Big Bear Area Regional Wastewater Agency

# Irrigation Management Plan

for the

## Lucerne Valley Facility

Prepared for:

Colorado River Region Water Quality Control Board

as Required by Board Order R7-2016-0026

Prepared Under the Responsible Charge of:

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California R.C.E. No. 72424, Expires 6/30/2022


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# 1 INTRODUCTION AND PURPOSE

Big Bear Area Regional Wastewater Agency (BBARWA) collects and treats the wastewater for its Member Agencies (the City of Big Bear Lake, Big Bear City Community Services District, and San Bernardino County on behalf of Service Area 53B) in the Big Bear Valley in the San Bernardino Mountains of California. BBARWA owns and operates a 4.9 million gallon per day (MGD) capacity wastewater treatment plant (WWTP) located just south of Baldwin Lake on the east side of the Valley. The WWTP currently treats approximately 2.2 MGD of municipal wastewater.

The WWTP discharge is currently regulated by two regulatory boards and discharge permits:

- Santa Ana Region of the California Regional Water Quality Control Board (RWQCB) under Waste Discharge and Producer/User Water Recycling Requirement (WDR) Order No. R8-2005-0044 (Santa Ana WDR), issued on June 24, 2005. The Santa Ana WDR regulates two discharge points in the Big Bear Valley.
- Colorado River Basin RWQCB under WDR Order No. R7-2016-0026 (Colorado River Basin WDR), issued on June 30, 2016. The Colorado River Basin WDR regulates one discharge point in the Lucerne Valley.

The Colorado River Basin WDR and the Lucerne Valley discharge point are the subject of this report.

BBARWA's treated undisinfected secondary effluent is discharged to a 480-acre site in Lucerne Valley (Lucerne Valley Facility) for crop irrigation. Use of treated effluent for crop irrigation at the Lucerne Valley Facility began in 1980 and 100% of the WWTP effluent is currently discharged to this location. The Lucerne Valley Facility also includes two overflow ponds that are used to dispose of excess treated effluent by percolation and evaporation.

As required by Special Provision No. 2 of the recently adopted Colorado River Basin WDR, BBARWA must prepare and submit an Irrigation Management Plan for the Lucerne Valley Facility that includes a water balance and nutrient balance to assure that recycled water is applied at appropriate rates.

This Irrigation Management Plan (Plan) provides background information on the Lucerne Valley Facility, BBARWA's wastewater effluent characteristics, and historic water and nutrient balances. For the purposes of this Plan, the nutrient balance is limited to nitrogen. This plan was originally prepared in 2016 and was updated in 2021 to cover the period from January 2005 to December 2020.

# 2 LUCERNE VALLEY FACILITY CHARACTERISTICS

## 2.1 SITE OVERVIEW

The Lucerne Valley Facility is a 480-acre site owned by BBARWA and located near the intersection of Camp Rock Road and Highway 247 (Old Woman Springs Road) in Lucerne Valley, CA, as shown in Figure 1. This site is located approximately 17 miles north of BBARWA's WWTP.

The Lucerne Valley Facility is surrounded by a barbed wire fence to restrict public access to the farm. Warning signs are clearly posted to inform the public that non-disinfected recycled water is used at this site, as shown in Figure 2.

### 2.1.1 Onsite Wells

There are three monitoring wells located onsite. Monitoring Well 1 is located along the south eastern side of the farm and Monitoring Wells 2 and 3 are located along the north western side of the farm, as shown in Figure 3.

Well 14, shown in Figure 3, is used onsite exclusively for non-potable uses. Bottled water serves as the exclusive potable water source onsite, so there is no potential for cross connection of the recycled water system with a potable water piping system.

All wastewater generated onsite is disposed of using a septic system.

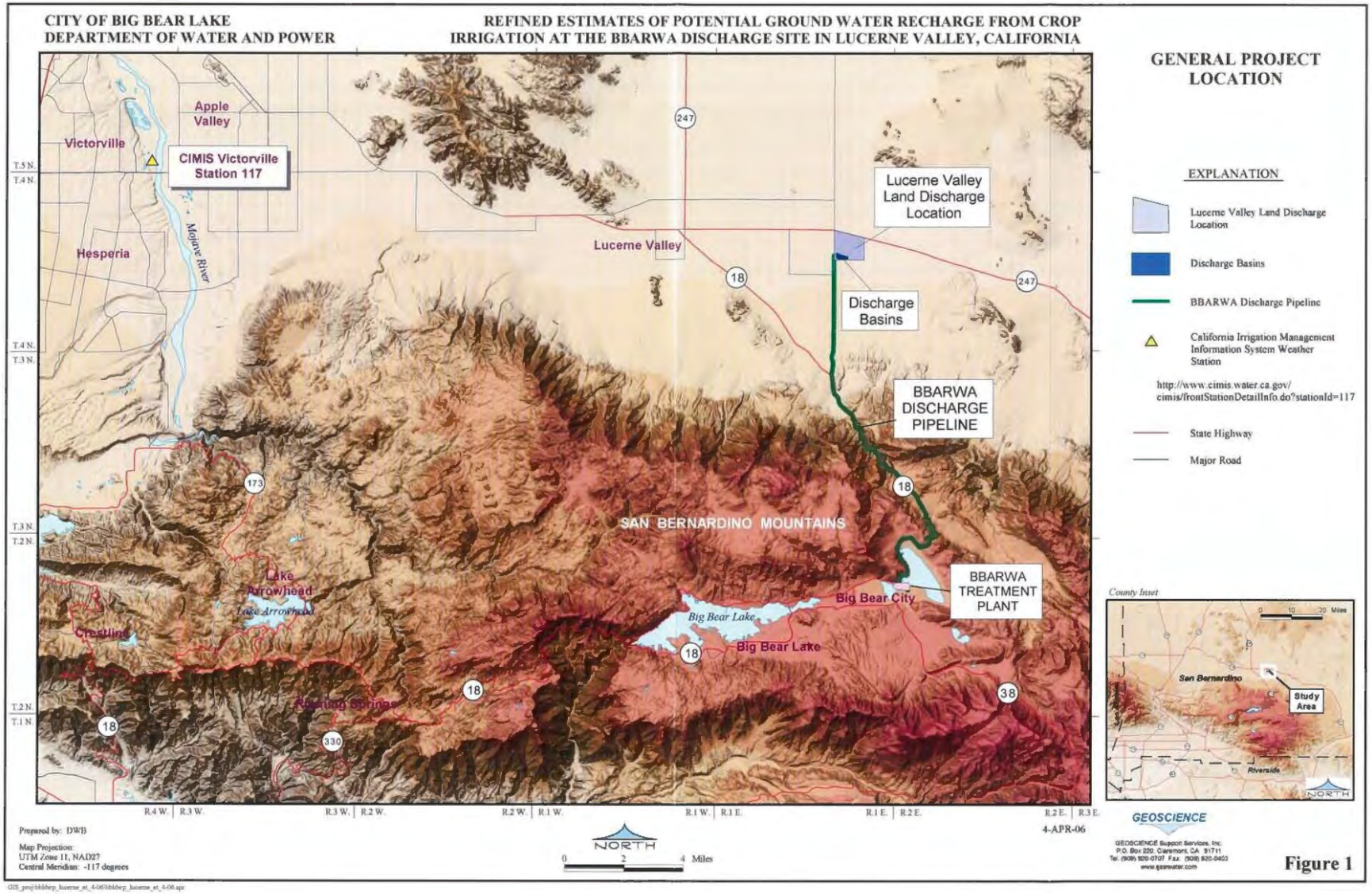


**Figure 1: Location of Lucerne Valley Irrigation Site (1)**


**Figure 2: Warning Signs at Lucerne Valley Facility**

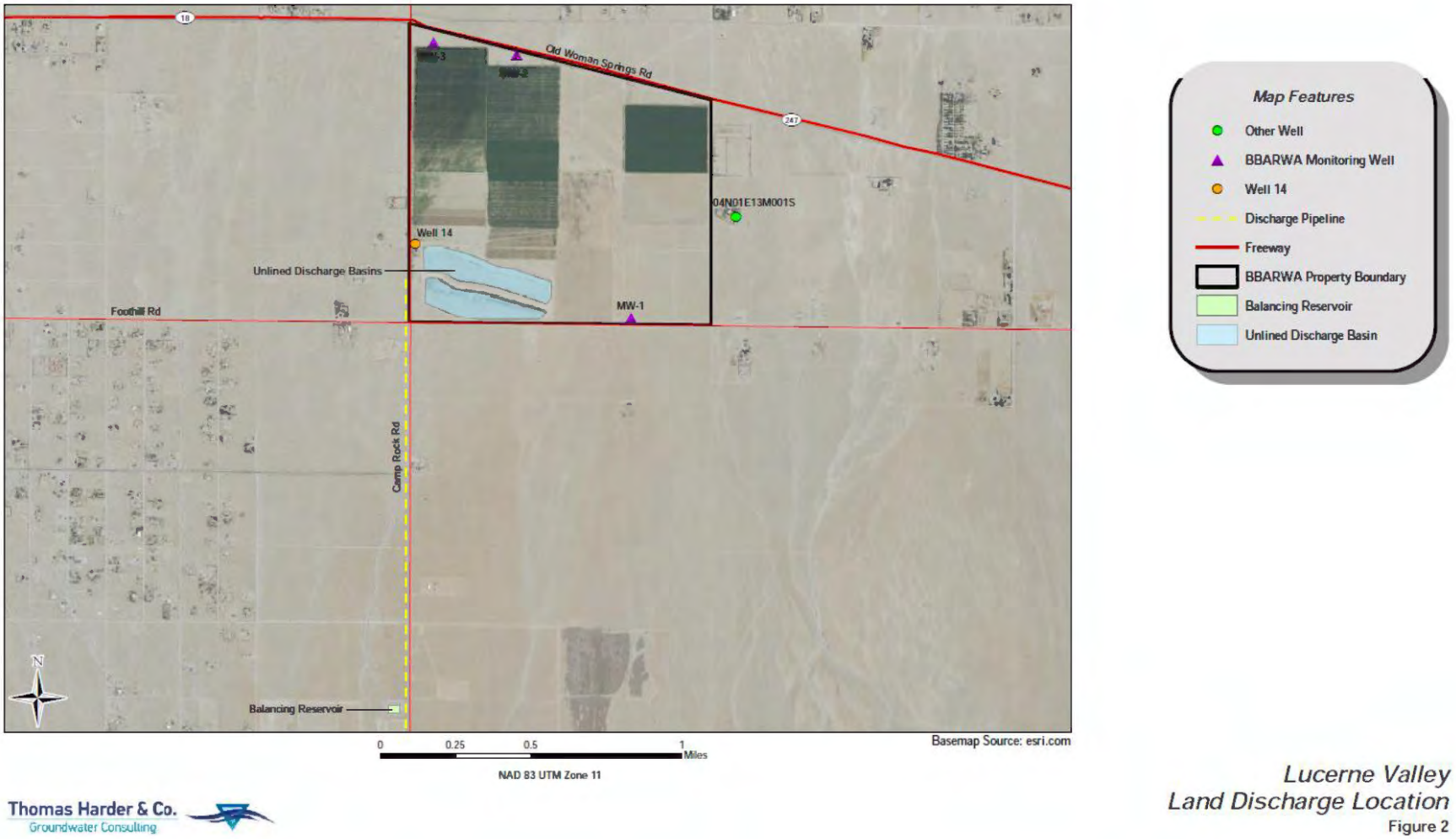


**Figure 3: Site Layout and Well Locations (2)**

## 2.2 FARMING OPERATION

The information presented in this section was obtained during a site visit and interview with the farmer and BBARWA staff conducted on September 6, 2016.

The Lucerne Valley Facility has been in operation as a farm since 1980 and is operated by a farmer who leases the land from BBARWA. Alfalfa and a grain mixture consisting of barley, oat and wheat are grown onsite and sold as feed for animals not producing milk for human consumption. Historically, up to 330 acres of the site has been farmed; however, the farmed area was reduced in 2012 to only 190 acres due to reduced water availability associated with drought conditions. The current farmed area remains at 190 acres with no plans to increase the acreage.

## 2.3 RECYCLED WATER DISTRIBUTION

The recycled water from the BBARWA WWTP flows to a concrete balancing reservoir along Camp Rock Road, shown in Figure 3, then by gravity to the Lucerne Valley Facility. At the Lucerne Valley Facility, the water can be directed to three locations: the West Fields, the East Fields, or the unlined discharge basin (Earth Basin). Two water meters located in the distribution system record flows to both the West and East Fields. Flow to the Earth Basin can be calculated by subtracting the sum of the metered flows to the West and East Fields from the total effluent flow leaving the BBARWA WWTP. The WWTP and field meters are calibrated annually by BBARWA.

During the summer months, all of the water is typically applied to the fields and little to none goes to the Earth Basin. In winter months, and on some other occasions, some or all of the water is routed to the Earth Basins for disposal. This is typically the result of one of the following:

- The recycled water flow is in excess of the crop needs. This occurs primarily in the winter when wastewater flows may be higher than average and crop water demands are lower.
- The concrete balancing reservoir is being drained for inspection or maintenance.
- An herbicide was applied at the BBARWA WWTP near the effluent storage ponds. Flow is diverted from the crops for a day or two to ensure that they are not impacted by the herbicide.

The amount of water applied to the fields and the Earth Basin each month is presented in the Water Balance in Section 4.

## 2.4 FARMING PRACTICES

Crop rotation is practiced on the farm at the Lucerne Valley Facility. Alfalfa is the primary crop grown on a 5-year cycle. Every five years, the alfalfa is replaced by a grain mixture of barley, oat and wheat to ensure healthy, nutrient-rich soil. This grain mixture is typically planted in late November, typically on a 50-acre portion of the farm at a time. The remaining fields continue to grow alfalfa. When planting crops, the farmer first disks the ground to prepare the soil, irrigates the prepared soil, then disks the ground again before planting the seed for the new crop.

### 2.4.1 Irrigation Practices

Irrigation is applied via a sprinkler system onsite as determined by the farmer; no automatic irrigation controller is used during the process. Irrigation is performed in sets that vary by the crop being irrigated. Each set covers a section that is approximately 100 ft by ¼ mile, or about 3 acres. The irrigation guidelines the farmer follows are detailed in Table 1. These durations are used throughout the entire year.

**Table 1: Typical Irrigation Schedule**

| Description | Area Irrigated | Duration |
|---|---|---|
| **Alfalfa** | 3 Acres | 12 Hour Set |
| **Reseeded Area** | 3 Acres | 4 Hour Set |
| **Grain Mixture** | 3 Acres | 6 Hour Set |

Precautionary measures are taken to ensure that the irrigation water is maintained onsite. The site is graded to prevent ponding and irrigation runoff from leaving the site. Any irrigation water that turns into runoff flows north to a ditch that is designed to contain the water on the property. Irrigation overspray leaving the property is prevented whenever possible. When the wind is blowing, the sprinkler heads located adjacent to the road are plugged in an effort to prevent the wind from carrying the irrigation water offsite.

### 2.4.2 Fertilizer Additions

When needed, fertilizer is typically applied with a loading of 100 pounds nitrogen/acre in the form of urea. Fertilizer is usually applied when switching from grain to alfalfa, but is not needed between rounds of alfalfa. Typically, fertilizer is applied on a three-year cycle that corresponds with the crop rotation schedule. However, the last fertilizer application occurred in April 2014, in which 70 acres of crops were fertilized. Available historical fertilizer information can be found in the nitrogen balance, attached as Appendix B.

The farmer's judgement is executed when deciding whether or not to apply the fertilizer. Soil samples were collected in 1999 to determine whether the alfalfa crops were getting the required nutrients, however no such samples have been taken since this 1999 study and the results of this study are unavailable. The farmer bases his decision on the look and feel of the crops. When the crops look yellow, additional fertilizer is added.

## 2.5 SOIL CHARACTERISTICS

Geophysical and lithologic logs from drilling the monitoring wells at the Lucerne Valley Facility indicate that the soil is composed of reddish brown sand, gravel and silt for the first 140 feet. Layers of unconsolidated sands, gravels, silts and clays extend to a depth of 255 feet below the Lucerne Valley Facility. An excerpt of the geologic profile is provided as Appendix A.

## 2.6 CLIMATIC CONDITIONS

The climatic conditions for the Lucerne Valley Region were determined using California Irrigation Management Information Systems (CIMIS) data for the Victorville Station (Station 117) and are summarized in Table 2. According to the Mojave Water Agency's 2015 Urban Water Management Plan, Victorville is representative of the regional climate for the surrounding region. However, the Lucerne Valley can be drier, windier and have greater temperature variability than is seen within the city of Victorville (3).

**Table 2: Climate Data for the Lucerne Valley Region**

| Station | Total $ET_o$ (in) | Total Precipitation (in) | Avg Max. Air Temp. (F) | Avg Min. Air Temp (F) | Avg Air Temp. (F) | Avg Wind Speed (mph) |
|---|---|---|---|---|---|---|
| **1997** | 68.4 | 6.4 | 74.7 | 45.9 | 61.4 | 6.3 |
| **1998** | 62.0 | 11.4 | 71.2 | 44.2 | 58.3 | 7.0 |
| **1999** | 67.8 | 3.2 | 74.6 | 43.7 | 60.0 | 6.7 |
| **2000** | 68.4 | 3.4 | 75.1 | 45.3 | 61.2 | 6.6 |
| **2001** | 67.3 | 6.9 | 74.9 | 46.5 | 61.5 | 6.2 |
| **2002** | 69.6 | 2.4 | 75.5 | 44.8 | 61.0 | 5.8 |
| **2003** | 66.6 | 12.4 | 75.2 | 46.3 | 61.5 | 6.1 |
| **2004** | 66.2 | 13.6 | 74.1 | 45.4 | 60.6 | 5.4 |
| **2005** | 64.6 | 13.2 | 73.7 | 46.4 | 60.6 | 5.9 |
| **2006** | 68.1 | 4.1 | 74.6 | 45.2 | 60.8 | 6.1 |
| **2007** | 71.2 | 3.3 | 75.5 | 45.9 | 61.5 | 6.2 |
| **2008** | 68.7 | 3.7 | 75.1 | 46.0 | 61.3 | 6.1 |
| **2009** | 66.1 | 3.0 | 74.8 | 45.7 | 58.9 | 6.0 |
| **2010** | 66.2 | 18.9 | 73.2 | 45.4 | 59.9 | 6.1 |
| **2011** | 67.1 | 12.2 | 73.3 | 44.4 | 59.3 | 6.0 |
| **2012** | 70.2 | 5.0 | 76.4 | 46.9 | 62.1 | 6.0 |
| **2013** | 68.9 | 1.1 | 75.4 | 46.2 | 61.1 | 5.6 |
| **2014** | 67.7 | 1.5 | 77.4 | 48.1 | 63.3 | 5.0 |
| **2015** | 67.7 | 2.4 | 76.3 | 47.9 | 62.3 | 5.5 |
| **2016** | 70.3 | 3.8 | 76.9 | 47.6 | 62.6 | 5.8 |
| **2017** | 70.0 | 2.2 | 77.5 | 47.1 | 62.8 | 5.5 |
| **2018** | 70.6 | 4.2 | 77.0 | 48.5 | 63.1 | 5.8 |
| **2019** | 67.9 | 7.6 | 74.0 | 46.9 | 60.7 | 6.0 |
| **2020** | 69.7 | 4.0 | 77.8 | 47.6 | 62.9 | 5.4 |
| **Avg** | **68.0** | **7.6** | **75.2** | **46.1** | **61.2** | **6.0** |

Source: CIMIS Station 117 (http://www.cimis.water.ca.gov/Default.aspx)

# 3 BBARWA EFFLUENT CHARACTERISTICS

## 3.1 EFFLUENT FLOW

BBARWA treats the wastewater of all of its Member Agencies. Following preliminary and secondary treatment, 100% of the effluent flow, including the winter peaks, is delivered to the Lucerne Valley Facility via the pipeline shown in Figure 1. The historic effluent flows beginning in the year 2005 are shown in Figure 4. Note that flows to the Lucerne Valley Facility dropped considerably after 2012 due to drought conditions and have remained lower except for larger rainstorms in 2017 and 2019. Flows increased in 2020 due to a sustained influx of visitors during the COVID-19 pandemic, but are expected to return to previous levels.

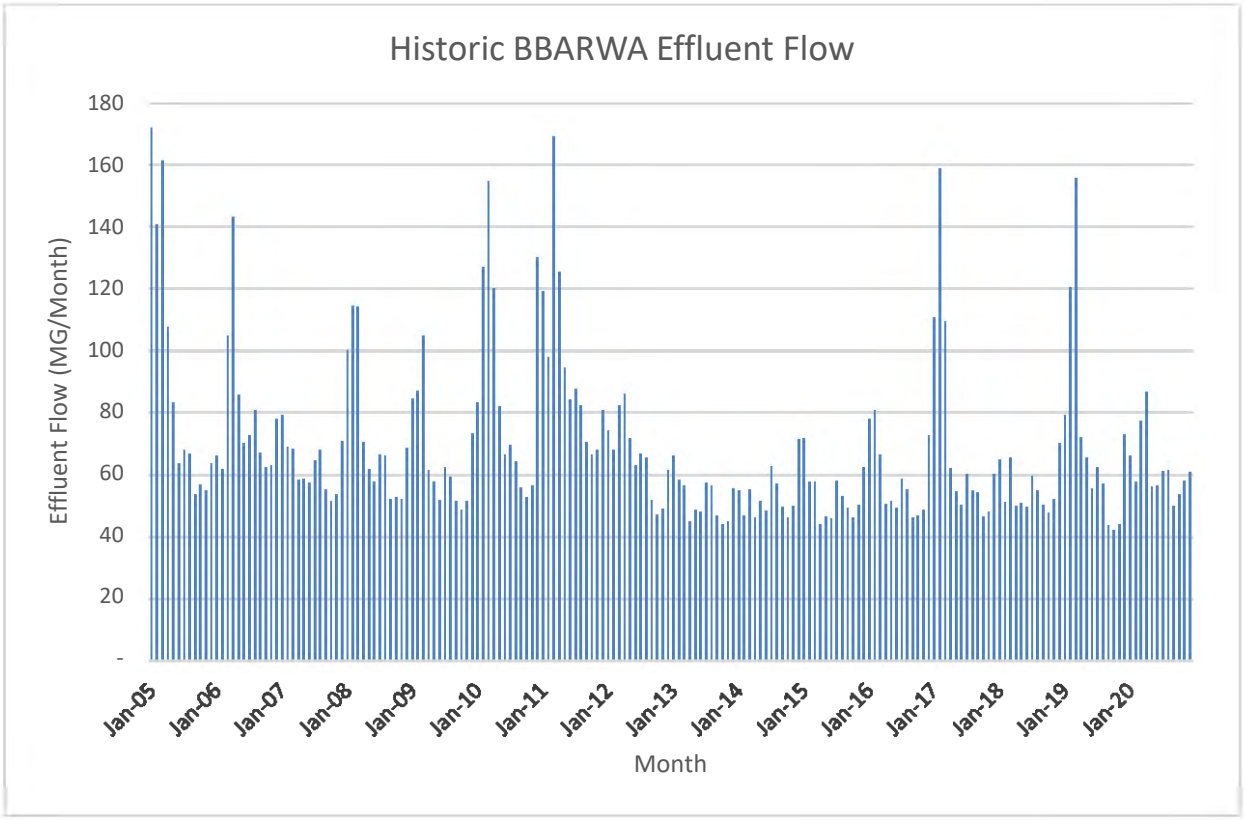


**Figure 4: Historic Effluent Flow**

## 3.2 EFFLUENT WATER QUALITY

BBARWA's effluent water quality delivered to the Lucerne Valley Facility is regulated by the Colorado River Region WDR. The quality of the water sent to the Lucerne Valley Facility is generally good and has not historically posed a threat to any of the crops. The farmer reports that the current irrigation practices have not resulted in salt buildup within the soil.

Constituents of concern specified in Colorado River Region WDR include nitrogen and TDS. Historic concentrations for each of these constituents are presented in Figure 5. Concentrations vary widely but have been in compliance historically. There are no planned process changes at the BBARWA WWTP that would impact future nitrogen and TDS concentrations. Despite lower flows in recent years due to drought conditions, the WWTP has successfully achieved nitrogen and TDS effluent compliance.

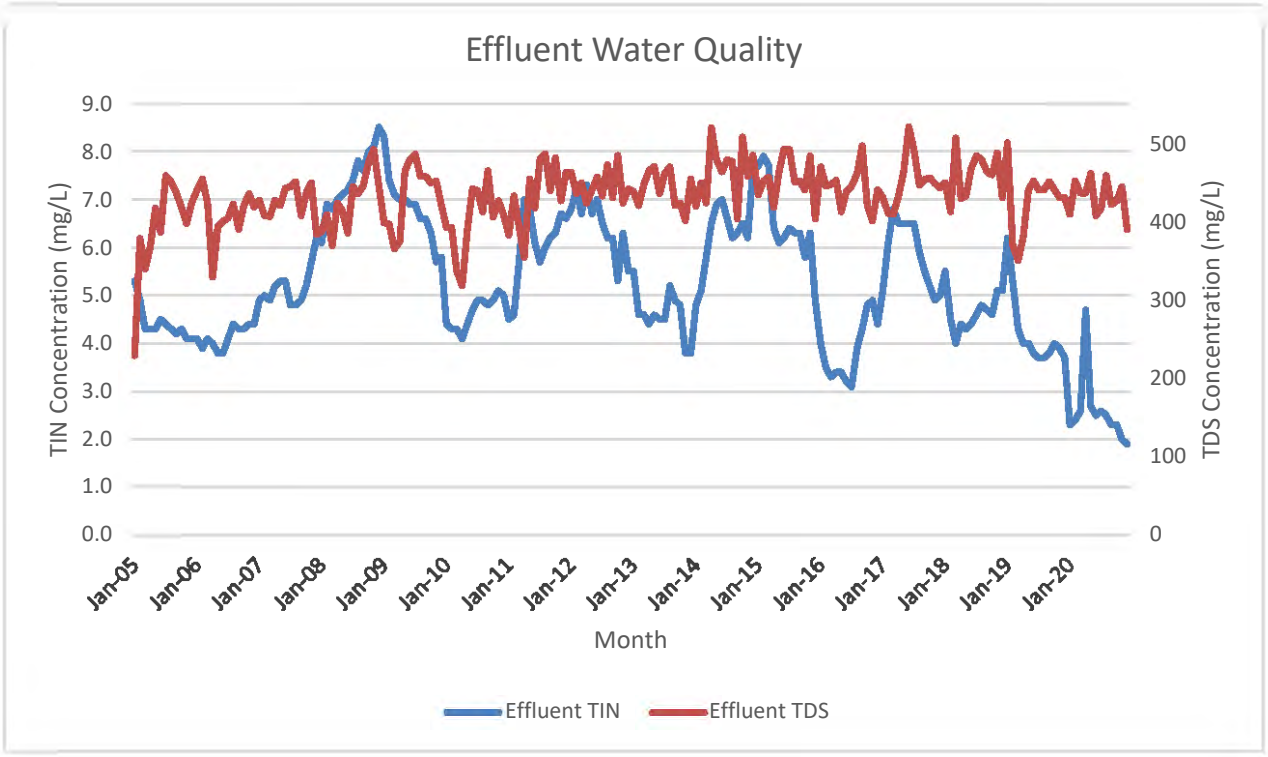


**Figure 5: BBARWA Effluent Quality**

## 3.3 SUMMARY OF DISCHARGE PERMIT COMPLIANCE

The effluent limitations specified in the Colorado River Region WDR for the earth basins are outlined in Table 3. During the study period for this report, which spans years 2005-2020, BBARWA's treated effluent discharged to the Lucerne Valley Facility has historically been in compliance with the Colorado River Basin WDR in effect at that time.

Note that an effluent limit for TDS is not included in the current Colorado River Basin WDR. Special Provision No. 1 of the WDR requires BBARWA to conduct a study of the groundwater in the vicinity of the Lucerne Valley Facility and propose an appropriate effluent limit for TDS. That study was completed on December 22, 2017 by Thomas Harder & Co. Groundwater Consulting.

**Table 3: WDR Effluent Limitations**

| Constituent | Units | 30-Day Arithmetic Mean | 7-Day Arithmetic Mean | Daily Maximum |
|---|---|---|---|---|
| **20°C $BOD_5$** | mg/L | 30 | 45 | - |
| **Total Suspended Solids** | mg/L | 30 | 45 | - |
| **Chloride** | mg/L | 60 | - | 80 |
| **Sulfate** | mg/L | 60 | - | 80 |
| **Boron** | mg/L | - | - | 0.75 |
| **Total Nitrogen** | mg/L | 10 | - | - |
| **Average Daily Dry Weather Flow** | MGD | 4.8 | - | - |
| **pH** | Unitless | $6.0 \leq pH \leq 9.0$ | | |

As part of Finding 11 of the Colorado River Region WDR, BBARWA must comply with Title 22 CCR Section 60304(d)(4) for irrigating with undisinfected secondary recycled water. BBARWA received approval for their Title 22 Engineering Report on November 3, 1980. Finding 12 of the WDR specifies the conditions under which sheep can graze at the irrigation site. While sheep have grazed on site in the past, there are no longer sheep grazing on site. During the last site visit by Colorado River Basin RWQCB Staff on June 13, 2016, the fence around the Lucerne Valley Facility was found to be damaged due to a tear resulting from an auto accident. This tear has since been repaired as directed by RWQCB staff.

# 4 WATER AND NITROGEN BALANCE

## 4.1 CROP IRRIGATION REQUIREMENTS

Crop irrigation requirements were estimated using evapotranspiration ($ET_o$) data gathered from the California Irrigation Management Information System (CIMIS) Station 117 in Victorville, CA, which is based on grass as the reference crop. Crop specific demand was estimated using Equation 1, where $K_c$ is a seasonal crop coefficient specific to each crop. This $K_c$ value was determined using the FAO Grass-Based Crop Coefficients method outlined in *ASCE Manual No. 70: Evaporation, Evapotranspiration, and Irrigation Water Requirements* (4). Under this methodology, there are four distinct growing periods in each growing cycle: the initial, crop development, midseason, and late season periods. There are three distinct crop coefficients (initial, middle, and end) that are used in tandem with these growing periods to develop a crop coefficient curve. To obtain reference crop coefficients applicable to the climate at the Lucerne Valley Facility, values from the ASCE Manual must be adjusted using the relative humidity and wind speed for the irrigation area. Using the corrected values and the crop coefficient curves (attached as Appendix C), a monthly crop coefficient value can be estimated for each crop. The calculated values for each crop for each month are tabulated in the Water and Nitrogen Balance in Appendix B.

$$ET_c = K_c * ET_o$$

**Equation 1: Crop Specific Evapotranspiration Rate**

### 4.1.1 Alfalfa

Alfalfa crop coefficients were determined using *ASCE Manual No. 70*. Based on the data provided in the manual, Alfalfa has two types of growing cycles – the initial cutting cycle and all other cycles. The initial cutting cycle typically lasts 60 days and all other subsequent cycles last 30 days according to *ASCE Manual No. 70* (4). However, the farmer typically performs five to six harvests a year. For the purposes of this report, six alfalfa harvests per year were used with cutting cycles of 60 days each to align with this timeline. The irrigation demand for the crop varies by growing stage due to differing $K_c$ values and varying rainfall but ranges from 1.3 to 8.7 inches of water/acre of alfalfa. This is discussed further in Section 4.1.3.

### 4.1.2 Grain Blend – Barley, Wheat, Oat

The grain blend crop coefficient was also determined using *ASCE Manual No. 70*. Crop coefficients for barley, wheat and oat were all estimated using the initial period, crop development period, midseason period, and late season period and the initial, middle, and end reference crop coefficients. These coefficients were then averaged over the three crops and corrected for relative humidity and wind speed to provide an estimate for the grain blend crop coefficient. The farmer performs one grain harvest per year and harvests the crop after 90 days, so 90 days was used for the cutting cycle duration. The irrigation demand for the grain blend varies by stage due to the seasonal nature of $K_c$ and varying rainfall, but ranges from 0 to 12.0 inches of water/acre of grain. This is discussed further in Section 4.1.3.

### 4.1.3 Historic Irrigation at Lucerne Valley Facility

A water balance was developed for the years 2005 to 2020 to determine whether irrigation water is being applied at appropriate rates. BBARWA maintains flow meters that log the amount of irrigation water being applied to the West and East Fields, however the meters have not been functional for many years. New meters for these fields were installed, calibrated, and connected to BBARWA's SCADA system in April 2021 and should provide more accurate data for effluent flow distribution to the fields and earth basin. When meter data for the fields was unavailable, BBARWA maintained daily log books to note whether the effluent was directed to the Earth Basin or to the fields each day (flow is not split between the basin or fields on a daily basis). The WWTP effluent meter flow data was then used to total monthly flows to the Earth Basin and the fields. Flow to each field was allocated in accordance with each field's area relative to the total field area (West Field plus East Field).

Evapotranspiration data from CIMIS Station 117 was used with the estimated crop coefficients (discussed in Section 4.1) to determine total crop water demand and rainfall supplied. Irrigation water and rainfall were summed to obtain the total water applied to the crops. Any water applied above crop demand, whether wastewater effluent or rain water, is regarded as excess irrigation. The excess irrigation for the Lucerne Valley Facility is plotted in Figure 6 and tabulated in Appendix B.

Based on the $ET_c$ water demand methodology discussed in Section 4.1, the historical irrigation analysis indicates that the farmer often over-waters the crops at the Lucerne Valley Facility, particularly during the winter months, in which rainfall is more prevalent. For the purposes of this water balance, it was assumed that 315 acres was farmed through the year 2011. At this point, drought conditions had reduced available recycled water supply resulting in the farmer reducing the farmed acreage to 190 acres in the year 2012. The farmed acreage has remained at 190 acres since the year 2012.

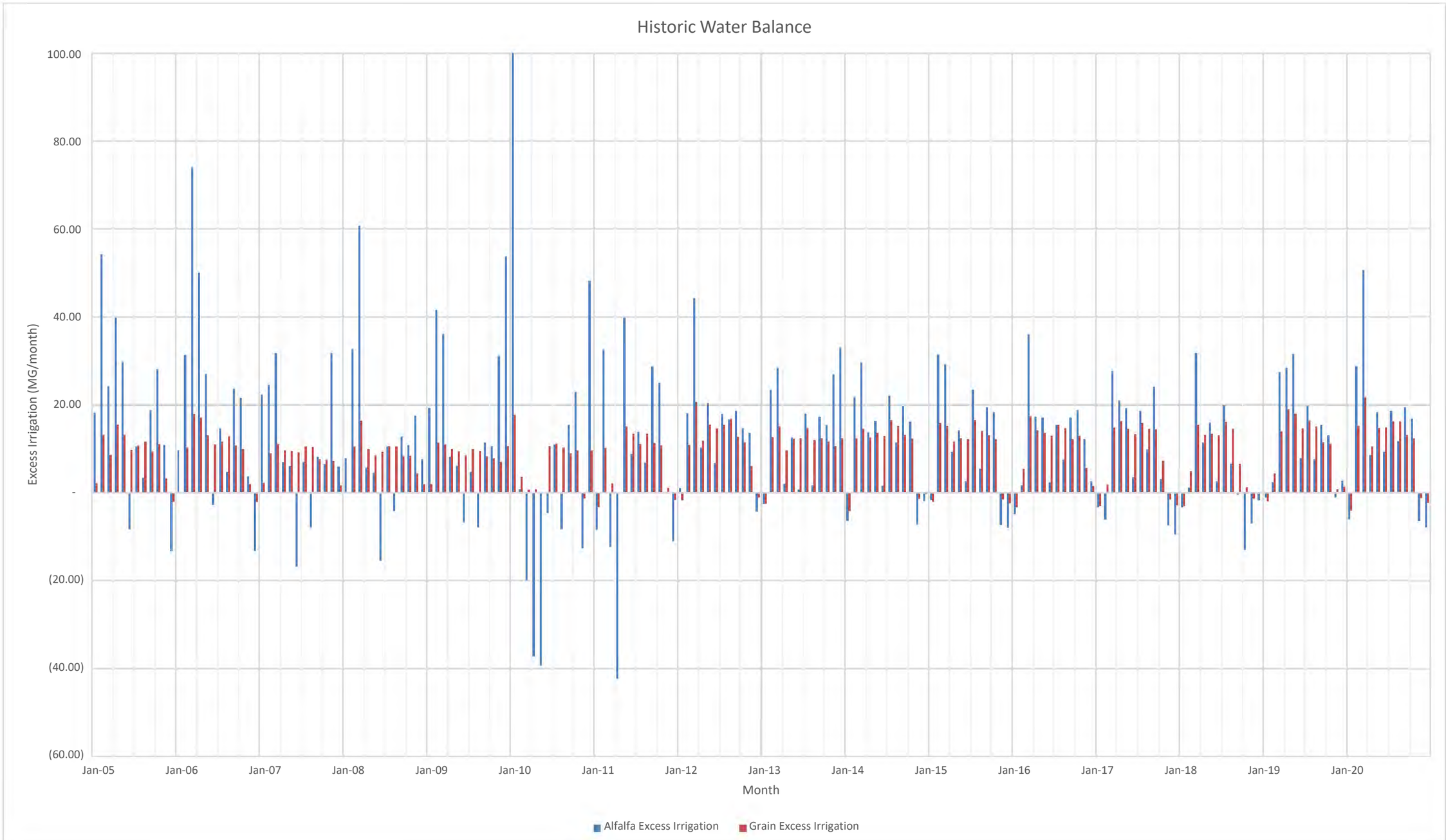


**Figure 6. Historic Irrigation at the Lucerne Valley Facility**

## 4.2 CROP NUTRIENT REQUIREMENTS – NITROGEN

### 4.2.1 Alfalfa

Alfalfa can supply 70-90% of its nitrogen requirements through a symbiotic relationship with nitrogen-fixing Rhizobium bacteria that grow on its roots. These bacteria are able to fix $N_2$ gas found in air into a form that the alfalfa is able to use. However, alfalfa will preferentially use nitrogen in the soil over nitrogen that can be fixed from the air. If the alfalfa consumes all of the nitrogen content from within the soil, it will resume the nitrogen fixation process to meet its nitrogen needs. (5)

As alfalfa can supply most of the nitrogen it needs, nitrogen requirements for alfalfa crops are not typically specified and fertilizer is not typically needed. However, alfalfa does have the capacity to remove nitrogen from the soil and irrigation water. For this Plan, the nitrogen removal capacity of alfalfa was estimated using the International Plant Nutrition Institute's (IPNI) calculator, which estimates nitrogen removal based on estimated crop yield in tons per acre. The farmer estimates the average yield for alfalfa at the Lucerne Valley Facility is 1 ton per acre. This value was used with the IPNI calculator to determine a nitrogen removal capacity of 51 lb/acre per crop cycle. According to the farmer, there are 6 complete cutting cycles throughout the year for alfalfa. For the purposes of this report, average monthly nitrogen removal capacity was estimated by multiplying the removal per cycle by the number of cycles and then dividing by 12 months. This results in an average alfalfa nitrogen removal capacity of 25.5 lb/acre per month. However, complete nitrogen removal capacity may not always be achieved. According to a UC Davis study, alfalfa will still fix 10-25% of its nitrogen from the air, even when the applied nitrogen concentrations are high (5). To minimize nitrogen leaching, it is recommended that nitrogen be applied at a rate that does not exceed 75-85% of the nitrogen removed in the harvest. This Plan uses an estimated nitrogen removal capacity for alfalfa of 75% of the 25.5 lb/acre per month, or 19.13 lb/acre per month.

For the purposes of this Plan, the average annual nitrogen uptake is used to calculate a constant monthly nitrogen removal capacity. Actual nitrogen uptake by the crops varies by growth stage.

The historic nitrogen loadings applied to the alfalfa crop at the Lucerne Valley Facility is presented in Section 4.2.3.

### 4.2.2 Grain blend – barley, wheat, oat

Barley, wheat and oat all have differing nitrogen removal capacities. In order to estimate the grain blend's nitrogen removal capacity, the grain blend was assumed to be equal parts barley, wheat and oat, and their individual nitrogen removals were averaged. Based on information from the farmer, each grain harvest yields 2.5 tons per acre, which equates to 84.2 bushels per acre. Nitrogen removal for each crop was estimated using IPNI's calculator for an 84.2 bushels per acre yield crop cycle.

- Barley has an expected nitrogen removal capacity of 83.3 lb N/acre per crop cycle.
- Winter wheat has an expected nitrogen removal capacity of 97.6 lb/acre per crop cycle.
- Oat yield has an expected nitrogen removal capacity of 64.8 lb/acre per crop cycle.

These nitrogen removal capacities were averaged, resulting in an estimated nitrogen removal capacity of 81.9 lb/acre per cycle. With one crop cycle occurring over 90 days, this demand was divided by 3 months to produce an estimated average nitrogen removal capacity of 27.3 lb/acre per month.

For the purposes of this Plan, the average annual nitrogen uptake is used to calculate a constant monthly nitrogen removal capacity. Actual nitrogen uptake by the crops varies by growth stage.

### 4.2.3 Nitrogen Application and Removal Capacity

A nitrogen balance was constructed for the years 2005 to 2020 for the Lucerne Valley Facility, which focuses on the nitrogen uptake of the alfalfa and grain mixture. The nitrogen content of the BBARWA effluent in the form of Total Inorganic Nitrogen (TIN) was used to estimate the quantity of nitrogen applied to the crops each month. This value was combined with the nitrogen content of any fertilizer applied to the crops and compared with the average crop nitrogen removal capacity presented in Section 4.2 to determine if the crop is receiving more nitrogen than it can remove. The total nitrogen application is compared with the nitrogen removal capacity and is plotted in Figure 7, which shows that the nitrogen removal capacity of the crops at the Lucerne Valley Facility generally exceeds the nitrogen applied to the crops. There are a few instances where higher than average effluent flows (2017) or fertilizer application (2014) result in the nitrogen applied exceeding the nitrogen capacity of the crops. However, in most of these instances, the removal capacity is only slightly less than the applied nitrogen. The crop's nitrogen removal capacity has been significantly greater than the nitrogen applied in recent years, indicating the farmer has made appropriate adjustments to his irrigation practices. BBARWA will continue to monitor the quantity of effluent applied relative to the crop removal capacity and coordinate with the farmer if adjustments need to be made to maintain balance.

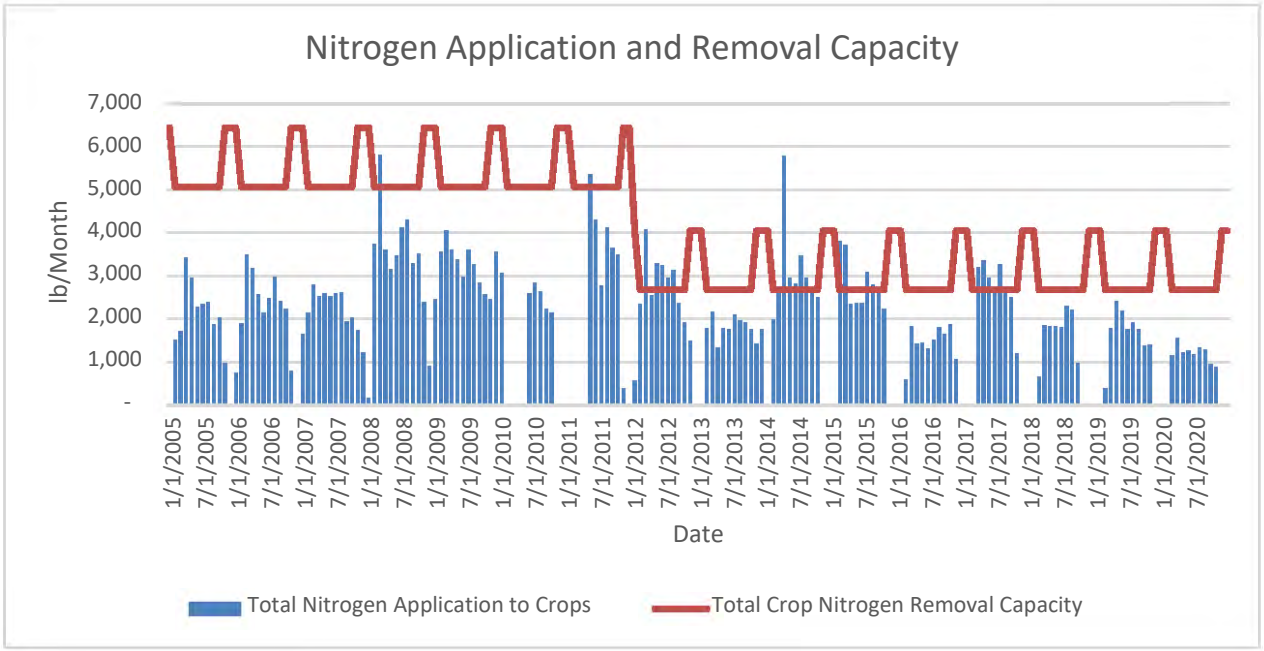


**Figure 7: Nitrogen Application and Removal Capacity**

# 5 CONCLUSIONS & RECOMMENDATIONS

The water and nutrient balance analyses indicate that the farmer is managing nutrient application at the Lucerne Valley Facility appropriately and that irrigation water in excess of the minimum crop requirement is often applied.

Based on the water balance conducted for alfalfa and grain (as shown in Figure 6), crops at the Lucerne Valley Facility often receive irrigation water in excess of the minimum crop requirements, particularly in the winter months where rainfall influences this value. In most of these instances, the rainfall provides more water than the crops need, so over-watering occurs even without application of effluent. It can be conservatively assumed that any applied irrigation water not required by the crop will percolate into the underlying groundwater. This incidental percolation is considered in the groundwater quality evaluation conducted by Thomas Harder & Co., as discussed in Section 3.3. In more recent years, the drought has limited irrigation water availability for the Lucerne Valley Facility and has forced the farmer to reduce the irrigated acreage at the site. This has also resulted in reduced occurrences of over-watering.

The nutrient balance for the alfalfa and grain mixture (as shown in Figure 7 and Appendix B) indicates that the crops planted at the Lucerne Valley Facility generally have the capacity to remove more nitrogen than is applied through the effluent and fertilizer, although actual removal rates will vary depending on crop growth cycles. BBARWA will continue to monitor the quantity of effluent applied relative to the crop removal capacity and coordinate with the farmer if adjustments need to be made to maintain a nutrient balance.

This report is intended to meet the requirement to perform an annual water and nutrient balance through 2020.

# 6 REFERENCES

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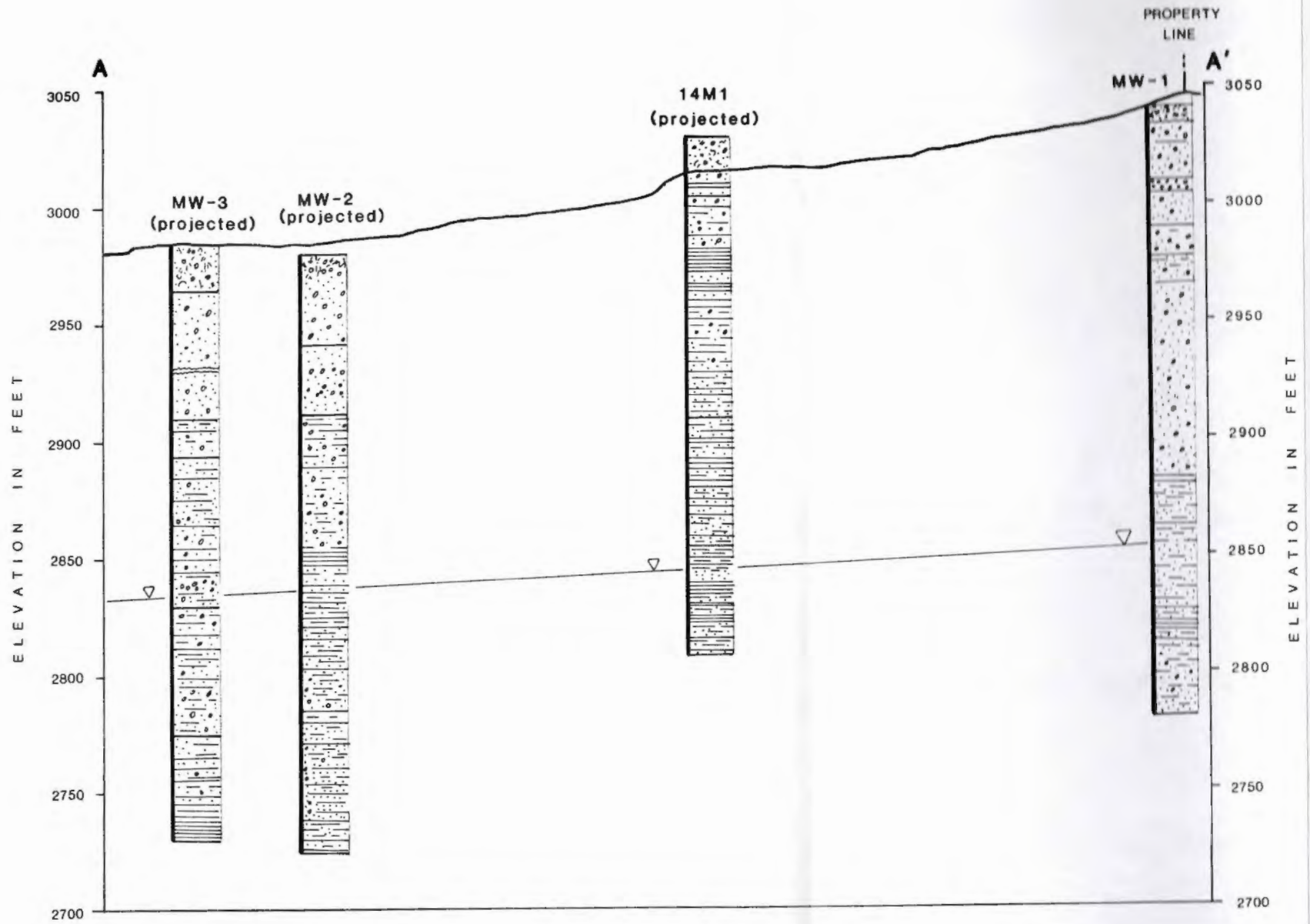
2. **Harder, Thomas.** *Work Plan for a Groundwater Quality Study at the Lucerne Valley Land Discharge Location.* s.l. : Thomas Harder & Co. Work Plan, September 27, 2016. p. 15.

3. **Kennedy/Jenks Consultants.** *2015 Urban Water Management Plan for Mojave Water Agency.* June 9, 2016. pp. 1-14 - 1-16.

4. **Jensen, Marvin E and Allen, Richard G.** *Evaporation, Evapotranspiration, and Irrigation Water Requirements Second Edition.* s.l. : ASCE Manuals and Reports on Engineering Practice No. 70, 2016. pp. 273-282; 471-497.

5. **Matthews, Marshall Campbell and Crohn, David.** *Assessing Nitrogen Uptake of Corn, Winter Forages and Alfalfa.* December 2, 2010. p. 6.

# APPENDIX A. SOIL BORING LOGS




LEGEND

- CLAY WITH SAND
- SILT WITH SAND
- SAND AND GRAVEL
- TOP SOIL
- MW-1 — MONITORING WELL LOCATION AND NUMBER
- ▽ WATER LEVEL

0 50 vertical

0 1000 horizontal

Scale in feet

| | | |
|---|---|---|
| BIG BEAR AREA REGIONAL WASTEWATER MANAGEMENT AGENCY LUCERNE VALLEY | GEOLOGIC SECTION A – A' | PROJ. NO. 58-966001 FIGURE 3 LAW ENVIRONMENTAL, INC. |

PROJECT No. 58-966001 DATE 1/17/92 PROJ. MGR. P.S. DFTR. M.G.

# APPENDIX B: WATER & NITROGEN BALANCE (2005-2020)

## Lucerne Valley Facility - Water and Nitrogen Balance

| Date | Month | Monthly Total Effluent Flow (MG)[1] | Earth Basin Estimates from BBARWA (MG) | West Field Flow (MG)[2] | East Field Flow (MG)[3] | Total Flow To Fields (MG) | Calculated Flow to Earth Basin (MG)[4] | Total Planted Acreage | Grain Acreage | Alfalfa Acreage | ETo (in)[5] | Rainfall (in)[6] | Alfalfa $K_c$[7] | Grain $K_c$[7] | $ET_c$ Alfalfa (in)[8] | $ET_c$ Grain (in)[8] | Effluent Depth on Total Acreage (in)[9] | Total Water Depth on Acreage (in)[10] | Alfalfa Surplus or Deficit (MG)[11] | Grain Surplus or Deficit (MG)[12] | Combined Surplus or Deficit (MG)[13] | Effluent TIN (mg/L)[14] | Urea Applied from Fertilizer to Fields (lbs) | TIN Loading to Fields (lbs)[15] | TIN Loading to Ponds (lbs)[16] | Alfalfa Nitrogen Removal Capacity (lbs/acre)[17] | Grain Nitrogen Removal Capacity (lbs/acre)[18] | Alfalfa Nitrogen Removal Capacity (lbs)[19] | Grain Nitrogen Removal Capacity (lbs)[20] | Total Nitrogen Removal Capacity (lbs)[21] | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/1/2005 | 1 | 171.92 | 171.92 | - | - | - | 171.92 | 315 | 50 | 265 | 1.72 | 3.65 | 0.65 | 1.21 | 1.12 | 2.08 | - | 3.65 | 18.19 | 2.13 | 20.32 | 5.3 | - | - | 7,604 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | |
| 2/1/2005 | 2 | 140.72 | 99.53 | 22.26 | 15.12 | 37.38 | 103.34 | 315 | 50 | 265 | 2.16 | 5.31 | 1.00 | 0.00 | 2.15 | - | 4.37 | 9.68 | 54.18 | 13.14 | 67.32 | 4.9 | - | 1,528 | 4,226 | 19.1 | - | 5,068 | - | 5,068 | |
| 3/1/2005 | 3 | 161.23 | 113.54 | 29.46 | 18.69 | 48.15 | 113.07 | 315 | 50 | 265 | 4.52 | 0.69 | 0.66 | 0.00 | 2.96 | - | 5.63 | 6.32 | 24.15 | 8.58 | 32.73 | 4.3 | - | 1,728 | 4,058 | 19.1 | - | 5,068 | - | 5,068 | |
| 4/1/2005 | 4 | 107.53 | - | 54.53 | 40.95 | 95.47 | 12.06 | 315 | 50 | 265 | 6.32 | 0.26 | 0.93 | 0.00 | 5.89 | - | 11.16 | 11.42 | 39.82 | 15.51 | 55.33 | 4.3 | - | 3,426 | 433 | 19.1 | - | 5,068 | - | 5,068 | |
| 5/1/2005 | 5 | 83.11 | - | 54.24 | 27.94 | 82.18 | 0.93 | 315 | 50 | 265 | 7.89 | 0.07 | 0.70 | 0.00 | 5.54 | - | 9.61 | 9.68 | 29.76 | 13.14 | 42.90 | 4.3 | - | 2,949 | 33 | 19.1 | - | 5,068 | - | 5,068 | |
| 6/1/2005 | 6 | 63.51 | - | 35.20 | 25.52 | 60.72 | 2.79 | 315 | 50 | 265 | 8.74 | 0.02 | 0.95 | 0.00 | 8.26 | - | 7.10 | 7.12 | (8.22) | 9.67 | 1.45 | 4.5 | - | 2,280 | 105 | 19.1 | - | 5,068 | - | 5,068 | |
| 7/1/2005 | 7 | 67.91 | - | 34.36 | 29.70 | 64.06 | 3.85 | 315 | 50 | 265 | 9.27 | 0.37 | 0.69 | 0.00 | 6.40 | - | 7.49 | 7.86 | 10.51 | 10.67 | 21.18 | 4.4 | - | 2,352 | 141 | 19.1 | - | 5,068 | - | 5,068 | |
| 8/1/2005 | 8 | 66.84 | - | - | - | 66.84 | 0.00 | 315 | 50 | 265 | 8.37 | 0.69 | 0.96 | 0.00 | 8.04 | - | 7.81 | 8.50 | 3.37 | 11.55 | 14.92 | 4.3 | - | 2,398 | - | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 9/1/2005 | 9 | 53.54 | - | - | - | 53.54 | 0.00 | 315 | 50 | 265 | 6.44 | 0.65 | 0.67 | 0.00 | 4.30 | - | 6.26 | 6.91 | 18.78 | 9.38 | 28.16 | 4.2 | - | 1,877 | - | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 10/1/2005 | 10 | 56.91 | - | - | - | 56.91 | 0.00 | 315 | 50 | 265 | 4.30 | 1.42 | 0.97 | 0.00 | 4.18 | - | 6.65 | 8.07 | 28.05 | 10.96 | 39.01 | 4.3 | - | 2,042 | - | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 11/1/2005 | 11 | 54.92 | 26.20 | - | - | 28.73 | 26.20 | 315 | 50 | 265 | 2.88 | 0.04 | 0.66 | 0.37 | 1.89 | 1.06 | 3.36 | 3.40 | 10.84 | 3.18 | 14.02 | 4.1 | - | 983 | 896 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | Field Meters were offline but BBARWA records indicate some effluent was sent to the ponds. Assumed that the remainder went to the fields. |
| 12/1/2005 | 12 | 63.73 | 63.73 | - | - | - | 63.73 | 315 | 50 | 265 | 1.95 | 0.07 | 0.98 | 0.80 | 1.91 | 1.56 | - | 0.07 | (13.26) | (2.03) | (15.29) | 4.1 | - | - | 2,181 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | Field Meters were offline but BBARWA records indicate all effluent was sent to the ponds. |
| 1/1/2006 | 1 | 66.03 | 20.05 | 14.42 | 7.43 | 21.85 | 44.18 | 315 | 50 | 265 | 2.49 | 0.39 | 0.65 | 1.21 | 1.62 | 3.01 | 2.55 | 2.94 | 9.50 | (0.09) | 9.41 | 4.1 | - | 748 | 1,512 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | |
| 2/1/2006 | 2 | 61.83 | 8.02 | 39.92 | 18.16 | 58.08 | 3.75 | 315 | 50 | 265 | 3.18 | 0.72 | 1.00 | 0.00 | 3.17 | - | 6.79 | 7.51 | 31.27 | 10.20 | 41.46 | 3.9 | - | 1,890 | 122 | 19.1 | - | 5,068 | - | 5,068 | |
| 3/1/2006 | 3 | 104.91 | 6.67 | 62.10 | 40.05 | 102.16 | 2.76 | 315 | 50 | 265 | 4.32 | 1.17 | 0.66 | 0.00 | 2.83 | - | 11.94 | 13.11 | 73.98 | 17.80 | 91.78 | 4.1 | - | 3,495 | 94 | 19.1 | - | 5,068 | - | 5,068 | |
| 4/1/2006 | 4 | 143.28 | 64.20 | 59.14 | 36.33 | 95.47 | 47.81 | 315 | 50 | 265 | 5.99 | 1.37 | 0.93 | 0.00 | 5.58 | - | 11.16 | 12.53 | 50.02 | 17.01 | 67.03 | 4.0 | - | 3,187 | 1,596 | 19.1 | - | 5,068 | - | 5,068 | Higher than typical value for effluent to Earth Basin; possible data error. |
| 5/1/2006 | 5 | 85.73 | 4.79 | 50.67 | 30.19 | 80.87 | 4.86 | 315 | 50 | 265 | 8.25 | 0.09 | 0.70 | 0.00 | 5.80 | - | 9.46 | 9.55 | 26.98 | 12.96 | 39.94 | 3.8 | - | 2,564 | 154 | 19.1 | - | 5,068 | - | 5,068 | |
| 6/1/2006 | 6 | 70.14 | 2.68 | - | - | 67.46 | 2.68 | 315 | 50 | 265 | 8.88 | 0.13 | 0.95 | 0.00 | 8.39 | - | 7.89 | 8.02 | (2.71) | 10.88 | 8.17 | 3.8 | - | 2,139 | 85 | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate some effluent was sent to the ponds. Assumed that the remainder went to the fields. |
| 7/1/2006 | 7 | 72.78 | - | - | - | 72.78 | 0.00 | 315 | 50 | 265 | 9.38 | - | 0.69 | 0.00 | 6.48 | - | 8.51 | 8.51 | 14.64 | 11.55 | 26.19 | 4.1 | - | 2,490 | - | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 8/1/2006 | 8 | 80.70 | - | - | 23.18 | 80.70 | 0.00 | 315 | 50 | 265 | 9.15 | - | 0.96 | 0.00 | 8.78 | - | 9.44 | 9.44 | 4.69 | 12.81 | 17.50 | 4.4 | - | 2,963 | - | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 9/1/2006 | 9 | 67.11 | - | - | 26.82 | 67.11 | 0.00 | 315 | 50 | 265 | 6.84 | - | 0.67 | 0.00 | 4.57 | - | 7.85 | 7.85 | 23.60 | 10.65 | 34.25 | 4.3 | - | 2,408 | - | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 10/1/2006 | 10 | 62.36 | - | - | 15.27 | 62.36 | 0.00 | 315 | 50 | 265 | 4.43 | - | 0.97 | 0.00 | 4.30 | - | 7.29 | 7.29 | 21.51 | 9.90 | 31.41 | 4.3 | - | 2,238 | - | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 11/1/2006 | 11 | 62.98 | 41.35 | - | 8.77 | 21.63 | 41.35 | 315 | 50 | 265 | 3.08 | - | 0.66 | 0.37 | 2.02 | 1.13 | 2.53 | 2.53 | 3.64 | 1.90 | 5.54 | 4.4 | - | 794 | 1,518 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | Field Meters were offline but BBARWA records indicate some effluent was sent to the ponds. Assumed that the remainder went to the fields. |
| 12/1/2006 | 12 | 78.01 | 78.01 | - | - | - | 78.01 | 315 | 50 | 265 | 2.10 | 0.23 | 0.98 | 0.80 | 2.06 | 1.69 | - | 0.23 | (13.17) | (1.98) | (15.14) | 4.4 | - | - | 2,865 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | Field Meters were offline but BBARWA records indicate that all effluent went to the ponds. |

## Lucerne Valley Facility - Water and Nitrogen Balance

| Date | Month | Monthly Total Effluent Flow (MG)[1] | Earth Basin Estimates from BBARWA (MG) | West Field Flow (MG)[2] | East Field Flow (MG)[3] | Total Flow To Fields (MG) | Calculated Flow to Earth Basin (MG)[4] | Total Planted Acreage | Grain Acreage | Alfalfa Acreage | ETo (in)[5] | Rainfall (in)[6] | Alfalfa $K_c$[7] | Grain $K_c$[7] | $ET_c$ Alfalfa (in)[8] | $ET_c$ Grain (in)[8] | Effluent Depth on Total Acreage (in)[9] | Total Water Depth on Acreage (in)[10] | Alfalfa Surplus or Deficit (MG)[11] | Grain Surplus or Deficit (MG)[12] | Combined Surplus or Deficit (MG)[13] | Effluent TIN (mg/L)[14] | Urea Applied from Fertilizer to Fields (lbs) | TIN Loading to Fields (lbs)[15] | TIN Loading to Ponds (lbs)[16] | Alfalfa Nitrogen Removal Capacity (lbs/acre)[17] | Grain Nitrogen Removal Capacity (lbs/acre)[18] | Alfalfa Nitrogen Removal Capacity (lbs)[19] | Grain Nitrogen Removal Capacity (lbs)[20] | Total Nitrogen Removal Capacity (lbs)[21] | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/1/2007 | 1 | 79.35 | 39.09 | - | 10.14 | 40.26 | 39.09 | 315 | 50 | 265 | 2.60 | 0.08 | 0.65 | 1.21 | 1.70 | 3.15 | 4.71 | 4.79 | 22.24 | 2.23 | 24.47 | 4.9 | - | 1,646 | 1,599 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | West field meter was offline. Estimated effluent to earth basin is based on BBARWA records. Assumed the remainder was sent to the fields. |
| 2/1/2007 | 2 | 68.90 | 17.40 | - | 19.76 | 51.50 | 17.40 | 315 | 50 | 265 | 3.13 | 0.50 | 1.00 | 0.00 | 3.12 | - | 6.02 | 6.52 | 24.51 | 8.85 | 33.36 | 5.0 | - | 2,149 | 726 | 19.1 | - | 5,068 | - | 5,068 | West field meter was offline. Estimated effluent to earth basin is based on BBARWA records. Assumed the remainder was sent to the fields. |
| 3/1/2007 | 3 | 68.20 | - | - | 22.18 | 68.20 | 0.00 | 315 | 50 | 265 | 5.59 | 0.11 | 0.66 | 0.00 | 3.67 | - | 7.97 | 8.08 | 31.79 | 10.97 | 42.76 | 4.9 | - | 2,789 | - | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 4/1/2007 | 4 | 58.21 | - | - | 19.36 | 58.21 | 0.00 | 315 | 50 | 265 | 6.50 | 0.20 | 0.93 | 0.00 | 6.06 | - | 6.81 | 7.01 | 6.83 | 9.51 | 16.34 | 5.2 | - | 2,526 | - | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 5/1/2007 | 5 | 58.59 | - | - | 15.67 | 58.59 | 0.00 | 315 | 50 | 265 | 8.67 | 0.07 | 0.70 | 0.00 | 6.09 | - | 6.85 | 6.92 | 5.97 | 9.40 | 15.37 | 5.3 | - | 2,592 | - | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 6/1/2007 | 6 | 57.28 | - | - | 14.67 | 57.28 | 0.00 | 315 | 50 | 265 | 9.60 | 0.05 | 0.95 | 0.00 | 9.07 | - | 6.70 | 6.75 | (16.75) | 9.16 | (7.59) | 5.3 | - | 2,533 | - | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 7/1/2007 | 7 | 64.64 | - | - | 20.52 | 64.64 | 0.00 | 315 | 50 | 265 | 9.73 | 0.13 | 0.69 | 0.00 | 6.72 | - | 7.56 | 7.69 | 6.99 | 10.44 | 17.42 | 4.8 | - | 2,589 | - | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 8/1/2007 | 8 | 67.95 | 2.60 | - | 27.16 | 65.35 | 2.60 | 315 | 50 | 265 | 9.10 | - | 0.96 | 0.00 | 8.74 | - | 7.64 | 7.64 | (7.88) | 10.37 | 2.49 | 4.8 | - | 2,618 | 104 | 19.1 | - | 5,068 | - | 5,068 | West field meter was offline. Estimated effluent to earth basin is based on BBARWA records. Assumed the remainder was sent to the fields. |
| 9/1/2007 | 9 | 55.08 | - | 28.76 | 18.63 | 47.38 | 7.69 | 315 | 50 | 265 | 6.61 | - | 0.67 | 0.00 | 4.41 | - | 5.54 | 5.54 | 8.11 | 7.52 | 15.63 | 4.9 | - | 1,938 | 315 | 19.1 | - | 5,068 | - | 5,068 | |
| 10/1/2007 | 10 | 51.47 | - | 36.67 | 10.36 | 47.03 | 4.44 | 315 | 50 | 265 | 4.74 | - | 0.97 | 0.00 | 4.60 | - | 5.50 | 5.50 | 6.45 | 7.47 | 13.91 | 5.2 | - | 2,041 | 193 | 19.1 | - | 5,068 | - | 5,068 | |
| 11/1/2007 | 11 | 53.75 | 9.46 | 25.48 | 11.28 | 36.77 | 16.98 | 315 | 50 | 265 | 2.89 | 2.02 | 0.66 | 0.37 | 1.90 | 1.06 | 4.30 | 6.32 | 31.80 | 7.14 | 38.94 | 5.7 | - | 1,749 | 808 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | |
| 12/1/2007 | 12 | 70.90 | 32.86 | 15.71 | 7.99 | 23.70 | 47.20 | 315 | 50 | 265 | 2.08 | 0.09 | 0.98 | 0.80 | 2.04 | 1.67 | 2.77 | 2.86 | 5.90 | 1.62 | 7.52 | 6.2 | - | 1,226 | 2,442 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | |
| 1/1/2008 | 1 | 100.22 | 100.22 | 3.19 | 0.04 | 3.23 | 96.99 | 315 | 50 | 265 | 2.13 | 2.09 | 0.65 | 1.21 | 1.39 | 2.58 | 0.38 | 2.47 | 7.76 | (0.15) | 7.61 | 6.1 | - | 164 | 4,937 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | |
| 2/1/2008 | 2 | 114.47 | 69.41 | 43.57 | 21.31 | 64.88 | 49.59 | 315 | 50 | 265 | 3.20 | 0.14 | 1.00 | 0.00 | 3.19 | - | 7.59 | 7.73 | 32.67 | 10.49 | 43.15 | 6.9 | - | 3,736 | 2,856 | 19.1 | - | 5,068 | - | 5,068 | |
| 3/1/2008 | 3 | 114.30 | 9.75 | 59.70 | 42.60 | 102.30 | 12.00 | 315 | 50 | 265 | 5.53 | 0.11 | 0.66 | 0.00 | 3.63 | - | 11.96 | 12.07 | 60.76 | 16.39 | 77.15 | 6.8 | - | 5,805 | 681 | 19.1 | - | 5,068 | - | 5,068 | |
| 4/1/2008 | 4 | 70.54 | - | 34.31 | 27.32 | 61.64 | 8.91 | 315 | 50 | 265 | 6.95 | 0.05 | 0.93 | 0.00 | 6.48 | - | 7.21 | 7.26 | 5.62 | 9.85 | 15.47 | 7.0 | - | 3,601 | 520 | 19.1 | - | 5,068 | - | 5,068 | |
| 5/1/2008 | 5 | 61.77 | 1.88 | 37.99 | 15.16 | 53.14 | 8.63 | 315 | 50 | 265 | 7.99 | 0.02 | 0.70 | 0.00 | 5.61 | - | 6.21 | 6.23 | 4.47 | 8.46 | 12.93 | 7.1 | - | 3,149 | 511 | 19.1 | - | 5,068 | - | 5,068 | |
| 6/1/2008 | 6 | 57.80 | - | 73.33 | 32.68 | 57.80 | 0.00 | 315 | 50 | 265 | 9.41 | - | 0.95 | 0.00 | 8.90 | - | 6.76 | 6.76 | (15.38) | 9.17 | (6.20) | 7.2 | - | 3,473 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 7/1/2008 | 7 | 66.51 | - | 31.24 | 14.59 | 66.51 | 0.00 | 315 | 50 | 265 | 9.16 | - | 0.69 | 0.00 | 6.32 | - | 7.78 | 7.78 | 10.45 | 10.56 | 21.01 | 7.4 | - | 4,107 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 8/1/2008 | 8 | 66.07 | - | 34.28 | - | 66.07 | 0.00 | 315 | 50 | 265 | 8.65 | - | 0.96 | 0.00 | 8.30 | - | 7.73 | 7.73 | (4.17) | 10.49 | 6.32 | 7.8 | - | 4,301 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 9/1/2008 | 9 | 51.94 | - | 29.56 | 2.01 | 51.94 | 0.00 | 315 | 50 | 265 | 6.46 | - | 0.67 | 0.00 | 4.31 | - | 6.07 | 6.07 | 12.66 | 8.24 | 20.91 | 7.6 | - | 3,294 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 10/1/2008 | 10 | 52.64 | - | 45.47 | - | 52.64 | 0.00 | 315 | 50 | 265 | 4.79 | - | 0.97 | 0.00 | 4.65 | - | 6.15 | 6.15 | 10.81 | 8.35 | 19.16 | 8.0 | - | 3,514 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 11/1/2008 | 11 | 52.00 | 10.28 | 32.71 | 2.78 | 35.49 | 16.51 | 315 | 50 | 265 | 2.61 | - | 0.66 | 0.37 | 1.72 | 0.96 | 4.15 | 4.15 | 17.52 | 4.34 | 21.85 | 8.1 | - | 2,399 | 1,116 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | |
| 12/1/2008 | 12 | 68.55 | 45.17 | 4.35 | 8.39 | 12.74 | 55.81 | 315 | 50 | 265 | 1.79 | 1.32 | 0.98 | 0.80 | 1.76 | 1.44 | 1.49 | 2.81 | 7.58 | 1.86 | 9.44 | 8.5 | - | 904 | 3,959 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | |

## Lucerne Valley Facility - Water and Nitrogen Balance

| Date | Month | Monthly Total Effluent Flow (MG)[1] | Earth Basin Estimates from BBARWA (MG) | West Field Flow (MG)[2] | East Field Flow (MG)[3] | Total Flow To Fields (MG) | Calculated Flow to Earth Basin (MG)[4] | Total Planted Acreage | Grain Acreage | Alfalfa Acreage | ETo (in)[5] | Rainfall (in)[6] | Alfalfa $K_c$[7] | Grain $K_c$[7] | $ET_c$ Alfalfa (in)[8] | $ET_c$ Grain (in)[8] | Effluent Depth on Total Acreage (in)[9] | Total Water Depth on Acreage (in)[10] | Alfalfa Surplus or Deficit (MG)[11] | Grain Surplus or Deficit (MG)[12] | Combined Surplus or Deficit (MG)[13] | Effluent TIN (mg/L)[14] | Urea Applied from Fertilizer to Fields (lbs) | TIN Loading to Fields (lbs)[15] | TIN Loading to Ponds (lbs)[16] | Alfalfa Nitrogen Removal Capacity (lbs/acre)[17] | Grain Nitrogen Removal Capacity (lbs/acre)[18] | Alfalfa Nitrogen Removal Capacity (lbs)[19] | Grain Nitrogen Removal Capacity (lbs)[20] | Total Nitrogen Removal Capacity (lbs)[21] | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/1/2009 | 1 | 84.49 | 24.09 | 29.27 | 6.16 | 35.43 | 49.07 | 315 | 50 | 265 | 2.35 | 0.07 | 0.65 | 1.21 | 1.53 | 2.84 | 4.14 | 4.21 | 19.28 | 1.86 | 21.14 | 8.3 | - | 2,454 | 3,399 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | |
| 2/1/2009 | 2 | 86.91 | - | 25.56 | 31.91 | 57.47 | 29.44 | 315 | 50 | 265 | 2.62 | 1.66 | 1.00 | 0.00 | 2.61 | - | 6.72 | 8.38 | 41.53 | 11.38 | 52.90 | 7.4 | - | 3,549 | 1,818 | 19.1 | - | 5,068 | - | 5,068 | |
| 3/1/2009 | 3 | 104.72 | 17.35 | 49.01 | 19.44 | 68.45 | 36.27 | 315 | 50 | 265 | 4.56 | - | 0.66 | 0.00 | 2.99 | - | 8.00 | 8.00 | 36.07 | 10.87 | 46.94 | 7.1 | - | 4,056 | 2,149 | 19.1 | - | 5,068 | - | 5,068 | |
| 4/1/2009 | 4 | 61.48 | - | 29.81 | 7.55 | 61.48 | 0.00 | 315 | 50 | 265 | 6.61 | 0.10 | 0.93 | 0.00 | 6.16 | - | 7.19 | 7.29 | 8.13 | 9.89 | 18.02 | 7.0 | - | 3,591 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 5/1/2009 | 5 | 57.86 | - | - | - | 57.86 | 0.00 | 315 | 50 | 265 | 8.58 | 0.11 | 0.70 | 0.00 | 6.03 | - | 6.77 | 6.88 | 6.10 | 9.33 | 15.43 | 7.0 | - | 3,380 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 6/1/2009 | 6 | 51.81 | - | - | - | 51.81 | 0.00 | 315 | 50 | 265 | 7.60 | 0.19 | 0.95 | 0.00 | 7.18 | - | 6.06 | 6.25 | (6.74) | 8.48 | 1.74 | 6.9 | - | 2,983 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 7/1/2009 | 7 | 62.46 | - | - | - | 62.46 | 0.00 | 315 | 50 | 265 | 9.65 | 0.01 | 0.69 | 0.00 | 6.66 | - | 7.30 | 7.31 | 4.68 | 9.93 | 14.61 | 6.9 | - | 3,597 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 8/1/2009 | 8 | 59.35 | - | - | - | 59.35 | 0.00 | 315 | 50 | 265 | 8.38 | 0.02 | 0.96 | 0.00 | 8.05 | - | 6.94 | 6.96 | (7.81) | 9.45 | 1.63 | 6.6 | - | 3,269 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 9/1/2009 | 9 | 51.44 | - | - | - | 51.44 | 0.00 | 315 | 50 | 265 | 6.70 | 0.04 | 0.67 | 0.00 | 4.47 | - | 6.01 | 6.05 | 11.38 | 8.22 | 19.60 | 6.6 | - | 2,833 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 10/1/2009 | 10 | 48.82 | - | - | - | 48.82 | 0.00 | 315 | 50 | 265 | 4.38 | 0.02 | 0.97 | 0.00 | 4.25 | - | 5.71 | 5.73 | 10.61 | 7.78 | 18.39 | 6.3 | - | 2,567 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 11/1/2009 | 11 | 51.49 | - | - | - | 51.49 | 0.00 | 315 | 50 | 265 | 2.82 | 0.15 | 0.66 | 0.37 | 1.85 | 1.03 | 6.02 | 6.17 | 31.06 | 6.97 | 38.03 | 5.7 | - | 2,449 | - | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 12/1/2009 | 12 | 73.41 | - | - | - | 73.41 | 0.00 | 315 | 50 | 265 | 1.82 | 0.66 | 0.98 | 0.80 | 1.79 | 1.46 | 8.58 | 9.24 | 53.66 | 10.57 | 64.23 | 5.8 | - | 3,553 | - | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 1/1/2010 | 1 | 83.27 | - | - | - | 83.27 | 0.00 | 315 | 50 | 265 | 1.87 | 5.56 | 0.65 | 1.21 | 1.22 | 2.26 | 9.74 | 15.30 | 101.28 | 17.69 | 118.98 | 4.4 | - | 3,058 | - | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 2/1/2010 | 2 | 127.13 | 127.13 | - | - | - | 127.13 | 315 | 50 | 265 | 2.50 | 2.60 | 1.00 | 0.00 | 2.49 | - | - | 2.60 | 0.80 | 3.53 | 4.33 | 4.3 | - | - | 4,562 | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate that all effluent went to the ponds. |
| 3/1/2010 | 3 | 154.70 | 154.70 | - | - | - | 154.70 | 315 | 50 | 265 | 4.96 | 0.50 | 0.66 | 0.00 | 3.25 | - | - | 0.50 | (19.81) | 0.68 | (19.13) | 4.3 | - | - | 5,552 | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate that all effluent went to the ponds. |
| 4/1/2010 | 4 | 120.12 | 120.12 | - | - | - | 120.12 | 315 | 50 | 265 | 6.18 | 0.59 | 0.93 | 0.00 | 5.76 | - | - | 0.59 | (37.18) | 0.80 | (36.38) | 4.1 | - | - | 4,110 | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate that all effluent went to the ponds. |
| 5/1/2010 | 5 | 81.96 | 81.96 | - | - | - | 81.96 | 315 | 50 | 265 | 7.79 | 0.02 | 0.70 | 0.00 | 5.47 | - | - | 0.02 | (39.23) | 0.03 | (39.20) | 4.4 | - | - | 3,010 | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate that all effluent went to the ponds. |
| 6/1/2010 | 6 | 66.34 | - | - | - | 66.34 | 0.00 | 315 | 50 | 265 | 8.94 | 0.05 | 0.95 | 0.00 | 8.45 | - | 7.76 | 7.81 | (4.63) | 10.60 | 5.96 | 4.7 | - | 2,602 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 7/1/2010 | 7 | 69.43 | - | - | - | 69.43 | 0.00 | 315 | 50 | 265 | 9.64 | 0.05 | 0.69 | 0.00 | 6.66 | - | 8.12 | 8.17 | 10.89 | 11.09 | 21.98 | 4.9 | - | 2,839 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 8/1/2010 | 8 | 64.32 | - | - | - | 64.32 | 0.00 | 315 | 50 | 265 | 9.06 | 0.03 | 0.96 | 0.00 | 8.70 | - | 7.52 | 7.55 | (8.26) | 10.25 | 1.99 | 4.9 | - | 2,630 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 9/1/2010 | 9 | 55.72 | - | - | - | 55.72 | 0.00 | 315 | 50 | 265 | 6.65 | 0.06 | 0.67 | 0.00 | 4.44 | - | 6.51 | 6.57 | 15.36 | 8.93 | 24.29 | 4.8 | - | 2,232 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 10/1/2010 | 10 | 52.65 | - | - | - | 52.65 | 0.00 | 315 | 50 | 265 | 3.94 | 0.86 | 0.97 | 0.00 | 3.83 | - | 6.16 | 7.02 | 22.95 | 9.52 | 32.47 | 4.9 | - | 2,153 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 11/1/2010 | 11 | 56.46 | 56.46 | - | - | - | 56.46 | 315 | 50 | 265 | 2.84 | 0.11 | 0.66 | 0.37 | 1.87 | 1.04 | - | 0.11 | (12.64) | (1.26) | (13.90) | 5.1 | - | - | 2,403 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | Field Meters were offline but BBARWA records indicate that all effluent went to the ponds. |
| 12/1/2010 | 12 | 129.97 | 129.97 | - | - | - | 129.97 | 315 | 50 | 265 | 1.83 | 8.49 | 0.98 | 0.80 | 1.80 | 1.47 | - | 8.49 | 48.17 | 9.53 | 57.70 | 5.0 | - | - | 5,423 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | Field Meters were offline but BBARWA records indicate that all effluent went to the ponds. |

## Lucerne Valley Facility - Water and Nitrogen Balance

| Date | Month | Monthly Total Effluent Flow (MG)[1] | Earth Basin Estimates from BBARWA (MG) | West Field Flow (MG)[2] | East Field Flow (MG)[3] | Total Flow To Fields (MG) | Calculated Flow to Earth Basin (MG)[4] | Total Planted Acreage | Grain Acreage | Alfalfa Acreage | ETo (in)[5] | Rainfall (in)[6] | Alfalfa $K_c$[7] | Grain $K_c$[7] | $ET_c$ Alfalfa (in)[8] | $ET_c$ Grain (in)[8] | Effluent Depth on Total Acreage (in)[9] | Total Water Depth on Acreage (in)[10] | Alfalfa Surplus or Deficit (MG)[11] | Grain Surplus or Deficit (MG)[12] | Combined Surplus or Deficit (MG)[13] | Effluent TIN (mg/L)[14] | Urea Applied from Fertilizer to Fields (lbs) | TIN Loading to Fields (lbs)[15] | TIN Loading to Ponds (lbs)[16] | Alfalfa Nitrogen Removal Capacity (lbs/acre)[17] | Grain Nitrogen Removal Capacity (lbs/acre)[18] | Alfalfa Nitrogen Removal Capacity (lbs)[19] | Grain Nitrogen Removal Capacity (lbs)[20] | Total Nitrogen Removal Capacity (lbs)[21] | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/1/2011 | 1 | 119.18 | 119.18 | - | - | - | 119.18 | 315 | 50 | 265 | 2.25 | 0.31 | 0.65 | 1.21 | 1.47 | 2.72 | - | 0.31 | (8.33) | (3.28) | (11.60) | 4.5 | - | - | 4,476 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | Field Meters were offline but BBARWA records indicate that all effluent went to the ponds. |
| 2/1/2011 | 2 | 97.78 | 97.78 | - | - | - | 97.78 | 315 | 50 | 265 | 2.94 | 7.45 | 1.00 | 0.00 | 2.93 | - | - | 7.45 | 32.55 | 10.11 | 42.66 | 4.6 | - | - | 3,753 | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate that all effluent went to the ponds. |
| 3/1/2011 | 3 | 169.12 | 169.12 | - | - | - | 169.12 | 315 | 50 | 265 | 4.91 | 1.51 | 0.66 | 0.00 | 3.22 | - | - | 1.51 | (12.30) | 2.05 | (10.25) | 5.7 | - | - | 8,045 | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate that all effluent went to the ponds. |
| 4/1/2011 | 4 | 125.36 | | - | - | - | 125.36 | 315 | 50 | 265 | 6.35 | 0.04 | 0.93 | 0.00 | 5.92 | - | - | 0.04 | (42.28) | 0.05 | (42.23) | 7.0 | - | - | 7,323 | 19.1 | - | 5,068 | - | 5,068 | Field Meters were offline but BBARWA records indicate that all effluent went to the ponds. |
| 5/1/2011 | 5 | 94.34 | 0 | 52.63 | 45.42 | 94.34 | 0.00 | 315 | 50 | 265 | 7.85 | 0.02 | 0.70 | 0.00 | 5.51 | - | 11.03 | 11.05 | 39.83 | 15.00 | 54.83 | 6.8 | - | 5,354 | - | 19.1 | - | 5,068 | - | 5,068 | Sum of meter readings indicates negative flow to ponds; assumed zero flow to ponds. |
| 6/1/2011 | 6 | 84.26 | 0 | 50.52 | 43.13 | 84.26 | 0.00 | 315 | 50 | 265 | 9.14 | 0.01 | 0.95 | 0.00 | 8.64 | - | 9.85 | 9.86 | 8.79 | 13.39 | 22.18 | 6.1 | - | 4,289 | - | 19.1 | - | 5,068 | - | 5,068 | Sum of meter readings indicates negative flow to ponds; assumed zero flow to ponds. |
| 7/1/2011 | 7 | 87.70 | 0 | 53.08 | 5.37 | 58.46 | 29.24 | 315 | 50 | 265 | 9.01 | 1.30 | 0.69 | 0.00 | 6.22 | - | 6.83 | 8.13 | 13.78 | 11.04 | 24.82 | 5.7 | - | 2,781 | 1,391 | 19.1 | - | 5,068 | - | 5,068 | Higher than typical value for effluent to Earth Basin; possible data error. |
| 8/1/2011 | 8 | 82.30 | 0 | 55.86 | - | 82.30 | 0.00 | 315 | 50 | 265 | 9.23 | 0.18 | 0.96 | 0.00 | 8.86 | - | 9.62 | 9.80 | 6.77 | 13.31 | 20.08 | 6.0 | - | 4,121 | - | 19.1 | - | 5,068 | - | 5,068 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 9/1/2011 | 9 | 70.39 | 0 | 45.37 | 39.49 | 70.39 | 0.00 | 315 | 50 | 265 | 6.46 | 0.06 | 0.67 | 0.00 | 4.31 | - | 8.23 | 8.29 | 28.61 | 11.25 | 39.87 | 6.2 | - | 3,642 | - | 19.1 | - | 5,068 | - | 5,068 | Sum of meter readings indicates negative flow to ponds; assumed zero flow to ponds. |
| 10/1/2011 | 10 | 66.56 | 0 | 27.91 | 40.79 | 66.56 | 0.00 | 315 | 50 | 265 | 4.52 | 0.07 | 0.97 | 0.00 | 4.39 | - | 7.78 | 7.85 | 24.91 | 10.66 | 35.57 | 6.3 | - | 3,499 | - | 19.1 | - | 5,068 | - | 5,068 | Sum of meter readings indicates negative flow to ponds; assumed zero flow to ponds. |
| 11/1/2011 | 11 | 67.90 | 59.771 | 3.03 | 3.92 | 6.95 | 60.95 | 315 | 50 | 265 | 2.43 | 0.78 | 0.66 | 0.37 | 1.60 | 0.89 | 0.81 | 1.59 | (0.03) | 0.95 | 0.92 | 6.7 | - | 389 | 3,408 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | |
| 12/1/2011 | 12 | 80.87 | 80.865 | - | - | - | 80.87 | 315 | 50 | 265 | 1.99 | 0.43 | 0.98 | 0.80 | 1.95 | 1.60 | - | 0.43 | (10.95) | (1.58) | (12.54) | 6.6 | - | - | 4,454 | 19.1 | 27.3 | 5,068 | 1,365 | 6,433 | Field Meters were offline but BBARWA records indicate that all effluent went to the ponds. |
| 1/1/2012 | 1 | 74.09 | 64.085 | 1.76 | 8.27 | 10.02 | 64.07 | 190 | 50 | 140 | 2.67 | 0.07 | 0.65 | 1.21 | 1.74 | 3.23 | 1.94 | 2.01 | 1.03 | (1.65) | (0.62) | 6.8 | - | 569 | 3,636 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 2/1/2012 | 2 | 68.09 | 22.562 | 24.14 | 14.74 | 38.88 | 29.20 | 190 | 50 | 140 | 3.19 | 0.40 | 1.00 | 0.00 | 3.18 | - | 7.54 | 7.94 | 18.10 | 10.78 | 28.88 | 7.2 | - | 2,336 | 1,755 | 19.1 | - | 2,678 | - | 2,678 | |
| 3/1/2012 | 3 | 82.45 | 0 | 40.63 | 32.34 | 72.97 | 9.48 | 190 | 50 | 140 | 5.36 | 1.02 | 0.66 | 0.00 | 3.52 | - | 14.15 | 15.17 | 44.28 | 20.59 | 64.87 | 6.7 | - | 4,080 | 530 | 19.1 | - | 2,678 | - | 2,678 | |
| 4/1/2012 | 4 | 85.95 | 0 | 18.59 | 23.20 | 41.79 | 44.16 | 190 | 50 | 140 | 6.44 | 0.59 | 0.93 | 0.00 | 6.00 | - | 8.10 | 8.69 | 10.23 | 11.80 | 22.03 | 7.3 | - | 2,546 | 2,690 | 19.1 | - | 2,678 | - | 2,678 | Higher than typical value for effluent to Earth Basin; possible data error. |
| 5/1/2012 | 5 | 71.74 | 0 | 36.63 | 22.22 | 58.85 | 12.89 | 190 | 50 | 140 | 8.58 | - | 0.70 | 0.00 | 6.03 | - | 11.41 | 11.41 | 20.45 | 15.49 | 35.94 | 6.7 | - | 3,290 | 721 | 19.1 | - | 2,678 | - | 2,678 | |
| 6/1/2012 | 6 | 63.07 | 0 | 26.04 | 29.37 | 55.41 | 7.66 | 190 | 50 | 140 | 9.51 | - | 0.95 | 0.00 | 8.99 | - | 10.74 | 10.74 | 6.66 | 14.58 | 21.24 | 7.0 | - | 3,237 | 447 | 19.1 | - | 2,678 | - | 2,678 | |
| 7/1/2012 | 7 | 66.72 | 2.253 | 25.31 | 28.98 | 54.30 | 12.42 | 190 | 50 | 140 | 9.62 | 0.82 | 0.69 | 0.00 | 6.64 | - | 10.53 | 11.35 | 17.88 | 15.40 | 33.28 | 6.5 | - | 2,945 | 674 | 19.1 | - | 2,678 | - | 2,678 | |
| 8/1/2012 | 8 | 65.54 | 0 | 29.70 | 30.91 | 60.61 | 4.93 | 190 | 50 | 140 | 8.35 | 0.65 | 0.96 | 0.00 | 8.02 | - | 11.75 | 12.40 | 16.66 | 16.83 | 33.49 | 6.2 | - | 3,136 | 255 | 19.1 | - | 2,678 | - | 2,678 | |
| 9/1/2012 | 9 | 51.73 | 0 | 29.13 | 16.71 | 45.84 | 5.89 | 190 | 50 | 140 | 6.70 | 0.49 | 0.67 | 0.00 | 4.47 | - | 8.89 | 9.38 | 18.63 | 12.73 | 31.36 | 6.2 | - | 2,372 | 305 | 19.1 | - | 2,678 | - | 2,678 | |
| 10/1/2012 | 10 | 47.22 | 1.79 | 27.31 | 16.30 | 43.62 | 3.61 | 190 | 50 | 140 | 4.74 | - | 0.97 | 0.00 | 4.60 | - | 8.45 | 8.45 | 14.64 | 11.48 | 26.12 | 5.3 | - | 1,929 | 160 | 19.1 | - | 2,678 | - | 2,678 | |
| 11/1/2012 | 11 | 48.95 | 16.422 | 6.34 | 21.89 | 28.22 | 20.72 | 190 | 50 | 140 | 2.94 | 0.03 | 0.66 | 0.37 | 1.93 | 1.08 | 5.47 | 5.50 | 13.57 | 6.01 | 19.57 | 6.3 | - | 1,484 | 1,089 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 12/1/2012 | 12 | 61.38 | 61.378 | - | - | - | 61.38 | 190 | 50 | 140 | 2.06 | 0.89 | 0.98 | 0.80 | 2.02 | 1.65 | - | 0.89 | (4.30) | (1.04) | (5.34) | 5.5 | - | - | 2,817 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |

## Lucerne Valley Facility - Water and Nitrogen Balance

| Date | Month | Monthly Total Effluent Flow (MG)[1] | Earth Basin Estimates from BBARWA (MG) | West Field Flow (MG)[2] | East Field Flow (MG)[3] | Total Flow To Fields (MG) | Calculated Flow to Earth Basin (MG)[4] | Total Planted Acreage | Grain Acreage | Alfalfa Acreage | ETo (in)[5] | Rainfall (in)[6] | Alfalfa $K_c$[7] | Grain $K_c$[7] | $ET_c$ Alfalfa (in)[8] | $ET_c$ Grain (in)[8] | Effluent Depth on Total Acreage (in)[9] | Total Water Depth on Acreage (in)[10] | Alfalfa Surplus or Deficit (MG)[11] | Grain Surplus or Deficit (MG)[12] | Combined Surplus or Deficit (MG)[13] | Effluent TIN (mg/L)[14] | Urea Applied from Fertilizer to Fields (lbs) | TIN Loading to Fields (lbs)[15] | TIN Loading to Ponds (lbs)[16] | Alfalfa Nitrogen Removal Capacity (lbs/acre)[17] | Grain Nitrogen Removal Capacity (lbs/acre)[18] | Alfalfa Nitrogen Removal Capacity (lbs)[19] | Grain Nitrogen Removal Capacity (lbs)[20] | Total Nitrogen Removal Capacity (lbs)[21] | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/1/2013 | 1 | 66.12 | 66.119 | - | - | - | 66.12 | 190 | 50 | 140 | 2.12 | 0.72 | 0.65 | 1.21 | 1.38 | 2.57 | - | 0.72 | (2.52) | (2.51) | (5.02) | 5.5 | - | - | 3,035 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 2/1/2013 | 2 | 58.34 | 8.902 | 30.56 | 15.96 | 46.52 | 11.82 | 190 | 50 | 140 | 3.06 | 0.20 | 1.00 | 0.00 | 3.05 | - | 9.02 | 9.22 | 23.46 | 12.51 | 35.97 | 4.6 | - | 1,786 | 454 | 19.1 | - | 2,678 | - | 2,678 | |
| 3/1/2013 | 3 | 56.38 | 0 | 26.24 | 30.46 | 56.70 | -0.32 | 190 | 50 | 140 | 5.56 | 0.13 | 0.66 | 0.00 | 3.65 | - | 10.99 | 11.12 | 28.41 | 15.10 | 43.51 | 4.6 | - | 2,176 | (12) | 19.1 | - | 2,678 | - | 2,678 | |
| 4/1/2013 | 4 | 44.89 | 0 | 11.06 | 25.34 | 36.40 | 8.49 | 190 | 50 | 140 | 7.02 | - | 0.93 | 0.00 | 6.54 | - | 7.06 | 7.06 | 1.96 | 9.58 | 11.54 | 4.4 | - | 1,337 | 312 | 19.1 | - | 2,678 | - | 2,678 | |
| 5/1/2013 | 5 | 48.56 | 0 | 23.34 | 23.35 | 46.69 | 1.88 | 190 | 50 | 140 | 8.23 | - | 0.70 | 0.00 | 5.78 | - | 9.05 | 9.05 | 12.42 | 12.29 | 24.71 | 4.6 | - | 1,792 | 72 | 19.1 | - | 2,678 | - | 2,678 | |
| 6/1/2013 | 6 | 48.08 | 0 | 22.15 | 24.72 | 46.87 | 1.21 | 190 | 50 | 140 | 9.42 | - | 0.95 | 0.00 | 8.90 | - | 9.09 | 9.09 | 0.69 | 12.33 | 13.02 | 4.5 | - | 1,760 | 45 | 19.1 | - | 2,678 | - | 2,678 | |
| 7/1/2013 | 7 | 57.33 | 0 | 22.57 | 33.43 | 56.00 | 1.34 | 190 | 50 | 140 | 8.87 | - | 0.69 | 0.00 | 6.12 | - | 10.85 | 10.85 | 17.98 | 14.74 | 32.72 | 4.5 | - | 2,103 | 50 | 19.1 | - | 2,678 | - | 2,678 | |
| 8/1/2013 | 8 | 56.53 | 0 | 19.09 | 26.10 | 45.19 | 11.34 | 190 | 50 | 140 | 8.68 | - | 0.96 | 0.00 | 8.33 | - | 8.76 | 8.76 | 1.62 | 11.89 | 13.51 | 5.2 | - | 1,961 | 492 | 19.1 | - | 2,678 | - | 2,678 | |
| 9/1/2013 | 9 | 46.76 | 0 | - | - | 46.76 | 0.00 | 190 | 50 | 140 | 6.75 | - | 0.67 | 0.00 | 4.51 | - | 9.06 | 9.06 | 17.33 | 12.31 | 29.63 | 4.9 | - | 1,912 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 10/1/2013 | 10 | 44.00 | 0 | - | - | 44.00 | 0.00 | 190 | 50 | 140 | 4.60 | - | 0.97 | 0.00 | 4.47 | - | 8.53 | 8.53 | 15.44 | 11.58 | 27.02 | 4.8 | - | 1,763 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 11/1/2013 | 11 | 44.78 | 0 | - | - | 44.78 | 0.00 | 190 | 50 | 140 | 2.44 | - | 0.66 | 0.37 | 1.60 | 0.89 | 8.68 | 8.68 | 26.90 | 10.57 | 37.47 | 3.8 | - | 1,420 | - | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 12/1/2013 | 12 | 55.44 | 0 | - | - | 55.44 | 0.00 | 190 | 50 | 140 | 2.10 | - | 0.98 | 0.80 | 2.06 | 1.69 | 10.75 | 10.75 | 33.02 | 12.30 | 45.32 | 3.8 | - | 1,758 | - | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 1/1/2014 | 1 | 54.93 | | - | - | - | 54.93 | 190 | 50 | 140 | 2.55 | - | 0.65 | 1.21 | 1.66 | 3.09 | - | - | (6.32) | (4.19) | (10.51) | 4.8 | - | - | 2,200 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | No records available, assumed all effluent went to ponds. |
| 2/1/2014 | 2 | 46.72 | 0 | - | - | 46.72 | 0.00 | 190 | 50 | 140 | 3.36 | - | 1.00 | 0.00 | 3.34 | - | 9.06 | 9.06 | 21.71 | 12.29 | 34.00 | 5.1 | - | 1,988 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 3/1/2014 | 3 | 55.06 | 0 | - | - | 55.06 | 0.00 | 190 | 50 | 140 | 4.37 | - | 0.66 | 0.00 | 2.87 | - | 10.67 | 10.67 | 29.67 | 14.49 | 44.16 | 5.8 | - | 2,665 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 4/1/2014 | 4 | 46.21 | 0 | - | - | 46.21 | 0.00 | 190 | 50 | 140 | 5.98 | 0.21 | 0.93 | 0.00 | 5.57 | - | 8.96 | 9.17 | 13.67 | 12.44 | 26.11 | 6.5 | 7,000.0 | 5,772 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. Fertilizer application of Nitrogen as Urea based on verbal report from farmer on 9/6/2016. |
| 5/1/2014 | 5 | 51.32 | 0 | - | - | 51.32 | 0.00 | 190 | 50 | 140 | 8.08 | 0.01 | 0.70 | 0.00 | 5.68 | - | 9.95 | 9.96 | 16.28 | 13.52 | 29.80 | 6.9 | - | 2,955 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 6/1/2014 | 6 | 48.40 | 0 | - | - | 48.40 | 0.00 | 190 | 50 | 140 | 9.51 | - | 0.95 | 0.00 | 8.99 | - | 9.38 | 9.38 | 1.49 | 12.74 | 14.23 | 7.0 | - | 2,827 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 7/1/2014 | 7 | 62.78 | 0 | - | - | 62.78 | 0.00 | 190 | 50 | 140 | 9.26 | 0.02 | 0.69 | 0.00 | 6.39 | - | 12.17 | 12.19 | 22.03 | 16.55 | 38.58 | 6.6 | - | 3,458 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 8/1/2014 | 8 | 57.16 | 0 | - | - | 57.16 | 0.00 | 190 | 50 | 140 | 8.52 | 0.08 | 0.96 | 0.00 | 8.18 | - | 11.08 | 11.16 | 11.33 | 15.15 | 26.48 | 6.2 | - | 2,958 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 9/1/2014 | 9 | 49.73 | 0 | - | - | 49.73 | 0.00 | 190 | 50 | 140 | 6.68 | 0.01 | 0.67 | 0.00 | 4.46 | - | 9.64 | 9.65 | 19.73 | 13.10 | 32.82 | 6.3 | - | 2,614 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 10/1/2014 | 10 | 46.29 | 0 | - | - | 46.29 | 0.00 | 190 | 50 | 140 | 4.86 | 0.01 | 0.97 | 0.00 | 4.72 | - | 8.97 | 8.98 | 16.20 | 12.19 | 28.40 | 6.5 | - | 2,511 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 11/1/2014 | 11 | 49.82 | | - | - | - | 49.82 | 190 | 50 | 140 | 3.02 | 0.09 | 0.66 | 0.37 | 1.98 | 1.11 | - | 0.09 | (7.20) | (1.38) | (8.58) | 6.2 | - | - | 2,578 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | No records available, assumed all effluent went to ponds. |
| 12/1/2014 | 12 | 71.49 | | - | - | - | 71.49 | 190 | 50 | 140 | 1.60 | 1.09 | 0.98 | 0.80 | 1.57 | 1.28 | - | 1.09 | (1.82) | (0.26) | (2.09) | 7.6 | - | - | 4,535 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | No records available, assumed all effluent went to ponds. |

## Lucerne Valley Facility - Water and Nitrogen Balance

| Date | Month | Monthly Total Effluent Flow (MG)[1] | Earth Basin Estimates from BBARWA (MG) | West Field Flow (MG)[2] | East Field Flow (MG)[3] | Total Flow To Fields (MG) | Calculated Flow to Earth Basin (MG)[4] | Total Planted Acreage | Grain Acreage | Alfalfa Acreage | ETo (in)[5] | Rainfall (in)[6] | Alfalfa $K_c$[7] | Grain $K_c$[7] | $ET_c$ Alfalfa (in)[8] | $ET_c$ Grain (in)[8] | Effluent Depth on Total Acreage (in)[9] | Total Water Depth on Acreage (in)[10] | Alfalfa Surplus or Deficit (MG)[11] | Grain Surplus or Deficit (MG)[12] | Combined Surplus or Deficit (MG)[13] | Effluent TIN (mg/L)[14] | Urea Applied from Fertilizer to Fields (lbs) | TIN Loading to Fields (lbs)[15] | TIN Loading to Ponds (lbs)[16] | Alfalfa Nitrogen Removal Capacity (lbs/acre)[17] | Grain Nitrogen Removal Capacity (lbs/acre)[18] | Alfalfa Nitrogen Removal Capacity (lbs)[19] | Grain Nitrogen Removal Capacity (lbs)[20] | Total Nitrogen Removal Capacity (lbs)[21] | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/1/2015 | 1 | 71.88 | | - | - | - | 71.88 | 190 | 50 | 140 | 1.94 | 0.84 | 0.65 | 1.21 | 1.27 | 2.35 | - | 0.84 | (1.62) | (2.05) | (3.66) | 7.7 | - | - | 4,619 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | No records available, assumed all effluent went to ponds. |
| 2/1/2015 | 2 | 57.81 | 0 | - | - | 57.81 | 0.00 | 190 | 50 | 140 | 3.40 | 0.46 | 1.00 | 0.00 | 3.38 | - | 11.21 | 11.67 | 31.48 | 15.84 | 47.31 | 7.9 | - | 3,811 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 3/1/2015 | 3 | 57.75 | 0 | - | - | 57.75 | 0.00 | 190 | 50 | 140 | 5.39 | 0.01 | 0.66 | 0.00 | 3.53 | - | 11.19 | 11.20 | 29.15 | 15.21 | 44.36 | 7.7 | - | 3,711 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 4/1/2015 | 4 | 44.04 | 0 | - | - | 44.04 | 0.00 | 190 | 50 | 140 | 6.55 | - | 0.93 | 0.00 | 6.10 | - | 8.54 | 8.54 | 9.25 | 11.59 | 20.84 | 6.4 | - | 2,352 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 5/1/2015 | 5 | 46.63 | 0 | - | - | 46.63 | 0.00 | 190 | 50 | 140 | 7.65 | 0.06 | 0.70 | 0.00 | 5.37 | - | 9.04 | 9.10 | 14.16 | 12.35 | 26.51 | 6.1 | - | 2,374 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 6/1/2015 | 6 | 45.90 | 0 | - | - | 45.90 | 0.00 | 190 | 50 | 140 | 8.75 | 0.03 | 0.95 | 0.00 | 8.27 | - | 8.90 | 8.93 | 2.49 | 12.12 | 14.61 | 6.2 | - | 2,375 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 7/1/2015 | 7 | 57.96 | 0 | - | - | 57.96 | 0.00 | 190 | 50 | 140 | 8.67 | 0.91 | 0.69 | 0.00 | 5.99 | - | 11.24 | 12.15 | 23.42 | 16.49 | 39.91 | 6.4 | - | 3,096 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 8/1/2015 | 8 | 53.16 | 0 | - | - | 53.16 | 0.00 | 190 | 50 | 140 | 9.27 | 0.03 | 0.96 | 0.00 | 8.90 | - | 10.30 | 10.33 | 5.45 | 14.03 | 19.48 | 6.3 | - | 2,795 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 9/1/2015 | 9 | 49.25 | 0 | - | - | 49.25 | 0.00 | 190 | 50 | 140 | 6.72 | 0.03 | 0.67 | 0.00 | 4.49 | - | 9.55 | 9.58 | 19.35 | 13.00 | 32.35 | 6.3 | - | 2,589 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 10/1/2015 | 10 | 46.12 | 0 | - | - | 46.12 | 0.00 | 190 | 50 | 140 | 4.26 | 0.01 | 0.97 | 0.00 | 4.14 | - | 8.94 | 8.95 | 18.30 | 12.15 | 30.45 | 5.8 | - | 2,233 | - | 19.1 | - | 2,678 | - | 2,678 | BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. |
| 11/1/2015 | 11 | 50.21 | | - | - | - | 50.21 | 190 | 50 | 140 | 2.90 | 0.01 | 0.66 | 0.37 | 1.91 | 1.06 | - | 0.01 | (7.21) | (1.43) | (8.64) | 6.3 | - | - | 2,640 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | No records available, assumed all effluent went to ponds. |
| 12/1/2015 | 12 | 62.45 | | - | - | - | 62.45 | 190 | 50 | 140 | 2.16 | 0.02 | 0.98 | 0.80 | 2.12 | 1.73 | - | 0.02 | (7.98) | (2.33) | (10.31) | 4.9 | - | - | 2,554 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | No records available, assumed all effluent went to ponds. |
| 1/1/2016 | 1 | 78.02 | 78.02 | (0.00) | (0.00) | (0.00) | 78.02 | 190 | 50 | 140 | 2.03 | 0.06 | 0.65 | 1.21 | 1.32 | 2.46 | (0.00) | 0.06 | (4.80) | (3.25) | (8.06) | 4.0 | - | (0) | 2,604 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 2/1/2016 | 2 | 80.78 | 60.64 | 13.78 | 6.36 | 20.14 | 60.64 | 190 | 50 | 140 | 3.51 | 0.01 | 1.00 | 0.00 | 3.49 | - | 3.90 | 3.91 | 1.60 | 5.31 | 6.91 | 3.5 | - | 588 | 1,771 | 19.1 | - | 2,678 | - | 2,678 | |
| 3/1/2016 | 3 | 66.28 | 0.00 | 45.35 | 20.93 | 66.28 | 0.00 | 190 | 50 | 140 | 5.16 | - | 0.66 | 0.00 | 3.38 | - | 12.85 | 12.85 | 35.97 | 17.44 | 53.42 | 3.3 | - | 1,825 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 4/1/2016 | 4 | 50.68 | 0.00 | 34.67 | 16.00 | 50.68 | 0.00 | 190 | 50 | 140 | 6.26 | 0.56 | 0.93 | 0.00 | 5.83 | - | 9.82 | 10.38 | 17.30 | 14.10 | 31.40 | 3.4 | - | 1,438 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 5/1/2016 | 5 | 51.48 | 0.00 | 35.22 | 16.26 | 51.48 | 0.00 | 190 | 50 | 140 | 7.82 | - | 0.70 | 0.00 | 5.49 | - | 9.98 | 9.98 | 17.05 | 13.55 | 30.60 | 3.4 | - | 1,461 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 6/1/2016 | 6 | 49.15 | 0.00 | 33.63 | 15.52 | 49.15 | 0.00 | 190 | 50 | 140 | 9.43 | - | 0.95 | 0.00 | 8.91 | - | 9.53 | 9.53 | 2.33 | 12.93 | 15.26 | 3.2 | - | 1,313 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 7/1/2016 | 7 | 58.57 | 0.00 | 40.07 | 18.49 | 58.57 | 0.00 | 190 | 50 | 140 | 10.59 | 0.01 | 0.69 | 0.00 | 7.31 | - | 11.35 | 11.36 | 15.40 | 15.43 | 30.83 | 3.1 | - | 1,515 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 8/1/2016 | 8 | 55.32 | 0.00 | 37.85 | 17.47 | 55.32 | 0.00 | 190 | 50 | 140 | 9.14 | - | 0.96 | 0.00 | 8.77 | - | 10.72 | 10.72 | 7.41 | 14.56 | 21.96 | 3.9 | - | 1,800 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 9/1/2016 | 9 | 46.16 | 0.00 | 31.59 | 14.58 | 46.16 | 0.00 | 190 | 50 | 140 | 6.70 | - | 0.67 | 0.00 | 4.47 | - | 8.95 | 8.95 | 17.01 | 12.15 | 29.16 | 4.3 | - | 1,657 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 10/1/2016 | 10 | 46.84 | 0.00 | 32.05 | 14.79 | 46.84 | 0.00 | 190 | 50 | 140 | 4.73 | 0.44 | 0.97 | 0.00 | 4.59 | - | 9.08 | 9.52 | 18.72 | 12.92 | 31.65 | 4.8 | - | 1,876 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 11/1/2016 | 11 | 48.63 | 22.76 | 17.70 | 8.17 | 25.87 | 22.76 | 190 | 50 | 140 | 2.91 | 0.10 | 0.66 | 0.37 | 1.91 | 1.07 | 5.01 | 5.11 | 12.17 | 5.50 | 17.66 | 4.9 | - | 1,058 | 931 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 12/1/2016 | 12 | 72.74 | 72.74 | - | - | - | 72.74 | 190 | 50 | 140 | 2.00 | 2.63 | 0.98 | 0.80 | 1.96 | 1.60 | - | 2.63 | 2.54 | 1.39 | 3.93 | 4.4 | - | - | 2,671 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 1/1/2017 | 1 | 110.77 | 110.77 | 0.00 | 0.00 | 0.00 | 110.77 | 190 | 50 | 140 | 2.49 | 0.78 | 0.65 | 1.21 | 1.62 | 3.01 | 0.00 | 0.78 | (3.21) | (3.03) | (6.24) | 5.1 | - | 0 | 4,714 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 2/1/2017 | 2 | 158.94 | 158.94 | - | - | - | 158.94 | 190 | 50 | 140 | 2.88 | 1.28 | 1.00 | 0.00 | 2.87 | - | - | 1.28 | (6.03) | 1.74 | (4.29) | 6.1 | - | - | 8,091 | 19.1 | - | 2,678 | - | 2,678 | |
| 3/1/2017 | 3 | 109.42 | 52.91 | 38.67 | 17.85 | 56.52 | 52.91 | 190 | 50 | 140 | 5.62 | - | 0.66 | 0.00 | 3.69 | - | 10.96 | 10.96 | 27.64 | 14.87 | 42.51 | 6.8 | - | 3,207 | 3,002 | 19.1 | - | 2,678 | - | 2,678 | |
| 4/1/2017 | 4 | 61.95 | 0.00 | 42.39 | 19.56 | 61.95 | 0.00 | 190 | 50 | 140 | 6.97 | - | 0.93 | 0.00 | 6.49 | - | 12.01 | 12.01 | 20.96 | 16.30 | 37.26 | 6.5 | - | 3,360 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 5/1/2017 | 5 | 54.49 | 0.00 | 37.28 | 17.21 | 54.49 | 0.00 | 190 | 50 | 140 | 7.99 | 0.08 | 0.70 | 0.00 | 5.61 | - | 10.56 | 10.64 | 19.12 | 14.45 | 33.57 | 6.5 | - | 2,956 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 6/1/2017 | 6 | 50.25 | 0.00 | 34.38 | 15.87 | 50.25 | 0.00 | 190 | 50 | 140 | 9.36 | - | 0.95 | 0.00 | 8.85 | - | 9.74 | 9.74 | 3.40 | 13.22 | 16.62 | 6.5 | - | 2,726 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 7/1/2017 | 7 | 60.22 | 0.00 | 41.20 | 19.02 | 60.22 | 0.00 | 190 | 50 | 140 | 9.80 | - | 0.69 | 0.00 | 6.77 | - | 11.67 | 11.67 | 18.65 | 15.85 | 34.50 | 6.5 | - | 3,266 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 8/1/2017 | 8 | 54.97 | 0.00 | 37.61 | 17.36 | 54.97 | 0.00 | 190 | 50 | 140 | 8.47 | 0.06 | 0.96 | 0.00 | 8.13 | - | 10.66 | 10.72 | 9.82 | 14.55 | 24.37 | 5.9 | - | 2,706 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 9/1/2017 | 9 | 54.32 | 0.00 | 37.16 | 17.15 | 54.32 | 0.00 | 190 | 50 | 140 | 6.28 | - | 0.67 | 0.00 | 4.19 | - | 10.53 | 10.53 | 24.08 | 14.29 | 38.38 | 5.5 | - | 2,493 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 10/1/2017 | 10 | 46.45 | 18.93 | 18.83 | 8.69 | 27.52 | 18.93 | 190 | 50 | 140 | 4.68 | - | 0.97 | 0.00 | 4.55 | - | 5.33 | 5.33 | 3.00 | 7.24 | 10.24 | 5.2 | - | 1,194 | 821 | 19.1 | - | 2,678 | - | 2,678 | |
| 11/1/2017 | 11 | 48.15 | 48.15 | 0.00 | 0.00 | 0.00 | 48.15 | 190 | 50 | 140 | 2.94 | - | 0.66 | 0.37 | 1.93 | 1.08 | 0.00 | 0.00 | (7.34) | (1.46) | (8.81) | 4.9 | - | 0 | 1,969 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 12/1/2017 | 12 | 60.14 | 60.14 | (0.00) | (0.00) | (0.00) | 60.14 | 190 | 50 | 140 | 2.55 | - | 0.98 | 0.80 | 2.50 | 2.05 | (0.00) | (0.00) | (9.51) | (2.78) | (12.29) | 5.0 | - | (0) | 2,509 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 1/1/2018 | 1 | 64.95 | 64.95 | - | - | - | 64.95 | 190 | 50 | 140 | 2.49 | 0.78 | 0.65 | 1.21 | 1.62 | 3.01 | - | 0.78 | (3.21) | (3.03) | (6.24) | 5.5 | - | - | 2,981 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 2/1/2018 | 2 | 51.30 | 33.35 | 12.28 | 5.67 | 17.94 | 33.35 | 190 | 50 | 140 | 3.35 | 0.15 | 1.00 | 0.00 | 3.33 | - | 3.48 | 3.63 | 1.12 | 4.93 | 6.04 | 4.5 | - | 674 | 1,253 | 19.1 | - | 2,678 | - | 2,678 | |
| 3/1/2018 | 3 | 65.63 | 10.02 | 38.05 | 17.56 | 55.62 | 10.02 | 190 | 50 | 140 | 4.55 | 0.56 | 0.66 | 0.00 | 2.98 | - | 10.78 | 11.34 | 31.77 | 15.40 | 47.16 | 4.0 | - | 1,857 | 334 | 19.1 | - | 2,678 | - | 2,678 | |
| 4/1/2018 | 4 | 49.92 | 0.00 | 34.15 | 15.76 | 49.92 | 0.00 | 190 | 50 | 140 | 7.18 | - | 0.93 | 0.00 | 6.69 | - | 9.68 | 9.68 | 11.35 | 13.14 | 24.49 | 4.4 | - | 1,833 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 5/1/2018 | 5 | 50.74 | 0.00 | 34.71 | 16.02 | 50.74 | 0.00 | 190 | 50 | 140 | 8.06 | 0.03 | 0.70 | 0.00 | 5.66 | - | 9.84 | 9.87 | 15.98 | 13.39 | 29.37 | 4.3 | - | 1,821 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 6/1/2018 | 6 | 49.46 | 0.00 | 33.84 | 15.62 | 49.46 | 0.00 | 190 | 50 | 140 | 9.42 | - | 0.95 | 0.00 | 8.90 | - | 9.59 | 9.59 | 2.60 | 13.02 | 15.61 | 4.4 | - | 1,816 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 7/1/2018 | 7 | 59.71 | 0.00 | 40.85 | 18.86 | 59.71 | 0.00 | 190 | 50 | 140 | 9.52 | 0.26 | 0.69 | 0.00 | 6.57 | - | 11.57 | 11.83 | 20.00 | 16.07 | 36.07 | 4.6 | - | 2,292 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 8/1/2018 | 8 | 55.00 | 0.00 | 37.63 | 17.37 | 55.00 | 0.00 | 190 | 50 | 140 | 9.31 | - | 0.96 | 0.00 | 8.94 | - | 10.66 | 10.66 | 6.55 | 14.47 | 21.02 | 4.8 | - | 2,203 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 9/1/2018 | 9 | 50.19 | 25.14 | 17.14 | 7.91 | 25.05 | 25.14 | 190 | 50 | 140 | 7.42 | - | 0.67 | 0.00 | 4.95 | - | 4.86 | 4.86 | (0.37) | 6.59 | 6.22 | 4.7 | - | 983 | 986 | 19.1 | - | 2,678 | - | 2,678 | |
| 10/1/2018 | 10 | 47.67 | 47.67 | - | - | - | 47.67 | 190 | 50 | 140 | 4.43 | 0.91 | 0.97 | 0.00 | 4.30 | - | - | 0.91 | (12.89) | 1.24 | (11.66) | 4.6 | - | - | 1,830 | 19.1 | - | 2,678 | - | 2,678 | |
| 11/1/2018 | 11 | 51.97 | 51.97 | - | - | - | 51.97 | 190 | 50 | 140 | 3.02 | 0.16 | 0.66 | 0.37 | 1.98 | 1.11 | - | 0.16 | (6.94) | (1.28) | (8.22) | 5.1 | - | - | 2,212 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 12/1/2018 | 12 | 70.06 | 70.06 | - | - | - | 70.06 | 190 | 50 | 140 | 1.85 | 1.36 | 0.98 | 0.80 | 1.82 | 1.48 | - | 1.36 | (1.73) | (0.17) | (1.90) | 5.1 | - | - | 2,982 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 1/1/2019 | 1 | 79.20 | 79.2 | - | - | - | 79.20 | 190 | 50 | 140 | 2.06 | 1.07 | 0.65 | 1.21 | 1.34 | 2.49 | - | 1.07 | (1.04) | (1.93) | (2.97) | 6.2 | - | - | 4,098 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 2/1/2019 | 2 | 120.34 | 111.6 | 5.99 | 2.77 | 8.76 | 111.58 | 190 | 50 | 140 | 2.63 | 1.52 | 1.00 | 0.00 | 2.62 | - | 1.70 | 3.22 | 2.28 | 4.37 | 6.65 | 5.3 | - | 388 | 4,935 | 19.1 | - | 2,678 | - | 2,678 | |
| 3/1/2019 | 3 | 155.70 | 106.2 | 33.87 | 15.63 | 49.51 | 106.20 | 190 | 50 | 140 | 4.69 | 0.68 | 0.66 | 0.00 | 3.08 | - | 9.60 | 10.28 | 27.37 | 13.95 | 41.32 | 4.3 | - | 1,777 | 3,811 | 19.1 | - | 2,678 | - | 2,678 | |
| 4/1/2019 | 4 | 72.11 | 0.0 | 49.34 | 22.77 | 72.11 | 0.00 | 190 | 50 | 140 | 6.99 | - | 0.93 | 0.00 | 6.51 | - | 13.98 | 13.98 | 28.37 | 18.98 | 47.35 | 4.0 | - | 2,407 | - | 19.1 | - | 2,678 | - | 2,678 | |

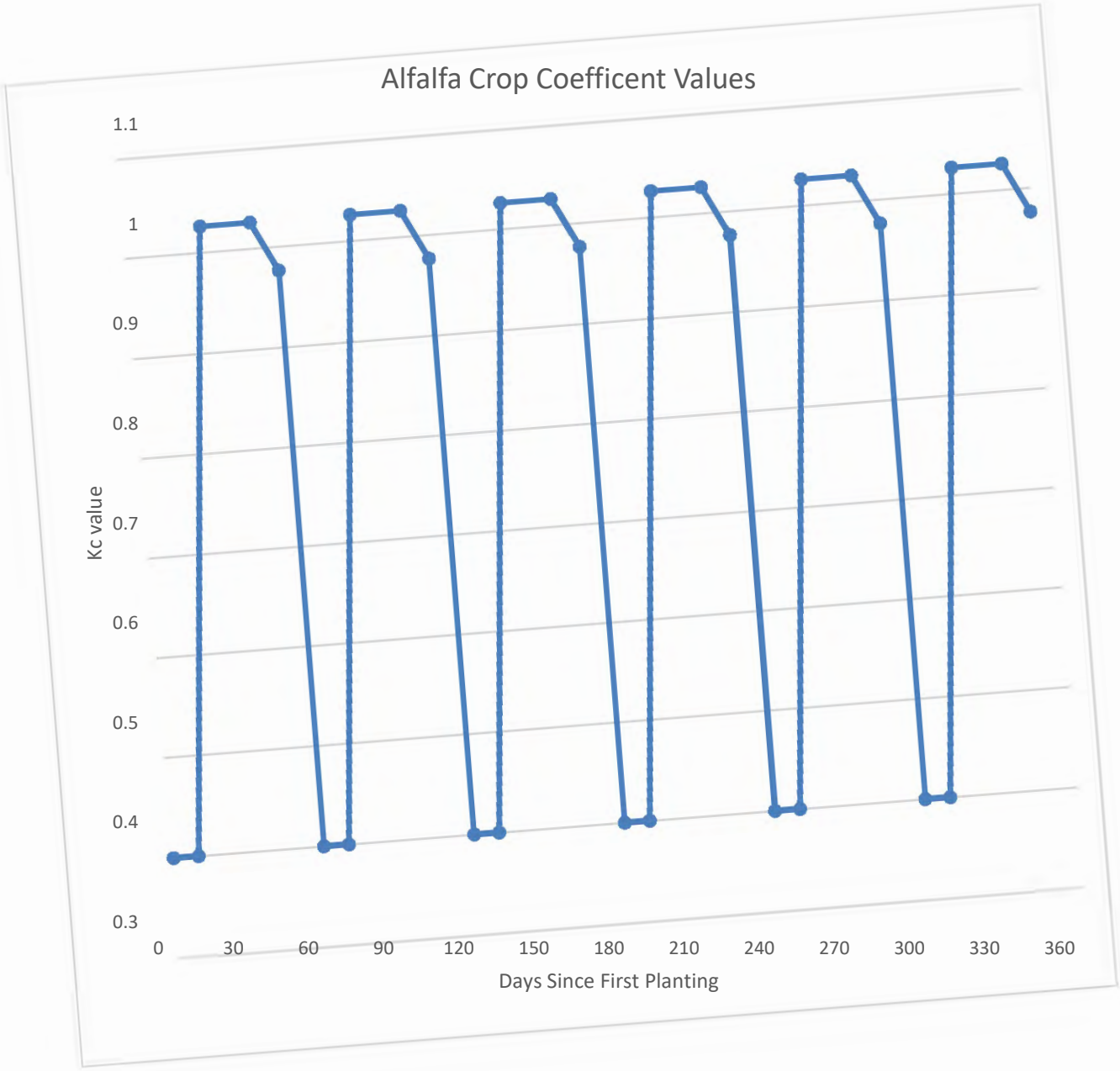
## Lucerne Valley Facility - Water and Nitrogen Balance

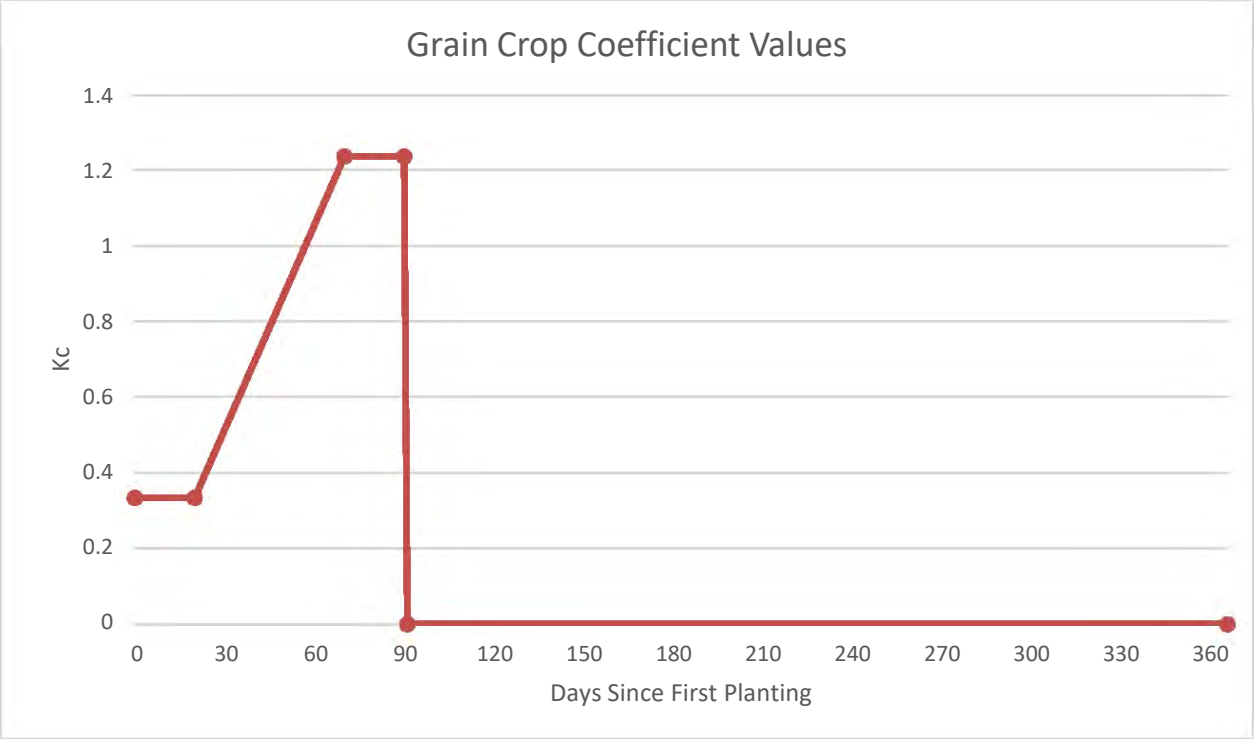
| Date | Month | Monthly Total Effluent Flow (MG)[1] | Earth Basin Estimates from BBARWA (MG) | West Field Flow (MG)[2] | East Field Flow (MG)[3] | Total Flow To Fields (MG) | Calculated Flow to Earth Basin (MG)[4] | Total Planted Acreage | Grain Acreage | Alfalfa Acreage | ETo (in)[5] | Rainfall (in)[6] | Alfalfa $K_c$[7] | Grain $K_c$[7] | $ET_c$ Alfalfa (in)[8] | $ET_c$ Grain (in)[8] | Effluent Depth on Total Acreage (in)[9] | Total Water Depth on Acreage (in)[10] | Alfalfa Surplus or Deficit (MG)[11] | Grain Surplus or Deficit (MG)[12] | Combined Surplus or Deficit (MG)[13] | Effluent TIN (mg/L)[14] | Urea Applied from Fertilizer to Fields (lbs) | TIN Loading to Fields (lbs)[15] | TIN Loading to Ponds (lbs)[16] | Alfalfa Nitrogen Removal Capacity (lbs/acre)[17] | Grain Nitrogen Removal Capacity (lbs/acre)[18] | Alfalfa Nitrogen Removal Capacity (lbs)[19] | Grain Nitrogen Removal Capacity (lbs)[20] | Total Nitrogen Removal Capacity (lbs)[21] | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5/1/2019 | 5 | 65.49 | 0.0 | 44.81 | 20.68 | 65.49 | 0.00 | 190 | 50 | 140 | 7.01 | 0.52 | 0.70 | 0.00 | 4.92 | - | 12.70 | 13.22 | 31.52 | 17.94 | 49.46 | 4.0 | - | 2,186 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 6/1/2019 | 6 | 55.51 | 0.0 | 37.98 | 17.53 | 55.51 | 0.00 | 190 | 50 | 140 | 9.23 | - | 0.95 | 0.00 | 8.73 | - | 10.76 | 10.76 | 7.74 | 14.61 | 22.35 | 3.8 | - | 1,760 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 7/1/2019 | 7 | 62.44 | 0.0 | 42.72 | 19.72 | 62.44 | 0.00 | 190 | 50 | 140 | 9.96 | - | 0.69 | 0.00 | 6.88 | - | 12.10 | 12.10 | 19.87 | 16.43 | 36.30 | 3.7 | - | 1,928 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 8/1/2019 | 8 | 57.17 | 0.0 | 39.12 | 18.05 | 57.17 | 0.00 | 190 | 50 | 140 | 9.48 | - | 0.96 | 0.00 | 9.10 | - | 11.08 | 11.08 | 7.53 | 15.04 | 22.57 | 3.7 | - | 1,765 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 9/1/2019 | 9 | 43.61 | 0.0 | 29.84 | 13.77 | 43.61 | 0.00 | 190 | 50 | 140 | 6.63 | 0.01 | 0.67 | 0.00 | 4.43 | - | 8.45 | 8.46 | 15.35 | 11.49 | 26.84 | 3.8 | - | 1,383 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 10/1/2019 | 10 | 42.04 | 0.0 | 28.77 | 13.28 | 42.04 | 0.00 | 190 | 50 | 140 | 4.86 | - | 0.97 | 0.00 | 4.72 | - | 8.15 | 8.15 | 13.04 | 11.06 | 24.10 | 4.0 | - | 1,403 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 11/1/2019 | 11 | 43.99 | 44.0 | - | - | - | 43.99 | 190 | 50 | 140 | 2.81 | 1.59 | 0.66 | 0.37 | 1.85 | 1.03 | - | 1.59 | (0.98) | 0.76 | (0.22) | 3.9 | - | - | 1,432 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 12/1/2019 | 12 | 73.03 | 73.0 | - | - | - | 73.03 | 190 | 50 | 140 | 1.58 | 2.25 | 0.98 | 0.80 | 1.55 | 1.27 | - | 2.25 | 2.66 | 1.33 | 3.99 | 3.7 | - | - | 2,255 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 1/1/2020 | 1 | 66.08 | 66.08 | 0.00 | 0.00 | 0.00 | 66.08 | 190 | 50 | 140 | 2.44 | - | 0.65 | 1.21 | 1.59 | 2.95 | 0.00 | 0.00 | (6.05) | (4.01) | (10.06) | 2.3 | - | 0 | 1,268 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 2/1/2020 | 2 | 57.56 | 0.00 | 39.39 | 18.18 | 57.56 | 0.00 | 190 | 50 | 140 | 3.63 | 0.01 | 1.00 | 0.00 | 3.61 | - | 11.16 | 11.17 | 28.72 | 15.16 | 43.88 | 2.4 | - | 1,153 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 3/1/2020 | 3 | 77.20 | 5.09 | 49.34 | 22.77 | 72.11 | 5.09 | 190 | 50 | 140 | 4.14 | 2.04 | 0.66 | 0.00 | 2.72 | - | 13.98 | 16.02 | 50.57 | 21.75 | 72.31 | 2.6 | - | 1,565 | 110 | 19.1 | - | 2,678 | - | 2,678 | |
| 4/1/2020 | 4 | 86.73 | 55.49 | 21.37 | 9.86 | 31.23 | 55.49 | 190 | 50 | 140 | 5.89 | 1.67 | 0.93 | 0.00 | 5.49 | - | 6.05 | 7.72 | 8.50 | 10.49 | 18.99 | 4.7 | - | 1,225 | 2,177 | 19.1 | - | 2,678 | - | 2,678 | |
| 5/1/2020 | 5 | 56.10 | 0.00 | 38.38 | 17.72 | 56.10 | 0.00 | 190 | 50 | 140 | 8.63 | - | 0.70 | 0.00 | 6.06 | - | 10.87 | 10.87 | 18.29 | 14.76 | 33.05 | 2.7 | - | 1,264 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 6/1/2020 | 6 | 56.48 | 0.00 | 38.64 | 17.84 | 56.48 | 0.00 | 190 | 50 | 140 | 9.03 | - | 0.95 | 0.00 | 8.54 | - | 10.95 | 10.95 | 9.17 | 14.86 | 24.03 | 2.5 | - | 1,178 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 7/1/2020 | 7 | 61.27 | 0.00 | 41.92 | 19.35 | 61.27 | 0.00 | 190 | 50 | 140 | 10.09 | - | 0.69 | 0.00 | 6.97 | - | 11.88 | 11.88 | 18.67 | 16.12 | 34.80 | 2.6 | - | 1,330 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 8/1/2020 | 8 | 61.45 | 0.00 | 42.05 | 19.41 | 61.45 | 0.00 | 190 | 50 | 140 | 9.22 | 0.01 | 0.96 | 0.00 | 8.85 | - | 11.91 | 11.92 | 11.67 | 16.19 | 27.86 | 2.5 | - | 1,282 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 9/1/2020 | 9 | 49.90 | 0.00 | 34.14 | 15.76 | 49.90 | 0.00 | 190 | 50 | 140 | 6.86 | - | 0.67 | 0.00 | 4.58 | - | 9.67 | 9.67 | 19.36 | 13.13 | 32.49 | 2.3 | - | 958 | - | 19.1 | - | 2,678 | - | 2,678 | |
| 10/1/2020 | 10 | 53.57 | 6.65 | 32.10 | 14.82 | 46.92 | 6.65 | 190 | 50 | 140 | 4.79 | - | 0.97 | 0.00 | 4.65 | - | 9.09 | 9.09 | 16.89 | 12.35 | 29.23 | 2.3 | - | 901 | 128 | 19.1 | - | 2,678 | - | 2,678 | |
| 11/1/2020 | 11 | 58.15 | 58.15 | 0.00 | 0.00 | 0.00 | 58.15 | 190 | 50 | 140 | 2.88 | 0.22 | 0.66 | 0.37 | 1.89 | 1.06 | 0.00 | 0.22 | (6.36) | (1.13) | (7.49) | 2.0 | - | 0 | 971 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |
| 12/1/2020 | 12 | 60.73 | 60.73 | 0.00 | 0.00 | 0.00 | 60.73 | 190 | 50 | 140 | 2.09 | - | 0.98 | 0.80 | 2.05 | 1.68 | 0.00 | 0.00 | (7.79) | (2.28) | (10.07) | 1.9 | - | 0 | 963 | 19.1 | 27.3 | 2,678 | 1,365 | 4,043 | |

Notes:

1. From effluent meter located at the BBARWA Wastewater Treatment Plant.
2. Data prior to 2016 is from the west field meter at the Lucerne Valley Site unless otherwise noted in the "Notes" column. For 2016 - 2020, field flow was estimated in accordance to the size of each field (60 acres in the east field and 130 acres in the west field).
3. Data prior to 2016 is from the east field meter at the Lucerne Valley Site unless otherwise noted in the "Notes" column. For 2016-2020, field flow was estimated in accordance with the size of each field (60 acres in the east field and 130 acres in the west field).
4. Estimated Effluent to Earth Basin = Earth Basin Estimates from BBARWA - West Field Flow - East Field Flow. The sum of the field meter readings is typically lower than the effluent flow meter reading when no flow is being sent to the pond. BBARWA considers this to be caused my compound meter tolerances, but the results produce conservative estimates of the volume of water sent to the Earth Basin.
5. ETo is the reference evapotranspiration. This data is provided as part of the CIMIS data set for Station 117. Source: CIMIS (http://www.cimis.water.ca.gov/)
6. Rainfall data is provided as part of the CIMIS data set for Station 117. Source: CIMIS (http://www.cimis.water.ca.gov/)
7. $K_c$ is the crop characteristics coefficient. This coefficient is seasonally based as it depends on the growth stage for the crop. Methodology follows the Food and Agriculture Organization of the United Nations' (FAO) Grass-Based Crop Coefficients method outlined in ASCE Manuals and Reports on Engineering Practice #70: Evaporation, Evapotranspiration, and Irrigation Water Requirements by Marvin Jensen, Ph.D., NAE and Richard Allen, Ph.D., PE. Calculations for these can be found on the "Alfalfa Kc" and "Grain Kc" tabs repectively.
8. $ET_c$ is the crop evapotranspiration for the specific crop under standard conditions. It represents the water demand for the specific crop during that time period. It is determined using the following formula:
   $ET_c = K_c * ETo$, where $K_c$ is the crop characteristics coefficient. Source: FAO (http://www.fao.org/docrep/x0490e/x0490e0b.htm)
9. Effluent Depth on Total Acreage = (Total Flow to Fields * 1,000,000 gal/MG * 0.1337 $ft^3$/gal * 12 in/ft)/(Total Planted Acreage * 43,560 $ft^2$/acre)
10. Total Water Depth on Acreage = Effluent Depth on Total Acreage + Rainfall
11. Alfalfa Surplus or Deficit = [(Total Water Depth on Acreage - $ET_c$ alfalfa) * Alfalfa Acreage * 43,560 $ft^2$/acre]/(12 in/ft * 0.1337$ft^3$/gal * 1,000,000 gal/MG)
12. Grain Surplus or Deficit = [(Total Water Depth on Acreage - $ET_c$ grain) * Grain Acreage * 43,560 $ft^2$/acre]/(12 in/ft * 0.1337$ft^3$/gal * 1,000,000 gal/MG)
13. Combined Surplus or Deficit = Alfalfa Surplus or Deficit + Grain Surplus or Deficit
14. Effluent Total Inorganic Nitrogen (TIN). Calculated using a flow weighted average. Source: (BBARWA Annual Reports)
15. TIN Loadings to Fields = [Calculated Flow to Fields * 1,000,000 gal/MG * 3.78541 L/gal * Effluent TIN mg/L]/[1,000 mg/g * 453.592 g/lb]
16. TIN Loadings to Ponds = [Calculated Flow to Earth Basin * 1,000,000 gal/MG * 3.78541 L/gal * Effluent TIN mg/L]/[1,000 mg/g * 453.592 g/lb]
17. Alfalfa Nitrogen Removal Capacity was determined using a yield of 1 ton/acre per harvest (Source: BBARWA farmer) with the International Plant Nutrition Institute's (IPNI) crop nutrient calculator ((Source: https://www.ipni.net/ipniweb/app/calc.nsf/0/0962F87B1D2E67718525808C00025B0C). This output is on a per harvest basis, so the number was multiplied by the number of cuttings (6 per the farmer) and then divided by 12 months to determine a monthly value. Additional information can be found on the "Nutrient Requirements" tab.
18. Grain Nitrogen Removal Capacity was determined based on the BBARWA farmer's reported output of 2.5 tons per acre for the grain mixture, which equates to a yield of 84.2 bushels per acre. For the purposes of the estimate, it was assumed that the mixture has equal yields among the barley, winter wheat, and oats. The IPNI calculator was used to estimate nitrogen uptake for each type of grain. The IPNI outputs were calculated for each grain's proportional yield and summed to get an average grain uptake , multiplied by the number of harvests (one per year), and then divided by 3 months (harvest cycle) to provide a monthly estimate. Additional information is found under the "Nutrient Requirements Tab."
19. Alfalfa Nitrogen Removal Capacity (lbs) = Alfalfa Nitrogen Removal Capacity (lb/acre) * Alfalfa Acreage (acres)
20. Grain Nitrogen Removal Capacity (lbs) = Grain Nitrogen Removal Capacity (lb/acre) * Grain Acreage (acres)
21. Total Nitrogen Removal Capacity (lb) = Alfalfa Nitrogen Removal Capacity (lb) + Grain Nitrogen Removal Capacity (lb)

# APPENDIX C: CROP COEFFICIENT CURVES




Grain Crop Coefficient Values
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Kc
0
30
60
90
120
150
180
210
240
270
300
330
360
Days Since First Planting