California Water Plan Update 2013
Groundwater Caucus Meeting

Groundwater Content Enhancement

Deliverable #6:
Inventory and Describe Potential for Conjunctive Management of Groundwater and Other Supplies

November 10, 2011

Deliverable #6

Three Main Goals:

1. Inventory existing conjunctive use, recharge and groundwater banking projects
2. Determine future conjunctive management potential
3. Define constraints

Deliverable #6: Conjunctive Management Potential

Goal 1: Inventory Existing Recharge, Conjunctive Use and Groundwater Banking Projects

- Data Gathering – Published Sources
  1. Compile published sources
  2. Summarize issues, lessons learned, policies, constraints
  3. Identify data gaps
- Data Gathering – Past Surveys of Groundwater Banks
  1. Update groundwater banking surveys
  2. Expand to other types
- Public/Private Partnership w/ACWA to update survey information
  1. Data gathering and compiling

Deliverable #6: Conjunctive Management Potential

Goal 2: Determine Future Conjunctive Management Potential

- Identify/map/describe (GIS tool?)
  1. Available aquifer storage space
  2. Potential recharge areas
  3. Sources of available water
  4. Compare with areas of critical need
- Groundwater Recharge Potential as a Result of Flooding

Deliverable #6: Conjunctive Management Potential

Goal 3: Define Constraints

- Limitations on Conjunctive Management
  1. Water quality
  2. Water rights issues
  3. Limiting shallow water table
  4. Land use
  5. Inconsistent and uncertain regulatory status re: commingling of differing water qualities
  6. Lack of data and tools
  7. Storage and conveyance capacity limitations

Deliverable #6: Conjunctive Management Potential

Consistency with CWP 2009

- Increase Groundwater Storage
- Use Surface Water as an Interrelated Part of Groundwater
  1. Improved local or regional water supply reliability
  2. Increased flood protection

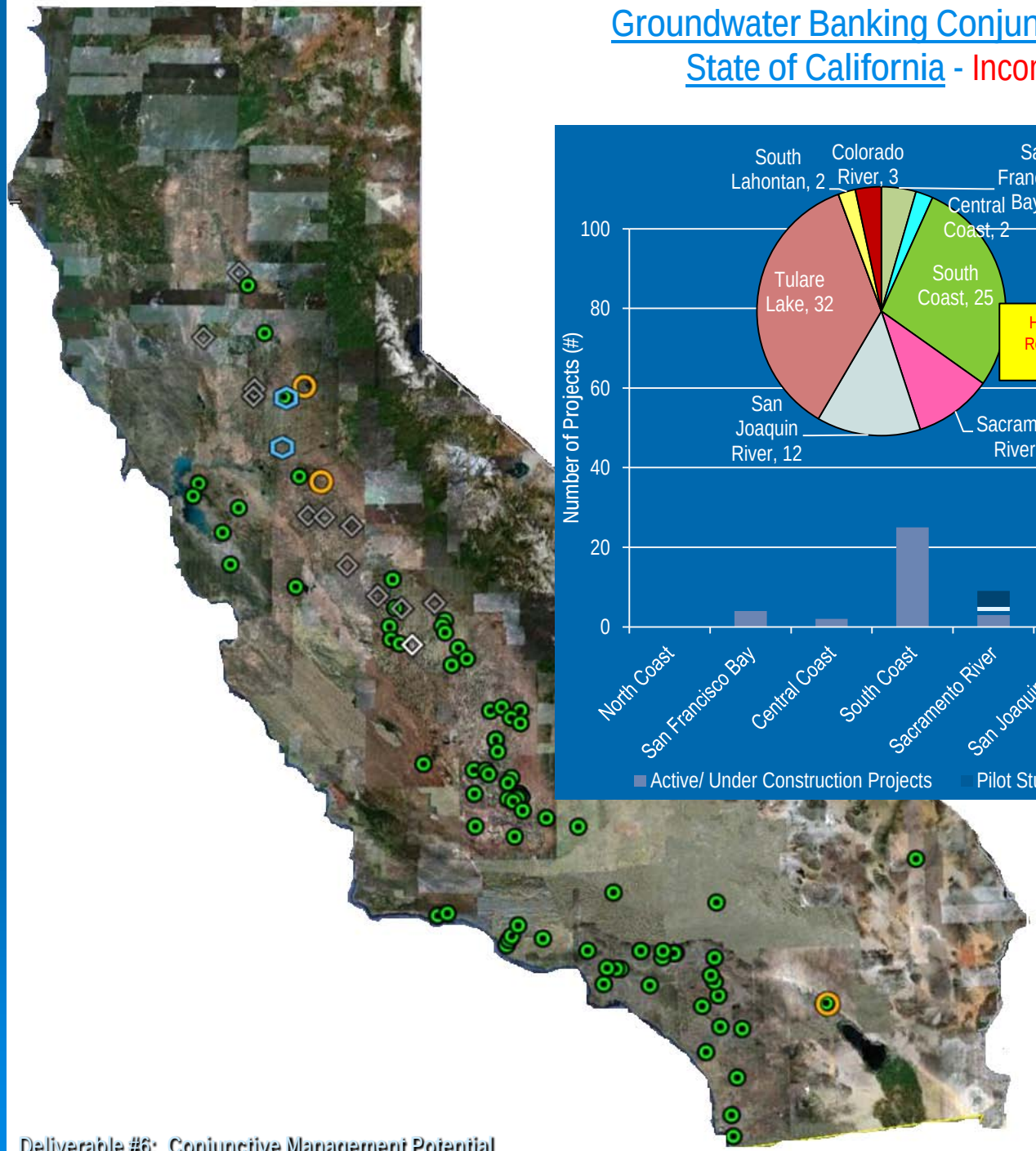
Deliverable #6: Status Update

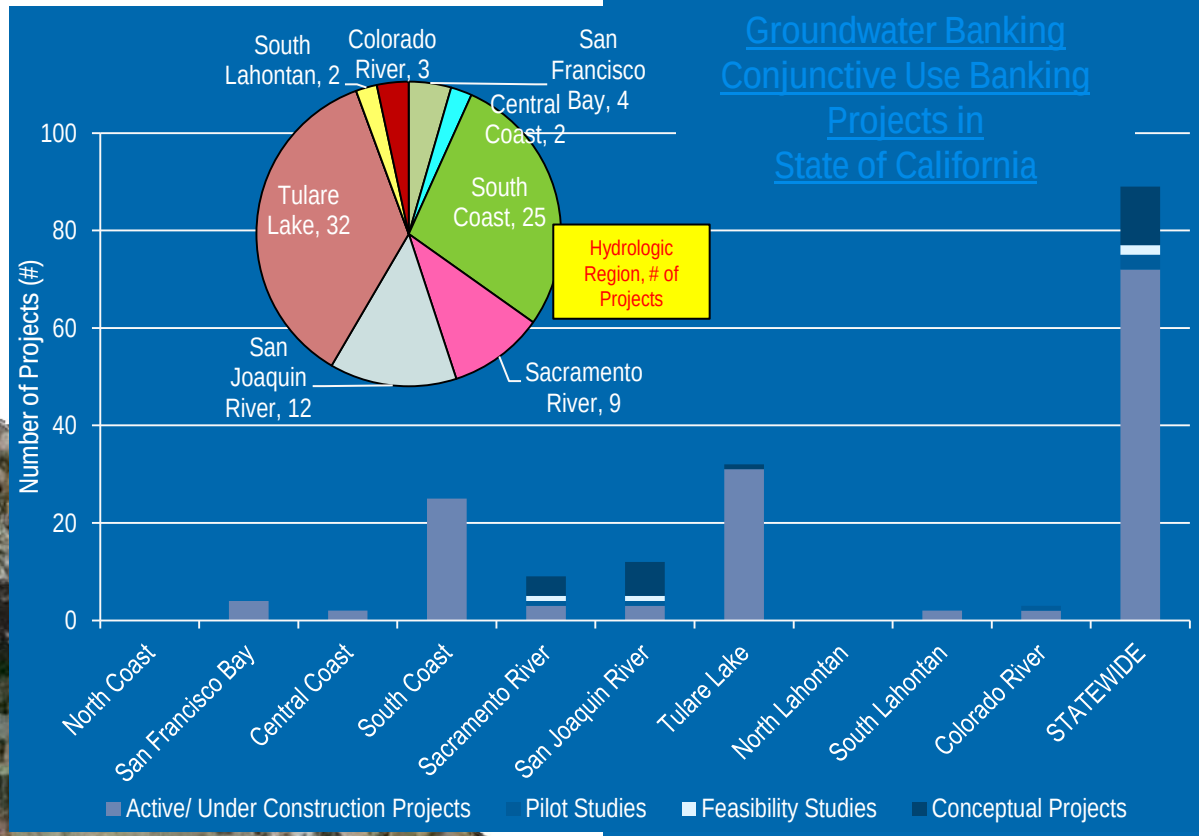
Goal 1: Data Gathering

Preliminary Survey Results:

Groundwater Bank Data

Groundwater Banking Conjunctive Use Banking Projects in State of California - Incomplete Preliminary DRAFT





LEGEND

- Active/ Under Construction Projects
- Pilot Studies
- Feasibility Studies
- Conceptual Projects

Groundwater Bank Data

Surface Storage – For Magnitude Comparison With GW Banks

North of the Delta	Storage Capacity (AF)
Pardee/Camanche Reservoirs	614,070
Trinity	2,477,700
Shasta	4,552,000
Almanor	1,143,000
Oroville	3,537,600
New Bullards Bar	966,103
Tahoe	732,000
Folsom	977,000
Berryessa	1,600,000
Subtotal	**16,599,473**

South of the Delta	Storage Capacity (AF)
Millerton Lake	520,500
Edison Lake	125,000
Florence Lake	64,000
Huntington Lake	89,000
Shaver Lake	136,000
Mammoth Pool	122,000
Redinger Lake	26,000
Crane Valley Reservoir	45,500
Kerckhoff Reservoir	4,188
Pine Flat Reservoir	1,000,000
Lake Isabella	568,000
New Don Pedro Reservoir	2,030,000
San Luis Reservoir	2,039,000
Lake Kaweah	184,000
New Exchequer	1,024,600
New Melones Lake	2,400,000
Cachuma	190,500
Casitas	254,000
Nacimiento/San Antonio	707,900
Subtotal	**11,530,188**
Grand Total	**28,129,661**

Groundwater Banks - Tulare Lake Hydrologic Region

		Type	Storage Capacity (AF)
Kern County GW Banks	Semitropic	in-lieu	1,650,000
	Kern Water Bank	percolation	1,000,000
	City of Bakersfield	percolation	800,000
	Arvin Edison	percolation	500,000
Meyers Water Bank and Wildlife Project		percolation	20,000
Turnipseed Basin (Delano-Earlimart ID)		percolation	
Leaky Acres (City of Fresno)		percolation	
Waldron Pond (Fresno ID)		percolation	
Consolidated ID		percolation	
Apex Conjuntive Use (Kings County WD)		percolation	20,000
		Total	**3,990,000**

Deliverable #6: Develop Additional Data

ACWA Survey Questionnaire

- Location of Project (groundwater basin level information)
- Year Project Developed
- Capital Costs to Develop Project
- Annual Operating Costs (O&M)
- Project Administrator/Operator
- Capacity of the Project in Acre Feet

Deliverable #6:
Is a GIS Tool Possible?

Goal 2: Determine Future Conjunctive Management Potential

- Identify/map/describe (GIS tool?)
  1. Available aquifer storage space
  2. Potential recharge areas
  3. Sources of available water
  4. Compare with areas of critical need

Deliverable #6: Available Aquifer Storage Space

Identify Permeable Aquifers

- Two (of Many) Possible Methods
  1. USGS Data – A driller's test and a rough measure of aquifer permeability, or, show me the gravel
  2. Gary Weissman Data

Available Aquifer Storage Space
USGS Data

Use of Ground-Water Reservoirs for Storage of Surface Water in the San Joaquin Valley California

By G. H. DAVIS, B. E. LOFGREN, *and* SEYMOUR MACK

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1618

Prepared in cooperation with the California Department of Water Resources

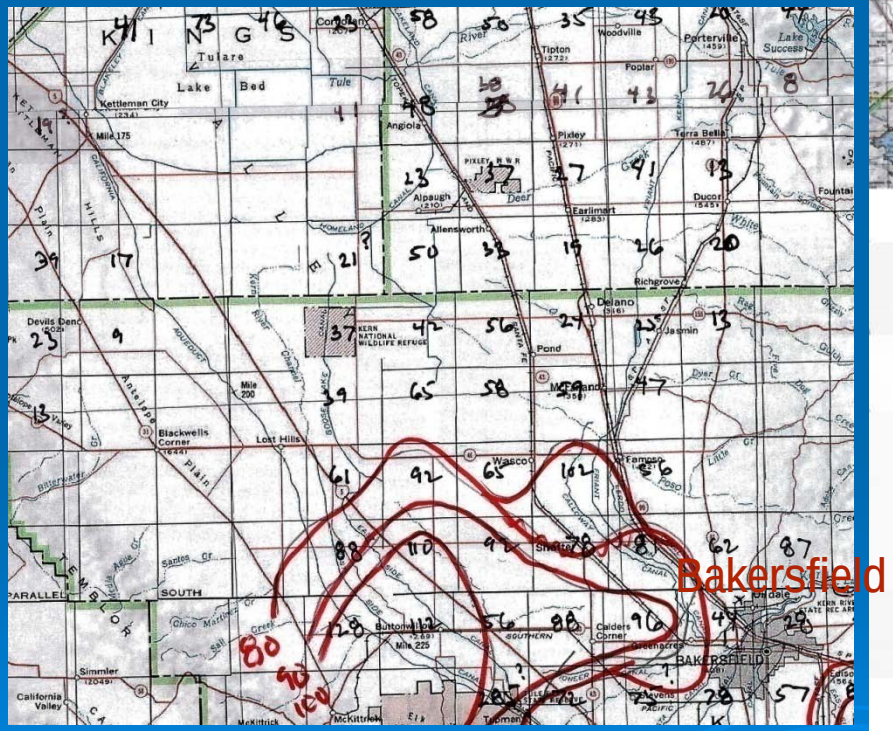
UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1964

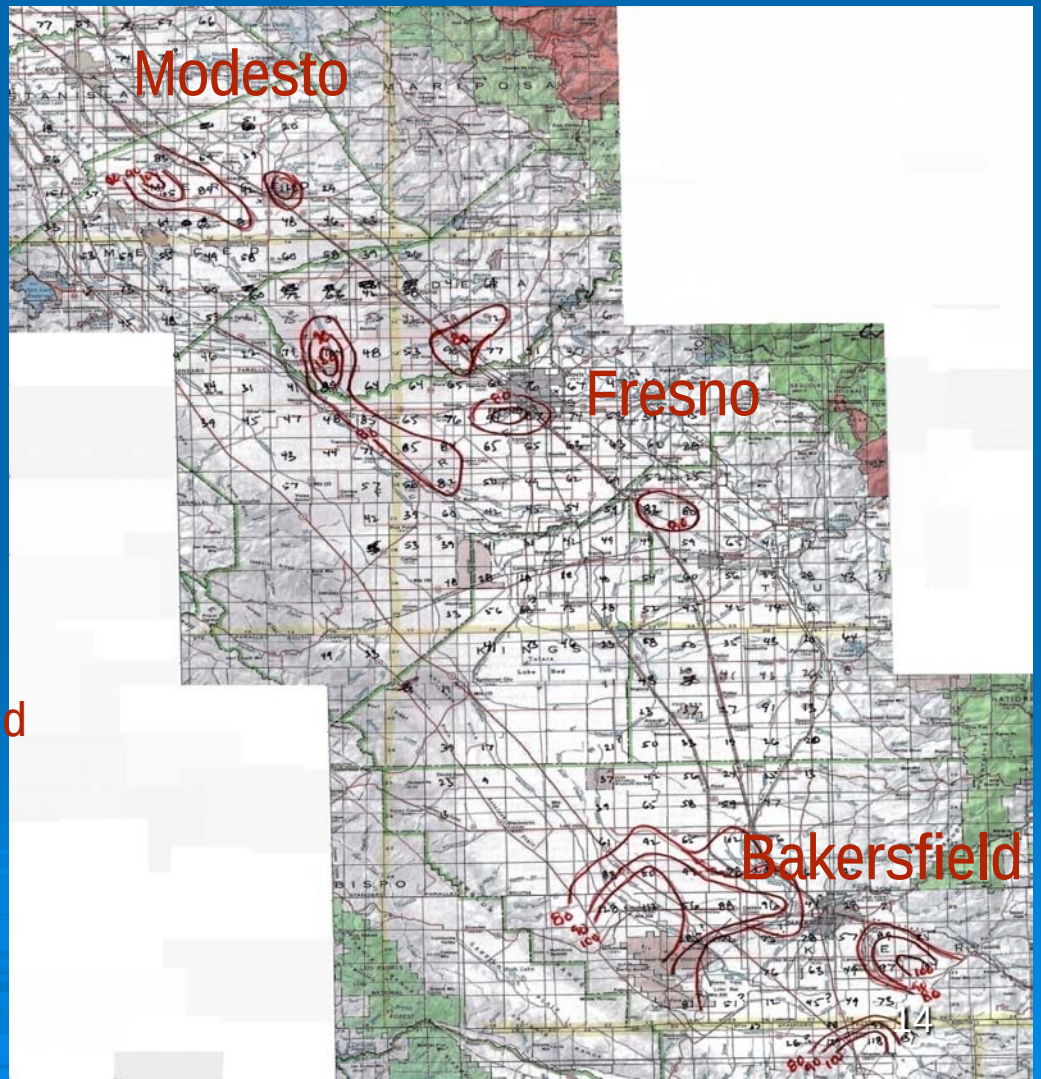
TABLE 3.—*Yield characteristics of irrigation wells in the San Joaquin Valley by townships*

[Data presented as averages. Pump test data from Pacific Gas & Electric Co. and Southern California Edison Co.]

Townships	Number of tests (discharge)	Static level (feet)	Pumping level (feet)	Drawdown (feet)	Discharge (gpm)	Specific capacity (gpm per foot)	Kilowatt-hour per acre-foot	Plant efficiency
Mount Diablo base line and meridian								
T. 1 S., R. 5 E.	4	10	34	24	1,182	37	57	51
T. 1 S., R. 6 E.	48	14	45	29	881	36	94	53
T. 1 S., R. 7 E.	38	15	34	16	1,163	72	142	52
T. 1 S., R. 8 E.	88	28	48	16	1,181	74	100	53
T. 1 S., R. 9 E.	25	46	63	19	895	57	125	57
T. 1 S., R. 10 E.	11	76	98	16	1,331	102	145	59
T. 1 S., R. 11 E.	2	--------	111	--------	685	--------	184	60
T. 2 S., R. 4 E.	1	141.8	200.8	--------	118	--------	778	--------
T. 2 S., R. 5 E.	17	23	69	32	1,163	31	239	57
T. 2 S., R. 6 E.	22	4	73	22	1,316	38	136	51
T. 2 S., R. 7 E.	22	1	30	13	993	64	186	54
T. 2 S., R. 8 E.	24	7	27	11	762	77	232	56
T. 2 S., R. 9 E.	23	6	45	16	994	54	160	52
T. 2 S., R. 10 E.	33	5	95	18	1,238	73	216	61
T. 2 S., R. 11 E.	15	95	111	20	1,340	57	194	64
T. 2 S., R. 12 E.	4	53	105	33	1,238	66	198	65
T. 3 S., R. 5 E.	10	140	190	29	1,225	30	351	52
T. 3 S., R. 6 E.	29	36	134	34	1,242	10	293	54
T. 3 S., R. 7 E.	1	--------	--------	--------	805	--------	48.4	25
T. 3 S., R. 10 E.	8	72	91	20	1,260	74	165	62
T. 3 S., R. 11 E.	4	94	119	21	1,270	78	163	61
T. 3 S., R. 13 E.	1	89.9	121.6	31.7	460	14.5	383	68
T. 4 S., R. 6 E.	7	--------	206	--------	1,178	--------	384	51
T. 4 S., R. 7 E.	7	35	57	16	1,731	72	141	58
T. 4 S., R. 13 E.	1	14.6	--------	--------	1,251	--------	75.1	--------
T. 5 S., R. 7 E.	18	128	160	43	1,354	14	329	60
T. 5 S., R. 8 E.	3	67	95	28	576	18	560	66
T. 5 S., R. 12 E.	1	--------	15.3	--------	1,573	--------	139.1	71.2
T. 5 S., R. 13 E.	2	20.6	43	--------	1,448	51	217	53
T. 5 S., R. 14 E.	1	9.0	12.1	3.1	61	19.7	332.1	28.1

Available Aquifer Storage Space
USGS Data



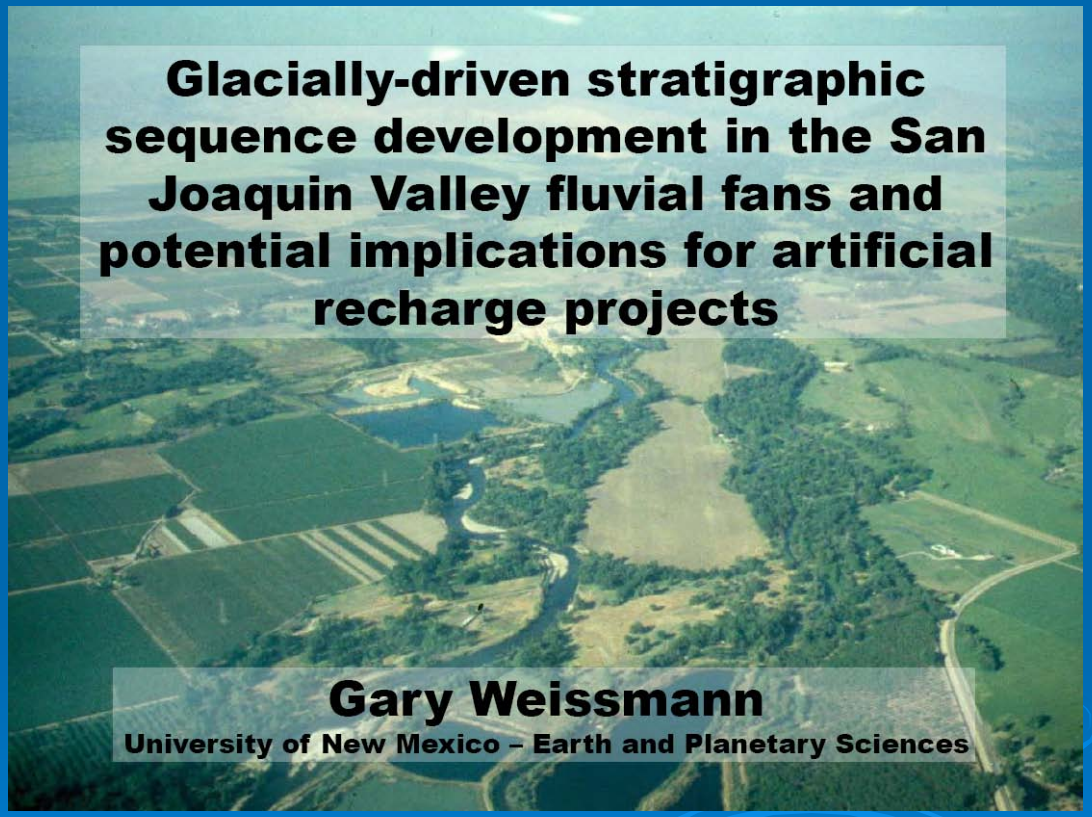


Available Aquifer Storage Space

Locating Permeable Aquifers

Gary Weissman Data

Glacial Floodwaters and Sediment Load – Rivers Connected to Glaciation



Available Aquifer Storage Space

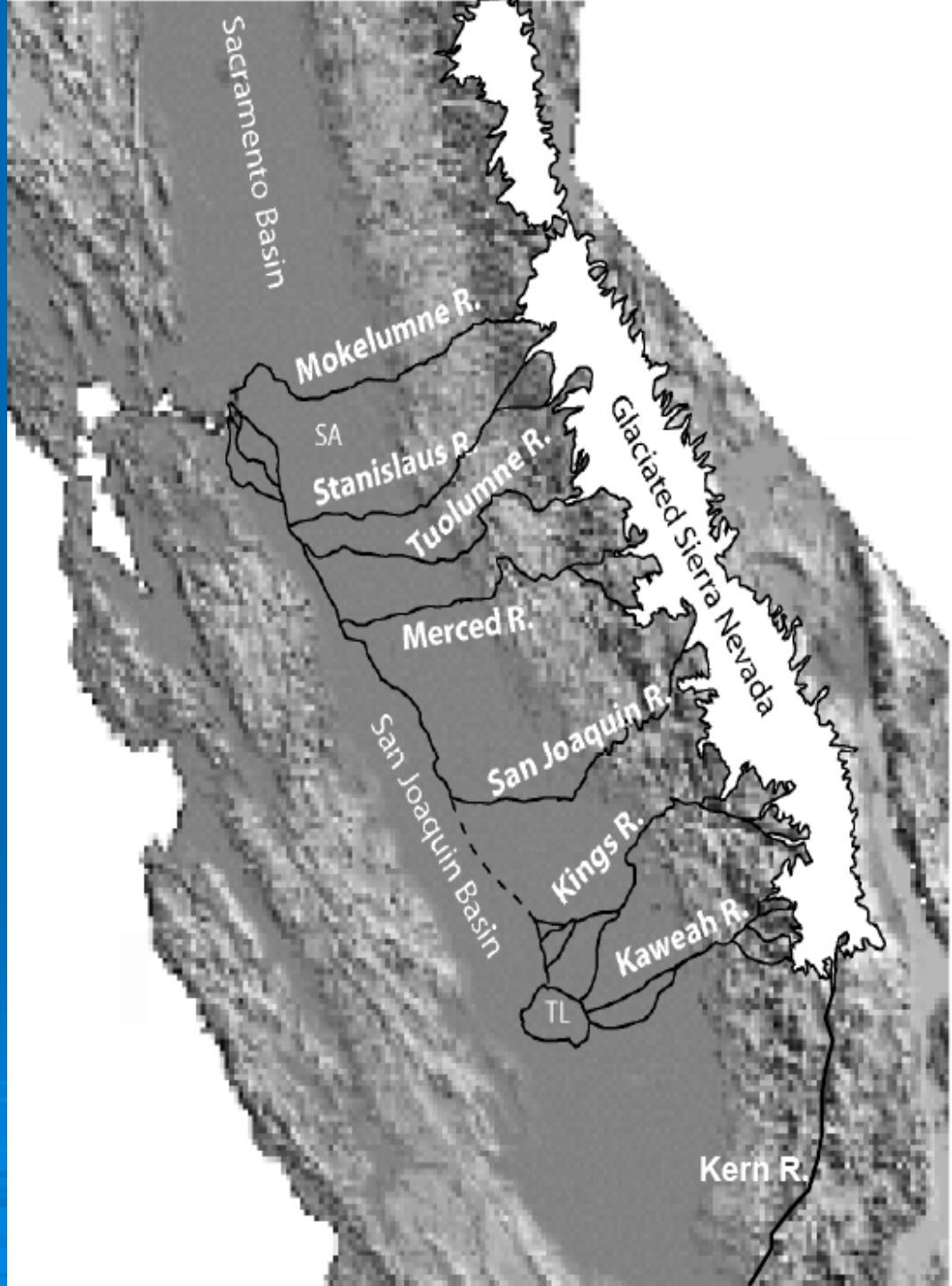
Locating Permeable Aquifers

Gary Weissman Data

Glacial Floodwaters and Sediment Load – Rivers Connected to Glaciation

Reference: Gary Weissmann, UNM, *Glacially-driven stratigraphic sequence development in the San Joaquin Valley fluvial fans and potential implications for artificial recharge projects*.

Evaluation of tens of thousands of drillers well logs

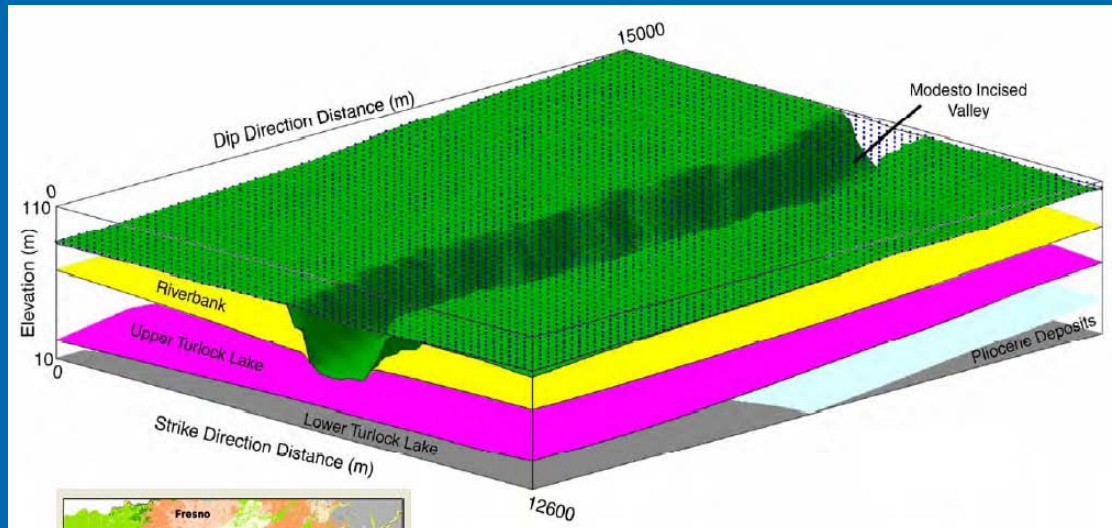


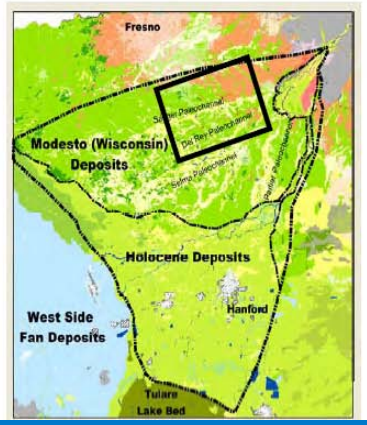
Available Aquifer Storage Space

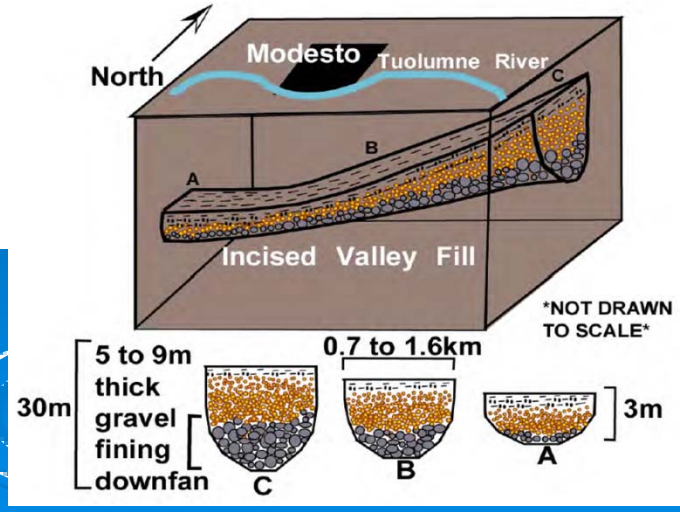
Locating Permeable Aquifers

Gary Weissman Data

Glacial Floodwaters and Sediment Load – Rivers Connected to Glaciation







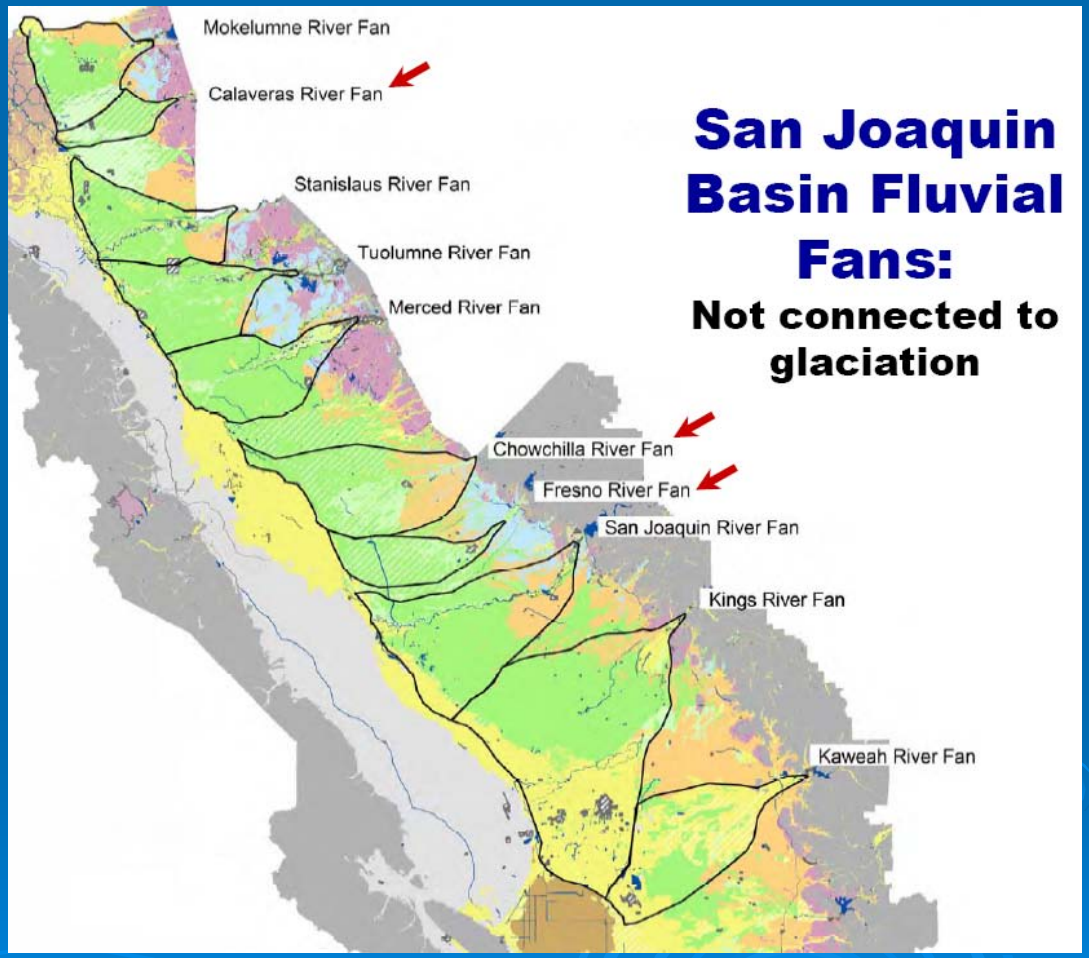
Reference: Gary Weissmann, UNM, *Glacially-driven stratigraphic sequence development in the San Joaquin Valley fluvial fans and potential implications for artificial recharge projects*.

Available Aquifer Storage Space

Locating Permeable Aquifers

Gary Weissman Data

San Joaquin Basin Fluvial Fans:
NOT connected to glaciation

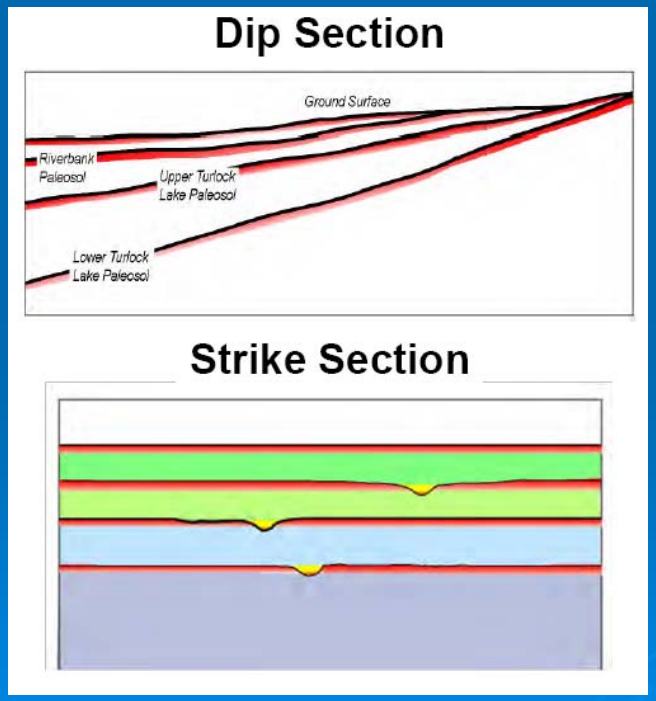


Reference: Gary Weissmann, UNM, *Glacially-driven stratigraphic sequence development in the San Joaquin Valley fluvial fans and potential implications for artificial recharge projects*.

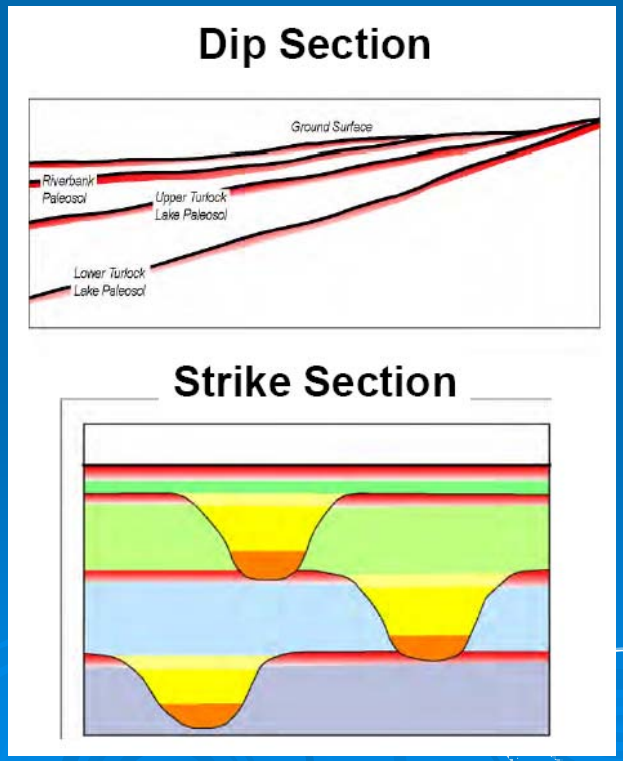
Locating Permeable Aquifers – Gary Weissmann Data

Glacial Floodwaters and Sediment Load – Rivers Not Connected to Glaciation Compared With Rivers Connected to Glaciation

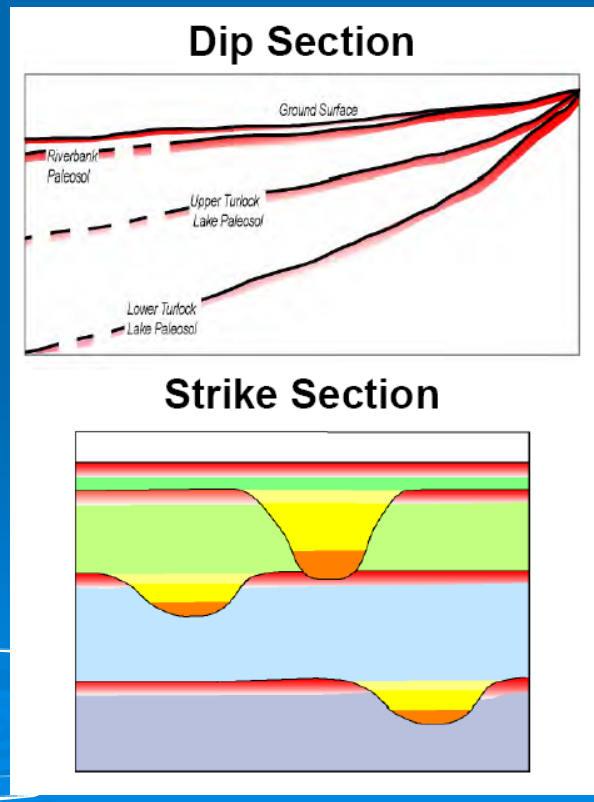
Chowchilla River Fluvial Fan



Tuolumne River Fluvial Fan



Kings River Fluvial Fan

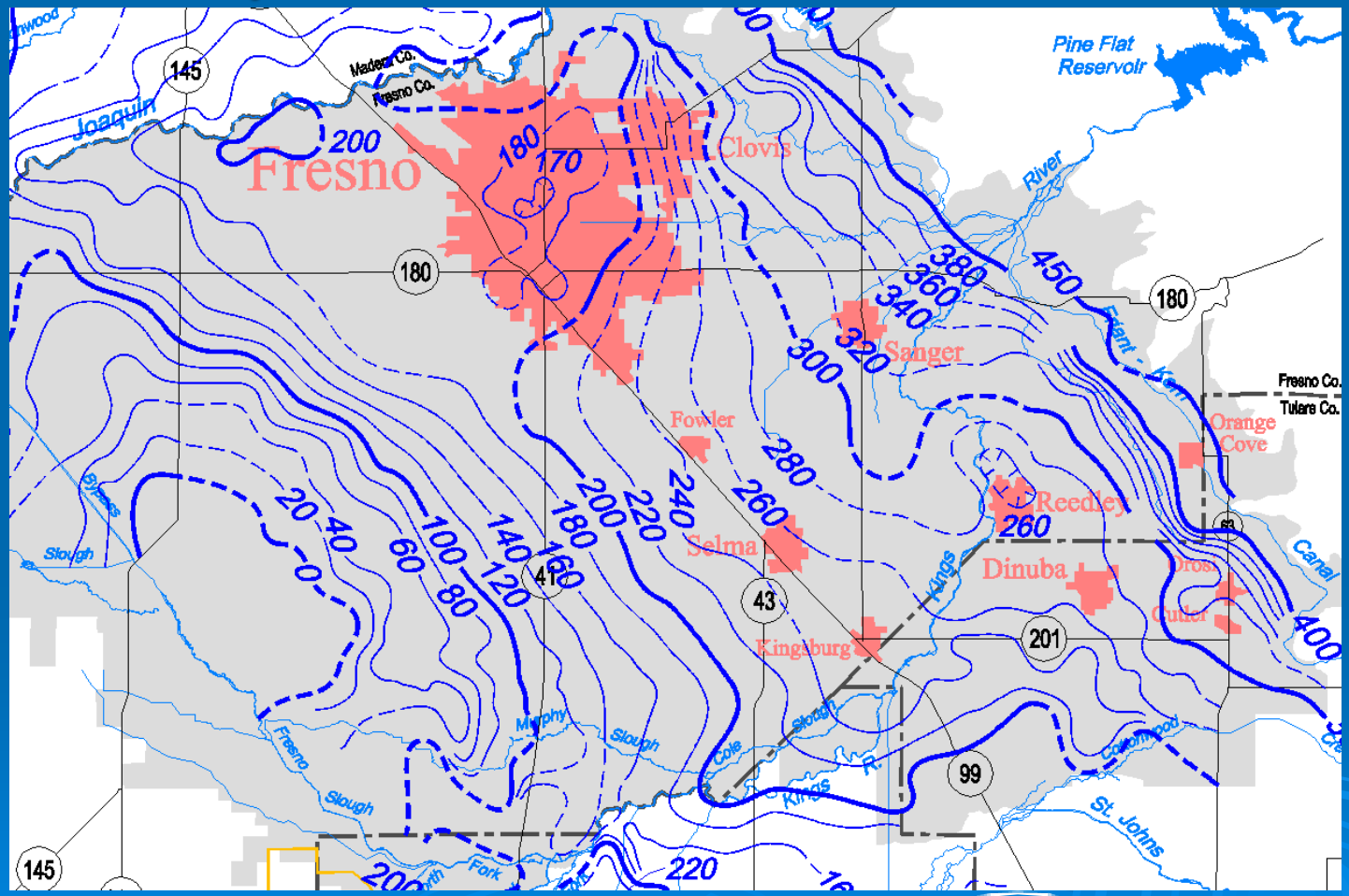


Deliverable #6:
Is a GIS Tool Possible?

Goal 2: Determine Future Conjunctive Management Potential

- Identify/map/describe (GIS tool?)
  1. Available aquifer storage space
  2. Potential recharge areas
  3. Sources of available water
  4. Compare with areas of critical need

Deliverable #6: Compare with Areas of Critical Need



Kings groundwater basin, 2009 groundwater elevations

Deliverable #6: Topics for Discussion

Policy/Guidance Related

- Critical Information you would like to see compiled
- Possible red flags
- Given general sensitivity of this issue and significant institutional, regulatory, infrastructure and other constraints, what would be the best way to develop and present this deliverable?

Informational

- Are you aware of conjunctive management projects with: description; capacity; O&M costs, etc.?
- Are you or your staff willing to participate in developing this deliverable?
- Can you recommend resource agencies/persons who may be willing to participate?