CONCEPTUAL ENGINEERING AND ENVIRONMENTAL CONSTRAINTS FOR DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY

APPENDICES

December 29, 2017

Prepared for:

SANDAG

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Prepared by:

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APPENDICES

I. Conceptual Double Track Alignment Alternatives between Del Mar Fairgrounds and Sorrento Valley
II. Environmental Constraints Report
III. Cultural Resources Report
IV. Geotechnical Evaluation
V. Conceptual Tunnel Ventilation Report
VI. Construction Cost Estimate
VII. Right of Way Cost Estimate
VIII. High Level Technical Review Memorandum

I. CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY

CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

VICINITY MAP

SCALE 1"=2000'

LEGEND

EXISTING CONDITIONS	PROPOSED CONDITIONS
MAJOR CONTOURS	LINE
MINOR CONTOURS	CURVE
EXISTING TRACK	SPIRAL
PARCEL LINES	TUNNEL EDGE LINE
EXISTING BRIDGE	

GENERAL NOTES

SOURCE OF BASE MAP DATA

THE AERIAL PHOTOGRAPHY AND CONTOURS SHOWN AS BACKGROUND IS BASED ON DIGITAL MAPPING PROVIDED BY EAGLE AERIAL IMAGING VENDOR AND DATED MAY 23, 2012.

SUPPLEMENTAL ELEVATION DATA IS SHOWN AT KEY SECTIONS BASED ON A FIELD SURVEY BY DAVID EVANS AND ASSOCIATES ON JUNE 27, 2012 FOR THE JIMMY DURANTE BOULEVARD/CAMINO DEL MAR INTERSECTION, CARMEL VALLEY ROAD CROSSING AND PORTOFINO ROAD CROSSING.

THE PROPERTY LINE INFORMATION SHOWN IS BASED ON SANGIS MAPPING AND IS SCHEMATIC.

THE RAILROAD RIGHT OF WAY SHOWN IS BASED ON THE RECORD OF SURVEY MAP NO. 17974, ROTATED AND TRANSLATED TO CORRESPOND TO FIELD VALUES OF CONTROL POINTS "ANNIE" AND "MARDEL".

DATUM

THE BASIS OF ELEVATIONS IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

FUTURE PROJECTS

FUTURE TRACK GRADING AND BRIDGE ALIGNMENTS BETWEEN MP 247 AND MP 248 ARE SHOWN IN ACCORDANCE WITH THE SORRENTO VALLEY DOUBLE TRACK, 90% SUBMITTAL DATED APRIL, 2011, PREPARED BY HDR FOR SANDAG.

THE EXISTING BRIDGE STRUCTURES WITHIN THE PENASQUITOS LAGOON ARE PLANNED TO BE REPLACED PER A SINGLE TRACK REPLACEMENT STRUCTURES PROJECT BY NCTD. THE DESIGN HAS BEEN COMPLETED BUT THE IS PROJECT IS CURRENTLY ON HOLD.

THE SAN DIEGUITO RIVER BRIDGE REPLACEMENT AND SECOND TRACK PROJECT FINAL PROJECT STUDY REPORT, BRIDGE 243.0 (PSR), DATED JUNE, 30 2009 PRESENTED ALTERNATIVE ALIGNMENTS FOR REPLACEMENT OF THE SAN DIEGUITO RIVER BRIDGE. THE FUTURE BRIDGE ALIGNMENT SHOWN ON THESE PLANS IS BASED ON THE PSR WEST ALIGNMENT ADJUSTED TO PROVIDE A FUTURE CENTER LOADING SEASONAL PLATFORM AT THE DEL MAR RACE TRACK.

ABBREVIATIONS

GENERAL

BLVD	BOULEVARD
CL	CENTERLINE
DIA, ø	DIAMETER
EXIST	EXISTING
MAX	MAXIMUM
MIN	MINIMUM
MP	MILEPOST
MPH	MILES PER HOUR
MT-1	'NORTH' MAINLINE
MT-2	'SOUTH' MAINLINE
NCTD	NORTH COUNTY TRANSIT DISTRICT
NTS	NOT TO SCALE
PKWY	PARKWAY
ROW, R/W	RIGHT OF WAY
RR	RAILROAD
SANDAG	SAN DIEGO ASSOCIATION OF GOVERNMENTS
SDGE	SAN DIEGO GAS AND ELECTRIC
SDDT	SAN DIEGUITO DOUBLE TRACK
ST	STREET
STA	STATION
SVDT	SORRENTO VALLEY DOUBLE TRACK
TC	TRACK CENTER
TOR	TOP OF RAIL
TYP	TYPICAL

TRACK ALIGNMENT – HORIZONTAL

Ea	ACTUAL SUPERELEVATION
Eu	UNBALANCED SUPERELEVATION
Ls	LENGTH OF SPIRAL
R	RADIUS OF CIRCULAR CURVE
V	VELOCITY (PASSENGER\FREIGHT)

TRACK ALIGNMENT – VERTICAL

LVC	LENGTH OF VERTICAL CURVE
PVIE	POINT OF VERTICAL INTERSECTION ELEVATION
PVIS	POINT OF VERTICAL INTERSECTION STATION

SHEET INDEX

SHEET NO.	DESCRIPTION
01	NOTES, ABBREVIATIONS, LEGEND, KEY MAP
02	SHEET INDEX MAP
03	CAMINO DEL MAR ALIGNMENT PLAN AND PROFILE
04	CAMINO DEL MAR ALIGNMENT PLAN AND PROFILE
05	CAMINO DEL MAR TYPICAL SECTIONS
06	CAMINO DEL MAR TYPICAL SECTIONS
07	CAMINO DEL MAR TYPICAL SECTIONS
08	CANYON CREST HIGHER SPEED ALIGNMENT PLAN AND PROFILE
09	CANYON CREST HIGHER SPEED ALIGNMENT PLAN AND PROFILE
10	CANYON CREST HIGHER SPEED TYPICAL SECTIONS
11	CANYON CREST HIGHER SPEED TYPICAL SECTIONS
12	CANYON CREST ALIGNMENT PLAN AND PROFILE
13	CANYON CREST ALIGNMENT PLAN AND PROFILE
14	CANYON CREST TYPICAL SECTIONS
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16	CANYON CREST TYPICAL SECTIONS
17	INTERSTATE 5 ALIGNMENT PLAN AND PROFILE
18	INTERSTATE 5 ALIGNMENT PLAN AND PROFILE
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20	INTERSTATE 5 TYPICAL SECTIONS
21	INTERSTATE 5 TYPICAL SECTIONS
22	INTERSTATE 5 EAST ALIGNMENT PLAN AND PROFILE
23	INTERSTATE 5 EAST ALIGNMENT PLAN AND PROFILE
24	INTERSTATE 5 EAST TYPICAL SECTIONS
25	INTERSTATE 5 EAST TYPICAL SECTIONS
26	INTERSTATE 5 EAST TYPICAL SECTIONS
27	STRUCTURAL SECTIONS – CUT AND COVER BOX
28	STRUCTURAL SECTIONS – CUT AND COVER BOX EMERGENCY ACCESS
29	STRUCTURAL SECTIONS – CUT AND COVER BOX EMERGENCY ACCESS
30	STRUCTURAL SECTIONS – CUT AND COVER BOX TEMPORARY SHORING
31	STRUCTURAL SECTIONS – BORED TUNNEL
32	STRUCTURAL SECTIONS – BORED TUNNELS
33	STRUCTURAL SECTIONS – BOX GIRDER BRIDGES
34	CLEARANCE ENVELOPES

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DRAWN BY	MCCO/MCDC	04/14
CHECKED BY	PMM	04/14
SANDAG	L. CULP	04/14

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NORTH COUNTY TRANSIT DISTRICT

SAN DIEGUITO RIVER BRIDGE REPLACEMENT, DOUBLE TRACK AND SPECIAL EVENTS PLATFORM

NOTES, ABBREVIATIONS, LEGEND, KEY MAP

SCALE

SANDAG CONTRACT NO. 5000931

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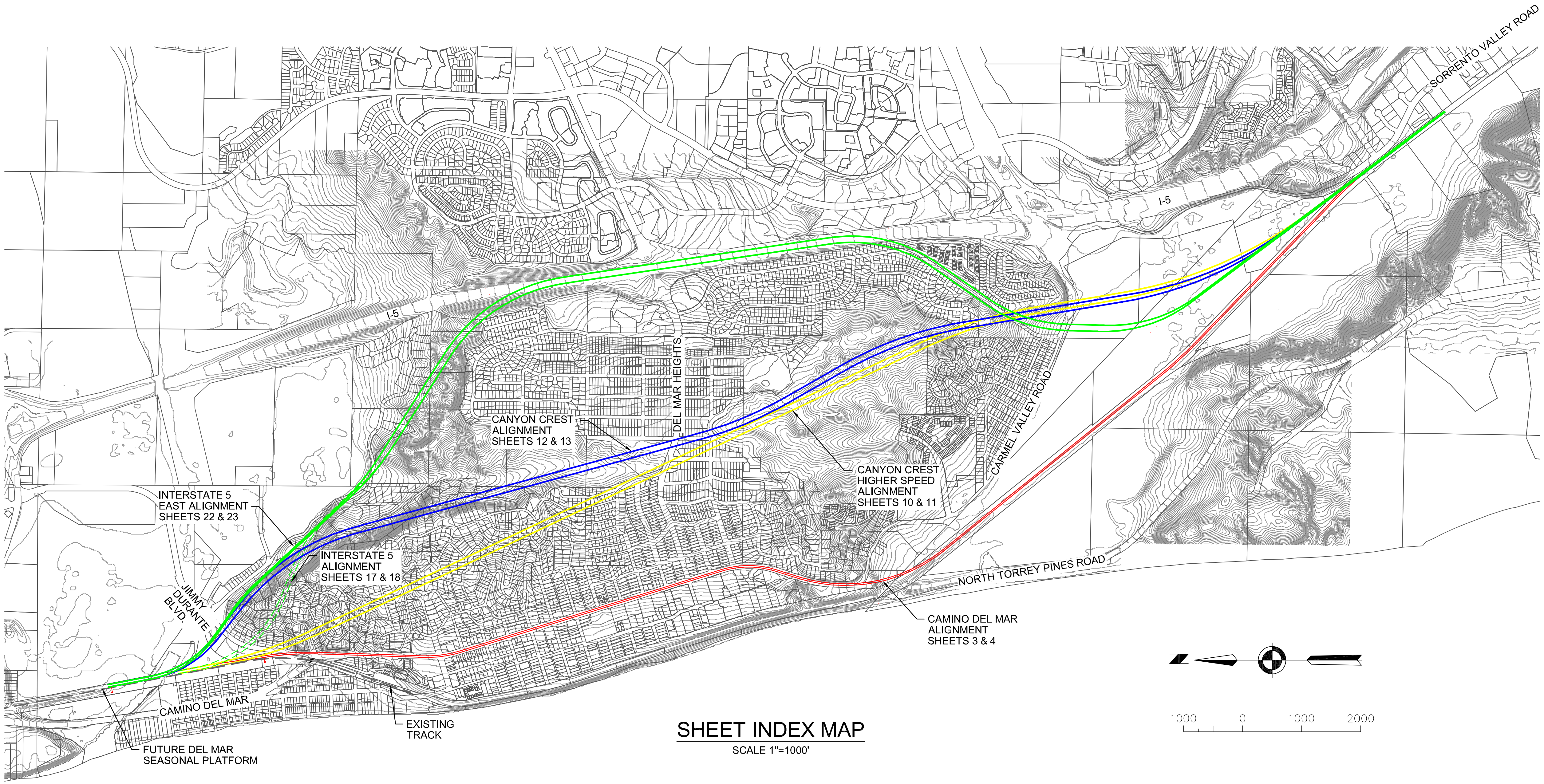
SHEET NO. 01



SHEET INDEX MAP

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SAN DIEGUITO RIVER BRIDGE REPLACEMENT, DOUBLE TRACK AND SPECIAL EVENTS PLATFORM

SHEET INDEX MAP

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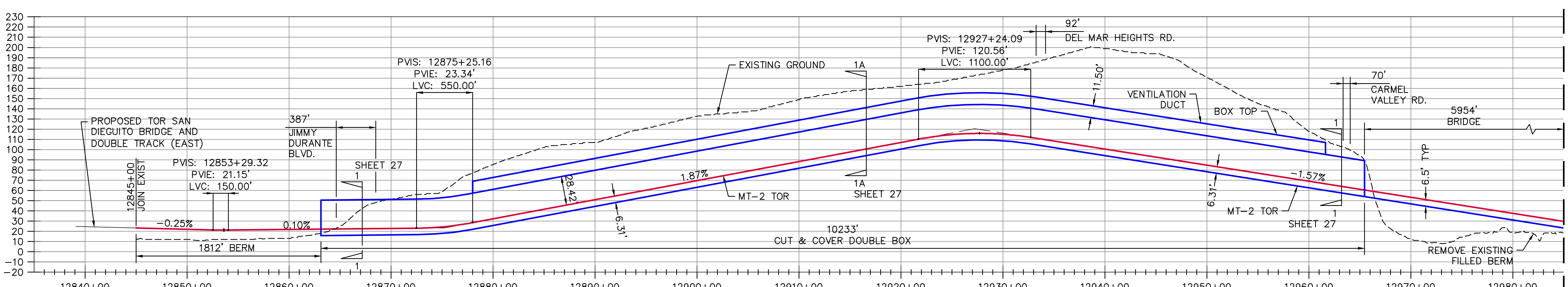
PLAN VIEW
SCALE 1"=500'



PROFILE VIEW
SCALE HORZ. 1"=500'
VERT. 1"=50'

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CAMINO DEL MAR ALIGNMENT PLAN AND PROFILE

SCALE 1"=500'

SANDAG CONTRACT NO. 5000931

DRAWING NO.

SHEET NO. 03

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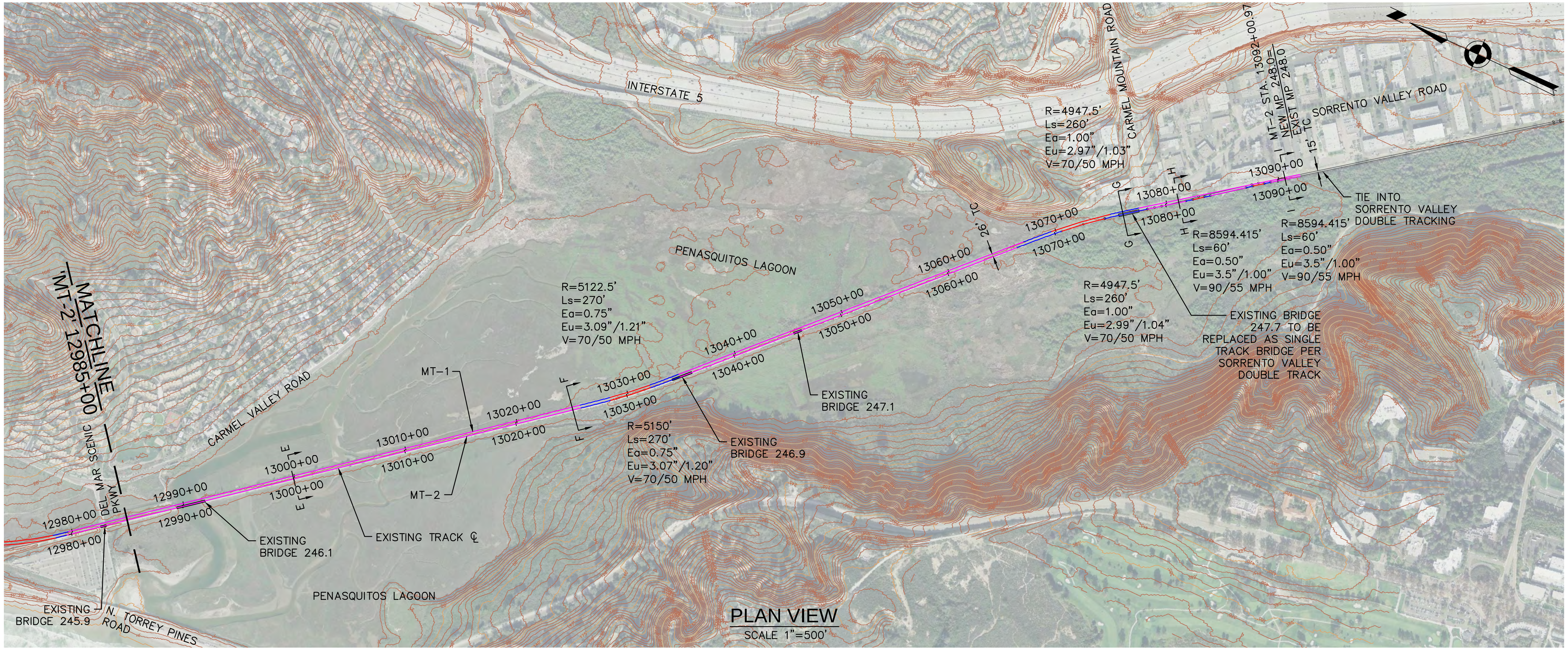

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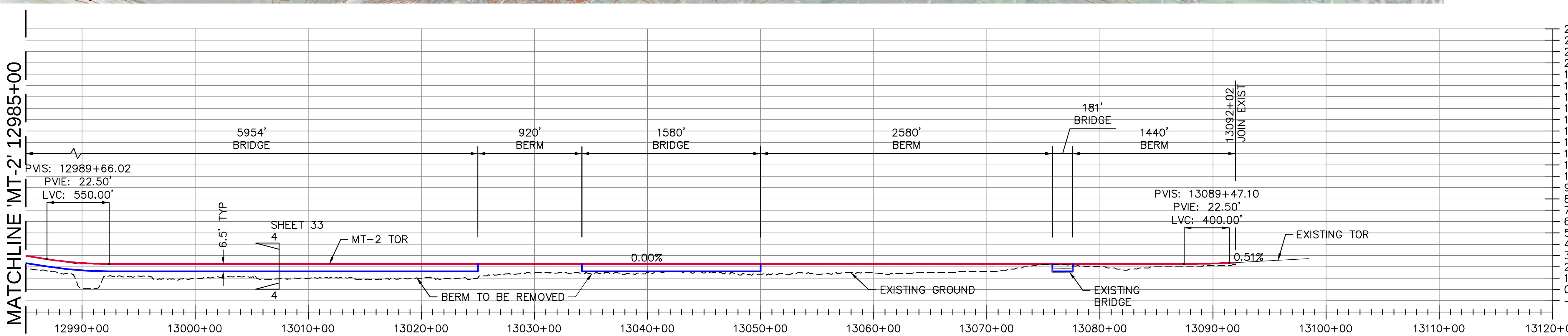
SCALE 1"=500'



PROFILE VIEW
SCALE HORZ. 1"=500'
VERT. 1"=50'

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CAMINO DEL MAR ALIGNMENT PLAN AND PROFILE

SCALE 1"=500'

SANDAG CONTRACT NO. 5000931

DRAWING NO.

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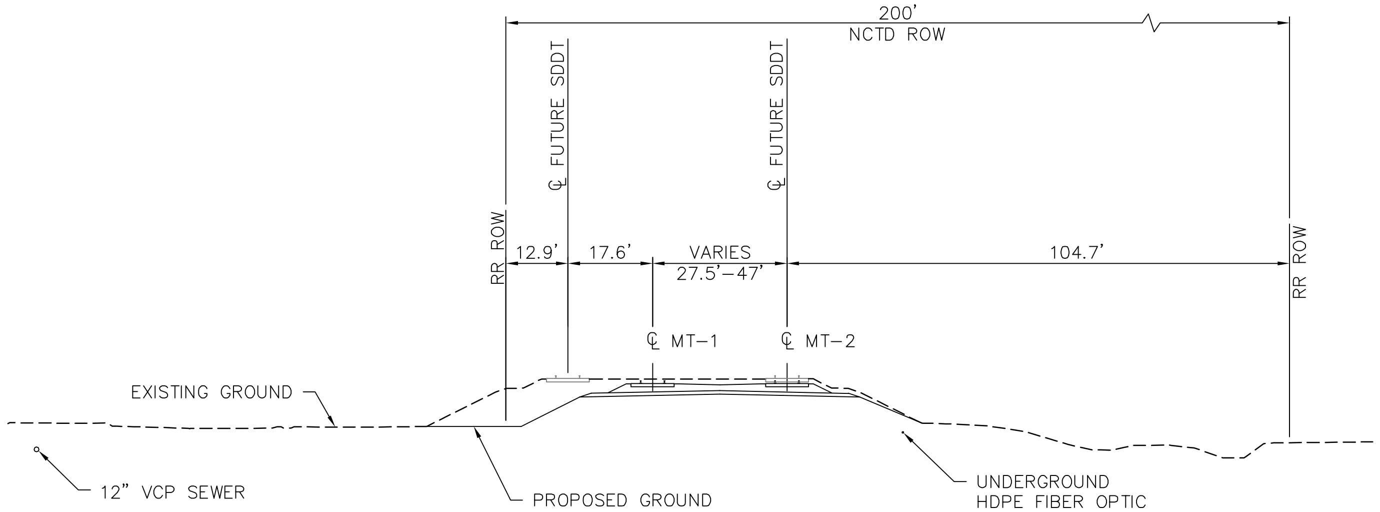

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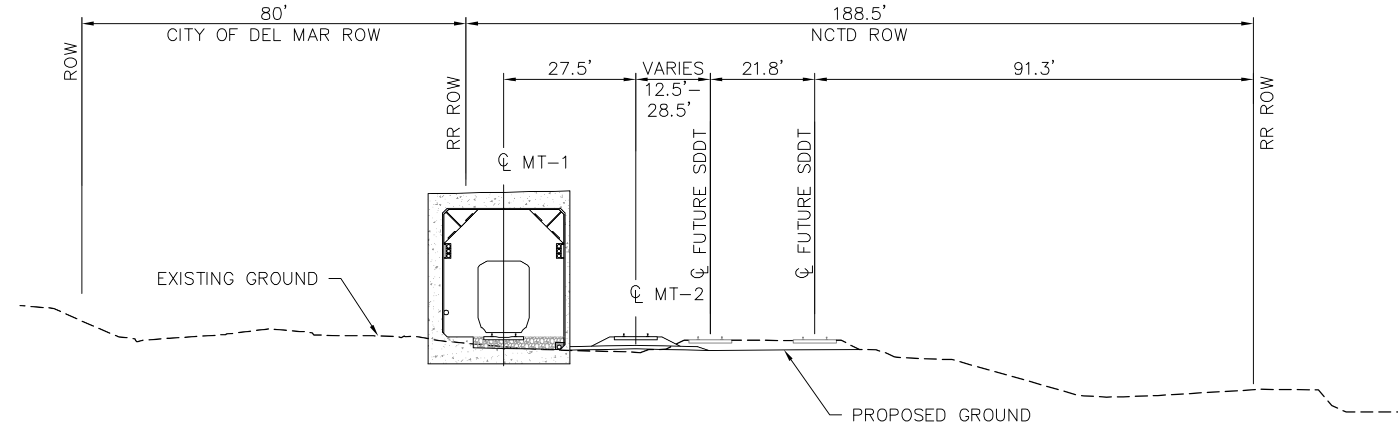

SECTION B-B
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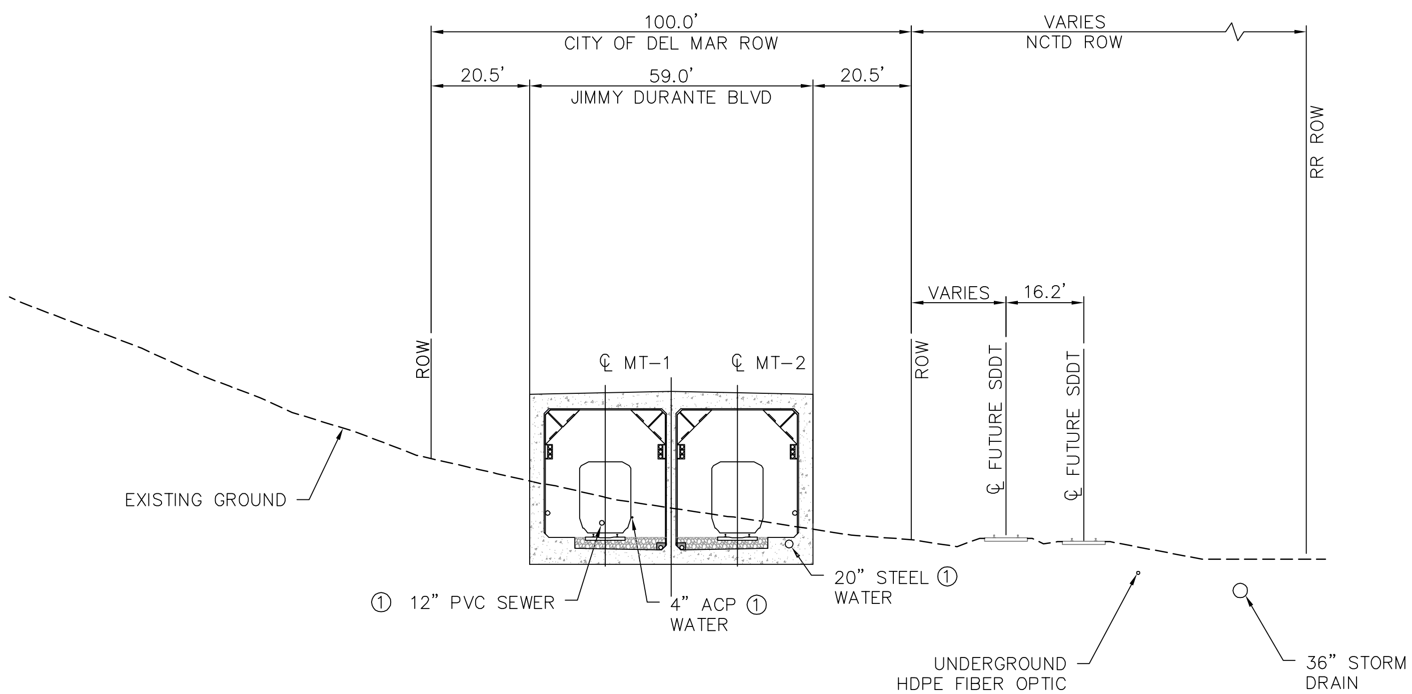
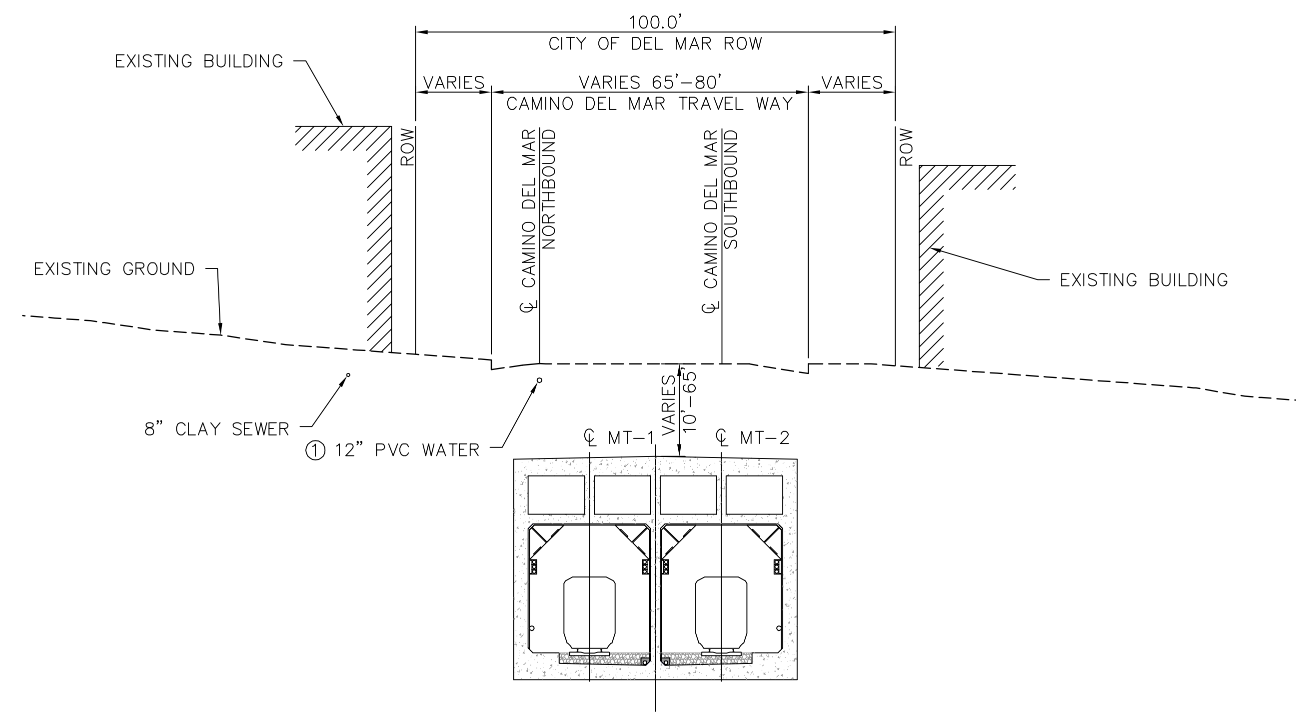


NOTE:
① EXISTING UTILITIES TO BE RELOCATED

SECTION C-C
'MT-2' 12863+12 TO 'MT-2' 12878+00
'MT-2' 12961+16 TO 'MT-2' 12965+45



SECTION D-D
'MT-2' 12878+00 TO 'MT-2' 12961+16

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CAMINO DEL MAR TYPICAL SECTIONS

SCALE 1"=20'
SANDAG CONTRACT NO. 5000931
DRAWING NO.
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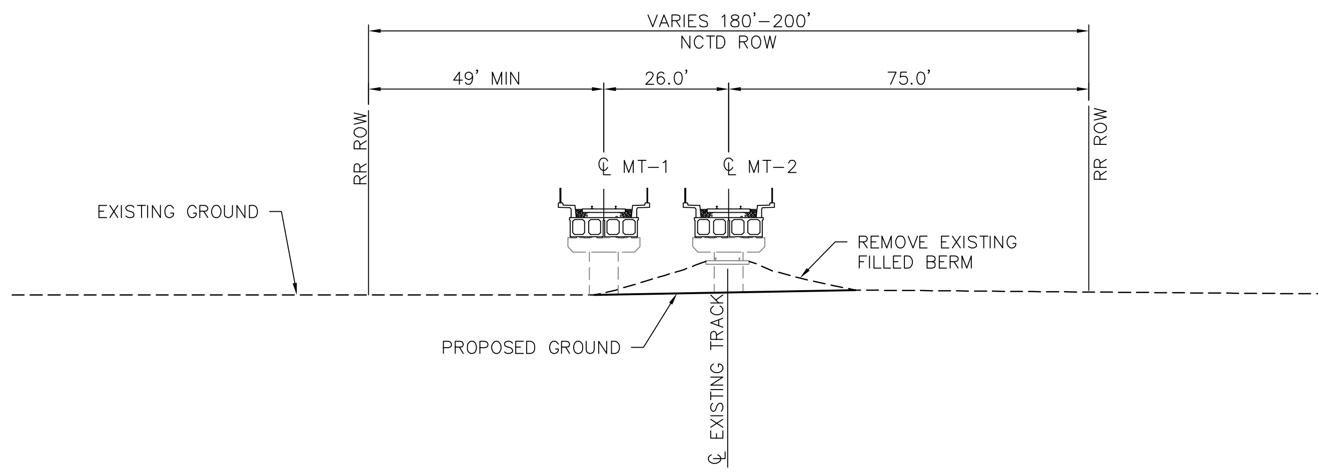

SECTION E-E

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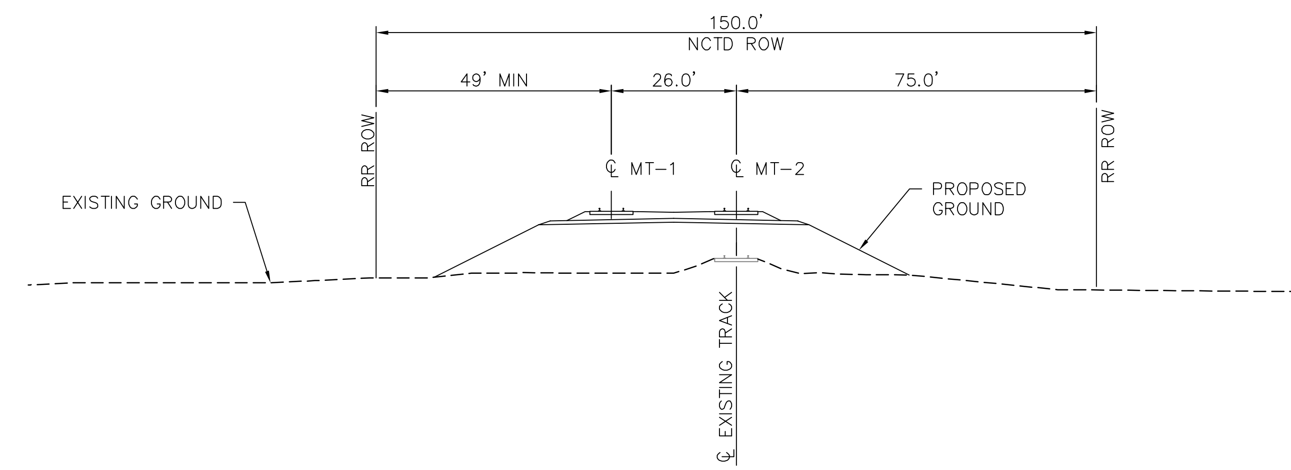
'MT-2' 13034+20 TO 'MT-2' 13050+00



SECTION F-F

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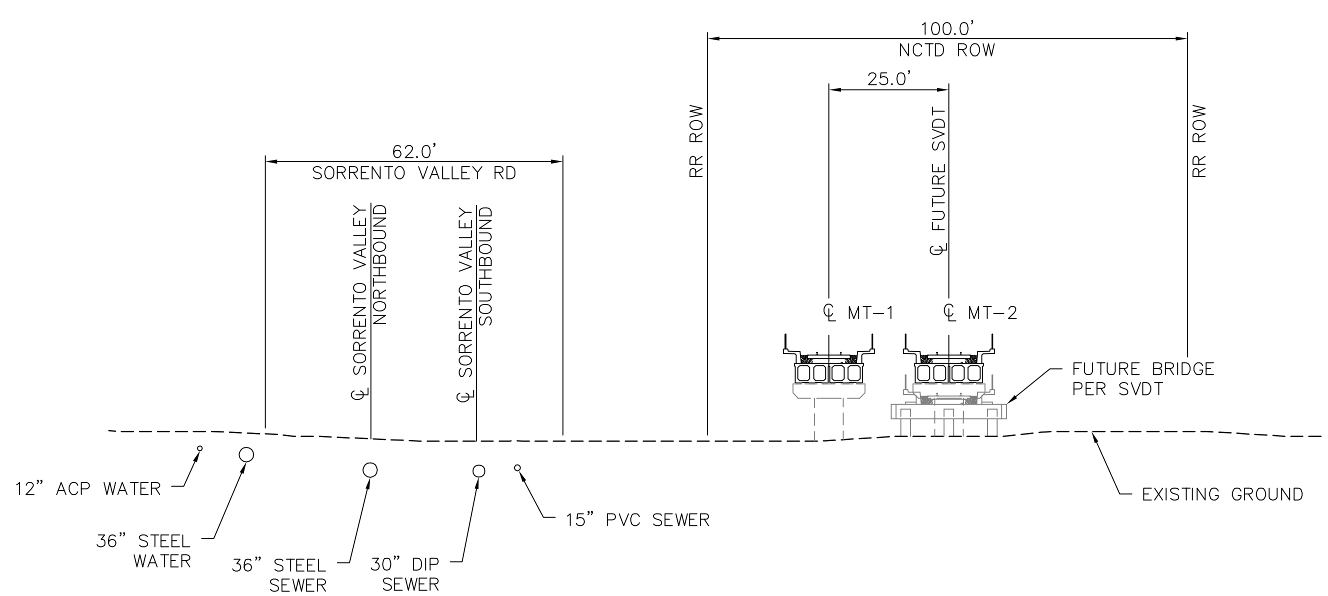
'MT-2' 13050+00 TO 'MT-2' 13075+00



SECTION G-G

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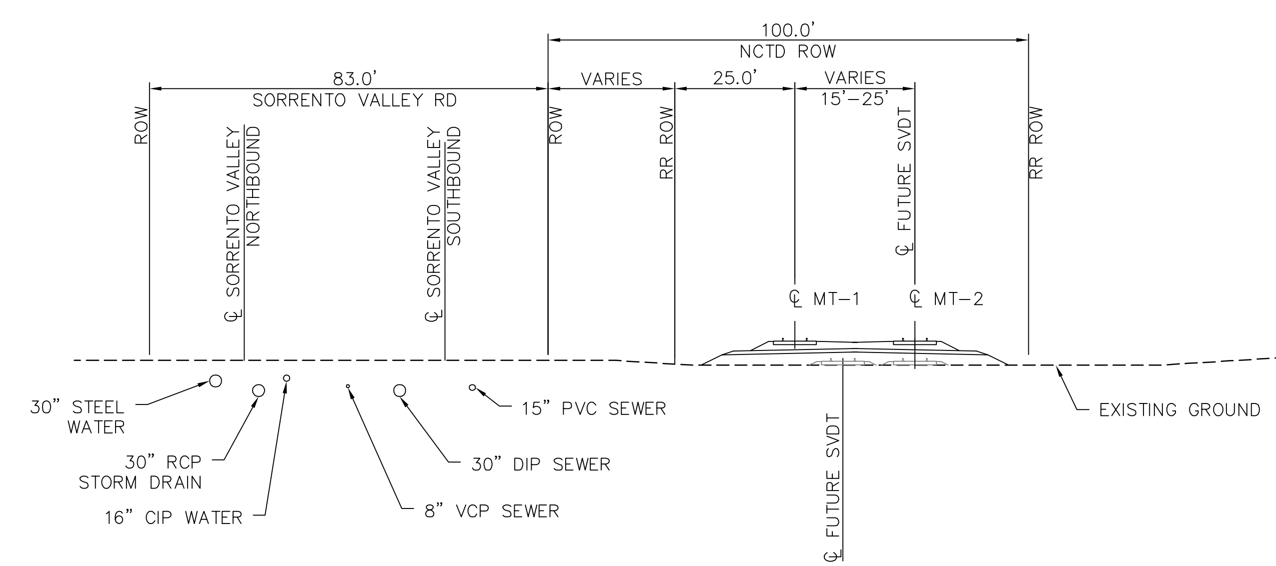

SECTION H-H

'MT-2' 13077+61 TO 'MT-2' 13089+39

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CAMINO DEL MAR
TYPICAL SECTIONS

SCALE 1"=20'

SANDAG CONTRACT NO. 5000931

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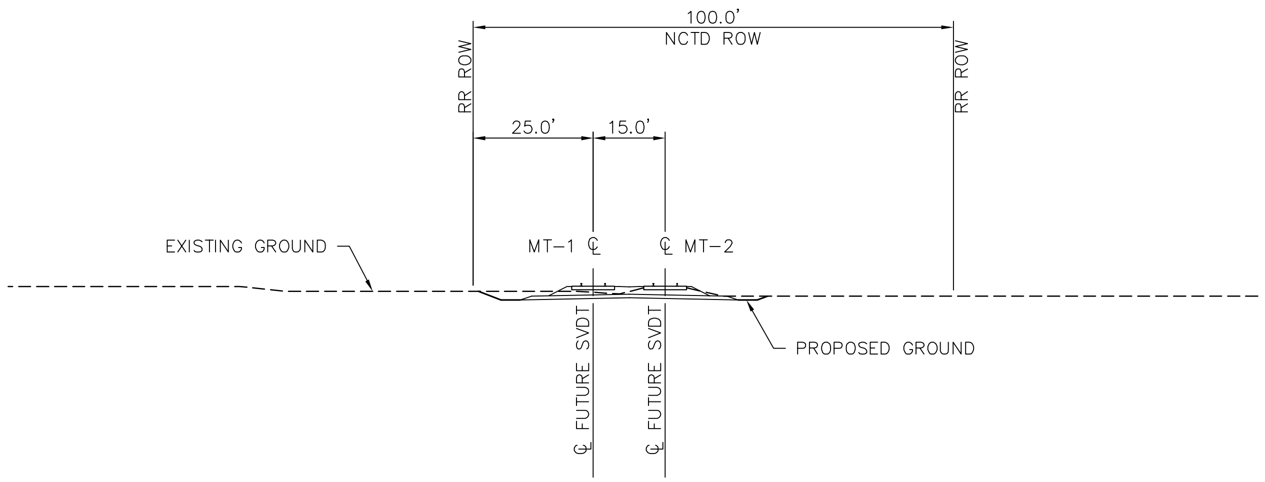

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SANDAG	LC	8/12

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES:
LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CAMINO DEL MAR
TYPICAL SECTIONS

SCALE 1"=20'

SANDAG CONTRACT NO. 5000931

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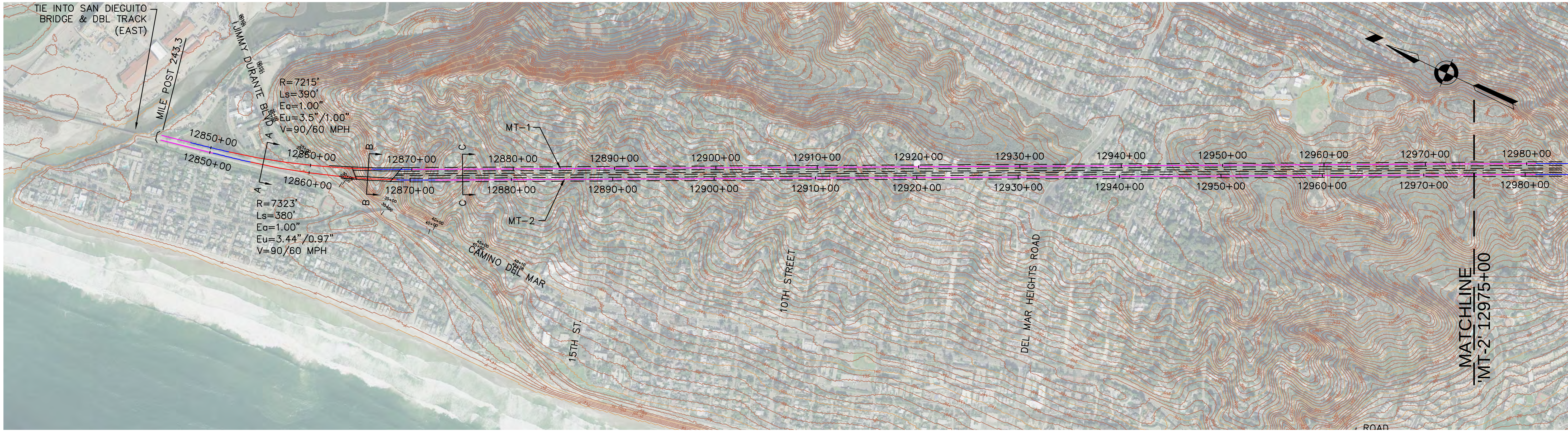
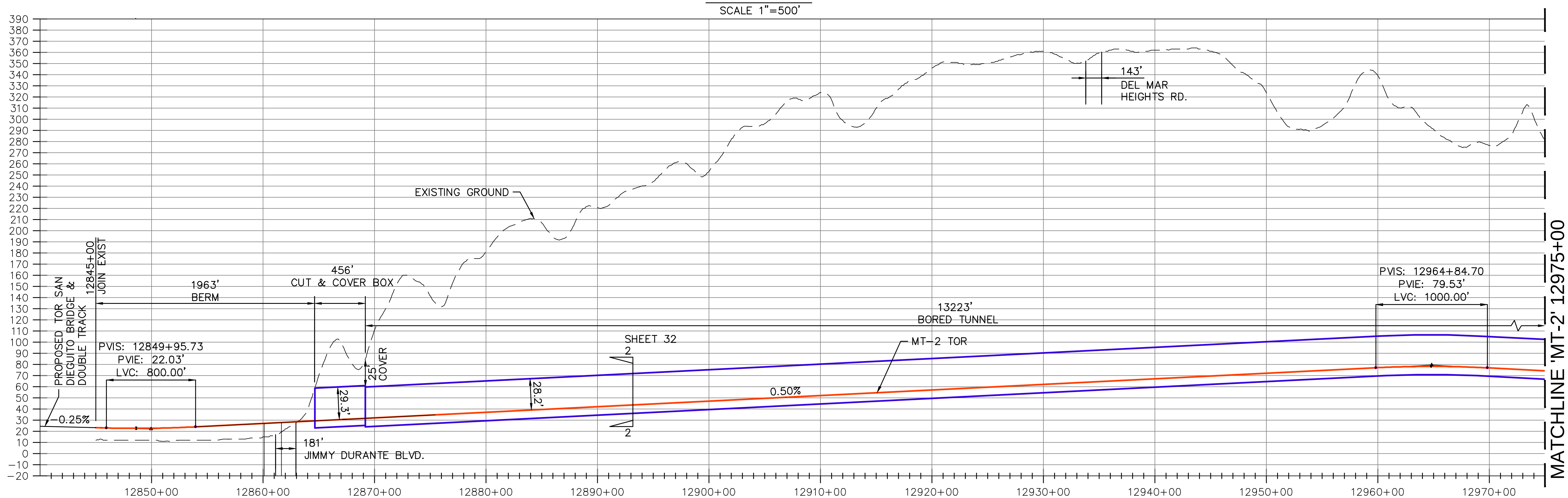


PLAN VIEW

SCALE 1"=500'



PROFILE VIEW

SCALE HORZ. 1"=500'
VERT. 1"=50'

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SANDAG	LC	8/12

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CREST CANYON ALIGNMENT HIGHER SPEED OPTION

SCALE 1"=500'

SANDAG CONTRACT NO. 5000931

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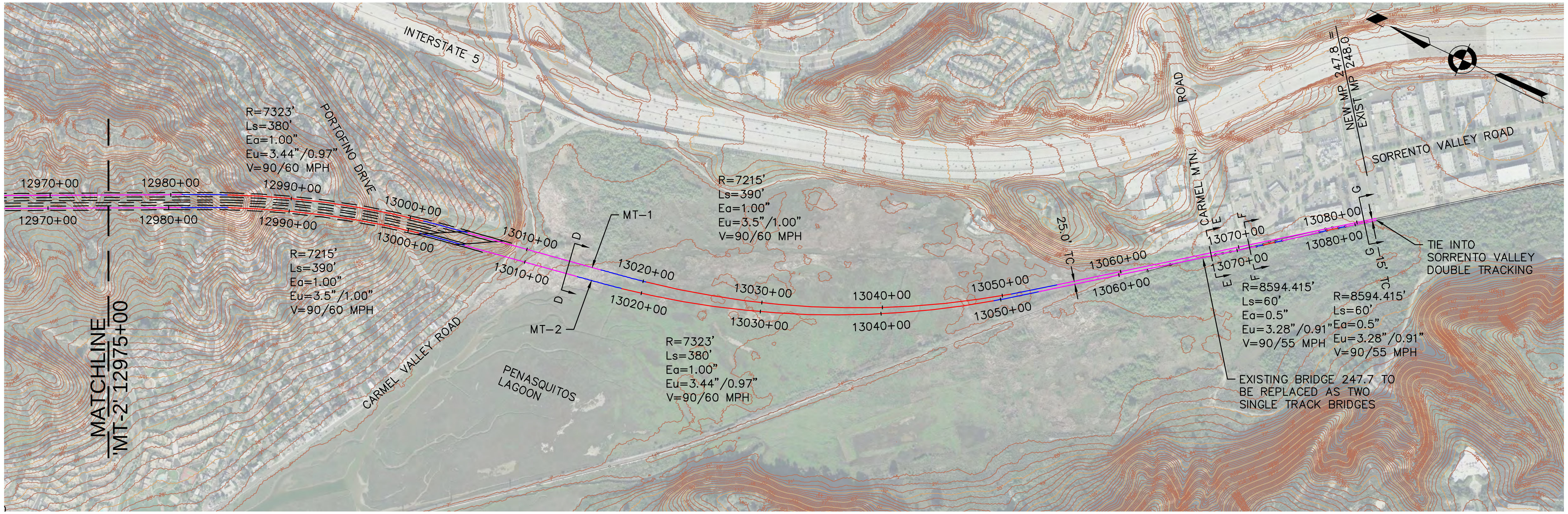

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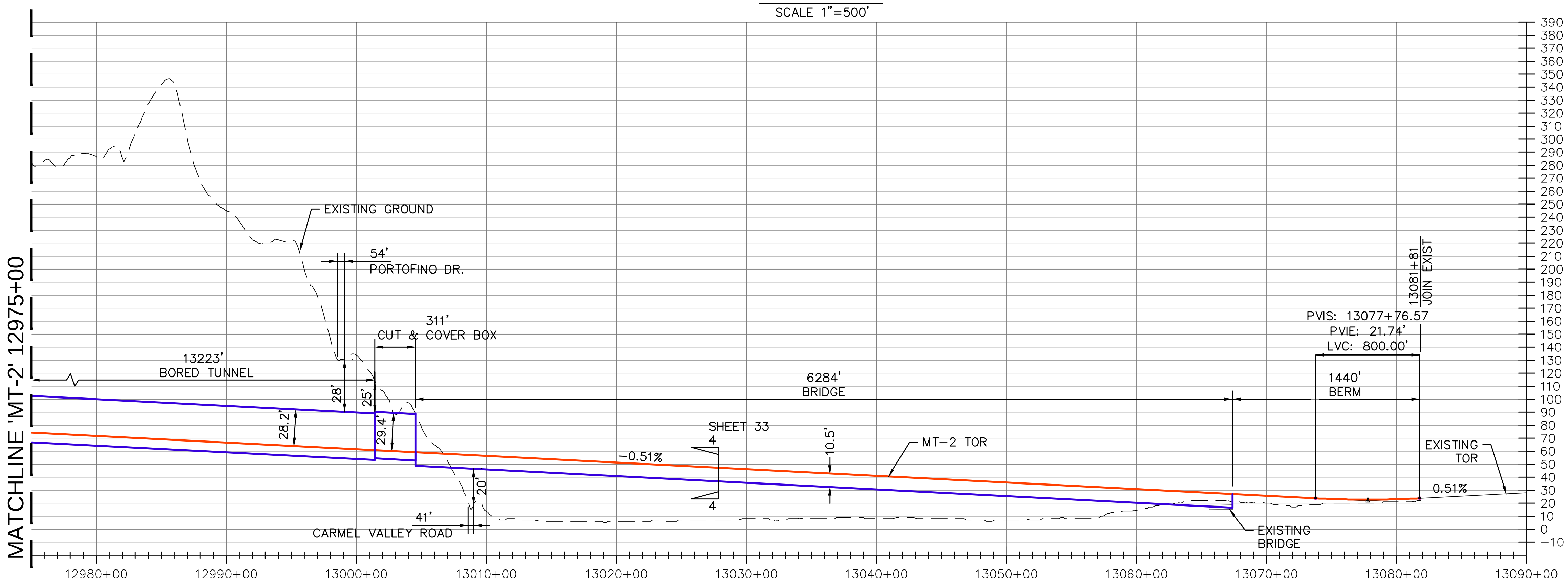

PROFILE VIEW
SCALE HORZ. 1"=500'
VERT. 1"=50'

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CREST CANYON ALIGNMENT
HIGHER SPEED OPTION

SCALE 1"=500'
SANDAG CONTRACT NO. 5000931
DRAWING NO.
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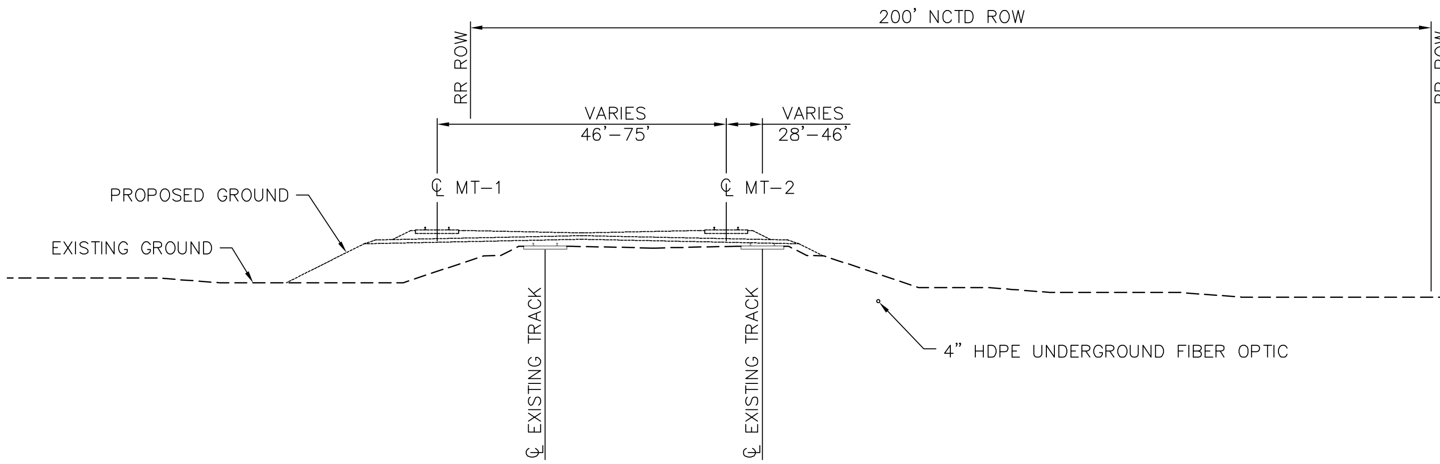

SECTION A-A
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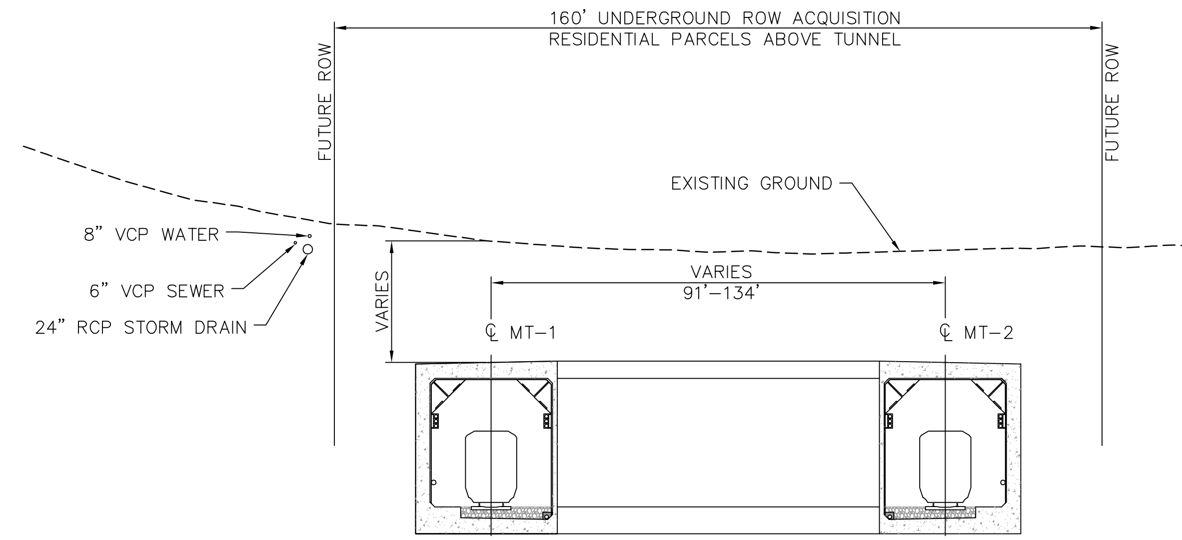

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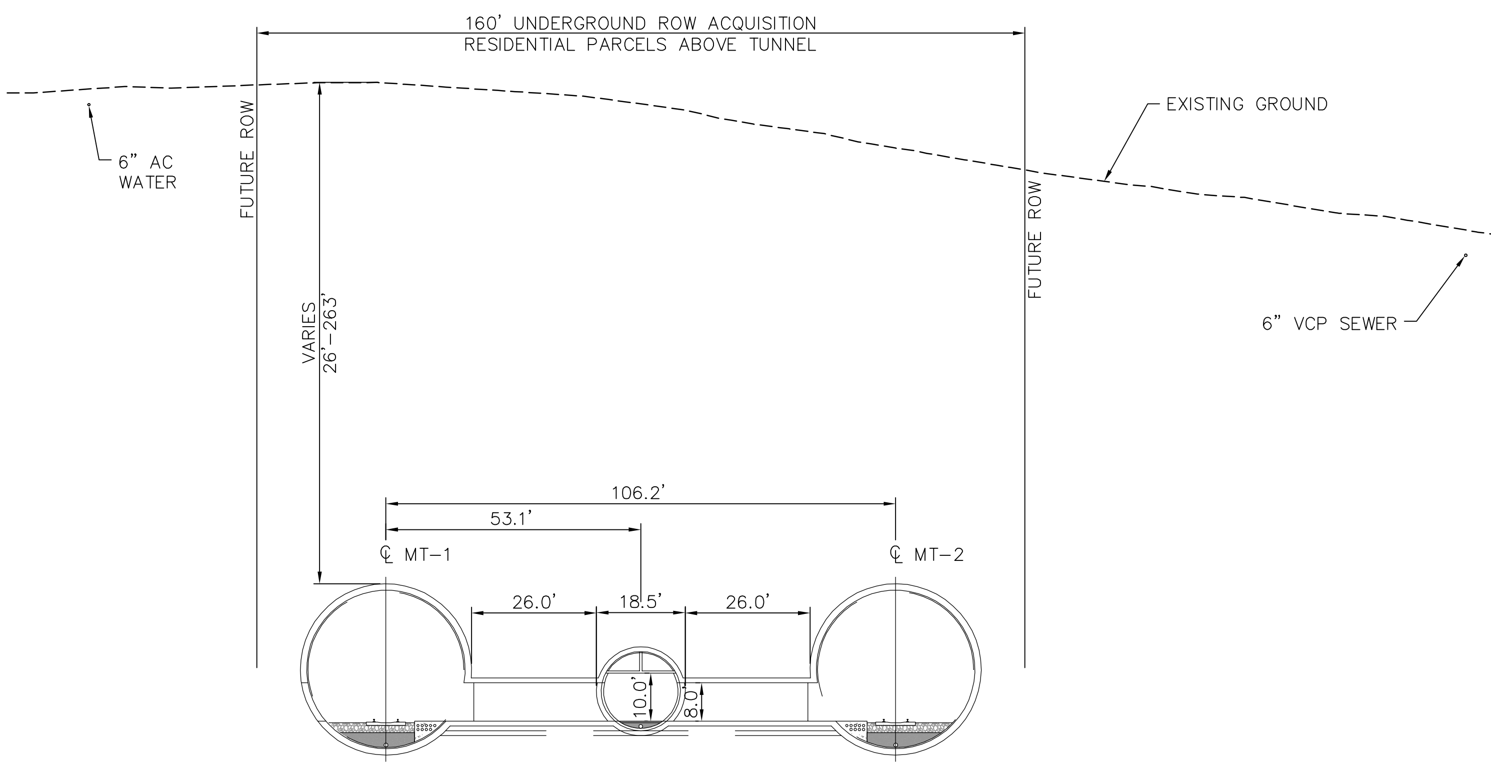
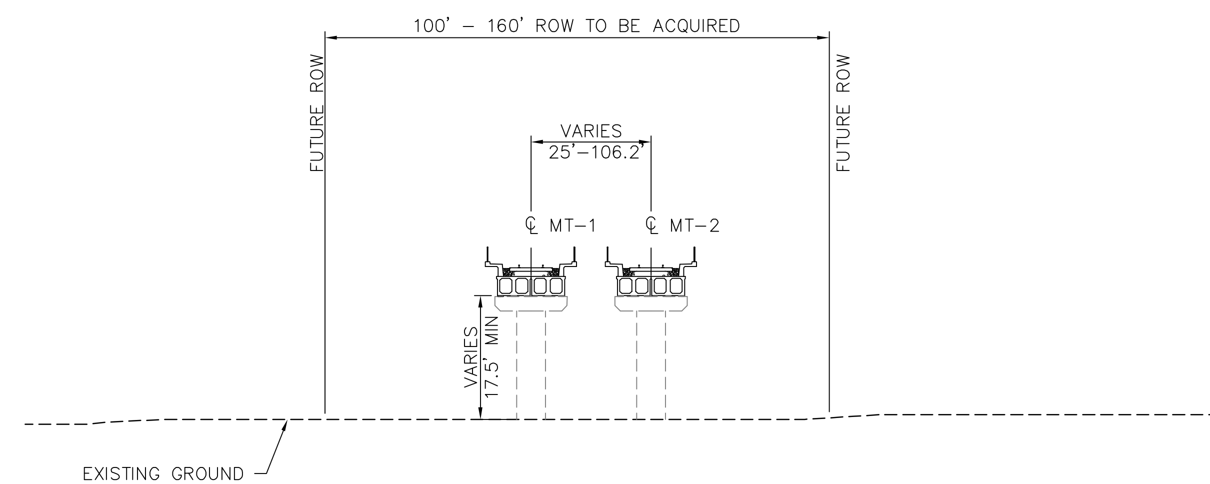
'MT-2' 13001+42 TO 'MT-2' 13004+53



SECTION C-C
'MT-2' 12869+19 TO 'MT-2' 13001+42



SECTION D-D
'MT-2' 13004+53 TO 'MT-2' 13065+61

NO.	DATE	REVISIONS	BY	CHK	APRV

DAVID EVANS AND ASSOCIATES INC.
110 West A Street, Suite 1700
San Diego California 92101
Phone: (619) 400-0600

REGISTERED PROFESSIONAL ENGINEER
PATRICIA M. McCOLL
No. 36873
Exp. 6-30-2014
CIVIL
STATE OF CALIFORNIA

DESIGNED BY	SNYO	8/12
DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

SANDAG
San Diego's Regional Planning Agency

NCTD

CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES:
LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CREST CANYON HIGHER SPEED
TYPICAL SECTIONS

SCALE 1"=20'

SANDAG CONTRACT NO. 5000931

DRAWING NO.

SHEET NO. 10

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3

CONCEPTUAL DESIGN — NOT FOR CONSTRUCTION

DATE: 08-27-2012 TIME: 5:00:26 PM

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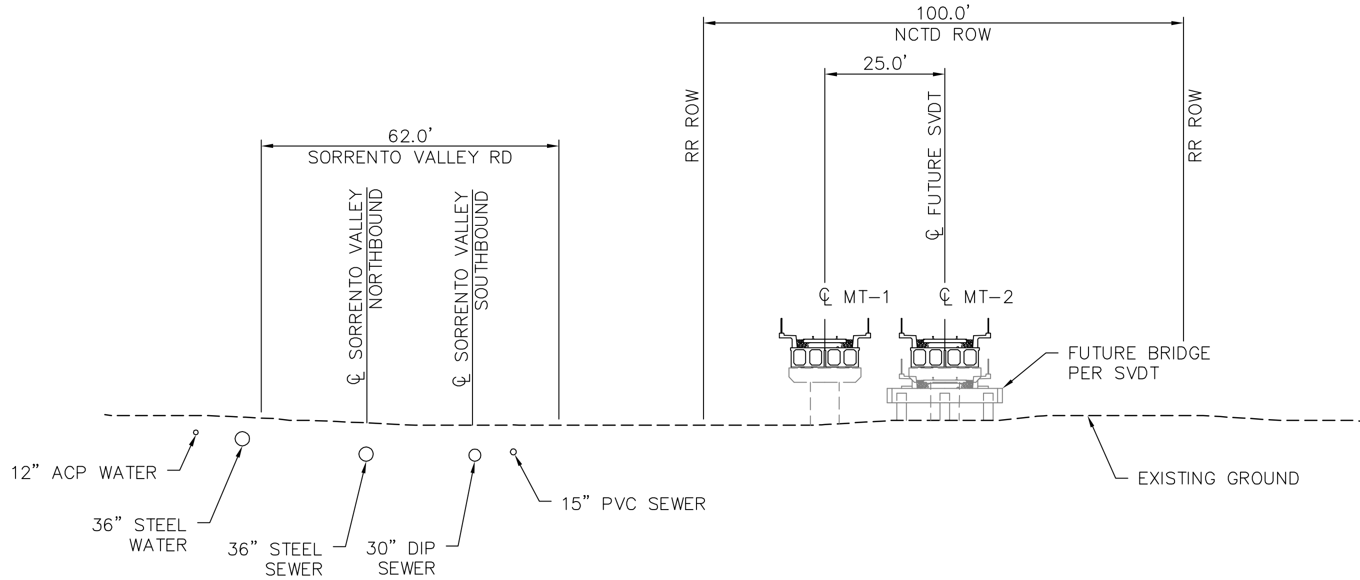
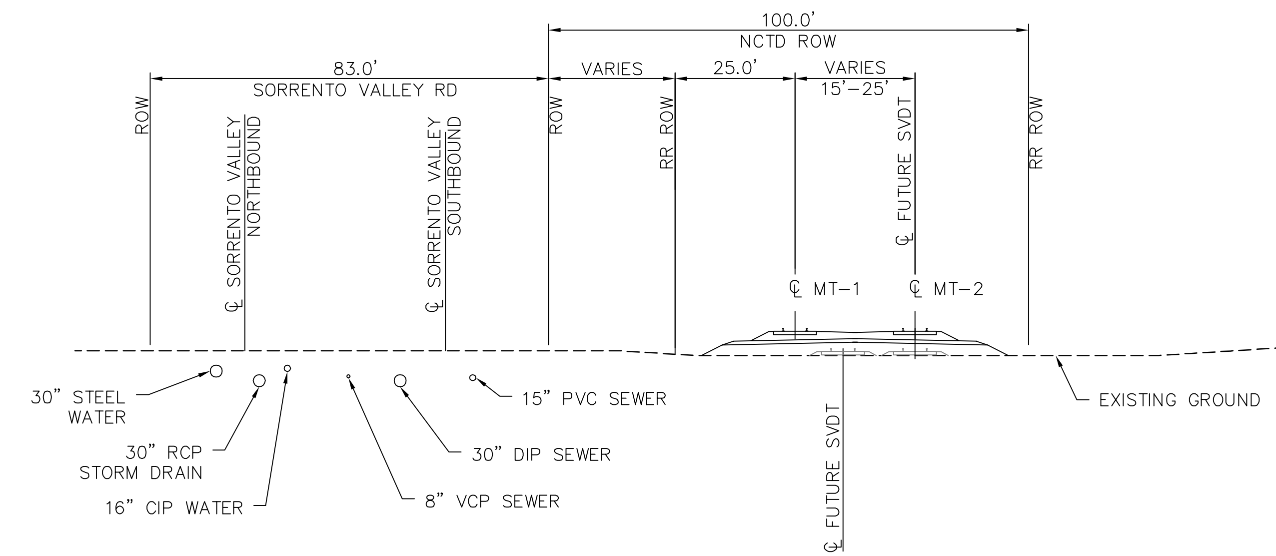
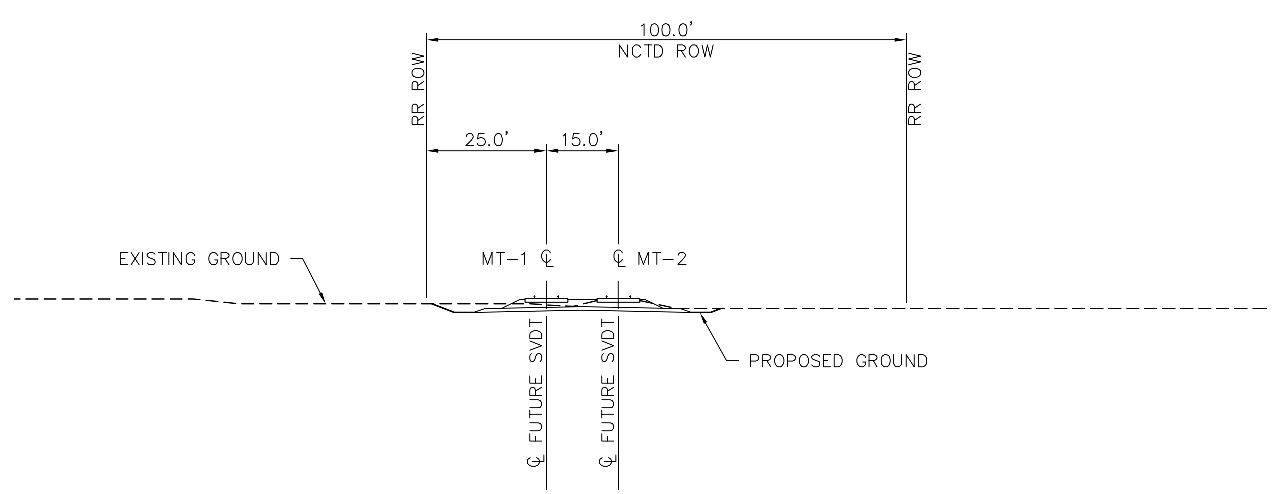


SECTION E-E
'MT-2' 13065+61 TO 'MT-2' 13067+41



SECTION F-F
'MT-2' 13067+41 TO MT-2' 13079+19



SECTION G-G
'MT-2' 13079+19 TO 'MT-2' 13081+81

NO.	DATE	REVISIONS	BY	CHK	APRV

DAVID EVANS AND ASSOCIATES INC.
110 West A Street, Suite 1700
San Diego California 92101
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REGISTERED PROFESSIONAL ENGINEER
PATRICIA M. McCOLL
No. 36873
Exp. 6-30-2014
CIVIL
STATE OF CALIFORNIA

DESIGNED BY	SNYO	8/12
DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

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San Diego's Regional Planning Agency

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES:
LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CREST CANYON HIGHER SPEED
TYPICAL SECTIONS

SCALE 1"=20'

SANDAG CONTRACT NO. 5000931

DRAWING NO.

SHEET NO. 11

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3

CONCEPTUAL DESIGN – NOT FOR CONSTRUCTION

TIME: 8:01:04 AM DATE: 11-13-2014

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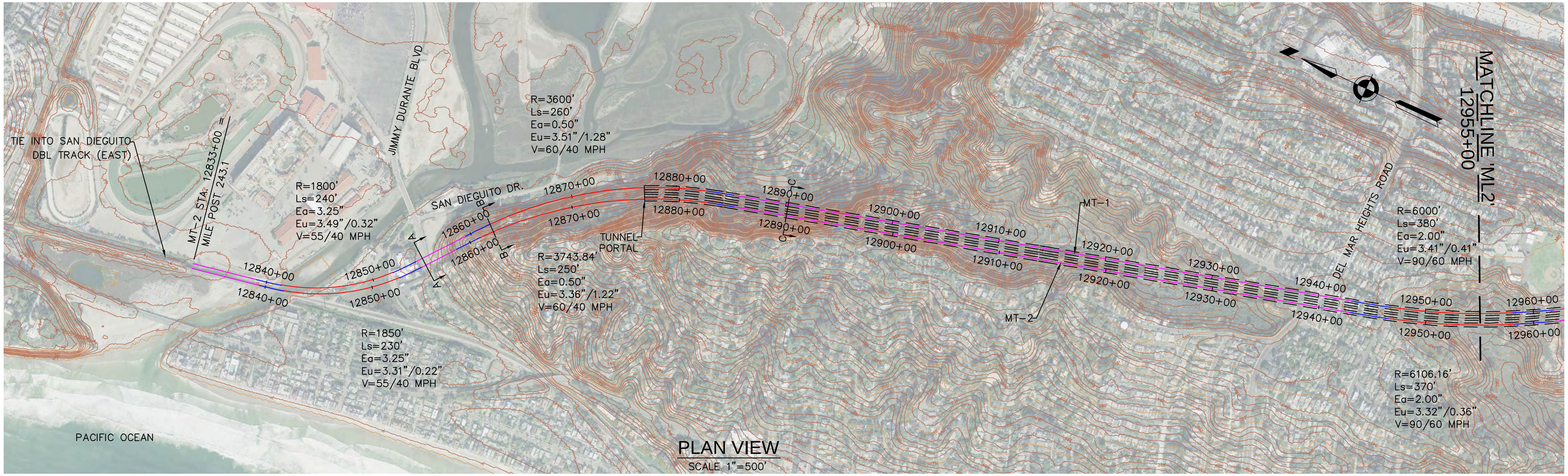
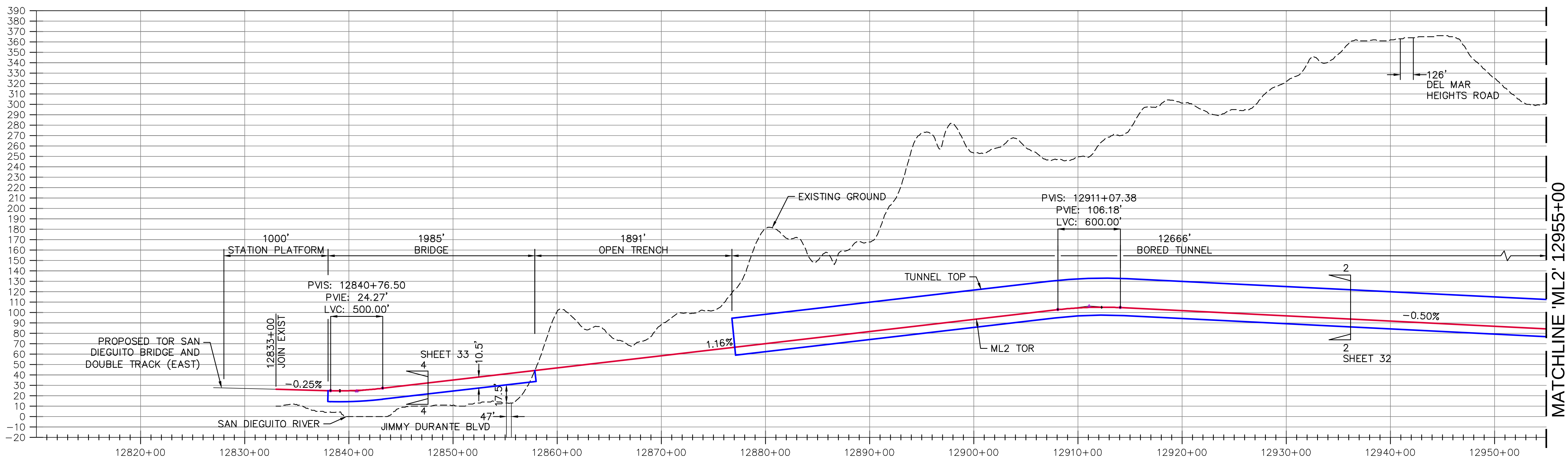


PLAN VIEW
SCALE 1"=500'



PROFILE VIEW
SCALE HORZ. 1"=500'
VERT. 1"=50'

NO.	DATE	REVISIONS	BY	CHK	APRV

DAVID EVANS AND ASSOCIATES INC.
110 West A Street, Suite 1700
San Diego California 92101
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REGISTERED PROFESSIONAL ENGINEER — PATRICIA M. McCOLL — No. 36873 — Exp. 6-30-2014 — CIVIL — STATE OF CALIFORNIA

DESIGNED BY	SNYO	8/12
DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

SANDAG
San Diego's Regional Planning Agency

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

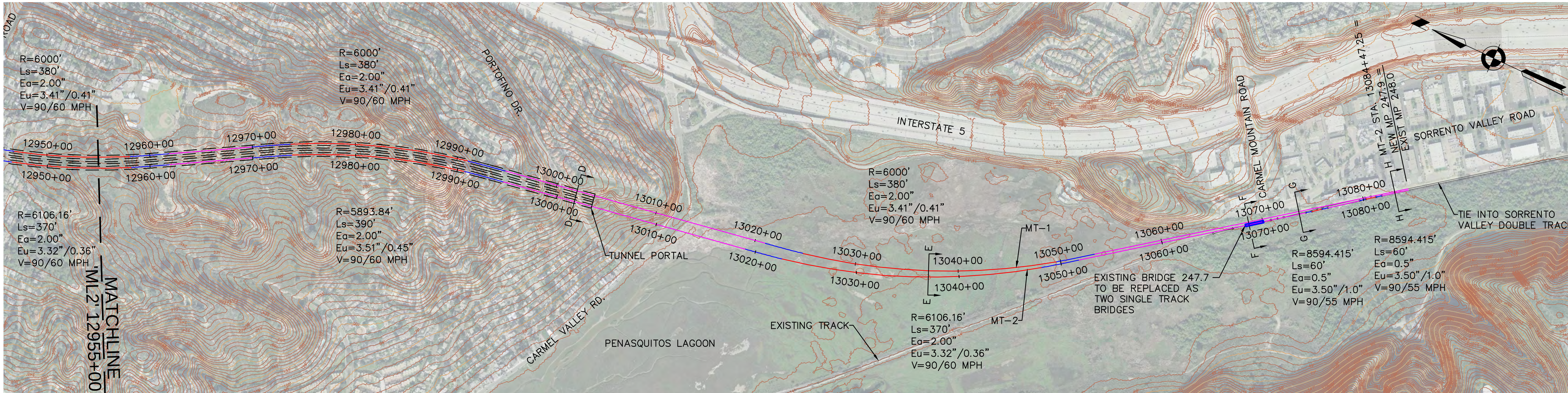
CREST CANYON ALIGNMENT PLAN AND PROFILE

SCALE 1"=500'

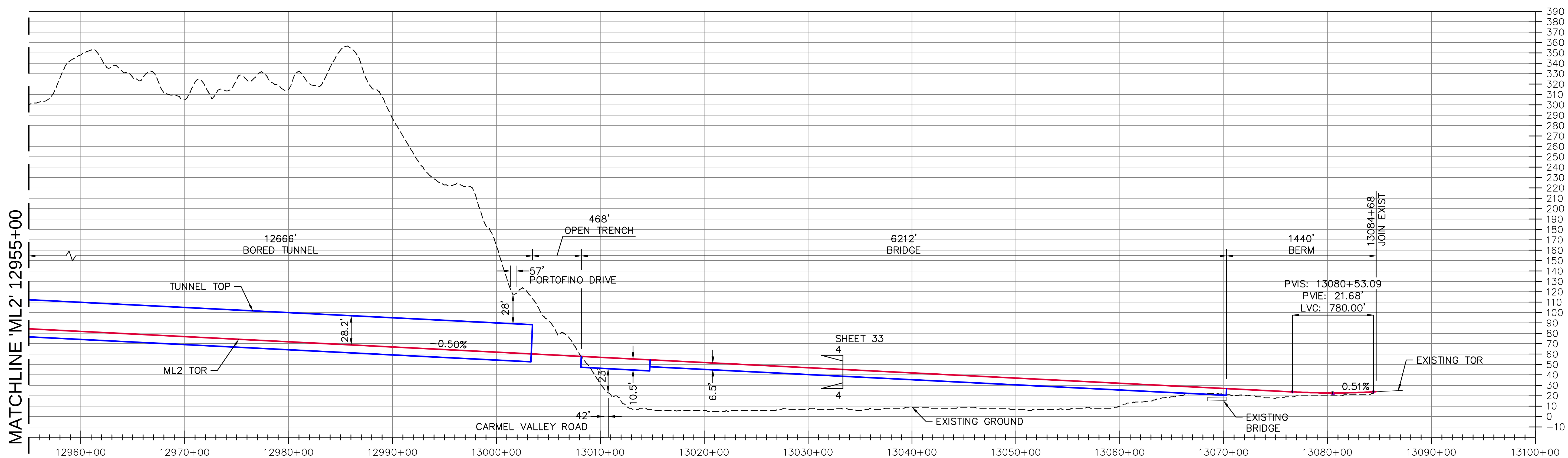
SANDAG CONTRACT NO. 5000931

DRAWING NO.

SHEET NO. 12



PLAN VIEW
SCALE 1"=500'



PROFILE VIEW
SCALE HORZ. 1"=500'
VERT. 1"=50'

CONCEPTUAL DESIGN – NOT FOR CONSTRUCTION

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES

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NO.	DATE	REVISIONS	BY	CHK	APRV

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REGISTERED PROFESSIONAL ENGINEER PATRICIA M. McCOLL No. 36873 Exp. 6-30-2014 CIVIL STATE OF CALIFORNIA

DESIGNED BY	SNYO	8/12
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CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

SANDAG San Diego's Regional Planning Agency

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CREST CANYON ALIGNMENT PLAN AND PROFILE

SCALE 1"=500'

SANDAG CONTRACT NO. 5000931

DRAWING NO. | SHEET NO. 13

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3

CONCEPTUAL DESIGN — NOT FOR CONSTRUCTION

DATE: 08-27-2012 TIME: 5:49:45 PM

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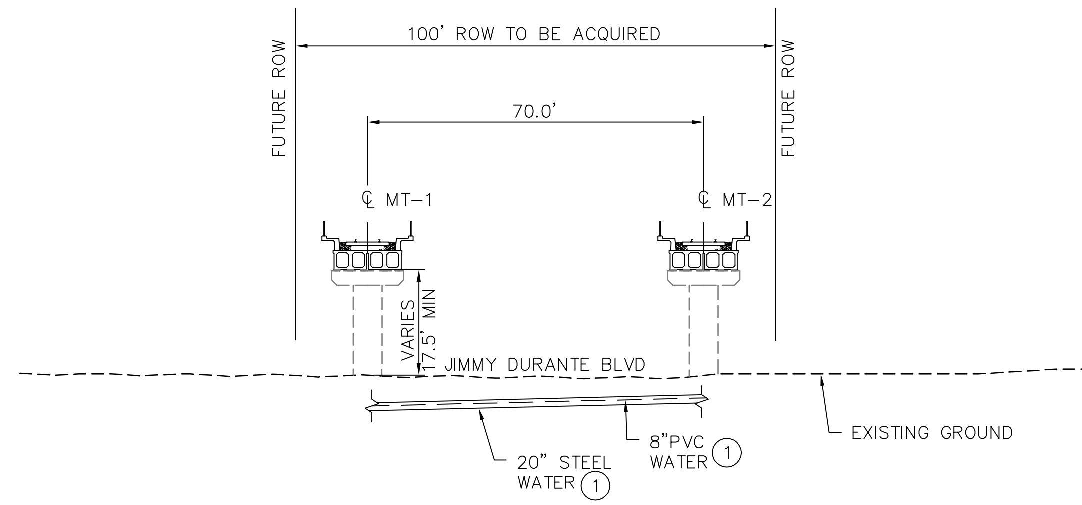
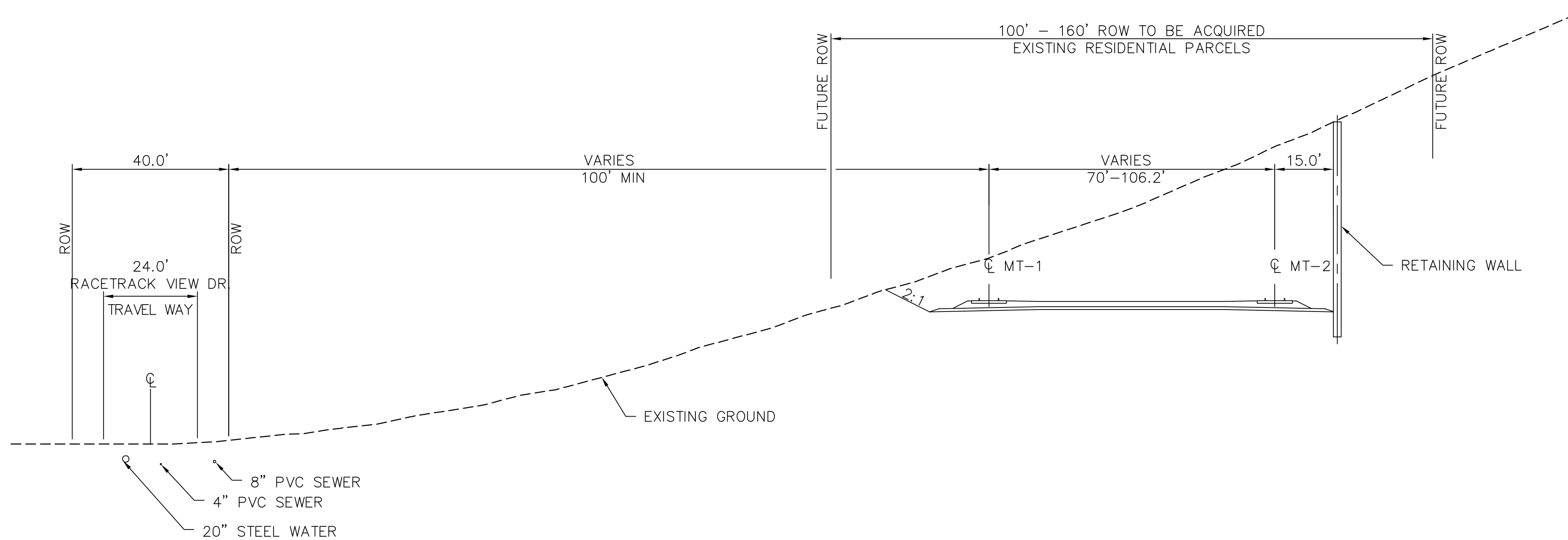


SECTION A-A
'MT-2' 12854+96 TO 'MT-2' 12855+77

NOTES:
(1) PROTECT EXISTING UTILITIES IN PLACE



SECTION B-B
'MT-2' 12857+87 TO 'MT-2' 12876+78

NO.	DATE	REVISIONS	BY	CHK	APRV

DAVID EVANS AND ASSOCIATES INC.
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CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES:
LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CREST CANYON
TYPICAL SECTIONS

SCALE 1"=20'
SANDAG CONTRACT NO. 5000931
DRAWING NO.
SHEET NO. 14

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3

CONCEPTUAL DESIGN —
NOT FOR CONSTRUCTION

TIME: 5:50:24 PM
DATE: 08-27-2012
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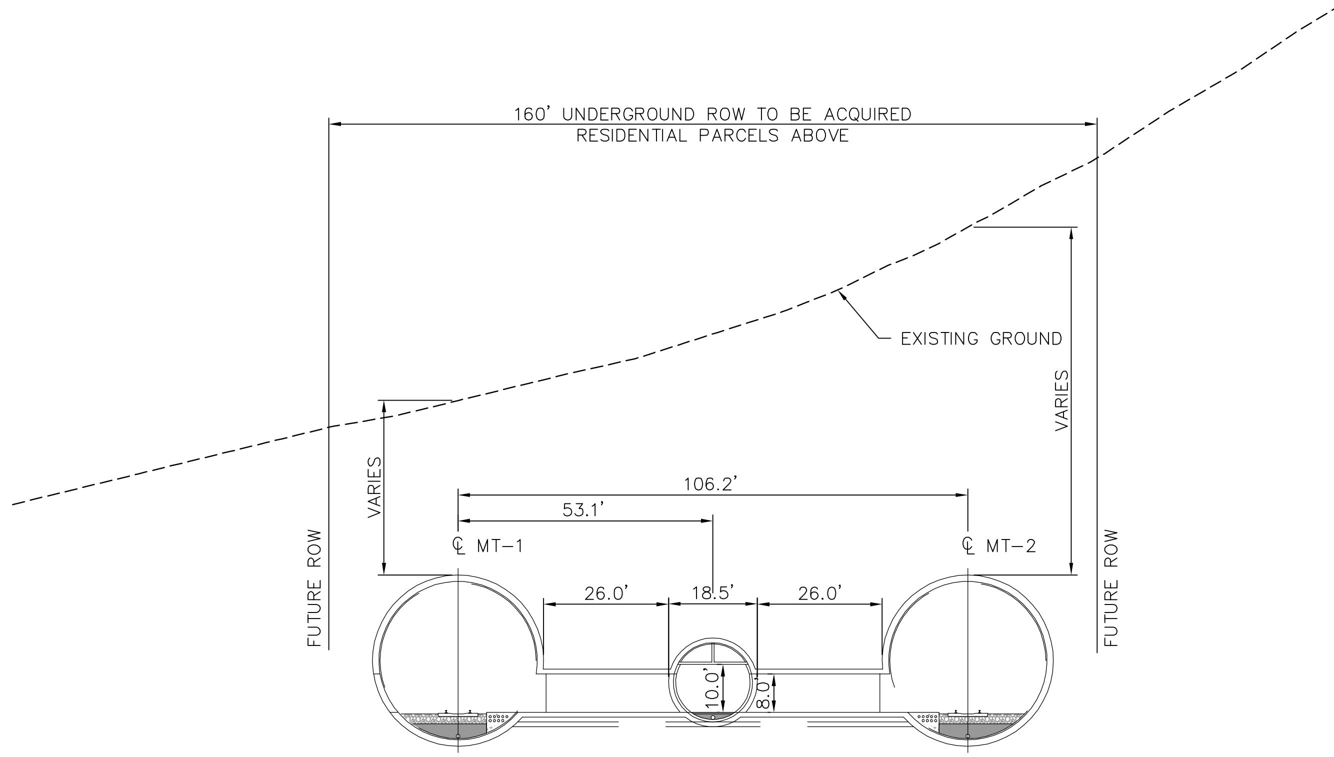
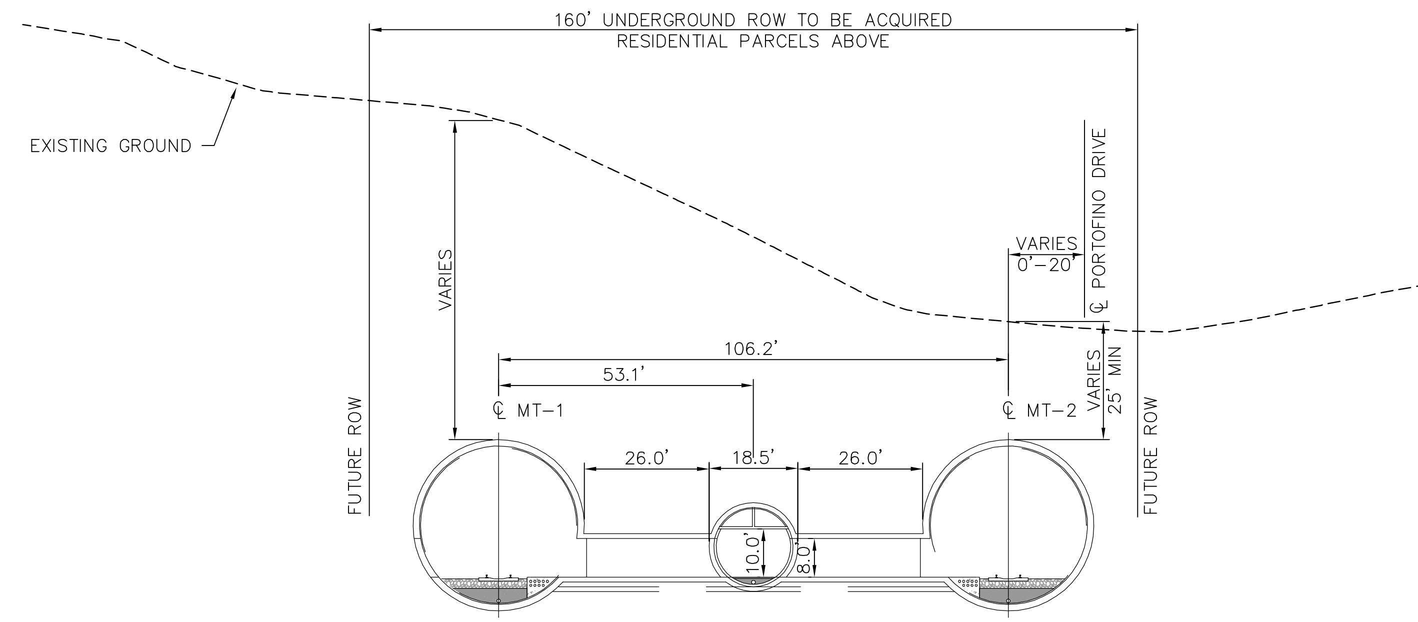
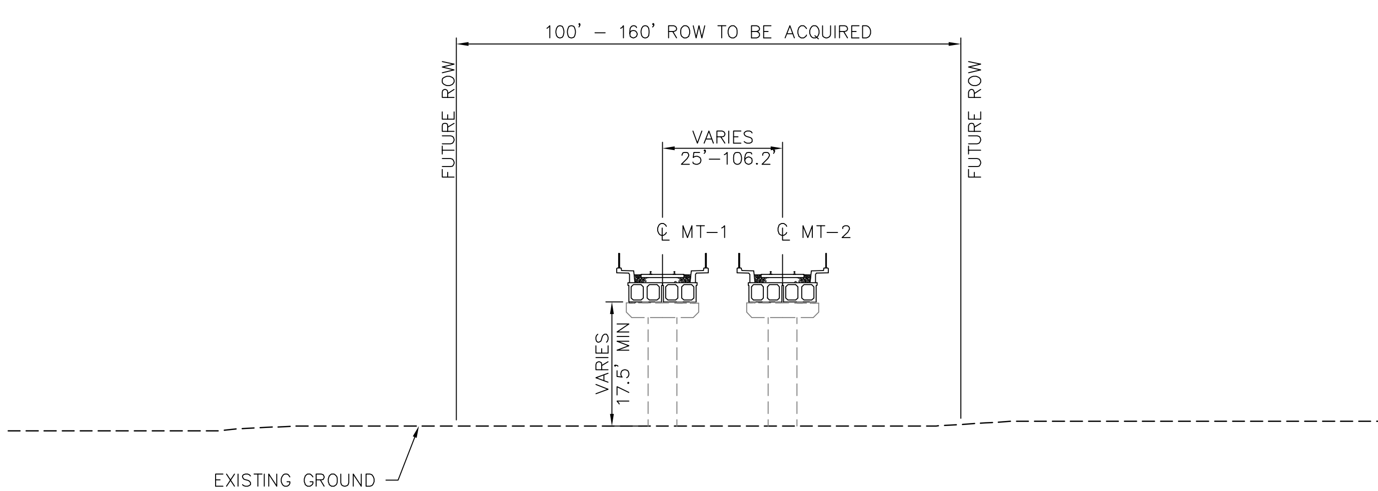


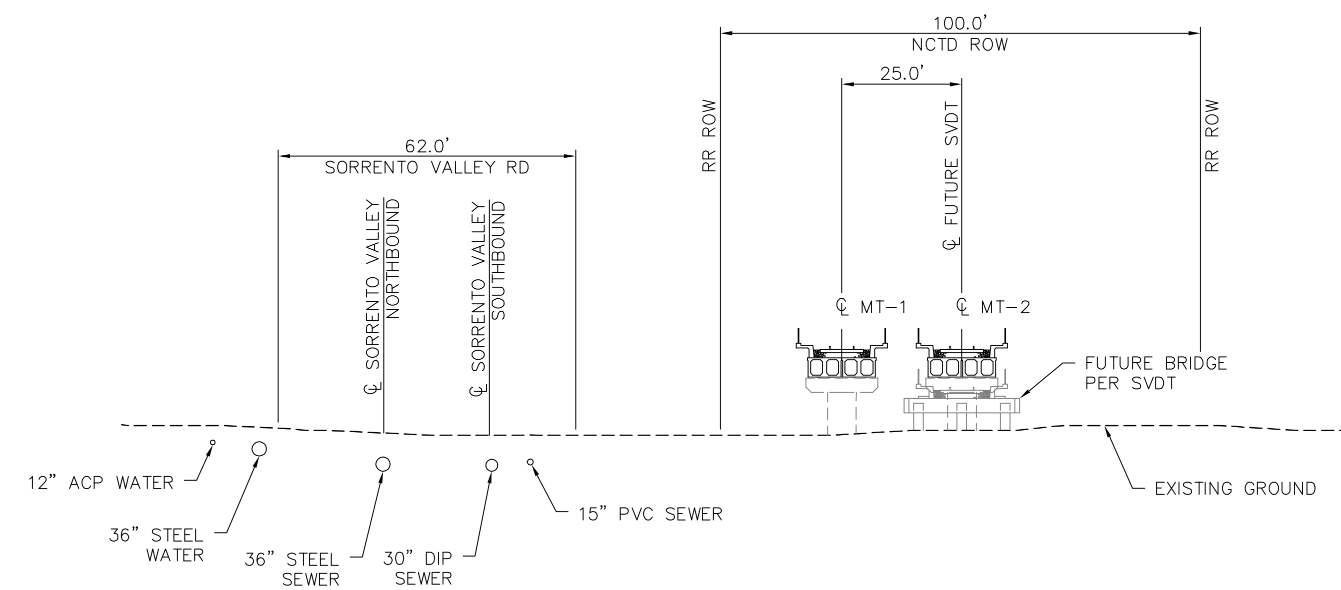
SECTION C-C
'MT-2' 12876+78 TO 'MT-2' 13001+22



SECTION D-D
'MT-2' 13001+22 TO 'MT-2' 13003+50



SECTION E-E
'MT-2' 13008+20TO 'MT-2' 13068+47



SECTION F-F
'MT-2' 13068+47 TO 'MT-2' 13070+28

NO.	DATE	REVISIONS	BY	CHK	APRV

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110 West A Street, Suite 1700
San Diego California 92101
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REGISTERED PROFESSIONAL ENGINEER
PATRICIA M. McCOLL
No. 36873
Exp. 6-30-2014
CIVIL
STATE OF CALIFORNIA

DESIGNED BY	SNYO	8/12
DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

SANDAG
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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES:
LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CREST CANYON
TYPICAL SECTIONS

SCALE 1"=20'
SANDAG CONTRACT NO. 5000931
DRAWING NO.
SHEET NO. 15

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3

CONCEPTUAL DESIGN — NOT FOR CONSTRUCTION

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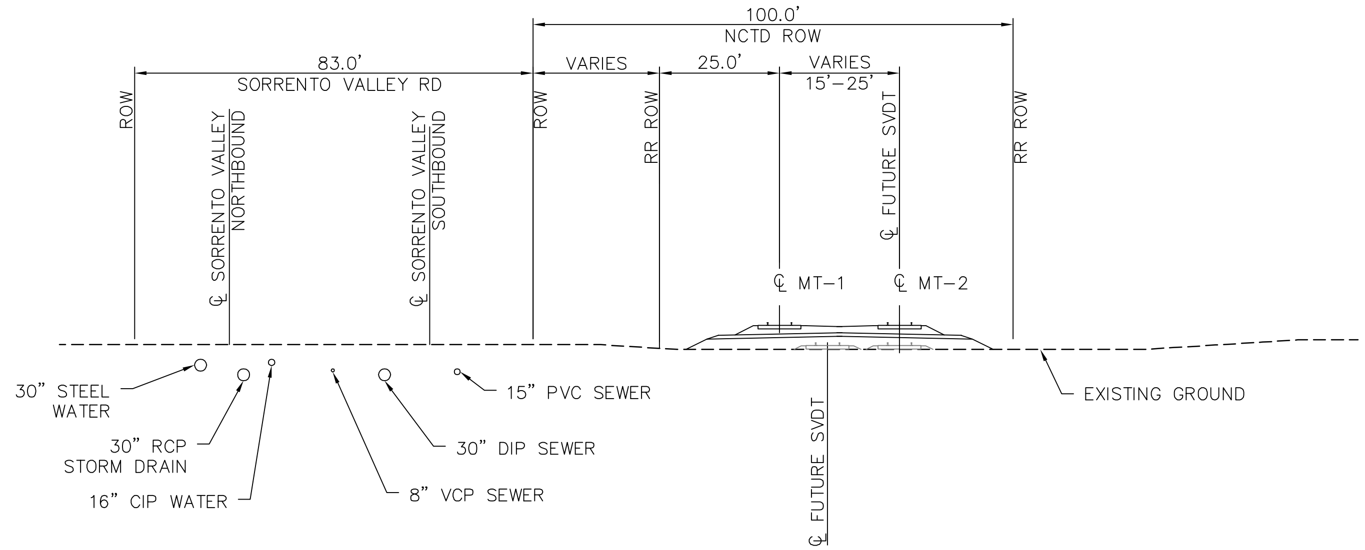
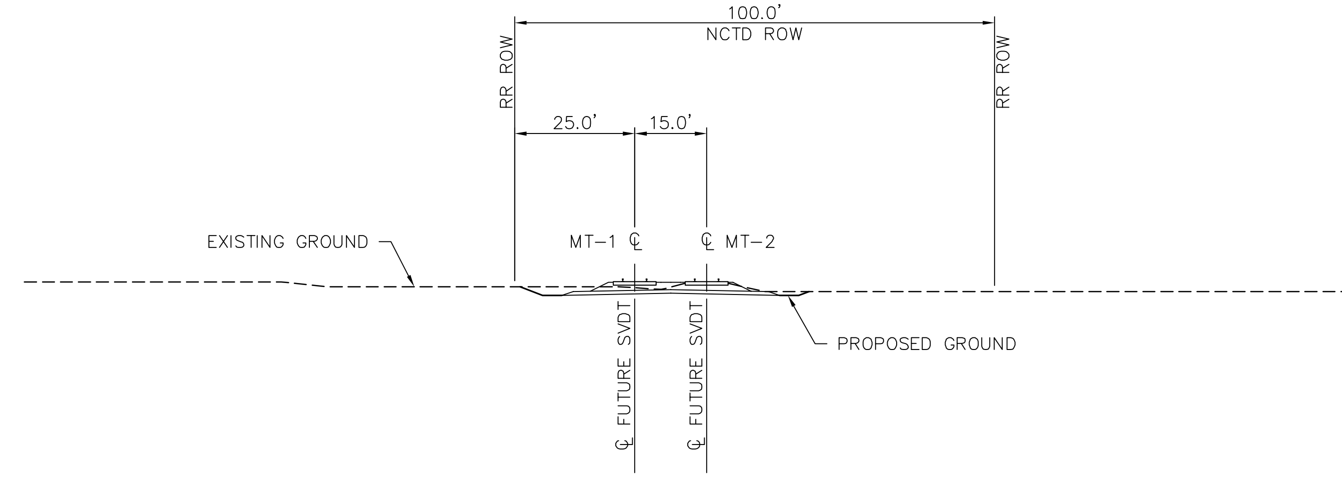


SECTION G-G
'MT-2' 13070+28 TO 'MT-2' 13082+06



SECTION H-H
'MT-2' 13082+06 TO 'MT-2' 13084+68

NO.	DATE	REVISIONS	BY	CHK	APRV

DAVID EVANS AND ASSOCIATES INC.
110 West A Street, Suite 1700
San Diego California 92101
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REGISTERED PROFESSIONAL ENGINEER PATRICIA M. McCOLL No. 36873 Exp. 6-30-2014 CIVIL STATE OF CALIFORNIA

DESIGNED BY	SNYO	8/12
DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

SANDAG
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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CREST CANYON
TYPICAL SECTIONS

SCALE 1"=20'

SANDAG CONTRACT NO. 5000931

DRAWING NO.

SHEET NO. 16

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

CONCEPTUAL DESIGN – NOT FOR CONSTRUCTION

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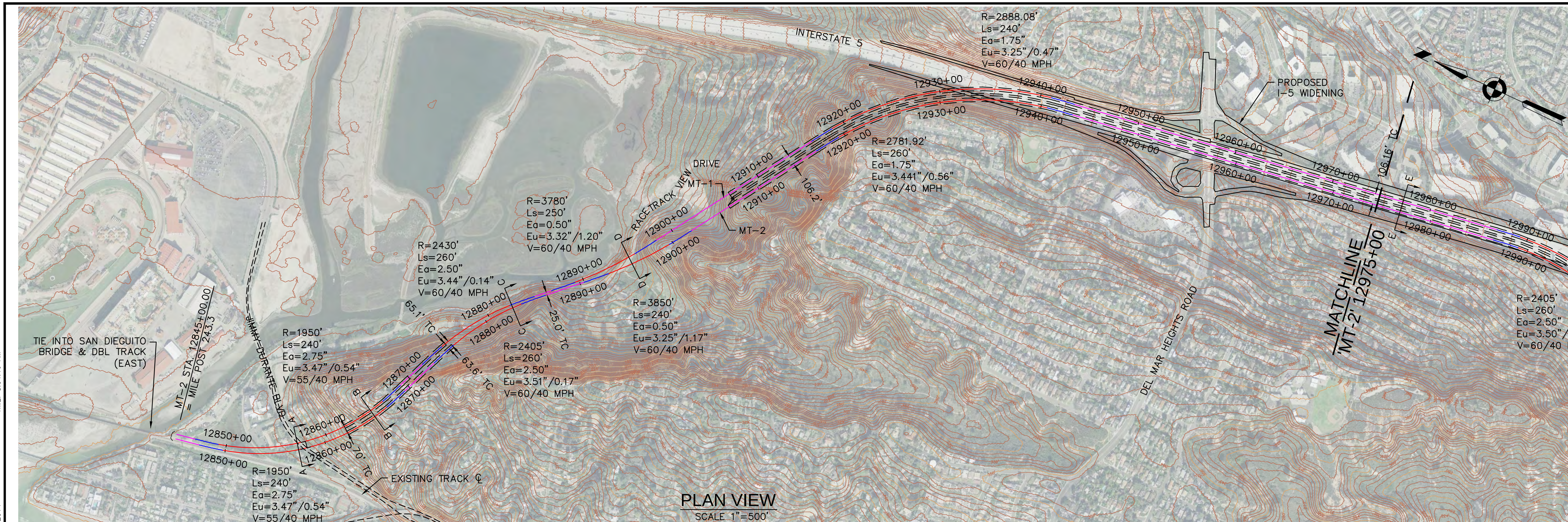

PLAN VIEW
SCALE 1"=500'

PROFILE VIEW
SCALE HORZ. 1"=500'
VERT. 1"=50'

NO.	DATE	REVISIONS	BY	CHK	APRV

DAVID EVANS AND ASSOCIATES INC.
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Phone: (619) 400-0600

REGISTERED PROFESSIONAL ENGINEER PATRICIA M. McCOLL No. 36873 Exp. 6-30-2014 CIVIL STATE OF CALIFORNIA

DESIGNED BY	SNYO	8/12
DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

SANDAG San Diego's Regional Planning Agency

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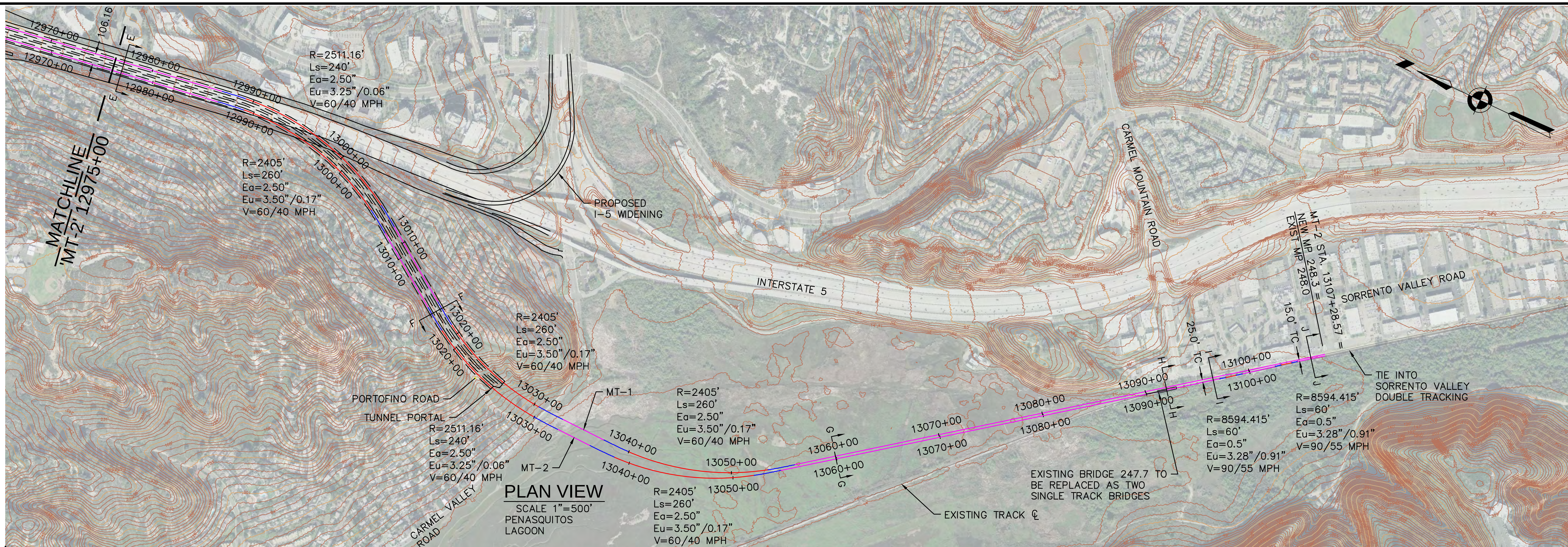
CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

INTERSTATE 5 ALIGNMENT PLAN AND PROFILE

SCALE 1"=500'

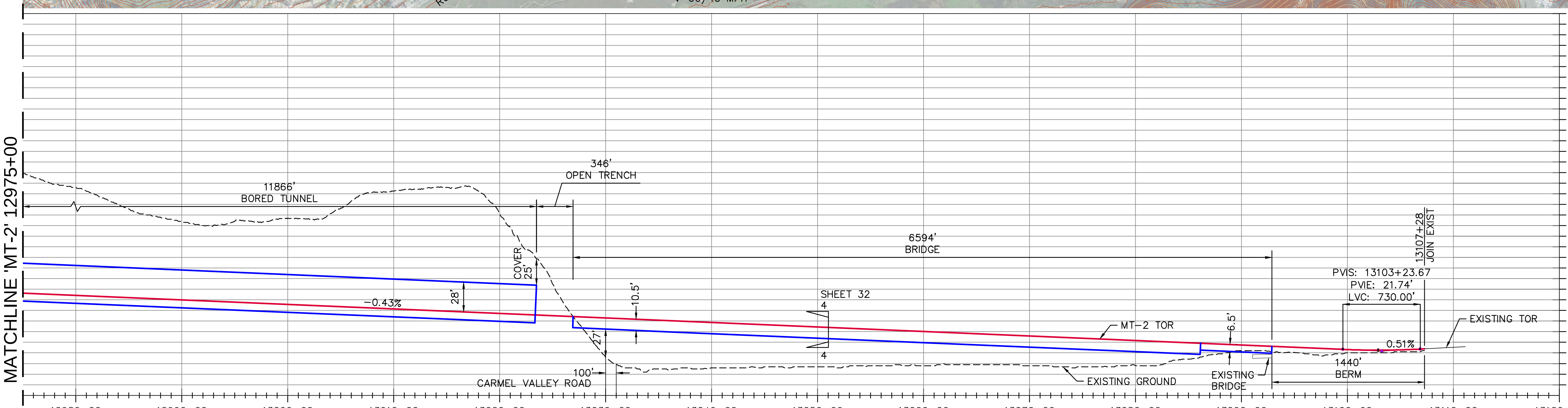
SANDAG CONTRACT NO. 5000931

DRAWING NO. | SHEET NO. 17



PLAN VIEW

SCALE 1"=500'



PROFILE VIEW

SCALE HORZ. 1"=500'
VERT. 1"=50'

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES

CONCEPTUAL DESIGN – NOT FOR CONSTRUCTION

TIME: 8:04:10 AM DATE: 11-13-2014 FILENAME: P:\S\SNDG00000054\0400CAD\EC\SHEETS\TUNNEL ALTS\17-18-ALT 3-OPT 3.DWG

NO.	DATE	REVISIONS	BY	CHK	APRV

DAVID EVANS AND ASSOCIATES INC.
110 West A Street, Suite 1700
San Diego California 92101
Phone: (619) 400-0600

REGISTERED PROFESSIONAL ENGINEER PATRICIA M. McCOLL No. 36873 Exp. 6-30-2014 CIVIL STATE OF CALIFORNIA

DESIGNED BY	SNYO	8/12
DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

SANDAG San Diego's Regional Planning Agency

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

INTERSTATE 5 ALIGNMENT PLAN AND PROFILE

SCALE 1"=500'
SANDAG CONTRACT NO. 5000931
DRAWING NO.
SHEET NO. 18

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
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TIME: 5:16:17 PM DATE: 08-27-2012

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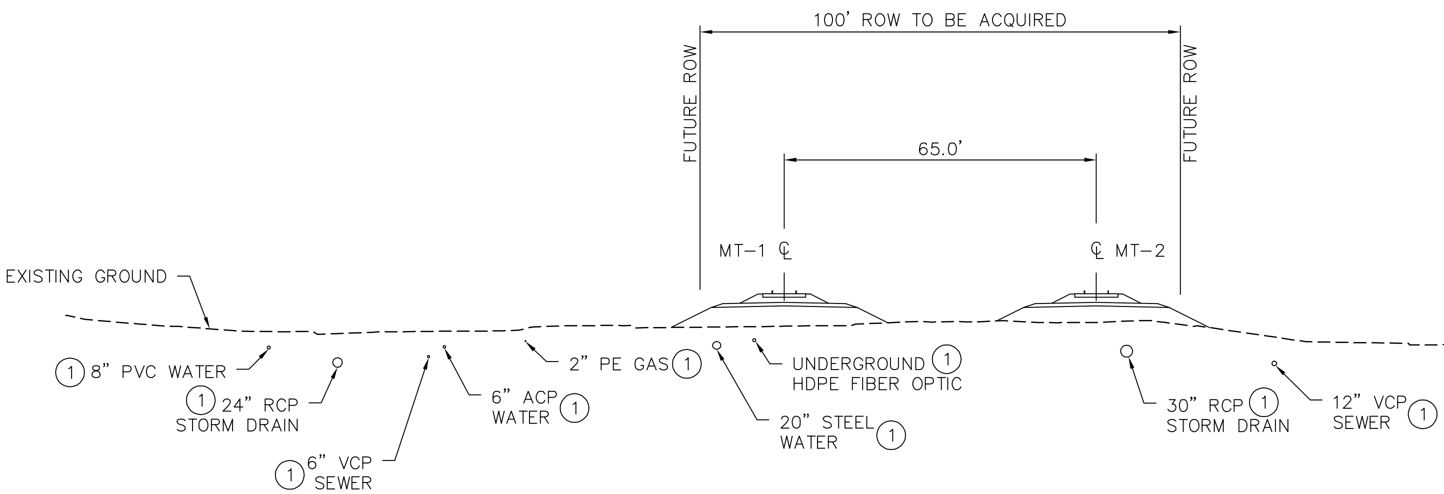
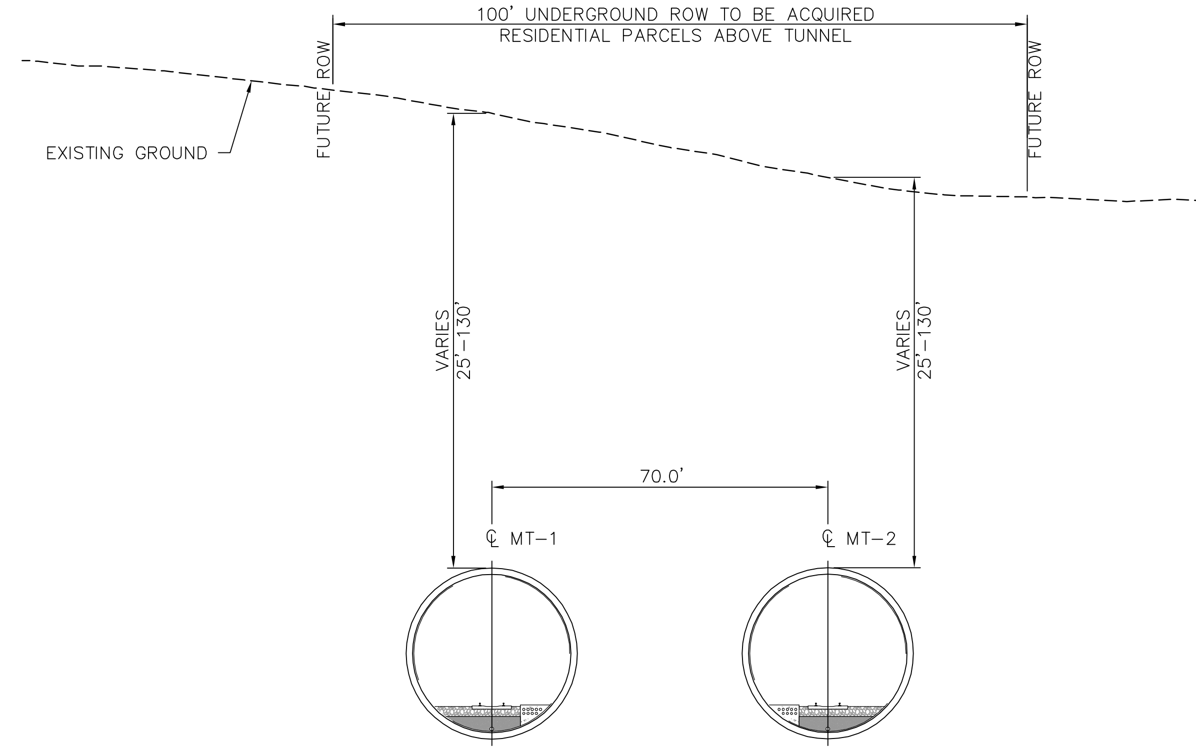
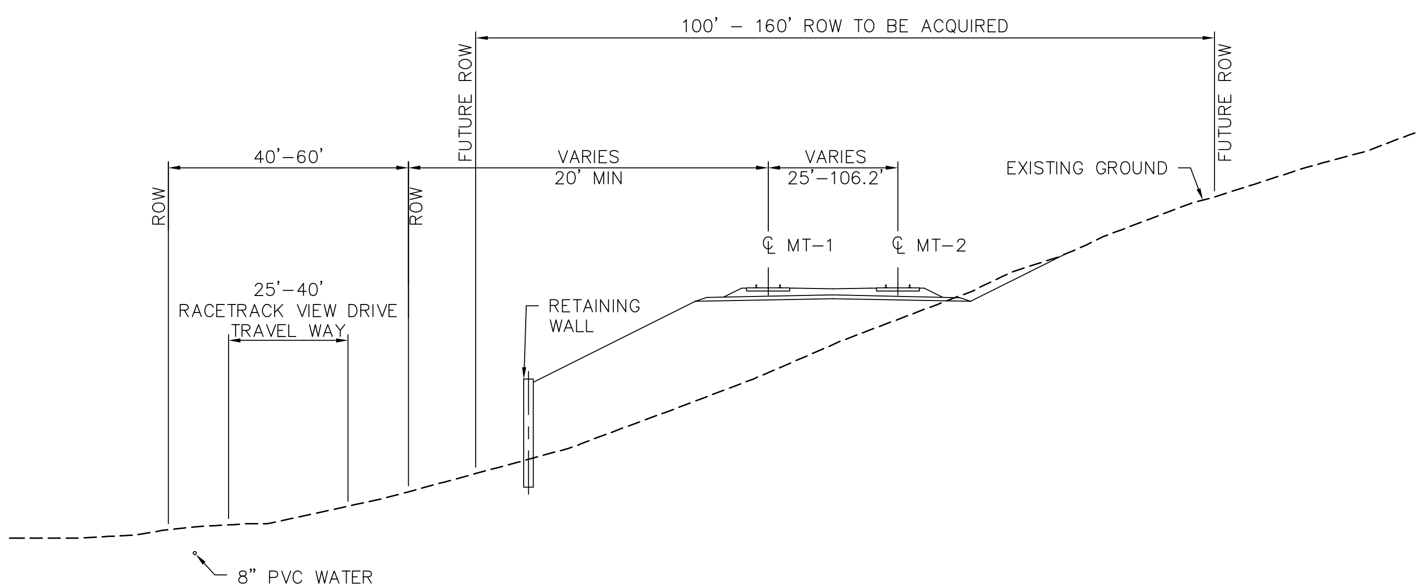


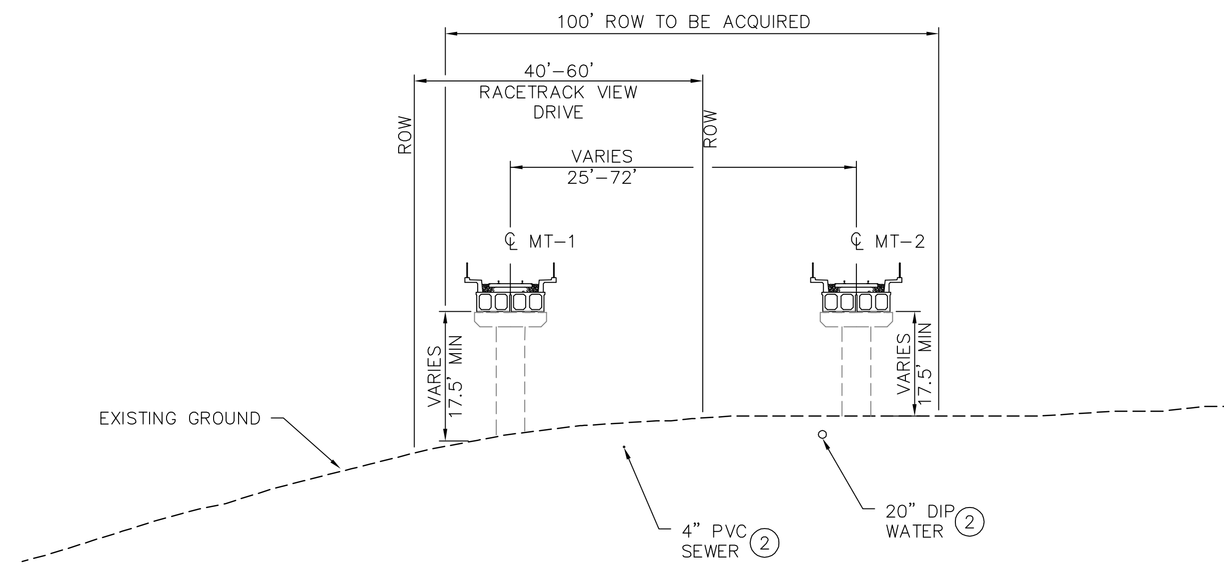
SECTION A-A
'MT-2' 12850+00 TO 'MT-2' 12862+11



SECTION B-B
'MT-2' 12862+11 TO 'MT-2' 12875+83



SECTION C-C
'MT-2' 12875+83 TO 'MT-2' 12886+33
'MT-2' 12896+94 TO 'MT-2' 12906+48



SECTION D-D
'MT-2' 12886+33 TO 'MT-2' 12896+94

NOTES:

1. EXISTING UTILITIES TO BE RELOCATED
2. PROTECT EXISTING UTILITIES IN PLACE

NO.	DATE	REVISIONS	BY	CHK	APRV

DAVID EVANS AND ASSOCIATES INC.
110 West A Street, Suite 1700
San Diego California 92101
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REGISTERED PROFESSIONAL ENGINEER PATRICIA M. McCOLL No. 36873 Exp. 6-30-2014 CIVIL STATE OF CALIFORNIA

DESIGNED BY	SNYO	8/12
DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

SANDAG San Diego's Regional Planning Agency

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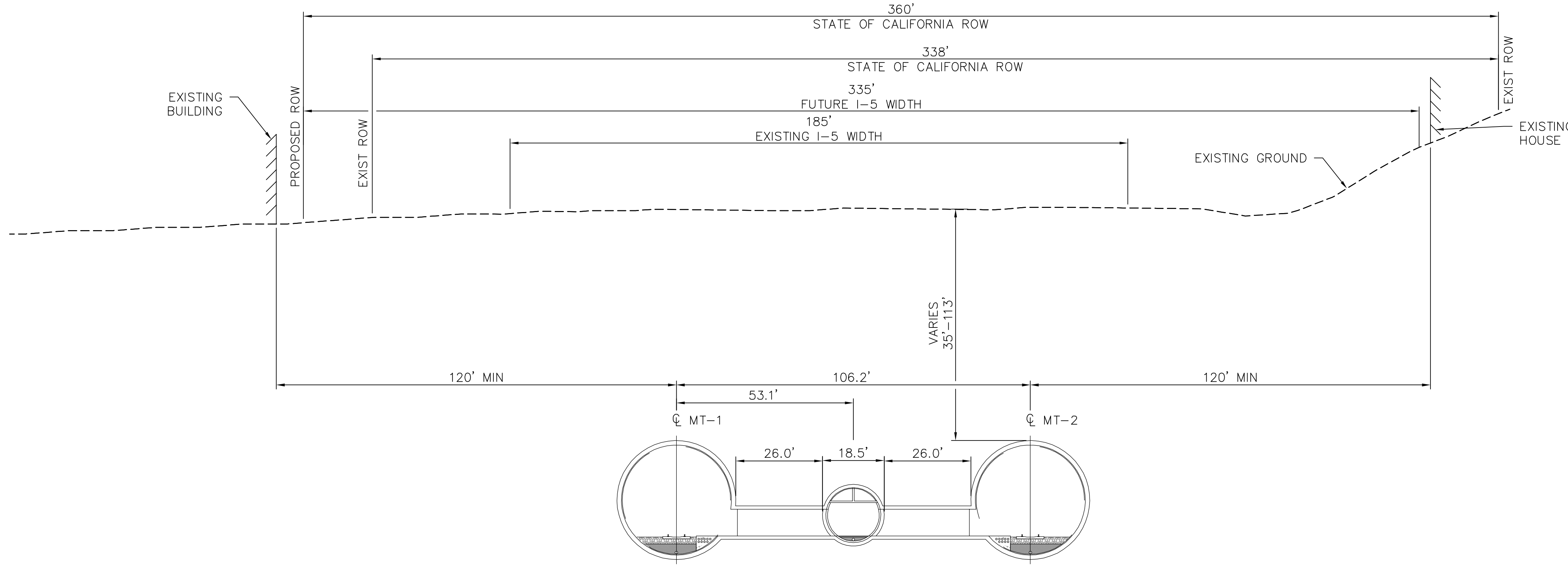
CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

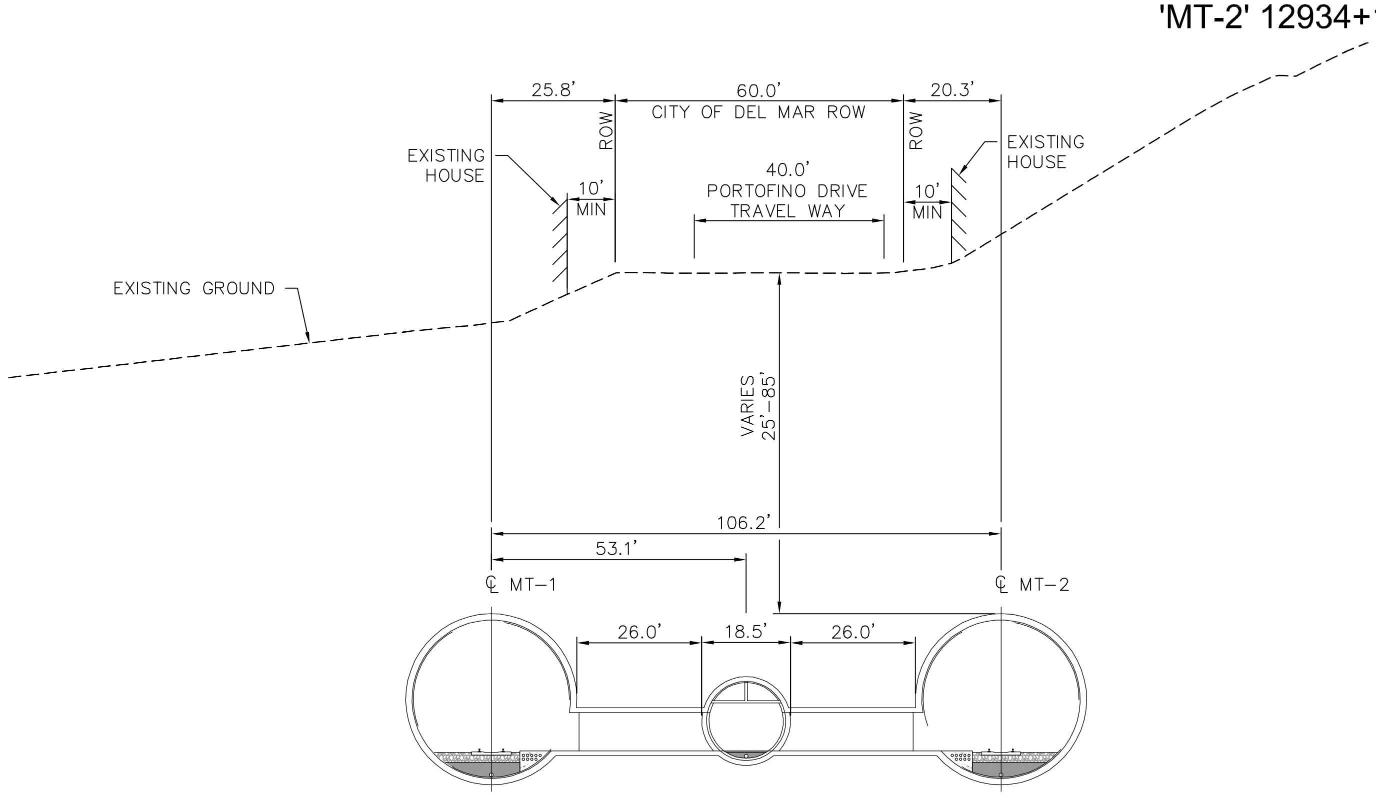
INTERSTATE 5
TYPICAL SECTIONS

SCALE 1"=20'
SANDAG CONTRACT NO. 5000931
DRAWING NO.
SHEET NO. 19



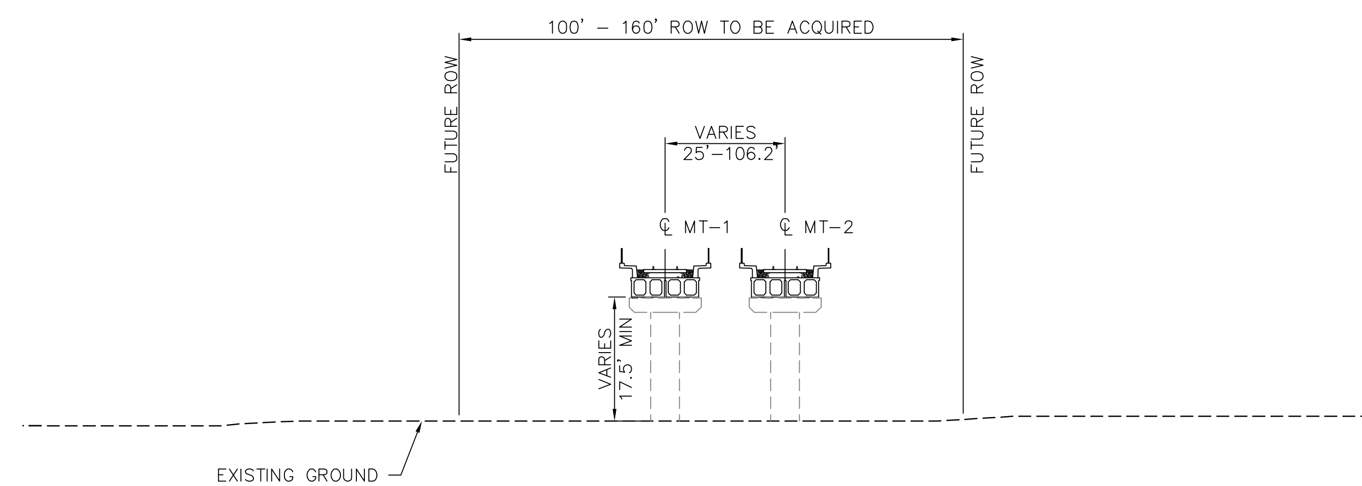
SECTION E-E

'MT-2' 12934+17 TO 'MT-2' 12998+20



SECTION F-F

'MT-2' 12998+20 TO 'MT-2' 13023+50



SECTION G-G

'MT-2' 13029+95 TO 'MT-2' 13068+47

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3

CONCEPTUAL DESIGN – NOT FOR CONSTRUCTION

TIME: 5:16:28 PM DATE: 08-27-2012

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NO.	DATE	REVISIONS	BY	CHK	APRV

DAVID EVANS AND ASSOCIATES INC.
110 West A Street, Suite 1700
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REGISTERED PROFESSIONAL ENGINEER PATRICIA M. McCOLL No. 36873 Exp. 6-30-2014 CIVIL STATE OF CALIFORNIA

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DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

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San Diego's Regional Planning Agency

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

INTERSTATE 5
TYPICAL SECTIONS

SCALE 1"=20'
SANDAG CONTRACT NO. 5000931
DRAWING NO.
SHEET NO. 20

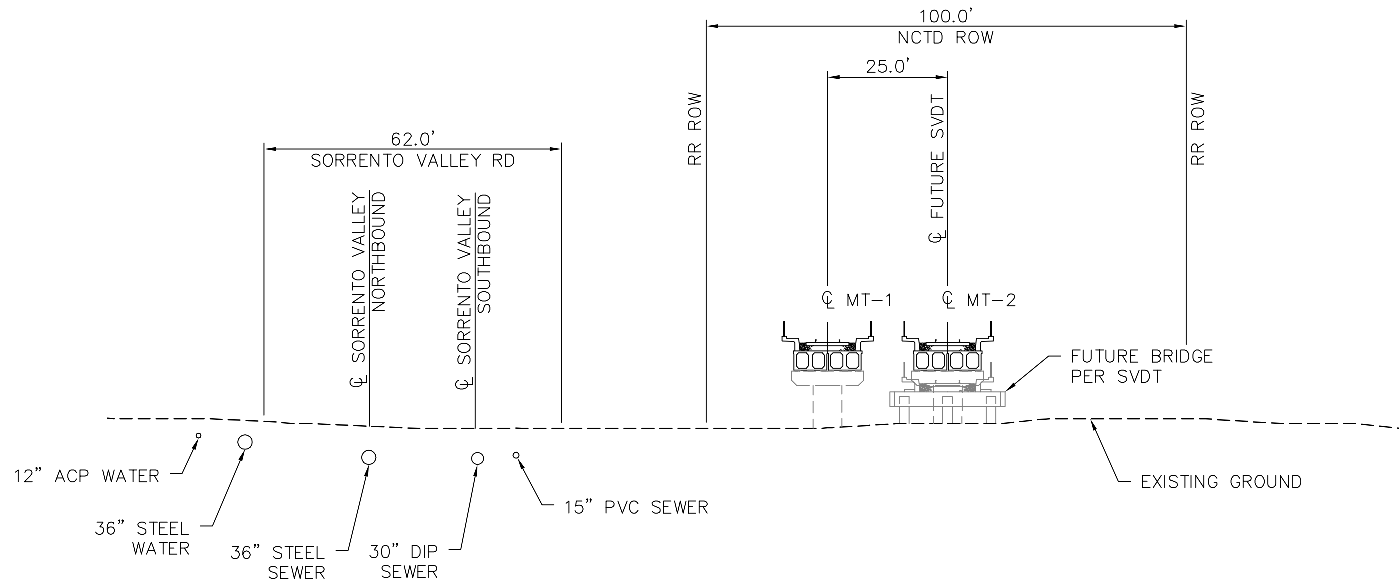
FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES

0 1 2 3

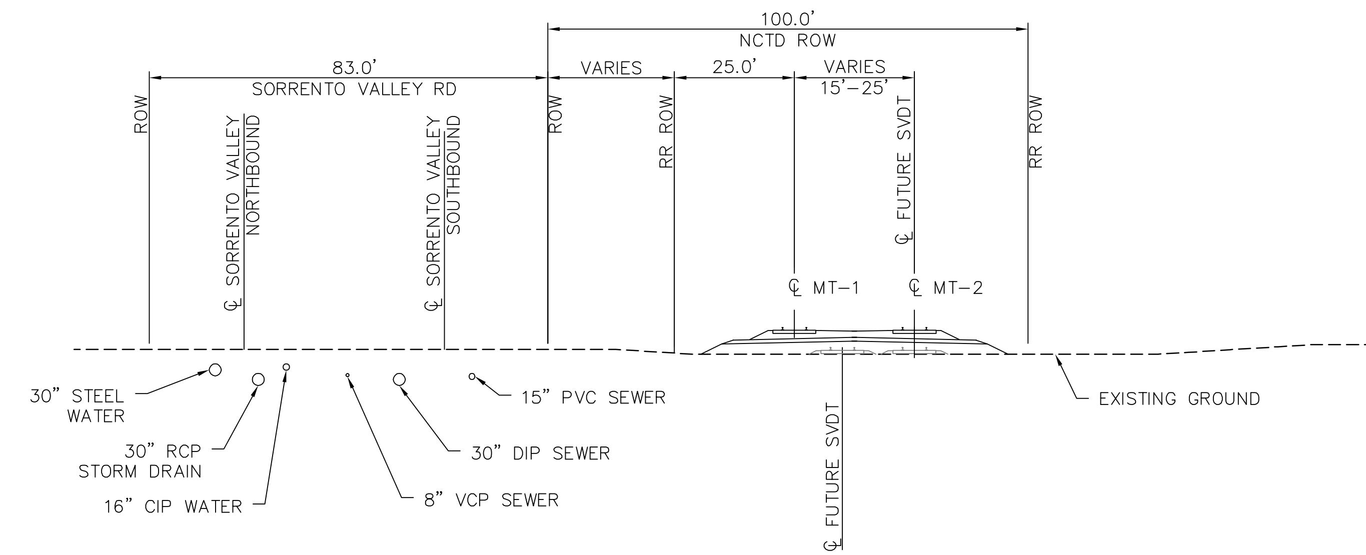
TIME: 5:16:38 PM

CONCEPTUAL DESIGN – NOT FOR CONSTRUCTION

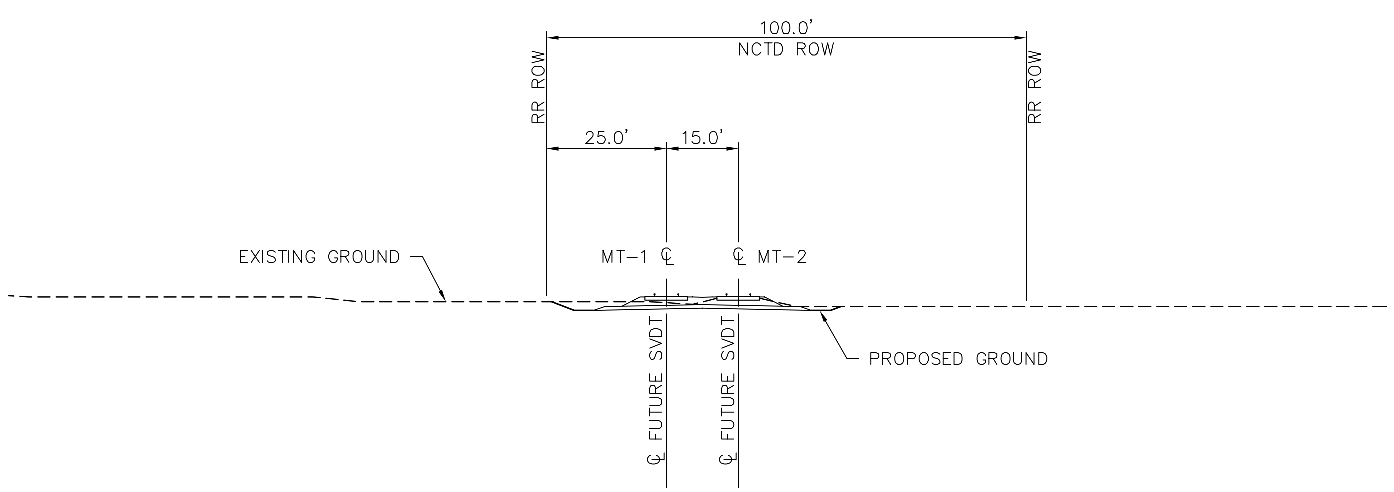
DATE: 08-27-2012



SECTION H-H
'MT-2' 13068+47 TO 'MT-2' 13070+28



SECTION I-I
'MT-2' 13082+06 TO 'MT-2' 13084+68



SECTION J-J
'MT-2' 13070+28 TO 'MT-2' 13082+06

FILENAME: P:\S\SNDG00000054\0400CAD\EC\SHEETS\TUNNEL\500SC TUNNEL ALTS\19-21-ALT 3-OPT 3 SECT.DWG

NO.	DATE	REVISIONS	BY	CHK	APRV

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REGISTERED PROFESSIONAL ENGINEER – PATRICIA M. McCOLL – No. 36873 – Exp. 6-30-2014 – CIVIL – STATE OF CALIFORNIA

DESIGNED BY	SNYO	8/12
DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

SANDAG
San Diego's Regional Planning Agency

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES:
LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

INTERSTATE 5
TYPICAL SECTIONS

SCALE 1"=20'

SANDAG CONTRACT NO. 5000931

DRAWING NO.

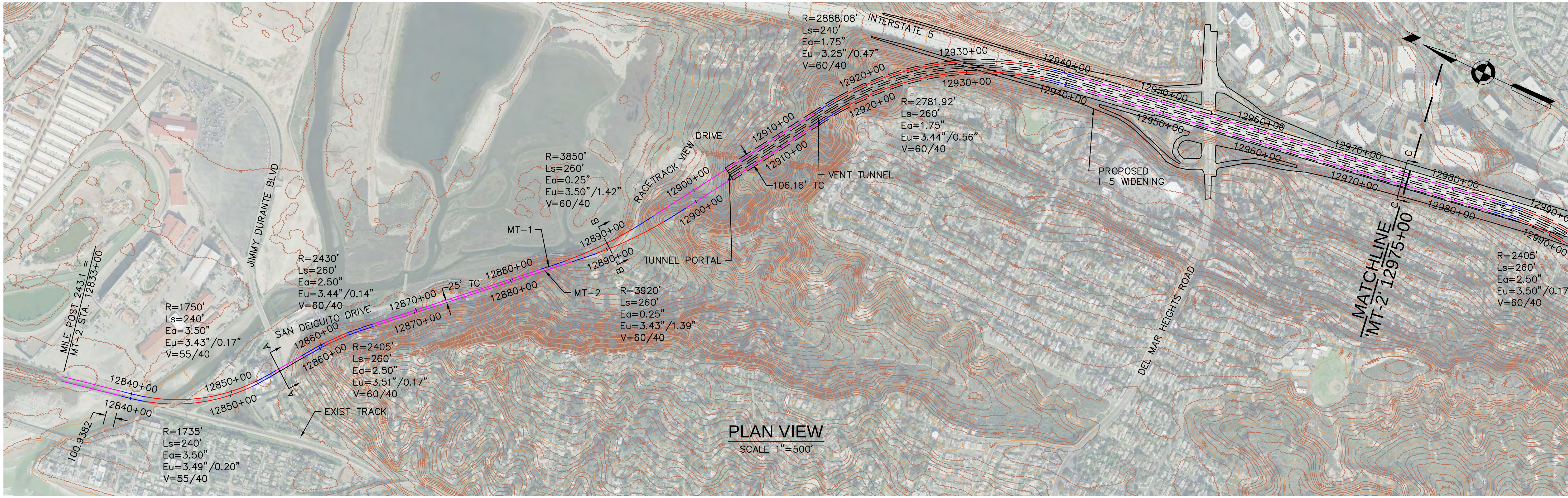
SHEET NO. 21

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

TIME: 8:20:26 AM

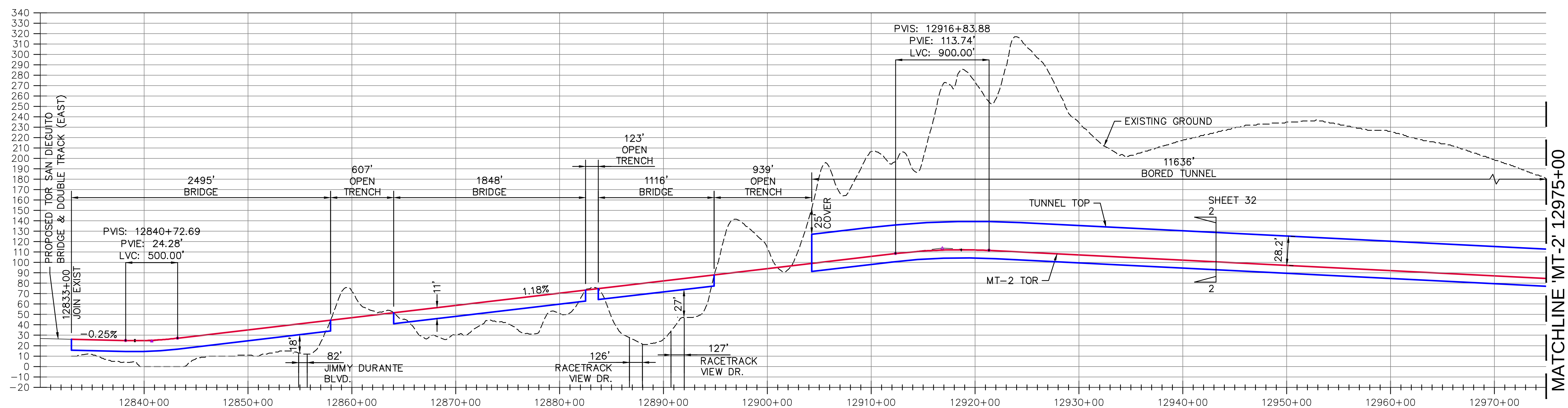
DATE: 11-13-2014

CONCEPTUAL DESIGN – NOT FOR CONSTRUCTION



PLAN VIEW

SCALE 1"=500'



PROFILE VIEW

SCALE HORZ. 1"=500'
VERT. 1"=50'

FILENAME: P:\S\SNDG00000054\0400CAD\EC\SHEETS\TUNNEL ALTS\22-23-ALT 3A-OPT 3-EAST.DWG

NO.	DATE	REVISIONS	BY	CHK	APRV

DAVID EVANS AND ASSOCIATES INC.
110 West A Street, Suite 1700
San Diego California 92101
Phone: (619) 400-0600

REGISTERED PROFESSIONAL ENGINEER PATRICIA M. McCOLL No. 36873 Exp. 6-30-2014 CIVIL STATE OF CALIFORNIA

DESIGNED BY	KLP	8/12
DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

SANDAG San Diego's Regional Planning Agency

NCTD

CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

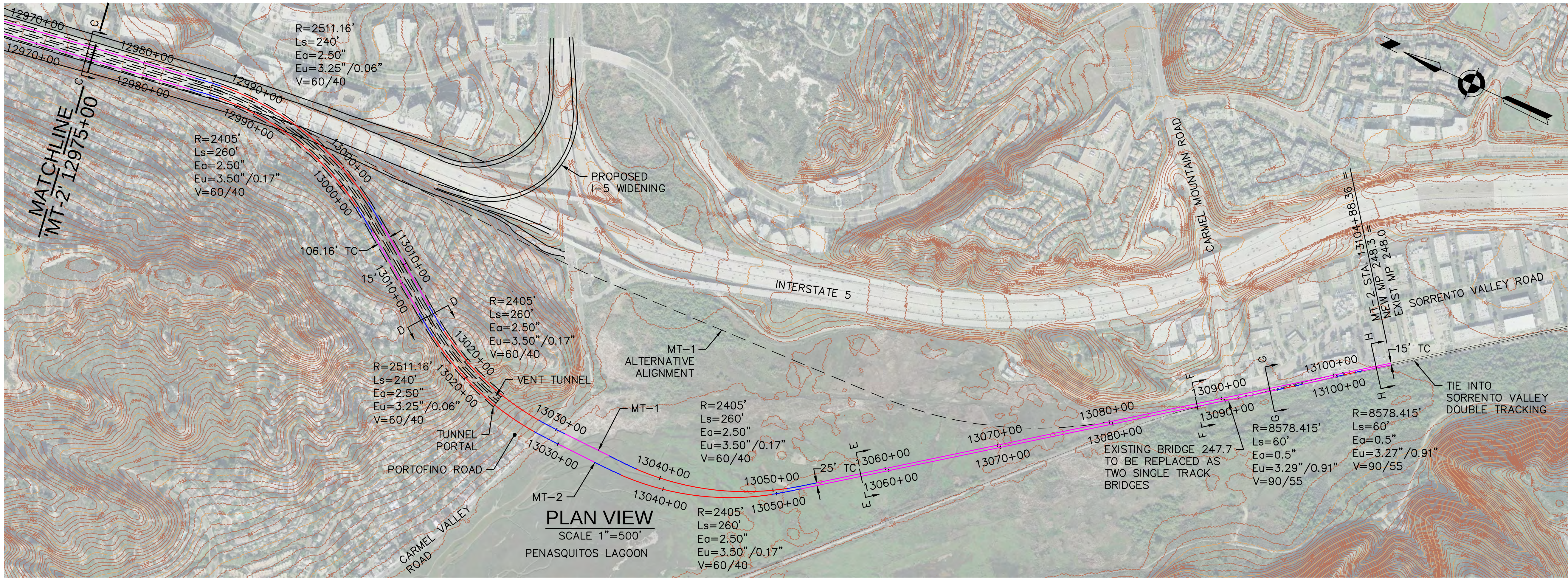
INTERSTATE 5 EAST ALIGNMENT PLAN AND PROFILE

SCALE 1"=500'

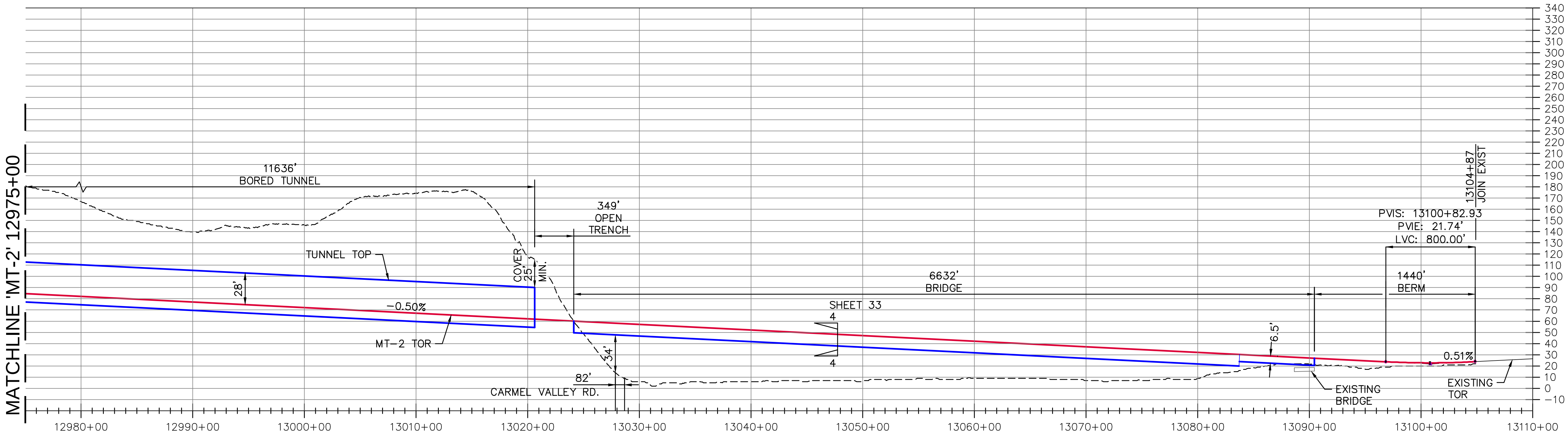
SANDAG CONTRACT NO. 5000931

DRAWING NO.

SHEET NO. 22



PLAN VIEW
SCALE 1"=500'



PROFILE VIEW
SCALE HORZ. 1"=500'
VERT. 1"=50'

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

CONCEPTUAL DESIGN – NOT FOR CONSTRUCTION

DATE: 11-13-2014 TIME: 8:19:55 AM

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DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

INTERSTATE 5 EAST ALIGNMENT PLAN AND PROFILE

SCALE 1"=500'
SANDAG CONTRACT NO. 5000931
DRAWING NO.
SHEET NO. 23

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3

CONCEPTUAL DESIGN – NOT FOR CONSTRUCTION

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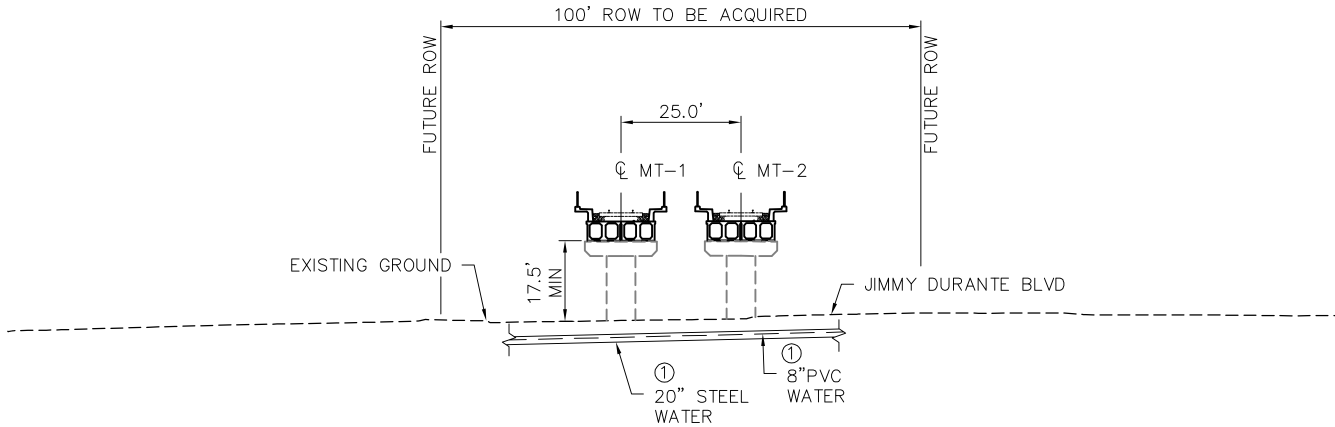
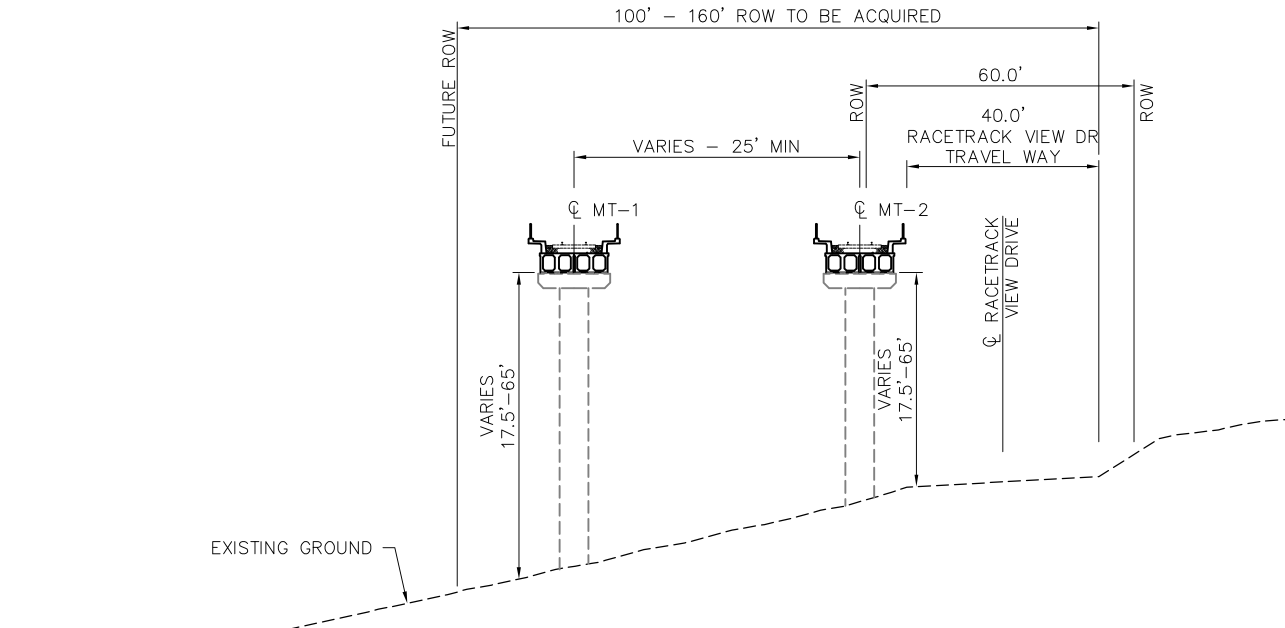


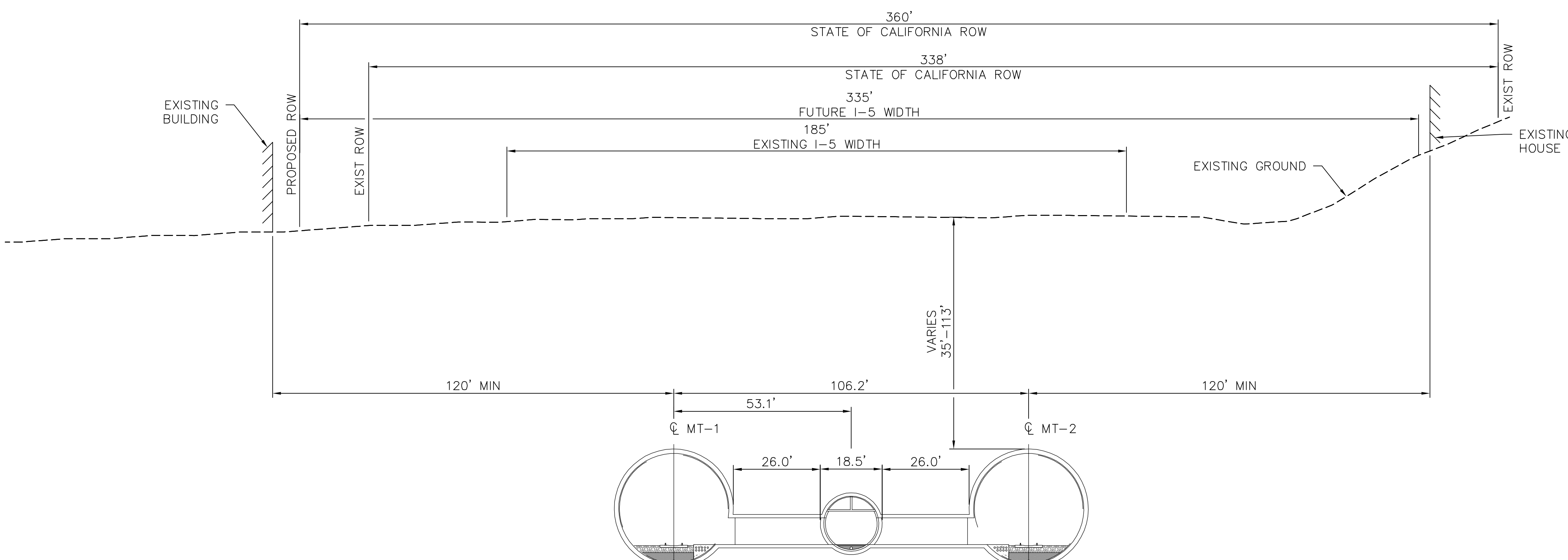
SECTION A-A

'MT-2' 12854+87 TO 'MT-2' 12855+68



SECTION B-B

'MT-2' 12883+72 TO 'MT-2" 12894+88



SECTION C-C

'MT-2' 12930+00 TO 'MT-2' 12990+00

NOTE:
① EXISTING UTILITIES TO BE PROTECTED IN PLACE

FILENAME: D:\TEMP\ACPUBLISH_5412\24-26-ALT 3A-OPT 3-EAST SECT.DWG

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DESIGNED BY	SNYO	8/12
DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

SANDAG San Diego's Regional Planning Agency

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

INTERSTATE 5 EAST TYPICAL SECTIONS

SCALE 1"=20'

SANDAG CONTRACT NO. 5000931

DRAWING NO.

SHEET NO. 24

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

CONCEPTUAL DESIGN — NOT FOR CONSTRUCTION

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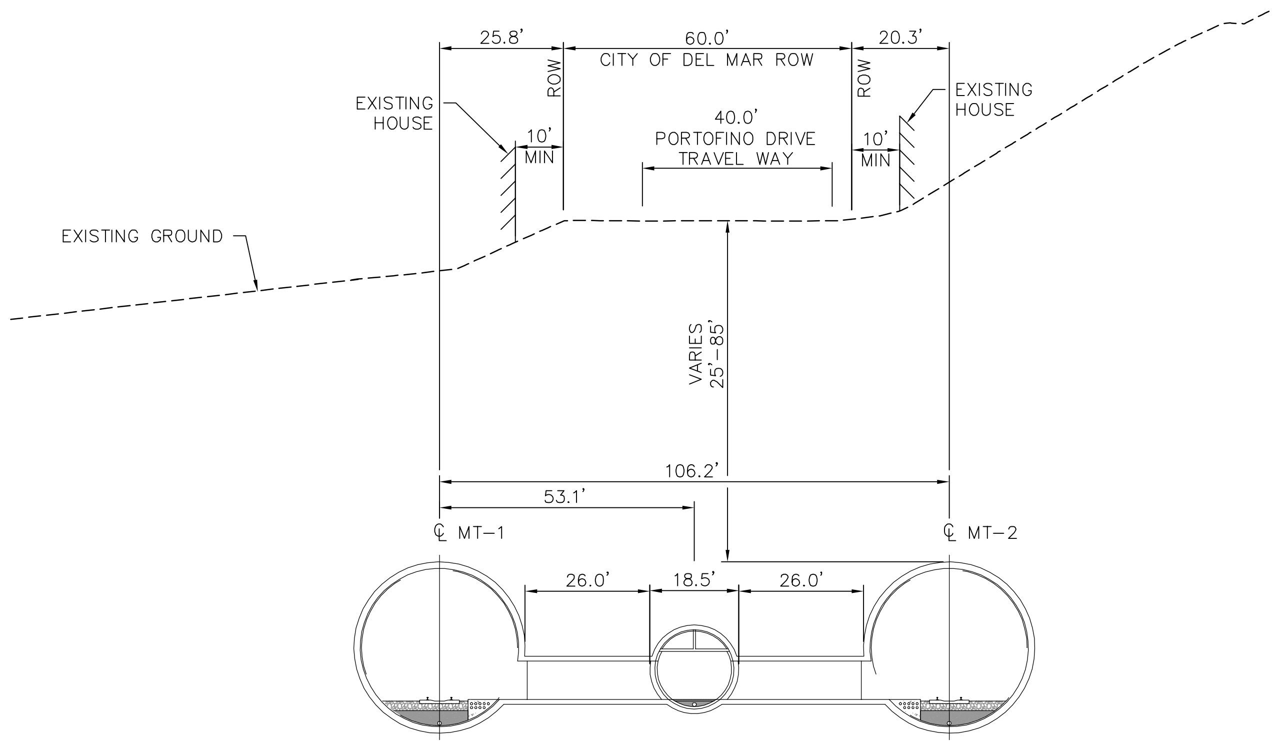
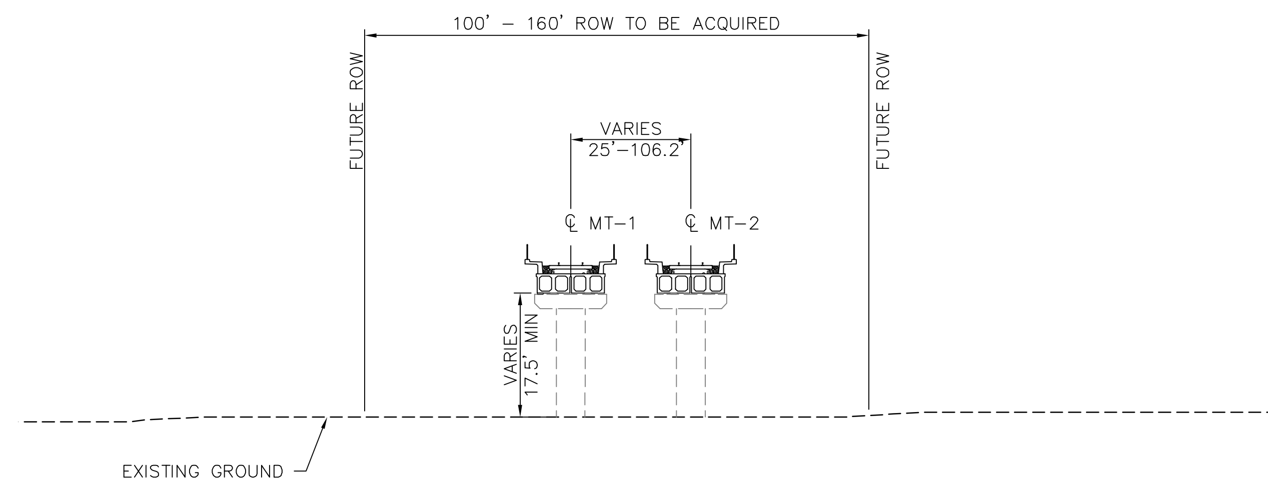


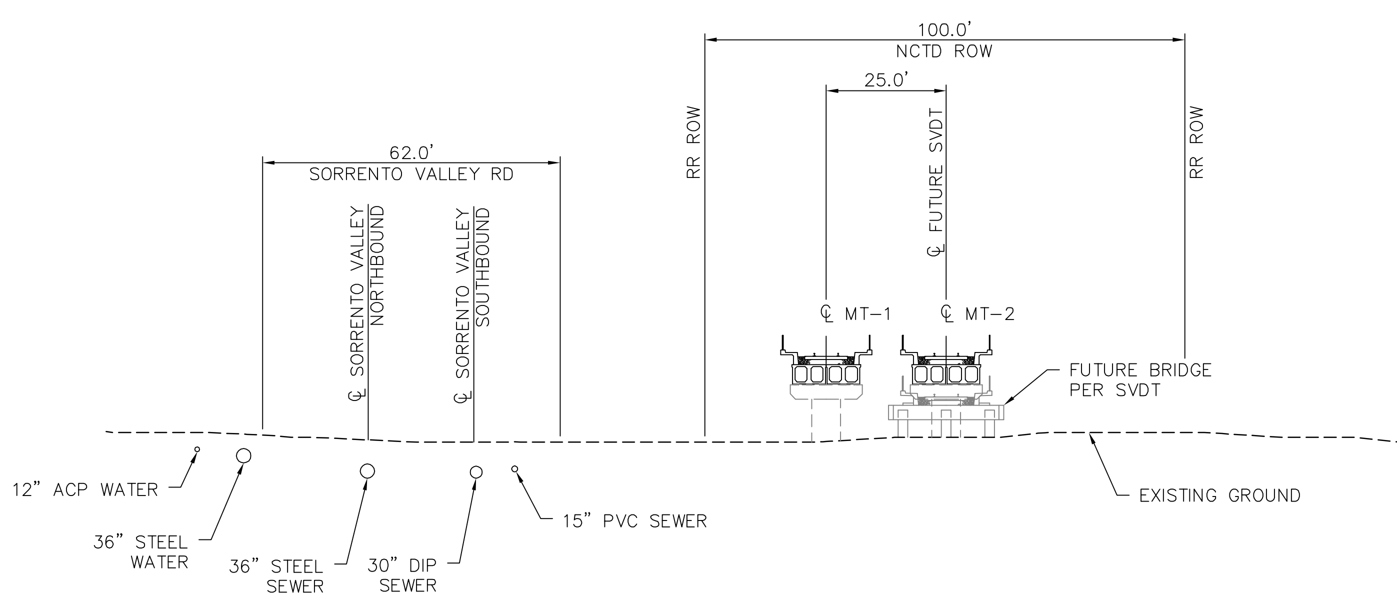
SECTION D-D

'MT-2' 12990+00 TO 'MT-2' 13024+11



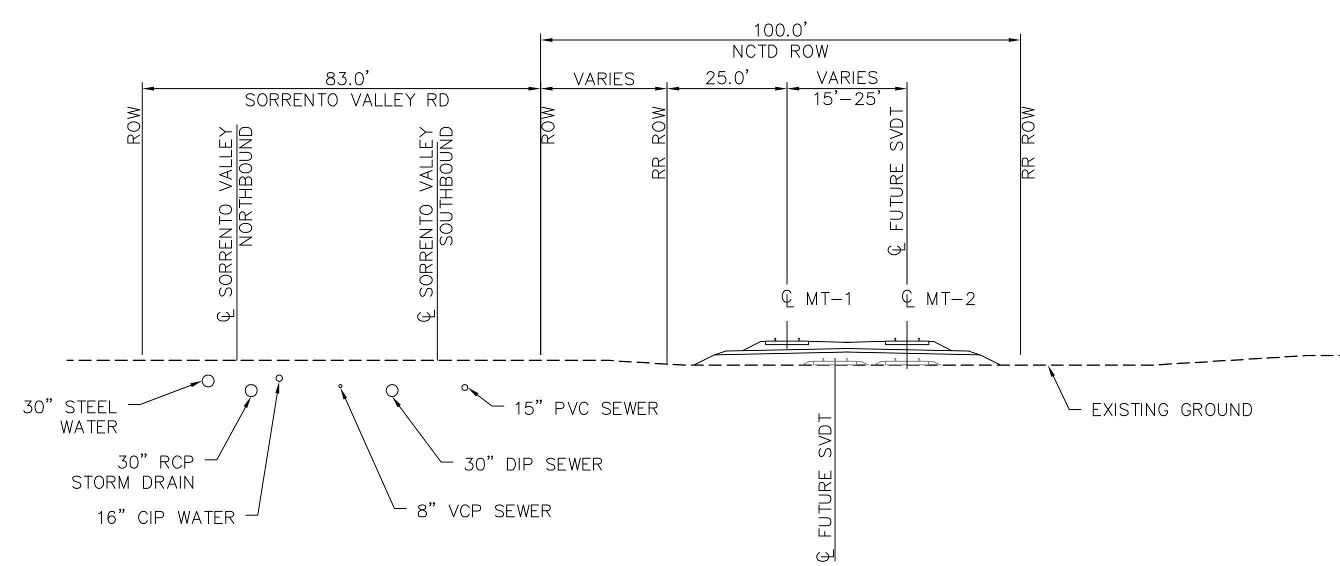
SECTION E-E

'MT-2' 13024+11 TO 'MT-2' 13088+68



SECTION F-F

'MT-2' 13088+68 TO 'MT-2' 13090+48



SECTION G-G

'MT-2' 13090+48 TO 'MT-2' 13102+26

NO.	DATE	REVISIONS	BY	CHK	APRV

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DESIGNED BY	SNYO	8/12
DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

SANDAG San Diego's Regional Planning Agency

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

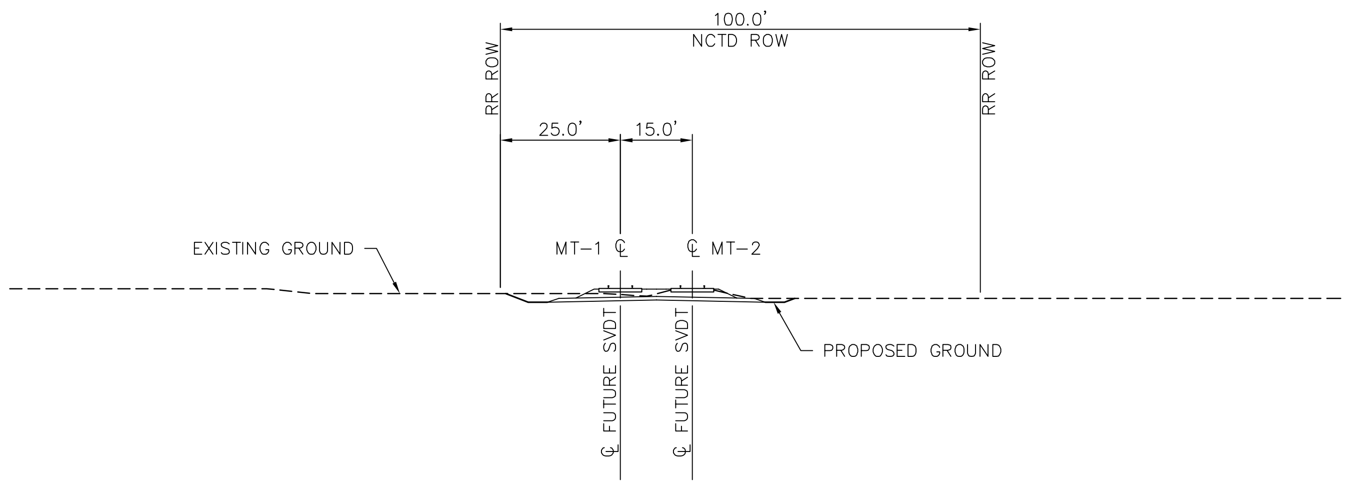
INTERSTATE 5 EAST TYPICAL SECTIONS

SCALE 1"=20'

SANDAG CONTRACT NO. 5000931

DRAWING NO.

SHEET NO. 25



SECTION H-H

'MT-2' 13102+26 TO 'MT-2' 13104+88

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

CONCEPTUAL DESIGN — NOT FOR CONSTRUCTION

DATE: 08-27-2012 TIME: 6:05:10 PM

FILENAME: D:\TEMP\ACPUBLISH_5412\24-26-ALT 3A-OPT 3-EAST SECT.DWG

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DESIGNED BY	SNYO	8/12
DRAWN BY	MCDC	8/12
CHECKED BY	SIFA	8/12
SANDAG	LC	8/12

SANDAG San Diego's Regional Planning Agency

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

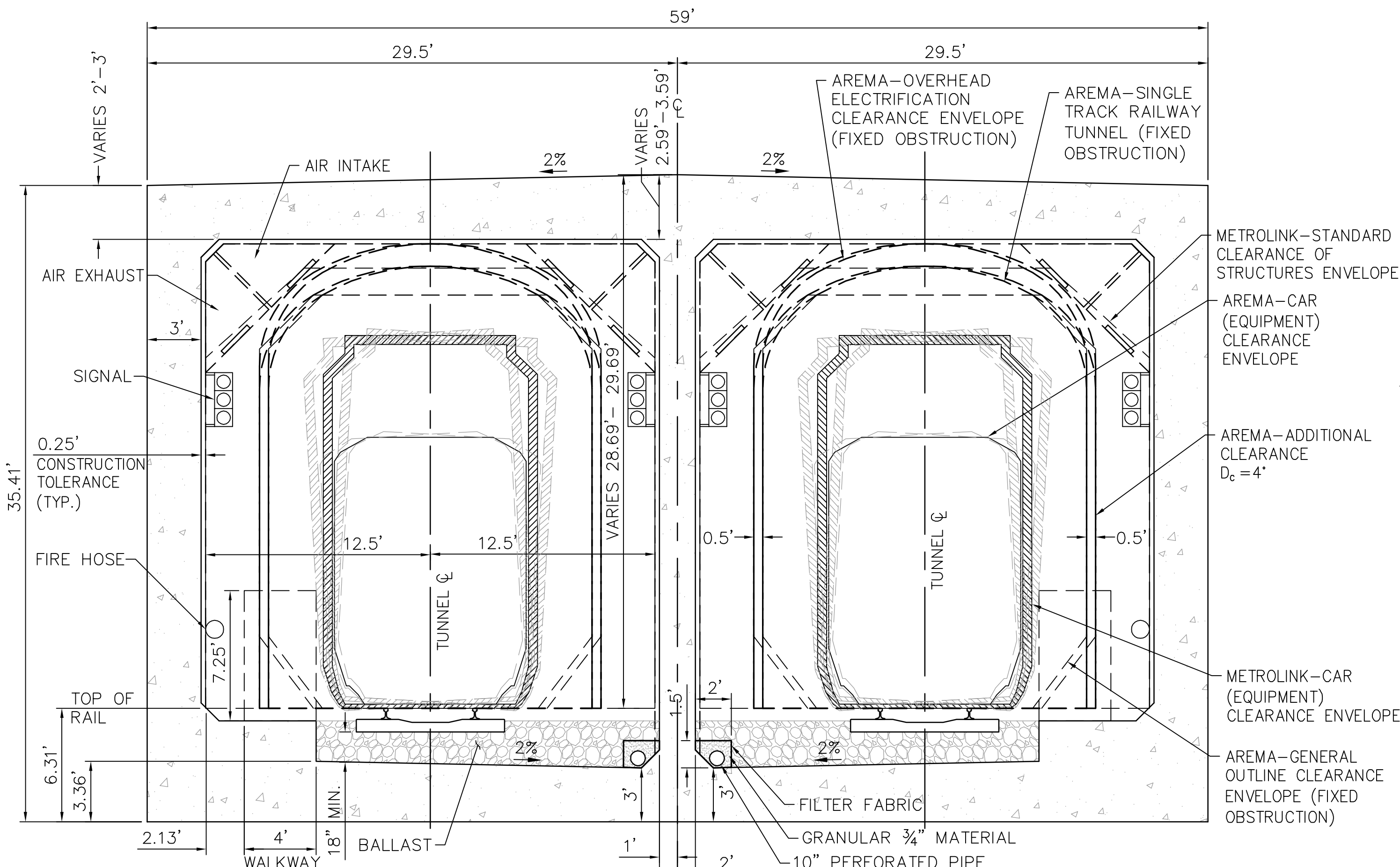
INTERSTATE 5 EAST TYPICAL SECTIONS

SCALE 1"=20'

SANDAG CONTRACT NO. 5000931

DRAWING NO.

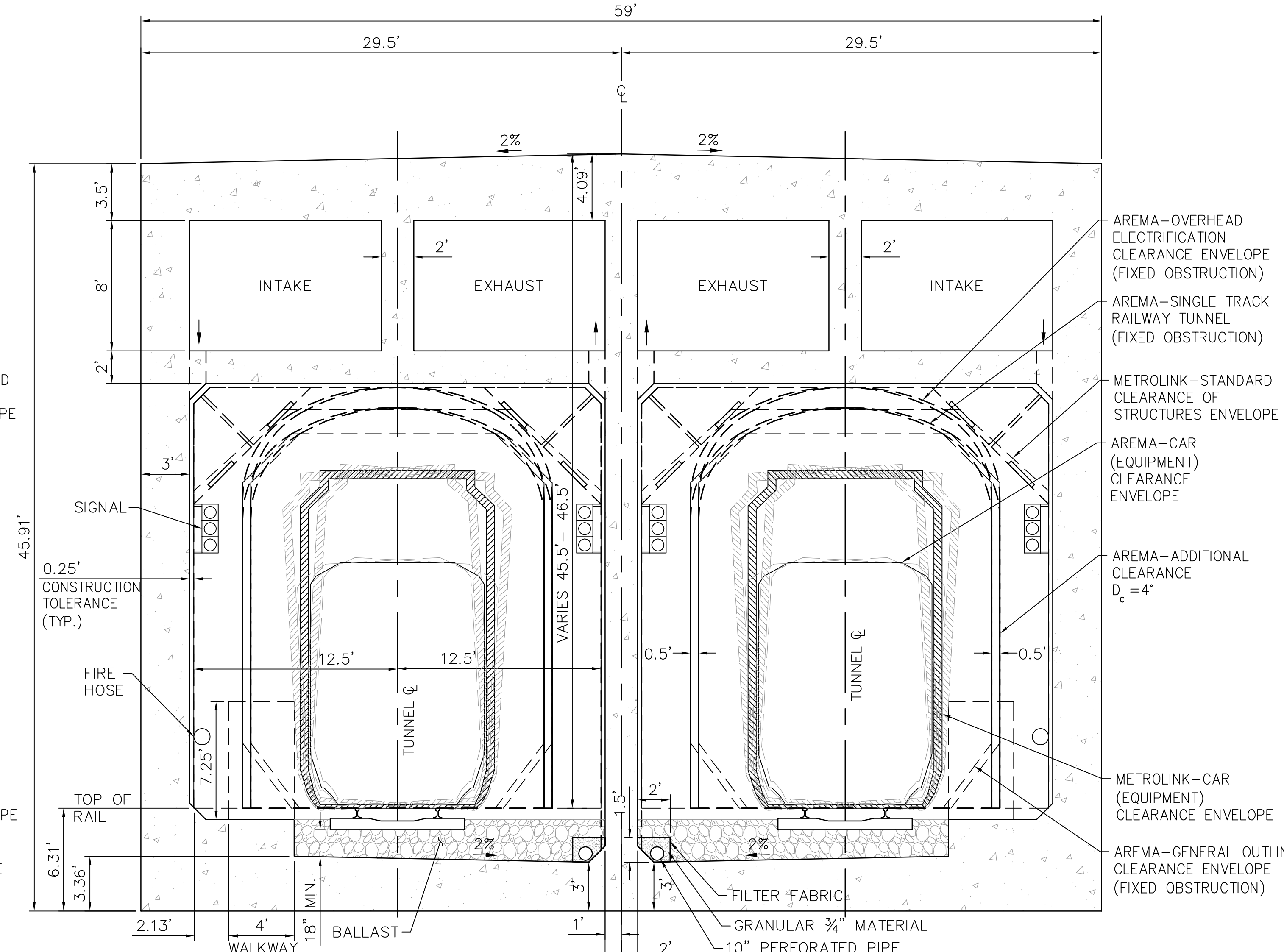
SHEET NO. 26



NOTES:
1. ADDITIONAL LATERAL CLEARANCE FOR $D_c=4'$ FOR ALIGNMENT ALONG CAMINO DEL MAR SHOWN.
2. ADDITIONAL TILT FOR VEHICLE OF 3 INCHES SUPER ELEVATION SHOWN ON DRAWING.
3. EMERGENCY WALK 4'-0"x7'-3".

TYPICAL TWIN CUT AND COVER TUNNEL TANGENT SECTION '1-1'

SCALE: 1"=5'



NOTES:
1. ADDITIONAL LATERAL CLEARANCE FOR $D_c=4'$ FOR ALIGNMENT ALONG CAMINO DEL MAR SHOWN.
2. ADDITIONAL TILT FOR VEHICLE OF 3 INCHES SUPER ELEVATION SHOWN ON DRAWING.
3. EMERGENCY WALK 4'-0"x7'-3".

TYPICAL TWIN CUT AND COVER TUNNEL TANGENT SECTION '1A-1A'

SCALE: 1"=5'

NO.	DATE	REVISIONS	BY	CHK	APRV

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San Diego California 92101
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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

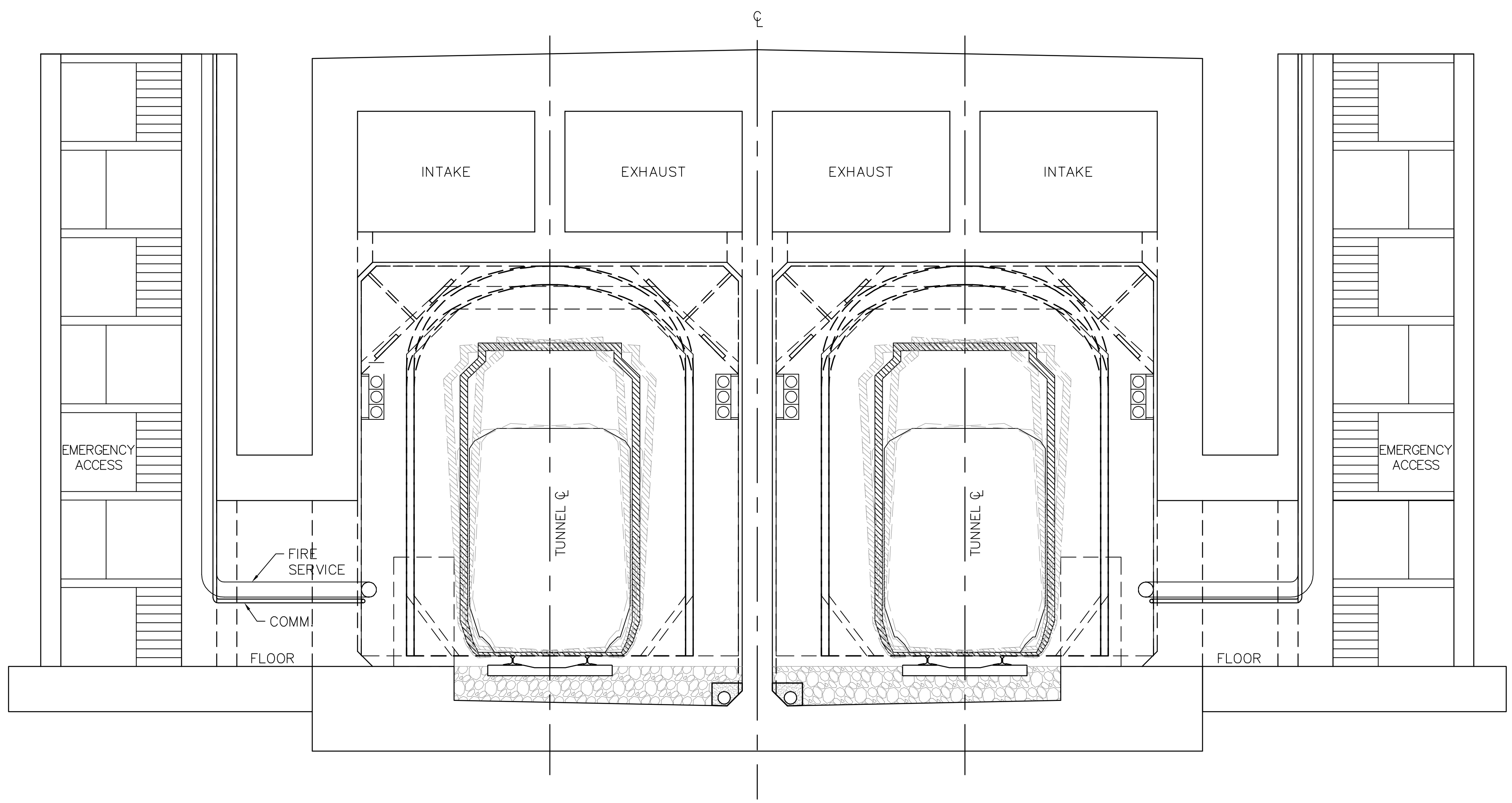
STRUCTURAL SECTION CUT AND COVER BOX

SCALE: SCALE: 1"=5'
SANDAG CONTRACT NO.
DRAWING NO.
SHEET NO. 27

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3

PROGRESS PRINT – NOT FOR CONSTRUCTION

DATE: 08-27-2012 TIME: 1:46:43 PM



SECTION VIEW

FILENAME: P:\S\SNDG00000054\0400CAD\EB\DWG\TUNNEL TYP SECTION.DWG

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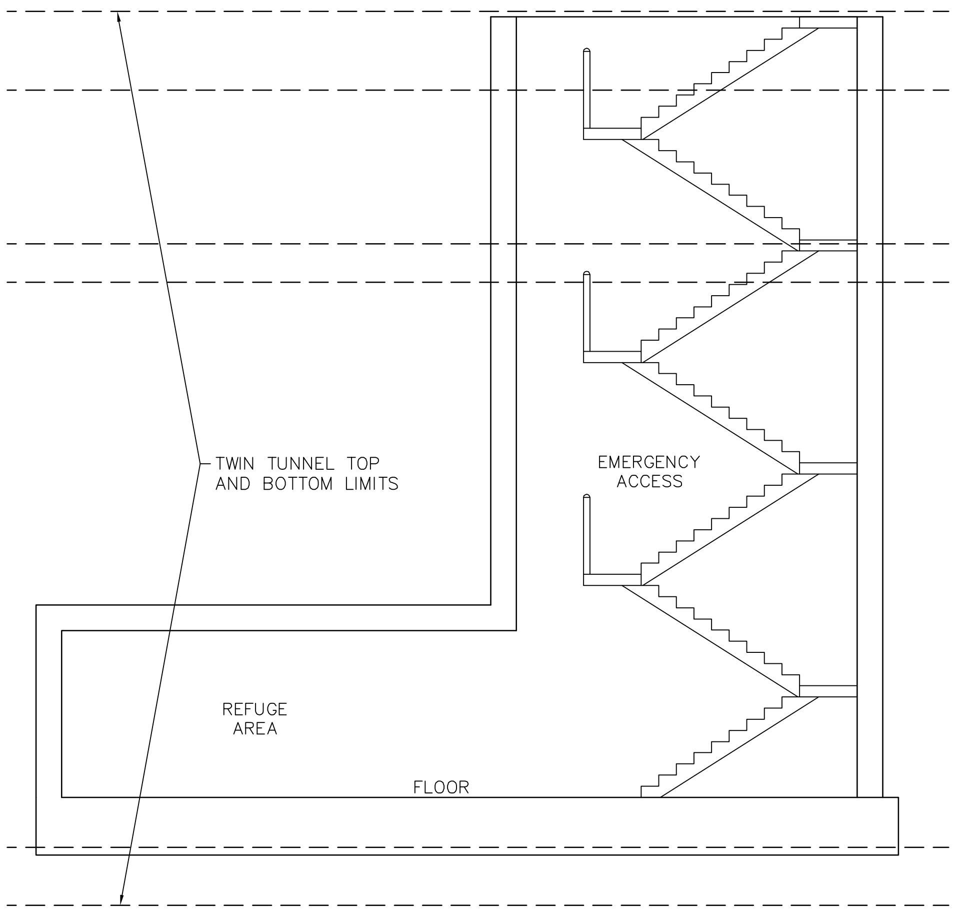
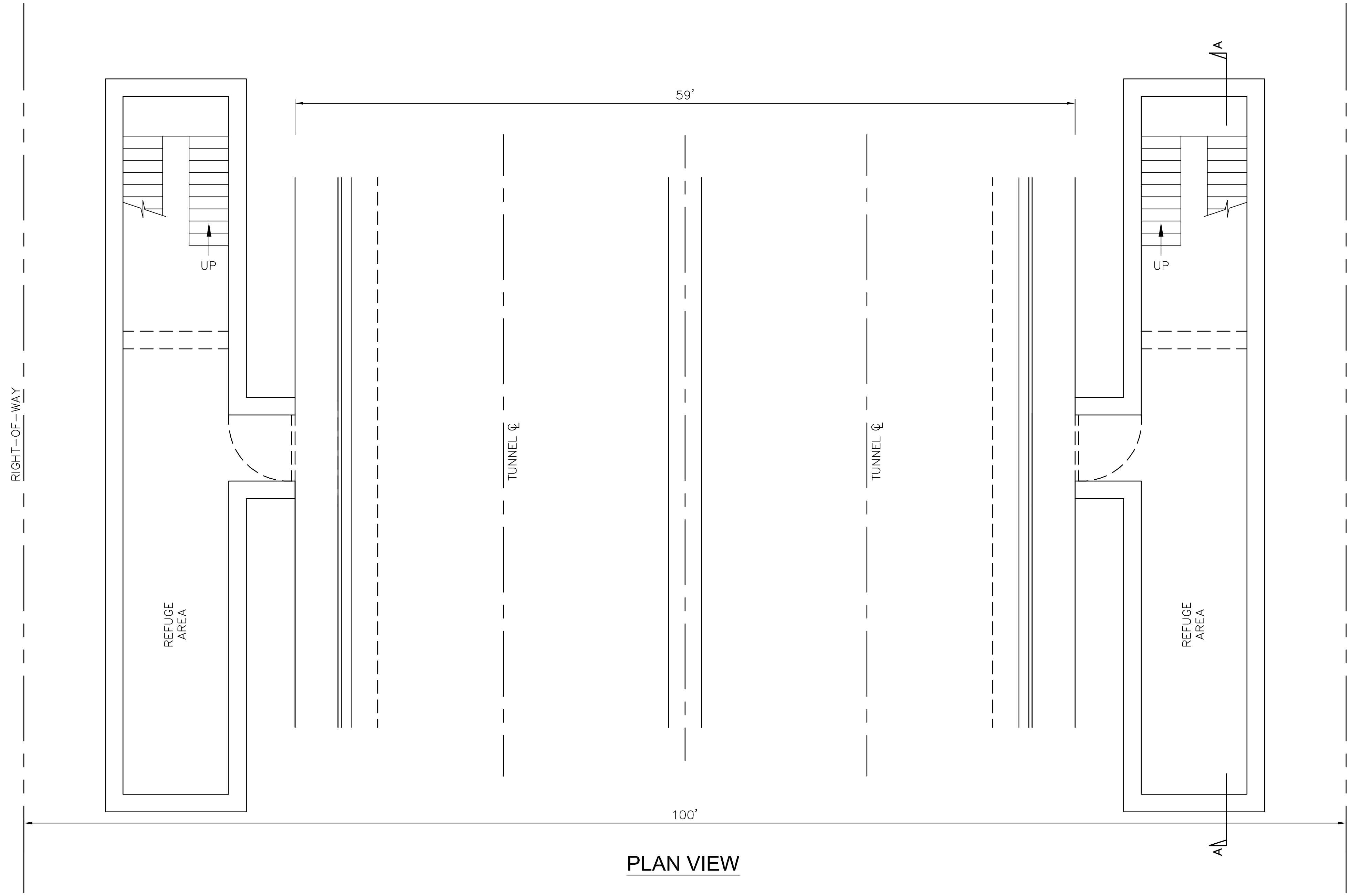
CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES:
LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

STRUCTURAL SECTION
CUT AND COVER EMERGENCY ACCESS

SCALE
SCALE: 1"=5'
SANDAG CONTRACT NO.
DRAWING NO.
SHEET NO. 28



SECTION VIEW 'A-A'



PLAN VIEW

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

PROGRESS PRINT — NOT FOR CONSTRUCTION

DATE: 08-27-2012 TIME: 1:46:43 PM

FILENAME: P:\S\SNDG00000054\0400CAD\EB\DWG\TUNNEL TYP SECTION.DWG

NO.	DATE	REVISIONS	BY	CHK	APRV

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES:
LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

STRUCTURAL SECTIONS
CUT AND COVER EMERGENCY ACCESS

SCALE
SCALE: 1"=5'
SANDAG CONTRACT NO.
DRAWING NO.
SHEET NO. 29

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3

PROGRESS PRINT — NOT FOR CONSTRUCTION

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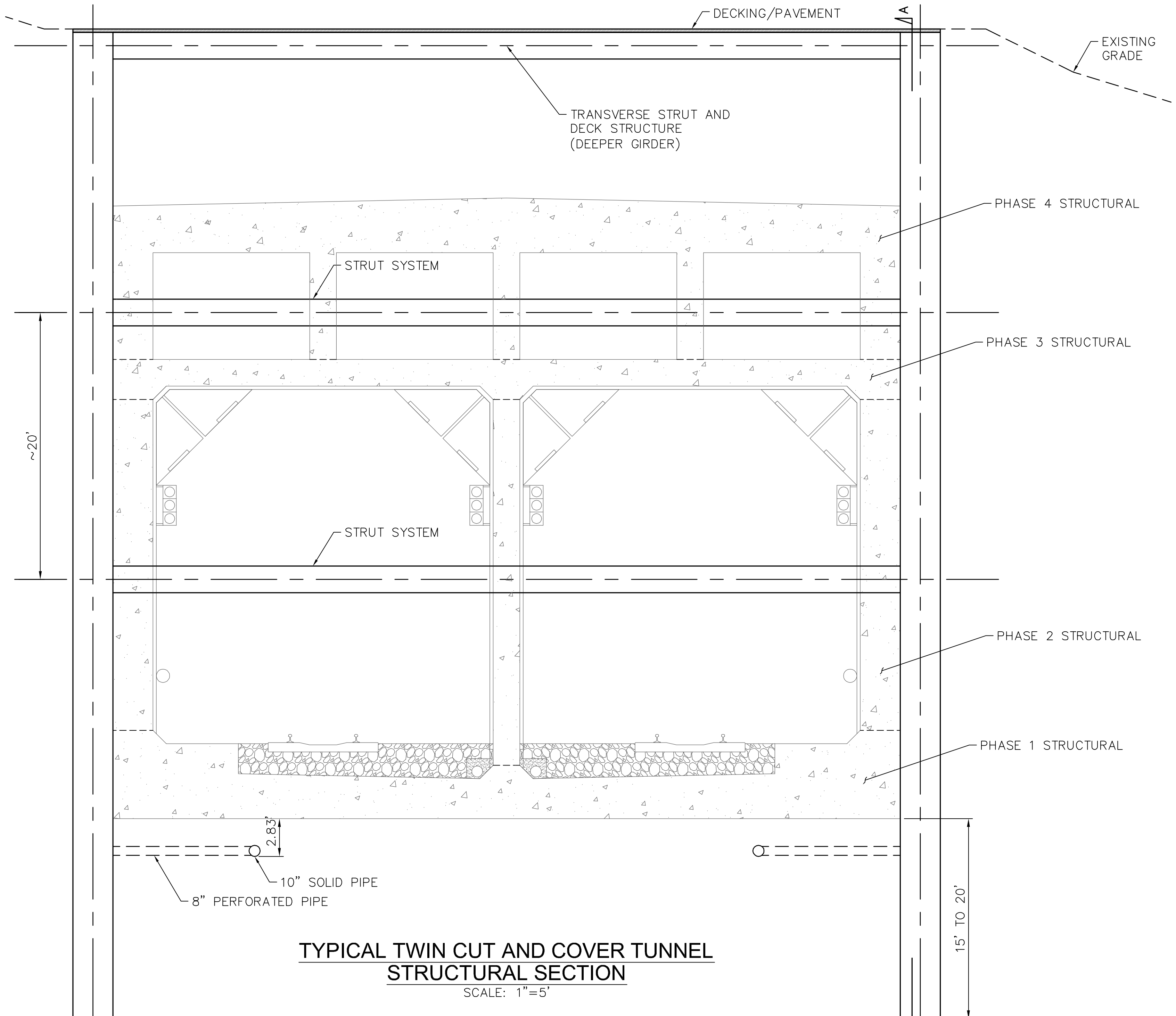
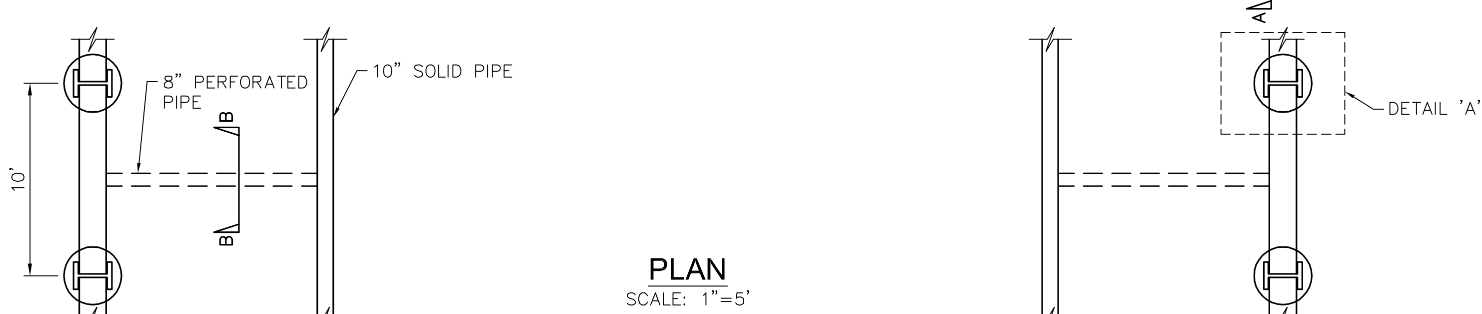


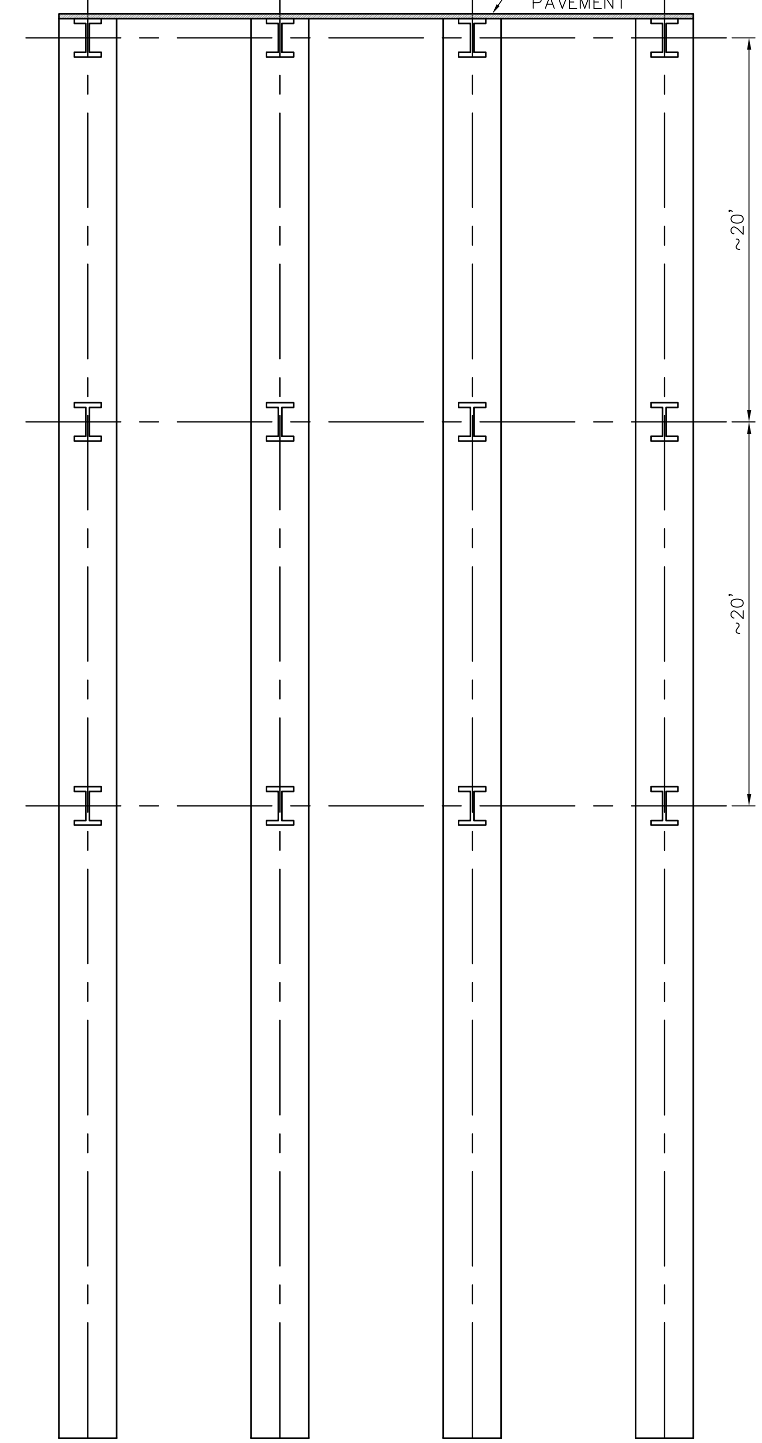
TYPICAL TWIN CUT AND COVER TUNNEL STRUCTURAL SECTION

SCALE: 1"=5'



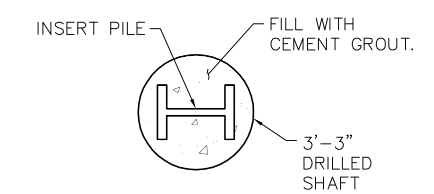
PLAN

SCALE: 1"=5'



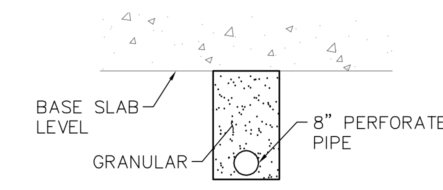
SECTION 'A-A'

SCALE: 1"=5'



DETAIL 'A'

NOT TO SCALE



SECTION 'B-B'

NOT TO SCALE

NO.	DATE	REVISIONS	BY	CHK	APRV

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CUT AND COVER STRUCTURAL PHASING

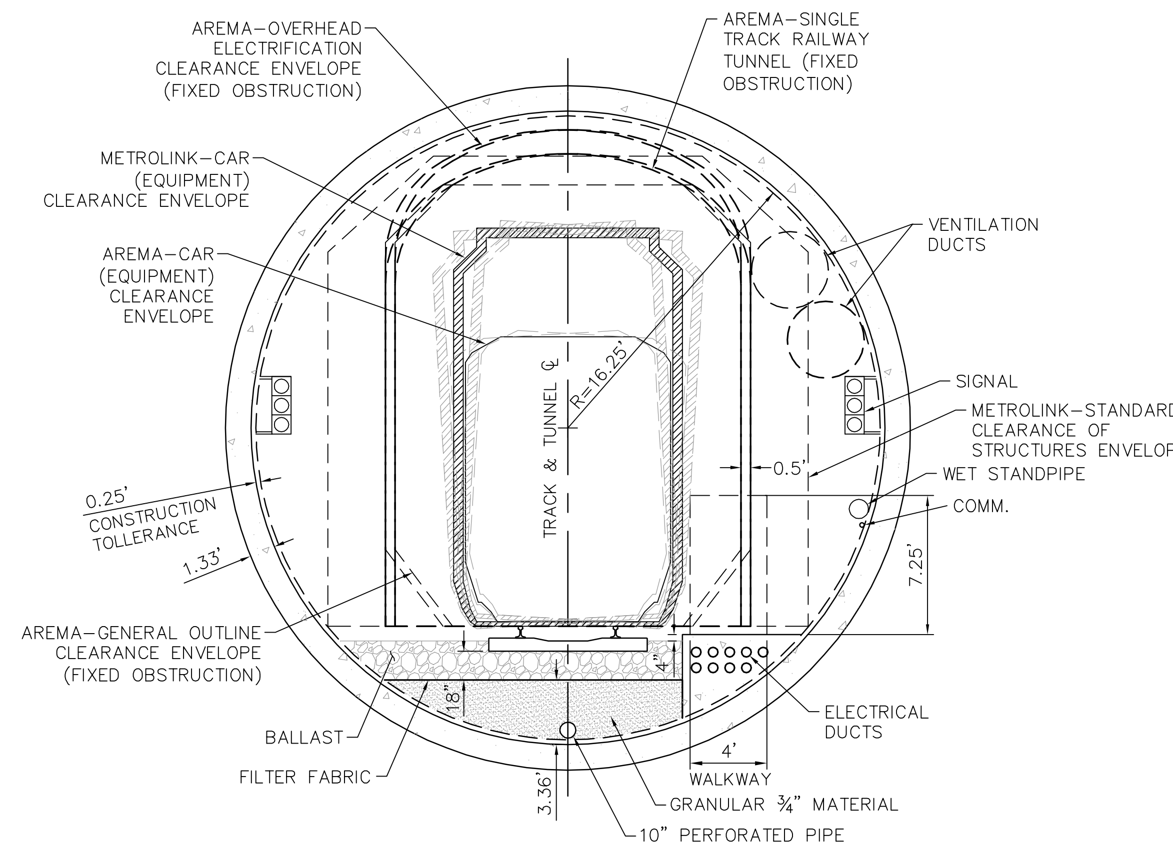
SCALE: SCALE: 1"=5'

SANDAG CONTRACT NO.

DRAWING NO.

SHEET NO. 30

FILENAME: P:\S\SNDG00000054\0400CAD\EB\DWG\TUNNEL TYP SECTION.DWG



TYPICAL BORED TUNNEL TANGENT SECTION

SCALE: 1"=5'

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

PROGRESS PRINT — NOT FOR CONSTRUCTION

DATE: 08-27-2012 TIME: 1:46:44 PM

FILENAME: P:\S\SNDG00000054\0400CAD\EB\DWG\TUNNEL TYP SECTION.DWG

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

STRUCTURAL SECTION BORED TUNNEL SECTION

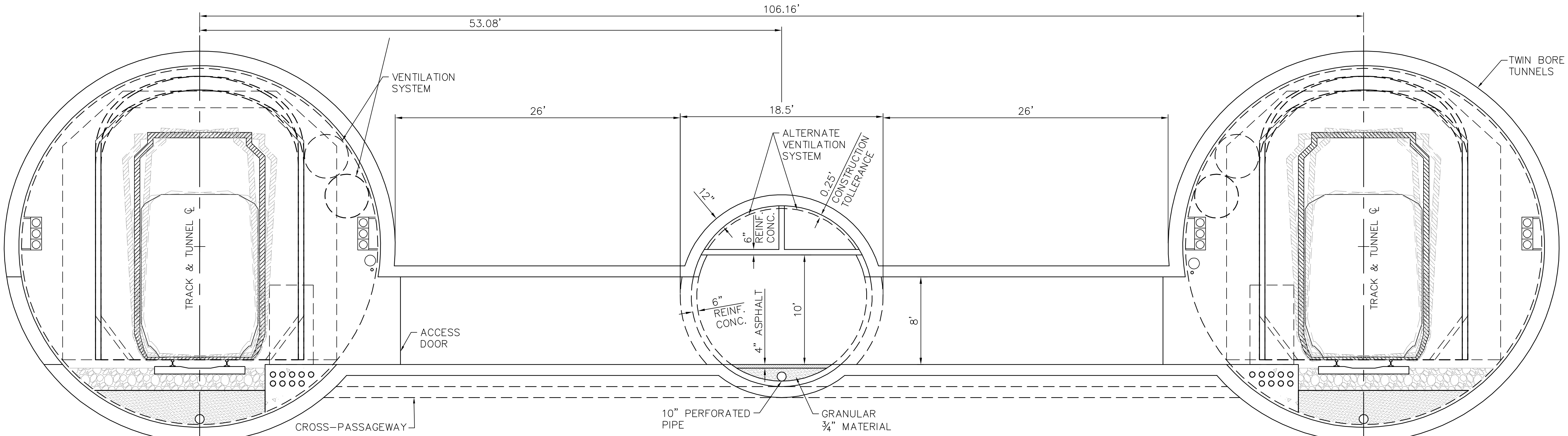
SCALE: 1"=5'
SANDAG CONTRACT NO.
DRAWING NO.
SHEET NO. 31

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES

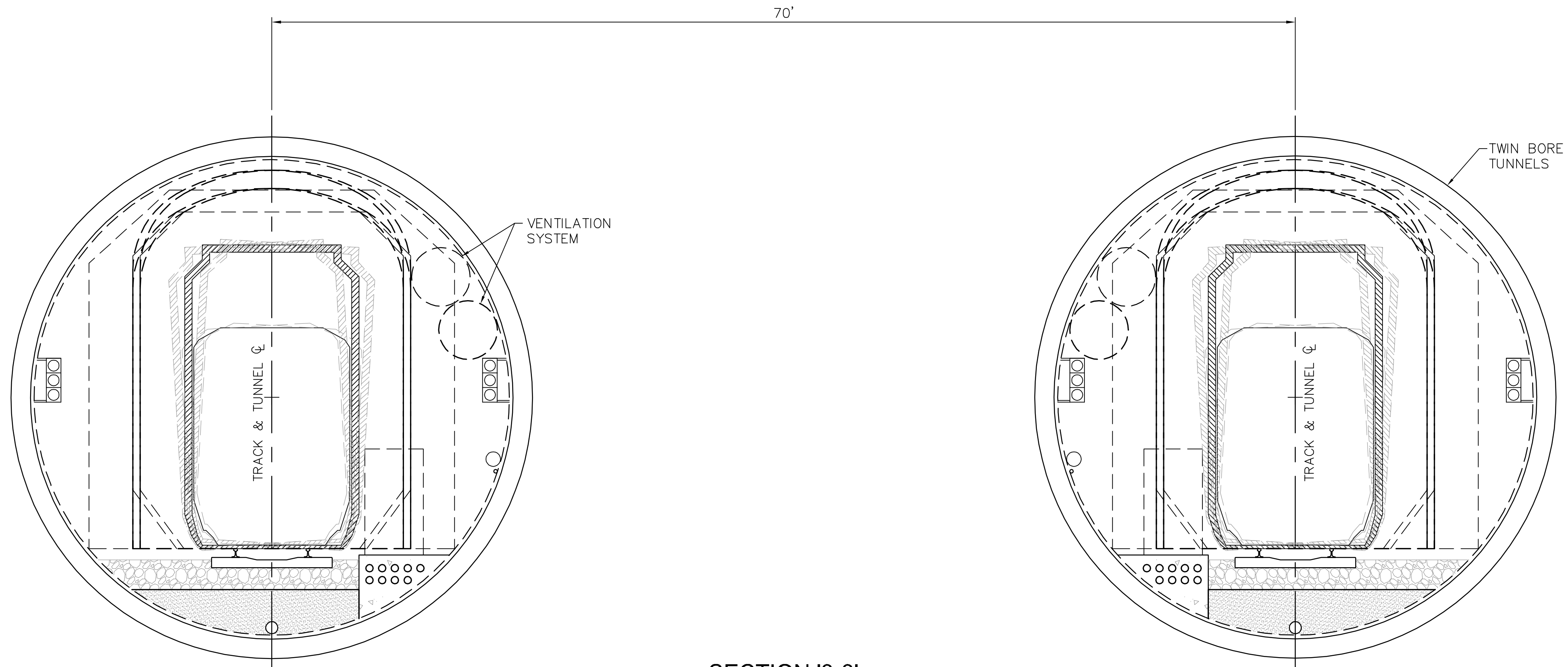
0 1 2 3

PROGRESS PRINT — NOT FOR CONSTRUCTION

DATE: 08-27-2012 TIME: 1:46:45 PM



SECTION '2-2'



SECTION '3-3'

FILENAME: P:\S\SNDG00000054\0400CAD\EB\DWG\TUNNEL TYP SECTION.DWG

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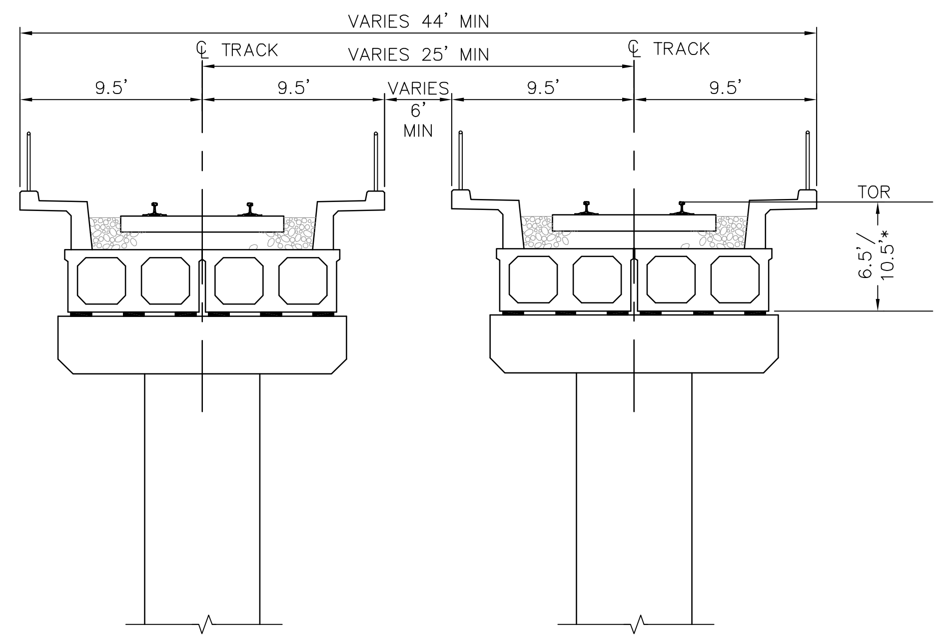
CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES:
LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

STRUCTURAL SECTIONS
BORED TUNNEL SECTIONS

SCALE
SCALE: 1"=5'
SANDAG CONTRACT NO.
DRAWING NO.
SHEET NO. 32

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2 3

PROGRESS PRINT — NOT FOR CONSTRUCTION
DATE: 08-27-2012 TIME: 1:46:45 PM



* BRIDGE DEPTH IS 6.5' FOR 50' SPANS OR 10.5' FOR 100' SPANS.

PRESTRESSED PRECAST CONCRETE DOUBLE CELL BOX GIRDER SECTION '4-4'

NO.	DATE	REVISIONS	BY	CHK	APRV

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CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

STRUCTURAL SECTION BOX GIRDER BRIDGES

SCALE: 1"=5'
SANDAG CONTRACT NO.
DRAWING NO.
SHEET NO. 33

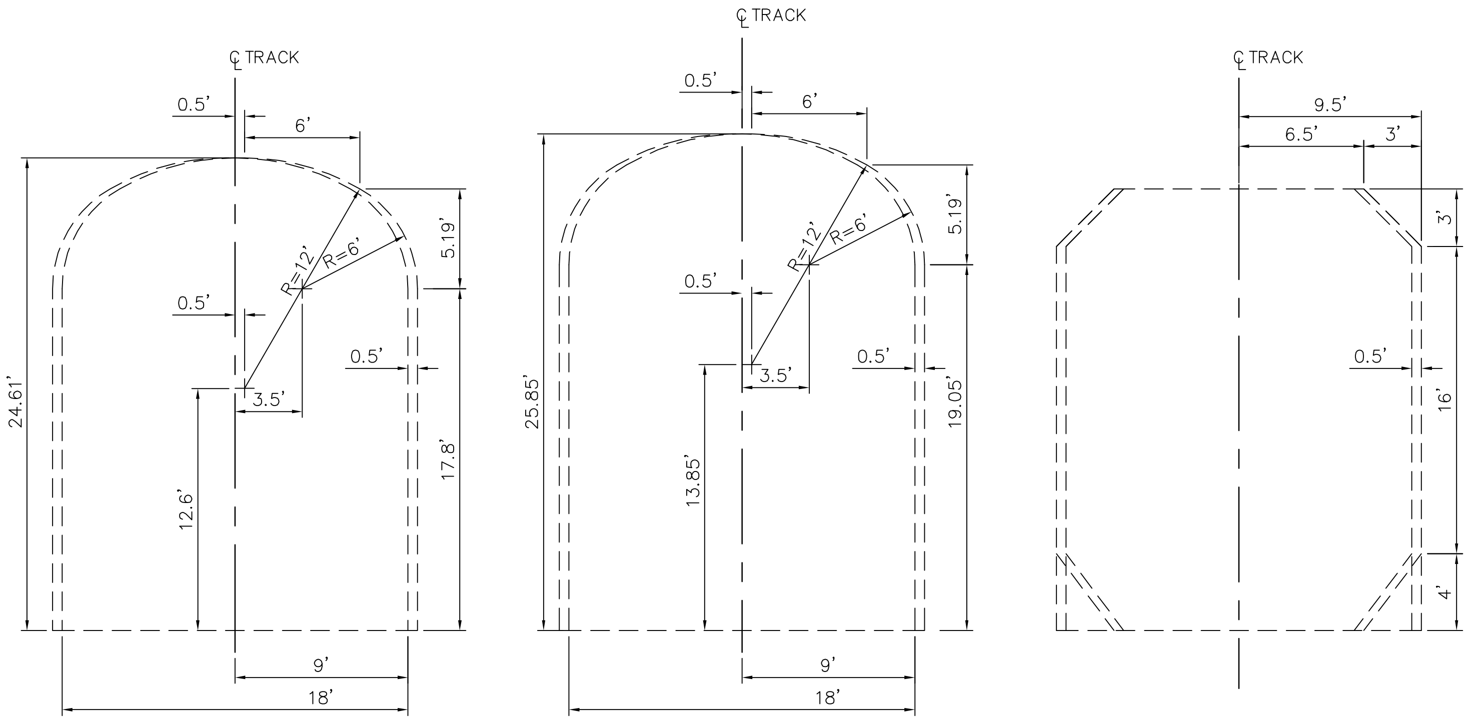
FILENAME: P:\S\SNDG00000054\0400CAD\EB\DWG\TUNNEL TYP SECTION.DWG

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

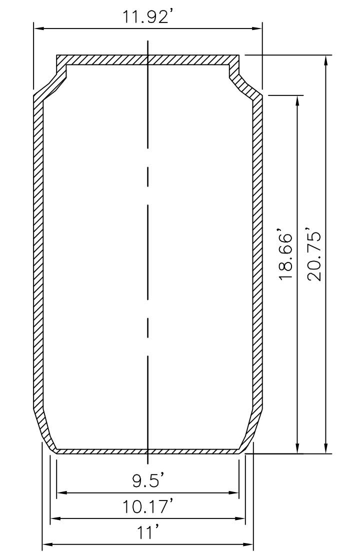
PROGRESS PRINT — NOT FOR CONSTRUCTION

DATE: 08-27-2012 TIME: 1:46:46 PM

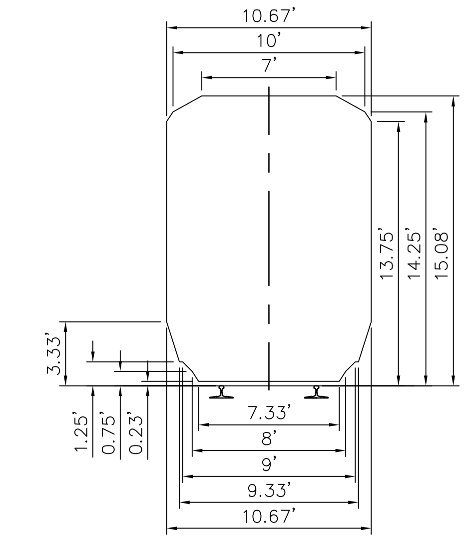
NOTE:
THROUGH DEL MAR ON CAMINO DEL MAR CURVATURE IS APPROXIMATELY $D_c = 4°$. ADDITIONAL LATERAL CLEARANCE TO ENVELOPE (FIXED OBSTRUCTIONS) ON BOTH SIDES OF CENTERLINE TRACK 6 INCHES SHALL BE ADDED.



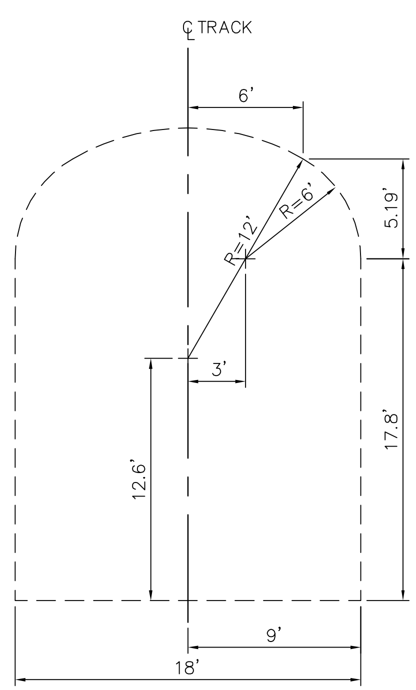
DEL MAR - SINGLE TRACK RAILWAY TUNNEL CLEARANCES (FIXED OBSTRUCTIONS) $D_C \leq 4°$



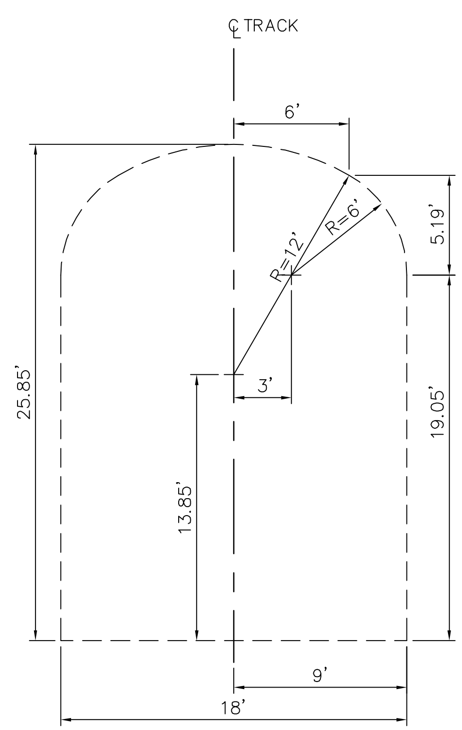
METROLINK-CAR (EQUIPMENT) CLEARANCE ENVELOPE



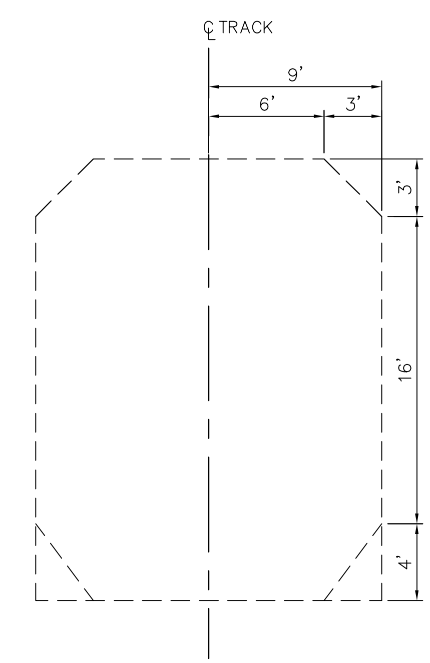
AREMA - CAR (EQUIPMENT) CLEARANCE ENVELOPE



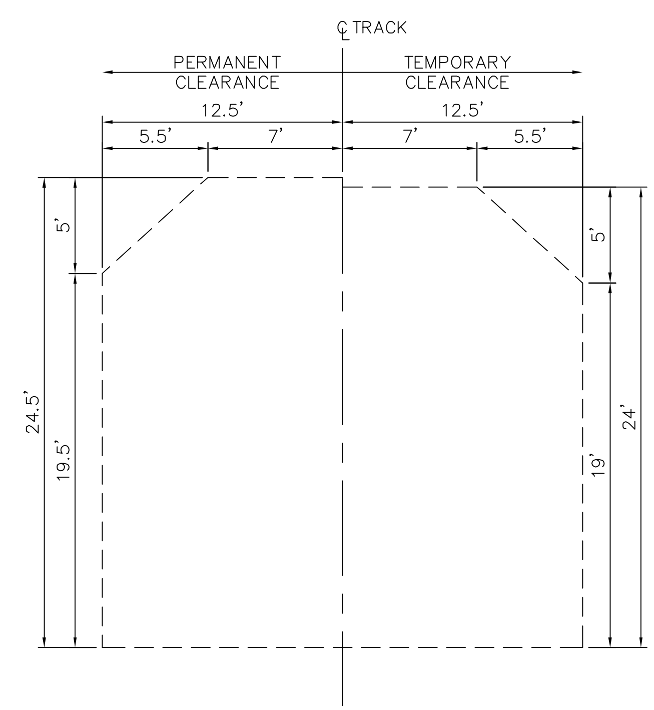
AREMA-SINGLE TRACK RAILWAY TUNNEL (FIXED OBSTRUCTION)



AREMA - OVERHEAD ELECTRIFICATION CLEARANCE ENVELOPE (FIXED OBSTRUCTION)



AREMA-GENERAL OUTLINE CLEARANCE ENVELOPE (FIXED OBSTRUCTION)



METROLINK-STANDARD CLEARANCE OF STRUCTURES ENVELOPE

NOTE:
AREMA — INCREASE TANGENT CLEARANCE FOR CLEARANCE DIAGRAMS FIXED OBSTRUCTIONS CHAPTER 28 CLEARANCES, SECTION 1.2, 1.3, 1.4, 1.5 BY 1.5" PER DEGREE OF CURVATURE.

NO.	DATE	REVISIONS	BY	CHK	APRV

DAVID EVANS AND ASSOCIATES INC.
110 West A Street, Suite 1700
San Diego California 92101
Phone: (619) 400-0600

DESIGNED BY DATE
DRAWN BY
CHECKED BY
SANDAG

SANDAG
San Diego's Regional Planning Agency

NCTD

CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES: LOSSAN SAN DIEGO CORRIDOR MP 244 TO MP 248

CLEARANCE ENVELOPES

SCALE
SCALE: 1"=5'
SANDAG CONTRACT NO.
DRAWING NO.
SHEET NO. 34

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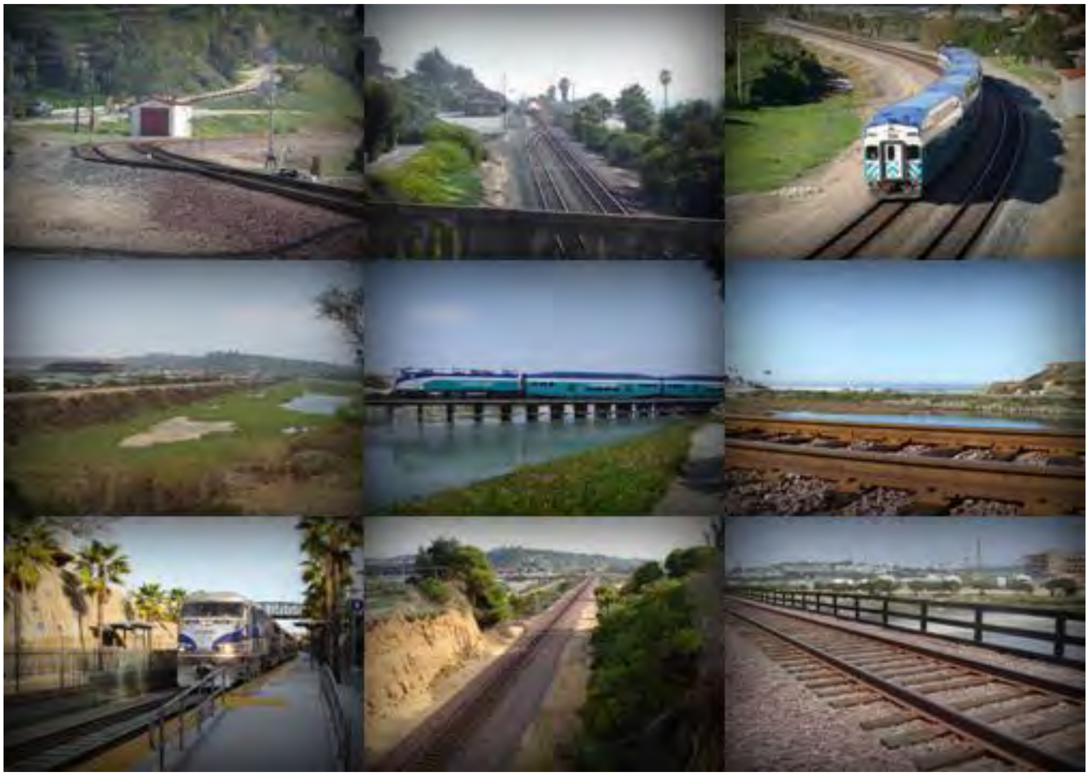
II. ENVIRONMENTAL CONSTRAINTS REPORT

ENVIRONMENTAL CONSTRAINTS FOR CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY

ENVIROMENTAL CONSTRAINTS REPORT



SANDAG

November 6, 2014

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HELIX
Environmental Planning

ENVIRONMENTAL CONSTRAINTS FOR CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY

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ENVIRONMENTAL CONSTRAINTS FOR CONCEPTUAL DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY

1.0 INTRODUCTION

This report evaluates environmental constraints associated with five alternatives for realigning the existing Los Angeles to San Diego to San Luis Obispo (LOSSAN) railroad corridor where it passes through the City of Del Mar and into north coastal City of San Diego. Figure 1 shows the regional location of the existing LOSSAN corridor segment that would be replaced with a new alignment. Because any realignment away from the Del Mar Bluffs and through the densely developed City of Del Mar or City of San Diego Torrey Pines Community would require tunneling, the potential project evaluated in this report is sometimes referred to in other planning documents as the Del Mar Tunnel even though not all of the realigned railroad corridor would be tunneled (or even necessarily within the City of Del Mar).

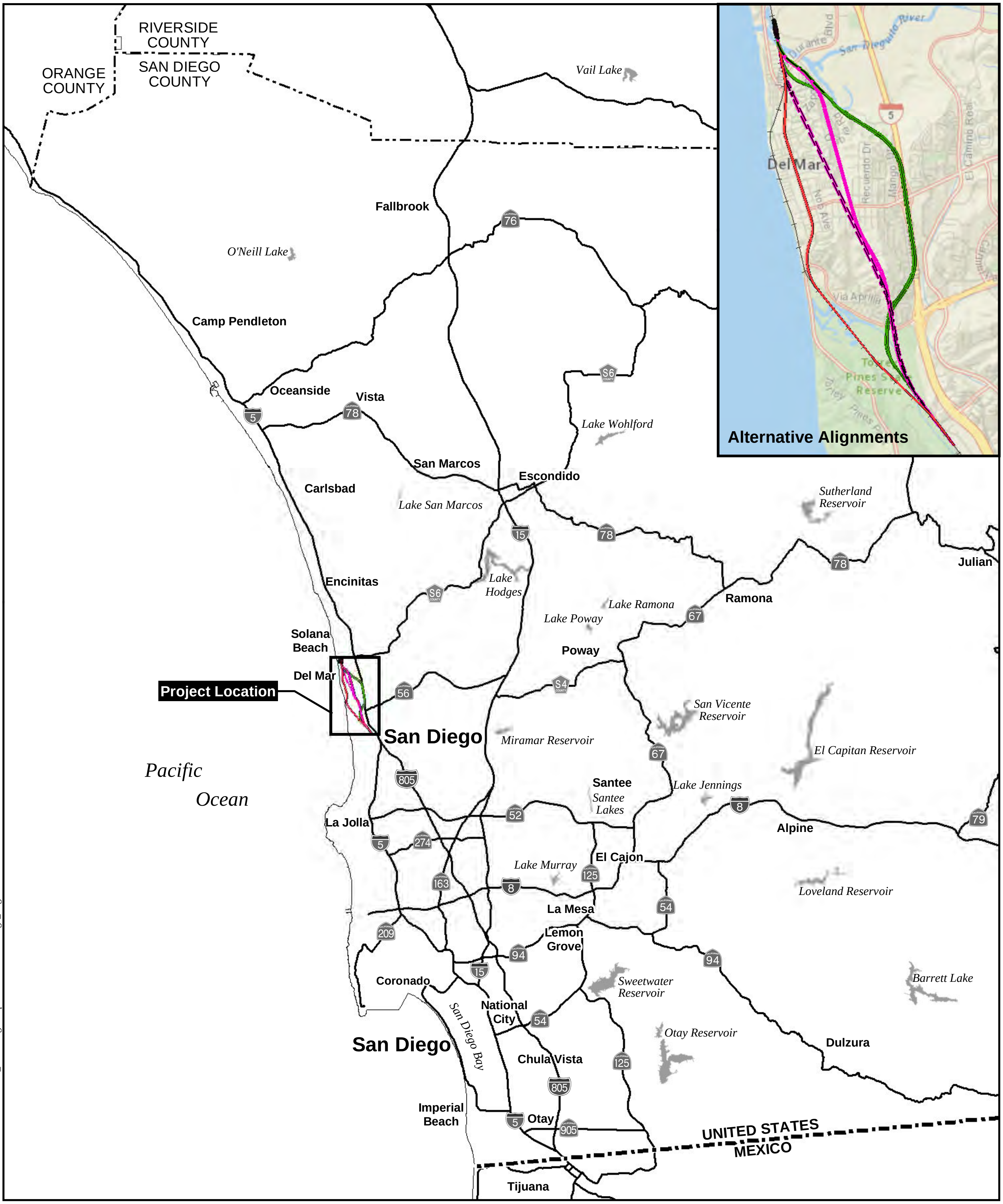
The purpose of preparing this environmental constraints report is to provide information to the San Diego Association of Governments (SANDAG), its member agencies, other agencies, and the public about potential environmental constraints associated with the proposed future railroad realignment. This Introduction provides an overview of the LOSSAN corridor and discusses the previously adopted *Los Angeles to San Diego Proposed Rail Corridor Improvements Program Environmental Impact Report/Environmental Impact Statement* (Program EIR/EIS) as it relates to the Del Mar Tunnel, the purpose of and need for the Del Mar Tunnel, and the methods used to address potential environmental constraints.

Subsequent sections describe the alternative alignments currently under consideration (Section 2.0), evaluate the environmental constraints associated with each alternative alignment (Section 3.0), summarize those constraints (Section 4.0), list the report's preparers (Section 5.0), and list the references cited (Section 6.0).

1.1 OVERVIEW OF THE LOSSAN CORRIDOR

The following overview of the LOSSAN corridor is derived from the April 2012 *LOSSAN Corridorwide Strategic Implementation Plan Final Report* prepared for the LOSSAN Rail Corridor Agency.

The LOSSAN corridor is a 351-mile-long intercity and commuter rail corridor, stretching from San Diego in the south, up the coast to Orange County, Los Angeles County, Ventura County, and Santa Barbara County to San Luis Obispo County. The LOSSAN rail corridor is the second



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Regional Location Map

DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY ENVIRONMENTAL CONSTRAINTS REPORT

HELIX Environmental Planning

N 0 8 Miles

Figure 1

highest in passenger travel on the entire Amtrak-operated system. Also known as Amtrak's *Pacific Surfliner* corridor, it serves Southern California's key coastal population centers and two of the state's most congested regions: Los Angeles and San Diego.

The LOSSAN corridor annually carries 4.5 million commuter rail (*COASTER* and *Metrolink*) passengers and 2.7 million Amtrak intercity and long-distance (*Pacific Surfliner*) passengers. In addition, BN&SF Railway and Union Pacific operate freight trains along the LOSSAN corridor.

1.2 LOS ANGELES TO SAN DIEGO PROPOSED RAIL CORRIDOR IMPROVEMENTS PROGRAM EIR/EIS

In 2009, the California Department of Transportation and Federal Railroad Administration (FRA) completed a Program EIR/EIS that evaluated improvements to the 125-mile-long Los Angeles to San Diego portion of the LOSSAN corridor. The purpose of the proposed improvements is to relieve the growing capacity and congestion constraints on intercity travel using existing highway and passenger rail infrastructure between Los Angeles, Orange, and San Diego Counties. Rail improvements evaluated in the Program EIR/EIS included various alternative alignments; improvements to existing stations; new stations; and design options including at-grade rail, tunnels, and trenches.

Specific to the current study area, the Program EIR/EIS' preferred alternative considered two alternative alignments, as indicated in Table 1, below:

Table 1. Del Mar Double track Options Considered in the Program EIR/EIS

Tunnel under Camino Del Mar; crosses San Dieguito and Los Peñasquitos Lagoon	Double tracking via a tunnel underneath Camino Del Mar. Tunnel would begin at Jimmy Durante Boulevard, and daylight at Carmel Valley Road where tracks would then connect with the existing alignment across Los Peñasquitos Lagoon. The existing rail track on the bluffs would be removed from service.
Tunnel along Interstate 5	Double tracking via a tunnel that would run under Interstate 5 and daylight along the southern boundary of San Dieguito Lagoon. Tracks would reconnect with the existing rail at-grade near the Del Mar race track. The existing rail track on the bluffs would be removed from service.

Source: Los Angeles to San Diego Proposed Rail Corridor Improvements Program Environmental Impact Report/Environmental Impact Statement (2009)

Based on the analysis provided in the Program EIR/EIS, the California Department of Transportation and the FRA determined both alignment options listed in the above table should be carried forward for project-level analysis prior to making alignment option decisions. The alternatives listed in the above table and evaluated programmatically in the EIR/EIS correspond generally to the Camino Del Mar and Interstate 5 alignments evaluated in this constraints report. The two alignments that generally follow Crest Canyon and are roughly halfway between Camino Del Mar and Interstate 5 were developed following the completion of the Program EIR/EIS and were therefore not evaluated in that document. Nothing in the Program EIR/EIS precludes the future, project-specific analysis of new alternatives. Readers should also note that while this environmental constraints report is a step toward the ultimate analysis of alternative double track alignments between the Del Mar Fairgrounds and Sorrento Valley pursuant to the National Environmental Policy Act (NEPA) and, if required, California Environmental Quality Act (CEQA), it is not the project-specific analysis of those alternatives that would be required prior to adopting and constructing a new rail alignment through/under the City of Del Mar and/or the City of San Diego's Torrey Pines Community.

In addition to NEPA and potentially CEQA compliance, a wide range of other environmental approvals and permits could be required for any of the alternative alignments, including a Coastal Consistency Certification/Determination, Clean Water Act Section 404 Individual Permit, Clean Water Act Section 401 Water Quality Certification, federal Endangered Species Act Section 7 Consultation and Incidental Take Permit, and, potentially, California Fish and Game Code Section 1602 Streambed Alteration Agreement, among others.

1.3 PURPOSE OF AND NEED FOR THE PROPOSED DOUBLE TRACK PROJECT BETWEEN THE DEL MAR FAIRGROUNDS AND SORRENTO VALLEY

The purpose of the proposed double track project between the Del Mar Fairgrounds and Sorrento Valley is to bypass the existing single-track rail alignment along the Del Mar Bluffs with a new alignment that can accommodate two main tracks. The new double track alignment is needed in order to improve the capacity of the San Diego County portion of the LOSSAN rail corridor and to reduce the duration of travel between stations that are separated by the single-tracked Del Mar bluffs. This new alignment is also needed to remove the rail corridor from the eroding Del Mar Bluffs.

When the Program EIR/EIS was certified, 51 percent of the LOSSAN Rail Corridor in San Diego County contained only a single track; this has since been reduced to 46 percent. Sharing the track leads to delays—most obviously because if trains are headed in opposite directions, one train must wait on a side track until the other train has passed. Single-track rail corridors also reduce flexibility to deal with equipment problems—no rail traffic can pass if a train is disabled on a single track—and constrain the hours of operation for each type of service (intercity, commuter, and freight). SANDAG's 2050 Regional Transportation Plan (2050 RTP) calls for double tracking the LOSSAN corridor within San Diego County. (The 2050 RTP also specifically includes "building the Del Mar Tunnel," noting that "Environmental and alternative analyses need to be conducted before construction of the Del Mar Tunnel… can move forward.")

In evaluating the potential to install a second main track along the Del Mar Bluffs, the Program EIR/EIS determined that:

> An at-grade second track along the coastal bluffs in Del Mar would compound existing barrier and safety factors…. In addition, since the bluffs are continually eroding, it was apparent that any double tracking alternative in this location would require significant excavation work to stabilize the bluff-top. Stabilization would also require structures that would create substantial visual impacts and likely require significant on-going maintenance efforts to address erosion and drainage concerns. Therefore, this option was eliminated due to high construction and operational impacts and costs.

Accordingly, the evaluation of alternatives focused on new alignments that would connect to the existing LOSSAN rail corridor to the north and south of the Del Mar Bluffs.

1.4 CONSTRAINTS ANALYSIS METHODS

This environmental constraints report evaluates biological resources, noise and vibration, air quality and greenhouse gases, land use, cultural resources, geology and soils, water quality/hydrology, and paleontological (fossil) resources. Visual quality will be evaluated in the future pending additional development of preliminary alternative alignment designs.

For the topics of biological resources, water quality/hydrology, and paleontological resources, the focus of the constraints analysis is on the potential for a given alternative alignment to affect the respective resource. The assessment of land use constraints addresses the extent to which an alternative alignment would require the removal of existing land uses and/or be inconsistent with adjacent planned uses. The analyses of noise/vibration and air quality/greenhouse gases focus on the potential for project-related emissions to affect the surrounding community, and the focus of the geology/soils analysis is on whether there are existing geology/soils constraints that would make an alternative infeasible from a geotechnical standpoint.

For each resource or issue area, existing (baseline) conditions are described and environmental constraints are discussed in narrative format and assessed as high, medium or low. Given the size of the project, the engineering and construction issues associated with a tunnel large enough to accommodate double train tracks, and related project features such as vents and safety access shafts, a case could be made that for virtually every issue area and every alignment addressed in this report, the constraint level is high. Ranking every topic and alignment in this report as having a high constraint would provide a conservative estimate of the environmental issues to be faced by future double track construction and operation, but would not be useful in helping decision-makers and members of the public in comparing the relative environmental merits and drawbacks of each alignment. Accordingly, a comparative approach is used. For example, each of the alternatives would generate some construction noise—probably round-the-clock—near noise sensitive land uses such as residences, and this typically warrants assessment of a high noise and vibration constraint. However, in light of the greater number of noise-sensitive land uses that would be affected by construction of the Camino Del Mar Alignment when compared to the Crest Canyon or Interstate 5 alignments, construction of the Camino Del Mar Alignment is assessed as having a high noise and vibration constraint, whereas construction of the Crest Canyon or Interstate 5 alignments is assessed as having a medium noise and vibration constraint (see Section 3.2 for the Noise and Vibration constraints analysis.) For some issue areas such as paleontological resources, however, the constraints facing each alignment are too similar to warrant the assessment of different constraint levels for different alignments.

Based on the preliminary nature of the alignment design and the anticipated timeframe before a preferred alignment is selected and project-specific environmental impact analysis is started, no quantification of impacts or ranking of alternative alignments is provided in this report. This report also does not address the removal of the existing railroad tracks from the Del Mar Bluffs because this removal would occur under each of the alternatives evaluated in this report and, therefore, the constraints facing track removal from the bluff would not affect the future selection of a double track alignment from the range of potential alternatives. The impacts and benefits of track removal from the Del Mar Bluffs would, however, be addressed in the future project-specific environmental analysis of the alternative alignments between the Del Mar Fairgrounds and Sorrento Valley.

2.0 PROJECT ALTERNATIVES

Five alternative alignments have been developed for evaluation, with the alternatives' names broadly reflective of the feature that would be tunneled under for that alternative: (1) Camino Del Mar, (2) Crest Canyon Higher Speed, (3) Crest Canyon, (4) Interstate 5, and (5) Interstate 5 East. Each of these is summarized below.

2.1 CAMINO DEL MAR ALIGNMENT

The Camino Del Mar Alignment extends 5.0 miles from the northerly abutment of the proposed new double track San Dieguito River Bridge to the northern limits of the Sorrento Valley Double Track Project (see Figure 2). The Camino Del Mar Alignment follows the existing railroad right of way south from the southerly abutment of the proposed San Dieguito River bridge for approximately 1,800 feet. At that point the alignment leaves the right of way and crosses Jimmy Durante Boulevard. The railway would be constructed within a double box structure. Jimmy Durante Boulevard would be raised to pass over the top of the railroad structure. The railway alignment would continue south following the Camino Del Mar right of way. The new railway would be constructed in a double concrete box structure 10 feet to 70 feet below the existing

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Camino Del Mar Alignment

DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY ENVIRONMENTAL CONSTRAINTS REPORT

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N 0 1,700 Feet

Figure 2

street grade. Most of the construction activities would be completed below a temporary deck structure to minimize construction impacts as further described in this section. The tunnel segment would be approximately 10,200 feet long. The railway alignment would leave the public street right of way south of Carmel Valley Road, at which point the tunnel segment would end at a portal structure in hillside east of the North Torrey Pines Road Bridge and transition to a bridge structure (see Figure 2). The railway alignment would curve easterly and return to the existing railway alignment and right of way through Los Peñasquitos Lagoon to meet the proposed Sorrento Valley Road Double Track Project. A combination of bridge structure and berm would be constructed in the lagoon. The bridge section would include two single track structures with 26-foot track centers. Where the existing graded berms would remain, the sections would be widened to accommodate the double tracking and raised above the 100-year water surface elevation. The single track bridge would be reconstructed to provide clearance above the 100-year water surface elevation. With the increased length of structure, the total graded footprint for the berms within the lagoon would be reduced compared to the existing condition.

The Camino Del Mar Alignment would cross existing public streets and require realignment of existing roads and utilities. Jimmy Durante Boulevard would be realigned vertically to cross over the top of the concrete box structure. Commercial and residential properties adjacent to Jimmy Durante Boulevard would be impacted by the higher roadway alignment. Existing sewer, water, gas and storm drain facilities would be relocated to avoid conflicts with the railway structures. Grading and construction of access roads would be required at each of the portals. Existing utilities within and crossing Camino Del Mar would be impacted on a temporary basis.

There are two possible means by which air pollutants could be vented from the tunnel and emergency access provided for passengers: (1) at the tunnel portals only, or (2) using the tunnel portals in combination with vertical shafts leading to the ground surface at locations along the tunnel alignment between the portals.

It may be possible to locate the air intakes, exhaust vents, and emergency access entrances/exits only at the portals, with no requirement for shafts along the tunnel alignment. Ducts and fans would be used to bring fresh air into the tunnel interior and expel air via vent structures at (or very near to) the portals. Similarly, it may be possible to provide safe emergency access (exit routes) for passengers via an additional parallel tunnel with several interior connections to the train tunnels and emergency entrances/exits leading to the surface located only at the portals.

Alternatively, air pollutants would be vented at the portals with air intakes located along the tunnel alignment. Under this approach, a ducted ventilation system would be used to limit the number of vent shafts at the surface. More specifically, two vent shafts with a cross sectional area of 400 square feet each would be constructed near each end of the tunnel alignment and two intake shafts would be constructed near the middle of the tunnel alignment. A total of eight access structures would be constructed to the surface for emergency egress. To be conservative, the analysis of potential environmental constraints assumes that the tunnel would use the ducted system with two air intakes and eight emergency access shafts along Camino Del Mar. In the event that these are not required, the environmental constraints associated with the non-portal air intakes and emergency access shafts would be avoided.

Construction of the underground portion of this alignment would entail an approach referred to as the "cut and cover box construction" method. A similar method was used for the San Diego Trolley tunnel at San Diego State University. Using this method, the tunnel would be constructed in approximately 50-foot-long sections. To start each section, shafts would be drilled every 10 feet along each side of the alignment to approximately 15 to 20 feet below the bottom of the planned tunnel. Each shaft would be filled with an I-beam and concrete. The existing 50-foot-long section of Camino Del Mar between the shafts would then be demolished and replaced with a metal deck covered with asphalt—this would allow vehicles to use the roadway while excavation is being done beneath the roadway. Soil and rock below the deck would be removed and the tunnel would be constructed.

After completion of each 50-foot-long cut-and-cover box segment, any drainage facilities or other underground utilities temporarily affected/re-routed by construction would be replaced, the excavation area above the box would be backfilled with suitable material, the vertical piles would be cut down 8 feet to 10 feet below the top of the existing ground, and the roadway would be reconstructed to its final condition.

2.2 CREST CANYON HIGHER SPEED ALIGNMENT

Two Crest Canyon alignments are evaluated in this constraints study. The "Crest Canyon Higher Speed Alignment" has a generally straighter alignment, with less tight curves than the "Crest Canyon Alignment" described below. The straighter alignment would allow trains to maintain higher operating speeds in comparison to the Crest Canyon Alignment.

The Crest Canyon Higher Speed Alignment extends 4.8 miles from the northerly abutment of the proposed new double track San Dieguito River bridge to the northern limits of the Sorrento Valley Double Track Project (see Figure 3). This alternative would not require structural modifications to the double track bridge proposed to be constructed over the San Dieguito River as part of the San Dieguito River Bridge Replacement, Double Track, and Del Mar Fairgrounds Special Events Platform Project. The alignment follows the existing railroad right of way from the southerly abutment of the proposed new double track bridge over the San Dieguito River south for approximately 1,300 feet. At that point the alignment leaves the right of way and crosses Jimmy Durante Boulevard on a graded section approximately 10 feet above the existing roadway. Jimmy Durante Boulevard would be raised to pass over the top of the railroad

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Crest Canyon Alignments

DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY ENVIRONMENTAL CONSTRAINTS REPORT

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N 0 1,700 Feet

Figure 3

alignment. A 500-foot-long segment of cut-and-cover box would be constructed as a transition to a three-tunnel section. Two 33.6-foot diameter tunnels would be constructed to accommodate the railway. An 18.5-foot diameter center tunnel would be constructed to accommodate emergency access. The tunnel segment would be approximately 13,200 feet in length with depths up to 270 feet. The alignment would pass under existing private property and continue under Portofino Road to the southerly portal located approximately 400 feet south of Portofino Road. A 300-foot-long cut-and-cover box section and open trench would transition from the tunnel section to a bridge section. The railway alignment would continue southerly on two single track bridge structures for approximately 6,300 feet and would include the replacement of an existing railroad bridge. The remainder of the alignment would be constructed on a berm to meet the double track alignment constructed as part of the Sorrento Valley Double Track Project. The new berm would be widened and raised to provide clearance above the 100-year water surface elevation. It is anticipated that, following completion of the new double track alignment, the existing single track railroad berm through Los Peñasquitos Lagoon would be removed such that there would be a net decrease in the extent of railroad berm within the lagoon.

This constraints analysis conservatively assumes that air intakes and/or vents may need to be located at the ground surface along the tunnel alignment (as opposed to only being located at the tunnel portals). In the event that these are not required, the environmental constraints associated with the air intakes/vents along the tunnel alignment would be avoided.

2.3 CREST CANYON ALIGNMENT

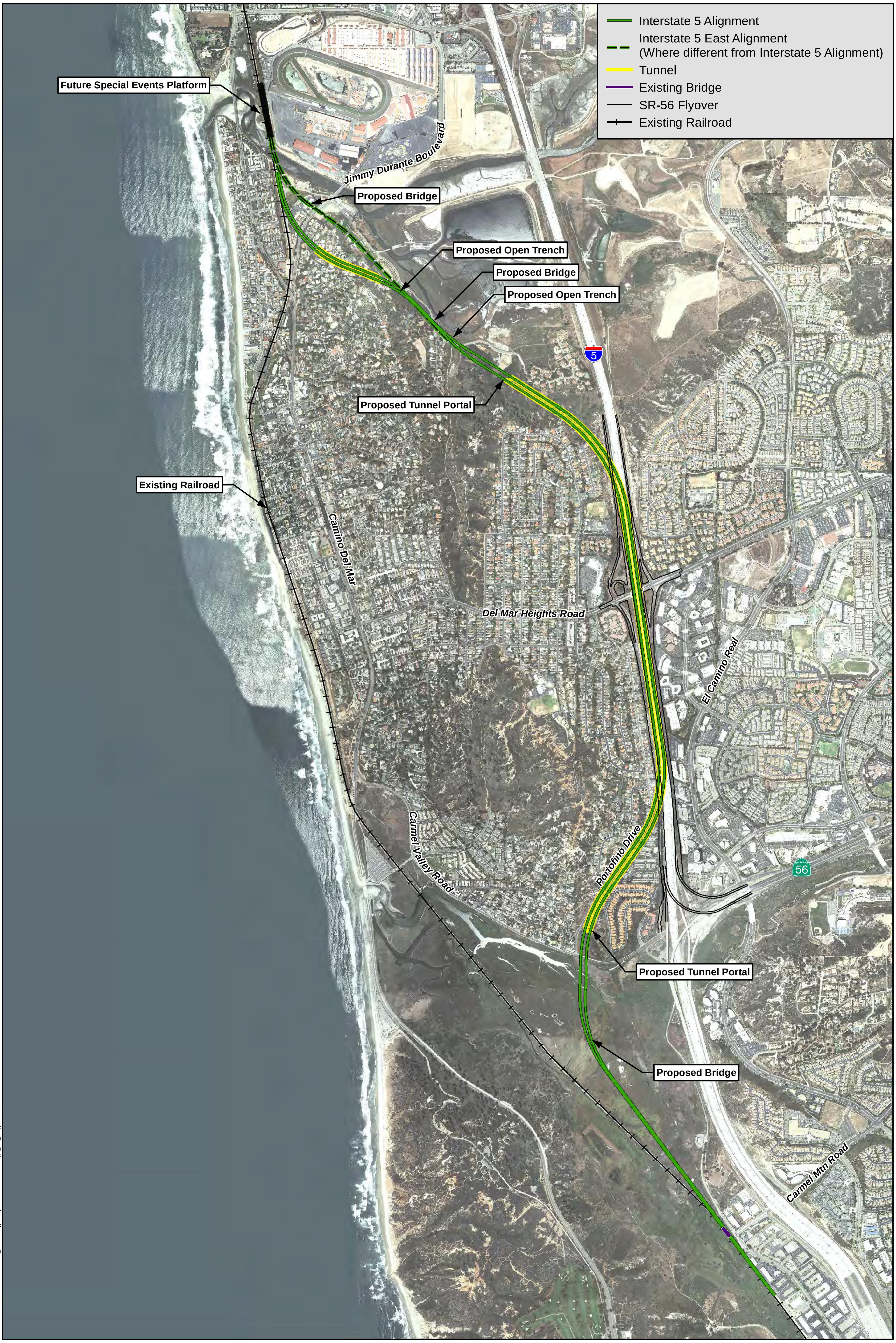
The Crest Canyon Alignment would extend 4.9 miles from the northern end of the proposed new double track San Dieguito River Bridge to the northern limits of the Sorrento Valley Double Track Project (see Figure 3). Approximately 600 feet of the proposed San Dieguito River bridge would be removed and reconstructed. The alignment would shift easterly across the City of Del Mar Public Works facility, through the North County Transit District Wye (i.e., a currently unused spur of railroad right-of-way), then through a commercial parcel and across Jimmy Durante Boulevard. This first segment would be constructed on two single-track bridge structures with clearance over Jimmy Durante Boulevard. The railway alignment would continue for approximately 2,000 feet in a graded open trench section generally parallel to and above Racetrack View Drive. The railway alignment would enter a three-tunnel section that generally follows the Crest Canyon Open Space avoiding private property. Two 33.6-foot-diameter tunnels would be constructed to accommodate the railway. An 18.5-foot-diameter center tunnel would be constructed to provide emergency access. The tunnel segment would be approximately 12,700 feet long with depths up to 250 feet. The alignment would pass under Portofino Drive with the southerly portal located in the open space hillside to the east. A cut-and-cover box section would transition to two single-track bridge structures crossing Carmel Valley Road. The alignment would continue southerly on bridge structures for approximately 6,200 feet and include the replacement of an existing bridge just north of the Sorrento Valley Double track Project limits. The remainder of the alignment would be constructed on a berm to meet the double track alignment constructed as part of the Sorrento Valley Double Track Project. The new berm would be widened and raised to provide clearance about the 100-year water surface elevation. Portions, or all, of the existing single track railroad berm through Los Peñasquitos Lagoon would be removed such that there would be a net decrease in the extent of railroad berm within the lagoon.

This constraints analysis conservatively assumes that air intakes and/or vents may need to be located at the ground surface along the tunnel alignment (as opposed to only being located at the tunnel portals). In the event that these are not required, the environmental constraints associated with the air intakes/vents along the tunnel alignment would be avoided.

2.4 INTERSTATE 5 ALIGNMENT

The Interstate 5 Alignment extends 5.3 miles from the northerly abutment of the proposed new double track San Dieguito River bridge to the northern limits of the Sorrento Valley Double Track Project (see Figure 4). No structural modification to the proposed new double track bridge would be required under this alternative. The Interstate 5 alignment would follow the existing railroad right of way from the proposed San Dieguito River bridge's southerly abutment south for approximately 1,200 feet on a raised berm. At that point the alignment would leave the right of way and cross Jimmy Durante Boulevard at an elevation approximately 10 feet above the existing roadway. The railway alignment would continue southeasterly in a twin-bored tunnel section for approximately 1,400 feet, then through a graded open trench for 1,050 feet, crossing Racetrack View Drive on two single-track bridge structures with 18 feet minimum clearance above the roadway. The alignment would continue southeasterly in a graded open trench for 950 feet until there is adequate cover for a tunnel section. Two 33.6-foot-diameter bored tunnels for railway and one 18.5-foot-diameter tunnel for emergency access would be constructed under Interstate 5 and Portofino Road for a length of nearly 12,000 feet. The cover under Interstate 5 varies from 80 feet to 120 feet and under Portofino Road varies from 50 feet to 80 feet. The southerly tunnel portal would be located in the hillside east of Portofino Road. The alignment would continue on two single bridge structures for approximately 7,000 feet and would replace an existing bridge just north of the Sorrento Valley Double Track Project limits. The remainder of the alignment would be constructed on a berm to meet the double track alignment constructed as part of the Sorrento Valley Double Track Project. The new berm would be widened and raised to provide clearance above the 100-year water surface elevation. It is anticipated that the existing single track railroad berm through Los Peñasquitos Lagoon would be removed such that there would be a net decrease in the extent of railroad berm within the lagoon.

This constraints analysis conservatively assumes that air intakes and/or vents may need to be located at the ground surface along the tunnel alignment (as opposed to only being located at the



Interstate 5 Alignments

DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY ENVIRONMENTAL CONSTRAINTS REPORT

Figure 4

HELIX Environmental Planning

N 0 1,700 Feet

I:\PROJECTS\D\DEA\DEA-04.09_SDRBridge\Map\ENV\Constraints\Fig4_I-5_Alignment.mxd DEA-04.09 11/03/14 -RK tunnel portals). In the event that these are not required, the environmental constraints associated with the air intakes/vents along the tunnel alignment would be avoided.

2.5 INTERSTATE 5 EAST ALIGNMENT

This alignment would be similar to the Interstate 5 Alignment except that this alternative would require modifications to the San Dieguito River double track railroad bridge and would follow a more easterly route in its northernmost segment, along the edge of the San Dieguito Lagoon (see Figure 4).

The Interstate 5 East Alignment would improve speed and lessen some land use impacts compared to the Interstate 5 Alignment. This alternative would remove approximately 650 feet of the San Dieguito River Bridge and shift the first 7,000 feet of the double track alignment to the east of the Interstate 5 Alignment. The majority of the railway alignment from the San Dieguito River Bridge to the northerly tunnel portal would be constructed on two single track bridge structures. Three shorter segments of graded open trench would be constructed as dictated by the existing elevations just east of Jimmy Durante Boulevard and north of the tunnel portal. From this point south, the Interstate 5 East Alignment would follow the Interstate 5 Alignment to meet the Sorrento Valley Double Track Project. The length of the Interstate 5 East Alignment would be 5.2 miles, similar to the Interstate 5 Alignment.

This constraints analysis conservatively assumes that air intakes and/or vents may need to be located at the ground surface along the tunnel alignment (as opposed to only being located at the tunnel portals). In the event that these are not required, the environmental constraints associated with the air intakes/vents along the tunnel alignment would be avoided.

3.0 ENVIRONMENTAL CONSTRAINTS

3.1 BIOLOGICAL RESOURCES

3.1.1 Resource Overview

Information on existing biological resources conditions, as described below for each potential alignment, was obtained from SANGIS mapping, the California Natural Diversity Database, and other sources as cited below.

3.1.2 Camino Del Mar Alignment

Existing Conditions

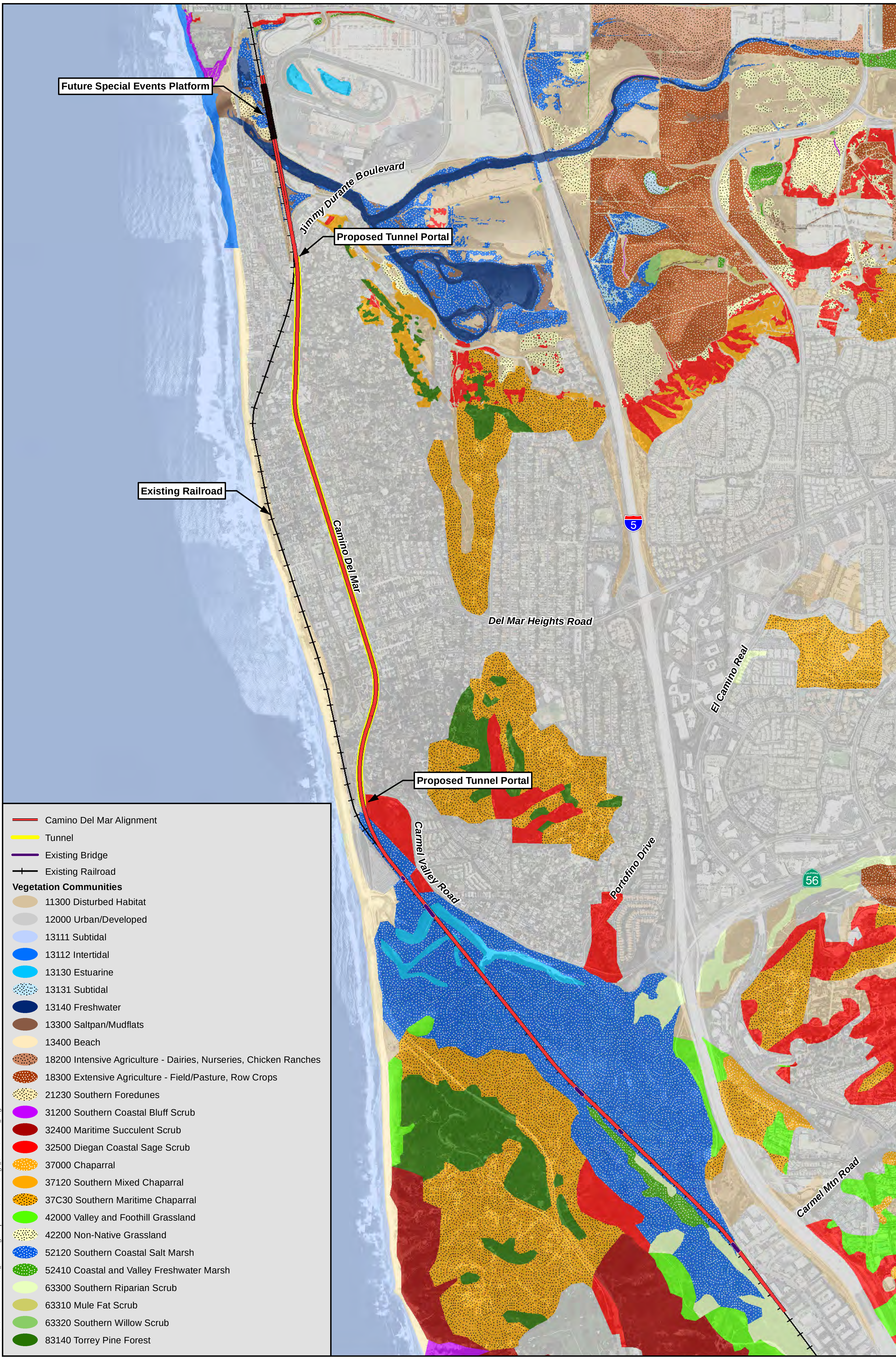
As shown on Figure 2, the tunnel portion of this alignment traverses a largely developed urban neighborhood with little natural resource value, while the above-ground portion extending from the southern tunnel portal to the connection with the Sorrento Valley double track traverses sensitive upland and wetland vegetation communities (see Figure 5).

The proposed tunnel alignment under Camino Del Mar supports very little native vegetation or other habitat that would be considered sensitive. There are landscaped areas along the tunnel alignment with trees that could support bird nests protected pursuant to the Migratory Bird Treaty Act (MBTA), but with the potential exception of any Torrey pines (*Pinus torreyana*) in the area, these trees are not biologically unique and in most instances are not native.

Diegan coastal sage scrub is present near the southern end of the tunnel alignment, and several observations of coastal California gnatcatcher (*Polioptila californica californica*), federally listed as Threatened, have been recorded in this area. The federally listed as Endangered Pacific pocket mouse (*Perognathus longimembris pacificus*) also has been recorded from the vicinity of the potential southern portal.

South of the southern tunnel portal, this alignment follows the existing railroad tracks through Los Peñasquitos Lagoon (also referred to as Los Peñasquitos Marsh). The lagoon supports salt marsh and freshwater marsh habitats on both sides of the railroad, which is located on a raised bed and four bridges where it passes through the lagoon/marsh. Toward the southern end of the lagoon, the existing railroad tracks also pass through riparian scrub habitat. Despite the four bridges, the existing railroad bed serves as a barrier to water flows through the lagoon, altering the lagoon's hydrology. Salt marsh, freshwater marsh, and riparian scrub are considered sensitive wetland habitats—this is especially true for salt marsh due to the relatively small amount of this habitat remaining in Southern California and the limited opportunities to create new or enhance existing saltwater marsh habitat as mitigation. The federally listed light-footed clapper rail (*Rallus longirostris levipes*) and Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) are known to nest in the lagoon area, and the lagoon may also be used as foraging habitat for the federally listed western snowy plover (*Charadrius nivosus nivosus*) and California least tern (*Sterna albifrons browni*).

The state-owned portions of Los Peñasquitos Lagoon are part of the Torrey Pines State Natural Reserve and are further designated as a State Preserve (Peñasquitos Marsh Natural Preserve) in recognition of this area's high biological resource value. The City of San Diego Multi-Habitat Planning Area (MHPA) encompasses the majority of the existing railroad alignment through Los Peñasquitos Lagoon. The MHPA is the City's planned habitat preserve within the Multiple Species Conservation Program (MSCP) subarea that encompasses the City. The MSCP is a comprehensive, long-term habitat conservation planning program that covers approximately 900 square miles in southwestern San Diego County pursuant to the federal and California Endangered Species Acts and the California Natural Community Conservation Planning Act.



Vegetation Communities - Camino Del Mar Alignment

DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS
AND SORRENTO VALLEY ENVIRONMENTAL CONSTRAINTS REPORT

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N 0 1,700 Feet

Figure 5

The *Wildlife Management Plan for Torrey Pines State Reserve* (California Department of Parks and Recreation 1997) identifies the following habitat management goals related to the railroad tracks and berm that bisect the lagoon:

> Advocate the construction of wildlife underpasses at various points along the railroad tracks running through the park. Locations of underpasses could be chosen to also facilitate restoration of tidal influences in the northeast portion of the lagoon…
>
> Advocate restoration of tidal flows into the eastern portions of the lagoon to enhance water/and habitat quality for Clapper Rails and the ecosystem, by creating additional openings through the railroad berm. If these openings were constructed to be wider than the channel, other terrestrial wildlife could also benefit from the safer passage.

Constraints

The tunnel portion of this alternative has a low biological resources constraint. The northern portal and the vents/access points along the tunnel would be in an urban community with little natural resource value. Should any trees require removal during tunnel construction, it would be relatively easy to avoid impacts to nesting birds by removing the trees prior to or after the avian nesting season. (No impacts to Torrey pines are anticipated.) At the southern portal of the potential tunnel alignment, the new above-ground railroad tracks would affect Diegan coastal sage scrub and could result in impacts to the federally listed coastal California gnatcatcher and potentially the Pacific pocket mouse, if still extant in this area.

The biological resource constraints associated with expanding the existing single-rail track through Los Peñasquitos Lagoon would be high. As noted above, the lagoon is a protected resource that supports sensitive salt marsh habitat and federally listed bird species. While the State Preserve and City of San Diego MHPA designations encompassing most of Los Peñasquitos Lagoon would not likely affect actions taken within the existing railroad right-of-way through the lagoon, these designations reflect the high value placed on this habitat and its sensitivity to impacts. Mitigating rail bed expansion impacts to the lagoon would be difficult. Ideally, mitigation would include the creation of new salt marsh habitat within the historical limits of the lagoon; however, there are extremely limited opportunities to accomplish this goal. Installing new double track bridges and removing the existing berm in sections of the lagoon could allow for creation of new salt marsh habitat such that there would be a net gain in this habitat once the double track is installed in the lagoon. This approach would also improve the hydrological connectivity between the portions of the lagoon bisected by the existing raised railroad track bed. Additional mitigation could include enhancing portions of the lagoon and its watershed that have been degraded through human activity and encroachment of native species.

In summary, the Camino Del Mar Alignment faces a high biological resources constraint.

3.1.3 Crest Canyon Higher Speed Alignment

Existing Conditions

The Crest Canyon Higher Speed Alternative alignment traverses upland and wetland habitat, as shown on Figure 6. Depending on final design, the northern portal of the Crest Canyon tunnel would likely occur within a developed area having little natural resource value. For the tunnel portion of this alternative, the only impacts at the surface would be where the vents and access points are located. The vents/access points would be in residential neighborhoods with primarily ornamental (low biological resource value) landscaping and in Crest Canyon, which supports southern mixed chaparral, southern maritime chaparral, Diegan coastal sage scrub, and Torrey pine forest.

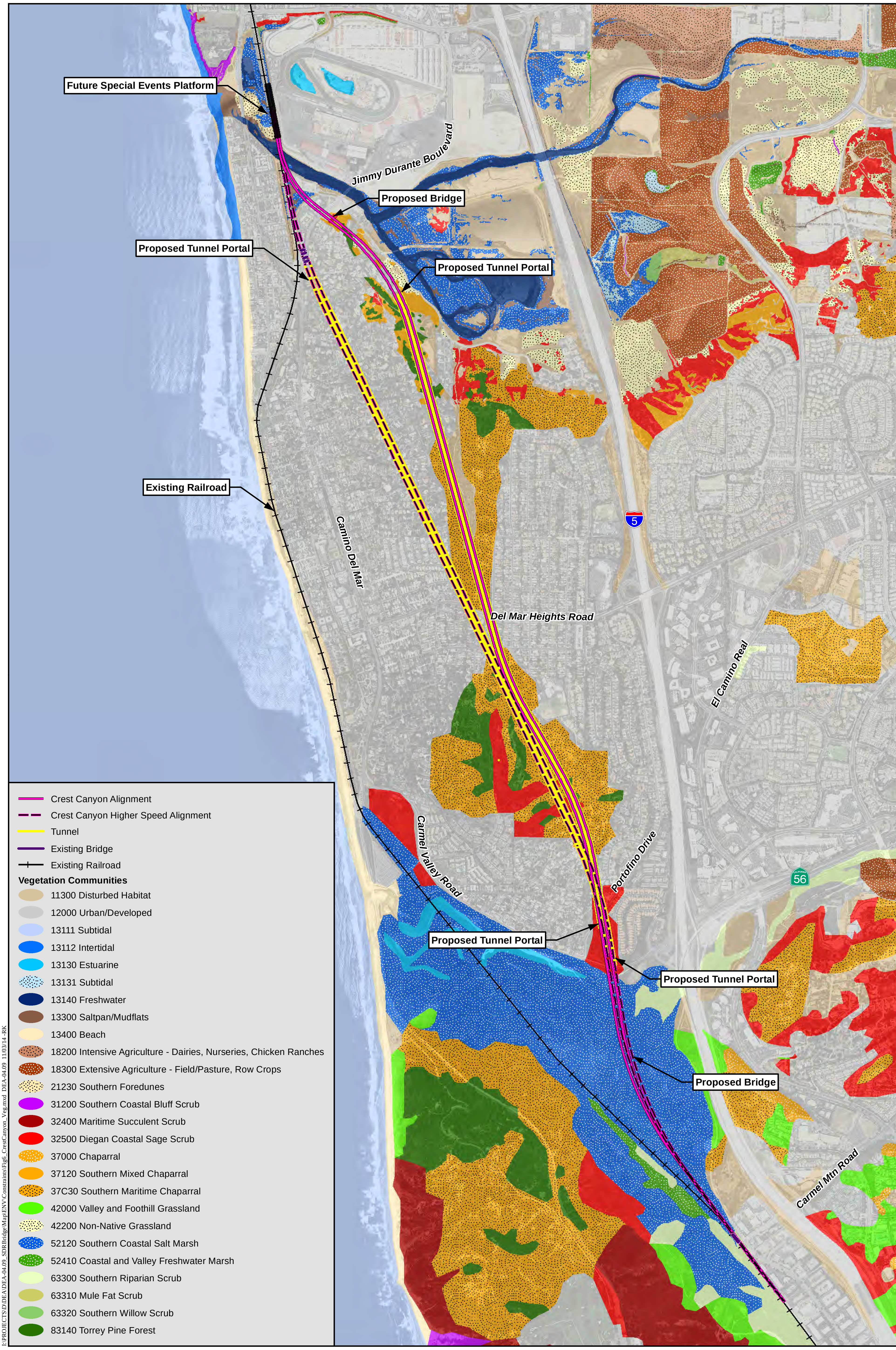
Torrey pines are the rarest and most geographically restricted pines in North America, and Torrey pine forest habitat is unique to (1) Torrey Pines State Reserve and the City of San Diego's Torrey Pines Community, (2) Crest Canyon and nearby residential areas in the cities of San Diego and Del Mar, and (3) on Santa Rosa Island (the island population is a subspecies) (Torrey Pines Natural Reserve 2011). Given the extremely small amount of Torrey pines forest that exists, this habitat has an extremely high level of impact sensitivity.

Southern maritime chaparral, although not as rare as Torrey pines forest, is also a sensitive vegetation community given its limited range and the plant and animal species that it supports. Rare plants known to occur in southern maritime chaparral include the federally listed Endangered Del Mar manzanita (*Arctostaphylos glandulosa* Eastw. ssp. *crassifolia*). As a reflection of southern maritime chaparral's high biological resource value, the City of San Diego designates it as Tier 1 habitat—the most sensitive of the four tiers established by the City.

The southern tunnel portal would be located within an undeveloped parcel containing upland habitat just south of Portofino Road. From there, the alignment would traverse Los Peñasquitos Lagoon on elevated structures (bridges), with the southernmost segment on a berm where the new tracks would tie into the Sorrento Valley Double Track Project. The *Wildlife Management Plan for Torrey Pines State Reserve* (California Department of Parks and Recreation 1997) makes specific reference to the undeveloped parcel that would house the southern tunnel portal, citing the following as a management goal:

> Protect and enhance the Portofino corridor as the only habitat link between the Extension and the Lagoon area, by maintaining the area northeast of the junction of Portofino and Carmel Valley Road in open space through easement or acquisition

As noted for the Camino Del Mar Alignment, Los Peñasquitos Lagoon is a sensitive biological resource that encompasses salt marsh habitat and hosts populations of federally listed bird and plant species. The section of lagoon traversed by the Crest Canyon Higher Speed Alignment is further east and supports more cord grass (*Spartina foliosa*) than the segment of lagoon traversed



Vegetation Communities - Crest Canyon Alignments

DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY ENVIRONMENTAL CONSTRAINTS REPORT

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N 0 1,700 Feet

Figure 6

by the Camino Del Mar Alignment and, as a result, is more likely to support light-footed clapper rail. Portions of Crest Canyon are within the City of San Diego's MHPA, as is the vast majority of the potential above-ground alignment within Los Peñasquitos Lagoon.

<u>**Constraints**</u>

The northern portion of the Crest Canyon Higher Speed Alignment faces relatively minor biological resources constraints because this portion of the alignment would be in an urban, developed area with little natural resources value.

The tunnel portion of this alignment would not face biological resource constraints except at the locations of air intakes/vents and at the southern portal. As noted above, air intakes/vents might impact Torrey pines forest or, more likely Southern maritime chaparral habitat, each of which is a City of San Diego-designated Tier 1 habitat. The southern portal would remove much of the native habitat within the undeveloped parcel identified in the *Wildlife Management Plan for Torrey Pines State Reserve* as an important link between Los Peñasquitos Lagoon and the upland habitat to the north.

The high resource value of Los Peñasquitos Lagoon has been previously noted, and any development within the lagoon has the potential to significantly affect sensitive habitat as well as federally and state-protected plant and wildlife species. Within the context of this constraints study, however, the relatively shorter amount of railroad track that would be located within the lagoon, and the fact that the vast majority of this new track would be elevated above the lagoon on bridges, would result in less obstruction to: (1) water flows and (2) wildlife movement in comparison to both the existing condition and the potential expansion of the existing alignment through the lagoon to accommodate a double track (i.e., the Camino Del Mar Alignment).

Removal of the existing railroad tracks, which would follow installation of the new double track alignment, would result in additional short-term disruption (impacts) within the lagoon; however, there would be a substantial long-term benefit to having the existing berm that bisects the lagoon removed.

In light of the comparatively lower, but still substantial, long-term effects of this alternative on Los Peñasquitos Lagoon, this alternative is rated as having a medium biological resources constraint.

3.1.4 Crest Canyon Alignment

<u>**Existing Conditions**</u>

The existing conditions of the Crest Canyon Alignment are similar to those of the Crest Canyon Higher Speed Alignment except for the portion of the alignment from San Dieguito River south and east to the northern tunnel portal. As described above, the Crest Canyon Alignment would modify the planned San Dieguito River double track railroad bridge and utilize a more northerly northern tunnel portal than the Crest Canyon Higher Speed Alignment.

This section of the San Dieguito River supports intertidal and salt marsh habitat (see Figure 6). The alignment also would traverse a relatively isolated "triangle" of salt marsh and salt pan/ mudflats. Salt marsh and salt pan/mudflats are considered sensitive habitats due to the relatively small amount of these habitats that remain and because geographic constraints and development patterns limit opportunities for the enhancement of existing, or creation of new, salt marsh and salt pan/mudflats habitat.

This alternative would also entail an above-ground section through the canyon south of San Dieguito Drive. This area supports southern mixed chaparral, non-native grassland, ornamental landscaping, and development (e.g., homes and driveways). This section of the alignment also roughly parallels the southern boundary of San Dieguito Lagoon. This portion of the San Dieguito Lagoon is known to support light-footed clapper rail, Belding's savannah sparrow, and California least tern.

From the northern tunnel portal south, the biological resources associated with this alignment would be similar to those described above for the Crest Canyon Higher Speed Alignment.

Constraints

The Crest Canyon Alignment would face a slightly higher biological resources constraint than the Crest Canyon Higher Speed Alignment because the northern portion of the Crest Canyon Alignment would affect intertidal, salt marsh, and pan/mudflats habitat, as well as potentially southern mixed chaparral and non-native grassland.

From an operations standpoint, this alternative would entail train operations in closer proximity to San Dieguito Lagoon, with a correspondingly higher potential for train noise and operations to disrupt wildlife. Once construction is complete, only approximately 1,500 feet of the alignment would be above ground in proximity of San Dieguito Lagoon, minimizing the potential indirect effects of train operations on wildlife within San Dieguito Lagoon.

Although the biological resources impacts of this alternative would be somewhat greater than those associated with the Crest Canyon Higher Speed Alignment, the biological resources constraint is still considered medium in comparison to the Camino Del Mar Alignment for the reasons described for the Crest Canyon Higher Speed Alignment.

3.1.5 Interstate 5 Alignment

Existing Conditions

South of the San Dieguito River, this alignment would briefly follow the existing railroad alignment before heading southeast through a portion of the above-noted triangle of salt marsh, and salt pan/mudflats habitat. From there, the alignment would traverse under residential properties with predominantly non-native ornamental landscaping.

Approximately 3,000 feet of this alignment would be above grade near San Dieguito Drive and roughly parallel the southern boundary of San Dieguito Lagoon which, as noted above, supports light-footed clapper rail, Belding's savannah sparrow, and California least tern. In addition to ornamental and developed habitat, this section of the alignment would traverse Diegan sage scrub and southern maritime chaparral vegetation communities. As noted above, southern maritime chaparral is a sensitive vegetation community that has been designated as Tier 1 habitat by the City of San Diego. Sensitive species recorded in or near this section of Crest Canyon include coastal California gnatcatcher and Pacific pocket mouse and Del Mar manzanita.

Southeast of Crest Canyon, the main tunnel segment passes under more southern maritime chaparral before reaching Interstate 5, which is largely devoid of any sensitive biological resources.

From the southern portal south, Interstate 5 Alignment would be identical to the Crest Canyon Higher Speed Alignment and Crest Canyon Alignment, as described above.

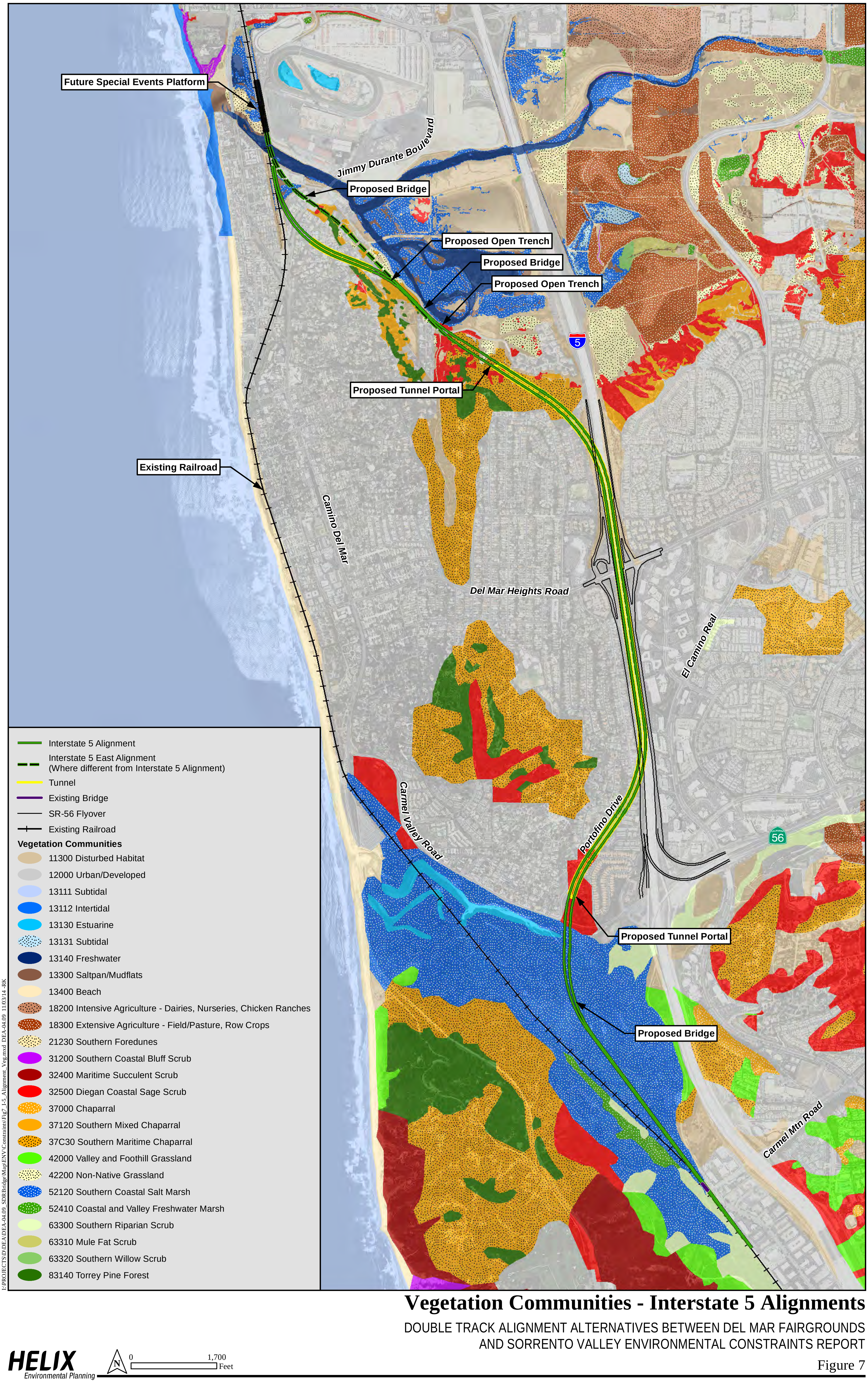
Constraints

The Interstate 5 Alignment would affect more habitat along Crest Canyon and have a greater potential for indirect effects (e.g., noise) on wildlife within the San Dieguito Lagoon than either of the Crest Canyon alignments. Nonetheless, this alternative would have the same impact on Los Peñasquitos Lagoon as the Crest Canyon alignments and would be rated as having a medium biological resources constraint in comparison to the Camino Del Mar Alignment for similar reasons.

3.1.6 Interstate 5 East Alignment

Existing Conditions

Existing conditions for the Interstate 5 East Alignment are almost identical to those described for the Interstate 5 Alignment, except that with the Interstate 5 East Alignment, impacts to the isolated triangle of salt marsh and saltpan/mudflat habitat would be greater, and a longer segment of this alignment (approximately 6,000 feet) parallels the San Dieguito Lagoon (see Figure 7).



Vegetation Communities - Interstate 5 Alignments

DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY ENVIRONMENTAL CONSTRAINTS REPORT

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Figure 7

Constraints

The biological resources constraints for Interstate 5 East Alignment are assessed as medium for similar reasons to those described for Interstate 5 Alignment.

3.2 NOISE AND VIBRATION

3.2.1 Resource Overview

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. *Noise* is defined as loud, unexpected, or annoying sound.

In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receiver, and the propagation path between the two. The loudness of the noise source and obstructions or atmospheric factors affecting the propagation path to the receiver determine the sound level and characteristics of the noise perceived by the receiver. The field of acoustics deals primarily with the propagation and control of sound. A logarithmic scale is used to describe sound pressure level in terms of decibels (dB). The threshold of hearing for young people is about 0 dB, and a doubling of sound energy correlates to a three-dB increase.

The decibel scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness or human response is determined by the characteristics of the human ear. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies. Then, an "A-weighted" sound level (expressed in units of dBA) can be computed based on this information. The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments of the relative loudness or annoyance of a sound, their judgments correlate well with the A-scale sound levels of those sounds. Table 2 describes typical A-weighted noise levels for various noise sources.

Within the context of this constraints report, *vibration* refers more specifically to groundborne vibration, which consists of oscillating waves that move from their source through the ground and can affect adjacent structures. Vibration *frequency* describes how fast an oscillation is occurring, as measured in cycles per second or *hertz* (Hz). The normal frequency range of most groundborne vibration that can be felt generally starts from a low frequency of less than 1 Hz to a high of about 200 Hz (Crocker 2007).

Table 2. Typical Noise Levels		
Common Outdoor Activities	**Noise Level (dBA)**	**Common Indoor Activities**
	--110--	Rock Band
Jet Fly-over at 300 meters (1,000 feet)	--100--	
Gas Lawn Mower at 1 meter (3 feet)	--90--	
Diesel Truck at 15 meters (50 feet), at 80 kilometers per hour (50 miles per hour)	--80--	Food Blender at 1 meter (3 feet); Garbage Disposal at 1 meter (3 feet)
Noisy Urban Area, Daytime Gas Lawn Mower at 30 meters (100 feet)	--70--	Vacuum Cleaner at 3 meters (10 feet)
Commercial Area Heavy Traffic at 90 meters (300 feet)	--60--	Normal Speech at 1 meter (3 feet)
Quiet Urban Daytime	--50--	Large Business Office Dishwasher in Next Room
Quiet Urban Nighttime	--40--	Theater, Large Conference Room (Background)
Quiet Suburban Nighttime	--30--	Library
Quiet Rural Nighttime	--20--	Bedroom at Night, Concert Hall (Background)
	--10--	Broadcast/Recording Studio
Lowest Threshold of Human Hearing	--0--	Lowest Threshold of Human Hearing

Source: Caltrans 2009

As described by the Federal Transit Administration (FTA; 2006)

> The effects of ground-borne vibration include feelable movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, the vibration can cause damage to buildings. Building damage is not a factor for normal transportation projects, with the occasional exception of blasting and pile-driving during construction. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by only a small margin. A vibration level that causes annoyance will be well below the damage threshold for normal buildings.
>
> The vibration of floors and walls may cause perceptible vibration, rattling of items such as windows or dishes on shelves, or a rumble noise. The rumble is the noise radiated from the motion of the room surfaces. In essence, the room surfaces act like a giant loudspeaker causing what is called ground-borne noise….
>
> Ground-borne vibration is almost never annoying to people who are outdoors. Although the motion of the ground may be perceived, without the effects associated with the shaking of a building, the motion does not provoke the same adverse human reaction. In addition, the rumble noise that usually accompanies the building vibration is perceptible only inside buildings.

Some land uses are sensitive to vibration levels that would not cause annoyance to humans, including some research and manufacturing facilities, hospitals with vibration-sensitive equipment, and university research operations. The type of equipment being used at a given location is the largest factor in determining sensitivity to minor vibrations—for example, electron microscopes (and even some optical microscopes) can be sensitive to vibration levels that fall well below the level of human annoyance.

Note under any of the alternatives discussed below, vibration dampeners would be used to minimize the potential for train operations to cause groundborne vibration above and around tunnels.

The FRA and FTA have regulations that address train noise and vibration, and the cities of Del Mar and San Diego have noise ordinances that address allowable construction noise levels and hours (although local ordinances may not be applicable to the project). It would be premature to address compliance with these regulations and ordinances at this time pending the future development of more specific project designs. At this preliminary level of design, it is possible to state that any new or modified railroad alignment would be expected to comply with applicable FRA and FTA regulations, and that if local noise ordinances are applicable, it is likely that variances from the Del Mar and San Diego municipal noise ordinances would be required regardless of which alternative is selected for implementation.

3.2.2 Camino Del Mar Alignment

Existing Conditions

Noise

There are two distinct noise environments along the Camino Del Mar Alignment: (1) the Camino Del Mar segment and (2) the segment through Los Peñasquitos Lagoon.

A noise report prepared for the Del Mar Village Specific Plan, which encompasses a corridor along Camino Del Mar between 9^{th} Avenue and approximately the easterly alignment of 17^{th} Street, found that the main noise sources along Camino Del Mar are traffic, trains, and the commercial operations of businesses along the roadway (Ldn Consulting 2012). Average measured noise levels taken during the day at three locations along Camino Del Mar ranged from 63.5 dB(A) L_{eq} to 66.3 dB(A) Leq.

There are fewer noise sources within the Los Peñasquitos Lagoon segment of this alignment, with train operations typically being the loudest single events, and with traffic on nearby roads—including Interstate 5, Carmel Valley Road, and North Torrey Pines Road—also contributing to ambient noise measurements. Ambient noise measurements are not available for the Los Peñasquitos Lagoon segment; however, they would be expected to be lower than along Camino Del Mar.

Noise-sensitive receptors along the Camino Del Mar portion of this alignment include single and multi-family residences, hotels, restaurants (some with outside seating), medical offices, a school, a library, and recreational open space. Within Los Peñasquitos Lagoon, there are few human noise receptors; however, some wildlife species—especially breeding birds—are considered noise sensitive receptors.

As described in Section 2.1, haul routes would be determined closer to actual construction; however, based on the potential portal locations, it is likely that trucks heading to/from the northern portal would use Jimmy Durante Boulevard and trucks heading to/from the southern portal would use Carmel Valley Road and/or North Torrey Pines Road/Genesee Avenue.

Roughly a dozen single-family residences are located along Jimmy Durante Boulevard south of the San Dieguito River, with few noise-sensitive land uses located between the river and Interstate 5. Carmel Valley Road is abutted on the north by noise sensitive land uses including just over 20 single family residences and a preschool. The potential North Torrey Pines Road/Genesee Avenue route to Interstate 5 includes Scripps Hospital and Scripps Clinic, which are also noise sensitive land uses. This route also passes by a section of Torrey Pines Golf Course; while recreational areas can be considered noise-sensitive in some contexts, the golf course would not be considered as sensitive to nighttime noise because it would out of use during those periods.

Vibration

As noted above, it is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads (FTA 2006). Accordingly, perceptible vibration levels are not typically expected along Camino Del Mar under the current condition. Although not measured for this study, vibrations are expected to be perceptible to persons near the existing railroad tracks when a train passes by, although the vast majority of the existing railroad right-of-way along this alternative alignment is not open to pedestrians.

Few, if any, of the above-noted vibration-sensitive land uses (e.g., research and manufacturing facilities, university research laboratories) exist along Camino Del Mar or would be expected along Camino Del Mar in the future. It is possible, however, that some of the medical offices along this alignment may use vibration-sensitive equipment.

Constraints

Noise

Construction of the Camino Del Mar Alignment would have the potential to generate noise impacts along its entire reach. Once the tunnel is constructed, noise impacts along the alignment would largely be restricted to the portals and, potentially, the tunnel vents. Vent noise impacts would be dependent on the level of fans or other mechanical ventilation equipment present at those locations. For the above-ground portion of this alignment through Los Peñasquitos Lagoon, there would be construction noise associated with the installation of the double track, as well as the ongoing noise of train operations.

Construction. As noted above, tunnel construction is anticipated to occur essentially around-the-clock. Activities at the tunnel portals would include bringing material and equipment to/from the site, loading and unloading material and equipment, hauling away excavated soil and importing high-quality fill, and related activities. To the extent that temporary ventilation is used to vent diesel exhaust at the portals, that ventilation equipment could also generate noise impacts at the portals. The construction noise at the portals would be disruptive and annoying to the residences near the north and south tunnel portals and could also affect wildlife in the habitat near the southern portal.

Along the surface of the tunnel alignment (i.e., between the tunnel portals), the drilling of piles would generate relatively high noise levels. The duration of this noise at any one location would be only a few days to a couple weeks because once the piles have been installed, construction would progress along the tunnel alignment. Construction at the vent/access shaft locations would take longer than pile-drilling activities, but would be less intrusive and occur for a shorter duration in comparison to the noise generated at the tunnel portals. As described under Existing Conditions, a wide range of noise-sensitive land uses are located along Camino Del Mar.

Other sources of noise associated with tunnel construction include the use of staging and laydown areas, if separate from the portals, and noise along the haul routes. As described above, each of the preliminary haul routes passes by at least some noise-sensitive receptors.

Within the lagoon, noise constraints would be largely related to the presence or potential presence of wildlife species, including state- and federally listed bird species. While round-the-clock construction would probably not be required along this section, nighttime construction might. Noise impacts to bird species are typically considered more of a cause for concern during the nesting season, which generally extends from February 15 through August 31.

Based on the amount of construction required near noise-sensitive receptors and the relatively large number of noise-sensitive receptors that would be affected—including at the portals, along the entire tunnel alignment, and along haul routes—construction noise associated with the Camino Del Mar tunnel represents a high level of constraint.

Operations. The noise of trains within the tunnel would range from somewhat perceptible to imperceptible, depending on the train's distance from the portal. The vents along the tunnel alignment may use fans or similar equipment that could generate noise, and it is assumed that potential noise impacts from this equipment could be reduced through design measures that would shield or otherwise abate the equipment noise. The above-ground portions of this alignment follow existing railroad track right-of-way, and noise associated with operations along these existing alignments would be considered a low constraint because operational noise levels would continue to occur along this alignment through the lagoon regardless of whether a double track is installed or not. Residents along the existing railroad tracks south of the northern tunnel portal would experience a substantive decline in train-related noise once the new alignment is in operation.

Vibration

Vibration could pose an environmental constraint during construction and operation of the tunnel, as described below.

Construction. Tunnel construction along Camino Del Mar has the potential to cause vibration-induced cracking in foundations and other portions of structures adjacent the alignment. The project would likely require an extensive pre-construction inspection and documentation of structures along the selected alignment, including existing cracks, foundation settlement, and any other structure problems which might be associated with the future project construction. This would need to be coupled with ongoing construction vibration monitoring along the alignment and monitoring for any shifting, settling or other foundation movement which may be associated with the tunnel construction. Because there are methods to evaluate and address/mitigate potential construction-related vibration, the constraint level associated with groundborne vibration along Camino Del Mar is considered low.

Within the Los Peñasquitos Lagoon segment, pile installation or other tunnel activities would not be required and the vibrations associated with double track construction would dissipate within the undeveloped lagoon. The potential for vibrations to affect wildlife species would be less than the above-assessed potential for noise impacts; accordingly, the potential vibration-related constraint within the lagoon segment is assessed as low.

Operations. As described in Section 2.0, the train tunnels would be designed to dampen vibrations associated with train operations. Future project-level analysis would be required to determine if any land uses (such as medical offices) along Camino Del Mar utilize vibration-sensitive equipment and, if so, ensure that appropriate vibration dampening can be achieved at those locations. Based on the assumption that any required vibration dampening could be achieved, this constraints analysis assumes that train vibration levels present only a low environmental constraint.

Summary

The Camino Del Mar Alignment is assessed as having a high construction noise constraint and a medium operation noise constraint. It is assessed as having a low construction-related vibration constraint and a low operation vibration constraint.

3.2.3 Crest Canyon Higher Speed Alignment

Existing Conditions

Noise

From north to south, the potential Crest Canyon alignment would utilize a northern portal similar to the one described for the Camino Del Mar Alignment, head under residential neighborhoods, a school, and open space, and emerge from a southern portal near residences and open space just north of Los Peñasquitos Lagoon. A new railroad alignment would be installed across the lagoon, closer to Interstate 5 than the existing railroad alignment, which would be removed. Residents and wildlife are considered noise-sensitive receptors. No noise measurements were made within the residential communities above the potential Crest Canyon alignment. Noise levels within Los Peñasquitos Lagoon would be similar to those described in Section 3.1.1, except that traffic noise from Interstate 5 would be more noticeable at this location given its closer proximity to the freeway, and traffic noise from North Torrey Pines Road would be correspondingly less audible in this part of the lagoon.

Vibration

Except for the occasional heavy truck that might pass by on an existing surface road, there are not sources of perceptible vibration along this alternative alignment.

Constraints

Noise

Construction. Similar to the Camino Del Mar Alignment, tunnel construction associated with the Crest Canyon Higher Speed Alignment would be anticipated to occur essentially around-the-clock, and construction noise would be disruptive and annoying to the residences near the north and south tunnel portals and could also affect wildlife in the habitat near the southern portal. This alternative would utilize a tunnel boring machine, meaning that drilling in piles along the surface of the tunnel alignment would not be required.

Construction at the air intake/vent locations would take longer than for the Camino Del Mar Alignment because the air intakes/vents would be as deep as 250 feet below the surface. Although final locations would be determined during more detailed design, it may not be possible to avoid constructing air intakes/vents near residences (and potentially near the school).

Noise impacts associated with haul routes to/from the northern portal would essentially be the same as described for the Camino Del Mar Alignment. The southern portal would be approximately 1,500 feet from Interstate 5 via Carmel Valley Road. Most of the homes that would be affected by this haul route also would experience noise impacts from construction activity at the southern portal.

Within the lagoon, noise constraints would be largely related to the presence or potential presence of wildlife species, including state- and federally listed bird species. While round-the-clock construction would probably not be required along this section, nighttime construction might. Noise impacts to bird species are typically considered more of a cause for concern during the nesting season, which generally extends from February 15 through August 31. Noise would be generated not only during the installation of the new track through the lagoon, but also by the removal of the existing track once the new segment is completed.

In comparison to the Camino Del Mar Alignment, construction noise constraints at the portals and in the lagoon would be similar, noise impacts at the tunnel air intakes/vents would last longer, and fewer noise-sensitive receptors would likely be affected by haul routes. The biggest difference is that this alternative would have very little pile-drilling activities along the tunnel alignment. Based on the minor amount of pile-drilling that would be required and the relatively lower amount of construction in close proximity to sensitive receptors that would be necessary in comparison to the Camino Del Mar Alignment, the Crest Canyon Higher Speed Alignment is assessed as having a medium construction noise constraint.

Operations. As noted above, the noise of trains within the tunnel would range from somewhat perceptible to imperceptible, depending on the train's distance from the portal. Unlike the Camino Del Mar Alignment, however, the above-ground portions of the Crest Canyon alignment represents a new railroad alignment, and one that, near the southern portal, is much closer to existing residences than the existing alignment through the lagoon. Residents along the existing railroad tracks south of the northern tunnel portal would experience a substantive decline in train-related noise once the new alignment is in operation.

The amount of lagoon habitat traversed by the railroad tracks would be less under this alternative than under the existing condition, likely resulting in a net benefit in terms of noise impacts to wildlife.

Based on the impacts to residents near the southern portal and reduced impact on wildlife within the lagoon, noise constraints associated with train operations are assessed as medium.

Vibration

Construction. Because of the depth of the potential Crest Canyon tunnel, construction-related vibration constraints are not anticipated for surface land uses. Within the Los Peñasquitos Lagoon segment, pile installation may be required because the track would be installed on bridges; however, more detailed design and assessment of probable construction techniques would be required to assess the specific potential for construction-related vibrations to affect wildlife. Given the relatively minor amount of surface vibrations expected to be required, this constraint is assessed as low.

Operations. This constraints analysis assumes that operational vibration levels are not a potential constraint to be considered as part of the tunnel selection process, and this analysis focuses on the above-ground portions of the alignment. As described above with regard to operational noise levels, this alternative alignment would traverse a shorter segment of Los Peñasquitos Lagoon than the existing railroad tracks. Accordingly, to the extent that vibrations from passing trains affect wildlife, if at all, there would be less of an effect under this alternative than under the existing condition, and the corresponding environmental constraint associated is assessed as low.

Summary

The Crest Canyon Higher Speed Alignment is assessed as having a medium construction noise constraint and a medium operation noise constraint. This alignment is assessed as having a low vibration constraint for construction and operation.

3.2.4 Crest Canyon Alignment

<u>Existing Conditions</u>

Noise

Noise levels and noise sensitive receptors associated with the Crest Canyon Alignment are similar to those described for the Crest Canyon Higher Speed Alignment, except along the northern, above-ground segment near the San Dieguito Lagoon. Along this segment, existing residences to the south of San Dieguito Road and wildlife within the lagoon and nearby upland habitat are considered sensitive noise receptors.

Vibration

Except for the occasional heavy truck that might pass by on an existing surface road, there are not sources of perceptible vibration along this alternative alignment.

<u>Constraints</u>

Noise

Construction. Construction noise constraints associated with this alternative would be similar to those described for the Crest Canyon Higher Speed Alignment, except between the San Dieguito Bridge and the northern portal. Construction of the Crest Canyon Alignment in this area could affect residents south of the alignment and wildlife in the San Dieguito Lagoon and nearby upland habitat.

Operations. Unlike the Camino Del Mar Alignment or Crest Canyon Higher Speed Alignment, the Crest Canyon Alignment would entail train operations on a new, above-ground section of railroad track near the San Dieguito Lagoon. Additionally, residents along Balboa Avenue, Gatun Street, and other roads overlooking Crest Canyon would be much closer to the new railroad alignment than they are to the existing alignment. Conversely, residents along the existing railroad tracks south of the San Dieguito Bridge would experience a substantive decline in train-related noise once the new alignment is in operation.

As noted above, the noise of trains within the tunnel would range from somewhat perceptible to imperceptible, depending on the train's distance from the portal. Tunnel vents may also generate noise; however, barring specific vent location and design information, it would be difficult to assess the potential noise constraints associated with these vents. Noise impacts at the southern tunnel portal and within the Los Peñasquitos Lagoon would be identical to those described for the Crest Canyon Higher Speed Alignment.

Based on the impacts to residents near the northern and southern portals, noise constraints associated with train operations are assessed as high.

Vibration

A low constraint is assessed for construction and operation-related vibrations for reasons similar to those described for the Crest Canyon Higher Speed Alignment.

Summary

The Crest Canyon Alignment is assessed as having a medium construction noise constraint and a high operation noise constraint. It is assessed as having a low construction and operation vibration constraint.

3.2.5 Interstate 5 Alignment

<u>Existing Conditions</u>

Noise

The largest contributor to ambient noise along the Interstate 5 Alignment is traffic, including vehicles traveling on Interstate 5 and, to a lesser degree, surface streets. The potential alignment passes through/under residential neighborhoods, open space associated with Crest Canyon and Los Peñasquitos Lagoon, and Interstate 5. Residences and wildlife within the open space areas are noise-sensitive land uses, as described above. The portion of Los Peñasquitos Lagoon traversed by this potential alignment is identical to that described for the two Crest Canyon alignments.

Vibration

Heavy vehicles on Interstate 5 or other surface streets traversed by the potential alignment might generate detectable vibration in their immediate vicinity. No other sources of perceptible vibration occur along the potential alignment.

Constraints

Noise

Construction. This alternative would have two underground segments. The northernmost underground segment, between approximately Jimmy Durante Boulevard and Crest Canyon, would have portals near single-family residences. As described for the previous alternatives, tunnel portals would generate round-the-clock construction noise that would be perceived as annoying and disruptive by nearby residents. The main tunnel section would extend from Crest Canyon southeast and then south under Interstate 5 to a portal just south of Portofino Road.

South of the tunnel segment, noise impacts within Los Peñasquitos Lagoon would be similar to those described above for the two Crest Canyon alignments.

In comparison to the previously addressed alternatives, construction noise constraints would be similar to those addressed for the two Crest Canyon alignments and less than those associated with the Camino Del Mar Alignment. Accordingly, the Interstate 5 Alignment is assessed as having a medium construction noise constraint.

Operations. As with the previously evaluated alternatives, the noise of trains within tunnels would range from somewhat perceptible to imperceptible, depending on the train's distance from the nearest portal. As with the Crest Canyon Alignment, the above-ground portions of the Interstate 5 Alignment represent a new railroad alignment. The above-ground portions of the Interstate 5 Alignment would occur at the northern limits of Crest Canyon and along the eastern edge of Los Peñasquitos Lagoon, relatively close to Interstate 5. Where the train tracks would be above-ground through Crest Canyon, residences not currently exposed to train noise (except the occasional train horn in the distance) would be exposed to train operation noise.

Noise constraints associated with the southern tunnel portal and Los Peñasquitos Lagoon segment would be identical to the noise constraints associated with the previously discussed Crest Canyon alignments.

Based on the impacts to residents near where the train tracks would be above-ground at Crest Canyon, noise constraints associated with train operations are assessed as high.

Vibration

Construction. Because of the depth of the potential Interstate 5 Alignment tunnels, construction-related vibration constraints are not anticipated for surface land uses. Within the Los Peñasquitos Lagoon segment, pile installation may be required because the vast majority of this railroad track would be installed on bridges; however, more detailed design and assessment of probable construction techniques would be required to assess the specific potential for construction-related vibrations to affect wildlife. Given the relatively minor amount of surface vibrations expected to be required, this constraint is assessed as low.

Operations. Vibration from trains in the tunnel segments would be addressed through tunnel design and construction and are not assessed as presenting an environmental constraint. As described above with regard to operational noise levels, this alternative alignment would traverse a shorter segment of Los Peñasquitos Lagoon than the existing railroad tracks. Accordingly, to the extent that vibrations from passing trains affect wildlife, if at all, there would be less of an effect under this alternative than under the existing condition, and the corresponding environmental constraint is assessed as low.

Summary

The Interstate 5 Alignment is assessed as having a medium construction noise constraint and a high operation noise constraint. It is assessed as having a low construction and operation vibration constraint.

3.2.6 Interstate 5 East Alignment

Existing Conditions

Noise

As described above, this alternative would have a different underground segment between the existing railroad tracks and Crest Canyon, where the alignment would roughly follow San Dieguito Drive east of Jimmy Durante Boulevard. In this area, the alignment would pass just south of San Dieguito Lagoon and just north of several single family residences. Both the wildlife in the lagoon and the people in the residences are considered noise sensitive. From Crest Canyon east and south, this alternative would be similar to the Interstate 5 Alignment.

Vibration

The existing conditions for vibrations are essentially the same as those described for the Interstate 5 Alignment.

Constraints

Noise

Construction. Where this alternative would roughly follow San Dieguito Drive east of Jimmy Durante Boulevard, open-cut trenching, cut-and-cover trenching, and bridge construction would be used to build the new railroad track. This would generate construction noise as work proceeds along the alignment, but would avoid the focused noise present at the portals of a tunnel operation. From Crest Canyon east and south, the alignment would be similar to the Interstate 5 Alignment, with nearly identical construction noise constraints and an assessed medium construction noise constraint.

Operations. Noise constraints associated with train operations under the Interstate 5 East Alignment would be similar to those described for the Interstate 5 Alignment, except that there would be nearly twice as much new, above-ground railroad track along the San Dieguito Lagoon, and the operational noise constraint associated with this alternative would be assessed as high for similar reasons.

Vibration

Vibration constraints associated with this alternative would be similar to those described for the Interstate 5 Alignment and would be assessed as low for both construction and operation for similar reasons.

Summary

The Interstate 5 East Alignment is assessed as having a medium construction noise constraint, a high operation noise constraint, and a low vibration constraint for construction and operation.

3.3 AIR QUALITY AND GREENHOUSE GAS EMISSIONS

3.3.1 Resource Overview

In addition to providing an overview of the topics of air quality and greenhouse gases (GHGs), this section summarizes existing air quality conditions in the region and the project area. This existing conditions information is provided prior to discussing the individual alternatives because most air quality conditions are regional in nature. Where there are notable differences between the alternatives, such as the presence of sensitive receptors, those differences are discussed with regard to the individual alternatives.

Air Quality

The proposed project site is located within the San Diego Air Basin (SDAB), which is a generally homogenous climatic zone that includes all of western San Diego County. The climate of the SDAB is dominated by a semi-permanent high-pressure cell located over the Pacific Ocean. This cell influences the direction of prevailing winds (westerly to northwesterly) and maintains clear skies for much of the year. The high-pressure cell also creates two types of temperature inversions that may act to degrade local air quality. Subsidence inversions occur during the warmer months, as descending air associated with the Pacific high pressure cell comes into contact with cool marine air. The boundary between the two layers of air creates a temperature inversion that traps pollutants. The other type of inversion (i.e., radiant inversion) develops on winter nights, when air near the ground cools by heat radiation and air aloft remains warm. The shallow inversion layer formed between these two air masses also can trap pollutants.

As the pollutants become more concentrated in the atmosphere, photochemical reactions occurs that produce ozone (O_3), commonly known as smog. The criteria pollutants of concern include volatile organic compounds (VOCs), oxides of nitrogen (NO_x), carbon monoxide (CO), particulate matter less than or equal to 10 microns in diameter (PM_{10}), and particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$). Although VOCs or NO_x (other than nitrogen dioxide) have no established ambient standards, they are important as precursors to ozone formation. Other criteria pollutants such as oxides of sulfur (SO_x) and lead (Pb) are not a major concern in the San Diego region.

Hazardous Air Pollutants

The hazardous air pollutants (HAPs) can cause various cancers depending on the particular chemicals, type and duration of exposure. Additionally, some of the HAPs may cause short-term and/or long-term health effects. The six HAPs posing the greatest health risk in San Diego are benzene, 1-3 butadiene, carbon tetrachloride, formaldehyde, methylene chloride, and diesel particulate matter.

The Clean Air Act (CAA) of 1990 identified 188 pollutants as HAPs, also known as toxic air contaminants (TACs). From this list, the U.S. Environmental Protection Agency (EPA) identified a group of 21 HAPs as mobile source air toxics (MSATs) in its final rule, *Control of Emissions of Hazardous Air Pollutants from Mobile Sources* (66 *Federal Register* [FR] 17235) in March 2001. From this list of 21 MSATs, the EPA has identified six MSATs—benzene, formaldehyde, acetaldehyde, diesel particulate matter/diesel exhaust organic gases, acrolein, and 1,3-butadiene—as being priority MSATs.

Greenhouse Gas Emissions

According to the EPA, a GHG is any gas that absorbs infrared radiation in the atmosphere. This absorption traps heat within the atmosphere, maintaining Earth's surface temperature at a level higher than would be the case in the absence of GHGs. GHGs include water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), halogenated chlorofluorocarbons (HCFCs), ozone, perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs). Naturally occurring

GHGs include water vapor, CO_2, CH_4, N_2O, and ozone. Human activities add to the levels of most of these naturally occurring gases.

Increasing levels of GHGs in the atmosphere result in an increase in the temperature of the Earth's lower atmosphere, a phenomenon which is commonly referred to as global warming. Warming of the Earth's lower atmosphere induces a suite of additional changes including changes in: global precipitation patterns; ocean circulation, temperature, and acidity; global mean sea level; species distribution and diversity; and the timing of biological processes. These large-scale changes are collectively referred to as global climate change.

GHGs are global pollutants, unlike criteria air pollutants (such as ozone precursors) and TACs. Criteria air pollutants and TACs occur locally or regionally, and local concentrations respond to locally implemented control measures. The long atmospheric lifetimes of GHGs allow them to be transported long distances from sources and to become well-mixed, unlike criteria air pollutants, which typically exhibit strong concentration gradients away from point sources. GHGs and global climate change represent cumulative impacts. GHG emissions contribute, on a cumulative basis, to the significant adverse environmental impacts of global climate change.

Regulatory Setting

Criteria Pollutants

Air quality is defined by ambient air concentrations of specified pollutants identified by the EPA to be of concern with respect to the health and welfare of the general public. The EPA is responsible for enforcing the federal CAA of 1970, as amended. The CAA required the EPA to establish National Ambient Air Quality Standards (NAAQS), which identify concentrations of pollutants in the ambient air below which no adverse effects on the public health and welfare are anticipated. In response, the EPA established both primary and secondary standards for several pollutants (called 'criteria pollutants'). Primary standards are designed to protect human health with an adequate margin of safety. Secondary standards are designed to protect property and the public welfare from air pollutants in the atmosphere.

The California Air Resources Board (CARB) is the state regulatory agency with authority to enforce regulations to both achieve and maintain the NAAQS and California Ambient Air Quality Standards (CAAQS). The San Diego Air Pollution Control District (APCD) is the local agency responsible for the administration and enforcement of air quality regulations for San Diego County. The APCD and SANDAG are responsible for developing and implementing the clean air plan for attainment and maintenance of the ambient air quality standards in the SDAB.

The CAA plan for San Diego County, the San Diego County Regional Air Quality Strategy (RAQS), was initially adopted in 1991 and is updated on a triennial basis. The RAQS was most recently updated in July 2009, and outlines APCD plans and control measures designed to attain the state air quality standards for ozone. The RAQS relies on information from CARB and SANDAG, including mobile and area source emissions, as well as information regarding projected growth in the County, to project future emissions and then determine corresponding strategies necessary for the reduction of emissions through regulatory controls. The CARB mobile source emission projections and SANDAG growth projections are based on population and vehicle trends and land use plans developed by the cities and by the County as part of the development of their general plans. As such, projects that propose development that is consistent with the growth anticipated by the general plans would be consistent with the RAQS.

Attainment (long-term maintenance) of the standards is the goal of each air basin. The APCD has also developed the air basin's input to the State Implementation Plan (SIP), which is required under the federal CAA for areas that are out of attainment of air quality standards. The latest SIP update was submitted by the CARB to the EPA in 2013. The SIP relies on the same information from SANDAG to develop emission inventories and emission reduction strategies that are included in the attainment demonstration for the air basin. The SIP also includes rules and regulations that have been adopted by the APCD to control emissions from stationary sources. These SIP-approved rules may be used as a guideline to determine whether a project's emissions would have the potential to conflict with the SIP and thereby hinder attainment of the NAAQS for ozone.

The SDAB initially was classified as a basic nonattainment area for the 8-hour ozone standard, but has been reclassified as a maintenance area for the standard. In 2012, the EPA designated the SDAB as a nonattainment area for the 2008 federal 8-hour ozone standard. The San Diego region also has been designated by the EPA as a federal maintenance area for the CO standard. The SDAB is in attainment for the NAAQS for all other criteria pollutants. The SDAB is currently classified as a nonattainment area under the CAAQS for ozone and $PM_{10}/PM_{2.5}$.

Hazardous Air Pollutants

Although NAAQS and CAAQS exist for criteria pollutants, no ambient standards exist for TACs. Many pollutants are identified as TACs because of their potential to increase the risk of developing cancer or because of their acute or chronic health risks. For TACs that are known or suspected carcinogens, the CARB has consistently found that there are no levels or thresholds below which exposure is risk-free. Individual TACs vary greatly in the risks they present. At a given level of exposure, one TAC may pose a hazard that is many times greater than another. TACs are identified and their toxicity is studied by the California Office of Environmental Health Hazard Assessment (OEHHA). TACs include air pollutants that can produce adverse human health effects, including carcinogenic effects, after short-term (acute) or long-term (chronic) exposure. Examples of TAC sources within the SDAB include industrial processes, dry cleaners, gasoline stations, paint and solvent operations, fossil fuel combustion sources such as the rail yard in downtown San Diego. For certain TACs, a unit risk factor can be developed to evaluate cancer risk. For acute and chronic health risks, a similar factor, called a Hazard Index, is used to evaluate risk.

In August 1998, the ARB identified particulate emissions from diesel-fueled engines as TACs. In September 2000, the ARB approved a comprehensive diesel risk reduction plan to reduce emissions from both new and existing diesel-fueled engines and vehicles. The goal of the plan is to reduce diesel PM_{10} emissions and the associated health risk by 75 percent in 2010 and by 85 percent by 2020.

Greenhouse Gas Emissions

Concern about the disproportionately negative impacts that global warming are expected to have on the California environment and economy has led the California Governor to adopt Executive Orders related to climate change and the State Legislature to pass several climate-change-related bills. These are aimed at controlling and reducing the emission of GHGs to slow the effects of global warming. Executive Orders and laws relevant to the potential alternative double track alignments are summarized below—these represent only a fraction of California's orders, laws, and regulations related to GHG emissions and climate change.

Executive Order S-3-05, signed by Governor Schwarzenegger on June 1, 2005, calls for a reduction in GHG emissions to year 1990 levels by the year 2020, and for an 80 percent reduction in GHG emissions by the year 2050. Executive Order S-3-05 also calls for the CalEPA to prepare biennial science reports on the potential impact of continued global warming on certain sectors of the California economy. The first of these reports, "Scenarios of Climate Change in California: An Overview," was published in February 2006. The report uses a range of emissions scenarios developed by the United Nations Intergovernmental Panel on Climate Change (IPCC) to project a series of potential warming ranges (i.e., temperature increases) that may occur in California during the 21^{st} century: lower warming range (3.0 - 5.5°F); medium warming range (5.5 - 8.0°F); and higher warming range (8.0 - 10.5°F). The report then presents analysis of future climate in California under each warming range.

The California Global Warming Solutions Act of 2006, widely known as AB 32, requires the CARB to develop and enforce regulations for the reporting and verification of statewide GHG emissions. CARB is directed to set a GHG emission limit, based on 1990 levels, to be achieved by 2020. The bill sets a timeline for adopting a scoping plan for achieving GHG reductions in a technologically and economically feasible manner.

The heart of the bill is the requirement that statewide GHG emissions must be reduced to 1990 levels by the year 2020. California needs to reduce GHG emissions by approximately 28.3 percent below the "business-as-usual" predictions to achieve this goal. The bill requires the CARB to adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective GHG reductions.

SB 375 was signed and passed into law on September 30, 2008. SB 375 enhances the CARB's ability to reach AB 32 goals. Specifically, SB 375 requires the CARB to set regional targets for the purpose of reducing GHG emissions from passenger vehicles for the years 2020 and 2035. If regions develop integrated land use, housing and transportation plans that meet the SB 375 targets, new projects in these regions can be relieved of certain review requirements of CEQA. The targets apply to the regions in the state covered by 18 metropolitan planning organizations (MPOs).

Per SB 375, the CARB appointed a Regional Targets Advisory Committee (RTAC) on January 23, 2009, to provide recommendations on factors to be considered and methodologies to be used in the CARB's target-setting process. The RTAC provided its recommendations in a report to the CARB on September 29, 2009. The CARB released its draft targets on June 30, 2010, and adopted their final targets on September 23, 2010.

SANDAG's 2050 RTP, adopted in 2011, was subject to the provisions of SB 375, which requires that MPOs prepare a Sustainable Communities Strategy (SCS) as part of the RTP. The SCS must demonstrate how development patterns and the transportation network, policies, and programs can work together to achieve the GHG emission reduction targets for cars and light trucks that will be established by the CARB, if there is a feasible way to do so.

In response to the Fiscal Year 2008 Consolidated Appropriations Act (H.R. 2764; Public Law 110–161), the federal Environmental Protection Agency (EPA) issued the "Mandatory Reporting of Greenhouse Gases Rule" (EPA 2009). The rule requires reporting of GHG emissions from large sources and suppliers in the U.S., and is intended to collect accurate and timely emissions data to inform future policy decisions. Under the rule, suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions are required to submit annual reports to EPA. The EPA has not, however, issued regulations limiting GHG emissions.

In October 2009, the President signed Executive Order 13514, Federal Leadership in Environmental, Energy and Economic Performance. This policy-establishing order directed federal agencies to measure, report, and reduce their GHG emissions from direct and indirect activities.

Existing Conditions

The APCD operates a network of ambient air monitoring stations throughout San Diego County. The purpose of the monitoring stations is to measure ambient concentrations of the pollutants and determine whether the ambient air quality meets the CAAQS and the NAAQS. The nearest ambient monitoring stations to the proposed project site are the Del Mar-Mira Costa College station, which is located approximately two miles north of the project site (ozone only), the Kearny Mesa station, which is located approximately seven miles to the east-southeast of the project site (NO_2, PM_{10}, and $PM_{2.5}$), and the downtown San Diego station, which is located approximately 17 miles south of the site (the closest monitoring station that measures CO and SO_2). Because of its coastal location similar to the project site, the Del Mar monitoring station ozone levels are considered most representative of the site. Also, because of its proximity to the site and location in an area that is less congested than downtown San Diego, the Kearny Mesa monitoring station concentrations for the NO_2, PM_{10}, and $PM_{2.5}$ pollutants are considered most representative of the project site. The downtown San Diego monitoring station is the nearest location to the project site where CO and SO_2 concentrations are monitored.

The monitoring data collected by these stations shows that the 1-hour state ozone standard was exceeded one time in 2009 at the Del Mar-Mira Costa College monitoring station during the time period from 2009 through 2013; the 1-hour federal ozone standard was not exceeded in this time period. The 8-hour federal ozone standard was exceeded once in 2009 and twice in 2012 during the same period, and the 8-hour state ozone standard was exceeded three times in 2009, twice in 2010 and 2012, and once in 2011. The Kearny Mesa monitoring station measured no federal or California exceedances of NO_2, $PM_{2.5}$, and PM_{10} from 2010 to 2013 (no data was available for 2009). The data from the downtown San Diego monitoring station measured that air quality is in attainment of the state and federal standards for CO and SO_2.

Because of the location of the monitoring station in downtown San Diego, where traffic congestion is prevalent, the station has higher concentrations of CO than are measured elsewhere in San Diego County and the background data are not likely to be representative of background ambient CO concentrations in the project vicinity. Use of downtown San Diego background data therefore provides a conservative estimate of background CO concentrations.

Issues Addressed With Regard to Potential Constraints

Six key air quality issues have been considered in this constraints assessment: (1) locomotive diesel particulate emissions, (2) construction equipment exhaust, (3) fugitive dust, (4) vehicle emissions, (5) CO hotspots, and (6) odors, as described below.

Locomotive Emissions. Locomotive engines emit large amounts of NOx and PM_{10}/$PM_{2.5}$, which can contribute to public health problems. The locomotive operations would involve passing train activities through the tunnels and on the above-ground track segments. There would be no train stops, refueling, and/or maintenance activities within the proposed tunnels or above-ground segments addressed in this constraints report.

Construction Equipment Exhaust. Construction activities cause combustion emissions from utility engines, heavy-duty construction vehicles, equipment hauling materials to and from construction sites and motor vehicles transporting construction crews. Exhaust emissions from construction activities vary daily as construction activity levels change. The use of construction equipment results in localized exhaust emissions.

Fugitive Dust. Fugitive dust emissions are generally associated with demolition, land clearing, exposure of soils to the air, and cut and fill operations. Dust generated during construction varies substantially on a project-by-project basis, depending on the level of activity, the specific operations and weather conditions. Construction emissions can vary greatly depending on the level of activity, the specific operation taking place, the equipment being utilized, local soils, weathers conditions, and other factors. There are a number of feasible control measures that can be reasonably implemented to significantly reduce $PM_{10}/PM_{2.5}$ emissions from construction.

Vehicle Emissions. Long-term air emissions impacts are those associated with increases in automobile travel within and around the County over time. Mobile source emissions would result from vehicle trips associated with increase substantially in the region. The San Diego APCD, local jurisdictions, and other parties responsible for protecting public health and welfare are continually seeking ways of minimizing the air quality impacts of growth and development in order to avoid further exceedances of the standards.

Local Carbon Monoxide Hotspots. Local air quality is most affected by CO emissions from motor vehicles and it does not readily disperse into the air. Because CO does not readily disperse, areas of vehicle congestion can create "pockets" of high CO concentration, called "hotspots." These pockets have the potential to exceed the State 1-hour standard of 20 ppm and/or the 8-hour standard of 9.0 ppm.

While CO transport is limited, it does disperse over time and with distance from the source under normal meteorological conditions. However, under certain meteorological conditions, such as stagnant air or temperature inversions CO concentrations near congested roadways or intersections may reach unhealthful levels affecting local sensitive receptors (e.g., residents, school children, the elderly, and hospital patients). Typically, high CO concentrations are associated with roadways or intersections operating at unacceptable levels of service or with extremely high traffic volumes. In areas with high ambient background CO concentration, air quality modeling is needed to determine a project's effect on local CO levels.

Odors. Odors are also an important element of local air quality conditions. Specific land uses (e.g., restaurants, landfills, manufacturing plants, animal and agricultural operations) can raise concerns on the part of nearby neighbors. While sources that generate objectionable odors must comply with air quality regulations, the public's sensitivity to locally produced odors often exceeds local ordinance regulations.

Conformity with State Implementation Plan

The transportation conformity analysis and findings for the 2050 RTP are addressed in a separate process from this constraints analysis, and under EPA regulations, include extensive requirements for consultation with transportation and air quality agencies and the public. The transportation conformity analysis for the 2050 RTP was prepared by SANDAG as Appendix B to the 2050 RTP (SANDAG 2011). SANDAG and the Department of Transportation (DOT) must make a determination that the 2050 RTP conforms to the SIP (i.e., will not create new or worsen existing air quality violations, or delay the attainment of NAAQS). SANDAG's analysis was conducted for ROG and NOX (ozone precursors) for which the SDAB is in federal nonattainment, and for CO, for which the SDAB is a federal maintenance area. SANDAG's analysis concluded that the double track Del Mar tunnel project in the 2050 RTP meets the applicable pollutant budgets and conforms to the applicable SIPs.

3.3.2 Camino Del Mar Alignment

<u>Existing Conditions</u>

This description of existing conditions focuses on receptors that may be sensitive to air quality impacts along the Camino Del Mar Alignment; refer to Section 3.3.1 for a discussion of ambient air quality. Sensitive receptors for air quality impacts are similar to (human) noise-sensitive receptors; as noted in the discussion of noise and vibration constraints, sensitive receptors along the proposed Camino Del Mar tunnel include single and multi-family residences, hotels, restaurants (some with outside seating), medical offices, a school, and a library. These land uses indicate that residents, school children, healthcare patients, and the elderly are also present along the alignment.

<u>Constraints</u>

Construction

Construction-related effects on air quality would be temporary and associated with activities such as tunnel excavation, soil stockpiling, rail track installations, and worker vehicle traffic. These could generate temporary increases in air quality (VOCs, NO_X, CO, $PM_{10}/PM_{2.5}$) emissions. In areas with idling vehicles, CO hotspots could occur.

CARB does not consider diesel-related cancer risks from construction equipment to be an issue due to the short-term nature of construction activities. Typically, assessment of diesel-related health risks is based on a 70-year exposure period. Construction-related exposure to diesel exhaust would be well below the 70-year exposure period; thus construction of the Camino Del Mar Alignment would not be anticipated to result in an elevated cancer risk to exposed persons due to the short-term nature of the diesel exhaust exposure.

The use of diesel equipment during construction or operation of the project could generate some nuisance odors.

Given the comparatively short-term nature of the Camino Del Mar Alignment construction emissions, they are considered to pose a low environmental constraint.

Operations

Operational impacts associated with the Camino Del Mar Alignment would be confined to impacts associated with locomotive emissions and underground gases (i.e., underground methane). Minor impacts would be attributable to periodic maintenance of the tunnel, but emissions from maintenance activities would be negligible.

Once the locomotive engines reach inside the tunnel, the emissions would be dispersed into the ventilation system and then released from the vent shaft at the surface. The ventilation systems would also exhaust underground flammable gas or vapors from the tunnel. The tunnel would have adequate ventilation and filters to dilute underground gasses and locomotive emissions to safe levels. Additional air quality analysis would be required to evaluate the potential for increases in localized hydrocarbon concentrations resulting from increases in underground gasses and locomotive emissions at the vent shafts. Micro-scale dispersion modeling would typically be performed to analyze these impacts on local sensitive receptors. This type of analysis would be performed in the future as part of a project-level analysis. As noted above, sensitive receptors within the Camino Del Mar area include residents, school children, healthcare patients, and the elderly.

There would be some flexibility in locating the vents (if needed) near the portals of the tunnel under Camino Del Mar; however, because there are sensitive receptors along virtually the entire segment of Camino Del Mar above the potential tunnel, it would probably not be possible to avoid siting tunnel vents near residences or other areas subject to significant human use (especially near the northern tunnel portal). Accordingly, this makes air quality a high constraint for the Camino Del Mar Alignment.

Summary

Construction emissions represent a low air quality constraint, and operational emissions—particularly at vent shaft locations along Camino Del Mar—represent a high air quality constraint.

3.3.3 Crest Canyon Higher Speed Alignment

<u>Existing Conditions</u>

Sensitive receptors for air quality impacts along the Crest Canyon Higher Speed Alignment include residents along the above-ground portions of the alignment and also those near portals and vents.

Constraints

Construction

Construction-related effects on air quality would be temporary and are assigned a low constraint level for reasons similar to those described for construction of the Camino Del Mar Alignment.

Operations

Similar to the Camino Del Mar Alignment, the largest air quality constraint associated with the Crest Canyon Higher Speed Alignment is related to the vents. As described previously, this constraints analysis conservatively assumes that vents would be required along the alignment. If required, the vents would reflect point sources of diesel emissions and other vented gases for the life of the railroad (unless all commuter and freight trains run off electric power at some point in the future—this is not foreseeable). The land above the Crest Canyon Higher Speed Alignment tunnel segment is less densely developed than the land along Camino Del Mar, giving slightly more flexibility for the placement of vents away from sensitive receptors. Nonetheless, given the maximum allowable distances between vents, it does not appear feasible to place all, or even the majority, of required vents away from residences. Accordingly, a high level of air quality constraints is assigned to this alternative.

Summary

Construction emissions represent a low air quality constraint, and operational emissions—particularly at vent shaft locations within the residential neighborhoods over the tunnel alignment—represent a high air quality constraint.

3.3.4 Crest Canyon Alignment

Existing Conditions

Sensitive receptors for air quality impacts along the Crest Canyon Alignment are similar to those along the Crest Canyon Higher Speed Alignment, except that more residences would be in proximity to above-ground track through Crest Canyon under this alternative, and the Canyon Crest Alignment tunnel also passes near (and approximately 250 feet below) Del Mar Heights School.

Constraints

Construction

Construction-related effects on air quality would be temporary and are assigned a low constraint level for reasons similar to those described for construction of the Camino Del Mar Alignment and Crest Canyon Higher Speed Alignment.

Operations

Similar to the previously discussed alignments, the largest air quality constraint associated with the Crest Canyon Alignment would be related to the vents. These vents would reflect point sources of diesel emissions and other vented gases for the life of the railroad (unless all commuter and freight trains run off electric power at some point in the future—this is not foreseeable). The land above the Crest Canyon Alignment tunnel segment is less densely developed than the land along Camino Del Mar, giving slightly more flexibility for the placement of vents away from sensitive receptors. Nonetheless, given the maximum allowable distances between vents, it does not appear feasible to place all, or even the majority, of required vents away from residences and possibly even the Del Mar Heights School. Accordingly, a high level of air quality constraints is assigned to this alternative.

Summary

Construction emissions represent a low air quality constraint, and operational emissions—particularly at vent shaft locations within the residential neighborhoods over the tunnel alignment—represent a high air quality constraint.

3.3.5 Interstate 5 Alignment

Existing Conditions

Sensitive receptors for air quality impacts along the Interstate 5 Alignment include residents between Jimmy Durante Boulevard and Crest Canyon and from Crest Canyon southeast toward Interstate 5. Although constructing vents within the Interstate 5 corridor would pose unique engineering and construction challenges, the freeway is not considered a sensitive receptor for air pollutant emissions because drivers on the freeway would have only temporary exposure to emissions from the vents as they travel on Interstate 5.

Constraints

Construction

Construction-related effects on air quality would be temporary and are assigned a low constraint level for reasons similar to those described for construction of the Camino Del Mar and the two Crest Canyon alignments.

Operations

Similar to the alternatives discussed above, the largest air quality constraint associated with the Interstate 5 Alignment is related to the vents. Substantially less of the Interstate 5 Alignment tunnel would be under residential neighborhoods or other sensitive receptors in the comparison to the Camino Del Mar and Crest Canyon tunnel alternatives. This would provide greater opportunity to vent the tunnels away from residences and other sensitive air quality receptors and, as a result, a medium level of air quality constraint is assigned to the operation of this alternative.

Summary

The Interstate 5 Alignment is assessed as having a low air quality constraint associated with construction and a medium air quality constraint associated with operations.

3.3.6 Interstate 5 East Alignment

Existing Conditions

Existing conditions for this alternative would be similar to the Interstate 5 Alignment.

Constraints

The Interstate 5 East Alignment would face very similar air quality constraints as those identified for the Interstate 5 Alignment. Specifically, this alternative is assessed as having a low air quality constraint associated with construction and a medium air quality constraint associated with operations for the reasons described for Interstate 5 Alignment.

3.4 LAND USE

3.4.1 Resource Overview

Within the context of environmental constraints and impact analysis, the topic of *land use* refers both to both existing land uses (i.e., what is land being used for currently) and planned land use (i.e., what land uses are planned for a given area based on zoning; general, community, and specific plan designations; and adopted policies that affect land development and use). Within this environmental constraints report, the focus of the land use analysis is on potential conflicts between the alternative alignments with existing land uses, as well the consistency between each alternative to applicable land use plans.

Existing Land Use

Existing land uses were assessed through a review of aerial photography and field verification.

Planned Land Use

Planned land uses were assessed through a review of applicable planning documents including the City of Del Mar Land Use Map (1993) and the City of San Diego's Torrey Pines Community Plan Land Use Plan (1995, as amended through 2011).

3.4.2 Camino Del Mar Alignment

Existing Conditions

Existing Land Use

Figure 2 depicts the Camino Del Mar Alignment on an aerial photographic base that illustrates the existing land uses along its route.

The Camino Del Mar Alignment would transition from the existing railroad tracks to a tunnel near the current Camino Del Mar overpass over the tracks. The portal location is within public and railroad rights-of-way which are abutted primarily by residences. Where the alignment passes under Camino Del Mar, the road is lined with a wide range of land uses including commercial (including retail, hotel, restaurant, visitor-serving, office, and medical office), residential, recreational, educational, and government uses. Near the southern end of the potential tunnel, the alignment also passes by (under) undeveloped open space. The southern portal also would be located in undeveloped open space, and the above-ground segment would follow the existing railroad track right-of-way through Los Peñasquitos Lagoon. As noted in Section 3.1, the vast majority of Los Peñasquitos Lagoon is a State Preserve, although this designation does not apply to the existing railroad right-of-way.

Planned Land Use

Planned land uses along Camino Del Mar reflect the wide variety of existing land uses located along this road and include (generally from north to south) High-Density Residential (R-2), Hotel Specific Plan (HSP), Plaza Specific Plan (PSP), Central Commercial (CC), Public Facilities (PF), Visitor Commercial (VC), Medium Density Single Family Residential (R1-5), Medium Density-Mixed South (RM-South), Low Density Residential (R1-10), Public Parkland, and Carmel Valley Precise Plan (CVPP).

The southern portal and alignment through Los Peñasquitos Lagoon would be within the City of San Diego on land designated as Openspace in the Torrey Pines Community Plan (although this land use designation is not technically applicable to railroad right-of-way and/or State-owned preserve lands).

Constraints

The largest land use constraints associated with the Camino Del Mar Alignment would be associated with the construction of air intakes/vents and access stairs at several locations along Camino Del Mar. This constraints analysis conservatively assumes that air intakes/vents and access shafts would be required along the tunnel alignment. If required, it would not be possible to construct these air intakes/vents and access shafts without requiring the removal of existing buildings and the displacement of the businesses that operate within them. The owners of affected buildings and displaced businesses would be compensated for their property losses and relocation costs in accordance with state and federal law. Despite the loss of up to several commercial buildings, the overall Camino Del Mar corridor would remain dominated by the same land use types described above for the existing condition.

Constraints related to the Los Peñasquitos Lagoon would be primarily associated with the biological resource values of the lagoon, addressed in Section 3.1 of this study. Because the vast majority of railroad track expansion within the lagoon would occur within the existing railroad right-of-way, which is not technically part of the State Preserve, this would not constitute a major land use constraint.

Because the displacement of businesses along Camino Del Mar would occur at several discrete locations—rather than requiring the demolition of multiple, contiguous residential properties, as described for the Crest Canyon and Interstate 5 alignments below—and because railroad track expansion within Los Peñasquitos Lagoon would occur primarily within the existing railroad right-of-way, the Camino Del Mar Alignment is assessed as having a medium land use constraint. This assessment is not meant to trivialize the effects that would be felt by specific building owners and/or the operators of affected businesses, nor is it intended to discount the effect to the community associated with a reduction in commercial land uses along Camino Del Mar. Instead, this assessment of a medium constraint is provided in comparison to the larger loss of residential and commercial properties that would be associated with other alternatives, as described below[1].

3.4.3 Crest Canyon Higher Speed Alignment

Existing Conditions

Existing Land Use

Figure 3 depicts the Crest Canyon Higher Speed Alignment on an aerial photographic base that illustrates the existing land uses along its route.

The northern portal of the Crest Canyon Higher Speed Alignment tunnel would be located in a single family neighborhood just west of Jimmy Durante Boulevard, and the tunnel portal site would require the demolition of several single-family residences. The tunnel alignment would traverse under primarily single family residences and open space. The southern portal would be in undeveloped open space that is below/south of Portofino Drive and above/north of Carmel Valley Road. Single family residential uses are located to the east and west of the southern portal site, with undeveloped open space to the north and south.

[1] This assessment does not address economic losses that would likely be incurred by businesses along Camino Del Mar during tunnel construction. Such losses would need to be addressed in future NEPA compliance documentation, as applicable.

Where the above-ground portion of this alignment traverses Los Peñasquitos Lagoon, it would be outside the existing railroad right-of-way on State-owned preserve land.

Planned Land Use

The northwestern portion of the tunnel, including the northern portal, would be within the City of Del Mar within/under land designated for Low Density Residential (R1-10) and Very Low Density Residential (R1-40) use. The majority of the tunnel would be within the City of San Diego's Torrey Pines Community and located under land designated in the Torrey Pines Community Plan Land Use Plan as Openspace, Low [Density] Residential (5-9 dwelling units per acre [DU/AC]), and Low Medium [Density] Residential (10-15 DU/AC).

The southern portal and alignment through Los Peñasquitos Lagoon would be within the City of San Diego on land designated as Openspace in the Torrey Pines Community Plan. As noted above, a local jurisdiction's land use plan designation is not typically enforceable on a State-owned preserve, although the Openspace designation is consistent with the State Preserve designation applied by the California Department of Parks and Recreation, which does have jurisdiction.

Constraints

The demolition of multiple residences within an existing neighborhood represents a high constraint. Depending on the placement of air intakes/vents over the tunnel portion of this alignment, air intake/vent construction could incrementally increase the number of residences demolished under this alternative; however, it is likely that there would be sufficient flexibility in the placement of air intakes/vents to minimize or avoid direct impacts to residences from air intake/vent construction. With regard to Los Peñasquitos Lagoon, the location of the portal in the open space just north of the lagoon would conflict with the *Wildlife Management Plan for Torrey Pines State Reserve* (California Department of Parks and Recreation 1997) policy to preserve this land in open space as a link between the lagoon and uplands to the north. On the other hand, removing the existing railroad tracks and berm that bisect the lagoon and replacing them with tracks located almost entirely on bridges further to the east would support policies calling for better hydrological connections within the lagoon and improved corridors for wildlife movement.

Based primarily on the anticipated loss of residences at the northern tunnel portal, this alignment is assessed as having a high land use constraint.

3.4.4 Crest Canyon Alignment

Existing Conditions

Existing Land Use

Figure 3 depicts the Crest Canyon Alignment on an aerial photographic base that illustrates the existing land uses along its route.

From the San Dieguito River bridge south and east to the northern tunnel portal, the Crest Canyon alignment would require the demolition of a multi-tenant commercial office building along Jimmy Durante Boulevard and also the demolition of several homes along San Dieguito Drive. From the tunnel segment south to the connection with the Sorrento Valley Double Track Project, existing land uses along the alignment would be similar to those described for the Crest Canyon High Speed Alignment, although the Crest Canyon Alignment would also pass near (and approximately 250 feet below) Del Mar Heights School, a kindergarten through sixth grade school on a traditional calendar with approximately 950 students (Del Mar Union Elementary School District 2012).

Planned Land Use

This alignment traverses land designated as North Commercial[2] (NC), Low Density Residential (R1-10), and Very Low Density Residential (R1-40) in the City of Del Mar. The majority of the alignment, including the tunnel segment, would be within the City of San Diego's Torrey Pines Community and located under land designated in the Torrey Pines Community Plan Land Use Plan as Openspace, Low [Density] Residential (5-9 dwelling units per acre [DU/AC]), and Low Medium [Density] Residential (10-15 DU/AC). Del Mar Heights School is designated as School in the Land Use Plan.

As with the Crest Canyon Higher Speed Alignment, the southern portal and alignment through Los Peñasquitos Lagoon would be within the City of San Diego on land designated as Openspace in the Torrey Pines Community Plan.

Constraints

This alignment is assessed as having a high land use impact primarily due to the required demolition of both a multi-tenant office building and multiple residences. As with the Crest Canyon Higher Speed Alignment, this alignment would conflict with a Los Peñasquitos Lagoon management policy related to the open space near Portofino Road (southern tunnel portal), but it would help achieve goals related to improved hydrological connectivity and wildlife movement.

[2] This land use classification is intended to allow commercial and professional activities that provide a service to the community. Development should be of low intensity and profile, offering substantial open space. (City of Del Mar "Description of Land Use Categories," undated)

3.4.5 Interstate 5 Alignment

Existing Conditions

Existing Land Use

As described previously, the Interstate 5 Alignment would involve, from northwest to southeast, (1) an above-ground segment extending southeast from just south of the San Dieguito River Bridge to just east of Jimmy Durante Boulevard, (2) a bored tunnel from just east of Jimmy Durante Boulevard southeast to Crest Canyon, (3) an above-ground segment roughly paralleling San Dieguito Drive through Crest Canyon, (4) the main tunnel (constructed using underground boring) extending from Crest Canyon southeast and south under Interstate 5 to the portal near Portofino Road, and (5) an above-ground segment extending near Portofino Road south across Los Peñasquitos Lagoon to a connection with the Sorrento Valley double track. Existing land uses are described for each of these five alignment segments.

San Dieguito River Bridge to Just East of Jimmy Durante Boulevard. This section of the alignment extends through a two-story commercial office building on the west side of Jimmy Durante Boulevard and several single-family residences on the east side of Jimmy Durante Boulevard.

East of Jimmy Durante Boulevard Southeast to Crest Canyon. This segment of the Interstate 5 Alignment extends through/under several single family residences.

Roughly Paralleling San Dieguito Drive through Crest Canyon. Where the alignment exits the southeastern portal of the cut-and-cover tunnel, it traverses through a large residential property adjacent to San Dieguito Drive and then across undeveloped land before entering the northern portal of the main tunnel.

Main Tunnel Between Crest Canyon and Southern Tunnel Portal. This underground segment of the alignment passes under undeveloped open space between Racetrack View Drive and Mango Way (and potentially under the property limits of some residences on Mango Way/Drive and Minorca Cove) and then follows the Interstate 5 right-of-way south before veering west to a portal near Portofino Road.

Los Peñasquitos Lagoon. South of the southern tunnel portal, this above-ground segment of the alignment traverses through Los Peñasquitos Lagoon. As noted previously, Los Peñasquitos Lagoon is a State Preserve and the vast majority of the lagoon, excluding the existing railroad tracks, is undeveloped.

Planned Land Use

The above-ground segment from the San Dieguito River Bridge to just east of Jimmy Durante Boulevard would be located in the City of Del Mar and traverse land designated as North Commercial (NC) and Low Density Residential (R1-10). The tunnel segment extending to Crest Canyon would pass through land designated as Low Density Residential (R1-10) and Very Low Density Residential (R1-40), and the above-ground segment through Crest Canyon would be located within land designated as Very Low Density Residential (R1-40) in the City of Del Mar and Openspace in the City of San Diego.

The northern portal of the main tunnel segment (i.e., on the eastern edge of Crest Canyon) would be within City of San Diego designated Openspace as well, as would the tunnel alignment between this portal and Interstate 5. The Interstate 5 right-of-way is a public highway that forms the eastern boundary of the Torrey Pines Community, and Interstate 5 does not have a land use designation per se in the Torrey Pines Community Plan Land Use Plan. From the southern tunnel portal south across Los Peñasquitos Lagoon, planned land uses are as described for the two Crest Canyon alignments.

Constraints

Construction of the Interstate 5 Alignment would require the demolition of many single family residences and a multi-tenant office building. Planned land use designations along this alignment largely reflect existing land uses; accordingly, where this alignment would require the demolition of existing land uses, it would also conflict with adopted plans' land use designations. Conflicts with Los Peñasquitos Lagoon, particularly this lagoon's designation as a State Preserve, are largely associated with the sensitive biological resources in the lagoon (see Section 3.1); additionally, it is anticipated that this alternative would include the removal of the existing trackbed from the lagoon, offsetting conflicts between the proposed installation of new double track and the preservation of biological resources within the lagoon. In comparison to other alternatives, and based primarily on the loss of residences and a commercial land use, this alternative is considered to have a high land use constraint.

3.4.5 Interstate 5 East Alignment

Existing Conditions

The majority of this alternative is similar to the Interstate 5 Alignment, except from the San Dieguito River Bridge to Crest Canyon, as described below.

The Interstate 5 East Alignment would require reconstruction of a substantial portion of the currently proposed double track San Dieguito River bridge (i.e., demolishing and rebuilding parts of the planned new bridge that is proposed for construction later this decade). South of the

San Dieguito River, an above-ground section of this alternative alignment passes through the southern edge of a City of Del Mar public works yard and a multi-tenant neighborhood office/industrial park located northwest of Jimmy Durante Boulevard. To the east of Jimmy Durante Boulevard, the tracks would be constructed using an open trench and bridge located just south of and roughly parallel to San Dieguito Drive. This section of the alignment would traverse through several single-family residential properties, with the alignment emerging into Crest Canyon at a large residential property just south of San Dieguito Drive. Similar to the Interstate 5 Alignment, the above-ground portion of the Interstate 5 East Alignment through Crest Canyon would traverse open space and residential properties.

On the eastern edge of Crest Canyon, this alternative would enter a portal to the main tunnel segment at a similar location as the Interstate 5 Alignment tunnel segment described above, and the existing land uses would be identical from this point southeast and south to the connection with the double track at Sorrento Valley.

Planned Land Use

The San Dieguito River Bridge and City of Del Mar public works yard are located within land designated as Floodway, and the office/light industrial complex northeast of Jimmy Durante Boulevard is designated as North Commercial (NC). To the east of Jimmy Durante Boulevard, where this alternative roughly parallels San Dieguito Drive, it passes through land designated as Very Low Density Residential (R1-40) by the City of Del Mar and Openspace by the City of San Diego. From the tunnel portal on the eastern side of Crest Canyon to the southeast and south, planned land uses are identical to those described above for the Interstate 5 Alignment.

Constraints

This alternative would require the demolition of several single family residences and a multi-tenant office building, as well as affecting a City of Del Mar public works yard. Planned land use constraints and land use constraints associated with an alignment through the eastern portion of Los Peñasquitos Lagoon, and the associated removal of the existing tracks from the center of the lagoon, would be similar to those described above for the Interstate 5 Alignment. This loss of residences and a commercial office building, in addition to the potential effects to the City of Del Mar public works yard, would constitute a high land use constraint.

3.5 CULTURAL RESOURCES

The following discussion of cultural resources constraints incorporates information from a technical report prepared by ASM Affiliates (ASM Affiliates 2014), with other sources cited as referenced below. The ASM Affiliates technical report was based primarily on the results of a June 2012 cultural resources records search conducted at the South Coastal Information Center at San Diego State University. The records search encompassed a one-quarter-mile buffer on either side of the potential alignments. Research on existing conditions and constraints did not include a pedestrian survey of the potential alignments.

3.5.1 Resource Overview

The term *cultural resources* refers to evidence of past human activity, which can include sites, structures, buildings, districts, and objects associated with or representative of people, cultures, and human activities and events. Cultural resources are also broadly categorized as either *prehistoric* or *historic* resources. Prehistoric resources are those resources associated with periods in time before written records. Historic resources, conversely, are those associated with written records; in Southern California, the beginning of the historic period generally correlates to the arrival of European explorers. Federal and State laws and regulations that protect cultural resources include Section 106 of the National Historic Preservation Act and California Public Resources Code Sections 5024.1 and 21084.1.

Overviews of the prehistorical and historical periods relevant to the Del Mar Tunnel area are provided below. These overviews are intended to provide a general cultural resources context for the project area rather than describing specific resources that may be present along the potential alignments; accordingly, the overviews are presented here rather than under the "Existing Conditions" descriptions later in this section.

Prehistory

Archaeological fieldwork along the Southern California coast has yielded a diverse range of human occupation extending from the early Holocene into the Ethnohistoric period (Erlandson and Colten 1991; Jones 1992; Moratto 1984). A variety of different regional chronologies, often with overlapping terminology, have been used in coastal Southern California, and they vary from region to region (Moratto 1984). Today, the prehistory of San Diego County is generally divided into three major temporal periods: Paleo-Indian, Archaic, and Late Prehistoric. These time periods are characterized by patterns in material culture that are thought to represent distinct regional trends in the economic and social organization of prehistoric groups.

Paleo-Indian Period

The antiquity of human occupation in the New World has been the subject of considerable debate over the last few decades. The currently accepted model is that humans first entered the western hemisphere between 12,000 and 15,000 years before present (B.P.). While there is no firm evidence of human occupation in coastal Southern California prior to 12,000 B.P., dates as early as 23,000 B.P. and even 48,000 B.P. have been reported (Bada et al. 1974; Carter 1980; Rogers 1974). The amino acid racemization technique used to date these sites has been largely discredited, however, by more recent accelerator radiocarbon dating of early human remains along the California coast (Taylor et al. 1985). Despite intense interest and a long history of research, no widely accepted evidence of human occupation of North America dating prior to 15,000 B.P. has emerged.

Based upon rather scant evidence from a small number of sites throughout San Diego County, it has been hypothesized that the people linked to the San Dieguito complex lived within a generalized hunter-gatherer society with band-level organization. This portrayal is essentially an extension to the inland and coastal areas of San Diego County of what has long been considered a continent-wide Paleo-Indian tradition. This immediate post-Pleistocene adaptation occurred within a climatic period of somewhat cooler and moister conditions than exists presently. The range of possible economic adaptations of San Dieguito bands to this environment is poorly understood at present, but it is typically assumed that these groups followed lifeways similar to other Paleo-Indian groups in North America.

Archaic Period

The Archaic period (also referred to as the Early Milling Period) extends back at least 7,200 years, possibly as early as 9000 B.P. (Moratto 1984; Rogers 1966; Warren et al. 2008). Archaic subsistence is generally considered to have differed from Paleo-Indian subsistence in two major ways. First, gathering activities were emphasized over hunting, with shellfish and seed collecting of particular importance. Second, milling technology, frequently employing portable ground stone slabs, was developed. The shift to maritime exploitation from a land-based focus is traditionally held to mark the transition from the Paleo-Indian period to the Archaic period. In reality, the implications of this transition are poorly understood from both an economic and cultural standpoint (see Warren et al. 2008 for an excellent review).

Early Archaic occupations in San Diego County are most apparent along the coast and the major drainage systems that extend inland from the coastal plains (Moratto 1984). Coastal Archaic sites are characterized by cobble tools, basin milling stones, hand stones, discoidals (disk-shaped grinding stones), a small number of “Pinto” and “Elko” series dart points, and flexed burials. Together these elements typify what is termed the La Jolla complex in San Diego County, which appears as the early coastal manifestation of a more diversified way of life.

Late Prehistoric Period

Assemblages derived from Late Prehistoric sites in San Diego County differ in many ways from those in the Archaic tradition. The occurrence of small, pressure-flaked projectile points, the replacement of flexed inhumations with cremations, the introduction of ceramics, and an emphasis on inland plant food collection, processing, and storage (especially acorns) are only a few of the cultural patterns that were well established by the second millennium A.D. The centralized and seasonally permanent residential patterns that had begun to emerge during the Archaic period became well established in most areas. Inland semisedentary villages appeared along major watercourses in the foothills and in montane valleys where seasonal exploitation of acorns and piñon nuts was common, resulting in permanent milling stations on bedrock outcrops. Mortars for acorn processing increased in frequency relative to seed-grinding basins.

Ethnohistoric Period

In ethnohistoric times, two main cultural groups occupied coastal San Diego County: the Shoshonean-speaking Luiseño and Juaneño in the north, and the Kumeyaay or Diegueño in the south. Traditionally, Luiseño territory encompassed an area from roughly Agua Hedionda on the coast, east to Lake Henshaw, north into Riverside County, and west through San Juan Capistrano to the coast (Bean and Shipek 1978; Kroeber 1925). The region inhabited by various bands of the Kumeyaay was much larger and probably extended from Agua Hedionda Lagoon eastward into the Imperial Valley and southward through much of northern Baja California. The Kumeyaay inhabited a diverse environment including marine, foothill, mountain, and desert resource zones.

Historic Period

Although the earliest historical exploration of the San Diego area can be traced to 1542 with the arrival of the first Europeans, particularly the exploration of San Miguel Bay by Juan Rodriguez Cabrillo, the widely accepted start of the historical period is 1769 with the founding of the joint Mission San Diego de Alcalá and Royal Presidio. The Hispanic period in California's history includes the Spanish Colonial (1769-1820) and Mexican Republic (1820-1846) periods. This era witnessed the transition from a society dominated by religious and military institutions, consisting of missions and presidios, to a civilian population residing on large ranchos or in pueblos.

The first intensive encounter of Spanish explorers and coastal villages of Native Americans was in 1769 with the establishment of Mission San Diego de Alcalá. The Mission of San Juan Capistrano was subsequently established in 1776, followed by San Luis Rey de Francia in 1798. The missions "recruited" the Native Americans to use as laborers and converted them to Catholicism. Local Native Americans rebelled briefly against Spanish control in 1775.

The effects of missionization, along with the introduction of European diseases greatly reduced the Native American population of Southern California. At the time of contact, Luiseño population estimates range from 5,000 to as many as 10,000 individuals. Inland Luiseño groups were not heavily affected by Spanish influence until 1816, when an outpost of the mission was established 20 miles further inland at Pala (Sparkman 1908). Most villagers, however, continued to maintain many of their aboriginal customs and simply adopted the agricultural and animal husbandry practices learned from Spaniards.

By the early 1820s, California came under Mexico's rule. In 1834, the missions were secularized. This resulted in political imbalance and Indian uprisings against the Mexican rancheros. Many of the Kumeyaay left the missions and ranchos and returned to their original village settlements (Shipek 1991). When California became a sovereign state in 1850, the Kumeyaay were heavily recruited as laborers and experienced even harsher treatment. Conflicts between Native Americans and encroaching Anglos finally led to the establishment of reservations for some villages, such as Pala and Sequan. Other Mission groups were displaced from their homes, moving to nearby towns or ranches. The reservation system interrupted the social organization and settlement patterns, yet many aspects of the original culture still persist today. Certain rituals and religious practices are maintained. Traditional games, songs, and dances continue, as well as the use of foods such as acorns, yucca, and wild game.

The subsequent American period (1846 to present) witnessed the development of San Diego County in various ways. This time period includes the rather rapid dominance over California culture by Anglo-Victorian (Yankee) culture and the rise of urban centers and rural communities. A Frontier period from 1845 to 1870 saw the region's transformation from a feudal-like society to an aggressive capitalistic economy in which American entrepreneurs gained control of most large ranchos and transformed San Diego into a merchant-dominated market town.

Major railroads expanded across California in the 1880s, bringing with them large numbers of immigrants. Between 1870 and 1930, urban development established the cities of San Diego, National City, and Chula Vista. A rural society based on family-owned farms organized by rural school district communities also developed.

The Town of Del Mar was founded in 1885 by "Colonel" Jacob Taylor and Theodore M. Loop, a contractor and engineer who worked on extending the railroad line between San Diego and San Bernardino. Taylor, who purchased 338 acres from a local homesteader, led the development of the town around a hotel-resort called Casa del Mar. Following the hotel's destruction by fire in 1889, development in the area remained dormant until the early 1900s, at which time the powerful South Coast Land Company began to develop San Diego County, including Del Mar. Among other developments, the South Coast Land Company built the Stratford Inn, which opened in 1910 on the northwest corner of 15th Street and Grand Avenue (now Camino Del Mar). Del Mar also offered a pier, a plunge (saltwater bath house), a golf course, and its own powerhouse (Del Mar Village Association 2012).

The Del Mar Fair opened at its current site in 1936 and the Del Mar Race Track's opening day followed soon thereafter in 1937. In 1959, the City of Del Mar was incorporated as a General Law City.

The City of San Diego's Torrey Pines community was annexed to the City in 1958. In 1963, the area contained only two large subdivisions: Del Mar Heights, a 760-lot subdivision, recorded in 1887, and the Del Mar Terrace subdivision, recorded in 1913, containing 547 lots. In 1963, however, the area contained only about 100 housing units with a population of 470 persons (City of San Diego 1995).

3.5.2 Camino Del Mar Alignment

Existing Conditions

Eight prehistoric sites are recorded within one-quarter mile of the Camino Del Mar Alignment. These include shell middens[3], lithic scatters[4] and habitation sites. In addition, nine historic structures relating to the railroad were recorded along the bluffs in Del Mar. None of these sites or historic structures is located adjacent to or within the potential Camino Del Mar Alignment.

No historic buildings are recorded adjacent to the potential Camino Del Mar Alignment. The City of Del Mar is conducting a historic resource survey of the City of Del Mar. The results of this city-wide survey had not been submitted to the South Coastal Information Center at the time of writing.

In association with this constraints analysis, in June 2012, ASM sent a letter to California's Native American Heritage Commission requesting a Sacred Lands File search. The Native American Heritage Commission responded that no known Traditional Cultural Place is located within the project area. The Native American Heritage Commission also provided a list of local tribes and individuals to consult regarding the project. ASM wrote letters to each of the contacts in July 2012, notifying them of the project and requesting their input on Traditional Cultural Places, Sacred Sites, resource collecting areas, or any other areas of concern. No responses were received.

Constraints

Tunnel construction could potentially result in damage to archaeological sites where the construction activity occurs near the surface, such as at portals and vents/access points. Although no archaeological sites or historic buildings were identified within or adjacent to the potential Camino Del Mar Alignment, it is possible that (A) archaeological sites are present in portions of this alignment that have not been previously surveyed, and/or (B) buildings along the alignment may be designated as historical resources between this writing and the ultimate construction of the Del Mar Tunnel[5]. Where construction occurs in native geologic formations (e.g., solid rock), there is no potential for impacts to archaeological resources.

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[3] *Midden* refers to a mound or deposit containing shells, animal bones, and other refuse that indicates the site of a human settlement.

[4] *Lithic scatter* refers to waste material (debitage) generated during the creation of prehistoric chipped stone tools such as projectile points.

[5] Typically, an age of 50 years is used to screen buildings and structures when evaluating whether to designate a building/structures as a historical resource (although in some circumstances, a building/structure that is less than 50 years old may be determined to be a historical resource). Because tunnel construction may not happen for 30 years, even when the City of Del Mar completes its current historic

The construction of tunnel vents along Camino Del Mar could potentially result in indirect impacts to a historic building(s) if the vents affected a building's setting or otherwise detracted from qualities that contributed to the designation of the building as a historic resource.

Based on the fact that no previously recorded resources are located adjacent to the proposed tunnel portals or vents, this alternative is assigned a low cultural resources constraint, with the understanding that the results of the City of Del Mar's historic inventory and/or future pedestrian surveys of the potential alignment could change this finding.

3.5.3 Crest Canyon Alignments

Existing Conditions

Thirty-one prehistoric and historic sites are recorded within one-quarter mile of the Crest Canyon Alignment studied by ASM[6]. Eleven of these resources, described below, are located adjacent to the potential alignments. The numbers referenced for each site are known as *site numbers* or *trinomials* and refer to the records for these sites kept at the South Coastal Information Center.

CA-SDI-195

This prehistoric site was originally recorded by Treganza on an unknown date. Bull and Gross re-recorded the site at a later time, however, no map, date, or further information was recorded for the site. Subsequently, this site was given a new primary number and trinomial when it was subsumed by CA-SDI-4629 in 1999 (see CA-SDI-4629 and CA-SDI-16653, below).

CA-SDI-4629

The site was originally recorded by the San Diego Museum of Man in 1968. It was later recorded by Laylander in 1986 and Pallette in 2005. The area measures 600 meters by 300 meters and consists of a large shell midden, lithic scatter, hearths, faunal remains, and burials. Based on radiocarbon dates, the site was dated to approximately 2,355 to 7,140 years B.P.

This site was given a new primary number and trinomial in 1999 when it was recorded as part of a larger site, CA-SDI-16653, which also subsumed site CA-SDI-195 (see CA-SDI-16653, below).

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resources inventory, it is possible that buildings/structures not designated as historical resources in that inventory may be considered as historical resources by the time a tunnel is constructed in the future.

[6] Because ASM did not separately study the two specific Crest Canyon alignments addressed in this constraints report, and the alignments have shifted since ASM obtained the records search results, the two Crest Canyon alignments are presented here together with the caveat that additional site-specific research would be required before assessing project-specific impacts of these alternative alignments on cultural resources.

CA-SDI-14456 (P-37-015861)

Mealey and McFarland recorded a historic concrete and sandstone cistern in 2005. The cistern feature had been backfilled, leaving behind a pit measuring approximately two meters by two meters with an unknown depth. No artifacts were found in association with the cistern; however, the feature was estimated to date to post-1945.

CA-SDI-16236 (P-37-024484)

This prehistoric site was recorded during an archaeological survey within Torrey Pines State Reserve, Extension area by Mealey et al. in 2002. The project area measured 95 meters (north/south) by 50 meters (east/west). The site consisted of fire-affected rock (FAR) features and scattered lithics. There were four possible hearth features with associated flakes and cores observed during 2002 survey.

CA-SDI-16237 (P-37-024485)

This prehistoric site was recorded during an archaeological survey within Torrey Pines State Reserve, Extension area by Mealey and Shabel in 2002. The area measured 25 meters (north/south) by 14 meters (east/west). The site consisted of FAR features and scattered lithics. There were two possible hearth features and a lithic scatter.

CA-SDI-16250 (P-37-024498)

This prehistoric site was recorded during an archaeological survey within Torrey Pines State Reserve, Extension area by Mealey et al. in 2002. The site measured 60 meters (north/south) by 60 meters (east/west). The site consisted of FAR features and flaking stations. There were three possible hearth features and two flaking stations.

CA-SDI-16251 (P-37-024499)

This prehistoric site was recorded during an archaeological survey within Torrey Pines State Reserve, Extension area by Mealey et al. in 2002. The site measured three meters (north/south) by one meter (east/west). The site consisted of a sparse lithic scatter or various materials and a basalt core.

CA-SDI-16252 (P-37-024500)

This prehistoric site was recorded during an archaeological survey within Torrey Pines State Reserve, Extension area by Mealey et al. in 2002. The site consisted of a single quartzite flake.

CA-SDI-16253 (P-37-024501)

This prehistoric site was recorded during an archaeological survey within Torrey Pines State Reserve, Extension area by Mealey et al. in 2002. The area measured five meters (north/south) by five meters (east/west). The site consisted of a lithic scatter of various materials.

CA-SDI-16256 (P-37-024504)

This prehistoric site was recorded during an archaeological survey within Torrey Pines State Reserve, Extension area by Mealey et al. in 2002. The site measured 11 meters (north/south) by 12 meters (east/west). This site consisted of a concentration of FAR and a small flaking station.

C-SDI-16653 (P-37-017122)

This prehistoric site includes previously recorded resources CA-SDI-195 and CA-SDI-4629. Williams, of Applied EarthWorks, Inc., recorded this site in 1999. The site measured 400 meters (east/west) by 15 meters (north/south). The site was a redeposited complex shell midden from an unknown location that contained shell and stone tools. The deposit was visible for approximately 300 meters along the south side of Carmel Valley Road and for about 75 meters along the north side of the road.

Human remains and lithic scatters were recovered from the site during San Diego Gas & Electric Company trench excavation in 1968.

Constraints

As noted above, tunnel construction could potentially result in damage to archaeological sites where the construction activity occurs near the surface, such as at portals and vents/access points. Also as noted above, it is possible that additional (i.e., undiscovered) archaeological sites or undocumented historical buildings/structures may occur along the potential alignment.

Previously recorded prehistoric site SDI-4629 is located adjacent to the south portal of this tunnel alternative. This extensive site dating to between 2355 and 7140 years B.P. contained multiple hearths and several burials. Several other prehistoric resources are recorded within and adjacent to the proposed alignment south of Del Mar Heights School on undeveloped land.

Based on the presence of these sites—particularly SDI-4629—the cultural resources constraint associated with the two Crest Canyon alignments is high.

3.5.4 Interstate 5 Alignments

Existing Conditions

Twenty-nine prehistoric archaeological sites are recorded within one-quarter mile of the Interstate 5 Alignment studied by ASM[7]. Three of these sites are recorded adjacent to the proposed alignment. These three sites include CA-SDI-4629 and CA-SDI-16653 (P-37-017122), which are described above, and CA-SDI-192, about which very little information was recorded other than it being a prehistoric site east of the road leading to the Del Mar Racetrack.

Constraints

As noted for the Camino Del Mar Alignment, tunnel construction could potentially result in damage to archaeological sites where the construction activity occurs near the surface, such as at portals and vents/access points. Also as noted above, it is possible that additional (i.e., undiscovered) archaeological sites or undocumented historical buildings/structures may occur along the potential alignment.

Three recorded prehistoric sites are located adjacent to the initially studied Interstate 5 alignment: SDI-192, SDI-4692 and SDI-16653. This alignment has the greatest potential to impact cultural resources between San Dieguito Bridge and Interstate 5 where the alignment traverses undeveloped land overlooking the San Dieguito Lagoon. While no information is available on site SDI-192, the bluffs overlooking lagoons have a high probability for significant Archaic Period sites, often containing burials. Several burials were recorded at site SDI-4692 at the southern end of this alignment, overlooking Los Peñasquitos Lagoon.

Given the number of archaeological resources that have been recorded along this alignment and potential for burials, the potential cultural resources constraint associated with this alternative is considered high.

3.6 GEOLOGY AND SOILS

3.6.1 Resource Overview

This section addresses the geologic formations and soil types that would be encountered during construction of the alternative double track alignments. In general, this analysis focuses on the potential constraints that geology and soils conditions would pose to the various tunnel alignments rather than the potential impacts of the alternative alignments on geology and soils

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7 Because ASM did not separately study the two specific Interstate 5 alignments addressed in this constraints report, and the alignments have shifted since ASM obtained the records search results, the two Interstate 5 alignments are presented here together with the caveat that additional site-specific research would be required before assessing project-specific impacts of these alternative alignments on cultural resources.

resources. The information presented in this section is from a preliminary geotechnical evaluation prepared by Ninyo & Moore (2014).

Regional Geologic Setting

The project study area is situated in the western portion of the Peninsular Ranges geomorphic province of Southern California. This geomorphic province encompasses an area that roughly extends from the Transverse Ranges and the Los Angeles Basin, south to the Mexican border, and beyond another approximately 800 miles to the tip of Baja California (Norris and Webb 1990; Harden 1998). The geomorphic province varies in width from approximately 30 to 100 miles, most of which is characterized by northwest trending mountain ranges separated by subparallel fault zones. In general, the Peninsular Ranges are underlain by Jurassic-age metavolcanic and metasedimentary rocks and by Cretaceous-age igneous rocks of the Southern California batholith. Geologic cover in the westernmost portion of the province in San Diego County generally consists of Upper Cretaceous-, Tertiary-, and Quaternary-age sedimentary rocks and includes the Eocene-age La Jolla Group. Structurally, the Peninsular Ranges are traversed by several major active faults. The Whittier-Elsinore, San Jacinto, and the San Andreas faults are major active fault systems located northeast of the site and the Rose Canyon, Coronado Bank, San Diego Trough, and San Clemente faults are major active faults located to the west-southwest. Major tectonic activity associated with these and other faults within this regional tectonic framework is generally right-lateral strike-slip movement. These faults, as well as other faults in the region, have the potential for generating strong ground motions in the project area.

Site Geology

The Del Mar Mesa, which would encompass any of the potential tunnel alignments, is underlain by gently dipping marine sedimentary rocks of the Eocene-age La Jolla Group. This series of sedimentary rocks underlies much of the coastal plain of western San Diego County and consists of several formations. Two of these formations, the Delmar Formation and the Torrey Sandstone, are likely to be encountered along the proposed tunnel alignments. In addition to formational units of the La Jolla Group, very old paralic deposits, old paralic deposits, alluvium, landslide deposits, colluvium, and fill soils were observed or inferred to underlie portions of the project area. Brief descriptions of the geologic units, as described in the cited literature or as observed, are presented below.

Fill (Qaf). Fill materials underlie developed areas, including existing railroad, highway, street, and building embankments, and may also be present as retaining wall and utility trench backfill.

Colluvium (not mapped). Colluvial soils are present on the face or near the toe of the hillside slopes along the proposed alignments. These soils (also described as "slopewash") were deposited by gravity and surface water flowing over the face of hillside slopes. Where observed, the colluvial deposits generally were composed of silty clay with fine sand and clayey fine sand.

Alluvium (Qya and Qpe). Recent alluvial and estuarine deposits exist north of Del Mar Mesa, within the San Dieguito River and Lagoon and south of Del Mar Mesa, within Los Peñasquitos Lagoon. Within the lagoons, the estuarine deposits may exceed 150 feet in depth. These materials typically consist of interlayered, unconsolidated, clays, silts, and sands, with scattered gravel layers.

Landslide Deposits (Qls). Two landslides have been mapped on the northern portion of the project site adjacent to Racetrack View Drive. These landslides are apparently large blocks of formational materials that have moved to the north along relatively low-angle clay-lined rupture surfaces.

Old Paralic Deposits ($Qop_{2\text{-}4}$ and Qop_6). In the areas along the edges of the San Dieguito and Los Peñasquitos Lagoons flanking the Del Mar Mesa, the margins of the active flood plains are underlain by the Late Pleistocene-Holocene-age old paralic deposits. Old paralic deposits are also mapped as underlying the coastal portion of the project site along the western edge of the City of Del Mar, where it unconformably overlies the Delmar Formation and the Torrey Sandstone. This unit was previously designated as the Bay Point Formation (Kennedy and Peterson 1975). The old paralic deposits include both marine and non-marine sediments consisting of loose to medium-dense, unconsolidated silty to clayey sand and sandy clay. These soils are exposed generally near sea level to approximately 80 to 120 feet above Mean Sea Level (MSL).

Very Old Paralic Deposits ($Qvop_{10}$, $Qvop_{10a}$, and $Qvop_{11}$). Unconformably overlying the Torrey Sandstone in the higher elevations of the Del Mar Mesa are very old paralic deposits, early Pleistocene marine terrace and beach ridge deposits. The very old paralic deposits were deposited upon a wave-cut terrace surface over much of coastal San Diego County and was previously designated as the Lindavista Formation (Kennedy and Peterson 1975). The very old paralic deposits consist of red-brown, massive, silty to clayey sandstone with cobble conglomerate interbeds. These materials are often well-cemented with distinctive red, ferruginous cement. The very old paralic deposits crop out above approximately 300 feet above MSL across the Del Mar Mesa.

Torrey Sandstone (Tt). The Eocene-age Torrey Sandstone is typically a light gray to white, medium- to coarse-grained arkosic sandstone, deposited in a near-shore barrier beach environment. Relatively thin, olive gray claystone beds exist near the base of the unit, where it is interbedded with the Delmar Formation. The Torrey Sandstone is exposed over much of the Del Mar Mesa and forms distinctive light-colored bluffs and near-vertical cliffs.

Delmar Formation (Td). The Eocene-age Delmar Formation conformably underlies and is interbedded with the Torrey Sandstone and was deposited in a brackish marine lagoonal environment. The Delmar Formation is composed of fossiliferous olive gray and dusky yellow sandy claystone and clayey sandstone. The claystone is typically highly expansive.

Geologic Structure

Bedding attitudes within the La Jolla Group range from essentially flat to dipping roughly three to five degrees to the east, northeast, and southeast. High angle cross-bedding is typical within the Torrey Sandstone. The very old paralic deposits (Lindavista) terrace is essentially flat lying and suggests that Quaternary tectonic activity is characterized by regional uplift as opposed to areas of local deformation.

Several high-angle faults are exposed in cut slopes near the intersection of Carmel Valley Road and North Torrey Pines Road. The faults dip steeply to the northwest, strike generally northeast, and define a zone of fracturing possibly up to several hundred feet wide. The primary component of displacement appears to be dip-slip; the Torrey Sandstone-Delmar Formation contact is offset down to the north-west on the order of 50 to 80 feet. Mapping by Kennedy (1975) indicates that the very old paralic deposits (Lindavista Formation) and the old paralic deposits (Bay Point Formation) are not displaced by this faulting. This suggests that these faults have a low level of activity and that displacement has not occurred within the past several hundred thousand years. Based on this information, these local faults are not considered to be active.

Geologic Hazards

The project area, like most of Southern California, is considered seismically active. In general, hazards associated with seismic activity include ground surface rupture, strong ground motion, liquefaction, seismically induced settlement, and tsunamis. Other geologic hazards include landsliding. These potential geologic hazards are discussed below.

Faulting and Seismicity

Based on Ninyo & Moore's review of the referenced geologic maps and stereoscopic aerial photographs, as well as on their geologic field mapping, the Del Mar Mesa area is not underlain by known active or potentially active faults (i.e., faults that exhibit evidence of ground displacement in the last 11,000 years and 2,000,000 years, respectively). However, the site is located in a seismically active area, as is the majority of Southern California, and the potential for strong ground motion is considered significant during the design life of the proposed structure. Table 3 lists selected principal known active faults that may affect the subject site and the maximum moment magnitudes (M_{max}) as published for the California Geological Survey (CGS) by Cao et al. (2003). The approximate fault-to-site distances were calculated using the computer program FRISKSP (Blake 2001).

Table 3 – Principal Active Faults

Fault	Distance in miles (kilometers) [1,2]	Moment Magnitude[2]
Rose Canyon	2.0 (3.2)	7.2
Coronado Bank	15.7 (25.2)	7.6
Newport-Inglewood	17.9 (28.8)	7.1
Elsinore (Julian Segment)	33.2 (53.5)	7.1
Elsinore (Temecula Segment)	34.4 (55.3)	6.8

[1] Blake (2001)
[2] Cao, et al. (2003)

The most significant seismic event likely to affect the proposed project would be a moment magnitude 7.2 earthquake within the Rose Canyon fault zone located approximately two miles west of the project site. The Rose Canyon fault zone is a part of a more extensive fault zone that includes the offshore zone of deformation and the Newport-Inglewood fault zone that extend northward and southward, both onshore and offshore. The Rose Canyon-Newport-Inglewood fault zone consists of predominantly right-lateral strike-slip faults that extend south-southeast from southern Los Angeles, through Long Beach, to the San Diego metropolitan area. However, various fault strands display strike-slip, normal, oblique, or reverse components of displacement (Treiman 1993).

Ground Surface Rupture

The alternative double track alignments cross mapped fault traces; however, these faults are not considered active and active faults have not been mapped within the project area. In addition, this area of north coastal San Diego County is not included within a mapped State of California Earthquake Fault (Alquist-Priolo Special Studies) Zone. Therefore, the potential for ground rupture due to faulting at the site is considered low. However, lurching or cracking of the ground surface because of a nearby seismic event is possible.

Strong Ground Motion

A significant seismic event that could affect the proposed facilities would be strong ground motion from a moment magnitude (M_W) 7.2 earthquake within the Rose Canyon fault zone. The site is located within a CBC Near-Source Zone for active faults. As noted above, the site is not located within a State of California Earthquake Fault Zone (Alquist-Priolo Special Studies Zone).

The 2010 California Building Code (CBC) recommends that the design of structures be based on the peak horizontal ground acceleration (PGA) having a two percent probability of exceedance in

50 years which is defined as the Maximum Considered Earthquake (MCE). The statistical return period for PGA_{MCE} is approximately 2,475 years. The PGA_{MCE} for the site was calculated as 0.47g using the United States Geological Survey (USGS) web-based ground motion calculator (USGS 2011). The design PGA was calculated to be 0.34g using the USGS ground motion calculator. These estimates of ground motion do not include near-source factors that may be applicable to the design of structures on site.

Liquefaction Potential

Liquefaction is the phenomenon in which loosely deposited granular soils with silt and clay contents of less than approximately 35 percent and non-plastic silts located below the water table undergo rapid loss of shear strength when subjected to strong earthquake-induced ground shaking. Ground shaking of sufficient duration results in the loss of grain-to-grain contact due to a rapid rise in pore water pressure, and causes the soil to behave as a fluid for a short period of time. Liquefaction is known generally to occur in saturated or near-saturated cohesionless soils at depths shallower than 50 feet. Factors known to influence liquefaction potential include composition and thickness of soil layers, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking.

The tunnel alternatives are proposed to be constructed predominantly within very dense formational materials of the Delmar Formation and the Torrey Sandstone. Due to the density of these materials, the potential for liquefaction and dynamic settlement to affect these areas of tunnels is considered low. Based on the relatively loose nature of the granular alluvial materials underlying the alignments where they cross the alluvial areas of the San Dieguito and Los Peñasquitos Lagoons, these portions of the alignment will be subject to liquefaction and dynamic settlement. An evaluation of the liquefaction potential for these portions of the alignments should be performed, including subsurface evaluation, laboratory analyses, and engineering analyses during the design phase.

Lateral Spreading

Lateral spreading of ground surface during an earthquake usually takes place along weak shear zones that have formed within a liquefiable soil layer. Lateral spread has generally been observed to take place in the direction of a free-face (i.e., retaining wall, slope, channel wall) but has also been observed to a lesser extent on ground surfaces with very gentle slopes. During the design phase of the project, the potential for lateral spread to occur in portal areas or where the alignment traverses alluvial areas should be further evaluated by subsurface evaluation and laboratory testing.

Tsunamis

Tsunamis are long seismic sea waves (long compared to ocean depth) generated by sudden movements of the sea floor caused by submarine earthquakes, landslides, or volcanic activity. Based on the relative elevation of the portal areas, the potential for damage due to tsunamis is considered low for the project tunnel alignments. The potential for tsunamis to impact low-lying potions of the proposed alignment along the tunnel approaches and in the lagoon areas is, however, considered to be high.

Landsliding

Two small landslides have been mapped adjacent to Racetrack View Drive. These landslides are apparently large blocks of formational materials that have moved north along relatively low-angle failure surfaces. The mapped landslides overlie a portion of the alignments that roughly parallel San Dieguito Lagoon (i.e., Crest Canyon, Interstate 5 Alignment, and Interstate 5 East Alignment).

The claystone interbeds within the Delmar Formation are typically highly fractured and sheared, thus contributing to potential instability of slopes underlain by this unit. Bedding plane shears and interbedded remolded clay seams are common; the presence of perched ground water above these features can also reduce strength characteristics.

Exposures of Torrey Sandstone and very old paralic deposits are typically broken by widely spaced, near-vertical joints. Block falls along joint surfaces are a characteristic form of mass-wasting within these units. The Torrey Sandstone and very old paralic deposits commonly erode to form near-vertical exposures.

Geologic Hazards Map

According to the City of San Diego Seismic Safety Study (City of San Diego 2008), the project alignments through Del Mar Mesa are located within Geologic Hazard Categories 52 and 53. Hazard Category 52 is described as “Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk.” Hazard Category 53 is described as “Level or sloping terrain, unfavorable geologic structure, low to moderate risk.” The portions of the alignments that cross Los Peñasquitos Lagoon are located within Hazard Category 31, which is described as having “High potential (for liquefaction) - shallow groundwater, major drainages, hydraulic fills.” A similar map of geologic hazards is not currently available for the City of Del Mar portion of the project.

3.6.2 Camino Del Mar Alignment

Existing Conditions

The northern portal of the Camino Del Mar Alignment tunnel would likely be excavated through a combination of old paralic deposits and claystone-sandstone of the Delmar Formation. The southern portal would likely be excavated into Delmar Formation and/or Torrey Sandstone. The main tunnel would be excavated within old paralic deposits, Torrey Sandstone, and Delmar Formation. Vertical air intake and emergency access shafts would be approximately 45 to 60 feet deep and would also be excavated through old paralic deposits, Torrey Sandstone, and Delmar Formation.

Constraints

Stability of the excavation at the southern portal may be a concern due to the presence of high-angle faults. Other potential concerns at the portals would include stability of excavations in old paralic deposits, groundwater seepage, and expansive claystone. Potential geotechnical concerns along the cut and cover portion of the Camino Del Mar Alignment could include stability of excavation sidewalls, groundwater seepage, and expansive claystone. Based on these factors, a medium constraint is assigned to the Camino Del Mar Alignment, which reflects that there would be geotechnical obstacles to overcome during design and construction, but that overall this appears to be a feasible alternative from a geology and soils standpoint.

3.6.3 Crest Canyon Alignments

Existing Conditions

The northern portals of the Crest Canyon alignments[8] would likely be excavated through a combination of old paralic deposits and claystone-sandstone of the Delmar Formation. The southern portals would be excavated into Torrey Sandstone and/or Delmar Formation. The tunnel excavation would likely encounter consolidated sandstone of the Torrey Sandstone and sandstone and claystone of the Delmar Formation. Vertical air intake and ventilation shafts up to approximately 250 feet deep would be drilled through very old paralic deposits, Torrey Sandstone, and Delmar Formation. Well-cemented sandstone and gravel conglomerate layers may be encountered during excavation of the very old paralic deposits.

Constraints

Potential concerns at the portals would include stability of excavations in old paralic deposits, groundwater seepage, and expansive claystone. These geologic units encountered during

8 Because Ninyo & Moore did not separately study the two specific Crest Canyon alignments addressed in this constraints report, and the alignments have shifted since Ninyo & Moore conducted its initial analysis, the two Crest Canyon alignments are presented here together.

tunneling should be generally stable and excavatable with standard boring machines. Weak claystone layers and clay-lined fractures may be encountered and the alignment may cross high angle faults. In addition, cemented layers and zones within the Delmar Formation and in the lower part of the Torrey Sandstone could slow the rate of penetration.

A medium constraint is assigned to the two Crest Canyon alignments, which reflects that there would be geotechnical obstacles to overcome during design and construction, but that overall they appear to be feasible from a geology and soils standpoint.

3.6.4 Interstate 5 Alignments

Existing Conditions

The northern tunnel portals of the Interstate 5 alignments[9] would likely be excavated through a combination of old paralic deposits and claystone-sandstone of the Delmar Formation. The southern portal would be excavated into Torrey Sandstone, old paralic deposits, and, potentially, fill placed for the construction of Interstate 5. The main body of the tunnel would be expected to be excavated through sandstone and claystone of the Delmar Formation and, to a lesser extent, sandstone of the Torrey Sandstone. Weak claystone layers and clay-lined fractures may also be encountered. The Interstate 5 alignments would also cross beneath mapped landslides. Based on Ninyo & Moore's preliminary estimates, the top of the tunnel could be within about 10 to 20 feet of the basal rupture surface of the landslide; however, subsurface excavation would be required to better determine the nature and depth of landslides.

Vertical air intake and ventilation shafts up to approximately 200 feet deep would be drilled through Torrey Sandstone and Delmar Formation. Well-cemented sandstone layers may be encountered during excavation.

Constraints

Potential concerns at the portals would include expansive claystone, the stability of excavations in old paralic deposits and fill, and groundwater seepage. These geologic units encountered during tunneling should be generally stable and excavatable with standard boring machines; however, cemented layers and zones, if present, could slow the rate of penetration. Depending on final design, the Interstate 5 tunnel alignments could cross beneath mapped landslides. Pending more detailed, future analysis regarding the nature and depth of mapped landslide areas, these could also pose a geology and soils constraint.

[9] Because Ninyo & Moore did not specifically study the two specific Interstate 5 alignments addressed in this constraints report, and the alignments have shifted since Ninyo & Moore conducted its initial analysis, the two Interstate 5 alignments are presented here together.

A medium constraint is assigned to the Interstate 5 alignments, which reflects that there would be geotechnical obstacles to overcome during design and construction, but that overall they appear to be feasible from a geology and soils standpoint.

3.7 WATER QUALITY AND HYDROLOGY

Information on existing surface water quality/hydrology conditions, as outlined below for each potential alignment, was obtained from sources including the San Diego Regional Water Quality Control Board (RWQCB) *Water Quality Control Plan for the San Diego Basin* (Basin Plan); Federal Emergency Management Agency (FEMA) floodplain mapping; water quality monitoring efforts conducted under the State Surface Water Ambient Monitoring Program (SWAMP) and the National Pollutant Discharge Elimination System (NPDES); and other published and unpublished data.

3.7.1 Resource Overview

The assessment of potential constraints related to hydrology and water quality for all five potential alignments involves concerns related to existing/proposed conditions associated with: (1) watershed and drainage characteristics, including drainage alteration and runoff rates/ amounts; (2) flood-related hazards; and (3) water quality issues, as outlined below. In addition, all five potential alignments would be required to conform with appropriate regulatory standards, including applicable elements of the Federal Clean Water Act/National Pollutant Discharge Elimination System (CWA/NPDES), Regional Water Quality Control Board (RWQCB) Basin Plan, and related local standards (with summary descriptions provided below).

For purposes of the following analysis, it is assumed that either shallow groundwater would not be encountered during any of the proposed surface or subsurface project construction activities, or that standard dewatering efforts would be applicable such that no significant constraints related to technical, environmental or regulatory concerns would result. Accordingly, no additional discussion of existing groundwater conditions or associated potential constraints is provided herein.

Clean Water Act/National Pollutant Discharge Elimination System Standards

Specific CWA/NPDES requirements applicable to all of the potential alignments include the following: (1) the General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit, NPDES No. CAS000002, State Water Resources Control Board [SWRCB] Order 2009-0009-DWQ); and (2) the NPDES Waste Discharge Requirements for Discharges of Urban Runoff from Municipal Separate Storm Sewer System (Municipal Permit, NPDES No. CAS0108758, RWQCB Order No. R9-2007-0001).

Construction General Permit

Conformance with the Construction General Permit is required prior to development of applicable sites exceeding one acre. Specific conformance requirements include implementing a Storm Water Pollution Prevention Plan (SWPPP), an associated Construction Site Monitoring Program (CSMP), employee training, and minimum best management practices (BMPs), as well as a Rain Event Action Plan (REAP) for applicable projects (e.g., those in Risk Categories 2 or 3, as outlined below). Under the Construction General Permit, project sites are designated as Risk Level 1 through 3 based on site-specific criteria (e.g., sediment and receiving water risk), with Risk Level 3 sites requiring the most stringent controls.

Municipal Storm Water Permit

The Municipal Permit is intended to protect environmentally sensitive areas and provide conformance with pertinent hydrology and water quality standards. Associated requirements involve using applicable planning, design, operation, treatment, and enforcement measures to maintain predevelopment runoff rates and amounts to the maximum extent practicable (MEP), avoid/address potential hydromodification[10] impacts, and reduce pollutant discharges to the MEP. Specifically, these measures include: (1) using jurisdictional controls to regulate flows and protect water quality; (2) requiring coordination between individual jurisdictions to provide watershed-based hydrology/water quality protection; (3) implementing applicable low impact development (LID) site design[11], source control, priority project, and/or treatment control BMPs to avoid, reduce, and/or mitigate effects including increased erosion and sedimentation, hydromodification, and the discharge of contaminants in urban runoff; and (4) using appropriate monitoring, reporting, and enforcement efforts to ensure proper implementation, documentation, and (as appropriate) modification of permit requirements.

Basin Plan Standards

The San Diego Basin Plan (RWQCB 1994) establishes beneficial uses and water quality objectives for water resources in the San Diego region. Beneficial uses are defined in the Basin Plan as “the uses of water necessary for the survival or well being of man, plus plants and wildlife.” Water quality objectives are identified as “the limits or levels of water quality

[10] Hydromodification is defined in the Municipal Permit as the change in natural watershed hydrologic processes and runoff characteristics (infiltration and overland flow) caused by urbanization or other land use changes that result in increased stream flows, sediment transport, and morphological changes in the channels receiving the runoff.

[11] LID site design BMPs are intended to control post-development runoff, erosion potential and contaminant generation by mimicking the natural hydrologic regime to the MEP, and capturing, filtering, storing, evaporating, detaining, and/or infiltrating runoff close to its source.

constituents or characteristics which are established for the reasonable protection of beneficial uses." Water quality objectives include both narrative requirements (which can encompass qualitative and quantitative standards) and specific numeric objectives for applicable constituents.

Local Standards

Pursuant to the CWA/NPDES and associated requirements described above, local agencies (including the cities of Del Mar and San Diego) have adopted pertinent ordinances and standards related to drainage and water quality issues. The principal local storm water standards applicable to the project alignments are listed below, with all of the identified sources providing detailed direction to ensure project conformance with applicable CWA/NPDES, RWQCB, and related local storm water requirements.

- City of Del Mar – Storm water and related standards adopted by the City of Del Mar include: (1) the City of Del Mar Standard Urban Stormwater Mitigation Plan (SUSMP, 2011); and (2) the City of Del Mar Stormwater Management and Discharge Control Ordinance (2010; Ordinance Nos. 652, 739, 752, 802, 839).

- City of San Diego – Applicable storm water standards adopted by the City of San Diego include: (1) the City Storm Water Management and Discharge Control Ordinance (San Diego Municipal Code §43.03 *et seq*.); (2) The City Grading Ordinance (San Diego Municipal Code §142.0101 *et seq*.); (3) The City Storm Water Standards (City of San Diego 2011); and (4) the Countywide Model SUSMP (Project Clean Water 2010).

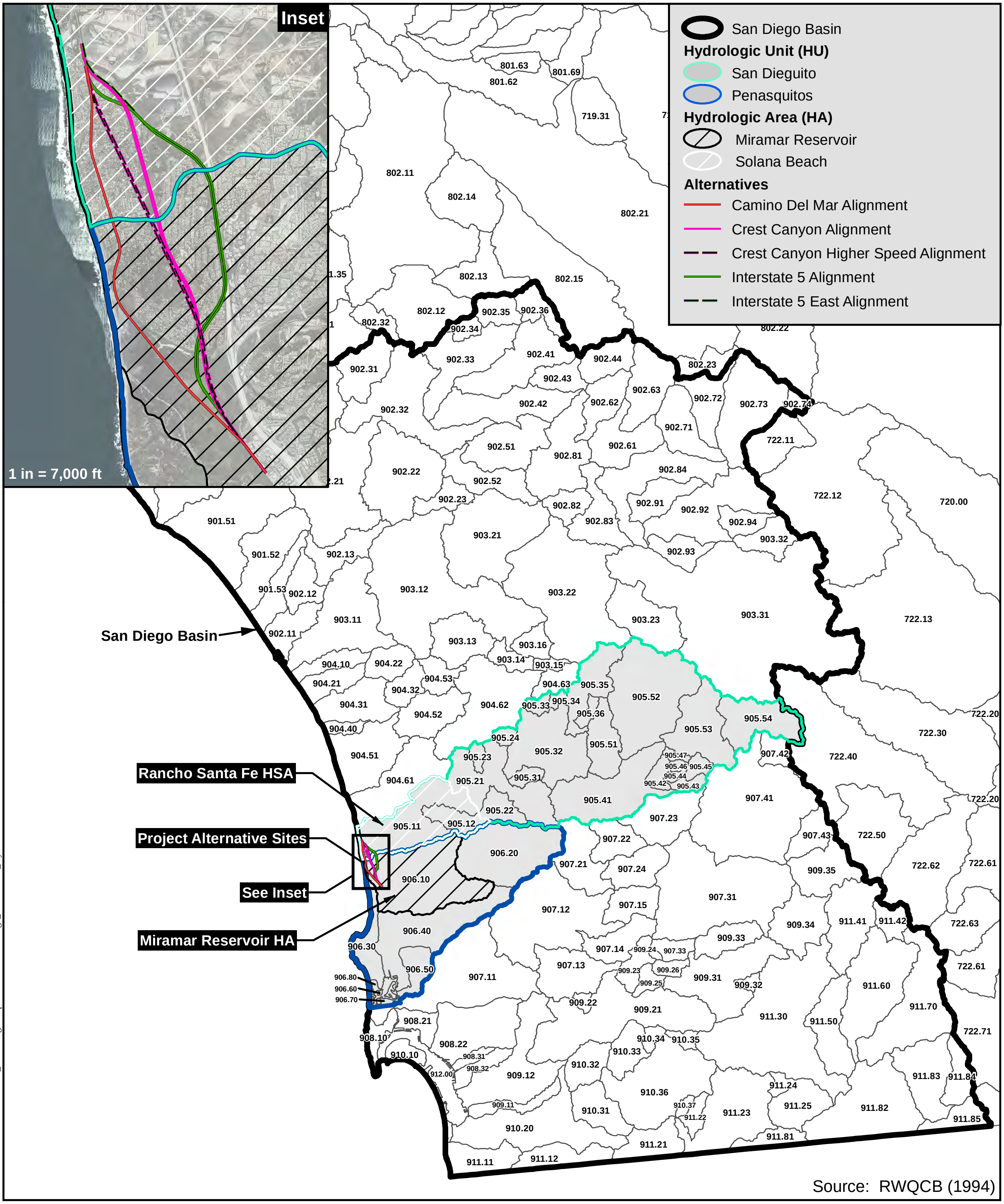
3.7.2 Camino Del Mar Alignment

Existing Conditions

Watershed and Drainage Characteristics

The Camino Del Mar Alignment is located within portions of the San Dieguito (905.00) and Peñasquitos (906.00) Hydrologic Units (HUs), two of 11 major drainage areas identified in the RWQCB Basin Plan. These HUs, along with associated Hydrologic Area (HA) and Hydrologic Subarea (HSA) designations, are described below and shown on Figure 8, *Alternative Locations Within Local Hydrologic Designations.*

San Dieguito Hydrologic Unit. The San Dieguito HU is a rectangular-shaped area of approximately 350 square miles, and extends generally from Santa Ysabel on the east to Solana Beach-Del Mar along the coast. The HU is divided into a number of HAs and HSAs based on local drainage characteristics, with applicable portions of the Camino Del Mar Alignment located in the Rancho Santa Fe HSA (HSA 905.11) of the Solana Beach HA (refer to Figure 8).



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Alternative Locations within Local Hydrologic Designations

DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY ENVIRONMENTAL CONSTRAINTS REPORT

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Figure 8

Surface drainage in the San Dieguito HU is primarily through the San Dieguito River, which extends through the Rancho Santa Fe HSA and flows into San Dieguito Lagoon. The San Dieguito Lagoon channel is located approximately 1,800 feet north of the Camino Del Mar Alignment at its closest point.

The portion of the Camino Del Mar Alignment footprint within the San Dieguito HU is predominantly developed, with associated drainage flowing generally north and east to the San Dieguito River/Lagoon via a number of storm drain facilities and unnamed tributary creeks. Average annual precipitation in the vicinity of the Camino Del Mar Alignment is approximately 10.4 inches, with over 90 percent of this occurring during the period of October through April (weather.com 2012).

Peñasquitos Hydrologic Unit. The Peñasquitos HU is a triangular-shaped area of approximately 170 square miles, and extends from Poway on the east to Mission Bay-Del Mar along the coast. The HU is divided into a number of HAs based on local drainage characteristics, with applicable portions of the Camino Del Mar Alignment located in the Miramar Reservoir HA (HA 906.10, refer to Figure 8). Surface drainage in the Peñasquitos HU is through a number of small to moderate size streams, including Los Peñasquitos and Carmel Valley creeks in the Miramar Reservoir HA. Both of these creeks flow into Los Peñasquitos Lagoon, which is crossed by the southern (surface double tracking) portion of the Camino Del Mar Alignment.

The portion of the Camino Del Mar Alignment footprint within the Peñasquitos HU includes mostly developed areas approximately between Del Mar Heights and Carmel Valley roads (tunnel area), and predominantly undeveloped areas south of Carmel Valley Road to the southern alignment terminus near Carmel Mountain Road. The southern area encompasses several native wetland (marine and freshwater) and upland habitats in Los Peñasquitos Lagoon (i.e., along the existing rail line). Flows in the noted developed areas drain generally east and/or south to the lagoon via existing storm drain facilities and unnamed natural creeks, while flows within the lagoon are controlled by tidal fluctuations, including fresh water drainage from inland creeks and salt water influx from the ocean. Average annual precipitation in applicable portions of the Peñasquitos HU is the same as that described above for the San Dieguito HU (weather.com 2012).

Flood Hazards

Portions of the Camino Del Mar Alignment located south of Carmel Valley Road (i.e., within and adjacent to Los Peñasquitos Lagoon) are within 100-year floodplain and/or floodway[12]

[12] Floodways are generally defined as the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

boundaries mapped by FEMA (Figure 9, *Alternative Locations within Mapped 100-year Floodplains*). The remaining portions of the alignment are mapped as Zone X, or areas determined to be outside the 500-year (and therefore 100-year) floodplain, with the mapped 100-year floodplain for the San Dieguito River located just north of the alignment (FEMA 2012, 1997a through 1997c).

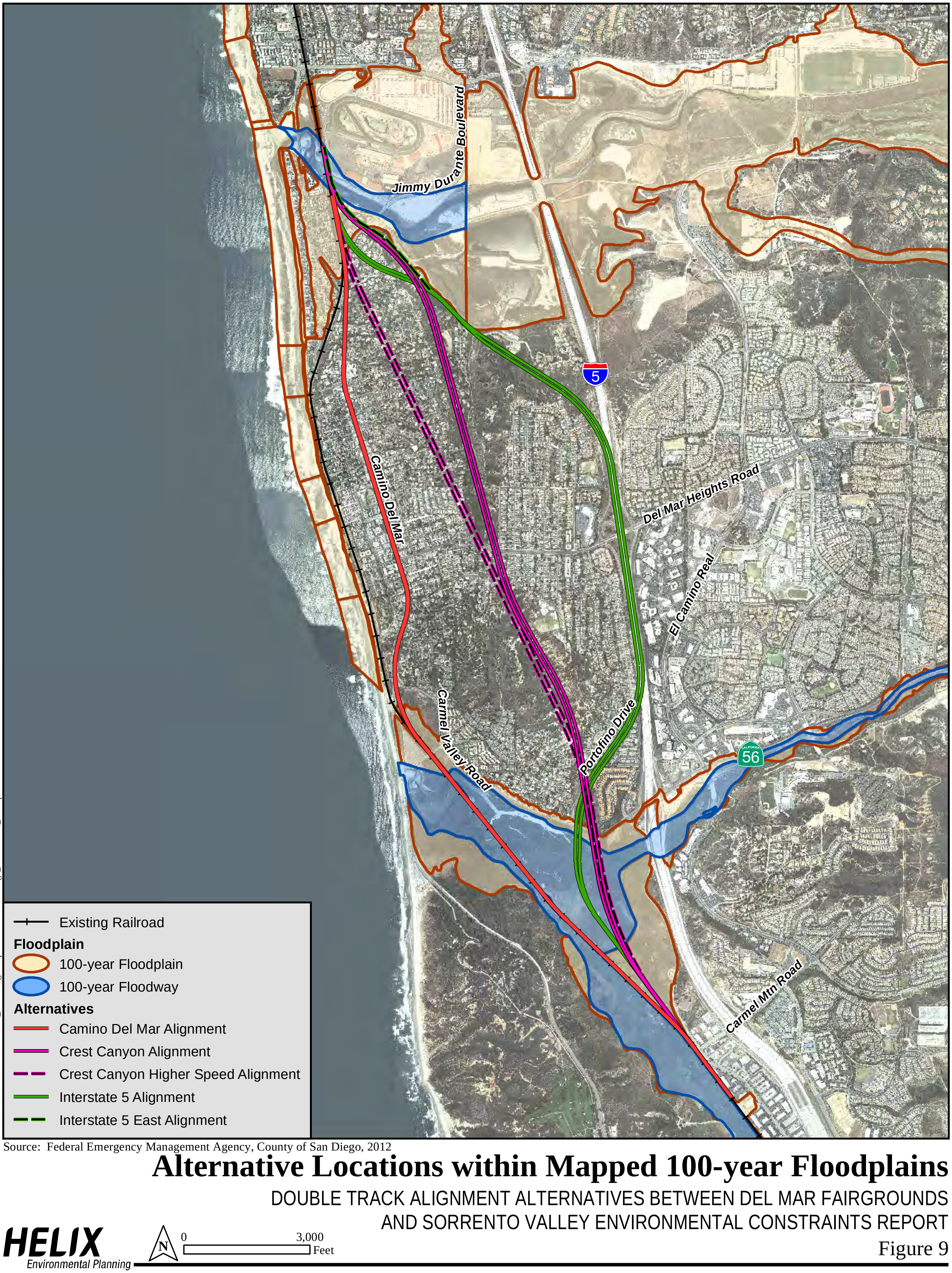
Water Quality

Surface water in the northern portion of the Camino Del Mar Alignment (approximately north of Carmel Valley Road) and vicinity consists predominantly of flows from storm events and (to a lesser extent) irrigation runoff. Surface drainage in the southern portion of the alignment includes similar storm and irrigation runoff, along with tidal flows in the lagoon as previously noted. No known water quality data are available for the alignment area itself, with storm flows and irrigation runoff subject to variations in water quality due to local conditions such as flow volumes and land use. Based on the developed nature of portions of the Camino Del Mar Alignment and immediate vicinity, as well as the extent and predominantly urban nature of existing upstream development, local surface water quality is expected to be generally moderate to poor.

The principal surface waters located downstream of the Camino Del Mar Alignment are the San Dieguito River/Lagoon and Pacific Ocean in the San Dieguito HU, and Los Peñasquitos Lagoon and the ocean in the Peñasquitos HU. Current water quality information for these downstream receiving waters (as well as applicable upstream areas) includes quantitative and qualitative data from the following sources: (1) SWAMP studies for the noted HUs; (2) monitoring associated with the NPDES Municipal Permit; and (3) the SWRCB and RWQCB CWA Section 303(d) list of impaired waters. Applicable monitoring data from these sources are summarized below for the San Dieguito and Peñasquitos HUs.

San Dieguito Hydrologic Unit. Water quality data sources for the San Dieguito HU include SWAMP monitoring data and NPDES data, as described below.

- <u>SWAMP Monitoring Data</u> - Monitoring conducted under the SWAMP periodically rotates among watersheds, with the San Dieguito HU most recently monitored in 2003 (SWAMP 2007a). This latest effort included water quality data from one monitoring location along the San Dieguito River approximately one mile upstream of the lagoon (Site No. SDQ9). This site was evaluated for water chemistry, water and sediment toxicity, and physical habitat conditions, with the resulting data from the San Dieguito River site (and other monitoring locations) supporting the overall analysis conclusions that "[t]he ecological condition of the San Dieguito watershed is moderately impacted, and the severity of the impact increases along a downstream gradient" (SWAMP 2007a).



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Source: Federal Emergency Management Agency, County of San Diego, 2012

Alternative Locations within Mapped 100-year Floodplains

DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY ENVIRONMENTAL CONSTRAINTS REPORT

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Figure 9

- NPDES Data – Monitoring under NPDES Municipal Permit requirements has occurred at a number of upstream locations over approximately the past decade, including: (1) wet weather and ambient monitoring at the San Dieguito River Mass Loading Station (MLS), located approximately 3.5 miles northeast of the northern alignment terminus; and (2) jurisdictional dry weather monitoring conducted at a number of upstream sites.

  For the most recent (2010/2011) wet weather monitoring at the MLS, regulatory standards were exceed at a high (> 50 percent) or medium (25 to 50 percent) frequency for constituents including total dissolved solids (TDS), toxicity to test species and fecal coliform bacteria (Weston Solutions, Inc. [Weston] 2012).

  For the most recent ambient monitoring in 2010/2011, regulatory standards were exceed at a high or medium frequency for constituents including TDS, toxicity, enterococcus bacteria, total phosphorus, nitrogen, and dissolved phosphorus (Weston 2012).

  For the most recent dry weather monitoring in 2011, regulatory standards were most commonly exceeded for turbidity, bacteriological constituents (fecal coliform and enterococcus bacteria), and nitrate (Weston 2013).

- CWA Section 303(d) Data – The SWRCB and RWQCB produce bi-annual qualitative assessments of statewide water quality conditions. These assessments are focused on federal CWA Section 303(d) impaired water listings and scheduling for assignment of total maximum daily load (TMDL) requirements. States are required to identify and document any and all polluted surface water bodies, with the resulting documentation referred to as the *Clean Water Act Section 303(d) List of Water Quality Limited Segments*, or more commonly the 303(d) list. The most current (2010) approved 303(d) list identifies the following impairments for applicable receiving waters in the San Dieguito HU: (1) the San Dieguito River is listed for fecal coliform and enterococcus bacteria, nitrogen, phosphorus, TDS and toxicity; and (2) the Pacific Ocean shoreline at the mouth of San Dieguito Lagoon is listed for total coliform bacteria (SWRCB 2010).

Peñasquitos Hydrologic Unit. Available water quality monitoring data in the Peñasquitos HU are from similar sources as noted above for the San Dieguito HU, and include the following results from SWAMP, NPDES and Section 303(d) efforts.

- SWAMP Monitoring Data - SWAMP monitoring for the Peñasquitos HU was most recently conducted in 2002, and included two sites along Los Peñasquitos Creek (LPC6) and Soledad Creek (SOL2) just upstream of Los Peñasquitos Lagoon (SWAMP 2007b). These sites were evaluated for water chemistry, water and sediment toxicity, physical habitat conditions, crayfish tissue contaminates (LPC6 only), and bioassessment[13] conditions. The resulting data from the two noted sites (and other monitoring locations) support the overall analysis conclusion that "[t]he watershed is in poor ecological health" (SWAMP 2007b).

- NPDES Data – Monitoring under NPDES Municipal Permit requirements has occurred at a number of upstream locations over approximately the past decade, including: (1) wet weather monitoring at the Los Peñasquitos Creek MLS and Temporary Watershed Assessment Station (TWAS), located approximately 1.1 and 2.7 miles southeast of the southern alignment terminus, respectively; and (2) jurisdictional dry weather monitoring conducted at a number of upstream sites.

  The most recent (2010/2011) wet weather monitoring at the MLS and TWAS include the following results: (1) regulatory standards at the MLS were exceeded at a high or medium frequency for constituents including TDS and fecal coliform bacteria; and (2) regulatory standards at the TWAS were exceeded at a high or medium frequency for constituents including total suspended solids (TSS), turbidity, TDS, fecal coliform bacteria, pH and Bifenthrin (a pyrethroid pesticide, Weston 2012).

  For the most recent dry weather monitoring in 2011, regulatory standards were most commonly exceeded for turbidity, ammonia, methylene blue active substances (MBAS, e.g., detergents), conductivity and enterococcus bacteria (Weston 2013).

- CWA Section 303(d) Data – The current 303(d) list identifies the following impairments for applicable receiving waters in the Peñasquitos HU: (1) approximately 469 acres of Los Peñasquitos Lagoon, listed for sedimentation/siltation; and (2) the Pacific Ocean shoreline at the mouth of Los Peñasquitos Creek/Lagoon, listed for total coliform bacteria (SWRCB 2010).

Constraints

Watershed and Drainage Constraints

Potential constraints related to watershed and drainage issues include: (1) drainage alteration (i.e., changes in flow pattern/directions) from project-related construction (e.g., grading/ excavation) and operational features (e.g., flow diversions through placement of facilities/ structures within drainage courses); and (2) increased runoff rates/amounts from the installation of new impervious surfaces (e.g., pavement or structures).

[13] Bioassessment monitoring involves evaluation of the taxonomic richness (i.e., number of taxonomic groups) and diversity (i.e., species diversity within taxonomic groups) of benthic macroinvertebrate communities.

For the northern (tunnel) portion of the Camino Del Mar Alignment, including areas within both the San Dieguito and the Peñasquitos HUs, potential constraints related to watershed and drainage considerations would be low. Specifically, surface operations in the tunnel portion of the alignment would be limited to relatively minor tunnel-related construction activities and installation of surface facilities such as portals and vents. These types of activities and facilities would be generally minor in extent, and would not represent substantial potential constraints related to alteration of existing surface drainage patterns/directions, installation of impervious surfaces, increased runoff rates/amounts, and related potential effects to downstream resources (e.g., lagoon ecology from additional freshwater influx) or drainage facilities (e.g., storm drain capacity issues).

Potential watershed and drainage constraints in the southern (surface double tracking) portion of the Camino Del Mar Alignment would be moderate to high, based on the location of this segment predominantly within Los Peñasquitos Lagoon. Specifically, depending on the final alignment design, implementation of this alignment could entail replacing and/or constructing new or expanded support facilities (i.e., rail foundations such as berms or levees) and crossing structures (e.g., bridges or culverts). The design of such facilities would be subject to applicable requirements from the RWQCB (and/or other regulatory bodies) to provide adequate flow capacity and avoid or minimize "tidal muting" (i.e., the level to which man-made features restrict the exchange of water between inland sources and the ocean). Potential constraints related to tidal flows in the lagoon would also encompass associated requirements related to biological resources, as discussed in Section 3.1, Biological Resources.

Floodplain/Hazard Constraints

Potential flood-related constraints include: (1) effects to project facilities/operations from flood waters (e.g., inundation/ flood damage and/or service interruptions); and (2) impacts from placing structures within mapped floodplains/floodways, such as impeding flood flows and/or increasing the horizontal and/or vertical extent of such flows.

Potential constraints related to flood hazards in the northern (tunnel) portion of the Camino Del Mar Alignment would be low. This conclusion is based on the designation of the associated area as "Zone X" by FEMA, as well as the fact that surface activities and facilities would be minor as previously described.

As shown on Figure 9, the southern portion of the Camino Del Mar Alignment (approximately south of Carmel Valley Road) is located within a mapped 100-year floodplain and/or the related floodway in Los Peñasquitos Lagoon. Associated potential constraints are considered medium, based on the fact that proposed activities would be required to incorporate design measures to protect rail facilities from flood-related effects, such as elevating the tracks above the 100-year flood level in applicable areas (i.e., similar to the existing rail line). While such requirements represent standard design and engineering practices, potential constraints are characterized as medium due to the following considerations: (1) facility design would be required to encompass requirements related to placing additional structures within the floodway, such as avoiding/minimizing impediments to flood waters and/or addressing increases in the horizontal and/or vertical extent of such flows; and (2) modifications to mapped 100-year floodplains and/or floodways would potentially require a Conditional Letter of Map Approval (CLOMR) from FEMA, as well as ultimate approval of a Letter of Map Approval (LOMR), which provides the official FEMA modifications to the associated flood map(s).

Water Quality Constraints

Potential water quality constraints for the Camino Del Mar Alignment would involve both short-term (construction) and long-term (operational) concerns. Short-term water quality constraints include potential erosion and sedimentation effects from construction-related grading and excavation, as well as effects from the use/storage and potential accidental discharge of construction-related contaminants such as vehicle fuels/lubricants, paints/solvents, concrete, wastewater, and trash/debris.

Potential short- and long-term water quality constraints in the northern (tunnel) portion of the Camino Del Mar Alignment would be low. This conclusion is based on the generally minor nature of associated construction and related activities as previously described, along with the fact that the project would be subject to applicable requirements under the NPDES Construction General/Municipal permits and related local standards. Specifically, as noted above, this would entail the implementation of an approved site-specific SWPPP and CSMP for construction activities, as well as the use of appropriate BMPs to address potential long-term pollutant generation and ensure conformance with related regulatory requirements. Due to the nature of potential construction and operational activities/facilities in the northern alignment area, CWA/NPDES and related regulatory conformance is anticipated to be provided through standard BMPs/pollution control measures, with no associated substantial constraints.

Potential short-term water quality constraints in the southern (surface) portion of the Camino Del Mar Alignment would be medium. Specifically, as previously described, project activities/facilities located approximately south of Carmel Valley Road would be located within Los Peñasquitos Lagoon. Activities/operations in this area would be subject to the same regulatory controls as noted above for the northern alignment area, although the nature of compliance efforts would be more complex due to their location within the lagoon. Specifically, more substantial sediment/sedimentation controls would likely be required to meet regulatory requirements associated with discharge to the lagoon, based on considerations including the associated Section 303(d) listing for sedimentation/siltation. For example, project construction could potentially require the use of an Active Treatment System (ATS), such as chemical coagulation/flocculation, to meet turbidity requirements for associated discharge.

Potential long-term water quality constraints in the southern portion of the Camino Del Mar Alignment are considered low. This conclusion is based on the fact that, once operational, proposed facilities and activities in this area would generally not result in substantial pollutant generation, and would be subject to associated regulatory requirements as previously described (with conformance anticipated through implementation of standard BMPs and control measures).

3.7.3 Crest Canyon Higher Speed Alignment

<u>Existing Conditions</u>

Watershed and Drainage Characteristics

The Crest Canyon Higher Speed alignment is located within portions of the San Dieguito and Peñasquitos Hydrologic Units (HUs), with associated regional watershed, drainage and related features the same as those described above for the Camino Del Mar Alignment. The northern (tunnel) portion of the Crest Canyon alignment includes developed and undeveloped areas within both the San Dieguito and Peñasquitos HUs, with similar overall drainage patterns and climatic conditions as described for the northern portion of the Camino Del Mar Alignment. The southern portion of the Crest Canyon Higher Speed alignment is located within Los Peñasquitos Lagoon, and also exhibits similar drainage features/conditions as noted for the Camino Del Mar Alignment.

Flood Hazards

Existing floodplain/floodway conditions within the Crest Canyon alignment are similar to those described above for the Camino Del Mar Alignment (refer to Figure 9). Specifically, the northern (tunnel) portion of the alignment is mapped as Zone X, while the areas south of Carmel Valley Road extend through a mapped 100-year floodplain and associated floodway within Los Peñasquitos Lagoon.

Water Quality

The nature of existing surface waters and associated water quality data/conditions in the Crest Canyon alignment and vicinity are the same as those described above for the Camino Del Mar Alignment.

<u>Constraints</u>

Potential constraints for the Crest Canyon Higher Speed Alignment related to watershed and drainage conditions, flood hazards, and water quality concerns are essentially the same as those described above for the Camino Del Mar Alignment.

3.7.4 Crest Canyon Alignment

This alignment has similar existing hydrology and water quality conditions as the Crest Canyon Higher Speed Alignment, except that a portion of this alignment is roughly parallel to, and just south of, San Dieguito Lagoon in the San Dieguito HU. As a result, a portion of this alignment is within the mapped 100-year floodplain along the San Dieguito River/Lagoon. Also due to the San Dieguito Lagoon's proximity and general water quality sensitivity, potential constraints in this area are considered low to medium, as regulatory requirements could entail more extensive BMPs and pollutant control measures (as outlined above for Los Peñasquitos Lagoon in the water quality discussion for the Camino Del Mar Alignment).

Potential constraints for the Crest Canyon Alignment related to watershed and drainage conditions, flood hazards, and water quality concerns are essentially the same as those described above for the Camino Del Mar and Crest Canyon Higher Speed alignments.

3.7.5 Interstate 5 Alignment

<u>**Existing Conditions**</u>

Watershed and Drainage Characteristics

The Interstate 5 Alignment is located within portions of the San Dieguito and Peñasquitos HUs, as previously described. Associated regional watershed, drainage and climatic conditions are the same as those discussed above for the Camino Del Mar Alignment, with specific drainage conditions in the Interstate 5 Alignment outlined below for both HUs.

San Dieguito Hydrologic Unit. The portion of the Interstate 5 Alignment within the San Dieguito HU includes both surface and subsurface (tunnel and trench excavation) areas. The northernmost segment exhibits mostly urban (residential) development with some open space areas. The southern segment is primarily undeveloped with some residential properties in the central area, while the standard tunnel segment is primarily undeveloped with urban (residential) sites adjacent to the west along the southernmost extent. Drainage from all of the noted segments flows into San Dieguito Lagoon, either directly (i.e., in adjacent areas) or via existing storm drain facilities and/or unnamed natural creeks.

Peñasquitos Hydrologic Unit. The portion of the Interstate 5 Alignment within the Peñasquitos HU includes a tunnel segment extending along the Interstate 5 corridor from the northern HU boundary to the southern tunnel portal near Portofino Road, and a surface (double track) segment from the portal to the southern alignment terminus at the Sorrento Valley Double track Project. The tunnel segment is predominantly developed, while the surface segment is similar to that described above for the Camino Del Mar Alignment in Los Peñasquitos Lagoon.

Flood Hazards

As shown on Figure 9, the northernmost portion of the Interstate 5 Alignment is within the mapped 100-year floodplain along the San Dieguito River/Lagoon. Existing floodplain and floodway conditions in the remainder of the alignment are similar to those described above for the Camino Del Mar and Crest Canyon alignments. Specifically, the areas between the noted San Dieguito floodplain and the southern tunnel portal are mapped as Zone X, while the surface double tracking areas south Carmel Valley Road extend through a mapped 100-year floodplain and associated floodway within Los Peñasquitos Lagoon.

Water Quality

The nature of existing surface waters and associated water quality data/conditions in the Interstate 5 Alignment and vicinity are the same as those described above for the Camino Del Mar and Crest Canyon alignments.

Constraints

Watershed and Drainage Characteristics

Potential constraints related to watershed and drainage issues for the Interstate 5 Alignment are similar in nature to those described above for the Camino Del Mar and Crest Canyon alignments, with site-specific constraints levels outlined below.

For the northern portions of the Interstate 5 Alignment, potential constraints related to drainage alteration would be low to medium. Specifically, surface operations in these areas would involve relatively extensive surface disturbance and related potential short-term effects to drainage patterns/directions (although it is anticipated that drainage conditions would be restored to a pre-development state per associated regulatory standards). Potential constraints in these areas associated with increased runoff rates/amounts would be low, as post-development conditions would not entail substantial new areas of impervious surfaces.

Potential constraints related to watershed and drainage issues would be low for the tunnel segment of this alignment, and medium to high for the surface double tracking segment located within Los Peñasquitos Lagoon. These constraint level conclusions are based on similar reasons as described above for associated segments in the Camino Del Mar Alignment.

Floodplain/Hazard Constraints

Potential flood-related constraints are similar in nature to those described above for the Camino Del Mar Alignment. Specifically, potential constraints related to flood hazards would be low in areas designated as Zone X by FEMA (as no flood hazards are present), as well as in areas proposed for standard tunneling or subsurface cut and cover excavation within the mapped 100-

year floodplain associated with the San Dieguito River/Lagoon. The latter constraints designation is based on the fact that proposed facilities would be located predominantly underground, with substantial effects related to flood hazards therefore not anticipated.

Potential constraints related to flood hazards in the portion of the Interstate 5 Alignment located south of the southern tunnel portal in Los Peñasquitos Lagoon are considered medium, for similar reasons as described above for the Camino Del Mar Alignment.

Water Quality

Potential constraints for the Interstate 5 Alignment related to water quality concerns are essentially the same as those described above for the Camino Del Mar Alignment. One potential exception to this conclusion involves the standard surface segment of this alignment located adjacent or in close proximity to San Dieguito Lagoon. Specifically, due to the lagoon proximity and general water quality sensitivity, potential constraints in this area are considered low to medium, as regulatory requirements could entail more extensive BMPs and pollutant control measures (as outlined above for Los Peñasquitos Lagoon in the water quality discussion for the Camino Del Mar Alignment).

3.7.5 Interstate 5 East Alignment

Existing conditions and constraints for this alternative are similar to those described above for Interstate 5 Alignment.

3.8 PALEONTOLOGICAL RESOURCES

3.8.1 Resource Overview

The term *paleontological resources* refers to what are also commonly called *fossils*—that is, the remains or traces of prehistoric plants and animals other than *Homo sapiens*. Specifically with regard to this constraints study, the term refers to as-yet-undiscovered fossils within the geologic formations that underlie the potential railroad track alignments. These fossils are considered resources because they may possess scientific and/or educational value.

The information on underlying geologic formations was provided by Ninyo & Moore, which is preparing a geotechnical evaluation of the potential tunnel alignments, and is based on a Ninyo & Moore site reconnaissance visit and existing reports and maps. Information regarding the paleontological sensitivity of the potentially affected geologic formations (that is, a given geologic formation's potential to contain important fossil resources) is based on *Paleontological Resources, County of San Diego* by Thomas Deméré and Stephen Walsh (1993).

As used in *Paleontological Resources, County of San Diego* (and, by incorporation, this constraints report), high resource potential and high sensitivity are assigned to geologic formations known to contain locations with rare, well preserved, fossil materials with a high scientific value. These formations also have the highest potential to produce unique invertebrate fossil assemblages or unique vertebrate fossil remains. Moderate resource potential and moderate sensitivity are assigned to geologic formations judged to have a strong, but often unproven, potential for producing unique fossil remains. *Paleontological Resources, County of San Diego* also assesses some geologic formations as having low, marginal, or no paleontological resource value; however, none of those formations are expected to be affected by tunnel construction, and these sensitivity levels are not further discussed in this constraints report.

Due to the nature of tunnel construction, this constraints analysis assumes that most, if not all, fossils encountered during construction would be either destroyed or damaged to such an extent as to substantially degrade their scientific and educational value. The analysis of paleontological resources as a potential environmental constraint takes into account not only the paleontological sensitivity of the potentially affected formations, but also the extent of probable impacts and also the fact that the affected fossils would likely remain buried for extremely long periods of time—potentially thousands of years or more for some of the deepest tunnel alignment—absent project construction.

3.8.2 Camino Del Mar Alignment

Existing Conditions

It is expected that potential Camino Del Mar Alignment encompasses the following:

- Old Paralic Deposits (Bay Point Formation) – high sensitivity;
- Torrey Sandstone – moderate sensitivity; and
- Delmar Formation – high sensitivity.

Constraints

This alternative would affect geologic formations with a high or moderate paleontological sensitivity, and it would likely do so through tunnel construction methods that would limit or preclude effective paleontological monitoring and recovery of fossil resources. Absent the construction of the Camino Del Mar Alignment tunnel, however, it is also likely that no other project would be developed that would have provided an opportunity for the recovery of the affected fossils. Accordingly, the paleontological resources constraint of this alternative is assessed as medium.

3.8.3 Crest Canyon Higher Speed Alignment

Existing Conditions

It is expected that potential Crest Canyon Higher Speed Alignment encompasses the following:

- Old Paralic Deposits (Bay Point Formation; only at the portals and vent shafts) – high sensitivity;
- Torrey Sandstone – moderate sensitivity;
- Delmar Formation – high sensitivity; and
- Very Old Paralic Deposits (Lindavista Formation) – moderate sensitivity.

Constraints

The paleontological resources constraint of this alternative is assessed as medium for reasons similar to those described for the Camino Del Mar Alignment.

3.8.4 Crest Canyon Alignment

Existing Conditions

It is expected that potential Crest Canyon Alignment encompasses the following:

- Old Paralic Deposits (Bay Point Formation; only at the portals and vent shafts) – high sensitivity;
- Torrey Sandstone – moderate sensitivity;
- Delmar Formation – high sensitivity; and
- Very Old Paralic Deposits (Lindavista Formation) – moderate sensitivity.

Constraints

The paleontological resources constraint of this alternative is assessed as medium for reasons similar to those described for the Camino Del Mar Alignment.

3.8.5 Interstate 5 Alignment

Existing Conditions

It is expected that potential Interstate 5 Alignment encompasses the following:

- Old Paralic Deposits (Bay Point Formation; at the portals) – high sensitivity;
- Torrey Sandstone – moderate sensitivity; and
- Delmar Formation – high sensitivity.

Constraints

The paleontological resources constraint of this alternative is assessed as medium for reasons similar to those described for the Camino Del Mar Alignment.

3.8.6 Interstate 5 East Alignment

Existing Conditions

The existing conditions for this alternative would be similar to those described for Interstate 5 Alignment.

Constraints

The paleontological resources constraint of this alternative is assessed as medium for reasons similar to those described for the Camino Del Mar Alignment.

4.0 SUMMARY

The following table provides a summary the environmental constraint levels assessed for each of the potential alternatives evaluated in this report.

Table 4. Summary of Assessed Environmental Constraint Level

Issue Area	**Constraints Ranking by Alternative***				
	Camino Del Mar	**Crest Canyon Higher Speed**	**Crest Canyon**	**Interstate 5**	**Interstate 5 East**
Biological Resources	H	M	M	M	M
Noise*	H/L	M/M	M/H	M/H	M/H
Vibration**	L	L	L	L	L
Air Quality and Greenhouse Gas	L/H	L/H	L/H	L/M	L/M
Land Use	M	H	H	H	H
Cultural Resources	L	H	H	H	H
Geology and Soils	M	M	M	M	M
Water Quality/ Hydrology†	H	H	H	H	H
Paleontological Resources	M	M	M	M	M

* Where two levels of environmental constraints are provided for one category (e.g., "high/low"), the first assessment reflects construction and the second reflects operations.

** The "Low" constraint for vibration is contingent on the success of planned vibration dampening in the tunnel segments under and adjacent to residences and businesses

† Because the Water Quality/Hydrology discussion provides separate constraints for a number of specific resource areas (e.g., watershed and drainage characteristics, floodplain/hazard, and water quality), the highest level of constraint for any of these topics is listed for each alignment

5.0 LIST OF PREPARERS

This report was prepared by HELIX Environmental Planning, Inc. under the direction of the San Diego Association of Governments (SANDAG) and David Evans and Associates, Inc. Key personnel from HELIX Environmental Planning, Inc. that participated in this report include:

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- Tom Huffman, Principal
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6.0 REFERENCES

ASM Affiliates, Inc.

2014 Draft Cultural Resources Report, Conceptual Engineering and Environmental Constraints for Double Track Alternative Alignments between Del Mar Fairgrounds And Sorrento Valley. November 6.

Bada, Jeffrey, Roy Schroeder, and George Carter

1974 New Evidence for the Antiquity of Man in North America Deduced from Aspartic Acid Racemization. Science 184:791-793.

Bean, Lowell J., and Florence C. Shipek

1978 Luiseño. In California, edited by Robert F. Heizer, pp. 575-587. Handbook of North American Indians, Vol. 8, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Blake, T.F.

2001 FRISKSP (Version 4.00) A Computer Program for the Probabilistic Estimation of Peak Acceleration and Uniform Hazard Spectra Using 3-D Faults as Earthquake Sources.

California Department of Parks and Recreation

1997 Wildlife Management Plan for Torrey Pines State Reserve. November. Revised December 1998.

California Department of Transportation (Caltrans)

2002 Transportation Related Earthborne Vibrations. Technical Advisory, Vibration TAV-02-01-R9601. February 20.

2009 Technical Noise Supplement. November

Cao, T., Bryant, W. A., Rowshandel, B., Branum, D., and Willis, C. J.

2003 The Revised 2002 California Probabilistic Seismic Hazards Maps: California Geological Survey: dated June.

Carter, George

1980 Earlier Than You Think: A Personal View of Man in the Americas. Texas A&M University, College Station.

Crocker, Malcolm J. (Editor)

2007 Handbook of Noise and Vibration Control. John Willey and Sons, Hoboken, New Jersey. As referenced in Ldn Consulting 2012.

Del Mar, City of

2011 City of Del Mar SUSMP, *Standard Urban Stormwater Mitigation Plan Requirements for Development Applications*. January 14.

2010 City of Del Mar Municipal Code: Title11, Health and Sanitation; Chapter 11.30, Stormwater Management and Discharge Control. May.

1993 Land Use Map

Del Mar Village Association

2012 Del Mar Village Association website, historical resources page. http://www.delmarmainstreet.com/del-mar-history.php. Accessed July 6

Deméré, Thomas A. and Stephen L. Walsh

1993 *Paleontological Resources, County of San Diego*

Erlandson, Jon M., and Roger H. Colten

1991 An Archaeological Context for Early Holocene Studies on the California Coast. In Hunter Gatherers of Early Holocene Coastal California, edited by Jon M. Erlandson and Roger H. Colten, pp. 1-10. Perspectives in California Archaeology (Volume 1). Institute of Archaeology, University of California, Los Angeles.

Federal Emergency Management Agency (FEMA)

2012 FEMA Metadata File HYD_FLOODPLFile Geodatabase Feature Class. June 22. Available at: file://C:\Documents and Settings\mstephens\Local Settings\Temp\tmpF0.tmp.htm.

1997a Flood Insurance Rate Map (FIRM), San Diego County, California and Incorporated Areas. Map No. 06073C1309 F. June 19.

1997b FIRM, San Diego County, California and Incorporated Areas. Map No. 06073C1317 F. June 19.

1997c FIRM, San Diego County, California and Incorporated Areas. Map No. 06073C1336 F. June 19.

Harden, D.R.

1998 California Geology: Prentice Hall, Inc.

HNTB

2012 LOSSAN Corridorwide Strategic Implementation Plan. April.

Jones, Terry

1992 Settlement Trends along the California Coast. In Essays on the Prehistory of Maritime California, edited by Terry L. Jones, pp. 1-38. Center for Archaeological Research at Davis No. 10. University of California, Davis.

Kroeber, Alfred

1925 Handbook of the Indians of California. Bureau of American Ethnology Bulletin No. 78. Washington, D.C.

Ldn Consulting

2012 Noise Impact Analysis, Del Mar Village Specific Plan, Del Mar, California. March.

Moratto, Michael

1984 California Archaeology. Academic Press, Orlando, Florida.

Ninyo & Moore

2014 Preliminary Geotechnical Evaluation NCTD Del Mar Railroad Tunnel Alternative Analysis Project Del Mar and San Diego, California.

Norris, R. M. and Webb, R. W.

1990 Geology of California, Second Edition: John Wiley & Sons, Inc.

Project Clean Water

2010 Countywide Model SUSMP, *Standard Urban Stormwater Mitigation Plan Requirements for Development Applications*. February 9.

Rogers, Malcolm

1966 Ancient Hunters of the Far West. Union-Tribune, San Diego.

Rogers, Spencer

1974 An Ancient Human Skeleton Found at Del Mar, California. San Diego Museum Papers No. 7.

San Diego Association of Governments (SANDAG)

2011 2050 Regional Transportation Plan.

San Diego, City of

2012 Storm Water Standards. January 20. Available at: http://www.sandiego.gov/development-services/news/pdf/stormwatermanual.pdf.

1995 Torrey Pines Community Plan. As updated through April 2011.

San Diego Regional Water Quality Control Board

1994 Water Quality Control Plan, San Diego Basin, Region 9. September 8, as amended. Available at:

http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/index.shtml.

Shipek, Florence

1991 Delfina Cuero: Her Autobiography. Ballena Press, Menlo Park, California.

Sparkman, Phillip Stedman

1908 The Culture of the Luiseño Indians. University of California Publications in American Archaeology and Ethnology 8:188-234. Berkeley.

State Surface Water Ambient Monitoring Program (SWAMP)

2007a Surface Water Ambient Monitoring Program (SWAMP) Report on the San Dieguito Hydrologic Unit. July.

2007b Surface Water Ambient Monitoring Program (SWAMP) Report on the Peñasquitos Hydrologic Unit. July.

State Water Resources Control Board (SWRCB)

2010 2008-2010 Clean Water Act Section 303(d) List of Water Quality Limited Segments. Available at: California 2010 303(d) combined list Excel files (combines category 4a, 4b, and 5).

Taylor, R., L. Payen, C. Prior, P. Slota, R. Gillespie, J. Gowlett, R. Hedges, A. Hull, T. Zabel, D. Donahue, and R. Berger

1985 Major Revisions in the Pleistocene Age Assignments for North American Human Skeletons by C14 Accelerator Mass Spectrometry: None Older Than 11,000 C14 Years B.P. American Antiquity 50: 136-140.

Torrey Pines State Natural Reserve

2012 Website. http://www.torreypine.org/parks/torrey-pine.html. Accessed June 8.

Treiman, J.A.

1993 Rose Canyon Fault Zone, Southern California: California Geological Survey

United States Geological Survey (USGS)

2011 Ground Motion Parameter Calculator v. 5.1.0, World Wide Web, http://earthquake.usgs.gov/research/hazmaps/design/.

Warren, Claude, Gretchen Siegler, and Frank Dittner

2008 Paleo-Indian and Early Archaic Periods. In Prehistoric and Historic Archaeology of Metropolitan San Diego: A Historic Properties Background Study, pp. 13-107. ASM Affiliates, Carlsbad, California.

Weather.com

2012 Monthly averages for Del Mar (92014) and San Diego (92121), California. Available at:

http://www.weather.com/weather/wxclimatology/monthly/graph/92121?from=month_bottomnav_undeclared.

http://www.weather.com/weather/wxclimatology/monthly/graph/92014?from=month_bottomnav_undeclared.

Weston Solutions, Inc. (Weston)

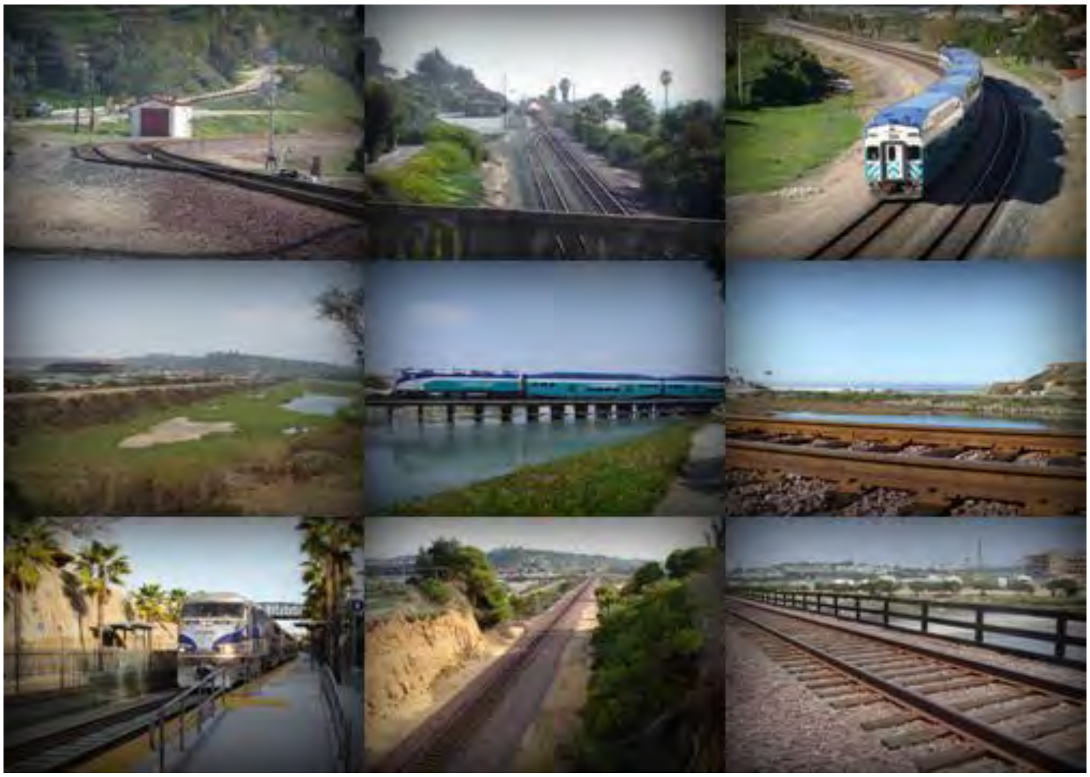
2013 San Diego County Copermittees 2011/2012 Receiving Waters and Urban Runoff Modeling Final Report. January.

2012 San Diego County Copermittees 2010/2011 Receiving Waters and Urban Runoff Modeling Final Report. January.

III. CULTURAL RESOURCES REPORT

CONCEPTUAL ENGINEERING AND ENVIRONMENTAL CONSTRAINTS FOR DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY

CULTURAL RESOURCES REPORT



SANDAG

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EXECUTIVE SUMMARY

This report presents the results of a cultural resource constraints report completed for the San Diego Association of Governments (SANDAG) Del Mar Fairgrounds to Sorrento Valley Double Track project in the cities of Del Mar and San Diego. It included a cultural resources records search to identify all previously recorded cultural and historical resources located within one-quarter mile of the proposed project alternatives. The Del Mar Fairgrounds to Sorrento Valley Double Track project includes conceptual engineering for three primary alignments and two modified alignment options from the Del Mar Fairgrounds to the Sorrento Valley Station. The alignments to be studied are approximately 5.7 miles in length with approximately 10,000 to 13,000 linear feet of tunnel in each option. Results of the records search are summarized for each of the alternatives.

This study did not include a survey or evaluation of any resources. Cultural resource surveys should be completed for those portions of the alignments that have the potential to impact cultural or historical resources. These include above-ground alignments, tunnel portal and vent locations. Historic resource inventories and evaluations of buildings within the viewshed of vent locations may also be required to determine visual and indirect effects on historic resources.

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1. INTRODUCTION

This report presents the results of a cultural resource constraints report completed for the San Diego Association of Governments (SANDAG) Del Mar Fairgrounds to Sorrento Valley Double Track project in the cities of Del Mar and San Diego. This study was completed in compliance with the National Environmental Protection Act (NEPA) and the California Environmental Quality Act (CEQA). It included a cultural resources records search to identify all previously recorded cultural and historical resources located within one-quarter mile of the proposed project alternatives. This study did not include a survey or evaluation of any resources.

PROJECT DESCRIPTION

The Del Mar Fairgrounds to Sorrento Valley Double Track project alignment alternatives analysis provides conceptual engineering for three primary alignments and two modified alignment options from the Del Mar Fairgrounds to the Sorrento Valley Double Track project (Figures 1 and 2). Alternative 1 follows Camino Del Mar, Alternative 2 traverses the Crest Canyon Open Space, and Alternative 3 follows Interstate 5 (I-5). Each of the alignments is approximately 5.0 miles in length. Tunnel segment lengths vary from approximately 10,000 feet for Camino Del Mar to 12,000 feet to 13,000 feet for I-5 options and 13,000 feet for Crest Canyon options. Each alternative includes the connection through Los Peñasquitos Lagoon to the Sorrento Valley Double Track Project. The Camino Del Mar alignment would be constructed using a cut and cover box section. The top of the box structure would be 10 feet to 70 feet below the roadway. The Crest Canyon and I-5 options would be constructed using bored sections. The Crest Canyon tunnel segment would reach depths of approximately 250 below the existing ground. The I-5 tunnel segment varies from 30 feet to 120 feet below the freeway elevation.

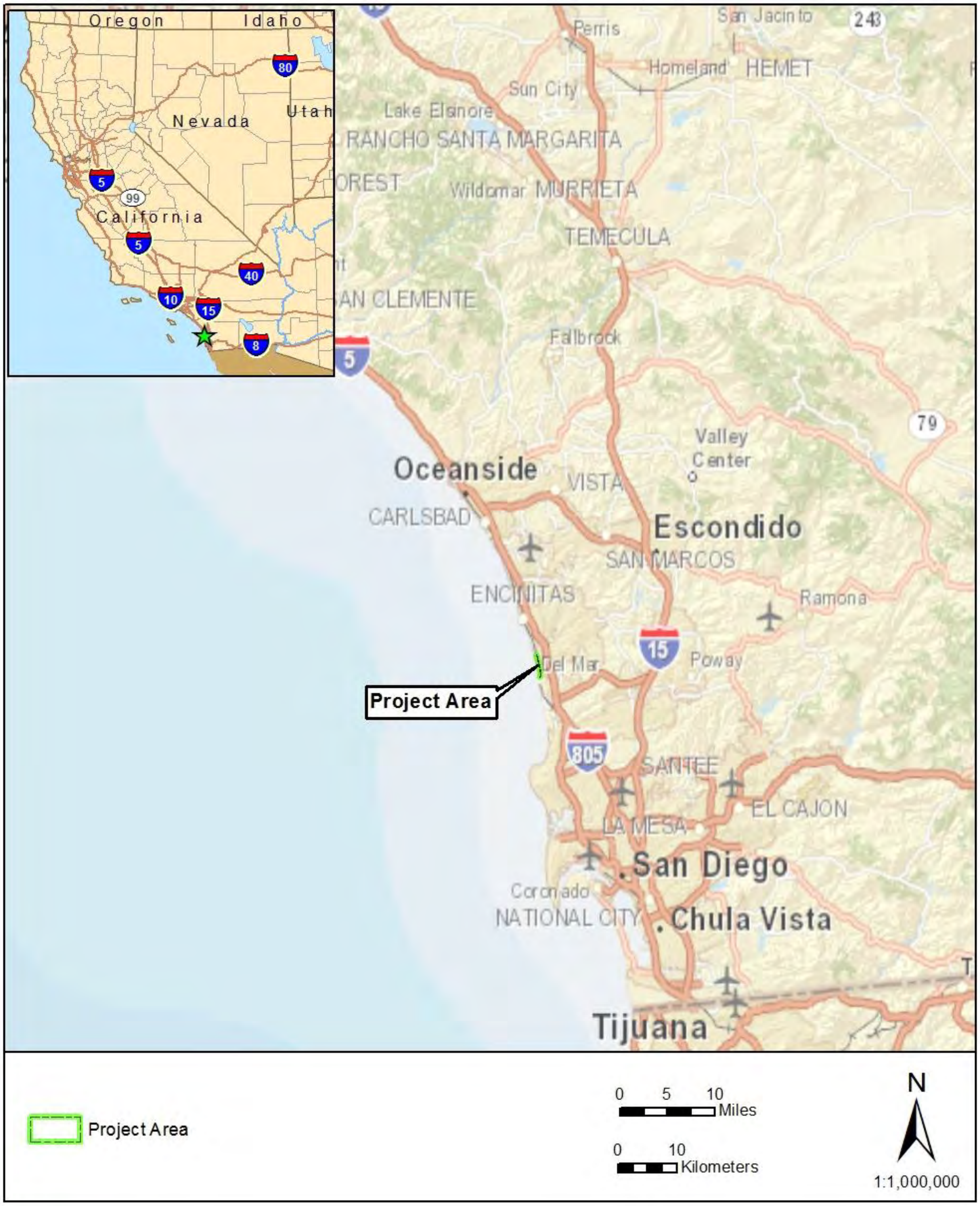

Figure 1. Regional project location.

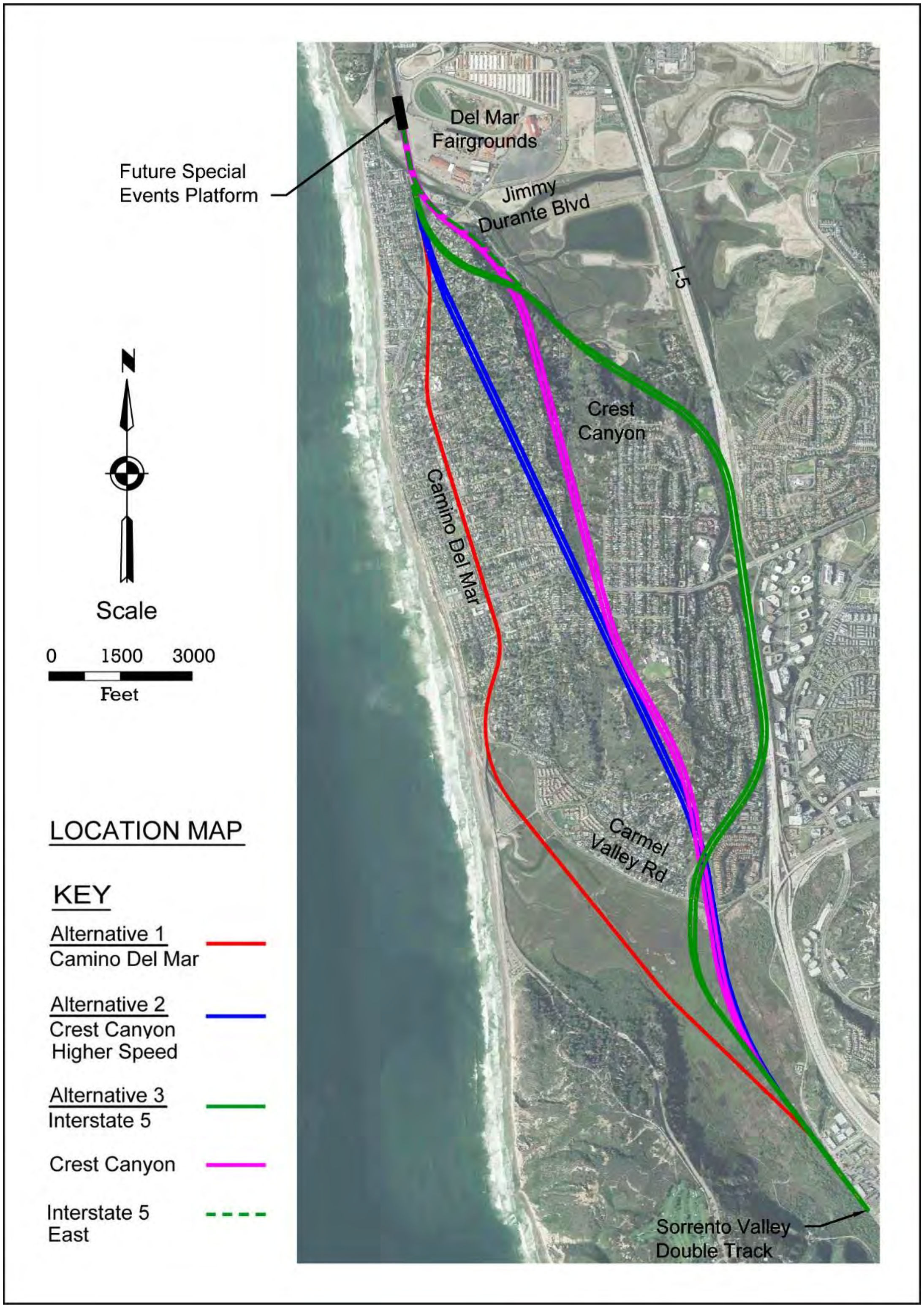

Figure 2. Del Mar Fairgrounds to Sorrento Valley double track alignment alternatives

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2. CULTURAL AND HISTORICAL OVERVIEW

PREHISTORY

Archaeological fieldwork along the southern California coast has yielded a diverse range of human occupation extending from the early Holocene into the Ethnohistoric period (Erlandson and Colten 1991; Jones 1992; Moratto 1984). A variety of different regional chronologies, often with overlapping terminology, have been used in coastal southern California, and they vary from region to region (Moratto 1984). Today, the prehistory of San Diego County is generally divided into three major temporal periods: Paleo-Indian, Archaic, and Late Prehistoric. These time periods are characterized by patterns in material culture that are thought to represent distinct regional trends in the economic and social organization of prehistoric groups. In addition, particular scholars referring to specific areas utilize a number of cultural terms synonymously with these temporal labels: San Dieguito for Paleo-Indian, La Jolla for Archaic, and San Luis Rey for Late Prehistoric (Meighan 1959; Moriarty 1966; Rogers 1939, 1945; True 1966, 1970; Wallace 1978; Warren 1964).

Paleo-Indian Period

The antiquity of human occupation in the New World has been the subject of considerable debate over the last few decades. The currently accepted model is that humans first entered the western hemisphere between 12,000 and 15,000 years before present (B.P.). While there is no firm evidence of human occupation in coastal southern California prior to 12,000 B.P., dates as early as 23,000 B.P. and even 48,000 B.P. have been reported (Bada et al. 1974; Carter 1980; Rogers 1974). The amino acid racemization technique used to date these sites has been largely discredited, however, by more recent accelerator radiocarbon dating of early human remains along the California coast (Taylor et al. 1985). Despite intense interest and a long history of research, no widely accepted evidence of human occupation of North America dating prior to 15,000 B.P. has emerged.

As in most of North America, the earliest recognized period of California prehistory is termed Paleo-Indian. In southern California, this period is usually considered to date from at least 10,000 B.P. until 8,500 to 7,200 B.P. (Moratto 1984; Warren et al. 2008), and is represented by what is known as the San Dieguito complex (Rogers 1966). Within the local classificatory system, San Dieguito assemblages are composed almost entirely of flaked stone tools, including scrapers, choppers, and large projectile points (Warren 1987; Warren et al. 2008). Until recently, the near absence of milling tools in San Dieguito sites was viewed as the major difference between Paleo-Indian economies and the lifeways which characterized the later Archaic period.

Based upon rather scant evidence from a small number of sites throughout San Diego County, it has been hypothesized that the people linked to the San Dieguito complex lived within a generalized hunter-gatherer society with band-level organization. This portrayal is essentially an extension to the inland and coastal areas of San Diego County of what has long been considered a continent-wide Paleo-Indian tradition. This immediate post-Pleistocene adaptation occurred within a climatic period of somewhat cooler and moister conditions than exists presently. The range of possible economic adaptations of San Dieguito bands to this environment is poorly understood at present, but it is typically assumed that these groups followed lifeways similar to other Paleo-Indian groups in North America.

This interpretation of the San Dieguito complex as the local extension of a post-Clovis big game hunting tradition is based primarily on materials from the Harris Site (Ezell 1983, 1987; Warren 1966, 1967). An unusually high percentage of large bifaces in the Harris assemblage seems indicative of a retooling station, a pattern not found at any other purported San Dieguito sites. Still, there does appear to be some evidence that large biface technology was typical of the earliest occupations of San Diego County, and that this pattern is shared by other complexes in the greater Southwest. What is less clear is how large a role these objects played in the day-to-day subsistence activities of their creators.

Archaic Period

The Archaic period (also referred to as the Early Milling Period) extends back at least 7,200 years, possibly as early as 9,000 B.P. (Moratto 1984; Rogers 1966; Warren et al. 2008). Archaic subsistence is generally considered to have differed from Paleo-Indian subsistence in two major ways. First, gathering activities were emphasized over hunting, with shellfish and seed collecting of particular importance. Second, milling technology, frequently employing portable ground stone slabs, was developed. The shift to maritime exploitation from a land-based focus is traditionally held to mark the transition from the Paleo-Indian period to the Archaic period. In reality, the implications of this transition are poorly understood from both an economic and cultural standpoint (see Warren et al. 2008 for an excellent review).

Early Archaic occupations in San Diego County are most apparent along the coast and the major drainage systems that extend inland from the coastal plains (Moratto 1984). Coastal Archaic sites are characterized by cobble tools, basin milling stones, hand stones, discoidals (disk-shaped grinding stones), a small number of “Pinto” and “Elko” series dart points, and flexed burials. Together these elements typify what is termed the La Jolla complex in San Diego County, which appears as the early coastal manifestation of a more diversified way of life.

For many years, the common model has included something that D. L. True (1958) termed the Pauma complex, an archaeological construct based upon a number of inland Archaic-period sites in northern San Diego that appeared to exhibit assemblage attributes different from coastal Archaic sites. Pauma complex sites were typically located on small saddles and hills overlooking stream drainages, and were characterized by artifact scatters of basin and slab milling stones, hand stones, some scraper planes, debitage, and occasional ground stone discoidals. Further analysis suggests that the Pauma complex is simply an inland counterpart to the coastal La Jolla complex (Cardenas and Van Wormer 1984; Gallegos 1987; True and Beemer 1982). Given that the distance between the two environments (coastal and inland) is relatively minimal, and that sites attributed to each complex appear to be contemporaneous, it seems more parsimonious to consider the differences in materials as seasonal manifestations of a mobile residence strategy using both coastal and inland resources. When similar environmental variability exists within Archaic complexes in other regions, such sites are usually considered to represent different aspects of the annual positioning strategies of a single hunter-gatherer culture complex (Bayham and Morris 1986; Sayles 1983; Sayles and Antevs 1941).

In recent years, local archaeologists have questioned the traditional definition of the Paleo-Indian San Dieguito complex as consisting solely of flaked lithic tools and lacking milling technology. There is speculation that differences between artifact assemblages of "San Dieguito" and "La Jolla" sites may reflect functional differences rather than temporal or cultural variability (Bull 1987; Gallegos 1987; Wade 1986). Gallegos (1987) has proposed that the San Dieguito, La Jolla, and Pauma complexes are manifestations of the same culture, that is, different site types are the result of differences in site locations and resources exploitation (Gallegos 1987:30). This hypothesis, however, has been strongly challenged by Warren and others (2008). In short, our understanding of the interplay between human land use, social organization, and material culture for the first several millennia of San Diego prehistory is poorly developed, although some progress has been made. Recent data collection has accelerated in the areas of paleoenvironmental analysis, paleoethnobotany, faunal analysis, and lithic technology studies. More importantly, efforts are being made to reexamine the assumptions surrounding existing artifact typologies and climatic reconstructions that form the basis of the standard systematics.

Late Prehistoric Period

In his later overviews of San Diego prehistory, Malcolm Rogers (1945) hypothesized that Yuman-speaking people from the Colorado River region migrated into southern California. This hypothesis was based primarily on patterns of material culture in archaeological contexts and his reading of ethnolinguistics. This "Yuman invasion" is still commonly cited in the literature, but some later linguistic studies suggest that the movement may have actually been northward from Baja California.

Assemblages derived from Late Prehistoric sites in San Diego County differ in many ways from those in the Archaic tradition. The occurrence of small, pressure-flaked projectile points, the replacement of flexed inhumations with cremations, the introduction of ceramics, and an emphasis on inland plant food collection, processing, and storage (especially acorns) are only a few of the cultural patterns that were well established by the second millennium A.D. The centralized and seasonally permanent residential patterns that had begun to emerge during the Archaic period became well established in most areas. Inland semisedentary villages appeared along major watercourses in the foothills and in montane valleys where seasonal exploitation of acorns and piñon nuts was common, resulting in permanent milling stations on bedrock outcrops. Mortars for acorn processing increased in frequency relative to seed-grinding basins.

The Late Prehistoric period is represented in the northern part of San Diego County by the San Luis Rey complex (Meighan 1954; True et al. 1974), and by the Cuyamaca complex in the southern portion of the county (True 1970). The San Luis Rey complex is the archaeological manifestation of the Shoshonean predecessors of the ethnohistoric Luiseño, while the Cuyamaca complex reflects the material culture of the Yuman ancestors of the Kumeyaay (also known as Diegueño).

According to True and others (1974), the Cuyamaca complex, while similar to the San Luis Rey complex, is differentiated by its greater frequencies of side-notched points, flaked stone tools, ceramics, and milling stone implements, a wider range of ceramic forms, a steatite industry, and cremations placed in urns. Assigning significance to these patterns should be done with caution, however, since it is obvious that seasonal camps in upland areas would reflect a different economic focus and would involve a slightly different set of trade relations than would be expected for populations on the seaboard. Thus a good deal of the variation in artifact form might be therefore attributed to functional differences or point of origin. Gross and others (1989) have suggested that these differences may not serve as indicators of cultural affiliation, and some may be due to different levels of organization. In regards to site structure, we might also expect occupational spans to differ between coastal and inland camps given the shorter summers at higher elevations.

Ethnohistoric Period

In ethnohistoric times, two main cultural groups occupied coastal San Diego County: the Shoshonean-speaking Luiseño and Juaneño in the north, and the Kumeyaay or Diegueño in the south. Traditionally, Luiseño territory encompassed an area from roughly Agua Hedionda on the coast, east to Lake Henshaw, north into Riverside County, and west through San Juan Capistrano to the coast (Bean and Shipek 1978; Kroeber 1925). The region inhabited by various bands of the Kumeyaay was much larger and probably extended from Agua Hedionda Lagoon eastward into the Imperial Valley and southward through much of northern Baja California (Almstedt 1982; Gifford 1931; Hedges 1975; Luomala 1978; Shipek 1982; Spier 1923).

The following short synopsis is derived from various ethnographic and historic documents and publications. More detailed culture histories for the Native American groups of the region are found in Barrows (1900), Bean (1978), Bean and Saubel (1972), Bean and Shipek (1978), Oxendine (1983), Shipek (1977), Sparkman (1908), and Strong (1929), among others.

The Kumeyaay inhabited a diverse environment including marine, foothill, mountain, and desert resource zones. The Kumeyaay speak a form of the Yuman language (including the dialects Ipai and Tipai) related to the large Hokan superfamily. There seems to have been considerable variability in the level of social organization and settlement patterns among the Kumeyaay. The Kumeyaay were organized into bands containing members of non-localized patrilineal, patrilocal lineages that claimed prescribed territories but did not own the resources except for some minor plants and eagle aeries (Luomala 1978; Spier 1923). Some of the bands occupied procurement ranges that required considerable residential mobility, such as those in the deserts (Hicks 1963). In the mountains, some of the larger bands occupied a few large residential bases that would be inhabited biannually, such as those inhabited in Cuyamaca in the summer and fall, and in Guatay or Descanso during the rest of the year (Almstedt 1982; Rensch 1975). According to Spier (1923), many desert and mountain Kumeyaay spent the period from spring to autumn in larger residential bases in the upland procurement ranges, and wintered in mixed groups in residential bases along the eastern foothills on the edge of the desert (i.e., Jacumba and Mountain Springs). This variability in settlement mobility and organization reflects the great range of environments within Kumeyaay territory. Most of Kumeyaay mythology was quite similar to the Quechan and Mojave of the Colorado River, as well as other Yuman groups in the Southwest (Gifford 1931; Hicks 1963; Luomala 1978; Spier 1923; Waterman 1910).

Acorns were the most important single food source utilized by the Kumeyaay. Kumeyaay villages were usually located near water, which was necessary for leaching acorn meal. Other storable resources such as mesquite or agave were equally valuable to bands inhabiting desert areas, at least during certain seasons (Hicks 1963; Shackley 1984). Seeds from grasses, manzanita, sage, sunflowers, lemonade berry, chia, and other plants were also used along with various wild greens and fruits.

Deer, small game, and birds were hunted, and fish and marine foods were eaten. Houses were arranged in the village without apparent patterns. Houses in primary villages were conical structures covered with tule bundles, having excavated floors and central hearths, while houses constructed at mountain bases generally lacked any excavation, probably due to the summer occupation. Other structures included sweathouses, ceremonial enclosures, ramadas, and acorn granaries. The material culture included ceramic cooking vessels, basketry, flaked stone tools, milling implements, arrow shaft straighteners, and bone, shell, and stone ornaments.

Hunting implements consisted of the bow and arrow, curved throwing sticks, nets, and snares. Bone and shell hooks, as well as nets, were used for fishing. Lithic resources of quartz and metavolcanics were commonly available throughout much of the Kumeyaay territory. Other raw materials, such as obsidian, chert, chalcedony, and steatite, occur in more localized areas. These raw materials were usually acquired through direct procurement or exchange. Projectile point types included the Cottonwood, as well as the Desert Side-notched, both commonly produced. Higher frequencies of ceramics and Desert Side-notched points in artifact assemblages at Kumeyaay sites have been documented (Gross et al. 1989; True 1966, 1970), and this may be one way to differentiate between Kumeyaay and Luiseño territories (True 1966).

HISTORIC PERIOD

Although the earliest historical exploration of the San Diego area can be traced to 1542 with the arrival of the first Europeans, particularly the exploration of San Miguel Bay by Juan Rodriguez Cabrillo, the widely accepted start of the historical period is 1769 with the founding of the joint Mission San Diego de Alcalá and Royal Presidio. The Hispanic period in California's history includes the Spanish Colonial (1769-1820) and Mexican Republic (1820-1846) periods. This era witnessed the transition from a society dominated by religious and military institutions, consisting of missions and presidios, to a civilian population residing on large ranchos or in pueblos (Chapman 1925).

The first intensive encounter of Spanish explorers and coastal villages of Native Americans was in 1769 with the establishment of Mission San Diego de Alcalá. The Mission of San Juan Capistrano was subsequently established in 1776, followed by San Luis Rey de Francia in 1798. The missions "recruited" the Native Americans to use as laborers and converted them to Catholicism. Local Native Americans rebelled briefly against Spanish control in 1775.

The effects of missionization, along with the introduction of European diseases greatly reduced the Native American population of southern California. At the time of contact, Luiseño population estimates range from 5,000 to as many as 10,000 individuals. Inland Luiseño groups were not heavily affected by Spanish influence until 1816, when an outpost of the mission was established 20 mi. further inland at Pala (Sparkman 1908). Most villagers, however, continued to maintain many of their aboriginal customs and simply adopted the agricultural and animal husbandry practices learned from Spaniards.

By the early 1820s, California came under Mexico's rule. In 1834, the missions were secularized. This resulted in political imbalance and Indian uprisings against the Mexican rancheros. Many of the Kumeyaay left the missions and ranchos and returned to their original village settlements (Shipek 1991). When California became a sovereign state in 1850, the Kumeyaay were heavily recruited as laborers and experienced even harsher treatment. Conflicts between Native Americans and encroaching Anglos finally led to the establishment of reservations for some villages, such as Pala and Sequan. Other Mission groups were displaced from their homes, moving to nearby towns or ranches. The reservation system interrupted the social organization and settlement patterns, yet many aspects of the original culture still persist today. Certain rituals and religious practices are maintained. Traditional games, songs, and dances continue, as well as the use of foods such as acorns, yucca, and wild game.

The subsequent American period (1846 to present) witnessed the development of San Diego County in various ways. This time period includes the rather rapid dominance over *Californio* culture by Anglo-Victorian (Yankee) culture and the rise of urban centers and rural communities. A Frontier period from 1845 to 1870 saw the region's transformation from a feudal-like society to an aggressive capitalistic economy in which American entrepreneurs gained control of most large ranchos and transformed San Diego into a merchant-dominated market town. Major railroads expanded across California in the 1880s, bringing with them large numbers of immigrants. Between 1870 and 1930, urban development established the cities of San Diego, National City, and Chula Vista. A rural society based on family-owned farms organized by rural school district communities also developed.

3. RESULTS OF INVESTIGATION

STUDY METHODS

A records search for this project was conducted at the South Coastal Information Center (SCIC) at San Diego State University on June 17, 2012. The records search encompassed a one-quarter-mile buffer on either side of the proposed project alternatives. It included a review of previously recorded archaeological and historic resources; a review of previous studies in the study area; a search of resources listed on National, State, and local historic registers; and a review of historic maps.

NATIVE AMERICAN CONSULTATION

Ms. Angela Pham, ASM Associate Archaeologist sent a letter to the Native American Heritage Commission (NAHC) requesting a Sacred Lands File search on June 21, 2012. The NAHC responded that no known Traditional Cultural Places (TCPs) are located within the project area. They also provided a list of local tribes and individuals to consult regarding the project. ASM wrote letters to each of the contacts between July 3 and July 7, 2012, notifying them of the project and requesting their input on TCP, Sacred Sites, resource collecting areas, or any other areas of concern. No responses were received by ASM. Correspondence relating to the Native American consultation for this project is provided in Appendix B.

RECORDS SEARCH RESULTS

Alternative 1

Eight prehistoric sites are recorded within one-quarter mile of Alternative 1. These include shell middens, lithic scatters and habitation sites (Table 1). In addition, nine historic structures relating to the railroad were recorded along the bluffs in Del Mar. None of these sites or historic structures are located adjacent to or within the proposed Alternative 1 alignment.

No historic buildings are recorded adjacent to Alternative 1 (Table 2). The vent locations located on Camino del Mar may result in visual impacts to historical resources.

Alternative 2

Thirty-one prehistoric and historic sites are recorded within one-quarter mile of the Alternative 2 alignments (Table 3). Eleven of these resources are located adjacent to the proposed Alternative 2 alignments and are described below.

Table 1. Alternative 1 Archaeological Sites

Designation				
Primary Number P-37-	Trinomial CA-SDI-	Contents	Recorder, Date	Cultural Resource Location in Relation Alternative 1
P-37-04612	04612	AP16.Other (Shell midden)	Mealey et al., 1996; Woodward, 1982; Colbern,1973	Outside
-	10149	AP2. Lithic scatter; AP16. Other (Shell midden)	Carrico and Thesken, 1984	Outside
-	10940	AP15. Habitation debris; AP16. Other (Shell midden and burial)	Pigniolo, 1988; Rogers, Unknown	Outside
P-37-017053	15093	AP11. Hearths; AP16. Other (Shell midden)	Barros, 1999	Outside
P-37-017121	15121	AP16. Other (Shell midden)	Pigniolo, 2007; Williams, 1999	Outside
P-37-024486	16238	AP2. Lithic scatter; AP11. Hearths/pits	Mealey and McFarland, 2005	Outside
P-37-024495	16247	AP2. Lithic scatter; AP11. Hearths/pits	Mealey et al., 2002	Outside
P-37-024619	16302	AP16. Other(Shell scatter)	Parker, 2002	Outside
P-37-024194	-	AH16. Other (Railroad retaining wall, culvert, or drain)	Pallette, 2001	Outside
P-37-024195	-	AH16. Other (Railroad retaining wall, culvert, or drain)	Pallette, 2001	Outside
P-37-024196	-	AH16. Other (Railroad retaining wall, culvert, or drain)	Pallette, 2001	Outside
P-37-024197	-	AH16. Other (Railroad retaining wall, culvert, or drain)	Pallette, 2001	Outside
P-37-024198	-	AH16. Other (Railroad retaining wall, culvert, or drain)	Pallette, 2001	Outside
P-37-024199	-	AH16. Other (Railroad retaining wall, culvert, or drain)	Pallette, 2001	Outside
P-37-024200	-	AH16. Other (Railroad retaining wall, culvert, or drain)	Pallette, 2001	Outside
P-37-024201	-	AH16. Other (Railroad retaining wall, culvert, or drain)	Pallette, 2001	Outside
P-37-024249	-	AH16. Other (Railroad retaining wall, culvert, or drain)	Pallette, 2001	Outside

Table 2. Alternative 1 Historic Addresses

Designation				
Primary Number P-37-	Trinomial CA-SDI-	Contents	Recorder, Date	Cultural Resource Location in Relation to Alternative 1
P-37-016285	-	HP19. Bridge	King, 1998	Outside
P-37-017450	-	HP39. Other (Powerhouse building and smokestack)	Bahorski, 1988	Outside
P-37-017657	-	HP2. Single family home	Barros, 1999	Outside
P-37-017658	-	HP2. Single family home; HP4. Ancillary structure (garage)	Barros, 1999	Outside

Table 3. Alternatives 2 Archaeological Sites

Designation				Cultural Resource Location in Relation to Alternative 2
Primary Number P-37-	Trinomial CA-SDI-	Contents	Recorder, Date	
-	**00195**	**AP1. Unknown**	**Treganza et al., Unknown**	**Inside**
-	**04629**	**AP2. Lithic scatter; AP11. Hearths; AP.15 Habitation debris; AP16. Other (Shell midden burials, and faunal)**	**Pallette, 2005; Laylander, 1986**	**Inside**
-	08591	AP2. Lithic scatter	Apple, 1980	Outside
P-37-09595	09595	AP2. Lithic scatter; AP11. Hearths	Mattingly and Gamble, 2006	Outside
P-37-09596	09596	AP16. Other (Shell scatter)	Mealey et al., 1996	Outside
-	09597	AP2. Lithic scatter	Parkman and Davis, 1982	Outside
P-37-015857	14452	AP2. Lithic scatter; AP16. Other (Shell scatter)	Mealey and McFarland, 2005	Outside
P-37-015859	14454	AP2. Lithic scatter	Mealey et al., 1996	Outside
P-37-015861	**14456**	**AH5. Well/cistern**	**Mealey and McFarland, 2005; Mealey et al., 1996**	**Inside**
P-37-015862	14457	AP2. Lithic scatter; AP16. Other (Shell scatter)	Mealey and McFarland, 2005	Outside
P-37-015863	14458	AH4. Privies/dumps/trash scatter	Morgan and Tennesen, 2010; Mealey and McFarland, 2005	Outside
P-37-018328	15557	AP11. Hearths/pits	Mealey and McFarland, 2005; Mealey et al., 2002; Mealey, 1999	Outside
P-37-024484	**16236**	**AP2. Lithic scatter; AP11. Hearths/pits**	**Mealey and McFarland, 2005; Mealey, 2002**	**Inside**
P-37-024485	**16237**	**AP2. Lithic scatter; AP11. Hearths/pits**	**Mealey and McFarland, 2005; Mealey et al., 2002**	**Inside**
P-37-024487	16239	AP2. Lithic scatter; AP11. Hearths/pits	Mealey et al., 2002	Outside
P-37- 024488	16240	AP11. Hearths/pits	Mealey et al., 2002	Outside
P-37-024489	16241	AP2. Lithic scatter; AP11. Hearths/pits	Mealey and McFarland, 2005; Mealey et al., 2002	Outside
P-37-024490	16242	AP2. Lithic scatter; AP11. Hearths/pits	Mealey et al., 2002	Outside
P-37-024496	16248	AP2. Lithic scatter; AP11. Hearths/pits	Mealey et al., 2002	Outside
P-37-024497	16249	AP11. Hearths/pits	Mealey et al., 2002	Outside
P-37-024498	**16250**	**AP2. Lithic scatter; AP11. Hearths/pits**	**Mealey et al., 2002**	**Inside**
P-37-024499	**16251**	**AP2. Lithic scatter**	**Mealey et al., 2002**	**Inside**
P-37-024500	**16252**	**AP2. Lithic scatter**	**Mealey et al., 2002**	**Inside**
P-37-024501	**16253**	**AP2. Lithic scatter**	**Mealey and McFarland, 2005; Mealey et al., 2002**	**Inside**
P-37-024504	**16256**	**AP2. Lithic scatter; AP11. Hearths/pits**	**Mealey et al., 2002**	**Inside**
P-37-024505	16257	AP2. Lithic scatter; AP11. Hearths/pits	Mealey and McFarland, 2005	Outside
P-37-024482	16259	AP4. Milling feature	Berryman, 2002	Outside
P-37-017122	**16653**	**AP15. Habitation debris; AP16. (Redeposited shell midden)**	**Williams, 1999**	**Inside**
P-37-026491	17387	AP11. Hearths/pits	Hedges, 1977	Outside
P-37-026492	17388	AP11. Hearths/pits	Unknown	Outside
P-37-017178	-	HP2.Single family property	Bevil, 1999	Outside
P-37-024762	-	AP16. Other (Shell scatter)	Mealey et al., 2002	Outside

CA-SDI-195 (refer to CA-SDI-16653)

This prehistoric site was originally recorded by Treganza on an unknown date. Bull and Gross re-recorded the site at a later time, however, no map, date, or further information was recorded for the site. Subsequently, this site was given a new primary number and trinomial when it was subsumed by CA-SDI-4629 in 1999.

CA-SDI-4629 (refer to CA-SDI-16653)

The site was originally recorded by the San Diego Museum of Man in 1968. It was later recorded by Laylander in 1986 and Pallette in 2005. The area measures 600 x 300 m and consists of a large shell midden, lithic scatter, hearths, faunal remains, and burials. Based on radiocarbon dates, the site was dated to approximately 2355 to 7140 years B.P.

This site was given a new primary number and trinomial in 1999 when it was recorded as part of a larger site, CA-SDI-16653, which also subsumed site CA-SDI-195.

CA-SDI-14456 (P-37-015861)

Mealey and McFarland recorded a historic concrete and sandstone cistern in 2005. The cistern feature had been backfilled, leaving behind a pit measuring approximately 2 x 2 m with an unknown depth. No artifacts were found in association with the cistern; however, the feature was estimated to date to post-1945.

CA-SDI-16236 (P-37-024484)

This prehistoric site was recorded during an archaeological survey within Torrey Pines State Reserve, Extension area by Mealey et al. in 2002. The project area measured 95 m (north/south) x 50 m (east/west). The site consisted of fire-affected rock (FAR) features and scattered lithics. There were four possible hearth features with associated flakes and cores observed during 2002 survey.

CA-SDI-16237 (P-37-024485)

This prehistoric site was recorded during an archaeological survey within Torrey Pines State Reserve, Extension area by Mealey and Shabel in 2002. The area measured 25 m (north/south) x 14 m (east/west). The site consisted of fire-affected rock (FAR) features and scattered lithics. There were two possible hearth features and a lithic scatter.

CA-SDI-16250 (P-37-024498)

This prehistoric site was recorded during an archaeological survey within Torrey Pines State Reserve, Extension area by Mealey et al. in 2002. The site measured 60 m (north/south) x 60 m (east/west). The site consisted of fire-affected rock (FAR) features and flaking stations. There were three possible hearth features and two flaking stations.

CA-SDI-16251 (P-37-024499)

This prehistoric site was recorded during an archaeological survey within Torrey Pines State Reserve, Extension area by Mealey et al. in 2002. The site measured three m (north/south) x one m (east/west). The site consisted of a sparse lithic scatter or various materials and a basalt core.

CA-SDI-16252 (P-37-024500)

This prehistoric site was recorded during an archaeological survey within Torrey Pines State Reserve, Extension area by Mealey et al. in 2002. The site consisted of a single quartzite flake.

CA-SDI-16253 (P-37-024501)

This prehistoric site was recorded during an archaeological survey within Torrey Pines State Reserve, Extension area by Mealey et al. in 2002. The area measured 5 m (north/south) x 5 m (east/west). The site consisted of a lithic scatter of various materials.

CA-SDI-16256 (P-37-024504)

This prehistoric site was recorded during an archaeological survey within Torrey Pines State Reserve, Extension area by Mealey et al. in 2002. The site measured 11 m (north/south) x 12 m (east/west). This site consisted of a concentration of fire-affected rock (FAR) and a small flaking station.

C-SDI-16653 (P-37-017122)

This prehistoric site includes previously recorded resources CA-SDI-195 and CA-SDI-4629. Williams, of Applied EarthWorks, Inc., recorded this site in 1999. The site measured 400 m (east/west) x 15 m (north/south). The site was a redeposited complex shell midden from an unknown location that contained shell and stone tools. The deposit was visible for approximately 300 m along the south side of Carmel Valley Road and for about 75 m along the north side of the road.

Human remains and lithic scatters were recovered from the site during San Diego Gas & Electric Company (SDG&E) trench excavation in 1968.

Alternative 3

Twenty-nine prehistoric archaeological sites are recorded within one-quarter mile of the Alternative 3 alignment (Table 4). Three of these sites are recorded adjacent to the proposed alignment and are described below.

CA-SDI-192

This prehistoric site was recorded by Treganza et al. (n.d.).The location of the site is east of the road to the Del Mar Racetrack. No further information was provided for this site on the Department of Parks and Recreation (DPR) form.

CA-SDI-4629 (refer to CA-SDI-16653)

The site was originally recorded by the San Diego Museum of Man in 1968. It was later recorded by Laylander in 1986 and Pallette in 2005. The site area measured 600 m x 300 m. The site consisted of a large shell midden, lithic scatter, hearths, faunal remains, and burials. Based on radiocarbon dates, the site dated to approximately 2355 to 7140 years B.P.

In 1999, this site was recorded as part of a larger site, CA-SDI-16653, which also subsumed previously recorded site CA-SDI-195.

CA-SDI-16653 (P-37-017122)

This prehistoric consists of CA-SDI-195 and CA-SDI-4629. Williams, of Applied EarthWorks, Inc., recorded this site in 1999. The site measured 400 m (east/west) x 15 m (north/south). The site was a redeposited complex shell midden from an unknown location that contained shell and stone tools. The deposit was visible for approximately 300 m along the south side of Carmel Valley Road and for about 75 m along the north side of the road.

Human remains and lithic scatters were recovered during SDG&E's trench excavation in 1968.

Table 4. Alternative 3 Archaeological Sites

Designation				
Primary Number P-37-	**Trinomial CA-SDI-**	**Contents**	**Recorder, Date**	**Cultural Resource Location in Relation to Alternative 3**
-	**00192**	**AP1. Unknown**	**Treganza, Unknown**	**Inside**
-	00193	AP1.Unknown	Treganza, Unknown	Outside
-	00197	AP2. Lithic scatter; AP11. Hearth/pit; AP15. Habitation debris	Palette, 2005; Gross et al., 1995	Outside
-	00613	AP16. Other (Shell scatter)	Kowta, 1959	Outside
P-37-001103	01103	AP2. Lithic Scatter; AP16. Other (Shell Scatter)	Palette, 2005; Laylander, 1986; Diamond, 1960	Outside
P-37-004605	04605	AP16. Other (Shell Midden)	Palette, 2005; Falk, 1964	Outside
-	**04629**	**AP2. Lithic scatter; AP11. Hearths; AP.15 Habitation debris; AP16. Other (Shell midden burials, and faunal)**	**Pallette, 2005; Laylander, 1986**	**Inside**
P-37-005225	05225	AP2. Lithic Scatter; AP5. Petroglyph; AP16. Other (Shell Scatter); AH4. Trash scatter	Palette, 2005; Hedges, 1979; Norwood, 1977	Outside
-	08050	AP2. Lithic Scatter; AP16. Other (Shell scatter)	Norwood, 1979	Outside
-	08051	AP2. Lithic Scatter; AP16. Other (Shell scatter)	Norwood, 1979	Outside
-	08052	AP2. Lithic Scatter; AP16. Other (Shell scatter)	Norwood, 1979	Outside
P-37-0010143	10143	AP2. Lithic Scatter; AP16. Other (Shell scatter)	Pallette, 2005; Laylander and Crotteau 1984	Outside
P-37-0010144	10144	AP16. Other (Shell scatter)	Pallette, 2005; Laylander and Price, 1984	Outside
-	11008	AP2. Lithic Scatter; AP16. Other (Shell scatter)	Smith, 1982	Outside
-	11787	AH4. Trash scatter	Saunders, 1990	Outside
P-37-012120	12120	AP2. Lithic Scatter; AP16. Other (Shell scatter)	Laylander, 2003; Dominici, 1991	Outside

Designation				
Primary Number P-37-	**Trinomial CA-SDI-**	**Contents**	**Recorder, Date**	**Cultural Resource Location in Relation to Alternative 3**
P-37-012121	12121	AP2. Lithic Scatter; AP16. Other (Shell scatter)	Laylander, 2006; Dominici, 1991	Outside
P-37-0012122	12122	AH4. Trash scatter	Pallette, 2005; Russell et al., 1991	Outside
P-37-015855	14451	AP11. Hearths/pits	Mealey et al., 2002	Outside
P-37-015867	14460	AP16. Other (Shell scatter)	Mealey and McFarland, 2005; Mealey et al., 1996; Rogers, 1929	Outside
P-37-024502	16254	AP2. Lithic scatter	Mealey and Shabel, 2002	Outside
P-37-024503	16255	AP2. Lithic scatter; AP11. Hearths/pits	Mealey and McFarland, 2005; Mealey et al., 2002	Outside
P-37-024506	16258	AP2. Lithic scatter; AP11. Hearths/pits	Mealey and McFarland, 2005; Mealey et al., 2002	Outside
P-37-025021	16561	AP16. Other (Shell scatter)	McGinnis and Kochert, 2003	Outside
P-37-017122	**16653**	**AP15. Habitation debris; AP16. (Redeposited shell midden)**	**Williams, 1999**	**Inside**
P-37-026493	17389	AP11. Hearths/pits	Unknown	Outside
P-37-029577	-	AP8. Stone feature (cairn)	Akyuz, 2008	Outside
P-37-029949	-	AP2. Lithic scatter	Hanna, 1979	Outside
P-37-029954	-	AP2. Lithic scatter	Hanna, 1979	Outside

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4. RECOMMENDATIONS

This constraints study provides an overview of previously recorded resources within and adjacent to the three tunnel alternatives and an assessment of the potential for project impacts to cultural and historical resources. The results are summarized below.

ALTERNATIVE 1 – CAMINO DEL MAR ALTERNATIVES

The tunnel alternative through the City of Del Mar appears to have a low potential of impacting cultural resources. No previously recorded resources are located adjacent to the proposed tunnel portals or vents. The vent locations located on Camino del Mar have the potential to result in visual impacts to historical resources.

ALTERNATIVE 2 – CREST CANYON HIGHER SPEED AND CREST CANYON ALTERNATIVES

Previously recorded prehistoric site SDI-4629 is located adjacent to the south portal of this tunnel alternative. This extensive site dating to between 2355 and 7140 years B.P. contained multiple hearths and several burials. Several other prehistoric resources are recorded within and adjacent to the proposed alignment south of Del Mar Heights School on undeveloped land. No historic resources are recorded in the vicinity of these alternatives.

ALTERNATIVE 3 – I-5 AND I-5 EAST ALTERNATIVES

Three prehistoric sites are located adjacent to this alternative: SDI-192, SDI-4692 and SDI-16653. This alignment has the greatest potential to impact cultural resources between San Dieguito Bridge and the I-5 where it will traverse undeveloped land overlooking the San Dieguito Lagoon. While no information is available on site SDI-192, the bluffs overlooking lagoons have a high probability for significant Archaic Period sites, often containing burials. Several burials were recorded at site SDI-4692 at the southern end of the alignment of both Alternatives 2 and 3, overlooking Peñasquitos Lagoon. No historic resources are recorded in the vicinity of these alternatives.

RECOMMENDATIONS

Cultural resource surveys should be completed for those portions of the alignments that have the potential to impact cultural or historical resources. These include above-ground alignments, tunnel portal and vent locations. During future design phases, the south portal site (Alternatives 2 and 3) should be accurately mapped in relation to prehistoric site SDI-4692 and, if possible, placed outside the site boundaries to avoid impacts to this cultural resource. Historic resource inventories and evaluations of buildings within the viewshed of vent locations may also be required to determine visual and indirect effects on historic resources.

REFERENCES

Almstedt, Ruth

1982 Kumeyaay and Ipay. In *APS/SDG&E Interconnection Native American Cultural Resources*, edited by Clyde Woods, pp. 6-20. Wirth Associates, San Diego.

Bada, Jeffrey, Roy Schroeder, and George Carter

1974 New Evidence for the Antiquity of Man in North America Deduced from Aspartic Acid Racemization. *Science* 184:791-793.

Barrows, David

1900 *The Ethno-Botany of the Cahuilla Indians of Southern California*. University of Chicago Press.

Bayham, Frank E., and Donald H. Morris

1986 Episodic Use of a Marginal Environment: A Synthesis. In *Prehistoric Hunter-Gatherers of South Central Arizona: The Picacho Reservoir Archaic Project*, edited by Frank E. Bayham, Donald H. Morris, and M. Steven Shackley, pp 359-382. Anthropological Field Studies No. 13, Arizona State University, Tempe.

Bean, Lowell J.

1978 Cahuilla. In *California*, edited by Robert F. Heizer, pp. 575-587. Handbook of North American Indians, Vol. 8, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Bean, Lowell J., and Katharine Siva Saubel

1972 *Temalpakh: Cahuilla Indian Knowledge and Usage of Plants*. Malki Museum Press, Banning, California.

Bean, Lowell J., and Florence C. Shipek

1978 Luiseño. In *California*, edited by Robert F. Heizer, pp. 575-587. Handbook of North American Indians, Vol. 8, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Bull, Charles

1987 A New Proposal: Some Suggestions for San Diego Prehistory. In *San Dieguito – La Jolla: Chronology and Controversy*, edited by Dennis Gallegos, pp. 35-42. San Diego County Archaeological Society Research Paper No. 1.

Byrd, Brian F.

1996 *Reconstructing the Regional Landscape: Considerations of a Multidisciplinary Research Strategy for Archaeological Survey of Camp Pendleton, California.* ASM Affiliates, Encinitas, California. Prepared for U.S. Army Corps of Engineers, Los Angeles District, California.

Byrd, Brian F., and Carol Serr

1993 *Multi-component Archaic and Late Prehistoric Residential Camps along the Sweetwater River, Rancho San Diego, California*. Brian F. Mooney Associates Technical Series No. 1. San Diego.

Byrd, Brian F., Drew Pallette, and Carol Serr

1995 *Archaeological Testing along San Mateo and San Onofre Creeks, Northwestern Camp Pendleton, San Diego County, California*. Brian F. Mooney Associates, San Diego. Technical report on file, U.S. Army Corps of Engineers, Los Angeles District, California.

Callahan, Everrett

1974 *Experimental Archaeology Papers, No. 3*. Department of Sociology and Anthropology, Virginia Commonwealth University, Richmond.

1979 *The Basics of Biface Knapping in the Eastern Fluted Point Tradition: A Manual for Flintknappers and Lithic Analysts*. Archaeology of Eastern North America No. 7. Eastern States Archaeological Federation, Washington, Connecticut.

Cardenas, D. Sean, and Stephen Van Wormer

1984 *Archaeological Investigations of SDI-4648 and SDM-W-348.* RBR and Associates, San Diego.

Carter, George

1980 *Earlier Than You Think: A Personal View of Man in the Americas*. Texas A&M University, College Station.

Chapman, Charles

1925 *A History of California: The Spanish Period*. The Macmillan Company, New York.

Erlandson, Jon M., and Roger H. Colten

1991 An Archaeological Context for Early Holocene Studies on the California Coast. In *Hunter Gatherers of Early Holocene Coastal California*, edited by Jon M. Erlandson and Roger H. Colten, pp. 1-10. Perspectives in California Archaeology (Volume 1). Institute of Archaeology, University of California, Los Angeles.

Ezell, Paul H.

1983 A New Look at the San Dieguito Culture. *Cultural Resource Management Center Casual Papers* 1(3):103-109. Department of Anthropology, San Diego State University. San Diego.

1987 The Harris Site – An Atypical San Dieguito Site or Am I Beating a Dead Horse? In *San Dieguito – La Jolla: Chronology and Controversy*, edited by Dennis Gallegos, pp. 15-22. San Diego County Archaeological Society Research Paper Number 1.

Frison, George

1968 A Functional Analysis of Certain Chipped Stone Tools. *American Antiquity* 33:149-155.

Gallegos, Dennis
1987 A Review and Synthesis of Environmental and Cultural Material for the Batiquitos Lagoon Region. In *San Dieguito – La Jolla: Chronology and Controversy*, edited by Dennis Gallegos, pp. 23-34. San Diego County Archaeological Society Research Paper Number 1.

Gifford, Edward
1931 *The Kamia of Imperial Valley*. Bureau of American Ethnology Bulletin No. 98. Washington, D.C.

Gross, G. Timothy, M. Steven Shackley, and Constance Cameron
1989 *Archaeological Investigations at CA-ORA-910A: A Late Prehistoric Hunting Field Camp in Southern Orange County, California*. Brian F. Mooney Associates, San Diego.

Hedges, Ken
1975 Notes on the Kumeyaay: A Problem of Identification. *Journal of California Anthropology* 2: 71-83.

Hicks, Frederic
1963 Ecological Aspects of Aboriginal Culture in the Western Yuman Area. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Los Angeles.

Jones, Terry
1992 Settlement Trends along the California Coast. In *Essays on the Prehistory of Maritime California*, edited by Terry L. Jones, pp. 1-38. Center for Archaeological Research at Davis No. 10. University of California, Davis.

Kroeber, Alfred
1925 *Handbook of the Indians of California*. Bureau of American Ethnology Bulletin No. 78. Washington, D.C.

Luomala, Katherine
1978 Tipai and Ipai. In *California*, edited by Robert F. Heizer, pp. 592-609. Handbook of the North American Indians, Vol. 8, edited by William C. Sturtevant. Smithsonian Institution, Washington, D.C.

Meighan, Clement
1954 A Late Complex in Southern California Prehistory. *Southwestern Journal of Anthropology* 10:215-227.
1959 California Cultures and the Concept of an Archaic Stage. *American Antiquity* 24: 289-305.

Moratto, Michael
1984 *California Archaeology*. Academic Press, Orlando, Florida.

Moriarty, James R., III

1966 Cultural Phase Divisions Suggested by Typological Change Coordinated with Stratigraphically Controlled Radiocarbon Dating at San Diego. *Anthropological Journal of Canada* 4:20-30.

Oxendine, Joan

1983 The Luiseño Village during the Late Prehistoric Era. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Riverside.

Rensch, Hero

1975 *The Indian Place Names of Rancho Cuyamaca*. Acoma Books, Ramona, California.

Rogers, Malcolm

1939 *Early Lithic Industries of the Lower Basin of the Colorado River and Adjacent Desert Areas*. San Diego Museum Papers No. 3.

1945 An Outline of Yuman Prehistory. *Southwestern Journal of Anthropology* 1:167-198.

1966 *Ancient Hunters of the Far West*. Union-Tribune, San Diego.

Rogers, Spencer

1974 *An Ancient Human Skeleton Found at Del Mar, California*. San Diego Museum Papers No. 7.

Sayles, E. B.

1983 *The Cochise Cultural Sequence in Southeastern Arizona*. Anthropological Papers of the University of Arizona No. 42. Tucson.

Sayles, E. B., and Ernst Antevs

1941 *The Cochise Culture*. Medallion Papers No. 29. Gila Pueblo, Arizona.

Shackley, M. Steven

1984 *Archaeological Investigations in the Western Colorado Desert: A Socioecological Approach*, Volume 1. Wirth Environmental Services, San Diego.

Shipek, Florence

1977 A Strategy for Change: The Luiseño of Southern California. Unpublished Ph.D. dissertation, Department of Anthropology, University of Hawaii.

1982 Kumeyaay Socio-Political Structure. *Journal of California and Great Basin Anthropology* 4:296-303.

1991 *Delfina Cuero: Her Autobiography.* Ballena Press, Menlo Park, California.

Smythe, William E.

1908 *History of San Diego, 1542-1908: An Account of the Rise and Progress of the Pioneer Settlement on the Pacific Coast of the United States.* The History Company, San Diego, California. Online version of the publication provided by the San Diego Historical Society.

Sparkman, Phillip Stedman
1908 The Culture of the Luiseño Indians. *University of California Publications in American Archaeology and Ethnology* 8:188-234. Berkeley.

Spier, Leslie
1923 Southern Diegueño Customs. *University of California Publications in American Archaeology and Ethnology* 20:295-358. Berkeley.

Strong, William D.
1929 Aboriginal Society in Southern California. *University of California Publications in American Archaeology and Ethnology* 26:1-358. Berkeley.

Taylor, R., L. Payen, C. Prior, P. Slota, R. Gillespie, J. Gowlett, R. Hedges, A. Hull, T. Zabel, D. Donahue, and R. Berger
1985 Major Revisions in the Pleistocene Age Assignments for North American Human Skeletons by C14 Accelerator Mass Spectrometry: None Older Than 11,000 C14 Years B.P. *American Antiquity* 50: 136-140.

True, Delbert
1958 An Early Complex in San Diego County, California. *American Antiquity* 23:255-263.
1966 Archaeological Differentiation of Shoshonean and Yuman Speaking Groups in Southern California. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Los Angeles.
1970 *Investigation of a Late Prehistoric Complex in Cuyamaca Rancho State Park, San Diego County, California*. Archaeological Survey Monographs No. 1. University of California, Los Angeles.

True, Delbert, and Eleanor Beemer
1982 Two Milling Stone Inventories from Northern San Diego County, California. *Journal of California and Great Basin Anthropology* 4:233-261.

True, Delbert, Clement Meighan, and Harvey Crew
1974 *Archaeological Investigations at Molpa, San Diego County, California*. University of California Publications in Anthropology No. 11. Berkeley.

Wallace, William
1978 Post-Pleistocene Archaeology, 9000 to 2000 B.C. In *California*, edited by Robert F. Heizer, pp. 25-36. Handbook of North American Indians, Vol. 8, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Warren, Claude
1964 Cultural Change and Continuity on the San Diego Coast. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Los Angeles.
1966 The San Dieguito Type Site. *San Diego Museum of Man Papers* No. 5.
1967 The San Dieguito Complex: Review and Hypothesis. *American Antiquity* 32:168-185.

1987 The San Dieguito and La Jolla: Some Comments. In *San Dieguito – La Jolla: Chronology and Controversy*, edited by Dennis Gallegos, pp. 73-85. San Diego County Archaeological Society Research Paper No. 1.

Warren, Claude, Gretchen Siegler, and Frank Dittner
2008 Paleo-Indian and Early Archaic Periods. In *Prehistoric and Historic Archaeology of Metropolitan San Diego: A Historic Properties Background Study*, pp. 13-107. ASM Affiliates, Carlsbad, California.

Waterman, Thomas
1910 The Religious Practices of the Diegueño Indians. *University of California Publications in American Archaeology and Ethnology* 8:271-358. Berkeley.

APPENDICES

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APPENDIX A

Record Search Results

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South Coastal Information Center
4283 El Cajon Blvd., Suite 250
San Diego, CA 92105
Office: (619) 594-5682
Fax: (619) 594-4483
www.scic.org
nick@scic.org

CALIFORNIA HISTORICAL RESOURCES INFORMATION SYSTEM RECORDS SEARCH

Company:	ASM & Affiliates
Company Representative:	Sinéad Ní Ghabhláin
Date Processed:	6/17/2012
Project Identification:	San Dieguito
Search Radius:	1/4 mile

Historical Resources: ND

Trinomial and Primary site maps have been reviewed. All sites within the project boundaries and the specified radius of the project area have been plotted. Copies of the site record forms have been included for all recorded sites.

Previous Survey Report Boundaries: ND

Project boundary maps have been reviewed. National Archaeological Database (NADB) citations for reports within the project boundaries and within the specified radius of the project area have been included.

Historic Addresses: ND

A map and database of historic properties (formerly Geofinder) has been included.

Historic Maps: ND

The historic maps on file at the South Coastal Information Center have been reviewed, and copies have been included.

Summary of SHRC Approved CHRIS IC Records Search Elements	
RSID:	425
RUSH:	no
Hours:	1
Spatial Features:	263
Address-Mapped Shapes:	yes
Digital Database Records:	8
Quads:	1
Aerial Photos:	0
PDFs:	Yes
PDF Pages:	709

This is not an invoice. Please pay from the monthly billing statement

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APPENDIX B

Native American Consultation Correspondence

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ASM affiliates
archaeology
history
architectural history
ethnography

July 3rd, 2012
Allen Lawson, Chairperson
San Pasqual Band of Mission Indians
PO Box 365
Valley Center, CA 92082

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Chairperson Lawson,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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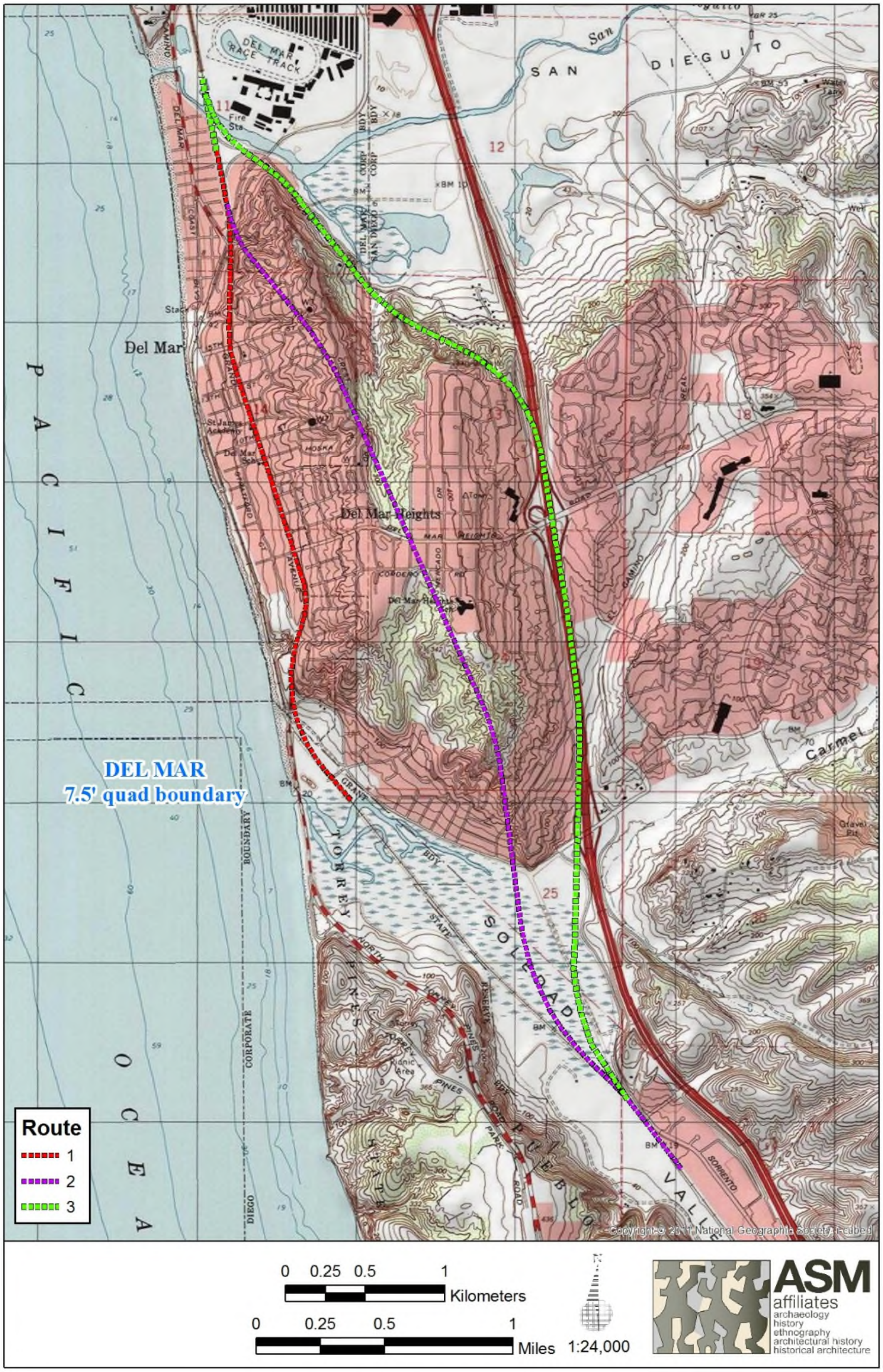
Sincerely,

Angela Pham

Angela Pham
Associate Archaeologist

Attachment: San Dieguito Alternative Project Map



San Dieguito Alternative Project Map.

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July 3rd, 2012
Anthony Pico, Chairperson
Viejas Band of Kumeyaay Indians
PO Box 908
Alpine, CA 91903

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Chairperson Pico,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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Angela Pham
Associate Archaeologist

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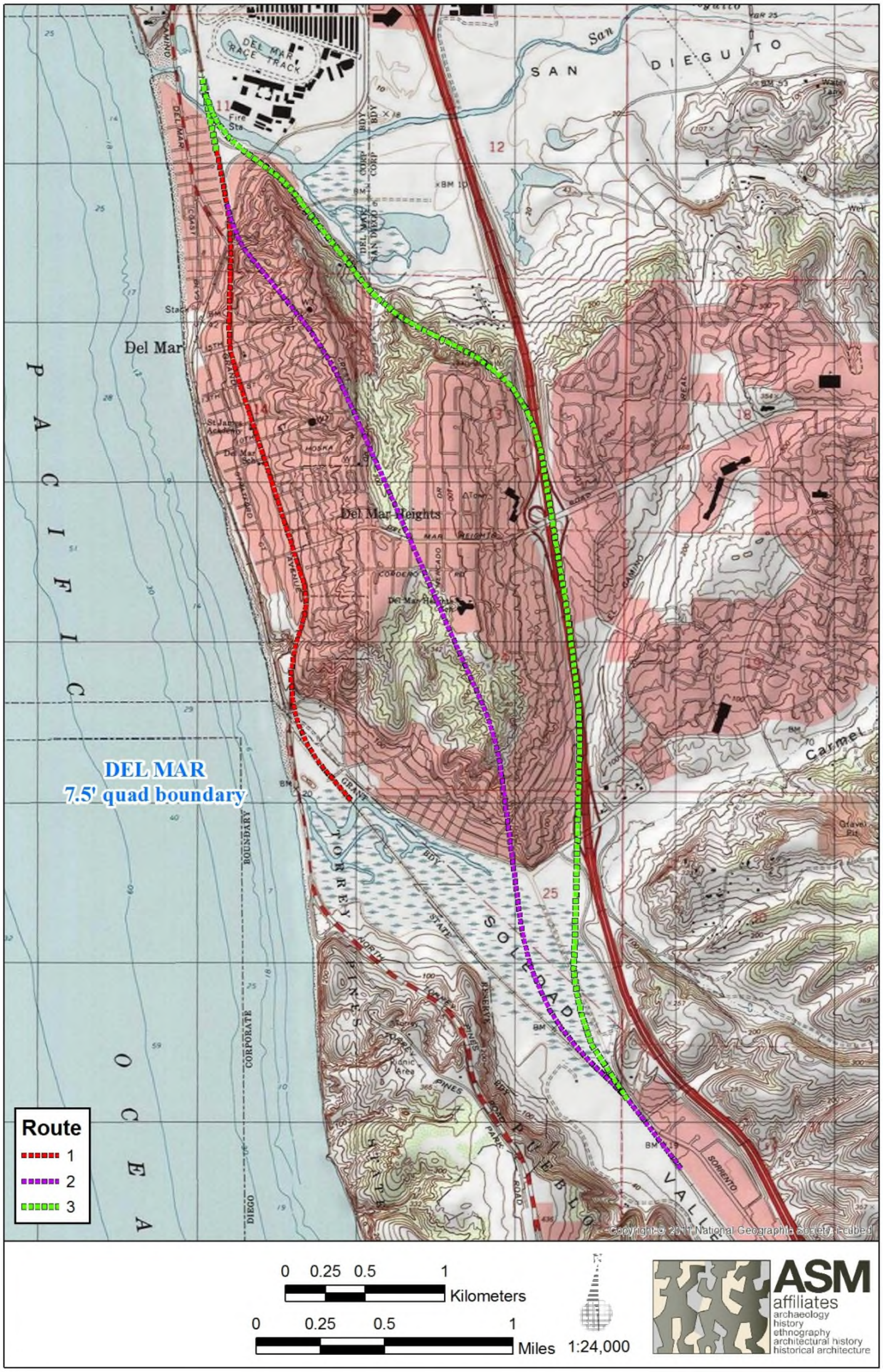

San Dieguito Alternative Project Map.

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July 3rd, 2012
Bennae Calac, Tribal Council Member
Pauma Valley Band of Luiseño Indians
PO Box 369
Pauma Valley, CA 92061

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Mrs. Calac,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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Sincerely,

Angela Pham

Angela Pham
Associate Archaeologist

Attachment: San Dieguito Alternative Project Map

2034 Corte del Nogal, Carlsbad, CA 92011 • 760-804-5757 • 760-804-5755-fax
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120 Vine St., Reno, NV 89503 • 775-324-6789 • 775-324-9666-fax
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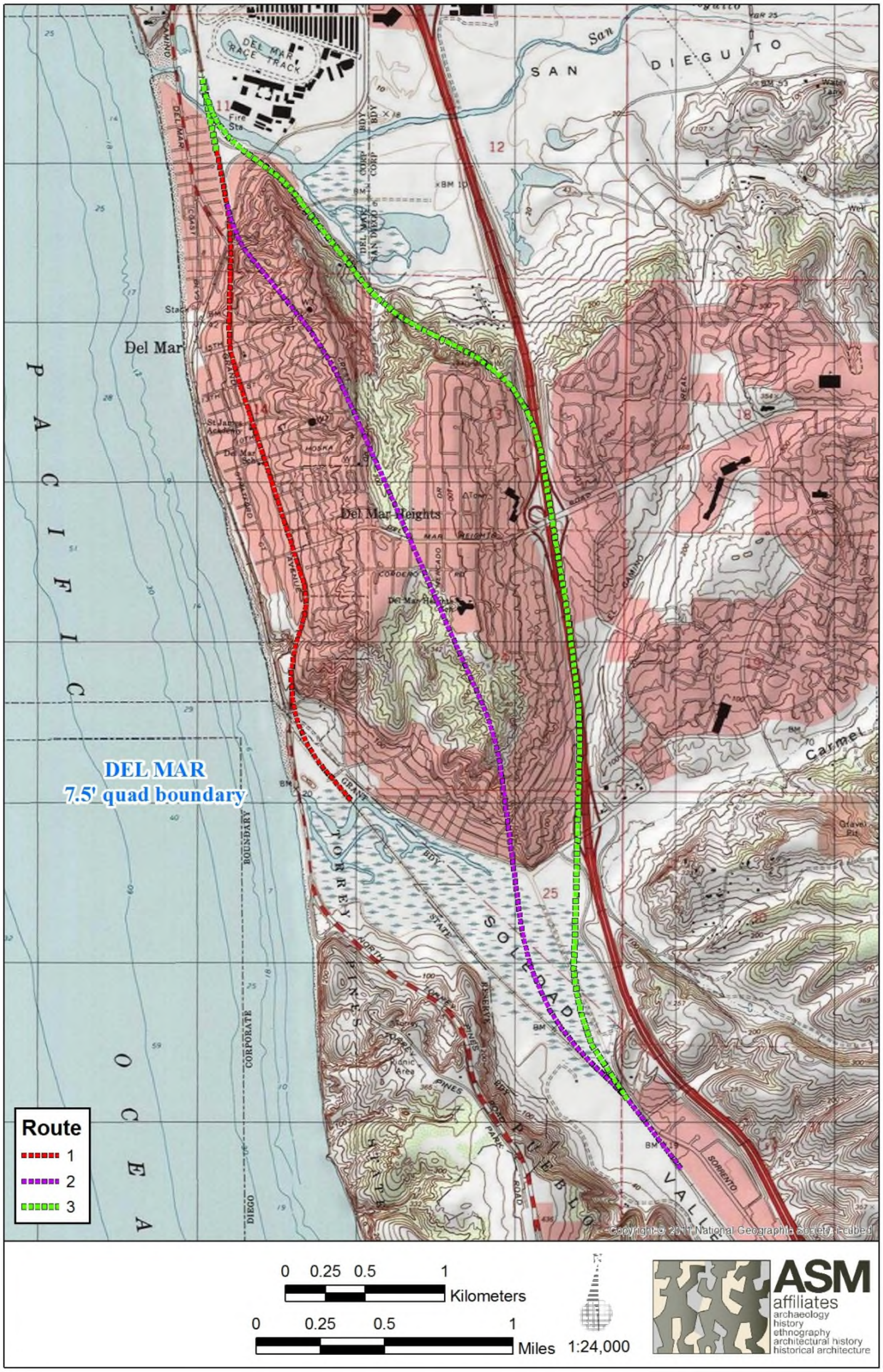

San Dieguito Alternative Project Map.

July 3rd, 2012
Bo Mazzetti, Chairperson
Rincon Band of Mission Indians
PO Box 68
Valley Center, CA 92082

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Chairperson Mazzetti,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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Associate Archaeologist

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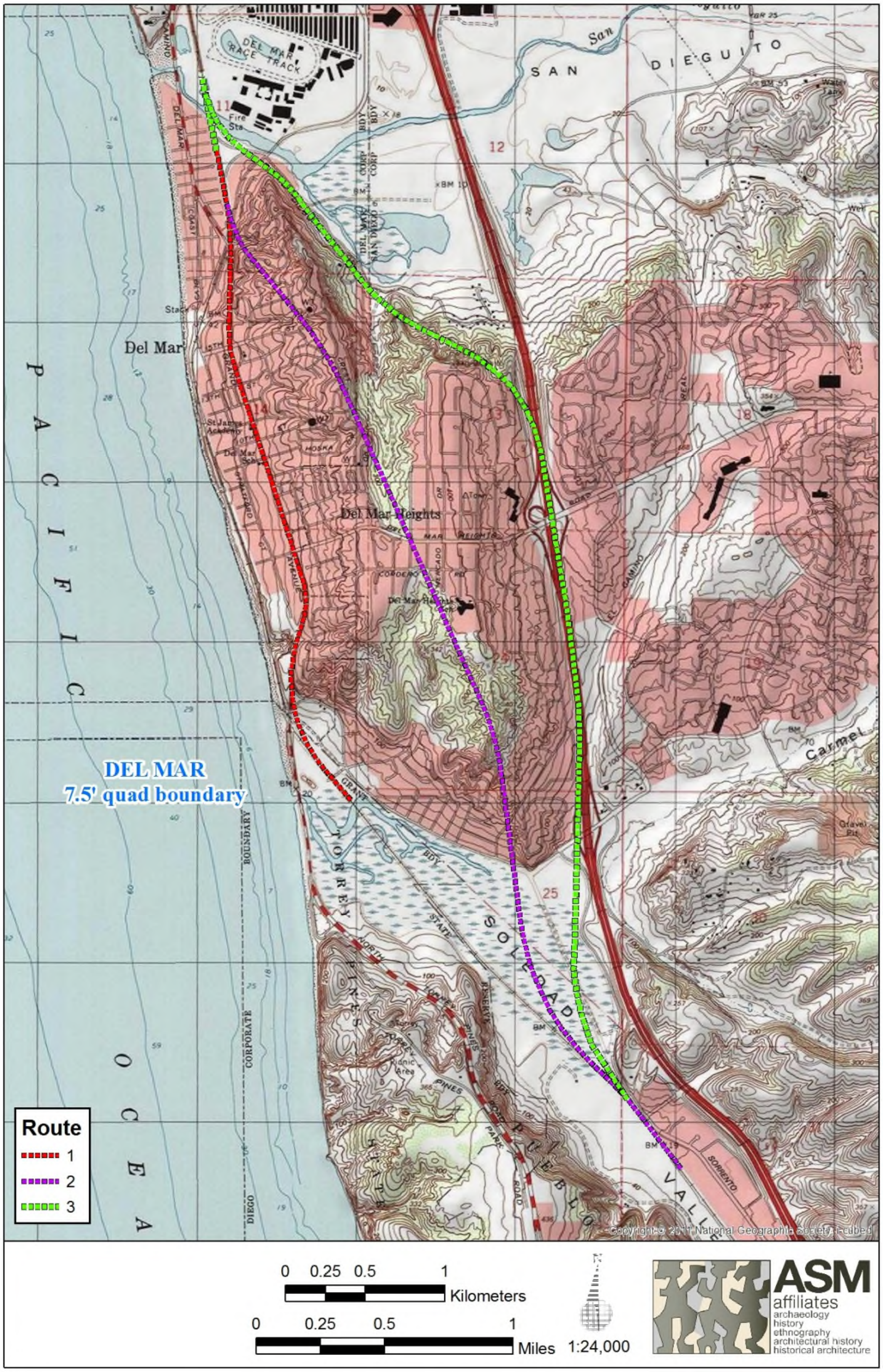

San Dieguito Alternative Project Map.

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July 3rd, 2012
Bernice Paipa, Vice-Spokesperson
Kumeyaay Cultural Repatriation Committee
1095 Barona Road
Lakeside, CA 92040

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Vice-Spokesperson Paipa,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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Associate Archaeologist

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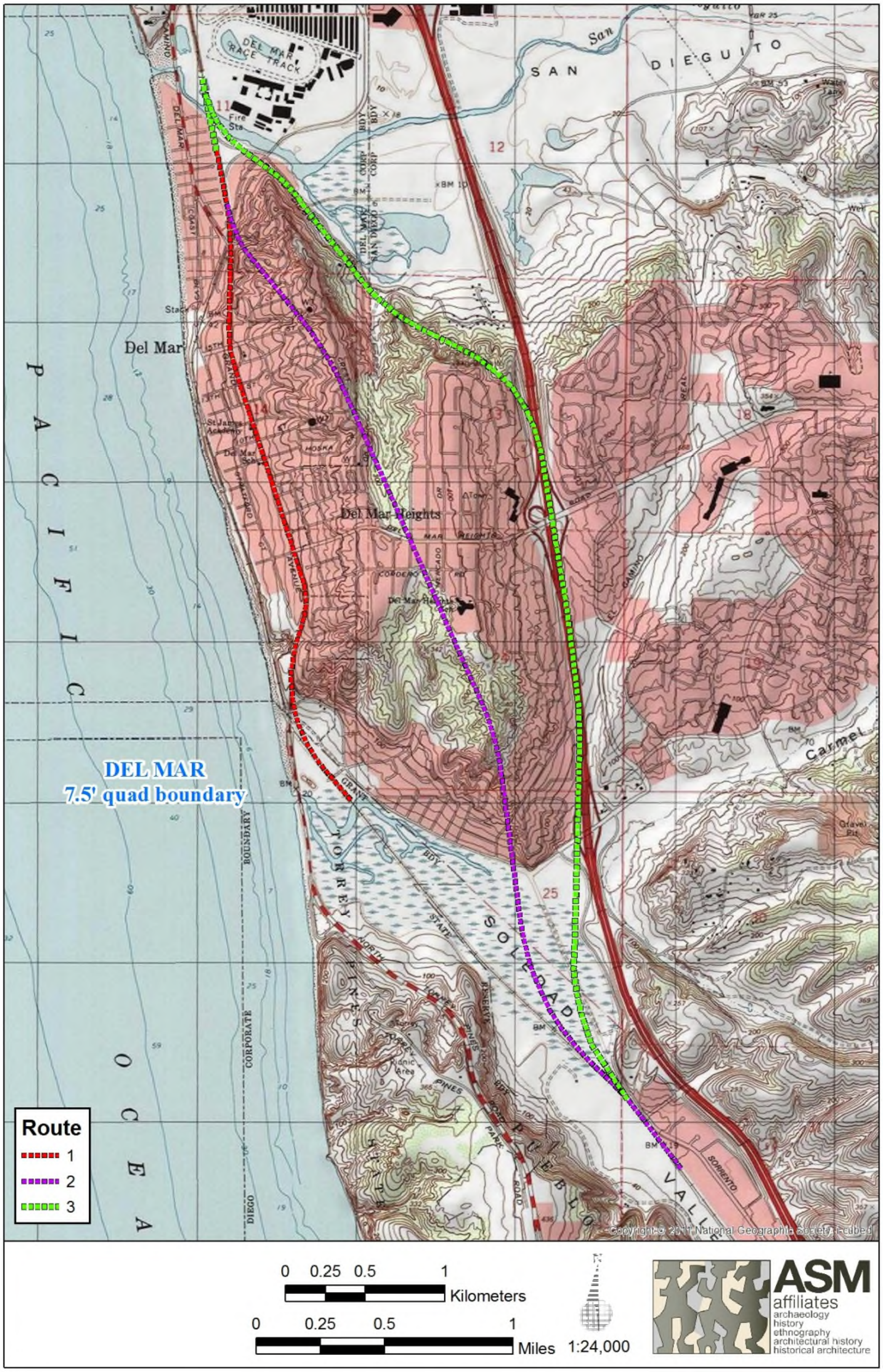

San Dieguito Alternative Project Map.

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July 3rd, 2012
Clint Linton, Director of Cultural Resources
Ipai Nation of Santa Ysabel
Po Box 507
Santa Ysabel, CA 92070

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Mr. Linton,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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Associate Archaeologist

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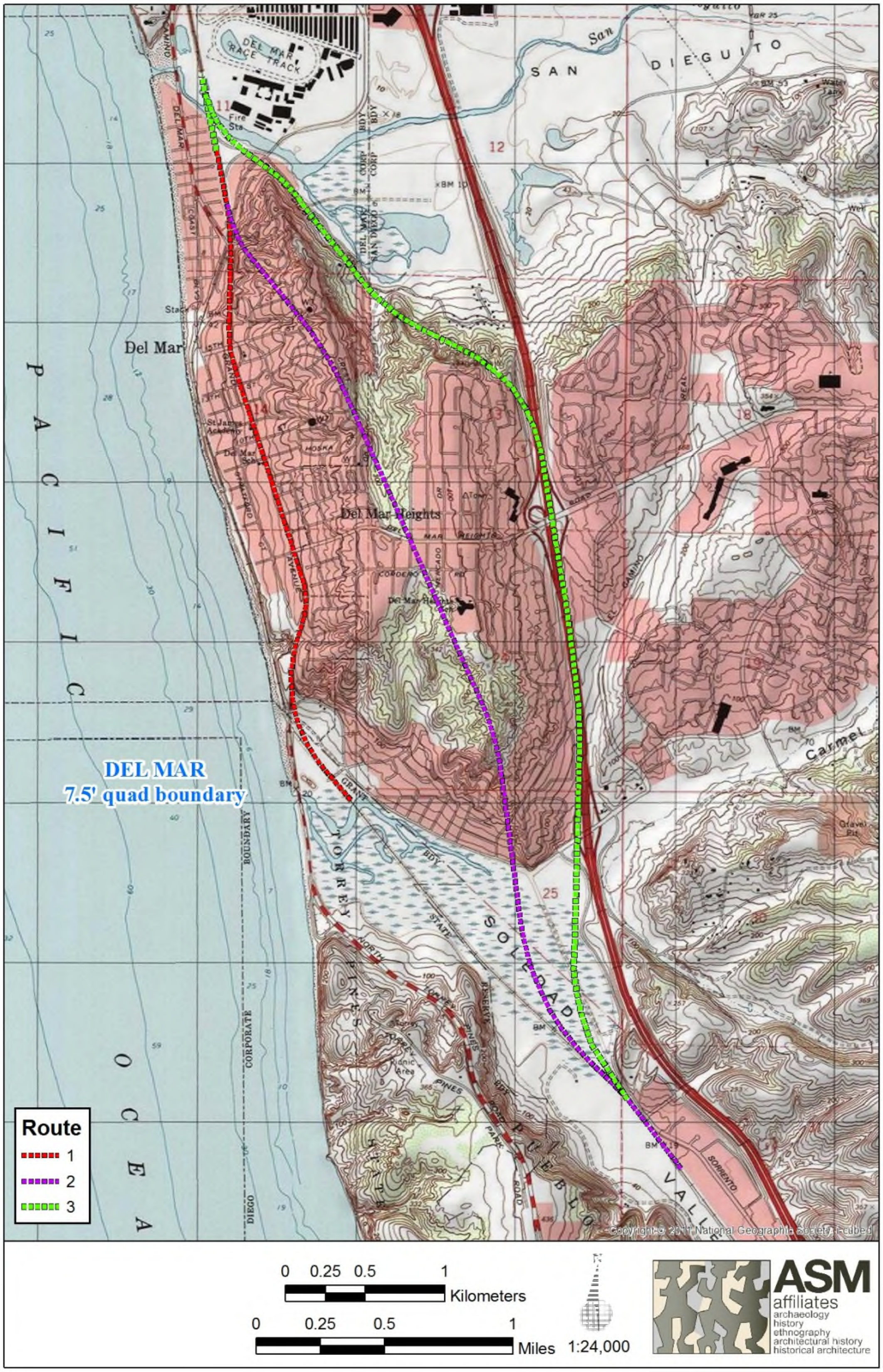

San Dieguito Alternative Project Map.

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July 3rd, 2012
Carmen Lucas
Kwaaymii Laguna Band of Mission Indians
PO Box 775
Pine Valley, CA 91962

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Mrs. Lucas,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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Sincerely,

Angela Pham
Associate Archaeologist

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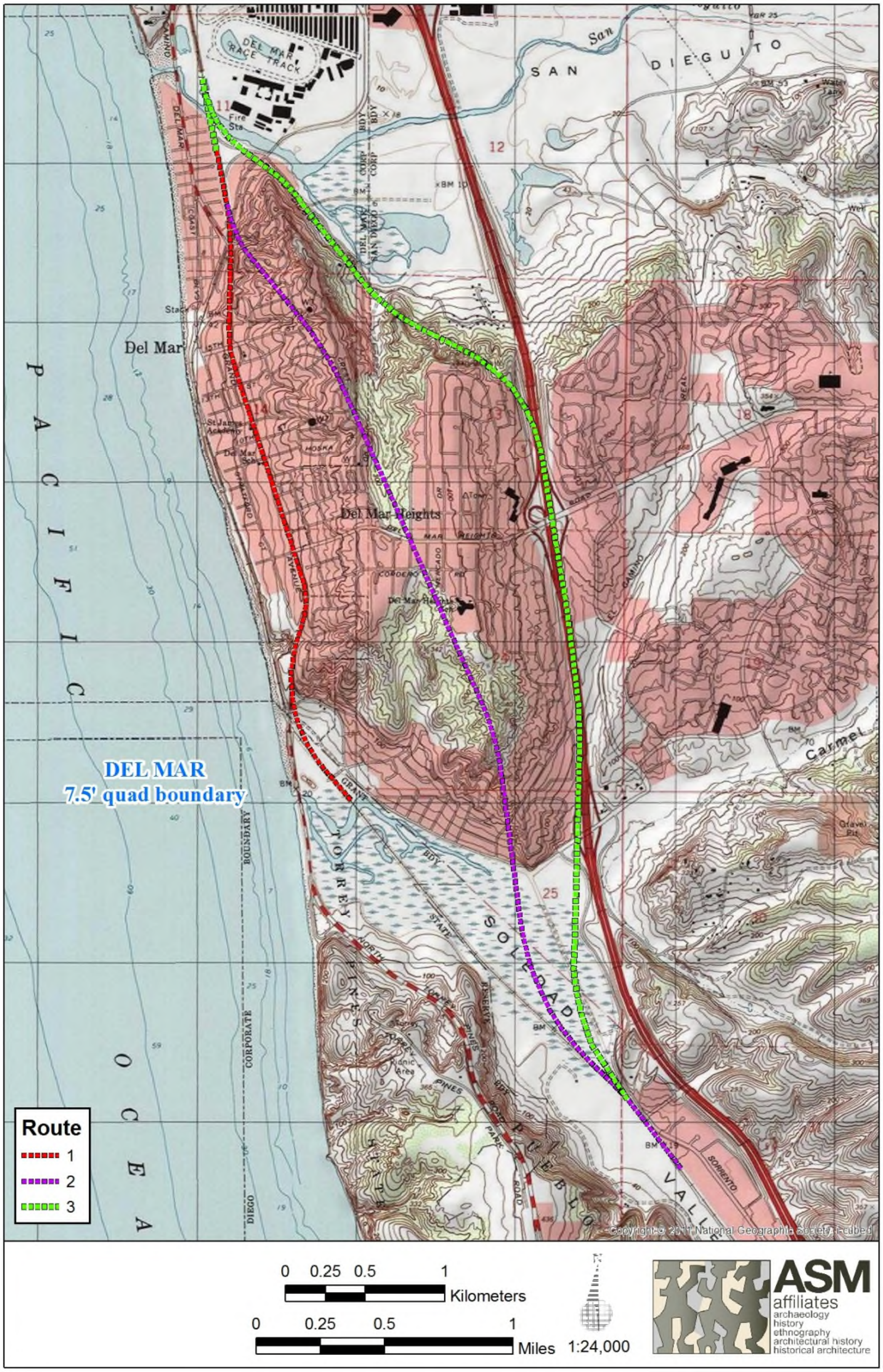

San Dieguito Alternative Project Map.

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DATE: June 21, 2012

Dave Singleton
California Native American Heritage Commission
915 Capitol Mall, Room 364
Sacramento, CA 95814
Via fax: (916) 657-5390

Re: San Dieguito Alternative, San Diego County, California

Dear Mr. Singleton,

ASM Affiliates is conducting an archaeological study of the San Dieguito Alternative, located in San Diego County, California. This study is being undertaken in accordance with CEQA. ASM has conducted a records search with the South Coastal Center in San Diego County, as well as a pedestrian survey of the project parcel. I am writing to inquire if you have registered any cultural resources, traditional cultural properties, or areas of heritage sensitivity within this proposed project area.

Our investigation will include direct consultation with local tribal entities in a manner that ensures complete confidentiality. We request that you send along a listing of the appropriate individuals to make contact with related to this project. Please submit your response to me at our Carlsbad office, listed above. Feel free to call, write, or e-mail (apham@asmaffiliates.com) if you have any questions.

Sincerely,

Angela Pham
Associate Archaeologist

Attachment: map of project parcel

Your Requested Information:

County – San Diego
USGS Quad – Del Mar 7.5' quad
Townships – 14S/15S
Ranges – 3W/4W
Sections – 11, 12, 13, 14, 23, 24, 25, 31

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121 California Avenue, Reno, Nevada 89509 • (775) 324-6789 • Fax: (775) 324-9666
453 Vandehei Avenue, Suite 140, Cheyenne, Wyoming 82009 • (307) 772-9317 • Fax: (307) 772-9350
1471 Dewar Dr., Suite 120A, Rock Springs, Wyoming 82901 • (307) 362-1390 • Fax: (307) 362-1377
9420 E. Golf Links Road, PMB 323, Tucson, Arizona 85730 • (520) 886-9034
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July 3rd, 2012
Danny Tucker, Chairperson
Sycuan Band of the Kumeyaay Nation
5459 Sycuan Road
El Cajon, CA 92019

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Chairperson Tucker,

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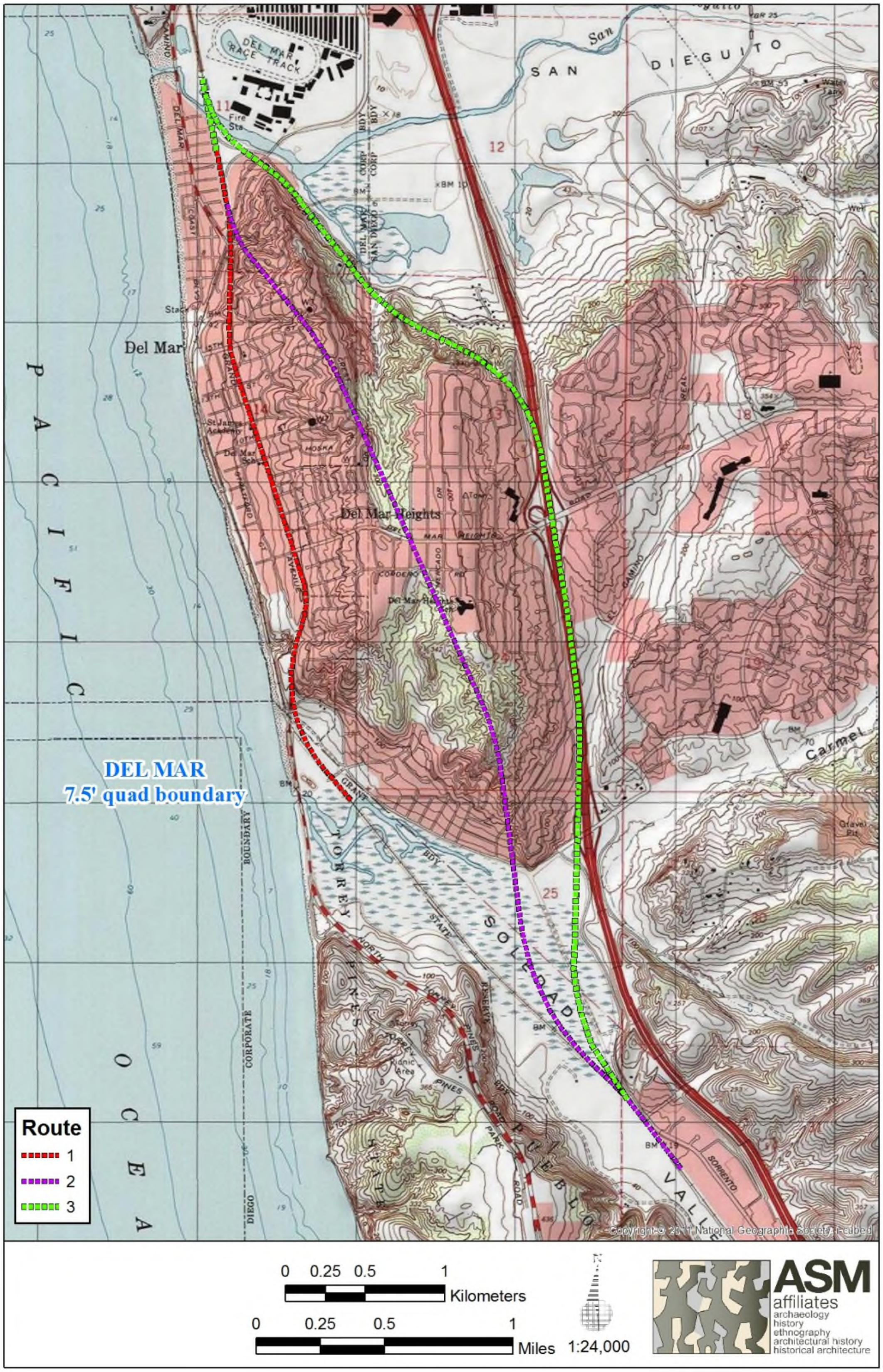

San Dieguito Alternative Project Map.

July 3rd, 2012
Edwin Romero
1095 Barona Road
Lakeside, CA 92040

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Chairperson Romero,

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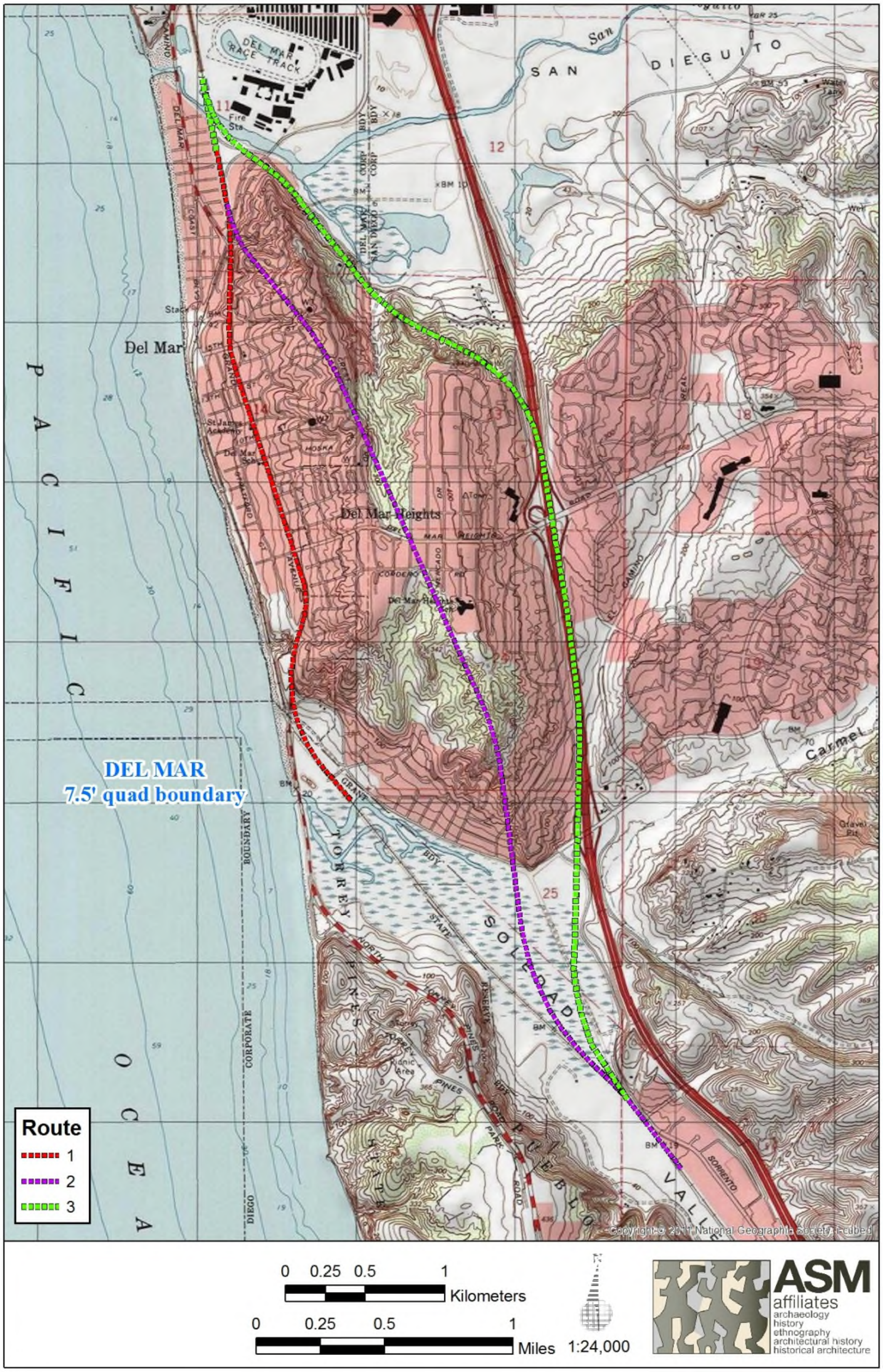

San Dieguito Alternative Project Map.

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July 3rd, 2012
Frank Brown, Coordinator
Inter-Tribal Cultural Resource Protection Council
240 Brown Road
Alpine, CA 91901

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Mr. Brown,

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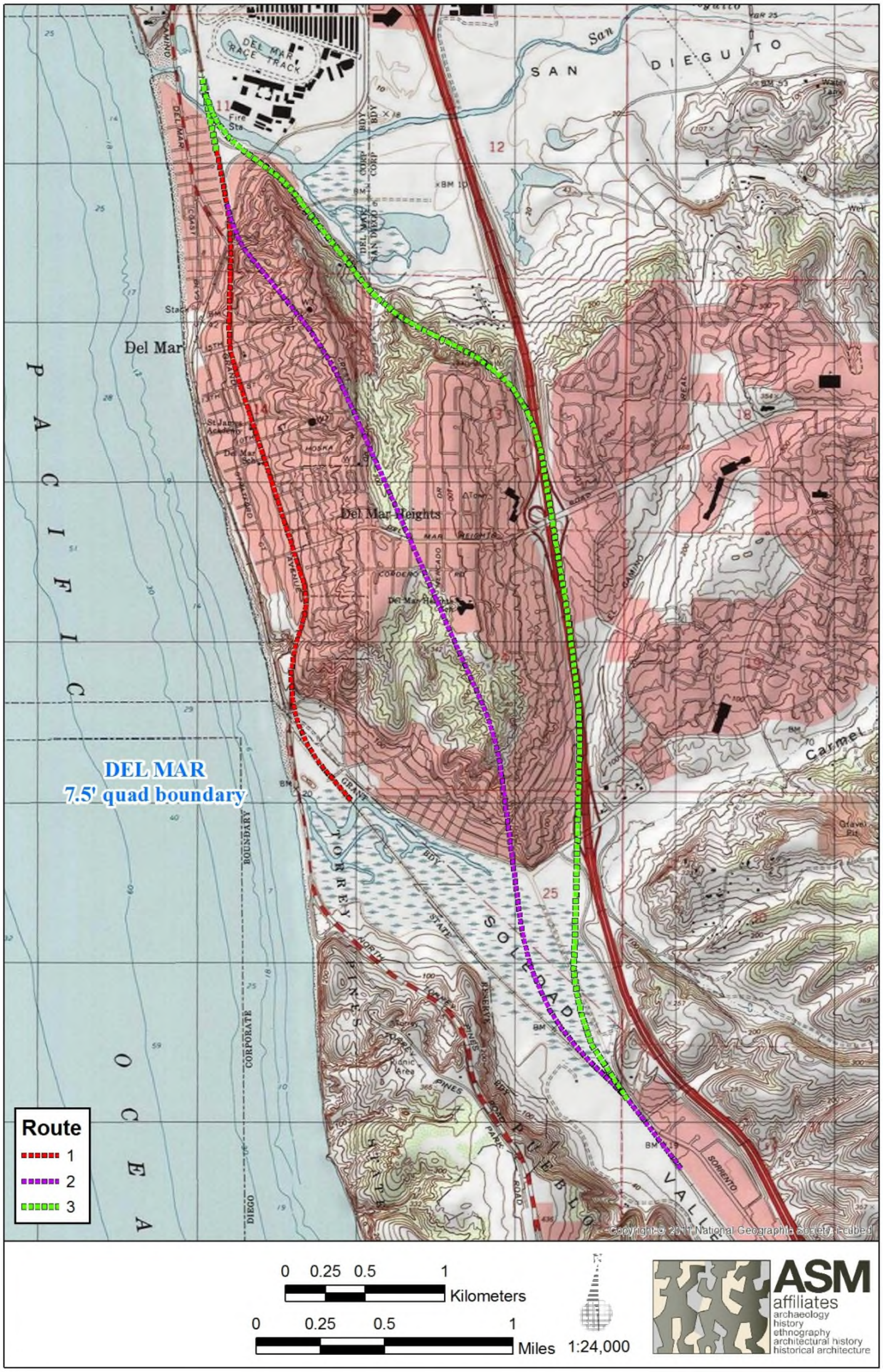

San Dieguito Alternative Project Map.

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July 3rd, 2012
Gwendolyn Parada, Chairperson
La Posta Band of Mission Indians
PO Box 1120
Boulevard, CA 91905

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Chairperson Parada,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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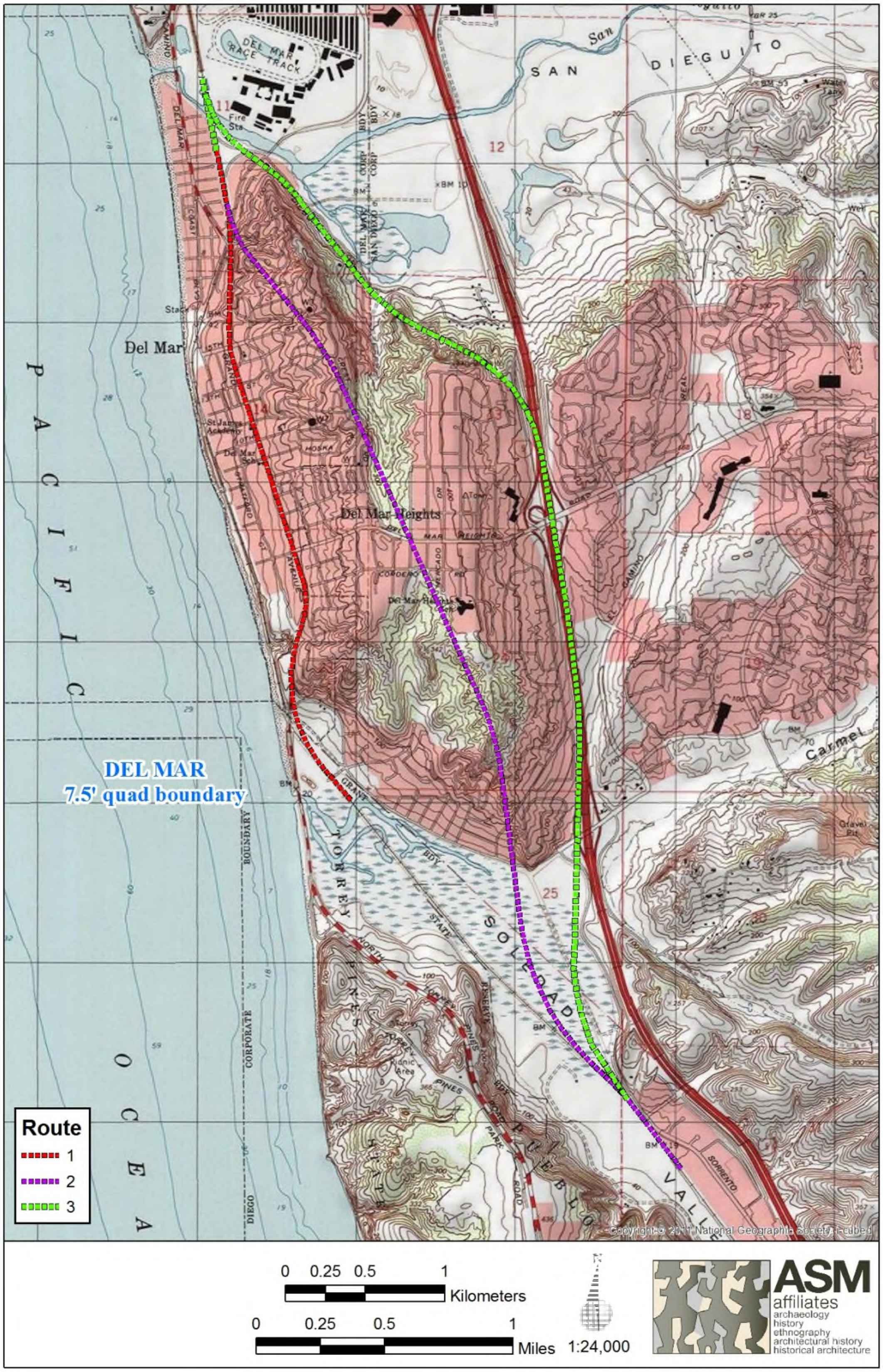

San Dieguito Alternative Project Map.

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July 3rd, 2012
Chairperson
Jamul Indian Village
PO Box 612
Jamul, CA 91935

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Chairperson,

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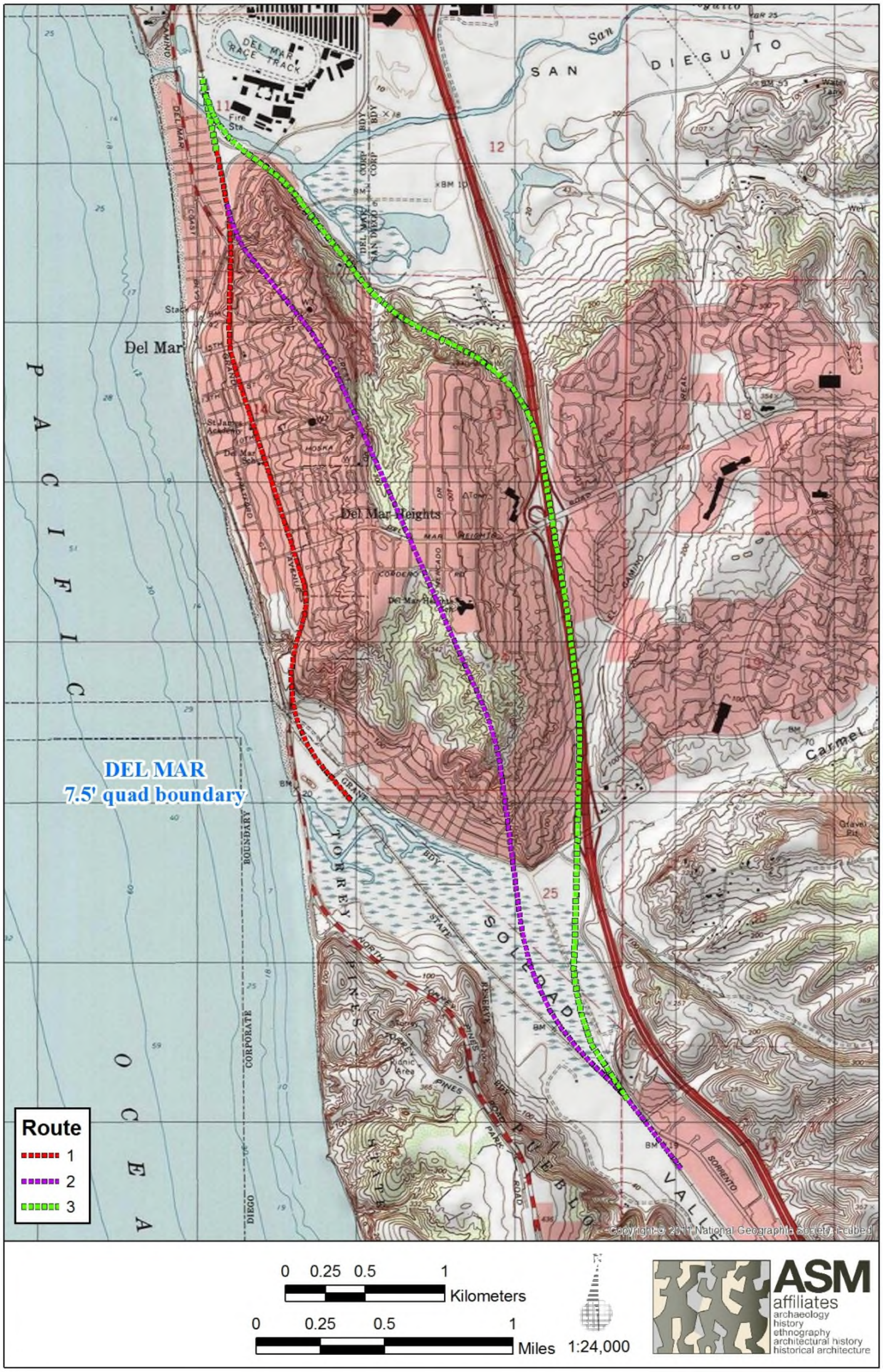

San Dieguito Alternative Project Map.

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July 3rd, 2012
Kristie Orosco, Environmental Coordinator
San Pasqual Band of Mission Indians
PO Box 365
Valley Center, CA 92082

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Mrs. Orosco,

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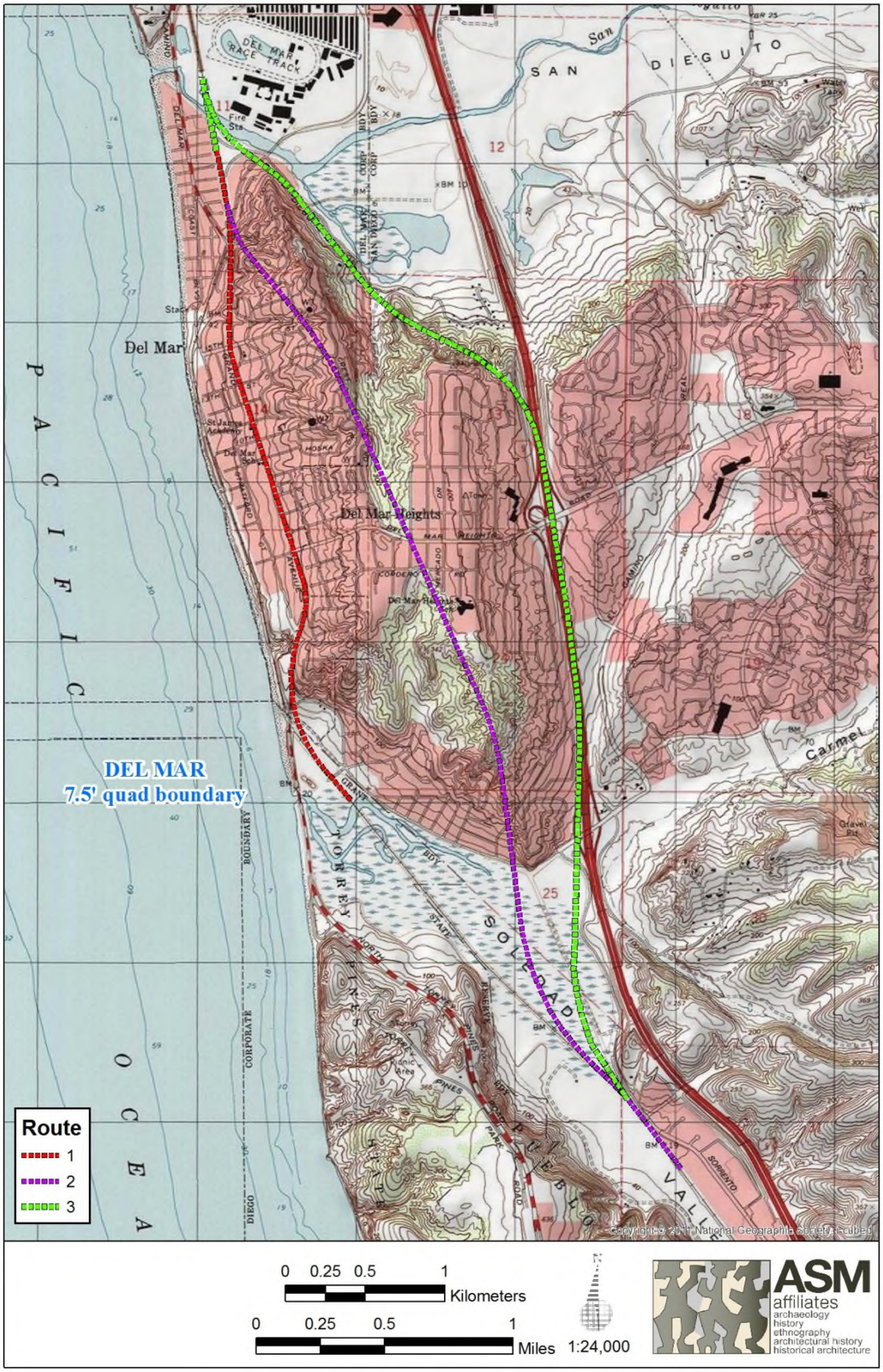

San Dieguito Alternative Project Map.

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July 3rd, 2012
Leroy Elliot, Chairperson
Manzanita Band of Kumeyaay Nation
PO Box 1302
Boulevard, CA 91905

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Chairperson Elliot,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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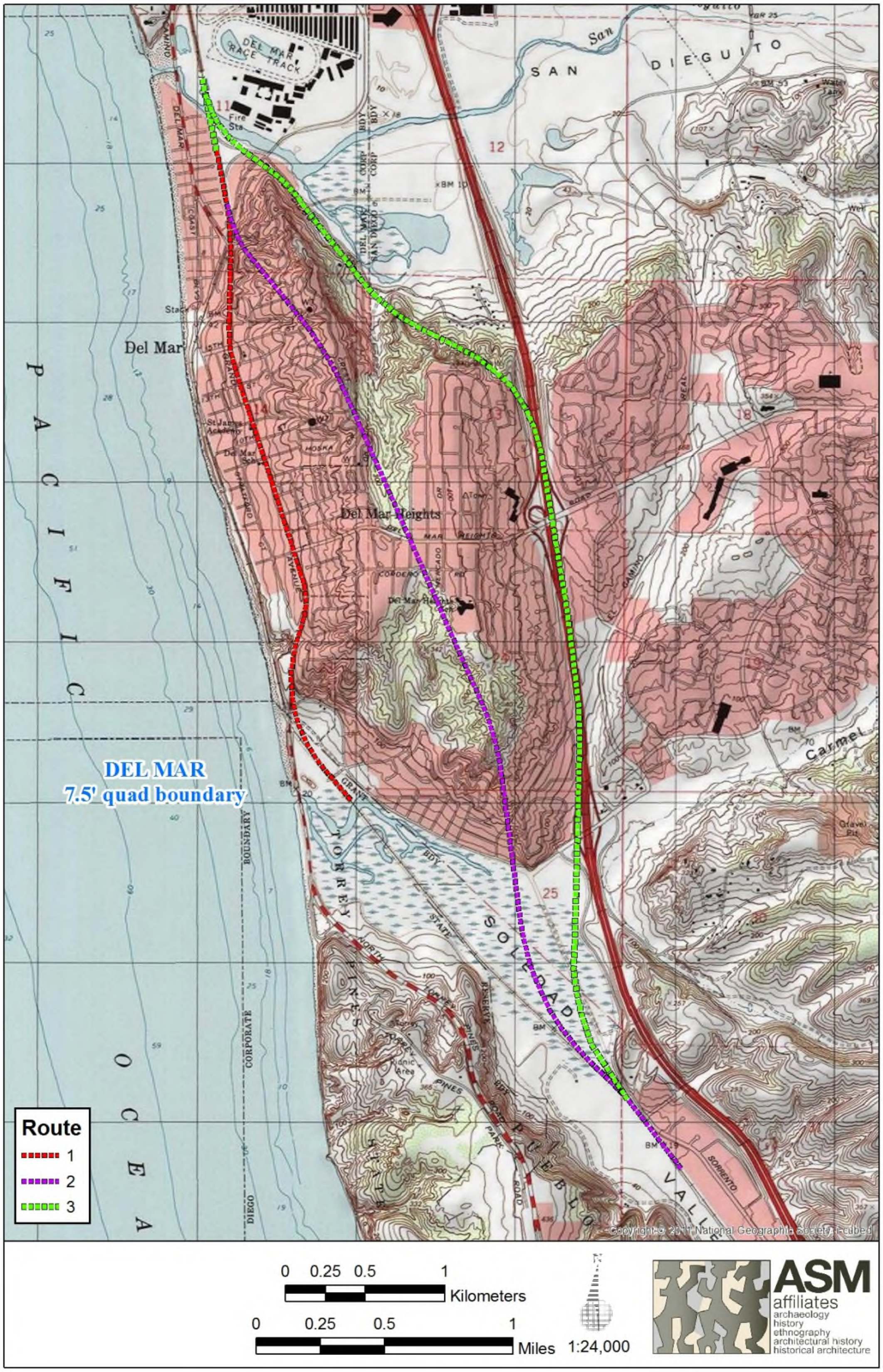
Sincerely,

Angela Pham
Associate Archaeologist

Attachment: San Dieguito Alternative Project Map



San Dieguito Alternative Project Map.

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July 3rd, 2012
Michael Garcia, Vice Chairperson
Ewiiaapaayp Tribal Office
4054 Willows Road
Alpine, CA 91901

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Vice Chairperson Garcia,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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Angela Pham

Angela Pham
Associate Archaeologist

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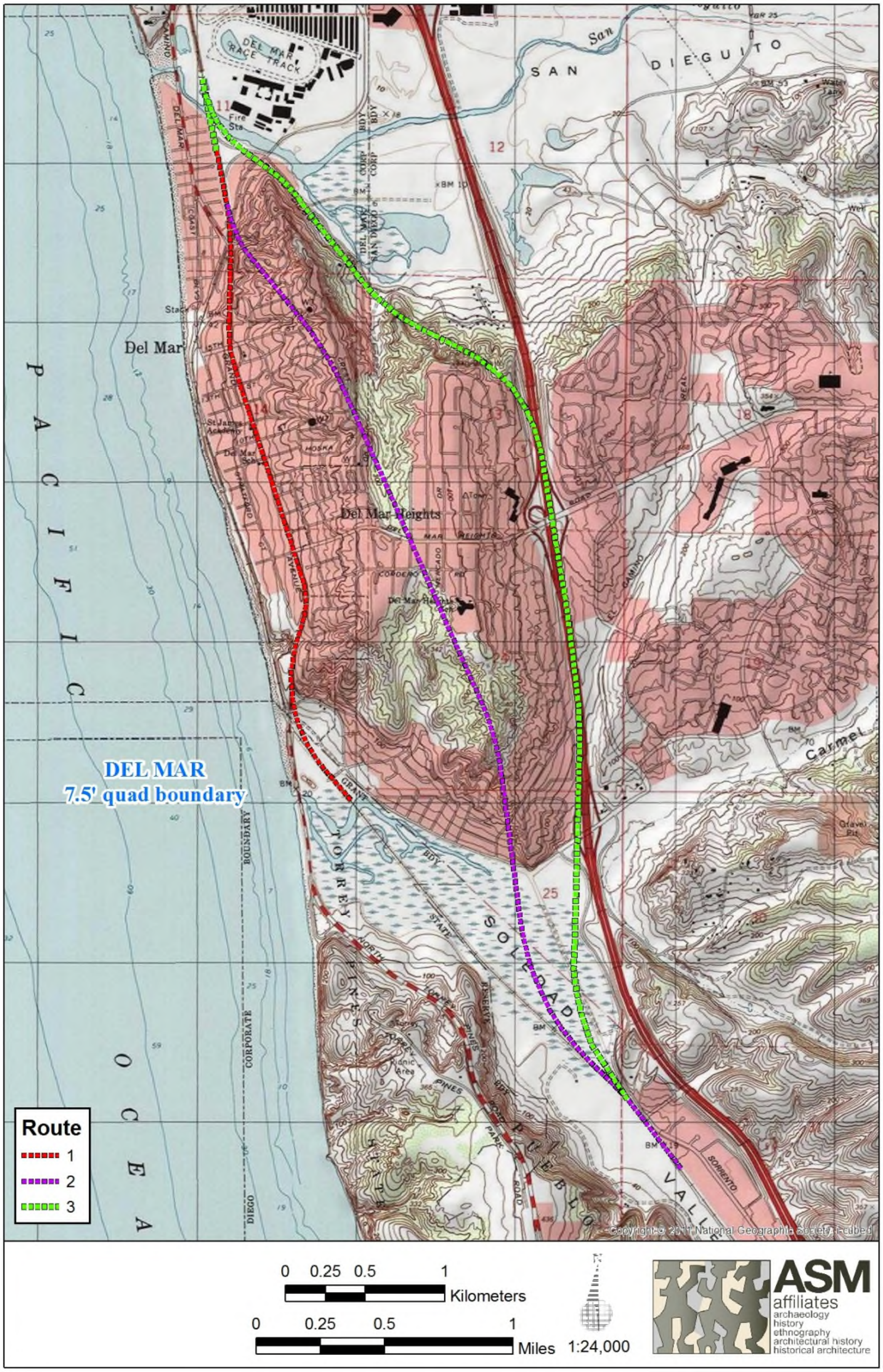

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July 3rd, 2012
Mark Romero, Chairperson
Mesa Grande Band of Mission Indians
PO Box 270
Santa Ysabel, CA 92070

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Chairperson Romero,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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Associate Archaeologist

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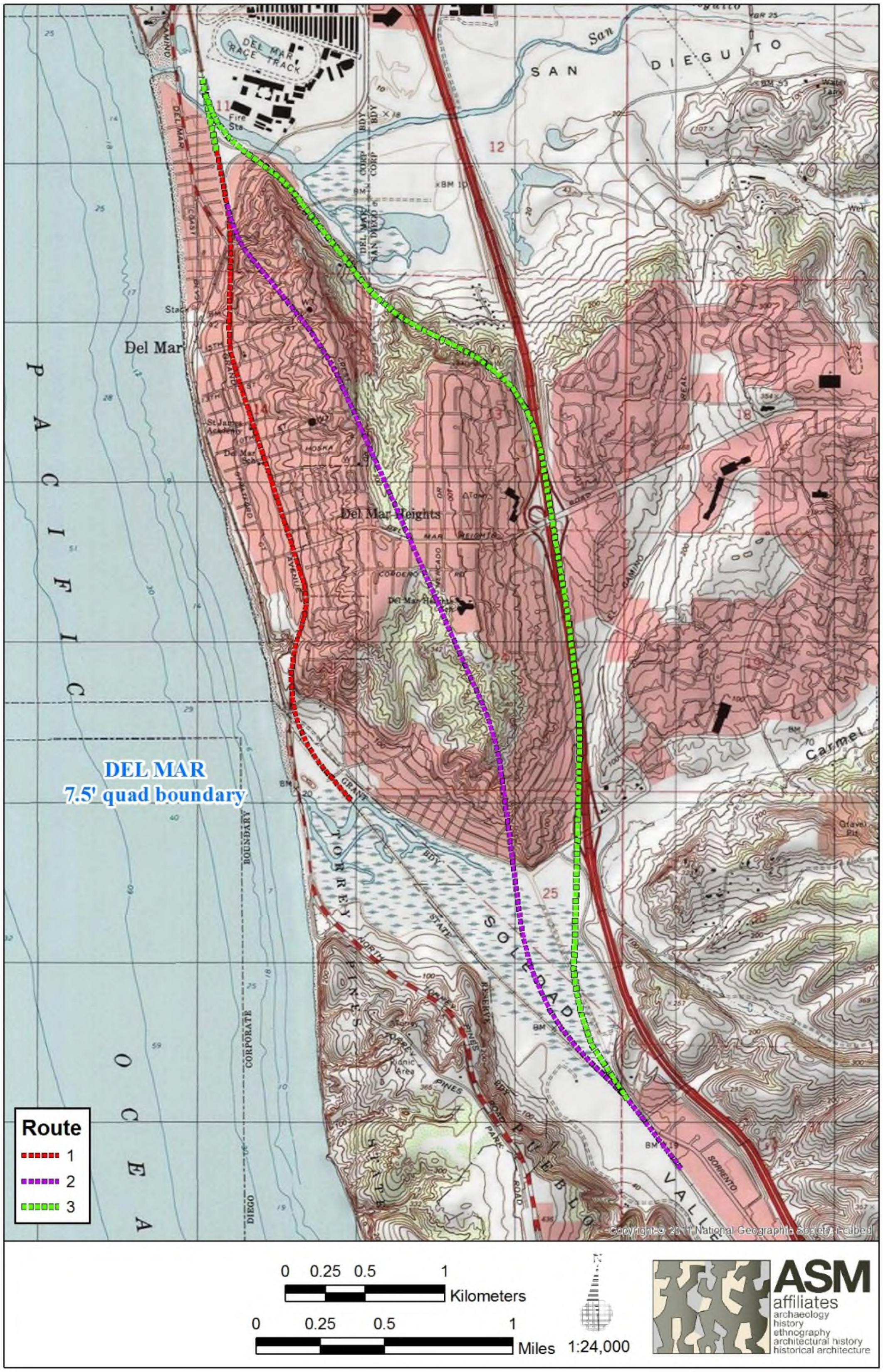

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July 3rd, 2012
Ron Christman
Kumeyaay Cultural Historic Committee
56 Viejas Grade Road
Alpine, CA 92001

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Mr. Christman,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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Associate Archaeologist

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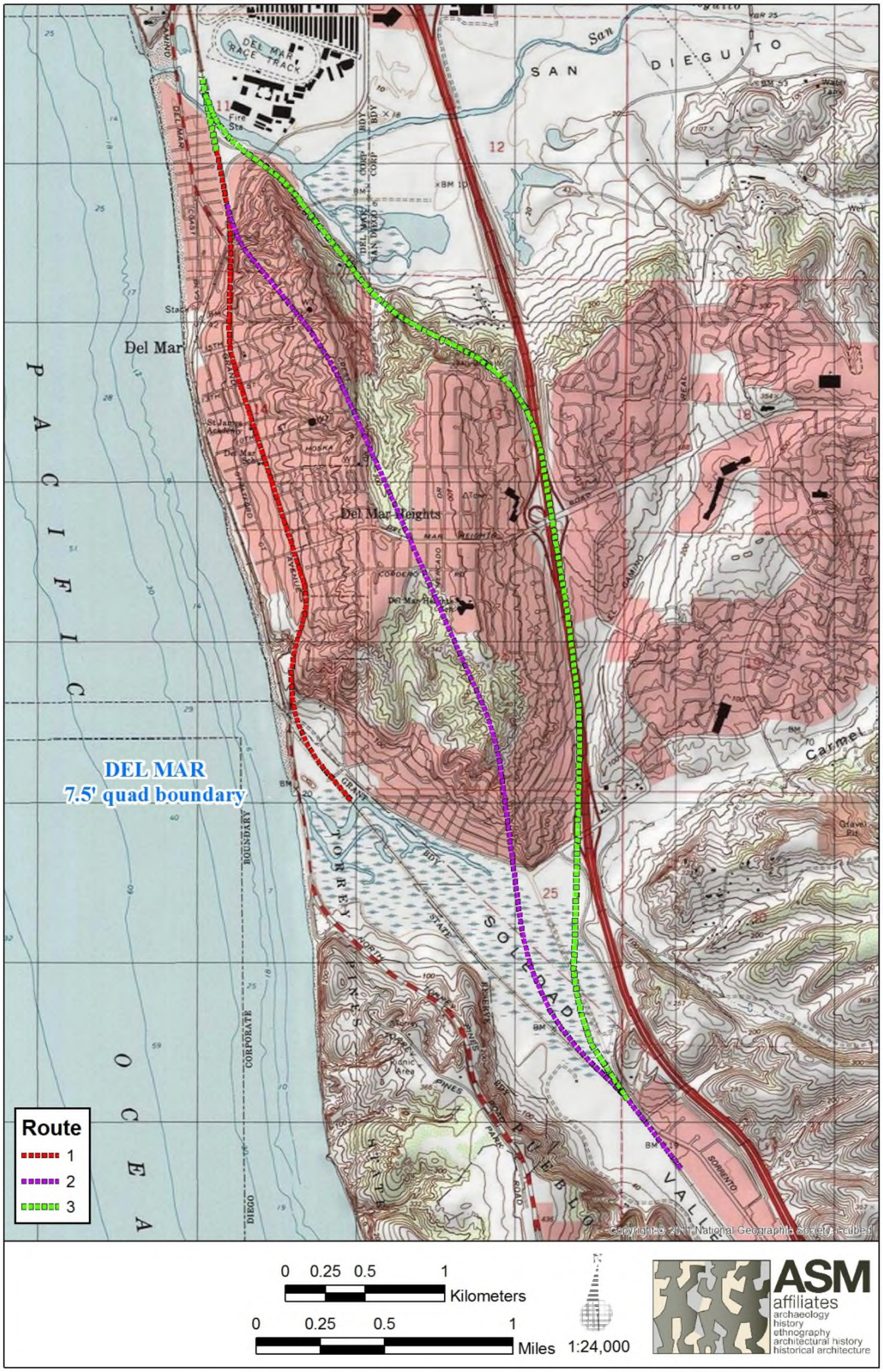

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July 3rd, 2012
Ralph Goff, Chairperson
Campo Band of Mission Indians
36190 Church Road, Suite 1
Campo, CA 91906

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Chairperson Goff,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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Sincerely,

Angela Pham
Associate Archaeologist

Attachment: San Dieguito Alternative Project Map

2034 Corte del Nogal, Carlsbad, CA 92011 • 760-804-5757 • 760-804-5755-fax
260 S. Los Robles Ave., Suite 311, Pasadena, CA 91101 • 626-793-7395 • 626-793-2008-fax
120 Vine St., Reno, NV 89503 • 775-324-6789 • 775-324-9666-fax
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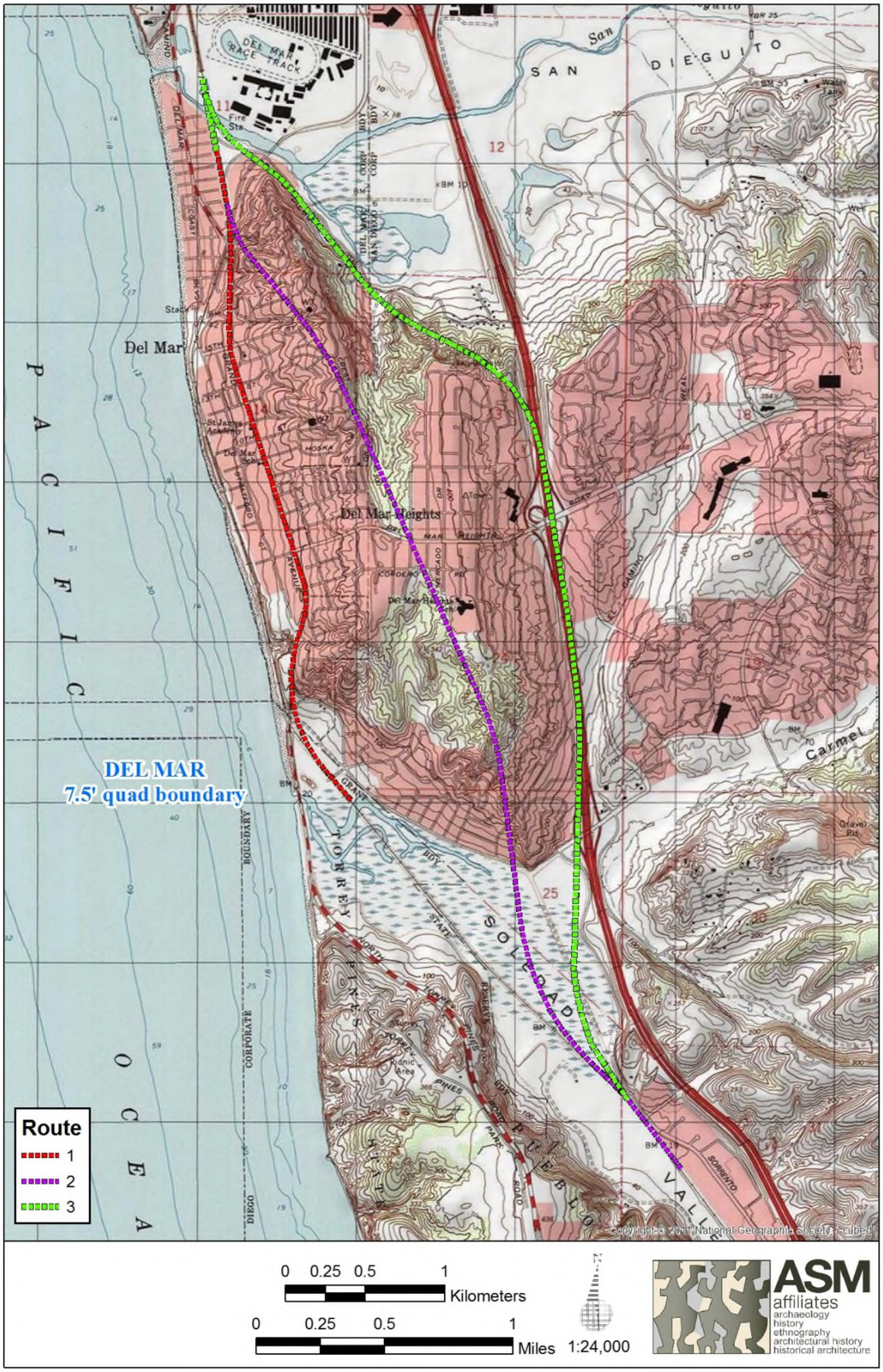

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July 3rd, 2012
Rebecca Osuna, Spokesperson
Inaja Band of Mission Indians
2005 S. Escondido Blvd.
Escondido, CA 92025

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Spokesperson Osuna,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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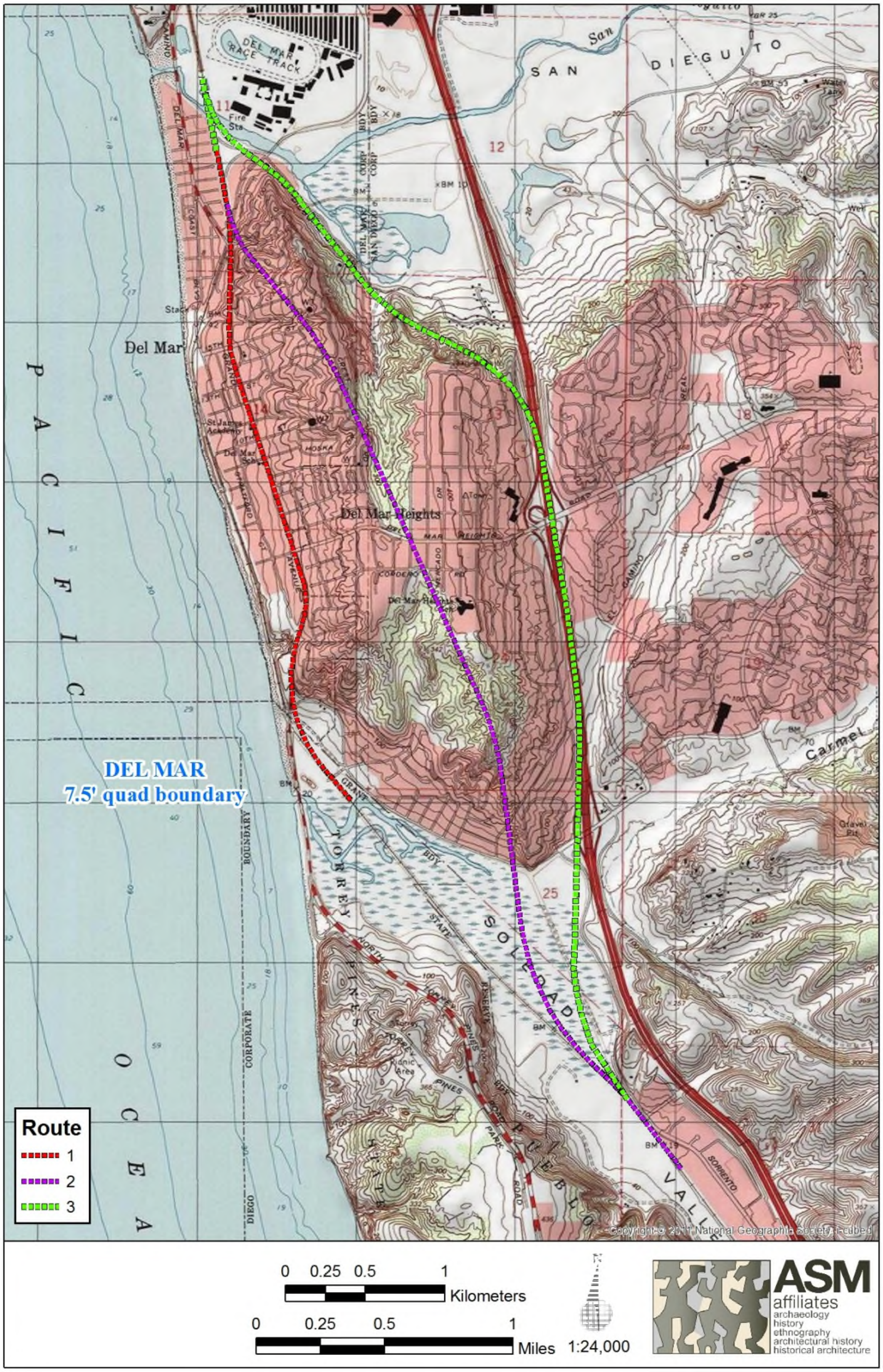

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July 3rd, 2012
Steve Banegas, Spokesperson
Kumeyaay Cultural Repatriation Committee
1095 Barona Road
Lakeside, CA 92040

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Spokesperson Banegas,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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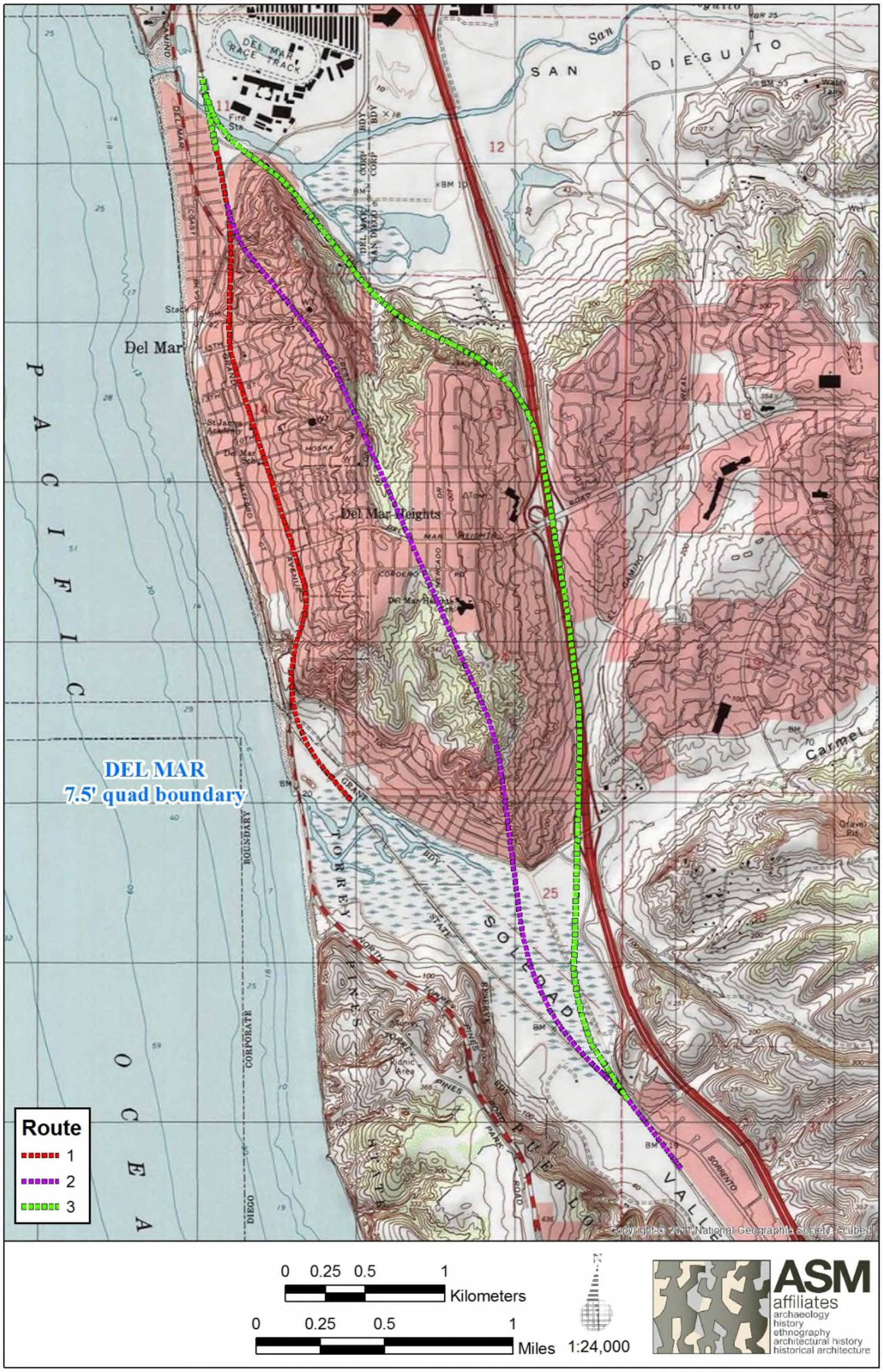

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July 3rd, 2012
Cultural Department
San Luis Rey Band of Mission Indians
1889 Sunset Drive
Vista, CA 92081

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Cultural Department representative,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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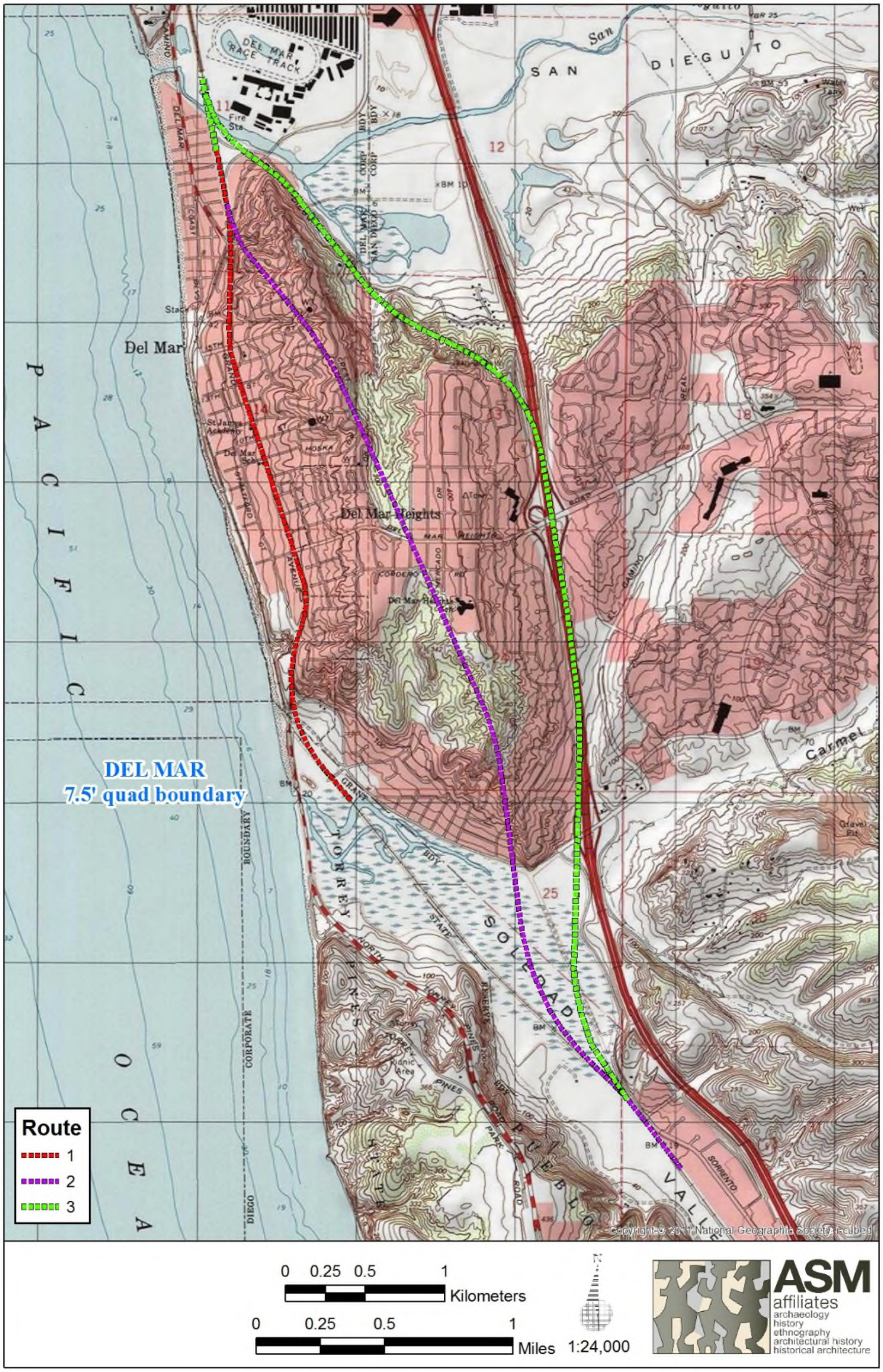

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July 3rd, 2012
Will Micklin, Executive Director
Ewiiaapaayp Tribal Office
4054 Willows Road
Alpine, CA 91901

Re: Archaeological Study for the San Dieguito Alternative Project, San Diego County, California

Dear Mr. Micklin,

ASM Affiliates, Inc. (ASM) is conducting a cultural resource investigation for the San Dieguito Alternative Project, San Diego County, California. ASM has completed a records search at the South Coastal Information Center and with the California Native American Heritage Commission. While the NHAC did not have records of resources, the SCIC records search proved positive in that prehistoric and/or historic resources have been previously identified within the proposed project area.

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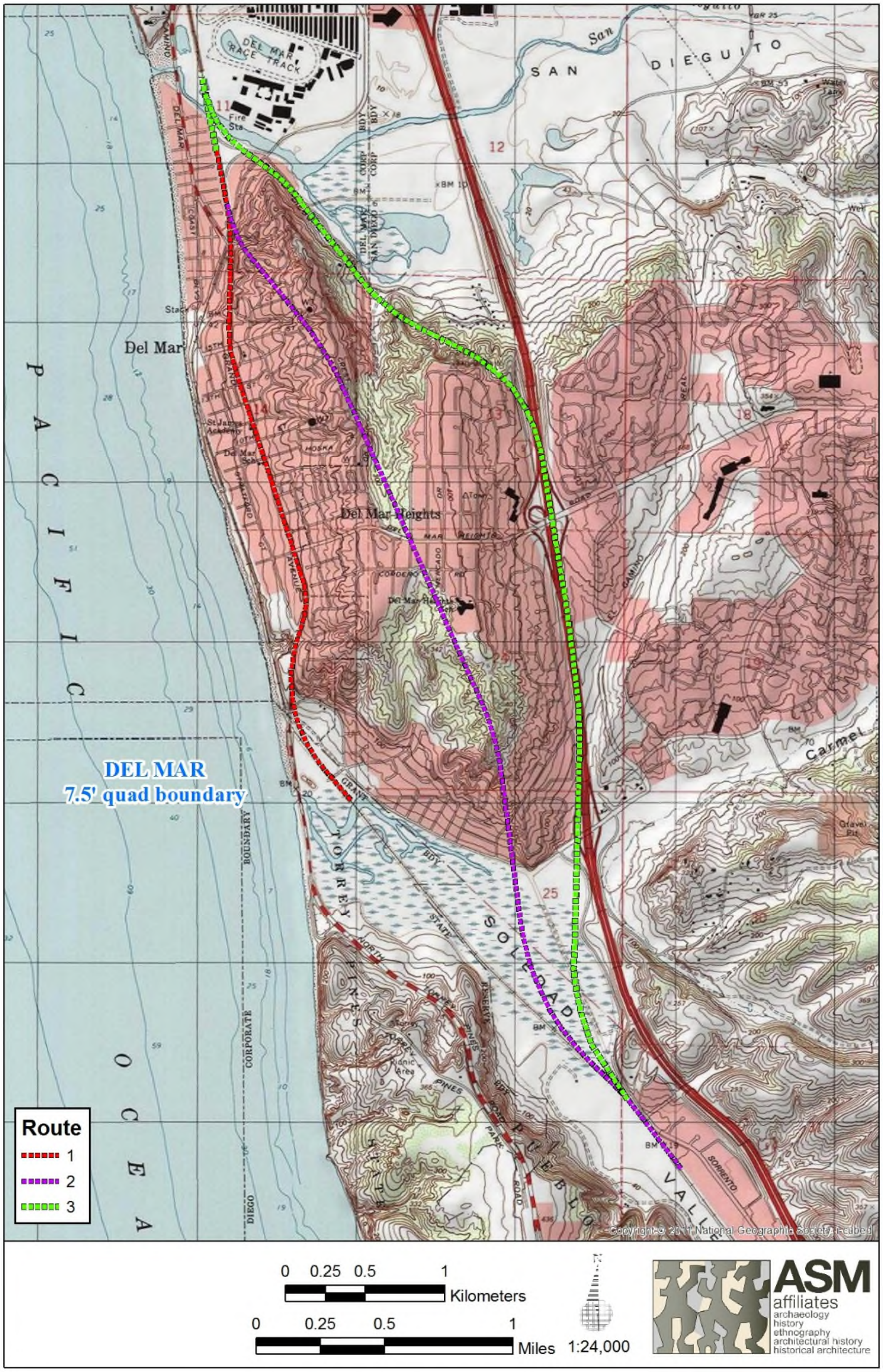
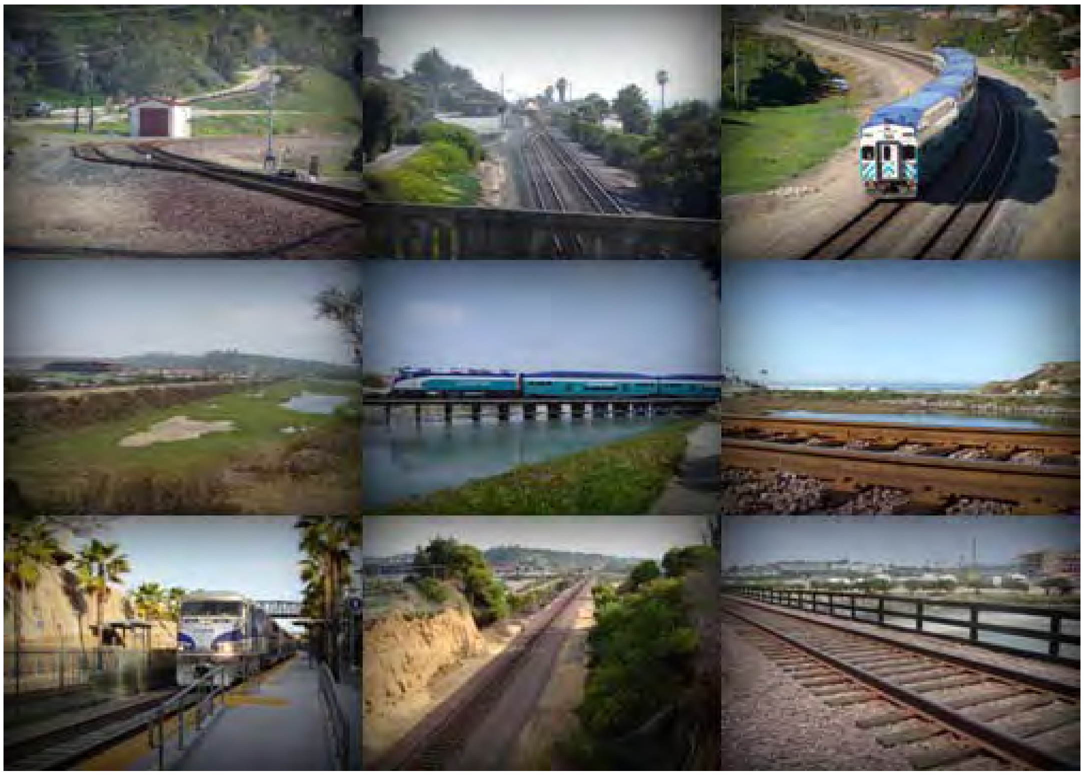


San Dieguito Alternative Project Map.

IV. GEOTECHNICAL EVALUATION

CONCEPTUAL ENGINEERING AND ENVIRONMENTAL CONSTRAINTS FOR DOUBLE TRACK ALTERNATIVE ALIGNMENTS BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY

PRELIMINARY GEOTECHNICAL EVALUATION



SANDAG

November 7, 2014

Prepared for:
SANDAG
401 B Street, Suite 800, San Diego, CA 92101

Prepared by:

Ninyo & Moore

November 7, 2014
Project No. 106810009

Ms. Patricia McColl
David Evans and Associates
110 West A Street, Suite 1700
San Diego, California 92101

Subject: Preliminary Geotechnical Evaluation
Conceptual Engineering and Environmental Constraints
Double Track Alternative Alignments
Between Del Mar Fairgrounds and Sorrento Valley

Dear Ms. McColl:

In accordance with your request and authorization, we have performed a preliminary geotechnical evaluation for support of the Conceptual Engineering and Environmental Constraints study for the Double Track Alternative Alignments between the Del Mar Fairgrounds and Sorrento Valley. This report presents our preliminary geotechnical findings, conclusions, and recommendations regarding the proposed project. We appreciate the opportunity to be of service on this project.

Respectfully submitted,
NINYO & MOORE

PROFESSIONAL GEOLOGIST RONALD D. HALLUM Exp. 11-30-15 No. 1484 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

Ronald D. Hallum, CEG
Chief Geologist

Soumitra Guha, Ph.D., GE
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER SOUMITRA GUHA NO. GE 2632 EXP. 6/30/15 GEOTECHNICAL STATE OF CALIFORNIA

NMM/RDH/SG/gg

Distribution: (1) Addressee (via e-mail)

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1. INTRODUCTION

In accordance with your request and authorization, we have performed a preliminary geotechnical evaluation for support of the Conceptual Engineering and Environmental Constraints study for the Double Track Alternative Alignments between the Del Mar Fairgrounds and Sorrento Valley. The project will ultimately result in a double-track width, railroad tunnel underneath the Del Mar Mesa, replacing the existing alignment along the coastline. The project is located in the cities of Del Mar and San Diego in north coastal San Diego County, California (Figure 1). The purpose of our study was to perform a preliminary desktop evaluation of the geotechnical conditions along the three proposed alternatives, two of which consider additional alignment sub-options. This report presents our preliminary findings, conclusions, and recommendations.

2. SCOPE OF SERVICES

Our scope of services included the following:

- Reviewing background geologic and geotechnical information including topographic maps, geologic maps, fault maps, aerial photographs, and existing geotechnical reports for the project vicinity. Information was obtained through research at the offices of the City of San Diego, the City of Del Mar, SANDAG, NCTD, Caltrans, and from previous reports by our office.
- Performance of a field reconnaissance of the project area by state-registered geologists from our office.
- Compiling data and performing preliminary engineering analyses of the information obtained from our background review and field reconnaissance.
- Preparing this report to provide our preliminary findings, conclusions, and recommendations for the three proposed tunnel alternatives.

3. SITE AND PROJECT DESCRIPTION

The Del Mar Mesa is bounded by the San Dieguito River and Lagoon to the north, the Pacific Ocean on the west, Peñasquitos Lagoon to the south, and Interstate Highway 5 on the east. The Del Mar Mesa generally consists of a pair of north-south trending ridges partially separated by Crest Canyon. The western ridge descends generally uniformly to the west and the coast. The eastern ridge is bounded to the west by Crest Canyon and to the east by Interstate Highway 5. The ridges are cut by numerous steep-sided valleys and ravines. Elevations range from roughly 10 feet above mean sea level (MSL) along the coast and in the lagoons north and south of the mesa to roughly 420 feet above MSL along the eastern ridge north of Del Mar Heights Road. The city of Del Mar occupies approximately the western half of the project area and the city of San Diego occupies the eastern half.

This project is a part of the proposed improvements and expansion of the railroad network along the Los Angeles-San Diego-San Luis Obispo (LOSSAN) corridor. In this area, the existing NCTD and MTS alignment passes through the city of Del Mar along bluff-tops and beaches adjacent to the Pacific Ocean and limits public access to the coast. It has been proposed to replace the existing single-track corridor through the Del Mar area with a double track alignment that utilizes tunnels. The proposed realignment would extend approximately 5 miles, starting near the existing railroad bridge west of the Del Mar Fairgrounds, passing under the Del Mar Mesa, and reconnecting with the existing alignment in Peñasquitos Lagoon, south of the Del Mar Mesa. The project alignments are shown on Figure 1.

The project team has identified three double-track tunnel alternatives, two of which include sub-options. A summary of the alternatives is presented below.

- **Alternative 1 – Camino Del Mar:** Alternative 1 (Plate 1) would include an approximately 10,200-foot tunnel section that would generally underlie Camino Del Mar through the center of the city of Del Mar. The northern portal would be near the intersection of Camino Del Mar and Jimmy Durante Boulevard. The southern portal would be in a south-facing bluff within Torrey Pines State Beach, south of the intersection of Camino Del Mar and Carmel Valley Road. The depth of the top of the tunnel below the existing ground surface would range from about 10 to 70 feet. Seven vertical vent/pedestrian escape shafts ranging in length from approximately 45 to 60 feet are proposed. Alternative 1 is proposed to be constructed within a double box structure by cut-and-cover methods.

- **Alternative 2 – Canyon Crest Higher Speed and Canyon Crest Sub-Option**

  Canyon Crest Higher Speed: Alternative 2 (Plate 2) would include a three-tunnel section extending approximately 13,200 feet. The northern portal would be east of the intersection of Camino Del Mar and Jimmy Durante Boulevard and the tunnel would extend to the southeast, pass under Del Mar Heights Road near Durango Road and emerge at a southern portal located south of Portofino Drive (approximately 600 feet north of Carmel Valley Road). The track would then extend along two single track bridges approximately one mile across Peñasquitos

Lagoon and ultimately connect to the Sorrento Valley Double Track alignment via a new berm. The depth of the top of the tunnel below the existing ground surface would range from approximately 15 to 270 feet. Six vertical vent shafts ranging in length from approximately 170 to 270 feet are proposed. Construction of Alternative 2 is proposed to be by tunnel boring methodology with cut-and-cover sections at either end of the tunnel alignment.

Canyon Crest Sub-Option: The Alternative 2 - Canyon Crest sub-option would include a three-tunnel section extending approximately 12,700 feet. The northern section would include reconstruction of the San Dieguito Railway Bridge and two single track bridges over Jimmy Durante Boulevard. The alignment would then extend toward the Crest Canyon Open Space along a graded open trench to the tunnel portal. The tunnel would generally be constructed within the open space area, east of the Canyon Crest Higher Speed alignment, pass under Portofino Drive, and emerge at a southern portal located in the open space hillside to the east. The track would then extend across an open trench section and transition to two single-track bridges and ultimately connect to the Sorrento Valley Double Track alignment via a new berm. The tunnel depth would range up to 250 feet. Six vertical ventilation shafts are proposed. Construction of the Canyon Crest sub-option is proposed to be by tunnel boring methodology, with open trench sections at either end of the tunnel alignment

- **Alternative 3: Interstate 5 and Interstate 5 East Sub-Option**

Interstate 5: Alternative 3 (Plate 3) would include two three-tunnel sections extending a total of approximately 13,400 feet. The northern tunnel would begin near the intersection of Jimmy Durante Boulevard and San Dieguito Drive and continue southeastward for approximately 1,400 feet. The alignment would then be constructed along an open trench until approximately 950 feet south of Racetrack View Drive, where the southern tunnel would be located. The second tunnel would extend approximately 12,000 feet, underlying Interstate Highway 5, and exiting east of Portofino Road near Carmel Valley Road. The tracks would then transition to two single-track bridges and ultimately connect to the Sorrento Valley Double Track alignment via a new berm. The depth of the top of the tunnel below Interstate 5 and Portofino Road would range from approximately 50 to 120 feet. Six vertical ventilation shafts are proposed. Construction of Alternative 3 is proposed to be by tunnel boring methodology with open trench sections near Racetrack View Drive.

Interstate 5 East: The Alternative 3 – Interstate 5 East sub-option would vary from the Interstate 5 alignment in that the northernmost 7,000 feet of the alignment would be shifted eastward and part of the San Dieguito Railway Bridge would be reconstructed.

4. GEOLOGY AND SUBSURFACE CONDITIONS

The following sections present our findings relative to regional and site geology, groundwater, and faulting and seismicity.

4.1. Regional Geologic Setting

The project study area is situated in the western portion of the Peninsular Ranges geomorphic province of southern California. This geomorphic province encompasses an area that roughly extends from the Transverse Ranges and the Los Angeles Basin, south to the Mexican border, and beyond another approximately 800 miles to the tip of Baja California (Norris and Webb, 1990; Harden, 1998). The geomorphic province varies in width from approximately 30 to 100 miles, most of which is characterized by northwest trending mountain ranges separated by subparallel fault zones. In general, the Peninsular Ranges are underlain by Jurassic-age metavolcanic and metasedimentary rocks and by Cretaceous-age igneous rocks of the southern California batholith. Geologic cover in the westernmost portion of the province in San Diego County generally consists of Upper Cretaceous-, Tertiary-, and Quaternary-age sedimentary rocks and includes the Eocene-age La Jolla Group. Structurally, the Peninsular Ranges are traversed by several major active faults. The Whittier-Elsinore, San Jacinto, and the San Andreas faults are major active fault systems located northeast of the site and the Rose Canyon, Coronado Bank, San Diego Trough, and San Clemente faults are major active faults located to the west-southwest. Figure 3 indicates the locations of the major regional faults in relation to the site. Major tectonic activity associated with these and other faults within this regional tectonic framework is generally right-lateral strike-slip movement. These faults, as well as other faults in the region, have the potential for generating strong ground motions in the project area. Further discussion of faulting and seismic hazards relative to the project area is provided in Section 5 of this report.

4.2. Site Geology

Figure 2 is a geologic map of the Del Mar Mesa project area. Geologic maps and geologic cross sections along each general alternative alignment are included as Plates 1, 2, and 3. It should be noted that the Canyon Crest Higher Speed and Canyon Crest alignments are anticipated to be generally consistent with that shown on Plate 2. The Del Mar Mesa is underlain by gently dipping marine sedimentary rocks of the Eocene-age La Jolla Group. This series of sedimentary rocks underlies much of the coastal plain of western San Diego County and consists of several formations. Two of these formations, the Delmar Formation and the Torrey Sandstone, are likely to be encountered along the proposed tunnel alignments. In addition to formational units of the La Jolla Group, very old paralic deposits, old paralic deposits, alluvium, landslide deposits, colluvium, and fill soils were observed or inferred to underlie portions of the project area. Brief descriptions of the geologic units, as described in the cited literature or as observed, are presented below.

4.2.1. Fill (Qaf)

Fill materials underlie developed areas, including existing railroad, highway, street, and building embankments, and may also be present as retaining wall and utility trench backfill.

4.2.2. Colluvium (not mapped)

Colluvial soils are present on the face or near the toe of the hillside slopes along the proposed alignments. These soils (also described as "slopewash") were deposited by gravity and surface water flowing over the face of hillside slopes. Where observed, the colluvial deposits generally were composed of silty clay with fine sand and clayey fine sand.

4.2.3. Alluvium (Qya and Qpe)

Recent alluvial and estuarine deposits exist north of Del Mar Mesa, within the San Dieguito River and Lagoon and south of Del Mar Mesa, within Peñasquitos Lagoon. Within the lagoons, the estuarine deposits may exceed 150 feet in depth. These materials typically consist of interlayered, unconsolidated, clays, silts, and sands, with scattered gravel layers.

4.2.4. Landslide Deposits (Qls)

Two landslides have been mapped on the northern portion of the project site adjacent to Racetrack View Drive. These landslides are apparently large blocks of formational materials that have moved to the north along relatively low-angle clay-lined rupture surfaces.

4.2.5. Old Paralic Deposits (Qop_{2-4} and Qop_6)

In the areas along the edges of the San Dieguito and Peñasquitos Lagoons flanking the Del Mar Mesa, the margins of the active flood plains are underlain by the Late Pleistocene-Holocene-age old paralic deposits. Old paralic deposits are also mapped as underlying the coastal portion of the project site along the western edge of the city of Del Mar, where it unconformably overlies the Delmar Formation and the Torrey Sandstone. This unit was previously designated as the Bay Point Formation (Kennedy and Peterson, 1975). The old paralic deposits include both marine and non-marine sediments consisting of loose to medium-dense, unconsolidated silty to clayey sand and sandy clay. These soils are exposed generally near sea level to approximately 80 to 120 feet above MSL.

4.2.6. Very Old Paralic Deposits ($Qvop_{10}$, $Qvop_{10a}$, and $Qvop_{11}$)

Unconformably overlying the Torrey Sandstone in the higher elevations of the Del Mar Mesa are very old paralic deposits, early Pleistocene marine terrace and beach ridge deposits. The very old paralic deposits were deposited upon a wave-cut terrace surface over much of coastal San Diego County and was previously designated as the Lindavista Formation (Kennedy and Peterson, 1975). The very old paralic deposits consist of red-brown, massive, silty to clayey sandstone with cobble conglomerate interbeds. These materials are often well-cemented with distinctive red, ferruginous cement. The very old paralic deposits crop out above approximately 300 feet above MSL across the Del Mar Mesa.

4.2.7. Torrey Sandstone (Tt)

The Eocene-age Torrey Sandstone is typically a light gray to white, medium- to coarse-grained arkosic sandstone, deposited in a near-shore barrier beach environment. Relatively thin, olive gray claystone beds exist near the base of the unit, where it is interbedded with the Delmar Formation. The Torrey Sandstone is exposed over much of the Del Mar Mesa and forms distinctive light-colored bluffs and near-vertical cliffs.

4.2.8. Delmar Formation (Td)

The Eocene-age Delmar Formation conformably underlies and is interbedded with the Torrey Sandstone and was deposited in a brackish marine lagoonal environment. The contact between the Delmar Formation and Torrey Sandstone was encountered at elevations of about 30 to 80 feet above MSL where observed near the proposed northern and southern portals of Alternatives 1 and 2. The Delmar Formation is composed of fossiliferous olive gray and dusky yellow sandy claystone and clayey sandstone. The claystone is typically highly expansive.

4.2.9. Geologic Structure

Bedding attitudes within the La Jolla Group range from essentially flat to dipping roughly 3 to 5 degrees to the east, northeast, and southeast. High angle cross-bedding is typical within the Torrey Sandstone. The very old paralic deposits (Lindavista) terrace is essentially flat lying and suggests that Quaternary tectonic activity is characterized by regional uplift as opposed to areas of local deformation.

Several high-angle faults are exposed in cut slopes near the intersection of Carmel Valley Road and North Torrey Pines Road (Figure 2). The faults dip steeply to the northwest, strike generally northeast, and define a zone of fracturing possibly up to several hundred feet wide. The primary component of displacement appears to be dip-slip; the Torrey Sandstone-Delmar Formation contact is offset down to the north-west on the order of 50 to 80 feet. Mapping by Kennedy (1975) indicates that the very old paralic deposits (Lindavista Formation) and the old paralic deposits (Bay Point Formation) are not displaced by this faulting. This suggests that these faults have a low level of activity and that displacement has not occurred within the past several hundred thousand years. Based on this information, these local faults are not considered to be active.

4.2.10. Groundwater

Groundwater is not anticipated to be encountered in the upper elevations of the Del Mar Mesa. Static groundwater is expected to be encountered along the lower elevations of the project site and should be further evaluated by subsurface evaluation.

Perched groundwater conditions exist in several areas along the contact between the Delmar Formation and the overlying Torrey Sandstone. Perched conditions are indicated by numerous springs and seeps exposed in the coastal bluffs and margins of the major drainages. This condition typically results from the presence of permeable sandstone underlain by less permeable claystone beds.

Groundwater levels are expected to fluctuate due to tidal variations, seasonal variations, groundwater withdrawal or injection, or other factors. Artesian conditions may exist in some areas where claystone and sandstone lenses interfinger. Water table elevations may also vary in the vicinity of faults or fractures.

5. GEOLOGIC HAZARDS

The project area, like most of southern California, is considered seismically active. In general, hazards associated with seismic activity include ground surface rupture, strong ground motion, liquefaction, seismically induced settlement, and tsunamis. Other geologic hazards include landsliding. Various geologic hazards that are considered by the City of San Diego as relevant are shown on Figure 4 for the eastern portion of the site. A similar map of geologic hazards is not currently available for the city of Del Mar portion of the project. These potential geologic hazards are discussed in the following sections.

5.1. Faulting and Seismicity

Based on our review of the referenced geologic maps and stereoscopic aerial photographs, as well as on our geologic field mapping, the Del Mar Mesa area is not underlain by known active or potentially active faults (i.e., faults that exhibit evidence of ground displacement in the last 11,000 years and 2,000,000 years, respectively). However, the site is located in a seismically active area, as is the majority of southern California, and the potential for strong ground motion is considered significant during the design life of the proposed structure. Table 1 lists selected principal known active faults that may affect the subject site and the maximum moment magnitudes (M_{max}) as published for the California Geological Survey (CGS) by Cao et al. (2003). The approximate fault-to-site distances were calculated by the United States Geological Survey (2008) National Seismic Hazard Maps database (web-based).

Table 1 – Principal Active Faults

Fault	Distance miles [1,2]	Moment Magnitude[2]
Rose Canyon	2.0	7.2
Coronado Bank	16.2	7.6
Newport-Inglewood	16.7	7.1
Elsinore (Julian Segment)	30	7.1
Elsinore (Temecula Segment)	30	6.8

Notes:
[1] USGS (2008)
[2] Cao, et al. (2003)

The most significant seismic event likely to affect the proposed project would be a moment magnitude 7.2 earthquake within the Rose Canyon fault zone located approximately 2.0 miles west of the project site. The Rose Canyon fault zone is a part of a more extensive fault zone that includes the offshore zone of deformation and the Newport-Inglewood fault zone that extend northward and southward, both onshore and offshore. The Rose Canyon-Newport-Inglewood fault zone consists of predominantly right-lateral strike-slip faults that extend south-southeast from southern Los Angeles, through Long Beach, to the San Diego metropolitan area. However, various fault strands display strike-slip, normal, oblique, or reverse components of displacement (Treiman, 1993).

5.2. Ground Surface Rupture

As noted, the proposed tunnel Alternatives 1 and 2 cross mapped fault traces. However, these faults are not considered active and active faults have not been mapped within the project area. In addition, this area of north coastal San Diego County is not included within a mapped State of California Earthquake Fault (Alquist-Priolo Special Studies) Zone. Therefore, the potential for ground rupture due to faulting at the site is considered low. However, lurching or cracking of the ground surface because of a nearby seismic event is possible.

5.3. Strong Ground Motion

A significant seismic event that could affect the proposed facilities would be strong ground motion from a moment magnitude (M_W) 7.2 earthquake within the Rose Canyon fault zone. The site is located within a CBC Near-Source Zone for active faults. As noted above, the site is not located within a State of California Earthquake Fault Zone (Alquist-Priolo Special Studies Zone).

The 2013 California Building Code (CBC) specifies that the Risk-Targeted, Maximum Considered Earthquake (MCE_R) ground motion response accelerations be used to evaluate seismic loads for design of buildings and other structures. The MCE_R ground motion response accelerations are based on the spectral response accelerations for 5 percent damping in the direction of maximum horizontal response and incorporate a target risk for structural collapse equivalent to 1 percent in 50 years with deterministic limits for near-source effects. The horizontal peak ground acceleration (PGA) that corresponds to the MCE_R for the site was calculated as 0.49g using the United States Geological Survey (USGS, 2014) seismic design tool (web-based).

The 2013 CBC specifies that the potential for liquefaction and soil strength loss be evaluated, where applicable, for the Maximum Considered Earthquake Geometric Mean (MCE_G) peak ground acceleration with adjustment for site class effects in accordance with the American Society of Civil Engineers (ASCE) 7-10 Standard. The MCE_G peak ground acceleration is based on the geometric mean peak ground acceleration with a 2 percent probability of exceedance in 50 years. The MCE_G peak ground acceleration with adjustment for site class effects (PGA_M) was calculated as 0.52g using the USGS (USGS, 2014) seismic design tool that yielded a mapped MCE_G peak ground acceleration of 0.52g for the site and a site coefficient (F_{PGA}) of 1.00 for Site Class D.

5.4. Liquefaction Potential

Liquefaction is the phenomenon in which loosely deposited granular soils with silt and clay contents of less than approximately 35 percent and non-plastic silts located below the water table undergo rapid loss of shear strength when subjected to strong earthquake-induced ground shaking. Ground shaking of sufficient duration results in the loss of grain-to-grain contact due to a rapid rise in pore water pressure, and causes the soil to behave as a fluid for a short period of time. Liquefaction is known generally to occur in saturated or near-saturated cohesionless soils at depths shallower than 50 feet. Factors known to influence liquefaction potential include composition and thickness of soil layers, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking.

The tunnel alternatives are proposed to be constructed predominantly within very dense formational materials of the Delmar Formation and the Torrey Sandstone. Due to the density of these materials, the potential for liquefaction and dynamic settlement to affect these areas of tunnels is considered low. Based on the relatively loose nature of the granular alluvial materials underlying the alignments where they cross the alluvial areas of the San Dieguito and Peñasquitos Lagoons, these portions of the alignment will be subject to liquefaction and dynamic settlement. An evaluation of the liquefaction potential for these portions of the alignments should be performed, including subsurface evaluation, laboratory analyses, and engineering analyses during the design phase.

5.5. Lateral Spreading

Lateral spreading of ground surface during an earthquake usually takes place along weak shear zones that have formed within a liquefiable soil layer. Lateral spread has generally been observed to take place in the direction of a free-face (i.e., retaining wall, slope, channel wall) but has also been observed to a lesser extent on ground surfaces with very gentle slopes. During the design phase of the project, the potential for lateral spread to occur in portal areas or where the alignment traverses alluvial areas should be further evaluated by subsurface evaluation and laboratory testing.

5.6. Tsunamis

Tsunamis are long seismic sea waves (long compared to ocean depth) generated by sudden movements of the sea floor caused by submarine earthquakes, landslides, or volcanic activity. Based on the relative elevation of the portal areas, the potential for damage due to tsunamis is considered low for the project tunnel alignments. The potential for tsunamis to impact low-lying potions of the proposed alignment along the tunnel approaches and in the lagoon areas is, however, considered to be high. A portion of a tsunami inundation map for the project area prepared by the State of California is presented as Figure 5.

5.7. Landsliding

Figure 6 is a portion of a State of California landslide hazard map indicating landsliding and potential slope instability in the project vicinity. As discussed previously, two small landslides have been mapped on the northern portion of the project site adjacent to Racetrack View Drive. These landslides are apparently large blocks of formational materials that have moved north along relatively low-angle failure surfaces. The mapped landslides overlie a portion of the Alternative 3 alignment (see Plate 3).

The claystone interbeds within the Delmar Formation are typically highly fractured and sheared, thus contributing to potential instability of slopes underlain by this unit. Bedding plane shears and interbedded remolded clay seams are common; the presence of perched ground water above these features can also reduce strength characteristics.

Exposures of Torrey Sandstone and very old paralic deposits are typically broken by widely spaced, near-vertical joints. Block falls along joint surfaces are a characteristic form of mass-wasting within these units. The Torrey Sandstone and very old paralic deposits commonly erode to form near-vertical exposures.

5.8. Geologic Hazards Map

According to the City of San Diego Seismic Safety Study (City of San Diego, 2008), the project alignments through Del Mar Mesa are located within Geologic Hazard Categories 52 and 53 (Figure 4). Hazard Category 52 is described as "Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk." Hazard Category 53 is described as "Level or sloping terrain, unfavorable geologic structure, Low to moderate risk." The portions of the alignments that cross Peñasquitos Lagoon are located within Hazard Category 31, which is described as having "High potential (for liquefaction) - shallow groundwater, major drainages, hydraulic fills." A similar map of geologic hazards is not currently available for the city of Del Mar portion of the project.

6. CONCLUSIONS

Based on the results of our background review, geotechnical reconnaissance, and preliminary engineering analysis, it is our opinion that the proposed Del Mar Fairgrounds to Sorrento Valley Alternatives are feasible from a geotechnical perspective. General conclusions regarding geotechnical conditions are presented below. Specific conclusions regarding conditions for each alternative alignment are presented in the following sections.

The very old paralic deposits, Torrey Sandstone, and Delmar Formation are generally expected to be stable unless weak beds are encountered. These materials are considered soft rock for tunneling purposes. Expansive clays within the Delmar Formation may cause invert heave and may have stability issues at the portals, especially if groundwater seepage is present. Torrey Sandstone and very old paralic deposits may be subject to raveling over time if left exposed to wet conditions. Portions of the old paralic deposits are relatively cohesionless and may be unstable in excavation sidewalls, especially under saturated conditions.

For Alternatives 2 and 3, tunnel excavation is anticipated to be technically feasible using shielded open face digger machines with breasting capabilities, or possibly a shielded full-face tunnel boring machine (TBM). In general, sequential excavation and support methods, e.g., New Austrian Tunneling Method (NATM) could be used. Various excavation and support types can be used, depending on the prevailing ground conditions. NATM relies primarily on the inherent strength of the ground mass to provide the primary tunnel support. A thin layer of shotcrete along with a combination of rock bolts, wire mesh and steel ribs is typically used as the primary lining. Drill-and-blast methods will probably not be required.

6.1. Alternative 1 – Camino Del Mar

The northern portal of Alternative 1 will be located near the intersection of Camino Del Mar and Jimmy Durante Boulevard and will likely be excavated through a combination of old paralic deposits and claystone-sandstone of the Delmar Formation. The southern portal would be located south of the intersection of Camino Del Mar and Carmel Valley Road and would likely be excavated into Delmar Formation and/or Torrey Sandstone. Stability of the excavation at the southern portal may be a concern due to the presence of high-angle faults. Other potential concerns at the portals would include stability of excavations in old paralic deposits, groundwater seepage, and expansive claystone.

We understand that it is proposed to construct the majority of the Alternative 1 tunnel by cut and cover methods. Excavation would be within old paralic deposits, Torrey Sandstone, and Delmar Formation. Potential geotechnical concerns along the cut and cover portion of the Alternative 1 tunnel could include stability of excavation sidewalls, groundwater seepage, and expansive claystone. Vertical ventilation shafts would be approximately 45 to 60 feet deep and would also be excavated through old paralic deposits, Torrey Sandstone, and Delmar Formation.

6.2. Alternative 2 – Crest Canyon High Speed and Crest Canyon

The northern portals of Alternative 2 will be located east of the intersection of Camino Del Mar and Jimmy Durante Boulevard and will likely be excavated through a combination of old paralic deposits and claystone-sandstone of the Delmar Formation. The southern portals will be excavated into Torrey Sandstone and/or Delmar Formation. Potential concerns at the portals would include stability of excavations in old paralic deposits, groundwater seepage, and expansive claystone.

We anticipate that the Alternative 2 tunnels would be excavated using shielded open face digger machines with breasting capabilities, or a shielded full-face TBM. The tunnel excavation will likely encounter consolidated sandstone of the Torrey Sandstone and sandstone and claystone of the Delmar Formation. These units should be generally stable and excavatable with standard boring machines. Weak claystone layers and clay-lined fractures may be encountered and the alignment may cross high angle faults as indicated on Plate 2. In addition, cemented layers and zones within the Delmar Formation and in the lower part of the Torrey Sandstone could slow the rate of penetration.

Vertical ventilation shafts up to approximately 270 feet deep would be drilled through very old paralic deposits, Torrey Sandstone, and Delmar Formation. Well-cemented sandstone and gravel conglomerate layers may be encountered during excavation of the very old paralic deposits.

6.3. Alternative 3 – Interstate 5 and Interstate 5 East

The northernmost portal of Alternative 3 will be located east of the intersection of Jimmy Durante Boulevard and San Dieguito Drive and will likely be excavated through a combination of old paralic deposits and claystone-sandstone of the Delmar Formation. The tunnels will be excavated into Torrey Sandstone, old paralic deposits, and, potentially, fill placed for the construction of Interstate 5. Potential concerns at the portals would include expansive claystone, the stability of excavations in old paralic deposits and fill, and groundwater seepage.

We anticipate that the Alternative 3 tunnels would be excavated using shielded open face digger machines with breasting capabilities, or a shielded full-face TBM. The tunnel excavations will likely encounter sandstone and claystone of the Delmar Formation and, to a lesser extent, sandstone of the Torrey Sandstone. These units should be generally stable and excavatable with standard boring machines. Weak claystone layers and clay-lined fractures may also be encountered. Cemented layers and zones could slow the rate of penetration. As proposed, portions of the Alternative 3 tunnel crosses beneath mapped landslides. Based on our estimates, the top of the tunnel could be within about 10 to 20 feet of the basal rupture surface of the landslide. The nature and depth of the landslides should be further evaluated by subsurface investigation.

Vertical ventilation shafts up to approximately 200 feet deep are anticipated and would be drilled through Torrey Sandstone and Delmar Formation. Well-cemented sandstone layers may be encountered during excavation.

7. RECOMMENDATIONS

We recommend that a comprehensive geotechnical evaluation, including development-specific subsurface exploration, laboratory testing, and geotechnical engineering analyses, be conducted prior to design and construction of the selected tunnel alternative. The purpose of the subsurface exploration would be to further evaluate the subsurface conditions in the area of the proposed improvements and to provide information pertaining to the engineering characteristics of earth materials at the project site. From these data, recommendations for grading/earthwork, tunneling, shoring design, and other pertinent geotechnical design considerations may be formulated.

8. LIMITATIONS

The evaluation and geotechnical analyses presented in this preliminary geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns or the presence of hazardous materials.

The purpose of this study was to evaluate geologic and geotechnical conditions within the project vicinity and to provide a geotechnical reconnaissance report to assist in the preparation of an alternatives analyses for the project. A comprehensive geotechnical evaluation, including subsurface exploration and laboratory testing, should be performed prior to design and construction of structural improvements

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site may change with time as a result of natural processes or the activities of man at the subject site or nearby site. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

9. REFERENCES

Allied Earth Technology, 1999, Soil Investigation, Three Proposed Single-Family Residence Building Sites, West Side of Mercado Drive Between El Amigo and Lozanna Road, San Diego, California: dated September 10.

Anderson, J.G., M., Rockwell, T.K., and Agnew, D.C., 1989, Past and Possible Future Earthquakes of Significance to the San Diego Region: Earthquake Spectra, Volume 5, No. 2.

Bartlett, S. F. and Youd, T. L., 1995, Revised 1999, Empirical Prediction of Liquefaction-Induced Lateral Spread, J. of Geotechnical Engineering, ASCE, Vol. 121, No. 4, April, 316-329.

California Building Standards Commission, 2013, California Building Code (CBC), Title 24, Part 2, Volumes 1 and 2: dated June.

California Department of Transportation, 1986, Log of Test Borings, Del Mar Heights Road Overcrossing, Sheet 22743-60-D: approval date October 27.

California Department of Transportation, 1992, Foundation Recommendations, Carmel Valley Creek Bridge Connector, Bridge No. 57-0590G, 11-SD-5-R32.72, 11203 030111: dated September 18.

California Department of Transportation, 2005, Preliminary Geotechnical Report, Construct State Route 5 Freeway in San Diego County from The 5/805 Interchange to North of State Route 76, 11-SD-5, PM R28.4/R55.3, EA 235800: dated October 5.

California Department of Transportation, 2006a, Standard Specifications: dated July.

California Department of Transportation, 2006b, Special Provisions.

California Department of Transportation, 2010, Structure Preliminary Geotechnical Report, Interstate-5/State Route-56 Interchange Project, Retaining Wall No. 542, 11-SD-5-PM R32.9/R33.4, 11-SD-56-PM 0.0/T0.5, EA 11-177900, EFIS 1100000092: dated September 3.

California Geological Survey, 2008, Guidelines for Evaluating and Mitigating Seismic Hazards in California, CGS Special Publication 117.

California Geological Survey, 2009, Tsunami Inundation Map for Emergency Planning, Del Mar Quadrangle: dated June 1.

Cao, T., Bryant, W. A., Rowshandel, B., Branum, D., and Willis, C. J., 2003, The Revised 2002 California Probabilistic Seismic Hazards Maps: California Geological Survey: dated June.

County of San Diego, 1959a, Topographic Survey Map, Sheet 282-1695, Scale 1: 2,400.

County of San Diego, 1959b, Topographic Survey Map, Sheet 286-1695, Scale 1: 2,400.

County of San Diego, 1973a, Orthotopographic Survey Map, Sheet 290-1683, Scale 1: 2,400.

County of San Diego, 1973b, Orthotopographic Survey Map, Sheet 290-1689, Scale 1: 2,400.

County of San Diego, 1977a, Orthotopographic Survey Map, Sheet 278-1695, Scale 1: 2,400.

County of San Diego, 1977b, Orthotopographic Survey Map, Sheet 286-1689, Scale 1: 2,400.

County of San Diego, 1978, Orthotopographic Survey Map, Sheet 282-1689, Scale 1: 2,400.

County of San Diego, 1985, Orthotopographic Survey Map, Sheet 294-1683, Scale 1: 2,400.

Dames & Moore, 1997, Report of Geotechnical Investigation, Carmel Valley Road Enhancements, San Diego, California: dated December 12.

Dokken Engineering, 2009, Del Mar Heights Road Overcrossing Replacement, Structure Preliminary Geotechnical Report, Bridge No. 57-0487, San Diego County, California, E.A. 11-081610: dated July.

Dokken Engineering, 2009, District Preliminary Geotechnical Report for the Interstate 5/State South 56 Interchange Project, San Diego County, California: dated October 19.

Geocon Incorporated, 1976, Soil Investigation for Del Mar Heights Residential Units, San Diego, California: dated November 17.

Geocon Incorporated, 1980, Preliminary Soil and Geologic Investigation for San Dieguito Drive Parcel Map: dated May 29.

Geocon Incorporated, 1995, Updated Geotechnical Investigation for Racetrack View, Lot 3, San Diego, California: dated July 3.

Geocon Incorporated, 2000, Update Geotechnical Investigation, Malies/Dumka Property, San Diego, California: dated August 25.

Federal Emergency Management Agency (FEMA), 2012, Flood Insurance Rate Map (FIRM), Map Numbers 06073C1307G, 06073C1309G, and 06073C1328G: dated May 16.

Harden, D.R., 1998, California Geology: Prentice Hall, Inc.

Ishihara, K., 1995, Effects of At-Depth Liquefaction on Embedded Foundations During Earthquakes, Proceedings of the Tenth Asian Regional Conference on Soil Mechanics and Foundation Engineering, August 29 through September 2, Beijing, China, Vol. 2, pp. 16-25.

Jennings, C.W., 2010, Fault Activity Map of California and Adjacent Areas: California Geological Survey, California Geologic Data Map Series, Map No. 6, Scale 1:750,000.

Kennedy, M.P. and Moore, G.W., 1971, Stratigraphic relations of Upper Cretaceous and Eocene Formations, San Diego Coastal area, California: American Association of Petroleum Geologists Bulletin, v.55, p. 709-722.

Kennedy, M.P. and Moore, G.L., 1975, Geology of the San Diego Metropolitan Area, California: California Geological Survey, Bulletin 200.

Kennedy, M.P., and Tan, S.S., 2005, Geologic Map of the San Diego 30′x 60′ Quadrangle, California; California Geological Survey, Regional Geologic Map Series, Scale 1:100,000.

Kennedy, M.P., and Tan, S.S., 2008, Geologic Map of the San Diego 30′x 60′ Quadrangle, California; California Geological Survey, Regional Geologic Map Series, Scale 1:100,000.

Kleinfelder, 2009, Final Geotechnical and Earthquake Engineering Report, North Torrey Pines Road Bridge (Sorrento Overhead), Seismic Retrofit Bridge No. 57C-0207, Del Mar, California: dated May 15.

Kleinfelder, 2009, Addendum No.1 to Final Geotechnical and Earthquake Engineering Report dated May 15, 2009, North Torrey Pines Road Bridge - Seismic Retrofit, Bridge No. 57C-0207, Del Mar, California: dated August 4.

Kleinfelder, 2009, Addendum No.2 to Final Geotechnical and Earthquake Engineering Report dated May 15, 2009, North Torrey Pines Road Bridge - Seismic Retrofit, Bridge No. 57C-0207, Del Mar, California: dated September 10.

Mualchin, L., 1996, A Technical Report to Accompany the Caltrans California Seismic Hazard Map, 1996, (Based on Maximum Credible Earthquakes): California Department of Transportation, Engineering Service Center, Office of Earthquake Engineering.

Mualchin, L., and Jones, A.L., 1992, Peak Acceleration from Maximum Credible Earthquakes in California (Rock and Stiff-Soil Site): California Geological Survey, Open-File Report 92-1.

Ninyo & Moore, In-House Proprietary Data.

Ninyo & Moore, 1997, Geotechnical Consulting Services for Project Study Report, Del Mar Bluffs Between 8th and 15th Streets, Del Mar, California, STV Job No. 1445, NCTD P.O. STV-OC9615-01: dated September 11.

Ninyo & Moore, 1998, Geotechnical Evaluation of Existing Slope, 11th Street Reservoir, Del Mar, California: dated May 11.

Ninyo & Moore, 1999, Geotechnical Evaluation, San Dieguito Lagoon Restoration, San Diego, California: dated January 14.

Ninyo & Moore, 1999, Preliminary Geotechnical Reconnaissance, Wildfire Protection Project, Southeast of Hidden Pines Road, Del Mar, California: dated August 11.

Ninyo & Moore, 2001, Third Party Geotechnical Review for Houston Project: dated August 2.

Ninyo & Moore, 2001, Third Party Geotechnical Review for "Report of Limited Geotechnical Evaluation of the Slope below 562-564 Tewa Street, Del Mar, California," by Evans, Colbaugh & Associates: dated October 5.

Ninyo & Moore, 2002, Retaining Wall Design Parameters, Proposed Camino Del Mar Retaining Wall, Del Mar, California: dated October 22.

Ninyo & Moore, 2002, Geotechnical Design Report, Del Mar Heights Road and Interstate 5, San Diego, California, K.P. 54.9, 11-SD-5/R34.175: dated August 28.

Ninyo & Moore, 2003, Geotechnical Reconnaissance, 21st Street Pump Station Upgrade, Del Mar, California: dated November 26.

Ninyo & Moore, 2004, Geotechnical Evaluation, San Dieguito Wetlands Restoration Project, San Diego and Del Mar, California: dated June 11.

Ninyo & Moore, 2004, Geotechnical Evaluation, Del Mar Fairgrounds Multipurpose Barns Project, Del Mar, California: dated July 23.

Ninyo & Moore, 2005, Limited Geotechnical Reconnaissance, Forest Way Adjacent to the Retaining Wall Failure Near Zuni Drive, Del Mar, California: dated March 15

Ninyo & Moore, 2005, Limited Geotechnical Evaluation, Del Mar Fairgrounds Master Plan, Del Mar, California: dated September 12.

Ninyo & Moore, 2006, Geotechnical Evaluation, Del Mar Racetrack Pump Station, Del Mar, California: dated November 30.

Ninyo & Moore, 2007, Geotechnical Evaluation, Hotel and Exhibit Hall at Del Mar Fairgrounds, Del Mar, California: dated May 9.

Ninyo & Moore, 2008, Geotechnical Evaluation, 21st Street Pump Station, Del Mar, California: dated April 18.

Ninyo & Moore, 2008, Geotechnical Evaluation, Del Mar Fairgrounds Sewer Relocation, Del Mar, California: dated July 28.

Ninyo & Moore, 2009, Preliminary Geotechnical Evaluation, San Dieguito River Bridge Replacement and Second Track Project, Solana Beach and Del Mar, California: dated March 20.

Ninyo & Moore, 2009, Geotechnical Evaluation, North County Transit District, Bridge 246.1 Replacement Project, Los Peñasquitos Lagoon, San Diego, California: dated April 7.

Ninyo & Moore, 2011, Geotechnical Reconnaissance, Del Mar Salt Marsh Restoration Project, Jimmy Durante Boulevard, Del Mar, California: dated March 23

Ninyo & Moore, 2012, Limited Geotechnical Evaluation, Camino Del Mar Bridge, Bridge Number 57C0209, Del Mar, California: dated April 18.

Norris, R. M. and Webb, R. W., 1990, Geology of California, Second Edition: John Wiley & Sons, Inc.

Public Works Standards, Inc., 2009, "Greenbook," Standard Specifications for Public Works Construction.

Robert Prater Associates, 1991, Geotechnical Investigation for Blackman Property, Parcel 2, Del Mar, California: dated June 4.

Rockwell, T.K., Lindvall, S.C. Haraden, C.C., Hirabayashi, C.K., and Baker, E., 1991, Minimum Holocene Slip Rate for the Rose Canyon Fault in San Diego, California in Abbott, P.L. and Elliott, W.J., eds., Environment Perils, San Diego Region: San Diego Association of Geologists.

Seed, H.B., and Idriss, I. M., 1982, Ground Motions and Soil Liquefaction During Earthquakes, Volume 5 of Engineering Monographs on Earthquake Criteria, Structural Design, and Strong Motion Records: Berkeley, Earthquake Engineering Research Institute.

Tan, S.S., and Giffen, D.G., 1995, Relative Landslide Susceptibility and Landslide Distribution Map, Del Mar Quadrangle, DMG Open File Report 95-04, Scale 1:24,000.

Treiman, J.A., 1993, Rose Canyon Fault Zone, Southern California: California Geological Survey.

United States Geological Survey (USGS), 2003, National Seismic Hazard Mapping Project, World Wide Web, http://geohazards.cr.usgs.gov/eq.

United States Geological Survey (USGS), 2008, National Seismic Hazard Maps – Fault Parameters Database, World Wide Web, http://geohazards.usgs.gov/cfusion/hazfaults_search/: accessed November 2014.

United States Geological Survey (USGS), 2012, Del Mar OE West Quadrangle, California; 7.5-Minute Series Topographic Map: scale 1:24,000.

United States Geological Survey (USGS), 2012, Del Mar Quadrangle, California-San Diego County; 7.5 Minute Series Topographic Map: scale 1:24,000.

United States Geological Survey, 2014, Seismic Design Maps Application, World Wide Web, http://earthquake.usgs.gov/designmaps/us/application.php: accessed November 3.

Wesnousky, S.G., 1986, Earthquakes, Faults, and Seismic Hazards in California: Journal of Geophysical Research, Vol. 91, No. B12.

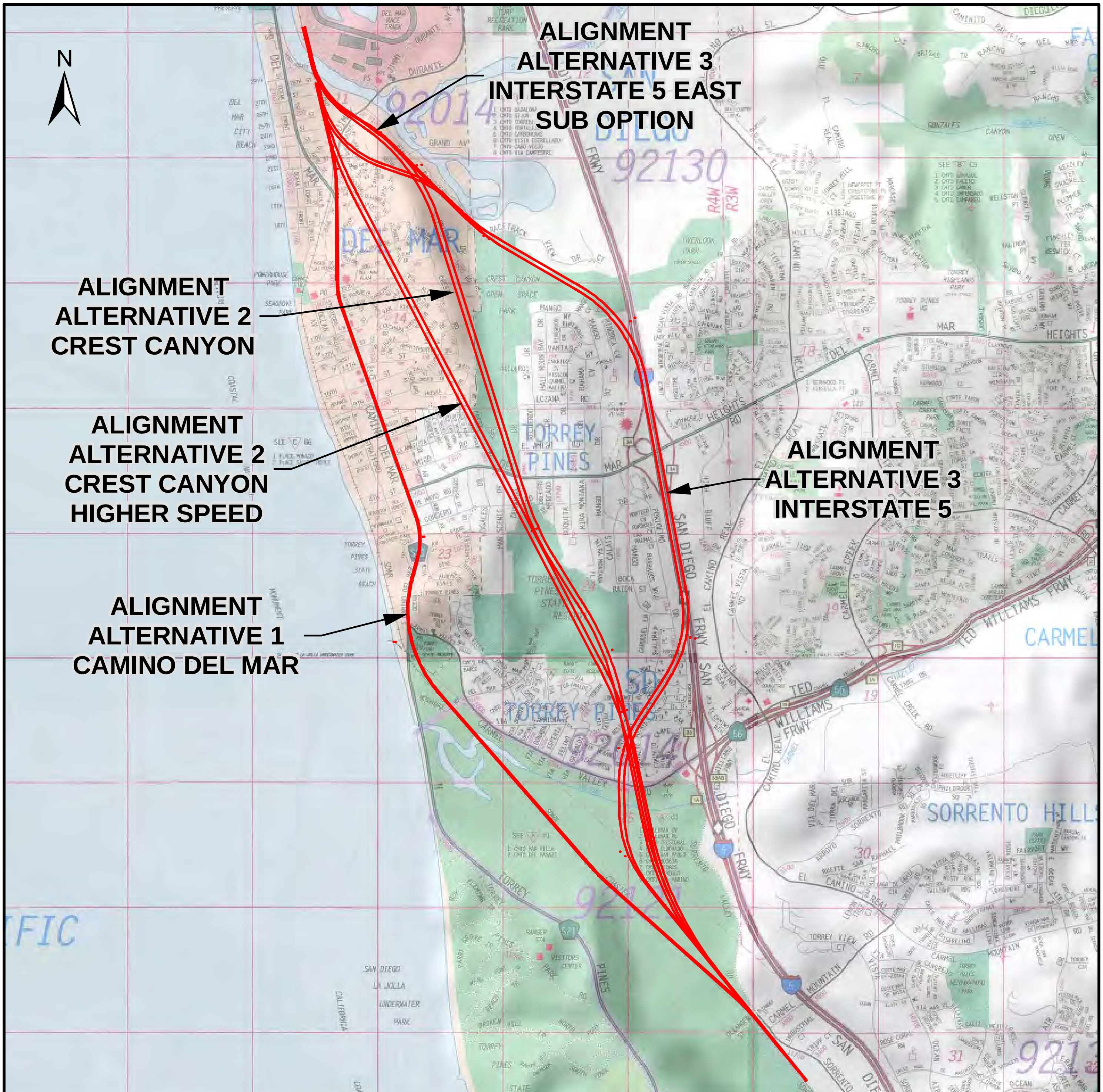
Woodward-Clyde Consultants, 1983, California High Speed Train: Preliminary Assessment of Geologic Conditions for Tunnels in Orange and San Diego Counties (Geotechnical Tasks A and B): dated March 24.

Youd, T.L., and Idriss, I.M. (Editors), 1997, Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils, Salt Lake City, Utah, January 5 through 6, 1996, NCEER Technical Report NCEER-97-0022, Buffalo, New York.

Youd, T.L., Hansen, C.M., and Bartlett, S.F., 2002, Revised Multilinear Regression Equations for Prediction of Lateral Spread Displacement: Journal of Geotechnical and Geoenvironmental Engineering, Vol. 128, No. 12, p. 1007-1017.

AERIAL PHOTOGRAPHS

Source	Date	Flight	Numbers	Scale
United States Department of Agriculture	April 11, 1953	AXN-8M	7 through 11	1:20,000



SOURCE: THOMAS GUIDE FOR SAN DIEGO COUNTY, STREET GUIDE AND DIRECTORY; 2009 MAP © RAND McNALLY, R.L.07-S-129

MAP INDEX

SCALE IN FEET

0 3,000 6,000

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

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Ninyo & Moore		PROJECT LOCATION	FIGURE
PROJECT NO.	DATE	CONCEPTUAL ENGINEERING AND ENVIRONMENTAL CONSTRAINTS DOUBLE TRACK ALTERNATIVE ALIGNMENTS BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY	1
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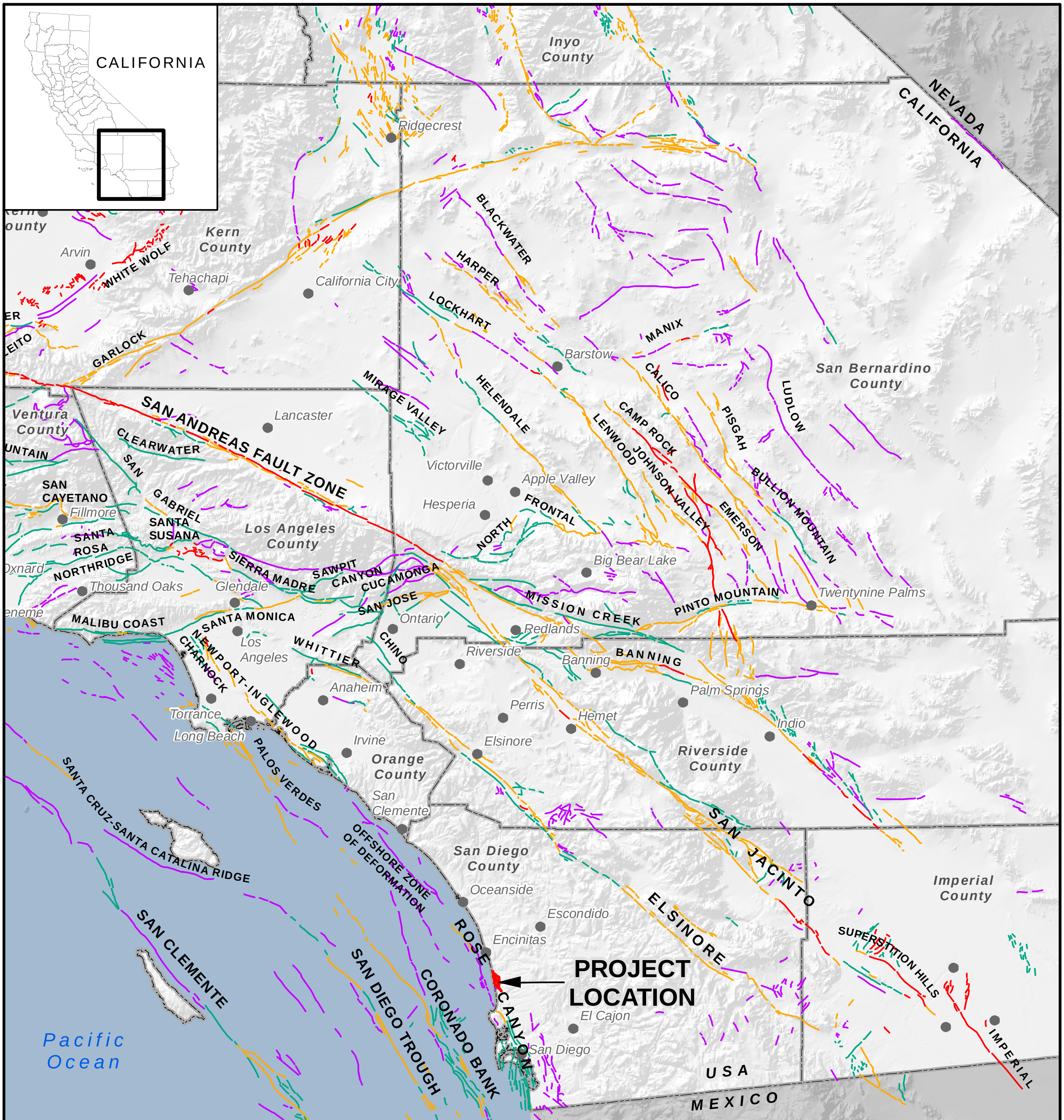

LEGEND

CALIFORNIA FAULT ACTIVITY

- HISTORICALLY ACTIVE
- HOLOCENE ACTIVE
- LATE QUATERNARY (POTENTIALLY ACTIVE)
- QUATERNARY (POTENTIALLY ACTIVE)
- STATE/COUNTY BOUNDARY

SOURCE:U.S. GEOLOGICAL SURVEY (CALIFORNIA GEOLOGICAL SURVEY), 2006, QUATERNARY FAULT AND FOLD DATABASE FOR THE UNITED STATES, ACCESSED 2012, FROM USGS WEB SITE: HTTP//EARTHQUAKES.USGS.GOV/REGIONAL/QFAULTS/

SCALE IN MILES

0 30 60

N

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

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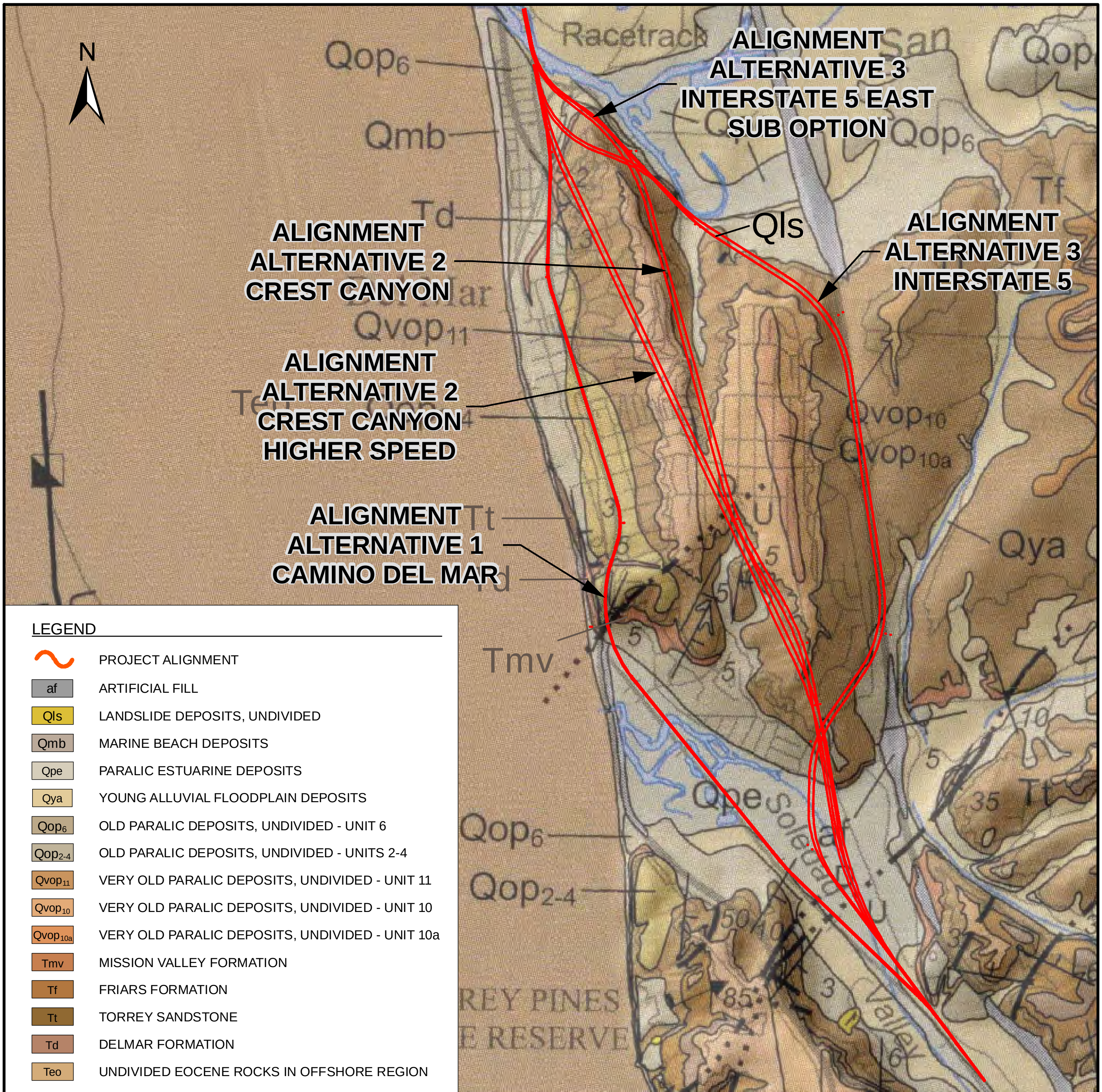
Ninyo & Moore		FAULT LOCATIONS	FIGURE
PROJECT NO.	DATE	CONCEPTUAL ENGINEERING AND ENVIRONMENTAL CONSTRAINTS DOUBLE TRACK ALTERNATIVE ALIGNMENTS BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY	2
106810009	11/14		



LEGEND

(orange line)	PROJECT ALIGNMENT
af	ARTIFICIAL FILL
Qls	LANDSLIDE DEPOSITS, UNDIVIDED
Qmb	MARINE BEACH DEPOSITS
Qpe	PARALIC ESTUARINE DEPOSITS
Qya	YOUNG ALLUVIAL FLOODPLAIN DEPOSITS
Qop_6	OLD PARALIC DEPOSITS, UNDIVIDED - UNIT 6
Qop_{2-4}	OLD PARALIC DEPOSITS, UNDIVIDED - UNITS 2-4
$Qvop_{11}$	VERY OLD PARALIC DEPOSITS, UNDIVIDED - UNIT 11
$Qvop_{10}$	VERY OLD PARALIC DEPOSITS, UNDIVIDED - UNIT 10
$Qvop_{10a}$	VERY OLD PARALIC DEPOSITS, UNDIVIDED - UNIT 10a
Tmv	MISSION VALLEY FORMATION
Tf	FRIARS FORMATION
Tt	TORREY SANDSTONE
Td	DELMAR FORMATION
Teo	UNDIVIDED EOCENE ROCKS IN OFFSHORE REGION

85 — FAULT - SOLID WHERE ACCURATELY LOCATED, DASHED WHERE APPROXIMATE, DOTTED WHERE CONCEALED. ARROW AND NUMBER INDICATE DIRECTION AND ANGLE OF DIP OF FAULT PLANE

U / D — FAULT - SOLID WHERE WELL DEFINED; DASHED WHERE APPROXIMATELY LOCATED; SHORT DASH WHERE INFERRED; DOTTED WHERE CONCEALED. WHERE AGE WAS DETERMINED, AGE SYMBOL IS SHOWN ASTRIDE FAULT AND RELATIVE OFFSET, IF KNOWN, IS SHOWN BY "D" AND "U" ON DOWNTHROWN AND UPTHROWN SIDES. AGES OF FAULTS ARE INDICATED AS FOLLOWS:

CUTS STRATA OF QUATERNARY AGE

LANDSLIDE - ARROWS INDICATE PRINCIPAL DIRECTION OF MOVEMENT, QUERIED WHERE EXISTENCE IS QUESTIONABLE

50 — STRIKE AND DIP OF BEDS, INCLINED

SOURCE: KENNEDY, M.P., AND TAN, S.S., 2008 GEOLOGIC MAP OF THE SAN DIEGO 30' X 60' QUADRANGLE, CALIFORNIA

SCALE IN FEET

0 3,000 6,000

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore

PROJECT NO.	DATE
106810009	11/14

GEOLOGY

CONCEPTUAL ENGINEERING AND ENVIRONMENTAL CONSTRAINTS
DOUBLE TRACK ALTERNATIVE ALIGNMENTS
BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY

FIGURE 3

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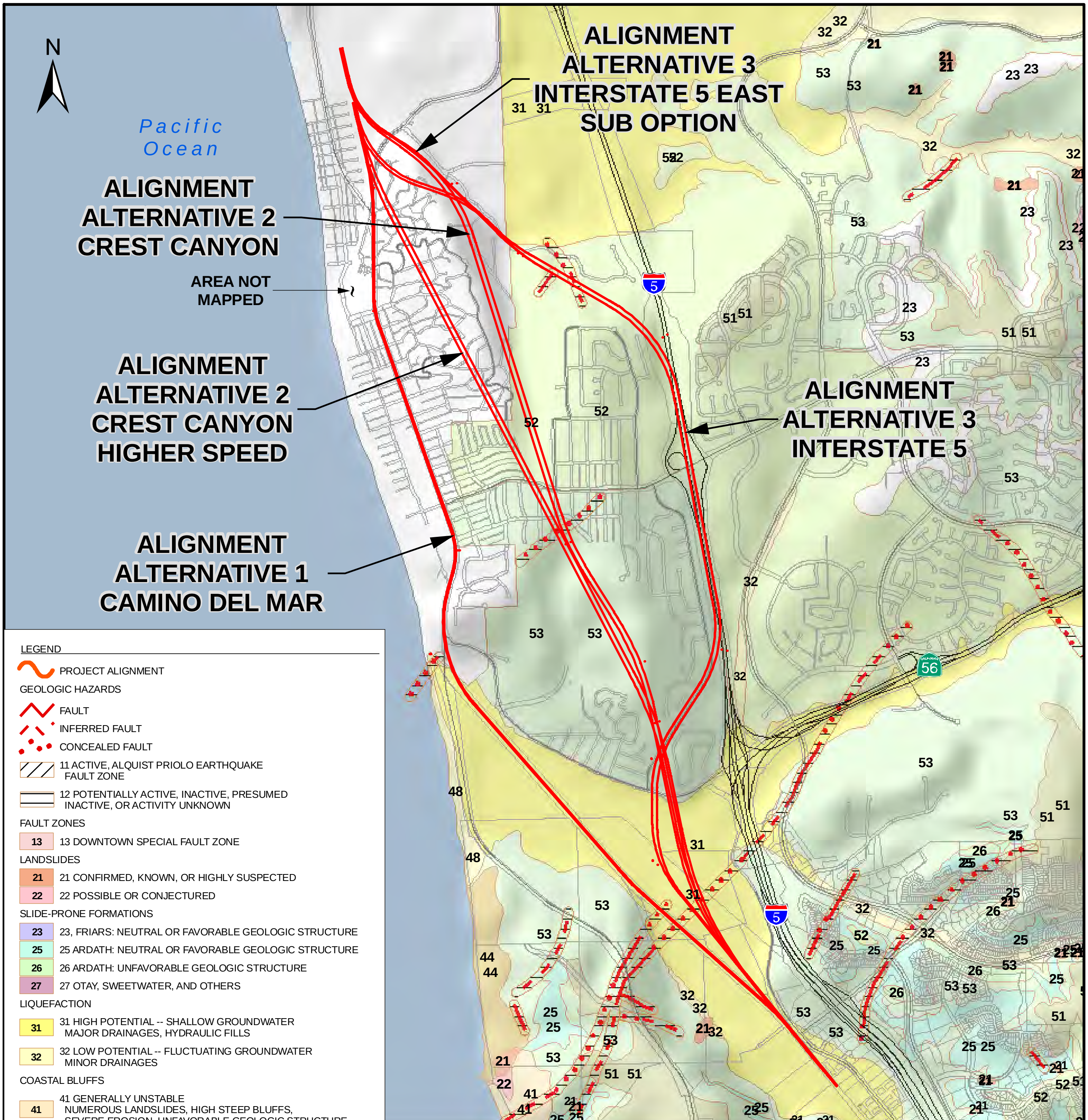


LEGEND

- PROJECT ALIGNMENT

GEOLOGIC HAZARDS

- FAULT
- INFERRED FAULT
- CONCEALED FAULT
- 11 ACTIVE, ALQUIST PRIOLO EARTHQUAKE FAULT ZONE
- 12 POTENTIALLY ACTIVE, INACTIVE, PRESUMED INACTIVE, OR ACTIVITY UNKNOWN

FAULT ZONES

- 13 — 13 DOWNTOWN SPECIAL FAULT ZONE

LANDSLIDES

- 21 — 21 CONFIRMED, KNOWN, OR HIGHLY SUSPECTED
- 22 — 22 POSSIBLE OR CONJECTURED

SLIDE-PRONE FORMATIONS

- 23 — 23, FRIARS: NEUTRAL OR FAVORABLE GEOLOGIC STRUCTURE
- 25 — 25 ARDATH: NEUTRAL OR FAVORABLE GEOLOGIC STRUCTURE
- 26 — 26 ARDATH: UNFAVORABLE GEOLOGIC STRUCTURE
- 27 — 27 OTAY, SWEETWATER, AND OTHERS

LIQUEFACTION

- 31 — 31 HIGH POTENTIAL -- SHALLOW GROUNDWATER MAJOR DRAINAGES, HYDRAULIC FILLS
- 32 — 32 LOW POTENTIAL -- FLUCTUATING GROUNDWATER MINOR DRAINAGES

COASTAL BLUFFS

- 41 — 41 GENERALLY UNSTABLE NUMEROUS LANDSLIDES, HIGH STEEP BLUFFS, SEVERE EROSION, UNFAVORABLE GEOLOGIC STRUCTURE
- 44 — 44 MODERATELY STABLE MOSTLY STABLE FORMATIONS, LOCAL HIGH EROSION
- 48 — 48 GENERALLY STABLE BROAD BEACH AREAS, DEVELOPED HARBOR

OTHER TERRAIN

- 51 — 51 LEVEL MESAS -- UNDERLAIN BY TERRACE DEPOSITS AND BEDROCK NOMINAL RISK
- 52 — 52 OTHER LEVEL AREAS, GENTLY SLOPING TO STEEP TERRAIN, FAVORABLE GEOLOGIC STRUCTURE, LOW RISK
- 53 — 53 LEVEL OR SLOPING TERRAIN, UNFAVORABLE GEOLOGIC STRUCTURE, LOW TO MODERATE RISK
- 55 — 55 MODIFIED TERRAIN (GRADED SITES) NOMINAL RISK

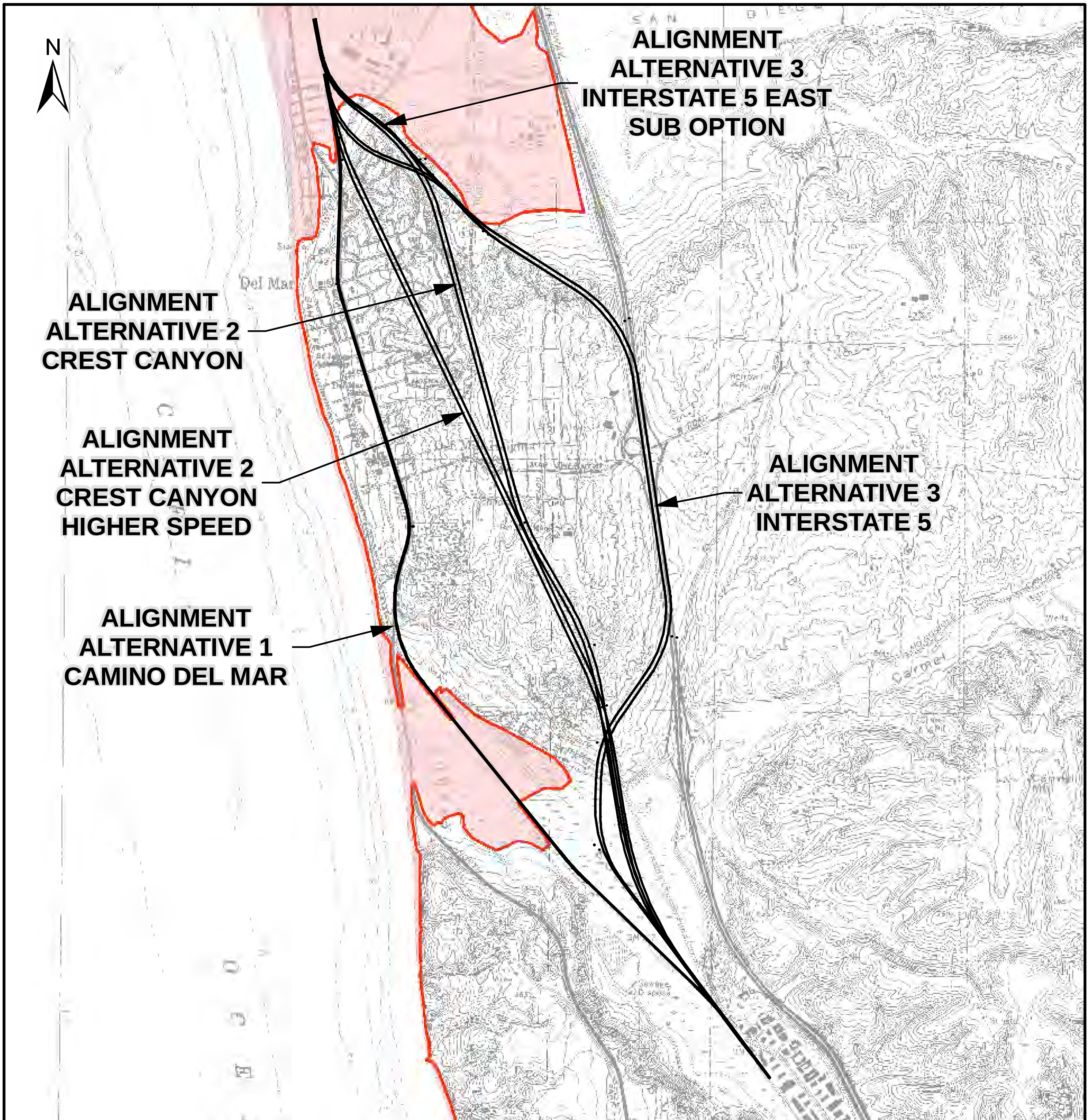
SOURCE: CITY OF SAN DIEGO SEISMIC SAFETY STUDY GEOLOGIC HAZARDS AND FAULTS; SANGIS, 2008.

SCALE IN FEET

0 1,500 3,000 6,000

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore		GEOLOGIC HAZARDS	FIGURE
PROJECT NO.	DATE	CONCEPTUAL ENGINEERING AND ENVIRONMENTAL CONSTRAINTS DOUBLE TRACK ALTERNATIVE ALIGNMENTS BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY	4
106810009	11/14		



SOURCE: TSUNAMI MAP FOR EMERGENCY PLANNING; STATE OF CALIFORNIA - COUNTY OF SAN DIEGO, 2009
USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE - DEL MAR, CALIFORNIA

LEGEND

- PROJECT ALIGNMENT
- TSUNAMI INUNDATION LINE
- TSUNAMI INUNDATION AREA

SCALE IN FEET

0 1,500 3,000 6,000

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

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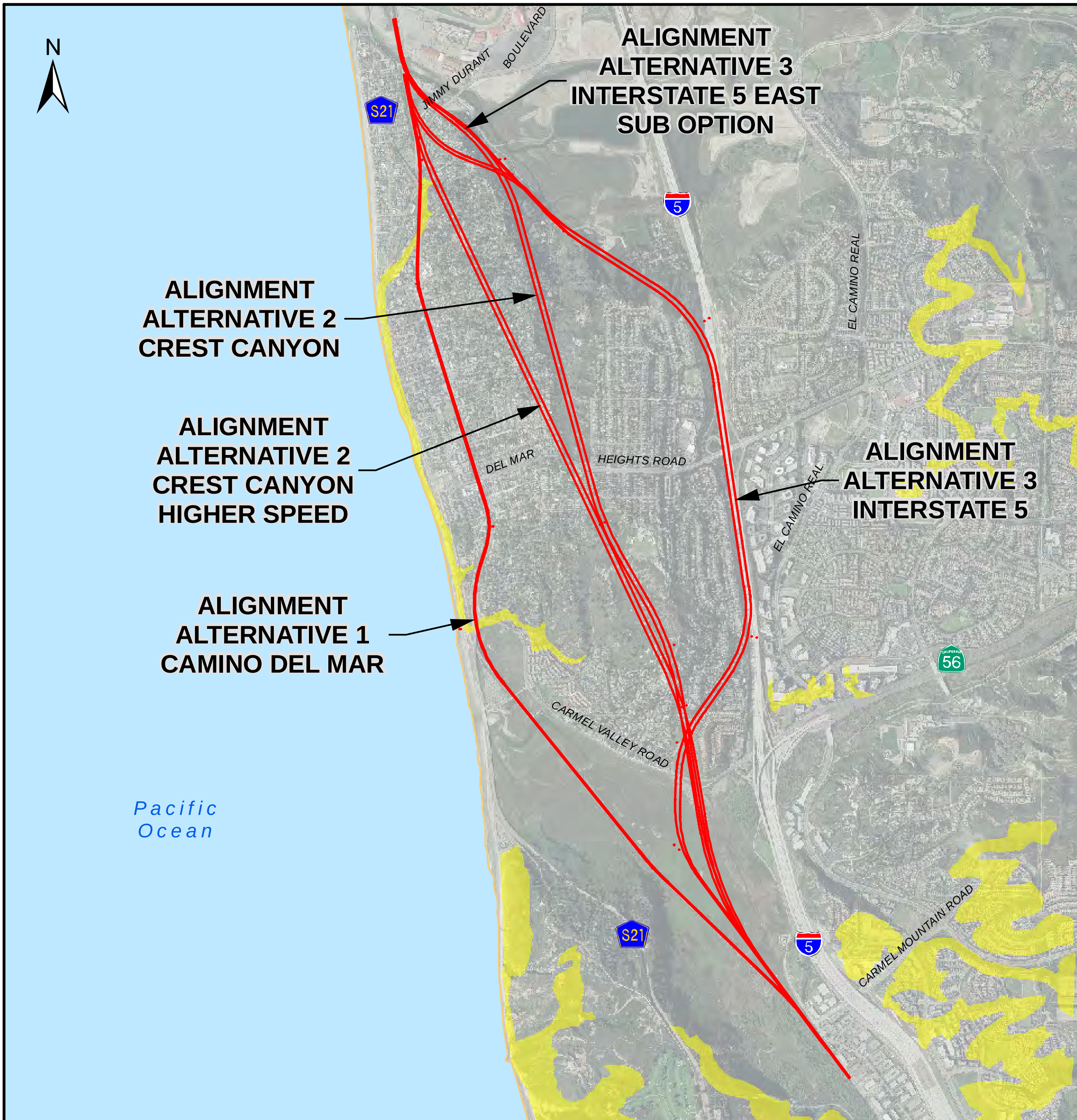
Ninyo & Moore

		TSUNAMI INUNDATION	FIGURE
PROJECT NO.	DATE	CONCEPTUAL ENGINEERING AND ENVIRONMENTAL CONSTRAINTS DOUBLE TRACK ALTERNATIVE ALIGNMENTS BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY	5
106810009	11/14		



SOURCES: TAN, S. S. & GIFFEN, D. G. - 1995 LANDSLIDE HAZARDS IN THE NORTHERN PART OF THE SAN DIEGO METROPOLITAN AREA, SAN DIEGO COUNTY, CALIFORNIA; AERIAL IMAGERY - BING MAPS, (C) 2012

LEGEND

PROJECT ALIGNMENT

MOST SUSCEPTIBLE TO LANDSLIDE (4-1 ON TAN & GIFFEN, 1995)

SCALE IN FEET

0 1,500 3,000 6,000

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore

PROJECT NO.	DATE	LANDSLIDE HAZARDS	FIGURE
106810009	11/14	CONCEPTUAL ENGINEERING AND ENVIRONMENTAL CONSTRAINTS DOUBLE TRACK ALTERNATIVE ALIGNMENTS BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY	6

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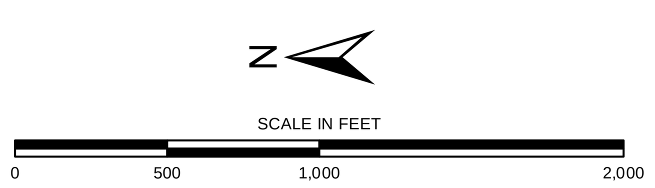
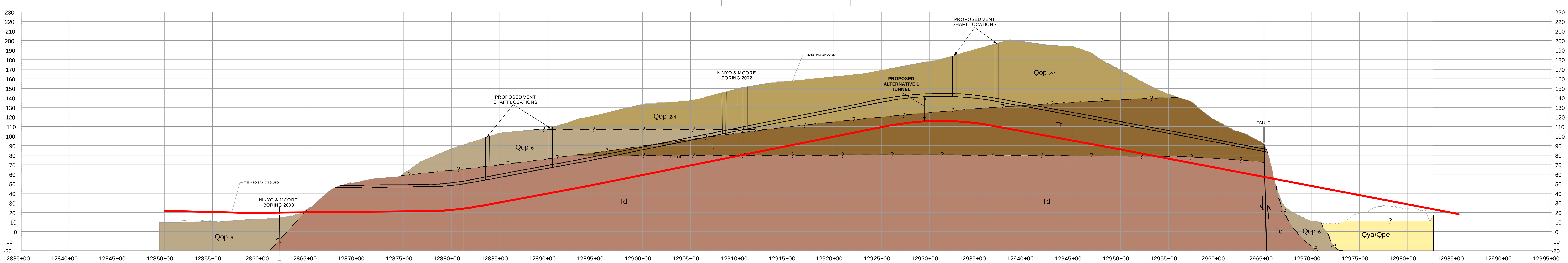
SOURCE: KENNEDY, M.P., AND TAN, S.S., 2008 GEOLOGIC MAP OF THE SAN DIEGO 30' X 60' QUADRANGLE, CALIFORNIA



LEGEND

(red line)	PROJECT ALIGNMENT
af	ARTIFICIAL FILL
Qls	LANDSLIDE DEPOSITS, UNDIVIDED
Qmb	MARINE BEACH DEPOSITS
Qpe	PARALIC ESTUARINE DEPOSITS
Qya	YOUNG ALLUVIAL FLOOD-PLAIN DEPOSITS
Qop_6	OLD PARALIC DEPOSITS, UNIT 6
Qop_{2-4}	OLD PARALIC DEPOSITS, UNITS 2-4
$Qvop_{11}$	VERY OLD PARALIC DEPOSITS, UNIT 11
$Qvop_{10}$	VERY OLD PARALIC DEPOSITS, UNIT 10
$Qvop_{10a}$	VERY OLD PARALIC DEPOSITS, UNIT 10a
Tt	TORREY SANDSTONE
Td	DELMAR FORMATION
85	FAULT - SOLID WHERE ACCURATELY LOCATED, DASHED WHERE APPROXIMATE, DOTTED WHERE CONCEALED. ARROW AND NUMBER INDICATE DIRECTION AND ANGLE OF DIP OF FAULT PLANE
U / D	FAULT - SOLID WHERE WELL DEFINED; DASHED WHERE APPROXIMATELY LOCATED; SHORT DASH WHERE INFERRED; DOTTED WHERE CONCEALED. WHERE AGE WAS DETERMINED, AGE SYMBOL IS SHOWN ASTRIDE FAULT AND RELATIVE OFFSET, IF KNOWN,IS SHOWN BY "D" AND "U" ON DOWNTHROWN AND UPTHROWN SIDES. AGES OF FAULTS ARE INDICATED AS FOLLOWS:
	CUTS STRATA OF QUATERNARY AGE
Qls?	LANDSLIDE - ARROWS INDICATE PRINCIPAL DIRECTION OF MOVEMENT, QUERIED WHERE EXISTENCE IS QUESTIONABLE
50	STRIKE AND DIP OF BEDS, INCLINED

PROFILE VIEW: PV - (2)
SCALE: 4
DATUM: -20.00



SOURCE: DAVID EVANS AND ASSOCIATES, 2012

NOTE: CROSS SECTION VERTICAL EXAGERATION 10X.

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

Ninyo & Moore		GEOLOGY AND CROSS SECTION - ALTERNATIVE 1	PLATE
PROJECT NO.	DATE	CONCEPTUAL ENGINEERING AND ENVIRONMENTAL CONSTRAINTS DOUBLE TRACK ALTERNATIVE ALIGNMENTS BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY	1
106810009	11/14		

SOURCE: 2008, KENNEDY, M.P., AND TAN, S.S., GEOLOGIC MAP OF THE SAN DIEGO 30' X 60' QUADRANGLE, CALIFORNIA

NOTE: CROSS SECTION VERTICAL EXAGERATION 10X.

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

Ninyo & Moore		GEOLOGY AND CROSS SECTION - ALTERNATIVE 2, CANYON CREST HIGHER SPEED	PLATE
PROJECT NO.	DATE	CONCEPTUAL ENGINEERING AND ENVIRONMENTAL CONSTRAINTS DOUBLE TRACK ALTERNATIVE ALIGNMENTS BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY	2
106810009	11/14		

SOURCE: KENNEDY, M.P., AND TAN, S.S., 2008 GEOLOGIC MAP OF THE SAN DIEGO 30' X 60' QUADRANGLE, CALIFORNIA

N

SCALE IN FEET

0 500 1,000 2,000

PROFILE VIEW: PV - I-5 WEST PORTAL
SCALE: 4
DATUM: -50.00

NOTE: CROSS SECTION VERTICAL EXAGERATION 10X.

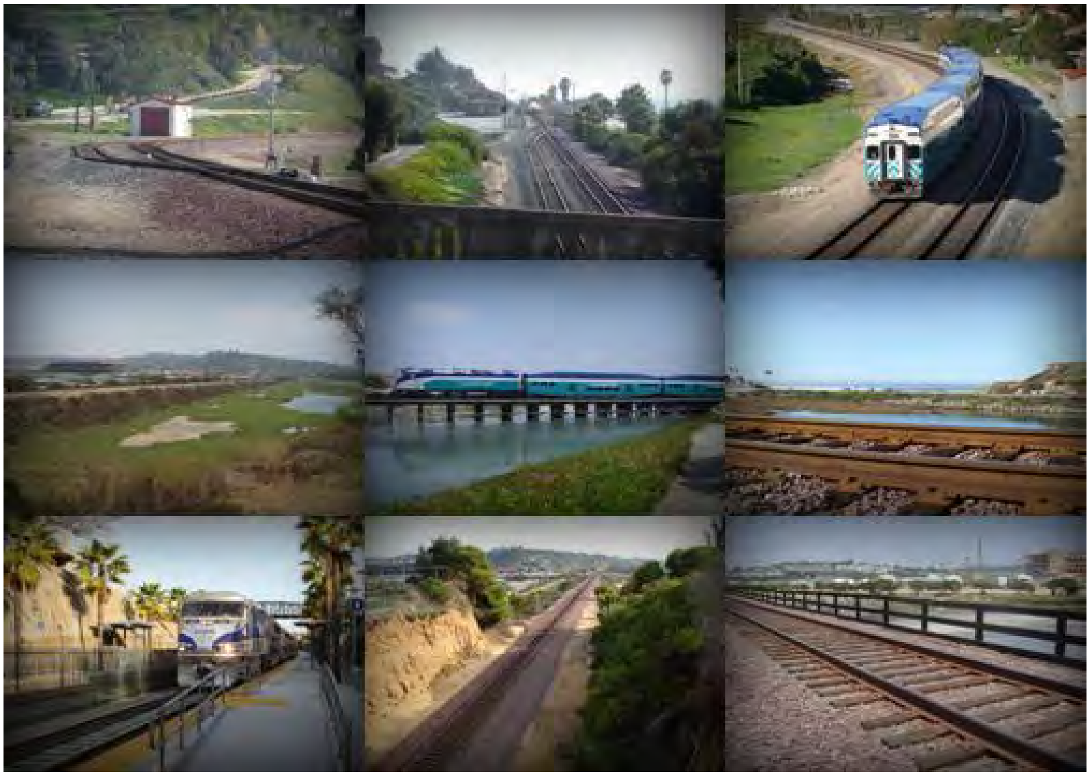
NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

Ninyo & Moore		GEOLOGY AND CROSS SECTION - ALTERNATIVE 3	PLATE
PROJECT NO.	DATE	CONCEPTUAL ENGINEERING AND ENVIRONMENTAL CONSTRAINTS DOUBLE TRACK ALTERNATIVE ALIGNMENTS BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY	3
106810009	11/14		

V. CONCEPTUAL TUNNEL VENTILATION REPORT

CONCEPTUAL ENGINEERING AND ENVIRONMENTAL CONSTRAINTS FOR DOUBLE TRACK ALIGNMENT ALTERNATIVES BETWEEN DEL MAR FAIRGROUNDS AND SORRENTO VALLEY

VENTILATION REPORT



SANDAG

November 14, 2014

Prepared for:
SANDAG
401 B Street, Suite 800, San Diego, CA 92101

Prepared by:

AECOM, 2101 Webster St, Suite 1900, Oakland, CA 94623

AECOM

TABLE OF CONTENTS

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1. Background

The high traffic volume predicted in the near future for the LOSSAN rail corridor creates a need for double tracking throughout the corridor. To provide double track in the Del Mar area, it will be necessary to move the alignment away from its current location along the beach and put it underground for a distance of approximately 2 to 3 miles, depending on the chosen alignment. The corridor is used by multiple passenger and freight lines including the COASTER, Amtrak, BNSF Railway and Union Pacific (UP) freight.

2. Alternatives

The alignment alternatives analysis provides conceptual engineering for three primary alignments and two modified alignment options from the Del Mar Fairgrounds to the Sorrento Valley Double Track project. The primary purpose of this study is to determine and compare the ventilation requirements for the tunnel segments for each of the three alternatives.

Alternative 1 – Camino Del Mar Alignment (Cut and Cover) – Length 10,200 feet.
This option places a cut and cover tunnel under Camino Del Mar, the main thoroughfare through the city of Del Mar. It is a relatively densely developed area with little room for vent shafts and with high value properties sensitive to environmental issues around the locations where vent shafts could be located.

Alternative 2 – Crest Canyon Higher Speed Alignment (Twin Bore) – Length 13,200 feet.
Crest Canyon Alignment (Twin-Bore)-Length 12,700 feet
Both options would be a twin bored tunnel under the Crest Canyon area. This would pass under high value residential properties which are also sensitive to environmental issues, but which are less densely developed than the downtown area. In addition to the higher cost of the bored tunnel, the depth of the tunnel would require very deep shafts (2-300 ft) to the surface. This is a construction and maintenance challenge and creates difficulties for passenger evacuation.

Alternative 3 – I-5 Alignment (Twin Bore) – Length 13,400 feet
I-5 East Alignment (Twin Bore)-Length 11,600 feet
This alternative is similar to Alternative 2 except that it is along the I-5 Freeway and avoids much of the developed property issues. The environmental and community concerns would be easier to address. One sub-option requires an additional, 1400 feet tunnel at the north end of the main tunnel.

3. Criteria

The primary governing documents relating to tunnel ventilation are:
NFPA 130 Standard for Fixed Guideway Transit and Passenger Rail Systems. National Fire Protection Association (NFPA) 130 specifies requirements for emergency ventilation and for providing egress capacity.

Emergency ventilation must be able to provide sufficient flow in the tunnel to meet critical velocity. Critical velocity is necessary to prevent back-layering. Back-layering is the buoyant flow of heat and smoke above the ventilation air being provided, thus contaminating the evacuation path. For emergency egress, there must be an exit to a point of safety every 2,500’ or less. Where the tunnels are separated by a 2-hour rated fire wall or are in twin bores, cross-passages between the two tunnels may be used if they are spaced not more that 800’ apart and meet other specified criteria.

OSHA, CalOSHA, NIOSH and ACGIH publish allowable exposure levels for persons exposed to specific pollutants. This preliminary study addresses complete flushing of the tunnels between trains and does not examine details of pollutants remaining after partial flushing.

In addition, there are operational criteria for the diesel locomotives operating in the tunnel. Sufficient fresh air must be provided so that the trailing locomotives have adequate oxygen and low enough air temperatures for efficient operation. The guidelines used, based upon other projects, are not more than 10% decrease in oxygen content at the engine inlet and maximum 100°F temperature at the engine and radiator inlets.

3.1 Emergency Criteria:

In case of a fire on a train stopped in the tunnel, there are different concerns for the passenger and freight vehicles. For the passenger vehicles, evacuation and safety of the passengers, some of whom may have limited mobility, is the primary concern. The ventilation direction is typically chosen to clear the largest number of train cars, providing the most protection to the largest number of passengers. For the freight trains, only the crew (usually considered to be able-bodied) must be evacuated, but a much larger fire may be present making it more difficult to provide access for fire fighters. Since the crew is normally in the front of the train, the ventilation direction is normally toward the rear of a freight train. In either case, emergency ventilation is used to provide flow through the tunnel to control smoke and heat.

For passenger trains, NFPA 130 specifies ventilation and tenability criteria for evacuation. For tunnel fires, the ventilation flow must meet critical velocity. For point extract systems, the fire products must be constrained to total tunnel length of 500 ft. While this does not necessarily apply to freight, it must be considered where freight and passenger operations share common tracks. Responder access must also be considered, particularly for passenger trains where it may be necessary to search for passengers unable to self-rescue.

3.2 Normal Operation Criteria:

During normal operation (when all trains are running on or near scheduled headways and speeds) the main concern is to provide fresh air by removing exhaust fumes and to prevent pressure transients from causing discomfort to passengers or damage to wayside equipment. Tunnel temperatures must also be limited to acceptable levels. The exhaust from the diesel locomotives produce heat and undesirable components such as NOx, CO, SO2, hydrocarbons and particulate matter, all of which must be cleared from the tunnel between trains or kept within the allowable exposure limits.

When trains pass through a tunnel, they push the air ahead of them and pull it behind. This is called piston effect as the train acts like a piston in a cylinder. The air in the tunnel moves in the same direction as the train, but the train moves faster than the air, resulting in some of the air ahead of the train effectively flowing around the train from front to back. This carries the exhaust from the front units to the rear. If there are multiple locomotives on the freight trains, this can create problems of oxygen starvation for the trailing locomotives. The frequency of trains through the tunnel during peak periods will lead to exhaust buildup and the airflow generated by piston effect will not be sufficient to keep it clear. Mechanical ventilation will be required to supplement the piston effect and to purge the exhaust from the tunnel between trains.

4. Egress Considerations

NFPA 130 requires exits to the surface every 2,500 ft. This spacing for emergency exits can be relieved by the use of cross passages, spaced not further than 800 ft apart, to reach a point of safety in the adjacent tunnel. This is only realistic if the evacuees are safe from traffic in the other tunnel. It is generally acceptable to stop traffic from entering the tunnel in either direction when there is an incident in one of the tunnels, but since there is some overlap in time when both passenger and freight are using the tunnels it would be theoretically possible to have a long, slow freight train passing through one tunnel when an incident happens in the other tunnel. The passengers evacuating from the incident tunnel would need to wait for the freight train to pass and, possibly, for exhaust to clear before they could enter the other tunnel. Thus, they could be in jeopardy either from the fire if they waited or from the passing train if they crossed to the other tunnel.

In the deep alignments, a center utility bore between the two running bores will provide an area of refuge and a safe path to the vent shafts or portals. Stairs and elevators will be located at the vent shaft locations to provide access to the surface.

Other options are possible and may be considered during later design stages. One of these that has been used in some modern road tunnels is a fire rated wall along one side of the tunnel creating a separate, protected walkway that could be used as an egress path. The cost of sufficient additional tunnel diameter to create a suitable walkway and the cost of constructing the wall would need to be weighed against the cost of other alternatives.

5. Ventilation Alternatives

Mechanical ventilation for emergencies and for purging during normal operation can be provided by several different methods.

5.1 Vent Shafts:

The most common ventilation for train tunnels is longitudinal ventilation driven by vent shafts to the surface with axial fans operated in supply or exhaust. Portal doors are often used in combination with the vent shafts to ensure air flows down the tunnel instead of being lost out the portal.

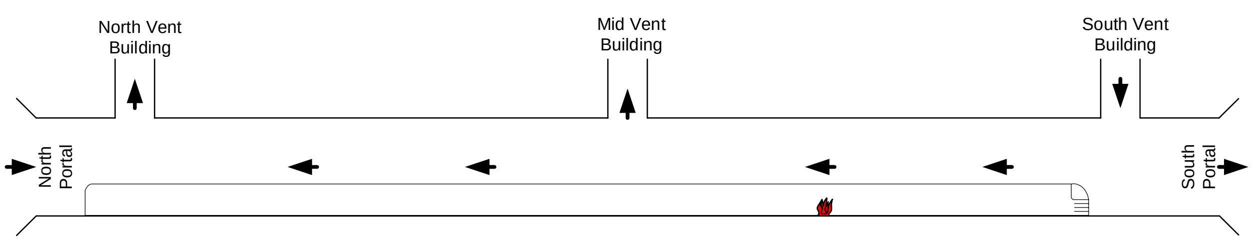


Figure 1 - Longitudinal ventilation with vent shafts

5.2 Jet Fans:

Longitudinal ventilation can also be provided by jet fans which are located along the tunnel and operate to push the air in the desired direction. Use of jet fans alone does not remove exhaust, fumes or smoke from the tunnel so, for long tunnels, some combination is often used with jet fans providing longitudinal movement and vent shafts extracting contaminated air at intermediate points.

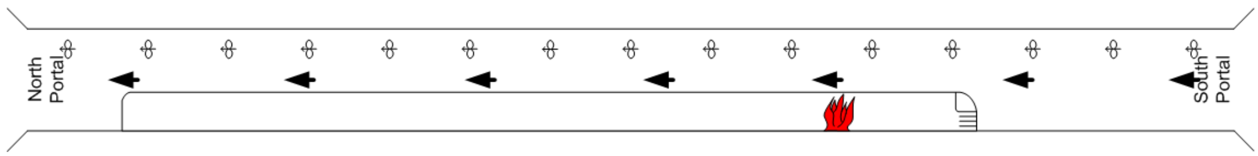


Figure 2 - Longitudinal ventilation with jet fans

5.3 Transverse:

Where space permits, another approach is to use transverse or semi-transverse ventilation where exhaust openings (semi-transverse) or both supply and exhaust openings (transverse) are distributed along the length of the tunnel extracting exhaust uniformly down the length. This requires a large parallel duct or ducts to carry the exhaust and supply air along the length of the tunnel with openings spaced along the tunnel to provide the exhaust or supply. The fans may be located at the ends or at intermediate points along the length of the tunnel. This is most effective for normal operation and must usually be combined with either longitudinal or point extract ventilation for fire emergency operation.

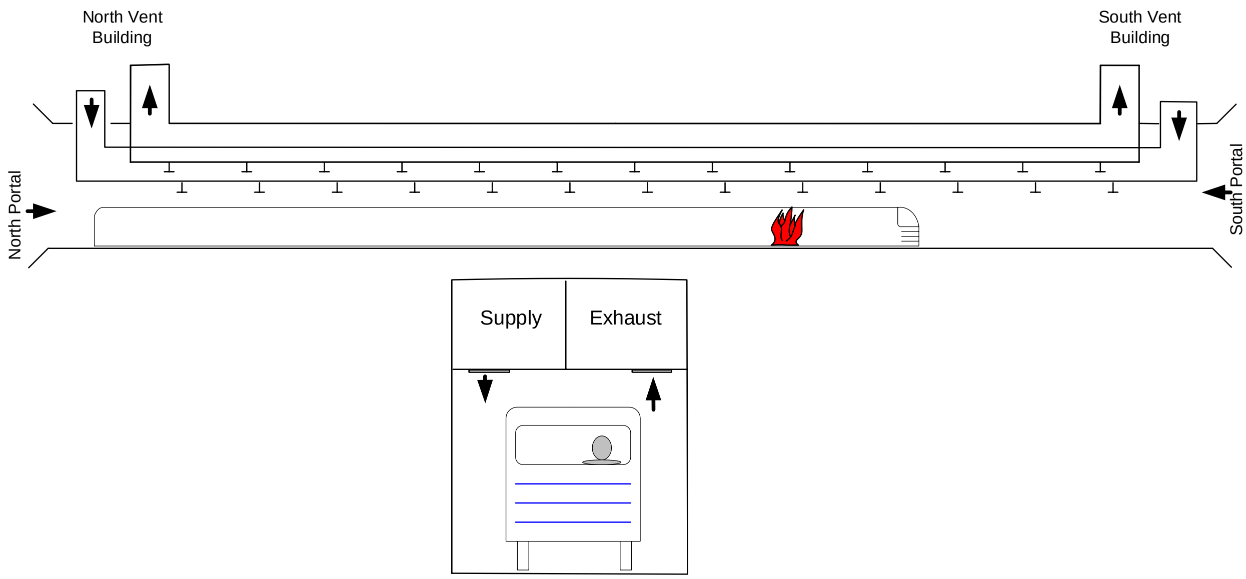


Figure 3 - Transverse ventilation with vent shafts at ends

Various combinations of ventilation methods were attempted to find a practical, cost effective approach for each of the three tunnel alignments. This evaluation was not exhaustive and further options should be evaluated in later design stages. Computer modeling was used to demonstrate the feasibility of the options and the capacities that would be required for ventilation of each alignment alternative. Two different types of modeling were used: the Subway Environment Simulation (SES) program and

Computational Fluid Dynamics (CFD) using ANSYS CFX software. SES is a one-dimensional, bulk flow analysis program with special features to model train movement, fan operation, fires in tunnels and other related parameters. CFD is a three-dimensional modeling tool that predicts the air flow and heat and smoke distribution in larger volume spaces or areas of complex flows such as crossovers where one-dimensional modeling is not adequate.

SES was used to model several scenarios and combinations of longitudinal ventilation types and fan capacities for all three tunnels. CFD was used to model the point extract ventilation for the emergency scenario and the transverse ventilation flow for purging in the cut and cover tunnel.

5.4 Results

Graphics of the modeling results are shown in Attachment 1. For each alignment alternative, a table is provided showing some of the ventilation options modeled in SES and the results for each. A representative flow diagram is also shown for each alternative. CFD graphics show the results of transverse ventilation at selected times during the purging process and show the temperature distribution at full heat release using point extract to control heat and smoke from a tunnel fire.

Bored tunnel alignment alternatives 2 and 3, were simulated with vent shafts at different locations and with jet fans, alone or in combination with vent shafts. The solution chosen was to use vent shafts located at a minimum distance of 800 feet and maximum distance of 2,000 feet from each portal and mid-tunnel vent shafts located approximately midway between the portal vent shafts. Each of the three locations would have a single 400 ft^2 shaft for each tunnel or a single, divided shaft serving both tunnels. Because of the depth of the alignment and corresponding length of the shafts, it will be necessary to locate the shafts between or at the sides of the tunnels. Each vent shaft will have a fan room with a capacity of 800 KCFM using a minimum of two reversible, vane-axial fans per fan room with associated dampers and silencers. The piston action caused by train movement will result in airflow in and out of the shaft. To prevent wind milling the fans, fan dampers must be provided to block the fans when they are not in use. Bypass dampers will provide an alternate, low resistance path for piston effect airflow during normal operation when the fans are not operating.

For emergency operation fans will be operated in a push-pull mode with fans upstream of the fire operated in supply and fans downstream operated in exhaust. Ventilation would be in the direction to clear the most cars of a passenger train or from front to rear for a freight train, clearing the crew on the locomotive. For normal operation, the fans would be operated in a push-pull mode in the direction of the train travel after the train has passed the shaft. If the fans are operated opposite to the direction of train travel, they will have to overcome the residual piston flow before the air starts moving in the right direction. If they are operated in the direction of travel before the train exits the tunnel, they will speed the airflow in the direction of travel, reducing the relative air flow back along the train, reducing the removal of heat and dilution of exhaust from the leading locomotives.

The dimensions of the fan room will be determined when the actual fan sizes have been selected. The following shaft and damper areas are estimated:

Vent shaft area – 400 ft^2 per tunnel per shaft location
Blast relief damper area – 270 ft^2

For Alignment Alternative 1, placement of a large mid-tunnel shaft and fan plant is problematic. In addition to the space limitations, the physical structure, noise and exhaust emissions will create serious environmental and aesthetic issues along Camino Del Mar. It may be possible to locate the fan rooms underground but space is still limited both on the sides of the tunnel, above the tunnel and on the surface. Thus other alternatives are considered for the Camino Del Mar alignment. Jet fans were considered, but the number of jet fans required was prohibitive from the standpoint of maintenance. The most attractive alternative is to use a ducted system for transverse ventilation where exhaust is drawn through openings in the ceiling connected to a longitudinal exhaust duct and fresh supply air is provided through openings, either along the other side of the ceiling or low on the wall, connected to another, parallel duct. For normal operation the supply and exhaust work together to sweep the fumes from the tunnel after the train passes. For emergency operation dampers would close all of the openings except those closest to the incident and both the supply and exhaust ducts would be operated in exhaust to remove smoke and heat from the vicinity of the fire. The make-up air would be drawn from the tunnel portals, keeping the evacuation path toward the portals clear.

Assuming the ventilation is started after the train exits the tunnel, transverse ventilation using 600 KCFM fans for supply and exhaust for each end of each tunnel will permit removing 98% of the emissions in approximately 20 minutes. The graphics in attachment 1 show the state at different times during the removal process. A more detailed study during final design could refine the flow rates and evaluate the impact of clearing less of the emissions for closer headways.

Ideally, the velocity in the longitudinal ducts should be limited to approximately 2,500 fpm for noise and horsepower considerations, but this would require a duct area of 240 ft^2 for each duct at the end nearest the fans. Smaller ducts can be used but may require acoustic treatment and would require larger fan motors and higher power demand. This may be mitigated by using more, smaller fan plants distributed along the tunnel if economically and environmentally acceptable locations can be found.

At the north end of the tunnel, it may be necessary to locate the fan plants a distance away from the tunnel due to availability of space. The fan plant would be connected to the tunnel by additional ducts that will further increase the head loss and fan horsepower.

6. Summary

This study selected ventilation alternatives to evaluate for each alternative to demonstrate feasibility of providing adequate tunnel ventilation. These are not necessarily the optimum approach and other alternatives will be evaluated at later stages of the project.

The two deep tunnel alternatives are very similar in terms of the ventilation approach evalutaed. Both use vent shafts near the portals and at mid-tunnel. The I-5 alignment with the short tunnel on the North end will require jet fans for ventilation in the short tunnel in addition to the vent shafts in the main tunnels. All of the vent locations for either alignment will require 400 ft^2 of shaft for each tunnel. These may be separate or combined in one large divided shaft, but each will be equipped with multiple, reversible, vane-axial fans with a combined capacity of 800 KCFM for each shaft.

The cut and cover Camino Del Mar alignment was evaluated using transverse ventilation with supply and exhaust ducts. This would require separate supply and exhaust ducts along the length of the tunnel plus 300 ft^2 vent shafts leading to vent plants of 600 KCFM each for each tunnel at each portal. Particularly at the north end, it may be necessary to locate the vent plants some distance away from the actual tunnel alignment, which would further increase the power requirements.

Del Mar
San Dieguito Tunnel
Ventilation

Attachment 1

Modeling Results

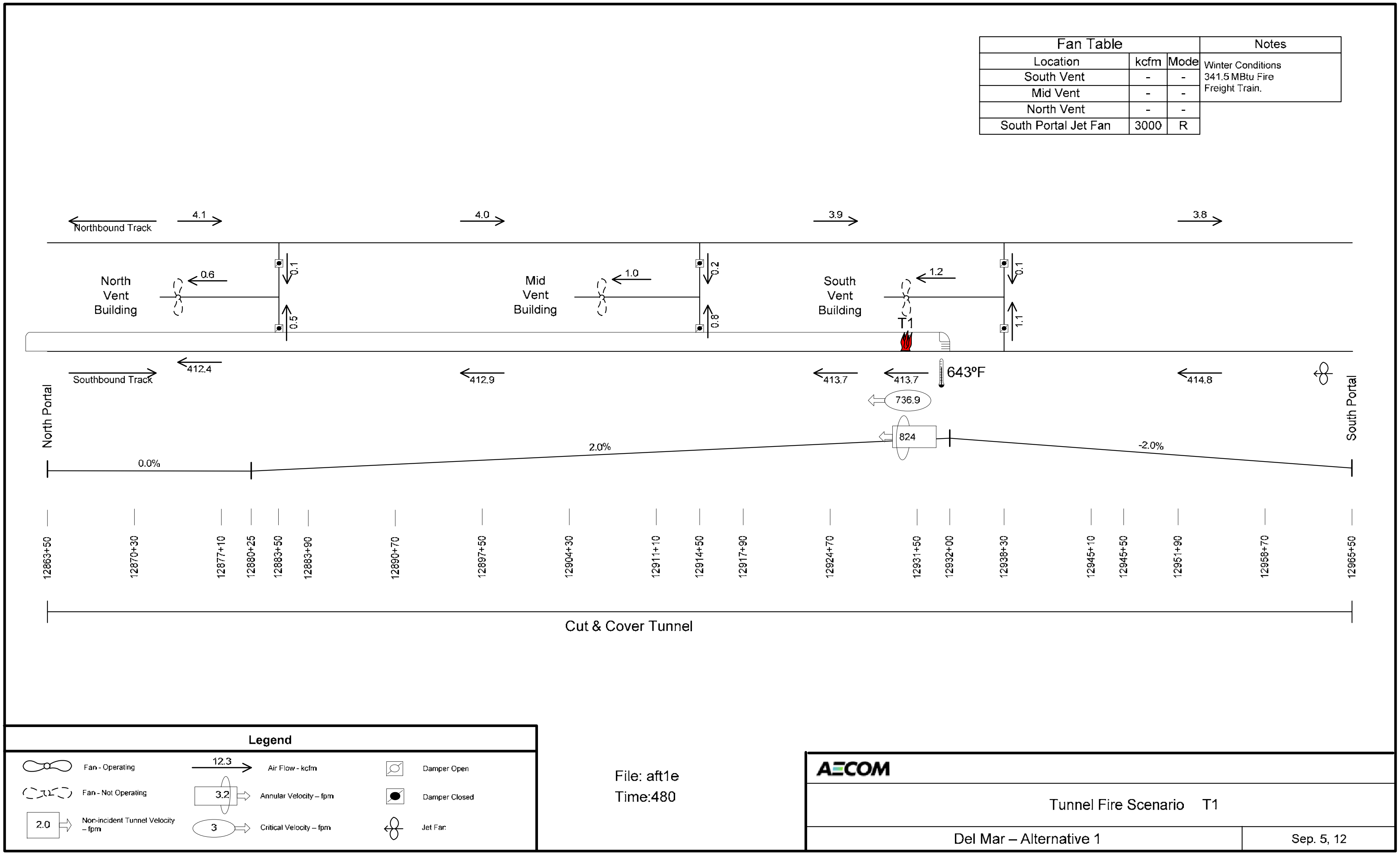
SES Simulation Results

Del Mar Alternative 1: SES Emergency Results

Case	File	Jet Fan	North Vent Building	Mid Vent Building	South Vent Building	Jet Fan	Open Cross Passages	Vact Annular (m/s)	Vcrit Annular (m/s)	Percent Pass	Train Type
T1	aft1a		X (600)		S (600)		none	258.00	736.90	-65	freight
T1	aft1b		X (600)	X (600)	S (600)		none	808.00	736.90	10	freight
T1	aft1c		X (600)	X (600)	S (600)	R (200)	none	868.00	736.90	18	freight
T1	aft1d		X (1000)		S (1000)	R (1000)	none	836.00	736.90	13	freight
T1	aft1e					R (3000)	none	824.00	736.90	12	freight
T1	aft1f		S (1250)		X (1250)		none	782.00	680.40	15	freight
T1	aft1g	F (900)	S (600)		X (600)		none	791.00	680.40	16	freight
T1	aft1h		X (1250)		S (1250)		none	808.00	736.90	10	freight
T1	aft1i		X (600)		S (600)	R (400)	none	715.00	660.50	8	metrolink
T1	aft1j					R (700)	none	685.00	660.50	4	metrolink
T1	aft1k		X (1250)		S (1250)		none	691.00	660.50	5	metrolink

F = Forward, R= Reverse, S= Supply, X= Exhaust, (xxx)=Capacity in kcfm

Sample Flow Diagram



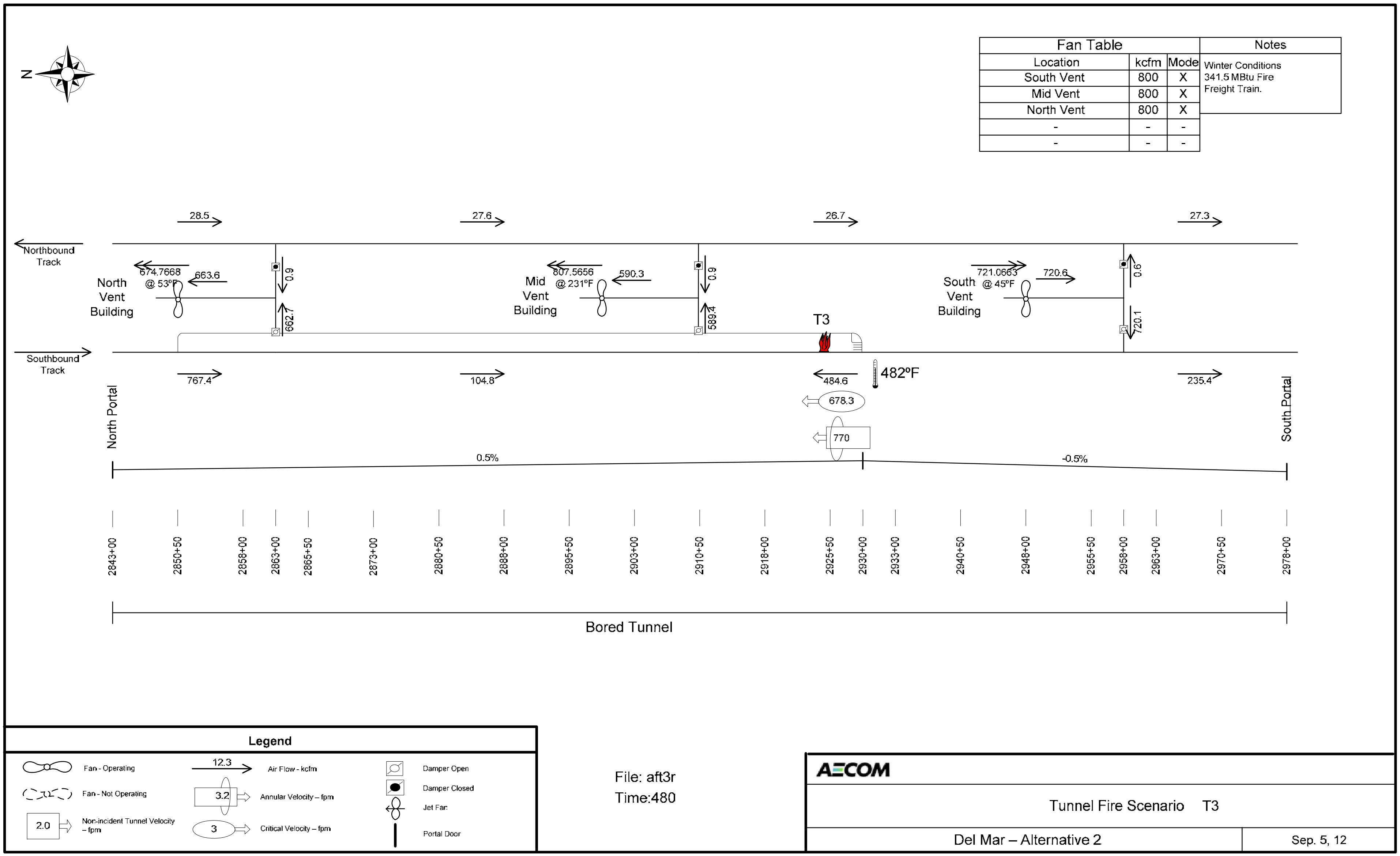
Fan Table		
Location	kcfm	Mode
South Vent	-	-
Mid Vent	-	-
North Vent	-	-
South Portal Jet Fan	3000	R

Del Mar Alternative 2: SES Emergency Results

Case	File	Jet Fan	North Vent Building	Mid Vent Building	South Vent Building	Jet Fan	Open Cross Passages	Vact Annular (m/s)	Vcrit Annular (m/s)	Percent Pass	Train Type
T3	aft3d					R (600)	none	670.00	601.30	11	metrolink
T3	aft3e		X (400)			R (600)	none	664.00	601.30	10	metrolink
T3	aft3f		X (1000)		S (1000)		none	610.00	601.30	1	metrolink
T3	aft3g	R (1000)	X (600)		S (600)	R (1000)	none	734.00	678.30	8	freight
T3	aft3h					R (3000)	none	765.00	678.30	13	freight
T3	aft3i		X (600)	X (600)		R (800)	none	774.00	678.30	14	freight
T3	aft3j		X (600)			R (2500)	none	763.00	678.30	12	freight
T3	aft3k		X (400)	X (400)		R (1500)	none	749.00	678.30	10	freight
T3	aft3l		X (400)			R (2500)	none	744.00	678.30	10	freight
T3	aft3m		X (400)	X (400)	SC (400)		none	338.00	678.30	-50	freight
T3	aft3n		X (800)	X (800)	SC (800)		none	769.00	678.30	13	freight
T3	aft3o		X (2000)		SC (2000)		none	660.00	678.30	-3	freight
T3	aft3oa		X (2000)		SC (2000)		none	540.00	678.30	-20	freight
T3	aft3ob		X (2000)		S (2000)		none	368.00	678.30	-46	freight
T3	aft3p		X (1500)		S (1500)		none	725.00	678.30	7	freight
T3	aft3q		X (400)		S (400)		portal doors	714.00	678.30	5	freight
T3	aft3r		X (800)	X (800)	S (800)		none	770.00	678.30	14	freight
T3	aft3s		X (600)	X (600)	S (600)		none	651.00	601.30	8	metrolink

F = Forward, R= Reverse, S= Supply, X= Exhaust, (xxx)=Capacity in kcfm

Sample Flow Diagram

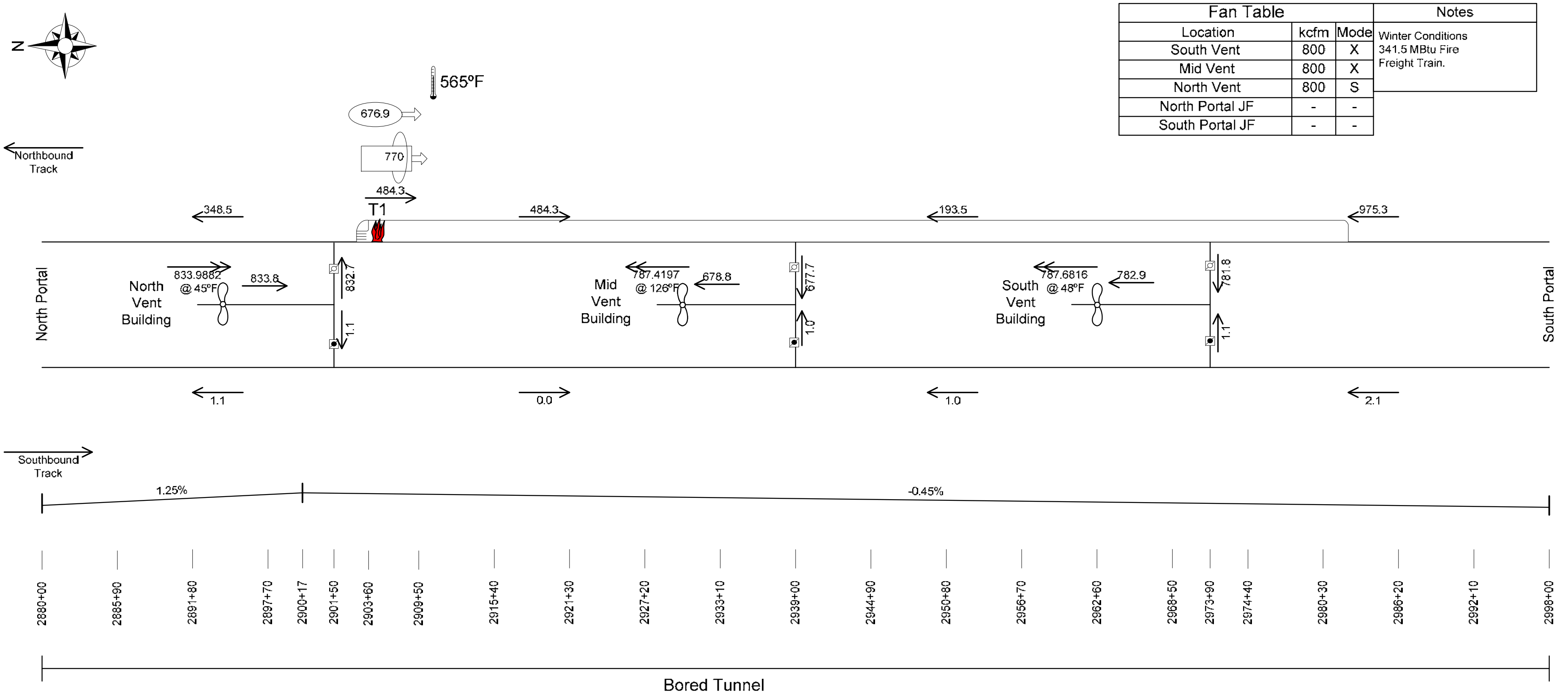


Del Mar Alternative 3: SES Emergency Results

Case	File	Jet Fan	North Vent Building	Mid Vent Building	South Vent Building	Jet Fan	Open Cross Passages	Vact Annular (m/s)	Vcrit Annular (m/s)	% Pass	Train Type
T1	aft1a		S (2000)		X (2000)		none	736.00	676.90	9	freight
T1	aft1b		S (800)	X (800)	X (800)		none	770.00	676.90	14	freight
T1	aft1c	F (600)		X (600)	X (600)		none	695.00	676.90	3	freight
T1	aft1d	F (2500)			X (600)		none	761.00	676.90	12	freight
T1	aft1e	F (2500)					none	712.00	676.90	5	freight
T1	aft1f	F (1500)		X (400)	X (400)		none	751.00	676.90	11	freight
T1	aft1g	F (2500)			X (400)		none	749.00	676.90	11	freight
T1	aft1h		X (1500)		S (1500)		none	716.00	660.60	8	freight
T1	aft1i		X (600)		S (600)	R (1500)	none	709.00	660.60	7	freight
T1	aft1j	F (600)					none	717.00	600.10	19	metrolink
T1	aft1k		S (1000)		X (1000)		none	674.00	600.10	12	metrolink
T1	aft1l	F (400)			X (600)		none	648.00	600.10	8	metrolink

F = Forward, R= Reverse, S= Supply, X= Exhaust, (xxx)=Capacity in kcfm

Sample Flow Diagram

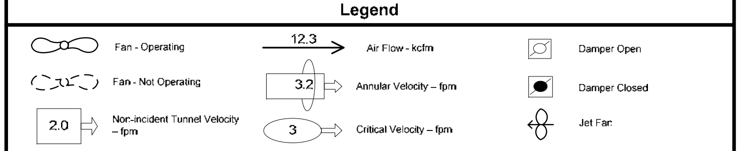


Fan Table		
Location	kcfm	Mode
South Vent	800	X
Mid Vent	800	X
North Vent	800	S
North Portal JF	-	-
South Portal JF	-	-

Notes

Winter Conditions
341.5 MBtu Fire
Freight Train.

Legend



File: aft1b
Time:480

AECOM

Tunnel Fire Scenario T1

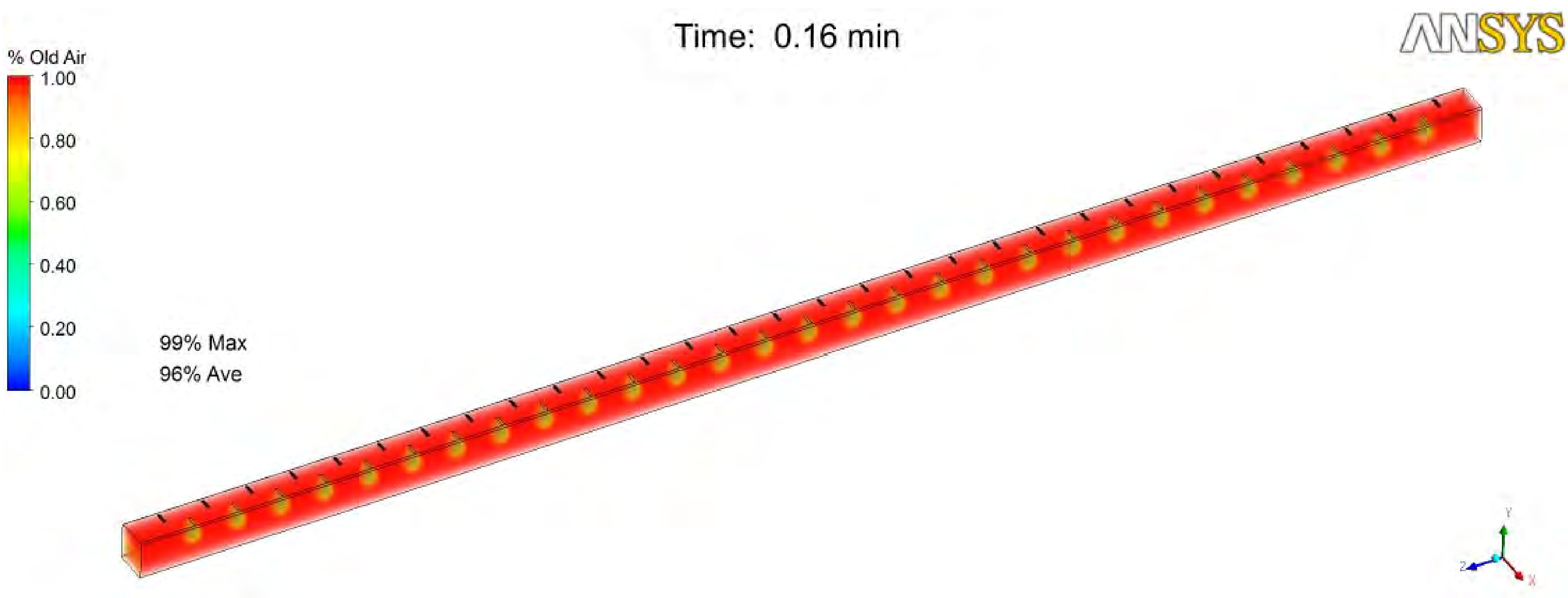
Del Mar – Alternative 3

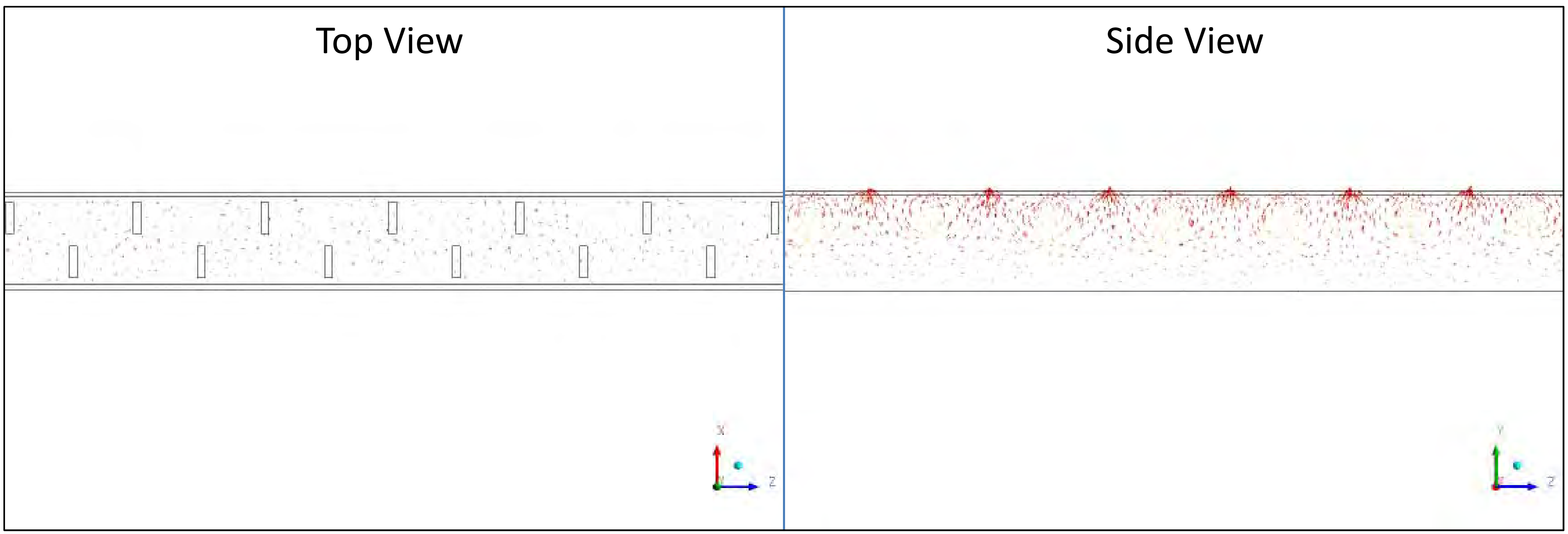
Sep. 5, 12

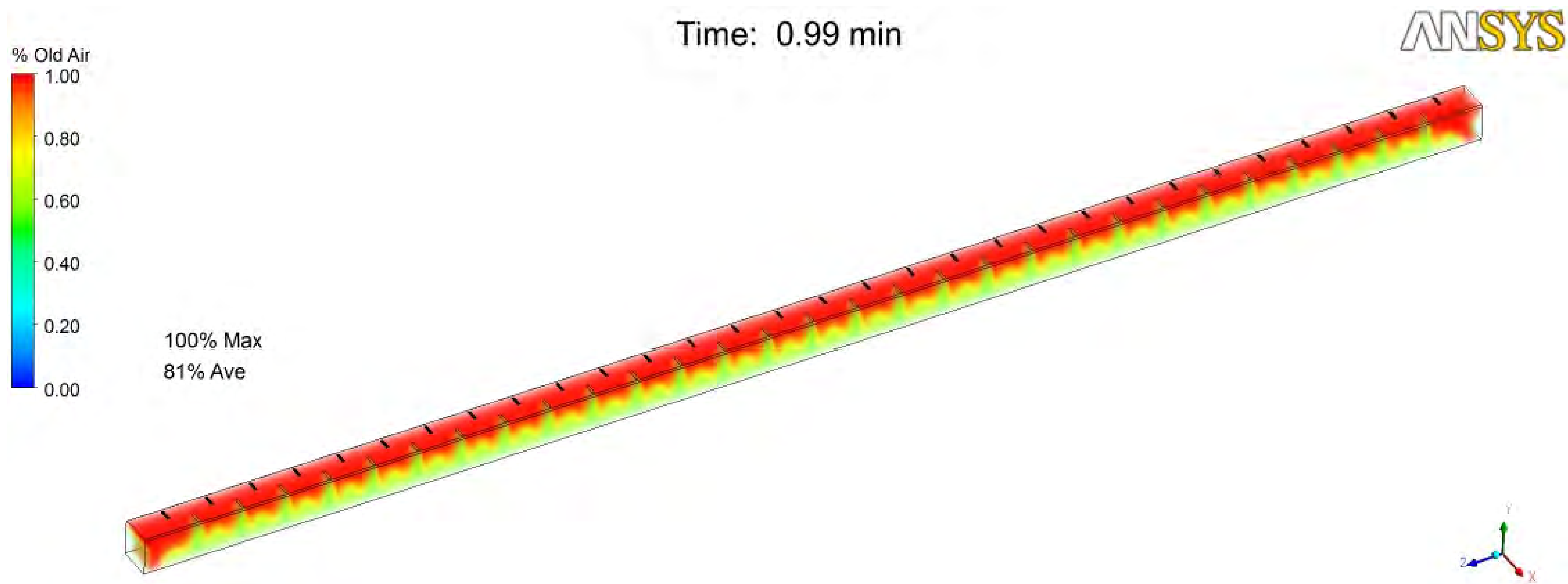
CFD Simulation Results

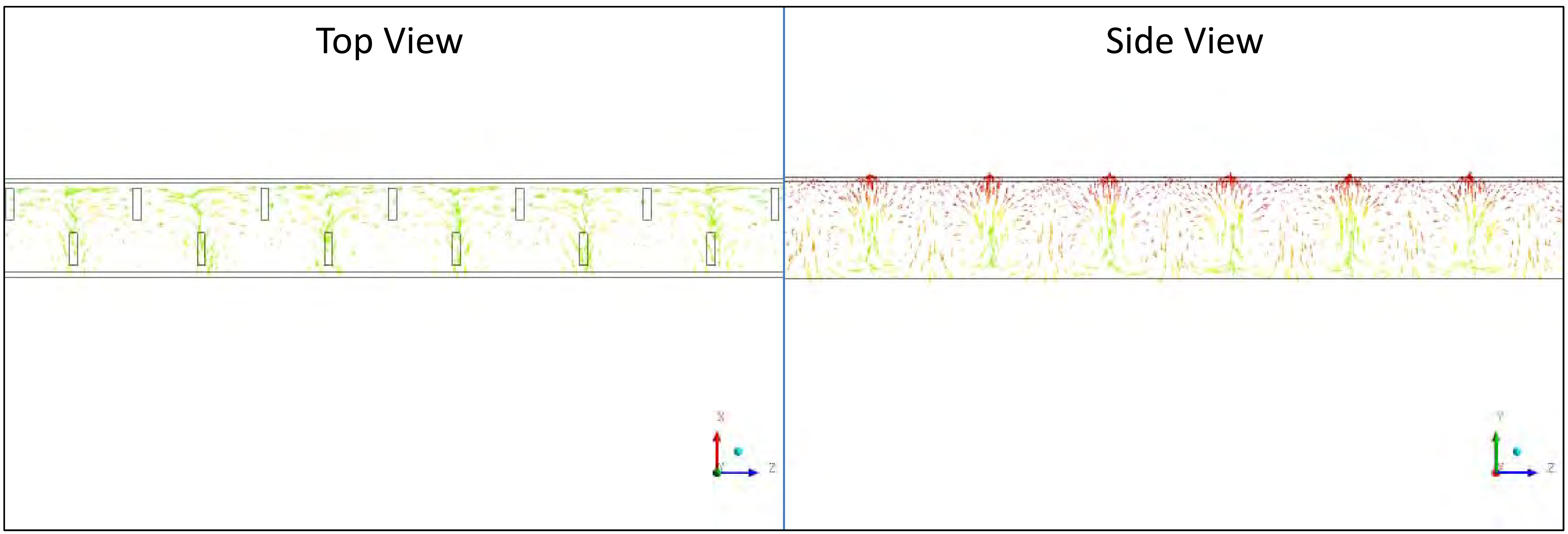
Normal Operation

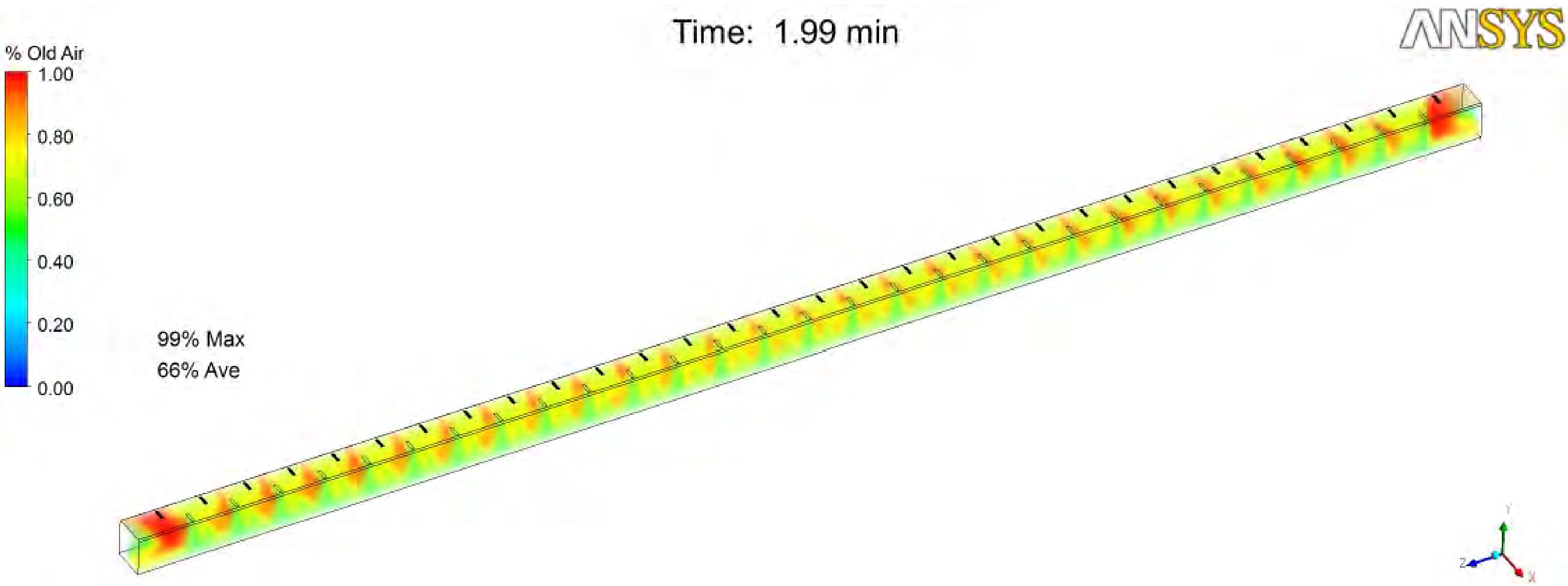
Transverse Ventilation

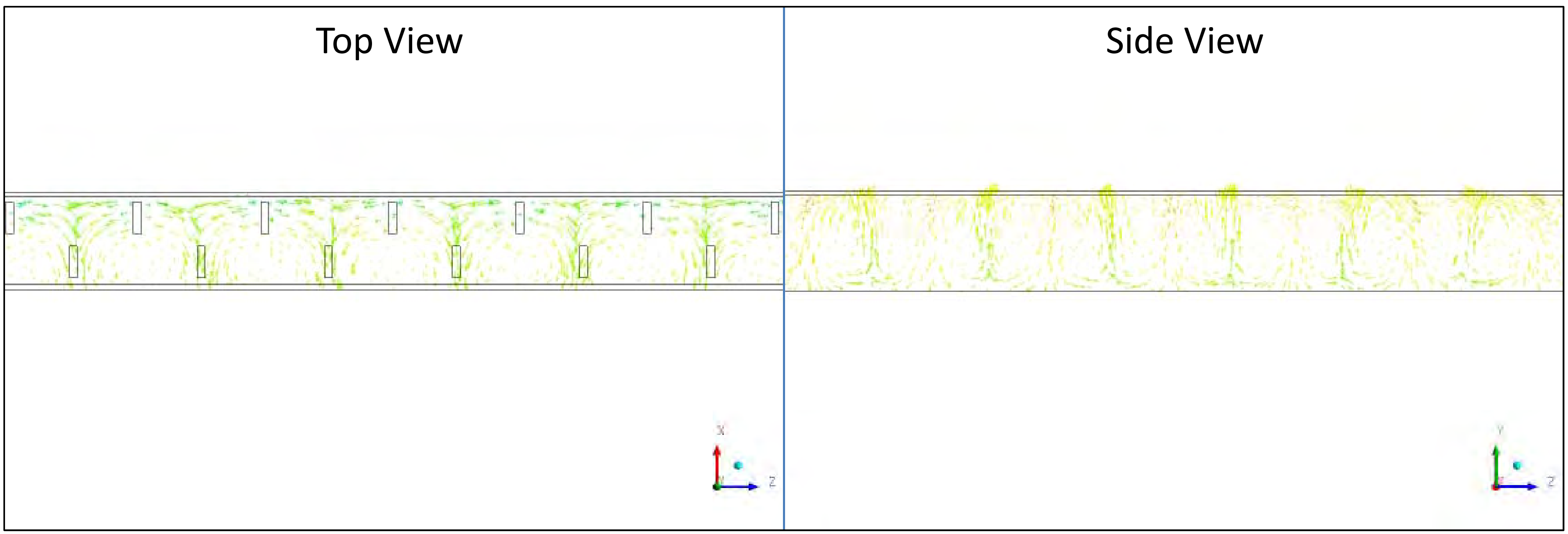

Time: 0.16 min
% Old Air
1.00
0.80
0.60
0.40
0.20
0.00
99% Max
96% Ave
Y
Z
X

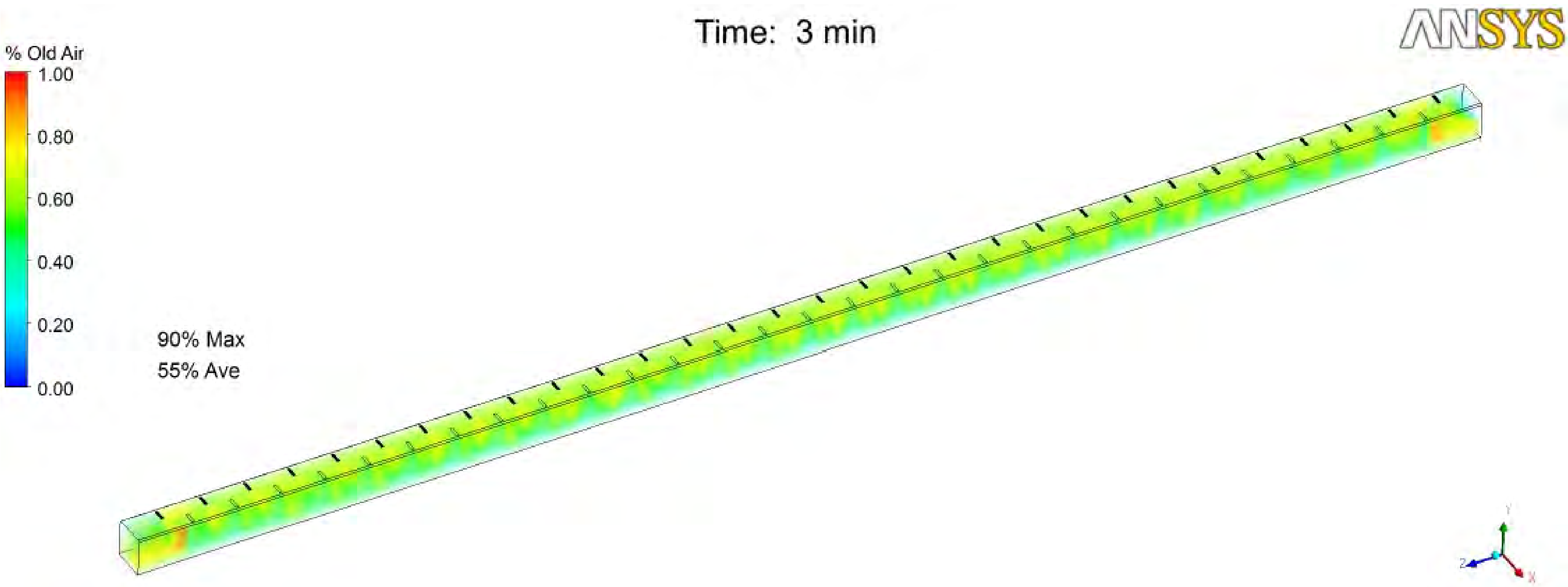

Top View
Side View
X
Z
Y
Z

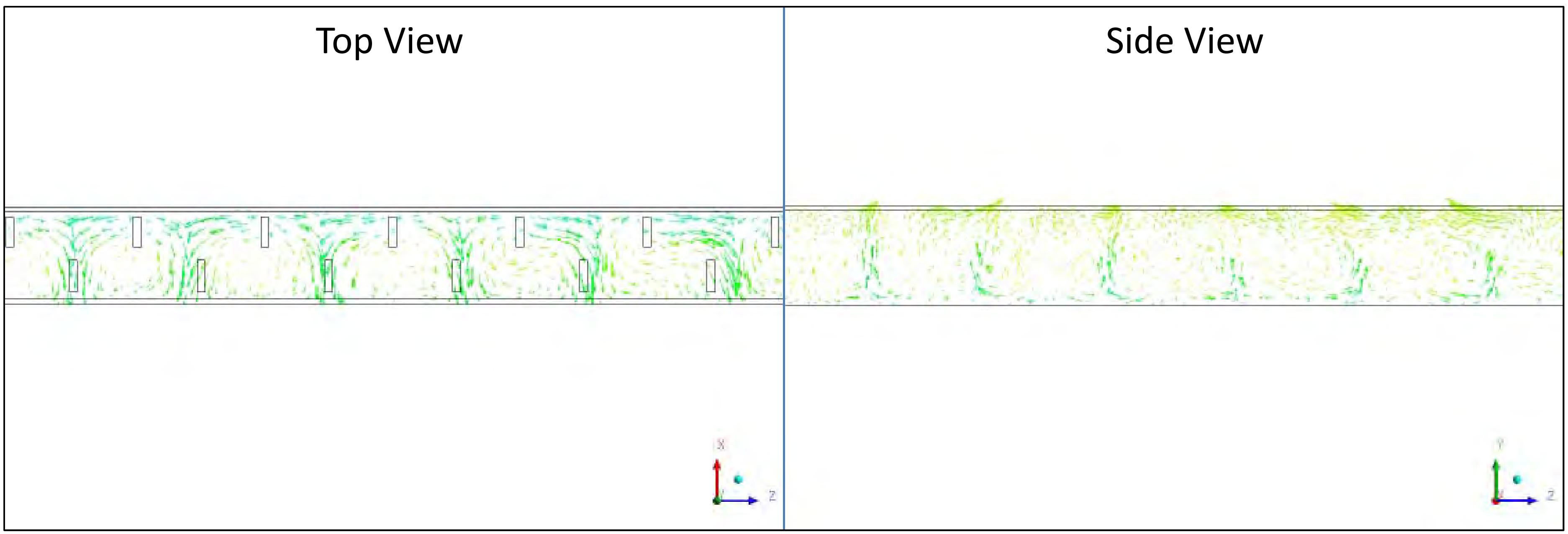

Time: 0.99 min
ANSYS
% Old Air
1.00
0.80
0.60
0.40
0.20
0.00
100% Max
81% Ave

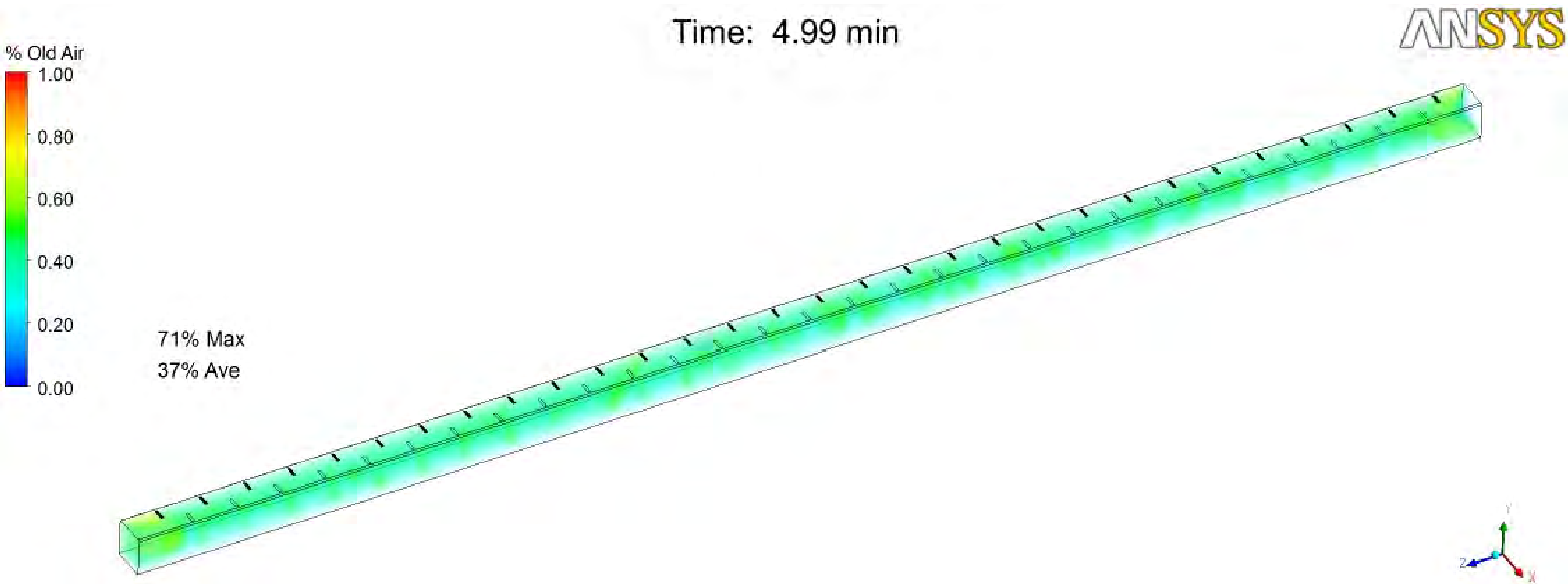

Top View
Side View


Time: 1.99 min
% Old Air
1.00
0.80
0.60
0.40
0.20
0.00
99% Max
66% Ave

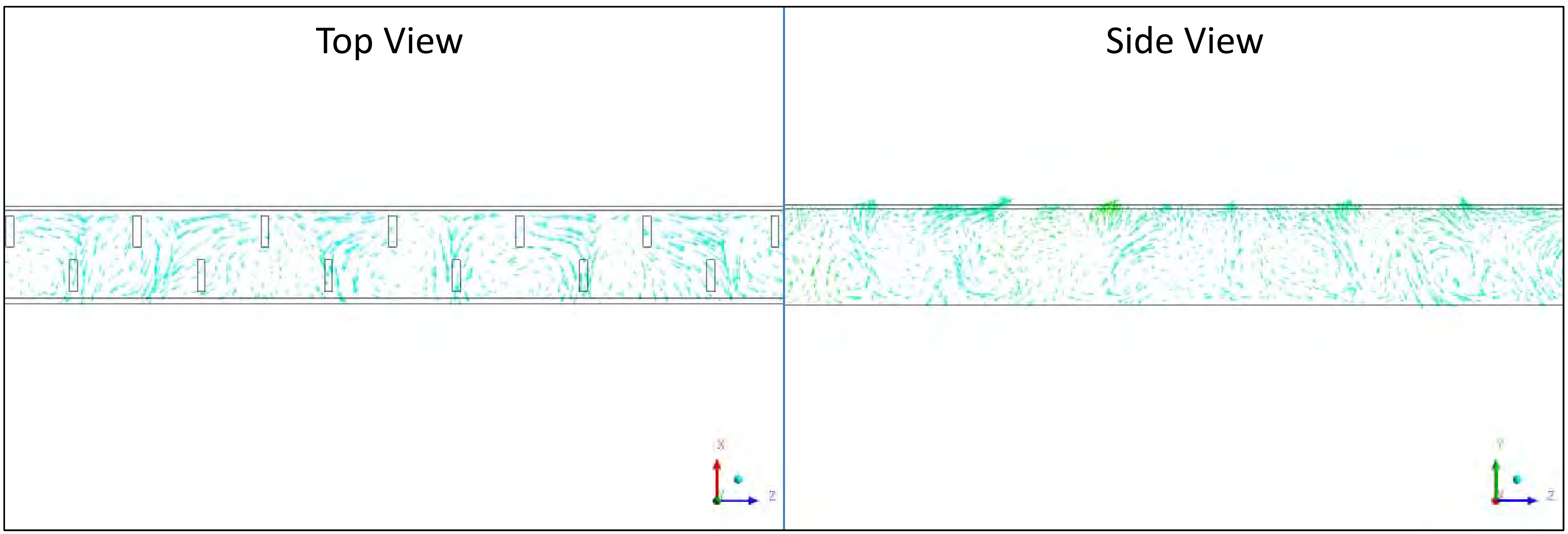

Top View
Side View


Time: 3 min
ANSYS
% Old Air
1.00
0.80
0.60
0.40
0.20
0.00
90% Max
55% Ave

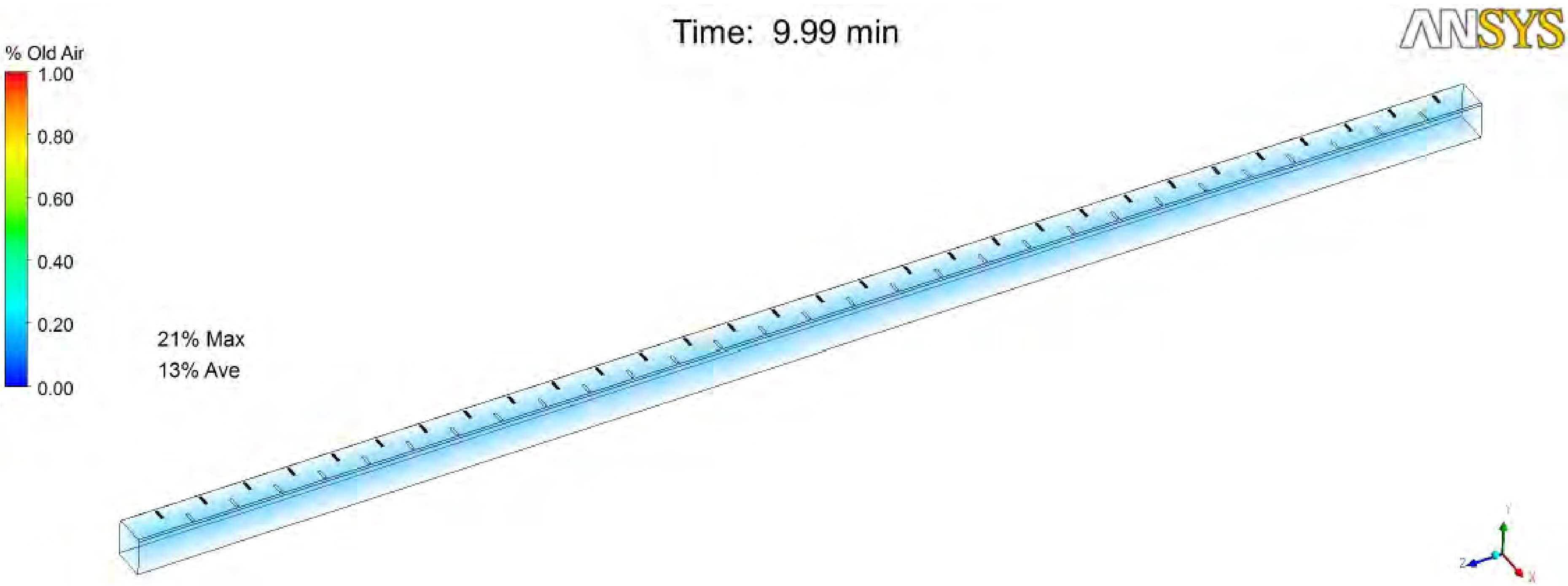

Top View
Side View



Time: 4.99 min
% Old Air
1.00
0.80
0.60
0.40
0.20
0.00
71% Max
37% Ave



Top View
Side View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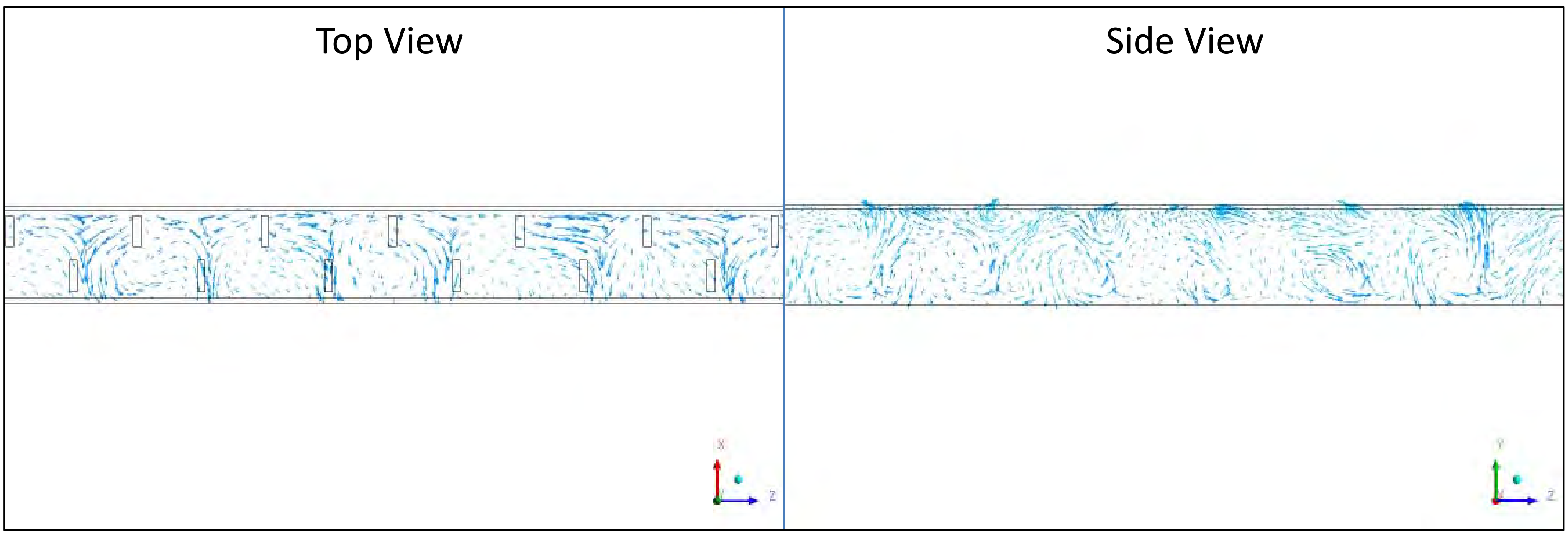
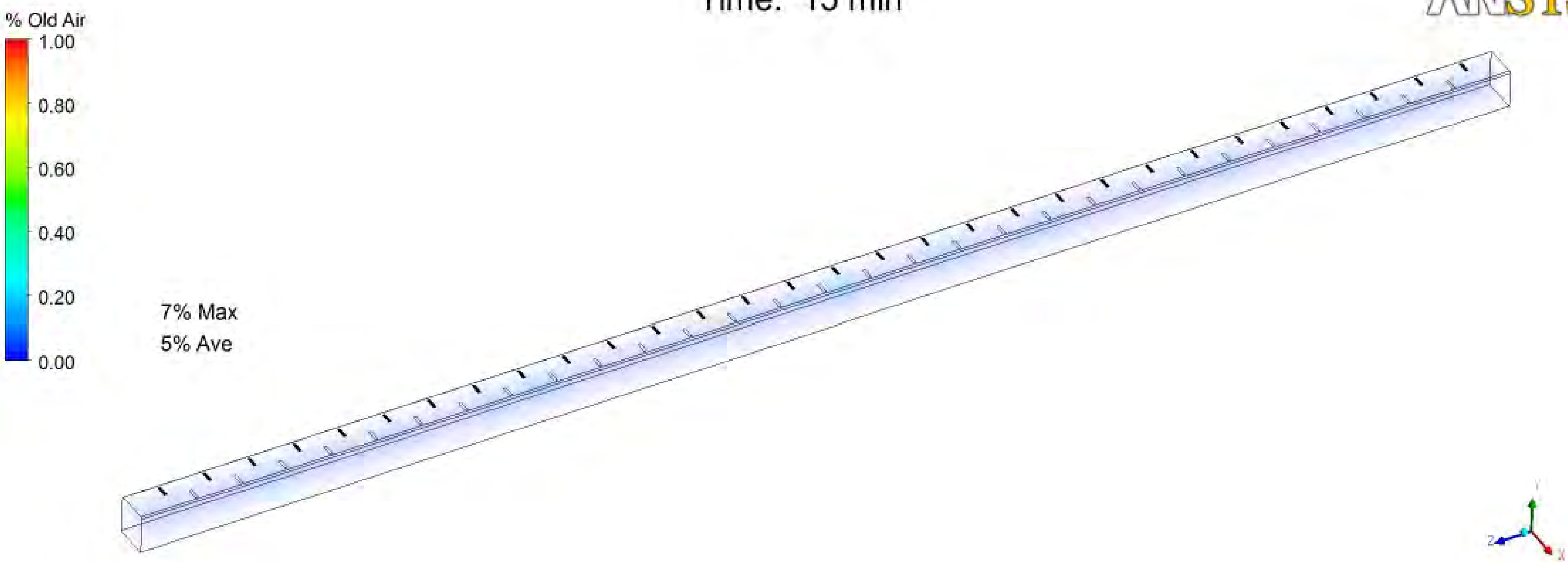
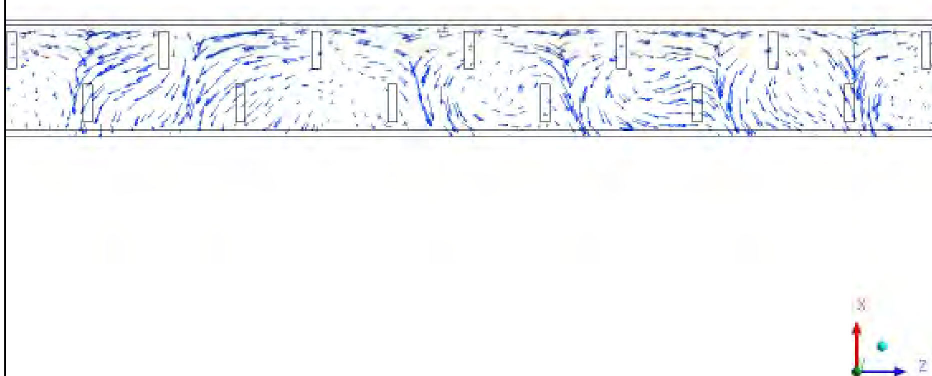
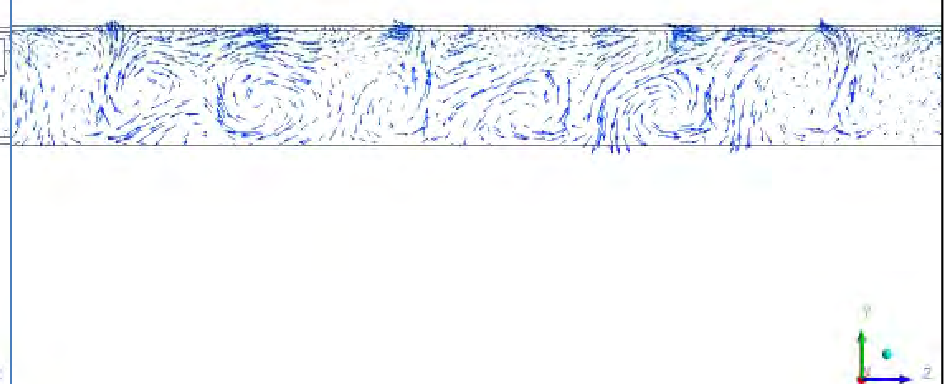
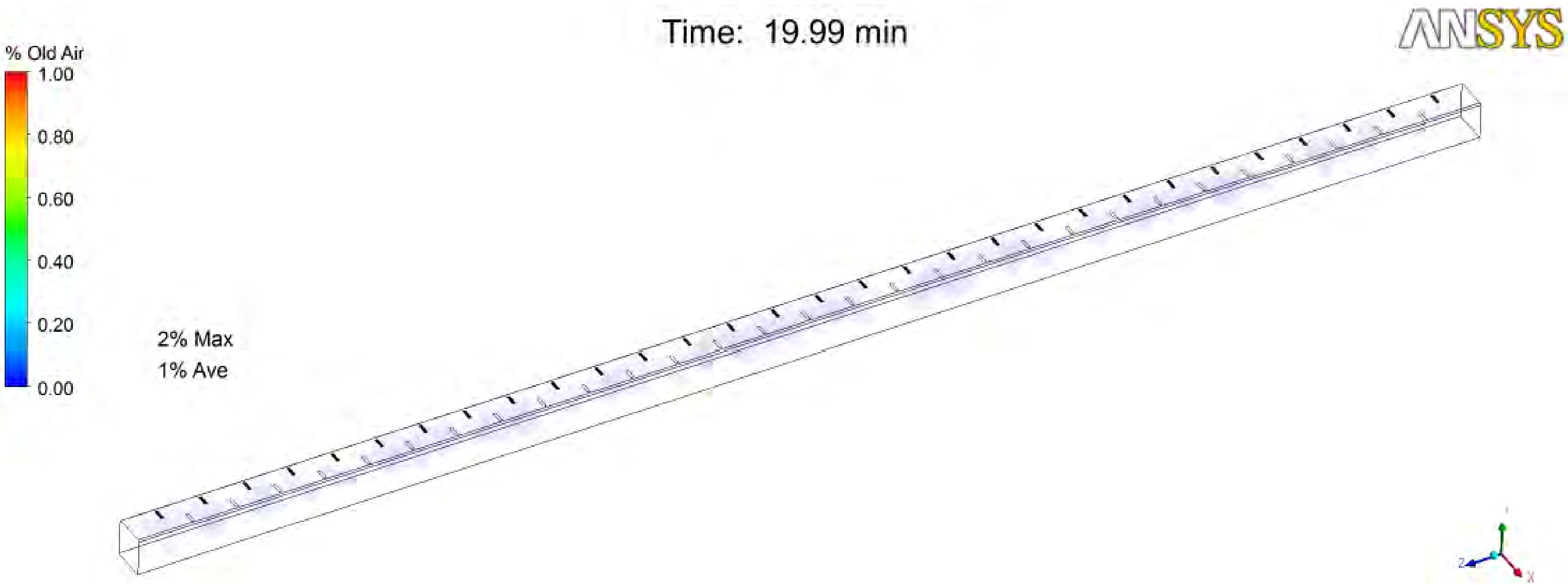
ANSYS
% Old Air
1.00
0.80
0.60
0.40
0.20
0.00
21% Max
13% Ave


Top View
Side View

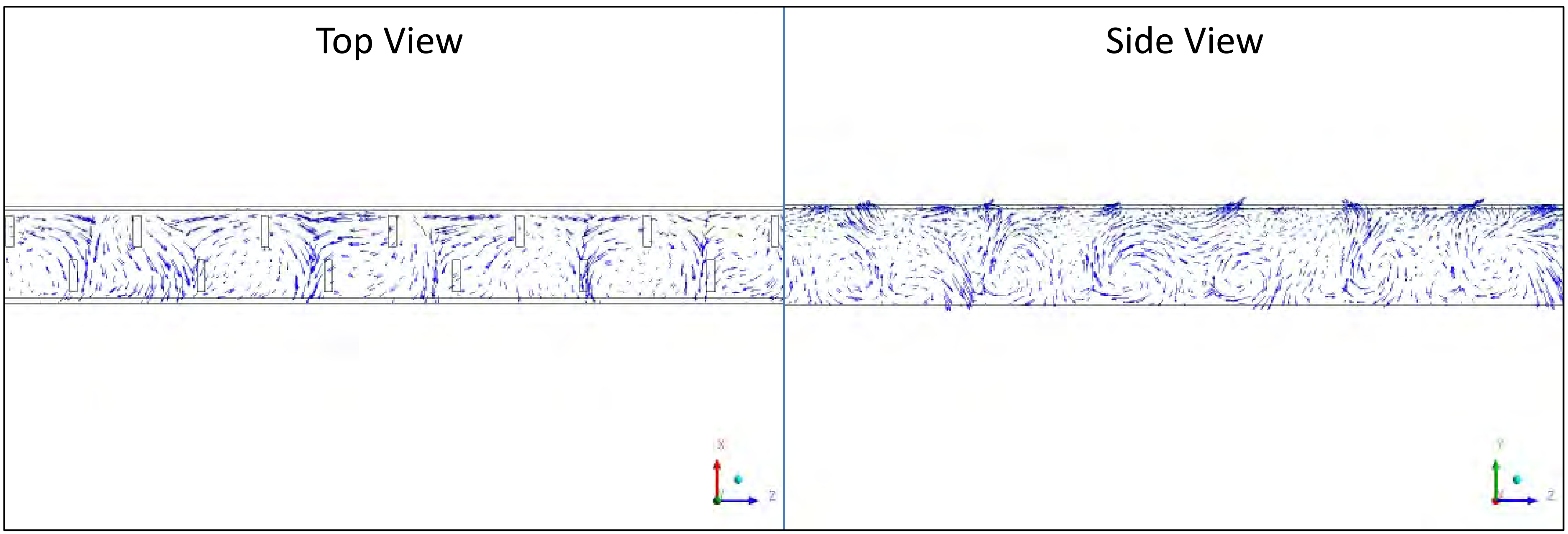
Time: 15 min



Top View	Side View
	



Time: 19.99 min
% Old Air
1.00
0.80
0.60
0.40
0.20
0.00
2% Max
1% Ave



Top View
Side View

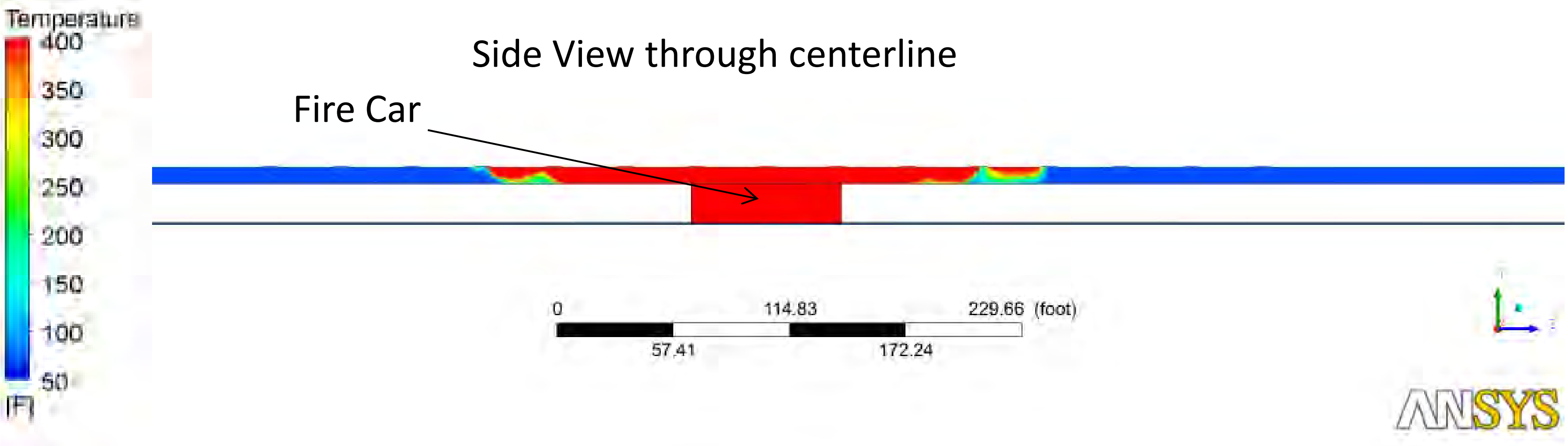
CFD Simulation Results

Emergency Ventilation

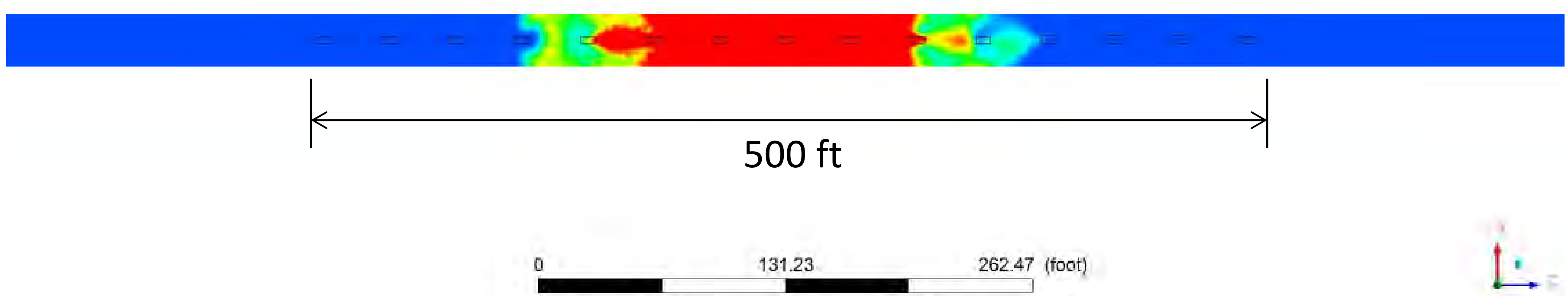
Point Extract

Temperature Distribution

Side View through centerline



Top View just above train



VI. COSTRUCTION COST ESTIMATE

HNTB

Construction Cost Estimate

Conceptual Engineering and Environmental Constraints for Double Track Alignment Alternatives Between Del Mar Fairgrounds and Sorrento Valley

Description	Quantity	Unit	Unit Rate	Total Cost	Notes
Alternative 1: Camino Del Mar - 4.7 Miles					
Guideway: Aerial Structure	7,715	LF	$35,000	$270,025,000	Cost from SD LOSSAN Corridor History
Guideway: Built-up Fill	6,752	LF	$8,962	$60,511,424	Cost from FTA Database
Guideway: Underground Cut & Cover	10,233	LF	$36,171	$370,137,843	Cost from FTA Database + added 30% due to size of structure
Local Roadways	1	LS	$120,000,000	$120,000,000	Estimated
TOTAL ALTERNATIVE 1				**$1,034,909,598**	
Alternative2: Crest Canyon Higher Speed Alignment - 4.5 Miles					
Guideway: Aerial Structure	6,284	LF	$35,000	$219,940,000	Cost from SD LOSSAN Corridor History
Guideway: Built-up Fill	3,403	LF	$8,962	$30,497,686	Cost from FTA Database
Guideway: Underground Cut & Cover	767	LF	$36,171	$27,743,157	Cost from FTA Database + added 30% due to size of structure
Guideway: Underground Tunnel	13,223	LF	$58,534	$773,995,082	Cost from FTA Database + added 30% due to diameter of tunnels + $7500/LF for third tunnel
Local Roadways	1	LS	$90,000,000	$90,000,000	Estimated
TOTAL ALTERNATIVE 2				**$1,334,775,871**	
Alternative 2A: Crest Canyon Alignment - 4.7 Miles					
Guideway: Aerial Structure	8,197	LF	$35,000	$286,895,000	Cost from SD LOSSAN Corridor History
Guideway: Built-up Fill	1,440	LF	$8,962	$12,905,280	Cost from FTA Database
Guideway: Open Trench	2,359	LF	$36,171	$85,327,389	Cost from FTA Database + added 30% due to size of structure
Guideway: Underground Tunnel	12,666	LF	$58,534	$741,391,644	Cost from FTA Database + added 30% due to diameter of tunnels + $7500/LF for third tunnel
Local Roadways	1	LS	$50,000,000	$50,000,000	Estimated
TOTAL ALTERNATIVE 2A				**$1,380,559,111**	
Alternative 3: Interstate 5 Alignment - 5.0 Miles					
Guideway: Aerial Structure	7,693	LF	$35,000	$269,255,000	Cost from SD LOSSAN Corridor History
Guideway: Built-up Fill	2,871	LF	$8,962	$25,729,902	Cost from FTA Database
Guideway: Underground Tunnel	13,031	LF	$58,534	$762,756,554	Cost from FTA Database + added 30% due to diameter of tunnels + $7500/LF for third tunnel
Guideway: Retained Cut or Fill	2,633	LF	$26,317	$69,292,661	Cost from FTA Database + added 30% due to size of structure
Local Roadways	1	LS	$80,000,000	$80,000,000	Estimated
TOTAL ALTERNATIVE 3				**$1,447,287,650**	
Alternative 3A: Interstate 5 East Alignment - 5.1 Miles					
Guideway: Aerial Structure	11,591	LF	$35,000	$405,685,000	Cost from SD LOSSAN Corridor History
Guideway: Built-up Fill	1,440	LF	$8,962	$12,905,280	Cost from FTA Database
Guideway: Underground Tunnel	11,636	LF	$58,534	$681,101,624	Cost from FTA Database + added 30% due to diameter of tunnels + $7500/LF for third tunnel
Guideway: Retained Cut or Fill	2,018	LF	$26,317	$53,107,706	Cost from FTA Database + added 30% due to size of structure
Local Roadways	1	LS	$50,000,000	$50,000,000	Estimated
TOTAL ALTERNATIVE 3A				**$1,451,842,487**	

https://www.transit.dot.gov/capital-cost-database

VII. RIGHT OF WAY COST ESTIMATE

	UNIT	ESTIMATED QUANTITY	COST / AC*	AMOUNT	NOTES
Alternative 1 - Camino Del Mar					
Right of Way Acquisition (Residential)	AC	0.50	$ 16,500,000.00	$8,250,000	Residential Parcels full take for new overpass construction at north portal
Right of Way Acquisition (Commercial)	AC	0.00	$ 19,500,000.00	$0	
Temporary Acquisition (Residential)	AC	4.70	$ 6,100,000.00	$28,659,917	Temporary acquisitions are 10' on either side of the tunnel and assumed 40% residential and 60% commercial temporary take along CDM
Bridge (100' wide easement)	AC	1.49	$ 125,000.00	$186,524	South Portal only
Underground Easement	AC	23.49	$ 2,500.00	$58,729	Complete take public ROW $250k/acre
Portals/Access Easement	AC	6.00	$ 18,300,000.00	$109,800,000	Access Roads/Sites, 2.0 acres each, at each portal & 3 1.0 acres access sites along tunnel, assume 40% residential/60% commercial take along CDM
Temporary Impact	AC	18.79	$ 4,000,000.00	$75,173,554	40' on either side of tunnel, in addition to a 10' Temporary Construction Easement
Temporary Staging	AC	4.00	$ 6,500,000.00	$26,000,000	Assumed staging will take place on commercial property
SUBTOTAL-ACQUISITION				**$250,000,000**	
Alternative 2A - Crest Canyon Higher Speed					
Right of Way Acquisition (Residential)	AC	7.40	$ 16,500,000.00	$122,100,000	7.4 acres of full take of residential parcels at northern portal
Right of Way Acquisition (Commercial)	AC	0.30	$ 19,500,000.00	$5,850,000	0.3 acres of partial take of commercial parcels at northern portal
Temporary Acquisition	AC	1.25	$ 6,100,000.00	$7,646,006	10' on either side of berm and cut and cover box at both ends of tunnel, 40% of take is assumed residential 60% of take is assumed commercial
Bridge (100' Easement)	AC	14.43	$ 125,000.00	$1,803,260	Entire length of bridge across the lagoon
Underground Easement	AC	51.39	$ 88,500.00	$4,547,713	80% Residential and 20% open space, 160' times the length of the tunnel and cut and cover sections.
Portals/Access Easement	AC	5.00	$ 8,437,500.00	$42,187,500	50% Open Space/ROW and 50% Residential Take
Temporary Staging	AC	4.00	$ 6,500,000.00	$26,000,000	Assumed staging will take place on commercial property
SUBTOTAL-ACQUISITION				**$210,000,000**	
Alternative 2B - Crest Canyon					
Right of Way Acquisition (Residential)	AC	4.40	$ 16,500,000.00	$72,600,000	First trench south of Jimmy Durante 100 feet wide
Right of Way Acquisition (Commercial)	AC	1.15	$ 19,500,000.00	$22,425,000	North bridge over commercial full take north of Jimmy Durante
Temporary Acquisition	AC	1.08	$ 5,500,000.00	$5,957,071	10' on either side of open trench, assumed 100% residential take
South Portal Trench		1.07	$ 375,000.00	$402,893	Open Space
South Portal Bridge (100' Easement)	AC	3.70	$ 125,000.00	$462,580	Open Space
Underground Easement	AC	46.52	$ 24,000.00	$1,116,562	80% Open Space/ROW and 20% Residential
Portals/Access Easement	AC	5.00	$ 8,437,500.00	$42,187,500	50% Residential and 50% Open Space/ROW take
Temporary Staging	AC	4.00	$ 6,500,000.00	$26,000,000	Assumed staging will take place on commercial property
SUBTOTAL-ACQUISITION				**$170,000,000**	
Alternative 3A - I-5					
Right of Way Acquisition (Residential)	AC	7.50	$ 16,500,000.00	$123,750,000	7.5 Acres of full residential take at north portal and 10.5 ac
Right of Way Acquisition (Commercial)	AC	3.30	$ 19,500,000.00	$64,350,000	3.3 acres of full commercial take at north portal
Temporary Acquisition	AC	1.05	$ 5,500,000.00	$5,767,677	10' on either side of open trench: 100% Residential
Trench Easement	AC	5.91	$ 16,500,000.00	$97,590,909	100% Residential
Bridge (100' Easement)	AC	17.57	$ 125,000.00	$2,196,683	Both bridges 100% Open Space/ROW
Underground Easement	AC	43.58	$ 56,250.00	$2,451,653	50% Open Space/ROW, 50% Residential
Portals/Access Easement	AC	7.00	$ 8,437,500.00	$59,062,500	50% Open Space/ROW, 50% Residential
Temporary Staging	AC	4.00	$ 6,500,000.00	$26,000,000	Assumed staging will take place on commercial property
SUBTOTAL-ACQUISITION				**$380,000,000**	

Alternative 3B - I-5 East					
Right of Way Acquisition (Residential)	AC	6.52	$ 16,500,000.00	$107,553,030	Assuming 100% residential take on first three open trenches.
Right of Way Acquisition (Commercial)	AC	1.15	$ 19,500,000.00	$22,338,154	20% of the first bridge is assumed Commercial Take
Temporary Acquisition	AC	0.77	$ 5,500,000.00	$4,214,646	10' on either side of all open trenches, 100% residential
Bridge (100' Easement in Open Space/ROW)	AC	20.61	$ 125,000.00	$2,576,045	
Bridge (100' Easement in Residential)	AC	6.80	$ 5,500,000.00	$37,424,242	
Underground Easement	AC	42.74	$ 56,250.00	$2,404,132	50% Residential and 50% Open Space/ROW take
Portals/Access Easement	AC	5.00	$ 8,437,500.00	$42,187,500	50% Residential and 50% Open Space/ROW take
Temporary Staging	AC	4.00	$ 6,500,000.00	$26,000,000	Assumed staging will take place on commercial property
SUBTOTAL-ACQUISITION				**$240,000,000**	

Market Values[1]*:	
Residential	$ 11,000,000.00
Commercial	$ 13,000,000.00
Open Space/Existing ROW	$ 250,000.00

[1]Market Values based on average cost of land per square foot of lot per Zillow.com and Redfin.com

* Market Value for land acquisition is weighted by land use type, i.e. 40% Residential and 60% Commercial
= (0.4 x $11,000,000) + (0.6 x $13,000,000) = $12,200,000

Notes:
1. Market Values have been adjusted to represent the reduction or increase in acquisition value based on type of take:
   a. Underground Easements = 1% of Total Value - supported by legal decisions on behalf of Sound Transit for Beacon Hill 2005
   b. Above Ground Easements over vacant land or open space = 100% of Total Value
   c. Above Ground Easements over commercial or residential property = 150% of Total Value (includes relocation/business loss)
   d. Temporary Easements = 50% of Total Value
2. Easements for bridge construction where some use is still available is assumed 50% of Total Value - Sound Transit Beacon Hill -2005. Value = value of partial take + diminution in value which is generally twice the actual value. Value varies.
3. Temporary impacts on Camino Del Mar commercial frontage, assumed $12 per SF monthly rent for two-story mixed used buildings.

VIII. HIGH LEVEL TECHNICAL REVIEW MEMORANDUM

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Date
10-31-17

To
Linda Culp,
SANDAG Project Manager

From
Mark Ramsey
Eric Wang
HNTB

High Level Technical Review Memo:
Conceptual Engineering and Environmental Constraints for Double Track Alignment Alternatives Between Del Mar Fairgrounds and Sorrento Valley

This memorandum presents our initial comments on the tunnel alignment alternatives based upon review of the following documents received:

- *Reference 1* - Conceptual Engineering and Environmental Constraints for Double Track Alignment Alternatives between Del Mar Fairgrounds and Sorrento Valley Draft Summary Report dated November 14, 2014 prepared by David Evans and Associates, Inc. (David Evans & Associates, 2014)
- *Reference 2* - Conceptual Engineering and Environmental Constraints for Double Track Alignment Alternatives between Del Mar Fairgrounds and Sorrento Valley Preliminary Geotechnical Evaluation dated November 7, 2014 prepared by Ninyo & Moore. (Ninyo & Moore, 2014)
- *Reference 3* - Memorandum – Peer Review of Alignment Alternatives San Dieguito Double Track (SDDT) Project dated May 31, 2013 prepared by Jacobs Associates. (Jacobs Associates, 2013)
- *Reference 4* - Conceptual Engineering and Environmental Constraints for Double Track Alignment Alternatives between Del Mar Fairgrounds and Sorrento Valley Ventilation Report dated November 14, 2014 prepared by AECOM. (AECOM, 2014)

Alignment Alternative 1 – Camino Del Mar

Comments

- The North Portal located within City of Del Mar Right-of-Way at approximate Station 12878+00 involves an approximately 74-ft deep cut excavation generally through 15-ft loose to medium-dense fine-grained overburden soils and almost 60-ft of soft rock (Delmar Formation) comprised of Claystone and Sandstone. Total 28-ft cover includes about 13-ft in soft rock.
  - Cross-section D-D on Sheet No. 5 of Reference 1 indicates an existing building adjacent to the portal approximately 25-ft beyond the limits of the cut-&-cover box. Subsequent

design phase should include gathering as-built foundation records, specifically type and location for assessment of excavation impact (EIAR) and to develop acceptable support of excavation systems and geotechnical monitoring requirements.

  - Moisture-sensitive unconsolidated Silty to Clayey SAND and Sandy CLAY should be protected from exposure by applying shotcrete to maintain stability of the excavation.
  - Section 5.7 of Reference 2 mentions "The claystone interbeds within the Delmar Formation are typically highly fractured and sheared, thus contributing to potential instability of slopes underlain by this unit." Landslide susceptibility of headwall area, depending on the location of these claystone interbeds and considering the relatively shallow 15-ft height of overburden, expectation of significant landslide appears low. However, slope stabilization contingency measures should be available in case of localized occurrence.
    Landslide susceptibility – Confirm space is available to accommodate "benching" or provide other stabilization measures

- Cut-&-cover tunnel approximately 10,200-linear foot.
  - Invert stability of the cut-and-cover box structure founded within Delmar Formation – claystone highly expansive requires Swell Potential [ASTM D4546] testing of representative samples for invert slab and box structure design loading.
  - Suggest consideration of Installing a center row of piles to facilitate deck beam installation for temporary lane closures. This will allow only half of the road to be closed for the installation of the decking thus significantly reducing the traffic and neighborhood impacts of the decking installation.
  - Cut-and-cover tunnel appears feasible if impacts on overlying utilities and surface structures can be minimized. The cut-and-cover tunnel will require significant utility relocations and/or utility improvements to be able to support some of the utilities in place.
  - Longitudinal profile shows that rock, either Delmar Formation of Torrey Sandstone is anticipated along the entire alignment. Depending on the rippability characteristics of the rock, mechanized excavators may be used in addition to drill-&-blast excavation for improved production associated reduction in noise and vibration levels.
  - Mining option - the shallow cover conditions (less than 0.5 times tunnel box width) would probably require modified curved arch cross-sectional geometry compatible with smaller mined Sequential Excavation Method (SEM) option with pre-support measures such as canopy arch piling, lattice girder and shotcrete system.

- South Portal at approx. Sta. 12961+19 is located near base of 1H:3V slope, north of existing fault and depression.
  - Reference 2 indicates faults within the project alignment are considered inactive. However, design of the support of excavation (SOE) for the south portal area near a fault should consider increased lateral loads due to presence of sheared rock and associated infill material creating potential "squeezing ground" conditions.
  - Reference 3 states "Muck haulage from excavation has to be hauled to the South Portal." Depending on suitability of the muck, explore option to use as backfill for

abutment of future bridge to the south if the volumes warrant. Consider potential alternatives to conventional muck haulage via trucking, such as use of elevated enclosed truss muck conveyance structure which may be incorporated with existing bridge structures spanning busy thoroughfares. Additional benefit of such a muck conveyance system would be reduced noise, vibration, dust and traffic impact on local streets and residents.
    - Identify available site locations near portal for sedimentation tank for temporary storage of tunnel dewatering for water quality testing and treatment prior to acceptance for discharge into public sewage system.

- Reference 4 indicates that the use of a transverse ventilation system will be the most effective. However, the material used for this ductwork/plenum needs to be carefully considered to ensure it can withstand the air pressure as well as any fire scenario.
- The vertical ventilation/escape shafts vary in depth from 45-ft to 60-ft typically extending from ground surface through overburden, but occasionally penetrating down into underlying rock before connecting to the tunnel. Ground control measures using rigid support of excavation (SOE) systems with sufficient embedment to ensure groundwater cut-off is anticipated where adverse ground conditions are present. Actual surface conditions including construction clearances and proximity to existing building foundations may restrict feasible drilling methods for SOE installation. Identify all structures within the zone of excavation influence, collect relevant as-built building and foundation data – type and location to evaluate excavation impact on those structures, conduct pre-construction condition survey to establish baseline conditions for geotechnical instrumentation and monitoring program requirements.

<u>Alignment Alternative 2 – Canyon Crest Alignment and Crest Canyon Higher Speed Option</u>

The Crest Canyon Alignment and Crest Canyon Higher Speed Option follow a similar alignment under Crest Canyon with the higher speed option following a straighter path to improve speed. The Crest Canyon Alignment removes part of the proposed SDDT bridge and turns sharply to the east with a bridge over Jimmy Durante Boulevard and 2,000 feet of open cut south of San Dieguito Drive to the tunnel portal. The Crest Canyon Higher Speed Option maintains the existing SDDT bridge and continues on a raised berm for approximately 2,000 feet before entering the tunnel segment. The comments below relate to both tunnel options.

- The South Portal construction will entail open trench excavation into the Delmar Formation at the base of very steep rock slope exceeding 120-ft (slightly less for Crest Canyon Alignment) at the north end of the bridge spanning existing depressed ground.
    - Due to the difficulty of installing rock slope stabilization for overlying Torrey Sandstone identified in Reference 2 as possessing relatively thin claystone beds near the base of the unit it may be helpful to consider the addition of portal canopies projected from the headwall to provide protection against potential rock falls.
- To minimize production delays, identify adequate site storage and handling location for the tunnel precast segmental lining. This will require a minimum of 2 acres.
- Design of tunnel precast segmental lining should consider the effects of the potential expansive clay.

- Pressurized face tunnel boring machine (TBM) with short tapered shield to provide ground support through soft rock with expansive clay features. Outfit the TBM with convergence measuring device to detect squeezing ground conditions in advance.
- Evaluate the squeezing ground potential in fault zone with consideration of relatively softer rock and convergence due to development of plastic failure zone. Modify excavation sequence to use over-boring with extra gauge housing in periphery of the cutterhead and allow initial controlled ground movement without risk of trapping the TBM. Install yielding support system.
- Reference 4 refers to use of vent shafts. If emergency exit shafts are planned, these emergency exits should be planned to house the vent shaft as well.
- The addition of an emergency egress center tunnel which is 18.5-ft diameter is unusual for a traditional twin bore tunnel design. This emergency egress tunnel could be eliminated with the excavation of cross passages between the running tunnels and a walkway within the running tunnels. This would allow evacuation into the non-event tunnel in case of an emergency. Another option would be to excavate emergency evacuation shafts at 2500' intervals along the alignment. The verticality of deep shaft SOE systems on the order of 270 feet deep would be challenging and may require the excavation of a telescoping shafts to control depths under each system. Explore walkway option to see if current diameter can accommodate or enlargement would be needed for the walkway.

<u>Alignment Alternative 3 – I-5 Alignment</u>

The I-5 Alignment and the I-5-East Alignment both include similar tunnel segments under I-5. The variations in alignment occur between the SDDT Bridge and the northerly tunnel portal. The I-5 alignment includes a second bored tunnel and maintains the existing SDDT bridge. The I-5 East Alignment removes a portion of the SDDT bridge and utilizes aerial structure to span local roads north of the tunnel portal. The comments below relate to both alignments.

- The North Portal would be constructed from a retained cut at the base of a very steep slope of approximately 160-ft high.
    - Considering that the open cut excavation would expect to encounter thin olive gray Claystone beds near the base of the Torrey Sandstone unit (Reference 2) unit as well as the very steep and high overlying rock slope, suggest that addition of a protective tunnel portal canopy extension be considered. Due to the significant slope height exceeding 150-ft, installation of surface protection and ground support of this area may be challenging.
- At the South Portal the existing 40-ft depression at the base of the steep southern slope would require construction of a bridge spanning the depressed ground and initial open trench to reach minimum 25-ft cover at south portal.
    - SOE for sloping ground to maximum 60-ft cut depth toed into underlying rock would be needed for stable retained cut.
    - TBM assembly and launch would commence after installation of portal headwall ground support.
- To minimize production delays, identify adequate site storage and handling location for the tunnel precast segmental lining. This will require a minimum of 2 acres.

- Design of tunnel precast segmental lining should consider the effects of the potential expansive clay.
- Consider Pressurized face tunnel boring machine (TBM) with short tapered shield to provide ground support through soft rock with expansive clay features. Outfit the TBM with convergence measuring device to detect squeezing ground conditions in advance.
- Reference 4 refers to use of vent shafts. If emergency exit shafts are planned, these emergency exits should be planned to house the vent shaft as well.
- The addition of an emergency egress center tunnel which is 18.5-ft diameter is unusual for a twin bore tunnel design. This emergency egress tunnel could be eliminated with the excavation of cross passages between the running tunnels and a walkway within the running tunnels. This would allow evacuation into the non-event tunnel in case of an emergency. Another option would be to excavate emergency evacuation shafts at 2500' intervals along the alignment. The verticality of deep shaft SOE systems on the order of 270 feet deep would be challenging and may require the excavation of a telescoping shafts to control depths under each system. Explore walkway option to see if current diameter can accommodate or enlargement would be needed for the walkway.