INFORMATION SHEET

WASTE DISCHARGE REQUIREMENTS ORDER __
CITY OF DIXON
DIXON WASTEWATER TREATMENT FACILITY
SOLANO COUNTY

Background

The City of Dixon ("Discharger") owns and operates a wastewater treatment facility (WWTF) that treats domestic and industrial wastewater. The WWTF is regulated by Waste Discharge Requirements (WDRs) Order 94-187 and Cease and Desist Order (CDO) R5-2008-0136. The 2008 CDO required the Discharger to implement salinity source control and complete WWTF improvements if necessary to comply with the Basin Plan and the 2008 CDO requirements. The Discharger has completed salinity source control efforts and submitted a Report of Waste Discharge (RWD) in November 2013 that proposes to achieve compliance by upgrading the WWTF.

Wastewater is currently treated using nine stabilization treatment ponds and four polishing ponds. The ponds are unlined and have a total surface area of 122 acres. Treated wastewater is disposed using percolation basins that have a total surface area of 160 acres. The WWTF also has 120 acres of land application area but the fields have not been used for disposal since 2009.

Compliance History

Prior to CDO R5-2008-0136, the City was previously regulated by CDO 96-152, CDO 97-193, and CDO R5-2005-0078. The previous CDOs required the Discharger to construct capacity improvements, address sewer inflow and infiltration (I/I) problems, and comply with groundwater limitations, particularly those related to salinity, which was determined to primarily be caused by residential and commercial self-regenerating water softeners. The City complied with the capacity and I/I requirements but did not take sufficient action resulting in full compliance with the 2005 CDO. Compliance with the 2005 CDO was partly hampered by a ratepayer initiative that prevented approval of a bond issue intended to fund the majority of planned compliance projects.

In September 2008, the Central Valley Water Board adopted CDO R5-2008-0136 due to noncompliance with CDO R5-2005-0078. The 2008 CDO provided site-specific numeric groundwater limitations based on background groundwater quality data available at that time or the most stringent interpretation of narrative water quality objectives set forth in the Basin Plan, whichever was greater. Based on those limits, the findings of the CDO concluded that the City caused pollution for chloride, sodium, electrical conductivity (EC), total dissolved solids (TDS), and boron. The 2008 CDO set interim performance-based effluent limits for chloride (340 mg/L) and sodium (330 mg/L), and final effluent limits (effective 1 January 2014) for chloride (106 mg/L) and sodium (143 mg/L). The final effluent limits were based on the most stringent interpretation of the narrative water quality objective to protect agricultural beneficial uses of groundwater or the background groundwater concentration, whichever was greater. The 2008 CDO also set an average daily dry weather flow limit of 1.82 MGD based on the treatment, storage, and disposal capacity of the WWTF.

The discharge of brine from residences and businesses using self-regenerating water softeners accounted for a significant portion of salinity at the WWTF. Residential discharges

alone were estimated to account for 40 to 50 percent of the total chloride load. The 2008 CDO required that the Discharger implement salinity source control, evaluate the effectiveness of the source control, submit progress reports, and submit a RWD if WWTF improvements were necessary to comply with the CDO requirements. The 2008 CDO allowed the Discharger to request re-evaluation of the groundwater limits and final effluent limits by providing an updated background groundwater quality evaluation.

In a 30 January 2013 letter from the Executive Officer and pursuant to Item 11 of the 2008 CDO, the due dates of the RWD, *Facilities Plan*, and compliance with the final effluent limits were extended. The extension was based on the number of days that the Executive Officer's letter exceeded the 60-day response deadline after receiving the Discharger's *Salinity Source Control Effectiveness Report*. All reports required by the 2008 CDO were submitted complete and on time. The Discharger's *Source Control Effectiveness Report* showed that the Discharger's efforts to control salinity sources have reduced the influent TDS and chloride concentrations by 20 percent and 50 percent, respectively. The influent sodium concentration has not changed and the influent boron concentration has unexpectedly increased by 35 percent. The boron increase is not associated with any changes in the domestic source water, and the cause is not clear, but may be associated with the removal of ion exchange water softeners.

The Discharger concluded that WWTF improvements are required to comply with the Basin Plan. The Discharger estimates that the large foot print of the treatment ponds and percolation basins causes salinity concentrations to increase by approximately 80 percent due to evapoconcentration from the time wastewater flows through treatment ponds until it percolates below the percolation basins.

The Discharger submitted a *WWTF Facilities Plan Report* that evaluated WWTF improvements and a range of other compliance alternatives and proposed a WWTF improvement project that will bring the facility into compliance with the Basin Plan and CDO R5-2008-0136.

Planned Changes in the Facility and Discharge

The Discharger plans to decommission the 122 acres of treatment ponds and construct an activated sludge treatment system to minimize evapoconcentration of salts. The new system will contain two treatment trains operated in parallel. Each treatment train will consist of a concrete oxidation ditch and a secondary clarifier. The RWD states that evapoconcentration during treatment will be negligible. The activated sludge treatment system will be constructed in the northern area of the current wastewater ponds.

Influent wastewater character is not expected to change except with respect to salinity and boron. The boron concentration may increase if residents use boron containing detergents to improve the cleaning efficiency of hard water and the loss of water softeners. Additionally, overall influent salinity could increase due to increased household water conservation.

Treated wastewater will continue to be disposed in the existing percolation basins. The basins will be operated to maximize percolation and minimize evaporation. The overall

salinity increase due to evapoconcentration is expected to be reduced from 80 percent to 20 percent.

The Discharger does not plan to use the 120 acres of former land application area (LAA) for effluent disposal, but may use the former LAA and/or the decommissioned treatment pond area to add additional percolation basins as operational backup of hydraulic capacity.

Decommissioning the wastewater treatment ponds will require the removal of accumulated sludge. The total accumulation is estimated to be about 2,000 dry tons. This Order requires the submittal of a pond closure workplan and closure report.

The new treatment system will use secondary clarifiers. Wasted sludge will be mechanically dewatered and further dewatering will occur seasonally using asphalt paved drying beds. Leachate and storm water runoff from the drying beds will be returned to the headworks. Dried solids will be disposed of at a landfill.

Site-Specific Conditions

The WWTF is relatively level at an approximate elevation of 40 feet mean sea level (MSL). Soils at the site generally consist of clays and silty clay loams 15 to 30 feet below ground surface. Surrounding land use is primarily agricultural. The Discharger's site-specific water quality objective study surveyed 5,400 acres within one mile of the WWTF and found that alfalfa and mixed pasture crops make-up approximately 55 percent of the surveyed area. Irrigation water used for agriculture upgradient of the WWTF is primarily high quality surface water from Lake Berryessa. In the area surrounding the WWTF, irrigation water is supplied by groundwater wells and previously used drainage water. The TDS concentration of surface water from Lake Berryessa is approximately 50 mg/L and the TDS concentration from groundwater wells is approximately 1,000 mg/l.

Groundwater Conditions

The depth to groundwater in the vicinity of the WWTF ranges from 15 to 40 feet below ground surface. The local groundwater flow direction is generally from west northwest toward east southeast.

Prior to the 2008 CDO, the Discharger's monitoring network contained 12 monitoring wells: TW-1, TW-2, TW-3, NW-2, SW-MWR, NE-MW, SE-MW, and MW-6 through MW-10. The monitoring well network was expanded in 2010 by installing five new monitoring wells (MW-11 through MW-15). In January 2012, the Discharger voluntarily submitted a *Groundwater Evaluation Report* that evaluated background groundwater quality. Based on a tracer study, the report determined which monitoring wells best represent background groundwater to assess background groundwater quality and site-specific water quality objectives. The report identified the following wells to be representative of either background or downgradient groundwater quality.

Background Wells	Downgradient Wells
SW-MWR	SE-MW
MW-11	MW-6
MW-12	MW-7
MW-13	MW-8
MW-14	MW-9
MW-15	MW-10

The shallow groundwater flow direction underlying the site varies seasonally and appears to be influenced by neighboring irrigation practices utilizing agricultural drainage waters and/or groundwater pumping for irrigation supply. The groundwater elevation gradient is typically to the east or northeast but has also been reported to be towards the north and northwest, which contrast with the local east˜southeast groundwater gradient.

An interwell analysis was conducted by grouping the background monitoring well data to determine current background groundwater quality and evaluating if the discharge has caused degradation in the compliance wells. Background groundwater quality for each constituent of concern was determined using a nonparametric distribution and by calculating the upper tolerance limit of the grouped background groundwater data with 95 percent confidence and 95 percent population coverage. This limit gives 95 percent confidence that 95 percent of future background groundwater samples will be below the calculated value.

The table below shows the average concentration for each background monitoring well calculated from the second quarter of 2010 (when data was first collected from monitoring wells MW-11 through MW-15) through the fourth quarter of 2013. The table also shows the background groundwater quality that was calculated using the upper tolerance limit described above.

Constituent	SW-MWR	MW-11	MW-12	MW-13	MW-14	MW-15	Background Groundwater Quality
Nitrate-N (mg/L)	24	31	14	11	51	9	61
TDS (mg/L)	1,280	830	960	1,310	1,410	1,430	1,600
Chloride (mg/L)	110	80	115	175	165	250	270
Sodium (mg/L)	235	95	120	215	160	85	280
Boron (mg/L)	0.35	0.25	0.75	0.60	0.35	0.70	0.8
Sulfate (mg/L)	280	100	145	205	130	385	410
Iron (mg/L)	<0.1*	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Manganese (mg/L)	<0.02*	<0.02	<0.02	<0.02	<0.02	<0.02	0.02

* One or more outliers were removed using the Thompson tau technique

The Discharger has been working with the Central Valley Salinity Alternatives for Long-term Sustainability (CV-SALTS) Technical Advisory Committee to develop site-specific agricultural water quality objectives for boron, total dissolved solids, chloride, and sodium. The following table summarizes the municipal water quality objectives and the site-specific agricultural water quality objectives proposed by the Discharger in their study report.

Constituent	Municipal WQO	Discharger Proposed Agricultural WQO
Nitrate-N (mg/L)	10[2]	--
TDS (mg/L)	500 – 1,500[3]	1,500
Chloride (mg/L)	250 – 600[3]	>880
Sodium (mg/L)	NA	>340
Boron (mg/L)	NA	1.65
Sulfate (mg/L)	250 – 600[3]	--
Iron (mg/L)	0.3[3]	--
Manganese (mg/L)	0.05[3]	--

[1] Municipal or agricultural WQO, whichever is lower.

[2] Primary MCL.

[3] Secondary MCL range or specified value.

NA = Not applicable

- - = Not proposed

On 11 April 2014, the CV-SALTS Technical Advisory Committee (TAC) issued comments about whether the Discharger's site-specific agricultural water quality objective study reports meet the objectives of CV-SALTS. In general, the comments stated that all statements and assumptions in the reports need to be supported by literature citations and/or data. In summary, CV-SALTS comments state that the boron study should use methods to select sensitive commercial crops previously discussed by CV-SALTS. Therefore, sunflowers should be the crop under consideration rather than a crop rotation of wheat and beans, which was chosen by the Discharger in an effort to be more conservative in the absence of published sensitivity curves for sunflower.

On 27 May 2014, the Discharger requested the CV-SALTS TAC for clarification on the use of sunflower to determine a site-specific agricultural water quality objective for boron. On 16 June 2014, the CV-SALTS Executive Committee submitted a letter stating that based on the available information and procedures specified in the Discharger's workplan, the Discharger's proposed boron concentration range of 1.65 to 1.83 mg/L would be protective of the 95 percent yield for sunflowers and that no additional information is required to finalize the boron study report. The CVSALTS TAC stated that it would be reasonably conservative to set the agricultural water objective at 1.65 mg/L to ensure that all agricultural beneficial uses are adequately protected.

The CV-SALTS TAC also stated that the proposed site-specific agricultural water quality objectives for sodium and chloride may be too conservative and should not be considered as objectives. The values are likely lower than necessary to be protective of agricultural beneficial uses and may not be appropriate for other study areas. This Order uses the Discharger's proposed values as a basis for comparison to municipal water quality objectives and/or background ground quality to determine protective groundwater limits.

The following table summarizes the site-specific water quality objectives, which is the lower value of either the municipal water quality objective or the agricultural water quality objective proposed by the Discharger and reviewed by CV-SALTS.

Constituent	Municipal WQO	Agricultural WQO	Site-specific WQO[1]
Nitrate-N (mg/L)	10[2]	--	10
TDS (mg/L)	500 – 1,500[3]	1,500	1,500
Chloride (mg/L)	250 – 600[3]	>880[4]	600
Sodium (mg/L)	NA	>340[4]	>340[4]
Boron (mg/L)	NA	1.65	1.65
Sulfate (mg/L)	250 – 600[3]	--	500[2]
Iron (mg/L)	0.3[3]	--	0.3
Manganese (mg/L)	0.05[3]	--	0.05

[1] Municipal or agricultural WQO, whichever is lower.

[2] Primary MCL.

[3] Secondary MCL range or specified value.

[4] Conservative value not recommended as a water quality objective; but can be used to determine protective groundwater limit.

NA = Not applicable

- - = Not proposed

The following table provides a comparison of the site-specific water quality objective, background groundwater quality, and each compliance well's worst case annual average concentration from 2010 through 2013.

Constituent	Site-specific WQO (mg/L)	Background Groundwater Quality (mg/L)	Maximum Annual Average Concentration (mg/L)					
			SE-MW	MW-6	MW-7	MW-8	MW-9	MW-10
Nitrate-N	10	61	30	<0.1	1.6	1.7	8.5	10.6
TDS	1,500	1,600	1530	1380	980	820	1120	880
Chloride	600	270	310	285	90	75	235	135
Sodium	>340[1]	280	235	105	200	115	120	150

Constituent	Site-specific WQO (mg/L)	Background Groundwater Quality (mg/L)	Maximum Annual Average Concentration (mg/L)					
			SE-MW	MW-6	MW-7	MW-8	MW-9	MW-10
Boron	1.65	0.8	0.7	1.0	1.5	1.0	0.7	0.7
Sulfate	500	410	330	370	120	115	130	155
Iron	0.3	<0.1	<0.1*	0.25	<0.1	<0.1	<0.1	<0.1
Manganese	0.05	<0.02	<0.02*	1.0	<0.02	0.06	<0.02	<0.02

[1] Conservative value not recommended as a water quality objective; but can be used to determine protective groundwater limit.

* One or more outliers were removed using the Thompson tau technique.

Monitoring well SE-MW shows degradation for chloride. Monitoring MW-6 shows degradation for boron, chloride, and iron and shows pollution for manganese. Monitoring well MW-7 shows degradation for boron. Monitoring well MW-8 shows degradation for boron and pollution for manganese.

Based on information provided by the Discharger, MW-6 is most likely impacted by background groundwater influences and not a reliable compliance monitoring well. Additionally, the apparent manganese pollution in MW-8 is not likely a result of the discharge.

Basin Plan, Beneficial Uses, and Regulatory Considerations

Local drainage is to Dickson Creek, which is a tributary of the Sacramento San Joaquin Delta. The beneficial uses of the Sacramento San Joaquin Delta, as stated in the Basin Plan, are municipal and domestic supply; agricultural supply; industrial service supply; industrial process supply; navigation; water contact recreation; non-contact water recreation; warm freshwater habitat; cold freshwater habitat; wildlife habitat; migration of aquatic organisms; and spawning, reproduction, and/or early development.

The beneficial uses of underlying groundwater as set forth in the Basin Plan are municipal and domestic supply, agricultural supply, industrial service supply and industrial process supply.

Antidegradation Analysis

This Order establishes effluent and groundwater limitations for the WWTF that will not unreasonably threaten present and anticipated beneficial uses or result in groundwater quality that exceeds water quality objectives set forth in the Basin Plan.

For total dissolved solids, sodium, nitrate, sulfate, iron, manganese, and total coliform organisms, current groundwater monitoring data indicate that groundwater has not been degraded beyond background groundwater quality by the previous discharge and that the future discharge does not pose a threat of degradation in the future. The requirements of this Order do not allow exceedance of a water quality objective.

For chloride and boron, current groundwater monitoring data indicate that groundwater has been degraded by the previous discharge but the degradation has not caused exceedance of a water quality objective. The Discharger has implemented treatment and control measures and is proposing further measures that when completed would be considered best practicable treatment or control (BPTC), so the degradation is allowable under Resolution 68-16.

The Discharger has implemented and is proposing treatment and control of the discharge that incorporates:

a. Installing deeper municipal supply wells and preferentially operating water supply wells with better quality to reduce salinity and hardness.

b. Prohibiting the installation of residential self-regenerating water softeners.

c. Investing $650,000 in a buyback program that removed more than 600 existing self-regenerating water softeners.

d. Setting TDS, sodium, and chloride effluent limits on industrial dischargers.

e. Performing routine sewer line monitoring for salinity to assess effectiveness of salinity control measures, verify compliance by industrial dischargers, and identify areas that require focus of a public outreach campaign.

f. Repairing sewer trunk lines that suffer from infiltration of agricultural percolate water that is high in salinity.

g. Proposing a new wastewater treatment design that minimizes evapoconcentration to reduce effluent salinity concentrations and is more effective at removing nitrogen.

Flow Limitations

Influent flows to the WWTF shall not exceed the following limits:

Flow Measurement	Flow Limit
Total Annual Flow [1]	701 MG
Average Annual Flow [2]	1.92 MGD

[1] As determined by the total flow for the calendar year.

[2] As determined by the total flow for the months of August through October, inclusive, divided by 92 days.

Effluent Limitations

Effective immediately and continuing through 30 June 2017, effluent discharged to the percolation basins shall not exceed the following limits:

Constituent	Units	Limit	Basis of Compliance Determination
BOD_5 [1]	mg/L	50	Monthly average
BOD_5	mg/L	80	Monthly maximum

Constituent	Units	Limit	Basis of Compliance Determination
Total nitrogen	mg/L	25	Flow-weighted annual average
Chloride	mg/L	200	Flow-weighted annual average
Boron	mg/L	1.2	Flow-weighted annual average

[1] 5-day biochemical oxygen demand at 20˚C.

Effective 1 July 2017, effluent discharged to the percolation basins shall not exceed the following limits:

Constituent	Units	Limit	Basis of Compliance Determination
BOD_5 [1]	mg/L	30	Monthly average
BOD_5	mg/L	50	Monthly maximum
Total nitrogen	mg/L	10	Flow-weighted annual average
Chloride	mg/L	150	Flow-weighted annual average
Boron	mg/L	1.4	Flow-weighted annual average

Groundwater Limitations

Release of waste constituents from any portion of the WWTF shall not cause groundwater to contain any of the specified constituents in a concentration statistically greater than the maximum allowable concentration tabulated below. The wells to which these requirements apply are specified in the Monitoring and Reporting Program.

Constituent	Units	Groundwater Limit [1]
Nitrate-N	mg/L	No temporal increase [2]
TDS	mg/L	1,600
Chloride	mg/L	600
Sodium	mg/L	340
Boron	mg/L	1.65

[1] Applies to all compliance monitoring wells listed in the Monitoring and Reporting Program.
[2] Temporal increase is defined as an increase relative to the 2013 annual average concentration for each individual compliance well.

Provisions

a. The Discharger shall submit a *Wastewater Pond Closure Plan*.

b. If the *Wastewater Pond Closure Plan* identifies ponds that will be backfilled prior to construction of the new WWTF, the Discharger shall submit a *Pond Closure Report*.

c. The Discharger shall submit a *Pond Closure Report* for all remaining wastewater treatment ponds that were not previously closed.

Monitoring Requirements

The Monitoring and Reporting Program is designed to verify compliance with the flow, effluent, and groundwater limitations and operational requirements of the WDRs. The Order requires monitoring of wastewater flows to the percolation basins, wastewater quality, groundwater, and residual solids. Groundwater limitations are necessary to protect the municipal and domestic use of groundwater. If results of the monitoring reveal a previously undetected threat to water quality or indicate a change in waste character such that the threat to water quality is significantly increased, the Central Valley Water Board may reopen this Order to reconsider groundwater limitations and other requirements to comply with Resolution 68-16.