CHAPTER 4 EXISTING FACILITIES DESCRIPTION

DISTRICT NO. 14 WASTEWATER TREATMENT FACILITIES

District No. 14 provides conveyance, treatment, and effluent management services for residential, commercial, and industrial wastewater generated by the majority of the City of Lancaster, part of the City of Palmdale, and adjacent areas within the unincorporated County. Wastewater treatment facilities serving District No. 14 include the LWRP and the AVTTP.

Lancaster Water Reclamation Plant

The LWRP, which was built in 1959, is located at 1865 West Avenue D in an unincorporated County area north of the City of Lancaster. The LWRP is a secondary treatment plant that treated an average flow of 12.8 mgd in 2002. The current permitted capacity of the LWRP is 16.0 mgd. Wastewater treatment consists of comminution, grit removal, primary sedimentation, oxidation (achieved with oxidation ponds), and solids processing (achieved with digestion tanks and drying beds). The recycled water produced at the LWRP is used to irrigate fodder crops at Nebeker Ranch, maintain a marsh-type habitat at Piute Ponds, and maintain the adjacent Impoundment Areas, which are used for seasonal duck hunting. A small side stream of the secondary-treated effluent undergoes tertiary treatment at the AVTTP and is conveyed to Apollo Park. Surplus effluent is stored in four, 40-acre reservoirs, which are located on the LWRP site.

Table 4-1 lists the design criteria for the major unit processes at the LWRP. A process flow diagram and treatment schematic are shown in Figures 4-1 and 4-2, respectively. The process flow diagram provides details associated with the treatment process, such as recycle streams and chemical addition, while the treatment schematic illustrates a more simplified overview of the LWRP system. The overall site plan for the LWRP, including oxidation ponds and storage reservoirs, is shown in Figure 4-3. A close-up view of the plant layout is provided in Figure 4-3a.

Antelope Valley Tertiary Treatment Plant

The AVTTP is located on the LWRP site and has been operational since 1969. The treatment facility has a capacity of 0.6 mgd and further treats secondary effluent from the oxidation ponds for reuse at Apollo Park. The treatment process includes chemical coagulation with a commercial grade of aluminum sulfate, prechlorination, flocculation, sedimentation, filtration through a dual-media (anthracite-sand) gravity filter, phosphorus removal, and post-chlorination followed by a minimum 8.4-hour detention in a chlorine contact chamber. Sludge from the sedimentation tank, together with filter backwash, is returned to the influent stream of the LWRP.

CONVEYANCE SYSTEM

The wastewater conveyance system for District No. 14 consists of an interconnected network of regional trunk sewers that convey wastewater from local lines to the LWRP. The trunk sewer system is shown in Figure 4-4.

Following treatment at the LWRP, recycled water is conveyed to various effluent utilization sites. A portion of the recycled water is conveyed to Nebeker Ranch via a 24-inch diameter, seven-mile pipeline, while a 12-inch diameter, 4.5-mile pipeline transports tertiary-treated recycled water from the AVTTP to Apollo Park. Discharges to Piute Ponds and the adjacent Impoundment Areas are conveyed from the LWRP to Amargosa Creek via an earthen channel. The location of the pipelines and earthen channel are illustrated in Figure 1-3.

Trunk Sewers

An approximately 64-mile network of trunk sewers form the backbone of the regional wastewater collection system. All trunk sewers are designed to convey wastewater by gravity flow. Trunk sewers with diameters less than 24 inches are generally made of vitrified clay pipe, while larger diameter sewer lines are typically built with reinforced concrete pipe.

Table 4-1
Summary of Current Design Criteria for the Lancaster Water Reclamation Plant

UNIT PROCESS	DESIGN CRITERIA	EXISTING FACILITIES
Plant Capacity	Average Flow Peak Sanitary Flow Peak Storm Flow	16.0 mgd 28.8 mgd 40 mgd
Influent Pump Station	Number of Pumps Capacity, each Total Wetwell Capacity	5 10 mgd 35,530 gallons
Comminutors	Number Capacity, each	2 26 mgd
Aerated Grit Channels	Number Total Capacity Detention Time @ Average Flow	4 28.8 mgd 1.57 minutes
Aerated Grit Blowers	Number Capacity, each	2 400 cfm
Primary Sedimentation Tanks	Number Length, each Width, each Depth, each Overflow Rate @ Average Flow Detention Time @ Average Flow	6 175 feet 16 feet 2 @ 7.5 feet 4 @ 10 feet 952 gpd/sf 1.73 hours
Primary Sludge Pumps	Number Capacity, each	2 1 @ 470 gpm 1 @ 550 gpm
Anaerobic Digestion Tanks	Primary Sludge Flow Total Number of Digesters Number of 1st Stage Digesters Capacity, each Detention Time Number of 2nd Stage Digesters Capacity, each Detention Time Total Detention Time	80,552 gpd 5 4 1 @ 504,000 gallons 3 @ 618,240 gallons 29.3 days 1 504,000 gallons 6.3 days 35.6 days
Digested Biosolids Transfer Pumps	Number Capacity, each	5 1 @ 450 gpm 1 @ 350 gpm 3 @ 280 gpm
Ferrous Chloride System	Number of Pumps Capacity, each Solution Tank Capacity	2 1 @ 39.9 gpm 1 @ 208 gph 5,700 gallons
Biosolids Drying Beds	Number Length, each Width, each Depth, each Design Loading Rate	12 140 feet 60 feet 3 feet 45 dry lbs/sf-yr
Supernatant Pumps	Number Capacity, each	2 250 gpm
Oxidation Ponds	Number of Treatment Ponds Total Capacity Average Surface Area, each Organic Loading Rate Total Surface Aerators	8 16 mgd 30.3 acres 175 lbs BOD/ac -d 24
Oxidation Pond Effluent Disinfection Station	Number Total Chlorination Capacity	1 16 mgd
Storage Reservoirs	Number Total Wetted Surface Area Average Capacity, each Total Capacity	4 160 acres 125 million gallons 500 million gallons
Agricultural Pump Station and Pipeline	Number of Pumps Capacity, each Pipeline Diameter	3 2 @ 2,100 gpm 1 @ 3,125 gpm 24 inches
Agricultural Reuse Operations	Total Farmed Area Total Land Area	616 acres 680 acres

District No. 14 is responsible for the construction, operation, and maintenance of trunk sewers. Sewer capacity and physical sewer conditions are generally checked biennially to determine if the sewers should be relieved, repaired, or replaced. The trunk sewers were last inspected in 2002, and it was determined that all but two trunk sewers had adequate hydraulic capacity or were in satisfactory physical condition. The two sewers, the Rosamond Outfall Trunk Sewer (Sections 1 and 2) and the Trunk "F" Trunk Sewer (Section 1), were recommended for repair and hydraulic relief. This project was addressed by District No. 14 in a separate document named *Rosamond Outfall and Trunk "F" Sewer Facilities Plan*, which was completed in March 2003.

Local Lines

Local lines are sewers that collect and convey wastewater from the lateral sewers of individually-owned parcels, to the District No. 14 trunk sewer conveyance system. They generally do not exceed 15 inches in diameter. The Cities of Lancaster and Palmdale own the local lines within their borders. The County owns the majority of the local sewers located in unincorporated areas. The County Consolidated Sewer Maintenance District, under an agreement with the Cities of Lancaster and Palmdale, operates and maintains most local lines within the District No. 14 service area. It is the responsibility of the user to connect to the local or regional trunk sewers as necessary.

SOLIDS PROCESSING AND BIOSOLIDS MANAGEMENT

Solids Processing

Primary sludge and skimmings, produced at the LWRP from the primary treatment process, are anaerobically digested on site. Digesters are maintained at about 96°F, and the average detention time of solids in the digesters is approximately 36 days. The digested solids are dewatered by spreading them onto concrete drying beds. The dewatered solids (biosolids), which are approximately 60 percent total solids by weight, are removed from the drying beds and are stockpiled on site for later reuse or disposal.

Biosolids Management

In 2002, approximately 3.44 million gallons of digested biosolids, with an average solids content of 5.9 percent, were delivered to the LWRP drying beds. This quantity is equivalent to 853 dry tons of biosolids. According to permit requirements, biosolids at the LWRP are removed from the drying beds and placed into stockpiles for removal within two years. In 2002, approximately 744 dry tons of biosolids were removed from the drying beds and added to the stockpile. Also in 2002, approximately 990 dry tons of biosolids, which includes 246 dry tons from 2001, were removed from the stockpile and transported to San Joaquin Composting, a facility in Kern County, to be processed into soil amendment and fertilizer for agricultural purposes. When biosolids are removed from the stockpile for reuse or disposal, the solids content is typically in excess of 80 percent.

It is anticipated that the biosolids currently stockpiled at the LWRP will be processed in a similar manner. If the stockpiled biosolids are not processed into a soil amendment, they will be disposed of in a landfill. Nearby landfills and composting facilities capable of accepting biosolids are listed in Table 4-2.

In compliance with 40 CFR Part 503, annual biosolids monitoring reports are submitted to the EPA. The reports contain biosolids treatment, quantity, monitoring, and quality data.

EFFLUENT MANAGEMENT

The existing LWRP effluent management system is schematically illustrated in Figure 4-5. Recycled water from the LWRP is reused at Nebeker Ranch and Apollo Park, or discharged to Piute Ponds and the adjacent Impoundment Areas. Examination of Figure 4-5 illustrates that the capacity of the LWRP effluent management system ultimately depends on

Table 4-2
Landfills/Composting Facilities Capable of Accepting Biosolids

FACILITY NAME	OWNER	LOCATION	DISTANCE[a] (miles)
Puente Hills Landfill	Districts	Unincorporated County	86
Ramona Landfill	San Diego County	Ramona	178
Sycamore Landfill	San Diego County	Santee	202
Otay Landfill	San Diego County	Chula Vista	206
Sunshine Canyon Landfill	Allied/BFI	Sylmar	50
Lancaster Landfill	Waste Management	Lancaster	5
Palmdale Landfill	Waste Management	Palmdale	11
Simi Valley Landfill	City of Simi Valley	Simi Valley	70
Kettleman City Landfill	Waste Management	Kettleman City	157
San Joaquin Composting	McCarthy Family Farms	Lost Hills	134
Synagro Regional Composting	Synagro Composting Co. of CA	Corona	98

(a) One-way distance from the LWRP in road miles.

two closely related parameters: evaporation and evapotranspiration. The demand for and/or capacity to accept recycled water at the various destinations identified is directly determined by the rate of evaporation or evapotranspiration at any given time. Since evapotranspiration rates are typically a function of evaporation rates, the capacity of the LWRP effluent management system is ultimately a function of evaporation rates.

In the Antelope Valley, evaporation rates are typically high during the summer and low during the winter. As a result, the ability to manage LWRP effluent also varies seasonally. During the summer months, daily demand for recycled water often exceeds the daily discharge of effluent from the LWRP. However, during the winter months, daily discharge of effluent from the LWRP generally exceeds daily demand for recycled water. In order to balance this supply and demand for recycled water throughout the year, the LWRP uses storage reservoirs.

The storage capacity of the four existing reservoirs at the LWRP is 500 million gallons, or 1,534 af. Recycled water generated that exceeds demand is stored in the LWRP reservoirs. When the LWRP storage reservoirs become full (typically by fall), recycled water in excess of the daily demand is discharged to Piute Ponds. Under these conditions, the discharges to Piute Ponds result in effluent-induced overflows onto Rosamond Dry Lake during the winter months.

Lancaster Water Reclamation Plant

Measurable losses from the LWRP oxidation ponds and storage reservoirs occur as a result of evaporation and are a function of the surface area of the facilities and evaporation rates. Using historical data and applicable assumptions, the losses from the LWRP facilities were estimated.

Linear regression of monthly evaporation rate data from the LWRP, consisting of measured losses from the wetted surface area of the oxidation ponds and storage reservoirs, was used to estimate the losses from the LWRP. The infiltration rate, which is a function of hydraulic head and hydraulic conductivity, was assumed to be negligible due to the high clay content of the soil underlying the LWRP facilities. The estimated monthly evaporation losses from the LWRP oxidation ponds and storage reservoirs, based on 270 wetted acres and 160 wetted acres, respectively, are provided in Table 4-3.

Piute Ponds

As noted previously, Piute Ponds was established following construction of C-Dike on EAFB in 1961. District No. 14 is obligated to maintain Piute Ponds in accordance with the 1981 LOA between District No. 14, EAFB, and DFG. Because Piute Ponds' current size is approximately 400 acres of wetted habitat, the evaporation losses from the ponds are defined in terms of the losses from 400 acres. The soils underlying Piute

Table 4-3
Estimated Losses From the Lancaster Water Reclamation Plant

MONTH	DAYS PER MONTH	EXPECTED EVAPORATION (inches)	ESTIMATED LOSS, OXIDATION PONDS [a] (million gallons)	ESTIMATED LOSS, STORAGE RESERVOIRS [b] (million gallons)	ESTIMATED LOSS, TOTAL (million gallons)
January	31	2.5	13.8	8.2	22.0
February	28	3.7	21.3	12.6	33.9
March	31	5.9	34.7	20.6	55.3
April	30	9.8	58.9	34.9	93.8
May	31	11.0	66.2	39.2	105.4
June	30	14.0	84.8	50.2	135.0
July	31	16.5	100.1	59.3	159.4
August	31	15.0	90.9	53.8	144.7
September	30	11.3	68.1	40.4	108.5
October	31	8.7	52.0	30.8	82.8
November	30	5.7	33.7	20.0	53.7
December	31	3.5	19.9	11.8	31.7
TOTAL	**365**	**107.6**	**644.4**	**381.8**	**1,026.2**

(a) Based on evaporation losses from 270 wetted acres.
(b) Based on evaporation losses from 160 wetted acres.

Ponds have a high clay content, therefore, infiltration was assumed to be negligible. The estimated monthly evaporation losses from Piute Ponds, based on 400 wetted acres, is provided in Table 4-4.

Impoundment Areas

In the late 1980s, Ducks Unlimited and EAFB built a series of impoundments just south of Piute Ponds. When filled with water, the surface area of the Impoundment Areas is approximately 90 acres. The approximate average depth of these impoundments is 1.5 feet.

Discharge to the Impoundment Areas is governed by the terms of an MOA between District No. 14 and EAFB. Under the current terms of the MOA, District No. 14 may annually discharge effluent to the Impoundment Areas from November 1 to April 15. Because the soils underlying the Impoundment Areas have a high clay content, infiltration losses from the impoundments were assumed to be negligible. The estimated monthly evaporation losses from the Impoundment Areas, based on 90 wetted acres, is provided in Table 4-5.

Nebeker Ranch

Deliveries of recycled water to the 680-acre Nebeker Ranch began in 1988 following construction of a pump station and 24-inch diameter, seven-mile recycled water pipeline from the LWRP. Recycled water is used to irrigate approximately 616 acres of alfalfa and other fodder crops at the ranch. The use of recycled water at the ranch is equal to the irrigation demands of cultivated crops, which are generally a function of the evapotranspiration rate of the crops, the quantity of precipitation, and the irrigation efficiency.

On average, the demand for recycled water by Nebeker Ranch is estimated by the monthly evapotranspiration rate for alfalfa cultivated in the Lancaster region, adjusted for monthly rainfall and irrigation system efficiency. Alfalfa cultivated in this region typically requires approximately 67.5 inches (5.6 feet) of water per year, after adjusting for rainfall, for proper growth. However, the actual quantities of water that must be delivered are greater than the above as a result of the inefficiencies inherent in irrigation

Table 4-4
Estimated Losses from Piute Ponds [a]

MONTH	ESTIMATED LOSS (million gallons)
January	20.4
February	31.5
March	51.5
April	87.2
May	98.0
June	125.6
July	148.3
August	134.6
September	100.9
October	77.1
November	50.0
December	29.6
TOTAL	**954.7**

(a) Based on evaporation losses from 400 wetted acres.

Table 4-5
Estimated Losses from the Impoundment Areas [a]

MONTH	ESTIMATED LOSS (million gallons)
January	4.6
February	7.1
March	11.6
April	19.6
May	22.1
June	12.1
July	0.0
August	0.0
September	0.0
October	0.0
November	11.2
December	6.7
TOTAL	**95.0**

(a) Based on evaporation losses from 90 wetted acres; discharge to Impoundment Areas permitted from November 1 to April 15; Impoundment Areas are dry by mid-June.

systems. Theoretical monthly irrigation demand for recycled water was estimated by dividing the water requirement by the irrigation system efficiency. Nebeker Ranch employs a flood irrigation system with an efficiency that can exceed 75 percent. Crops cultivated at Nebeker Ranch, therefore, would require approximately 90 inches (7.5 feet) of water if all water were provided via flood irrigation. However, Nebeker Ranch typically does not irrigate during December and January. During particularly dry years, some irrigation may be required during the winter months, but in general, irrigation is very low during this time. In addition, during extraordinarily wet years, Nebeker Ranch may curtail or eliminate irrigation during early spring months, especially during March. In general, however, expected monthly requirements for alfalfa irrigation in Table 4-6 were calculated as the quotient of the monthly evapotranspiration rate for alfalfa and an irrigation system efficiency of 75 percent. A typical monthly irrigation schedule, which is based on these calculations, is provided in Table 4-6.

Table 4-6
Typical Alfalfa Irrigation Schedule

MONTH	EVAPOTRANSPIRATION RATE (ETo) FOR LANCASTER (inches)	ALFALFA EVAPOTRANSPIRATION RATE ETalf=0.95*ETo (inches)	EXPECTED RAINFALL (inches)	ALFALFA WATER REQUIREMENT AT 75% IRRIGATION EFFICIENCY Water Req=(ETalf-rain)/0.75 (inches)	IRRIGATION RATE[a] FOR 616 ACRES OF ALFALFA IRRIGATED AT 75% EFFICIENCY (af)
January	2.14	2.03	1.1	1.24	63.7
February	2.98	2.83	1.2	2.17	111.6
March	4.64	4.41	0.9	4.68	240.2
April	5.91	5.61	0.5	6.81	349.8
May	8.54	8.11	0.1	10.68	548.2
June	9.69	9.21	0.0	12.28	630.4
July	10.98	10.43	0.0	13.91	713.9
August	9.76	9.27	0.0	12.36	634.5
September	7.32	6.95	0.1	9.13	468.8
October	4.64	4.41	0.2	5.61	288.2
November	2.78	2.64	0.7	2.59	132.8
December	1.71	1.62	0.9	0.96	49.3
TOTAL	**71.09**	**67.52**	**5.7**	**82.43**	**4,231.2**

Source: Goldhamer and Snyder, Irrigation Scheduling, 1988
(a) An acre-foot is equal to 0.3259 million gallons.

The alfalfa irrigation schedule provided in Table 4-6 was derived based on several assumptions, and differs slightly from actual irrigation practices at Nebeker Ranch. In general, Nebeker Ranch uses somewhat less water than predicted above. The disparity between the predicted irrigation rate and the actual irrigation rate reflects the use of groundwater during crop germination, achievement of irrigation efficiencies in excess of 75 percent, and the fact that during the peak summer months the pipeline operates near capacity and cannot deliver additional quantities of recycled water. Historical average monthly recycled water irrigation rates at Nebeker Ranch from 1998 to 2002 are provided in Table 4-7.

Apollo Lakes Regional County Park

Deliveries of recycled water to Apollo Park, which was opened to the public in 1972, began after the completion of the treatment and conveyance facilities required to deliver recycled water from the LWRP to the park. The required facilities included the AVTTP and a 12-inch diameter pipeline. Disinfected, tertiary-treated recycled water from the AVTTP is reused in three lakes at Apollo Park.

Table 4-7
Historical Average Recycled Water Irrigation at Nebeker Ranch[a]

MONTH	IRRIGATION RATE (af)	IRRIGATION RATE (million gallons)
January	12.9	4.2
February	159.9	52.1
March	320.0	104.3
April	329.9	107.5
May	476.2	155.2
June	476.5	155.3
July	492.5	160.5
August	516.7	168.4
September	493.4	160.8
October	459.3	149.7
November	128.6	41.9
December	37.7	12.3
TOTAL	**3,903.6**	**1,272.2**

(a) Irrigation rates are averages for the years 1998 to 2002.

Apollo Park provides facilities for picnicking, boating, and fishing. Water is withdrawn from the lakes for landscape irrigation and can also be used for fire protection at the park and at nearby General William Fox Airfield.

Delivery of recycled water to Apollo Park occurs in the late spring, summer, and early fall months and generally averages approximately 0.15 mgd, however, peak demand approaches 0.5 mgd during midsummer months. A schedule of the historical average monthly delivery of recycled water to Apollo Park from 1998 to 2002 is provided in Table 4-8. The total current effluent management capacity of the LWRP, in million gallons per year (mgy) and mgd, is summarized in Table 4-9.

Table 4-8
Historical Average Recycled Water Delivery to Apollo Lakes Regional County Park[a]

MONTH	RECYCLED WATER DELIVERED (million gallons)
January	0.0
February	0.0
March	0.0
April	1.5
May	7.8
June	9.3
July	9.4
August	9.6
September	7.3
October	9.4
November	1.6
December	0.0
TOTAL	**55.9**

(a) Recycled water delivery rates are averages for the years 1998 to 2002.

Table 4-9
Lancaster Water Reclamation Plant Effluent Management Capacity

LOCATION	EFFLUENT MANAGEMENT CAPACITY (mgy)	EFFLUENT MANAGEMENT CAPACITY (mgd)
Oxidation Ponds[a]	644.4	1.77
Storage Reservoirs[b,c]	381.8	1.05
Piute Ponds	954.7	2.62
Impoundment Areas	95.0	0.26
Nebeker Ranch	1,272.2	3.49
Apollo Park	55.9	0.15
TOTAL	**3,404.0**	**9.34**

(a) Based on evaporation losses from 270 wetted acres.
(b) Based on evaporation losses from 160 wetted acres.
(c) Does not include the total storage reservoir capacity of 500 million gallons.