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NITRATE ASSESSMENT

West Lilac Farms (Tentative Map 5276)

San Diego County, California

Prepared by:

Michael R. Welch, Ph.D., P.E.
Consulting Engineer

July 2003

Nitrate Assessment

Nitrate Mass Balance Analysis of Proposed Development of West Lilac Farms Tentative Map 5276

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Revised Version: July 7, 2003

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October 28, 2010

Mr. Wesley W. Peltzer
Law Offices of Wesley W. Peltzer
751 Rancheros Drive, Suite 4
San Marcos, CA 92069

Dear Wes:

Subject: Nitrate Load Assessment for West Lilac Development (TM 5276)

This is a follow-up to our conversations regarding the West Lilac project (TM 5276) located near the intersection of Via Ararat Road and Mt. Ararat Way, south of West Lilac Road. In 2003, I prepared an evaluation (*Nitrate Assessment, West Lilac Farms*, July 2003) that concluded that the conversion of existing agricultural lands on the West Lilac property to 28 residential sites would not adversely impact groundwater nitrate concentrations. This conclusion was based on computations that demonstrated that the proposed West Lilac residential land use would result in reduced nitrate loads to local groundwater compared to nitrate loads from existing agricultural uses on the site.

It is my understanding that the currently proposed West Lilac development plan differs slightly from the development plan addressed in the 2003 nitrate assessment. While both the currently-proposed plan and the plan proposed in 2003 involve 28 residential lots, the currently-proposed plan would maintain 22.6 acres of agricultural lands as an agricultural preserve. Further, I understand that an additional 35.9 acres of existing agricultural lands could (at the discretion of the homeowners association) be maintained in agricultural production. The originally-proposed development plan addressed in the 2003 nitrate study did not include any such agricultural preserve. The net result of the currently-proposed development plan is that at least 22.6 acres of existing avocado/citrus production would be maintained, and that 34.3 acres of existing agricultural land would be converted to 28 residential lots.

The 2003 nitrate assessment concluded that conversion of existing avocado/citrus agricultural lands to residential lands would not result in a significant impact to nitrate concentrations in local groundwater. This conclusion remains valid under the proposed development plan.

As reported in the 2003 nitrate study, septic tank discharges from the 28 proposed homesites would generate approximate 800 pounds per year of nitrate loads. The 800 pounds per year septic tank nitrate load estimate is based on an average of 250 gallons per day of wastewater generated from 28 homesites, 40 mg/l nitrate concentrations in the wastewater, and the assumption that only 10 percent of the septic tank nitrate loads are taken up by surface vegetation.

Nitrate loads from the proposed residential septic tanks would be offset by reductions in nitrate loads from fertilizers associated with taking 34.3 acres (or more) of avocado/citrus out of production. According to Mr. Jerome Stehly, the site agricultural manager, fertilizer applications to avocado/citrus trees on the site the past several years have averaged approximately 250 to 300 pounds of nitrogen per acre per year. Over 34.3 acres of citrus/avocado, this translates to an annual total of approximately 8,600-10,000 pounds of nitrogen within the applied fertilizers. (All values herein are rounded to two significant figures.)

A significant majority of this applied nitrogen (estimated at 80 percent in the 2003 nitrate study) will be taken up by the avocado/citrus trees as nutrients, but a portion of the nitrogen will be transported downward to groundwater by the leaching fraction of the irrigation water. Assuming (per the 2003 nitrate study) that 80 percent of applied fertilizer is taken up by vegetation, total annual groundwater nitrate loads associated with fertilizing 34.3 acres of avocado/citrus would be on the order of 1700-2000 pounds.

Even allowing for fertilizer applications on irrigated landscaped portions of the proposed 28 residential lots, post-development nitrogen loads to groundwater are projected to be less than the existing annual pre-project nitrate loads of 1700-2000 pounds. Consequently, the overall "no significant impact" conclusions of the 2003 nitrate study remain valid even though the currently-proposed project would maintain more land in agricultural production that was addressed in the 2003 study.

Please call me if you have any questions.

Sincerely,

Michael R Welch

Michael R. Welch, Ph.D., P.E.
CONSULTING ENGINEER

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List of Abbreviations

AFY	acre-feet per year
CRWQCB	California Regional Water Quality Control Board, San Diego Region
DEH	County of San Diego Department of Environmental Health
DHS	State of California Department of Health Services
gals	gallons
HSA	Hydrologic Subarea
LLC	Limited Liability Corporation
lbs	pounds
MCL	Maximum Contaminant Level (drinking water standard)
mg/l	milligrams per liter
MWD	Metropolitan Water District of Southern California
N	nitrogen
RMWD	Rainbow Municipal Water District
SDCWA	San Diego County Water Authority
TM	Tentative Map

1.0 Introduction

Project Overview. West Lilac Farms (Tentative Map 5276) is located west of Interstate 15, south of the community of Fallbrook. Figure 1-1 (page 2) presents the location of West Lilac Farms.

West Lilac Farms consists of two parcels. The first parcel (West Lilac #1) covers 39.2 acres. West Lilac #1 is approximately square in shape (roughly 1300 feet on a side), and is located at the intersection of Via Ararat Road and Mt. Ararat Way, south of West Lilac Road. The second parcel (West Lilac #2), is a 53.5-acre "L" shaped parcel adjacent to and immediately northeast of West Lilac #1. The Second San Diego Aqueduct and Aqueduct Road are located on the eastern boundary of West Lilac #2.

Tentative Map 5276 proposes the creation of a total of 28 residential lots within the 92.7-acre West Lilac Farms site. A total of 11 residential lots are proposed on West Lilac #1, and 17 lots are proposed on West Lilac #2.

Water service for the residential lots would be provided by Rainbow Municipal Water District (RMWD). Septic tanks and leach fields within each residential lot are proposed for disposing of wastewater.

Purpose of Study. The State of California Department of Health Services establishes a Maximum Contaminant Level (MCL) for nitrate in drinking water at 10 mg/l (as nitrogen). Groundwater concentrations in wells located in the vicinity of West Lilac Farms have been reported to exceed this MCL. The County of San Diego Department of Environmental Health (DEH) is concerned that the use of onsite septic tanks may exacerbate the existing groundwater nitrate problem. As a condition to approval of Tentative Map 5276, DEH required the West Lilac Farms proponent to "provide a nitrate mass balance study for the subdivision to determine the proposed project's impact on nitrate levels in the groundwater."

In accordance with this DEH requirement, the objectives of this study are to (1) assess and compare pre-project and post-project nitrate mass emissions, and (2) assess whether the proposed project will result in positive or negative impacts to groundwater nitrate concentrations.

This study was prepared by Michael R. Welch, Ph.D., P.E., Consulting Engineer. Preparation of this study was authorized by the property owner, James D. Pardee, Jr., West Lilac Farms II, LLC.

Study Approach. To determine how development of Tentative Map 5276 may affect groundwater nitrate concentrations, this study assesses nitrate loadings to groundwater that are projected to occur as a result of the proposed 28-lot development. These estimated nitrate mass loadings are then compared to existing mass loadings (mass loadings that would continue to occur in the absence of approval and development of Tentative Map 5276). Conclusions are then presented on whether the development of West Lilac Farms (Tentative Map 5276) will result in deterioration or improvement in existing groundwater quality.

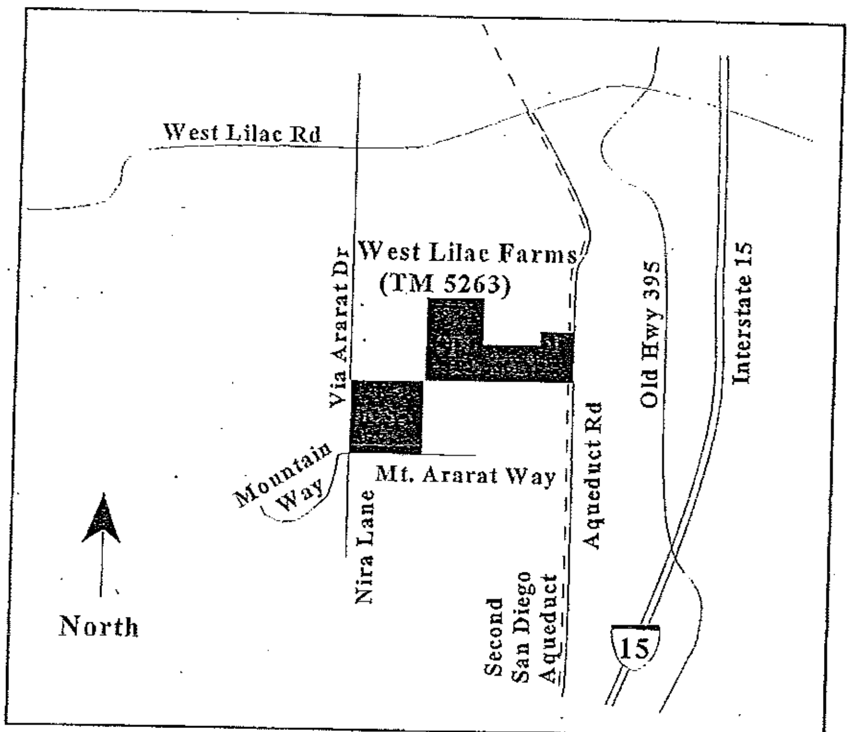

Figure 1-1 Location of West Lilac Farms (Tentative Map 5276)

2.0 Project Description

Hydrographic Setting. West Lilac Farms is located within the Bonsall Hydrographic Subarea (HSA 3.12) of the San Luis Rey Hydrologic Unit. The project site is approximately two miles south of the San Luis Rey River.

Groundwater within HSA 3.12 occurs in two aquifers. Alluvial aquifers exist along the San Luis Rey River valley (north of West Lilac Farms) and within Moosa Canyon (south of West Lilac Farms). In the immediate vicinity of West Lilac Farms, groundwater occurs in consolidated sediments (residuum) and fractured rock. Yields from wells that tap the residuum/fractured rock aquifer underlying West Lilac Farms are highly variable, but tend to be several dozen gallons per minute or less. (San Diego County Water Authority, 1997)

Three wells currently exist at West Lilac Farms. One well within West Lilac #1 is currently not in use, but develops approximately 18 gallons per minute (gpm). Two wells exist within West Lilac #2 that develop approximately 50 gpm. The two West Lilac #2 wells are used for irrigating citrus groves. (Jerome Stehly, 2003) Table 2-1 summarizes existing groundwater nitrate concentrations in water produced from the three wells. As shown in Table 2-1, groundwater nitrate concentrations in the three wells currently comply with DHS drinking water standards for nitrate, and with California Regional Water Quality Control Board (CRWQCB) Basin plan groundwater quality objectives for nitrate.

Table 2-1
Existing Groundwater Nitrate Concentrations
Production Wells at West Lilac Ranch #1 and #2

Well	Nitrate Concentration (mg/l)	
	Nitrate as N	Nitrate as NO_3
Existing Groundwater Quality		
West Lilac #1 Well[1]	4.6	20.6
West Lilac #2, Well No. 1[1]	7.8	35.2
West Lilac #2, Well No. 2[1]	7.4	33.2
DHS Drinking Water Standard[2]	10	45
CRWQCB Basin Plan Objective[3]	10	45

1 From sample collected on July 1, 2003. See appendix for laboratory analysis reports.
2 State and federal drinking water Maximum Contaminant Level (MCL) for nitrate.
3 Basin Plan objective not to be exceeded more than 10 percent of the time, as established by CRWQCB in *Water Quality Control Plan for the San Diego Basin* (1994).

Existing Agricultural Production. Mature avocado, lemon, and orange groves currently exist on the West Lilac Farms site. In addition, flowers (for the cut flower market) are annually planted within the West Lilac Farm site. Table 2-2 summarizes existing groves and farmed land within West Lilac farms. As shown in Table 2-2, West Lilac Farms currently features 46 acres of avocado trees, 17 acres of lemon trees, 10 acres of orange trees, and 1 acre of flower production.

Existing Irrigation Demands. West Lilac Farms is managed by Stehly Grove Management. Stehly Grove Management reports that onsite irrigation demands for avocados and flowers are met using water purchased from RMWD. (Jerome Stehly, 2003) Onsite wells in West Lilac #2 are used for irrigating the lemon and orange groves. Stehly Grove Management reports that the wells typically provide approximately 75 percent of the citrus irrigation demand. Water purchased from RMWD provides the remainder of the citrus water demand. Annual irrigation water demands at West Lilac Farms depend on hydrologic conditions (precipitation, humidity, cloud cover, and temperature).

On the basis of District-wide water use records, San Diego County Water Authority (2000) reports typical irrigation application rates within RMWD at 4.1 feet per year for avocados and 4.5 feet per year for citrus. Under the professional grove management practices employed at West Lilac Farms, however, irrigation water application rates are less than the RMWD District-wide averages for avocados and citrus. Stehly Grove Management reports an annual irrigation water rate at West Lilac Farms of approximately 3.5 feet per year for avocados and 3.0 feet per year for citrus. (Jerome Stehly, 2003)

Table 2-3 (page 5) presents annual average water demands at West Lilac Farms. As shown in Table 2-3, on a long-term average annual basis, total annual irrigation water demands at West Lilac Farms are estimated at approximately 245 acre-feet.

Table 2-2
Summary of Existing Land Use
Existing Agricultural Production at West Lilac Farms

Land Use	Acres[1]		
	West Lilac #1	West Lilac #2	Total
Hass avocados	20	26	46
Eureka lemons	17		17
Naval oranges		5	5
Valencia oranges		5	5
Cut flowers		1	1
Totals	37	37	74

1 Values reported by James D. Pardee, Jr., West Lilac Farms LLC

Table 2-3
Estimated Annual Water Use
Existing Agricultural Production at West Lilac Farms

Land Use	Estimated Mean Annual Irrigation Rate[1] (feet per year)	Estimated Mean Annual Irrigation Water Use[2] (acre-feet)		
		Groundwater Pumping	RMWD Imported Water	Total
Hass avocados	3.5	0	161	161
Eureka lemons	3.0	38	13	51
Naval oranges	3.0	11	4	15
Valencia oranges	3.0	11	4	15
Cut flowers	3.0	0	3	3
Totals	---	60	185	245

1 Annual irrigation demands will depend on hydrologic conditions (temperature, humidity, cloud cover, and precipitation). On the basis of RMWD water use records, San Diego County Water Authority (2000) reports typical avocado irrigation application rates of 4.1 feet per year, and typical citrus application rates of 4.5 feet per year within RMWD. Using professional grove management practices, however, Stehly Grove Management achieves an avocado irrigation rate of 3.5 feet per year, and a citrus irrigation rate of 3.0 feet per year. (Jerome Stehly, 2003) While RMWD water use records (see SDCWA, 2000) indicate an average annual District-wide irrigation rate of 6.0 feet per year for the agricultural category of "flowers and nurseries", the cut flowers at West Lilac Farms are estimated to use significantly less water than this District-wide water use rate.

2 Estimated long-term annual water use rate multiplied by the number of acres (see Table 2-2 on page 4) in production at West Lilac Farms. Values rounded to the nearest acre-foot.

As noted, 100 percent of the West Lilac Farms avocado and flower irrigation supply is derived from RMWD. Onsite groundwater wells provide approximately 75 percent (approximately 60 acre-feet) of the irrigation demand for citrus at West Lilac Farms. (Jerome Stehly, 2003)

Existing Nitrogen Fertilizer Application. Nitrogen fertilizer application rates depend, in part, on crop demands, leaf nitrogen content, and the timing and method of application. Stehly Grove Management report that annual nitrogen fertilization rates at West Lilac Farms are approximately 150 pounds per acre for avocados, and 75 pounds per acre for citrus. As reported by University of California (2000) and UC Davis (1998), the nitrogen fertilizer application rates employed at West Lilac Farms are in keeping with typical fertilization rates at professionally managed groves within San Diego County. (Fertilization rates on groves that are not professionally managed are typically higher than those at West Lilac Farms.)

Table 2-4 (page 6) summarizes estimated fertilizer use at West Lilac Farms under current agricultural operations. As shown in Table 2-4, total nitrogen fertilizer applications at West Lilac Farms are estimated at approximately 9,300 pounds of nitrogen.

Table 2-4
Estimated Annual Nitrogen Fertilizer Applications
Existing Agricultural Production at West Lilac Farms

Land Use	Estimated Mean Annual Nitrogen Fertilizer Application Rate[1] (lbs nitrogen per acre)	Estimated Mean Annual Nitrogen Application at West Lilac Farms[2] (lbs nitrogen)
Hass avocados	150[1]	6,900
Eureka lemons	75[1]	1,300
Naval oranges	75[1]	400
Valencia oranges	75[1]	400
Cut flowers	300[3]	300
Totals	---	9,300

1 Annual fertilizer application rates reported by Stehly Grove Management for West Lilac Farms. These application rates are typical for professionally managed groves in San Diego County. (See University of California, 1995; University of California Davis, 1998; California Fertilizer Association, 1998; and Grangetto Agricultural Supply, undated.)
2 Estimated long-term fertilizer application rate multiplied by the number of acres (see Table 2-2) in production at West Lilac Farms. Values rounded to the nearest 100 pounds.
3 Typical fertilizer application rates for cut flowers may range from several hundred to several thousand pounds per acre. To be conservative, the lower value from this typical range is used for purposes of estimating nitrogen fertilizer use at West Lilac Farms.

Proposed Development of West Lilac Farms. As noted, Tentative Map 5276 proposes the subdivision of the 92.7-acre West Lilac Farms site into 28 residential lots. Table 2-5 (page 7) summarizes proposed 28-lot development.

As shown in Table 2-5, road and road easements would comprise 8.5 acres of the West Lilac Farms site, while San Diego Aqueduct easements would comprise another 1.7 acres. A total of 11.6 additional acres would be set aside for a biological open space easements and a 100-foot wide fire clearance around the biological open space easements.

Construction pads and driveways proposed as part of Tentative Map 5276 for the 28 lots would range from approximately 0.6 to 0.8 acres in size, while septic tank leach fields would average approximately 0.3 acres in size. In total, approximately 27 acres would be taken up by construction pads, driveways, and septic tank leach fields.

To date, landscape plans for each lot have not been developed. Given homeowner preferences in similar developments within the Fallbrook, Bonsall, and Valley Center areas, it is probable that irrigated landscape vegetation installed by homeowners may average from 0.1 to 0.5 acres per lot. Assuming an average of approximately one-third acre of irrigated landscaping per lot, total irrigated landscaping installed by homeowners within the 28-lot subdivision may be on the order of 9 acres.

Table 2-5
Summary of Proposed Site Development[1]
Tentative Map 5276, West Lilac Farms

Lot Number	Gross Lot Size[1] (acres)	Road Easements[1] (acres)	San Diego Aqueduct Easement[2] (acres)	Biological Open Space Easement & Fire Clearance[2] (acres)	Construction Pad, Driveways, and Septic Tank Leach Field[2] (acres)	Remaining Lot Area[3] (acres)
1	5.9	0.6	0	2.5	1.0	1.8
2	4.6	0.3	0	3.1[4]	0.6[4]	0.6
3	5.4	0.6	0	1.5	1.0	2.3
4	2.1	0.1	0	0.7[4]	0.7[4]	0.6
5	2.4	0.2	0	0.5	1.0	0.8
6	2.9	0.3	0	0	1.0	1.6
7	3.9	0.5	0	0	1.0	2.5
8	4.0	0.3	0	0	1.0	2.7
9	2.7	0.2	0	0	1.0	1.5
10	2.7	0.1	0	0	1.0	1.5
11	2.5	0.2	0	0	1.0	1.3
12	3.2	0.2	0	0	1.1	1.9
13	4.2	0.0	0	0	1.0	3.2
14	4.3	0.1	0	0	1.0	3.2
15	4.4	0.1	0	0.5	1.1	2.7
16	4.2	0.0	0	2.8[4,5]	0.7[4,5]	0.7
17	3.2	0.4	0	0	1.0	1.7
18	2.5	0.5	0	0	0.9	1.1
19	3.0	0.6	0	0	1.0	1.4
20	2.4	0.4	0	0	0.9	1.1
21	2.6	0.5	0	0	0.9	1.2
22	2.6	0.5	0	0	1.0	1.1
23	2.5	0.5	0	0	0.9	1.1
24	3.7	0.6	1.1	0	1.0	2.1
25	3.6	0.2	0.6	0	1.0	2.4
26	2.4	0.2	0	0	1.0	1.2
27	2.4	0.2	0	0	0.9	1.3
28	2.4	0.2	0	0	1.0	1.2
Totals	92.7	8.5	1.7	11.6	26.7	45.9

1 Values reported on the preliminary grading plan for Tentative Map 5276 prepared by Walsh Engineering & Surveying, Inc. (2003). Acreage totals rounded to nearest 0.1 acre.
2 Estimates based on preliminary grading plan for Tentative Map 5276 prepared by Walsh Engineering & Surveying, Inc. (2003). Acreage totals rounded to nearest 0.1 acre.
3 Remaining portion of lot not that is not part of a road easement, aqueduct easement, construction pad, driveway, or septic tank leach field. Values rounded to the nearest 0.1 acre. This remaining portion of the lot will be comprised of either irrigated or non-irrigated landscaping, or tree groves.
4 Much of the 0.3 acre-septic tank leach field would be constructed within the proposed 100-foot set-back fire protection zone.
5 A portion of the construction pad would be located within the proposed 100-foot set-back fire protection zone.

As part of developing West Lilac Farms per Tentative Map 5276, the flower field would be removed, and avocado, lemon, and orange trees would be removed within areas set aside for easements, driveways, construction pads, septic tank leach fields. It is probable, however, that some of the existing citrus and avocado trees will be preserved on selected lots to provide homeowners with ready-to-produce mini-groves.

It has not been determined how many citrus and avocado trees are to preserved on each of the 28 lots for use by home buyers. Given the land available (see Table 2-5), it is probable that the amount of avocado/lemon/orange trees that are preserved within the site after development of the 28 lots would total no more than 20 acres. (Preserving a total of 20 acres of avocado and citrus groves would correspond to an average of approximately 0.7 acres of avocado/citrus per homesites.)

Table 2-6 (page 9) summarizes the proposed development plan for the 28 residential lots proposed by Tentative Map 5276. As shown in Table 2-6, a combined total of approximately 9 acres (or less) of landscaped irrigation areas is projected for the 28-lot subdivision. Total irrigated acreage after development of the 28 proposed residential lots (landscaped areas plus preserved avocado/citrus trees) is projected to be 29 acres (or less).

Table 2-6
Comparison of Existing Land Use with Probable Post-Development Land Use
Tentative Map 5276, West Lilac Farms

Land Use	Estimated Acreage	
	Pre-Development Conditions (Existing Agriculture)	Estimated Probable Post-Development Conditions (Development per Tentative Map 5276)
Hass avocados	46 [1]	15 [3]
Citrus (lemons/oranges)	27 [1]	5 [3]
Cut flowers	1 [1]	0 [3]
Road easements	3.6 [2]	8.5 [4]
Aqueduct easement	1.7 [2]	1.7 [4]
Biological Open Space Easement & Fire Clearance	0	11.6 [4]
Irrigated landscaping	0	9 [5]
Other non-irrigated lands [6]	3.4	41.9
Totals	92.7	92.7

1 From Table 2-2 on page 4.

2 Values reported on the preliminary grading plan for Tentative Map 5276 prepared by Walsh Engineering & Surveying, Inc. (2003). Acreage totals rounded to nearest 0.1 acre.

3 As part of developing West Lilac Farms per Tentative Map 5276, the flower field would be removed, and avocado, lemon, and orange trees would be removed within areas set aside for easements, driveways, construction pads, septic tank leach fields. Some of the existing citrus and avocado trees, however, may be preserved on selected lots to provide homeowners with ready-to-produce mini-groves. While it has also not been determined how many citrus and avocado trees are to preserved on each of the 28 lots for use by home buyers, given the land available (see Table 2-5), it would appear that the amount of avocado/lemon/orange trees that are preserved within the site after development of the 28 lots would total no more than 20 acres. For purposes of showing potential post-development land use at West Lilac Farms, it is assumed that 15 acres of these trees would be avocado and 5 acres would be citrus.

4 From Table 2-5 on page 7.

5 Irrigated landscaping will be installed by each homeowner. On the basis of similar development in the Fallbrook/RCWD area, it is estimated that an average of approximately one-third of an acre would be comprised of irrigated landscaping on each lot, for a total of approximately 9 acres within West Lilac Farms.

6 Includes driveways, patios, swimming pools, homesites, non-irrigated portions of construction pads, and other non-irrigated portions of the West Lilac Farms site. Values computed by subtracting the above-listed land use acreage from the total West Lilac Farms acreage of 92.7 acres.

3.0 Nitrate Analysis

Mass Emission Approach. Nitrogen can exist in water in several forms, including organic nitrogen, ammonia nitrogen, nitrate nitrogen, and nitrite nitrogen. Within groundwater, however, virtually all nitrogen exists in the form of nitrate. While atmospheric nitrogen (N_2) can be converted to nitrate by nitrogen-fixing bacteria, the vast majority of nitrate in groundwater is derived from the downward infiltration of nitrate from:

- fertilizers applied to surface soils,
- septic tank discharges of treated wastewater,
- irrigated imported water, and
- irrigated groundwater.

Of these above nitrate sources, fertilization and septic tank discharges are typically the dominant contributing factors that affect groundwater nitrate concentrations. Both fertilization and septic tank discharges result in nitrate (or other forms of nitrogen) being imported into the surface soil/groundwater system. Nitrogen from both of these sources are also predominantly in the form of nitrate, which can be readily transmitted through the ground to groundwater.

Nitrate concentrations in irrigation supplies derived from pumped groundwater can represent another source of nitrate added to the soil, but such nitrate loads essentially result in a recirculation of nitrate from saturated groundwater to the surface soils, and back to saturated groundwater. As a result of this recirculation, nitrate mass balance effects associated with groundwater pumping tend to be less a factor in influencing groundwater quality than fertilization and septic tank loads.

Imported water supplies within San Diego County contain only minute concentrations of nitrate (and other forms of nitrogen), and are insignificant in affecting overall groundwater nitrate mass loads. (Metropolitan Water District of Southern California, 2000) Because of the overall low nitrate concentration in imported waters, imported water nitrate loads are neglected in this mass balance study.

Since virtually all nitrogen in groundwater exists as nitrate, a nitrogen mass balance is an appropriate tool for assessing potential nitrate contamination due to septic tank discharges. Such a nitrogen mass balance approach is further appropriate, as all forms of nitrogen applied to the ground surface can be converted to nitrate (which is mobile in groundwater).

To assess potential impacts associated with development of West Lilac Farms (Tentative Map 5276), pre-development nitrogen mass emissions to the groundwater system are estimated and compared with post-development nitrogen mass emissions. The following approach is used to assess nitrate mass balance effects associated with development of West Lilac Farms:

1. Boundaries of the groundwater "system" are defined,
2. Mass quantities of nitrate that into and out of the system boundaries are identified and tabulated,
3. Quantities of water that pass into and out of the system boundaries are identified and tabulated, and
4. Water quality effects for pre-development and post-development conditions are compared.

The groundwater "system" considered as part of the West Lilac Farms nitrate mass balance consists of all groundwaters within the West Lilac Farms property boundaries below the root zone. As part of the mass balance analysis, nitrate mass and water influx/outflux terms that cross this root zone boundary are assessed and compared.

Pre-Development (Historic) Groundwater Nitrate Loads. The amount of nitrate that is added to groundwater under pre-development conditions includes (1) nitrate added back into the groundwater system via irrigation of pumped groundwater, and (2) nitrate added into the groundwater system through fertilization. Nitrate added to the groundwater system through groundwater irrigation and fertilization is a function of

- the amount of nitrate applied to the soil, and
- the percent of the applied nitrogen that infiltrates to groundwater.

The percent of applied nitrogen that infiltrates to groundwater, in turn, is a function of nitrate uptake by vegetation and the irrigation efficiency (leaching fraction). Since the avocado/lemon/orange groves at West Lilac Farms are professionally managed, it can be conservatively estimated that the percent of applied nitrogen that is taken up by vegetation at West Lilac Farms is approximately equal to the irrigation efficiency.

The *San Diego County Water Authority Agricultural Water Management Plan* (SDCWA, 2000) notes that a well-managed avocado or citrus grove can be maintained using an irrigation efficiency of 80 percent. Stehly Grove Management reports that an average leaching fraction of 80 percent is typically achieved at West Lilac Farms. (Jerome Stehly, 2003)

Assuming that 80 percent of applied nitrate is taken up by vegetation (with 20 percent infiltrating to groundwater), Table 3-1 (page 12) estimates historic mass emissions of nitrogen to groundwater from existing agricultural operations at West Lilac Farms. As shown in Table 3-1, total annual historic (pre-project) nitrate loads to groundwater from West Lilac Farms are estimated at 2,100 pounds of nitrate per year. As also shown in Table 3-1, total nitrate mass pumped from the groundwater system under pre-project conditions is estimated at approximately 1,200 pounds of nitrate per year.

Table 3-1
Estimate of Historic (Pre-Project) Nitrate Loading
Tentative Map 5276, West Lilac Farms

Pre-Project Parameter	Estimated Value
Mass of nitrate applied to site through fertilization	9,300 lbs/year [1]
Mass of nitrate applied to the site through groundwater use	1,300 lbs/year[2]
Total mass of nitrate applied to the site	10,600 lbs/year
Percent of applied nitrogen taken up by vegetation	80% [3]
Percent of applied nitrogen percolating to groundwater	20% [3]
TOTAL PRE-PROJECT NITRATE INFLUX TO GROUNDWATER SYSTEM	2,100 lbs/year [4]
TOTAL PRE-PROJECT NITRATE OUTFLUX FROM GROUNDWATER SYSTEM	1,200 lb/year [5]

1 Annual pounds of nitrate historically applied to the West Lilac Farms through fertilization, per estimates presented in Table 2-4 on page 6.

2 Annual estimated pounds of nitrate applied to the West Lilac Farms site in irrigated groundwater. Based on 7.6 mg/l nitrate (as N) groundwater nitrate concentrations (see Table 2-1 on page 2) and 60 AFY of applied irrigated groundwater (see Table 2-3 on page 5).

3 Most of the applied fertilizer will be taken up by the grove trees. A portion of the applied fertilizer will be lost to groundwater either through (1) direct leaching of irrigation waters, or (2) breakdown of nitrogen from leaves, fruit, and other organic matter that falls from the trees to the ground. Since the existing grove at West Lilac Farms are professionally managed, it can be estimated that the percent of applied nitrogen that is taken up by vegetation is approximately equivalent to the irrigation efficiency at the site. The San Diego County Water Authority *Agricultural Water Management Plan* (SDCWA, 2000) notes that a well-managed citrus or avocado grove can be maintained using an irrigation efficiency of 80 percent. Stehly Grove Management (Jerome Stehly, 2003) confirm that an average 80 percent leaching fraction is achieved at West Lilac Farms.

4 Computed as the product of 10,600 pounds per year nitrate multiplied by 20 percent (the fraction of applied nitrogen that can reach groundwater). Value rounded to nearest 100 pounds per year.

5 Based on 60 AFY of pre-development groundwater pumping (see Table 2-3 on page 5) at a groundwater nitrate concentration of 7.6 mg/l (see Table 2-1 on page 3).

Post-Development Groundwater Nitrate Loads. If Tentative Map 5276 is approved, nitrate could be infiltrated to groundwater as a result of (1) septic tank discharges, (2) nitrate within groundwaters applied as irrigation water by private land owners, (3) the infiltration of fertilizer applied to existing citrus and avocado trees preserved on some or all of the 28 residential lots, and (4) the infiltration of fertilizer applied to irrigated landscaped areas on the 28 residential lots.

Table 3-2 (page 13) presents post-development estimates of groundwater nitrate loads for the West Lilac Farms site. As shown in Table 3-2, post-development groundwater nitrate loads due to septic tank discharges are estimated at approximately 800 pounds of nitrogen per year. Post-development groundwater nitrate loads due to groundwater use and fertilization of existing preserved avocado/citrus trees are estimated at approximately 600 pounds of nitrogen per year. Post-development groundwater nitrate loads due to other onsite landscape irrigation are projected at approximately 200 pounds of nitrogen per year. Total combined post-development activities are projected to result in groundwater nitrate loads of approximately 1,600 pounds per year at West Lilac Farms. Post-development groundwater nitrate extractions are projected at approximately 600 pounds per year.

Table 3-2
Estimate of Post-Project Nitrate Loading
Tentative Map 5276, West Lilac Farms

Parameter	Estimated Value	Post-Project Nitrate Load
SEPTIC TANK CONTRIBUTIONS:		
Number of residential lots	28 lots	
Septic tank flow rate per homesites	250 gals/day [1]	
Mean septic tank total nitrogen concentration	40 mg/l [1]	
Percent of septic tank nitrogen that reaches groundwater	90% [2]	
Total septic tank nitrogen mass emissions to groundwater		800 lbs/year [3]
GROUNDWATER AND CITRUS/AVOCADO IRRIGATION:		
Number of acres of preserved avocado/citrus trees	15 acres (avocado)[4] 5 acres (citrus)[4]	
Nitrogen fertilizer application rate	150 lb/acre/yr (avocado)[5] 75 lb/acre/year (citrus)[5]	
Mass of fertilizer nitrate applied to preserved avocado/citrus trees	2600 lbs/year[6]	
Mass of nitrate applied to avocado/citrus via pumped groundwater	600 lbs/year[7]	
Total mass of nitrate applied to avocado/citrus	3200 lbs/year[8]	
Percent of applied nitrogen percolating to groundwater	20% [9]	
Mass of nitrate that percolates to groundwater		600 lbs/year [10]
OTHER LANDSCAPE IRRIGATION:		
Total landscaped areas within residential lots	9 acres [4]	
Nitrogen fertilizer application rate for lawns and landscaped areas	100 lb/acre/year [11]	
Mass of nitrate fertilizer applied to irrigated landscape areas	900 lbs/year	
Percent of applied nitrogen percolating to groundwater	20% [9]	
Mass of nitrate fertilizer that percolates to groundwater		200 lbs/year [10]
TOTAL POST-PROJECT NITRATE INFLUX TO GROUNDWATER		1600 lbs/year[12]
TOTAL POST-PROJECT NITRATE OUTFLUX FROM GROUNDWATER		600 lbs/year[7]

1 Typical septic tank discharge rate and nitrogen concentration for an individual home septic tank.
2 A portion of the septic tank effluent nitrogen will be taken up by roots from surface vegetation. (This is evidenced by the "grass is greener over the leach field" phenomena.) The remainder of the septic tank nitrogen will leach to groundwater. The above example conservatively assumes that nearly all (90 percent) of the applied nitrogen will infiltrate to saturated groundwater.
3 Product of 250 gallons per day multiplied by 40 mg/l and 90%, converted to units of lbs/year. Estimated value rounded to the nearest 100 pounds per year.
4 See Table 2-6 on page 9.
5 While private homeowners typically over fertilize avocado and citrus trees, to be conservative, it is assumed that the existing professionally-applied fertilizer rates (per those listed in Table 2-4 on page 6) will be maintained.
6 Product of post-development irrigated acreage (see Table 2-6 on page 9) and irrigation rate (see Table 2-3 on page 5).
7 Post-development groundwater use will be dependent on whether homeowners install individual wells for irrigation purposes. Because of well development costs, hydrogeologic limitations on many of the lots, and overall small irrigation areas within each lot, it is unlikely that many homeowners will choose to bear the expense of putting in onsite irrigation wells. To be conservative, however, the above water balance assumes that post-development groundwater use will be 50 percent of the 60 AFY pre-development groundwater use. With 30 AFY of post-development groundwater use and the existing 7.6 mg/l groundwater nitrate concentration (see Table 2-1 on page 3), post-development groundwater irrigation nitrate loads are estimated at approximately 600 lb/year. (Estimated value rounded to nearest 100 lbs/year.
8 Sum of post-development fertilizer loads (2600 lb/year) and groundwater irrigation nitrate loads (600 lb/year).
9 See footnote 2 to Table 3-1 on page 12. The 20 percent nitrate leaching estimate for landscaping is in concert with estimates presented for turf grass by Petrovic (1990).
10 Product of pounds of applied nitrate multiplied by 20 percent (the fraction that may infiltrate to groundwater). Estimated value rounded to nearest 100 lbs/year.
11 Typical fertilization rate for landscaped areas for Southern California. From California Fertilizer Association (1998). Estimated value rounded to nearest 100 pounds per year.
12 Sum of septic tank nitrogen to groundwater, nitrogen to groundwater from irrigation of preserved avocado/citrus trees, and nitrogen to groundwater from irrigation of landscaped areas. Value rounded to nearest 100 pounds per year.

Estimated Water Balance. To assess what effect changes in mass loadings may have on groundwater quality, it is necessary to evaluate groundwater influx/outflux that may occur under pre-project and post-project conditions. Historic groundwater recharge from the West Lilac Farms site has included infiltrating precipitation recharge and infiltrating irrigation waters applied to the avocado/citrus groves. Groundwater recharge volumes will change with the 28-lot development proposed under Tentative Map 5276 development. Recharge to groundwater under post-development conditions will include contributions from:

- infiltrating precipitation recharge (which will be lessened as a result of increased impervious areas of houses, roads, driveways, pools, and patios),
- infiltrating water from the irrigation (via groundwater and imported water) of the citrus/avocado trees on the residential lots,
- infiltrating water from the irrigation of landscaped areas on the residential lots, and
- infiltrating water from the onsite septic tanks/leach field discharges.

Table 3-3 (page 15) presents volumetric estimates of groundwater influx/outflux terms under pre- and post-development conditions at West Lilac Farms. As shown in Table 3-3, existing groundwater recharge associated with the West Lilac Farms site (excluding groundwater pumping) is estimated at 66 acre-feet per year. Since approximately 60 acre-feet per year of groundwater pumping currently occurs, existing (pre-development) net groundwater recharge rates at West Lilac Farms are estimated to be slightly higher than onsite groundwater pumping.

Post-project groundwater recharge from the West Lilac Farms site is estimated at 45 acre-feet per year. Because of well development costs, hydrogeologic limitations on many of the lots, and overall small irrigation areas within each lot, it is unlikely that many homeowners will choose to bear the expense of putting in onsite irrigation wells. Even if sufficient homeowners install wells to achieve 30 acre-feet per year of pumping (approximately one-half the current rate), however, total net recharge at West Lilac Farms is projected to remain at a value slightly in excess of groundwater pumping.

Projected Effects on Groundwater Quality. Table 3-4 (page 16) summarizes groundwater recharge and nitrate mass balance influx/outflux terms for pre- and post-project conditions. Figure 3-1 (page 16) schematically summarizes net recharge and nitrate mass balance terms for pre- and post-development conditions at West Lilac Farms.

As shown in Table 3-4 and Figure 3-1, pre-project conditions are projected to result in a total net (influx minus outflux) nitrate mass of approximately 900 pounds per year distributed over a net recharge quantity of 6 AFY. Thus, each year under pre-project conditions, approximately 150 pounds of nitrate are added to the groundwater system for each acre-foot of net recharge contributed by the project.

Post-project conditions are projected to result in a net (influx minus outflux) nitrate mass of approximately 1000 pounds per year distributed over a net recharge quantity of 15 AFY. Under post-project conditions, approximately 70 pounds of nitrate are added to the groundwater system for each acre-foot of net recharge. Development of West Lilac Farms will thus result in a reduction in the mass:recharge ratio (for project-related terms) by more than a factor of two (compared to existing pre-development conditions).

Table 3-3
Estimate of Pre-Project and Post-Project Volumes of Groundwater Recharge
Tentative Map 5276, West Lilac Farms

Parameter	Estimated Annual Recharge to Groundwater (acre-feet per year)	
	Existing Conditions at West Lilac Farms	Post-Development Conditions at West Lilac Farms
Infiltration recharge from avocado/citrus trees	49 [1]	14 [2]
Infiltration recharge from irrigated landscape areas	0	7 [3]
Recharge from septic tank discharges	0	7 [4]
Precipitation infiltration	17 [5]	17 [6]
Recharge Subtotal	66	45
Onsite Groundwater Use	60	30 [7]
TOTAL NET RECHARGE TO GROUNDWATER	6	15

1 SDCWA (2000) reports that properly operated avocado groves can be operated to achieve an irrigation efficiency of approximately 80 percent. Stehly Grove Management (Jerome Stehly, 2003) confirms that the 80 percent irrigation efficiency is achieved at West Lilac Farms. The above recharge estimate is based on a 245 acre-feet per year annual irrigation application rate (see Table 2-2 on page 4) over the West Lilac Farms site, and an 80 percent irrigation efficiency. Estimated value rounded to the nearest acre-foot.

2 Based on 15 acres of avocado (see Table 2-6 on page 9) irrigated at 3.5 feet per year (see Table 2-3 on page 5) and 5 acres of citrus (see Table 2-6 on page 9) irrigated at 3.0 feet per year (see Table 2-3 on page 5) at an irrigation efficiency of 80 percent.

3 Based on an average irrigation rate of four feet per year for landscaped areas (SDCWA, 2000), 80% irrigation efficiency (SDCWA, 2000), and 9 acres of landscaped acreage on the residential lots. Estimated value rounded to the nearest acre-foot per year.

4 Product of 250 gallons per day multiplied by 30 lots, converted to units of acre-feet per year (AFY). Estimated value rounded to the nearest acre-foot per year.

5 Based on an average annual precipitation rate of 15 inches per year for the site (per San Diego County precipitation records) and approximately 89 acres of pre-development pervious area. Per SDCWA (1997) and California Department of Water Resources (1991), it is estimated that 15 percent of the precipitation recharges groundwater for pervious areas.

6 Development of West Lilac Farms (per Tentative Map 5276) will increase the acreage of impervious lands within the site. Under the proposed grading and development plan, however, storm runoff prevention measures are projected to result in no significant changes to site runoff coefficients, as precipitation falling on driveways, roads, patios, and roofs will flow off onto adjacent pervious areas. As a result, no net reduction in groundwater recharge is anticipated due to development of West Lilac Farms. Values rounded to nearest acre-foot per year.

7 Post development groundwater use will be dependent on whether homeowners install individual wells for irrigation purposes. Because of well development costs, hydrogeologic limitations on many of the lots, and overall small irrigation areas within each lot, it is unlikely that many homeowners will choose to bear the expense of putting in onsite irrigation wells. To be conservative, however, the above water balance assumes that post-development groundwater use will be 50 percent of the pre-development groundwater use.

Table 3-4
Estimate of Pre-Project and Post-Project Nitrate Mass within Groundwater Recharge
Tentative Map 5276, West Lilac Farms

Conditions	Existing (Pre-Project) Conditions at West Lilac Farms[1]	Post-Project Conditions at West Lilac Farms (28-lot development proposed under Tentative Map 5276)
WATER INFLUX/OUTFLUX		
Sum of Recharge Terms	66 AFY[3]	45 AFY[3]
Sum of Discharge Terms (Groundwater Pumping)	60 AFY[3]	30 AFY[3]
NET ANNUAL RECHARGE TO GROUNDWATER	6 AFY[3]	15 AFY[3]
NITRATE INFLUX/OUTFLUX		
Sum of Nitrate Influx Terms	2100 lb/year[4]	1600 lb/year[4]
Sum of Nitrate Outflux Terms (Groundwater Pumping)	1200 lb/year[4]	600 lb/year[4]
NET ANNUAL MASS INFLUX TO GROUNDWATER	900 lb/year[4]	1000 lb/year[4]
NITRATE MASS/VOLUME RATIO OF NET RECHARGE[5]	150 lb/yr/AFY	70 lb/yr/AFY

1 Existing (pre-project) conditions would continue at West Lilac Farms in the absence of development of the site as proposed under Tentative Map 5276.
2 Post-project conditions that would occur at West Lilac Farms under the proposed 28-lot development proposed by Tentative Map 5276.
3 Groundwater recharge/discharge values from Table 3-3 on page 15.
4 Pre-project nitrate influx/outflux terms from Table 3-1 on page 12. Post project nitrate influx/outflux terms from Table 3-2 on page 13.
5 Computed by dividing the estimated nitrate mass influx to groundwater by the estimated volume of net annual groundwater recharge. Value rounded to the nearest 100 pounds per acre-foot.

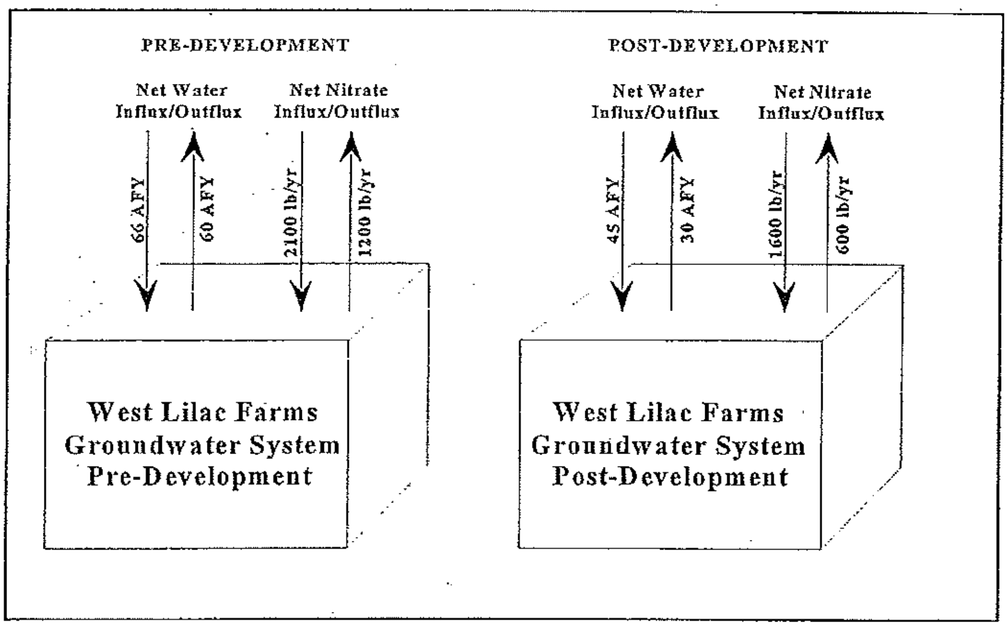

Figure 3-1 Schematic of Groundwater Mass Balance Terms
West Lilac Farms, Pre- and Post-Development

The mass:recharge ratios presented in Table 3-4 are not the only factors that will influence groundwater nitrate concentrations beneath the West Lilac Farms Site. Groundwater nitrate concentrations beneath the West Lilac Farms site will also be influenced by a number of additional factors, including:

- subsurface groundwater flows into the West Lilac Farms groundwater system from adjoining lands,
- local and regional hydrologic conditions, and other local and regional point sources of recharge (such as streamflow infiltration), and
- the quantity of groundwater stored within the West Lilac Farms groundwater system.

Current West Lilac Farms mass emissions have been ongoing for several decades. As a result of long-standing onsite fertilization and irrigation operations, it would be expected that sufficient time has elapsed so that pre-project nitrate mass emission effects would be exhibited in existing groundwater quality. As shown in Table 2-1 (page 3), existing West Lilac Farms groundwater concentrations are within drinking water Maximum Contaminant Levels (MCLs). Additionally, onsite groundwater nitrate concentrations are significantly lower than the estimated long-term pre-project mass:recharge ratio presented in Table 3-4. Because existing groundwater quality is significantly better than the pre-project mass:recharge ratio shown in Table 3-4, it would appear that onsite mass emission effects on groundwater quality are significantly dampened by groundwater inflows from adjoining lands and regional/local hydrologic and recharge factors.

"Vadose Zone" Recharge Concentration. Information presented in Tables 3-3 and 3-4 can be used to compute a "vadose zone" recharge concentration by dividing the project-related mass nitrate mass influx (2100 pounds per year under pre-development conditions and 1600 pounds per year under post-development conditions) by the volume of vadose zone recharge (66 AFY under pre-development conditions and 45 AFY under post-development conditions). Table 3-5 (page 18) presents such "vadose zone" recharge concentration estimates. As shown in Table 3-5, post-project "vadose zone" concentrations are projected to be slightly higher than pre-project vadose zone concentrations. Additionally, both pre- and post-project "vadose zone" recharge values are in excess of Regional Board Basin Plan objectives and DHS drinking water standards.

While post-project vadose zone concentrations are projected to be slightly higher than pre-project levels, several conclusions may be developed. First, the difference between the computed pre- and post-project vadose zone values is within 10 percent - a value well within the margin of error for the recharge and mass balance estimated used for developing the vadose zone recharge concentrations. As a result, computed the pre- and post-project vadose zone values are may be treated as being essentially equivalent.

Second, the vadose zone concentration is only one element of the overall groundwater system water balance. As noted above, groundwater quality is influenced by a variety of additional factors, including hydrologic factors not related to the project. As a result, such a "vadose zone" concentration value does necessarily not allow any conclusions to be derived as to whether the underlying groundwater quality will be positively or negatively impacted by the proposed project. (A lowering of the vadose zone recharge concentration value does not necessarily translate to improved groundwater concentrations, and an increase in this computed vadose zone concentration value does not necessarily translate to degraded groundwater quality.)

Table 3-5
Projected "Vadose Zone" Concentrations
Pre- and Post-Development Conditions, West Lilac Farms

Parameter	Computed "Vadose" Zone Nitrate Concentration (mg/l as N)
Pre-Project Conditions	12[1]
Post-Project Conditions	13[2]

1 Computed by dividing project-related nitrate mass emissions under pre-project conditions (2100 lb/year) by the amount of project-related groundwater recharge estimated under pre-project conditions (66 AFY).
2 Computed by dividing project-related nitrate mass emissions under post-project conditions (1600 lb/year) by the amount of project-related groundwater recharge estimated under post-project conditions (45 AFY).

Demonstrating the disconnect between groundwater quality and the computed vadose zone recharge values, pre-project groundwater nitrate concentrations (see Table 2-1 on page 2-3) are significantly less than the computed pre-project vadose zone concentration. Since (as noted above) current West Lilac Farms mass emissions have been ongoing for several decades, it would be expected that sufficient time has elapsed so that pre-project nitrate mass emission effects would be exhibited in existing groundwater quality. Differences between computed pre-project vadose zone concentration values and actual groundwater quality indicate the site activities at West Lilac Farms are not the only factor that influences local groundwater nitrate concentrations.

Third, recharge and mass emission estimates presented in this chapter are conservative, particularly with respect to post-project conditions. Under the existing pre-project conditions in which onsite agricultural operations are professionally managed, estimates on irrigation and fertilization practices can be developed with a degree of confidence. A significant number of unknowns exist for the post-development conditions, however. As a result, conservative estimates are used for assessing post-development recharge and mass emissions. For example, it is probable that homeowners will not maintain the same irrigation efficiency as the existing professionally-managed grove, resulting in a greater recharge fraction under post-development conditions. Additionally, homeowners may not be as diligent in maintaining scheduled fertilization as the existing professionally-managed agricultural operations, resulting in less fertilizer-related mass emissions. For these reasons, mass emission estimates presented herein for post-development conditions (and the corresponding post-project "vadose zone" recharge value) may be over-estimated. Since little difference exists between the computed pre- and post-project vadose zone concentrations (see Table 3-5), actual post-project vadose zone concentrations may be significantly less than the conservatively-estimated projections.

4.0 Conclusions

On the basis of the analyses presented herein, it is concluded that the proposed 28-lot development at West Lilac Farms (Tentative Map 5276) will not result in degradation of local groundwater nitrate concentrations. Compared to existing pre-project conditions, development of the 28-lot TM 5276 will result in a reduction in the mass of "new" (non-recirculated) nitrate imported into the West Lilac Farms groundwater system. The proposed project will also result in a reduction (by approximately a factor of two) in the ratio of project-related nitrate mass emissions to net project-related groundwater recharge.

As shown in Table 2-1 (page 3), groundwater nitrate concentrations within the three existing West Lilac Farms wells are less than state and federal primary drinking water Maximum Contaminant Levels (MCLs). Existing groundwater nitrate concentrations are also less than designated Basin Plan groundwater quality objectives for the Bonsall Hydrographic Subarea (HSA 3.12).

Estimated "vadose zone" nitrate concentrations for pre-project conditions are projected to be approximately the same (within the margin of estimating error) as post-project conditions. Existing groundwater quality is significantly better in quality than computed pre-project vadose zone concentrations, indicating that other hydrologic factors act to dampen water quality effects associated with nitrate mass emissions from West Lilac Farms.

Despite significant pre-project nitrate loading, existing groundwater nitrate quality is within DHS drinking water standards and Regional Board Basin Plan objectives. Development of the proposed project will result in less annual nitrate mass being recharged to groundwater and a greater annual volume of net groundwater recharge within which to dilute the nitrate mass. Development of the proposed project will not result in a significant change in project-related "vadose zone" nitrate concentrations. On the basis of these factors, the proposed West Lilac Farms development is not projected to result in any deterioration in the nitrate quality of local groundwater.

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Appendix
Groundwater Quality
Laboratory Analyses

Environmental Engineering Laboratory
3538 Hancock Street
San Diego, CA 92110
(619) 298-6131

ELAP certificate number 1738

STEHLY ENTERPRISES, INC.
32013 CAMINITO QUIETO
BONSALL , CA
92003

Customer # : 4671 Sample # : 30709720
Reference : WEST LILAC # 1 WELL
Sampled : 06/30/03 08:00PM
Received : 07/01/03 08:40AM P.O. #
Comment : FAX RESULTS 760-731-6417

Date Started : 07/01/03
Date Completed: 07/07/03

Test Run:

	Result:	MCL	DL	Method:
Nitrogen, Nitrate (as NO_3)	20.6 mg/L	45	0.18	EPA300.
Chloride	PENDING mg/L		0.2	EPA300.
Solids, Dissolved	PENDING mg/L		10	SM2450C

ND = None Detected DL = Detection Limit MCL = Max Contaminant Level

Reported by Robert L. Chambers M.S. Michael M. Chambers M.S., P.E. Michael Harris PhD 07/07/03 Date

Environmental Engineering Laboratory
3538 Hancock Street
San Diego, CA 92110
(619) 298-6131

ELAP certificate number 1738

STEHLY ENTERPRISES, INC.
32013 CAMINITO QUIETO
BONSALL , CA
92003

Customer #: 4671 Sample #: 30709722
Reference : WESL LILAC #2 WELL 1
Sampled : 06/30/03 08:00PM
Received : 07/01/03 08:40AM P.O. #
Comment :

Date Started : 07/01/03
Date Completed: 07/07/03

Test Run:

	Result:	MCL	DL	Method:
Nitrogen, Nitrate (as NO_3)	35.2 mg/L	45	0.18	EPA300.
Solids, Dissolved	PENDING mg/L		10	SM2450C
Chloride	PENDING mg/L		0.2	EPA300.

ND = None Detected DL = Detection Limit MCL = Max Contaminant Levels

Reported by Robert L. Chambers M.S. Michael M. Chambers M.S., P.E. Michael Harris PhD 07/07/03 Date

Environmental Engineering Laboratory
3538 Hancock Street
San Diego, CA 92110
(619) 298-6131

ELAP certificate number 1738

STEHLY ENTERPRISES, INC.
32013 CAMINITO QUIETO
BONSALL , CA
92003

Customer #: 4671 Sample #: 30709721
Reference : WEST LILAC #2 / WELL #2
Sampled : 06/30/03 08:00PM
Received : 07/01/03 08:40AM P.O. #
Comment :

Date Started : 07/01/03
Date Completed: 07/07/03

Test Run:

	Result:	MCL	DL	Method:
Nitrogen, Nitrate (as NO_3)	33.2 mg/L	45	0.18	EPA300.
Chloride	PENDING mg/L		0.2	EPA300.
Solids, Dissolved	PENDING mg/L		10	SM2450C

ND = None Detected DL = Detection Limit MCL = Max Contaminant Levels

Reported by Robert L. Chambers M.S. Michael H. Chambers M.S., P.E. Michael Harris PhD 07/07/03
Date