Table 4-2 (page 4-3) summarizes estimated long-term mean annual groundwater recharge and groundwater outflow terms for the four HSAs, as presented in the City's 1993 HARRF recycled water report of waste discharge. As shown in Table 4-2, streamflow infiltration, precipitation infiltration, and infiltration from applied irrigation waters represent the dominant sources of recharge within the HSAs. Surfacing groundwater and groundwater pumping represent the dominant sources of groundwater outflow within HSA 4.52, HSA 4.62, and HSA 5.23. Within HSA 5.21, subsurface groundwater flow represents an additional dominant outflow.

As shown by comparing mean annual recharge/outflow estimates presented in Table 4-2 (page 4-3) with groundwater storage estimates presented in Table 4-1, mean annual groundwater basin recharge averages approximately 10 percent of the total groundwater volume for alluvium/residuum aquifers (HSAs 4.52, 4.62, and 5.21). (Such a value is typical for San Diego County coastal and inland groundwater basins.)

Table 4-1
Summary of Physical Characteristics
HSAs 4.52, 4.62, 5.21, and 5.23

Characteristic	Eastern Portion of HSA 4.52	HSA 4.62	HSA 5.21	HSA 5.23
Principal surface water course[1]	San Marcos Creek	Escondido Creek	San Dieguito River	Felicita Creek
Approximate area[1]	3.3 sq. miles[3]	44 sq. miles	18 sq. miles	3.3 sq. miles
Predominant Aquifer Type[2]	Alluvium underlain by fractured rock	Alluvium underlain by fractured rock	Alluvium underlain by fractured rock	Fractured rock
Estimated Max. Groundwater Storage Capacity[2]	11,500 AF[3]	70,000 AF	35,000 AF	5,000 AF

1 From U.S. Geological Survey topographic maps (Escondido Quadrangle, San Marcos Quadrangle, Rancho Santa Fe Quadrangle, and Valley Center Quadrangle, 7.5 minute series.)

2 From *City of Escondido Water Reclamation and Reuse Program Report of Waste Discharge* (Montgomery Watson, 1993).

3 While the total area of HSA 4.52 is approximately 14 square miles, the proposed City of Escondido reuse would be limited to the eastern (upstream) portion of the basin. For purposes of assessing impacts of this recycled water use, this study assesses the upstream 2100 acres (3.3 square miles) of HSA 4.52.

Table 4-2
Estimated Long-Term Average Groundwater Recharge and Outflow[1]

Recharge/Outflow Parameter	Mean Annual Recharge/Outflow in AFY[1,2]			
	HSA 4.52[3]	HSA 4.62	HSA 5.21	HSA 5.23
MEAN ANNUAL BASIN RECHARGE				
Infiltrating streamflow	350	500	500	250
Direct precipitation	140	1,750	720	130
Septic tank discharges	10	70	20	20
Infiltrating applied imported water[4]	360	5,100	1,350	360
Infiltrating applied local groundwater[4]	60	600	240	80
Infiltrating applied recycled water[4]	0	0	0	0
Subsurface groundwater inflow	50	0	500	0
SUBTOTAL - BASIN RECHARGE	970	8,020	3,330	840
MEAN ANNUAL BASIN OUTFLOW				
Mean annual groundwater pumping	250	2,500	1,000	350
Phreatophytes & evaporation	60	290	280	80
Estimated surfacing groundwater[5]	560	5,230	750	370
Subsurface outflow	100	0	1,300	40
SUBTOTAL - BASIN OUTFLOWS	970	8,020	3,330	840

1 Mean annual basin recharge and outflow estimates are from the City's 1993 HARRF recycled water report of waste discharge, entitled *City of Escondido Water Reclamation and Reuse Program Report of Waste Discharge* (Montgomery Watson, 1993).

2 Estimated long-term average mean annual groundwater basin recharge and groundwater basin outflow for the respective HSAs, rounded to the nearest 10 AFY. The above long-term average estimates are based on long-term hydrologic data superimposed on existing irrigation and land uses. The estimates are also based on a long-term balance between groundwater recharge and outflows for each respective HSA. It should be noted that groundwater recharge and outflow in any given year is highly variable, and differ considerably from the estimated long-term average. Infiltrating streamflow and precipitation recharge are dependent on local hydrologic conditions, while applied irrigation recharge (imported water, recycled water, and groundwater) is dependent on weather and water availability. Surfacing groundwater and subsurface outflow are dependent on groundwater table elevations, and will vary significantly depending on hydrologic conditions and groundwater pumping. Values rounded to nearest 10 acre-feet per year (AFY).

3 Eastern 2100 acres of Richland HSA 4.52.

4 Based on 70 percent irrigation efficiency. (At an irrigation efficiency of 70 percent, the application of 1000 AF of irrigation water would result in 300 AF of recharge to saturated groundwater.)

5 Sum of groundwater contributions to stream "base flow", and groundwater losses to seeps and springs

1993 report of waste discharge identified one active well within the eastern portion of HSA 4.52. Given the suburban nature of land use within the HSA, however, it is possible that a number of unregistered irrigation wells exist within the eastern portion of HSA 4.52.

Groundwater quality data for HSA 4.52 are sparse. Table 4-4 summarizes groundwater quality within the eastern portion of HSA 4.52, as reported by the City's 1993 HARRF recycled water report of waste discharge. The limited available data indicate that groundwater concentrations within the eastern portion of HSA 4.52 are within assigned Basin Plan water quality objectives, and that assimilative capacity appears to exist within the HSA for boron, iron, and manganese. (Chapter 5 of this report quantitatively assesses the capacity within HSA 4.52 for assimilating additional loads of boron, iron, and manganese while still maintaining compliance with Basin Plan groundwater quality objectives.)

Table 4-4
Groundwater Quality
Richland HSA (HSA 4.52)

Constituent	Concentraton[1] (mg/l)
TDS	810
Chloride	120
Sulfate	230
Boron	0.16
Fluoride	0.19
Iron	0.10
Manganese	0.015

1 February 1991 water quality analyses of groundwater from Well No. 12N/2S-18F1 from *City of Escondido Water Reclamation and Reuse Program Report of Waste Discharge* (Montgomery Watson, 1993).

4.4 Description of Escondido HSA 4.62

The majority of the City of Escondido is located within HSA 4.62. The 44-square-mile HSA 4.62 watershed is drained by Reidy Creek and Escondido Creek.

HSA 4.62 features alluvial aquifers that extend along Escondido Creek and Reidy Creek in the central portion of the HSA. The alluvial aquifers are underlain by a fractured rock aquifer. The fractured rock aquifer extends beyond the alluvium to the foothills along the edges of HSA 4.62. In approximately one-quarter of HSA 4.62, the fractured rock aquifer has been weathered to form a water-bearing residuum (decomposed granite). In the downstream portion of the HSA, the broad alluvium/residuum aquifer is constricted into a narrow canyon at Harmony Grove. Surfacing groundwater and urban runoff from HSA 4.62 insure year-round surface flows of Escondido Creek as the creek exits the HSA.

City of Escondido studies performed concurrent with preparation of the City's 1993 HARRF recycled water report of waste discharge identified more than 60 wells within HSA 4.62. Table 4-5 (pages 4-7 and 4-8) summarizes groundwater quality data from the identified wells.

As shown in Table 4-5, groundwater concentrations of boron, iron, and manganese are in general compliance with Basin Plan groundwater quality objectives for HSA 4.62. As a result, HSA 4.62 appears to have the capacity to assimilate additional loads of boron, iron, and manganese without causing exceedance of Basin Plan groundwater quality objectives. (Chapter 5 of this report quantitatively assesses the capacity within HSA 5.21 for assimilating additional loads of boron, iron, and manganese while still maintaining compliance with Basin Plan groundwater quality objectives.)

4.5 Description of Del Dios HSA 5.21

HSA 5.21 encompasses the downstream portion of the San Pasqual Valley, and includes Lake Hodges. Groundwater within HSA 5.21 primarily occurs in a deep alluvial aquifer that stretches from Lake Hodges to the San Pasqual Valley "narrows". Due to the depth and extent of the alluvial aquifer, total alluvial groundwater storage in HSA 5.21 is estimated at approximately 35,000 acre-feet (AF).

The alluvial valley of HSA 5.21 is underlain and surrounded to the north and south by foothills that comprised of residuum overlying fractured rock. Lands overlaying the alluvial aquifer are primarily undeveloped, while foothills on either side of the valley are predominantly urban and suburban. (The foothills extend to the southern portion of the City of Escondido and the northern portion of Rancho Bernardo.)

A number of irrigation wells exist within HSA 5.21, including irrigation wells in the valley alluvium in the eastern portion of the HSA (overlying City of San Diego lands) and City of Escondido wells in the vicinity of Kit Carson Park. (The City's 1993 HARRF recycled water report of waste discharge identified 15 active wells within HSA 5.21.)

Table 4-6 (page 4-9) summarizes available groundwater data for the wells. As shown in Table 4-6, concentrations of boron, iron, and manganese are generally within assigned Basin Plan groundwater quality objectives. Consequently, HSA 5.21 appears to have the capacity to assimilate additional loads of boron, iron, and manganese without causing exceedance of Basin Plan groundwater quality objectives. (Chapter 5 of this report quantitatively assesses the capacity within HSA 5.21 for assimilating additional loads of boron, iron, and manganese while still maintaining compliance with Basin Plan groundwater quality objectives.)

Table 4-5
Groundwater Quality, Escondido HSA[1] (HSA 4.62)

Sample Date	Well Number	Concentration in mg/l						
		TDS	Chloride	Sulfate	Boron	Fluoride	Iron	Mn
06/15/87	12S/2N-3M1	1300	330	400	0.13	0.2	0.02	0.02
06/15/87	12S/2N-4Q1	1400	430	370	0.16	0.5	0.02	0.09
06/15/87	12S/2N-9R1	1500	330	470	0.1	0.3	0.02	0.01
06/15/87	12S/2N-10K1	1800	470	640	0.13	0.4	0.02	0.01
06/16/87	12S/1N-18M1	1000	160	360	0.2	0.3	0.008	0.04
06/16/87	12S/2N-12B1	960	180	260	0.13	0.3	0.006	0.001
06/16/87	12S/2N-13E2	785	224	87	0.19	0.1		
06/16/87	12S/2N-15C1	800	240	110	0.09	0.3	0.005	0.015
06/16/87	12S/2N-21N1	4500	1700	1000	0.21	0.3	0.05	0.06
06/16/87	12S/2N-29H2	1300	290	410	0.1	0.3	0.02	0.01
06/16/87	12S/2N-30K1	1100	280	240	0.15	0.2	0.008	0.18
06/17/87	11S/2N-18A1	900	230	220	0.08	0.3	0.004	0.19
06/17/87	11S/2N-34M2	820	250	130	0.07	0.3	0.006	0.032
06/17/87	12S/2N-12K1	720	210	110	0.04	0.7	0.007	1.0
06/17/87	12S/2N-27B4	1200	330	290	0.1	0.3	0.02	0.01
06/15/87	11S/2N-21K3	1100	290	300	0.09	0.3	0.008	0.12
06/15/87	11S/2N-33C1	700	180	170	0.1	0.5	0.011	0.004
06/17/87	12S/1N-6M1	860	180	190	0.14	0.6	0.006	0.002
07/02/87	12S/2N-2Q1	1100	220	300	0.18	0.5	0.005	0.001
07/02/87	12S/2N-17H1	1000	140	390	0.004	0.3	0.004	0.005
01/28/91	11S/1N-31P	1070	420	180	0.05	0.41	0.91	0.038
01/28/91	12S/1N-6M4	840	220	160	0.18	0.41	0.10	0.015
01/28/91	12S/1N-6A	1070	190	270	0.08	0.3	0.10	0.015
01/28/91	12S/2N-12C	1300	260	490	0.13	0.51	0.10	0.015
01/29/91	12S/2N-12E1	1450	390	500	0.075	0.32	0.10	0.015
01/29/91	12S/2N-12E2	1510	320	380	0.14	0.28	0.10	0.015
01/30/91	12S/2N-12L1	1550	330	500	0.11	0.2	0.10	0.015
01/30/91	12S/2N-3L3	1250	280	370	0.062	0.15	0.10	0.015

(Table 4-5 is continued on Page 4-8)

1 From *City of Escondido Water Reclamation and Reuse Program Report of Waste Discharge* (Montgomery Watson, 1993), and *City of Escondido Proposed Basin Plan Amendment, Escondido Hydrologic Subarea 4.62* (Montgomery Watson, 1993).

3.0 Primary Constituents of Concern

Manganese is a natural component of rock and soil. Aquifers that feature manganese-rich media may naturally leach manganese into the groundwater and lake, resulting in naturally high groundwater and lake concentrations of this constituent. An increase of manganese was attributed to the City of Escondido's usage of the local domestic water supply. The Escondido-Vista Water Treatment Plant (WTP) frequently uses a high percentage of water from Lake Wohlford in its potable water production. This source water contributes to higher levels of manganese in recycled water due to residual sludge discharged from WTP. The City is attempting to minimize the manganese source by using chemicals that contain fewer impurities such as manganese. Due to agreements with other agencies, the City of Escondido is obligated to use this local water supply, when available, as a potable water source.

Total dissolved solid (TDS) is another constituent of concern. When Colorado River water is imported to San Diego County Water Authority, the TDS concentration in imported water is higher than local sources and is consistently above 550 mg/l. That leads to high TDS values of over 1000 mg/l coming in to the wastewater treatment plant, which may cause TDS to increase above 1000 mg/l in recycled water. The TDS has been selected as an expression of salinity for determining whether recycled water is acceptable for purposes of reuse in irrigation.