January 11, 2006

Mark Rauscher
Surfrider Foundation
PO Box 6010
San Clemente, CA 92674

Re: Transmittal of “Potential Toll Road Impacts on San Mateo Creek Watershed Processes, Mouth Morphology and Trestles Surfing Area, Final Report”

Dear Mark,

Please find attached an electronic version (PDF) of “Potential Toll Road Impacts on San Mateo Creek Watershed Processes, Mouth Morphology, and Trestles Surfing Area, Final Report.”

We have enjoyed working on this project and hope you are pleased with the final report. Please don’t hesitate to contact me with any questions.

Sincerely,
PHILIP WILLIAMS & ASSOCIATES

Bob Battalo
Principal

Cc: Bill White (Shute, Mihaly & Weinberger LLP), Dan Silver (Endangered Habitats League)
FINAL REPORT

POTENTIAL TOLL ROAD IMPACTS ON SAN MATEO CREEK WATERSHED PROCESSES, MOUTH MORPHOLOGY AND TRESTLES SURFING AREA

Prepared for

The Surfrider Foundation

Prepared by

Philip Williams & Associates, Ltd.

January 11th 2006

PWA REF. # 1815.00
Services provided pursuant to this Agreement are intended solely for the use and benefit of The Surfrider Foundation.

No other person or entity shall be entitled to rely on the services, opinions, recommendations, plans or specifications provided pursuant to this agreement without the express written consent of Philip Williams & Associates, Ltd., 720 California Street, 6th Floor, San Francisco, CA 94108.
TABLE OF CONTENTS

1. INTRODUCTION 1

2. SUMMARY & CONCLUSIONS 2

3. THE RELATIONSHIP BETWEEN TRESTLES SURFING AREA AND THE SAN MATEO CREEK WATERSHED 3
   3.1 Conceptual Model of Trestles Surfing Area 3
      3.1.1 Description of the Surfing Resource 3
      3.1.2 Morphologic Setting of the Coast 3
      3.1.3 Sediment Budgets and Littoral Transport 7
      3.1.4 Dependence of Surf Quality on Morphology of the Mouth 8
   3.2 Potential Impacts of SOCTIIP on Hydrologic and Sediment Processes in the San Mateo Creek Watershed 11

4. REVIEW OF THE SOCTIIP EIS/SEIR 12
   4.1 Description of the Project With Respect to Runoff and Sediment Transport 13
   4.2 Assessing the Impact of the Proposed Project at the Sub-Watershed Scale 14
      4.2.1 Field Assessment of Channel Sensitivity to Runoff 18

5. REFERENCES 23

6. LIST OF PREPARERS 25

LIST OF TABLES

Table 1. Percentage of sub-watershed disturbed and made impermeable

LIST OF FIGURES

Figure 1. Trestles Surf Spot Relative to Proposed Toll Road
Figure 2. Trestles Surf Spots
Figure 3. Historic Topography and Hydrography of San Mateo Point
Figure 4. Possible Process for Cobble Placement
Figure 5. Subbasins Disturbed within San Mateo Creek Watershed
Figure 6. Northeastern Subbasins in Disturbed Area of San Mateo Creek Watershed
Figure 7. Southwestern Subbasins in Disturbed Area of San Mateo Creek Watershed
Figure 8. Site 1. Subwatershed SM_3
Figure 9. Site 2. Subwatershed C_12
Figure 10. Site 3. Subwatersheds C_16 – C_20
1. INTRODUCTION

This report addresses the adequacy of the recently published EIS/SEIR and various related documents prepared by the Project Sponsor in describing the potential impacts of the South Orange County Transportation Infrastructure Improvement Project (SOCTIIP) (referred to as the “Toll Road”) on the hydrologic processes in the San Mateo Creek watershed, and Trestles surfing area at the creek mouth. Philip Williams & Associates (PWA) has been retained by The Surfrider Foundation to assess the potential for the SOCTIIP to affect sediment issues, water quality and surfing conditions at Trestles. Potential impacts of concern include changes in the watershed leading to local or regional stream destabilization and change, and alterations of the sediment delivery regime. Such changes could have significant impacts at various local and regional scales, and possibly alter the morphology of Trestles (and its surfing characteristics), as well as result in water quality impacts.

PWA staff have reviewed the EIS/SEIR, the SOCTIIP Hydrology Technical Report (PSOMAS, 2003a), the Sediment Continuity Analysis (Boop and Cleary-Milan, 2004) and the Skelly Engineering TCA Surfing Resources Study (2000), and conducted a field reconnaissance of San Mateo Creek at its mouth, along the proposed road alignment through the main San Mateo Creek valley, and in the Donna O’Neil Land Conservancy. We provide a brief review of these reports as they relate to the Trestles surfing area.

This report focuses on potential impacts in the San Mateo Watershed. While comparable concerns may exist in the San Juan Creek watershed, they are not addressed here.
2. SUMMARY & CONCLUSIONS

Trestles surfing area is an internationally-significant recreational resource that lies adjacent to the proposed project area. Its significance is a function of the high quality and consistency of its waves, which is controlled by the dynamics of the lagoon - beach barrier - delta system at the mouth of San Mateo Creek. It is believed that Trestles beach and surfing dynamics are sensitive to the supply of cobbles and sand. The exact relationship between surfing conditions and sediment delivery is not fully understood, and represents a significant omission in the EIS/SEIR.

The SOCTIIP EIS/SEIR indicates that the proposed project will have less than significant effects on Trestles surfing area because a) the predicted net change in peak runoff will be less than 3% for the watershed as a whole, and b) sediment supply in San Mateo Creek is believed to be transport-limited and thus unlikely to be affected by changes in watershed sediment supply. PWA’s review of the EIS/SEIR questions the focus on conclusions drawn at the entire watershed scale, and the relatively low importance the EIS/SEIR attaches to impacts at the sub-watershed scale. The twenty sub-watersheds closest to Trestles that the proposed road alignment crosses will be impacted to a much greater extent than the average figure in the EIS/SEIR for the entire 136 square mile San Mateo Creek watershed implies. For example, the limits of cut and fill occupy as much as 100% of individual sub-watersheds and increase the impermeable area of up to 29%. The cut and fill limits of the road in the Donna O’Neil Land Conservancy will occupy on average 47% of each sub-watershed, while along the west valley side of San Mateo Creek the disturbance limits will occupy on average 43% of each watershed. Disturbance of this magnitude has been shown to cause severe erosion and channel geomorphic degradation in other parts of Orange and San Diego Counties, including sites along the proposed alignment that have been visited as part of this review. Previous studies have shown that increases in impermeable area of 10% cause severe degradation of aquatic resources in watersheds, with increases of 25% rendering creeks unrestorable downstream.

A particular concern with the proposed project is that increased erosion in sand and silt dominated sub-watersheds close to the mouth of San Mateo Creek could increase the proportion of fine to medium texture sediment relative to the cobbles that appear to sustain Trestles, potentially impacting the surfing area and the lagoon habitats. An increase in fine-medium sediment delivery from the watershed could result in a reduction in coarse sediment delivery to Trestles even in the current transport-limited condition of San Mateo Creek.

Our review of the EIS/SEIR also finds that the proposed runoff management and sediment control measures are unlikely to control runoff of fine sediment from the road cut and fill areas during events such as the 2-year flow which contribute the majority of sediment in most watersheds. These events will exceed the planned capacity of the sediment settling basins, allowing fine sediment to reach the stream system, the lagoon habitat and Trestles. Increased fine sediment delivery and deposition in the lagoon could degrade water quality.
3. THE RELATIONSHIP BETWEEN TRESTLES SURFING AREA AND THE SAN MATEO CREEK WATERSHED

3.1 CONCEPTUAL MODEL OF TRESTLES SURFING AREA

3.1.1 Description of the Surfing Resource

The world renowned Trestles surf spots are located in the vicinity of the mouth of San Mateo Creek. There are four main surf breaks associated with San Mateo Point and the river mouth deposits. The general location of Trestles relative to San Mateo Creek and the toll road is depicted in Figure 1 while the particular surf spots are shown in more detail in Figure 2. Santa Catalina and San Clemente Islands partially shelter this region from northwest swells however west and southwest swells approach with little hindrance. The apex of Uppers is located immediately southwest of the creek mouth which generally breaks best on a northwest swell where waves peel around the point to the south. On large swells, continuous waves can peel all the way into the small embayment separating Uppers from Lowers. Lowers is located at the smaller point southeast of Uppers. Lowers can pick up both northwest and west/southwest swells although is best for surfing on a southwest swell. There is both a left and a right at Lowers – the right peels wide from the apex of the point in a southeastwardly direction while the left peels a little tighter from the apex in a more northeastwardly direction. The two remaining main surf breaks, Cottons Point and Church, are located on the periphery of San Mateo Point. Cottons Point, located north of Uppers, is a deep water left best on bigger southern swells. In contrast, Church, a submerged rock point south of Lowers, breaks best on a northwest swell.

Surfers have been riding waves off San Mateo Point since the sport came to California and the quality of the wave has remained consistently good over the years (pers. comm. Jerry Collamer). It is truly a versatile surfing environment as the exposure and form of San Mateo Point provide a wide range of conditions for surfers to choose from depending on swell direction, board preferences, and style. On any given swell, the crowd in the water is a testament to Trestles’ recreationally unique quality and diversity of wave types.

3.1.2 Morphologic Setting of the Coast

The coastline in the vicinity of San Mateo Point and Trestles is generally characterized by relatively narrow, semi-continuous sandy beaches backed by wave-cut seacliffs (Inman and Masters, 1991). The continental shelf adjacent to San Mateo Point is narrow and slopes gradually to the southwest to depths of 262 feet (Inman and Masters, 1991). Recent geophysical surveys of the ocean floor conducted for the San Clemente Shoreline Feasibility Study show that sandy silts and silty sands blanket the shelf with a very thin veneer. Bedrock surfaces can be encountered four to ten feet below littoral deposits one mile seawards of the beach and in many places are exposed (USACE, 2004b). The surveys also pick up a number of bedrock spurs, the largest being the seaward extension of San Mateo Point, that can rise as much as 18 feet above the surrounding ocean floor (USACE, 2004b). As shown in Figures 3, the general
Figure 1

Toll Road Effects on Trestles Surfing Area

Trestles Surf Spot Relative to Proposed Toll Road

Source: image from GoogleEarth 2005
Figure 2

Toll Road Effects on Trestles Surfing Area
Trestles Surf Spots

Source: image from GoogleEarth (2005)

PWA Ref#: 1815

C:/j.stephenson/JuliesDocuments/Project Files/Trestles/Report/Figures/SurfSpots.doc
Figure 3

Toll Road Effects on Trestles Surfing Area
Historic Topography and Hydrography of San Mateo Point

Source: U.S. Coast and Geodetic Survey, 1886, 1889, 1934, 1972
form of San Mateo Point has changed little between the late 1800’s and the present. The same is true for the adjacent nearshore area between 1935 and 1972, as also depicted in Figure 3. when the topographic survey was taken and between 1935 and 1972 when the hydrographic surveys were conducted. The predominance of relatively stable, resistant bedrock features offshore and to the north and south of the river valley and cobble-boulder deposits have most likely enabled the persistence of the point and the consistency of the surf. Skelly (2000) provides an interpretation of aerial photos of San Mateo Point from 1932 to the present which implies a lot of shoreline movement but persistent points at Uppers and Lowers. The report, however, is not adequate to gauge the accuracy of the interpretation.

San Mateo Creek currently discharges to the ocean at the northern margin of a narrow river valley bounded by the resistant headlands which form San Mateo Point. A small lagoon and marsh exist in the low gradient nearshore, behind the active beach. Under natural conditions, prior to construction of the railroad for which the surf spot is named, the creek mouth most likely migrated between the north and south valley walls (Skelly, 2000). Construction of the railroad trestles, upstream agricultural fields and the Interstate-5 have restricted San Mateo Creek to its present discharge location along the northern margin. A sand barrier blocks discharge of suspended sediments from San Mateo Creek from entering the ocean except during very large discharge events. When flows in the creek are great enough, the sand barrier is breached temporarily (for weeks to a month – pers comm. Zachary Ponsen) and the creek flow discharges directly to the ocean, where sediments are temporarily deposited and reworked in the surf zone. Cobbles, structured in the form of a fan, extend from the mouth of San Mateo Creek. This feature extends to just north of Cottons Point and to south of Uppers surf spot. A similar, smaller fan-shaped feature extends from the smaller point where Lowers surf spot is located. Per accounts from long-time Trestles surfers, the cobble bed extending seawards from approximately MLW, has remained a relatively stable feature as long as they can remember. Published literature provides very little discussion of the origin of this characteristic.

3.1.3 Sediment Budgets and Littoral Transport

San Mateo Point forms the southern boundary of the northernmost sub-cell in the Oceanside littoral cell. Littoral cells are portions of the coast within which sediment is circulated. They are bounded by features that naturally deflect the longshore transport of sediments offshore and out of active shore-parallel transport. Although littoral cells may “leak” a portion of sediment, they can be thought of as independent confined systems, each with their own sediment budget. The Oceanside littoral cell extends approximately 56 miles from Dana Point to Point La Jolla. It can be split up into three sub-cells: 1) Dana Point to San Mateo Point; 2) San Mateo Point to Carlsbad Submarine Canyon; and 3) Carlsbad Submarine Canyon to Point La Jolla. The sediment budget and dynamics of the surf zone, while dictated by the amount and type of yield from local sources, hydrography and wave energy, can also play a role in determining how waves propagate and break onshore. There have been a number of littoral transport studies conducted for the US Army Corps of Engineers Coast of California Storm and Tidal Waves Study including, Hales (1978), Weggel et al. (1983), Sonu (1988), and Everts (1990). Inman and Masters provide a summary and synthesis of information presented in previous reports in their “Budget of Sediment and Prediction of the Future State of the Coast” (Inman and Masters, 1991).
Sand and gravel are delivered to the north sub-cell of the Oceanside littoral cell via San Juan Creek, San Mateo Creek and bluff erosion. Most studies assume that there is no longshore transport past Dana Point, the northern cell boundary. Sediment is lost from the north sub-cell via longshore transport to the south within both the surf zone and along the shorerise (seawards of the surf zone where the shelf slope increases in a typical shore face profile) and through downwelling of sediments to depths greater than that of closure. Closure depth, or the maximum depth of seasonal changes, is about 33 feet in the Oceanside littoral cell and generally corresponds to the landward boundary of the shorerise. Inman and Masters (1991) note that erosion occurring during storm cluster episodes extends to depths in excess of 49 feet. Replacement of eroded material following such storm clusters back into the surf zone is thus dependent on the ability of wave energy to push eroded sediments up and over the slope of the shorerise. The shorerise within the Oceanside littoral cell is relatively steep and wave energy is not generally strong enough to replace sediments lost to such depths. Thus, severe storm clusters probably result in irreversible erosion in the surf zone and on the shorerise of the Oceanside littoral cell and accretion seawards of the shorerise (Inman and Masters, 1991).

Sediment budgets were assessed in three periods punctuated by changes in the wave climate. Under natural conditions (1900 – 1938), prior to upstream dam construction on tributary rivers, sediment inputs and outputs to the sub-cells were generally in equilibrium (Inman and Masters, 1991). Between 1960 and 1978, a period characterized by a mild, uniform northwesterly wave climate and north – south longshore transport, the yield of sediment from streams decreased due to construction of dams but bluff erosion increased due to urbanization. In the north sub-cell, inputs exceeded outputs and a widening of the beaches was observed. Beginning in the 1980’s, the wave climate became more variable as the vicinity received much more wave energy from the west and southwest, creating a more northward littoral transport. The net longshore transport was not in one direction but rather the north and south components were nearly equal. The north subcell experienced net accretion (Inman and Masters, 1991). In general, gross transport (sum of northward and southward longshore transport components) is much greater than the net transport (difference). Accretion has continued in the north subcell of the Oceanside littoral cell even though fluvial inputs have most likely decreased. Inman and Masters (1991) hypothesize that this accretion has persisted due to the supplementation of the natural sediment budget by increased bluff erosion.

3.1.4 Dependence of Surf Quality on Morphology of the Mouth

It is said by long-time surfers of the area that Trestles is consistently good when the incident swell is favorable (typically, favorable swell is characterized by coherent, organized mid to long period wave trains of average or larger size, incident from preferred direction(s), with favorable local winds). Some surfers have said that following the breach of the barrier, the surf at Uppers can be at its best (pers. comm. Zachary Ponsen). During large storms when the barrier is breached, a large volume of sand is discharged to the surf zone where it is quickly reworked offshore to form bars. Per accounts from surfers, the sand never blankets the cobble at the outlet due to energy in the surf zone but rather forms an ephemeral offshore bar extending southward from the mouth of the creek. These temporary sand features, which
enhance the quality of a certain type of wave, are dependent upon the episodic delivery of large volumes of sand to the creek mouth.

Because the surf at Trestles is said to be consistently good by long-time surfers, it is implied that the quality of the waves is more dependent on stable bathymetric features such as the cobble fan, than on the episodic, ephemeral deliveries of sands from the creek. While these surges in sandy sediment within the surf zone can temporarily enhance a certain type of wave, they do not seem to be wholly responsible for the excellence of the surf spot. Published littoral transport studies primarily focus on sand transport (Hales (1978), Weggel et al. (1983), Sonu (1988), Everts (1990) and Inman and Masters (1991)). There is little published discussion of the nature of the cobble concentrated at the mouth of San Mateo Creek and interspersed throughout the sand layers in the intermittent stretches of beach. Skelly (2000) notes that the deltas around San Mateo Point are formed by cobbles and boulders derived from the watershed and transported to the surf zone as bedload in San Mateo Creek. He characterizes the features as relatively immobile and intermittently covered by sand. Although possible, there are no citations or studies to support this. In addition, Skelly (2000) claims that the amount of large cobbles transported via San Mateo Creek as bedload will not be affected by construction of the toll road although this conclusion is made without justification. Without studies confirming the morphologic nature of the cobble formation, it is difficult to assess what impacts the toll road will have on the fan-shaped cobble feature near the mouth of San Mateo Creek.

Knowledge of the morphology of the cobbles is pertinent in assessing the impacts that the toll road will have on Trestles as a surfing resource. Cobbles have been observed in the stream bed but their past or present transport dynamics have not been studied in detail. It is speculation that the cobble feature could have been formed by any or a combination of three processes including: 1) historic or active transport via San Mateo Creek as bedload during high flows and deposition at the creek mouth, 2) historic or active littoral transport south from eroding alluvial bluffs, discharges of the San Juan Creek or remnant floodplain deposits exposed during periods of severe beach erosion, and 3) reshaping of ancient deposits previously discharged by San Mateo Creek at lower stands of sea level by wave energy during the recent sea level transgression. This process is consistent with Figure 4 from Inman (1983) which shows that during periods of lower sea level, river incision results in the erosion of sand and cobble from the former river bed. This material is deposited at the mouth of the river during that period. As sea level begins to rise again, the cobbles are reworked shoreward by the gradual transgression of the high energy wave zone. The focus of wave energy on the point could have resulted in the concentration of cobbles extending out from the creek mouth as larger sized material tends to pile (Coastal Frontiers et al.,2001, Everts, 2000).

Many questions regarding the dynamics of the cobble features off of San Mateo Point remain unanswered. The longevity and stability of its expression implicates its importance in the consistency of good surfing waves at all Trestles breaks. Additional studies are necessary to understand the morphology of the cobble feature, its origins and relation to the surf.
Possible Process for Cobble Placement

Source: Inman (1983)
Notes: from Inman - (A) Schematic diagram for valley cutting during lowered sea level and bay trapping of sediment during sea level rise (B) Assumed sea level curve for times $t_1 - t_5$
3.2 POTENTIAL IMPACTS OF SOCTIIP ON HYDROLOGIC AND SEDIMENT PROCESSES IN THE SAN MATEO CREEK WATERSHED

Large infrastructure projects such as SOCTIIP affect the generation and delivery of water and sediment in their watersheds. Roads and their associated steep cut and fill slopes increase the amount of impermeable area, resulting in greater peaks and volumes of runoff from the same amount of rainfall. In addition runoff concentrates more rapidly, creating ‘flashier’ conditions that tend to create more surface erosion. This can be exacerbated when a road crosses local drainage lines. When the increased volume of runoff from impermeable areas is delivered to creeks it generally results in downcutting and erosion of the creek bed, leading to bank erosion and fine sediment delivery downstream. Thus, roads typically cause increases in erosion and fine sediment delivery in the watersheds through which they pass. This effect is especially pronounced in Mediterranean environments such as Orange and San Diego Counties, where numerous studies have shown that the landscape is especially sensitive to small increases in runoff. Because of the extreme seasonality of rainfall and the sparse vegetation cover, relatively small disturbances in the watershed can result in channel instability and increases in sediment yield (Cooke and Reeves, 1976).

Previous studies have shown that the degree of channel erosion and degradation is related to the degree of disturbance and the increase in impermeable area in the watershed upstream of the channel. Many studies have used the impermeable area values of 10% and 25% as thresholds denoting different levels of channel degradation. Channels where the upstream watershed has more than 10% impermeable area are generally considered to be severely impacted, while channels with more than 25% impermeable area upstream are often considered irreversibly damaged.

Theoretically, the use of erosion control features such as cut and fill slope revegetation, detention basins and bio-swales should limit erosion and reduce flow peaks from the road project. However, these features frequently do not perform as well as expected in erosion-prone Mediterranean landscapes, and the overall increase in runoff volume almost inevitably results in increased channel erosion, as demonstrated by the sites discussed in Section 4.2.1.

Whether excess sediment that is generated from the watershed is delivered to the river mouth depends on the grain size distribution of the sediment and the transport capacity of the creeks receiving the sediment. In transport-limited systems the creek carries the maximum amount of sediment possible for a given volume of water and gradient, so any additional sediment that is delivered is balanced by deposition of the excess sediment in the channel, leaving the total sediment load unchanged. Thus, in transport-limited creeks, increasing sediment delivery from the watershed does not increase the volume of sediment delivery to the creek’s mouth in the short to medium term (years to tens of years). In the longer term (tens to hundreds of years) the excess sediment deposited in the creek’s channel creates a steeper profile, increasing sediment transport capacity and delivering the excess sediment to the mouth. However, even in the short term changes in the size distribution of sediment delivered to the creek can be felt at the mouth. When there is an increase in the delivery of fine- and medium-sized sediment (silt and sand) to the creek, the creek will tend to deposit coarser sediment (gravel and cobbles) in its bed and transport the finer
sediment to the mouth. Thus while the volume of sediment remains the same (controlled by sediment transport capacity) the distribution of sediment becomes finer. This process has the potential to reduce the delivery of cobbles to Trestles.

4. REVIEW OF THE SOCTIIP EIS/SEIR

This section of the report reviews the SOCTIIP EIS/SEIR and supporting documents to assess the adequacy with which potential impacts to Trestles have been evaluated. The first sub-section discusses the project alignment and creek crossings. Subsequent sub-sections assess the amount of change that the project will cause in the ten to twelve sub-watersheds closest to the Trestles surfing area.

A key issue in our evaluation of the EIS/SEIR and its supporting documents is the large scale at which the EIS/SEIR evaluated watershed impacts. The EIS/SEIR bases the impacts of the toll road on sediment delivery to the mouth of San Mateo Creek on the PSOMAS (2003) hydrology report that assessed the runoff impact of the project. The PSOMAS (2003) study assessed the increase in impermeable area under the project, relative to the total area of San Mateo Creek watershed, and determined that because of the large watershed area relative to the area of the project the increase in runoff would be very small (1-2% for most storms). This predicted small increase in runoff in turn led to a small increase in predicted sediment yield in the sediment transport assessment of Boop and Cleary-Milan (2004). While it is true that the project footprint represents a small percentage of the total San Mateo Creek watershed area, it represents a very large percentage of each of the twenty sub-watersheds that it passes through on its course through San Mateo Creek watershed. These sub-watersheds are also proximate to Trestles, so that changes in sediment yield have a greater impact than equivalent changes in more distant sub-watersheds. In our review of the EIR/SEIS we focus on the potential impacts in the sub-watersheds closest to the Trestles surfing area.

The EIS/SEIR’s conclusions that surfing conditions at Trestles are unlikely to be affected by the proposed project are also very sensitive to the assumption that sediment supply in San Mateo Creek is transport-limited. In a transport-limited system changes in watershed sediment supply may be irrelevant provided that more sediment is still delivered to the creek than the creek can deliver to its mouth. While our reconnaissance-level investigation of San Mateo Creek suggested that the creek may well be transport-limited, changes to the distribution of sediment sizes supplied from the watershed will still be felt at the creek mouth. Focusing solely on the volume of sediment overlooks the composition of the sediment, which may be crucial to the lagoon - beach barrier - delta dynamics of Trestles, and its resulting surf quality.
4.1 DESCRIPTION OF THE PROJECT WITH RESPECT TO RUNOFF AND SEDIMENT TRANSPORT

From the northeast, the proposed alignment of the SOCTIIP crosses from the San Juan Creek watershed and enters the San Mateo Creek watershed via the Cristianitos Canyon sub-watershed in the Donna O’Neil Land Conservancy. The alignment then joins the main valley of San Mateo Creek where it runs down the west side of the valley before joining Interstate-5 where the existing Interstate-5 bridge crosses San Mateo Creek. This proposed alignment traverses the core of the relatively less-disturbed and naturally functioning portions of the San Mateo watershed. It will have major impacts to approximately 20 individual and mostly natural subwatersheds. In this alignment, it crosses approximately 12 USGS ‘blue line’ creeks (creeks recorded on topography maps) draining sub-watersheds that are tributaries of San Mateo Creek and numerous smaller, ephemeral creeks. The proposed road alignment and design will result in significant alteration and degradation of the hydrologic and sediment regimes of each of these drainages. At present each of these sub-watersheds and related stream channel systems have evolved in response to the existing rainfall runoff patterns. The catchments have relatively little development and related impervious areas. As such, the watersheds supply surface runoff and subsurface infiltration into the streams that support the appropriate wetland and riparian vegetation. The sub-watersheds will respond to the full range of rainfall events that occur, ranging from frequent, low-intensity events to extreme, high-intensity rainstorms. The stream channels, vegetation and wildlife have all developed in response to the complex interaction between precipitation, watershed morphology, land cover, etc. Based on our field observations, with even relatively minor changes in the watershed land use, the stream channels are prone to instability and rapid degradation, with drastic impacts to both sediment production and channel habitat structure and function.

The construction of the toll road directly through all of these subwatersheds will result in massive changes to the hydrology of each of these drainages. The grading to create the road platform through this hilly (and at times, extremely steep) terrain will result in massive changes to the local land morphology. In addition, both the regraded slope areas and the impervious road surface areas will greatly alter rainfall-runoff relationships. Further alteration will result from the conveyance systems, and various proposed drainage facilities (detention basins, swales etc). Collectively, these changes result in the “hydromodification” impact, in which the rainfall-runoff processes and the corresponding flow frequency regime of the stream are altered by development.

The assessment of potential hydromodification impacts from this project on each of the local watersheds is inadequate. In the assessment of potential hydrologic impacts at the “local scale”, the Runoff Management Plan (Psomas, 2003b) relies on the use of the “Rational Method” to characterize potential impacts to the rainfall-runoff process. This is a simplistic 3-parameter equation to estimate peak flow rates at one point in the watershed for one theoretical major storm event. While this method is useful for sizing flood conveyance facilities, it is completely inadequate for assessing the actual changes in the hydrologic regime of the watershed as it relates to stream channel stability, vegetation maintenance and other ecologic functions. It cannot be used to characterize how the runoff and consequent streamflow in each of the sub-watersheds will change for the wide range of actual rainstorms that occur over many
years. The runoff management report suggests that the application of standard highway BMPs will acceptably mitigate for the potential changes in runoff, but this is nowhere demonstrated in any of the documents. Numerous studies on the nature of hydromodification have demonstrated that the “design storm” methodology is inadequate to characterize the true changes in rainfall runoff response for hydromodification (and subsequent changes to channel stability and associated habitat functions). Additionally, the types of BMPs proposed (related primarily to water quality treatment and the removal of pollutants) are not adequate to prevent the destabilization of downstream channels (cf McCuen, 1979). As presented, it appears that the proposed drainage system will result in the reduction of flows in some subwatersheds (to convey the water to the proposed EDFs) while others will see increased water volume. From the simplistic analyses used, it not possible to determine either where these impacts will occur, or how significant they will be.

4.2 ASSESSING THE IMPACT OF THE PROPOSED PROJECT AT THE SUB-WATERSHED SCALE

To provide an initial assessment of the true scale of potential impacts of the project on the subwatersheds along the proposed road alignment, we used standard GIS tools to delineate the sub-watersheds, and superimposed the project disturbance limits to quantify the percentage of each sub-watershed that would be directly impacted by the proposed project. We also estimated the minimum impermeable area (taken as the footprint of the road pavement and shoulder) and assessed the area of the watershed that this represented. We also looked at the road footprint and impervious surface areas as a percentage of that portion of the subwatershed that lies upstream of the crossing location. This is a more accurate measure of the true scale of project impact on the stream channel and riparian corridor that are located downstream of the toll road. Potential impacts to these downstream reaches extend to the junction with San Mateo Creek. The results are shown in Table 1, and the project footprint and sub-watersheds shown in Figures 5-7.

This assessment shows that the toll road footprint and roadway represent a significant portion of each subwatershed, and an even greater percentage of the subwatershed areas at the point of crossing. These numbers are very high when compared with the 10 and 25% thresholds for channel impact due to watershed urbanization.

4.2.1 Field Assessment of Channel Sensitivity to Runoff

In order to assess the sensitivity of the project area to increases in impermeable area and to creek crossings we conducted a reconnaissance of several creeks on the west side of San Mateo valley and Cristianitos Creek that will be crossed by the proposed alignment.

Site 1. Sub-watershed SM_3 near San Onofre State Park Campsite

Cristianitos Road crosses several unnamed tributaries of San Mateo Creek that will also be crossed by the proposed toll road alignment. PWA visited the tributary that passes under Cristianitos Road near to the entrance to San Onofre State Park Campsite to assess sensitivity of the channel to existing levels of...
Figure 5
Toll Road Effects on Trestles Surfing Area
Subbasins Disturbed within San Mateo Creek Watershed

Source: image from GoogleEarth (2005)
Figure 6

Toll Road Effects on Trestles Surfing Area
Northeastern Subbasins in Disturbed Area of San Mateo Creek Watershed

Source: image from GoogleEarth (2005)
Figure 7

Toll Road Effects on the Trestles Surfing Area
Southwestern Subbasins in Disturbed Area of San Mateo Creek Watershed

PWA Ref#: 1815.00

Source: image from Google Earth (2005)
Table 1. Percentage of sub-watershed disturbed and made impermeable

<table>
<thead>
<tr>
<th>Watershed Identifier</th>
<th>Watershed Area (ac)</th>
<th>% Watershed Area Occupied by Road Prism</th>
<th>% Watershed Area Impermeable</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM_01</td>
<td>443</td>
<td>70%</td>
<td>29%</td>
</tr>
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Note: SM denotes watersheds draining to San Mateo Creek mainstem, C denotes watersheds draining to Cristianitos Canyon. Watersheds are numbered from downstream to upstream. See Figures 6 and 7 for location.

disturbance from the watershed and Cristianitos Road (Figure 8). The channel is highly incised both upstream and downstream of the road, and the banks of the creek are actively slumping. The incision emanates from a crossing under a fire trail close to the upper end of the watershed. A small area of watershed has been developed upstream of this point, probably triggering the erosion downstream. This site shows the sensitivity of channels in this watershed to very small increases in impermeable area and to ground disturbance.

Site 2. Sub-watershed C_12 near San Onofre State Park Campsite
Site 2 is located at a culvert passing under Calle Extremo in a sub-watershed that drains to Cristianitos Creek (Figure 9). Downstream of the culvert erosion has caused a large amount of channel incision. Rock has been placed to try to prevent erosion, but due to the steep angle of the channel (close to the angle of repose) the rock is failing and the gully is eroding immediately downstream of the rock, undermining the repair. We would expect the rock to eventually fail and require replacement. As with Site 1, only the
a) Active channel erosion upstream of Cristianitos Road near San Onofre State Park Campsite (sub-watershed SM_3)

b) Site 1 location showing the incised channel and the small developed portion of the upper watershed.

Source: a) PWA Field Investigations (2005), b) from GoogleEarth 2005

Figure 8

Toll Road Effects on Trestles Surfing Area
Site 1. Subwatershed SM_3

PWA Ref# 1815.00
a) Channel erosion downstream of Calle Extremo culvert (sub-watershed C_12)

b) Site 2 location showing incised channel and proposed toll road crossing.

Source: a) PWA Field Investigations (2005), b) from GoogleEarth 2005

Toll Road Effects on Trestles Surfing Area
Site 2. Subwatershed C_12
upper-most portion of this watershed has been developed and the impermeable area is relatively small. This site indicates the sensitivity of channels to small increases in impermeable area upstream, and also demonstrates the problems of channel erosion even with recently installed culverts.

Site 3. Sub-watersheds C_16 – C_20 in the Donna O’Neil Land Conservancy
The proposed road alignment will drastically alter the morphology and hydrologic regime of all 5 watersheds in the Donna O’Neil Land Conservancy which drains to Cristianitos Creek (shown in Figure 10). The site is composed of extremely rugged terrain that is currently undisturbed. The channels have an average slope of approximately 7%, which is extremely steep for channels passing through fine-grained soils such as are found in this watershed. Adding runoff to these streams is highly likely to lead to serious erosion problems. The Toll Road footprint will include 50% of several of the watersheds. The hydrology and sediment transport within the streams will be highly altered by the proposed project.
Site 3. Subwatersheds C_16 – C_20

Source: a) PWA Field Investigations (2005), b) from GoogleEarth 2005

Figure 10

Toll Road Effects on Trestles Surfing Area

a) View of the proposed alignment through the Donna O’Neil Land Conservancy from Site 3

b) Location of Site 3, showing the approximate proposed road alignment
5. REFERENCES

Boop, P. and M. Cleary-Milan, 2004, Sediment Continuity Analysis, Lower San Mateo Creek, South Orange County Transportation Infrastructure Improvement Project, Prepared for Foothill/Eastern Transportation Corridor Agency, September 2004


Psomas, 2003a, South Orange County Transportation Infrastructure Improvement Project Hydrology Technical Report, Prepared for Foothill/Eastern Transportation Corridor Agency, December 2003


Skelly, D.W., 2000, Transportation Corridor Agencies Surfing Resources Study, April 2000


USACE, 2004a, San Clemente Shoreline Feasibility Study, Orange County, California, Coastal Engineering Appendix, April 2004

USACE, 2004b, San Clemente Shoreline Feasibility Study, Orange County, California, Geotechnical Appendix, June 2004
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