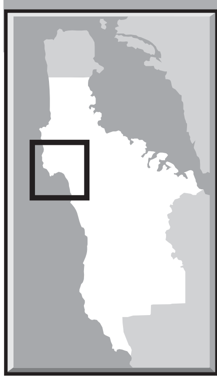
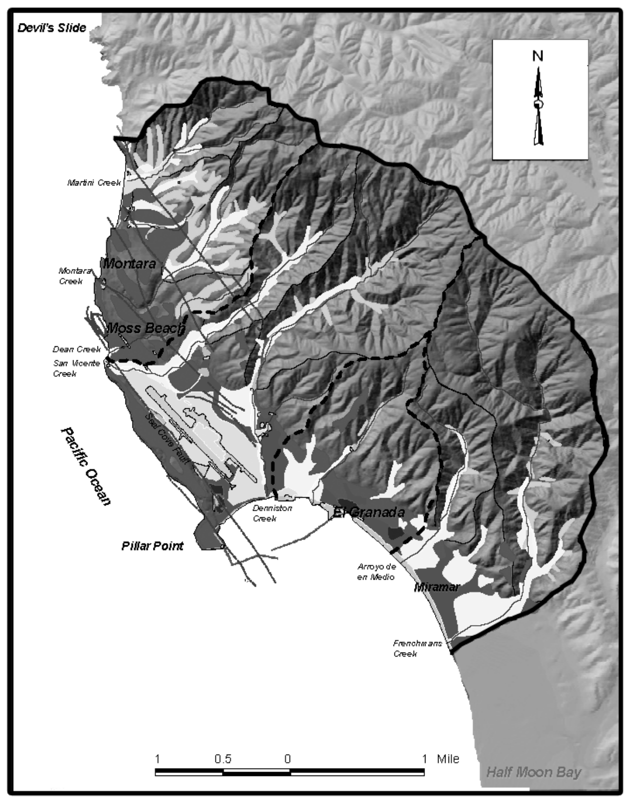
Kleinfelder Midcoast Groundwater Study

April 2009



Summary and Errata



Prepared by
Planning & Building Department
San Mateo County ▪ California

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Midcoast Groundwater Study Summary

Summary of Kleinfelder Midcoast Groundwater Study

Attachments

SUMMARY OF KLEINFELDER MIDCOAST GROUNDWATER STUDY

INTRODUCTION

- Due to the use of individual wells to support existing and proposed development in the Midcoast, and potentially limited groundwater sources, San Mateo County commissioned the Midcoast Groundwater Study to assist in long-term groundwater basin and watershed planning.

- The initial purposes of the study were to evaluate Midcoast groundwater conditions and assess the suitability and long-term sustainability of Midcoast groundwater supplies. This was to include an analysis of the potential impacts of groundwater withdrawals on sensitive areas such as riparian and wetland habitats, and an estimation of "safe yield." However, as the study progressed, it was determined that safe yield and groundwater/habitat relationships could not be accurately assessed due to the limited availability of well data, concerns regarding the accuracy of the data, and information gaps regarding surface water flows.

- As a result of these limitations, Kleinfelder developed generalized water balance models based on aquifer characteristics, average pumping rates, and rainfall amounts over a 50-year period (1950-2005). These models estimate the basins' inputs and outputs, and how variations in annual rainfall affect groundwater levels and storage. The Seal Cove area is not addressed by the report because well monitoring data was not available. A map of the groundwater basins and subareas is provided as Attachment A.

- While the study provides valuable information regarding Midcoast groundwater basins, additional data and analyses are needed to determine the specific amounts of water that can be extracted without causing adverse long-term impacts.

- The report submitted to the County by Kleinfelder contains errors that are corrected by the errata sheet and replacement pages included in this summary as Attachment B.

SETTING AND METHODOLOGY

- The Midcoast can be generally divided into the following two groundwater storing geologic formations:

    - Coastal marine terrace or stream valley alluvial deposits where groundwater is stored in loose, unconsolidated, coarse-grained sand.

- Upland granitic bedrock where groundwater is stored in weathered rock openings and in rock fractures.

- The generalized water storage potential of Midcoast geologic formations is shown below:

Good Source of Groundwater	**Poor or Limited Source of Groundwater**
Marine Terrace Deposits	Monterey Formation
Younger Alluvial Fans	Colluvium
	Granitic Bedrock (Montara Mountain)
Stream Channel Deposits	Purisima Formation

- Although recharged by percolated rainwater, there is generally limited storage capacity in weathered or fractured granite; most groundwater flows to downstream aquifers.

- The Midcoast study area is divided into eight groundwater subbasins, which are further divided into the following 21 subareas. The subareas consist of similar geologic units within a subbasin, e.g., terraces, uplands, and stream valleys through which groundwater flows.

Frenchman's Subbasin	
1	Frenchman's Terrace Subarea
2	Frenchman's Upland Subarea
3	Frenchman's Stream Valley Subarea
Arroyo de en Medio Subbasin	
4	Miramar Terrace Subarea
5	Arroyo de en Medio Upland Subarea
6	Arroyo de en Medio Stream Valley Subarea
El Granada Subbasin	
7	El Granada Terrace Subarea
8	El Granada Upland Subarea
Airport Subbasin	
9	Airport Terrace Subarea
10	Dennison Upland Subarea
11	Dennison Stream Valley Subarea
13	San Vicente Upland Subarea*

14	San Vicente Stream Valley Subarea*
Moss Beach Subbasin	
12	Lower Moss Beach Subarea
13	San Vicente Upland Subarea*
14	San Vicente Stream Valley Subarea*
15	Dean Creek Subarea
19	Upper Moss Beach Subarea
20	Lighthouse Subarea
Montara Creek Subbasin	
16	Portola Subarea
17	Montara Creek Upland Subarea
18	Lower Montara Creek Subarea
21	Wagner Valley Subarea
22	Montara Terrace Subbasin
23	Martini Upland Subbasin
*The San Vicente Upland and Stream Valley Subareas contribute to both the Airport and Moss Beach Subbasins.	

- Of the 1,087 Midcoast well records in the County's database, only 539 were deemed usable for the study due to the lack of information on actual well locations. Of the remaining 539 well records only about half of them had useful data for evaluation such as depth to groundwater, groundwater production, specific capacity estimates or well log data.

- Twenty-six existing private Midcoast wells were monitored for one year to measure the depth to groundwater, estimate groundwater surface elevations and observe groundwater behavior.

- Pumping tests were conducted in four private wells to estimate transmissivity and hydraulic conductivity values of the aquifers. Transmissivity is the rate water flows within the aquifer under a unit hydraulic gradient. Transmissivity is dependent on the aquifer's "hydraulic conductivity." Hydraulic conductivity is the ease of internal water flow through a porous medium.

- Two of the four test wells had high yields and would be adequate for municipal or irrigation purposes. These wells are located in the Airport Terrace subarea of the Airport Subbasin, and the Lower Moss Beach subarea of the Moss Beach Subbasin, respectively.

- The other two test wells showed low aquifer yield and very low transmissivity. These wells are located in the Dean Creek subarea of the Moss Beach Subbasin and the El Granada Subbasin at the edge of the El Granada Upland subareas, respectively.

- Water balance analyses were conducted for the Midcoast groundwater subbasins using the rainfall record for the 55-year period (1950-2005). Water balance analysis relates the amount of water entering and leaving the groundwater storage system. The difference between the amount that enters and leaves the aquifer is the amount that is retained in storage.

- A “terrace aquifer water balance model” was developed for use in the El Granada, Arroyo de en Medio, and Moss Beach Subbasin terrace areas. Other water balance assessment methodologies were applied for the Airport and Montara Terrace Subbasins, the Dean Creek and Upper Moss Beach subareas of Moss Beach Subbasin, and the Portola subarea of the Montara Creek Subbasin.

- Groundwater evaluations were not conducted for the Montara Creek Upland (Montara Knob), Lower Montara Creek and Wagner Valley subareas of the Montara Creek Subbasin, and the Martini Creek Subbasin. The study did not assess these areas because of insufficient groundwater data. No large-scale future development is anticipated in these areas.

GENERAL CONCLUSIONS

- Midcoast aquifers that have a considerable groundwater surplus in average rainfall years can have a deficit in dry and very dry years.

- The marine terrace subareas appear to be in long-term hydrologic balance under current pumping conditions, and should remain in long-term balance with a moderate increase in water extractions. This conclusion assumes rainfall patterns experienced during the 55-year period used for analyses are representative of long-term future conditions, and that periods when the water table falls below sea level will be of short duration.

- Although the marine terrace aquifers appear to be in long-term balance, current pumping rates have lowered the water table to near sea level during dry years, and potentially below sea level during very dry years, posing risks of saltwater intrusion. Increased pumping over long periods of time, especially during drier years, will increase the amount of time that the water table falls near or below sea level. This increases the risk of saltwater intrusion.

- Potential groundwater deficits may occur more frequently in the granitic aquifers underlying Montara Terrace Subbasin, Upper Moss Beach and Dean Creek subareas of the Moss Beach Subbasin, and the Portola subarea of the Montara Creek Subbasin. Although these areas appear to be in general long-term balance, individual wells may go dry during prolonged dry years and pumping increases could cause local detrimental impacts. The data is limited to quantify these impacts and their distribution.

SPECIFIC CONCLUSIONS

❖ **El Granada Subbasin**

- The El Granada Subbasin is made up of the El Granada Terrace and El Granada Upland subareas, as shown on the attached Midcoast Study Area map.

- Approximately 93 acre-feet of groundwater is pumped annually from the El Granada Subbasin. This is associated with the extraction of approximately 27 acre-feet per year by about 97 wells in the upland subarea, and about 66 acre-feet per year from approximately 237 wells in the terrace subarea.

- The water balance model developed by Kleinfelder indicates that the elevation of the El Granada terrace water table may have fluctuated about 45 feet and averaged about 15.5 feet above sea level. In a dry year (1987-88), groundwater elevations were modeled to be 8.4 feet above sea level. In a very dry year (1976-77), the model indicates that groundwater elevations dropped 0.7 feet below sea level.

- The model suggests that there were six “water years” over the 55-year period when the water table approached (less than 5 feet above) sea level, or dropped below sea level. These were 1960-1961, 1971-1972, 1975-1977 and 1989-1991. Such significant lowering of the water table accounts for 11% of the 55 years studied, and occurred after two or more consecutive dry years.

- The model estimates that storage volume for the El Granada Subbasin aquifer ranged between about 0 and 1,580 acre-feet during the 55-year period. The average storage volume within the marine terrace subarea was estimated to be about 560 acre-feet. Kleinfelder was not able to quantify the amount of storage in the upland area of the Subbasin based on current information.

- During the 1987-1988 dry year, the model estimated aquifer storage at about 300 acre-feet of groundwater. During the 1976-1977 very dry year, there may have been a 26 acre-foot deficit. This could have caused the water table to fall below sea level and limited seawater intrusion to occur.

- The study concludes that although water levels fluctuate significantly, groundwater at the El Granada Subbasin appears to be in “general long-term balance.” Although groundwater deficits occur, there appears to be no long-term depletion trend and the aquifer can recharge itself following an average to wet year.

- Planning staff estimates that there are 590 vacant lots designated for residential development within the urban area of the Subbasin. If each of these lots were developed with a single-family residence that obtained water from a well and connected to the sanitary sewer system, pumping would increase from 93 to 259 acre-feet per year, and the probability of the groundwater falling to levels near or below sea level in the mid-part of the terrace would increase from 11% to about 24%. A prolonged drop in groundwater levels below sea level may have detrimental impacts due to saltwater intrusion.

❖ **Arroyo de en Medio and Frenchman's Subbasins**

- The Arroyo de en Medio and Frenchman's Subbasins are made up of the Miramar Terrace, Arroyo de en Medio Upland, Arroyo de en Medio Stream Valley, Frenchman's Terrace, Frenchman's Upland, and Frenchman's Stream Valley subareas. These subbasins are shown on the attached Midcoast Study Area map. Both subbasins drain to the Miramar marine terrace.

- The hydrogeologic conditions in the Arroyo de en Medio Subbasin are similar to the conditions in the El Granada Subbasin.

- Approximately 169 acre-feet of groundwater is pumped annually from the Arroyo de en Medio Subbasin, 167 acre-feet of which is extracted from more than 80 wells in the terrace area. Approximately six active wells in the upland area extract about 2 acre-feet per year.

- The model estimates that the elevation of groundwater in the terrace area averaged 21 feet above mean sea level between 1950 and 2005. In a dry year (1987-88), groundwater elevations may have lowered to 13 feet above sea level. During a very dry year (1976-77), groundwater elevations were modeled to drop to 2 feet below sea level.

- There were four "water years" when the water table approached or dropped below sea level (1971-1972), (1976-1977), and (1989-1991). This represents a frequency of 7%.

- The model estimates that the amount of water stored in the terrace area averaged 502 acre-feet. In a dry year (1987-88), groundwater storage was reduced to 309 acre-feet. During a very dry year (1976-77), the model indicates that the amount of water leaving the aquifer exceeded the amount entering by 37 acre-feet.

- The Frenchman's Subbasin was not modeled in detail due to the limited information for that area, e.g., lack of existing wells.

- The Frenchman's Terrace subarea is contiguous with the Miramar Terrace subarea with no apparent groundwater divide separating the two areas. They share the similar hydrogeologic properties and have similar quantities of water in storage.

- The Frenchman's Upland subarea is larger and higher than the Arroyo de en Medio Upland subarea and should provide somewhat more water to the aquifer.

- Given the similarities of the Arroyo de en Medio and Frenchman's Subbasins, the general conclusions for the former may be applicable to the latter.

- The study concludes that the Arroyo de en Medio Subbasin is in general long-term balance. Hence, the Frenchman's Subbasin is probably also in general long-term balance.

- Planning staff estimates that there are 230 vacant lots designated for residential use within the urban area of the Miramar Terrace subarea. If each of these lots were developed with a single-family residence that obtained water from a well and connected to the sanitary sewer system, the amount of groundwater pumped from the Arroyo de en Medio Subbasin would increase from 169 to 235 acre-feet per year, and the probability of the groundwater falling to levels near or below sea level would increase from 7% to about 18%. A prolonged drop in groundwater levels below sea level may have significant detrimental impacts due to saltwater intrusion.

❖ **Airport Subbasin**

- The Airport Subbasin is made up of the Airport Terrace, Denniston Upland and Denniston Stream Valley subareas. The San Vicente Upland and San Vicente Stream Valley subareas also contribute to the Airport Subbasin. This subbasin is shown on the attached Midcoast Study Area map.

- Approximately 513 acre-feet of groundwater is pumped annually from the Airport Subbasin. These withdrawals consists of 169 acre-feet of average annual pumping by the Coastside Community Water District, 224 acre-feet of average annual pumping by the Montara Water and Sanitary District, about 96 acre-feet of extractions by approximately six agricultural wells, and approximately 24 acre-feet of withdrawals by about 87 domestic and other wells.

- The water table drops during dry years, but can quickly rebound during wet years.

- Based on prior studies, the 55-year precipitation record, monitoring data from two wells within the Airport subarea, and other factors, Kleinfelder estimates that the average annual inflow to the basin of 2,780 acre-feet per year equals the average annual output. As a result, the report states that the Airport Subbasin appears to be in long-term hydrologic balance.

- The volume of Denniston Creek water that enters the Airport Terrace sub-area is a significant recharge factor that is not well understood because long-term gaging data are not available. It is difficult to estimate the water balance in the Airport Terrace subarea without a better understanding of this recharge.

- A 1991 study by Earth Sciences Associates referenced by the report concluded that at least 45 to 87 additional acre-feet could be annually pumped from the Airport Subbasin without detrimental impacts. The Kleinfelder study does not indicate whether or not additional groundwater is available for pumping due to significant hydrological uncertainties in the area.

- Planning staff estimates that there are 61 vacant lots designated for residential uses in the urban area of the Airport Subbasin. If each of these lots were developed with single-family residence that obtains water from a well, pumping would increase by 17 acre-feet per year. The report is inconclusive regarding the sustainability of such increases.

❖ **<u>Moss Beach Subbasin</u>**

- The Moss Beach Subbasin is made up of the Lower Moss Beach, Dean Creek, Upper Moss Beach, and Lighthouse subareas. The San Vicente Upland and San Vicente Stream Valley subareas also contribute to the Moss Beach Subbasin. This subbasin is shown on the <u>Midcoast Study Area</u> attached map.

- Approximately 32 acre-feet of groundwater is pumped annually from the Moss Beach Subbasin. This is based on the estimation that 54 wells in the Lower Moss Beach subarea extract 15 acre-feet per year, about 6 acre-feet is pumped annually from 20 wells in the Upper Moss Beach subarea, and approximately 15 acre-feet of water is extracted each year from 55 wells in the Dean Creek subarea, 4 acre-feet of which is returned to the watershed via 31 permitted septic systems.

- No long-term data was available to assess groundwater trends in the Lower Moss Beach subarea. Using the 55 years of precipitation data and current pumping rates, the water balance model developed by Kleinfelder indicates that water levels in the Lower Moss Beach subarea vary from year to year but have not approached sea level, and that the subarea is currently in general balance.

- The model estimates that average storage volume for the Lower Moss Beach subarea is about 719 acre-feet. Following a very dry year (1976-77), the model estimates that groundwater storage is about 332 acre-feet.

- The water balance model developed by Kleinfelder indicates that in an average rainfall year, 720 acre-feet of water flows into the Lower Moss Beach subarea, and 719 acre-feet flows out. In a very dry year, the model estimates that 215 acre-feet flows into the subarea, and 421 acre-feet flows out.

- Kleinfelder's assessment hypothesizes that 75% of the water that recharges the Lower Moss Beach aquifer comes from the San Vincente watershed. Because data are not available to validate the assumed inflow from this watershed, Kleinfelder recommends implementation of a long-term stream flow and gauging program.

- Planning staff estimates that there are 160 vacant lots within the urban area of the Lower Moss Beach subarea designated for residential use. If each of these lots were developed with a single-family residence that obtains its water from a well, extractions from the subarea will be about three times the amount of existing withdrawals.

- The Upper Moss Beach and Dean Creek subareas store groundwater in weathered or fractured granite. Although the long-term sustainability of granitic sources is low, the percolation recharge rate from rainfall is generally high. During extended droughts, water in these subareas may drop significantly.

- During the 55-year precipitation record, the volume of recharge in the Dean Creek subarea was six times the pumping demand. However, in 9 of the 55 years (16%), percolation recharge was less than the total pumping volume.

- Planning staff estimates that there are nine vacant parcels in the Dean Creek subarea designated for residential use. If each of these lots were developed with a single-family residence that obtains water from a well, the frequency of years in which pumping exceeds recharge would remain relatively the same.

- In the Upper Moss Beach subarea, recharge was less than pumping demand in 14 out of the 55 years (25%). Between 1953 and 1964, there were seven years when pumping exceeded recharge (64%). However, the average estimated recharge rate during this 11-year period was over double the pumping demand.

- Planning staff estimates that there are 83 vacant parcels in the urban area of the Upper Moss Beach subarea designated for residential use. If each of these lots were developed with a single-family residence that obtains water from a well, the frequency of years in which withdrawals will exceed recharge increases up to 67%. Under these conditions, the Upper Moss Beach subarea would be out of long-term balance.

- The study suggests that an un-quantified amount of additional groundwater from the aquifer may be available for pumping without significant saltwater intrusion. Before additional pumping is carried out, the report suggests that estimates on inputs and outputs should be refined and confirmed, particularly the volume of water that enters the subbasin from the San Vincente watershed.

❖ **Montara Terrace Subbasin**

- The Montara Terrace Subbasin is bounded by the Pacific Ocean to the west, Martini and Kanoff Creeks to the north, Wagner Valley to the east, and Montara Creek to the south, as shown on the attached Midcoast Study Area map.

- Approximately 50 acre-feet of groundwater is pumped annually from the Montara Terrace Subbasin. This is based on an estimated 184 wells supporting residential uses, and 11 septic systems that return some of this water to the groundwater basin.

- The Montara Terrace Subbasin consists of marine terrace deposits over-laying weathered granitic bedrock. In the upper areas of this subbasin, the marine terrace deposits are absent.

- The marine terrace deposits tend to “thicken” downslope, which may allow for a great water storage volume.

- Well monitoring during the 2004-2005 water year showed generally stable water levels with a peak water-surface elevation occurring at the end of the rainy season.

- Rainfall-runoff modeling generated data indicate that if the current pumping rates of the existing wells in the Montara Terrace Subbasin were maintained during the 55-year period, for 14 of the years (25%), more water would be drawn from the aquifer system than enters it. Wells at higher elevations would likely be at more risk of increased drawdown and going dry.

- In a very dry year (1976-77), there may have been about a 50 acre-foot groundwater deficit, i.e., where outflow exceeded inflow.

- Planning staff estimates that there are 304 vacant parcels designated for residential use within the urban area of the Montara Terrace Subbasin. If each of these parcels were developed with a single-family residence that obtained water from a well, the frequency of years where pumping exceeds recharge would increase to 38% if septic systems were used, and 53% if the residences connected to the sewer system. The resulting drawdown on the water table would depend on the proximity of individual wells, localized hydrogeologic characteristics, volume of water in storage from prior years, and numbers of consecutive dry years. Wells at higher elevations would likely be at more risk of increased drawdown and going dry.

- The study concludes that although "there have been wide swings year to year between surplus and deficit in the Montara Subbasin, in general, the area appears to be in long-term balance."

- The study further concludes that overall limited additional water could be pumped; however, there would be significant risk of localized well interference, large well drawdowns in dry years and the risk of individual wells going dry in dry and very dry years.

❖ **Montara Creek Subbasin**

- The Montara Creek Subbasin is made up of the Portola, Montara Creek Upland (Montara Knob), Lower Montara Creek and Wagner Valley subareas. This subbasin is shown on the attached Midcoast Study Area map.

- Within the Montara Creek Subbasin, groundwater evaluations were conducted for the Portola subarea, but not for the Montara Creek Upland, Lower Montara Creek and Wagner Valley subareas. The study did not assess these areas because of insufficient groundwater data and unanticipated future large-scale development.

- Approximately 44 acre-feet of groundwater is pumped annually from the Portola subarea. This is based on an estimated 35 wells supporting residential uses, including two production wells operated by the Montara Water and Sanitary District, and 18 septic systems.

- The Portola subarea consists of weathered and fractured granitic rocks. Groundwater is primarily recharged by infiltration and percolation of rainwater falling on the area. Near the western edge of the area, groundwater from the Wagner Valley may also seep into the weathered granitic rocks to an unknown extent.

- Model generated data for the existing wells in the Portola subarea indicates that in 20 of the 55 years (36%) of precipitation records, more water would have been drawn from the groundwater system than enters it. Wells at higher elevations would likely to be at more risk of increased drawdown or of going dry.

- In a very dry year (1976-77), there may have been about a 45 acre-foot groundwater deficit, i.e., where outflow exceeded inflow.

- In a dry year (1987-88), there may have been a 16 acre-foot groundwater deficit.

- Planning staff estimates that there are 51 vacant parcels designated for residential use within the urban area of the Montara Terrace Subbasin. If each of these parcels were developed with a single-family residence that obtained water from a well, the frequency of years where pumping exceeds recharge would increase to 45% if septic systems were use, and 51% if the residences connected to the sewer system.

- The study concludes that although there have been wide swings year to year between surplus and deficit in the Portola subarea, in general, the area appears to be in long-term balance.

- The study further concludes that additional pumping in the Portola subarea runs the significant risk of localized well interference, large well drawdowns in dry years and the risk of individual wells going dry in dry and very dry years.

❖ **Martini Creek Subbasin**

- The Martini Creek Subbasin, located north of Montara, is shown on the attached Midcoast Study Area map.

- Groundwater evaluations were also not conducted for the Martini Creek Subbasin because of the lack of sufficient groundwater data, and that future large-scale development there is not expected.

RECOMMENDATIONS

The study recommends that the following measures be considered by the County to improve the long-term groundwater use in the area:

- A long-term stream flow and gauging program should be implemented to better define the area's hydrology.

- The County's database of wells should be carefully evaluated and corrected where possible. A survey of well owners should be considered. This would help in correctly locating wells, recording well characteristics, and assessing actual pumping demands.

- Updated well information should be incorporated in the Distance-to-Wells spreadsheet and the spreadsheet should be used along with well site observation to evaluate minimum distances between proposed and existing wells, and to record instances of well interference.

- The County should select or construct "strategic index" monitoring wells in each subbasin to collect representative groundwater data on a long-term, periodic basis.

- In areas of marginal or limited groundwater production, the County may consider metering water use and water levels.

- Although fractured granite bedrock wells are generally unpredictable, the presence of interconnected fractures and joints that can provide reliable quantities of good quality water. Continued assessment of fractured granitic rock groundwater sources should be considered.

- Expanded distribution systems may be considered to even out groundwater supplies in the Midcoast area.

- In the event of extended lean rainfall years, alternative sources of water, including imported water, should be considered.

- Wells that are not in use should be considered for destruction in compliance with County and State guidelines.

SUPPLEMENTAL RECOMMENDATION

Since 2007-08 and 2008-09 have been dry years, the County should measure water levels in Midcoast wells to see how far they have gone down. This will provide hard data on what really happens during a dry year and provide valuable data for future calibration and validation of any modeling and further study.

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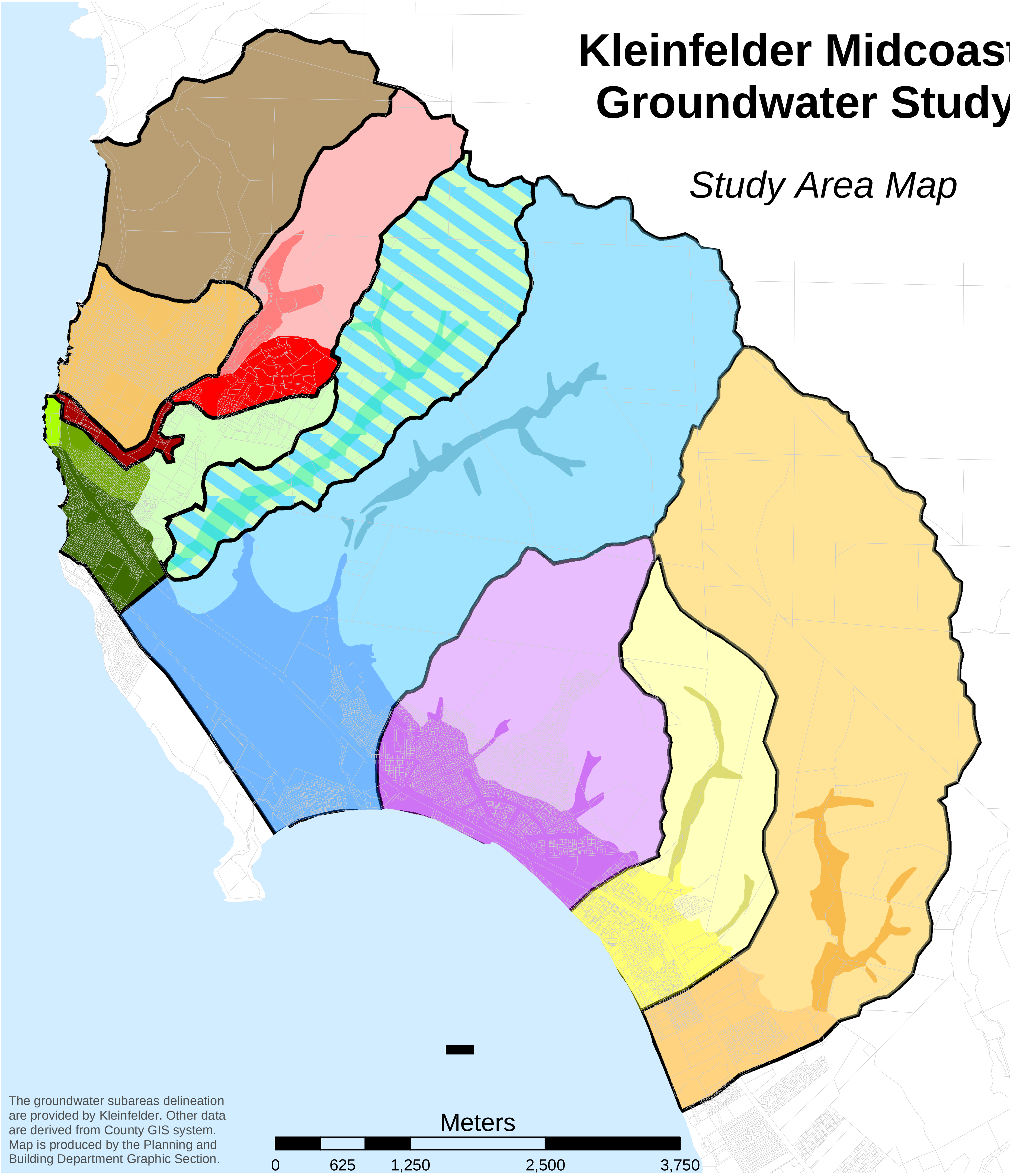
Attachment A

Kleinfelder Midcoast Groundwater Study

Study Area Map



Legend

Frenchmans Subbasin
- Frenchmans Terrace subarea
- Frenchmans Upland subarea
- Frenchmans Stream Valley subarea

Arroyo de en Medio Subbasin
- Miramar subarea
- Arroyo de en Medio Upland subarea
- Arroyo de en Medio Stream Valley subarea

El Granada Subbasin
- El Granada subarea
- El Granada Upland subarea

Airport Subbasin
- Airport subarea
- Denniston Upland subarea
- Denniston Stream Valley subarea

Moss Beach Subbasin
- Lower Moss Beach subarea
- Dean Creek subarea
- Upper Moss Beach subarea
- Lighthouse subarea

San Vicente Subareas
- San Vicente Upland subarea
- San Vicente Stream Valley subarea

The San Vicente Upland and Stream Valley subareas contibute to both the Airport and Moss Beach Subbasins.

Montara Creek Subbasin
- Portola subarea
- Montara Creek Upland subarea
- Lower Montara Creek subarea
- Wagner Valley subarea

Montara Terrace Subbasin

Martini Upland Subbasin

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Midcoast Groundwater Study Summary
Attachment B: Errata

Revisions to Study

1. Third paragraph, page 1 - revise first sentence as follows:

   The San Mateo County Board of Supervisors has determined that because of the ~~rapid growth~~ <u>use of individual wells</u> within the Midcoast area of the County and the potential limited groundwater source in the area, a new comprehensive study of the hydrogeologic conditions of the area should be conducted.

2. Table 2, page 17 - correct data and revise footnote as follows:

Table 2
Subarea Data

Hydrogeologic Units (Subareas)		Number of Wells	Number of Septic Tanks	Area (acres)	Ocean Frontage (ft.)	Potential New Residential Wells*
1	Frenchman<u>'s</u>	7	2	313	3,318	
4	Miramar	93	4	264	3,684	230
7	El Granada	260	2	453	7,280	590
9	Airport	91	2	871	3,616	61
12	Lower Moss Beach	54	2	189	3,640	160
19	Upper Moss Beach	20	1	71	------	83
20	Lighthouse	0	0	17		
2	Frenchman<u>'s</u>	7	0	2,556	------	
5	Arroyo de en Medio	7	1	703	------	
8	El Granada	103	5	1,056	------	
10	Denniston	0	0	9,018	------	
13	San Vicente	1	1	1,001	------	
15	Dean Creek	55	31	25	------	9
16	Portola	35	18	157	------	51
17	Montara Knob	3	2	506	-----	2
22	Montara	184	11	438	4,726	304
23	Martini	6	5	991	3,943	
Stream Valleys						
3	Frenchman<u>'s</u>	0	0	132	------	
6	Arroyo de en Medio	1	1	52	------	
11	Denniston	1		10	------	

Table 2 Subarea Data						
Hydrogeologic Units (Subareas)		**Number of Wells**	**Number of Septic Tanks**	**Area (acres)**	**Ocean Frontage (ft.)**	**Potential New Residential Wells***
14	San Vicente	1	1	14	------	
18	Lower Montara Creek	8	3	58	------	
21	Wagner Valley	9		79	------	13
Totals		**946**	**92**	**189,746**	**30,207**	~~**30,207**~~ **1,503**

Numbers in left column refer to Hydrogeologic Units depicted on Plate 6.

*Estimates of potential new residential wells within the Midcoast Urban Area were provided by ~~Steve Monowitz (~~the San Mateo County Planning and Building Department,~~)~~ and are based on an assumption that one single-family residence will be constructed and served by a well on each vacant lot in the R-1 and R-3 zoning districts as of ~~5/29/08 and~~ 7/8/08.

3. First paragraph, page 29 – revise second sentence as follows:

> *For the Midcoast hydrogeologic study, hydrologic budgets were developed for subareas within the seven subbasins (Plate 3)~~ and the urban limit lines shown on Plate 1~~.*

4. Plate 2 - delete “site” reference.

5. Plate 7 – replace Plate 7 contained in the report with the map of vacant parcels included as Attachment C.

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Attachment C

Midcoast Vacant Lots as of 2008