5. ALTERNATIVES SCREENING

On February 10, 2010, Napa Sanitation District (District) staff and consultants participated in the Alternatives Identification Workshop, during which attendees discussed 16 liquid treatment alternatives. Based on attendee experience and professional judgment, attendees chose six of the 16 liquid treatment alternatives to undergo detailed evaluation. In addition, the group agreed to conduct a detailed evaluation on three solids treatment alternatives.

5.1 Liquid Treatment Alternatives

The liquid treatment alternatives focus on improvements to meet future treatment and hydraulic needs, including:

- Increased peak-hour hydraulic capacity to better manage influent flows.
- Additional capacity for five-day biochemical oxygen demand (BOD) removal.
- Additional capacity for ammonia removal in the event lower effluent limits are required by a future permit.
- Additional capacity for river discharge and water reclamation.

5.1.1 Project Improvements Common to All Alternatives

Workshop attendees identified several improvements common to all liquid treatment alternatives (see Table 5-1). Since these common improvements would have identical impacts on all alternatives and would not alter significantly the outcome of the business case evaluation (BCE) process, they were excluded from the BCE process. The improvements will, however, be incorporated into the recommended Capital Improvement Program (CIP).

Table 5-1. Project Improvements Common to all Alternatives

Item	Description
Influent Pump Station (IPS)	Increase reliable hydraulic capacity
Headworks	Improve reliability
Primary Diversion Structure	Adjust weir elevations to increase primary clarifier hydraulic capacity
Aeration Basins	Replace panel diffusers to increase aeration capacity
Oxidation Ponds	Improve reliability; includes transfer structure replacement and pump station upgrades
Disinfection	Add mixer to the third basin to maximize capacity
Recycled Water Pumping	Add jockey pump for energy savings
Digestion	Improve digester heating capacity
Condition Assessment	Identify miscellaneous improvements
Hydraulic Assessment	Identify miscellaneous improvements

5.1.2 Requirements for Alternatives

For the proposed alternatives to meet the core levels of service (LOS) outlined in Chapter 2, three factors were found to be critical—the potential for lower effluent ammonia limits, recycled water capacity and river discharge capacity. Each is discussed in more detail below.

5.1.2.1 Effluent Ammonia Limit

A range of potential ammonia limits was identified for alternatives screening, as discussed in Section 2.2.5. Table 5-2 presents the high and low ammonia limits that formulated alternatives would meet. For a higher ammonia limit, the wastewater treatment plant (WWTP) might be able to produce effluent suitable for discharge with little or no immediate process modification. With a lower ammonia limit, improvements would likely be more extensive. In either case, the District would need to add capacity for growth.

Table 5-2. Potential Future Effluent Ammonia Limits[1]

Item	High Ammonia-Nitrogen Limit mg/L	Low Ammonia-Nitrogen Limit mg/L
Winter River Discharge Operational Mode (November - April)		
Average monthly effluent limitation	45	10
Maximum daily effluent limitation	109	25
Summer Reclamation Mode (Emergency Discharge Only) (May - October)		
Average monthly effluent limitation	9	2
Maximum daily effluent limitation	22	5

[1] *2011 permit limits (summer and winter) are 21 mg/L average month and 49 mg/L maximum day. Technical evaluation showed that treatment facilities recommended for the high ammonia-nitrogen limit alternatives are also sufficient for the 2011 permit limits.*

5.1.2.2 Recycled Water Capacity

Chapter 2 presents a discussion of recycled water demands, including results of the water balance. The water balance results were not available during alternatives screening. As a common basis for comparison, all alternatives were formulated to meet a peak day recycled water demand of 10.0 million gallons per day (mgd).

Implementation plans for the preferred alternative(s) (see Chapter 7) will describe the additional elements and costs to incrementally expand the recycled water capacity to meet recycled water demand up to 14.4 mgd.

5.1.2.3 River Discharge Capacity

The WWTP is operated to maintain a water balance based on past experience, wet weather flows and summer recycled water demand, and as governed by the National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permit allows discharge to the Napa River from November through April. Starting November 1, the WWTP normally discharges water to

the river at full capacity to drain the oxidation ponds. The alternatives were formulated to provide at least 25.1 mgd of discharge capacity during peak rain events to equal the maximum month 2030 influent flows. Water balance results confirmed that this capacity is sufficient to prevent pond overflow for all conditions.

The WWTP does not discharge to the river in summer under normal conditions, but wet weather during the late spring or fall (May through October) sometimes leads to one or more summer emergency discharges. The NPDES permit allows emergency discharge under certain conditions. The minimum required emergency discharge capacity is 8.55 mgd (the projected 2030 average dry weather flow [ADWF]), which would prevent ponds from filling. Additional emergency discharge capacity is desirable. All alternatives include identified summer emergency discharge capacity.

5.1.3 Alternatives Screening

As previously noted, workshop attendees considered 16 liquid treatment alternatives during screening. *TM 9 – Alternatives Screening* further describes these alternatives. Most alternatives incorporated some combination of the two existing biological treatment facilities—oxidation ponds and activated sludge. The alternatives considered a wide range of possible treatment options to meet both high and potential low ammonia limits, including:

- Expanding the natural system with additional pond aerators and non-mechanical algae removal (wetlands or covered storage).
- Expanding the natural system with additional pond aerators and mechanical algae removal.
- Adding aeration basin volume to increase activated sludge process capacity.
- Treating pond effluent after algae removal in the activated sludge process to remove ammonia.
- Replacing activated sludge process with the membrane bioreactor (MBR) process.
- Replacing activated sludge process with the integrated fixed-film activated sludge (IFAS) process.
- Adding facilities for year-round discharge.
- Adding facilities to the mechanical activated sludge process, and using oxidation ponds for water storage only.

The alternatives for replacing the activated sludge process with MBR were eliminated from further consideration, since an MBR process would be too costly and require increased energy and chemical use. The high-quality MBR effluent is not a driver for this particular facility, nor do site constraints require the small footprint of the MBR process.

The alternatives for replacing activated sludge with IFAS were eliminated from further consideration, since IFAS would require increased energy use compared to activated sludge. IFAS would be beneficial if space was limited or if excessively cold temperatures limited nitrification, neither of which applies at this facility.

Year-round discharge was eliminated from further consideration due to the uncertainty in both regulatory feasibility and corresponding nature of requirements. Year-round discharge would

limit the recycled water production capacity to less than the proposed recycled water scenarios, which does not meet proposed LOS. In addition, capital costs for mechanical plant expansion to process peak flows would be much higher than other alternatives.

The alternative to add facilities to the mechanical plant and use the ponds for water storage only was eliminated from further consideration. Capital costs for mechanical plant expansion to process all influent flows would be much higher than other alternatives.

As noted previously, workshop attendees identified six liquid treatment alternatives for detailed evaluation—three to meet the potential high ammonia effluent limits and three to meet the potential low ammonia effluent limits. These alternatives meet the basic LOS and discharge requirements and maximize the use of existing facilities. If future regulatory changes reduce allowable discharge ammonia concentrations, all high ammonia alternatives could be readily upgraded for compliance as regulations change. Table 5-3 summarizes the six selected alternatives, which are described in detail in Chapter 6.

Table 5-3. Summary of Selected Liquid Treatment Alternatives

Alternative		Required Improvements[1]	Ammonia Limit[2]	Summer Emergency River Discharge Capacity, mgd[3]
H1	Expand mechanical system	Add addition aeration basin volume to meet BOD loading projections Add pond aerators if necessary to meet BOD loading projections Add secondary effluent equalization Expand and separate effluent filters	High	12
H2	Expand natural system with mechanical algae removal	Add additional pond aerators to meet BOD loading projections Use mechanical algae removal, either expanding the flocculating clarifiers or converting to dissolved air flotation Add secondary effluent equalization Expand and separate effluent filters	High	10
H3	Expand natural system with non-mechanical algae removal	Add additional pond aerators to meet BOD loading projections Add non-mechanical algae removal to replace flocculating clarifiers (wetland or covered zone) Add secondary effluent equalization Expand and separate effluent filters	High	10
L1	Expand mechanical system	Add additional aeration basin volume to meet BOD loading projections Add pond aerators if necessary to meet BOD loading projections Add belt filter press filtrate equalization, so filtrate can be continuously routed to the activated sludge process Add secondary effluent equalization Expand and separate effluent filters	Low	8

Table 5-3. Summary of Selected Liquid Treatment Alternatives (continued)

Alternative		Required Improvements[1]	Ammonia Limit[2]	Summer Emergency River Discharge Capacity, mgd[3]
L2	Expand natural system	Add additional pond aerators to meet BOD loading projections Use mechanical algae removal, either expanding the flocculating clarifiers or converting to dissolved air flotation Add secondary effluent equalization Expand and separate effluent filters Add belt filter press filtrate equalization, so filtrate can be continuously routed to the ammonia removal process Add ammonia removal following non-mechanical algae removal, using filtrate to keep the process alive during summer when pond effluent ammonia concentrations are low	Low	20
L3	Combine natural and mechanical systems	Add pond effluent to activated sludge for nitrification Add an aeration basin and secondary clarifier to meet BOD loading projections and provide capacity to handle higher flows Add pond aerators if necessary to meet BOD loading capacity	Low	15

Notes:

[1]All liquid treatment alternatives provide 10 mgd of recycled water capacity (Strategy 2 recycled water demand). All liquid alternatives provide sufficient winter river discharge capacity of at least 25.1 mgd during peak influent flow.

[2]High ammonia-nitrogen limits are 45 mg/L monthly average in winter and 9 mg/L monthly average in summer. Low ammonia limits are 10 mg/L monthly average in winter and 2 mg/L monthly average in summer. Adopted 2011 permit limits (summer and winter) were 21 mg/L average month and 49 mg/L maximum day. Based on historical pond effluent ammonia concentrations, high ammonia alternatives will be sufficient to meet 2011 permit limits.

[3]Summer emergency discharge capacity assumes all activated sludge effluent can be discharged, along with a limited quantity of flocculating clarifier or pond effluent, depending on the ammonia limit. Summer ammonia limits assumed for the alternatives screening were lower than the adopted permit. With adopted 2011 permit limits, emergency discharge capacities for the alternatives would be greater than shown in this table.

5.2 Solids Treatment Alternatives

The three solids treatment alternatives will be evaluated independently from the liquid treatment alternatives. Required upgrades are similar for all liquid treatment alternatives, although the timing of improvements may vary. The solids treatment alternatives focus on improvements to provide additional capacity and increased redundancy. The alternatives included:

- Additional digester capacity and redundancy for the existing digester
- Redundancy for the dissolved air flotation thickener (DAFT)

5.2.1 Requirements for Solids Alternatives

Proposed alternatives would meet the core LOS outlined in Chapter 2. For the solids alternatives, several factors were found to be critical. To maintain odor emissions at current or reduced levels and comply with future biosolids regulatory requirements, the WWTP must have a plan to take the existing digester and DAFT out of service. Capacity for alternatives to accept non-traditional wastes (fats, oil and grease [FOG], winery waste and/or septage) should be considered.

5.2.2 Solids Alternatives Screening

The screening process initially led to eight solids treatment alternatives. *TM 9 – Alternatives Screening* further describes these alternatives.

Attendees agreed that redundant digestion capacity was key to meeting District LOS successfully. Even with the addition of aerators, pond performance could be compromised if the digester failed and the entire primary and waste activated sludge loading was directed to the ponds. Odors and poor effluent water quality might result. Because the ponds must produce high-quality water for reclamation and river discharge, using the ponds as backup for the digester is not recommended.

Additional facilities to accommodate algae digestion are not recommended, as additional gas generated from digesting algae is not expected to offset additional thickening and dewatering costs; however, the District should include and possibly pilot test the flexibility to digest algae with the selected processes when capacity is available. Continuing to route algae sludge to the ponds will not significantly increase the pond sludge accumulation over the next 20 years.

Workshop attendees determined that the District should not need a second DAFT to meet treatment goals. With relatively minor piping/process modifications, the District could implement either of two alternatives for DAFT redundancy (short-term co-thickening in the primary clarifiers or short-term WAS routing to the ponds).

From the eight alternatives, attendees selected three solids alternatives for detailed evaluation. Table 5-4 summarizes the selected alternatives. All alternatives provide redundancy for the digester and DAFT. Under normal operation with all units in service, redundant digester facilities will have considerable capacity for non-traditional wastes. Chapter 6 further describes and develops these alternatives.

Table 5-4. Summary of Selected Solids Treatment Alternatives

Alternative	
S1	Add conventional digester and keep existing half-egg-shaped digester in service as sludge storage/gas holder
S2	Complete the second egg-shaped digester and add digested sludge storage and gas storage
S3	Add a covered anaerobic sludge lagoon