

April 6, 2009

Mr. Paul Nielsen  
Tahoe Regional Planning Agency  
P.O. Box 5310  
Stateline, NV 89449

Re: Boulder Bay – BMP Calculations

Dear Mr. Nielsen:

Contained herein are the BMP infiltration requirements and calculations for the above project. The impervious areas for the site are broken into eight main areas with respect to the BMP improvement(s) that infiltrate the runoff generated by that area. These areas are referred to as follows:

1. Park: The trails in the park drain to infiltration trenches located adjacent to the trails.
2. Infiltration Galleries 2 and 3: The onsite roof areas of Buildings A (1-4) and B, the ADA ramp to the park and the driveway entrance to Building A (Wellness Way) drain to Infiltration Galleries 2 and 3 located adjacent to Building A. The roof drain system has downspouts that enter a storm sewer system, and the ADA ramp and driveway entrance drain to catch basins. These collection points drain via storm sewer to Infiltration Galleries 2 and 3. In addition to these areas within the project area, runoff from Lakeview Ave. and Wassau Rd. will be infiltrated in Galleries 2 and 3.
3. Infiltration Gallery 4: The onsite roof areas of Building C and its porte-cochere as well as the area of Boulder Way from the HWY 28 entrance to the porte-cochere drain to Infiltration Gallery 4, which is located adjacent to Building C. The roof drain system has downspouts that enter a storm sewer system. Boulder Way and its entrance drain to catch basins. These collection points drain via storm sewer to Infiltration Gallery 4.
4. Infiltration Galleries 5-7: The onsite roof area of Building G, as well as the entrance and patio on the eastern side of Building G, drain to the three proposed Infiltration Galleries (5, 6 and 7) located adjacent to the building. The roof drain

system has downspouts that enter a storm sewer system, which drain to the two infiltration galleries.

5. Southwest Corner: The onsite roof areas of Buildings D, E, F and H, the pool/patio areas between Buildings D and F and F and G, the entrances to Building D off Stateline Rd. and Boulder Way from Stateline Rd. to the porte-cochere at Building C drain to Detention Basins 1 and 2 and Infiltration Gallery 8, which are located at the southwest corner of the project site. The roof and patio/pool drain systems have downspouts that enter a storm sewer system. Boulder Way and its entrance drain to catch basins. These collection points drain via storm sewer to the detention basins.
6. Infiltration Gallery 9: Runoff from Stateline Rd. (Washoe County) and Highway 28 (NDOT) drains to the proposed infiltration gallery located at the vacant lot on the California side of Stateline Rd. between Calaneva and Crystal Drives. Runoff from Highway 28 and Stateline Rd. is collected in catch basins and conveyed to the California site via storm sewer across Highway 28 to the infiltration gallery.
7. Crystal Bay Hotel: Runoff from Highway 28 (NDOT), as well as runoff from the roofs, walkways and parking lot on the Crystal Bay Hotel site, drains to the existing Detention Basin 3 located to the south of the Crystal Bay Hotel. Highway 28 runoff is collected in catch basins and conveyed to the detention basin via storm sewer across HWY 28 to the hotel site.
8. Nugget Parking Lot: Runoff from the Nugget Parking Lot drains to the proposed Detention Basin 4 and Infiltration Gallery 10 located to the south of the Crystal Bay Hotel. Runoff from the parking lot is collected in a catch basin and conveyed to the detention basin via storm pipe and rock-lined ditch.
9. Infiltration Trenches: The walkways on the west side of Building A and highway side of Buildings C, G and H drain to infiltration trenches located adjacent to the walkways.

TRPA requires that BMP improvements be sized to infiltrate the runoff generated by the upstream impervious areas for a 20yr 1hr storm, which is estimated at 1 inch of rainfall over the impervious area. Boulder Bay intends to infiltrate the runoff generated by the upstream impervious areas for a 50yr 1hr storm. The NOAA Atlas 14 Point Precipitation Frequency Estimates value of 1.25 inches for the 50yr 1hr storm is used as an estimate for the 50yr 1hr storm. The comparison of the runoff generated to the infiltration capacity is provided below for each area.

1. Park: The enclosed calculations show that the trenches along the edges of the paths in the park have a combined capacity of 774 CF, which is greater than the 469 CF of cumulative runoff generated by the 50yr 1hr storm from the paths.
2. Infiltration Galleries 2 and 3: Infiltration Galleries 2 and 3 are designed linearly; Gallery 2 is connected to Gallery 3 by an overflow pipe. The enclosed calculations show that these galleries have a combined capacity of 10,887 CF,

which is greater than the 7,806 CF of cumulative runoff generated by the 50yr 1hr storm from the contributing areas. Runoff from these contributing areas within the Project Area boundaries will be treated mechanically with the use of treatment vaults prior to entering the infiltration galleries. A proposed mechanical treatment vault within the County ROW will treat runoff from the contributing areas outside the project boundaries – portions of Lakeview Ave and Wassau Rd.

3. Infiltration Gallery 4: The enclosed calculations show that Infiltration Gallery 4 has a capacity of 5,037 CF, which is greater than the 4,736 CF of runoff generated by the 50yr 1hr storm from the roof and paved areas. Runoff from these contributing areas will be treated with the use of bio-retention treatment units.
4. Infiltration Galleries 5-7: Infiltration Galleries 5, 6 and 7 are designed linearly; Gallery 5 connects to Gallery 6, and Gallery 6 connects to Gallery 7 with storm drains. In addition, Gallery 7 is connected to Detention Basins 3 and 4 at the Crystal Bay Hotel site by storm drain. The enclosed calculations show that Galleries 5, 6 and 7 have a combined capacity of 2,561 CF, which is greater than the 1,817 CF of cumulative runoff generated by the 50yr 1hr storm from the contributing areas. Runoff from these contributing areas will be treated mechanically with the use of treatment vaults prior to the infiltration galleries.
5. Detention Basins 1 and 2, Infiltration Gallery 8: Detention Basins 1 and 2 and Infiltration Gallery 8 are designed linearly. Basin 2 overflows to Basin 1, and Basin 1 overflows into Infiltration Gallery 8. In addition, any possible overflow from Gallery 8 is connected in series to Infiltration Gallery 9, located at the California Site. The enclosed calculations show that these Basins and Gallery have a combined capacity of 16,082 CF, which is greater than the 15,938 CF of cumulative runoff generated by the 50yr 1hr storm from the contributing areas. Runoff from Boulder Way and the proposed adjacent buildings will be treated with the use of bio-retention treatment units, while the remainder of the runoff from within the Project Area is treated mechanically with the use of treatment vaults prior to the infiltration galleries and detention basin. Runoff from County ROW shall be treated with a proposed mechanical treatment vault.
6. Infiltration Gallery 9: The enclosed calculations show that Infiltration Gallery 9 has a capacity of 14,248 CF, which is greater than the 10,646 CF of runoff generated by the 50yr 1hr storm from the contributing area. Runoff from the NDOT portion of this area will continue to be treated by the existing treatment vault located at the corner of Highway 28 and Stateline Road. Runoff from the Washoe County portion of this area (Stateline Road) will be treated with the use of a new treatment vault.
7. Detention Basin 3: The enclosed calculations show that Detention Basin 3 has a capacity of 3,954 CF, which is greater than the 3,492 CF of runoff generated by the 50yr 1hr storm from the contributing areas. In addition, Detention Basin 3 is

connected in series to Detention Basin 4, located downstream of Detention Basin 3 on the Crystal Bay Hotel Site.

8. Detention Basin 4 and Infiltration Gallery 10: Detention Basin 3 and Infiltration Gallery 10 are designed linearly so that overflow from Basin 4 flows via storm pipe to Gallery 10. The enclosed calculations show that Detention Basin 3 and Infiltration Gallery 10 have a combined capacity of 2,082 CF, which is greater than the 2,042 CF of runoff generated by the 50yr 1hr storm.
9. Infiltration Trenches: The enclosed calculations show that the trenches have a combined capacity of 2,527 CF, which is greater than the 2,118 CF of cumulative runoff generated by the 50yr 1hr storm from the walkways.

The above comparison shows that each of the areas has sufficient infiltration capacity to capture, detain and infiltrate the 50yr 1hr storm. In addition, the galleries are designed linearly so that if it occurs that an upstream gallery is clogged or over-burdened, the additional capacity in the downstream galleries will absorb some of the overflow.

Please note that these calculations only take into account capacities of the proposed infiltration galleries, detention basins and infiltration trenches. The above comparison does not take into account other BMP's, such as pervious pavement, green roofs and street sweeping, that cannot be quantified at this time due to uncertainties in final design and structural requirements. It is estimated that at a minimum 30% of the proposed paving on site will be constructed pervious pavement. Also, green roofs are proposed for Buildings G and H. The addition of these elements in the final BMP design will only increase the overall treatment capacity of the BMP design.

Please let me know if you need any additional information.

Sincerely,

Brian McRae P.E.  
Project Manager

Enclosures:  
BMP Calculations

**Boulder Bay LLC**  
**Boulder Bay**  
**BMP Contributing Areas**  
**April 6, 2009**

**Buildings A and B (Gallery 2)**

Contributing Areas (SF)	15,167	Building A
	21,151	Building B
	1,688	ADA Ramp at Park Entrance
	19,833	Lakeview and Wassau (Washoe County)
Total Contributing Area (SF)	57,839	

**North Entrance (Gallery 3)**

Contributing Areas (SF)	17,095	Entrance and Wellness Drive
Total Contributing Area (SF)	17,095	

**Building C (Gallery 4)**

Contributing Areas (SF)	37,520	Building C
	972	Porte Cochere
	6,970	North Portion of Boulder Way
Total Contributing Area (SF)	45,462	

**Building G (Infiltration Galleries 5, 6 & 7)**

Contributing Areas (SF)	17,280	Building G
	162	Building G Patio
Total Contributing Area (SF)	17,442	

**Crystal Bay Motel (Basin 3)**

Contributing Areas (SF)	18,868	Hwy 28 (NDOT)
	14,654	Crystal Bay Motel Site
Total Contributing Area (SF)	33,522	

**Nugget Parking Lot (Basin 4 and Gallery 10)**

Contributing Areas (SF)	18,158	Nugget Parking Lot
	1,443	Entrance to Nugget Parking Lot
Total Contributing Area (SF)	19,601	

**Boulder Bay LLC  
 Boulder Bay  
 BMP Contributing Areas  
 April 6, 2009**

**Southwest Project Site (Basins in southwest corner)**

Contributing Areas (SF)	25,175	Building D
	18,012	Building E
	12,679	Building F
	21,484	Building H
	14,489	Interior Road Portion
	25,113	Interior Road Portion
	24,638	Patio between Bldgs D&F
	9,594	Patio below Building F
	356	Driveway Entrance to Building D
	1,467	Building H Patio
Total Contributing Area (SF)	153,007	

**Infiltration Trench 1 (Behind Bldg A)**

Contributing Areas (SF)	3,318	Path behind Bldg A
Total Contributing Area (SF)	3,318	

**Infiltration Trench 2 (In front of Bldg C & G)**

Contributing Areas (SF)	8,646	Sidewalk in front of Bldg C & G
	271	Entrance Walkway to Bldg G
Total Contributing Area (SF)	8,917	

**Infiltration Trench 3 (In Front of Bldg H)**

Contributing Areas (SF)	4,258	Sidewalk in front of Bldg H
Total Contributing Area (SF)	4,258	

**Infiltration Trench 4 (Southwest Corner of Site)**

Contributing Areas (SF)	3,835	Sidewalk at southwest corner of site
Total Contributing Area (SF)	3,835	

**Infiltration Trench 5 (Park - Trails)**

Contributing Areas (SF)	4,498	Park - Trails and Ammenities
Total Contributing Area (SF)	4,498	

**Gallery 8 (California Site)**

Contributing Areas (SF)		NDOT Contribution from Brockway Existing
	54,450	Conditions Analysis by Placer County
	32,386	Washoe County above 28
	15,363	Washoe County below 28
Total Contributing Area (SF)	102,199	

**Boulder Bay LLC**  
**Boulder Bay**  
**Infiltration Gallery Capacity Calculations**  
**April 6, 2009**

**Infiltration Gallery Capacity Calculations**

<b>Gallery #</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
Length, L (ft)	90.00	36.00	60.00	30.00	30.00	21.00	66.00	99.00	18.00
Width, W (ft)	21.00	18.00	18.00	10.50	10.50	7.50	42.00	45.00	6.00
Depth of Gravel, H (ft)	4.50	3.00	4.50	3.00	3.00	3.00	3.00	3.00	3.00
Void Ratio	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Storage Capacity (CF)	8,080	1,847	4,617	898	898	449	7,900	12,697	308
Infiltration Capacity (CF)	720	240	420	125	125	67	968	1,551	48
<b>Total Capacity (CF)</b>	<b>8,800</b>	<b>2,087</b>	<b>5,037</b>	<b>1,023</b>	<b>1,023</b>	<b>515</b>	<b>8,868</b>	<b>14,248</b>	<b>356</b>

Notes:

- Gallery dimensions based on StormTank unit dimensions.
- StormTank literature quotes a Void Ratio of 0.97. 0.95 is used in the calculations to be conservative.

**Boulder Bay LLC**  
**Boulder Bay**  
**Infiltration Gallery Summary**  
**April 6, 2009**

**20Yr - 1Hr Storm Calculations**

Gallery #	2*	3*	4	5**	6**	7**	8***	9***	10****
Total Contributing Area (SF)	57,839	17,095	45,462	17,442	0	0	0	102,199	0
20-Yr Storm Volume (CF)	4,820	1,425	3,789	1,454	0	0	0	8,517	0
Overflow Volume from upstream Gallery (CF)	0	0	0	0	431	0	5,537		-93
Volume to Gallery (CF)	4,820	1,425	3,789	1,454	431	0	5,537	8,517	-93
Gallery Capacity (CF)	8,800	2,087	5,037	1,023	1,023	515	8,868	14,248	356
Enough Capacity (20yr)?	YES	YES	YES	NO	YES	YES	YES	YES	YES

**50Yr - 1Hr Storm Calculations**

Gallery	2*	3*	4	5**	6**	7**	8***	9***	10****
Total Contributing Area (SF)	57,839	17,095	45,462	17,442	0	0	0	102,199	0
50yr/1hr accumulation (in)*****	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
50-Yr Storm Volume (CF)	6025	1781	4736	1817	0	0	0	10646	0
Overflow from upstream Basin (CF)	0	0	0	0	794	0	8,724	0	316
Volume to Gallery (CF)	6,025	1,781	4,736	1,817	794	0	8,724	10,646	316
Gallery Capacity (CF)	8,800	2,087	5,037	1,023	1,023	515	8,868	14,248	356
Enough Capacity?	YES	YES	YES	NO	YES	YES	YES	YES	YES
Difference	2,775	306	301	-794	229	515	144	3,602	40
% 50-yr Contained	146%	117%	106%	56%	113%	141%	101%	134%	102%

\* Gallery 2 overflows to Gallery 3

\*\* Gallery 5 overflows to Gallery 6, and Gallery 6 overflows to Gallery 7

\*\*\* Overflow from detention basins 1 and 2 reach Gallery #8, located beneath basin #1. Overflow from Gallery #8 reaches Gallery #9 at the California

\*\*\*\* Overflow from detention basin 4 reaches Gallery #10.

\*\*\*\*\* 50yr/1hr storm accumulation value taken from NOAA Point Precipitation Frequency Estimates



**Boulder Bay LLC  
Boulder Bay  
Detention Basin Summary  
April 6, 2009**

**20Yr - 1Hr Storm Calculations**

Basin	1	2	Onsite Basins (1-2)*	Gallery #8 (Under Basin 1)*	3** (Crystal Bay Motel)	4*** (Crystal Bay Motel)
Total Contributing Area (SF)	153,007		153,007	0	33,522	19,601
20-Yr Storm Volume (CF)	12,751		12,751	0	2,794	1,633
Overflow Volume from upstream Basin (CF)			0	5,537	0	0
Volume to Basin (CF)			12,751	5,537	2,794	1,633
Basin Capacity (CF)	6,336	878	7,214	8,868	3,954	1,726
Enough Capacity?			NO	YES	YES	YES

**50Yr - 1Hr Storm Calculations**

Basin	1	2	Onsite Basins (1-2)*	Gallery #8 (Under Basin 1)*	3** (Crystal Bay Motel)	4*** (Crystal Bay Motel)
Total Contributing Area (SF)	153,007	0	153,007	0	33,522	19,601
50yr/1hr Storm Accumulation (in)****	1.25	1.25	1.25	1.25	1.25	1.25
50yr/1hr Storm Volume (CF)	15,938	0	15,938	0	3,492	2,042
Overflow from Upstream Basin/Gallery			0	8,724		
Volume to Basin			15,938	8,724	3,492	2,042
Basin Capacity	6,336	878	7,214	8,868	3,954	1,726
Enough Capacity?			NO	YES	YES	NO***
Difference			-8,724	144	462	-316
% 50yr Contained			45%	101%	113%	85%

\* Basin 2 overflows to Basin 1; Basin 1 overflows to Gallery #8 (below Basin 1)

\*\* Basin 3 overflows to Basin 4

\*\*\* Basin 4 overflows to Gallery 10

\*\*\*\* 50yr/1hr storm accumulation value taken from NOAA Point Precipitation Frequency Estimates

**Boulder Bay LLC**  
**Boulder Bay**  
**Infiltration Trench Summary**  
**April 6, 2009**

**Trench Capacity Calcs**

Trench Areas	1	2	3	4	5
Length	515	570	154	145	810
Width	12	18	24	24	12
Excavation Depth (in.)	18	18	27	27	12
Ksat (in/hr)	4	4	4	4	4
Void Ratio	0.4	0.4	0.4	0.4	0.4
Volume (CY)	28.6	47.5	25.7	24.2	30.0
Capacity	652	988	457	430	774

**20Yr - 1Hr Storm Calculations**

Trench Areas	1	2	3	4	5
Contributing Areas (SF)	3,318	8,917	4,258	3,835	4,498
20-Yr Storm Volume (CF)	277	743	355	320	375
Trench Capacity (CF)	652	988	457	430	774
Enough Capacity (20-yr)?	YES	YES	YES	YES	YES

**50Yr - 1Hr Storm Calculations**

Trench Areas	1	2	3	4	5
Contributing Areas (SF)	3,318	8,917	4,258	3,835	4,498
50yr/1hr accumulation (in)*	1.25	1.25	1.25	1.25	1.25
50-Yr Storm Volume (CF)	346	929	444	399	469
Trench Capacity (CF)	652	988	457	430	774
Enough Capacity (20-yr)?	YES	YES	YES	YES	YES

\* 50yr/1hr storm accumulation value taken from NOAA Point Precipitation Frequency Estimates

**Boulder Bay LLC**  
**Boulder Bay**  
**BMP Contributing Areas - With TMDL Reduction Implementations**  
**April 6, 2009**

**Buildings A and B (Gallery 2)**

Contributing Areas (SF)	12,979	Building A	Reduced by 2,188 SF for green roofs.
	0	Building B	Reduced by 21,151 SF for storm water catchment.
	938	ADA Ramp at Park Entrance	Reduced by 750 SF for pervious pavers.
	19,833	Lakeview and Wassau (Washoe County)	
Total Contributing Area (SF)	33,750		

**North Entrance (Gallery 3)**

Contributing Areas (SF)	1,108	Entrance and Wellness Drive	Reduced by 15,987 SF for pervious pavers.
Total Contributing Area (SF)	1,108		

50yr/1hr Storm Accumulation (in)\*\*\*\*

**Building C (Gallery 4)**

Contributing Areas (SF)	21,533	Building C	Reduced by 15,987 SF for storm water catchment.
	972	Porte Cochere	
	1,614	North Portion of Boulder Way	Reduced by 5,356 SF for pervious pavers.
Total Contributing Area (SF)	24,119		

**Building G (Infiltration Galleries 5, 6 & 7)**

Contributing Areas (SF)	0	Building G	Reduced by 17,280 SF for green roofs.
	162	Building G Patio	
Total Contributing Area (SF)	162		

**Crystal Bay Motel (Basin 3)**

Contributing Areas (SF)	18,868	Hwy 28 (NDOT)	
	14,654	Crystal Bay Motel Site	
Total Contributing Area (SF)	33,522		

100yr/1hr Storm Accumulation (in)\*\*\*\*

**Nugget Parking Lot (Basin 4 and Gallery 10)**

Contributing Areas (SF)	18,158	Nugget Parking Lot	
	1,443	Entrance to Nugget Parking Lot	
Total Contributing Area (SF)	19,601		

**Southwest Project Site (Basins in southwest corner)**

Contributing Areas (SF)	7,486	Building D	Reduced by 17,689 SF for storm water catchment.
	11,556	Building E	Reduced by 6,456 SF for storm water catchment.
	12,679	Building F	
	6,317	Building H	Reduced by 15,167 SF for green roofs.
	6,061	Interior Road Portion	Reduced by 8,428 SF for pervious pavers.
	12,599	Interior Road Portion	Reduced by 12,514 SF for pervious pavers.
	24,638	Patio between Bldgs D&F	
	9,594	Patio below Building F	
	0	Driveway Entrance to Building D	Reduced by 356 SF for pervious pavers.
1,467	Building H Patio		

**Boulder Bay LLC**  
**Boulder Bay**  
**BMP Contributing Areas - With TMDL Reduction Implementations**  
**April 6, 2009**

Total Contributing Area (SF)	92,397		
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**Infiltration Trench 1 (Behind Bldg A)**

Contributing Areas (SF)	0	Path behind Bldg A	Reduced by 3,318 SF for pervious pavers.
Total Contributing Area (SF)	0		

**Infiltration Trench 2 (In front of Bldg C & G)**

Contributing Areas (SF)	3,580	Sidewalk in front of Bldg C & G	Reduced by 5,066 SF for pervious pavers.
	271	Entrance Walkway to Bldg G	
Total Contributing Area (SF)	3,851		

**Infiltration Trench 3 (In Front of Bldg H)**

Contributing Areas (SF)	1,737	Sidewalk in front of Bldg H	Reduced by 2,521 SF for pervious pavers.
Total Contributing Area (SF)	1,737		

**Infiltration Trench 4 (Southwest Corner of Site)**

Contributing Areas (SF)	574	Sidewalk at southwest corner of site	Reduced by 3,261 SF for pervious pavers.
Total Contributing Area (SF)	574		

**Infiltration Trench 5 (Park - Trails)**

Contributing Areas (SF)	4,498	Park - Trails and Ammenities	
Total Contributing Area (SF)	4,498		

**Gallery 8 (California Site)**

Contributing Areas (SF)		NDOT Contribution from Brockway Existing Conditions Analysis by Placer County	
	54,450		
	32,386	Washoe County above 28	
	15,363	Washoe County below 28	
Total Contributing Area (SF)	102,199		

**Boulder Bay LLC**  
**Boulder Bay**  
**Infiltration Gallery Capacity Calculations**  
**April 6, 2009**

**Infiltration Gallery Capacity Calculations**

<b>Gallery #</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
Length, L (ft)	90.00	36.00	60.00	30.00	30.00	21.00	66.00	99.00	18.00
Width, W (ft)	21.00	18.00	18.00	10.50	10.50	7.50	42.00	45.00	6.00
Depth of Gravel, H (ft)	4.50	3.00	4.50	3.00	3.00	3.00	3.00	3.00	3.00
Void Ratio	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Storage Capacity (CF)	8,080	1,847	4,617	898	898	449	7,900	12,697	308
Infiltration Capacity (CF)	720	240	420	125	125	67	968	1,551	48
<b>Total Capacity (CF)</b>	<b>8,800</b>	<b>2,087</b>	<b>5,037</b>	<b>1,023</b>	<b>1,023</b>	<b>515</b>	<b>8,868</b>	<b>14,248</b>	<b>356</b>

Notes:

- Gallery dimensions based on StormTank unit dimensions.
- StormTank literature quotes a Void Ratio of 0.97. 0.95 is used in the calculations to be conservative.

**Boulder Bay LLC  
Boulder Bay  
Infiltration Gallery Summary - With TMDL Reduction Implementations  
April 6, 2009**

**20Yr - 1Hr Storm Calculations**

Gallery #	2*	3*	4	5**	6**	7**	8***	9***	10****
Total Contributing Area (SF)	33,750	1,108	24,119	162	0	0		102,199	0
20-Yr Storm Volume (CF)	2,813	92	2,010	14	0	0	0	8,517	0
Overflow Volume from upstream Gallery (CF)	0	0	0	0	0	0	486		0
Volume to Gallery (CF)	2,813	92	2,010	14	0	0	486	8,517	0
Gallery Capacity (CF)	8,800	2,087	5,037	1,023	1,023	515	8,868	14,248	356
Enough Capacity (20yr)?	YES	YES	YES	YES	YES	YES	YES	YES	YES

**50Yr - 1Hr Storm Calculations**

Gallery	2*	3*	4	5**	6**	7**	8***	9***	10****
Total Contributing Area (SF)	33,750	1,108	24,119	162	0	0	0	102,199	0
50yr/1hr Storm Accumulation (in)****	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
50-Yr Storm Volume (CF)	3516	115	2512	17	0	0	0	10646	0
Overflow from upstream Basin (CF)	0	0	0	0	0	0	2,411	0	316
Volume to Gallery (CF)	3,516	115	2,512	17	0	0	2,411	10,646	316
Gallery Capacity (CF)	8,800	2,087	5,037	1,023	1,023	515	8,868	14,248	356
Enough Capacity?	YES	YES	YES	YES	YES	YES	YES	YES	YES
Difference	5,284	1,971	2,525	1,006	1,023	515	6,458	3,602	40
% 50-yr Contained	250%	1808%	200%	6061%	12121%	15176%	167%	134%	102%

\* Gallery 2 overflows to Gallery 3

\*\* Gallery 5 overflows to Gallery 6, and Gallery 6 overflows to Gallery 7

\*\*\* Overflow from detention basins 1 and 2 reach Gallery #8, located beneath basin #1. Overflow from Gallery #8 reaches Gallery #9 at the California

\*\*\*\* 50yr/1hr storm accumulation value taken from NOAA Point Precipitation Frequency Estimates

**100Yr - 1Hr Storm Calculations**

Gallery	2*	3*	4	5**	6**	7**	8***	9***	10****
Total Contributing Area (SF)	33,750	1,108	24,119	162	0	0	0	102,199	0
100yr/1hr accumulation (in)****	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55
100-Yr Storm Volume (CF)	4359	143	3115	21	0	0	0	13201	0
Overflow from upstream Basin (CF)	0	0	0	0	0	0	4,721	0	1,182
Volume to Gallery (CF)	4,359	143	3,115	21	0	0	4,721	13,201	1,182
Gallery Capacity (CF)	8,800	2,087	5,037	1,023	1,023	515	8,868	14,248	356
Enough Capacity?	YES	YES	YES	YES	YES	YES	YES	YES	NO
Difference	4,440	1,944	1,922	1,002	1,023	515	4,148	1,047	-826
% 100-yr Contained	202%	1458%	162%	4888%	9775%	12238%	135%	108%	

100yr/1hr Storm Accumulation (in)\*\*\*\*

**Boulder Bay LLC**  
**Boulder Bay**  
**Detention Basin Summary - With TMDL Reduction Implementations**  
**April 6, 2009**

**20Yr - 1Hr Storm Calculations**

Basin	1	2	Onsite Basins (1-2)*	Gallery #8 (Under Basin 1)*	3** (Crystal Bay Motel)	4*** (Crystal Bay Motel)
Total Contributing Area (SF)	92,397		92,397	0	33,522	19,601
20-Yr Storm Volume (CF)	7,700		7,700	0	2,794	1,633
Overflow Volume from upstream Basin (CF)			0	486	0	0
Volume to Basin (CF)			7,700	486	2,794	1,633
Basin Capacity (CF)	6,336	878	7,214	8,868	3,954	1,726
Enough Capacity?			NO	YES	YES	YES

**50Yr - 1Hr Storm Calculations**

Basin	1	2	Onsite Basins (1-2)*	Gallery #8 (Under Basin 1)*	3** (Crystal Bay Motel)	4*** (Crystal Bay Motel)
Total Contributing Area (SF)	92,397	0	92,397	0	33,522	19,601
50yr/1hr Storm Accumulation (in)****	1.25	1.25	1.25	1.25	1.25	1.25
50yr/1hr Storm Volume (CF)	9,625	0	9,625	0	3,492	2,042
Overflow from Upstream Basin/Gallery			0	2,411	0	0
Volume to Basin			9,625	2,411	3,492	2,042
Basin Capacity	6,336	878	7,214	8,868	3,954	1,726
Enough Capacity?			NO	YES	YES	NO***
Difference			-2,411	6,458	462	-316
% 50yr Contained			75%	167%	113%	85%

\* Basin 2 overflows to Basin 1; Basin 1 overflows to Gallery #8 (below Basin 1)

\*\* Basin 3 overflows to Basin 4

\*\*\* Basin 4 overflows to Gallery 10

\*\*\*\* 50yr/1hr storm accumulation value taken from NOAA Point Precipitation Frequency Estimates

**100Yr - 1Hr Storm Calculations**

Basin	1	2	Onsite Basins (1-2)*	Gallery #8 (Under Basin 1)*	3** (Crystal Bay Motel)	4*** (Crystal Bay Motel)
Total Contributing Area (SF)	92,397	0	92,397	0	33,522	19,601
100yr/1hr Storm Accumulation (in)****	1.55	1.55	1.55	1.55	1.55	1.55
100yr/1hr Storm Volume (CF)	11,935	0	11,935	0	4,330	2,532
Overflow from Upstream Basin/Gallery	0		0	4,721		376
Volume to Basin			11,935	4,721	4,330	2,908
Basin Capacity	6,336	878	7,214	8,868	3,954	1,726
Enough Capacity?			NO	YES	NO	NO**
Difference			-4,721	4,148	-376	-1,182
% 100yr Contained			60%	135%	91%	59%



**Boulder Bay LLC**  
**Boulder Bay**  
**Infiltration Trench Summary - With TMDL Reduction Implementations**  
**April 6, 2009**

**Trench Capacity Calcs**

Trench Areas	1	2	3	4	5
Length	515	570	154	145	810
Width	12	18	24	24	12
Excavation Depth (in.)	18	18	27	27	12
Ksat (in/hr)	4	4	4	4	4
Void Ratio	0.4	0.4	0.4	0.4	0.4
Volume (CY)	28.6	47.5	25.7	24.2	30.0
Capacity	652	988	457	430	774

50yr/1hr Storm Accumulation (in)\*\*\*\*

Trench Areas	1	2	3	4	5
Contributing Areas (SF)	0	3,851	1,737	574	4,498
20-Yr Storm Volume (CF)	0	321	145	48	375
Trench Capacity (CF)	652	988	457	430	774
Enough Capacity (20-yr)?	YES	YES	YES	YES	YES

**50Yr - 1Hr Storm Calculations**

Trench Areas	1	2	3	4	5
Contributing Areas (SF)	0	3,851	1,737	574	4,498
50yr/1hr accumulation (in)*	1.25	1.25	1.25	1.25	1.25
50-Yr Storm Volume (CF)	0	401	181	60	469
Trench Capacity (CF)	652	988	457	430	774
Enough Capacity (50-yr)?	YES	YES	YES	YES	YES

\* 50yr/1hr storm accumulation value taken from NOAA Point Precipitation Frequency Estimates

100yr/1hr Storm Accumulation (in)\*\*\*\*

Trench Areas	1	2	3	4	5
Contributing Areas (SF)	0	3,851	1,737	574	4,498
100yr/1hr accumulation (in)*	1.55	1.55	1.55	1.55	1.55
100-Yr Storm Volume (CF)	0	497	224	74	581
Trench Capacity (CF)	652	988	457	430	774
Enough Capacity (100-yr)?	YES	YES	YES	YES	YES