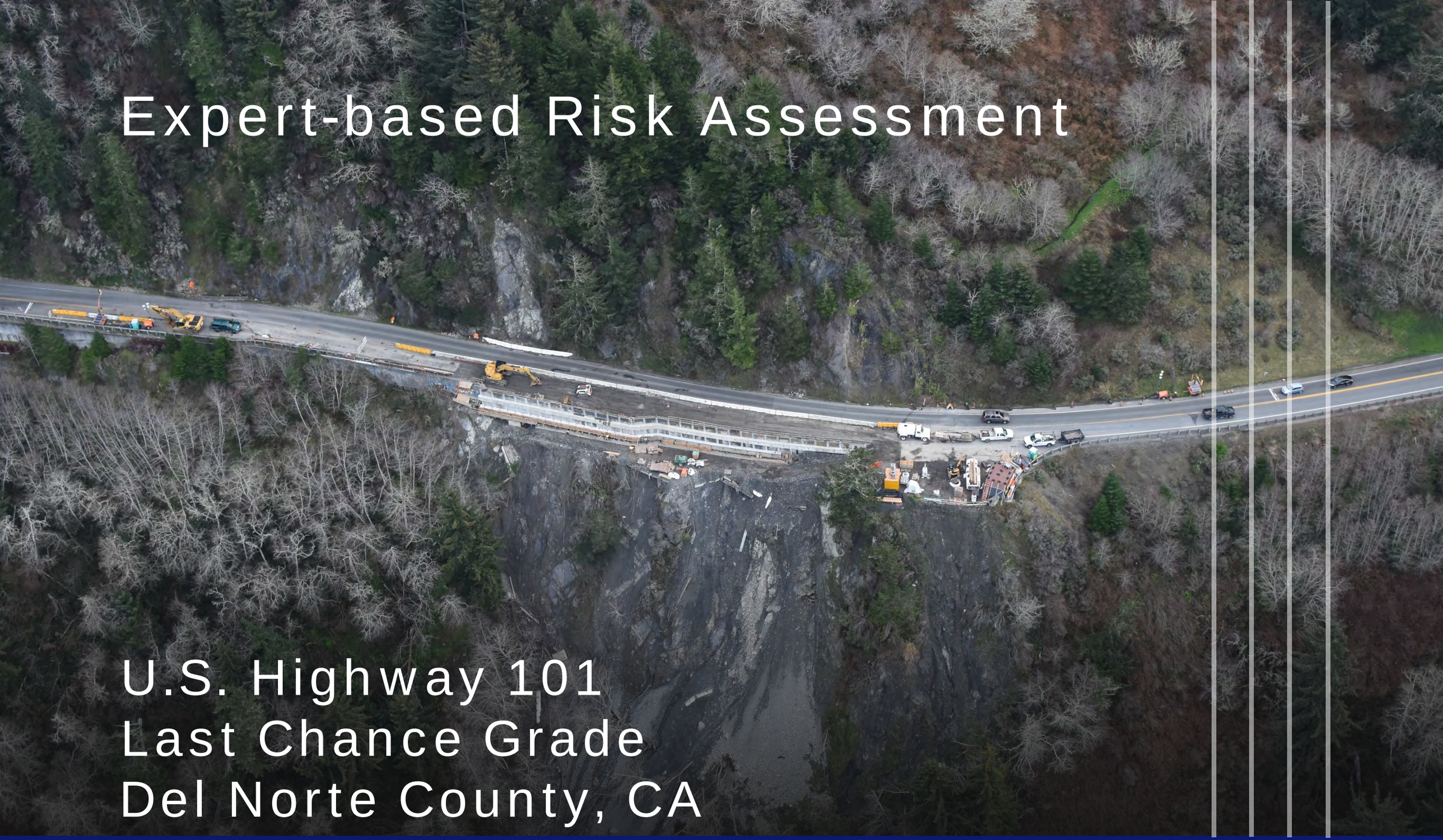
Expert-based Risk Assessment



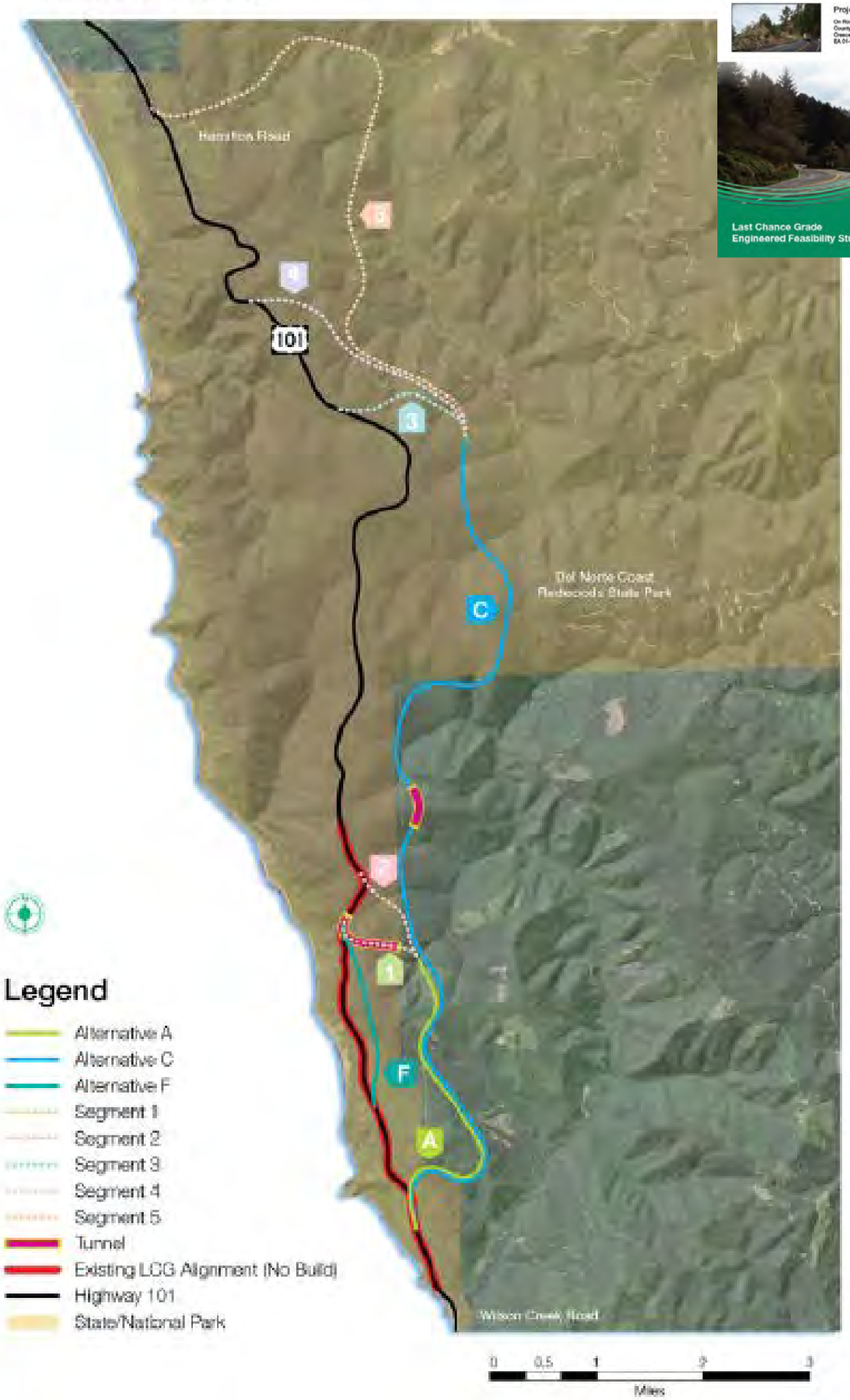
U.S. Highway 101
Last Chance Grade
Del Norte County, CA

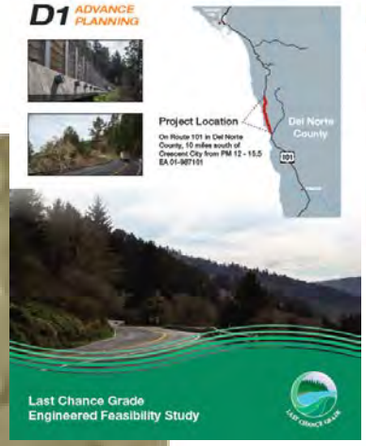
bgcengineering.com

BGC

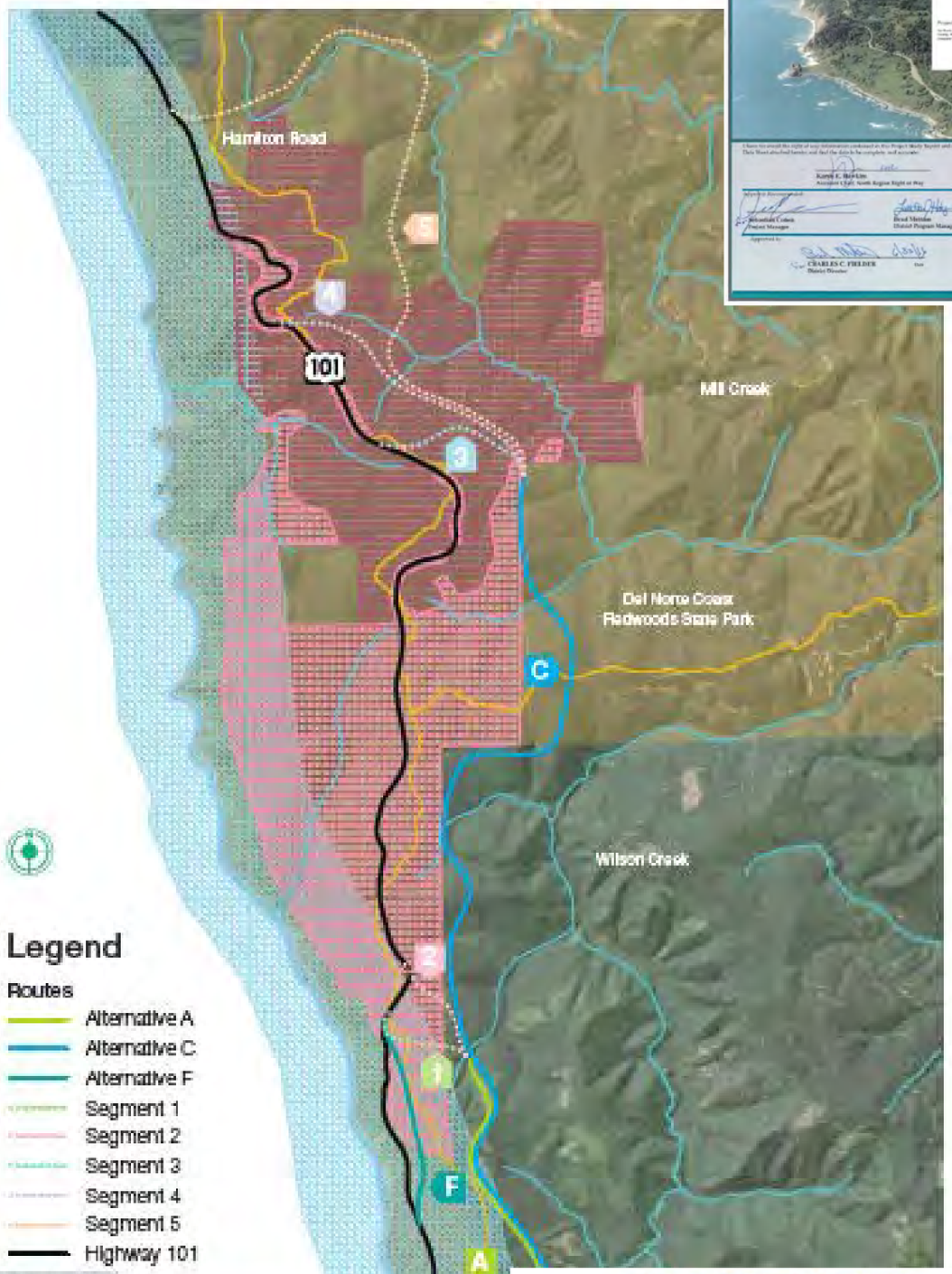
MAP OF ALTERNATIVES

A1, A2, C3, C4, C5, F

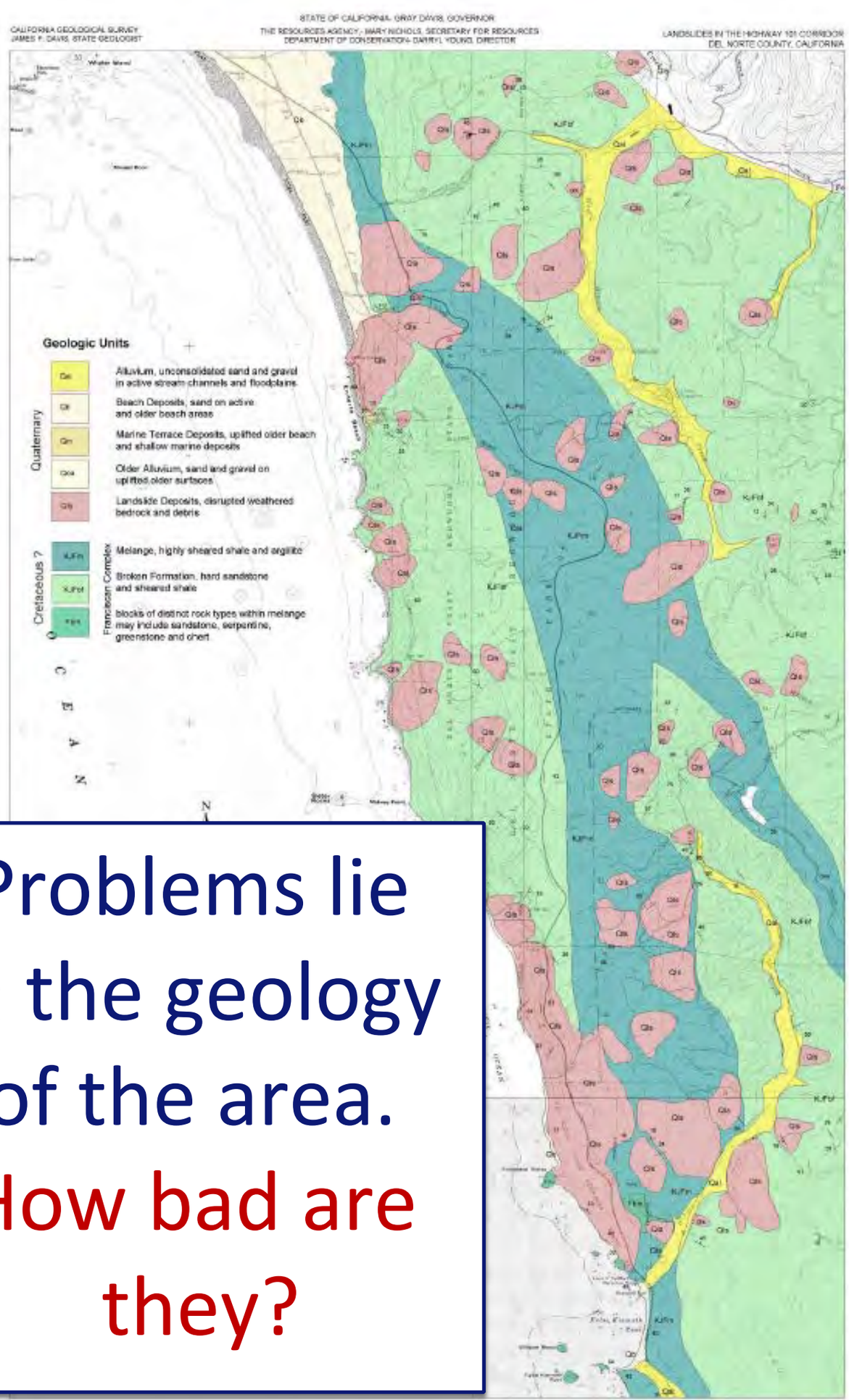


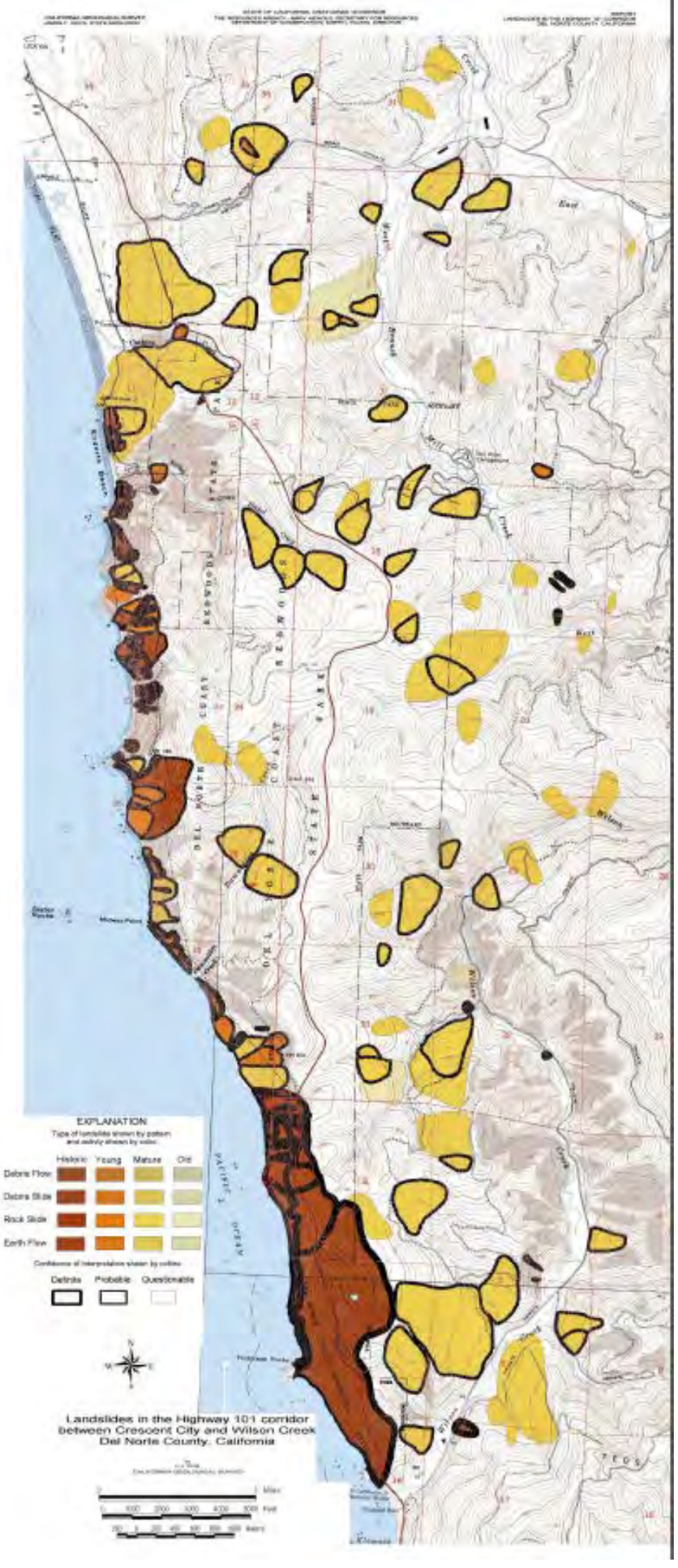


ENVIRONMENTAL RESOURCES



Preliminary Alternatives:
A1, A2, C3, C4, C5, F

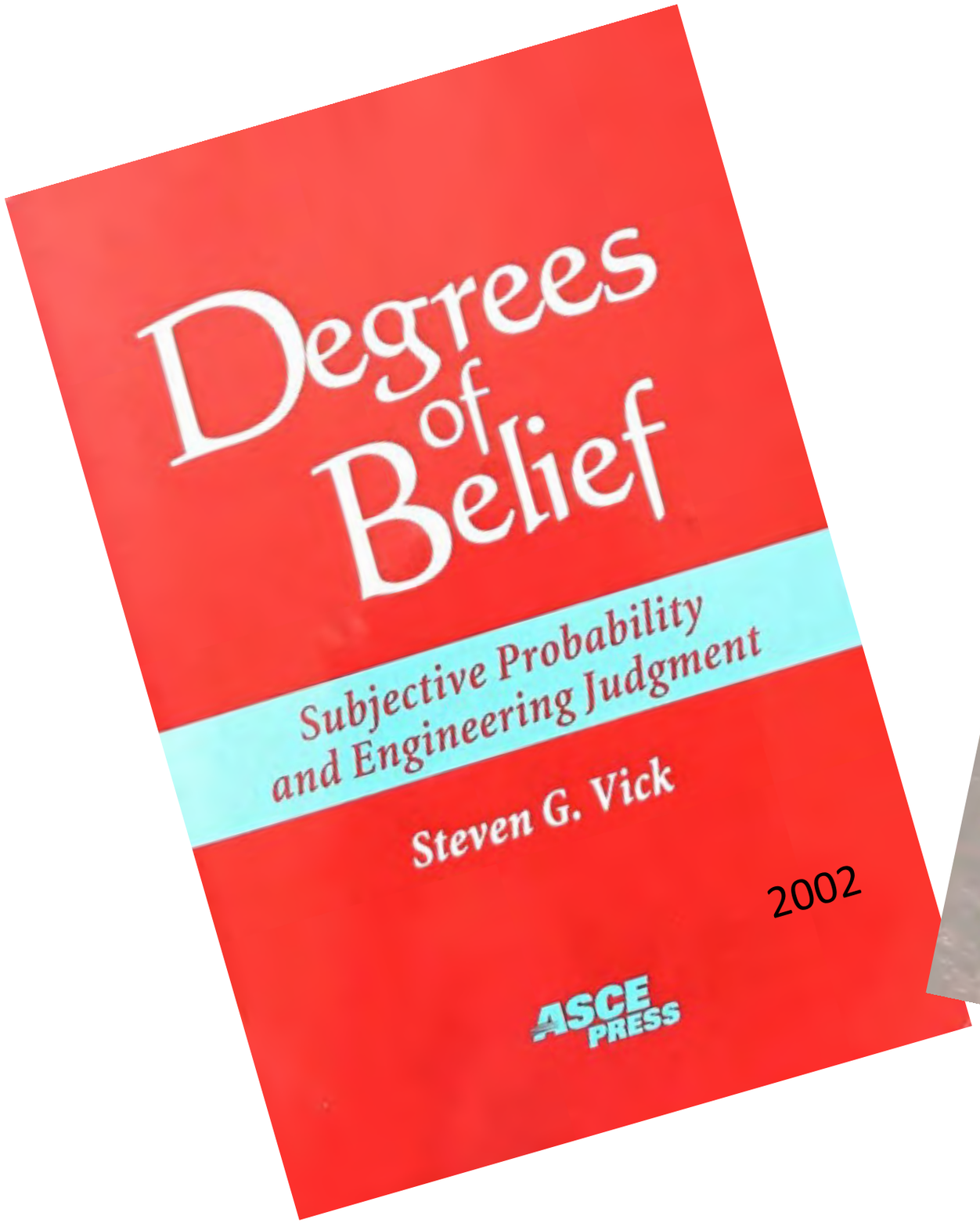




Problems lie in the geology of the area.

How bad are they?

Quantifying Judgment

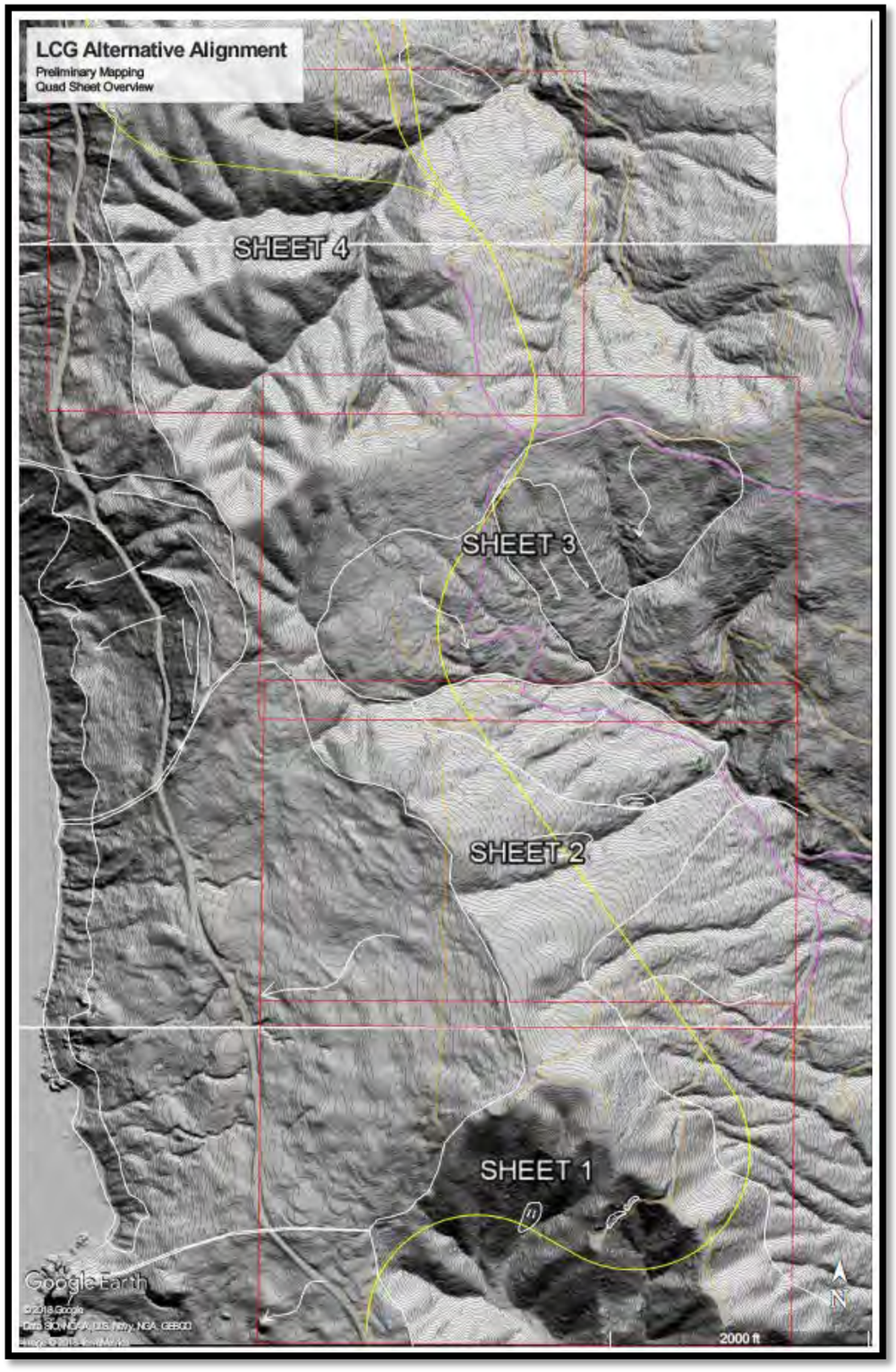


Transfer Project Understanding

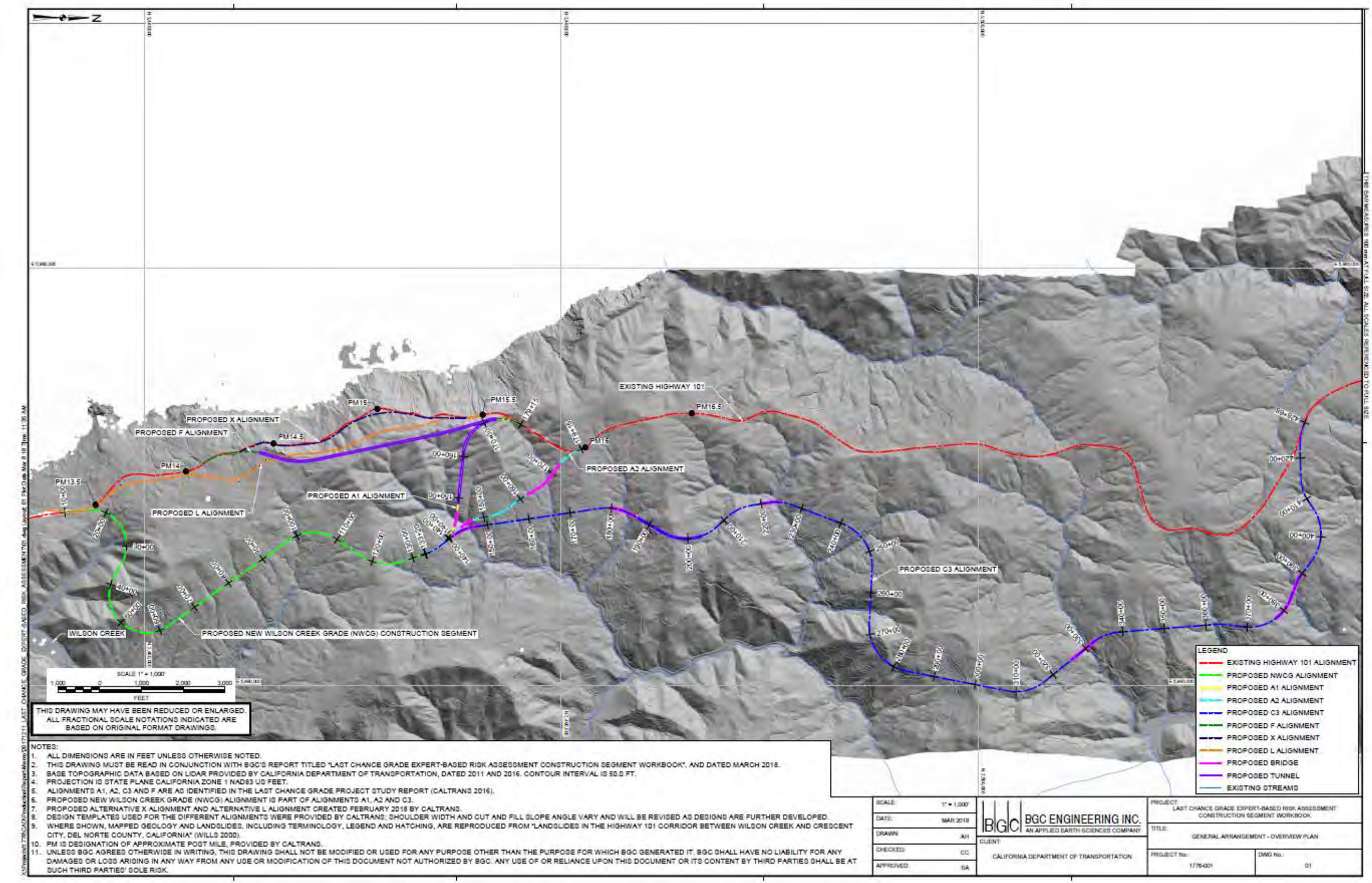
- In the field

Transfer Project Understanding

- At the desk
  - Caltrans' experience
  - Published reports and materials
  - Geologic and landslide studies



Lidar Hillshade of Alternatives



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3. BASE TOPOGRAPHIC DATA BASED ON LIDAR PROVIDED BY CALIFORNIA DEPARTMENT OF TRANSPORTATION, DATED 2011 AND 2016. CONTOUR INTERVAL IS 50.0 FT.
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SCALE:	1" = 1,000
DATE:	MAR 2018
DRAWN:	AH
CHECKED:	CC
APPROVED:	SA

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AN APPLIED EARTH SCIENCES COMPANY

CLIENT: CALIFORNIA DEPARTMENT OF TRANSPORTATION

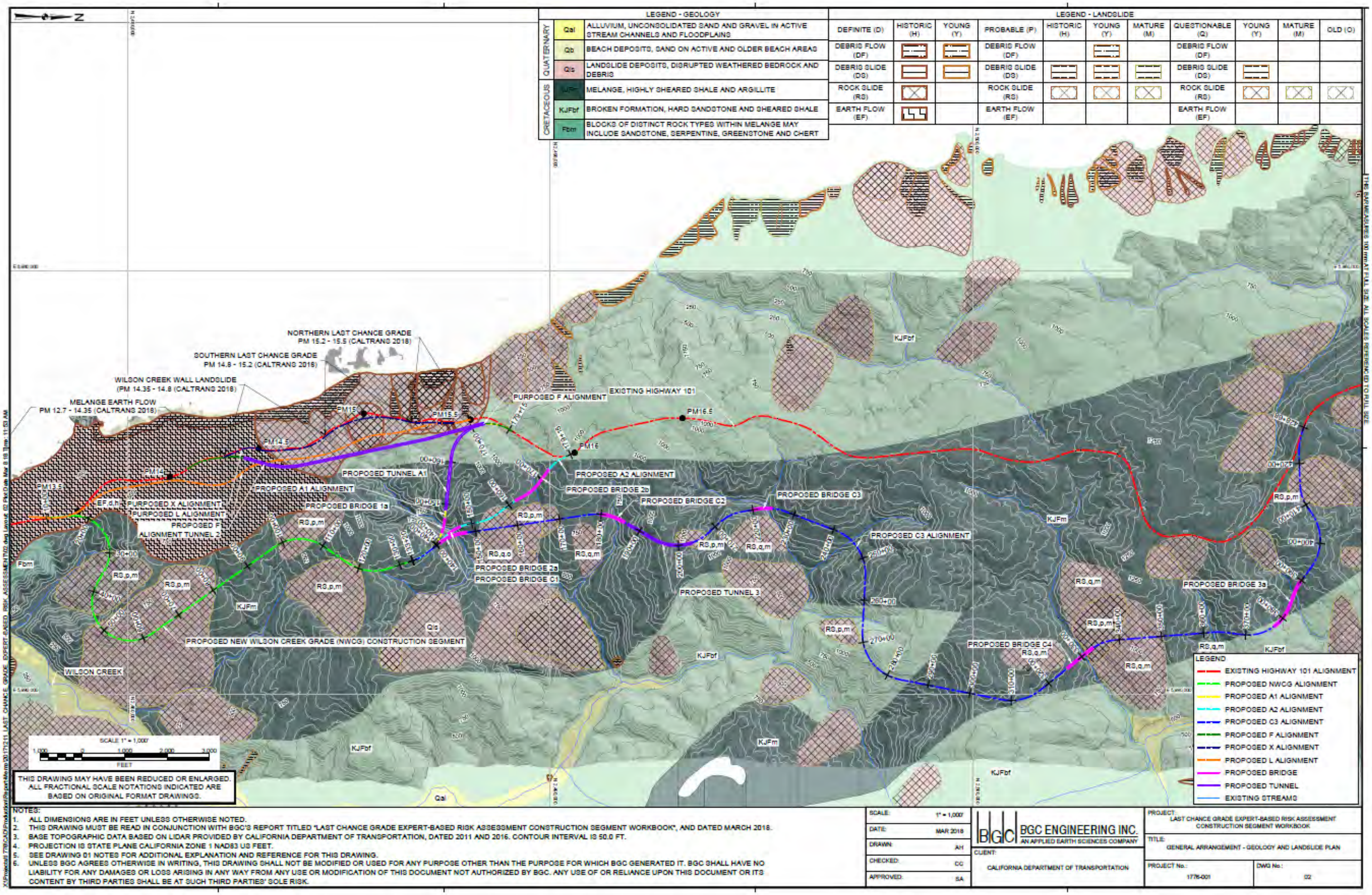
PROJECT: LAST CHANCE GRADE EXPERT-BASED RISK ASSESSMENT CONSTRUCTION SEGMENT WORKBOOK

TITLE: GENERAL ARRANGEMENT - OVERVIEW PLAN

PROJECT No.: 1776001

DWG No.: 01

Geology and Landslides



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AN APPLIED EARTH SCIENCES COMPANY

CLIENT: CALIFORNIA DEPARTMENT OF TRANSPORTATION

PROJECT: LAST CHANCE GRADE EXPERT-BASED RISK ASSESSMENT CONSTRUCTION SEGMENT WORKBOOK

TITLE: GENERAL ARRANGEMENT - GEOLOGY AND LANDSLIDE PLAN

PROJECT No.: 1776-001

DWG No.: 02

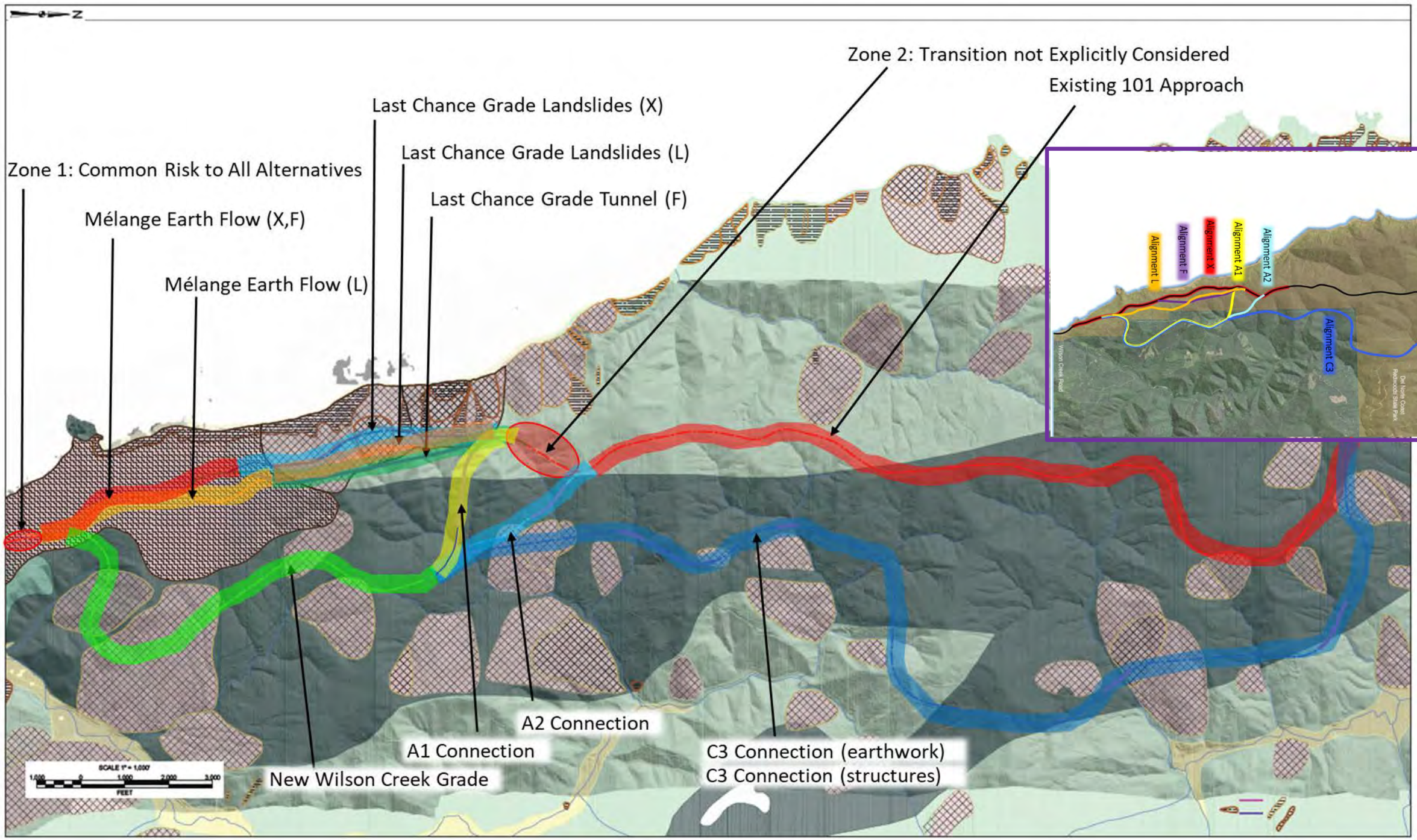
HoloLens Model

Mixed Reality
partnership with
Microsoft

HoloLens Model

The panel gets to work:

- One Construction Segment at a time
- Precise Definitions
- Rules of Probability



Sometime after construction, what is the chance of:

... having high maintenance cost?

... unusual repairs that cause delays?

... requiring long-term closure or abandonment?

Two Times *and* Three Impacts

10 & 50 years *and* "Cost", "Mobility", "Closure"

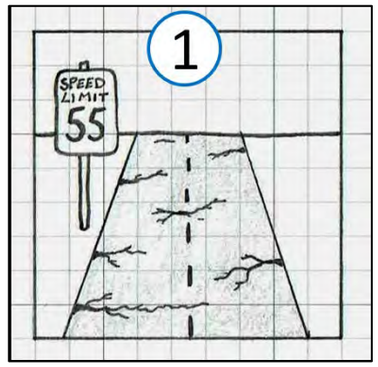
Six Alternatives

Alignments X, L, F, A1, A2, C3 (as viewed from the south)

Partial results shown here

Impacts

"Cost"



Low Cost?

Yes

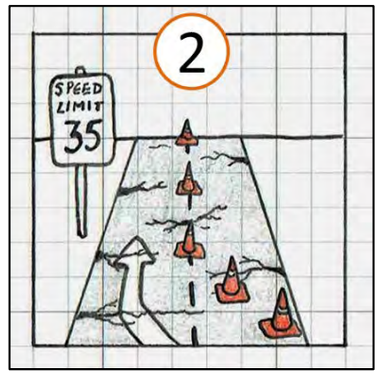
No

Only A Little Delay?

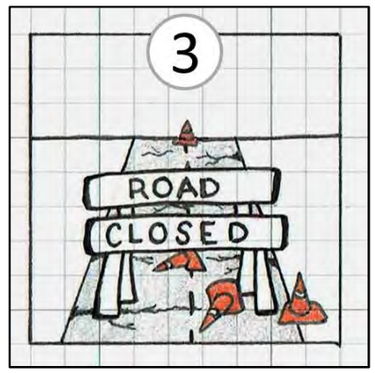
Yes

No

"Mobility"



"Closure"



Long-term Closure Avoided?

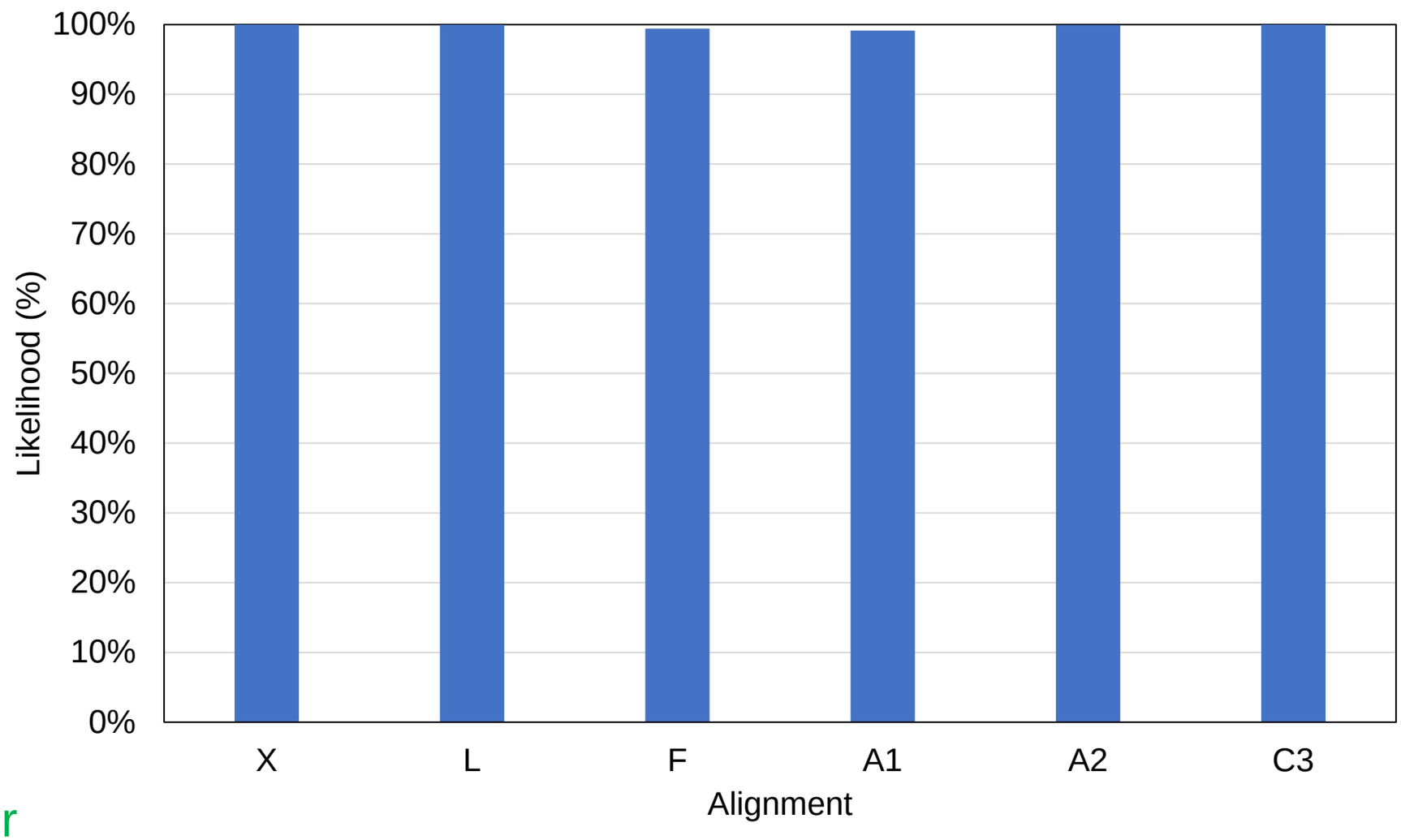
Yes

No

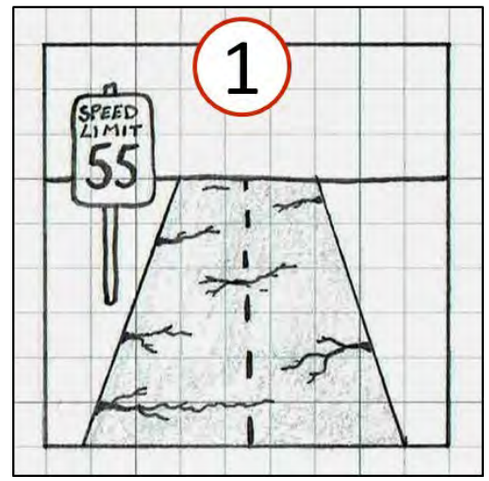
Impacts happen in sequence

Impact of Maintenance Cost
(through 50 Years)

Worse

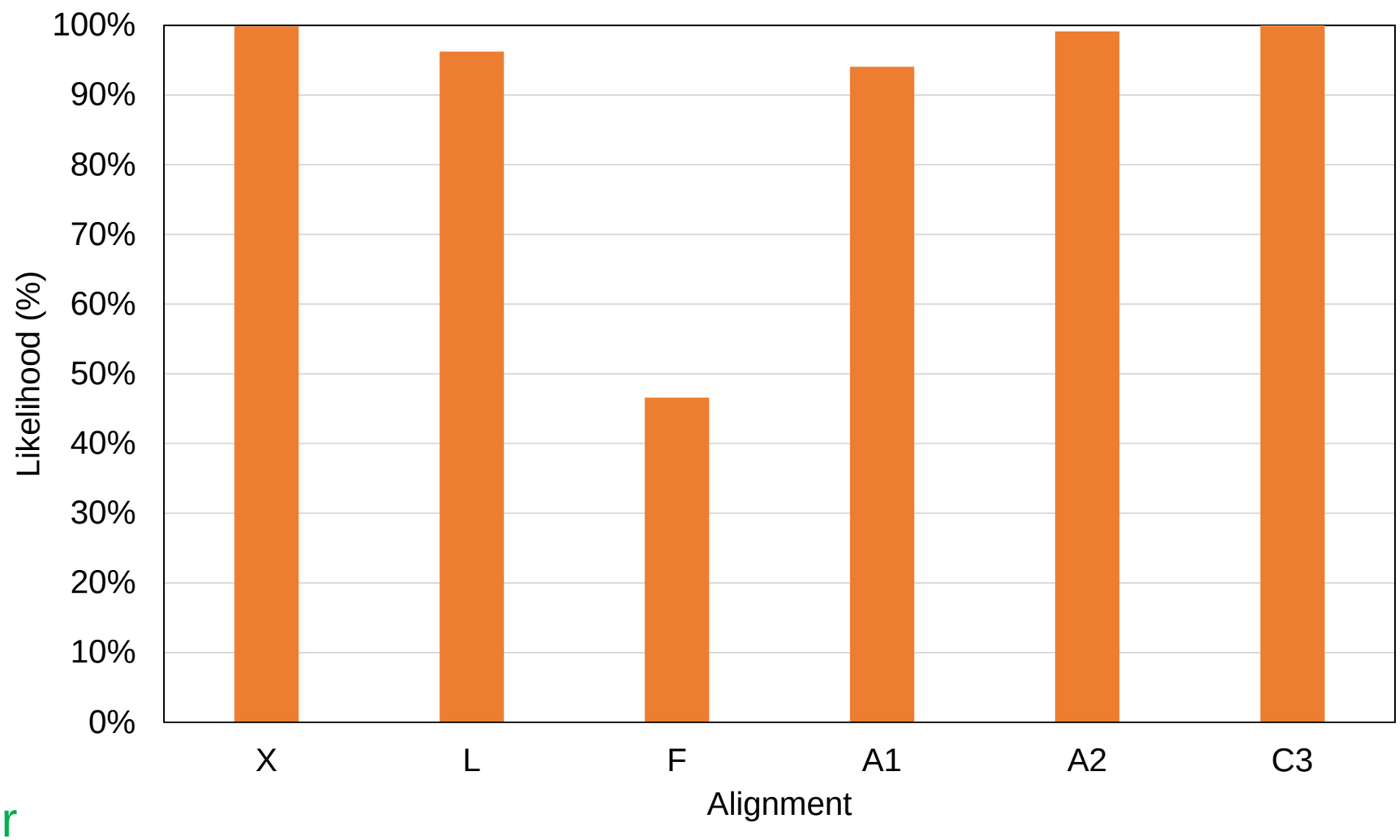


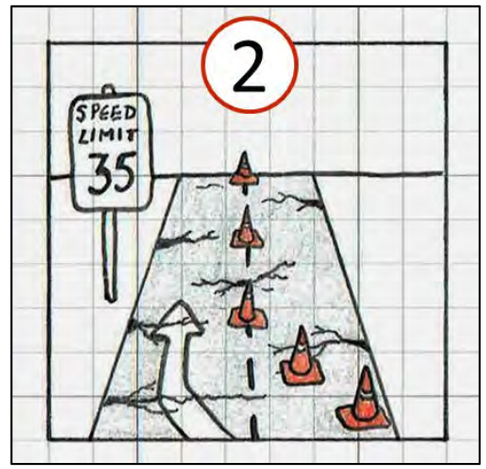
Better



Impact of Repair Delays
(through 50 Years)

Worse

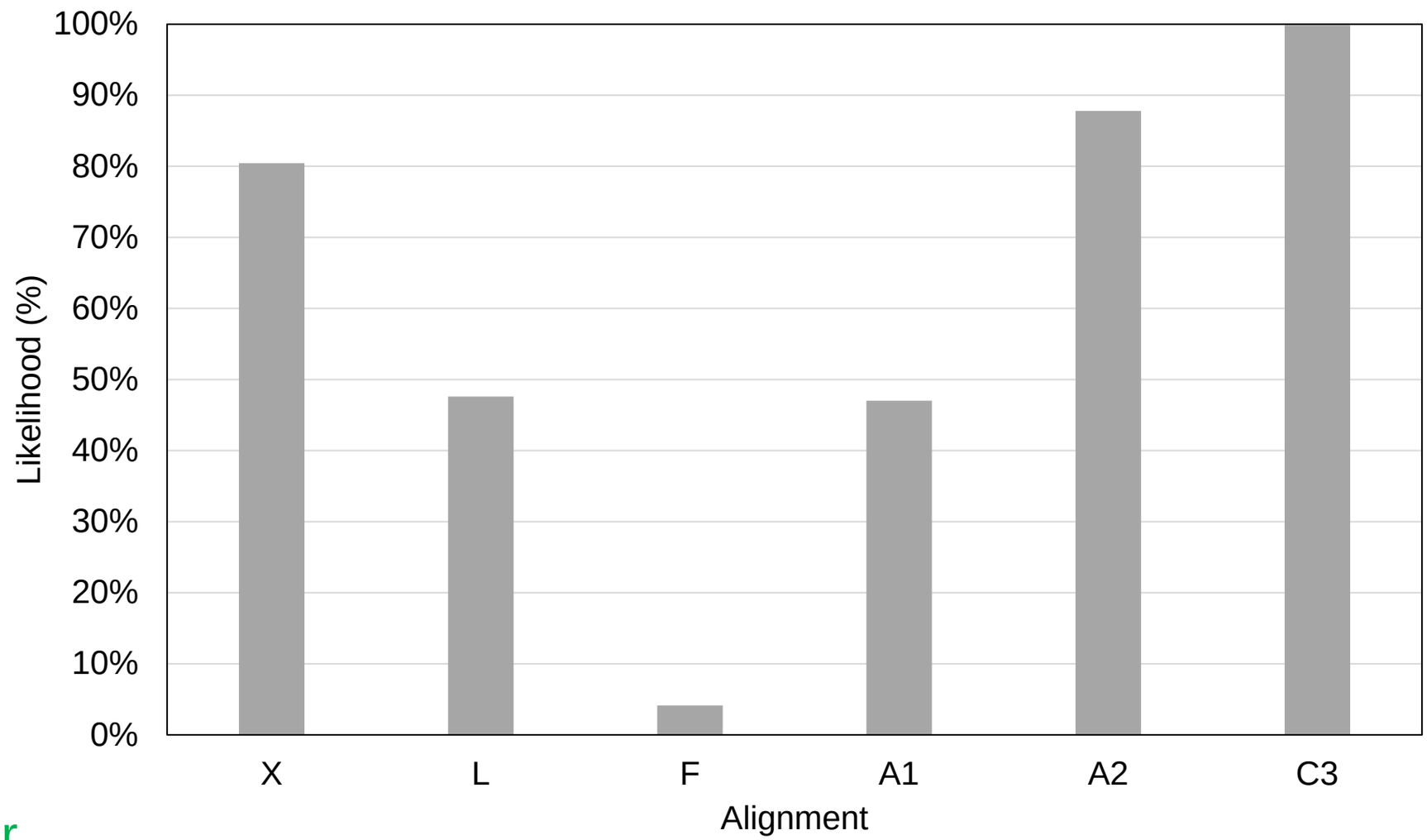




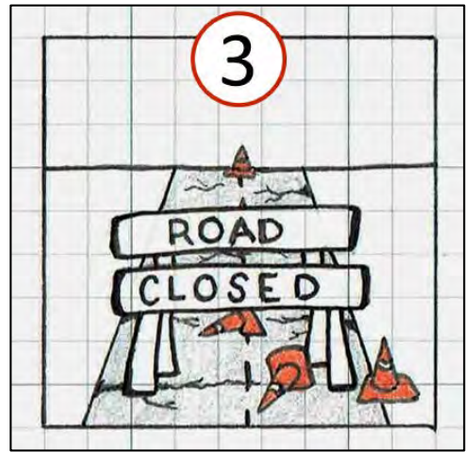
Better

Risk of Closure
(through 50 Years)

Worse

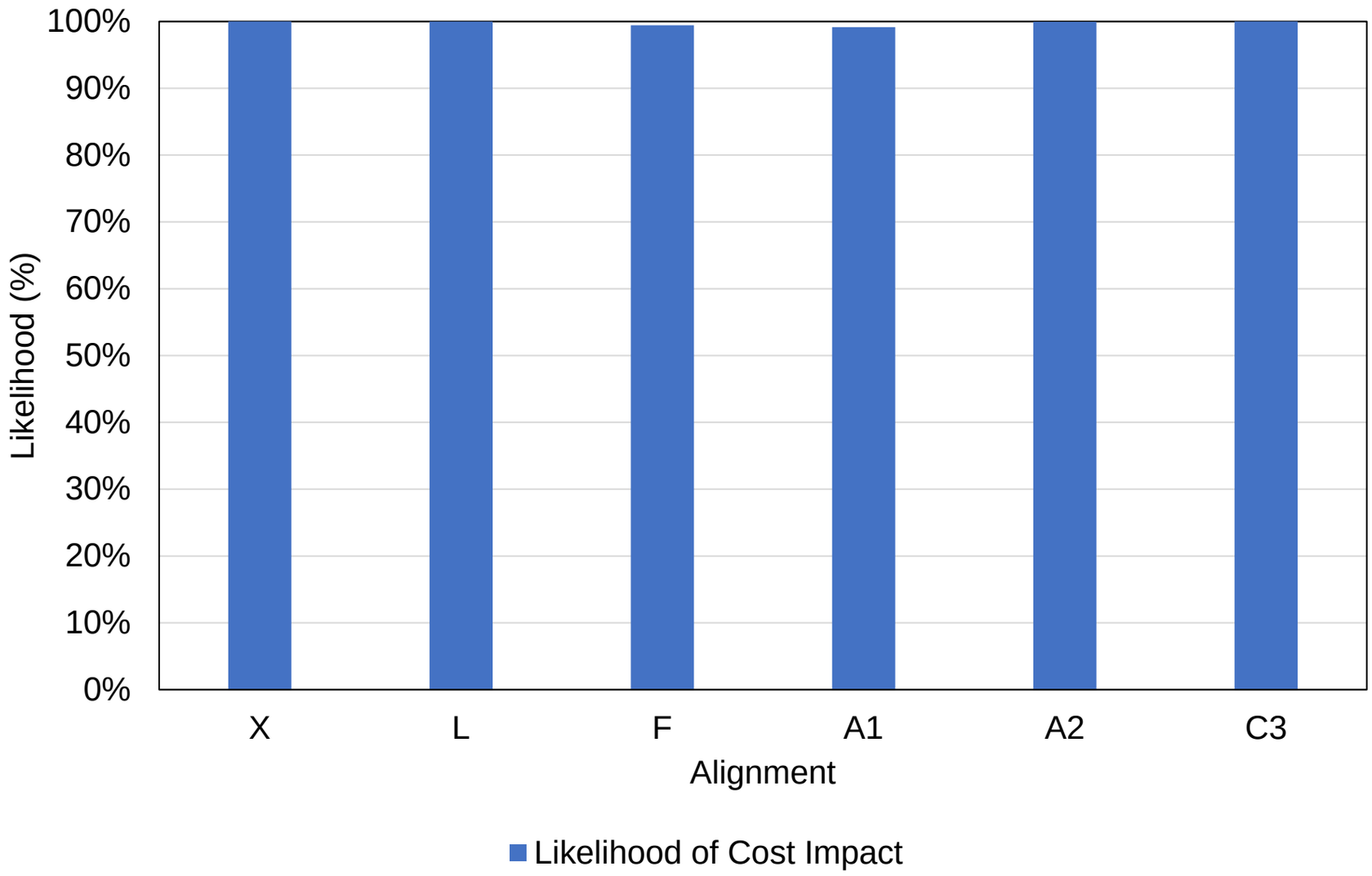


Better



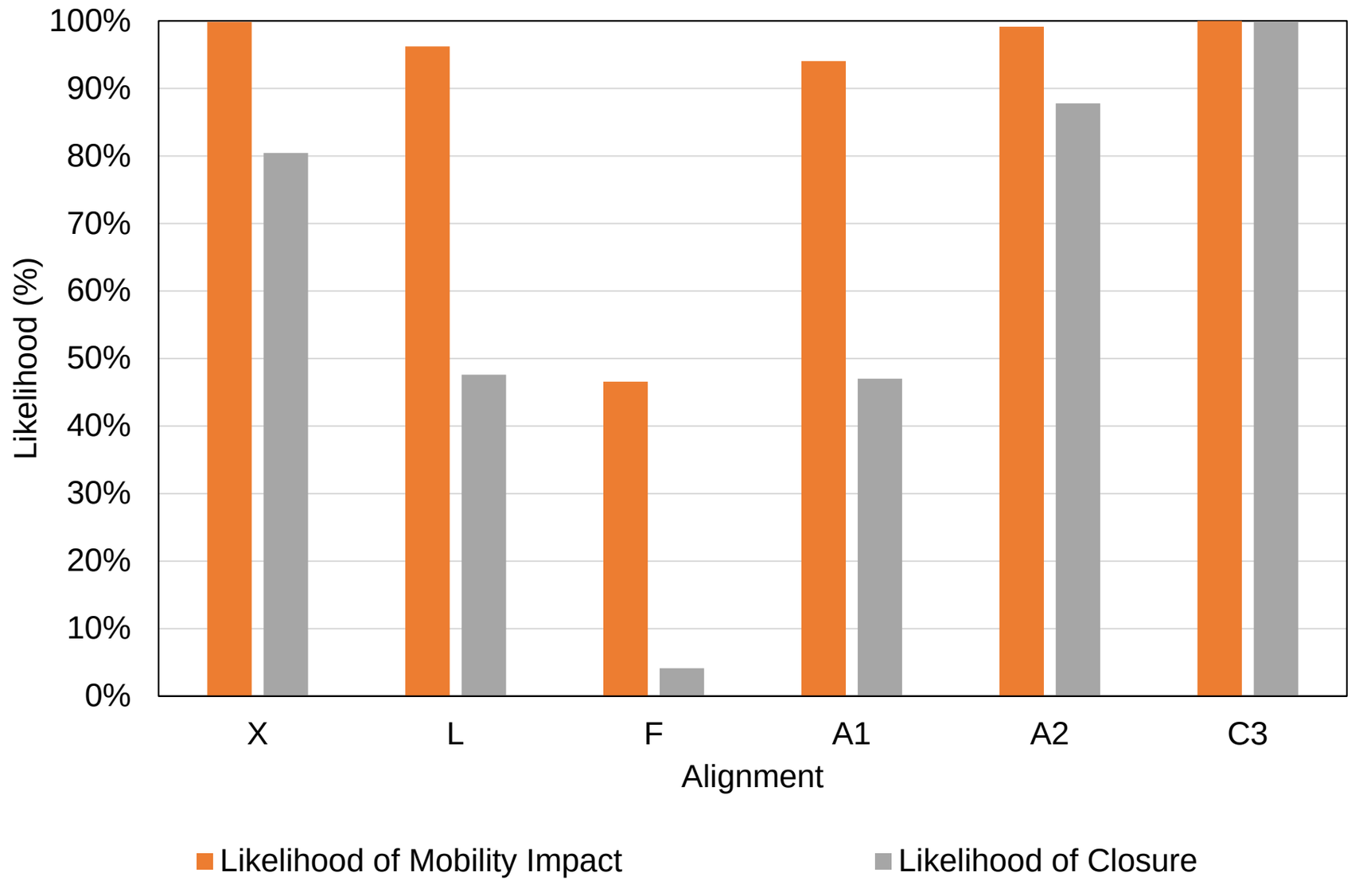
Summary of Observations

- All Alternatives are expected to be high cost:



Summary of Observations

- Likelihood of delays and closure vary:



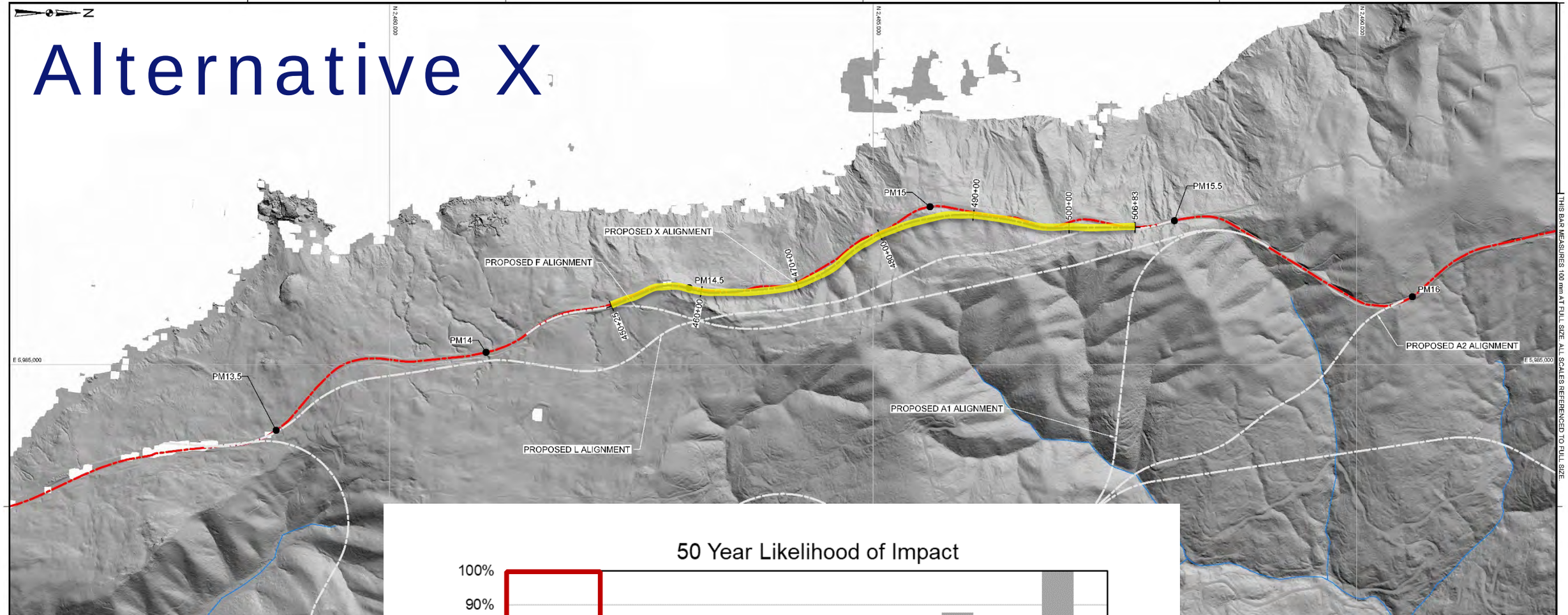
Summary of Observations

Closure in 50 years

3 general categories: High, Medium and Low

Review Alternatives in map view

Alternative X



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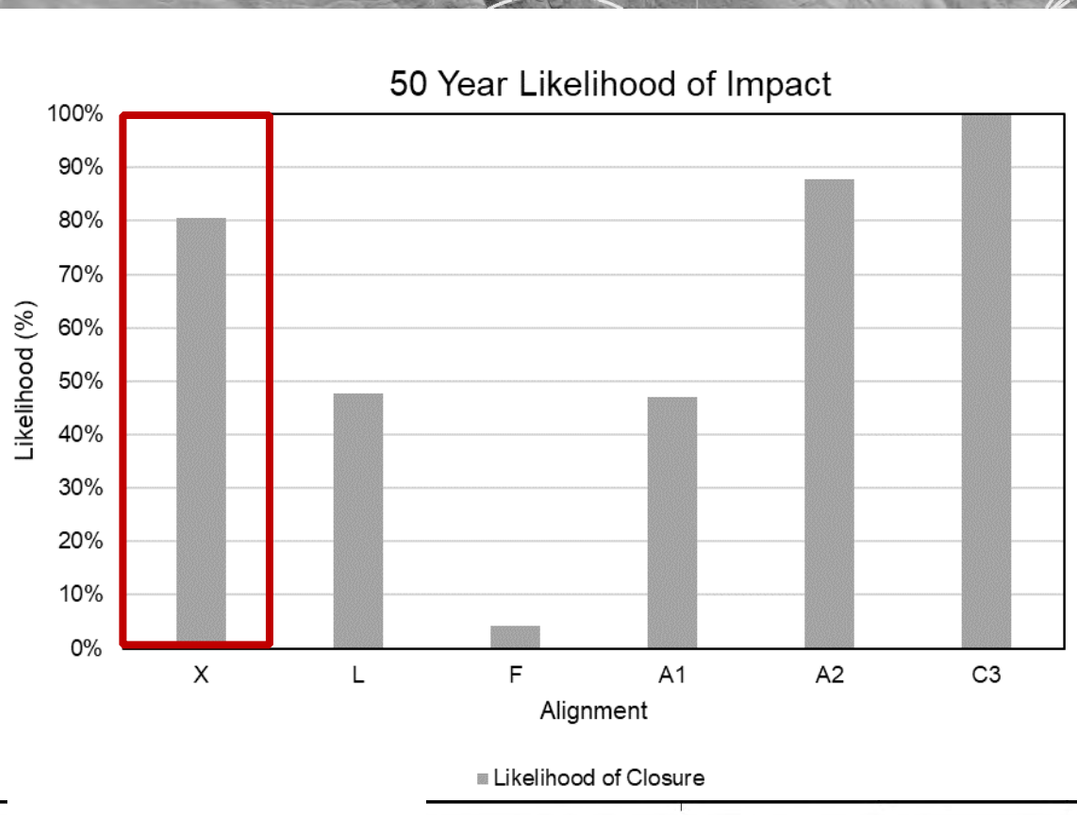

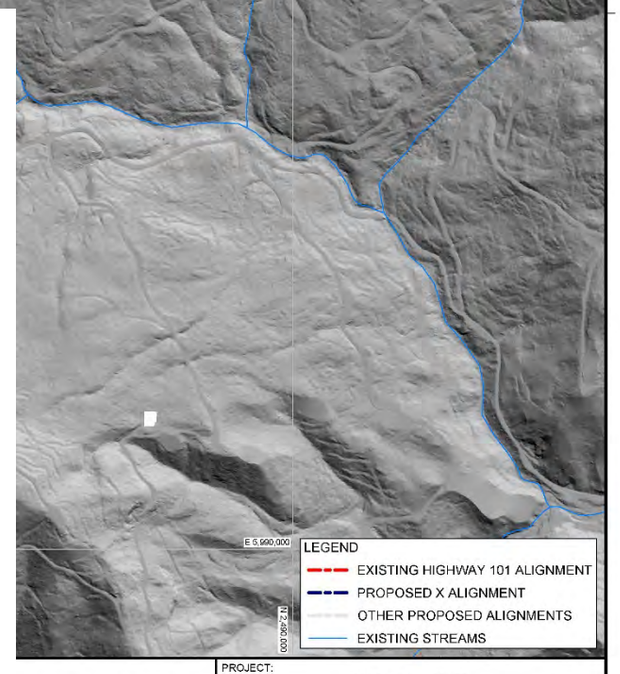

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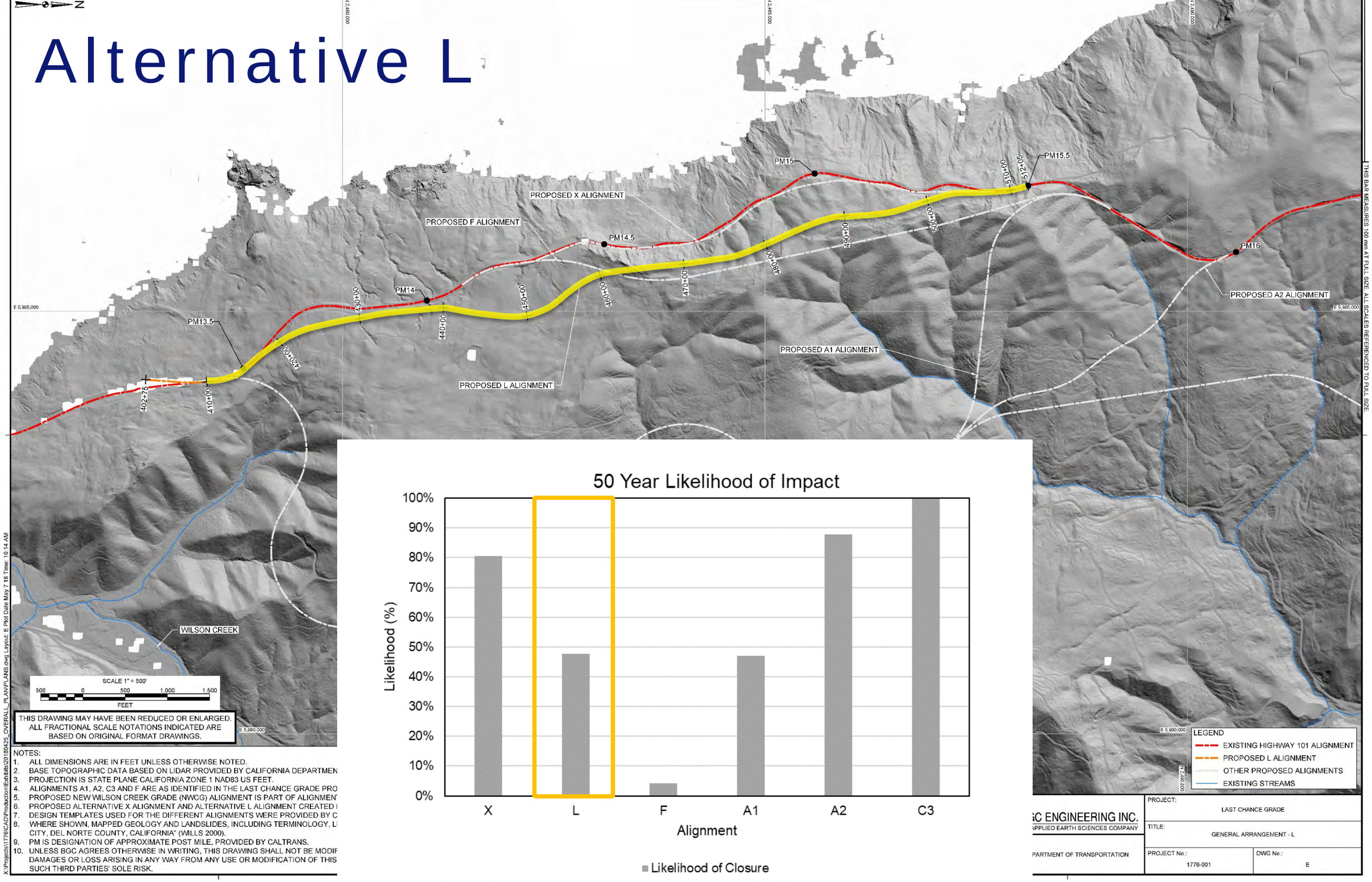
APPLIED EARTH SCIENCES COMPANY
PARTMENT OF TRANSPORTATION

PROJECT: LAST CHANCE GRADE	
TITLE: GENERAL ARRANGEMENT - X	
PROJECT No.: 1776-001	DWG No.: D

HIGH RISK

Alternative L



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LEGEND
- EXISTING HIGHWAY 101 ALIGNMENT
- PROPOSED L ALIGNMENT
- OTHER PROPOSED ALIGNMENTS
- EXISTING STREAMS

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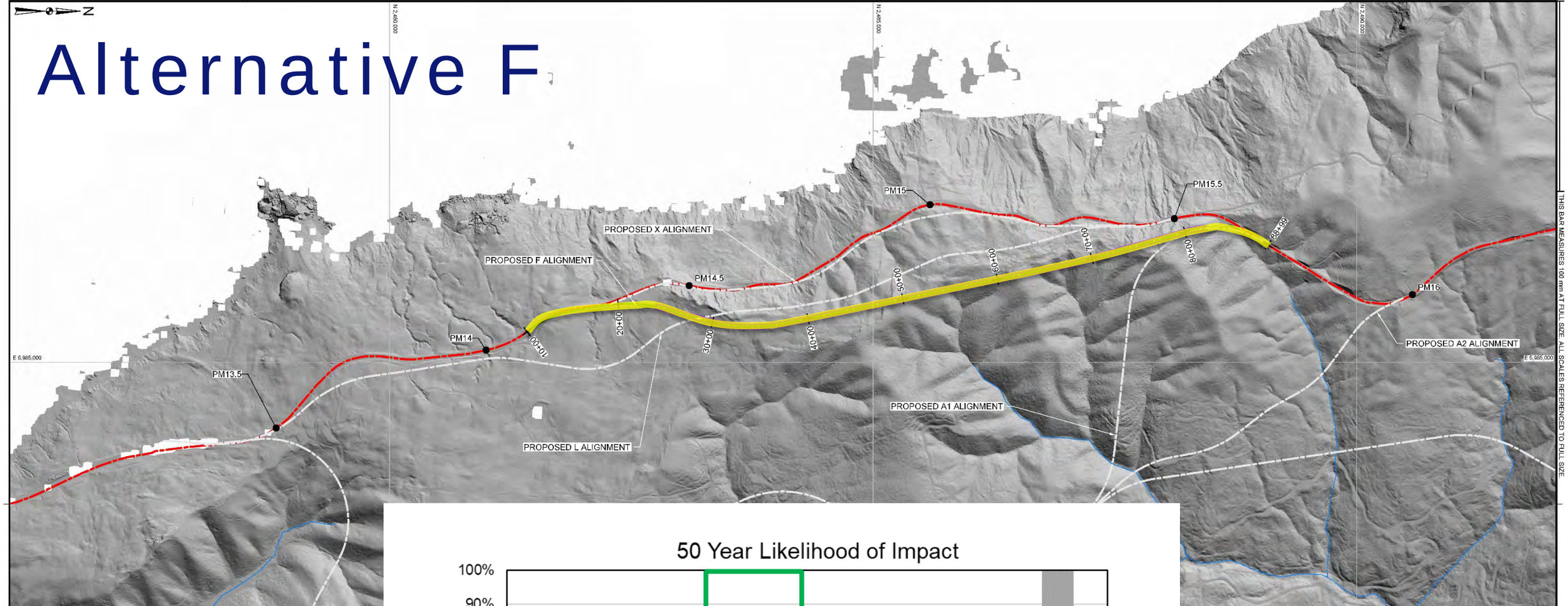
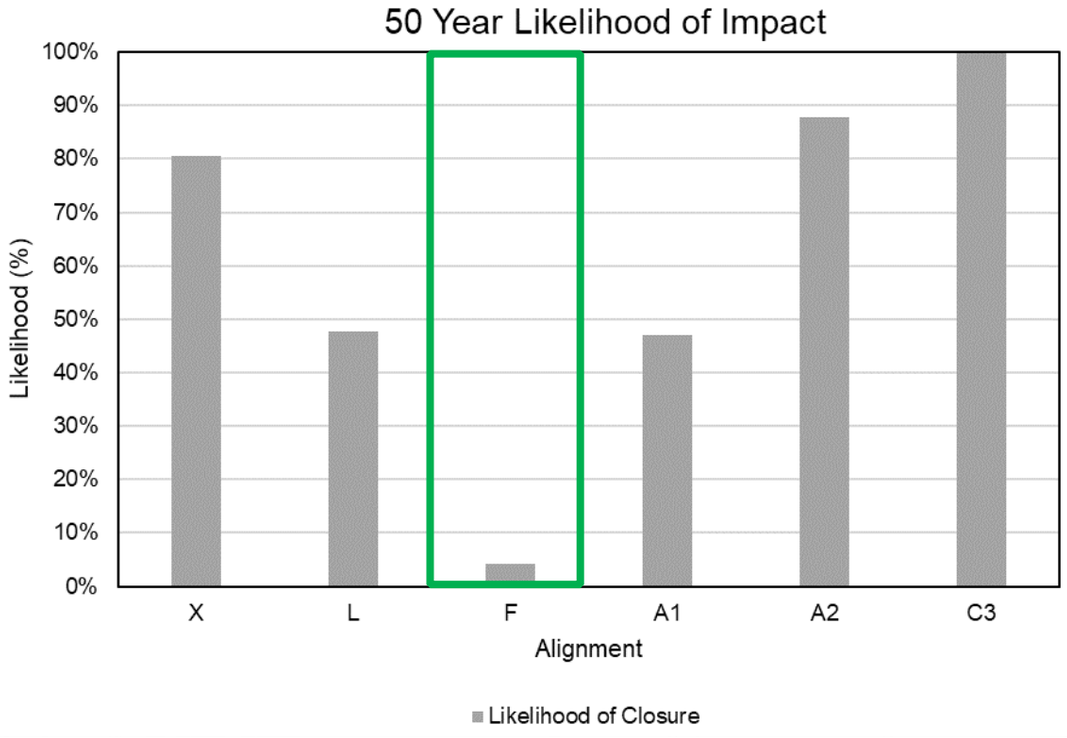
PARTMENT OF TRANSPORTATION

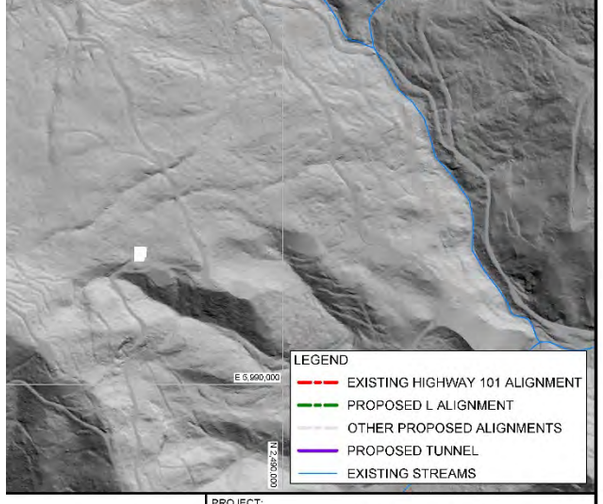
PROJECT: LAST CHANCE GRADE
TITLE: GENERAL ARRANGEMENT - L
PROJECT No.: 1776-001
DWG No.: E

MEDIUM RISK

Alternative F







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PROJECT: LAST CHANCE GRADE
TITLE: GENERAL ARRANGEMENT - F
PROJECT No.: 1776-001
DWG No.: F

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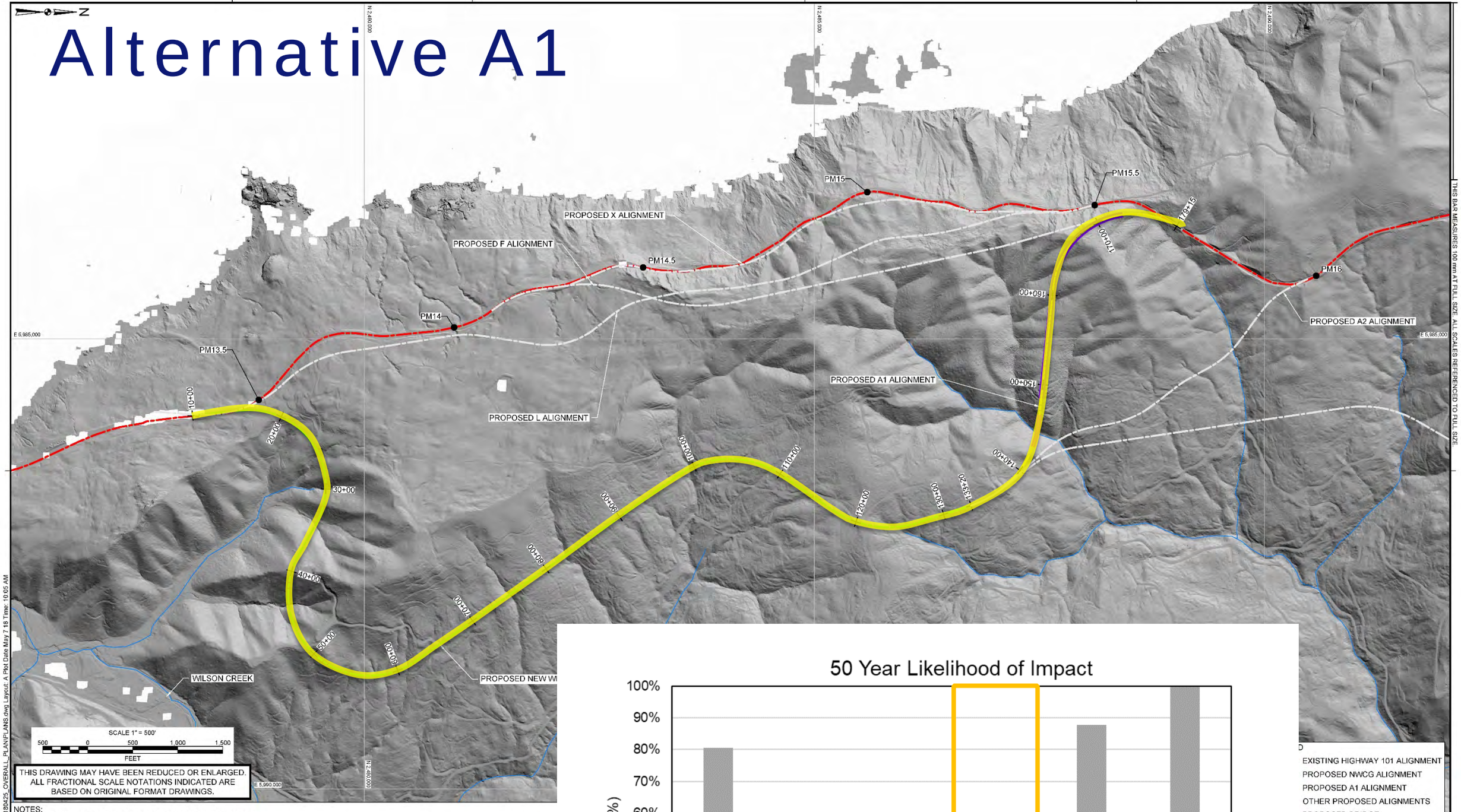
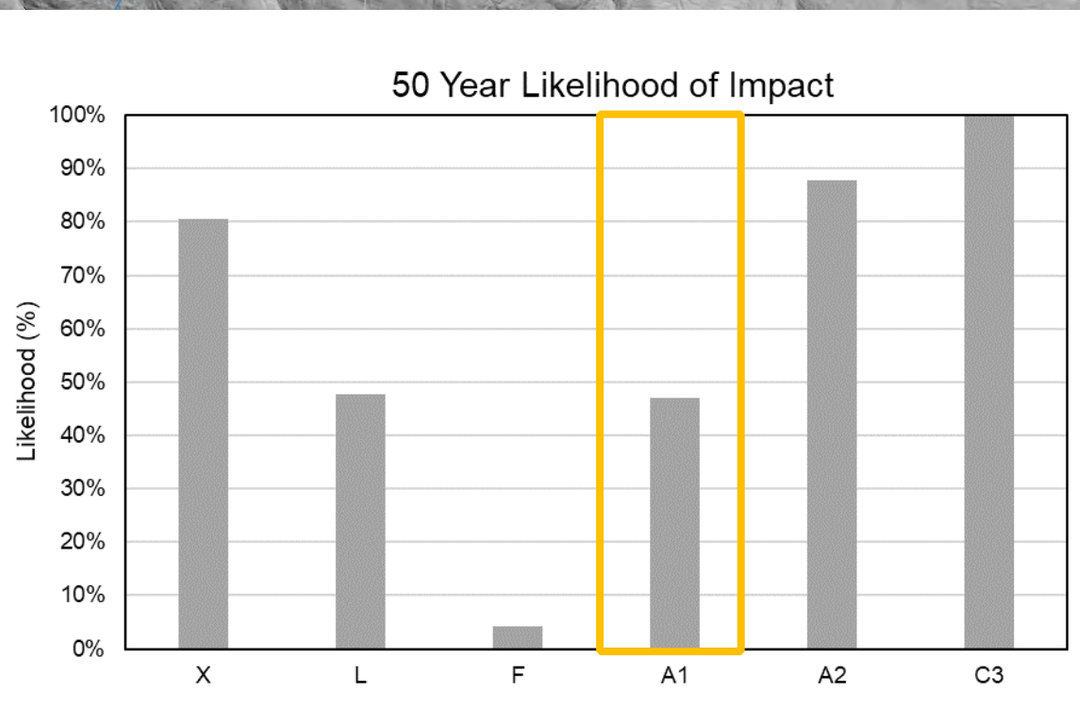
LOW RISK

Alternative A1





MEDIUM RISK

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EXISTING HIGHWAY 101 ALIGNMENT
PROPOSED NWCG ALIGNMENT
PROPOSED A1 ALIGNMENT
OTHER PROPOSED ALIGNMENTS
PROPOSED BRIDGE
PROPOSED TUNNEL
EXISTING STREAMS

LAST CHANCE GRADE

. ARRANGEMENT - NWCG AND A1

DWG No.:
A

THIS BAR MEASURES 100 mm AT FULL SIZE. ALL SCALES REFERENCED TO FULL SIZE.

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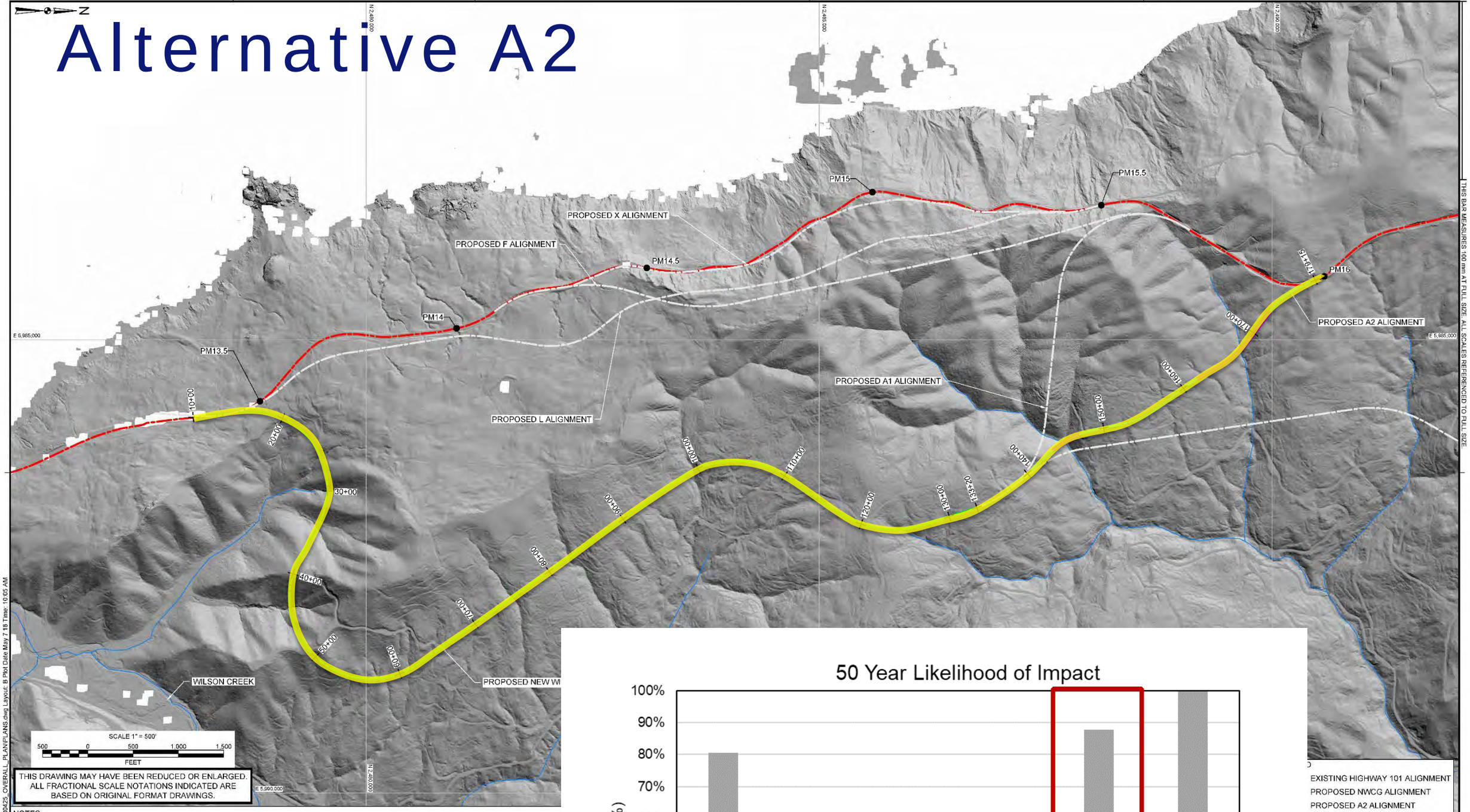
Alternative A2



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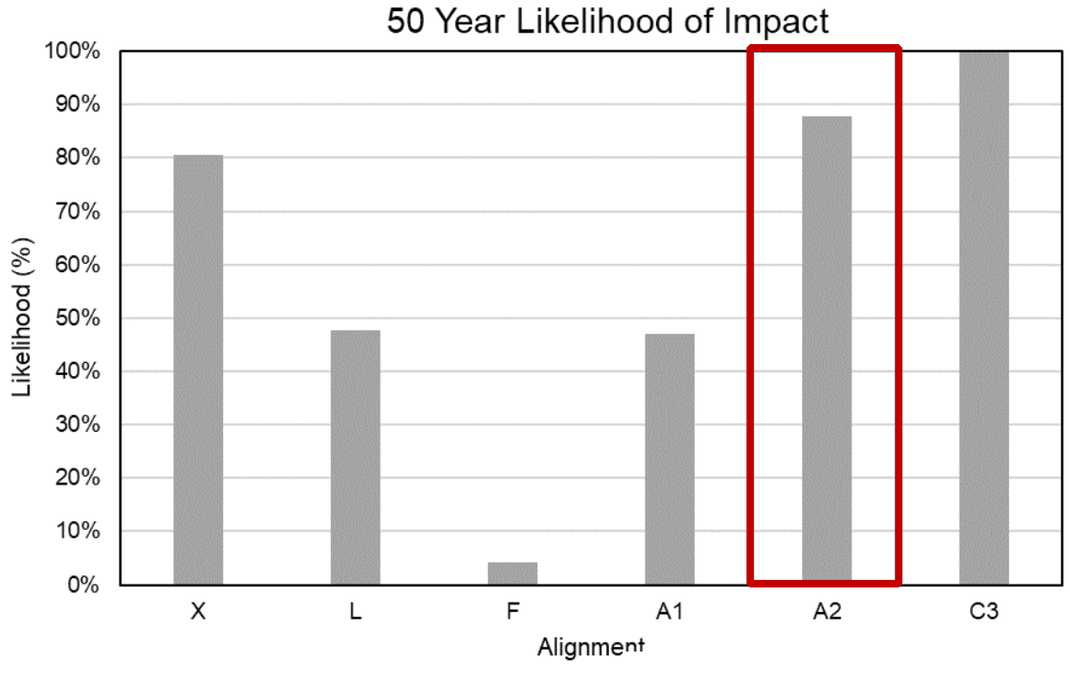
EXISTING HIGHWAY 101 ALIGNMENT
PROPOSED NWCG ALIGNMENT
PROPOSED A2 ALIGNMENT
OTHER PROPOSED ALIGNMENTS
PROPOSED BRIDGE
EXISTING STREAMS

LAST CHANCE GRADE

ARRANGEMENT - NWCG AND A2

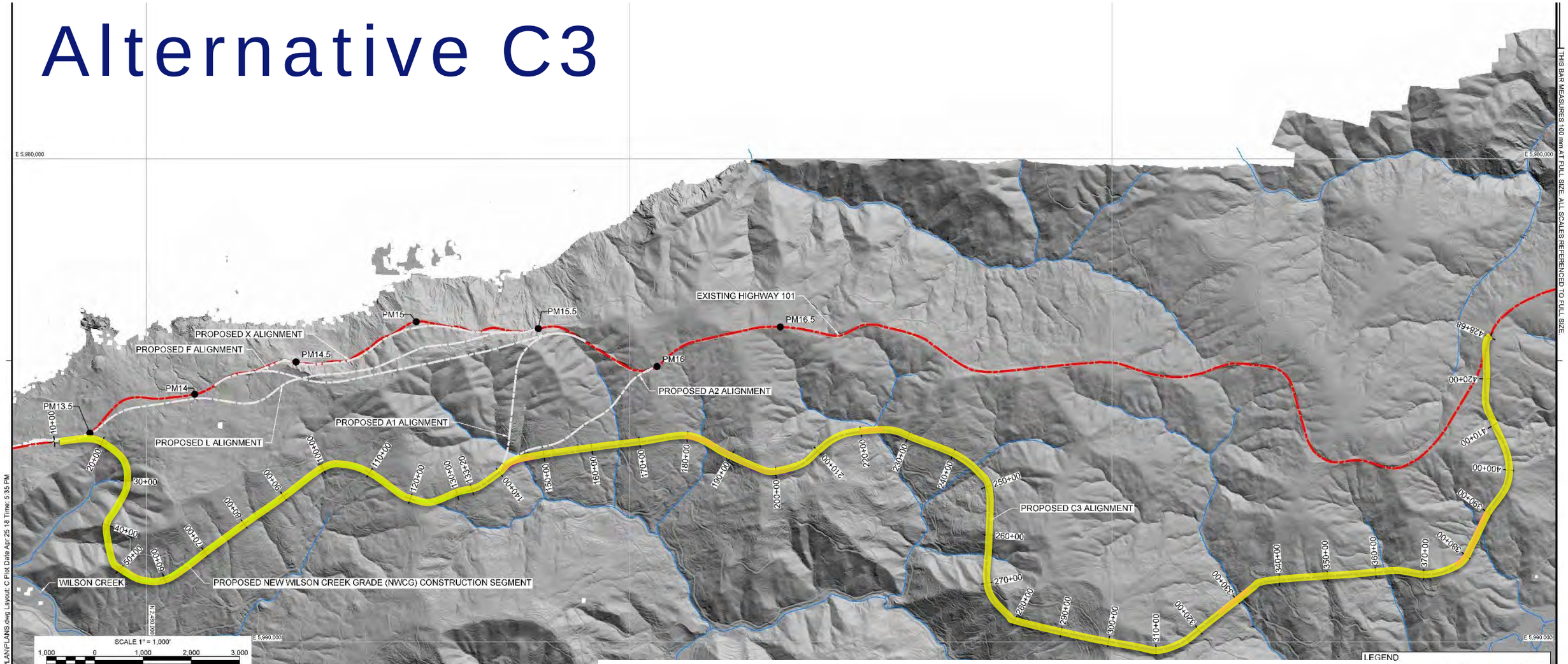
DWG No.:
B

X:\Projects\1776\CAD\Production\Exhibits\20180425_OVERALL_PLANFLANS.dwg Layout: B Plot Date May 7 18 Time: 10:05 AM



HIGH RISK

Alternative C3



NOTES:

1. ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
2. BASE TOPOGRAPHIC DATA BASED ON LIDAR PROVIDED BY CALIFORNIA DEPARTMENT OF TRANSPORTATION, DATED 2011 AND 2016. CO
3. PROJECTION IS STATE PLANE CALIFORNIA ZONE 1 NAD83 US FEET.
4. ALIGNMENTS A1, A2, C3 AND F ARE AS IDENTIFIED IN THE LAST CHANCE GRADE PROJECT STUDY REPORT (CALTRANS 2016).
5. PROPOSED NEW WILSON CREEK GRADE (NWCG) ALIGNMENT IS PART OF ALIGNMENTS A1, A2 AND C3.
6. PROPOSED ALTERNATIVE X ALIGNMENT AND ALTERNATIVE L ALIGNMENT CREATED FEBRUARY 2018 BY CALTRANS.
7. DESIGN TEMPLATES USED FOR THE DIFFERENT ALIGNMENTS WERE PROVIDED BY CALTRANS; SHOULDER WIDTH AND CUT AND FILL SL
8. WHERE SHOWN, MAPPED GEOLOGY AND LANDSLIDES, INCLUDING TERMINOLOGY, LEGEND AND HATCHING, ARE REPRODUCED FROM "
   CITY, DEL NORTE COUNTY, CALIFORNIA" (WILLS 2000).
9. PM IS DESIGNATION OF APPROXIMATE POST MILE, PROVIDED BY CALTRANS.
10. UNLESS BGC AGREES OTHERWISE IN WRITING, THIS DRAWING SHALL NOT BE MODIFIED OR USED FOR ANY PURPOSE OTHER THAN THI
    DAMAGES OR LOSS ARISING IN ANY WAY FROM ANY USE OR MODIFICATION OF THIS DOCUMENT NOT AUTHORIZED BY BGC. ANY USE O
    SUCH THIRD PARTIES' SOLE RISK.

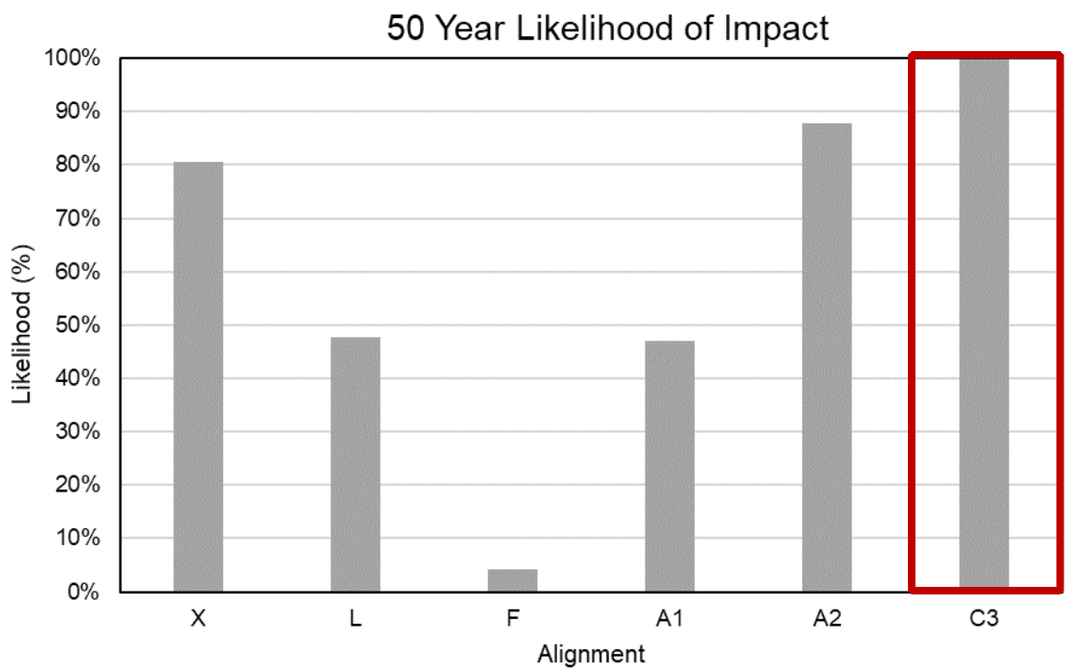
LEGEND

- EXISTING HIGHWAY 101 ALIGNMENT
- PROPOSED NWCG ALIGNMENT
- PROPOSED C3 ALIGNMENT
- OTHER PROPOSED ALIGNMENTS
- PROPOSED BRIDGE
- PROPOSED TUNNEL
- EXISTING STREAMS

LAST CHANCE GRADE

. ARRANGEMENT - NWCG AND C3

DWG No.:
C



HIGHEST RISK

Conclusions

- All Alternatives are expected to have high maintenance cost
- Risks of delay and closure vary
- Alternative C is judged highest risk
- Alternative F is judged lowest risk
- Risks are for long-term ownership
- More information can lead to better judgment of risks