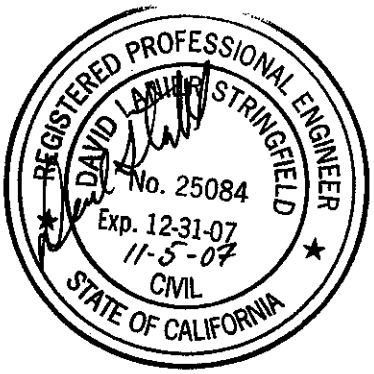
APPENDIX N

Existing Institutional Arrangements TM 1.9 by Carollo Engineers



City of Fresno

Metropolitan Water Resources
Management Plan Updates

TECHNICAL MEMORANDUM NO. 1.9
EXISTING INSTITUTIONAL ARRANGEMENTS

REVISED FINAL
October 2007

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CITY OF FRESNO

METROPOLITAN WATER RESOURCES MANAGEMENT PLAN UPDATE

TECHNICAL MEMORANDUM NO. 1.9
EXISTING INSTITUTIONAL ARRANGEMENTS

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EXISTING INSTITUTIONAL ARRANGEMENTS

1.0 PURPOSE

This technical memorandum identifies interagency agreements, contracts, and significant regulatory actions related to the City of Fresno's (City) wastewater disposal, including foreseeable modifications or additions.

The Regional Wastewater Reclamation Facilities (RWRF) serve the cities of Fresno and Clovis; the Pinedale Water District and Pinedale Utilities District, both of which are within the city limits of Fresno; and some areas within Fresno County not within the city limits of Fresno or Clovis. The City of Clovis owns 9.3 million gallons per day (mgd) treatment capacity, while the City of Fresno owns the rest. The City of Fresno is responsible for the day-to-day RWRF operations.

2.0 INTERAGENCY AGREEMENTS PERTAINING TO EFFLUENT DISPOSAL

The City currently has two agreements that pertain specifically to effluent reuse and disposal. They are summarized below. The City's interagency agreement with the City of Clovis is also summarized in order to clarify ownership with respect to effluent recycling and disposal facilities.

2.1 City of Clovis

The Fresno/Clovis RWRF is owned and operated by the City of Fresno. The City of Clovis owns 9.3 mgd of the RWRF's current 80 mgd capacity through an agreement with Fresno. Depending on the expansion of the new Clovis WWTP, the City of Clovis may need to purchase an additional 1 mgd capacity in 2017/2018, and then again in 2026/2027. This will depend on many variables, including development activity. Similarly, if there are delays in building their new plant, it is possible the City of Clovis may need an additional 1 mgd in 2011/2012 and again in 2016/2017.

On March 3, 1977, the City entered into a joint powers agreement (JPA) with the City of Clovis. The JPA and subsequent agreements provide the following purpose for the joint capacity use and capacity rights ownership in the Regional Treatment and Trunk facilities in the Regional Sewage System:

- Designation of the City as the entity responsible for day to day management, operation, and maintenance of the collection system and treatment facilities
- Establish capital and operating cost bases

- Regulate discharges into the collection system
- Allow Clovis to acquire additional flow capacity in future sewers and treatment facilities as needed, based on paying a pro-rata share of the cost of such facilities.

Clovis does participate in paying for capital projects for effluent disposal facilities (percolation ponds and associated pipelines and canals, etc.). This includes paying for effluent recycling facilities (pumps, pipelines, canals, etc.) and the groundwater extraction wells and associated facilities. Clovis pays a pro rata share of both operations and maintenance (O&M) and capital expenditures using formulas set forth in the JPA. The formulas use either an actual flow percent or a capacity share percent to determine the pro rata share of costs to Clovis.

2.2 Fresno Irrigation District

In 1974, the City entered into an exchange agreement with Fresno Irrigation District (FID) to establish a groundwater reclamation system consisting of onsite extraction wells and piping that delivers groundwater to FID's Dry Creek and Houghton Canals. The extracted water typically mixes with a variable amount of surface water prior to unrestricted reuse on crops, including fodder, fiber, and food for human consumption (e.g., almonds, beans, peaches, raisins, and wine grapes, etc.) The extracted groundwater is discharged to the canals during the growing season for agricultural use on the western side of FID. Each canal can convey up to about 200 cubic feet per second. To date, there are no regulatory restrictions on the use of extracted groundwater discharged to FID canals.

The 1974 agreement between the City and FID currently stipulates, in part, that (a) the City must discharge into FID canals a minimum of 100,000 af of extracted groundwater during any ten year period; (b) the City may discharge a maximum of 30,000 af/yr of extracted groundwater to FID canals; (c) for every acre-foot of extracted groundwater the City discharges to FID canals, the City is entitled to receive 0.46 af of surface water from FID. The City uses this surface water throughout the City of Fresno for aquifer recharge (i.e. by discharging to ground water recharge basins situated within the metropolitan area). The surface water delivered to the City's groundwater recharge basins is from the Friant Division of the Central Valley Project (CVP), operated by the U.S. Bureau of Reclamation (Bureau), and from Kings River entitlements held by FID.

The RWRF normally delivers between 15,000 and 34,000 af/yr of extracted groundwater to FID canals, an amount that is equivalent to 19 to 43 percent of the current annual RWRF inflow. Any increase in the discharge of extracted groundwater beyond that stipulated in the 1974 agreement is subject to FID approval. Historic discharge of extracted groundwater is shown in Table 1.

Table 1	Recycled Water Flow Data Existing Institutional Arrangements City of Fresno				
Year	Plant Influent Acre Feet	Effluent Direct Use To Farmers Acre Feet	Extracted Groundwater Discharge to FID Canals Acre Feet	Total Recycled Acre Feet	Percentage Recycled (%)
1990	58,590	7,834	8,013	15,847	27%
1991	60,518	8,055	6,102	14,157	23%
1992	65,192	5,121	13,854	18,975	29%
1993	68,764	4,530	14,497	19,028	28%
1994	73,997	7,267	18,700	25,966	35%
1995	80,844	3,940	18,128	22,068	27%
1996	79,911	4,897	20,328	25,225	32%
1997	69,519	4,118	20,653	24,771	36%
1998	73,974	2,887	13,053	15,940	22%
1999	74,506	3,044	16,250	19,294	26%
2000	76,197	3,798	15,633	19,431	26%
2001	76,236	4,972	26,824	31,796	42%
2002	78,078	6,756	28,902	35,658	46%
2003	78,504	6,715	33,958	40,673	52%
2004	79,452	9,103	32,324	41,427	52%
2005	78,894	8,509	25,022	33,531	43%

The 1974 agreement also stipulates that the City cannot extract the filtered effluent from beneath the RWRF in volumes that will cause the groundwater level to drop below levels observed in the previous year. This clause of the agreement is intended to prevent overdraft of the groundwater in the area surrounding the RWRF.

The City of Fresno and FID have a separate cooperative agreement, dated 1976, that provides for the agencies to use FID's distribution system to satisfy their respective water supply rights, and to work together to protect and preserve the groundwater basin. Section 13 of the agreement also stipulates that the City will retain its sewage effluent within the boundaries of FID unless written consent from FID is obtained.

In accordance with the Section 13 of the 1976 agreement, the City and FID entered into a separate agreement, dated August 3, 2001, whereby FID provided its consent for the delivery of up to 7,000 AF/year of reclaimed water to the Central Valley Energy Center (CVEC). The City has the discretion to deliver either treated effluent or extracted groundwater to the CVEC facility. The water would be used for boiler make-up water, cooling, and other industrial uses. Use of the water for agricultural purposes is not allowed. The City and FID would share equally (50%/50%) in the net proceeds of the sale of reclaimed water to CVEC. This project has not been implemented at this time (see below).

2.3 Central Valley Energy Center

The RWRF and Central Valley Energy Center (CVEC) entered into an agreement for the purchase and sale of reclaimed water effective August 27, 2001. Reclaimed water would be provided primarily from new reclamation wells built specifically for the CVEC project. The facility has not been constructed as of the time of this writing and it is not known if or when the project will be implemented.

Terms of the agreement extend to the year 2061. All costs associated with new wells and pipeline facilities necessary for the conveyance would be the responsibility of CVEC. The agreement allows the City to use the existing reclamation wells to deliver reclaimed water to CVEC during times when the capacity of the new wells is insufficient to meet the City's delivery obligations, only to the extent the use is consistent with the agreement between the City and FID. The maximum allowable quantity of reclaimed water from the existing and new wells combined was limited to a maximum 7,000 AF/year.

3.0 CONTRACTS WITH FARMERS

The City discharges effluent for irrigation of agricultural land on-site and off-site. On-site reclamation refers to parcels adjacent to or near the RWRF that are owned by the City and leased to farmers. The City holds the discharge permit for their practices. Off-site reclamation refers to privately owned agricultural land for which the farmers hold their own discharge permit and the City provides them with treated effluent. As shown in Table 1, the combined on-site and off-site usage is about 6,000 to 8,000 acre-feet per year, or approximately 10 percent of the total plant flow.

3.1 On-site Reclamation Contracts

The following is a list of on-site farmers, as of June 2006:

- Quist Dairy, six parcels with a total of 528 acres
- Daniel Souza, one parcel totaling 158 acres
- Stephen England, two parcels totaling 285 acres

3.2 Off-site Reclamation Contracts

The following is a list of off-site farmers, as of June 2006:

- Alfred Coelho with 560 acres
- Daniel Souza with 800 acres
- Golden State Vintners with 1470 acres

3.3 Contractual Terms

RWRF effluent is made available to the contracted farmers at no charge. Farmers are typically required to install and operate at their expense the necessary pumps and pipelines to transport the effluent to their own land. On some occasions, the City has provided pipeline and pumping facilities. The agreements have a short duration (i.e. three years) and can be renewed for successive terms of duration. Agreements can be terminated, provided notice is given by either the City or the farmer at least 12 months prior to the expiration date of the agreement.

4.0 SIGNIFICANT REGULATORY ACTIONS

4.1 Waste Discharge Requirements

The RWRF is governed by Waste Discharge Requirements (WDR) Order No. 5-01-257 issued by the California Regional Water Quality Control Board (RWQCB). Both Fresno and Clovis are named on the WDR as co-permittee.

The purpose of the WDR is to set limits on pollutants in discharges of waste to receiving waters. The limits are designed to protect human health, present and future beneficial uses of receiving water and to preserve water quality objectives developed on a regional basis. The WDR protects the quality of water and beneficial uses for both surface and groundwater.

As noted in the following sections, the WDR contains numeric and narrative limits for the RWRF effluent, and groundwater beneath and beyond the RWRF boundary. In terms of effluent requirements, discharge to both the percolation ponds and to restricted use irrigation require undisinfected secondary effluent.

4.1.1 Effluent Limitations

4.1.1.1 Effluent Flow Limitations

The discharge flow from the RWRF shall not exceed:

- An annual monthly daily average discharge flow of 80 MGD; and
- A maximum monthly average daily discharge flow of 88 MGD.

4.1.1.2 Effluent Discharge Limits for Pond Discharge

The RWRF's effluent discharge requirements for discharge directly to the disposal ponds are summarized in Table 2. In addition to the requirements in the table, several other stipulations apply:

Table 2 Effluent Discharge Limits for Discharge to Ponds Existing Institutional Arrangements City of Fresno

Constituents	Units	Monthly Average	Daily Maximum
5-day Biochemical Oxygen Demand (BOD_5)	mg/L	40	80
Total Suspended Solids (TSS)	mg/L	40	80
Settleable Solids	ml/L	0.2	0.5

- The arithmetic mean of BOD_5 and TSS in effluent samples collected over a monthly period shall not exceed 20 percent of the arithmetic mean of the values for influent samples collected at approximately the same time during the same period (80 percent removal).
- The discharge shall not have a pH less than 6.0 or greater than 9.0.

4.1.1.3 Effluent Electrical Conductivity (EC)Limits

The monthly average EC shall not exceed the average EC of the municipal source water supply EC plus 500 μmhos/cm, or a total of 900 μmhos/cm, whichever is less. The EC of the source water must be determined as a flow-weighted average. The flow-weighted average for the source water shall be a moving average for the most recent twelve months. For 2005, the twelve-month flow weighted source water EC ranged from 282 μmhos/cm to 318 μmhos/cm, therefore, the effluent limit ranged from 782 μmhos/cm to 818 μmhos/cm.

4.1.2 Groundwater Limitations

The discharge of wastes from any storage, treatment, or disposal component associated with the RWRF shall not, in combination with other sources of waste constituents, cause

the groundwater under and beyond the RWRF and discharge area(s) to exceed the concentrations listed in Table 3.

- In addition to the constituents listed in Table 3, WDR Provision G states that wastewater discharge must not cause the groundwater to exceed the following concentrations below, or natural background, whichever is greater.
- Total coliform organisms of 2.2 MPN/100 mL.
- Total nitrogen in excess of 10 mg/L.
- The maximum contaminant levels (MCLs) for any of California's Title 22 drinking water standards.
- Taste and odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses, including but not limited to, ammonia (as N) in excess of 0.5 mg/L or natural background, whichever is greater.
- Constituent concentrations identified as follows or natural background concentrations, whichever is greater: toxic substances in concentrations that produce detrimental physiological responses in human, plant, or animal life; or chemical constituents and pesticides in concentrations that adversely affect beneficial uses.

Table 3 Groundwater Limitations
Existing Institutional Arrangements
City of Fresno

Constituent	Units	Limitation[1]
Boron	mg/L	0.7
Chloride	mg/L	106
EC	μmhos/cm	990
Sodium	mg/L	115
Total Coliform Organisms	MPG/100 mL	2.2
Total Dissolved Solids	mg/L	560
Total Nitrogen	mg/L	10
Ammonia (as NH_4)	mg/L	0.5

Note:
1. Concentration listed or natural background, whichever is greater.

4.2 Water Quality Control Plan for the Tulare Lake Basin

The effluent quality in the RWRF's discharge must meet the objectives developed in the Water Quality Control Plan for the Tulare Lake Basin (5D) Second Edition, 1995 (Basin

Plan). The Basin Plan addresses water quality objectives for both surface and groundwater. The current WDR issued by the RWQCB has set discharge requirements consistent with the Basin Plan. The Basin Plan identifies the beneficial uses for the major rivers, creeks, and associated tributaries with the basin, and incorporates by reference plans and policies adopted by the SWRCB.

Beneficial Uses, which in part dictate the level of treatment required for the effluent to be discharged to a receiving water, have been identified and are contained in the WDR. Beneficial uses identified for the groundwater beneath the RWRF include municipal and domestic, agricultural, industrial service and process supply and water contact and noncontact water recreation.

The Basin Plan cites numerical water quality objectives for waters designated as municipal supply. These are the maximum contaminant levels (MCLs) specified in the following provisions of Title 22, California Code of Regulations: Tables 64431-A (Inorganic Chemicals) and 64431-B (Fluoride) of Section 64431; Table 64444-A (Organic Chemicals) of Section 64444; and Table 64449-A (Secondary Maximum Contaminant Levels Consumer Acceptance Limits), and 64449-B (Secondary Maximum Contaminant Levels Ranges) of Section 64449.

The Basin Plan contains narrative groundwater quality objectives that address constituents in the discharge that are potentially harmful to beneficial uses. Guidelines for identifying the quality of irrigation water necessary to sustain various crops were compiled by Ayers and Westcot in 1985 (Food and Agriculture Organization of the United Nations - Irrigation Drainage Paper No. 29).

The RWQCB has used the most sensitive crops and conditions from the Ayers and Westcot guidelines in estimating the potential hazards to crop production associated with long-term use of the particular water being evaluated. The guidelines divide water quality characteristics as having relative degree of restriction on use.

As an example, the RWQCB included many of the guidelines from Ayers and Westcot (1985) in the WDR, in Finding No. 59. The guidelines are presented in Table 4. The guidelines are used by the RWQCB to evaluate potential future uses of the groundwater underlying the RWRF.

In 2005, Stephen R. Grattan and Daniel Isidoro-Ramirez from the University of California completed an independent evaluation for the Fresno RWRF. Based on a site-specific survey of soil, water management, climate conditions, and crops grown in the area, the scientists evaluated crop tolerances for the dominant crops in the vicinity of the RWRF. Their findings indicate the crops in the area of the RWRF can tolerate salinity levels that are higher than the most stringent values developed by Ayers and Wescot.

Table 4 Numeric Guidelines for Irrigation Water Existing Institutional Arrangements City of Fresno		
Problem and Related Constituent	**No Problem**	**Increasing Problem**
Salinity of Irrigation Water (EC, μmhos/cm)	<750	750 - 3,000
Salinity of Irrigation Water (TDS, mg/L)[1]	<450	450 - 1,800
Specific Ion Toxicity from ROOT Absorption		
Sodium (mg/L)	<69	69 - 207
Chloride (mg/L)	<142	142 - 355
Boron (mg/L)	0.5	0.5-2.0
Specific Ion Toxicity from FOLIAR Absorption		
Sodium (mg/L)	<69	>69
Chloride (mg/L)	<106	>106
Miscellaneous		
NH_4-N (mg/L) (for susceptible crops)	<5	5 - 30
NO_3-N (mg/L) (for sensitive crops)	<5	5 - 30
HCO_3 (mg/L) (only with overhead sprinklers)	<90	90 - 520
pH	Normal range = 6.5 - 8.4	

Note:
1. Assumes an EC;TDS ratio of 0.6:1

The Basin Plan identifies the greatest long-term problem facing the entire Tulare Lake Basin as the increase in salinity in groundwater, which has accelerated due to the intensive use of soil and water resources by irrigated agriculture. The Basin Plan recognizes that degradation is unavoidable until a valley wide drain is constructed to carry salts out of the basin. Until the drain is available, the Basin Plan described numerous salt management recommendations and requirements. The latter includes the requirement that discharges to land from wastewater treatment facilities not have an EC greater than source water plus 500 μmhos/cm. If source water is from more than one source, the Basin Plan indicates that source water EC shall be a weighted average of all sources. Accordingly, the Basin Plan allows for salinity degradation and focuses on controlling the rate of increase.

4.3 Best Practicable Treatment and Control (BPTC)

Provisions in the current WDR state that the RWRF cannot degrade groundwater and must take measures to assure degradation does not occur through BPTC. The City of Fresno is evaluating this now and will implement recommendations once they are established, most likely controlling salinity discharged to the groundwater underlying the RWRF.

One of the main emphases of the WDR is to ensure protection of the groundwater underlying the RWRF. To accomplish this goal, several provisions require studies to determine that the groundwater will be protected. These provisions include a simple statement of the goal, requirements to characterize the groundwater, and specify studies to determine Best Practicable Treatment and Control (BPTC).

The primary goal is simply stated in Provision H.24:

"The Discharger shall use best practicable treatment and control of the discharge, including proper operation and maintenance, to comply with terms of this Order."

Groundwater studies required to determine compliance with BPTC are presented in Provisions H.12 and H.13. At the end of the studies, the RWRF is to propose those improvements to the plant that will bring it into compliance with BPTC, and specific groundwater limits that reflect full implementation of BPTC.

This BPTC policy is the outcome of the State Water Resources Control Board Resolution No. 68-16, known as the "Anti-Degradation Policy", although it predates the federal policy, and, is similar to the federal anti-degradation policy (40 CFR Section 131.12).

Specifically, Resolution No. 68-16 states the following:

1. *Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high qualities will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.*

2. *Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.*

Resolution No. 68-16 establishes in (1) above that where waters are of higher quality than required by State policies, such higher quality shall be maintained. The resolution also establishes the requirement in (2) that discharges to waters of the State shall be regulated

to assure that the highest water quality is maintained. The discharges to waters of the State are required to use the best practicable treatment or control (BPTC) necessary to maintain the highest water quality. The resolution is not a zero discharge standard, but a policy that existing quality be maintained when it is reasonable to do so.

In order to comply with the policy, it is important to understand the intent of BPTC as determined by the RWQCB. The RWQCB determined that BPTC applies to both treatment and control of wastewater. Treatment includes processes designed to remove constituents from wastewater discharges to levels that will not adversely impact the quality of receiving waters. Examples would include treatment facilities at the RWRF and programs such as industrial pretreatment programs. Control includes containment of constituents so that degradation of receiving waters is minimized. Examples of control of discharge include eliminating or minimizing sewer infiltration or exfiltration and concrete treatment structures.

Although the outcome of the RWRF's BPTC program is not known at this time, it can be assumed that the effluent quality and the underlying groundwater quality will improve in the future as a result of BPTC, in order to protect current and future beneficial uses.

4.4 Water Reclamation Requirements

The Fresno/Clovis WDR does not contain specific provisions for direct reuse of effluent on farmland. This is covered in specific Water Reclamation Requirements (WRR) for the parcels listed in section 3.0. Crops grown on the permitted parcels include fodder, fiber, animal feed crops, etc. The RWRF's current effluent quality (undisinfected secondary effluent) can be used for these uses.

4.5 Probable Future Regulatory Requirements

Effluent quality requirements can be expected to become more stringent in the future, both in the near-term and long-term horizons. As is typical for most cities, each revision of the Waste Discharge Requirements brings more stringent regulations and monitoring requirements for publicly owned treatment works (POTWs). The Fresno/Clovis RWRF is no exception.

4.5.1 Probable Nitrogen Limits

As previously stated, the WDR requires a BPTC Comprehensive Technical Evaluation and a Technical Report. These tasks are underway and may result in a revision of the effluent discharge limitations to include a limit on nitrogen concentrations. This revision could potentially include the following:

- An ammonia (NH_3) discharge limit, which would require the RWRF to nitrify.
- A nitrate (NO_3) discharge limit, which would require the RWRF to both nitrify and denitrify.

At this stage, it is still uncertain whether these probable nitrogen discharge limits will be applied, and what discharge concentrations the RWQCB would establish. Based upon past experience, a total nitrogen limit of approximately 10 milligrams per liter (mg/L) is possible, with no specific NH_3 or NO_3 limits.

At this time, the average influent Total Nitrogen concentration at the RWRF is around 30 mg/L to 50 mg/L. This means that the RWRF would potentially have to nitrify and denitrify to meet the discharge limit.

4.5.2 Probable Tertiary Treatment

There is currently no requirement for tertiary treatment (filtration and disinfection) since final effluent is discharged to percolation ponds, and irrigation is restricted to animal feed and fiber crops. However, tertiary treatment would greatly expand options for re-use, such as less restricted use on crops, thereby providing more land for disposal. This is a possibility that may be considered at some future time.

4.5.3 Disinfection of Extracted Groundwater

To date, the RWQCB has not regulated the reclamation well discharge or imposed any restrictions on the use of the extracted groundwater to FID canals. In order to satisfy information requirements from the Department of Health Services (DHS), the current WDR includes a provision requiring the RWRF evaluate the level of filtration and virus removal that is accomplished through percolation of the plant effluent. The purpose of the evaluation is to confirm that the percolated effluent meets the standards of "disinfected tertiary recycled water" for unrestricted use on food crops. These studies are currently underway.

Future WDRs may impose standards or regulations on the discharge of the extracted groundwater. It is probable that future WDRs may ultimately require disinfection of the effluent or extracted groundwater prior to discharge to the FID canals, in order to meet the disinfected tertiary classification. It is also probable that future WDRs will include requirements for the extracted groundwater to meet Basin Plan objectives to protect beneficial uses. If this occurs, additional treatment such as membrane filtration could possibly be required.

4.5.4 Groundwater Limitations

The groundwater limitations contained in the WDR are interim limits at this time (Table 3). They are subject to change, based on the outcome of the City's Best Practicable Treatment and Control (BPTC) evaluation. The limits could become more stringent, less stringent, or eliminated (if the City can so justify). It is also possible that limits for additional constituents may be recommended. Based on the progress of the City's current BPTC evaluations, and those of other valley cities, it appears likely that groundwater limits will continue, at a minimum for salinity and nitrogen.