INFORMATION SHEET

ORDER NO. R5-2007-____
KIRKWOOD MEADOWS PUBLIC UTILITY DISTRICT
WASTEWATER TREATMENT PLANT
ALPINE AND AMADOR COUNTIES

Background

Kirkwood Meadows Public Utility District (KMPUD) owns and operates a wastewater treatment plant that serves the community of Kirkwood Meadows in Alpine and Amador Counties. Sources of wastewater treated and disposed of by the WWTP include wastes generated from residential and commercial units, and the Kirkwood Ski Resort.

In the fall of 2005, KMPUD upgraded its WWTP from a conventional activated sludge treatment process to a membrane bioreactor (MBR) treatment process. The upgraded wastewater treatment, which is designed to treat and dispose of 190,000 gallons per day (monthly average), provides tertiary treatment and disinfection. The treatment process includes influent screening, equalization storage, anoxic basins for denitrification, chemical additives for phosphorus removal, aeration basins, membrane basins, membrane filtration, disinfection with sodium hypochlorite, an effluent pump system, and emergency storage. Wastewater is disposed via subsurface leachfields.

Due to significant snowfall accumulation in the winter, the wastewater treatment system is largely located indoors. All key wastewater treatment mechanical equipment systems, pumping systems, and aeration units are provided with redundant standby units so that treatment can proceed at full capacity, even when a piece of equipment fails or is taken out of service for maintenance.

Solids and Biosolids Disposal

Screenings and grit removed from the influent wastewater is accumulated in a bagging unit and are picked up weekly for off-site disposal Biological sludge waste from the MBR treatment process is accumulated and partially digested in an aerated solids holding tank, prior to being dewatered in a centrifuge unit. The dewatered sludge is disposed of at an off site landfill by a commercial hauling service.

Basin Plan, Beneficial Uses, and Regulatory Considerations

Surface water from the effluent disposal area flows to Kirkwood Creek, which is a tributary to Caples Creek. Caples Creek flows into the Silver Fork of the American River, which flows into the South Fork of the American River. The *Water Quality Control Plan for the California Regional Water Quality Control Board Central Valley Region, Fourth Edition* (Basin Plan), designates beneficial uses, establishes water quality objectives, and contains implementation plans and policies for all waters of the Basin. Beneficial uses often determine the water quality objectives that apply to a water body. For example, waters designated as municipal and domestic supply must meet the maximum contaminant levels (MCLs) for drinking waters. The Basin Plan sets forth the applicable beneficial uses (industrial, agricultural, and domestic and municipal supply in this instance) of groundwater, procedure for application of water quality

objectives, and the process for and factors to consider in allocating waste assimilation capacity.

Antidegradation

The antidegradation directives of State Water Board Resolution No. 68-16, "Statement of Policy With Respect to Maintaining High Quality Waters in California," or "Antidegradation Policy" require that waters of the State that are better in quality than established water quality objectives be maintained "consistent with the maximum benefit to the people of the State." Waters can be of high quality for some constituents or beneficial uses and not others. Policies and procedures for complying with this directive are set forth in the Basin Plan.

Resolution 68-16 is applied on a case-by-case, constituent-by-constituent basis in determining whether a certain degree of degradation can be justified. It is incumbent upon the Discharger to provide technical information for the Regional Board to evaluate that fully characterizes:

- All waste constituents to be discharged;
- The background water quality of the uppermost layer of the uppermost aquifer;
- The background quality of other waters that may be affected;
- The underlying hydrogeologic conditions;
- Waste treatment and control measures;
- How treatment and control measures are justified as best practicable treatment and control;
- The extent the discharge will impact the quality of each aquifer; and
- The expected degree of degradation below water quality objectives.

In allowing a discharge, the Regional Water Board must comply with CWC Section 13263 in setting appropriate conditions. The Regional Water Board is required, relative to the groundwater that may be affected by the discharge, to implement the Basin Plan and consider the beneficial uses to be protected along with the water quality objectives essential for that purpose. The Regional Board need not authorize the full utilization of the waste assimilation capacity of the groundwater (CWC 13263(b)) and must consider other waste discharges and factors that affect that capacity.

Certain domestic wastewater constituents are not fully amenable to waste treatment and control and it is reasonable to expect some impact on groundwater. Some degradation for certain constituents is consistent with maximum benefit to the people of California because the technology, energy, water recycling, and waste management advantages of municipal utility service to the State far outweigh the environmental impact of a community that would otherwise be reliant on numerous concentrated individual wastewater systems. Economic prosperity of local communities is of maximum benefit to the people of California, and therefore sufficient reason to accommodate wastewater discharge provided terms of reasonable

degradation are defined and met. The proposed Order authorizes some degradation consistent with the maximum benefit to the People of the State but does not authorize pollution (i.e., violation of any water quality objective).

No groundwater monitoring wells currently exist upgradient or downgradient of the wastewater disposal areas; therefore, staff was unable to establish the most appropriate groundwater limits. In addition, certain aspects of wastewater treatment and control practices may not be justified as representative of Best Practicable Treatment and Control (BPTC). Reasonable time is necessary to gather specific information about the WWTP to make informed, appropriate, long-term decisions. This Order, therefore, establishes interim groundwater limitations to assure protection of the beneficial uses of groundwater of the State pending the completion of certain tasks and provides time schedules to complete those tasks. During this period, degradation may occur from certain constituents, but cannot exceed water quality objectives (or natural background water quality should it exceed objectives) or cause nuisance.

According to the Basin Plan, water quality objectives define the least stringent limits that could apply as water quality limitations for groundwater at this location, except where natural background quality unaffected by the discharge of waste already exceeds the objective. The interim groundwater limits below apply numeric and narrative water quality objectives that must be met to maintain specific beneficial uses of groundwater. The constituents listed are those that are expected to be found in treated domestic wastewater or to be released from the soil upon the application of such waste. The *Policy for Application of Water Quality Objectives* in Chapter IV of the Basin Plan provides a mechanism to apply narrative objectives using relevant and appropriate numeric limits published by other agencies and organizations. Due to the expected high quality of natural background groundwater in the location of the discharge, numeric limits were selected so as to require that conditions of nuisance, adverse tastes and odors, toxicity, or impact to sensitive agricultural uses would not be expected to occur. For the same reason, where incorporated drinking water MCLs are expressed as ranges, limits were selected that represent no impact on the municipal or domestic supply beneficial use. Unless natural background for a constituent proves to be higher, the groundwater quality limit established in proposed Order is the most stringent of the values for the listed constituents. Once the discharger provides information on background water quality and best practicable treatment or control, the groundwater limits may need to be adjusted (see *Reopener* below).

Constituent	Units	Limit	Beneficial Use	Water Quality Objective	Criteria or Justification
Ammonia	mg/L	1.5	MUN [1]	Tastes and Odors	Odor Threshold [2]
Boron	mg/L	0.7	AGR [3]	Chemical Constituents	Protect sensitive crops [4]
	mg/L	1.0	MUN[1]	Toxicity	Calif. Drinking Water Notification Level based on toxicity[11]

Chloride	mg/L	106	AGR [3]	Chemical Constituents	Sensitivity of certain crops irrigated via sprinklers [4]
		142	AGR [3]	Chemical Constituents	Chloride sensitivity on certain crops [4]
		250	MUN [1]	Chemical Constituents	Recommended Secondary MCL [5]
		500	MUN [1]	Chemical Constituents	Upper Secondary MCL [5]
Iron	mg/L	0.3	MUN [1]	Chemical Constituents	Secondary MCL [6]
Manganese	mg/L	0.05	MUN [1]	Chemical Constituents	Secondary MCL [6]
Nitrate plus Nitrite as N	mg/L	10	MUN [1]	Chemical Constituents	Primary MCL [7]
Nitrite as N	mg/L	1	MUN [1]	Chemical Constituents	Primary MCL [7]
Sodium	mg/L	69	AGR [3]	Chemical Constituents	Sensitivity of certain crops [4]
Total Dissolved Solids	mg/L	450[8]	AGR [3]	Chemical Constituents	Crop sensitivity [4]
		500	MUN [1]	Chemical Constituents	Recommended Secondary MCL [5]
		1,000	MUN [1]	Chemical Constituents	Upper Secondary MCL [5]
Total Coliform Organisms	MPN/100 ml	<2.2	MUN [1]	Bacteria	Basin Plan and non-detect
Trihalomethanes	µg/L	80	MUN [1]	Chemical Constituents	MCL [8]
Bromoform	µg/L	4	MUN [1]	Toxicity	USEPA IRIS Cancer Risk Level [9]
Bromodichloromethane	µg/L	0.27	MUN [1]	Toxicity	Cal/EPA Cancer Potency Factor [12]
Chloroform	µg/L	1.1	MUN [1]	Toxicity	Cal/EPA Cancer Potency Factor [12]
Dibromochloromethane	µg/L	0.37	MUN [1]	Toxicity	Cal/EPA Cancer Potency Factor [12]
pH	pH Units	6.5 to 8.5	MUN [1]	Chemical Constituents	Secondary MCL [10]
		6.5 to 8.4	AGR [3]	Chemical Constituents	Protect sensitive crops [4]

1 Municipal and domestic supply
2 J.E. Amoore and E. Hautala, *Odor as an Aid to Chemical Safety: Odor Thresholds Compared with Threshold Limit Values and Volatilities for 214 Industrial Chemicals in Air and Water Dilution*, Journal of Applied Toxicology, Vol. 3, No. 6 (1983).
3 Agricultural supply
4 Ayers, R. S. and D. W. Westcot, Water Quality for Agriculture, Food and Agriculture Organization of the United Nations – Irrigation and Drainage Paper No. 29, Rev. 1, Rome (1985)
5 Title 22, California Code of Regulations (CCR), Section 64449, Table 64449-B which is incorporated by reference into the Basin Plan.
6 Title 22, CCR, Section 64449, Table 64449-A which is incorporated by reference into the Basin Plan.

7 Title 22, CCR, Section 64431, Table 64431-A which is incorporated by reference into the Basin Plan.
8 Title 22, CCR, Section 64439, which applies the narrative objective to fully protect the cited beneficial use.
9 USEPA Integrated Risk Information System, http://www.epa.gov/iris.
10 Title 40, Code of Federal Regulations, Section 143.3, which applies the narrative objective to fully protect the cited beneficial use.
11 California Department of Health Services, Division of Drinking Water and Environmental Management, Drinking Water Notification Levels, http://www.dhs.ca.gov/ps/ddwem.
12 CAL/EPA Toxicity Criteria Database (OEHHA), http://www.oehha.org/risk/ChemicalDB.

Domestic wastewater contains numerous dissolved organic and inorganic constituents that together comprise Total Dissolved Solids (TDS). Each component constituent is not individually critical to any beneficial use. Critical constituents are individually listed. The cumulative impact from the other constituents, along with the cumulative affect of the constituents that are individually listed can be effectively controlled using TDS as a generic indicator parameter. The relevant numerical water quality limit for salinity is 450 mg/L, and is used through Basin Plan procedures to apply the narrative Chemical Constituents water quality objective for the protection of agricultural supply, the beneficial use most sensitive to TDS. This limit assumes no impact on sensitive agricultural uses, consistent with the high quality of expected natural background water quality in the area of the discharge. Most individual salt components can safely be assumed to be proportionately low such that TDS can be an effective indicator parameter in their regulation.

Not all TDS constituents pass through the treatment process and soil profile in the same manner or rate. Chloride tends to pass through both rapidly to groundwater. As chloride concentrations in most groundwaters in the region are much lower than in treated municipal wastewater, chloride is a useful indicator parameter for evaluating the extent to which effluent reaches groundwater. Boron is another TDS constituent that may occur in wastewater in concentrations greater than groundwater depending on the source water and the extent residents use cleaning products containing boron. Other indicator constituents for monitoring for groundwater degradation due to recharged effluent include total coliform bacteria, ammonia and total nitrogen, and Total Trihalomethanes (TTHMs), a by-product of chlorination.

A Groundwater Limitation for chloroform is included in this Order and is based on the Basin Plan Toxicity objective and OEHHA Toxicity Criteria for the protection of human health. The Office of Environmental Health Hazard Assessment (OEHHA) has published and maintains the Toxicity Criteria Database, which contains cancer potency factors for chemicals, including chloroform, that have been used as a basis for regulatory actions by the boards, departments and offices within the California Environmental Protection Agency (Cal/EPA). The cancer potency factor for oral exposure to chloroform in this database is 0.031 milligrams per kilogram body weight per day (mg/kg-day). By applying standard toxicologic assumptions used by OEHHA, USEPA and other environmental agencies in evaluating health risks via drinking water exposure (i.e., 70 kg body weight and 2 liters per day water consumption), this cancer potency factor is equivalent to a concentration in drinking water of 1.1 ug/L (ppb) at the 1-in-a-

million cancer risk level. The 1-in-a-million risk level is consistent with that used by the Department of Health Services (DHS) to set de minimis risks from involuntary exposure to carcinogens in drinking water in the development of drinking water MCLs and Action Levels and by OEHHA to set negligible cancer risks in the development of Public Health Goals for drinking water. The one-in-a-million cancer risk level is also mandated by USEPA in applying human health protective criteria contained in the National Toxics Rule and the California Toxics Rule for priority toxic pollutants in California surface waters.

Similarly, Groundwater Limitations for bromoform, bromodichloromethane, and dibromochloromethane are included in this Order and are based on the Basin Plan Toxicity objective and USEPA IRIS cancer risk levels for the protection of human health. The U.S. Environmental Protection Agency maintains the Intetrated Risk Information System (IRIS), which contains concentrations of constituents in drinking water associated with specified cancer risk levels. The Groundwater Limitations for bromoform, bromodichloromethane, and dibromochloromethane were selected from IRIS based on the 1-in-a-million risk level. Assumptions and rationale for selection of these limitations are identical to those discussed above for chloroform.

Treatment Technology and Control

Given the character of domestic wastewater, tertiary treatment technology is generally sufficient to control degradation of groundwater from decomposable organic constituents. Adding disinfection significantly reduces populations of pathogenic organisms, and reasonable soil infiltration rates and unsaturated soils can reduce them further. Neither organics nor total coliform organisms, the indicator parameter for pathogenic organisms, should be found in groundwater in a well-designed, well-operated facility. The bacteria objective in the Basin Plan, cited as a groundwater limitation in the order, is equivalent to requiring that coliform organisms not be detected in groundwater. Due to the high quality of groundwater quality within the Kirkwood Meadows Valley, the Discharger has elected to perform tertiary treatment with chlorine disinfection on the wastewater. Chlorine disinfection of effluent causes formation of trihalomethanes, which are toxic priority pollutants. Treatment to reduce these in wastewater generally has not been performed, and little is known at this point on the typical impact on groundwater.

Domestic wastewater typically contains nitrogen in concentrations greater than water quality objectives, which vary according to the form of nitrogen. The WWTP has a nitrification/denitrification activated sludge treatment process, which is usually considered BPTC for nitrogen compounds. Such a process typically can produce an effluent with total nitrogen concentrations of less that 10 mg/L. However, KMPUD’s wastewater is not typical because of cold temperatures, variable flows related to resort activities, and variable strengths of waste due to I&I and water conservation practices. Wastewater strength has a direct impact on the ability of a MBR nitrification/denitrification activated sludge treatment process to achieve a total nitrogen effluent of less than 10mg/L. Wastewater effluent concentrations for nitrogen

range from approximately 4.5 to 45 mg/L. Background groundwater concentrations appear to be approximately 1.0 mg/L for total nitrogen (see Finding # 35). Based on these effluent concentrations and the apparent background groundwater quality, the current wastewater treatment process for nitrogen compounds does not appear adequate to protect the underlying groundwater from pollution by nitrogen compounds. This Order requires the Discharger to submit a *BPTC Evaluation Workplan* to evaluate the facility's waste treatment and disposal system to determine additional best practicable treatment and control for nitrogen compounds.

Waste constituents that are forms of salinity pass through the treatment process and soil profile and effective control of long-term affects relies upon effective source control. Long-term discharge of domestic wastewater with higher concentrations of TDS than groundwater will degrade that groundwater. The quality of source water for the KMPUD is very good, with a TDS of approximately 160 mg/L. Salt addition through use higher than the expected range, as effluent reveals a TDS of approximately 495 mg/L. For comparison, the national average increment for TDS ranges from 100 to 300 mg/L, according to *Wastewater Engineering* by Metcalf & Eddy; the incremental maximum in the Basin Plan for the Tulare Lake Basin is 500 umhos/cm (about 300 mg/L); and the incremental average standard allowed in the Santa Ana Basin in 230 mg/L. The proposed Order sets for interim effluent limits at the current discharge concentration, while requiring the development of salinity reduction BPTC measures.

Other constituents in domestic wastewater that may pass through the treatment process and the soil profile, include recalcitrant organic compounds, radionuclides, and pharmaceuticals. Hazardous compounds are not usually associated with domestic wastewater and when present are reduced in the discharge to inconsequential concentrations through dilution and treatment. It is inappropriate to allow degradation of groundwater with such constituents.

A discharge of wastewater that overloads soils with nutrients and organics can result in anaerobic conditions in the soil profile, which in turn creates organic acids and decreases soil pH. Under conditions of low soil pH (below 5), iron and manganese compounds in the soil can solubilize and leach into groundwater. Though iron and manganese limits are set at the numerical water quality objectives (MCLs incorporated by reference), groundwater pH is expected to remain the same as background.

Title 27

Title 27, CCR, Section 20005 et seq. (Title 27), contains regulations to address certain discharges to land. Title 27 establishes a waste classification system, specifies siting and construction standards for containment of classified waste, requires extensive monitoring of groundwater and the unsaturated zone for any indication of failure of containment, and specifies closure and post-closure maintenance requirements. Generally, no degradation of groundwater quality by any waste constituent is acceptable under Title 27 regulations.

Discharges of domestic wastewater can be treated and controlled to a degree that will not result in unreasonable degradation of groundwater. For this reason, they have been conditionally exempted from Title 27. Discharges of domestic sewage and treated effluent which are regulated by WDRs and treatment and storage facilities associated with the WWTP are considered exempt from Title 27 under Section 20090(a), provided that the discharges and facilities will not result in a violation of any water quality objective. As the exemption specifically excludes the discharge to land of: 1) solid waste such as grit and screenings that result from treatment of domestic sewage, and 2) residual sludge that will not be further treated at the WWTP, such discharges must comply with provisions of Title 27.

The discharge of wastewater and the operation of treatment and/or storage facilities associated with a wastewater treatment plant can be allowed without requiring compliance with Title 27 only if groundwater degradation complies with the Basin Plan, Resolution No. 68-16 (Antidegradation Policy), and does not violate any water quality objectives.

Proposed Order Terms and Conditions

Discharge Prohibitions and Specifications

The proposed Order establishes a monthly average discharge flow limit of 190,000 gpd and a peak daily flow of 274,000 gallons.

The proposed Order's Effluent Limitations for BOD_5 are based on the predicted effluent quality as stated in the RWD. The RWD did not predict TDS quality; that limit is based on the current performance of the facility, as is the nitrogen effluent limit. Both of these limits are interim values, and will be revised upon the Discharger's completion of BPTC studies.

Monitoring Requirements

Section 13267 of the CWC authorizes the Regional Board to require monitoring and technical reports as necessary to investigate the impact of a waste discharge on waters of the state. In recent years there has been increased emphasis on obtaining all necessary information, assuring the information is timely as well as representative and accurate, and thereby improving accountability of any discharger for meeting the conditions of discharge. Section 13268 of the CWC authorizes assessment civil administrative liability where appropriate.

The proposed Order includes influent and effluent monitoring requirements, land disposal (leachfields) area monitoring, groundwater monitoring, sludge monitoring, and water supply monitoring. In order to adequately characterize effluent, the Discharger is required to monitor for BOD, total coliform organisms, TDS, nitrogen, phosphorous, pH, and other constituents. Monitoring of additional minerals is required on an annual basis.

The Title 27 zero leakage protection strategy relies heavily on extensive groundwater monitoring to increase a discharger's awareness of, and accountability for, compliance with the prescriptive and performance standards. With wastewater being applied to land, monitoring takes on even greater importance. The proposed Order includes monitoring of effluent water quality, application rates, and groundwater quality.

Title 27 regulations pertaining to groundwater monitoring and the detection and characterization of waste constituents in groundwater have been in effect and successfully implemented for many years. No regulation currently specifies similar criteria more suitable for a situation where extensive land application of wastewater occurs. It is appropriate that the Title 27 groundwater monitoring procedures be extended and applied on a case-by-case basis under Water Code Section 13267.

The Discharger must monitor groundwater for wastewater constituents expected to be present in the discharge, and capable of reaching groundwater, and violating groundwater limitations if its treatment, control, and environmental attenuation, proves inadequate. Background groundwater quality is not defined; this Order requires the Discharger to install and monitor groundwater monitoring wells upgradient and downgradient of the wastewater disposal areas to detect potential groundwater impacts.

For each constituent listed in the Groundwater Limitations section, the Discharger must, as part of each monitoring event, compare concentrations of constituents found in each monitoring well (or similar type of groundwater monitoring device) to the background concentration or to prescribed numerical limitations to determine compliance.

Reopener

The conditions of discharge in the proposed Order were developed based on currently available technical information and applicable water quality laws, regulations, policies, and plans, and are intended to assure conformance with them. However, information is presently insufficient to develop final effluent and groundwater limitations, so the proposed Order contains interim limitations. Additional information must be developed and documented by the Discharger as required by schedules set forth in the proposed Order. As this additional information is obtained, decisions will be made concerning the best means of assuring the highest water quality possible and that could involve substantial cost. It may be appropriate to reopen the Order if applicable laws and regulations change. The CWC requires that waste discharge requirements implement all applicable requirements.

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