Technical Memorandum

SMCSD Headworks, Primary and Secondary Treatment Pre-Design

Subject: **Recommended Project Summary**

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The purpose of this technical memorandum (TM) is to present the Recommended Project Summary for the new headworks, primary and secondary treatment facilities for the Sausalito-Marin City Sanitary District (SMCSD) Wastewater Treatment Plant (WWTP). The content of the Recommended Project Summary is based on the findings and recommendations from the individual TM's written for each of the major plant processes, which are included as appendices. This TM is organized as in the following sections:

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For ease of reference, all drawings listed in the individual design TMs are included as one complete package in the Appendix to this summary.

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1 Project Goals and Approach

SMCSD is currently evaluating upgrades to its WWTP. The main goals for the SMCSD WWTP upgrades are:

- Protection of public health and bay water quality
- Improve WWTP operation including:
    - Reliability
    - Operational flexibility
    - Minimization of maintenance requirements
- Avoid wet weather blending
- Address site issues including:
    - Plant and truck loading access
    - District administration needs and existing parking difficulties
    - Space constraints and future site flexibility
    - National Park setting and coordination with the National Park Service (NPS)

To achieve these goals, the addition of a new headworks facility, primary treatment, increased secondary treatment capacity and upgraded tertiary treatment were evaluated. A core consideration of the evaluation is SMCSD's unique treatment plant site which presents several challenges not common at most WWTPs.

In addition, SMCSD is currently preparing for discussions with the National Park Service (NPS) regarding an extension of the existing lease agreement for the land (owned by the NPS) on which the SMCSD WWTP is located. SMCSD would also like to include additional land requirements for upgraded treatment facilities as part of the lease extension discussion with the NPS; therefore the preliminary design evaluation will also be used to identify additional land requirements for the process upgrades.

1.1 Improve WWTP Operation

The addition of headworks process and additional primary treatment capacity is being evaluated in order to improve treatment plant operation and performance, reduce maintenance on downstream process, and provide additional operational flexibility and redundancy. The process areas that were added or upgraded to specifically improve WWTP operation include the headworks (i.e. screening and grit), primary treatment, and tertiary treatment process.

Screenings and Grit Removal

Screenings and grit removal is critical to the protection of wastewater treatment equipment as the trash and inert particles present in wastewater, such as sand and gravel, can cause unnecessary abrasion and wear on mechanical equipment, deposits in pipelines and channels, and accumulation in process structures. Screenings and grit facilities will allow SMCSD to remove trash and grit at the beginning of the wastewater process and will provide a more effective method for handling these waste materials.

Primary Treatment Redundancy and Performance

The SMCSD WWTP currently has one circular primary clarifier which was built in the 1950's. All flow to the treatment plant passes through the existing primary clarifier. Therefore, the clarifier cannot be taken out of service for maintenance or repairs without adversely impacting plant performance.

Although the existing primary clarifier can hydraulically pass the peak instantaneous wet weather flow, the surface overflow rate during wet weather flow is higher than the typical peak design value. The clarifier's solids removal capacity is greatly reduced at peak flow rates, especially given the relatively shallow side water depth. Consequently, there is a need to increase primary treatment capacity at peak wet weather flow rates.

The addition of a second primary clarifier will provided SMCSD with additional redundancy during dry weather and will provide additional process capacity during wet weather.

Tertiary Treatment Upgrade

SMCSD has existing continuously backwashing sand filters which are used to remove additional suspended solids from the secondary effluent. The sand filters were added as a side stream process that can treat a maximum flow of 1.0 MGD. The sand filters are a necessary part of the treatment process because they reduce the total suspended solids (TSS) concentration in the secondary effluent from 45 mg/L to below the SMCSD NPDES permit limit of 30 mg/L (monthly average). The District has worked to optimize the filters over the years and they are currently performing adequately as a polishing step. However, the filters have been in service for approximately 30 years and are approaching the end of their useful life.

In addition, because the existing sand filters only have a capacity of 1.0 MGD, they are ineffective at proving polishing treatment during peak wet weather events. Increasing the tertiary treatment capacity to 6.0 MGD will improve operational flexibility while also improving treatment plant performance during wet weather.

1.2 Wet Weather Blending

During peak wet weather events, the influent flow to the treatment plant can exceed the process capacity of the fixed film reactors (FFR), which is limited to the 6.8 MGD capacity of the FFR feed pump station. Above 6.8 MGD, primary effluent is passively routed around the fixed film reactors and directed to the secondary clarifiers. The operational strategy of mixing primary effluent and secondary effluent is commonly referred to as “blending” and is currently allowed under SMCSD NPDES permit.

However, when the WWTP is blending, additional sampling, data collection and record keeping are required. In addition, the Regional Water Quality Control Board (RWQCB) has required SMCSD to look at alternatives to blending which include equalization, increasing secondary treatment capacity and/or adding treatment specifically for blended flows. Blending could be eliminated from future SMCSD NPDES permits which are renewed every 5 years. The existing NPDES permit is schedule to be renewed in 2012. Therefore, assessment of whether blending can be eliminated, and at what cost, are important project issues to be addressed.

1.3 Siting/Land Requirements

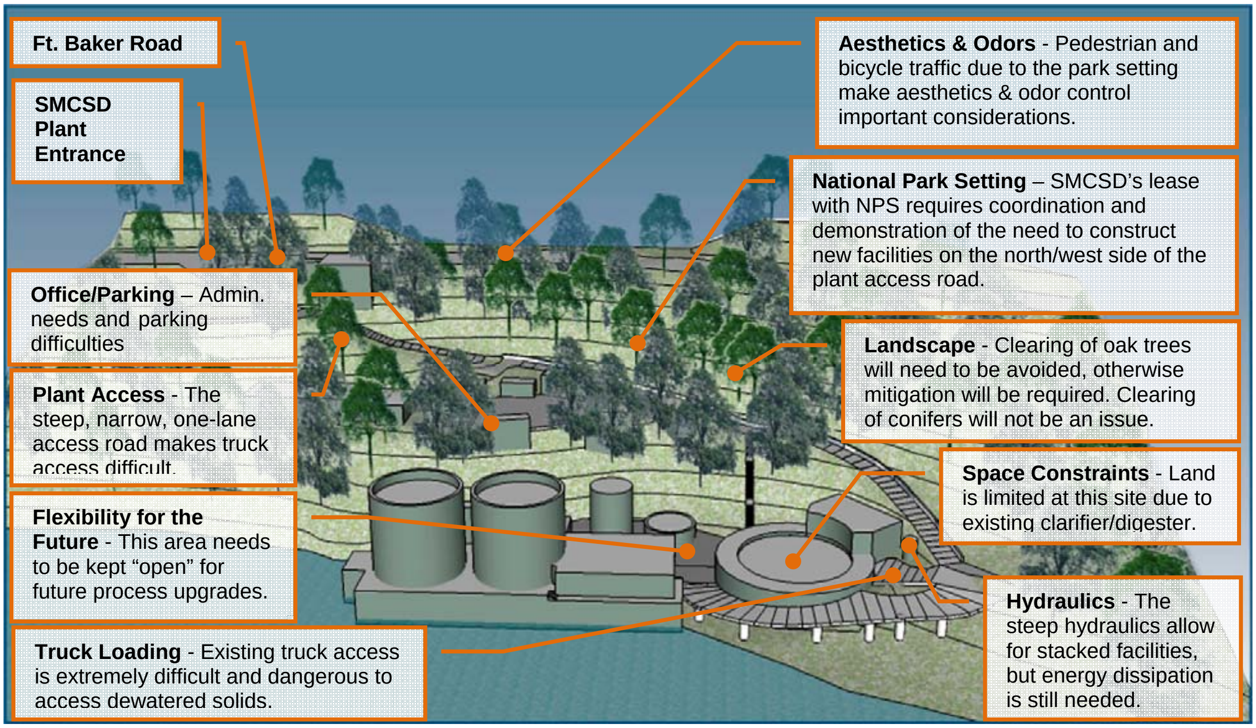
The goal of the siting evaluation was to select a location for the new headworks and primary treatment facility that maximizes the following objectives:

- **Minimize the interruptions to the existing treatment process -** The existing plant has to be kept in operation while the new facilities are constructed. The current plant is the result of several plant expansions and upgrades dating back to the 1950’s and, as a result, buried utilities and the current flow path will be difficult to ‘patch’ into without disrupting current operations.
- **Take advantage of the natural drop in ground elevation -** The existing SMCSD site is located on a steep hill-slope which can allow for more use of hydraulic grade when configuring the layout for the new facility.
- **Simplify waste material handling and storage -** Material handling at the existing facility is difficult and time consuming due to access and site constraints.
- **Use the existing site as efficiently as practical -** Provide as much contiguous area as practical for future plant upgrades (other plant upgrades, improvements, etc). Any construction outside the

existing plant footprint could require additional environmental documentation and/or coordination with the NPS which would extend the timeline for the project. Coordination with the NPS will also be required to secure additional land for process upgrades and as part of SMCSD's lease extension discussions.

The selected site plan must be able to accommodate the elements listed above, while meeting the objectives of the project. The specific site issues considered are summarized in Figure 1.

Figure 1: Site Issue Summary



2 Recommend Project Summary

The following are recommended to improve plant operation, reliability, performance and to reduce wet weather blending events:

- Improve WWTP Operations
  - New screening and grit removal facilities
  - New material handling area with truck turntable
  - New circular primary clarifier
  - Replacement and increased capacity of existing tertiary filtration process
- Avoid Wet Weather Blending
  - Minimum of 0.6 MG of equalization storage
  - New FFR feed pumps with 9.0 MGD capacity
  - Replacement of existing FFR media
- Address Siting Constraints
  - Relocate access road north to accommodate headworks, primary and material facilities

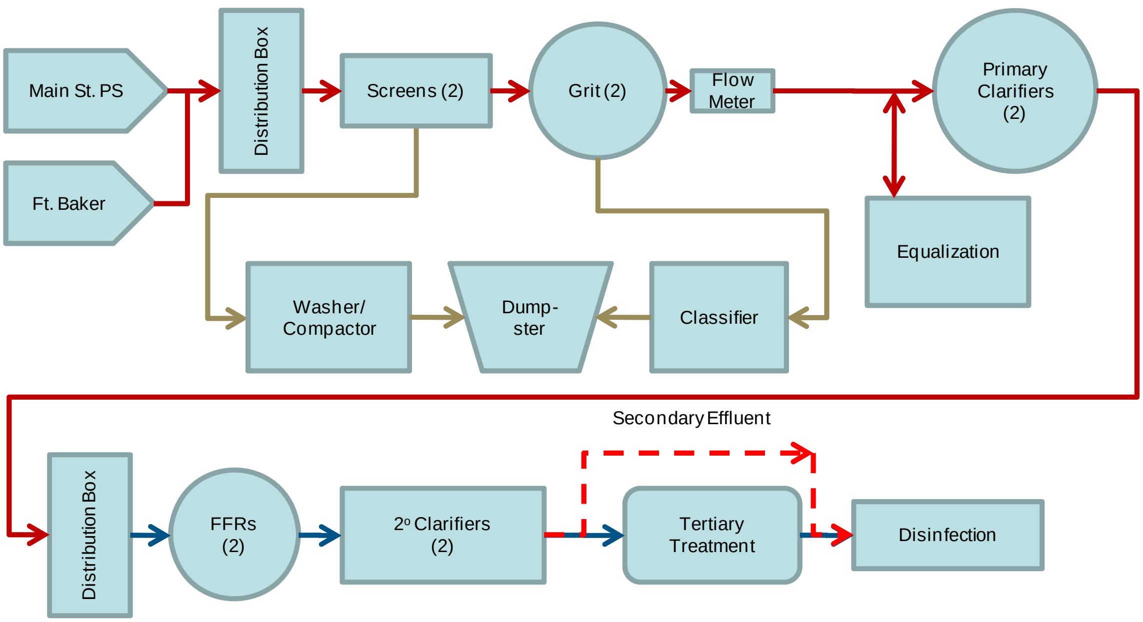
- Locate FFR and tertiary process within existing treatment areas
- Provide additional administration and parking space

Detailed discussions of each of the recommended improvements are included in their respective process TMs (TM 1 through 8) which are included in the Appendices.

2.1 Design Criteria

The basis for the process design criteria are summarized in TM 1: Design Criteria and presented in the individual process TMs. A simplified process flow schematic for the recommended project is shown as Figure 2. A more detailed process flow schematic and design criteria are shown in Drawing G-4.

Figure 2: Simplified Process Flow Schematic



2.1.1 Design Flows

Based on the estimated influent flows to the SMCSD treatment facility, it is recommended that the new headworks and primary treatment facilities be designed to treat 6.0 MGD with accommodation for peak wet weather flows up to 13.0 MGD. Design of the new processes was based on the projected flow data presented in Table 1.

Table 1: Influent Flow Rates

Condition	Influent Flow (MGD)
	0.25
Average Day Dry Weather Flow (ADWF)	1.5
Peak Day Dry Weather Flow (PDWF)	3.2
Average Day Wet Weather Flow (AWWF)	1.8
Peak Day Wet Weather Flow (PWWF)	6.2
5-Year Event Instantaneous Peak Wet Weather Flow	12.3
10-Year Event Instantaneous Peak Wet Weather Flow	13.0

The design flows for the treatment plant improvements are summarized below:

- The mechanical screens at the headworks are designed to handle the future maximum day flow of 6.0 MGD. The addition of a manual bar screen allows screening of the current maximum instantaneous peak flow of 13 MGD.
- The grit process is sized to handle the future maximum day flow of 6.0 MGD. Depending on the actual sizing and configuration of the grit basin(s), the grit process should be designed to hydraulically handle up to the peak instantaneous flow of 13 MGD.
- The new primary treatment process is designed to match the existing primary clarifier and is nominally designed for a peak flow of 6.0 MGD. Using the new primary clarifier in conjunction with the existing primary clarifier will allow primary treatment of the current maximum instantaneous peak flow of 13 MGD. However, with the addition of equalization, the peak flow to the primary treatment process will be 9.0 MGD.
- The new on-site equalization is sized to provide 0.6 MG of storage and limit flow to the secondary process to 9.0 MGD.
- The FFR pump station is sized to pump 9.0 MGD to the fixed film reactors.
- The FFR reactor media is being replaced to address aging infrastructure and to accommodate the additional hydraulic loading of up to 9.0 MGD.
- Replace the existing sand filters with 6.0 MGD of rotating disk filtration capacity to address aging infrastructure and increase treatment capacity during wet weather.

The updated treatment plant hydraulic profile is attached Drawing G-5.

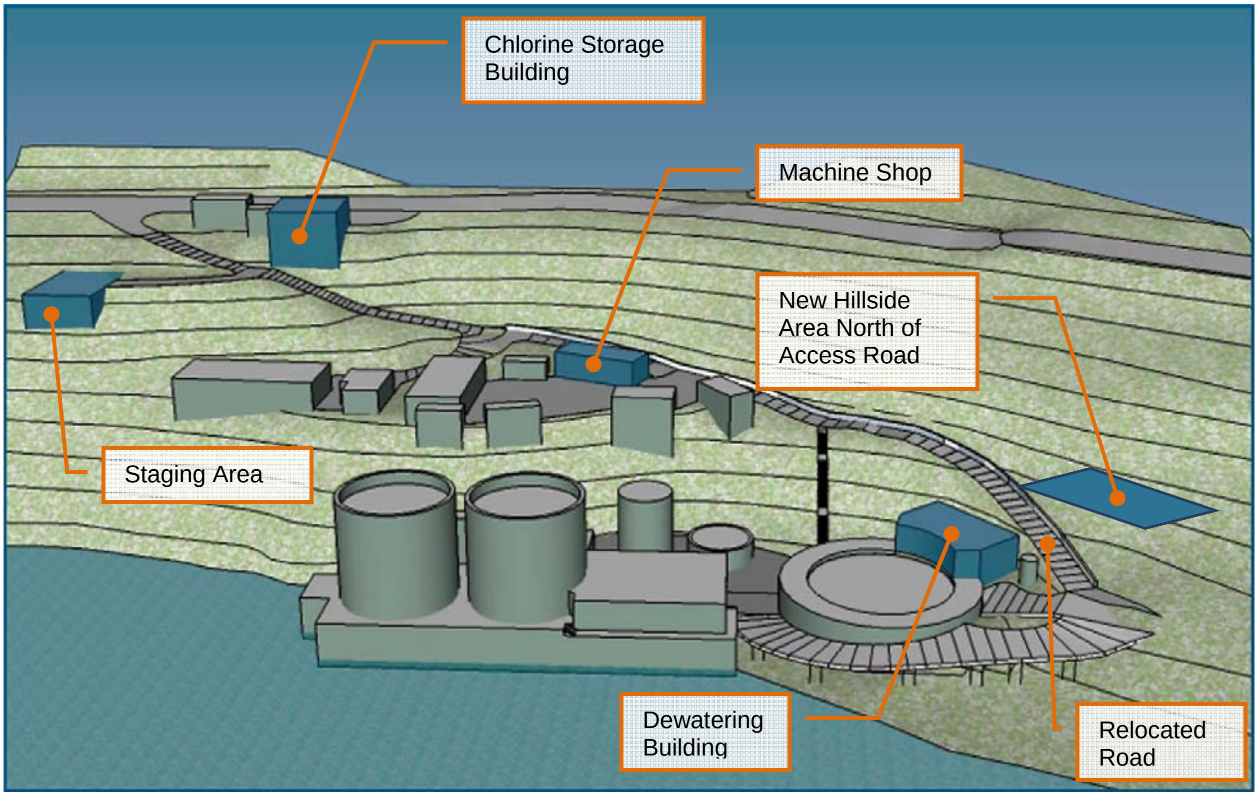
2.1.2 Design Loadings

The design of the new headworks and primary treatment will be based on hydraulic capacity. Therefore, influent loading from BOD, TSS and other constituents will not have a significant impact on equipment selection or sizing. For the secondary process upgrades, the primary objective is to provide additional hydraulic capacity to handle peak wet weather flows while meeting NPDES permit effluent limits. A constant mass loading was assumed during wet weather because the majority of wet weather flow can be attributed to inflow and infiltration, which would not provide a substantial increase in influent BOD and TSS mass loadings.

2.2 Siting

An initial set of potential sites for the new headworks/primary treatment facility was developed and are shown in Figure 3.

Figure 3: Potential Headwork/Primary Treatment Site Locations



Based on the objectives of the project and site issues, specifically potential aesthetic and odor impacts, the list of potential site locations for the new headworks and primary facilities was narrowed down to three sites options, all located below the intermediate administration level at the SMCSD site. The secondary treatment process upgrades will be located within existing process area or in the location of the existing sand filters (See TM 7: Secondary Treatment).

The three site plan alternatives were developed based on the dewatering building location (Bayside Option), a new hillside location (Hillside Option) and moving the existing access road to the north (Relocated Road Option). For each option, location and layout alternatives were developed for the evaluation. While all three alternatives have different configurations, they all have the same core process features, components, and meet the objectives for the new facility. One of the key differentiators amongst the alternatives is that the Bayside Option would be completely contained within the existing treatment plant footprint. The Hillside Option and Relocated Road Option both would require additional land for implementation. Obtaining additional land would require negation with the NPS and additional environmental documentation.

Recommended Site Plan

Although a new facility could be configured under the Bayside Option, it would require stacking several process units and would provide a very compact operating space. The main disadvantage of the Hillside Option is that it would effectively be isolated from the existing treatment plant site by the existing access road.

In addition, both the Bayside and Hillside Options would require the use a compact primary treatment technology. Although it is believed that a compact primary clarifier technology would perform adequately, it would not provide the same level of redundancy or ease of operation that a traditional primary treatment technology would offer.

The Relocated Road Option is the recommended alternative as it will provide enough space to accommodate a conventional circular primary clarifier, while also meeting the objectives for the new facilities. An overall site plan for the recommended project, including the secondary upgrades, is shown on Drawing C-1 and in Figure 4and Figure 5, below. Additional details on the siting evaluation and recommend site are presented in TM 2: Siting.

Figure 4: Overall Recommend Project Site Plan

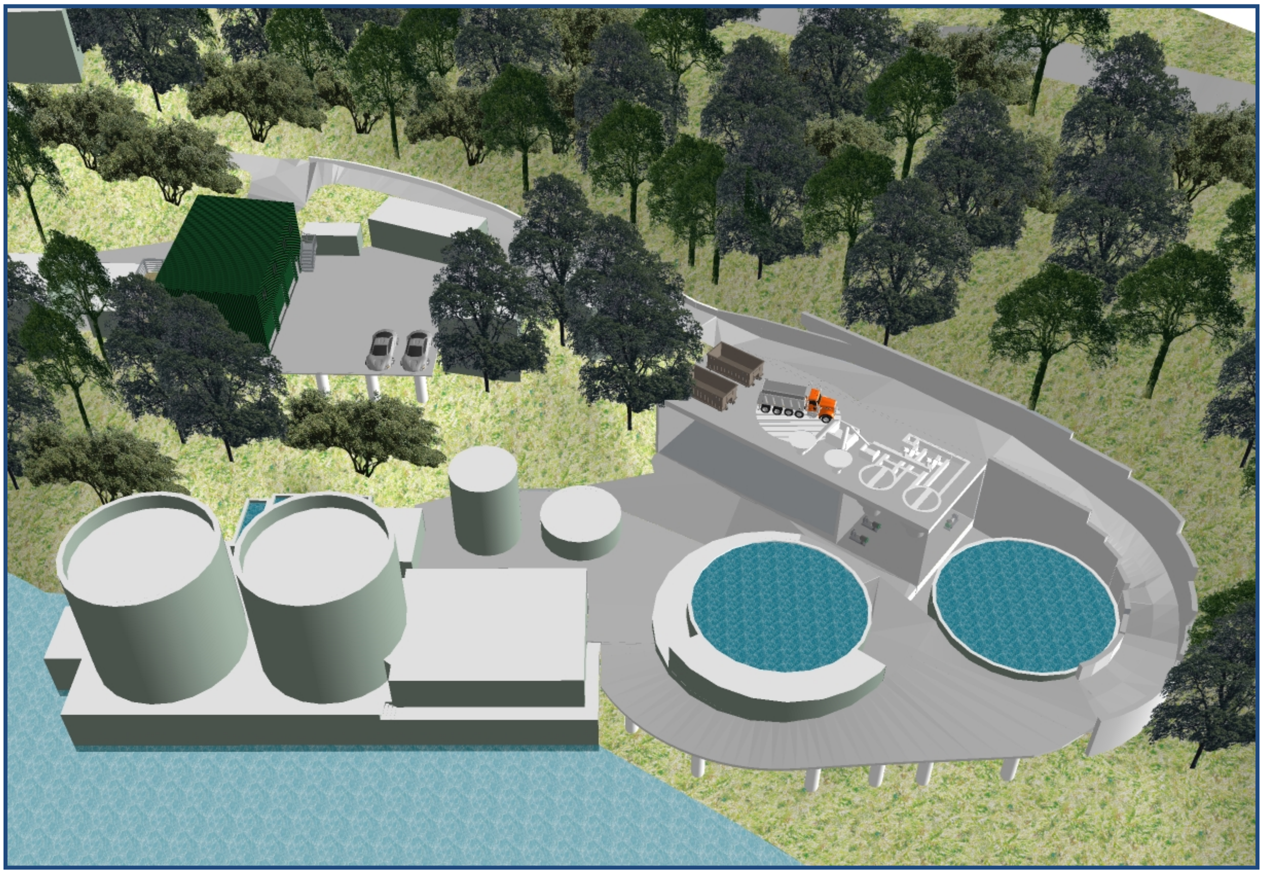
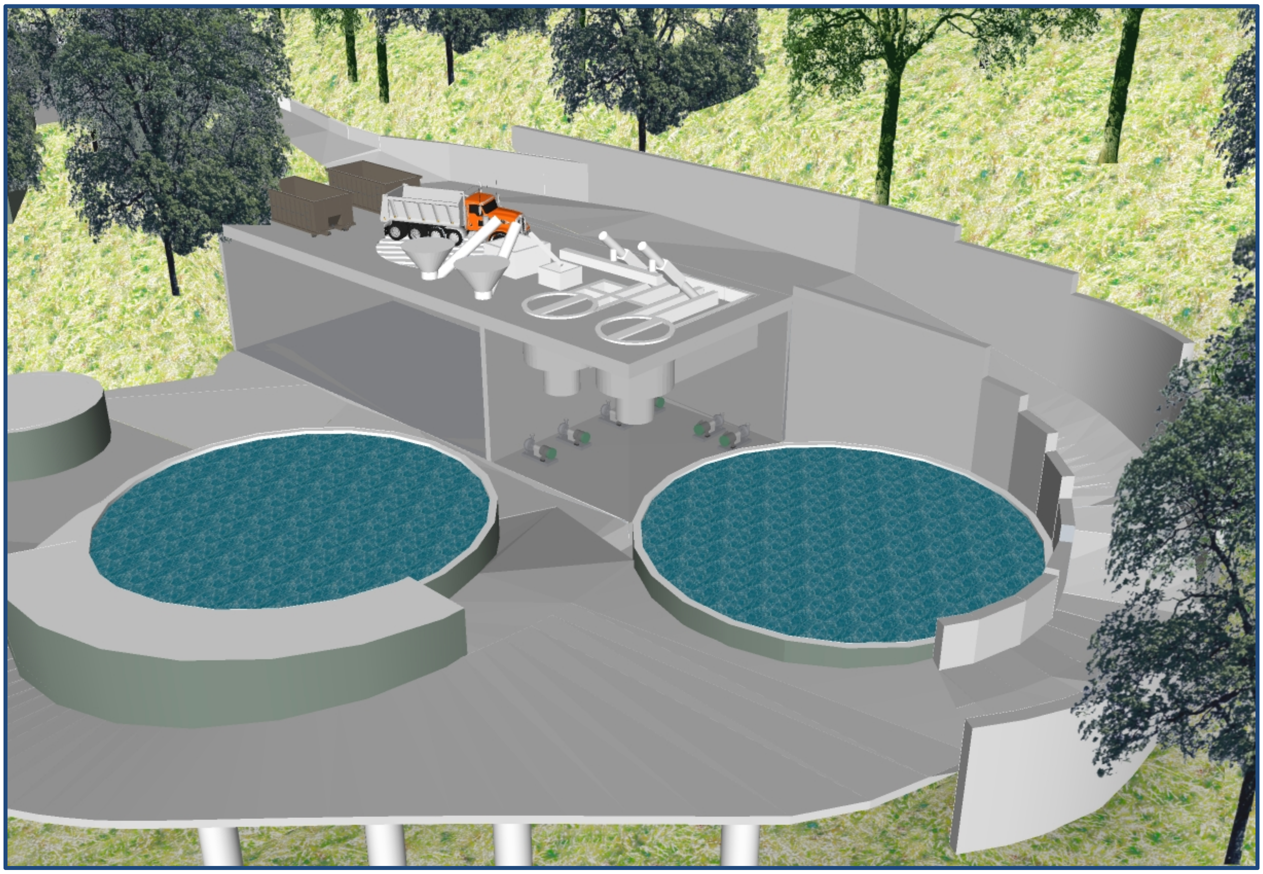


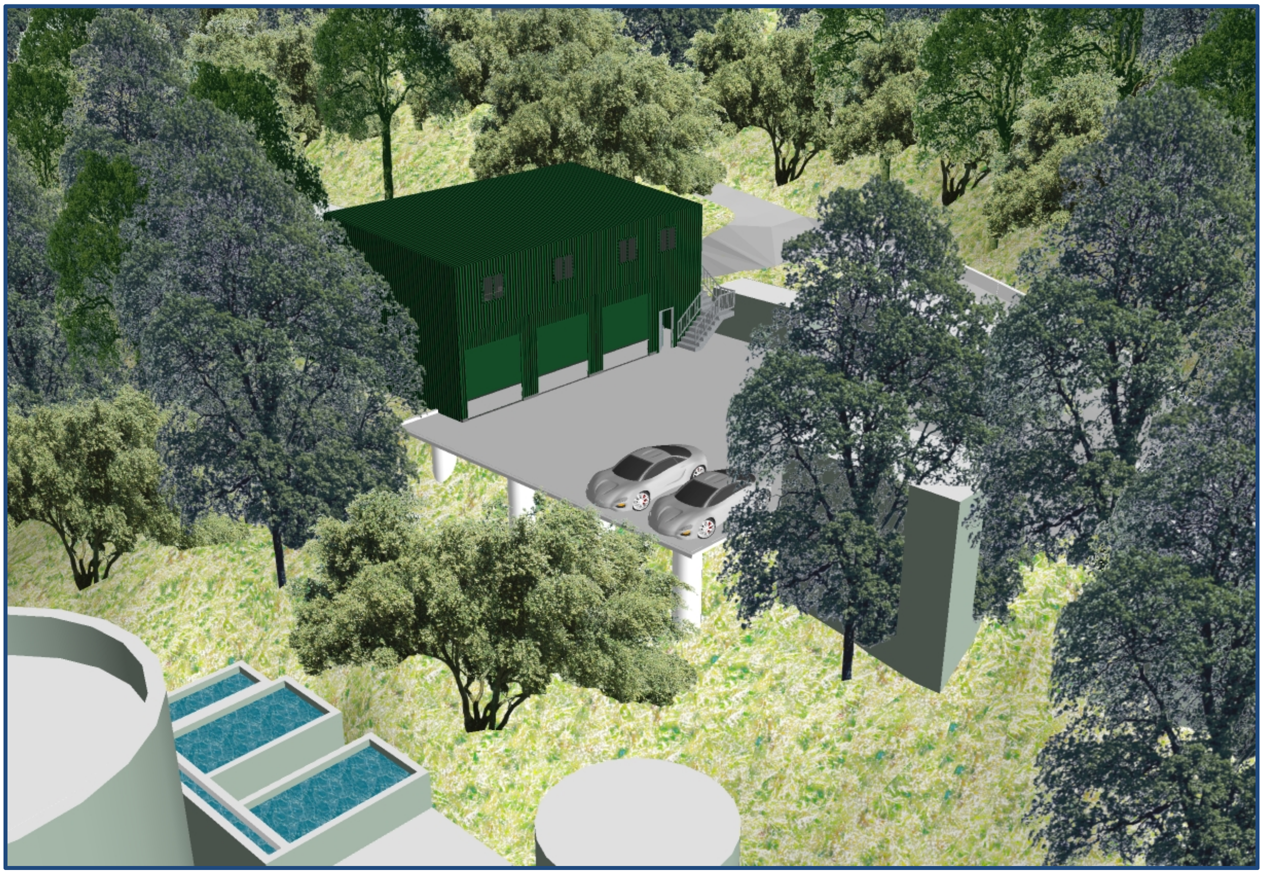
Figure 5: Relocated Road Option



Office and Parking Space

The District is currently examining the feasibility of adding office space above the existing maintenance/storage building. The current plan would be to add an elevated pre-engineered building while preserving the maintenance and storage space below. In addition, an extended parking area for will be installed along the area between the General Manager's Office and the existing maintenance/storage building. The proposed location for the new office space is shown on Drawing C-3. It is recommended that SMCSD pursue siting of the new office space above the existing maintenance/storage building. It is recommended that the project provide additional parking for SMCSD staff and visitors by removing two existing shipping containers and construction of an elevated parking area adjacent to the new administration building. The new parking area will be created from an existing paved area and will include a new portion that will extend over the hillside. An illustration of the new administration building and parking area is shown in Figure 6.

Figure 6: Proposed Office and Parking Space



2.3 Headworks/Primary/Materials Handling Facilities

The headworks, primary treatment and material handling facilities will be located on the north end on the existing treatment plant site. Screening and grit processes would be located within a new headworks building. A truck turntable would be located next to the headworks to facilitate materials handling including dewatered cake, screenings and grit disposal. Equalization storage would be located below the materials handling and headworks structure.

2.3.1 Headworks

The headworks process area includes screenings and grit along with the related supporting equipment.

Screens

The sieve auger screen is recommended due to better removal and washing of screenings. The sieve auger screens will have ¼ inch openings and will be designed to handle a minimum combined flow of 6 MGD (3 MGD each). The manual bar rack and bypass channel will be used during flows above 6 MGD, or if a filter screen is out of service during peak wet weather flow. Manual bar screening for flows above 6 MGD should be adequate as most of the debris in the collection system would have flushed into the treatment facility before flow levels rise above 6 MGD. The screenings will be cleaned and washed by a separate washer/compactor unit that will discharge directly to the grit bin. Additional details on the screening evaluation and recommendation are presented in TM 3: Screening.

Grit

Due the lower relative capital and O&M cost and proven reliable performance, it is recommended that a mechanical vortex grit system be used. The mechanical vortex grit system provides the best combination of small footprint, good removal efficiency, low power consumption, and low odor generation.

Grit removed by the grit removal system will be pumped to a grit reduction/classification system to remove organic material and reduce the total volume of grit requiring disposal. It is recommended that an air lift pump be used to pump the grit to the grit reduction/classification system.

A Huber Coanda (or similar) grit washer is recommended for the SMCSD facility. The Huber Coanda is recommended because it produces a relatively cleaner grit than a cyclone/classifier and has lower capital and O&M costs compared to the Eutek Slurry Cup. Additional details on the grit evaluation and recommendation are presented in TM 4: Grit Removal.

2.3.2 Primary Treatment

Due to the limited amount of space available on the existing WWTP site, additional land would be required to accommodate a new conventional circular primary clarifier. If additional land can be secured, a new circular primary clarifier is recommended giving SMCSD two primary clarifiers with the exact same capacity and configuration. The new primary clarifier would be installed to match the hydraulic gradeline of the existing primary clarifier. Primary sludge and scum pumps would be located underneath the new headworks and adjacent to the new primary clarifier. A preliminary layout of the primary sludge and scum pumps is shown on Drawing M-14. The new primary clarifier would be covered with a flat aluminum exposed trussed cover to minimize odors.

Flow distribution would be achieved in the primary influent distribution box in the headworks. To improve redundancy and reliability, it is recommended that the effluent from the new primary clarifier be conveyed in a dedicated line to the downstream diversion box where it will join the effluent from the existing primary clarifier. A single primary clarifier would be sufficient for nearly all flows to the treatment plant, including moderate peak wet weather events up to 6 MGD. For flows greater than 6 MGD, both primary clarifiers would be in service.

The layout and location for the primary clarifier is discussed in TM 2: Siting, and illustrated on Drawings M-10, M-11 and M-12. Additional details on the primary treatment evaluation and recommendations are presented in TM 5: Primary Treatment.

2.3.3 Materials Handling

In order to facilitate waste hauler access and maneuverability, it is also recommended that a truck turntable be installed. The turntable will minimize the amount of space required for truck access. In addition to material handling, the truck turntable could be used to help other plant functions such as chemical and other supply deliveries.

The District will continue to manually perform in-plant transfer of dewatered sludge to an on-site storage bin. A new front loading vehicle has been purchased by the District to facilitate the in-plant transfer. The District has also purchased two 14 CY roll-off dumpsters for dewatered sludge which will be picked up twice per week by a contract hauler for disposal.

Grit will be placed directly in a waste bin from the grit washing process. A 6 CY bin is recommended for grit because it is small enough that it can be maneuvered within the headworks building and it is large enough to allow more than a week’s worth of grit storage, if needed. Due to the small volume of screenings produced, it is recommended that screenings be stored in the same bin as the grit.

Additional details on the materials handling evaluation and recommendation are presented in TM 6: Materials Handling, Storage and Disposal.

2.4 Secondary Upgrades

Based on input from District staff, the recommended secondary process upgrade configuration will include equalization storage. Therefore, the treatment of blended wet weather flows will not be required. With equalization and tertiary treatment, the recommended process configuration is summarized below:

- Add equalization storage (~0.6 MG) as part of the headworks structure
- Upgrade the FFRs to 9.0 MGD hydraulic capacity
  - Upgraded FFR feed pumps
  - New FFR media
  - FFR odor control covers
- Replace existing 1.0 MGD sand filters with expanded tertiary process located within the same footprint with capacity between 4.5 MGD and 6.0 MGD.

Additional details on the secondary treatment evaluation and recommendations are presented in TM 7: Secondary Treatment.

2.4.1 Equalization

Based conveyance system hydraulic modeling, with a secondary capacity of 9.0 MGD, 0.6 MG of storage would prevent the District from having to blend for influent flows up to and including the 5-year event. Although there is a relatively small increase in peak flow between the 5-year and 10-year events, there is a significant increase in the duration and volume (above 9 MGD) between the two events which would require 2.0 MG of storage. It is recommended that a minimum of 0.6 MG of equalization storage be provided which will allow SMCSD to avoid blending up to and including the 5-year event. The equalization storage tank would be integrated into the new headworks structure and would have the capacity to store a minimum of 0.6 MG of primary influent. The final volume will be determined during final design based on the volume that can be readily made available within the headworks structure.

The equalization tank would be configured to store primary influent which would be controlled by an adjustable weir gate in the primary influent distribution box. An equalization return pump station would be provided to return flow to the primary influent distribution box. In order to minimize cleaning and maintenance, the equalization tank will be compartmentalized into either two or three separate basins. Overflow weirs would be provided in each basin so that flow will enter the next basin when full. Each compartment would also include sloped floors and a tipping trough to facilitate wash down and cleaning.

2.4.2 Fixed Film Reactor Upgrades

Currently blending is needed because peak wet weather flow into the treatment plant exceeds the capacity of the secondary process (specifically the FFRs). The existing FFRs are currently limited to a capacity of 6.8 MGD and were originally designed for a hydraulic loading of 1.66 gal/min-ft^2. Because peak wet weather flows are the result of inflow and infiltration, the additional flow does not necessarily increase BOD mass loadings to the treatment plant. Therefore blending could be avoided by increasing the hydraulic capacity of the FFRs while maintaining the current level of biological treatment.

Sending the full 5-year event flow (12.3 MGD) to the FFRs would result in a hydraulic loading of 3.4 gpm/ft^2, which is much higher than typical design peak hydraulic loading rates. A more moderate increase in flow to the FFRs during peak wet weather events would allow SMCSD to increase the secondary treatment capacity while minimizing the concerns associated with hydraulically overloading the FFRs. For example, using the 0.6 MG equalization described previously, would limit flow rates to the FFRs to 9 MGD and hydraulic loading rates to 2.5 gpm/ft^2. Stress testing of a single FFR can be performed to confirm the adequate process operation at 2.5 gpm/ft^2 hydraulic loading rate.

Implementation of the capacity upgrade to 9.0 MGD would involve the following upgrades:

- Replace existing FFR feed pumps to provide 9.0 MGD to the FFRs.
- Replace the FFR media
- FFR odor control covers

New or upgraded FFR feed pumps would be needed to provide 4.5 MGD of flow to each FFR. The pump upgrade would include new motors and variable frequency drives (VFDs). The distributer mechanism on the FFRs was recently upgraded to mechanically driven units. The existing distributer was designed to allow up to 7.2 MGD of flow through the distributer arms. Flows in excess of 7.2 MGD are designed to overflow the center column on the distributer mechanism. The existing FFR media was installed 30 years ago. Given the age of the media and the additional hydraulic loading, it is recommended that the FFR media be replaced.

2.4.3 Tertiary Upgrades

To better accommodate peak wet weather flows, provide redundancy, and add tertiary capacity, the replacement and expansion of the existing polishing treatment process was evaluated. The tertiary process would be added after secondary clarification to help remove additional TSS and BOD to meet NPDES permit limits.

It is recommended that the rotating disk filer be used, pending further evaluation to confirm their suitability for use at SMCSD. The rotating disk filters would have the lowest construction cost and require the smallest footprint. The recommended next steps would be to pilot testi a rotating disk filter unit. It is also recommended that SMCSD staff visit an operating disk filter facility to obtain feedback on the units. If it is determined that the cloth media filters cannot be used, then it is recommended that continuous backwashed sand filters be used.

Rotating disk filters would be installed where the existing sand filters are located. The existing filter feed pumps would be upgraded to provide additional flow. The tertiary filtration process will be supplied as a package system including controls for filter operation. The addition of coagulant and/or polymer upstream of the filters may be used to increase filter loading rates. SMCSD may be able to operate at either a lower chemical dose or without any chemicals depending upon the filter loading rate needed to meet capacity requirements. For the purposes of this evaluation, it was assumed that only a coagulant would be used.

The backwash water from the filters will be conveyed back to the head of the treatment plant or to the equalization basin. The backwash pump station will be adjacent to the filters and within the existing footprint of the existing sand filter area.

2.5 Electrical/ Instrumentation & Controls (I&C)

Preliminary electrical/I&C details were developed as part the evaluation. New process loads can be added within the existing electrical system at the treatment plant. The existing standby generator is sufficient to handle the additional treatment plant essential loads. The preliminary results of the electrical evaluation are presented in TM 8: Electrical/I&C and will be confirmed during the design.

3 Capital Cost Estimate

Pre-design level cost estimates were developed using cost estimating references, vendor quotes, and previous job experience. Raw construction costs developed for each option were the estimated sum of materials, labor, and equipment. The following percentages were used to develop the total estimated project cost:

- Pre-Design Level Estimating Contingency 30%
- Sales Tax 10%
- Contractor Overhead & Profit 10%
- Change Order Allowance 5%
- Project Implementation (Eng./CM/Admin/Permits) 31%

A summary of the capital is presented in Table 2. The estimated construction cost is escalated to the estimated midpoint of construction (July 2013). A more detailed construction cost estimate is included in the Appendices. The estimated capital cost presented should be considered a budget level estimate; actual project cost can be expected to range from 30 percent more than to 15 percent less than the estimated capital cost of $21.0M. For comparison purposes, the estimated capital cost of the Relocated Road and Bayside alternatives would be similar. The Hillside alternative would have a capital cost of approximately $1.5M less than the Bayside and Relocated Road alternatives.

Table 2: Capital Cost Estimate Summary - Recommended Relocated Road Alternative

Item	Cost
Raw Construction Cost (July 2011)	**$9,630,000**
Project Contingency (30%)	$3,090,000
Sales Tax on Materials (10%)	$510,000
Contractor Overhead & Profit (10%)	$1,030,000
Total Construction Cost	**$14,930,000**
July 2013 Construction Cost ENR Adjustment	$1,470,000
Total Escalated Construction Cost (Bid Amount)	**$15,460,000**
Change Order Allowance (5%)	$770,000
Total Construction Amount	**$16,230,000**
Design Allowance (10%)	$1,546,000
Legal / Admin / CEQA (5%)	$773,000
Construction Management Allowance (10%)	$1,546,000
Engineering Services During Construction Allowance (6%)	$928,000
Total Capital Cost	**$21,020,000**

4 Operation and Maintenance (O&M)

The addition of new or expanded process facilities will require increased operation and maintenance labor as well as power consumption to run the equipment. The only process upgrades with maintenance or operation costs associated with them are included. O&M labor or costs for dewatered cake handling and hauling or the FFR upgrades are not included since these areas will not be operated in a substantially different way from their current operation. In addition, the increases in O&M labor and costs associated with primary clarification and tertiary treatment may be redundant to some degree with existing operations.

4.1 O&M Labor

Some annual maintenance will be required for normal servicing and infrequent failures. However, the additional labor is expected to be minor because the systems are automated and rugged. The addition of screens, grit and additional primary treatment is also expected to reduce labor in other areas of the plant, primarily in the solids system, because there will be less pump clogging and digester cleaning required. Therefore, although new process facilities are being added, it is anticipated that the additional process facilities would improve overall plant performance and will result in some reduced O&M labor requirements in other parts of the treatment plant. The estimated net annual impact on SMCSD labor is presented in Table 3.

Table 3: Estimated Additional Annual O&M Labor Summary (Hours/Year)

Item	Turntable	Screening	Grit Removal	Primary Clarification	EQ and Tertiary Treatment	Totals
Operations	52	208	208	104	156	728
Maintenance	20	104	104	52	26	306
Total Labor	72	312	312	156	182	1,034

4.2 O&M Cost

The annual O&M cost estimate for each process area incorporates estimates for consumables (e.g. parts, oil, etc.), power, labor, and chemicals. Conservative estimates for chemical dose, power utilization, etc. were assumed in the analysis. The following unit rates were utilized for O&M estimates:

- Consumables
  - 1.0% of equipment capital cost (cost/year)
  - 1.0% of mechanical capital cost (cost/year)
- Power $0.15/kwh
- Labor Rate $45.00/hr
- Coagulant $0.08/Dry lb

Consumables include the annual costs for parts and materials for maintaining equipment and mechanical systems which are estimated at 1% of the capital cost. The estimated increases in annual O&M costs for each relevant process area are shown in Table 4. A more detailed breakdown of the O&M costs for each process is listed in each process TM. For the purposes of this evaluation, it was assumed that coagulant would be added to the tertiary treatment process; however SMCSD may decide to operate the tertiary process at lower surface loading rate to minimize or eliminate the need for chemical addition.

Table 4: Estimated Additional Annual O&M Cost Summary

Item	Turntable	Screening	Grit Removal	Primary Clarification	EQ and Tertiary Treatment	Totals (Rounded)
Consumables	$2,000	$3,900	$5,400	$2,900	$6,900	**$21,000**
Power Costs	$160	$7,500	$6,800	$2,700	$18,200	**$35,000**
Labor	$3,200	$14,100	$14,100	$7,000	$8,200	**$47,000**
Chemicals	$-	$-	$-	$-	$40,900	**$41,000**
Total O&M Cost	$5,360	$25,500	$26,300	$12,600	$74,200	**$144,000**