Monitoring Report Submittal Transmittal Form

Attn: Harold Hold (916) 464-4676
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive #200
Rancho Cordova, CA 95670-6114

Discharger:	Bear Valley Water District
Name of Facility:	Bear Valley Wastewater Treatment and Disposal Facility
WDRs Order Number:	***5-201-208***
County:	Alpine County
Regulator Program:	Waste Discharge to Land (Non15)
Unit:	Compliance
CIWQS Place ID:	209035

The Bear Valley Water District is hereby submitting to the Central Valley Regional Water Quality Control Board the following information:

Check all that apply:

Annual Monitoring Report for the year 2017

1st / 2nd / 3rd / 4th (**circle one**) Quarterly Monitoring Report for the year of_____

1st / 2nd (**circle one**) Semi-annual Monitoring Report for the year _____

Monthly Monitoring Report for the year _____

Violation Notification

During the monitoring period, there were / were not **(circle one)** any violations of the WDRs.

1. The violations were:
   See attached report

2. The actions to correct the violations were:
   See attached report

Certification Statement

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

Signature: _____ Phone: 209-753-2112

Printed Name: Jeff Gouveia
General Manager

Date: January 31, 2018

BEAR VALLEY WATER DISTRICT
2017 ANNUAL REPORT

ORDER # 5-01-208

JANUARY 31, 2018

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SECTION 1 - INTRODUCTION AND BACKGROUND

1.1 Introduction

The Bear Valley Water District (District) provides sanitary sewer collection, treatment and disposal services for approximately 650 residential and commercial equivalent dwelling units (EDUs) in the Alpine County community of Bear Valley. The District's service area is comprised of approximately 3000 acres located primarily north of California State Highway 4. The District serves the developed private, residential and commercial areas of the Bear Valley village as well as the developed adjoining federal recreational lands including the United States Forest Service's (USFS) Lake Alpine Resort and campgrounds, special use permit (SUP) residential cabins and the Bear Valley Mountain downhill ski resort. The District's wastewater treatment and disposal facility (WWTF) is regulated by the Central Valley Regional Water Quality Control Board (Regional Board) under Waste Discharge Requirements (WDRs) Order No. 5-01-208 and Order No. R5-2016-0045-01.

1.2 2017 Facility Operations - Overview

During the 2017 water year (October 2016 to September 2017), an annual daily average flow of approximately 0.099 million gallons per day (MGD) (approximately 36.46 MG total) was received at the District WWTF. WDRs Order No. 5-01-208 currently limit influent flow to 0.1 MGD (annual average basis).

Preliminary treatment at the District's main pump station (headworks) consists of shredding (comminutor) and grit removal before the influent reaches the primary sedimentation tank where the settable solids are allowed to fall to the bottom of the tank. Effluent flow is then measured through an Endress and Hauser magnetic flow tube during transfer via three, 10 horse power (HP) Paco pumps to a 14.18 million gallon (MG) two cell, aerated treatment lagoon for secondary biological nutrient removal. While in the two cell lagoon system, the constituents are largely consumed and/or sequestered. Air is delivered to the secondary treatment lagoon via one 40 HP, variable frequency drive (VFD) equipped Gardner Denver positive displacement blower to thirty six (36) – 9' high, 18" diameter, submerged helixor, coarse bubble diffusers. Inline YSI sensors communicate with the VFD blower by way of the SCADA system to keep dissolved oxygen (DO) and suspended solids (TSS) at optimum levels. Treated effluent from the aerated lagoon is then chlorinated during transfer via (2) - 375 gallon per minute (GPM) Paco pumps through a 12,000

gallon chlorine contact tank. The chlorinated effluent is then placed into storage and receives further treatment in a 76.4 MG effluent polishing reservoir.

During the irrigation season, typically late spring through early autumn, the polished effluent is disposed of through spray irrigation on up to approximately 80 acres of sprayfields: 40 acres of land which is authorized by Special Use Permit (SUP) from the USFS and 40 acres under private lease through 2048. Both the leased disposal area and the permitted land have been in service since before the installation of the groundwater monitoring wells (approximately 40 years for the leased land) at the site.

Based on the volume of effluent in storage and available to apply to land at the beginning of the land application cycle, a determination is made on the number of acres of land to irrigate. At the beginning of the 2017 land disposal season with approximately 20 MG of effluent in storage, spray fields areas 1 through 6 (27.8 total acres) were placed into operation.

Effluent disposal via spray irrigation involves the disbursement of the effluent through low impact, high uniformity, Nelson sprinkler heads upon soils and vegetation within the disposal area. The average monthly application rates to the 27.8 acre spray field area during the peak disposal months of 2017 ranged from approximately 2.34 MG – 7.49 MG per month (0.084 MG – 0.269 MG per acre per month). The water is allowed to percolate into the soil and evapotranspirate into the atmosphere. WDRs Order No. 5-01-208 limit application of wastewater to reasonable rates considering soil, climate, and irrigation management system.

1.3 Regulatory Requirements

Discharge at the Bear Valley Water District WWTF is subject to requirements contained in the two wastewater permits: Order No. 5-01-208 and Order No. R5-2016-0045-01. These include the Standard Provisions and Reporting Requirements for Waste Discharge Requirements effective 1 March 1991, Revised Monitoring and Reporting Program No. 5-01-208 effective 1 July 2002, Monitoring and Reporting Program, NPDES, Appendix E. effective 1 August 2016, and the Water Quality Control Plan for the California Regional Water Quality Control Board, Central Valley Region and associated documents (Basin Plan).

The District's WDRs also contain monitoring and reporting requirements, which include tri-annual monitoring of groundwater. The District's Third Tri-Annual 2017 Groundwater Monitoring Report prepared by Stantec Consulting Services is submitted under separate cover. These requirements and policies are discussed below as they relate to discharges to land and groundwater limitations at the WWTF.

SECTION 2 – GROUNDWATER MONITORING

Please see the ***Bear Valley Water District Third Tri-Annual 2017 Groundwater Monitoring Report*** submitted under separate cover for an evaluation of groundwater quality beneath the wastewater facility as well as a discussion of current groundwater compliance status.

The Monitoring and Reporting Program (MRP) of WDR Order No. 5-01-208 states that the tri-annual reports shall be submitted to the Regional Board by the first day of July (1st Tri-Annual Report), September (2nd Tri-Annual Report), and February (3rd Tri-Annual Report) of each year.

However, these reporting requirements do not take into account the unique climatic factors that control when the District can access and sample their groundwater monitoring wells. Pursuant to email correspondence from Regional Board staff, Regional Board staff will not recommend enforcement to the Executive Officer so long as the 1st and 2nd tri-annual monitoring reports are submitted by September 1st and November 1st of each year, respectively, instead of the dates currently required in the MRP. The third tri-annual report will remain due by February 1st each year.

SECTION 3 - WATER CONSERVATION AND I/I REDUCTION SUMMARY

3.1 Water Conservation Activities

The District's Water Conservation Plan has been fully implemented since its development in 2002. The District is solely a wastewater service provider and does not provide potable water to its service area. Instead, the Lake Alpine Water Company (LAWC) is the water purveyor for 50-60 percent of water used in the service area.

Much of the water conservation promotion is currently being undertaken by the Lake Alpine Water Company. Most significantly, Lake Alpine Water Company installed residential water meters for all its customers in 2008 and since this period water delivered to LAWC customers has decreased dramatically. Decreases have resulted not only from decreased consumption based on new usage fees but from the ability of LAWC to identify and quickly remedy water lost through faulty winterizing of vacation homes in the area as well as through pipe breaks due to freezing.

The water conservation efforts undertaken by Lake Alpine Water Company are consistent with the intent of the District's Water Conservation Plan as a means to minimize extraneous flows into the wastewater system. The District does not believe that it is cost effective to duplicate efforts of the Lake Alpine Water Company; however, it has supplemented those efforts as warranted.

It should be noted that water conservation within homes and businesses in the District will continue to reduce the annual volume of water arriving at the WWTF but that wastewater may contain higher concentrations of contaminants, if all other factors in the homes and businesses remain the same. Thus, excessive water conservation measures have the potential to increase the risk for the District of failing to comply with effluent limitations.

3.2 I/I Reduction Activities

The Bear Valley Water District continues to implement Infiltration and Inflow (I/I) reduction activities to reduce wastewater volume. During 2017, these activities included continued annual assessments of the collection system. The assessment consists of video analysis, hydro jetting and flushing of collection lines to identify potential problem areas.

In an effort to maximize the I/I reduction program, the District purchased a digital push camera in 2013 to conduct its own collection line video analysis. Additionally, the District purchased a trailer jetting unit in August 2017 to perform its own jetting and rely less on costly contract jetting services. These investments have enabled the District to increase the frequency of which the entire 83,210 linear feet (15.76 miles), of gravity collection system is assessed on a recurring basis by increasing the length of collection system assessed annually.

During 2017, 23,855 linear feet (29 %) of the gravity collection system was flushed, 3,500 linear feet (4 %) of the collection system was hydro-jetted, and 1500 linear feet (2 %) was investigated by video using the District's sewer camera to identify collection system defects, such as root intrusion, cracked pipe, and pipe separations. In 2017, the District's video analysis did not reveal any pipe defects requiring repair or replacement.

In addition to these collection system measures, the District has continued efforts to reduce the influx of storm water into the polishing reservoir. Typically, subsurface and surface flow of snowmelt storm water may contribute as much as 60 % to the storage volume of the reservoir. In late 2011, the consulting firm MWH independently evaluated the existing storm water diversion system and made recommendations for improvements. In 2012, the District re-graded the existing diversion ditch in general conformance with MWH's option 3, as found in their December 2011 Memo, "Bear Valley Water District Polishing Reservoir Influx Mitigation Study." Per MWH's Memo, this improvement is estimated to improve the ditches performance to divert storm water flow from the reservoir by 25 percent, which is an approximate reduction of 10 million gallons during a 1- in-100 water year.

SECTION 4 – HYDRAULIC CAPACITY EVALUATION

4.1 Influent Flows

During the 2017 water year (October 2016 to September 2017) the total annual influent flow was approximately 36.46 million gallons (MG), with the highest influent flow months being January and February. The highest daily influent flow was 1,603,000 gallons per day and occurred on February 9, 2017. WY 2017 total influent flows were approximately 15.06 MG more than WY 2016 total influent flows of 21.40 MG. WY 2017 influent flows are summarized in Table 1 below.

Table 1 - WY 2017 Influent Flows

Month and Year	Influent Flow (gallons)	Peak Day Flow (gal/day)
October 2016	677,000	76,000
November 2016	989,000	60,000
December 2016	2,900,000	373,000
January 2017	4,713,000	1,200,000
February 2017	5,943,000	1,603,000
March 2017	3,752,000	183,000
April 2017	4,704,000	230,000
May 2017	5,784.000	237,000
June 2017	3,261,000	163,000
July 2017	1,894,000	103,000
August 2017	1,077,000	71,000
September 2017	769,000	70,000
Total Water Year	36,463,000	--

4.2 Projected Influent flows

As of this writing, wastewater influent flows for the 2018 water year are anticipated to be significantly lower than the 2017 water year. This is a result of drought like conditions in the region and the absence to date of the large hydraulic or "atmospheric river" events which characterized the previous water year. The increase in these atmospheric river events as well as the quantity and duration of the snowmelt period remain the controlling factor in determining if available

WWTF storage is adequate and if a discharge to surface waters (Bloods Creek) will be utilized as permitted under Order R5-2016-0045-01.

It is anticipated that the 2018 water year will result in below average to average snowfall. A corresponding reduction in tourism resulting in proportionally decreased commercial and residential waste generation is anticipated as well as decreased runoff into the polishing reservoir directly and from snowmelt on adjacent land.

4.3 Storage and Disposal Summary

Land discharge at the Bear Valley Water District WWTF is required to be maximized in order to minimize the potential for a surface water discharge to Bloods Creek. The magnitude of the discharge is largely controlled by the amount of precipitation, particularly snowfall, and the timing of the snowmelt period. In light of the significant increase in precipitation which resulted in decreased storage capacity, surface water discharge to Bloods Creek was necessary during WY2017.

Provision IX.B of the District's Monitoring & Reporting Program (MRP) in Order R5-2016-0045-01) requires the District to electronically submit self-monitoring reports (eSMRs) using the State Water Board's California Integrated Water Quality System (CIWQS) Program Web site. The District submitted monthly SMR's including the results of all required monitoring on or before the due date according to the reporting schedule of the current Order. On November 20, 2017, the Central Valley Water Board staff reviewed the electronic self-monitoring reports (eSMRs) for the surface water discharge permitted by the Discharger for the March 2017 through August 2017 monitoring periods and identified no violations of the WDRs or MRP from review of the eSMRs. The District's 2017 Annual Report for Order R5-2016-0045-01further discusses this discharge and is submitted under separate cover.

Effluent land disposal began on July 1, 2017 on Fields 1 through 6 (approximately 27.80 acres). Effluent disposal via spray irrigation involves the disbursement of the effluent through low impact, high uniformity, Nelson sprinkler heads upon soils and vegetation within the disposal area. The average monthly application rates to the 27.80 acre spray field area during the peak disposal months of 2017 ranged from approximately 2.34 MG – 7.49 MG per month (0.029 MG – 0.094 MG

per acre per month). The water is allowed to percolate into the soil and evapotranspirate into the atmosphere.

The disposal season ended on September 29, 2017, when the effluent storage reservoir was essentially empty (e.g., no carryover) and could no longer be feasibly pumped by existing equipment. A summary of irrigation disposal operations during 2017 is presented in Table 2.

Table 2 - 2017 Land Disposal Season Summary

Month and Year	Monthly Disposal Volume (gal)	Maximum Acreage Applied	Storage Volume (Million gallons)
July 2017	7,485,939	27.8	16.05
August 2017	6,228,007	27.8	8.77
September 2017	2,336,646	27.8	Negligible
Total 2017 Disposal Season	16,050,592	--	

Note that the naturally irregular bottom of the reservoir, coupled with limitations to measuring elevations of effluent occurring in low spots, prevents exact estimates of the small amount of wastewater remaining in storage when the reservoir is nearly empty and cannot be pumped with existing equipment.

However, District staff assessed the storage reservoir minimum pool volume on October 2, 2013, and, with the assistance of the District engineer, determined the minimum pool volume to be approximately 14,000 gallons, significantly less than the estimated volume of 5 MG derived from 1974 Construction Drawings. Accordingly, the volume of wastewater remaining at the end of the disposal season, and at minimum pool, is considered negligible.

As of October 1, 2017 the reservoir was at or below minimum pool with a calculated volume of approximately 14,000 gallons. Approximate reservoir storage volumes on October 1 for the previous 10 years dating back to 2008 are presented in Table 3 below:

Table 3 – Comparison of Reservoir Volumes on October 1 for Previous 10 Years

DATE	VOLUME (MG)
October 2008	8 MG
October 2009	8 MG
October 2010	8 MG
October 2011	50 MG
October 2012	Negligible
October 2013	0.014
October 2014	0.014
October 2015	0.014
October 2016	0.014
October 2017	0.014

4.4 Projected Water Balance

The District's storage reservoir was aerial surveyed on September 23, 2013 and several discrepancies were identified between the actual reservoir and the 1974 construction drawings, which previously formulated the basis for the storage reservoir size and capacity.

The 2013 aerial survey and analysis indicates that the reservoir is only 18.6 acres in gross area (not 21.3 acres) and the total storage capacity is 76.4 million gallons (not 106 million gallons). These values suggest that input from I/I into the ponds (directly and from snowmelt on adjacent land) may be less than previously estimated. The District has incorporated the 2013 surveyed storage capacity into their evaluation of maximum wastewater flows, including I/I, which will be contained during a maximum precipitation year with a 1-in-100 year return frequency.

The District Engineer recently revised and updated the District's water balance in August 2017 following the adoption of NPDES Order R5-2016-0045-01 and the collection of valid creek flow data for Bloods Creek for the entire permitted discharge period of January through June. In addition, the successful surface discharge during the March through June 2017 period provided the District Engineer the opportunity to update its 1-in-100 year water balance to verify the

assumptions, limitations and capacity determinations which were utilized in previous water balances.

Based on the updated water balance, the latest projected capacity of the District has been determined to be 1196 additional equivalent dwelling units (EDUs) assuming no infiltration associated with any new connections. Attached as Appendix A. find the 2017 updated water balance that provides detail on treatment and disposal calculations for this capacity determination.

SECTION 5 - LAND DISPOSAL AGREEMENTS

Current Land Disposal Agreements are as follows:

1. United States Forest Service (USFS) Special Use Permit (SUP) #1029-01
    a. 40 acres of Sprayfield - Expired July 1, 2015 (In Renewal Phase)
    b. 20 Acres of Buildings and Transmission Lines - Expired July 1, 2015 (In Renewal Phase)
2. C. Bruce Orvis and TBH Partners - 118 acres - Expires December 7, 2048.
3. C. Bruce Orvis and TBH Partners - Sewer Line Easement - Expires December 7, 2048. (Applies to outfall facilities outside of long-term lease land)

The USFS and BVWD have been working closely to maintain continued land use within federally permitted limits. Following the June 16, 2011 expiration of the 10-year, 40 additional acre, temporary amendment to SUP #1029-01 ratified in 2001, the USFS and BVWD have been working to better craft the District's remaining 40 acre SUP to better match actual land use. To this end, the USFS performed a site visit in 2012 and, together with District staff, used global positioning (GPS) technology to better identify the District's current land disposal array. This visit yielded a map which now defines the active SUP.

On May 28, 2014, the District provided a copy of communication with a USFS representative reflecting their intent to renew the special use permit in accordance with Order No. R5-2011-0053, Special Provision VI.C.2.c. Subsequently, a meeting was held with the USFS Calaveras District Ranger, Forest Supervisor, and three other USFS representatives on January 9, 2015 to further discuss District use of federal land for effluent spray field application. All indications from the USFS representatives were that the 20 year permit expiring in 2015 would be renewed in the form of a two permits: one, 40 year permit for permanent infrastructure and conveyance systems (collection lines) and one, 10 year permit for effluent spray field application. With respect to the 10 year permit, the USFS recommended the District begin to consider purchasing the land from the federal government through the Townsite Act to ensure long term, sustainable control of these areas for spray field purposes.

On March 17, 2015, in advance of the July 1, 2015 expiration date, the District submitted Standard Form 299, "Application for Transportation and Utility Systems and Facilities on Federal Lands" to the USFS to trigger the SUP reissuance process.

As of December 2017, the USFS informed the District that the Stanislaus National Forest has pushed the project as far as they were capable and that the renewal is now on a list of projects at the USFS regional office in Vallejo to conduct and finish the NEPA review prior to permit renewal. According officials at the Stanislaus National Forest, as resources become available the project is expected to be added to the program of work at the regional office in the next year or two. However, depending on what new projects and priorities the USFS Regional office takes on it may still take several years for this renewal project to be accepted and listed as a priority.

SECTION 6 - SLUDGE/SOLID WASTE DISPOSAL

6.1 Treatment Lagoon

Effluent is transferred from the District's headworks following preliminary treatment to a 14.18 million gallon (MG) two cell, aerated treatment lagoon for secondary biological nutrient removal. While in the two cell lagoon system, the solids are largely consumed and/or sequestered as air is delivered to the secondary treatment lagoon to thirty six (36) - 9' high, 18" diameter, submerged helixor, coarse bubble diffusers. The aeration and mixing strategy employed by the District suspends solids sufficiently for successful floc formation permitting efficient biological consumption of most solids.

Limited sludge at the WWTF has accumulated at the bottom of the two cell treatment lagoon since 1972. The sludge depth at the bottom of the treatment pond is measured with a sludge judge annually. Sludge measurement in September 2017 revealed that the sludge has not exceeded six inches on average and is more commonly one to three inches in most portions of the 270' x 280' square lagoon.

In July 2017, staff also performed a sonar scan and analysis of the bottom of the treatment lagoon. This scan revealed some sludge accumulation on the sides of the baffle wall as well as around the (36) 9' high, 18" diameter helixors where ostensibly the mixers cannot properly suspend the solids.

In general, the organic solids loading rate on the pond system appears to be so low compared to their natural decay and consumption rate that no material accumulation of sludge appears to have occurred over the past 40+ years. At some point in the distant future, the treatment ponds may require sludge to be removed and disposed of at an appropriate landfill.

The following table presents results of sludge monitoring of the District's treatment lagoon performed on September 16, 2017.

Table 4 - Annual Sludge Monitoring

Sampling Date	9/16/2017
Cadmium (mg/L)	<0.10
Chromium (mg/L)	<0.10
Copper (mg/L)	0.17
Lead (mg/L)	<0.10
Nickel (mg/L)	<0.50
Zinc (mg/L)	16

6.2 Lift Stations

At the headworks of the WWTF, the most common materials generated generally include grease, sediment, and minor non-organic solid waste. The items not shredded during pretreatment are removed as necessary from the waste stream and disposed of in local, municipal waste transfer stations bound for landfill. Meanwhile, annual organic solids removal at all four (4) District lift stations, totaling approximately 1500 – 2000 gallons, is routinely performed each September or October and was completed this year by El Dorado Septic on September 21, 2017.

SECTION 7 - ANNUAL WATER SUPPLY AND POND MONITORING

7.1 Annual Water Supply Monitoring

Annual water supply monitoring was conducted in September 2017 in which six (6) samples were taken to include all unique sources of water used by District customers, including three discrete springs, two wells and the surface water treated by the Lake Alpine Water Company sourced from Bear Lake.

The following table presents results for potable water from the BVWD office served by Lake Alpine Water Company (surface water - about 57.72 % of influent), the Bear Valley Mountain Lodge spring (about 18.03 % of influent), the Lake Alpine Lodge well (about 9.80 % of influent), the USFS Lake Alpine Campground well (about 14.44 % of influent), the Old Subdivision spring and the Bear Valley Mountain Resort Shop spring (percentage of influent not available).

Table 4 - Annual Water Supply Monitoring

	Lake Alpine Water Co. (Surface Water)	Bear Valley Mountain Resort Lodge (Spring)	Old Subdivision Home #407 (Spring)	Lake Alpine Resort (Well)	Bear Valley Mountain Resort Shop (Spring)	USFS Lake Alpine Campgrounds (Well)
Sampling Date	9/24/17	9/24/17	9/24/17	9/24/17	9/24/17	9/24/17
% of Influent	57.72	18.03	NA	9.80	NA	14.44
Boron (ug/L)	<60	<60	<60	<60	<60	<60
Sodium (ug/L)	20,000	2700	3100	1900	7900	5700
Iron (ug/L)	33	<20	<20	<20	<20	<20
Manganese (ug/L)	7.3	<6.0	<6.0	<6.0	<6.0	<6.0
Calcium (ug/L)	6300	5400	9100	4400	13000	14000
Magnesium (ug/L)	710	2200	3000	1500	1300	160
Chloride (mg/L)	8	1	0.6	.34	0.48	0.67
Hardness, Total (mg/L)	19	23	35	17	37	36
Specific Conductance (EC) (umhos/cm)	139.2	66.9	97.5	55.2	129.3	147.2
Total Dissolved Solids (mg/L)	99.0	47.7	69.5	39.2	93	10.5

7.2 Annual Pond Monitoring

Municipal wastewater contains numerous dissolved inorganic waste constituents which are forms of salinity that may pass through the treatment process and soil profile. Effective control of long term impacts on groundwater quality relies on monitoring and effective source control. As described in Order No. 05-01-208, even in the best of circumstances, long-term land discharge of treated municipal wastewater may potentially degrade groundwater with salt and the individual components of salts (e.g. sodium, chloride).

Order No. 05-01-208 stipulates annual pond monitoring, including sampling and analysis, of boron, chloride, iron, manganese, and sodium. Certain constituents (e.g. sodium, chloride, boron) are useful indicator parameters for evaluating the extent to which effluent reaches and potentially degrades groundwater. Other constituents (e.g. iron, manganese) are useful indicators to determine whether components of the WWTF with high-strength waste constituents, such as sludge handling facilities, may be ineffective in containing waste.

The following table summarizes the annual pond monitoring results for these constituents sampled on September 24, 2017.

TABLE 5 - Annual Pond Monitoring

CONSTITUENT	STORAGE RESERVOIR	TREATMENT POND
Boron (mg/L)	<0.060	<0.060
Chloride (mg/L)	17	13
Iron (mg/L)	1.7	1.2
Manganese (mg/L)	0.14	0.12
Sodium (mg/L)	10	18

BEAR VALLEY WATER DISTRICT, 2017 ANNUAL REPORT

Appendix A 2017 Water Balance - Prepared August 2, 2017

APPENDIX A 2017 WATER BALANCE

BEAR VALLEY WATER DISTRICT WASTEWATER TREATMENT AND DISPOSAL SYSTEM 1/29/2018 13:13

(2017 update- 2011 Precip. Pattern) 1 in 100 Year Water Balance Projection - 2000 thru 5/2016 90TH Percentile monthly ADF plus 1196 RLU (201 gpd/RLU) - Assumes no infiltratin with new RLUs

INPUT DATA

TREATMENT POND CHARACTERISTICS		STORAGE RESERVOIR		IRRIGATION AREA CHARACTERISTICS		CLIMATOLOGICAL FACTORS	
GROSS AREA (ac).....	3.2	GROSS AREA (ac).....	18.6	DISTRICT DISPOSAL LAND (AC).....	80		
WATER SURFACE AREA (ac).....	2.9	MAX. WATER SURFACE (ac).....	14.2	SOIL WATER DEFICIT BEFORE IRRIGATION (IN).....	n/a	OCT-APR EVAP/AVG EVAP RATIO.....	0.76
				FRACT OF LAND IRRIGATED	n/a	MAY-SEP EVAP/AVG EVAP RATIO.....	1.00
		STORAGE CAPACITY (MG).....	76.43	IRRIGATION EFFICIENCY (DECIMAL FRACT).....	n/a	PAN COEFFICIENT.....	0.80
		FRAC EST. PERC.....	1.0	FRACTION OF EST. PERC RATE	n/a	LAND PRECIP COLLECTED (FRAC).....	0.9

PARAMETER / MONTH	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	ANNUAL
DAYS IN MONTH	30	31	31	28	31	30	31	30	31	31	30	31	365
AVG PAN EVAP (IN)	0.89	0.61	0.76	0.83	2.14	3.69	5.34	6.64	7.63	6.87	5.17	3.05	43.62
ESTIMATED PRECIP (IN)	10.66	20.00	2.84	10.62	21.42	3.37	4.65	1.57	1.66	0.00	1.86	4.35	83.00
ESTIMATED SNOW ACCUM (IN Water)$_{(g)}$	7.82	23.83	26.08	36.04	53.71	41.62	22.88	0.00	0.00	0.00	0.00	2.96	
ESTIMATED SNOW MELT IN MONTH (IN Water)	0.00	0.00	0.36	0.12	0.71	13.40	21.11	22.88	0.00	0.00	0.00	1.42	60.00
ESTIMATED NEW SNOW IN MONTH (IN Water)	7.82	16.01	2.61	10.08	18.38	1.30	2.37	0.00	0.00	0.00	0.00	1.53	60.11
ESTIMATED MAX PERCOLATION (IN)$_{(a)}$	10.0	29.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
# OF ADDITIONAL CONNECTIONS (RLU)	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	
ADDITIONAL INFLUENT FLOW (GAL/D)	240,396	240,396	240,396	240,396	240,396	240,396	240,396	240,396	240,396	240,396	240,396	240,396	
90TH PERCENTILE EXISTING FLOWS (Avg. GAL/D)	35,340	75,835	83,020	108,476	123,884	184,549	184,888	125,446	74,976	64,231	40,142	32,953	
TOTAL INFLUENT FLOW (GAL/D)	275,736	316,231	323,416	348,872	364,280	424,945	425,284	365,842	315,372	304,627	280,538	273,349	

CALCULATIONS

	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	ANNUAL
WASTEWATER VOLUME (gal)	8,272,080	9,803,161	10,025,896	9,768,416	11,292,680	12,748,350	13,183,804	10,975,260	9,776,532	9,443,437	8,416,140	8,473,819	122,179,575
EVAPORATION (IN)	0.5	0.4	0.5	0.5	1.3	2.2	4.3	5.3	6.1	5.5	4.1	1.9	32.6
PRECIPITATION (IN)	10.66	20.00	2.84	10.62	21.42	3.37	4.65	1.57	1.66	0.00	1.86	4.35	83.00
TREATMENT POND													
PERCOLATION (IN)	8.38	5.41	12.69	7.74	5.73	21.66	15.57	17.29	4.18	2.11	2.81	2.97	106.55
PERC VOLUME (gal)	659,620	426,378	999,502	609,371	451,372	1,705,370	1,226,247	1,361,614	329,361	166,362	221,115	233,864	8,390,176
EVAP. VOLUME (gal)	39,374	31,499	39,374	39,374	102,372	173,244	338,614	417,361	480,359	433,111	322,864	149,620	2,567,166
PRECIP. VOLUME (gal)	917,603	1,721,582	244,465	914,160	1,843,814	290,087	400,268	135,144	142,891	0	160,107	374,444	7,144,564
TREATMENT DISPOSAL(GAIN)/ (gal)	218,609	1,263,705	(794,411)	265,415	1,290,070	(1,588,528)	(1,164,593)	(1,643,831)	(666,829)	(599,473)	(383,872)	(9,040)	(3,812,778)
POLISHING RESERVOIR													
PERCOLATION (IN)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC VOLUME (gal)	0	0	0	0	0	0	0	0	0	0	0	0	0
W.S. AREA (ac)$_{(b)}$	6.20	9.37	11.21	11.71	12.19	12.46	11.02	10.79	9.80	9.69	6.30	2.57	
EVAP. VOLUME (gal)	84,162	101,769	152,244	158,953	430,172	744,194	1,286,794	1,553,151	1,623,738	1,446,786	700,934	132,594	8,415,492
PRECIP. VOLUME (gal)	5,032,887	9,614,764	1,379,515	5,172,859	10,461,230	1,648,344	2,256,279	760,823	799,978	0	878,649	2,010,894	40,016,223
MONTHLY AVAIL. SNOWMELT (IN)$_{(c)}$	0.00	0.00	0.36	0.12	0.71	13.40	21.11	22.88	0.00	0.00	0.00	1.42	60.00
ESTIMATED SNOW CONTR. (%)$_{(d)}$	0%	0%	0%	0%	0%	0%	45%	28%	50%	50%	50%	50%	
ESTIMATED AREA OF INFLUENCE (ac)	50	50	50	50	50	50	50	50	50	50	50	50	
ESTIMATED INFLUX TO STORAGE (gal)$_{(e)}$	0	0	0	0	0	0	12,897,727	8,697,780	0	0	0	966,122	22,561,629
RESERVOIR DISPOSAL(GAIN) (gal)	4,948,725	9,512,995	1,227,271	5,013,906	10,031,058	904,150	13,867,212	7,905,452	(823,760)	(1,446,786)	177,715	2,844,422	54,162,360
IRRIGATION													
IRRIGATION DISPOSAL (gal)$_{(f)}$	0	0	0	0	0	0	0	0	10,796,000	22,361,000	17,521,000	11,999,000	62,677,000
STORAGE													
BEGINNING STORAGE (gal)	4,060,000	17,499,415	38,079,276	44,138,032	50,185,768	53,699,576	35,763,549	33,049,972	21,686,853	19,176,796	4,212,974	0	
CALCULATED STORAGE GAIN (gal)	13,439,415	20,579,861	10,458,756	15,047,737	22,613,808	12,063,973	25,886,423	17,236,881	-2,510,057	-14,963,822	-9,311,017	-689,799	
PROJECTED ESTIMATED STORAGE (gal)	17,499,415	38,079,276	48,538,032	59,185,768	72,799,576	65,763,549	61,649,972	50,286,853	19,176,796	4,212,974	0	0	
AMOUNT DISCHARGED TO BLOODS CREEK (gal)	0	0	4,400,000	9,000,000	19,100,000	30,000,000	28,600,000	28,600,000	0	0	0	0	119,700,000
ESTIMATED STORAGE (gal)	17,499,415	38,079,276	44,138,032	50,185,768	53,699,576	35,763,549	33,049,972	21,686,853	19,176,796	4,212,974	0	0	

MAXIMUM STORAGE (MG)..... 53.70
AVAILABLE STORAGE (MG)..... 76.43

SUMMARY

ANNUAL INFLOW (MG)	
WASTEWATER	122.18
PRECIPITATION.....	47.16
SNOW INFLUX (MG).....	22.56
TOTAL	191.90

ANNUAL OUTFLOW POTENTIAL (MG)	
AMOUNT DISCHARGED TO BLOODS CREEK.....	119.70
EVAPORATION.....	10.98
PERCOLATION.....	8.39
IRRIGATION.....	62.68
TOTAL	201.75

OVERALL BALANCE	
UNUSED DISPOSAL CAPACITY (MG).....	5.79
(MUST NOT BE NEGATIVE)	
UNUSED STORAGE CAPACITY (MG).....	22.73
(MUST NOT BE NEGATIVE)	

(a) Estimated percolation based upon measured inflow components, estimated evaporation, and actual reservoir levels in 2011 - in Storage Reservoir only.
(b) Reservoir water surface area is a function of storage volume at start of month.
(c) Estimated snowmelt volume available for influx to storage reservoir.
(d) Estimated percentage of snowmelt contributing to influx to reservoir.
(e) Estimated based on fraction of accumulated snow within reservoir "area of influence" entering the reservoir during snowmelt months.
(f) Disposal capacity based on maximum estimated land disposal volumes.
(g) Per Bloods Creek Gauging Station
(h) Not used in calculations

BEAR VALLEY WATER DISTRICT WASTEWATER TREATMENT AND DISPOSAL SYSTEM 1/29/2018 13:14

(2017 update - 2017 Precip. Pattern) 1 in 100 Year Water Balance Projection - 2000 thru 5/2016 90TH Percentile monthly ADF plus 1196 RLU (201 gpd/RLU) - Assumes no infiltratin with new RLUs

INPUT DATA

TREATMENT POND CHARACTERISTICS		STORAGE RESERVOIR		IRRIGATION AREA CHARACTERISTICS		CLIMATOLOGICAL FACTORS	
GROSS AREA (ac)	3.2	GROSS AREA (ac)	18.6	DISTRICT DISPOSAL LAND (AC)	80		
WATER SURFACE AREA (ac)	2.9	MAX. WATER SURFACE (ac)	14.2	SOIL WATER DEFICIT BEFORE IRRIGATION (IN)	n/a	OCT-APR EVAP/AVG EVAP RATIO	0.76
				FRACT OF LAND IRRIGATED	n/a	MAY-SEP EVAP/AVG EVAP RATIO	1.00
		STORAGE CAPACITY (MG)	76.43	IRRIGATION EFFICIENCY (DECIMAL FRACT)	n/a	PAN COEFFICIENT	0.80
		FRAC EST. PERC	1.0	FRACTION OF EST. PERC RATE	n/a	LAND PRECIP COLLECTED (FRAC)	0.9

PARAMETER / MONTH	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	ANNUAL
DAYS IN MONTH	30	31	31	28	31	30	31	30	31	31	30	31	365
AVG PAN EVAP (IN)	0.89	0.61	0.76	0.83	2.14	3.69	5.34	6.64	7.63	6.87	5.17	3.05	43.62
ESTIMATED PRECIP (IN)	3.17	8.48	30.79	22.56	5.72	9.28	1.10	1.91	0.00	0.00	0.00	0.00	83.00
ESTIMATED SNOW ACCUM (IN Water)(g)	2.23	4.46	27.12	42.39	39.69	38.40	0.00	0.00	0.00	0.00	0.00	0.00	
ESTIMATED SNOW MELT IN MONTH (IN Water)	0.82	1.06	0.00	1.29	8.10	10.33	38.40	0.00	0.00	0.00	0.00	0.00	60.00
ESTIMATED NEW SNOW IN MONTH (IN Water)	3.05	3.29	22.66	16.56	5.40	9.04	0.00	0.00	0.00	0.00	0.00	0.00	60.00
ESTIMATED MAX PERCOLATION (IN)(a)	10.0	29.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
# OF ADDITIONAL CONNECTIONS (RLU)	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	
ADDITIONAL INFLUENT FLOW (GAL/D)	240,396	240,396	240,396	240,396	240,396	240,396	240,396	240,396	240,396	240,396	240,396	240,396	
90TH PERCENTILE EXISTING FLOWS (Avg. GAL/D)	35,340	75,835	83,020	108,476	123,884	184,549	184,888	125,446	74,976	64,231	40,142	32,953	
TOTAL INFLUENT FLOW (GAL/D)	275,736	316,231	323,416	348,872	364,280	424,945	425,284	365,842	315,372	304,627	280,538	273,349	

CALCULATIONS

	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	ANNUAL	
WASTEWATER VOLUME (gal)	8,272,080	9,803,161	10,025,896	9,768,416	11,292,680	12,748,350	13,183,804	10,975,260	9,776,532	9,443,437	8,416,140	8,473,819	122,179,575	
EVAPORATION (IN)	0.5	0.4	0.5	0.5	1.3	2.2	4.3	5.3	6.1	5.5	4.1	1.9	32.6	
PRECIPITATION (IN)	3.17	8.48	30.79	22.56	5.72	9.28	1.10	1.91	0.00	0.00	0.00	0.00	83.01	
TREATMENT POND														
PERCOLATION (IN)	8.38	5.41	12.69	7.74	5.73	21.66	15.57	17.29	4.18	2.11	2.81	2.97	106.55	
PERC VOLUME (gal)	659,620	426,378	999,502	609,371	451,372	1,705,370	1,226,247	1,361,614	329,361	166,362	221,115	233,864	8,390,176	
EVAP. VOLUME (gal)	39,374	31,499	39,374	39,374	102,372	173,244	338,614	417,361	480,359	433,111	322,864	149,620	2,567,166	
PRECIP. VOLUME (gal)	272,871	729,951	2,650,375	1,941,944	492,372	798,814	94,687	164,411	0	0	0	0	7,145,425	
TREATMENT DISPOSAL(GAIN)/ (gal)	(426,123)	272,074	1,611,500	1,293,199	(61,372)	(1,079,801)	(1,470,174)	(1,614,564)	(809,720)	(599,473)	(543,979)	(383,484)	(3,811,918)	
POLISHING RESERVOIR														
PERCOLATION (IN)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
PERC VOLUME (gal)	0	0	0	0	0	0	0	0	0	0	0	0	0	
W.S. AREA (ac)(b)	6.20	9.02	10.52	12.32	13.41	13.33	12.67	12.50	10.89	10.58	9.12	6.65		
EVAP. VOLUME (gal)	84,162	97,925	142,888	167,265	473,377	796,269	1,479,375	1,799,534	1,803,763	1,580,200	1,015,010	343,175	9,782,944	
PRECIP. VOLUME (gal)	1,496,647	4,068,510	14,898,468	11,026,175	2,812,579	4,561,027	538,670	934,466	0	0	0	0	40,336,541	
MONTHLY AVAIL. SNOWMELT (IN)(c)	0.82	1.06	0.00	1.29	8.10	10.33	38.40	0.00	0.00	0.00	0.00	0.00	60.00	
ESTIMATED SNOW CONTR. (%)(d)	100%	100%	100%	100%	40%	40%	30%	0%	0%	0%	0%	0%		
ESTIMATED AREA OF INFLUENCE (ac)	50	50	50	50	50	50	50	50	50	50	50	50		
ESTIMATED INFLUX TO STORAGE (gal)(e)	1,115,930	1,434,767	0	1,753,604	4,399,951	5,611,532	15,638,956	0	0	0	0	0	29,954,738	
RESERVOIR DISPOSAL(GAIN) (gal)	2,528,414	5,405,352	14,755,579	12,612,514	6,739,152	9,376,289	14,698,250	(865,067)	(1,803,763)	(1,580,200)	(1,015,010)	(343,175)	60,508,335	
IRRIGATION														
IRRIGATION DISPOSAL (gal)(f)	0	0	0	0	0	0	0	0	10,796,000	22,361,000	17,521,000	11,999,000	62,677,000	
STORAGE														
BEGINNING STORAGE (gal)	4,060,000	14,434,371	29,914,958	51,907,933	66,582,062	65,452,522	56,497,361	54,309,241	34,204,870	30,571,918	15,474,682	4,810,833		
CALCULATED STORAGE GAIN (gal)	10,374,371	15,480,587	26,392,975	23,674,129	17,970,460	21,044,839	26,411,880	8,495,628	-3,632,951	-15,097,236	-10,663,849	-4,251,841		
PROJECTED ESTIMATED STORAGE (gal)	14,434,371	29,914,958	56,307,933	75,582,062	84,552,522	86,497,361	82,909,241	62,804,870	30,571,918	15,474,682	4,810,833	558,993	=CARRYOVER	
AMOUNT DISCHARGED TO BLOODS CREEK (gal)	0	0	4,400,000	9,000,000	19,100,000	30,000,000	28,600,000	28,600,000	0	0	0	0	119,700,000	
ESTIMATED STORAGE (gal)	14,434,371	29,914,958	51,907,933	66,582,062	65,452,522	56,497,361	54,309,241	34,204,870	30,571,918	15,474,682	4,810,833	558,993		

MAXIMUM STORAGE (MG) 66.58

AVAILABLE STORAGE (MG) 76.43

SUMMARY

ANNUAL INFLOW (MG)	
WASTEWATER	122.18
PRECIPITATION	47.48
SNOW INFLUX (MG)	29.95
TOTAL	199.62

ANNUAL OUTFLOW POTENTIAL (MG)	
AMOUNT DISCHARGED TO BLOODS CREEK	119.70
EVAPORATION	12.35
PERCOLATION	8.39
IRRIGATION	62.68
TOTAL	203.12

OVERALL BALANCE	
UNUSED DISPOSAL CAPACITY (MG)	-0.56
(MUST NOT BE NEGATIVE)	
UNUSED STORAGE CAPACITY (MG)	9.85
(MUST NOT BE NEGATIVE)	

(a) Estimated percolation based upon measured inflow components, estimated evaporation, and actual reservoir levels in 2011 - in Storage Reservoir only.

(b) Reservoir water surface area is a function of storage volume at start of month.

(c) Estimated snowmelt volume available for influx to storage reservoir.

(d) Estimated percentage of snowmelt contributing to influx to reservoir.

(e) Estimated based on fraction of accumulated snow within reservoir "area of influence" entering the reservoir during snowmelt months.

(f) Disposal capacity based on maximum estimated land disposal volumes.

(g) Per Bloods Creek Gauging Station

(h) Not used in calculations