

ATTACHMENT J
WATER BALANCE



August 8, 2008

Mr. Jonathon Tracy
Sonoma County Permit and Resource Management
Project Review Division
2250 Ventura Avenue
Santa Rosa, CA 95403-2829

Subject: **Sea Ranch Lodge Expansion Plan Water Balance**
Sea Ranch Lodge, Sonoma County

Dear Mr. Tracy:

Per our meeting on July 20, 2008, Fall Creek Engineering (FCE) has generated a water balance comparison to analyze the effects the increased disposal of wastewater at the Sea Ranch Lodge. This comparison will help address the sea bluff impact issues mentioned in the Draft Health Use Permit Conditions dated April 28, 2008. The results of the water balance show that although there is an increased wastewater flow, the change of location of the leach field and use of a drip dispersal irrigation system to reuse wastewater for landscape irrigation throughout the site will decrease the flow to the leach fields and reduce the seepage per lineal foot of bluff. The following section discusses the components of the water balance and the results.

Water Balance

FCE developed a water balance to quantify water into and out of the 58-acre site on a monthly basis and to evaluate the magnitude and possible impacts of the proposed project compared with existing conditions. The components incorporated into the water balance are:

- Groundwater in storage;
- Rainfall;
- Evapotranspiration;
- Surface water flow onto the site;
- Groundwater flow into the site;
- Natural recharge;
- Induced recharge from trenches distributing treated water;



- Induced recharge from drip lines distributing treated water;
- Surface water flow off of the site; and
- Groundwater discharge to surface streams (seeps) flowing off site.

Currently, Sea Ranch Lodge generates about 4,000 gallons per day of untreated wastewater. All of this untreated wastewater is distributed through existing leach field trenches located west of the building and in close proximity to the bluff edge, and added directly to the groundwater system. The total annual amount of wastewater is 192,513 cubic feet. The project will increase the total quantity of wastewater to an average of 9,594 gallons per day, with a peak discharge of 15,990 gallons per day if the Lodge is at full capacity. Under the proposed plan wastewater will receive tertiary treatment, and will only be discharged to leach field trenches for five months per year. The total annual amount water added directly into groundwater via the leach fields would be of 192,393 cubic feet, which is less than the existing scenario. During the other remaining seven months, treated effluent wastewater will be discharged to a subsurface dispersal system where the majority of the water will be lost to evaporation and transpiration into the onsite vegetation. Therefore, the use of the drip system will help mitigate the increased wastewater flows during the dry months.

To further mitigate the potential impacts to the sea bluffs, the location of the leach fields have been moved to a more favorable location. The relocation increases the drainage area in which the groundwater flows and therefore distributes the seepage across a greater area. The existing leach fields drained to approximately 300 linear feet of sea bluff, where drainage is concentrated in a small area. The project increases the drainage area to about 1,000 linear feet of sea bluff, which distributes the water over a greater area, reducing the erosion that may impact bluff stability. Changing the drainage area will distribute the increased flows to decrease the overall seepage impacts by 683 cubic feet per linear foot of seepage throughout the year.

Tables 1 and 2 show the monthly flow of water through the 58-acre site under existing conditions (Table 1) and under proposed conditions brought about by the project (Table 2).

In conclusion, the results of the water balance analysis indicated that the proposed project will significantly reduce the amount of groundwater seepage occurring along the sea bluff and reduce the potential for erosion.

Thank you for this opportunity to address this issue. If you have any questions or require additional information, please contact me at (831) 426-9054.

Sincerely,

A handwritten signature in black ink, appearing to read "Peter Haase", is written over a horizontal line.

PETER HAASE, P.E.
Principal Engineer

Table 1. Monthly Water Balance Calculations for Existing Conditions

Month	In Storage on 1st of Month (cf)	Precipitation During Month (in)	Reference ET (in)	Surface Flow onto Site (cf)	GW flow onto Site (cf)	Waste Water to Trenches (gpd)	Waste Water to Drip Lines (gpd)	Surface Flow off of site (cf)	Water Lost to ET (cf)	GW Recharge From Rain (cf)	GW Discharge to Seeps (cf)	ft of Seeps (cft/ft)	In Storage at end of Month (cf)
October	505,296	2.41	2.2	75,935	30,000	4,000	0	193,740	416,869	400,847	11,250	38	524,067
November	524,067	5.04	1.18	158,802	31,114	4,000	0	393,306	223,593	838,286	11,668	39	1,174,249
December	1,174,249	6.16	0.73	194,092	69,716	4,000	0	492,590	138,325	1,024,572	26,144	87	2,120,111
January	2,120,111	8.07	1.02	254,273	125,873	4,000	0	658,277	193,276	1,342,256	47,203	157	3,363,805
February	3,363,805	5.96	1.32	187,790	199,713	4,000	0	526,194	250,122	991,307	74,892	250	4,245,853
March	4,245,853	5.17	2.2	162,898	252,081	4,000	0	486,012	416,869	859,909	94,530	315	4,862,486
April	4,862,486	2.57	2.95	0	288,691	4,000	0	108,259	558,984	427,459	108,259	361	4,927,437
May	4,927,437	1	3.54	0	292,548	4,000	0	109,705	299,191	166,327	109,705	366	4,993,457
June	4,993,457	0.39	4.13	0	296,467	4,000	0	111,175	185,075	64,867	111,175	371	5,074,584
July	5,074,584	0.1	4.27	0	301,284	4,000	0	112,981	131,930	16,633	112,981	377	5,163,632
August	5,163,632	0.26	4.27	0	306,571	4,000	0	114,964	164,230	43,245	114,964	383	5,250,296
September	5,250,296	0.57	3.54	0	311,716	4,000	0	116,894	224,901	94,806	116,894	390	5,331,067

Table 2. Monthly Water Balance Calculations for Project Conditions

Month	In Storage on 1st of Month (cf)	Precipitation During Month (in)	Reference ET (in)	Surface Flow onto Site (cf)	GW flow onto Site (cf)	Waste Water to Trenches (gpd)	Waste Water to Drip Lines (gpd)	Surface Flow off of site (cf)	Water Lost to ET (cf)	GW Recharge From Rain (cf)	GW Discharge to Seeps (cf)	GW Discharge/Linear ft of Seeps (cf/ft)	In Storage at end of Month (cf)
October	505,296	2.41	2.2	75,935	30,000	0	9,594	219,990	416,869	400,847	37,500	38	520,252
November	520,252	5.04	1.18	158,802	30,888	9,594	0	420,248	223,593	838,286	38,610	39	1,165,702
December	1,165,702	6.16	0.73	194,092	69,209	9,594	0	552,958	138,325	1,024,572	86,511	87	2,073,125
January	2,073,125	8.07	1.02	254,273	123,084	9,594	0	764,930	193,276	1,342,256	153,855	154	3,229,813
February	3,229,813	5.96	1.32	187,790	191,758	9,594	0	690,999	250,122	991,307	239,697	240	3,961,537
March	3,961,537	5.17	2.2	162,898	235,201	9,594	0	685,483	416,869	859,909	294,001	294	4,384,254
April	4,384,254	2.57	2.95	0	260,298	0	9,594	325,373	558,984	427,459	325,373	325	4,195,351
May	4,195,351	1	3.54	0	249,083	0	9,594	311,353	539,318	166,327	311,353	311	3,767,785
June	3,767,785	0.39	4.13	0	223,698	0	9,594	279,622	392,000	64,867	279,622	280	3,392,423
July	3,392,423	0.1	4.27	0	201,412	0	9,594	251,765	309,192	16,633	251,765	252	3,057,206
August	3,057,206	0.26	4.27	0	181,510	0	9,594	226,887	314,632	43,245	226,887	227	2,748,137
September	2,748,137	0.57	3.54	0	163,160	0	9,594	203,950	350,436	94,806	203,950	204	2,459,413