California Regional Water Quality Control Board
United States Environmental Protection Agency

**Prepared by**

**Regional Board Staff**

**California Regional Water Quality Control Board**
**Colorado River Basin Region**
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**STAFF REPORT IN SUPPORT OF A BASIN PLAN AMENDMENT TO PROHIBIT THE DISCHARGE OF WASTEWATER INTO THE GROUND FROM INDIVIDUAL SUBSURFACE DISPOSAL SYSTEMS IN THE CATHEDRAL CITY COVE**

## INTRODUCTION

The California Regional Water Quality Control Board, Colorado River Basin Region (Regional Board; CRWQCB--CRBR) is charged by the California Water Code (CWC) with protecting the quality of ground and surface waters of the State within the region. Each Regional Board adopts regulations to carry out its powers and duties pursuant to guidelines established by the State Water Resources Control Board (SWRCB), CWC (§ 13222).

A Basin Plan is a regulatory instrument that designates beneficial uses for water bodies, and establishes water quality objectives and implementation plans to protect those beneficial uses. Regional Boards are empowered to develop and amend Basin Plans as necessary to protect the waters of the region (CWC §13225 and §13240).

The Basin Plan for the Colorado River Basin Region uses guidelines adopted in 1974 and revised in 1979 to establish regulations and construction requirements for subsurface wastewater disposal systems (Resolution No. 79-42: Guidelines for Sewage Disposal from Land Development). The guidelines identify: (a) types of systems that need discharge requirements, (b) setback distances, and (c) soil conditions (distance to water table, slope, and percolation rate). The guidelines do not restrict wastewater discharges from these systems in any part of the region. In 1993, the Regional Board approved a resolution to waive discharge requirements for individual subsurface disposal systems, provided they were permitted by the county, and complied with Basin Plan criteria and Regional Board guidelines (Resolution No. 93-004 Waiving Waste Discharge Requirements for Specific Types of Discharges).

An amendment to prohibit subsurface wastewater disposal systems in the Cathedral City Cove area is required by CWC § 13286. Section 13286 states that "[o]n and after January 1, 2012, the appropriate regional board shall prohibit the discharge of wastewater into the ground through the use of individual subsurface disposal systems in the Cove area of Cathedral City…for the purpose of protecting the health and safety of residents consuming the ground water of the Upper Coachella Valley Ground Water Basin and achieving the applicable water quality objectives."

In adopting Section 13286, the Legislature made the following findings:

1. The rising nitrate levels in the ground water of the Whitewater River Subbasin of the Upper Coachella Valley Ground Water Basin are caused by the continued use of individual residential and commercial subsurface disposal systems, which discharge more than one million gallons of wastewater daily into the ground within the Cove area of Cathedral City in Riverside County.

2. The continued use of individual residential and commercial subsurface disposal systems within the Cove area of Cathedral City will result in violations of water quality objectives, impair present and future beneficial uses of water, and cause pollution and contamination of the ground water of the Whitewater River Subbasin of the Upper Coachella Valley Ground Water Basin that is used as a water supply for much of the greater Coachella Valley.

3. Adequate protection of the quality and beneficial use of the ground water of the Whitewater River Subbasin of the Upper Coachella Valley Ground Water Basin and the prevention of pollution and contamination of that ground water caused by the use of individual residential and commercial subsurface disposal systems cannot be sufficiently achieved by redesign, relocation, alterations

to size and spacing, reconstruction, or increased maintenance of existing individual disposal systems.

4. The only viable alternative to the continued use of existing substandard individual disposal systems that utilize subsurface disposal within the Cove area of Cathedral City is the construction and installation of a sanitary public domestic and commercial wastewater disposal system in the Cove area and to prohibit the continued discharge of wastewater into the ground through the use of individual subsurface disposal systems.

5. Without the construction and installation of a sanitary public domestic and commercial wastewater disposal system in the Cove area, the city will be unable to meet the water quality objectives adopted by the regional water quality control board.

6. A wastewater disposal system is necessary to adequately meet the Coachella Valley's needs for present and probable future beneficial uses of water and to ensure the valley's quality of available water continues to meet or exceed minimum standards.

7. In the interest of achieving the applicable water quality objectives, it is necessary to protect present and future beneficial uses of the ground water of the Upper Coachella Valley Ground Water Basin and to prevent any further pollution and contamination of that ground water by immediately constructing and installing a sanitary public domestic and commercial wastewater disposal system in the Cove area of Cathedral City and prohibiting the discharge of wastewater into the ground through the use of individual subsurface disposal systems.

8. In order to protect the health and safety of the citizens currently consuming the ground water of the Upper Coachella Valley Ground Water Basin, a sanitary public domestic and commercial wastewater disposal system should be immediately constructed and installed in the Cove area of Cathedral City and the discharge of wastewater into the ground through the use of individual subsurface disposal systems should be prohibited.

(Stats. 2001, c. 700 (A.B. 358), §1.) Accordingly, CWC Sections 13280 and 13281 do not apply to this amendment. However, the following report addresses all of the factors set forth in Sections 13280 and 13281.

**PROBLEM STATEMENT**

Discharges from subsurface wastewater disposal systems in Cathedral City Cove violate water quality objectives for ground water, impair present and future beneficial uses, and cause nuisance through surface ponding and greywater discharge. Discharges from subsurface wastewater disposal systems have contaminated ground water with nitrates and human-borne pathogens, a direct violation of the State anti-degradation policy (SWRCB Resolution 68-18: Statement of Policy with Respect to Maintaining High Quality of Waters in California). Staff proposes that the Regional Board amend the Basin Plan as required by Section 13286 to prohibit wastewater discharge from individual subsurface wastewater disposal systems in Cathedral City Cove, to prevent further degradation of ground water. Residents and businesses will be required to discontinue usage of these systems by January 1, 2012 in accordance with Section 13286.

**AREA CHARACTERISTICS**

**Location**

Cathedral City is located in Coachella Valley approximately 100 miles east of Los Angeles, California (Figure 1 & 2). The city has 12,480 acres and approximately 44,500 residents. The climate is arid, with zero to five inches of precipitation annually. Seasonal temperatures fluctuate from 120 degrees Fahrenheit in summer, to near freezing temperatures in winter.

Cathedral City Cove is bound to the north by the Whitewater River, to the south by Cathedral City city limits, to the east by Date Palm Drive, and to the west by the Santa Rosa Mountains (Figure 2). Over 90% of the Cove is developed with Neighborhood Residential and Mixed Corridor zoning (i.e., mixed residential and commercial areas) (Krieger and Stewart, 1996). A 1990 census indicates that 28% of permanent Cathedral City residents (approximately 8,300 people) reside in the Cove on about 500 acres. Approximately 2,500 subsurface disposal systems are utilized by Cove residents and local industry (Desert Water Agency and Krieger and Stewart, 2001).

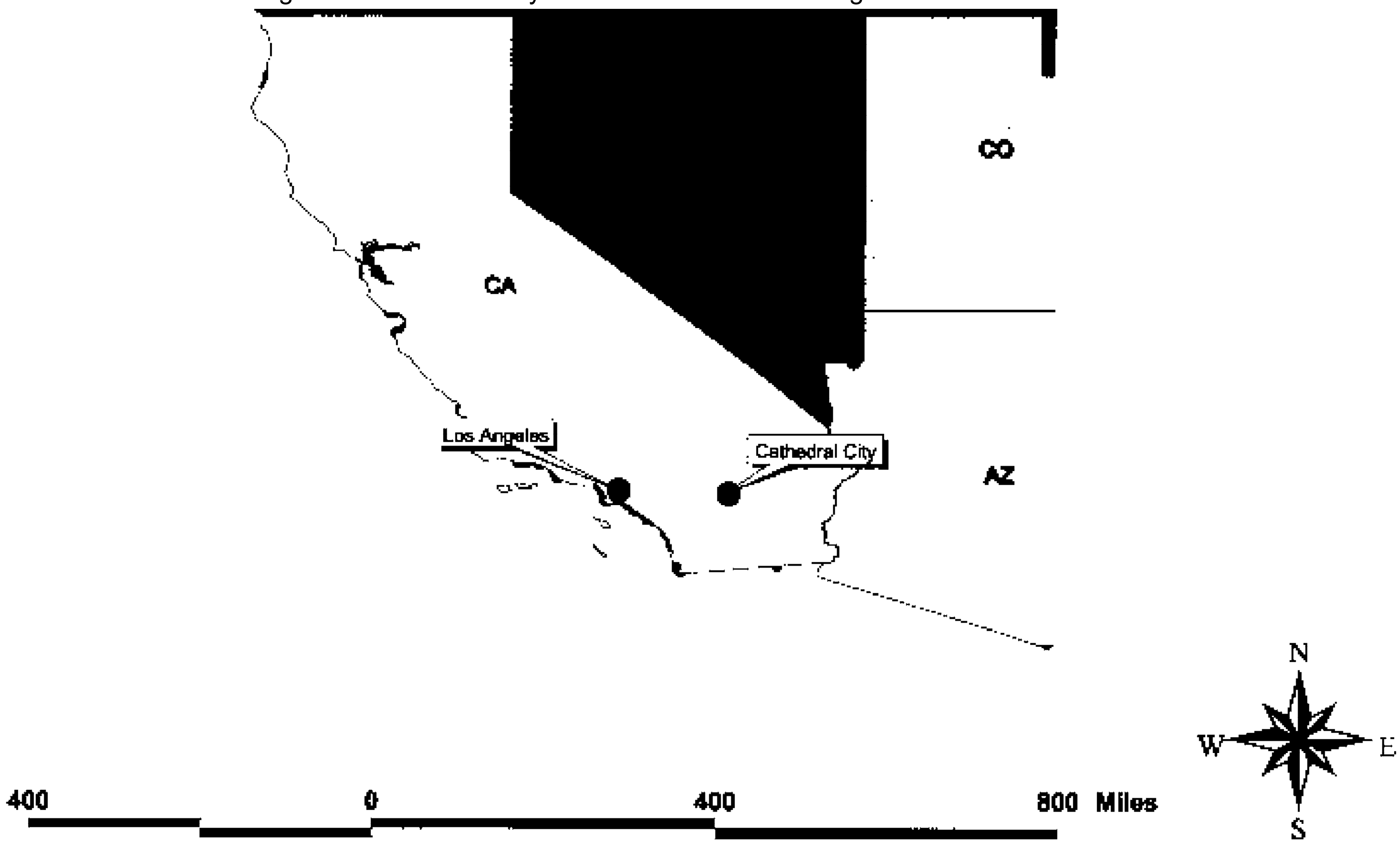
**Geology**

The Cove is situated on northeast-sloping alluvial fan deposits from the Santa Rosa Mountains (Figure 2). Borings drilled to 850 feet below ground surface indicate coarse textured, poorly consolidated, poorly sorted gravelly granitic alluvium with good to excellent drainage properties (U.S. Department of Agriculture Soil Conservation Service and University of California Agricultural Experiment Station, 1980). No extensive fine-grained layers to confine or restrict ground water or wastewater migration are observed. Clays and silts occur in minor amounts, mixed with coarser sediments or in thin lens (Desert Water Agency and Krieger and Stewart, 2001; Coachella Valley Water District, 2001).

**Hydrogeology**

Cathedral City Cove is in the Whitewater River Hydrologic Subbasin, which is part of the Upper Coachella Valley Ground Water Basin. The Whitewater River Subbasin encompasses about 400 square miles and receives runoff and artificial recharge from the Colorado River (Coachella Valley Water District, 2001). The subbasin is currently in overdraft by an estimated 0.24% per year (Coachella Valley Water District, 2001). Ground water occurs at 150 to 180 feet below ground surface, and flows to the northeast following surface contours (Figure 2).

Figure 1.  Cathedral City location relative to Los Angeles.



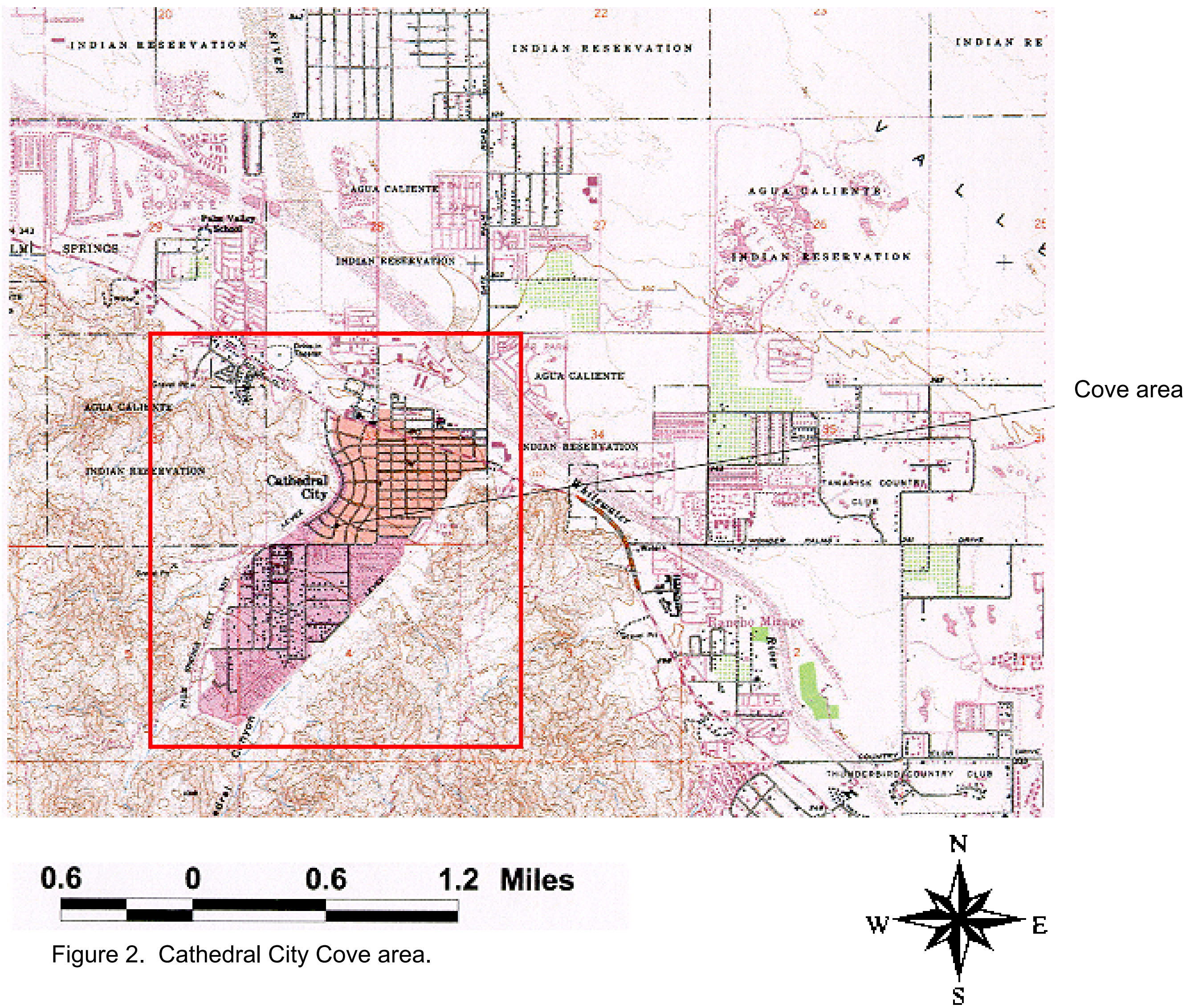



Figure 2. Cathedral City Cove area.

**Beneficial Uses of Area Ground Water**
The Coachella Valley Aquifer is the principle municipal water source utilized by the Desert Water Agency to service Cathedral City and surrounding communities (Desert Water Agency and Krieger and Stewart, 2001; CRWQCB--CRBR, 1994). Ground water in the Upper Coachella Valley generally is unconfined (Reichard and Meadows, 1992; CRWQCB--CRBR, 1994; Coachella Valley Water District, 2000). The amendment to prohibit subsurface disposal systems will protect current and future beneficial uses of Coachella Valley ground water. These include Municipal and Domestic Supply, Industrial Service Supply, and Agriculture Supply (Table 1).

Table 1. Beneficial Uses of Coachella Hydrologic Subunit Groundwater

| Designated Beneficial Uses | Description |
|---|---|
| Municipal and Domestic Supply | Uses of water for community, military, or individual water supply systems including but not limited to drinking water supply. |
| Industrial Service Supply | Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well pressurization. |
| Agriculture Supply | Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing. |

Source: California Regional Water Quality Control Plan for the Colorado River Basin Region (CRWQCB--CRBR, 1994)

## SUBSURFACE WASTEWATER DISPOSAL SYSTEMS

**Description**
Subsurface disposal systems treat wastewater by removing solid materials, and sustaining microorganisms that degrade residual solids and harmful contaminants (Figure 3). Subsurface disposal systems consist of two parts: a septic tank and soil absorption field. Wastewater first enters the septic tank where solids, greases, fats, and oils are removed in a process called clarification. Efficient clarification takes time because solids, greases, fats, and oils travel slowly in water and may require hours to float to the top, or settle to the bottom of the tank. A septic tank should retain wastewater for 24 to 48 hours for optimal effluent segregation and clarification (Noah, 2001). Anaerobic and facultative bacteria degrade residual solids. Biodegradation may require several hours to complete, with treatment efficiency again linked to detention time.

Clarified effluents migrate from the septic tank to the soil absorption field, constructed a few feet below ground surface (Figure 3). The soil absorption field consists of tile lines, or a seepage pit. Effluent may evaporate if the system is near the surface, or percolate through the soil to ground water. Soil will filter suspended solids in the effluent not removed by the septic tank, and filter or adsorb disease-causing bacteria. Microbes in soil near the absorption field also facilitate breakdown of residual solids (Kaplan, 1987).

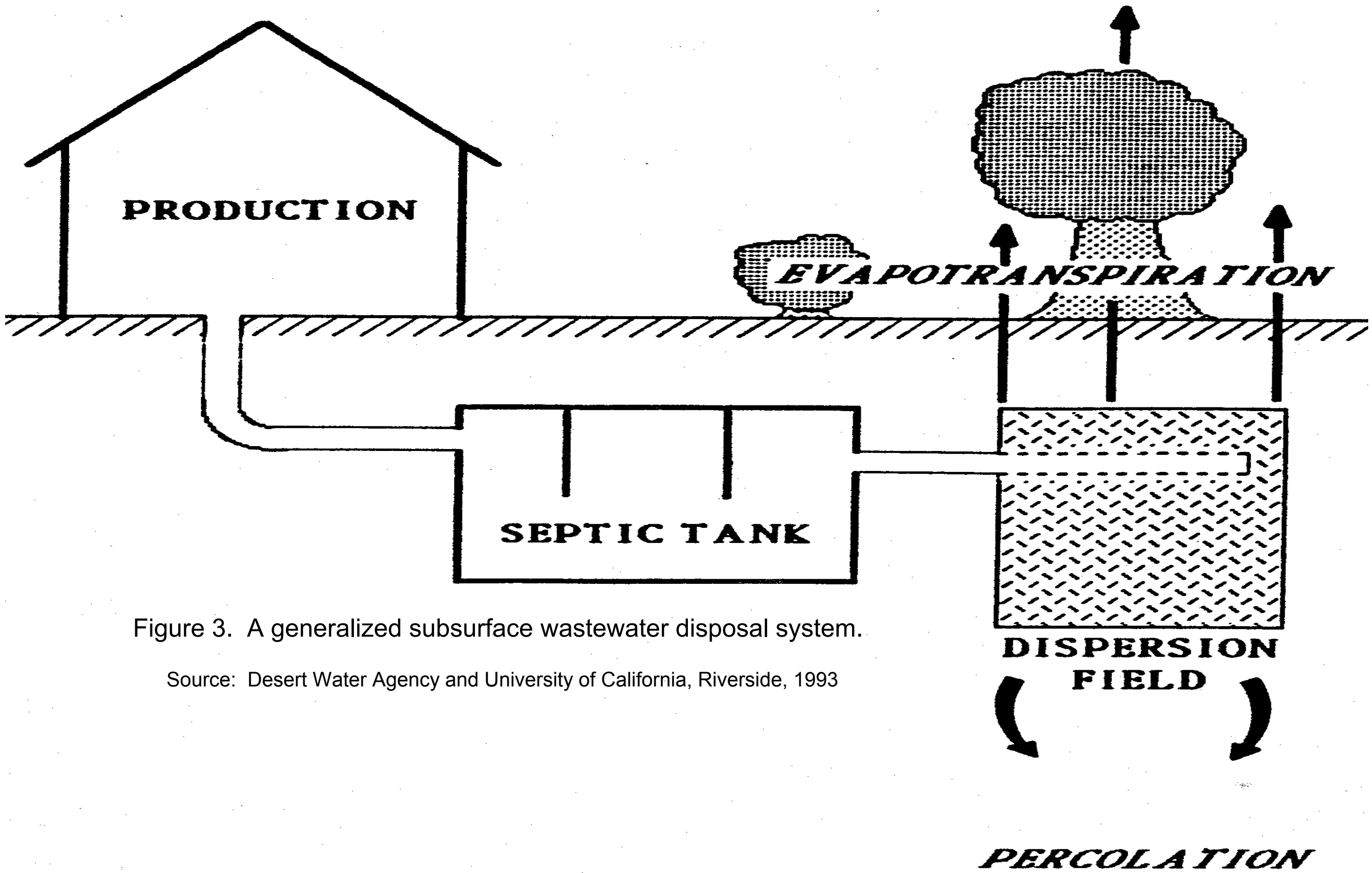



Figure 3. A generalized subsurface wastewater disposal system.

Source: Desert Water Agency and University of California, Riverside, 1993

**Maintenance and Operations**
Proper maintenance and operation of subsurface disposal systems involves not overwhelming the system with wastewater, and periodically pumping the tank to prevent accumulation of solids. Properly maintained and operated systems can treat wastewater effectively for 15 to 20 years. Improperly maintained systems become filled with solids, decreasing treatment efficiency and the life of the system (Falvey, 2000).

Excessive solids in the septic tank reduce treatment efficiency by decreasing wastewater detention time. This allows more solids to pass from the septic tank to the absorption field, leading to soil clogging (plugging of soil pores). Soil clogging reduces porosity, permeability, and the infiltration rate of the effluent. This can create a public health hazard and nuisance by allowing inadequately treated effluent to pond at the ground surface (Photo 1 & 2). Inadequately treated wastewater may contain high concentrations of total suspended solids, pathogens, and inorganic constituents (Kaplan, 1987).

Some Cove residents utilize inappropriate corrective measures, such as drain or septic tank cleaners, to treat failed subsurface disposal systems. These measures may compound the problem or create new ones. Drain and septic tank cleaners contain strong acids and toxic chemicals that kill microorganisms and degrade water quality in the process (Springer, 2001; U.S. Environmental Protection Agency, 1986). Some residents resort to reducing the amount of wastewater entering their systems by diverting greywater (domestic wastewater other than toilet water) to the ground surface (Photo 3). Greywater may contain human-borne pathogens that impact public health directly through contact or indirectly through rodent and insect vectors.

**Sources of Ground water Contamination**
Subsurface disposal systems are used in many rural areas where municipal wastewater disposal systems are impractical because of cost. More than 1.1 million subsurface disposal systems were in use in California in 1990 (U.S. Census Bureau, 1999). Treated wastewater discharges from septic tanks frequently contain pollutants harmful to human health or water quality that were not removed during treatment, or formed after treatment.

Subsurface disposal systems are the third leading cause of ground water contamination in the United States. Effluents from these systems contaminate ground and surface waters with heavy metals, eutrophication nutrients (nitrogen and phosphorus), and human-borne pathogens (U.S. Environmental Protection Agency, 2000; McKay, 1993; Brown, 1998; Scalf et al., 1977; Tomson et al., 1984; Waller et al., 1987; Falvey, 2001).

**Contamination in Cathedral City**
Cathedral City Cove residents and businesses utilize subsurface septic tanks rather than the city's municipal wastewater treatment facility for wastewater disposal. Septic system density is typically high, ranging up to 8.3 tanks per acre. This is considerably greater than the recommended 0.7 tanks per acre (Desert Water Agency and University of California, Riverside, 1993). Approximately 300,000 gallons of wastewater percolate into the ground from Cove area septic systems daily (Desert Water Agency and Krieger and Stewart, 2001). Many Cove systems are improperly maintained and operated, resulting in system failures and ponding of foul-smelling wastewater. A six-year study (1985-1991) by the Riverside County Health Department indicated that one in every one-hundred Cathedral City homes received a notice of violation due to wastewater overflow or surfacing (Desert Water Agency and University of California, Riverside, 1993). The number of violations increased to one in forty in densely populated areas (Desert Water Agency and Krieger and Stewart, 2001).

Photo 1.  Wastewater ponding in Cathedral City.

Source: Desert Water Agency and University of California, Riverside, 1993

Photo 2.  Wastewater ponding on groundsurface.

Source: Desert Water Agency and University of California, Riverside, 1993


Photo 3.  Greywater on groundsurface.

Source: Desert Water Agency and University of California, Riverside, 1993

Desert Water Agency staff, in cooperation with the University of California, Riverside, published a report in February 1993 that assessed the effects of subsurface disposal systems on ground water quality in Cathedral City Cove (Desert Water Agency and University of California, Riverside, 1993). Ground water samples were evaluated for wastewater constituents from four monitoring wells located downgradient of the Cove. Elevated concentrations of nitrates and human pathogenic viruses occurred in all samples. Coliphage was detected in all monitoring wells, and provides conclusive evidence of warm-blooded animal waste impacts to ground water. (Coliphage viruses infect *E.coli* bacteria commonly found in fecal wastes of warm-blooded animals, and can be used to detect *E.coli* presence). Well samples also contained enteroviruses, which are specific to intestinal tracts of humans, monkeys, and apes. Their occurrence clearly indicates that human waste has impacted ground water. Coliphage and enteroviruses also were identified in water samples collected in 2001 (Desert Water Agency and Krieger and Stewart, 2001).

Table 2. Volume of wastewater produced in unsewered areas of Cathedral City. East Cove is the Cathedral City Cove.

| Area | gal/ day |
|---|---|
| East Cove | 289,959 |
| West Cove | 242,034 |
| Dream Homes | 201,485 |
| Cree Ranch | 63,755 |
| Business Dist. | 278,832 |
| **Total** | **1,076,064** |

(Adapted from Desert Water Agency and University of California, Riverside, 1993)

Evidence indicating subsurface disposal systems are the source of nitrates in Cathedral City Cove ground water include the: (a) high nitrate concentration, (b) presence of indicator viruses, (c) high density of subsurface disposal systems, (d) absence of alternative nitrate sources, (e) location of sampling wells downgradient of the Cove, and (f) occurrence of ground water contamination at the top of the aquifer near the septic tanks (Desert Water Agency and University of California, Riverside, 1993).

Nitrate is the primary contaminant of concern in Cathedral City ground water, given its high concentration. Nitrate levels in well samples are 2 to 6 times greater than the maximum contaminant limit for drinking water (45 mg $NO_3^-$/L), and 10 to 15 times greater than the Desert Water Agency's nearest productive well (Desert Water Agency and University of California, Riverside, 1993). Nitrate concentration in ground water near the top of the water table (less than 200 feet below ground surface) is consistently high (Table 3), and suggests that the contamination source is above the aquifer (Desert Water Agency and Krieger and Stewart, 2001; Eccles and Bradford, 1977).

Table 3. Measured concentration of nitrate (mg $NO_3^-$/L) in four sampling wells in the Cathedral City cove area.

| Date | CCM-1[1] | CCM-2 | CCM-3 | CCM-4 | Rainfall |
|---|---|---|---|---|---|
| JUN-91 | 304.4 | 229.2 | 228.0 | 37.9 | 0 |
| JUL | -WELL DATA UNAVAILABLE - | | | | 1.51 |
| AUG | 261.5 | 232.4 | 224.5 | 42.9 | 0.7 |
| SEP | 214.0 | 201.5 | 195.5 | 37.6 | 0.05 |
| OCT | 188.5 | 192.5 | 203.5 | 42.6 | 0 |
| NOV | 229.8 | 215.1 | 218.4 | 45.1 | 0 |
| DEC | 225.5 | 192.0 | 192.5 | 57.4 | 0.99 |
| JAN-92 | 219.5 | 207.0 | 210.0 | 82.3 | 0.64 |
| FEB | 222.5 | 213.5 | 215.5 | 90.8 | 3.58 |
| MAR | 222.8 | 200.1 | 225.2 | 110.6 | 1.97 |
| APR | 243.5 | 230.5 | 235.0 | 110.5 | 0.38 |
| MAY | 246.5 | 214.5 | 230.0 | 86.0 | 0 |
| JUN | 213.0 | 190.5 | 196.5 | 84.1 | 0 |
| JUL | 230.5 | 204.5 | 206.0 | 83.1 | 1.05 |
| AUG | 209.0 | 166.0 | 169.0 | 98.0 | 0.5 |
| SEP | 212.0 | 182.2 | 186.0 | 133.0 | 0 |
| OCT | 224.0 | 200.0 | 202.0 | 113.5 | 0.25 |
| NOV | 210.0 | 168.0 | 171.0 | 121.0 | 0 |
| Average | 228.06 | 202.32 | 206.39 | 80.95 | (Adapted from Desert Water Agency and University of California, Riverside, 1993) |

1 CCM- Cathedral City Monitoring well.

## NITRATES

### Health Concerns

Excessive nitrate consumption can lead to life-threatening conditions. Several studies show a positive correlation between nitrate consumption and cancer (Canter, 1997). Newborn infants ingesting water high in nitrates may develop methemoglobinemia (blue-baby syndrome), a condition that impairs the ability to assimilate and transport oxygen through the circulatory system (Canter, 1997).

Nitrate concentration in drinking water is regulated to protect public health. Primary Maximum Contaminant Levels (MCLs) for drinking water are based on the one-in-a-million incremental cancer risk for carcinogens, and threshold toxicity levels for non-carcinogens. They are adopted by the California Department of Health Services (DHS), and enforced by DHS, health departments, water supply systems, and regulatory agencies. The primary MCL for nitrate is 45 milligrams of nitrate per liter (mg $NO_3^-$/L), or 10 milligrams of nitrogen expressed as nitrogen per liter (mg N/L). Nitrate concentrations in ground water samples collected outside the Cove are low, approximating 1 to 3 mg $NO_3^-$/L (Desert Water Agency and Krieger and Stewart, 2001). In contrast, nitrate concentrations in the Cove average 200 mg $NO_3^-$/L (Table 3).

### Chemistry

Nitrate is a naturally-occurring, stable form of nitrogen formed by the decomposition of nitrogen-rich organic matter in wastewater. Ammonia ($NH_3$) or ammonium ($NH_4^+$) derived from proteins and urea is the main source of nitrogen in wastewater (Canter, 1997). Microbial reactions occurring in septic tanks or near soil absorption fields break down organic wastes and release nitrogen (Table 4). Further microbial activity alters the nitrogen to nitrate ($NO_3^-$) (Scalf et al., 1977). Nitrates are highly soluble and can migrate with wastewater to contaminate ground or surface waters.

Table 4. Chemical equations that regulate nitrate production and loss in the subsurface environment. (Adapted from Canter, 1997)

[1] $$organic - N + microorganisms \xrightarrow{enzymes} NH_3 / NH_4^+ + products$$

[2] $$NH_3 + H_2O \rightarrow NH_4^+ + OH^-$$

[3] $$NH_3 + 2O_2 \rightarrow NO_3^- + H_2O + H^+$$

[4] $$NH_4^+ + 1.5O_2 \xrightarrow{Nitrosomonas} NO_2^- + 2H^+ + H_2O + energy$$

[5] $$NO_2^- + 0.5O_2 \xrightarrow{nitrobacter} NO_3^- + energy$$

[6] $$NO_3^- + organic - C \rightarrow NO_2^- + organic - C \rightarrow N_2 + CO_2 + H_2O$$

Table 4 shows chemical reactions for nitrate development from the breakdown of nitrogen-rich organic matter. Processes in nitrogen cycling are biologically facilitated. The first equation shows the liberation of nitrogen as ammonia from organic compounds, in a process known as mineralization. Equilibrium pH conditions regulate the phase of the released ammonia, to either ammonia or protonated ammonium ion [2]. Ammonia and ammonium is converted to nitrate via nitrification in equations [3], [4] and [5].

The nitrate can percolate through the ground, or convert to nitrogen gas via denitrification and escape to the atmosphere. Denitrification produces diatomic nitrogen gas ($N_2$) by reducing nitrate ions [6]. Because organisms participate in the nitrogen cycle, environmental conditions are important. Denitrification requires a suitable carbon source and oxygen deficiency. If oxygen is present, bacteria capable of using nitrogen as the terminal electron acceptor will prefer oxygen to nitrogen. Remaining nitrates are highly soluble and either percolate to ground water or adsorb to soil, particularly clay**.**

**Model**

Mathematical equations can be used to model nitrate concentrations released from subsurface wastewater disposal systems (RAMLIT and Associates, 1982; California Regional Water Quality Control Board--Santa Ana Region, 1989). The amount of nitrate impacting ground water will depend on the physical and chemical environment, and wastewater characteristics. The mathematical model illustrates the effects of loading, denitrification, and wasteload application rate on nitrate concentrations in percolating wastewater (Angoli, 2000; Noah, 2001; Waller et al., 1987; Kaplan, 1987; Scalf et al., 1977), and predicts nitrate concentrations in wastewater impacting ground water in the Cove.

Mass loading rate is the daily amount of pollutant produced per person, and varies with an individual's physical characteristics and socio-economic level. The mass loading rate of nitrogen in wastewater usually ranges between 6 to 17 grams per person per day (U.S. Environmental Protection Agency, 1980). The mass loading rate of nitrogen in Cathedral City wastewater falls in this range**.** Fifteen percent of the total nitrogen in wastewater typically is lost to chemical processes in the septic tank (RAMLIT and Associates, 1982). Total nitrogen content of septic tank effluents can be calculated using the following equation:

Total Nitrogen Content of Septic Tank Effluents = Mass Loading Rate * 0.85
=17 grams N/person/day * 0.85
=14.45 grams N/person/day
(Assumes a mass loading rate of 17 grams N/person/day)

Denitrification is the conversion of inorganic aqueous phase nitrogen compounds to gaseous dinitrogen ($N_2$). Denitrification may occur in soil after wastewater leaves the subsurface disposal system. Little denitrification is expected in the unsaturated zone of sandy soils, given the scarcity of organic carbon and the presence of oxygen (California Regional Water Quality Control Board--Santa Ana Region, 1989). Denitrification may be significant in localized areas where suitable carbon sources and anaerobic conditions exist (Schroeder et al., 1993). Nitrogen content after denitrification can be calculated using the following equation:

Total Nitrogen Content after Denitrification = Corrected Nitrogen Content *(1-_%Denitrification)
15% Denitrification = 14.45 grams N/person/day*(1- 0.15)
=12.285 grams N/person/day
(14.45 grams N/ person/ day carries over from the previous calculation. Also assumes 15% Denitrification)

Nitrogen content in wastewater will depend on wastewater flow rate, or the daily amount of wastewater produced per person. The average Cathedral City individual produces about 90 gallons (340 liters) of wastewater daily (Desert Water Agency and Krieger and Stewart, 2001). Total nitrogen concentration in wastewater can be calculated using the following equation:

$$\text{Total Nitrogen Concentration in Wastewater} = \frac{\text{Total Nitrogen Content}}{\text{Wastewater Flow}}$$

$$= \frac{\text{12.285 grams N/person/day}}{\text{340 liter/person/day}}$$

=. 036 gram N/liter

= 36 mg N/liter

Total nitrogen and nitrate concentrations in wastewater were calculated for different mass loading rates, denitrification rates, and wastewater flow rates assuming total conversion of nitrogen to nitrates (Table 5). With a mass loading rate of 12 grams per person per day, a denitrification rate of 15%, and a wastewater flow rate of 90 gallons per person per day, the model predicts 29.94 milligrams of nitrogen in a liter of wastewater. This is significantly higher than the drinking water MCL for nitrate (10 mg N/L, or 45 mg $NO_3^-$/L). Comparing measured nitrate concentrations for Cathedral City in Table 3 with predicted nitrate concentrations in Table 5 supports the model's predictions.

Table 5. Predicted concentration of nitrogen and nitrate in wastewater.

| Mass Loading (grams N/person/day | Denitrification (%) | Wastewater Flow[1] (gal/person/day) | Nitrogen in Wastewater (mg N/L)[2] | Nitrate in Wastewater (mg $NO_3^-$/L)[3] |
|---|---|---|---|---|
| 6 | 0 | 30 | 52.83 | 233.98 |
| | | 60 | 26.42 | 116.99 |
| | | 90 | 17.61 | 77.99 |
| 6 | 0.15 | 30 | 44.91 | 198.88 |
| | | 60 | 22.45 | 99.44 |
| | | 90 | 14.97 | 66.29 |
| 12 | 0 | 30 | 105.67 | 467.96 |
| | | 60 | 52.83 | 233.98 |
| | | 90 | 35.22 | 155.99 |
| 12 | 0.15 | 30 | 89.82 | 397.77 |
| | | 60 | 44.91 | 198.88 |
| | | 90 | 29.94 | 132.59 |
| 17 | 0 | 30 | 149.70 | 662.95 |
| | | 60 | 74.85 | 331.47 |
| | | 90 | 49.90 | 220.98 |
| 17 | 0.15 | 30 | 127.24 | 563.51 |
| | | 60 | 63.62 | 281.75 |
| | | 90 | 42.41 | 187.84 |

[1] The Wastewater Flow from each person in Cathedral City is estimated at 90 gal/ person/day.

[2] Concentration of Nitrogen in wastewater calculated as milligrams of nitrogen per liter.

[3] Concentration of Nitrates calculated by multiplying the Concentration of Nitrogen by 4.42, the ratio of molecular weight of nitrate to nitrogen

**IMPLEMENTATION**

The most likely municipal responses to the septic prohibition are to: (a) collect and transport wastewater to an existing sewage treatment facility or (b) construct a municipal wastewater collection system in the Cove. Several local communities with similar septic tank/ground water issues are implementing these approaches (Yucca, Desert Hot Springs, Rancho Mirage).

The Desert Water Agency has prepared an implementation plan (Krieger and Stewart, 1996) that outlines the type of construction and costs associated with installing a municipal wastewater collection system in the Cove and Town Center Precise areas. Municipal system construction will occur in phases. The

Desert Water Agency reports that the first phase (installing the pumping station, force main, and trunk piping for wastewater conveyance) is complete. Remaining tasks include; (a) lateral piping installation in Cove streets to allow user connection, and (b) removal, or "graveyarding," of subsurface disposal systems once the municipal system is available.

The statutory deadline for compliance is January 1, 2012, which allows sufficient time to complete construction of the municipal wastewater collection system. Regional Board staff is working closely with Cathedral City so that residents will be in compliance with the prohibition by the deadline. Events can be completed concurrently and include:

1. **Identify sources of funding.** The City will develop programs to secure funding from local sources, such as: (a) bonds, (b) special property taxes, (c) wastewater service charges, or (d) connection fee charges. The City has also applied for Proposition 13 Grant funding. In October 2003, the State Water Resource Control Board will consider final approval of a 2.809 million dollar grant for sewer installation in the Cove. The City can still apply for federal grants or other state funding programs to fund sewer construction. The U.S. Environmental Protection Agency funds the State Revolving Fund Loan Program, which provides low interest loans for financing the construction of wastewater treatment and reclamation facilities. Public involvement and support of City efforts will facilitate securing funds.

2. **Develop and produce engineering documents outlining construction.** The Desert Water Agency has prepared a facility plan that provides the materials and piping locations for a wastewater collection system in Cathedral City Cove. Specific piping locations and a construction plan are required to identify and mitigate possible difficulties.

3. **Prepare environmental documents.** The California Environmental Quality Act requires developers to: (a) evaluate environmental consequences of land-use decisions, (b) disclose significant environmental effects to the public and decision-makers, and (c) identify and implement mitigation measures to avoid or reduce the impact.

4. **Complete construction.** The City has adopted a phased approach toward sewerage system construction. These phases can be subdivided or combined, depending on funding.

5. **Connect residents and businesses and graveyard old systems.** Once construction is complete and residents and businesses are connected to the municipal collection system, the old systems can be graveyarded by: (a) pumping septic tanks and filling them with sand, or (b) removing septic tanks. The wastewater treatment facility that receives wastewater from the Cove should revise Waste Discharge Requirements to account for the additional load.

The City shall provide annual progress reports to the Regional Board, describing progress, difficulties encountered, and remedies to complete tasks.

**CONSIDERATIONS**

CWC § 12381 requires regional boards to consider, among other things, the factors set forth in CWC §13241 before prohibiting discharges from subsurface disposal systems. CWC §13281 does not apply to this project, since the legislature mandated the prohibition in Section 13286. Nevertheless, Regional Board staff has provided an analysis of the Section 13241 factors.

Section 13241, subdivision (d), requires the regional board to consider economics when preparing basin plan amendments. Regional Board staff contacted the Office of Statewide Initiatives Economics and Effectiveness Unit to analyze the economics of enacting a prohibition of discharge of wastewater into the ground from individual subsurface disposal systems in the Cove area. Regional Board staff provided relevant and requested documentation to Economics and Effectiveness Unit staff.

The Economic and Effectiveness Unit completed their analysis on June 5, 2002. Costs associated with constructing a wastewater collection system and graveyarding old systems were calculated, which is the method Cathedral City is planning to implement to meet prohibition requirements. The analysis indicates that costs may be a substantial burden to Cove residents. Cathedral City staff is investigating various finance options to construct a wastewater collection system.

CWC Section 13241, subdivision (e) and (f), requires the regional board to consider the need to develop housing, and to develop/use recycled water when preparing basin plan amendments. Greater than 90% of the Cove is developed (Krieger & Stewart Inc. 1996). Prohibiting the discharge of wastewater from individual subsurface disposal systems ensures new housing will not contribute ground water contamination from septic tanks after January 2012. Raw wastewater from individual subsurface disposal systems is not suitable for recycling. However, wastewater could be diverted to a wastewater collection system/water reclamation plant for treatment and possible reuse.

The factors set forth in CWC Section 13241, subdivisions (a), (b) and (c) are discussed throughout this report.

**CONCLUDING STATEMENT**

Subsurface wastewater disposal systems in Cathedral City Cove have degraded water quality in the Coachella Valley Aquifer, the area's primary drinking water source, with nitrates and bacteria. Nitrate concentrations in Cove ground water range up to 300 mg $NO_3^-$/L, significantly exceeding the primary MCL of 45 mg $NO_3^-$/L. Improper operation and maintenance of subsurface disposal systems cause wastewater ponding, thus creating a public nuisance and health concern from odor and human-borne pathogens. This degradation is significant and violates water quality objectives and impairs beneficial uses.

If no action is taken, further degradation to ground water in Cathedral City Cove may result, and deeper zones of the Coachella Valley Aquifer used for drinking water supply, may be impacted. The Desert Water Agency has three production wells downgradient of the Cove. Closure of these wells may be necessary if ground water contamination from septic tanks is allowed to continue in Cathedral City Cove. Regional Board staff recommends that the Regional Board amend the Basin Plan to prohibit the discharge of wastewater into the ground from individual subsurface disposal systems in the Cove area of Cathedral City. This prohibition satisfies the regional board requirement to prohibit the discharge of wastewater into the ground as described in CWC § 13286.

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