Final Performance Report:

To: Michigan Department of Agriculture & Rural Development

A Study on the Effectiveness of Onsite Wastewater Treatment Systems for Michigan Wineries

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Project Summary

Michigan wineries produce various amounts of wastewater onsite, much of which passes through preliminary treatment before being released to the ground surface through a variety of methods. The wastewater at these sites has been shown to contain elevated concentrations of sodium, chloride (intermittently), biochemical and chemical oxygen demand (BOD/COD), and nitrogen (in various states). As such, Michigan Department of Environmental Quality (DEQ) has begun to strongly encourage wineries to obtain groundwater discharge permits and provide adequate treatment of their process wastewater.

Within the winery industry, there was a general lack of knowledge with regard to effective onsite treatment options for the specific parameters regularly found in winery effluent. The wastewater is not inherently harmful; however, insufficient or unmonitored disposal methods can cause problems to the surrounding environment, specifically to nearby groundwater, if not properly managed. This study was designed to collect the necessary information to further explore onsite wastewater treatment options for Michigan wineries.

Furthermore, Lakeshore Environmental, Inc. (LEI) set out to provide essential permit information to the winery industry, in response to increased DEQ pressure.

This project did not build off any previously funded projects.

Project Approach

Five Michigan winery participants were chosen to participate in this study. Wineries A, B, C, D, and E were chosen based on various factors. Ultimately, three different treatment systems were examined throughout this study. Wineries A, B, and E operated subsurface passive aeration systems; Winery C operated an existing dry well treatment system; Winery D utilized surface land application for wastewater treatment.

Monitoring equipment was used to collect wastewater, groundwater, and soil pore water samples to evaluate the effectiveness of the treatment system. LEI and the Grand Traverse Conservation District (GTCD) collected wastewater and soil pore water samples from each of the study sites on a bi-monthly basis, increasing to monthly during peak production season. Two of the study sites (Winery A and D) were equipped with upgradient and downgradient groundwater monitoring wells which were sampled quarterly throughout the study.

Wastewater samples were used for general characterization of the winery wastewater and represented the "influent" to each treatment system. Lysimeters were installed to collect soil pore water samples at two and four feet below discharge level. Soil pore water samples represented the "effluent", or treated wastewater, at each system. Lastly, groundwater samples were used as additional effluent results and represented final, treated wastewater comingled with natural groundwater.

Analytical results varied among the study sites, though the wastewater was generally categorized as "high strength" due to elevated BOD and other key parameter concentrations. Wastewater that was found to contain especially high concentrations of key analytes also appeared to strongly correlate with sediment accumulation in the settling tanks. Sodium and chloride were occasionally present in concentrations that exceed general DEQ Part 22 discharge standards. Fresh water dilution played a role in wastewater characterization at some sites.

Findings from this study indicated that surface land application and subsurface passive aeration were effective long term treatment options for Michigan wineries. The dry well system was found to be a short term solution only; evidence of clay and sludge development and general infiltration concerns arose in systems older than approximately 2 years (seasons) in use. Aeration in one or more of the settling tanks, where utilized, was highly effective as a pre-treatment option, prior to discharge to the onsite system. Additional information on study findings is provided below.

Contributing parties to this study include:

- Lakeshore Environmental, Inc. (LEI)
- Grand Traverse Conservation District (GTCD)
- 5 Michigan wineries
- Michigan Department of Agriculture and Rural Development (MDARD)

Goals & Outcomes Achieved

Wastewater Characterization

When characterizing wastewater, BOD and COD are the primary indicators of wastewater strength. Wastewater analytical data collected throughout this study (summarized in Table 1) showed that winery wastewater was a "high strength" wastewater stream. Full analytical results are provided in **Attachment A**.

Table 1: Summary of Wastewater Analytical Results

Constituent (Results in mg/L, unless otherwise noted)	Average Concentration (All Wineries)	Standard Deviation (All Wineries)	Winery A	Winery B	Winery C	Winery D	Winery E
BOD	**2,046**	**1,768**	2,249	336	3,578	3,111	957
COD	**3,236**	**3,143**	3,423	493	5,244	5,722	1,299
Sodium	**279**	**300**	396	792	53	124	28
Chloride	**459**	**612**	673	1,500	10.8	53.2	7.20
Ammonia	**7.53**	**9.60**	4.97	3.64	18.4	7.90	2.43
Nitrite	**0.14**	**0.13**	ND	ND	0.23	0.07	0.02
Nitrate	**0.54**	**0.67**	0.07	ND	0.13	0.90	0.85
TIN (Calculated)	**7.60**	**9.50**	4.44	3.64	18.5	8.77	2.63
Phosphorus	**5.26**	**4.61**	8.26	1.29	5.82	9.19	1.72
pH (S.U.)	**6.13**	**0.90**	5.8	6.7	5.5	6.0	6.8
Dissolved Oxygen	**1.15**	**1.11**	2.1	1.0	0.3	0.8	1.0

High strength wastewater is very common in processing facilities, especially those involving fruit and/or other products high in natural sugar content. Although wastewater strength was generally high, there was a bit of variation between the study sites. Particularly high strength wastewater appeared to strongly correlate with sediment accumulation in the settling tanks. Treatment systems at Wineries A, C, and D each included the use of older settling tanks where sediment, particulate, and fruit pieces were observed during sampling events. Meanwhile, Wineries B and E utilized new settling tanks (about one year of use, at the time of this study) and showed BOD/COD concentrations below 1,000 mg/L. Furthermore, Winery B redirects some wash water from outdoor activities to a separate surface land application area, thereby bypassing the settling tanks analyzed during this study. Fresh water dilution effected analytical results at Winery E by reducing analytical concentrations but increasing overall water use and discharge rates.

Sodium and chloride are also common in process wastewater and can often act as a tracer to demonstrate treatment within a system. The presence of high sodium and chloride was generally related to the use of a water softening system. Study sites where the water used in the process area was softened showed significantly higher sodium and chloride concentrations than those that did not. Furthermore, sodium and chloride concentrations in the wastewater at these sites occasionally exceeded DEQ Part 22 Discharge standards of 400 mg/L and 500 mg/L, respectively. These concentrations are not expected to cause concern to the surrounding

environmental based on the several factors: depth to groundwater, low discharge volume (annually), diffusion/re-mineralization in the vadose zone, etc.

Finally, field readings of the study site wastewater indicated generally acidic, anaerobic (i.e. oxygen deficient) conditions. Typically, a dissolved oxygen concentration below 1.0 mg/L is considered anaerobic. Sites where aeration was installed in one or more of the settling tanks showed dissolved oxygen concentrations at or above 1.0 mg/L, while sites without aeration averaged closer to 0.0 mg/L. Volatile, odor causing compounds are created and maintained in low pH (acidic), low oxygen (anaerobic) environments and odor was often a primary concern at sites without aeration included for wastewater treatment.

Design Considerations & Calculations

This study successfully evaluated a few of the many treatment options for Michigan wineries in order to provide a base for the industry as it moves forward in sustainability and responsible management. With that, it is important to remember that wastewater treatment is not "one size fits all". There are several considerations that should be taken into account when designing an onsite treatment system. In conjunction with loading calculations (discussed below), a facility must consider its specific site characteristics and land availability. The amount of land available to dedicate to the treatment system will greatly impact the design. Attention must always be paid to nearby supply wells, irrigation wells, and neighboring drinking water wells to prevent unintended impact to a neighboring water source. Isolation distances outlined by the DEQ Permit Section are as provide in the permitting discussion, later in this report.

Understanding the potential loading is an essential step in designing a successful treatment system. This includes BOD loading, hydraulic loading, and nutrient loading/accumulation potential, which requires a thorough understanding of a facility's water use, both daily and annually, as it compares to activities in the processing area. Flow meters are the preferred way to track and monitor a process area's water use, as they provide raw data to demonstrate water entering or leaving the facility.

BOD loading, the most common benchmark for onsite wastewater treatment systems, is measured in pounds per acre per day and is therefore dependent on the area available for disposal, the wastewater concentration, and wastewater flow rate or volume. The equation used to calculate this loading rate is as follows:

Equation 1

$$\frac{BOD\ \left(\frac{mg}{L}\right) * Volume\ (gallons) * 8.34}{Area\ (acres) * 1{,}000{,}000} = BOD\ Loading\ (\frac{lbs.}{acre})$$

Equation 1 can also be used to calculate loading of other analytical parameters, such as nitrate, sodium, or phosphorus by substituting the parameter concentration (also in mg/L) for BOD in the equation.

In Michigan, an average loading rate (or target maximum) of 50 pounds per acre per day is common. This study, along with several other documented cases, has shown that this standard can be exceeded as along as the area is given adequate periods of rest for recovery. A seasonal spike in processing activities and/or wastewater strength is very common in agriculture related production and must be accounted for in the treatment system's design. In the case of wineries, considerably high loading for 60 days (+/-), followed by a reduced or even eliminated

load for the remainder of the year is a feasible treatment strategy as long as the operator is aware of the process and monitoring the system. Example calculations based on one acre of discharge area and various flows/concentrations, are provided below.

Table 2: Daily BOD Loading Example, One Acre Discharge Area

lbs./ac./day BOD		BOD Concentration (mg/L)						
		250	**500**	**750**	**1,000**	**2,000**	**3,000**	**4,000**
Gallons Per Day (GDP)	**250**	0.5	1.0	1.6	2.1	4.2	6.3	8.3
	500	1.0	2.1	3.1	4.2	8.3	12.5	16.7
	750	1.6	3.1	4.7	6.3	12.5	18.8	25.0
	1,000	2.1	4.2	6.3	8.3	16.7	25.0	33.4
	1,250	2.6	5.2	7.8	10.4	20.9	31.3	41.7
	1,500	3.1	6.3	9.4	12.5	25.0	37.5	50.0
	1,750	3.6	7.3	10.9	14.6	29.2	43.8	58.4
	2,000	4.2	8.3	12.5	16.7	33.4	50.0	66.7
	2,250	4.7	9.4	14.1	18.8	37.5	56.3	75.1
	2,500	5.2	10.4	15.6	20.9	41.7	62.6	83.4
	2,750	5.7	11.5	17.2	22.9	45.9	68.8	91.7
	3,000	6.3	12.5	18.8	25.0	50.0	75.1	100.1
	3,250	6.8	13.6	20.3	27.1	54.2	81.3	108.4
	3,500	7.3	14.6	21.9	29.2	58.4	87.6	116.8
	3,750	7.8	15.6	23.5	31.3	62.6	93.8	125.1
	4,000	8.3	16.7	25.0	33.4	66.7	100.1	133.4
	4,250	8.9	17.7	26.6	35.4	70.9	106.3	141.8
	4,500	9.4	18.8	28.1	37.5	75.1	112.6	150.1
	4,750	9.9	19.8	29.7	39.6	79.2	118.8	158.5
	5,000	10.4	20.9	31.3	41.7	83.4	125.1	166.8
	5,250	10.9	21.9	32.8	43.8	87.6	131.4	175.1
	5,500	11.5	22.9	34.4	45.9	91.7	137.6	183.5

Table 3: Example – Annual Treatment Schedule, One Acre Discharge Area

	Days per Year	**BOD Loading (lbs./acre/day)**	**BOD Loading (lbs./acre/yr.)**
"Peak" Season	60	200	12,000
"Off-peak" Season	200	25	5,000
No Discharge	105	0	0
Total Annual Loading (lbs. /acre/yr.):			**17,000**
Daily Average (lbs./acre/day):			**47**

Project Goals

The proposed goals of this study, with results and discussion, are provided below.

Goal #1: Determine the success and efficiency of one or more onsite treatment system(s) for Michigan wineries

Surface land application and subsurface passive aeration were shown to be viable, long term treatment options for Michigan winery wastewater. These treatment systems demonstrated high reduction rates of key wastewater analytical parameters at both two feet and four feet below discharge, as shown below in Table 4.

Table 4: Average Parameter Reduction Results

Winery ID:	**Winery A**	**Winery B**	**Winery C**	**Winery D**	**Winery E**
WW Treatment System:	Subsurface, Passive Aeration	Subsurface, Passive Aeration*	Dry Well	Surface Land Application	Subsurface, Passive Aeration**
Settling Tank Info:	(2) 1,600-gal	(1) 1,000-gal (2) 1,600-gal	(1) 1,600-gal (two chamber)	(2) 14,000-gal (chambered)	(2) 2,000-gal
Aeration?	Yes	Yes	No	No	No
			Avg. Percent Reduction: 2' Below Discharge		
Sodium	99%	99%	*ID*	*ID*	*Increase*
COD	98%	97%	92%	92%	*Increase*
Chloride	99%	100%	*ID*	65%	*Increase*
Ammonia	84%	92%	98%	97%	82%
Nitrate-Nitrite	*Increase*	*Increase*	*Increase*	*Increase*	*Increase*
TIN	*Increase*	*Increase*	*Increase*	86%	63%
Phosphorus	97%	54%	94%	75%	72%
			Avg. Percent Reduction: 4' Below Discharge		
Sodium	95%	99%	*ID*	65%	*Increase*
COD	98%	91%	74%	92%	*Increase*
Chloride	99%	100%	*ID*	43%	*Increase*
Ammonia	97%	93%	98%	98%	44%
Nitrate-Nitrite	*Increase*	*Increase*	*ID*	*Increase*	*Increase*
TIN	*Increase*	1%	*ID*	90%	29%
Phosphorus	99%	75%	*ID*	64%	68%

ID: Insufficient Data

**Surface land application used for some outdoor wash down activities*

***Surface land application option, used for summer months.*

A complete reduction analysis has been provided in **Attachment B**.

In addition to the lysimeter results information, groundwater samples collected from Winery A and Winery D demonstrated further reduction of key parameters with no indication of groundwater quality degradation.

All wastewater treatment systems evaluated throughout this study demonstrated some reduction in key wastewater chemical compounds, thereby indicating that each system was an effective option for onsite wastewater treatment at Michigan wineries. However, surface land application and subsurface passive aeration systems (or a combination of the two) are recommended as long term treatment options based on treatment capacity, maintenance requirements, and system longevity.

The dry well system LEI evaluated was one which had been in use for at least two seasons prior to the study commencement. During the 2014 production season, some infiltration issues and treatment deficiencies were observed. A field investigation showed evidence of clay and sludge development in the stone infiltration bottom, as well as persistent anaerobic conditions and odor concerns. The reduced infiltration capacity limited lysimeter sample volumes and significantly reduced soil pore water data for this site. Observations made during this study indicated that the dry well treatment system can provide sufficient treatment, but is only recommended for short term use or in conjunction with significant pretreatment. After two or three seasons of use, plugging and decreased treatment efficiency can be expected and repair or replacement will be required.

Some parameters analyzed and compared throughout this study did not demonstrate a reduction from wastewater to soil pore water, but rather consistently showed increased concentrations. Soil pore water samples collected from each site consistently showed higher concentrations of nitrogen, specifically nitrate, than were observed in the respective site's wastewater stream. This was primarily due the presence of existing nitrate in the study areas, which is not uncommon for rural settings with historical agricultural use, and "nitrification" which is the biological oxidation of nitrogen from ammonia to nitrate.

With regard to nitrogen, it should be noted that ammonia was the most common form of nitrogen in the wastewater samples, while nitrate was the more prevalent form in soil pore water and groundwater samples. This was consistent with the characterization observation of generally anaerobic conditions in the wastewater. The perceived decrease of ammonia in the soil pore water samples indicated that treatment was occurring and ammonia was being converted to nitrite-nitrate in the process (i.e. "nitrification"), especially at sites with one or more forms of aeration included with the treatment system.

Winery E showed several areas of increased parameter concentrations when comparing wastewater to soil pore water results. This site included some dilution of the wastewater with fresh water from the cooling jackets and other areas of the process area. While this dilution resulted in generally lower analytical concentrations, it significantly increased the volume of water discharged to the system. This resulted in a temporary hydraulic overload to the system and slowed treatment capacity during peak season. Effective treatment was still observed, but at a slower rate since the time required for the wastewater to pass through the system was increased. Results from this site, in conjunction with results collected from Wineries A and B indicated that the subsurface passive aeration system remained an effective treatment option.

Lastly, Winery D showed some increased soil pore water parameter concentrations between October and January, which correlated to peak production season when wastewater strength

and the cycle rate of discharge was increased. Although important to note, this was not cause for concern. This particular system has been operating for several years, which indicated that samples collected at the beginning of the study (spring 2014) were likely representative of recovered field conditions. As previously mentioned, high strength low volume discharge patterns allow for short term heavy loading of the treatment system followed by a period of rest to allow for recovery in preparation for the following year. Groundwater monitoring at this site showed no evidence of impact.

Goal #2: Determine the effect of sanitation additives on wastewater quality.

Results for this portion were insignificant. Sanitation chemicals were generally consistent among the five wineries included with this study and did not appear to significantly impact water quality.

Goal #3: Develop a guidance document for the selection of a permitting program and treatment system for Michigan wineries based on site-specific conditions.

LEI developed the following summary and guidance information for the Michigan DEQ Groundwater Discharge Permit Program(s). All of the participating wineries for this study required a DEQ groundwater discharge permit, as opposed to a National Pollutant Discharge Elimination System (NPDES) Permit (NPDES permit required for discharge to surface water). LEI determined groundwater discharge permits to be the primary permit program for Michigan wineries.

A facility that discharges wastewater directly to surface waters without a NPDES permit is in violation of state and federal law. In Michigan, the DEQ's Water Resources Division has responsibility for processing NPDES permits under the authority of the Federal Water Pollution Control Act, and Part 31 of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Please visit the following website for more information:

http://michigan.gov/deq/0,4561,7-135-3313_3682_3713---,00.html

Michigan DEQ Permit Program Overview

General information for the Michigan DEQ Groundwater Discharge Permit is provided in **Attachment C**.

Under the Michigan Natural Resources and Environmental Protection Act (NREPA) of 1194, PA 451, as amended, any facility discharging waste or waste effluent into waters of the state must be in possession of a valid permit to discharge from the DEQ. A quick summary of all permit program options are outlined in Table 5.

(next page)

Table 5: Michigan DEQ Permit Program Summary

Permit Group	Permit Type	Annual Fees	Brief Description
Group 3	Rule 2211	$200	Pre-defined activity list; See Attachment C
	Rule 2213	$200	Pre-defined activity list; See Attachment C
Group 2	Rule 2210(Y)	$1,500	Site Specific Authorization for discharges with insignificant potential to be harmful based on volume and wastewater components. Typically requires additional monitoring.
	Rule 2215	$1,500	Pre-defined activity list; See Attachment C
	Rule 2216	$1,500	Pre-defined activity list; See Attachment C
Group 1	Rule 2218	$3,650	Site Specific Authorization for all other discharges; very common for large processing facilities. Additional information required. Requires additional monitoring.

The 2211 Permit is a simple permit by "notification" to the department that includes the following pre-defined activities:

Table 6: Rule 2211 Permit Pre-defined Activities

Wastewater Type	Daily Maximum Discharge
(a) Sanitary Sewage	6,000 – 10,000 GPD
(b) Laundromat	< 500 GPD
(c) Non-contact Cooling Water	> 10,000 GPD
(d) Fruit & Vegetable Wash water	< 50,000 GPD
(e) Portable Power Washer	< 1,000 gal./ac./mo.
(f) Pump test Water	n/a
(g) Hydrostatic Test Water	n/a
(h) Commercial Animal Care	50 - 1,000 GPD

LEI Recommendations

In conclusion to this study, LEI found that a 2211 Permit was the ideal program for Michigan wineries, although a 2210(Y) Permit may be required in some instances.

LEI recommends the Rule 2211(d) Fruit and Vegetable Wash Water Permit. Of the pre-defined permits outlined above, this is the most representative of the fruit component in winery production. This permit section has a maximum daily discharge limit of 50,000 gallons per day; significantly more than most wineries produce on a daily basis, even during peak season. This is a simple permit with little to no required monitoring and maximum daily discharge standards that wineries can easily adhere to. The use of this permit will allow the majority of wineries to be permitted under the same rule and provide consistency throughout the industry.

Historically, the DEQ has issued Rule 2211(e) Portable Power Washer Permits to Michigan wineries, and in some instances required a 2210(Y). The Rule 2211(e) permit is a viable option, if not only to remain in the "Group 3" permitting tier. However, this rule includes a maximum discharge of 1,000 gallons per acre per month. This is not a standard the majority of the industry can adhere to during peak production season. In this instance, the alternative to the Rule 2211(e) permit would be a Rule 2210(Y), which typically requires significantly more monitoring and reporting throughout the life of the permit. This is a significant discrepancy and inconsistency within the Part 22 rules overall which the use of a Rule 2211(d) Permit could eliminate.

Based the information available during this study, LEI estimated between 10 and 12 gallons of wastewater were discharged per case of wine produced, on an annual basis. This total volume estimate is comprised as follows: approximately 3 to 4 gallons of wastewater was produced per case of wine during the 60 day production season with the remaining 7 to 9 gallons resulting from tank wash water, etc., throughout the year. These estimates are generally conservative to allow for fluctuation in the final application of LEI's recommendations.

Based on these numbers, LEI recommends a winery with an annual production less than or equal to 25,000 cases qualify for a Rule 2211(d) Permit. Wineries with annual production volumes greater than 25,000 cases may require a Rule 2210(Y) Permit, unless data can be provided to demonstrate Rule 2211 applicability.

Using a conservative ratio of 12 gallons of wastewater per case of wine, an annual production of 25,000 cases would yield roughly 300,000 gallons per year. Assuming a 60 day season, during which both water use and wastewater concentrations are at their peak, maximum daily discharge volumes at a facility of this size would range from 1,000 to 1,500 gallons per day, with typical or "off season" discharge volumes of less than or equal to 500 gallons per day.

With a one-quarter acre discharge area, average BOD loading rates would not exceed the "standard" 50 pounds per acre per day over the course of an entire year. As previously discussed, a temporary increase in loading to a treatment system is acceptable when followed by adequate periods of rest.

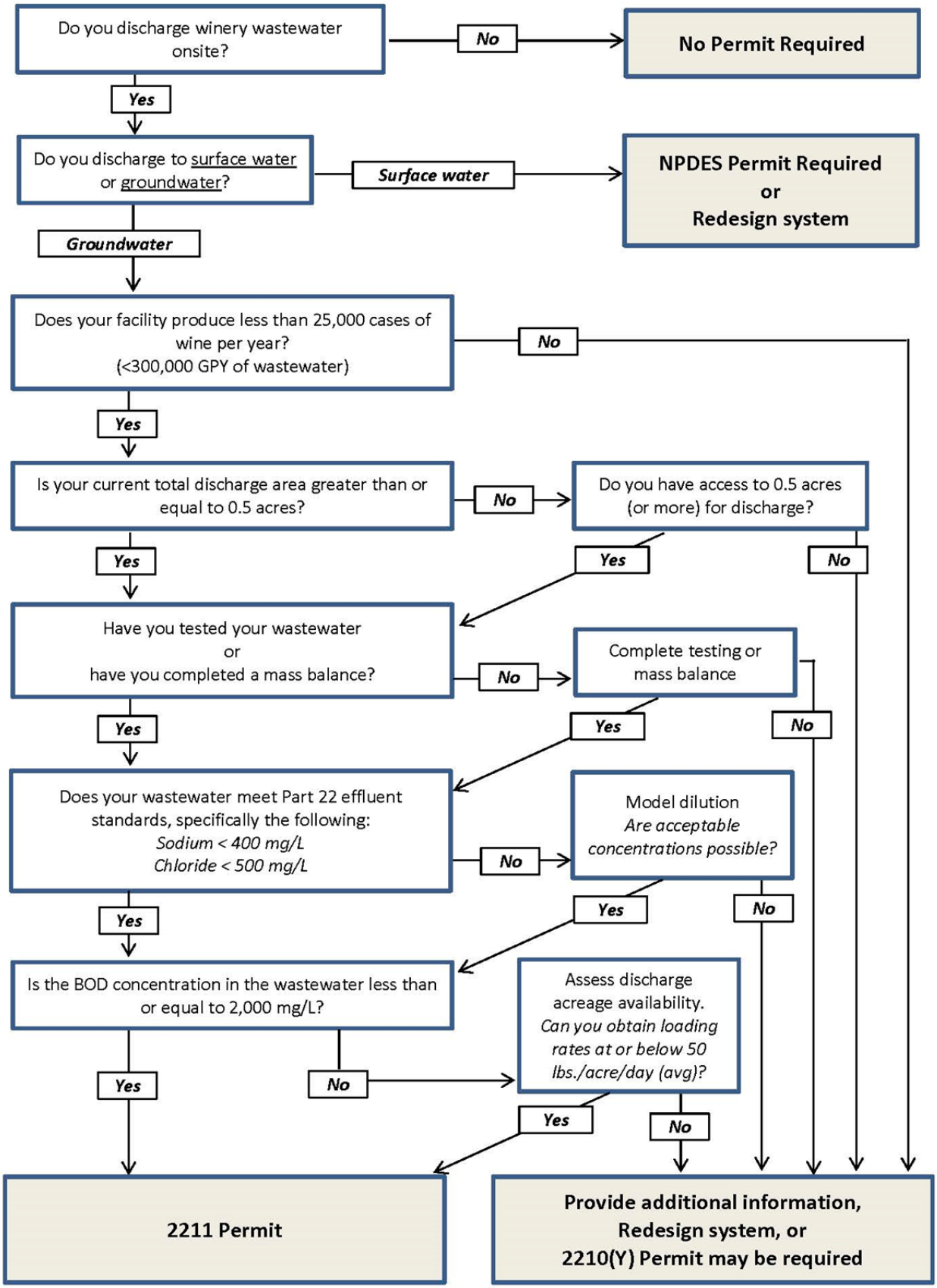
Some guideline BOD loading calculations are provided in the table below.

(next page)

Table 7: Annual BOD Loading Example, One-Quarter Acre Discharge Area

Average lbs./ac./day BOD		BOD Concentration (mg/L)						
		500	750	1,000	1,500	2,000	2,500	3,000
Gallons Per Year (GDY)	50,000	2.3	3.4	4.6	6.9	9.1	11.4	13.7
	75,000	3.4	5.1	6.9	10.3	13.7	17.1	20.6
	100,000	4.6	6.9	9.1	13.7	18.3	22.8	27.4
	125,000	5.7	8.6	11.4	17.1	22.8	28.6	34.3
	150,000	6.9	10.3	13.7	20.6	27.4	34.3	41.1
	175,000	8.0	12.0	16.0	24.0	32.0	40.0	48.0
	200,000	9.1	13.7	18.3	27.4	36.6	45.7	54.8
	225,000	10.3	15.4	20.6	30.8	41.1	51.4	61.7
	250,000	11.4	17.1	22.8	34.3	45.7	57.1	68.5
	275,000	12.6	18.9	25.1	37.7	50.3	62.8	75.4
	300,000	13.7	20.6	27.4	41.1	54.8	68.5	82.3
	325,000	14.9	22.3	29.7	44.6	59.4	74.3	89.1
	350,000	16.0	24.0	32.0	48.0	64.0	80.0	96.0
	375,000	17.1	25.7	34.3	51.4	68.5	85.7	102.8
	400,000	18.3	27.4	36.6	54.8	73.1	91.4	109.7
	425,000	19.4	29.1	38.8	58.3	77.7	97.1	116.5
	450,000	20.6	30.8	41.1	61.7	82.3	102.8	123.4
	475,000	21.7	32.6	43.4	65.1	86.8	108.5	130.2
	500,000	22.8	34.3	45.7	68.5	91.4	114.2	137.1
	525,000	24.0	36.0	48.0	72.0	96.0	120.0	144.0
	550,000	25.1	37.7	50.3	75.4	100.5	125.7	150.8
	575,000	26.3	39.4	52.6	78.8	105.1	131.4	157.7
	600,000	27.4	41.1	54.8	82.3	109.7	137.1	164.5

LEI's permitting recommendations have been summarized in the following flow chart, also included in **Attachment D**.



Beneficiaries

Michigan's winery industry will benefit from the results of this study. Winemaking is a fast growing industry in the state of Michigan and continued environmental compliance is an essential component to the sustainability of the industry. In the past, many wineries expressed interest in proper management of the process wastewater, but the information was not available to them. The information provided in this report provides a knowledge base to the entire industry, in order to grow equally and sustainably.

Lessons Learned

The sampling frequency outlined in the grant proposal/agreement was decreased to bi-monthly sampling for wastewater and the lysimeters due to an increase in the overall study duration. Bi-monthly sampling continued through August 2014 and provided sufficient analytical data at each site to make the necessary conclusions. Sampling frequency was increased to monthly beginning in September 2014 and continued through the remainder of the study.

Winter data was limited due to improper protection and maintenance of the sampling equipment. LEI and the GTCD experienced some issues with the lysimeters freezing and/or breaking during the winter months.

Some lysimeter sampling events provided less that the required volume amount to analyze for the entire parameter list outlined in the grant proposal. Low sample volume is often an issue when using lysimeters to sample soil pore water. This is dependent on several factors during installation and has proven nearly unavoidable, though every effort was made to gather the greatest sample volume possible during each sampling event.

Additional Information

Results from this study were presented at the 2015 Michigan Grape and Wine Conference on March 4, 2015.

Additional information regarding this study is available by contacting Lakeshore Environmental, Inc.

Attachment A

Analytical Result Tables

Table A: Wastewater Lysimeter Analytical Summary

Michigan Winery Wastewater Treatment Study

Grant Number 791N430009/ LEI Job No. 13-611

Constituent (Results in mg/L, unless otherwise noted)	Part 22 Effluent/ Wastewater Discharge Standards	Average Concentration (All Wineries)	Standard Deviation (All Wineries)	Winery A									Winery B								
				Wastewater/Effluent									Wastewater/Effluent								
				3/4/2014	4/29/2014	7/1/2014	8/12/2014	9/15/2014	10/21/2014	11/20/2014	12/16/2014	1/20/2015	2/26/2014	4/29/2014	6/30/2014	8/11/2014	9/15/2014	10/21/2014	11/20/2014	12/16/2014	1/20/2015
Biochemical Oxygen Demand (BOD)	NC	2,046	1,768	**3,000**	**1,800**	**2,200**	**1,300**	**1,200**	**700**	**5,600**	**3,600**	**840**	**680**	**380**	**58**	**67**	**170**	**550**	**300**	**470**	**350**
Chemical Oxygen Demand (COD)	NC	3,236	3,143	**4,200**	**2,700**	**2,700**	**2,000**	**1,700**	**810**	**11,000**	**4,400**	**1,300**	**1,000**	**580**	**190**	**350**	**280**	**510**	**500**	**480**	**550**
Sodium	400	279	300	**400**	**520**	**290**	**470**	**640**	**280**	**340**	**300**	**320**	**620**	**600**	**790**	**990**	**850**	**940**	**740**	**890**	**710**
Chloride	500	459	612	**630**	**1,000**	**400**	**640**	**1,100**	**500**	**510**	**610**	**670**	**1,000**	**1,000**	**1,400**	**1,800**	**1,700**	**1,900**	**1,600**	**1,800**	**1,300**
Ammonia as Nitrogen	5.0	7.53	9.60	**11**	**15**	**5.2**	**1.4**	**6.3**	**0.76**	<0.40	**0.045**	**0.056**	**0.17**	**20**	**5.7**	**5.2**	**0.58**	**0.28**	**0.39**	**0.32**	**0.12**
Nitrogen (Nitrite)	0.5	0.14	0.13	<0.10	<0.10	<0.020	<0.10	<0.10	<0.10	<0.10	<0.020	<0.10	<0.020	<0.020	<0.10	<0.020	<0.10	<0.10	<0.020	<0.020	<0.020
Nitrogen (Nitrate)	5.0	0.54	0.67	<0.10	**0.048**	**0.046**	<0.10	<0.10	<0.10	**0.130**	<0.10	<0.020	<0.020	<0.020	<0.10	<0.020	<0.10	<0.10	<0.020	<0.10	<0.020
TIN (Calculated)	5.0	7.60	9.50	**11**	**15**	**5.3**	**1.4**	**6.3**	**0.76**	**0.14**	**0.046**	**0.056**	**0.19**	**20**	**5.7**	**5.2**	**0.58**	**0.28**	**0.41**	**0.32**	**0.12**
Total Phosphorus	5.0	5.26	4.61	**14**	**11**	**9.5**	**8.4**	**6.6**	**1.5**	**11.0**	**7.5**	**4.8**	**4.2**	**1.2**	**1.4**	**1.5**	**0.57**	**0.52**	**0.75**	**0.59**	**0.91**
pH (S.U.)	6.5 to 8.5 (E)	6.13	0.90	5.4	4.7	4.9	5.0	NA	6.9	7.7	4.5	7.1	5.9	6.3	7.0	7.0	NA	6.6	6.7	6.7	7.3
Dissolved Oxygen	NC	1.15	1.11	NA	NA	NA	NA	NA	2.78	3.06	0.00	2.60	NA	NA	NA	NA	NA	3.08	0.00	NA	0.02

Constituent (Results in mg/L, unless otherwise noted)	Average Concentration (All Wineries)	Standard Deviation (All Wineries)	Winery A									Winery B								
			3/4/2014	4/29/2014	7/1/2014	8/12/2014	9/15/2014	10/21/2014	11/24/2014	12/16/2014	1/20/2015	2/26/2014	4/29/2014	6/30/2014	8/11/2014	9/15/2014	10/21/2014	11/24/2014	12/16/2014	1/20/2015
			2' Below Discharge									2' Below Discharge								
Iron	2.43	2.08	NA	NA	NA	NA	NA	NA	<0.80	<0.40	NA	NA	NA	NA	NA	NA	NA	<0.80	<0.40	NA
Manganese	0.88	1.10	NA	NA	NA	NA	NA	NA	<0.050	<0.050	NA	NA	NA	NA	NA	NA	NA	<0.050	<0.050	NA
Sodium	30	34	NA	NA	NA	NA	NA	NA	**2.9**	**4.5**	NA	NA	NA	NA	NA	NA	NA	**5.3**	**8.5**	NA
Chemical Oxygen Demand (COD)	189	367	NA	**54**	**36**	**46**	**51**	**19**	**43**	**24**	NA	NA	**11**	**11**	**11**	**16**	**5.3**	**12**	<5.0	NA
Chloride	12	12	NA	NA	NA	NA	NA	NA	<3.0	NA	NA	NA	NA	NA	NA	NA	NA	**5.4**	NA	NA
Ammonia as Nitrogen	0.21	0.30	NA	<0.025	**0.22**	**0.39**	**0.25**	**0.055**	<0.025	0.03	NA	NA	**0.038**	**0.23**	**0.11**	**0.088**	**0.051**	<0.025	<0.025	NA
Nitrogen (Nitrate-Nitrite)	16	21	NA	**4.5**	**32**	**32**	**31**	**40**	**31**	**36**	NA	NA	**7.0**	**7.3**	**5.0**	**6.8**	**5.8**	**5.1**	**5.6**	NA
TIN (Calculated)	14	20	NA	**4.5**	**32**	**32**	**31**	**40**	**31**	**36**	NA	NA	**7.0**	**7.5**	**5.1**	**6.9**	**5.9**	**5.1**	**5.6**	NA
Total Phosphorus	2.73	1.51	NA	<0.10	NA	NA	NA	NA	<0.050	<0.50	NA	NA	NA	NA	NA	NA	NA	<0.050	<0.50	NA
			4' Below Discharge									4' Below Discharge								
Iron	4.93	7.55	NA	<0.080	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.40	NA
Manganese	0.42	0.89	NA	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.050	<0.050	NA
Sodium	41	37	NA	**27**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**9.3**	**10.0**	NA
Chemical Oxygen Demand (COD)	330	681	NA	**8.0**	**30**	**41**	**49**	**10**	NA	NA	NA	NA	**93**	**40**	**61**	**16**	<5.0	**13**	**6.2**	NA
Chloride	17	20	NA	**12**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**4.5**	NA	NA
Ammonia as Nitrogen	0.18	0.26	NA	<0.025	**0.15**	**0.081**	**0.053**	**0.03**	NA	NA	NA	NA	**0.027**	NA	NA	**0.047**	**0.036**	<0.025	<0.025	NA
Nitrogen (Nitrate-Nitrite)	4.89	8.33	NA	**8.2**	**7.4**	**2.3**	**5.1**	**18**	NA	NA	NA	NA	**0.3**	NA	NA	**1.6**	**0.11**	**0.47**	**0.2**	NA
TIN (Calculated)	4.19	7.75	NA	**8.2**	**7.6**	**2.4**	**5.2**	**18**	NA	NA	NA	NA	**0.33**	NA	NA	**1.6**	**0.15**	**0.47**	**0.2**	NA
Total Phosphorus	2.71	1.23	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.050	<0.25	NA

Notes:

Bold values represent detectable concentrations of constituent

NA - Not Available/Not Analyzed

NC - No criteria developed

Table A: Wastewater Lysimeter Analytical Summary

Michigan Winery Wastewater Treatment Study

Grant Number 791N430009/ LEI Job No. 13-611

Constituent (Results in mg/L, unless otherwise noted)	Part 22 Effluent/ Wastewater Discharge Standards	Winery C									Winery D								
		Wastewater/Effluent									Wastewater/Effluent								
		2/26/2014	4/29/2014	6/30/2014	8/11/2014	9/15/2014	10/21/2014	11/20/2014	12/16/2014	1/20/2015	2/24/2014	4/15/2014	6/9/2014	9/9/2014	9/29/2014	10/22/2014	11/20/2014	12/18/2014	1/15/2015
Biochemical Oxygen Demand (BOD)	NC	**6,600**	**2,900**	**2,000**	**2,400**	**7,100**	**1,600**	**3,400**	**3,500**	**2,700**	**1,500**	**2,400**	**2,500**	**4,000**	**4,100**	**3,500**	**4,900**	**2,600**	**2,500**
Chemical Oxygen Demand (COD)	NC	**9,400**	**3,800**	**2,600**	**3,100**	**12,000**	**1,600**	**7,600**	**2,000**	**5,100**	**2,600**	**3,200**	**8,200**	**9,000**	**6,800**	**4,000**	**8,200**	**4,000**	**5,500**
Sodium	400	**60**	**64**	**47**	**59**	**53**	**27**	**33**	**60**	**78**	**95**	**66**	**230**	**160**	**91**	**26**	**150**	**150**	**150**
Chloride	500	**8.0**	**4.5**	**2.7**	**3.9**	**8.2**	**8.5**	**29**	**12**	**20**	**36**	**42**	**120**	**31**	**33**	**24**	**63**	**57**	**73**
Ammonia as Nitrogen	5.0	**31**	**5.2**	**27**	**19**	**11**	**6.8**	**11**	**8.0**	**47**	**5.4**	**6.0**	**22**	**14**	**2.8**	**1.8**	**13**	**1.4**	**4.7**
Nitrogen (Nitrite)	0.5	**0.35**	**0.11**	<0.10	<0.020	<0.10	<0.10	<0.020	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.020	<0.10	<0.020	<0.10	**0.065**
Nitrogen (Nitrate)	5.0	<0.020	**0.28**	**0.047**	**0.021**	**0.16**	<0.10	**0.160**	<0.10	**0.11**	**1.2**	**1.5**	**0.21**	**0.13**	**0.93**	**2.5**	**1.1**	**0.35**	**0.19**
TIN (Calculated)	5.0	**31**	**5.6**	**27**	**19**	**11**	**6.8**	**11**	**8.1**	**47**	**6.6**	**7.5**	**22**	**14**	**3.7**	**4.3**	**14**	**1.8**	**5.0**
Total Phosphorus	5.0	**9.9**	**3.2**	**6.3**	**5.4**	**4.4**	**2.1**	**7.7**	**3.4**	**10**	**4.8**	**7.9**	**23**	**8.2**	**8.4**	**2.2**	**11**	**7.2**	**10**
pH (S.U.)	6.5 to 8.5 (E)	5.2	5.0	6.0	5.8	NA	5.4	5.1	5.6	5.9	NA	6.7	5.6	5.5	5.4	6.4	NA	6.4	5.8
Dissolved Oxygen	NC	NA	NA	NA	NA	NA	0.34	NA			NA	NA	1.20	0.22	0.02	NA	NA	1.20	1.24

Constituent (Results in mg/L, unless otherwise noted)	Winery C									Winery D								
	2/26/2014	4/29/2014	6/30/2014	8/11/2014	9/15/2014	10/21/2014	11/24/2014	12/16/2014	1/20/2015	2/24/2014	4/15/2014	6/9/2014	9/9/2014	9/29/2014	10/22/2014	12/4/2014	12/18/2014	1/15/2015
	2' Below Discharge									2' Below Discharge								
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.080	NA	NA	**0.49**	**1.1**
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0050	NA	NA	**0.067**	**0.038**
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**38**	NA	NA	**72**	**99**
Chemical Oxygen Demand (COD)	NA	**1,200**	**360**	**130**	**87**	**58**	**43**	<50	NA	NA	**52**	**41**	**75**	**38**	**48**	**83**	**1,800**	**710**
Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1.3**	NA	**20**	**39**	NA
Ammonia as Nitrogen	NA	**0.38**	**1.2**	NA	**0.12**	**0.072**	**0.048**	<0.025	NA	NA	**0.11**	**0.087**	**0.080**	**0.025**	**0.053**	**0.062**	**0.130**	**0.190**
Nitrogen (Nitrate-Nitrite)	NA	**0.053**	**0.071**	NA	**30**	**82**	**65**	NA	NA	NA	**0.94**	**1.8**	**3.1**	**1.9**	**0.12**	<0.10	<0.10	**0.030**
TIN (Calculated)	NA	**4.3**	**1.3**	NA	**30**	**82**	**65**	NA	NA	NA	**1.0**	**1.9**	**3.2**	**1.9**	**0.053**	**0.13**	**0.20**	**0.22**
Total Phosphorus	NA	NA	NA	NA	NA	NA	<0.50	NA	NA	NA	NA	NA	NA	<0.25	NA	<0.50	**4.3**	**3.2**
	4' Below Discharge									4' Below Discharge								
Iron	NA	NA	NA	NA	NA	NA	0.24	NA	NA	NA	NA	NA	NA	<0.080	NA	NA	<0.40	**1.0**
Manganese	NA	NA	NA	NA	NA	NA	0.12	NA	NA	NA	NA	NA	NA	<0.0050	NA	NA	**0.053**	**0.033**
Sodium	NA	NA	NA	NA	NA	NA	**91**	NA	NA	NA	NA	NA	NA	**1.2**	NA	NA	**60**	**97**
Chemical Oxygen Demand (COD)	NA	**680**	**3,400**	**940**	**82**	**31**	**30**	**30**	NA	NA	**20**	**12**	**63**	**31**	**21**	**1,500**	**1,300**	**630**
Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2.0**	NA	**60**	**39**	NA
Ammonia as Nitrogen	NA	**0.25**	**1.2**	**0.24**	**0.042**	**0.053**	<0.025	<0.025	NA	NA	**0.083**	**0.066**	**0.13**	<0.020	**0.035**	**0.13**	**0.11**	**0.220**
Nitrogen (Nitrate-Nitrite)	NA	**0.067**	**0.21**	**0.06**	**32**	**26**	**5.9**	NA	NA	NA	**3.3**	**3.1**	**0.39**	**0.022**	<0.10	<0.10	<0.10	**0.034**
TIN (Calculated)	NA	**0.32**	**1.4**	**0.30**	**32**	**26**	**5.9**	NA	NA	NA	**3.4**	**3.2**	**0.52**	**0.038**	**0.035**	**0.16**	**0.14**	**0.25**
Total Phosphorus	NA	NA	NA	NA	NA	NA	<0.50	NA	NA	NA	NA	NA	NA	NA	NA	**4.1**	**3.1**	**2.9**

Notes:

Bold values represent detectable concentrations of constituent

NA - Not Available/Not Analyzed

NC - No criteria developed

Table A: Wastewater Lysimeter Analytical Summary

Michigan Winery Wastewater Treatment Study

Grant Number 791N430009/ LEI Job No. 13-611

Constituent (Results in mg/L, unless otherwise noted)	Part 22 Effluent/ Wastewater Discharge Standards	Winery E								
		Wastewater/Effluent								
		2/24/2014	4/15/2014	6/9/2014	9/8/2014	9/30/2014	10/22/2014	11/20/2014	12/18/2014	1/15/2015
Biochemical Oxygen Demand (BOD)	NC	**1,100**	**9.4**	**1,000**	**7.5**	**14**	**90**	**690**	**3,500**	**2,200**
Chemical Oxygen Demand (COD)	NC	**1,800**	**31**	**1,100**	**43**	**50**	**78**	**890**	**4,900**	**2,800**
Sodium	400	**20**	**6.4**	**19**	**8.1**	**7.5**	**7.9**	**8.8**	**40**	**130.0**
Chloride	500	**9.8**	**5.0**	**4.2**	**4.8**	**4.4**	**4.6**	**6.8**	<10	**18**
Ammonia as Nitrogen	5.0	**2.3**	**1.2**	**6.8**	**0.72**	**1.4**	**0.21**	**1.5**	**3.4**	**4.30**
Nitrogen (Nitrite)	0.5	**0.021**	<0.020	<0.020	<0.10	<0.020	<0.020	<0.10	<0.10	<0.020
Nitrogen (Nitrate)	5.0	<0.020	<0.020	**0.2**	<0.10	<0.020	<0.020	**1.5**	<0.10	<0.020
TIN (Calculated)	5.0	**2.3**	**1.2**	**7.0**	**0.72**	**1.4**	**0.22**	**3.0**	**3.5**	**4.3**
Total Phosphorus	5.0	**1.5**	**0.27**	**3.9**	**0.31**	**0.41**	**0.38**	**1.3**	**4.1**	**3.3**
pH (S.U.)	6.5 to 8.5 (E)	NA	7.5	6.3	7.6	7.8	7.2	NA	5.5	5.5
Dissolved Oxygen	NC	NA	NA	1.7	0.11	0.00	NA	NA	1.90	1.21

Constituent (Results in mg/L, unless otherwise noted)	Winery E								
	2/24/2014	4/15/2014	6/9/2014	9/8/2014	9/30/2014	10/22/2014	12/4/2014	12/18/2014	1/15/2015
	2' Below Discharge								
Iron	NA	<0.080	NA	NA	<0.080	**4.6**	NA	**5.3**	**0.66**
Manganese	NA	**0.25**	NA	NA	**1.3**	**3.3**	NA	**1.1**	**0.099**
Sodium	NA	**14**	NA	NA	**9.8**	**9.2**	NA	**11**	**91**
Chemical Oxygen Demand (COD)	NA	**38**	**7.6**	**10**	**6.8**	**480**	**430**	**230**	**360**
Chloride	NA	**6.1**	NA	NA	**4.7**	**5.8**	<10	<10	NA
Ammonia as Nitrogen	NA	**0.15**	**0.032**	**0.060**	<0.020	**0.036**	**1.3**	**0.26**	**0.31**
Nitrogen (Nitrate-Nitrite)	NA	<0.10	**9.7**	**0.45**	<0.020	<0.020	<0.020	<0.10	<0.020
TIN (Calculated)	NA	**0.15**	**9.7**	**0.51**	<0.020	**0.036**	**1.3**	<0.10	**0.31**
Total Phosphorus	NA	NA	NA	NA	<0.25	<0.050	<0.50	<0.25	**0.69**
	4' Below Discharge								
Iron	NA	<0.080	NA	NA	<0.4	**18**	NA	NA	**0.47**
Manganese	NA	**0.049**	NA	NA	**0.096**	**2.6**	NA	NA	**0.017**
Sodium	NA	**3.2**	NA	NA	**49**	**8.5**	NA	NA	**96**
Chemical Oxygen Demand (COD)	NA	**150**	<5.0	**8.6**	**5.3**	**570**	NA	NA	**360**
Chloride	NA	**5.3**	NA	NA	**4.5**	**9.0**	NA	NA	NA
Ammonia as Nitrogen	NA	<0.025	**0.035**	**0.033**	<0.020	**0.67**	NA	NA	**0.32**
Nitrogen (Nitrate-Nitrite)	NA	<0.10	**1.8**	**0.13**	**0.71**	<0.020	NA	NA	<0.020
TIN (Calculated)	NA	<0.10	**1.8**	**0.16**	**0.71**	**0.69**	NA	NA	**0.32**
Total Phosphorus	NA	NA	NA	NA	<0.25	<0.050	NA	NA	**0.72**

Notes:

Bold values represent detectable concentrations of constituent

NA - Not Available/Not Analyzed

NC - No criteria developed

Winery A											
Wastewater Analytical Results											
Constituent (Results in mg/L, unless otherwise noted)	**Part 22 Effluent/ Wastewater Discharge Standards**	**Average**	3/4/2014	4/29/2014	7/1/2014	8/12/2014	9/15/2014	10/21/2014	11/20/2014	12/16/2014	1/20/2015
Biochemical Oxygen Demand (BOD)	NC	2,249	**3,000**	**1,800**	**2,200**	**1,300**	**1,200**	**700**	**5,600**	**3,600**	**840**
Chemical Oxygen Demand (COD)	NC	3,423	**4,200**	**2,700**	**2,700**	**2,000**	**1,700**	**810**	**11,000**	**4,400**	**1,300**
Sodium	400	792	**400**	**520**	**290**	**470**	**640**	**280**	**340**	**300**	**320**
Chloride	500	673.3	**630**	**1,000**	**400**	**640**	**1,100**	**500**	**510**	**610**	**670**
Ammonia as Nitrogen	5.0	5.0	**11**	**15**	**5.2**	**1.4**	**6.3**	**0.76**	<0.40	**0.045**	**0.056**
Nitrogen (Nitrite)	0.5	--	<0.10	<0.10	<0.020	<0.10	<0.10	<0.10	<0.10	<0.020	<0.10
Nitrogen (Nitrate)	5.0	0.075	<0.10	**0.048**	**0.046**	<0.10	<0.10	<0.10	**0.130**	<0.10	<0.020
TIN (Calculated)	5.0	4.4	**11**	**15**	**5.3**	**1.4**	**6.3**	**0.76**	**0.14**	**0.046**	**0.056**
Total Phosphorus	5.0	8.26	**14**	**11**	**9.5**	**8.4**	**6.6**	**1.5**	**11.0**	**7.5**	**4.8**
pH (S.U.)	6.5 to 8.5 (E)	5.77	5.4	4.7	4.9	5.0	NA	6.9	7.7	4.5	7.1
Dissolved Oxygen	NC	2.11	NA	NA	NA	NA	NA	2.78	3.06	0.00	2.60
Soil Pore Water Analytical Results											
Constituent (Results in mg/L, unless otherwise noted)			3/4/2014	4/29/2014	7/1/2014	8/12/2014	9/15/2014	10/21/2014	11/24/2014	12/16/2014	1/20/2015
			2' Below Discharge								
Iron			NA	NA	NA	NA	NA	NA	<0.80	<0.40	NA
Manganese			NA	NA	NA	NA	NA	NA	<0.050	<0.050	NA
Sodium			NA	NA	NA	NA	NA	NA	**2.9**	**4.5**	NA
Chemical Oxygen Demand (COD)			NA	**54**	**36**	**46**	**51**	**19**	**43**	**24**	NA
Chloride			NA	NA	NA	NA	NA	NA	<3.0	NA	NA
Ammonia as Nitrogen			NA	<0.025	**0.22**	**0.39**	**0.25**	**0.055**	<0.025	0.03	NA
Nitrogen (Nitrate-Nitrite)			NA	**4.5**	**32**	**32**	**31**	**40**	**31**	**36**	NA
TIN (Calculated)			NA	**4.5**	**32**	**32**	**31**	**40**	**31**	**36**	NA
Total Phosphorus			NA	<0.10	NA	NA	NA	NA	<0.050	<0.50	NA
			4' Below Discharge								
Iron			NA	<0.080	NA	NA	NA	NA	NA	NA	NA
Manganese			NA	<0.0050	NA	NA	NA	NA	NA	NA	NA
Sodium			NA	**27**	NA	NA	NA	NA	NA	NA	NA
Chemical Oxygen Demand (COD)			NA	**8.0**	**30**	**41**	**49**	**10**	NA	NA	NA
Chloride			NA	**12**	NA	NA	NA	NA	NA	NA	NA
Ammonia as Nitrogen			NA	<0.025	**0.15**	**0.081**	**0.053**	**0.03**	NA	NA	NA
Nitrogen (Nitrate-Nitrite)			NA	**8.2**	**7.4**	**2.3**	**5.1**	**18**	NA	NA	NA
TIN (Calculated)			NA	**8.2**	**7.6**	**2.4**	**5.2**	**18**	NA	NA	NA
Total Phosphorus			NA	<0.10	NA	NA	NA	NA	NA	NA	NA

NA - Not Available/Not Analyzed

NC - No criteria developed

Winery A											
Groundwater Analytical Results											
Constituent (Results in mg/L, unless otherwise noted)	**Part 201 Generic Cleanup Criteria Residential Drinking Water Criteria & RBSLs**	**Part 201 Generic Cleanup Criteria Groundwater Surface Water Interface Criteria & RBSLs**	**MW-1**			**MW-2**			**MW-3**		
			Upgradient			*Downgradient*			*Downgradient*		
			Q2 2014	*Q3 2014*	*Q4 2014*	*Q2 2014*	*Q3 2014*	*Q4 2014*	*Q2 2014*	*Q3 2014*	*Q4 2014*
			6/17/2014	9/25/2014	11/11/2014	6/17/2014	9/25/2014	11/11/2014	6/17/2014	9/25/2014	11/11/2014
Iron	0.3 (E) 2.0	NA	<0.20	**0.38**	<0.20	**2.6**	**0.27**	<0.20	<0.20	<0.20	<0.20
Iron dissolved	0.3 (E) 2.0	NA	NA	NA	NA	NA	NA	**0.11**	NA	NA	NA
Manganese	0.050 (E) 0.860	(G,X)	<0.050	<0.050	<0.050	**0.11**	<0.050	<0.050	<0.050	<0.050	<0.050
Manganese dissolved	0.050 (E) 0.860	(G,X)	NA	NA	NA	NA	NA	**0.010**	NA	NA	NA
Sodium	120	NA	**1.6**	**1.8**	**1.3**	**3.8**	**1.4**	**1.2**	**1.4**	**1.6**	**2.0**
Sodium dissolved	120	NA	NA	NA	NA	NA	NA	**3.5**	NA	NA	NA
Chemical Oxygen Demand (COD)	NC	NC	**15**	**19**	**8.6**	**64**	**14**	**10**	<5.0	**18**	**6.2**
Chloride	250	{FF}	**1.6**	<10	<3.0	**14**	<10	<3.0	**1.9**	<10	**20**
Ammonia as Nitrogen	10 (N)	(G,X)	**0.044**	**0.026**	<0.025	<0.025	<0.025	<0.025	**0.067**	<0.025	**0.051**
Nitrogen (Nitrite)	1.0 (N)	(G,X)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrogen (Nitrate)	10 (N)	NA	**1.0**	**0.69**	**0.95**	<0.10	**0.10**	**0.11**	**9.7**	**7.1**	**4.2**
TIN (Calculated)	NA	NA	**1.1**	**0.72**	**0.95**	**0.078**	**0.12**	**0.12**	**9.8**	**7.1**	**4.3**
Total Phosphorus	63	(EE)	<0.050	<0.010	<0.050	**0.19**	<0.050	<0.050	<0.050	<0.050	<0.050
Temperature (°C)	NA	NA	11.50	14.00	11.63	12.20	13.9	11.0	9.00	12.52	11.48
pH (S.U.)	6.5 to 8.5 (E)	6.5 to 9.0	7.04	7.40	7.45	7.85	7.40	7.49	6.85	6.99	7.20
Conductivity (us/cm)	NC	NC	430	410	475	384	437	485	573	604	709
ORP (mV)	NA	(EE)	NM	64.9	-77.0	NM	-15.1	-96.6	NM	62.1	-19.3
DO (mg/L)	NA	(EE)	6.94	3.39	8.72	1.64	2.2	4.8	8.19	2.2	5.12
Turbidity (NTU)	NA	(EE)	NM	11.3	4.2	NM	20.1	53.0	NM	9.6	2.6

NA - Not Available/Not Analyzed

NM - Not Measured

BGS - Below ground surface (feet).

NC - No criteria developed

Winery B											
Wastewater Analytical Results											
Constituent (Results in mg/L, unless otherwise noted)	**Part 22 Effluent/ Wastewater Discharge Standards**	**Average**	2/26/2014	4/29/2014	6/30/2014	8/11/2014	9/15/2014	10/21/2014	11/20/2014	12/16/2014	1/20/2015
Biochemical Oxygen Demand (BOD)	NC	414	**680**	**380**			**170**	**550**	**300**	**470**	**350**
Chemical Oxygen Demand (COD)	NC	493	**1,000**	**580**	**190**	**350**	**280**	**510**	**500**	**480**	**550**
Sodium	400	792	**620**	**600**	**790**	**990**	**850**	**940**	**740**	**890**	**710**
Chloride	500	1,500.0	**1,000**	**1,000**	**1,400**	**1,800**	**1,700**	**1,900**	**1,600**	**1,800**	**1,300**
Ammonia as Nitrogen	5.0	3.6	**0.17**	**20**	**5.7**	**5.2**	**0.58**	**0.28**	**0.39**	**0.32**	**0.12**
Nitrogen (Nitrite)	0.5	--	<0.020	<0.020	<0.10	<0.020	<0.10	<0.10	<0.020	<0.020	<0.020
Nitrogen (Nitrate)	5.0	--	<0.020	<0.020	<0.10	<0.020	<0.10	<0.10	<0.020	<0.10	<0.020
TIN (Calculated)	5.0	3.6	**0.19**	**20**	**5.7**	**5.2**	**0.58**	**0.28**	**0.41**	**0.32**	**0.12**
Total Phosphorus	5.0	1.29	**4.2**	**1.2**	**1.4**	**1.5**	**0.57**	**0.52**	**0.75**	**0.59**	**0.91**
pH (S.U.)	6.5 to 8.5 (E)	6.70	5.9	6.3	7.0	7.0	NA	6.6	6.7	6.7	7.3
Dissolved Oxygen	NC	1.03	NA	NA	NA	NA	NA	3.08	0.00	NA	0.02
Soil Pore Water Analytical Results											
Constituent (Results in mg/L, unless otherwise noted)			2/26/2014	4/29/2014	6/30/2014	8/11/2014	9/15/2014	10/21/2014	11/24/2014	12/16/2014	1/20/2015
			2' Below Discharge								
Iron			NA	NA	NA	NA	NA	NA	<0.80	<0.40	NA
Manganese			NA	NA	NA	NA	NA	NA	<0.050	<0.050	NA
Sodium			NA	NA	NA	NA	NA	NA	**5.3**	**8.5**	NA
Chemical Oxygen Demand (COD)			NA	**11**	**11**	**11**	**16**	**5.3**	**12**	<5.0	NA
Chloride			NA	NA	NA	NA	NA	NA	**5.4**	NA	NA
Ammonia as Nitrogen			NA	**0.038**	**0.23**	**0.11**	**0.088**	**0.051**	<0.025	<0.025	NA
Nitrogen (Nitrate-Nitrite)			NA	**7.0**	**7.3**	**5.0**	**6.8**	**5.8**	**5.1**	**5.6**	NA
TIN (Calculated)			NA	**7.0**	**7.5**	**5.1**	**6.9**	**5.9**	**5.1**	**5.6**	NA
Total Phosphorus			NA	NA	NA	NA	NA	NA	<0.050	<0.50	NA
			4' Below Discharge								
Iron			NA	NA	NA	NA	NA	NA	NA	<0.40	NA
Manganese			NA	NA	NA	NA	NA	NA	<0.050	<0.050	NA
Sodium			NA	NA	NA	NA	NA	NA	**9.3**	**10.0**	NA
Chemical Oxygen Demand (COD)			NA	**93**	**40**	**61**	**16**	<5.0	**13**	**6.2**	NA
Chloride			NA	NA	NA	NA	NA	NA	**4.5**	NA	NA
Ammonia as Nitrogen			NA	**0.027**	NA	NA	**0.047**	**0.036**	<0.025	<0.025	NA
Nitrogen (Nitrate-Nitrite)			NA	**0.3**	NA	NA	**1.6**	**0.11**	**0.47**	**0.2**	NA
TIN (Calculated)			NA	**0.33**	NA	NA	**1.6**	**0.15**	**0.47**	**0.2**	NA
Total Phosphorus			NA	NA	NA	NA	NA	NA	<0.050	<0.25	NA

NA - Not Available/Not Analyzed

NC - No criteria developed

Winery C											
Wastewater Analytical Results											
Constituent (Results in mg/L, unless otherwise noted)	**Part 22 Effluent/ Wastewater Discharge Standards**	**Average**	2/26/2014	4/29/2014	6/30/2014	8/11/2014	9/15/2014	10/21/2014	11/20/2014	12/16/2014	1/20/2015
Biochemical Oxygen Demand (BOD)	NC	3,578	**6,600**	**2,900**	**2,000**	**2,400**	**7,100**	**1,600**	**3,400**	**3,500**	**2,700**
Chemical Oxygen Demand (COD)	NC	5,244	**9,400**	**3,800**	**2,600**	**3,100**	**12,000**	**1,600**	**7,600**	**2,000**	**5,100**
Sodium	400	792	**60**	**64**	**47**	**59**	**53**	**27**	**33**	**60**	**78**
Chloride	500	10.8	**8.0**	**4.5**	**2.7**	**3.9**	**8.2**	**8.5**	**29**	**12**	**20**
Ammonia as Nitrogen	5.0	18.4	**31**	**5.2**	**27**	**19**	**11**	**6.8**	**11**	**8.0**	**47**
Nitrogen (Nitrite)	0.5	0.2	**0.35**	**0.11**	<0.10	<0.020	<0.10	<0.10	<0.020	<0.10	<0.10
Nitrogen (Nitrate)	5.0	0.130	<0.020	**0.28**	**0.047**	**0.021**	**0.16**	<0.10	**0.160**	<0.10	**0.11**
TIN (Calculated)	5.0	18.5	**31**	**5.6**	**27**	**19**	**11**	**6.8**	**11**	**8.1**	**47**
Total Phosphorus	5.0	5.82	**9.9**	**3.2**	**6.3**	**5.4**	**4.4**	**2.1**	**7.7**	**3.4**	**10**
pH (S.U.)	6.5 to 8.5 (E)	5.50	5.2	5.0	6.0	5.8	NA	5.4	5.1	5.6	5.9
Dissolved Oxygen	NC	0.34	NA	NA	NA	NA	NA	0.34	NA		
Soil Pore Water Analytical Results											
Constituent (Results in mg/L, unless otherwise noted)			2/26/2014	4/29/2014	6/30/2014	8/11/2014	9/15/2014	10/21/2014	11/24/2014	12/16/2014	1/20/2015
			2' Below Discharge								
Iron			NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese			NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium			NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Oxygen Demand (COD)			NA	**1,200**	**360**	**130**	**87**	**58**	**43**	<50	NA
Chloride			NA	NA	NA	NA	NA	NA	NA	NA	NA
Ammonia as Nitrogen			NA	**0.38**	**1.2**	NA	**0.12**	**0.072**	**0.048**	<0.025	NA
Nitrogen (Nitrate-Nitrite)			NA	**0.053**	**0.071**	NA	**30**	**82**	**65**	NA	NA
TIN (Calculated)			NA	**4.3**	**1.3**	NA	**30**	**82**	**65**	NA	NA
Total Phosphorus			NA	NA	NA	NA	NA	NA	<0.50	NA	NA
			4' Below Discharge								
Iron			NA	NA	NA	NA	NA	NA	0.24	NA	NA
Manganese			NA	NA	NA	NA	NA	NA	0.12	NA	NA
Sodium			NA	NA	NA	NA	NA	NA	**91**	NA	NA
Chemical Oxygen Demand (COD)			NA	**680**	**3,400**	**940**	**82**	**31**	**30**	**30**	NA
Chloride			NA	NA	NA	NA	NA	NA	NA	NA	NA
Ammonia as Nitrogen			NA	**0.25**	**1.2**	**0.24**	**0.042**	**0.053**	<0.025	<0.025	NA
Nitrogen (Nitrate-Nitrite)			NA	**0.067**	**0.21**	**0.06**	**32**	**26**	**5.9**	NA	NA
TIN (Calculated)			NA	**0.32**	**1.4**	**0.30**	**32**	**26**	**5.9**	NA	NA
Total Phosphorus			NA	NA	NA	NA	NA	NA	<0.50	NA	NA

NA - Not Available/Not Analyzed

NC - No criteria developed

Winery D											
Wastewater Analytical Results											
Constituent (Results in mg/L, unless otherwise noted)	**Part 22 Effluent/ Wastewater Discharge Standards**	**Average**	2/24/2014	4/15/2014	6/9/2014	9/9/2014	9/29/2014	10/22/2014	11/20/2014	12/18/2014	1/15/2015
Biochemical Oxygen Demand (BOD)	NC	3,111	**1,500**	**2,400**	**2,500**	**4,000**	**4,100**	**3,500**	**4,900**	**2,600**	**2,500**
Chemical Oxygen Demand (COD)	NC	5,722	**2,600**	**3,200**	**8,200**	**9,000**	**6,800**	**4,000**	**8,200**	**4,000**	**5,500**
Sodium	400	792	**95**	**66**	**230**	**160**	**91**	**26**	**150**	**150**	**150**
Chloride	500	53.2	**36**	**42**	**120**	**31**	**33**	**24**	**63**	**57**	**73**
Ammonia as Nitrogen	5.0	7.9	**5.4**	**6.0**	**22**	**14**	**2.8**	**1.8**	**13**	**1.4**	**4.7**
Nitrogen (Nitrite)	0.5	0.1	<0.10	<0.10	<0.10	<0.10	<0.020	<0.10	<0.020	<0.10	**0.065**
Nitrogen (Nitrate)	5.0	0.901	**1.2**	**1.5**	**0.21**	**0.13**	**0.93**	**2.5**	**1.1**	**0.35**	**0.19**
TIN (Calculated)	5.0	8.8	**6.6**	**7.5**	**22**	**14**	**3.7**	**4.3**	**14**	**1.8**	**5.0**
Total Phosphorus	5.0	9.19	**4.8**	**7.9**	**23**	**8.2**	**8.4**	**2.2**	**11**	**7.2**	**10**
pH (S.U.)	6.5 to 8.5 (E)	5.99	NA	6.7	5.6	5.5	5.4	6.4	NA	6.4	5.8
Dissolved Oxygen	NC	0.78	NA	NA	1.20	0.22	0.02	NA	NA	1.20	1.24
Soil Pore Water Analytical Results											
Constituent (Results in mg/L, unless otherwise noted)			2/24/2014	4/15/2014	6/9/2014	9/9/2014	9/29/2014	10/22/2014	12/4/2014	12/18/2014	1/15/2015
			2' Below Discharge								
Iron			NA	NA	NA	NA	<0.080	NA	NA	**0.49**	**1.1**
Manganese			NA	NA	NA	NA	<0.0050	NA	NA	**0.067**	**0.038**
Sodium			NA	NA	NA	NA	**38**	NA	NA	**72**	**99**
Chemical Oxygen Demand (COD)			NA	**52**	**41**	**75**	**38**	**48**	**83**	**1,800**	**710**
Chloride			NA	NA	NA	NA	**1.3**	NA	**20**	**39**	NA
Ammonia as Nitrogen			NA	**0.11**	**0.087**	**0.080**	**0.025**	**0.053**	**0.062**	**0.130**	**0.190**
Nitrogen (Nitrate-Nitrite)			NA	**0.94**	**1.8**	**3.1**	**1.9**	**0.12**	<0.10	<0.10	**0.030**
TIN (Calculated)			NA	**1.0**	**1.9**	**3.2**	**1.9**	**0.053**	**0.13**	**0.20**	**0.22**
Total Phosphorus			NA	NA	NA	NA	<0.25	NA	<0.50	**4.3**	**3.2**
			4' Below Discharge								
Iron			NA	NA	NA	NA	<0.080	NA	NA	<0.40	**1.0**
Manganese			NA	NA	NA	NA	<0.0050	NA	NA	**0.053**	**0.033**
Sodium			NA	NA	NA	NA	**1.2**	NA	NA	**60**	**97**
Chemical Oxygen Demand (COD)			NA	**20**	**12**	**63**	**31**	**21**	**1,500**	**1,300**	**630**
Chloride			NA	NA	NA	NA	**2.0**	NA	**60**	**39**	NA
Ammonia as Nitrogen			NA	**0.083**	**0.066**	**0.13**	<0.020	**0.035**	**0.13**	**0.11**	**0.220**
Nitrogen (Nitrate-Nitrite)			NA	**3.3**	**3.1**	**0.39**	**0.022**	<0.10	<0.10	<0.10	**0.034**
TIN (Calculated)			NA	**3.4**	**3.2**	**0.52**	**0.038**	**0.035**	**0.16**	**0.14**	**0.25**
Total Phosphorus			NA	NA	NA	NA	NA	NA	**4.1**	**3.1**	**2.9**

NA - Not Available/Not Analyzed

NC - No criteria developed

Winery D											
Groundwater Analytical Results											
Constituent (Results in mg/L, unless otherwise noted)	**Part 201 Generic Cleanup Criteria Residential Drinking Water Criteria & RBSLs**	**Part 201 Generic Cleanup Criteria Groundwater Surface Water Interface Criteria & RBSLs**	**MW-1**			**MW-2**			**MW-3**		
			Upgradient			*Downgradient*			*Downgradient*		
			Q2 2014	*Q3 2014*	*Q4 2014*	*Q2 2014*	*Q3 2014*	*Q4 2014*	*Q2 2014*	*Q3 2014*	*Q4 2014*
			6/17/2014	9/25/2014	11/11/2014	6/17/2014	9/25/2014	11/11/2014	6/17/2014	9/25/2014	11/11/2014
Iron	0.3 (E) 2.0	NA	<0.080	**0.17**	**0.33**	<0.080	<0.080	**0.63**	<0.080	<0.080	**3.2**
Iron dissolved	0.3 (E) 2.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	0.050 (E) 0.860	(G,X)	<0.0050	<0.0050	**0.015**	<0.0050	<0.0050	**0.0087**	<0.0050	<0.0050	**0.17**
Manganese dissolved	0.050 (E) 0.860	(G,X)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	120	NA	**40**	**45**	**18**	**7.7**	**27**	**25**	**9.8**	**16**	**18**
Sodium dissolved	120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Oxygen Demand (COD)	NC	NC	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chloride	250	{FF}	**74**	**91**	**56**	**11**	**18**	**36**	**13**	**22**	**25**
Ammonia as Nitrogen	10 (N)	(G,X)	<0.020	<0.025	<0.020	<0.020	<0.025	<0.020	<0.020	<0.025	<0.020
Nitrogen (Nitrite)	1.0 (N)	(G,X)	<0.020	NA	<0.020	<0.020	NA	<0.020	<0.020	NA	<0.020
Nitrogen (Nitrate)	10 (N)	NA	**5.9**	**5.3**	**4.0**	**2.4**	**11**	**7.9**	**0.4**	**1.4**	**1.2**
TIN (Calculated)	NA	NA	**5.9**	**5.3**	**4.0**	**2.4**	**11**	**7.9**	**0.4**	**1.4**	**1.2**
Total Phosphorus	63	(EE)	<0.050	<0.050	<0.050	<0.050	<0.050	**0.055**	<0.050	<0.050	<0.050
Temperature (°C)	NA	NA	12.17	12.44	7.90	12.67	12.83	10.40	12.08	11.52	NM
pH (S.U.)	6.5 to 8.5 (E)	6.5 to 9.0	7.74	7.72	6.00	7.64	7.68	6.52	7.79	7.66	6.47
Conductivity (us/cm)	NC	NC	814	893	NM	532	698	NM	490	622	NM
ORP (mV)	NA	(EE)	-4.80	-80.10	NM	2.10	-63.60	NM	-0.30	-63.00	NM
DO (mg/L)	NA	(EE)	10.57	10.43	7.80	11.81	10.59	5.20	8.51	10.36	7.53
Turbidity (NTU)	NA	(EE)	1.18	3.04	NM	1.68	3.10	NM	2.25	2.68	NM

NA - Not Available/Not Analyzed

NM - Not Measured

BGS - Below ground surface (feet).

NC - No criteria developed

Winery E											
Wastewater Analytical Results											
Constituent (Results in mg/L, unless otherwise noted)	**Part 22 Effluent/ Wastewater Discharge Standards**	**Average**	2/24/2014	4/15/2014	6/9/2014	9/8/2014	9/30/2014	10/22/2014	11/20/2014	12/18/2014	1/15/2015
Biochemical Oxygen Demand (BOD)	NC	957	**1,100**	**9.4**	**1,000**	**7.5**	**14**	**90**	**690**	**3,500**	**2,200**
Chemical Oxygen Demand (COD)	NC	1,299	**1,800**	**31**	**1,100**	**43**	**50**	**78**	**890**	**4,900**	**2,800**
Sodium	400	792	**620**	**600**	**790**	**990**	**850**	**940**	**740**	**890**	**710**
Chloride	500	7.2	**9.8**	**5.0**	**4.2**	**4.8**	**4.4**	**4.6**	**6.8**	<10	**18**
Ammonia as Nitrogen	5.0	2.4	**2.3**	**1.2**	**6.8**	**0.72**	**1.4**	**0.21**	**1.5**	**3.4**	**4.30**
Nitrogen (Nitrite)	0.5	0.0	**0.021**	<0.020	<0.020	<0.10	<0.020	<0.020	<0.10	<0.10	<0.020
Nitrogen (Nitrate)	5.0	0.850	<0.020	<0.020	**0.2**	<0.10	<0.020	<0.020	**1.5**	<0.10	<0.020
TIN (Calculated)	5.0	2.6	**2.3**	**1.2**	**7.0**	**0.72**	**1.4**	**0.22**	**3.0**	**3.5**	**4.3**
Total Phosphorus	5.0	1.72	**1.5**	**0.27**	**3.9**	**0.31**	**0.41**	**0.38**	**1.3**	**4.1**	**3.3**
pH (S.U.)	6.5 to 8.5 (E)	6.78	NA	7.5	6.3	7.6	7.8	7.2	NA	5.5	5.5
Dissolved Oxygen	NC	0.97	NA	NA	1.7	0.11	0.00	NA	NA	1.90	1.21
Soil Pore Water Analytical Results											
Constituent (Results in mg/L, unless otherwise noted)			2/24/2014	4/15/2014	6/9/2014	9/8/2014	9/30/2014	10/22/2014	12/4/2014	12/18/2014	1/15/2015
			2' Below Discharge								
Iron			NA	<0.080	NA	NA	<0.080	**4.6**	NA	**5.3**	**0.66**
Manganese			NA	**0.25**	NA	NA	**1.3**	**3.3**	NA	**1.1**	**0.099**
Sodium			NA	**14**	NA	NA	**9.8**	**9.2**	NA	**11**	**91**
Chemical Oxygen Demand (COD)			NA	**38**	**7.6**	**10**	**6.8**	**480**	**430**	**230**	**360**
Chloride			NA	**6.1**	NA	NA	**4.7**	**5.8**	<10	<10	NA
Ammonia as Nitrogen			NA	**0.15**	**0.032**	**0.060**	<0.020	**0.036**	**1.3**	**0.26**	**0.31**
Nitrogen (Nitrate-Nitrite)			NA	<0.10	**9.7**	**0.45**	<0.020	<0.020	<0.020	<0.10	<0.020
TIN (Calculated)			NA	**0.15**	**9.7**	**0.51**	<0.020	**0.036**	**1.3**	<0.10	**0.31**
Total Phosphorus			NA	NA	NA	NA	<0.25	<0.050	<0.50	<0.25	**0.69**
			4' Below Discharge								
Iron			NA	<0.080	NA	NA	<0.4	**18**	NA	NA	**0.47**
Manganese			NA	**0.049**	NA	NA	**0.096**	**2.6**	NA	NA	**0.017**
Sodium			NA	**3.2**	NA	NA	**49**	**8.5**	NA	NA	**96**
Chemical Oxygen Demand (COD)			NA	**150**	<5.0	**8.6**	**5.3**	**570**	NA	NA	**360**
Chloride			NA	**5.3**	NA	NA	**4.5**	**9**	NA	NA	NA
Ammonia as Nitrogen			NA	<0.025	**0.035**	**0.033**	<0.020	**0.67**	NA	NA	**0.32**
Nitrogen (Nitrate-Nitrite)			NA	<0.10	**1.8**	**0.13**	**0.71**	<0.020	NA	NA	<0.020
TIN (Calculated)			NA	<0.10	**1.8**	**0.16**	**0.71**	**0.69**	NA	NA	**0.32**
Total Phosphorus			NA	NA	NA	NA	<0.25	<0.050	NA	NA	**0.72**

NA - Not Available/Not Analyzed

NC - No criteria developed

Attachment B

Reduction Summary of Key Analytical Parameters

Table B: Analytical Parameter Reduction Summary

Michigan Winery Wastewater Treatment Study

Grant Number 791N430009/ LEI Job No. 13-611

Constituent (Results in mg/L, unless otherwise noted)	Average Reduction (All Wineries)	Standard Deviation (All Wineries)	Winery A									Winery B								
			3/4/2014	4/29/2014	7/1/2014	8/12/2014	9/15/2014	10/21/2014	11/24/2014	12/16/2014	1/20/2015	2/26/2014	4/29/2014	6/30/2014	8/11/2014	9/15/2014	10/21/2014	11/24/2014	12/16/2014	1/20/2015
			Percent Reduction: 2' Below Discharge									Percent Reduction: 2' Below Discharge								
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	99%	99%	NA	NA	NA	NA	NA	NA	NA	99%	99%	NA
Chemical Oxygen Demand (COD)	73%	101%	NA	98%	99%	98%	97%	98%	100%	99%	NA	NA	98%	94%	97%	94%	99%	98%	99%	NA
Chloride	29%	54%	NA	NA	NA	NA	NA	NA	99%	NA	NA	NA	NA	NA	NA	NA	NA	100%	NA	NA
Ammonia as Nitrogen	91%	17%	NA	100%	96%	72%	96%	93%	94%	40%	NA	NA	100%	96%	98%	85%	82%	94%	92%	NA
Nitrogen (Nitrate-Nitrite)	-14303%	20380%	NA	-9275%	-69465%	-31900%	-30900%	-39900%	-23746%	-35900%	NA	NA	-34900%	-7200%	-24900%	-6700%	-5700%	-25400%	-5500%	NA
TIN (Calculated)	-3277%	13376%	NA	70%	-504%	-2186%	-392%	-5163%	-22043%	-78161%	NA	NA	65%	-32%	2%	-1090%	-2007%	-1144%	-1650%	NA
Total Phosphorus	77%	26%	NA	99%	NA	NA	NA	NA	100%	93%	NA	NA	NA	NA	NA	NA	NA	93%	15%	NA
			Percent Reduction: 4' Below Discharge									Percent Reduction: 4' Below Discharge								
Sodium	NA	NA	NA	95%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	99%	99%	NA
Chemical Oxygen Demand (COD)	52%	147%	NA	100%	99%	98%	97%	99%	NA	NA	NA	NA	84%	79%	83%	94%	99%	97%	99%	NA
Chloride	28%	64%	NA	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	100%	NA	NA
Ammonia as Nitrogen	87%	56%	NA	100%	97%	94%	99%	96%	NA	NA	NA	NA	100%	NA	NA	92%	87%	94%	92%	NA
Nitrogen (Nitrate-Nitrite)	NA	NA	NA	-16983%	-15987%	-2200%	-5000%	-17900%	NA	NA	NA	NA	-1400%	NA	NA	-1500%	-10%	-2250%	-50%	NA
TIN (Calculated)	NA	NA	NA	45%	-43%	-71%	17%	-2268%	NA	NA	NA	NA	98%	NA	NA	-176%	46%	-15%	53%	NA
Total Phosphorus	NA	NA	NA	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	93%	58%	NA

Constituent (Results in mg/L, unless otherwise noted)	Winery C									Winery D								
	2/26/2014	4/29/2014	6/30/2014	8/11/2014	9/15/2014	10/21/2014	11/24/2014	12/16/2014	1/20/2015	2/24/2014	4/15/2014	6/9/2014	9/9/2014	9/29/2014	10/22/2014	12/4/2014	12/18/2014	1/15/2015
	Percent Reduction: 2' Below Discharge									Percent Reduction: 2' Below Discharge								
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	58%	NA	NA	52%	34%
Chemical Oxygen Demand (COD)	NA	68%	86%	96%	99%	96%	99%	98%	NA	NA	98%	100%	99%	99%	99%	99%	55%	87%
Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	96%	NA	68%	32%	NA
Ammonia as Nitrogen	NA	93%	96%	NA	99%	99%	100%	100%	NA	NA	98%	100%	99%	99%	97%	100%	91%	96%
Nitrogen (Nitrate-Nitrite)	NA	81%	-51%	NA	-18650%	-81900%	-40525%	NA	NA	NA	37%	-757%	-2285%	-104%	95%	91%	71%	84%
TIN (Calculated)	NA	23%	95%	NA	-173%	-1106%	-491%	NA	NA	NA	87%	91%	77%	49%	99%	99%	89%	96%
Total Phosphorus	NA	NA	NA	NA	NA	NA	94%	NA	NA	NA	NA	NA	NA	97%	NA	95%	40%	68%
	Percent Reduction: 4' Below Discharge									Percent Reduction: 4' Below Discharge								
Sodium	NA	NA	NA	NA	NA	NA	-176%	NA	NA	NA	NA	NA	NA	99%	NA	NA	60%	35%
Chemical Oxygen Demand (COD)	NA	82%	-31%	70%	99%	98%	100%	99%	NA	NA	99%	100%	99%	100%	99%	82%	68%	89%
Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	94%	NA	5%	32%	NA
Ammonia as Nitrogen	NA	95%	96%	99%	100%	99%	100%	100%	NA	NA	99%	100%	99%	99%	98%	99%	92%	95%
Nitrogen (Nitrate-Nitrite)	NA	76%	-347%	-205%	-19900%	-25900%	-3588%	NA	NA	NA	-120%	-1376%	-200%	98%	96%	91%	71%	82%
TIN (Calculated)	NA	94%	95%	98%	-191%	-282%	46%	NA	NA	NA	55%	85%	96%	99%	99%	99%	92%	95%
Total Phosphorus	NA	NA	NA	NA	NA	NA	94%	NA	NA	NA	NA	NA	NA	NA	NA	63%	57%	71%

Constituent (Results in mg/L, unless otherwise noted)	Winery E								
	2/24/2014	4/15/2014	6/9/2014	9/8/2014	9/30/2014	10/22/2014	12/4/2014	12/18/2014	1/15/2015
	Percent Reduction: 2' Below Discharge								
Sodium	NA	-119%	NA	NA	-31%	-16%	NA	73%	30%
Chemical Oxygen Demand (COD)	NA	-23%	99%	77%	86%	-515%	52%	95%	87%
Chloride	NA	-22%	NA	NA	-7%	-26%	-47%	0%	NA
Ammonia as Nitrogen	NA	88%	100%	92%	99%	83%	13%	92%	93%
Nitrogen (Nitrate-Nitrite)	NA	-400%	-4750%	-350%	0%	0%	99%	0%	0%
TIN (Calculated)	NA	88%	-39%	29%	99%	84%	57%	97%	93%
Total Phosphorus	NA	NA	NA	NA	39%	87%	62%	94%	79%
	Percent Reduction: 4' Below Discharge								
Sodium	NA	50%	NA	NA	-553%	-8%	NA	NA	26%
Chemical Oxygen Demand (COD)	NA	-384%	100%	80%	89%	-631%	NA	NA	87%
Chloride	NA	-6%	NA	NA	-2%	-96%	NA	NA	NA
Ammonia as Nitrogen	NA	98%	99%	95%	99%	-219%	NA	NA	93%
Nitrogen (Nitrate-Nitrite)	NA	-400%	-800%	-30%	-3450%	0%	NA	NA	0%
TIN (Calculated)	NA	92%	74%	78%	49%	-214%	NA	NA	93%
Total Phosphorus	NA	NA	NA	NA	39%	87%	NA	NA	78%

Notes:

Negative values represent no reduction; Indicate an increase at soil pore water

NA - Not Available/Not Analyzed

BGS - Below ground surface (feet).

NC - No criteria developed

Attachment C

General information for Groundwater Discharge Permit Application,

From Michigan DEQ

STATE OF MICHIGAN

Rick Snyder, Governor

Dan Wyant, Director

DEPARTMENT OF ENVIRONMENTAL QUALITY

Instructions for
GROUNDWATER DISCHARGE PERMIT APPLICATION

for the purpose of wastewater disposal to the ground or groundwater

Groundwater Permits Unit
Permits Section
Water Resources Division
P.O. Box 30458
Lansing, MI 48909
Telephone: 517-284-5570
Fax: 517-241-9003

PREFACE

This document contains instructions on how to apply for a groundwater discharge permit. The instructions are organized to assist the applicant in determining the type of permit required and how to obtain it. Page 11 of these instructions lists reference materials such as applicable laws, rules and guidesheets, and how to access them. Many of the discharges require supporting documentation in addition to the application form. The guidesheets describe how to gather and report the information in a manner that is acceptable to the Michigan Department of Environmental Quality (Department). This does not preclude you from using alternative methods. It only means that if the guidance is followed, the methodology for collecting and reporting the information will be acceptable. Separate application forms incorporate the requirements of each rule.

The **instructions** are organized as follows:

- Types of groundwater discharges that are prohibited.
- Types of discharges that do not require a permit. If the proposed discharge is on this list, it is not necessary to submit an application form.
- Types of discharges that are of lesser impact to the groundwater that require short form applications.
- Types of discharges not grouped above.

Each **application form** is a complete stand-alone form with two parts. The first part of each form consists of general information. The second part is tailored to the specific rule covered by that form. Certain forms cover multiple types of discharges. Complete the sections that pertain to your discharge.

Annual Fees:
Annual fees are assessed for all permitted discharges in accordance with Section 3122(1) of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. The fees are divided into three groups and the amount is assessed based on the type of the permit. The fees are as follows:

Group 1	Rule 2218	$3,650
Group 2	Rules 2210(y), 2215, 2216	$1,500
Group 3	Rules 2211, 2213	$ 200

Invoices are mailed annually by January 15th for those permitted to discharge on the previous December 15. Payment is due on March 1.

There is no application fee associated with groundwater permits. Additional information can be found at:
http://www.michigan.gov/deq/0,4561,7-135-3313_4117---,00.html

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A. GENERAL INFORMATION

1. WHO MUST APPLY FOR A PERMIT

Section 3112(1) of Part 31, Water Resources Protection, of the Michigan Natural Resources and Environmental Protection Act of 1994, PA 451 as amended (Act 451), states that any person discharging any waste or waste effluent into the waters of this state must be in possession of a valid permit to discharge from the Department. **Activities that do not require a permit are identified in Section B beginning on page 5.**

A "person" is defined as an individual, partnership, corporation, association, governmental entity, or other legal entity.

2. PURPOSE

The purpose of the Part 22 Rules is to preserve the quality of groundwater for all of its protected uses, both present and future uses. Section 3109(1) of Act 451 prohibits the direct or indirect discharge into any waters of the state any substance that is or may become injurious to any protected uses of those waters. The Department enforces this prohibition through the "Part 22" Administrative Rules, contained at M.A.C. R323.2201 through R323.2240. These rules are referenced in this document as Rule 2201 through 2240. The protected uses include public health, safety, and welfare; domestic, commercial, industrial, agricultural, recreational or other uses that may be made of such waters; the value or utility of riparian lands; and the use of the water by livestock, wild animals, birds, fish, aquatic life, or plants or the growth or propagation of those entities.

3. INFORMATION REQUIREMENTS FOR ALL DISCHARGERS

Rules 2206 and 2217 require that an applicant must provide all information for the Department to make a decision regarding an application for a groundwater discharge permit. **If the information is not provided, the application will be returned as incomplete.**

4. REQUIREMENTS FOR ALL DISCHARGERS

Rule 2204 establishes certain requirements for all dischargers. These are:

1. The discharge must not become injurious.
2. The discharge must not cause runoff to, ponding of, or flooding of adjacent property.
3. The discharge must not cause erosion.
4. The discharge must not cause nuisance conditions.
5. The discharge must be located not less than 100 feet inside the boundary of the property where the discharge occurs, unless a lesser distance is approved by the Department.
6. The discharge must be isolated from water supply wells as indicated in Rule 2204(2)(d).
7. The discharge must not create a facility under Part 201, Environmental Remediation, of Act 451.

5. DISCHARGE PROHIBITIONS

Rule 2205 prohibits:

1. A discharge without a permit under Rule 2204.
2. A discharge from a general-purpose floor drain unless authorized under Rule 2210(v), Rule 2215 or Rule 2218.

6. ISOLATION DISTANCES

If the discharge is authorized under Rules 2216 or 2218, the point of discharge must be at least 100 feet within the property boundary, unless an alternate distance is required or allowed by the Department. Also, there are requirements under Rule 2204(2)(d) for isolation distances from existing water supply wells. The following table lists those isolation requirements.

Minimum Isolation Distances

Well Type	Permit: R 2218, R 2216(3)	All Others
I (serves water year round; more than 15 units; or not less than 25 residents)	2000 ft	200 ft
IIa (serves water at least 6 months per year; not less than 25 same residents)	2000 ft	200 ft
IIb (serves water at least 60 days per year; more than 15 connections; or not less than 25 people)	800 ft	75 ft
III (serves water less than 60 days per year; or less than 25 people and 15 connections)	800 ft	75 ft
Domestic: single living unit	300 ft	50 ft

7. CHANGES TO AN EXISTNG PERMIT

If you anticipate there will be a change in either the quantity or quality of your discharge, you must notify the Department prior to making the change. Within 30 calendar days of receiving the notice of modification, the Department will notify you whether the modification is considered minor or significant. If the Department determines the change is **minor**, you can make the changes you have identified, and the existing permit will be modified to reflect those changes. The Department will send you a copy of the amended permit. If the changes are determined to be **significant**, then you must reapply for a permit by completing the application form and submitting it to the Department for review and approval.

8. DEMONSTRATING ALTERNATIVE EQUIVALENCY

The Part 22 Rules allow you to provide equivalent information or alternative ways of meeting the conditions of the Rules. To demonstrate equivalency, you should provide both a narrative description and technical data to show that the alternative proposed meets the intent and achieves the same purpose as the Rule in question. For example, there are specific requirements for source water for Fruit and Vegetable Washwater, Rule 2211(c). The rule lists municipal water, a water source meeting state or federal criteria, or water meeting standards of Rule 2222 as appropriate source water. The rule does not list surface water. If the applicant desires to use water from a surface water source, the applicant must demonstrate how the surface water meets the intent of the Rule and provides equivalent environmental protection compared to the sources specified in the rule. Demonstrations can include but are not limited to water quality testing, analytical testing, etc.

9. WATER TREATMENT ADDITIVES

An additive as defined in Part 22 means a substance added to water to enhance its effectiveness for uses such as cleaning, disinfecting, heating, and cooling. A substance may be added to water directly or indirectly by being added to a process in such a way that it becomes a constituent of the wastewater.

If the wastewater contains additives, provide the information requested in the application form. The Department does not withhold issuance of a permit prior to approval of the additives. Instead, additives undergo a toxicology review and are approved by the Department under the terms of the permit. However, any data provided with this application, such as MSDS forms, will expedite the process. The Department will notify you if approval of the additives requires additional information and to whom the information is to be directed.

B. IDENTIFYING THE TYPE OF PERMIT REQUIRED

This section lists the specific discharges identified in the Part 22 Rules. You should review the list and determine if your discharge is listed, and then follow the directions for how that particular discharge is permitted.

1. DISCHARGES THAT DO NOT REQUIRE A PERMIT

Pursuant to Rule 2210 the activities listed below may be discharged without a permit from the Department, provided the requirements of Rule 2204 are met. You do not need to submit an application form.

(a) **Sanitary sewage** in either of the following circumstances if the sanitary sewage is not mixed with other waste:

(i) **The discharge is less than 1,000 gallons per day** and the disposal system is approved by the county, district, or city health department that has jurisdiction in accordance with either the requirements of the local sanitary code or the provisions of the publication entitled “Michigan Criteria

for Subsurface Sewage Disposal," April 1994 http://www.michigan.gov/documents/deq/deq-wb-dwehs-osw-mcssd_241120_7.pdf.

(ii) **The discharge is less than 6,000 gallons per day**, the disposal system is designed and constructed in accordance with the provisions of the publication entitled "Michigan Criteria for Subsurface Sewage Disposal," April 1994 http://www.michigan.gov/documents/deq/deq-wb-dwehs-osw-mcssd_241120_7.pdf, and the system is approved by the county, district, or city health department that has jurisdiction.

(b) **Controlled application of any of the following**:
   (i) An authorized substance to suppress dust. The following are authorized substances:
      (A) Water.
      (B) Calcium chloride.
      (C) Lignosulfate products.
      (D) Emulsified asphalt or resin stabilizers.
      (E) Vegetable by-products.
   (ii) A deicing substance.
   (iii) A substance for a natural resource or right-of-way maintenance program.
   (iv) A substance for a domestic activity.
   (v) A commercially manufactured pesticide or fertilizer for its intended use.

(c) **Stormwater**, other than from a secondary containment facility**,** when discharged through surface infiltration.

(d) **Stormwater** from a secondary containment facility that does not contain leaks or spills if the stormwater is inspected to ensure it meets the standards established in Rule 2222.

(e) **Water from a well used temporarily for dewatering at a construction site** if the water pumped does not create a site of environmental contamination under Part 201.

(f) **A discharge from an animal feeding operation** that has less than 5,000 animal units if the discharge is determined by the director of the department of agriculture or his or her designated representative, to be in accordance with generally accepted agricultural and management practices, as defined in Act No. 93 of the Public Acts of 1981, as amended, being 286.471 to 286.474 of the Michigan Compiled Laws, and known as the Michigan Right to Farm Act. For purposes of this Rule, 5,000 animal units is equal to 5,000 head of slaughter or feeder cattle; 3,500 mature dairy cattle; 12,500 swine weighing more than 25 kilograms or approximately 55 pounds; 50,000 sheep or lambs; 2,500 horses; 275,000 turkeys; 150,000 laying hens or broilers; or 25,000 ducks. An animal feeding operation is a lot or facility, or series of lots or facilities under single ownership which are adjacent to one another or which use a common area or system for the disposal of wastes that meets both of the following conditions:
   (i) Animals, other than aquatic animals, have been, are, or will be stabled or confined and fed or maintained for a total of 45 calendar days or more in any 12-month period.
   (ii) Crops, vegetation, forage growth, or postharvest residues are not sustained in the normal growing season over the portion of the lot or facility where animals are confined.

(g) Less than 50 gallons of wastewater per day from a **commercial animal care facility**.

(h) **Observation or monitoring well development or evacuation water**.

(i) **Potable water used for domestic or domestic equivalent activities** other than sanitary sewage disposal. This rule requires approval. Contact the nearest district office; see map link on page 11. Examples include but are not limited to:
   (i) Meat cutting waste water that is permitted to be discharged in a septic tank and tile field system permitted by the local health department
   (ii) A cheese maker who feeds whey to animals and produces 125 gallons per day of wastewater from cleaning kettles and utensils (only).
   (iii) Seasonal deer cutting.

(j) **Step test or pump test water** from any of the following:
   (i) A potable well or well used to develop a potable water supply.
   (ii) A well producing water that meets state or federal criteria for use as potable water.
   (iii) A test well where the quality of the test well discharge water is equal to or better than the background groundwater quality of the aquifer receiving the discharge.

(k) **Exfiltration from sanitary sewer collection systems**.

(l) **Wastewater from a heat pump** that has a heat exchange capacity of 300,000 Btu per hour or less if there is no chemical additive to the system.

(m) **Wastewater from a portable power washer** when used in either of the following circumstances:
   (i) By the occupant of a household for washing buildings, vehicles, or other surfaces associated with the domestic occupation of the household.
   (ii) By a commercial operator or in a commercial or industrial setting to remove nonpolluting substances from vehicles or surfaces when no additives are used and the washing process does not add significant pollutants to the water.

(n) **Swimming pool drainage and backwash water** discharged in accordance with sections 12521 to 12534 of Act No. 368 of the Public Acts of 1978, as amended, being 333.12521 to 333.12534 of the Michigan Compiled Laws.

(o) **Water treatment filter backwash water** if disposal is in accordance with plans and specifications approved by the Department under Act No. 399 of the Public Acts of 1976, as amended, being 325.1001et seq. of the Michigan Compiled Laws, and known as the safe drinking water act.

(p) **Carpet cleaning wastewater** discharged by a noncommercial operator or by a commercial operator at a site receiving wastewater from not more than one location where carpet cleaning has occurred.

(q) **Less than 10,000 gallons per day of noncontact cooling water** that does not contain additives if the source of the cooling water is any of the following:
   (i) A municipal water supply.
   (ii) A water supply meeting state or federal criteria for use as potable water.
   (iii) Another source of water meeting the standards of Rule 2222.
   (iv) Another source approved by the Department.

(r) **Land application of process sludge from a wastewater treatment facility** treating sanitary sewage when applied in accordance with applicable state and federal law.

(s) **Land application of process sludge from an industrial or commercial wastewater treatment facility** when authorized under R 299.4101 to R 299.4922, the administrative Rules implementing Part 115.

(t) **Placement of other solid waste on the ground when authorized under Part 115**. This provision does not apply to the disposal of wastewater generated through the operation of a facility licensed under Part 115.

(u) **Wastewater associated with an environmental response activity** described in any of the following paragraphs if the discharge is to the plume of groundwater contamination, including an area 100 feet hydraulically upgradient of the edge of the plume, and any additive used in the treatment process that is not part of the contamination plume meets the standards of Rule 2222:
   (i) A pump test discharge that does not change the physical dimensions of the plume in groundwater or, if the dimensions are changed, the changes are accounted for in the design of the final groundwater remediation plan.
   (ii) A remedial investigation, feasibility study, or remedial action discharge that is at or below the residential criteria authorized by section 20101a(1)(a) of the act, if applicable, or section 21304(a) of the act, if applicable.
   (iii) A discharge for a remedial investigation, feasibility study, or remedial action above the residential criteria authorized by section 20101a(1)(a) of the act, if applicable, or section 21304(a) of the act, if applicable, if a remediation investigation, feasibility study, or remediation plan has been approved by the Department division that has compliance oversight. The remediation plan must indicate that the treatment system is designed and will be operated so that contaminated groundwater will eventually meet the appropriate land use-based cleanup criteria authorized by section 20120a(1)(a) to (d) of the act, if applicable, or section 21304(a) of the act, if applicable.

(v) **Precipitation and snow melt drainage off vehicles** discharged through a general-purpose floor drain in a parking structure in which maintenance activities do not occur.

(w) A discharge that has been specifically authorized by the Department under a permit if the permit was not issued under this part.

(x) A discharge that occurs as the result of **placing waste materials on the ground in compliance with a designation of inertness issued under Part 115** or **leaving contaminated materials in place in compliance with Part 201 or 213.**

2. DISCHARGES THAT REQUIRE A PERMIT (PRE-DEFINED ACTIVITY)

The following chart lists **specific** discharges organized by rule for which you must submit an application prior to discharge. Please note that there are specific qualifications that must be met for each of the permits listed below which are contained in the Part 22 Rules.

WASTEWATER TYPE	DAILY MAXIMUM DISCHARGE, (GALLONS)
RULE 2211 PERMIT	
(a) Sanitary Sewage	6,000 – 10,000
(b) Laundromat	< 500
(c) Non-contact Cooling Water	> 10,000
(d) Fruit & Vegetable Wash water	< 50,000
(e) Portable Power Washer (per acre/month)	< 1,000
(f) Pump test Water	
(g) Hydrostatic Test Water	
(h) Commercial Animal Care	50 - 1,000
RULE 2213 PERMIT:	
(2) Non-contact cooling water, with additives	< 10,000
(3) Egg washing wastewater	< 10,000
(4) Cooling water	< 5,000
(5) Groundwater remediation, outside plume	
RULE 2215 PERMIT	
10-1 Sanitary Sewage, above ground	< 10,000
10-2 Vehicle wash, not open to public	< 2,000
10-3 Meat Processing	< 2,000
10-4 Gravel, sand, limestone, dolomite mining	
10-5 Oil Field Brine	
10-7 Hydrodemolition	
10-8 Hydrostatic test water, no additives, new pipelines and new tanks	
RULE 2216 PERMIT:	
(2) Sanitary Sewage: Constructed Wetland or Alternative treatment (*Pre-application meeting recommended prior to submittal of application.*)	< 20,000
(3) Sanitary Sewage: Specific 2216 Design	< 50,000
(4) Laundromat wastewater	< 20,000

3. DISCHARGES THAT REQUIRE A SITE SPECIFIC AUTHORIZATION

If the discharge does not appear on any of the previous lists, the applicant must apply for authorization under Rule 2210(y) or Rule 2218.

Rule 2210(y) Site Specific Authorization applies to discharges that have an insignificant potential to be harmful based on volume and wastewater components. This authorization covers discharges that do not fit the criteria of other categories. A site specific authorization can cover a variety of discharge types and volumes. If you believe your discharge may qualify for a Rule 2210(y) site specific authorization you should contact the Department to schedule a pre-application meeting prior to completing the application.

Rule 2218 applies to all other discharge activities. Facilities seeking a permit under this rule must provide the following types of information as part of the application:

a) The applicant must submit a basis of design for the treatment system as required by Rule 2218(2). The information required is listed in Rule 2218(2);
b) The applicant must submit an evaluation of the feasibility of alternatives to discharge to the groundwater. Prior to applying under Rule 2218 the applicant must conduct an evaluation of the feasibility of alternatives to discharging to the groundwater and submit that as part of the application. The analysis should contain at least the items listed in Rule 2219. Feasibility includes the practical ability to implement the alternative and a comparison of the cost of the alternative to its benefits.
c) The applicant must submit a wastewater characterization as required by Rule 2220.
d) The applicant must submit a hydrogeological report as required by Rule 2221.
e) The applicant must submit information that shows the groundwater quality standards contained in Rule 2222 are met. Standards must be met either in the discharge; or, in the groundwater if the applicant intends to rely on land application for treatment. The standards are complex, and it is strongly recommended that a pre-application meeting is scheduled to discuss them with program staff. This item “e” may be satisfied in part or in entirety by fulfilling the requirements of other items in this section, such as in item “h”
f) If a standard applicable to the discharge is to be determined under Rule 2222(5), the applicant must submit the information necessary to determine that standard, including whether a substance is a hazardous substance under Part 201.
g) The applicant must submit a proposed sampling and analysis plan that establishes criteria for collecting representative samples of effluent and groundwater as specified in Rule 2223.
h) The applicant must submit a description of the discharge methods set forth in a discharge management plan and information that demonstrates that the land treatment requirements of Rule 2233 will be met.
i) If a lagoon is included in the treatment process, the applicant must submit information that demonstrates that the requirements of Rule 2237 will be met.

Technical guidance documents have been drafted for items c, d, f, h and i above. They are identified in Part I, Section C.4 as additional reference materials. Section C.4 also lists the applicable Statutes and the Rules along with the web location for downloading all documents.

A pre-application meeting is recommended. The process for requesting a pre-application meeting is found on Page 10, Section C.1 of these instructions. You may also contact staff at the address or phone number found on Page 11 of these instructions for printed copies of the rules and guidesheets.

C. APPLICATION PROCESS

This section describes the process of filing an application form with the Department, formally requesting the permit.

1. WHEN TO APPLY FOR A PERMIT

For **new discharges or significant changes to an existing discharge,** you must submit the application at least 180 days in advance of the proposed date of discharge or significant change (Rule 2106, of Part 21 Rules). Permits are generally issued for five years, at which time an updated application must be submitted. For **reissuance** of an existing permit, you must submit the completed application form and the necessary attachments **180 days prior to the expiration date** of your current permit (Rule 2151(1), of Part 21 Rules).

Prior to submitting an initial application, an application for a Rule 2210(y) authorization, or Rule 2218 permit it is strongly recommended that you request a pre-application meeting with staff of the Groundwater Permit Unit, Water Resource Division. Technical staff will be available to discuss the proposed discharge, and can answer questions and provide information to you regarding such items as treatment alternatives, hydrogeologic studies, waste characterization, etc. It is recommended that you and/or your consultant be prepared to describe, at least in general terms, the basis of design for the proposed or existing wastewater treatment and disposal facilities.

To arrange a pre-application meeting, please contact:

Groundwater Permits Unit Chief
Permits Section
Water Resources Division
P.O. Box 30458
Lansing, MI 48909
Telephone: 517-284-5570
Fax: 517-241-9003

2. HOW THE FORMS ARE ORGANIZED

Each **application form** is a complete stand-alone form with two parts. The first part of each form consists of general information. The second part is tailored to the specific rule covered by that form. Certain forms cover multiple types of discharges. Complete the sections that pertain to your discharge.

3. WHO MUST SIGN THE APPLICATION FORM

The Part 21 Rules have very specific requirements for who must sign an application form.

- **Corporation.** The form must be signed by a principal executive officer of at least the level of vice president, or his/her designated representative, if the representative is responsible for the overall operation of the facility from which the discharge described in the permit application (a letter of authorization must be provided by a corporate executive to demonstrate the position and responsibility of the designated representative).
- P**artnership.** The form must be signed by a general partner.
- **Sole proprietorship.** The form must be signed by the proprietor.
- **Municipal, state or other public facility.** The form must be signed by a principal executive officer, the mayor, village president, city or village manager, or other duly authorized employee.

All signatures submitted to the Department must be **original signatures**, or the application will be returned to you. The details of these requirements are found in Rule 2114.

4. HOW TO ACCESS ADDITIONAL REFERENCE MATERIALS: RULES AND GUIDESHEETS

The following is a list of the acts, rules, forms and other items that can be obtained from the Groundwater Program to assist an applicant in filling out an application form and providing information necessary to obtain a groundwater discharge permit or permit exemption: This information is available electronically on the Internet at the following address:
http://www.michigan.gov/deq/0,1607,7-135-3313_4117---,00.html

1. Part 31, Water Resources Protection, of Act 451
2. Part 41, Sewerage Systems, of Act 451
3. Part 21 Wastewater Discharge Permits - Rules of Part 31 of Act 451
4. Part 22 Groundwater Quality - Rules of Part 31 of Act 451
5. Communities Participating in the Michigan Wellhead Protection Plan
6. Guidesheet I Guidance document for hydrogeologic studies
7. Guidesheet II Guidance document for discharge management plans
8. Guidesheet III Guidance document for waste characterization
9. Guidesheet IV Guidance document for wastewater treatment and storage lagoons
10. Guidesheet V Guidance document for development of toxicology information
11. Guidesheet VI Guidance document for the Operation and Maintenance Manual
12. Example Water Usage Diagram

Requests for a hard copy of the application form or any of the above items should be made to:

Permits Section
Groundwater Permits Unit
Water Resources Division
Michigan Department of Environmental Quality
P. O. Box 30458
Lansing, Michigan 48909
Telephone: 517-284-5570
FAX: 517-241-9033

5. WHERE TO GET QUESTIONS ANSWERED

If you have questions about the form or process, please call or fax your questions to the following numbers:

Telephone: 517-284-5570
FAX: 517-241-9033

Or contact the District Office
(Find your district office at http://www.mi.gov/deq/0,1607,7-135-3306_3329-12306--,00.html)

6. WHERE TO SEND THE APPLICATION BOTH PAPER AND ELECTRONIC

Retain one copy of the application for your files. Maintaining a copy will significantly reduce the effort when re-application is required. Submit **one copy (without special covers or binders), including the signed original,** of the application form and all pertinent attachments, to the following address:

Permits Section
Groundwater Permits Unit
Water Resources Division
Michigan Department of Environmental Quality
P. O. Box 30458
Lansing, Michigan 48909

In lieu of a paper copy, an electronic copy may be submitted to thelens5@michigan.gov.
The paper original signature page must still be forwarded to the above address.

7. OPERATIONAL REQUIREMENTS

There are operational requirements that are mandated by the Part 22 Rules for each particular permit. Please refer to the specific rule for detailed requirements.

8. New Submittal Requirements for Self-Monitoring Data

Part 31 of Act 451 of 1994, as amended, specifically Section 324.3110(3) and Rule 323.2155(2) of Part 21 allows the Department to specify the forms to be utilized for reporting the required self-monitoring data. Unless instructed on the effluent limitations page to conduct "Retained Self-Monitoring" the permittee shall submit self-monitoring data via the Department's Electronic Environmental Discharge Monitoring Reporting (e2-DMR) system.

Upon issuance of a permit a packet of instructions and forms will be enclosed with the permit documents; unless the permittee is already set-up in the electronic reporting system. The instructions and forms will assist new participants in the program with initiating access to the electronic reporting site. Thereafter, the permittee shall utilize the information provided on the e2-Reporting website @ **https://secure1.state.mi.us/e2rs/** to access and submit the electronic forms.

9. PENALTIES

It is against the law to knowingly discharge wastewater into the groundwater without a permit or in violation of an existing permit. It is also against the law to intentionally make false statements in a permit application. A person who commits these offenses is guilty of a felony and substantial fines, and perhaps imprisonment, are the consequences. Section 3115(2) of Act 451 contains the details of the penalties associated with violating Part 31.

Attachment D

Permitting Guidance Document for Michigan Wineries

Michigan DEQ Permit Program
Guidance Document for Michgian Wineries