

TECHNICAL PAPER

04

Hydrology and flooding impact assessment

Appendix C Design case cumulative flood impact maps

Appendix C4 Hazard (velocity x depth) change maps

NARRABRI TO NORTH STAR—PHASE 2 ENVIRONMENTAL IMPACT STATEMENT



Appendix C – Design case cumulative flood impact maps

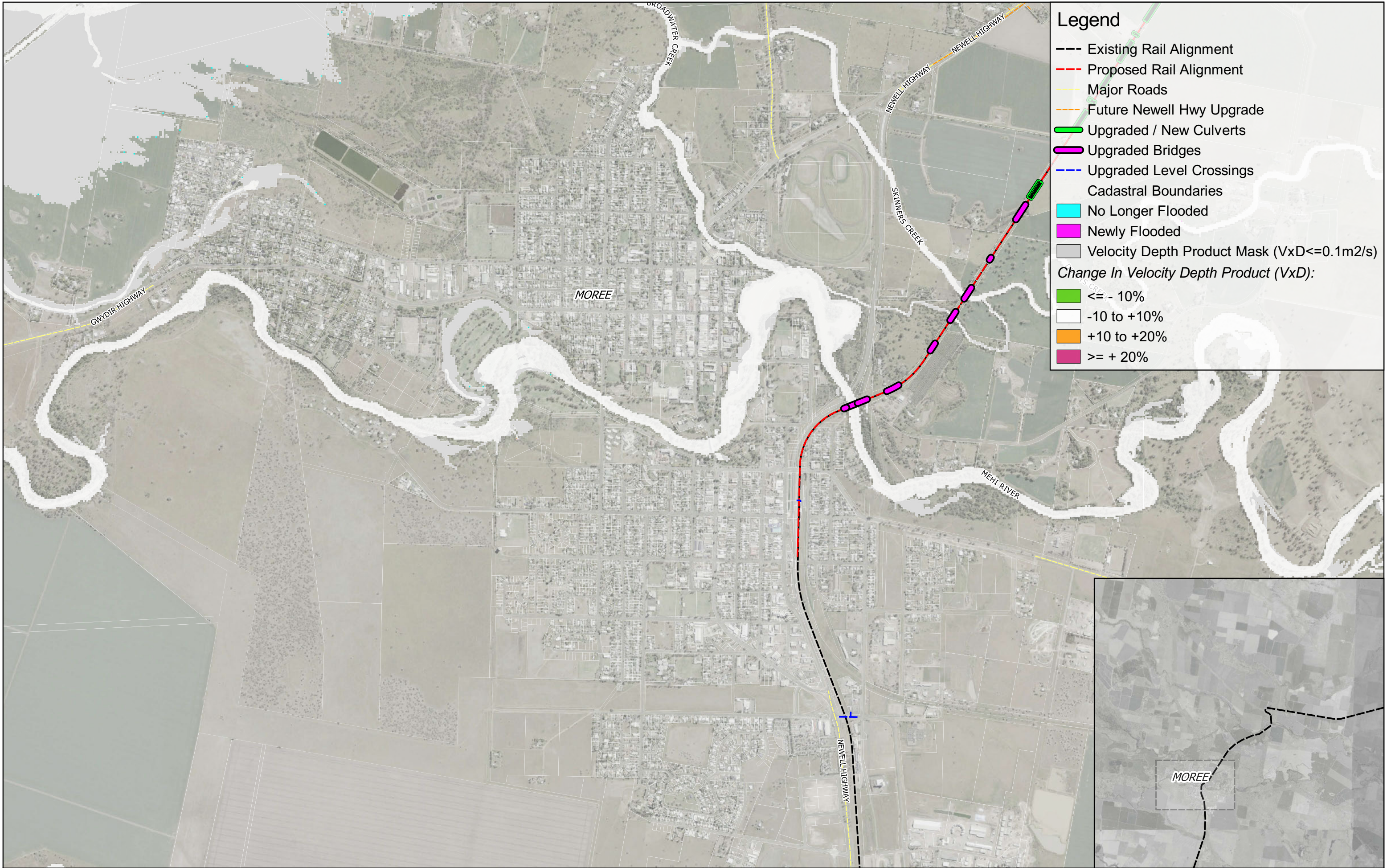
Map list

MAP SET ID	MAP CONTENTS
DESNH_AFF_020	Flood Level Change (Afflux) – Cumulative Design Case, 20% AEP Event
DESNH_AFF_010	Flood Level Change (Afflux) – Cumulative Design Case, 10% AEP Event
DESNH_AFF_005	Flood Level Change (Afflux) – Cumulative Design Case, 5% AEP Event
DESNH_AFF_002	Flood Level Change (Afflux) – Cumulative Design Case, 2% AEP Event
DESNH_AFF_001	Flood Level Change (Afflux) – Cumulative Design Case, 1% AEP Event
DESNH_CHV_020	Flood Velocity Change Impact – Cumulative Design Case, 20% AEP Event
DESNH_CHV_010	Flood Velocity Change Impact – Cumulative Design Case, 10% AEP Event
DESNH_CHV_005	Flood Velocity Change Impact – Cumulative Design Case, 5% AEP Event
DESNH_CHV_002	Flood Velocity Change Impact – Cumulative Design Case, 2% AEP Event
DESNH_CHV_001	Flood Velocity Change Impact – Cumulative Design Case, 1% AEP Event
DESNH_CHDUR_020	Flood Duration Change – Cumulative Design Case, 20% AEP Event
DESNH_CHDUR_010	Flood Duration Change – Cumulative Design Case, 10% AEP Event
DESNH_CHDUR_005	Flood Duration Change – Cumulative Design Case, 5% AEP Event
DESNH_CHDUR_002	Flood Duration Change – Cumulative Design Case, 2% AEP Event
DESNH_CHDUR_001	Flood Duration Change – Cumulative Design Case, 1% AEP Event
DESNH_CHHAZ_020	Flood Hazard (Velocity x Depth) Change – Cumulative Design Case, 20% AEP Event
DESNH_CHHAZ_010	Flood Hazard (Velocity x Depth) Change – Cumulative Design Case, 10% AEP Event
DESNH_CHHAZ_005	Flood Hazard (Velocity x Depth) Change – Cumulative Design Case, 5% AEP Event
DESNH_CHHAZ_002	Flood Hazard (Velocity x Depth) Change – Cumulative Design Case, 2% AEP Event
DESNH_CHHAZ_001	Flood Hazard (Velocity x Depth) Change – Cumulative Design Case, 1% AEP Event

C.4 Hazard (velocity x depth) change

Map list

MAP SET ID	MAP CONTENTS
DESNH_CHHAZ_020	Flood Hazard (Velocity x Depth) Change – Cumulative Design Case, 20% AEP Event
DESNH_CHHAZ_010	Flood Hazard (Velocity x Depth) Change – Cumulative Design Case, 10% AEP Event
DESNH_CHHAZ_005	Flood Hazard (Velocity x Depth) Change – Cumulative Design Case, 5% AEP Event
DESNH_CHHAZ_002	Flood Hazard (Velocity x Depth) Change – Cumulative Design Case, 2% AEP Event
DESNH_CHHAZ_001	Flood Hazard (Velocity x Depth) Change – Cumulative Design Case, 1% AEP Event



Legend

Existing Rail Alignment

Proposed Rail Alignment

Major Roads

Future Newell Hwy Upgrade

Upgraded / New Culverts

Upgraded Bridges

Upgraded Level Crossings

Cadastral Boundaries

No Longer Flooded

Newly Flooded

Velocity Depth Product Mask ($VxD \leq 0.1 \text{m}^2/\text{s}$)

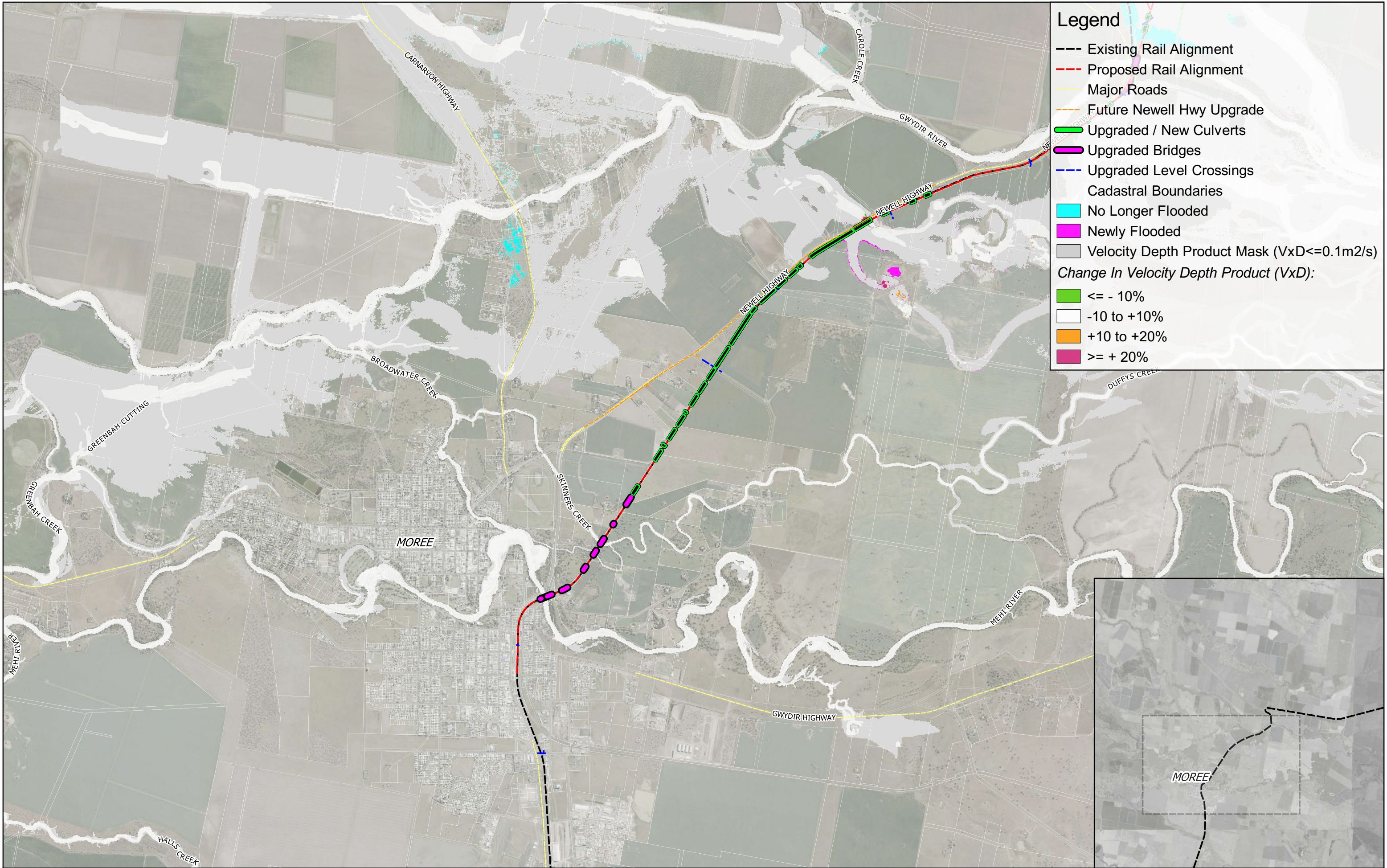
Change In Velocity Depth Product (VxD):

 $\leq -10\%$

-10 to +10%

+10 to +20%

 $\geq +20\%$



Legend

Existing Rail Alignment

Proposed Rail Alignment

Major Roads

Future Newell Hwy Upgrade

Upgraded / New Culverts

Upgraded Bridges

Upgraded Level Crossings

Cadastral Boundaries

No Longer Flooded

Newly Flooded

Velocity Depth Product Mask ($V \times D \leq 0.1 \text{m}^2/\text{s}$)

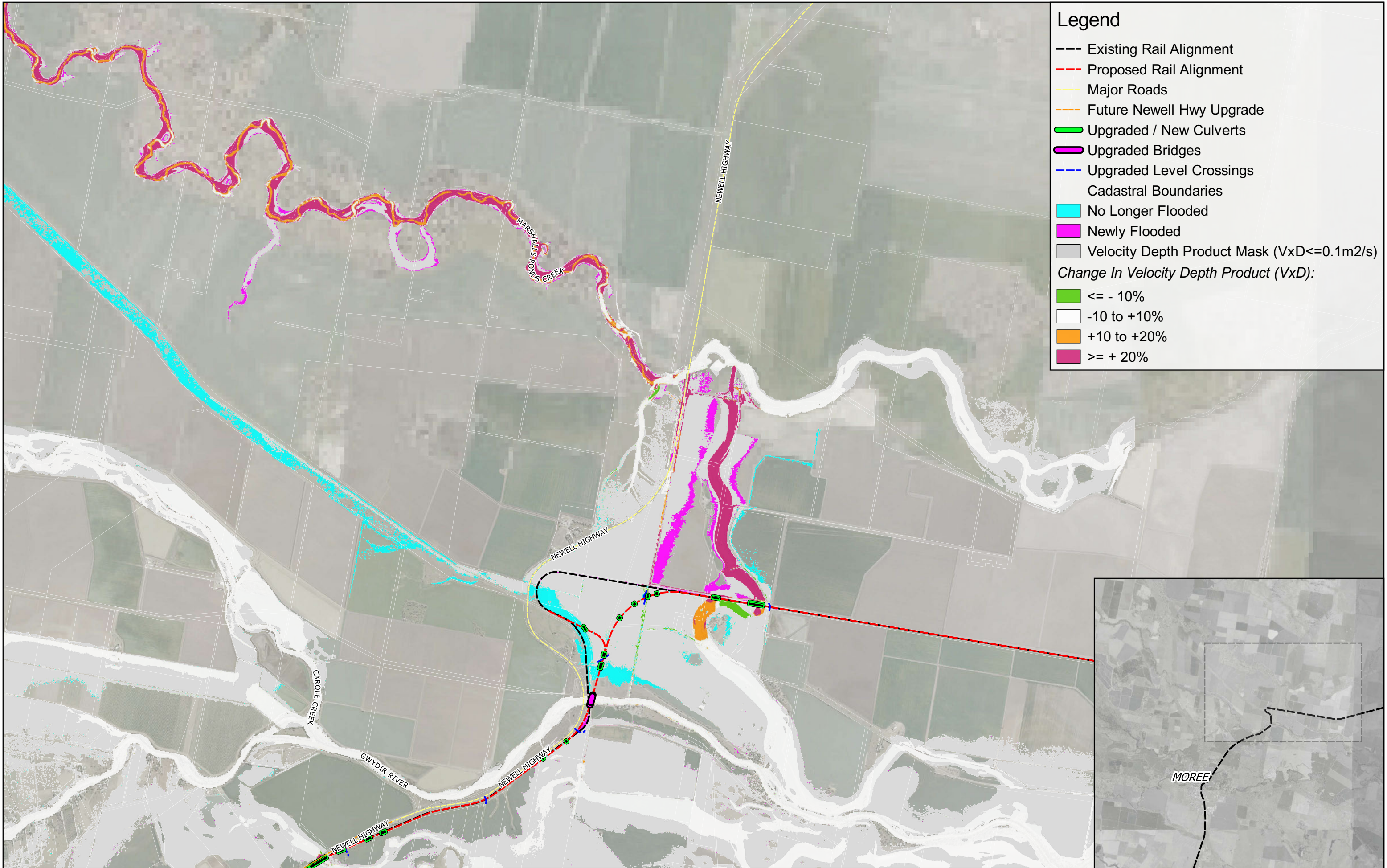
Change In Velocity Depth Product ($V \times D$):

 $\leq -10\%$

-10 to +10%

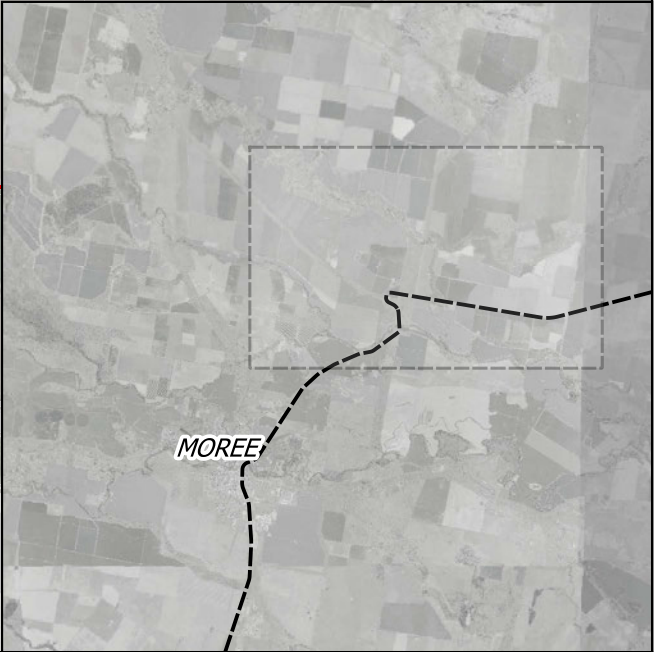
+10 to +20%

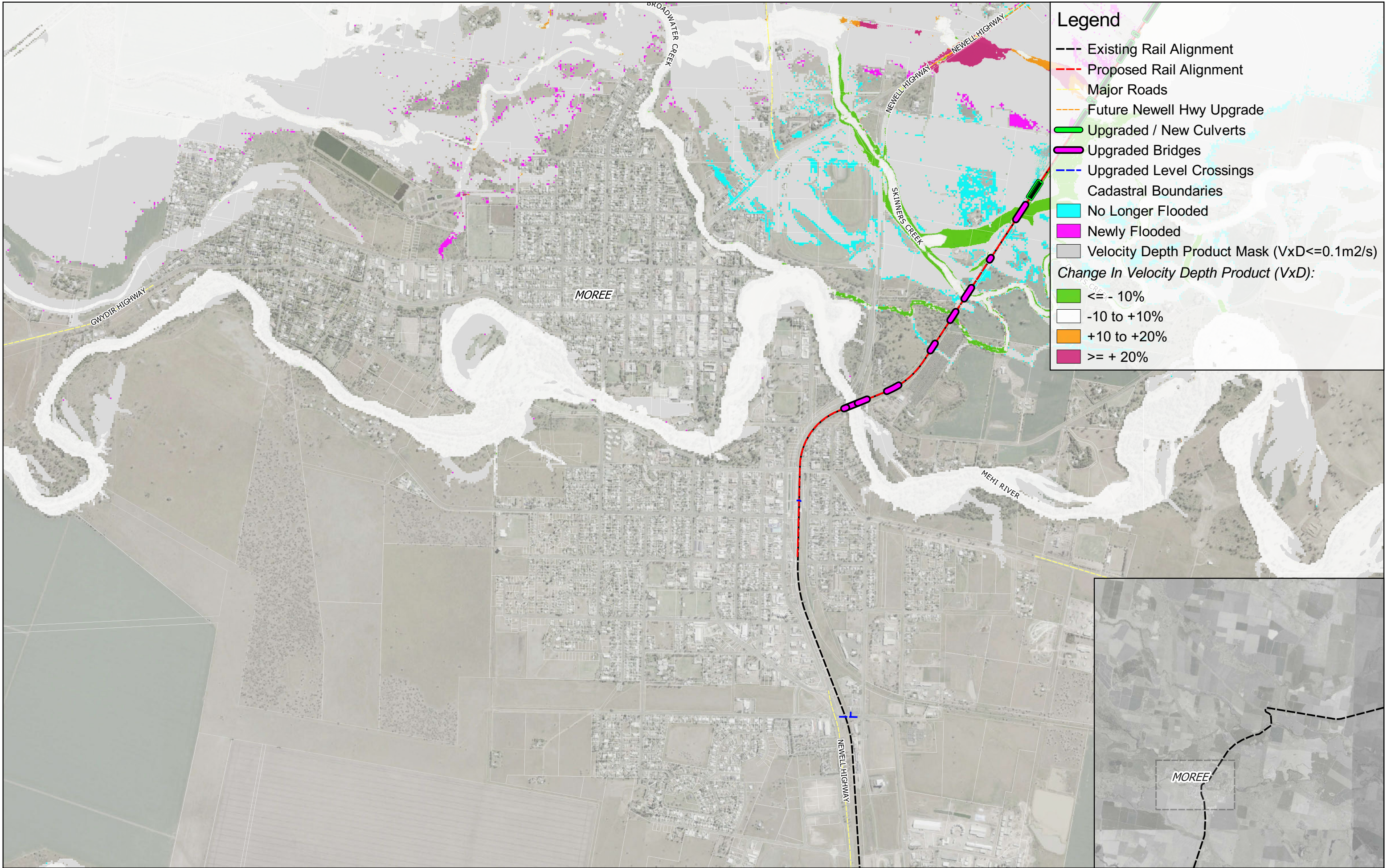
 $\geq +20\%$



Legend

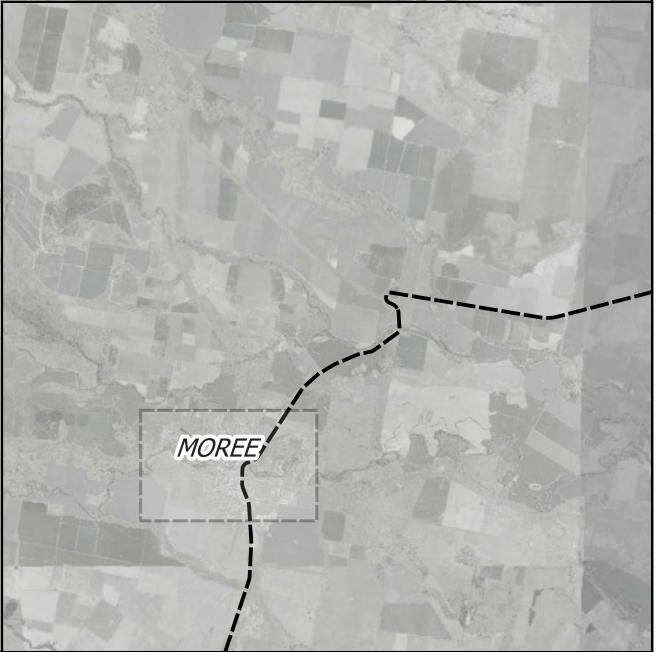
- Existing Rail Alignment
- - - Proposed Rail Alignment
- Major Roads
- Future Newell Hwy Upgrade
- Upgraded / New Culverts
- Upgraded Bridges
- Upgraded Level Crossings
- Cadastral Boundaries
- No Longer Flooded
- Newly Flooded
- Velocity Depth Product Mask ($VxD \leq 0.1 \text{ m}^2/\text{s}$)
- Change In Velocity Depth Product (VxD):
 - $\leq -10\%$
 - 10 to +10%
 - +10 to +20%
 - $\geq +20\%$



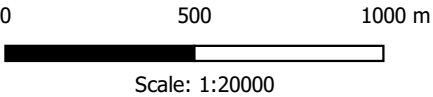


Legend

- Existing Rail Alignment
 - Proposed Rail Alignment
 - Major Roads
 - Future Newell Hwy Upgrade
 - Upgraded / New Culverts
 - Upgraded Bridges
 - Upgraded Level Crossings
 - Cadastral Boundaries
 - No Longer Flooded
 - Newly Flooded
 - Velocity Depth Product Mask ($VxD \leq 0.1 \text{ m}^2/\text{s}$)
- Change In Velocity Depth Product (VxD):
- $\leq -10\%$
 - 10 to +10%
 - +10 to +20%
 - $\geq +20\%$

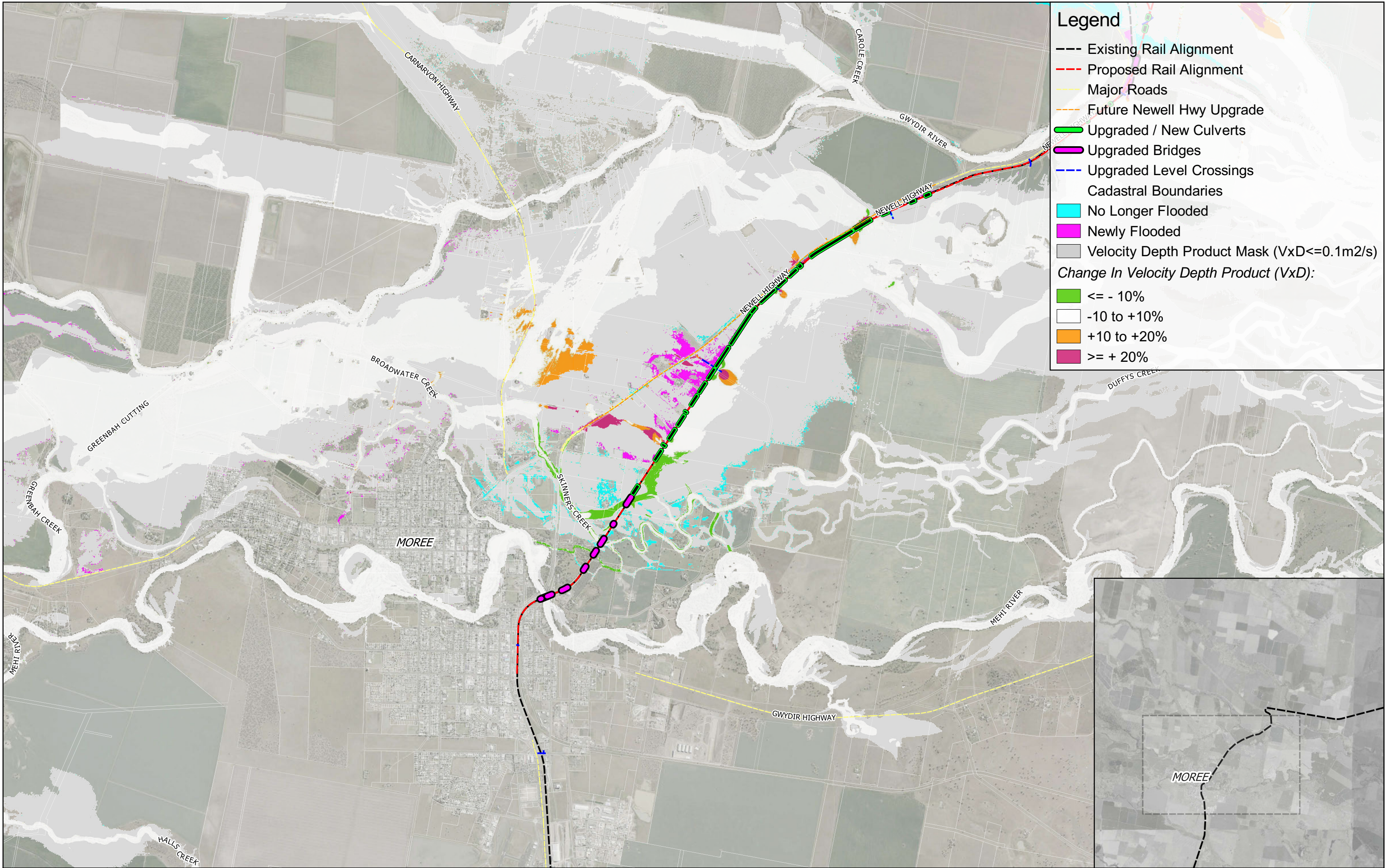


Prepared for: ARTC
Coordinate system: GDA 1994 MGA Zone 55
Aerial Source: NSW Six Maps
Scale ratio correct when printed at A3



Stage: EIS
Version: C
Author: JS
Approved by: RL
Date: 30/03/2022

Inland Rail - Narrabri to North Star Phase 2
Change in Flood Hazard - Proposed Design Scenario
Event: 10% AEP
Cumulative Impact of N2NS and Newell Highway Upgrade - Sheet 1
Map ID: DESNH_CHHAZ_010_1



Legend

Existing Rail Alignment

Proposed Rail Alignment

Major Roads

Future Newell Hwy Upgrade

Upgraded / New Culverts

Upgraded Bridges

Upgraded Level Crossings

Cadastral Boundaries

No Longer Flooded

Newly Flooded

Velocity Depth Product Mask ($VxD \leq 0.1m^2/s$)

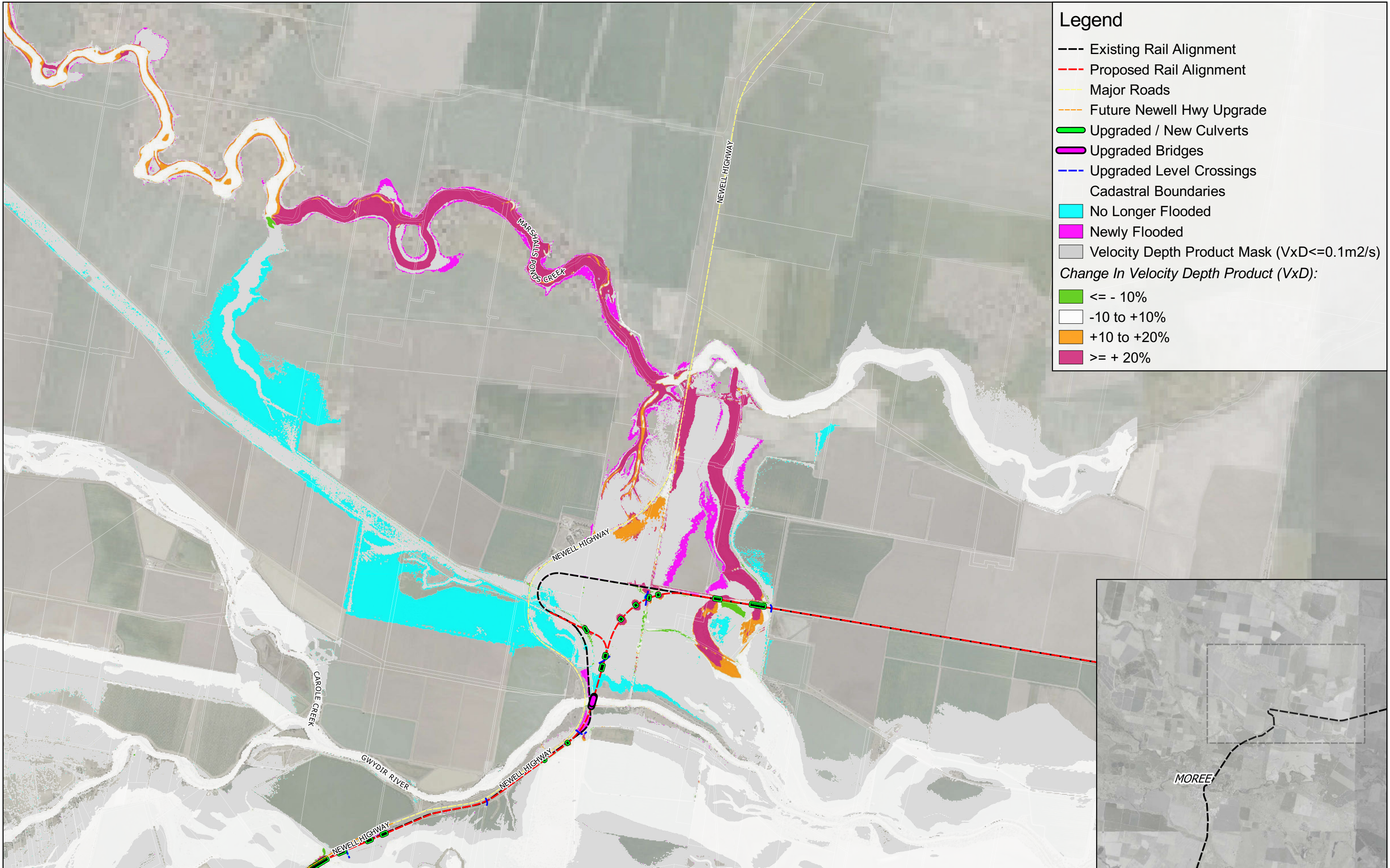
Change In Velocity Depth Product (VxD):

 $\leq -10\%$

 -10 to $+10\%$

 $+10$ to $+20\%$

 $\geq +20\%$



Legend

 Existing Rail Alignment

 Proposed Rail Alignment

 Major Roads

 Future Newell Hwy Upgrade

 Upgraded / New Culverts

 Upgraded Bridges

 Upgraded Level Crossings

 Cadastral Boundaries

 No Longer Flooded

 Newly Flooded

 Velocity Depth Product Mask ($VxD \leq 0.1 \text{ m}^2/\text{s}$)

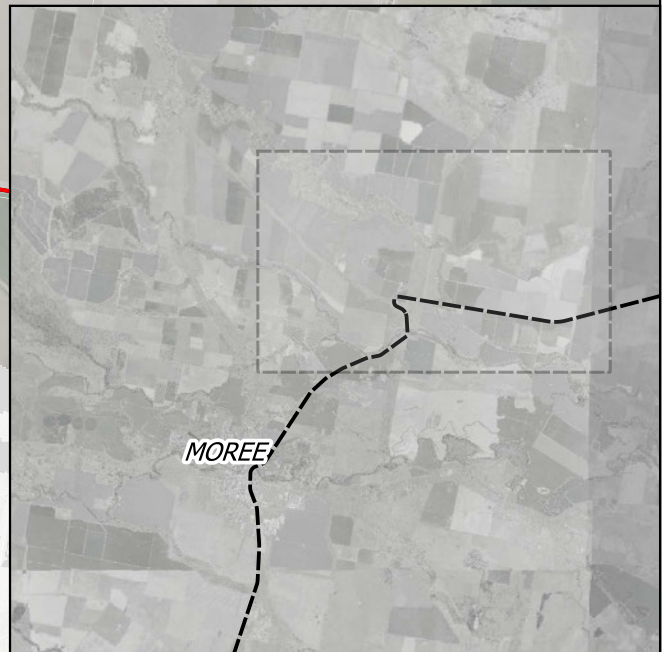
Change In Velocity Depth Product (VxD):

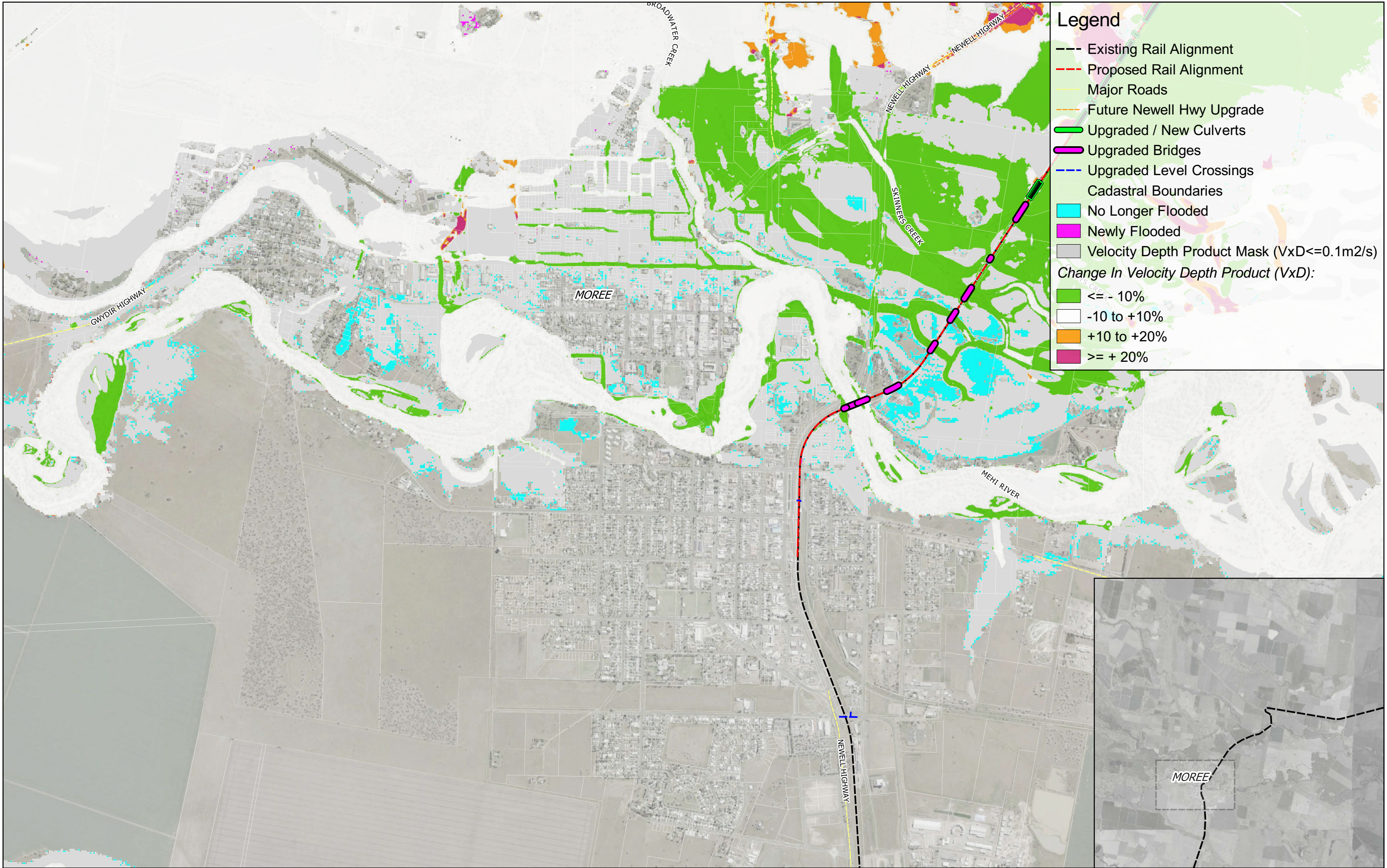
 $\leq -10\%$

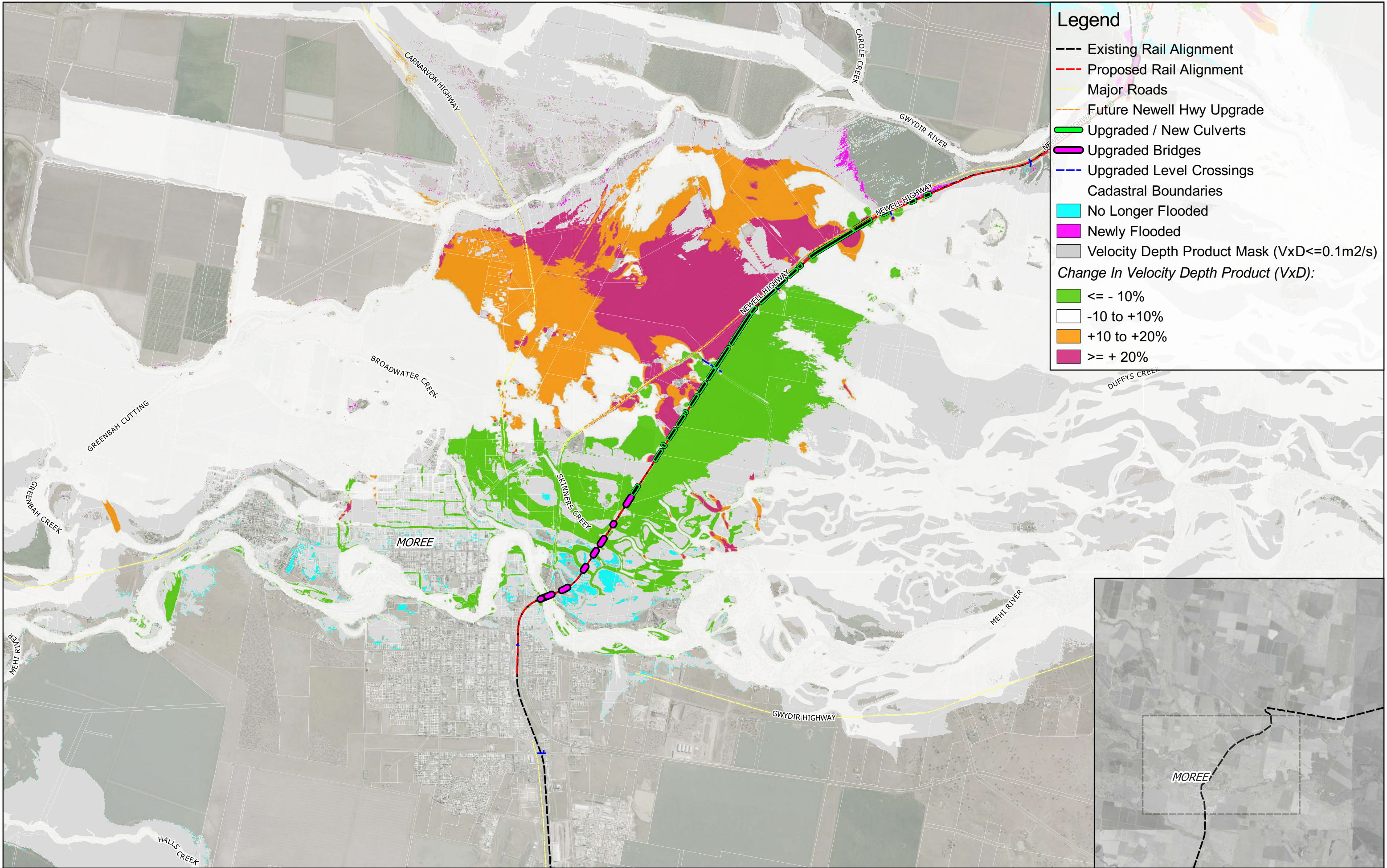
 -10 to +10%

 +10 to +20%

 $\geq +20\%$







Legend

- Existing Rail Alignment
 - Proposed Rail Alignment
 - Major Roads
 - Future Newell Hwy Upgrade
 - Upgraded / New Culverts
 - Upgraded Bridges
 - Upgraded Level Crossings
 - Cadastral Boundaries
 - No Longer Flooded
 - Newly Flooded
 - Velocity Depth Product Mask ($V \times D \leq 0.1 \text{ m}^2/\text{s}$)
- Change In Velocity Depth Product ($V \times D$):
- $\leq -10\%$
 - -10 to $+10\%$
 - $+10$ to $+20\%$
 - $\geq +20\%$



Prepared for: ARTC
Coordinate system: GDA 1994 MGA Zone 55
Aerial Source: NSW Six Maps
Scale ratio correct when printed at A3

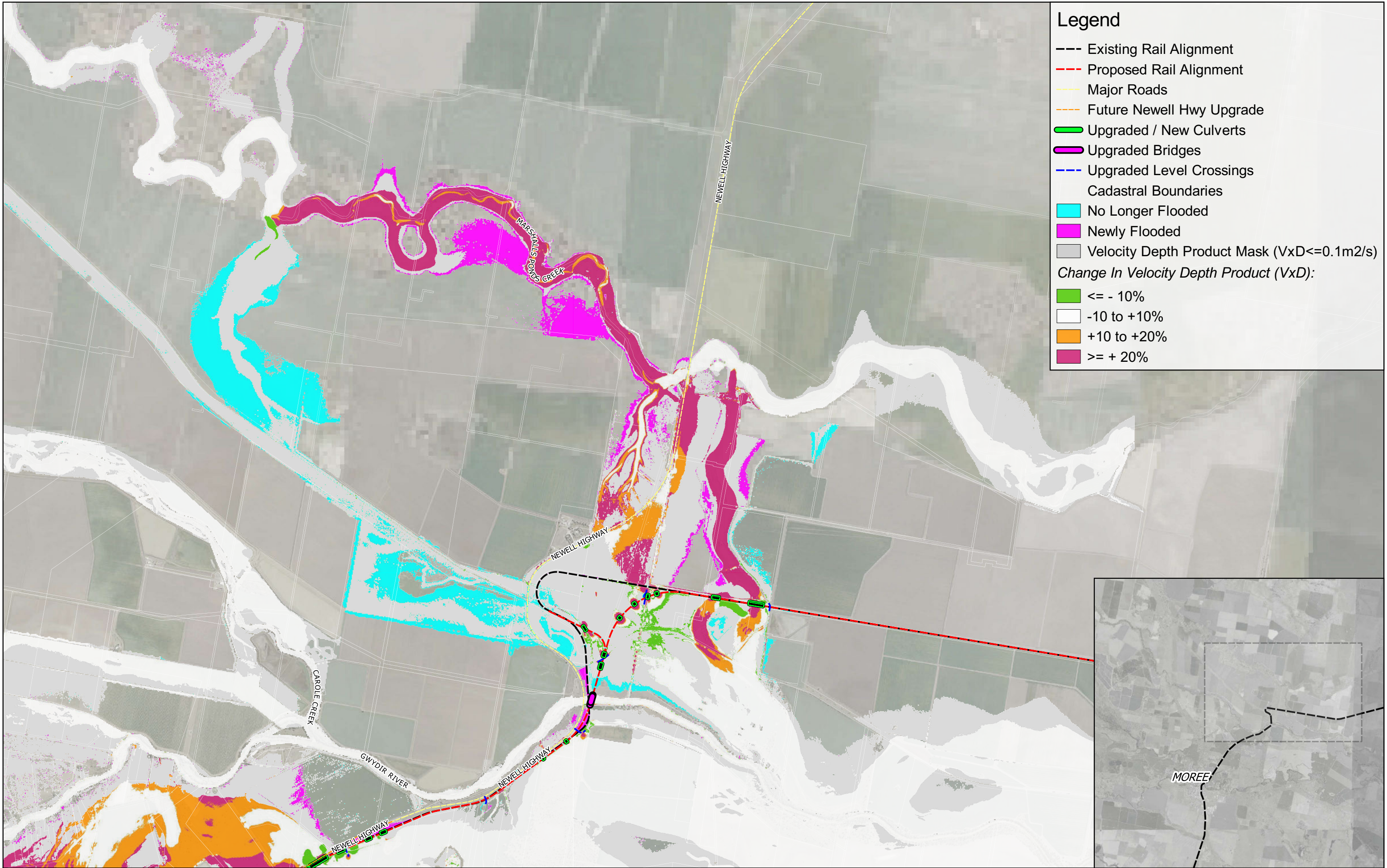
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Scale: 1:40000



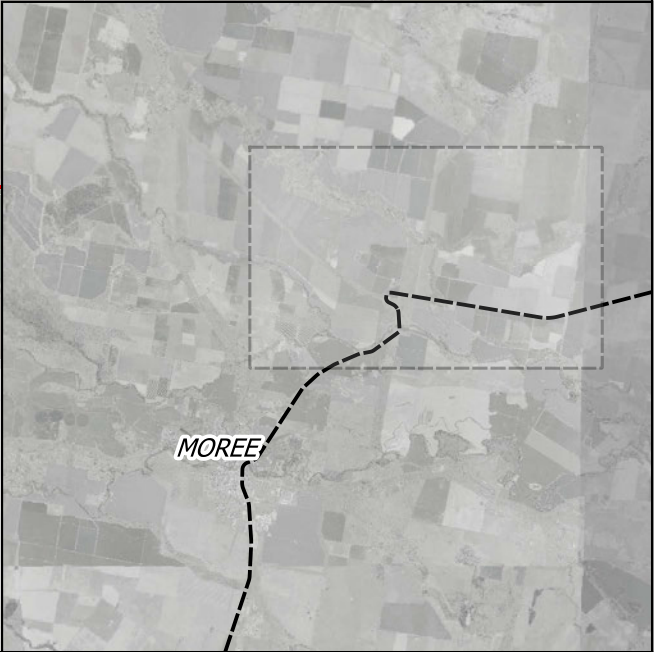
Stage: EIS
Version: C
Author: JS
Approved by: RL
Date: 30/03/2022

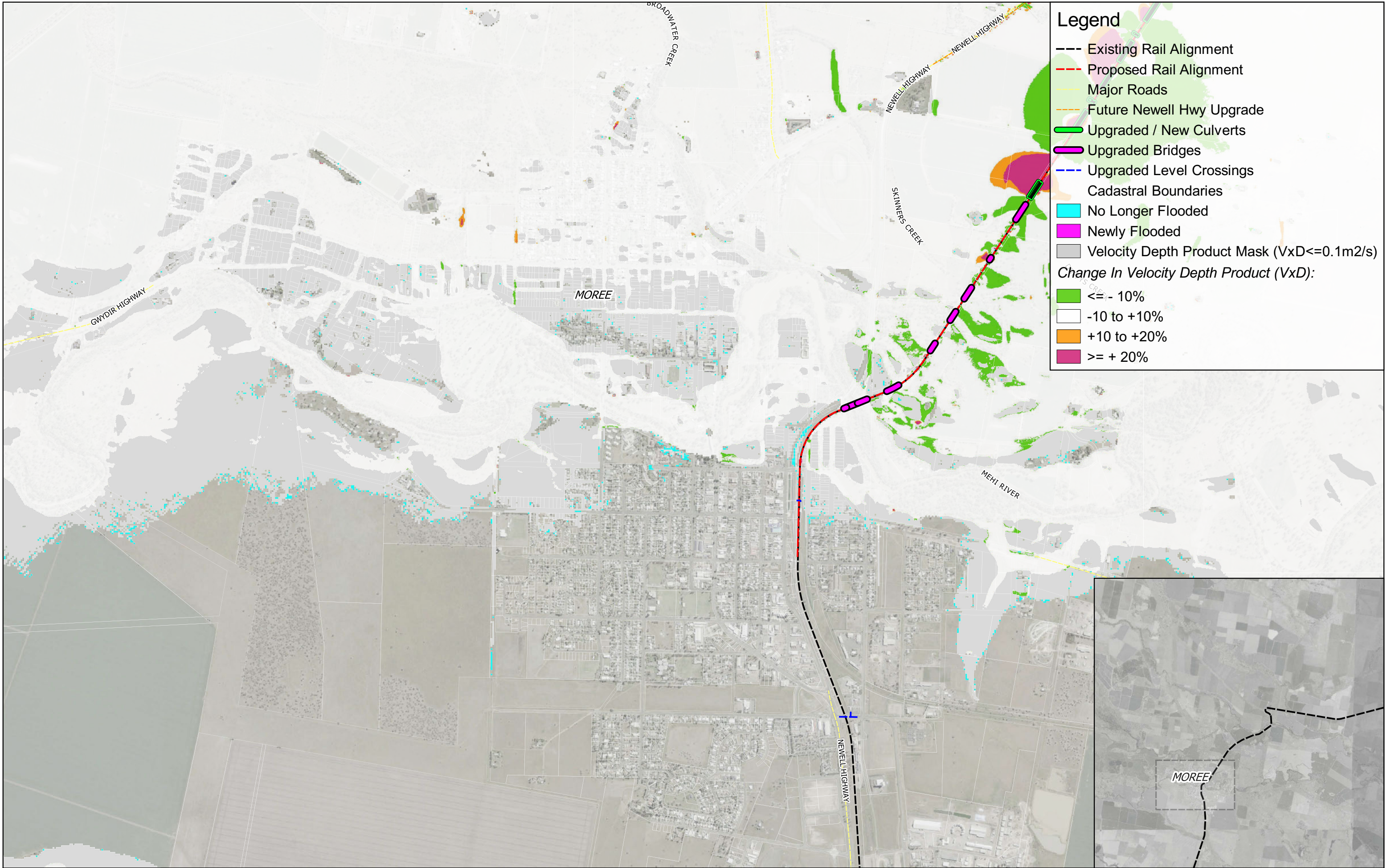
Inland Rail - Narrabri to North Star Phase 2
Change in Flood Hazard - Proposed Design Scenario
Event: 5% AEP
Cumulative Impact of N2NS and Newell Highway Upgrade - Sheet 2
Map ID: DESNH_CHHAZ_005_2



Legend

- Existing Rail Alignment
- - - Proposed Rail Alignment
- Major Roads
- Future Newell Hwy Upgrade
- Upgraded / New Culverts
- Upgraded Bridges
- Upgraded Level Crossings
- Cadastral Boundaries
- No Longer Flooded
- Newly Flooded
- Velocity Depth Product Mask ($VxD \leq 0.1 \text{m}^2/\text{s}$)
- Change In Velocity Depth Product (VxD):*
 - $\leq -10\%$
 - 10 to +10%
 - +10 to +20%
 - $\geq +20\%$



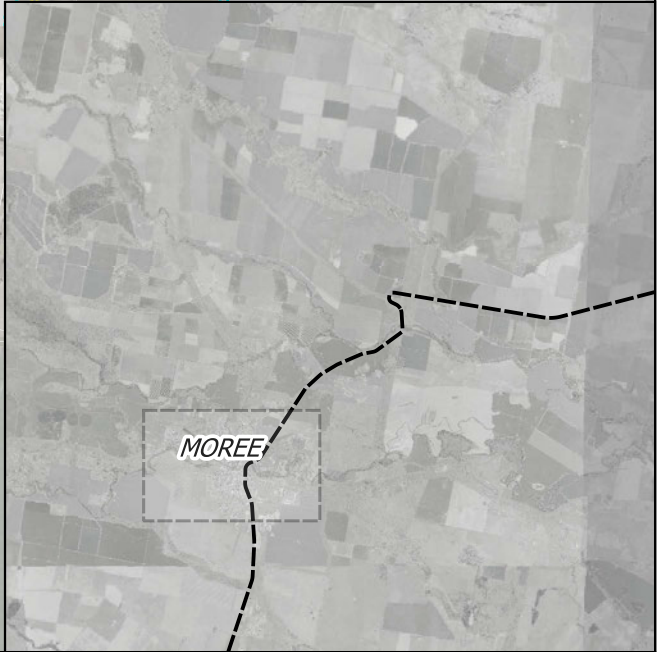


Legend

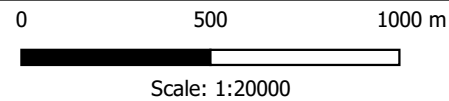
- Existing Rail Alignment
- - - Proposed Rail Alignment
- Major Roads
- - - Future Newell Hwy Upgrade
- Upgraded / New Culverts
- Upgraded Bridges
- Upgraded Level Crossings
- Cadastral Boundaries
- No Longer Flooded
- Newly Flooded
- Velocity Depth Product Mask ($VxD \leq 0.1 \text{ m}^2/\text{s}$)

Change In Velocity Depth Product (VxD):

- $\leq -10\%$
- 10 to +10%
- +10 to +20%
- $\geq +20\%$

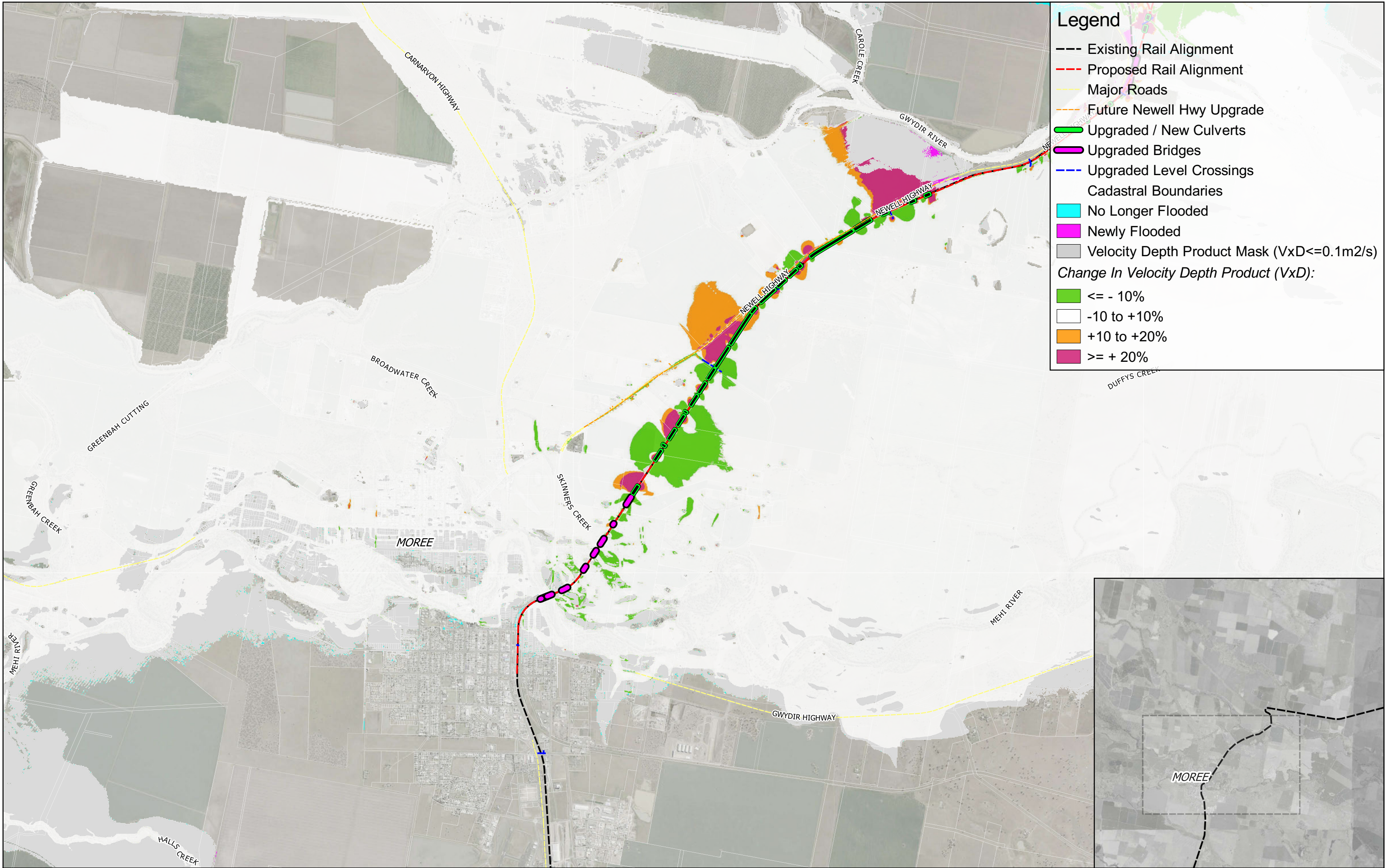


Prepared for: ARTC
Coordinate system: GDA 1994 MGA Zone 55
Aerial Source: NSW Six Maps
Scale ratio correct when printed at A3



Stage: EIS
Version: C
Author: JS
Approved by: RL
Date: 30/03/2022

Inland Rail - Narrabri to North Star Phase 2
Change in Flood Hazard - Proposed Design Scenario
Event: 2% AEP
Cumulative Impact of N2NS and Newell Highway Upgrade - Sheet 1
Map ID: DESNH_CHHAZ_002_1



Legend

Existing Rail Alignment

Proposed Rail Alignment

Major Roads

Future Newell Hwy Upgrade

Upgraded / New Culverts

Upgraded Bridges

Upgraded Level Crossings

Cadastral Boundaries

No Longer Flooded

Newly Flooded

Velocity Depth Product Mask ($V \times D \leq 0.1 \text{ m}^2/\text{s}$)

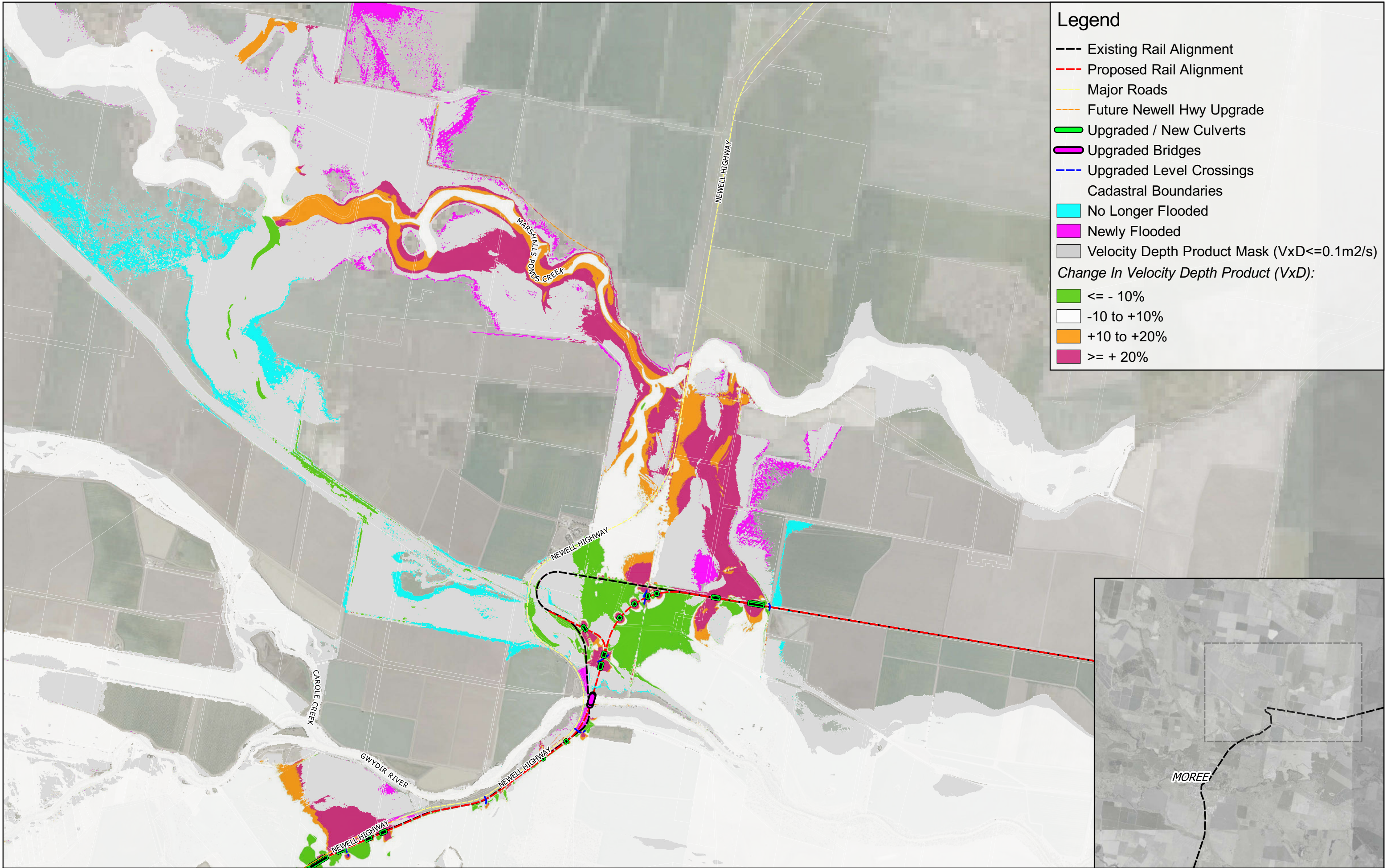
Change In Velocity Depth Product ($V \times D$):

 $\leq -10\%$

-10 to +10%

+10 to +20%

 $\geq +20\%$



Legend

Existing Rail Alignment

Proposed Rail Alignment

Major Roads

Future Newell Hwy Upgrade

Upgraded / New Culverts

Upgraded Bridges

Upgraded Level Crossings

Cadastral Boundaries

No Longer Flooded

Newly Flooded

Velocity Depth Product Mask ($VxD \leq 0.1 \text{m}^2/\text{s}$)

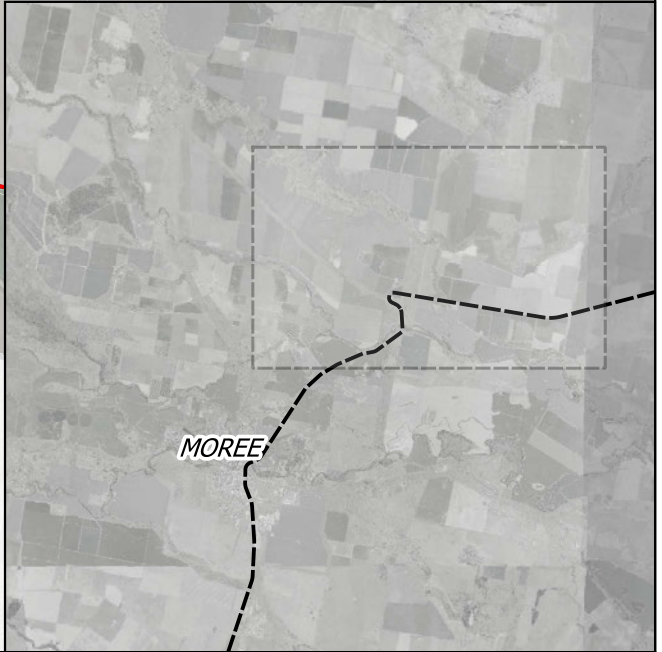
Change In Velocity Depth Product (VxD):

 $\leq -10\%$

-10 to +10%

+10 to +20%

 $\geq +20\%$





Legend

Existing Rail Alignment

Proposed Rail Alignment

Major Roads

Future Newell Hwy Upgrade

Upgraded / New Culverts

Upgraded Bridges

Upgraded Level Crossings

Cadastral Boundaries

No Longer Flooded

Newly Flooded

Velocity Depth Product Mask ($VxD \leq 0.1\text{m}^2/\text{s}$)

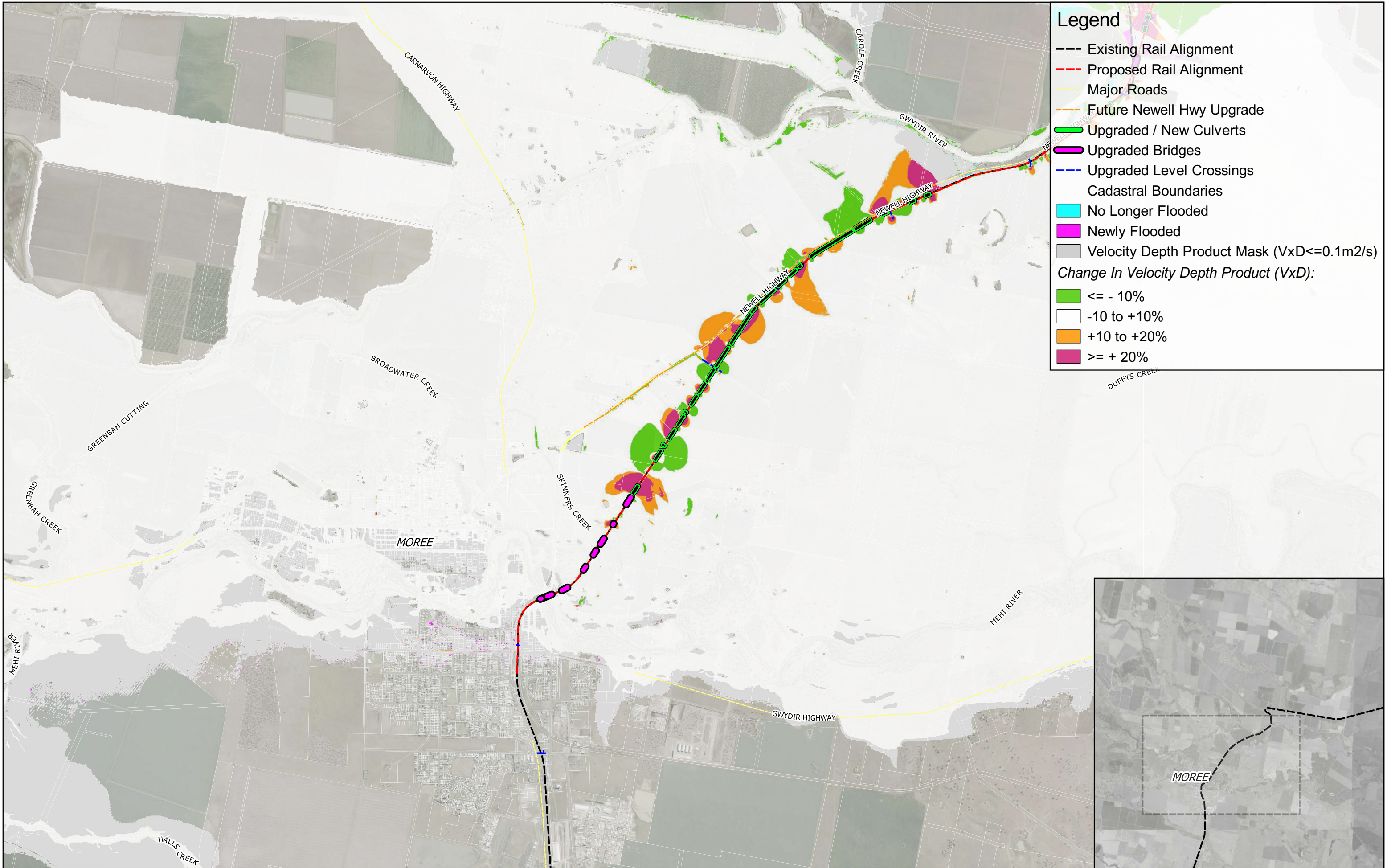
Change In Velocity Depth Product (VxD):

$\leq -10\%$

-10 to +10%

+10 to +20%

$\geq +20\%$



Legend

Existing Rail Alignment

Proposed Rail Alignment

Major Roads

Future Newell Hwy Upgrade

Upgraded / New Culverts

Upgraded Bridges

Upgraded Level Crossings

Cadastral Boundaries

No Longer Flooded

Newly Flooded

Velocity Depth Product Mask ($VxD \leq 0.1m^2/s$)

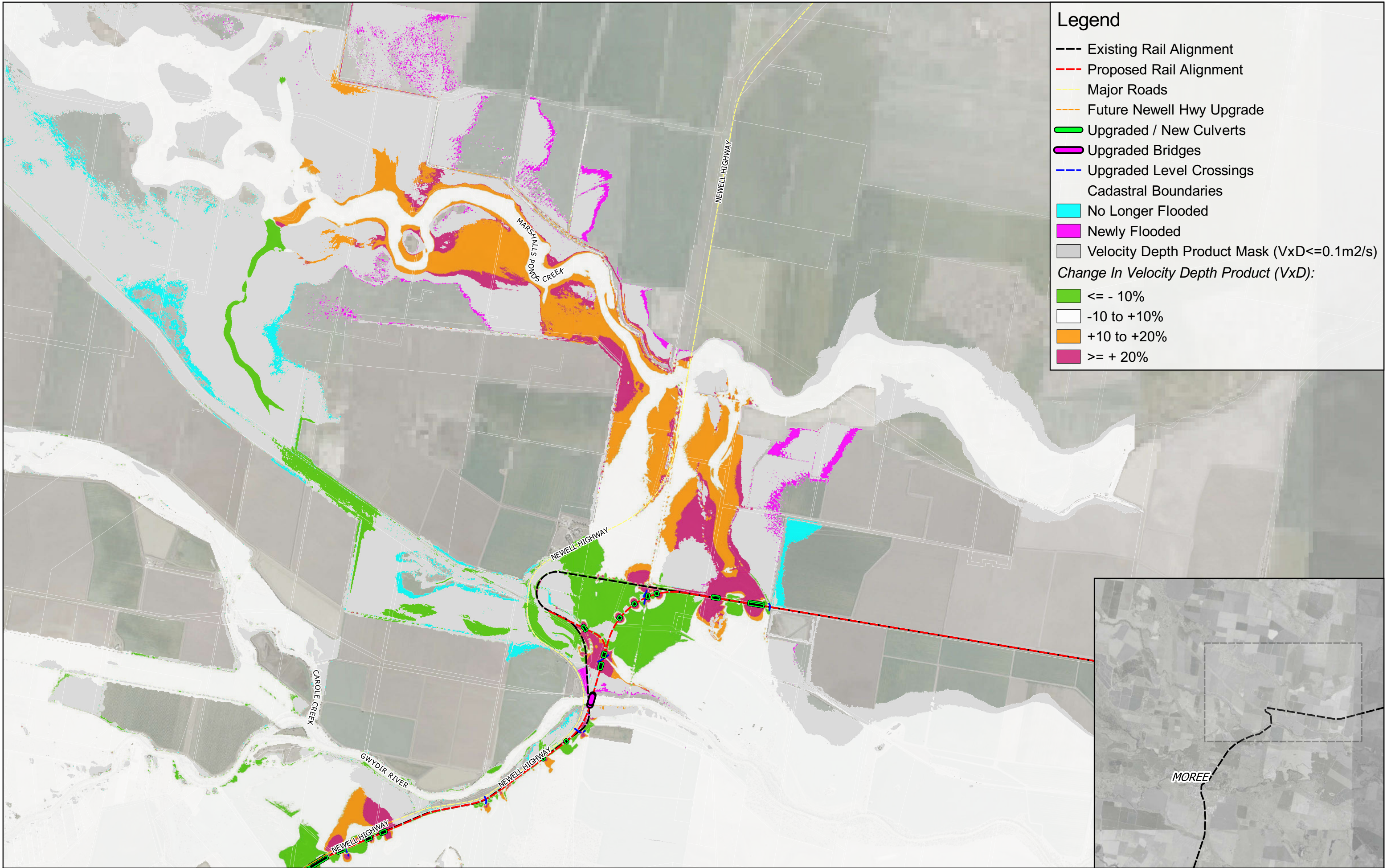
Change In Velocity Depth Product (VxD):

 $\leq -10\%$

-10 to +10%

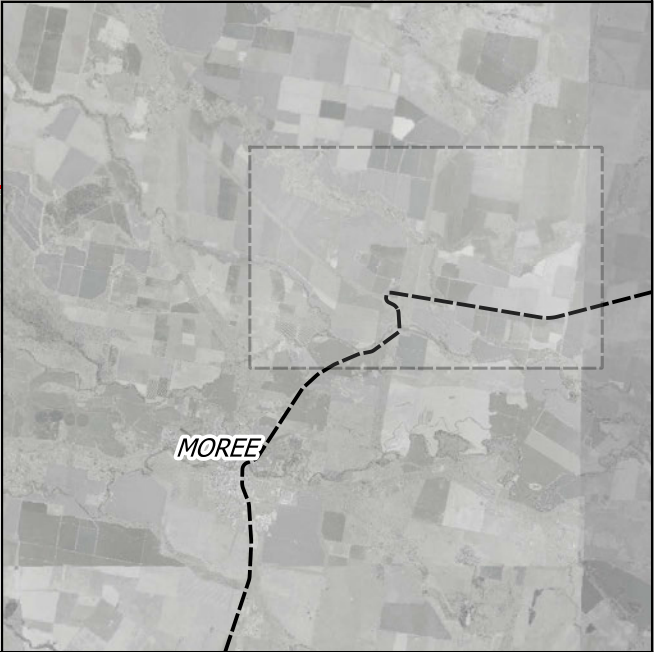
+10 to +20%

 $\geq +20\%$

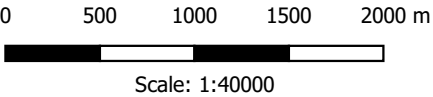


Legend

- Existing Rail Alignment
- - - Proposed Rail Alignment
- Major Roads
- Future Newell Hwy Upgrade
- Upgraded / New Culverts
- Upgraded Bridges
- Upgraded Level Crossings
- Cadastral Boundaries
- No Longer Flooded
- Newly Flooded
- Velocity Depth Product Mask ($VxD \leq 0.1 \text{m}^2/\text{s}$)
- Change In Velocity Depth Product (VxD):
 - $\leq -10\%$
 - 10 to +10%
 - +10 to +20%
 - $\geq +20\%$



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Stage: EIS
Version: C
Author: JS
Approved by: RL
Date: 30/03/2022

Inland Rail - Narrabri to North Star Phase 2
Change in Flood Hazard - Proposed Design Scenario
Event: 1% AEP
Cumulative Impact of N2NS and Newell Highway Upgrade - Sheet 3
Map ID: DESNH_CHHAZ_001_3