Reach 4B, Eastside Bypass and Mariposa Bypass Channel and Structural Improvements Project

Land Suitability for Riparian Vegetation Establishment

Administrative Draft

Technical Memorandum

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Subject to Revision

SAN JOAQUIN RIVER
RESTORATION PROGRAM

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Acronyms & Abbreviations

DWR	California Department of Water Resources
SJRRP	San Joaquin River Restoration Program
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
USDA	U.S. Department of Agriculture
NRCS	Natural Resources Conservation Service
EM38	Geonics Electromagnetic Ground Conductivity meter EM38
EMh	EM38 reading with meter in the horizontal to the ground position
EMv	EM38 reading with the meter in the vertical to the ground position
QA	Quality assurance
QC	Quality control
RPD	Relative percent difference
ECe	Electrical conductivity of the soil saturation extract
ECa	Electrical conductivity of the bulk soil
ECp	Electrical conductivity of the saturated soil paste
PSA	Particle size analysis
SAR	Sodium adsorption ratio
RM	River mile

1 Executive Summary

This study is intended to support riparian vegetation enhancement and maintenance activities as part of the Reach 4B, Eastside Bypass, and Mariposa Bypass Channel Structural Improvements Project being undertaken by the San Joaquin River Restoration Program (SJRRP). Soil sampling and soil salinity field measurements were conducted in and near the San Joaquin River Reach 4B river channel, the Sand Slough area, the Mariposa bypass area, and the Eastside bypass area. Eighty sites were evaluated for soil salinity in the survey area. In addition, soil profile data from about 140 existing sites from previous studies were also evaluated. The study area was included in the US Department of Agriculture, Natural Resources Conservation Service (NRCS) soil surveys of eastern Merced (1) and western Merced county (2). These surveys were found to be accurate and were used to considerable advantage in this study. About 52 sites have been sampled for soil salinity, sodicity, and soluble boron. Some of these sites were also sampled for soil fertility, lime content, and particle size analysis. A total of 173 soil samples were sent to analytical laboratories. Several field soil salinity measurements were also presented on the soil logs. Laboratory data, soil profile logs, and site location coordinates and maps are attached in Appendix 1-4.

Existing soil information includes NRCS soil surveys, 121 soil profile logs from the 1997 West and East Gallo studies conducted by the Bureau of Reclamation (BOR) (3) in the northern portions of reach 4B2 and the lower eastside bypass. Forty eight sites were sampled for soil salinity and sodicity. Twelve sites were sampled for trace element analysis. Existing data also includes 20 sites from the SJRRP baseline soil salinity studies (4). Soil salinity was measured at all of these sites, located near river reach 4B1. California Department of Water Resources (DWR) geotechnical data reports (5) are also available for many areas on and near levees. Although these reports don't contain salinity information they do contain soil logs and extensive information on soil texture and other characteristics that will affect deep percolation, future soil salinity changes, and potential seepage losses.

Soil salinity was generally higher in lands outside the levees of the Eastside bypass. However soil salinity was locally high in some areas inside the Eastside Bypass levees despite periodic flooding. Much of the eastside basin and basin rim was historically affected by soils containing excess salts and sodium. Typical soil series include the Fresno, Waukena, Rossi , Pozo, Merced and the Traver soil. These soils are best suited for salt tolerant vegetation such as salt grass (*Distichlis* spp.) and salt tolerant shrubs. Grasses like Bermuda grass (*Cynodon dactylon*), alkali sacaton (*Sporobolus airoides*), and mouse barley (*Hordeum murinum*) should also do well. These soils also contain some alkali scald areas with little vegetation. It should be kept in mind that these barren areas are natural components of eastside basin rim vegetative communities.

Soils of the basin include the Merced and Rossi series. These fine textured soils were subject to periodic flooding under natural conditions and are well suited for marsh type vegetation such as cattails, bulrushes, and tules. These soils tend to be less saline than the basin rim soils that lie further to the northeast. In areas of the bypass and near the San Joaquin River Reach 4B river channel the Merced soil is often overwashed with coarse loamy and loamy recent alluvium.

Irrigated soils in the river oxbows tend to be very productive and non-saline. Riparian vegetation should be easy to establish on these soils.

Non-irrigated soils on the natural levee of the river channel are generally non-saline and light to medium textured in the surface soil but tend to be moderately saline in the substrata. The substrata are not sodic therefore cottonwoods, willows, and other riparian vegetation should be relatively easy to establish on these soils. Salt tolerance data for common riparian plants is presented in Table 1-1.

Table 1-1. Salt tolerance data for common riparian plants in the study area.

Plant	**Salinity Tolerance (ECe [dS/m] - active root zone)**	**Data Sources and Remarks**
Willows (*Salix* spp.)	Sensitive (< 3)	Miyamoto (6), Texas sites
Willows (*Salix* spp.)	Moderately Sensitive (>5)	Hangs et al. (7), Canadian prairie sites
Seep Willow (*Baccharis salicifolia*)	Moderately Sensitive (3-6)	Miyamoto (6)
Cottonwoods (*Populus* spp.)	Moderately Sensitive (3-6)	Miyamoto (6)
Russian Olive (*Elaeagnus angustifolia*)	Moderately Tolerant (6-8)	Miyamoto (6)
California Wild Rose (*Rosa californica*)	Tolerant (8-10)	Author estimate
Salt Cedar (*Tamarix* spp.)	Tolerant (8-10)	Miyamoto (6), noxious weed
Arrundo (*Arundo donax*)	Highly Tolerant (>10)	Author estimate, noxious weed
Salt Bush (*Atriplex* spp.)	Tolerant (8-10)	Miyamoto (6)
Cockleburr (*Xanthium strumarium*)	Moderately Sensitive (3-6)	Author estimate, noxious weed
Saltgrass (*Distichlis* spp.)	Highly Tolerant (>10)	Miyamoto (6)
Bermuda Grass (*Cynodon dactylon*)	Tolerant (8-10)	Miyamoto (6)
Seep Weed (*Suaeda* spp.)	Highly Tolerant (>10)	USDA Handbook 60 (8)
Iodine Bush (*Allenrolfea occidentalis*)	Highly Tolerant (>10)	USDA Handbook 60 (8)
Pickleweed (*Salicornia* spp.)	Highly Tolerant (>10)	Miyamoto (6)
Tall Wheatgrass (*Thinopyrum ponticum*)	Highly Tolerant (>10)	Miyamoto (6)
Cattails (*Typha* spp.)/Tules	Highly Tolerant (>10)	Author estimate

2 Introduction

The Reach 4B and Eastside Bypass project consists of incorporating new floodplain and related riparian habitat to ensure conveyance of at least 4,500 cfs through Reach 4B of the San Joaquin River. Project alternatives under consideration include channel modifications to ensure fish passage, and modifications in the Eastside and Mariposa bypass channels to support anadromous fish migration. One of the channel and floodplain modifications under consideration is augmentation or reestablishment of riparian vegetation in the floodplain to support anadromous fish restoration.

2.1 Purpose

The purpose of this technical memorandum is to document recent studies of land suitability that will inform program decisions regarding augmentation and re-establishment of riparian vegetation in the Reach 4B and Eastside bypass floodplains. The primary purpose of the soil salinity evaluation is to determine soil salinity conditions in areas where riparian vegetation will be established, enhanced, and/or maintained.

2.2 Study Area

The Reach 4B Project study area includes Reach 4B of the San Joaquin River, Reaches 2 and 3 of the Eastside Bypass, and the Mariposa Bypass in Merced County, California (See Figure 2-1). The Reach 4B Project study area includes a 32.5-mile stretch of the San Joaquin River in Merced County, California. Reach 4B of the San Joaquin River begins at the Sand Slough Control Structure (River Mile [RM] 168.5) and extends to the confluence of the Eastside Bypass and San Joaquin River (RM 136) (see Figure 2-2). Reach 4B has been further divided into two subreaches; Reach 4B1 from the Sand Slough Control Structure to the Mariposa Bypass, and Reach 4B2 from the Mariposa Bypass to the confluence of the Eastside Bypass and the San Joaquin River. The study area for the Reach 4B Project also includes the Eastside and Mariposa bypasses. The Eastside and Mariposa bypasses are flood control channels that convey flood flows and reduce flooding to surrounding lands. The portions of the Eastside Bypass within the Reach 4B Project study area include Reach 2, which begins at the Sand Slough Control Structure and ends at Eastside Bypass Control Structure, and Reach 3, which begins at the Eastside Bypass Control Structure and ends at the confluence with the San Joaquin River. The Mariposa Bypass conveys flows from the end of the Eastside Bypass Reach 2 to the San Joaquin River Reach 4B2.

Figure 2-1. Project Location.

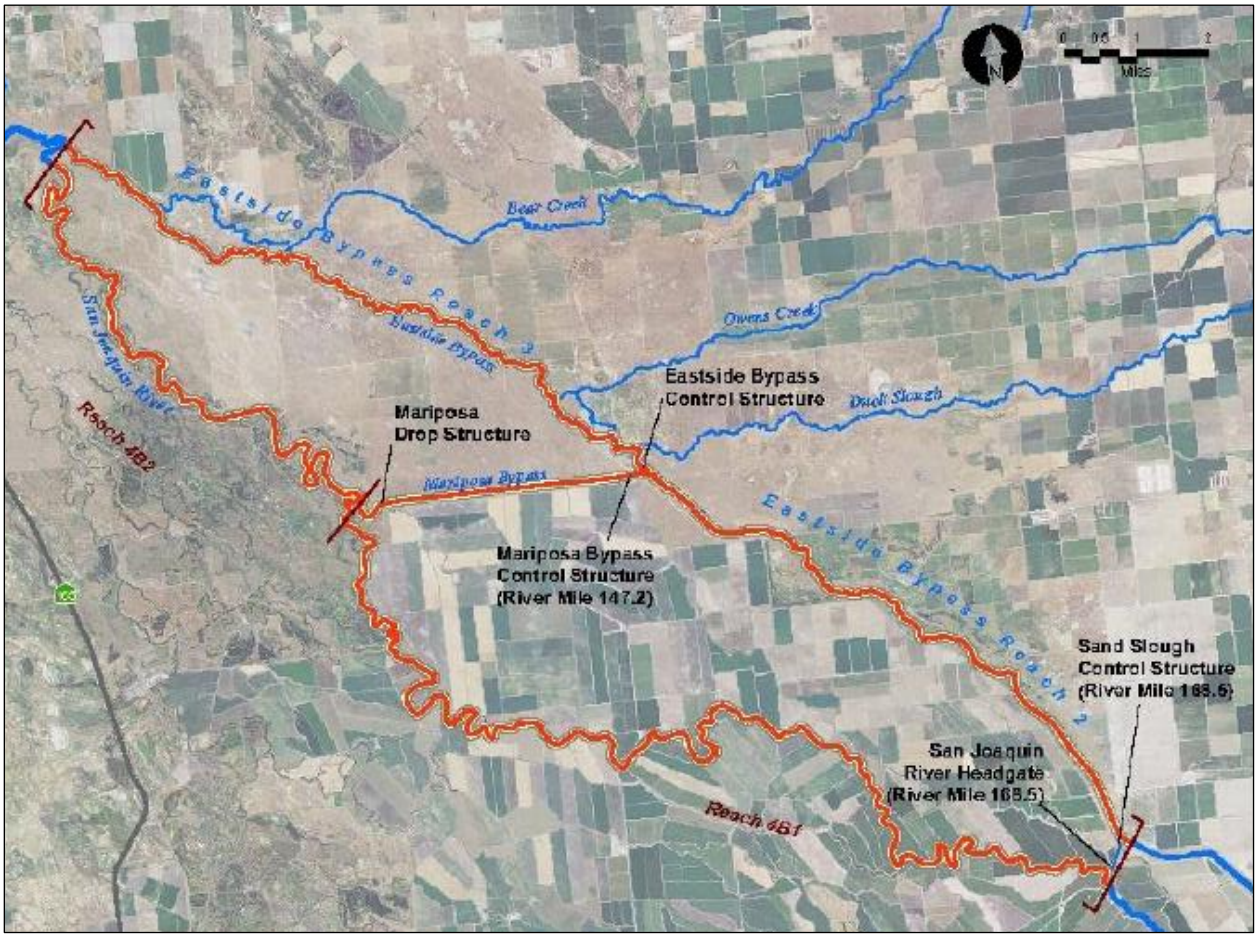


Figure 2-2. Project Area showing reach locations.

3 Methods

Soil Sampling was typically done by a one or two man crew under the direction of the lead soil scientist.

3.1 Sample Locations

Soil salinity evaluation sites from this study are shown on the location maps in Appendix A; site coordinates are presented in Appendix B, as well as coordinates for the 20 baseline soil salinity sites near the river and bypass from the 2010 /2011.

3.2 EM 38 Survey

If soil moisture levels were sufficiently moist an EM38 survey was conducted within a 100 foot radius of the initial selected site. At least 12 paired EM measurements were made. The EM38 in the horizontal position (EMh) generally measures the bulk soil electrical conductivity to a depth of about 30 inches while the vertical EM signal (EMv) generally reflects the bulk electrical

conductivity of the 0-60 inch soil depth. The number of measurements can be increased if the survey area has variable readings. The EM readings were averaged and adjusted for soil temperature. Each individual pair of readings was also evaluated for estimated ECe. Measurements at or near the sampling site were commonly well within the range of readings surrounding the site. Sites with unusually high or low EM readings were usually not chosen for central boring sites.

The EM38 has several advantages: It can provide many real time soil salinity measurements, measures bulk soil electrical conductivity of an area about 6 feet long x 5 feet deep and about 2.5 feet wide and provides real time information on soil salinity levels, salt distribution in the profile, and spatial variation of soil salinity within an area surrounding the boring site.

3.3 Central Borings

The soil scientist carefully hand augured the central boring and collected soil samples at 0-12 inches; 12-30 inches; and 30-60 inches. The 0-12 inch sample was not collected at the central boring of many sites since the surface soil multi increment composite sample is a much better representation of the site conditions. In a few cases the soils could not be sampled to the full 60 inches due to the presence of unstable saturated soils or hardpan layers. The soil was examined and a soil profile log was prepared using the USDA soil textural system and nomenclature. Special emphasis was given to depth of mottling, and or gleying, capillary fringe thickness; and depth to shallow groundwater.

3.4 Multi-Increment Composite Sampling

A separate multi-increment spatial composite soil sample of surface soil (0-1 foot) was collected from an area within a 100 foot radius of the central boring. These samples contained at least 4 increments and some contained over 30 increments. These samples were collected with a one inch diameter Dakota probe or in some cases a tile spade or 1.5 inch diameter hand augur. Multi-increment composite soil samples in field crops and row crops were collected in a stratified random manner to ensure that the top, sides, bed shoulders, and furrows were represented in the composite surface soil samples. Orchard and vineyard areas were carefully sampled to avoid underground plastic pipe manifolds and trench backfill, and to insure that the spatial composite soil samples included increments collected from near the emitter, near the center of the tree rows, and areas near the edge of the tree canopy. In some cases soil sampling procedures were customized for each orchard or vineyard depending on the type of irrigation system used. The multi increment surface soil composite soil samples were used for most evaluations including establishment of soil salinity levels for planting, reclamation leaching water volume, and gypsum requirements.

Replicate soil samples and/or replicate EM38 surveys were conducted at a few sites using the same multi-increment composite soil sampling method. The Relative percent differences (RPD) values of replicate soil samples and EM surveys is presented below. Soil sampling for the baseline soil salinity surveys using the same methods as the revegetation sites averaged 14.6 percent with a 95 % confidence range of 10.1-19.1 percent. Drip and micro sprinkler sites averaged RPD 16, while gravity and sprinkler irrigated sites averaged RPD 13.8.

Other parameters evaluated during the field investigation include:

- Water table depth
- Capillary fringe thickness
- Presence and depth of soil mottling and gleying
- Soil moisture levels
- Soil temperature
- USDA soil texture
- Soil reaction
- Saturation percentage
- Qualitative soil lime content
- Root abundance and depth
- Estimated exchangeable sodium percentage
- Soil gypsum requirement
- Soil soluble boron content
- Plant nutrient evaluation
- Available water holding capacity
- Reclamation leaching water volumes at each site
- Trace element toxicity hazards

Replicate EM38 surveys were conducted by two separate operators. The EM38 calibration and survey was done independently by each operator on the same survey area in the dual dipole mode. Relative percent differences (RPD) values for these replicate surveys are presented in Table 3-1.

The replicate surveys summarized in Table 3-1 generally indicate that 12 measurements in the 200 foot diameter areas surrounding the soil borings was sufficient to determine the average soil salinity on most sites and that different trained operators did not affect the EM38 survey results. Salinity is variable on old basin rim soils. These soils contain small saline alkali barren spots with scattered seepweed and iodine bush. The number of EM38 readings was often increased on these soils.

3.5 Texture and Moisture

Soil textures and estimates of field soil moisture content were determined by the soil scientist in the field using the feel method. At least one small soil sample per day was collected in a moisture proof plastic bag in the field for particle size analysis (PSA) in the soil scientist's home office laboratory. These samples were sometimes collected at discrete depth increments. These samples were also checked for field moisture percentage, muncell color (moist), and in some cases coarse fragment content. The PSA data was recorded on the soil logs. Comparison of field determined texture with field lab determined PSA was considered good for this investigation. The PSA evaluations were done with the hydrometer method with readings taken at 40 seconds for sand content and 7.25 hours for clay content.

Table 3-1. Summary of replicate soil salinity surveys (EM38)

Site / mode	Survey 1	Survey 2	RPD	Land use
Rip16 / EMh	51.3	49.8	3.0	Irrigated cropland
Rip 16 / EMv	62.8	66.2	5.3	Irrigated cropland
Rip 17 / EMh	55.1	55.9	1.4	Irrigated cropland
Rip 17 / EMv	60.8	63.6	4.5	Irrigated cropland
Rip 78 / EMh	47.1	45.6	3.2	Low terrace meadow
Rip 78 / EMv	75.5	75.4	< 1	Low terrace meadow
Rip 83 / EMh	92.9	82.1	12.3	Old basin rim soil with poor spots
Rip 83 / EMv	133.2	124.9	6.4	Old basin rim soil with poor spots

A few small soil samples were collected for real time soil moisture and soil salinity evaluation. These samples were run in a small field laboratory. Field moisture percent, saturation percent and ECp of the soil saturated paste were determined. The ECe level was estimated based on the ECp and the saturation percentage.

Bulk soil salinity (ECa) was also determined at a few field sites using the Hanna soil conductivity meter. Ece was estimated using a graph prepared by the USDA.

3.6 Laboratory data evaluation

Soil samples were delivered to Delavalle Laboratory in Fresno, California and the Fruitgrowers laboratory in Santa Paula, California for analysis. A wide range of plant nutrients were determined on selected samples. All samples were tested for soil salinity, sodicity, and soluble boron levels.

The Delavalle laboratory was inspected prior to sample delivery. All soil preparation methods and equipment appeared to be appropriate for soil drying, grinding, and mixing. Laboratory staff in the soil preparation rooms were very knowledgeable and aware of the importance of adequate screening, grinding and mixing of field soil samples. The analytical portion of the laboratory seemed well staffed and equipped. Two local agronomists and soil scientists indicated that Delavalle laboratory had provided acceptable soil salinity data in the past. Split soil samples were evaluated to insure consistency and a cross checking procedure was used to assess accuracy. All data from this laboratory was judged to be usable for this investigation. This data can also be used for the baseline soil salinity program but may not be as defensible for soil salinity trend analysis due to the reduced level of QA/QC samples incorporated in sample batches.

Data from the Fruitgrowers laboratory was evaluated using a more comprehensive QA/QC procedure. Double blind reference materials, split samples, blanks, as well as the cross checking procedure were used to assess data quality at this laboratory. Nearly 1 in 3 samples in the sample batches were QA samples. The Fruitgrowers laboratory data is of high quality and is considered fully usable for this investigation as well as the baseline soil salinity program.

4 Results

4.1 EM38 surveys

Em38 surveys were completed at most sites; some sites were too dry for reliable surveys. EM 38 surveys indicate variable soil salinity conditions at most sites especially drip and micro sprinkler irrigated orchards. The laboratory data discussed below provides information about soil salinity levels and salt distribution in soils, however it must be realized that the soil samples collected from 12-30 and 30-60 inches only represent a small area surrounding the sampling site. The 0-12 multi increment composite soil samples represent a 200 foot diameter area surrounding the central soil sampling site. These samples provide information on the average soil salinity levels in the area but don't provide information on salinity trends or random variability of soil salinity levels. The EM38 meter provides information on salinity spatial trends as well as random variability. Soil salinity levels estimated for each EM38 measurement at site 8 illustrate soil salinity variability at a typical cultivated site. Soil salinity is usually more variable at non-cultivated sites. This data is presented in Tables 4-1 and 4-2. This data assumes uniform soil moisture and soil clay content of the 200 foot diameter EM38 measurement area.

Table 4-1. Site 11 soil salinity (estimated ECe 0-36 inches) variability; cultivated site

Site designation RPD#	EMv (mS/m)	EMh (mS/m)	Estimated ECe 0-36 inches (dS/m)	inverted profile
11-1	61	39	1.0	No
11-2	67	48	2.25	No
11-3	73	49	2.07	No
11-4	74	53	2.73	No
11-5	61	42	1.53	No
11-6	65	44	1.65	No
11-7	55	39	1.35	No
11-8	60	43	1.77	No
11-9	70	58	3.99	No
11-10	78	54	2.66	No
11-11	61	49	2.86	No
11-12	74	54	2.92	No
Average	66.6	47.7	2.23	No

Laboratory ECe 0-30" 2.07 dS/m
ECe calculated from average EM38 measurements 2.22 dS/m
Coefficient of variation EMh = 13.2; Coefficient of variation EMv = 10.8

Table 4-2. Soil salinity variation natural range site: Rip 77

Site designation RPD #	EMv	EMh	Estimated ECe 0-36in (dS/m)	Inverted profile
77-1	94	60	3.64	No
77-2	75	50	2.90	No
77-3	118	83	6.61	No
77-4	87	56	3.30	No
77-5	91	68	5.46	No
77-6	79	53	3.23	No
77-7	87	53	2.74	No
77-8	79	51	2.84	No
77-9	68	49	3.18	No
77-10	55	38	1.84	No
77-11	44	32	1.39	No
77-12	48	31	1.00	No
77-13	82	54	3.23	No
77-14	90	57	3.31	No
Average	78.3	52.5	3.19	No

Field Laboratory ECe 0-30” 3.03 dS/m
ECe calculated from average EM38 measurements 3.19 dS/m
Coefficient of variation EMv = 25.1; Coefficient of variation EMh = 25.8

Some sites were only evaluated with an EM38 survey. A Dakota probe core was evaluated near the center of the prospective survey area to evaluate soil texture and moisture content. If soil moisture conditions were acceptable the survey was conducted.

4.2 Soil characteristics of landforms

Soil salinity evaluation sites are scattered throughout the survey area and tend to be in clusters. Access permission for soil sampling was not granted in some areas. These areas were evaluated based on NRCS soil survey data. Based on the NRCS soil type/observed soil characteristics at the sampling sites it appears the NRCS soil survey information is accurate especially in non-farmed areas. Some farmed areas have been ripped and or reclaimed from native conditions. These lands have been improved for agricultural purposes as well as establishment of some types of riparian vegetation. However these lands are generally not well suited to wetland conversion due to regional flood control measures and ripping of shallow hardpan hydraulic barrier layers.

4.3 Bypass areas inside current levees

Areas very near the low flow channel in the Eastside bypass and Mariposa bypass seem to be suitable for willows and streamside brush however areas away from the low flow stream channel are sometimes too saline/sodic for this type of vegetation. Salinity is spotty in these areas and some areas would require reclamation leaching for riparian vegetation establishment.

Long term flows in the eastside bypass should gradually reduce soil salinity in some areas especially near the low flow channels. Some of the less saline areas currently contain dense stands of cocklebur. The more saline and /sodic areas are dominated by salt grass and various scattered salt and alkali tolerant scrubs.

The low flow channels in bypasses are entrenched about 10 feet in many areas, and sometimes lower terraces are present a few feet above the low flow channels. The upper terraces usually consist of old basin soils overwashed with a relatively thin layer of recent loamy alluvial deposits.

The salinity and sodicity of the bypass areas tends to increase as one moves downstream. Areas north of the Merced refuge (Sandy Mush Road) tend to be underlain by fine textured and/or sodic basin deposits. A layer of loamy overwash is often present to a depth of 12 inches or so. The presence of high sodium levels in the substrata should greatly delay leaching of salts and reduce deep percolation in bypass areas.

4.4 Areas outside bypasses within 250 feet of levees

Some of the alternatives call for widening of the bypass areas. Most of the widening would probably be on the east side of the bypasses since valuable farmland is present along the western bypass levee south of Sandy Mush road. These farmlands are protected by interceptor drains usually located between about 50 and 100 feet from the southwest levee toe. Eastside basin rim deposits are very common in this area. Soils are often saline sodic and have a lime silica hardpan in the substrata. Soil salinity levels are variable within short distances. Soils on farmlands along the west bank have been improved by artificial drainage and land development operations.

4.5 Reach 4B1 - San Joaquin River channel

Some alternatives call for flows in the old river channel. In order to accommodate these flows the existing levees would need to be moved back and the channel deepened somewhat in many areas. These operations could destroy riparian and wetland vegetation that currently chokes the reach 4B1 channel and greatly reduces flow capacity. Surface soils in the channel are variable but sandy channel bottoms and riverbanks are common. Review of DWR levee drilling indicates finer textured basin soils are present below the recent alluvial deposits. Areas of peat were also observed in tule beds in the channel bottom. This reach seems to receive some drainage water since casual water was observed in the channel at some locations. The electrical conductivity of the casual water in the reach 4B1 channel varied from about 2.5-5 dS/m indicating the water was probably from seepage or irrigation return flows rather than natural river water leaking through the Sand Slough headgate valve structure.

4.6 Reach 4B2 - San Joaquin River channel

This reach is north of the Mariposa bypass and would receive flows from both the Mariposa bypass and river reach 4b1. Most of the soil information for this area is from land classification studies completed about 20 years ago for the San Joaquin Basin Action plan (3). Both irrigation suitability and wetland suitability were mapped in these surveys. Trace element data was also available from these studies. Since land use has not changed in the last 20 years soil salinity and

sodicity levels should still be representative of current conditions. DWR drilling logs indicate most of the area is underlain by fine textured basin deposits however some sandy paleo channels may also be present. Deep sandy soils were identified in DWR 10 foot soil borings WCLBSJ 17H and WCLRBSJ 11H, 12H, 13H, 14H and WCLRB 29H and 30H (5). Some of the areas between the existing levees are saline /sodic or sodic. Most areas near the river channel have sandy or loamy surface soils.

4.7 Natural levee areas near the San Joaquin River - 4B1 channel

In some areas natural levees occur in close proximity to the river channel. These levees appear to be very sandy. These sandy levees would probably be graded down in some areas to permit flows to spread out somewhat. Excess salts are sometimes present in the substrata however sodic soils were not encountered to a depth of five feet.

4.8 Oxbow areas

Many oxbow areas occur in the San Joaquin River 4B1 channel. It may be desirable to include some of these oxbow areas inside future levees. The Columbia soil is often present in these areas. Revegetation of these areas should be fairly easy since most of these areas have been improved by farming operations. Improvements include leveling, ripping of dense substrata and hardpans, and in some cases leaching to reduce soil salinity and sodicity levels in the soils.

4.9 Farmland within 250 feet of the San Joaquin River - 4B1 channel

In order to increase flow capacity in the 4b1 channel some areas of farmland may be retired. These areas are mostly used for small grain. The fields are irregularly shaped and are probably expensive to farm on a per acre basis. These areas are mostly east of the river channel and between a large irrigation canal and the river. Soils on these areas are commonly fine textured basin soils overwashed by recent coarse loamy to fine silty alluvium.

4.10 Common riparian plant communities observed in the survey area

- Tule marshes currently occupy areas very shallow to groundwater, the edges of free water surfaces and shallow areas of ponded water. (0-6 inch ECe 1-5 dS/m)
- Bermuda grass meadows; wet moderately saline meadows (0-12in ECe 2-8 dS/m)
- Salt bush, iodine bush and alkali scald areas slightly hummocky saline/ sodic areas (ECe 0-12in 3 to over 20 dS/m)
- Willows; wet areas near river channels (ECe less than 5 dS/m)
- Salt grass meadows; wet saline/sodic soils (ECe 0-12in 5-12 dS/m)
- Cottonwoods – slightly elevated coarse textured areas near river channels; not subject to flooding. (0-12in ECe less than 4 dS/m)
- Winter annual grasslands; slightly elevated areas away from river channels. (0-12in ECe less than 4 dS/m) but may be saline and/or sodic in the subsoils and substrata.

5 Interpretation of soil data

Soil fertility testing at selected sites generally indicated low potassium levels in the soils. Nitrate and phosphate was also somewhat low. These elements were sometimes high in highly saline surface soils but leaching of salts will also leach nitrogen and potassium out of these surface soils. The project should consider using some starter Nitrogen and Potassium fertilizer around Cottonwood and Willow seeding's planted inside levee areas. Grass meadows should not require fertilization. Current Bermuda grass and salt grass stands were fairly vigorous.

Zinc levels were variable. Sites with low zinc levels may require zinc fertilization for Willow and Cottonwood seedlings.

Boron levels were non- toxic at most sampled sites even those with an elevated ECe levels. Leaching of sites with elevated salinity levels will reduce soluble boron to even lower levels. Elevated boron levels were found in a few soils sampled north of the lower eastside bypass river channel between the north levee and the channel.

Soil sodicity levels were high at some sites and seemed to increase in downstream areas. The laboratory provided gypsum requirement levels in terms of pounds of pure gypsum per acre 6 inches of soil. The laboratory test used for gypsum requirement determinations would dissolve any native gypsum present in the soils. In some cases gypsum application amounts were estimated from ESP or SAR data and the soil texture. Only surface soils are considered for gypsum applications. Many sites have high sodium in subsoils and substrata but the costs of complete reclamation are prohibitive. Applications of gypsum are not recommended for some types of native vegetation such as salt grass or Bermuda grass.

The following sites may benefit from gypsum applications if native grass, willows, and cottonwood plantings are considered: The amount of gypsum should be increased to account for gypsum purity and by a factor of 1.25 to account for cation exchange reaction efficiency. (8) No more than 5 tons per acre is recommended for surface applications. Multiple applications are recommended in areas with a high gypsum requirement. Sulfur can be used at sites with calcareous surface soils.

5.1 Trace element testing

As part of the San Joaquin basin action plan studies, soils in areas near reach 4B2 and the lower eastside bypass were sampled for trace elements. These areas should have the highest concentrations of trace elements in the survey area due to their downstream location in the valley basin. Twelve samples were analyzed for total concentrations of a wide range of trace elements and 27 soil samples were analyzed for total selenium, arsenic, and mercury. Eight saturation extracts were analyzed for boron and mercury. The results of this testing are summarized in Table 5-1.

Total concentrations of trace elements in soil were found to at levels commonly found in soils of the western states. Soluble trace elements were generally non-toxic to plants with the possible exception of boron at a few sites in the northern portion of the survey area. Ten sites had boron

levels above 1 ppm in the saturation extract, this level is high enough to reduce growth in some boron sensitive plants.

Table 5-1. Gypsum requirements at selected sites

Site Rip	Texture (est. CEC)	SAR	ESP	Estimated gypsum requirement (tons of sulfur per acre foot to reduce ESP to 10)
1	Lt sicl (28)	-	24.0	8.3
5	Loam (20)	-	62.1	17.7* (3.3)
7a	Lt loam (15)	-	34.1	7.7* (1.4)
25	H sil (25)	24.5	26	8.5* (1.6)
33	Loam (20)	21.4	22	5.1
36	H sil (25)	32.8	32	11.7
38	Loam (20)	44.9	38	11.9* (2.2)
53	Lt Sic (35)	29.7	30	14.9* (2.8)
54	Lt sicl (28)	31.9	31	13.0
70	Loam (20)	14.3	16	2.0

*Calcareous sample

Boron is an essential element for plants and non-essential for animals. Animals are fairly tolerant of boron. Plant sensitivity varies widely. Toxic levels range from 1 ppm for sensitive plants such as citrus to greater than 10 ppm for tolerant plants. Many wetland plants such as bulrush, sedge, cattail, and duckweed are very tolerant to boron and even bioaccumulate boron. Available boron in soils ranged from less than 0.1 ppm to about 5.87 ppm in soils of the survey area. The higher boron levels generally occurred in the northern portion of the survey area on rangelands away from the river. Some sites within the levees of the eastside bypass / Bear creek channel had elevated soluble boron levels. Boron seemed to be associated with high soluble sodium levels in the subsoils. It appears that very little leaching occurs in these soils despite historic occasional flooding from flood flows.

The 1997 soil study found that mercury was at levels exceeding aquatic life criteria in 5 soil samples out of 8. In general the detection limit for mercury was too high for a good evaluation of mercury toxicity potential on the other three samples. Since aquatic life criteria is applied in receiving waters it is difficult to evaluate the relationship between soil concentrations and the concentrations in receiving waters. All elevated mercury levels were found in areas outside the levees. Mercury is non-essential for both plants and animals but mercury can be highly toxic to algae and to animals.

5.2 Volume of leaching water needed

The volume of leaching water is dependent on the initial soil salinity level, the desired salinity level, and the depth of soil that will be leached to the target soil salinity level. The salinity of the leaching water is also a consideration. Table 5-2 assumes use of Delta Mendota canal water for leaching. Use of very low salinity San Joaquin River water would decrease water infiltration and penetration rates especially on sodic soils. Table 5-2 also estimates the leaching water volumes

needed for sites with a surface soil ECe over 4. Reclamation leaching is not required at other sites. Leaching of salts may be appropriate at some sites that are currently outside of the bypass prior to planting cottonwoods or willows. The target surface soil ECe is 2dS/m, and the projected plants are cottonwood and willow trees. Leaching water is assumed to be applied intermittently and assumes an extra two inches of water would be needed to bring the surface soil to the field capacity level to the 1 foot target depth. Table 5-2 is based on data (7) that indicates a leaching water depth of 50 percent of the soil depth will leach about 50 percent of the salts. More recent data presented in FAO paper 29 (9) indicates that intermittent leaching with 0.5 unit depth of water will remove about 70 percent of the salts present initially.

Table 5-2. Estimated volume of leaching water needed at selected soil sampling sites

Site Rip	Initial ECe 0-12 in (dS/m)	Volume of applied water (inches)	Volume of leaching water (inches)	Final ECe (dS/m)
1	6.93	8	6	3.5
5	40.2	20	18	5.0
18*	4.68	8	6	2.4
23	4.23	8	6	2.2
36	5.87	8	6	2.9
38*	4.16	8	6	2.1
50	4.64	8	6	2.3

*Sites are affected by shallow groundwater, may be very hard to leach unless the water table is lowered.

5.3 Soil available water holding capacity estimates

Estimates of soil available water holding capacity (AWC) were developed by dividing the saturation percentage by 4 and multiplying the result by the estimated bulk density of the soil zone. Bulk density estimates ranged from 1.1-1.5grams/cubic centimeter based on soil texture and soil profile notes. Values were usually rounded high to account for soil profile stratification effects on moisture retention. Table 5-3 lists estimated soil water holding capacity for all sites. AWC is the amount of water a soil can store for plant use. In some cases the saturation percentage is very high due to excess sodium therefore the AWC was limited to 0.2 inches per inch. The total AWC was limited to 12 inches in a five foot soil profile.

5.4 Undesirable plants

The eastside bypass currently contains dense growths of cocklebur in some areas. This weed provides very poor habitat, is toxic to livestock, and should be replaced with more desirable vegetation. This weed seems to colonize low terraces that are non-saline.

Other undesirable plants include Salt cedar, Russian olive, Poison oak (*Toxicodendron diversilobum*), and Arundo. These plants have the potential to invade the area however they are not common at the present time in the survey area.

Table 5-3. Available water holding capacity (AWC).

Site Rip	AWC 0-12 (inches)	AWC 12-30 (inches)	AWC 30-60 (inches)	AWC total 0-60 (inches)
1	1.26	3.57	4.1	8.93
2	2.23	3.40	5.88	11.43
5	1.66	2.39	3.49	7.54
6	2.19	2.75	3.68	8.62
8	2.05	2.22	3.99	8.26
9	1.94	2.40	4.39	8.73
10	1.48	1.09 Hp	0.00	2.57 (Hp 20)
11	1.12	2.65	5.46	10.35
12	1.16	2.16	3.61	6.93
16	1.14	2.15	4.27	7.56
17	2.08	2.80	3.94	8.82
18	1.89	2.84	4.17 Hp	8.9 (Hp 55)
25	2.25	3.6 L	2.84	8.69
28	2.4 L	3.6 L	3.45	9.45 (Hp 43)
30	2.29	3.6 L	6.00 L	11.89
31	1.68	3.33	2.23	7.24
33	1.64	3.6 L	6.00 L	11.24
34	1.52	3.6 L	5.20	10.32
35	1.53	2.01	4.44	7.98
36	1.97	3.6 L	5.73	11.48
37	1.35	2.58	5.48	9.41
38	1.87	3.6 L	6.0 L	11.47
39	1.67	3.18	6.00 L	10.85
42	1.64	3.04	6.00	10.68
44	1.47	3.44	3.41	8.32
45	1.63	3.49	4.00	9.12
47	1.50	2.24	3.69	7.43
48	2.09	3.6 L	4.42	10.35
50	1.72	2.53	4.02	8.27
53	2.40 L	3.6 L	6.00 L	12
54	2.4 L	3.6 L	4.60	10.6
56	2.02	3.06	6.00 L	11.08
58	2.31	3.6 L	6.00 L	11.91
59	2.12	3.6 L	5.23	10.95
60	2.15	2.46	2.44	7.05
61	1.38	1.59	3.54 Hp	6.51 (Hp 57)
65	1.99	2.86	4.46	9.31

Site Rip	AWC 0-12 (inches)	AWC 12-30 (inches)	AWC 30-60 (inches)	AWC total 0-60 (inches)
66	1.74	2.11	3.61	7.46
67	2.23	3.6 L	5.86	11.69
69	1.33	2.49	6.00 L	9.82
70	1.42	2.95	5.75	10.12
71	2.10	3.15	4.84	10.09

L = limited
Hp = hardpan

6 Recommendations

Some areas are covered by the SJRRP baseline soil salinity sampling sites and some areas are covered by Reclamation wetland suitability studies completed in the late 1990s. Soil data from these studies should still be accurate especially in dryland areas. These surveys should be used in areas where soil sampling was not conducted. For example a large area of the eastside bypass downstream of the Mariposa bypass and upstream of the confluence with Bear creek was not sampled. Since the area is mostly rangeland the old soil survey salinity and sodicity data in the areas outside the bypasses should still be accurate.

Use NRCS data in areas where access was denied. The NRCS data appears to be very accurate in the areas sampled. NRCS Web Soil Surveys could be used on the Sloan ranch area. This area is mostly rangeland and the sodicity and salinity data from the soil survey should still be accurate. Nearly all the NRCS Soil Mapping Unit delineations contain some minor inclusions of other soil series.

Willow/ cottonwood revegetation should be limited to the areas immediately surrounding the low flow channels in the bypass areas. Too much vegetation in the bypass areas will reduce flood flow capacity. Grazing should be maintained in these areas. Areas away from the low flow channel should be managed for rangeland. A mixture of desirable range grasses and legumes would be ideal for the higher terraces. Bermuda grass and salt grass should colonize some of the areas on the lower terraces near the low flow channel. Excess sodium in the substrata causes impermeable soil layers and greatly reduces deep percolation potential in many areas of the east side bypass. Deep percolation would be higher if the old 4B1 and 4B2 river channels were used to convey water.

The 4B1 river channel currently is overgrown with riparian and wetland vegetation. Much of this vegetation would probably be destroyed if the 4b1 channel was modified to carry significant flows of water. The 4B1 and 4B2 river channels have many meanders. This would increase the distance the flows travel and could have implications for water temperature, deep percolation losses, and flow losses due to water use by riparian vegetation.

7 References

(1) Soil survey of Merced Area, California; NRCS; 1950
(2) Soil survey of Merced County California; Western part; NRCS; 1983
(3) Soil Investigation of East and West Gallo Properties; Bureau of Reclamation; March 6, 1997
(4) Soil Salinity Monitoring Report 2013; Technical Memorandum; Appendix B and C; SJRRP; February 2014
(5) Geotechnical Data Report; volumes 1 of 2 and 2 of 2; San Joaquin river restoration program; priority two study area; California Department of Water Resources; February 2018
(6) Landscape plant lists for salt tolerance assessment; Miyamoto S. etal April 2004
(7) Examining salt tolerance of willow (salix spp) bioenergy species for use on salt affected agricultural lands. Hangs R. D. Canadian journal of soil science; 2011
(8) USDA Handbook 60 Diagnosis and improvement of saline and alkali soils; issued 1954; revised 1969;
(9) FAO Handbook 29; Water quality for agriculture; 1984

Appendix A: Soil Survey Site Location Maps

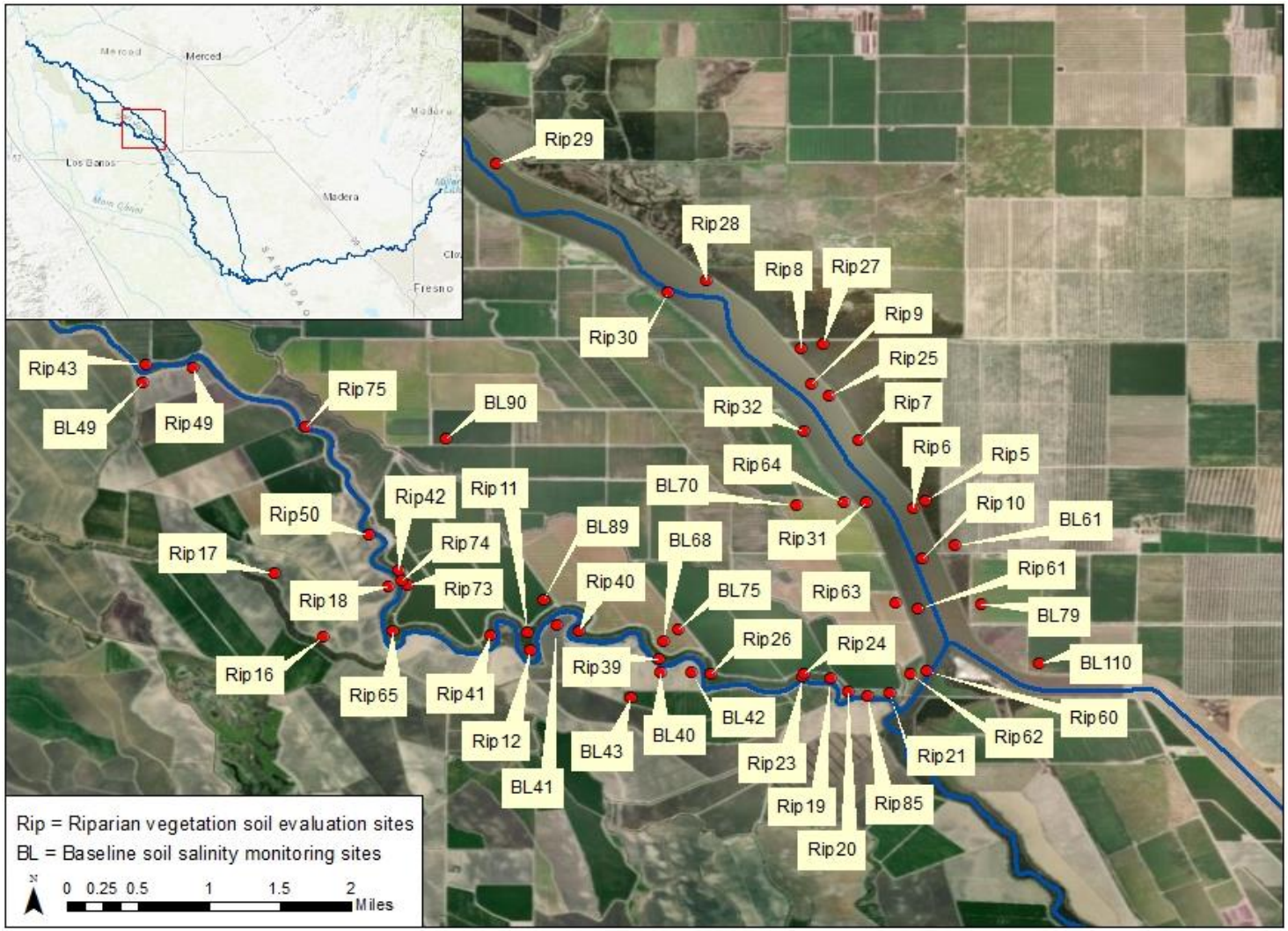


Figure 0-1. Soil survey site locations.

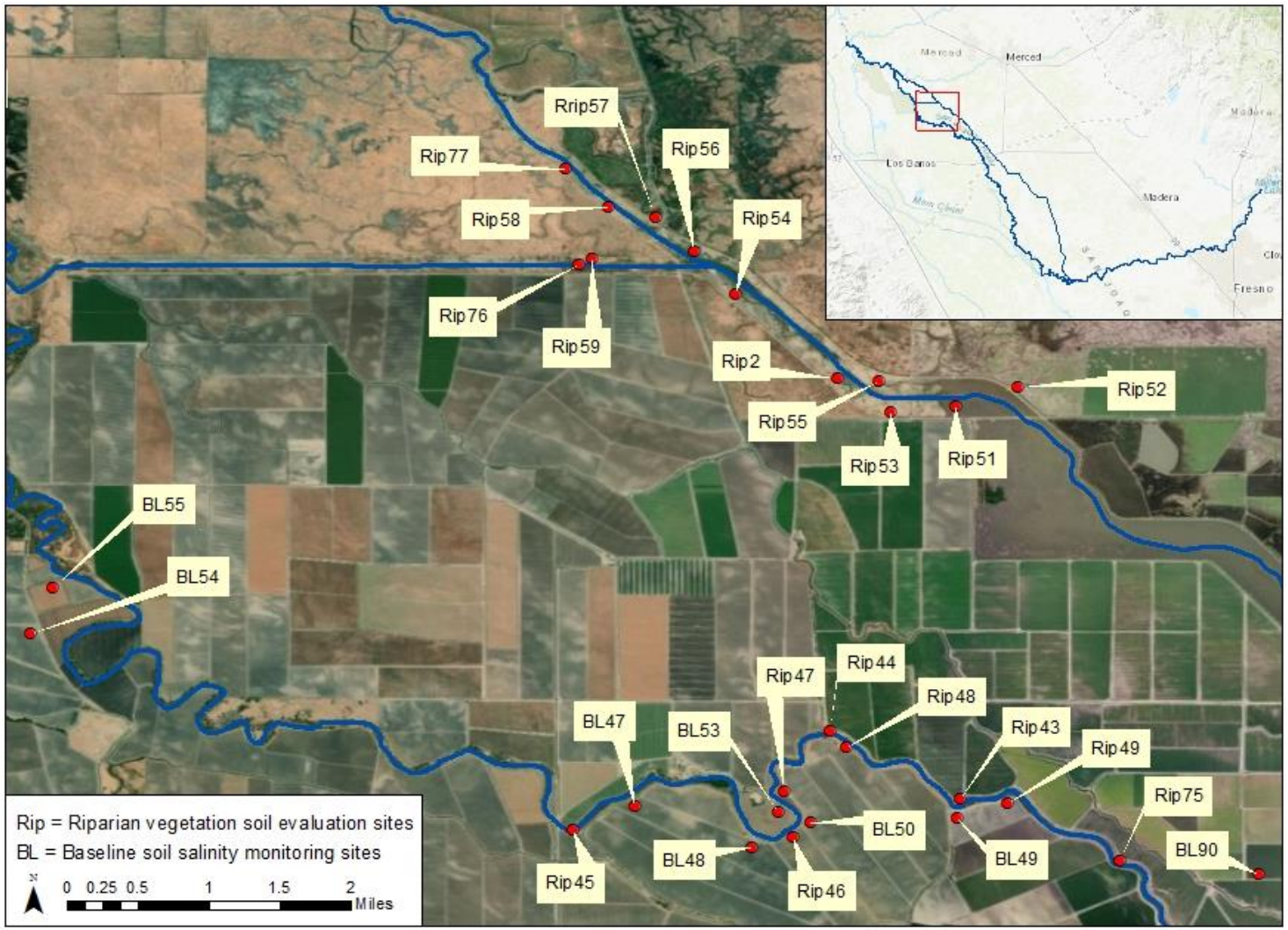


Figure 0-2. Soil survey site locations.

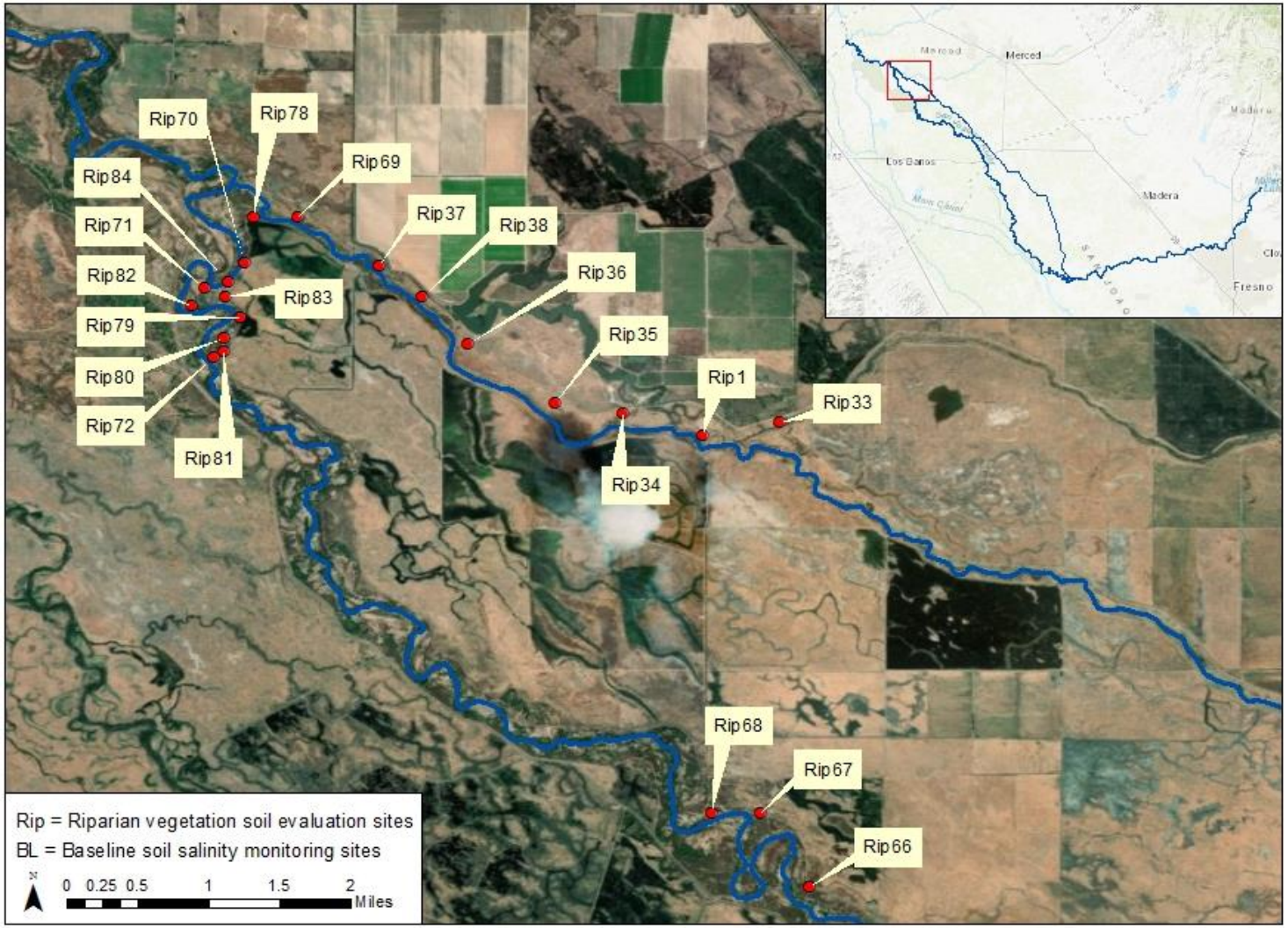


Figure 0-3. Soil survey site locations.

Appendix B: Soil Survey Site Coordinates

Site ID	Lat	Lon
Rip1	37.25391	120.77943
Rip2	37.19016	120.67857
Rip3	36.78667	120.36479
Rip4	36.78917	120.37160
Rip5	37.13326	120.58672
Rip6	37.13260	120.58795
Rip7	37.13944	120.59342
Rip8	37.14891	120.59941
Rip9	37.14527	120.59826
Rip10	37.12744	120.58697
Rip11	37.11991	120.62718
Rip12	37.11815	120.62701
Rip13	36.78960	120.36761
Rip14	36.79048	120.36636
Rip15	36.79002	120.36501
Rip16	37.11950	120.64802
Rip17	37.12587	120.65309
Rip18	37.12460	120.64146
Rip19	37.11526	120.59630
Rip20	37.11386	120.59452
Rip21	37.11378	120.59030
Rip23	37.11544	120.59914
Rip24	37.11571	120.59911
Rip25	37.14405	120.59644
Rip26	37.11570	120.60850
Rip27	37.14933	120.59706
Rip28	37.15584	120.60906
Rip29	37.16776	120.63038
Rip30	37.15455	120.61294
Rip31	37.13312	120.59277
Rip32	37.14037	120.59899
Rip33	37.25520	120.77168
Rip34	37.25623	120.78762
Rip35	37.25721	120.79461
Rip36	37.26332	120.80352

Site ID	Lat	Lon
Rip37	37.27129	120.81254
Rip38	37.26801	120.80818
Rip39	37.11722	120.61378
Rip40	37.12006	120.62192
Rip41	37.11964	120.63108
Rip42	37.12619	120.64037
Rip43	37.14724	120.66608
Rip44	37.15420	120.67941
Rip45	37.14402	120.70559
Rip46	37.14333	120.68314
Rip47	37.14803	120.68403
Rip48	37.15252	120.67774
Rip49	37.14683	120.66131
Rip50	37.12986	120.64336
Rip51	37.18739	120.66656
Rip52	37.18928	120.66022
Rip53	37.18675	120.67324
Rip54	37.19884	120.68903
Rip55	37.18997	120.67439
Rip56	37.20315	120.69320
Rrip57	37.20661	120.69712
Rip58	37.20777	120.70196
Rip59	37.20237	120.70368
Rip60	37.11603	120.58659
Rip61	37.12226	120.58743
Rip62	37.11568	120.58828
Rip63	37.12285	120.58978
Rip64	37.13322	120.59492
Rip65	37.12002	120.64095
Rip66	37.20778	120.76867
Rip67	37.21531	120.77356
Rip68	37.21535	120.77862
Rip69	37.27622	120.82082
Rip70	37.27161	120.82624
Rip71	37.26904	120.83034

Site ID	Lat	Lon
Rip72	37.26189	120.82937
Rip73	37.12479	120.63954
Rip74	37.12524	120.64009
Rip75	37.14085	120.64980
Rip76	37.20184	120.70499
Rip77	37.21164	120.70639
Rip78	37.27619	120.82536
Rip79	37.26590	120.82666
Rip80	37.26389	120.82841
Rip81	37.26249	120.82831
Rip82	37.26722	120.83160
Rip83	37.26812	120.82818
Rip84	37.26952	120.82781
Rip85	37.11347	120.59263
BL40	37.11576	120.61376
BL41	37.12060	120.62429
BL42	37.11580	120.61058
BL43	37.11331	120.61670
BL46	37.13351	120.69548
BL47	37.14653	120.69930
BL48	37.14231	120.68734
BL49	37.14531	120.66642
BL50	37.14479	120.68125
BL53	37.14596	120.68462
BL54	37.16418	120.76085
BL55	37.16873	120.75858
BL61	37.12873	120.58365
BL68	37.11902	120.61333
BL70	37.13292	120.59976
BL75	37.12015	120.61181
BL79	37.12283	120.58097
BL89	37.12322	120.62559
BL90	37.13960	120.63561
BL110	37.11679	120.57509

Appendix C: Soil Profile Logs

SJR riparian vegetation suitability study

Well or Boring# rip 1 Sampler: brummer lee Date: 10/17/2016

location wgs84 utm 0696931 4125351 wp362 Landform basin NRCS Map Unit waukena

Location Notes on low terrace 100 ft north of river

Topography gently undulating Vegetation & Conditon scattererd saltgrass and annual grasses

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches 18 Soil Temperature, ^{0}C (2") _____ (16") _____

Estimated water holding capacity 0-60" 8.9 in Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-14	lt sicl	28	25	gray		dry	none				very hard, 0-4in platy
	14-30	cl	28	30	gray		sm	none				hard, few hp fragments
	30-40	h loam	24	30	dkgrbr		sm	few				friable
	40-48	sil	20	20	grbrown		nd	few				hard
	48-54	loam	18	35	grbrown		nd	few				hard
	54-60	sil	16	20	lt gray		nd	few				ESP Boron GR tons/ac6in
	0-4 12xcomp					0			6.6	6.93	46	24.0 0.8 1.9
	0-12					++			7.4	11.1	42	36.3 0.7 3.3
	12 to 30					+			9.2	18.7	61	75.4 1.4 16.7
	30-60					++			8.4	33.9	42	70.0 0.2 7.8
jb	0-12						7.1			7.3e	50.3	field replicate
jb	0-4 12xcomp	loam	20.5	32	2.5y 4/2		5.3			6.2e	46.2	field split

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

too dry for em38; area appears saline sodic; 30-60in few carbonates

mottles are faint; no water table or cap fringe to 60in

54-60in soft

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip2 Sampler: brummer, lee Date: 10/17/2016

location wgs84 37.19016 120.67857 wp363 Landform basin NRCS Map Unit merced

Location Notes reach 4b1 middle eastside bypass

Topography nearly level Vegetation & Conditon native grasses. Curly cup gumweed

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches 4 feet Soil Temperature, ^{0}C (2") _____ (16") _____

Estimated water holding capacity 0-60" 11.2 in Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	lt cl	28	35	vdk gray		nd	none				brown clods on surface
	12to40	clay	45	30	vdk gray		sm	none				very firm
	40-53	loam	24	35	olbrown		sm	few				firm
	53-60	hsl	18	55	olgray		sm	few				friable common carbonates
												esp boron gyp req tons/ac6in
	0-4 comp 12x					0			6.1	1.8	59	0.2 0.3 0.0
	0-12					0			6.1	1.63	62	2.5 0.3 0.0
	12to30					0			7	1.61	63	8.9 <0.01 0.0
	30-60					+++			7.8	3.92	56	18.4 <0.01 0.8
jb	22-26	clay	45.5	25.5	2.5y 3/1		15.2			1.83e	66.5	

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

too dry for em38; 40-53in common seg carbonates

heavy grass cover; no water table or cap fringe to 60in

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip3 Sampler: brummer,lee Date: 10/18/2016

location wgs84 36./8667 120.36479 wp329lee Landform floodplain NRCS Map Unit columbia

Location Notes 100 feet north of drain ditch

Topography nearly level Vegetation & Conditon grasses, no alfalfa; mostly pidgeon grass

Irrigation System Type: gravity Irrigation Quadrant 5//5

Avg EM Measurements; EM_V 14 EM_H 7 EM Calibration Site: EM_V 13.9 Emh 7.3

Root depth inches 36in Soil Temperature, ^{0}C (2") 82f (16") 67f

Estimated water holding capacity 0-60" 9.3 in Em38 est Ece 0-36" less than 2.0

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-17	sil	15	30	brgray		sm	none				very friable
	17-30	lt loam	12	40	grbrown		moist	common				very friable
	30-55	loam	21	30	dkgrbr		vm	many				friable
	55-70	sand	1	95	lt gray		sm	few				loose single grained
												esp boron gr tons/ac6in
	0-6 12xcomp					0			5.6	2.61	54	1.9 0.6 0.0
	0-12					0			5.5	2.18	56	2.1 0.6 0.0
	12to30					0			6.2	1.02	59	2.6 0.4 0.0
	30-60					0			5.9	0.65	39	3.3 0.3 0.0
jb	36-40	loam	15.5	35	2.5y 3/2		22.1			0.5e	49.5	

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

no water table or capillary fringe to 70 inches; alfalfa drowned out in area;

too dry for Emh reading

ok for Emv reading

lime requirement 10100 pounds top 6 inches of soil.

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H
14	8	14.1	7.2
14	5	12.2	7.1
15.5	7.8		
14.2	8.2		
14.5	7.6		
12.9	7.7		

SJR riparian vegetation suitability study

Well or Boring# rip4 Sampler: brummer, lee Date: 10/18/2016

location wgs84 36.78917 120.37160 wp326lee Landform low terrace NRCS Map Unit fill

Location Notes about 150 feet from river

Topography undulating Vegetation & Conditon riparian brush and grassy meadows

Irrigation System Type: dry Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches _____ Soil Temperature, ^{0}C (2") _____ (16") _____

Estimated water holding capacity 0-60" 8.6 in Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	vsfl	5	60	brgray		nd	none				very friable soft
	12to60	vfsl	7	55	grbrown		sm	none				very friable
												esp boron gypreq
	0-12 30xcomp					0			6.8	6.03	47	3.8 1.5 0.0
	12to30					0			6.4	4.95	54	10.4 0.9 0.0
	30-60					0			5.5	4.98	52	11.1 0.4 0.0

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

no 0-12 sample; no water table or cap fringe to 60in; too dry for EM;
land is slightly elevated; may be fill from river or pool dredging;
12-60in includes layers of sil and loam in spots

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip5 Sampler: brummer, schubert Date: 10/24/2016

location wgs84 37.13336 120.58672 wp364 Landform basin NRCS Map Unit fresno

Location Notes 150 feet est of levee

Topography nearly level Vegetation & Conditon native grasses; salt grass in spots

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches 42inches Soil Temperature, ^{0}C (2") _____ (16") _____

Estimated water holding capacity 0-60" 6.9 in Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-14	loam	20	40	gray		dry	none				soft
	14-30	loam	17	40	gray		nd	none				common roots
	30-57	sl	14	60	grbrown		sm	none				few roots
	51-62	ls	3	85	brown		sm	few				hp reminant
												esp boron gr tons/ac6in
	0-612xcomp					+++			7.3	40.2	46	62.1 1.3 7.4
	0-12					+++			8.3	3.77	47	28.5 1.0 6.3
	12to30					+++			8.3	7.89	38	31.9 0.5 4.2
	30-60					+++			7.7	11.2	31	24.2 0.2 1.5

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

30-51 few hp fragments; too dry for EM;

no water table or capillary fringe to 62 inches; slightly cemented at 50 inches;

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip6 Sampler: brummer, schubert Date: 10/24/2016

location wgs84 37.13260 120.58795 wp 365 Landform basin NRCS Map Unit fresno

Location Notes 150 feet south west of levee; in ES bypass

Topography nearly level Vegetation & Conditon dry star thistle and grasses

Irrigation System Type: dry rangeland Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches 48in plus Soil Temperature, ^{0}C (2") _____ (16") _____

Estimated water holding capacity 0-60" 8.7 in Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-8	loam	18	40	lt gray		dry	none				soft
	8to28	sl	10	60	lt gray		nd	none				contains 2 very hard layers
	28-40	loam	17	35	brgray		sm-m	none				few hp fragments
	40-63	loam	17	40	grbrown		vm-wet	few				oxic; contains hp fragments
	63-75	sil	15	35	dk grbr		wet-sat	few				segregated carbonates
												esp boron greq tons/ac6in
	0-612xcomp					++			7.1	3.84	52	1.1 0.2 0.0
	0-12					++			7.1	7.41	61	5.1 0.3 0.0
	12to30					++			7.8	1.9	47	2.0 <0.1 0.0
	30-60					++			8	1.16	35	0.7 <0.1 0.0
jb	49-51	lt sil	10.5	35	2.5y 5/3		23.4			1.00e	37	above field cap, oxic

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

cappillary rise to 28 inches; site is in es bypass; 40-63in faint mottles;
Water table 71in after 15 minutes;
capillary fringe 40-71 inches
no water uptake by plants ; cap rise to 28 inches;
8-28in many hp fragments; 63-71 anoxic; 40-63 near or above field capacity; 28-40 below field capacity
anoxic zone 10 inches thick; Capillary fringe zone 31 inches thick; total capillary rise 43 inches

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip7 Sampler: brummer schubert Date: 10/26/2016

location wgs84 37.13944 120.59342 wp366 Landform basin NRCS Map Unit fresno

Location Notes 120ft from levee toe, in es bypass

Topography nearly level to undulating Vegetation & Conditon weeds, salt grass, bermuda, native annual grasses

Irrigation System Type: dryland range Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches 29 inches Soil Temperature, ^{0}C (2") _____ (16") _____

Estimated water holding capacity 0-60" 3.4 in to 29in Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-7	lt loam	14	38	grey		dry	none				soft
	7to29	loam	20	35	lt grey		nd	none				hard few hp fragments
		hp										
												esp boron gypreq t/ac6in
	0-6	12x comp				++			7.6	2.41	49	2.9 0.2 0.0
	0-12					++			7.6	1.53	42	2.5 0.2 0.0
	12to29					++			8	1.06	33	3.7 0.1 0.0
7a	0-6 4xcomp					++			8	15.3	42	34.1 0.6 1.0

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: Numeric values indicate percent moisture by weight.

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H

stopped by hardpan at 29 inches; sample 7a collected 160 feet southwest of site in low area with green saltgrass and salt tolorant weeds

Eca low area 6.49, 2.54, 7.01 ds/m; estmated Ece 18.0 dS/m;

7a area is affected by capillary moisture from water table; water in nearby coffee colored stagnant pond EC 8.1 dS/m

SJR riparian vegetation suitability study

Well or Boring# rip8 Sampler: brummer, schubert Date: 10/24/2016

location wgs84 37.14891 120.59941 wp367 Landform basin NRCS Map Unit fresno

Location Notes 200 ft se of levee

Topography nearly level Vegetation & Conditon weeds, range grasses

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches few roots to 60 inches Soil Temperature, ^{0}C (2") _____ (16") _____

Estimated water holding capacity 0-60" 8.3 in Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-14	sil	22	25	dk gray		nd	none				soft
	14-27	sil	24	25	dk gray		sm	none				hard
	27-42	loam	18	35	brgray		moist	few				few hp fragments
	42-61	loam	17	45	brgray		moist	few				few hp fragments
												esp boron gypreq t/ac6in
	0-612xcomp					++			7.4	3.74	55	6.3 0.4 0.0
	0-12					++			7.6	2.37	57	4.1 0.3 0.0
	12to30					++			7.9	7.74	38	14.1 0.2 0.7
	30-60					++			7.6	1.76	38	11.9 0.1 0.4

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

no water table or cap fringe to 61 inches;

27-61in thin hp layers in spots otherwise friable;

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip9 Sampler: brummer, schubert Date: 10/24/2016

location wgs84 37.14527 120.59826 wp369 Landform basin NRCS Map Unit fresno

Location Notes 200 feet sw of levee in ES bypass

Topography nearly level Vegetation & Conditon bermuda, salt grass, and thistles

Irrigation System Type: dryland range Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches over 36in Soil Temperature, ^{0}C (2") _____ (16") _____

Estimated water holding capacity 0-60" 8.8 in Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-8	sil	22	20	dkgray		dry	none				soft
	8to21	sil	20	20	gray		nd	none				hard
	21-31	loam	20	35	gray		sm	none				friable
	31-42	loam	21	40	olgray		moist	none				segregated carbonates
	42-54	loam	17	40	olgray		moist	none				few hp fragments
	54-60	loam	17	35	grbrown		vm	few				friable
	60-62	sl	10	65	grbrown		m	few				friable
												esp boron gypreq t/ac6in
	0-612xcomp					+			7	3.85	61	6.9 0.4 0.0
	0-12					++			7.5	4.22	54	13.1 0.2 0.3
	12to30					++			7.7	5.71	41	13.0 0.2 0.6
	30-60					++			7.8	1.07	45	6.0 <0.1 0.0
jb	55-59	loam	15	40	2.5y 5/2		20.3			1.38e	34.1	above field capacity

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

54-60in faint rust mottles;

no water table to 62 inches.

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip 10 Sampler: brummer, schubert Date: 10/24/2016

location wgs84 37.12744 120.58687 wp370 Landform basin NRCS Map Unit fresno

Location Notes 120 feet south of road; in bypass future floodplain

Topography nearly level Vegetation & Conditon star thistle and weeds

Irrigation System Type: dryland range Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches 20 inches Soil Temperature, ^{0}C (2") _____ (16") _____

Estimated water holding capacity 0-60" 2.6 in to 20in Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-3	fsl	10	60	gray		dry	none				soft, platy
	3to20	lt loam	12	45	lt gray		nd	none				soft
	hp											
												esp boron gypreq t/ac6in
	0-612xcomp					0			7.2	2.04	41	0.7 0.1 0.0
	0.12					0			7.6	1.89	41	<0.1 0.1 0.0
	12to20					++			7.5	1.13	39	1.2 0.1 0.0

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

stopped by hardpan at 20 inches;

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip11 Sampler: brummer, lee Date: 10/27/2016

location wgs84 37.11991 120.62718 wp327lee Landform natural levee NRCS Map Unit columbia/ merced

Location Notes 150 feet inside ditch/levee

Topography nearly level Vegetation & Conditon corn stubble

Irrigation System Type: gravity Irrigation Quadrant 2//5

Avg EM Measurements; EM_V 67 EM_H 48 EM Calibration Site: EM_V 73 emh 49

Root depth inches Soil Temperature, ^{0}C (2") 69 (16") 67

Estimated water holding capacity 0-60" 9.3 in Em38 est Ece 0-36" 2.46 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-22	sl	15	55	grbrown		sm-m	none				friable
	22-36	sicl	32	20	vdkgray		moist	none				firm, buried soil
	36-42	sicl	32	20	dkgray		moist	none				firm
	42-60	cl	30	30	olgray	++	moist	none				firm, segregated carbonates
												esp boron gypreq t/ac6in
	0-1230xcomp					0			7.1	2.11	32	3.7 <0.1 0.0
	0-12					0			6.6	2.23	34	3.6 0.2 0.0
	12to30					0			7.2	2.02	49	4.2 0.1 0.0
	30-60					++			7.6	1.2	56	4.1 <0.1 0.0
jb	0-12											
jb	30-34	sicl	36	17.5	2.5y 4/1		21			1.88e	58.1	

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

oxbow area; no water table or capillary fringe to 60in;soil surface dry;

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H
61	39	55	39
67	48	60	43
73	49*	70	58
74	53	78	54
61	42	61	49
65	44	74	54

SJR riparian vegetation suitability study

Well or Boring# rip 12 Sampler: brummer, lee Date: 10/27/2016

location wgs84 37.11815 120.62701 wp328lee Landform natural levee NRCS Map Unit riverwash

Location Notes 100-150ft from river channel; 12a in river channel about 250 ft sw of site 12

Topography nearly level Vegetation & Conditon corn stubble

Irrigation System T 12.2 gravity Irrigation Quadrant 5//5

Avg EM Measurements; EM_V 29 emh 22 EM Calibration Site: EM_V 19 emh 13.7

Root depth inches about 4 feet Soil Temperature, ^{0}C (2") 69 (16") 67

Estimated water holding capacity 0-60" 7.0 in Em38 est Ece 0-36" 1.73 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-18	fsl	9	60	brgray	0	sm-m	none				very friable
	18-39	lt fsl	7	75	brgray	0	moist	none				very friable
	39-61	lfs	5	80	rdbrown	0	vm	common				very friable
	61-75	sand	2	90	ltgrbr	0	vm-wet	common				single grained; loose
												esp boron gypreq t/ac6in
	0-1230xcomp					0			7.4	1.66	40	3.6 0.1 0.0
	0-12					0			6.9	1.36	42	4.6 <0.1 0.0
	12to30					0			7.1	1.15	40	4.0 <0.1 0.0
	30-60					0			7.2	0.79	37	4.9 <0.1 0.0
jb	0-12	fsl	12.5	53.5	2.5y 4/2		12.2			1.34e	35.9	
12a	0-3									0.6e		river bottom thalweg

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

point of oxbow; 39-75in prominent rust mottles; no water table to 76in;

70-76in wet may be top of cappilary fringe;

sample 12a Eca measurement in tule bed in river bottom. Eca = 0.12dS/m

em38 survey indicates slightly higher salinity and/or finer texture north of boring site

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H
40	32	18	9
44	32	19	12
41	37	22	14
49	39	25	20
43	37	30	23
22	13	18	12*

SJR riparian vegetation suitability study

Well or Boring# rip 13 lopes 1 RV Sampler: brummer, lee Date: 3/28/2017

location wgs84 36.78960 120.36761 Landform low terrace NRCS Map Unit chino loam slt salin

Location Notes wp 359

Topography nearly level Vegetation & Conditon good young almonds

Irrigation System Type: drip Irrigation Quadrant 4//5

Avg EM Measurements; EM_V 57 Emh 47 EM Calibration Site: EM_V Emh

Root depth inches 60 Soil Temperature, ^{0}C (2") 20 (16") 15.6

Estimated water holding capacity 0-60" 9.25in Em38 est Ece 0-36" 3.12 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-18	sil	17	25	dk gray	0	vm	none				friable
	18-24	sil	17	25	dk gray	0	wet	none				friable
	24-42	vfsl	5	60	brown	0	wet	none				very friable
	42-50	lt cl	30	35	dk gray	0	wet	few				firm
	50-57	ls	5	80	olgray	0	wet	few				friable
	57-66	h loam	26	35	dk gray	0	saturated	common				firm
												sar boron
	0-12 30x	comp					19.2		6.01	2.45	57.6	3.1 0.31 lee
	0-12						23.4		6.53	4.26	52.6	2.7 0.06
	12to30						23.8		7.21	4.3	45.1	6.0 0.31
	30-60						24.1		7.29	4.66	39.8	18.1 0.81

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

river flow about 4000 cfs; field may have been built up; cf 18-61 in 25-68 TOB;
field is 3 feet higher than area to north; water table 61in from orchard floor
boring depth measurements from floor of orchard; water table 68 inches from top of tree berm.
boring is 150 feet north of ponded low area.

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H
54	44	55	43
69	53	52	50
63	44	45	42
65	47	50	45
49	41	64	50
66	56	51	45

SJR riparian vegetation suitability study

Well or Boring# Rip 14 lopes 2 RV Sampler: brummer, lee Date: 3/28/2017

location wgs84 36.79048 120.36636 Landform low terrace NRCS Map Unit chino loam slt salin

Location Notes 200 feet into the orchard wp360 lee

Topography nearly level Vegetation & Conditon good almonds

Irrigation System Type: drip Irrigation Quadrant 4//5

Avg EM Measurements; EM_V 39 EM_H 33 EM Calibration Site: EM_V 44 Emh 30

Root depth inches 60 inches Soil Temperature, ^{0}C (2") 25.6 (16") 15.6

Estimated water holding capacity 0-60" 7.5 Em38 est Ece 0-36" 1.08 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-14	loam	12	50	dkgray		vm	none				very friable
	14-23	sil	15	25	dkgray		vm	none				very friable
	23-34	fsl	8	60	brown		vm-wet	few				very friable
	34-39	sl	12	70	dkgray		vm-wet	few				friable
	39-54	ltsl	6	75	brgray		wet	few				very friable
	54-60	sand	2	90	brgray		saturated	few				single grained, loose
												sar boron
	0-12 30x comp	lt loam	14	50	10yr 4/1	dk gray	16.4		6.38	2.56	43.4	2.6 0.26
	0-12						16.5		6.18	0.46	42.6	2.1 0.41
	12to30						20.4		6.95	1.3	42.9	6.0 0.46
	30-60						14.2		6.57	2.2	28.9	7.3 0.73
jb	19-21	sil					22.1			1.27e	47.3	ecp 0.60 near field capacity

[1] Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong

[2] Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

suction at 54 inches; water table 49 inches; 56in top of bed;

capillary fringe 39-49in; 46-56 top of bed;

site is 250 feet north of ponded area;

all soil profile measurements are from orchard floor;

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H
33	36	40	29
40	35	43	35
37	30	44	30
44	35	41	27
43	31	32	32
51	34	37	28

SJR riparian vegetation suitability study

Well or Boring# Rip 15 lopes 3 rv Sampler: brummer, lee Date: 3/28/2017

location wgs84 36.79002 120.36501 wp361 lee Landform low terrace NRCS Map Unit chino loam slt salin

Location Notes about 500 feet north of low lying ponded area

Topography nearly level Vegetation & Conditon fair almonds

Irrigation System Type: drip Irrigation Quadrant 2//5

Avg EM Measurements; EM_V 50 EM_H 38 EM Calibration Site: EM_V 49 Emh 33

Root depth inches 60 inches Soil Temperature, ^{0}C (2") 26.7 (16") 17.8

Estimated water holding capacity 0-60" 8.5in Em38 est Ece 0-36" 2.20 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-25	fsl	10	54	dkgray	0	vm	none				very friable
	25-32	vfsl	7	60	grbrown	0	vm	none				very friable
	32-49	sil	20	20	dkbrown	0	vm	none				friable
	49-56	lt loam	14	40	brgray	0	vm	none				very friable
	56-76	sil	24	15	dkgrbr	++	vm-wet	few				firm
	76-84	loam	20	40	dkgrbr	++	saturated	few				friable
												sar boron
	0-12	30x comp					15.3		6.14	2.1	45	2.5 0.28
	0-12						11.9		5.77	0.57	43	2.1 0.25
	12to30						12.1		7.21	1.87	36.3	4.1 0.44
	30-60						19.9		7.42	1.59	44.5	12.4 1.21
jb	72-75	sil					21			2.87e	50.6	near field capacity ecp 1.45
jb site 3b	0-10	5x comp					16.4			8.80e	30.6	near field capacity ecp 2.70

[1] Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong

[2] Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

boring depths relative to orchard floor; water table measurements from top of tree berm;

water table 80in orchard floor; 86in top of tree berm; capillary fringe 80-86 tob;

Em data indicates that soils become more saline about 50 feet east of boring;

site 3b is located in saline area about 400 feet to the south east; tree skips, salts on surface.

site 3b is wunjuy very fine sandy loam strongly saline/alkali

river flow about 4000 cfs;

EM38 Measurements:	EM_V	EM_H	EM_V	EM_H
	37	36	58	45
	56	50	49	33
	62	49	41	27
	60	43	35	29
	70	44	33	20
	79	68	38	26

SJR riparian vegetation suitability study

Well or Boring# rip 16 Sampler: brummer eacock Date: 5/5/2017

location wgs84 37.11950 120.64802 Landform natural levee NRCS Map Unit bisgani loamy sand

Location Notes 150 feet into field

Topography nearly level Vegetation & Conditon young cotton

Irrigation System Type: gravity /drip Irrigation Quadrant 1//5

Avg EM Measurements; EM_V 63 EM_H 51 EM Calibration Site: EM_V Emh

Rooting depth inches over 60in Soil Temperature, ^{0}C (2") 30e (16") 25e

Estimated water holding capacity 0-60" 7.9 Em38 est Ece 0-36" 3.56 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-16	ltl	12	45	brgray	0	m-vm	none				very friable
	16-28	ls	4	86	lt grbr	0	vm	none				loose single grained
	28-36	lfs	5	80	lt gray	0	vm	few				very friable
	36-48	vfsl	5	54	gray	0	wet	few				very friable
	48-56	loam	18	35	vdkgr	0	wet	few				friable
	56-62	cl	38	20	vdkgr	0	wet	few				firm; structured
												sar boron mg/l
	0-12	30x	comp				10.20%		6.72	2.86	39.9	carson 3.0 0.7
	12 to 30						11.20%		6.94	2.3	31.8	3.1 0.45
	30-60						20.90%		7.08	2.11	40.7	4.9 0.20

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: Numeric values indicate percent moisture by weight.

capillary fringe at 36inches; no water table to 62 inches

few sulfur granules on surface;

site is along pick anderson bypass, west of river channel

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H
62	55	59	46
63	56	57	42
59	52	62	48
68	52	61	46
67	60	57	43
65	54	73	61

SJR riparian vegetation suitability study

Well or Boring# rip 17 Sampler: brummer eacock Date: 5/5/2017

location wgs84 37.12587 120.65309 wp375 lee Landform basin NRCS Map Unit bolfar clay loam

Location Notes 150 feet into field partially drained

Topography nearly level Vegetation & Conditon young cotton

Irrigation System Type: gravity / drip Irrigation Quadrant 1//5

Avg EM Measurements; EM_V 61 Emh 55 EM Calibration Site: EM_V Emh

Rooting depth inches 60 Soil Temperature, ^{0}C (2") 28e (16") 22e

Estimated water holding capacity 0-60" 8.9in Em38 est Ece 0-36" 1.92 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-24	sil	23	25	dkgray	0	sm-vm	none				friable-firm
	24-38	loam	22	30	olgr/dkgr	0	vm	none				varigated colors; friable
	38-60	scl	20	50	olgray	0	vm	few				friable
	60-76	loam	20	25	olgray	++	wet	common				friable; segregated carbonates
												sar boron mg/l
	0-12 30x	comp					15.10%		7.6	2.03	53.4	2.8 0.43
	12 to 30						18.40%		7.84	1.53	44.4	4.5 0.31
	30-60						13.10%		7.82	1.77	37.5	5.2 0.23
site 17a	0-3in									1.5 est		ECa 0.62; hanna EC meter

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

thin clay loam layer at 60-62inches; no water table to 76 inches;

60-76in appears to be capillary fringe zone

site 17a in cattails, cottonwoods 300 ft west of rip17 in slough area; ECa 0.62 est Ece 1.5 dS/m

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H
66	62	62	53
57	50	63	53
56	63	57	51
47	42	45	54
71	54	61	60
69	58	76	71

SJR riparian vegetation suitability study

Well or Boring# rip 18 Sampler: brummer eacock Date: 5/5/2017

location wgs84 37.12460 120.64146 wp377 lee Landform basin NRCS Map Unit bolfar clay loam

Location Notes 150 feet into field partially drained

Topography nearly level Vegetation & Conditon young cotton

Irrigation System Type: gravity / drip Irrigation Quadrant 4//5

Avg EM Measurements; EM_V 116 EM_H 91 EM Calibration Site: EM_V Emh

Rooting depth inches 55 inches Soil Temperature, ^{0}C (2") 28e (16") 22e

Estimated water holding capacity 0-60" 8.9in Em38 est Ece 0-36" 3.58 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-8	sil	20	30	grbr		moist	none				friable
	28to38	loam	22	35	dkgray		vm	none				friable
	28-38	sicl	30	20	drab gray		vm	few				firm
	38-53	sil	20	20	olbrown		vm	few				friable
	53-55	hsl	18	52	olbrown		wet	common				crunchy; common hp frags
												sar boron mg/l
	0-12 30x	comp					15.30%		7.65	4.68	48.1	3.4 1.05
	12to30						20.10%		7.85	2.6	45	6.0 0.23
	30-55						18.60%		7.84	3.13	47.7	8.1 0.23

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

stopped by lime silica hardpan at 55 inches; large open drain 200 feet to east;

water perched on hardpan at 54 inches;

soil surface appears slightly puddled;

EM38 Measurements:

EM_V	EM_H	EM_V	EM_H
129	83	122	93
90	76	126	92
103	81	119	97
96	76	114	114
125	88	188	95
135	99	120	95

SJR riparian vegetation suitability study

Well or Boring# rip19 Sampler: lee burton Date: 6/8/2017

location wgs84 37.11526 120.59630 wp382 lee Landform NRCS Map Unit

Location Notes 100 feet north of reach 4b channel right bank

Topography Vegetation & Conditon fallow field formerlly wheat recently disked

Irrigation System Type: . Irrigation Quadrant

Avg EM Measurements; EM_V 61 EM_H 44 EM Calibration Site: EM_V 58.5 Emh 40.8

Root depth inches Soil Temperature, ^{0}C (2") 30 (16") 27

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.6 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	loam	15	40			moist					friable
												sar boron mg/l
	0-12 20x	comp					14.40%		7.08	1.47	41	3.7 0.19

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

20 x composite split in the field.

EM38 Measurements:

EM_V	EM_H	Ece dS/m	EM_V	EM_H
58.5	40.8	1.2	63	48.5
67.5	56.2	3.2	54.4	36.7
64.4	45.7	1.6	49.4	34
58.9	41	1.2	52.6	37.6
50.2	32.6	0.4	67.1	46.4
76.9	60	3.3	68.8	49.3

SJR riparian vegetation suitability study

Well or Boring# rip20 Sampler: lee burton Date: 6/8/2017

location wgs84 37.11386 120.59452 Landform NRCS Map Unit

Location Notes recently disked wheat field- washington road

Topography Vegetation & Conditon fallow field; formerly wheat;

Irrigation System Type: . Irrigation Quadrant

Avg EM Measurements; EM_V 90 EM_H 63 EM Calibration Site: EM_V 81.1 Emh 58.6

Root depth inches Soil Temperature, ^{0}C (2") 30e (16") 27e

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.7 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	loam	18	35	brgray		moist					
												sar boron mg/l
	0-12	20x comp					10.20%		6.17	1.05	42	3.3 0.14

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

20x soil sample split in field;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
81.1	53.6	2.4	99.1	72.4
96.2	68.8	3.1	80.5	54.6
94.8	70.5	3.5	106.8	78.1
85	60.2	2.4	80.1	57
91.1	64.1	2.7	89.2	60.2
91.3	69.6	3.5	78.2	52

SJR riparian vegetation suitability study

Well or Boring# rip21 Sampler: lee burton Date: 6/8/2017

location wgs84 37.11378 120 59030 wp378lee Landform _____ NRCS Map Unit _____

Location Notes recently disked wheat field; washington road

Topography level Vegetation & Conditon fallow field formerly wheat

Irrigation System Type: . Irrigation Quadrant _____

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches _____ Soil Temperature, ^{0}C (2") 30e (16") 27e

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.8dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	silt loam	20	25	grbrown		moist					friable
												sar boron mg/l
	0-12	20x comp					16.5		7.58	0.79	45.6	3.7 0.11
	0-12	20x comp										field split

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

sample split in field; fractional shovelling method

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
69.7	47	1.1	75.5	57.4
71.7	53.6	2	62.3	47.1
67.8	48.8	1.5	48.1	37.3
63.5	47.2	1.4	68.5	47.7
69.4	50.9	1.7	71.1	50.4
51.8	38.3	0.8	74.8	53.4

SJR riparian vegetation suitability study

Well or Boring# rip 22 Sampler: brummer lee Date: 2/1/2018

location wgs84 37.18864 120.66125 wp436 Landform basin NRCS Map Unit merced

Location Notes inside eastside bypass about 150 feet from east levee

Topography nearly level Vegetation & Conditon pasture

Irrigation System Type: dry land Irrigation Quadrant na

Avg EM Measurements; EM_V 82 Emh 62 EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") 17 (16") 12

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.9 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-16	clay	45	16	dk gray		m-vm					firm
jb	0-16	clay	45	16	2.5y 4/1		28.2			2.4 est	72.9	Ecp 1.75 dS/m; psa

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

cows are fed in area; em indicates variable salinity in area.

Emv Emh Ece

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
60	40	1	68	48
69	56	1.53	71	57
81	64	2.05	82	62
114	77	2.24	78	64
103	74	2.35	82	64
87	68	2.32	84	67

SJR riparian vegetation suitability study

Well or Boring# rip23 Sampler: lee burton Date: 6/8/2017

location wgs84 37.11544 120 59914 wp380 Landform _____ NRCS Map Unit _____

Location Notes 30 feet north of r4b channel (right bank)

Topography _____ Vegetation & Conditon _____

Irrigation System Type: . Irrigation Quadrant _____

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches _____ Soil Temperature, ^{0}C (2") 30e (16") 27e

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.5 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	vfsl	14	53	grbr		moist					
												sar boron mg/l
	0-12	20x comp					16.1		6.28	4.23	44.9	1.5 0.32
	0-12	20x comp										field split

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

field split by fractional shovelling method

em 38 salinity estimate lower than soil sample; may be inverted salinity profile.

high soluble calcium and sulfate in soil sample, suggest recent dry gypsum application on surface;

recommend using em 38 salinity estimate for salinity apprisal at this site. Ece 1.5dS/m

very high phosphate and potassium may indicate recent fertillizer applications;

Em38 cannot pick up dry gypsum in soil; subtract 2dS/m from Ece to account for gypsum;

EM38 Measurements:	**EM_V**	**EM_H**	**Ece**	**EM_V**	**EM_H**
	62*	44.1	1.6	58.2	40.8
	66.3	40.7	0.9	54.4	34.5
	65.6	47.5	1.9	66	47.5
	68	50.7	2.3	61.8	42.8
	53.1	35.4	0.7	65.1	49.1
	60.2	40.7	1.2	61.8	46.5

SJR riparian vegetation suitability study

Well or Boring# rip24 Sampler: lee burton Date: 6/8/2017

location wgs84 37.11571 120.59911 wp381 Landform _____ NRCS Map Unit _____

Location Notes approx 100 feet north of r4b channel

Topography _____ Vegetation & Conditon fallow field formerlly wheat; recently disked

Irrigation System Type: . Irrigation Quadrant _____

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V 60.5 Emh 40.6

Root depth inches _____ Soil Temperature, ^{0}C (2") 30e (16") 2e 27e

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.5 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	fsl	10	55	grbrown		moist					friable
												sar boron mg/l
	0-12	20x comp					14.90%		6.28	1.15	40	2.7 0.14
	0-12	20x comp										field split

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

sample split by fractional shovelling method

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
60.5	40.6	1.7	61.5	41.7
59.4	38.8	1.4	60.1	42
58.8	39.8	1.6	48.9	30.6
57.4	39.9	1.7	57.8	39.5
55.2	38	1.5	50	32.8
58.6	41.6	1.9	50.3	32.2

SJR riparian vegetation suitability study

Well or Boring# rip 25 Sampler: brummer lee Date: 9/19/2017

location wgs84 37.14405 120.59644 wp389lee Landform floodplain NRCS Map Unit merced overwashe

Location Notes 100 feet from east levee

Topography nearly level Vegetation & Conditon nearly barren saltgrass area

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches 60 inches Soil Temperature, ^{0}C (2") 75 (16") 75

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 5.0 ds/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-8	hsil	25	20	olgray	0	sm	none				0-2in dry,soft
	8to20	sicl	35	20	dkgray	+	moist	none				firm
	20-30	sicl	35	20	dkgray	+	wet	none				firm
	30-36	scl	22	50	brgray	+	wet	few				firm
	36-46	sl	10	70	brgray	++	wet	few				friable
	46-62	ls	5	80	brgray	+	wet-sat	few				friable
												sar boron lime%
	0-12 20x comp								8.41	3.01	57.8	24.7 0.53 2.1
	12to30								9.74	3.02	82.8	40.3 1.39 3.4
	30-60								9.52	1.77	27	22.9 0.50 1.4

[1] Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong

[2] Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

cracks on surface; water table 57 inches after 15 minutes; cap fringe 20-57inches

boring represents barren area; Em38 could miss surface salts in dry soil;

surrounding areas have heavy cockle bur vegetation lower EM readings;

EM38 Measurements: EM_V	EM_H	Ece est	EM_V	EM_H
89	59	1.6	142	128
126	106	6.7	92	104
100	96	6.8	104	82
108	90	5.2	92	79
116	85	4	78	53
91	64	2.2	132	112

SJR riparian vegetation suitability study

Well or Boring# rip26 Sampler: lee burton Date: 6/8/2017

location wgs84 37.11570 120.60850 wp383lee Landform NRCS Map Unit

Location Notes approx 150 feet east of right bank reach 4b1 channel

Topography Vegetation & Conditon fallow field; recently wheat

Irrigation System Type: . Irrigation Quadrant

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V 63.2 Emh 45.7

Root depth inches Soil Temperature, ^{0}C (2") 30e (16") 27e

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.4 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	sil	18	20	dkgrbr		moist					friable
												sar boron mg/l
	0-12	20x comp					16.70%		7.87	1.25	45	4.9 0.14
	0-12	20x comp										field split

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

split by fractional shovelling method

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
63.2	45.7	1.4	63.2	43.8
60	46.3	1.7	63.6	44.5
64	45.5	1.3	64.6	45.8
62.7	44.8	1.3	71.5	54.4
63.1	44.7	1.2	55.7	41.3
61.7	44.8	1.3	56.5	41.9

SJR riparian vegetation suitability study

Well or Boring# rip 27 Sampler: brummer lee Date: 9/19/2017

location wgs84 37.14933 120.59706 wp390lee Landform basin NRCS Map Unit

Location Notes 500 feet east of east levee

Topography nearly level Vegetation & Conditon salt grass, rushes, bermuda

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V Emh

Root depth inches over 24in Soil Temperature, ^{0}C (2") 75f (16") 75f

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 8.1

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-2	h sil	25	20			nd					
	2to24	sil	22	20			moist					

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

em only; dakota probe check holes

em readings are higher in barren areas;

not sampled

vegetation indicates spotty salinity

EM38 Measurements:	**EM_V**	**EM_H**	**Ece**	**EM_V**	**EM_H**
	135	100	7.1	130	102
	151	117	9.2	84	78
	128	101	7.8	78	41
	141	104	7.5	166	131
	147	121	10.2	155	121
	145	112	8.7	142	118

SJR riparian vegetation suitability study

Well or Boring# rip 28 Sampler: brummer lee Date: 9/19/2017

location wgs84 37.15584 120.60906 wp391 lee Landform floodplain NRCS Map Unit merced sicl

Location Notes 150 ft from east levee inside bypass

Topography nearly level Vegetation & Conditon bermuda cockle burr

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches 44 inches Soil Temperature, ^{0}C (2") 80f (16") 76f

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.1 ds/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-4	lt sicl	28	20	lt brgr	0	nd	none				cracks; slightly hard
	4to19	sicl	32	20	dkgray	0	moist	none				firm
	19-35	sicl	35	20	olgray	++	vm*wet	none				firm
	35-44	loam	18	35	olbrown	+++	wet-sat	few				faint mottles friable
	hardpan											boron sar lime%
	0-12	20x comp	lee						7.81	1.9	64.6	0.1 8.9 0.8
	12to30								8.68	1.32	95.6	0.15 15.5 4.9
	30-44								8.77	1.81	61.6	0.17 18.2 11.4

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

inside bypass; stopped by hardpan at 44 inches; cf 19-35 inches;
watertable 35 inches after 15 minutes
salinity in area is variable;

EM38 Measurements:

	EM_V	EM_H	Ece	EM_V	EM_H
	106	78	2.5	124	82
	53	37	0.5	91	60
	58	38	0.5	62	44
	53	34	0.5	133	88
	82	54	0.5	147	102
barren	172	149	8.6	57	34

SJR riparian vegetation suitability study

Well or Boring# rip 29 Sampler: brummer lee Date: 9/19/2017

location wgs84 37.16776 120.63038 wp393 lee Landform flood plain NRCS Map Unit

Location Notes 150feet from east levee

Topography nearly level Vegetation & Conditon barren, salt grass

Irrigation System Type: dryland Irrigation Quadrant

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V Emh

Root depth inches 36 plus Soil Temperature, ^{0}C (2") (16")

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.7 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-6	sic	43.5	14	dkgray		nd 14.7			3.4est	89	very hard
	6to36	clay	55	10	olive gr		m-vm			6.0 est	135	very firm

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

dakota probe; variable salinity; very high sp values indicate area is sodic;

psa sand silt clay usda texture

0-6in 14 42.5 43.5 silty clay

6-24in 10 35 55 clay

EM38 Measurements:	**EM_V**	**EM_H**	**ece**	**EM_V**	**EM_H**
calsite	298	319*	4.71	245	193
	119	91	1	172	119
	56	37	1	207	161
	73	55	1	312	273
	59	41	1	272	218
	234	179	1.3	251	209

SJR riparian vegetation suitability study

Well or Boring# rip 30 Sampler: brummer lee Date: 9/19/2017

location wgs84 37.15455 120.61294 wp394lee Landform floodplain NRCS Map Unit

Location Notes 150 feet from levee; 70 feet from low flow channel

Topography nearly level Vegetation & Conditon cockle burr, bermuda grass

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V Emh

Root depth inches 60inches Soil Temperature, ^{0}C (2") (16")

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.8 d/s/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-10	sil	24	20	brgray	0	nd-sm	none				slightly hard
	10to28	sicl	30	20	black	0	moist	none				friable
	28-42	lt clay	40	25	olgray	+	very moist	none				firm
	42-58	lt cl	28	25	olgray	+	wet	few				friable
	58-60	lt cl	28	25	olgray	+	saturated	few				friable
												boron sar lime%
	0-12	20x comp	slee dk pr.						6.98	1.71	65.5	0.08 3.7 0.1
	12to30								8.77	2.12	112	0.1 32.6 3.4
	30-60								8.6	1.89	75.7	0.13 24.0 3.3

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

capillary fringe 28-52inches; water table 52in after 15 minutes;

EM38 Measurements:

EM_V	EM_H	ece	EM_V	EM_H
64	44	1	104	68
77	50	1	68	40
83	56	1.2	68	42
96	60	1.2	71	47
92	59	1.3	75	52
195	143	7.9	91	60

SJR riparian vegetation suitability study

Well or Boring# rip31 Sampler: brummer lee Date: 9/20/2017

location wgs84 37.13312 120.59277 wp395lee Landform flood plain NRCS Map Unit

Location Notes 180ft from levee; 120 feet from low flow channel

Topography slightly undulating Vegetation & Conditon bermuda grass

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V 55 Emh 44

Root depth inches 60 inches Soil Temperature, ^{0}C (2") (16")

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.6 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-14	loam	21	40	brgray		nd	none				slightly hard
	14to27	lt cl	29	35	dkgrbr		sm	none				firm
	27-32	loam	22	45	grbrown		moist	few				friable
	32-55	sand	1	95	ltbrgr		vm	few				32-35 sl; loose,single grained
	55-70	loam	14	50	olbr		vm-sat	few				very friable
												boron sar lime%
slee	0-6 8x cmp								7.71	2.13	46.5	0.23 8.6 1.0
	0-12								7.82	1.61	43.2	0.28 9.5 0.5
	12to30								9.01	2.9	52.9	0.40 29.4 1.1
	30-60								9.07	1.43	21.2	0.16 14.4 <0.1

[1] Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong

[2] Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

may be too dry for good em; water table 64in; cf 54-64in; fsl at 71inches

EM38 Measurements:

EM_V	EM_H	ece	EM_V	EM_H
55	44	1.7	48	35
54	48	2.5	37	21
93	83	6.1	38	20
49	28	1	35	17
32	19	1	46	32
32	18	1	33	18

SJR riparian vegetation suitability study

Well or Boring# rip32 Sampler: brummer lee Date: 9/28/2017

location wgs84 37.14037 120.59899 wp396lee Landform flood plain NRCS Map Unit

Location Notes 50 feet from west levee; 50 feet fromlow flow channel

Topography gently undulating Vegetation & Conditon mallow bermuda cockle bur

Irrigation System Type: dryland Irrigation Quadrant

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V 69 Emh 47

Root depth inches Soil Temperature, ^{0}C (2") (16") 2e

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 0.7dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-10	loam					nd					tile spade
	10to22	cl					sm					dk probe
	22-40	sicl					m-vm					dk probe firm

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

em38 only; may be too dry for best measurements

L= sparse vegetation H == heavy vegetation

EM38 Measurements:	EM_V	EM_H	Ece	EM_V	EM_H
L	74	48	1.2	49	34
L	64	45	1.3	41	28
H	40	26	0.5	43	28
H	41	26	0.5	46	31
H	33	20	0.5	35	22
	44	29	0.5	80	49

SJR riparian vegetation suitability study

Well or Boring# rip33 Sampler: brummer lee Date: 9/20/2017

location wgs84 37.25520 120.77168 wp397lee Landform low terrace NRCS Map Unit waukena

Location Notes entranched river about 100 feet to the south

Topography nearly level Vegetation & Conditon salt grass saltbush iodine bush

Irrigation System Type: dryland Irrigation Quadrant

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") (16")

Estimated water holding capacity 0-60" Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-10	loam	22	30	lt gray	0	dry	none				very hard
	10to24	sil	20	25	brgray	+	sm-m	none				friable
	24-42	lt cl	28	25	olbrown	++	moist	none				firm
	42-54	loam	22	30	olgray	+++	sm-m	none				few hp fragments
												boron sar lime%
slee tile sp	0-4	4x comp							6.55	3.28	42.1	0.73 21.4 <0.1
	12to30								9.98	10.8	60.5	2.79 122 3.4
	30-54								9.61	5.13	73.8	0.42 79.9 13.0

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

stopped by hardpan at 54 inches; area appears to be saline alkali;
very hard surface limits surface comp sample to4 increments.
too dry for em survey;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip34 Sampler: brummer lee Date: 9/20/2017

location wgs84 37.25623 120.78762 wp398lee Landform low terrace NRCS Map Unit

Location Notes 150 feet south of north levee road

Topography nearly level Vegetation & Conditon spikeweed foxtail brome mouse barley saltbush salt grass

Irrigation System Type: dryland Irrigation Quadrant

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") (16")

Estimated water holding capacity 0-60" Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-14	h sil	25	20	lt gray	+	dry	none				very hard
	14to32	sil	23	15	olbrown	+	sm	none				friable
	32-53	sil	21	15	gray	++	moist	few				friable, few hp fragments
	53-62	vfsl	8	60	brgray	+	moist	few				very friable
												boron sar lime%
	0-4	4x comp							6.1	1.64	35.1	0.51 12.2 <0.1
	0-12								7.87	3.6	38.9	0.57 28.8 0.2
	12to30								9.47	7.84	68.7	2.38 77.9 33.5
	30-60								8.53	16.7	49.5	0.33 86.7 4.1

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

area appears to be saline sodic; too dry for em survey;
no water table to 62 inches plus; old stream channel 100 feet to south;
composite sample limited by very hard dry surface soil

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip35 Sampler: brummer lee Date: 9/20/2017

location wgs84 37.25721 120.79461 wp399lee Landform flood plain NRCS Map Unit

Location Notes 250 feet south of levee road

Topography slightly undulating Vegetation & Conditon spikeweed mouse barley salt bush

Irrigation System Type: dryland Irrigation Quadrant

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") (16") 2e

Estimated water holding capacity 0-60" Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-18	loam	15	38	gray	0	nd	none				very hard
	18to41	loam	18	42	ltgrbr	0	sm	few				hard
	41-61	h sl	17	52	grbrown	0	m-vm	common				friable
												boron sar lime%
lee tile sp	0-4	4x comp							5.75	2.01	39.2	0.74 9.5 <0.1
	4to30								7.86	2.64	31.9	1.28 22.1 <0.1
	30-60								10.1	5.69	42.3	3.12 67.6 <0.1
jb psa	50-60		19	57			16.9			9.0e	44.8	below field capacity Ecp 3.22 dS/m

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

too dry for em survey; 36-50 contains a few thin scl layers; no wt to 61 inches;
area appears to be saline alkali; few slickspots in area;
surface soil very hard complcates comp sample collection;
psa 50-60in sand silt clay texture
57 34 19 heavy sandy loam

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip36 Sampler: brummer lee Date: 9/27/2017

location wgs84 37.26332 120.80352 wp400lee Landform basin NRCS Map Unit rossi

Location Notes 250 feet from toe of levee

Topography nearly level Vegetation & Conditon dock; mouse barley, salt bush, salt grass

Irrigation System Type: dryland Irrigation Quadrant

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") (16")

Estimated water holding capacity 0-60" Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-11	h sil	26	20	gray	0	nd	none				very hard
	11to15	scl	20	50	olbrown	0	nd	none				very hard
	15-41	lt cl	28	25	olbrown	++	sm	none				slightly hard
	41-50	sil	22	20	olbrown	++	moist	none				friable; few hp fragments
	50-60	sil	20	20	olbrown	+	moist	common				friable; few hp fragments
												boron sar lime%
	0-12	7x comp							7.03	5.87	50.7	1.42 32.8 <0.1
	12to30								8.48	15.9	66.8	2.31 73.7 2.3
	30-60								8.92	18.7	54.6	0.85 117 7.0

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

no water table or cap fringe to 60 inches; too dry for Em survey;

slee collected comp sample with 1.5 inch hand augur;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip37 Sampler: brummer lee Date: 9/27/2017

location wgs84 37.27129 120.81254 wp401lee Landform dissected terrace NRCS Map Unit riverwash

Location Notes 150 feet from north levee toe

Topography gently undulating Vegetation & Conditon heavy weeds johnson grass, smartweed,sunflower

Irrigation System Type: dryland Irrigation Quadrant

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") (16")

Estimated water holding capacity 0-60" Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	fine sand	2	93	lt gray		nd	none				loose single grained
	12to28	lfs	5	85	ltgrbr		sm	none				loose single grained
	28-42	lt loam	10	52	olgray		moist	none				very friable
	42-47	sil	18	25	olgray		moist	few				friable
	47-50	lfs	4	87	lt gray		moist	none				very friable
	50-60	sil	23	20	dkgray		moist	few				firm buried soil
												boron sar lime%
	0-12	6x comp							6.23	1.1	34.7	0.25 2.5 <0.1
	12to30								6.75	1.28	41	0.18 3.6 <0.1
	30-60								8.02	3.18	52.2	0.19 15.0 <0.1

[1] Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong

[2] Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

too dry for em survey; site represents a 3-4 acre low terrace area; meandering slough disects area; no sign of water table or cap fringe to a depth of 60 inches; recent sandy alluvium over older basin deposits; slee collected comp sample with 1.5 inch hand augur;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip38 Sampler: brummer lee Date: 9/28/2017

location wgs84 37.26801 120.80818 wp402lee Landform basin NRCS Map Unit waukena

Location Notes 180feet from north levee

Topography nearly level Vegetation & Conditon saltgrass

Irrigation System Type: dryland range Irrigation Quadrant

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V Emh

Root depth inches 60 Soil Temperature, ^{0}C (2") (16")

Estimated water holding capacity 0-60" Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-8	loam	23	30	gray	+	dry	none				very hard
	8to55	cl	30	30	olgray	+	sm-moist	few				faint mottles firm
	55-61	cl	28	30	gleyed	+	vm	common				firm
	61-64	sand	1	94	gleyed	0	wet	common				capillary fringe
												boron sar lime%
	0-12	6x comp							8.5	4.16	48	1.05 44.9 0.8
	12to30								10.5	7.67	71.5	5.83 123 1.3
	30-60								10.3	5.31	84	2.94 81.3 1.5

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

water table 63 inches after 10 minutes; capillary fringe from 55 -63 inches;
roots to 60 inches plus; soil surface soils too dry for EM survey
0-8 inches appears to be recent overwash.
slee collected comp sample with 1.5 inch hand augur;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip 39 Sampler: brummer lee Date: 1/16/2018

location wgs84 37.11772 120.61378 wp414 Landform basin NRCS Map Unit merced sil overwas

Location Notes about 150feet ne of river channel

Topography nearly level Vegetation & Conditon weedy grain

Irrigation System Type: gravity Irrigation Quadrant 3//5

Avg EM Measurements; EM_V 69 EM_H 49 EM Calibration Site: EM_V Emh

Root depth inches 60 inches Soil Temperature, ^{0}C (2") 13 (16") 12

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.0 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-24	sil	20	25	dkgrbr	0	vm	none				friable
	24-40	sicl	30	20	dkgray	0	moist	none				firm
	40-60	h sil	26	22	olgray	++	moist	none				seg carbonates; firm
												sar boron
	0-12 20x	comp							7.21	1.57	43	3.6 0.25
	0-12								7.16	1.05	41.4	3.3 0.20
	12to30								7.55	1.51	50.4	5.5 0.14
	30-60								7.81	1.77	60.4	4.2 0.04

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

soil becomes sandier near river channel; no water table or capillary fringe to 60 inches:

soil transistions from sandy near the river to heavy 50 feet sw of boring;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
82	59	2.92	43	33
81	60	3.16	51	33
75	54	2.47	81	53
76	54	2.41	77	54
69	54	2.85	70	48
49	39	1.45	74	50

SJR riparian vegetation suitability study

Well or Boring# rip 40 Sampler: brummer lee Date: 1/16/2018

location wgs84 37.12006 120.62192 wp415 Landform natural levee NRCS Map Unit columbia fsl

Location Notes 200 feet from edge of river channell

Topography nearly level Vegetation & Conditon grain

Irrigation System Type: gravity Irrigation Quadrant 2//5

Avg EM Measurements; EM_V 43 EM_H 35 EM Calibration Site: EM_V 48 Emh 38

Root depth inches over 44 inches Soil Temperature, ^{0}C (2") 13 (16") 12

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.3 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-24	loam	16	40	brown		vm	none				friable
	24-44	fsl	10	55	brown		vm	few				lfs in spots
jb	0-18	loam	15	37	2.5y 4/2		27.8			1.5	40.5	psa, wet, Ecp 0.6 dS/m
jb	18-42						21.4			2.8	50	Ecp 1.4 dS/m

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

em site dakota probe samples for em calibration

soil becomes coarser toward river;

no wt or cap fringe to 44 inches;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
44	37	2.62	45	44
42	35	2.35	56	44
33	29	1.79	50	39
33	27	1.34	46	35
39	30	1.51	41	36
39	29	1.3	48	28

SJR riparian vegetation suitability study

Well or Boring# rip 41 Sampler: brummer lee Date: 1/16/2018

location wgs84 37.11964 120.63108 wp416 Landform basin NRCS Map Unit columbia fsl

Location Notes 60 feet from river channel

Topography nearly level Vegetation & Conditon young grain

Irrigation System Type: gravity Irrigation Quadrant 2//5

Avg EM Measurements; EM_V 57 EM_H 46 EM Calibration Site: EM_V 58 Emh 43

Root depth inches over 38 inches Soil Temperature, ^{0}C (2") 13 (16") 12

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.8 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
ns	0-24	sil	18	25	dkgray		vm	none				friable
	24-38	loam	20	32	olivegray	++	moist	none				firm: common carbonates

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

no water table or cap fringe to 38 inches;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
58	43	2.04	58	46
56	44	2.36	67	52
59	48	2.9	58	49
58	48	2.98	55	41
51	44	2.73	53	44
5	47	3.01	56	51

SJR riparian vegetation suitability study

Well or Boring# rip42 Sampler: brummer lee Date: 1/16/2018

location wgs84 37.12619 120.64037 Landform natural levee NRCS Map Unit merced overwashe

Location Notes 100 feet from river channel

Topography nearly level Vegetation & Conditon fallow

Irrigation System Type: dryland Irrigation Quadrant

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V Emh

Root depth inches 60 inches plus Soil Temperature, ^{0}C (2") (16")

Estimated water holding capacity 0-60" Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-14	fsl	6	70	graybr	0	moist	none				very friable
	14-26	lfs	5	75	pale br	0	nd	none				loose single grained
	26-44	h loam	25	30	variegated	0	sm	none				stratified l/cl/fsl
	44-60	sic	40	20	drab gray	0	sm	none				very firm
												sar boron
	0-12 20x	comp							7.34	0.63	42	1.4 0.19
	12 to30								7.79	2.1	48.3	4.1 0.31
	30-60								7.37	2.56	57.7	2.9 0.03
jb psa	0-12	fsl	6	63	2.5y 3/2		16.2			0.7e	35.2	Ecp 0.25 dS/m
jb psa	49-51	clay loam	35	30	2.5y 5/2		1720.00%					particle size analysis
jb 42a	0-6	peat/sand	5	75	black		vm-wet			4.7est	230	Eca 0.9 dS/m; many roots

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

too dry for em38; no water table or cap fringe to 60 inches;
overbank over basin soil; rip42a in river channel tules and smartweed;
ECa river banks 0.1 dS/m channel bottom 0.9 dS/m

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip43 Sampler: brummer lee Date: 1/16/2018

location wgs84 37.14724 120.66608 wp418 Landform basin NRCS Map Unit merced

Location Notes 150 feet from river channell

Topography nearly level Vegetation & Conditon young alfalfa

Irrigation System Type: gravity Irrigation Quadrant 3//5

Avg EM Measurements; EM_V 87 EM_H 80 EM Calibration Site: EM_V none Emh

Root depth inches over 30 inches Soil Temperature, ^{0}C (2") 13 (16") 12

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 6.7 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-30	lt cl	29	30	dkgray		m-vm	none				firm

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

good young crop of alfalfa; river channel has tules and casual water in bottom;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
85	77	6.13	96	94
80	75	6.15	104	97
88	80	6.49	85	78
86	77	6.05	88	80
86	81	6.87	82	75
81	76	6.27	82	74

SJR riparian vegetation suitability study

Well or Boring# rip44 Sampler: brummer lee Date: 1/16/2018

location wgs84 37.15420 120.67941 wp419 Landform overbank/basin NRCS Map Unit columbia fsl

Location Notes 20 feet from river channel

Topography nearly level Vegetation & Conditon idle; waste area

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 82 EM_H 63 EM Calibration Site: EM_V none Emh

Root depth inches 58 inches Soil Temperature, ^{0}C (2") 13 (16") 12

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 5.27 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-18	fsl	14	55	dkgrbr	trace	vm	none				very friable
	18-25	lt loam	15	45	grbrown	trace	moist	none				very friable
	25-36	loam	21	30	dkgray	+	moist	none				friable
	36-58	loam	22	35	olgray	++	moist	few				firm; seg carbonates; few hp frags
	58-60	hardpan			gray							cemented; penetratable
												sar boron
	0-12	20xcomp							7.63	4.59	33.8	2.5 0.34
	12to30								7.47	8.82	40.9	4.5 0.32
	30-60								7.52	8.72	40.6	7.2 0.11
jb	0-12						16.2			2.88est	35.1	ecp 1.01

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

lime distribution indicates profile may have been disturbed by road maintence activities;
no water table or capillary fringe to 60 inches; river bottom wet; tule vegetation.
boring is located in a small non irrigated idle area between the road and the river channel
em survey indicates variable soil salinity and texture around site.

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
94	69	5.67	95	96
95	74	6.67	51	32
101	67	4.78	42	29
78	65	3.9	62	47
98	72	6.01	92	72
83	58	4.17	88	79

SJR riparian vegetation suitability study

Well or Boring# rip45 Sampler: brummer lee Date: 1/30/2018

location wgs84 37.14402 120 70359 wp420lee Landform basin NRCS Map Unit bolfar

Location Notes 100 feet into field; 200feet from river channel

Topography nearly level Vegetation & Conditon fallow cropland; tomatoe beds

Irrigation System Type: drip / gravity Irrigation Quadrant 3//5

Avg EM Measurements; EM_V 39 EM_H 34 EM Calibration Site: EM_V 40 Emh 33

Root depth inches 60 inches Soil Temperature, ^{0}C (2") 15 (16") 11

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.4 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:	
	0-14	loam	17	35	dk gray	+	moist	none				friable	
	14-36	loam	20	35	pale brn	++	moist	none				friable	
	36-60	sicl	31	20	drab gray	++	moist	few				very faint mottles; common carbs	
												sar	boron
	0-12 20x comp								7.74	3.27	41.9	2.9	0.36
	0-12								7.18	1.36	42.4	1.8	0.46
	12to36								8.05	1.96	41.6	4.7	0.29
	36-60								7.94	1.74	47.6	3.8	0.15

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

no water table or capillary fringe to 60 inches; measurements from top of bed;
scattered sulfer granuales on surface;
field appears to be artificially drained;
comp sample bed shoulders; 0-12 sample in furrow

EM38 Measurements:	**EM_V**	**EM_H**	**Ece**	**EM_V**	**EM_H**
	40	33	1.93	39	35
	37	34	2.46	39	32
	40	34	2.16	37	32
	33	34	2.92	43	39
	41	35	2.31	39	35
	36	34	2.57	39	33

SJR riparian vegetation suitability study

Well or Boring# rip46 Sampler: brummer lee Date: 1/30/2018

location wgs84 37.14333 120.68314 wp421lee Landform natural levee NRCS Map Unit pallazzo sl

Location Notes

Topography nearly level Vegetation & Conditon tomatoe beds fallow

Irrigation System Type: drip/gravity Irrigation Quadrant 4//5

Avg EM Measurements; EM_V 41 EM_H 33 EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") 15 (16") 11

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.4 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
ns	0-18	loam	20	35	dkgray		moist					friable
	18-42	sl	6	70	pale brn		moist					friable
jb	0-12	loam	24.5	30	2.5y 4/1		23.6			4.2 est	44.6	particle size analysis; Ecp 1.89dS/

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

em 38 only dakota probe log

0-12 jb sample from bed shoulder;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
51	44	4.16	22	21
55	44	3.78	30	22
42	34	2.59	30	26
52	38	2.66	37	29
49	34	2.02	40	33
30	25	1.54	55	42

SJR riparian vegetation suitability study

Well or Boring# rip47 Sampler: brummer lee Date: 1/30/2018

location wgs84 37.14803 wp422lee Landform natural levee area NRCS Map Unit riverwash

Location Notes 150 feet from river channel

Topography nearly level Vegetation & Conditon weeds and saltbush to north

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 62 Emh 43 EM Calibration Site: EM_V 40 Emh 23

Root depth inches 62 inches plus Soil Temperature, ^{0}C (2") 15 (16") 11

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 4.7 d/s/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-16	lfs	4	85	gray		moist	none				very friable
	16-40	fine sand	1	92	brgay		moist	none				loose single grained
	40-62	sand	1	96	lt redbr		sm	common				rust mottles; loose single grained
												sar boron
	0-12	20x comp							7.65	2.88	35.8	2.9 0.37
	12to30								7.94	4.08	33.2	2.3 0.27
	30-60								7.77	2.4	32.8	4.8 0.10

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

no water table or capillary fringe to 62 inches; heavier more saline soils in saltbush areas; boring in sand streak;

Emv	Emh	Ece
38	21	1.08
42	26	1.91
39	22	1.23
38	22	1.29

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
40	23	1.38	27	13
39	21	1.02	23	14
44	33	3.45	152	117
100	68	7.36	92	70
72	55	6.55	45	30
141	124	18.3	52	37

SJR riparian vegetation suitability study

Well or Boring# rip 48 Sampler: brummer lee Date: 1/30/2018

location wgs84 37.15252 120.67774 wp423 lee Landform oxbow overbank NRCS Map Unit

Location Notes 100 feet from river channel

Topography nearly level Vegetation & Conditon weeds

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V Emh

Root depth inches 60inches Soil Temperature, ^{0}C (2") (16")

Estimated water holding capacity 0-60" Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	loam	21	40	dkgr	0	moist	none				friable
	12to25	loam	23	38	dkgr	0	sm	none				firm
	25-45	h loam	25	35	gray	+	moist	none				few carbonates; firm
	45-56	scl	25	50	olgray	++	m-vm	common				firm; common carbonates
	56-64	scl	25	50	olgray	++	vm	many				firm; common carbonates
												sar boron
	0-12	20xcomp							6.58	2.1	53.6	1.4 0.57
	12to30								7.26	8.22	61	7.4 0.41
	30-60								7.66	6.08	42.1	7.5 0.31
jb psa	0-12	loam	19	32	2.5y 3/1		21.4			3.4est	42.5	psa

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

possible capillary fringe at 56 inches; too dry for em38 survey;
sandy natural levee about 80 feet to east;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip49 Sampler: brummer lee Date: 1/30/2018

location wgs84 37.14683 120.66131 wp424 lee Landform basin NRCS Map Unit

Location Notes 200 feet from river channel

Topography nearly level Vegetation & Conditon disked and bedded cotton stubble

Irrigation System Type: drip / gravity Irrigation Quadrant 5//5

Avg EM Measurements; EM_V 42 EM_H 36 EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") 15 (16") 11

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.7 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
jb	0-20	loam	22	40	dkgray		18.8 sm-m	none				friable to firm; ecp 2.1 dS/m
jb psa	0-20	loam	24	35	2.5y 4/2		18.8			3.7 est	56.4	psa 35s, 39si 24 clay

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

em38 only; psa sample

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
41	38	3.07	44	39
39	33	2.01	48	39
42	39	3.22	38	34
45	40	3.16	37	32
51	45	3.81	37	31
53	44	3.36	34	30

SJR riparian vegetation suitability study

Well or Boring# rip50 Sampler: brummer lee Date: 1/30/2018

location wgs84 37.12986 120.64336 wp425 lee Landform low terrace NRCS Map Unit

Location Notes 40 feet from river channel

Topography nearly level Vegetation & Conditon idle, weeds

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 68 EM_H 49 EM Calibration Site: EM_V 65 Emh 47

Root depth inches 62 inches plus Soil Temperature, ^{0}C (2") 13 (16") 12

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 5.97 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-17	fsl	9	54	grbr	0	moist	none				very friable
	17-40	lt fsl	7	60	brown	0	moist	few				very friable
	40-57	lt fsl	5	64	lt brown	0	moist	common				very friable
	57-62	fine sand	2	92	lt gray	0	sm	few				single grained , loose
												sar boron
	0-12 20x	comp							6.11	4.64	44.3	3.8 0.73
	12to30								6.68	12.8	43.2	9.1 0.34
	30-60								6.47	12.4	41.2	8.0 0.22
jb	0-12	fsl	9	54	2.5y 5/2		20.5			2.0 est	42.7	particle size analysis;

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

no water table or capillary fringe to 62 inches; variable Ece and texture in area

sandy natural levee near river channel

0-12in Ecp 0.84 dS/m

EM38 Measurements:

Emv	Emh	Ece
56	36	3.24
51	35	3.41
65	40	3.55
75	52	5.44

EM_V	EM_H	Ece	EM_V	EM_H
70	46	4.72	91	70
65	47	5.48	100	72
39	20	1	53	37
56	56	9.55	65	48
77	69	10.98	100	76
88	68	9.32	65	47

SJR riparian vegetation suitability study

Well or Boring# rip51 Sampler: brummer lee Date: 2/1/2018

location wgs84 37.18939 120.66656 wp435 Landform basin NRCS Map Unit merced

Location Notes 250 feet from levee inside bypass

Topography nearly level Vegetation & Conditon pasture

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 74 EM_H 54 EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") 17 (16") 12

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.7 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
ns	0-4	sicl	28	20					m			firm
	4to20	sicl	40	20					m			firm
	20-24	sicl	40	20					sm			firm

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

dakota probe exposure; cows in area.

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
86	55	1	77	52
71	62	3	61	46
56	40	1	59	45
74	49	1	51	35
98	72	2.95	72	55
86	63	2.2	67	42

SJR riparian vegetation suitability study

Well or Boring# rip52 Sampler: brummer lee Date: 2/1/2018

location wgs84 37.18928 120.66022 wp437joe Landform basin NRCS Map Unit merced

Location Notes 150feet east of levee south of cattle feeding area

Topography nearly level Vegetation & Conditon alkali pasture

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 110 EM_H 99 EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") 17 (16") 12

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 6.3 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	sic	40	20	vdkgray		moist					firm

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

variable soil salinity

large open drain near levee;

site is east of eastside bypass;

EM38 Measurements: Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			89	75	3.67	135	124
113	109	7.88	126	115	7.95	121	100
162	153	12	123	95	4.8	72	63
85	74	2.27	57	52	1.96	63	61
108	77	2.87	84	70	3.16	79	60
145	108	5.57	121	137	10.74	109	106

SJR riparian vegetation suitability study

Well or Boring# rip53 Sampler: brummer lee Date: 2/1/2018

location wgs84 37.18675 120.67324 wp438joe Landform basin NRCS Map Unit merced

Location Notes 120 feet from levee

Topography nearly level Vegetation & Conditon salt grass pasture

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 185 EM_H 146 EM Calibration Site: EM_V 180 Emh 128

Root depth inches over 64 inches Soil Temperature, ^{0}C (2") 17 (16") 12

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 7.7 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-16	cl	35	24	gray	+	vm-m	none				firm
	16-38	sic	43	20	olgray	++	moist	none				firm
	38-56	lt cl	29	25	olgray	+++	sm	none				friable
	56-64	lt cl	29	30	olgray	+++	sm	common				friable
												sar boron
	0-12	20x comp							8.53	2.93	73.1	29.7 0.23
	12to30								9.43	5.96	127	90.1 0.37
	30-60								9.73	9.44	69.7	130 0.12
jb	0-12	clay loam	35	24	2.5y 5/1		24.9			3.6e	67	psa s24 si41 clay35

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

salt grass pasture; no water table or capillary fringe to 64 inches

EM38 Measurements:

Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			204	170	9.97	156	122
141	99	3.44	208	155	7.67	143	105
180	148	8.16	232	188	10.99	128	95
			251	197	11.24	129	108
			263	236	16.22	178	142
			213	172	9.76	157	107

SJR riparian vegetation suitability study

Well or Boring# rip54 Sampler: brummer lee Date: 2/1/2018

location wgs84 37.19884 120.68903 wp439joe Landform basin NRCS Map Unit merced

Location Notes 250 feet from levee; about 150 feet from river

Topography very gently undulating Vegetation & Conditon pasture and weeds

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 73 EM_H 58 EM Calibration Site: EM_V 79 Emh 66

Root depth inches over 62 inches Soil Temperature, ^{0}C (2") 63 (16") 53

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.9 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-11	lt cl	29	25	dk gray	0	moist	none				friable
	11to25	clay	42	25	gray	+	sm	none				very firm; strongly structured
	25-37	sic	40	20	olgray	++	moist	none				firm
	37-53	loam	20	35	lt gray	+++	sm	none				few thin hard layers
	53-62	lt loam	17	35	lt rdbrn	++	moist	few				very friable
												sar boron
	0-12	20x comp							8.02	2.5	61.8	31.9 0.11 lee
	12to30								9.08	2.77	143	34.7 0.12
	30-60								8.6	1.88	47.2	18.7 0.07
jb	0-11	lt cl	29	25	2.5y 4/2		19.3			1.6est	61.7	psa; Ecp 1.0

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

no water table to 62 inches; 37-53 contains hard fragments; variable salinity in area;

EM38 Measurements: Emh	Emv	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			76	67	3.91	38	31
50	33	1	122	89	4.68	50	49
82	65	3.14	76	56	2.01	78	78
65	46	1.04	59	50	2.08	32	26
121	98	6.23	64	52	2.09	34	25
120	93	5.45	106	87	5.33	120	93

SJR riparian vegetation suitability study

Well or Boring# rip55 Sampler: brummmer lee Date: 2/1/2018

location wgs84 37.18997 120.67439 wp440joe Landform basin NRCS Map Unit merced

Location Notes 350 feet from levee

Topography nearly level Vegetation & Conditon weedy pasture

Irrigation System Type: dryland Irrigation Quadrant

Avg EM Measurements; EM_V 80 EM_H 60 EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") 17 (16") 12

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.0 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
ns	0-5	loam	20	40	brgray		moist					friable, recent overwash
	5to30	h cl	38	30	vdkgray		moist					firm

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

dakota probe exposure;

near stream channell;

EM38 Measurements:			EM_V	EM_H	Ece	EM_V	EM_H
Emv	Emh	Ece	57	46	1	185	142
92	63	1.54	65	51	1.21	106	78
75	52	1	51	32	1	69	44
50	33	1	53	40	1	72	52
70	45	1	61	54	1.91	74	62
59	41	1	132	104	5.25	93	72

SJR riparian vegetation suitability study

Well or Boring# rip56 Sampler: brummer lee Date: 26/2018

location . 69320 37.20315 120.69320 wp441joe Landform basin NRCS Map Unit merced

Location Notes 100 feet from stream channell; opposite mariposa bypass structure

Topography nearly level Vegetation & Conditon pasture

Irrigation System Type: dryland Irrigation Quadrant

Avg EM Measurements; EM_V 73 Emh 49 EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") 60 (16") 56

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.17 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:	
	0-9	sil	20	25	grbrown	0	moist	none				friable	
	9to16	loam	15	40	ltolgray	+++	sm	none				friable with hard layers	
	16-20	loam	18	30	lt graybr	++	sm	none				friable	
	20-60	h sicl	38	20	vdkgray	trace	moist	none				firm	
												sar	boron mg/l
	0-12	20x comp							7.68	1.2	56.2	0.6	0.09
	12to30								7.76	1.22	52.3	2.2	0.06
	30-60								7.3	7.45	66.5	6.5	0.02

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

EM38 Measurements:	**EM_V**	**EM_H**	**Ece**	**EM_V**	**EM_H**
0-9in recent overbank;	77	50	2.13	86	56
9-16in possible transported soil from excavation area; unnatural layer;	68	44	1.56	72	47
16-20in older overbank deposit	77	51	2.32	69	50
20-60in natural basin soil;	93	60	3.03	56	38
almost too dry for EM38 survey;	79	52	2.39	47	42
9-16in contains hardpan fragments; high lime content;	82	54	2.58	69	45

SJR riparian vegetation suitability study

Well or Boring# rip57 Sampler: brummer lee Date: 2/6/2018

location wgs84 37.20661 120.69712 wp442joe Landform basin NRCS Map Unit merced sicl

Location Notes 120 feet ne of levee outside bypass;

Topography nearly level Vegetation & Conditon salt grass pasture

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 160 Emh 158 EM Calibration Site: EM_V 121 Emh 139

Root depth inches Soil Temperature, ^{0}C (2") 16 (16") 13

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 5.16 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
jb	0-30	sicl	35	20	dkgray		moist			5.38e	86.2	firm, SP suggests sodic soil
	30-42	sicl	32	20	olgray		moist					firm

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

EM38 Measurements:

	Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
em only; 0-2in loam overwash;				139	121	4.35	151	135
scattered small slick spots in area; good stand alkali pasture;	145	148	5.43	239	208	7.3	135	131
inverted salinity profiles at half of EM sites;	137	135	4.51	218	238	9.34	173	178
site is near the mariposa creek confluence with the east side bypass;	168	160	5.67	215	233	9.08	141	142
probable high water table in area;	121	139	4.35	185	176	6.42	120	126
				156	123	2.75	115	138

SJR riparian vegetation suitability study

Well or Boring# rip58 Sampler: brummer lee Date: 2/6/2018

location wgs84 37.20777 120.70196 wp443joe Landform basin NRCS Map Unit merced

Location Notes 60 feet from river channell in east side bypass

Topography nearly level Vegetation & Conditon saltgrass and weeds

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches 60 inches Soil Temperature, ^{0}C (2") _____ (16") _____

Estimated water holding capacity 0-60" Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-4	loam	20	36	brgrey	+	moist	none				friable recent overwash
	4to20	sic	40	20	dkgray	+	sm	none				firm
	20-30	sic	40	20	gray	+	sm	none				firm
	30-39	h sicl	38	20	olgray	++	sm	common				common carbonates, firm
	39-52	loam	24	40	lt olgray	++	sm	few				friable faint rust mottles
	52-61	loam	18	38	lt olgray	++	moist	few				very friable,
												sar boron mg/l
	0-6 20x com								7.1	3.13	64.3	10.8 0.18 lee tilespade
	0-12								7.27	2.21	63.1	7.8 0.17
	12to30								8.94	3.85	117	35.3 0.60
	30-60								8.86	6.43	61.9	50.4 0.19

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

too dry for EM survey; terrace above river channell;

river channell entrenched about 10 feet into old basin deposits

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip59 Sampler: brummer lee Date: 2/6/2018

location wgs84 37.20237 120.70368 wp444joe Landform basin NRCS Map Unit merced overwashe

Location Notes in mariposa bypass about 100 feet from north levee and 100 feet from stream channell

Topography nearly level Vegetation & Conditon weeds cocklebur

Irrigation System Type: dryland Irrigation Quadrant

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V Emh

Root depth inches over 61 inches Soil Temperature, ^{0}C (2") (16")

Estimated water holding capacity 0-60" Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-10	loam	18	38	brgrey	0	moist	none				very friable, recent overwash
	10to40	sic	41	20	gray	+	nd	none				very hard
	40-55	lt scl	20	50	lt gray	++	nd	none				very hard
	55-61	fsl	10	55	ltbrgrey	++	sm	few				friable
												sar boron mg/l
	0-10	20x comp							7.4	1.15	58.8	4.0 0.15 lee
	0-12								6.85	1.06	52.7	3.3 0.18
	12to30								8.72	1.51	89	19.7 0.31
	30-60								8.43	6.77	53.6	31.9 0.10

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

45-48in weak hardpan layers; too dry for em38 survey

40-55 contains many small sand size hp fragments;

site on terrace; channel has cut through about 10 feet into old basin deposits;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip60 Sampler: brummer lee Date: 2/13/2018

location wgs84 37.11603 120.58659 wp426lee Landform basin NRCS Map Unit merced overwashe

Location Notes inside sand slough bypass; 50 feet from levee toe

Topography nearly level Vegetation & Conditon weeds cockle bur, bur clover

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V 33 Emh 24

Root depth inches 60in plus Soil Temperature, ^{0}C (2") 13 (16") 10

Estimated water holding capacity 0-60" Em38 est Ece 0-36" <1 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	sil	22	25	grbrown	0	m-sm	none				friable, overwash
	12to29	sicl	35	20	vdkgry	0	sm-m	none				firm
	29-38	h loam	25	35	olbrown	++	moist	none				firm
	38-50	sl	12	60	olbrown	++	vm-wet	none				friable
	50-60	fsl	10	55	olgray	++	saturated	few				few hp fragments
												sar boron mg/l
	0-12	20x comp							6.85	0.85	59.7	0.4 0.11 lee
	0-12								6.56	0.64	64.2	0.5 0.19
	12to30								7.71	0.59	42	2.3 0.13
jb	30-60								8.45	0.93	21.7	9.5 0.16

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

water table 4.3 feet after 20 minutes; capillary fringe 46-53 inches

0-12 recent deposits; 12-29 buried basin soil;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
34	24	1	29	20
32	24	1	28	20
30	21	1	38	27
26	18	1	28	21
24	18	1	29	21
21	12	1	31	24

SJR riparian vegetation suitability study

Well or Boring# rip61 Sampler: brummer lee Date: 2/13/2018

location wgs84 37.12226 120.58743 wp427 Landform overwash/basin NRCS Map Unit riverwash

Location Notes in bypass 200 feet from west levee

Topography gently undulating Vegetation & Conditon scatterd cocklebur; rangeland

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches 57 inches Soil Temperature, ^{0}C (2") _____ (16") _____

Estimated water holding capacity 0-60" Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-8	lt sl	5	71	ltgrbr	0	sm	none				very friable
	8to23	sand	1	95	lt gray	0	nd	none				loose single grained
	23-32	sl	8	75	grbr	0	nd	none				very friable
	32-39	sil	18	20	brgr	0	nd	none				friable-firm
	39-42	sil	22	20	black	0	nd	none				friable; buried A horizon
	42-57	fsl	11	60	lt olgr	+++	nd	none				contains hardpan fragments
												sar boron mg/l
	0-12	20x comp							7.4	0.93	35.5	0.3 0.09 lee
	12to30								7.52	0.47	27.2	0.3 0.08
	30-57								7.88	0.52	40.3	1.3 0.07
jb	0-8	lt sl	5	71	2.5y 5/2		10.4			0.84est	30.9	psa s71 si24 clay5 Ecp 0.26

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

stopped by hardpan at 57 inches; too dry for em38; 0-8in very recent;
8-39in overwash; 39-57in buried basin rim soil;
not water table or cap fringe to 57 inches;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip62 Sampler: brummer lee Date: 2/13/2018

location wgs84 37.11568 120.58828 wp428lee Landform basin NRCS Map Unit

Location Notes 180 feet from levee toe west of bypass

Topography nearly level Vegetation & Conditon good alfalfa

Irrigation System Type: gravity Irrigation Quadrant 3//5

Avg EM Measurements; EM_V 37 EM_H 29 EM Calibration Site: EM_V 40 Emh 32

Root depth inches over 36 inches Soil Temperature, ^{0}C (2") 13 (16") 10

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.2 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	loam	15	40	grbrown		vm					very friable
	12to36	sil	20	30	dkgray		vm					friable
jb	0-36						23.5			3.08est	44.5	ecp 1.37

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

em only

EM38 Measurements:

Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			40	32	1.33	39	27
36	27	1	39	31	1.2	42	31
38	27	1	38	27	1	39	30
41	41	3.26	32	25	1	40	34
			33	24	1	33	28
			38	28	1	32	24

SJR riparian vegetation suitability study

Well or Boring# rip63 Sampler: brummer lee Date: 2/13/2018

location wgs84 37.12285 120.58978 google earth plot Landform basin rim NRCS Map Unit fresno

Location Notes west of field drains; 120 feet into field

Topography nearly level Vegetation & Conditon good alfalfa

Irrigation System Type: gravity Irrigation Quadrant 5//5

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches 28 inches Soil Temperature, ^{0}C (2") _____ (16") _____

Estimated water holding capacity 0-60" Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-16	loam	15	40	dkgrbr		sm-m					friable
	16-28	loam	15	40	olivebr		sm-m					common carbonates

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

stopped by probable hardpan at 28 inches; dakota probe site;
no samples or EM38 survey due to cattle congregating in area;
crop condition indicates favorable soil salinity conditions;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip64 Sampler: brummer lee Date: 6/13/2018

location wgs84 37.13322 120.59492 wp429lee Landform basin NRCS Map Unit

Location Notes 150 ft west of west bypass levee

Topography nearly level Vegetation & Conditon weedy tomatoe beds

Irrigation System Type: gravity sprinkler Irrigation Quadrant 5//5

Avg EM Measurements; EM_V EM_H EM Calibration Site: EM_V 43 Emh 36

Root depth inches 30 inches Soil Temperature, ^{0}C (2") 55f (16") 50f

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.8 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-18	loam	16	40	dkgray		vm	none				friable
	18-30	sl	15	55	olbrown		vm	none				few carbonates
jb	0-30						23.7			2.68e	40.2	ecp1.08

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

stopped by hardpan at 30 inches;

specific conductance of drain effluent in nearby ditch; 1150

site is near new subsurface drains;

dakota probe site;

EM38 Measurements: Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			43	37	2.55	45	40
41	36	2.5	43	26	2.32	37	34
41	36	2.5	43	38	2.78	40	36
40	35	2.36	53	48	4.18	37	34
			51	47	4.14	36	31
			49	44	3.62	46	40

SJR riparian vegetation suitability study

Well or Boring# rip65 Sampler: brummer lee Date: 2/13/2018

location wgs84 37.12002 120.64095 wp430lee Landform oxbow natural levee NRCS Map Unit columbia

Location Notes site in large oxbow of old river channel;

Topography very gently undulating Vegetation & Conditon idle land

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches 64 plus Soil Temperature, ^{0}C (2") _____ (16") _____

Estimated water holding capacity 0-60" Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-20	loam	19	35	brgray	0	sm	none				friable
	20-45	loam	20	35	gray	0	sm	none				friable
	45-58	sil	20	30	brgray	0	moist	few				friable
	58-64	fsl	12	55	gray	0	vm	few				friable
												sar boron mg/l
	0-12	20xcomp							6.5	2.08	50.8	3.4 0.35 lee
	0-12								6.67	1.15	53	2.7 0.35
	12to30								6.58	9.4	48.9	7.1 0.13
	30-60								6.95	7.43	45.7	6.6 0.03

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

too dry for em38 survey; river channel and banks 100 feet to west is very sandy

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip66 Sampler: brummer lee Date: 3/29/2018

location wgs84 37.20778 120.76867 wp434lee Landform floodplain NRCS Map Unit riverwash

Location Notes inside levee ; about 100 feet from river;

Topography very gently undulating; uneven Vegetation & Conditon riparian meadow; grasses

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 8 EM_H 7 EM Calibration Site: EM_V Emh

Root depth inches 60inches Soil Temperature, ^{0}C (2") 80 (16") 65

Estimated water holding capacity 0-60" Em38 est Ece 0-36" less than 1

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-6	loam	15	36	grbrown		moist	none				very friable
	6to22	lt fsl	6	75	lt br		moist	none				very friable
	22-47	fs	1	94	vlt br		dry	none				loose single grained
	47-62	sand	0	99	ltgrbr		sm	few				loose single grained; faint mottles
												sar boron
	0-12	20x comp							6.05	0.32	44.5	0.6 0.11 lee
	0-12								5.85	0.29	39.9	0.7 0.09
	12to30								6.24	0.11	33.5	0.8 0.05
	30-60								6.72	0.06	34.4	0.9 0.03

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

no water table or capillary fringe to 62 inches; em indicates very low salinity

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
8	7.3	<1	7.9	7.7
9	8.1	<1	6.4	5
6.2	5.3	<1		
6.6	5.5	<1		
10.5	8.7	<1		
10.2	8.5	<1		

SJR riparian vegetation suitability study

Well or Boring# rip67 Sampler: brumeer lee Date: 3/29/2018

location wgs84 37.21531 120.77356 wp432lee Landform basin NRCS Map Unit merced

Location Notes 80 feet inside levee road; near dry oxbow cutoff channel

Topography uneven Vegetation & Conditon grassy area; pasture

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 145 EM_H 106 EM Calibration Site: EM_V 160 Emh 106

Root depth inches 60 inches Soil Temperature, ^{0}C (2") 80e (16") 65e

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 4.12 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-14	h cl	39	29	dkgr	0	moist	none				firm
	14-30	cl	33	30	gray	+++	sm	none				common salts and carbonates
	30-44	sicl	34	25	olbrown	++	moist	few				firm
	44-60	loam	20	35	yelbr	0	moist	common				friable
												sar boron
	0-12	20xcomp							6.97	1.4	62	4.0 0.14 lee
	12to30								8.34	2.82	81.4	20.3 0.24
	30-60								7.99	12.7	60.1	28.0 0.28
jb	0-14	h cl	39	29	2.5y 4/1		19.3			2.55e	55	psa s29 si 32 c 39

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

no water table or capillary fringe to 60inches; salinity decreases toward river channel;

44-60in fine silty strata; loam, sil

emv	emh	Ece
166	119	4.75
160	106	3.5
161	107	3.57

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H
153	107	3.88	172	136
138	112	5.18	101	75
154	108	3.96	82	60
172	131	5.94	105	79
171	122	4.9	97	76
176	124	4.92	173	131

SJR riparian vegetation suitability study

Well or Boring# rip68 Sampler: brummer lee Date: 3/29/2018

location wgs84 37.21535 120.77862 wp433lee Landform low terrace NRCS Map Unit columbia

Location Notes 150 feet from refuge boundary; 200ft ne of river

Topography uneven Vegetation & Conditon pasture grasses;

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 65 Emh 49 EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") 80e (16") 67e

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.15 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
ns	0-24	sil	19	36	dkgray		moist	none				friable

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

em38 only; dakota probe core; sm at 25 inches;

EM38 Measurements:

Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			57	50	2.8	55	42
57	48	2.43	60	48	2.21	81	60
57	48	2.43	52	43	1.87	82	59
58	39	0.82	58	41	1.14	72	55
			74	56	2.69	74	48
			79	59	2.89	57	45

SJR riparian vegetation suitability study

Well or Boring# rip69 Sampler: brummer lee Date: 4/5/2018

location wgs84 37.27622 120.82082 wp445jb Landform terrace/basin NRCS Map Unit waukena

Location Notes 150 feet from river; 250 ft from north levee

Topography uneven Vegetation & Conditon grasses and forbs; grazing land

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V _____ EM_H _____ EM Calibration Site: EM_V _____ Emh _____

Root depth inches 60 Soil Temperature, ^{0}C (2") _____ (16") _____

Estimated water holding capacity 0-60" Em38 est Ece 0-36"

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-20	lt loam	15	40	gray	0	dry	none				hard;
	20-28	sil	18	25	rdbrown	+	sm	none				firm
	28-45	sicl	30	20	brgray	+	sm	few				firm
	45-60	loam	24	30	grbrown	+	sm-m	few				friable; few hard layers
												sar boron
lee	0-4	8x comp							6.61	1.76	36.9	8.6 0.51
	0-12								6.07	3.07	36.4	15.3 0.62
	12to30								8.95	9.48	39.5	105 2.84
	30-60								9.72	13.7	62.5	166 2.08

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

too dry for em38 survey; mottles are faint rust; possible hardpan at 60 inches;
area has some salt tolerant weeds;

EM38 Measurements:

EM_V	EM_H	Ece	EM_V	EM_H

SJR riparian vegetation suitability study

Well or Boring# rip70 Sampler: brummer lee Date: 4/5/2018

location wgs84 37.27161 120.82624 wp446jb Landform terrace /basin NRCS Map Unit waukena

Location Notes 80 feet from levee road; 80 feet from river;

Topography uneven Vegetation & Conditon grasses, forbs scattered iodine bush

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 122 Emh 85 EM Calibration Site: EM_V 154 Emh 91

Root depth inches 33 inches Soil Temperature, ^{0}C (2") 25.6 (16") 17.8

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 5.07 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	loam	18	38	dkgray	0	sm	none				friable
	12to24	scl	27.5	48	grbr	+	sm-m	few				firm
	24-33	loam	23	30	lt gray	+++	sm	none				common hp fragments
												sar boron
lee	0-4	8x comp							6.65	3.07	42	18.2 1.79
0	0-12								6.74	2.39	39.4	14.3 1.22
	12to24								8.42	1.44	46.8	14.0 1.15
	24-33								8.41	5.56	54.8	28.0 1.91
jb psa	14-24	scl	27.5	48	2.5y 5/2		14.6			1.72e	50.6	ecp0.87 dS/m s 48 si 24.5 c 27.5

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

stopped by large hardpan fragment at 33 inches;

24-33 inches, many segregated carbonates;

EM38 Measurements:

Emv	Emh	Ece
74	52	1.97
113	78	4.03

EM_V	EM_H	Ece	EM_V	EM_H
154	91	3.98	184	140
120	78	3.66	159	110
123	88	5.12	139	116
123	91	5.63	86	72
90	54	1.45	102	62
131	91	5.15	103	70

SJR riparian vegetation suitability study

Well or Boring# rip71 Sampler: brummer lee Date: 4/5/2018

location wgs84 37.26904 120.83034 wp447jb Landform low terrace NRCS Map Unit columbia

Location Notes oxbow area

Topography uneven Vegetation & Conditon filaree, weeds; rushes in spots

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 72 EM_H 50 EM Calibration Site: EM_V 82 Emh 58

Root depth inches 60 Soil Temperature, ^{0}C (2") 25.6 (16") 17.8

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.15 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:	
	0-11	sil	20	25	grbrown	0	moist	none				friable	
	11to14	sil	22	20	vdkgray	0	moist	none				friable	
	14-33	sil	18	30	gray	+	sm	none				friable	
	33-40	sicl	30	20	gray	+	moist	few				firm; faint rust mottles	
	40-51	sil	20	30	brgray	++	moist	few				friable	
	51-61	sl	15	55	brgray	++	moist	few				friable; com sand size hp frags	
												sar	boron
lee	0-12 20x	comp							5.78	0.88	58.4	1.7	0.23
	0-12								5.57	1.45	58.2	1.4	0.26
	12to30								7.35	2.32	50	3.1	0.10
	30-60								7.71	5.55	46.1	8.0	0.17

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

pasture land; mottles are faint;

no water table or capillary fringe to 61 inches;

EM38 Measurements:

Emv	Emh	Ece
80	57	2.82

EM_V	EM_H	Ece	EM_V	EM_H
84	58	2.75	67	46
86	61	3.14	63	50
90	61	2.91	50	37
69	50	2.28	52	39
76	50	1.87	56	39
71	45	1.33	91	62

SJR riparian vegetation suitability study

Well or Boring# rip72 Sampler: brummer lee Date: 4/5/2018

location wgs84 37.26189 120.82937 wp435lee Landform low terrace/ floodplain NRCS Map Unit columbia

Location Notes near refuge boundary fence

Topography uneven Vegetation & Conditon sunflower,grasses, few rushes

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 76 EM_H 55 EM Calibration Site: EM_V 82 Emh 60

Root depth inches Soil Temperature, ^{0}C (2") 25.6 (16") 17.8

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.48 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-24	loam	19	40	dk grbr	moist 18.3%				2.44e	41.8	friable; ecp 1.02
jb psa	0-24		19	40								psa s 40 si 41 c 19 loam

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

em 38 only; dakota probe site

EM38 Measurements:

Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			85	64	3.39	56	47
87	59	2.44	74	57	2.88	85	61
84	59	2.61	64	48	1.97	86	62
80	56	2.35	64	47	1.8	84	62
			56	42	1.45	88	62
			48	34	0.59	91	67

SJR riparian vegetation suitability study

Well or Boring# rip73 Sampler: brummer lee Date: 4/12/2018

location wgs84 37.12479 120.63954 wp448jb Landform natural levee NRCS Map Unit merced overwashe

Location Notes 100 feet ne of river channell

Topography nearly level Vegetation & Conditon fallow cropland

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 71 EM_H 52 EM Calibration Site: EM_V 72 Emh 51

Root depth inches Soil Temperature, ^{0}C (2") 18.3 (16") 15.6

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.54 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
jb	0-36	sil	23	35	dk gray		moist					friable

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

dakota probe site; em38 only;

EM38 Measurements:

Emh	Emv	ECe	EM_V	EM_H	Ece	EM_V	EM_H
			74	54	2.72	61	46
62	43	1.49	70	47	1.72	76	55
76	56	2.95	68	46	1.67	74	54
			67	50	2.44	88	68
			69	53	2.86	71	53
			80	61	3.61	57	41

SJR riparian vegetation suitability study

Well or Boring# rip74 Sampler: brummer lee Date: 4/12/2018

location wgs84 37.12524 120.64009 wp436lee Landform river channel NRCS Map Unit riverwash

Location Notes edge of water

Topography uneven Vegetation & Conditon tules, willows

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 85 EM_H 90 EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") 15.6 (16") 15.6

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 7.09 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
ns	0-6	loam	20	40	black		wet			11.0e		highly organic, Eca 2.7

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

Ece river water; 3.53 dS/m (casual water)

wet site in 4b1 channel bottom;

EM38 Measurements:	**EM_V**	**EM_H**	**Ece**	**EM_V**	**EM_H**
channel	88	100	8.48		
channel	84	80	7.01		
channel	93	85	7.28		
channel	120	130	11.85		
bank	70	52	4.63		
bank	52	40	3.31		

SJR riparian vegetation suitability study

Well or Boring# rip75 Sampler: brummer lee Date: 4/12/2018

location wgs84 37.14085 120.64980 wp 437lee Landform natural levee NRCS Map Unit merced overwashe

Location Notes 40 feet from edge of river channell

Topography uneven Vegetation & Conditon fallow

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 37 Emh 28 EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") 22.2 (16") 18.3

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.12 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-16	fsl	15	55	ltbrgr		moist					very friable
	16-20	cl	38	25	dkgray		sm					firm; well structured

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

em38 only; tile spade exposure;

casual cofee colored water in river channell EC 5.50 dS/m;

site 75a is in river channell bottom about 70 feet sw of site 75; estimated Ece about 9.65 dS/m

river channel has cottonwoods, willows, saltbush and tules; wet organic loam soil;

depth to groundwater in MW152 just north of site 10.5 ft bgs;

EM38 Measurements:	EM_V	EM_H	Ece	EM_V	EM_H
	48	41	1.99	43	34
	50	38	1.26	48	36
	51	39	1.38	24	17
	37	25	1	29	26
	25	15	1	26	17
	35	24	1	34	22

SJR riparian vegetation suitability study

Well or Boring# rip76 Sampler: brummer lee Date: 4/12/2018

location wgs84 37.20184 120.70499 wp438lee Landform basin NRCS Map Unit merced

Location Notes near bottom of mariposa bypass channel

Topography uneven Vegetation & Conditon rushes, clover, grasses

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 65 EM_H 53 EM Calibration Site: EM_V 101 Emh 81

Root depth inches Soil Temperature, ^{0}C (2") 21.2 (16") 18.3

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.85 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
jb	0-24	sil	23	25	grey		moist	few				firm

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

EM38 indicates variable Ece levels;

EM38 Measurements: Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			101	81	5.4	44	35
69	52	2.35	110	84	5.34	42	31
62	50	2.45	62	53	3.01	36	29
52	38	1	52	38	1	42	33
67	60	3.96	41	32	1	96	82
60	49	2.41	52	40	1.33	53	44

SJR riparian vegetation suitability study

Well or Boring# rip77 Sampler: brummer lee Date: 4/12/2018

location wgs84 37.21164 120.70639 wp439lee Landform basin NRCS Map Unit

Location Notes in bypass

Topography nearly level Vegetation & Conditon grassas,clover,some saltbush

Irrigation System Type: dryland range Irrigation Quadrant na

Avg EM Measurements; EM_V 78 EM_H 53 EM Calibration Site: EM_V 87 Emh 53

Root depth inches Soil Temperature, ^{0}C (2") 22.2 (16") 18.3

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 3.19 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
jb	0-30	lt cl	28	28	gr brown		sm			3.03	50.8	friable-slt hard
duplicate	0-30split	h loam	27	29						2.96	54.1	lab split fractional shoveling
rpd %			3.6	3.5						2.3	6.3	good consistency
jb psa					2.5y 5/2							s 28.5 si 44 c 27.5 l / cl

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

too dry for dakota probe below 10 inches;

stream is entrenched about 10 feet below site;

site is 100 feet west of entrenched low flow channel;

field lab split by fractional shovelling; rpd ECe = 2.3; rpd saturation %=6.3

EM38 Measurements: Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			94	60	3.64	79	51
87	53	2.74	75	50	2.9	68	49
90	57	3.31	118	83	6.61	55	38
			87	56	3.3	44	32
			91	68	5.46	48	31
			79	53	3.23	82	54

SJR riparian vegetation suitability study

Well or Boring# rip78 Sampler: brummer burton Date: 4/13/2018

location wgs84 37.27619 120.82536 wp441lee Landform low terrace NRCS Map Unit riverwash

Location Notes 300 feet from eastside bypass channell

Topography uneven Vegetation & Conditon smartweed,,coarse bunch grasses

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 76 EM_H 47 EM Calibration Site: EM_V 73 Emh 43

Root depth inches Soil Temperature, ^{0}C (2") 16.7 (16") 15.6

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 5.10 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
jb	0-36	lt sl	5	70	ltgray		sm-m					very friable; single gr in spots

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

sandy low terrace; coarse sandy strata s,lfs,sl

EM38 Measurements:

Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			84	50	5.12	68	44
80	50	5.43	76	48	5.24	84	50
73	43	4.19	66	40	3.96	103	64
			53	35	3.71	91	56
			66	42	4.48	73	48
			69	44	4.76	69	46

SJR riparian vegetation suitability study

Well or Boring# rip79 Sampler: brummer burton Date: 4/13/2018

location wgs84 37.26590 120.82666 wp442lee Landform low terrace NRCS Map Unit columbia

Location Notes 50 feet from levee toe

Topography uneven to undulating Vegetation & Conditon rushes, oxeye daisy,grasses

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 47 EM_H 33 EM Calibration Site: EM_V 57 Emh 41

Root depth inches Soil Temperature, ^{0}C (2") 16.7 (16") 15

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.24 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
jb	0-12	sil	20	20			m-vm					friable

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

em only

EM38 Measurements:

Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			61	38	1.05	53	40
36	22	1	51	36	1.28	52	37
57	41	1.84	51	34	1	40	32
			52	38	1.6	33	27
			45	32	1	49	32
			43	28	1	38	26

SJR riparian vegetation suitability study

Well or Boring# rip80 Sampler: brummer burton Date: 4/13/2018

location wgs84 37.26389 120.82841 wp443lee Landform low terrace NRCS Map Unit columbia

Location Notes in river oxbow

Topography uneven Vegetation & Conditon cockle bur,grasses,forbs, rushes

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 41 EM_H 32 EM Calibration Site: EM_V 42 Emh 29

Root depth inches Soil Temperature, ^{0}C (2") 16.1 (16") 15.6

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.46 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-12	sil	21	25	brgray		moist	few				friable
	12to30	l / fsl	18	35	gray		moist	few				friable, stratified

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

em38 only

EM38 Measurements:

Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			43	33	1.68	54	35
59	45	3.07	42	29	1	46	40
40	30	1.25	47	35	1.81	41	28
36	22	1	44	34	1.82	41	30
			39	30	1.33	42	28
			39	24	1	39	30

SJR riparian vegetation suitability study

Well or Boring# rip81 Sampler: brummer burton Date: 4/13/2018

location wgs84 37.26249 120.82831 wp444lee Landform terrace NRCS Map Unit temple cl

Location Notes 150 ft from levee toe

Topography uneven Vegetation & Conditon rushes, young cocklebur, sunflower, grasses

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 62 EM_H 42 EM Calibration Site: EM_V 65 Emh 42

Root depth inches Soil Temperature, ^{0}C (2") 15.6 (16") 16.1

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 2.46 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
jb	0-12	sicl	30	19	vdk gray		moist	few				friable psa
jb	12to30	loam	20	36	dk gray		moist	few				friable
jb psa	0-12	sicl	30	19	2.5y 3/1		24.3			1.1 est	61.5	psa s 19 si 51 c 30 sicl Ecp 0.67
jb psa	12to30	loam	20	36	2.5y 4/1		16.4			1.56est	36.2	psa s 36 si 44 c 20 L Ecp 0.55

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

10-14in moderate medium angular blocky structure;

tile spade to 14 inches, dk probe to 30in;

EM38 Measurements:

Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			65	39	1.76	73	48
			64	44	2.88	78	50
			53	37	2.13	50	35
			63	43	2.73	58	38
			61	41	2.43	57	36
			61	45	3.33	65	42

SJR riparian vegetation suitability study

Well or Boring# rip82 Sampler: brummer burton Date: 4/13/2018

location wgs84 37.26722 120.83160 wp445lee Landform low area on recent terrace NRCS Map Unit columbia

Location Notes about 100 feet from river; large oxbow area

Topography uneven Vegetation & Conditon grasses and forbs

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 17 Emh 14 EM Calibration Site: EM_V Emh

Root depth inches Soil Temperature, ^{0}C (2") 15.6 (16") 15.6

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.13 ds/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
	0-20	fsl	14	55			moist					very friable
	20-30	ls	4	80			moist					single grained

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

higher elevation areas in oxbow about 55h and 80v (EM38)

site appears to be is located on a sand channel area. (Paleo channell)

EM38 Measurements:

Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			14.1	13.5	1	19.8	11.1
			15.9	15.3	1.11	16.4	12.8
			13.7	9.8	1	20.7	13.3
			19.8	22.6	2.04	16.3	15
			13.2	11.3	1	20.4	16.6
			12.2	9.1	1	18.4	18.9

SJR riparian vegetation suitability study

Well or Boring# rip83 Sampler: brummer burton Date: 4/13/2018

location wgs84 37.26812 120.82818 wp446lee Landform basin NRCS Map Unit waukena

Location Notes 120 fett from toe of levee

Topography uneven Vegetation & Conditon clover, mouse barley,seepweed,saltgrass

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 133 EM_H 93 EM Calibration Site: EM_V 139 Emh 100

Root depth inches Soil Temperature, ^{0}C (2") 16.7 (16") 15.6

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 6.43 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
jb	0-28	sicl	28	20	gray		sm-m					firm

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

represents large area of basin soils away from recent river deposits

EM38 Measurements:

Emv	Emh	Ece
111	83	5.95
130	101	8.15

EM_V	EM_H	Ece	EM_V	EM_H
139	101	7.52	121	87
138	98	7.02	139	86
119	77	4.34	150	98
141	100	7.21	131	88
147	104	7.57	141	90
132	111	10.04	126	77

SJR riparian vegetation suitability study

Well or Boring# rip84 Sampler: brummer burton Date: 4/13/2018

location wgs84 37.26952 120.82781 wp440jb Landform terrace NRCS Map Unit

Location Notes 60 feet from new river channel; lower area

Topography uneven Vegetation & Conditon 2 willow trees; grasses, weeds

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 83 EM_H 57 EM Calibration Site: EM_V 67.5 Emh 44.5

Root depth inches Soil Temperature, ^{0}C (2") 17.2 (16") 15.6

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 3.82 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
ns	0-10	sil	18	25			moist					friable
ns	10to30	sicl	28	20			m-sm					firm

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

em38 only

EM38 Measurements:

Emv	Emh	Ece	EM_V	EM_H	Ece	EM_V	EM_H
			65	41	1.69	99	71
70	49	2.97	67	46	2.56	89	56
82	60	4.42	73	52	3.38	82	56
67	41	1.58	98	73	6	93	62
71	45	2.1	65	50	3.56	80	52
			159	121	11.71	68	43

SJR riparian vegetation suitability study

Well or Boring# rip85 Sampler: brummer lee Date: 4/18/2018

location wgs84 37.11347 120.59263 wp449lee Landform natural levee NRCS Map Unit columbia

Location Notes 40-80 feet from river; a few hundred yards downstrean from sand slough gate

Topography uneven Vegetation & Conditon fallow; weeds

Irrigation System Type: dryland Irrigation Quadrant na

Avg EM Measurements; EM_V 27 EM_H 20 EM Calibration Site: EM_V 24.5 Emh 15.5

Root depth inches Soil Temperature, ^{0}C (2") 16.6 (16") 16.4

Estimated water holding capacity 0-60" Em38 est Ece 0-36" 1.6 dS/m

PROFILE DESCRIPTION AND LABORATORY DATA

Sample No.	Depth (Inches)	USDA Texture	% Clay	% Sand	Color	Reaction to HCL[1]	Moisture Content[2]	Mottles	pH Paste	ECe dS/m	Sat. %	Notes:
ns	0-30	fsl	7	68	ltgrbr		moist					very friable; Eca 0-2in 0.20 dS/m

[1] **Lime content; HCL reaction 0 none; + slight; ++ moderate +++ strong**

[2] **Soil moist: nearly dry=nd; slightly moist = sm; moist = m; very moist= vm; wet = w; saturated=S;**

Field capacity will be considered very moist. Wet will be considered capillary fringe conditions.

Site Remarks: **Numeric values indicate percent moisture by weight.**

4B1 river water EC 2.7 dS/m; casual water about 1 foot deep in river

Eca sandy river bank 0.22 dS/m; Eca near checkhole 0.20 dS/m

salinity increases as one moves away from river;

site is very sandy in spots near river;

EM38 Measurements:	Emv	Emh	Ece
	27.3	17.8	1
	44.4	30.6	2.92

EM_V	EM_H	Ece	EM_V	EM_H
24.5	15.5	1	41.1	27.6
21.4	14.7	1	28.6	21.9
23.8	14.7	1	25.6	16.7
29.7	20.4	1.42	20.7	17.1
30.4	21.2	1.58	14.6	9.1
36.6	24.8	2.01	21.7	13.1

Appendix D: Laboratory Data Sheets and Graphs for Soil Fertility Sites

FGL ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

September 27, 2017

U.S. Bureau of Reclamation
Attn: Victor Stokmanis
2800 Cottage Wy.
MP-157
Sacramento, CA 95825
Description : RIP16 30 X Comp 0-12
Project : SJR Baseline Soil Salinity Monitoring

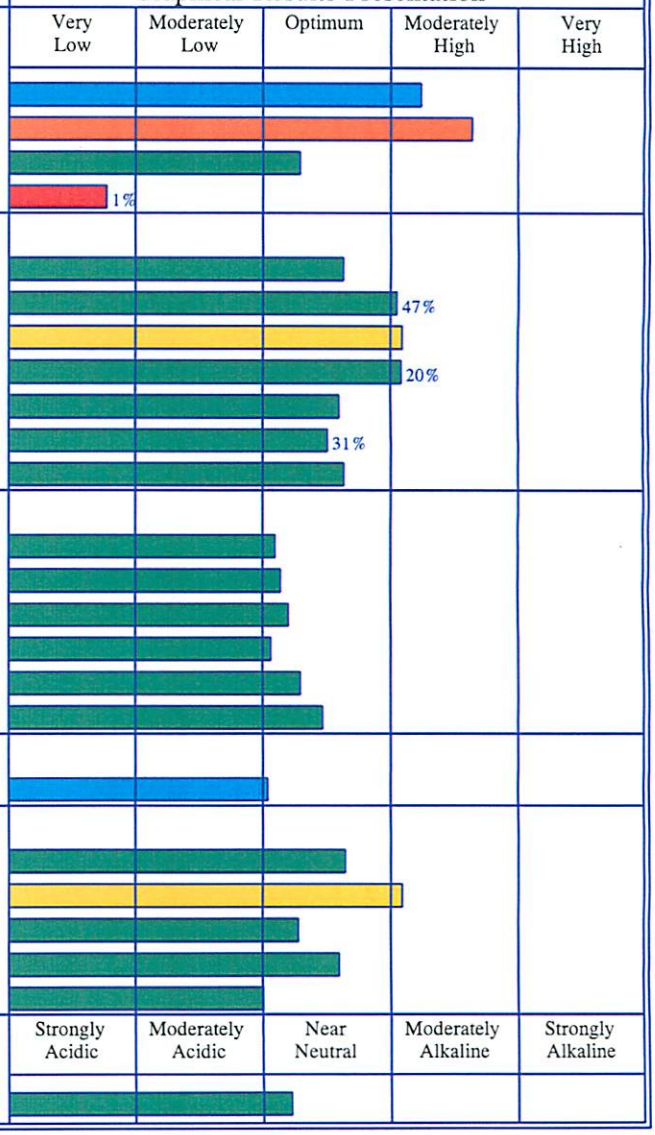
Lab ID : STK1738839-002
Customer ID : 3-16426

Sampled On : May 5, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range
Primary Nutrients			
Nitrate-Nitrogen	41.4	PPM	17 - 37
Phosphorus	59	PPM	27 - 37
Potassium (Exch)	140	PPM	58 - 340
Potassium (Sol)	0.418	meq/L	0.92 - 2.9
Secondary Nutrients			
Calcium (Exch)	2140	PPM	1800 - 2400
Calcium (Sol)	14.5	meq/L	2.8 - 9.2
Magnesium (Exch)	388	PPM	180 - 360
Magnesium (Sol)	6.17	meq/L	0.76 - 4.0
Sodium (Exch)	100	PPM	0.0 - 170
Sodium (Sol)	9.64	meq/L	0.0 - 19
Sulfate	15.6	meq/L	2.9 - 23
Micro Nutrients			
Zinc	5.0	PPM	1.3 - 40
Manganese	10.6	PPM	2.7 - 61
Iron	23.1	PPM	11 - 71
Copper	2.7	PPM	0.30 - 40
Boron	0.699	PPM	0.35 - 1.5
Chloride	2.89	meq/L	0.15 - 6.0
CEC	14.7	meq/100g	14 - 35
% Base Saturation			
CEC - Calcium	72.8	%	60 - 80
CEC - Magnesium	21.7	%	10 - 20
CEC - Potassium	2.37	%	1.0 - 6.0
CEC - Sodium	2.96	%	0.0 - 5.0
CEC - Hydrogen	< 1.00	%	0.0 - 3.0
pH	6.72	Units	6.5 - 7.5

Graphical Results Presentation



Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

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9415 W. Goshen Avenue
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CA ELAP Certification No. 2810

September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738839-002
Customer ID : 3-16426
Description : RIP16 30 X Comp 0-12

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	2.86	dS/m	0.0 - 2.0	
SAR	3.0		0.0 - 6.0	
Limestone	< 0.10	%	0.0 - 0.50	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	< 0.50	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	10.2	%	4.0 - 28	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	39.9	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Scott Bucy

Scott Bucy, Director of Ag. Services

SB1:JRJ

FGL ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

September 27, 2017

U.S. Bureau of Reclamation
Attn: Victor Stokmanis
2800 Cottage Wy.
MP-157
Sacramento, CA 95825
Description : RIP16 30-60
Project : SJA Baseline Soil Salinity Monitoring

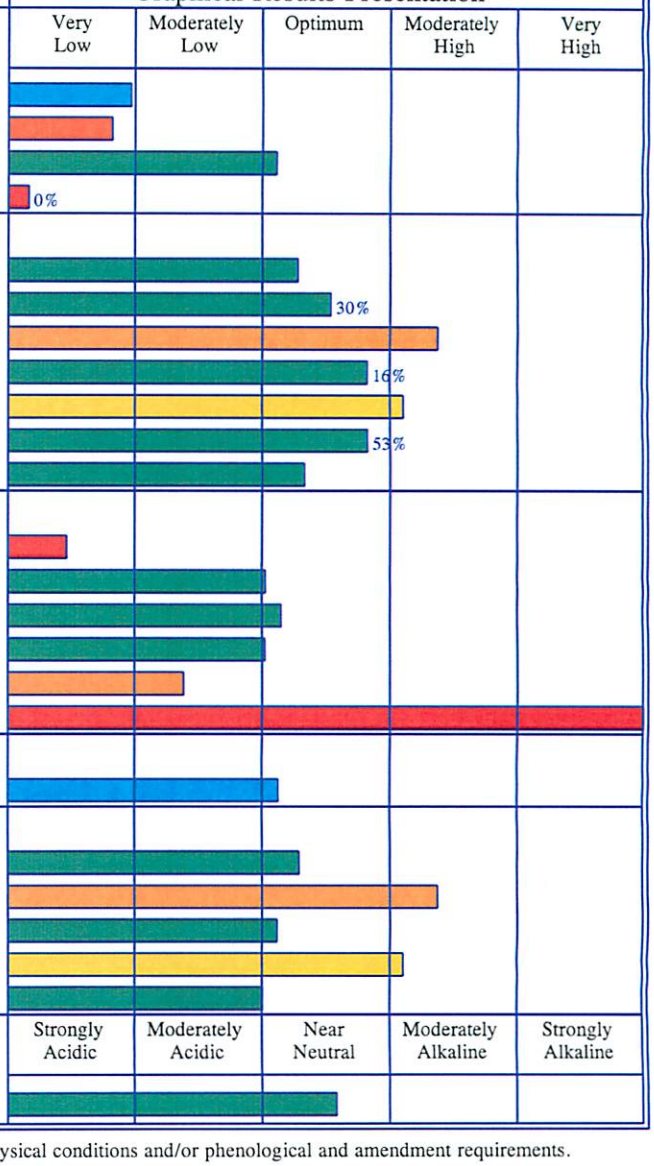
Lab ID : STK1738840-002
Customer ID : 3-16426

Sampled On : May 5, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range
Primary Nutrients			
Nitrate-Nitrogen	10.3	PPM	16 - 36
Phosphorus	12	PPM	27 - 37
Potassium (Exch)	100	PPM	65 - 390
Potassium (Sol)	0.089	meq/L	0.93 - 2.9
Secondary Nutrients			
Calcium (Exch)	2180	PPM	2000 - 2700
Calcium (Sol)	5.90	meq/L	2.7 - 8.7
Magnesium (Exch)	551	PPM	200 - 400
Magnesium (Sol)	3.24	meq/L	0.78 - 3.8
Sodium (Exch)	210	PPM	0.0 - 190
Sodium (Sol)	10.5	meq/L	0.0 - 13
Sulfate	8.15	meq/L	1.6 - 22
Micro Nutrients			
Zinc	0.4	PPM	1.4 - 41
Manganese	4.2	PPM	2.7 - 61
Iron	20.5	PPM	12 - 72
Copper	1.1	PPM	0.31 - 40
Boron	0.20	PPM	0.35 - 1.5
Chloride	8.76	meq/L	0.15 - 6.0
CEC	16.6	meq/100g	14 - 35
% Base Saturation			
CEC - Calcium	65.7	%	60 - 80
CEC - Magnesium	27.3	%	10 - 20
CEC - Potassium	1.57	%	1.0 - 6.0
CEC - Sodium	5.50	%	0.0 - 5.0
CEC - Hydrogen	< 1.00	%	0.0 - 3.0
pH	7.08	Units	6.5 - 7.5

Graphical Results Presentation



Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

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CA ELAP Certification No. 2810

September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738840-002
Customer ID : 3-16426
Description : RIP16 30-60

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	2.11	dS/m	0.0 - 2.0	
SAR	4.9		0.0 - 6.0	
Limestone	< 0.10	%	0.0 - 0.50	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	< 0.50	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	20.9	%	4.1 - 28	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	40.7	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Scott Bucy

Scott Bucy, Director of Ag. Services

SB1:JRJ

ENVIRONMENTAL FGL AGRICULTURAL
Analytical Chemists

September 27, 2017

U.S. Bureau of Reclamation
Attn: Victor Stokmanis
2800 Cottage Wy.
MP-157
Sacramento, CA 95825
Description : RIP16 12-30
Project : SJA Baseline Soil Salinity Monitoring

Lab ID : STK1738840-003
Customer ID : 3-16426

Sampled On : May 5, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range
Primary Nutrients			
Nitrate-Nitrogen	29.7	PPM	12 - 32
Phosphorus	42	PPM	25 - 35
Potassium (Exch)	90	PPM	38 - 230
Potassium (Sol)	0.257	meq/L	0.78 - 2.8
Secondary Nutrients			
Calcium (Exch)	1440	PPM	1200 - 1600
Calcium (Sol)	10.2	meq/L	2.2 - 8.2
Magnesium (Exch)	253	PPM	120 - 240
Magnesium (Sol)	4.49	meq/L	0.34 - 3.4
Sodium (Exch)	70	PPM	0.0 - 110
Sodium (Sol)	8.36	meq/L	0.0 - 16
Sulfate	11.6	meq/L	1.7 - 22
Micro Nutrients			
Zinc	3.3	PPM	1.1 - 40
Manganese	6.9	PPM	2.1 - 60
Iron	21.2	PPM	8.6 - 69
Copper	1.6	PPM	0.22 - 40
Boron	0.45	PPM	0.31 - 1.5
Chloride	3.04	meq/L	0.11 - 6.0
CEC	9.82	meq/100g	14 - 35
% Base Saturation			
CEC - Calcium	73.3	%	60 - 80
CEC - Magnesium	21.2	%	10 - 20
CEC - Potassium	2.31	%	1.0 - 6.0
CEC - Sodium	3.23	%	0.0 - 5.0
CEC - Hydrogen	< 1.00	%	0.0 - 3.0
pH	6.94	Units	6.5 - 7.5

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

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CA ELAP Certification No. 2810

September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738840-003
Customer ID : 3-16426
Description : RIP16 12-30

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	2.30	dS/m	0.0 - 2.0	
SAR	3.1		0.0 - 6.0	
Limestone	< 0.10	%	0.0 - 0.50	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	< 0.50	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	11.2	%	3.2 - 22	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	31.8	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Scott Bucy

Scott Bucy, Director of Ag. Services

SB1:JRJ

FGL ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

September 27, 2017

U.S. Bureau of Reclamation
Attn: Victor Stokmanis
2800 Cottage Wy.
MP-157
Sacramento, CA 95825

Description : RIP17 30 X Comp 0-12
Project : SJA Baseline Soil Salinity Monitoring

Lab ID : STK1738840-001
Customer ID : 3-16426

Sampled On : May 5, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range
Primary Nutrients			
Nitrate-Nitrogen	42.4	PPM	22 - 42
Phosphorus	43	PPM	30 - 40
Potassium (Exch)	210	PPM	110 - 680
Potassium (Sol)	0.247	meq/L	1.1 - 3.1
Secondary Nutrients			
Calcium (Exch)	4330	PPM	3500 - 4600
Calcium (Sol)	9.79	meq/L	3.6 - 9.6
Magnesium (Exch)	734	PPM	350 - 700
Magnesium (Sol)	4.09	meq/L	1.4 - 4.4
Sodium (Exch)	170	PPM	0.0 - 330
Sodium (Sol)	7.27	meq/L	0.0 - 16
Sulfate	11.1	meq/L	1.8 - 22
Micro Nutrients			
Zinc	5.6	PPM	1.8 - 43
Manganese	9.8	PPM	3.7 - 65
Iron	9.4	PPM	16 - 80
Copper	2.9	PPM	0.45 - 43
Boron	0.43	PPM	0.42 - 1.6
Chloride	1.64	meq/L	0.22 - 6.1
CEC	28.9	meq/100g	14 - 35
% Base Saturation			
CEC - Calcium	74.7	%	60 - 80
CEC - Magnesium	20.9	%	10 - 20
CEC - Potassium	1.89	%	1.0 - 6.0
CEC - Sodium	2.50	%	0.0 - 5.0
CEC - Hydrogen	< 1.00	%	0.0 - 3.0
pH	7.60	Units	6.5 - 7.5

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

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September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738840-001
Customer ID : 3-16426
Description : RIP17 30 X Comp 0-12

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	2.03	dS/m	0.0 - 2.0	
SAR	2.8		0.0 - 6.0	
Limestone	< 0.10	%	0.0 - 0.50	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	< 0.50	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	15.1	%	5.3 - 37	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	53.4	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Scott Bucy

Scott Bucy, Director of Ag. Services

SB1:JRJ

FGL
ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

September 27, 2017
U.S. Bureau of Reclamation
Attn: Victor Stokmanis
2800 Cottage Wy.
MP-157
Sacramento, CA 95825
Description : RIP17 12-30
Project : SJA Baseline Soil Salinity Monitoring

Lab ID : STK1738840-004
Customer ID : 3-16426

Sampled On : May 5, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Primary Nutrients				Very Low / Moderately Low / Optimum / Moderately High / Very High
Nitrate-Nitrogen	14.9	PPM	17 - 37	
Phosphorus	8	PPM	28 - 38	
Potassium (Exch)	110	PPM	92 - 550	
Potassium (Sol)	0.045	meq/L	0.99 - 3.0	0%
Secondary Nutrients				
Calcium (Exch)	3410	PPM	2800 - 3800	
Calcium (Sol)	5.30	meq/L	3.0 - 9.0	32%
Magnesium (Exch)	639	PPM	290 - 570	
Magnesium (Sol)	2.25	meq/L	0.97 - 4.0	14%
Sodium (Exch)	250	PPM	0.0 - 270	
Sodium (Sol)	8.73	meq/L	0.0 - 12	53%
Sulfate	9.10	meq/L	1.5 - 22	
Micro Nutrients				
Zinc	0.6	PPM	1.6 - 44	
Manganese	2.9	PPM	3.1 - 66	
Iron	11.0	PPM	14 - 78	
Copper	1.3	PPM	0.36 - 44	
Boron	0.31	PPM	0.37 - 1.6	
Chloride	2.25	meq/L	0.17 - 6.1	
CEC	23.6	meq/100g	14 - 35	
% Base Saturation				
CEC - Calcium	72.0	%	60 - 80	
CEC - Magnesium	22.3	%	10 - 20	
CEC - Potassium	1.19	%	1.0 - 6.0	
CEC - Sodium	4.53	%	0.0 - 5.0	
CEC - Hydrogen	< 1.00	%	0.0 - 3.0	
				Strongly Acidic / Moderately Acidic / Near Neutral / Moderately Alkaline / Strongly Alkaline
pH	7.84	Units	6.5 - 7.5	

Good — Problem. Blue: Indicates physical conditions and/or phenological and amendment requirements.

September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738840-004
Customer ID : 3-16426
Description : RIP17 12-30

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	1.53	dS/m	0.0 - 2.0	
SAR	4.5		0.0 - 6.0	
Limestone	< 0.10	%	0.0 - 0.50	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	< 0.50	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	18.4	%	4.4 - 31	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	44.4	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Scott Bucy

Scott Bucy, Director of Ag. Services

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FGL ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

September 27, 2017

U.S. Bureau of Reclamation
Attn: Victor Stokmanis
2800 Cottage Wy.
MP-157
Sacramento, CA 95825
Description : RIP17 30-60
Project : SJA Baseline Soil Salinity Monitoring

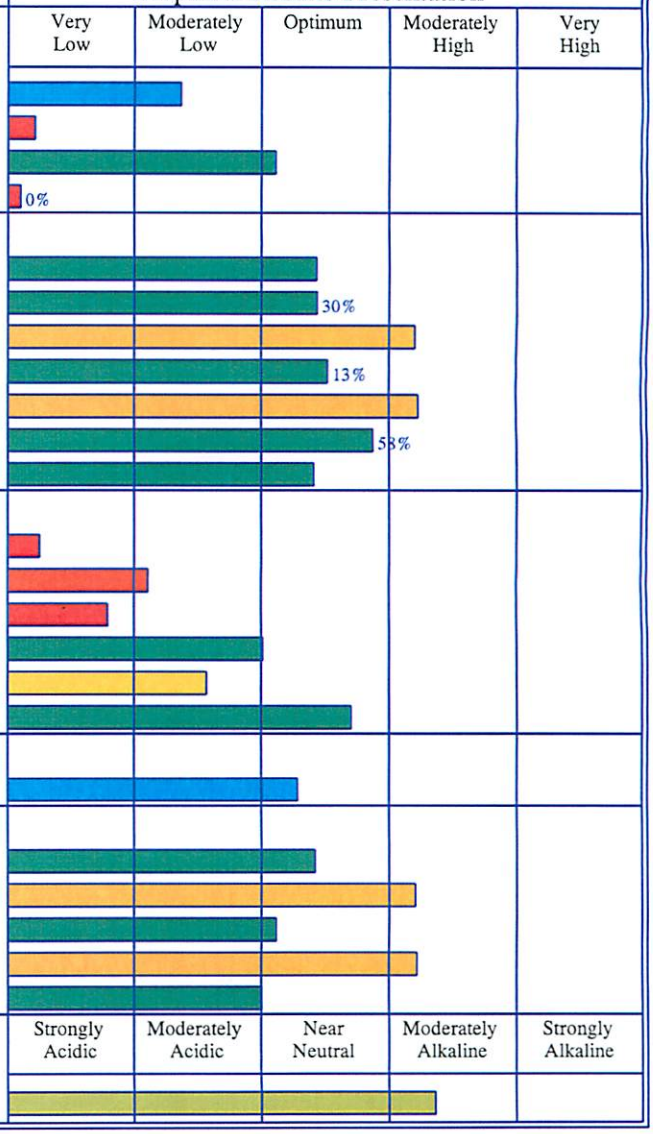
Lab ID : STK1738840-005
Customer ID : 3-16426

Sampled On : May 5, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range
Primary Nutrients			
Nitrate-Nitrogen	10.6	PPM	14 - 34
Phosphorus	3	PPM	26 - 36
Potassium (Exch)	120	PPM	78 - 470
Potassium (Sol)	0.032	meq/L	0.88 - 2.9
Secondary Nutrients			
Calcium (Exch)	2730	PPM	2400 - 3200
Calcium (Sol)	5.08	meq/L	2.5 - 8.5
Magnesium (Exch)	580	PPM	240 - 480
Magnesium (Sol)	2.16	meq/L	0.62 - 3.6
Sodium (Exch)	280	PPM	0.0 - 230
Sodium (Sol)	9.88	meq/L	0.0 - 11
Sulfate	9.33	meq/L	1.2 - 21
Micro Nutrients			
Zinc	0.2	PPM	1.3 - 44
Manganese	1.7	PPM	2.7 - 65
Iron	5.4	PPM	11 - 76
Copper	0.7	PPM	0.29 - 43
Boron	0.23	PPM	0.34 - 1.5
Chloride	4.27	meq/L	0.14 - 6.0
CEC	19.9	meq/100g	14 - 35
% Base Saturation			
CEC - Calcium	68.3	%	60 - 80
CEC - Magnesium	24.0	%	10 - 20
CEC - Potassium	1.56	%	1.0 - 6.0
CEC - Sodium	6.08	%	0.0 - 5.0
CEC - Hydrogen	< 1.00	%	0.0 - 3.0
pH	7.82	Units	6.5 - 7.5

Graphical Results Presentation



Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

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September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738840-005
Customer ID : 3-16426
Description : RIP17 30-60

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	1.77	dS/m	0.0 - 2.0	
SAR	5.2		0.0 - 6.0	
Limestone	< 0.10	%	0.0 - 0.50	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	< 0.50	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	13.1	%	3.8 - 26	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	37.5	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Scott Bucy

Scott Bucy, Director of Ag. Services

SB1:JRJ

FGL ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

September 27, 2017

U.S. Bureau of Reclamation
Attn: Victor Stokmanis
2800 Cottage Wy.
MP-157
Sacramento, CA 95825
Description : RIP18 30-55
Project : SJA Baseline Soil Salinity Monitoring

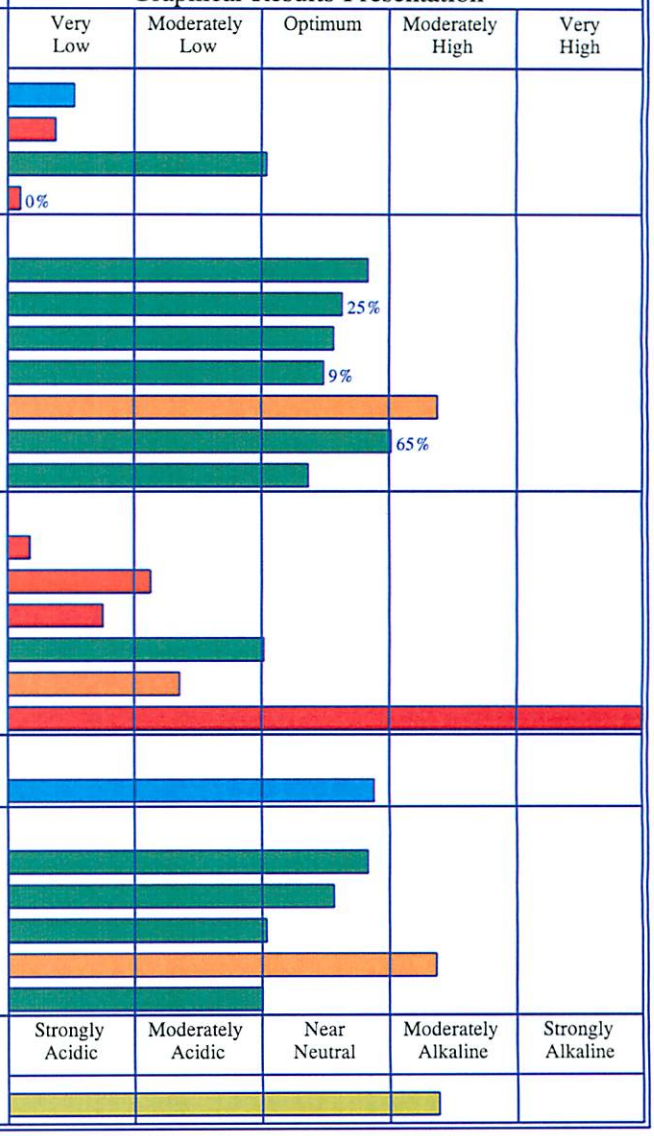
Lab ID : STK1738840-007
Customer ID : 3-16426

Sampled On : May 5, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range
Primary Nutrients			
Nitrate-Nitrogen	8.5	PPM	21 - 41
Phosphorus	7	PPM	31 - 41
Potassium (Exch)	150	PPM	130 - 760
Potassium (Sol)	< 0.054	meq/L	9.0 - 2.9
Secondary Nutrients			
Calcium (Exch)	4970	PPM	3900 - 5200
Calcium (Sol)	6.94	meq/L	3.2 - 9.2
Magnesium (Exch)	614	PPM	390 - 790
Magnesium (Sol)	2.58	meq/L	1.1 - 4.1
Sodium (Exch)	510	PPM	0.0 - 370
Sodium (Sol)	17.7	meq/L	0.0 - 13
Sulfate	11.1	meq/L	3.7 - 24
Micro Nutrients			
Zinc	0.2	PPM	1.7 - 44
Manganese	2.4	PPM	3.3 - 66
Iron	7.7	PPM	15 - 80
Copper	1.1	PPM	0.39 - 44
Boron	0.228	PPM	0.39 - 1.6
Chloride	13.2	meq/L	0.19 - 6.1
CEC	32.4	meq/100g	14 - 35
% Base Saturation			
CEC - Calcium	76.5	%	60 - 80
CEC - Magnesium	15.6	%	10 - 20
CEC - Potassium	1.16	%	1.0 - 6.0
CEC - Sodium	6.79	%	0.0 - 5.0
CEC - Hydrogen	< 1.00	%	0.0 - 3.0
pH	7.84	Units	6.5 - 7.5

Graphical Results Presentation



Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

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September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738840-007
Customer ID : 3-16426
Description : RIP18 30-55

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	3.13	dS/m	0.0 - 2.0	
SAR	8.1		0.0 - 6.0	
Limestone	1.2	%	0.0 - 0.50	
				0 1 2 3 4 5 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	1.2	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	18.6	%	4.8 - 33	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	47.7	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Scott Bucy

Scott Bucy, Director of Ag. Services

SB1:JRJ

FGL ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

September 27, 2017

U.S. Bureau of Reclamation
Attn: Victor Stokmanis
2800 Cottage Wy.
MP-157
Sacramento, CA 95825
Description : RIP18 12-30
Project : SJA Baseline Soil Salinity Monitoring

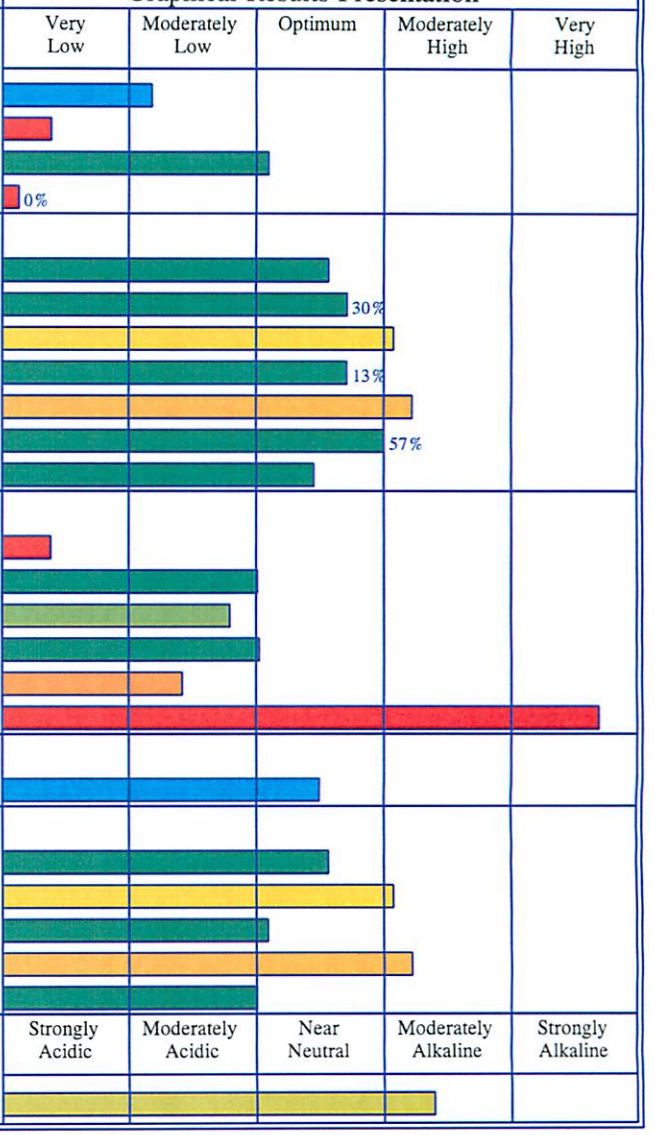
Lab ID : STK1738840-006
Customer ID : 3-16426

Sampled On : May 5, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range
Primary Nutrients			
Nitrate-Nitrogen	14.6	PPM	19 - 39
Phosphorus	6	PPM	28 - 38
Potassium (Exch)	140	PPM	95 - 570
Potassium (Sol)	0.081	meq/L	1.0 - 3.0
Secondary Nutrients			
Calcium (Exch)	3470	PPM	2900 - 3900
Calcium (Sol)	7.25	meq/L	3.0 - 9.0
Magnesium (Exch)	633	PPM	300 - 590
Magnesium (Sol)	3.12	meq/L	1.0 - 4.0
Sodium (Exch)	340	PPM	0.0 - 280
Sodium (Sol)	13.7	meq/L	0.0 - 14
Sulfate	11.7	meq/L	2.7 - 23
Micro Nutrients			
Zinc	0.4	PPM	1.6 - 44
Manganese	3.7	PPM	3.2 - 66
Iron	12.8	PPM	14 - 79
Copper	1.3	PPM	0.37 - 44
Boron	0.23	PPM	0.38 - 1.6
Chloride	7.39	meq/L	0.17 - 6.1
CEC	24.3	meq/100g	14 - 35
% Base Saturation			
CEC - Calcium	71.2	%	60 - 80
CEC - Magnesium	21.4	%	10 - 20
CEC - Potassium	1.44	%	1.0 - 6.0
CEC - Sodium	6.09	%	0.0 - 5.0
CEC - Hydrogen	< 1.00	%	0.0 - 3.0
pH	7.85	Units	6.5 - 7.5

Graphical Results Presentation



Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

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CA ELAP Certification No. 2810

September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738840-006
Customer ID : 3-16426
Description : RIP18 12-30

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	2.60	dS/m	0.0 - 2.0	
SAR	6.0		0.0 - 6.0	
Limestone	< 0.10	%	0.0 - 0.50	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	< 0.50	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	20.1	%	4.5 - 32	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	45.0	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Scott Bucy

Scott Bucy, Director of Ag. Services

SB1:JRJ

FGL ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

September 27, 2017

U.S. Bureau of Reclamation
Attn: Victor Stokmanis
2800 Cottage Wy.
MP-157
Sacramento, CA 95825
Description : RIP18 30 X Comp 0-12
Project : SJR Baseline Soil Salinity Monitoring

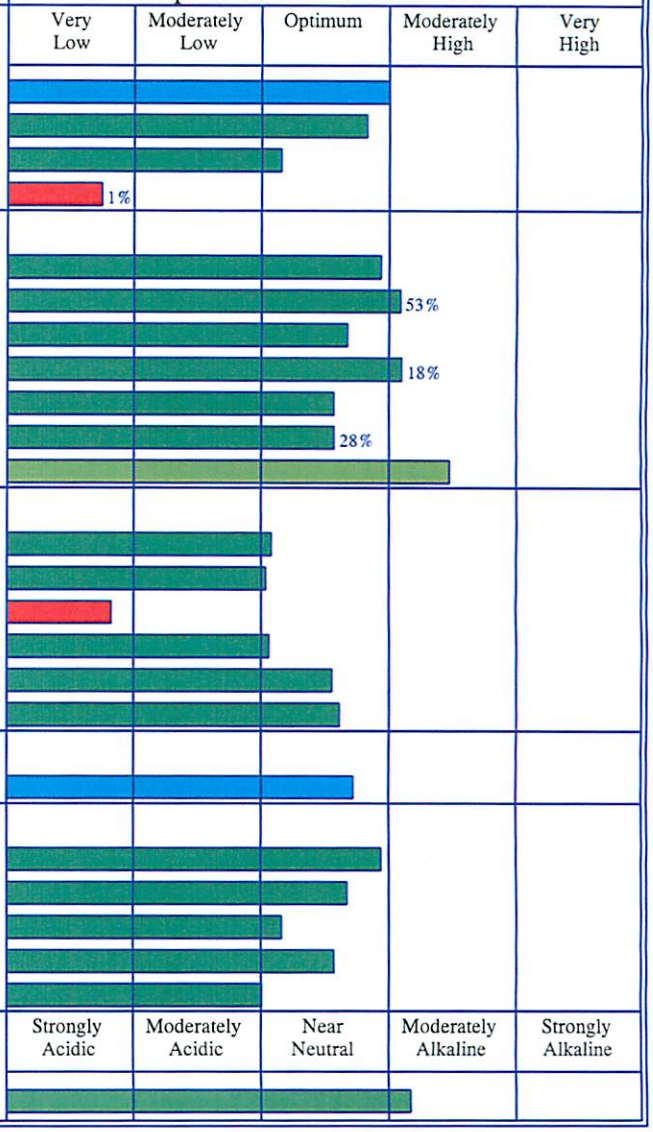
Lab ID : STK1738839-003
Customer ID : 3-16426

Sampled On : May 5, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range
Primary Nutrients			
Nitrate-Nitrogen	44.4	PPM	24 - 44
Phosphorus	40	PPM	32 - 42
Potassium (Exch)	200	PPM	110 - 680
Potassium (Sol)	0.506	meq/L	9.0 - 2.9
Secondary Nutrients			
Calcium (Exch)	4590	PPM	3500 - 4700
Calcium (Sol)	27.6	meq/L	3.2 - 9.2
Magnesium (Exch)	591	PPM	350 - 710
Magnesium (Sol)	9.45	meq/L	1.1 - 4.2
Sodium (Exch)	190	PPM	0.0 - 340
Sodium (Sol)	14.7	meq/L	0.0 - 26
Sulfate	36.8	meq/L	7.0 - 27
Micro Nutrients			
Zinc	4.9	PPM	1.7 - 43
Manganese	5.3	PPM	3.3 - 65
Iron	8.5	PPM	15 - 78
Copper	2.8	PPM	0.39 - 43
Boron	1.05	PPM	0.39 - 1.6
Chloride	3.77	meq/L	0.19 - 6.1
CEC	29.1	meq/100g	14 - 35
% Base Saturation			
CEC - Calcium	78.7	%	60 - 80
CEC - Magnesium	16.7	%	10 - 20
CEC - Potassium	1.79	%	1.0 - 6.0
CEC - Sodium	2.83	%	0.0 - 5.0
CEC - Hydrogen	< 1.00	%	0.0 - 3.0
pH	7.65	Units	6.5 - 7.5

Graphical Results Presentation



Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

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September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738839-003
Customer ID : 3-16426
Description : RIP18 30 X Comp 0-12

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	4.68	dS/m	0.0 - 2.0	
SAR	3.4		0.0 - 6.0	
Limestone	1.6	%	0.0 - 0.50	
				0 1 2 3 4 5 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	< 0.50	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	15.3	%	4.8 - 34	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	48.1	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Scott Bucy

Scott Bucy, Director of Ag. Services

SB1:JRJ

FGL ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

September 27, 2017

U.S. Bureau of Reclamation
Attn: Victor Stokmanis
2800 Cottage Wy.
MP-157
Sacramento, CA 95825
Description : RIP19 20 X Comp 0-12
Project : SJR Baseline Soil Salinity Monitoring

Lab ID : STK1738839-006
Customer ID : 3-16426

Sampled On : June 8, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range
Primary Nutrients			
Nitrate-Nitrogen	31.7	PPM	16 - 36
Phosphorus	33	PPM	27 - 37
Potassium (Exch)	80	PPM	52 - 310
Potassium (Sol)	0.131	meq/L	0.93 - 2.9
Secondary Nutrients			
Calcium (Exch)	2020	PPM	1600 - 2100
Calcium (Sol)	5.21	meq/L	2.7 - 8.7
Magnesium (Exch)	297	PPM	160 - 320
Magnesium (Sol)	1.92	meq/L	0.80 - 3.8
Sodium (Exch)	120	PPM	0.0 - 150
Sodium (Sol)	7.07	meq/L	0.0 - 11
Sulfate	1.84	meq/L	1.4 - 21
Micro Nutrients			
Zinc	1.4	PPM	1.4 - 41
Manganese	6.5	PPM	2.8 - 61
Iron	24.2	PPM	12 - 72
Copper	1.0	PPM	0.31 - 40
Boron	0.19	PPM	0.35 - 1.5
Chloride	2.37	meq/L	0.16 - 6.0
CEC	13.3	meq/100g	14 - 35
% Base Saturation			
CEC - Calcium	75.9	%	60 - 80
CEC - Magnesium	18.3	%	10 - 20
CEC - Potassium	1.59	%	1.0 - 6.0
CEC - Sodium	3.77	%	0.0 - 5.0
CEC - Hydrogen	< 1.00	%	0.0 - 3.0
pH	7.08	Units	6.5 - 7.5

Graphical Results Presentation

Very Low | Moderately Low | Optimum | Moderately High | Very High

1%
36%
13%
49%

Strongly Acidic | Moderately Acidic | Near Neutral | Moderately Alkaline | Strongly Alkaline

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

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September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738839-006
Customer ID : 3-16426
Description : RIP19 20 X Comp 0-12

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	1.47	dS/m	0.0 - 2.0	
SAR	3.7		0.0 - 6.0	
Limestone	< 0.10	%	0.0 - 0.50	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	< 0.50	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	14.4	%	4.1 - 29	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	41.0	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Scott Bucy

Scott Bucy, Director of Ag. Services

SB1:JRJ

ENVIRONMENTAL FGL AGRICULTURAL
Analytical Chemists

September 27, 2017

U.S. Bureau of Reclamation
Attn: Victor Stokmanis
2800 Cottage Wy.
MP-157
Sacramento, CA 95825
Description : RIP20 20 X Comp 0-12
Project : SJR Baseline Soil Salinity Monitoring

Lab ID : STK1738839-004
Customer ID : 3-16426

Sampled On : June 8, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Primary Nutrients				
Nitrate-Nitrogen	26.2	PPM	16 - 36	
Phosphorus	24	PPM	27 - 37	
Potassium (Exch)	70	PPM	43 - 260	
Potassium (Sol)	0.120	meq/L	0.95 - 3.0	1%
Secondary Nutrients				
Calcium (Exch)	1660	PPM	1300 - 1800	
Calcium (Sol)	3.41	meq/L	3.2 - 10	34%
Magnesium (Exch)	271	PPM	140 - 270	
Magnesium (Sol)	1.36	meq/L	0.90 - 4.5	14%
Sodium (Exch)	90	PPM	0.0 - 130	
Sodium (Sol)	5.07	meq/L	0.0 - 9.2	51%
Sulfate	1.10	meq/L	1.4 - 21	
Micro Nutrients				
Zinc	1.3	PPM	1.4 - 40	
Manganese	9.7	PPM	2.8 - 61	
Iron	52.0	PPM	12 - 72	
Copper	1.2	PPM	0.32 - 40	
Boron	0.14	PPM	0.36 - 1.6	
Chloride	1.38	meq/L	0.16 - 6.1	
CEC	11.1	meq/100g	14 - 35	
% Base Saturation				
CEC - Calcium	74.8	%	60 - 80	
CEC - Magnesium	20.1	%	10 - 20	
CEC - Potassium	1.70	%	1.0 - 6.0	
CEC - Sodium	3.67	%	0.0 - 5.0	
CEC - Hydrogen	< 1.00	%	0.0 - 3.0	
				Strongly Acidic / Moderately Acidic / Near Neutral / Moderately Alkaline / Strongly Alkaline
pH	6.17	Units	6.5 - 7.5	

Good — Problem Indicates physical conditions and/or phenological and amendment requirements.

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September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738839-004
Customer ID : 3-16426
Description : RIP20 20 X Comp 0-12

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	1.05	dS/m	0.0 - 2.0	
SAR	3.3		0.0 - 6.0	
Limestone	< 0.10	%	0.0 - 0.50	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	< 0.50	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	16.6	%	4.2 - 29	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	42.0	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Scott Bucy

Scott Bucy, Director of Ag. Services

SB1:JRJ

FGL ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

September 27, 2017

U.S. Bureau of Reclamation
Attn: Victor Stokmanis
2800 Cottage Wy.
MP-157
Sacramento, CA 95825
Description : RIP21 20 X Comp 0-12
Project : SJR Baseline Soil Salinity Monitoring

Lab ID : STK1738839-001
Customer ID : 3-16426

Sampled On : June 8, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Primary Nutrients				
Nitrate-Nitrogen	21.3	PPM	18 - 38	
Phosphorus	12	PPM	28 - 38	
Potassium (Exch)	90	PPM	65 - 390	
Potassium (Sol)	0.064	meq/L	1.0 - 3.0	1%
Secondary Nutrients				
Calcium (Exch)	2540	PPM	2000 - 2700	
Calcium (Sol)	2.41	meq/L	3.0 - 9.0	30%
Magnesium (Exch)	383	PPM	200 - 410	
Magnesium (Sol)	0.865	meq/L	1.0 - 4.0	11%
Sodium (Exch)	150	PPM	0.0 - 190	
Sodium (Sol)	4.68	meq/L	0.0 - 7.6	58%
Sulfate	0.842	meq/L	1.5 - 22	
Micro Nutrients				
Zinc	0.6	PPM	1.6 - 43	
Manganese	5.8	PPM	3.2 - 64	
Iron	17.2	PPM	14 - 77	
Copper	1.2	PPM	0.37 - 42	
Boron	0.11	PPM	0.38 - 1.6	
Chloride	0.78	meq/L	0.18 - 6.1	
CEC	16.7	meq/100g	14 - 35	
% Base Saturation				
CEC - Calcium	76.0	%	60 - 80	
CEC - Magnesium	18.9	%	10 - 20	
CEC - Potassium	1.32	%	1.0 - 6.0	
CEC - Sodium	3.98	%	0.0 - 5.0	
CEC - Hydrogen	< 1.00	%	0.0 - 3.0	
				Strongly Acidic / Moderately Acidic / Near Neutral / Moderately Alkaline / Strongly Alkaline
pH	7.58	Units	6.5 - 7.5	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

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September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738839-001
Customer ID : 3-16426
Description : RIP21 20 X Comp 0-12

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	0.79	dS/m	0.0 - 2.0	
SAR	3.7		0.0 - 6.0	
Limestone	< 0.10	%	0.0 - 0.50	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	< 0.50	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	16.5	%	4.6 - 32	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	45.6	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Scott Bucy

Scott Bucy, Director of Ag. Services

SB1:JRJ

FGL ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

September 27, 2017

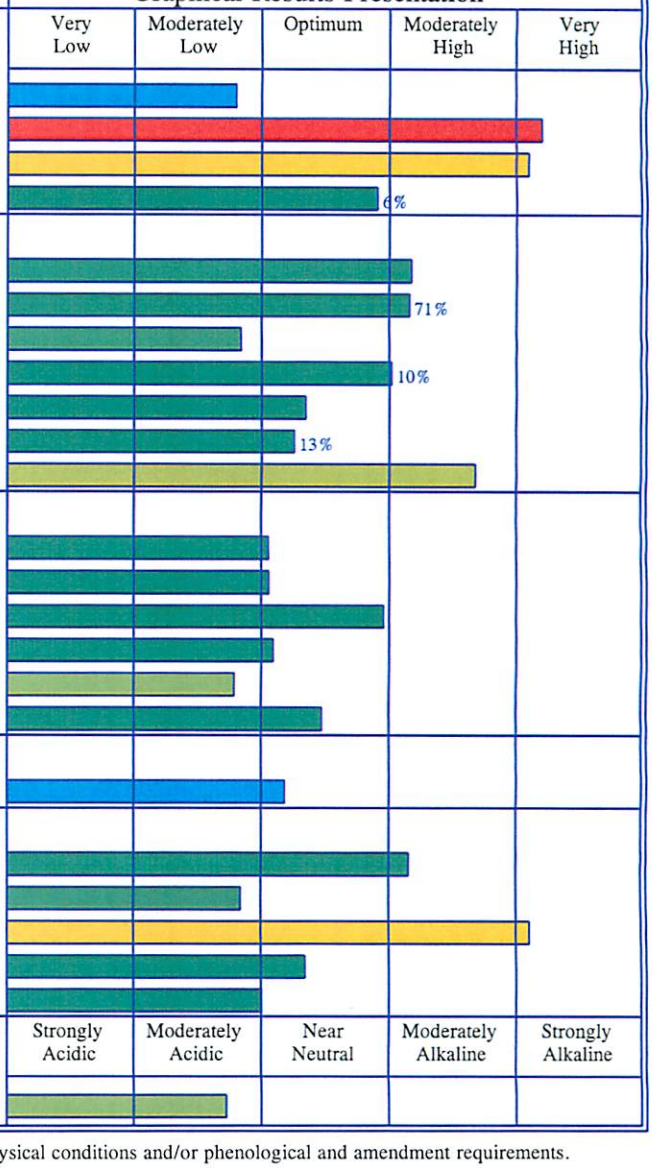
U.S. Bureau of Reclamation
Attn: Victor Stokmanis
2800 Cottage Wy.
MP-157
Sacramento, CA 95825
Description : RIP23 20 X Comp 0-12
Project : SJR Baseline Soil Salinity Monitoring

Lab ID : STK1738839-005
Customer ID : 3-16426

Sampled On : June 8, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range
Primary Nutrients			
Nitrate-Nitrogen	20.9	PPM	22 - 42
Phosphorus	87	PPM	28 - 38
Potassium (Exch)	570	PPM	70 - 420
Potassium (Sol)	2.80	meq/L	1.0 - 3.0
Secondary Nutrients			
Calcium (Exch)	2910	PPM	2100 - 2800
Calcium (Sol)	34.9	meq/L	3.3 - 10
Magnesium (Exch)	188	PPM	220 - 430
Magnesium (Sol)	5.08	meq/L	1.0 - 4.6
Sodium (Exch)	70	PPM	0.0 - 200
Sodium (Sol)	6.61	meq/L	0.0 - 26
Sulfate	40.1	meq/L	6.0 - 26
Micro Nutrients			
Zinc	3.6	PPM	1.5 - 40
Manganese	6.2	PPM	3.0 - 61
Iron	70.1	PPM	13 - 73
Copper	3.8	PPM	0.35 - 40
Boron	0.322	PPM	0.38 - 1.6
Chloride	2.94	meq/L	0.17 - 6.1
CEC	17.8	meq/100g	14 - 35
% Base Saturation			
CEC - Calcium	81.5	%	60 - 80
CEC - Magnesium	8.71	%	10 - 20
CEC - Potassium	8.20	%	1.0 - 6.0
CEC - Sodium	1.69	%	0.0 - 5.0
CEC - Hydrogen	< 1.00	%	0.0 - 3.0
pH	6.28	Units	6.5 - 7.5



Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738839-005
Customer ID : 3-16426
Description : RIP23 20 X Comp 0-12

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	4.23	dS/m	0.0 - 2.0	
SAR	1.5		0.0 - 6.0	
Limestone	< 0.10	%	0.0 - 0.50	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	< 0.50	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	16.1	%	4.5 - 31	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	44.9	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Scott Bucy

Scott Bucy, Director of Ag. Services

SB1:JRJ

FGL ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

September 27, 2017

U.S. Bureau of Reclamation
Attn: Victor Stokmanis
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Sacramento, CA 95825

Description : RIP24 20 X Comp 0-12
Project : SJR Baseline Soil Salinity Monitoring

Lab ID : STK1738839-008
Customer ID : 3-16426

Sampled On : June 8, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Primary Nutrients				
Nitrate-Nitrogen	37.5	PPM	15 - 35	
Phosphorus	32	PPM	27 - 37	
Potassium (Exch)	70	PPM	37 - 220	
Potassium (Sol)	0.163	meq/L	0.92 - 2.9	1%
Secondary Nutrients				
Calcium (Exch)	1420	PPM	1100 - 1500	
Calcium (Sol)	4.45	meq/L	3.0 - 10	40%
Magnesium (Exch)	225	PPM	110 - 230	
Magnesium (Sol)	1.83	meq/L	0.80 - 4.3	16%
Sodium (Exch)	60	PPM	0.0 - 110	
Sodium (Sol)	4.74	meq/L	0.0 - 11	42%
Sulfate	1.03	meq/L	1.3 - 21	
Micro Nutrients				
Zinc	1.2	PPM	1.3 - 40	
Manganese	9.6	PPM	2.7 - 61	
Iron	50.6	PPM	11 - 71	
Copper	1.2	PPM	0.30 - 40	
Boron	0.14	PPM	0.35 - 1.5	
Chloride	0.95	meq/L	0.15 - 6.0	
CEC	9.40	meq/100g	14 - 35	
% Base Saturation				
CEC - Calcium	75.5	%	60 - 80	
CEC - Magnesium	19.7	%	10 - 20	
CEC - Potassium	1.94	%	1.0 - 6.0	
CEC - Sodium	2.87	%	0.0 - 5.0	
CEC - Hydrogen	< 1.00	%	0.0 - 3.0	
				Strongly Acidic / Moderately Acidic / Near Neutral / Moderately Alkaline / Strongly Alkaline
pH	6.28	Units	6.5 - 7.5	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

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September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738839-008
Customer ID : 3-16426
Description : RIP24 20 X Comp 0-12

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	1.15	dS/m	0.0 - 2.0	
SAR	2.7		0.0 - 6.0	
Limestone	< 0.10	%	0.0 - 0.50	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	< 0.50	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	14.9	%	4.0 - 28	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	40.0	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Scott Bucy

Scott Bucy, Director of Ag. Services

SB1:JRJ

FGL ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

September 27, 2017

U.S. Bureau of Reclamation
Attn: Victor Stokmanis
2800 Cottage Wy.
MP-157
Sacramento, CA 95825

Description : RIP26 20 X Comp 0-12
Project : SJR Baseline Soil Salinity Monitoring

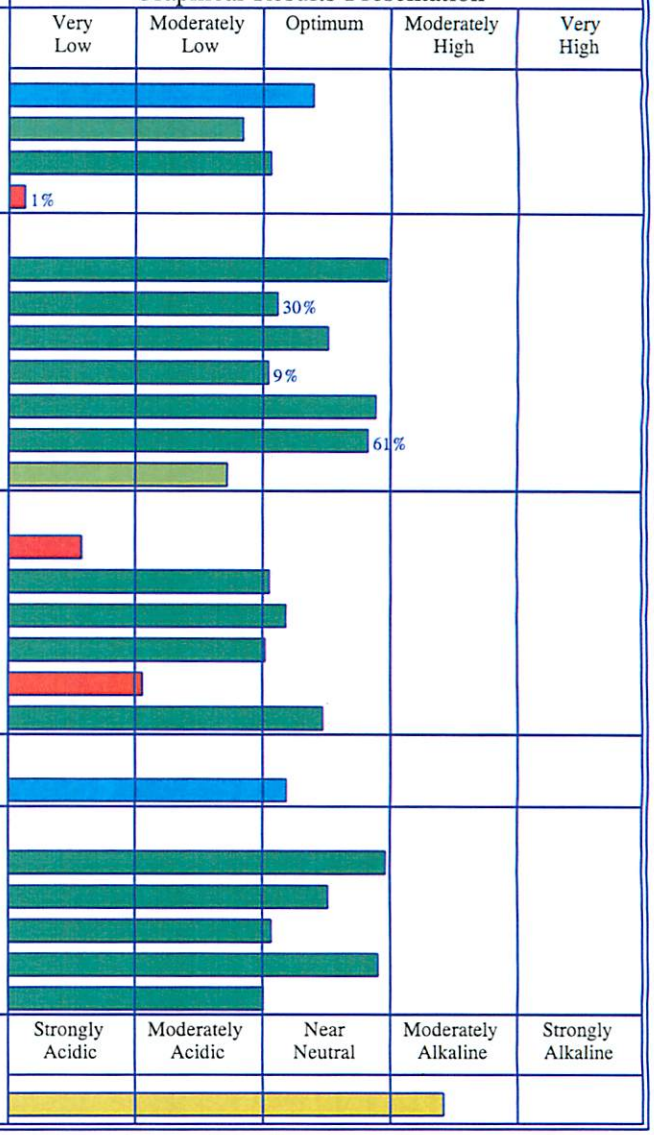
Lab ID : STK1738839-007
Customer ID : 3-16426

Sampled On : June 8, 2017
Sampled By : Victor Stokmanis
Received On : July 14, 2017
Depth : N/A

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range
Primary Nutrients			
Nitrate-Nitrogen	25.3	PPM	18 - 38
Phosphorus	26	PPM	28 - 38
Potassium (Exch)	90	PPM	70 - 420
Potassium (Sol)	0.078	meq/L	1.0 - 3.0
Secondary Nutrients			
Calcium (Exch)	2830	PPM	2100 - 2800
Calcium (Sol)	3.68	meq/L	3.0 - 9.0
Magnesium (Exch)	326	PPM	220 - 430
Magnesium (Sol)	1.12	meq/L	1.0 - 4.0
Sodium (Exch)	180	PPM	0.0 - 200
Sodium (Sol)	7.56	meq/L	0.0 - 9.3
Sulfate	1.36	meq/L	1.5 - 22
Micro Nutrients			
Zinc	0.6	PPM	1.6 - 44
Manganese	6.2	PPM	3.2 - 66
Iron	25.2	PPM	14 - 79
Copper	1.1	PPM	0.37 - 44
Boron	0.14	PPM	0.38 - 1.6
Chloride	2.93	meq/L	0.17 - 6.1
CEC	17.8	meq/100g	14 - 35
% Base Saturation			
CEC - Calcium	79.2	%	60 - 80
CEC - Magnesium	15.1	%	10 - 20
CEC - Potassium	1.33	%	1.0 - 6.0
CEC - Sodium	4.49	%	0.0 - 5.0
CEC - Hydrogen	< 1.00	%	0.0 - 3.0
pH	7.87	Units	6.5 - 7.5

Graphical Results Presentation



Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

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September 27, 2017

U.S. Bureau of Reclamation

Lab ID : STK1738839-007
Customer ID : 3-16426
Description : RIP26 20 X Comp 0-12

GENERAL SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	1.25	dS/m	0.0 - 2.0	
SAR	4.9		0.0 - 6.0	
Limestone	< 0.10	%	0.0 - 0.50	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	---	
Gypsum Requirement	< 0.50	Tons/AF	---	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	16.7	%	4.5 - 32	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	45.0	%	40 - 50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Soils with gypsum requirements over 10 tons should be applied incrementally at a maximum of 10 tons per acre per year and reanalyzed yearly after each application.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

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