Design

The flows and loads of interest for design of the new treatment facilities under Alternative 2a are the same as for Alternative 1c with the difference being ultimate conveyance to and treatment at the Windsor WWTP instead of the FWD WWTP. These flows and loads of interest were presented in Table 8-17[25].

8.4.3 Required Facility Improvements

This section addresses the required improvements to convert provide EQ at the RRCSD, GSCD, and FWD treatment facilities along with the estimated connection fee to cover costs of expanded treatment at the Windsor WWTP. These improvements are as follows:

- The existing storage ponds and aeration basins at the RRCSD would be modified to provide equalization of RRCSD service area flows[26]. A new influent control structure and internal pipelines would also be needed.
- The GCSD headworks will be upgraded with a new mechanical screening facility.

[25] These flows and loads reflect contributions from 5,319 ESDs from West County and 3,128 ESDs from the unsewered communities, totaling 8,447 ESDs. The estimate of unsewered ESDs is based on an approach used for the Monte Rio feasibility study.

[26] It is assumed that flows could be equalized to 3.5 mgd. Unsewered flows would not be equalized.

- The existing GCSD and FWD treatment ponds would be reconfigured to provide EQ at each site[27]. Required infrastructure for this conversion includes:
  - New influent control structures at the GCSD site
  - A new drain pump for the FWD ponds
  - A new flow control structure at the FWD site to allow flexible flow direction within the facility (e.g., directing flow to the ponds or pump station, or combining flows)
  - Additional internal pipelines within the facilities
- A connection/capacity fee of $111.0 million will be paid to Windsor to cover the cost of constructing new facilities[28]. and this capacity cost split between RRCSD, FWD/GCSD and the unsewered communities in proportion to their ADWF values.

Site layouts for Alternative 2a will mirror those already presented in Chapter 4. The infrastructure required to convert the existing ponds at the RRCSD and GCSD WWTPs into EQ ponds is similar to Alternative 1c and is illustrated on Figures 4-4 and 4-5, respectively, as noted with Alternative 1c. The proposed infrastructure improvements to convert the existing treatment ponds at the FWD WWTP to EQ ponds are the same as those presented in Chapter 4 (Figure 4-8).

8.4.4 Conveyance Infrastructure

Relevant conveyance infrastructure includes collection system conveyance for the unsewered parcels, raw wastewater conveyance to the Windsor WWTP and potential infrastructure for the return of recycled water flows from the Windsor system.

8.4.4.1 Collection System Infrastructure for Unsewered Community Clusters

A conceptual alignment is shown on Figure 8-8 of the new cluster connection pipelines and associated conveyance infrastructure to the associated WWTPs under Alternative 2a. The main force main alignment would be the same as without the unsewered flows (Figure 3-7). In addition, each cluster would have a new pipeline connection as summarized in Table 8-28.

Table 8-28. Sizing of Conveyance Infrastructure from Unsewered Areas for Alternative 2a

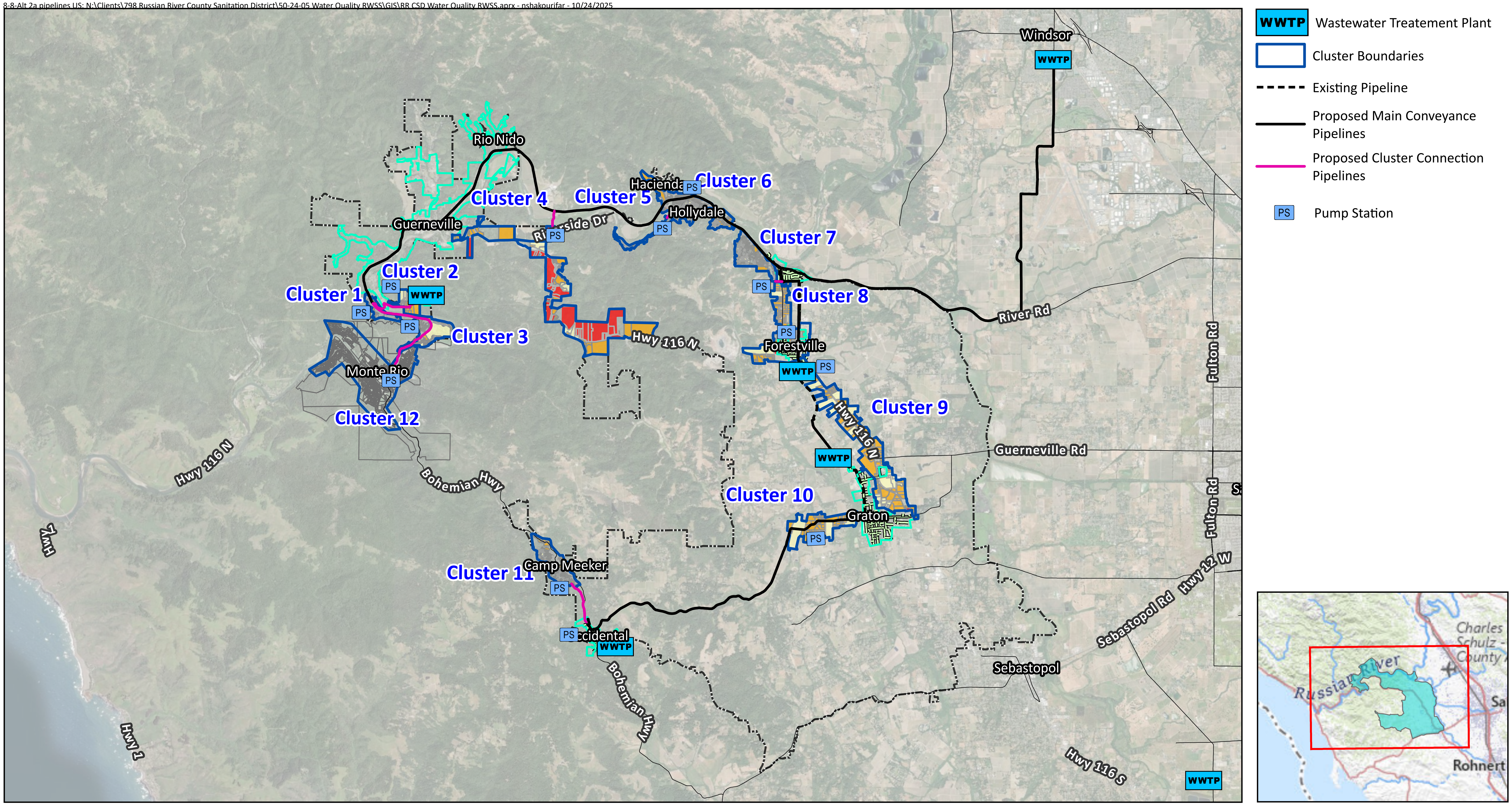
Cluster(s)[(a)]	Pipeline Distance, miles	Pipeline Diameter, inches
2, 4, 5, 7, 8, 9 & 11	1.6	4
12	1.2	6
3	0.8	8
Total Pipeline Length	**3.6**	

(a) Clusters 1, 6 and 8 connect directly to the RRCSD to FWD pipeline, and Cluster 10 connects directly to the OCSD to GCSD pipeline.

[27] It is assumed the GCSD and FWD flows could be equalized to the maximum 30-day average values (0.9 mgd combined total). Unsewered flows would not be equalized.

[28] Windsor staff provided construction cost of improvements to estimate this fee and indicated that an additional 25 percent should be included to define total project costs.

8-8-Alt 2a pipelines US: N:\Clients\798 Russian River County Sanitation District\50-24-05 Water Quality RWSS\GIS\RR CSD Water Quality RWSS.aprx - nshakourifar - 10/24/2025



Prepared by:

WEST YOST

Prepared for:

Russian River County Sanitation District
Water Quality and Recycled Water Supply Feasibility Study

Sonoma Water

Proposed Pipeline Alignments
Alternative 2a

Figure 8-8

8.4.4.2 Raw Wastewater Conveyance to Windsor WWTP

The following major conveyances will be required for discharge or transfer of effluent and recycled water:

- New 4.3 mgd, 0.9 mgd and 1.4 mgd discharge pump stations would be constructed at the RRCSD, GCSD and FWD facilities, respectively, for raw wastewater export.
- 18.9 miles of conveyance pipeline for raw wastewater between the RRCSD and FWD/GCSD sites to a junction point and then to the Windsor WWTP. The cost of this conveyance is shared between RRCSD and FWD/GCSD facilities, based on the proportion of flow each contributes to the combined conveyance system beyond the junction.
- Rehabilitation of the existing 8-inch ductile iron pipeline between the GCSD and FWD WWTPs, and a new 0.8-mile, 6-inch extension of the existing HDPE pipeline.

Without unsewered flows, this alternative included 18.9 miles of 20- to 24-inch conveyance pipeline. The total conveyance pipeline length would remain as 18.9 miles, with the following components:

- 1.0 mile of 16-inch diameter
- 9.9 miles of 24-inch diameter
- 8.0 miles of 30-inch diameter

8.4.4.3 Potential Recycled Water Infrastructure

Chapter 6 introduces the facilities required to return exported water back to the FWD/GSCD recycled water system for local use. To support the return of recycled water, the following additional infrastructure was identified:

- A 3.0 mgd pump station located near the existing outfall in Mark West Creek, to accommodate estimated peak day recycled water flow.
- A 3.7-mile, 12-inch diameter pipeline that extends southward down Trenton-Healdsburg Road from the existing outfall location, then turns westward along River Road to Trenton Road,[29] then along Trenton Road to Covey Road, and then southward along Covey Road/Forestville Street, terminating at the FWD WWTP recycled water storage pond.

[29] The new Windsor outfall to Russian River could be accommodated by extending a pipeline from this location along River Road to a location northwest of Forestville and downstream of Sonoma Water's Mirabel water supply intake. The extension and outfall are not included in this analysis. If a regional project were to be implemented with Windsor, construction of a new outfall and the associated recycled water extension should be evaluated. Windsor staff have noted that if an outfall were to be constructed as part of the project, these costs could potentially offset some of the connection fees that have been identified by the Town.

In addition, 185 acre-feet of additional recycled water storage would be needed. A water balance has not been developed specific to this alternative, but it is assumed recycled water usage would be similar to that under Alternative 1c. The water balance for Alternative 1c indicates no additional users (land application area) would be needed, but 185 AF of additional recycled water storage and extension of the existing system to the quarries near Forestville would be required.

Because of the uncertainty around the return of recycled water, the capital cost for Alternative 2a discussed below is presented both with and without the additional infrastructure to support return of recycled water.

8.4.5 Project Costs

The OPCC and OPTCC for Alternative 2a project elements are presented in Table 8-29, which also shows the estimated cost shares for RRCSD, FWD/GSCD and for unsewered communities. Additional details regarding these costs are provided in a Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendix G-3. The OPCC and OPTCC accounting for the potential infrastructure needed to return recycled water to the GCS/FWD system are presented in Table 8-30.

For both sets of capital costs, the following cost share approach was used:

- Costs of improvements needed to accommodate treatment of all anticipated flows and loads are split between existing users and new customers based on their respective portion of capacity provided.
- Cost of EQ improvements are applied to each community (i.e., RRCSD, GCSD and FWD).
- Any improvements or costs associated with collection systems or raw wastewater conveyance (including existing systems) are only applied to users of those systems (proportional to peak flow).

Table 8-29. OPCC and OPTCC for Alternative 2a

Facility Component	Components	Cost, $ million RRCSD	FWD/GCSD	Unsewered	Total[(a)]
Treatment		**$45.1**	**$29.2**	**$41.5**	**$115.8**
RRCSD	Convert storage ponds to EQ facility	0.3	--	--	0.3
FWD	Convert treatment ponds to EQ ponds	--	3.4	--	3.4
GCSD	Headworks improvements	--	0.8	0.1	0.9
	Convert treatment ponds to EQ facility	--	0.2	--	0.2
Connection Fee to Windsor		44.8	24.8	41.4	111.0
Conveyance		**$122.1**	**$22.1**	**$53.5**	**$197.7**
New Pump Stations	0.9 mgd pump station at GCSD for secondary effluent transfer to FWD	--	1.7	0.7	2.4
	1.4 mgd pump station at FWD for wastewater transfer to Windsor	--	1.8	1.0	2.8
	4.3 mgd pump station at RRCSD for wastewater transfer to Windsor	3.1	--	0.7	3.8
Pipeline	18.9-mile of 10 to 30-inch conveyance pipeline	119.0	15.7	45.7	180.4
	Pipelines connections between FWD/GCSD: • 0.8 mile, 6-inch pipeline extension of existing HDPE pipe • Rehab existing 1.7 mile, 8-inch pipeline between GCSD and FWD	--	2.9	1.0	3.9
	3.6 miles of 4-to-8-inch community conveyance lines	--	--	4.4	4.4
Unsewered Service Area Systems (Collection Systems and Dedicated Pump Stations)		**--**	**--**	**$362.5**	**$362.5**
	Engineer's Preliminary OPCC	**$167**	**$51**	**$458**	**$676**
Engineering Design, Environmental Planning and Studies, Permitting, Construction Management, ESDC and Legal and Admin Costs, 25 percent of OPCC (*applied to all*)		42	13	114	169
	Engineer's Preliminary OPTCC	**$209**	**$64**	**$572**	**$845**

(a) Project Phase-Level OPCC estimating contingency of 30 percent applied to all elements.

Table 8-30. OPCC and OPTCC for Alternative 2a with Recycled Water Return						
		Cost, $ million			
Facility Component	Components	RRCSD	FWD/GSCD	Unsewered	Total
Engineer's Preliminary OPTCC without Recycled Water Return		**$209**	**$64**	**$572**	**$845**
Recycled Water Infrastructure	5.1 miles of 12-inch diameter pipeline, including conveyance to quarries	4	3	5	12
	3.0 mgd pump station from Windsor outfall	1	1	1	3
	Recycled Water Storage (185 acre-feet)[a]	0-5[a]	0-3	0-7	0-15
Total Additional OPTCC[a]		**$5-10**	**$4-7**	**$6-13**	**$15-30**
Additional Soft Costs = 25 percent of OPCC[a]		1-3	1-2	2-3	4-8
Engineer's Preliminary OPTCC[a]		**$215-222**	**$69-73**	**$579-588**	**$864-883**

(a) Cost ranges shown with and without recycled water storage.

8.4.6 Operations and Maintenance Costs

This section provides a summary of the additional O&M costs associated with this alternative, focused on the following elements:

- Power costs
- Labor costs
- Chemical costs
- Equipment repair and replacement costs
- Windsor WWTP O&M rate costs

Following this summary of the additional O&M elements, the total additional O&M costs are presented along with the 20-year, present-worth lifecycle O&M cost. Additional details regarding these O&M costs are provided in the Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendices H-5 and H-6.

8.4.6.1 Power Costs

The annual power costs for Alternative 2a are summarized in Table 8-31. These costs account for increased energy demands for long-distance pumping and projected savings resulting from operational changes at the West County facilities.

Table 8-31. Annual Power Costs for Alternative 2a

Cost Element	Cost, $
Conveyance Pumps	128,500
RRCSD, GCSD and FWD WWTPs Operation[a]	-614,800
Total	**-$486,300**

(a) Assuming 95 percent of the current treatment power costs at RRCSD and 90 percent at FWD/GCSD would be eliminated.

8.4.6.2 Labor Costs

Under this alternative, similar to Alternative 1c, the following labor reductions are assumed:

- 75 percent reduction at RRCSD WWTP
- 90 percent reduction in operations labor and 50 percent reduction in administrative costs at the GCSD WWTP
- 80 percent reduction at the FWD WWTP

Based on these assumptions, the estimated annual labor cost savings is $3.6 million. This is unchanged from Chapter 4.

8.4.6.3 Chemical Costs

As shown in Table 8-32, since treatment processes are eliminated at the facilities, all existing chemical costs would be entirely saved for Alternative 2a. This is the same assumption used in Chapter 4.

Table 8-32. Annual Chemical Costs for Alternative 2a

Cost Element	Cost, $
RRCSD, GCSD, and FWD WWTPs Operation[(a)]	- 154,700
(a) Assuming elimination of 100 percent of chemical costs at RRCSD, GCSD and FWD WWTPs.	

8.4.6.4 Equipment Repair and Replacement Costs

A summary of the estimated major equipment repair and replacement costs for Alternative 2a is provided in Table 8-33. Replacement costs for equipment with replacement frequencies of more than 20 years were excluded from this analysis (e.g., pumps). These costs are higher than those used for Alternative 2a in Chapter 4 because of additional piping and pump capital cost from which the operating costs are calculated.

Table 8-33. Equipment Repair and Replacement Costs for Alternative 2a

Cost Element	Cost, $		Cost Basis Assumption
	Annual Basis	Cost Basis (if different)	
Piping and Valve Maintenance and Replacement Cost	315,600	-	5 percent of mechanical and piping cost
Pumps Rebuild and Major Maintenance	15,000	158,000	30 percent of pump cost, Every 10 Years
RRCSD, GCSD and FWD WWTPs Operation[(a)]	-995,600	-	Annual
Total Annual Costs	**-$665,000**	**-**	--

(a) Assumes a 90 percent cost reduction for parts replacement, permitting, and testing/analysis at the RRCSD WWTP, a 50 percent reduction in SCADA-related costs at RRCSD, 80 percent reduction in equipment maintenance costs at the existing GCSD WWTP, and 60 percent reduction in existing equipment maintenance costs at the FWD WWTP.

8.4.6.5 Windsor WWTP O&M Rate Costs

The estimated annual charge rates for treatment of 1.1 mgd ADWF at the Windsor WWTP is approximately $7.9 million, based on the rate currently paid for Sonoma Water's agreement for discharges from the Airport/Larkfield/Wikiup Sanitation Zone. These rates are expected to increase significantly over the next several years, likely to support the construction of new treatment facilities. However, the current analysis accounts for new facility capital costs within the connection fee.

8.4.6.6 Total Additional Annual O&M Costs

Total additional annual O&M costs are provided in Table 8-34 based on the information presented in the previous sections. Also shown are estimated cost shares, using the following approach:

- For treatment and recycled water costs, costs are divided between RRCSD, FWD/GSCD and unsewered users based on the proportional flows and loads.
- Routine O&M for conveyance refers to the major conveyance pipelines, and those costs are divided proportional to peak flows.
- For collection system costs, any new O&M is for the unsewered communities, so those are shown assigned solely to the unsewered communities.

Table 8-34. Additional Annual O&M Costs for Alternative 2a

Service Area	RRCSD, $	FWD/GCSD, $	Unsewered, $	Total Annual OpEx, $
Treatment/Recycled Water				
Power	-317,000	-171,000		-488,000
Labor	- 2,964,000	-598,000		-3,562,000
Chemicals	-35,000	-120,000		-155,000
Major Parts Replacement	4,800	5,100		9,900[(a)]
Routine O&M for Treatment[(b)]	-846,000	-132,000		-978,000[(a)]
Windsor O&M Costs	2,700,000	1,500,000	3,600,000	7,800,000
Total Treatment Annual OpEx	**- $1,457,200**	**$484,100**	**$3,600,000**	**$2,626,900**
Collection				
Routine O&M for Conveyance	186,000	33,000	79,000	298,000[(a)]
Collection System O&M[(c)]	-	-	2,679,000	2,679,000
Total Collection Annual OpEx	**$186,000**	**$33,000**	**$2,758,000**	**$2,977,000**

(a) These cost items comprise the total annual equipment repair and replacement cost in Table 8-33.
(b) Routine O&M for treatment accounts for both paying proportional Windsor rates and proportional savings from reduced routine O&M at the West County facilities.
(c) Based on estimated costs shown in Table 8-5.

8.4.6.7 Total 20-Year Present Worth of O&M Costs

The total 20-year, present-worth O&M costs for Alternative 2a are shown in Table 8-35. Additional details are provided in Appendices H-5 and H-6.

Table 8-35. Present Worth O&M Cost for Alternative 2a

O&M Cost Component	Total 20 Year Cost, $ million
Power	-10.3
Labor	-74.8
Chemicals	-3.3
Equipment Repair and Replacement	-14.1
Windsor O&M Rates	163.8
Unsewered Collection Systems	56.3
Total 20-Year, Present-Worth O&M Costs	**$118**

8.4.7 Total Lifecycle Costs

A total lifecycle cost for Alternative 2a is calculated as shown in Table 8-36 using the OPTCC from Table 8-29 and total 20-year O&M costs from Table 8-35.

Table 8-36. Lifecycle Cost for Alternative 2a

Cost Component	Cost, $ million
Total Project Capital Cost (CapEx)	**845-883**[(a)]
Total Present Worth O&M Costs (OpEx)	118[(b)]
Total Lifecycle Cost	**$963-1,001**[(a)]

(a) Range shown based on CapEx with and without recycled water return.
(b) Additional OpEx for recycled water facilities not accounted for.

8.4.8 Potential Annual Operating Costs per ESD

As with the other alternatives, the additional operating costs (Table 8-34) can be combined with current operating costs to review total operating costs per ESD. The same methodology used for Alternative 1c was applied for this alternative, as well (i.e., all unsewered communities combined). These per parcel costs include estimated operating costs only and do not include any costs related to debt that may arise from the implementation of a regional project. Therefore, the costs should not be interpreted as the annual charges paid by a sanitation district customer.

Table 8-37. Total Estimated Annual O&M Costs for Alternative 2a				
Category	RRCSD, $	FWD/GCSD, $	Unsewered, $	Total Annual OpEx, $
Current Annual O&M for Treatment	5.5 M[(a)]	1.6 M[(a)]	-	7.1 M
Additional Annual O&M for Treatment	- 1.5 M	0.5 M	3.6 M	2.6 M
Current Collection System O&M	3.3 M[(a)]	0.9 M[(a)]	-	4.2 M
Additional Collection System O&M	0.2 M	0.03 M	2.8 M	3.0 M
Total Annual OpEx	**$7.5 M**	**$3.0 M**	**$6.4 M**	**$16.9 M**
Total Annual OpEx per ESD	**$2,100**	**$1,800**	**$2,000**	

(a) Current annual O&M from FY 24/25 budgets.

8.5 ALTERNATIVE 2B

Alternative 2b includes conveying untreated West County flows to the Laguna WWTP for treatment. This section presents a description of how the selected unsewered community clusters would be incorporated into this regional strategy, the associated basis of design for the facility improvements, a summary of the required facility improvements, site layout, project costs, O&M costs and total lifecycle costs.

8.5.1 Incorporation of Unsewered Clusters

The unsewered community clusters would be added in as follows:

- Clusters 1, 2, 3, and 12 would connect to a pump station that also conveys the RRCSD flows to the Laguna WWTP site.
- Clusters 4 through 7 would connect downstream to the same force main to the Laguna WWTP.
- Cluster 8 would be directly pumped first to the FWD WWTP site before combining with FWD flows in a pump station to the main force main conveying the flows detailed above.
- Cluster 9 would be conveyed initially to the GCSD pump station before being pumped into the force main from the GCSD pump station.
- Cluster 11 would initially be conveyed via the OCSD pump station and force main before traveling to the GCSD WWTP site with Cluster 10 and GCSD flows for conveyance to a pump station conveying OCSD, GCSD and Clusters 9, 10 and 11 flows to the Laguna WWTP.

8.5.2 Basis of Design

The flows and loads of interest for design of the new treatment facilities under Alternative 2b are the same as for Alternative 1c with the difference being ultimate conveyance to and treatment at the Laguna WWTP instead of the FWD WWTP. These flows and loads of interest were presented in Table 8-17. As with Alternative 2a, these flows and loads reflect contributions from 5,319 ESDs from West County and 3,128 ESDs from the unsewered communities, totaling 8,447 ESDs.

8.5.3 Required Facility Improvements

This section addresses the required improvements to convert provide EQ at the RRCSD, GSCD, and FWD treatment facilities along with the estimated connection fee to cover costs of expanded treatment at the Laguna WWTP. These improvements are as follows:

- The existing storage ponds and aeration basins at the RRCSD would be modified to provide equalization of RRCSD service area flows.[30] A new influent control structure and internal pipelines would also be needed.
- The GCSD headworks will be upgraded with a new mechanical screening facility.
- The existing GCSD and FWD treatment ponds would be reconfigured to provide EQ at each site.[31] Required infrastructure for this conversion includes:
  - New influent control structures at the GCSD site
  - A new drain pump for the FWD ponds
  - A new flow control structure at the FWD site to allow flexible flow direction within the facility (e.g., directing flow to the ponds or pump station, or combining flows).
  - Additional internal pipelines within the facilities.
- An estimated connection/capacity fee of $122.6 million will need to be paid to buy capacity in the Laguna WWTP.[32][33] These costs would be split between RRCSD, FWD/GCSD and the unsewered communities in proportion to their ADWF values.

Like Alternative 2a, site layouts showing the proposed infrastructure upgrades needed to convert the facilities into EQ facilities have been provided on Figures 4-4, 4-5 and 4-8.

8.5.4 Conveyance Infrastructure

Similar to Alternative 2a, relevant conveyance infrastructure includes collection system conveyance for the unsewered parcels, raw wastewater conveyance to the Santa Rosa collection system, and return of recycled water from the Santa Rosa system.

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[30] It is assumed that flows could be equalized to 3.5 mgd. Unsewered flows would not be equalized.

[31] It is assumed the GCSD and FWD flows could be equalized to the maximum 30-day average values (0.9 mgd combined total). Unsewered flows would not be equalized.

[32] For consistency with the approach used to define connection fee costs for Windsor, the 25 percent estimate applied to define total project cost has also been assumed.

[33] Chapters 3 and 4 also discussed a $5 million nominal cost to Santa Rosa as a placeholder for expansion of storage. If expansion of the Santa Rosa recycled water system is determined to be needed to support disposal of West County flows, the more specific infrastructure and costs identified in Chapter 6 would replace the $5 million placeholder previously defined. Therefore, this placeholder has been removed from the estimated connection fee costs.

8.5.4.1 Collection System Infrastructure for Unsewered Community Clusters

A conceptual alignment is shown on Figure 8-9 of the new cluster connection pipelines and associated conveyance infrastructure to the associated WWTPs under Alternative 2b. The main force main alignment would change from that favored in Chapter 3 (Figure 3-8); specifically, between Guerneville and Forestville, the northern alignment would be favored. In addition, each cluster would have a new pipeline connection as summarized in Table 8-28.

Table 8-38. Sizing of Conveyance Infrastructure from Unsewered Areas for Alternative 2a

Cluster(s)[(a)]	Pipeline Distance, miles	Pipeline Diameter, inches
2, 4, 5, 9 & 11	1.1	4
7 & 12	1.3	6
1 & 3	0.8	8
Total Pipeline Length	**3.2**	

(a) Clusters 1, 6 and 8 connect directly to the RRCSD to FWD pipeline, and Cluster 10 connects directly to the OCSD to GCSD pipeline.

Details of the conveyance from the clusters would be the same as under Alternative 1c, already presented in Table 8-19.

8.5.4.2 Raw Wastewater Conveyance to Santa Rosa Collection System

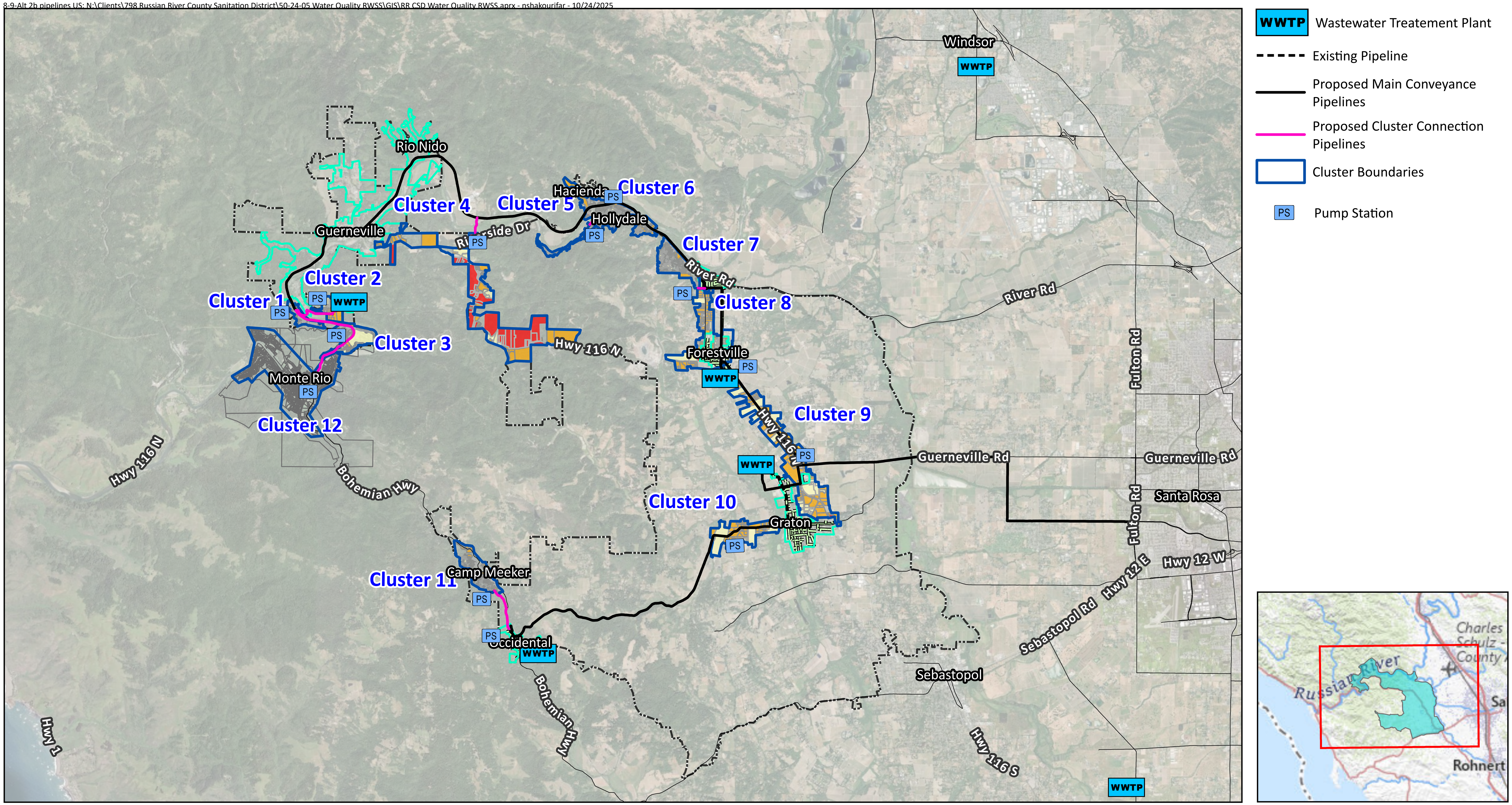
The following major conveyances will be required for discharge or transfer of effluent and recycled water:

- New 4.3 mgd, 0.9 mgd and 5.4 mgd discharge pump stations would be constructed at the RRCSD, GCSD and FWD facilities, respectively, to support raw wastewater export.
- 21 miles of 16- to 30-inch conveyance pipeline for raw wastewater would be constructed between the RRCSD and FWD/GCSD sites to a junction point and then to the Santa Rosa collection system near the intersection of Hall and Fulton Roads, as further discussed with conveyance infrastructure below. The cost of this conveyance is shared between RRCSD and FWD/GCSD facilities, based on the proportion of flow each contributes to the combined conveyance system beyond the junction.

Without unsewered flows, this alternative included 18.0 miles of 16- to 24-inch conveyance pipeline. The total conveyance pipeline length would increase to 20.8 miles, with the following components used for raw wastewater conveyance:

- 1.0 mile of 16-inch diameter
- 13.5 miles of 24-inch diameter
- 6.3 miles of 30-inch diameter

8-9-Alt 2b pipelines US: N:\Clients\798 Russian River County Sanitation District\50-24-05 Water Quality RWSS\GIS\RR CSD Water Quality RWSS.aprx - nshakourifar - 10/24/2025



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WEST YOST

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Prepared for:

Russian River County Sanitation District
Water Quality and Recycled
Water Supply Feasibility Study

Sonoma Water

Proposed Pipeline Alignments
Alternative 2b

Figure 8-9

8.5.4.3 Potential Recycled Water Infrastructure

Chapter 6 also introduces the possibility of returning exported water for local recycled water use. To support the return of recycled water, the following additional infrastructure was identified:

- A 3.0 mgd pump station located near the existing recycled water storage pond adjacent to Santa Rosa Creek, to accommodate estimated peak day recycled water flow.
- A 3.6-mile, 12-inch diameter pipeline that extends westward to reach Guerneville Road, then continues westward along Guerneville Road to Highway 116, then loops down Highway 116, along Green Valley Road, and up the West County trail, terminating at the GCSD recycled storage ponds.

In addition, 185 acre-feet of additional recycled water storage would be needed. The Santa Rosa system may be able to accommodate some or all of that storage. A water balance has not been developed specific to this alternative, but it is assumed recycled water usage would be similar to that under Alternative 1c. The water balance for Alternative 1c indicates that no additional users (land application area) would be needed, but 185 AF of additional recycled water storage and expansion of the conveyance system to incorporate serve the quarries would be needed (an additional 1.4 miles of 12-inch pipeline).[34]

Because of the uncertainty around the return of recycled water, the capital cost for Alternative 2b discussed below is presented both with and without the additional infrastructure to support return of recycled water.

8.5.5 Project Costs

The OPCC and OPTCC for Alternative 2b project elements are presented in Table 8-39, which also shows the estimated cost shares for RRCSD, FWD/GSCD and for unsewered communities. Additional details regarding these costs are provided in a Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendix G-4. The same cost share approach is used as for Alternative 2a. The OPCC and OPTCC accounting for return or recycled water to the FWD/GSCD system are presented in Table 8-40. Ranges are shown to allow for the possibility that some or all of the recycled water storage could be accommodated within the Santa Rosa system.

[34] Chapters 3 and 4 included a nominal cost as a placeholder for expansion of recycled water storage under Alternative 2b. For this chapter, the costs identified in Chapter 6 would replace the $5 million placeholder previously defined.

Table 8-39. OPCC and OPTCC for Alternative 2b

Facility Component	Components	Cost, $ million			
		RRCSD	FWD/GCSD	Unsewered	Total[a]
Treatment		**$47.8**	**$30.7**	**$48.9**	**$127.4**
RRCSD	Convert storage ponds to EQ facility	0.3	--	--	0.3
FWD	Convert treatment ponds to EQ ponds	--	3.4	--	3.4
GCSD	Headworks improvements	--	0.8	0.1	0.9
	Convert treatment ponds to EQ facility	--	0.2	--	0.2
Santa Rosa WWTP Connection/Capacity Fee		47.5	26.3	48.8	122.6
Conveyance		**$119.8**	**$13.2**	**$48.9**	**$181.9**
New Pump Stations	0.9 mgd pump station at GCSD for secondary effluent transfer to Santa Rosa	--	1.7	0.7	2.4
	5.4 mgd pump station at FWD for wastewater transfer to Santa Rosa	2.7	0.2	1.2	4.1
	4.3 mgd pump station at RRCSD for wastewater transfer to FWD	3.1	--	0.7	3.8
Pipeline	21-mile of 16 to 30-inch conveyance pipeline	114.1	11.4	42.7	168.1
	3.2 miles of 4 to 8 inch community conveyance lines	--	--	3.5	3.5
Unsewered Service Area Systems (Collection Systems and Dedicated Pump Stations)		**--**	**--**	**$362.5**	**$362.5**
	Engineer's Preliminary OPCC	**$168**	**$44**	**$460**	**$672**
Engineering Design, Environmental Planning and Studies, Permitting, Construction Management, ESDC and Legal and Admin Costs, 25 percent of OPCC (*applied to all*)		42	11	115	168
	Engineer's Preliminary OPTCC	**$210**	**$55**	**$575**	**$840**

(a) Project Phase-Level OPCC estimating contingency of 30 percent applied to all elements.

Table 8-40. OPCC and OPTCC for Alternative 2b with Recycled Water Return					
		Cost, $ million			
Facility Component	Components	RRCSD	FWD/GCSD	Unsewered	Total[a]
Engineer's Preliminary OPTCC without Recycled Water Return[a]		**$210**	**$55**	**$575**	**$840**
Recycled Water Infrastructure	5.0 miles of 12-inch diameter pipeline	8	1	3	12
	3.0 mgd pump station from Santa Rosa Reservoir	2	<1	1	3
	Recycled Water Storage (185 acre-feet)[b]	0-5[a]	0-3	0-7	0-15
	Total Additional OPTCC[b]	**$10-15**	**$1-4**	**$4-11**	**$15-30**
Additional Soft Costs = 25 percent of OPCC[a]		3-4	0-1	1-3	4-8
	Engineer's Preliminary OPTCC[b]	**$223-229**	**$56-60**	**$580-589**	**$845-878**

(a) OPTCC from Table 8-39 with the nominal Santa Rosa storage removed.
(b) Cost ranges shown with and without recycled water storage provided by Santa Rosa.

8.5.6 Operations and Maintenance Costs

This section provides a summary of the additional O&M costs associated with this alternative, focused on the following elements:

- Power costs
- Labor costs
- Chemical costs
- Equipment repair and replacement costs
- Laguna WWTP O&M rate costs

Following this summary of the additional O&M elements, the total additional O&M costs are presented along with the 20-year, present-worth lifecycle O&M cost. Additional details regarding these O&M costs are provided in the Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendices H-7 and H-8.

8.5.6.1 Power Costs

The annual power costs for Alternative 2b are summarized in Table 8-41. These costs account for increased energy demands for long-distance pumping and projected savings resulting from operational changes at the West County facilities.

Table 8-41. Annual Power Costs for Alternative 2b	
Cost Element	Cost, $
Conveyance Pumps	302,200
RRCSD, GCSD and FWD WWTPs Operation[a]	-614,800
Total	**-$312,600**

(a) Assuming 95 percent of the current treatment power costs at RRCSD and 90 percent at FWD/GCSD would be eliminated.

8.5.6.2 Labor Costs

The same labor cost reductions are assumed as under Alternative 2a, with the same estimated annual labor cost savings of $3.6 million. This is unchanged from Chapter 4.

8.5.6.3 Chemical Costs

The same reduction in chemical costs is assumed as under Alternative 2a ($154,700 a year savings), which is the same assumed in Chapter 4 for Alternatives 2a and 2b.

8.5.6.4 Equipment Repair and Replacement Costs

A summary of the estimated major equipment repair and replacement costs for Alternative 2b is provided in Table 8-42. Replacement costs for equipment with replacement frequencies of more than 20 years were excluded from this analysis (e.g., pumps). These costs are higher than those used for Alternative 2b in Chapter 4 because of additional piping and pump capital cost from which the operating costs are calculated.

Table 8-42. Equipment Repair and Replacement Costs for Alternative 2b

Cost Element	Cost, $		Cost Basis Assumption
	Annual Basis	Cost Basis (if different)	
Piping and Valve Maintenance and Replacement Cost	315,600	-	5 percent of mechanical and piping cost
Pumps Rebuild and Major Maintenance	12,900	135,000	30 percent of pump cost, Every 10 Years
RRCSD, GCSD and FWD WWTPs Operation[(a)]	-995,600	-	Annual
Total Annual Costs	**-$661,000**	**--**	--

(a) Assumes a 90 percent cost reduction for parts replacement, permitting, and testing/analysis at the RRCSD WWTP, a 50 percent reduction in SCADA-related costs at RRCSD, 80 percent reduction in equipment maintenance costs at the existing GCSD WWTP, and 60 percent reduction in existing equipment maintenance costs at the FWD WWTP.

8.5.6.5 Laguna WWTP O&M Rate Costs

The estimated annual rates for treatment of 1.1 mgd ADWF at Santa Rosa's Laguna WWTP are approximately $8.8 million, based on a review of published wastewater rates and discussions with Santa Rosa staff.

8.5.6.6 Total Additional Annual O&M Costs

Total additional annual O&M costs are provided in Table 8-43 based on the information presented in the previous sections. Also shown are estimated cost shares, using the same approach as for Alternative 2a.

Table 8-43. Additional Annual O&M Costs for Alternative 2b				
Service Area	RRCSD, $	FWD/GCSD, $	Unsewered, $	Total Annual OpEx, $
Treatment/Recycled Water				
Power	-149,000	-165,000		-314,000
Labor	-2,964,000	-598,000		-3,562,000
Chemicals	-35,000	-120,000		-155,000
Major Parts Replacement	5,000	8,000		13,000[a]
Routine O&M for Treatment[b]	2,153,000	1,570,000		7,823,000[a]
Santa Rosa O&M Costs	3,000,000	1,700,000	4,100,000	8,800,000
Total Treatment Annual OpEx	**- $990,000**	**$695,000**	**$4,100,000**	**$3,805,000**
Collection				
Routine O&M for Conveyance	201,000	20,000	82,000	303,000[a]
Collection System O&M[c]	-	-	2,679,000	2,679,000
Total Collection Annual OpEx	**$201,000**	**$20,000**	**$2,761,000**	**$2,982,000**

(a) These cost items comprise the total annual equipment repair and replacement cost in Table 8-42.
(b) Routine O&M for treatment accounts for both paying proportional Santa Rosa rates and proportional savings from reduced routine O&M at the West County facilities.
(c) Based on estimated costs shown in Table 8-5.

8.5.6.7 Total 20-Year Present Worth of O&M Costs

The total 20-year, present-worth O&M costs for Alternative 2b are shown in Table 8-44. Additional details are provided in Appendices H-7 and H-8.

Table 8-44. Present Worth O&M Cost for Alternative 2b	
O&M Cost Component	Total 20 Year Cost, $ million
Power	-6.6
Labor	-74.8
Chemicals	-3.3
Equipment Repair and Replacement	-13.9
Santa Rosa Rate	184.8
Unsewered Collection Systems	56.3
Total 20-Year, Present-Worth O&M Costs	**$143**

8.5.7 Total Lifecycle Costs

A total lifecycle cost for Alternative 2b is calculated as shown in Table 8-45 using the OPTCC from Table 8-39 and total 20-year O&M costs from Table 8-44.

Table 8-45. Lifecycle Cost for Alternative 2b	
Cost Component	Cost, $ million
Total Project Capital Cost (CapEx)	840 - 878[a]
Total Present Worth O&M Costs (OpEx)	143[b]
Total Lifecycle Cost	**983 – 1,021**[a]

(a) Range shown based on CapEx with and without recycled water return.
(b) Additional OpEx for recycled water facilities not accounted for.

8.5.8 Potential Annual Operating Costs per ESD

As with the other alternatives, the additional operating costs (Table 8-43) can be combined with current operating costs to review total operating costs per ESD. The same methodology used for Alternatives 1c and 2a was applied for this alternative, as well (i.e., all unsewered communities combined). These per parcel costs include estimated operating costs only and do not include any costs related to debt that may arise from the implementation of a regional project. Therefore, the costs should not be interpreted as the annual charges paid by a sanitation district customer.

Table 8-46. Total Estimated Annual O&M Costs for Alternative 2b

Category	RRCSD, $	FWD/GCSD, $	Unsewered, $	Total Annual OpEx, $
Current Annual O&M for Treatment	5.5 M[a]	1.6 M[a]	-	7.1 M
Additional Annual O&M for Treatment	- 1.0 M	0.7 M	4.1 M	3.8 M
Current Collection System O&M	3.3 M[a]	0.9 M[a]	-	4.2 M
Additional Collection System O&M	0.2 M	0.02 M	2.8 M	3.0 M
Total Annual OpEx	**$8.0 M**	**$3.2 M**	**$6.9 M**	**$18.1 M**
Total Annual OpEx per ESD	**$2,200**	**$1,900**	**$2,200**	

(a) Current annual O&M from FY 24/25 budgets.

8.6 ALTERNATIVE 3B

Alternative 3b involves conveying all untreated wastewater flows from the RRCSD service areas to the Windsor WWTP for treatment. Flows from FWD, GCSD, and OCSD would be treated at a combined FWD/GCSD WWTP and recycled water system that is sized to accommodate zero surface water discharge (i.e., in lieu of making treatment improvements to meet the nitrogen effluent limitations that have been prescribed for surface discharge). This section presents a description of how the selected unsewered community clusters would be incorporated into this regional strategy, the associated basis of design for the facility improvements, a summary of the required facility improvements, site layout, project costs, O&M costs and total lifecycle costs.

8.6.1 Incorporation of Unsewered Clusters

Several of the unsewered community clusters would be added in with RRCSD flows as follows:

- Clusters 1, 2, 3, and 12 would connect to a pump station that also conveys the RRCSD flows to the Windsor WWTP (same as Alternative 2a).
- Clusters 4 through 7 would connect downstream to the same force main to the Windsor WWTP (same as Alternative 2a).

For Alternative 3b, flows from FWD, GCSD, and OCSD would be treated at a combined FWD/GCSD WWTP and recycled water system sized to accommodate zero surface water discharge, as with Alternative 1a. The remaining unsewered community clusters would be added in with the West County flows as follows:

- Cluster 8 would connect to the FWD WWTP (different from Alternative 1a).
- Clusters 9 through 11 would connect ultimately to the GCSD WWTP for secondary treatment (same as Alternative 1a).
- Cluster 11 would initially be conveyed via the OCSD pump station and force main before traveling to the GCSD WWTP site with Cluster 10 and GCSD flows for secondary treatment at the GCSD WWTP (same as Alternative 1a).

This section presents a description of the basis of design for the facility improvements, a summary of the required facility improvements, site layout, project costs, O&M costs and total lifecycle costs.

8.6.2 Basis of Design

The relevant design flows and loads for Alternative 3b are presented in Table 8-47 for the respective components to the Windsor and FWD WWTPs.

Table 8-47. Future West County Flows and Loads Relevant to Alternative 3b				
Scenario	ADWF, mgd	Relevant Peak Flow Condition	Peak Flow, mgd	Maximum 30 Day BOD Load, lb/day
Flows and Loads to Windsor WWTP				
Projected RRCSD Flows and Loads	0.38	PDF	4.2[(a)]	2,620
Clusters 1-7 & 12	0.37	Peak Flow	1.5	600
Total to Windsor WWTP[(a)]	**0.75**	--	**5.7**	**3,220**
Flows and Loads to FWD/GSCD WWTPs				
Projected GCSD/OCSD Flows and Loads	0.15	MWF	1.1[(b)]	680
Projected FWD Flows and Loads	0.064	MMF	0.39[(b)]	270
Clusters 8-11	0.13	Peak Flow	0.5	900
Total to FWD/GCSD WWTPs	**0.34**	**--**	**2.0**	**1,850**

(a) Equalized peak flow. The RRCSD Treatment Plant Master Plan indicates that Peak Day flows through the WWTP can be equalized to 5.0 mgd with use of existing Emergency Storage Pond. If 0.4 MG EQ basin is also available, flows can be equalized to 4.2 mgd. For this analysis, it is assumed flows can be equalized to 4.2 mgd.
(b) Equalized peak flow. Chapter 4 discusses use of equalization storage to equalize peak flows to the treatment ponds.
(c) Total ESDs to Windsor of 5,949, comprised of 3,621 ESDs from RRCSD and 2,328 ESDs from the identified unsewered communities.

8.6.3 Required Facility Improvements

This section addresses the required RRCSD treatment facility improvements, the required GSCD/FWD treatment facility improvements, and the required recycled water system improvements.

8.6.3.1 RRCSD Treatment Infrastructure Improvements

The RRCSD would be converted for use as EQ and export pumping only under this alternative, same as under Alternative 1c. Section 8.2.3.1 describes the components of the EQ conversion at RRCSD. The proposed infrastructure improvements for the RRCSD WWTP are unchanged from a site layout perspective from what was presented in Chapter 4 (Figure 4-4). The only distinctions are that conveyance would be to the Windsor WWTP instead of the FWD WWTP, and the wastewater pump station at the RRCSD site would be designed accordingly.

A connection/capacity fee of $76.3 million will also need to be paid to Windsor to cover the cost of expanded treatment. These costs would be split between RRCSD and the associated unsewered communities in proportion to their respective ADWF values.

8.6.3.2 FWD/GSCD Treatment Infrastructure Improvements

The major infrastructure required for the FWD and GCSD sites under Alternative 3b is the same as for these sites under Alternative 1a, detailed in Section 8.3.3.2.

The proposed new treatment systems and infrastructure improvements for the FWD and GCSD WWTPs are to the same as those already described under Alternative 1a, with site layouts as presented on Figure 8-2 and Figure 4-3 for the respective sites, as well as Figure 8-3 for the expanded effluent storage ponds at the GCSD WWTP.

8.6.3.3 Recycled Water Infrastructure Improvements at FWD/GCSD

Water balances for the combined FWD/GCSD system have been updated from those discussed in Chapter 3 to account not the addition of unsewered flows, as well as to address the findings presented in Chapter 6 of relatively low vineyard irrigation demands and additional demands from quarries near the FWD WWTP. Updated FWD/GCSD 100-year water balance results are presented in Table 8-7 for projected West County flows with and without the unsewered clusters.

Table 8-48. FWD/GCSD Water Balance Results for Alternative 3b

Scenario	Storage Volume Required, acre feet	Irrigated/Disposal Area Required, acres
Existing Facilities		
FWD/GCSD	70[a]	325[b]
FWD/GCSD Water Balance Results (100-Year Rainfall 75 in/yr)		
Projected	335	1,385
Projected + Unsewered	490	2,250

(a) Existing 7 acre-feet of storage at FWD assumed to be filled to support new treatment facilities.
(b) Existing 20.5 acres of GCSD irrigation area assumed used for siting new recycled water storage.

The updated water balance analysis indicates a need for the following:

- 1,920 acres of additional land application area[35].
- 420 acre-feet of new recycled water storage, corresponding to a land acquisition need of about 20 acres.

8.6.4 Conveyance Infrastructure

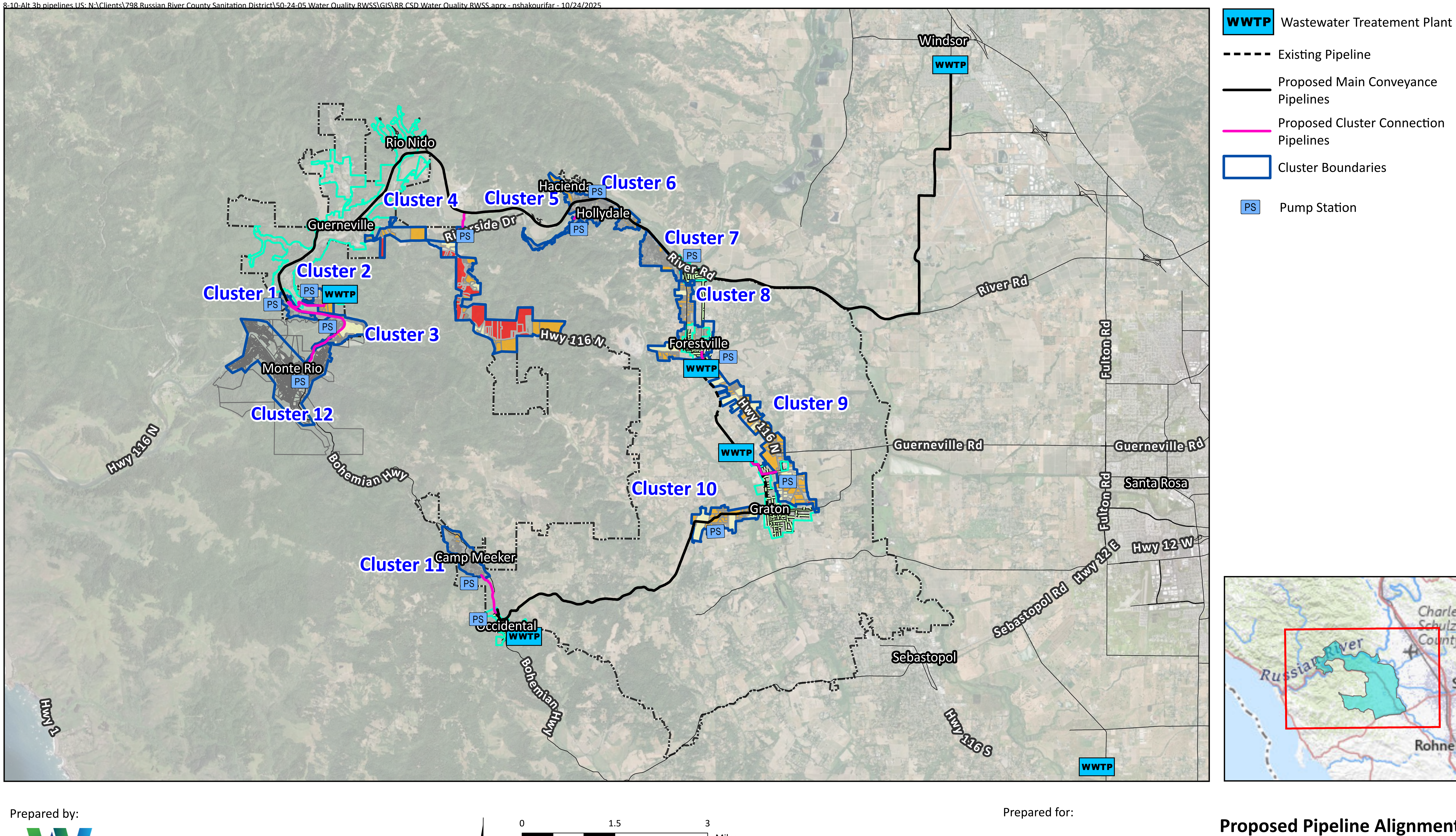
Relevant conveyance infrastructure includes collection system conveyance for the unsewered parcels, raw wastewater and secondary effluent conveyance to and from the GCSD WWTP and recycled water conveyance.

8.6.4.1 Collection System Infrastructure for Unsewered Community Clusters

A conceptual alignment is shown on Figure 8-10 of the new cluster connection pipelines and associated conveyance infrastructure to the associated WWTPs under Alternative 3b. The main force main alignment would be the same as in Chapter 3 (Figure 3-11).

[35] The parallel analysis in Chapter 3 included a conclusion that the existing irrigation FWD/GCSD reuse sites would be able to accommodate the combined recycled water flow generated (without unsewered flows). These updated results reveal that even with the additional quarry demands, more than 1,000 acres of additional land application area would be needed. The addition of the quarry demands did reduce the required additional recycled water storage without unsewered flows from 310 acre-feet to 265 acre-feet.

8-10-Alt 3b pipelines US: N:\Clients\798 Russian River County Sanitation District\50-24-05 Water Quality RWSS\GIS\RR CSD Water Quality RWSS.aprx - nshakourifar - 10/24/2025



Prepared by:

WEST YOST

Prepared for:

Russian River County Sanitation District
Water Quality and Recycled
Water Supply Feasibility Study

Sonoma Water

Proposed Pipeline Alignments
Alternative 3b

Figure 8-10

The distances and diameters of the conveyance pipelines are summarized in Table 8-50.

Table 8-49. Sizing of Conveyance Infrastructure from Unsewered Areas for Alternative 3b

Cluster(s)[(a)]	Pipeline Distance, miles	Pipeline Diameter, inches
2, 4, 5, 8, 9 & 11	2.3	4
12	1.2	6
3 & 8	1.0	8
Total Pipeline Length	**4.5**	

(a) Clusters 6 and 7 connect directly to the RRCSD to Windsor pipeline, and Cluster 10 connects directly to the OCSD to GCSD pipeline.

8.6.4.2 RRCSD Wastewater Conveyance to Windsor WWTP

The following major conveyances will be required for export of raw wastewater to the Windsor WWTP:

- A new 6.0 mgd discharge pump station would be constructed at the RRCSD for raw wastewater export.
- A new, 16 to 24-inch diameter, 19-mile pipeline would be constructed between the RRCSD site and Windsor WWTP.

8.6.4.3 Conveyance Between GCSD WWTP and FWD WWTP

The proposed pipeline conveyances between the GCSD and FWD WWTPs under Alternative 3b would be the same as under Alternative 1a and have already been described in Section 8.2.4.3. Two of the three pump stations would be smaller because of some additional unsewered flows being exported with RRCSD flows to the Windsor WWTP, as follows:

- **Tertiary Effluent from FWD to GCSD Storage Ponds and Recycled Water Customers:**
  - The existing 0.7 mgd effluent pump station at the FWD WWTP needs to be expanded to 2.0 mgd to allow for transfer of flows from the FWD site to the ponds at the GCSD site.
- **Tertiary Effluent from GCSD Storage Ponds to Recycled Water Customers:**
  - A new, 3.4 mgd[36] recycled water pump station at the GCSD site is needed to distribute recycled water from the storage ponds to recycled water customers.

[36] The recycled water pump station has been sized based on the maximum month recycled water demand from the water balance, multiplied by an assumed peak day peaking factor of 1.5 to serve recycled customers.

8.6.4.4 Recycled Water Conveyance Infrastructure

A potential expanded recycled water service area and associated recycled water main service pipelines was presented on Figure 8-5 for Alternative 1a. At a feasibility level, these conveyances are assumed to be 12-inch diameter. Alternative 3b is estimated to require only about a third of the land application area of Alternative 1a. This required acreage for Alternative 1c is assumed to include most of the northern portion of the potential land use areas shown on Figure 8-5. A total of 5 miles of conveyance pipeline is estimated, including pipelines to serve the nearby quarries. In addition, $5,000 per acre is assumed to be needed to cover costs of additional piping and other required irrigation infrastructure on individual irrigated parcels.

8.6.5 Project Costs

The OPCC and OPTCC for Alternative 3a project elements are presented in Table 8-50, which also shows the estimated cost shares for RRCSD, FWD/GSCD and for unsewered communities. Additional details regarding these costs are provided in a Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendix G-5.

The following cost share approach was used:

- Costs of improvements needed to accommodate treatment/disposal of all anticipated flows and loads are split between existing users and new customers based on their respective portions of capacity provided.
- New FWD/GCSD customers pay a wastewater system connection fee based on existing rate structures for use of existing facilities.
- Any improvements or costs associated with collection systems or raw wastewater conveyance (including existing systems) are only applied to users of those systems (proportional to peak flow).

Table 8-50. OPCC and OPTCC for Alternative 3b

Facility Component	Components	Cost, $ million RRCSD	Unsewered to RRCSD	FWD/ GCSD	Unsewered to FWD/GCSD	Total(a)
Treatment		**$45.1**	**$31.5**	**$19.2**	**$11.7**	**$107.5**
RRCSD	Convert storage ponds to EQ facility	0.3		--	--	0.3
FWD	New SAF/cloth disk filtration facility and disinfection expansion	--		12.7	7.9	20.6
GCSD	Headworks improvements	--		0.7	0.2	0.9
	Convert treatment ponds to complete mix system	--		5.8	3.6	9.4
Windsor WWTP Connection/Capacity Fee		44.8	31.5	--	--	76.3
Conveyance		**$126.3**	**$43.8**	**$11.7**	**$8.4**	**$190.2**
New Pump Stations	1.5 mgd pump station at GCSD for secondary effluent transfer to FWD	--	--	1.9	0.6	2.5
	3.4 mgd pump station at GCSD for tertiary effluent delivery to distribution system	--	--	2.3	0.7	3.0
	2.0 mgd pump station at FWD for tertiary effluent transfer to GCSD	--	--	2.1	0.6	2.7
	4.3 mgd pump station at RRCSD for wastewater transfer to Windsor	3.1	0.7	--	--	3.8
Pipeline	19-miles of 16 to 24-inch conveyance pipelines to Windsor	123.2	39.2	--	--	162.5
	Pipeline Connections Between FWD/GCSD: • 0.8 mile, 6-inch pipeline extension of existing HDPE pipe • 1.7 mile, 14-inch pipeline • Rehab existing 1.7 mile, 8-inch ductile iron pipeline	--	--	5.5	4.0	9.5
	4.5 miles of 4-8-inch community conveyance lines	--	3.8	--	2.4	6.2
Recycled Water		**--**	**--**	**$33.0**	**$20.1**	**$53.1**
Land Application Area	1,920 acres	--	--	6.0	3.6	9.6
Storage	420 acre-feet (GCSD)	--	--	15.8	9.6	25.4
	20 acres land purchase	--	--	1.2	0.8	2.0
Pipeline to Use Areas	5 miles of 6- to 12-inch conveyance pipeline	--	--	10.0	6.1	16.1
Unsewered Service Area Systems (Collection Systems and Dedicated Pump Stations)		**--**	**$268.6**	**--**	**$93.9**	**$362.5**
	Engineer's Preliminary OPCC	**$171**	**$344**	**$64**	**$134**	**$713**
Engineering Design, Environmental Planning and Studies, Permitting, Construction Management, ESDC and Legal and Admin Costs, 25 percent of OPCC (*applied to all*)		43	86	16	34	178
	Engineer's Preliminary OPTCC	**$214**	**$430**	**$80**	**$168**	**$892**
	Wastewater Agency's Treatment Plant Connection Fees	--	--	- $8	$8	--
	OPTCC with Connection Fees Included	**--**	**--**	**$72**	**$175**	**--**

(a) Project Phase-Level OPCC estimating contingency of 30 percent applied to all elements.

8.6.6 Operations and Maintenance Costs

This section provides a summary of the additional O&M costs associated with this alternative, focused on the following elements:

- Power costs
- Labor costs
- Chemical costs
- Equipment repair and replacement costs
- Windsor O&M rate costs

Following this summary of the additional O&M elements, the total additional O&M costs are presented along with the 20-year, present-worth lifecycle O&M cost. Additional details regarding these O&M costs are provided in the Basis for Cost Estimating TM in Appendix A and detailed cost tables in Appendices H-9 and H-10.

8.6.6.1 Power Costs

The annual power costs for Alternative 3b are summarized in Table 8-51. These costs account for the energy demands of new treatment systems and conveyance infrastructure, as well as projected savings resulting from operational changes at the RRCSD and GCSD WWTPs. A net savings would be realized, but much less than under the export only alternatives ($300,000 to $500,000 a year savings).

Table 8-51. Annual Power Costs for Alternative 3b

Cost Element	Annual Cost, $
Treatment Pond at GCSD WWTP	173,200
RRCSD, GCSD and FWD WWTPs Operation[(a)]	-565,800
Cloth Disk Filtration	900
SAF	12,800
Conveyance Pumps	168,200
Total	**-$210,700**

(a) Assuming elimination of 90, 95 and 60 percent of GCSD, RRCSD and FWD current treatment power costs.

8.6.6.2 Labor Costs

As with Alternative 1a, which includes the same approach for the FWD/GCSD systems, two additional full-time employees are assumed to be required for FWD/GCSD WWTP recycled water system O&M. This equates to a total labor cost of $400,000 per year for these systems.

For the RRCSD component, a 75 percent reduction in labor costs at the RRCSD WWTP is assumed, same as in Chapter 4 for this alternative. This assumption results in an estimated annual savings of $3.0 million.

8.6.6.3 Chemical Costs

The chemical costs for the new treatment systems at FWD, as well as the savings at GCSD, are similar to those presented for Alternative 1a in Section 8.2.6.3. Additionally, further chemical cost savings will occur at RRCSD due to the elimination of treatment at that facility. A summary of estimated annual chemical cost Is provided in Table 8-52. The savings assumed at the RRCSD and GCSD WWTP are the same as those used in Chapter 4. Additional SAF chemical and chlorine costs would be incurred to treat the unsewered flows, proportional to the increased flows.

Table 8-52. Annual Chemical Costs for Alternative 3b

Cost Element	Annual Cost, $
SAF	89,600 [a]
CCB	32,000 [b]
RRCSD and GCSD WWTPs Operation	-104,700[c]
Total	**$16,900**

(a) Based on chemical usage at the existing GCSD SAF facility.
(b) Additional chlorine gas and sodium bisulfite required for the expanded CCB at the FWD WWTP are estimated using FWD current design criteria and the projected increase in annual average flow from GCSD.
(c) Assuming elimination of 100 percent of GCSD and RRCSD chemical costs.

8.6.6.4 Equipment Repair and Replacement Costs

A summary of the estimated major equipment repair and replacement costs for Alternative 3b is provided in Table 8-53. Replacement costs for equipment with replacement frequencies of more than 20 years were excluded from this analysis (e.g., pumps). These costs are higher than those used for Alternative 3b in Chapter 4 because of capital cost from which the various operating costs components are calculated.

Table 8-53. Equipment Repair and Replacement Costs for Alternative 3b

Cost Element	Cost, $		Cost Basis Assumption
	Annual Basis	Cost Basis (if different)	
Filter Cloth Replacement	2,700	-	Annual
Routine O&M[(a)]	9,400	-	Annual
Piping and Valve Maintenance and Replacement Cost	344,900	-	5 percent of mechanical and piping cost
Instrumentation Maintenance	3,800	80,000	5 percent of instrumentation and controls cost, Year 15
Pumps Rebuild and Major Maintenance	5,300	56,000	30 percent of pump cost, Every 10 Years
10-Year Equipment Replacement[(b)]	200	2,100	Every 10 years
Major Equipment Replacement	2,100	43,200	Every 15 Years
RRCSD WWTP Operation[(c)]	-853,600	-	Annual
Total Annual Costs	**-$485,200**	**-**	-

(a) Includes cloth disk filtration routine lubrication of backwash pumps, drive motor and gear box, SAF parts replacement, pond cleaning, pond blower filter/belt/ oil changes.
(b) Includes cloth disk filtration main “V-Ring” seal replacement.
(c) Assumes a 90 percent cost reduction for parts replacement, permitting, and testing/analysis at the RRCSD WWTP and a 50 percent reduction in SCADA-related costs at RRCSD.

8.6.6.5 Windsor WWTP O&M Rate Costs

The annual rates for 0.77 mgd from the RRCSD WWTP to the Windsor WWTP are estimated to be $5.4 million, based on the rate currently paid for discharges from the Airport area, with an adjustment to reflect the smaller flow for RRCSD. As noted with discussion of these rates with Alternative 2a, the Airport rates are expected to increase significantly in the coming years, likely to support the construction of new treatment facilities, but the current analysis accounts for new facility capital costs within the connection fees.

8.6.6.1 Total Additional Annual O&M Costs

Total additional annual O&M costs are provided in Table 8-54 based on the information presented in the previous sections. Also shown are estimated cost shares, using the same approach as Alternatives 2a and 1a for RRCSD and FWD/GSCD, respectively.

Table 8-54. Additional Annual O&M Costs for Alternative 3b

Service Area	RRCSD, $	Windsor Unsewered, $	FWD/GCSD, $		Total Annual OpEx, $
Treatment/Recycled Water					
Power	-287,000		75,000		-212,000
Labor	- 2,964,00		400,000		-2,564,000
Chemicals	-35,000		52,000		17,000
Major Parts Replacement	2,000		8,000		12,000[(a)]
Routine O&M for Treatment	-853,000[(b)]		83,000		-770,000[(a)]
Windsor O&M Costs	2,700,000	2,700,000	-		5,400,000
Total Treatment Annual OpEx	**-$1,437,000**	**$2,700,000**	**$620,000**		**$1,883,000**
Collection	**RRCSD**	**Unsewered**	**FWD/GSCD**	**Unsewered**	**Total**
Routine O&M for Conveyance	185,000	67,000	22,000	3,000	277,000[(a)]
Collection System O&M[(c)]	-	2,322,000	-	357,000	2,679,000
Total Collection Annual OpEx	**$187,000**	**$2,387,000**	**$22,000**	**$360,000**	**$2,956,000**

(a) These cost items comprise the total annual equipment repair and replacement cost in Table 8-53.
(b) Accounts for proportional savings from reduced routine O&M at the RRCSD WWTP.
(c) Based on estimated costs shown in Table 8 5.

8.6.6.2 Total 20-Year Present Worth of O&M Costs

The total 20-year, present-worth O&M costs for Alternative 3b are shown in Table 8-55. Additional details are provided in Appendices H-9 and H-10.

Table 8-55. Present Worth O&M Cost for Alternative 3b

O&M Cost Component	Total 20 Year Cost, $ million
Power	-4.5
Labor	-53.8
Chemicals	0.4
Equipment Repair and Replacement	-10.2
Windsor Rate	113.4
Unsewered Collection Systems	56.3
Total 20-Year, Present-Worth O&M Costs	**$102**

8.6.7 Total Lifecycle Costs

A total lifecycle cost for Alternative 3b is calculated as shown in Table 8-56 using the OPTCC from Table 8-50 and total 20-year O&M costs from Table 8-55.

Table 8-56. Lifecycle Cost for Alternative 3b

Cost Component	Cost, $ million
Total Project Capital Cost (CapEx)	892
Total Present Worth O&M Costs (OpEx)	102
Total	**$994**

8.6.8 Potential Annual Operating Costs per ESD

As with the other alternatives, the additional operating costs (Table 8-54) can be combined with current operating costs to review total operating costs per ESD. The same methodology used for the respective alternatives (Alternatives 2a and 1a) was applied for this alternative, as well. These per parcel costs include estimated operating costs only and do not include any costs related to debt that may arise from the implementation of a regional project. Therefore, the costs should not be interpreted as the annual charges paid by a sanitation district customer.

Table 8-57. Total Estimated Annual O&M Costs for Alternative 3b

Category	RRCSD, $	Windsor Unsewered, $	FWD/GCSD, $	FWD/GSCD Unsewered, $	Total Annual OpEx, $
Current Annual O&M for Treatment	5.5 M[(a)]	-	1.1 M[(a)]	0.5 M	7.1 M
Additional Annual O&M for Treatment	- 1.5 M	2.7 M	0.4 M	0.2 M	1.9 M
Current Collection System O&M	3.3 M[(a)]	-	0.9 M[(a)]	-	4.2 M
Additional Collection System O&M	0.2 M	2.4 M	0.02 M	0.4 M	3.0 M
Total Annual OpEx	**$7.5 M**	**$5.1 M**	**$2.4 M**	**$1.1 M**	**$16.2 M**
Total Annual OpEx per ESD	**$2,100**	**$2,100**	**$1,400**	**$1,400**	

(a) Current annual O&M from FY 24/25 budgets.

8.7 COMPARISON OF ALTERNATIVES

This section provides a summary and comparison of the alternatives, focused on capital cost per ESD for the unsewered communities, total lifecycle costs and updated screening criteria scoring to inform drawing conclusions with regards to a best alternative considering the opportunities to bring in flows from the unsewered communities.

8.7.1 Summary of Estimated Lifecycle Costs

The estimated project lifecycle costs for all five of the feasible alternatives are summarized in Table 8-58, which shows capital costs, 20-year, present-worth O&M costs, and total 20-year lifecycle costs. The capital cost share between RRCSD and FWD/GCSD is also shown.

Table 8-58. Summary of Estimated Lifecycle Costs, $ million

Estimated Cost Component	Alternative 1a	Alternative 1c	Alternative 2a	Alternative 2b	Alternative 3b
Capital Cost	716	806	845	850	892
RRCSD Share	*15*	*196*	*209*	*210*	*214*
FWD/GSCD Share	*75*	*48*	*64*	*55*	*72*
Unsewered Share	*626*	*561*	*571*	*585*	*605*
20-Year, Present-Worth O&M (OpEx)	80	-2	118	143	102
Estimated Total 20-Year Lifecycle Cost	**796**	**804**	**963**	**983**	**994**
Estimated Total 20-Year Lifecycle Cost with Returning Recycled Water to West County	*not applicable (n/a)*	*n/a*	**1,021**	**1,001**	*n/a*

The project costs presented in Table 8-58 shows Alternatives 1a and 1c as the least cost alternatives with similar total lifecycle costs. While Alternative 1c has a much lower (and the lowest) operating costs, the significantly lower capital cost of Alternative 1a compensates.

In contrast, Alternative 3b represents the highest-cost scenario, driven by (1) the highest capital cost and (2) relatively high operating costs. Alternatives 2a and 2b have slightly lower total costs than Alternative 3b, but are still much higher than Alternatives 1a and 1c, driven by (1) relatively high capital cost and (2) the highest operating costs values.

8.7.2 Potential Costs for Unsewered Community Clusters

This section addresses the alternatives with respect to the potential costs to the unsewered communities.

8.7.2.1 Potential Capital Costs

Reviewing the capital cost per ESD for each of the community clusters can inform whether one or more alternatives would represent significant unit cost savings over other alternatives[37]. Estimated capital cost per ESD for the unsewered communities has been calculated as follows:

- Number of ESDs for each cluster is calculated from the total number of parcels in Table 8-4, divided by the single-family residential unit flow of 158 gallons per day established in the Monte Rio Study Report.
- The share of unsewered OPCC from the respective alternatives is taken from the project cost tables (Table 8-9, Table 8-20, Table 8-29, Table 8-39 and Table 8-50).
- These OPCC shares are split out to the respective clusters as follows:
  - proportional to peak flows for pump station costs
  - proportional to average flows for all other components except pipelines
  - for pipelines, total costs for relevant segments to each cluster have been used (For example, under Alternative 1c, clusters near the RRCSD WWTP have to travel through longer length of pipelines than for those closer to the FWD WWTP.)
- The components costs are summed to give a total OPCC for each cluster.
- A factor of 25 percent is added for soft cost, and the OPCC and soft costs added to give an OPTCC for each cluster.
- The cluster OPTCC is divided by the respective number of ESDs to give the capital cost per ESD.

The ESD and capital cost per ESD values are presented in Table 8-59, which also shows an ESD-weighted average capital cost per ESD for comparison across alternatives. These unit capital costs should be based on feasibility-level costs to provide a general (order of magnitude) average cost across the community. Individual parcel costs within each community could vary significantly (±50 percent) depending on the complexity of serving the parcel.

[37] Note that the community cluster collection system costs presented early in this Chapter were provided on a per connection (or per parcel) basis. This allowed for a direct translation between the various sources of cost information (which were developed on a per connection basis) and the costs assigned to the group of parcels within each community cluster. However, costs to individual users within a centralized wastewater system are typically assigned on an Equivalent Single-Family Dwelling (or ESD) basis. Under an ESD cost-allocation approach, a commercial user or multi-family property may be assigned more than one ESD based on their flow and/or load contributions to the system. This then results in that commercial user or multi-family entity paying an overall higher amount than a single-family homeowner would to account for the higher costs associated with conveyance and treatment of the higher flows and/or loads.

Table 8-59. Estimated Capital Cost per ESD for Unsewered Communities, $ million							
ID	Name	Number of ESDs	Alternative 1a(a)	Alternative 1c	Alternative 2a(b)	Alternative 2b(b)	Alternative 3b(b) (c)
1	Guerneville South of River	55	0.187	0.206	0.211	0.215	0.212
2	Guerneville North of River	58	0.214	0.239	0.244	0.247	0.246
3	Northwood	196	0.179	0.201	0.205	0.207	0.206
4	Hwy 116 East of Guerneville	119	0.259	0.184	0.185	0.188	0.187
5	Summerhome Park Road	103	0.269	0.217	0.217	0.220	0.219
6	Hacienda and Hollydale	443	0.239	0.186	0.186	0.190	0.188
7	River Road North of Forestville	454	0.208	0.163	0.161	0.166	0.163
8	Forestville	173	0.213	0.169	0.174	0.172	0.213
9	Hwy 116 between Forestville and Graton	161	0.204	0.157	0.162	0.156	0.207
10	Graton West	70	0.236	0.191	0.201	0.195	0.235
11	Camp Meeker	376	0.211	0.167	0.178	0.172	0.213
12	Monte Rio/Villa Grande	943	0.153	0.175	0.179	0.181	0.180
Total ESDs		**3,151**					
ESD-Weighted Average CapEx per ESD			**0.200**	**0.180**	**0.180**(a)	**0.180**(a)	**0.190**

(a) Blue shaded cells indicate clusters that are assumed to connect to the FWD/GCSD system under Alternative 1a.
(b) Purple shaded cells indicate clusters that are assumed to connect to an export pipeline for treatment at a regional facility.
(c) Green shaded cells indicate clusters that are assumed to connect to the FWD/GCSD system under Alternative 3b.
(d) Under Alternatives 2a and 2b, weighted average is the same with or without accounting for recycled water return.

The following observations are made from the capital cost per ESD results for the unsewered communities in Table 8-59:

- Capital cost per ESD varies from $150,000 to $270,000, with variation within each cluster of $30,000 (Cluster 1, Cluster 2, Cluster 3 and Cluster 12) to $80,000 (Cluster 4). The variation across the alternatives for the remaining clusters ranged from $40,000 to $50,000.
- No one alternative represents a global minimum or maximum for all clusters, reflected by the fact that the weighted-average values are all similar, between $180,000 and $200,000 per ESD.
- The highest average capital cost per ESD values occur for Clusters 2 and 5, while the lowest average capital cost per ESD values occur for Clusters 7, 9, and 12.

- For Cluster's 1, 2, 3, and 12 (i.e., the clusters west of Guerneville), the one alternative that includes directing flow to the RRCSD (i.e., Alternative 1a) is a lower cost than the four alternatives that involve export out of the area (i.e., Alternatives 1c, 2a, 2b, and 3a).
- For the remaining areas (i.e., Clusters 4 through 11) Alternative 1a is the highest cost. However, Alternative 1c (i.e., discharge to a new regional treatment facility at the FWD site) is generally a lower cost compared to the alternatives that include export to a regional treatment facility.
- For Cluster 4, there is the largest difference in cost between Alternative 1a and the four alternatives that involve export out of the Guerneville area. This is because under Alternative 1a, Cluster 4 would be in the only flow in the conveyance system for a significant distance before it connects to another system or facility, whereas it would be small portion of the flow in any alternative that involves export out of the Guerneville area. This indicates that unless an export pipeline is constructed, it may be more cost effective for Cluster 4 to connect to the RRCSD system. This approach should be evaluated further.

8.7.2.2 Potential Annual Operating Costs per ESD

The potential annual operating costs per ESD for the different alternatives shown in previous tables are summarized in Table 8-60, from which the following observations are made:

- Alternative 1c would have the lowest operating costs for all communities. This is primarily driven by the fact that treatment-related operating costs would be consolidated at a single facility.
- For the unsewered community clusters, the local alternatives (1a and 1c) offer the lowest potential annual operating costs.

The operating costs are based on a feasibility-level analysis to provide a general (order of magnitude) average annual operating costs. These costs include estimated operating costs only and do not include any costs related to debt service or other related administrative costs that may arise from the implementation of a regional project. Therefore, the estimated annual operating costs shown in Table 8-60should not be interpreted as the annual rates paid by a sanitation district customer.

Table 8-60. Summary of Annual Operating Cost per ESD[a]

Community	Alternative 1a	Alternative 1c	Alternative 2a	Alternative 2b	Alternative 3b
RRCSD	$2,100	$1,700	$2,100	$2,200	$2,100
RRCSD Unsewered	$2,100	n/a	n/a	n/a	n/a
FWD/GSCD	$1,200	$800	$1,800	$1,900	$1,400
FWD/GSCD Unsewered	$1,500	$1,200	n/a	n/a	$1,400
Regional Facility Unsewered	n/a	n/a	$2,000	$2,200	$2,100

(a) These costs also include estimated operating costs only and do not include any costs related to debt service or other related administrative costs that may arise from the implementation of a regional project.

8.7.3 Updated Screening Criteria Scoring

Qualitative screening scores were provided in Chapter 3 (Table 3-12) for all eight of the original alternatives and repeated in Chapter 4 (Table 4-35) for the five feasible alternatives. The scores that were provided in Table 4-35 for the feasible alternatives have been reviewed in light of the additional information developed for the current chapter, namely impacts of adding in the unsewered communities. A summary of the screening scores for each criterion for each alternative is provided in Table 8-61. Detailed explanations of the scoring are provided in Table 8-62.

Table 8-61. Summary of Screening Criteria Scoring

Criteria	Alternative 1a	Alternative 1c	Alternative 2a	Alternative 2b	Alternative 3b
Reliability/ Ease of Operation	1.0	4.0	5.0	5.0	3.0
Long-Term Regulatory Compliance	3.5	4.0	4.0	5.0	4.5
Flexibility for Adding Critical Unsewered Communities	1.0	5.0	4.0	4.0	2.5
Local Recycled Water Benefits	5.0	2.0	1.0	1.0	4.0
Environmental	2.0	3.0	5.0	5.0	3.5
Resiliency	1.0	3.0	4.0	4.0	2.5
Ease of Implementation	2.0	4.5	2.5	2	1.0
Average Score	**2.2**	**3.6**	**3.6**	**3.7**	**3.0**
Total Score	**15.5**	**25.5**	**25.5**	**26.0**	**21.0**
Weighted Average Score	**2.1**	**3.7**	**3.7**	**3.7**	**3.0**

(a) Scores weighted by applying the stakeholder-identified weighting factors presented in Table 4-36.

Table 8-62. Screening Criteria Scoring Details

Criteria	Scoring of Alternative[a]					Scoring Comments
	1a: Two Local Facilities	1c: One Facility at FWD	2a: Export to Windsor	2b: Export to Santa Rosa	3b: Treat at GCSD/FWD; Export RRCSD to Windsor	
Reliability/ Ease of Operation	1	4	5	5	3	• The Export Scenarios (2a and 2b) involve sending flow to larger, regional facilities and would offer greater reliability and ease of operation for West County agencies. • The remaining alternatives were scored lower depending on how many, smaller facilities would continue to be operated and whether additional flow equalization would be provided. • The lowest score was assigned to the alternative that continues to have three facilities in operation with no additional equalization for peak flows (1a). • Alternative 1c scored the highest of the local facility scenarios, as it provides for equalization at all three existing sites and provides for a new treatment system and a new discharge into the Russian River. • Alternative 3b was rated between Alternative 1a and Alternative 2a. The RRCSD system would be similar under both options, but the FWD treatment system would involve two different treatment plants with no additional equalization and a large, complex recycled water system.
Long-Term Regulatory Compliance	3.5	4	4	5	4.5	• The Export Scenarios (2a and 2b) involve sending flow to larger, regional facilities and would offer greater potential for adjusting to future regulatory changes. The local facilities would be operated to provide equalization, which would also help to mitigate compliance concerns related to peak flows. Alternative 2b ranks higher because the Santa Rosa system has limited need for surface water discharge, while the Windsor facility is reliant on wet-season discharges each year – potentially driving more stringent effluent limitations. • Alternative 3b scored the second highest because it includes a GSCD/FWD facility that has zero surface water discharge. A zero-surface water discharge approach provides significant resilience to changing regulatory requirements. • The two remaining alternatives include one local treatment facility that discharges to surface water. – Providing all treatment at FWD (1c) scored the highest of the local treatment surface water discharge scenarios. Although all the flow would be discharged to surface waters, the new facility would be properly sized to accommodate this flow. Moreover, all three of the existing treatment systems would have equalization to help mitigate peak flow concerns. Finally, the alternative includes a new discharge location into the Russian River, providing significant dilution for discharged flows. – Alternative 1a scored high on one hand because it provides zero surface water discharge for a portion of the flow – thus having a higher level of resilience than discharging to surface waters. However, it also includes continued treatment at the RRCSD WWTP, which is an older treatment facility with ongoing peak flow issues.
Flexibility for Future Expansion	1	5	4	4	2.5	• Alternative 1c provides the highest flexibility to accommodate regional growth, as the treatment and conveyance systems could be expanded as new development occurs (or additional communities seek to eliminate OWTS). • Scenarios that involve export to Santa Rosa or Windsor score lower. Although the treatment systems could be readily expanded, the capacity to accept flows could be limited by initial pipeline sizing. • Scenario 1a would require expansion of an already significant recycled water system as new development is brought online – complicating the ability for expansion. • Scenario 3b scores between Scenario 1a and 2a, as it provides elements of both approaches.
Local Recycled Water Benefits	5	2	1	1	4	• Scenario 1a ranks the highest because it significantly expands recycled water use in the West County area. • The combination scenario (3b) also scored high because it significantly expands reuse in the Graton/Forestville area. However, it was derated because it involves export of recycled water from the Guerneville area. • Scenario 1c scored lower than 3b because it would retain all existing recycled water uses in the Forestville/Graton area, but export of recycled water from the Guerneville area. • The export scenarios (2a and 2b) scored the lowest because they involve loss of all locally available recycled water.
Environmental	2	3	5	5	3.5	• Alternatives 2a and 2b would include pumping of wastewater to large, conventional wastewater facilities that in themselves use significant energy. However, overall energy usage would be lower than providing treatment at multiple, smaller facilities. It also provides for centralized treatment that provides more efficient use of resources. • Alternative 1a scored the lowest due to the need for major construction at the FWD and GCSD WWTPs and the need for construction of a substantial pipeline network to expand the recycled water use area around the Graton/Forestville communities. • Alternative 3b is similar to 2a (both involve export to Windsor) but is derated for the same reasons that Alternative 1a is rated low. • Alternative 1c scored the second lowest. Although it requires the least amount of additional pipeline construction and has the smallest overall footprint, it is derated due to the need to construct a new conventional facility at the FWD WWTP site and a new outfall in the Russian River.
Resiliency	1	3	4	4	2.5	• The export scenarios (2a and 2b) will be more resilient because the larger, regional facilities will have more resources to maintain resiliency over the long term. These scenarios therefore scored the highest. Neither option received the highest rating (5) because of a construction of the pipeline along River Road, which would be susceptible to seismic and flooding impacts. • Alternatives that continue to rely on the Russian River and Graton WWTPs are scored the lowest (1a) due to their reliance on a treatment facility that is near/in a floodplain and thus particularly vulnerable to seismic and flooding impacts. • Alternative 1c is considered more resilient than 1a because the treatment system would be at the FWD WWTP, which is more protected from flooding than the other two local facilities. • Alternative 3b was ranked between 1a and 2a because it provides elements of both options.

Table 8-62. Screening Criteria Scoring Details

Criteria	Scoring of Alternative[a] 1a: Two Local Facilities	1c: One Facility at FWD	2a: Export to Windsor	2b: Export to Santa Rosa	3b: Treat at GCSD/FWD; Export RRCSD to Windsor	Scoring Comments
Ease of Implementation	2	4.5	2.5	2	1	• Alternative 1c would be the easiest to implement, as it includes agencies that are currently involved with this study. Although it would require expanding and/or constructing new facilities, these improvements are necessary to support ongoing operations at the FWD/GCSD WWTPs. This approach could also be phased to optimize funding opportunities and allow for growth/expansion over time. This alternative was slightly derated (from 5) because it would likely require modifying the existing governance structure for the West County utilities. • Alternative 1a ranked relatively low. While it does involve the least amount of treatment infrastructure, it will take significant time to develop and implement a complex recycled water system to achieve zero surface water discharge. Moreover, FWD/GCSD are operating under a timeline to complete necessary upgrades for surface water discharge and it would be challenging to develop and implement such a complex recycled water system in that timeframe. • The export alternatives (2a and 2b) are large linear construction projects that would bring some construction complexity but would be fairly easy to construct. However, it would generally not be feasible to phase these projects and right sizing infrastructure could be complicated. These alternatives would also require coordination with the Town of Windsor or the City of Santa Rosa for a discharge agreement. Coordinating with the City of Santa Rosa will likely require more negotiation than with the Town of Windsor due to both the uncertainty in costs and a governance structure involving multiple external agencies. • The combination scenario (3b) would also be relatively simple to construct from a treatment perspective (like 1a). However, the large export pipeline and complex recycled water system make this a more complicated approach. Like the other regional options, this alternative provides less flexibility for phasing and requires more coordination than the local treatment alternatives. Therefore, this alternative ranks the lowest.
Average Score	**2.2**	**3.6**	**3.6**	**3.7**	**3.0**	
Total Score	**15.5**	**25.5**	**25.5**	**26.0**	**21.0**	

(a) Not all categories include scores of 1 or 2 because the relative scoring is similar among the alternatives.

8.7.4 Comparison of Alternatives

A plot of the average (or total) screening scores against the estimated lifecycle costs from Table 8-58 is provided on Figure 8-11 to compare alternatives in terms of both costs and qualitative criteria scores.

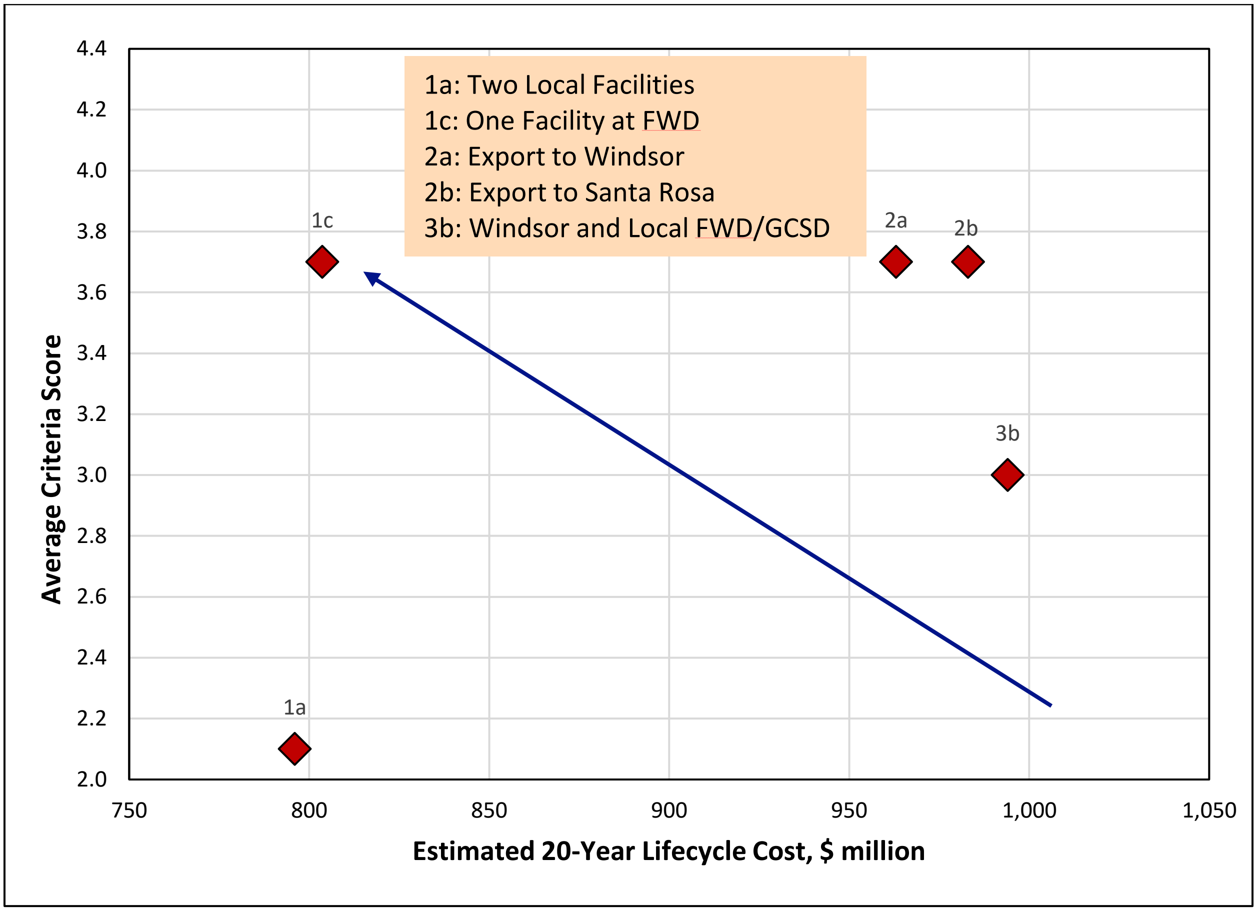


Figure 8-11. Comparison of Alternatives based on Weighted Average Criteria Score vs. 20-Year Lifecycle Cost

The results on Figure 8-11 reveal Alternative 1c as the most favorable alternative, having the highest qualitative criteria score and with the estimated lifecycle cost only slightly above Alternative 1a. The alternatives with export components (2a, 2b, and 3b) continue to have significantly higher lifecycle costs.

It is noted that Alternative 1a would have similar qualitative criteria score to Alternative 1c if Alternative 1a included upgraded treatment and surface water discharge (instead of year-round reuse with zero discharge). Moreover, lifecycle costs for Alternative 1a would still likely be lower than Alternative 1c if the surface water discharge approach were assumed based on the following:

- RRCSD estimated project costs under Alternative 1a is $21 million[38] (see Table 8-9) compared to $196 million under Alternative 1c (see Table 8-20). This suggests that costs to RRCSD are significantly lower by maintaining treatment at the existing facility.
- FWD/GSCD estimated project costs under Alternative 1a is $94 million[39] (see Table 8-9) compared to $48 million under Alternative 1c (see Table 8-20). Even without the savings realized from the economies of scale under Alternative 1c, costs to construct a new treatment plant to allow for continued surface water discharge for a combined FWD/GSCD facility would like be similar in cost if not more cost effective than expanding the recycled water system to achieve zero surface water discharge. Perhaps more importantly, the feasibility of implementing a strategy where a new facility is constructed to allow for continued surface water discharge is significantly higher than the feasibility of implementing a zero surface water discharge option. In other words, a modified Alternative 1a approach would have a similar qualitative criteria score as Alternative 1c.

Future studies completed by FWD/GCSD to assess strategies for meeting the near-term treatment capacity and water quality needs for their respective facilities should include evaluation of a modified Alternative 1a that assumes a combined FWD/GSCD facility is constructed to provide the water quality required for continued seasonal surface water discharge.

Adding recycled water return for Alternatives 2a and 2b would result in those two alternatives ranking slightly higher than Alternative 1c on the qualitative scoring. However, this approach would add to additional costs, making those alternatives even more expensive. Therefore, including facilities to return recycled water does not change the overall recommendations from this study.

[38] $15 million including the estimated connection fee provided by new community cluster users.

[39] $75 million including the estimated connection fee provided by new community cluster users.

CHAPTER 9
Findings and Recommendations

This Chapter provides a summary of the key findings and recommendations from this Feasibility Study.

9.1 SUMMARY OF FINDINGS

Eight regionalization alternatives for the four wastewater agencies of interest were developed and evaluated. These included alternatives focused on wastewater treatment and reuse locally within the West County area, as well as those that provided for the export of wastewater treatment to the Windsor WWTP and/or Santa Rosa's Laguna WWTP. An initial screening evaluation of these eight regionalization alternatives identified the following five feasible approaches:[1]

- **Alternative 1a:** Two local facilities with RRCSD flows treated at the existing RRCSD WWTP with seasonal discharge and FWD/GCSD/OCSD flows treated at a combined FWD/GCSD WWTP operation that is designed and operated to achieve zero surface water discharge.
- **Alternative 1c:** One Local Facility that is constructed at the FWD WWTP site and provides the facilities and water quality required to allow for seasonal surface water discharge to the Russian River, northeast of Forestville.
- **Alternative 2a:** Export all wastewater to the Windsor WWTP.
- **Alternative 2b:** Export to wastewater to the Santa Rosa's Laguna WWTP.
- **Alternative 3b:** Export wastewater from the RRCSD to the Windsor WWTP and treat FWD/GCSD/OCSD flows at a combined FWD/GCSD WWTP operation that is designed and operated to achieve zero surface water discharge.

An examination of the 20-year lifecycle costs for these five feasible alternatives demonstrated that retaining treatment and reuse locally (Alternatives 1a and 1c) is more cost-effective. However, approaches that involved broader regionalization (Alternatives 2a, 2b and 3b) had a higher qualitative ranking - driven primarily by higher scores in the following categories:

- **Reliability/ease of operation –** Treating all the flow in a larger, regional system (either the Windsor WWTP or the Laguna WWTP) will be easier overall to operate and maintain then operating several smaller facilities.
- **Long-term regulatory compliance –** Larger, regional facilities would offer greater potential for adjusting to future regulatory changes. Operating the local facilities to provide equalization will also help mitigate current treatment impacts associated with processing peak influent flows.
- R**esiliency (i.e., vulnerability to flooding, climate change and/or seismic impacts) –** Larger, regional facilities will have more resources to maintain resiliency over the long term.
- **Flexibility for adding unsewered communities –** Export to the Windsor WWTP or Laguna WWTP requires the installation of a long force main that will allow for connection of more unsewered communities along its alignment.

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[1] "Feasible alternatives are defined based on costs and other qualitative factors. Identifying a final, preferred approach will need to include additional engineering analysis and assessment of governance and financing feasibility that are outside the scope of this technical feasibility study.

The incorporation of the wastewater infrastructure needed to provide service to the twelve community clusters of interest into the analysis further confirmed that the local alternatives were the most cost-effective regionalization strategies. The two local alternatives (Alternatives 1a and 1c) had estimated 20-year lifecycle costs of approximately $800 million, compared with the alternatives that rely on export to Windsor or Santa Rosa (Alternatives 2a, 2b and 3b) that had lifecycle costs ranging between $960 million and $1.02 billion.

This difference in costs between the two approaches is attributed to the fact that both Windsor and Santa Rosa would require that the West County communities significantly invest in treatment upgrades at their respective facilities. These investments would be on par with the cost of constructing a new treatment facility. These treatment costs, combined with the cost of new conveyance infrastructure to connect to the West County communities to the Windsor and/or Laguna WWTPs, make the regional strategies cost prohibitive. Based on this assessment, continued local treatment of wastewater is likely to be the best strategy for the West County area.

With respect to the two local alternatives, Section 8.7.4 of the study identifies that a *modified* Alternative 1a — combining the two local treatment plant approach with seasonal surface water discharge for both RRCSD and FWD/GCSD — could outperform Alternative 1c economically and environmentally. Therefore, a modified version of Alternative 1a (local treatment with continued seasonal discharge for all facilities) should be advanced for future feasibility evaluation.

9.2 KEY FINDINGS FOR RRCSD

The RRCSD WWTP is an advanced treatment facility that provide a high-level of treatment allowing for surface water discharge to the Russian River. Continued local treatment and reuse at RRCSD is recommended for the following reasons:

- The RRCSD WWTP has available capacity in some unit processes to accommodate flows from the local unsewered community clusters. These findings are supported by the Master Planning effort being concurrently completed.[2]
- Some condition-related and capacity-related improvements have been identified to date for the RRCSD facility, requiring a relatively modest investment (approximately $20 million) in the next 20 years compared to the cost of wastewater export and constructing a new facility at an alternative location ($200 to 210 million).

[2] Additional assessment of the required facilities and operational strategies for processing peak flows at the RRCSD WWTP may be needed considering the recent (January 2026) wet weather spill event. This assessment effort may identify the additional capital improvements beyond those included in this analysis. Although unlikely, the additional assessment may also demonstrate that a significant expansion of facility footprint is required to accommodate the additional unsewered community cluster flows and loads that were included under this study. IF this were to occur, the approach for Alternative 1a would potentially need to be modified.

- The RRCSD WWTP site does have higher environmental risks (i.e., seismic and landslides) compared to the FWD WWTP site. The RRCSD collection system is also subject to significant I&I, which has resulted in wastewater spills into the Russian River. Nevertheless, this can be mitigated through increased capital investment in the collection system. In addition to ongoing efforts to invest in lift station and forcemain improvement, Sonoma Water staff are currently planning an I&I study and are committed to further investments in the collection system to reduce I&I. Nevertheless, these I&I improvements would require significantly less capital investment than the $200 million required for export.
- Despite the potential for inundation of the collection system, the majority of the RRCSD WWTP would maintain resiliency in a 100-year flood event even under projected climate change conditions. Infrastructure required for long-term flood protection under future climate change scenarios is not expected to be significant.
- The RRCSD WWTP and identified nearby unsewered community clusters are relatively isolated within West County, whereas the FWD WWTP is about 10 miles away and both the Windsor WWTP and Laguna WWTP are about 20 miles away. Consequently, discharge to the RRCSD WWTP provides the lowest-cost regional wastewater treatment option for these local unsewered communities.
- RRCSD has some existing land application area that could be expanded. The recent purchase of nearly 400 acres of nearby forested area may accommodate an additional modest expansion of the existing reuse system.

9.3 KEY FINDINGS FOR GCSD AND FWD

Both the GCSD and FWD WWTPs are required through their current permits to complete major treatment upgrades to provide the nitrogen removal needed to allow for continued surface water discharge. Therefore, either a major upgrade to these WWTPs will be needed or a major recycled water system expansion to allow for zero surface water discharge will need to be implemented. The GCSD WWTP will also require more secondary treatment capacity to handle the planned increased loads from OCSD. Finally, both facilities have tertiary filtration and/or disinfection systems capacity/condition-related challenges that must be addressed.

These two existing WWTPs are less than 2 miles apart and already share infrastructure for recycled water storage and distribution. Therefore, on request from these agencies, this study examined how the existing GCSD WWTP and FWD WWTP needs could be accomplished by combining the resources of the two facilities to achieve zero surface water discharge - while also incorporating flows from the selected unsewered community clusters.

The analysis demonstrates that zero surface water discharge would be challenging to implement due to limitations on recycled water demands in the area. Specifically, vineyards are the primary agricultural land use in the vicinity, but they have very low water demands. It is estimated that approximately 3,000 acres of additional land application area and 620 acre-feet of storage would be needed to support zero surface water discharge. Developing a reuse program of this magnitude would require a significant investment and could limit the ability for a combined FWD/GCSD system to accommodate flows from unsewered communities in the area.

The analysis also demonstrates that costs to FWD/GCSD for upgrading and expanding the FWD/GCSD treatment and reuse systems to allow for zero surface water discharge could be up to approximately $100 million (Table 8-9), while costs to costs to FWD/GCSD for constructing a new WWTP at the FWD site to allow for surface water discharge of FWD/GCSD and unsewered community cluster flows would be approximately $50 million (Table 8-19). Although both of these costs do reflect an economy of scale received through a larger, regional footprint, the difference in costs still supports a conclusion that constructing a centralized treatment system may to allow for continued surface water discharge and may be the best path forward for the FWD and GCSD.

9.4 KEY FINDINGS FOR SELECTED UNSEWERED COMMUNITY CLUSTERS

A total of about 3,000 currently unsewered parcels (12 community clusters) have been evaluated for inclusion in the regional strategies. The analysis demonstrates that the project costs for these unsewered communities are similar across all of the alternatives evaluated. This is primarily because these communities will need to invest in collection systems, conveyance facilities, and treatment facilities regardless of what regional alternative is applied.

The analysis demonstrates that for the clusters located closest to the RRCSD service area, directing flow to the RRCSD WWTP (i.e., Alternative 1a) would have a lower capital cost than export. However, for the remaining unsewered areas, it would be more financially beneficial if a RRCSD WWTP export option were implemented (instead of continued treatment at the RRCSD WWTP). This is because of the closer proximity of these small communities to the large wastewater conveyance system that would pass by these communities to deliver wastewater from the RRCSD WWTP to an alternative site for treatment.

The analysis also demonstrates that treatment at the FWD WWTP would generally be more cost effective for the community clusters than exporting flows to Windsor or Santa Rosa for treatment. Moreover, although not specifically evaluated as part of this study, the finding that Alternative 1a is the most expensive approach for the community clusters that are not located near the RRCSD WWTP supports a conclusions that without the contribution from a large service area like the RRCSD, discharge to the Windsor WWTP or Laguna WWTP would be even less economically feasible.

The analysis also demonstrates that the overall costs to existing West County wastewater agency rate payers will be lowest if the agencies partner with other local communities to accept their flows for treatment. For these reasons, it is recommended that the unsewered communities in the West County area and the RRCSD, FWD and GCSD work together to develop facilities that can serve the greater West County region.

9.5 RECOMMENDATIONS FOR FUTURE STUDIES

This section presents recommendations that should be considered as additional studies and analyses are completed to further advance regional strategies for management of wastewater generated by unsewered communities in the West County Area. As the agency responsible for management of local OWTS, it is anticipated that Sonoma County will take the lead in moving these efforts forward in partnership with local communities. Specific recommendations related to these future efforts are as follows:

- This study identifies unsewered community clusters that should likely be considered as part of future evaluations due to their opportunities for connection to local treatment facilities and the risks related to septic system impacts on the Russian River. However, additional areas should also be considered beyond those presented herein[3].
- Connecting existing unsewered parcels to a centralized WWTP will require multi-agency coordination, funding partnerships, and new governance structures. It is recommended that strategies for consolidating resources with respect to management and operations of the individual community collection systems be evaluated, as this approach can significantly reduce ongoing O&M costs.

The local wastewater agencies evaluated as part of this study can support these activities by structuring their planning efforts and future projects in a manner that provides for the potential to accept unsewered flows in the future. Agencies can also support this effort by better defining costs for connection of unsewered parcels that are outside of their current service areas.

Specific to RRCSD, the following are recommended next steps:

- Participate in discussions with Sonoma County, the Monte Rio/Villa Grande unsewered community, and other unsewered communities in the region regarding connection to the RRCSD WWTP.
- Complete data collection needed (as recommended in the current RRCSD Treatment Plant Master Plan) to better define current influent BOD and TSS load peaking factors during storm events and confirm long-term secondary treatment capacity needs.
- Evaluate the feasibility and cost of expanding the existing irrigation/disposal area by up to 55 acres[4]. This analysis should also consider whether expanding the irrigation/disposal into a small portion of the recently acquired 394-acre forested property would be aligned with existing conservation easement requirements.
- Continue to identify and make the improvements needed to safely and reliably operate the WWTP during peak flow conditions.

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[3] Several unsewered parcels in the area west of Graton and Forestville are near Green Valley and Atascadero Creeks (and likely within their floodplains). These parcels were not flagged as high risk (orange or red) as part of this study primarily because of their limited accessibility from the GCSD and FWD WWTPs. However, if a new raw wastewater conveyance pipeline is constructed between Graton and Forestville, it may be prudent to also revisit the feasibility of connecting additional community clusters located in this area.

[4] The required acreage could be as low as 17 acres if the expansion areas are able to accommodate similar irrigation volumes as supplied to the Upper Burch property.

- Identify and implement the necessary WWTP resiliency-related improvements needed to address current seismic vulnerabilities and flooding vulnerabilities under potential future climate change scenarios. For future flood protection, it may be necessary to raise the height of the levee around the Emergency Storage Pond. Such a project would increase EQ capacity and provide enhanced flood protection.
- Coordinate with the Regional Water Board regarding discharge expectations during extreme dry-year conditions.
- As condition-related improvements are completed, consider potential long-term capacity needs and whether equipment should be upsized to accommodate potential future flows. Because increasing treatment unit capacities to accommodate flows generated outside of a designated service areas could lead to growth inducing issues being raised during an environmental review process, agencies should prioritize condition-related improvement projects that would benefit from expansion under a future regional approach until after the regional strategies have been bettered defined and subsequently evaluated through their own environmental review process.
- Utilize information included in this report and information developed under the current Treatment Plant Master Plan effort to better define buy-in costs for new users.
- Consider leveraging available statewide funding for septic-to-sewer projects to expand service to unsewered parcels within the existing RRCSD Service Area.

Specific to FWD/GCSD, the following actions are recommended:

- Complete a wastewater treatment facilities planning effort to better define the improvements needed at the GCSD WWTP and FWD WWTP to address nitrogen removal requirements for continued surface water discharge. As part of this effort, complete the following assessments:
  - Define the preferred technology for a new treatment plant that provides the capacity and level of treatment required to meet the FWD/GCSD needs, including solids handling processes.
  - Determine if a common post-secondary treatment system for nitrogen removal, filtration, and advanced disinfect could be a cost-effective strategy (in lieu of building an entirely new treatment plant).
  - Define the preferred location for the new treatment facilities (either at the GCSD or FWD site).
  - Consider potential expansion that may be needed to accommodate unsewered communities when selecting a preferred treatment strategy and identifying space needs.
- Better define the available discharge capacity at the two existing surface water discharge locations. Identify what flow trigger would necessitate construction of a new outfall to provide the required dilution. Given the significant cost of the new outfall, the disposal capacity provided by the existing discharge sites could be a limiting factor for growth. With this effort an evaluation of the viability of potential lower-cost supplemental local discharge sites could also be warranted.
- Better define roles and responsibilities related to management of the existing combined recycled water system for more integrated operations.

- As condition-related improvements are completed, consider potential long-term capacity needs and whether equipment should be upsized to accommodate potential future flows. Because increasing treatment unit capacities to accommodate flows generated outside of a designated service areas could lead to growth inducing issues being raised during an environmental review process, agencies should prioritize condition-related improvement projects that would benefit from expansion under a future regional approach until after the regional strategies have been bettered defined and subsequently evaluated through their own environmental review process.
- Evaluate governance structure and cost allocation mechanisms (e.g., formal joint-operations or JPA structure) needed for more integrated, long-term joint FWD/GCSD operations. This should include additional evaluation of opportunities for shared operations staff to improve overall cost-efficiency.
- Participate in discussions with Sonoma County and unsewered communities in the region regarding connection to the GCSD WWTP and/or FWD WWTP.
- Utilize information included in this report and information developed in the recommended facilities planning effort to better define buy-in costs for new users.
- Further evaluate the opportunity to deliver recycled water to the local quarries and whether existing quarry storage ponds could be used to offset long-term storage needs. Implement this strategy if it is determined to be viable.
- Complete additional modeling of flooding in the Atascadero Creek watershed to confirm the resiliency of the GCSD WWTP to flooding under climate change scenarios.
- Coordinate with the Regional Water Board regarding discharge expectations during extreme dry-year conditions.
- When appropriate, complete an analysis to identify environmental constraints related to installing a new outfall in the Russian River.
- Work with Sonoma Water to determine if the size of the planned OCSD conveyance infrastructure should be increased to allow for additional flows from unsewered areas near OCSD and along the planned pipeline alignment. Alternatively, and pending further hydraulic analysis, a parallel pipeline may be needed to accommodate future connections of unsewered areas.
- Consider leveraging available statewide funding for septic-to-sewer projects to expand service to unsewered parcels within the existing FWD/GCSD Service Areas.

Concord

1001 Galaxy Way, Suite 310
Concord CA 95420
925-949-5800

Davis

2020 Research Park Drive, Suite 100
Davis CA 95618
530-756-5905

Irvine

25 Edelman, Suite 120
Irvine, CA 92618
949-420-3030

Lake Oswego

5 Centerpointe Drive, Suite 130
Lake Oswego OR 97035
503-451-4500

Medford

3235 Hillcrest Park Drive, Suite 106
Medford OR 97504
458-299-0843

Oceanside

804 Pier View Way, Suite 100
Oceanside CA 92054
760-795-0365

Phoenix

4505 E Chandler Boulevard, Suite 265
Phoenix AZ 85048
602-337-6110

Pleasanton

6800 Koll Center Parkway, Suite 150
Pleasanton CA 94566
925-426-2580

Sacramento

100 Howe Avenue, Suite 110S
Sacramento CA 95825
916-306-2250

San Diego

11545 West Bernardo Court, Suite 209
San Diego CA 92127
858-505-0075

Santa Rosa

2235 Mercury Way, Suite 105
Santa Rosa CA 95407
707-543-8506