SVZ-USA, INC.

OTHELLO, WASHINGTON

LAND TREATMENT REPORT FOR 2022
& CROP MANAGEMENT PLAN FOR 2023

Washington State DOE Discharge Permit No. ST8077

prepared by

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1. INTRODUCTION

The SVZ-USA Inc. processing plant in Othello, Washington, produces fruit and vegetable juice concentrates and purees from fresh and frozen produce. The wastewater produced from the process is treated by a combination of land application and discharge to the City of Othello publicly owned wastewater treatment facility. This crop management plan was developed to meet Washington State D.O.E. permit ST-8077 requirements for that portion of the wastewater treated by land application. The specific information included was obtained through site visits by Soiltest staff, and by verbal and written information obtained from SVZ staff and the farm operator.

The goal of land application of wastewater is to match the application of the waste constituents to the uptake or consumption of the constituents by crops, soil micro-organisms and natural chemical precipitation or adsorption processes of the soil to which it is applied. Managing applications requires first measuring the application to the land of wastewater and other constituents and, second, measuring the constituent removal rate by the crops which are grown. The net loading rates are calculated as the difference between additions and removals. Some estimation is involved in calculating applications and removals. The inactivation rate of constituents by internal soil processes is not precisely known for most conditions. Consequently, periodic soil testing is used to monitor concentrations of wastewater constituents in the soil through time to determine whether labile concentrations are increasing or decreasing. Estimates can then be made regarding the likelihood of deleterious effects on soil properties or potential negative impacts. Monitor wells are used to further evaluate impacts on ground water due to the application of wastewater.

Typically, a few key constituents can be identified and used as indicators for these studies. The constituents of concern with the effluent generated by the SVZ-USA plant in Othello are nitrogen (N), water, sodium (Na), biological oxygen demand (BOD) and total salts (specifically fixed dissolved solids, FDS). These constituents are the most likely to cause soil, environmental, or plant growth problems. SVZ has made an agreement with the City of Othello to treat a portion of the wastewater generated by SVZ to increase capacity and reduce field loading rates. A small portion of the waste stream was initially treated by Othello in 2016, more in 2017 and all of the wastewater was treated by the Othello POTW in 2018. In 2022 approximately 71% of the wastewater produced was land applied.

1.1 Treatment System

The water management system at SVZ Foods consists of a lined reservoir capable of holding approximately 7.7 million gallons (MG) of plant effluent in its two chambers. A large chamber on the north end holds 7.0 MG and a small chamber equipped with aerators on the south end holds the balance. The effluent in the large chamber is connected by a control valve to a wet well where a pump is situated to pressurize the center-pivot sprinkler systems of the land application fields or to discharge to the City of Othello. Fresh water from the East Columbia Irrigation District can be admitted by means of a control valve into the wet well if supplemental water is needed for the crop. The supplemental water is not blended with the process water at the wet well as the valve controls are set to only admit 100% wastewater or 100% Irrigation District water.

Two fields make up the land treatment site. At the beginning of 2021, three half-circle, center pivot irrigation systems were installed in the two fields (Figure 1). Field 1 lies immediately east of the SVZ facility and encompasses 15.9 acres comprised of two half pivots, Circle 1 (8.6 acres) and Circle 2 (7.3 acres). Field 3 lies east of the lagoon and north of Field 1; it comprises Circle 3 (16.7 acres). Fields 1 and 3 were seeded to alfalfa hay in the spring of 2021. A third field, Field 2, comprises 2.5 acres and is left to native grasses and weeds. It can be watered with a solid set sprinkler system; however, the sprinkler system is in disrepair and the site has only been used for equipment storage. The soil at Field 2 is generally quite shallow, barely one foot in depth. Because of its small size and shallow soil, Field 2 has never been utilized for land treatment by SVZ and is not anticipated to be used.

1.2 Irrigation Efficiency and Uniformity

The fraction of pumped irrigation water that enters and stays in the root zone of the growing crop is the application efficiency. The typical application efficiency for sprinkler irrigation ranges from 60% to 95%[1] depending on system type, design, maintenance, weather, and run-off conditions. On average, center pivot systems operate at approximately 75%-85% overall efficiency, much more efficient than the wheel line systems previously used. Because the system is brand new and the land treatment site is nearly level and no runoff typically occurs, an efficiency factor of 85% is estimated to be appropriate for the center pivot systems installed on Fields 1 and 3.

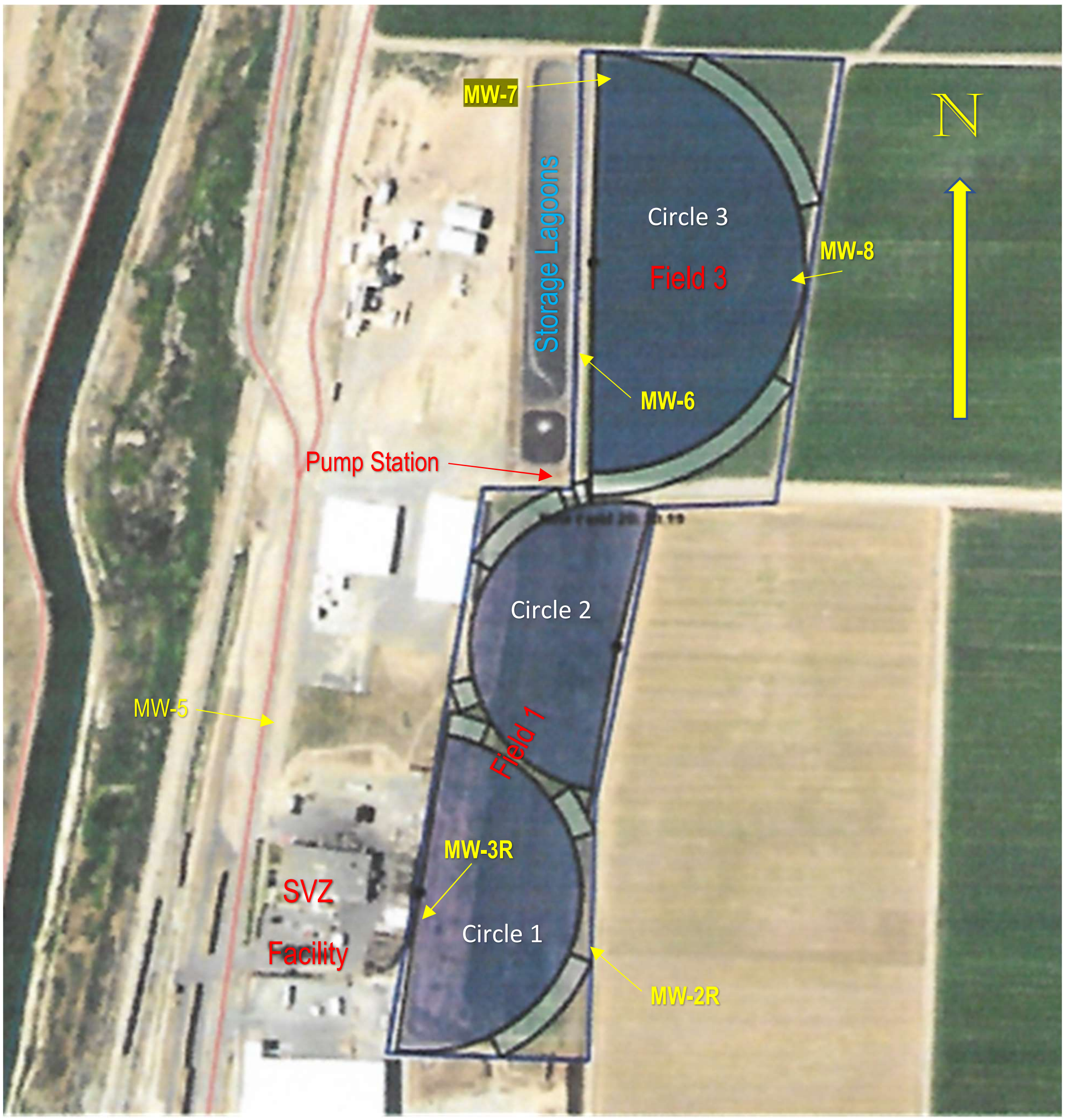
1.3 Irrigation Timing

The application of irrigation water is based upon crop need and soil storage. Crop water use or evapotranspiration (ET) is a function of the crop, crop health, the growth stage, soil moisture and prevailing weather conditions. Specific crop water consumption is calculated in Table 1 for conditions in 2022. Soil moisture storage is dependent upon

[1]USDA, NRCS. National Engineering Handbook, Irrigation Guide. 1997.

the texture, structure, organic matter content, coarse fragment content, and depth of the soil.

FIGURE 1: MAP OF SVZ-USA LAND TREATMENT SITE



The basic premise of irrigation frequency is to irrigate before the crop experiences water stress. When crop water use has depleted the available water to approximately 60% of field capacity in the root zone an irrigation should be initiated to minimize crop stress. To avoid excessive leaching, the amount of water applied in any irrigation should be limited to the amount of the available water holding capacity not already filled (e.g., 40% of the available water holding capacity).

In 2012, a consultant was hired to assist with irrigation timing. Irrigations were planned using dielectric soil moisture probes connected to data loggers and automatic rain gages in conjunction with ET data obtained from the WSU-Othello Experiment Station. In 2015, the loggers were updated to enable connection to a website where soil moisture, rain gage output and temperatures can be viewed in real-time. Reports are generated with suggested irrigation times and amounts (Figures 2A & 2B).

2. SOIL FACTORS

The physical and chemical characteristics of the soil determine the suitability of the site for land treatment purposes. Of primary concern is the suitability of the site for crop production. Specific soil properties determine the management strategies to be employed during the land treatment process.

Field 1 of the SVZ, Othello site is well suited for crop production and land treatment uses. The slope is nearly level. The nearest surface water is the Potholes Canal of the Columbia Basin Irrigation District. The shallow lakes of the Potholes area are located approximately one mile north and west of the site. Ground water is not found near enough to the surface to interfere with cropping activities. Soil drainage is good, neither excessive nor poor. No areas of salt accumulation or other undesirable chemical characteristics are naturally found. Soil depth to cobbly substratum is a bit shallow in places for root crops, but adequate for forage and grain crops. Yields of production crops at the site have been near Columbia Basin averages. Although Field 2 has never been used for wastewater treatment, grain and forage crops could be grown. The shallow soil of Field 2 will limit the productive capacity of the field and will also require careful water management to avoid excessive leaching or ponding at the site. The soil of Field 3 is like that of Field 1 only it grades to deeper soil as it progresses northward. Although still too rocky for root crop production, Field 3 has a higher yield potential than Field 1 due to greater soil depths. The discharge permit requests soil monitoring to a depth of 6 feet. Cobbles and large gravel cause auger refusal often at depths of 2 ft in Fields 1 and 3. Occasionally, a site is sampled where the auger passes between stones and can penetrate deeper.

FIGURE 3: SUMMARY OF SOIL TEST MONITORING

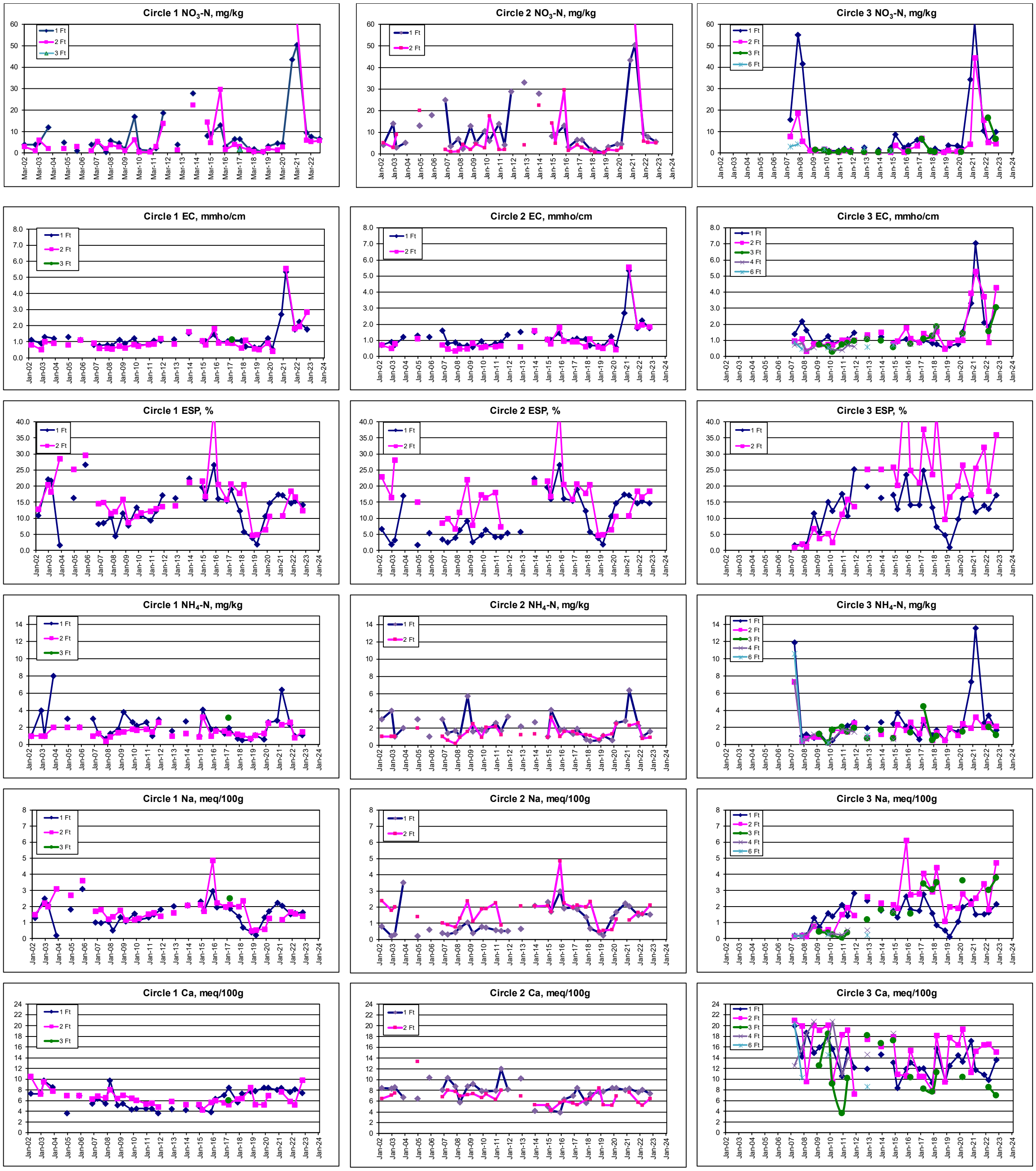


FIGURE 3: SUMMARY OF SOIL TEST MONITORING (CONTINUED)

2.1 Infiltration Rates and Water Holding Capacity

The soil at the land treatment site is predominantly Scooteney loam. The water infiltration rate ranges from 0.8 to 2.5 inches per hour. The available water holding capacity of the loam soils at the land treatment site are approximately 2.0 inches of water per foot of topsoil and approximately 1.0 inch per foot for the cobbly and gravelly subsoil.[2] Site investigations have revealed the depth to cobbly subsoil ranges from 12 to 30 inches, with the soil depth greatest at the northeast edge of the area. The irrigations are managed for a depth of 24 inches as that is the maximum average soil depth of the two functioning fields.

2.2 Compaction and Puddling Potential

The soils at the land treatment site have loam and gravelly loam textures. In addition, the soils have low to moderate organic matter and low clay content. Consequently, the soils have a moderately strong soil structure and tend not to compact easily. Compaction can be ameliorated by minimizing traffic, eliminating traffic during wet periods, and by maintaining a perennial crop to maximize root structure.

Generally, sodium becomes problematic when the exchangeable sodium percentage (ESP) reaches 15% in the surface soil. The soil at the land treatment site contains sufficient clay and has moderate enough slopes that 15% is the appropriate maximum for ESP. This level of sodium should not be exceeded in the surface soils at the SVZ land application site to avoid possible infiltration problems. Elevated soil salinity can facilitate infiltration when the ESP is greater than 15%; however, excessively high salinity levels can impede crop production. Should sodium approach problematic levels in the surface soils, gypsum (calcium sulfate) can be applied to maintain or improve soil structure. Controlled leaching events should be planned to remove excess sodium sulfate from the surface horizon of the soil.

2.3 Soil Monitoring

The soils of the treatment fields have been monitored for many years. The permit guidelines require that the fields be sampled to a depth of 6 feet twice each year: once prior to the initiation of crop growth in the spring and again in the fall after the last harvest is completed. Field 2 has not been sampled for several years because equipment has been stored on the site, which precluded access to some of the monitoring locations. The site has only been used for equipment storage and no plans exist to grow crops on the site or to apply process wastewater on Field 2: it was decided that monitoring the soil of the field was unnecessary. In 2007 soil monitoring was initiated on Field 3, which was added to the treatment system. Although the soil column extends to a depth of 6 feet, the rocky and gravelly nature of the soil inhibits

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[2] Soil Survey of Adams County Washington. USDA SCS. 1967.

auger penetration to that depth most of the time. By happenstance a sampling site will be chosen that allows the auger to slip between the rocks and reach a depth greater than 2 feet. This occurred once in 2017 in Circle 1. A sampling depth of 6 feet was achieved at one location in Circle 3 only four times since 2007. In 2022, sampling depths of 2 feet were achieved in Circle 1 and 3 feet in Circle 3. The sampling sights were split up in 2021 to reflect the management change from 2 Fields to 3 Circles. As Circles 1 and 2 are within Field 1, they have a shared soil testing history until 2021.

The soil test reports from 2022 are included in the Appendix. Graphical summaries of all constituents can be found in Figure 3. In addition to the constituents charted in Figure 3, each soil sample is checked for the presence of ferrous iron using a dipyridyl reagent in the field. All soil samples at all sampling events tested negative for the presence of ferrous iron in 2022. No positive test for ferrous iron has been obtained since monitoring began in 2012. A brief discussion of significant soil trends is provided below.

Soil nitrate levels at the surface have been typically cyclical in nature. Field 2 monitoring ended in 2012 when 1-ft soil nitrate was at an all-time high for unknown reasons (this field was never utilized). Nitrate in Circle 1 has been low and stable for the last 4 years. Soil nitrate in Circle 3 has been low and stable since shortly after it's addition to the treatment system in 2007; however, in 2021, nitrate at 1- and 2- foot depths spiked at 60 and 45 mg/kg, respectively. Soil nitrate concentration is affected by the addition of fertilizer, irrigation and crop growth. If a crop does not grow well and is not harvested, nitrate will accumulate. No harvests were made in 2020, so an accumulation of soil nitrate would be expected. Field 1 (Circles 1 and 2) was replanted several times over the years. The minimal crop growth during replanting cannot remove all the nitrogen mineralized from the organic matter and is the likely cause of the spikes in nitrate. The establishment of a stable crop will usually result in minimal residual soil nitrogen. The newly now-established alfalfa that was planted in 2021 has brought nitrate levels in all Circles to below 10 mg/kg as of the 10/22 sampling.

Soil salinity is monitored by measuring the electrical conductivity (EC) of the soil solution. EC levels below approximately 4 mmho/cm will not injure or reduce yields of most crops: until 2021, the EC of all Circles were well below this threshold. The EC of all Circles spiked in the spring of 2021. It is likely that the lack of irrigation and crop growth in 2020 resulted in salt accumulation. 2022 monitoring shows the EC of Circles 1 and 2 returned to acceptable limits while Circle experienced another small spike; however, salinity stayed below 4 mmho/cm.

Sodium is monitored by extractable sodium and by the exchangeable sodium percentage (ESP, which is the extractable sodium divided by the cation exchange capacity, CEC). ESP is of greatest concern in the surface layer of the soil where it can impact water infiltration. ESP of all three Circles have historically exceeded the critical level of 15% at various times and at both depths monitored. Circles 1 and 2 have a stable trend for ESP since 2020, hovering around the critical limit since. Circle 3 has had no real trend but measured over the critical level multiple times over the last 7 years; ESP in the first foot has stayed near the critical limit since 2020 while the ESP in the second foot has continued to increase. High ESP in the subsoil is not as concerning as at the surface where water infiltration is most sensitive. No infiltration problems have been observed. Gypsum has been applied periodically to manage ESP and maintain adequate water infiltration rates. A portion of the wastewater has been sent to the City of Othello since 2016. The combination of gypsum applications and declining wastewater loading since 2016 have resulted in the improving or at least stabilizing ESP conditions of the soils in recent years. A gypsum application of approximately 2,500 pounds/ac is recommended for all Circles for 2023.

The levels of other cations (Ca, Mg, K) and sulfate-S in the soil show no trends and are found at normal levels. The soil total nitrogen values (also called Total Kjeldahl Nitrogen or TKN) for all Circles demonstrate a slightly increasing trend. Total phosphorus (Total P) demonstrates no trend. Soil organic matter (OM) is fairly consistent; the concentration seems to be increasing in Circle 3 the last several years. It is desirable to have a high OM level in the soil as it improves structure, water and gas infiltration, microbial activity and acts to store plant nutrients.

3. CROP WATER MANAGEMENT

A balance sheet approach is used for water management analysis in this report. The inputs are identified and quantified. Losses or consumption are quantified and subtracted from the additions. The water balance is calculated and discussed in relation to leaching requirements and crop health and production.

3.1 Crop Water Use and Irrigation Requirement

Alfalfa hay was seeded into Fields 1 and 3 in the spring of 2021. The 2022 monthly and annual water consumption for alfalfa hay for each of the circles can be found in Table 2. Precipitation is subtracted from ET to calculate the Rainfall Balance. Excess precipitation is carried over into the subsequent month to reflect soil storage. The irrigation requirement is calculated from the rainfall balance using a net system application efficiency of 85%. This efficiency may adequately cover some of the needed leaching requirements; however, soil test data will be used to determine the need for additional planned leaching events. In a typical season, alfalfa may utilize 42 inches of water and require 50 inches of irrigation water. The summer weather of 2022 was moderate: total annual rainfall was 5.9 inches; consumptive water use was approximately 38.2 inches. The irrigation requirement was approximately 39.6 inches. Figures 2A & B demonstrate the irrigation management reports showing ET (brown bars), irrigation (blue bars),and soil moisture (red, green and blue lines).

FIGURE 2A: EXAMPLE IRRIGATION MANAGEMENT REPORT FOR FIELD 1

soiltest farm consultants, inc.

2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

Irrigation Summary & Recommendation

SVZ
ALFALFA
Field 1 S

Rooting Depth		24 Inches
GPM:	260	
Acres:	30	

Soil Type & Water Holding Capacity

Soil Depth, in.	4	12	24	36
AWHC, in/increment	0.80	1.60	2.30	2.40

0.39 inches/24 hrs @ 85% Efficiency
2.5 hours @ 100%

Weekly Reporting

DATE	WATER USE, INCHES Last Week	Next Week	APPLIED INCHES	% of field capacity 4"	12"	24"	MOISTURE GOAL	RECOMMENDATION SYSTEM	INCHES	HRS.	REVS	%	Rain Only
31-Oct	0.00	0.00	0.30	95%	73%	71%	85%	9-00	0.45	27	0	0	0.00
CUMLATIVE:	24.62		21.31										
		Rainfall:	2.18										
		Irrigation:	19.13										

2022 Report

Run 0 sets @ 24 hrs each and 0 sets @ 16 hrs each and 0 sets@ 8 hrs each

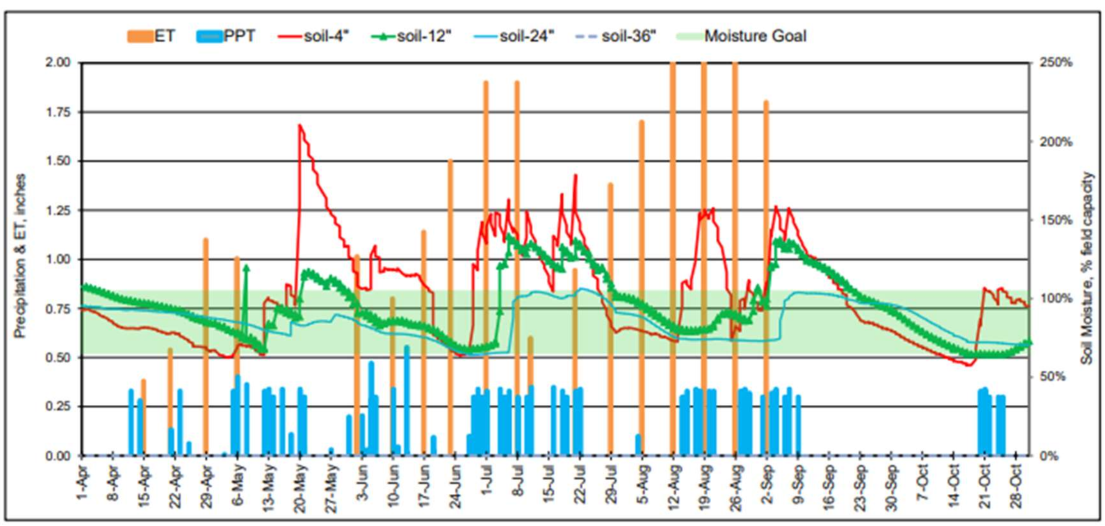


FIGURE 2B: EXAMPLE IRRIGATION MANAGEMENT REPORT FOR FIELD 3

soiltest
farm consultants, inc.
2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

Irrigation Summary & Recommendation

SVZ
ALFALFA
Field North 3 N

Rooting Depth		24 Inches
GPM:	300	
Acres:	15	

Soil Type & Water Holding Capacity

Soil Depth, in.	4	12	24	36
AWHC, in/increment	0.80	1.60	2.30	2.40

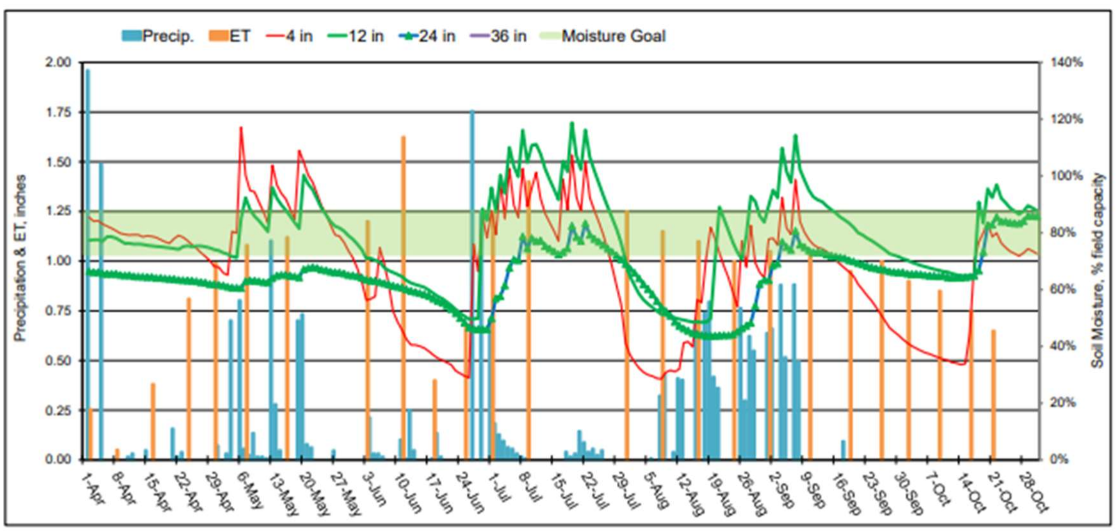
0.85 inches/24 hrs @ 80% Efficiency
6.5 hours @ 100%

Weekly Reporting

DATE	WATER USE, INCHES Last Week	WATER USE, INCHES Next Week	APPLIED INCHES	% of field capacity 4"	% of field capacity 12"	% of field capacity 24"	MOISTURE GOAL	RECOMMENDATION SYSTEM	RECOMMENDATION INCHES	RECOMMENDATION HRS.	RECOMMENDATION REVS	RECOMMENDATION %	Rain Only
21-Oct	***0.65***	***0.36***	***0.00***	***79%***	***92%***	***83%***	***80%***	***9-00***	***0.11***	***3***	***6***	***1288***	***0.00***
CUMLATIVE:	22.93		25.36										
		Rainfall:	2.22										
		Irrigation:	23.14										

2022 Report

Run 4 *sets @* 24 *hrs each* *and* 0 *sets @* 16 *hrs each* *and* -12 *sets@* 8 *hrs each*



3.2 Water Balance

In 2022, the total wastewater flow from the SVZ processing facility to the lagoon was 37.3 MG (Table 1A), 4.1 MG more than last year. Approximately 21.4 MG of wastewater (71% of the total) was pumped from the lagoon and land applied, 6.8 MG less than last year. The wastewater that was sent to the lagoon and then on to the City of Othello for treatment was approximately 6.3 MG, leaving an estimated 1.7 MG in the lagoon as change in storage (see Figure 4). There were some issues with the flow meter measuring the wastewater discharge to the lagoon starting in November of 2022 and was replaced. It ultimately failed in February 2023 and was replaced. It is possible that some of the 1.7 MG of storage increase was due to readings from a failing meter; however, with multiple meters involved in the various measurements, some discrepancies are bound to occur in the balance calculations. Flow meter data show that 9.5 MG of fresh water was applied to the fields in 2022, 4.6 MG less than that applied last year. Flow meters are placed to measure all water applied to each field, but not each circle. Estimates were made based on acreage covered to split the water sent to Field 1 between Circle1 and Circle 2.

The water balances for each circle are calculated in Table 2. It is estimated that the alfalfa in Circles 1 and 2 transpired 38.2 inches of water and that the irrigation requirement was 39.6 inches. Approximately 37.5 inches of water were applied to Circle 1; wastewater comprised 28.8 inches (77%) of this total. An additional 5.9 inches of rainfall was received. The water balance indicates that the field was under-irrigated by 2.1 inches (negative balance). The water balance was significantly positive during the months of March, May and October. Deficit irrigation was practiced for the remaining 5 months of the irrigation season.

The consumptive use and irrigation requirement in Circle 3 was the same as for Circles 1 and 2 because alfalfa is the common crop. The hydraulic loading for Circle 3 was 44.0 inches; wastewater comprised 31.4 inches (71%) of this total. The irrigations exceeded consumptive use by 4.4 inches for the year. March and October were the only months with significant positive water balances; deficit irrigation was experienced during 5 months of the irrigation season. The 2021 management plan recommended applying 14.4 inches of wastewater to each circle in 2022. Wastewater loading to all three circles was approximately twice of that planned in 2021.

The leaching requirement is estimated to be 6% as calculated from the water quality parameters in Tables 1A and 1B and an average mix of 66% wastewater in all water, including rainfall. The leaching requirement is the same for all three circles as they receive water from the same sources at nearly the same ratios; further, they are planted to the same crop and the soil is substantially consistent across both fields. The maximum desirable saturated paste EC for both fields was set at 3.5 mmho/cm for the calculation. As the EC of neither the supplemental water nor the wastewater is measured, it was estimated using a commonly used general relationship: EC=TDS/640.

Since we generally are concerned with FDS in vegetable wastewater, the same formula was applied using FDS rather than TDS. As indicated in Table 2, wastewater made up 75% of all irrigation water applied to the fields on average. The weighted average EC for all the rain and irrigation water applied to the field is then 1.0 mmho/cm. The Leaching Requirement is calculated by the following relationship:

> LR= ECw / [(5xECw) – ECe],
>
> where LR is Leaching Requirement; ECw is the EC of the average water applied; ECe is the maximum allowable EC of the soil solution. Inserting the values discussed yields a LR of 6.0%.

The 2022 leaching requirement is nearly identical to that calculated for 2021.

FIGURE 4: SVZ WASTEWATER PRODUCTION AND DISTRIBUTION

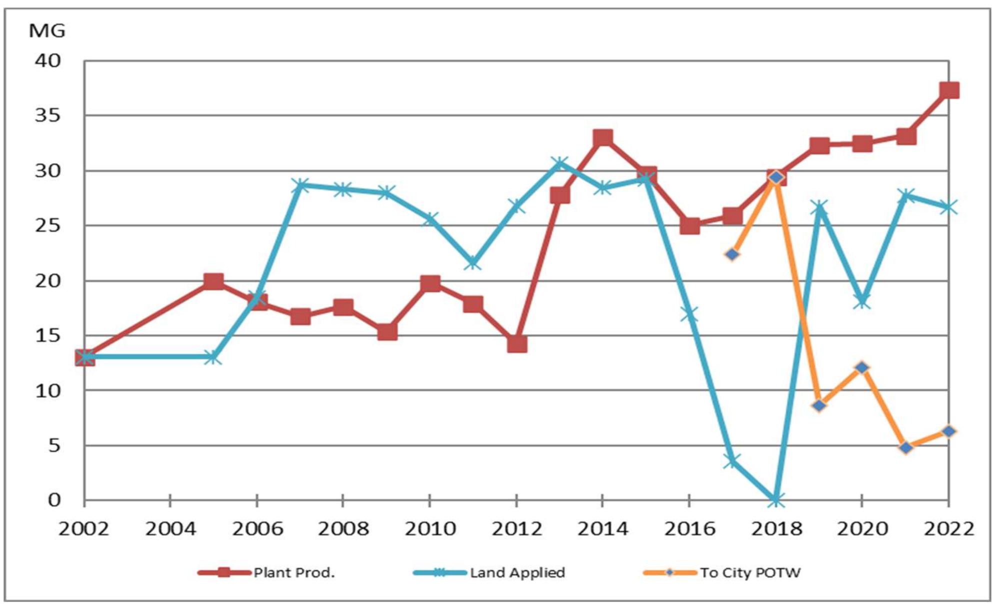


TABLE 1A: WASTEWATER PRODUCTION AND LAND APPLICATION TOTALS

	PLANT PROCESS WATER PRODUCTION		IRRIGATION WASTEWATER								
			AVERAGE MONTHLY ANALYSES, mg/L							LAND-APPLIED	
MONTH	MG	Ac-Ft	TKN	BOD	COD	sBOD	FDS	Na	NH4-N	MG	Ac-Ft
JAN	3.313	10.168								0.000	0.00
FEB	2.064	6.336								0.000	0.00
MAR	3.487	10.700	9	204	609	168	727	293	2.1	4.163	12.78
APR	2.488	7.636								0.000	0.00
MAY	2.520	7.732	25	570	1,310	370	977	293	1.3	3.584	11.00
JUN	2.941	9.026								5.312	16.30
JUL	3.462	10.624	12	117	202	118	1,062		1.8	4.512	13.85
AUG	4.260	13.073	18	45	270	45	983		4.3	2.401	7.37
SEP	3.199	9.817	18	45	270	45	983	283	4.3	1.694	5.20
OCT	3.631	11.142	14	57	277	37	832		1.3	4.994	15.32
NOV	3.238	9.937								0.000	0.00
DEC	2.740	8.409								0.000	0.00
AVG	3.112	9.550	16	173	490	131	927	289	2.5	2.222	6.818
			TOTAL LAND APPLIED, LBS								
TOTAL	37.343	114.60	2,736	32,434	88,660	24,410	162,627	63,999	380	26.660	81.815

Notes: Plant wastewater was used for irrigation all season excluding April and June; an additional 9.493 MG of supplemental irrigation district water was also applied.

Est. Lagoon Evaporation Loss	
2.70	Mgal

TABLE 1B: SUPPLEMENTAL WATER TOTALS

	units	result	MGal Applied		Total Pounds Applied
NITRATE-N	mg/L	**0.04**			
TKN	mg/L	**0.30**			
NITROGEN	mg/L	**0.3**	**9.49**	**Nitrogen**	**26.9**
TDS (salts)	mg/L	**117**		**TDS**	**9263**
Sodium (Na)	mg/L	**0.1**		**Sodium**	**8**

Note: Green indicates that MDL was used in place of non-detect for calculation purposes.

TABLE 2: HYDRAULIC LOADING SUMMARY

CIRCLE 1 (S) 8.6 acres

MONTH	Consump-tive Use ac-in/ac	Precip-itation ac-in/ac	Rainfall Balance ac-in/ac	Irrigation Req't at 85% Efficiency ac-in/ac	Irrigation ac-in/ac	Irrigation ac-in/ac	Irrigation ac-in/ac	Balance w/Precip. ac-in/ac
JAN	0.12	0.29	0.2	0.0	0.0	0.0	0.0	0.0
FEB	0.37	0.17	-0.2	0.2	0.0	0.0	0.0	-0.2
MAR	0.87	0.52	-0.4	0.4	4.2	0.0	4.2	3.7
APR	1.40	1.08	-0.3	0.4	0.0	0.0	0.0	-0.4
MAY	4.36	0.61	-3.8	4.4	5.3	0.5	5.8	1.4
JUN	6.50	0.95	-5.6	6.5	7.3	0.0	7.3	0.8
JUL	8.04	0.31	-7.7	9.1	3.9	1.9	5.8	-3.3
AUG	7.96	0.01	-8.0	9.4	2.2	4.0	6.1	-3.2
SEP	5.63	0.11	-5.5	6.5	1.5	0.0	1.5	-5.0
OCT	2.54	0.26	-2.3	2.7	4.4	2.4	6.7	4.1
NOV	0.33	0.69	0.4	0.0	0.0	0.0	0.0	0.0
DEC	0.11	0.92	0.8	0.0	0.0	0.0	0.0	0.0
YEAR	**38.24**	**5.92**	**-32.3**	**39.6**	**28.8**	**8.8**	**37.5**	**-2.1**

Total Hydraulic Load, ac-in/ac.	**37.5**	**2021 Load**	**40.3**	**WW from 2021 plan, in.**	**14.4**
Hydraulic Load Limit, ac-in/ac.	**30.0**	**% Change**	**93%**	**change fron planned**	**199.7%**
% of Limit ac-ft/ac	**125%**			**Process, % of Total**	**77%**
% of Irrig Reqirement	**95%**			**Leaching Fraction as-applied**	**-5.2%**
				Calculated Leaching Requirement	**6.0%**

CIRCLE 2 (Mid) 7.3 acres

MONTH	Consump-tive Use ac-in/ac	Precip-itation ac-in/ac	Rainfall Balance ac-in/ac	Irrigation Req't at 85% ac-in/ac	Irrigation ac-in/ac	Water ac-in/ac	Loading ac-in/ac	Balance ac-in/ac
JAN	0.12	0.29	0.2	0.0	0.0	0.0	0.0	0.0
FEB	0.37	0.17	-0.2	0.2	0.0	0.0	0.0	-0.2
MAR	0.87	0.52	-0.4	0.4	4.2	0.0	4.2	3.7
APR	1.40	1.08	-0.3	0.4	0.0	0.0	0.0	-0.4
MAY	4.36	0.61	-3.8	4.4	5.3	0.5	5.8	1.4
JUN	6.50	0.95	-5.6	6.5	7.3	0.0	7.3	0.8
JUL	8.04	0.31	-7.7	9.1	3.9	1.9	5.8	-3.3
AUG	7.96	0.01	-8.0	9.4	2.2	4.0	6.1	-3.2
SEP	5.63	0.11	-5.5	6.5	1.5	0.0	1.5	-5.0
OCT	2.54	0.26	-2.3	2.7	4.4	2.4	6.7	4.1
NOV	0.33	0.69	0.4	0.0	0.0	0.0	0.0	0.0
DEC	0.11	0.92	0.8	0.0	0.0	0.0	0.0	0.0
YEAR	**38.24**	**5.92**	**-32.3**	**39.6**	**28.8**	**8.8**	**37.5**	**-2.1**

Total Hydraulic Load, ac-in/ac.	**37.5**	**2021 Load**	**43.4**	**WW from 2021 plan, in.**	**14.4**
Hydraulic Load Limit, ac-in/ac.	**30.0**	**% Change**	**86%**	**change fron planned**	**199.7%**
% of Limit ac-ft/ac	**125%**			**Process, % of Total**	**77%**
% of Irrig Reqirement	**95%**			**Leaching Fraction as-applied**	**-5.2%**
				Calculated Leaching Requirement	**6.0%**

CIRCLE 3 (N) 16.7 acres

MONTH	Consump-tive Use ac-in/ac	Precip-itation ac-in/ac	Rainfall Balance ac-in/ac	Irrigation Req't at 85% ac-in/ac	Irrigation ac-in/ac	Water ac-in/ac	Loading ac-in/ac	Balance ac-in/ac
JAN	0.12	0.29	0.2	0.0	0.0	0.0	0.0	0.0
FEB	0.37	0.17	-0.2	0.2	0.0	0.0	0.0	-0.2
MAR	0.87	0.52	-0.4	0.4	5.2	0.0	5.2	4.8
APR	1.40	1.08	-0.3	0.4	0.0	0.0	0.0	-0.4
MAY	4.36	0.61	-3.8	4.4	2.9	0.4	3.3	-1.1
JUN	6.50	0.95	-5.6	6.5	4.7	0.0	4.7	-1.8
JUL	8.04	0.31	-7.7	9.1	6.2	2.9	9.1	0.0
AUG	7.96	0.01	-8.0	9.4	3.2	5.2	8.4	-1.0
SEP	5.63	0.11	-5.5	6.5	2.3	0.0	2.3	-4.2
OCT	2.54	0.26	-2.3	2.7	6.8	4.1	11.0	8.3
NOV	0.33	0.69	0.4	0.0	0.0	0.0	0.0	0.0
DEC	0.11	0.92	0.8	0.0	0.0	0.0	0.0	0.0
YEAR	**38.24**	**5.92**	**-32.3**	**39.6**	**31.4**	**12.6**	**44.0**	**4.4**

Total Hydraulic Load, ac-in/ac.	**44.0**	**2021 Load**	**28.7**	**WW from 2021 plan, in.**	**14.4**
Hydraulic Load Limit, ac-in/ac.	**30.0**	**% Change**	**153%**	**change fron planned**	**199.7%**
% of Limit ac-ft/ac	**147%**			**Process, % of Total**	**71%**
% of Irrig Reqirement	**111%**			**Leaching Fraction as-applied**	**11.1%**
				Calculated Leaching Requirement	**6.0%**

(ET and Precip. data from AgWeatherNet Othello)

4. NUTRIENT MANAGEMENT

A balance sheet approach is used for nutrient management analysis in this report, like the method used for water management. The inputs are identified and quantified. Losses and removals are also identified, quantified and compared to projections from last year. Finally, a balance is calculated and discussed in comparison to soil test results.

4.1 Constituent Additions

Significant amounts of wastewater were applied to both of the treatment fields (all three circles) in 2022 (Table 2), double that planned in the 2021 annual report. Thus, the nutrients and salts included in the wastewater were also applied (Table 1A). The nitrogen and salts contained in the supplemental fresh water added little to the loadings (Table 1B). No commercial fertilizer applications were made; however, 1 ton/ac of gypsum was applied to all circles to counteract sodium accumulations.

Gross nitrogen additions from wastewater were 80 lbs-N/ac to Circle 1, 80 lbs-N/ac to Circle 2, and 88 lbs-N/ac to Circle 3. None of the N loading exceeded the design N loading of 165 lbs-N/ac. Fresh water nitrogen additions were negligible at approximately 1 lbs-N/ac. Salt (FDS) additions from wastewater were 4,763 lbs/ac (14 lbs/ac-day) to Circles 1 and 2, and 5,203 lbs/ac (15 lbs/ac-day) to Circle 3. All salt loadings exceeded the 4,000 lbs/ac-yr or 11 lbs/ac-day design maximum. Salt loading from supplemental water was approximately 300 lbs/ac. Negligible sodium loading was derived from the supplemental water; however, wastewater added 1,875 lbs-Na/ac to Circles 1 and 2, and 2,048 lbs/ac to Circle 3. Circles 1 and 2 received 950 lbs/ac (4 lbs/ac-day) of BOD from wastewater and Circle 3 received 1,038 lbs/ac (4 lbs/ac-day). All BOD loading values are well below the 100 lbs/ac-day design maximum. Loading trends are plotted in Figure 5.

4.2 Constituent Losses and Harvest Removals

Nitrogen loss from denitrification and volatilization can result in relatively low uptake efficiencies under fertigation with wastewater containing high BOD. No losses are deducted in Table 1A or 1B, but in calculating the total loading in Table 4 the sums were adjusted by the following nitrogen use efficiencies: 75% of the wastewater-N and 85% of the fresh water-N and fertilizer-N were carried into the total (Allison, F.E. 1965. *Evaluation of Incoming and Outgoing Processes That Affect Soil Nitrogen*, in Soil Nitrogen. Agronomy Monograph 10, Bartholomew, W.V. & Clark, Francis E. eds. American Society of Agronomy, Madison, WI).

Table 3 summarizes the harvest removal of selected constituents in the harvested portion of the crop. Yields and analyses from each harvest were used to calculate constituent removals. On average, 329 lbs-N/ac and 977 lbs-salt/ac were removed in harvests. Sodium removal was much less at 31 lbs/ac. Chloride removal was estimated to be 41 lbs/ac as no harvest analyses were made in 2022.

FIGURE 5: WASTEWATER CONSTITUENTS LAND APPLIED

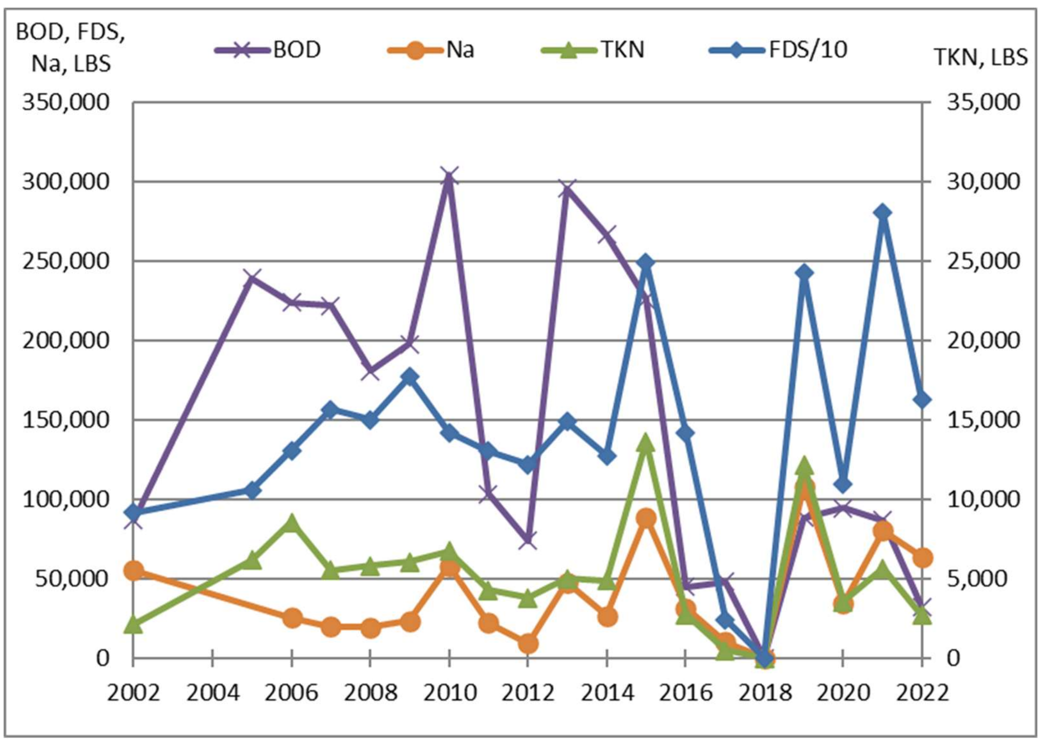


TABLE 3: HARVEST REMOVAL TOTALS

							---------------------------- %, TOTAL ANALYSIS -----------------------------------				
FIELD	**CROP**	**YIELD, lbs**	**DM**	**N**	**P**	**Na**	**Ca**	**Mg**	**K**	**Cl**	**Ash**
CIRCLE 1 (S)		**8.6 acres**									
1st Cutting	Alfalfa	38,937	19.8%	3.66%	0.34%	0.26%	0.67%	0.19%	2.73%	0.43%	11.1%
2nd Cutting	Alfalfa	37,988	92.0%	2.75%	0.34%	0.26%	0.91%	0.25%	3.15%	0.43%	9.4%
3rd Cutting	Alfalfa	37,988	93.2%	2.93%	0.28%	0.30%	0.98%	0.20%	2.61%	0.43%	10.5%
4th Cutting	Alfalfa	16,620	85.6%	3.84%	0.39%	0.54%	1.28%	0.26%	4.01%	0.43%	10.6%
Total	lbs	131,533									
	t/ac	7.65									
Net Removal	**lbs/ac**		**10,731**	**329**	**35**	**34**	**105**	**24**	**326**	**46.1**	**1,089**
CIRCLE 2 (Mid)		**7.3 acres**									
1st Cutting	Alfalfa	33,052	19.8%	3.66%	0.34%	0.26%	0.67%	0.19%	2.73%	0.43%	11.1%
2nd Cutting	Alfalfa	32,245	92.0%	2.75%	0.34%	0.26%	0.91%	0.25%	3.15%	0.43%	9.4%
3rd Cutting	Alfalfa	32,245	93.2%	2.93%	0.28%	0.30%	0.98%	0.20%	2.61%	0.43%	10.5%
4th Cutting	Alfalfa	14,107	85.6%	3.84%	0.39%	0.54%	1.28%	0.26%	4.01%	0.43%	10.6%
Total	lbs	111,650									
	t/ac	7.65									
Net Removal	**lbs/ac**		**10,731**	**329**	**35**	**40**	**123**	**29**	**384**	**54.4**	**1,283**
CIRCLE 3 (N)		**16.7 acres**									
1st Cutting	Alfalfa	75,611	13.2%	3.4%	0.31%	0.41%	0.94%	0.18%	2.86%	0.43%	12.0%
2nd Cutting	Alfalfa	73,767	92.2%	3.1%	0.37%	0.25%	1.13%	0.26%	3.32%	0.43%	9.0%
3rd Cutting	Alfalfa	73,767	93.2%	2.9%	0.28%	0.30%	0.98%	0.20%	2.61%	0.43%	10.5%
4th Cutting	Alfalfa	32,273	86.4%	3.8%	0.37%	0.56%	1.05%	0.26%	4.13%	0.43%	10.8%
Total	lbs	255,418									
	t/ac	7.65									
Net Removal	**lbs/ac**		**10,457**	**331**	**35**	**18**	**58**	**13**	**173**	**23.8**	**558**

Note: Yield data and analyses for individual harvests were utilikuzed where available. Cl was not tested and is estimated from previous years.

4.3 Constituent Balances

The nutrient balances are calculated for all 3 circles in Table 4. In these calculations, it was assumed that 100% of all constituents, except nitrogen as explained above, passed through the conveyance and application system and entered the soil. Positive values in the balance rows in Table 4 indicate an accumulation of constituents in the soil of the land treatment field. The N loading rates were all down from last year and N removal in harvests up. The average nitrogen balance was -267 lbs-N/ac. Seldom does harvest removal of salts exceed loading. Circles 1 and 2 received a net loading of 3,907 and 3,713 lbs/ac of salts, respectively. Circle 3 received a net load of 4,978 lbs/ac of salt. More sodium was also applied than removed in harvests: Circles 1 and 2 had balances of approximately 1,840 lbs/ac balance of sodium and Circle 3 had a 2,030 lbs/ac balance. Historical nitrogen and salt removals and balances are summarized in Figure 6. Loading in 2022 was down significantly from 2021.

FIGURE 6: NITROGEN AND SALT REMOVAL & NET APPLICATION

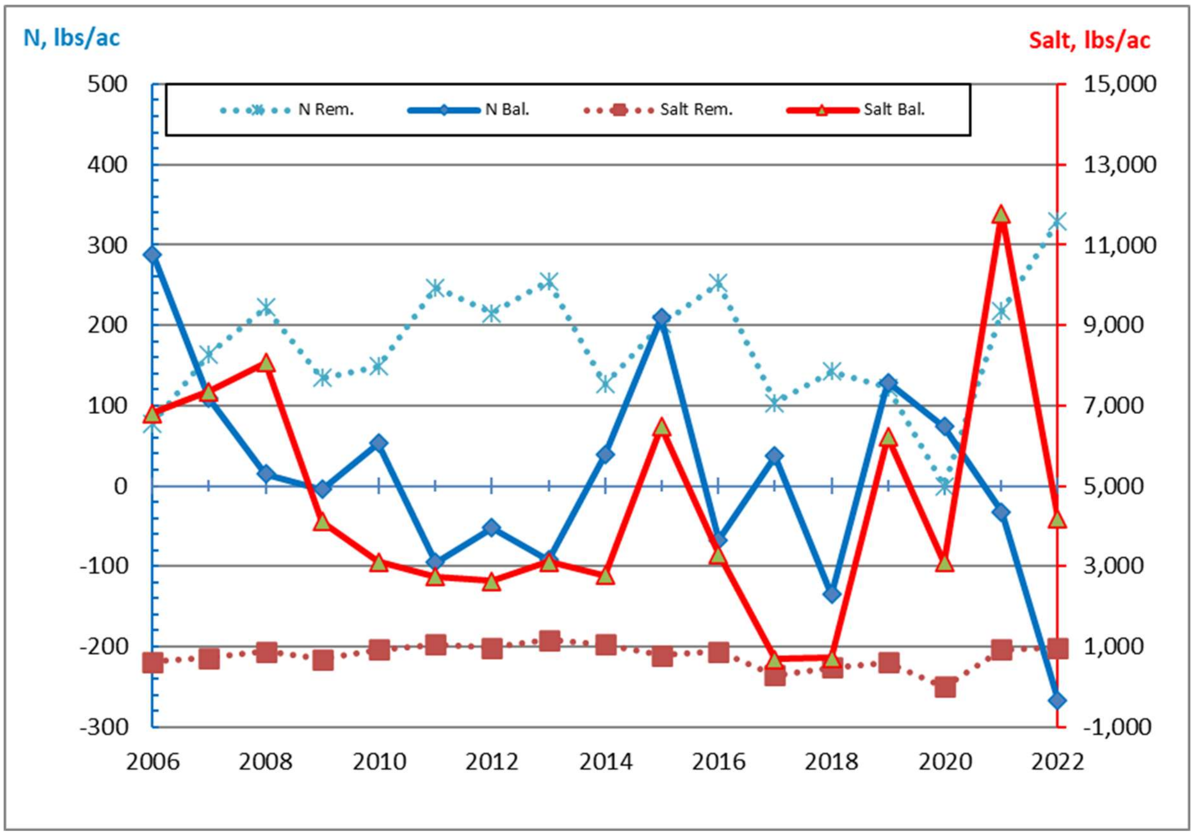


TABLE 4: BALANCE OF CONSTITUENTS LAND APPLIED

Source	N, lbs/ac 2022	N, lbs/ac 2021	Sodium, lbs/ac 2022	Sodium, lbs/ac 2021	FDS or Salt, lbs/ac 2022	FDS or Salt, lbs/ac 2021	BOD, lbs/ac 2022	BOD, lbs/ac 2021
CIRCLE 1 8.6 acres								
Wastewater	80	245	1,875	3,484	4,763	12,153	950	3,771
Freshwater	0.7	1.7	0.2	0.5	232	569	0	0
Fertilizer	0	0	0	0	0	0	0	0
SUM^	**61**	185	**1,875**	3,485	**4,996**	12,722	**950**	3,771
% difference from last year		**-67%**		**-46%**		**-61%**		**-75%**
					14	lbs/ac/day*	**4**	**lbs/ac/day***
Permit Design	**165**	lbs/yr	**N/A**	**N/A**	**11**	lbs/ac/day	**100**	**lbs/ac/day**
% of Design	**37%**	112%	**N/A**	**N/A**	**124%**		**4%**	
ed, lbs/ac	**329**	218	**34**	7	**1,089**	934	**N/A**	**N/A**
Balance, lbs/ac	**-268**	-33	**1,841**	3,478	**3,907**	11,788	**N/A**	**N/A**
CIRCLE 2 7.3 acres								
Wastewater	80	245	1,875	3,484	4,763	12,153	950	3,771
Freshwater	0.7	1.7	0.2	0.5	232	569	0	0
Fertilizer	0	0	0	0	0	0	0	0
SUM^	**61**	185	**1,875**	3,485	**4,996**	12,722	**950**	3,771
% difference from last year		**-67.2%**		**-46.2%**		**-60.7%**		**-75%**
					14	lbs/ac/day*	**4**	**lbs/ac/day***
Permit Design	**165**	lbs/yr	**N/A**	**N/A**	**11**	lbs/ac/day	**100**	**lbs/ac/day**
% of Design	**37%**	112%	**N/A**	**N/A**	**124%**		**4%**	
ed, lbs/ac	**329**	0	**40**	7	**1,283**	934	**N/A**	**N/A**
Balance, lbs/ac	**-268**	185	**1,835**	3,478	**3,713**	11,788	**N/A**	**N/A**
CIRCLE 3 16.7 acres								
Wastewater	88	105	2,048	1,496	5,203	5,220	1,038	1,620
Freshwater	1.0	0.8	0.3	0.2	333	279	0	0
Fertilizer	0	0	0	0	0	0	0	0
SUM^	**66**	79	**2,048**	1,496	**5,536**	5,499	**1,038**	1,620
% difference from last year		**-16.3%**		**36.9%**		**0.7%**		**-36%**
					15	lbs/ac/day*	**4**	lbs/ac/day*
Permit Design	**165**	lbs/yr	**N/A**	**N/A**	**11**	lbs/ac/day	**100**	**lbs/ac/day**
% of Design	**40%**	48%	**N/A**	**N/A**	**138%**		**4%**	
ed, lbs/ac	**331**	218	**18**	7	**558**	934	**N/A**	**N/A**
:e, lbs/ac	**-264**	-139	**2,030**	1,489	**4,978**	4,565	**N/A**	**N/A**

Notes: ^Sum of Nitrogen was calculated assuming 75% use efficiency of wastewater N and 85% use efficiency of commercial fertilizer N.

* FDS, pounds/acre/day was calculated over 365 days in a year; BOD pounds/ac/day was calculated using the 245 day irrigation season.

5. GROUNDWATER MONITORING

Eight monitor wells have been installed at the land treatment site; the location of each is indicated in Figure 1. Monitor wells 1 through 5 were installed prior to the date SVZ assumed operations of the site. Wells 6 through 8 were installed in the spring of 2008 in preparation for adding Field 3 to the treatment site. Wells 1 and 2 were damaged during fall field work in 2013. These wells were abandoned along with monitor wells 3 and 4 in 2014 when two new wells, 2R and 3R, were installed. The wells are monitored monthly for water level and various physical and chemical parameters as required by permit.

Historical data for nitrate and TDS are reported in Figure 5. The data for the new wells 2R and 3R is appended to that of the original wells 2 and 3 in Figure 5 as they are in approximately the same locations. In the 2012 Fact Sheet Update for State Waste Discharge Permit ST-8077 the background values for groundwater nitrate and TDS for well 2R were modified to 5.62 and 507 mg/L, respectively. The background values for well 8 as determined in the same Fact Sheet were 18.1 mg/l for nitrate-N and 916 mg/l for TDS. The background lines and data trend lines for these two parameters are included in Figure 5.

The Field 1 up-gradient well, MW2/2R demonstrates variations in TDS of approximately 200 mg/l. No overall long-term trend is apparent. TDS levels in MW2/2R have exceeded background levels at various times throughout the record; however, the long-term trend line falls just slightly below the background line. Up-gradient well MW8 in Field 3 demonstrated a steady increase of approximately 300 mg/l from its installation in 2008 until 2012, then decreasing to below original levels by the end of 2017. Since 2017, the trend has been very slightly increasing and below the 2012 background level.

The down-gradient wells are mixed in their responses over time. TDS in Well 3/3R (down-gradient of Field 1) demonstrates a downward trend but remained approximately 200 mg/L above background in 2022 and may be trending upward the last two years. Wells 5, 6 and 7 all exhibit long-term increasing TDS over the monitoring period and experienced variable upticks in TDS the last two years. Even with the uptick, MW6 remained below the Enforcement Limit of 916 mg/L. MW5 has been above the background TDS level in all but a few measurements prior to 2010. MW7 jumped above the Enforcement Limit in April 2022 and has remained above 1200 mg/L.

The nitrate levels in Field 1 up-gradient well, MW2 & 2R, are well above background and exhibit an increasing long-term trend with considerable annual variations. Some very high values were recorded in the winters of 2016, 2017, 2018 and 2021. The nitrate level in the Field 3 up-gradient well, MW8, has trended downward but levelled out and begun to increase since 2018. Nitrate levels in 2022 continued to increase and ended less than 2 mg/L below the background level established in 2012.

The nitrate level in the down-gradient wells, MW3/3R and MW5, remain above background levels and demonstrate variably increasing trends with wide variations. MW5 had relatively low levels of nitrate in 2018-2020, then jumped to all-time highs in 2021 and 2022. The reason for these large variations is unknown. MW3/3R has varied from zero to nearly 30 mg/l at various times with a resultant increasing trend. MW3/3R experienced low nitrate levels in 2018-2020 with a subsequent increase in 2021 and 2022 similar to MW5 but less dramatic; at the end of the year, the nitrate level was 27.9 mg/L, well above the background level.

The nitrate levels in Field 3 down-gradient wells, MW6 and MW7, demonstrated an overall flat trend until 2021; nitrate levels have been increasing significantly since. The nitrate levels in MW6 climbed above the 2012 background level in July 2021 and remained above background throughout 2022. Nitrate in MW7 climbed rapidly in 2022, exceeding the background level and peaking at 53.4 mg/L.

FIGURE 5: SUMMARY OF SVZ WELL MONITORING (Field 1 Wells)

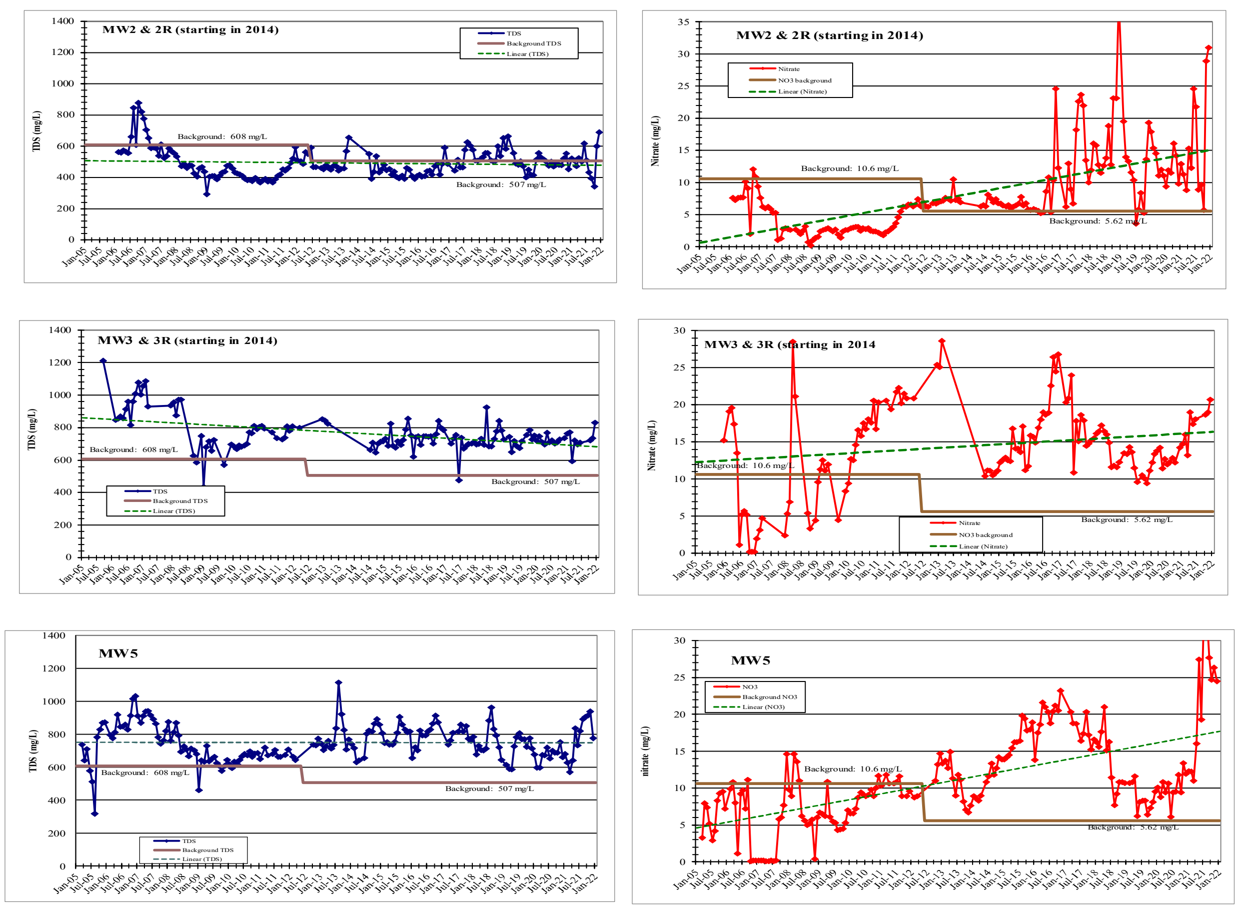
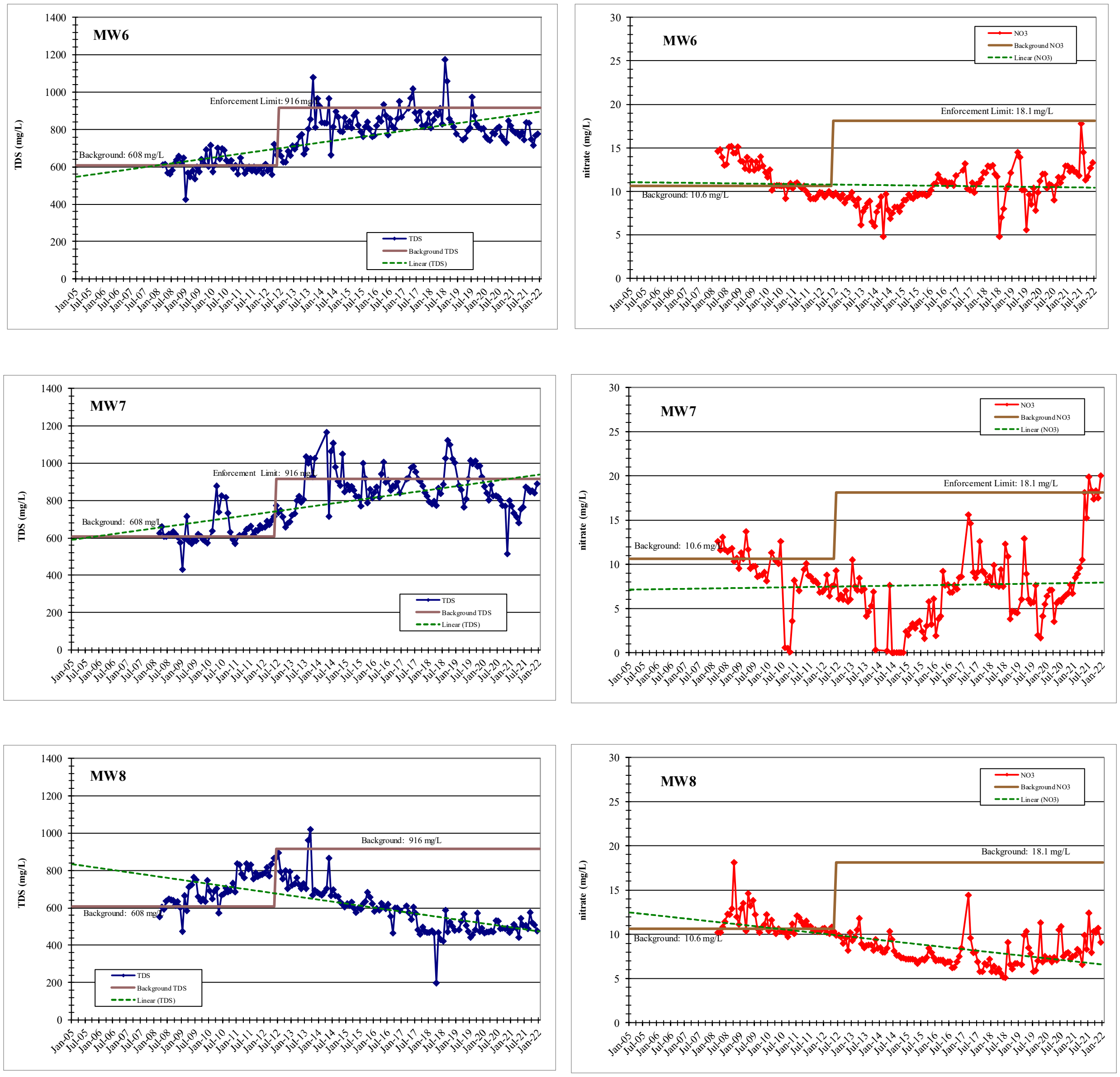


FIGURE 5: SUMMARY OF SVZ WELL MONITORING (Field 3 Wells)



6. 2023 CROP PLAN

In the early spring of 2021, SVZ removed the wheel-line irrigation systems from Fields 1 and 3 and replaced them with 3 small center pivot half-circle systems. As the old Field 2 has no plans for use, the naming system in future reports will be modified to match that used by SVZ. Field 1 will continue to be the name for the south field which will be irrigated with two half-circle center pivot systems, Pivot 1 to the south and Pivot 2 to the north. The north field will continue to be called Field 3 and will be irrigated with a single half-circle system, Pivot 3. The total under center pivot irrigation is 32.6 acres, approximately 4 acres less than that when irrigated by wheel-lines. All three pivots were seeded to alfalfa in the spring of 2021.

The nitrogen requirement in any given year depends on the crop, growing conditions/weather, water and nutrient management and disease/pest pressure. Most of these factors can only be estimated ahead of time from historical values or experience; the result is called the agronomic rate. The crop nitrogen requirement can be met by nitrogen from four main sources, soil residual, wastewater, fresh water, and fertilizer. Not all the nitrogen applied from any of these sources remains available for crop use. Volatilization and denitrification result in nitrogen loss from the system and each of these sources has an efficiency of use that needs to be included in the balance equation. If planning suggests that nitrogen availability from one of these sources is anticipated to be higher, then nitrogen from one or more of the other sources should be reduced. Alfalfa is a legume crop. Using a symbiotic relationship with Rhizobium bacteria, alfalfa can fix its own nitrogen and thus, requires no nitrogen fertilizer. However, alfalfa has the ability to utilize mineral nitrogen from the soil, if it is available, in place of that fixed by the bacteria. A well-managed alfalfa crop in the Columbia Basin can remove in excess of 400 lbs/ac of nitrogen from the soil in a single season. It will also remove significant amounts of potassium and other salts. These capabilities make alfalfa an ideal crop for treatment of wastewater containing variable amounts of nitrogen.

6.1 Soil Monitoring

The DOE land treatment permit requires that soil samples be collected in the spring and fall: this will continue to be accomplished in 2023. The purpose of soil testing is to monitor salt and nutrient concentrations over time and act as a back-up to the nutrient balance calculations. Modifications in management will be triggered by significant changes in soil test values. Soil samples will be collected and analyzed from Fields 1 and 3 to monitor chemical changes and salt conditions. The monitoring sites may need to be modified due to the change to center pivot irrigation systems but will be maintained as close to the original sites as practical. No sampling will occur on the old Field 2 as SVZ has no plans to utilize it for treatment or crop production.

6.2 Cropping Pattern and Wastewater Applications

After the new center pivot irrigation systems were installed, Fields 1 and 2 were seeded to alfalfa hay for the 2022 season. Alfalfa will remain the treatment crop for 2023 and is anticipated to remain the treatment crop for at least two more years. The Projected Management Plan for 2023 (Table 5) was developed with the following assumptions and goals:

1) The weather, ET and precipitation, for 2023 will not vary substantially from

2017 to 2022 average.

2) Wastewater analyses will not diverge greatly from those observed in 2022.

3) Wastewater applications will be limited such that gross salt loading to the fields will remain below 4,000 lbs/ac **and** net nitrogen loading to the fields will remain below 165 lbs/ac.

4) Crop yields in 2023 will be near those experienced in previous years.

With these considerations in mind, it is recommended that no fertilizer nitrogen be applied to the alfalfa crop (Table 5). An application of 1 lb/ac of boron may be beneficial to alfalfa production; no other nutrients are recommended based on the fall 2022 soil test results. Sodium levels in the soils suggest an application of approximately 2,500 lbs/ac of gypsum would be helpful to ensure that sodium does not damage the soil structure and the water infiltration rate remains sufficient.

There are three limits to keep in mind during management planning: 1) total wastewater application should not exceed 18 inches (no more than 21.4 MG over all 3 circles); 2) wastewater Salt loading needs to be kept below 4,000 lbs/ac (15.9 MG over all 3 circles); 3) wastewater nitrogen loading needs to be kept below 165 lbs/ac (52 MG over all 3 circles). BOD also has a limit of 100 lbs/ac/day during the irrigation season; however, this limit under current conditions would allow 710 MG of wastewater to be applied, which is 19 times the total plant output. The most stringent limit is the 18 inches of irrigation wastewater/year. Thus, for 2023, no more than 15.9 MG of wastewater should be utilized for irrigation purposes. This application amount will result in a nitrogen loading from wastewater of approximately 50 lbs/ac, well below the 165 lbs/ac limit, and 2,975 lbs/ac of salts, also well below the 4,000 lbs/ac limit. All wastewater generated by the plant in excess of 15.9 MG should be sent to the City of Othello for treatment. Additional irrigation requirements will need to be met with supplemental water, as approximated in Table 5. The Fresh Water recommendation in Table 5 includes the necessary 6% leaching fraction. Application of more wastewater than the limit is not only a violation of permit requirements, but will shorten the life of the treatment fields due to salt and sodium loadings.

TABLE 5: PROJECTED PLAN FOR 2023

			Anticipated Water Use less Anticipated in-season Rain		Irrigation Plan				Anticipated Wastewater Gross Loading			Soil Resicual	Estimated Fertilizer Nitrogen	Gypsum
	Treated				Wastewater		Fresh Water^		N	Salts	BOD	N*	Needed	Require-ment
Field I.D.	Acres	Crop	inches	MG	inches	MG	inches	MG	lbs/ac	lbs/ac	lbs/ac-day	lbs/ac	lbs/ac	lbs/ac
CIRCLE 1 (S)	8.6	Mature Alfalfa	36.3	8.5	18.0	4.2	20.5	4.8	50	2,975	2	123	0	2500
CIRCLE 2 (Mid)	7.3		36.3	7.2	18.0	3.6	20.5	4.1	50	2,975	2	118	0	2500
CIRCLE 3 (N)	16.7		36.3	16.5	18.0	8.1	20.5	9.3	50	2,975	2	168	0	2500
					total MG	15.9	total MG	18.16						
	32.6			WW limits**	18	15.93			165	4,000	100			

* Soil residual N is calculated from the sum of tested nitrogen from the previous fall soil test.

**Wastewater irrigation is adjusted to keep total nitrogen load below 165 lbs-N/ac and wastewater hydraulic loading below 18 inches/ac (15.9 MG total), and salt loading below 4,000 lbs/ac per design criteria.

^ Fresh water recommendation includes the necessary leaching fraction.

7. Summary and Recommendations

Wastewater production in 2022 (37.3 MG) was the highest recorded, slightly exceeding the previous high in 2021 (33.2 MG). The volume land applied was high (26.7 MG) but not as high as experienced in some previous years (Figure 4). Wastewater comprised approximately 73% of the irrigation water applied. This volume of wastewater resulted in the land application of salt (FDS) in excess of the permit maximum.

The land application system was modified with the change to 3 center-pivot irrigation systems replacing the wheel line systems. The center-pivot systems allowed easier and better management of the water applications. The irrigations were better managed: Circles 1 and 2 were irrigated with just 2 inches less water than used by the crop (deficit irrigation). Circle 3 received just 2 inches of irrigation more than the crop utilized. The treatment crops must be managed to produce well to help maintain soil health and favorable field N and salt balances. Proper water management is the first and most important step. Wastewater application should not exceed the planned amount in order to not overload salts, especially sodium. Adequate supplemental water must be applied to optimize crop growth and provide the required leaching fraction. SVZ upgraded the soil moisture monitoring equipment in 2015 making real-time visualization of the field conditions available to SVZ and the farm manager. Proper utilization of such information will assist the manager in matching irrigations to crop water requirements.

Alfalfa is an excellent treatment crop and grew well in 2022, producing approximately 7.6 t/ac of hay. The alfalfa crops removed more than 250 lbs/ac of nitrogen than was applied.

Mineral salt loadings (FDS) in 2022 were well below the highest recorded (Figure 5) but well over the permit limit. After accounting for salt removal by the harvested crop, the Circles averaged a net loading of nearly 4,200 lbs-salt/ac. Sodium, which is included in the FDS measurement, was applied with a net addition of approximately 1,900 lbs/ac. Salt build-up in the soil can be prevented by incorporating the leaching fraction in the irrigation scheduling. Sodium accumulation can be managed by the addition of gypsum (calcium sulfate) in conjunction with the required leaching fraction. Irrigations in the last few years have not provided the necessary leaching fractions. Thus, salts and sodium have increased. It is recommended that 2,500 lbs/ac of gypsum be applied in 2023. Application of adequate fresh water to achieve the desired leaching fraction of approximately 6% will prevent salt accumulation at the surface. This leaching fraction is built into the Fresh Water recommendation in Table 5. Adequate water will also increase hay yield, thus improving the treatment capacity of the site. Avoid over-application of wastewater (no more than 15.9 MG total) to reduce sodium and salt loadings. This means that some wastewater may need to be diverted to the City of Othello during the summer. An alternative is to obtain additional treatment acres. SVZ recognized that drainage from parking and outside work and storage areas was collected into the lagoons. Ice-melt applied for safety purposes in the winter was contributing to the salt load. Plans were made to modify the drainage from the surface areas so they do not enter the lagoon and impact the loadings sent to either the land or the City of Othello.

Pesticides will be used only as needed. It is anticipated that some herbicide may be applied to the fields for weed control. Need for chemical and fertilizer applications will be determined by a certified crop advisor or similar professional. All pesticide applications will be made in accordance with label directions by licensed applicators.

The flow meters worked well in 2022 which allowed accurate evaluation of the hydraulic balances in the fields. It would be advisable to check the calibration of each flow meter at least annually and provide the dates of calibration for inclusion in this report.

APPENDIX

2022

DMR REPORTS FOR

Washington State DOE Discharge Permit No. ST8077

CAN BE VIEWED AT THE FOLLOWING LINK:

https://fortress.wa.gov/ecy/paris/ComplianceAndViolations/ViewDMRData.aspx

HARVEST REPORTS

soiltest farm consultants, inc.

2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

2021 Certified NIRS by NFTA — National Forage Testing Association — DM CP ADF NDF — Excellence in Forage Testing

SVZ-USA
P.O. BOX 715
Othello , WA 99344
GROWER:

DATE RECEIVED: 6/1/2022
DATE REPORTED: 6/7/2022
LAB NUMBER: F22-00633

FIELD ID.: SOUTH HAYLAGE 1ST
NIR CALIBRATION: Alfalfa

GROWER ACCOUNT #:
GROWER SAMPLE ID:

NIR FEED ANALYSIS

	As Received Basis	100% Dry Matter
MOISTURE %	80.2	
DRY MATTER %	19.8	100
Protein		
CRUDE PROTEIN	4.5	22.9
DIGESTIBLE PROTEIN	3.6	18.3
Fiber		
ACID DET. FIBER %	5.1	25.8
NEUTRAL DET. FIBER %	6.0	30.5
LIGNIN %	0.9	4.6
dNDF48 (% of NDF)	10.6	53.6
RFV		210
RFQ		224
FAT %	0.3	1.4
STARCH %	1.1	5.39
ESC %	1.7	8.4
NSC %	3.1	15.7
ASH %	2.2	11.1
WSC %	2.04	10.3
Minerals		
CALCIUM (Ca) %		
PHOSPHORUS (P) %		
POTASSIUM (K) %		
MAGNESIUM (Mg) %		
Other Analysis:		
NITRATE NITROGEN mg/kg	617	655

		As Received Basis	100% Dry Matter Basis
TDN %	[ADF]	14.1	71.0
NEL, MCAL/KG	[ADF]	0.3	1.5
NEM, MCAL/KG	[ADF]	0.4	2.2
NEG, MCAL/KG	[ADF]	0.3	1.5
ME MCAL/KG		0.54	2.71
DE MCAL/KG		0.6	3.1
DDM %		13.6	68.8
DMI % of Body Wt.		0.8	3.9
Wet Chemistry Minerals:			
Boron (B) mg/kg		6.58	33.21
Calcium (Ca) %		0.13	0.67
Copper (Cu) mg/kg		1.01	5.12
Iron (Fe) mg/kg		24	119
Magnesium (Mg) %		0.04	0.19
Manganese (Mn) mg/kg		2.83	14.31
Phosphorus (P) %		0.07	0.34
Potassium (K) %		0.54	2.73
Sodium (Na) %		0.05	0.26
Sulfur (S) %		0.06	0.30
Zinc (Zn) mg/kg		3.26	16.46
Chloride (Cl) mg/kg			

* TOTAL AFLATOXIN (B1, B2, G1, G2) (AgraStrip 8.0 ppb)

Relataive Feed value includes both ADF and NDF in accordance with AFGC Hay Market Task Force Equations

We make every effort to provide an accurate analysis of your sample. For reasonable cause we will repeat tests, but because of factors beyond our control in sampling procedures and the inherent variability of feeds, our liability is limited to the price of the tests.

This is your Invoice F22-00633 Account #: 288000 Reviewed by: K. Bair, PhD, CPSS List Cost

soiltest farm consultants, inc.
2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

2021 Certified NIRS by NFTA

SVZ-USA
P.O. BOX 715
Othello , WA 99344
GROWER:

DATE RECEIVED: 6/1/2022
DATE REPORTED: 6/7/2022
LAB NUMBER: F22-00634

FIELD ID.: NORTH HAYLAGE 1ST
NIR CALIBRATION: Alfalfa

GROWER ACCOUNT #:
GROWER SAMPLE ID:

NIR FEED ANALYSIS

	As Received Basis	100% Dry Matter
MOISTURE %	86.8	
DRY MATTER %	13.2	100
Protein		
CRUDE PROTEIN	2.8	21.2
DIGESTIBLE PROTEIN	2.2	16.6
Fiber		
ACID DET. FIBER %	4.3	32.3
NEUTRAL DET. FIBER %	4.9	37.3
LIGNIN %	0.8	5.9
dNDF48 (% of NDF)	6.0	45.6
RFV		159
RFQ		156
FAT %	0.2	1.36
STARCH %	0.4	3.33
ESC %	0.9	6.7
NSC %	1.6	12.0
ASH %	1.6	12.0
WSC %	1.15	8.7
Minerals		
CALCIUM (Ca) %		
PHOSPHORUS (P) %		
POTASSIUM (K) %		
MAGNESIUM (Mg) %		
Other Analysis:		
NITRATE NITROGEN mg/kg	737	783

		As Received Basis	100% Dry Matter Basis
TDN %	[ADF]	8.5	64.1
NEL, MCAL/KG	[ADF]	0.2	1.3
NEM, MCAL/KG	[ADF]	0.3	1.9
NEG, MCAL/KG	[ADF]	0.2	1.2
ME MCAL/KG		0.32	2.41
DE MCAL/KG		0.4	2.8
DDM %		8.4	63.7
DMI % of Body Wt.		0.4	3.2
Wet Chemistry Minerals:			
Boron (B) mg/kg		4.89	37.04
Calcium (Ca) %		0.12	0.94
Copper (Cu) mg/kg		0.87	6.60
Iron (Fe) mg/kg		25	186
Magnesium (Mg) %		0.02	0.18
Manganese (Mn) mg/kg		2.55	19.35
Phosphorus (P) %		0.04	0.31
Potassium (K) %		0.38	2.86
Sodium (Na) %		0.05	0.41
Sulfur (S) %		0.04	0.33
Zinc (Zn) mg/kg		2.50	18.97
Chloride (Cl) mg/kg			

* TOTAL AFLATOXIN (B1, B2, G1, G2) (AgraStrip 8.0 ppb)

Relataive Feed value includes both ADF and NDF in accordance with AFGC Hay Market Task Force Equations

We make every effort to provide an accurate analysis of your sample. For reasonable cause we will repeat tests, but because of factors beyond our control in sampling procedures and the inherent variability of feeds, our liability is limited to the price of the tests.

This is your Invoice F22-00634 Account #: 288000 Reviewed by: K. Bair, PhD, CPSS List Cost

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2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

NATIONAL FORAGE TESTING ASSOCIATION 2022 Certified NIRS by NFTA Excellence in Forage Testing DM CP ADF NDF

SVZ-USA
P.O. BOX 715
Othello , WA 99344
GROWER:

DATE RECEIVED: 7/20/2022
DATE REPORTED: 7/21/2022
LAB NUMBER: F22-01968

FIELD ID.: SOUTH 2ND
NIR CALIBRATION: Alfalfa

GROWER ACCOUNT #:
GROWER SAMPLE ID:

NIR FEED ANALYSIS

	As Received Basis	100% Dry Matter
MOISTURE %	8.0	
DRY MATTER %	92.0	100
Protein		
CRUDE PROTEIN	15.8	17.2
DIGESTIBLE PROTEIN	11.8	12.8
Fiber		
ACID DET. FIBER %	35.2	38.3
NEUTRAL DET. FIBER %	40.7	44.2
LIGNIN %	7.5	8.2
dNDF48 (% of NDF)	38.6	42.0
RFV		124
RFQ		122
FAT %	1.0	1.12
STARCH %	2.2	2.40
ESC %	4.4	4.8
NSC %	8.0	8.7
ASH %	8.6	9.4
WSC %	5.80	6.3
Minerals		
CALCIUM (Ca) %		
PHOSPHORUS (P) %		
POTASSIUM (K) %		
MAGNESIUM (Mg) %		
Other Analysis:		
NITRATE NITROGEN mg/kg	1166	1221

		As Received Basis	100% Dry Matter Basis
TDN %	[ADF]	53.1	57.7
NEL, MCAL/KG	[ADF]	1.1	1.2
NEM, MCAL/KG	[ADF]	1.6	1.7
NEG, MCAL/KG	[ADF]	0.9	1.0
ME MCAL/KG		1.95	2.12
DE MCAL/KG		2.3	2.5
DDM %		54.4	59.1
DMI % of Body Wt.		2.5	2.7
Wet Chemistry Minerals:			
Boron (B) mg/kg		36.28	39.44
Calcium (Ca) %		0.84	0.91
Copper (Cu) mg/kg		7.26	7.89
Iron (Fe) mg/kg		266	289
Magnesium (Mg) %		0.23	0.25
Manganese (Mn) mg/kg		16.44	17.87
Phosphorus (P) %		0.31	0.34
Potassium (K) %		2.90	3.15
Sodium (Na) %		0.24	0.26
Sulfur (S) %		0.28	0.30
Zinc (Zn) mg/kg		11.85	12.88
Chloride (Cl) mg/kg			

* TOTAL AFLATOXIN (B1, B2, G1, G2) (AgraStrip 8.0 ppb)
Relataive Feed value includes both ADF and NDF in accordance with AFGC Hay Market Task Force Equations

We make every effort to provide an accurate analysis of your sample. For reasonable cause we will repeat tests, but because of factors beyond our control in sampling procedures and the inherent variability of feeds, our liability is limited to the price of the tests.

This is your Invoice F22-01968 Account #: 288000 Reviewed by: K. Bair, PhD, CPSS List Cost $42.00

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farm consultants, inc.
2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

National Forage Testing Association 2022 Certified NIRS by NFTA — Excellence in Forage Testing — DM CP ADF NDF

SVZ-USA
P.O. BOX 715
Othello , WA 99344
GROWER:

DATE RECEIVED: 7/20/2022
DATE REPORTED: 7/21/2022
LAB NUMBER: F22-01969

FIELD ID.: NORTH 2ND
NIR CALIBRATION: Alfalfa

GROWER ACCOUNT #:
GROWER SAMPLE ID:

NIR FEED ANALYSIS

	As Received Basis	100% Dry Matter
MOISTURE %	7.8	
DRY MATTER %	92.2	100
Protein		
CRUDE PROTEIN	17.9	19.4
DIGESTIBLE PROTEIN	13.7	14.9
Fiber		
ACID DET. FIBER %	31.7	34.4
NEUTRAL DET. FIBER %	36.8	39.9
LIGNIN %	6.9	7.5
dNDF48 (% of NDF)	41.7	45.2
RFV		145
RFQ		149
FAT %	1.2	1.27
STARCH %	2.0	2.16
ESC %	4.8	5.2
NSC %	8.5	9.2
ASH %	8.3	9.0
WSC %	6.45	7.0
Minerals		
CALCIUM (Ca) %		
PHOSPHORUS (P) %		
POTASSIUM (K) %		
MAGNESIUM (Mg) %		
Other Analysis:		
NITRATE NITROGEN mg/kg	896	941

		As Received Basis	100% Dry Matter Basis
TDN %	[ADF]	57.1	61.9
NEL, MCAL/KG	[ADF]	1.2	1.3
NEM, MCAL/KG	[ADF]	1.8	1.9
NEG, MCAL/KG	[ADF]	1.1	1.2
ME MCAL/KG		2.13	2.31
DE MCAL/KG		2.5	2.7
DDM %		57.3	62.1
DMI % of Body Wt.		2.8	3.0
Wet Chemistry Minerals:			
Boron (B) mg/kg		39.75	43.11
Calcium (Ca) %		1.04	1.13
Copper (Cu) mg/kg		7.39	8.02
Iron (Fe) mg/kg		207	224
Magnesium (Mg) %		0.24	0.26
Manganese (Mn) mg/kg		16.44	17.83
Phosphorus (P) %		0.34	0.37
Potassium (K) %		3.06	3.32
Sodium (Na) %		0.23	0.25
Sulfur (S) %		0.32	0.35
Zinc (Zn) mg/kg		17.11	18.56
Chloride (Cl) mg/kg			

* TOTAL AFLATOXIN (B1, B2, G1, G2) (AgraStrip 8.0 ppb)
Relataive Feed value includes both ADF and NDF in accordance with AFGC Hay Market Task Force Equations

We make every effort to provide an accurate analysis of your sample. For reasonable cause we will repeat tests, but because of factors beyond our control in sampling procedures and the inherent variability of feeds, our liability is limited to the price of the tests.

This is your Invoice F22-01969 Account #: 288000 Reviewed by: K. Bair, PhD, CPSS List Cost $42.00

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Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

SVZ-USA
P.O. BOX 715
Othello , WA 99344
GROWER:

DATE RECEIVED: 8/31/2022
DATE REPORTED: 9/1/2022
LAB NUMBER: F22-03199

FIELD ID.: SOUTH 3RD
NIR CALIBRATION: Alfalfa

GROWER ACCOUNT #:
GROWER SAMPLE ID:

NIR FEED ANALYSIS

	As Received Basis	100% Dry Matter
MOISTURE %	6.8	
DRY MATTER %	93.2	100
Protein		
CRUDE PROTEIN	17.1	18.3
DIGESTIBLE PROTEIN	13.0	13.9
Fiber		
ACID DET. FIBER %	35.6	38.2
NEUTRAL DET. FIBER %	39.8	42.7
LIGNIN %	7.5	8.1
dNDF48 (% of NDF)	38.1	40.9
RFV		129
RFQ		124
FAT %	1.2	1.31
STARCH %	2.4	2.59
ESC %	4.5	4.8
NSC %	8.4	9.0
ASH %	9.8	10.5
WSC %	5.96	6.4
Minerals		
CALCIUM (Ca) %		
PHOSPHORUS (P) %		
POTASSIUM (K) %		
MAGNESIUM (Mg) %		
Other Analysis:		
NITRATE NITROGEN mg/kg	1365	1435

		As Received Basis	100% Dry Matter Basis
TDN %	[ADF]	54.0	57.9
NEL, MCAL/KG	[ADF]	1.1	1.2
NEM, MCAL/KG	[ADF]	1.7	1.8
NEG, MCAL/KG	[ADF]	0.9	1.0
ME MCAL/KG		1.99	2.13
DE MCAL/KG		2.4	2.6
DDM %		55.2	59.2
DMI % of Body Wt.		2.6	2.8
Wet Chemistry Minerals:			
Boron (B) mg/kg		29.92	32.10
Calcium (Ca) %		0.91	0.98
Copper (Cu) mg/kg		7.06	7.57
Iron (Fe) mg/kg		378	406
Magnesium (Mg) %		0.19	0.20
Manganese (Mn) mg/kg		19.52	20.94
Phosphorus (P) %		0.26	0.28
Potassium (K) %		2.43	2.61
Sodium (Na) %		0.28	0.30
Sulfur (S) %		0.27	0.29
Zinc (Zn) mg/kg		14.53	15.59
Chloride (Cl) mg/kg			

* TOTAL AFLATOXIN (B1, B2, G1, G2) (AgraStrip 8.0 ppb)

Relataive Feed value includes both ADF and NDF in accordance with AFGC Hay Market Task Force Equations

We make every effort to provide an accurate analysis of your sample. For reasonable cause we will repeat tests, but because of factors beyond our control in sampling procedures and the inherent variability of feeds, our liability is limited to the price of the tests.

This is your Invoice F22-03199 Account #: 288000 Reviewed by: James Graff List Cost $42.00

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National Forage Testing Association 2022 Certified NIRS by NFTA — Excellence in Forage Testing — DM CP ADF NDF

SVZ-USA
P.O. BOX 715
Othello , WA 99344
GROWER:

DATE RECEIVED: *10/14/2022*
DATE REPORTED: *10/17/2022*
LAB NUMBER: F22-04210

FIELD ID.: SOUTH 4TH
NIR CALIBRATION: Alfalfa

GROWER ACCOUNT #:
GROWER SAMPLE ID:

NIR FEED ANALYSIS

	As Received Basis	100% Dry Matter
MOISTURE %	14.4	
DRY MATTER %	85.6	100
Protein		
CRUDE PROTEIN	20.5	24.0
DIGESTIBLE PROTEIN	16.5	19.3
Fiber		
ACID DET. FIBER %	25.2	29.4
NEUTRAL DET. FIBER %	27.6	32.2
LIGNIN %	5.6	6.6
dNDF48 (% of NDF)	39.5	46.1
RFV		190
RFQ		194
FAT %	1.2	1.42
STARCH %	2.0	2.35
ESC %	5.4	6.3
NSC %	8.3	9.7
ASH %	9.1	10.6
WSC %	6.25	7.3
Minerals		
CALCIUM (Ca) %		
PHOSPHORUS (P) %		
POTASSIUM (K) %		
MAGNESIUM (Mg) %		
Other Analysis:		
NITRATE NITROGEN mg/kg	972	1011

		As Received Basis	100% Dry Matter Basis
TDN %	[ADF]	57.5	67.2
NEL, MCAL/KG	[ADF]	1.2	1.4
NEM, MCAL/KG	[ADF]	1.8	2.1
NEG, MCAL/KG	[ADF]	1.1	1.3
ME MCAL/KG		2.17	2.54
DE MCAL/KG		2.6	3.0
DDM %		56.5	66.0
DMI % of Body Wt.		3.2	3.7
Wet Chemistry Minerals:			
Boron (B) mg/kg		54.16	63.27
Calcium (Ca) %		1.10	1.28
Copper (Cu) mg/kg		7.75	9.05
Iron (Fe) mg/kg		412	481
Magnesium (Mg) %		0.22	0.26
Manganese (Mn) mg/kg		25.54	29.84
Phosphorus (P) %		0.33	0.39
Potassium (K) %		3.43	4.01
Sodium (Na) %		0.46	0.54
Sulfur (S) %		0.40	0.47
Zinc (Zn) mg/kg		33.19	38.77
Chloride (Cl) mg/kg			

* TOTAL AFLATOXIN (B1, B2, G1, G2) (AgraStrip 8.0 ppb)

Relataive Feed value includes both ADF and NDF in accordance with AFGC Hay Market Task Force Equations

We make every effort to provide an accurate analysis of your sample. For reasonable cause we will repeat tests, but because of factors beyond our control in sampling procedures and the inherent variability of feeds, our liability is limited to the price of the tests.

This is your Invoice F22-04210 Account #: 288000 Reviewed by: K. Bair, PhD, CPSS List Cost $42.00

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Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

SVZ-USA
P.O. BOX 715
Othello , WA 99344
GROWER:

DATE RECEIVED: 10/14/2022
DATE REPORTED: 10/17/2022
LAB NUMBER: F22-04211

FIELD ID.: NORTH 4TH
NIR CALIBRATION: Alfalfa

GROWER ACCOUNT #:
GROWER SAMPLE ID:

NIR FEED ANALYSIS

	As Received Basis	100% Dry Matter
MOISTURE %	13.6	
DRY MATTER %	86.4	100
Protein		
CRUDE PROTEIN	20.5	23.7
DIGESTIBLE PROTEIN	16.4	19.0
Fiber		
ACID DET. FIBER %	25.7	29.8
NEUTRAL DET. FIBER %	28.1	32.5
LIGNIN %	5.7	6.6
dNDF48 (% of NDF)	39.7	45.9
RFV		188
RFQ		190
FAT %	1.2	1.4
STARCH %	1.8	2.07
ESC %	5.4	6.3
NSC %	8.1	9.4
ASH %	9.3	10.8
WSC %	6.39	7.4
Minerals		
CALCIUM (Ca) %		
PHOSPHORUS (P) %		
POTASSIUM (K) %		
MAGNESIUM (Mg) %		
Other Analysis:		
NITRATE NITROGEN mg/kg	767	797

		As Received Basis	100% Dry Matter Basis
TDN %	[ADF]	57.7	66.8
NEL, MCAL/KG	[ADF]	1.2	1.4
NEM, MCAL/KG	[ADF]	1.7	2.0
NEG, MCAL/KG	[ADF]	1.1	1.3
ME MCAL/KG		2.19	2.53
DE MCAL/KG		2.5	2.9
DDM %		56.8	65.7
DMI % of Body Wt.		3.2	3.7
Wet Chemistry Minerals:			
Boron (B) mg/kg		44.83	51.89
Calcium (Ca) %		0.91	1.05
Copper (Cu) mg/kg		6.55	7.58
Iron (Fe) mg/kg		397	459
Magnesium (Mg) %		0.22	0.26
Manganese (Mn) mg/kg		20.56	23.80
Phosphorus (P) %		0.32	0.37
Potassium (K) %		3.57	4.13
Sodium (Na) %		0.48	0.56
Sulfur (S) %		0.39	0.45
Zinc (Zn) mg/kg		15.32	17.73
Chloride (Cl) mg/kg			

* TOTAL AFLATOXIN (B1, B2, G1, G2) (AgraStrip 8.0 ppb)

Relataive Feed value includes both ADF and NDF in accordance with AFGC Hay Market Task Force Equations

We make every effort to provide an accurate analysis of your sample. For reasonable cause we will repeat tests, but because of factors beyond our control in sampling procedures and the inherent variability of feeds, our liability is limited to the price of the tests.

This is your Invoice F22-04211 Account #: 288000 Reviewed by: K. Bair, PhD, CPSS List Cost $42.00

DOE SOIL TESTING RESULTS

soiltest
farm consultants, inc.
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Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

SVZ-USA
P.O. BOX 715
OTHELLO, WA 99344

DATE RECEIVED 3/24/2022
DATE REPORTED 3/25/2022
INVOICE # S22-03801

NORTH

							NH40AC			
SAMPLE I.D.	LAB NO	NO3-N mg/Kg	NH4-N mg/Kg	TKN mg/Kg	TOTAL P mg/Kg	OLSEN P mg/Kg	K mg/Kg	Ca meq/100g	Mg meq/100g	Na meq/100g
1FT	S22-03801	5.3	3.4	1141	914	21	492	9.8	2.4	1.62
2FT	S22-03802	5	2.4	636	727		330	16.5	2.9	1.82
3FT	S22-03803	16.3	2	520	684		108	8.5	1.9	3.01

		DTPA EXT					Est Sat Paste			
SAMPLE I.D.	LAB NO	SULFUR mg/Kg	B mg/Kg	Zn mg/Kg	CEC meq/100g	ESP %	SOL SALTS mmhos/cm	pH 1:1	OM %	Fe2+ field test
1FT	S22-03801	8	1.70	9.9	12.5	13.0	1.83	8.6	1.8	NEG
2FT	S22-03802	8			9.9	18.4	0.88	9.0	1.1	NEG
	S22-03803	26					1.55	8.4		NEG

REVIEWED BY______________ **KB**

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DATE RECEIVED 3/24/2022
DATE REPORTED 3/25/2022
INVOICE # S22-03799

SOUTH

							NH40AC			
SAMPLE I.D.	LAB NO	NO3-N mg/Kg	NH4-N mg/Kg	TKN mg/Kg	TOTAL P mg/Kg	OLSEN P mg/Kg	K mg/Kg	Ca meq/100g	Mg meq/100g	Na meq/100g
1FT	S22-03799	7.7	1	1027	828	26	547	8.1	2.3	1.58
2FT	S22-03800	5.3	0.8	648.8	877		529	5.2	3.4	1.56

		DTPA EXT					Est Sat Paste			
SAMPLE I.D.	LAB NO	SULFUR mg/Kg	B mg/Kg	Zn mg/Kg	CEC meq/100g	ESP %	SOL SALTS mmhos/cm	pH 1:1	OM %	Fe2+ field test
1FT	S22-03799	2.6	0.23	0.8	10.3	15.3	2.23	8.3	2.3	NEG
2FT	S22-03800	1.3			9.4	16.6	1.96	8.5	1.1	NEG

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DATE RECEIVED 10/17/2022
DATE REPORTED 10/19/2022
INVOICE # S22-24624

NORTH

SAMPLE I.D.	LAB NO	NO3-N mg/Kg	NH4-N mg/Kg	TKN mg/Kg	TOTAL P mg/Kg	OLSEN P mg/Kg	NH40AC K mg/Kg	NH40AC Ca meq/100g	NH40AC Mg meq/100g	NH40AC Na meq/100g
1FT	S22-24624	9.8	1.7	1003	1051	19	349	13.6	2.7	2.14
2FT	S22-24625	4.4	2.1	601	506		250	15.1	2.6	4.72
3FT	S22-24626	6.5	1.1	505	941		292	6.9	1.6	3.77

SAMPLE I.D.	LAB NO	SULFUR mg/Kg	DTPA EXT B mg/Kg	DTPA EXT Zn mg/Kg	CEC meq/100g	ESP %	Est Sat Paste SOL SALTS mmhos/cm	pH 1:1	OM %	Fe2+ field test
1FT	S22-24624	50.21	0.4	1.5	12.5	17.1	3.04	8.8	1.9	NEG
2FT	S22-24625	50.43			13.1	36.0	4.26	9.6	0.9	NEG
3FT	S22-24626	34.8					3.04	9.7		NEG

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DATE RECEIVED 10/17/2022
DATE REPORTED 10/19/2022
INVOICE # S22-24624

MIDDLE

							----NH40AC----			
SAMPLE I.D.	LAB NO	NO3-N mg/Kg	NH4-N mg/Kg	TKN mg/Kg	TOTAL P mg/Kg	OLSEN P mg/Kg	K mg/Kg	Ca meq/100g	Mg meq/100g	Na meq/100g
1FT	S21-27810	5.7	1.6	945	994	28	509	7.4	2.7	1.54
2FT	S21-27811	5	0.9	563	1037		566	6.5	4.3	2.11
3FT	AUGER REFUSAL									

	---- DTPA EXT ----						Est Sat Paste			
SAMPLE I.D.	LAB NO	SULFUR mg/Kg	B mg/Kg	Zn mg/Kg	CEC meq/100g	ESP %	SOL SALTS mmhos/cm	pH 1:1	OM %	Fe2+ field test
1FT	S21-27810	7.93	0.27	1.2	11.7	14.66019	1.7576	8.8	1.5	NEG
2FT	S21-27811	34.81			11.7	18.44444	1.8252	8.9	0.8	NEG
3FT	AUGER REFUSAL									

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DATE RECEIVED 10/17/2022
DATE REPORTED 10/19/2022
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SOUTH

SAMPLE I.D.	LAB NO	NO3-N mg/Kg	NH4-N mg/Kg	TKN mg/Kg	TOTAL P mg/Kg	OLSEN P mg/Kg	NH40AC K mg/Kg	NH40AC Ca meq/100g	NH40AC Mg meq/100g	NH40AC Na meq/100g
1FT	S22-24629	6.8	1.1	1026	1237	24	512	7.4	2.8	1.63
2FT	S22-24630	5.7	1.5	492	1179		530	9.8	3.9	1.4
3FT	AUGER REFUSAL									

SAMPLE I.D.	LAB NO	SULFUR mg/Kg	DTPA EXT B mg/Kg	DTPA EXT Zn mg/Kg	CEC meq/100g	ESP %	Est Sat Paste SOL SALTS mmhos/cm	pH 1:1	OM %	Fe2+ field test
1FT	S22-24629	11.4	0.32	1.2	11.6	14.1	1.76	8.7	1.5	NEG
2FT	S22-24630	20.05			11.2	12.5	2.84	8.7	0.6	NEG
3FT	AUGER REFUSAL									

REVIEWED BY__________KEB__________

LABORATOTRY & CONSULTANT

CERTIFICATIONS

The State of Washington
Department of Ecology

Soiltest Farm Consultants, Inc. Laboratory
Moses Lake, WA

has complied with provisions set forth in Chapter 173-50 WAC and is hereby recognized by the Department of Ecology as an ACCREDITED LABORATORY for the analytical parameters listed on the accompanying Scope of Accreditation. This certificate is effective September 8, 2022 and shall expire September 7, 2023.

Witnessed under my hand on September 12, 2022

Rebecca Wood
Lab Accreditation Unit Supervisor

Laboratory ID
C605

The Soil Science Society of America
Soils Certification Board

has conferred upon

Daniel P. Nelson, PhD

the designation of

Certified Professional Soil Scientist

By successfully fulfilling the requirements, passing a rigorous examination, subscribing to the Certified Professional Soil Scientist Code of Ethics and committing to ongoing professional development.

Certification effective from
1/1/2021 to **12/31/2022**

Certification Number: **03231**

CPSS
Certified Professional Soil Scientist

SSSA President

Soils Certification Board Chair