December 12, 2012

M E M O R A N D U M

TO: Todd Crutcher, P.E., Engineering Manager, Boise Regional Office

FROM: Valerie Greear, P.E., Staff Engineer, Boise Regional Office

SUBJECT: Staff Analysis of the Sorrento Lactalis, Inc. (Canyon)
Draft Recycled Water Reuse Permit Renewal I-091-03 (formerly LA-000091-02)

1.0 PURPOSE

The purpose of this memorandum is to present the basis for the requirements included in the draft Reuse Permit No. I-091-03 for the industrial wastewater treatment and recycled water reuse system owned and operated by Sorrento Lactalis, Inc., located in Nampa, ID, and to satisfy the requirements of the *Recycled Water Rules* (Rules), IDAPA 58.01.17.400.05, for issuing reuse permits. The permittee will hereafter be referred to as Sorrento or the permittee.

The permit application prepared by Forsgren Associates Inc., annual reports prepared by SPF Water Engineering and Forsgren Associates, Inc., and other historical correspondence between DEQ and the facility were used to develop the draft reuse permit, which is hereby being released for a 40-day public review and comment period. The Staff Analysis and draft permit were provided to the facility for comment, and these comments were incorporated into this analysis and the permit as appropriate. A copy of the facility's comments and DEQ's response is available upon request. After the public review period is closed, the Department of Environmental Quality (DEQ) will provide written responses to all relevant comments and prepare a final permit for Sorrento Lactalis, Inc. for irrigation with recycled water.

2.0 PROCESS DESCRIPTION

Sorrento Lactalis, Inc. is a cheese processing facility located in Nampa, ID, on East Franklin Road between Star Road and McDermott Road. Process wastewater is treated in a wastewater treatment plant (WWTP) consisting of screening and equalization, sequencing batch reactors (SBR), chemical treatment clarifiers, sand media filtration, and UV disinfection. A lined lagoon at the reuse site provides effluent flow equalization prior to use for irrigation via siphon tubes and furrows. The recycled water reuse site is divided into two management units that cover 133.1 acres directly east of the plant. The permittee holds a lease for use of the land application site through 2019. A site map is included as Attachment 2 to this document.

Sorrento primarily operates under their National Pollutant Discharge Elimination System (NPDES) Permit No. ID-002803-7, and discharges treated effluent to the Purdam Gulch Drain. During the current reuse permit term, the land application site has been used as a backup option to apply effluent that did not meet the limits in the NPDES permit, or for the diversion of influent that would otherwise cause a WWTP upset. The WWTP treats industrial process water only; domestic wastewater is treated separately through an on-site septic system.

3.0 SUMMARY OF EVENTS

An application for renewal of Sorrento's reuse permit was received on November 12, 2010. A pre-application conference was held with the permittee, their consultant (Forsgren Associates Inc.), and DEQ on October 29, 2010.

The facility was owned and operated by Simplot Dairy Products from 1991 to 1999. In early 1999, Sorrento Lactalis, Inc. became the permittee and has been operating the facility and land application site since. The current permit, Wastewater Reuse Permit No. LA-000091-02, was issued on May 5, 2006, and expired on that date in 2011.

The current permit restricts the use of the land application site to situations where wastewater cannot be discharged to surface water due to non-compliance with the NPDES permit effluent requirements, to prevent a WWTP upset, or other emergency situations. The permit defines the wastewater streams that can be land applied as:

1. final WWTP effluent that is out of compliance with the NPDES permit,
2. SBR effluent that does not meet sand filter feed requirements,
3. and as a last alternative the following could also be applied: high strength wastewater that is unacceptable to feed directly to the WWTP, raw wastewater in the event of a power failure, WWTP failure or process upset, and waste activated sludge.

When the current permit was issued, it was expected that the land application site would be used as an emergency backup only, and therefore be utilized infrequently. However, in 2010 Sorrento expanded their production facility to include a whey dryer, which added a significant volume of water to their wastewater stream and was an additional source of phosphorus. During startup and periodically since then, the facility has not always been able to meet the mass loading and concentration limits for phosphorus in the NPDES permit, and have used their recycled water reuse site more frequently. Sorrento has asked that the renewal reuse permit allow for more flexibility in the use of the site, and that wastewater effluent application not be limited to emergency situations. Sorrento's preferred option is NPDES discharge however, and they have applied for a renewal NPDES permit that will reflect current and future effluent flows. The current NPDES permit expired on October 31, 2010, and the application for a renewal permit was received by EPA on May 3, 2010.

Sorrento submitted a Facility Planning Study (FPS) on September 9, 2011, which was approved by DEQ. The plan outlined improvements and expansions to the WWTP that would increase the capacity of the treatment plant, and improve the capability to handle fluctuations in influent flow and quality. The improvements include adding an influent aerated equalization tank, a third SBR, a second tertiary clarifier, a second set of sand filters, a second chemical clarifier, and a belt filter press. The plan looked forward to 2014, and predicted that wastewater flow will be between 0.72 and 1.01 mgd. The design flow for the WWTP upgrades is 1.2 mgd, of which 1.0 mgd is influent and 0.2 mgd is recycled water. Thus far, Sorrento has installed a larger equalization tank and converted the previous tank (EQ-200 in Figure 1) to a holding tank for untreated or off-specification water. Water in this holding tank can be returned to the influent of the WWTP or land applied. This has helped with handling fluctuations in influent flow and concentration, but did not increase capacity. Sorrento is currently in the process of building an expansion of their mozzarella cheese production line, and expects to start up in 2013. Sorrento is also in the process of reviewing the wastewater treatment process and will be updating the FPS during the coming permit

term.

The following process diagram shows the system before the addition of the new equalization basin. Water for land application is pumped from EQ-200 to the storage lagoon at the recycled water reuse site (see Attachment 2).

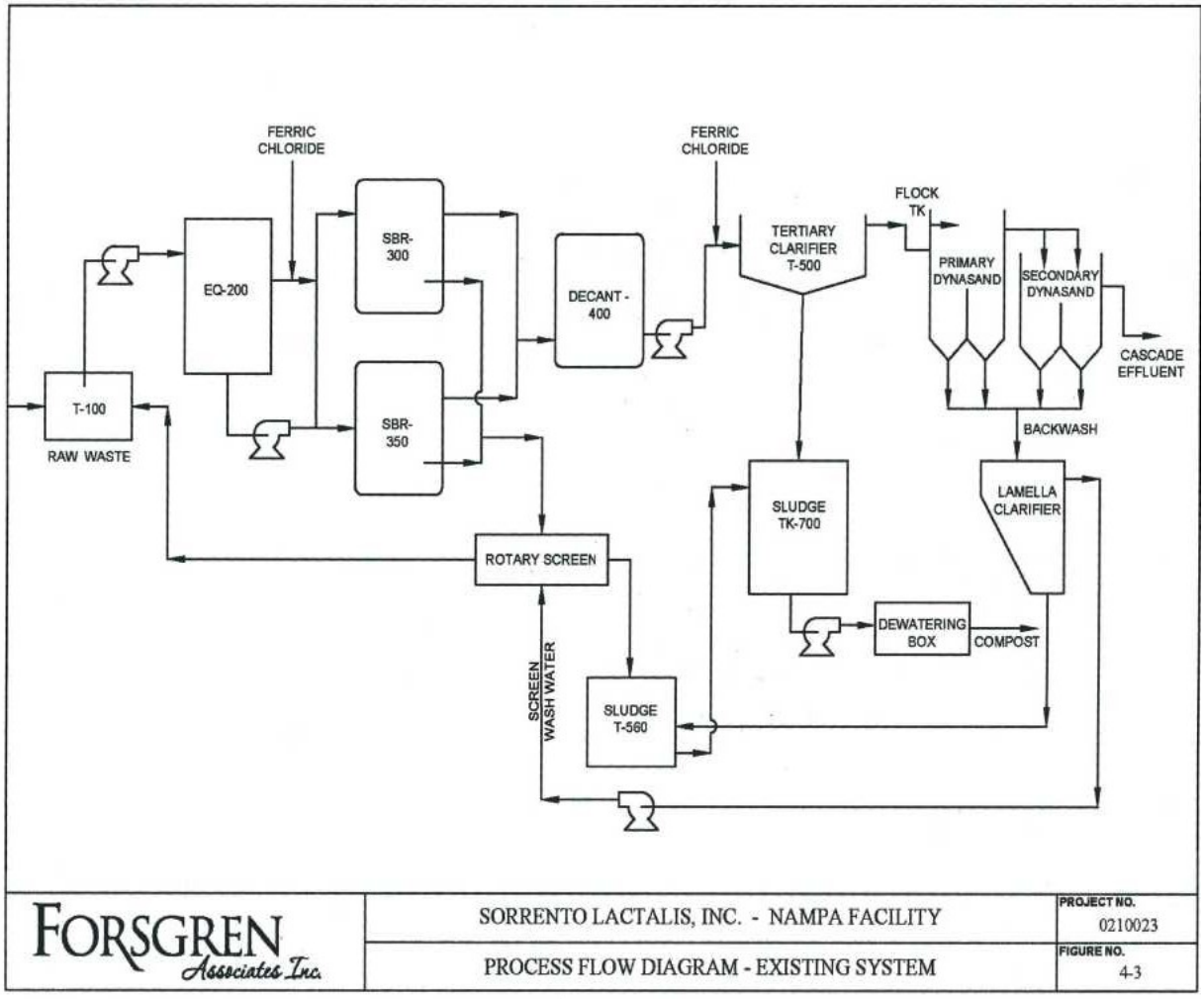


Figure 1: Process Flow Diagram from Wastewater Facilities Planning Study, September 9, 2011.

4.0 ENVIRONMENTAL DISCUSSION

4.1 Soils

Soils onsite are primarily Power-Purdam Silt Loam, which is described by the National Resource Conservation Service Soil Survey as well drained, deep soils.

Soil data from 2001 to the present was reviewed during the writing of this permit. The facility sampled the soil annually in the spring and monitored multiple constituents, including many minerals as well as the

following analytes required by the permit: Electrical Conductivity (EC), Nitrate-Nitrogen, Ammonia-Nitrogen, Plant Available Phosphorus, and pH. Most of the constituents monitored showed downward trending concentrations based on a linear regression analysis. The exceptions to this were nitrate (levels are within the low to medium range, below 25 mg/L), Sodium Adsorption Ratio (SAR), and Potassium (HMU2 only). Potassium and SAR analyses were conducted at the permittee's discretion, and data evaluated were through 2008.

According to the DEQ *Guidance for Reclamation and Reuse of Municipal and Industrial Wastewater* (Guidance), "SAR values above 13 classify the soils as sodic or alkali, has sodium as the dominant cation, and may possibly experience infiltration problems due to deflocculation of soil colloids." The elevated SAR value in soil is likely due to high salt loadings, which is discussed further in following sections. Figure 2 shows the SAR levels measured in the soil at both management units. The plots include linear regression trend lines, but a thorough statistical analysis was not conducted.

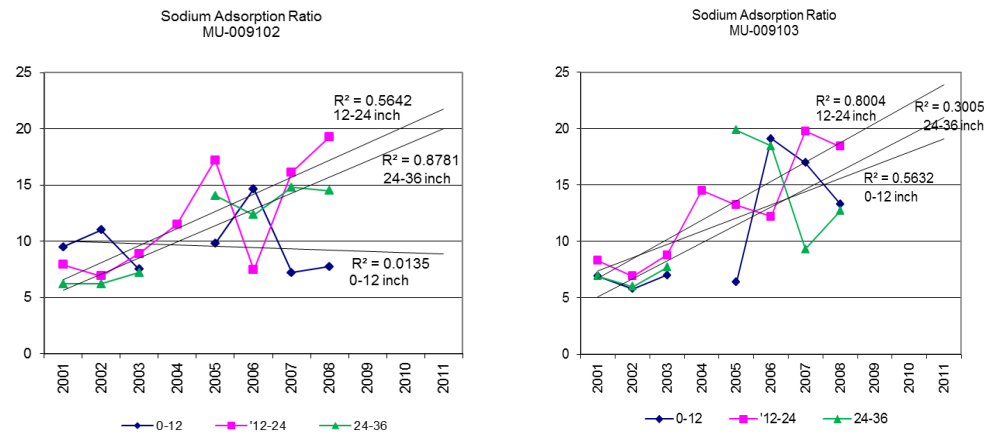


Figure 2: Sodium Adsorption Ratio (SAR) in each management unit.

Staff recommends that the annual soil sample analysis requirements in the draft permit should include SAR in addition to the analytes required in the current permit, and that sodium, potassium, calcium, magnesium, sulfur, cation exchange capacity, lime percent, and DTPA-Fe[2] and DTPA-Mn[1] be sampled in the first and last year of the permit. These constituents were last sampled in 2008, and it will be beneficial to watch the long term trends in the soil.

4.2 Surface Water

The site is bordered on the west by Rachel Drain and on the north by Perkins Drain. Rachel Drain joins Perkins Drain at the northwest corner of the site, and Perkins Drain joins the Purdam Gulch Drain shortly thereafter as shown in Figure 4. Purdam Gulch Drain discharges to Mason Creek which then discharges to the Boise River. The Boise River is impaired for phosphorus, and therefore phosphorus limits are placed

1 DTPA stands for Diethylenetriamine Pentaacetic Acid, and is an extractant used to assess the availability of iron and manganese in soil.

on upstream dischargers in their NPDES permits. Sorrento discharges to Purdam Gulch Drain, and, barring upsets, the WWTP can reliably remove phosphorus to the level required.

Sampling and analysis of these drains is not required in the current reuse permit. Samples were collected biweekly from January through April of 2011 however, as part of monitoring conducted under an agreement with DEQ during the 2010-2011 non-growing season during the period when the whey dryer was being started up and effluent application above the permitted limit was requested. The following plot shows the analytical results of total phosphate concentrations in the surface water during this period. Figure 4 shows the locations of surface water sample collection which correspond with the data collection points in Figure 3.

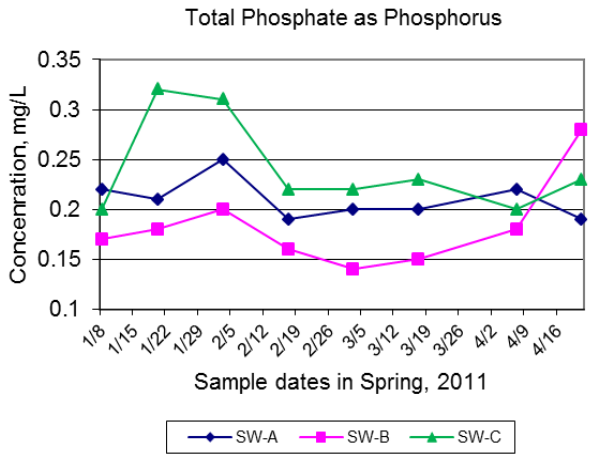


Figure 3: Total phosphate concentration in surface water as monitored in the spring of 2011.

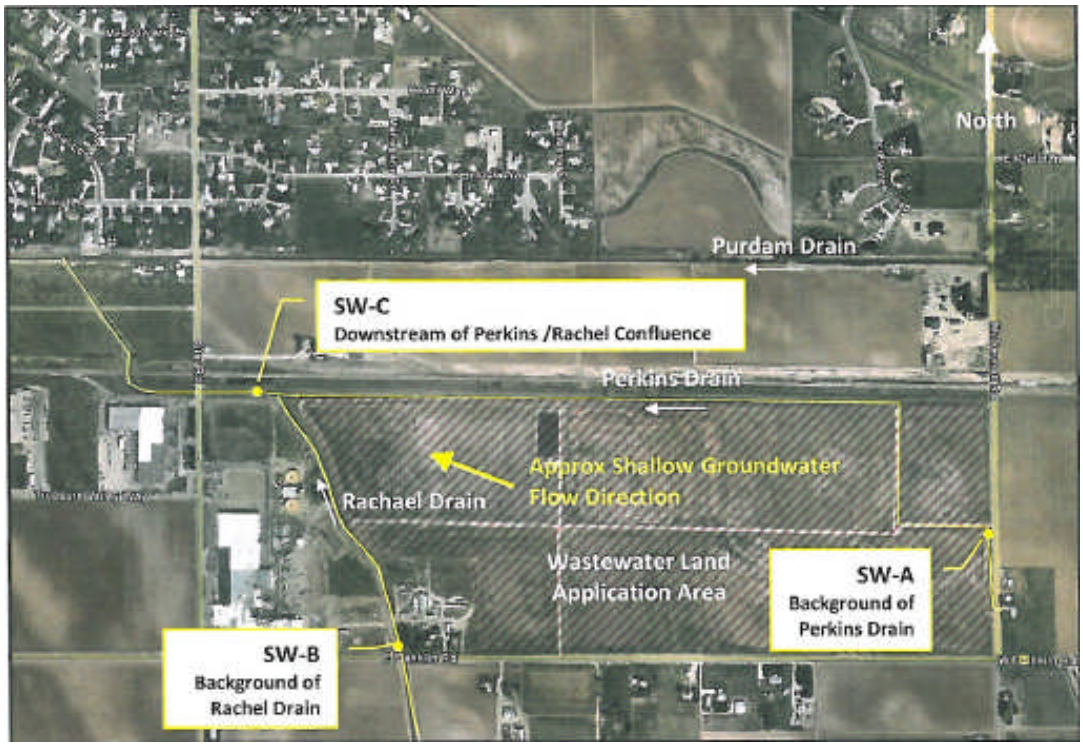


Figure 4: Locations of the surface water samples during 2010-2011 non-growing season.

While the phosphorus concentration was monitored, the flow was not collected, so no conclusions can be drawn from the data shown in Figure 3. Additionally, there is one more contributing background source at the northeast corner of the site that was not monitored. However, there is the potential that an interconnection between ground water and surface water may exist, and prevention of the migration of phosphorus into the surface water is important because the water quality in the Lower Boise Subbasin, which is a tributary of the Snake River – Hells Canyon Subbasin, is impaired for phosphorus.

In order to keep phosphorus from moving through the soil, beyond the plant root zone and into the ground water, it is recommended that a phosphorus loading limit of 100% of crop uptake be included in the permit, as is discussed in Section 5.3.2. It is also recommended that phosphorus concentrations be monitored in the top three feet of the soil column, in order to watch for potential phosphorus migration through the soil, and to monitor phosphorus in ground water. The average concentrations of total phosphorus in ground water are between 0.17 mg/L and 0.36 mg/L across the site, with the exception of MW-4 which has an average concentration of 1.12 mg/L in the spring and 2.57 mg/L in the fall.

Monitoring of phosphorus concentrations in soil and ground water in addition to limiting the phosphorus loading rate is meant to preempt the migration of phosphorus to surface water. However, it is recommended that the new permit contain a requirement to investigate a potential ground water – surface water interconnection as part of a Compliance Activity to conduct a ground water study, which is discussed in Section 7.2 if this document.

4.3 Ground Water and Geology

Ground water in the vicinity of the site is first encountered at less than 5 feet below ground surface (bgs) in some areas to about 15 feet bgs. This unconfined aquifer is found in alluvial gravels, and extends to an average depth of about 40 feet. Beyond that is an intermediate aquifer that is separated from the shallow aquifer by confining clay layers between 5 and 20 feet thick that are found between 40 and 80 feet bgs. A deep regional aquifer is below 200 feet in this region. Most of the domestic wells in the vicinity of the site are in the intermediate aquifer. This information was presented in the 1996 Well Location Acceptability Analysis, which found that this intermediate aquifer had a strong upward gradient with several of these wells being artesian, including the plant's production well.

4.3.1 Monitoring Well Network

The site has nine dedicated monitoring wells which are drilled in the shallow aquifer to a depth of between 14.5 feet and 24 feet. Monitoring wells MW-1 through MW-4 were drilled in 1990, and MW-5 through MW-9 were drilled in 1995.

Ground water flows in a northwesterly direction across the site, toward the two drains discussed in Section 4.2 which border the site and flow in a western and northwestern direction. See the Attachments 3 and 4 for locations of the monitoring wells and ground water flow contours. Monitoring wells MW-3, MW-5, and MW-6 are up-gradient of the site, MW-4 is within Hydraulic Management Unit 3 (HMU), and MW-2 is within HMU 2. MW-1 and MW-9 are down-gradient of the site and located on the other side of Rachel Drain from the site, and MW-7 and MW-8 are down-gradient and located on the other side of Perkins Drain from the site. MW-1 is located near the former wastewater lagoons that were closed in 2008; due to recent construction at the site, MW-1 is now located near a storm water basin.

4.3.2 Well Location Acceptability Analysis Discussion

A Well Location Acceptability Analysis (WLAA) was first completed in 1996 for the Simplot Dairy Products Division Nampa Plant, and was updated in 2007 for Sorrento. The 1996 WLAA collected and reviewed samples from 58 wells within ¼ mile of the Sorrento land application site, and the 2007 WLAA conducted sampling and analysis of 11 of these wells. The permit application includes further sampling of 10 of those wells for the same constituents, which in all three years (1995, 2006, and 2010) included nitrate and TDS, and in 2006 and 2010 also included total phosphate. The results indicated that the site is not impacting these wells, with the possible exception of Well 25. This domestic well is located on the other side of Perkins Drain from the site (approximately NNW of MW-2, see Attachment 4). This well showed elevated TDS as compared to the other wells and was above the secondary constituent standard for TDS in the Ground Water Quality Rule (IDAPA 58.01.11) of 500 mg/L. The TDS levels in this well, and the averages of the other 10 wells, are included below in Table 1.

Table 1: Total Dissolved Solids (TDS) Concentrations in Ground Water from the 1996 and 2007 Well Location Acceptability Analyses and the 2010 Permit Application.

Year Sampled	Up-gradient Average of 2 Wells	Side-gradient Average of 4 Wells	Down-gradient Average of 4 Wells[1]	Well 25
1995	418	458	372	550
2006	272	363	324	766
2010	76[2]	338	347	570

1. Not including Well 25
2. Only one of the two original up-gradient wells was sampled in 2010.

An addendum to the 2007 WLAA submitted on May 31, 2007 included further analysis of Well 25, and also included sampling of the nearby irrigation well, Well 24. The TDS concentration in Well 24 was 460 mg/L in 1995 and 513 mg/L in 2007. Sampling and analysis of ground water in both wells has been conducted periodically from 1993 through 2010 for TDS and other constituents including chloride, iron, manganese, nitrate, phosphorus and electrical conductivity. It appears that the 2006 TDS result in Well 25 was the highest at 766 mg/L, and that the other values fluctuate, and are between 538 and 710 mg/L. The last result from Well 25, collected in October of 2010, was 660 mg/L. For comparison, Figure 5 shows the TDS concentrations in the ground water monitoring wells. A map showing the location of these wells, as well as the other wells included in the WLAA, is included as Attachment 4 to this document.

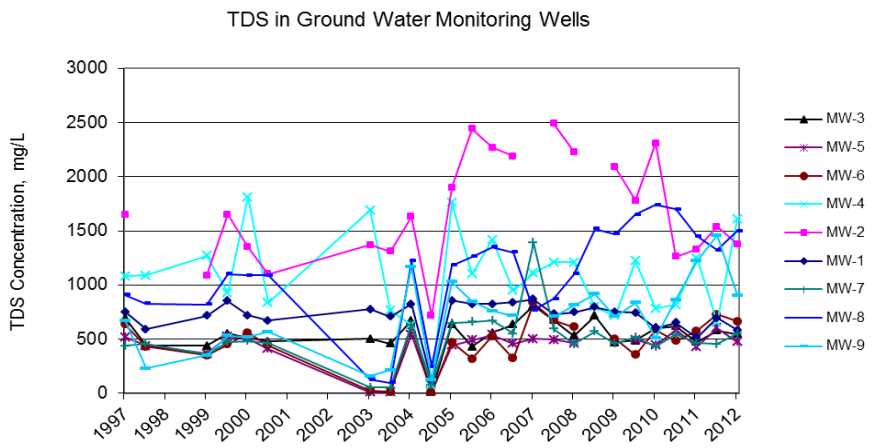


Figure 5: Total Dissolved Solids (TDS) Concentration in mg/L in the Up-gradient (MW-3, MW-5, MW-6), Mid-gradient (MW-2 and MW-4) and Down-gradient (MW-1, MW-7, MW-8, MW-9) Ground Water Monitoring Wells.

The 2007 WLAA addendum does not conclude that the elevated monitoring results in Wells 24 and 25 are a result of activities at Sorrento's recycled water reuse site, and states that the causes could also include site history or well construction. The WLAA addendum recommended, and DEQ concurred in the approval letter dated June 18, 2007, that Wells 24 and 25 be sampled annually in conjunction with the regular permitted schedule for the dedicated monitoring wells. It is not recommended that this be included in the draft reuse permit however, because, as noted above, many years of data have already been collected from these wells and the continued collection of data is not likely needed. Instead, a conclusion should be reached as to whether these wells are being affected by the reuse activities in a WLAA and ground water

study recommended to be required in the draft permit and further discussed in Section 7.2, Recommended Compliance Activities.

4.3.3 Ground Water Quality

Ground water levels are shallow in the area of the land application site, and the data in the up-gradient wells and down-gradient wells tend to be different. This was the case whether land application was occurring or not. The following sections discuss relevant constituents of concern that have ground water quality standards in the *Ground Water Quality Rule* (IDAPA 58.01.11). The monitoring requirements recommendations follow this discussion in Section 4.3.3.5.

4.3.3.1 Nitrate

The primary constituent standard for nitrate in the *Ground Water Quality Rule* is 10 mg/L. Figure 6 shows the spring and fall concentrations of nitrate in each of the monitoring wells, as an average of data from 2004-2011. It can be seen that nitrate concentrations are higher than 10 mg/L in the up-gradient wells but decrease across the site, with the exception of MW-2.

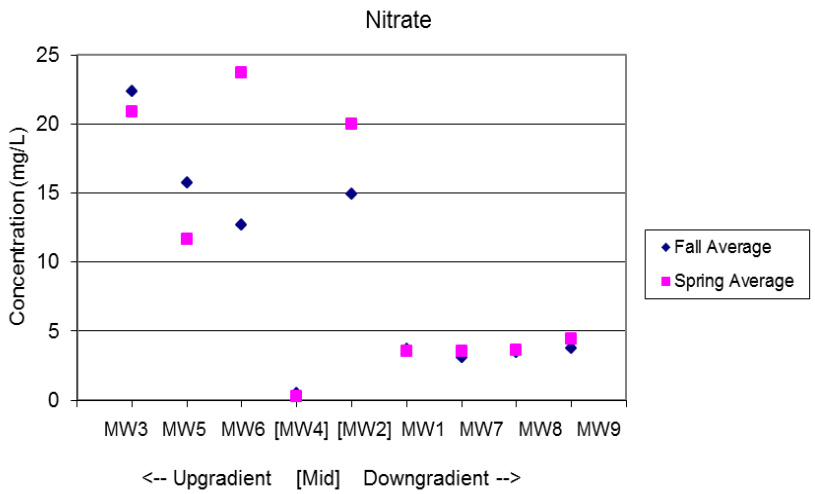


Figure 6: Average Nitrate concentrations in up-gradient and down-gradient monitoring wells. Data is from the 2004-2011 Annual Report submittals.

Given the decrease in nitrate concentration in down-gradient wells as compared to up-gradient wells, it appears that conditions may become anoxic in the vicinity of the site, and that nitrate is being reduced. Evidence that anaerobic activity may exist is also seen in the increased concentrations of dissolved iron and dissolved manganese, as discussed in the following section.

Anoxic conditions can develop when recycled water containing a high concentration of Chemical Oxygen Demand (COD) is applied over a sustained period of time, especially during the non-growing season. Sorrento's recycled water has variable levels of COD which can be high at times, but they have not exceeded the seasonal average, in lb/ac/day, permitted limit. Anaerobic activity in the soil or ground water is one possibility that the facility should explore when analyzing the ground water monitoring well

network, which is discussed in Section 7.2, Recommended Compliance Activities.

4.3.3.2 Iron and Manganese

Iron and manganese have secondary constituent standards of 0.3 mg/L and 0.05 mg/L respectively. Both constituents become soluble and mobile in an anoxic environment; as discussed in the previous section, the decrease in nitrate concentration between up-gradient and down-gradient wells could be showing that conditions are becoming anoxic in the soil or ground water at the site. The averaged results of 2002-2010 data for dissolved manganese and dissolved iron are shown in Table 2; non-detects were calculated as half of the detection limit. Dissolved manganese is above 0.05 mg/L in five of nine wells, including one up-gradient well. Dissolved iron is below 0.3 mg/L in all but one well.

Table 2: Concentrations in mg/L of Dissolved Manganese, Dissolved Iron, Nitrate (average of 2002-2010 data), and Dissolved Oxygen (April 25, 2012) in Monitoring Wells.

	Upgradient Wells			Mid-Gradient Wells		Downgradient Wells			
	MW-3	MW-5	MW-6	MW-4	MW-2	MW-1	MW-7	MW-8	MW-9
Dissolved Manganese	0.02	0.01	0.06	6.69	0.10	0.03	0.03	0.08	4.02
Dissolved Iron	0.01	0.02	0.02	12.64	0.01	0.02	0.01	0.01	0.25
Dissolved Oxygen	5.0	7.0	8.0	1.0	7.0	1.5	3.5	1.0	1.0
Nitrate	21.9	13.7	17.5	0.28	17.0	3.3	2.3	2.0	1.8

Also shown in this table are the average nitrate concentrations for the same period, and dissolved oxygen levels from a sample set taken on April 25, 2012. The low dissolved oxygen levels in the wells correlate with low nitrate, and vary in the correlation with higher dissolved iron or higher dissolved manganese as compared to the other wells. The data in this table could also be interpreted as showing that the up-gradient wells and down-gradient wells are not all hydraulically interconnected. This is another possibility that should be explored when analyzing the ground water monitoring well network, which is discussed in Section 7.2, Recommended Compliance Activities.

4.3.3.3 Total Dissolved Solids

The secondary constituent standard for Total Dissolved Solids (TDS) in ground water is 500 mg/L. Figure 7 shows the spring and fall concentrations of TDS in each of the monitoring wells, as an average of data from 2004-2011. It can be seen that both up-gradient and down-gradient monitoring wells generally exceed this standard, and that TDS is higher in most of the down-gradient wells.

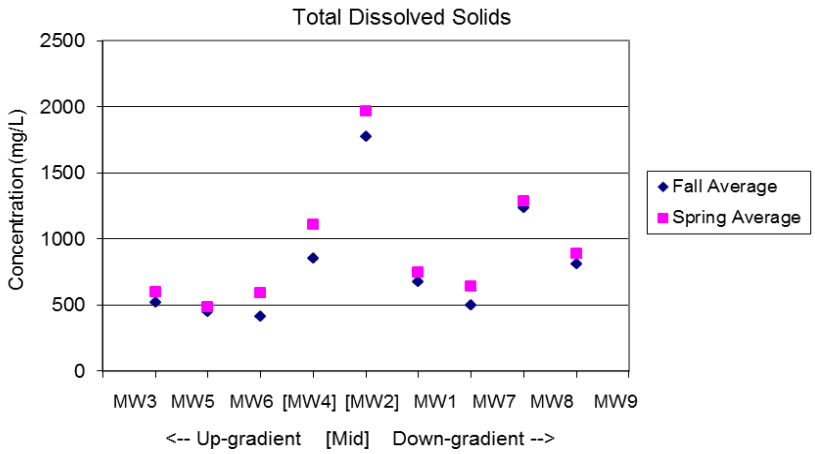


Figure 7: Average Total Dissolved Solids concentrations in up-gradient and down-gradient monitoring wells. Data is from the 2004-2011 Annual Report submittals.

4.3.3.4 Chloride

The secondary constituent standard for chloride is 250 mg/L. Figure 8 shows the concentration of chloride in up-gradient and down-gradient wells. Chloride can be used as an indication of human impact on ground water, as it is not seen in native environments. The data in this figure appear to show that site activities are having a direct impact on ground water.

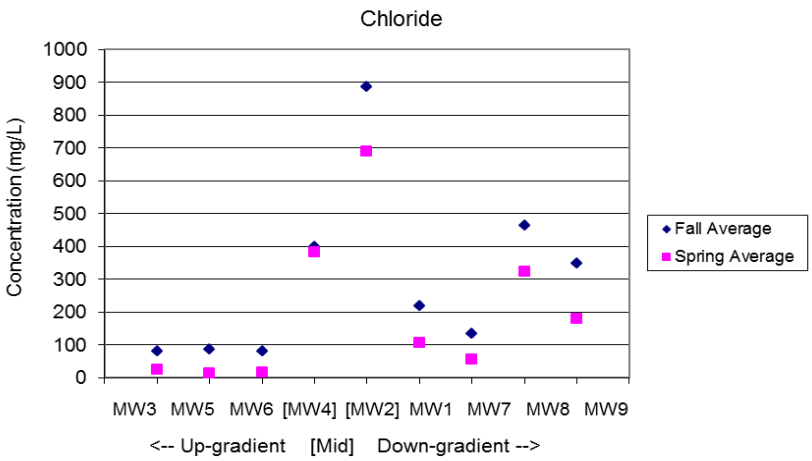


Figure 8: Average Chloride concentrations in up-gradient and down-gradient monitoring wells. Data is from the 2004-2011 Annual Report submittals.

4.3.3.5 Recommended Monitoring Requirements

The current permit requires sampling of the ground water monitoring wells twice per year, in April and October for the following constituents: nitrate, total phosphorus, TDS, chloride, total and dissolved iron, and total and dissolved manganese. The draft permit specifies that COD also be monitored, as was

required in the previous permit and is commonly required in the ground water monitoring wells of industrial reuse sites, and which may provide useful information about ground water as it travels across the site. Field parameters: electrical conductivity, dissolved oxygen, pH and temperature, were also specified.

5.0 RECYCLED WATER REUSE DISCUSSION

Sorrento is located in eastern Nampa, just north of I-84. Maps of the land application area with labeled Hydraulic Management Units (HMU) and locations of the monitoring wells are included as attachments to this document. The application system consists of seven furrow irrigated fields divided into two management units. There are a total of 133.1 acres that are permitted for use during the Growing Season (GS) and Non-Growing Season (NGS).

Sorrento was issued an NPDES permit that became effective on November 1, 2005, and has been utilizing surface water discharge as the primary wastewater discharge option. DEQ issued the current reuse permit on May 5, 2006 for emergency use only, so that Sorrento had a backup wastewater discharge option. The current permit states "in the event of wastewater treatment plant upsets and non-compliance with NPDES permit requirements, extended power outages, or diversion of high strength raw wastewater to prevent WWTP upsets, this permit allows land application of the following streams…" which are paraphrased as follows: final WWTP effluent that is out of compliance with NPDES permit requirements, SBR effluent not in compliance with the sand filter feed criteria requirements, high strength wastewater that is unacceptable to feed directly to the WWTP, raw wastewater in the event of an extended power failure, WWTP failure, or process upset, and waste activated sludge in the event that Food By-Products Management (FBM) cannot accept it. Refer to Section D, Facility Information, of the current permit for the full text.

The application of wastewater was minimal during this permit cycle when compared to the hydraulic and constituent permit limits until the whey dryer was started up in September of 2010. The addition of this process resulted in substantially increased flows to the wastewater treatment plant, and during the start-up period produced a variable influent flow rate of varying quality and introduced new or increased constituent concentrations to the WWTP influent, which has led to plant upsets. The land application site has been used more heavily since then, and Sorrento has requested that the new permit not restrict wastewater application to emergency uses only.

5.1 Hydraulic Loading

Wastewater can be applied to two land application hydraulic management sites year round. The hydraulic loading to the 133.1 acre site during the current permit term is listed in Table 3.

Table 3. Wastewater Hydraulic Loading Rate, as reported in Annual Reports.

Reporting Year	GS	NGS	GS	NGS	Total GS Application[a]
	Million Gallons (MG)		Acre-In/Acre		Acre-In/Acre
2006	6.99	0	1.84	0	1.84
2007	43.4	6.10	11.42	1.60	11.42
2008	37	0	10.24	0	50.16
2009	15.20	0	4.21	0	43.21
2010	8.2	0.68	2.52/2.19[b]	0.78/0.00[b]	56.59
2011	10.53	49.90	2.91	13.80	68.36
Current Limit	IWR[c]	24.25 MG[d]	IWR[c]	6.71 Inches[d]	IWR[c]

GS: Growing Season, NGS: Non-Growing Season, IWR: Irrigation Water Requirement, MG: Million Gallons

a. Total GS application includes supplemental water.
b. The first value is for application to HMU2, the second value is for application to HMU3. The rest of the values reported were not calculated separately for each management unit.
c. Irrigation Water Requirement (IWR) is defined in Section C of the permit, and applies to the sum of wastewater and supplemental water. DEQ calculated the IWR for this site as 38.02 inches (137.41 MG) for alfalfa - frequent cuttings, and 38.98 inches (140.89 MG) for grass hay, using the Nampa Agrimet Station and not taking into account irrigation efficiency. Alfalfa was grown in 2010 and 2011; grass hay was grown 2006-2009.
d. This was calculated in the current permit for a Soil Available Water-holding Capacity of 9.72 inches, NGS precipitation of 5.81 inches (November 1 – March 31), and Evapotranspiration of 2.80 inches.

The irrigation method used at the site is furrow irrigation with siphon tubes. Wastewater is discharged to the lagoon located within the land application site, and the irrigation ditch return flows also discharge to this pond. Irrigation water is pumped to the fields from this pond. A set of siphon tubes is estimated to have a flow rate of 80 gpm, and the irrigation rate per field has been estimated by recording the amount of time that each set of siphon tubes is operated. A flow meter has since been installed on the effluent line from this pond. This pond is essentially an equalization pond, and when effluent has been discharged to the pond it is typically pumped from the pond to the application area within 24 hours, according to the facility.

5.1.1 Growing Season Hydraulic Loading

The current permit condition for the growing season hydraulic loading rate is to irrigate at a rate substantially equal to the Irrigation Water Requirement (IWR). IWR is specific to the general location of the site and to the crop grown, and is calculated using the Precipitation Deficit (P_{def}) values on the University of Idaho Kimberly Research and Extension Center website http://www.kimberly.uidaho.edu/ETIdaho/ (Allen, 2009). IWR is found by dividing the P_{def} for the crop grown by the irrigation efficiency for the site. Sorrento has been using an irrigation efficiency of 60%, as found in the *Principles of Farm Irrigation System Design* (James, 1988). The Guidance lists a range of efficiencies from 35% to 65% for furrow irrigation. The following figure shows the total hydraulic loading in 2011 in comparison to the IWR for alfalfa (Nampa Agri-Met Station) for 35%, 50% and 60% irrigation efficiencies.

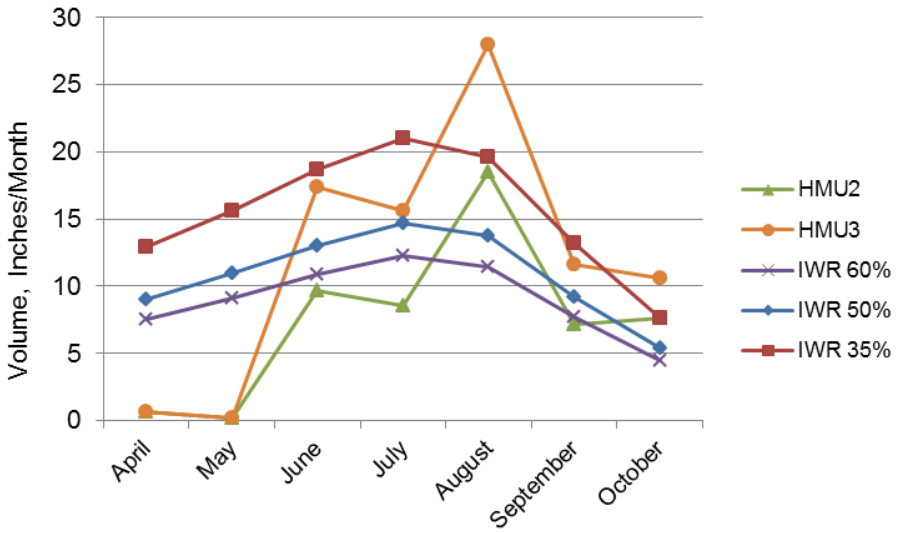


Figure 9: Growing Season Hydraulic Loading in 2011 versus the Irrigation Water Requirement of Alfalfa for Irrigation Efficiencies of 35%, 50% and 60%.

The farming operation at Sorrento has improved in 2010 and 2011, and the alfalfa crop has been well managed and productive. Staff recommends that the Growing Season hydraulic loading rate requirement of substantially equal to IWR be carried forward into the new permit. It is also recommended that an irrigation efficiency of 60% be used, because it is conservative and will be protective of ground water.

5.1.2 Non-Growing Season Hydraulic Loading

The NGS loading rates were calculated during the last permit cycle as Soil Available Water Holding Capacity (AWC) - $\text{Precipitation}_{NGS}$ + Evaporation_{NGS} from AWC numbers found in the 2005 permit application (McMahon, 2005). The limit was based on mean monthly precipitation at the Boise Airport (5.81 inches), an evaporation of 0.0209 in/day, and a soil AWC of 9.75 inches. This limit has been recalculated in the same way but using updated numbers. The calculation is explained in Attachment 1 to this document. The NGS hydraulic loading rate limit in the draft permit is 7.36 inches, or 26.62 MG. Although this limit is an increase over the previous permit limit, it is recommended that the facility not utilize non-growing season application extensively, to limit the potential to negatively affect the soil and ground water.

5.2 Historic Wastewater Quality and Nutrient Loading

Wastewater samples of each land application event are collected prior to discharge to the pond. In the current permit, land application events are defined as follows:

a. Land application of off-grade final effluent from the WWTP for 5 days;
b. Land application of 10,000 gallons of high strength wastewater as a result of an in-plant spill;
c. Land application of 50,000 gallons of SBR effluent which does not meet sand filter feed requirements.

The wastewater characteristics vary widely depending on the source of the water, but the annual averages

during this permit cycle are shown in Table 4. There are no limits on wastewater effluent concentrations.

Table 4. Average Annual Wastewater Quality in mg/L.

Reporting Year	Total Phosphorus	Total Nitrogen	Non-Volatile Dissolved Solids	Chemical Oxygen Demand
2006	2.9	9.37	1698	383
2007	9.9	29.6	2176	472
2008	0.86	3.5	2223	42
2009	23.7	23.3	2209	2620
2010	35.2	99.1	1709	3371
2011	27.6	64.8	2384	2277

The nutrient loading rates reported in the 2006-2011 annual reports are shown in Table 5.

Table 5. Nutrient Loading Rates.

Reporting Year	Total Phosphorus	Total Nitrogen	Non-Volatile Dissolved Solids	Chemical Oxygen Demand	
				GS	NGS
	lb/acre/yr total			lb/acre/day seasonal average	
2006	2	2.7	748	0.2	0
2007	31	90.9	6857	3.60	2.63
2008	2.6	4.3	6796	0.6	0
2009	22.6	22.3	2115	6.3	0
2010	17.6	53.2	1027	9.1	1.4
2011	17	70.4	7318	10.2	5.2
Current Limits	**100% of typical crop uptake[1]**	**150% of typical crop uptake[1]**	**100% of typical crop uptake[1,2]**	**50 lbs/acre-day average for each season**	

1. Typical Crop Uptake is defined in the current permit as the average of the three previous years' crop uptake.
2. Crop ash content is used to calculate crop uptake of Non-Volatile Dissolved Solids.

The annual crop production and uptake numbers for 2009 through 2011 are shown in Table 6. An alfalfa and oat mix was grown in 2009, and alfalfa was grown in 2010 and 2011.

Table 6. Annual Crop Production and Uptake.

Reporting Year	Crop Production		Annual Uptake in lbs/acre		
	Dry Tons/acre	Number of Cuttings	Total Phosphorus	Total Nitrogen	Ash
2009	2.5	2	12	92	475
2010	7.1	3	42	343	1523
2011	7.5[1]	4	44	366	1249

1. The moisture percentage of the first cutting of 2011 was estimated using the results from 2012.

The cropping practices at Sorrento improved significantly during 2010 through 2012. In the years prior to 2009, the crop yields and uptakes for the grass hay grown were insignificant, and are not discussed here. It is anticipated that Sorrento will continue to actively farm the site, and that the recent numbers are predictive of future values.

5.3 Future Wastewater Quality and Nutrient Loading

The values in Table 7 are the projected recycled water quality concentrations provided in the permit application.

Table 7. Projected Recycled Water Quality in mg/L as presented in the 2010 Permit Renewal Application.

	Concentration (mg/L)
Nitrate+Nitrite	1.46
TKN	3.5
Total Nitrogen	4.96
Total Phosphate	0.425
COD	38.7
Chloride	1000
Total Dissolved Solids	2180
Volatile Dissolved Solids	78
Non-Volatile Dissolved Solids	2102

The numbers in Table 7 were derived under the assumption that the water for reuse would come from the Decant Tank (see Figure 1), where some treatment would have taken place. The following sections discuss the constituents of concern and recommend permit limits and conditions, using the average 2011 concentrations from Table 4 and the crop uptake from Table 6.

5.3.1 Total Nitrogen

The current permit limits the total nitrogen application to 150% of typical crop uptake. If the crop uptake in 2010 is typical, the limit would be 514 lb/acre. A total nitrogen concentration of 64.8 mg/L is equal to 540.4 lb/MG. At IWR with a 60% irrigation efficiency, alfalfa needs 229 MG/yr, which would result in a total nitrogen application rate of 929.8 lb/ac/yr. Based on crop uptake, total nitrogen could be the limiting factor for this site. As was discussed in Section 4.3.3.1 of this document, nitrate is not a concern in ground water down-gradient from this site. Staff recommends that the limit of 150% of typical crop uptake be carried forward into the new permit.

5.3.2 Total Phosphorus

The current permit limits total phosphorus application to 100% of typical crop uptake. The crop uptake in 2010 was 42.28 lb/acre, and the average 2011 concentration of total phosphate was 27.6 mg/L, or 230.18 lb/MG. Similar to total nitrogen, total phosphorus could be the limiting factor for this site, and there is no ground water quality standard for total phosphorus in ground water but as was discussed in Section 4.2 of this document, phosphorus may be a concern if a ground water – surface water interconnection exists. Also, phosphorus concentration in the soil column is high, which is probably a result of historic loadings since phosphorus loading in recent years has been low. Staff recommends that the limit of 100% of typical crop uptake be carried forward into the new permit.

5.3.3 Chemical Oxygen Demand

The current permit limits COD loading to 50 lb/ac/day on a seasonal average. The predicted COD concentration is 38.7 mg/L, or 322.8 lb/MG, but the 2011 average concentration was 2277 mg/L, or 18,990 lb/MG. The COD values in 2011 ranged from 10 mg/L to 12,460 mg/L. Staff recommends that

the current permit limit be carried forward into the new permit, and notes that COD loading is of most concern in the winter and spring when soil and weather conditions are more conducive to becoming anaerobic under a high COD loading. In order to protect ground water and limit the potential for odors, Sorrento should make an effort to limit high COD loadings particularly during these times.

5.3.4 Non-Volatile Dissolved Solids

The current permit limits Non-Volatile Dissolved Solids (NVDS) to 100% of crop uptake. This limit is intended to protect the ground water with respect to TDS, which was discussed in Section 4.3.3.3 of this document. This NVDS loading limit is typically the limiting factor for land application of wastewater at this site. In the permit application, Sorrento requested that the new permit not include an NVDS loading limit. In lieu of a limit, the facility proposes monitoring the eleven (11) domestic wells that were sampled as part of the 1996 and 2007 WLAAs and the 2010 permit application, which are summarized in Table 1.

As has been discussed previously, TDS is high in the ground water surrounding the site, and it is higher in down-gradient wells than in the up-gradient wells. And, as can be seen in Tables 5 and 6, the NVDS loading exceeds the crop uptake. Additionally, as discussed in Section 4.1, soil sampling has shown an increasing trend in SAR, which is likely being caused by the high salt loading. Increasing SAR levels will eventually lead to reduced crop productivity.

It is recommended that an NVDS limit not be included in the draft permit at this time, as was requested by the permittee and because further analysis is necessary before an appropriate limit can be established, if it is determined that one is necessary. Several conditions are recommended for inclusion in the draft permit that would lead to a determination of whether a limit is necessary. These conditions are discussed in the compliance activity section of this document (Section 7.2) and the conclusions and recommendations section (Section 8). While there is a Ground Water Quality Standard for TDS concentrations in ground water, it is a secondary constituent standard that is included for aesthetic reasons, such as corrosivity and taste, and is not a health threat.

6.0 SITE MANAGEMENT

6.1 Operations and Maintenance

Operation of the wastewater treatment plant has been focused primarily on meeting the NPDES limits. The operation of the land application field was secondary, but a contract farmer was brought in to manage the farming operation, and alfalfa was planted in 2009. Management of the field has improved significantly since that time, and there were four cuttings in 2011. The WWTP is operated and maintained very well, with problems occurring mostly because of upsets upstream of the plant or due to the lack of WWTP capacity to treat the entire influent flow.

6.2 Nuisance Odor Management Plan

Sorrento periodically receives nuisance odor complaints, which they have responded to and reported to DEQ. It is unknown if there currently is a Nuisance Odor Management Plan, and the proposed compliance activity to submit a Plan of Operations (see Section 7.2) includes a requirement to include a Nuisance Odor Management Plan in the submitted document.

6.3 Grazing Plan

No grazing on the land application site has taken place. Should the facility want to have grazing on the site in the future, a grazing plan will be required prior to any animals being located onsite.

6.4 Waste Solids Management

Sorrento does not currently land apply waste solids at their recycled water reuse site. Various waste solids are generated at the site, including cheese whey sludge and sludge from the clean-in-place process at the whey plant. Currently, the former is primarily sent to a composter where it is mixed with composting materials and used as fertilizer, or to a farmer where it is mixed with other material and turned into cattle feed. The latter is sent to off-site treatment and storage facilities.

The proposed compliance activity to update the Plan of Operations (see Section 7.2) includes a requirement to submit a Waste Solids Management Plan in the document. This plan should include discussion of the treatment, generation, and transportation of the solids, the recipient responsibilities, and safety considerations such as spill response and any sampling and analysis that will be conducted. The plan should include a contract with the recipient outlining what will be done with the solids. The plan should be kept up-to-date, with proposed modifications and updates to the plan approved by DEQ prior to implementation.

6.5 Buffer Zones and Wellhead Protection

In the current permit there are no mandated buffer zones from the land application site to dwellings, areas accessible to the public, or surface water since irrigation is accomplished via siphon tubes and furrows, so overspray is not an issue. The current and draft permits specify a buffer zone of 500 feet to private wells and 1000 feet to public wells.

The proposed compliance activity to update the Plan of Operations (see Section 7.2) includes a requirement to submit a Runoff Management Plan and a Buffer Zone Plan in the document. A second proposed compliance activity would require that the surface seals on all monitoring wells be checked for integrity. The draft permit added the requirement that a 100 foot buffer zone be maintained between the site and inhabited dwellings. Other buffer zones typical for recycled water reuse sites are 100 feet to permanent and intermittent surface waters and 50 feet to irrigation ditches and canals. This is not feasible for Sorrento given that the Perkins Drain and Rachel Drain cross through the land application site. Since the permittee does not spray irrigated, the potential for effluent to enter surface water via over-spray is nil. These buffer zones were not added to the draft permit, but the draft permit would require the permittee to include ditch maintenance and runoff control as part of a Compliance Activity in Section 2 of the permit and which is discussed further in Section 7.2 of this document.

6.6 Lagoon (Pond 3)

Effluent for land application is sent to a lined lagoon located to the north of the site, where the two HMUs meet. Irrigation water and return flow from the field irrigation also flow to this lagoon. Effluent from this lagoon is pumped to the ditches for irrigation.

To the knowledge of the facility, seepage testing has not been conducted on this lagoon. A requirement to seepage test this lagoon has not been included in the draft permit at this time, because the majority of the

water in the lagoon is irrigation water, and recycled water is not held in the lagoon for extended periods of time (typically less than 24 hours, according to the facility). However, a condition to determine if the monitoring wells are capturing the effects that this lagoon may be having on ground water has been included in a Compliance Activity in Section 2 of the permit, as is discussed in the following section.

7.0 COMPLIANCE ACTIVITIES

7.1 Summary of Compliance Activities in LA-000091-02

CA-091-01: Submit a revised Plan of Operation containing a "high strength wastewater management plan."
Status unknown.

CA-091-02: Submit a Well Location Acceptability Analysis, due 3 months after permit issuance.
Submitted: January 23, 2007
Approval: February 20, 2007
Addendum: May 31, 2007
Approval: June 18, 2007

CA-091-03: Submit a plan for the closure of the two wastewater treatment ponds, including soil monitoring results for the soil column below each of the ponds.
Completed.

CA-091-04: Submit a Sampling and Analysis Plan for land application monitoring requirements.
Submitted: March 4, 2010
Approved: March 15, 2010

7.2 Recommended Compliance Activities in I-091-03

The following compliance activities are recommended for inclusion in the renewal permit.

CA-091-01: Sorrento submitted a Wastewater Facilities Planning Study on September 9, 2011 which was approved by DEQ on September 12, 2011. The study contained recommendations for an expansion to the wastewater treatment plant to provide capacity to treat an effluent flow of up to 1.01 mgd. The draft permit contains a requirement to update this planning study as necessary to reflect updated process and production plans, and to provide a schedule for completion of the phases of treatment plant expansion.

CA-091-02: A Total Dissolved Inorganic Solids (TDIS) Management Plan is needed to address the high levels of TDS (and NVDS) in the effluent, and the increasing levels of TDS in the ground water that appear to be a result of land application activities. Since the facility intends to continue to utilize land application, the issue of TDS in ground water must be addressed. This condition is proposed to be due at the same time as the Wastewater Facilities Planning Study, as the two issues are related and should be completed in conjunction with one another.

The condition requires that the permittee determine the sources of TDIS, and analyze

process and treatment alternatives that could reduce TDIS in the land application effluent. The condition also would require that the current and future loading rates be determined, and that the ground water impact be predicted based on these loading rates. It is anticipated that the permittee will conduct a ground water mixing zone analysis to determine the predicted impact at the site boundaries.

CA-091-03: A Plan of Operations (PO) should be submitted to DEQ for review and approval. The draft permit requires that the plan address all of the relevant items on the Plan of Operations checklist included in Section 1.9 of the Guidance, which includes site management plans such as a Nuisance Odor Management Plan, a Runoff Management Plan and a Waste Solids Management Plan. The compliance activity narrative expands upon certain checklist items that should be addressed in subsections of the plan.

In addition to the checklist items, the compliance activity requires that the plan include a Quality Assurance Project Plan for all sampling, monitoring and reporting required by the permit. It is recommended that the condition also require that a Contingency Plan be included in the PO, which would contain a discussion of situations that result in discharges to the recycled water reuse site of untreated or partially treated effluent and water that would cause a violation of the NPDES permit. The plan would describe the management and response during these situations. The plan would include a discussion of influent changes that can cause a WWTP upset, and the upstream facility discharges that cause these changes in influent characteristics. The plan would also discuss nutrient and hydraulic loadings that could result from these applications, and management of the reuse site to avoid potential environmental impacts of the applications. The Contingency Plan should also contain the typical analytical results of the offending influent and discharges that have been occurring on a semi-regular basis, outline management practices during these upsets, and discuss how they can be avoided. Sorrento should report non-compliances to DEQ in accordance with the reporting requirements of Section 6 of the permit, and when diversions result in non-compliance with the Reuse Permit, a report should be sent to DEQ and EPA in accordance with the NPDES permit. The reports should include the reason for the diversion(s), the volume diverted, the analytical reports, and the associated hydraulic and constituent loading.

CA-091-04: A Ground Water Study is needed to understand the flow of ground water in the vicinity of the site, to determine if the monitoring well network is adequately capturing the influence of the activities on the ground water, to determine if the nearby domestic wells are being affected by the site, and to determine if a ground water – surface water connection exists. A plan for the ground water study would be required to be submitted to DEQ for review prior to conducting the study activities. This plan should include a Quality Assurance Project Plan to provide assurances that project will produce useful and accurate information.

An analysis of the ground water monitoring well network is needed due to unexplainable data in certain wells, such as the mid-gradient wells MW-2 and MW-4, and down-gradient well MW-9. The permittee should inspect all of the wells for the integrity of the well casing and screens, determine if the surface seals are adequate and intact, and determine if the well data are indicative of site conditions, if more wells are needed, or if certain wells should be decommissioned. Concurrently, in lieu of seepage testing, this condition would require that the permittee determine if the wells are capturing the effects of the lagoon. If they are not, the lagoon will either need to be seepage tested or additional wells installed to monitor the

influence on ground water.

This compliance activity would also require that the facility finalize the Well Location Acceptability Analysis for Wells 24 and 25 to determine if they are being influenced by activities at the site. It is recommended that it be determined if these wells are screened in the upper aquifer.

Surface water must also be evaluated as part of this overall study to determine if there is a ground water – surface water connection.

It is recommended that the Ground Water Study include water mineral analysis for major cations and anions and plotted on a trilinear diagram. This analysis will give the chemical characterization of the ground water, and a comparison of the up-gradient and down-gradient results can be used to assess connectivity of the water and potential environmental impacts. Stable isotopes analysis using the isotopes of oxygen and hydrogen as tracers for specific sources of water would be definitive as to whether ground water in any of these wells is influenced by surface water or wastewater. Field parameters and nitrate, phosphorus and TDS information should also be collected in the forms appropriate for the media. In the study, samples of ground water, surface water, irrigation water and wastewater should be collected.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The following is a summary of the limits and conditions that are recommended for inclusion in the permit.

Section 3.2, Hydraulic Loading Limits. The hydraulic loading rate limit is recommended to be "substantially at the IWR" in the growing season, and set to 7.36 inches in the NGS, as discussed in Section 5.1.2.

Section 3.3, Constituent Loading Limits. The following constituent limits, as discussed in Section 5.3, are recommended: nitrogen application is limited to 150% of typical crop uptake, phosphorus is limited to 100% of crop uptake, and COD is limited to 50 lb/acre/day as a seasonal average. Concentration limits for NVDS have been removed from the permit at this time, but as a result of Compliance Activities CA-091-01, CA-091-02, and CA-091-04, a modification to this permit to include an NVDS loading limit in the future may be necessary.

Section 3.4, Buffer Zones. The buffer zone distances to private and public wells are 500 feet and 1000 feet, as required in the current permit. The following buffer zone was added to the draft permit: 100 feet to inhabited dwellings. This section also includes a requirement to post signs at each access point and at each corner of the recycled water reuse site.

Section 3.5, Other Conditions. The draft permit contains conditions to test all backflow prevention devices and calibrate all flow measurement devices annually.

Section 4.1.1, Microbial and Constituent Monitoring. Weekly grab samples are to be collected of the wastewater treatment plant effluent during periods of use for irrigation. When untreated or partially treated wastewater is discharged to the lagoon for subsequent land application, the draft permit requires one daily

grab sample. A new requirement was included to collect one grab sample per month of the supplemental irrigation water, which could be collected up-stream or from the lagoon when no recycled water has been discharged. These samples will be used to calculate the constituent loading from irrigation water as required in Section 5.1 of the draft permit. And finally, this section contains a new sampling requirement to submit an analysis of the TDIS in the final WWTP effluent twice annually, in order to understand the chemical makeup of the TDIS. In addition, a new requirement has been included that requires the permittee record the reason for all diversions of untreated and partially treated water and the subsequent discharges, and what was done to remedy the situation.

Section 4.1.2, Flow Monitoring. Flow rates of the following flow streams are to be measured: recycled water flow to the lagoon or HMU, flow from the lagoon to the fields, and irrigation water at the diversion.

Section 4.2, Ground Water. As discussed in Section 4.3.3.5, the monitoring wells are to be sampled twice annually.

Section 4.3, Soil. Composite samples are to be collected annually in March, with analysis for additional select constituents collected in March of the first and last permit years, as discussed in Section 4.1 of this document.

Section 4.4, Plant Tissue. The draft permit retains the requirement to take a sample of each harvested crop for each management unit in order to calculate uptake.

Section 5.1, Annual Report Requirements. This section of the draft permit outlines what is required in the annual report submittals, which include the results of all monitoring required by the permit as well as calculations of loading and uptake, an update on compliance activities, and an analysis of application and monitoring.

9.0 RECOMMENDATION FOR ISSUANCE OR DENIAL OF PERMIT

Based on a review of applicable state rules, staff recommends that DEQ issue draft Reuse Permit No. I-091-03 for a public review and comment period. The draft permit contains effluent quality requirements for the wastewater treatment system, hydraulic and constituent loading limits, and terms and conditions required for operation of the recycled water reuse system. Compliance activities have been incorporated into Section 2 of the draft permit to address outstanding issues. Monitoring and reporting requirements have been included to demonstrate compliance with the permit conditions, and demonstrate protection of human health and the environment with respect to operation of the facility.

10.0 REFERENCES

Forsgren Associates, Inc. 2011, Wastewater Facilities Planning Study, Sorrento Lactalis, Inc.

Forsgren Associates, Inc. 2011, Sorrento Lactalis, Inc. Water Quality Monitoring Report for Wintertime Land Application 2010-2011.

Scanlan, Terry M., 1996, Simplot Dairy Products Division Nampa Plant Well Location Acceptability Analysis.

Pietrich, Christian, 2007, Well Location Acceptability Analysis (Additional addendum in 2007).

Allen, Richard G. and Clarence W. Robison, 2009. Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho: Supplement updating the Time Series through December 2008, Research Technical Completion Report, Kimberly Research and Extension Center, University of Idaho, Moscow, ID.

James, Larry, 1988, *Principles of Farm Irrigation System Design*, John Wiley and Sons, Inc., New York.

McMahon Associates Inc., 2005, Application for Land Application Permit, On-Site Land Application System prepared for Sorrento Lactalis, Inc. Production Facility Nampa, Idaho.

Attachment 1: Non-Growing Season Loading Rate Limit Calculation

The following documents how the non-growing season loading rate was calculated for the draft permit.

The National Resource Conservation Service (NRCS) Soil Survey maps were used to identify the soil types present at the site (shown below), and the official soil series descriptions were used to determine the available water-holding capacities of those soils.

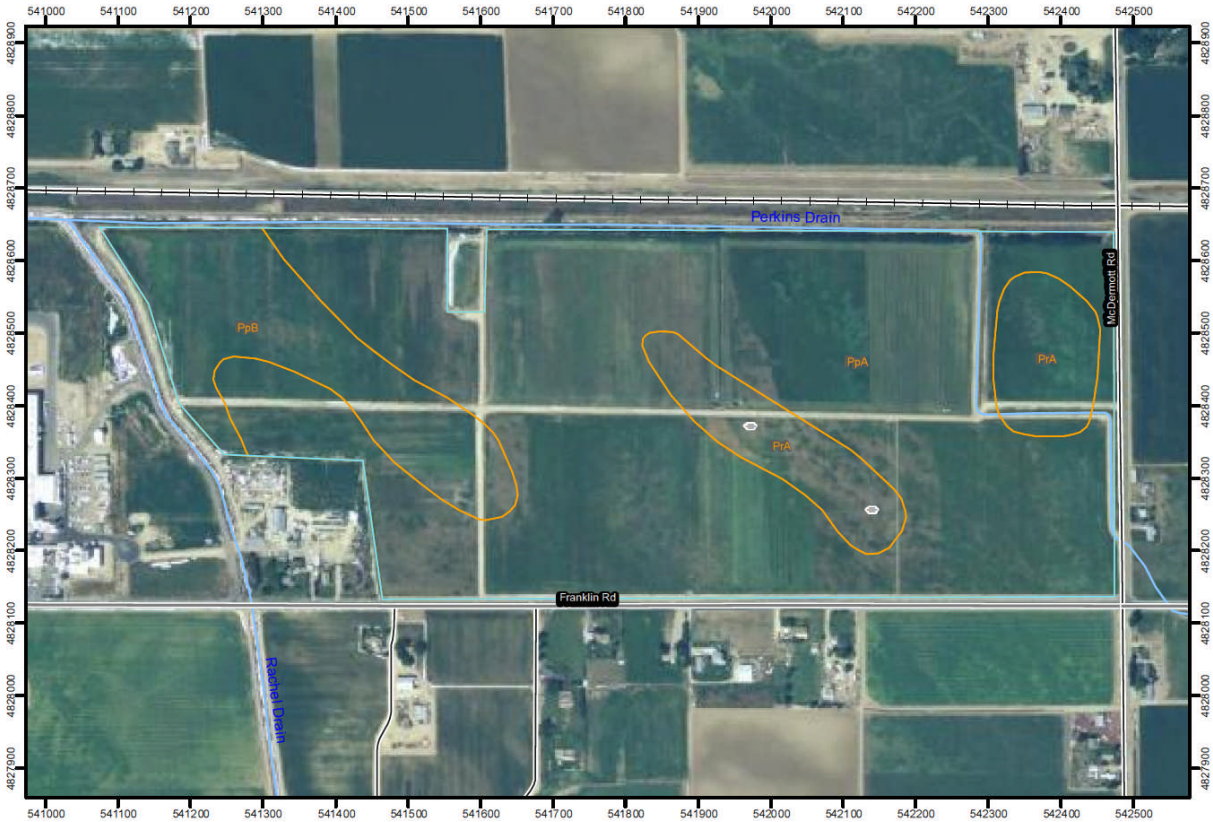


Figure 1: Site Coverage of Soil Types from the National Resource Conservation Service Soil Survey

Table 1: Percent of Site Coverage of Soil Types from the National Resource Conservation Service Soil Survey

Canyon Area, Idaho (ID665)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
PpA	Power-Purdam silt loams, 0 to 1 percent slopes	113.4	75.8%
PpB	Power-Purdam silt loams, 1 to 3 percent slopes	20.5	13.7%
PrA	Purdam silt loam, 0 to 1 percent slopes	15.8	10.5%
Totals for Area of Interest		**149.7**	**100.0%**

From the official soil descriptions, also from NRCS, the percentage of each type of soil was used to calculate the AWC for the site, as follows.

Table 2: Calculation of Available Water-Holding Capacity

Soil Classification	Soil Composition	Percent Soil Composition	AWC	AWC for Soil Classification	Percent Coverage of Site	Area Weight AWC
PpA	Power Purdam	65% 25%	10.6 4.7	8.065	75.8%	6.11
PpB	Power Purdam	65% 25%	10.6 4.7	8.065	13.7%	1.10
PrA	Purdam Other	90% 10%	4.7 --	4.23	10.5%	0.44

The sum of the area weighted AWC is 7.66 inches.

The non-growing season precipitation for several weather stations was taken from the Idaho Extension website http://www.kimberly.uidaho.edu/ETIdaho/ for the months of November through March. The evapotranspiration data for those same stations was also taken from that website for alfalfa – frequent cuttings. This data is shown in the following table.

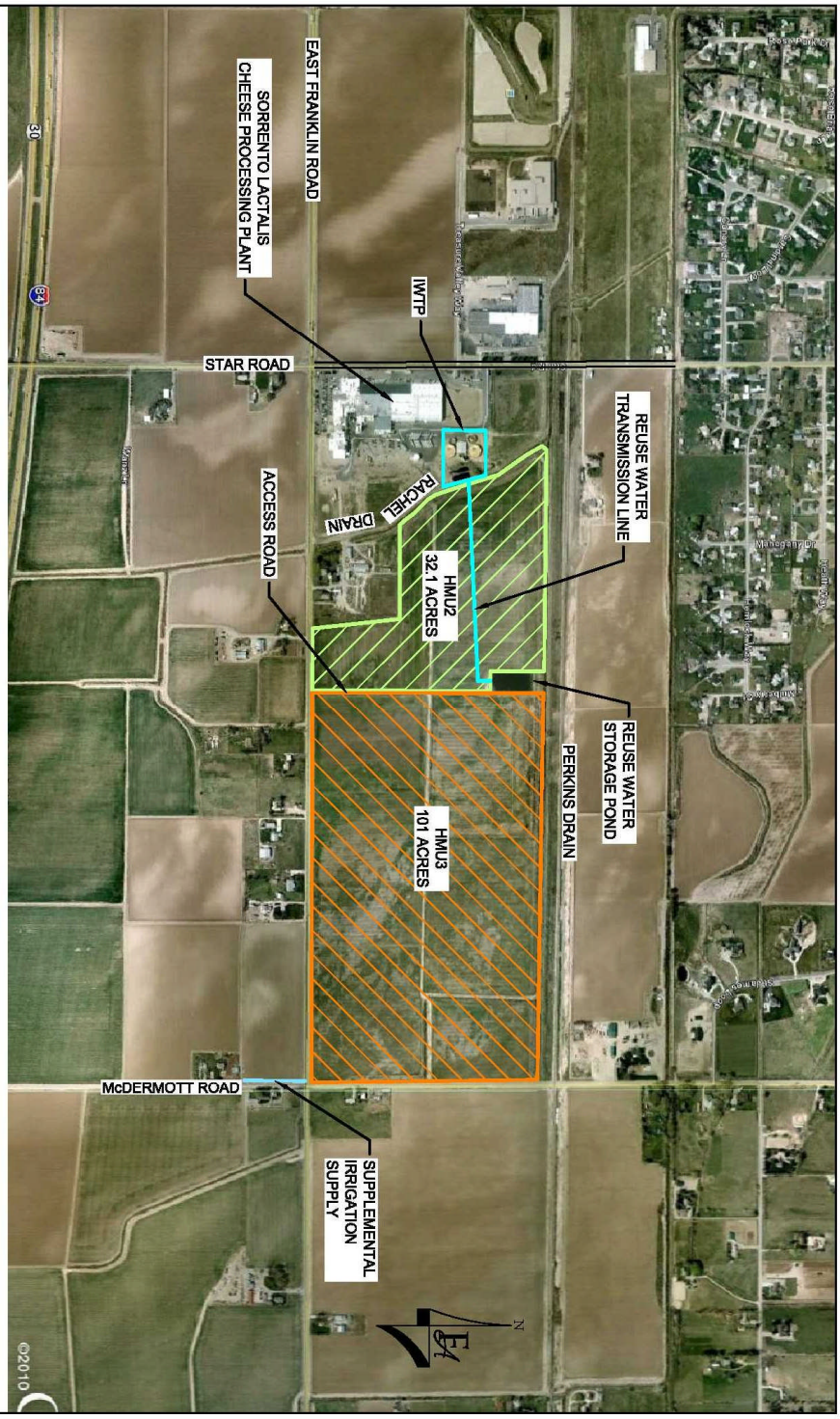
Table 3: Non-Growing Season Loading Calculations for Local Weather Stations

	Nampa AgriMet	Boise WSFO	Kuna	Caldwell
AWC (Table 2)	7.66	7.66	7.66	7.66
Precipitation, NGS	4.05	6.93	5.26	6.84
Evapotranspiration Alfalfa-frequent cuttings	5.77	5.50	4.61	6.02
Sum	9.39	6.22	7.01	6.84

This data was averaged to arrive at the non-growing season hydraulic loading limit in the permit, which is 7.36 inches. This is equal to 26.62 MG/NGS for the 133.1 acre site.

Attachment 2: Site Map

P:\210023 - Sorrento WW Permitting\CADD\Submittal Drawings\Permit\2 Permit Sorrento Reuse Site.dwg, 10/29/2010 9:15:48 AM, rb



FORSGREN Associates Inc.

SORRENTO LACTALIS, INC. - NAMPA FACILITY

REUSE SITE AND FACILITIES

PROJECT NO. 02210023

FIGURE NO. 2

Attachment 3: Ground Water Wells and Contours

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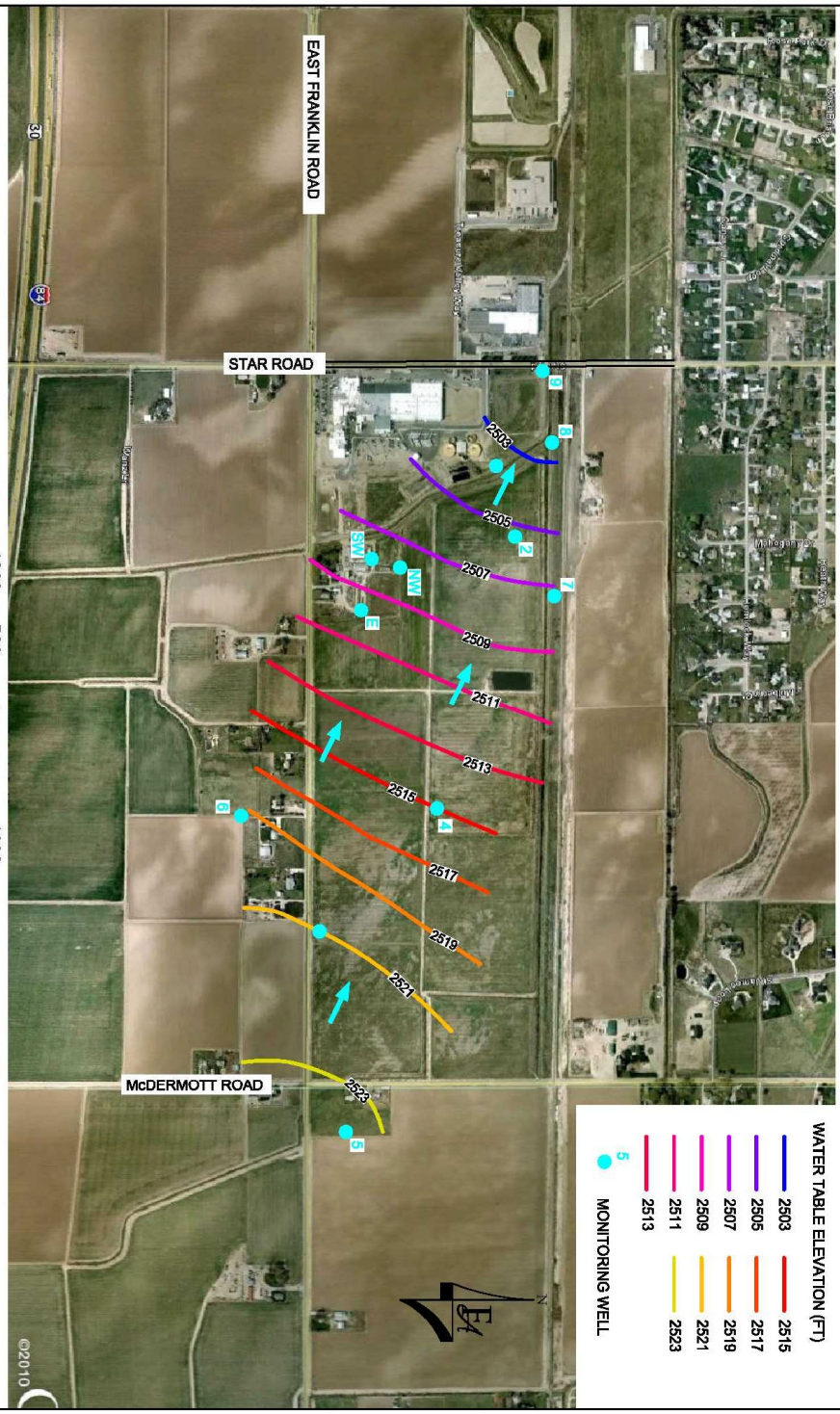

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SORRENTO LACTALIS, INC. - NAMPA FACILITY

SHALLOW GROUNDWATER FLOW DIRECTION

PROJECT NO. 02210023

FIGURE NO. 7

Attachment 4: Local Wells