APPENDIX F

APPENDIX F

Schaaf & Wheeler:

- Letter – Lexington Quarry Stilling Basin Sizing, April 23, 2002
- Letter - Riser Pipe Sizing, May 28, 2002
- Letter - Design Discharge Estimates, May 28, 2002

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April 23, 2002

APPENDIX F

HYDROLOGY REPORT

Mr. Mike Sheehy
Ruth & Going, Inc.
The Alameda
Santa Clara, CA 95050

Re: Lexington Quarry Stilling Basin Sizing

Dear Mr. Sheehy:

Schaaf & Wheeler has completed their analysis of three stilling basins for the Lexington Quarry. The results of our analysis including the proposed size of the three basins, the size of the particles to be settled in the basins, and the residence time required for the particles to settle out have been included in this memorandum.

The first part of our analysis was to estimate a sediment load that the basins would have to accommodate based on average sediment yield rates for the area with adjustments being made for loss of canopy and ground cover, estimates of the maximum expected annual discharge of sediment, and a factor of safety. The average sediment yield rates were taken from a 1974 Soils Conservation Service publication, "Erosion, Sediment, and Related Salt Problems and Treatment Opportunities: Special Projects Division." The average rate of 0.2 ac-ft/sq. mi./yr. was doubled for the active mining side to account for the presence of piles of material observed during a recent site visit. These piles of material would be subject to erosion and could therefore contribute sediment loading to Basin 1. The results of our basin sizing efforts are shown below:

Basin 1 - Active Mining on East Side

Drainage area contributing sediment	=	22.7 acres = .0355 sq. mi.
Average sediment yield rate	=	0.4 ac-ft/sq. mi./yr
(0.4) * (15, years of avg. sediment yield in one year)	=	6.0 ac-ft/sq. mi.
(6.0 ac-ft/sq. mi) * (.0355 sq. mi.)	=	0.213 ac-ft
(0.213 ac-ft) * (10, adj. for no canopy or ground cover)	=	2.13 ac-ft
(2.13 ac-ft) * (1.2, factor of safety)	**=**	**2.6 ac-ft**

Total Volume of Basin 1, per Ruth & Going grading	=	3.44 ac-ft
Approx. Dimensions of Basin 1 (L X W X H)	=	**170' X 60' X 15'**

Basin 2 - Inactive Hillside on West Side

Drainage area contributing sediment	=	17.8 acres = .0278 sq. mi.
Average sediment yield rate	=	0.2 ac-ft/sq. mi/yr
(0.2) * (15, years of avg. sediment yield in one year)	=	3.0 ac-ft/sq. mi.
(3.0 ac-ft/sq. mi) * (.0278 sq. mi.)	=	0.083 ac-ft
(0.083 ac-ft) * (10, adj. for no canopy or ground cover)	=	0.83 ac-ft
(0.83 ac-ft) * (1.2, factor of safety)	=	**1.0 ac-ft**
Total Volume of Basin 2 Ponds, per Ruth & Going	=	4.08 ac-ft

At the request of the client we have configured Basin 2 into a multi-cell pond, with the approximate dimensions of the most downstream pond (Cell 1) shown below. The total volume of the Basin 2 ponds is approximately 4 times greater than the volume required to store 15-years worth of sediment production, providing for an increased level of protection to be discussed later in this report. Please note that Cell 1 has been sized to provide the required residence time to settle out the 0.1 mm. particle size as discussed below.

Approx. Dimensions of Basin 2, Cell 1 (L X W X H) = 180' X 55' X 7'

Basin 3 - Knoll Active Hillside on East Side

Drainage area contributing sediment	=	1.7 acres = .0027 sq. mi.
Average sediment yield rate	=	0.4 ac-ft/sq. mi/yr
(0.4) * (15, years of avg. sediment yield in one year)	=	6.0 ac-ft/sq. mi.
(6.0 ac-ft/sq. mi) * (.0027 sq. mi.)	=	0.016 ac-ft
(0.016 ac-ft) * (10, adj. for no canopy or ground cover)	=	0.16 ac-ft
(0.16 ac-ft) * (1.2, factor of safety)	=	**0.2 ac-ft**
Total Volume of Basin 3, per Ruth & Going grading	=	0.5 ac-ft
Approx. Dimensions of Basin 1 (L X W X H)	=	**62.5' X 32.5' X 10'**

The second part of our analysis was to estimate the residence time in the basins required to settle out the 0.1 mm. particle size. A particle size of 0.1 mm. represents a trap efficiency of approximately 92 percent and 86 percent, respectively, for the active and inactive sides of the quarry. Stokes' Law was used to estimate the settling velocity of the 0.1 mm. particle size. Assuming a water temperature of 55 degrees Fahrenheit, a particle specific gravity of 2.6, and a particle size of 0.1 mm. resulted in a settling velocity of .024 ft/s.

The final part of our analysis was to determine whether there was adequate length in the proposed stilling basins to settle out the particles in the time required for the 100-year flow to pass through the basins. The 100-year flow was determined using the Rational Method with a C-value of 0.88, a time of concentration of 10 minutes, and a rainfall intensity of 4.3 inches per hour obtained from the Santa Clara County Drainage Manual.

The residence time in the basins was calculated as the time required for the 100-year discharge to pass through the basins assuming flow was going out of the basin at the same rate as it was entering the basins. The average velocity through the basins was determined by assuming that the basins were already half full of sediment and the cross-sectional area available for flow was the product of the basin width multiplied by half of the depth of the basin. The velocity was then taken to be the 100-year flow rate divided by the cross-sectional area. The settling time required for a particle diameter of 0.1 mm. Was determined for a settling depth of one-half the depth of the basin divided by the settling velocity calculated using Stokes' Law, 0.024 ft/s.

The results of this final part of the analysis are shown below:

Basin 1 - Active Mining on East Side

Drainage area contributing rainfall runoff	=	25.1 acres
Runoff Coefficient, C	=	0.88
Rainfall Intensity, i	=	4.3 in/hr
100-year runoff, Q_{100}	**=**	**95 cfs**
Basin area available for 100-year discharge	=	450 sq. ft.
Velocity through basin	=	0.21 ft/s*
Residence time in basin	**=**	**810 sec.**
Depth of settling in basin	=	7.5 ft.
Settling time in basin	**=**	**315 seconds**

Basin 2 - Inactive Hillside on West Side

Drainage area contributing rainfall runoff	=	22.0 acres

Runoff Coefficient, C	=	0.88
Rainfall Intensity, i	=	4.3 in/hr
100-year runoff, Q_{100}	=	85 cfs
Area of Basin 2, Cell 1 available for 100-year discharge	=	192.5 sq. ft.
Velocity through basin	=	0.44 ft/s
Residence time in basin	=	**410 sec.**
Depth of settling in basin	=	3.5 ft.
Settling time in basin	=	**150 seconds**

Basin 3 - Knoll Active Hillside on East Side

Drainage area contributing rainfall runoff	=	1.7 acres
Runoff Coefficient, C	=	0.88
Rainfall Intensity, i	=	4.3 in/hr
100-year runoff, Q_{100}	=	**6 cfs**
Basin area available for 100-year discharge	=	162.5 sq. ft.
Velocity through basin	=	0.037 ft/s
Residence time in basin	=	**1690 sec.**
Depth of settling in basin	=	5 ft.
Settling time in basin	=	**210 seconds**

The results of our analysis show that given the proposed stilling basin dimensions, the basins would provide adequate residence time to settle out the 0.1 mm. diameter particles of sediment while still conveying the 100-year discharge, even with the basin half-full of sediment.

Our analysis assumes that the ponds will outfall to Limekiln Creek through culverts with riser pipes installed in the ponds. In the case of Basin 2, the additional 3 cells upstream of Cell 1 should be connected by culverts with riser pipes. In addition, the Basins will be equipped with emergency spillways. In the unlikely event that one of the culverts becomes blocked, the pond(s) will overtop and the spill(s) will travel through the site, across the access road to Lexington Quarry, discharging directly into Limekiln Creek.

As previously mentioned, Basin 2 has been sized to be much larger than required to accommodate 15-years worth of sediment production. Based on our calculations, Basin 2 has capacity for over 40 years worth of sediment production assuming the reclamation planting efforts continue to provide an increased level of ground cover and canopy. Based on our field reconnaissance, it appears that the plantings have begun to establish themselves, particularly on top of each of the benches. The 40 plus years of sediment production capacity in the Basin 2 ponds also assumes the stilling basin currently upstream of the Basin 2 ponds is filled in and grading is performed to direct the runoff that currently drains into the stilling basin into the Basin 2 ponds. Assuming similar re-planting efforts on the active hillside currently being mined, upon reclamation, Basin 1, as currently configured, would also have capacity for over 40 years of sediment production and Basin 3 would have capacity for over 75 years of sediment production. In addition, Basin 1 could be enlarged after the mining efforts have concluded to provide additional capacity for an increased level of sediment production.

We appreciate the opportunity to provide this analysis for you. Please review our results and discuss the basin sizing parameters with your client to determine their feasibility. If you have any questions or need additional information, please do not hesitate to contact Jim Gessford at (206) 624-9932 or myself at (408) 246-4848.

Very truly yours,
SCHAAF & WHEELER

James R. Schaaf, PhD, PE

REGISTERED PROFESSIONAL ENGINEER
JAMES ROBERT SCHAAF
28234
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May 28, 2002

Mr. Mike Sheehy
Ruth & Going, Inc.
The Alameda
Santa Clara, CA 95050

Re: Lexington Quarry – Riser Pipe Sizing

Dear Mr. Sheehy:

Schaaf & Wheeler is pleased to respond to your request to provide design sizes for the riser pipes required to drain the proposed stilling basins for both the active and inactive sides of the Lexington Quarry. The pipe sizing is based on the riser inflow nomograph included with this correspondence.

The riser pipes for each of the stilling basins were sized to discharge the 100-year design discharge in each basin assuming 1.5 feet of head above the crest of the riser. The 100-year design discharges for each side of the Quarry were previously estimated by Schaaf & Wheeler and documented in our letter to you dated April 23, 2002. The design discharge estimates are 95 cfs, 85 cfs, and 6 cfs for the active mining side, inactive hillside, and the knoll on the upstream side of the active hillside, respectively.

Based on these design discharges and the riser inflow nomograph, the ponds on the active side would require a riser diameter of 72 inches. The ponds on the inactive side would require a riser diameter of 54 inches. The pond proposed to take the runoff from the knoll at the upstream end of the active hillside would require a riser diameter of 15 inches and a head above the crest of the weir of approximately one foot.

In addition to the riser inflow nomograph, we are also including several typical design details for use in designing the riser pipes to drain the proposed stilling basins. If you need additional design details or assistance in designing the riser pipe outfalls, please do not hesitate to contact either Jim Gessford me.

Very truly yours,
SCHAAF & WHEELER

REGISTERED PROFESSIONAL ENGINEER
JAMES ROBERT SCHAAF
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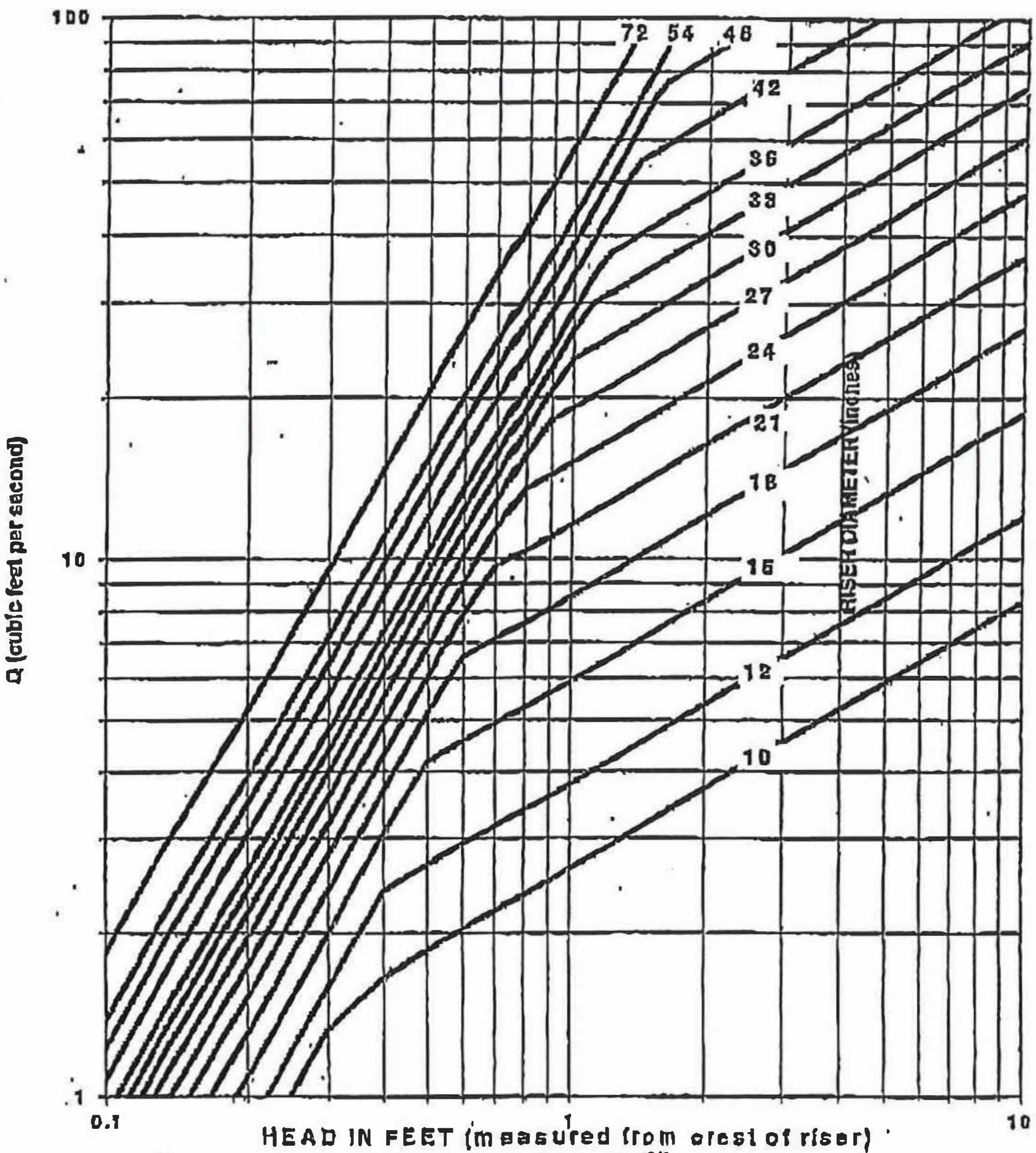
Exp. 3/31/06
CIVIL
STATE OF CALIFORNIA

James R. Schaaf, PhD, PE
Principal

Enclosures

Cc: Mr. Chuck Barnett, West Coast Aggregates (w/ enclosures)

Riser Overflow. The nomograph in Figure 3.24 can be used to determine the head (in feet) above a riser of given diameter and for a given flow (usually the 100-year peak flow for developed conditions).



$Q_{weir} = 9.739\ DH^{3/2}$

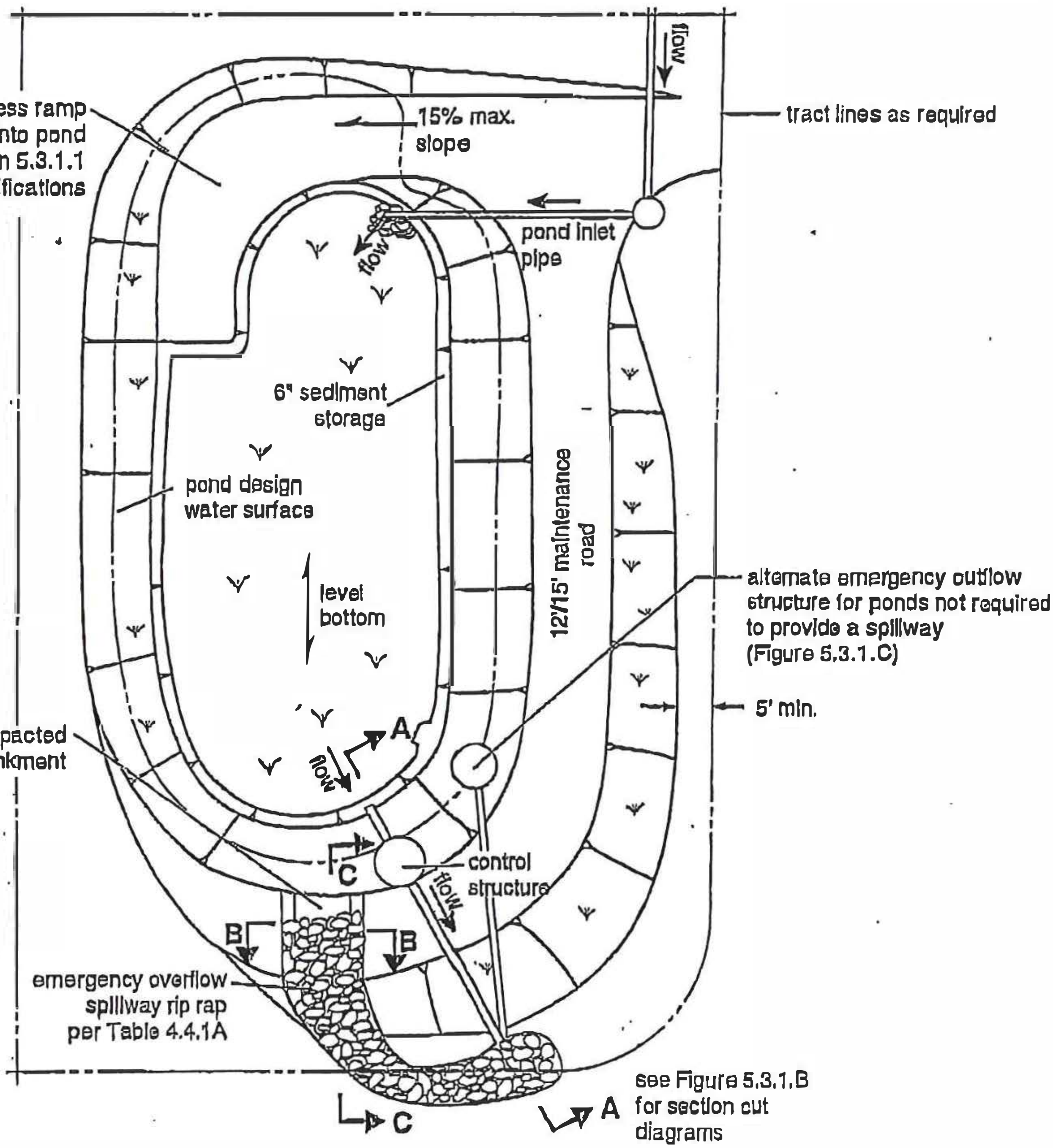
$Q_{orifice} = 3.782\ D^2H^{1/2}$

Q in cfs, D and H in feet

Slope change occurs at weir-orifice transition

Figure 3.24 Riser Inflow Curves

FIGURE 5.3.1.A TYPICAL DETENTION POND



NOTE:
This detail is a schematic representation only. Actual configuation will vary depending on specific site constraints and applicable design criteria.

FIGURE 5.3.1.B TYPICAL DETENTION POND SECTIONS

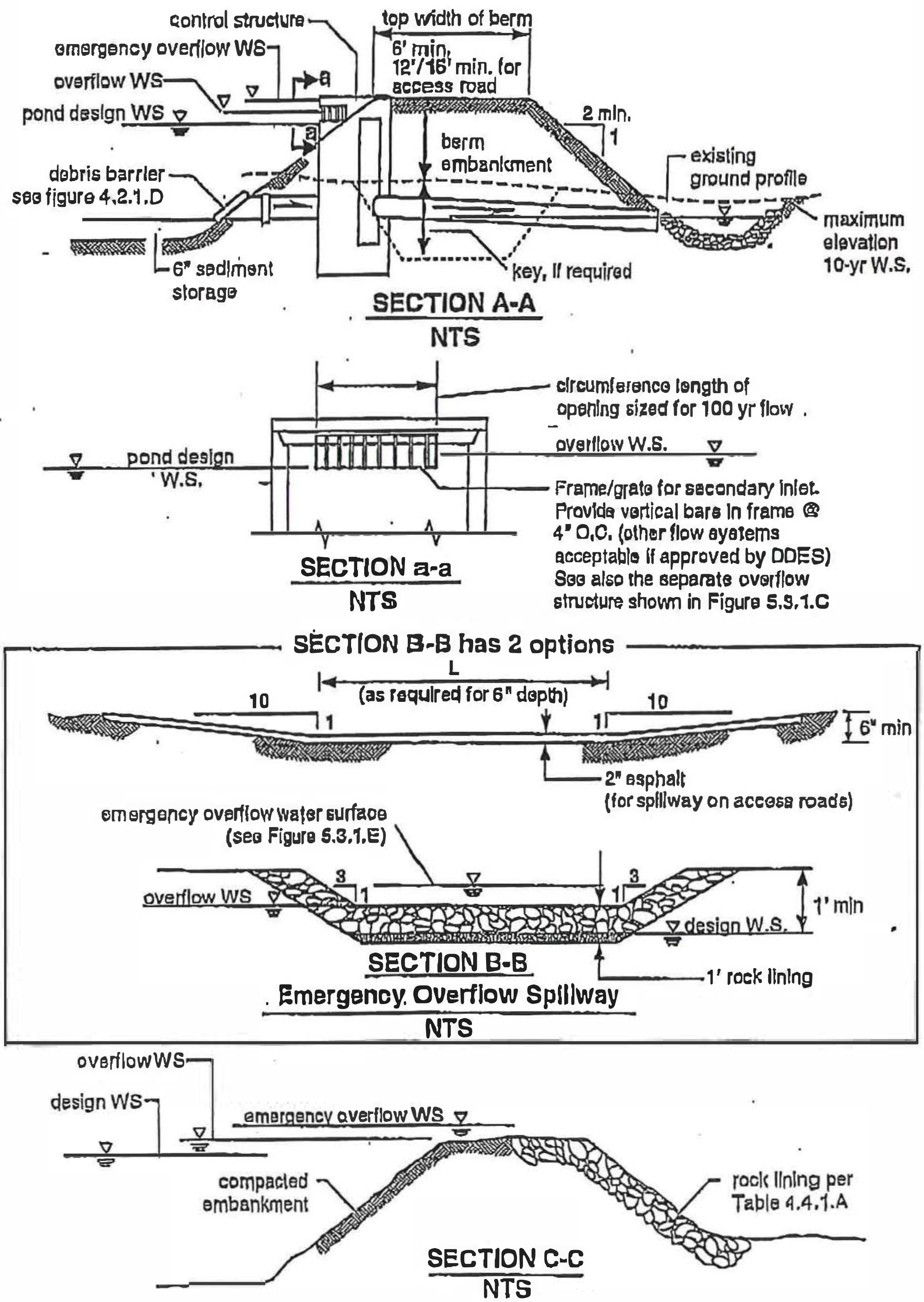
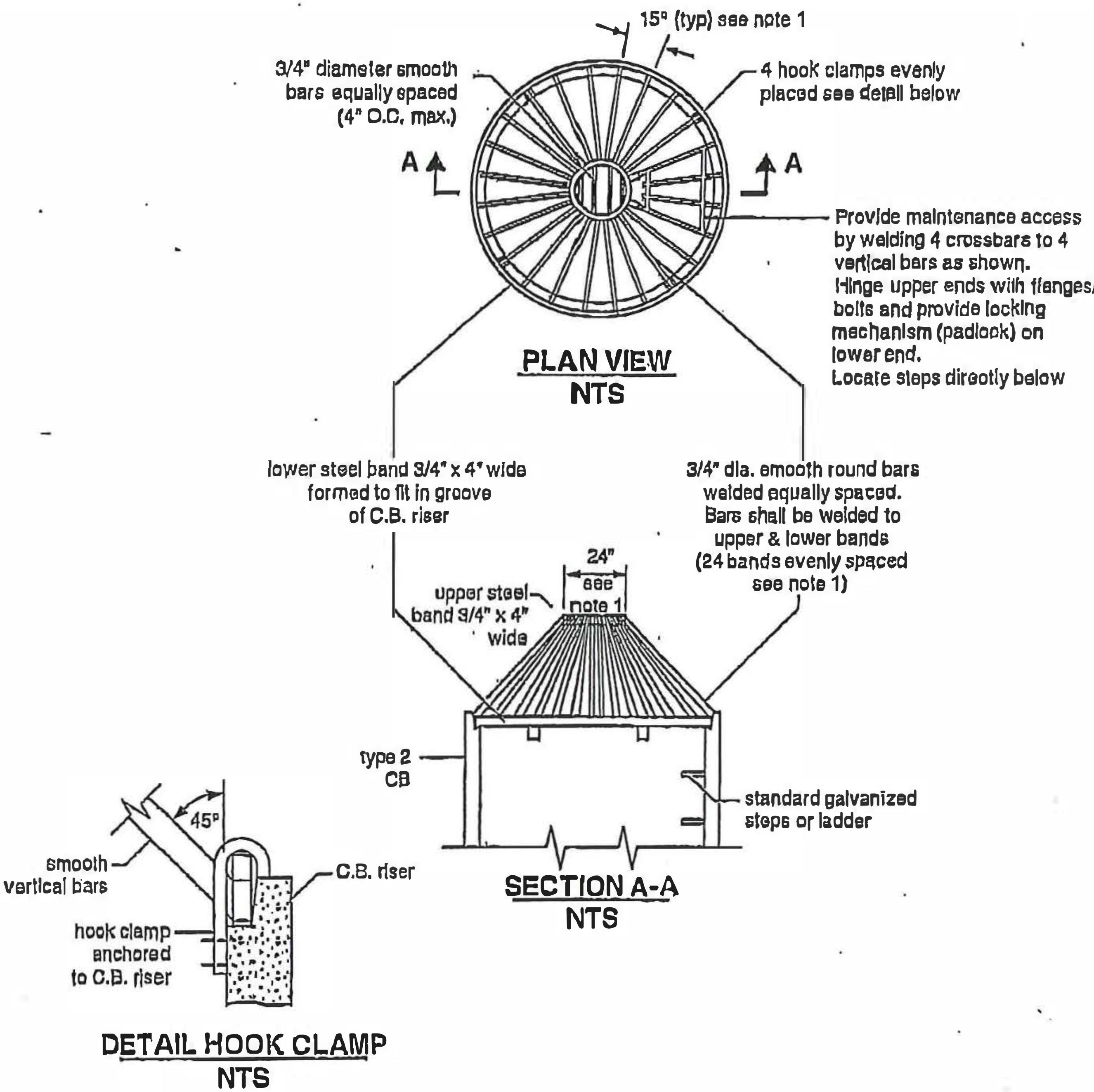
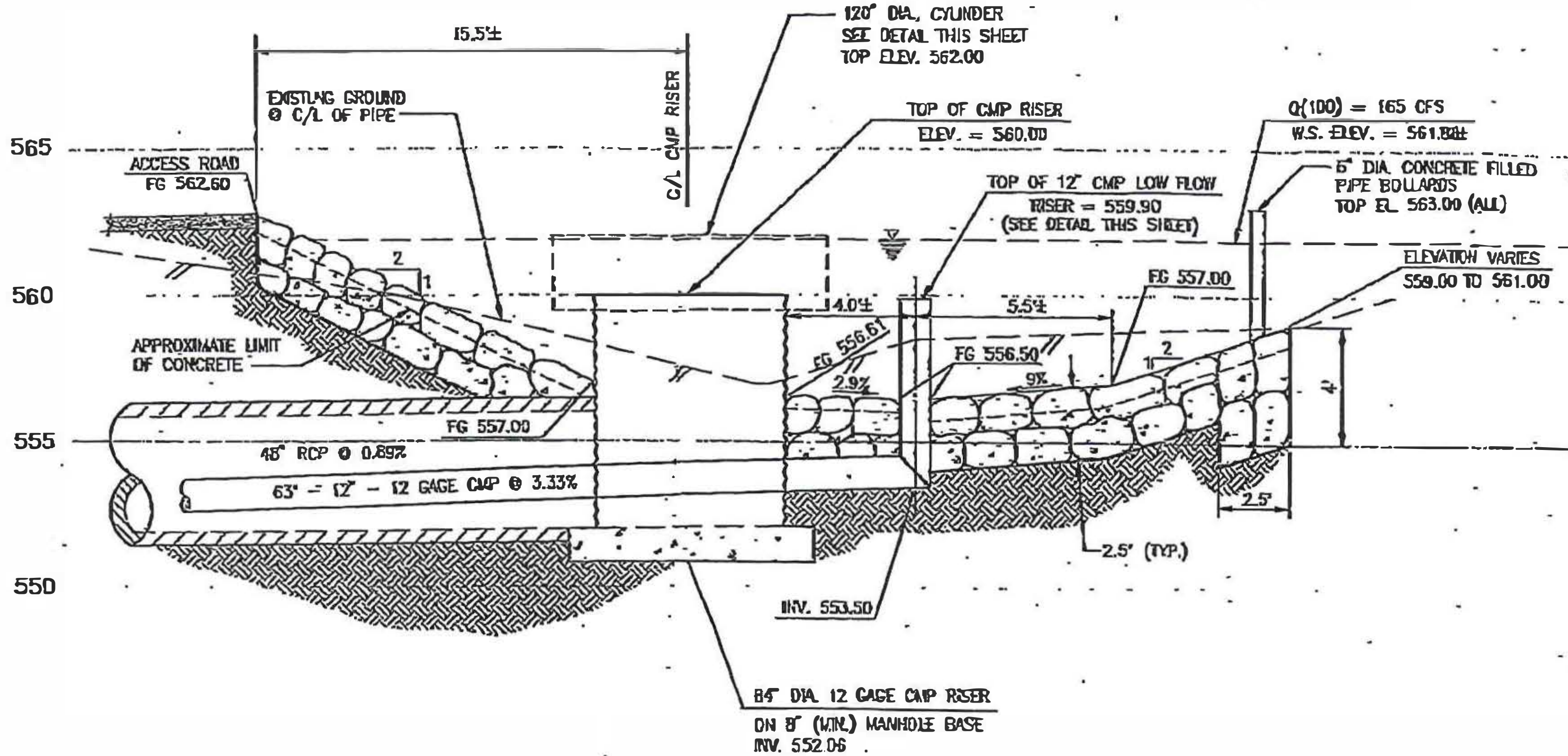


FIGURE 5.3.1.C OVERFLOW STRUCTURE



NOTES:

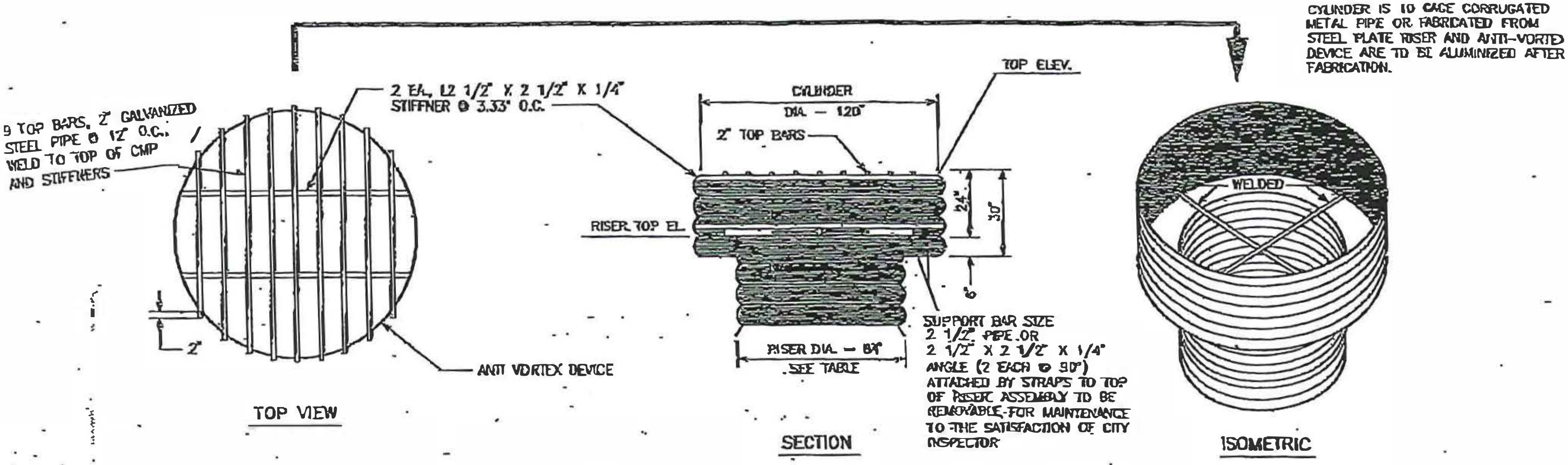
1. Dimensions are for illustration on 54" diameter CB For different diameter CB's adjust to maintain 45° angle on "vertical" bars and 7" o.c. maximum spacing of bars around lower steel band.
2. Metal parts must be corrosion resistant; steel bars must be galvanized.
3. This debris barrier is also recommended for use on the inlet to roadway cross-culverts with high potential for debris collection (except on type 2 streams)
4. This debris barrier is for use outside of road right-of-way only. For debris cages within road right-of-way, see Drawing 2-028 KCRS.



SECTION A – A

SCALE: HOR. 1" = 4'
VERT. 1" = 4'

F-11



OVERFLOW CYLINDER TRASH RACK AND ANTI—VORTEX DEVICE

(NTS)

DIMENSIONAL DATA

RISER			CYLINDER			
DIA.	GA.	TOP EL.	DIA.	GA.	TOP EL.	BOTTOM EL.
12"	12	559.90	24"	12	561.40	559.40
84"	10	560.00	120"	10	562.00	559.50

NOTES:

1. RISER TOP EL. IS THE ELEVATION WHERE WATER BEGINS TO FLOW INTO RISER.

2. ALL COMPONENTS FOR BOTH RISERS TO BE ALUMINIZED AFTER FABRICATION.

Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS

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May 28, 2002

Mr. Mike Sheehy
Ruth & Going, Inc.
The Alameda
Santa Clara, CA 95050

Re: Lexington Quarry – Design Discharge Estimates

Dear Mr. Sheehy:

Schaaf & Wheeler is pleased to respond to your request to provide design discharge estimates for the restoration channel proposed for the Lexington Quarry site. The design discharges presented here were estimated using the Santa Clara Valley Water District's procedures outlined in their *Hydrology Procedures Manual* (Draft, December 1998).

For watersheds less than 2 square miles, referred to as small watersheds, the design discharge estimates are given by the following equation:

$$Q = 10^{a0} A^{a1} MAP^{a2} S^{a3} L^{a4} \exp\left[2.3026 M_e + 2.65 SD_e^2\right]$$

Where:
- Q = Design discharge estimate, cfs
- A = Watershed area, mi^2
- MAP = Mean annual precipitation, in.
- S = Average basin slope, ft/ft.
- L = Basin length, mi.
- a_0, a_1, a_2, a_3, a_4 = Model parameters
- M_e = Mean of the model residuals
- SD_e = Standard deviation of the model residuals

The watershed parameters were obtained from the USGS Los Gatos quadrangle using measurement procedures described in the District's manual. The parameters shown in Table 1 are for both the main channel upstream of the quarry and for the tributary entering the main channel from the southeast where the existing channel bypass changes from a 48" CMP to a 27" CMP combined with a 36" CMP.

Table 1 – Watershed Parameters

Watershed	A, mi2	MAP, in.	S, ft/ft	L, mi.
Main Channel	0.47	42	0.1065	1.515
Tributary Channel	0.0625	42	0.308	0.517

The model parameters, a_0, a_1, a_2, a_3, a_4, M_e, and SD_e, were obtained from the District's manual. The values of the model parameters depend upon the return interval and duration of the desired design discharge. The parameter values shown in Table 2 are for the instantaneous peak discharge for the 10- and 100-year return intervals.

Table 2 – Model Parameters

Return Interval, yrs.	a_0	a_1	a_2	a_3	a_4	M_e	SD_e
10	0.6687	1.341	1.017	-0.2719	-0.8789	0.00	0.2960
100	0.9979	1.067	0.8228	-0.3110	-0.4436	0.00	0.3070

The results of the analysis are shown on Table 3 for both the main channel and the tributary channel. A design discharge value on the main channel downstream of the tributary is best estimated as the sum of the two listed discharges.

Table 3 – Design Discharge Estimates

Watershed	Return Interval	
	10-Year	100-Year
Main Channel	122	210
Tributary Channel	16	30

If you have any questions or need additional information, please do not hesitate to contact Jim Gessford or me.

Very truly yours,
SCHAAF & WHEELER

James R. Schaaf, PhD, PE
Principal

REGISTERED PROFESSIONAL ENGINEER
JAMES ROBERT SCHAAF
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Exp. 3/31/06
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STATE OF CALIFORNIA

Cc: Mr. Chuck Barnett, West Coast Aggregates

APPENDIX F-1

Ruth & Going:

- Final Report Lexington Quarry Stilling Basins, October 10, 2003
- Hydrologic Findings, May 28, 2008

APPENDIX F-1

October 1 0, 2003

Mr. Mike Sheehy
Ruth & Going, Inc.
The Alameda
Santa Clara, CA 95050

Re: Final Report Lexington Quarry Stilling Basins

Schaaf & Wheeler is pleased to submit this final report documenting their analyses of the proposed sediment stilling basins for the Lexington Quarry (Quarry). This report serves as a summary of the work completed by Schaaf & Wheeler from February, 2002 to October, 2003. The results of the analyses including the proposed size of the basins, the size of the particles to be settled in the basins, the residence time required for the particles to settle out have been included in this memorandum. In addition, this report contains a discussion of the Modified-Puls routing technique used to route the stormwater runoff from the Quarry through the basins, design criteria to size the riser pipes in the basins, and design discharge estimates for the "restoration channel" proposed for the Quarry.

Stilling Basin Sizing

Schaaf & Wheeler went through several revisions to size and locate the stilling basins for the Quarry. Initially it was proposed that there be two basins, one on the active mining (East) side of the basin and another on the inactive (west) side of the Quarry. Ultimately the analyses resulted in the need for three basins, one on the active mining (east) side (Basin 1), a series of four, tiered cells on the inactive (west) side (Basin 2), and a small basin at the base of the knoll on the active (east) side of the Quarry (Basin 3). Schaaf & Wheeler has completed their analysis of three stilling basins for the Lexington Quarry. The proposed size of the three basins, the size of the particles to be settled in the basins, and the residence time required for the particles to settle out are included in this report.

The first part of the basin sizing analysis was to estimate a sediment load that the basins would have to accommodate based on average sediment yield rates for the area with adjustments being made for loss of canopy and ground cover, estimates of the maximum expected annual discharge of sediment, and a factor of safety. The average sediment yield rates were taken from a 1974 Soils Conservation Service publication, "Erosion, Sediment, and Related Salt Problems and Treatment Opportunities: Special Projects Division." The average rate of 0.2 ac-ft/sq. mi./yr.

was doubled for the active mining side to account for the presence of piles of material observed during a recent site visit. These piles of material would be subject to erosion and could therefore contribute sediment loading to Basin 1. In addition, the predicted rates were multiplied by a factor of 10 to account for the loss of ground cover and tree canopy at the Quarry site. The predicted rates were then multiplied by a 1.2 factor of safety, resulting in an estimated sediment yield rate of 2.4 ac-ft/sq. mi./yr. for the inactive side and 4.8 ac-ft/sq. mi./yr. for the active side of the Quarry. Finally based on an analysis of the cube of the daily discharges (Q^3) in nearby Saratoga Creek it was determined that on any given year that the sediment yield could be 15 times that of the average yield, therefore, the basins should be designed to accommodate a minimum of 15 years worth of sediment.

At the request of the Santa Clara Valley Water District (District), Schaaf & Wheeler compared the aforementioned sediment yield rates to those found in the USGS report, *Effects of Limestone Quarrying and Cement Plant Operations on Runoff and Sediment Yields in the Upper Permanente Creek Basin, Santa Clara County, California* (USGS, 1989). This comparison was made to address the District's concern that "the probable average sediment yield rate from the quarry is much higher than what was identified by the applicant."

The USGS study made a comparison between the sediment yield rates of the West Fork Permanente Creek ("natural" condition) and Permanente Creek ("quarry" condition). The USGS study reports that the sediment yield rate from a basin on the West Fork is 480 tons/mi^2. By way of comparison, the study reports a sediment yield rate from a basin on Permanente Creek of 5,870 tons/mi^2, nearly 12 times the rate for the "natural" West Fork watershed. The USGS study also reports an average weight of sediment removed from the Permanente Creek basin of 2,700 lb/yd^3. This average weight allows for the conversion of the reported sediment yield rates from tons/mi^2 to acre-ft/mi^2 in order to compare their rates to those estimated by Schaaf & Wheeler.

The "natural condition" rate of 480 tons/mi^2 for the nearby West Fork Premanente Creek converts to a sediment yield rate of 0.22 acre-ft/mi^2, nearly identical to the 0.2 acre-ft/mi^2 "natural condition" rate referenced in the basin sizing calculations. The "quarry condition" rate of 5,870 tons/mi^2 for nearby Permanente Creek converts to a sediment yield rate of 2.7 acre-ft/mi^2, close to the 2.4 acre-ft/mi^2 "inactive quarry" conditions rate referenced in the basin sizing calculations. The "active quarry" conditions rate of 4.8 acre-ft/mi^2 used in the basin sizing calculations is nearly 1.8 times the "quarry condition" rate predicted by the USGS study, therefore the sediment yield rates used by Schaaf & Wheeler to size the sediment stilling basins for the Quarry are conservative.

The results of the sediment basin sizing efforts are shown below:

Basin 1 - Active Mining on East Side

Drainage area contributing sediment	=	22.7 acres = .0355 sq. mi.
Average sediment yield rate	=	0.4 ac-ft/sq. mi./yr
(0.4) * (15, years of avg. sediment yield in one year)	=	6.0 ac-ft/sq. mi.
(6.0 ac-ft/sq. mi) * (.0355 sq. mi.)	=	0.213 ac-ft

(0.213 ac-ft) * (10, adj. for no canopy or ground cover) = 2.13 ac-ft

(2.13 ac-ft) * (1.2, factor of safety) = 2.6 ac-ft

Total Volume of Basin 1, per Ruth & Going grading = 3.44 ac-ft

Approx. Dimensions of Basin 1 (L X W X H) = 170' X 60' X 15'

Basin 2 - Inactive Hillside on West Side

Drainage area contributing sediment = 17.8 acres = .0278 sq. mi.

Average sediment yield rate = 0.2 ac-ft/sq. mi/yr

(0.2) * (15, years of avg. sediment yield in one year) = 3.0 ac-ft/sq. mi.

(3.0 ac-ft/sq. mi) * (.0278 sq. mi.) = 0.083 ac-ft

(0.083 ac-ft) * (10, adj. for no canopy or ground cover) = 0.83 ac-ft

(0.83 ac-ft) * (1.2, factor of safety) = 1.0 ac-ft

Total Volume of Basin 2 Ponds, per Ruth & Going = 4.08 ac-ft

At the request of the client, Basin 2 was configured into a tiered, multi-cell pond, with the approximate dimensions of the most downstream pond (Cell 1) shown below. The total volume of the Basin 2 ponds is approximately 4 times greater than the volume required to store 15-years worth of sediment production, providing for an increased level of protection to be discussed later in this report. Please note that Cell 1 was sized to provide the required residence time to settle out the 0.1 mm. particle size as discussed below.

Approx. Dimensions of Basin 2, Cell 1 (L X W X H) = 180' X 55' X 7'

Basin 3 - Knoll Active Hillside on East Side

Drainage area contributing sediment = 1.7 acres = .0027 sq. mi.

Average sediment yield rate = 0.4 ac-ft/sq. mi/yr

(0.4) * (15, years of avg. sediment yield in one year) = 6.0 ac-ft/sq. mi.

(6.0 ac-ft/sq. mi) * (.0027 sq. mi.) = 0.016 ac-ft

(0.016 ac-ft) * (10, adj. for no canopy or ground cover) = 0.16 ac-ft

(0.16 ac-ft) * (1.2, factor of safety)	=	**0.2 ac-ft**
Total Volume of Basin 3, per Ruth & Going grading	=	0.5 ac-ft
Approx. Dimensions of Basin 1 (L X W X H)	=	**62.5' X 32.5' X 10'**

The second part of the analysis was to estimate the residence time in the basins required to settle out the 0.1 mm. particle size. A particle size of 0.1 mm. represents a trap efficiency of approximately 92 percent and 86 percent, respectively, for the active and inactive sides of the quarry. Stokes' Law was used to estimate the settling velocity of the 0.1 mm. particle size. Assuming a water temperature of 55 degrees Fahrenheit, a particle specific gravity of 2.6, and a particle size of 0.1 mm. resulted in a settling velocity of .024 ft/s.

The final part of the analysis was to determine whether there was adequate length in the proposed stilling basins to settle out the particles in the time required for the 100-year flow to pass through the basins. The 100-year flow was determined using the Rational Method with a C-value of 0.88, a time of concentration of 10 minutes, and a rainfall intensity of 4.3 inches per hour obtained from the Santa Clara County Drainage Manual.

The residence time in the basins was calculated as the time required for the 100-year discharge to pass through the basins assuming flow was going out of the basin at the same rate as it was entering the basins. The average velocity through the basins was determined by assuming that the basins were already half full of sediment and the cross-sectional area available for flow was the product of the basin width multiplied by half of the depth of the basin. The velocity was then taken to be the 100-year flow rate divided by the cross-sectional area. The settling time required for a particle diameter of 0.1 mm. was determined for a settling depth of one-half the depth of the basin divided by the settling velocity calculated using Stokes' Law, 0.024 ft/s.

The results of this final part of the basin sizing analysis are shown below:

Basin 1 - Active Mining on East Side

Drainage area contributing rainfall runoff	=	25.1 acres
Runoff Coefficient, C	=	0.88
Rainfall Intensity, i	=	4.3 in/hr
100-year runoff, Q_{100}	=	**95 cfs**
Basin area available for 100-year discharge	=	450 sq. ft.
Velocity through basin	=	0.21 ft/s
Residence time in basin	=	**810 sec.**

Depth of settling in basin	=	7.5 ft.
Settling time in basin	=	**315 seconds**

Basin 2 - Inactive Hillside on West Side

Drainage area contributing rainfall runoff	=	22.0 acres
Runoff Coefficient, C	=	0.88
Rainfall Intensity, i	=	4.3 in/hr
100-year runoff, Q_{100}	=	85 cfs
Area of Basin 2, Cell 1 available for 100-year discharge	=	192.5 sq. ft.
Velocity through basin	=	0.44 ft/s
Residence time in basin	=	**410 sec.**
Depth of settling in basin	=	3.5 ft.
Settling time in basin	=	**150 seconds**

Basin 3 - Knoll Active Hillside on East Side

Drainage area contributing rainfall runoff	=	1.7 acres
Runoff Coefficient, C	=	0.88
Rainfall Intensity, i	=	4.3 in/hr
100-year runoff, Q_{100}	=	**6 cfs**
Basin area available for 100-year discharge	=	162.5 sq. ft.
Velocity through basin	=	0.037 ft/s
Residence time in basin	=	**1690 sec.**
Depth of settling in basin	=	5 ft.
Settling time in basin	=	**210 seconds**

The results of the basin sizing analysis show that given the proposed stilling basin dimensions, the basins would provide adequate residence time to settle out the 0.1 mm. diameter particles of sediment while still conveying the 100-year discharge, even with the basin half-full of sediment.

The analysis assumes that the ponds will outfall to Limekiln Creek through culverts with riser pipes installed in the ponds. In the case of Basin 2, the additional 3 cells upstream of Cell 1 should be connected by culverts with riser pipes. In addition, the Basins should be equipped with emergency spillways. In the unlikely event that one of the culverts becomes blocked, the pond(s) will overtop and the spill(s) will travel through the site, across the access road to Lexington Quarry, discharging directly into Limekiln Creek.

As previously mentioned, Basin 2 was sized to be much larger than required to accommodate 15-years worth of sediment production. **Based on the calculations, Basin 2 has capacity for over 40 years worth of sediment production assuming the reclamation planting efforts continue to provide an increased level of ground cover and canopy.** Based on the field reconnaissance, it appears that the plantings have begun to establish themselves, particularly on top of each of the benches. The 40 plus years of sediment production capacity in the Basin 2 ponds also assumes the stilling basin currently upstream of the Basin 2 ponds is filled in and grading is performed to direct the runoff that currently drains into the stilling basin into the Basin 2 ponds. **Assuming similar re-planting efforts on the active hillside currently being mined, upon reclamation, Basin 1, as currently configured, would also have capacity for over 40 years of sediment production and Basin 3 would have capacity for over 75 years of sediment production. In addition, Basin 1 could be enlarged after the mining efforts have concluded to provide additional capacity for an increased level of sediment production.**

Finally, based on the provisions set forth in the State Mining and Reclamation Act (SMRA) the State of California Division of Mines and Geology requires that sediment stilling basins located on quarry sites be adequately sized to hold the 20-Year, 1-hour storm. The basins being proposed for the Lexington Quarry site have been designed to pass the 100-Year, 24-hour storm, therefore, the SMRA requirement has been met and exceeded for the proposed basins.

MODIFIED-PULS ROUTING, PEAK DISCHARGE

At the request of the Santa Clara Valley Water District (District) and Santa Clara County (County), Schaaf & Wheeler analyzed the previously sized sediment stilling basins for the Lexington Quarry site to estimate the removal efficiency of the ponds using the Modified-Puls routing technique in the U.S. Army Corps of Engineers' HEC-1 hydrologic computer program.

The Return Period-Duration Specific (TDS) Regional Equation contained in the District's *Draft Hydrology Procedures Manual* (December 1998) was used to estimate the 100-year, 24-hour precipitation depth for the drainage areas contributing stormwater runoff to each of the stilling basins. The resulting precipitation depth of 11.04 inches was multiplied by the same Rational Method runoff coefficient, C, used in the basin sizing calculations, 0.88, to account for rainfall losses due to infiltration. Finally, this depth was multiplied by the drainage area contributing runoff to each of the basins to determine the 100-year, 24-hour volume of stormwater runoff into each of the basins.

The 100-year, 24-hour volumes of stormwater runoff and the peak runoff values calculated in the earlier basin sizing work were used to "balance" the 100-year, 24-hour duration, 5-minute time-increment stormwater runoff hydrograph obtained from hydrologic modeling work previously performed in Santa Clara County. These "balanced" hydrographs were then routed through the basins in HEC-1 using the Modified-Puls routing technique. For routing purposes it was assumed that only the area above the top of the riser pipe and below the top of the pond (1.5 feet for Basins 1 and 2 and 1.0 foot for Basin 3) was available for active storage (i.e., it was assumed that the sediment basins were full of water up to the lip of the riser pipe at the start of the 100-year, 24-hour storm). It was also assumed that half of the pond was filled with sediment and that only the top half was available for routing the stormwater through the pond. Finally, the diameters of the riser pipes were assumed to be 72-, 54- and 15-inches for Basins 1, 2, and 3, respectively as suggested in Schaaf & Wheeler's May 21, 2002 letter to Ruth & Going. Figures 1, 2, and 3 show the inflow and routed outflow hydrographs for Basins 1, 2, and 3, respectively.

Table 1 shows the results of the Modified-Puls routing in HEC-1. It should be noted that flow was routed through a sequence of four, tiered cells comprising Basin 2. Only the bottom cell was used to calculate the sediment removal efficiency.

Table 1 - HEC-1 Results

Basin	100-Year, 24-hr. Volume (ac-ft)	Peak Flow (cfs)	Routed Flow (cfs)[1]
1	20.3	95	70
2	17.8	85	54
3	1.4	6	4.5

The routed flow obtained from HEC-1 was used to estimate the flow-through velocity in the stilling basins. The velocities were obtained by assuming that half of each of the basins would be full of sediment and that only the cross-sectional area of the top half of each of the basins would be available for conveying stormwater runoff. These velocities along with the length of each of the basins were used to calculate the residence time in the basins available for settling out the sediment particles as shown in Table 2.

Table 2 - Stilling Basin Residence Time

Basin	Basin Dimensions (W X H)	Flow Velocity Through Basin (ft/s)	Basin Length (ft.)	Residence Time (sec.)
1	60' X 7.5'	0.156	170	1100
2	55' X 3.5'	0.28	180	640
3	32.5' X 5'	0.028	62.5	2260

Finally, the residence time in the basins was used to calculate the settling velocity of the sediment particles in the basins in order to estimate the minimum sediment particle size removed and removal efficiency of each of the basins. The settling velocity was obtained by assuming

[1] Flow resulting from routing peak flow through stilling basin using the Modifed-Puls technique in HEC-1

that half of the basins would be full of sediment and that the sediment particles would have to fall a distance equal to the remaining depth of the basin (1/2 of the total depth of the basin) within the allotted residence time shown in Table 2. These settling velocities were then used to solve Stokes' Law to estimate the minimum particle size removed from the basins. The gradation curves obtained by Schaaf & Wheeler and Parikh Consultants (1/30/02) were then used to estimate the removal efficiency of each of the basins as shown on Table 3.

Table 3 - Stilling Basin Removal Efficiency

Basin	Settling Depth (ft.)	Settling Velocity (ft/s)	Minimum Sediment Particle Size Removed (mm.)	Removal Efficiency (%)
1	7.5	0.0068	0.053	94
2	3.5	0.0055	0.048	88
3	5.0	0.0022	0.030	95

In conclusion, the results of the Modified-Puls routing using HEC-1 slightly improves the earlier estimates for the minimum particle size that could be removed and slightly improves the removal efficiency that can be attained by using sediment stilling basins to treat the stormwater runoff from the Lexington Quarry site before discharging it into Limekiln Creek.

MODIFIED-PULS ROUTING, 24-HOUR AVERAGE DISCHARGE

The aforementioned Modified-Puls routing procedure was repeated using the 24-hour average discharge instead of the peak discharge that occurs for a very short time (10 minutes) to better predict the sediment removal efficiency and the minimum sediment particle size expected to be settled in the basins. The 24-hour average flow rates used in the analysis are shown on Table 4.

Table 4 - HEC-1 Results

Basin	Peak Flow (cfs)	24-Hour Average Flow (cfs)
1	95	20
2	85	18
3	6	1

As before, the 24-hour average flow rate obtained from HEC-1 was used to estimate the flow-through velocity in the stilling basins. The velocities were obtained by assuming that half of each of the basins would be full of sediment and that only the cross-sectional area of the top half of each of the basins would be available for conveying stormwater runoff. These velocities along with the length of each of the basins were used to calculate the residence time in the basins available for settling out the sediment particles as shown in Table 5.

Table 5 - Stilling Basin Residence Time

Basin	Basin Dimensions (W X H)	Flow Velocity Through Basin (ft/s)	Basin Length (ft.)	Residence Time (sec.)
1	60' X 7.5'	0.044	170	3825
2	55' X 3.5'	0.094	180	1925
3	32.5' X 5'	0.006	62.5	10,156

Finally, the residence time in the basins was used to calculate the settling velocity of the sediment particles in the basins in order to estimate the minimum sediment particle size removed and removal efficiency of each of the basins. The settling velocity was obtained by assuming that half of the basins would be full of sediment and that the sediment particles would have to fall a distance equal to the remaining depth of the basin (1/2 of the total depth of the basin) within the allotted residence time shown in Table 5. These settling velocities were then used to solve Stokes' Law to estimate the minimum particle size removed from the basins. The gradation curves obtained by Schaaf & Wheeler and Parikh Consultants (1/30/02) were then used to estimate the removal efficiency of each of the basins as shown on Table 6.

Table 6 - Stilling Basin Removal Efficiency

Basin	Settling Depth (ft.)	Settling Velocity (ft/s)	Minimum Sediment Particle Size Removed (mm.)	Removal Efficiency (%)
1	7.5	0.0020	0.028	95
2	3.5	0.0018	0.027	91
3	5.0	0.0005	0.014	96

In conclusion, using the 24-hour average discharge instead of the instantaneous peak discharge gives us a better picture of how well the proposed basins will perform over time in removing sediment from the stormwater runoff draining to Limekiln Creek and ultimately to Lexington Reservoir. Using the 24-hour average discharge also results in removal efficiencies and minimum particle sized removed values that are consistent with what the District requested.

RISER PIPE SIZING

Schaaf & Wheeler provided design sizes for the riser pipes required to drain the proposed stilling basins for both the active and inactive sides of the Quarry. The pipe size estimates were based on the riser inflow nomograph included as Figure 4.

The riser pipes for each of the stilling basins were sized to discharge the 100-year design discharge for each side of the Quarry assuming 1.5 feet of head above the crest of the riser. The 100-year design discharges for each side of the Quarry were previously estimated by Schaaf & Wheeler and documented in a letter to an April 23, 2002 letter to Ruth & Going. The design discharge estimates are 95 cfs, 85 cfs, and 6 cfs for the active mining side, inactive hillside, and the knoll on the upstream side of the active hillside, respectively.

Based on these design discharges and the riser inflow nomograph, the ponds on the active side would require a riser diameter of 72 inches. The ponds on the inactive side would require a riser diameter of 54 inches. The pond proposed to take the runoff from the knoll at the upstream end of the active hillside would require a riser diameter of 15 inches and a head above the crest of the weir of approximately one foot.

In addition to the riser inflow nomograph, several typical design details for use in designing the riser pipes to drain the proposed stilling basins are included as Figures 5 through 7.

Lexington Quarry Design Discharge Estimates

Design discharge estimates were provided by Schaaf & Wheeler for the restoration channel proposed for the Lexington Quarry site. The design discharges presented here were estimated using the Santa Clara Valley Water District's procedures outlined in their *Hydrology Procedures Manual* (Draft, December 1998).

For watersheds less than 2 square miles, referred to as small watersheds, the design discharge estimates are given by the following equation:

$$Q = 10^{a0} A^{a1} MAP^{a2} S^{a3} L^{a4} \exp\left[2.3026 M_e + 2.65 SD_e^2\right]$$

Where:
- Q = Design discharge estimate, cfs
- A = Watershed area, mi^2
- MAP = Mean annual precipitation, in.
- S = Average basin slope, ft/ft.
- L = Basin length, mi.
- a_0, a_1, a_2, a_3, a_4 = Model parameters
- M_e = Mean of the model residuals
- SD_e = Standard deviation of the model residuals

The watershed parameters were obtained from the USGS topographic quad sheet for Los Gatos, California using the measurement procedures described in the District's manual. The parameters shown in Table 7 are for both the main channel and the tributary entering the main channel from the southeast where the channel bypass changes from a 48" CMP to a 27" CMP combined with a 36" CMP.

Table 7 – Watershed Parameters

Watershed	A, mi2	MAP, in.	S, ft/ft	L, mi.
Main Channel	0.47	42	0.1065	1.515
Tributary Channel	0.0625	42	0.308	0.517

The model parameters, a_0, a_1, a_2, a_3, a_4, M_e, and SD_e, were obtained from the District's manual. The values of the model parameters depend upon the return interval and duration of the desired design discharge. The values shown in Table 8 are for the instantaneous peak discharge for the 10- and 100-year return intervals.

Table 8 – Model Parameters

Return Interval, yrs.	a_0	a_1	a_2	a_3	a_4	M_e	SD_e
10	0.6687	1.341	1.017	-0.2719	-0.8789	0.00	0.2960
100	0.9979	1.067	0.8228	-0.3110	-0.4436	0.00	0.3070

The results of the analysis to obtain design discharge estimates for the 10- and 100-year return interval floods are shown on Table 9 for both the main channel and the tributary channel.

Table 9 – Design Discharge Estimates

Watershed	Return Interval	
	10-Year	100-Year
Main Channel	122	210
Tributary Channel	16	30

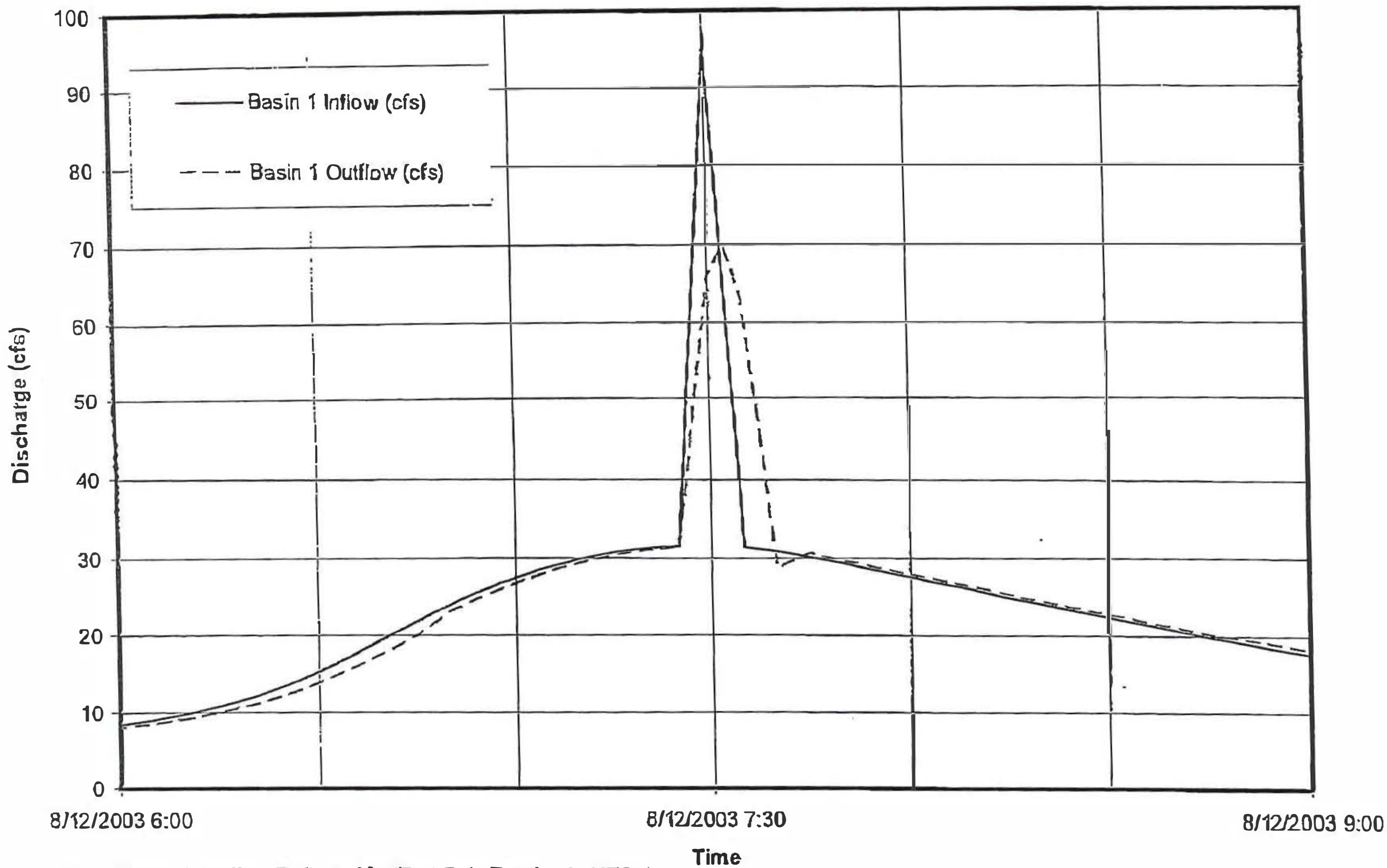
We appreciate the opportunity to provide this information to you. Please review the final report and discuss it with your client to make sure we've included everything you need. If you are satisfied with the final report, please forward copies to Mignone Wood and David Powers. If you have any questions or need additional information, please do not hesitate to contact Jim Gessford at (206) 624-9932 or myself at (408) 246-4848. .

Very truly yours,
SCHAAF & WHEELER

James R. Schaaf, PhD, PE
Principal

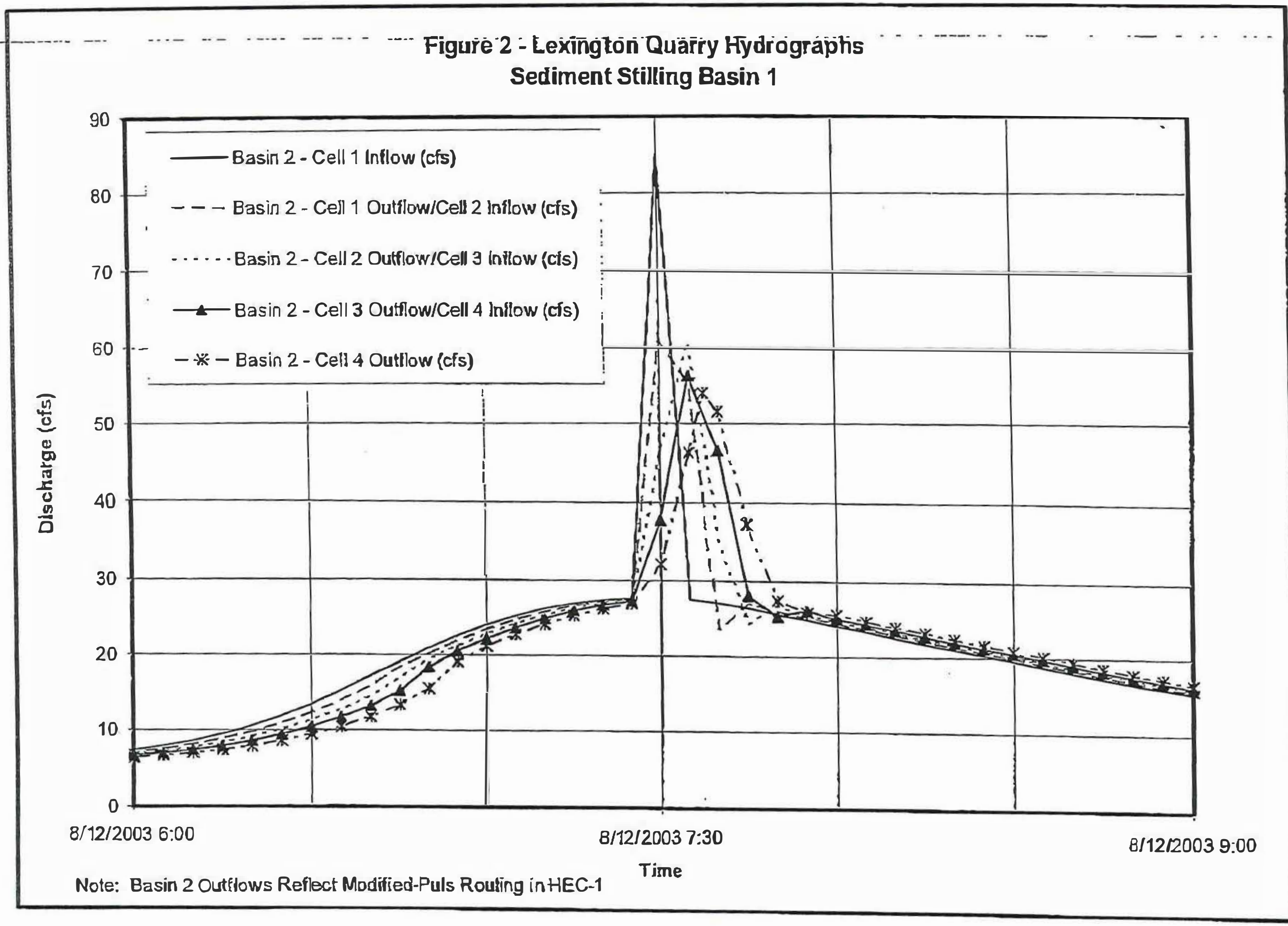
Cc: Mr. Chuck Barnett, West Coast Aggregates

Figure 1 - Lexington Quarry Hydrogprahs
Sediment Stilling Basin 1



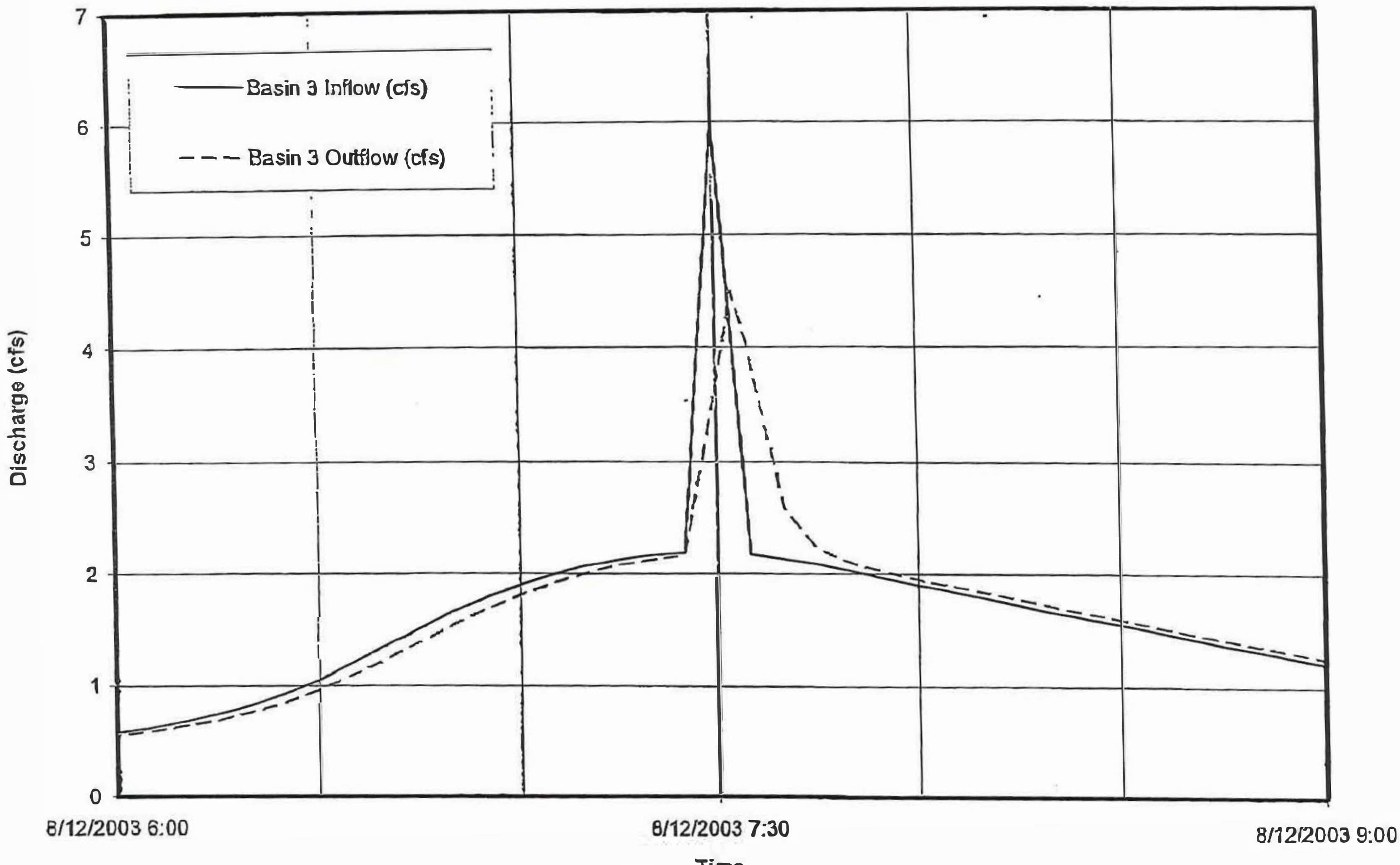
Note: Basin 1 Outflow Reflects Modified-Puls Routing in HEC-1

OCT. 29. 2003 11:02AM RUTH & GOING INC NO. 047 P. 14/19

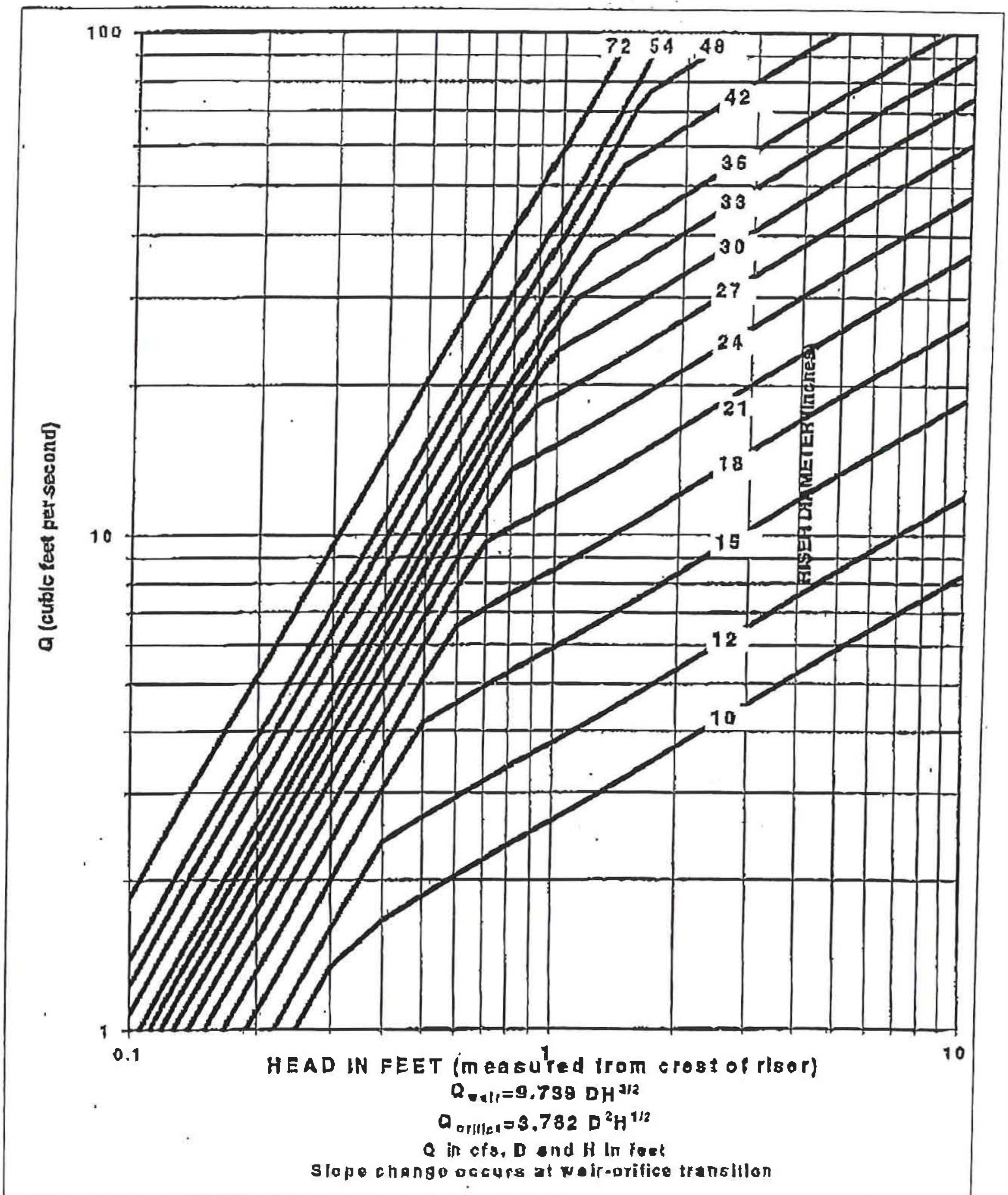


F-1M

Figure 3 - Lexington Quarry Hydrographs
Sediment Stilling Basin 3

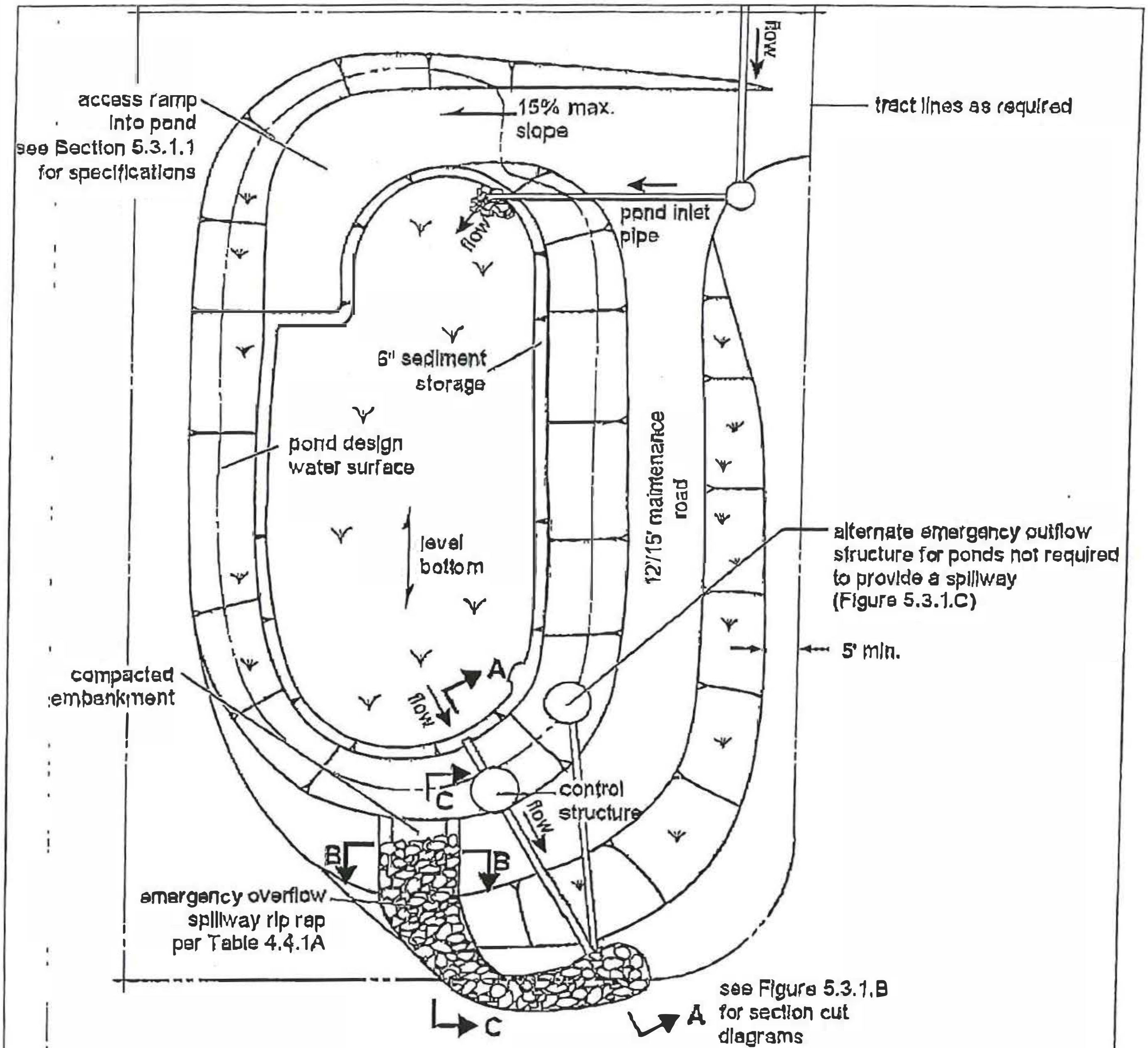


Note: Basin 3 Outflow Reflects Modified-Puls Routing in HEC-1



Source: Surface Water Design Manual, King County, Washington (Sept. 1998)
Figure 5.3.4.H

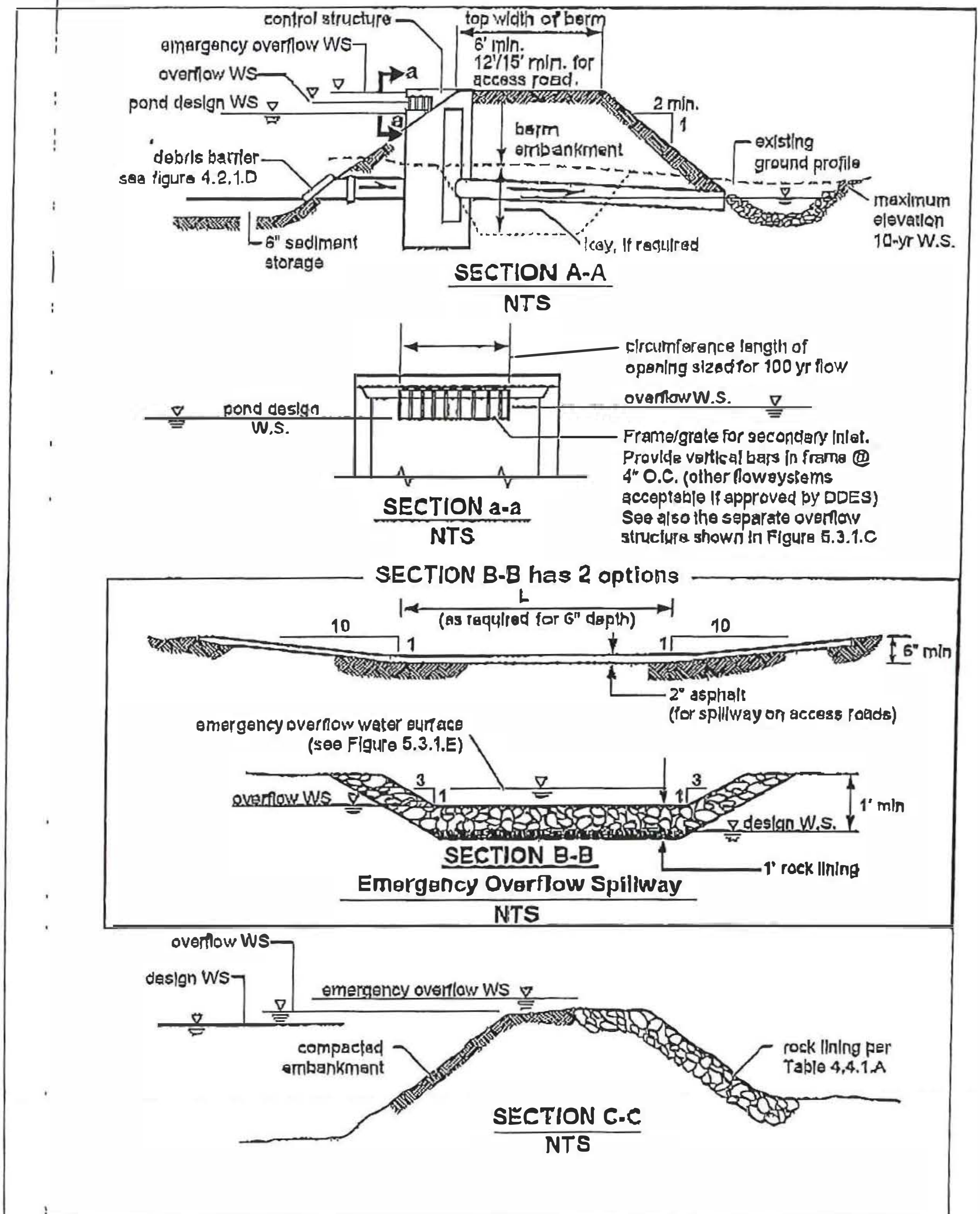
FIGURE 4 – RISER INFLOW NOMOGRAPH



NOTE:
This detail is a schematic representation only. Actual configuation will vary depending on specific site constraints and applicable design criteria.

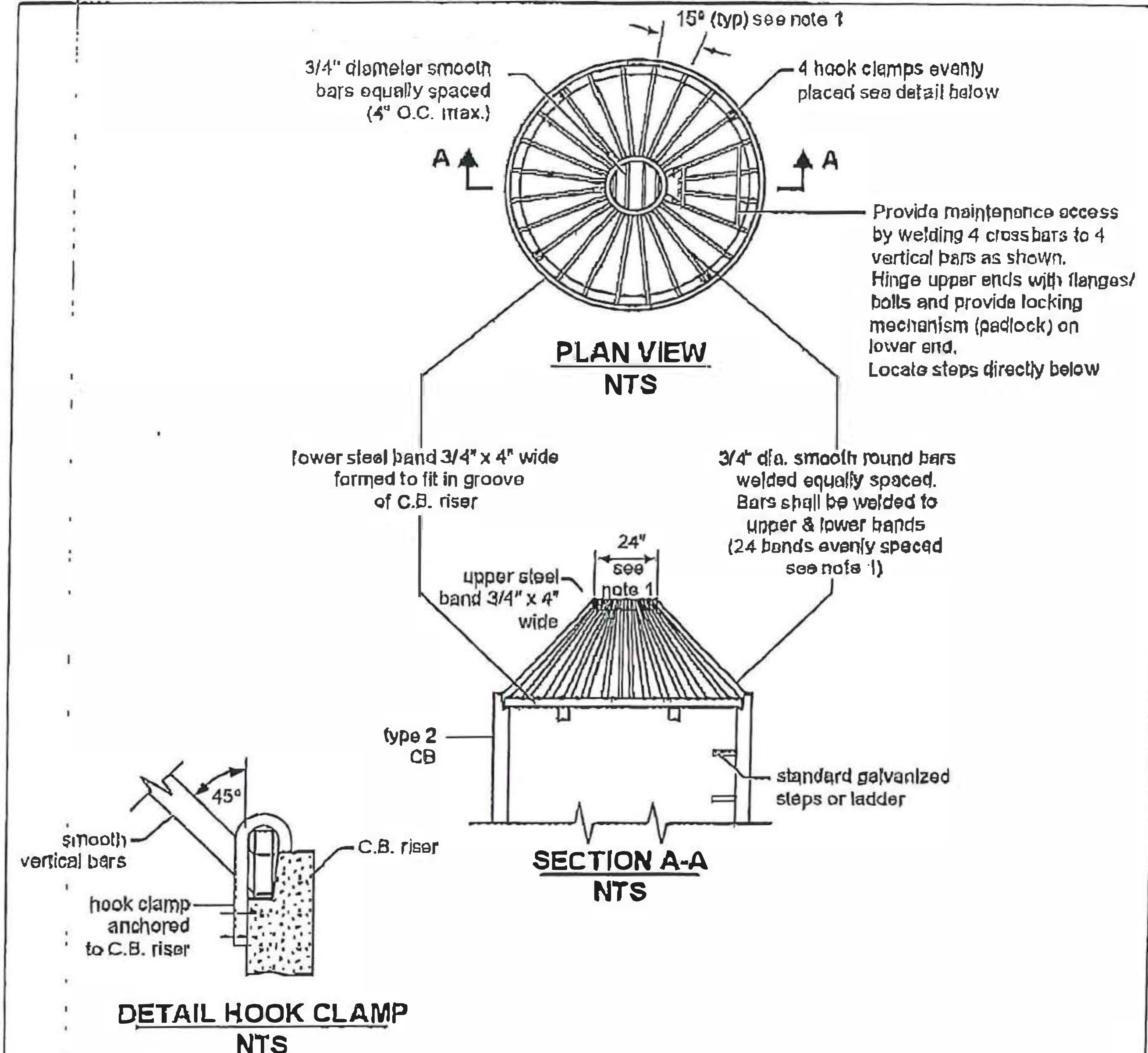
Source: Surface Water Design Manual, King County, Washington (Sept. 1998)
Figure 5.3.1.A

FIGURE 5 – TYPICAL DETENTION POND



Source: Surface Water Design Manual, King County, Washington (Sept. 1998)
Figure 5.3.1.B

FIGURE 6 – TYPICAL DETENTION POND SECTIONS



NOTES:

1. Dimensions are for illustration on 54" diameter CB For different diameter CB's adjust to maintain 45° angle on "vertical" bars and 7" o.c. maximum spacing of bars around lower steel band.
2. Metal parts must be corrosion resistant; steel bars must be galvanized.
3. This debris barrier is also recommended for use on the inlet to roadway cross-culverts with high potential for debris collection (except on type 2 streams)
4. This debris barrier is for use outside of road right-of-way only. For debris cages within road right-of-way, see Drawing 2-028 KCRS.

Source: Surface Water Design Manual, King County, Washington (Sept. 1998)
Figure 5.3.1.C

FIGURE 7 – OVERFLOW STRUCTURE

May 28, 2008

Mr. Richard DeAtley
West Coast Aggregate, Inc.
XXX YYYY
San NNNN, CA XXX

Re: Hydrologic Findings for Lexington Quarry Plan

Dear Mr. DeAtley

Plans for the mining of the Lexington Quarry and the Final Reclamation Plan Grading were on a plan sheet completed by Ruth & Going and dated 05/05/08. A field visit was held on May 13, 2008 to verify current basin sizes and current locations and sizes of outfall structures.

Two issues are addressed in this letter report: the change in peak discharges to the Tributary of Lime Kiln Creek for the various mining and reclamation conditions over time; and, the sediment storage and trapping efficiency of the various basins over time.

Three scenarios were investigated: existing; interim; and future reclaimed. All were defined by the Ruth & Going plan set. In addition, a "base condition" was defined as the condition prior to any mining occurring on the site.

Peak Runoff

Utilizing the procedures specified in the Santa Clara County Drainage Manual (2007) base condition peak discharges were defined for each side of the Tributary to Lime Kiln Creek. The east side is the side that is currently being actively mined and the west side is the side that was previously mined, is undergoing reclamation but which will need to undergo some additional grading to stabilize slopes. The runoff coefficient was set at 0.3. The time of concentration was defined as the time for a drop of water to flow from the ridge line down the steep slopes into the Tributary to Lime Kiln Creek and then flow down the Tributary into Lime Kiln Creek.

The peak discharges for the base condition are shown below:

Side of Tributary	10-year Peak Discharge (cfs)	100-year Peak Discharge (cfs)	Drainage Area (acres)
West – Inactive	13.6	19.5	29.3
East – Active	13.8	20.0	24.2

The attenuation of peak discharges as the runoff goes through the silt basins was computed by using a Modified Rational method as shown in the Santa Clara County Drainage Manual. The method is adequate for watersheds less than 50 acres in drainage area.

West Side Basins

The three basins on the west side have 18" risers between basins 1 (upstream) and 2 (middle), and between basins 2 and 3. The outlet from basin 3 is a 54" riser to discharge runoff into Lime Kiln Creek. As the runoff goes through the basins the inflow peak is attenuated by the storage above the risers. The storage below the tops of the risers is not counted as this "dead storage" is set aside for the storage of the silt load that accompanies the surface runoff.

The runoff coefficients for the three conditions were set to 0.3 for natural conditions, 0.88 for actively mined conditions and 0.8 for reclaimed conditions. The drainage areas were based on the grading plans which showed drainage direction with arrows. During the rainy season runoff from the east side is diverted to the west side by placing K-rails across the access road. This diversion increases the runoff volume to the west side basins as well as increases the silt load sent to those basins.

The storages needed to limit the outflow from the west side basins to the west side "base condition" peak discharge were found for the 100-year return period to be:

	Existing Condition	Interim Condition	Future Condition
Drainage Area (acres)	32.6	32.6	30.3
Storage Needed (acre-feet)	1.33	1.33	0.91
Storages Available (cubic feet)	1.34	1.34	1.34

The three basins on the west side have adequate storage to attenuate the outflow to or below the "base condition" for all conditions if and only if there are 3.5 feet between top of riser and top of berm at the two upstream basins. The downstream basin needs a distance between top of riser and top of berm of 2.75 feet.

East Side Basins

Under existing conditions, the three basins have 15" risers between basins 1 and 2, and between basins 2 and 3. Basin 3, a very small volume, discharges to Lime Kiln Creek through two, 15' horizontal pipes. In both the existing and the interim conditions runoff from the east side will be sent directly to Lime Kiln Creek. The future condition, however, will send runoff into the Tributary just upstream of its junction with Lime Kiln Creek.

The storage computations for the three east side conditions are:

	Existing Condition	Interim Condition	Future Condition
Drainage Area (acres)	8.4	8.4	20.8
Storage Needed (acre-feet)	0.1	0.1	0.5
Storage Available (acre-feet)	0.2	0.9	1.9

The east side basins – existing as well as proposed for interim and future conditions – have adequate storage to limit the outflow to Lime Kiln Creek to the "base condition" peak discharge for the 100-year event.

Silt Storage

As in past reports on silt storage for the Lexington Quarry, the silt generation rates were based on a value of 0.2 acre-feet/square mile/year for natural conditions. To that base value a factor of 15 was multiplied to account for the above average sediment load during a 100-year flood year. The generation value for a 100-year flood year is computed to be 4 acre-feet/square mile.

For reclaimed land, this base rate was increased by a factor or 10 to account for the lack of mature vegetation. This rate for reclaimed land is 36 acre-feet/square mile. For actively mined land the base rate was increased by a factor of 20; the rate being 72 acre-feet/square mile.

It was assumed that while active mining was going on at the quarry, the silt basins would be entirely cleaned every year before the rainy season was to start.

West Side Basins

The three basins on the west side are all assumed to have 8 feet of depth below the top of the riser pipes. This "dead storage" is used to trap and hold the sediments that flow along with the runoff. The table below shows the available storage in the basins and the 100-year sediment inflow volume (with the factor of safety.) The basins are large enough to hold the anticipated sediment under all three conditions.

	Existing Conditions	Interim Conditions	Future Conditions
Silt Storage Available (acre-feet)	3.25	3.25	3.25
Silt Storage Needed (acre-feet)	3.03	3.03	1.61

Under future conditions the west side basins have sufficient silt storage capacity to hold 30 years of average silt load.

East Side Basins

The basins for the east side (not the northeast basin that is present only during the future condition) also have sufficient dead storage to hold the silt load. The table below shows the available storage in the east side basins and the needed storage for all three conditions.

	Existing Conditions	Interim Conditions	Future Conditions
Silt Storage Available (acre-feet)	1.72	2.73	7.53
Silt Storage Needed (acre-feet)	0.95	0.95	1.17

The silt basin for the future, reclaimed condition has the capacity to hold 97 years of average silt generation.

Northeast Basin

This basin only is shown on the grading plans under future conditions. The needed silt storage is 0.1 acre-feet and the available storage from the grading plans is 0.19 acre-feet. Under reclaimed conditions this silt basin storage could hold 30 years of average silt generation.

Settling Efficiency

Stokes law was applied, as previously, to the basins on each side and under each condition. Table 1 shows the results. These are similar to those shown previously. The trap efficiency for the 10-year storm is approximately 0.02 mm. That for the 100-year storm is approximately 0.03 mm. For more frequent events the basins will trap even finer materials than those shown here.

Conclusion

The combination silt basins and detention basins are large enough to trap silt during large events down to a 0.02 or 0.03 mm level, and to store silt for a 100-year event, and to provide sufficient detention to keep the discharges into Lime Kiln Creek at or less than they were prior to any mining taking place in the area.

Table 1: Settling Calculations

	West Basin				*East Basin*						*NorthEast Basin*	
Rational Method	**Existing/Interim**		**Future**		**Existing**		**Interim**		**Future**		**Future**	
	10-Year	**100-Year**	**10-Year**	**100-Year**	**10-Year**	**100-Year**	**10-Year**	**100-Year**	**10-Year**	**100-Year**	**10-Year**	**100-Year**
Q (cfs) (inflow)	54.4	79.2	52.1	77.0	24.2	34.9	24.2	34.9	33.6	49.2	4.5	6.5
Q (cfs) (outflow)	13.6	19.5	13.6	19.5	13.8	20.0	13.8	20.0	13.8	20.0	1.7	2.5
Basin Dimensions (L X W X H)	370' X 60' X 10'		370' X 60' X 10'		80' X 80' X 15'		130' X 80' X 15'		400' X 100' X 15'		60' X 40' X 15'	
A (sq. ft.) [1]	300	300	300	300	600	600	600	600	750	750	300	300
V (fps)	0.05	0.06	0.05	0.06	0.02	0.03	0.02	0.03	0.02	0.03	0.01	0.01
Basin Length (ft.)	370	370	370	370	80	80	130	130	400	400	40	40
Res. Time (sec.)	8138	5707	8138	5707	3491	2399	5673	3898	21818	14993	7059	4898
Particle Size	**Settling Velocity (fps.) - Based on Stokes Law**											
0.1 mm.	0.024											
0.05mm.	0.006											
0.025 mm.	0.001											
0.01 mm.	0.0002											
Particle Size	**Settling Time (sec.) - Based on Stokes Law**											
0.1 mm.	212		212		317		317		317		317	
0.05 mm.	847		847		1270		1270		1270		1270	
0.025 mm.	3386		3386		5079		5079		5079		5079	
0.01 mm.	21164		21164		31746		31746		31746		31746	
	10-Year	**100-Year**	**10-Year**	**100-Year**	**10-Year**	**100-Year**	**10-Year**	**100-Year**	**10-Year**	**100-Year**	**10-Year**	**100-Year**
Removal Size (mm.)	0.021	0.023	0.021	0.023	0.035	0.043	0.021	0.033	0.016	0.019	0.024	0.026

[1] Assuming Basin is Half Full

APPENDIX F-2

Schaaf & Wheeler:

- Letter - Lexington Quarry Stilling Basin No. 2 Sizing, August 14, 2006

APPENDIX F-2

Schaaf & Wheeler
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August 14, 2006

Mr. Mike Sheehy
Ruth & Going, Inc.
The Alameda
Santa Clara, CA 95050

Re: Lexington Quarry Stilling Basin No. 2 Sizing

Dear Mr. Sheehy:

Schaaf & Wheeler has completed their analysis of the newly configured stilling basin on the currently inactive side of the quarry. The original sizing was done specified in a letter to you dated April 23, 2002 and included as Attachment A to this letter. The required size was estimated at 1 acre-foot.

The inactive side will have three stilling basins. Each will have a minimum of 7 feet of active storage for sediment. (Excavation can go down below 7 feet without any adverse effects to the settling and storage characteristics of the stilling basin.) The downstream basin will hold a minimum of 0.8 acre-feet; the middle basin a minimum of 1.2 acre-feet and the upstream basin a minimum of 0.6 acre-feet. The total storage available for sediment is 2.6 acre-feet.

The settling characteristics of the three stilling basins are based on the Stokes' law settling theory as shown in Attachment B, dated October 22, 2002. This analysis was done to show the trapping efficiency of the previous stilling basin configuration.

The proposed center basin is approximately 80 feet in length from upstream to downstream and is approximately 80 feet in width. The velocity for a 100-year flood would then be 0.34 feet per second. It would take 235 seconds for a particle to travel the 80-foot length of the basin. This settling time would drop out all particles greater than 0.09 mm.

The downstream basin is approximately 80 feet in width but approximately 150 feet in length to the narrow outlet neck and another 60 feet to the outlet pipe. Using the 150-foot length as the settling length, the 100-year discharge would take 441 seconds to traverse the distance. As can be seen from Attachment B, all particles greater than 0.06 mm would settle out.

The 2-year flood discharge of 35.6 cfs would travel at a velocity of 0.15 feet per second through the basins and would take approximately 1,000 seconds to travel the 150 feet of the downstream basin. As can be seen from Attachment B, all particles greater than 0.04 mm would settle out.

Therefore, the proposed three stilling/settling basins will perform in a manner similar to those proposed in the past.

We appreciate the opportunity to provide this analysis for you. If you have any questions or need additional information, please do not hesitate to contact me.

Very truly yours,
SCHAAF & WHEELER

James R. Schaaf

James R. Schaaf, PhD, PE

Attachments

Attachment A

To

Letter to Mr. Mike Sheehy

Dated: August 14, 2006

April 23, 2002

Mr. Mike Sheehy
Ruth & Going, Inc.
The Alameda
Santa Clara, CA 95050

Re: Lexington Quarry Stilling Basin Sizing

Dear Mr. Sheehy:

Schaaf & Wheeler has completed their analysis of three stilling basins for the Lexington Quarry. The results of our analysis including the proposed size of the three basins, the size of the particles to be settled in the basins, and the residence time required for the particles to settle out have been included in this memorandum.

The first part of our analysis was to estimate a sediment load that the basins would have to accommodate based on average sediment yield rates for the area with adjustments being made for loss of canopy and ground cover, estimates of the maximum expected annual discharge of sediment, and a factor of safety. The average sediment yield rates were taken from a 1974 Soils Conservation Service publication, "Erosion, Sediment, and Related Salt Problems and Treatment Opportunities: Special Projects Division." The average rate of 0.2 ac-ft/sq. mi./yr. was doubled for the active mining side to account for the presence of piles of material observed during a recent site visit. These piles of material would be subject to erosion and could therefore contribute sediment loading to Basin 1. The results of our basin sizing efforts are shown below:

<u>Basin 1 - Active Mining on East Side</u>

Drainage area contributing sediment	=	22.7 acres = .0355 sq. mi.
Average sediment yield rate	=	0.4 ac-ft/sq. mi./yr
(0.4) * (15, years of avg. sediment yield in one year)	=	6.0 ac-ft/sq. mi.
(6.0 ac-ft/sq. mi) * (.0355 sq. mi.)	=	0.213 ac-ft
(0.213 ac-ft) * (10, adj. for no canopy or ground cover)	=	2.13 ac-ft
(2.13 ac-ft) * (1.2, factor of safety)	**=**	**2.6 ac-ft**
Total Volume of Basin 1, per Ruth & Going grading	=	3.44 ac-ft
Approx. Dimensions of Basin 1 (L X W X H)	**=**	**170' X 60' X 15'**

Basin 2 - Inactive Hillside on West Side

Drainage area contributing sediment	=	17.8 acres = .0278 sq. mi.
Average sediment yield rate	=	0.2 ac-ft/sq. mi/yr
(0.2) * (15, years of avg. sediment yield in one year)	=	3.0 ac-ft/sq. mi.
(3.0 ac-ft/sq. mi) * (.0278 sq. mi.)	=	0.083 ac-ft
(0.083 ac-ft) * (10, adj. for no canopy or ground cover)	=	0.83 ac-ft
(0.83 ac-ft) * (1.2, factor of safety)	**=**	**1.0 ac-ft**
Total Volume of Basin 2 Ponds, per Ruth & Going	=	4.08 ac-ft

At the request of the client we have configured Basin 2 into a multi-cell pond, with the approximate dimensions of the most downstream pond (Cell 1) shown below. The total volume of the Basin 2 ponds is approximately 4 times greater than the volume required to store 15-years worth of sediment production, providing for an increased level of protection to be discussed later in this report. Please note that Cell 1 has been sized to provide the required residence time to settle out the 0.1 mm. particle size as discussed below.

Approx. Dimensions of Basin 2, Cell 1 (L X W X H) = 180' X 55' X 7'

Basin 3 - Knoll Active Hillside on East Side

Drainage area contributing sediment	=	1.7 acres = .0027 sq. mi.
Average sediment yield rate	=	0.4 ac-ft/sq. mi/yr
(0.4) * (15, years of avg. sediment yield in one year)	=	6.0 ac-ft/sq. mi.
(6.0 ac-ft/sq. mi) * (.0027 sq. mi.)	=	0.016 ac-ft
(0.016 ac-ft) * (10, adj. for no canopy or ground cover)	=	0.16 ac-ft
(0.16 ac-ft) * (1.2, factor of safety)	**=**	**0.2 ac-ft**
Total Volume of Basin 3, per Ruth & Going grading	=	0.5 ac-ft
Approx. Dimensions of Basin 1 (L X W X H)	**=**	**62.5' X 32.5' X 10'**

The second part of our analysis was to estimate the residence time in the basins required to settle out the 0.1 mm. particle size. A particle size of 0.1 mm. represents a trap efficiency of approximately 92 percent and 86 percent, respectively, for the active and inactive sides of the quarry. Stokes' Law was used to estimate the settling velocity of the 0.1 mm. particle size.

Assuming a water temperature of 55 degrees Fahrenheit, a particle specific gravity of 2.6, and a particle size of 0.1 mm. resulted in a settling velocity of .024 ft/s.

The final part of our analysis was to determine whether there was adequate length in the proposed stilling basins to settle out the particles in the time required for the 100-year flow to pass through the basins. The 100-year flow was determined using the Rational Method with a C-value of 0.88, a time of concentration of 10 minutes, and a rainfall intensity of 4.3 inches per hour obtained from the Santa Clara County Drainage Manual.

The residence time in the basins was calculated as the time required for the 100-year discharge to pass through the basins assuming flow was going out of the basin at the same rate as it was entering the basins. The average velocity through the basins was determined by assuming that the basins were already half full of sediment and the cross-sectional area available for flow was the product of the basin width multiplied by half of the depth of the basin. The velocity was then taken to be the 100-year flow rate divided by the cross-sectional area. The settling time required for a particle diameter of 0.1 mm. was determined for a settling depth of one-half the depth of the basin divided by the settling velocity calculated using Stokes' Law, 0.024 ft/s.

The results of this final part of the analysis are shown below:

Basin 1 - Active Mining on East Side

Drainage area contributing rainfall runoff	=	25.1 acres
Runoff Coefficient, C	=	0.88
Rainfall Intensity, i	=	4.3 in/hr
100-year runoff, Q_{100}	**=**	**95 cfs**
Basin area available for 100-year discharge	=	450 sq. ft.
Velocity through basin	=	0.21 ft/s
Residence time in basin	**=**	**810 sec.**
Depth of settling in basin	=	7.5 ft.
Settling time in basin	**=**	**315 seconds**

Basin 2 - Inactive Hillside on West Side

Drainage area contributing rainfall runoff	=	22.0 acres
Runoff Coefficient, C	=	0.88
Rainfall Intensity, i	=	4.3 in/hr
100-year runoff, Q_{100}	=	85 cfs

Area of Basin 2, Cell 1 available for 100-year discharge	=	192.5 sq. ft.
Velocity through basin	=	0.44 ft/s
Residence time in basin	=	**410 sec.**
Depth of settling in basin	=	3.5 ft.
Settling time in basin	=	**150 seconds**

Basin 3 - Knoll Active Hillside on East Side

Drainage area contributing rainfall runoff	=	1.7 acres
Runoff Coefficient, C	=	0.88
Rainfall Intensity, i	=	4.3 in/hr
100-year runoff, Q_{100}	=	**6 cfs**
Basin area available for 100-year discharge	=	162.5 sq. ft.
Velocity through basin	=	0.037 ft/s
Residence time in basin	=	**1690 sec.**
Depth of settling in basin	=	5 ft.
Settling time in basin	=	**210 seconds**

The results of our analysis show that given the proposed stilling basin dimensions, the basins would provide adequate residence time to settle out the 0.1 mm. diameter particles of sediment while still conveying the 100-year discharge, even with the basin half-full of sediment.

Our analysis assumes that the ponds will outfall to Limekiln Creek through culverts with riser pipes installed in the ponds. In the case of Basin 2, the additional 3 cells upstream of Cell 1 should be connected by culverts with riser pipes. In addition, the Basins will be equipped with emergency spillways. In the unlikely event that one of the culverts becomes blocked, the pond(s) will overtop and the spill(s) will travel through the site, across the access road to Lexington Quarry, discharging directly into Limekiln Creek.

As previously mentioned, Basin 2 has been sized to be much larger than required to accommodate 15-years worth of sediment production. Based on our calculations, Basin 2 has capacity for over 40 years worth of sediment production assuming the reclamation planting efforts continue to provide an increased level of ground cover and canopy. Based on our field reconnaissance, it appears that the plantings have begun to establish themselves, particularly on top of each of the benches. The 40 plus years of sediment production capacity in the Basin 2 ponds also assumes the stilling basin currently upstream of the Basin 2 ponds is filled in and grading is performed to direct the runoff that currently drains into the stilling basin into the Basin 2 ponds. Assuming similar re-planting efforts on the active hillside currently being mined, upon reclamation, Basin 1, as currently configured, would also have capacity for over 40 years of sediment production and Basin 3 would have capacity for over 75 years of sediment production. In addition, Basin 1 could be enlarged after the mining efforts have concluded to provide additional capacity for an increased level of sediment production.

We appreciate the opportunity to provide this analysis for you. Please review our results and discuss the basin sizing parameters with your client to determine their feasibility. If you have any questions or need additional information, please do not hesitate to contact Jim Gessford at (206) 624-9932 or myself at (408) 246-4848.

Very truly yours,
SCHAAF & WHEELER

James R. Schaaf, PhD, PE

Attachment B

To

Letter to Mr. Mike Sheehy

Dated: August 14, 2006

Lexington Quarry
Sediment Stilling Basin Sizing

	Rational Method Parameters	Basin 1 (active side)			Basin 2 (inactive side)			Basin 3 (active side)		
		2-Year	10-Year	100-Year	2-Year	10-Year	100-Year	2-Year	10-Year	100-Year
Rational Method Calculations	C	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
	A	25.1	25.1	25.1	22	22	22	1.7	1.7	1.7
	K	0.93	1.45	2.16	0.93	1.45	2.16	0.93	1.45	2.16
	n	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
	T (hrs.)	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
	i (in/hr)	1.84	2.86	4.27	1.84	2.86	4.27	1.84	2.86	4.27
	Q (cfs)	40.6	63.3	94.3	35.6	55.5	82.6	2.7	4.3	6.4
Residence Time Calculations	A (sq. ft.)	450	450	450	192.5	192.5	192.5	162.5	162.5	162.5
	V (fps)	0.09	0.14	0.21	0.18	0.29	0.43	0.02	0.03	0.04
	Basin Length (ft.)	170	170	170	180	180	180	62.5	62.5	62.5
	Res. Time (sec.)	1885	1209	812	974	625	419	3695	2370	1591
Removal Efficiency Calculations	Particle Size	Settling Time (sec.) - Based on Stokes Law								
	0.1 mm.	317			148			212		
	0.05 mm.	1270			593			847		
	0.025 mm.	5079			2370			3386		
	0.01 mm.	31746			14815			21164		
	Removal Size (mm.)	0.044	0.053	0.074	0.043	0.049	0.07	0.021	0.038	0.039
	Removal Eff. (%)	94	93	92	89	88	87	95	94	94

F-2J

APPENDIX F-3

Schaff & Wheeler:

- Letter - Hydrologic Findings for Lexington Quarry Plan, September 11, 2008
- Memorandum - Hydrologic Findings for Lexington Quarry Plan September 11, 2008
- Memorandum - Basin Attenuation Clarification for Lexington Quarry, September 30, 2008

Schaaf & Wheeler
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Offices in
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Sacramento
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September 11, 2008

Mr. Richard DeAtley
West Coast Aggregate, Inc.
P.O. Box 1061
Tracy, CA 95378

Re: Hydrologic Findings for Lexington Quarry Plan

Dear Mr. DeAtley,

Please find enclosed our technical memorandum regarding our hydrologic findings for the Lexington Quarry Plan. It was found that the combination silt basins/detention basins are large enough to: 1) trap silt down to an overall weighted average of 0.021 mm for a 10-year event and 0.026 for a 100-year event; 2) store silt for a 100-year event under all conditions considered; and, 3) provide sufficient detention volume to keep the peak discharges in Lime Kiln Creek at or less than those for existing conditions.

Very truly yours,
SCHAAF & WHEELER

Stephanie Conran, PE
Associate Engineer

REGISTERED PROFESSIONAL ENGINEER
STEPHANIE LEE CONRAN
No. 71882
EXP. 12/31/09
CIVIL
STATE OF CALIFORNIA

Enclosure: Technical Memorandum – Hydrologic Findings for Lexington Quarry Plan

Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS

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TECHNICAL MEMORANDUM

TO:	Richard DeAtley	DATE:	September 11, 2008
FROM:	Stephanie Conran, PE	JOB #:	WCAI.01.02
SUBJECT:	**Hydrologic Findings for Lexington Quarry Plan**		

Schaaf & Wheeler has analyzed the hydrology for the Lexington Quarry Plan. Plans for the mining of the Lexington Quarry and the Final Reclamation Plan Grading were on plan sheets completed by Ruth & Going with revisions dated August 1, 2008. A field visit was held on May 13, 2008 to verify current basin sizes and current locations and sizes of outfall structures.

Two issues are addressed in this letter report: the change in peak discharges to the Tributary of Lime Kiln Creek for the various mining and reclamation conditions over time; and, the sediment storage and trapping efficiency of the various basins over time.

Three scenarios were investigated: existing; interim; and future reclaimed. All were defined by the Ruth & Going plan set. In addition, a "base condition" was defined as the condition prior to any mining occurring on the site.

Peak Runoff

Utilizing the procedures specified in the Santa Clara County Drainage Manual (2007) base condition peak discharges were defined for each side of the downstream-most areas of the Tributary to Lime Kiln Creek. The east side of those downstream-most areas is the side that is currently being actively mined and the west side is the side that was previously mined, is undergoing reclamation but which will need to undergo some additional grading to stabilize slopes. The runoff coefficient was set at 0.30 for all areas prior to mining. The time of concentration was defined as the time for a drop of water to flow from the ridge line down the steep slopes into the Tributary to Lime Kiln Creek and then flow down the Tributary into Lime Kiln Creek. The time of concentration was computed by using a length and a velocity from the Figure in Appendix A of the Santa Clara County Manual. The slope was computed as the average slope of these steeply-sided watersheds tributary to the Lime Kiln Creek Tributary.

The peak discharges for the base condition are shown below:

Side of Tributary	10-year Peak Discharge (cfs)	100-year Peak Discharge (cfs)	Drainage Area (acres)
West – Inactive	13.6	19.5	29.3
East – Active	13.8	20.0	24.2

The attenuation of peak discharges as the runoff goes through the silt basins was computed by using a Modified Rational method as shown in the Santa Clara County Drainage Manual and using the simplified procedures outlined in that Manual. The Manual allows a simplified method to be used only for watersheds less than 50 acres in drainage area.

<u>West Side Basins</u>

The three basins on the west side have 18” risers between basins 1 (upstream) and 2 (middle), and between basins 2 and 3. The outlet from basin 3 is a 54” riser that provides for discharge of runoff into Lime Kiln Creek. As the runoff goes through the three basins the inflow peak is attenuated by the storage above the risers. The storage below the tops of the risers is not counted because this “dead storage” is set aside for the storage of the silt load that accompanies the surface runoff.

The runoff coefficients for the three conditions were set to 0.30 for natural conditions as mentioned previously, 0.88 for actively mined conditions, and 0.80 for reclaimed conditions. The drainage areas were based on the grading plans which showed drainage direction with arrows. During the rainy season runoff from the east side is diverted to the west side by placing K-rails across the access road. This diversion increases the runoff volume to the west side basins as well as increases the silt load sent to those basins.

The storages needed to limit the outflow from the west side basins to the west side “base condition” peak discharge were found for the 100-year return period to be:

	Existing Condition	Interim Condition	Future Condition
Drainage Area (acres)	32.6	32.6	30.3
Runoff Coefficient	0.85	0.85	0.77
Storage Needed (acre-feet)	1.33	1.33	0.91
Storage Available (cubic feet)	1.34	1.34	1.30

The Runoff Coefficient, C in the Rational formula, does not vary between existing and interim conditions because the watershed area that is subject to mining activity does not change significantly. The mining is removing more of the volume of the watershed but does not significantly change the drainage area subject to mining.

The three basins on the west side have adequate storage to attenuate the outflow to or below the "base condition" for the existing and interim conditions if and only if there are 3.5 feet between top of riser and top of berm at the two upstream basins. Since this distance is not currently achieved in the existing condition, the berms will be raised for the interim condition as shown on the plans. The downstream basin needs a distance between top of riser and top of berm of 2.75 feet. For the future condition, active storage is defined as the storage between the top of the riser and the spillways and is adequate based on geometry as shown in the plans.

East Side Basins

Under existing conditions, the three basins have 15" risers between basins 1 and 2, and between basins 2 and 3. Basin 3, a very small volume, discharges to Lime Kiln Creek through two, 15" horizontal pipes. In both the existing and the interim conditions, runoff from the east side will be sent directly to Lime Kiln Creek immediately upstream of the confluence with the Tributary. In the future condition, however, the runoff will be sent into the Tributary just upstream of its junction with Lime Kiln Creek.

The storage computations for the three east side conditions are:

	Existing Condition	Interim Condition	Future Condition
Drainage Area (acres)	8.4	8.4	20.8
Runoff Coefficient	0.88	0.88	0.80
Storage Needed (acre-feet)	0.1	0.1	0.5
Storage Available (acre-feet)	0.2	0.9	1.9

The east side basins – existing as well as proposed for interim and future conditions – have adequate storage to limit the outflow to Lime Kiln Creek to the "base condition" peak discharge for the 100-year event.

Northeast Basin

All volumes of both active storage for peak flow detention and dead storage for silt storage are based on the following depths:

	Active Storage Depth (ft)	Dead Storage Depth (ft)	Total Depth (ft)
West			
Existing	• 1.0-2.0 Upper two ponds (inadequate – will be remedied in the interim condition) • 2.75 Lower pond	7.0	8.0-9.0
Interim	• 3.5 Upper two ponds • 2.75 Lower pond	8.0	11.5
Future	2.5	8.0	10.5
East			
Existing	1.5	12.0	13.5
Interim	3.0	12.0	15.0
Future	3.0	12.0	15.0
Northeast			
Future	3.0	7.0	10.0

Active storage is defined as the storage between the top of the riser and the lowest elevation on the berm or spillway. Dead storage is defined as all storage below the riser.

<u>Lime Kiln Creek Flows</u>

These basins on the east and west sides of the Tributary to Lime Kiln Creek have been designed so that flows leaving each individual basin do not discharge at a rate greater than the pre-mining condition peak discharges. It is typical practice to analyze sub-watersheds individually since analyzing them in a full watershed context can be time intensive and can introduce a greater margin of error since more assumptions are made and the watershed hydrology is more generalized, hence the basin-by-basin or sub-watershed approach was the chosen approach for design. However, an investigation into the impacts, if any, on the peak discharge in Lime Kiln Creek was requested to show that there are no expected increases to existing conditions discharges in Lime Kiln Creek downstream from the Tributary and the mining areas.

To determine flows in Lime Kiln Creek, simplified triangular hydrographs were developed using the County procedure to estimate time of concentration for larger watersheds. A Lag equation was used for Lime Kiln Creek and the Tributary which reflected the watershed characteristics of Length, Average Slope and Watershed Condition. This Lag was converted to Time to Peak which is equivalent to the time of concentration used for analysis of the various basins on the mining property. The individual triangular hydrographs for all sub-watersheds were added together to achieve a full basin context. This context included: the quarry routed through the basins, the watershed above the quarry routed through the quarry and the main watershed of Lime Kiln Creek immediately above the quarry outfalls. When these hydrographs are added together, the 100-year maximum flow in Lime Kiln Creek below the quarry outfalls in the existing condition was determined to be 395 cfs. The interim condition was the same. The future condition flow was 380 cfs (a slight, 4 percent decrease).

There is no change in hydrology for the existing and interim conditions, so there is no change in discharges. The future reclaimed condition decreases the flows since the drainage areas within the quarry more closely match the pre-mining condition and thus the basins are enabled to maximize allowable outflows and thus drain more quickly. This allows them to finish draining before the naturally delayed peak of the main watershed comes through.

Silt Storage

As in past reports on silt storage for the Lexington Quarry, the silt generation rates were based on a value of 0.2 acre-feet/square mile/year for natural conditions. To that base value a factor of 15 was applied to account for the above average sediment load during a 100-year flood year (nearby stream records show the 15 years of average sediment loading can be produced during the 100-year flood). The generation value for a 100-year flood year is computed to be 3.0 acre-feet/square mile.

For reclaimed land, this base rate was increased by a factor or 10 to account for the lack of mature vegetation. This rate for reclaimed land is 30 acre-feet/square mile. For actively mined land the base rate was increased by a factor of 20; the rate being 60 acre-feet/square mile. When sizing silt basins a factor of safety of 1.2 was used to make certain that the basins had sufficient volume to store sediment. The final generation factors, then, used for siltation storage sizing are: 36 acre-feet/square mile for reclaimed land, and 72 acre-feet/square mile for actively mined land.

It was assumed that while active mining was going on at the quarry, the silt basins would be entirely cleaned every year before the rainy season was to start and thus no allowance was needed for “residual silt” due to previous year’s accumulation.

West Side Basins

The three basins on the west side are all assumed to have 8 feet of depth below the top of the riser pipes as shown on the plans for all conditions. This “dead storage” is used to trap and hold the sediments that flow along with the runoff. The table below shows the available storage in the basins and the 100-year sediment inflow volume (with the factor of safety.) The basins are large enough to hold the anticipated sediment under all three conditions.

	Existing Conditions	Interim Conditions	Future Conditions
Silt Storage Available (acre-feet)	3.87	3.87	3.94
Silt Storage Needed (acre-feet)	3.03	3.03	1.61

Under future conditions the west side basins have sufficient silt storage capacity to hold 37 years of average silt load under reclaimed conditions of silt generation

East Side Basins

The basins for the east side (not the northeast basin that is present only during the future condition) also have sufficient dead storage to hold the silt load, assuming a dead storage depth of 12 feet as shown on the grading plans. The table below shows the available storage in the east side basins and the needed storage for all three conditions.

	Existing Conditions	Interim Conditions	Future Conditions
Silt Storage Available (acre-feet)	1.72	2.73	7.53
Silt Storage Needed (acre-feet)	0.95	0.95	1.17

The silt basin for the future, reclaimed condition has the capacity to hold 97 years of average silt generation.

Northeast Basin

This basin only is shown on the grading plans under future conditions. The needed silt storage is 0.1 acre-feet and the available storage from the grading plans is 0.19 acre-feet, based on an assumed dead storage depth of 7 feet. Under reclaimed conditions this silt basin storage could hold 30 years of average silt generation.

Settling Efficiency

Stokes law was applied, as previously, to the basins on each side and under each condition conservatively assuming that each basin was half full of sediment. Table 1 shows the results. These are similar to results shown previously. The west side basins, under both existing/interim and future conditions trap particles that are greater than about 0.02 mm for both the 10-year storm and the 100-year storm. The east side basins in the existing condition do not do quite as well but become progressively better as conditions progress toward the future condition where the basin will trap all particles slightly less than 0.02 mm. The northeast basin traps particles between 0.025 and 0.037 mm and larger at the future condition. It is important to note that during even more frequent events such as the 2-year flood the basins will trap even finer materials than the limits shown here.

Conclusion

The combination silt basins/detention basins are large enough to: 1) trap silt down to an overall weighted average of 0.021 mm for a 10-year event and 0.026 for a 100-year event; 2) store silt for a 100-year event under all conditions considered; and, 3) provide sufficient detention volume to keep the peak discharges in Lime Kiln Creek at or less than those for existing conditions.

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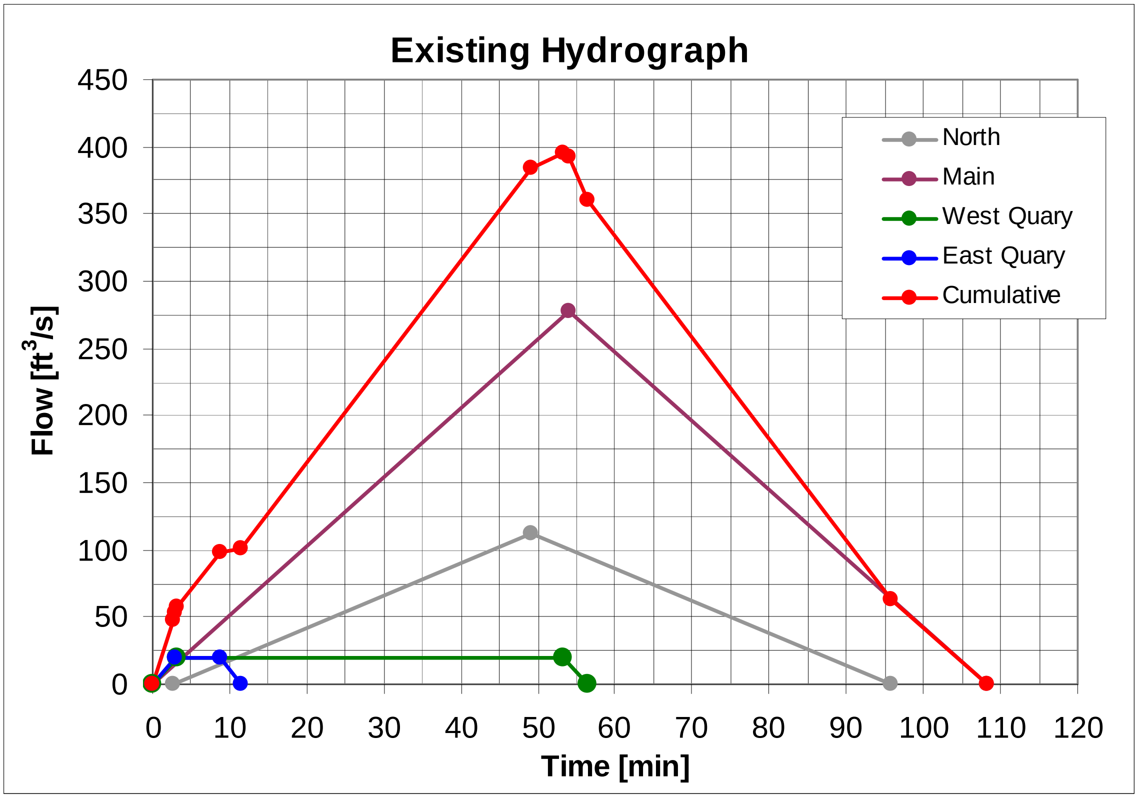
MEMO

TO:	Richard DeAtley	DATE:	September 30, 2008
FROM:	Stephanie Conran, PE	JOB #:	WCAI.01.02
SUBJECT:	Basin Attenuation Clarification for Lexington Quarry		

The attenuation time for each of the basins was calculated by balancing the water volume. The hydrograph for the drainage area for each basin represents a total volume of water being shed from area. The detention basins cut down the peak and store the resulting excess volume due to the outflow reduction. The resulting attenuation time is the time required to release the total volume assuming that, once the maximum basin outflow (as outlined in the report) is reached, that maximum outflow stays constant until the active storage volume has been released. This method is per Santa Clara County Drainage Manual outlines.

The following figures show the hydrographs for each of the contributing drainage areas and the total composite hydrograph in Lime Kiln Creek just downstream of the quarry. The existing and interim conditions are the same since there is no change is drainage area and the composite “n” value remains the same. The difference in attenuation times between the existing/interim and future conditions is due mostly to the change is drainage area and thus the change in volume that must be held.


Existing Hydrograph
Flow [ft³/s]
Time [min]
North
Main
West Quary
East Quary
Cumulative
0
50
100
150
200
250
300
350
400
450
0
10
20
30
40
50
60
70
80
90
100
110
120

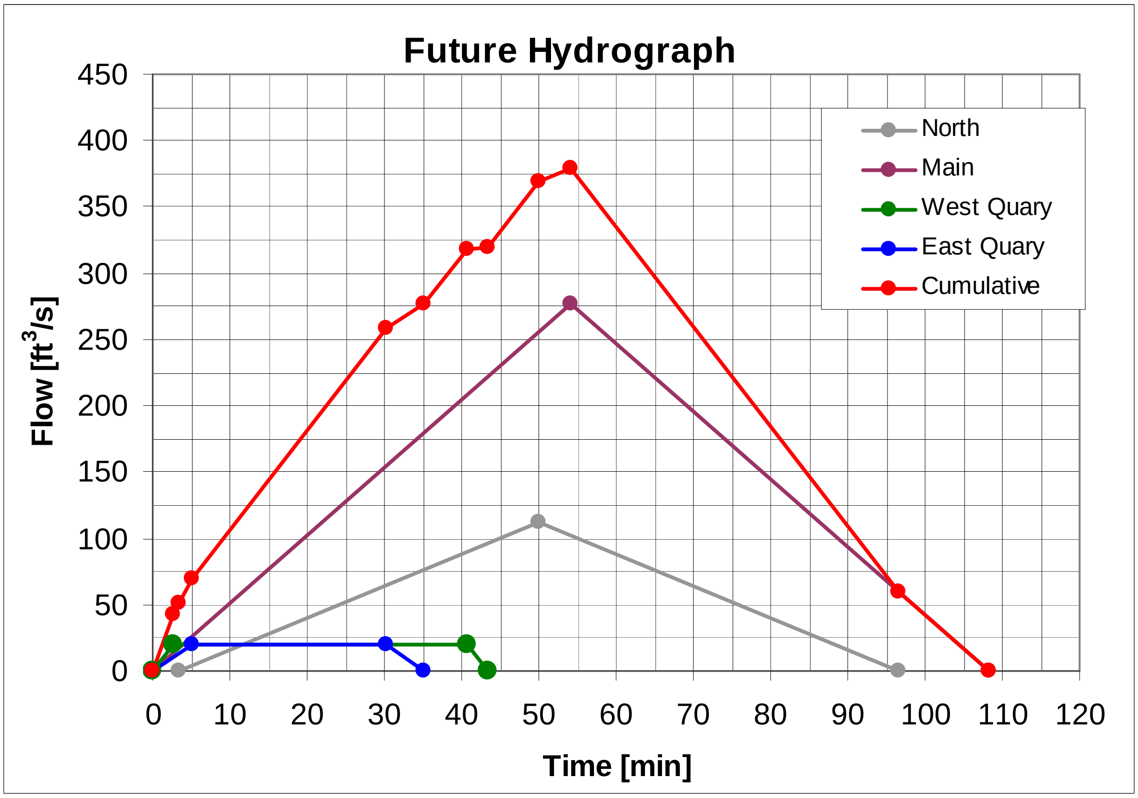

Future Hydrograph
Flow [ft³/s]
Time [min]
North
Main
West Quary
East Quary
Cumulative
0
50
100
150
200
250
300
350
400
450
0
10
20
30
40
50
60
70
80
90
100
110
120

Table 1: Settling Calculations

Rational Method	*West*				*East*						*NorthEast*	
	Existing/Interim		Future		Existing		Interim		Future		Future	
	10-Year	100-Year	10-Year	100-Year	10-Year	100-Year	10-Year	100-Year	10-Year	100-Year	10-Year	100-Year
Q (cfs) (inflow)	54.4	79.2	52.1	77.0	24.2	34.9	24.2	34.9	33.6	49.2	4.5	6.5
Q (cfs) (outflow)	13.6	19.5	13.6	19.5	13.8	20.0	13.8	20.0	13.8	20.0	1.7	2.5
Basin Dimensions (L X W X H)	370' X 60' X 11.5'		370' X 60' X 10.5'		80' X 80' X 15'		130' X 80' X 15'		400' X 100' X 15'		60' X 40' X 10'	
A (sq. ft.) [1]	345	345	345	345	600	600	600	600	750	750	200	200
V (fps)	0.04	0.06	0.04	0.06	0.02	0.03	0.02	0.03	0.02	0.03	0.01	0.01
Basin Length (ft.)	370	370	370	370	80	80	130	130	400	400	40	40
Res. Time (sec.)	9359	6563	9359	6563	3491	2399	5673	3898	21818	14993	4706	3265
Particle Size	**Settling Velocity (fps.) - Based on Stokes Law**											
0.1 mm.	0.024											
0.05 mm.	0.006											
0.025 mm.	0.001											
0.01 mm.	0.0002											
Particle Size	**Settling Time (sec.) - Based on Stokes Law**											
0.1 mm.	212		212		317		317		317		317	
0.05 mm.	847		847		1270		1270		1270		1270	
0.025 mm.	3386		3386		5079		5079		5079		5079	
0.01 mm.	21164		21164		31746		31746		31746		31746	
	10-Year	**100-Year**	**10-Year**	**100-Year**	**10-Year**	**100-Year**	**10-Year**	**100-Year**	**10-Year**	**100-Year**	**10-Year**	**100-Year**
Removal Size (mm.)	0.020	0.022	0.020	0.022	0.035	0.043	0.021	0.033	0.016	0.019	0.025	0.037

[1] Assuming Basin is Half Full