

Seepage Project Handbook

**Working Draft
Subject to Revision**



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1 List of Abbreviations and Acronyms

2	Act	San Joaquin River Restoration Settlement Act
3	BNLL	Blunt Nosed Leopard Lizard
4	C-B	soil-cement-bentonite
5	CDFG	California Department of Fish and Game
6	CEC	Categorical Exclusion Checklist
7	CEQA	California Environmental Quality Act
8	cfs	cubic feet per second
9	CNDDDB	California Natural Diversity Database
10	CVRWQCB	Central Valley Regional Water Quality Control Board
11	dba	A-weighted decibel
12	dS/m	deci-Siemens per meter
13	DWR	California Department of Water Resources
14	EA	Environmental Assessment
15	EC	electrical conductivity
16	EIR	Environmental Impact Report
17	EIS	Environmental Impact Statement
18	ESA	Endangered Species Act
19	FONSI	Finding of No Significant Impact
20	ft	feet
21	IS	Initial Study
22	ITA	Indian Trust Assets
23	LTAA	Likely to adversely affect
24	MOA	Memorandum of Agreement
25	NEPA	National Environmental Policy Act
26	NLTAA	Not likely to adversely affect
27	NPDES	National Pollution Discharge Elimination System
28	NRDC	National Resources Defense Council
29	O&M	operations and maintenance
30	QAPP	Quality Assurance Project Plan
31	Reclamation	U.S. Department of the Interior, Bureau of Reclamation
32	ROD	Record of Decision
33	RPA	Reasonable and Prudent Alternative
34	S-B	soil-bentonite
35	SCTFG	Seepage and Conveyance Technical Feedback Group
36	SF-424	Federal “Application for Federal Assistance” Form
37	SHPO	California State Historic Preservation Officer
38	SJRRP	San Joaquin River Restoration Program
39	SJVAPCD	San Joaquin Valley Air Pollution Control District

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1	SMAQMD	Sacramento Metropolitan Air Quality Management
2		District
3	SMP	Seepage Management Plan
4	SOW	Scope of Work
5	SPH	Seepage Project Handbook
6	TEP	temporary entry permit
7	USACOE	U.S. Army Corps of Engineers
8	USCS	Unified Soil Classification System
9	USDA	U.S. Department of Agriculture
10	USFWS	U.S. Fish and Wildlife Service
11	USGS	U.S. Geological Survey
12	VdB	vibration decibels
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1 1.0 Introduction

2 1.1 Purpose

3 The Seepage Project Handbook (SPH) establishes the process the Bureau of Reclamation
4 will use to coordinate with landowners on evaluation, design and construction of projects
5 to reduce or avoid adverse material impacts from groundwater seepage as part of the San
6 Joaquin River Restoration Program (SJRRP).

7 1.2 Background

8 The release of Interim and Restoration flows under the SJRRP will raise water surface
9 elevations, which contribute to shallow groundwater table rise on lands adjacent to the
10 San Joaquin River (SJR) and Lower San Joaquin Flood Control Project (LSJFCP).
11 Consistent with the Seepage Management Plan (SMP), Reclamation will coordinate with
12 local operators to limit releases from Friant Dam, Mendota Dam, and Sack Dam to non-
13 damaging flow rates. Consistent with this SPH, the SJRRP will coordinate with
14 landowners on a process for building seepage projects that allow for increased flow in the
15 SJR.

16 The SMP includes thresholds for groundwater levels and salinity, and describes the
17 operations Reclamation will take to limit Interim and Restoration flows to the current
18 channel capacity to avoid material adverse impacts. The SMP also identifies fields or
19 parcels potentially at risk to impacts due to Interim or Restoration flows, and prioritizes
20 those locations into tiers of parcel groups for evaluation.

21 The objectives of seepage management actions and completed seepage projects include:

- 22 1) Reduce or avoid material adverse impacts from groundwater seepage, salinity, or
23 levee instability from Interim or Restoration flows along the San Joaquin River
24 from Friant Dam to the confluence with the Merced River without harming
25 conditions for fish.
- 26 2) Increase channel capacity along the San Joaquin River in Reaches 1, 2A, 3, 4A,
27 and 5 to allow up to maximum anticipated default flow schedule releases under
28 Restoration Flows.

29 The Stipulation of Settlement (Settlement) in *Natural Resources Defense Council*
30 *(NRDC), et al., v. Kirk Rodgers, et al.*, establishes two primary goals, one to restore and
31 maintain fish populations in “good condition” in the main stem of the San Joaquin River
32 below Friant Dam to the confluence of the Merced River, and the other to reduce or avoid
33 adverse water supply impacts to the Friant Division long-term contractors that may result
34 from the Interim and/or Restoration Flows provided for in the Settlement.

1 The San Joaquin River Restoration Settlement Act (Act), Title X of Public Law 111-11,
2 authorizes Reclamation to implement the Settlement. The Act, passed in 2009, also
3 requires the Department of the Interior to “reduce Interim Flows to the extent necessary
4 to address any material adverse impacts to third parties from groundwater seepage”
5 caused by Interim or Restoration Flows identified by SJRRP monitoring.

6 **1.3 Seepage Projects Process**

7 Objectives of the SPH include:

- 8 1) Delineate expectations of Reclamation, landowners, Settling Parties, third parties
9 and other stakeholders for implementing seepage projects;
- 10 2) Establish a process for implementing seepage projects, including estimated
11 timelines and lists of potential activities;
- 12 3) Identify deliverables for stakeholder input; and
- 13 4) Develop strategies to overcome challenges to increased flow.

14 Site-specific seepage projects may refer to the SPH for guidance on process, timelines,
15 and deliverables.

16 Reclamation will prioritize sites for seepage project planning and construction by the
17 severity of the flow constraint (i.e., the sites that prevent the lowest flow are the highest
18 priority). An initial priority tier developed in the SMP identifies the areas that would
19 experience the greatest seepage impacts to Interim or Restoration Flow (i.e., those parcel
20 groups that most restrict flows). Reclamation or designee will work through these parcel
21 groups first, conducting site evaluations, plan formulation, and if deemed necessary,
22 installing projects. Then the Seepage and Conveyance Technical Feedback Group
23 (SCTFG) will update the SMP with the next round of priority locations, and the next
24 group of potential seepage projects will begin the process set out in this document. Site-
25 specific projects will be planned concurrently with developing the SPH, and the SPH will
26 be updated on an annual basis to reflect additional knowledge gained from the site-
27 specific seepage projects.

28 Projects may include a variety of real estate or physical actions, including license
29 agreements, easements, acquisition, habitat, interceptor drains, relief drains, drainage
30 ditches, seepage berms, slurry walls, shallow groundwater pumping, buildup of low lying
31 lands, or channel conveyance improvements. Depending on the site, a variety of
32 constraints may exist, such as:

- 33 1) Presence of threatened and endangered species;
- 34 2) Presence of historical and cultural resources;
- 35 3) Compliance with water quality regulations regarding drainage water;

1.0 Introduction

- 1 4) Maintenance of existing flood protection facilities and/or channel capacities;
- 2 5) Limited or no access to private property; and
- 3 6) Conflicts between fish habitat and existing waterfowl habitat.

4 1.4 Document Outline

5 This SPH walks through the steps to implementing seepage management projects.
6 Specific sections include:

- 7 • **Section 1 - Introduction:** Describes the overall purpose and objectives.
- 8 • **Section 2 - Site Evaluation:** Introduces the conceptual model to describe the
9 scientific method, and process for evaluating sites and developing initial
10 alternatives.
- 11 • **Section 3 - Plan Formulation:** Describes selection criteria, and weighting of
12 criteria used to evaluate alternatives and chose a preferred alternative.
- 13 • **Section 4 - Design Data Collection:** Explains procedures to gather design
14 level data.
- 15 • **Section 5 - Design:** Discusses final design protocols for the preferred
16 alternative.
- 17 • **Section 6 - Environmental Compliance:** Identifies the steps needed to
18 comply with the National Environmental Policy Act, the California
19 Environmental Quality Act if required, and other applicable environmental
20 laws.
- 21 • **Section 7 - Construction:** Explains construction timelines and constraints.
- 22 • **Section 8 - Financial Assistance:** Describes process for funding seepage
23 projects. Includes a template landowner agreement.

24 Appendices include:

- 25 • **Appendix A:** Reclamation's Final Design Process, April 2008
- 26 • **Appendix B:** Chapter 3 Section 8 of Reclamation's Technical Services Center
27 Data Collection for Feasibility Designs Standards
- 28 • **Appendix C:** Slurry Wall Template Design Sketch and Cost Estimate
- 29 • **Appendix D:** Draft financial assistance agreement template

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2 **1.5 Seepage Projects Process, Timelines and Milestones**

3 Table 1 shows the estimated timelines for different steps in the seepage project process.
 4 The rest of this handbook goes into detail about these steps. Items in bold are deliverables
 5 or other check-in points with landowners.

6
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**Table 1
 Seepage Project Process and Due Dates**

Event	Timeline
Initial Site Visit. Kicks off the seepage project process.	Following hotline call follow-up site visit or identification in SMP
Site Evaluation – Records Review	Immediately following site visit
Site Evaluation – Methods Report	~1 month after site visit
Site Evaluation – Fieldwork & Analysis	Following landowner approval of Methods Report
Site Evaluation Report	~6 months after site visit
Appraisal Level Designs for Initial Alternatives	Following Site Evaluation Report
Plan Formulation Meeting	~8 months after site visit
Feasibility Design	Following plan formulation and choosing of preferred alternative
Quantities and Cost Estimates	With feasibility design
Project Report	~10 months after site visit
Environmental Compliance	~10 months after site visit
Financial Assistance Agreement	~10 months after site visit
Final Design	Following Project Report
Bid	Following final design
Pre-Construction Meeting	Following bid, with contractor
Pre-construction surveys	Immediately prior to construction
Construction	Following notice to proceed

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1 **1.6 Document Revisions**

2 *May 10, 2011: Initial outline and draft components for discussion at the Seepage*
3 *and Conveyance Technical Feedback Meeting.*

4 *August 1, 2011: Draft Prioritization and Site Evaluation section for discussion at*
5 *August Seepage and Conveyance Technical Feedback Meeting.*

6 *September 2, 2011: Draft Plan Formulation and Design Data Collection sections for*
7 *discussion at September Seepage and Conveyance Technical*
8 *Feedback Meeting.*

9 *October 31, 2011: Completed Environmental Compliance Section*

10 *November 7, 2011: Edits incorporating input from Seepage and Conveyance Technical*
11 *Feedback Meetings*

12 *December 8, 2011: Draft of Construction Section added; edits made to other sections*

13 *April 26, 2012: Draft of Agreements Section added; edits made to other sections*

1 **2.0 Site Evaluation**

2 **2.1 Introduction**

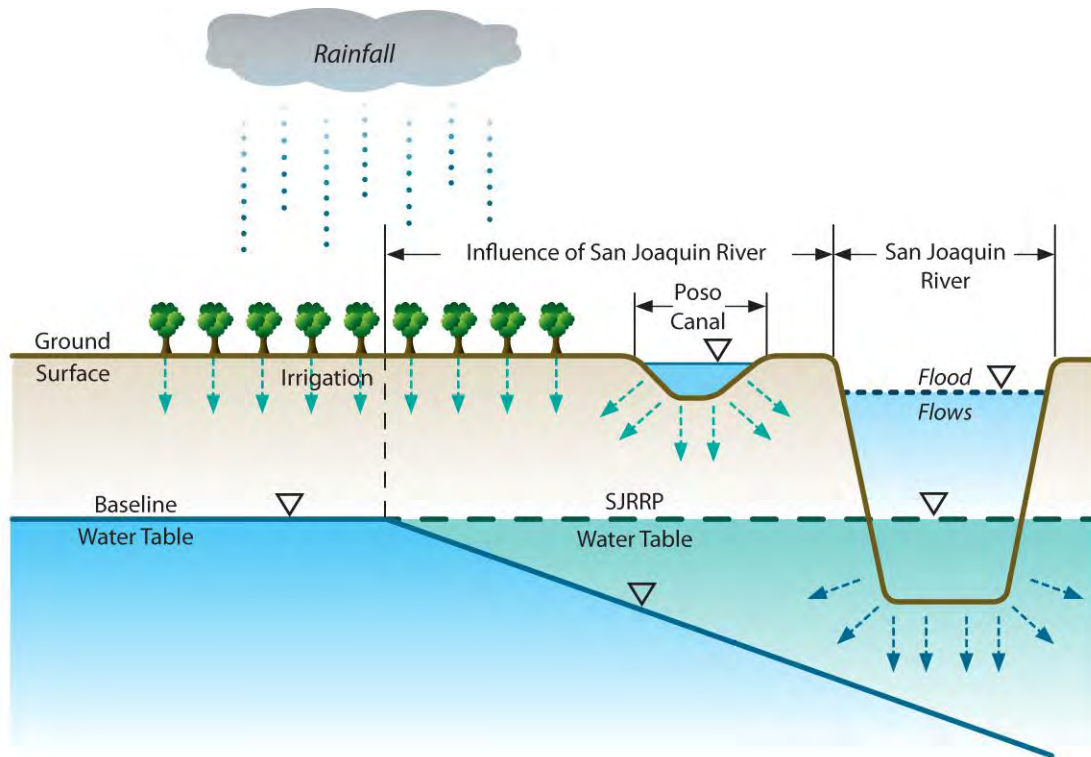
3 The site evaluation identifies and screens potential project alternatives prior to extensive design
4 and environmental compliance work. Evaluations identify the major sources of groundwater and
5 potential salinity and identify advantages and limitations of specific projects based on site-
6 specific conditions. Evaluations result in a Site Evaluation Report that will list potential project
7 alternatives.

8 An investigation into the major potential causes of groundwater rise and/or increased salinity
9 provides backup and justification for selecting seepage project. A Site Evaluation Report allows
10 both Reclamation and landowners to understand why specific projects may or may not achieve
11 the objective of seepage control. This report documents the basis for moving forward with
12 certain project alternatives while screening others out.

13 Site-Specific Groundwater Evaluation

14 A site-specific groundwater evaluation will be conducted and documented in the Site Evaluaton
15 Report. The evaluation will be based on the graphical depiction of influences on groundwater
16 levels and root-zone salinity shown in Figure 1.

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Figure 1
Site Evaluation Conceptual Model

4 Salinity sources may include:

- 5 • Irrigation Water
- 6 • Fertilizer and Soil Amendments
- 7 • Weathering of Natural Soil Minerals
- 8 • Shallow Groundwater Rise into the Root Zone

9 Groundwater recharge sources may include:

- 10 • Rainfall
- 11 • Irrigation
- 12 • Canal Seepage
- 13 • Flood Flow Seepage
- 14 • SJRRP Seepage

2.0 Site Evaluation

1 Additional factors for agricultural conditions would include: meteorological conditions
2 influencing the temperature of the ambient air and soils; and pumping, bare-soil evaporation, and
3 transpiration from water table affecting groundwater levels.

4 The evaluation of a particular site will include:

- 5 1) **Records Review:** Records review may include collection of existing groundwater, flow,
6 soil texture and precipitation records, as well as any available information from
7 Reclamation or the landowner regarding areas such as salinity sampling, irrigation
8 practices, or canal seepage. A full list of information that may be required is attached in
9 Reclamation's Feasibility Designs – Drains – Chapter 3.
- 10 2) **Field Work:** Field work gathers missing data pieces that may be key for a particular site.
11 Examples include hydraulic conductivity testing, soil salinity sampling, and water quality
12 testing. For sites without prior access where more data is needed, activities may include
13 installation of groundwater monitoring wells.
- 14 3) **Analysis:** Analysis gathers together existing data and field work to evaluate the key
15 influences on a particular site and the sources of groundwater or salinity issues. Analysis
16 may include hydraulic calculations, flow net diagrams, qualitative descriptions from
17 cross-sections and profiles, and modeling.
- 18 4) **Reporting:** Reporting documents the steps above, publishes the data and conclusions to
19 allow for landowner input, and establishes initial alternatives for future analysis during
20 design.

21 **2.2 Records Review**

22 Reclamation will gather existing data on the particular site including publicly available data, data
23 Reclamation may have collected if the landowner allowed access, and data the landowner may
24 be able to share. Chapter 3 Section 8 of Reclamation's Technical Services Center Data
25 Collection for Feasibility Designs Standards describes all data collected for drainage design.

26 The following sections describe the purpose of obtaining records.

27 **2.2.1 Precipitation**

28 Precipitation records allow analysis of the effects, if any, of precipitation on groundwater levels,
29 irrigation scheduling, and soil salinity changes. Reclamation will collect precipitation records in
30 inches of rainfall per day from nearby meteorological stations via internet searches or from local
31 landowner or water district records. Precipitation events plotted against groundwater levels may
32 or may not show rises in groundwater that correspond in timing and amount to precipitation
33 events. Groundwater rise may be greater than the precipitation measured due to the available soil
34 water holding capacity of the soil column. Groundwater rise that corresponds only to
35 precipitation events indicates other factors do not greatly influence groundwater levels.

36 **2.2.2 Aerial Photos**

37 Aerial photos may identify sand stingers from old sloughs for drainage evaluation. Imagery such
38 as LandSAT or others may allow comparison of crop health to known historical conditions.

1 Reclamation will request true-color aerial photos in digital or hard copy formats from existing
2 public domain imagery such as LandSAT, historic or current aerial flights, ESRI aerial services,
3 or other available aerial imagery from landowners. Reclamation will obtain aerial photos and
4 look for lighter colored curved lines indicating old river channels. Reclamation will also compare
5 crop health using infrared or true-color imagery over time, and look for the historical flooding
6 range. Properties with numerous historical river channels may demonstrate greater connectivity
7 to the river channel and indicate a need to perform calculations of loss and flow net analysis or
8 modeling. Also, surface or buried sand sloughs may be ideal locations for drainage projects due
9 to relatively high hydraulic conductivity. Correlation of crop health to historical conditions may
10 allow for estimation of primary factors controlling yields. For example, good crop health during
11 flood flow years may indicate river flows are not a primary influencing factor.

12 **2.2.3 Cultural Resources**

13 Cultural resources review allows analysis of the effects, if any, of potential projects on cultural
14 resources or National Historic Preservation Act compliance. Initial estimates of the likelihood for
15 discovery of cultural resources help inform future data collection. Reclamation will review their
16 existing cultural resources information for the seepage project site. Maps showing a high
17 probability for buried resources and confirmed sites with historical resources will be overlain on
18 the site. Seepage project sites located on areas of high probability for cultural resources may be
19 less likely to develop a physical project due to expense associated with archeological surveys.
20 Additional cultural surveys in areas of high probability may add significant costs to the project.
21 The SJRRP will make an effort to minimize ground disturbance during this process.

22 **2.2.4 Biological Resources**

23 Biological resources will need to be considered during site evaluation to develop and rank initial
24 alternatives. Reclamation will review the California Natural Diversity Database (CNDDDB), as
25 well as information from United State Fish and Wildlife Service (USFWS) species accounts, and
26 California Department of Fish and Game (CDFG) species accounts available online. CNDDDB
27 database maps and other sources will be scanned to look for any critical habitat or potential
28 species on the property. Identified species of concern may help dictate timelines and planning
29 efforts.

30 **2.2.5 Irrigation Records**

31 Irrigation records allow analysis of the effects, if any, of irrigation on groundwater levels.
32 Reclamation will obtain irrigation measurements in inches or acre-feet per day per acre from
33 landowners or water districts in hand-written or digital format. Water district records may not
34 show the level of detail desired. Reclamation will plot irrigation volumes with groundwater
35 levels and river flows and note the range of daily fluctuations, if any, in groundwater levels.
36 Reclamation will make correlations between irrigation events and river stages and/or
37 groundwater level changes and note any delay, or lag, between irrigation events and water-table
38 responses. This can occur where fine-grained materials exist in the shallow subsurface.
39 Groundwater level increases that correspond to irrigation events, whether immediate or lagged,
40 indicate that irrigation affects groundwater levels.

41 **2.2.6 Fertilizer and Soil Amendment Applications**

42 Fertilization and soil amendment records allow analysis of the effects, if any, of fertilizer or soil
43 amendments on salinity and sodicity levels. Some fertilizers may contain charged ions or salts

2.0 Site Evaluation

1 that increase salinity. Applied gypsum can increase soil salinity (ECe) by two to three deci-
2 Siemens per meter (dS/m). Reclamation will obtain fertilization and soil amendment
3 measurements in tons or pounds per acre per application or some similar unit from landowners,
4 in hand-written or digital format, including the type of fertilizers or soil amendments used and
5 the date of application. Obtain records of timing and amount of fertilizer or soil amendment
6 application. Research salinity of fertilizer and compare to other salt sources. Fertilizer or soil
7 amendments in absence of other salt sources may be a major influence on salinity levels. Soil
8 amendments may not substantially influence salinity levels except within a few weeks of an
9 application.

10 **2.2.7 Yield Data**

11 Yield data allows observation of possible correlation and potential impacts of high groundwater,
12 and/or salinity, and/or river flows. Reclamation will request yield data in tons per acre or some
13 similar unit from landowners, in hand-written or digital format. Reclamation will plot yield data
14 per year. Evaluation of trends and correlation of crop yields to groundwater, salinity and other
15 potential factors allows for a simple, preliminary, qualitative estimate of the primary factors
16 affecting crop production.

17 **2.2.8 Infrastructure**

18 Reclamation will identify nearby canals, surface and subsurface drains, groundwater pumping,
19 etc. to understand effects, if any, on groundwater levels. Also, this information may help with
20 conceptual designs as part of initial alternatives development. Reclamation will request maps in
21 digital or paper format showing locations of surface and subsurface drains, groundwater
22 pumping wells, nearby canals, sloughs, head and drainage ditches from the landowner.
23 Combined with discharge or loss measurements, nearby infrastructure can be included or ruled
24 out as an influencing factor on groundwater levels. Combined with water quality information,
25 nearby infrastructure locations can identify potential effects of drains, canals, etc. on salinity
26 levels. Finally, infrastructure may indicate additional data collection needs. For example, if a
27 certain site uses drip irrigation, examining and sampling a soil profile may be useful.

28 **2.2.9 Historical Flooding**

29 Reclamation or consultant will search for available records such as those available from the
30 California Department of Water Resources (DWR), local agencies, and the United States Army
31 Corps of Engineers (USACOE), as well as aerial photos, gaging station records or anecdotal
32 evidence describing historical flooding on the property. This indicates potential levee concerns
33 as well as the extent of seepage and flooding risk on the property. It also informs operation and
34 maintenance costs of the project in the long term as well as potential effects from the project
35 after floods to downstream neighbors or species.

36 **2.2.10 Property Easements / Contracts / Programs**

37 Reclamation, partner agency or consultant will work with the landowner to identify prior
38 encumbrances on the property or programs specifying specific uses of the property. These could
39 include United States Department of Agriculture (USDA) drainage programs, fertilization
40 programs, interceptor drains, habitat improvements, or conservation easements. In addition, the
41 team will record other programs such as regional land use plans, resource management
42 initiatives, flood management plans, groundwater management plans, water quality programs, or

1 species habitat areas. These programs could preclude certain types of projects, or could place
2 added cost on the project construction.

3 **2.3 Field Work**

4 Approximately a month after the initial site visit to initiate site evaluation, following the Records
5 Review, a methods report will detail future field work plans and requests for landowner
6 approval. Field work may include hydraulic conductivity testing, soil salinity sampling, water
7 quality sampling, groundwater monitoring, and other methods. The following sections describe
8 these different field work efforts, their purpose, and analysis techniques. Additional methodology
9 details are included in Appendix B.

10 **2.3.1 Groundwater Monitoring**

11 Groundwater monitoring identifies groundwater depths and gives a general indication of
12 groundwater flow patterns and drainage over time. Reclamation, DWR, U.S. Geological Survey
13 (USGS), or contractor drill crews will drill monitoring wells as approved by landowners along
14 existing farm roads or other locations out of the way of farm operations. Wells may be drilled
15 after access is granted, environmental compliance and permitting is complete, and a monitoring
16 well agreement is signed with the landowner. Drill crews will use dry hollow-stem-auger
17 collection methods for temporary disturbance in an area approximately 100 by 50 feet. The
18 permanent structure of PVC piping, steel casing, protective posts and a concrete pad covers an
19 area of 3 feet in diameter and protrudes 2-3 feet from ground surface. Reclamation will oversee
20 installation of instrumentation in the wells to provide a continuous (often hourly) record of water
21 levels in each well, making it possible to measure responses to precipitation, irrigation, and flow
22 events.

23 Reclamation will calculate depth to groundwater by subtracting the difference between the top of
24 casing elevation and the ground surface elevation from the depth below top of casing. These
25 measurements plotted over time will allow Reclamation and the landowner to see various
26 groundwater level responses to various influences such as river stage, canal seepage, crop
27 irrigation, rainfall, leaching practices, etc. Groundwater depths below ground surface compared
28 with thresholds may or may not indicate drainage issues. Reclamation will convert these depths
29 below ground surface to elevations to establish groundwater horizontal and vertical hydraulic
30 gradients by subtracting the depth from the top of the casing from the elevation of the top of the
31 casing.

32 **2.3.2 Surface Water Monitoring**

33 Surface water monitoring allows elevations to be collected to see the effects, if any, of river stage
34 on groundwater levels. River elevation monitoring also helps determine the extent of the river's
35 influence and compare elevations for drainage assessment. Reclamation will install staff gages
36 on metal posts in the river channel adjacent to groundwater monitoring well transects. In some
37 cases Reclamation may drive larger tubes into the riverbed and install pressure transducers to
38 take hourly measurements of stage.

39 Correlations may be made by plotting water surface elevations with groundwater levels, either to
40 track responses in groundwater, or in cross-section to calculate groundwater slope. These allow

2.0 Site Evaluation

1 one to determine the effect of river stage on groundwater levels and if seepage is forcing
2 groundwater levels to rise underneath adjacent fields.

3 **2.3.3 Soil Texture**

4 Soil texture data helps interpret soil salinity and groundwater movement in soils and substrata,
5 and identify soil types for conceptual designs as part of initial alternatives development.
6 Reclamation or Reclamation's contractor will drill hand-auger holes. Soil borings can be
7 evaluated to a depth of about 10 feet or until hardpan layers or saturated unstable soils below the
8 water table are encountered and make deeper hand auguring impractical. If the landowner agrees,
9 backhoe pits can allow observation of broader soil texture trends. Reclamation will log soils in
10 hand-auger borings or pit holes according to USDA standards to identify soil texture, texture
11 changes, mottling, gleying, estimated in-situ moisture content, capillary fringe thickness, and
12 water table level. Reclamation drillers that install the observation wells will collect soil texture
13 information using the unified soil classification system (USCS).

14 Soil texture may determine limitations of a certain project alternative due to high clay content or
15 high sand content. Soil texture also helps identify field locations or influences (river flows,
16 drains) that may be more hydraulically connected to groundwater levels than others due to sand
17 stringers or soil types. Soil texture also helps to properly interpret electrical conductivity (EM38)
18 data and as supplemental information for drain spacing calculations.

19 **2.3.4 Soil Salinity Sampling**

20 Salinity sampling determines the existence of any historic or current root-zone salinity issues,
21 and provides a baseline for pre-SJRRP soil salinity levels. Reclamation or Reclamation's
22 contractor will drill hand auger holes approximately 5 feet deep or until free water is standing in
23 the hole in several locations representative of field conditions. Reclamation will spread a tarp on
24 the ground adjacent to the borehole to examine and log soils, and collect soil samples in plastic
25 bags. Following logging, Reclamation will backfill the borehole with excavated material and
26 tamp into place.

27 Salinity sampling allows for evaluation of salinity trends and sources. For example an increase in
28 surface soil salinity may indicate upflux of water and salts from a shallow groundwater table.
29 This situation may improve with installation of artificial drainage.

30 **2.3.5 Electrical Conductivity (EM 38) Measurements**

31 EM 38 measurements allow a wide area to be quickly surveyed for shallow salinity levels,
32 evaluating spatial and depth soil salinity variation trends in soils and fields. Reclamation will
33 take EM 38 measurements during springtime, when moisture contents are still relatively high, in
34 a dozen or more locations throughout a given field. The EM 38 is a hand held portable
35 instrument that is placed on the ground in 2 positions. The instrument provides both horizontal
36 and vertical real-time bulk soils electrical conductivity measurements. These measurements are
37 recorded and adjusted to a soil temperature of 25-degrees Celsius. This allows measurement of
38 bulk soil electrical conductivity and salt distribution patterns to depth of 5 feet. EM 38 can
39 identify shallow salinity trends, helping identify salt sources.

2.3.6 Water Quality Testing

Reclamation will evaluate shallow groundwater, irrigation supply, subsurface drain system and San Joaquin River water quality for SJRRP seepage investigations. Tests conducted on water quality samples show potential problems prior to implementation of physical solutions to drainage problems. Reclamation will use this data to evaluate alternatives for disposal of water discharged from interceptor drains or shallow wells that may provide subsurface drainage. During site evaluation, Reclamation will collect water quality samples from groundwater wells, surface water supplies and surface or subsurface drain effluent, if any, using 3/8-inch vinyl tubing connected to a surface deployed peristaltic pump or grab samples to a churn splitter. Reclamation will send water quality samples to a certified analytical lab for analysis in accordance with a project Quality Assurance Project Plan (QAPP).

Reclamation will measure the specific conductivity (EC), pH, temperature and turbidity at the sample locations at times of sample collection. Lab testing may include Bicarbonate, Calcium, Carbonate, Chloride, Magnesium, Nitrate as NO₃, Potassium, Sodium, Sulfate, Boron, Selenium, pesticides, and other constituents, and will show irrigation or river discharge suitability.

2.3.7 Hydraulic Conductivity Testing

Shallow groundwater flow from irrigation, canal losses, and river seepage loss, is subject to the hydraulic conductivity (or permeability) of the soil material it is flowing through. Subsurface materials are not uniform and can have a wide range of permeability due to factors that include depositional environment, grain size, degree of compaction, soil structure and soil structure stability to name a few. Hydraulic conductivity constrains the rate at which water can move through soil, a key parameter in determining seepage rates from various sources such as canals or rivers to groundwater. Knowledge of the local subsurface properties also informs initial alternatives development choices as well as drainage design.

During site evaluation, Reclamation or Reclamation's contractor will mobilize a small drilling rig to drill several small boreholes (4 to 6 inch diameter and generally to a depth of 20 ft). Reclamation will describe and record the soil profile, the depth to the water table and the depth of various soil layers at all locations of exploration holes. Reclamation will conduct hydraulic conductivity tests at any number of sites in order to obtain a representation of the subsurface hydraulic conductivity of the area. Reclamation will conduct tests to evaluate both the permeable high flow zones and the slowly permeable relative barrier zones. Reclamation will use the two most common field test methods: the shallow well bail-out test (also called the auger hole test) and the piezometer test, both conducted in saturated soil (below the water table). Reclamation will perform the tests and calculations as described in Reclamation's Drainage Manual.

Hydraulic conductivity tests will be used to identify and describe the properties of the subsoil associated with the movement of groundwater. Measured hydraulic conductivity values provide site-specific data that can be used for various types of computations of groundwater flow, interceptor and relief drain flow, and potential quantity of discharge or discharge rate for initial alternatives development. The site evaluation process will include an exploration plan intended to identify the subsurface hydraulic properties of the local area. The exploration plan may become a grid pattern of exploration holes or a cross section type of exploration plan. The exploration plan and location of investigation holes and tests will generally work around existing crop areas and use field edges and field access roads. Reclamation may ask to install some

2.0 Site Evaluation

1 temporary monitoring wells or in some cases staked open soil borings to track localized changes
2 in the depth to the water table. Reclamation will describe subsurface soil profiles and record the
3 depth to the water table.

4 **2.4 Data Interpretation and Analysis**

5 The following sections describe data analysis activities of Reclamation. Appendix B includes
6 additional information.

7 **2.4.1 Cross-Sections**

8 Cross-sections of groundwater and surface water elevations show the lateral groundwater
9 gradients. Gradients can indicate the extent of the San Joaquin River influence, the direction of
10 drainage in relation to river stage and time of the year, and the potential degree of connectivity of
11 fields with the river channel.

12 **2.4.2 Profiles**

13 Longitudinal profiles of groundwater, surface water, and terrain elevations show the relationship
14 of the river to surrounding fields and well elevations. Profiles show the maximum potential for
15 groundwater rise from river sources and areas at risk for a range of flow rates.

16 **2.4.3 Depth to Water / Elevation Maps**

17 Reclamation or the USGS will develop maps of groundwater-level elevation and depth below
18 ground surface using monitoring data to determine groundwater gradients and variability over
19 the site, and to identify areas potentially most vulnerable to seepage effects.

20 **2.4.4 Flow Nets**

21 Reclamation or SJRRP partners may use flow nets to delineate groundwater contours and
22 associated flow lines, and thus provide information on the local hydraulic gradients and flow
23 directions.

24 **2.4.5 Modeling**

25 The USGS or Reclamation may use modeling to interpret groundwater responses to individual
26 sources of recharge, enabling determination of the key influences on a site. Tools currently
27 being developed by the SJRRP will enable development of parcel- or multi-parcel-scale
28 hydrologic models nested within a regional-scale model, thus enabling consideration of
29 hydrologic responses to off-site activities such as irrigation of adjacent fields, wetting-up of
30 habitat areas, and other activities.

31 The USGS or Reclamation may use parcel-scale models to evaluate the potential effectiveness of
32 various physical seepage control alternatives prior to making large expenditures.

33 **2.5 Reporting**

34 The Site Evaluation Report provides for landowner input on any missing information, gathers
35 site-specific soil and water data together for future landowner use, and sets initial alternatives for

1 future seepage project plan formulation. It will be shared with the landowner in draft form
2 approximately 6 months after the initial site visit for project kick-off, and will include a write-up
3 of methods used, results obtained, discussion and conclusions from the site evaluation and data
4 collection, as well as sections devoted to initial screening and initial alternatives as described
5 below. The following lists the anticipated sections of the Site Evaluation Report.

- 6 I. Introduction: description of the site and relevant features
- 7 II. Methods: proposed approach for evaluation
- 8 III. Results: data collection and numerical analysis
- 9 IV. Discussion: applicability and limitations of the evaluation
- 10 V. Conclusions and Recommendations: process for moving forward including
11 initial screening, initial alternatives for a project and/or revised threshold
12 pending completion of a project
- 13 VI. Field Visit Documentation Appendix: attendees, data collected, and discussion
14 items for each trip to the site
- 15 VII. Data Appendix – measurements including:
 - 16 1. Groundwater Levels
 - 17 2. Surface Water
 - 18 3. Water Quality
 - 19 4. Soil Hydraulic Conductivity
 - 20 5. Soil Chemistry
- 21 VIII. Numerical Analysis Appendix: computations and results
- 22

23 **2.6 Initial Screening**

24 Potential seepage projects may include real estate actions, such as easements or acquisition, or
25 physical projects, including relief drains, interceptor drains, slurry walls, drainage ditches,
26 shallow well pumping, or conveyance improvements.

27 Reclamation and its SJRRP partners will perform initial screening of projects with the data
28 gathered during site evaluation. Site evaluation informs the design, feasibility, and suitability to
29 site conditions criteria for project selection. Additional considerations at this step include
30 landowner acceptability and environmental compliance.

31 The following bullets describe initial screening that may be done as part of the Site Evaluation Report to
32 identify and remove unreasonable options and develop initial alternatives.

- 33 • Effective existing surface or subsurface drains may lean towards relief or interceptor
34 drains as a project
- 35 • Lack of availability of a suitable outlet for subsurface drain discharge may rule out
36 subsurface drains as a project
- 37 • Very fine soils may decrease effectiveness or increase costs of drainage projects

2.0 Site Evaluation

- 1 • Sand stringers may require further analysis or specialized solutions for drainage
2 projects
- 3 • High EC drain water may not be allowed to enter San Joaquin River; may require
4 drainage discharge to irrigation district for blending
- 5 • Heavy Metals or other trace elements may impact fish populations; may require
6 drainage discharge to irrigation district for blending
- 7 • High probability of cultural resources may limit project options requiring extensive
8 excavation if cost is a priority
- 9 • Excavation in Blunt Nosed Leopard Lizard (BNLL) habitat if there is state
10 involvement may be adverse effects to species; may not choose that project
- 11 • Lands historically flooded may not be considered for subsurface drains
- 12 • Projects that improve lands beyond the productivity historically experienced would
13 require cost share with the landowner

14 **2.7 Initial Alternatives Development**

15 The Site Evaluation Report results in a list of initial alternatives potentially feasible for the site.
16 Initial Alternatives will include all projects that make it through initial screening. Initial
17 Alternatives will also include potential placement, size, or extent, and design data collection.
18 Plan formulation, the next step, will evaluate the initial alternatives in detail, perform additional
19 design work, and select a preferred project through weighting of various selection criteria.

20 The list below provides a starting point for initial options. Landowners may identify additional
21 options upon initiation of a site evaluation.

- 22 • Interceptor Drains
- 23 • Relief Drains
- 24 • Drainage Ditches
- 25 • Shallow Groundwater Pumping with existing or new wells
- 26 • Slurry or Cutoff Walls
- 27 • Buildup of Low Lying Areas
- 28 • Channel Conveyance Improvements
- 29 • License Agreements / Easements

- 1 • Acquisition
 - 2 • Changes to Cropping Patterns: Working with the USDA or other programs to
 - 3 incentivize salt or shallow groundwater tolerant crops
 - 4 • Partnerships: Partner with Non-government organizations for conservation easements,
 - 5 acquisition for wetland mitigation, etc.
- 6 National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA)
- 7 compliance requires establishment of a baseline for comparison of potential environmental
- 8 impacts. The baseline is described as a No Action Alternative that would evaluate conditions
- 9 with Interim and Restoration flows in the San Joaquin River without the seepage project in place.

10 **2.8 Process and Timelines**

11 The site evaluation process begins with a site visit. Following the site visit, Reclamation or

12 designee will review existing records and put together a Methods Report detailing future field

13 investigations. The landowner may expect Reclamation or designee to contact them to review the

14 Methods Report approximately 1 month following the site visit. At this time, the landowner may

15 raise any concerns they may have about field site investigation and adjustments can be made as

16 necessary to the Methods Report. Landowners or other interested parties they approve will have

17 two weeks to review the report.

18 If not already agreed, the landowner must sign a temporary entry permit (TEP) to allow

19 Reclamation to access their land to conduct the site investigation, and may need to sign a

20 monitoring well agreement or other agreement for specific fieldwork. The draft TEP and any

21 necessary agreements will be sent to the landowner with the Methods Report for approval. The

22 landowner may suggest changes to the TEP or monitoring well agreement in the same two week

23 period they have to review the Methods Report. Reclamation or designee will make revisions to

24 documents within two weeks or less of receipt of comments, or if the landowner raises major

25 concerns, both parties will work to resolve them as quickly as possible. Parties understand that

26 delay in review will delay the project.

27 Following landowner approval of the Methods Report or a preliminary draft that provides a

28 maximum extent of impact, Reclamation initiates the permitting process with a second site visit

29 focused on permitting activities. Based on the results of this second site visit, an Endangered

30 Species Act affects analysis and cultural resources analysis are prepared and submitted to the

31 appropriate agencies for review and approval. These analyses are required for National

32 Environmental Policy Act compliance, and are typically completed with a Categorical Exclusion.

33 The permitting timelines can take between 1.5 to 3 months assuming no issues arise.

34 After satisfactory environmental compliance and any necessary permitting, Reclamation or

35 designee will begin fieldwork. Fieldwork, depending on the extent and type, can take 1-3

36 months. Reclamation or designee will then conduct data analysis and write the Site Evaluation

37 Report. As data comes in for the Site Evaluation Report, Reclamation or designee will begin the

38 screening process and come up with a list of initial alternatives for inclusion in the Site

2.0 Site Evaluation

- 1 Evaluation Report. The landowner can expect a draft Site Evaluation Report with all collected
- 2 data 6 months following the initial site visit assuming no issues arise..

1 **3.0 Plan Formulation**

2 **3.1 Introduction**

3 The purpose of plan formulation is to select a preferred alternative from a list of initial
4 alternatives. Plan formulation needs a defensible approach to identify project components
5 of importance and rank projects based on these components. During the plan formulation
6 process Reclamation and the landowner will use weighted selection criteria to score each
7 alternative, obtain a final project type, and move on to design data collection and design.

8 Quantitative criteria allow for fair and transparent decision making. Any team member
9 may suggest adjustments to these criteria, as well as to any aspect of the SPH, on an
10 annual basis. Reclamation will evaluate suggested revisions and gather input from the
11 Seepage and Conveyance Technical Feedback Group, as the group initially developed the
12 criteria.

13 **3.2 Appraisal Level Designs**

14 Reclamation’s contractor or other team members will develop appraisal level designs for
15 each initial alternative identified in the Site Evaluation Report to inform plan
16 formulation. Appraisal level designs follow Reclamation’s final design step Concept.
17 Appraisal level designs should include review of existing geologic, hydrologic, and
18 groundwater data, lab testing reports, general plan/ arrangement of concept alternatives,
19 thirty-percent-design cost estimates, etc.

20 For additional detail on appraisal level design, see Reclamation’s Final Design Process
21 Stage: Concept, pages 6 – 9, as included in Attachment A. Section 5 also includes
22 additional information about design.

23 **3.3 Criteria**

24 Reclamation developed the criteria shown below with input from the SCTFG
25 Landowners may request revisions to criteria or additional criteria through comments on
26 the SPH, but adjustments to the plan formulation criteria will apply to all upcoming
27 projects throughout the SJRRP area. This maintains consistency and defensibility. The
28 following list (Table 2) describes the criteria used, and includes various wordings
29 developed by attendees at the August 4, 2011 SCTFG.

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Table 2
Plan Formulation Criteria and Original Stakeholder Text from SCTFG

San Joaquin River Restoration Program

Criteria Topic	Stakeholder Text
Ability to increase flows to 4,500 cfs	Ability to increase flows; meeting 4,500 cfs goal
Effectiveness of project in protecting lands	Projects to avoid damages; Certainty of performance;
Landowner acceptability, including upstream and downstream landowners	Landowner acceptability; landowner acceptability - with neighboring lands protected; consideration of surrounding land use; project works with both upstream and downstream landowners; impacts to adjacent landowners; coordination with other seepage projects
Regional solutions ranked higher	Entire regions of reach protected; larger projects, especially near river; how the project fits into the larger regional 'mitigation' program i.e. no impacts to others
Temperature	Not increase water temp when fish in the river;
Water Quality (especially Selenium)	water quality will not be degraded; not increase selenium runoff (green sturgeon);
Site Suitability (near the seepage source)	Site Suitability; suitability to site conditions as per <i>all</i> criteria from SCTFG; soil structure - extremely important; projects oriented at the source - near the river; cropping patterns
Long term viability & low O&M costs	Cost, long-term viability; Sustainability of improvements over the long term; long term O&M costs; long term O&M;
Opportunities for habitat improvements	Opportunities for habitat improvements;
No barriers to fish passage (stranding)	Does not create a barrier to fish passage; does not create stranding of adult fish without addressing passage; does not preclude the ability for fish to be in the river while projects are installed - fish do not wait for 4500 cfs
Project ownership	Ownership of project;
Does not increase subsidence	design such that if there is a potential for subsidence, the issue is not exacerbated;
Alignment with other programs (district water quality plans, regional plans)	Fits with other programs i.e. EQUIP or CMS programs
Creates rearing habitat for fish	Creates rearing habitat for fish;
Cost	Cost of project; cost;
Regulatory permitting (time)	Regulatory permitting (time); temporary solutions can be used until such time as funds are available for higher dollar options
Environmental Compliance	Environmental Compliance;

1 3.4 Rankings

2 Reclamation and the landowner will discuss the appraisal level designs and score
 3 alternatives at a meeting. Reclamation's final design process calls this a concept briefing
 4 meeting, or a plan formulation meeting. Parties will reach an agreement on the preferred
 5 alternative before continuation of designs.

6 Reclamation developed quantitative statements for each selection criteria described
 7 above. These are shown in Table 4 below. The specific values for each alternative and
 8 criteria will come from site evaluation and appraisal-level designs. This allows
 9 comparison with data collected on the site during the site evaluation and information
 10 from the appraisal-level designs, and helps create an objective selection process.

11 Reclamation and the landowner will chose the preferred alternative as the alternative that
 12 scores the best on the plan formulation criteria. Reclamation, or designee, will weight

3.0 Plan Formulation

1 each criterion according to the High, Medium or Low weight in Table 3. Reclamation, or
2 designee, will convert each criterion to a score out of 100 before weighting so that each
3 'high' criterion has the same weight as another 'high' criterion. This preferred alternative
4 will then continue to additional design data collection, design, environmental compliance,
5 permitting and agreements.

6 **3.5 Documentation**

7 The Project Report will include the results of plan formulation, appraisal level designs,
8 and work for the preferred alternative as discussed in Section 7.

9 **3.6 Process and Timelines**

10 Reclamation expects plan formulation to take up to 2 months to develop appraisal level
11 designs, determine criteria numbers for each alternative, schedule and hold a meeting
12 with the landowner assuming no issues arise. In total, it is expected that the plan
13 formulation meeting will occur approximately 8 months after the initial site visit.

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San Joaquin River Restoration Program

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3.0 Plan Formulation

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**Table 3
Plan Formulation Criteria and Assessment Methodology**

Criteria Topic	Criteria	Unit	Analytical Tool	Weight
Ability to increase flows to 4,500 cfs	4,500 cfs WSE does not cause surface ponding in fields	Y/N	hydraulic model, CVHM	screening
Environmental Compliance	Major environmental concern – significant impact to a resource area and unavoidable with mitigation measures	Y/N	Environmental compliance	screening
Effectiveness of project in protecting lands	-1 point for each 0.5 groundwater level above threshold at 4,500 cfs	feet	hydraulic model, CVHM	High
Landowner acceptability, including upstream and downstream landowners	+1 point for each landowner	point	landowner meeting	High
Regional solutions ranked higher	+1 for each additional seepage parcel group solved	point	appraisal level design	High
Temperature	-1 point for each degree increase in river temperature	degree	Water Quality monitoring	High
Water Quality (especially Selenium)	-1 point for each 0.5 increase in Selenium	ppb	Water Quality monitoring	High
Site Suitability (near the seepage source)	Project targets seepage source	Y/N	appraisal level design; site evaluation - CVHM	High
Long term viability & low O&M costs	+1 point for each unit less than most expensive O&M alternative. Expected effectiveness over time (scale 0-5, 0 being most effective), estimated O&M for 20 years. (Effectiveness x \$50,000 + O&M)/#acres protected	\$10 per acre	appraisal level design & cost estimate	High
Opportunities for habitat improvements	+1 point for each mile of non-hard structural fix adjacent to river (within 500 feet of levee)	mile	appraisal level design	High
	+1 point for each 50 acres of fallow or open land near river	acre	appraisal level design	High
	+1 point for each additional 50 acres of riparian habitat	acre	appraisal level design	High
No barriers to fish passage (stranding)	-1 point for each 0.5 foot lowered river WSE post project compared with pre project conditions	WSE	hydraulic model	High
Project ownership	Landowner owns project	Y/N	project agreement	Medium
Does not increase subsidence	-1 point for each 0.5 foot lowered ground surface	feet	CVHM / subsidence model	Medium
Alignment with other programs (district water quality plans, regional plans), habitat corridor,	+1 point if project aligns with a regional plan	Y/N	Site Evaluation Records Review	Medium

San Joaquin River Restoration Program

Criteria Topic	Criteria	Unit	Analytical Tool	Weight
and migration pathways				
Creates rearing habitat for fish	+1 point for each additional 5 acres of rearing habitat	acre	hydraulic model	Medium
Cost	+1 point for each \$10 less per acre than the lowest cost project alternative	dollars per acre	appraisal level cost estimate	Medium
Time to construction	+1 point for each month sooner the project is in the ground than the slowest alternative	months	Project schedule	Low

1

1 **4.0 Design Data Collection**

2 **4.1 Introduction**

3 Design data collection expands upon the earlier site evaluation efforts to gather site-specifics for
4 the preferred alternative. The project report includes this information.

5 **4.2 Field Work**

6 Additional site investigations will likely include additional surveying and geotechnical
7 investigation. Please see the Site Evaluation section for more information on fieldwork activities
8 and disturbance. Also, please see Reclamation's guidance on design data collection for drains
9 attached to this Handbook as Appendix B.

10 **4.3 Process and Timelines**

11 Design data collection can be lengthy process, and as such it is important to define initial design
12 data needs early in the process. In Reclamation's design process, definition happens during the
13 SCHED phase and data collection itself happens during design concept phase. Reclamation
14 anticipates that much of the data collection will occur under site evaluation, and so design data
15 collection will take a relatively short amount of time. If investigations involve ground
16 disturbance, permits will be required. This process could take two to four months, including
17 permitting and field work time, assuming no issues arise.

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San Joaquin River Restoration Program

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1 **5.0 Design**

2 **5.1 Introduction**

3 Design determines the conceptual layout of the seepage project, quantities of materials and
4 excavation / fill needed, and costs. Reclamation or designee will develop appraisal level designs
5 for all initial alternatives to quantify criteria for the plan formulation stage. Reclamation or
6 designee will also develop a feasibility level design for the preferred alternative. Feasibility
7 design for the preferred alternative will include conceptual layouts, quantities and costs. After
8 feasibility level design, Reclamation will likely contract or provide financial assistance for
9 another entity to conduct Final Design, with Reclamation in a review capacity. Please see
10 Reclamation's guidance on the Final Design Process attached as Appendix A.

11 **5.2 Feasibility Design**

12 The design steps involve developing the scope of design, including functional and operational
13 requirements. Preliminary items include establishing a funding source, scheduling, staffing, and
14 definition of design data requirements as described in Section 4, Design Data Collection.

15 Feasibility design, approximately equivalent to industry's 5 to 30% design, involves any
16 additional field exploration, materials testing and hydraulic studies necessary. It also involves
17 developing the design drawings, cost estimates and a schedule, and completing value
18 engineering. Reclamation or designee would complete feasibility level designs for the preferred
19 alternative.

20 **5.3 Project Report**

21 Reclamation or designee will document the feasibility designs, data, analysis, and environmental
22 compliance in a Project Report. The report will include, in this approximate outline:

- 23 I. Introduction
- 24 II. Methods
- 25 III. Results
- 26 IV. Discussion
- 27 V. Conclusion and Recommendation
- 28 VI. Field Visit Documentation Appendix
- 29 VII. Data Appendix
- 30 VIII. Analysis Appendix
- 31 IX. Environmental Compliance (EA/IS or EIS/EIR)
- 32 X. Appraisal Designs
- 33 XI. Feasibility Design for Preferred Alternative
- 34 XII. Permit Applications

1 **5.4 Final Design**

2 Final design will occur after the completed Project Report. A non-federal entity will likely
3 complete final design.

4 Final design, approximately equivalent to industry's 30 to 60% design, involves preliminary
5 drawings, and permits initiated. Draft specifications, which is actually a design phase
6 approximately equivalent to industry's 90% design, involves specifications sent for review,
7 quantities and bid schedules completed, and all lab testing and TMs finalized. Following the 90%
8 design a review phase occurs, at which point Reclamation conducts a Design Estimates and
9 Constructability review of the project.

10 Reclamation calls 100% design FINAL SPEC, at which point final design drawings and
11 specifications are completed and sent for bids.

12 **5.5 Template Designs**

13 This section contains template designs for several seepage control projects.

14 **5.5.1 Slurry Wall**

15 Reclamation designed a template slurry wall for comparison purposes. This section details the
16 assumptions made, includes a sketch of a potential slurry wall, and includes estimated costs for
17 different depth and slurry mixtures.

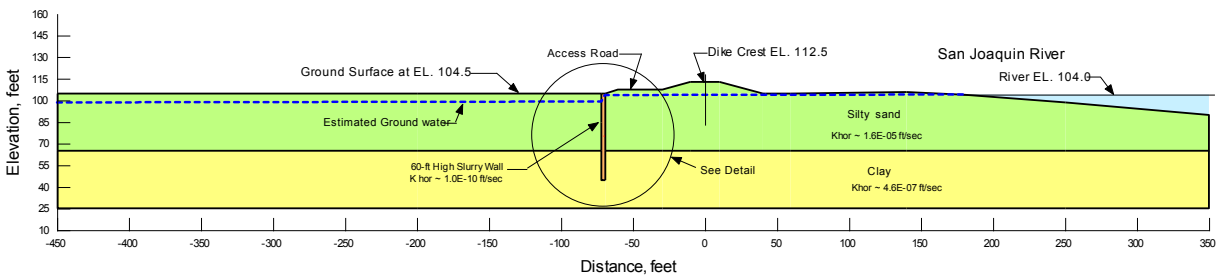
18 The river water surface elevation used was based on the elevation at 800 cfs. The historic/target
19 ground water table depth in the farm lands adjacent to the river was assumed to be 6 feet below
20 the ground surface.

21 Based on what appeared to be the predominant geology along the river, seepage analysis was
22 performed using silty-sand and clayey soil foundations with assumed permeability values.
23 Figure 2 shows the results of just one of the seepage analyses performed. Cost estimates were
24 determined for 60-foot deep and 40-foot deep cutoff walls included in Appendix C. It is noted
25 that the geology was not studied in detail, and a deeper wall may be required in the event that the
26 soils, either locally or globally, are more permeable than estimated. It is not likely that a
27 shallower wall would lower the groundwater sufficiently.

28 Preliminary level cost estimates were provided for soil-bentonite (S-B) and soil-cement-
29 bentonite (C-B) slurry cutoff walls. A typical slurry cutoff wall thickness of 3 feet was used.
30 The S-B wall is more economical and would likely perform comparably to the C-B wall.
31 Reclamation calculated costs for a 40-foot deep S-B wall of approximately \$5 million per mile.
32 A 60-foot deep S-B wall calculated a cost of \$9 million per mile, while the C-B wall at 60-foot
33 deep was \$13 million per mile. Approximately 40% of these costs are contingencies.

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5.0 Design



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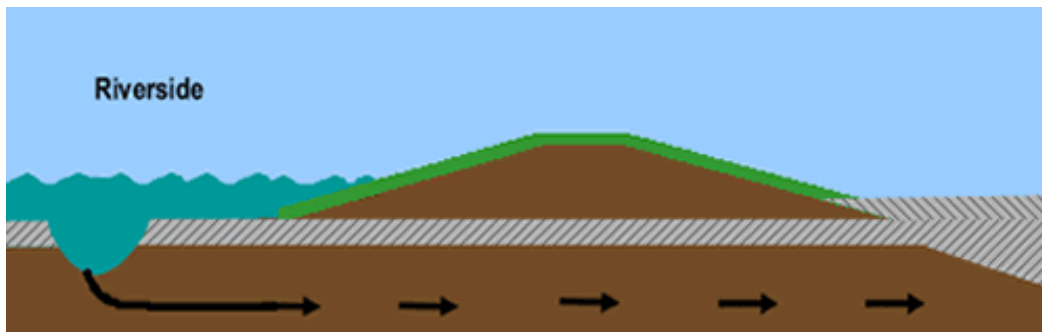
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Figure 2
Slurry Wall Template Design

5.5.2 Seepage Berm

5 Estimated costs indicate around \$2.3 million per mile of seepage berm installed. Approximately
6 40% of this cost is contingencies. This includes clearing and grubbing, borrow excavation,
7 inspection trench excavation, compacted embankment, and bank protection. Reclamation
8 calculated a clearing and grubbing cost assuming very few large trees or other major vegetation,
9 primarily stripping below organic material in foundation for one foot. Borrow excavation
10 assumes borrow sources are within 3 miles of the levee centerline.



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Figure 3
Seepage Berm Template Design

5.5.3 Drainage Ditch

15 To be developed.

5.5.4 Interceptor Line

17 The templates for drains could estimate costs per mile of constructing drains 8, 10 or 12 feet
18 deep. These costs may be misleading in terms of costs of water table control since under some
19 conditions a 12 foot deep drain may be more economical than tightly spaced 8 foot deep drains.

5.5.5 Shallow Groundwater Pump

21 To be developed.

5.5.6 Buildup of Low Lying Areas

23 To be developed.

1 **5.5.7 Channel Conveyance Improvements**

2 Channel conveyance improvements include dredging of material out of the river channel,
3 removal of structures, adjustments to channel bathymetry such as creation of low flow or side
4 channels, levee work, and other adjustments to the channel.

5 Generally sediments coarser than fine sand could be used to buildup road surfaces, while fine
6 sand or finer sediments could improve and build up low lying agricultural lands near the river or
7 bypass. The dredging could create a low water channel in the bypass / rivers.

8 **5.5.8 Habitat Improvements**

9 To be developed.

10 **5.6 Real Estate Actions**

11 The information provided above primarily involves the design and construction of a physical
12 seepage control project. However, there are several real estate actions (i.e., non-physical
13 projects) that could be undertaken to control seepage impacts.

14 **5.6.1 Easements**

15 A seepage easement would be an easement on the landowner's property that would allow
16 Reclamation to increase groundwater levels on all or a portion of the property. By having the
17 authority to increase groundwater levels on the property, Reclamation would be able to increase
18 flow in the SJR adjacent to the property.

19 To develop an easement agreement Reclamation would contract with the Office of ???? to
20 conduct and appraisal of the property. Based on the appraised value, Reclamation and the
21 landowner would negotiate fair compensation for the easement.

22 **5.6.2 License Agreements**

23 A license agreement is similar to an easement with the exception of the agreement's term. An
24 easement is a permanent agreement, while a license agreement is a shorter-term (e.g., 5 years)
25 agreement.

26 **5.7 Process and Timelines**

27 Project partners can expect completed feasibility level design approximately 10 months after the
28 initial site visit assuming no issues arise. If issues arise such as environmental compliance or
29 permitting challenges, design discrepancies, project partner disagreements, or weather or other
30 delays in site evaluation or design data collection fieldwork, the completed final design may
31 exceed the estimated timeframe. Reclamation, irrigation districts, landowners, or other recipients
32 of financial assistance may perform the actual design.

33 Completed final design may take 3 months assuming no issues arise and environmental
34 compliance only requires a categorical exclusion assuming no issues arise. This translates to 13
35 months after the initial site visit. Also if issues arise such as permitting challenges, design

5.0 Design

- 1 discrepancies, project partner disagreements, disagreements about financial assistance, weather
- 2 or other delays in final design fieldwork, the completed final design may exceed the estimated
- 3 timeframe.

1 **6.0 Environmental Compliance**

2 **6.1 Introduction**

3 Environmental compliance includes documentation and permitting to meet federal, state,
4 and local requirements. After completing environmental documentation, the responsible
5 party will apply for required permits with appropriate state or federal agencies that may
6 have jurisdiction over parts of the project. Reclamation or irrigation districts under a
7 financial assistance agreement will likely conduct environmental compliance.

8 Federal agencies must comply with NEPA for projects in which there is a Federal
9 undertaking. As the lead Federal agency, Reclamation will review and approve NEPA
10 documents to ensure all essential information is obtained, and the analysis is adequate to
11 meet NEPA standards. Projects involving state agencies require compliance with CEQA.
12 A project is a “Federal undertaking” and requires NEPA compliance if any of the
13 following are true:

- 14 • Has Federal discretion (i.e., permits, approvals, etc.),
- 15 • Is on Federal property, or
- 16 • Is funded wholly or in part through a Federal source.

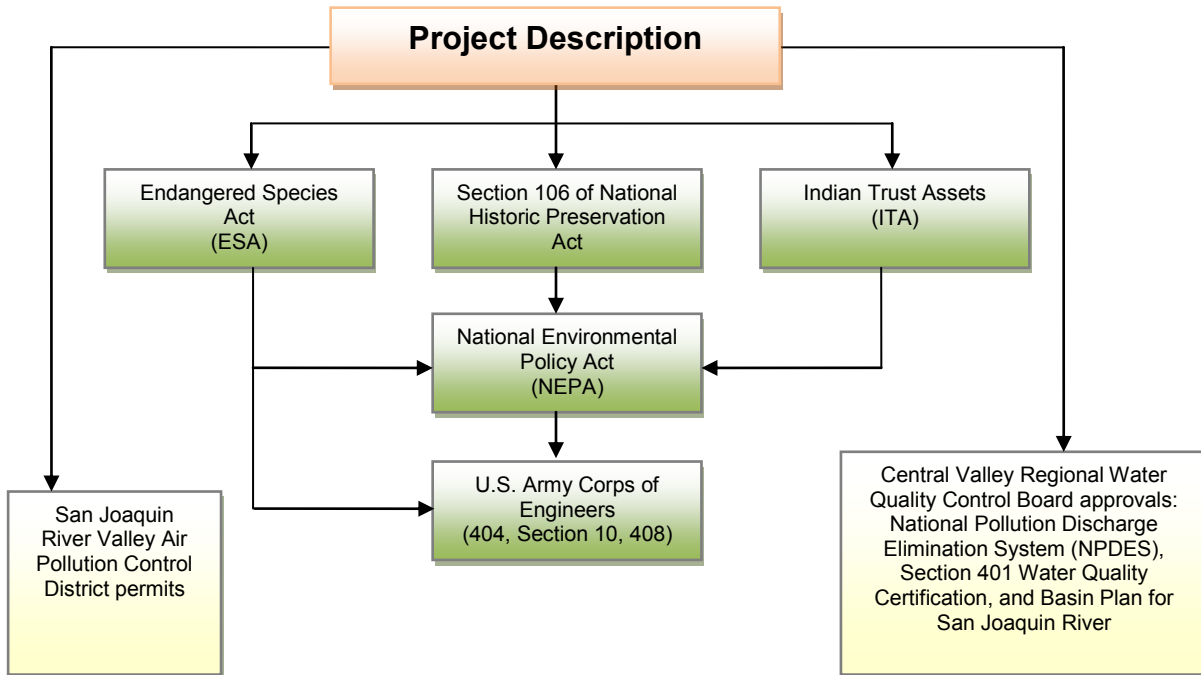
17 **6.2 National Environmental Policy Act**

18 To initiate the appropriate environmental compliance process(es), Reclamation and the
19 project partner will develop a project description for review by the SJRRP Environmental
20 Compliance and Permitting Workgroup. A project description explains the proposed
21 action and the methods used to get to an expected outcome. A project description also
22 explains what the project consists of in order for agencies to determine what
23 environmental compliance activities will be required. Project descriptions include:

- 24 • Alternatives considered
- 25 • Objective of proposed action
- 26 • Project limits (depths, quantities, length, staging areas, etc.)
- 27 • Construction methods and best management practices (types of equipment
28 needed, dust abatement, etc.)

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**Figure 4
Federal Environmental Compliance Process**

4

NEPA documents impacts to environmental resources. The NEPA document, if an EA or EIS, could include the following environmental resources and analysis.

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- **Aesthetics:** Visual resources analysis includes a qualitative assessment of views from communities or buildings occupied from people, and any changes that may occur to them.

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- **Agricultural Resources:** Analysis identifies project area agricultural revenue, acres of farmland including prime farmland, unique farmland, and farmland of statewide importance, and irrigated acres of farmland. Any effects to agricultural resources such as reduced water supply, bridge closures, Williamson Act impacts, or a positive effect from additional lands to convert to agriculture would be included in the analysis.

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- **Air Quality:** Air quality analysis would likely include estimating construction criteria pollutant and precursor pollutant emissions using the San Joaquin Valley Air Pollution Control District's (SJVAPCD) Guide for Assessing and Mitigating Air Quality Impacts and guidance provided by SJVAPCD staff. Construction emission estimates would likely include calculations from the Sacramento Metropolitan Air Quality Management District's (SMAQMD) Road Construction Emissions Calculator based on default fleet characteristics, the most conservative emissions factors. These calculated values would then be compared to SJVAPCD thresholds and Federal conformity determinations.

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6.0 Environmental Compliance

- 1 • **Biological Resources:** The ESA effects analysis would include searches of
2 USFWS’s species database, CDFG’s species accounts, reports, the CNDDDB,
3 and literature from other sources. Then a comparison would document any
4 overlap of the project area where construction would occur and the habitat of
5 special status species. An assumed presence approach would then dictate
6 biological protection measures or Best Management Practices as per the
7 SJRRP Conservation Strategy. An alternate approach would be to conduct
8 biological surveys to determine presence in the field, and suggest biological
9 protection measures based on field survey data.
- 10 • **Cultural Resources:** Records reviews of prehistoric and historical
11 archaeological sites, architectural properties of importance such as buildings,
12 bridges, and infrastructure, and resources important to Native Americans will
13 include existing and eligible inclusions on the National Register of Historic
14 Places. For any projects involving ground disturbance, cultural resources
15 surveys will evaluate any potential effects to archeological resources, and the
16 State Historic Preservation Office may concur. Identified archeological
17 resources will include mitigation through consultations with the State Historic
18 Preservation Office, Native American tribes, and interested parties.
- 19 • **Environmental Justice:** Environmental justice evaluations include searches
20 for local economically disadvantaged communities, and potential effects on
21 their visual resources, noise levels, air quality, and jobs.
- 22 • **Earth Science:** Earth science analysis includes potential impacts to geology,
23 soils or paleontological resources. Analysis would include an assessment of
24 ground-disturbing activities and changes as a result.
- 25 • **Groundwater:** The Kings, Delta-Mendota, Madera, Chowchilla, or Merced
26 groundwater subbasins of the San Joaquin Valley Groundwater Basin may
27 contain the project. Groundwater analysis will likely include research from the
28 California Water Plan Updates as well as U.S. Geological Survey modeling,
29 and the San Joaquin Valley Drainage Monitoring Program on groundwater
30 overdraft. Environmental documentation would also show calculations of any
31 predicted changes in groundwater levels.
- 32 • **Land Use:** Analysis will identify any potential changes to land use (such as
33 conversion to agriculture, conversion to natural areas, etc.) from the project.
- 34 • **Noise:** Noise analysis includes calculations of construction equipment noise
35 emission levels and traffic in A-weighted decibel (dBA) equivalent noise
36 levels. Analysis would also include calculations from groundborne vibration
37 and noise in units of vibration decibels (VdB). Then environmental
38 documentation would show comparisons between calculated noise levels and
39 local noise standards at nearby sensitive receptors with the lowest allowed
40 levels.

San Joaquin River Restoration Program

- 1 • **Public Health:** Public health analysis includes potential for emergency
2 services disruption due to traffic, and potential for hazardous waste spills.

- 3 • **Recreation:** Analysis includes identification of nearby recreation areas, any
4 generated demand for recreation, construction or expansion of recreation
5 amenities, or restrictions for access to recreation.

- 6 • **Socioeconomics:** Analysis documents existing population, income, and job
7 levels in the area. Environmental compliance would include qualitative
8 assessments of how population, income and job levels could change with the
9 project.

- 10 • **Transportation:** Analysis includes descriptions of existing roads, uses, and
11 extent of use. Analysis of the proposed action includes calculations of
12 additional traffic, changes to road cross-sections, stability, or alignments, road
13 closings, and any removal of existing utilities.

- 14 • **Utilities:** Analysis will identify nearby utilities and any utilities disturbed or
15 removed as part of the Proposed Action. Utility providers would be contacted
16 before project construction to determine the location of any underground
17 utilities.

- 18 • **Water Supply:** Analysis would include calculations on changes in water
19 supplies for fish and wildlife as well as agricultural uses, both in terms of
20 quantities, timing, and locations.

- 21 • **Water Quality:** Analysis will include summaries of existing water quality
22 testing in the area, and comparison to municipal and agricultural standards.
23 Alternatives with a discharge may require water quality sampling in the river,
24 groundwater and sampling or predicted discharge water quality.

- 25 • **Other:** Other resource areas may include climate change, power and energy
26 resources or population and housing.

27 Project effects will be evaluated based on the criteria of context and intensity. Context means the
28 affected environment in which a proposed project occurs. Intensity refers to the severity of the
29 effect, which is examined in terms of the type, quality, and sensitivity of the resource involved,
30 location and extent of the effect, duration of the effect (short- or long-term), and other
31 consideration of context. Both adverse and beneficial effects are considered. When there is no
32 measurable effect, no impact is found to occur. The intensity of adverse effects will be described
33 in terms of the degree or magnitude of the potential adverse effect and will be summarized as
34 negligible, moderate, or substantial.

35 The significance criteria used in the project environmental compliance document will be based on
36 the environmental checklist presented in Appendix G of the State CEQA Guidelines; factual or
37 scientific information and data; and regulatory standards of Federal, State, regional, and local
38 agencies. These thresholds will also include the factors taken into account under NEPA to

6.0 Environmental Compliance

1 determine the significance of the action in terms of the context and the intensity of its effects. The
2 Project environmental compliance document will use these or similar criteria as appropriate.

3 NEPA requires all federal agencies to fully and publicly disclose any reasonably
4 foreseeable adverse impacts that could result from the federal undertaking.

5 Reclamation may prepare and distribute the following documents for NEPA:

- 6 • Categorical Exclusion Checklist (CEC)
- 7 • Environmental Assessment (EA) and Finding of No Significant Impact
8 (FONSI)
- 9 • Environmental Impact Statement (EIS) and Record of Decision (ROD)

10 An EA and EIS both require public comment periods. Following a Public Draft document
11 and a Final Draft, Reclamation would issue a Finding of No Significant Impact FONSI
12 for an EA, or a ROD for an EIS to document the final alternative.

13 The following sections provide more details about some key portions of NEPA
14 compliance.

15 **6.3 Endangered Species Act**

16 The Endangered Species Act requires analysis for potential impacts to species. Projects
17 with Federal-only action only require analysis of federally listed species per ESA, while
18 projects with a state action require analysis of state listed species per the California
19 Endangered Species Act, which includes more species. Field reviews/surveys are needed
20 to identify both:

- 21 • Presence/absence of species and
- 22 • Presence/absence of potential habitat.

23 Following biological surveys, Reclamation prepares an effects analysis and makes one of
24 the following determinations.

- 25 • **No Effect:** The proposed project has no effect on the species. The means the
26 project will not harm, harass, injure, pursue, capture or kill the species.
- 27 • **May effect, not likely to adversely affect (NLTAA):** The proposed project is
28 within the habitat of the species or near a sighting, but with or without
29 conservation measures the project is not likely to adversely affect the species.
- 30 • **Likely to adversely affect (LTAA):** The project may have take and harm,
31 harass, injure, pursue, capture or kill the species.

San Joaquin River Restoration Program

1 If the project determines a NLTAA or LTAA, consultation must be undertaken with U.S.
2 Fish and Wildlife Service and/or National Marine Fisheries Service per Section 7 of the
3 Endangered Species Act, as Reclamation's involvement triggers a federal nexus. If no
4 Federal agency is involved, the project team must go through a habitat conservation plan
5 process which is generally more complex. The U.S. Fish and Wildlife service has an
6 informal consultation process for a NLTAA determination, and a formal consultation
7 process for a LTAA determination. The formal consultation process results in a
8 Biological Opinion, which may include either a jeopardy opinion (the project will have
9 take) or a no jeopardy opinion.

10 USFWS consultation may result in requirements that help the project go forward without
11 creating affects to species. In informal consultation, these are called conservation
12 measures. In a Biological Opinion they are called either Reasonable and Prudent
13 Alternatives (RPA) or Terms and Conditions. Terms and Conditions are the most
14 stringent in terms of putting requirements on the project.

15 **6.4 Section 106 – National Historic Preservation Act**

16 Section 106, or the National Historic Preservation Act, requires analysis to determine
17 potential effects to historic properties, paleontological or prehistoric resources. If any
18 ground excavation is proposed, field surveys are needed to identify:

- 19 • Surface cultural and archaeological resources,
- 20 • Subsurface cultural and archaeological resources, and
- 21 • Eligibility status of resources.

22 Reclamation gathers the findings from surveys in a report and sends a letter to the
23 California State Historic Preservation Officer (SHPO) with a request for concurrence for
24 a finding. Findings may include:

- 25 • **No Historic Properties Affected:** No eligible resources in the area that will
26 be effected
- 27 • **No Effect:** No change to an eligible resource
- 28 • **No Adverse Effect:** A change to the resource, but not damaging
- 29 • **Adverse Effect:** Will alter, damage, destroy, or change the resource and its
30 eligibility

31 SHPO has 30 days to respond with their concurrence with Reclamation's findings. If the
32 proposed action has an Adverse Effect, then the project needs additional coordination
33 through a Memorandum of Agreement (MOA).

1 **6.5 Indian Trust Assets**

2 Indian Trust Assets analysis is necessary to approve any Department of Interior
3 undertaking. Indian Trust Assets (ITA) is the protection of property interests held by the
4 U.S. for the benefit of Indian Tribes or Individuals. ITA analysis generally involves a
5 simple request to identify the nearest ITA asset. There are no known ITA assets in the
6 program area.

7 **6.6 Permitting**

8 **6.6.1 San Joaquin Valley Air Pollution Control District**

9 The SJVAPCD may require permits for ozone and particulate matter emissions.

10 **6.6.2 U.S. Army Corps of Engineers Permits**

11 USACOE permits are required for work within Waters of the U.S., navigable waterways,
12 and for modifications to federal flood control projects. USACOE permits come in two
13 forms – Section 404 permits, authorized under the Clean Water Act, regulate disposal of
14 dredge and fill material. Section 10 of the Rivers and Harbors Act gives the USACOE
15 authority over navigable waterways, and requires permits for actions that could disrupt
16 boating traffic.

17 **6.6.3 Central Valley Regional Water Quality Control Board**

18 The Central Valley Regional Water Quality Control Board (CVRWQCB) requires
19 permits for construction activities in relation to water quality protections (stormwater and
20 activities within state waters), basin plan authorities and enforcement.

21 Alternatives or projects with a discharge will require a NPDES permit. Reclamation,
22 landowner or designee must file a report on waste discharge with the CVRWQCB that
23 includes a description of the project, the quantity of discharge water, the quality of
24 discharge water, and completed CEQA environmental compliance. The CVRWQCB
25 would specify limits on discharge and a monitoring program to ensure compliance.
26 Discharges to go to agricultural supply canals may have fewer restrictions, providing the
27 canals do not drain to the San Joaquin River or a tributary of the San Joaquin River.
28 Options, including agricultural water supply for salt tolerant crops, should be described in
29 the report on waste discharge if they are possible especially in cases with discharge water
30 high in salinity, selenium, boron or molybdenum.

31 CVRWQCB approvals of the permit application / report on waste discharge must be
32 approved by the board. Approvals may take 120 days or more.

33 **6.7 Process and Timelines**

34 If project expected to have no or minor impacts to cultural resources, ESA, etc. and no
35 discharge:

San Joaquin River Restoration Program

- 1 • **Field surveys for Section 106 and ESA:** 1 day to 2 weeks (includes time to
2 schedule staff and coordinate with property owners, depends on size of site,
3 etc.)
- 4 • **Compilation of Field Results:** Approximately 2 weeks
- 5 • **NEPA (assuming CEC):** Approximately 3 days
- 6 • **Section 106 SHPO Concurrence:** 30 days

7 The total compliance time for a minor project with no adverse or significant impacts to
8 resources, such as installation of a monitoring well, is approximately 2 months.

9 If greater impacts to resources are suspected from a project based on field reviews, then
10 the project participants would need to assess timelines on a case-by-case basis. EIS
11 documents generally take at least a year to complete. Reclamation or a designee would
12 develop a schedule for these projects that outlines the process and expected timelines.

13 If Reclamation / the landowner expect a discharge, the Regional Water Quality Control
14 Board or another non-federal agency may be the CEQA lead. Reclamation and the CEQA
15 lead can prepare a joint NEPA/CEQA document, and then submit this to the CVRWQCB
16 for approval for a NPDES permit among other permit applications. CVRWQCB
17 approvals of the permit application / report on waste discharge must be approved by the
18 board. Approvals may take 120 days or more.

7.0 Construction

7.1 Introduction

This section discusses construction planning activities necessary to begin construction of the project. Reclamation or the partnering agency, in coordination with the landowner, will develop a construction plan to be included as part of the specifications in the RFQ for the construction contract.

In developing the construction plan, Reclamation or the partnering agency will adopt an approach that would cause minimal disturbance to grower operations, property, or crops. Reclamation or the partnering agency would also ensure that construction is undertaken such that effects to the environment (e.g., any endangered species, whether plant or animal) are minimized. The construction plan will include the timeline of construction. Reclamation or the partnering agency and the landowner will develop the construction plan together, with an initial meeting to bring up ideas and landowner review of the draft plan.

The following sections describe timelines and constraints/limitations associated with each potential physical project.

7.2 Potential Constraints

7.2.1 Slurry Wall

This section outlines the preliminary timeline and potential limitations associated with the construction of a slurry wall as discussed in Section 5. The location and length of the slurry wall would be determined based on local site conditions. Construction of slurry walls would involve a process that includes: (1) mobilization of trenching and mixing equipment; (2) excavation of trenches; (3) mixing and placing slurry in trenches; and (4) demobilization of equipment. The following factors will be considered during the scheduling of construction activities:

- 1) **Schedule:** Construction would be scheduled to occur during winter months (i.e., December to March) if possible to minimize disturbance to local farming activities. The schedule may vary depending on the crop types and irrigation facilities and practices of the site.
- 2) **Mobilization:** Mobilization of construction equipment would be made through existing farm roads wherever possible; however, if existing roadways cannot be used, care would be taken to minimize property damages. Proper dust mitigation measures would be used during construction.
- 3) **Construction Footprint:** The construction plan will optimize the digging/trenching and staging footprints to reduce disturbance to the land owners and minimize permanent loss

1 of agricultural land. Use of fallow fields or bare areas will likely be required for staging
2 areas.

3 4) **Endangered Species:** The effects of construction activities on endangered species/plants
4 will be factored into the planning, permitting, and scheduling of construction efforts.
5 Reclamation and partnering agencies will follow the Program Biological Assessment and
6 existing conservation strategy to protect endangered species present on the site.

7 **7.2.2 Seepage Berm**

8 This section outlines the preliminary timeline and potential limitations associated with the
9 construction of a seepage berm. Designs would likely place seepage berms along the levee toe.
10 Construction of seepage berms would involve a process that includes: (1) mobilization of
11 equipment; (2) excavation of foundation; (3) excavation of borrow areas; (4) placing and
12 compaction of soil; and (5) bank protection. The following factors will be considered during the
13 scheduling of construction activities:

14 1) **Schedule:** Construction would be scheduled to occur during winter months (i.e.,
15 December to March) if possible to minimize disturbance to local farming activities. The
16 schedule may vary depending on the crop types and irrigation facilities and practices of
17 the site.

18 2) **Mobilization:** Mobilization of construction equipment would be made through existing
19 farm roads wherever possible; however, if existing roadways cannot be used, care would
20 be taken to minimize property damages. Proper dust mitigation measures would be used
21 during construction.

22 3) **Construction Footprint:** The construction plan will optimize the staging footprints to
23 reduce disturbance to the landowners. Use of fallow fields or bare areas will likely be
24 required for staging areas.

25 4) **Endangered Species:** The effects of construction activities on endangered species/plants
26 will be factored into the planning, permitting, and scheduling of construction efforts.
27 Reclamation and partnering agencies will follow the Programmatic Biological
28 Assessment and existing conservation strategy to protect endangered species present on
29 the site.

30 **7.2.3 Drainage Ditch**

31 Construction of drainage ditches would require deepening of existing drainage ditches/trenches
32 or the excavation of new ditches/trenches. This activity would involve: (1) mobilization of
33 digging/trenching equipment; (2) digging/trenching and stabilization of drainage slopes (if
34 required); (3) demobilization of construction equipment. The following factors will be
35 considered during the scheduling of construction activities:

36 1) **Schedule:** Construction would be scheduled to occur during winter months (i.e.,
37 December to March) if possible to minimize disturbance to local farming activities. The

8.0 Agreements

1 schedule may vary depending on the crop types and irrigation facilities and practices of
2 the site.

3 2) **Construction:** For new ditches, the construction plan will optimize the digging/trenching
4 and staging footprints to reduce disturbance to the land owners and minimize permanent
5 loss of agricultural land. Proper dust mitigation measures will be used during
6 construction.

7 3) **Endangered Species:** The effects of construction activities on endangered species/plants
8 will be factored into the planning, permitting, and scheduling of construction efforts.
9 Reclamation and partnering agencies will follow the Programmatic Biological
10 Assessment and existing conservation strategy to protect endangered species present on
11 the site.

12 7.2.4 Interceptor Line

13 Construction of an interceptor line would involve similar activities as involved for a slurry wall.
14 However, interceptor line construction would occur more quickly and be less intrusive because
15 the interceptor line would typically be installed shallower than a slurry wall, and no mixing of a
16 slurry mixture would be required. This construction activity would involve: (1) mobilization of
17 digging/trenching equipment; (2) digging and trenching; (3) laying interceptor pipelines and
18 installing sump pumps (if necessary) which could include electrical work; (4) demobilization of
19 construction equipment. The following factors will be considered during the scheduling of
20 construction activities:

21 1) **Schedule:** Construction would be scheduled to occur during winter months (i.e.,
22 approximately December through March) if possible to minimize disturbance to local
23 farming activities. The schedule may vary depending on the crop types and irrigation
24 facilities and practices of the site.

25 2) **Mobilization:** Mobilization of construction equipment would be made through existing
26 farm roads wherever possible; however, if existing roadways cannot be used, care would
27 be taken to minimize property damages. Proper dust mitigation measures would be used
28 during construction.

29 3) **Construction:** The construction plan will optimize the digging/trenching and staging
30 footprints to reduce disturbance to the landowners. The design and construction plan
31 would describe use or modification of any existing drainage infrastructure in the design
32 and construction.

33 4) **Endangered Species:** The effects of construction activities on endangered species/plants
34 will be factored into the planning, permitting, and scheduling of construction efforts.
35 Reclamation and partnering agencies will follow the Programmatic Biological
36 Assessment and existing conservation strategy to protect endangered species present on
37 the site.

1 **7.2.5 Shallow Groundwater Pump**

2 Shallow groundwater pump installation would include: (1) mobilization of drill rig equipment;
3 (2) digging/installation of shallow wells and groundwater pump; (3) some electrical work may be
4 necessary depending on the location of the pump; and (4) demobilization of equipment. The
5 following factors will be considered during the scheduling of construction activities:

- 6 1) **Schedule:** Construction would be scheduled to occur during winter months (i.e.,
7 December to March) if possible to minimize disturbance to local farming activities. The
8 schedule may vary depending on the crop types and irrigation facilities and practices of
9 the site.
- 10 2) **Mobilization:** Mobilization of construction equipment would be made through existing
11 farm roads wherever possible; however, if existing roadways cannot be used, care would
12 be taken to minimize property damages. Proper dust mitigation measures would be used
13 during construction.
- 14 3) **Construction Footprint:** The construction plan will optimize the digging/trenching and
15 staging footprints to reduce disturbance to the landowners and minimize permanent loss
16 of agricultural land. Reclamation would try to install the pumps adjacent to farmlands
17 wherever possible to reduce property damage.
- 18 4) **Endangered Species:** The effects of construction activities on endangered species/plants
19 will be factored into the planning, permitting, and scheduling of construction efforts.
20 Reclamation and partnering agencies will follow the Programmatic Biological
21 Assessment and existing conservation strategy to protect endangered species present on
22 the site.

23 **7.2.6 Buildup of Low Lying Areas**

24 The buildup of low lying areas would require clearing and cultivation of land prior to raising the
25 ground surface. The land surface would be built up using finer textured sediments to reduce
26 seepage effects in these areas. This activity could involve significant earthwork including
27 dredging or excavating soil from the bypass or river channels and filling nearby low lying areas
28 with the dredged or excavated material. Buildup of low lying areas may occur in conjunction
29 with channel conveyance and improvements, providing an area to place dredged material.
30 Reclamation and the partnering agencies will consider the constraints discussed above for other
31 seepage control projects; however, the nature of this activity would make it difficult to ensure no
32 disturbance to farm land during a growing season. The net effect of this type of project would be
33 to improve the agricultural productivity of lands that are currently adversely affected by seepage.

34 **7.2.7 Channel Conveyance Improvements**

35 Channel conveyance improvements include: (1) mobilization of dredging and removal
36 equipment; (2) dredging of material out of the river channel, removal of structures, construction
37 of levee and side channels; (3) demobilization of equipment. The following factors will be
38 considered during the scheduling of construction activities:

8.0 Agreements

- 1) **Schedule:** Reclamation would try to schedule construction during the winter months (i.e. December to March) if possible; however, the nature of this activity might require a longer construction period. Reclamation would try to ensure minimal disturbance to farming activities during the growing season.
- 2) **Mobilization:** Mobilization of construction equipment would be made through existing farm roads wherever possible; however, if existing roadways cannot be used, care would be taken to minimize property damages. Proper dust mitigation measures would be used during construction.
- 3) **Construction Footprint:** the construction plan will optimize the digging/trenching and staging footprints to reduce disturbance to the landowners and minimize permanent loss of agricultural land.
- 4) **Endangered Species:** The effects of construction activities on endangered species/plants will be factored into the planning, permitting, and scheduling of construction efforts. Reclamation and partnering agencies will follow the Programmatic Biological Assessment and existing conservation strategy to protect endangered species present on the site.

7.2.8 Habitat Improvements

Habitat improvements include: (1) mobilization of excavation and grading equipment; (2) cut, fill and grading of land; and potentially (3) revegetation. The following factors will be considered during the scheduling of construction activities:

- 1) **Schedule:** Reclamation would try to schedule construction during the winter months (i.e. December to March) if possible; however, the nature of this activity might require a longer construction period. Reclamation would try to ensure minimal disturbance to farming activities during the growing season.
- 2) **Mobilization:** Mobilization of construction equipment would be made through existing farm roads wherever possible; however, if existing roadways cannot be used, care would be taken to minimize property damages. Proper dust mitigation measures would be used during construction.
- 3) **Construction Footprint:** The construction plan will optimize the staging footprints to reduce disturbance to the landowners.
- 4) **Endangered Species:** The effects of construction activities on endangered species/plants will be factored into the planning, permitting, and scheduling of construction efforts. Reclamation and partnering agencies will follow the Programmatic Biological Assessment and existing conservation strategy to protect endangered species present on the site.

1 **7.3 Process and Timelines**

- 2 Reclamation or the partner agency or consultant will develop the construction plan with the final
- 3 design process and specifications. The landowner will receive at least one opportunity to review
- 4 the plan and the team will schedule a meeting to discuss details with the landowner if any
- 5 concerns arise.

1 8.0 Agreements

2 8.1 Introduction

3 This section discusses process involved in developing a financial assistance agreement with
4 Reclamation for the purpose of (1) final design and construction of a seepage control project and
5 / or (2) the long-term operations and maintenance (O&M) of a project, or other agreements that
6 will be necessary for Reclamation to conduct (1) and (2). This section describes the process,
7 scope of work, and terms for receiving federal funds as related to seepage projects. This process
8 will be initiated before the final design and after the Project Report has been completed. The
9 scope of the financial assistance agreement will vary from project to project based on decisions
10 made between Reclamation and the landowner (or water district).

11 8.2 Authorization and Funding

12 Federal Acquisition Regulation provides Reclamation with the ability to develop two types of
13 financial assistance agreements: (1) grants and (2) cooperative agreements. Public Law 111-11,
14 the SJRRP Act, provides the authorization to enter into such agreements. A variety of funding
15 sources are available for Reclamation to utilize to fund such agreements. All agreements are
16 subject to the availability of funds.

17 8.2.1 Process

18 Reclamation anticipates working with landowners and districts to develop a Memorandum of
19 Understanding with the potential seepage project operators. This will document the long-term
20 approach to physical seepage project agreements. Financial assistance agreements may be
21 entered into with districts or landowners for tasks described herein. Financial assistance with
22 districts may be for implementation of multiple seepage projects. For each individual seepage
23 project, an agreement between the landowner, seepage project operator, and Reclamation will be
24 developed to specify the site-specific constraints regarding the operation of the seepage project.

25 The general process for financial assistance agreements is as follows:

- 26 1) **Develop Scope of Work:** Reclamation will develop a Scope of Work (SOW) that
27 describes the requirements of the work that will need to be accomplished. A sample
28 SOW is provided in Appendix D.
- 29 2) **Advertisement.** The SOW would be advertised via posting to grants.gov under the
30 Catalog of Federal Domestic Assistance.
- 31 3) **Recipient Submittal.** The grants.gov website lists the information required for an
32 applicant to apply for the grant or cooperative agreement. At a minimum, an applicant
33 would need to complete and submit the appropriate SF-424 forms, which are required for

1 all financial assistance agreements. The form and instructions can be found at
2 <https://apply07.grants.gov/apply/FormsMenu?source=agency>.

3 4) **Selection.** All applications that meet the minimum criteria in the posting are evaluated.
4 Selection is made per the selection criteria identified in the announcement.

5 5) **Execution of Agreement.** The selected recipient will be required to enter into an
6 agreement with Reclamation, similar to a contract. This agreement will define the specific
7 terms and conditions of the agreement along with role and responsibilities of Reclamation
8 and the recipient.

9 6) **Reporting.** Following selection, the recipient would need to provide Reclamation with
10 the required reporting and invoicing. Reporting requirements would include:

11 a. *Federal Financial Report, Form SF-425.* This form would need to be submitted
12 quarterly. This form can be found at
13 [http://www.whitehouse.gov/sites/default/files/omb/assets/grants_forms/SF-](http://www.whitehouse.gov/sites/default/files/omb/assets/grants_forms/SF-425.pdf)
14 [425.pdf](http://www.whitehouse.gov/sites/default/files/omb/assets/grants_forms/SF-425.pdf).

15 b. *Request for Advance or Reimbursement, Form SF-270.* This form would need to
16 be submitted quarterly. The form can be found at
17 <http://www.whitehouse.gov/sites/default/files/omb/grants/sf270.pdf>.

18 c. *Quarterly Progress Report.* This form would need to be submitted quarterly and
19 should report progress for the last quarter, challenges encountered, and expected
20 accomplishments for the upcoming quarter.

21 d. *Final Report.* A final report is due to Reclamation 90 days after the expiration or
22 termination of the financial assistance agreement.

23 **8.3 Roles and Responsibilities**

24 Financial assistance agreements currently envisioned would involve some of the following tasks:
25 final design and construction of a seepage project, environmental compliance, long-term
26 monitoring and / or operations and maintenance (O&M) of the project. It should be noted that
27 not all seepage projects would involve each of these tasks.

28 For physical seepage projects, an agreement will be developed between Reclamation and the
29 landowner. This agreement may be a three-party agreement (e.g. Reclamation, landowner and
30 district) if a discharge to a canal is involved.

31 The roles and responsibilities of Reclamation, the landowner, and the water district are listed
32 below. The items listed below may vary from project to project depending on factors such as
33 project type and the entities involved.

34 **8.3.1 Reclamation**

35 The basic responsibilities of Reclamation will be to:

8.0 Agreements

- 1 • Develop and oversee the financial assistance in coordination with landowners
- 2 • Develop and oversee site-specific agreements in coordination with landowners
- 3 • Conduct periodic quality checks of the financial assistance recipient's work,
- 4 • Collect required reports from the recipient, and
- 5 • Develop a Memorandum of Understanding for operations and maintenance

6 **8.3.2 Landowner**

7 Depending on the project, the landowner may be responsible for:

- 8 • Providing access to the seepage project for Reclamation staff and, potentially, the entity
9 responsible for O&M (if different than the landowner).
- 10 • Signing agreements with Reclamation and/or the water district to allow for financial
11 assistance and O&M,
- 12 • Following the terms of the financial assistance and site-specific agreements,
- 13 • Developing and signing a Memorandum of Understanding for operations and
14 maintenance, and
- 15 • Submitting the required receipts and reports to Reclamation.

16 **8.3.3 Water District**

17 Depending on the project, the water district may be responsible for:

- 18 • Signing agreements with Reclamation and/or the landowner to allow for financial
19 assistance and O&M,
- 20 • Developing and signing a Memorandum of Understanding for operations and
21 maintenance,
- 22 • Following the terms of the financial assistance and site-specific agreements, and
- 23 • Submitting the required receipts and reports to Reclamation.

24 **8.3.4 Seepage Project Operator**

25 The operator of the seepage project could be Reclamation, the landowner, or the water district.
26 Regardless of which entity serves as the operator of the project, the operator's responsibilities
27 include:

- 28 • O&M of the seepage project,
- 29 • Collecting the necessary monitoring data (e.g., discharge water quality and rate), and

- 1 • Following the terms of the financial assistance agreement and site-specific agreements.

2 **8.4 Agreement Terms**

3 The scope of work for a financial assistance agreement could include terms regarding the
4 following depending on the type of project and the decisions made by the landowner,
5 Reclamation and/or the District:

- 6 • Final design and construction,
- 7 • Environmental compliance and permitting,
- 8 • Operations and maintenance of the physical project, and
- 9 • Long-term monitoring.

10 Reclamation would reserve the right to perform quality inspections of the project and O&M
11 operations. All O&M financial agreements would contain performance measures to ensure that
12 the project is operating effectively and that O&M is being performed appropriately. The District
13 or landowner would be responsible for conducting the performance monitoring. In addition, all
14 agreements are the sole discretion of Reclamation and would be subject to the availability of
15 federal funds.

16 **8.4.1 Final Design and Construction**

17 As discussed in previous sections of the SPH, the completion of the Project Report will be
18 followed by final design, bid and award of contract, and construction. The steps following the
19 Project Report could be performed by a non-Federal entity (e.g., landowner, water district, or
20 contractor hired by the non-Federal entity). In the event that these activities are not performed
21 by Reclamation, a financial assistance agreement would be developed between Reclamation and
22 the non-Federal entity to provide compensation for performing the required tasks.

23 **8.4.2 Environmental Compliance and Permitting**

24 The environmental compliance and permitting of a seepage project will also be required. If a
25 district performs the O&M of a project, CEQA analysis may also be required.

26 **8.4.3 Operations and Maintenance**

27 A financial assistance agreement for the O&M of the seepage project will be developed between
28 Reclamation and the non-Federal entity if Reclamation retains responsibility for paying for the
29 O&M activities. Multiple federal O&M financial assistance agreements may be needed over
30 time as each agreement has a time limit. O&M agreements are subject to the availability of
31 federal funds. Operations and maintenance terms could include:

- 32 • Discharge timing requirements for discharge to the river,
- 33 • Discharge amount requirements for discharge to the river,

8.0 Agreements

- 1 • Routine maintenance of project equipment
- 2 • Operation of project equipment according to the project design,
- 3 • Replacement of project equipment should failure occur.

4 **8.4.4 Long-Term Monitoring**

5 As described above, regular and recurring monitoring activities will need to be performed at the
6 project site after the completion of the project. These monitoring activities may be related to
7 permitting requirements or performance monitoring and include the measurement of:

- 8 • Adjacent groundwater levels;
- 9 • Discharge quality, flow rate, and volume; and
- 10 • Project performance (i.e., metrics will be established to ensure that the seepage project is
11 operating according to the intended design).

12 **8.4.5 Cost Share**

13 Financial assistance can only be claimed for project scope items that mitigate seepage impacts
14 due to Interim or Restoration flow. Seepage impacts caused by other actions (e.g., flood flows),
15 or projects that lower the groundwater table below historic levels will not be paid for by
16 Reclamation. However, a seepage project could be designed, constructed, and operated in such a
17 way that additional benefit is provided to the landowner or District. In this situation,
18 Reclamation and the non-Federal entity would negotiate a cost-sharing agreement to allow for an
19 increased project scope (above protecting from Interim and Restoration flows). The non-Federal
20 entity would assume the cost of design, construction, and operation and maintenance costs of this
21 additional project scope in a cost-share portion of the financial assistance agreement.

22 **8.4.6 Mandatory Terms**

23 Each agreement will contain a number of mandatory terms which may include:

- 24 • **Appendix A to 2 CFR 25 – Registration:** The recipient will need to have a current
25 DUNS number and Central Contractor Registration.
- 26 • **Appendix to 2 CFR 35 – Recipient Integrity.** If the recipient currently has active
27 federal grants, contracts, etc. over \$10 million, the recipient will be required to provide
28 information pertaining to criminal convictions, civil proceedings resulting in fines, or
29 administrative proceedings resulting in a fine to the FAPIIS database.
- 30 • **Appendix A to 2 CFR 170 – Subaward Reporting:** The recipient must report each
31 action that obligates \$25,000 or more in Federal funds.
- 32 • **OMB Circular A-133 – Audits:** Recipients that expend \$500,000 or more a year in
33 federal funds must have an independent auditor perform a single of program-specific
34 audit for that year.

- 1 • **Civil Rights, Discrimination:** Recipients must comply with the Civil Rights Act, 14th
2 amendment, Rehabilitation Act of 1973, Age Discrimination Act of 1975, and similar
3 anti-discrimination statutes.

- 4 • **Assurances.** Standard assurances according to SF-424B (non-construction) or SF 424D
5 (construction) will be included. Form SF-424B can be found at
6 <http://www.acf.hhs.gov/programs/ofs/grants/sf424b.pdf>. Form SF-424D can be found at
7 <http://www.acf.hhs.gov/programs/ofs/grants/sf424d.pdf>.

- 8 • **2 CFR 230 (A-122) – Cost Principles.** Portions of 2 CFR 230 (A-122) may also need to
9 be followed to determine which costs are allowed or disallowed.

10 **8.5 Process and Timelines**

11 At the Plan Formulation meeting, after selection of the project, Reclamation and the
12 landowner/District will discuss the financial assistance agreement and decide who will construct,
13 operate and maintain the project. This agreement will enable Reclamation to begin the
14 contracting process to provide financial assistance. Near the completion of the Project Report,
15 Reclamation will schedule a meeting with the landowner/District to discuss the terms and
16 conditions of the necessary financial assistance agreements.

17

8.0 Agreements

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