Response to Comments 10

A complete draft of this report was published on August 7, 2007 and distributed, in electronic form, to the Technical Advisory Group. Paper copies of the publication were also prepared and sent to the San Francisco Estuary Institute (SFEI), for technical peer review. The reviewers at SFEI were Rainer Hoenicke, Mike Connor, Lester McKee, Robin Grossinger, and Josh Collins. Upon review of this document by SFEI, comments were prepared and submitted to the authors. A discussion between the authors and the reviewers occurred on September 27,2007 at the offices of the San Francisco Estuary Institute, Oakland, California.

The table below enumerates the September 27, 2007 comments from SFEI, and the responses to those comments by the authors. When given, page numbers refer to the publication dated August 7, 2007.

SFEI Peer Review Comment	Project Team Response
1.1 - What is the end product of the conceptual model? How will it be used? To inform a more "fully automated and dynamic model?" Perhaps mentioning this future computational model more clearly in the beginning would constitute another reason to build a conceptual model first, especially given that there is a chapter dedicated to models.	The previous Introduction provided inadequate guidance to the reader on what to expect in the report. The introductory chapter has been reworked and these questions have been addressed in the executive summary.

SFEI Peer Review Comment	Project Team Response
1.1 – I do not fully understand the organization of this section and what, in particular, I should expect in the report. There are several lists: objectives (which is clear), "specific management decisions" to be evaluated, and "components necessary to develop a comprehensive assessment." How does the report approach each of these and in what sequence? Based on the first two paragraphs, I understand the main focus of the report is to develop conceptual models for a better integrated understanding of the watershed.	The reworked Introduction provides a better summary of what the reader should expect.
1.6 – "Each section…has been divided into three topical areas" – Hasn't the report (rather than each section) been divided into three topical areas? (The first three main headings in the table of contents are the three identified topical areas).	Correct. This has been reworded.
It would be good to have a map showing the Upper and Lower Laguna Watershed areas.	There is not an exact boundary between the Upper and Lower Laguna Watersheds, therefore a map delineating these distinct areas can't be provided. In addition, the boundaries vary across different tributaries (depending on where depositional processes become significant along a given tributary). However, a description of what processes define these areas would help in roughly delineating the downstream boundary of each tributary adjacent to the mainstem Laguna. The Upper Laguna Watershed consists of headwater zones of tributary channels to the Laguna and the main stem tributary channels and represents sediment production and transport zones. This domain is the source for sediment through hillslope processes but also serves as the transport link between headwater zones and the Lower Laguna. The Lower Laguna Watershed consists of the main channel of Laguna and its floodplain, including the lower reaches of the tributary channels and floodplains. The Lower Laguna Watershed represents the depositional zone in the Laguna system where stream channels act as sediment sinks.

SFEI Peer Review Comment	Project Team Response
Are there problems that arise during periods of low flows – what are the important factors to concentrate on at different times of the year? Should the seasonality of problems and how they relate be clarified?	Increased summer flows from irrigation likely increase in-channel vegetation growth. In winter, increased peak flows from development result in increased channel erosion and sediment transport.
Link to the anthropogenic causes are not clear from the studies discussed. How is the link going to be clearly made between hydrologic regimes and sedimentation processes and anthropogenic influences? More clearly, I don't necessarily see the report summaries and associated data at the beginning of this chapter leading directly into and informing the discussions of the conceptual models.	PWA's 2001 study on Geomorphic Investigation in the Laguna Watershed detailed the anthropogenic influences on hydrology and sedimentation in the Laguna. The report included a chapter titled "Assessment of Historical Changes" that addressed issues such as land use changes in the watershed, early river management, river management associated with flood control, and recent river management activities in the watershed along with chapters on assessment of hydrology, geology, and channel sediment character. The PWA 2004 study summarized those findings and reinterpreted earlier observations based on more detailed technical analyses. Both of these reports can be requested from the US Army Corps of Engineers. We incorporated a summary discussion of land use changes and their effect on hydrology and sediment processes in the introduction to Chapter 4.
Should anthropogenic causes of sedimentation be mentioned in the introduction to the chapter? They are discussed extensively in the discussions of the conceptual models, starting at 2.3.	Yes. We incorporated a summary discussion of land use changes and their effect on hydrology and sediment processes in the introduction to Chapter 4.

SFEI Peer Review Comment	Project Team Response
"2002-2003 Turbidity Measurements:" Upon what parameters is suspended sediment concentration dependent on? It's partially a function of discharge—what else? I would be interested in more explanation of Fig 2-10 through 2-12.	The mainstem Laguna channel is a transport-limited system whereas downstream reaches of the tributary channels are either transport- or supply-limited. Please refer to the PWA (2004) report on the geomorphic reconnaissance of the tributary channels and observed sediment transport characteristics. Figures 4-12 and 4-13 (in this final report) are mainstem Laguna locations where the channel is transport-limited (capacity-limited) and represent reaches where many variables such as discharge, depth, velocity, width, slope, and bed topography influence sediment transport. Figure 4-14 shows the suspended sediment concentration at Santa Rosa Creek at Willowside Road, where the suspended sediment transport is primarily supply-limited (except the sand-sized materials, which are occasionally transported in suspension). Therefore, in addition to the rate of supply and discharge, seasonal differences and hysteresis (where sediment wave is not synchronous with the water wave) also affect suspended sediment concentrations. Please note this effect and the closer correlation of concentration with discharge on Figure 4-14 compared to Figures 4-12 and 4-13.
2.3 – Change "the Laguna system or its physical and ecological" to "the Laguna system and its physical and ecological?"	Modified as suggested.
2.3.1 – Identified the distinct difference between pre- and post-European influence. May also want to discuss differences due to the agricultural shift to vineyard and the parallel expansion of urban areas in the latter part of the 20th century.	Please refer to PWA (2004) and Laguna de Santa Rosa Foundation (2006) studies for more discussion of land use changes and their effects on the temporal variability of hydrologic and sediment delivery.

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p. 39 – Agriculture can also cause dewatering of the channel depending on water extraction practices (location and depth of wells), the balance of urban influence, and the location of the groundwater table. This, however, may only occur in upper reaches. This comment relates to a general need for distinction between the Upper and Lower watershed. That is, when are comments addressing the whole watershed, and when do they only apply to the lower Laguna system?	Groundwater pumping for agriculture primarily occurs in the Lower Laguna. Comment noted. However, typically the processes for Upper and Lower Watersheds are discussed in separate sections.
p. 39 – Can increases in low flows also be due to channel incision (streambed closer to groundwater table)?	This could conceivably be true. However, incision is predominant in the upper part of the system and would not explain increases in low flows in the Lower Laguna Watershed.
p. 39 – Is it possible to link the elevated groundwater table (and subsequent increased low flows) to the increased summer water supply in the mainstem Russian River as a result of management practices at the dams and the Eel River diversion?	The groundwater movement is toward the Russian River (p.39: "the Santa Rosa Plain subbasin drains northwest to toward the Russian River"). It is not likely that increases in groundwater levels along the Russian River would translate back very far toward the Laguna groundwater elevations, limiting the effect of this mechanism. The USGS groundwater model would provide a more definitive answer if queried on this point.
p. 41 – The effect of geology and soils – What is the Laguna dominated by and where? (Impervious and resistant or permeable and loose?)	Please refer to PWA (2004) and Laguna de Santa Rosa Foundation (2006) studies for more discussion on the geology and soils of Laguna, as well as the groundwater section in this report.

SFEI Peer Review Comment	Project Team Response
p. 39-41 – How have the discussions of hydrologic modifications due to (sub)urbanization in the Lower versus Upper Watersheds been distinguished? Has the Lower Watershed not been influenced by land cover change and stream channel alteration, given that this is discussed in the Upper watershed section? Should the differences be brought out more clearly and perhaps linked to the physical differences between the Lower and Upper Watersheds (different types of development and agriculture leading to different types of consequences)?	Given the distinguishing characteristic that defines the Upper and Lower Laguna Watersheds as different zones (source/transport zone versus depositional zone) by our definition, we have discussed the aspects of (sub)urbanization that support each of those characteristics as appropriate to the region being discussed. While aspects of development could support increases in sediment production in the Lower Laguna (depositional) zone, for example, the predominant processes of concern in this zone will be those that support deposition. There are not strict physical landscape (or development) distinctions between the two zones, as described above, so discussion of these differences has not been included in the text.
p.46 – Figure 2-16 needs a title	Comment noted.
2.3.4, p50-51 – Why is the project rate of water supply by 2030 expected to decrease to 3,000 acre-feet? Secondly, are these figures part of the 29,700 acre-feet figure listed in the preceding paragraph, or is it in addition?	This number references groundwater that is expected to be used in 2030. The number is expected to decline as a result of increased surface water supplies becoming available. The 29,700 acre-foot value is an estimate of total pumping, both public and private, and would therefore include the portion of these "total groundwater and local supplies" that represent groundwater pumping from the Santa Rosa subbasin. The numbers come from two different sources and are getting at somewhat different things, but help to identify the scale of total pumping versus the much smaller scale of pumping for public water supply.
Question 3, p. 54 – This question seems to be more clearly focused on the Lower Laguna area – should this be specified (summer flows may not be elevated in upper reaches).	The question is indeed focused on the Lower Laguna. Modified the question as suggested to: "Is it likely that present and/or expected future condition low flows, especially in the Lower Laguna Watershed, do or will impair beneficial uses?"
Question 6, p. 56 – This seems to be a key question, especially in terms of management implications.	Question 6 asks, "What is the magnitude of bedload contribution from each source (e.g., roadside ditches, landslides, gullies, creek banks, etc.) and each geographic subregion, and how are these expected to change in the future?" We agree that this is a key question in terms of its management implications.

SFEI Peer Review Comment	Project Team Response
p10 – ac-ft per year is an off unit for sediment yield. 25% delivery to the Russian R. seems too high – I would expect more like 10%. Please justify.	The sediment yield estimates were derived from the PWA (2004) study, the focus of which was to estimate sediment deposition rates and volumes in relation to flood storage. Typically, flood storage issues are discussed and reported in acre-feet. Since, one of our focus areas is flood management for the current report, the units from the original estimates were not revised. In addition, the PSIAC method estimates sediment yield in units of acre-feet per year. 25% delivery to the Russian River is derived from estimates of sediment storage in the upper watershed and the trap efficiency of the Laguna. We estimated that 50% of sediment from the watershed is coarse sediment and is stored in the upper watershed and upper tributary channels (based on observed particle size distributions, delivery patterns, and a limited record of channel sediment removal activity at one location –Hinebaugh Creek). We estimated the trap efficiency of the Laguna as 50% based on Brune's empirical relationship to estimate long-term trap efficiency in normally impounded reservoirs based on the correlation between the capacity to inflow ratio. Therefore, 25% (50% of 50%) of sediment is deposited in the Laguna, while the remaining 25% is delivered to the Russian River.
p11 – median flows of 500 cfs seems too high. I looked up the data and it appears more like <10 cfs (9.2). Please check.	We rechecked the statistics for the Laguna de Santa Rosa near Sebastopol station from the USGS website. Median of daily mean values for each day is typically less than 10 cfs from May to December. However, median flows go up to 490 cfs in the first couple of days in January and are typically higher than 100 cfs from January to mid-March.
p20 – it would be helpful to the reader to have main creek names on this map as well as an outline of the position of the Laguna.	Figure modified.
p23 – do you mean tables 2-3 to 2-5? These figures do not show flow-duration curves – wrongly referenced? Please check.	Text deleted. The flow duration curves are not included in this report. Please refer to PWA (2004) study for flow duration relationships.
Table 2-6. Number of significant figures detracts from the information.	Deleted significant figures.

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p26 – last paragraph and in the table – mixing units is at best odd and at worst ambiguous and leads to the likely misuse of the data by a future reader. (metric tons per year v tons/sq-mi/yr). Please consider being consistent or being very thorough of stating the units with definitions	Comment noted. Tons/year is adopted.

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p27 – These are v. high sediment yields. Given the style of the channel – I have to wonder how transport is supported. Is it possible that floodplain storage is a large and unquantified term? Please add a comment as you see fit.	As indicated in Section 2.3.3 "Perspective on Sediment Yield Estimates", based on our understanding of sediment production in the watershed, field observations, and comparison to other studies, we concluded that the MUSLE method significantly overestimated sediment yields in the Laguna watershed. The MUSLE results are only presented to provide a range and a high upper limit for sediment yield estimates. Below discussion further explains this conclusion and is extracted from the discussion in the PWA (2004) report: "The MUSLE estimated sediment yield is much larger than the value produced by PSIAC… These estimates are significantly out of line with both the Matanzas reservoir and Russian River basin measurements, suggesting this method overestimated sediment yield for the Laguna watershed. In addition, using our own data for sediment deposition in the Laguna, we would require a trap efficiency of 50 percent and a delivery ratio of less than 10 percent to arrive at a convergence between sediment deposited and sediment yield. Based on rough calculations of channel area length and width it is apparent that to store this amount of sediment in the channel system would require tens of feet of storage (channel bed aggradation) across the whole river system, which is clearly not the case. There are three possible explanations for the inconsistency of our findings with the high MUSLE figures. "Firstly, we could have miscalculated the sediment deposition depth and thus the volume in the Laguna. Assuming a sediment delivery ratio of 50 percent and a sediment trap efficiency of 50 percent the MUSLE figures would result in 12,500 ac-ft of deposition over the recorded time period, as opposed to our estimate of 1,806 ac-ft. Based on our depth-volume calculations this would require approximately 7 feet of sediment deposition. Even given the caveats we presented regarding inaccuracies in survey locations and depths, it is extremely unlikely that the assessment could be this inaccurate, or indeed that 7 feet of deposition on

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(continued)	the floodplain (adjacent to infrastructure such as roads and bridges) would go unnoticed. We therefore reject this possibility. "Secondly, we could have made incorrect assumptions regarding the horizontal extent of sediment deposition (e.g. sediment could have accreted as layers parallel to the ground surface rather than horizontally. This is more plausible than a large error in depth calculation, but even doubling the horizontal extent of our depositional area would leave the estimated sediment volume greatly below the figure estimated by MUSLE. We again reject this possibility. "Lastly, sediment produced in line with the MUSLE could have been eroded, but not transported into the channel system (i.e. stored in the fields where it was generated). To match our sediment volume figures approximately 90 percent of all eroded sediment would have to be stored on site for this to be possible. This may be possible, but is unlikely. Once sediment is detached we would expect more than 10 percent of it to reach the drainage system over a 46-year period. "Therefore it is likely that the MUSLE figures are an overestimation of sediment production. The inaccuracy of the MUSLE estimation may be due to USACE generated high runoff figures. Using regional runoff curves from the USGS rather than the HEC-HMS values used for the MUSLE analysis gives much lower predicted runoff values, suggesting a potential reason for the higher soil erosion estimates. In addition, use of MUSLE for such large watershed areas is questionable, given its intended use as a tool for estimating erosion at the farm field scale".

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p28 – The data may be bad. Please provide the reader with more detail on what probe was used and how it was able to measure turbidity >1800 ntu. What influence did water color have on the turbidity measurements given you mention earlier in the report that the water is tea-colored. Please clarify and comment. What was the brand and model probe that was used?	Figures 4-12 through 4-14 (in this final report) show discharge versus suspended sediment concentration (not turbidity) at the gauged locations. Maximum turbidity values were observed in the beginning of the monitoring period and ranged from 800 NTU at Occidental Road, to 950 NTU at Stony Point Road, to 400 NTU at Willowside Road (PWA, 2004). We used an optical backscatter turbidity sensor (OBS-3 by D&A Instruments), a pressure transducer (PT-1230 from Druck), and a date logger (CR-510 by Campbell). OBS-3 can measure turbidities up to 2,000 NTU (http://www.d-a-instruments.com/obs3+.html).
It appears that none of the references in hydrology and sedimentation chapter are in the reference list. Miliman is spelt [sic] incorrectly.	All of the references have been added to the reference list; the incorrect spelling of Milliman has been corrected.
p43 – discharge seems high but reasonable – I convert your number to 400 mm of runoff (about the same as Sonoma Creek).	Comment noted. Please also note that the average annual runoff in the watershed based on Rantz's 1974 mean annual runoff distribution map in the San Francisco Bay region results in approximately 360 mm of runoff for the watershed.

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p45 – When several estimates converge, that has no bearing on the quality of the estimate. It is how they compare to your conceptual model of magnitude and process. Please remove the comment and justify you estimate from the basis of your understanding of sediment loads in other bay area landscapes or some other conceptual models.	We agree that the convergence of several estimates has no bearing on the quality of the estimate. However, if the quality of the estimates is adequate and the estimates themselves are deemed reliable based on a solid understanding of the watershed processes, comparison to nearby systems, and best judgment, the convergence of estimates is meaningful. We concluded that a sediment yield estimate of 0.6 to 0.8 ac-ft/sq-mi/yr, that is 1,000 to 1,400 tons/sq-mi/yr (using a specific weight of 90 lb/ft^3) is representative of sediment yield in the Laguna watershed. Please refer to PWA (2004) report for details on different assessment methods, assumptions, and caveats. Sediment yield estimates in the nearby watersheds or in Northern California watersheds also underlain by Franciscan complex are comparable to our estimates. Sonoma Ecology Center has published a sediment budget of the Sonoma Creek watershed in which an annual sediment yield of approximately 1,100 tons/sq-mi was estimated. Ritter and Brown (1971) evaluated suspended sediment transport in the Russian River basin. For the years 1965 to 1968, Ritter and Brown found a suspended load of 1,150 to 14,000 tons/sq-mi/year, the highest being in the very wet 1965 water year. Griggs and Hein (1980) estimated average erosion rates for a number of Northern California watersheds based on off-shore sedimentation studies. Their study suggested an erosion rate of approximately 1,600 tons/sq-mi/yr in the Russian River watershed. California Geological Survey (CGS) prepared a technical memorandum reviewing the EPA's July 2002 analysis of impacts of timberland management on water quality (2002). It concluded that from a review of the literature and analysis of recent studies conducted by the CGS watersheds underlain by Franciscan mélange are likely to have natural/background sediment loads of approximately 1,000 tons/sq-mi/year or greater (Bedrossian and Custis, 2002). Therefore, we believe that our sediment yield estimates are representative of a Northern California coastal watershed that is underlain by Franciscan mélange and that has undergone land use changes. The above comparative information has been included in the revised text.

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p46 – Please remove this figure so that there is no confusion on your recognition that the number are off.	Figure 2-16 removed.
p52 – Key uncertainties and data gaps paragraph. I agree, in terms of the academic question on sediment transport through the Laguna, the largest data gaps appear to be the influence of bi-directional flow and over-bank flow on storage. As it related to storage of nutrients and flooding, it may be an important management question as well.	Comment noted.
p56 – Question 7 seems to be a priority question.	We agree that locations of present sediment deposition areas within stream channels and floodplains is an important unknown (there is no hierarchical arrangement of questions in terms of priority). The current USGS study will address this question for the studied reach along the Laguna. Anecdotal reporting from SCWA maintenance staff, monitoring data, as well as future hydrodynamic models of the mainstem Laguna and tributary channels would help to address this critical question.

SFEI Peer Review Comment	Project Team Response
p61 Geological sources of phosphorus have been overlooked in the conceptual model. I have found that P concentrations in Napa, Sonoma and Pinole Creek in some sub-watersheds seemed likely associated with geological sources no land use / management.	We agree that it is possible that geological sources of phosphorus could be a providing a significant background load. The conceptual model figure has been modified to include this as a potential source. The Santa Rosa Plain is largely comprised of Clear Lake Series Soils. These soils contain high percentage of clay (35-59%) and are susceptible to erosion. Clay particles bind with phosphorus and certain metals. Therefore during winter storms, phosphorus inputs associated with sediment erosion can be a source to the Laguna. However we have been unable to identify any information providing the nutrient content of soils within the Laguna. Therefore, at the conceptual model level, we are not able to quantify the geological background source of nutrient loading. We believe that the Laguna is a naturally eutrophic system due to its low gradient, its surrounding productive terrestrial environment, and possibly high background levels of nutrient loading. However the Laguna has extremely high nutrient levels when compared to other waterbodies within the ecoregion (see Table 10-1) and the historical anthropogenic point sources and non-point sources of nutrients have played an unmistakable role in creating the hypereutrophic conditions that exist today.
p63 Please provide a justification to the reader why medians are greater than means. Is it because the system is point-source dominated? If so, figure 3-20 would suggest that the point sources are triggered by rainfall process because we still see high concentrations in the wet season – normally not what would happen if dilution was at play. The ammonia and nitrite numbers seem very high – please justify the data quality.	The Laguna is dominated by nonpoint sources in some locations and point sources in others. For this specific dataset, the medians are greater than means. Depending on which direction the data are skewed, medians can be higher than the mean. For this case, the median and mean are actually very close (0.38 vs. 0.36) and should not be a cause for concern. The dataset is also limited by its number of data points (i.e. 9). We believed the ammonia concentrations to be real as they also correspond to high TKN and TN values. The dataset was provided by the City of Santa Rosa, which has a demonstrated track record of excellent QA procedures.
Table 3-5. It would be helpful to normalize these numbers to area so that they can be compared to world literature by a reviewer and in the text. Please add some comparisons to other systems as a justification for data quality.	Please see the new Table 5-5b "Loadings normalized to area."

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p71 – I think the ammonia number for urban runoff are high – my own data set for Sonoma and Napa downstream of the urban areas maxed out at <86 ug/L. Please justify your data quality.	Santa Rosa has an intermixing of horse pastures, fairgrounds, and dairies within the urban stormwater boundary. In addition the stormwater monitoring data collected by the City of Santa Rosa is subject regular quality assurance checks. The project team believes that the reported values are real.
Table 3-9 Nutrient numbers for urban stormwater in this table seem believable except those of ammonia which seem to be perhaps 10x too high. I did not check the other numbers, but it would be great if the author could compare them to the literature on dairying watersheds to see if they are believable.	These loading estimates for dairies were developed using source values that were extrapolated from literature provided by the local University of California Agricultural Extension Service agent who has been conducting research on local conditions (i.e. Lewis et al. 2001).
Figure 3-16. Please turn the y axis captions 180 degrees.	Comment noted – Axis captions for all figures have been rotated 180 degrees.
Figure 3-20. These patterns suggest a non-point source dominance in some parts of the watershed and a point source (but perhaps still wet-season influenced) dominance in other areas.	Agree. High background NH3 concentrations (might be due to manure).
p93 – Figure 3-25 very high NH3 – seems like secondary treated sewage or dairy shed overflows.	These values are in close proximity to dairies prior to the implementation of the Waste Reduction Strategy. The success of the program has resulted in lower concentrations for the period of 1995 to 2000 (Figure 5-26).
p96 – very high TKN also. Please justify to the reader that the ammonia and TKN numbers are not caused by bad data.	The high values for NH3 and TKN are due to the close proximity to dairies prior to the implementation of the nutrient management strategy. The monitoring and analytical programs were both subject to rigorous quality assurance guidelines.
p130 – Q2 – has DO always been that low? Perhaps management will not get it about 3 mg/L or some other target.	It is clear that the Laguna is a low elevation eutrophic system that is subject to hot summers. However there are several impacts that if addressed would result in improved overall DO results in the Laguna. These impacts include high loads of organic matter, high loads of nutrients, riparian canopy removal, and degradation of stream channel habitat. The project team believes that current conditions do not reflect historical or future potential conditions.

Table 10-1 Water quality monitoring data

Laguna de Santa Rosa compared to other waterbodies within Ecoregion 6

Chemical	Stream Type	Most Sensitive BU (Tier I/II)	Most Sensitive BU (Tier II/III)	Median	Average	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	No. of data points
NH3	Minimally Impacted			0.02	0.05	0.01	0.02	0.04	3.25	261
(mg/l)	Unimpaired			0.02	0.41	0.01	0.02	0.07	32.94	1229
	Impaired (nutrient)			0.05	0.34	0.01	0.05	0.14	12.10	907
	Impaired (other)			0.05	0.47	0.02	0.05	0.12	17.10	1279
	Laguna de Santa Rosa			0.40	1.16	0.10	0.40	0.90	15.00	279
	Nutrient Target Matrix									
NO2	Minimally Impacted			0.00	0.01	0.00	0.00	0.00	0.06	110
(mg/l)	Unimpaired			0.02	0.15	0.01	0.02	0.13	12.00	1500
	Impaired (nutrient)			0.04	0.09	0.01	0.04	0.10	5.00	861
	Impaired (other)			0.02	0.14	0.01	0.02	0.09	2.95	1160
	Laguna de Santa Rosa			0.09	0.41	0.02	0.09	0.40	4.30	66
	Nutrient Target Matrix									
NO3	Minimally Impacted			0.05	0.16	0.05	0.05	0.15	2.85	112
(mg/l)	Unimpaired			0.36	4.45	0.05	0.36	3.70	48.09	1301
	Impaired (nutrient)			4.74	5.02	1.17	4.74	7.50	31.84	600
	Impaired (other)			2.2	4.71	0.56	2.20	4.80	48.10	1037
	Laguna de Santa Rosa			2.30	0.32	0.80	2.30	5.20	26.70	285
	Nutrient Target Matrix									
TKN	Minimally Impacted			0.25	0.31	0.13	0.25	0.41	1.20	156
(mg/l)	Unimpaired			0.40	1.01	0.20	0.40	0.93	42.70	1425
	Impaired (nutrient)			0.7	1.06	0.40	0.70	1.20	11.00	868
	Impaired (other)			0.6	0.97	0.30	0.60	1.10	33.00	1486
	Laguna de Santa Rosa			1.11	1.09	0.81	1.20	6.10	19.00	67
	Nutrient Target Matrix									
PO4	Minimally Impacted			0.04	0.05	0.02	0.04	0.07	0.23	260
(mg/l)	Unimpaired			0.08	0.49	0.02	0.08	0.50	28.73	1671
	Impaired (nutrient)			0.22	0.60	0.03	0.22	0.90	8.10	1056
	Impaired (other)			0.05	0.45	0.02	0.05	0.26	40.00	1793
Total PO4	Laguna de Santa Rosa			0.82	1.38	0.46	0.82	1.80	6.20	68
Ortho PO4	Laguna de Santa Rosa			0.75	1.93	0.37	0.75	1.90	46.0	66
TP	Minimally Impacted			0.08	0.08	0.03	0.08	0.09	0.30	34
(mg/l)	Unimpaired			0.07	0.36	0.01	0.07	0.27	24.80	633
	Impaired (nutrient)			0.13	0.77	0.05	0.13	1.07	7.94	525
	Impaired (other)			0.07	0.34	0.03	0.07	0.22	45.10	1069
	Laguna de Santa Rosa			0.64	0.66	0.47	0.66	0.70	1.20	27
	Nutrient Target Matrix									

Chemical	Stream Type	Most Sensitive BU (Tier I/II)	Most Sensitive BU (Tier II/III)	Median	Average	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	No. of data points
TOC	Minimally Impacted									
(mg/l)	Unimpaired									
	Impaired (nutrient)									
	Impaired (other)									
	Laguna de Santa Rosa			12.00	14.72	9.80	12.00	16.00	84.00	51
	Nutrient Target Matrix									
DOC	Minimally Impacted									
(mg/l)	Unimpaired									
	Impaired (nutrient)									
	Impaired (other)									
	Laguna de Santa Rosa			11.00	12.13	8.80	11.00	13.00	52.00	50
	Nutrient Target Matrix	<3 (MUN)								
Chl-A	Minimally Impacted									
(ug/l)	Unimpaired									
	Impaired (nutrient)									
	Impaired (other)									
	Laguna de Santa Rosa			20.0	42.37	8.00	20.00	50.00	564.00	157
	Nutrient Target Matrix	<5.0 (COLD/ MUN)	>10 (COLD/ MUN)							
Benthic Algal Density	Minimally Impacted									
(mg/m2)	Unimpaired									
	Impaired (nutrient)									
	Impaired (other)									
	Laguna de Santa Rosa									
	Nutrient Target Matrix	<100 (COLD/ MUN/ SPWN)	>150 (COLD/ MUN/ SPWN)							

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p131 – restoration of light limitation may be the most cost effective management measure in areas where full canopy can be achieved.	The project team agrees that in many cases riparian and channel restoration may be the most cost-effective approach to address nuisance conditions. However long-term nutrient reduction strategies must be retained as a core part of the ecosystem recovery strategy.
p132 – last hypothesis – yes likely – monitoring at a key USGS gauge should easily provide the data.	DOC is not included in the parameters monitored at the USGS gauge station. It is important that both forms of organic carbon inputs to the Laguna be reduced to ensure restoration of Beneficial Uses.
p133 – reduced and oxidized forms.	The oxidized form was added to the text.
p135 – Q11. What was it like historically? Perhaps no amount of management can influence the way it naturally (?) functions.	The Laguna was historically a eutrophic system of high productivity. Historical accounts of water quality and fish populations suggest that there has been a recent and significant decline in conditions. Small improvements have been achieved through the nutrient management strategy. The recent influx of sediment (Shallowing), high organic matter and nutrient inputs have impacted DO conditions. It stands to reason that removing excess organic and nutrient inputs and restoring habitat integrity will improve conditions beyond existing conditions.
p136 – Key uncertainties – Historic information needed.	The development of the document "Enhancing and Caring for the Laguna" pulled together a large amount of source material that could be used to develop historical ecology framework. The project team agrees that this is a key uncertainty and that it should be addressed.

SFEI Peer Review Comment	Project Team Response
p136-140 – Given that there is likely a natural supply of phosphorus from geological sources, it would seem reasonable to hypothesize that P would not have been limiting historically. Given nutrient sources in a modern system like this one, excess nitrogen relative to phosphorus is likely from dairying (because N is the dominant nutrient applied and consumed in grass-based dairying systems) and treated sewage (because phosphorus is removed through sludge). However, since the Laguna is loaded with nutrients, it seems just as likely that light or competition are limiting. Without a detailed process-based evaluation, it is hard to make further comments. In the absence of such knowledge, managers typically have to "pick the low-hanging fruit" and watch to see how the system changes through time. Usually the low-hanging fruit are those under control of public agencies and the higher effort level is private property and stewardship. It comes down to a stakeholder decision. I think a key data gap is learning what is currently supplying and limiting nutrient-based ecosystem function in the Laguna. A model could then be used to predict how long it will take after management measures are implemented before the system becomes either N or P limiting.	The project team believes that due to the high concentrations of both nitrogen and phosphorus that neither is limiting within the Laguna ecosystem. However we agree that any "low hanging fruit" should be taken to reduce nutrient loads regardless of whether it is nitrogen or phosphorus. It is also likely that even implementing nutrient controls within the Laguna today that the Laguna sediments will be a substantial source of nutrients for many years. Because of factors like sediment banked nutrients any restoration strategy will be subject to a long recovery timeline.
p142 – Hypothesis – atmospheric and GW could be sources during storms – yes, but minor compared to direct human sources such as fertilizers and animal and pet manures entrained by rainfall induced surface runoff during storms.	The project agrees with the suggestion and will make the necessary change to the text.

SFEI Peer Review Comment	Project Team Response
Evaluation of what is known about flood capacity is extensive, and data requirements for scenario-planning are well explained. The brief section on anticipated climate change impacts could reference any estimates of upward migration of tidal influence in the Russian River and how that may affect hydrology at the Laguna-Russian River confluence.	DWR's 2006 report on climate change titled "Progress on Incorporating Climate Change into Management of California's Water Resources" (available at http://baydeltaoffice.water.ca.gov/) is the most recent study on anticipated climate change impacts that we are aware of that specifically addresses anticipated precipitation changes in California. The report does not make quantitative predictions of how precipitation and runoff amounts and patterns will change in different parts of California. However, it elaborates on historic changes and trends in runoff volumes for selected river basins in California. Table 2-4 of the report indicates that in the Russian River basin, runoff has increased negligibly for the period of April through July and has increased by approximately 1,000 acre-feet since 1941. This is not a significant change. Based on current state of knowledge and assuming similar trends for the future, climate change is not expected to significantly impact runoff volumes in the watershed. In terms of sea level rise projections, Independent Science Team to CALFED estimated a sea level rise of up to approximately (8 feet). Upward migration of tidal influence along the Russian River may be possible due to sea level rise of such extent and climate change; however, it is not likely that this effect will be felt more than 20 miles upstream at the Laguna confluence.

SFEI Peer Review Comment	Project Team Response
The report doesn't make it obvious how the compiled information can or should be used in decisions pertaining to WHERE and HOW flood peak attenuation features can be restored or created, how water management planning activities can benefit water quality attainment strategies, or how land use decisions can be improved to achieve better integration of beneficial uses, restoration/ protection, management and prevention of biological invasions, water supply reliability enhancements, achievement of flood protection goals, and restoration of watershed functions and processes. This is one of the key areas where additional funding could be pursued to improve the value to environmental managers. The report only takes the first, albeit most important, step toward a planning and management framework - understanding the system and formulating hypotheses that should be tested with short-term special studies or tracking progress toward specific environmental goals or targets.	Water Management Planning is not an *objective* of this study. It was listed in the original proposal as an objective that a basin-scale model should *support* (and therefore can not be an objective, for a planning and management framework). Additional funding will be required to achieve this objective. The paragraphs in Section 1 of the original report which discuss this have been modified to clarify this.
Add larger-scale maps showing the key watershed features along the lines of the figure on the small fact sheet accompanying the report, the natural and artificial drainage network including stormdrains, land cover and land use, land slide hazard maps, and any other easily obtainable data layers that could help the reader follow some of the interpretive text.	Larger scale maps are incorporated into this final document.

SFEI Peer Review Comment	Project Team Response
The report could benefit from a thorough copy-editing job. There are numerous typos and syntax errors sprinkled throughout, but particularly in the latter third of the report. Someone needs to check that all figures have titles (e.g. 2-16), improve resolution of some of the figures that are barely readable, and insure all citations and references are actually listed in Section 8.	The final report has been copy-edited.
The end use of the conceptual model could be better explained. Is it designed as an education and communication tool, as a tracking tool during the anticipated years of prioritized data collection activities, to allocate resources for future sensitivity analyses, or all of the above and possibly more?	This has been addressed in the executive summary and has been changed in the introduction of the final report.
The report organization is a bit confounding at first. The Introduction identifies objectives, specific management decisions to be evaluated, and components necessary to develop a comprehensive assessment. How does the report approach each of these and in what sequence? The first two paragraphs in the Introduction make it sound as though the report's overall goal is to develop conceptual models for a better integrated understanding of the watershed, but it really does much more than that. Why not say right up-front that it also serves as a summary of our current understanding of how the system works, what we don't know, and what needs to be done to inform restoration and protection decisions?	The introduction has been changed to reflect a better integration of the new report organization and includes a more comprehensive statement of the report's overall goals.

SFEI Peer Review Comment	Project Team Response
The description of 1.6 can be improved. The first three sections represent more or less characterization of conditions and human-caused or –induced alterations of the physical, chemical, and biological integrity of water (which is the definition of pollution in the Clean Water Act) and the watershed as a whole.	This section has been updated to give a more accurate description of each section of the document.
Explore in more detail the implications of the lack of suitable models capable of accounting for reverse flood flows from the Russian River into the Laguna system.	Suitable models capable of accounting for reverse flood flows do exist; however, there is a lack of data to develop such models. Quantifying the volume of water and the amount of sediment that is delivered to the Laguna by the Russian River is hard in the absence of good long-term flow records for the lower Laguna, and sediment and flow records for the Russian River in the vicinity of the confluence. We recommend the installation of an acoustic Doppler sensor at the River Road Bridge to record flow direction and velocity so that inflows form the Russian River can be quantified. In addition, a two-dimensional hydrodynamic and sediment transport modeling of the Laguna and the Russian River confluence is recommended to gain a greater understanding of sediment and water movement. Such a model can simulate a range of typical flood events to assess the volume of sediment delivered under different return frequency events. Beyond its use in assessing Russian River inputs, developing such a linked model is desirable for the insights it would offer on deposition in the lower Laguna and in quantifying how sediment deposition affects flood stage in both the Laguna and the Russian River.
The report could be significantly enhanced via an Executive Summary with the following suggested outline:	An executive summary has been added to the final report according to the reviewers' suggested outline.

SFEI Peer Review Comment	Project Team Response
(1) Characterization of the watershed in terms of physical geography, historical and current conditions, current stressors, and the kinds of management intervention steps at the policy, program, and project levels that have already been taken to move undesirable trends in condition or watershed processes toward a more desirable state. This approach could pull together the pertinent elements currently dispersed throughout the report in each of the sections on hydrology/geomorphology, water quality, and valued ecosystem components and can set the stage for later recommendations. An Executive Summary might be one way to link all the individual chapters together better.	This is addressed in the executive summary.

SFEI Peer Review Comment	Project Team Response
(2) Management questions and resulting assessment questions arranged in hierarchical order. What is described as "management questions" in the report are really "assessment questions" that could be more logically arranged along a "critical path" (answers to some questions are required prior to being able to tackle the next). Management questions might better be expressed in terms that decision-makers at the policy and program level can relate to, such as: "What options exist for enhancing flood protection now and under various climate change scenarios?" "What range of management intervention steps (e.g. BMPs) have already been implemented to reduce nutrient and sediment inputs into the drainage network, and what is their geographical coverage?" So, the Executive Summary could include a table that identifies half a dozen or so broad management questions with corresponding assessment questions linked to them in critical path fashion (e.g. MQ: "What options exist for enhancing flood protection now and under various climate change scenarios?" Corresponding AQs: 1) "What is the current flood storage capacity?" 2) What are current flood peaks, durations, and volumes and their recurrence intervals?" 3) "How will future land use change and hydromodification affect flood conditions and the future hydrologic regime?"	Management questions are now in a separate section at the beginning of the document.

SFEI Peer Review Comment	Project Team Response
(3) Bits and pieces of references to historical conditions are sprinkled throughout the report and could be summarized in a section of the Executive Summary, including key unknowns that should be explored further if they affect restoration or protection options (e.g., has low DO always represented a migration barrier to salmonids in the southerly tributaries? If so, salmonid restoration attempts in Copeland Creek may not make much sense). Also, historical information could inform the need for recovery target adjustments or for site-specific water quality objectives.	This is included in executive summary.
(4) Model descriptions and modeling needs are not very well linked to either management or assessment questions. The Executive Summary could contain a table that makes it apparent how data requirements relate to management and assessment questions, how models relate to forecasting and scenario-planning activities, and how proposed data collection activities could serve to parameterize or calibrate models to increase their predictive power.	The project team agrees that such a table would be very informative and helpful, but at this point in time we need more interactions with decision makers before we can go through this analysis step. We agree that this is high on the priority list for next steps.
(5) Recommendations for next steps should go beyond monitoring recommendations included in the final chapter of the report. While the report's goal is to provide a planning and modeling framework, its focus is currently too narrow and seems to emphasize primarily data collection activities for model calibration and uncertainty reduction without balancing that focus with a planning framework for strategic early actions that might proceed in light of uncertainty and paucity of data.	The project team agrees that this is a high priority for next steps in the planning process. We have changed the introduction to reflect a more realistic set of goals for this body of work.

Reviewer's response to questions agreed upon to guide review process

Questions were posed to the peer review team, by the authors, to guide their review. The authors' questions together with the reviewers' comments are provided in the left-hand column. The authors' response to these comments are provided in the right-hand column.

Authors' questions with reviewers' comments	Response to comments
Question 1. Does the report adequately address the objective outlined in Section 1 of the document?	This is addressed individually, by objective, immediately below.
Objective 1: Baseline Characterization.The report succeeds in bringing together in one place all pertinent data and to a large extent succeeds in transforming raw data into information. The report also succeeds in pointing out inter-relationships between human-caused or human-induced alterations in the physical, chemical, and biological integrity of water and desired environmental conditions.	Agreed.
Objective 2: Restoration Planning. A key element for setting restoration planning guidelines is missing from the report and is the basis for a MAJOR recommendation addressing questions 7, 8, and 10 below. Our experience with restoration planning is that without having a picture of how the watershed functioned during times prior to massive modifications of the landscape and hydrologic regime, restoration opportunities can easily be overlooked, or alternatively, restoration targets may not be realistic or optimal.	The Laguna de Santa Rosa Restoration and Management Plan entitled "Enhancing and Caring for the Laguna" contains some of the basic historical information referred to here. However, we agree with the reviewers comments that a more extensive comparison of specific historic and current conditions would be beneficial for the whole planning effort. We also agree that sensitivity analyses could be beneficial in prioritizing data gaps.

Authors' questions with reviewers' comments	Response to comments
Objective 3: Flood Protection Planning. Evaluation of what is known about flood capacity is extensive, and data requirements for scenario-planning are well explained. The brief section on anticipated climate change impacts could reference any estimates of upward migration of tidal influence in the Russian River and how that may affect hydrology at the Laguna-Russian River confluence.	DWR's 2006 report on climate change titled "Progress on Incorporating Climate Change into Management of California's Water Resources" (available at http://baydeltaoffice.water.ca.gov/) is the most recent study on anticipated climate change impacts that we are aware of that specifically addresses anticipated precipitation changes in California. The report does not make quantitative predictions of how precipitation and runoff amounts and patterns will change in different parts of California. However, it elaborates on historic changes and trends in runoff volumes for selected river basins in California. Table 2-4 of the report indicates that in the Russian River basin, runoff has increased negligibly for the period of April through July and has increased by approximately 1,000 acre-feet since 1941. This is not a significant change. Based on current state of knowledge and assuming similar trends for the future, climate change is not expected to significantly impact runoff volumes in the watershed.

Authors' questions with reviewers' comments	Response to comments
Objective 4: Water Quality Assessments. This section addresses the key issues adequately. However, it is very difficult for someone not intimately familiar with the geography to follow the locations of identified "trouble spots." A map with dots indicating the "good, bad, and ugly" would be very helpful in following the rationale behind some of the hypotheses and would let the reader make associations between land use characteristics and areas where standards are not being met or beneficial use impairment has been documented. This would also assist with following the rationale behind monitoring and assessment recommendations, which currently appear overwhelming and difficult to evaluate and prioritize in relation to undesirable conditions and management goals. While the assessment of impacts is quite exhaustive, it isn't yet in a form that is very useful to decision-makers and water quality managers. A key next step could be to sort through the information and conduct initial sensitivity analyses on the range of management options for remediation and restoration. Do sufficient data exist in some reaches or areas where the relative importance of each of the sources of nutrients and sediment could be evaluated, so the range of data collection activities could be prioritized? Currently, the implied message that the report conveys is "We need everything and the kitchen sink" before we can begin implementation of remediation steps in adaptive fashion. Reduction of nutrients and sediment inputs (essential in tackling the D.O. issue as well) can occur in two and three key ways, respectively: (1) reducing anthropogenically mobilized sediment and nutrients to natural background levels, enhancing or restoring sediment storage and nutrient transformation/uptake outside the channel network, and (3) in the case of sediment, restoring the hydrograph to minimize bed and bank erosion in the higher-velocity reaches and maximize sediment transport in the lower-velocity reaches. Where do opportunities present themselves to pursue any or all of these general goals?	In terms of sea level rise projections, Independent Science Team to CALFED estimated a sea level rise of up to approximately (8 feet). Upward migration of tidal influence along the Russian River may be possible due to sea level rise of such extent and climate change; however, it is not likely that this effect will be felt more than 20 miles upstream at the Laguna confluence.

Authors' questions with reviewers' comments	Response to comments
Objective 5: Water Quality Assessments. The report doesn't make it obvious how the compiled information can or should be used in decisions pertaining to WHERE and HOW flood peak attenuation features can be restored or created, how water management planning activities can benefit water quality attainment strategies, or how land use decisions can be improved to achieve better integration of beneficial use restoration/protection, management and prevention of biological invasions, water supply reliability enhancements, achievement of flood protection goals, and restoration of watershed functions and processes. This is one of the key areas where additional funding could be pursued to improve the value to environmental managers. The report only takes the first, albeit most important, step toward a planning and management framework - understanding the system and formulating hypotheses that should be tested with short-term special studies or tracking progress toward specific environmental goals or targets.	Water Management Planning was listed in the original proposal as an objective that a basin-scale model should support (and therefore can not be an objective for a planning and management framework). We agree that additional funding will be required to achieve this objective. This objective was taken out of Section 1 as an objective of the current study.

Authors' questions with reviewers' comments	Response to comments
Question 2. Does the report adequately outline a clear course of action for what steps should be taken next in the watershed to achieve the stated objectives? The report is organized in a fashion that puts considerable (and almost exclusive) emphasis on what is known and not known about the system and documents how useful (or not) various simulation models may be for purposes of forecasting water and pollutant transport and storage scenarios and various aquatic/riparian habitat recovery trajectories. The information is likely to be overwhelming to three key audiences of the report: Land use decision-makers, public works and stormwater managers, and private land stewards in the urban, ex-urban, and agricultural communities. A clear course of action emerges only with regard to filling huge data gaps (in non-prioritized fashion) and parameterizing recommended scenario-planning models. Much of the suggestions for an Executive Summary could remedy the "bottom-up" approach the report takes and work more from the "top-down," starting with a prioritization of management questions, identification of adaptive management opportunities, where incremental and pilot-level early implementation steps could be taken and then evaluated through targeted data collection and monitoring efforts in a watershed context. While the proposed list of indicators and monitoring recommendations seems sound and reasonable, their implementation is unlikely to proceed without first evaluating the likely "bang for the buck." Without an explicit linkage of monitoring recommendations to their management and policy-making relevance, decision gridlock and much "hand-wringing" is likely to emerge.	This is addressed in the executive summary.

Authors' questions with reviewers' comments	Response to comments
Question 3. What uncertainties should be assigned the highest priority to be addressed in our monitoring recommendations? Our experience with finding an "acceptable" level of uncertainty is that the lower the implementation costs are to society as a whole (through taxes or fees) or individual stakeholder groups (via fees, loss of use, or compliance with regulations), the greater the comfort level with relatively large uncertainties and vice versa. Without first conducting an analysis of uncertainty "comfort levels" (plus or minus 50% chance of moving a condition onto a more desirable trend line; plus of minus 5% chance) by involving groups with a vested interest in the status quo, this question is hard to answer definitively. However, the data compilation seems to suggest that one of the most important unknowns in the nutrient budget is the relative importance of external loadings compared to the internal cycling of accumulated nutrients between the sediment and biomass. Since the creation of riparian buffer zones, for example, through zoning changes, land use ordinances, or easements/acquisitions falls into the category of "high costs" to both society and individual stakeholder groups, the burden of proof is likely very high to support a "menu" of external nutrient control strategies and management measures versus alternative, possibly cheaper in the short term, management strategies involving reduction of internal "sources" through continuous maintenance (e.g. dredging) or increased nutrient exports out of the Laguna system via the Russian River (e.g. enhancing flushing).	The proposed modelling framework and monitoring recommendations were provided to address uncertainty regarding relative loading from the various categories that have been identified. Internal cycling is likely to be a key source of loading and its impact will be exerted on the Laguna for a long period of time. Any recovery strategy will need to accurately represent and communicate a long-term recovery trajectory to realistically manage expectations regarding the time frame required to achieve water quality improvements. Therefore any restoration strategy will require a combination of approaches that both reduce external loadings to the system and mitigate / reduce internal loading within the Laguna (e.g., low flow channels to reduce water column exposure to nutrient rich sediments). The external load reduction strategies have additional benefits to the ecosystem that should be incorporated into the management option rationale. Restoring the Laguna will require a substantial investment over a long period of time regardless which source is the largest.

Authors' questions with reviewers' comments	Response to comments
Question 4. Have we identified the relevant loading categories and the uncertainty regarding their potential relative magnitude? Are the relative orders of magnitude assigned to the various nutrient inputs appropriate? The report does identify the relevant loading categories and does an excellent job at identifying the relative contribution from various sources. The estimated pollutant loading tables may give the false impression to some readers that the numbers are more precise than they are. They could benefit from including coefficients of variation in parentheses behind each number. Also, for comparison purposes, it would be useful to estimate natural background loadings to the Laguna under natural land cover condition or, at a minimum, reference the TMDL loading or reduction targets. As a next step, it would be important to determine which of the loading categories would be most sensitive to load reduction efforts, which could then make a compelling case for data collection prioritization. For example, by how much would one expect urban stormwater contributions to decrease via broadly accepted urban retrofitting techniques during re-development and applying low-impact development principles in areas expected to be converted from agricultural or open space to urban or ex-urban land uses?	The project team does not have sufficient information to realistically quantify estimates for the loading categories. We prefer the qualitative characterization as a relative order of magnitude comparison of categories. The estimates were developed using different inputs. For some of the point sources actual monitoring data was used while for others loading coefficients were extrapolated to land use information. The estimates are intended to be useful for a first order assessment of the potential relative importance of the various loading categories. A consistent uncertainty assessment for each category is not possible and the project team prefers to retain the qualitative statements that limit the use of the information to broad comparison of categories. The project team requested natural background loading information from an ongoing application of the SWAT model within the watershed. These estimates may be available in the future but were not available at the time the conceptual model report was being written. More precise loading estimates will be developed as part of the TMDL source characterization work, which will then be used to optimize loading reduction strategies as part of the allocation phase of the TMDL.

Authors' questions with reviewers' comments	Response to comments
Question 5. How well do the individual sections of the report link together? Wherever there is a lack of linkage, how could better linkage be achieved? It is apparent that the three main sections of hydrology/geomorphology, water quality, and ecosystem were prepared by different groups of authors as more or less "stand-alone" chapters. The Ecosystem chapter has the potential of being the "integrative" section of the report but doesn't quite fulfill that potential. Internal linkage between the information compilation and review, the anthropogenic causes of impairment, and the discussion of the conceptual models in each chapter could be achieved relatively easily by highlighting the management relevance of the data evaluations, and to what extent the existing data do are do not show associations that could be used to weight the relative importance of the conceptual model boxes. Expanding on the knowledge bases and incorporating findings and key elements from the water quality and hydrology sections into both text and schematics in the Ecosystem Conceptual Model could improve the linkages. Alternatively, the Executive Summary could take major findings from each section and serve as the place for an integrative "bottom line."	The executive summary serves as the integrative "bottom line."

Authors' questions with reviewers' comments	Response to comments
Question 6. For which sections of the report could additional funding be pursued in order to improve findings? As alluded to above, the whole planning effort could benefit from a much more extensive comparison of historical and current conditions, which probably would require additional funding. There is likely a substantial amount of historical information (publicly available but not yet compiled) that could inform interpretations of system hydrology, appropriate habitat and TMDL targets, water supply reliability enhancement opportunities, and the relative importance of key stressors. Also, sufficient data exist both within the Laguna system and from similar watersheds to conduct sensitivity analyses on some of the water quality issues (including sediment impairment), so that additional data collection activities can be prioritized. The monitoring chapter could benefit from additional funding as well. The current list of data gaps appears daunting and needs to be prioritized. The state's surface water monitoring strategy, located on the Waterboards' website (http://www.waterboards.ca.gov/swamp/docs/cw102swampcmas.pdf) could serve as a guidance document for the development of a monitoring and special study design and implementation plan over the next five to ten years. Integration of TMDL implementation monitoring activities, NPDES monitoring requirements for both Phase I and Phase II municipal permittees and the POTW, WDR and/or waiver conditions, 401 certification conditions, and implementation guidance for the forthcoming stream and wetland protection policy could all be strategically aligned to work with the Surface Water Ambient Monitoring Program and forthcoming Proposition 84, and 1E grants to fill data gaps in prioritized fashion. This will likely require considerable resources. The forthcoming SWAMP Assessment Framework or "business plan" could serve as a template. Increased and consistent participation in SWAMP activities by a NCRWQCB staff member as the tech transfer and coordination resource might defer some of the costs.	The Laguna de Santa Rosa Restoration and Management Plan entitled "Enhancing and Caring for the Laguna" contains some of the basic historical information referred to here. However, we agree with the reviewers comments that a more extensive comparison of specific historic and current conditions would be beneficial for the whole planning effort. We also agree that sensitivity analyses could be beneficial to the need for prioritization of addressing data gaps.

Authors' questions with reviewers' comments	Response to comments
Question 7. What advice do you have for the Foundation regarding next steps? Next steps are alluded to above but can be summarized as follows: 1) Convene appropriate stakeholders to prioritize data collection activities via special studies and status and trends monitoring. 2) Evaluate and develop a list of "early actions" that promise to meet TMDL targets and habitat goals, where they exist. 3) Conduct a thorough compilation of historical condition records, put them in digital format (GIS data layers) and explore the feasibility of a watershed goals process that is informed by a picture of the past, a picture of present conditions, and change, with subsequent identification of tradeoffs among potentially conflicting goals (urban development vs. floodplain protection and enhancement of water supply reliability). 4) Identify and analyze barriers to implementation beyond scientific uncertainties and data gaps (e.g., counterproductive policies; financial barriers; education and awareness gaps; etc.)	This project has already served one purpose: to speed up the schedule for the development of Laguna TMDLs. The TMDL process has now been started using the final report document as the conceptual background. The project team agrees with all the steps outlined here for next steps in the process to improve the Laguna watershed with regard to natural and human-related functions.
Question 8. Which indicators and monitoring recommendations should be considered highest priority? An answer to this question is possible AFTER sensitivity analyses have been conducted and considerable effort has been put into implementation of the steps outlined in the Statewide Surface Water Monitoring Strategy.	Agreed.
Question 9. What recommendations can you offer for moving forward with a comprehensive planning and stewardship management framework in five areas: key questions, uncertainties, stewardship indicators, monitoring program activities, and model development?	
1) Work with key decision-makers in the various environmental management agencies (public works, stormwater, water recycling, water supply, natural resource trustees) and in the land use arena to fine-tune the management and assessment questions and arrange them hierarchically and along a critical path.	1) Agreed.

Authors' questions with reviewers' comments	Response to comments
2) Estimate societal and individual costs of the range of policy, program, and project implementation options that have shown environmental benefits and prioritize data collection and modeling efforts based on the anticipated "burden of proof" that is required to move ahead in adaptive fashion.	2) We believe the report, with sufficient study, provides much of the information that is needed to support these discussions. These discussions would be most productive if they included key agencies and stakeholders who would be involved in the implementation of restoration options and who would be impacted by these options.
3) Conduct analyses of anticipated relative benefits of various implementation options (e.g., would urban retrofits reducing imperviousness and enhancing stormwater retention capacity provide greater benefits than widespread implementation of agricultural BMPs?).	3) The driver for model capabilities is to be able to simulate various restoration scenario options for as many categories as possible. This would include (but not limited to) pollutant reduction strategies, riparian and channel improvement projects, stormwater management practices. It is likely that a combination of several possible mitigation approaches will be required to restore the Laguna to a "proper functioning condition." This is why the model framework includes compartments for watershed processes, hydrology, sediment processes, and water quality. It is not clear whether the modeling framework itself is feasible but the goal is the evaluation of multiple implementation options.
4) Focus model development on scenario planning tools that have the greatest utility for decision-makers in selecting courses of action.	4) It is possible that the development of a comprehensive model capable of detailed scenario simulation may not be feasible. But the model development goal is directed to achieving exactly the recommendation stated in this comment. It is possible that the scenarios will need to be more conceptual in nature. The development of conceptual scenarios would be supported through additional monitoring conducted within the Laguna.

Authors' questions with reviewers' comments	Response to comments
5) Incorporate available, but not yet compiled and digitized, historical records into the uncertainty analyses, identification of opportunities for beneficial use protection and restoration, and evaluation of tradeoffs among possibly conflicting goals.	5) The project team agrees that a more complete historical ecology analysis is needed, but the requested analysis will need to be included in the next phase of this process. The Laguna Foundation has compiled much of the information that would be used in the next phase of any historical ecology analysis.