agricultural crop is and will be grapes. Other land uses include dry-land farming of grasses and native vegetation in support of livestock grazing.

Currently, approximately 169 acres of vineyards are planted within the hydrogeologic study area. Vineyards in the area require 1.0 to 1.2 acre-feet of irrigation water per acre per year (afy/ac) (Fugro West and ETIC Engineering, 2005). Using the higher value of 1.2 afy/ac, the estimated current groundwater demand to satisfy vineyards is up to 203 afy.

Intensification of conversion from fallow land to vineyards is expected for much of the study area. The soil types and topography in the area are similar to those in areas to the north and east of the CCL currently developed with vineyards. In some places, steep slopes and heavy vegetation make vineyard development less likely. These areas have not been included in the acreage calculations. As many as 550 acres of new vineyards may be planted within the next 20 years. By assigning a water duty factor of 1.2 acre-feet of irrigation water per acre per year (Fugro West and ETIC Engineering, 2005), this would increase demand for groundwater by approximately 660 afy. Total groundwater demand to satisfy the estimated 719 acres of vineyards after build-out could be as great as 863 afy. The increase in groundwater demand from approximately 200 afy to approximately 860 afy would represent a four fold increase in groundwater demand related to vineyards, directly proportional to the increase in vineyard acreage.

Based on parcel data supplied by the County of San Luis Obispo Planning and Building Department (Morro Group, 2008), approximately 70 parcels exist within the study area and each of which contain at least a single dwelling. For this analysis, we assumed that all parcels except for the landfill currently have a single dwelling. Based on the County's standard water consumption rates, each dwelling requires approximately 1.26 afy (City of Santa Barbara, 1989). Therefore, the current domestic water consumption within the hydrogeologic study area is approximately 88 afy.

Construction of second dwellings will be the only source of residential development within the study area within the next 20 years (Morro Group, 2008). This type of development is possible for parcels that are both designated within the RR land use category and within the study area. A total of 42 such parcels exist on which second dwellings could potentially be constructed (Morro Group, 2008). For purposes of this analysis, it was assumed that second dwellings do not already exist on the parcels in the RR land use category. In addition, to develop a reasonable worst-case development scenario, our analysis assumed that all parcel configurations within the RR land use category could accommodate a second dwelling, which would be regulated by the San Luis Obispo County Land Use Ordinance (Title 22). This may not be the case on smaller parcels and those with steep slopes. Based on City of Santa Barbara guidelines (1989), each secondary well requires approximately 0.33 afy. Therefore, total water consumption resulting from future development of second dwellings would equal approximately 14 afy (Morro Group, 2008).

Current water consumption in the area related to domestic and agricultural uses is estimated to be approximately 292 afy. Increases associated with both residential and agricultural development could increase total groundwater demand by approximately 674 afy, for a total of 900 afy. The proposed project would increase demand by approximately 9 afy, an increase from 35 afy to approximately 44 afy. Total groundwater demand could increase from approximately 326 afy to as much as 1,009 afy or an increase of 210 percent. The CCL demand would increase by approximately 26 percent, domestic demand by 16 percent and vineyard demand by over 300 percent. Estimates of current and maximum future groundwater demand within the study area are presented in Table 6.

Table 6. Summary of Estimated Current and Maximum Future Groundwater Demand within the Study Area

Groundwater User	Current Demand (afy)	Maximum Future Demand (afy)	Increased Demand	
			Afy	%
Cold Canyon Landfill	35	44	9	26
Domestic Use	88	102	14	16
Agriculture (vineyards)	203	863	660	324
Total	**326**	**1,009**	**683**	**210**

HYDROGEOLOGIC CONNECTIVITY BETWEEN LANDFILL AND ADJACENT PROPERTIES

The CCL is located in an area relatively isolated from its surroundings hydrogeologically. The hydrogeologic study area, which contains the CCL is bounded on the north by the Edna Valley fault and the other sides by shallow alluvial valleys. The hydrogeologic study area is underlain largely by the Pismo and Monterey Formations, with alluvial clay and sand deposits in the surrounding valleys. The study area encompasses approximately 1,687 acres, of which the expanded CCL will encompass 209 acres, or approximately 12 percent of the entire area. As described below, groundwater users outside of the hydrogeologic study area will likely not be affected by groundwater drawdown associated with pumpage at the CCL. The boundaries of the hydrogeologic study area consist of a barrier to flow (northern boundary) or a recharge boundary (alluvium). The hydrogeologic study area is believed to be the maximum extent of hydraulic communication with the CCL.

A Theis analysis was performed by ERCE (1991) to predict drawdown at distances of 0.25, 1, and 1.5 miles from two pumping wells (DG-1 and PW-2) at the project site. Well DG-1 was located in the far western corner of the existing landfill property (ERCE, 1991). Other than the location of the well and the aquifer parameters of hydraulic conductivity and storativity calculated from a pumping test (presented below) little is known about this well. The predicted drawdowns were calculated for durations of 1, 5, 10, and 20 years from wells that had not been pumped previously. The results of the analyses overestimated actual drawdown because the predicted values were based upon a condition that no previous pumpage had occurred. Pumping from the production wells at rates of 2 and 4 gpm, respectively, did not cause significant drawdown. The Theis analysis, as performed in this geologic setting is appropriate to use as a guide to assess drawdown impacts. The area is geologically complex with various fracture and joint systems, geologic contacts, and adjacent groundwater basins and faults and the geologic materials are not laterally extensive. The use of Theis analyses to predict drawdown at any great distance is not appropriate in such a complex geologic setting. It is not appropriate to reproduce simple Theis analyses to predict drawdown at any great distance from the current pumping wells using current and future on-site groundwater pumping rates. This analysis should only be used to gain a general understanding of predicted drawdown as general worst-case guidance.

In the current study, a Theis analysis was used to generally predict drawdown within Well Nos. 1 and 2 while pumping at average rates sufficient to satisfy average future demand, or 24 and 14 gpm, respectively. The analysis was also used to predict drawdown a short distance to the nearest property boundary of approximately 80 feet from Well No. 1 and 400 feet from Well No. 2. In lieu of pumping test data from Well Nos. 1 and 2, hydraulic conductivity values of 2.3×10^{-4} cm/sec or 4.9 gpd/ft^2 for the Pismo Formation at the site were used (Golder, 2007). Golder calculated storativity of the Pismo Formation to be approximately 0.25. Both pumping wells are completed within the Pismo Formation. These values are considered reasonable for the geologic materials. One set of analyses of pumping test data performed on Well DG-1 (ERCE, 1991) indicated that hydraulic conductivity values of 24 to 32 gpd/ft^2 may be warranted, which would cause predicted drawdowns to be less than predicted. For Well Nos. 1 and 2, we calculated worst-case predicted drawdowns at the end of 1, 5, 10 and 20 years of pumping using saturated thickness values of 116 and 130 feet, respectively. A summary of predicted drawdown in Well Nos. 1 and 2 is presented in Tables 7 and 8, respectively.

Table 7. Predicted Drawdown in Well No. 1

Pumping Duration (years)	Predicted Drawdown (feet)	Base of Well (feet. Below TOC)	Saturated Thickness (feet)
1	73.62	186	42.38
5	81.42	186	34.58
10	84.78	186	31.22
20	88.14	186	27.86

Table 8. Predicted Drawdown in Well No. 2

Pumping Duration (years)	Predicted Drawdown (feet)	Base of Well (feet. Below TOC)	Saturated Thickness (feet)
1	38.58	156	77.42
5	42.64	156	73.36
10	44.39	156	71.61
20	46.13	156	69.87

On the basis of these calculations, approximately 28 feet of saturated thickness would remain within Well No. 1 at the end of 20 years of pumping. Well No. 2 would have approximately 70 feet of saturated thickness remaining at the end of 20 years of pumping. At the property boundary nearest Well No. 1, drawdown after 1 year of pumping would be 17.8 feet; after 20 years of pumping, drawdown would be 32 feet. At the property boundary nearest Well No. 2, drawdown after 1 year of pumping would be 2.2 feet; after 20 years of pumping, drawdown would be 9 feet. Water levels will not likely decline significantly beyond the footprint of the current and expanded CCL due to pumpage associated with the project.

The analysis as performed is considered conservative (worst-case) for the following reasons. The drawdown predictions assume no prior pumpage of the production wells has occurred. Because both wells have been producing for many years, steady state conditions may have already been achieved and future drawdown in Well Nos. 1 and 2 would be expected to be significantly less than the calculations suggest. The drawdown predictions represent water levels due to pumpage associated the project expansion, but do not consider what the drawdowns would be at the current pumpage rates. The current pumpage (35.2 afy) is about 80 percent of future proposed pumpage (44.0 afy). Therefore, it is reasonable to conclude that the impacts of the proposed project cause about 20 percent of the predicted drawdown and the current pumpage would cause about 80 percent of the predicted drawdown. Analysis of mutual interference was not performed, which would have increased predicted drawdown slightly. However, it is believed that the prior pumping of the wells (lack of steady state) and cumulative predicted drawdown (current plus future demand) overestimate the predicted drawdown associated with the proposed project significantly.

During periods of increased pumpage associated with summer-time irrigation at the adjacent winery, water levels in the Weir wells declined somewhat (Rizzoli, 2007). The magnitude of the decline is not evident in on-site water level hydrographs, so is likely less than several feet (Plate 5).

The water level hydrographs presented on Plate 5 indicate no significant declining water level trends in most monitoring wells, some of which have continuous water level data dating from as early as January 1989. The water level in Monitoring Well P-6, located approximately 800 feet west of Well No. 2, has declined approximately 7 feet between 1993 and 2006. Similarly, Monitoring Well MW-8 (to be decommissioned) has shown 6 feet of water level decline between 2000 and 2006. Monitoring Well MW-2 is a Monterey Formation monitoring well with the longest period of record and is to be decommissioned. MW-2 is located approximately 800 feet north-northwest of Well No. 2. Water levels within MW-2 have declined from an initial high of approximately 218 feet above MSL in 1989 to a low (dry state) of 200 feet MSL in 2004. Between 2004 and 2006 (above average water years), water levels rose 2 feet for a period-of-record decline of 16 feet, or about 1 foot per year on average. The observed historic water level variations are not considered significant.

Localized subsidence will not occur due to the groundwater pumpage related to the expansion operations at the CCL because of the bedrock environment underlying the site, and the limited magnitude and duration of groundwater pumping from the CCL.

GROUNDWATER RECHARGE ESTIMATE

An estimate of recharge in the hydrogeologic study area was performed by considering percolation of precipitation. For this analysis, we considered all components of groundwater inflow and outflow. For lack of data and geologic complexity, it is assumed that subsurface inflow and subsurface outflow are equal and as a result neither contribute nor remove water from the aquifer. Of the components of inflow (recharge), percolation of precipitation is often the component that contributes the greatest quantities of water to the aquifer, as can, to a lesser degree, percolation of applied irrigation and percolation of streamflow. Calculation of streamflow percolation requires streamflow data, which are not available for the hydrogeologic study area. Therefore, only percolation of precipitation and percolation of applied irrigation water were utilized to estimate groundwater recharge within the study area. Such an approach is considered reasonable to estimate a gross water balance for the area.

Only a small portion of total rainfall percolates to groundwater. Some of the rainfall runs off, some evaporates directly from the soil surface, or is taken up by plants to be transpired to the atmosphere (a process jointly referred to as ETo). Only after a sufficient amount of rainfall has saturated the soil to some depth can any additional precipitation percolate to become groundwater. Detailed estimates of percolation of precipitation require surface area, soil type, daily measurements of precipitation and ETo and runoff data. We referred to a study conducted in the Arroyo Grande - Nipomo Mesa area (DWR, 2002) that presents estimates of percolation of precipitation based on annual precipitation. Based on that study, between 9 (Tri-Cities Mesa - Arroyo Grande Plain) and 16 percent (Santa Maria Valley) of average annual precipitation percolates to groundwater. For our calculations we chose a factor of 12 percent of average annual precipitation to estimate percolation of precipitation. Average annual precipitation in the area is approximately 22.1 inches per year. Application of the DWR's average value is 12 percent of the 22.1 inches, or 2.65 inches, to the study area of approximately 1,687 acres, leads to an estimated percolation of precipitation of approximately 373 afy. This estimate would not change significantly following expansion of the CCL. Arguably, percolation of precipitation directly on the coarser alluvial materials (refer to Qa and Qoa on Plate 3) would increase the recharge estimate, as would percolation of streamflow.

Percolation of applied irrigation water can be calculated relative to total applied irrigation water. Based on studies in the region that included detailed water balances (Fugro West, 2002; DWR, 2002), it is estimated that as much as 15 percent of irrigation water applied within the study area percolates deeply to the aquifer. If so, an estimated 31 afy would recharge the groundwater. If the future projections of conversion to vineyards are accurate, as much as 129 afy of applied irrigation water could percolate to the aquifer after build out. Total recharge due to percolation of precipitation and applied irrigation water is approximately 404 afy. If fallow land is converted to the full extent estimated, a total of 502 afy will recharge the groundwater in the study area.

Components of groundwater outflow include groundwater pumpage, underflow, and extraction by phreatophytes. Underflow into and out of the aquifer are assumed to be equal. Phreatophytes (deep rooted plants that obtain water from shallow groundwater) typically located within alluvial valleys, are not present within the study area to a significant degree. Generally, the quantity of phreatophytes is considered so small as to be negligible in the overall water balance. Therefore, extractions by phreatophytes were not estimated as a groundwater outflow component.

The only significant and quantifiable groundwater outflow component is groundwater pumpage from the CCL and domestic and agricultural users. Currently, groundwater pumpage (326 afy) is lower than the estimated recharge (404 afy). Total future groundwater demand of as great as 1,009 afy would be significantly greater than the estimated future recharge of 502 afy by as much as 507 afy.

A comparison of the components of groundwater recharge and outflow is presented as Table 9 – Gross Water Balance for Hydrogeologic Study Area.

Table 9. Gross Water Balance for the Hydrogeologic Study Area

Period	Components of Recharge (afy)		Component of Outflow (afy)	Surplus / Deficit (afy)
	Percolation of Precipitation	Percolation of Irrigation	Pumpage	
Current	373	31	326	78
Proposed	373	129	1,009	-507

Without future conversion of fallow land to vineyards, total future groundwater pumpage within the study area would be approximately 349 afy, a value lower than the estimated recharge of 404 afy. Of this increase in pumpage over current conditions of 26 afy, a total of 17 afy would be due to the addition of secondary homes and 9 afy would be due to expansion of the CCL.

GROUNDWATER QUALITY

Existing Groundwater Quality

Groundwater quality data from EMCON Associates (1992) and RMC Geoscience (2007) were reviewed in order to determine the background water quality on and surrounding the site, the variability of the native water quality, the impact of the various operations at the CCL on water quality, and the record of compliance with relevant groundwater quality requirements.

Water quality data through 1965 were considered as conditions present prior to the landfilling operations, a time before which landfill operations were not likely to cause any groundwater contamination. EMCON's analysis of water quality extended regionally as far northwest as Well -12D9 located near the San Luis Obispo County Airport, and as far north as Well -16D2 located on Righetti Road north of Orcutt Road. More locally, EMCON attempted to compile water quality data for all wells within a 1-mile radius of the CCL. Generally, water quality both regionally and from wells within a 1-mile radius of the CCL is magnesium bicarbonate in chemical character and has not changed significantly since CCL operations began. Within 1 mile west of the CCL, total dissolved solids (TDS) ranged between 423 and 1,227 mg/l, nitrate ranged between 0 and 27 mg/l, and sodium ranged between 27 and 67 mg/l. South of the site within 1-mile, the TDS ranged between 608 and 693 mg/l, nitrate ranged between 0 and 14 mg/l, and sodium ranged between 56 and 135 mg/l. East of the site within 1-mile, TDS ranged between 420 and 484 mg/l, nitrate ranged between 0 and 31 mg/l and sodium ranged between 34 and 72 mg/l.

Generally, groundwater within a mile radius to the west of the CCL is high in TDS and slightly elevated with respect to sodium. According to Mr. Rizzoli (2007), groundwater west of the site (within the Monterey Formation), including the Shop Wells, has elevated hydrogen sulfide (H_2S) concentrations, which limit potablity. Hydrogen sulfide is commonly associated with hydrocarbons in the diatomaceous Monterey Formation. TDS concentrations are lower within a mile radius to the south of the site, but sodium concentrations are elevated. Water quality from the alluvium and Pismo Formation east of the site is generally considered to be of potable quality. The three Weir wells are completed in the Pismo Formation.

Water quality data for the site are more complete than regional water quality data. Groundwater sampling has been performed at the site regularly since 1987, originally as part of a hydrogeologic site characterization study (EMCON, 1987). In February 1989, groundwater samples collected from wells MW-1, MW-2, MW-5, PW-2, UG-1, and DH-1 were analyzed for organic and inorganic constituents for comparison with California drinking water standards (maximum contaminant limits or MCLs). The results indicate that secondary (aesthetic) MCLs were exceeded for: TDS in all wells, electrical conductivity in all wells except MW-3, chloride in PW-2, and sulfate in MW-2. Generally, except for chloride and sulfate, all downgradient exceedences were also exceeded in upgradient MW-5. The elevated chloride and sulfate character of the groundwater may reflect natural groundwater conditions within the shallow geologic formations in which they were detected (RMC, 2007b and ERCE, 1991). The chloride and sulfate concentrations are likely controlled by relatively higher solubility of chloride and sulfate minerals relative to bicarbonate minerals. The reasons for the increases in chloride and sulfate are not known in all instances (RMC, 2007b). The WDRs require quarterly monitoring of groundwater quality to determine if a statistical exceedence occurred in any well and constituent.

The RWQCB issued WDRs for the site in 1975, subsequently updated in January 1990 (Order 90-33). Order No. 93-51 was issued in 1993 to allow a horizontal and vertical expansion of the landfill. In response to the requirements of the order, the CCL capped 14 acres of the unlined area and constructed a gas extraction system. The Order was updated in 2002, during which RWQCB staff issued a letter indicating that the CCL was in substantial compliance with the requirements of the Order and that a comprehensive file review from 1993 to 2002 failed to turn up a single Notice of Violation or other formal enforcement action. The report also indicated that Volatile Organic Compounds (VOC) had been reduced to levels below detectable limits as a result of several corrective actions (RMC, 2007b).

The 2002 RWQCB report indicated that there may have been a release (of undocumented constituents) from the existing landfill in the vicinity of MW-2 and MW-3. However, upon installing Wells P-8 and P-9, and performing subsequent monitoring, it was determined that the release had not migrated beyond MW-2 and MW-3 (RMC, 2007b). Subsequent groundwater monitoring reports have not identified any release. The methods to mitigate statistically significant releases through a corrective action plan are discussed below.

In March 2002, CCL documented that chloride and sulfate concentrations measured in well P-7 were statistically significant.. The cause was identified as seepage associated with a former wet-weather fill area, which has since been corrected (RMC, 2007b). The CCL prepared an Amended Report of Waste Discharge that concluded that the conditions in Well P-7 were not replicated. Additional monitoring or corrective action were not required (RMC, 2007b).

Current Groundwater Quality Monitoring

Currently, the CCL is subject to water quality sampling requirements contained in the adopted WDR MRP No. R3-2002-0065. The MRP requires that 15 of the monitoring wells on site be sampled and analyzed on a quarterly or semiannual basis as a part of three routine monitoring programs. Detection monitoring includes those constituents that have not been exceeded. Corrective action monitoring is based on inorganic constituents that occasionally exceed statistically-derived concentration limits for chloride, sulfate, or dissolved manganese. All constituents involved with Corrective Action Monitoring are naturally occurring or associated with naturally-occurring oil and tar in the geologic formations underlying the site. A summary of the monitoring status of each of the monitoring wells is presented in Table 10 - Summary of Groundwater Monitoring Requirements (RMC, 2007b).

Table 10. Summary of Groundwater Monitoring Requirements

Well	Detection Monitoring	Corrective Action Monitoring	Other Monitoring
MW-1	X (VOCs)	X (Inorganics)	
MW-2		X (VOCs and Inorganics)	
MW-3	X (VOCs)	X (Inorganics)	
MW-5	X		
P-1A			X
P-1B	X		
P-2			X
P-3A	X (VOCs)	X (Inorganics)	
P-3B	X		
P-4			X
P-5	X		
P-6			X
P-7	X (VOCs)	X (Inorganics)	
P-8	X		
P-9	X		

Note: X indicates inclusion in monitoring program

The MRP requires that a total of 8 quarters of background monitoring be performed prior to the expansion of the CCL. Two years of monitoring is a sufficient time to provide the CCL and RWQCB a "fingerprint" of the native groundwater quality, against which future groundwater quality can be compared to demonstrate whether any significant impacts are occurring. The extended background monitoring will include the additional Monitoring Wells P-10 through P-14 located in the expansion area (Plates 4 and 6). The addition of these five monitoring wells will allow more complete monitoring of the water-bearing zone underlying the present and expanded CCL.

In the event that monitoring results identify significant levels of contamination, the RWQCB will be notified immediately and an evaluation monitoring program will be initiated per Chapter 15 of the California Code of Regulations requirements. The evaluation monitoring program would include a subsurface investigation to assess the vertical and horizontal extent of the contamination plume and potential sources. If it is determined through the evaluation monitoring program that a release has occurred and the nature and extent of the release are known, an incident-specific corrective action program would be designed and implemented. The corrective action program would also take corrective action to remediate releases, such as the installation of one or more pumping wells to remove the contaminant. A water quality monitoring program shall be implemented to demonstrate the effectiveness of the corrective action program. We are not aware of any past corrective action plans at the CCL. Determination of the details of potential costs, specific responsibilities, and logistical issues is not possible until a release is identified and an appropriate corrective action plan is adopted.

Leachate Collection System

A system is installed within each module to collect and remove liquids that migrate downward through the waste. Captured liquids are conveyed to a sump where they are pumped into an above-ground storage tank located in the southwest corner of the site (Plate 4). On average, the landfill generates approximately 700,000 gallons of leachate per year (Morro Group, 2007). The generated leachate offsets groundwater pumpage for dust control as an in-lieu water source.

Leachate collected from Modules 6, 7, and 8 is collected in an 11,000 gallon above-ground storage tank, which when full, is applied on the lined portions of the landfill for dust control or, if it is deemed hazardous, sent off-site to a wastewater treatment facility that can accept hazardous wastes. Leachate from the storage tank is analyzed annually. The most recent analysis of leachate was performed in 2006, the results of which are presented in Appendix E - Summary of Recent Leachate Analytical Results. To date, the leachate has been determined to be non-hazardous and acceptable for use in dust control operations.

IMPACTS ANALYSIS

Thresholds of significance for the project were adopted from Section 15382 of the State CEQA Guidelines. Based on information contained in CEQA Guidelines, the proposed project would have a significant environmental effect if it would:

- Violate any water quality standards or waste discharge requirements;
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level;
- Create or contribute runoff water, which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff; or
- Otherwise substantially degrade water quality.

In addition to CEQA Guidelines impacts, the proposed project may pose significant environmental effects if it would:

- Cause groundwater overdraft;
- Contribute to leachate migration into the groundwater; or
- Contribute to short- and long-term leachate production.

VIOLATION OF WATER QUALITY STANDARDS OR WASTE DISCHARGE REQUIREMENTS

We reviewed the CCL's record of compliance related to the WDRs and MRPs. The CCL has complied with the water quality monitoring and reporting requirements of the RWQCB. The proposed project will continue to be monitored within the current regulatory setting. Before onset of expansion of the landfill, the CCL will have obtained 8 quarters of background water quality data from the monitoring well network. Data obtained from these 8 quarters will be used to develop the future WDRs and MRPs. The intent of the MRP will be to obtain water quality data from the recently installed monitoring wells (P-10 through P-14) and the existing monitoring well network. Compliance with the WDRs and MRPs will require quarterly review of water quality data for identification of any statistically-significant releases from the CCL.

The RWQCB requires that any release from the landfill, as determined from periodic groundwater, leachate, and landfill gas monitoring be reported immediately followed by implementation of a corrective action plan. Such plans typically include comprehensive investigations to assess the vertical and horizontal extent of the release. If any groundwater contamination is deemed significant (a release), a groundwater remediation program would be required by the RWQCB.

The monitoring program in place is considered appropriate to detect a release from the landfill that could affect groundwater quality. Compliance with the future required monitoring and reporting programs will mitigate potential adverse effects of the project on water groundwater quality to a level that is **less-than-significant.**