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**Revised Project Work Plan**

*Development of site-specific criteria for electrical conductivity and pH to protect agricultural beneficial uses in the vicinity of the discharge from the Easterly Wastewater Treatment Plant (Solano County).*

**September 2010**

**Prepared by:**

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**Easterly Wastewater Treatment Plant  
Elmira, California**

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## 1.0 BACKGROUND

The Central Valley Regional Water Quality Control Board (RWQCB) has expressed concern that the discharge of treated wastewater from wastewater treatment plants in the region may adversely affect downstream agricultural uses of surface waters. These concerns have centered on the salinity of the treated water, typically expressed in terms of its electrical conductivity (EC). In general terms, if the EC of an agricultural water supply is too high, the yield for salt-sensitive crops will be reduced. The RWQCB is obligated to regulate wastewater discharges so as to protect beneficial uses of the water in accordance with the California Water Code and Federal Clean Water Act.

The City of Vacaville (City) was required by its National Pollutant Discharge Elimination System (NPDES) Permit No. CA0077691, Waste Discharge Requirements (WDRs) Order No. R5-2008-0055 (Permit) for the City's Easterly Wastewater Treatment Plant (EWWTP) to submit a Work Plan in October 2008 to complete a site-specific investigation to determine appropriate EC and pH levels to protect the beneficial use of agricultural supply for the most salt-sensitive crops in areas irrigated with water from Old Alamo Creek, New Alamo Creek, and Ulatis Creek in the vicinity of the discharge under reasonable worst-case conditions. The City submitted the EC and pH Work Plan on October 23, 2008. On November 21, 2008, the City received comments on the Work Plan from Water Board staff.

Since submittal of the October 2008 work plan by the City, developments pertaining to salinity have occurred regarding approaches to determining applicable standards for salinity in Central Valley receiving waters. The developments include the CV-SALTS efforts initiated by the Regional Water Board and the State Water Resource Control Board's reevaluation of southern Delta salinity objectives. To ensure that its efforts are consistent with approaches being developed under these two efforts, the City requested a new time schedule for this project. In March 2009, the Regional Board adopted Order R5-2010-0027 that amended compliance schedule in Order No. R5-2008-0055 as follows:

Submit Revised Work Plan – September 18, 2010

Submit Study Report – April 1, 2015

The City is aware of the similar approach for developing site-specific studies for EC taken by the Regional Board with other dischargers in the region (e.g., UC Davis, Cities of Woodland and Davis). The phases and tasks described below may be influenced by the discussions and decisions that occur as these and other similar studies are completed. The changing nature of the regulations, and potentially the science, directly-effect the proposed work, and ultimately, the recommendations in the final study report. As a consequence, some tasks of the project will be managed adaptively. Changes in the direction or intent of the work plan tasks will be documented in the final study report and summarized annually in the progress report.

The purpose of the City's study is to evaluate site-specific information to properly interpret the narrative chemical objective. We propose to conduct the site-specific investigation in four phases.

### ***2.0 PHASE I: RESOLUTION OF SIGNIFICANT POLICY ISSUES THROUGH STAKEHOLDER PROCESSES***

The City currently participates in and intends to use the CV-SALTS stakeholder process to resolve significant policy issues that are delaying RWQCB approval and discharger progress on the permit-required EC and pH studies. The expectation is to formulate an acceptable solution and a path forward in a manner consistent with other area dischargers, other regulators (SWRCB), and the California Water Code.

The City will remain involved in the relevant policy discussions with the Regional Water Board or State Water Board as necessary to inform the process and seek resolution on policy issues through direct participation or through representation as a member of the Central Valley Clean Water Association (CVCWA).

CV-SALTS has identified some of the policy issues that may potentially impact the work outlined in this plan in Table 2-1.

**Table 2-1. Significant Identified Policy Issues for EC/pH Site-Specific Studies**

	<b>Topic:</b>
A	Is a transient model that accounts for constantly changing soil water conditions and rainfall patterns and distribution (as is described in this work plan) acceptable?
B	What level of crop protection is reasonable for a site-specific study?
C	What winter bare-soil evaporation rate is appropriate?
D	What soil water root uptake pattern is most appropriate?
E	What is the best way to determine leaching fractions and is there a conservative assumption to use in the absence of a site-specific value?
F	What crop type is appropriate for the determination of level of protection for a site-specific study?

### **3.0 PHASE II: EC MODELING**

Completion of part of this phase is dependent upon adequate resolution of the policy issues described in Phase I. Other Phase II tasks can progress without resolution, however finalization of Phase II EC Modeling in order to recommend site-specific numeric values for EC that are reasonably protective of agricultural beneficial use, is dependent on Phase I.

In this phase, a model, developed at the University of California, Davis by Drs. Isidoro and Grattan (Investigators) that is designed to determine the maximum EC of an irrigation water supply that is protective of crop production, would be modified to reflect site-specific conditions at the Vacaville study site. Inputs to the model would include site-specific data for rainfall, crop type, soil type (physical properties from soil surveys), evapotranspiration (based on historical weather data), and irrigation water quality. The model would be run using either the dominant crop in the area that is most sensitive to salinity or the most sensitive crop that can be grown in the area (pending outcome of Phase I). The model would allow numerous irrigation schedules to be tested under actual rainfall situations for the area. Short and long-term rainfall scenarios would be evaluated representing both average and reasonable worst-case dry periods. The results would indicate if soil water salinity gets high enough to adversely affect the yield of the appropriate crop under the given irrigation practices and site specific conditions. The salinity of the irrigation water would be gradually increased in the model simulations until the seasonal average rootzone reaches the yield threshold limit for the appropriate crop chosen for the study.

#### ***3.1 Task II-A: Gather Existing/relevant information***

The City will provide Dr. Isidoro and Dr. Grattan a map of the study area and dominant cropping patterns in the area. The investigators, with the assistance of the City, will gather important information for inputs to the model, including rainfall history, crop types, soil maps (including soil types with soil physical characteristics), evapotranspiration potential, and irrigation water quality. This information will be compiled specifically for the identified study area. Data on sodium absorption ratios (SAR) of Vacaville's effluent will be collected with the assistance of the City. These data, along with soil samples collected at the site by the Investigators (see Phase III), will be needed to assess potential reductions in soil water infiltration potential for local soils. Soils will also be evaluated for pH to assess the potential problem of fluoride in effluent water.

#### ***3.2 Task II-B: Calculate impact of EC on crop yields***

Dr. Isidoro will modify the existing model using data and assumptions obtained in Task II-A to calculate an EC level in irrigation water that is protective of agricultural beneficial uses based on site-specific conditions (e.g., climate records, historical rainfall, soil type) for either the dominant crop in the area that is most sensitive to salinity or the most sensitive crop that can be grown in the area (pending outcome of Phase I). Soil salinity

(ECe) will be determined in a probabilistic fashion since salt leaching is a random process that is dependent upon rainfall and flooding frequency (if applicable). The model will be run with several soil types representing the dominant soils in the vicinity of the site and representing a range in soil physical properties. The results will represent different irrigation water ECs that result in fully protective ECe values with a given probability.

#### **4.0 PHASE III: SOIL STUDY**

This phase of the study will characterize the sodium adsorption ratio (SAR) and alkalinity (pH) of the dominant soils in the study area through soil sampling and analysis. These analyses will help evaluate the effects of SAR on infiltration of water into the soil and the potential risk to agricultural beneficial use from fluoride in effluent water. Dr. Grattan will develop a detailed sampling plan based on the information obtained during Phase II and will subsequently collect soil samples in the vicinity of the study site pursuant to the sampling plan. Soil samples will be collected from the study site and sent to a State-certified laboratory for analyses to assess the alkalinity (pH) and the SAR of the agricultural area.

#### **5.0 PHASE IV: REPORTING**

The final phase would consist of report preparation. The report would be prepared based on the outcomes and results from the first three phases of the study. A draft report will be provided to the City and a meeting will be held to discuss possible revisions to the report. A final draft will then be prepared based on discussions and input from the City.

The report will describe the process, assumptions, and model as modified to investigate effects of salt levels in irrigation water drawn from Old Alamo Creek, New Alamo Creek, and Ulati Creek on crop production. The report will recommend site-specific numeric values for EC and pH that are reasonably protective of the agricultural beneficial use. The report will also include an assessment of site soils, including the SAR and the potential affect on soil water infiltration and alkalinity and the potential impacts related to fluoride toxicity.

The City may incorporate relevant information from other studies or reports into the final report recommendations since the purpose of the study is based on the protection of agricultural beneficial use in the receiving water (not solely the effluent). For example, the City is concurrently conducting a dilution study on the Old Alamo/New Alamo Creek receiving water system that will determine the available dilution within the creeks<sup>1</sup>. The primary purpose of the dilution study is to determine the appropriate dilution credit applicable for protection of downstream human health beneficial uses. However, the data

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<sup>1</sup> Robertson-Bryan, Inc. *Dilution Study for the Easterly Wastewater Treatment Plant*. May 18, 2010.

collected and findings established from the dilution study may also be applicable for use during the consideration of site-specific numeric values for EC and pH that are reasonably protective of the agricultural beneficial use within these receiving waters.

In addition, since an economic model is not included in the EC model, the City may obtain additional guidance from the CVSALTS process for the consideration of economic factors when forming the final report recommendations. CVSALTS has an established committee (i.e. Economic and Social Cost Committee) that has been tasked with discussing this type of issue.

Starting in 2009, interim progress reports were prepared annually for submittal to the RWQCB that describe the progress and status of the study until its completion. Annual progress reporting will continue.

## **6.0 MEETINGS**

Meetings involving stakeholders will be held periodically throughout the process to discuss the scope of the study and work plan progress. Ongoing meetings will occur through the CVSALTS process to facilitate the resolution of policy issues; project-specific meetings will be held, if needed, to attempt to resolve policy issues if the schedule of the project requires. A meeting will be held with the City and the RWQCB early on in Phase II to review the Revised Work Plan, clarify the study scope, and make necessary adjustments before substantial work begins.

## **7.0 KEY STAFF**

A majority of the model preparation and calculations will be performed by Dr. Daniel Isidoro, a scientist from Spain who developed the model with Dr. Grattan while at the University of California, Davis. Dr. Isidoro is currently affiliated at the Agrifood Research and Technology Centre of Aragón (CITA-DGA) in Zaragoza, Spain and will conduct his tasks in Spain as a private consultant. He will travel to California to work with Dr. Grattan on the modification of the model and to discuss model simulations at least once during the duration of the project. Dr. Stephen Grattan is a known irrigation salinity expert at the University of California Davis. Dr. Grattan will work as a private consultant and be responsible for planning and supervising the development of the project. He is responsible for attending the meetings, drafting the report and finalizing the recommendations for EC as produced by the model, which was developed/modified by Dr. Isidoro. SAR and fluoride assessment will be conducted by Dr. Grattan.

**8.0 SCHEDULE**

The tasks identified above and summarized below will be conducted according to a schedule such that completion of the tasks will ensure that the study is completed to meet the City's permit requirement of submittal to the Regional Board by April 1, 2015.

**Table 8-1. Schedule of Tasks**

<b>Task:</b>	
Submittal of Work Plan	October 23, 2008
CVSALTS or alternate regulatory process	Ongoing; Initiated involvement in 2008
Submittal of Revised Work Plan	September 16, 2010
Review comments or approval of Revised Work Plan from RWQCB	Pending*
Meeting with Investigators and City of Vacaville to Tour Site	Pending*
Gather Existing/Relevant Information and Evaluate Model Assumptions	Pending*
Schedule and Convene Meeting between City of Vacaville and RWQCB	Pending*
Calculate Impact of EC on Crop Yields	Pending*
Collect Soil Samples and Assess the Alkalinity (pH) and the SAR	Pending*
Meet with the City on initial findings	Pending*
Prepare Draft Report	Pending*
Meet with City of Vacaville/ Comment on Draft Report	Pending*
Prepare Final Report	Pending*
Submit Final Report to Regional Board:	April 1, 2015
-- Annual Progress Reports:	June 1, 2009; June 1, 2010 ; June 1, 2011; June 1, 2012; June 1, 2013; June 1, 2014
*Task to be scheduled based on progress and/or resolution of significant policy issues as described in Phase I of the Revised Work Plan.	