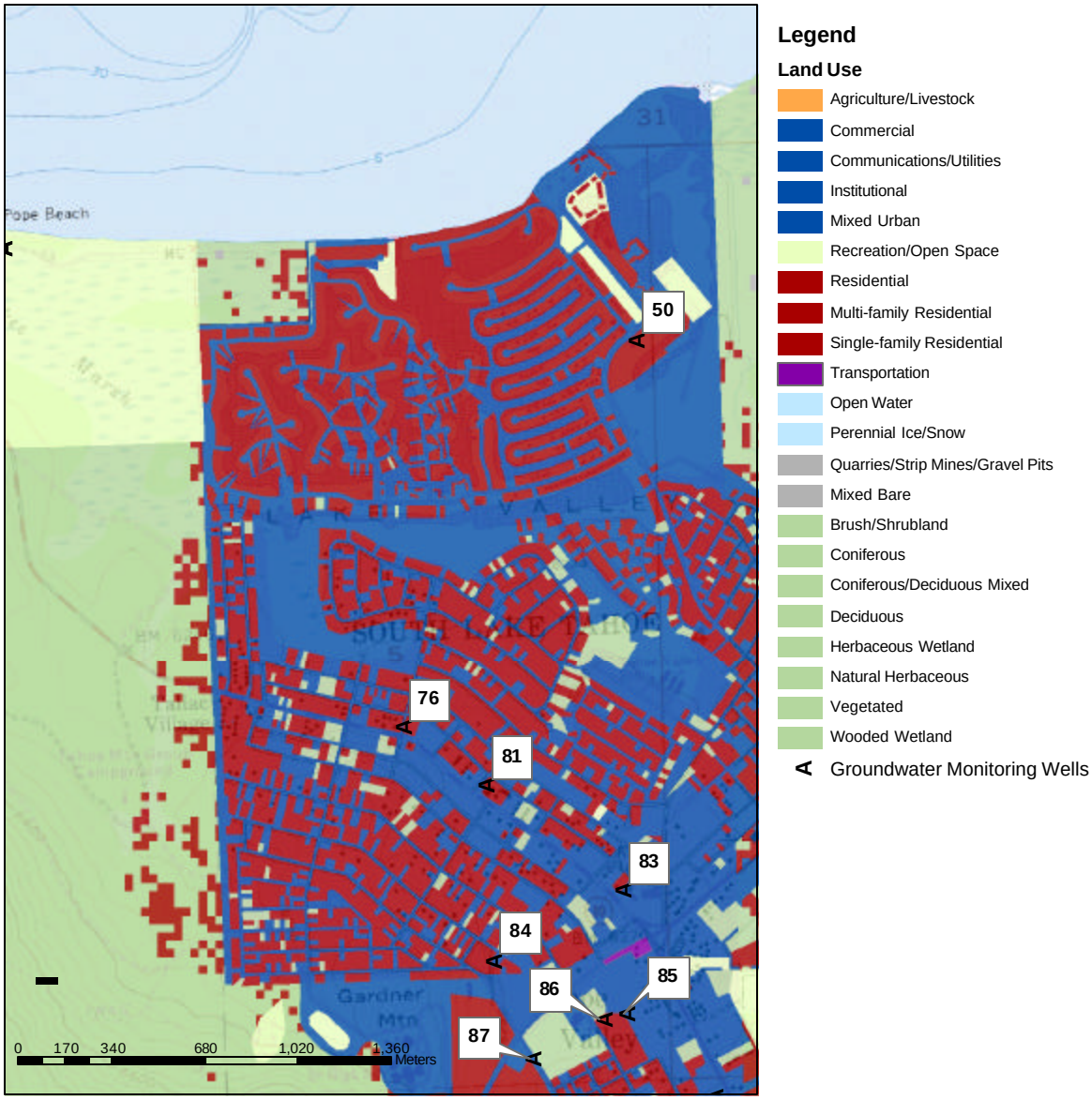
Figure 4-10. South Lake Tahoe Subregion 2 Groundwater Wells and Land Use



Notes:
1. Land use coverage provided by Tahoe Research Group
2. Only wells with groundwater elevation and/or analytical data are shown.

4.3.4 Subregion 3 Nutrient Concentrations

The wells and land use in the area are depicted in Figure 4-11. Wells 045 and 049 have been monitored for all forms of the dissolved nutrients of interest to this evaluation. The remaining wells shown in Table 4-6 have only been sampled for dissolved nitrate and total dissolved phosphorus. Wells 034 and 044 have only been sampled to monitor drinking water standard compliance which includes only total nitrate and nitrite.

The dissolved ammonia + organic nitrogen concentrations for wells 045 and 049 range from 0.01 mg/L to 0.2 mg/L, averaging 0.124 mg/L. The dissolved nitrate concentrations for all wells shown in Table 4-6, which include nitrite, range from 0.01 mg/L to 1.31 mg/L with an average of 0.346 mg/L. Wells 045 and 049 have an average total dissolved nitrogen concentration of 0.396 mg/L. The average total nitrate concentrations found in wells 034 and 044 are 1.276 mg/L and 3.614 mg/L, respectively. Table 4-6 includes the dissolved nitrogen concentrations for wells 039, 042, 045 and 049.

Orthophosphorus concentrations for wells 049 and 045 range from 0.01 mg/L to 0.04 mg/L, averaging 0.021 mg/L. The range of total dissolved phosphorus for all wells shown in Table 4-6 is 0.012 mg/L to 0.7 mg/L, averaging 0.033 mg/L. No phosphorus concentrations have been measured in the other wells in the area. Table 4-6 includes the dissolved phosphorus concentrations for wells 039, 042, 045 and 049.

The high total nitrate concentrations found in well 044 could be due to groundwater migrating towards the pumping wells from the vicinity of the golf course and residential neighborhood. Unlike the nutrient concentrations found in subregion 2, the higher nitrogen concentrations are found in the deeper aquifer in this region. Phosphorus concentrations do not vary much with depth. This may be due to the fact that wells 042 and 039 are municipal supply wells used by STPUD. Wells 042 and 039 are STPUD's two primary wells municipal supply for the area. As shown by the groundwater flow model, the pumping forms a significant cone of depression (Fenske 2003). These wells may be drawing the groundwater, along with the nutrients, towards the wells.

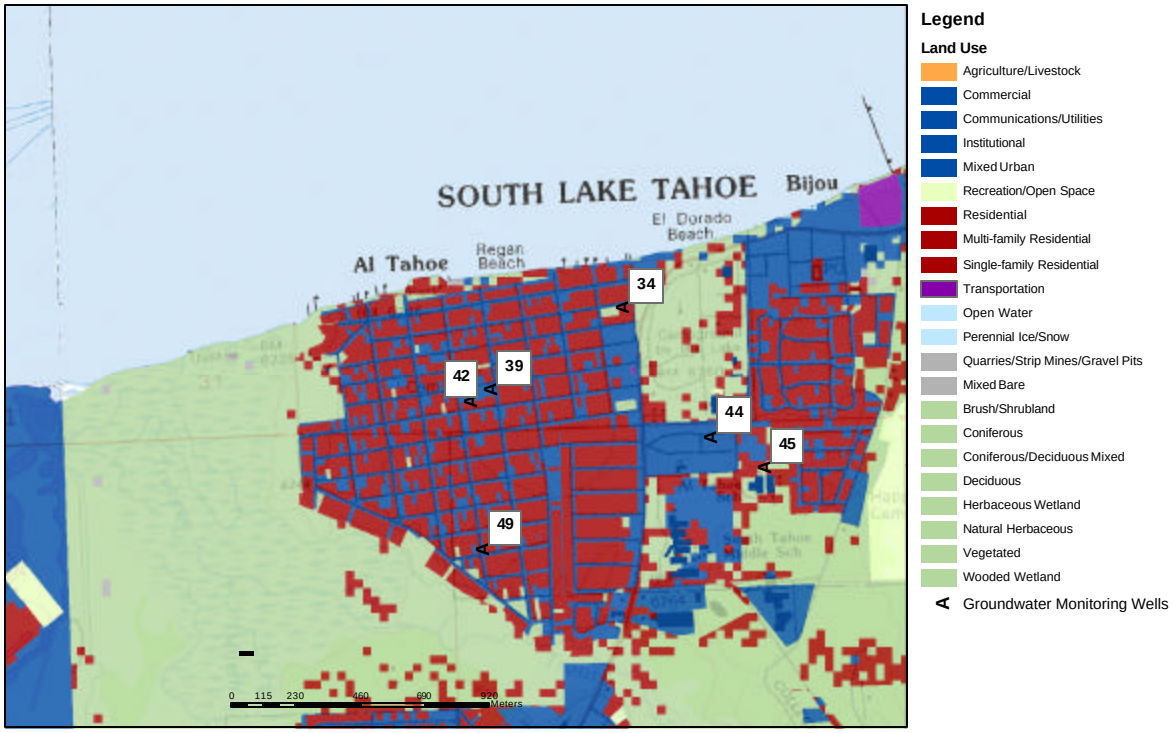
Table 4-6. South Lake Tahoe Subregion 3 Average Nutrient Concentration (mg/L)

	Well ID			
Constituent	049	042	039	045
Ammonia + Organic	0.2	na	na	0.0476
Nitrate	0.1553	0.2879	0.5499	0.3894
Total Nitrogen	0.3553	--	--	0.437
Orthophosphorus	0.028	na	na	0.014
Total Phosphorus	0.028	0.0378	0.0387	0.0294
Top of Open Interval (ft bgs)	268	170	180	86

Notes:

1. All concentrations reported are dissolved.
2. Data obtained from USGS, STPUD, and El Dorado EM.
3. Top of Open Interval with a – indicates the open interval is unknown. A < indicates less than the total depth of the well.
4. na – not analyzed
5. Total Nitrogen is calculated for those wells with both ammonia + organic and nitrate concentrations
6. Nitrate concentrations include nitrite.

Figure 4-11. South Lake Tahoe Subregion 3 Groundwater Wells and Land Use



Notes:
1. Land use coverage provided by Tahoe Research Group
2. Only wells with groundwater elevation and/or analytical data are shown.

4.3.5 Subregion 4 Nutrient Concentrations

The wells and land use in subregion 4 are depicted in Figure 4-12. Wells 024 - 026, 031, 032, 040, and 046 have been monitored for all forms of the dissolved nutrients of interest to this evaluation. The remaining wells shown in Table 4-7 have only been sampled for dissolved nitrate and total dissolved phosphorus. All other wells shown on Figure 4-12 have only been sampled to monitor drinking water standard compliance which includes only total nitrate and nitrite.

The dissolved ammonia + organic nitrogen concentrations for wells 024 - 026, 031, 032, 040, and 046 range from 0.01 mg/L to 4.8 mg/L, averaging 0.535 mg/L. The dissolved nitrate concentrations for all wells shown in Table 4-7, which include nitrite, range from 0.01 mg/L to 10 mg/L with an average of 0.747 mg/L. The average total dissolved nitrogen for wells 024 - 026, 031, 032, 040, and 046 ranges from 0.292 mg/L to 5.294 mg/L, averaging 1.508 mg/L. The total nitrate concentrations range from are 0.009 mg/L and 3.613 mg/L, averaging 0.345 mg/L. Table 4-7 includes the dissolved nitrogen concentrations for wells 024 - 026, 031, 032, 040, and 046.

Orthophosphorus concentrations for wells 024 - 026, 031, 032, 040, and 046 range from 0.006 mg/L to 4.1 mg/L, averaging 0.119 mg/L. The range of total dissolved phosphorus for all wells shown in Table 4-6 is 0.006 mg/L to 0.97 mg/L, averaging 0.052 mg/L. No phosphorus concentrations have been measured in the other wells in the area. Table 4-7 includes the dissolved phosphorus concentrations for wells 024 - 026, 031, 032, 040, and 046.

Again, subregion 4 shows high levels of nitrogen in both the shallow and deep aquifers and a slight difference in the phosphorus concentrations (Table 4-7). A majority of the wells located within the subregion are designed to measure groundwater quality from specific sources. These areas do show an increased nutrient concentration related to those sources. The most notable is well 046 which is located within the Bijou golf course.

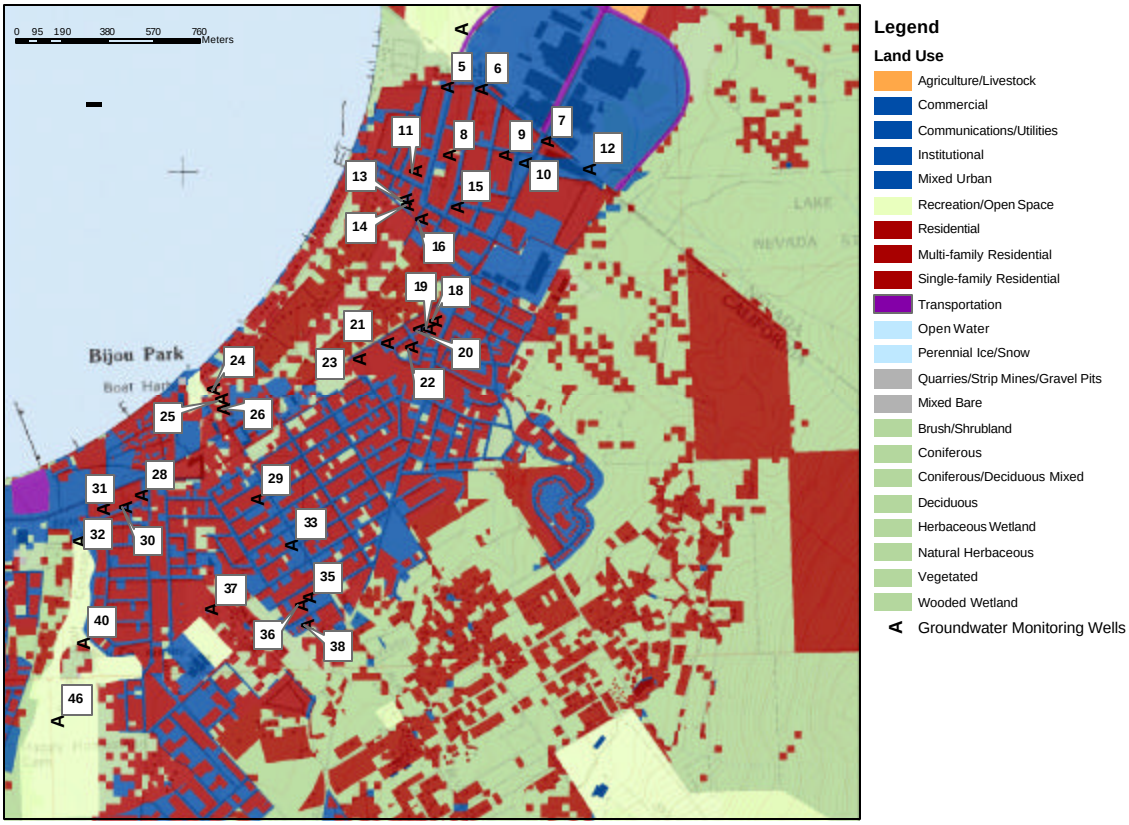
Table 4-7. South Lake Tahoe Subregion 4 Average Nutrient Concentration (mg/L)

	Well ID					
Constituent	031	026	013	014	016	046
Ammonia + Organic	0.0636	0.2	na	na	na	0.2736
Nitrate	0.7784	0.092	0.4837	0.0816	0.2911	5.02
Total Nitrogen	0.842	0.292	--	--	--	5.2936
Orthophosphorus	0.0207	0.006	na	na	na	0.029
Total Phosphorus	0.0354	0.006	0.0178	0.0134	0.01	0.0313
Top of Open Interval (ft bgs)	50	<142	168	169	181	Shallow
	Well ID					
Constituent	032	040	007	012	024	025
Ammonia + Organic	0.2614	0.54	na	na	0.6538	1.7545
Nitrate	0.5135	0.38	1.2518	0.0448	0.0138	0.0136
Total Nitrogen	0.7749	0.92	--	--	0.6676	1.7681
Orthophosphorus	0.5188	0.026	na	na	na	na
Total Phosphorus	0.0542	0.021	na	na	0.2026	0.1318
Top of Open Interval (ft bgs)	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow

Notes:

1. All concentrations reported are dissolved.
2. Data obtained from USGS, LRWQCB, STPUD, El Dorado EM.
3. Top of Open Interval with a – indicates the open interval is unknown. A < indicates less than the total depth of the well.
4. na – not analyzed
5. Total Nitrogen is calculated for those wells with both ammonia + organic and nitrate concentrations.
6. Nitrate concentrations include nitrite.

Figure 4-12. South Lake Tahoe Subregion 4 Groundwater Wells and Land Use



Notes:
1. Land use coverage provided by Tahoe Research Group
2. Only wells with groundwater elevation and/or analytical data are shown.

4.3.6 Stateline Nutrient Concentrations

The wells and land use in the Stateline area are depicted in Figure 4-13. All wells included in Table 4-8 have been monitored for all forms of the dissolved nutrients of interest to this evaluation.

The dissolved ammonia + organic nitrogen concentrations for Stateline wells range from 0.01 mg/L to 1.1 mg/L, averaging 0.365 mg/L. The dissolved nitrate concentrations for Stateline wells, which include nitrite, range from 0.001 mg/L to 16.3 mg/L with an average of 0.972 mg/L. The average total dissolved nitrogen for Stateline wells ranges from 0.127 mg/L to 8.88 mg/L, averaging 1.337 mg/L. Table 4-8 includes the dissolved nitrogen concentrations for Stateline wells.

Orthophosphorus concentrations for Stateline wells range from 0.001 mg/L to 0.049 mg/L, averaging 0.015 mg/L. The range of total dissolved phosphorus for Stateline wells is 0.005 mg/L to 0.069 mg/L, averaging 0.023 mg/L. Table 4-8 includes the dissolved phosphorus concentrations for Stateline wells.

The Stateline area wells demonstrate a difference between the deep and shallow groundwater nutrient concentrations. The nitrogen concentrations in the golf course increase downgradient, indicating that the golf course is acting as a source of additional nutrients to the groundwater. The area in the northern portion of the golf course shows significant detections of nitrogen. This is likely due to not only the golf course, but also the upgradient residential land use (Figure 4-13). Wells 198 - 202 are interesting to observe. The upgradient well, 198 is located within a residential area and shows high concentrations of nitrogen. The concentration decreases downgradient and then slightly increases again, showing that the more significant source of nitrogen is in the residential area as opposed to the open area closer to the lake. The phosphorus shows a consistent increase in concentration as the groundwater progresses towards the lake. The residential area does not prove to be a significant contributor of phosphorus, rather there seems to be a natural increase in phosphorus as it passes through the open area near the lake.

Table 4-8. Stateline Average Nutrient Concentration (mg/L)

	Well ID				
Constituent	004	003	001	002	198
Ammonia + Organic	0.12	1.1	0.14	0.3	0.45
Nitrate	0.0069	0.01	1.402	2.8	0.055
Total Nitrogen	0.1269	1.11	1.542	3.1	0.505
Orthophosphorus	0.0141	0.024	0.003	0.005	0.006
Total Phosphorus	0.0321	0.033	0.0075	0.005	0.0135
Top of Open Interval (ft bgs)	<23	<6	<8	<10	<18
	Well ID				
Constituent	193	186	219	199	200
Ammonia + Organic	0.2147	0.6	0.04	0.6	0.8
Nitrate	8.6659	0.01	0.143	0.08	0.01
Total Nitrogen	8.8806	0.61	0.183	0.68	0.81
Orthophosphorus	0.0092	0.049	0.015	0.012	0.037
Total Phosphorus	0.0241	0.054	0.017	0.016	0.065
Top of Open Interval (ft bgs)	<25	<8	0	<11	<9
	Well ID				
Constituent	201	202	188	197	
Ammonia + Organic	0.4	0.2	0.0735	0.0694	
Nitrate	0.01	0.01	0.0631	0.34	
Total Nitrogen	0.41	0.21	0.1366	0.4094	
Orthophosphorus	0.008	0.007	0.009	0.0078	
Total Phosphorus	0.005	0.01	0.0238	0.0227	
Top of Open Interval (ft bgs)	<9	<13	<200	<58	

Notes:

1. All concentrations reported are dissolved.
2. Data obtained from USGS.
3. Top of Open Interval with a – indicates the open interval is unknown. A < indicates less than the total depth of the well.
4. na – not analyzed
5. Total Nitrogen is calculated for those wells with both ammonia + organic and nitrate concentrations
6. Nitrate concentrations include nitrite.

Figure 4-13. Stateline Groundwater Wells and Land Use