

Internal Review of Napa Sanitation District's Capacity to Received Trucked Winery Waste

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Abstract

There are on average 6-7 trucks of winery waste per day traveling from Napa to EBMUD, or about 11 million gallons per year. Through its standard wastewater treatment process, NSD could process most of this waste, but would consume all available treatment capacity in the plant. The cost of treatment would be 36.4% higher than the EBMUD option. Through its existing digester, NSD only has the hydraulic capacity to accept 4 trucks per day. NSD may not have the physical space at its current facility to build a third digester to accept the waste being hauled to EBMUD, and even if built, the cost to build and operate the second and third digesters would be significantly greater than the option to haul waste to EBMUD. The costs of building and operating a pretreatment system at NSD and/or installing new aerators on the oxidation ponds are roughly equal, but each option would be greater than the cost of hauling waste to EBMUD. Combining a pretreatment solution and utilizing the existing oxidation ponds without adding new aerators is the least cost option, but is still 9% higher than hauling to EBMUD. Any solution involving building facilities at NSD would require long-term financial commitments from winery waste producers to be viable, since all NSD-based options are likely to be more expensive than the market alternative.

How much trucked waste is there?

The Napa Sanitation District accepts winery waste; however, the rates established in ordinance are significantly greater than the next closest facility that accepts this waste, East Bay Municipal Utility District (EBMUD). Because of EBMUD's low "tipping fee" of 3-cents per gallon for winery waste, EBMUD receives almost all hauled winery waste from the North Bay area.

According to the Accounts Receivable Department at EBMUD, over the last 13 months (August 2013 to August 2014), EBMUD on average received 944,840 gallons of winery waste per month from facilities with "Napa" listed as the city for billing purposes. This equates to the following:

Gallons

- 11,338,080 gallons per year
- 944,840 gallons per month
- 31,495 gallons per calendar day
- 42,947 gallons per working day (assuming 22 working days in a month)

Truckloads

- 1,705 trucks per year
- 142 trucks per month
- 6 to 7 trucks per working day

The District is also aware that recent months have shown an increase in hauling to EBMUD. NSD staff believes that this increase is due to one facility within its service district that is hauling significant amounts of waste to EBMUD, but on a temporary basis until their pretreatment system has been fixed and operates properly.

A recent Napa Valley Register article states that there are 12,000 truckloads of winery waste being sent to EBMUD (“Surging Wine Waste Stymies Napa Sanitation District,” August 16, 2014). Based on the average truck hauling 6,650 gallons of waste and 275 working days per year, this equates to 44 trucks per day and 293,000 gallons per day, or 80 million gallons per year.

The newspaper’s numbers, 80 million gallons per year / 12,000 Trucks per year, is incorrect and greatly exaggerates the actual hauled waste from NSD’s service area. In conversations with the author of the article, it was determined that the 80 million gallon per year number was derived from the *Winery Waste Management – Technical Memorandum* prepared by Oakley Water Strategies in October 2009. The number came from a table in the report that estimated winery waste from **all sources**, including hold and haul **AND** being delivered to NSD through the sewer system.

What is the strength of the trucked waste?

The strength of each truckload of winery waste can vary significantly. However, there are several sources of information that can inform us of the average expected strength.

- Samples of untreated winery & brewery waste by industrial user – One of NSD’s permitted industrial users does only very limited pretreatment of its waste (pH adjustment) before discharging to NSD. Based on samples analyzed by CalTEST, this facility’s waste ranges from 670-14,000 mg/L BOD₅ and 84-12,000 mg/L TSS.
- Samples of winery waste by industrial user prior to pretreatment – One of NSD’s permitted industrial users took samples of their effluent prior to pretreatment. Those samples included ranges from 1,400-17,000 COD (equates to approximately 700-8,500 mg/L BOD₅) and 200-1,000 mg/L TSS.
- An academic review (Mosse et al., “Review: Winery wastewater quality and treatment options in Australia,” 2011, Australian Society of Viticulture and Oenology Inc.) found BOD₅ to range from 125-130,000 mg/L with an average 8,858 mg/L, and TSS to range from 0-30,300 mg/L with an average of 760 mg/L.
- The Winery Waste Management – Technical Memorandum (Oakley Water Strategies, October 2009) estimated BOD₅ at 131-7,200 mg/L during vintage periods. TSS was estimated at 5-660 mg/L.

There is significant variance in these sources of data. For the sake of this analysis, the following assumptions have been used for untreated winery-related wastewater:

BOD₅: 7,000 mg/L

TSS: 600 mg/L

Option 1 – Can NSD take the waste at the septic receiving station (through primary and secondary treatment)?

There are two areas of investigation to determine an answer to this question – there is an engineering answer and a cost/market based answer.

Engineering Analysis

One way for the District to accept winery waste is into its existing septic hauler receiving station. This receiving point feeds into headworks where waste is treated as if it were delivered to the plant through the sewer pipes. The waste goes through primary treatment and secondary treatment. In this process, some solids are removed through primary clarifiers (gravity/sedimentation), but most of

the waste in winery waste is treated in the secondary treatment process, the biological treatment in the aeration basins (ABs). The biology in this process consumes and breaks down the organic waste matter in the winery waste. This process requires significant energy to add air into the ABs to maintain dissolved oxygen levels. After the ABs, the water then goes through secondary clarification where, biological solids are separated from the treated wastewater. Finally, the water goes through a disinfection process (sodium hypochlorite application) before either being dechlorinated and discharged to the Napa River or going through additional treatment for use as recycled water.

The existing ABs in the District have some capacity to process additional waste. Assuming 7,000 mg/L of BOD₅ strength in winery waste, the ABs could process 70,000 to 80,000 gallons of winery waste each day. At 6,600 gallons per truck, this equates to between 10 and 12 trucks of winery waste per day.

It is important to note that accepting the 6-7 trucks of winery waste per day on average would consume 60-70% of all available extra treatment capacity in the plant. Also important is that the 6-7 trucks per day is an average based on annual gallons delivered to EBMUD, and that actual daily numbers are likely to fluctuate significantly during the year as different winery-related activities were occurring. This is most significant during the fall crush period, where the truck volumes could double or more, exceeding NSD's capacity to treat the waste. So effectively, a practice of accepting winery waste at the NSD facility would mean that there would be no additional capacity for other growth in the community, including houses, restaurants, hotels and other developments.

Accepting the 6-7 trucks per day would also mean that there would be no available capacity to manage additional regulatory requirements. Currently, the Regional Board is studying and developing regulations for nutrient removal (e.g., ammonia), which the District could accommodate by using some of the available capacity for enhanced treatment processes. However, if all of the treatment capacity is used by winery waste, there would be no capacity to accommodate this need for existing flows and further treatment processes would need to be constructed.

Cost/Market Analysis

For hauling waste to NSD to be a viable alternative to hauling to EBMUD, the cost of hauling to NSD must be equal to or less than hauling to EBMUD. This section will compare the cost of hauling to each facility.

Hauling to EBMUD includes three cost components: tipping fee, transportation pick-up fee and transportation fee based on mileage. EBMUD charges \$0.03 per gallon to dispose of winery waste. Based on the fees charged to a large facility that is currently hauling waste, the pick-up fee is \$200 and the fee to transport the waste to EBMUD is \$333 per trip. Based on a typical truck volume of 6,650 gallons, the all-in cost to haul and dispose of winery waste at EBMUD is about \$0.11 per gallon.

Hauling waste to NSD involves the cost of treating the waste through the ABs plus the cost to transport the waste from the winery facility to NSD. The cost to treat winery waste is based on the assumed strength of the hauled winery waste and the existing sewer service charges and capacity charge fees established by the District for single family residences. The calculation of treatment costs is as follows:

Strength Factor Calculation = $0.5 + ((7,000 \text{ mg/L BOD}_5 / 175) * 0.25) + ((600 \text{ mg/L TSS} / 200) * .25)$
 Strength Factor (SF) = $0.5 + 10.0 + 0.75 = 11.25$

Sewer Service Charge (SSC) calculation - Per Gallon - at SF of 11.25
 76,650 gallons/year (standard house) @ 1.0 SF = \$469.82
 76,650 gallons/year @ 11.25 SF = \$5,285.47
 SSC = $(\$5,285.47 / 76,650 \text{ gallons}) = \0.069 per gallon

Capacity Charge Calculation - Per Gallon
 Capacity Charge = $\text{Flow Factor} * \text{SF} * \text{EDU rate} / 20 \text{ years} / 76,650 \text{ gallons} * 75\% \text{ (WWTP only)}$
 Capacity Charge = $1 * 11.25 * \$8,723 / 20 / 76,650 * 0.75$
 Capacity Charge = \$0.048 per gallon

NSD Tipping Fee = SSC per gallon + Capacity Charge per gallon
 NSD Tipping Fee = \$0.069 per gallon + \$0.048 per gallon
NSD Tipping Fee = \$0.117 per gallon

The cost of treating the waste at NSD is \$0.117 per gallon. The additional cost consideration is the estimated cost to haul the waste from the winery facility to NSD. The transportation pick-up fee should be the same (\$200), but the transportation fee based on mileage should be much less. We have estimated that fee to be \$25. Based on the same 6,650 gallon truck size, the transportation fee is estimated at \$0.034 per gallon.

The all-in cost to haul and dispose of winery waste at NSD (treatment cost plus transportation cost) is about \$0.15 per gallon.

The cost to haul waste to NSD (\$0.15 per gallon) is 36.4% higher than the cost to haul to EBMUD (\$0.11 per gallon). The cost to haul to NSD and treat the waste through the ABs is not competitive with EBMUD's costs, and it is likely that winery facilities would continue to choose to haul to EBMUD.

Option 2 – Can hauled waste be pretreated at the wastewater treatment plant prior to introduction into the treatment process?

Another options for NSD is to build a pretreatment system. Trucks would bring the winery waste into a separate process, where the waste went through a treatment process prior to being sent through the regular treatment process. The advantage of this would be to reduce the strength of the winery waste so that the cost of treatment would be less. This option would require designing and installing a transfer station to receive waste from trucks, storage volume, a roughing tower (or some other type of pretreatment process, such as Moving Bed Biofilm Reactor), air blowers, pH treatment, and dosing pumps.

Engineering Analysis

The addition of a pretreatment process, such as a roughing tower, moving bed biofilm reactor or some other pretreatment process, would typically expect to see a reduction in the loading rates of 40-60%. This means that the facility could take about twice as much winery waste through its standard treatment process before reaching the capacity of the aeration basins (ABs).

Assuming 3,500 mg/L of BOD₅ strength in winery waste (half the normal, due to the pretreatment process), the ABs could process 140,000 to 160,000 gallons of winery waste. At 6,650 gallons per

truck, this equates to between 21 and 24 trucks of winery waste per day. Assuming a range of trucking activity between 4 trucks per day (less activity) and 18 trucks per day (crush, etc), this new facility would result in the hauled waste consuming between 16% and 85% of all available capacity in the plant.

Accepting trucks of winery waste, given the estimate range of activity, would consume almost all available extra treatment capacity in the plant during certain times of year. This would mean that there would be very little additional capacity for other growth in the community, including houses, restaurants, hotels and other developments. And as noted previously, a lack of available capacity also means challenges when managing additional regulatory requirements.

Cost/Market Analysis

Operating Costs would be calculated the same as for introduction of the waste into the standard treatment process, except that the loading would be less. The pretreatment could reduce the waste strength by 40-60%. Assuming a 50% reduction, the operating cost would be as follows:

<p>Pretreated Waste Assumptions (cost after pretreatment): 3,500 mg/L BOD₅ 300 mg/L TSS</p> <p>Strength Factor Calculation = $0.5 + ((3,500 \text{ mg/L BOD}_5 / 175) * 0.25) + ((300 \text{ mg/L TSS} / 200) * .25)$ Strength Factor (SF) = $0.5 + 5.0 + 0.38 = 5.88$</p> <p>Sewer Service Charge (SSC) calculation - Per Gallon - at SF of 5.88 76,650 gallons/year (standard house) @ 1.0 SF = \$469.82 76,650 gallons/year @ 5.88 SF = \$2,762.54 SSC = $(\\$2,762.54 / 76,650 \text{ gallons}) = \\0.036 per gallon</p> <p>Capacity Charge Calculation - Per Gallon Capacity Charge = $\text{Flow Factor} * \text{SF} * \text{EDU rate} / 20 \text{ years} / 76,650 \text{ gallons} * 75\% \text{ (WWTP only)}$ Capacity Charge = $1 * 5.88 * \\$8,723 / 20 / 76,650 * 0.75$ Capacity Charge = \$0.025 per gallon</p> <p>Treatment Operating Cost = SSC per gallon + Capacity Charge per gallon Treatment Operating Cost = \$0.036 per gallon + \$0.025 per gallon Treatment Operating Cost = <i>\$0.061 per gallon</i></p>

There will be additional operating costs associated with operating the pretreatment process, mainly electricity, some regular maintenance, and some additional lab work. Those estimates are as follows:

\$18,000 – electricity (pumps, blowers, mechanical, etc.)
25,000 – maintenance costs (parts, some outsourced labor) on mixers, pumps, blowers, etc.
<u>3,000 – additional lab work (outsourced BOD₅, other constituent testing)</u>
\$46,000 – Total

This additional operating cost, based on 11.3 million gallons per year, equates to \$0.004 per gallon.

Capital costs would vary significantly based on the amount of waste treated in the new pretreatment process. Assuming a waste loading of up to 95,000 gallons per day (18 trucks per day during high volume periods), the NSD staff estimates that a capital facility might be constructed for an estimated \$3,635,000.

\$ 330,000	design/engineering/CEQA/permits
\$1,100,000	transfer facility (incl. accommodating 18 trucks/day)
\$ 900,000	daily storage volume (95,000 gallons)
\$1,100,000	roughing tower (incl. all mechanical components)
\$ 125,000	air blowers
\$ 20,000	dosing pumps and other related
<u>\$ 60,000</u>	<u>other site improvements (electrical, plumbing, concrete pad, etc.)</u>
\$3,635,000	Total

Assuming debt issued at 3.5% interest, a 20 year term, and a 1.25x coverage ratio (i.e., current market conditions), NSD would need to generate \$320,000 per year to cover debt service payments. \$320,000 per year on a base of 11.3 million gallons per year equates to \$0.028 per gallon for the capital costs.

Transportation costs for the winery waste would be the same as calculated above in this paper, at \$0.034 per gallon.

Total cost for this option is estimated at \$0.127 per gallon. This is 15% more than the all-in cost of hauling to EBMUD at \$0.11 per gallon. This option’s viability relies on winery waste producers willingness to commit to paying more than current market rate, and on the accuracy of the very rough estimates of cost to build the pretreatment process.

Option 3 – Can NSD take the waste through its existing digester?

Why is digestion better than going through the standard treatment process?

When EBMUD accepts winery waste, it does not treat the waste through its standard wastewater treatment process. Instead the winery waste is mixed with an abundance of other organic waste which is then injected directly into their digesters. The digesters use anaerobic process to convert the volatile organic compounds (VOCs) in the waste into biogas (a mixture of methane, carbon dioxide and other trace gases). That biogas is then used in a “combined heat and power” cogeneration engine to create energy that is used by the wastewater treatment plant.

In 2011, NSD built a fats, oils and grease (FOG) receiving station. The facility consists of two 15,000 tanks that hold FOG that is hauled to the District and is then pumped directly into the District’s digester at a steady rate. This facility could be used to accept winery waste for direct injection into the District’s digester. It is unclear at this point whether there is enough energy value in the winery waste to generate significant amounts of biogas.

Capacity of the Digester

NSD has one digester. Currently, the digester processes 15 million gallons of waste per year, or 41,100 gallons per day. NSD staff estimates that the digester’s total capacity is about 25 million gallons per year, or 68,500 gallons per day. This equates to an available annual capacity of 10 million gallons, or 27,400 gallons per day. Assuming a truck hauls 6,650 gallons, the NSD digester has the hydraulic capacity to accept up to 4 trucks per day.

Winery waste (approximately 1% solids) is less dense than regular digestate (4% solids), and it is unknown how introduction of winery waste will impact the operation of the digester’s ability to digest VOCs and create biogas. It is also unknown how much biogas the introduction of winery waste would generate. NSD staff is currently performing tests by bringing smaller amounts of winery waste into the FOG receiving station to measure its impacts.

It is unknown the impact introducing winery waste will have on the digester. (Preliminary results from a pilot project at the District show no benefit in biogas production from adding winery waste into the digester at strength of 7,000 mg/l BOD₅.) However, even if winery waste proves beneficial in energy production, there is only capacity in the existing digester to accept up to 4 trucks per day. Acceptance of those 4 trucks would use ALL available capacity in the digester and would not provide capacity for additional growth in the community.

Option 4 – Can NSD build new digesters to accept the waste?

Again, there are two different ways to answer this question. First, could NSD physically build the facilities to accommodate this waste? And second, would the cost to build and accept this waste exceed the cost of trucking the waste to EBMUD?

Physical Limitations

It is assumed that there is 11.3 million gallons of winery waste being trucked to EBMUD annually that otherwise could be delivered to NSD. For this analysis, assume that all of that waste would divert and be delivered to NSD.

To meet Federal regulations for processing biosolids (40CRF403(b)), the District averages a 45 day retention of materials in the digester. Processing 11.3 million gallons of waste annually equates to about 31,500 gallons per calendar day. To maintain a 45 day retention time, and also provide a 40% buffer to account for different winery wastewater flow rates throughout the year, this means that the District would need 2 million gallons of digester capacity.

The District's very large "egg" digester holds 1.3 million gallons. It is estimated that to develop 2 million gallons of digester capacity, the District would need to finish construction of the second egg digester and build 1 more traditional (cylindrical) digester, along with biogas storage, dewatering equipment, and a cogeneration engine or other energy-production device.

It is unclear where at the current NSD facilities the third digester, additional gas storage, and energy production facilities would be located. It is also unclear whether or not satisfactory performance of the digester can be achieved with such a high ratio of winery waste to other waste. It is also unclear how much biogas would be generated from winery waste.

Cost/Economic Consideration

The District's engineering staff analyzed the cost of adding digester capacity and estimated the capital cost of new facilities at around \$25.1 million.

- \$2.3 million – engineering and CEQA
- \$20 million – finish second egg digester and build additional digester
- \$2 million – additional gas storage and cogeneration/energy-production equipment
- \$0.5 million – dewatering equipment
- \$0.3 million – piping, electrical, and other improvements
- \$25.1 million – Total

Assuming debt issued at 3.5% interest, a 30 year term, and a 1.25x coverage ratio (i.e., current market conditions), NSD would need to generate \$1.7 million per year to cover debt service payments.

\$1.7 million per year on a base of 11.3 million gallons per year equates to \$0.15 per gallon for the capital costs.

Operating costs would increase as a result of this new equipment and processing. Those costs include accepting the waste from 4-18 trucks per day, regular and major maintenance on the equipment (particularly the energy-production equipment), operating and maintenance of the dewatering process and equipment. Some of this cost would be offset by PG&E energy savings resulting from the energy gained from the biogas generated, but it is unreasonable to believe that this savings would offset all of the operating costs. For the sake of this analysis, the additional operating cost is estimated at \$70,000 per year, or \$0.006 per gallon. (Note that EBMUD charges \$0.03 per gallon to pay for its operating costs.)

Transportation costs for the winery waste would be the same as calculated above in this paper, at \$0.034 per gallon.

Capital, operating and transportation costs total \$0.19 per gallon. The cost of building capacity to treat the estimated winery waste through digestion (19 cents per gallon) is greater than the cost of standard treatment, and is over 70% higher than the cost to haul the waste to EBMUD. This is due to the significant capital costs associated with building new digesters.

Option 5 – Can NSD take the waste through its existing oxidation ponds for treatment?

NSD maintains 340 acres of oxidation ponds for use in treating wastewater. A current CIP project is to add nine aerators to Pond #1 to aid in treating wastewater, through the introduction of air to increase dissolved oxygen in the pond. Adding air increases the capacity of the ponds to treat waste. There currently is no way for hauled waste to be discharged directly to the ponds, so a receiving station of some kind would need to be built. Additionally, extra loading on the ponds would require additional dredging to remove solids from the ponds.

Engineering Analysis

According to the 2011 Treatment Plant Master Plan, the ponds are currently at their maximum capacity for treating wastewater. The District is currently adding nine aerators to the pond, to increase the capacity of the ponds by 2,700 lbs/day of BOD₅ to meet current loading. This same capacity, 2,700 lbs/day of BOD₅, equates to about 10 trucks of hauled winery waste per day. This option is viable only if additional aerators, beyond what is currently being installed, were added to the oxidation ponds.

It is feasible to add more aerators to the ponds, but at some point there is a point where a maximum loading is reached and adding more biology is not feasible. NSD has not studied the maximum loading capacity of the ponds with additional aerators. However, it is likely that an additional nine aerators would be viable to treat additional winery waste.

Economic Analysis

The District's engineering staff analyzed the cost of adding additional aerators and a waste transfer facility and estimated the capital cost of new facilities at around \$6.7 million.

\$0.6 million – engineering and CEQA

\$1.3 million – nine additional aerators added to Pond #1

\$2.0 million – additional dredging capacity and dewatering equipment

\$2.5 million – waste receiving station (pipes, tanks, pumping, electrical, etc.)

\$0.3 million – road/site improvements for truck turnaround

\$6.7 million – Total

Assuming debt issued at 3.5% interest, a 20 year term, and a 1.25x coverage ratio (i.e., current market conditions), NSD would need to generate \$590,000 per year to cover debt service payments.

\$590,000 per year on a base of 11.3 million gallons per year equates to \$0.052 per gallon for the capital costs.

Operating costs would increase as a result of this new equipment and processing. Those costs include accepting the waste from up to 18 trucks per day, regular and major maintenance on the equipment (particularly the aeration equipment), and operating and maintenance of the dredging process and equipment. There would be no offset from any energy generation, and the blowers consume considerable energy during operations. Annual operating costs are estimated as follows:

\$85,000 – maintenance costs (parts, outsourced labor) on aerators, pumps, road, etc.

\$300,000 – electricity (aerators, dredging, dewatering)

\$140,000 – staffing 1.0 FTE (receiving station, dredging, dewatering, biosolids transport and application)

\$20,000 – additional biosolids application – materials, equipment

\$545,000 – Total

For the sake of this analysis, the additional operating cost is estimated at \$545,000 per year, or \$0.048 per gallon. Transportation costs for the winery waste would be the same as calculated above in this paper, at \$0.034 per gallon.

Capital, operating and transportation costs total \$0.134 per gallon. This compares to the cost of hauling to EBMUD at \$0.11 per gallon.

Option 6 – Can NSD build and implement a pretreatment process, then take the waste through its existing oxidation ponds for treatment?

This option combines Option #2 – Pretreatment, with Option #5 – Processing through the Oxidation Ponds, but eliminates the installation of additional aerators.

The current CIP project to add nine aerators to Pond #1 is necessary to treat the current loading of the ponds during the winter months. However, during the other months, there is additional treatment capacity in the ponds to receive winery waste. Because of the mass loading that results from adding winery waste directly to the ponds for treatment, it would be beneficial to install and operate pretreatment of the waste prior to introducing it into the pond system. Additional engineering analysis would need to be conducted to evaluate the total amount of waste that could be received at different times of year. This analysis assumes that the ponds could accommodate all of the loadings during 9 months out of the year (excluding the winter months).

Engineering Analysis

As noted above, the addition of a pretreatment process, such as a roughing tower, moving bed biofilm reactor or some other pretreatment process, would typically expect to see a reduction in the loading rates of 40-60%. This means that the operating costs to process the wastewater, including electricity (blowers), dredging and dewatering, would also be reduced.

Assuming a nine-month operation of 6-7 trucks per day going through the pretreatment process, this equates to 960 lbs/day of BOD₅, or about 35% of the new capacity currently being added to Pond #1 with the current aerator CIP project. As the CIP project is designed to meet 100% of capacity in the winter months, an increase of 35% during this period is not feasible, but there may be capacity in the remaining nine months to treat this waste.

Economic Analysis

Capital costs would vary significantly based on the amount of waste treated in the new pretreatment process. Assuming a waste loading of up to 66,500 gallons per day (10 trucks per day during 9 months out of the year), the NSD staff estimates that a capital facility might be constructed for an estimated \$3,205,000.

\$ 330,000	design/engineering/CEQA/permits
\$1,100,000	transfer facility (incl accommodating 10 trucks/day)
\$ 670,000	daily storage volume (95,000 gallons)
\$ 900,000	roughing tower (incl. all mechanical components)
\$ 125,000	air blowers
\$ 20,000	dosing pumps and other related
<u>\$ 60,000</u>	<u>other site improvements (electrical, plumbing, concrete pad, etc.)</u>
\$3,205,000	Total

Assuming debt issued at 3.5% interest, a 20 year term, and a 1.25x coverage ratio (i.e., current market conditions), NSD would need to generate \$280,000 per year to cover debt service payments.

\$280,000 per year on a base of 8.5 million gallons per year (75% of 11.3 million gallons) equates to \$0.033 per gallon for the capital costs.

Operating costs would increase as a result of this new equipment and processing. Those costs include accepting the waste, regular and major maintenance on the equipment (both the pretreatment system and the increased maintenance from increased aeration equipment usage), and operating and maintenance of the dredging process and equipment. There would be no offset from any energy generation, and the aeration blowers consume considerable energy during operations. Annual operating costs are estimated as follows:

\$46,000	– operation and maintenance of the pretreatment system (from Option #2)
\$25,000	– maintenance costs (parts, outsourced labor) on aerators, pumps, road, etc.
\$225,000	– electricity (aerators, dredging, dewatering)
\$140,000	– staffing 1.0 FTE (receiving station, dredging, dewatering, biosolids transport and application)
<u>\$15,000</u>	<u>– additional biosolids application – materials, equipment</u>
\$451,000	– Total

For the sake of this analysis, the additional operating cost is estimated at \$451,000 per year, or \$0.053 per gallon. Transportation costs for the winery waste would be the same as calculated above in this paper, at \$0.034 per gallon.

Capital, operating and transportation costs total \$0.12 per gallon. This compares to the cost of hauling to EBMUD at \$0.11 per gallon.

If the preferred option results in using all of the plant's existing capacity, is there a way to proceed?

NSD's capacity model is based on ratepayers building future capacity then being reimbursed for adding that capacity when growth occurs through capacity charges. At the beginning of FY 2014/15, ratepayers had spent \$23 million more than they have received in capacity, and this has resulted in the extra capacity that is being discussed in this paper as "available" for use for winery waste.

Capacity charges for the new winery waste, as presented in this paper, are shown as an "add-on" cost to the tipping fee at NSD. In practice, this is not a viable option by itself, as allowing winery waste to take up all built capacity would leave NSD without any capacity for additional growth in the community and without the capital resources to build new capacity.

With the capacity charge in the tipping rate, the District could build new facilities using debt, where the capacity charge component of the tipping fee is the primary and dedicated revenue source for paying back the debt service. However, economic analysis shows that in every case there is an alternative that is less expensive than NSD—hauling waste to EBMUD.

To overcome the EBMUD alternative problem, winery waste producers would need to make a long-term financial commitment to haul their winery waste to NSD. One alternative that would likely be acceptable to the bond market would be for wineries to form a property assessment district to guarantee the debt service payments, in exchange for no or lower tipping fees at NSD. The program could be developed in a way so that the costs to the hauler on an annual basis were the same as if the fees were all in the NSD tipping fee. Other options could potentially be developed.

Summary of Options

Option	Engineering Analysis	Economic Analysis
1. Septic Receiving	Could take 6-7 trucks per day (average); would effectively consume 100% of available capacity in ABs.	Cost to treat waste at NSD (\$0.15 per gallon) is 36.4% higher than cost to haul to EBMUD (\$0.11 per gallon).
2. Pretreatment at NSD	Could take 6-7 trucks per day average (range of 4-18 per day); would consume up to 85% of available capacity in ABs at certain times of year.	Capital and operations costs are estimated at \$0.127 per gallon, 15% more than the current EBMUD cost of \$0.11 per gallon.
3. NSD's existing digester	Could take 4 trucks per day; would consume 100% of available digester capacity.	Not evaluated.
4. Build new digesters	Would require space for a new digester, plus facilities for dewatering, biogas storage, and energy production.	Operating and capital costs (\$0.19 per gallon) significantly exceed the cost of hauling to EBMUD (\$0.11 per gallon).
5. NSD's oxidation ponds	Could accept up to 10 trucks per day; would require additional aerators to increase capacity. Continuous dredging and land application of the biosolids will be required.	Capital, operating and hauling costs are estimated at \$0.134 per gallon, almost 22% higher than the current EBMUD cost of \$0.11 per gallon.
6. Pretreatment prior to oxidation ponds (no new aerators)	Pretreatment as described in Option 2 would reduce loadings. Under this option, NSD could accept winery waste for nine months out of the year directly into the pond system, but could not receive winery waste during the winter months.	Operating and capital costs (\$0.12 per gallon) exceed the cost of hauling to EBMUD (\$0.11 per gallon).