EXHIBIT G

APPENDIX C-2

TECHNICAL MEMORANDUM – REVIEW OF ISSUES RELATED TO PROPOSED GREGORY CANYON LANDFILL

Technical Memorandum

Date: June 24, 2009

To: Mr. William Hutton
Law Offices of E. William Hutton
6303 Owensmouth Ave
Woodland Hills, CA 91367

From: Dr. David Huntley
Professor Emeritus of Geological Sciences
San Diego State University

Subject: Review of issues related to proposed Gregory Canyon Landfill
(Privileged and Confidential)

As requested, I have undertaken an overview of the groundwater conditions and proposed groundwater monitoring plan for the proposed Gregory Canyon Landfill to provide an independent, outside review of the adequacy of, or possible weaknesses in, that plan. I have been provided the 1997 Phase 5 Hydrogeologic Investigation; Appendix C of the 2003 Geologic, Hydrologic, and Geotechnical Investigations Report; Appendix C of the 2004 Supplemental Hydrogeologic Investigation Report; the 2007 Water Supply Report; and the 2007 Water Quality Monitoring Report; all prepared by GeoLogic Associates. In addition, I have been provided San Diego Regional Water Quality Control Board (RWQCB) Tentative Order R9-2009-04, Tentative Monitoring and Reporting Program R9-2009-04, and the Technical Report for Order R9-2009-04.

It should be noted that this review focused on the "big picture". The RWQCB raised concerns about the adequacy of the downgradient (point of compliance) monitoring program and noted that I raised similar concerns about monitoring the groundwater in and around the proposed Campo Landfill, placed in a similar fractured rock environment. Accordingly, much of my review was focused on that issue. This memo does not address any, more detailed, opinions that I might have about the analyses described in the above reports, except those that related to the "big picture" issues that are the subject of this memorandum.

Adequacy of Point of Compliance Monitoring

As of the date of this memorandum the point of compliance monitoring is comprised of wells GMW-1, GLA-2, GLA-12, GLA-13, GLA-14, GLA-A, GLA-B, GLA-C, GLA-D, GLA-E, GLA-F and GLA-G in the fractured rock system, and well GMW-3 in the alluvium, with sentry wells GLA-16 and SLRMWD #34R. The

RWQCB, in their technical report related to the tentative order, expresses three concerns:

1. The hydrogeologic setting at Gregory Canyon is comprised of three systems – an alluvial system located downgradient of the footprint of the landfill, a weathered bedrock aquifer that underlies and is north (downgradient) of the footprint of the landfill, and a fractured rock system that, in turn, underlies the weathered bedrock. The proposed monitoring plan treats the weathered bedrock and underlying bedrock systems as one, so monitoring is not capable of distinguishing between the two.

2. Much of the aquifer testing was conducted in wells that are completed in both the weathered and un-weathered bedrock, though most research and texts recommend separately testing individual aquifers in a multiple aquifer system.

3. Monitoring of groundwater quality from point-source releases of contaminants, such as a breach in a liner, in a fractured rock system is very difficult.

In my opinion, these concerns are worthy of consideration. In particular, groundwater flow is markedly different in weathered and un-weathered bedrock. Weathered bedrock acts much more like an intergranular porous medium, with directions of groundwater flow defined more by the gradient and less by discrete avenues of permeability. Directions of groundwater flow are largely defined by discrete pathways in a fractured rock system. Therefore, a monitoring network is more likely to pick up indications of releases in weathered bedrock than in a fractured rock system. Wells that are completed in both weathered bedrock and in slightly fractured rock are likely to be providing information about the weathered bedrock system and may provide little or no information about the underlying fractured bedrock. It is much preferable to have wells separately completed in weathered and un-weathered bedrock. Further, aquifer testing of wells completed in both weathered and slightly fractured un-weathered bedrock is likely to provide little or no information about the fractured, un-weathered bedrock.

A review of the well logs and, more importantly, the geophysical and tracer logs conducted by Colog, provides some insight about which zones are likely to be monitored by the proposed wells. Wells GLA-A, GLA-E, GLA-2, GLA-F, GLA-D, and GLA-13 are all screened only in the fractured rock to the west of the thalweg of Gregory Canyon. Weathered bedrock is above the water table in all of those wells, so monitoring of weathered bedrock west of GLA-13 is not possible or appropriate.

The only monitoring well along the canyon thalweg is GMW-1, which is completed only in weathered bedrock. This appears to be an oversight, as the canyon thalweg parallels the primary fracture orientation and appears as a lineament in aerial photos. I recommend:

1. That a well completed only in unweathered, fractured rock be drilled at this location to a depth sufficient to intersect conductive fractures.

2. In addition, the water table appears to be above the weathered bedrock/alluvium interface at that location, so a monitoring well in alluvium should be placed there as well.

3. Because no monitoring wells are completed in weathered bedrock west of the canyon thalweg, I recommend that a well be drilled between GLA-3 and GLA-13 and screened only in weathered bedrock.

To the east of the canyon thalweg, wells GLA-C, GLA-B, and GLA-G appear to be completed only in weathered bedrock (the well log of GLA-G appears to identify materials consistent with weathered bedrock to the total depth of the well, though cross-section AA' shows unweathered bedrock at the base). Only well GLA-12 appears to be screened in unweathered, fractured bedrock (though cross-section AA' shows the well completed in weathered bedrock, the well log shows unweathered bedrock at 30 ft of depth, above the screened interval of the well and above the water table). Therefore, the weathered bedrock appears to be adequately monitored east of the canyon thalweg. However, the un-weathered fractured rock system is largely unmonitored east of the canyon thalweg. I recommend:

1. Additional wells be drilled and completed in the unweathered and fractured bedrock between GMW-1 and GLA-12.

2. These wells should be spaced and drilled to depths that, based on fracture geometry (fracture spacing and orientation) are very likely to intersect most productive fractures.

Completion of additional monitoring wells based on the above recommendations should provide additional assurance that the monitoring well network will detect any significant release. However, as I commented on the proposed Campo Landfill, there is simply no way in a fractured rock system that anyone can guarantee that any releases will be detected by a monitoring well network. It should be noted, however, that the relation between the landfill and potential receptors is different at Gregory Canyon Landfill than at the proposed Campo Landfill. At the proposed Campo Landfill, the most sensitive receptors were groundwater users dependent upon wells that are completed in the fractured rock system. One of the characteristics of solute transport in fractured rock is that velocities can be surprisingly high, due to moderate permeabilities and low porosities, and there is little dilution of solutes along the flow path. Therefore, wells intersecting fractures that have become contaminated by a release may be impacted quite soon after the release and at concentrations nearly the same as concentrations in the source area.

At Gregory Canyon, there are no receptor wells completed in fractured rock downgradient of the proposed landfill before groundwater flows into the alluvial aquifer of the San Luis Rey River Valley. Potential receptor wells are all completed in the alluvium. And while solutes can travel very rapidly in fractures and with little dilution, the flux is relatively low. Contaminants flowing through fractures with a low flux to an alluvial system are subject to a lot of dilution. For example, a series of fractures over a width of 50 ft with an effective hydraulic conductivity of 0.1 ft/day, subject to a gradient of 0.1 ft/day will transmit 0.5 ft^3/day/ft of depth to the alluvial aquifer at the base of Gregory Canyon. That alluvial aquifer, under a gradient of 0.01 and with a hydraulic conductivity of 20 ft/day will transmit 10 ft^3/day/ft of depth over a 50 ft wide section. That means that concentrations of VOCs on the order of 20 ug/l in the fractured rock system would be diluted to concentrations of 1 ug/l or less over a distance of 50 ft in the alluvial system. Research over the past decade indicates that the primary pathway in fractured rock systems is actually the intersection of fractures (a line), not the length of the fracture (a plane), so additional dilution would occur because of the vertical interval of contamination in the fractured rock system is much smaller than the corresponding interval in the alluvial aquifer. It is very likely that, if any release occurs to the fracture rock system, contaminants would be rapidly diluted to below the detection limit in the adjacent alluvial system. I am unaware of any alluvial aquifer which has been contaminated by releases to an adjacent fractured rock aquifer.

Summary of Recommendations

1. Additional groundwater monitoring wells should be completed in the fractured rock (unweathered) system at GMW-1 and between GMW-1 and GLA-12. The number of wells between GMW-1 and GLA-12 should be based on the proposed depth and the spacing and orientation of fractures in nearby boreholes, but should be spaced such that there is a reasonable assurance of intersecting permeable fractures.

2. An additional well completed in the weathered bedrock should be placed between GLA-3 and GLA-13.

3. An additional monitoring well should be completed in the alluvium at GMW-1 or downgradient of GMW-1 but as close to GMW-1 that alluvium becomes saturated.

EXHIBIT H

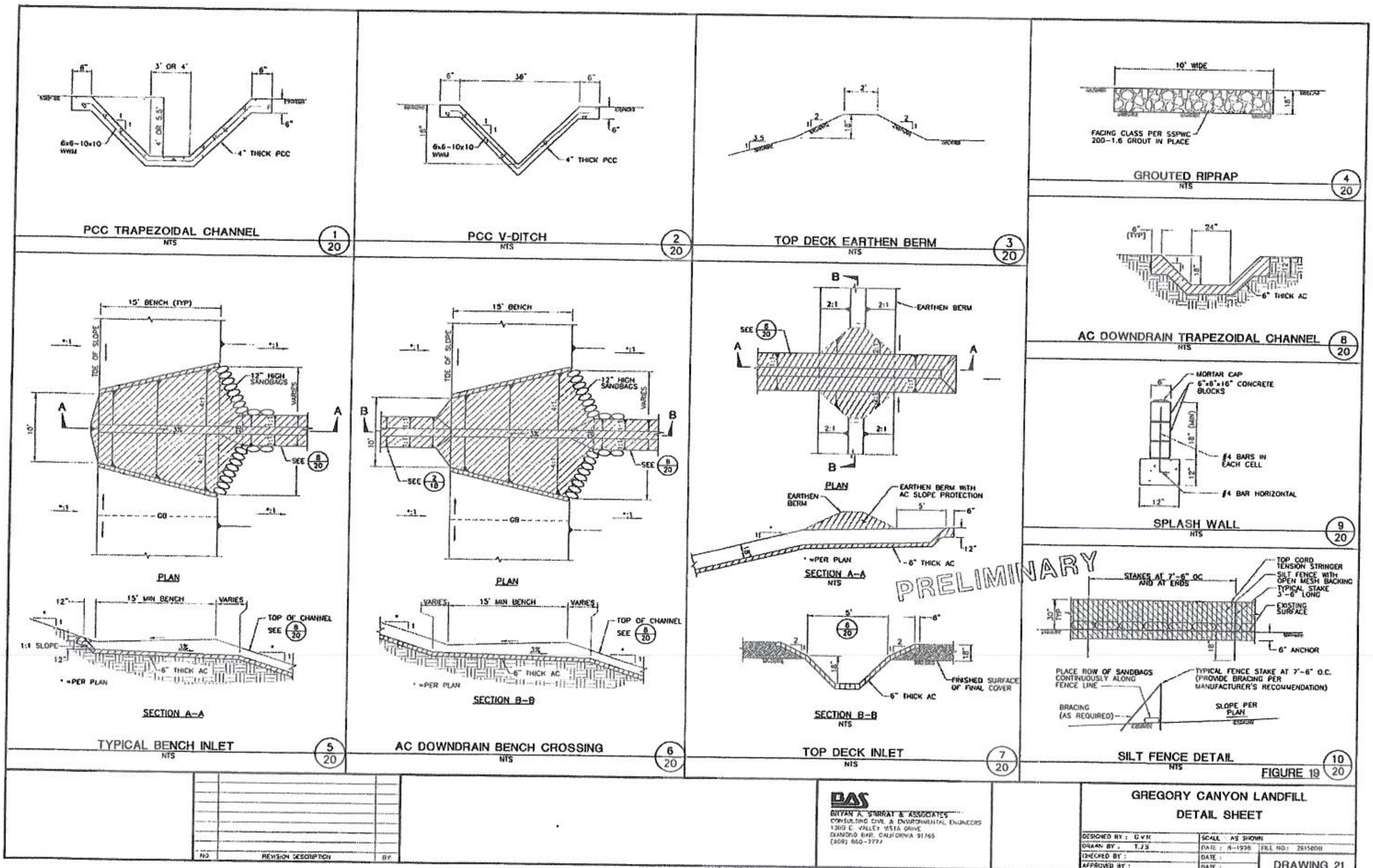

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EXHIBIT I

Estimated Leachate Production Rates

Modeling of potential leachate generation was performed using the U.S. Army Corps of Engineers HELP3 (Hydrologic Evaluation of Landfill Performance) computer program, which uses representative rainfall and evapo-transpiration data to determine the amounts of leachate that might be generated in municipal solid waste landfills. The program takes into account the total area landfilled, representative precipitation patterns, representative evapo-transpiration, and the hydraulic conductivity of various construction materials to calculate leachate generation and accumulation. The initial climate properties (excluding precipitation) were selected from HELP3 default values for the City of San Diego, and corrected for the latitude of the proposed Gregory Canyon Landfill. Precipitation data were adjusted to a conservative 50-year annual average of 18 inches, with a minimum yearly total of 4.40 inches and a maximum yearly total of 24.79 inches. The annual average precipitation value was evaluated for consistency by reviewing data compiled by Wright et al, (1991) from 116 rainfall stations throughout the county and presented on a map prepared for the County of San Diego Department of Public Works. On this map, the Gregory Canyon site falls between the 15- and 18-inch average annual precipitation contours. In addition, review of the National Oceanic and Atmospheric Administration (1974) database, indicated an estimated average annual precipitation of 16 inches in this part of the county. It should be noted that heavy rain does not necessarily result in increased leachate generation, because leachate generation is a function of infiltration, not precipitation.

Modeling was performed by subdividing the 185-acre landfill (excludes the three transmission pads on the eastern edge) into eight zones for the "floor" area (40.6 acres), and another eight for the "slope" areas (145.8 acres). Modeling of refuse placement was performed taking into account the anticipated timing and volumes of refuse that will be placed, as well as the footprint areas and elevations that are expected as the landfill incrementally approaches capacity. During active phases of landfilling at any given zone, it was conservatively assumed that refuse was left uncovered, but it was also assumed that an interim cover was placed at the conclusion of refuse placement on that zone. For the model, leachate drains in the Leachate Collection and Recovery System (LCRS) were positioned at 500-foot intervals within the bottom LCRS gravel. Along the side slopes, drains were positioned at 100-foot intervals (measured along the slope). Closure of the proposed Gregory Canyon Landfill was modeled using a prescriptive CCR, Title 27 low-permeability final cover.[9]

The results of the HELP3 analysis indicate generally low values for both the total leachate generation and peak daily leachate generation until the final cover is placed in year 31, with the exception for significant "spikes" associated with heavy precipitation over a considerable length of time to allow significant infiltration during years 3, 16 and 22. After the final cover is placed in year 31, leachate generation would be expected to decrease substantially. The amount of leachate generated reaches a maximum value in year 16, when the projected total leachate generation is estimated at 53,984 ft^3 (403,854 gallons), of which 8,187 ft^3 (61,247 gallons) are generated from the floor area and 45,797 ft^3 (342,607 gallons) are generated from the slope area. The peak daily leachate generation is estimated to be 142 ft^3 (1,062 gallons) for the floor areas

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9 As indicated in Section 3.7.1.5, if an alternative final cover design were to be considered, the appropriate modeling would be performed and presented to the reviewing agencies to ensure consistency with the performance of a prescriptive cover system. In addition, while this EIR evaluates the environmental impacts of closure to ensure that all phases of the project have been considered, a separate discretionary action and CEQA review and clearance will be required prior to approval of the Final Closure Plan.

and 1,094 ft^3 (8,184 gallons) for the slope areas during the 16th year. Calculated peak daily head on the liner reaches a maximum at 0.25 inches during the 16th year. The proposed LCRS design complies with Federal Standards Title 40, Section 258.40 of Subpart D, which allows a 12-inch range.

Potential Contamination of Adjacent Groundwater Supplies

The proposed landfill will occupy one of the tributary canyons to the Pala groundwater basin (Exhibit 4.3-1). The western part of the basin is managed by the San Luis Rey Municipal Water District (SLRMWD). In 1995, SLRMWD requested that Gregory Canyon Ltd. perform an assessment of potential impacts that could occur to the basin if leachate was released from the proposed landfill. GLA (1995) performed computer model simulations of groundwater flow for the Pala basin in the vicinity of the proposed landfill, estimated worst-case leakage from the landfill, and identified production wells (ones from which water is extracted) within the basin that could be impacted by a leachate release. The analysis assumed that the leachate containment systems incorporated in the project design meet the requirements for environmental protection mandated by U.S. and California EPAs.

GLA (1995) developed a two-dimensional groundwater flow model using the finite difference computer program Flowpath (Franz and Guiguer, 1992). Constituent transport modeling with the Flowpath computer program is accomplished with the use of particle tracking techniques, which simulate constituents as "particles" that follow the groundwater flowlines. The particle tracking method is a case of simple advective transport where no dispersion, absorption or decay are allowed. Particles are tracked until they are pulled into a modeled pumping well, or until they stagnate and are overwhelmed by a much larger flux of groundwater.

Two conditions were simulated using the groundwater flow model. The first (Exhibit 4.3-5) was to simulate groundwater flow under existing conditions with a worst-case leakage through the liner of 10 gallons per day per acre (1,850 gallons per day for the entire site) and head conditions in the Pala basin at levels approximately equal to those as provided by the SLRMWD from measurements taken in 1993. (The GLA study assumed a landfill footprint of 185 acres, which excludes the three transmission pads on the eastern edge of the landfill.) The release is assumed to be a point source and is modeled as an injection well. The second simulation (Exhibit4.3-6) involved dropping groundwater approximately 10 feet lower than ground surface in the southwest corner of the basin, as could happen if increased pumping took place during extended drought periods.

The first model showed that steady-state groundwater flow in the Pala basin can be reasonably assumed to follow the topography, with flow lines following the general trend of the river (Exhibit 4.3-5). Owing to slightly increased recharge in the vicinity of the river, groundwater velocities are higher immediately adjacent to the trace of the river. Exhibit 4.3-5 also shows the predicted pathways of particles released from the proposed landfill. The particle pathways are shown to extend past the on-site wells #41 and #42 (San Luis Rey Water District designations) when allowed to flow under steady state conditions.

The particle pathways then extend along the southern perimeter of the canyon until the particles intercept the point of constriction within the canyon, on the western side of the site at the base of the bluff where the Verboom homestead is located. (This is within the site at least 1/3 of a mile from the down gradient boundary.) At this point the pathway merges with the underflow of the San Luis Rey River. The particles do not extend beyond this point because the computer

EXHIBIT J

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January 3, 2011

Mr. Mike Porter, Engineering Geologist
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Dear Mr. Porter:

I am providing this letter for your consideration on behalf of RiverWatch and the Pala Band of Mission Indians to address their concerns with the impacts to water quality that would occur if the proposed Gregory Canyon Landfill is approved as presently planned. Specifically, I explain why the project proponent has failed to model stormwater flows in the canyon properly because of the use of out-dated and poorly applied modeling techniques. I also explain why the proposed stormwater management facilities are inadequate to control stormwater flows and sediment transport during the 30-year period of operation and the 30 years of post-closure.

In forming my opinions I reviewed and assessed a number of documents submitted to describe the project overall and its stormwater management features, including but not limited to:

Updated Evaluation of Hydrogeomorphology and Beneficial Uses at Gregory Canyon (Updated Evaluation Report);
The Hydrogeologic Map of the Gregory Canyon area;
Joint Technical Document, Volumes 1 and 2, Gregory Canyon Landfill, San Diego County, California (JTD);
Revised Final Environmental Impact Report (FEIR) and Technical Appendices A Through D;
U.S. Army Corps of Engineers' Jurisdictional Delineation (ACOE Delineation); and
Aerial photographs of the Gregory Canyon area.

In evaluating the Gregory Canyon Landfill documents I applied the experience of my 34 years of work in the stormwater management field and 11 additional years of engineering practice. During this period I have performed research, taught, and offered consulting services on all aspects of the subject, including investigating the sources of pollutants and other causes of aquatic ecological damage, impacts on organisms in waters receiving urban stormwater drainage, and the full range of methods of avoiding or reducing these impacts. The attachment to this letter presents a more complete description of my background and experience. My full *curriculum vitae* are available upon request.

THE PROJECT PROPONENT USED OUT-DATED AND POORLY APPLIED MODELING TECHNIQUES

Overall, the conclusion that stormwater can be managed to eliminate negative impacts to the San Luis Rey River and its beneficial uses is predicated on the use of methods that are inadequate to support the conclusions reached or to serve as a basis for design decisions for such an important project. Furthermore, the methods were often applied in a less than rigorous and sometimes inconsistent fashion, with inadequate input data and insufficient detail and explanation for an independent analyst to evaluate conclusions and design specifications. Accordingly, the Regional Board should require a reanalysis of the site's hydrology, employing methods I outline in this letter; reconsideration of the stormwater management plan; redesign of the conveyance and treatment facilities as needed; and thorough demonstration that the resulting system will allay the many concerns I express.

Inadequacy of the Selected Hydrologic Models

The most fundamental shortcoming is the proponent's reliance on hydrologic models of very limited capability and the failure even to apply these models in the most effective way. Modeling was based on the Rational Method and the HEC-1 model, models that have serious limitations, in different applications over the course of project development as reported in the JTD and Updated Evaluation Report. Because of those limitations, the hydrologic modeling field has begun using the superior "continuous hydrograph simulation" method, a technique also developed for the San Diego region. San Diego County and its municipal stormwater co-permittees have a beta version of a continuous simulation model, based on the U.S. Environmental Protection Agency's (USEPA's) Hydrologic Simulation Program—FORTRAN (HSPF), under testing to be completed by January 14, 2011, prior to release into regular practice.

The Rational Method amounts to an equation with which a dependent variable (flow) is computed as the product of three independent variables that are supposed to represent all of the physical processes that determine how much rainfall in a storm event is converted to surface runoff and at what peak rate it flows. It has been used in essentially the same form since its introduction in 1851, which is equivalent to communicating with Morse's telegraph (invented in 1844) in the internet age. The extremely simplistic Rational Method is severely limited in representing actual hydrologic events and magnitudes for a multitude of reasons and has no standing whatsoever among well informed hydrology professionals.

The HEC-1 model incorporates some basic hydrologic processes, like rainfall interception and depression storage, and thus avoids some of the limitations of the Rational Method. However, it still is restricted to predicting runoff from one precipitation event at a time and is better suited to watersheds larger than Gregory Canyon. Results produced by a single-event model, like both the Rational Method and HEC-1, are a function of the event or events selected, often a specified return frequency (e.g., 10 years) and duration (e.g., 6 hours). Such a selection always has some degree, and often a high degree, of arbitrariness. These models are usually run for only one or a few events, a practice followed in the Gregory Canyon analysis, and thus give a poor idea of the runoff outcome of the numerous and highly variable natural geophysiographic conditions responsible for runoff generation.

A continuous simulation model overcomes the major disadvantages of these event-based models and permits an examination of runoff produced by all of the storms in a precipitation record. It thus incorporates a full range of site-specific variables, such as total quantity of rainfall, intensity, antecedent dry period, repetitiveness of storms in a short period of time, etc. This capability allows identification of the critical conditions that must be taken into account in assessing potential impacts and in designing appropriate management facilities. These advantages have important implications for the effectiveness of facilities in protecting the aquatic ecosystems and beneficial uses of waters receiving stormwater discharges. Whereas single-event models predict only the runoff from the rather arbitrarily selected storm frequency and duration, continuous simulations provide runoff estimates for a host of other possible conditions, such as relatively intense storms (high rainfall per unit time) and repeated storms in a short period of time (e.g., three storms, each of one to several inches, within a week). A stormwater basin designed correctly based on a peak rate and volume of flow from a given storm might still lack capacity under conditions like those described, and consequently fail to protect the receiving water from the impacts of high and prolonged flows and pollutant loadings delivered by the discharges in excess of those expected based on the inferior model.

Jurisdictions like the state of Washington and many of its municipalities, some years ago, and Contra Costa County, California, more recently, moved to computerized, continuous simulation hydrologic models as the standard of practice. These jurisdictions made the foundation model, usually the USEPA's HSPF, convenient to use by developing "runoff files" encapsulating input data appropriate for the area. The San Diego region has recognized the merits of this superior approach in its movement to develop such a model for the area, which as stated above is imminently ready for full use. The Regional Board should require the proponent to reanalyze the Gregory Canyon Landfill project using an HSPF-based model, either the regional runoff files version or the base HSPF model with input data supplied by the analyst.

<u>Poor Application of the Models Selected</u>

While the models selected were inadequate, as I pointed out above, the user failed even to take maximum advantage of their limited capabilities. Specifically, the analysis was performed with insufficient precipitation and soils data.

Precipitation patterns vary substantially in an area with considerable topographic variation like Gregory Canyon. Modeling of runoff in response to rainfall events benefits greatly from the use of on-site data. In this case, even though there was every opportunity to do so, the project proponent did not install a rain gauge on the site at the outset of planning for the project, diminishing the ability to make reliable hydrologic forecasts.

Pages 2-6 and 2-7 of the Updated Evaluation Report indicate that an on-site rain gauge had been installed by January 2010. While very tardy, this equipment could be useful in upgrading the hydrologic forecasts. Assuming that it continued to operate through the year, it would have recorded one of the potentially critical meteorologic events instrumental in determining existing flow patterns in Gregory Canyon and the San Luis Rey River, predicting future flows after the project's inception, and designing the stormwater facilities to manage these flows for the protection of the natural water resources. The Fallbrook gauge recorded approximately 9 inches of rain from December 18 to 22, 2010. This is exactly the type of rainfall pattern that must be taken into account in designing stormwater management infrastructure, and that is missed by single-event models but captured by continuous simulations.

In lieu of an on-site gauge, and to provide a long-term record, data could be used from three rain gauges located in the general vicinity of Gregory Canyon, which exhibit substantial variability. Instead of taking advantage of all three gauges, the proponent used data from only one (Fallbrook according to the Updated Evaluation Report). An approach yielding better hydrologic predictions is to use data from all available gauges in the vicinity and standard techniques to interpolate the rainfall at the site from the multiple records. I encourage the Regional Board to require the proponent to reanalyze the project's hydrology with a computerized, continuous simulation hydrologic model using the full precipitation record from the three vicinity gauges, supplemented by the short-term record from the on-site gauge.[1]

In addition, the available documents indicate that the proponent collected limited on-site soils data (at 19 locations over a depth range of 0-7 ft, with percolation testing at 10 according to the FEIR) and relied heavily on the U.S. Department of Agriculture (USDA) soil survey to identify on-site soils. In my experience, the USDA soil survey is often incorrect at the site-specific level, even if properly representing the broader-scale soil matrix. Another issue is potential debris flow from the adjacent mountainsides into the project area and its runoff conveyances and desilting and infiltration basins. While the FEIR briefly addressed this issue and stated that a gabion diversion structure "... may [emphasis added] need to be installed ..." in Basin 1, it did not quantify the sediment loading expected to occur under actual storm conditions. Without that analysis, it was impossible to consider the implications of debris flow sediment loading for designing the site and its stormwater conveyances and basins and subsequently maintaining those features.

It is essential, in my opinion, that the proponent thoroughly characterize the soils of all portions of the site that would flow through the proposed perimeter channels, desilting basins, and infiltration basins. This characterization should include areally extensive soil coring to some depth below the surface and the beds of the proposed stormwater management basins, analysis of textural properties in the core samples, percolation testing to determine infiltration rates, and

[1] I note that there is inconsistency in the average rainfall data employed in different portions of the site analysis. Whereas hydrologic modeling to estimate runoff and to design conveyance and treatment facilities was based on an average annual rainfall of 14.1 inches, the FEIR used an average annual rainfall amount of 25 inches as the basis for estimating the groundwater recharge potential of the fractured bedrock system, based on rainfall amounts at Lake Henshaw. As it is impossible for there to be two different average annual rainfall amounts at a single site, let alone these two wildly different amounts, the Regional Board must require that the proponent choose one or the other for all purposes. That said, the average annual rainfall at a location somewhat remote from the site is not the key meteorological statistic for analyzing runoff generation and designing stormwater management facilities. Instead, these analyses should be performed with a continuous simulation model equipped with precipitation input from the best available, representative network of rain gauges.

identification of any areas where seasonal high water table could affect runoff production and stormwater management facility design and operation. The resulting data should be employed in the improved modeling effort I propose.

Soils and these related hydrogeologic conditions can vary extensively within short distances. There is no single numerical rule governing the number or spacing of monitoring locations. A strategy would be to scatter pits throughout the entire property and then replicate them in order to narrow spacings. Areas for proposed infiltration basins should be especially well covered (one test site for each 5000 ft^2 of basin surface is recommended by the Stormwater Management Manual for Western Washington). If replication should show little variability in some locations but more in others, it would then be reasonable to concentrate the last set of tests in the areas of greater variability. This strategy is consistent with the advice in what, in my opinion, is one of the better stormwater manuals, issued by the City of Santa Barbara:

> The number of test pits required depends largely on the specific site and the proposed development plan. Additional tests should be conducted if local conditions indicate significant variability in soil types, geology, water table levels, bedrock, topography, etc. Similarly, uniform site conditions may indicate that fewer test pits are required.

Unreliability of Modeling Results

The two models used by the proponent gave widely varying runoff quantity estimates. For example, in modeling Gregory Canyon flow rates the Updated Evaluation Report estimated the 10-year, 24-hour peak flow rate at 8 cubic ft/second (cfs) by one method and 31 cfs by another, and the 50-year, 24-hour rate at 105 or 423 cfs. In this source the 10-year, 6-hour peak rate is given as 5 cfs. However, the ACOE Delineation estimated the rate for this latter frequency and duration at a much higher 343.5 cfs. In modeling for the desilting basins, the alternative models yielded extreme variability. As shown in the Stormwater Management Plan (JTD, Volume II-B, Appendix I), post-project flows associated with the 10-year, 24-hour design condition were estimated as summarized in Table 1. Even with variations of an order of magnitude for volumes, and higher yet for flow rates, the proponent did not seek to reconcile the differences in any way. While it is not clear which runoff estimate was used to design the stormwater management facilities, it appears that the lower flow estimates were used, at least for the infiltration basins.

Table 1. Flow Rates and Volumes Estimated by the Proponent for Desilting Basins Using Two Hydrologic Models

	East Basin	West Basin
Flow rate by Rational Method (cfs)	290	210
Flow rate by HEC-1 (cfs)	11	3
Volume by Rational Method (acre-ft)	16.3	15.8
Volume by HEC-1 (acre-ft)	2.5	1.2

Given these broad deviations, I assert that it is irresponsible to proceed to the design phase at all. Instead, a third model with more advanced capabilities and better input data must be used to obtain more assurance as to what runoff rates and volumes actually can be expected.

THE PROPONENT IMPROPERLY USED PAST OBSERVATIONS TO MAKE FUTURE PREDICTIONS

Forecasts of future discharge patterns are compromised by drawing upon past observations in the existing Gregory Canyon system, whereas the contributing catchments and the discharge conveyances would change markedly if the project goes forward.

Modified Land Cover

Land cover in the canyon now is native soils and native with some invasive vegetation, with little present-day or recent human disturbance. This cover will be extensively disturbed through clearing, grading, and covering the waste with soil from the borrow areas.

The JTD states that a "disturbed" area will be declared "undisturbed" when a specified degree of vegetation cover returns. However, the document cites two different revegetation levels, 20 and 70 percent, as the criterion for the assignment of "undisturbed" status. The Revised Universal Soil Loss Equation (RUSLE) predicts that annual soil loss at 20 percent cover would be approximately 6.7 times as great as with the 70 percent cover, everything else being equal. But even the 70 percent level itself is not highly protective. The RUSLE prediction of soil loss at 70 percent is about six (6) times as great as at 90 percent, again with equality in all other factors. Comparing 90 and 20 percent, the difference would be approximately 40 times as much annual soil loss with the lesser cover. Incompletely stabilized areas would not only result in higher sediment loadings to the flow but would also yield more runoff, at higher velocities, than from truly undisturbed or fully restabilized lands.

The runoff from these "undisturbed" areas is proposed to be collected in the perimeter drainage channels and to discharge to the infiltration areas, bypassing the desilting basins. In addition to lands disturbed in the landfill operation and then restabilized, the "undisturbed" areas will comprise mountainsides draining onto the property along with locations on the site outside the operational area. However, there is no analysis of how the infiltration basins will be able to manage the flows from all of these areas, especially for larger storm events, or whether they can assimilate the sediment loads and still function as claimed.

Sediments entering infiltration basins have a high potential to clog the beds over time and reduce the amount of water that will actually infiltrate. Clogging is a common cause of failure of infiltration facilities, and that vulnerability makes it essential to protect the basins from heightened sediment inputs. The best protection for the basins is strong source control to prevent sediment release to the flows in the first place. Disturbed areas should be required to attain at least 90 percent cover, as verified by a qualified botanist of horticultural professional, to be declared "undisturbed" and allowed to flow to infiltration basins. While California's construction stormwater general permit allows permit termination with establishment of 70 percent final cover, among other conditions, the Gregory Canyon landfill is not a short-term construction site and should be held to a higher standard.

Still, sediment loading to the infiltration basins from debris flows off the mountainsides would remain a concern. The proponent should be required to analyze the potential problem and alternative solutions, including source controls; diversion of debris flows away from the perimeter channels and infiltration basins; interception in debris basins of fully adequate design capacity ahead of infiltration areas; and combinations of these strategies.

Modified Conveyance Systems

The Updated Evaluation Report is incorrect in asserting that runoff from the canyon would be the same after construction because "Development of the landfill will result in creation of similar channels around both sides of the landfill to direct occasional concentrated flows past the landfill." As described in the JTD, the proposed perimeter channels will have a regular trapezoidal geometry and concrete pavement. That design would eliminate or reduce the effect of a number of phenomena that occur when water flows in the canyon today. For example, once collected in the channels, the water would no longer infiltrate into the subsurface in the canyon, eliminating recharge to the bedrock system and increasing the volume of the flow being directed to the river. Flows also would increase because there no longer would be water uptake into vegetative tissues for storage and transpiration to the atmosphere. Also, channel "roughness" created by irregular topography, rocks, and vegetation would no longer slow the flow of the water or result in the deposition of sediments. The result of all these factors would be higher runoff flow rates and total volumes, swifter flow velocities, and greater downstream delivery of sediments than exist now.

THE BASES FOR THE STORMWATER FACILITY SPECIFICATIONS IS UNCLEAR, BUT THE DESIGNS APPEAR TO BE INADEQUATE

Stormwater Collection and Conveyance System

The JTD claims that the perimeter channels will collect runoff from all "undisturbed" areas. However, after a careful reading, I could not determine how this system will collect and direct water into the perimeter channels. For example, there is no explanation of the elevations of the undisturbed areas within the proposed landfill footprint relative to the channels and how water from some of those areas, which appear to lie at lower elevations, would enter the channels. There also is no description of: (1) where and how water would sheet flow into the channels, (2) where and how concentrated flows in specific drainages would enter the channels, and (3) how these issues were addressed in designing the system and how they will be addressed in the construction and operation of the channels. This lack of clarity on important details raises serious questions as to whether the system as proposed would even work.

Infiltration Basins

Likewise, the methodology used to site and design the infiltration basins is not provided. Infiltration basins are customarily designed relative to a runoff quantity from the hydrologic model output, the soil's infiltration rate as established by on-site testing, and a specified maximum drain time. It is not clear that any of these factors were taken into account or could be with the information assembled. As pointed out earlier, the hydrologic models employed are inadequate and their output is unreliable. Also, there is no evidence that basin site soil types or their infiltration rates were identified. These crucial omissions pose great risk of failure for the project's key stormwater management feature, the infiltration basins.

To gain some insight into the possible adequacy of the infiltration basin sizes, I assumed a favorable condition for the smaller (1-acre) eastern basin, alluvial soil with an infiltration rate of 2.4 inches/hour, the maximum rate commonly recommended in stormwater management to protect groundwater quality, unless pretreatment is employed. With an additional assumption of a maximum 72-hour drain time, I estimated that the eastern basin could infiltrate up to approximately 5.4 acre-ft of runoff. As Table 1 above shows the discharge from the upstream east desilting basin alone was estimated by the proponent to be as high as 16.3 acre-ft. Additional flow would enter from the perimeter channel on that side of the project. This analysis raises serious questions about the adequacy of the infiltration basins.

Desilting Basins

Even though the desilting basins will only treat runoff from the "disturbed" areas, they still are inadequate to prevent sediment transport in their discharges. Again, the design of these basins suffers from the same problem as the infiltration basins, in that they rely on inadequate hydrologic modeling. Furthermore, their design is insufficient for facilities operating over a 60-year or longer period. The 10-year frequency design storm, while commonly used to design construction-site settling ponds, is not adequate for facilities that will operate for years. Construction generally finishes in a year or two, making the occurrence of the 10-year frequency storm less rather than more likely. In contrast, the proposed Gregory Canyon desilting basins would operate for 60 or more years, meaning that the basins would most likely experience a 10-year frequency storm multiple times, as well as larger events of less frequent occurrence (e.g., 25, 50, and possibly 100-year events). With the proposed 10-year frequency design basis, runoff from those larger storms would receive inadequate treatment.

The desilting basins as designed are sized to target the settling of particles in the medium range of the silt size fraction, or larger, at the design flow. Even at that flow, finer silts and all particles in the clay fraction would discharge before settling. At larger than design flows, some of the medium silts and larger particles would also escape. Since there are only spotty on-site soils data, there is no firm basis for setting a particle size capture target.

I analyzed the adequacy of the basins for their stated purpose using a simplified rule commonly applied for designing short-term construction phase desilting basins. At 1.8 acres in area, the east desilting basin could capture the medium silt particles in a flow of approximately 75 cubic ft/second (cfs), whereas the Rational Method prediction cited in the Stormwater Management Plan is 290 cfs flowing from the catchment contributing to this basin during the 10-year, 6-hour rainfall. The equivalent figures for the 3.7-acre west basin are a capability of treating a flow of about 150 cfs, with 210 cfs predicted by the Rational Method.

The desilting basins thus are too small even judged with respect to the inadequate design event criterion and improper modeling techniques. Even if the underlying rationale was more stringent and the basins were properly designed in relation to that rationale, they would still not be adequate in attenuating sediment transport. The most fundamental reason for that opinion is that size of the basins must increase greatly to capture relatively small particles, and small particles often make up the largest fraction of solids. Of course, without much site-specific soils data, no one can objectively and quantitatively evaluate this issue; but it is highly likely that small particles are an important consideration at this site. It is virtually impossible to design a basin to capture sediment toward or into the clay range without either making it very large or employing chemical treatment, discussed further below. This unfortunate truth about settling basins points out the primacy of source control as a strategy to prevent mobilizing sediments in the first place. A stabilization target of 20 percent cover, or even 70 percent, is not a prescription for effective source control. The sediments escaping the desilting basins will flow to the infiltration basins where, as pointed out earlier, they risk clogging the surface soils and causing the infiltration basins to fail.

Chemical treatment of sediment-bearing stormwater has been perfected in the construction industry in the Pacific Northwest and has begun spreading out to other regions. Injection with non-toxic chemicals like chitosan or another polymer followed by settling has been shown to yield impressive reductions of suspended sediments, turbidity, phosphorus, and other pollutants. The proponent should be required to analyze this method of desilting, and to adopt it and design adequate facilities to implement it, or explain fully why it is not being adopted.

PROBABLE CONSEQUENCES OF DESIGN INADEQUACIES

The core of Gregory Canyon landfill's stormwater management plan is directing runoff from "disturbed" areas to desilting basins and then to infiltration basins, while flows from "undisturbed" areas bypass the desilting basins and pass straight to infiltration. The flow estimates for both of these sources and pathways are suspect because of the use of inferior hydrologic models, inadequate input data for the chosen models, and a faulty presumption that concrete channels will create flow patterns similar to those in the existing natural drainage ways. Even accepting the flow estimates, I have concluded that the desilting and infiltration basins are too small to serve their intended functions.

Both the "disturbed" and "undisturbed" areas will contribute sediments to the runoff flows. Sediments from "disturbed" areas will not be effectively captured by the under-designed desilting basins, and much of that sediment loading will flow on to the infiltration basins. "Undisturbed" areas will yield approximately six times as much sediment over time when stabilized to the proposed 70 percent cover as compared to a more stringent 90 percent requirement. This sediment will also reach the infiltration basins. Mountainside debris flows will be intercepted by the perimeter channels and flow unimpeded to the infiltration basins. All of these sediment sources risk clogging the infiltration basins, preventing them from infiltrating water as expected and allowing runoff and sediments to discharge on the surface.

As proposed, the east and west infiltration basin discharge points are in the San Luis Rey River floodplain, with the smaller eastern infiltration area itself being within the 100-year floodplain and close to the river channel, especially in high flow periods. The project documents do not provide sufficient information for me to determine if, when, and under what circumstances the site flow and sediments would reach the river's channel, what quantities would be involved, and the resulting effects on the designated beneficial uses. However, with insufficient basin sizes and the high potential to clog the infiltration basins, I have no doubt that the probability of flow and sediments originating from the landfill site and reaching the active channel would be far higher after the project's inception than at present. I believe it is incumbent on the proponent to correct the major flaws in the analysis performed to date, improve the management plan, and make a full demonstration to alleviate this concern.

I would be pleased to answer any questions you may have and invite you to contact me if you with wish.

Sincerely,

Richard R. Horner

Richard R. Horner

Attachment: Background and Experience; Richard R. Horner, Ph.D.

BACKGROUND AND EXPERIENCE

RICHARD R. HORNER, PH.D.

I have 34 years of experience in the urban stormwater management field and 11 additional years of engineering practice. During this period I have performed research, taught, and offered consulting services on all aspects of the subject, including investigating the sources of pollutants and other causes of aquatic ecological damage, impacts on organisms in waters receiving urban stormwater drainage, and the full range of methods of avoiding or reducing these impacts.

I received a Ph.D. in Civil and Environmental Engineering from the University of Washington in 1978, following two Mechanical Engineering degrees from the University of Pennsylvania. Although my degrees are all in engineering, I have had substantial course work and practical experience in aquatic biology and chemistry. For 12 years beginning in 1981 I was a full-time research professor in the University of Washington's Department of Civil and Environmental Engineering. I now serve half time in that position and have adjunct appointments in two additional departments (Landscape Architecture and the College of Forest Resources' Center for Urban Horticulture). While my research and teaching continue at a somewhat reduced level, I spend the remainder of my time in private consulting through a sole proprietorship. My full credentials are available upon request.

I have conducted numerous research investigations and consulting projects involving all aspects of stormwater management. Serving as a principal or co-principal investigator on more than 40 research studies, my work has produced three books, approximately 30 papers in the peer-reviewed literature, and over 20 reviewed papers in conference proceedings. I have also authored or co-authored more than 80 scientific or technical reports. In addition to graduate and undergraduate teaching, I have taught many continuing education short courses to professionals in practice. My consulting clients include federal, state, and local government agencies; citizens' environmental groups; and private firms that work for these entities, primarily on the West Coast of the United States and Canada but in some instances elsewhere in the nation.

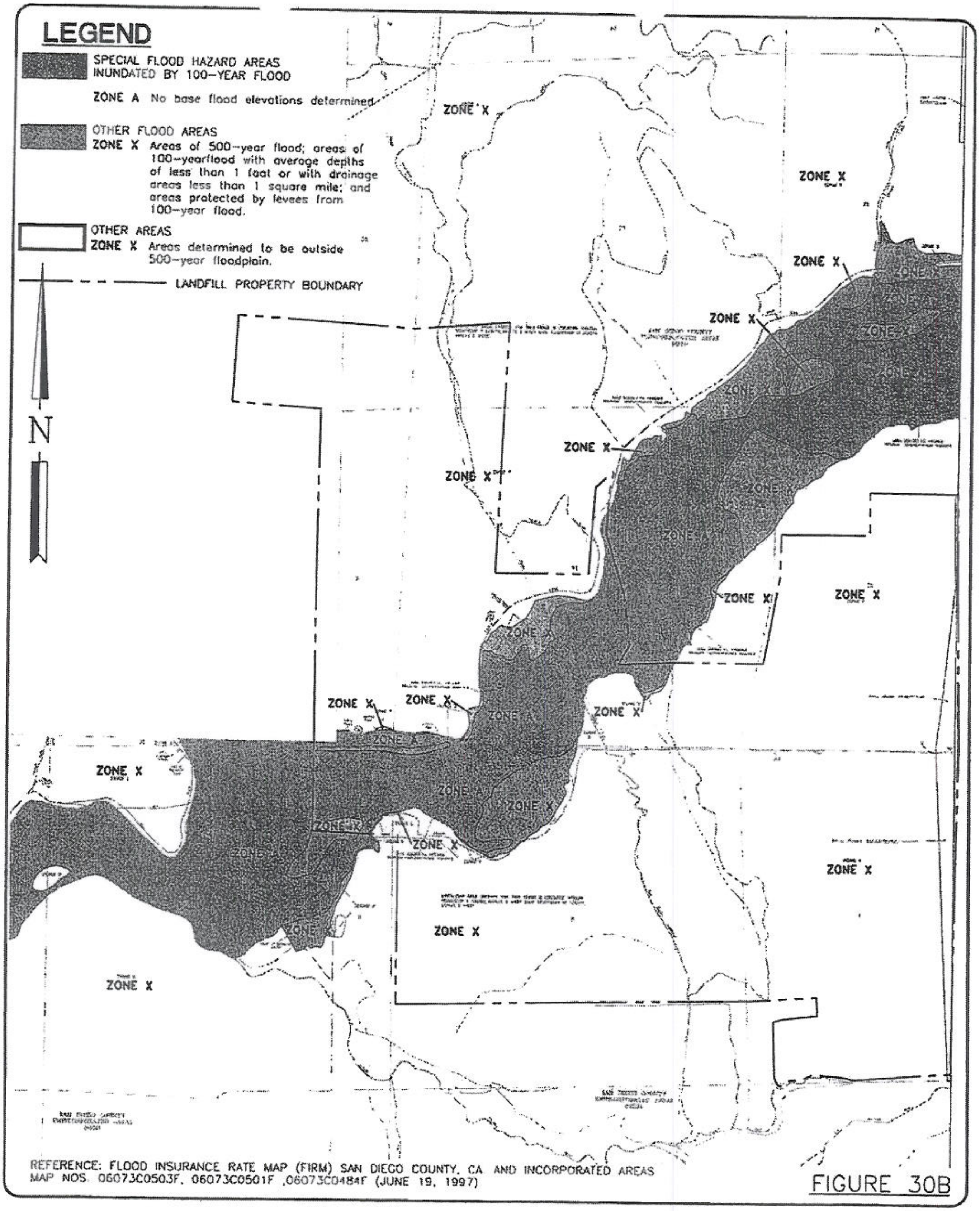
Over an 18-year period I spent a major share of my time as the principal investigator on two extended research projects concerning the ecological responses of freshwater resources to urban conditions and the urbanization process. I led an interdisciplinary team for 11 years in studying the effects of human activities on freshwater wetlands of the Puget Sound lowlands. This work led to a comprehensive set of management guidelines to reduce negative effects and a published book detailing the study and its results. The second effort, extending 10 years, involved an analogous investigation of human effects on Puget Sound's salmon spawning and rearing streams. These two research programs had broad sponsorship, including the U.S. Environmental Protection Agency, the Washington Department of Ecology, and a number of local governments.

I have helped to develop stormwater management programs in Washington State, California, and British Columbia and studied such programs around the nation. I was one of four principal participants in a U.S. Environmental Protection Agency-sponsored assessment of 32 state, regional, and local programs spread among 14 states in arid, semi-arid, and humid areas of the West and Southwest, as well as the Midwest, Northeast, and Southeast. This evaluation led to the 1997 publication of "Institutional Aspects of Urban Runoff Management: A Guide for Program Development and Implementation" (subtitled "A Comprehensive Review of the Institutional Framework of Successful Urban Runoff Management Programs").

My background includes 15 years of work in Southern California, where I have been a federal court-appointed overseer of stormwater program development and implementation at the city and county level and for two Caltrans districts. I was directly involved in the process of developing the 13 volumes of Los Angeles County's Stormwater Program Implementation Manual, working under the terms of a settlement agreement in federal court as the plaintiffs' technical representative. My role was to provide quality-control review of multiple drafts of each volume and contribute to bringing the program and all of its elements to an adequate level. I have also evaluated the stormwater programs in San Diego, Orange, Riverside, San Bernardino, Ventura, Santa Barbara, San Luis Obispo, and Monterey Counties, as well as a regional program for the San Francisco Bay Area. At the recommendation of San Diego Baykeeper, I have been a consultant on stormwater issues to the City of San Diego, the San Diego Unified Port District, and the San Diego County Regional Airport Authority.

I was a member of the National Academy of Sciences-National Research Council (NAS-NRC) committee on Reducing Stormwater Discharge Contributions to Water Pollution. NAS-NRC committees bring together experts to address broad national issues and give unbiased advice to the federal government. The present panel was the first ever to be appointed on the subject of stormwater. Its broad goals were to understand better the links between stormwater discharges and impacts on water resources, to assess the state of the science of stormwater management, and to apply the findings to make policy recommendations to the U.S. Environmental Protection Agency relative to municipal, industrial, and construction stormwater permitting. The committee issued its final report in October 2008.

EXHIBIT K



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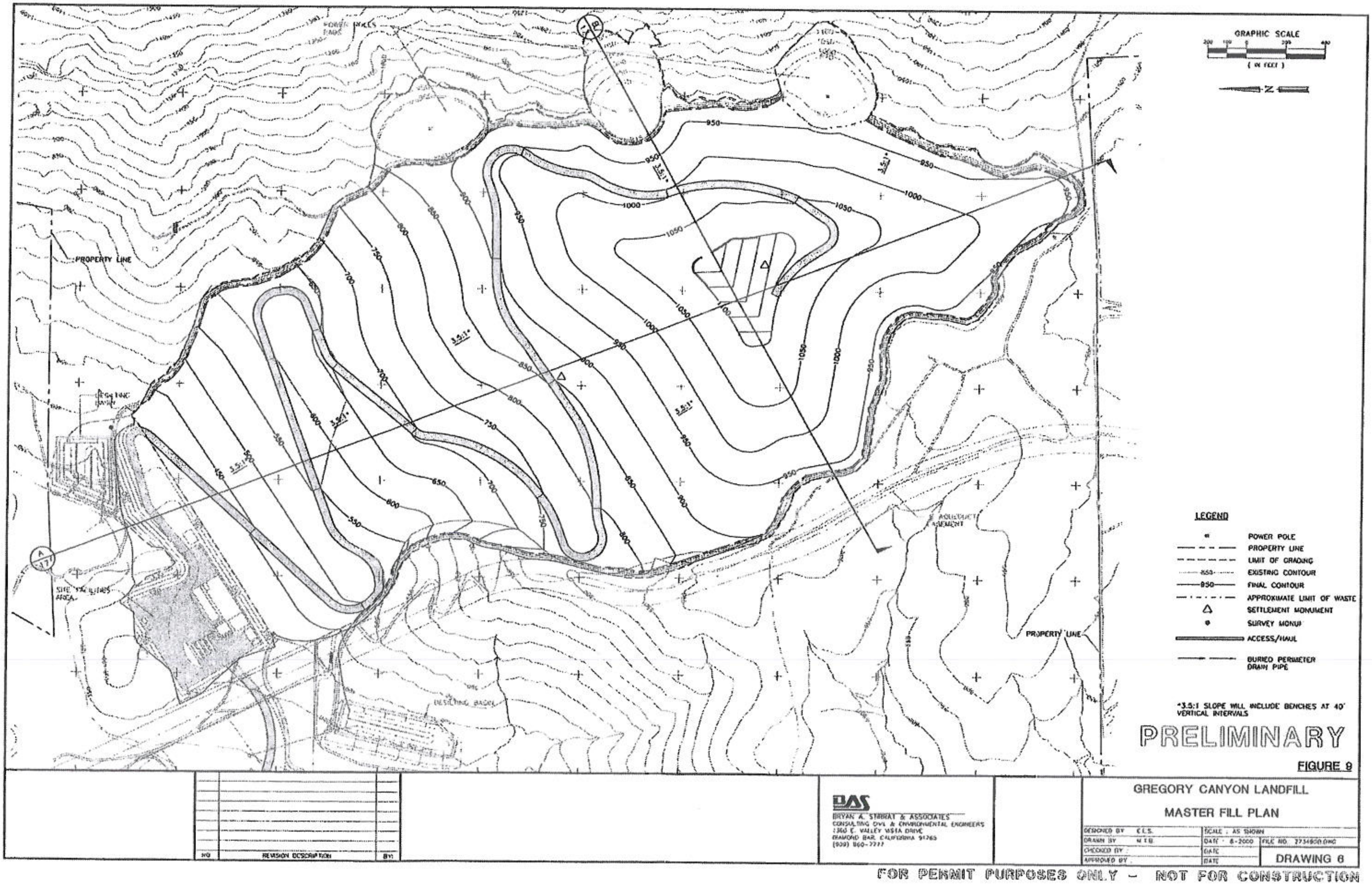
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MASTER FILL PLAN
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