Study 2

Lateral Gradient of Water Table

Public Draft
2013 Monitoring and Analysis Plan

SAN JOAQUIN RIVER
RESTORATION PROGRAM

September 2012

2.0 Lateral Gradient of Water Table

2.1 Statement of Need

The 2012 Interim Flows seepage operations conceptual model provides a framework to analyze the following:

- Lateral extent of influence from surface water flow in Reach 4A on the near-river, shallow groundwater system response.
- Relationships of surface water flows to other groundwater influences, including rainfall, irrigation of fields, and canal conveyance facilities.
- Changes in the soil salinity profile and the movement of salts from different sources.

2.2 Background

The 2010 seepage operations conceptual model simplified groundwater interactions as a 1:1 relationship with river stage, and sought to avoid river levels that would cause seepage impacts on surrounding lands. Implicit in this assumption is a direct hydraulic connection between the river and the near-river aquifer, the absence of a groundwater gradient (slope) near the river, monitoring sites representative of critical locations, and the river as the sole influence on shallow groundwater levels beneath lands adjacent to the river. The 2010 conceptual model was designed to avoid seepage impacts, and lacked representation of significant physical processes that affect changes in groundwater and agricultural production.

Groundwater and surface water monitoring is currently used to inform real-time management of SJRRP Interim Flows in the study area. Management decisions regarding the magnitude, duration, and routing of SJRRP Interim Flows require an evaluation of potential impacts to farm lands, subsurface drainage systems, and levees adjacent to the San Joaquin River. The primary metric currently used to evaluate impacts is depth to groundwater from the land surface on land adjacent to the river. A better understanding of the relationship between flows in the San Joaquin River and the associated response in the shallow groundwater system will allow SJRRP water managers to make better informed real-time management decisions, and informed decisions regarding seepage mitigation actions, should they be required.

A new conceptual model includes evaluation of groundwater levels on the basis of groundwater gradients. Determining the groundwater gradient at different river flow levels allows determination of the extent of influence of the San Joaquin River on

groundwater levels as well as inclusion of other potential groundwater influences. Figure 2-1 illustrates the principles of the proposed WY 2012 conceptual model.

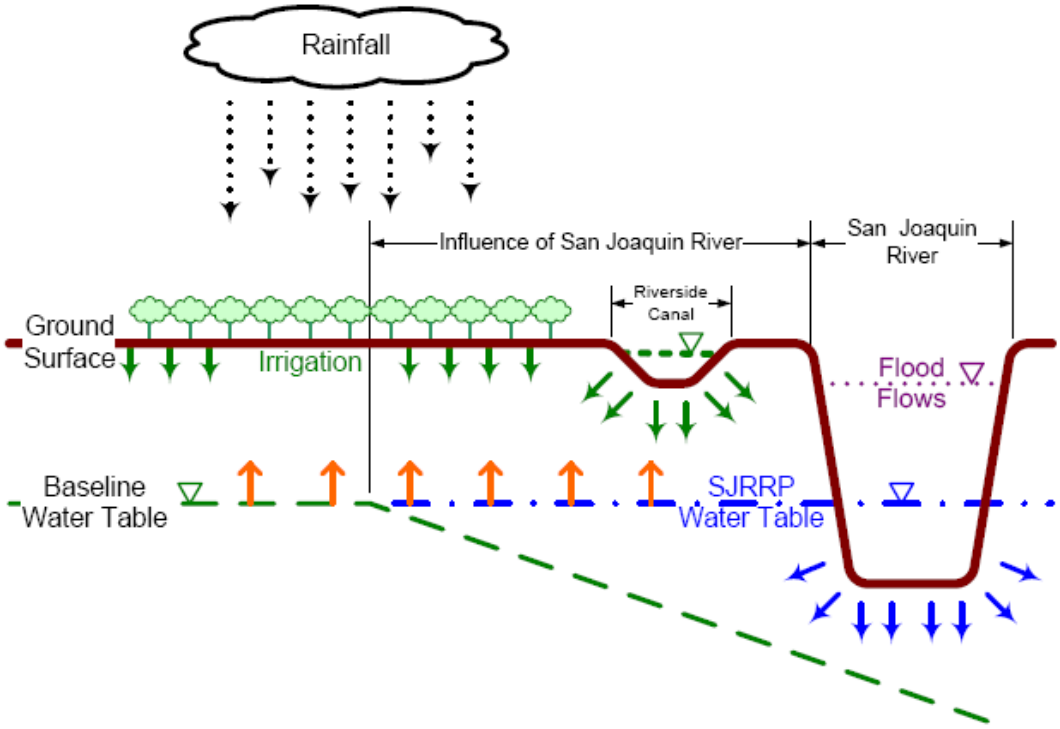

Figure 2-1.
WY 2012 Interim Flows Seepage Operations Conceptual Model

A listing of factors to consider in this study includes the following:

- Sources of groundwater recharge
  - Rainfall
  - Irrigation
  - Canal seepage
  - Flood flow seepage
  - SJRRP seepage
- Sources of soil salinity
  - Irrigation water
  - Fertilizer
  - Natural soil minerals
  - Shallow groundwater rise
- Additional factors
  - Weather patterns

2.3 Anticipated Outcomes

At the end of the study, conclusions should result in the following:

- Updated thresholds
- Description of conditions indicating seepage from the SJRRP
- Procedure for assessing the range and extent of potential impacts from existing flows
- Description of the limitations that future flows would impose

2.4 Methods

Surface water, groundwater, soil monitoring, and tile drain system flow data gathered during the spring 2011 Interim Flows inform understanding of the interaction of surface water and near-river groundwater. Surface water data consist of 15-minute river stage data and flow data from the gages located below Sack Dam (San Joaquin River gage (SJR) near Dos Palos, River Mile (RM) 181.5) and at the top of Reach 4B (SJR at Washington Road, RM 168.2). River stage data from temporary staff gages at State Route 152 (RM 173.9) and the San Juan Ranch (RM 170) were used. Groundwater-level data from numerous monitoring wells and soil borings collected at frequencies ranging from hourly to weekly are used to quantify shallow groundwater response. Flow data from existing subsurface tile drain systems are also considered as part of the analysis. In addition to data collection, the following analysis procedures will be part of this study:

- Delineate change in groundwater
  - Obtain elevation measurements periodically
  - Survey monitoring wells
  - Convert groundwater below ground surface (bgs) measurements to elevations
- Delineate change in groundwater due to surface water stage
  - Evaluate flow and stage in the river adjacent to monitoring well transects
  - Attempt to determine maximum distance of SJR influence, if difficult
  - Determine non-SJR influences on groundwater

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