NORTH KERN WATER STORAGE DISTRICT

North Kern Water Storage District

2015 Agricultural Water Management Plan

December 2015

AGRICULTURAL WATER MANAGEMENT PLAN

FOR THE

North Kern Water Storage District

January 2016

Completed In Accordance With the

WATER CONSERVATION BILL OF 2009
(SBx7-7)

and

EXECUTIVE ORDER B-29-15

Plan Checklist

The following is a checklist of plan contents drawn from the *DWR Guidebook to Assist Agricultural Water Suppliers to Prepare a 2015 Agricultural Water Management Plan*. This checklist shows where required plan elements are presented in the North Kern Agricultural Water Management Plan.

AWMP Requirement Checklist

AWMP Location	Guidebook Location	Description	Water Code Section (or other, as identified)
Sec.I – yes	1.4	AWMP Required?	10820, 10608.12
Sec.I – yes	1.4	At least 25,000 irrigated acres At least 10,000 irrigated acres	10853 Executive Order B-29-15
Sec.I – NA	1.4	10,000- 25,000 irrigated acres and funding provided.	10853
Sec.I.C.1 – yes	1.4	December 31, 2015 update. July 1, 2016 AWMP for agricultural water suppliers to 10,000 to 25,000 acres	10820(a) Executive Order B-29-15
Sec.I.C.1 – yes	1.4	5-year cycle update.	10820(a)
Sec.I – NA	1.4	New agricultural water supplier after December 31, 2012 – AWMP prepared and adopted within 1 year.	10820(b)
Sec.I.C.1 - no	1.5, 4.2	1999 AWMC MOU: Report on EWMP implemented or scheduled for implementation included.	10827
Sec.I.C.1 – NA	1.5, 5	USBR water management/conservation plan:	10828(a)
Sec.I.C.1 – NA	1.5, 5.1	Adopted and submitted to USBR within the previous four years, AND	10828(a)(1)
Sec.I.C.1 – NA	1.5, 5.1	The USBR has accepted the water management/conservation plan as adequate.	10828(a)(2)
Sec.I.A – yes	1.4	UWMP or participation in area wide, regional, watershed, or basin wide water management planning: does the plan meet requirements of SBx7-7 2.8 **(use checklist)**	10829
Sec.I.A	3.1 A	Description of previous water management activities.	10826(d)
Sec.I.B.1 – yes	3.1 B.1	Was each city or county within which supplier provides water supplies notified that the agricultural water supplier will be preparing or amending a plan?	10821(a)
Sec.1.B.1	3.2 B.2	Was the proposed plan available for public inspection prior to plan adoption?	10841

AWMP Requirement Checklist (cont.)

AWMP Location	Guidebook Location	Description	Water Code Section (or other, as identified)
App A	3.1 B.2	Publically-owned supplier: Prior to the hearing, was the notice of the time and place of hearing published within the jurisdiction of the publicly owned agricultural water supplier in accordance with Government Code 6066?	10841
App A	3.1 B.2	14 days notification for public hearing?	GC 6066
App A	3.1 B.2	Two publications in newspaper within those 14 days?	GC 6066
App A	3.1 B.2	At least 5 days between publications? (not including publication date)	GC 6066
Sec.I.C.1 – NA	3.1 B.2	Privately-owned supplier: was equivalent notice within its service area and reasonably equivalent opportunity that would otherwise be afforded through a public hearing process provided?	10841
Sec.I.C.1 – yes	3.1 C.1	After hearing/equivalent notice, was the plan adopted as prepared or as modified during or after the hearing?	10841
Sec.I.C.2	3.1 C.2	Was a copy of the AWMP, amendments, or changes, submitted to the entities below, no later than 30 days after the adoption?	10843(a)
Sec.I.C.3 – yes	3.1 C.2	The department.	10843(b)(1)
Sec.I.C.3 – yes	3.1 C.2	Any city, county, or city and county within which the agricultural water supplier provides water supplies.	10843(b)(2)
Sec.I.C.3- no	3.1 C.2	Any groundwater management entity within which jurisdiction the agricultural water supplier extracts or provides water supplies.	10843(b)(3)
Sec.I.C.3 – no	3.1 C.2	Any urban water supplier within which jurisdiction the agricultural water supplier provides water supplies.	10843(b)(4)
Sec.I.C.3 – yes	3.1 C.2	Any city or county library within which jurisdiction the agricultural water supplier provides water supplies.	10843(b)(5)
Sec.I.C.3 – yes	3.1 C.2	The California State Library.	10843(b)(6)
Sec.I.C.3 – no	3.1 C.2	Any local agency formation commission serving a county within which the agricultural water supplier provides water supplies.	10843(b)(7)
Sec.1.C.3	3.1 C.3	Adopted AWMP availability.	10844
S.I.C.3 – no	3.1 C.3	Was the AWMP available for public review on the agricultural water supplier's Internet Web site within 30 days of adoption?	10844(a)
Sec.I.C.3 – yes	3.1 C.3	If no Internet Web site, was an electronic copy of the AWMP submitted to DWR within 30 days of adoption?	10844(b)
Sec.I.D – yes	3.1 D.1	Implement the AWMP in accordance with the schedule set forth in its plan, as determined by the governing body of the agricultural water supplier.	10842

AWMP Requirement Checklist (cont.)

AWMP Location	Guidebook Location	Description	Water Code Section (or other, as identified)
Sec.II	3.2	Description of the agricultural water supplier and service area including:	10826(a)
Sec.II.A.1	3.2 A.1	Size of the service area.	10826(a)(1)
Sec.II.A.2	3.2 A.2	Location of the service area and its water management facilities.	10826(a)(2)
Sec.II.A.3	3.2 A.3	Terrain and soils.	10826(a)(3)
Sec.II.A.4	3.2 A.4	Climate.	10826(a)(4)
Sec.II.B.1	3.2 B.1	Operating rules and regulations.	10826(a)(5)
Sec.II.B.2	3.2 B.2	Water delivery measurements or calculations.	10826(a)(6)
Sec.II.B.3	3.2 B.3	Water rate schedules and billing.	10826(a)(7)
Sec.II.B.4	3.2 B.4	Water shortage allocation policies. Drought Management Plan	10826(a)(8) Executive Order B-29-15
Sec.III	3.3	Water uses within the service area, including all of the following:	10826(b)(5)
Sec.III.A	3.3 A	Agricultural.	10826(b)(5)(A)
Sec.III.B	3.3 B	Environmental.	10826(b)(5)(B)
Sec.III.C	3.3 C	Recreational.	10826(b)(5)(C)
Sec.III.D	3.3 D	Municipal and industrial.	10826(b)(5)(D)
Sec.III.E	3.3 E	Groundwater recharge.	10826(b)(5)(E)
Sec.III.F	3.3 F	Transfers and exchanges.	10826(b)(5)(F)
Sec.III.G	3.3 G	Other water uses.	10826(b)(5)(G)
Sec.IV	3.4 A	Description of the quantity of agricultural water supplier's supplies as:	10826(b)
Sec.IV.A.1	3.4 A.1	Surface water supply.	10826(b)(1)
Sec.IV.A.2	3.4 A.2	Groundwater supply.	10826(b)(2)
Sec.IV.A.3	3.4 A.3	Other water supplies.	10826(b)(3)
Sec.IV.A.4	3.4 A.4	Drainage from the water supplier's service area.	10826(b)(6)
Sec.IV.B	3.4 B	Description of the quality of agricultural waters suppliers supplies as:	10826(b)
Sec.IV.B.1	3.4 B.1	Surface water supply.	10826(b)(1)
Sec.IV.B.2	3.4 B.2	Groundwater supply.	10826(b)(2)
Sec.IV.B.3	3.4 B.3	Other water supplies.	10826(b)(3)
Sec.IV.C	3.4 C	Source water quality monitoring practices.	10826(b)(4)
Sec.IV.B.4, Sec.IV.C.2	3.4 B.4	Drainage from the water supplier's service area.	10826(b)(6)

AWMP Requirement Checklist (cont.)

AWMP Location	Guidebook Location	Description	Water Code Section (or other, as identified)
Sec.V	3.5	Description of water accounting, including all of the following:	10826(b)(7)
Sec.V.A	3.5 A	Quantifying the water supplier's water supplies.	10826(b)(7)(A)
Sec.V.B	3.5 B	Tabulating water uses.	10826(b)(7)(B)
Sec.V.C	3.5 C	Overall water budget.	10826(b)(7)(C)
Sec.V.D	3.5 D	Description of water supply reliability.	10826(b)(8)
Sec.VI	3.6	Analysis of climate change effect on future water supplies analysis.	10826(c)
Sec.VII	3.7	Water use efficiency information required pursuant to Section 10608.48.	10826(e)
Sec.VII.A	3.7A	Implement efficient water management practices (EWMPs).	10608.48(a)
Sec.VIII	3.7 A.1	Implement Critical EWMP: Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10 and to implement paragraph (2).	10608.48(b)
Sec.VII.A	3.7 A.1	Implement Critical EWMP: Adopt a pricing structure for water customers based at least in part on quantity delivered.	10608.48(c)
Sec.VII.A	3.7 A.2	Implement additional locally cost-effective and technically feasible EWMPs.	10608.48(c)
Sec.VII.B	3.7 B	If applicable, document (in the report) the determination that EWMPs are not locally cost-effective or technically feasible.	10608.48(d)
Sec.VII.A	3.7 A	Include a report on which EWMPs have been implemented and planned to be implemented.	10608.48(d)
Sec.VII.A	3.7 A	Include (in the report) an estimate of the water use efficiency improvements that have occurred since the last report, and an estimate of the water use efficiency improvements estimated to occur five and 10 years in the future.	10608.48(d)
NA	5	USBR water management/conservation plan may meet requirements for EWMPs.	10608.48(f)
Sec.VIII.D	6 A	Lack of legal access certification (if water measuring not at farm gate or delivery point).	CCR §597.3(b)(2)(A)
Sec.VIII.A	6 B	Lack of technical feasibility (if water measuring not at farm gate or delivery point).	CCR §597.3(b)(1)(B), §597.3(b)(2)(B)
Sec.VIII.B	6 A, 6 B	Delivery apportioning methodology (if water measuring not at farm gate or delivery point).	CCR §597.3.b(2)(C)
Sec.VIII.A	6 C	Description of water measurement BPP.	CCR §597.4(e)(2)
Sec.VIII.C	6 D	Conversion of measurement to volume.	CCR §597.4(e)(3)
Sec.VIII.F.4	6 E	Existing water measurement device corrective action plan? (if applicable, including schedule, budget and finance plan)	CCR §597.4(e)(4)

Table of Contents

Table of Contents i
List of Figures iii
List of Tables iii
List of Appendices (included as attachments) iv
List of Acronyms v

Section I. Plan Preparation and Adoption 1
A. Description of Previous Water Management Activities 4
B. Coordination Activities 5
C. Plan Adoption and Submittal 5
D. Plan Implementation 6
Section II. Description of the North Kern Water Storage District and Service Area 7
A. Physical Characteristics 7
B. Operational Characteristics 17
Section III. Quantity of the Water Uses of the Agricultural Water Supplier 28
A. Agricultural Water Use 28
B. Environmental Water Use 32
C. Recreational Water Use 32
D. Municipal and Industrial Water Use 32
E. Groundwater Recharge Use 33
F. Transfer and Exchange Use 34
G. Other Water Use 35
H. Projected Water Use 35
Section IV. Quantity/Quality of the Water Resources of the Agricultural Water Supplier 37
A. Water Supply Quantity 37
B. Water Supply Quality 41
C. Water Quality Monitoring Practices 43
Section V. Water Accounting and Water Supply Reliability 45
A. Quantifying the Water Supplier's Water Supplies 45
B. Quantification of Water Uses 48
C. Overall Water Budget 50
D. Water Supply Reliability 51
E. Future Water Supply 51
Section VI. Analysis of Effect of Climate Change 56
A. Effects of Climate Change on Water Demand 56
B. Effects of Climate Change on Agriculture's Water Supply 57
C. Regional Vulnerability Assessment 58
D. Response to Effects of Climate Change 66
Section VII. Water Use Efficiency Information 69
A. EWMP Implementation and Reporting 69
B. Documentation for Non-Implemented EWMPs 74
A. Description of Water Measurement Best Professional Practices 75
B. Engineer Certification and Apportionment 76

C. Water Measurement Conversion to Volume.....76
D. Legal Certification and Apportionment – Legal Access to the Farm-gate.....77
E. Device Corrective Action Plan.....77
F. Farm Gate Measurement and Device Accuracy Compliance.....77
Section VIII. References 81

List of Figures

Figure 1. Management Area and Neighboring Water Agencies 3
Figure 2. Facilities and Water Service Areas.....9
Figure 3. Generalized Soil Texture Map.....16
Figure 4. April-July Kern River Runoff (1984-2015).....22
Figure 5. Annual Kern River Supply Under North Kern's Diversion Rights.....24
Figure 6. Map of District in Relation to Groundwater Basin(s) 39
Figure 7. Groundwater Pumping from District-Owned Deep Wells 40
Figure 8. Typical North Kern Irrigation Turnout 75
Figure 9. Histogram of Percent Measurement Error at Individual Turnouts.....79

List of Tables

Table 1. Summary of Coordination, Adoption and Submittal Activities 6
Table 2. Water Supplier History and Size 8
Table 3. Expected Changes to Service Area.....10
Table 4. Water Conveyance and Delivery System 11
Table 5. Water Supplier Reservoirs 12
Table 6. Tailwater/Operational Outflow Recovery System.....13
Table 7. Landscape Characteristics.....14
Table 8. Summary Climate Characteristics 17
Table 9. Detailed Climate Characteristics 17
Table 10. Supplier Delivery System 18
Table 11. Water Allocation Policy.....18
Table 12. Actual Lead Times.....19
Table 13. Water Delivery Measurements 19
Table 14. Water Rate Basis.....20
Table 15. Rate Structure 20
Table 16. Frequency of Billing 20
Table 17. Decreased Water Supplies Allocation 21
Table 18. Enforcement Methods of Allocation Policies.....21
Table 19. Representative Years 27
Table 20. Agricultural Water Use (AF) 28
Table 21.a Agricultural Crop Data for 2013.....29
Table 21.b Agricultural Crop Data for 2014.....30
Table 21.c Agricultural Crop Data for 2015.....31
Table 22. Irrigated Acres (acres) 31
Table 23. Multiple Crop Information (acres).....31
Table 24. Environmental Water Uses 32
Table 25. Recreational Water Uses.....32
Table 26. Municipal/Industrial Water Uses (AF) 33
Table 27. Groundwater Recharge Water Uses (AF).....33
Table 28. Transfers and Exchanges Water Uses.....34
Table 29. Other Water Uses (AF) 35

Table 30. Surface Water Supplies (AF) 37
Table 31. Restrictions on Water Sources 37
Table 32. Groundwater Basins 38
Table 33. Groundwater Management Plan 38
Table 34. Groundwater Supplies* 41
Table 35. Drainage Discharge 41
Table 36. Surface Water Supply Quality – 2012 42
Table 37. Drainage Reuse Effects 43
Table 38. Water Quality Monitoring Practices 44
Table 39. Water Quality Monitoring Programs for Surface/Sub-Surface Drainage 44
Table 40.a Surface and other Water Supplies for 2013 (AF) 45
Table 40.b Surface and other Water Supplies for 2014 (AF) 45
Table 40.c Surface and other Water Supplies for 2015 (AF) 45
Table 41.a Groundwater Supplies Summary for 2013 (AF) 46
Table 41.b Groundwater Supplies Summary for 2014 (AF) 47
Table 41.c Groundwater Supplies Summary for 2015 (AF) 47
Table 42. Effective Precipitation Summary (AF) 48
Table 43. Applied Water 48
Table 44. Quantify Water Use (AF) 49
Table 45. Quantify Water Leaving the District (AF) 49
Table 46. Irrecoverable Water Losses (AF) 49
Table 47. Quantify Water Supplies (AF) 50
Table 48. Budget Summary for 2008 (AF) 50
Table 49. Report of EWMPs 70
Table 50. Schedule to Implement EWMPs 72
Table 51. Report of EWMPs Efficiency Improvements 73
Table 52. Non-Implemented EWMP Documentation 74

List of Appendices (included as attachments)

Appendix A. Public Hearing Notice
Appendix B. Public Hearing Notification Letters
Appendix C. Resolution of Plan Adoption
Appendix D. North Kern WSD: Rules and Regulations for Distribution and Use of Water
Appendix E. Water Meter Accuracy Verification Form

List of Acronyms

AF	acre-feet
AWMP	Agricultural Water Management Plan
cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
CVC	Cross Valley Canal
CVP	Central Valley Project
CVRWQCB	Central Valley Regional Water Quality Control Board
DWR	Department of Water Resources
EC	Electrical Conductivity
ET	Evapotranspiration
ET_c	Crop evapotranspiration
ET_o	Reference evapotranspiration
EWMP	Efficient Water Management Practice
ID	Irrigation District
IRWMP	Integrated Regional Water Management Plan
GHG	Greenhouse Gas
GWMP	Groundwater Management Plan
KCWA	Kern County Water Agency
LGA	Local Groundwater Assistance
M&I	Municipal and Industrial
MUD	Municipal Utility District
ppm	parts per million
RRID	Rosedale Ranch Improvement District
RWMG	Regional Water Management Group
USACE	U.S. Army Corps of Engineers
UWMP	Urban Water Management Plan
SBx7-7	Water Conservation Act of 2009
SCADA	Supervisory Control and Data Acquisition
SWP	State Water Project
TDS	Total Dissolved Solids
WSD	Water Storage District

AGRICULTURAL WATER MANAGEMENT PLAN

Section I. Plan Preparation and Adoption

The North Kern Water Storage District (North Kern, North Kern WSD, or District) Agricultural Water Management Plan (AWMP) has been prepared in accordance with the requirements of the Water Conservation Bill of 2009 (SBx7-7, Water Code §10820) and the Governor's Executive Order B-29-15 (Executive Order). Figure 1 is a map showing the location of the District. Because the District serves an area greater than 25,000 acres and was formed before December 31, 2012, North Kern is among the water suppliers required to prepare an updated plan by December 31, 2015. Development of the original plan was supported by a grant for $50,000 from the Department of Water Resources (DWR).

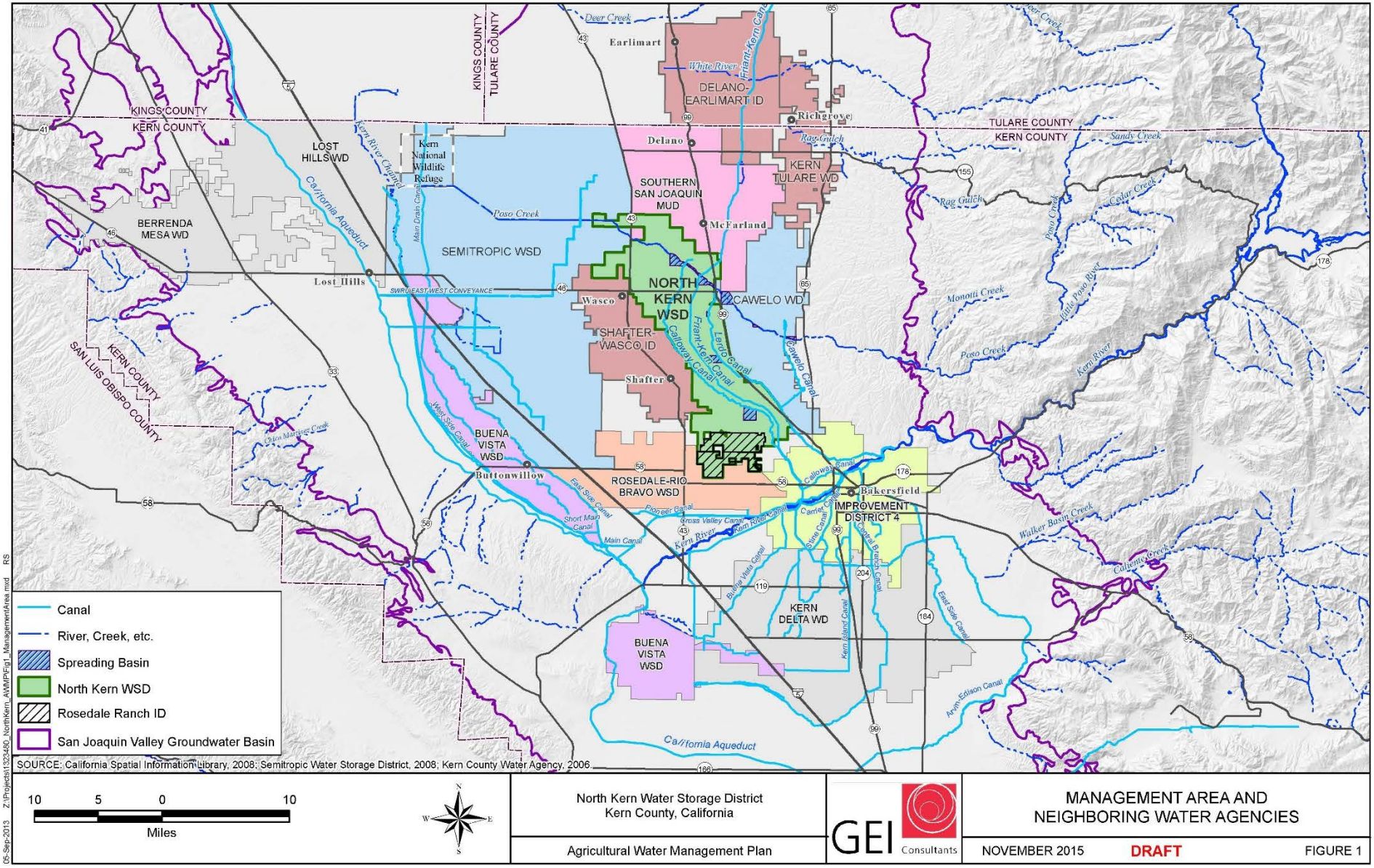
This document conforms to the framework presented in *A Guidebook to Assist Agricultural Water Suppliers to Prepare a 2015 Agricultural Water Management Plan* (2015 Guidebook) that was issued by the DWR in June 2015 to aid water suppliers in preparing Agricultural Water Management Plans in accordance with the requirements of SBx7-7 and the Executive Order. Although this plan was prepared in conformance with the 2015 Guidebook, some of the requirements presented in the Guidebook, such as consideration of facilitating alternative uses for lands with exceptionally high water duties or whose irrigation contributes to significant problems, are not applicable to the District's facilities or operations.

The Governor's Executive Order was issued on April 1, 2015 in response to the 2013-15 drought conditions and requires detailed drought management plans, as well as the quantification of water supplies and demands for 2013, 2014, and 2015. The requirements introduced by SBx7-7 are intended to encourage agricultural water suppliers to assess current efficient water management practices, to evaluate additional practices that may conserve water, and to provide for the accurate measurement of water. As such, the AWMP process presents an opportunity for water suppliers to demonstrate existing and planned activities and programs designed to improve water use efficiency.

Included in Section VII of this plan is an analysis of each of the Efficient Water Management Practices (EWMPs) presented in the 2015 Guidebook. The EWMPs are grouped into the following categories:

- Critical Efficient Water Management Practices
    1. Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of California Water Code Section 531.10 and to implement paragraph (2) of the legislation.
    2. Adopt a pricing structure for water customers based at least in part on quantity delivered.
- Conditional Efficient Water Management Practices
    1. Facilitation of alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including problem drainage.

2. Facilitation of use of available recycled water that otherwise would not be used beneficially, meets health and safety criteria, and does not harm crops or soils. The use of recycled urban wastewater can be an important element in overall water management.
3. Facilitate the financing of capital improvements for on-farm irrigation systems.
4. Implement an incentive pricing structure that promotes one or more of the following goals:
    A. More efficient water use at the farm level such that it reduces waste;
    B. Conjunctive use of groundwater;
    C. Appropriate increase of groundwater recharge;
    D. Reduction in problem drainage;
    E. Improved management of environmental resources, and
    F. Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.
5. Expand lined or piped distribution systems, construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance, and reduce seepage.
6. Increase flexibility in water ordering by, and delivered to, water customers within operational limits.
7. Construct and operate supplier operational outflow and tailwater systems.
8. Increase planned conjunctive use of surface water and groundwater within the supplier service area.
9. Automate canal control devices.
10. Facilitate or promote customer pump testing and evaluation.
11. Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports.
12. Provide for the availability of water management services to water users. These services may include, but are not limited to, all of the following:
    A. On-farm irrigation and drainage system evaluations;
    B. Normal year and real-time irrigation scheduling and crop evapotranspiration information;
    C. Surface water, groundwater, and drainage water quantity and quality data, and
    D. Agricultural water management educational programs and materials for irrigators.
13. Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional change to allow more flexible water deliveries and storage.
14. Evaluate and improve the efficiencies of the suppliers' pumps.


KINGS COUNTY
KERN COUNTY
KINGS COUNTY
TULARE COUNTY
TULARE COUNTY
KERN COUNTY
KERN COUNTY
SAN LUIS OBISPO COUNTY
LOST HILLS WD
BERRENDA MESA WD
Kern National Wildlife Refuge
SEMITROPIC WSD
SOUTHERN SAN JOAQUIN MUD
DELANO-EARLIMART ID
KERN TULARE WD
NORTH KERN WSD
CAWELO WD
SHAFTER-WASCO ID
BUENA VISTA WSD
ROSEDALE-RIO BRAVO WSD
IMPROVEMENT DISTRICT 4
KERN DELTA WD
BUENA VISTA WSD
Earlimart
Richgrove
Delano
McFarland
Wasco
Shafter
Lost Hills
Buttonwillow
Bakersfield
Deer Creek
White River
Friant-Kern Canal
Rag Gulch
Sandy Creek
Cedar Creek
Poso Creek
Little Poso River
Monolti Creek
Kern River
Kern River Channel
Main Drain Canal
California Aqueduct
SWRU/EAST-WEST CONVEYANCE
Friant-Kern Canal
Lerdo Canal
Cawelo Canal
Calloway Canal
West Side Canal
East Side Canal
Short Main Canal
Main Canal
Pioneer Canal
Gross Valley Canal
Kern River Canal
Stine Canal
Carrier Canal
Buena Vista Canal
Kern Island Canal
Central Branch Canal
Arvin-Edison Canal
Walker Basin Creek
Caliente Creek
Glen Martinez Creek
Canal
River, Creek, etc.
Spreading Basin
North Kern WSD
Rosedale Ranch ID
San Joaquin Valley Groundwater Basin
SOURCE: California Spatial Information Library, 2008; Semitropic Water Storage District, 2008; Kern County Water Agency, 2006.
10 5 0 10
Miles
N
W
E
S
North Kern Water Storage District
Kern County, California
Agricultural Water Management Plan
GEI Consultants
MANAGEMENT AREA AND
NEIGHBORING WATER AGENCIES
NOVEMBER 2015
DRAFT
FIGURE 1
05-Sep-2013 Z:\Projects\1323460_NorthKern_AWMP\Fig1_ManagementArea.mxd RS

A. Description of Previous Water Management Activities

Water management activities previously implemented or now being implemented by the District include:

- Encourage and facilitate the construction of irrigation distribution system facilities to lands which rely exclusively on pumped groundwater for the purpose of expanding the District's capability to deliver surface water in lieu of groundwater pumping.
- Deliver surface water in lieu of groundwater pumping when practicable; use water pricing, as appropriate, to encourage such deliveries.
- Maximize use of available surface water supplies for irrigation and spreading; use water pricing, water exchanges, and water banking as appropriate.
- Enter into temporary contracts for CVP water which is available from time to time on the Friant-Kern Canal.
- Develop water exchanges and/or water banking arrangements that result in a net increase in District water supplies, when practicable.
- Encourage USACE to expedite the "fix" for Isabella Dam deficiencies and remove the storage restriction that has been in place since 2006.
- Maintain existing recharge capability in areas of the District that urbanize.
- Encourage and support neighboring water agencies with the importation of available surface water supplies.
- Recharge the aquifer with high quality surface water.
- Promote water use efficiency through financial support of the North West Kern RCD-DWR Mobile Laboratory and by encouraging landowners to take advantage of this resource by requesting field irrigation evaluations.
- Actively participate in regional water management planning through the Poso Creek Regional Water Management Group. The District also participates in local water resource management forums, including the Semitropic Water Storage District's Groundwater Monitoring Committee, the Kern River Watershed Water Quality Coalition, the Kern Fan Monitoring Committee, and the Kern Groundwater Management Committee.
- Expand the District's website to include data on groundwater levels and quality.
- Encourage the installation of flow meters on private wells.
- Identify wells monitored by DWR or the Kern County Water Agency (KCWA) and consolidate water level readings from these wells with readings from wells measured by North Kern.
- Identify wells which are sampled for water quality by DWR or KCWA.

- Take delivery of oil-field produced water to augment irrigation supplies and for groundwater recharge.

As noted above, the District participates in area-wide, regional, watershed or basin-wide water management planning though the Poso Creek Regional Water Management Group.

B. Coordination Activities

1. Notification of AWMP *Preparation*

The 2015 Guidebook does not specify how much advance time is required for notification of cities and counties of plan preparation, does not require notification to any other agency(s) and does not require that comments from any city, county or other agency must be solicited and considered. In complying with these provisions, North Kern notified the entities shown in Table 1. Appendix A presents the public notice of plan preparation, and Appendix B includes Public Hearing Notification Letters.

2. *Public Participation*

Public participation activities associated with preparation of the AWMP are presented in Table 1.

C. Plan Adoption and Submittal

The purposes of this AWMP are to assess North Kern's current and planned water management operations and to respond to the provisions of SBx7-7, the associated Agricultural Water Management Planning Act (Section 1, Part 2.8, Division 6 of the Water Code), the subsequent Agricultural Water Measurement Regulation requirements (described in Title 23 California Code of Regulations) and the Governor's Executive Order. The plan describes the District's status in implementation of two mandatory EWMPs, includes a discussion of the potential impacts of climate change on District operations and describes the District's program for drought response. The two mandatory EWMPs required by SBx7-7 are:

- Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10 and to implement paragraph (2) of the legislation.
- Adopt a pricing structure for water customers based at least in part on quantity delivered.

The plan includes an analysis confirming that the District is in compliance with the legislation's requirements, noted above, regarding 1) delivery measurement, and 2) volumetric pricing.

1. *Plan Adoption*

In preparing this plan, North Kern solicited public input by holding a public hearing and inviting oral and written comments prior to adoption of the plan at a Board of Director's meeting on December 15, 2015. Table 1 shows the state and local interested parties who were notified of and/or provided input to this AWMP. Appendix C of this document includes a Resolution of Plan Adoption. This plan will be updated on a 5-year cycle. North Kern is a public entity but is not a CVP contractor. Therefore, the District has not prepared either a USBR management/conservation plan in the past.

2. *Plan Submittal*

The steps to be followed in submittal of AWMPs are described in the *Guidebook* and are outlined in Table 1. A copy of the adopted plan was submitted to DWR and the other entities shown on Table 1 on ___, 2016.

3. *Plan Availability*

The requirements for availability of the District's AWMP are presented in *A Guidebook to Assist Agricultural Water Suppliers to Prepare a 2015 Agricultural Water Management Plan.* The District's compliance with these requirements is shown in Table 1.

The AWMP, as adopted by the District, will be available from the District by request.

Table 1. Summary of Coordination, Adoption and Submittal Activities

Potential Interested Parties	Notified of Plan Preparation	Assisted in Preparation	Received Draft Plan	Notified of Public Meetings	Notified of Intention to Adopt	Sent Copy of Adopted Plan
County of Kern	X			X		X
City of Shafter	X			X		
City of Wasco	X			X		
DWR						X
Bakersfield Public Library						X
California State Library						X

D. Plan Implementation

North Kern is implementing EWMPs based upon the program described in Section VII of this AWMP. These EWMPs include improvements to district operations that enhance water management and promote water conservation as well as the EWMPs mandated by SBx7-7 that promote water measurement and volumetric pricing. The drought response measures described in this plan will be implemented as required.

Section II. Description of the North Kern Water Storage District and Service Area

A. Physical Characteristics

The North Kern WSD, established in 1935, is a public agency which supplies surface water from the Kern River and groundwater to primarily agricultural customers. About 52,000 acres of the 60,000 gross acres (87 percent) in the North Kern service area have been essentially fully developed to irrigated agriculture for over forty years; however, cropping patterns have varied over the years.

Most of the water in the Kern River comes from snowmelt, with peak runoff occurring from April through July, during which time about two-thirds of the annual flow volume occurs. Historically, the supply available to North Kern from this source has ranged from less than 10,000 AF in a "dry" year to nearly 400,000 AF in a "wet" year. Owing to the highly variable Kern River supply, North Kern supplements available surface water supplies with pumped groundwater in "dry" years, and recharges the underlying groundwater using spreading ponds (about 1,500 acres) in "wet" years.

1. *Size of the Service Area*

The District was organized in 1935 and adopted its "Project Report" in 1950, with implementation of improvements laid out in the report beginning shortly thereafter. Fundamentally, the Project provided for the District to purchase the right in perpetuity to all water accruing under various Kern River "pre-1914" water rights. Because the river rights purchased by North Kern were largely "junior" rights and subject to large swings in yield depending on river hydrology, the Project Report also described a series of projects focused on "re-regulating" these highly variable supplies for the purpose of "maintaining economic pumping lifts" for landowners within the District. Re-regulation was primarily to be accomplished through construction and operation of "recharge/spreading ponds" to maximize the capture of wetter year river supplies accruing to the rights and groundwater wells to "recover" previously recharged water in drier years when surface supplies accruing to the rights were limited.

To supplement its "base" Kern River supplies described above, the District entered into an additional Kern River water supply contract with the City of Bakersfield in 1976. Although the "basic term" of this contract expired at the end of 2011, the contract continues pursuant to "extension term" provisions and is expected to continue to provide water supplies to the District in the future, particularly during wetter years. In addition to its Kern River supplies, the District uses occasional flows available from Poso Creek and takes advantage of other supplies available from the State Water Project (SWP) and the Federal Central Valley Project (CVP) from time to time. These water supplies have allowed the District to maintain a positive long-term supply balance, primarily for agricultural purposes.

The District is comprised of two service areas; a surface water service area (Class 1) and a groundwater service area (Class 2), each comprising about one-half of the District's area. These service areas are identified on Figure 2. North Kern delivers surface water and/or pumped groundwater to satisfy all of the irrigation water requirements of the surface water service area. The remaining one-half of the District

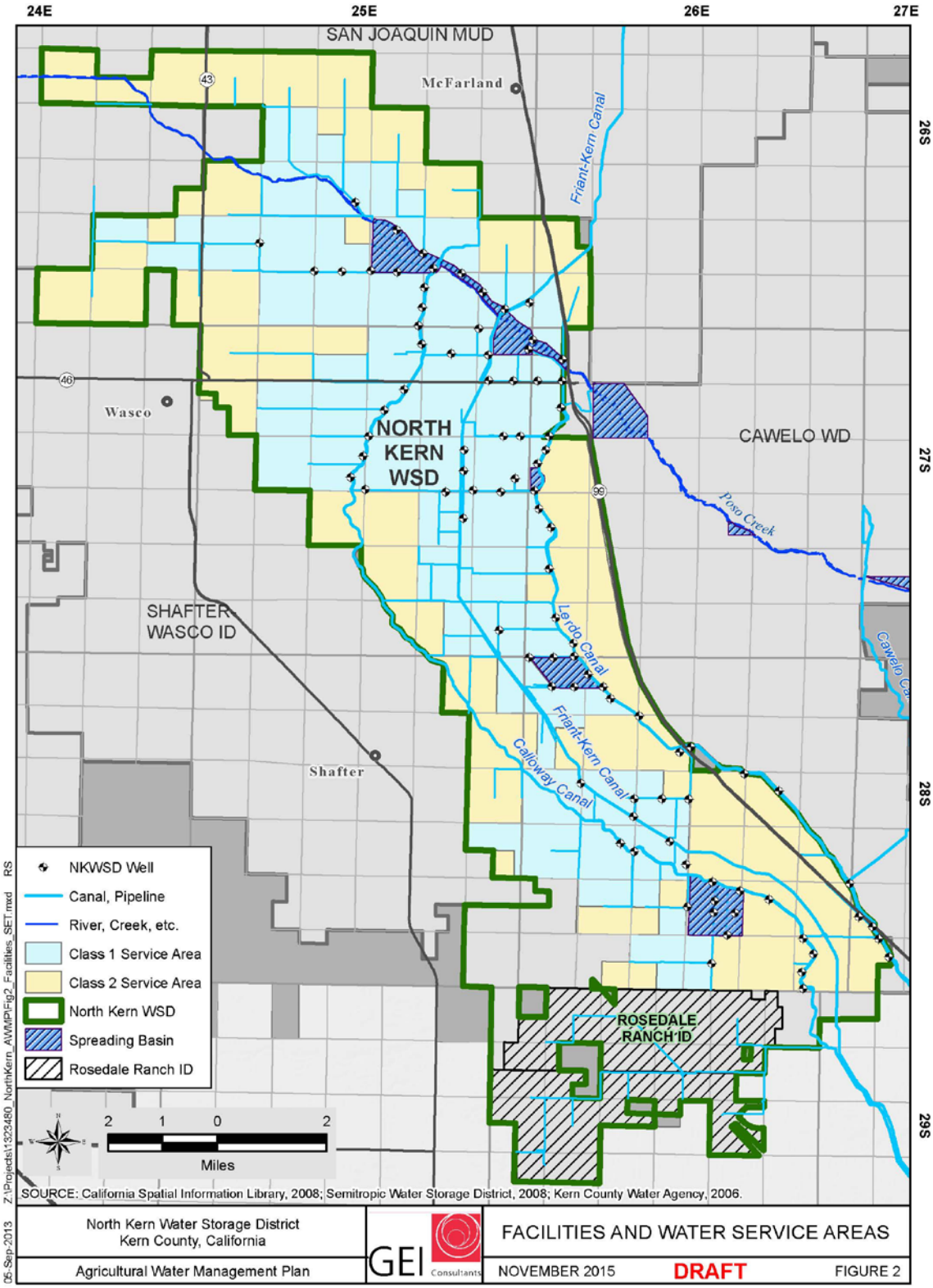
principally relies on groundwater pumped through the use of on-farm wells; however, to the extent that the District has water available for spreading (i.e., over and above the needs of the surface water service area) and there is an irrigation demand that can be physically reached, surface water is delivered to the Class 2 service area as well.

In addition to the 60,000-acre "old District", since 1980, North Kern has also serviced approximately 9,200 acres of additional land referred to as the Rosedale Ranch Improvement District (RRID). This area is located immediately to the south of the "old District" (near the City of Bakersfield) and has a distribution system with the capacity to meet the irrigation water requirements of all irrigated lands. The Improvement District does not benefit from the same water rights that are available to the "old District"; accordingly, groundwater remains the principal source of water within RRID, with surface water being purchased and delivered by North Kern on an "as-available" basis, which is relatively infrequent. Because RRID does not hold the same water rights as North Kern and does not have access to the same sources of water, RRID is not included in the plan's water balance or in the discussion of water management practices. The RRID service area is identified on Figure 2.

Table 2. Water Supplier History and Size

Date of Formation	1935
Source of water	
Local surface water	X
Local groundwater	X
Gross acreage at time of formation	61,854 acres
Gross acreage - current service area (2012) – Old District	60,000 acres
Gross acreage – current service area (2012) – RRID	9,200 acres
Current irrigated acreage (2012) – Old District	52,936 acres
Current irrigated acreage (2012) - RRID	7,400 acres

North Kern is governed by a five-member Board of Directors. Each member represents a geographical area within the District known as a division. Each board member must be a landowner (or a representative of a landowner) within the District and be elected by the landowners within their division.


24E
25E
26E
27E
26S
27S
28S
29S
SAN JOAQUIN MUD
McFarland
Friant-Kern Canal
Wasco
NORTH KERN WSD
CAWELO WD
Poso Creek
SHAFTER-WASCO ID
Lerdo Canal
Friant-Kern Canal
Calloway Canal
Shafter
ROSEDALE RANCH ID
NKWSD Well
Canal, Pipeline
River, Creek, etc.
Class 1 Service Area
Class 2 Service Area
North Kern WSD
Spreading Basin
Rosedale Ranch ID
2 1 0 2
Miles
SOURCE: California Spatial Information Library, 2008; Semitropic Water Storage District, 2008; Kern County Water Agency, 2006.
Z:\Projects\1323480_NorthKern_AWMP\Fig2_Facilities_SET.mxd RS
05-Sep-2013
North Kern Water Storage District
Kern County, California
Agricultural Water Management Plan
GEI Consultants
FACILITIES AND WATER SERVICE AREAS
NOVEMBER 2015
DRAFT
FIGURE 2

Land use within North Kern is primarily agricultural. In the 1950s, at the time of North Kern's original project, the District's lands were developed almost exclusively to annual crops. Currently, permanent crops, principally nuts and grapes, account for about 85 percent of the irrigated area. In the past, the principal annual crops have included cotton, tomatoes, and wheat. While the cropping pattern has changed over time, the total farmed acreage has varied with the economics of farming. Going forward, it is reasonable to anticipate that the farmed acreage will continue to evidence modest annual fluctuations without any increasing trend (since the District is essentially fully developed) or decreasing trend.

Where farm lands in North Kern are proximate to urban areas, there has been pressure to convert these lands to urban uses. Urbanization is occurring throughout the Kern County Subbasin and other water districts are also facing this issue. To date, the Rosedale Ranch area has been the primary target for urbanization as the City of Bakersfield expands to the north. Approximately 1,000 acres have been annexed to the City of Bakersfield since formation of the Improvement District in 1980. Rosedale Ranch continues to carry on discussions with appropriate agencies to help ensure the management of the groundwater resource. In 2006, the City of Shafter annexed about 5,200 acres located within North Kern, generally in the area bounded on the south by Seventh Standard Road and extending north about five miles. Most of the annexed land remains in irrigated agriculture. The anticipated magnitude of the urbanization trend to both North Kern and RRID, in terms of land use, is shown in Table 3.

Table 3. Expected Changes to Service Area

Change to Service Area	Estimate of Magnitude	Cause of Change	Effect on Water Supplier
Reduced Service Area	Negligible	Urbanization	No substantive impact
Increased Service Area	Negligible		None
Reduction in Irrigated Area	Negligible		None

2. *Location of the Service Area and Water Management Facilities*

North Kern is located in Kern County, west of U.S. Highway 99, southwest of the City of McFarland, northwest of the City of Bakersfield, and east of the cities of Shafter and Wasco. As noted previously, while most of North Kern lies north of Seventh Standard Road, those lands lying south of Seventh Standard Road fall into Rosedale Ranch Improvement District. Figure 1 illustrates the District's location within Kern County. Neighboring irrigation districts are Cawelo WD to the east, Shafter-Wasco ID and Semitropic WSD to the west, and Southern San Joaquin MUD to the north. Similar to North Kern, these other water districts rely on surface water supplies for irrigation from the SWP, the CVP and the Kern River to supplement groundwater supplies.

North Kern and neighboring districts overlie a common groundwater basin. Due to concerns regarding the future reliability of historically available surface water supplies, in 2007 North Kern and other districts and entities in the Poso Creek region prepared the Poso Creek Integrated Regional Water Management Plan (Poso Creek IRWMP) that identified potential new facilities and "non-structural" measures to

improve intra- and inter-district management of water supplies.[1] The overarching goal of the Poso Creek IRWMP is to maximize the capture and use of surface water supplies available to the region and thereby reduce the impacts of existing and potential regional loss of water supply reliability.

Delivery of surface water and groundwater in North Kern is accomplished through a network of largely unlined canals; however, the system also includes some pipelines and lined canals. The District's principal supply artery, and the most upstream of its two points of diversion from the Kern River, is the Beardsley-Lerdo system. This system is entirely gravity and consists of the diversion structure, or headworks, on the Kern River and a canal which delivers water along the eastern or "high" side of the District. The lined portion of this canal extends from the headworks to the District's boundary and is referred to as the Beardsley Canal, while the portion within North Kern is unlined and is referred to as the Lerdo Canal. Up to 850 cfs has been conveyed through the Beardsley Canal for delivery into the District. The second point of diversion, located about 4.5 miles downstream of the first, is the Calloway Headworks which serves the relatively large, unlined section of the Calloway Canal. This facility is also entirely gravity and extends for 10.4 miles before entering the District at Seventh Standard Road. This "wet-year" facility has a capacity of 1,000 cfs at the headworks. Distribution laterals are generally unlined ditches and deliver water to farm turnouts by gravity from the previously-described main conveyance facilities. The main conveyance canals and distribution laterals within North Kern are shown on Figure 2.

Typically, District-owned wells are only used during "dry" years when surface water supplies are inadequate. Groundwater is delivered to customers during dry years via a network of small, lined canals running parallel to the larger, unlined canals used for conveyance of surface water. The District owns and operates about 100 wells at locations shown in Figure 2. Approximately 200 privately-owned wells in the Class 2 service area are used to meet irrigation demands in this part of the District.

Poso Creek traverses the north part of the District, however, significant flows from this creek are infrequent, and it is dry much of the time. The District holds a water rights permit for the diversion and use of Poso Creek water. An agreement with Cawelo WD and Semitropic WSD provides for allocation of Poso Creek water among the three districts. In addition, the channel of Poso Creek is periodically used for groundwater recharge with other surface water supplies available to North Kern. Water is only recharged in Poso Creek when the stream bed is dry so water introduced for recharge does not contribute to the creek's natural flow. Table 4 provides a summary of existing irrigation facilities in North Kern.

Table 4. Water Conveyance and Delivery System

System Used	Number of Miles
Unlined Canals	130
Lined Canals	20
Pipelines	20
Drains	0

[1] The Poso Creek IRWMP was initially adopted in 2007; however, a 2014 Plan Update was recently prepared and adopted, which brings the Plan into compliance with "Proposition 84" standards.

North Kern relies heavily on storage and recovery of groundwater for the year-to-year regulation which is required to manage North Kern's highly variable Kern River supplies. Seasonal regulation and some year-to-year regulation are provided by the District's use of conservation storage space in Isabella Reservoir.

The U.S. Army Corps of Engineers (USACE) constructed Isabella Dam in the 1950s and is responsible for day-to-day operations. Isabella Reservoir, with a total storage capacity of 568,500 AF, is located well to the east of the District in the southern Sierra Nevada Mountains. Later, in the 1960s, the District contracted with the United States to acquire conservation storage capacity in Lake Isabella as a means to further regulate its Kern River supplies. Surface water supplies regulated in Isabella Reservoir are used conjunctively with the groundwater storage underlying the District.

Isabella Reservoir is a multiple purpose water storage facility with the primary mission being flood control. Flood control operating criteria developed by the USACE require that total reservoir storage be no more than 170,000 AF by November 1 of each year, unless otherwise approved by USACE. Historically, the maximum total reservoir storage approved by USACE has been 245,000 AF. With a minimum pool of 30,000 AF, North Kern's carryover storage ranges from about 34,000 to 48,000 AF.

In addition to flood control, the reservoir is used to store water for irrigated agriculture, release water to generate electricity, and as a recreation and water sports facility. North Kern is not responsible for maintenance of the reservoir but does pay its allocated share of maintenance costs based on a contract with the USACE.

North Kern's share of the available conservation space in the reservoir ranges from 24 to 34 percent. Based on the reservoir's capacity at the spillway crest, this implies a range of about 129,000 to 183,000 AF. However, current storage restrictions have reduced this range to about 79,000 to 112,000 AF.

The District has small volumes of operational storage available in mid-system reservoirs within its service area. However, since this storage is used exclusively for canal regulation, this reservoir capacity is not included in Table 5.

Table 5. Water Supplier Reservoirs

Reservoir	Capacity (AF)	North Kern's Storage Rights (AF)
Isabella Reservoir (at Spillway Crest)	568,500	129,000 - 183,000
Isabella Reservoir (with USACE storage restriction)	360,000	79,000 – 112,000
Isabella Reservoir (carryover storage)	170,000	34,000 – 48,000
North Kern Reservoirs*	N/A	N/A

* Small operational storage facilities within North Kern WSD, not included in AWMP budget.

The majority of land within the District's service area is well drained, and the need for on-farm surface drainage is minimal since the majority of farmland is irrigated with low-volume application methods. Table 6 summarizes the existence of tailwater/operational outflow recovery systems. Currently, North Kern has no District-operated recovery system, while the number of on-farm operated tailwater/operational outflow recovery systems is minimal.

Table 6.Tailwater/Operational Outflow Recovery System

System	Yes/No
District Operated Tailwater Recovery	No
Landowner Operated Tailwater Recovery	Yes

Following is a list of recent key improvements made to North Kern maintained canals and conveyance channels; refer to Figure 2 for specific canal names. This list supplements the description of previous water management activities presented in Section 1 and the description of specific EWMP implementation and reporting included in Section VII (Table 49).

- Installed new pump station and one mile of 96-inch diameter concrete pipe to convey water from the Calloway Canal to the Lerdo Canal, a 40-foot lift. This improvement increases the District's ability to take advantage of CVP supplies that become available from time to time from the Friant-Kern Canal (typically during "wet" years) by allowing such water to reach all of the District's irrigation demand and spreading ponds. In addition, it eliminated a portion of the 8-1 Canal and the associated canal seepage. *[Calloway-to-Lerdo Intertie]*
- Installed a lined canal between the Calloway Canal and the Cross Valley Canal (CVC), including a new turnout on the CVC, all of which increases the District's ability to divert and utilize water supplies that are available in the California Aqueduct from time to time and to facilitate water management exchanges. *[Calloway-to-CVC Intertie]*
- Converted the 8-9 and 9-6 canals into pipeline conveyances, which eliminated potential seepage and evaporation losses.
- Implemented Supervisory Control and Data Acquisition (SCADA) monitoring to check water levels at strategic locations in the District's distribution system and prevent overflow of regulating reservoir storage.
- Lined portions of the Calloway Canal with bentonite to reduce seepage potential, specifically in areas that were known to exhibit relatively high rates of seepage.
- Replaced old, worn-out propeller meters (McCrometer and Seametrics models) at turnouts with new meters.
- Implemented iPhone scanning and real-time water meter reading network so water consumer usage can be uploaded to the District's server and accounting program. This has reduced human error in reporting water usage and has assisted in verifying compliance with SBx7-7 delivery volume measurements.

- Construction of a pipeline to convey oil-field produced water from the Kern Front Oil Field to the Lerdo Canal for application to irrigated lands and to the Rosedale Spreading Ponds for groundwater recharge. Because conveyance to both locations is by gravity, this project protects groundwater levels by reducing the need to pump groundwater to augment surface water supplies and, at the same time, reduces energy usage and emission of greenhouse gases.

3. *Terrain and Soils*

The North Kern Water Storage District is located on the valley floor of the southern portion of the San Joaquin Valley, a physiographic trough. The northwest-southeast trending valley is bounded by the Sierra Nevada Range to the east, the Tehachapi Mountains to the south and the Temblor Range and Coast Range to the west. The valley floor is characterized by low alluvial plains and fans and by overflow lands and old lakebeds.

Alluvial deposits in the Kern County sub-basin generally consist of sand, silt, and clay laid down in a complex sequence principally by the Kern River, Poso Creek, Deer Creek, the White River, small drainages along the Sierra Nevada Mountains to the east, and to a lesser extent, by streams along the Coast Range to the west. The terminus for these flows in the geologic past was Tulare Lake, located to the north of Kern County on the west side of the San Joaquin Valley. The axis of the San Joaquin Valley Basin along the west side of the valley has been subsiding over time and, as a generalization, the sediments tend to dip and thicken towards the axis of the basin and pinch out on the east and west edges. The District's service area is flat with land surface elevations ranging from over 320 feet above sea level on the east to less than 300 feet above sea level on the west.

The predominant irrigation systems in North Kern are above-ground drip systems for permanent orchard and vineyard crops. Annual crops are irrigated largely with hand-move sprinkler systems. Over the last five years, the percentage of acreage irrigated by each of the systems noted above has remained constant.

The soil types in Kern County vary in structure, texture, and chemistry with geographical location. Valley floor soils within North Kern are derived mostly from mixed granitic and sedimentary rocks and are characterized as saline-alkaline. The generalized soils map units or soil associations underlying the area are described in the published soil survey for northwestern Kern County and are presented in Figure 3. A general soil map unit consists of one or more major soil types and some minor soils that occur together in a recognizable pattern.

Soils are described in this report in terms of associations because of the size of the District and because of their similarities to each other. Soils within the District do not have any identifiable impacts upon water operations and management in the service area. Table 7 summarizes the topographic characteristics of the irrigated lands.

Table 7. Landscape Characteristics

Topography Characteristic	Percent of the District	Effect on Water Operations and Drainage
Flat Land	100%	Land is adaptable to sprinkler and micro irrigation systems

4. *Climate*

North Kern lies at the southern end of the San Joaquin Valley, a portion of the valley that is partially surrounded by a horseshoe-shaped ring of mountains. The Sierra Nevada Mountains to the east shut out most of the cold air that flows southward over the continent in winter. It also catches and accumulates snow, which provides irrigation water for use during the dry summer months.

Summers are typically hot and dry. The average length of the growing season is 265 days, typically lasting from March to November. December and January are characterized by frequent fog or low clouds which occur mostly at night. These conditions prevail when cold, moist air is trapped in the valley by a high pressure system. In extreme cases, fogginess or cloudiness may occur continuously for two to three weeks. The depth of the fog or clouds is usually less than 3,000 feet. Under these conditions, there usually are clear skies and mild temperatures in the surrounding foothill and mountain areas. Most of the precipitation occurs in the winter with little to none occurring during the summer months of June through August. By contrast, rates for evaporation and transpiration are low in the cooler, wetter months and peak during the hot, dry summer growing season.

Table 8 summarizes climate data from the CIMIS station at the City of Shafter. Temperatures in the summer are typically in the upper 90s and nights are fairly warm. Throughout the year, the mean temperatures vary from 38°F in December to 98°F in July. Annual precipitation typically ranges between five to seven inches. More detailed climatic data from the Shafter station are presented in Table 9.

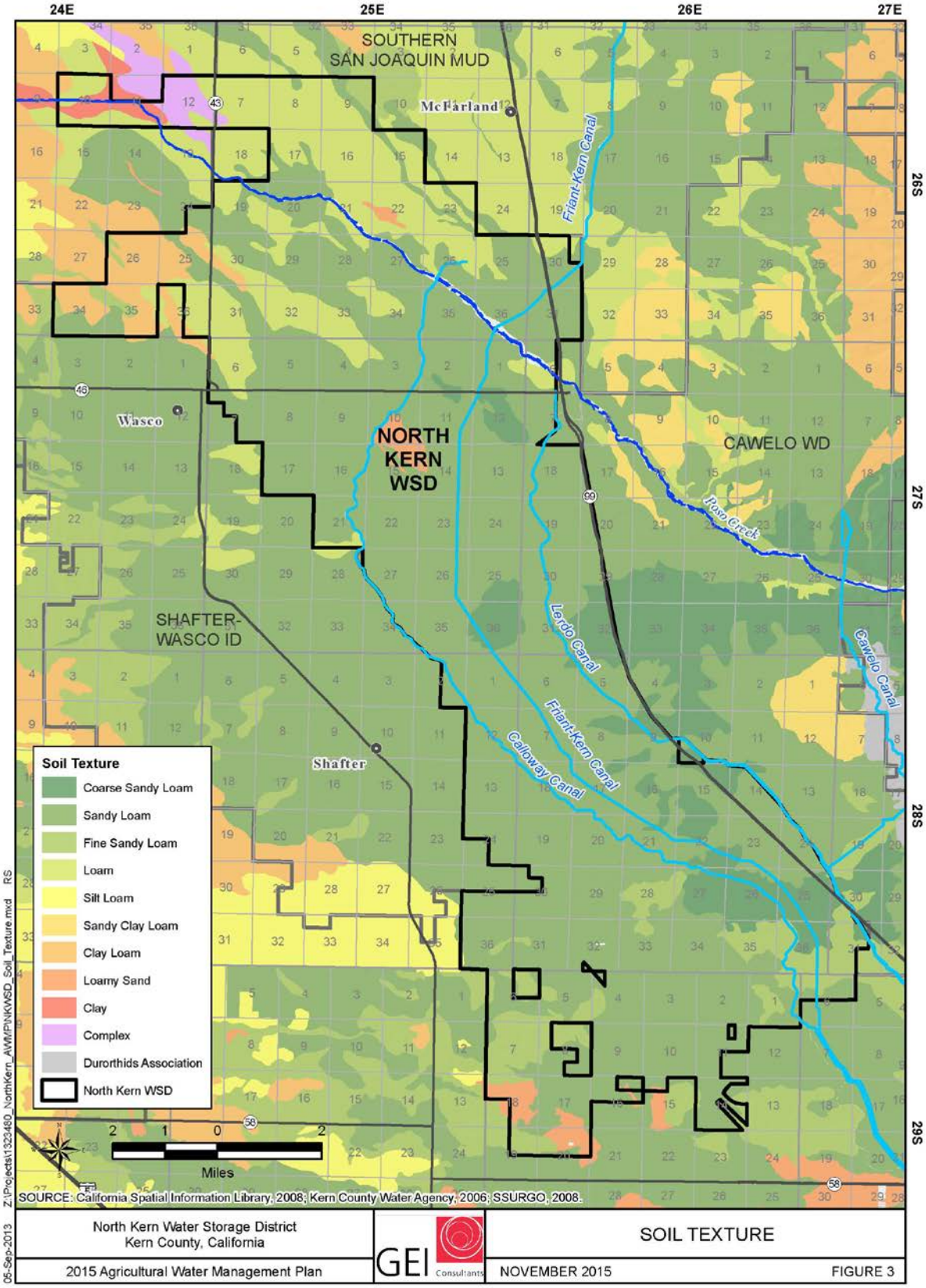

24E
25E
26E
27E
26S
27S
28S
29S
SOUTHERN SAN JOAQUIN MUD
McFarland
Wasco
NORTH KERN WSD
CAWELO WD
SHAFTER-WASCO ID
Shafter
Friant-Kern Canal
Poso Creek
Lerdo Canal
Calloway Canal
Cawelo Canal
Soil Texture
Coarse Sandy Loam
Sandy Loam
Fine Sandy Loam
Loam
Silt Loam
Sandy Clay Loam
Clay Loam
Loamy Sand
Clay
Complex
Durorthids Association
North Kern WSD
2 1 0 2
Miles
SOURCE: California Spatial Information Library, 2008; Kern County Water Agency, 2006; SSURGO, 2008.
Z:\Projects\1323480_NorthKern_AWMP\NKWSD_Soil_Texture.mxd RS
05-Sep-2013
North Kern Water Storage District
Kern County, California
2015 Agricultural Water Management Plan
GEI Consultants
SOIL TEXTURE
NOVEMBER 2015
FIGURE 3

Table 8.Summary Climate Characteristics

Climate Characteristic	Value*
Average Precipitation	5.80 Inches
Minimum Monthly Precipitation	0 Inches
Maximum Monthly Precipitation	5.97 Inches
Minimum Temperature (Avg. December Minimum)	38.3 ˚F
Maximum Temperature (Avg. July Maximum)	98.5 ˚F

*Obtained from DWR CIMIS data for Shafter/USDA Station #5

Table 9. Detailed Climate Characteristics

Month/Time	Average Precipitation (inches)	Average Reference ET_o (inches)*	Average Minimum Temperature, ºF	Average Maximum Temperature, ºF
January	0.9	1.60	38.6	56.9
February	1.1	2.41	42.6	63.9
March	1.0	4.36	45.8	68.9
April	0.6	5.67	50.1	75.9
May	0.2	6.96	57.3	84.6
June	0.1	8.12	64.0	92.4
July	0.0	8.10	69.6	98.5
August	0.1	7.75	68.5	96.6
September	0.2	5.74	63.5	90.1
October	0.3	3.97	54.8	80.7
November	0.7	1.82	44.7	66.8
December	0.6	0.99	38.3	56.5
Wet Season	4.3**	11.18**	42.0***	62.6***
Dry Season	1.5**	46.31**	61.1***	89.4***
Annual	5.80**	57.49**	53.2***	77.7***

* Obtained from DWR CIMIS data for Shafter/USDA Station #5. "Wet Season" constitutes average of November through March; "Dry Season" covers remaining months (April through October).
** Total seasonal and annual values
*** Average of seasonal and annual monthly values

B. Operational Characteristics

1. *Operating Rules and Regulations*

North Kern's adopted *Rules and Regulations for Distribution and Use of Water* (Rules and Regulations) is the guideline for District operations and delivery of water (included as Appendix D**).** The *Rules and Regulations* cover the procedures which are followed to distribute irrigation water in an orderly, efficient, and equitable manner.

As presented in the *Rules and Regulations*, water orders are to be placed a minimum of 48 hours prior to the time that service is requested, and water deliveries run continuously until the scheduled amount of water has been delivered. No "turn on" orders are accepted for less than a 24-hour period unless special

arrangements have been made with the District or the District has in effect a less-than-24 hour-program where water users can place orders for periods of fewer than 24 hours. For the purpose of properly scheduling District activities and facilities, "turn off" orders are given at the same time as "turn on" orders.

Although the *Rules and Regulations* describe North Kern's obligations for water delivery, in practice, the District strives to accommodate growers' water orders, regardless of notice, so long as the orders can be delivered without disrupting other scheduled orders. Therefore, North Kern routinely operates as a scheduled on-demand system. On the day a water order is put into effect, one of the district's canal tenders turns the delivery gate on or off, in accordance with the scheduled delivery, at the time a canal tender passes the gate on his regular run. Generally, turn ons, turn offs and adjustments are made in the mornings. Whenever possible, service is provided as requested; however, at times, the District may require the rescheduling of service due to capacity limitations within the District's distribution system or necessary shutdowns for emergencies beyond the District's control.

Table 10. Supplier Delivery System

Type	Check if Used	Percentage of System Supplied
On Demand		0 %
Arranged Demand	X (48 hr notice)	100 %
Rotation		0 %

North Kern delivers nearly all of the irrigation water required in the Class 1 Service Area, and deliveries to the Class 2 Service Area are made to the extent supplies are available. Table 11 illustrates factors used to allocate water in North Kern. These factors are considered in setting the annual water allocation that is applied uniformly across the District.

Table 11. Water Allocation Policy

Basis of Water Allocation	(Check if applicable)			Allocation	
	Flow	Volume	Seasonal Allocations	Normal Year	Percent of Water Deliveries (%)
Land within the service area		x			97
Reservoir storage					
Riparian rights					
Water year type		x			
Amount of land owned					
Predicted runoff					

Although the District makes every reasonable effort to comply with water orders, the conveyance and delivery capabilities of the District's facilities, as well as the achievement of overall economy of operational costs, make it necessary that at times, and particularly during periods of peak irrigation use,

essentially 24-hour operation of facilities be maintained to assure that all water users receive adequate supplies of irrigation water.

In the event of emergencies, water users may turn off the supply of water to their turnout. In these events, water users must immediately notify the district office by telephone or in person. Water users who do not notify the District and receive authorization prior to the change may be charged a special service fee for each occurrence.

Table 12 illustrates the lead times for requested service, as part of the arranged-demand service, as mentioned earlier.

Table 12. Actual Lead Times

Operations	Hours/Days
Water orders	48 hours
Water shut-off	48 hours

2. *Water Delivery Measurements or Calculations*

All deliveries of surface water and groundwater by the District are measured. Meter readings at each turnout are taken every day a turnout is running and also at the end of every month by District staff, using permanently stationed on-farm propeller meters (McCrometer and Seametrics models). Bar code readings are used to ensure the time and location of each measurement and to reduce transcription errors by electronically downloading data into the District's dispatch office. Most deliveries to irrigators are measured using the on-farm meters, which are periodically checked as part of the District's maintenance program. The meters provide a very accurate method of water measurement at District turnouts. Table 13 shows levels of accuracy for typical types of measurement devices.

All propeller meters used by the District are equipped with totalizers, which accumulate the volume of flow at each turnout. According to the manual *SBx7 Flow Rate Measurement Compliance for Agricultural Irrigation Districts* by the Irrigation Training & Research Center of the California Polytechnic Institute, San Luis Obispo, devices with totalizers provide measurements that are sufficiently precise to assume that the flow rate accuracy is equivalent to the calibrated volumetric accuracy. As a result, the devices used by the District to measure delivery rates provide data that enables reliable computation of volumes of water delivered from North Kern canals. Section VIII of this report discusses steps the District is taking to comply with the water measurement requirements of SBx7-7 by verifying the accuracies of metering devices.

Table 13. Water Delivery Measurements

Type of Measurement	Frequency of Measure (Days)	Frequency of Calibration (Months)	Frequency of Maintenance (Months)	Est. Level of Accuracy (%)
Propeller meters	Daily	Infrequently	As needed	± 5%
Weirs	Daily	Infrequently	As needed	± 10%
Pump, runtime	15 days	As needed	As needed	± 5%

3. Water Rate Schedules and Billing

The North Kern WSD Board of Directors annually establishes a base service charge which is applied on a per-acre basis to all lands and is based on budget requirements and Board policy. Water tolls are based on available water supply, estimated deliveries, and the revenue required to balance the District's budget.

Effective February 1, 2013, the water toll rate was $115.00 per acre-foot for Class 1 water and $185.00 per acre-foot for Class 2 water for water users not participating in the "standby" program. Another option for Class 2 water includes a "standby" (i.e. guaranteed allocation) for water delivery including a flat-rate fee of $35.00 charged in May and $150.00 per acre-foot upon delivery. In 2015, the water toll was raised to $135.00 for both Class 1 and Class 2 lands, but this rate was dropped to it to $100.00 for both classes beginning on November 1 of this year.

Table 14. Water Rate Basis

Type of Billing	Check if Used	Percent of Water Deliveries (%)	Description
Volume of Water Delivered	X	100	All water billings are based on volume of water delivered
Area (acres)			N/A
Crop			N/A
Land Assessment			N/A

A different but uniform rate is set for each of the Class 1 and Class 2 service areas each year so as to balance the District's budget for that year. Table 15 provides this information in tabular form.

Table 15. Rate Structure

Type of Billing	Check If Used	Description
Uniform	X	Varies from year to year based on availability of surface water and need for groundwater pumping

Currently North Kern bills its irrigation water users either at the end of each month, or the first day of the following month, depending on the volume and timing of water deliveries to users. The frequency of billing is shown in Table 16.

Table 16. Frequency of Billing

Frequency	Check If Used
Monthly	X

4. *Water Shortage Allocation Policies*

Water supplies on the Kern River vary depending on watershed precipitation, snow melt runoff, and North Kern's share of the prior year's carryover storage in Isabella Reservoir. As such, water supply planning must take into consideration the amount of water that will be available during the irrigation season, the current year's water requirements, and the target carryover storage for the following season.

During years of short surface water supply, North Kern conjunctively uses groundwater, through the operation of District-owned wells, and water users in the Class 2 service area increase their use of groundwater through the operation of private wells. North Kern currently has the well capacity to avoid prorating deliveries to Class 1 lands, except in extremely dry years such as 2013, which is one of the driest years in the over 100 years of flow records on the Kern River.

Table 17 lists the measures that the North Kern Board may exercise to respond to water shortages.

Table 17. Decreased Water Supplies Allocation

Allocation Method	Check If Used
Decrease Allocated Water	X
Shorten Irrigation Season	N/A
Restrict Water to Certain Crops	N/A

The District may refuse to deliver water to irrigators as a consequence of wasting water, either willfully, carelessly, or on account of defective ditches or pipelines. The District may also refuse to deliver water to inadequately prepared land or users who flood certain portions of the land to an unreasonable depth or amount in order to properly irrigate other portions. Water service may be resumed when these conditions have been remedied. Table 18 summarizes enforcement methods available to curtail wasteful water use.

Table 18. Enforcement Methods of Allocation Policies

Enforcement Method	Check If Used
Shut-off of Water	
Refuse service	X
Fines/Penalties	

Drought Management Plan

The Drought Management Plan details how North Kern would prepare for droughts and manage water supplies and allocations during drought conditions. Some components or actions may require review of conditions, policy changes, and long-term capital improvements. Additionally, as conditions change and new technology and knowledge becomes available, opportunities and constraints will change. The drought management plan describes the following components prescribed in the Guidebook:

1) ***What hydraulic levels or conditions (reservoir levels, stream flows, groundwater, snowpack etc.) are monitored and measured to determine the water supply available and level of drought severity.***

   Hydrologic conditions in the Kern River watershed, including snowpack and precipitation, are measured by snow surveys and rain gauges. Data on precipitation, snowpack, temperature and other parameters assist in forecasting inflow to Isabella Reservoir. Estimates of reservoir storage and projected inflow are, in turn, used to determine the volume of Kern River water available to the District. Releases from storage for delivery to North Kern are then measured, as are diversions from the river into the North Kern system. In addition to extensive measurement of surface water to enable prediction of supplies and observation of deliveries, groundwater elevations are

extensively monitored in the District both for compliance with DWR's CASGEM system and for operational purposes.

The data on snowpack, precipitation, storage in Lake Isabella and groundwater elevations are also used by the District to assess the severity of drought.

2) ***The district's policy and process for declaring a water shortage and implementing the water shortage allocation and drought management plan.***

Water supplies on the Kern River vary depending on watershed precipitation, snow melt runoff, and North Kern's share of the prior year's carryover storage in Isabella Reservoir. The North Kern Board of Directors takes factors including the forecasted water supplies, the current year's projected water requirements and target carryover storage into account when determining the volume of water that will be available during the irrigation season.

During years when the availability of water from the Kern River is limited, North Kern pumps groundwater from District-owned wells. In addition, water users in the Class 2 service area, which is irrigated largely through pumping of private wells, increase their use of groundwater. North Kern has maintained the well capacity needed to avoid prorating deliveries to Class 1 lands, except in extremely dry years such as 2013, 2014, and 2015 which were three of the driest years in over 100 years of flow records on the Kern River as shown in Figure 4. Due to the severe drought conditions, deliveries were prorated on July 1, 2015 and reduced to 2.4 AF per assessable acre.

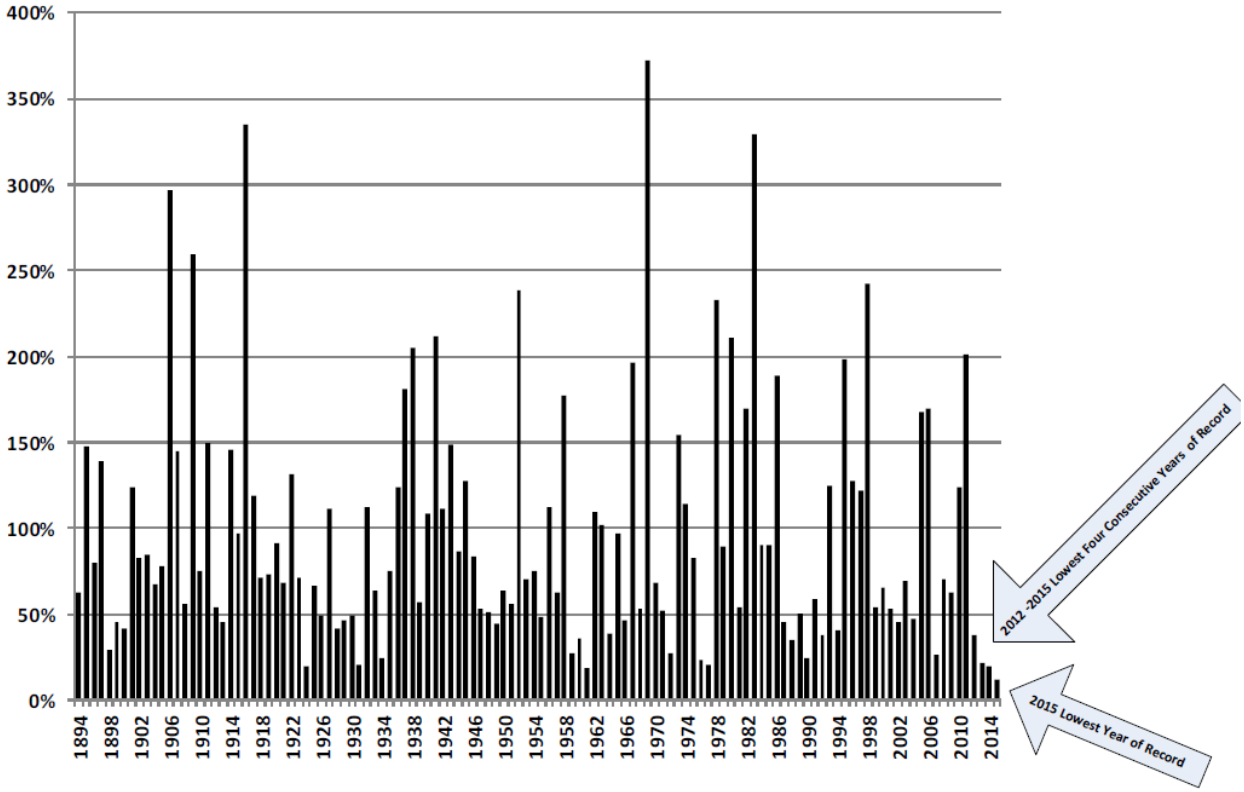


Figure 4: April-July Kern River Runoff (1894-2015)

As well as installing 12 replacement wells necessary to maintain groundwater pumping capacity, the District is also nearing completion of its *North Kern Drought Relief Project* which augments the District's water supply by introducing up to 21,200 AF/year of oil-field produced water. Because this water is available under all hydrologic conditions, it is particularly valuable as a drought response measure and as a tool for minimizing the need to prorate deliveries.

3) Operational Adjustments – changes in district water management and district operations to respond to drought, including canal and reservoir operations and groundwater management.

As Figure 4 highlights, there is significant year-to-year variability in the volume of Kern River runoff. Figure 5 shows the annual Kern River supply available to North Kern from 1992-2015 and illustrates the resulting wide range of fluctuations in the availability of surface water to the District. In a "dry" year, surface water supplies can be very limited (less than 50,000 AF), and pumping from District-owned-and-operated wells is significant. In a "wet" year, Kern River water supplies can be nearly 350,000 AF and are sufficient not only to satisfy irrigation water requirements (and thereby avoid the use of District-owned deep wells), but to make significant deliveries to spreading ponds for direct groundwater recharge.

During dry periods, surface water supplies available to the District are minimal and therefore measures to improve management of surface water through canal and reservoir operations have limited effectiveness due to the relatively small amounts of water being stored or conveyed by the related infrastructure. North Kern's typical response to dry conditions has been to exercise conjunctive management by increasing extraction of groundwater from District- and privately-owned pumps to compensate for reduced deliveries of surface water. Since the District's formation, North Kern's capacity to replenish groundwater through unlined canals and dedicated recharge basins has enabled the District to maintain groundwater levels.

Due to its length and severity, the current drought has compelled the District to implement drought response measures that go beyond its conjunctive management practices. Examples of these measures include: 1) prorating deliveries to Class 1 land to bring District deliveries in line with available supplies, 2) replacing non-functioning or under-producing District wells to improve capacity, and 3) development of the *North Kern Drought Relief Project*, which augments supplies of surface water and groundwater by introducing a new source of water supply (oil-field produced water) into the North Kern system.

The District has historically diverted all available supplies at the District's Beardsley Canal and Calloway Canal head gates on the Kern River for conveyance into North Kern for direct use for irrigation or groundwater recharge. Recharged Kern River supplies are subsequently pumped in drier years and are a key component of the District's Drought Management Plan. As described in the "Alternative Water Supplies" section below, North Kern may develop additional River supplies through its pending application for appropriation filed with the State Water Resources Control Board (State Board). Under certain conditions, these additional Kern River supplies may not be diverted at the District's head gates on the Kern River, but will be recharged in the Kern River channel and thereby establish an additional supply of water to be used in North Kern under drought conditions.

In addition to the drought response measures undertaken by the District, individual landowners within the North Kern service area have been actively managing water supplied to them to minimize drought-induced impacts on their farming operations. These activities are described in greater detail below.

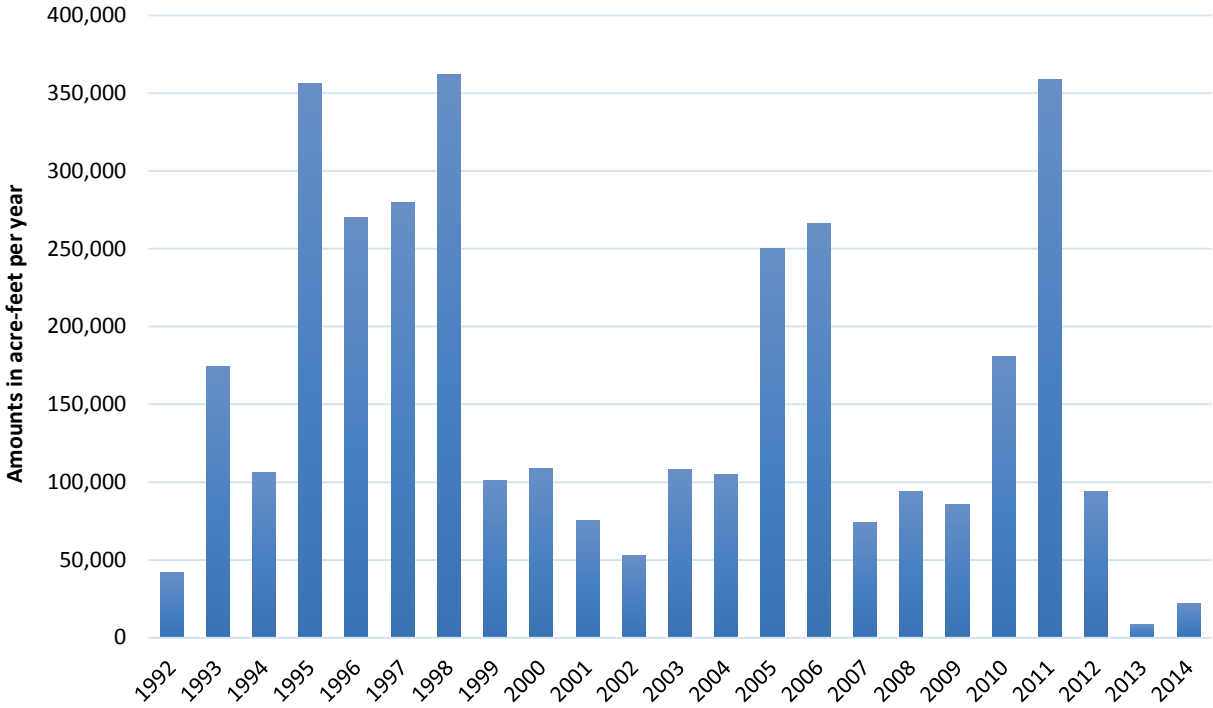


Figure 5. Annual Kern River Supply under North Kern's Diversion Rights

4) ***Demand Management – policies and incentives in addition to the water shortage allocation plan to lower on-farm water use.***

Rather than instituting district-governed policies and incentives to lower on-farm water use, North Kern's approach to demand management is to provide the high degree of flexibility and responsiveness in deliveries necessary to enable growers to manage water efficiently under all conditions. The District also provides clear estimates of water allocations so that growers can make well-informed farming decisions. The level of operational responsiveness provided by North Kern, together with early projections of water allocations, are particularly crucial during droughts when farmers must make challenging decisions on how best to manage their farmland.

5) ***Alternative Water Supplies – discuss the potential if possible for the district to obtain or utilize additional water supplies. These supplies could include transfers from another water agency or district, the use of recycled water and desalination of brackish groundwater or drainage water.***

North Kern's principal source of surface water is the Kern River; however, through exchanges and water purchases, the District can gain access to SWP and CVP water as well as surface water originating from other sources that has been wheeled through State and Federal facilities. Due to the duration and extent of the current drought, alternative sources of surface water have been few

and the cost of transferred or exchanged water has been high. Therefore, as a conjunctively managed district, North Kern has adhered to the strategy of relying on groundwater recharged during wet years to serve as a reservoir that could be relied upon during droughts. While recharge primarily consists of Kern River water, it has also included local Poso Creek water and imported SWP and CVP water from time to time. Here again, the severity of the current drought has tested this practice as groundwater elevations have declined in 2015 during the peak irrigation season by 20 feet from 2014 levels .

An additional source of water, which has recently begun to be utilized within North Kern, is oil-field produced water from California Resources Company's Kern Front oilfield. Because produced water is a byproduct of oil extraction, this water source is effectively insulated from hydrologic conditions, and therefore is a reliable source of water even during severe droughts. North Kern began accepting produced water into their system in August 2015 as part of the aforementioned *North Kern Drought Relief Project*. Under most conditions, produced water is blended with water from the Kern River and applied to irrigated lands. During periods when irrigation canals are taken out of service for maintenance or when sufficient water is available from the Kern River to satisfy all demands, the produced water is routed to spreading grounds for groundwater recharge. In both applications, produced water is a valuable supplement to the District's established supplies of surface water and groundwater.

North Kern (with the City of Shafter) has filed an application to "appropriate" Kern River water supplies with the State Board based on Kern River supplies forfeited by Kern Delta Water District, pursuant to a 2007 Court of Appeal's decision. Should the State Board determine that forfeited supplies are available for appropriation, North Kern and Shafter intend to appropriate all available forfeited supplies. This would result in additional water supplies being available, including certain Kern River supplies recharged in the Kern River channel for future use under drought conditions. These supplies would increase total drought supplies available to the District.

6) Stages of Actions – includes the stages of action and corresponding levels of drought severity that district will implement in response to the drought.

Drought response in North Kern is a responsibility shared by the District and its growers. The District's drought response policies are intended to allocate available surface water, augmented by groundwater pumped from district-owned wells, in a manner that is equitable and consistent with the District's operational policies with respect to Class 1 and Class 2 lands while maintaining the District's financial viability. An important objective of this approach is to provide growers with an accurate assessment of the volume and cost of water that will become available to them so that they can utilize this water in a manner that is best suited to the requirements of their farming operations.

Because the quantity of Kern River water available to North Kern in any given year is beyond the District's control, North Kern's drought response measures center on managing groundwater. In 2013, 2014, and 2015, the District delivered no surface water to Class 2 lands and prorated deliveries to Class 1 lands. Proration of deliveries to Class 1 lands was driven by the combination

of extremely low supplies from the Kern River and other surface water sources and, given the magnitude of this shortfall, the high cost of pumping a sufficient volume of groundwater to enable delivery of a full allocation. Proration of deliveries leaves growers with the responsibility of determining how best to allocate limited water supplies through deficit irrigation, fallowing of annual crops, and other water conservation measures.

As noted earlier, in addition to instituting measures to manage traditional surface water and groundwater supplies during drought, North Kern began accepting oil-field produced water into their system in August 2015 under the *North Kern Drought Relief Project*. Because the District is required by their agreement with the California Resources Company to accept produced water under all conditions, the volume of water received from this project is not modified in response to either water demands or the availability for water from other sources.

7) Coordination and Collaboration – include a description of how coordination and collaboration with other local districts and water agencies or regional groups will be used in drought response.

The Poso Creek Regional Water Management Group (RWMG) has proven itself to be an effective organization for operational coordination and for collaboration on development of water conveyance, groundwater recharge, and oil-field produced water projects. These projects have introduced new water into North Kern and other participating districts, improved the ability to distribute water within the region, and expanded the capability of its members to exchange and transfer water for irrigation applications and for recharge. In addition to formulating and evaluating projects, the RWMG has been successful in obtaining state and federal funding for development and implementation of numerous projects that have improved regional resiliency to drought.

The use of Kern River water supplies appropriated under North Kern's State Board application and recharged in the Kern River channel would be coordinated with other entities having interests in the channel and underlying aquifer. It is also likely that North Kern would collaborate with some of these entities to facilitate water exchanges, transfers, and other programs that would establish an additional supply of water to be used in North Kern under drought conditions.

Implementation of the recently enacted Sustainable Groundwater Management Act (SGMA) will provide yet another mechanism for regional collaboration and coordination. Regional efforts to implement this legislation will provide a firm, cooperative basis for management of groundwater during all conditions, but will be particularly important as a tool for drought response. In this regard, North Kern is one of the founding members of the Kern Groundwater Authority.

8) Revenues and Expenditures – describes how the drought and lower water allocations will affect the district's revenues and expenditures.

The North Kern Board of Directors annually establishes a water toll which is applied on a per-acre-foot basis. Water tolls are based on available water supply, estimated deliveries, and the revenue required to balance the District's budget. Uniform but different tolls are set for the Class 1 and Class 2 service areas with the goal of having overall revenues from the two service classes sufficient to balance the District's budget for the year.

The North Kern Board's responsibility for adjusting water tolls each year offers a limited opportunity to reduce the financial impacts of drought by adjusting tolls to compensate for changes in the availability and demand for water. Although adjustment of tolls can buffer the financial impact of drought, the impact remains significant due to both reductions in the volumes of water delivered and increases in the costs for supplying water.

Costs for water delivery are relatively stable for surface water, but can vary widely for groundwater. Because Kern River water is delivered by gravity, the cost of distributing surface water is not closely tied to annual hydrology as most of the distribution cost is attributable to the fixed costs of operating and maintaining the canal system. By contrast, the costs to the District, as well as to private well owners, of increased groundwater pumping are substantial both because of the greater volumes of groundwater pumped during droughts and because the cost of pumping each unit of water increases as groundwater elevations decline. Although rates are based on the volume of surface water projected to be available to the District during the coming irrigation season, uncertainties in these projections, as well as in the cost of groundwater pumping, can result in unexpected expenditures.

The *North Kern Drought Relief Project* will help to stabilize fluctuations in the costs of supplying water as both the volume of produced water and the unit cost of delivering the water are constant and do not vary with hydrologic conditions. In addition, substitution of produced water in place of groundwater will reduce fluctuations in groundwater elevations and moderate variations in pumping costs.

5. *Basis for Reporting Water Quantities*

The nature of North Kern's water rights is such that there is significant year-to-year variability in the available surface water supplies. In a "dry" year, surface water supplies are very limited and pumping from District-owned-and-operated wells is significant. In a "wet" year, surface water supplies are sufficient not only to satisfy irrigation water requirements (and thereby avoid the use of District-owned deep wells), but to make significant deliveries to spreading ponds for direct groundwater recharge. Figure 5, shown previously, illustrates the variation in Kern River supply under North Kern's water rights during the period from 1992 through 2014.

In accordance with the Governor's Executive Order and the 2015 Guidebook, the operations from the years 2013, 2014, and 2015 are reported in this plan where data was available.

Table 19. Representative Years

	Description		
Representative year based upon	2013	2014	2015
First month of representative year	January	January	January
Last month of representative year	December	December	August

Section III. Description of Quantity of the Water Uses of the Agricultural Water Supplier

North Kern's principal surface water supply is the Kern River, which is diverted and delivered northward into the District through a largely open canal, gravity system. The District serves approximately 210 accounts with an average of 280 acres per account.

Owing to the highly variable Kern River supply, North Kern supplements available surface water supplies with underlying groundwater resources. During "wet" years, when irrigation water requirements are easily met, significant deliveries of surface water are also made to spreading (i.e. for groundwater recharge). The District maintains approximately 100 water wells that are used to supplement surface water supplies, primarily during "dry" years.

North Kern is well positioned to participate in exchanges to supplement local water supplies, which involve SWP and CVP supplies owing to its proximity to major SWP and CVP conveyances and service areas.

A. Agricultural Water Use

The primary crops grown within North Kern are deciduous trees (mostly almonds and pistachios), grape vines, grains, row crops, and nursery crops. Improvements in irrigation water delivery systems and changing economic conditions have brought many changes to the crop mix within the District. Nut trees and grapes have been among the crops with the most rapidly expanding acreages, now accounting for around 85 percent of the total irrigated area. During the last several decades, thousands of acres of annual crop land have been converted to these high value permanent crops.

The change from annual to permanent crops has led to a "hardening" of the District's total water requirements over time, especially in recent years. Table 20 summarizes agricultural water use within the District for the representative years.

Table 20. Agricultural Water Use (AF)

Source	2013	2014	2015**
Agricultural Water Supplier Delivered			
Surface and groundwater	149,420	154,168	92,342
Other (M&I Use)	NA	NA	NA
Other Water Supplies			
Surface Water	NA	NA	NA
Groundwater (Private Pumping*)	29,335	31,425	32,612
Other	NA	NA	NA
TOTAL	**169,886**	**185,593**	**124,954**

* Measured volume from private wells discharged into district facilities for conveyance and use within the District.

** Data reported for 2015 represents January-August operations

Table 21 presents water needs for specific crops grown within the North Kern service area. The efficiency of on-farm applications and crop water demands varies by crop, soil type, irrigation method and other factors; however, for the purposes of this water balance, a uniform adjustment for crop water demands in excess of ET was applied to all crops. This adjustment was approximated by comparing the estimated average unit crop ET derived from Table 21 (for 2013 and 2014, the two years with complete data, it was 3.22 AF/acre) with the per-acre volume of Class 1 water deliveries measured by the District in 2013, 84,521 AF. Dividing the volume of delivered water by the area served by Class 1 water, estimated to be 50 percent of the total cropped area served in 2013 or 27,830 acres, yields a Total Crop Water Demand of 3.04 AF/acre, a benchmark assumed to satisfy all water requirements of Class 1 lands. In most years, the per acre volume of water applied to Class 1 lands exceeds the ET requirement and can be used to gage water applied in excess of the ET requirement to satisfy the leaching fraction and other cultural practices. However, the volume of water applied to Class 1 lands in 2013 and 2014 was only 94% of the estimated crop water requirement suggesting that due to the pro-rated allocation of water to Class 1 land, growers on these lands were either deficit irrigating (applying less water than the full crop requirement) or supplementing water delivered by the District with water from privately-owned wells. For the purposes of this water budget, it is assumed that growers were practicing deficient irrigation. Because of the low salinity of water from the Kern River and the efficient irrigation practices used on Class 1 lands, it is likely that growers could practice a small degree of deficit irrigation with little penalty in crop yield or quality.

Table 21.a Agricultural Crop Data for 2013

Crop	Total Acres	Estimated ETc (ft)	Crop ET Requirement (AF)	Crop Water Demand Excess of ET (AF)	Total Crop Water Demand (AF)
Grapes-Table	6,453	2.36	15,219	0	15,219
Almonds	35,076	3.40	119,143	0	119,143
Alfalfa	3,688	3.96	14,602	0	14,602
Beans	232	2.19	508	0	508
Carrots	226	1.53	345	0	345
Corn, Field Corn	140	2.45	342	0	342
Cotton	1,546	2.80	4,320	0	4,320
Wheat	509	1.36	692	0	692
Pomegranates	341	2.93	1,000	0	1,000
Tomatoes	212	2.07	440	0	440
Roses	1,759	3.26	5,726	0	5,726
Pistachios	3,746	2.97	11,115	0	11,115
Apples	1,010	3.39	3,419	0	3,419
Cherries	21	3.39	72	0	72
Potatoes	410	2.88	1,181	0	1,181
Plums	186	3.39	629	0	629
Other	102	2.09	213	0	213
TOTAL	**55,660**		**178,965**	**0**	**178,965**

* Assumes practice of deficit irrigation with volume of water applied equal to estimated ETc with no adjustment for leaching or other cultural practices.

Table 21.b Agricultural Crop Data for 2014

Crop	Total Acres	Estimated ETc (ft)	Crop ET Requirement (AF)	Crop Water Demand in Excess of ET (AF)	Total Crop Water Demand (AF)
Grapes-Table	6,096	2.36	14,376	0	14,376
Almonds	39,628	3.40	134,603	0	134,603
Alfalfa	1,758	3.96	6,959	0	6,959
Beans	611	2.19	1,337	0	1,337
Carrots	38	1.53	58	0	58
Corn, Field Corn	163	2.45	398	0	398
Cotton	106	2.80	296	0	296
Wheat	524	1.36	711	0	711
Pomegranates	658	2.93	1,927	0	1,927
Tomatoes	69	2.07	144	0	144
Roses	1,414	3.26	4,603	0	4,603
Pistachios	3,751	2.97	11,129	0	11,129
Apples	1,802	3.39	6,101	0	6,101
Cherries	81	3.39	276	0	276
Potatoes	146	2.88	419	0	419
Plums	447	3.39	1,512	0	1,512
Other	102	2.09	213	0	213
TOTAL	**57,393**		**185,063**	**0**	**185,063**

* Assumes practice of deficit irrigation with volume of water applied equal to estimated ETc with no adjustment for leaching or other cultural practices.

Table 21.c Agricultural Crop Data for 2015

Crop	Total Acres	Estimated ETc (ft)	Crop ET Requirement (AF)	Crop Water Demand in Excess of ET (AF)	Total Crop Water Demand (AF)
Grapes-Table	4,813	2.36	11,349	0	11,349
Almonds	16,745	3.40	56,877	0	65,877
Alfalfa		3.96	0	0	0
Beans	77	2.19	169	0	169
Carrots	69	1.53	106	0	106
Corn, Field Corn		2.45	0	0	0
Cotton		2.80	0	0	0
Wheat	145	1.36	197	0	197
Pomegranates		2.93	0	0	0
Tomatoes		2.07	0	0	0
Roses		3.26	0	0	0
Pistachios	448	2.97	1,330	0	1,330
Apples	193	3.39	652	0	652
Cherries		3.39	0	0	0
Potatoes		2.88	0	0	0
Plums		3.39	0	0	0
Other		2.09	0	0	0
TOTAL	**22,490**		**70,681**	**0**	**70,681**

* Assumes practice of deficit irrigation with volume of water applied equal to estimated ETc with no adjustment for leaching or other cultural practices.

The District's gross service area now encompasses approximately 60,000 acres. As shown in Table 22, approximately 52,400 acres were irrigated from surface water and groundwater sources.

Table 22. Irrigated Acres (acres)

	2013	2014	2015
Service Area	60,000	60,000	60,000
Surface Water and Groundwater Irrigated Area	52,396	52,396	52,396

For the purposes of this report, cropped acres are the same as irrigated acres with the amount of irrigated land not cropped at any time during the year shown in Table 21 as "Open Land". In 2015, over 85 percent of the cropped acres are planted with permanent crops with almonds being the predominant permanent crop with 30,289 acres. Inter-cropping is not a common practice in the North Kern service area.

Table 23. Multiple Crop Information (acres)

	2013	2014	2015
Cropped	52,396*	52,396*	52,396*
Inter-cropping	Negligible	Negligible	Negligible
Double cropping	7,306	7,306	7,306

*Includes crops irrigated with surface water and groundwater.

B. Environmental Water Use

North Kern does not make deliveries of water specifically for environmental purposes. Any environmental water uses realized from District-maintained water supplies are incidental to the District's operations. In particular, to the extent that there is water in the District's canals or the 1,500 acres of spreading ponds that are periodically flooded, it is available to local wildlife and provides incidental habitat benefits. The USACE is responsible for Isabella Reservoir operations and any environmental use of water stored in Isabella Reservoir is incidental to that operation.

These potential sources do not qualify as consumptive environmental water uses applicable to the AWMP water balance and Table 24 has been completed accordingly.

Table 24. Environmental Water Uses

Environmental Resources	Volume (AF)*		
	2013	2014	2015
In-stream flow releases	0	0	0
Streams	0	0	0
Lakes or reservoirs	0	0	0
Riparian vegetation	0	0	0
Total	0	0	0

*There is no water consumption assigned to environmental water uses.

C. Recreational Water Use

Recreational activities at Isabella Reservoir, also known as Lake Isabella, include camping, fishing, and boating. USACE is responsible for day-to-day reservoir operations, while the Kern County Parks and Recreation Department administers the recreational activities at the lake. North Kern is not responsible for any recreational activities at Lake Isabella. Recreational use of District water supplies is incidental to the District's storage of water in the reservoir, which is for the purpose of regulating the supplies. Accordingly, no consumptive use of water has been assigned North Kern's water in Isabella storage for the purpose of the water accounting in this plan.

Table 25. Recreational Water Uses

Recreational Facility	Volume (AF)*
	N/A

* There is no water consumption assigned to recreational water uses.

D. Municipal and Industrial Water Use

North Kern delivers only raw (non-potable) water throughout its service area; accordingly, there are no direct deliveries for M&I purposes. All M&I water use in the North Kern service area is supplied by groundwater pumping. To date, the City of Shafter, other local communities, rural residences and businesses have relied exclusively on groundwater pumped from the Kern County Subbasin for domestic and commercial uses. When available surface water supplies permit, the District replenishes the underlying groundwater through significant recharge operations which are conducted at multiple spreading pond locations. The spreading operations are carried out in

support of the pumping required to satisfy the irrigation water requirements within the District; however, as a practical matter, the same groundwater system supplies both agricultural uses and M&I uses.

In 1952, North Kern entered into an agreement which provides the District access to water for purposes limited to irrigation, livestock watering, and groundwater replenishment. In 2008, North Kern entered into an amendment to the 1952 agreement which provides for M&I water uses. To date, these uses have been relatively small. In particular, the City of Shafter has pumped less than 1,000 AF for such purposes.

Table 26 summarizes the District's municipal and industrial water uses.

Table 26. Municipal/Industrial Water Uses (AF)

Municipal/Industrial Entity	2013	2014	2015
Municipal Entity			
	0	0	0
Industrial Entity			
	0	0	0
Total	**0**	**0**	**0**

E. Groundwater Recharge Use

Indirect recharge occurs to the extent that the District delivers surface water in lieu of pumped groundwater to satisfy irrigation water requirements. Kern River water which is surplus to immediate irrigation requirements and cannot be regulated in the District's share of conservation storage space available in Isabella Reservoir is available for direct recharge. In this regard, North Kern makes use of over 1,500 acres of spreading ponds, the dry channel of Poso Creek, and unlined canals. The spreading ponds have been in use for over 60 years and consist of relatively small ponds or cells within a given spreading site, separated by contour dikes. There are five sites, which range from about 60 acres up to about 600 acres, with the locations shown on Figure 2. Since the spreading ponds were constructed in the 1950s, North Kern has spread over 3.25 million AF of water. It is noteworthy that, prior to the development of its extensive spreading grounds, North Kern initiated field experimentation and research in 1936 regarding the use of artificial recharge methods in the southern San Joaquin Valley.

During particularly "wet" years, direct recharge through the use of spreading ponds is significant in the basin. Table 27 lists the volume of water allocated towards groundwater recharge in the drought years of 2013, 2014, and 2015 and does not reflect "wet" year operations.

Table 27. Groundwater Recharge Water Uses (AF)

Location/Groundwater Basin	Method of Recharge	2013	2014	2015
District Spreading Ponds	Spreading of Surface Water	914	3,733	0
District Canal Seepage*		41,173	47,622	0
Poso Creek*		115	0	0
Total		**42,202**	**51,355**	**0**

*Values have not been reduced by potential evaporation, represent gross estimates.

F. Transfer and Exchange Use

North Kern is well-positioned to participate in exchanges which involve SWP and CVP supplies owing to its proximity to major SWP and CVP conveyances and service areas. Regarding CVP water, it is noted that the Friant-Kern Canal slices through the middle of North Kern from north to south. In addition, two of North Kern's immediate neighbors are CVP-Friant contractors; namely, the Southern San Joaquin Municipal Utility District and the Shafter-Wasco Irrigation District. Regarding SWP water, the Cross Valley Canal conveys SWP water from the California Aqueduct into the metropolitan Bakersfield area, where water is pumped into North Kern's Beardsley Canal for delivery to the Cawelo Water District. Though not a long-term CVP contractor, North Kern has purchased CVP water that has been available from time to time, typically during the peak runoff period of wet years, generally through "Section 215" contracts. In this regard it is noteworthy that the District has constructed two turnouts from the Friant-Kern Canal to facilitate such purchases, as well as having instituted water banking and exchange arrangements with neighboring districts. Table 28 summarizes North Kern activity in water exchanges during the representative years.

Table 28. Transfers and Exchanges Water Uses

From What Agency	To What Agency	Type of Transfer or Exchange (Ag to M&I, M&I to Ag, or Ag to Ag)	Volume (AF)		
			2013	2014	2015
Cawelo WD	North Kern WSD	Agricultural to Agricultural			1,691
CVC Conduit A	North Kern WSD	Agricultural to Agricultural			1,525
North Kern WSD	Kern-Tulare WD	Agricultural to Agricultural			3,493
North Kern WSD	Delano-Earlimart ID	Agricultural to Agricultural			1,339
North Kern WSD	Cawelo WD	Agricultural to Agricultural			895
Cawelo WD	North Kern WSD	Agricultural to Agricultural		2,408	
CVC Conduit A	North Kern WSD	Agricultural to Agricultural		698	
North Kern WSD	Kern-Tulare WD	Agricultural to Agricultural		8,473	
North Kern WSD	Delano-Earlimart ID	Agricultural to Agricultural		5,114	
North Kern WSD	Cawelo WD	Agricultural to Agricultural		2,322	
Semitropic WSD	North Kern WSD	Agricultural to Agricultural	2,973		
CVC Conduit A	North Kern WSD	Agricultural to Agricultural	8,472		
North Kern WSD	Kern-Tulare WD	Agricultural to Agricultural	4,609		
North Kern WSD	Delano-Earlimart ID	Agricultural to Agricultural	4,104		
North Kern WSD	Cawelo WD	Agricultural to Agricultural	2,160		

In 2012 North Kern and other members of the Poso Creek Regional Water Management Group (Poso Creek RWMG) completed State (California Environmental Quality Act – CEQA) and Federal (National Environmental Policy Act – NEPA) environmental documents for groundwater banking, transfer, and exchange programs among the members of the RWMG. These programs, which may involve SWP, CVP and local water supplies, envision the expansion of water management programs among the RWMG in response to reductions in historically available regional surface water supplies as documented in the Poso Creek IRWMP. Expanded water

banking, transfer and exchange programs designed to improve regional water management will assist in reducing the adverse impacts on regional groundwater conditions and agricultural operations associated with regional losses of surface water supplies.

As noted elsewhere in this report and in the Poso Creek IRWMP, North Kern has substantial assets to both recharge and recover water supplies for banking, transfer and exchange purposes. North Kern is also faced with potentially large reductions in its historically available Kern River water supplies due largely to the State Water Resources Control Board's decision in 2010 to remove the Kern River from the "fully appropriated stream" list and proposed actions of the City of Bakersfield and the Kern Delta Water District. Consequently, North Kern must optimize the use of its water and facilities assets through banking, transfer, and exchange programs within the Poso Creek region, and in others areas of Kern County, which can be assisted because of the District's excellent proximity to the Friant-Kern Canal and CVP "Friant Division" contractors. These actions are necessary for the continuation of viable agricultural operations within the District.

G. Other Water Use

All water uses of any significance have been described previously in this section. Negligible volumes of water are used within the District for livestock watering, mixing with agricultural chemicals before spraying, and dust abatement. Table 29 notes that the cumulative water use for these purposes is insignificant.

Table 29. Other Water Uses (AF)

Water Use	
No other uses of significance	N/A

H. Projected Water Use

Projections of future water use in the District are directly related to the future availability of water supplies. Should North Kern's surface water supplies be reduced from historical levels, both the District and the District's landowners will increase reliance on groundwater; the same situation applies to other members of the Poso Creek RWMG. However, it is very unlikely that continuously high levels of groundwater pumping can be sustained without the availability of adequate supplemental surface water supplies. It is intended that existing and future groundwater banking, transfer and exchange programs will bring additional surface water supplies into North Kern to offset some of the losses in historically available supplies.

As previously discussed, Kern River water supplies constitute the significant majority of surface water supplies available to the District to support groundwater levels and agricultural operations. As discussed more fully in Section V.D – Water Supply Reliability and Section V.E – Future Water Supply, reductions in the historical availability of the District's Kern River supplies are likely in the future, and significant reductions are possible. Additionally, the availability and reliability of other historical surface water supplies to support groundwater conditions in the Poso Creek Region have been reduced as a result of environmental concerns affecting the SWP and

CVP-Delta and CVP-Friant, and it is likely that supplies from these sources will continue to be reduced due to on-going environmental restrictions. Although the districts overlying the Poso Creek drainage are implementing plans and projects through the IRWM process intended to mitigate reductions in historically available surface water supplies, it is unlikely that these projects will fully offset these reductions. Should offsets be insufficient, absent a reduction in demand, it is reasonable to expect an increased reliance on pumped groundwater going forward.

Future demand patterns in the District will also certainly change as some irrigated agricultural lands are converted to urban uses; however, the total demand may or may not change depending on a number of factors, including the density of urban development. There may be less recharge with urban development, owing to impervious surfaces and piping of wastewater to a treatment facility for reuse. If dual systems are part of the urban development, then non-potable supplies could be delivered to landscape irrigation uses.

Section IV. Description of Quantity and Quality of the Water Resources of the Agricultural Water Supplier

A. Water Supply Quantity

1. *Surface Water Supply*

With regard to surface features, the Calloway, Friant-Kern, and Lerdo canals run north-south through the District; Poso Creek runs northwest through the northern part of the District; and the Kern River is south of the District. North Kern's principal surface water supply is the Kern River, diverted and delivered by gravity to water users through the aforementioned canals. Poso Creek is a relatively small, intermittent source of local surface water. Table 30 shows North Kern's diversions from the Kern River for the years 2007-2011 in AF per year (amounts are measured at Seventh Standard Road, the District's south boundary).

Surface water is retained and regulated in the District's conservation storage space in Isabella Reservoir, as noted in Table 5. The USACE constructed Isabella Dam in the 1950s and is responsible for day-to-day reservoir operations. Isabella "surface storage" is used by the District to supplement groundwater storage associated with the District's recharge and recovery activities. Table 31 lists restrictions or imposed limitations on sources of North Kern's water supply, in particular, the storage of water in Isabella Reservoir.

Table 30. Surface Water Supplies (AF)

Source	Diversion Restriction	2007	2008	2009	2010	2011	2013	2014	2015
Kern River	Water year type and priority rights	73,177	93,321	84,909	180,110	358,165	8,869	22,018	6,788

Source: North Kern WSD

Table 31. Restrictions on Water Sources

Source	Restrictions or Imposed Limitations	Name of Agency Imposing Restrictions	Operational Constraints
Kern River	Storage	USACE	Dam-safety considerations caused USACE to impose a maximum storage restriction of 360,000 AF, which is about 200,000 AF less than the reservoir's capacity at spillway crest. This restriction will be in place until the dam-safety concerns have been addressed.

2. *Groundwater Supply*

In years of deficient surface water supply, continuity of delivery to the surface water service area is maintained by the operation of approximately 100 wells which are owned and operated by the District, while on-farm wells are used to meet irrigation demands in the remainder of North Kern.

Long-term water-level data in selected wells representing the unconfined to semi-confined aquifers are used to evaluate groundwater movement, storage conditions, and pumping costs. Historically,

water levels in supply wells have been measured twice a year, in both the "spring" and "fall", with the timing of these measurements intended to coincide with the annual water level high and low, respectively. Measurement of water levels will continue to be performed in both spring and fall to show seasonal variations in water levels throughout the District, and groundwater levels at select wells will be monitored on a monthly basis. These data have been made available to the KCWA and the DWR for the District-owned wells.

The average depth to groundwater in the District has been around 200 feet at the end of a "wet" period (1986) and around 270 feet at the end of a "dry" period (1993). Over the last 20 years, the annual (average) spring water levels have fluctuated within a band of about 50 feet. Seasonal fluctuations can be significant and are a function of the amount of groundwater pumping in a given year and the location within the District. In general, seasonal fluctuations are greatest in the northern portion of the District and are less pronounced in the south.

The San Joaquin Valley portion of Kern County is referred to as the Kern County Subbasin, the north boundary of which is coincident with the north county line. North Kern WSD is within the Kern County Subbasin, designated as DWR Groundwater Basin Number 5-22.14, and the District is shown in relation to the groundwater basin boundary in Figure 6.

The Kern County Subbasin is well-studied, with major investigations having been conducted by both state and federal agencies. Project reports and environmental documents prepared by local water districts are a source of more site-specific data. Table 32 summarizes information on the size and capacity of the Kern County Subbasin. Importantly, the "safe yield" of the basin - the amount of water that can be withdrawn based on "natural" basin replenishment (i.e., excluding conjunctive use/banking programs) - has not been determined but is clearly a relatively small fraction of groundwater production from the Subbasin in dry years. Table 33 lists the firm responsible for preparation of the District's groundwater management plan which is available upon request.

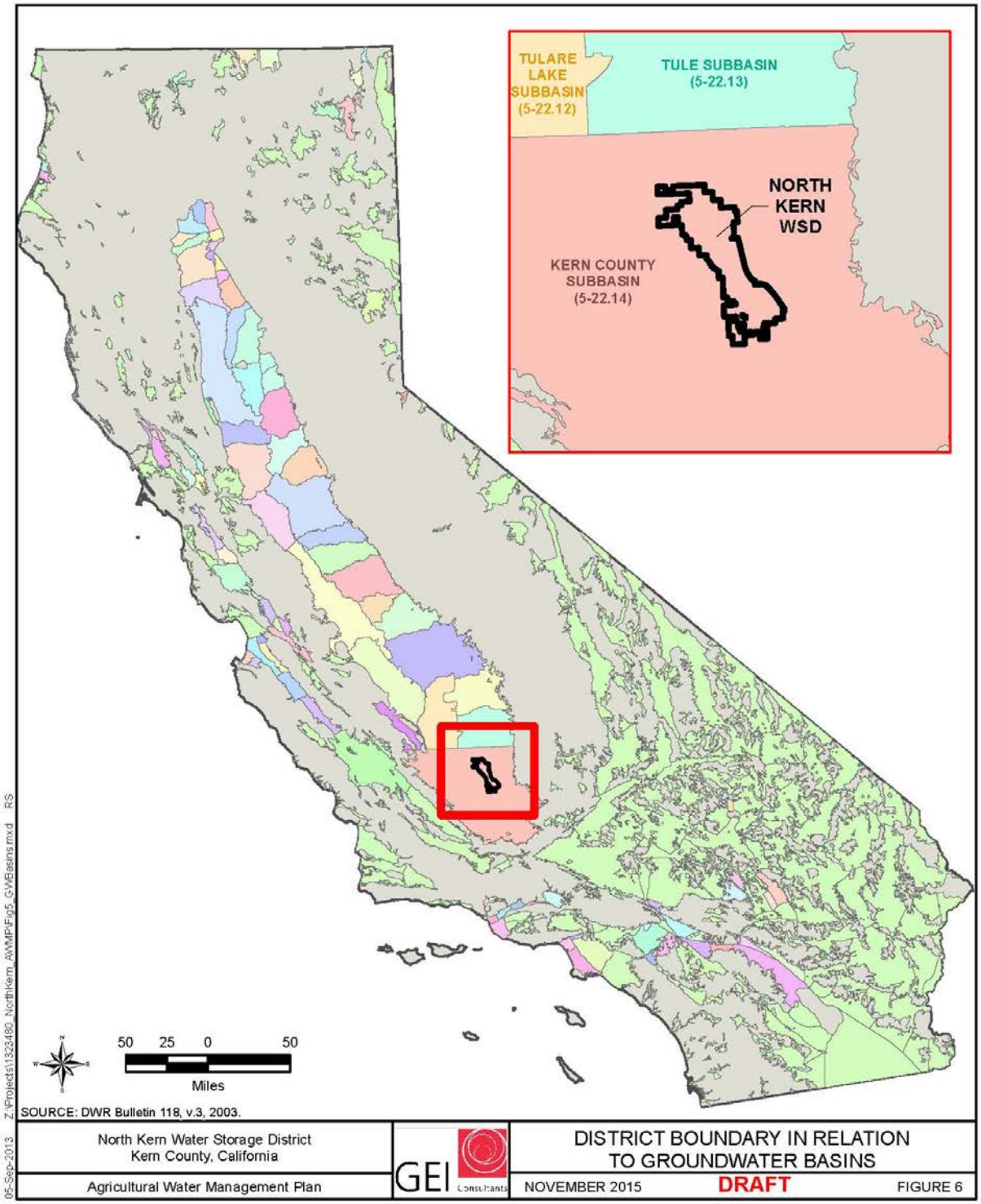
Table 32. Groundwater Basins

Basin Name	Size (Sq. Mi.)	Estimated Capacity (AF)	Safe Yield (AFY)
Kern County Groundwater Subbasin	3,040	40,000,000	Unknown

DWR San Joaquin District Kern County Groundwater Basin Information:
http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/5-22.14.pdf

Table 33. Groundwater Management Plan

Prepared By:	GEI Consultants
Year:	2012
Is Appendix Attached?	No, but it is available upon request


TULARE LAKE SUBBASIN (5-22.12)
TULE SUBBASIN (5-22.13)
NORTH KERN WSD
KERN COUNTY SUBBASIN (5-22.14)
50 25 0 50
Miles
SOURCE: DWR Bulletin 118, v.3, 2003.
Z:\Projects\1323480_NorthKern_AWMP\Fig5_GWBasins.mxd RS
05-Sep-2013
North Kern Water Storage District
Kern County, California
Agricultural Water Management Plan
GEI Consultants
DISTRICT BOUNDARY IN RELATION TO GROUNDWATER BASINS
NOVEMBER 2015
DRAFT
FIGURE 6

Irrigation Wells

Groundwater pumping by the District is used to offset deficiencies in available surface water supplies. About one-half of the District's approximately 100 wells were constructed in the 1950s and are about 800 feet in depth, while wells constructed since that time are typically drilled to a depth of about 1,000 feet, with the top of the screened interval located from 400 to 500 feet below ground surface and extending 500 to 600 feet.

Pumping lifts vary with hydrology and with location; however, they are estimated to have ranged from 350 to 400 feet over recent years. The at-well pumping drawdowns during the irrigation season can exceed 100 feet, but are typically about 50 to 75 feet. Based on a 2008 field survey, privately-owned on-farm wells totaled over 200, about 70 percent of which were in a ready-to-operate condition.

During the drier years, the District's well field is principally operated during the nine-month period extending from February through October and is operated at or near capacity from May into August. Annual pumpage from District wells has ranged up to 100,000 AF. Conversely, there are years where available surface water supplies are adequate and the well field is not used at all. In fact, there have been instances where District wells have not been operated for several consecutive years, as illustrated in Figure 7.

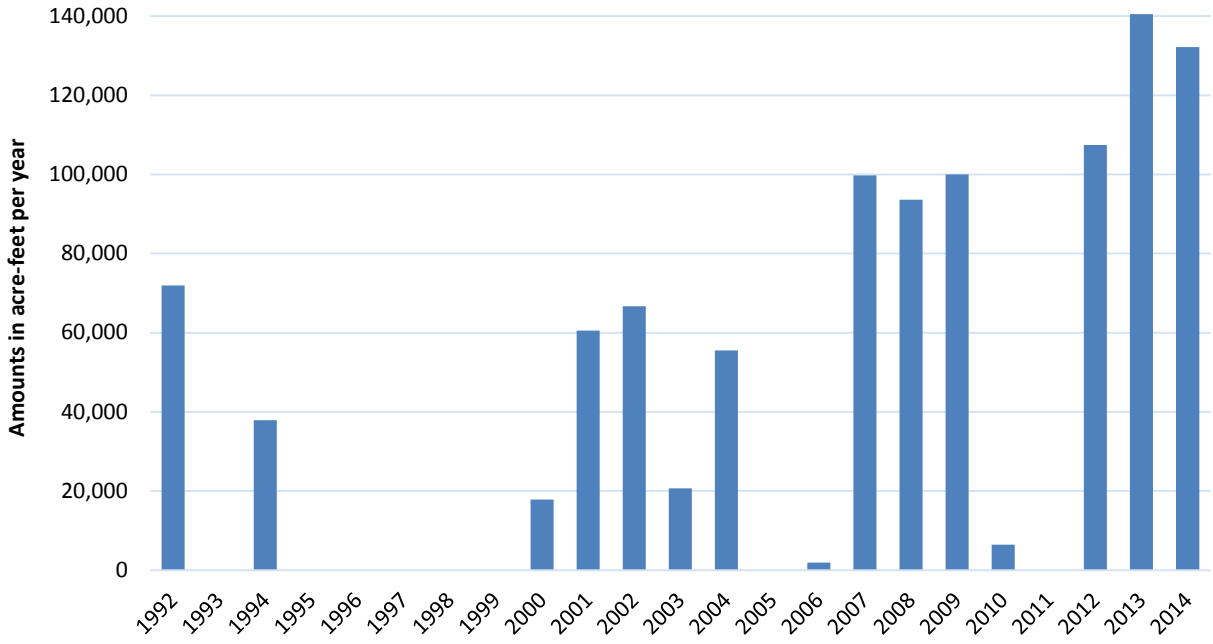


Figure 7. Groundwater Pumping from District-Owned Deep Wells.

District water is priced lower in wet years when Kern River supplies are "plentiful", thereby incentivizing the use of District (surface) water over groundwater pumping. In dry years, the District pumps large volumes of groundwater and District water prices are higher, encouraging water users to conserve.

The volume of measured groundwater pumped within the boundaries of North Kern in 2013. 2014 and 2015 for discharge into the North Kern distribution system is shown in Table 34. Although additional non-district (or privately-owned) wells are pumped within the District for direct application onto farmland without conveyance through North Kern facilities, the volume is not reported to the District.

Table 34. Groundwater Supplies*

Groundwater Basin	Total (AF)		
	2013	2014	2015**
District Deep Wells	140,551	132,150	85,554
Non-District Deep Wells	29,335	31,425	32,612
Total	**169,886**	**163,575**	**118,166**

* Measured volume discharged into district facilities for conveyance and use within the District

**Values are representative of the months January to August

3. *Other Water Supplies*

In general, North Kern does not have uncontrolled inflows to the District. The exception to this is Poso Creek which is frequently dry but which, at times, is a source of unregulated inflow. Flows from Poso Creek are measured at weirs which enable the District to estimate inflows except during storms when accurate measurement by the weirs is not possible.

4. *Drainage from the Water Supplier's Surface Area*

Drainage wells and surface drainage systems are not employed by the District. As Table 35 summarizes, there are no flows to saline sinks or to a perched water table.

Table 35. Drainage Discharge

Surface/Subsurface Drainage Path	(AF)
Flows to saline sink	None
Flows to perched water table	None

B. Water Supply Quality

North Kern's groundwater and surface water quality is generally good to excellent. Surface water diverted from the Kern River originates from snowpack in the Sierra Nevada Mountains, in particular the Kings-Kern Divide. The Kern River watershed covers approximately 2,300 square miles of the western slopes of the Sierras towards the southern end of the Central Valley. Kern River water contains low amounts of total dissolved solids (TDS) and minimal or negligible amounts of other water quality constituents that impact agricultural and/or domestic water use. The quality of the underlying groundwater is much more variable.

The District is a member of the Kern River Watershed Coalition Authority which, among other things, implements the Central Valley Regional Water Quality Control Board (CVRWQCB) Irrigated Lands Regulatory Program (ILRP). North Kern also performs water quality monitoring consistent with the ILRP including water quality analyses at the canal inlets for the main supply

arteries. Water quality sensors collect data for temperature, conductivity and pH which are later analyzed by the District.

1. *Surface Water Supply – Kern River (Head of the Beardsley Canal)*

Water is diverted from the Kern River at two points. The principal supply artery, and most upstream diversion, is the Beardsley-Lerdo canal system. Surface water quality monitoring is generally performed at this station, indicative of the water from the Kern River that is diverted into North Kern canals. The diverted water at this location has a TDS of approximately 69 milligrams per liter (mg/l) with low concentrations of other constituents, as seen in Table 36. The quality of the river water is fairly consistent from year to year.

Note that Table 36 presents data from 2012 and not from the representative year used in previous tables and text (2008). This presents a more current depiction of the quality of water diverted from the Kern River.

Table 36. Surface Water Supply Quality – 2012

Parameter	Units	2012
B	mg/l	< 0.1
Ca	mg/l	13
Mg	mg/l	2.4
Na	mg/l	15
K	mg/l	0.94
Cl	mg/l	4.4
SO_4	mg/l	17
NO_3	mg/l	< 2.0
TDS	mg/l	69

2.*Groundwater Supply*

Groundwater in the eastern part of the subbasin is typically sodium bicarbonate type water, while groundwater to the west is characterized by calcium sulfate type water. Criteria set by the DWR define three classes of groundwater, referred to as Class 1 (TDS < 700 ppm), Class 2 (700 ppm < TDS < 2000 ppm), and Class 3 (TDS > 2000 ppm), where Class 1 is the best quality. Most of the historical water quality sampling in the District has been done for agricultural purposes. Based on this sampling, groundwater underlying the District generally meets the Class 1 criteria; however, there are exceptions. The most notable is an area of high salinity extending south from the Shafter Airport to near Seventh Standard Road and Highway 99. Outside of this area, total dissolved solids (TDS) concentrations in the District groundwater typically range from 250 to 500 ppm which is good from an irrigation water perspective.

Of the constituents typically included in an irrigation water quality analysis, nitrate nitrogen (NO_3) is one constituent with concentrations that have, in some cases, exceeded the corresponding primary drinking water maximum contaminant level (MCL) of 10 mg/L. In particular, there are three principal areas where this has occurred:

1) Between Highway 46 and Kimberlina Road.
2) South of Kimberlina Road and east of the Friant-Kern Canal.
3) South of Dresser Avenue, primarily northeast of or near the Friant-Kern Canal.

Full drinking water quality analyses are much more limited in North Kern. With the recently lowered MCL for arsenic of 0.01 mg/L, meeting these standards may be problematic for many public supply wells in the San Joaquin Valley; however, testing to date suggests that arsenic concentrations in groundwater underlying North Kern is typically below the MCL.

3. *Other Water Supplies*

There are no additional water supplies other than those described in this plan, so the characteristics of the District's water supply are captured through monitoring of surface water and groundwater.

4. *Drainage from the Water Supplier's Surface Area*

The District does not provide any drainage facilities, nor does it control or monitor any on-farm subsurface drainage systems Therefore limitations to drainage reuse is not of concern to the District, as shown in Table 37. As noted above, the District does participate in and help facilitate the ILRP in cooperation with the KCWA and the Kern River Watershed Coalition Authority, including participating in a cooperative program to monitor water quality on Poso Creek.

On-farm tailwater drainage within the District's service area is minimal due to the prevalence of low-volume and level-basin irrigation systems. In cases where on-farm tailwater is generated, the water users typically contain it within their property.

Table 37. Drainage Reuse Effects

Analyte	Drainage Reuse Limitations				
	Increased Leaching	Blending Supplies	Restricted Area of Use	Restricted Crops	Other
TDS	N/A	N/A	N/A	N/A	N/A

C. Water Quality Monitoring Practices

1. Source Water

North Kern regularly monitors the quality of surface water diverted from the Kern River to confirm the suitability of this water for agricultural use. The majority of monitoring locations are at main supply diversions from the Kern River. Groundwater is occasionally monitored at district deep well locations, typically in years of heavy use due to low surface water supply. Table 38 provides general information on monitoring of source water quality in the District.

Table 38. Water Quality Monitoring Practices

Water Source	Monitoring Location	Monitoring Practice	Frequency of Analysis
Kern River	Head of the Beardsley	Agricultural Suitability	Monthly
Kern River, Groundwater*	7th Standard, Zachary, Kimberlina, Stiff House	Agricultural Suitability	Monthly

* During wet years all flow at this location may be surface water. During dry years, groundwater is also conveyed past this location with the volume of groundwater inversely proportional to the availability of surface water.

2. Drainage Water

Drainage water is essentially non-existent in the district due to extent of permanent crops. As noted in Table 39, North Kern will conduct monitoring of surface drainage and groundwater as needed to confirm the suitability of this water for reuse.

Table 39. Water Quality Monitoring Programs for Surface/Sub-Surface Drainage

Monitoring Program	Analyses Performed	Frequency of Analysis
Surface and Groundwater	EC and NO_3	As needed

Section V. Water Accounting and Water Supply Reliability

A. Quantifying the Water Supplier's Water Supplies

1. *Agricultural Water Supplier Water Quantities*

Diversions of surface water from the Kern River vary from year to year depending on the weather, the amount of runoff, and operational considerations. The year years of 2013, 2014, and 2015 represent extreme drought conditions. Table 40 a, b, and c summarizes monthly diversions from the Kern River to North Kern delivery canals. Note that these values represent the monthly amount of water arriving within District boundaries after consideration of operational losses which occur outside of the District's service area (which include canal seepage and evaporative losses at Isabella Reservoir).

Table 40.a Surface and other Water Supplies for 2013 (AF)

Source	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Kern River	2,393	8,478	11,836	21,090	27,484	28,889	30,734	22,158	16,199	13,458	6,133	1,039	189,891
Transfers & Exchanges	0	0	0	0	0	0	0	0	0	0	0	0	0
Recycled Water	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**2,393**	**8,478**	**11,836**	**21,090**	**27,484**	**28,889**	**30,734**	**22,158**	**16,199**	**13,458**	**6,133**	**1,039**	**189,891**

Table 40.b Surface and other Water Supplies for 2014 (AF)

Source	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Kern River	4,874	9,539	10,765	17,347	24,215	26,681	30,472	18,291	17,394	14,896	5,317	8,670	188,461
Transfers & Exchanges	0	0	0	0	0	0	0	0	0	0	0	0	0
Recycled Water	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**4,874**	**9,539**	**10,765**	**17,347**	**24,215**	**26,681**	**30,472**	**18,291**	**17,394**	**14,896**	**5,317**	**8,670**	**188,461**

Table 40.c Surface and other Water Supplies for 2015 (AF)

Source	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep*	Oct*	Nov*	Dec*	Sub Total
Kern River	3,258	5,559	12,596	18,677	21,692	23,931	22,943	19,301					127,957
Transfers & Exchanges	0	0	0	0	0	0	0	0					0
Recycled Water	0	0	0	0	0	0	0	0					0
Total	**3,258**	**5,559**	**12,596**	**18,677**	**21,692**	**23,931**	**22,943**	**19,301**					**127,957**

* Data not yet available

Along with water diverted from the Kern River, North Kern and local communities and irrigators pump groundwater from the Kern County Subbasin. North Kern reporting of groundwater pumping includes district-owned wells, about 100 at different locations across the District, and estimates of pumping from privately-owned wells that discharge into District-owned facilities for distribution within the District boundaries. All groundwater pumped by North Kern, and water received through exchanges with neighboring districts, is used to supplement the available surface water supply when it is less than the demand.

Table 41 summarizes the quantity of groundwater pumped by North Kern. This includes the District-owned deep wells, as well as those private wells which are pumped into the District's system for conveyance and delivery.

Table 41.a Groundwater Supplies Summary for 2013 (AF)

Month	District Deep Wells	Non-District Deep Wells[1]	Total[2]
January	0	0	0
February	8,218	0	8,218
March	11,446	292	11,738
April	17,865	2,083	19,948
May	18,613	4,834	23,447
June	19,250	5,282	24,532
July	19,148	5,695	24,843
August	15,786	5,068	20,854
September	12,593	3,606	16,199
October	10,983	2,475	13,458
November	6,022	0	6,022
December	627	0	627
Total	**140,551**	**29,335**	**169,886**

[1] Pumped into North Kern distribution system for irrigation use within the District

[2] Does not include private groundwater pumping not conveyed through district facilities

Table 41.b Groundwater Supplies Summary for 2014 (AF)

Month	District Deep Wells	Non-District Deep Wells[1]	Total[2]
January	4,033	0	4,033
February	9,404	0	9,404
March	8,472	0	8,472
April	12,720	1,787	14,507
May	16,459	6,015	22,474
June	17,823	5,679	23,502
July	17,213	6,633	23,846
August	13,020	5,207	18,227
September	13,020	4,374	17,394
October	13,196	1,700	14,896
November	5,072	30	5,102
December	1,718	0	1,718
Total	**132,150**	**31,425**	**163,575**

[1] Pumped into North Kern distribution system for irrigation use within the District

[2] Does not include private groundwater pumping not conveyed through district facilities

Table 41.c Groundwater Supplies Summary for 2015 (AF)

Month	District Deep Wells	Non-District Deep Wells[1]	Total[2]
January	1,636	0	1,636
February	4,706	26	4,732
March	11,478	337	11,815
April	12,405	6,073	18,478
May	15,503	6,016	21,519
June	15,227	6,770	21,997
July	12,934	7,563	20,497
August	11,665	5,827	17,492
September[3]			
October[3]			
November[3]			
December[3]			
Total	**85,554**	**32,612**	**118,166**

[1] Pumped into North Kern distribution system for irrigation use within the District

[2] Does not include private groundwater pumping not conveyed through district facilities

[3] Data not yet available

2. *Other Water Sources Quantities*

Surface water diverted from the Kern River and groundwater are the two sources of water actively managed by North Kern. Effective precipitation constitutes an uncontrolled source of supply which reduces the applied irrigation water requirement. Because precipitation was so low during 2013, 2014 and 2015, effective precipitation during this period made a negligible contribution to the overall water supply and will not be included in the water balances for these three years.

Table 42. Effective Precipitation Summary (AF)

	2013	2014	2015
Total Annual Effective Precipitation	0	0	0

B. Quantification of Water Uses

Table 43 shows the volume of water delivered through District facilities to North Kern irrigation customers. The volume of water delivered is based on flow measurements at the farm turnouts.

Table 43. Applied Water

	Volume (AF)		
	2013	2014	2015*
District Deliveries to Farm Turnouts	132,233	123,174	91,024

* Values for 2015 represent the months of January-August

Table 44 summarizes water uses within the North Kern service area for 2013, 2014. Because incomplete data are available for 2015, no water balance will be performed for this year. The calculated crop ETc was used in developing the District's water balance (Table 44). The estimate of losses from the canal system is based on balancing measured system inflows and outflows and is recorded in Table 44 as "conveyance seepage and evaporation" (item 4).

Table 44. Quantify Water Use (AF)

Estimated Water Use	2013	2014	2015
Crop Water Use			
1 Crop Water Requirement (ETc only due to drought conditions) (Table 21)	178,965	185,603	NA
2 Leaching (included in item 1) [(a)]	NA	NA	NA
3 Cultural practices [(a)]	NA	NA	NA
Conveyance and Storage System			
4 Conveyance seepage & evaporation (Table 27)	41,173	47,622	NA
5 Conveyance operational outflows [(b)]	NA	NA	NA
6 Reservoir evaporation [(c)]	0	0	0
7 Reservoir seepage [(c)]	0	0	0
Environmental Use			
8 Environmental use – wetlands (Table 24)	0	0	0
9 Environmental use – other (Table 24)	0	0	0
10 Riparian vegetation (Table 24)	0	0	0
11 Recreational use (Table 25)	0	0	0
Municipal and Industrial			
12 Municipal (from Table 26)	0	0	0
13 Industrial (from Table 26)	0	0	0
Outside the District			
14 Transfers or Exchanges out of the service area (from Table 28)	10,873	15,909	0
Conjunctive Use			
15 Groundwater recharge [(d)] (Table 27)	1,029	3,733	0
Other (from Table 29)	NA	NA	NA
Subtotal	232,040	252,807	NA

[(a)] Included in item 1, see Table 21 and preceding text.
[(b)] Operational outflows are directed into the channel of Poso Creek for groundwater recharge.
[(c)] Included in item 4.
[(d)] This amount reflects direct recharge only, i.e., it does not include canal seepage (which is included in item 4) or the deep percolation of applied irrigation water.

Table 45 summarizes the amount of monitored on-farm surface and subsurface drainage water leaving the service area. As discussed earlier, drainage wells and surface drainage systems are not employed by the District.

Table 45. Quantify Water Leaving the District (AF)

Drain Water	2013	2014	2015
Surface drain water leaving district	0	0	0
Subsurface drain water leaving district	0	0	0
Subtotal	0	0	0

Table 46 shows that there are no irrecoverable losses from the District.

Table 46. Irrecoverable Water Losses (AF)

Drain Water	2013	2014	2015
Flows to saline sink	None	None	None
Flows to perched water table	None	None	None
Subtotal	None	None	None

C. Overall Water Budget

Table 47 summarizes the total water supplies available to the North Kern service area. Surface water is the volume of water diverted from the Kern River to the North Kern water system (canals). The groundwater volume includes both North Kern pumping from deep wells and private pumping that is discharged for conveyance into district facilities, but does not include private pumping not conveyed through the North Kern distribution system. As described above, because of the drought conditions, effective rainfall is not

Table 47. Quantify Water Supplies (AF)

Water Supplies	2013	2014	2015**
1 Surface Water (summary total from Table 30)	8,869	22,018	6,788
2 Groundwater (summary total from Table 41)	169,886	163,575	118,116
3 Annual Effective Precipitation (summary total from Table 42)	0	0	0
4 Water purchases	0	0	0
5 Transfers or exchanges into District	11,445	3,106	3,216
Subtotal	189,889	188,699	128,120

* Included in item 1.
** Values for 2015 represent the months of January-August

Table 48 summarizes the water budget for the service area. Because of the uncertainty regarding the lack of accounting for the extent of private pumping in the North Kern water budget, the closure term of the budget represents an approximation of the level of private pumping that occurred in 2013, 2014 and 2015.

Table 48. Budget Summary for 2008 (AF)

Water Accounting	2013	2014	2015*
1 Subtotal of Water Supplies (Table 47)	189,889	188,699	NA
2 Subtotal of Water Uses (Table 44)	244,433	260,476	NA
3 On-farm Drainage Water Leaving Service Area (Table 45)	0	0	0
Closure term attributed to estimated private pumping within North Kern	54,544	71,717	NA

*Values for 2015 represents the months of January-August

Because the District pro-rated allocations to Class 1 lands in 2013, 2014 and 2015 and delivered no surface water to Class 2 lands during these years, the expectation is that the closure term computed for 2013 and 2014 would be substantially higher than the closure term of 35,908 AF computed in the previous Ag Water Management where 2008 was used as a representative year. As Table 49 indicates, the volume of private pumping going directly onto fields without being conveyed through District facilities is estimated to be about 1.5 and 2.0 times the 2008 value in 2013 and 2014, respectively. This increase in private pumping is indicative of the severity of the ongoing drought and of the dependence placed on private wells when North Kern is compelled to pro-rate allocations.

D. Water Supply Reliability

The Kern River is North Kern's principal source of surface water supply and the amount available to the District in any given year is highly variable, ranging from less than 10,000 AF in a "dry" year to nearly 400,000 AF in a "wet" year. Therefore, efficient water management practices and conjunctive management (i.e. the coordinated use of surface water and groundwater sources) are critical. During "dry" years with reduced availability of surface water supplies, the District relies on carryover storage in Isabella Reservoir to the extent available, but also relies heavily on pumped groundwater (derived primarily from previously recharged surface water).

The Poso Creek IRWMP identified water supply reliability as the region's principal water resources concern going forward and identified and prioritized a number of projects to mitigate the anticipated reduction in water supply reliability. Several of these projects have been constructed, are under construction, or will be under construction in the near term. Some examples of improvements to District facilities are illustrated in Section II.

Because North Kern shares a common groundwater basin with other districts in the Poso Creek region, the future reliability of water supplies available to support agriculture in North Kern is closely tied to regional water supply reliability.

Despite the significant success of North Kern's conjunctive use program, as well as water management programs conducted by other districts in the Poso Creek region, significant concerns regarding future regional groundwater conditions persist. These concerns result from reductions of historically available surface water supplies to the region. Specifically, over the last five to ten years supplies of SWP and CVP "Cross Valley Contractors" and "Friant Division" supplies available to the region have been reduced as a result of environmental issues affecting the California Bay-Delta and the "San Joaquin River Settlement". Additionally, over the last several years, Kern River water supplies historically available to the region have also been reduced, and further reductions in Kern River supply could result from proceedings pending before the State Water Resources Control Board.[2] Surface water supply reductions result in increased levels of groundwater pumping with adverse impacts on groundwater levels and conditions.

E. Future Water Supply

North Kern derives nearly all of its surface water from diversions from the Kern River; therefore, future changes in the North Kern water supply will be driven by changes in Kern River hydrology and particularly by the volume, nature and timing of precipitation in the watershed. The discussion presented in Section VI of this plan describes how climate change may affect the hydrology of the Kern River watershed.

[2] In April 2010, the State Board removed the Kern River from the "fully appropriated stream" list, indicating their intention to process several pending "applications for appropriation" – including an application filed by North Kern.

In addition to variations in the District's Kern River supplies associated with hydrology, the District is faced with serious threats to its historical Kern River supplies through projects and actions proposed by the City of Bakersfield and the Kern Delta Water District. If implemented, these projects would result in a significant reallocation of Kern River supplies away from North Kern and toward the City and/or Kern Delta. Given North Kern's heavy dependence on Kern River supplies, such a reallocation would result in a corresponding increase in groundwater pumping which would have substantial adverse impacts on North Kern's water supply balance.

To the extent portions of North Kern's historical Kern River supplies are reduced as described above, less surface water would be available to offset groundwater pumping and for direct groundwater recharge. Combined with other reductions in the availability of regional surface water supplies, recharge to the underlying groundwater reservoir would be significantly reduced while pumping would increase to offset the loss of surface water supplies.

While changes in watershed hydrology may reduce the reliability of surface water from the Kern River watershed in ways the District cannot control, the District will adapt its water management practices to respond to these changes to the extent practicable. This may involve adaptive management strategies for water consumers or the expansion of water banking transfers and exchanges, which are addressed in the discussion that follows.

1. Expansion of Water Banking, Transfers, and Exchanges

In response to potential losses of historical Kern River supplies and resulting adverse impacts to groundwater, North Kern, through the Poso Creek IRWMP, has identified and constructed several major capital improvements that enhance the District's capabilities to conjunctively use its Kern River supplies, other surface supplies available to the District, and, through water banking, transfer, and exchange agreements, surface supplies available to other agencies in the Poso Creek region, Kern County, and along the Friant-Kern Canal.

The District's primary objective in developing additional banking, transfer and exchange programs is to maximize deliveries of surface water supplies into the District to offset potential losses in historical supplies which support groundwater levels underlying the District and thereby sustain future agricultural operations. To accomplish this objective, it is in the District's interest to consider diverse water banking, transfer, and exchange programs with Poso Creek RWMG agencies, other agencies in Kern County, and agencies within the Friant-Kern Canal service area.

<u>Existing Water Banking and Exchange Programs</u>

North Kern has implemented water banking and exchange programs to optimize management of water supplies, increase the total volume of water brought into the District, and develop facilities to improve future water management. These programs include numerous "bucket-for-bucket" exchanges, one-time "low priority/mutually agreeable" banking programs, and several longer-term higher priority programs. All of the District banking programs include provisions whereby 10 percent of the water banked is "left behind" (not recovered) to support groundwater levels in the

District. Furthermore, development of the higher priority programs included construction of facilities (e.g., wells, turnouts, etc.) that benefit both the banker and the District.

Expansion of Water Banking and Exchange Programs

As discussed previously, through the Poso Creek IRWMP, North Kern identified several capital projects to improve the District's water management capabilities in order to partially compensate for losses in water supply reliability. More specifically, the District identified projects focused on significant conveyance improvements that allow the North Kern to more fully utilize its existing water management assets, particularly its facilities to recharge water in wetter years.

Many of "North Kern's" projects identified in the Poso Creek IRWMP have been completed or are in the process of being completed, and the District has effectively established additional water banking and exchange "capacity" particularly with regard to water supplies available from the CVP Friant Division and the SWP. For the reasons previously described, North Kern intends to develop additional banking and exchange programs to more fully utilize its recharge capabilities to support the viability of continued agricultural operations in the District. These programs will increase the District's overall water supplies since a minimum of 10 percent (and as much as 50 percent or more) of additional water recharged in the District will not be recovered by bankers and will thereby support groundwater conditions underlying the District.

District Water Banking and Exchange Capacity

As noted previously, the District has substantial recharge and recovery assets/capabilities. The use of most of these assets is prioritized to manage the District's highly variable surface water supplies for the direct benefit of District landowners (primarily agricultural operators). However, during certain periods, substantial portions of these assets are available to support banking and exchange programs with third parties.

- Recharge Capacity

  In addition to substantial capacity to recharge water "in-lieu" of groundwater pumping by the District and District landowners, North Kern operates about 1,500 acres of recharge ponds with a capacity to recharge up to 25,000 AF of water per month and with a maximum annual recharge capacity of 300,000 AF. The District directly recharges significant quantities of water in about three of ten years, with an average of 150,000 AF recharged in its spreading ponds in these years. Although the District has an additional 150,000 AF of physical recharge capacity available in these wetter years, based on the typical timing for the availability of wet year supplies from the Friant and SWP systems, it is not reasonable to assume additional water would be available for recharge during the entire year. However, through expanded water banking programs, additional recharge on the order of 75,000 AF is possible in wet years, with lesser quantities recharged in moderately wet years. These additional recharge volumes would increase the District's water supplies by up to 15,000 AF per year on average based on a "2 for 1" type unbalanced banking program

(i.e., 50 percent of water recharged is left behind). Finally, should the District lose a portion of its historical supplies, additional recharge capacity would become available for third-party banking and exchange programs.

- Recovery Capacity and Timing

  A portion of additional water recharged through expanded banking programs (typically 50 percent to 90 percent) must be recovered for the banking entity. North Kern operates a system of 100 wells with an approximate instantaneous capacity of 350 cfs. This capacity is approximately equal to peak irrigation season demands for Class 1 lands.[3] Unused District well capacity is available for use by Class 2 lands in the District and to return water to District banking and exchange partners.

  If the District's wells were operated continuously over a 10-month period, total production could be on the order of 200,000 AF. Since the maximum District Class 1 and 2 demands met from District wells is approximately 150,000 AF, about 50,000 AF per year of well capacity would be available to return previously banked water to banking partners. Approximately 15,000 AF per year of this capacity is committed to the District's existing banking programs.

  As noted above, the District's instantaneous well recovery capacity roughly matches its peak irrigation season obligation to Class 1 lands. Consequently, under very dry conditions when the District has limited surface water storage available in Lake Isabella, little well capacity is available to return water to banking partners during the peak irrigation months (approximately May through August). To the extent North Kern's banking partners require recovery of previously banked water during this period, additional wells would be necessary. Importantly, these additional "peaking" wells will not increase the total volume of previously banked water recovered from the District, but will simply allow the timing of water recovery to match the banking partners' needs.

2.Effects of Expanded Water Banking and Exchange Programs

As previously discussed, in 2012 North Kern and other members of the Poso Creek RWMG completed CEQA and NEPA environmental documentation for groundwater banking, transfer, and exchange programs among the RWMG. These programs envision the expansion of water management programs among the RWMG to assist in reducing the adverse impacts on regional groundwater conditions (and agricultural operations) associated with losses of surface water supplies. Since these programs are intended to reduce the adverse impacts of regional water supply losses by bringing additional wetter year supplies into the region, analyses concluded that the programs would be environmentally beneficial compared with the "no project" alternative.

[3] The District supplies nearly all of the water required to meet the irrigation water requirements of the Class 1 service area.

To support the continued viability of agricultural operations in the District, through this AWMP North Kern is proposing to broaden water banking and exchange programs previously reviewed in the Poso Creek environmental documents to include other agencies in Kern County with State and Federal water supply contracts as well as CVP "Friant Division" contractors located outside of Kern County. Broadening these programs outside the Poso Creek RWMG would provide the District with additional opportunities to supplement water supplies available for agricultural operations in the District. Since these programs would increase District surface water supplies they would be expected to incrementally improve groundwater conditions.

The secondary source of water supply for the District is groundwater. Although not immediately affected by changes in surface water hydrology, local groundwater is derived from surface water in that groundwater recharge is driven primarily by excess surface water (i.e. beyond irrigation requirements) during wet years and percolation of applied irrigation water.

Section VI. Analysis of Effect of Climate Change

A. Effects of Climate Change on Water Demand

Several investigations of the possible effects of climate change to surface and groundwater sources in the Central Valley have been conducted by the USGS California Water Science Center (CAWSC). Two of these studies (USGS, 2009; Water Resources Research, 2012) report the results of modeling efforts to quantify the hydrological effects of warming climate scenarios, including a model of runoff and recharge from the watersheds of the Sierra Nevada Mountains and a model of agricultural water-deliveries and use in the Central Valley. The warming scenarios were based on a commonly accepted projection of 21st century climate from the GFDL CM2.1 (Geophysical Fluid Dynamics Lab Climate Model 2.1) global climate model, responding to assumptions of rapidly increasing greenhouse-gas emissions (GHGs). The scenarios predict California's climate will become warmer (+2 to +4° C) and drier (10-15 percent) relative to historical conditions. The California Energy Commission's Cal-Adapt Web site predicts temperature differences in the North Kern service area from a baseline historical average (1961 to 1990) to a projected average (2070 to 2090). The projection shows an increase in annual average temperature of about 3.4°F to 6.1°F under low carbon and high carbon emission scenarios, respectively. Based on these projections, the CAWSC reports suggest that climate change could result in the following types of water resources impacts:

- Declines in total streamflow (up to 40 percent) leading to reduced surface water deliveries for agriculture and riparian habitat.
- Increased demands for irrigation water, which combined with reduced surface water deliveries, would be met by increased groundwater extraction. This in turn, would be likely to lead to the following impacts:
    - Increased streamflow infiltration;
    - Reduced base flow;
    - Reduced groundwater outflows;
    - Increased depths to groundwater, and
    - Increased land subsidence.

These combined effects have the potential to shift the District from a surface water dominated system, relying on groundwater to supplement years when surface supplies are inadequate to meet demand, to a groundwater dominated system (Water Resources Research, 2012). Increased depths to groundwater will also result in increased power and energy requirements for groundwater pumping (which has its own greenhouse gas implications) and which in turn increases the cost per acre-foot of water delivered to the farmers. According to a third CAWSC study (Proceedings of the Eighth International Symposium on Land Subsidence, 2010), Kern County may experience an extreme amount of land subsidence due to the increased demand on groundwater that may result from climate change.

Climate change is expected to increase both daytime and nighttime temperatures in the Central Valley resulting in lengthening of the growing season. Cal-Adapt predicts that the number of days

exceeding the "extreme heat threshold" of 104°F for the North Kern service area will increase from a historical baseline average of 4 extreme heat days (1961-1990) to a projected average of 21 extreme heat days (2070-2090). Using the same baseline and projection years, the number of nights exceeding the "warm night threshold" of 73°F is expected to increase from 4 nights to about 21 nights. This general increase in temperatures coupled with greater variability and unpredictability in precipitation (depicted in decadal average projections by Cal-Adapt) is expected to lead to increases in evapotranspiration resulting from warmer seasons, thereby creating an increase in demand for irrigation water and an increase in the year-to-year variability of demand.

Temperate fruit and nut trees such as almonds, pistachios, and apples require adequate winter chill to produce economically viable yields. As explained above, the number of warm nights will increase, and therefore the number of winter chill hours will decrease, causing adverse effects on the yield of these orchard crops which currently account for approximately 77 percent of total crops in North Kern. Today, the number of hours of winter chill in the San Joaquin Valley has shrunk from about 1,500 a few decades ago, to approximately 1,000 to 1,200 hours (PLoS ONE, 2009). By the end of the century, the adequate winter chill needed for almonds, pistachios and apples is predicted to disappear.

B. Effects of Climate Change on Agriculture's Water Supply

The future of North Kern's water supply will be driven largely by changes in hydrology and particularly by changes in the volume, nature, and timing of precipitation in the Sierra Nevada Mountains, which affects the Kern River watershed, the District's main source of surface water supply.

The DWR examined 12 future climate scenarios in a report titled 'Using Future Climate Projections to Support Water Resources Decision Making in California' (Chung et al. 2009) to assess the future water supply reliability of the SWP and CVP due to climate change. The 12 statewide scenarios represent projections from six Global Climate Models for higher and lower GHG emissions while taking into account potential Delta salinity intrusion due to sea level rise. For all climate projections studied, the reliability, and thus volume of water delivered, by the SWP and CVP water supply systems is expected to be reduced. For instance, average annual SWP exports under future climate scenarios from 2013 to 2033 conditions are projected to decrease 5.6 percent (DWR, 2013). Current long-term reliability predictions of SWP Table A deliveries, modeled under historic (1921-2003) precipitation and runoff patterns and accounting for future conditions such as land use and climate change, are expected to decrease 6 percent from the historic average (DWR, 2013).

This assumption of reduced reliability can be extended to Kern River water supplies (the primary source of surface water for the District) as the reliability of the Kern River will be principally affected by the amount and timing of precipitation and snowfall. Snowpack in the Sierra Nevada Mountains, which serve as the source of runoff to the Kern River, is projected to decrease, as predicted by Cal-adapt. This results from a shift toward more rain and less snow, causing snow to melt earlier in the year which reduces the availability of water during the summer.

Local communities, rural residences, and businesses rely on groundwater from the Kern County Subbasin as their main supply. North Kern only pumps groundwater when surface supplies are inadequate to satisfy demand (e.g. during dry years). Currently, North Kern recharges groundwater during wet years in spreading ponds and unlined canals across the District. The combination of groundwater use in dry years and recharge in wet years has provided a balance in water supply. Should climate change result in a reduction in water available from the Kern River, this may prompt North Kern to increase the frequency of groundwater pumping which would lead to a decrease in groundwater storage without the necessary means of replenishing the depleted storage, impacting all groundwater users.

C. Regional Vulnerability Assessment

The Modified IRWMP Climate Change Vulnerability Assessments Matrix below provides an assessment of the regional vulnerability to the potential climate change impacts, using the 'Vulnerability Assessment Checklist' found in the 'Climate Change Handbook for Regional Water Planning' (DWR, 2011). As previously mentioned, North Kern Water Storage District is a member of the Poso Creek Regional Water Management Group (RWMG). This checklist is a modified version of the checklist provided in the 2014 Poso Creek IRWM Plan Update, tailoring information more specifically to North Kern. The checklist provides a further evaluation of the effects of climate change on regional water demands and supplies, as well as water quality, flooding events, environmental and ecosystems, and hydropower systems.

Vulnerability ratings, identified in the matrix, are based on presumed level of impact to regional conditions based on climate change considerations given in the checklist. For this assessment, the following rating system was used:

- "High" rating: expected impacts of climate change on listed item pose a severe risk to regional or District operations in the future, including, impacts that greatly inhibit the ability to deliver water supplies to users within the region or District.
- "Medium" rating: expected impacts of climate change on listed item pose a moderate risk to regional or District operations in the future, including, impacts that require management and planning changes in order to mitigate adverse effects.
- "Low" rating: expected impacts of climate change on listed item pose a low risk to regional or District operations in the future, including, impacts that may be mitigated through relatively simple planning or management changes but are not critical to regional or District operations.
- "Not Applicable" (N/A) to the region or District, or impacts that will not affect regional operations.

Modified IRWMP Climate Change Vulnerability Assessments Matrix

List No.[1]	Checklist Item	Regional Conditions	Vul. Rating
I. Water Demand Assessment			
I.A	Are there major industries that require cooling/process water in your planning region?	Currently, requirements for cooling/process water are insignificant in North Kern.	Low
I.B	Does water use vary by more than 50% seasonally in parts of your region?	Yes. Irrigated agriculture is the predominant use of water for the District. While annual water demands are fairly consistent from year to year, there is considerable seasonal variation, with the highest demands occurring in the summer and lowest demands in the winter.	Medium
I.C	Are crops grown in your region climate-sensitive? Would shifts in daily heat patterns, such as long heat lingers before night-time cooling, be prohibitive for some crops?	All crops grown in North Kern are climate sensitive to some extent. Modest shifts in heating and cooling patterns are likely to affect crop yield; however, significant shifts could affect the viability of continuing to grow certain crops. As explained previously, the number of extreme heat days and warm nights are expected to increase in the area, which is likely to affect the quality and yield of crops.	Medium
I.D	Do groundwater supplies in your region lack resiliency after drought years?	Groundwater levels will decline with a period of dry years. The resiliency of the District's groundwater resource is directly related to the reliability of surface water supplies, primarily the availability of water from the Kern River since groundwater is used to meet demands that are not fulfilled by surface water supplies. To this extent, "resiliency" has been reduced.	High
I.E	Are water use curtailment measures effective in your region?	There has been a trend in North Kern toward permanent crops which limits the ability to curtail water use in any given year by fallowing. Although North Kern has not initiated permanent demand reduction by purchasing and retiring land, some neighboring districts have instituted this practice.	Medium
I.F	Are some in-stream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?	There are no in-stream flow requirements within the North Kern service area. However, the surface water supplies available to the District may be affected by such requirements, particularly on the Kern River downstream of Isabella Reservoir.	Low

[1] Numbers based on checklist shown in Section 4.3 of the 'Climate Change Handbook for Regional Water Planning' (DWR, 2011).

Modified IRWMP Climate Change Vulnerability Assessments Matrix

List No.	Checklist Item	Regional Conditions	Vul. Rating
II. Water Supply Assessment			
II.A	Does a portion of the water supply in your region come from snowmelt?	Yes. All surface water inflows are primarily a function of snowmelt runoff; however, the snowmelt does not occur within the IRWM Region[2].	High
II.B	Does part of your region rely on water diverted from the Delta, imported from the Colorado River, or imported from other climate-sensitive systems outside your region?	Yes. The District's primary source of supply is the Kern River. The Kern River has its watershed in the Sierra Nevada Mountains, which have been identified as climate-sensitive. North Kern also has to capability to participate in exchanges for water diverted from the Delta through the SWP and for water from the Friant Unit of the CVP.	High
II.C	Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?	No.	N/A
II.D	Would your region have difficulty in storing carryover surpluses from year to year?	Carryover of Kern River water in Isabella Reservoir is limited by the Reservoir's flood control purpose, USACE operating rules and restrictions now in place of reservoir levels due to seismic concerns. There is limited carryover available for SWP water in San Luis Reservoir, and carryover of CVP water in Millerton Reservoir is essentially non-existent. The most effective means of local regulation is through the use of banking activities. The District has been actively working to optimize the use of its water to both recharge and recover water supplies through its banking program within the Region and other areas of Kern County.	High
II.E	Has your region faced a drought in the past during which it failed to meet local water demands?	In the past three years, the drought resulted in an insufficient availability of District water supplies to meet local water demands. The District therefore prorated deliveries to Class 1 farmers and was not able to deliver any water to Class 2 farmers. The farmers, however, were able to meet their necessary demands via their privately-owned wells.	High
II.F	Does your region have invasive species management issues at your facilities, along conveyance structure, or in habitat areas?	Invasive species issues are minimal in North Kern, primarily consisting of algae growth in canals during times of low conveyance with low velocities or ponded water conditions.	Low

[2] For the entirety of this checklist, "Region" refers to the Poso Creek IRWM Region.

Modified IRWMP Climate Change Vulnerability Assessments Matrix

List No.	Checklist Item	Regional Conditions	Vul. Rating
III. Water Quality Assessment			
III.A	Are increased wildfires a threat in your region? If so, does your region include reservoirs with fire-susceptible vegetation nearby which could pose a water quality concern from increased erosion?	Wildfires are not a threat within North Kern; however, wildfires are a threat in the Kern River watershed. Wildfires and subsequent erosion upstream of Isabella Reservoir would likely be mitigated by detention in the reservoir. Wildfires and subsequent erosion downstream of the reservoir would have greater potential to affect the irrigation operations in the Region, particularly those relying on micro-irrigation methods. Depending on timing, direct recharge of groundwater in spreading ponds could also be adversely impacted. There would be no threat to M&I uses within North Kern since all such uses are met with groundwater.	Low
III.B	Does part of your region rely on surface water bodies with current or recurrent water quality issues related to eutrophication, such as low dissolved oxygen or algal blooms? Are there other water quality constituents potentially exacerbated by climate change?	Some local and regional canals seasonally have algae blooms that require maintenance, including minimal treatment or cleanup efforts. Algae blooms may become more frequent with climate change as a result of increased temperatures in North Kern and less water moving through the canals.	Low
III.C	Are seasonal flows decreasing for some water-bodies in your region? If so, are the reduced low flows limiting the water-bodies' assimilative capacity?	Poso Creek is the only "water body" in the Region with seasonal flows; however, whether seasonal flows are decreasing is unknown.	N/A
III.D	Are there beneficial uses designated for some water bodies in your region that cannot always be met due to water quality issues?	No.	N/A
III.E	Does part of your region currently observe water quality shifts during rain events that impact treatment facility operation?	No. M&I uses in the District are supplied by groundwater pumping and surface water supplies are not treated for irrigation use.	N/A

Modified IRWMP Climate Change Vulnerability Assessments Matrix

List No.	Checklist Item	Regional Conditions	Vul. Rating
IV. Sea Level Rise Assessment			
IV.A	Has coastal erosion already been observed in your region?	The North Kern Water Storage District is located in the Southern San Joaquin Valley, and the concerns regarding coastal regions are not applicable.	N/A
IV.B	Are there coastal structures, such as levees or breakwaters, in your region?		N/A
IV.C	Is there significant coastal infrastructure, such as residences, recreation, water and wastewater treatment, tourism, and transportation at less than six feet above mean sea level in your region?		N/A
IV.D	Are there climate-sensitive low-lying coastal habitats in your region?		N/A
IV.E	Are there areas in your region that currently flood during high tides or storm surges?		N/A
IV.F	Do tidal gauges along the coastal parts of your region show an increase over the past several decades?		N/A
V. Flooding Assessment			
V.A	Does critical infrastructure in your region lie within the 200-year floodplain?	Although flows in Poso Creek are infrequent, flooding of adjacent lands has occurred from time to time. The Poso Creek floodplain traverses the northern portion of the Region from east to west. Most of the area within the floodplain consists of irrigated agriculture; however, a reach of State Highway 99 and a portion of the City of McFarland are also included. Highway 99 is a major north-south transportation corridor, the disruption of which would have public safety, as well as economic, implications.	Medium
V.B	Does part of your region lie within the Sacramento-San Joaquin Drainage District?	No.	N/A

Modified IRWMP Climate Change Vulnerability Assessments Matrix

List No.	Checklist Item	Regional Conditions	Vul. Rating
V. Flooding Assessment (cont.)			
V.C	Does aging critical flood protection infrastructure exist in your region?	No. Storage restrictions have been in place on Isabella Reservoir since 2006 and will remain in place until dam safety concerns are adequately addressed. While Isabella Reservoir does not present a flood control issue for the Region, it is a water supply issue, inasmuch as it regulates the delivery of Kern River water to the Region. The District has actively encouraged USACE to expedite the "fix" for Isabella Dam deficiencies.	Medium
V.D	Have flood control facilities (such as impoundment structures) been insufficient in the past?	While there are not any flood control impoundment structures in North Kern, investigations have been conducted in the past with regard to the feasibility of constructing a dam on Poso Creek (which has yet to pass the benefit-cost test).	Low
V.E	Are wildfires a concern in parts of your region?	As noted in III.A (above), wildfires are not a concern in North Kern; however, wildfires are a concern in the watersheds that provide the District with its surface water supplies.	Low
VI. Ecosystem and Habitat Vulnerability Assessment			
VI.A	Does your region include inland or coastal aquatic habitats vulnerable to erosion and sedimentation issues?	Coastal aquatic habitats are not applicable to North Kern. The potential for erosion or sedimentation exists along the channel of Poso Creek. Significant flow in Poso Creek is very infrequent.	Low
VI.B	Does your region include estuarine habitats which rely on seasonal freshwater flow patterns?	No.	Low
VI.C	Do climate-sensitive fauna or flora populations live in your region?	No.	Low
VI.D	Do endangered or threatened species exist in your region? Are changes in species distribution already being observed in parts of your region?	Yes. They consist of San Joaquin Kit Fox, Tipton Kangaroo Rat, and San Joaquin Wooly Threads. Whether or not changes in species distribution have occurred is unknown. The District supports the management efforts for endangered and threatened species led by the Tulare Basin Wildlife Partners, who actively monitor species distribution and habitat changes in the Region.	Medium

Modified IRWMP Climate Change Vulnerability Assessments Matrix

List No.	Checklist Item	Regional Conditions	Vul. Rating
VI. Ecosystem and Habitat Vulnerability Assessment (cont.)			
VI.E	Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?	Recreational water use in the Region is limited to duck clubs which rely on seasonal flooding of ponds which have been developed for that purpose.	Low
VI.F	Are there rivers in your region with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?	No.	N/A
VI.G	Do estuaries, coastal dunes, wetlands, marshes, or exposed beaches exist in your region? If so, are coastal storms possible/frequent in your region?	No.	N/A
VI.H	Does your region include one or more of the habitats described in the Endangered Species Coalition's Top 10 habitats vulnerable to climate change?	No. The Central Valley of California, where the District is located, is not listed as one of the 'Top 10' habitats vulnerable to Climate Change according to the 'It's Getting Hot Out There: Top 10 Places to Save for Endangered Species in a Warming World' Report (Endangered Species Coalition, 2010).	Low
VI.I	Are there areas of fragmented estuarine, aquatic, or wetland wildlife habitat within your region? Are there movement corridors for species to naturally migrate? Is there infrastructure projects planned that might preclude species movement?	The Region includes the channel of Poso Creek. Poso Creek traverses the Region from east to west and connects with the Refuge. The channel of Poso Creek provides an east-west movement corridor for wildlife, which extends from the foothills in the east to the trough of the San Joaquin Valley in the west. Flow in this reach of Poso Creek is infrequent. While infrastructure projects are planned which involve Poso Creek, they would not adversely affect the use of Poso Creek as a wildlife movement corridor. In particular, maintenance of the channel's flow carrying capacity is compatible with its use as a movement corridor. The RWMG has planned some projects and programs to improve existing facilities while not changing the movement corridors.	Low

Modified IRWMP Climate Change Vulnerability Assessments Matrix

List No.	Checklist Item	Regional Conditions	Vul. Rating
VII. Hydropower Assessment			
VII.A	Is hydropower a source of electricity in your region?	PG&E and SCE provide electrical service to North Kern, and their sources of electricity are many and varied. As of 2012, SCE's electrical generation portfolio contained less than 10% hydropower (which includes the 12-MW Borel Powerhouse at Lake Isabella), while PG&E's was a little more than 10%. In both cases, the hydrogenation takes place outside of the Region. Hydropower generation within the Region is very minor and is incidental to the operation of irrigation conveyance and distribution facilities.	Low
VII.B	Are energy needs in your region expected to increase in the future? If so, are there future plans for hydropower generation facilities or conditions for hydropower generation in your region?	It is reasonable to expect that energy needs for the District will increase in the future as a result of several factors. These include changes in land use from agricultural to urban uses; increases in groundwater pumping resulting from reductions in historically available surface water supplies that are anticipated as a result of climate-induced changes in hydrology and increases in groundwater pumping to satisfy higher ET requirements for irrigated agriculture. A feasibility study is currently underway by USACE, SCE and the Federal Energy Regulatory Commission for decommissioning the Borel Powerhouse in response to safety changes at the Isabella Dam. Shutting down the plant, instead of re-aligning the Borel Canal conduit, may reduce construction costs as well as environmental impacts from constructing a new canal. If the new canal is constructed, the Borel Powerhouse would remain reliant on the availability of water in the Lake Isabella dam from which SCE receives the water for Borel. Other future plans for hydropower generation facilities in the Region are unknown, however any such plans would be limited to small hydropower facilities which would be incidental to the operation of irrigation conveyance and distribution systems. In this regard, based on currently available technology, solar generation is more likely than small hydropower.	Low

The score sheet below summarizes the results of the vulnerability assessment presented in the matrix. The seven sections of the assessment are listed in order of vulnerability, from highest to lowest.

IRWMP Climate Change Vulnerability Assessment Score-Sheet

Section No. [1]	Section Title	Vulnerability Rating			
		High	Medium	Low	N/A
II	Water Supply Assessment	4	0	1	1
I	Water Demand Assessment	1	3	2	0
V	Flooding Assessment	0	2	2	1
VI	Ecosystem and Habitat Vulnerability Assessment	0	1	4	2
III	Water Quality Assessment	0	0	2	3
VII	Hydropower Reliance Assessment	0	0	3	1
IV	Sea Level Rise Assessment	0	0	0	6
Total Climate Change Assessment Score		**5**	**6**	**14**	**14**

[1] Numbers based on checklist shown in Section 4.3 of the 'Climate Change Handbook for Regional Water Planning' (DWR, 2011).

Based on the vulnerability assessment summarized in the score sheet, "Water Supply" and "Water Demand" appear to have the highest level of vulnerability to potential Climate Change impacts to the District. This confirms the projected outlook for the District presented in Sections A and B, respectively. The remaining sections assessed in the matrix, while important, do not pose as much of a projected risk to regional water resources operations or management efforts.

D. Response to Effects of Climate Change

North Kern is committed to monitoring key indicators of climate change that affect the hydrology of the Kern River watershed and growing conditions in the District's service area. The goal of the District is to utilize the available surface water and groundwater resources as effectively as possible in meeting the requirements of the District's water users. The following sections describe ways in which the District, as well as the RWMG, are responding to the above mentioned effects of climate change.

Water Supply

As previously noted, any reduction in surface water supplies can be expected to increase the use of energy in North Kern due to increased groundwater pumping, which would result in an assumed increase in GHG emissions at the source of the increased generation of electrical energy. The District is aware of the reduced reliability of its surface water supply and the increased energy associated with groundwater pumping. Twelve wells are being installed this year to replace pre-1950 wells, return to pre-2010 capacity, and improve energy efficiency.

Water supply reliability will be further enhanced by the "North Kern Drought Relief Project" which involves the construction of a 14,900 linear-foot pipeline connecting the North Kern service area to an existing California Resources Corporation (CRC) pipeline. The pipeline will convey up to 21,299 AF/year

of oil-field produced water from the Kern Front oil field to the North Kern service area. These annual deliveries will provide a new water supply for agricultural irrigation, with the added benefit of reducing energy consumption and GHG emissions as a result of the produced water being gravity fed to the Lerdo Canal, ultimately reducing groundwater extractions.

Water Demand

Farmers are already seeing the effects of climate change on the crops and are altering their practices to accommodate effects like increased water demands and reduced winter chill. Some farmers are beginning to overcome decreasing winter chill by planting trees closer together and using new varieties. Another recent practice adapted by farmers in the area involves reducing the volume of irrigation water applied to pistachios to instead have sufficient water for almonds. While this practice will sacrifice production of pistachios over the short term, pistachios have the ability to recover from drought stress, while almonds, once stressed, may not rebound to their previous levels of production, and therefore require more fundamental maintenance.

Studies are now underway to prepare farmers for the likely impacts of climate change. Such efforts include breeding varieties of fruit trees which can withstand the decreased water chill hours, developing tools to aid crops in coping with insufficient chill, and researching the temperature responses of particular orchard crops to better understand potential long-term effects. However, some solutions such as replanting orchards with altered crop varieties or the installation of aiding tools may not be feasible for many irrigators.

Poso Creek RWMG

The 2014 Poso Creek IRWMP Update provided the following strategies which were deemed the most practical and effective for climate change preparation in the Region, while also providing measurable benefits to current water management practices:

- Expand in-lieu service areas in the Region, by expanding water conveyance to lands which are currently dependent solely on groundwater supplies (i.e., reduce dependency on groundwater basin during “wetter” periods).
- Improve agricultural and urban water use efficiency.
- Expand groundwater recharge and banking efforts through expansion of spreading pond acreage to capture surplus wet-period water supplies and thereby help to maintain groundwater levels.
- Encourage changes in regional crop varieties that are more resistant to climate change.

The RWMG emphasizes these strategies not only in response to climate change, but also to cope with significant surface water supply deficiencies that already face the Region. Because North Kern is primarily reliant on the Kern River, the impacts of climate change on the hydrology of the Kern River will have an immediate impact on North Kern, whereas the implications of climate change and regulatory restrictions on Delta water supplies will be felt more acutely by many of North Kern’s

neighboring districts. In all instances, the major tool North Kern and other members of the RMWG have to respond to increasingly tenuous supplies of surface water has been and will continue to be conjunctive management of both surface water and groundwater resources. Management practices will therefore have to be adaptive in nature.

Section VII. Water Use Efficiency Information

A. EWMP Implementation and Reporting

The California Water Code sets forth specific Efficient Water Management Practices (EWMPs) for agriculture; two of which are identified as "critical" and 14 of which are to be implemented if they are "locally cost effective and technically feasible". The latter are referred to as "conditionally required" in DWR's *2015 Guidebook*. Each of the 16 EWMPs is listed in the *2015 Guidebook* and in Section 1.2 of this plan. Table 49 summarizes the status of implementation of EWMPs at North Kern. The two "critical" EWMPs are listed first and are followed by the 14 "conditionally required" EWMPs.

As described throughout this report, North Kern takes a programmatic approach to water management and has implemented a number of initiatives to conserve water, protect water quality and maintain groundwater elevations throughout its service area that combine features of individual EWMPs.

Table 50 provides an estimate of the improvements in efficiency that have been achieved in North Kern since the issuance of the District's last AgWMP. Table 51 identifies an implementation schedule, finance plan and budget allocation of EWMPs implemented by the District. Table 52 describes EWMPs that are not planned for implementation because they are either technically infeasible or not locally cost effective.

North Kern's 2016 capital improvements budget includes $230,000 for direct capital expenditures including projects that are partially funded by grant revenues. The description of implemented EWMPs presented here includes projects described in Section 1.A. of this plan. It should be noted that North Kern has chosen to implement some EWMPs that, when viewed in isolation, are not locally cost effective water conservation measures but that contribute to the District's overall water management strategy.

Table 49. Report of EWMPs

Water Code Reference	EWMP	Current Status	Status of EWMP
10608.48.b(1)	Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10 and to implement paragraph (2) of the legislation.	Proceeding with implementation	North Kern currently measures, monitors, and controls flows throughout its water delivery system. The District also measures deliveries in order to bill water users accurately for the volume of water used. The District is committed to comply with the requirements of SBx7-7 by verifying the accuracy of measurement of irrigation water deliveries using the methodology described in Section VIII of this report.
10608.48.b(2)	Adopt a pricing structure for water customers based at least in part on quantity delivered.	Currently Implemented	North Kern charges water users based on the volume of water delivered.
10608.48.c(1)	Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.	Not Applicable	North Kern facilitates and considers requests for alternative land uses, but does not actively search for alternate land use possibilities.
10608.48.c(2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.	Currently Implemented	The District considers requests for use of recycled water. One potential area of interest is use of water originating from oilfields. In 2015, the District brought online the *North Kern Drought Response Project* which brings 21,200 AF/year of produced water from the Kern Front Oil Field for application to irrigated lands and for recharge in the District's Rosedale spreading pond.
10608.48.c(3)	Facilitate financing of capital improvements for on-farm irrigation systems.	Currently Implemented	The District does not provide direct financial support for capital improvements to on-farm systems. However, North Kern does assist in implementation of on-farm improvements by agreeing to provide a fixed level of financial support to irrigators and then reducing water charges according to a schedule that will satisfy the commitment of support.
10608.48.c(4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) more efficient water use at the farm level; (B) conjunctive use of groundwater; (C) appropriate increase of groundwater recharge; (D) reduction in problem drainage; (E) improve management of environmental resources; (F) effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	Currently Implemented	North Kern's Board of Directors annually establishes a water rate that is the basis for volumetric pricing of delivered water. Water is priced higher in dry years when the District incurs significant pumping costs and lower in wet years with little or no district pumping. Wet-year pricing is set at levels below the costs for landowners to pump their private wells, thereby encouraging the conjunctive use of available surface water *in lieu* of groundwater pumping. During 2013, 2014 and 2015 water allocations were proportionately reduced (pro-rated) due to the effect of the drought on water supplies from the Kern River.
10608.48.c(5)	Expand line or pipe distribution system, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage.	Currently Implemented	North Kern has two main conveyance canals which are capable of diverting water from the River and delivering it within the service area. One of these canals is lined between the river and North Kern and is the principal conveyance facility. Within North Kern, seepage from canals and regulatory reservoirs is recoverable as pumped groundwater. North Kern has 20 miles of lined canal within the District which were constructed specifically for dry-year operations in order to reduce canal seepage. Some of the unlined distribution canals have been replaced with buried pipelines. The District has lined portions of the Calloway Canal with bentonite to reduce seepage potential, specifically in areas that were known to exhibit relatively high rates of seepage. The preponderance of the District's distribution system, however, remains unlined, adding to the District's recharge capability during wet years.
10608.48.c(6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits.	Currently Implemented	To the extent that deliveries are being made from storage in Isabella Reservoir the District's ability to be flexible in water order times are limited. The District, however, does strive to add flexibility to water ordering and delivery wherever possible. This includes the use of in-system storage reservoirs to help regulate mismatches between water supply and demand. In addition, District policy allows water transfers between water users within the boundaries of the District. The policy allows water users to transfer water to parcels owned or rented by the water user.
10608.48.c(7)	Construct and operate supplier operational outflows and tailwater recovery systems.	Not Applicable	Due to the nature of the on-farm irrigation practices utilized in North Kern, spillage and tailwater recovery systems are not utilized as they would have little effect on water use efficiency.

Table 50. Report of EWMPs, Continued

Water Code Reference	EWMP	Current Status	Status of EWMP
10608.48.c(8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area.	Currently Implemented	The District has been operating a very significant and successful conjunctive use project for over 60 years. Kern River and other surface water available to North Kern is used in preference to groundwater to the extent available. In "wet" years, available supplies which are in excess of irrigation demand are used to recharge the underlying groundwater (primarily through 1,500 acres of dedicated spreading ponds). In "dry" years, groundwater is pumped to offset deficiencies in available surface water supplies. Through the Poso Creek IRWMP, North Kern identified and has constructed several major capital improvements that enhance the District's capabilities to conjunctively use its Kern River supplies, other surface water supplies available to the District and through water banking, transfer, and exchange agreements, surface water supplies available to others in the Poso Creek region, Kern County, and on the Friant-Kern Canal. District operations in 2013, 2014 and 2015 have demonstrated the value of the District's commitment to conjunctive management and have led to additional investments in facilities both to increase groundwater recharge and to maintain the District's capacity to extract stored groundwater.
10608.48.c(9)	Automate canal control structures.	Currently Implemented	North Kern has automated approximately 21 water level and flow monitoring stations at water diversion points and has installed monitoring stations along some reaches of its canals. The District has identified another 2 locations that could be automated for greater water management flexibility. The District has added, and will continue to add, canal automation to its in-house SCADA system to enhance water delivery flexibility to water users. The District has plans to install meters on all wells. As with other district initiatives, North Kern has proceeded with implementation of this EWMP as a vehicle to improve customer service. Improved control of deliveries has benefited North Kern growers during the drought by enabling them to make effective use of pro-rated allocations.
10608.48.c(10)	Facilitate or promote customer pump testing and evaluation.	Currently Implemented	The District mandates that private landowners measure and test the water that they discharge into the canal.
10608.48.c(11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports.	Proceeding with Implementation	The North Kern Board of Directors is in the process of appointing a Water Conservation Coordinator.
10608.48.c(12)	Provide for the availability of water management services to water users.	Currently Implemented	North Kern (1) measures all deliveries to water users and provides each user with the volume of water delivered during each billing cycle; (2) financially supports the mobile irrigation lab which is operated by the North West Kern RCD (which provides free irrigation system performance testing to District growers); and (3) publishes a periodic newsletter for the dissemination of information from UC Cooperative Extension and other sources.
10608.48.c(13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	Currently Implemented	The District's surface water supply originates from the Kern River, which is regulated by Isabella Reservoir (a USACE-operated facility). Due to dam-safety considerations, USACE imposed a storage restriction on Isabella Reservoir in 2006, and this restriction will likely be in place for several years to come. In certain water supply years, reduced regulation in Isabella Reservoir increases the District's reliance on regulation through use of groundwater storage. North Kern and the other River interests are working closely with USACE to expedite the necessary repairs and ultimately lift the storage restriction.
10608.48.c(14)	Evaluate and improve the efficiencies of the supplier's pumps.	Currently Implemented	The District has a program for regular inspection and maintenance of pumps and motors to keep them in good working order. Pumping plant efficiencies are periodically determined and, if less than a given threshold value, the pump and motor are pulled for inspection and rehabilitation.

The 2016 North Kern Water Operations budget for capital improvement and work orders contains funding for operation and continued implementation of the EWMPs described in Table 49. This budget includes $230,000 for capital expenditures and work orders. Table 50 presents the schedule for implementing EWMPs.

Table 50. Schedule to Implement EWMPs

EWMP	Activities Scheduled for 2016	Staffing Requirements	Budget Allotment	AWMC MOU Demand Measures
Critical				
1 - Water Measurement	On-going	Routine activity with no dedicated staff requirement	Not applicable	C-1
2 - Volume-based Pricing	Currently implemented	Routine activity with no dedicated staff requirement	Not applicable	
Conditional				
1 - Alternate Land Use	Not applicable	Not applicable	Not applicable	B-1
2 - Recycled Water Use	Currently implemented	Routine maintenance on facilities for the *North Kern Drought Response Project* - staffing requirement: one quarter full-time equivalent.	Operations	B-2
3 - On-Farm Irrigation Capital Improvements	Currently implemented	Not applicable	Not applicable	B-3
4 – Incentive Pricing Structure	On-going	Routine management activity with no dedicated staffing requirement	Not applicable	C-2
5 – Infrastructure Improvements	Various activities*	Staffing requirement for grant and program management: one half full-time equivalent.	Capital expenditures	B-5
6 – Order/Delivery Flexibility	On-going	Routine activity with no dedicated staff requirement	Not applicable	B-6
7 – Supplier Operational Outflow and Tailwater Systems	Not applicable	Not applicable	Not applicable	B-7
8 – Conjunctive Use	On-going	Routine activity with no dedicated staff requirement	Operations	B-8
9 – Automated Canal Controls	Currently implemented	Routine operational duty with no dedicated staffing requirement. Additional projects planned	Capital Expenditures	B-9
10 – Customer Pump Test/Evaluation	On-going	Routine activity with staffing requirement of one quarter full-time equivalent	Operations	
11 – Water Conservation Coordinator	Planned activity	Anticipated staffing requirement of one quarter full-time equivalent	Operations	A-2
12 – Water Management Services to Customers	On-going activity with no dedicated staff requirement	Routine activity with no dedicated staffing requirement	Not Applicable	A-3
13 - Identify Institutional Changes	On-going	Routine management duty with no dedicated staff requirement	Not Applicable	A-5
14 – Supplier Pump Improved Efficiency	On-going	Routine operational requirement with no dedicated staffing commitment	Not Applicable	A-6

*Meter, gates and turnout installations, weir and structure replacement, CT-1 Canal lining, Shafter-Wasco ID South Interconnection, Shafter-Wasco ID North Interconnection, 8-17 Calloway Central

Table 51 presents an estimate of the water savings or improvements in water management anticipated to occur over the next five and ten years as a result of programs now being implemented or being planned by the District.

Table 51.Report of EWMPs Efficiency Improvements

EWMP No.[1]	EWMP	Estimate of Water Use Efficiency That Occurred Since Last Report	Estimated Water Use Efficiency 5 and 10 years in Future
5	Lined portions of Calloway Canal to reduce seepage.	2,265 AF (2,265 AF/yr over one year)	Estimated annual seepage reduction of 2,265 AF for lining of reaches A, B, C and D. Water conserved over: 5 years: 113,250 AF 10 years: 226,500 AF
9	Implemented SCADA monitoring to check water levels at strategic locations in the District's distribution system and to prevent overflow of regulating reservoir storage.	1,000 AF (500 AF/yr over two years)	This project is estimated to reduce annual losses from overflow by 500 AF. Water conserved over: 5 years: 2,500 AF 10 years: 5,000 AF
5	Converted the 8-9 and 9-6 canals into pipeline conveyance.	8,000 AF (4,000 AF/yr over two years)	Average annual seepage and evaporation reduction of 4,000 AF. Water conserved over: 5 years: 20,000 AF 10 years: 40,000 AF
5	Constructed a lined canal between the Calloway Canal and the Cross Valley Canal (CVC) including a new turnout on the CVC.	Newly completed	Average annual seepage reduction of 2,465 AF. Water conserved over: 5 years: 12,325 AF 10 years: 24,650 AF
5	Installed a new pump station and one mile of 96-inch diameter concrete pipe to convey water from the Calloway Canal to the Lerdo Canal.	3,800 AF (1,900 AF/yr over two years)	Average annual seepage and evaporation reduction of 1,900 AF. Water conserved over: 5 years: 9,500 AF 10 years: 19,000 AF
1	Replaced old propeller meters with new meters.	NA	Improved measurement accuracy but no quantifiable improvements in water use efficiency.
1	Implemented iPhone scanning and real-time water meter reading network so delivery information can be uploaded to the District's server and accounting program.	NA	Improved accuracy in reporting of deliveries and in accounting and billing of water usage.
2	Implemented the *North Kern Drought Response Project* which delivers oil-field produced water to the Lerdo Canal and to the Rosedale Spreading Pond	Newly completed	Will introduce 21,200 AF per year of highly reliable supply into the North Kern system with this supply replacing groundwater now pumped within the North Kern service area. New supply delivered: 5 years: 106,000 AF 10 years: 212,000 AF

[1] EWMP numbers correspond to Water Code §10608.48(c).

B. Documentation for Non-Implemented EWMPs

North Kern has implemented, or is in the process of implementing, each of the recommended EWMPs other than those categorized in Table 49 as being Not Applicable. Although certain of these measures are not locally cost-effective as individual water conservation measures, the District views them as elements of a broad program that enables North Kern to provide a high level of service to its agricultural customers and to responsibly manage surface water and groundwater resources in the District's service area. This position is summarized below in Table 52.

Table 52. Non-Implemented EWMP Documentation

EWMP #	Description	(check one of both)		Justification/Documentation
		Technically Infeasible	Not Locally Cost-Effective	
10608.48.c(1)	Facilitate alternative land uses			The District would consider requests for alternative land uses, but there is little need to modify land use as a means of improving the efficiency of irrigation service. Therefore, although alternative land uses are neither "technically infeasible" nor are they "not locally cost-effective", they are not measures that typically fit within either the purpose or the operational practices of the District.
10608.48.c(7)	Tailwater recovery systems	X		On-farm practices at North Kern generate little tailwater because of the on-farm application methods used by the District's growers. Spillage is now recovered and is an element of the District's groundwater recharge program. Therefore, because little tailwater is generated within the District, implementation of tailwater recovery measures is not technically necessary.

Supporting Documentation: Agricultural Water Measurement Regulation Documentation

A. Description of Water Measurement Best Professional Practices

Section 10608.48(b) of the California Water Code requires that agricultural water suppliers governed by this section of the code, "Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10" of the legislation. Further, Section 531.10(a) requires that, "An agricultural water supplier shall submit an annual report to the department (DWR) that summarizes aggregated farm-gate delivery data, on a monthly or bi-monthly basis, using best professional practices."

North Kern's ability to comply with these requirements rests on the fact that all irrigation deliveries in the District are measured to support the District's volumetric water pricing to its customers. All deliveries are made through piped turnouts, with the diameters of the pipes ranging between 8 and 12 inches. Deliveries at most farm turnouts are measured with propeller flowmeters manufactured by McCrometer and Seametrics although a few turnouts still use Armco (Waterman) gates where flows are calculated based on the gate opening. The propeller meters are mounted within the turnout piping following accepted engineering practices and measure flow rates and also record the total volume of water delivered. Figure 8 is a photograph of a typical farm turnout from a District canal.

Figure 8. Typical North Kern Irrigation Turnout.

Data on volumes of delivered water recorded by the District are updated on a daily basis. Ditch-tenders enter water delivery readings into the District's water management software by first scanning the code for the turnout into their cell phone and then entering the reading from the water meter. This

information is emailed from the field, uploaded into the District's water management software and reviewed by a supervisor as a quality control procedure. Irrigated acreage is determined based upon a cropping forecast that is prepared each winter for the upcoming season. These crop reports include information obtained directly from water users that identify the crop type, irrigation method and acreage. The irrigated acreage values are verified by checking the acreage identified in the Kern County Assessor's Parcel Number database and are further field confirmed by North Kern field staff. As all turnouts at North Kern deliver water to single fields, there is a direct correspondence between the turnout identification number and the area served by that turnout.

Water delivery data are made available to water users whenever it is requested throughout the season, which enables irrigators to monitor their water usage. The District's billing system uses the pricing structure adopted by North Kern's Board of Directors and the flowmeter readings at a given farm turnout to determine the water bill associated with District deliveries through that turnout.

B. Engineer Certification and Apportionment

The methodology used to determine the individual device accuracy values found in Section 597.3(a) will be verified by a Professional Engineer using industry accepted standards. These methods will take into account the differential in water levels and/or fluctuations in the flow rate or velocity during the delivery event and the type, size and characteristics of the measuring device being verified.

Flowmeters at each farm turnout measure District deliveries to each irrigator's place of use. The flowmeter indicates the instantaneous flow rate and the cumulative total of water delivered, with the latter function referred to as a "totalizer".

Previously, meters were only repaired or replaced when a meter was observed to be malfunctioning or when a water user questioned the accuracy. However, in 2012 the District checked the accuracy of over 15 percent of the district's meters to provide documentation for this plan. The methodology used to determine whether the accuracy of a representative sample of the flow-measurement devices complies with the requirements of Section 597.3(a) is described later in this section. North Kern plans to adopt this methodology for field testing of existing flow metering devices and to present a report approved by a California-registered Professional Engineer as the basis for ongoing compliance with SBx7-7.

C. Water Measurement Conversion to Volume

SBx7-7 requires an annual volumetric accuracy of within ±12 percent on existing devices. Since North Kern's flow-measurement devices include totalizers (which directly record cumulative flow volume), the devices' accuracy in measuring flow rates is representative of their ability to measure volumes of water delivered. Therefore, the discussion presented later in this section that relates to testing the accuracy of measurement of flow rates applies equally to determination of the accuracy of measurement of volumes of delivered water.

D. Legal Certification and Apportionment – Legal Access to the Farm-gate

North Kern staff has legal access to install, measure, maintain, operate, and monitor flow-measurement devices at all farm turnouts from the District's irrigation distribution system. In addition, with few exceptions turnouts deliver water to single fields. Therefore there are no institutional or legal impediments that restrict access to turnouts or measurement of water and, for the purposes of satisfying SBx7-7, there is no need to measure water upstream of points of delivery to individual customers.

E. Device Corrective Action Plan

As noted above, in the past North Kern has repaired or replaced flow meters only when there was some obvious deficiency in their performance or when a water user questioned the accuracy of a meter. In 2012 North Kern verified the accuracy of measurement at over 15 percent of its turnouts to document measurement accuracy for this plan.

Devices identified during the 2012 program to have measurement accuracies that departed by more than ±12 percent from flows measured by a calibrated device will be sent to the district shop for repair. If the shop is not able to correct the inaccuracy in flow measurement, the device will be replaced. After installation in the field, the accuracy of repaired meters will be verified using a calibrated device, and an affidavit will be submitted by a California-registered Professional Engineer certifying the accuracy of each repaired meter to be within ±10 percent by volume. New replacement meters will be laboratory certified by their manufacturer prior to installation to have an accuracy of measurement within ±6 percent by volume. Repair or replacement of these flow meters will be completed within three years of approval of this testing program by DWR.

F. Farm Gate Measurement and Device Accuracy Compliance

SBx7-7 requires that agricultural water suppliers measure the volume of water delivered to customers with sufficient accuracy to comply with standards described in the legislation. These standards are presented below.

1. *Measurement Options at the Delivery Point or Farm-gate of a Single Customer*

   An agricultural water supplier shall measure the volume of water delivered at the delivery point or farm-gate of a single customer. If a device measures a value other than volume, for example, flow rate, velocity or water elevation, the accuracy certification must incorporate the measurements or calculations required to convert the measured value to volume. An existing measurement device shall be certified to be accurate to within ±12 percent by volume.

2. *Initial Certification of Device Accuracy*

   For existing measurement devices, the device accuracy shall be initially certified and documented by either:

   - *Field-testing that is completed on a random and statistically representative sample of the existing measurement devices. Field-testing shall be performed by individuals trained in the use of field-testing equipment and documented in a report approved by an engineer.*
   - *Field-inspections and analysis completed for every existing measurement device. Field-inspections and analysis shall be performed by trained individuals in the use of field inspection and analysis, and documented in a report approved by an engineer.*

3. *Protocols for Field Testing*

   Field-testing shall be performed for a sample of existing measurement devices according to manufacturer's recommendations or design specifications and following best professional practices. It is recommended that the sample size be no less than 10 percent of existing devices, with a minimum of 5, and not to exceed 100 individual devices for any particular device type. Alternatively, the supplier may develop its own sampling plan using an accepted statistical methodology.

   If during the field-testing of existing measurement devices, more than one quarter of the samples for any particular device type do not meet the relevant accuracy criteria, the agricultural water supplier shall provide in its Agricultural Water Management Plan a plan to test an additional 10 percent of its existing devices, with a minimum of 5, but not to exceed an additional 100 individual devices for the particular device type. This second round of field-testing and corrective actions shall be completed within three years of the initial field-testing.

   Field-inspections and analysis protocols shall be performed and the results shall be approved by an engineer for every existing measurement device to demonstrate that the design and installation standards used for the installation of existing measurement devices meet the relevant accuracy standards and that operation and maintenance protocols meet best professional practices.

4. *North Kern WSD Program for Compliance with Water Measurement Requirements*

   In 2012 North Kern followed the guidelines described above by identifying 33 randomly-selected turnouts to serve as a representative sample for verification of flow measurement. This sample population represents 16.7 percent of the District's 198 turnouts. These turnouts deliver water to 10 percent of the District's irrigated area. Flows measured at each of the turnouts within the sample population were compared with measurements recorded by a calibrated ultrasonic flowmeter to determine the accuracy of measurement. The sample population is shown in Appendix E.

   Because the propeller meters used by the District are equipped with totalizers, errors detected in the measurement of flow rates correspond with errors in measurement of delivered water volumes,

with measurement error being defined as the percentage departure between the propeller flowmeter reading and the corresponding reading taken with the calibrated ultrasonic meter. This formula for computing error conforms with the following language from Section 572.2 of the legislation.

> *"Accuracy" means the measured volume relative to the actual volume, expressed as a percent. The percent shall be calculated as 100 x (measured value – actual value) / actual value, where the "measured value" is the value indicated by the device or determined through calculation using a measured value by the device, such as flow rate, combined with a duration of flow, and "actual value" is the value as determined through laboratory, design or field testing protocols using best professional practices.*

A histogram of the error of measurement values is shown below in Figure 89. Note that all readings were taken for a period of 10 minutes at each turnout.

Figure 9. Histogram of percent measurement error at individual turnouts

As illustrated in the histogram, although the sample population includes a maximum value of 79 percent, the mean sample error was 6.1 percent, with a standard deviation of 16.8 percent and with approximately 58 percent of the individual error values falling within ±6 percent of the calibrated values and 76 percent falling within ±12 percent. This analysis indicates that flow measurement at a majority of turnouts meets the ±12 percent volumetric measurement accuracy required by SBx7-7 for existing measurement devices, with the accuracy of about 24 percent of the sampled devices falling outside of the acceptable accuracy limits.

The next analysis was performed using sampling errors that had been weighted so that the error of measurement is proportional to the volume of water delivered at the turnout. Weighting was

accomplished by multiplying the error of measurement computed at each turnout by the flow meter reading. This weighted data yielded a 10.6 percent error of measurement for the total sample population. However, as illustrated in Figure 8, much of the total sample error is the result of errors associated with a small number of turnouts. For example, if the turnouts with the four highest weighted measurement errors (Turnouts 8-00-60-A, 8-00-78B, 8-03-25A, and 8-17-6B) were removed from the remaining population, the error of the sample population would be reduced to 5.9 percent. This value indicates that, with few exceptions, the volume of water delivered by the turnouts included in the sample population is measured at an accuracy that conforms with the standards presented in SBx7-7.

Section VIII. References

1. California Code of Regulations; Title 23; Water; Division 2, DWR. Chapter 5.1 Water Conservation Act of 2009. Article 2. Ag Water Measurement
2. California Department of Water Resources. 2010. "The State Water Project Delivery Reliability Report 2009."
3. California Department of Water Resources. 2012. "A Guidebook to Assist Agricultural Water Suppliers to Prepare a 2012 Agricultural Water Management Plan."
4. California Department of Water Resources. 2014. "The State Water Project Final Delivery Reliability Report 2013."
5. California Department of Water Resources. 2014. "The State Water Project Final Delivery Capability Report 2015."
6. California Water Code Section 20500. 1887. California Irrigation Districts Act.
7. Chung et al. California Department of Water Resources. 2009. "Using Future Climate Projections to Support Water Resources Decision Making in California."
8. Hanson, R.T.; Flint, A.L.; Flint, L.E.; Faunt, C.C.; Schmid, W.; Dettinger, M.D.; Leake, S.A.; and Cayan, D.R., 2010. "Integrated Simulation of Consumptive Use and Land Subsidence in the Central Valley, California, for the Past and for a Future Subject to Urbanization and Climate Change". Proceedings of the Eighth International Symposium on Land Subsidence (EISOLS).
9. Hanson, R.T.; Flint, A.L.; Flint, L.E.; Faunt, C.C.; Schmid, W.; Dettinger, M.D.; Leake, S.A.; and Cayan, D.R., 2010. "Integrated Simulation of Consumptive Use and Land Subsidence in the Central Valley, California, for the Past and for a Future Subject to Urbanization and Climate Change". Proceedings of the Eighth International Symposium on Land Subsidence (EISOLS).
10. Hanson, R.T.; Flint, L.E.; Flint, A.L.; Dettinger, M.D.; Faunt, C.C.; Cayan, D.R., and Schmid, W., 2012. "A Method for Physically Based Model Analysis of Conjunctive Use in Response to Potential Climate Change", Water Resources Research, Vol. 48.
11. Irrigation Training and Research Center. 2012. "SBx7 Compliance for Agricultural Districts", draft.
12. Kern County Water Agency. 2008. "Water Supply Report: 2008"
13. Kern County Water Agency. 2013. "Consolidated Contract through Amendment No. 36", Dept. of Water Resources website. SWP A0 – Water Supply Contracts.
14. Kern River Watershed Coalition Authority. 2013. Memorandum for comments on Kern River Watershed Coalition Authority re-draft of "Waste Discharge Requirements General Order for Discharges from Irrigated Lands within the Central Valley Region for Dischargers not Participating in a Third-Party Group." (November 2012 Draft).
15. Luedeling, E; Zhang, M; Girvetz, E.H., July 2009. "Climatic Changes Lead to Declining Winter Chill for Fruit and Nut Trees in California during 1950-2099". PLoS ONE 4(7).

16. North Kern Water Storage District, “2012 Groundwater Management Plan”, draft
17. Poso Creek Integrated Regional Water Management (IRWM) Group. Adopted 2007. “IRWM Plan (Poso Creek IRWMP).”
18. United States Geological Survey. Fact Sheet 2009-3074. September 2009. “Effects of Climate Variability and Change on Groundwater Resources in the United States”.
19. Water Resources Research, Vol. 48, 2012. “A Method for Physically Based Model Analysis of Conjunctive Use in Response to Potential Climate Change”.

APPENDIX A Public Hearing Notice

Exhibit "A"

PROOF OF PUBLICATION

(2015.5 C.C.P.)
(GENERAL FORM)

STATE OF CALIFORNIA
County of Kern } ss.

I, the undersigned, am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a part of or interested in the above entitled matter. I am the chief clerk/publisher of *The Shafter Press*, a newspaper of general circulation, printed and published weekly, in the City of Shafter, County of Kern, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court order number 29926, of the County of Kern; that the notice, of which the annexed is a printed copy, has been published in each regular and entire issue of said newspaper and in any supplement thereof on the following dates, to-wit: December 2, 9, 2015

I certify (or declare) under the penalty of perjury that the foregoing is true and correct.

Diane Flores
(Signature)

Executed on 12-9-15
at Shafter, California

The *SHAFTER PRESS*
PO Box 1600
Shafter, CA 93263

Phone (661) 746-4942

PUBLIC NOTICE

NORTH KERN WATER STORAGE DISTRICT
PUBLIC HEARING NOTICE

Notice is hereby given that the North Kern Water Storage District (NKWSD) will hold a public

hearing on **December 15, 2015 at 7:30 AM** regarding the updated **Agricultural Water Management Plan,** and consider adoption of the Plan.

The Water Conservation Act of 2009 and the Governor's Executive Order B-29-15 requires certain agricultural water suppliers in California to prepare Agricultural Water Management Plans (Ag WMPs). To meet the requirements of this legislation, NKWSD is preparing an Ag WMP. The Ag WMP includes a discussion of NKWSD and its irrigation facilities, water supply and demand, and various programs, policies and efficient water management practices being implemented now or planned in the coming years. The NKWSD Board of Directors will hold a hearing to consider public comments on the proposed Ag WMP.

A copy of the Ag WMP may be reviewed at the NKWSD office (33380 Cawelo Avenue, Bakersfield, CA). Written comments, submitted prior to the hearing, should be directed to:

Richard A. Diamond
North Kern Water Storage District
P.O. Box 81435 Bakersfield, CA 93380

Comments may also be provided at the hearing.

If you have questions regarding the Ag WMP, please contact Richard A. Diamond at (661) 393- 2696.

Publish *Shafter Press* December 2, 9, 2015

PUBLIC HEARING NOTICE

Notice is hereby given that the North Kern Water Storage District (NKWSD) will hold a public hearing on:

December 15, 2015 at 7:30 AM

Regarding:

2015 Agricultural Water Management Plan

The Water Conservation Act of 2009 and the Governor's Executive Order B-29-15 requires certain agricultural water suppliers in California to prepare Agricultural Water Management Plans (Ag WMPs). To meet the requirements of this legislation, NKWSD is preparing an Ag WMP. The Ag WMP includes a discussion of NKWSD and its irrigation facilities, water supply and demand, and various programs, policies and efficient water management practices being implemented now or planned in the coming years. The NKWSD Board of Directors will hold a hearing to consider public comments on the proposed Ag WMP.

A copy of the Ag WMP may be reviewed at the NKWSD office (33380 Cawelo Avenue, Bakersfield, CA) or on the District's website (www.NorthKernwsd.com). Written comments, submitted prior to the hearing, should be directed to:

Ram Venkatesan
North Kern Water Storage District
P.O. Box 81435
Bakersfield, CA 93380

Comments may also be provided at the hearing.

If you have questions regarding the Ag WMP, please contact Ram Venkatesan at (661) 393-2696.

APPENDIX B Letter for Cities and County

November __, 2015

Example address

Dear Gentlemen,

RE: North Kern WSD Agricultural Water Management Plan – Public Hearing Notice

The North Kern Water Storage District (North Kern, District) is scheduled to hold a Public Hearing to receive public comment on the District's Agricultural Water Management Plan (Ag WMP) at 7:30 AM on December 15, 2015 in the District's Board Room located at 33380 Cawelo Avenue, Bakersfield, CA. At the hearing, the District's Board will receive public comments on the draft Ag WMP. The North Kern Board will consider adoption of the Ag WMP at a meeting to be held following the Public Hearing.

The Ag WMP includes a discussion of North Kern and its irrigation facilities, water supply and demand, and various programs, policies and efficient water management practices, being implemented now or planned in the coming years. A copy of the draft plan is available for review at the District office.

Any comments prior to the hearing should be submitted to:

Ram Venkatesan
North Kern Water Storage District
P.O. Box 81435
Bakersfield, CA 93380

Any questions regarding the draft Ag WMP or the adoption process should be directed to Ram Venkatesan at (661) 393-2696 or ram@northkernwsd.com.

Sincerely,

APPENDIX C Board Resolution

RESOLUTION NO. 15-180
ADOPTING NORTH KERN WATER STORAGE DISTRICT'S
AGRICULTURAL WATER MANAGEMENT PLAN

WHEREAS, with the passage of the 2009 Water Conservation Act and SBx7-7 and the issuance of the Governor's Executive Order B-29-15, preparation of a 2015 Agricultural Water Management Plan became mandatory and the requirements introduced were intended to encourage agricultural water suppliers to assess current efficient water management practices, to evaluate additional practices that may conserve water, to require accurate measurement of water, and to prepare drought response plans; and

WHEREAS, the District has prepared a 2015 Agricultural Water Management Plan pursuant to the guidelines that were issued by the California Department of Water Resources in June 2015 to aid water suppliers in preparing Agricultural Water Management Plans in accordance with the requirements of SBx7-7 and E.O. B-29-15.

WHEREAS, the District posted the Plan for a two-week review period and subsequently held a hearing on December 15, 2015 to hear and consider comments from the public on the Plan; and

WHEREAS, at the public hearing, there were no verbal objections to the Plan.

NOW, therefore, BE IT RESOLVED, that the Board of Directors of the North Kern Water Storage District does hereby approve and adopt the District's 2015 Agricultural Water Management Plan as presented and prepared in accordance with SBx7-7, California's 2009 Water Conservation Act regarding Efficient Water Management Practices and with E.O. B-29-15.

Moved by Director Glende, seconded by Director Mendes, that the foregoing resolution be adopted.

The following vote was had:

Ayes:	Andrew, Glende, Mendes and Fornoff
Noes:	None
Absent:	Waterhouse
Abstain:	None

The President declared the resolution adopted.

I, Patrick Mize, Assistant Secretary of the Board of Directors of the NORTH KERN WATER STORAGE DISTRICT, do hereby CERTIFY that the foregoing is a full, true and correct copy of a resolution duly adopted at a meeting of said Board of Directors held the 15th day of December, 2015.

NORTH KERN WATER STORAGE DISTRICT

Secretary of the Board of Directors

APPENDIX D Rules and Regulations for Distribution of Water

When Recorded return to:

For the Benefit of the District

North Kern Water Storage District
33380 Cawelo Avenue
Bakersfield, CA 93308-9575

James W. Fitch, Assessor – Recorder
Kern County Official Records
Recorded at the request of
Public

PATTI
10/29/2003
12:26 PM

DOC#: 0203236557

Stat Types: 1 Pages: 22

Fees	0.00
Taxes	0.00
Others	0.00
PAID	$0.00

NORTH KERN WATER STORAGE DISTRICT

RULES AND REGULATIONS FOR DISTRIBUTION AND USE OF WATER

Amended and Restated October 21, 2003

INDEX

SECTION		PAGES
	INTRODUCTION	1
I	DEFINITIONS District, District Office, District Records, Board, Manager, Project and Adopted Project, Distribution System, Class I Lands, Class I Water, Class II Lands, Class II Water, Special Purpose Water, Water User, Water Toll Rate, Base Service Charge, Agricultural Use, Application for Water Service.	1-3
II	AUTHORITY OF DISTRICT MANAGER AND EMPLOYEES Manager, District Employees, Agents and Designees	3
III	DELIVERY AND USE OF WATER	3-4
IV	APPLICATION FOR WATER SERVICE AND AUTHORIZATION FOR ADMINISTRATION THEREOF	4-6
V	ORDERING WATER SERVICE AND MEASUREMENT OF WATER	6-7
VI	EMERGENCY TURN OFF	7
VII	INTERRUPTIONS IN SERVICE	8
VIII	CONTROL, USE AND RECAPTURE OF WATER	8
IX	BILLINGS, PAYMENT AND DELINQUENCY	8-10
X	INTERFERENCE WITH DISTRIBUTION SYSTEM	10
XI	RIGHT OF ENTRY	10
XII	ENFORCEMENT OF RULES AND REGULATIONS	10
XIII	PROCEDURE FOR ANNUALLY FIXING THE AMOUNT OF BASE SERVICE CHARGES	11-14
XIV	ENCROACHMENT ON DISTRICT PROPERTY	14

SECTION		PAGES
XV	ACCESS TO DISTRICT RECORDS	14
XIV	GENERAL PROVISIONS	15
XVII.	UNUSED ENTITLEMENT IN DISTRICT'S DISTRIBUTION SYSTEM.	15
XVIII	CHANGES IN RULES AND REGULATIONS	15
XVIV	SEVERABILITY OF PROVISIONS	15
	ANNEX	
	1. Map of District - Class I and Class II lands	16
	2. Resolution No. 03-91 amending Rules and Regulations	17

NORTH KERN WATER STORAGE DISTRICT

RULES AND REGULATIONS FOR
DISTRIBUTION AND USE OF WATER

INTRODUCTION

These Rules and Regulations are established pursuant to the requirements of Division 14, particularly Section 43003, of the California Water Code to enable the North Kern Water Storage District to perform its functions economically, and to achieve an efficient distribution of water for the benefit of the District.

These Rules and Regulations are in implementation of the District's Project as herein defined and are applicable only to lands within the District located north of Seventh Standard Road excepting the lands located within the Rosedale Ranch Improvement District of the District.

Section I. DEFINITIONS

Unless the provision or context otherwise requires, the definitions contained herein govern the construction of these Rules and Regulations.

1. "District" means the North Kern Water Storage District.

2. "District Office" is the office designated from time to time by the Board of Directors pursuant to Section 40650 of the California Water Code and is currently located at 33380 Cawelo Avenue, Bakersfield, California 93308-9575. The mailing address of the District Office is P.O. Box 81435, Bakersfield, California 93380-1435. The telephone number is 661-393-2696.

3. "District Records" means the records on file at the District Office.

4. "Board" means the Board of Directors of the North Kern Water Storage District as duly constituted pursuant to Division 14 of the California Water Code.

5. "Manager" is the person appointed by the Board pursuant to its directions to manage and control the activities of the District.

6. "Project" and Adopted Project" is the District's Original Project, adopted July 31, 1951, as modified in the Report on Modification of North Kern Water Storage District, Adopted 1950, which modified report was adopted March 3, 1964, and the new project for a proposed contract with the United States for use of conservation storage space in Isabella Reservoir, adopted by vote of the landowners on August 25, 1964 and includes District's distribution system, including rights of way, land and water used in connection therewith which are collectively referred to as "Project Facilities."

7. "Distribution System" means all fixed installations which are owned and/or operated by the District having the mission of diversion, conveyance, control, measurement, pumping, storage, spreading and delivery of water to land within the District.

8. "Class I Lands" are those lands defined and classified as Class I Lands in the 1950 Project Report on file at the District Office as modified from time to time by action of the Board. These lands are also referred to as "Canal Served Lands," and are shown on the map attached hereto.

9. "Class I Water" is project water as defined in District's adopted project that is available for delivery pursuant to these Rules and Regulations, to Class I lands or so-called "Canal Served Lands." Class I water has as its main source of supply the District's canal system, supplemented in shortage years by water obtained from groundwater from District pumps.

10. "Class II Lands" are lands defined as Class II Lands in the 1950 Project Report on file at the District Office as modified from time to time by action of the Board. These lands are also referred to as so-called "Private Pump Served Lands," and are shown on the map attached hereto. Their main source of water supply is derived from their own private pumping plants.

11. "Class II Water" is water made available by District to a portion of Class II lands. At no time is the District under any obligation to provide surface water service to Class II lands. There are three types of Class II water. "Regular Class II Water" is water made available to Class II lands in years or at times when the full water needs of Class I lands have been satisfied and/or District spreading is occurring. "Special Class II Water" is water made available to Class II lands in years or at such times when the District is able to purchase water from others for the benefit and use by Class II lands. "Emergency Class II Water" is water made available to Class II lands on a temporary, interruptible basis while the private pumping facilities serving said lands are inoperative.

12. "Special Purpose Water" is water delivered on an interruptible and nondependable basis for construction work or other special purposes not directly related to agricultural uses under conditions established by the Board.

13. "Water User" is an owner of land which is entitled to receive surface water service from the District pursuant to these Rules and Regulations.

14. "Water Toll Rate" is the charge established from time to time by the Board as the amount to be paid by Water User for surface water service furnished by the District pursuant to these Rules and Regulations.

15. "Base Service Charge" is defined at Section XIII hereof.

16. "Agricultural Use" means water delivered primarily for production of agricultural crops, livestock and incidental use.

17. "Application for Water Service" is the form to be provided by the District to be completed and filed by Water User and acknowledged by the landowner. Two different types of forms are utilized. One form or application to be executed by the Class I Water User; the other form or application to be executed by the Class II Water User.

For purposes of clarification, the singular includes the plural and masculine includes feminine.

SECTION II. AUTHORITY OF DISTRICT MANAGER AND EMPLOYEES

1. Manager

The District's Distribution system is under the exclusive management and control of the Manager. No other person except the Manager, or his designee, shall operate any of the facilities of the District's system. The responsibility for carrying out said operations shall rest with the Manager of the District, who shall designate certain District employees for operation and maintenance responsibilities of District's distribution system.

2. District Employees, Agents and Designees

The Manager shall supervise the duties and activities of all District employees, agents and designees in a manner that produces, at all times, an efficient and economical operation of all District facilities.

Any controversy arising between a Water User and a District employee, agent or designee that cannot be amicably resolved by the parties shall be directed to the Manager for consideration. If the resultant settlement decision by the Manager does not meet with the satisfaction of the Water User, an appeal in writing can be addressed to the Board of Directors, whose subsequent decision shall be final.

SECTION III. DELIVERY AND USE OF WATER

1. Water User may use project water only as provided in these Rules and Regulations. Water User acquires no property right in the District's Distribution System or in the project water and the District retains the right to all water not consumptively used by a Water User.

2. District will deliver water to Water Users through its Distribution System only pursuant to these Rules and Regulations.

3. Water furnished by the District other than Special Purpose Waters is to be used for agricultural use only. All water furnished by the District is in a raw, untreated condition and is considered unfit for human consumption without treatment. The character and quality of the water furnished may vary from time to time, and the District does not represent, guarantee or warrant in any manner or respect the character of quality thereof. The District may, however, suspend service during any period of time it has determined that the water is unfit for agricultural purposes which determination shall be final and conclusive.

4. Emergency Class II water may be made available to a person requesting such service if the Manager determines that providing such service is in the best interest of the District and will not interfere with obligations of the District. The Manager shall keep the Board advised of any Emergency Class II Water Service. Alternatively, the Board may direct that Emergency Class II water be made available upon finding such action would be in the best interest of the District and would not interfere with obligations of the District.

5. Special purpose water service may be made available if the Board determines that it is in the best interest of the District, will be for a limited period of time and will only be made if it does not interfere with the obligations of the District.

SECTION IV. APPLICATION FOR WATER SERVICE AND AUTHORIZATION FOR ADMINISTRATION THEREOF

1. In order to be eligible for surface water service the owner of the lands eligible to be served must complete, execute and file with the District an Application for Water Service which describes the lands to be served and establishes those persons authorized to place turn on and turn off orders pursuant to Section V hereof.

No application will become effective for a water user who is delinquent in any District charge or for service to any lands for which any assessment, toll or charge is delinquent unless said water user meets the criteria pursuant to Section IX-8.

Forms of the application are available at the District Office. The original and one copy of the completed application shall be returned to the District office for filing. Should the District have actual knowledge that there are Class I lands within the District for which no application has been filed, it may mail an application to the owner in accordance with the ownership and address shown on the current records at the District office. None of the foregoing establishes a duty on the District and it remains the duty of the landowner to see that a proper application is on file with the District.

When land is sold or title otherwise transferred, or when a new tenant takes possession, the District will not deliver water to such lands until a proper and binding Application for Water Service is completed and filed by the new owner and/or the new tenant.

2. An application shall be executed by all persons that are owners of record of the lands to be served and each signature must be acknowledged before a Notary Public.

If the application is executed in any of the following capacities it shall be accompanied by the following information:

a. A guardian, conservator, administrator, executor or trustee of a testamentary trust shall furnish a certified copy of an appropriate order of court authorizing such action.

b. A trustee of an intervivos trust shall furnish a copy of the recorded trust powers.

c. A partnership shall furnish a copy of a statement of partnership recorded under Corporation Code Section 15010.5. An application executed by a General Partner in a limited partnership shall furnish evidence of authority to obligate the partnership.

d. An attorney-in-fact shall furnish a copy of the recorded power of attorney.

e. Any other person acting in any representative capacity shall furnish evidence of his authority to act to the satisfaction of the Board.

3. If an Application for Water Service is executed by any of the following, it shall be accompanied by an Appointment of Agent to Act For Water User form which provides authority to do any and all acts to be done by the water user pursuant to these Rules and Regulations, including but not limited to, the authority to order water service for the designated lands, to receive all notices and billings from the District and to appoint sub-agents with like authority.

Such agents are to be appointed where the ownership of the land affected is in more than one person, excepting a husband and wife living at the same address, including but not limited to the situation where the subject land is owned by:

a. A corporation.
b. A partnership.
c. A Limited Liability Corporation.
d. A Limited Liability Partnership.
e. A joint venture.
f. The State, a county or other public agency.
g. Similar entities.

Forms of the Appointment of Agent are available at the District office. They are to be executed and filed in the same form and manner as the application.

4. Water user or his duly appointed agent may designate a person or persons other than himself to place orders for and/or receive District billings pursuant to Section IX hereof. Said designation shall be on forms provided by the District and shall constitute the consent of the Water user to the collection by the District of all tolls and charges arising from the water orders so authorized in the manner authorized by Sections 47181 to 47185, inclusive, of the California Water Code.

5. Without limiting any other provision in these Rules and Regulations, the power and authority of an agent or designee appointed pursuant hereto shall continue until the owner of the lands affected shall revoke such appointment. In event of such revocation, the District Manager shall be notified in writing. In the event of multiple ownerships a revocation may be made by a majority of the landowners affected, determined on an acreage basis. It is understood that the agency or designation made pursuant hereto shall not be revoked by death or incapacity of less than all of the appointing landowners.

6. In administering these Rules and Regulations, the District will rely upon the records on file at the District office for matters regarding title to land, address of landowners, authorizations, appointments, designations, and the like, filed with the District by a water user pursuant hereto which are continuing representations upon which the District is entitled to rely unless and until the District has received at the District office actual written notice of revocation. Such representations are for the benefit of the lands affected and any charge or obligation arising in favor of the District by reason of its reliance upon such continuing representations, authorizations, applications, appointments, designations and the like filed with the District shall constitute a lien upon the lands affected thereby with the same force and effect and priority as an assessment lien and, in addition to all other remedies which may be available to the District shall be collectible, all as provided in Sections 47181 to 47185, inclusive, and Section 43003 of the California Water Code.

SECTION V. ORDERING WATER SERVICE AND MEASUREMENT OF WATER

The landowner, by filing a fully executed Application, making the necessary appointments and by paying all assessments, tolls and charges when due, satisfies these Rules for servicing of water orders.

Orders to turn on and turn off water shall be made by the landowner, or the person authorized pursuant to Section IV hereof, at the District Office, personally or by telephone Bakersfield, 661-393-3361 or Shafter-Wasco 661-746-3364.

Charges for water service made available pursuant to water orders will be calculated on the basis of continuous flow, from the time of the scheduled turn on to the scheduled turn off, multiplied by the appropriate water toll rate, and in accordance with Section IV.5. hereof.

Water user acquires no property right in the District's water supply or District's facilities by filing such order and the District retains the right to all water not consumptively used by the water user.

1. Such orders shall be submitted a minimum of 48 hours prior to the time service is requested. Water delivered will run continuously day and night until the amount of water ordered and scheduled by District for the period has been delivered. No "turn on" order will be accepted for less than a 24-hour period, unless special arrangements can be made with the District or the District has in effect a less-than-24-hour run program where water users can place orders for specific less than 24-hour periods. For the purpose of properly scheduling District's activities, it is important that "turn off" orders be given at the same time that a "turn on" order is given.

2. In general, service will be provided as requested; however, at times, District may require the rescheduling of service due to capacity limitations within the District's distribution system or necessary shutdowns for emergencies beyond District control.

3. On the day the order is put into effect the system attendant will turn the delivery gate on or off, in accordance with the scheduled delivery, at the time he passes the gate on his regular run. Generally, turn ons, turn offs and adjustments will be made by District's system attendant in the mornings. Orders for a certain hour cannot be accepted, but the system attendant will cooperate with the water user as far as possible and still maintain efficient operation of the system.

4. In the event water delivery is reduced or turned off due to actions taken by the water user, his agents, designees or their employees (including but not limited to a request that District make a non-scheduled turn off) the full amount of the water service ordered by the water user and scheduled by the District shall be paid for in accordance with the terms of the Application for Water Service and the accepted water order. If a water user, his agent, servant, employee or designee effects such unauthorized turn off he must immediately notify the system attendant or District Office.

SECTION VI. EMERGENCY TURN OFF

Water user or the District may, in an emergency, turn off the supply of water at the delivery facility. If the District effects such an emergency turn off, the water user receiving service will be notified as soon as possible. As soon as service can be resumed the water user will be notified that the District is completing his order. If a water user, his agents, servants, employees or designees effects such emergency turn off he must immediately notify the system attendant or District Office. Water users, by executing the Application for Water Service, agree to be responsible for loss or damage caused by effecting such a turn off, which amount may be collected in the same manner as the water service charges.

SECTION VII. INTERRUPTIONS IN SERVICE

Temporary shutdowns may be made by District to make improvements and repairs. Except in any emergency, all affected water users will be notified prior to making such temporary shutdowns.

In the event the District projects a water shortage for the balance of the seasonal year then the available supply will be proportioned as determined by the Board of Directors for all Class I landowners in a manner equitable and fair.

SECTION VIII. CONTROL, USE AND RECAPTURE OF WATER

1. The District will not be responsible for the control, carriage, handling, use, disposal or distribution of water delivered to water user hereunder outside the facilities then being operated and maintained by District. Water user shall indemnify, assume the defense of and hold harmless the District and its officers, agents and employees from any and all loss, damage, liability, claims or causes of action of every nature whatsoever, for damage to or destruction of property, including District's property, or for injury to or death of persons, in any manner arising out of or incidental to the control, carriage, handling, use, disposal or distribution of water outside such facilities.

2. District retains the right to all Project water not consumptively used by a water user. District may recapture water delivered to water user which may return to a District facility from any source. Such recapture shall not relieve a water user from any liability under sub-section 1 above. Once recaptured, water user causing such water to be subject to recapture shall have no recourse to District except as to such right as he may have as a water user.

SECTION IX. BILLINGS, PAYMENT AND DELINQUENCY

1. The landowner is responsible to the District for the payment of all tolls, charges and assessment incurred or assessed against said lands pursuant to said Adopted Project or these Rules and Regulations.

2. The Board may from time to time establish separate tolls for Class I Water, Regular Class II Water, Emergency Class II Water, and Special Purpose Water, less-than-24-hour-run-surcharge, or other classifications of water service it may establish. Likewise the Board may from time to time establish tolls and charges for use of District facilities. Water tolls and charges shall be filed with the District's records and shall be available for public inspection.

3. Charges for water service made available pursuant to water orders will be calculated on the basis of continuous flow from the time of the scheduled turn on to the scheduled turn off multiplied at the appropriate water toll rate.

In the event water delivery is reduced or turned off due to actions taken by the water user, his agents, or designees or their employees, including but not limited to a request that District make a non-scheduled turn off, the full amount of the water service ordered by the water user and scheduled by the District shall be paid.

4. Billings for water service made available pursuant to water orders will be prepared in accordance with water the District scheduled for delivery pursuant to turn on and turn off orders made pursuant to Section V hereof. The billings will be calculated on the basis of continuous flow during all days and nights, including Sundays and holidays, from the time of the scheduled turn on to the scheduled turn off multiplied the appropriate water toll rate and in accordance with Section IV.5 hereof.

5. For convenience of the water users, invoices for water service will be sent to the person designated in the Application for Water Service or Authorization to Receive District Billings and to place water orders shortly after the first of the month for the water taken during the prior month. Payments are due, payable and delinquent as provided in subsection IX.7 hereof.

No water will be delivered if the water user's account is delinquent or if the lands to be served are delinquent as to any District assessment, toll or charge.

6. Payment by check should be made to the order of the North Kern Water Storage District and payments may be mailed to P. O. Box 81435, Bakersfield, California 93380-1435 provided they are received with the time specified. Payments by check shall be deemed payment on the date received provided the check clears the bank in the ordinary course of business.

7. Payment is due and payable on the 1st day of the month following delivery and, if the payment is not received by the District by 5:00 o'clock p.m. on the 30th day following the date it is due and payable, said payment is delinquent within the meaning of the provisions of Water Storage District Law and the availability of water to said lands and delivery of water to said water user will be discontinued. Water service will no longer be made available to said delinquent lands and no deliveries of water will be made to said delinquent water user until all sums due and payable to District from said lands and water user, together will all interest and penalties, have been paid. To reinstate a delinquent account payment of all charges, principal and interest must be paid in full and advance payments or security deposits may be instituted by order of the Board as a condition of future availability of water to said water user. Under Water Storage District Law, such toll and charge, <u>when delinquent, must be increased by a penalty of 10% and the resulting total bears interest at the rate of 12% per year from the date of delinquency until date of payment</u>.

Should a water user be delinquent on January 1, the Board at its next regular meeting shall commence proceedings to collect the charge as provided in Sections 47181 to 47185, inclusive, of the California Water Code. This may lead to a sale of the property

affected and to continued refusal of water service. The District may also initiate such at other times during the year as directed by the Board.

8. Upon being provided evidence that a water user may be able to utilize a deepwell or other alternative water supply, the District staff may allow a prepayment for water delivery to lands in which any assessment, toll or charge is delinquent. Upon utilization of the prepayment for water deliveries all deliveries shall cease.

SECTION X. INTERFERENCE WITH DISTRIBUTION SYSTEM

No person shall molest, tamper with, or interfere with structures, meters or devices used for the delivery of water. In this connection attention is directed to the following:

> SECTION 592, PENAL CODE OF THE STATE OF CALIFORNIA: WATER DITCHES, ETC., PENALTY FOR TRESPASS OR INTERFERENCE WITH.
>
> "Every person who shall, without authority of the owner or managing agent, and with intent to defraud, take water from any canal, ditch, flume or reservoir used for the purpose of holding or conveying water for manufacturing, agricultural, mining, irrigating or generation of power, or power, or domestic uses, or who shall without like authority, raise, lower or otherwise disturb any gate or other apparatus thereof, used for the control or measurement of water, or who shall employ or place, or cause to be emptied or placed, into any such canal, ditch, flume or reservoir, any rubbish, filth, or obstruction to the free flow of the water, is guilty of a misdemeanor."

SECTION XI. RIGHT OF ENTRY

By execution of an Application for Water Service, water user grants to District, its agents, servants, employees, and designees, a right of entry of water user's lands for the purpose of properly providing requested service by the water user.

SECTION XII. ENFORCEMENT OF RULES AND REGULATIONS

The manager shall be responsible for the enforcement of these Rules and Regulations. Refusal to comply with any of the Rules and Regulations shall be sufficient cause for the termination of water service, and water service will not again be furnished until full compliance has been made with all the requirements herein set forth. In no event shall any liability accrue against the District or any of its officers, agents or employees, for damage, direct or indirect, arising from such temporary discontinuance or reduction of water deliveries.

SECTION XIII. PROCEDURE FOR ANNUALLY FIXING THE AMOUNT OF BASE SERVICE CHARGES

1. In accordance with Section 43003 of the Water Code, the following procedures are established for fixing tolls and charges authorized by Sections 43006 and 47180.

In order to provide for payment of project costs in proportion to services rendered to all lands within the District and in proportion to the services rendered to developed Class I and Class II lands under present Project conditions it is necessary that a Base Service Charge, in addition to tolls and charges fixed for surface water service, including charges for use of the District's distribution system, be established which charge shall be made due and payable or a day certain between November 1st and December 1st of each year.

The Base Service Charge is the amount of money necessary to be raised by the District to provide for and to recover costs incurred in the administration of the District, including salaries, services and supplies, and the costs incurred by reason of the construction and operation of its adopted Project, in excess of income from surface water service, including charges for use of the District's distribution system, plus a reasonable percentage not to exceed 15% for delinquency, and a percentage necessary to cover costs of collection.

Since there are no undeveloped assessable lands in the District and since all assessable Class I lands use or have the potential to use District surface water service and all other assessable lands are Class II lands developed in reliance upon the use of groundwater, which includes all commercial, industrial and residential lots or parcels, benefit from the District and its operations, District costs to be recovered from the Base Service Charge shall be allocated in accordance with the benefits attributable to Class I and Class II lands, which costs shall be shared equally on a per acre basis among all landowners of each class of land; EXCEPTING, that minimum rates per parcel may be established for tracts of land less than five acres in area.

2. It is necessary that the following procedure be established for annually fixing and collecting the Base Service Charge:

a. At the regular meeting in October or at such other time as may be announced at said meeting, the Board shall consider, determine and by resolution fix the total amount to be collected by reason of such charges; The percentage for delinquency and cost of collection attributable to such charges; the amount to be collected from Class I and Class II lands and the estimated rates per acre necessary to collect the charge from the respective classes of land; the minimum rate for sub-five acre parcels; order the adoption of the preliminary roll and that the roll be extended by the Manager in accordance with

the findings of the Board and filed with the Secretary; set the time and place of hearing of objections to the roll as provided in subparagraph (d) hereof and determine the newspaper or newspapers in which notice shall be published.

b. Prior to the fixing of the charge by the Board, the Manager shall prepare and file with the Board a report recommending an allocation of costs proposed to be collected as the Base Service Charge together with a proposed preliminary roll. The report shall contain an estimate of the total amount to be collected by reason of such charge and as allocated to Class I and Class II lands; the percentage for delinquency and cost of collection attributable to such charge; the estimated rates per acre for Class I and Class II lands and the minimum charge for parcels less than five acres in area.

The roll shall set forth the assessee parcels and assessee names for each parcel of assessable land in the District, determined in accordance with the provisions of Chapter 3, Part 1, Division 14 (commencing with Section 39050) of the Water Code and matters on file in District's records; the County Assessor's parcel numbers; the acreage assessed to each such assessee according to District's records and the classification of each such tract of land.

The Manager shall estimate the preliminary rates per acre for said charges, which rates shall be based upon the matters set forth in said roll and the determinations of the Board and shall be separately stated as a rate per acre for Class I and Class II lands and the rate of tracts less than 5 acres.

Said roll may include information mentioned in Sections 47325 et seq. of the Water Code dealing with collection of assessments against which bonds have been issued.

c. Said report, resolution and preliminary roll as extended shall be filed with the Secretary and be available for public inspection at the District office. Plat maps of assessable acreage shall be prepared by the District's staff and shall be kept on file at the District's office.

Without designation the Secretary shall forthwith publish notice of the filing of the preliminary roll, which notice shall set forth the preliminary rates per acre, the minimum charge for parcels less than five acres in area and declare the time and place set by the Board when the Board will meet and hear any objection to the charges established for said respective tracts of land as set forth in the roll. Said notice may contain matters required by Section 47325

et seq. Of the Water Code dealing with collection of assessments against which bonds have been issued. The notice shall be published once a week for two successive weeks, as provided in Sections 39057 and 47326 of the Water Code. Said hearing shall not be less than three weeks after the first date of publication.

As a convenience to the assessees the Secretary shall deposit a copy of said notice in the mail, addressed to each assessee shown on the preliminary roll at their address as set forth in said roll. The mailing shall be completed at least 10 days prior to the hearing date.

d. At the time and place for hearing of objections, the Board shall consider such objections to the roll and make such corrections thereto as are necessary and proper. Upon conclusion of the hearing, the Board shall by resolution adopt said roll as finally fixed and determined; make such changes in the preliminary rates per acre necessitated thereby; fix the date the charges shall be due and payable which date shall be no later than December 1; order that the charges be collected by the District Treasurer; and order the Treasurer of the District to certify said roll. provided, however, that the Board may order that a portion of the charge may be paid as a second installment due and payable no later than April 1 of the following year. The certified roll shall be filed with the Secretary of the District.

e. The Secretary shall forthwith publish notice of the filing of the roll as finally fixed and adopted which notice shall contain the information mentioned in Subparagraph (c). hereof as the same has been finally determined. As a convenience to the assessees, the Secretary shall deposit in the mail, addressed to each assessee as shown on the roll, an invoice stating the amount of the Base Service Charges due and payable to the District Treasurer for said parcel prior to December 1st of each year. Said invoice may include information regarding payment of calls on assessments against which bonds have been issued as is mentioned in Sections 47352 et seq. of the Water Code.

f. The Base Service Charge becomes delinquent if payment is not received by the District Treasurer by 5:00 o'clock p.m. on the 30th day following the date charges are due and payable. Delinquent accounts and affected landowners shall be subject to the same provision applicable to water tolls and affected water users, as more particularly described at Section IX.7 above.

g. The policy and procedure contained in this section shall continue until such time as the Board determines, pursuant to noticed public hearing, that said charges, or any of them, are to be fixed on some basis other than that herein provided or until such time as there has been a reassessment of Project costs as provided in Section 46355 of the Water Code.

SECTION XIV. ENCROACHMENT ON DISTRICT PROPERTY

Without limiting rights otherwise reserved, consent for encroachment will be required from the District before any drains, fences, pipelines or other encroachments will be permitted upon District's property. Consent forms will be furnished by the District to the applicant and must first be approved by the Manager or his designee before any construction begins. Where District rights in any property are an easement, no encroachments will be permitted which will in any manner interfere with the rights under said easement, and the District's consent must first be obtained before any pipelines or other encroachments are constructed in any easement area. The work shall be constructed to specifications approved by the District at the sole expense of the permittee and maintained to the satisfaction of the District. If such consent is granted, the permittee shall be solely responsible for and shall indemnify and shall assume the defense of and hold harmless the District and its officers, agents and employees from any and all loss, damage, liability, claims or cause of action of every nature whatsoever, for damage, to or destruction of property, including the District's property, or for injury to or death of persons, in any manner, arising out of permittee's exercise of rights and privileges given in the granting of the such consent. Issuance of consent does in no way grant a permanent right, and if the District determines at a future date that said works do in fact interfere with its operations, said works shall be removed and the District's property restored to its original state at the sole expense of the permittee. Granting of such consent does in no way and in no extent surrender or subordinate the District's control or supervision over the encroachment. Any person or his authorized agent who uses the property of District for the movement of equipment shall be responsible to District for any damage to District property. Any persons using a District right-of-way for any purpose assumes all risks associated therewith and assumes the responsibility for any damage to District property resulting therefrom and also for any damage to private property caused by such dame to District property.

SECTION XV. ACCESS TO DISTRICT RECORDS

All District records shall be maintained at the District Office. Such records are for the exclusive use of the District and shall be made available for use for other purposes only as provided by Resolution No. 80-44, as amended from time to time, adopted pursuant to the California Public Records Act (Government Code Sections 6250 et seq.).

SECTION XVI. GENERAL PROVISIONS

1. No water necessary to meet the demands of Class I lands under these Rules and Regulations shall be diverted at any time for the irrigation of Class II lands. Water user shall use the project water only upon the lands shown in his Application for Water Service and to be irrigated pursuant to the turn on order.

2. As stated in Section III.3, the water furnished by the District is not treated to make it safe for drinking purposes and anyone making such use of District water does so contrary to these Rules and Regulations at his own risk.

SECTION XVII. UNUSED ENTITLEMENT IN DISTRICT'S DISTRIBUTION SYSTEM.

The Board may authorize the use of such unused capacity in its Distribution System as the Board may in its absolute discretion determine that it is to the best interest of the Class I and Class II Lands for the benefit of areas annexed to the District by proceedings known as Annexation No. 1 (1966) upon such terms and conditions as the Board may from time to time establish.

Northing herein contained shall detract from the conditions under which such lands were annexed to the District including that portion reading as follows: "No annexed area nor any of the landowners within the annexed area shall acquire any use or right of use of existing property of the North Kern Water Storage District, real or personal, including but not limited to rights for conveyance of water by reason of the annexation of said territory.

SECTION XVIII. CHANGES IN RULES AND REGULATIONS

These Rules and Regulations shall become effective October 21, 2003, and can or may be added to, amended or repealed at any time by resolution of the Board.

SECTION XVIV. SEVERABILITY OF PROVISIONS

If any provision of these Rules and Regulations, or the application thereof to any person or circumstances, is held invalid, the remainder of these Rules and the application of its provisions to other persons or circumstances, shall not be affected thereby.

ANNEX

1. Map of District - Class I and Class II lands.

2. Copy of resolution of Board of Directors for Adoption of Rules and Regulations effective October 21, 2003.

LOCATION MAP

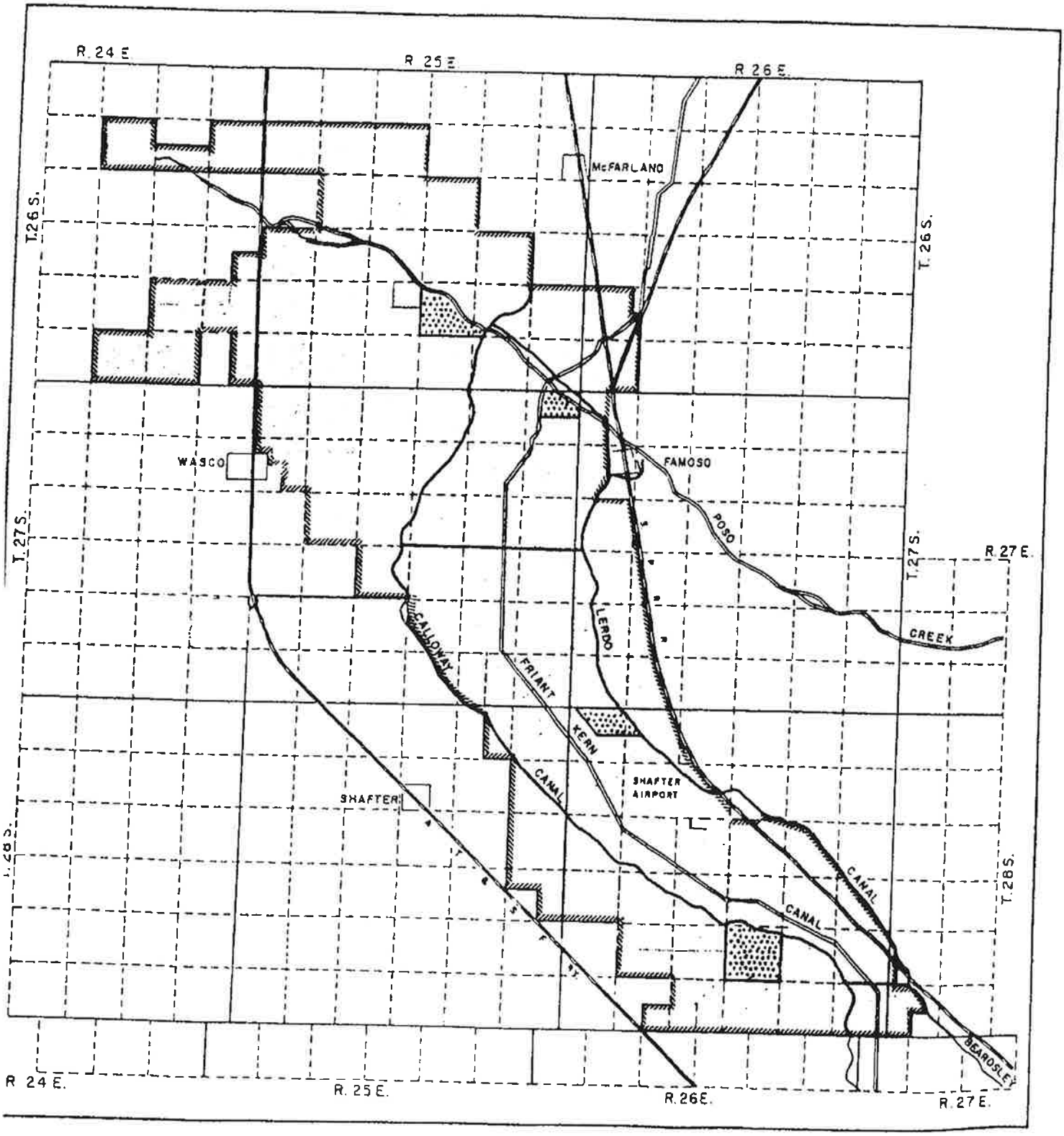
NORTH KERN WATER STORAGE DISTRICT

ANNEX NO. 1
DISTRICT RULES & REGULATIONS

District Boundary
Class I Lands
Class II Lands
District Spreading Ponds

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SECTION NO'S WITHIN TOWNSHIP



BOARD OF DIRECTORS
North Kern Water Storage District
Minutes of Regular Meeting - October 21, 2003

The following is a portion of the actual Minutes of October 21, 2003.

(03-91) Upon motion of Director Castle, seconded by Director Fanucchi, that the " **Rules and Regulations for Distribution and Use of Water for the North Kern Water Storage District, Amended and Restated on October 21, 2003"** was authorized by the following vote:

AYES: Directors Castle, Fanucchi and Wilkendorf
NOES: None
ABSENT: Directors Andrew and Camp
ABSTAIN: None

Anne Koop

Anne Koop, Assistant Secretary
North Kern Water Storage District

CERTIFICATE OF ACCEPTANCE
GOVERNMENT CODE SECTION 26281:

THIS IS TO CERTIFY that the NORTH KERN WATER STORAGE DISTRICT hereby accepts for public purposes the within document and consents to the recordation thereof.

IN WITNESS THEREOF, I have hereunto set my hand this 28th **day of** October**, 20**03**.**

Anne Koop

Assistant Secretary
Board of Directors
North Kern Water Storage District

NORTH KERN WATER STORAGE DISTRICT
(SEAL)

C:\MyFiles\AGREEMEN\CertificateofAcceptance.wpd

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT

State of California
County of KERN } ss.

On 10/28/2003 (Date), before me, Diane A Williams, Notary Public (Name and Title of Officer (e.g., "Jane Doe, Notary Public")),

personally appeared Anne Koop (Name(s) of Signer(s)),

☒ personally known to me
☐ proved to me on the basis of satisfactory evidence

to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

DIANE A. WILLIAMS
COMM. #1348474
NOTARY PUBLIC • CALIFORNIA
KERN COUNTY
My Comm. Exp. Apr 22, 2006

Place Notary Seal Above

WITNESS my hand and official seal.

Diane A. Williams
Signature of Notary Public

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

Description of Attached Document

Title or Type of Document: NKWSD Rules and Regulations for Distribution of Water - 10/21/2003

Document Date: _____ Number of Pages: _____

Signer(s) Other Than Named Above: _____

Capacity(ies) Claimed by Signer

Signer's Name: _____

☐ Individual
☐ Corporate Officer — Title(s): _____
☐ Partner — ☐ Limited ☐ General
☐ Attorney in Fact
☐ Trustee
☐ Guardian or Conservator
☐ Other: _____

RIGHT THUMBPRINT OF SIGNER
Top of thumb here

Signer Is Representing: _____

© 1999 National Notary Association • 9350 De Soto Ave., P.O. Box 2402 • Chatsworth, CA 91313-2402 • www.nationalnotary.org Prod. No. 5907 Reorder: Call Toll-Free 1-800-876-6827

RECORDING REQUESTED BY

NORTH KERN WATER STORAGE DISTRICT

WHEN RECORDED MAIL TO

NAME NORTH KERN WATER STORAGE DISTRICT

MAILING ADDRESS P.O. Box 81435

CITY, STATE Bakersfield, CA

ZIP CODE 93380

Kern County Recorder
Conformed Copy

AUG 25 2008

Document_____

SPACE ABOVE THIS LINE RESERVED FOR RECORDER'S USE

Fee Exempt
Govt. Code
Section 610

TITLE(S)

COPY

RESOLUTION NO. 08-76 AMENDING RULES AND REGULATIONS FOR DISTRIBUTION AND USE OF WATER

Legal Solutions Plus LS-201

BEFORE THE BOARD OF DIRECTORS OF
NORTH KERN WATER STORAGE DISTRICT

IN THE MATTER OF: RESOLUTION NO. 08-_76_

AMENDING RULES AND REGULATIONS FOR
DISTRIBUTION AND USE OF WATER

SECTION A

WHEREAS, this Board of Directors Declares and Determines as follows:

(1) Pursuant to Water Code Section 43003 and 43003.5, the Board of Directors is empowered and has previously adopted rules and regulations for distribution and use of water in the District, which were last amended and restated effective October 21, 2003 ("Rules and Regulations" herein after), and recorded with the Official Records of Kern County as Document No. 6203236557.

(2) A significant portion of the District's water rights were acquired under an agreement dated January 1, 1952 entitled "Agreement for Use of Water Rights" by and between Kern County Land Company, et al and North Kern Water Storage District ("1952 Agreement").

(3) On August 20, 2008 the District and the City of Bakersfield (successor to Kern County Land Company, et al, under the 1952 Agreement), entered into a settlement agreement of certain disputed claims stated in litigation filed March 6, 2007 entitled "City of Bakersfield v. North Kern Water Storage Water District, et al (Tulare County Superior Court Case No. CIV224933), and pursuant to the above referenced settlement agreement have executed Amendment No. 1 to the 1952 Agreement ("Amendment No. 1").

(4) This Amendment of the Rules and Regulations is adopted to establish interim procedures under which landowners may utilize District water supplies for municipal and industrial purposes, which is provided for under Amendment No. 1.

SECTION B

NOW, THEREFORE, BE IT RESOLVED, by the Board of Directors as follows:

(1) The foregoing findings are true and correct.
(2) The Rules and Regulations for Distribution of Water are hereby further Amended to add as paragraph 6 to Section III the following:

"6. No person owning land within the boundaries of the District is authorized by the District to use any water derived from water rights identified in the January 1952 "Agreement for Use of Water Rights" by and between the Kern County Land Company, et al and North Kern Water Storage District for any purpose other than irrigation, stock watering and underground water replenishment. Specifically, the District does not authorize the use of such water for any municipal and industrial purpose (M&I "Use") until such time that the project proponent has complied with all applicable laws, including, but not limited to, the California Environmental Policy Act (Public Resources Code Section 21000, et. seq.) and these Rules and Regulations, as they may be amended; provided, however, the foregoing does not restrict use of groundwater supplies used for any domestic water used on farmsteads consisting of actual homes or offices that are located on working farms, or any water used incidental to preparing or processing agricultural crops for market, or any M&I use that exists as of August 20, 2008."

(3) The District does not propose any action or project to use water derived from the 1952 Agreement for purposes other than irrigation, stock watering and underground water replenishment, as is consistent with historic practices, except as provided in the above-referenced Rule III.6.

(4) This Amendment of the Rules and Regulations shall be effective upon the execution of Amendment No. 1 by the City of Bakersfield.

(5) A certified copy of this resolution shall forthwith be recorded with the County Recorder of Kern County pursuant to Water Code Section 43003.5 and copies of same shall be available for public inspection at the District office.

ALL THE FOREGOING, being on motion of Director Castle, seconded by Director Camp, was hereby authorized by the following vote, to wit:

AYES: Castle, Camp, Fanucchi, and Wilkendorf

NOES: None

ABSTAIN: None

ABSENT: Andrew

I HEREBY CERTIFY that the foregoing is a true copy of the resolution of the Board of Directors of THE NORTH KERN WATER STORAGE DISTRICT as duly passed and adopted by said Board of Directors at a meeting held this 19th day of August, 2008.

WITNESS my hand and official seal of said Board of Directors this 22nd day of August, 2008.

Secretary of the Board of Directors

[DISTRICT SEAL]

APPENDIX E Water Meter Accuracy Verification Form

North Kern Water Storage District - Water Meter Accuracy Verification Form

Date	Turnout No	Meter Name and Model	Year Installed	Pipe Size (in)	Flowmeter Reading (gpm) A	Ultrasonic meter Reading (gpm) B	Elapsed Time	Difference (A-B) C	Percent Error (C/B)*100	Test Person Initial
10/3/2012	8-00-29	McCrometer 03-05307-10	2003	10"	950gpm	935gpm	10Min	15gpm	1.6%	SM
10/3/2012	8-00-34	McCrometer 02-03-145-10	2002	10"	1450gpm	1504gpm	10Min	54gpm	3.5%	SM
10/3/2012	8-00-40	McCrometer		10"	1400gpm	1401gpm	10Min	1gpm	0.7%	SM
10/3/2012	8-00-63B	McCrometer 03-02610-10	2003	10"	1000gpm	1132gpm	10Min	132gpm	11.6%	SM
10/3/2012	8-00-63A	McCrometer 03-02609-10	2003	10'	1100gpm	1115gpm	10Min	15gpm	1.3%	SM
10/4/2012	8-00-60A	McCrometer 97-8729-10	1997	10"	1290gpm	1059gpm	10Min	231gpm	21.8%	SM
10/4/2012	8-00-60B	McCrometer 97-8727-10	1997	10"	500gpm	482gpm	10Min	18gpm	3.7%	SM
10/4/2012	8-00-66	McCrometer 06-66620-12	2006	12"	700gpm	946gpm	10Min	246gpm	26.0%	SM
10/4/2012	8-00-78B	Seametrics 05119468		10"	2155gpm	1739gpm	10Min	416gpm	23.0%	SM
10/4/2012	8-00-78a	Seametrics 05119483		10"	1963gpm	1844gpm	10Min	119gpm	6.4%	SM
10/4/2012	8-17-24b	McCrometer 97-05601-12	1997	12"	2100gpm	1960gpm	10Min	139gpm	7.1%	SM
10/8/2012	8-00-43	McCrometer		6"	400gpm	400gpm	10Min	0gpm	0.0%	SM
10/8/2012	8-00-24	McCrometer 97-5186-10	1997	10"	1400gpm	1414gpm	10Min	14gpm	1.0%	SM
10/8/2012	8-0-25	McCrometer 94-8453-10	1994	10"	1350gpm	1323gpm	10Min	26gpm	2.0%	SM
10/9/2012	8-03-5C	McCrometer 08-04650-08	2008	8"	500gpm	520gpm	10Min	30gpm	5.7%	SM
10/9/2012	8-03-25A	McCrometer 08-04939-08	2008	8"	1500gpm	838gpm	10Min	662gpm	78.0%	SM
10/11/2012	8-03-43A	McCrometer 97-05602-10	1997	10"	1900gpm	1740gpm	10Min	160gpm	9.1%	SM
10/11/2012	8-03-43B	McCrometer 99-02340-10	1999	10"	1350gpm	1280gpm	10Min	70gpm	5.4%	SM
10/11/2012	9-07-12B	McCrometer 98-7259-12	1998	12"	2280gpm	2340gpm	10Min	60gpm	2.5%	SM
10/11/2012	9-07-12A	McCrometer 91-12-742	1991	12"	2700gpm	2563gpm	10Min	137gpm	5.3%	SM
10/11/2012	9-00-27	McCrometer 07-12100-08	2007	8"	800gpm	758gpm	10Min	42gpm	5.5%	SM
10/11/2012	9-00-24	McCrometer 08-11724-10	2005	10"	850gpm	857gpm	10Min	7gpm	0.8%	SM
10/11/2012	8-11-8B	McCrometer 97-8730-10	1997	10"	1200gpm	1034gpm	10Min	166gpm	16.0%	SM
10/11/2012	8-11-8A	McCrometer 97-8726-10	1997	10"	1100gpm	1248gpm	10Min	148gpm	11.8%	SM
10/14/2012	8-17-6A	McCrometer 03-06877-10	2003	10"	1000gpm	976gpm	10Min	24gpm	2.4%	SM
10/14/2012	8-17-6C	McCrometer 08-07592-10	2008	10'	1300gpm	1300gpm	10Min	0gpm	0.0%	SM
10/14/2012	8-00-87D	McCrometer 03-06880-10	2003	10"	1200gpm	1184gpm	10min	16gpm	1.3%	SM
10/14/2012	8-00-87C	McCrometer 06-03483-10	2006	10"	1400gpm	1237gpm	10Min	163gpm	13.1%	SM
10/14/2012	8-00-87B	McCrometer 99-2717-10	1999	10"	1385gpm	1286gpm	10Min	99gpm	7.6%	SM
10/14/2012	8-00-87A	McCrometer 97-08275-10	1997	10"	1800gpm	1556gpm	10Min	244gpm	15.6%	SM
10/14/2012	8-21-3A	McCrometer 06-03362-10	2006	10"	1050gpm	1032gpm	10Min	18gpm	1.7%	SM
10/14/2012	8-17-6B	McCrometer 97-08277-10	1997	10"	1500gpm	1139gpm	10Min	361gpm	31.0%	SM
10/14/2012	8-17-6D	McCrometer 03-06880-10	2003	10"	1200gpm	1184gpm	10Min	16gpm	1.3%	SM

NORTH KERN WATER STORAGE DISTRICT

North Kern Water Storage District

2015 Agricultural Water Management Plan