NEWLAND SIERRA
GEOMORPHIC ASSESSMENT PHOTO EXHIBIT
FEBRUARY 2017

HYDROMODIFICATION SCREENING

FOR

NEWLAND SIERRA
(SUPPLEMENTAL 2016 REPORT)

February 7, 2017

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FOR REVIEW ONLY

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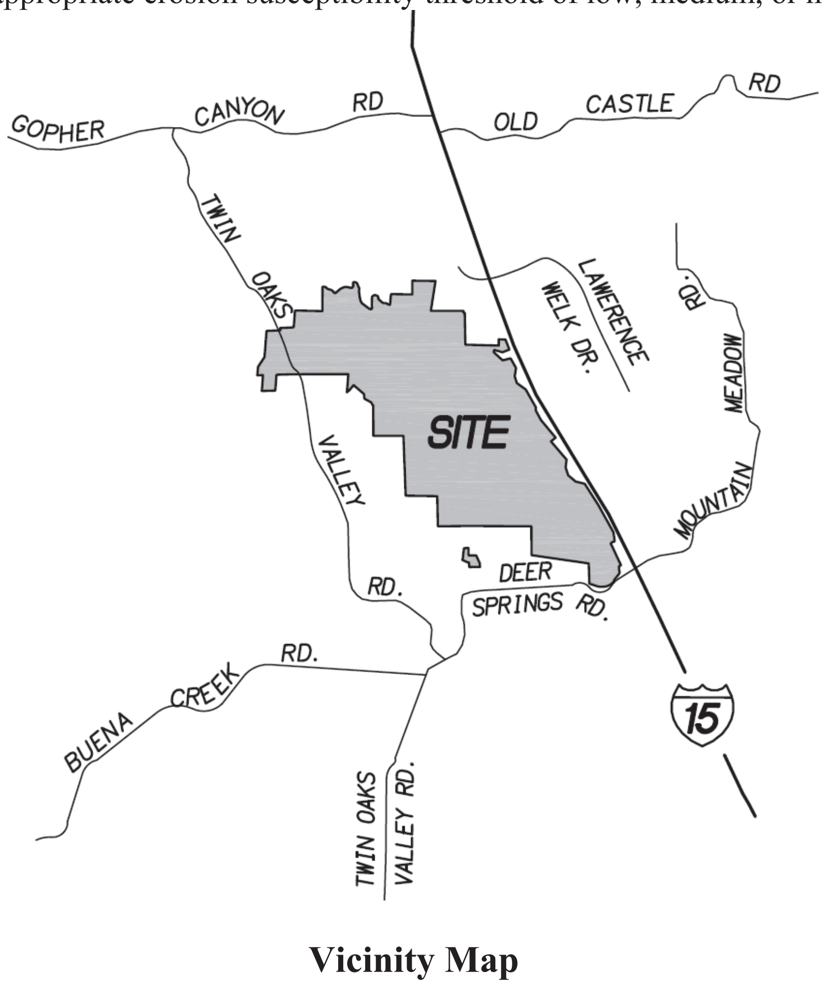
INTRODUCTION

The County of San Diego's March 2011, *Final Hydromodification Management Plan;* January 8, 2011, *Standard Urban Stormwater Mitigation Plan* (SUSMP); and February 2016, *BMP Design Manual* outline low flow thresholds for hydromodification analyses. The thresholds are based on a percentage of the pre-project 2-year flow (Q_2), i.e., $0.1Q_2$ (low flow threshold and high susceptibility to erosion), $0.3Q_2$ (medium flow threshold and medium susceptibility to erosion), or $0.5Q_2$ (high flow threshold and low susceptibility to erosion). A flow threshold of $0.1Q_2$ represents a natural downstream receiving conveyance system with a high susceptibility to bed and/or bank erosion. This is the default value used for hydromodification analyses and will result in the most conservative (largest) on-site facility sizing. A flow threshold of $0.3Q_2$ or $0.5Q_2$ represents downstream receiving conveyance systems with a medium or low susceptibility to erosion, respectively. In order to qualify for a medium or low erosion susceptibility rating, a project must perform a channel screening analysis based on the March 2010, *Hydromodification Screening Tools: Field Manual for Assessing Channel Susceptibility,* developed by the Southern California Coastal Water Research Project (SCCWRP). The SCCWRP results are compared with the critical shear stress calculator results from the County of San Diego's Critical Flow Calculator spreadsheet to establish the appropriate erosion susceptibility threshold of low, medium, or high.



Vicinity Map

This report provides hydromodification screening analyses for a portion of the Newland Sierra project for which a tentative map is being prepared by Fuscoe Engineering (Fuscoe). The project site consists of approximately 1,985 acres and is bounded by Interstate 15 on the east, Deer Springs Road on the south, and Twin Oaks Valley Road on the west, with a small portion of the northwestern edge of the site traversed by Twin Oaks Valley Road. Gopher Canyon Road is located approximately 1.5 miles north of the site's northern boundary, and approximately 2.5 miles north of proposed site development (see the Vicinity Map). The developed project will include seven neighborhoods (also referred to as planning areas for planning purposes) with a total of 2,135 single- and multi-family residential units with a variety of housing types as well as parks, a school, and commercial development. The seven planning areas will be designed to promote land stewardship and avoid the most sensitive biological, cultural, and topographical resources.

Under pre-project conditions, the site primarily contains undisturbed natural hillside areas, many portions of which are moderately to steeply sloping. Storm runoff from the undeveloped site primarily occurs as sheet flow on the natural ground surface before entering one of several natural hillside ravines or canyons. The runoff flows down the hillside areas and exits the site at various locations around its boundary. The runoff to the south, west, and southwest ultimately flows to Twin Oaks Valley Creek, the runoff to the northwest ultimately flows to the south fork of Gopher Canyon Creek, and the runoff to the north and east ultimately flows to the south fork of Moosa Canyon Creek.

The proposed project will create a large open space conservation area including approximately 1,200 acres of biological open space restoration. The flow patterns within the open space will be preserved by the project since this natural area is being preserved. In addition, the development footprint will generally maintain the pre-project flow directions in accordance with engineering requirements. The proposed on-site storm drain systems will have several discharge locations into the natural surrounding area. This report provides a downstream channel assessment for four of the discharge locations or points of compliance (labeled POC A through D on the Study Area Exhibit). A prior January 14, 2015 report, *Hydromodification Screening for Newland Sierra,* was prepared by Chang Consultants and approved by the County of San Diego. The 2015 report analyzed six other POCs, which achieved low to medium threshold ratings.

The SCCWRP screening tool requires both office and field work to establish the vertical and lateral susceptibility of a downstream receiving channel to erosion. The vertical and lateral assessments are performed independently of each other although the lateral results can be affected by the vertical rating. A screening analysis was performed to assess the low flow threshold for each POC.

This report is being submitted for the CEQA-level processing. During final engineering, the results herein shall be refined based on the final design. Vegetation will not be used as a grade control in the analyses. All of the project's POCs for which a lower threshold is desired shall be analyzed at final engineering.

The initial step in performing the SCCWRP screening analysis is to establish the domain of analysis and the study reaches within the domain. This is followed by office and field components of the screening tool along with the associated analyses and results. The following sections cover these procedures in sequence.

DOMAIN OF ANALYSIS

SCCWRP defines an upstream and downstream domain of analysis, which establish the study limits. The County of San Diego's HMP specifies the downstream domain of analysis based on the SCCWRP criteria. The HMP indicates that the downstream domain is the first point where one of these is reached:

- at least one reach downstream of the first grade control point (preferably second grade control location)
- tidal backwater/lentic waterbody
- equal order tributary
- accumulation of 50 percent drainage area for stream systems or 100 percent drainage area for urban conveyance systems (storm drains, hardened channels, etc.). This is also defined as a two-fold increase in drainage area (see Section 5.2 and 6.1 of the HMP).

The upstream limit is defined as:

- proceed upstream for 20 channel top widths or to the first grade control point, whichever comes first. Identify hard points that can check headward migration and evidence of active headcutting.

SCCWRP defines the maximum spatial unit, or reach (a reach is circa 20 channel widths), for assigning a susceptibility rating within the domain of analysis to be 200 meters (656 feet). If the domain of analysis is greater than 200 meters, the study area should be subdivided into smaller reaches of less than 200 meters for analysis. Most of the units in the HMP's SCCWRP analysis are metric. Metric units are used in this report only where given so in the HMP. Otherwise English units are used.

Downstream Domain of Analysis

The downstream domain of analysis locations for the study areas covered by this report have been determined by assessing and comparing the four bullet items above. As discussed in the Introduction, the project runoff will be collected by a series of proposed drainage facilities that outlet at several different locations around the site. Fuscoe has identified four specific locations to be analyzed by this report (see the Study Area Exhibit in the map pocket). A downstream domain of analysis has been identified below each of Fuscoe's four requested points of compliance (POCs A through D on the Study Area Exhibit). Each downstream domain of analysis location was selected as follows.

Per the first bullet item, the first permanent grade control in the natural drainage courses below each of the four POCs was located (see the Study Area Exhibit). For POC A, this occurs at a rock-lined drop structure approximately 50 feet downstream of the POC (see Figures 2 and 3). The drop structure spans across the channel bed and the upstream channel has reached a stable elevation matching the top of the drop structure as would be expected. The runoff from POC B and C flows in an easterly direction in two separate streams. The natural hillside streams below the two POCs ultimately confluence before continuing towards Interstate 15. For POC B and C, the first grade control occurs at the existing culvert under Interstate 15. For POC D, a permanent grade control exists at large rock/boulder outcroppings within the natural drainage course approximately 250 feet downstream of the POC (see Figure 12). The boulders extend across the drainage course and stabilize the upstream channel bed.

The second bullet item is the tidal backwater or lentic (standing or still water such as ponds, pools, marshes, lakes, etc.) waterbody location. Based on review of Google Earth, there is no tidal backwater or lentic waterbody near any of the four POCs. The nearest such waterbody is at Lake San Marcos, which is over 6.4 miles southwest of the site. Therefore, the second bullet item criteria will not govern over the other bullet item criteria for any of the POC's.

The third bullet item is met when the natural drainage course below a POC confluences with a stream with an equal order or larger tributary area. The Study Area Exhibit contains the drainage areas tributary to POC A through D based on Fuscoe's drainage report analyses and work map. The areas are summarized in Table 1. The third bullet item criteria is met when each drainage course confluences with a drainage course having a tributary area equal to or larger than the associated area in Table 1. It is apparent from the Study Area Exhibit that the drainage courses below POC A and D do not confluence with an equal order drainage course before their grade controls, so the third bullet criteria will not govern over the first bullet criteria for these two POCs. Furthermore, the topography on the Study Area Exhibit reveals that the drainage courses below POC B and C will confluence with larger tributary west of Interstate 15 created by the hillside area.

Point of Compliance	Tributary Drainage Area[1], ac	50 Percent Drainage Area, ac
A	73.90	36.95
B	19.04	9.52
C	4.96	2.48
D	138.00	69.00

[1]Area obtained from Fuscoe drainage report

Table 1. Area Tributary to POCs

The fourth bullet item was assessed by delineating the drainage area tributary to each POC, and then determining the location in each downstream drainage course where an additional 50 percent drainage area is accumulated. The 50 percent drainage area values are given in Table 1. The 50 percent rather than 100 percent criteria applies because each drainage course below the four POCs is a natural stream system, and not an urban conveyance. The project's topographic mapping was used to determine where bullet item 4 will govern over the other bullet items. The drainage courses below POC A and D do not accumulate a 50 percent drainage area before their grade controls, so the fourth bullet criteria will not govern over the first bullet criteria for these two POCs.

On the other hand, Study Area Exhibit shows that the fourth bullet item governs for POCs B and C. The area tributary to each of these POCs is 19.04 and 4.96 acres, respectively, per Table 1 and the Study Area Exhibit. Fifty percent of these values is 9.52 and 2.48 acres, respectively. The drainage courses below these two POCs accumulates the associated 50 percent or greater area before reaching the location where one of the other bullet criteria is met (see the Study Area Exhibit). For POC C the accumulated area is greater than 50 percent because a larger tributary contributes a greater area at the confluence.

From the above information, the downstream domain of analysis locations for the POCs are based on different criteria. For POCs A and D, the closest locations from the four bullet items are established by the permanent grade control criteria. The natural drainage course below each of these POCs contains a natural rock/boulder grade control across the entire channel bed. The rock/boulders will prevent erosion of the upstream channel bed, so these are considered permanent grade controls. For POCs B and C, the closest criteria is met by the fourth bullet item. The downstream domain of analysis for these two POCs occurs where 50 percent or greater tributary area is accumulated.

Upstream Domain of Analysis

The proposed drainage facilities tributary to POCs A, B, C, and D outlet into the uppermost end of their receiving drainage courses. Since the natural drainage courses do not extend upstream of the drainage facility outlets, the upstream domain of analysis location for these four POC's will be at each POC.

Study Reaches within Domain of Analysis

The entire domain of analysis contains four study reaches (see Study Area Exhibit). A study reach occurs below each POC. The following describes the four study reaches.

Reach 1 (86 feet long) is the study reach below POC A. It extends from the upstream domain of analysis location at POC A, which is at a proposed storm drain outlet into a natural drainage course. Since the downstream domain of analysis for POC A is based on the first bullet criteria, the second grade control below POC A was located and establishes the downstream domain of analysis location. The second grade control is a large natural rock drop structure located approximately 36 feet downstream of the upper grade control (see Figure 5).

Reach 2 (576 feet long) is the study reach below POC B. It extends from the upstream domain of analysis location at the proposed storm drain outlet at POC B to the downstream domain of analysis location where 50 percent drainage area is accumulated.

Reach 3 (419 feet long) is the study reach below POC C. It extends from the upstream domain of analysis location at POC C to the downstream domain of analysis location where over 50 percent drainage area is accumulated.

Reach 4 (292 feet long) is the study reach below POC D. It extends from the upstream domain of analysis location at POC D, which is at a proposed storm drain outlet into a natural drainage course. Since the downstream domain of analysis for POC D is based on the first bullet criteria, the second grade control below POC D was located and establishes the downstream domain of analysis location. The second grade control is a roadway crossing of the natural drainage course located approximately 42 feet downstream of the upper grade control (see Figure 14 for the roadway culvert).

Reaches 1 through 4 are within the 656 foot (200 meters) maximum reach length recommended by SCCWRP.

INITIAL DESKTOP ANALYSIS

After the domain of analysis is established, SCCWRP requires an "initial desktop analysis" that involves office work. The initial desktop analysis establishes the watershed area, mean annual precipitation, valley slope, and valley width. These terms are defined in Form 1, which is included in Appendix A. SCCWRP recommends the use of National Elevation Data (NED) to determine the watershed areas, valley slopes, and valley widths. The NED data is similar to USGS mapping. For the project the following topographic mapping sources were used. Fuscoe provided their grading plans and 5-foot contour interval topographic mapping for the project site and adjacent areas. This mapping is more detailed that NED data, so will provide more accurate results. Fuscoe also provided their proposed condition drainage analyses and basin boundaries. The mapping sources and proposed condition watershed delineations are included on the Study Area Exhibit in the map pocket. Fuscoe provided a separate exhibit with the existing condition watershed delineations, which is also included in the map pocket.

The mean annual precipitation was obtained from the rain gages closest to the site. These are the Western Regional Climate Center's Vista 1 NE and Valley Center 2 NNE gages (see Appendix A). The average annual rainfall measured at these gages for their periods of record are 13.1 and 17.5 inches, respectively. The "Rain Gages Nearest to Study Area" exhibit in Appendix A shows that the ratio of distances from the site to the Vista and Valley Center gages are approximately 1/3 and 2/3, respectively. The average annual rainfall values at each gage were interpolated based on the distance ratios to calculate an average annual rainfall at the site of 14.6 inches.

Reach	Existing Condition Drainage Area, sq. mi.	Proposed Condition Drainage Area, sq. mi.	Valley Slope, m/m	Valley Width, m
1	0.0968	0.1187	0.1047	1.2
2	0.0301	0.0446	0.1250	1.5
3	0.0195	0.0213	0.3604	3.0
4	0.2318	0.2376	0.0584	2.4

Table 2. Summary of Drainage Area, Valley Slope, and Valley Width

The valley slope and valley width were determined for each study reach from the 5-foot contour interval flown topographic mapping. NED data was not used because it is not very accurate for these parameters. The valley slope is the longitudinal slope of the channel bed along the flow line, so it is determined by dividing the elevation difference within a study reach by the length of the flow line. The valley width is the valley bottom width dictated by breaks in the hillslope. The valley slope and valley width within each reach along with the area are included in Table 2. The analyses discussed later in this report are based on the greater of the existing and proposed condition drainage areas to generate conservative (greater potential for erosion) results. In this case, the proposed condition areas are all larger so were used.

These values were input to a spreadsheet to calculate the simulated peak flow, screening index, and valley width index outlined in Form 1. The input data and results are tabulated in Appendix A. This completes the initial desktop analysis.

FIELD SCREENING

After the initial desktop analysis is complete, a field assessment must be performed. The field assessment is used to establish a natural channel's vertical and lateral susceptibility to erosion. SCCWRP states that although they are admittedly linked, vertical and lateral susceptibility are assessed separately for several reasons. First, vertical and lateral responses are primarily controlled by different types of resistance, which, when assessed separately, may improve ease of use and lead to increased repeatability compared to an integrated, cross-dimensional assessment. Second, the mechanistic differences between vertical and lateral responses point to different modeling tools and potentially different management strategies. Having separate screening ratings may better direct users and managers to the most appropriate tools for subsequent analyses.

The field screening tool uses combinations of decision trees and checklists. Decision trees are typically used when a question can be answered fairly definitively and/or quantitatively (e.g., d_{50} < 16 mm). Checklists are used where answers are relatively qualitative (e.g., the condition of a grade control). Low, medium, high, and very high ratings are applied separately to the vertical and lateral analyses. When the vertical and lateral analyses return divergent values, the most conservative value shall be selected as the flow threshold for the hydromodification analyses.

Vertical Stability

The purpose of the vertical stability decision tree (Figure 6-4 in the County of San Diego HMP) is to assess the state of the channel bed with a particular focus on the risk of incision (i.e., down cutting). The decision tree is included in Figure 19. The first step is to assess the channel bed resistance. There are three categories defined as follows:

1. Labile Bed – sand-dominated bed, little resistant substrate.
2. Transitional/Intermediate Bed – bed typically characterized by gravel/small cobble, Intermediate level of resistance of the substrate and uncertain potential for armoring.
3. Threshold Bed (Coarse/Armored Bed) – armored with large cobbles or larger bed material or highly-resistant bed substrate (i.e., bedrock).

Based on the photographs in the figures, site investigation, and geotechnical data, the bed material and resistance is within the threshold bed category because the underlying ground contains bedrock (see Figures 15 through 18). In addition to the material size and compaction, there are several factors that establish the erodibility of a channel such as the flow rate (i.e., size of the tributary area), grade controls, channel slope, vegetative cover, channel planform, etc. The Introduction of the SCCWRP Hydromodification Screening Tools: Field Manual identifies several of these factors. When multiple factors influence erodibility, it is appropriate to perform the more detailed SCCWRP analysis, which is to analyze a channel according to SCCWRP's transitional/intermediate bed procedure. This requires the most rigorous steps and will generate the appropriate results given the range of factors that define erodibility. The transitional/intermediate bed procedure takes into account that bed material may fall within the various categories (the bed material size is used in SCCWRP's Form 3 Figure 4), but other factors may trend towards a less erodible condition. Dr. Eric Stein from SCCWRP, who co-authored the Hydromodification Screening Tools: Field Manual in the Final Hydromodification Management Plan (HMP), indicated that it would be appropriate to analyze channels with multiple factors that impact erodibility using the transitional/intermediate bed procedure. Consequently, this procedure was used to produce more accurate results.

Transitional/intermediate beds cover a wide susceptibility/potential response range and need to be assessed in greater detail to develop a weight of evidence for the appropriate screening rating. The three primary risk factors used to assess vertical susceptibility for channels with transitional/intermediate bed materials are:

1. Armoring potential – three states (Checklist 1)

2. Grade control – three states (Checklist 2)

3. Proximity to regionally-calibrated incision/braiding threshold (Mobility Index Threshold – Probability Diagram)

These three risk factors are assessed using checklists and a diagram (see Appendix B), and the results of each are combined to provide a final vertical susceptibility rating for the intermediate/transitional bed-material group. Each checklist and diagram contains a Category A, B, or C rating. Category A is the most resistant to vertical changes while Category C is the most susceptible.

Checklist 1 determines armoring potential of the channel bed. The beds along Reach 1 through 4 are all within Category A, which represents coarse, tightly packed gravels and cobbles. During the site visit, large grain sizes were visible on the ground surface surrounded by smaller grain size soils (see the figures for large grain sizes and boulders). Leighton and Associates, Inc. is the project's geotechnical consultant and has performed a detailed assessment of the drainage courses associated with the POC's in this report. They prepared the June 10, 2016 and December 15, 2016 letters attached after the figures in this report, which states that "it is our opinion that the bed resistance of existing drainages can be considered to be a Coarse/Armored Bed that should not be susceptible to erosion due to the underlying hard rock (Bledsoe, 2010)." The December 2016 letter includes photographic records of the bedrock. Since the reaches contain bedrock, a pebble count is not required and Category A applies.

Checklist 2 determines grade control characteristics of the channel bed. This is reliant on the spacing of the grade controls. The categories for Checklist 2 are related to a grade control spacing of $2/S_v$ and $4/S_v$, where S_v is the valley slope from Appendix A. The $2/S_v$ and $4/S_v$ results are in meters, so a factor is applied to convert to feet. A reach is in Category A if it has a spacing of less than $2/S_v$. A reach is in Category B if it has a spacing between $2/S_v$ and $4/S_v$. Finally, a reach is in Category C if it has a spacing greater than $4/S_v$. Table 3 summarizes the S_v, $2/S_v$ and $4/S_v$ values for Reaches 1 through 4 along with the maximum grade control spacing in each reach. Table 3 also identifies each reach's category, which are either B or C.

Reach	S_v, feet/feet	$2/S_v$, feet	$4/S_v$, feet	Grade Control Spacing, feet	Category
1	0.1047	63	125	50	A
2	0.1250	52	105	No G.C.	C
3	0.3604	18	36	No G.C.	C
4	0.0584	112	225	250	C

Table 3. Checklist 3 Values based on Grade Control Spacing

The d_{50} value is the particle size in which 50 percent of the particles are smaller and 50 percent are larger. The screening index values (INDEX) for the four reaches are tabulated on Form 1 in Appendix A. The Screening Index Threshold diagram in Appendix B provides 50% Risk values for various d_{50} values. If the INDEX value is less than the 50% Risk value, the reach has less than 50 percent probability of incising and falls within Category A. Since the study reaches are underlain with hard rock per Leighton and Associates, the 50% Risk value for each reach is based on the maximum d_{50} in the diagram of 128 mm, which has a 50% Risk value of 0.145. This is higher than Reach 1 through 4's INDEX values, so Reach 1 through 4 are all in Category A.

The overall vertical rating is determined from the above described Checklist 1, Checklist 2, and Mobility Index Threshold results. The scoring is based on the following values:

Category A = 3, Category B = 6, Category C = 9

The vertical rating score is based on these values and the equation:

$$\text{Vertical Rating} = [(\text{armoring} \times \text{grade control})^{1/2} \times \text{screening index score}]^{1/2}$$

Table 4 summarizes the Checklist 1, 2, and 3 values for each reach as well as their vertical rating. The results show the vertical rating for Reaches 1 through 4 is less than 4.5, so these reaches all have a low threshold for vertical susceptibility.

Reach	Checklist 1 (armoring)	Checklist 2 (grade control)	Checklist 3 (screening index)	Vertical Rating
1	3	3	3	3.0
2	3	9	3	3.9

3	3	9	3	3.9
4	3	9	3	3.9

Table 4. Overall Vertical Rating

Lateral Stability

The purpose of the lateral decision tree (Figure 6-5 from County of San Diego HMP included in Figure 20) is to assess the state of the channel banks with a focus on the risk of widening. Channels can widen from either bank failure or through fluvial processes such as chute cutoffs, avulsions, and braiding. Widening through fluvial avulsions/active braiding is a relatively straightforward observation. If braiding is not already occurring, the next logical step is to assess the condition of the banks. Banks fail through a variety of mechanisms; however, one of the most important distinctions is whether they fail in mass (as many particles) or by fluvial detachment of individual particles. Although much research is dedicated to the combined effects of weakening, fluvial erosion, and mass failure, SCCWRP found it valuable to segregate bank types based on the inference of the dominant failure mechanism (as the management approach may vary based on the dominant failure mechanism). A decision tree (Form 4 in Appendix B) is used in conducting the lateral susceptibility assessment. Definitions and photographic examples are also provided below for terms used in the lateral susceptibility assessment.

The first step in the decision tree is to determine if lateral adjustments are occurring. The adjustments can take the form of extensive mass wasting (greater than 50 percent of the banks are exhibiting planar, slab, or rotational failures and/or scalloping, undermining, and/or tension cracks). The adjustments can also involve extensive fluvial erosion (significant and frequent bank cuts on over 50 percent of the banks). Neither mass wasting nor extensive fluvial erosion was evident within any of the reaches during a field investigation. As seen in the figures, the banks are either densely vegetated confirming that mass wasting and extensive fluvial erosion has not occurred, or sloping with no extensive mass wasting.

The next step in the Form 4 decision tree is to assess the consolidation of the bank material. The banks were moderate to well-consolidated. This determination was made because the ground surface was difficult to penetrate with a probe. The banks were densely vegetated or naturally rock-lined as seen in the figures. In addition, the banks showed no evidence of crumbling and were composed of relatively well-packed particles.

Form 6 (see Appendix B) is used to assess the probability of mass wasting. Form 6 identifies a 10, 50, and 90 percent probability based on the bank angle and bank height. From the topographic mapping and site investigation, the average bank angles in all four reaches are equal to or flatter than 1.5:1 (33.7 degrees) – most are 2:1 or less. Form 6 shows that the probably of mass wasting and bank failure has less than 10 percent risk for a 33.7 degree bank angle or less regardless of the bank height.

The final two steps in the Form 4 decision tree are based on the braiding risk determined from the vertical rating as well as the Valley Width Index (VWI) calculated in Appendix A. If the vertical rating is high, the braiding risk is considered to be greater than 50 percent. Excessive braiding can lead to lateral bank failure. For the four study reaches the vertical rating is low or medium, so the braiding risk is less than 50 percent. Furthermore, a VWI greater than 2 represents channels unconfined by bedrock or hillslope and, hence, subject to lateral migration. The VWI calculations in the spreadsheet in Appendix A show that the VWI for all four reaches is less than 2.

From the above steps, the lateral susceptibility rating is low for Reaches 1 through 4 (colored circles are included on the Form 4: Lateral Susceptibility Field Sheet decision tree sheets in Appendix B showing the decision path).

CONCLUSION

The SCCWRP channel screening tools were used to assess the downstream channel susceptibility for a portion of the Newland Sierra tentative map by Fuscoe Engineering. The project's storm runoff will be collected by proposed on-site drainage systems and conveyed to various outfalls. Fuscoe selected four of the outfalls (POC A through D) for this report. A downstream channel assessment for each POC was performed based on office analyses and field work. The assessments were based on the greater of the existing and proposed condition drainage areas since this will yield the most conservative (greater potential for erosion) results. For all of the study reaches, the proposed condition drainage areas were larger. The results indicate a low threshold for vertical and lateral susceptibility for Reaches 1 through 4.

The HMP requires that these results be compared with the critical stress calculator results. The Critical Flow Calculator (spreadsheet provided by the County of San Diego) results are included in Appendix B for each of the four study reaches. The channel dimensions were estimated from the topographic mapping and site visit, while the additional input parameters are from Form 1 in Appendix A. The critical stress results returned a low threshold for each reach. Therefore, the SCCWRP analyses will govern and demonstrate that a low overall threshold is applicable to Reach 1 through 4 (i.e., $0.5Q_2$).

This report is being submitted for the CEQA-level processing. During final engineering, the results herein shall be refined based on the final design. Vegetation will not be used as a grade control in the analyses. All of the project's POCs for which a lower threshold is desired shall be analyzed at final engineering.

Figure 1. Looking Downstream towards Reach 1 from Upper End near POC A

Figure 2. Looking Upstream from Middle of Reach 1 (towards upper rock grade control)

Figure 3. Upper Rock Drop Structure/Grade Control near Middle of Reach 1

Figure 4. Looking Downstream towards Lower End of Reach 1

Figure 5. Natural Rock Drop Structure at Lower End of Reach 1

Figure 6. Looking Downstream at Reach 2 from Upper End

Figure 7. Middle and Lower End of Reach 2

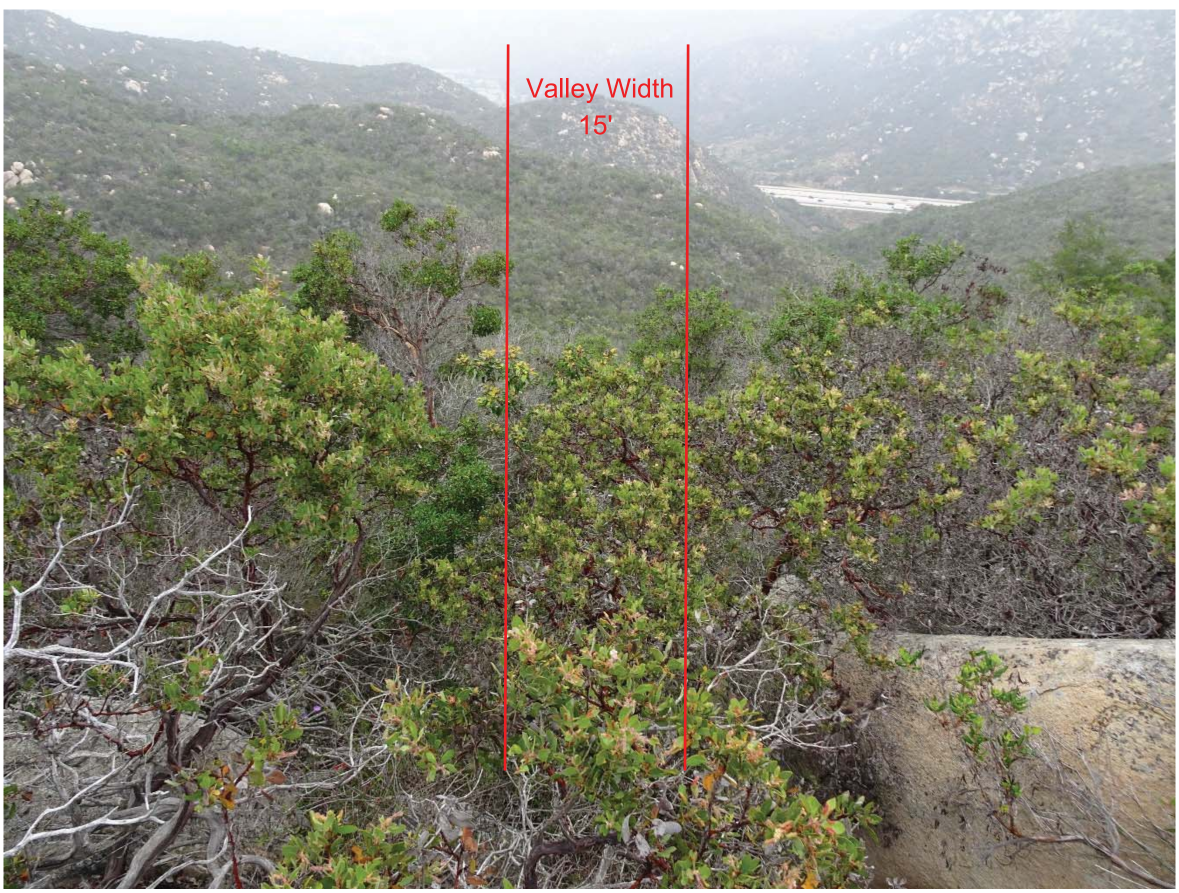


Figure 8. Looking Downstream at Reach 3 from Upper End

Figure 9. Looking Upstream towards Lower End of Reach 2 and 3

Figure 10. Upper End of Reach 4

Figure 11. Middle Reach 4

Figure 12. Natural Rock and Boulder Outcrop/Grade Control near Middle of Reach 4

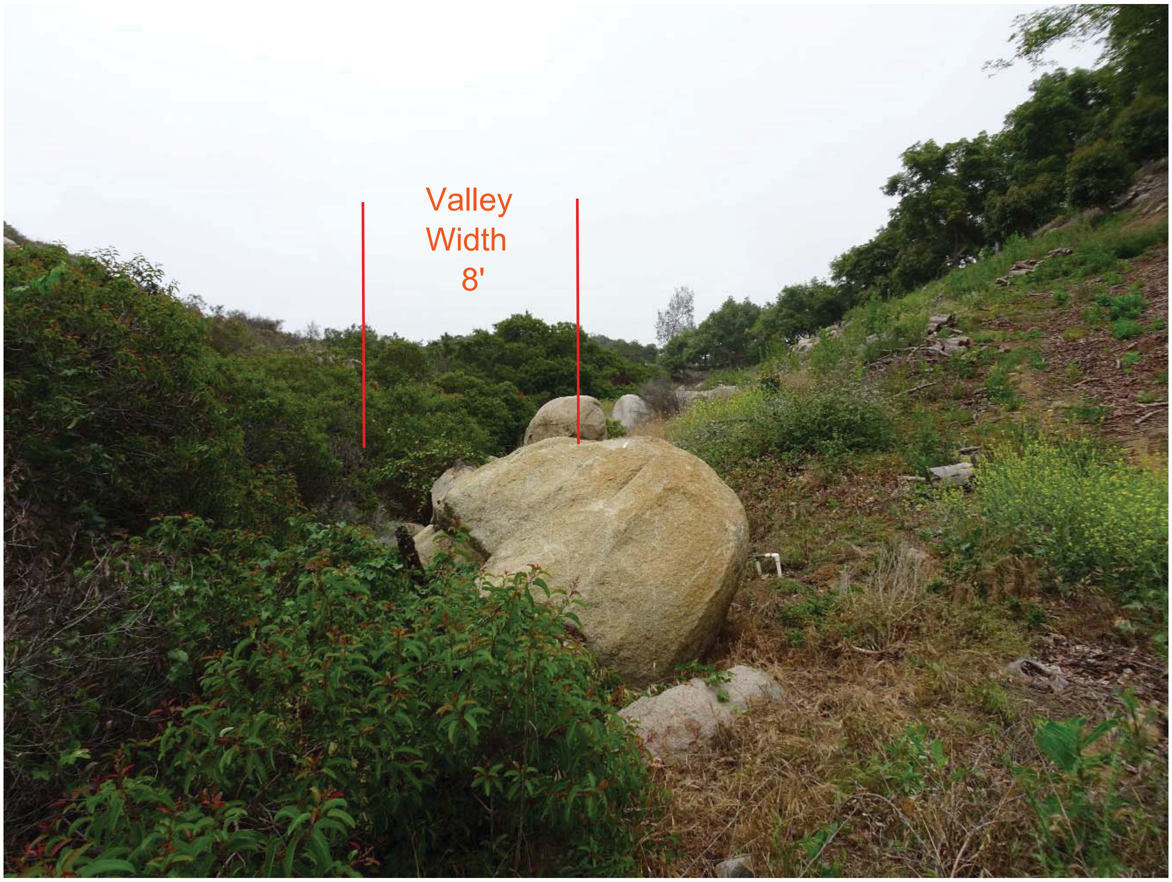


Figure 13. Looking Upstream from Lower End of Reach 4


Figure 14. Roadway Culvert at Lower End of Reach 4

Figure 15. Gravelometer along Reach 1

Figure 16. Gravelometer along Reach 2

Figure 17. Gravelometer along Reach 3

Figure 18. Gravelometer along Reach 4

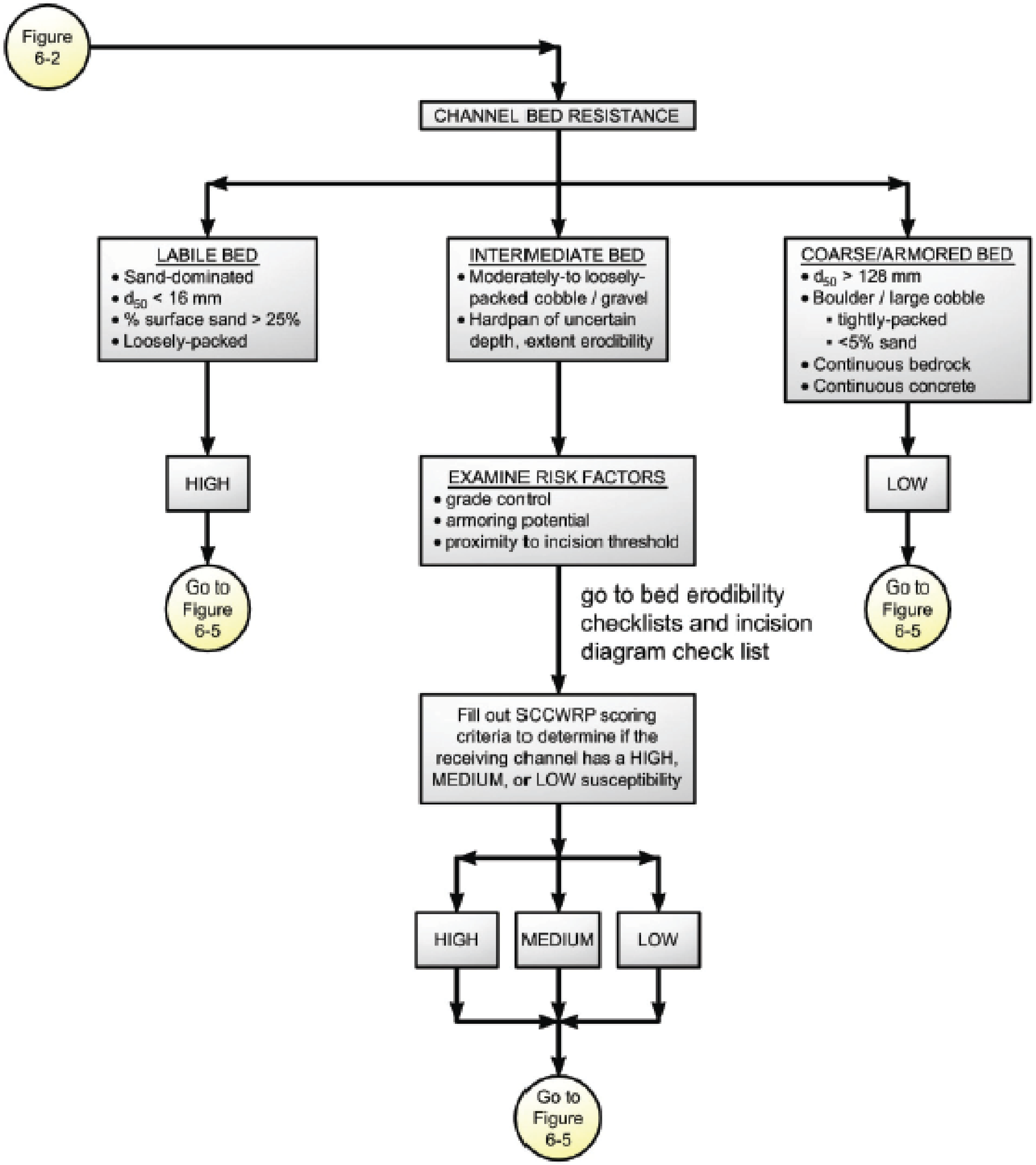


Figure 6-4. SCCWRP Vertical Susceptibility

Figure 19. SCCWRP Vertical Channel Susceptibility Matrix

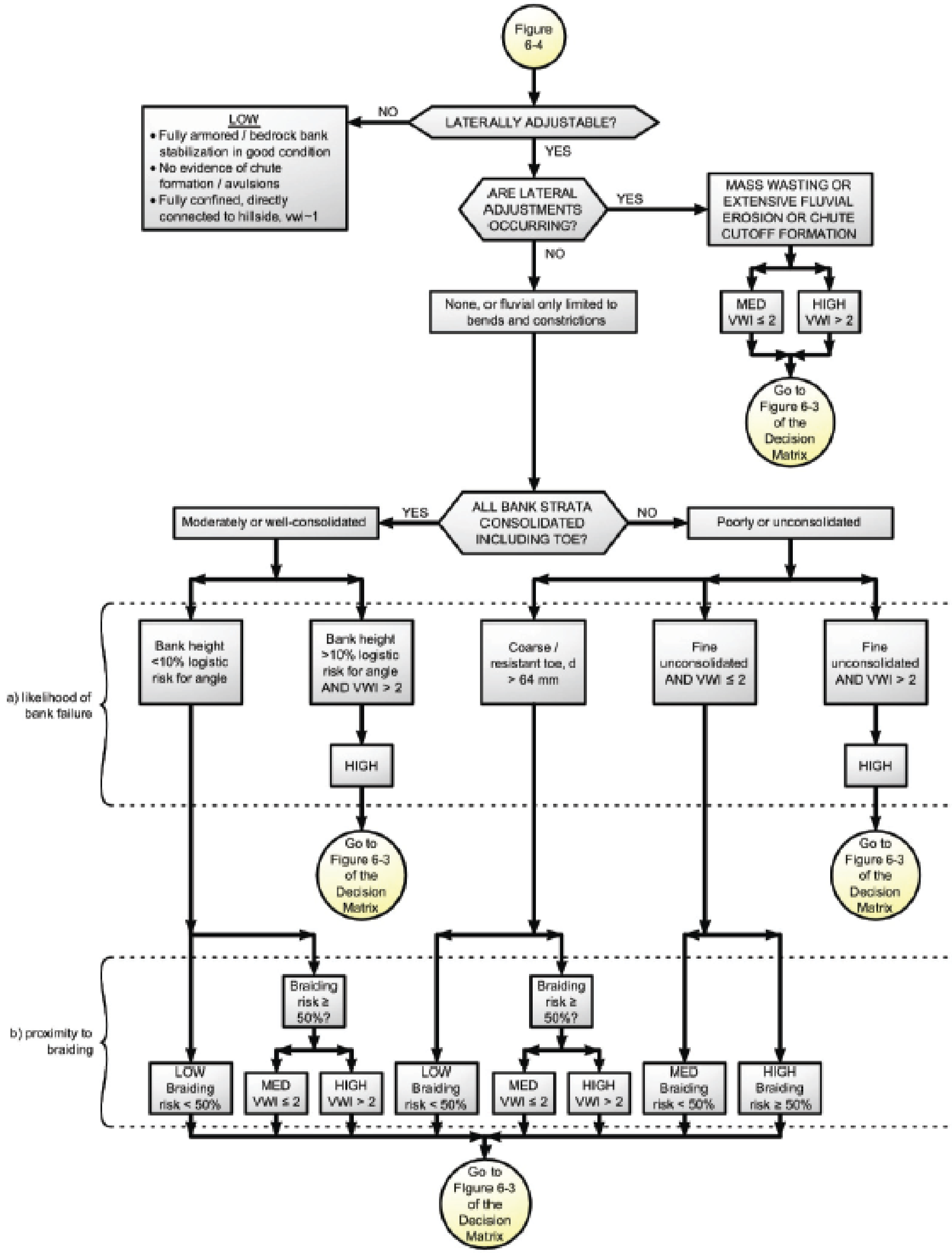


Figure 6-5. Lateral Channel Susceptibility

Figure 20. SCCWRP Lateral Channel Susceptibility Matrix

Leighton and Associates, Inc.
A LEIGHTON GROUP COMPANY

June 10, 2016

Project No. 10618.002

To: Ms. Rita Brandin
Newland Sierra, LLC
9820 Town Centre Drive, Suite 100
San Diego, California 92121

Subject: Natural Drainage Observations, POC Areas 13B, 19 & 26
Newland Sierra, San Diego County, California

In accordance with your request, we have conducted a reconnaissance of three natural drainages which exist on the slopes at the Newland Sierra project located in northern San Diego County, California (Figure 1). The undersigned visited the site on May 31, 2016 and conducted a visual reconnaissance within Point of Compliance (POC) Areas 13B, 19 and 26 which are presented on the attached Newland Sierra Critical Coarse Sediment Yield Impact Exhibit (Fuscoe, 2016). The purpose of this reconnaissance is to provide the design team with appropriate geologic information regarding the nature of the existing drainages to aid in the stream channel susceptibility characterization (armoring potential) process for storm water management design.

Based on our site visit and review of our referenced preliminary geotechnical report (Leighton, 2015), the primary bedrock unit onsite is Cretaceous-aged Granite although Jurassic-aged Metavolcanic rock is present along the western margin. These units are in turn overlain by surficial units consisting of colluvium, alluvium, slopewash and minor undocumented fill soils. Surficial soil deposits generally consist of relatively fine-grained material useful during grading of a site where abundant oversize material is expected.

We have confirmed through our geologic reconnaissance of POC Areas 13B, 19 and 26, that the existing channel bottoms are comprised of hard rock covered in some areas with a very thin veneer of alluvial soil that consists of fine to coarse rock fragments and boulders. It should be noted, due to thick impassable areas of brush located in all three natural drainages, our observations performed during our reconnaissance should be considered limited in terms of the extent of the reaches we could access, but not in terms of our conclusions. In other words, it is our opinion that the bed resistance of existing drainages can be considered to be a Coarse/Armored Bed that should not be susceptible to erosion due to the underlying hard rock (Bledsoe, 2010). In addition, for the County of

San Diego Critical Shear Stress Flow Calculator, the d_{50} will be indeterminate, and in any case larger than 24 inches, as the permissible shear stress will be in excess of 10 pounds per cubic feet.

The recommendations contained in this letter report are based on available project information. Changes made during design development and construction, should be reviewed by Leighton to determine if recommendations are still applicable.

We appreciate this opportunity to be service to you. If you have any questions regarding our letter, please contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

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(1) Fuscoe Engineering; Attention: Mr. Eric Armstrong

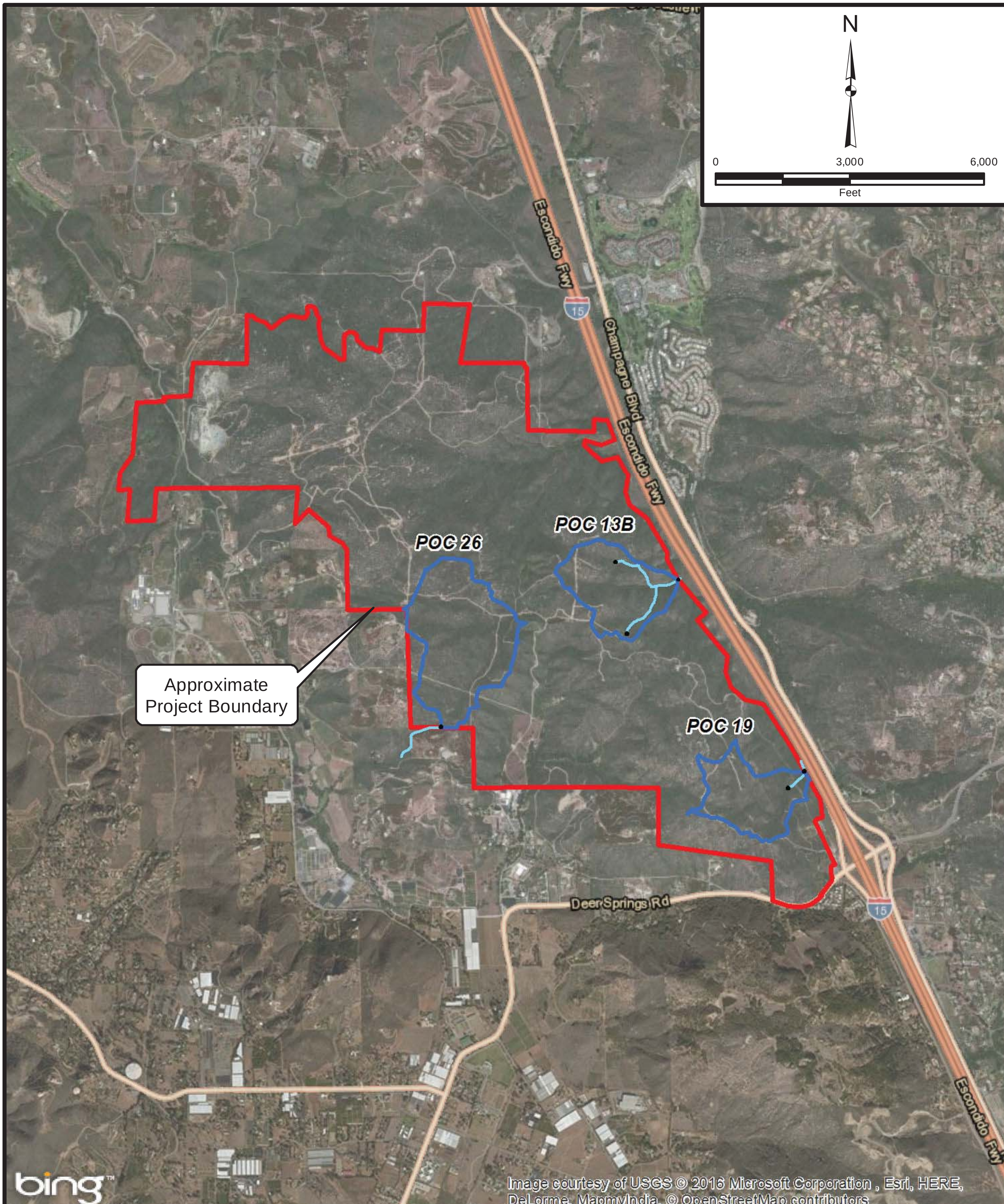
Attachments: Figure 1 – Site Location Map
Newland Sierra Critical Coarse Sediment Yield Impact Exhibit

REFERENCES

Bledsoe, B.P et al, Hydromodification Screening Tools, Field Manual for Assessing Channel Susceptibility, Technical Report 606, March, 2010.

Fuscoe Engineering, Newland Sierra Critical Coarse Sediment Yield Impact Exhibit, dated February, 2016.

Leighton and Associates, Preliminary Geotechnical Investigation, Newland Sierra, San Diego County, California, Project No. 10618.002, dated June 26, 2015.



Project: 10618.002	Eng/Geol: WDO/RCS	SITE LOCATION MAP	Figure 1
Scale: 1 " = 3,000 '	Date: June 2016	Newland Sierra	Leighton
Base Map: ESRI ArcGIS Online 2016		San Diego, California	
Author: mmurphy (mmurphy)			

Map Saved as P:\Drafting\10618\002\Maps\10618-002_F01_SLM_2016-06-03.mxd on 6/3/2016 1:32:18 PM