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Wastewater Feasibility Study

Opus One Winery P14-00177
Planning Commission Hearing Date May18, 2016

WASTEWATER FEASIBILITY STUDY

FOR

OPUS ONE WINERY
7900 ST HELENA HWY,
OAKVILLE, CA 94562
APN 031-020-007

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Project No. 2014096
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CIVIL STRUCTURAL WATER|WASTEWATER ELECTRICAL

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ENCLOSURE A

WASTEWATER MANAGEMENT SYSTEM DESCRIPTION

OPUS ONE WINERY

Oakville, Napa County, California

WASTEWATER MANAGEMENT SYSTEM DESCRIPTION

PROJECT DESCRIPTION

Opus One Winery has an existing wastewater management system installed in 1989 and has been operational, without any significant problems reported for 24 years. Opus One Winery proposes to increase wine production from 110,000 gallons to 250,000 gallons. This proposed production increase will generate additional process wastewater. The following wastewater handling, treatment, and disposal description analyzes the existing system with additional wastewater treatment equipment using the proposed wastewater flow increase.

Opus One is proposing to continue to treat the process wastewater (PW) through the existing aerated pond system, and the sanitary sewage (SS) through a new Package Treatment System with disposal through the existing mound system and a new subsurface drip system. A Package Treatment System is a small footprint package treatment system provided by equipment manufacturers with subsurface drip for disposal. Examples include: Orenco Systems, Inc. Advantex Textile Filters, Lyve Treatment System, Biomicrobics, and others. For this wastewater feasibility study the Orenco's Advantex system is discussed in the following sections.

Installation of a new wastewater management system will be permitted and inspected by Napa County Planning, Building and Environmental Services (PBES).

SITE DESCRIPTION

The existing facility is located at 7900 St. Helena Highway, near the town of Oakville. The winery owns two neighboring parcels. Parcel one (APN 030-020-007) has 49.17 acres, and parcel two (APN 030-020-009) has 49.34 acres, and both are surrounded by neighboring residences and vineyards. The parcels are located in the valley floor, so the topography is relatively flat, and includes existing vineyard and winery buildings.

WINERY PROCESS WASTEWATER TREATMENT

PROCESS WASTEWATER CHARACTERISTICS

Process wastewater will consist primarily of wastewaters collected at floor drains and trenches within the winery, receiving, crush, tank, and wash-down areas. No sanitary wastewater will be discharged into the PW management system. Exterior tank and process areas not under a roof are provided with diversion capability for routing rainwater to the storm drainage system when those areas are not in use for process purposes. However, stormwater collected in a small area (220 sf) of the winery, not under a roof, will be directed to the ponds. The stormwater contribution from this area is small and should not affect the capacity of the ponds to provide sufficient treatment and storage for the PW flows. No distillation will occur at the facility; hence there will be no stillage waste. Typical winery process wastewater (PW) characteristics are summarized below:

Table 1. Typical Winery Process Wastewater Characteristics

		Crushing Season	Non-crushing Season
Characteristic	Units	Range	Range
pH	--	2.5 - 9.5	3.5 - 11.0
Dissolved Oxygen	mg/L	0.5 - 8.5	1.0 - 10.0
BOD_5	mg/L	500 – 12,000	300 – 3,500
COD	mg/L	800 – 15,000	500 – 6,000
Grease	mg/L	5 - 30	5 - 50
Settleable Solids	mg/L	25 - 100	2 - 100
Nonfilterable Residue	mg/L	40 - 800	10 - 400
Volatile Suspended Solids	mg/L	150 - 700	80 - 350
Total Dissolved Solids	mg/L	80 – 2,900	80 – 2,900
Nitrogen	mg/L	1 - 40	1 - 40
Nitrate	mg/L	0.5 - 4.8	-
Phosphorous	mg/L	1 - 10	1 - 40
Sodium	mg/L	35 - 200	35 - 200
Alkalinity ($CaCO_3$)	mg/L	40 - 730	10 - 730
Chloride	mg/L	3 - 250	3 - 250
Sulfate	mg/L	10 - 75	20 - 75

PROCESS WASTEWATER CONVEYANCE, TREATMENT AND DISPOSAL

A discussion of each of these features is provided below. Refer to the wastewater management system schematic in Enclosure C for a flow diagram of the PW management system. The following existing features are included in the existing process wastewater management system:

1. Initial Screening – Provided by existing screened baskets and strainers installed on the trench drains and floor drains within the winery. Assumed screen opening sizes are approximately 1/4 inch for exterior drains and 1/8 inch for interior drains.
2. Gravity collection system –Existing piping is assumed to be compatible with process wastewater and satisfies Uniform Plumbing Code and local requirements.
3. Pretreatment – Consisting of the following elements:
    a. Pump Stations – The wastewater management system has two existing pump stations each consisting of one set of duplex pumps. The first pump station collects the PW gravity drainage and pumps it to the rotary screen where it flows by gravity into the second pump station, pumped through a flow meter and ultimately conveyed to the first cell of the aerated ponds.
    b. Flow measurement – An inline flow measurement device is provided to measure PW flows from the pump stations to the aeration pond.
    c. Solid removal rotary screen – A motorized rotary drum screen is installed to eliminate the large solids from the system and, as a result, reduce the biological loading and the accumulation of solids in the aerated pond system. Solids from the screening operations are treated as pomace (residual grape solids) and returned to the vineyard or an off-site compost facility (refer to the later discussion on solid wastes in this enclosure).
4. Aerated Pond – An aerated pond system was established by the conversion of an existing irrigation reservoir. The pond was divided into three cells by floating curtain baffles. Biological stabilization takes place in the facultative aerated pond system which consists of two mechanically aerated cells (Cell #1 & #2) and one irrigation storage cell (Cell #3). Cell #1 and #2 provide approximate normal residence times of 152 days and 166 days respectively at average day peak harvest month flows and the entire pond provides a total detention time of approximately 807 days (see Enclosure B). For ultimate wastewater/rainfall inputs and evaporation/irrigation outputs based on a pond water balance, refer to the pond water balance in Enclosure D, based on 10 year rainfall and a minimum two foot freeboard. The total volume of the system is approximately 6.6 MG (Cell #1: 1.25 MG, Cell # 2: 1.36 MG, Cell # 3: 4.01 MG).

    The existing surface mechanical aerators for the two aeration cells are sized to satisfy biochemical oxygen demand only, oxygen dispersion requirements were not considered in the original design because of extensive residence times. This assumption, that the excessive residence times and dilution will allow for superior treatment without meeting the recommended Power/Volume, is still valid. Time clock control of the aerators is provided to allow operations personnel to adjust aerator operation to changing winery functions and pond conditions.

5. Flow measurement – An additional flow measurement device is provided to measure the discharge flows from the storage pond cell to the surface irrigation system.
6. Irrigation disposal (reuse) – Final reuse (disposal) of effluent is accomplished by irrigation of approximately 71 acres of existing vineyards. The vineyard irrigation demand exceeds the estimated annual reclaimed wastewater volume. See the pond water balance in Enclosure D for proposed effluent storage and diversions to irrigation disposal. See Enclosure D for proposed irrigation application rates to the vineyard reuse areas.

OTHER CONSIDERATIONS

Odor Control

There have been no obnoxious odors from the existing system. No odors are anticipated from the proposed production increase.

Noise Control

There should be no intolerable noises associated with the proper operation of the treatment system.

Ground Water Contamination

The nearest water well to any of the winery process wastewater treatment and disposal systems is a minimum of 1,700 feet. No disposal of reclaimed wastewater will occur within 100 feet of the existing wells.

Irrigation/disposal of treated effluent is considered a beneficial use and is considered an effective means to protect groundwater quality. Well water may be added to the treated PW in storage when capacity permits to supplement the volume of water used for irrigation.

Surface Waters

All wastewater treatment facilities are designed with sufficient drainage facilities to divert local runoff. Irrigation/disposal operations will be routinely monitored to ensure against surface runoff. Irrigation/disposal of PW effluent will be suspended for approximately 48 hours prior to, during and following any forecasted storms. Irrigation/disposal will be suspended as long as saturated soil conditions persist.

Protection

The aerated pond is fenced to restrict public access.

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ALTERNATIVE COURSES OF ACTION

Although no operational difficulties are foreseen, the following additional courses of action would be available if necessary:

1. Ability to add carbon dioxide to reduce pH at the pretreatment site
2. Ability to add hydrogen peroxide to the ponds as a supplemental oxygen source or for odor control
3. Provision of higher aeration capacity in cell #1 and cell #2
4. Additional stages of treatment with recirculation to increase effluent quality

The facultative aerated lagoons are designed for retention of wastewater and rainwater through the majority of the rainy season with minimal discharges to irrigation/disposal fields (based on a 10 year seasonable rainfall). Should there be a winter with more rainfall than the design condition, several operational procedures are available to compensate:

1. Additional water conservation at the winery
2. Light irrigation during periods between storms -- not exceeding the assimilative capacity of the soil
3. Pumping and truck transfer of treated and diluted wastewater to a sewage treatment plant or land disposal site

SOLID WASTES

Solid wastes from the winery include primarily pomace, seeds, and stems. The estimated quantities of these wastes (at ultimate capacity) are as follows:

$$Annual\ Grape\ Tons = \frac{250{,}000\ gal\ wine/year}{165\ gal\ wine/ton} = 1{,}515\ tons/year$$

$$Ultimate\ Annual\ Solids\ Total = 1{,}515\ tons/year\ x\ 35\ \% \ = 530.25\ tons/year$$

Based on a unit weight of 38 pounds per cubic foot, the annual volume of solids wastes would be:

$$530.25\ tons/year\ x\ \frac{2{,}204\ lbs}{1\ ton}\ x\ \frac{1\ ft^3}{38\ lbs}\ x\ \frac{1\ yard^3}{27\ ft^3} = 1{,}139\ yard^3$$

$$\frac{1{,}139\ yard^3}{71\ acres}\ x\ \frac{1\ acre}{4{,}840\ yard^2}\ x\ \frac{36\ inches}{1\ yard} = 0.12\ inches$$

This quantity of solids wastes applied to 71 acres of vineyard is approximately 0.12 inches deep per year. These organic solids can be composted but generally solid wastes will be hauled to an off-site composting location.

Solids, in the form of sludge, will also accumulate in the ponds requiring periodic removal every 5-10 years. Those highly decomposed solids are also hauled to a solid waste disposal site.

SANITARY SEWAGE TREATMENT

SANITARY SEWAGE CHARACTERISTICS

Sanitary sewage (SS) at Opus One Winery consists of typical wastewater generated from restrooms, laboratory, and kitchen/lunch room facilities. The SS flows at Opus One Winery will be generated from up to 75 employees (65 full time and 10 part time during weekdays), and daily visitation of up to 165 visitors on a weekday, and 500 visitors on a weekend day. Wastewater flows from events up to 100 visitors will be handled by the proposed SS system, and events with greater than 100 visitors will utilize portable toilets. As a result, approximately 2,950 gpd of SS flows will be generated on a peak day (during harvest). SS flows will be handled separately from the process wastewater (PW) flows in a dedicated treatment and sub-surface disposal system. SS will be treated and disposed of using septic tanks, dosing tanks with controls, a pre-treatment system, and disposal through the existing mound system and a new subsurface drip system. Typical SS characteristics are summarized below:

Table 2. Typical Sanitary Sewage Characteristics

Characteristic	Units	Raw Wastewater Range[1]
BOD_5	mg/L	110 - 500
Grease	mg/L	50-100
Total Suspended Solids (TSS)	mg/L	100 - 220
Volatile Suspended Solids	mg/L	80 - 165
Total Dissolved Solids (TDS)	mg/L	250 - 500
Nitrogen	mg/L	20 - 40
Nitrate	mg/L	0
Phosphorous	mg/L	4 - 8
Alkalinity ($CaCO_3$)	mg/L	50 - 100
Chloride	mg/L	30 - 50
Sulfate	mg/L	20 - 30

[1] Typical composition of untreated domestic wastewater, Metcalf & Eddy, “Wastewater Engineering, Third Edition”, 1991

SANITARY SEWAGE CONVEYANCE, TREATMENT AND DISPOSAL WITH REUSE

A discussion of each of the common features to all treatment options is provided below. For each particular treatment option, the following features are discussed in the following sections, separately. Refer to the wastewater management system schematic in Enclosure C for a flow diagram of the SS management system. The SS treatment and disposal system will have the following components:

1. (E) Gravity collection system – Designed to provide low maintenance and no infiltration or exfiltration. Piping is compatible with sanitary sewage and satisfies Uniform Plumbing Code and local requirements.
2. (E) SS sump – The wastewater management system has an existing pump station with one set of duplex pumps for collection of the SS flows from the gravity drainage and to pump them to the septic tanks.
3. New and existing septic tanks with effluent filter – Two existing precast concrete septic tanks of approximately 1,500 gallons each, are provided for solids removal prior to treatment with the high rate package system. An additional 6,000 gallons septic tank will be provided for treatment of the increased SS flows. Removal of solids in the septic tanks helps to reduce BOD loads on the system, minimize the frequency of sludge removal in aerobic systems, and reduce the potential for clogging of the mound system. The septic tank configuration will provide approximately 3 days of retention during peak flows. Effluent filters will also be provided to remove additional suspended solids which do not settle out in the tanks.
4. (E) Dosing tanks and controls – Three existing precast concrete tanks of 1,500 gallons each are used for collection of pretreated SS flows and dosing to the high rate system prior disposal to the existing mound. A duplex pump system will allow for timed dosing to the high rate package system. The dosing tanks could be used as additional septic volume. SS from the dosing tank would then be handled as outlined in option 1 or 2 below.
5. (E) Flow switch – The SS flows would be pumped from dosing tanks #2 and #3 through an existing liquid flow switch to the new recirculation tank
6. (E) Flow measurement – The SS flows would be pumped from dosing tanks #2 and #3 through an existing "Recordall" turbo series flow meter prior entering the new recirculation tank

<u>SANITARY SEWAGE TREATMENT, OPTION 1</u>

1. New automated 3 way ball valve – a new three way ball valve will be provided to split the SS flows between the existing mound system (1,300 gpd) and a new subsurface drip system (1,650 gpd). The facility will be responsible for monitoring the SS flows to the existing mound to ensure the capacity is not exceeded. The flowmeter provides feedback for automatic diversion when daily flows exceed the maximum capacity of the mound system.

2. New recirculation tank – A new precast concrete recirculation tank of approximately 1,500 gallons will be provided for dilution and buffering of peak hydraulic and organic loads. A duplex pumping system will be installed in the recirculation tank to dose the AdvanTex filter pod.
3. New pre-treatment system –AdvanTex Treatment System Package. A high rate package treatment system would be used for treatment of 1,650 gpd SS prior disposal through the new subsurface drip system.
4. New Dosing tank – A new precast concrete dosing tank of approximately 3,000 gallons will be provided for metered dosing of the treated SS flows to the new subsurface drip system through a duplex pump system.
5. New Flow measurement – A new flowmeter will be provided for metering the flows dosed to the new subsurface drip system.
6. (E) Wisconsin Mound System – The existing mound system would continue to be used for disposal of up to 1,300 gpd of the treated SS flows. The additional flows will be disposed through the subsurface drip system.
7. New subsurface drip headworks – A Geoflow automatic headworks system will be provided. This headworks system is a pre-assembled unit including the filter, valves, and pressure gauge in a utility box which is installed between the subsurface dosing tank and the subsurface drip disposal field.
8. New subsurface drip disposal field – 1,650 gpd of treated effluent will be discharged into a 3,000 square foot subsurface drip field. The proposed drip field utilizes subsurface drip tubing as manufactured by Geoflow. A 200% reserve area for the subsurface drip system will also be provided.

SANITARY SEWAGE TREATMENT, OPTION 2

1. New recirculation tank – A new precast concrete recirculation tank of approximately 2,500 gallons will be provided for dilution and buffering of peak hydraulic and organic loads. A duplex pumping system will be installed in the recirculation tank to dose the AdvanTex filter pod.
2. New pre- treatment system – Advantex Treatment System Package. A pre-treatment system would be used for treatment of 2,950 gpd SS prior disposal through the new subsurface drip system.
3. New Dosing tank – A new precast concrete dosing tank of approximately 5,000 gallons will be provided for metered dosing of the treated SS flows to the subsurface drip system through a duplex pump system.
4. New Flow measurement – A new flowmeter will be provided for metering the flows dosed to the subsurface drip system to ensure the flows do not exceed the treatment capacity of the system.
5. New subsurface drip headworks – A Geoflow automatic headworks system will be provided. This headworks system is a pre-assembled unit including the filter, valves, and pressure gauge in a utility box which is installed between the subsurface dosing tank and the subsurface drip disposal field.

6. Subsurface drip disposal field – 2,950 gpd of treated effluent will be discharged into a 5,000 square foot subsurface drip field. The proposed drip field utilizes subsurface drip tubing as manufactured by Geoflow. A 200% reserve area for the subsurface drip system will also be provided. The primary and reserve areas for the subsurface drip system will be located in the area where the current mound system is, after complete removal of the mound system.

OTHER CONSIDERATIONS

Odor Control

There should be no obnoxious odors from a properly designed and operated system.

Noise Control

There should be no intolerable noises associated with the proper design and operation of the treatment system.

Solids Handling

Excess solid wastes generated from the septic tanks and high rate treatment system will be pumped and hauled for off-site regulated treatment and disposal.

Ground Water Contamination

The nearest water well to the any of the winery sanitary sewage and disposal systems is a minimum of 1,700 feet. No disposal of wastewater will occur within 100 feet of any existing wells.

Protection

Exposed wastewater treatment facilities will be posted with appropriate warning signs.

ALTERNATIVE COURSES OF ACTION

Although no operational difficulties are foreseen, the following additional courses of action would be available if necessary:

1) Ability to add pH control
2) Additional stages of treatment to increase effluent quality
3) Increased use of disposal area to increase discharge capacity
4) Additional storage capacity for treated effluent prior disposal
5) Pumping and truck transfer of treated and diluted wastewater to an approved treatment plant or land disposal site.

ENCLOSURE B

WASTEWATER MANAGEMENT SYSTEM DESIGN CRITERIA

OPUS ONE WINERY

Oakville, Napa County, California

WASTEWATER MANAGEMENT SYSTEM DESIGN CRITERIA

WINERY PROCESS WASTEWATER TREATMENT

Process wastewater (PW) is currently generated at cellar, receiving, and fermentation locations at the existing winery. PW is currently treated in facultative aerated ponds created by installing floating baffles within a larger irrigation/frost protection water storage pond. The floating baffles are configured to form two aerated cells, Aerated Cells #1 and #2 have approximate volumes of 1.25 MG and 1.36 MG respectively. The total volume of the irrigation/frost protection pond is approximately 6.6 MG. PW is screened and pumped from the winery and processing areas to Aerated Cell #1 for primary treatment. Treated PW flows to Aerated Cell # 2 for final polishing and from there to the third pond cell or the irrigation reservoir where it is stored for vineyard irrigation. Storm water contribution generated from a small area without storm diversion (220 sf) will be diverted to the PW system; this storm contribution (0.009 MG per year) should not affect the capacity of the PW treatment pond or storage systems.

Opus One Winery is proposing an increase in production from 110,000 gal wine/year to 250,000 gal wine/year. This study will determine the feasibility of utilizing the existing process wastewater management system to treat the increased PW generated by the proposed production expansion.

Based on information from Opus One Winery, and typical flow data from wineries of similar size and characteristics and corresponding process wastewater (PW) generation rates, projected flows are calculated as follows:

PROCESS WASTEWATER DESIGN FLOWS

<u>Annual Volume</u>

Annual production (projected)	=	104,167 cases/year
	=	104,167 cases/year x 2.4 gal wine/case
	=	250,000 gal wine/year
PW generation rate (assumed)	=	6.0 gal PW/gal wine
PW flow	=	250,000 gal wine x 6.0 gal PW/gal wine
	=	<u>1,500,000 gal PW/year</u>

<u>Average Day Flow</u>

1,500,000 gal PW/365 days = 4,110 gal PW/day
= 4,200 gal PW/day

Napa County Peak Day Flow

$$\frac{250{,}000 \text{ gallons wine} \times 1.5}{60 \text{ day harvest}} = 6{,}250 \text{ gal PW/day}$$

Average Day, Peak Month Flow

The harvest month of September accounts for approximately 16.4 percent of the annual PW flow.

$$\frac{1{,}500{,}000 \text{ gal PW} \times (16.4\%)}{30 \text{ day}} = 8{,}200 \text{ gal PW/day}$$

The design flow rate will account for the most conservative approach, which is the Average Day, Peak Month flow method. The design flow rate shall be 8,200 gal PW/day.

POND SIZING

A total retention time of 90 to 120 days for an Average Day, Peak Month Flow is recommended for this type of pond system to provide required treatment with at least 60 days in the first pond.

The existing wastewater management consists of two aerated cells within the confines of a large irrigation pond. This pond configuration will provide more than adequate residence time for the proposed flows, as calculated below:

Average Day, Peak Month = 8,200 gal PW/day

Cell # 1

Total Volume = 1.25 Mgal

$$\text{Detention Time} = \frac{1{,}250{,}000 \text{ gal}}{8{,}200 \text{ gal PW/day}}$$

= 152 days

Cell # 2

Total Volume = 1.36 Mgal

$$\text{Detention Time} = \frac{1{,}360{,}000 \text{ gal}}{8{,}200 \text{ gal PW/day}}$$

= 166 days

Cell # 3

Total Volume = 4.01 Mgal

Detention Time = $\frac{4{,}010{,}000 \text{ gal}}{8{,}200 \text{ gal PW/day}}$

= 489 days

Totals Cell No. 1, Cell No. 2 and Cell No. 3

Detention Time = 152 days +166 days + 489 days = 807 days

Detention Time of approximately 807 days

AERATION REQUIREMENTS

Sizing parameters for the aerators are as follows:

BOD_5 Concentration	=	7,700 mg/l
Average Day Peak Month Harvest Flow	=	8,200 gal PW/day
Oxygen Requirement	=	1.5 lbs O_2/lb BOD
Oxygen Transfer Rate(Vertical Turbine Aerator)	=	2.2 lbs O_2/HP - hr
Power/Vol Ratio, Pond No. 1	=	0.10 - 0.20 HP/1,000 cu ft
Power/Vol Ratio, Pond No. 2	=	0.05 - 0.10 HP/1,000 cu ft
Pond No. 1 Volume	=	1.25 Mgal
Pond No. 2 Volume	=	1.36 Mgal

Aerated Cell # 1

BOD_5 Mass Loading:

$$\frac{(7{,}700 \text{ mg/L})(8{,}200 \text{ gal PW/day})(8.345 \text{ lbs/gal})}{100{,}000 \text{ gal/MG}} = 527 \text{ lbs } BOD_5\text{/day}$$

Oxygen Requirements:

$$\frac{(1.5 \text{ lbs } O_2\text{/lbs } BOD_5)(527 \text{ lbs } BOD_5\text{/day})}{(24 \text{ hrs/day})} = 33 \text{ lbs } O_2\text{/hr}$$

Aerator Horsepower Required:

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$$\frac{33 \text{ lbs } O_2/\text{hr}}{2.2 \text{ lbs } O_2/\text{HP-hr}} = 15 \text{ HP}$$

Use 15 HP (10 HP existing)

Check Power-to-Volume Ratio:

$$P\backslash V = \frac{15 \text{ HP}}{1{,}250{,}000 \text{ gal}} \times \frac{7.48\text{gal}}{\text{cf}} \times \frac{10^3}{1{,}000 \text{ cf}} = \underline{\underline{0.09 \text{ HP}/1{,}000 \text{ cf}}}$$

P\V of 0.09 HP/1,000 cf is slightly outside the recommended range of 0.10 – 0.20. The original system was designed on the basis of BOD loading only based on the extensive detention times and dilution. The assumption that the large total volume and lengthy detention times will produce acceptable quality effluent and not produce excessive odors is still valid. Therefore, only the additional 5 Hp of aeration will be provided to meet oxygen requirements. Oxygen transfer and mixing are expected to occur in the upper 3-4 feet of the pond as required in a facultative aerated lagoon system.

Aerated Cell #2

$$P\backslash V = \frac{5 \text{ HP}}{1{,}360{,}000 \text{ gal}} \times \frac{7.48\text{gal}}{\text{cf}} \times \frac{10^3}{1{,}000 \text{ cf}} = \underline{\underline{0.028 \text{ HP}/1{,}000 \text{ cf}}}$$

P/V of 0.028 HP/1,000 cf is not within the recommended range of 0.05 – 0.10. However again, the original system was designed on the basis of BOD loading only based on the extensive detention times and dilution. The assumption that the large total volume and lengthy detention times will produce acceptable quality effluent and not produce excessive odors is still valid. Therefore, no additional aeration is required. Oxygen transfer and mixing are expected to occur in the upper 3-4 feet of the pond as required in a facultative aerated lagoon system.

SANITARY SEWAGE TREATMENT

SANITARY SEWAGE DESIGN FLOWS

The existing treatment system at Opus One Winery Sanitary Sewage (SS) flows consists of gravity collection of SS through the winery, pretreatment in septic tanks followed by a series of dosing tanks and disposal of the effluent through a mound system. Soil percolation testing and subsequent design of a sanitary wastewater mound system was performed by Peter Lescure in 1989.

The proposed sanitary sewage (SS) management system at Opus One Winery will consist of typical wastewater generated from restroom, laboratory, and lunch room facilities. Events with more than 100 attendees will use portable toilets. Anticipated sanitary wastewater flows are projected as follows:

Peak Weekday with tasting and Event							
Employee (full-time)	65	x	15	gpcd	=	975	gal/day
Employee (part-time)	10	x	15	gpcd	=	150	gal/day
Tasting Visitors	165	x	3	gpcd	=	495	gal/day
Private Event Visitors	100	x	10	gpcd	=	1,000	gal/day
Total					=	**2,620**	**gal/day**

Peak Weekend Day with tasting and Event							
Employee (full-time)	20	x	15	gpcd	=	300	gal/day
Employee (part-time)	5	x	15	gpcd	=	75	gal/day
Employee (harvest weekends)	5	x	15	gpcd	=	75	gal/day
Tasting Visitors	500	x	3	gpcd	=	1,500	gal/day
Private Event Visitors	100	x	10	gpcd	=	1,000	gal/day
Total					=	**2,950**	**gal/day**

The design flow rate will account for the most conservative approach, with a SS flow rate of 2,950 gal SS/day.

SS SEPTIC TANK SIZING

The required septic tank size for the winery SS flows according to the Uniform Plumbing code is:

Volume = 1,125 + 0.75 x Flow rate
Volume = 1,125 + 0.75 (2,950 gpd)
Volume = 3,338 gallons
Volume = 4,000 gallons

Orenco Systems, Inc. recommends 3 days of septic tank volume for commercial SS systems prior treatment in an Advantex treatment system. Based on Orenco guidelines, the septic tank should be sized as shown below:

Volume = 3 x Flow rate
Volume = 3 x (2,950 gpd)
Volume = 8,850 gallons
<u>Volume = 9,000 gallons</u>

Because Orenco's guidelines result in a larger recommended volume, and we are proposing AdvanTex as the pretreatment option, a total volume of 9,000 gallons will be provided for septic tankage. The existing system has two 1,500 gallon septic tanks for a total of 3,000 gallons. An additional new 6,000 gallon septic tank is recommended to provide an adequate settling capacity for SS flows. An effluent filter will be added to the outlet of the new septic tank to reduce solids passage to the pump station and treatment package unit.

SS DOSING TANK SIZING AND CONTROLS

Effluent from the SS septic tanks would flow to the existing three 1,500 gallon precast concrete pump tanks for equalization of SS flows. The pump would incorporate duplex pump control to direct flow on a timed base with pump operation controlled via float switch positions. The dosing tank volume could be used as additional septic tankage volume.

<u>SANITARY SEWAGE TREATMENT, OPTION 1</u>

AUTOMATED 3 WAY BALL VALVE

A new 3 way automated ball valve will divert 1,300 gpd to the existing mound system, and once the mound has reached its daily capacity the additional SS flows (1,650 gpd) would be diverted to the recirculation tank and high rate treatment system for disposal though the new subsurface drip system.

EXISTING WISCONSIN MOUND SYSTEM

The sanitary sewage generated from the winery will be disposed of in the existing mound system and proposed subsurface drip system. The existing mound system was designed for 2,000 gpd. Based on current code standards, the capacity is approximately 1,300 gpd. A maximum of 1,300 gpd of SS flows will be diverted through an automated 3 way ball valve and disposed of into the mound system.

Current code design parameters:

Soil infiltration rate	= 1.00 gal/SF/day
Sand fill loading rate	= 0.8 gal/SF/day
Dispersal bed depth	= 1 LF
Dispersal bed width	= 8 LF
Dispersal bed length	= 208 LF
Dispersal bed area	= 1,664 SF
Slope	= 1 %

Mound sizing:

Current Mound Capacity	=	1,664 SF x 0.8 gal/SF/Day	=	1,331 gpd
			=	1,300 gpd
Linear Loading Rate	=	8 LF x 0.8 gal/SF/Day	=	6.4 gal/SF/Day
Minimum basal area required	=	$\frac{1{,}300 \text{ gpd}}{1.00 \text{ gal/SF/day}}$	=	1,300 SF

A current capacity of 1,300 gpd will be assumed for the existing mound system.

RECIRCULATION TANK

Orenco Systems Inc. recommends a recirculation/blending tank volume of a minimum of 80 percent of peak daily flows prior treatment in an Advantex treatment system, as follows:

Volume = 0.8 x Flow rate
Volume = 0.8 x (1,650 gpd)
Volume = 1,320 gallons
Volume = 1,500 gallons

A new recirculation tank of 1,500 gallons will be provided for blending of the peak organic and hydraulic SS loads. A duplex pumping system will be installed in the recirculation/blending tank to dose the AdvanTex Treatment System. The controls for the recirculation/blending tank pump system will consist of a timer with float switch override high water alarm, and a duplex pump control panel equipped with remote telemetry and web based monitoring system.

PRE-TREATMENT SYSTEM

Although several pre-treatment systems may be evaluated for installation, the following section provides information relating to the Advantex Treatment System. All pretreatment systems will require a treated wastewater dosing tank prior disposal through the new subsurface drip system.

Advantex Treatment System

An Advantex Treatment System is based on a packed bed filter with attached growth biological treatment approach. In addition to the bed filter, the treatment system will include a recirculation tank and a dosing tank both with duplex pump system and controls. Controls will consist of timers with float switch override, high water alarms, and a duplex pump control panel. An Advantex AX- 100 should be sufficient for treatment at peak flows. This number will be confirmed with the vendor prior to any permitting or construction of the SS treatment system.

The system components' sizing is as follows:

Advantex treatment unit:	1 – AX - 100
Recirculation Tank:	1 – 1,500 gallon tank
Dosing Tank:	1 – 3,000 gallon tank

DOSING TANK

A new precast concrete dosing tank of 3,000 gallons will be provided for the collection of treated effluent prior to disposal through the new subsurface drip system. The proposed dosing tank provides 1.8 times the peak design flow and will be designed to ensure it provides more than one day's storage volume above the high water alarm. A duplex pump system will be used for timed dosing to the new subsurface drip system. The dosing tank operations will be time controlled with a high water alarm, timer override, and redundant off float. AdvanTex filter backwash water will be returned to the recirculation tank.

SITE SOIL EVALUATION

The proposed subsurface drip system size is based on the soil evaluation performed by Summit Engineering, Inc. and Napa County PBES Registered Environmental health Specialist (REHS) Rebecca Setliff on September 17th, 2014 at the location of the proposed SS primary and reserve disposal areas. This evaluation also showed acceptable soils for the existing mound system. Based on the soil type and topography, it is proposed to use a subsurface drip system for disposal of treated SS effluent from the AdvanTex Treatment System. Acceptable soil was qualified in the primary area up to a depth of 36 inches. A hydraulic loading rate of 0.6 gal/SF/day will be used for the design based on Geoflow (the subsurface drip tubing manufacturer) guidelines, which is more conservative than PBES guidelines (ASTS Table 10) for sandy clay loam which recommends a loading rate of 0.75 gal/SF/day with treatment. Each

Geoflow drip line will be placed approximately 8" below ground surface. Please refer to Enclosure F for the soil site evaluation report.

SUBSURFACE DRIP HEADWORKS

A Geoflow Wasteflow Automatic Headworks assembly will be provided between the dosing tank and the subsurface disposal field. The headworks is a pre-assembled unit which includes the filter, valves, and pressure gauge.

SUBSURFACE DRIP SYSTEM

The area required for disposal of the projected SS flows in a subsurface drip field system is calculated as follows:

$$\text{Drip Field Size} = \frac{1{,}650 \text{ gpd}}{0.6 \text{ gal/SF/day}} = 2{,}750 \text{ SF}$$

Proposed subsurface drip area = 40 LF x 75 LF
= 3,000 SF

A subsurface distribution system with 3,000 SF of drip line should be adequate to handle the peak wastewater flow of 1,650 gpd. The drip tubing will be installed approximately 12 inches below grade in a dripfield area with a slope of less than 1%. Warning signs and/or fencing should be installed to indicate the boundaries of the drip field area.

Per Napa County PBES requirements, a suitable expansion area of 200% (6,000 SF) must also be identified. Please refer to the Site Soil Evaluation Plan on Enclosure F for the locations of the primary and reserve areas.

<u>SANITARY SEWAGE TREATMENT ONLY, OPTION 2</u>

RECIRCULATION TANK

Orenco Systems Inc. recommends a recirculation/blending tank volume of a minimum of 80 percent of peak daily flows prior treatment in an Advantex treatment system, as follows:

Volume = 0.8 x Flow rate
Volume = 0.8 x (2,950 gpd)
Volume = 2,360 gallons
<u>Volume = 2,500 gallons</u>

A new recirculation tank of 2,500 gallons will be provided for blending of the peak organic and hydraulic SS loads.

HIGH RATE PACKAGE TREATMENT SYSTEM

Advantex Treatment System

The system components' sizing is as follows:

Advantex treatment unit:	1 – AX - 100
Recirculation Tank:	1 – 2,500 gallon tank
Dosing Tank:	1 – 5,000 gallon tank

DOSING TANK

A new precast concrete dosing tank of 5,000 gallons will be provided for the collection of treated effluent prior to disposal through the new subsurface drip system. The proposed dosing tank provides 1.7 times the peak design flow and will be designed to ensure it provides more than one day's storage volume above the high water alarm. A duplex pump system will be used for timed dosing to the new subsurface drip system. The dosing tank operations will be time controlled with a high water alarm, timer override, and redundant off float. AdvanTex filter backwash water will be returned to the recirculation tank.

SUBSURFACE DRIP SYSTEM

The area required for disposal of the projected SS flows in a subsurface drip field system is calculated as follows:

$$\text{Drip Field Size} = \frac{2{,}950 \text{ gpd}}{0.6 \text{ gal/SF/day}} = 4{,}917 \text{ SF}$$

Proposed subsurface drip area = 50 LF x 100 LF
= 5,000 SF

A subsurface distribution system with 5,000 SF of drip line should be adequate to handle the peak wastewater flow of 2,950 gpd. The drip tubing will be installed approximately 12 inches below grade in a dripfield area with a slope of less than 1%. Warning signs and/or fencing should be installed to indicate the boundaries of the drip field area.

Per Napa County PBES requirements, a suitable expansion area of 200% (10,000 SF) must also be identified. Please refer to the Site Soil Evaluation Plan on Enclosure F for the locations of the primary and reserve areas.

ENCLOSURE C

VICINITY MAP

WATER & WASTEWATER SITE PLAN

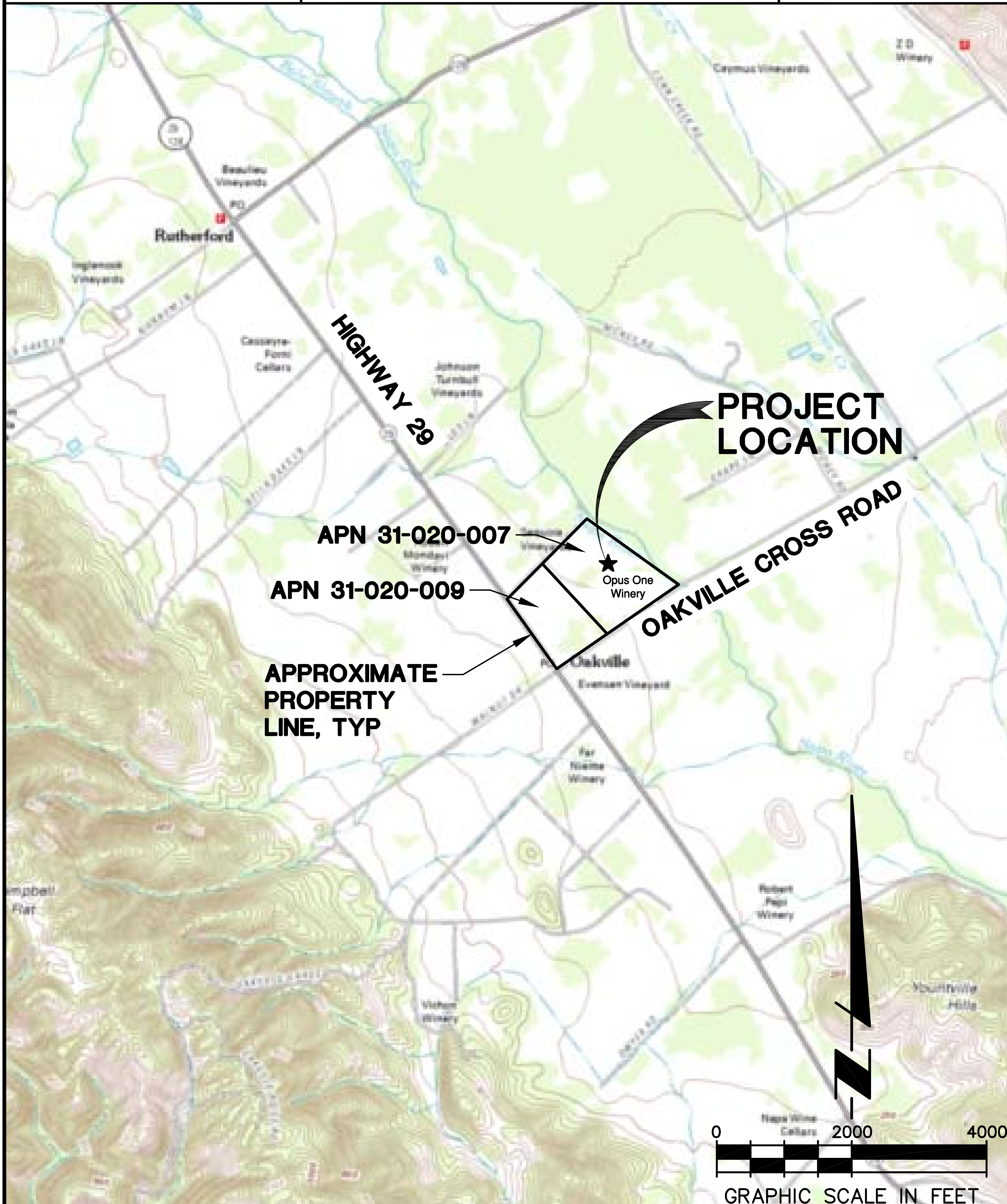
WASTEWATER MANAGEMENT SYSTEM SCHEMATICS

SUMMIT

OPUS ONE WINERY
7900 HIGHWAY 20
OAKVILLE, CALIFORNIA
APN 31-020-007

VICINITY MAP

PROJECT NO. 2014096
DATE 2014-09-22
SHT NO ____ OF ____
BY SMI CHK CL



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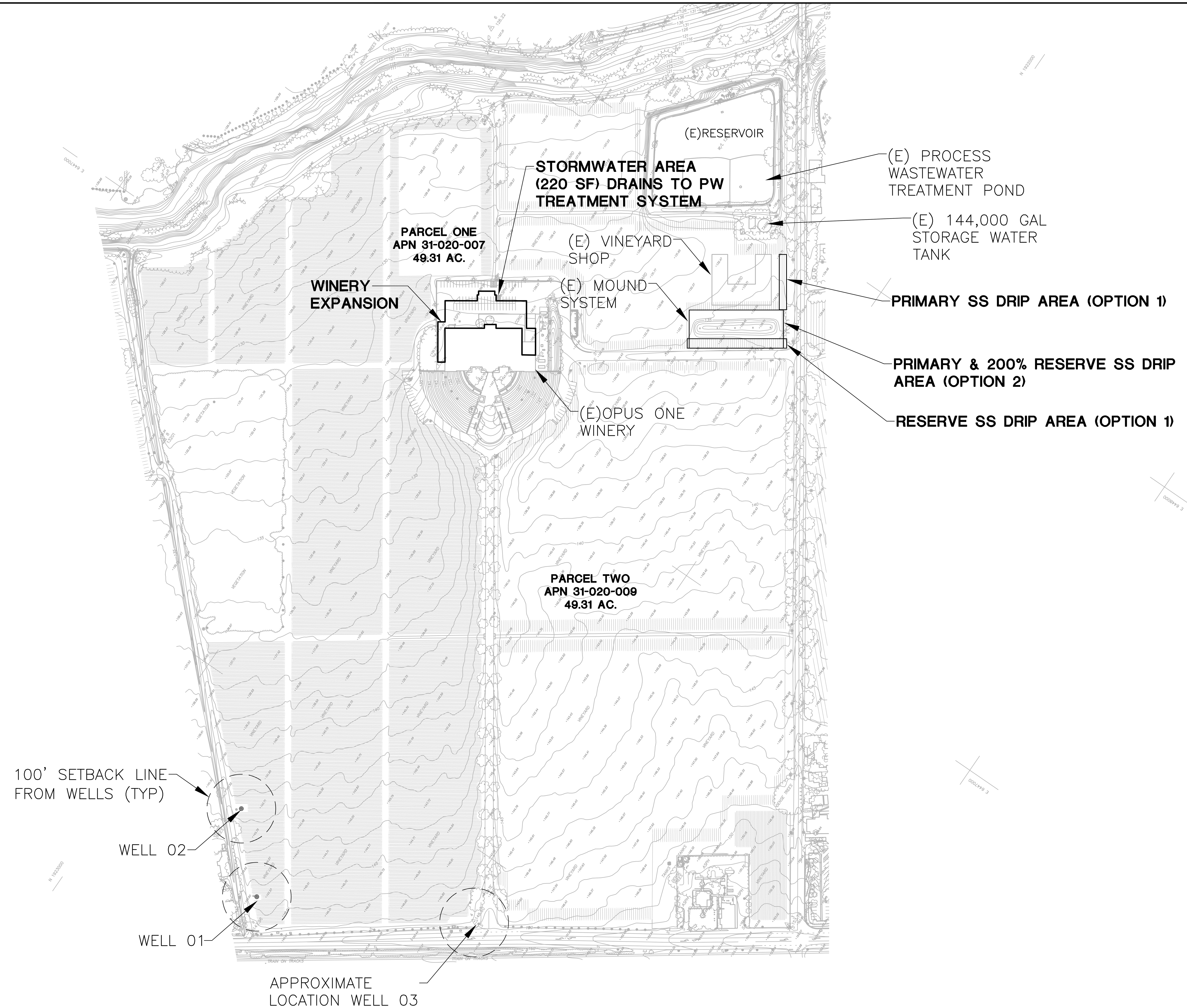
Summit Engineering, Inc
463 Aviation Blvd., Suite 200 • Santa Rosa, CA 95403 • 707-527-0775 • www.summit-sr.com



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OPUS ONE WINERY
7900 ST. HELENA HWY
OAKVILLE, CALIFORNIA
APN 31-020-007

OPUS ONE WINERY

SITE PLAN
WATER & WASTEWATER

2015-11-12 USE PERMIT SUBMITTAL

DATE:	2014-09-22
JOB NO:	2014096
SCALE:	AS SHOWN
DRAWN:	SMI
CHECKED:	CL
SHEET	UP2

P:\2014\2014096 OPUS ONE WINERY UP ASSISTANCE\CAD\WWW\14096-UP1-UP4.DWG

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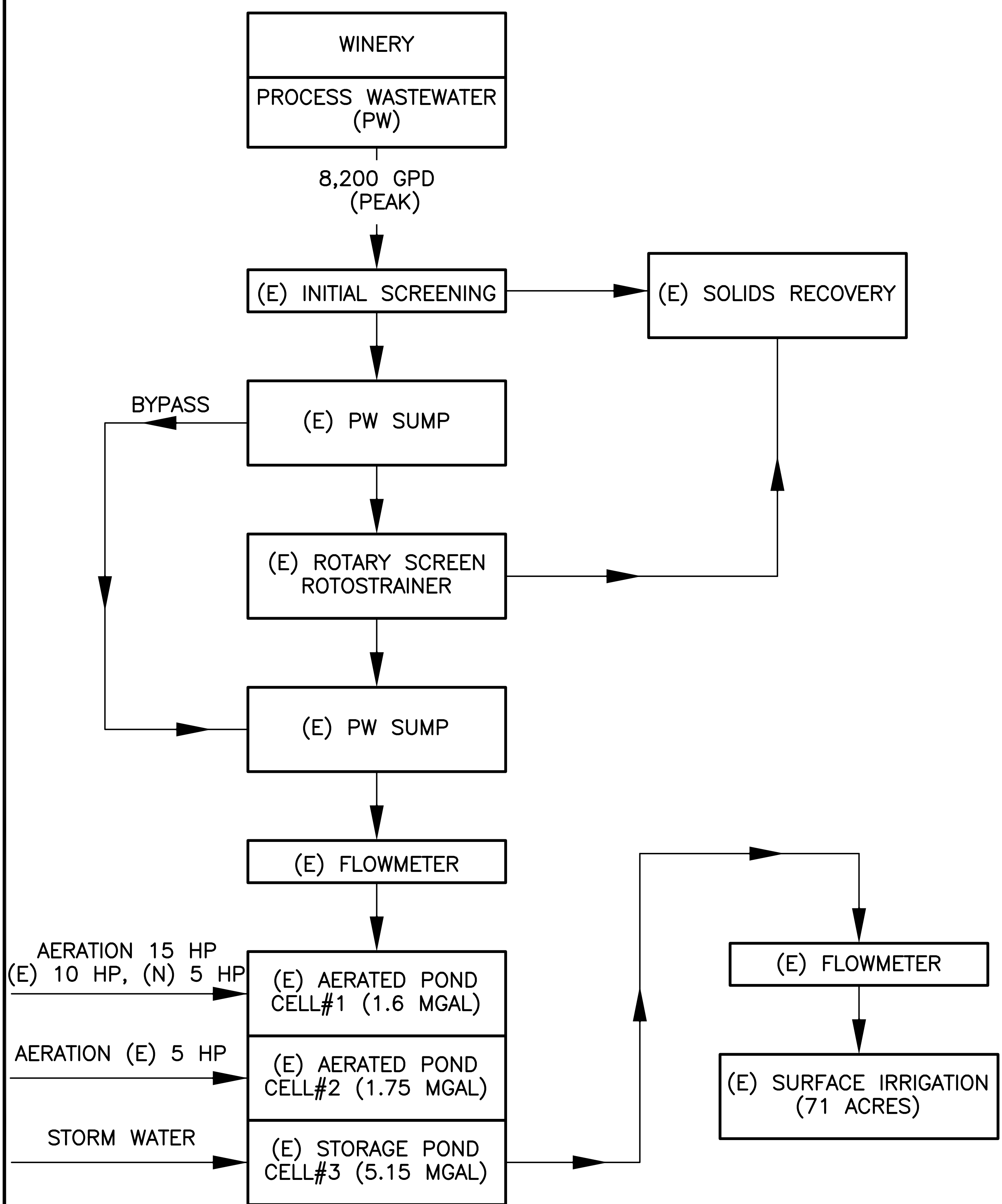
SUMMIT

OPUS ONE WINERY
7900 ST. HELENA HWY
OAKVILLE, CA
APN 031-020-007

PW TREATMENT SCHEMATIC

PROJECT NO. 2014096
DATE 11-11-15
SHT NO 1 OF 1
BY CL CHK GG



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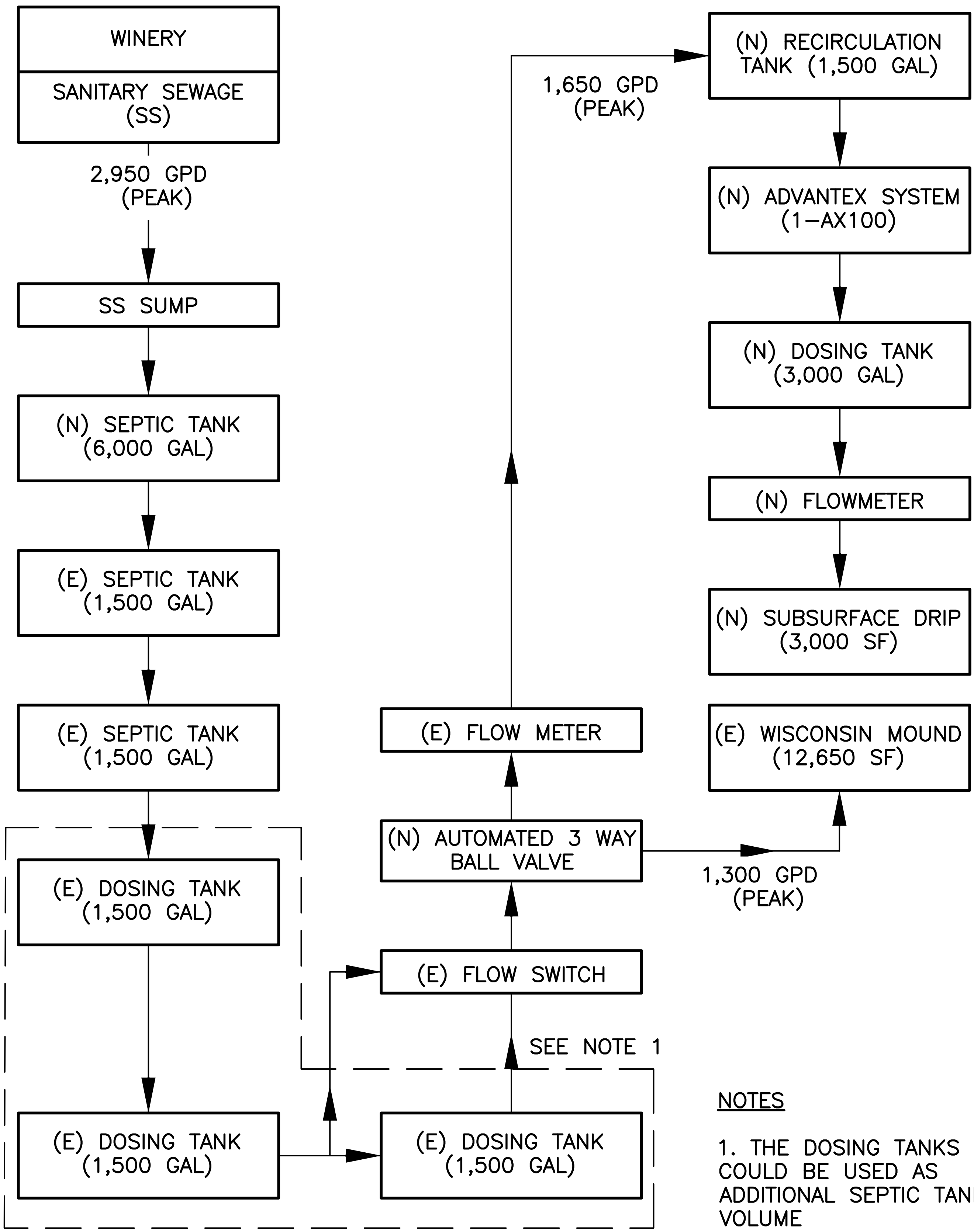
SUMMIT

OPUS ONE WINERY
7900 ST. HELENA HWY
OAKVILLE, CA
APN 031-020-007

SS TREATMENT SCHEMATIC OPTION 1

PROJECT NO. 2014096
DATE 11-11-15
SHT NO 1 OF 1
BY CL CHK GG



NOTES

1. THE DOSING TANKS COULD BE USED AS ADDITIONAL SEPTIC TANK VOLUME

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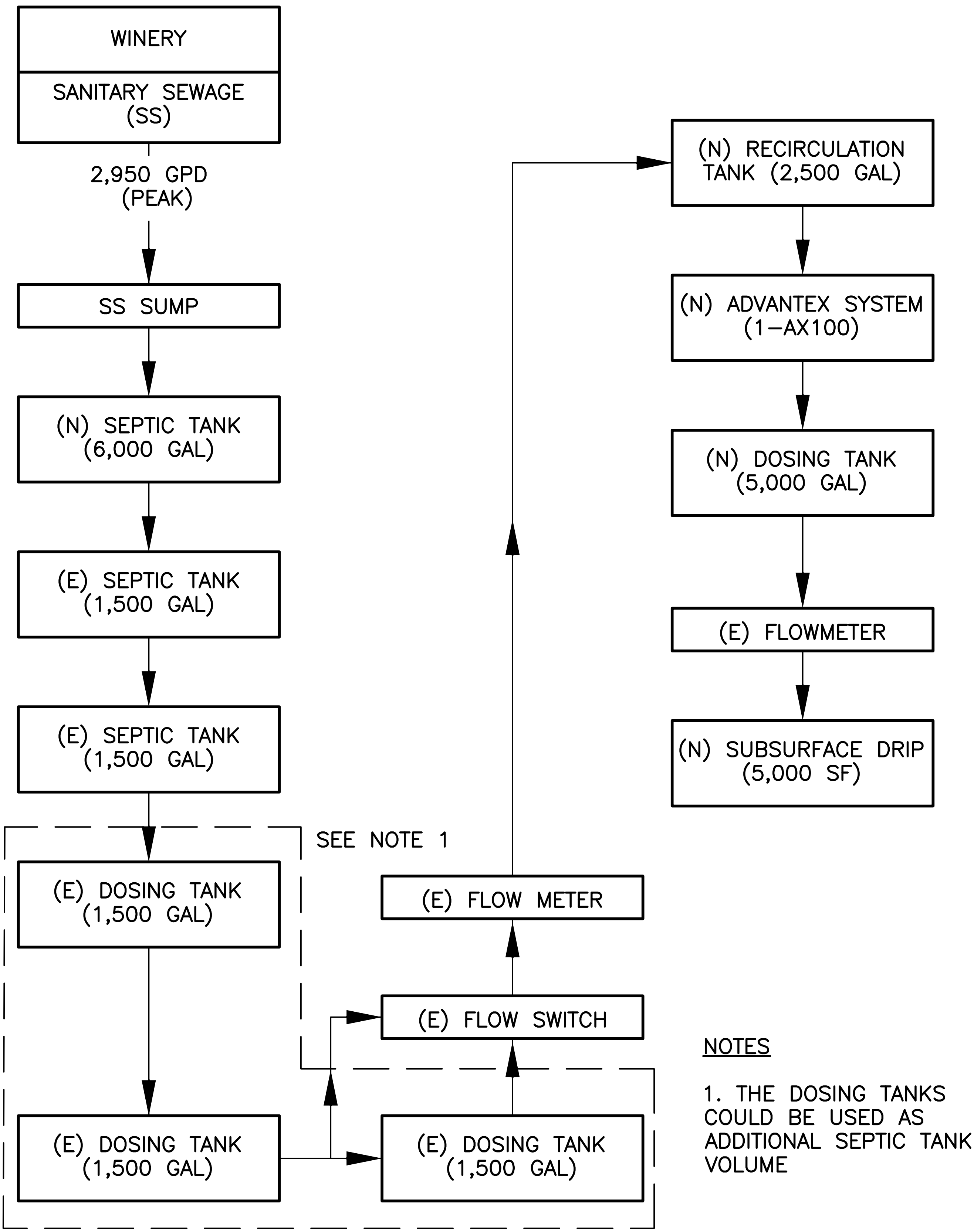
SUMMIT

OPUS ONE WINERY
7900 ST. HELENA HWY
OAKVILLE, CA
APN 031-020-007

SS TREATMENT SCHEMATIC OPTION 2

PROJECT NO. 2014096
DATE 11-11-15
SHT NO 1 OF 1
BY CL CHK GG



NOTES

1. THE DOSING TANKS COULD BE USED AS ADDITIONAL SEPTIC TANK VOLUME

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ENCLOSURE D

PROCESS WASTEWATER FLOWS

POND WATER BALANCE WITH STORM WATER INPUT

PROCESS WASTEWATER DISPERSAL BALANCE

SUMMIT ENGINEERING, INC.	OPUS ONE Wastewater Feasibility Study Process Wastewater Flows	PROJECT NO. 2014096 BY: CL CHK: GG

PROCESS WASTEWATER

Annual Volume

Annual Production (projected)					=	104,167 cases wine/year
Generation Rate (assumed)[a]					=	2.4 gal wine/case of wine
Annual Production	104,167 cases wine/year	x	2.4 gal wine/case of wine		=	250,000 gal wine/year
Generation Rate (assumed)[b]					=	165 gal wine/ton grapes
Tons Crushed	250,000 gal wine/year	÷	165 gal wine/ton grapes		=	1,515 tons grapes/year
Process Wastewater (PW) Generation Rate[c]					=	6.00 gal PW/gal wine
Annual PW Flow	250,000 gal wine/year	x	6.00 gal PW/gal wine		=	***1,500,000 gal PW/year***

Average Day Flow

	1,500,000 gal PW/year	÷	365 days	=	*4,110 gal PW/day*

Napa County Peak Day ***4,200 gal PW/day***

Length of Harvest				=	60 days
Peak Flow	250,000 gal wine/year / 60 days	x	1.5	=	***6,250 gal PW/day***

Average Day Peak Harvest Month Flow

Assume:
1. 16.4% of the PW flows are accounted for during September
2. 30 days in September

Peak Flow	(1,500,000 gal PW/year x 16.4%) / 30 days	=	*8,200 gal PW/day*

DESIGN FLOW = ***8,200 gal PW/day***

a. 2.4 gallons of wine per case of wine
b. 165 Gal wine per ton of grapes is used as a wine industry standard
c. 6.0 gal of PW per gallon wine produced over the course of 1 year is based on the average of data from approximately 16 wineries
d. Peak week tonnage was based on input from winery (for existing production)

SUMMIT ENGINEERING, INC. Consulting Civil Engineers	OPUS ONE WINERY WASTEWATER FEASIBILITY STUDY Design Criteria	PROJECT NO. 2015118 BY: CL CHK:

DESIGN CRITERIA

FULL PRODUCTION

Production Level	104,167	cases/year	
Annual Production	250,000	gal wine/year	
Crush Period	60	day	* per PBES criteria
Annual PW Flow	1,500,000	gal PW/year	
Average PW Flow	4,110	gal PW/day	
PW Generation Rate	6.0	gal PW/gal wine	
Peak Harvest Day	6,250	gal PW/day	* per PBES criteria
PW Flows accounted during September	16.4	%	
Average Day Peak Harvest Month	8,200	gal PW/day	

EXISTING POND VOLUME	Volume (MG)	HRT (days)	
		Average Day Peak Harvest Month	Average PW Flow
Pond Cell # 1 Volume (aerated)	1.25	152	304
Pond Cell # 2 Volume (aerated)	1.36	166	331
Pond Cell # 3 Volume (storage)	4.01	489	976
Total Pond Volume	6.62	807	1,611

AREA CONTRIBUTING RAINWATER TO PROCESS WASTEWATER SYSTEM

Location[a]	Area (ft^2)	Runoff Factor
Area not covered in storm collection system	220	0.9

STORMWATER FLOWS TO PROCESS WASTEWATER SYSTEM

Month	100-Year Precipitation[a] (in)	Total Rainwater Flow (gal)	Monthly Rainwater Flow (gpd)
August	0.2	20.3	0.7
September	0.9	103.9	3.5
October	4.0	466.3	15.0
November	10.4	1,224.0	40.8
December	11.3	1,322.9	42.7
January	16.1	1,890.5	61.0
February	15.3	1,799.3	64.3
March	11.5	1,345.7	43.4
April	3.8	441.0	14.7
May	1.5	172.3	5.6
June	0.4	43.1	1.4
July	0.1	10.1	0.3
Total	**75.4**	**8,839.4**	

a. Precipitation, 100-year rainfall event, see Climate Data Worksheet.

DESIGN PROCESS WASTEWATER FLOWS

Month	PW Monthly Percentage of Annual Flow[a] (%)	Total PW Flow[a] (Mgal)	Total Rainwater Flow (Mgal)	Total PW & RW Flow (Mgal)
August	10.5%	0.158	0.000	0.158
September	16.4%	0.246	0.000	0.246
October	12.9%	0.194	0.000	0.194
November	7.4%	0.111	0.001	0.112
December	6.4%	0.096	0.001	0.097
January	6.6%	0.099	0.002	0.101
February	7.2%	0.108	0.002	0.110
March	7.6%	0.114	0.001	0.115
April	6.8%	0.102	0.000	0.102
May	6.4%	0.096	0.000	0.096
June	5.6%	0.084	0.000	0.084
July	6.2%	0.093	0.000	0.093
Total	**100%**	**1.500**	**0.009**	**1.509**

[a] Assumption of monthly percentage of annual flow based on average of PW flow data for similar small wineries

SUMMIT ENGINEERING, INC. Consulting Civil Engineers	OPUS ONE WINERY WASTEWATER FEASIBILITY STUDY Climate Data	PROJECT NO. 2015118 BY: CL CHK:

Month	Days	Average Temp[a] (F)	Reference Evapotranspiration[b] (in)	Pan Evaporation[c] (in)	Lake Evaporation[d] (in)	Average Precipitation[e] (in)	10-Year Precipitation[f] (in)	100-Year Precipitation[f] (in)
August	31	71.0	6.5	12.06	9.3	0.08	0.1	0.2
September	30	68.6	5.1	8.67	6.7	0.41	0.6	0.9
October	31	62.5	3.4	5.72	4.4	1.84	2.8	4.0
November	30	53.4	1.8	2.48	1.9	4.83	7.3	10.4
December	31	47.6	0.9	1.66	1.3	5.22	7.9	11.3
January	31	47.9	1.2	1.53	1.2	7.46	11.3	16.1
February	28	51.4	1.7	2.15	1.7	7.10	10.7	15.3
March	31	54.1	3.4	3.79	2.9	5.31	8.0	11.5
April	30	58.6	4.8	5.82	4.5	1.74	2.6	3.8
May	31	63.6	6.2	8.90	6.9	0.68	1.0	1.5
June	30	68.8	6.9	11.00	8.5	0.17	0.3	0.4
July	31	71.6	7.4	13.22	10.2	0.04	0.1	0.1
Total	**365**		**49.4**	**77.0**	**59.3**	**34.9**	**52.6**	**75.4**

[a] Average monthly temperature observed between 1931 and 2001 for Saint Helena, Napa, CA from NOAA

[b] Average monthly reference evaporation rates for Zone 8, Inland San Fransisco Bay Area, typical rainfall year, CIMIS, DWR, 2001. See www.itrc.org.

[c] Average monthly pan evaporation rates observed at Lake Berryessa, between 1957 and 1970. See http://www.calclim.dri.edu/ccda/comparative/avgpan.html

[d] Pan evaporation rates adjusted by a factor of 0.77 to determine lake evaporation.

[e] Average monthly rainfall observed between 1931 and 2001 for Saint Helena, Napa, CA from NOAA

[f] Average monthly rainfall adjusted by the ratio of 10-yr and 100-yr wet year return storm identified by Pearsons Log III Distribution (St Helena)

SUMMIT ENGINEERING, INC. Consulting Civil Engineers	OPUS ONE WINERY WASTEWATER FEASIBILITY STUDY PW/SS Design Criteria	PROJECT NO. 2014096 BY: CL CHK:

DESIGN CRITERIA - EXISTING

Sizing Parameters

PW BOD Concentration[a]	7,500	mg/L
PW Peak Daily Flow	8,200	gal PW/day

[a] Influent BOD concentration based on average of PW data for similar small wineries

Oxygen Requirement	1.5	lbs O_2/lb BOD	
Oxygen Transfer Rate	2.2	lbs O_2/HP - hr	* vert Turbine Aerator
Power/ Volume Ratio, Pond Cell No. 1	0.10 - 0.20 Hp/1,000 cu ft		
Power/ Volume Ratio, Pond Cell No. 2	0.05 - 0.10 Hp/1,000 cu ft		
Pond Cell No. 1 Volume	1.25	Mgal	
Pond Cell No. 2 Volume	1.36	Mgal	

Pond Cell #1 Aeration

BOD Mass Loading	513	lbs BOD/day
Aerator Run Time	24	Hrs/day
Oxygen Requirement	32	lbs O_2
Aerator Horsepower Required	15	HP
Existing Aerator Horsepower	10	HP
Future Aerator Horsepower	0	HP
Total Aeration	**10**	**HP**
Check Power-to-Volume Ratio	0.06	Hp/ 1,000 CF

P\V range desired is 0.10 to 0.20, this will enable oxygen transfer and mixing to occur within the upper 3-4 feet of the pond as required in a facultative aerated lagoon system.

Pond Cell #2 Aeration

Existing Aerator Horsepower	5	HP
Check Power-to-Volume Ratio	0.03	Hp/ 1,000 CF

P\V range desired is 0.05 to 0.10, this will enable oxygen transfer and mixing to occur within the upper

SUMMIT ENGINEERING, INC. Consulting Civil Engineers	OPUS ONE WINERY WASTEWATER FEASIBILITY STUDY Pond Worksheet	PROJECT NO. 2015118 BY: CL CHK:

Pond No. 1

Bottom Width	65.0'	Bottom Radius	30.0'	Start Month	August
Bottom Length	109.0'	Top Radius	40.0'	Min. Depth	5.0'
Interior Side Slope (x:1)	2.0	Depth	14.0'	Annual PW	1.50 Mgal
Length:Width	0.6	Freeboard	2.0'	Initial Depth	8.0'

Depth (ft)	Surface Area (ft^2)	Total Volume (Mgal)	
0	6,316	0.00	
1	6,991	0.05	
2	7,625	0.10	
3	8,359	0.16	
4	9,125	0.22	
5	10,002	0.30	
6	10,833	0.38	
7	11,695	0.46	
8	12,588	0.56	
9	13,512	0.65	
10	14,467	0.76	
11	15,453	0.87	
12	16,470	0.99	
13	17,519	1.12	
14	18,598	1.25	1.25

Pond No. 2

Bottom Width	72.5'	Bottom Radius	30.0'	Start Month	August
Bottom Length	109.0'	Top Radius	40.0'	Min. Depth	5.0'
Interior Side Slope (x:1)	2.0	Depth	14.0'	Annual PW	1.50 Mgal
Length:Width	0.7	Freeboard	2.0'	Initial Depth	8.0'

Depth (ft)	Surface Area (ft^2)	Total Volume (Mgal)	
0	7,134	0.00	
1	7,839	0.06	
2	8,500	0.11	
3	9,264	0.18	
4	10,059	0.25	
5	10,970	0.34	
6	11,831	0.42	
7	12,722	0.51	
8	13,645	0.61	
9	14,599	0.72	
10	15,584	0.83	
11	16,600	0.95	
12	17,648	1.08	
13	18,726	1.21	
14	19,836	1.36	1.36

Pond No. 3

Bottom Width	116.5'	Bottom Radius	30.0'	Start Month	August
Bottom Length	226.0'	Top Radius	40.0'	Min. Depth	5.0'
Interior Side Slope (x:1)	2.4	Depth	14.0'	Annual PW & RW	1.51 Mgal
Length:Width	0.5	Freeboard	2.0'	Initial Depth	8.0'

Depth (ft)	Surface Area (ft^2)	Total Volume (Mgal)	
0	25,725	0.00	
1	27,190	0.20	
2	28,696	0.39	
3	30,412	0.61	
4	32,173	0.84	
5	34,162	1.11	
6	36,018	1.38	
7	37,920	1.65	
8	39,866	1.94	
9	41,858	2.25	
10	43,895	2.57	
11	45,977	2.91	
12	48,104	3.26	
13	50,277	3.63	
14	52,494	4.01	4.01

TOTAL POND VOLUME **6.62 Mgal**

SUMMIT ENGINEERING, INC. Consulting Civil Engineers	OPUS ONE WINERY WASTEWATER FEASIBILITY STUDY Pond Water Balance	PROJECT NO. 2015118 BY: CL CHK:

Pond No.1

Month	Initial Volume (Mgal)	Pond Evaporation (Mgal)	PW Inflow (Mgal)	100 Year Precipitation (Mgal)	Volume Change (Mgal)	Total Volume (Mgal)	Divert Volume (Mgal)	Final Volume (Mgal)	Final Pond Depth (ft)	Volume Check (Mgal)	Surface Area (ft^2)
August	0.758	-0.084	0.158	0.002	0.076	0.834	0.000	0.834	10.6	0.000	14,467
September	0.834	-0.063	0.246	0.010	0.194	1.027	0.038	0.989	12.0	0.038	15,055
October	0.989	-0.045	0.194	0.046	0.194	1.184	0.194	0.989	12.0	0.194	16,470
November	0.989	-0.020	0.111	0.121	0.212	1.202	0.212	0.989	12.0	0.212	16,470
December	0.989	-0.013	0.096	0.131	0.214	1.203	0.214	0.989	12.0	0.214	16,470
January	0.989	-0.012	0.099	0.187	0.274	1.263	0.274	0.989	12.0	0.274	16,470
February	0.989	-0.017	0.108	0.178	0.269	1.258	0.269	0.989	12.0	0.269	16,470
March	0.989	-0.030	0.114	0.133	0.217	1.206	0.217	0.989	12.0	0.217	16,470
April	0.989	-0.046	0.102	0.044	0.100	1.089	0.100	0.989	12.0	0.100	16,470
May	0.989	-0.070	0.096	0.017	0.043	1.032	0.043	0.989	12.0	0.043	16,470
June	0.989	-0.087	0.084	0.004	0.001	0.990	0.001	0.989	12.0	0.001	16,470
July	0.989	-0.105	0.093	0.001	-0.011	0.979	0.221	0.758	10.0	0.000	16,470
Total		**-0.591**	**1.500**	**0.874**	**1.783**		**1.783**			**1.562**	

Pond No. 2

Month	Initial Volume (Mgal)	Pond Evaporation (Mgal)	PW Inflow (Mgal)	100 Year Precipitation (Mgal)	Volume Change (Mgal)	Total Volume (Mgal)	Divert Volume (Mgal)	Final Volume (Mgal)	Final Pond Depth (ft)	Volume Check (Mgal)	Surface Area (ft^2)
August	0.830	-0.090	0.000	0.002	-0.088	0.742	0.000	0.742	9.2	0.000	15,584
September	0.742	-0.062	0.038	0.011	-0.012	0.730	0.000	0.730	9.1	0.000	14,794
October	0.730	-0.040	0.194	0.049	0.203	0.933	0.000	0.933	10.8	0.000	14,696
November	0.933	-0.020	0.212	0.129	0.322	1.255	0.176	1.079	12.0	0.176	16,395
December	1.079	-0.014	0.214	0.140	0.339	1.418	0.339	1.079	12.0	0.339	17,648
January	1.079	-0.013	0.274	0.199	0.460	1.539	0.460	1.079	12.0	0.460	17,648
February	1.079	-0.018	0.269	0.190	0.440	1.519	0.440	1.079	12.0	0.440	17,648
March	1.079	-0.032	0.217	0.142	0.327	1.406	0.327	1.079	12.0	0.327	17,648
April	1.079	-0.049	0.100	0.047	0.097	1.175	0.097	1.079	12.0	0.097	17,648
May	1.079	-0.075	0.043	0.018	-0.015	1.064	0.000	1.064	11.8	0.000	17,648
June	1.064	-0.092	0.001	0.005	-0.086	0.978	0.000	0.978	11.2	0.000	17,436
July	0.978	-0.107	0.221	0.001	0.115	1.093	0.263	0.830	9.9	0.014	16,807
Total		**-0.612**	**1.783**	**0.932**	**2.103**		**2.103**			**1.854**	

Pond No. 3

Month	Initial Volume (Mgal)	Pond Evaporation (Mgal)	PW Inflow (Mgal)	RW Inflow (Mgal)	100 Year Precipitation (Mgal)	Volume Change (Mgal)	Total Volume (Mgal)	Divert Volume (Mgal)	Final Volume (Mgal)	Final Pond Depth (ft)	Volume Check (Mgal)	Surface Area (ft^2)
August	2.570	-0.254	0.000	0.000	0.006	-0.248	2.321	0.000	2.321	9.2	0.000	43,895
September	2.321	-0.176	0.000	0.000	0.029	-0.147	2.174	0.000	2.174	8.7	0.000	42,262
October	2.174	-0.113	0.000	0.000	0.130	0.017	2.192	0.000	2.192	8.8	0.000	41,256
November	2.192	-0.049	0.176	0.001	0.342	0.470	2.661	0.000	2.661	10.2	0.000	41,456
December	2.661	-0.035	0.339	0.001	0.369	0.674	3.336	0.078	3.257	12.0	0.078	44,308
January	3.257	-0.035	0.460	0.002	0.528	0.954	4.212	0.954	3.257	12.0	0.954	48,104
February	3.257	-0.050	0.440	0.002	0.502	0.895	4.152	0.895	3.257	12.0	0.895	48,104
March	3.257	-0.088	0.327	0.001	0.376	0.616	3.874	0.616	3.257	12.0	0.616	48,104
April	3.257	-0.134	0.097	0.000	0.123	0.086	3.343	0.086	3.257	12.0	0.086	48,104
May	3.257	-0.206	0.000	0.000	0.048	-0.157	3.100	0.000	3.100	11.5	0.000	48,104
June	3.100	-0.248	0.000	0.000	0.012	-0.236	2.864	0.000	2.864	10.8	0.000	47,035
July	2.864	-0.289	0.263	0.000	0.003	-0.023	2.841	0.271	2.570	10.0	0.000	45,557
Total		**-1.678**	**2.103**	**0.009**	**2.467**	**2.901**		**2.900**			**2.630**	

SUMMIT ENGINEERING, INC. Consulting Civil Engineers	OPUS ONE WINERY WASTEWATER FEASIBILITY STUDY Irrigation & Effluent Application Rates	PROJECT NO. 2015118 BY: CL CHK:

Applied Irrigation Area	Vineyard	50.00	acres
	Pasture	0.0	acres
Total Area Available for Irrigation	Vineyard	71.0	acres
	Pasture	0.0	acres

Month	Reference ET[a]	Pasture Crop Coefficient[b]	Vineyard Crop Coefficient[c]	Pasture ET[d]	Vineyard ET[d]	Precipitation[e]	Irrigation Demand[f]		Operating Days per Month[g]	Percolation Capacity[h]		Assimilative Capacity[i]		Effluent Applied[j]		Excess Capacity
	(in)			(in)	(in)	(in)	(in)	(Mgal)	(d)	(in)	(Mgal)	(in)	(Mgal)	(Mgal)	(in)	(Mgal)
August	6.5	0.9	0.5	5.9	2.9	0.2	2.8	3.745	31	37.94	51.550	40.7	55.295	0.000	0.00	55.30
September	5.1	0.9	0.3	4.6	1.3	0.9	0.4	0.598	30	36.72	49.887	37.2	50.485	0.000	0.00	50.48
October	3.4	0.9	0.1	3.1	0.2	4.0	0.0	0.000	16	19.58	26.606	19.6	26.606	0.000	0.00	26.61
November	1.8	0.8	0.0	1.4	0.0	10.4	0.0	0.000	14	17.14	23.281	17.1	23.281	0.000	0.00	23.28
December	0.9	0.8	0.0	0.7	0.0	11.3	0.0	0.000	5	6.12	8.315	6.1	8.315	0.078	0.06	8.24
January	1.2	0.8	0.0	1.0	0.0	16.1	0.0	0.000	6	7.34	9.977	7.3	9.977	0.954	0.70	9.02
February	1.7	0.8	0.0	1.3	0.0	15.3	0.0	0.000	5	6.12	8.315	6.1	8.315	0.895	0.66	7.42
March	3.4	0.8	0.0	2.7	0.0	11.5	0.0	0.000	12	14.69	19.955	14.7	19.955	0.616	0.45	19.34
April	4.8	0.9	0.2	4.3	0.8	3.8	0.0	0.000	13	15.91	21.618	15.9	21.618	0.086	0.06	21.53
May	6.2	0.9	0.6	5.6	3.6	1.5	2.1	2.889	16	19.58	26.606	21.7	29.495	0.000	0.00	29.50
June	6.9	0.9	0.7	6.2	4.9	0.4	4.5	6.156	17	20.81	28.269	25.3	34.426	0.000	0.00	34.43
July	7.4	0.9	0.6	6.7	4.8	0.1	4.7	6.352	30	36.72	49.887	41.4	56.239	0.271	0.20	55.97
Total	**49.4**			**43.6**	**18.5**	**75.4**	**14.5**	**19.7**	**195.0**	**238.7**	**324.3**	**253.2**	**344.0**	**2.900**	**2.1**	**341.11**

(a) Average monthly reference evapotranspiration rates, see Climate Data Worksheet.
(b) Kc coefficients for pasture from Table 5-1, "Irrigation with Reclaimed Municipal Wastewater-A Guidance Manual"- California State Water Resources Control Board, July 1984 (San Joaquin Valley).
(c) Kc coefficients for vineyards from Table 5-12, Irrigation with Reclaimed Municipal Wastewater - A Guidance Manual, 84-1 wr, SWRCB.
(d) ET=ETo x Kc. A weighted value is determined on the basis of the available irrigated acreage of vineyard and pasture.
(e) Precipitation, 100-year rainfall event, see Climate Data Worksheet.
(f) Irrigation Demand = ET-Precipitation, inches. A weighted value is determined on the basis of the available irrigated acreage of vineyard and pasture.
(g) Number of operating days per month based on estimated irrigation days available based on 24-hr post storm criteria for a 100-year return period. Summit Engineering, NBRID Capacity Study, April 1996.
(h) Design percolation rate is a maximum of.75 inches per day for the number of operating day per month. Per USDA soil survey, predominant soil type is bale loam.
Sizing perc rate based on clay soils pretreated loading rates for non-shrink clay soils adjusted by a 0.04 safety factor to account for typical slow rate land application design methodology.
(i) Assimilative capacity is the sum of irrigation demand and percolation applied.
(j) Effluent applied depths exceeding 1 inch/month could result in ponding; if ponding occurs, additional disposal area may be required for expansion

Percolation Adjustment			
Hourly Percolation Rate	1.275	in/hr	Average per USDA soil Ksat for Bale Loam, Bale Clay Loam and Yolo Loam (0.57-1.98 in/hr)
15	24	hr/day	
Daily Percolation Rate	30.6	in/day	
Land Application Safety Factor	0.04		
Adjusted Percolation Rate	1.22	in/day	

ENCLOSURE E

SANITARY SEWER FLOWS

MOUND SYSTEM

SUBSURFACE DRIP DISPOSAL AREA

SUMMIT ENGINEERING, INC.	OPUS ONE WINERY Wastewater Feasibility Study Sanitary Sewage Flows	PROJECT NO. 2015118 BY: CL CHK: GG

SANITARY SEWAGE

Peak Weekday with tasting and Event

Employee (full-time)	65	x	15	gpcd	=	975	gal/day	
Employee (part-time)	10	x	15	gpcd	=	150	gal/day	
Tasting Visitors	165	x	3	gpcd	=	495	gal/day	
Private Event Visitors	100	x	10	gpcd	=	1,000	gal/day	(meals prepared off-site)
Total					=	**2,620**	**gal/day**	

Peak Weekend Day with tasting and Event

Employee (full-time)	20	x	15	gpcd	=	300	gal/day	
Employee (part-time)	5	x	15	gpcd	=	75	gal/day	
Employee (harvest weekends)	5	x	15	gpcd	=	75	gal/day	
Tasting Visitors	500	x	3	gpcd	=	1,500	gal/day	
Private Event Visitors	100	x	10	gpcd	=	1,000	gal/day	(meals prepared off-site)
Total					=	**2,950**	**gal/day**	

SUMMIT ENGINEERING, INC	OPUS ONE	PROJECT NO. 2014096
9/25/2014	EXISTING MOUND SYSTEM CURRENT CAPACITY	BY: GG

DATA:

Daily Design Flow	=	1,331	gpd	
Soil Infiltration Rate	=	1.00	gpd/SF	
Sand Fill Loading Rate	=	0.8	gpd/SF	(1.0 gpd/SF for residential & 0.8 gpd/SF for commercial per Napa County Code)
Linear Loading Rate	=		gpd/LF	(Based on soil type and depth see table 7 Napa County Code)
(F) Dispersal Bed Depth	=	1	LF	(9" for residential and 12" for commecial per Napa County Code)
(D) Filter Media Depth Upslope	=	1	LF	
(H) Crown Height	=	1.5	LF	
(S) Slope	=	1	%	
Upslope Correction Factor	=	0.97		(see table 8 Napa County Code)
Donwslope Correction Factor	=	1.03		(see table 8 Napa County Code)

CALCULATIONS:

Infiltrative Surface Area	=	Design Flow (gpd) / Soil Infiltration Rate (gpd/SF)	=	1,664	SF	
(A) Dispersal Bed Width			=	8	LF	
(B) Dispersal Bed Length	=	Infiltrative Surface Area (SF) / (A) Bed Width (LF)	=	208	LF	
(E) Filter Media Depth Downslope	=	(D) + (Slope %)*(A)	=	1.08	LF	
(J) Upslope Width of Mound	=	[D + F +2]*3* Upslope Factor	=	11.64	LF	
(I) Downslope Width of Mound	=	[E + F +2]*3* Downslope Factor	=	12.61	LF	
(K) Endslope Length of Mound	=	[(D + E)/2 + F + H] *3	=	10.62	LF	
Basal Area Required	=	Design Flow (gpd) * 1.3*2 / Soil Infiltration Rate (gpd/SF)	=	3,461	SF	(1.3 Napa County Safety Factor) (2 Expansion Factor)
Basal Area Available	=	B *(A + I + J)	=	6,707	SF	
Basal Area Available*	=	B *(A + I)	=	4,286	SF	

Drip System (Option 1)

Sizing based on Geoflow guidelines					
Design Flow	=	1,650	gal/day		
Depth to Groundwater or other limit	=	36	inches *minimum		
Application	=	0.6	gal/sf/day		Based on moderate sandy clay loam per Napa County
Square Footage required	=	2,750	sf		
Primary Area required	=	40	x	75	
	=	3,000	square feet		
200% Reserve Area Required	=	80	x	75	
	=	6,000	square feet		
	=	0.14	acres		
	=	9,000	square feet total		
Total Area Required	**=**	**0.21**	**acres total**		

Drip System (Option 2)

Sizing based on Geoflow guidelines					
Design Flow	=	2,950	gal/day		Based on moderate sandy clay loam per Napa County
Depth to Groundwater or other limit	=	36	inches *minimum		
Application	=	0.6	gal/sf/day		
Square Footage required	=	4,917	sf		
Primary Area required	=	50	x	100	
	=	5,000	square feet		9,917
200% Reserve Area Required	=	100	x	100	
	=	10,000	square feet		
	=	0.23	acres		
	=	15,000	square feet total		
Total Area Required	**=**	**0.34**	**acres total**		

ENCLOSURE F

SOIL SITE EVALUATION REPORT

Napa County Department of Environmental Management

SITE EVALUATION REPORT

Please attach an 8.5" x 11" plot map showing the locations of all test pits triangulated from permanent landmarks or known property corners. The map must be drawn to scale and include a North arrow, surrounding geographic and topographic features, direction and % slope, distance to drainages, water bodies, potential areas for flooding, unstable landforms, existing or proposed roads, structures, utilities, domestic water supplies, wells, ponds, existing wastewater treatment systems and facilities.

Permit #:	
APN: 030-020-007	
(County Use Only) Reviewed by:	Date:

PLEASE PRINT OR TYPE ALL INFORMATION

Property Owner Opus One Winery	☐ New Construction ☒ Addition ☐ Remodel ☐ Relocation ☐ Other:
Property Owner Mailing Address 7900 St. Helena Hwy	Residential - # of Bedrooms: Design Flow: gpd
City: Oakville State: CA Zip: 94562	☒ Commercial – Type: Sanitary Waste: 3,625 gpd Process Waste: 8,200 gpd
7900 St. Helena Hwy, Oakville Ca 94562	☐ Other: Sanitary Waste: gpd Process Waste: gpd

Evaluation Conducted By:

Company Name Summit Engineering, Inc	Evaluator's Name Claudia Llerandi	Signature (Civil Engineer, R.E.H.S., Geologist, Soil Scientist)
Mailing Address: 463 Aviation Blvd Ste 200		Telephone Number (707) 527-0775
City: Santa Rosa	State: CA Zip: 95403	Date Evaluation Conducted 09/17/2014

Primary Area	**Expansion Area**
Acceptable Soil Depth: 58 in. Test pit #'s: SP 1, 2, 3	Acceptable Soil Depth: 36 in. Test pit #'s: SP 4, 5
Soil Application Rate (gal. /sq. ft. /day): 0.75	Soil Application Rate (gal. /sq. ft. /day): 0.75
System Type(s) Recommended: Subsurface drip system	System Type(s) Recommended: Subsurface drip system
Slope: 1 %. Distance to nearest water source: + 100 ft.	Slope: 1 %. Distance to nearest water source: + 100 ft.
Hydrometer test performed? No ☒ Yes ☐ (attach results)	Hydrometer test performed? No ☒ Yes ☐ (attach results)
Bulk Density test performed? No ☒ Yes ☐ (attach results)	Bulk Density test performed? No ☒ Yes ☐ (attach results)
Groundwater Monitoring Performed? No ☒ Yes ☐ (attach results)	Groundwater Monitoring Performed? No ☒ Yes ☐ (attach results)

Site constraints/Recommendations:

Sandy clay loams soils were identified during the soil evaluation up to a depth of 58 inches in all test pits. Mottling was identified on test pit # 5 at a depth of 36 inches. A subsurface drip system is recommended for sanitary sewage disposal for both the primary and reserve areas.

Name: Opus One Winery   Pit# 1   %Slope   Date: 09/17/2014

Depth: 0-8"   SAMPLE: 1

Color/chip

Gravelly 15-35   very 35-65   extremely >65%   BE   Pea   3/4   1-1/2   2-3   **40% rock**

Texture: Sandy Clay Loam

Mottles: None — few 2%, common 2-20%, many >20%; fine <5 mm, medium 5-15mm, large >15 mm; faint, distinct, prominent

Structure: Massive, single grain, weak, **moderate, strong**; granular, platy, prismatic, columnar, abk, **sbk**

Consistence: lo, so, sh, **h,** vhy, exh; lo, vy frb, frb, **frm,** v frm, exfrm; ns, **ss,** s, vs, np, **sp,** p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<10**	**<10**	<1	<1
Common	10-100	10-100	**1-10**	**1-5**
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<25**	<10	<1	**<1**
Common	25-200	**10-50**	**1-5**	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1   clear 1" to 2.5"   **gradual 2.5" to 5"**   diffuse >5"

0 10 20 30   ○ 2 mm   ◯ 5 mm

Depth: 8-36"   SAMPLE: 2

Color/chip 10YR2/1

Gravelly 15-35   very 35-65   extremely >65%   BE   Pea   3/4   1-1/2   2-3   **20-30% rock**

Texture: Sandy Clay Loam

Mottles: None — few 2%, common 2-20%, many >20%; fine <5 mm, medium 5-15mm, large >15 mm; faint, distinct, prominent

Structure: Massive, single grain, weak, **moderate,** strong; granular, platy, prismatic, columnar, abk, **sbk**

Consistence: lo, so, **sh,** h, vhy, exh; lo, vy frb, frb, **frm,** v frm, exfrm; ns, **ss,** s, vs, np, **sp,** p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<10**	**<10**	<1	**<1**
Common	10-100	10-100	**1-10**	1-5
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<25**	**<10**	<1	**<1**
Common	25-200	10-50	**1-5**	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1   clear 1" to 2.5"   **gradual 2.5" to 5"**   diffuse >5"

0 10 20 30   ○ 2 mm   ◯ 5 mm

Depth: 36-65"   SAMPLE: 3

Color/chip

Gravelly 15-35   very 35-65   extremely >65%   BE   Pea   3/4   1-1/2   2-3   **15% rock**

Texture: Sandy Loam

Mottles: None — few 2%, common 2-20%, many >20%; fine <5 mm, medium 5-15mm, large >15 mm; faint, distinct, prominent

Structure: Massive, **single grain, weak,** moderate, strong; **granular,** platy, prismatic, columnar, abk, sbk

Consistence: lo, **so,** sh, h, vhy, exh; lo, **vy frb, frb,** frm, v frm, exfrm; **ns,** ss, s, vs, **np**, sp, p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<10**	**<10**	**<1**	**<1**
Common	10-100	10-100	1-10	1-5
Many	>100	>100	>10	>5

Pores: N/A

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<25	<10	<1	<1
Common	25-200	10-50	1-5	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1   clear 1" to 2.5"   gradual 2.5" to 5"   diffuse >5"

0 10 20 30   ○ 2 mm   ◯ 5 mm

Depth: SAMPLE:

Color/chip

Gravelly 15-35   very 35-65   extremely >65%   BE   Pea   3/4   1-1/2   2-3

Texture:

Mottles: few 2%, common 2-20%, many >20%; fine <5 mm, medium 5-15mm, large >15 mm; faint, distinct, prominent

Structure: Massive, single grain, weak, moderate, strong; granular, platy, prismatic, columnar, abk, sbk

Consistence: lo, so, sh, h, vhy, exh; lo, vy frb, frb, frm, v frm, exfrm; ns, ss, s, vs, np, sp, p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<10	<10	<1	<1
Common	10-100	10-100	1-10	1-5
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<25	<10	<1	<1
Common	25-200	10-50	1-5	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1   clear 1" to 2.5"   gradual 2.5" to 5"   diffuse >5"

0 10 20 30   ○ 2 mm   ◯ 5 mm

Name: Opus One Winery Pit# 2 %Slope Date: 09/17/2014

Depth: 0-12" SAMPLE: 1

Color/chip

Gravelly very extremely BE Pea 3/4 1-1/2 2-3
15-35 35-65 >65% **15% rock**

Texture: Sandy Clay Loam

Mottles: few 2% common 2-20% many >20%

None fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, weak, **moderate, strong**
granular, platy, prismatic, columnal, abk, **sbk**

Consistence:
lo, so, sh, **h,** vhy, exh
lo, vy frb, frb, **frm,** v frm, exfrm
ns, **ss,** s, vs, np **sp,** p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<10**	**<10**	<1	<1
Common	10-100	10-100	**1-10**	**1-5**
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<25**	<10	<1	**<1**
Common	25-200	**10-50**	**1-5**	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 clear 1" to 2.5" **gradual 2.5" to 5"** diffuse >5"

0 10 20 30 ○ 2 mm ◯ 5 mm

Depth: 12-44" SAMPLE: 2

Color/chip 10YR2/1

Gravelly very extremely BE Pea 3/4 1-1/2 2-3
15-35 35-65 >65% **10% rock**

Texture: Sandy Clay Loam

Mottles: few 2% common 2-20% many >20%

None fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, weak, **moderate,** strong
granular, platy, prismatic, columnal, abk, **sbk**

Consistence:
lo, so, **sh,** h, vhy, exh
lo, vy frb, frb, **frm,** v frm, exfrm
ns, **ss,** s, vs, np **sp,** p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<10**	**<10**	<1	**<1**
Common	10-100	10-100	**1-10**	1-5
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<25**	**<10**	<1	**<1**
Common	25-200	10-50	**1-5**	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 clear 1" to 2.5" **gradual 2.5" to 5"** diffuse >5"

0 10 20 30 ○ 2 mm ◯ 5 mm

Depth: 44-58" SAMPLE: 3

Color/chip

Gravelly very extremely BE Pea 3/4 1-1/2 2-3
15-35 35-65 >65% **20-30% rock**

Texture: Sandy Clay Loam

Mottles: few 2% common 2-20% many >20%

None fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, weak, **moderate,** strong
granular, platy, prismatic, columnal, abk, **sbk**

Consistence:
lo, so, **sh,** h, vhy, exh
lo, vy frb, frb, **frm,** v frm, exfrm
ns, **ss,** s, vs, np **sp,** p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<10**	**<10**	<1	**<1**
Common	10-100	10-100	**1-10**	1-5
Many	>100	>100	>10	>5

Pores: N/A

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<25**	**<10**	<1	**<1**
Common	25-200	10-50	**1-5**	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 clear 1" to 2.5" gradual 2.5" to 5" diffuse >5"

0 10 20 30 ○ 2 mm ◯ 5 mm

Depth: SAMPLE:

Color/chip

Gravelly very extremely BE Pea 3/4 1-1/2 2-3
15-35 35-65 >65%

Texture:

Mottles: few 2% common 2-20% many >20%

fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, weak, moderate, strong
granular, platy, prismatic, columnal, abk, sbk

Consistence:
lo, so, sh, h, vhy, exh
lo, vy frb, frb, frm, v frm, exfrm
ns, ss, s, vs, np sp, p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<10	<10	<1	<1
Common	10-100	10-100	1-10	1-5
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<25	<10	<1	<1
Common	25-200	10-50	1-5	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 clear 1" to 2.5" gradual 2.5" to 5" diffuse >5"

0 10 20 30 ○ 2 mm ◯ 5 mm

Name: Opus One Winery **Pit#** 3 **%Slope** **Date:** 09/17/2014

Depth: 0-40" **SAMPLE:** 1

Color/chip

Gravelly very extremely BE Pea 3/4 1-1/2 2-3

15-35 35-65 >65% **10% rock**

Texture: Sandy Clay Loam

Mottles: few 2% common 2-20% many >20%

None fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, weak, **moderate,** strong

granular, platy, prismatic, columnal, abk, **sbk**

Consistence:
lo, so, **sh,** **h,** vhy, exh
lo, vy frb, **frb,** frm, v frm, exfrm
ns, **ss,** s, vs, np **sp,** p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<10	<10	<1	<1
Common	**10-100**	**10-100**	**1-10**	**1-5**
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<25	<10	<1	<1
Common	25-200	10-50	1-5	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 | clear 1" to 2.5" | **gradual 2.5" to 5"** | diffuse >5"

0 10 20 30 ○ 2 mm ○ 5 mm

Depth: 40-58" **SAMPLE:** 2

Color/chip

Gravelly very extremely BE Pea 3/4 1-1/2 2-3

15-35 35-65 >65% **35% rock**

Texture: Sandy Clay Loam

Mottles: few 2% common 2-20% many >20%

None fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, weak, **moderate, strong**

granular, platy, prismatic, columnal, abk, **sbk**

Consistence:
lo, so, sh, **h, vhy,** exh
lo, vy frb, frb, **frm,** v frm, exfrm
ns, ss, s, vs, np sp, p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<10	<10	<1	<1
Common	**10-100**	**10-100**	**1-10**	**1-5**
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<25	<10	<1	<1
Common	25-200	10-50	1-5	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 | clear 1" to 2.5" | **gradual 2.5" to 5"** | diffuse >5"

0 10 20 30 ○ 2 mm ○ 5 mm

Depth: **SAMPLE:**

Color/chip

Gravelly very extremely BE Pea 3/4 1-1/2 2-3

15-35 35-65 >65%

Texture:

Mottles: few 2% common 2-20% many >20%

fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, weak, moderate, strong

granular, platy, prismatic, columnal, abk, sbk

Consistence:
lo, so, sh, h, vhy, exh
lo, vy frb, frb, frm, v frm, exfrm
ns, ss, s, vs, np sp, p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<10	<10	<1	<1
Common	10-100	10-100	1-10	1-5
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<25	<10	<1	<1
Common	25-200	10-50	1-5	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 | clear 1" to 2.5" | gradual 2.5" to 5" | diffuse >5"

0 10 20 30 ○ 2 mm ○ 5 mm

Depth: **SAMPLE:**

Color/chip

Gravelly very extremely BE Pea 3/4 1-1/2 2-3

15-35 35-65 >65%

Texture:

Mottles: few 2% common 2-20% many >20%

fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, weak, moderate, strong

granular, platy, prismatic, columnal, abk, sbk

Consistence:
lo, so, sh, h, vhy, exh
lo, vy frb, frb, frm, v frm, exfrm
ns, ss, s, vs, np sp, p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<10	<10	<1	<1
Common	10-100	10-100	1-10	1-5
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<25	<10	<1	<1
Common	25-200	10-50	1-5	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 | clear 1" to 2.5" | gradual 2.5" to 5" | diffuse >5"

0 10 20 30 ○ 2 mm ○ 5 mm

Name: Opus One Winery **Pit#** 4 **%Slope** **Date:** 09/17/2014

Depth: 0-10" **SAMPLE:** 1

Color/chip

Gravelly	very	extremely	BE	Pea	3/4	1-1/2	2-3
15-35	35-65	>65%	**10% rock**				

Texture: Sandy Clay Loam

Mottles: few 2% common 2-20% many >20%

None fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, weak, **moderate, strong**

granular, platy, prismatic, columnal, abk, **sbk**

Consistence:

lo,	so,	sh,	**h,**	vhy,	exh		
lo,	vy frb,	frb,	**frm,**	v frm,	exfrm		
ns,	**ss,**	s,	vs,	np	**sp,**	p,	vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<10	<10	<1	<1
Common	**10-100**	**10-100**	**1-10**	**1-5**
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<25**	<10	<1	**<1**
Common	25-200	**10-50**	**1-5**	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 | clear 1" to 2.5" | **gradual 2.5" to 5"** | diffuse >5"

0 10 20 30 ○ 2 mm ○ 5 mm

Depth: 10-23" **SAMPLE:** 2

Color/chip

Gravelly	very	extremely	BE	Pea	3/4	1-1/2	2-3
15-35	35-65	>65%					**35-45% rock**

Texture: Sandy Clay Loam - Red rock layer

Mottles: few 2% common 2-20% many >20%

None fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, weak, **moderate,** strong

granular, platy, prismatic, columnal, abk, **sbk**

Consistence:

lo,	so,	**sh,**	h,	vhy,	exh		
lo,	vy frb,	frb,	**frm,**	v frm,	exfrm		
ns,	**ss,**	s,	vs,	np	**sp,**	p,	vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<10	<10	<1	<1
Common	**10-100**	**10-100**	**1-10**	**1-5**
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<25**	**<10**	<1	**<1**
Common	25-200	10-50	**1-5**	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 | **clear 1" to 2.5"** | gradual 2.5" to 5" | diffuse >5"

0 10 20 30 ○ 2 mm ○ 5 mm

Depth: 23-36" **SAMPLE:** 3

Color/chip

Gravelly	very	extremely	BE	Pea	3/4	1-1/2	2-3
15-35	35-65	>65%	**10% rock**				

Texture: Sandy Clay Loam

Mottles: few 2% common 2-20% many >20%

None fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, **weak,** moderate, strong

granular, platy, prismatic, columnal, abk, **sbk**

Consistence:

lo,	**so,**	**sh,**	h,	vhy,	exh		
lo,	vy frb,	frb,	frm,	v frm,	exfrm		
ns,	**ss,**	s,	vs,	np	**sp,**	p,	vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<10	<10	<1	<1
Common	**10-100**	**10-100**	**1-10**	**1-5**
Many	>100	>100	>10	>5

Pores: N/A

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<25**	**<10**	<1	**<1**
Common	25-200	10-50	**1-5**	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 | clear 1" to 2.5" | gradual 2.5" to 5" | **diffuse >5"**

0 10 20 30 ○ 2 mm ○ 5 mm

Depth: 36-58" **SAMPLE:** 4

Color/chip

Gravelly	very	extremely	BE	Pea	3/4	1-1/2	2-3
15-35	35-65	>65%		**15-35% rock**			

Texture: Sandy Clay Loam

Mottles: few 2% common 2-20% many >20%

None fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, weak, **moderate,** strong

granular, platy, prismatic, columnal, abk, **sbk**

Consistence:

lo,	so,	sh,	**h,**	vhy,	exh		
lo,	vy frb,	frb,	**frm,**	v frm,	exfrm		
ns,	ss,	s,	vs,	np	sp,	p,	vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<10**	**<10**	**<1**	**<1**
Common	10-100	10-100	1-10	1-5
Many	>100	>100	>10	>5

Pores: N/A

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<25	<10	<1	<1
Common	25-200	10-50	1-5	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 | clear 1" to 2.5" | gradual 2.5" to 5" | diffuse >5"

0 10 20 30 ○ 2 mm ○ 5 mm

Name: Opus One Winery Pit# 5 %Slope Date: 09/17/2014

Depth: 0-25" SAMPLE: 1

Color/chip

Gravelly very extremely BE Pea 3/4 1-1/2 2-3

15-35 35-65 >65% **15% rock**

Texture: Sandy Clay Loam

Mottles: few 2% common 2-20% many >20%

None fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, weak, **moderate,** strong

granular, platy, prismatic, columnal, abk, **sbk**

Consistence: lo, so, sh, **h,** vhy, exh

lo, vy frb, frb, **frm,** v frm, exfrm

ns, **ss,** s, vs, np **sp,** p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<10**	<10	<1	<1
Common	10-100	**10-100**	**1-10**	**1-5**
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<25	<10	<1	<1
Common	25-200	10-50	1-5	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 **clear 1" to 2.5"** gradual 2.5" to 5" diffuse >5"

0 10 20 30 ○ 2 mm ◯ 5 mm

Depth: 25-36" SAMPLE: 2

Color/chip

Gravelly very extremely BE Pea 3/4 1-1/2 2-3

15-35 35-65 >65% **40% rock**

Texture: Sandy Clay Loam

Mottles: few 2% common 2-20% many >20%

None fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, **weak,** moderate, strong

granular, platy, prismatic, columnal, abk, **sbk**

Consistence: lo, so, **sh,** h, vhy, exh

lo, vy frb, frb, **frm,** v frm, exfrm

ns, **ss,** s, vs, np **sp,** p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<10	<10	<1	<1
Common	**10-100**	**10-100**	**1-10**	**1-5**
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<25	<10	<1	<1
Common	25-200	10-50	1-5	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 **clear 1" to 2.5"** gradual 2.5" to 5" diffuse >5"

0 10 20 30 ○ 2 mm ◯ 5 mm

Depth: 36-58" SAMPLE: 3

Color/chip

Gravelly very extremely BE Pea 3/4 1-1/2 2-3

15-35 35-65 >65% **10-15% rock**

Texture: Sandy Clay Loam

Mottles: few 2% **common 2-20%** many >20%

Red Mottling fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, **weak, moderate,** strong

granular, platy, prismatic, columnal, abk, **sbk**

Consistence: lo, so, **sh,** h, vhy, exh

lo, vy frb, frb, **frm,** v frm, exfrm

ns, **ss,** s, vs, np **sp,** p, vp

Roots:

	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	**<10**	**<10**	**<1**	**<1**
Common	10-100	10-100	1-10	1-5
Many	>100	>100	>10	>5

Pores: N/A

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<25	<10	<1	<1
Common	25-200	10-50	1-5	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 clear 1" to 2.5" gradual 2.5" to 5" diffuse >5"

0 10 20 30 ○ 2 mm ◯ 5 mm

Depth: SAMPLE:

Color/chip

Gravelly very extremely BE Pea 3/4 1-1/2 2-3

15-35 35-65 >65%

Texture:

Mottles: few 2% common 2-20% many >20%

fine <5 mm medium 5-15mm large >15 mm

faint distinct prominent

Structure: Massive, single grain, weak, moderate, strong

granular, platy, prismatic, columnal, abk, sbk

Consistence: lo, so, sh, h, vhy, exh

lo, vy frb, frb, frm, v frm, exfrm

ns, ss, s, vs, np sp, p, vp

Roots:

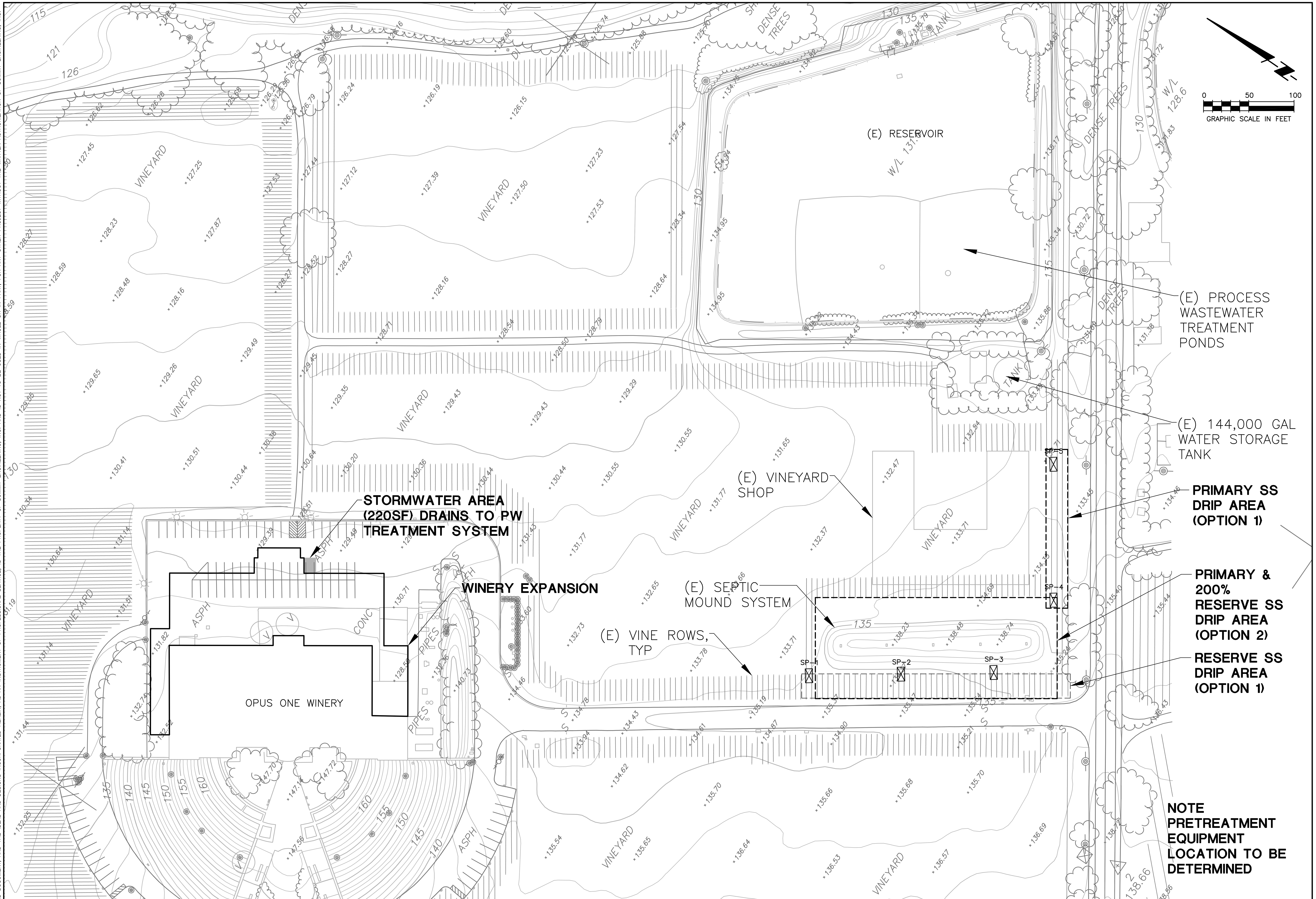
	vy fine 1 mm	fine 1-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<10	<10	<1	<1
Common	10-100	10-100	1-10	1-5
Many	>100	>100	>10	>5

Pores:

	vy fine 0.1-0.5 mm	fine 0.5-2 mm	medium 2-5 mm	coarse 5-10 mm
Few	<25	<10	<1	<1
Common	25-200	10-50	1-5	1-2.5
Many	>200	>50	>5	>2.5

Boundary: abrupt <1 clear 1" to 2.5" gradual 2.5" to 5" diffuse >5"

0 10 20 30 ○ 2 mm ◯ 5 mm



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OPUS ONE WINERY
7900 ST. HELENA HWY
OAKVILLE, CALIFORNIA
APN 31-020-007

OPUS ONE WINERY

SITE SOIL EVALUATION PLAN

2015-11-12 USE PERMIT SUBMITTAL

DATE:	2014-10-23
JOB NO:	2014096
SCALE:	AS SHOWN
DRAWN:	SMI
CHECKED:	CL
SHEET	UP3

P:\2014\2014096 OPUS ONE WINERY UP ASSISTANCE\CAD\WWW\14096-UP1-UP4.DWG

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