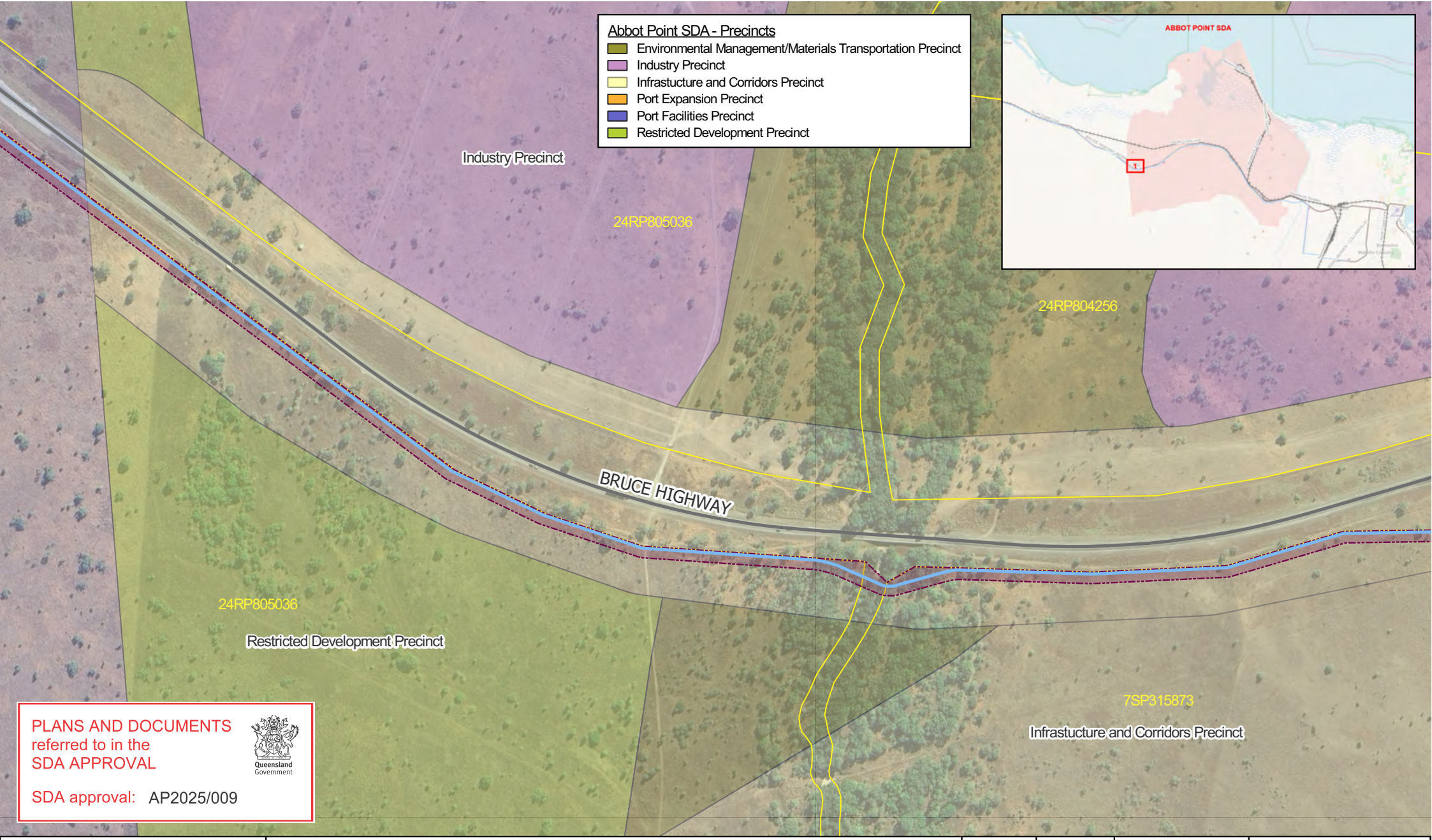


PLANS AND DOCUMENTS referred to in the SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

rps MAKING COMPLEX EASY
A TETRA TECH COMPANY
Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:

Bowen Pipeline - Abbot Point SDA - Sheet 1

Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

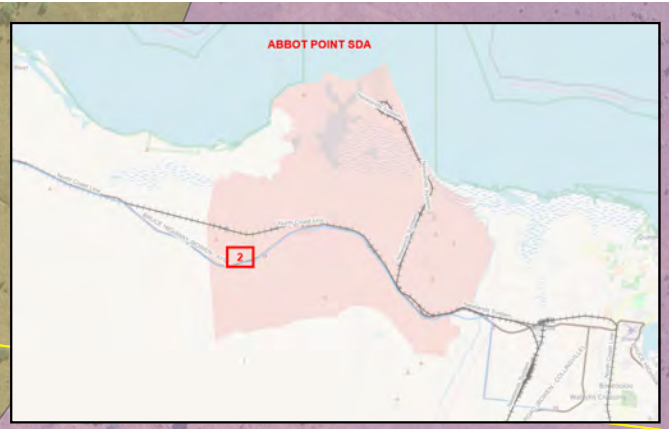
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Scale @A3: 1:4000

Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend
- Pipeline
- Pipeline Corridor
- Railways
- Roads
- Land Parcels

N



Abbot Point SDA - Precincts
- Environmental Management/Materials Transportation Precinct
- Industry Precinct
- Infrastructure and Corridors Precinct
- Port Expansion Precinct
- Port Facilities Precinct
- Restricted Development Precinct

3HR1712

Industry Precinct

3HR1712

24RP804256

BRUCE HIGHWAY

7SP315873

Infrastructure and Corridors Precinct

11SP315873

7SP315873

Industry Precinct

PLANS AND DOCUMENTS referred to in the SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

MAKING COMPLEX EASY

A TETRA TECH COMPANY

Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:

Bowen Pipeline - Abbot Point SDA - Sheet 2

Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

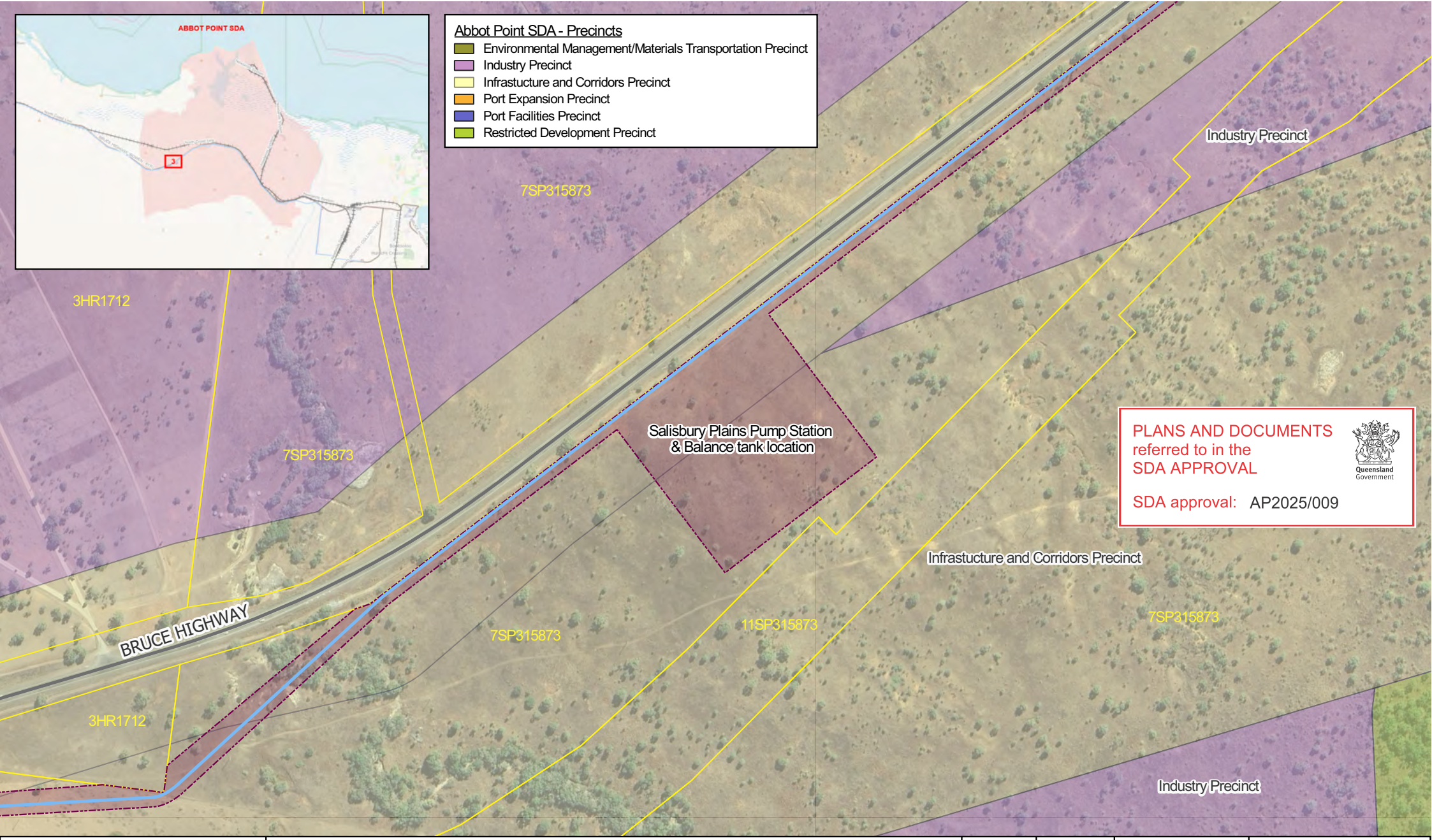
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Scale @A3: 1:4000

Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend
- Pipeline
- Pipeline Corridor
- Railways
- Roads
- Land Parcels

N



MAKING COMPLEX EASY
A TETRA TECH COMPANY
Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:

Bowen Pipeline - Abbot Point SDA - Sheet 3

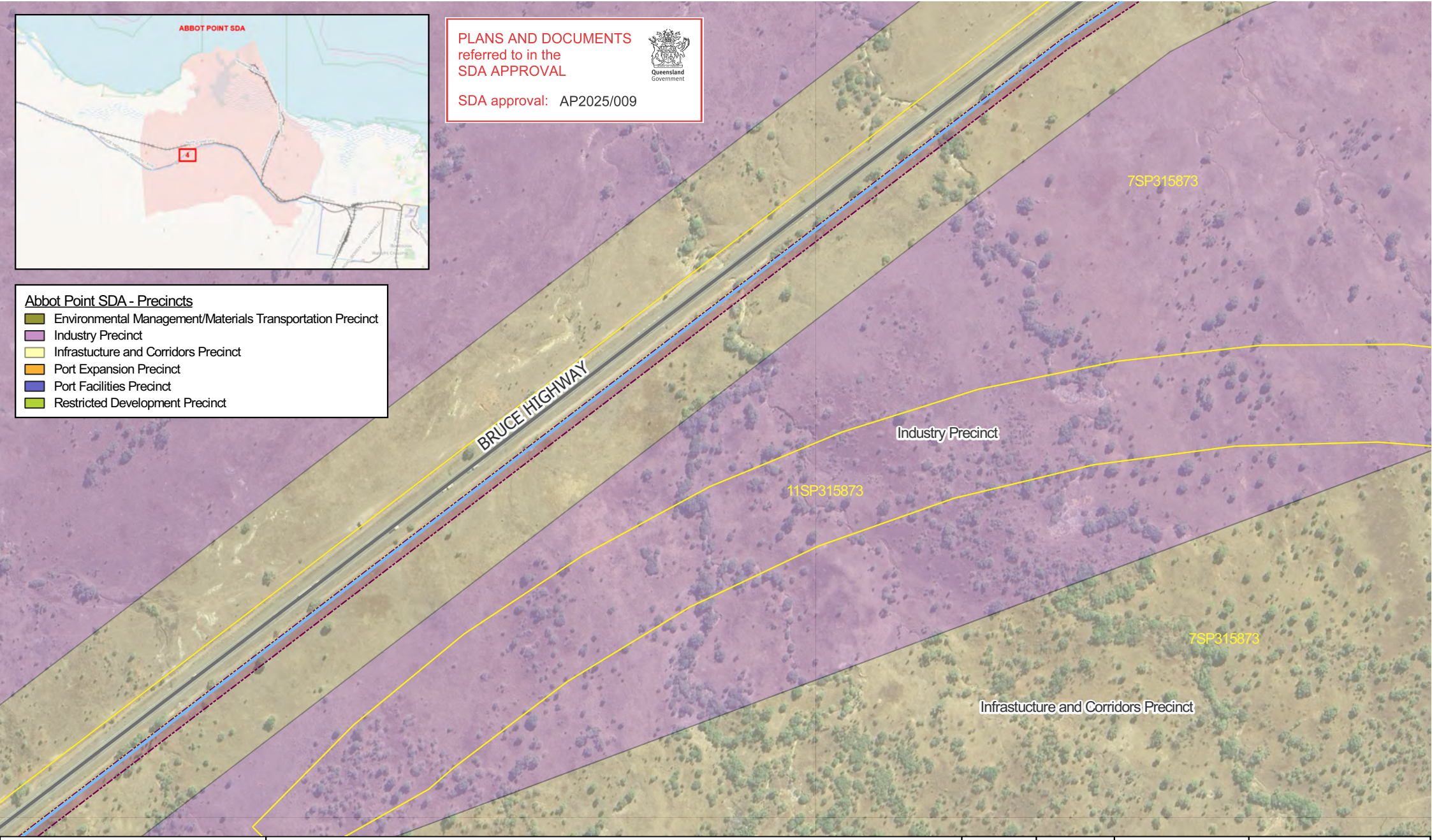
Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

0 50 100 150 200 250 m

Scale @A3: 1:4000

Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend
Pipeline
Pipeline Corridor
Railways
Roads
Land Parcels
N



MAKING COMPLEX EASY
A TETRA TECH COMPANY
Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:

Bowen Pipeline - Abbot Point SDA - Sheet 4

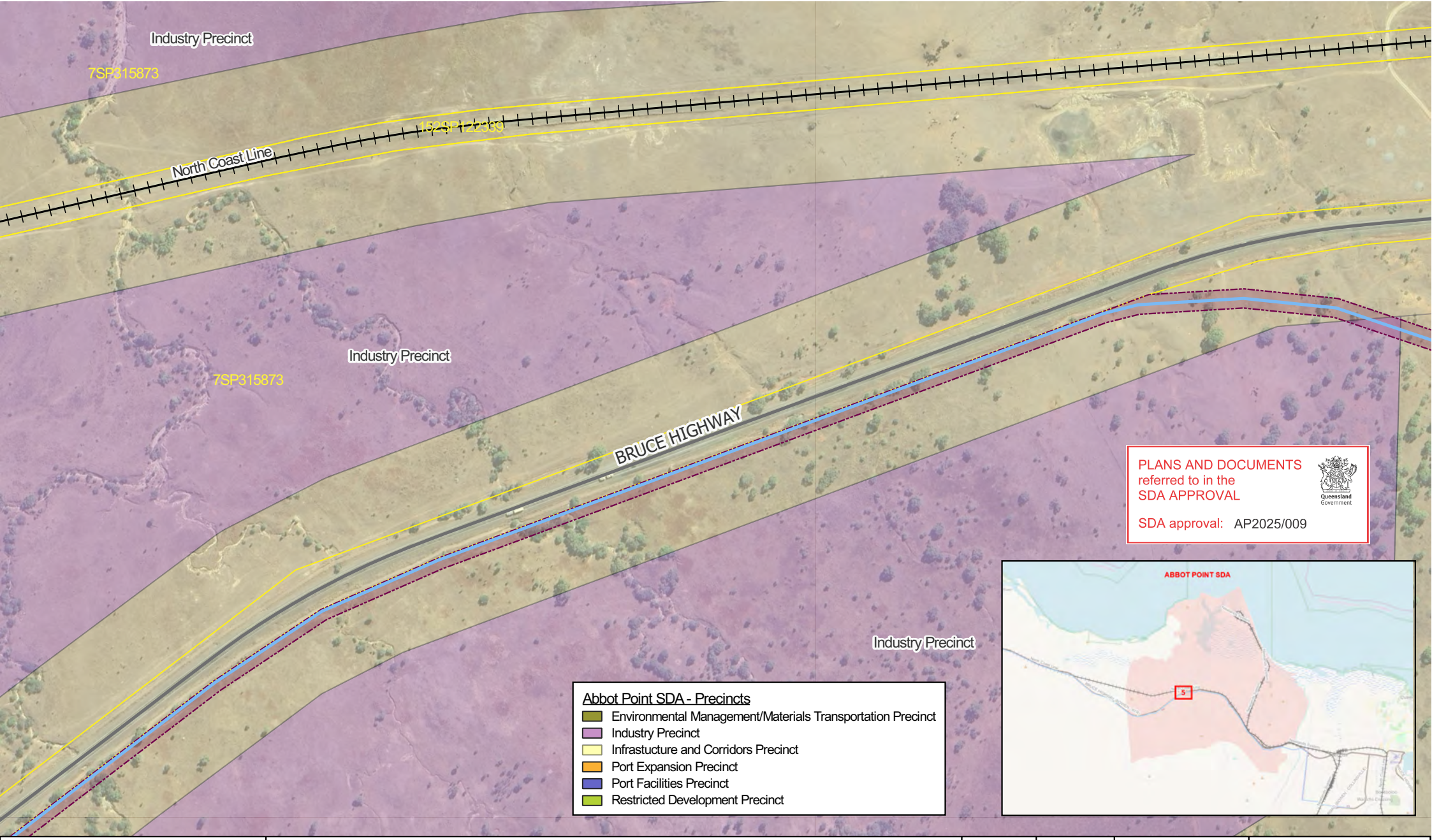
Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

0 50 100 150 200 250 m

Scale @A3: 1:4000

Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend
Pipeline
Pipeline Corridor
Railways
Roads
Land Parcels
N



MAKING COMPLEX EASY
A TETRA TECH COMPANY
Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:

Bowen Pipeline - Abbot Point SDA - Sheet 5

Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

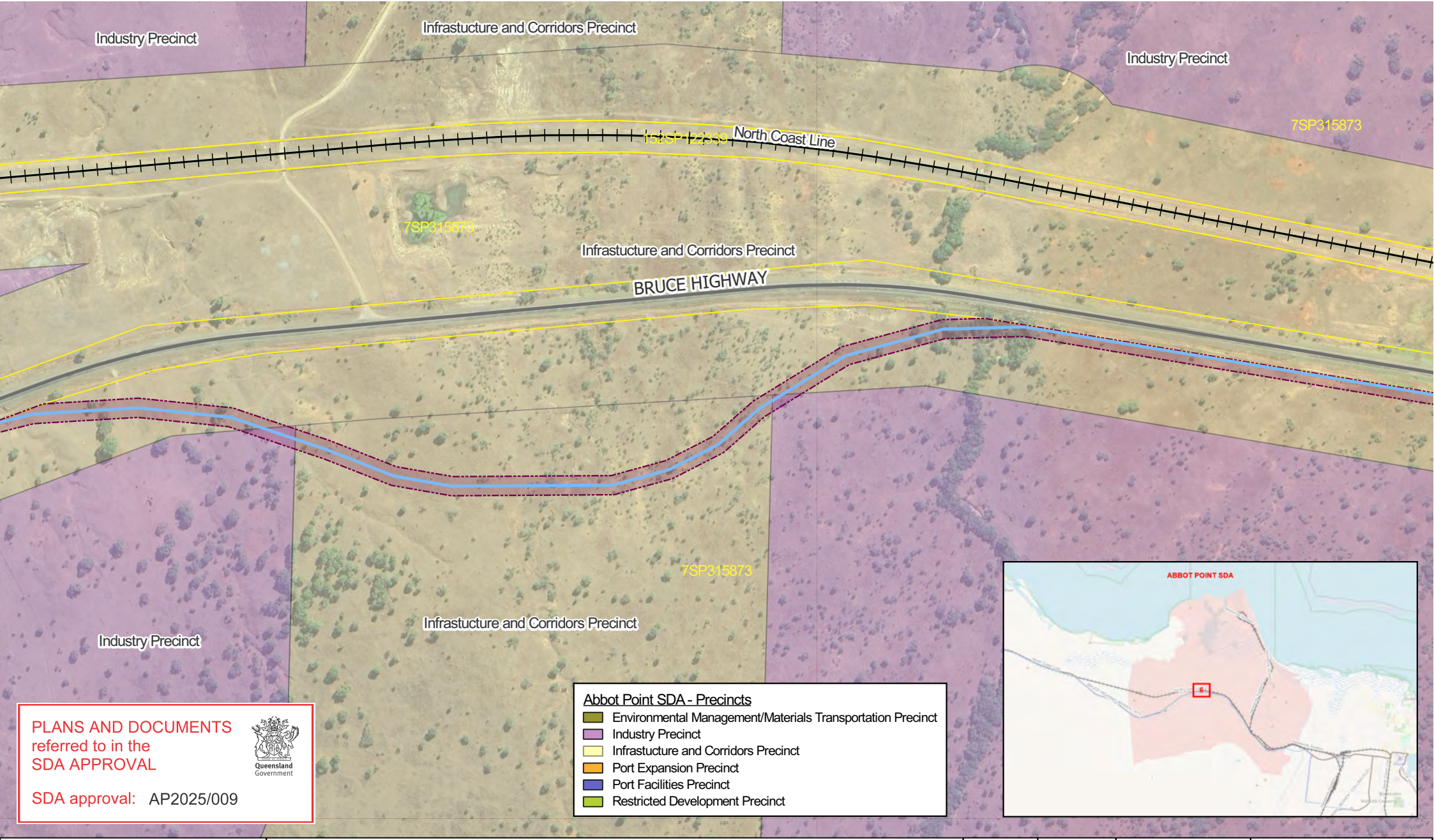
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Scale @A3: 1:4000

Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend
- Pipeline
- Pipeline Corridor
- Railways
- Roads
- Land Parcels

N



PLANS AND DOCUMENTS referred to in the SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

rps MAKING COMPLEX EASY

A TETRA TECH COMPANY

Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:

Bowen Pipeline - Abbot Point SDA - Sheet 6

Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

0 50 100 150 200 250 m

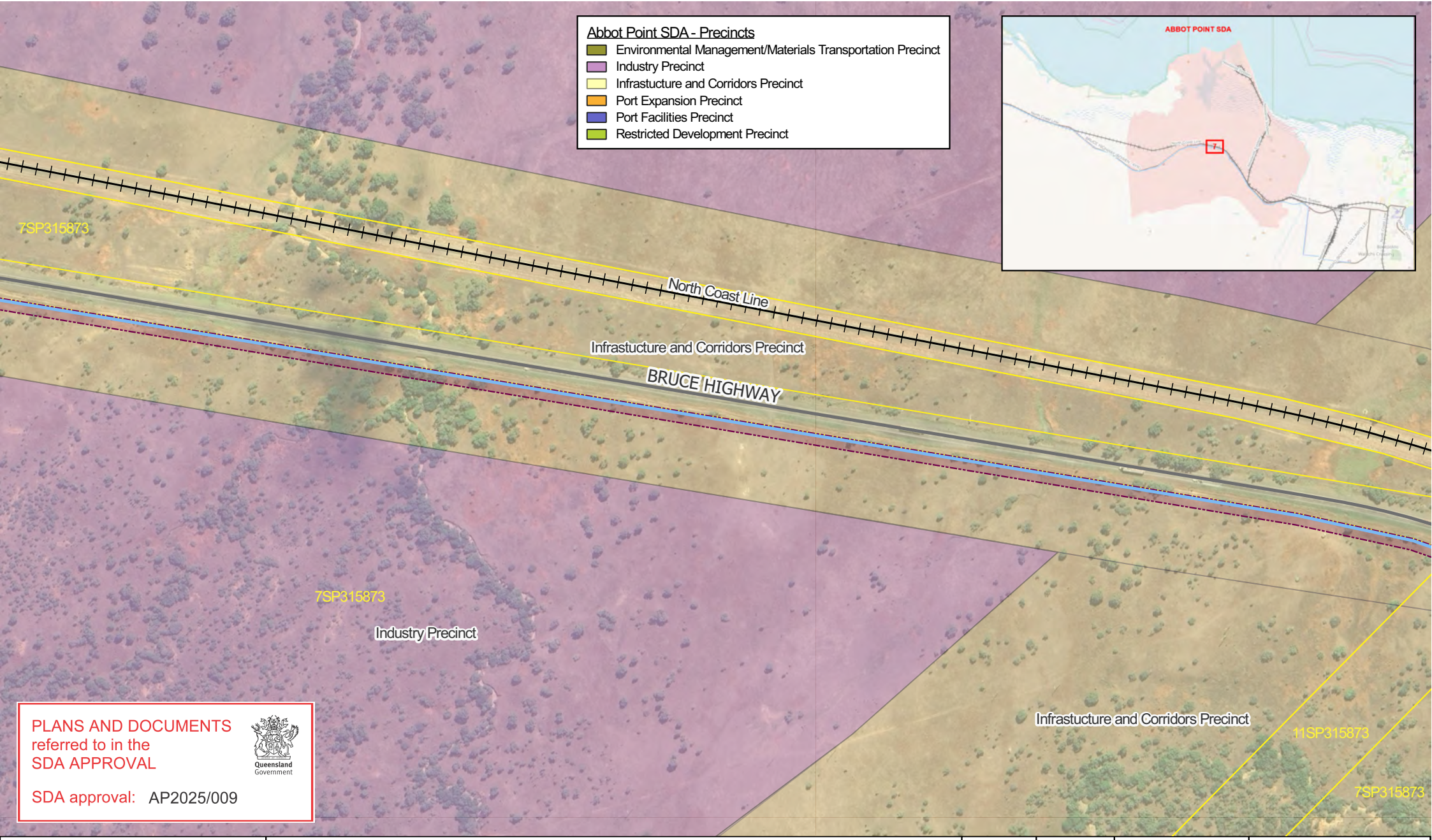
Scale @A3: 1:4000

Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend

- Pipeline
- Pipeline Corridor
- Railways
- Roads
- Land Parcels

N



PLANS AND DOCUMENTS referred to in the SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

rps MAKING COMPLEX EASY

A TETRA TECH COMPANY

Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:

Bowen Pipeline - Abbot Point SDA - Sheet 7

Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

0 50 100 150 200 250 m

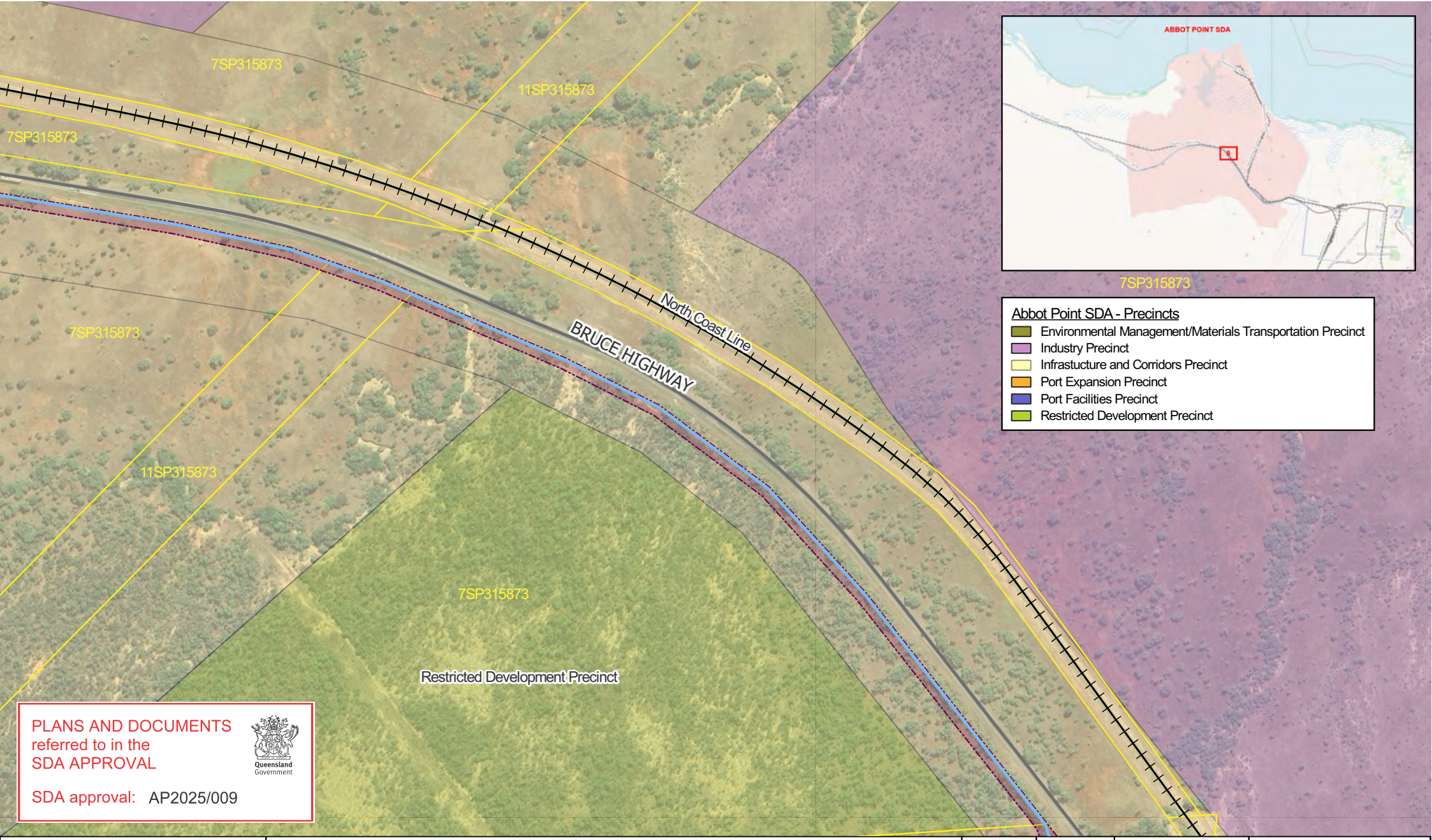
Scale @A3: 1:4000

Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend

- Pipeline
- Pipeline Corridor
- Railways
- Roads
- Land Parcels

N



PLANS AND DOCUMENTS referred to in the SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

rps MAKING COMPLEX EASY

A TETRA TECH COMPANY

Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:

Bowen Pipeline - Abbot Point SDA - Sheet 8

Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

0 50 100 150 200 250 m

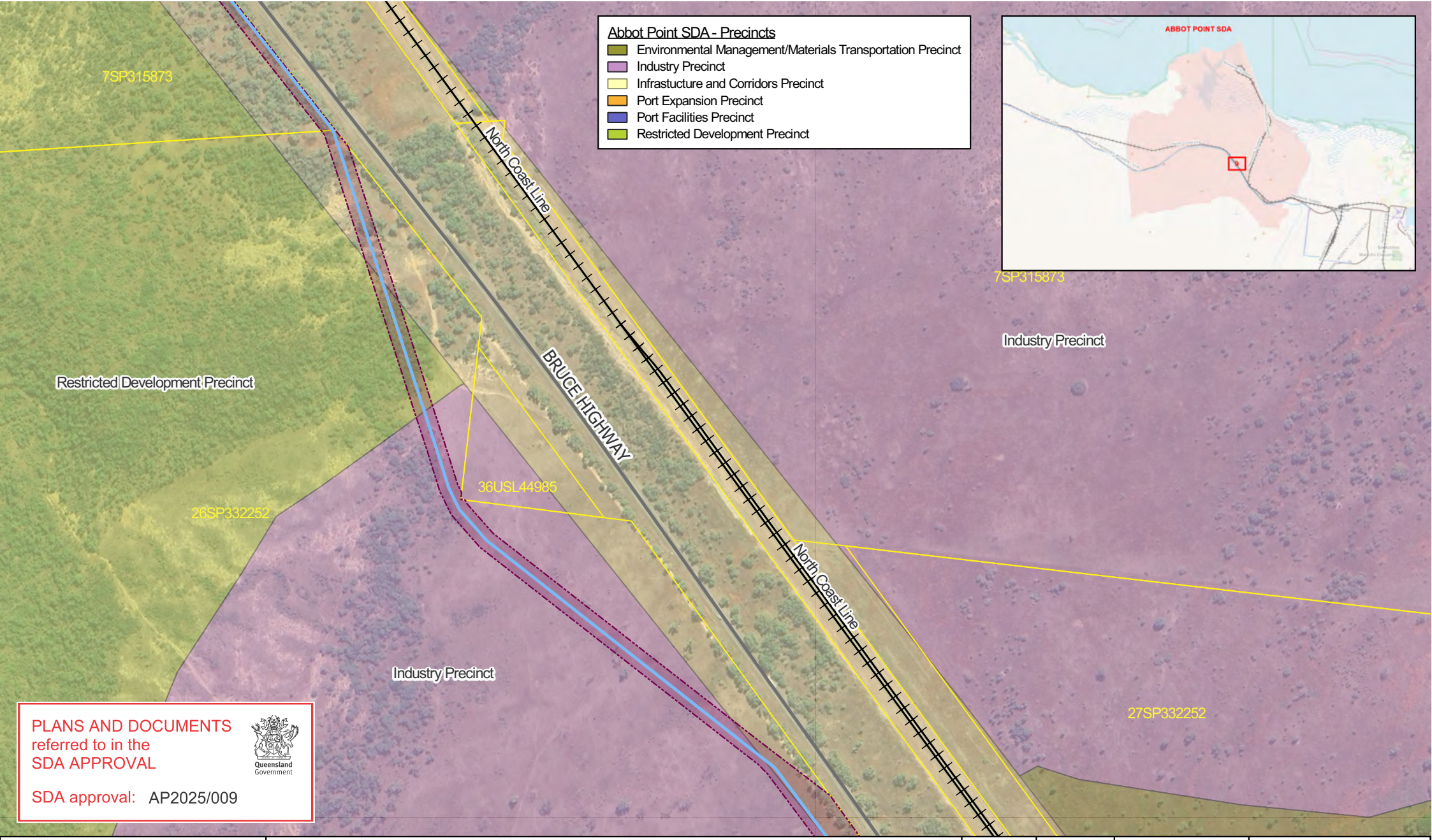
Scale @A3: 1:4000

Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend

- Pipeline
- Pipeline Corridor
- Railways
- Roads
- Land Parcels

N



PLANS AND DOCUMENTS referred to in the SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

rps MAKING COMPLEX EASY

A TETRA TECH COMPANY

Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:

Bowen Pipeline - Abbot Point SDA - Sheet 9

Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

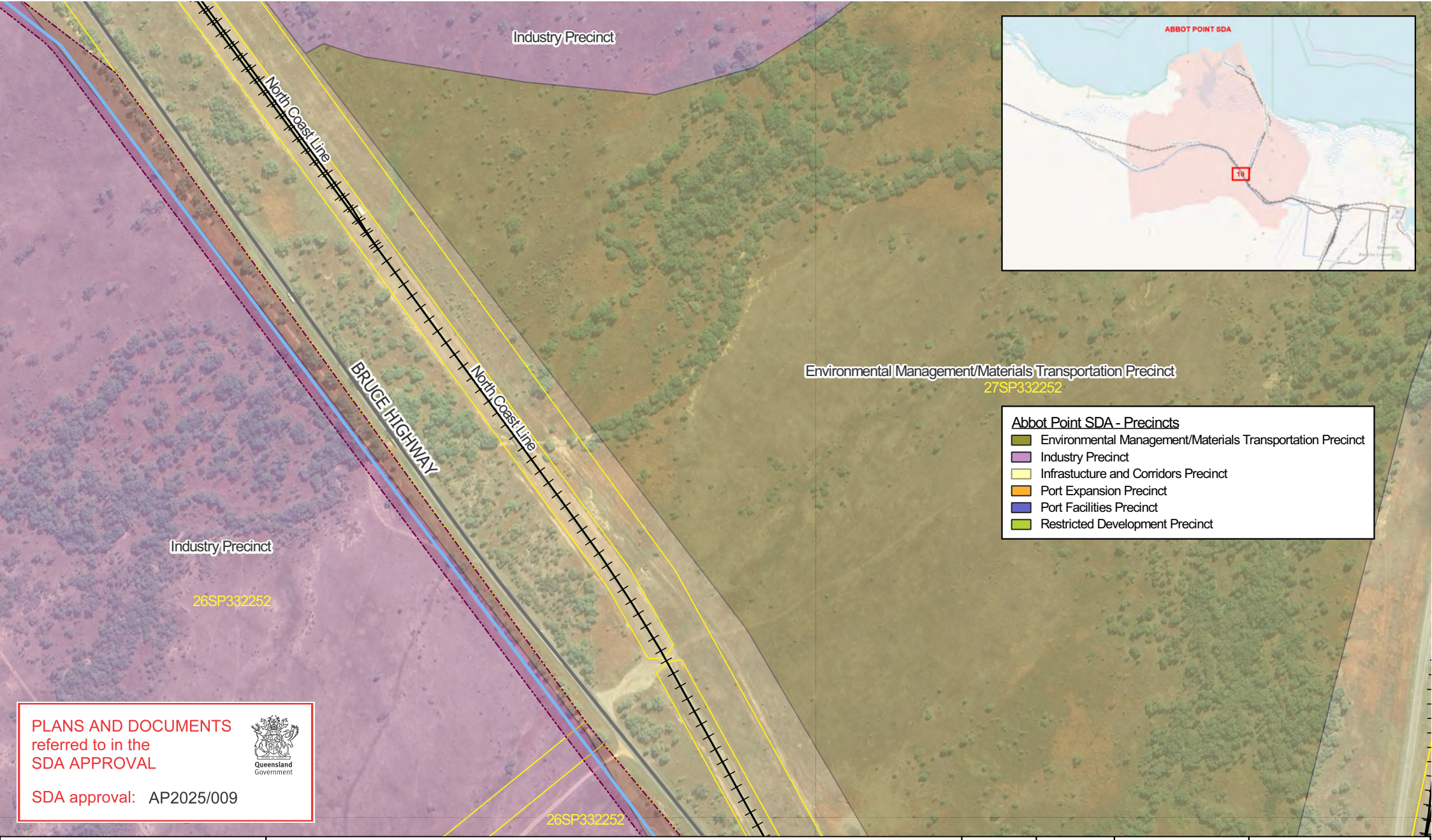
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Scale @A3: 1:4000

Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend
- Pipeline
- Pipeline Corridor
- Railways
- Roads
- Land Parcels

N



PLANS AND DOCUMENTS
referred to in the
SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

rps MAKING COMPLEX EASY
A TETRA TECH COMPANY
Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:

Bowen Pipeline - Abbot Point SDA - Sheet 10

Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

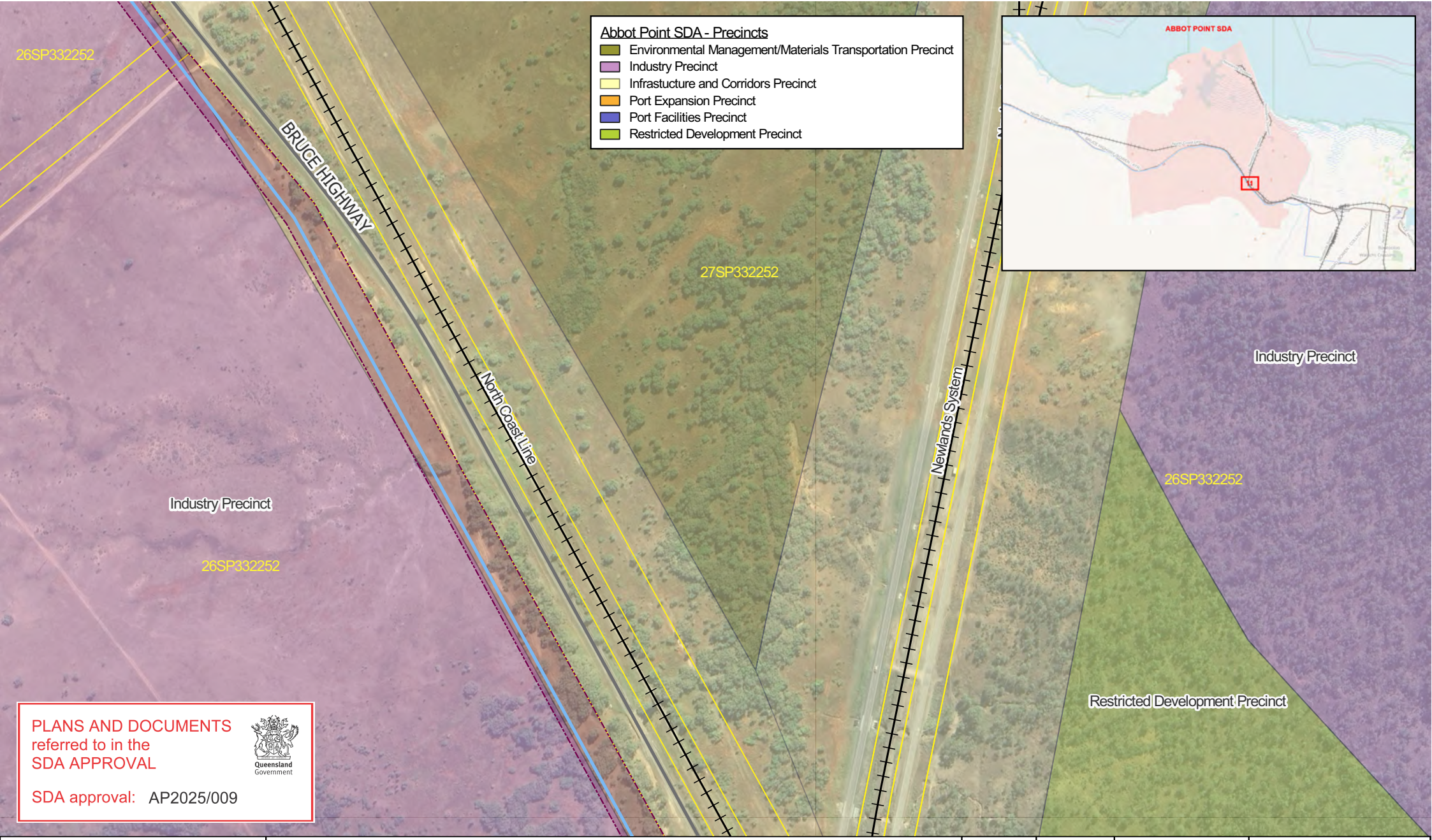
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Scale @A3: 1:4000

Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend
- Pipeline
- Pipeline Corridor
- Railways
- Roads
- Land Parcels

N



PLANS AND DOCUMENTS referred to in the SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

rps MAKING COMPLEX EASY
A TETRA TECH COMPANY
Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:

Bowen Pipeline - Abbot Point SDA - Sheet 11

Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

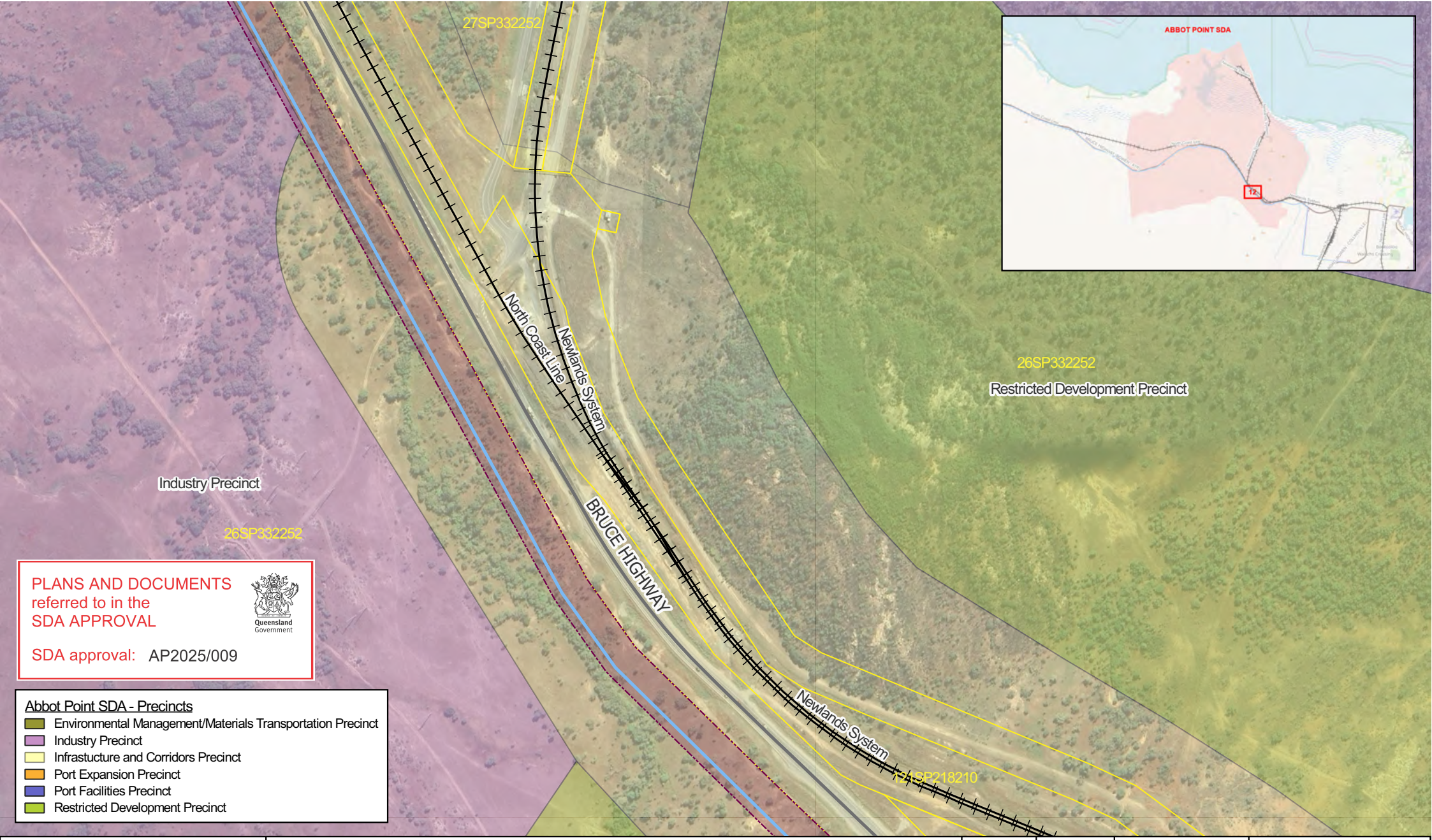
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Scale @A3: 1:4000

Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend
- Pipeline
- Pipeline Corridor
- Railways
- Roads
- Land Parcels

N



PLANS AND DOCUMENTS referred to in the SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

Abbot Point SDA - Precincts

- Environmental Management/Materials Transportation Precinct
- Industry Precinct
- Infrastructure and Corridors Precinct
- Port Expansion Precinct
- Port Facilities Precinct
- Restricted Development Precinct

rps MAKING COMPLEX EASY

A TETRA TECH COMPANY

Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:

Bowen Pipeline - Abbot Point SDA - Sheet 12

Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

0 50 100 150 200 250 m

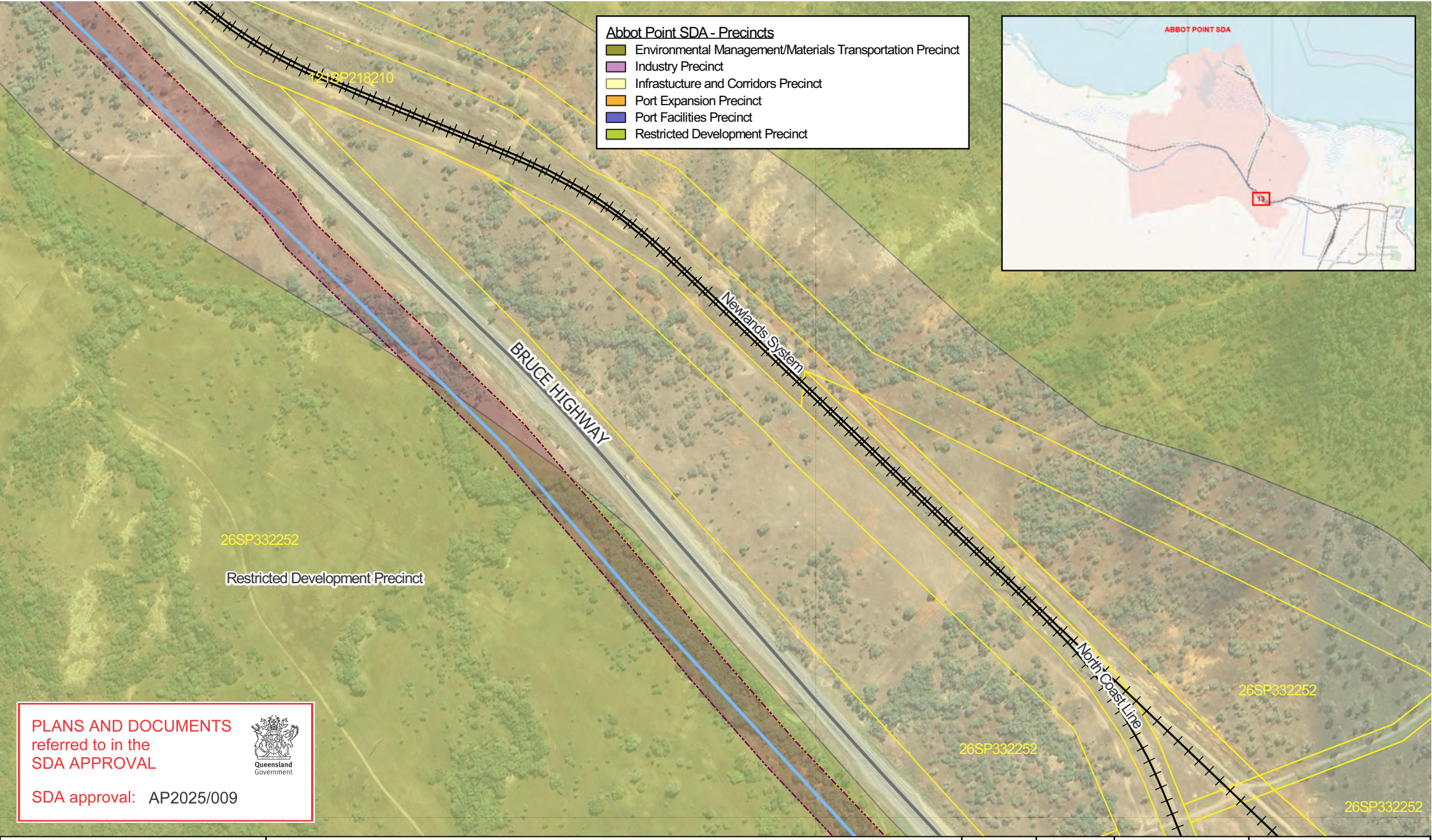
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Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend

- Pipeline
- Pipeline Corridor
- Railways
- Roads
- Land Parcels

N



PLANS AND DOCUMENTS referred to in the SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

MAKING COMPLEX EASY

A TETRA TECH COMPANY

Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:

Bowen Pipeline - Abbot Point SDA - Sheet 13

Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

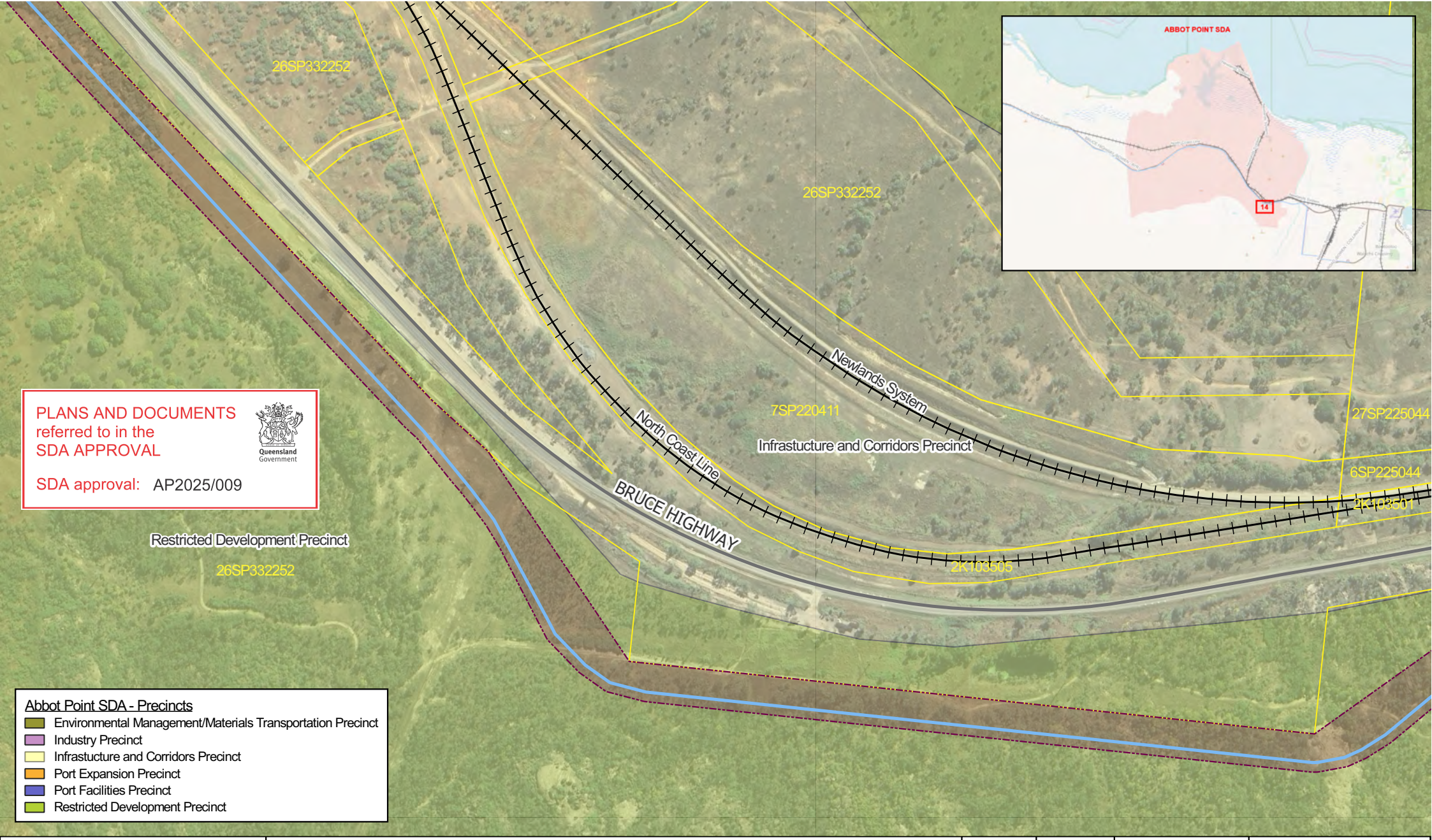
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Scale @A3: 1:4000

Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend
- Pipeline
- Pipeline Corridor
- Railways
- Roads
- Land Parcels

N



rps MAKING COMPLEX EASY
A TETRA TECH COMPANY
Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:

Bowen Pipeline - Abbot Point SDA - Sheet 14

Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

0 50 100 150 200 250 m

Scale @A3: 1:4000

Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend
- Pipeline
- Pipeline Corridor
- Railways
- Roads
- Land Parcels

N

PLANS AND DOCUMENTS
referred to in the
SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

Restricted Development Precinct

26SP332252

27SP225044

6SP225044

Infrastucture and Corridors Precinct

26SP332252

42RP746944

2K103501

Newlands System 7SP220411

BRUCE HIGHWAY

North Coast Line 2K103505

Restricted Development Precinct

26SP332252



Abbot Point SDA - Precincts
- Environmental Management/Materials Transportation Precinct
- Industry Precinct
- Infrastucture and Corridors Precinct
- Port Expansion Precinct
- Port Facilities Precinct
- Restricted Development Precinct

rps MAKING COMPLEX EASY
A TETRA TECH COMPANY
Level 8, 31 Duncan Street
Fortitude Valley QLD 4006
T +61 7 3539 9500

Drawing title:
Bowen Pipeline - Abbot Point SDA - Sheet 15

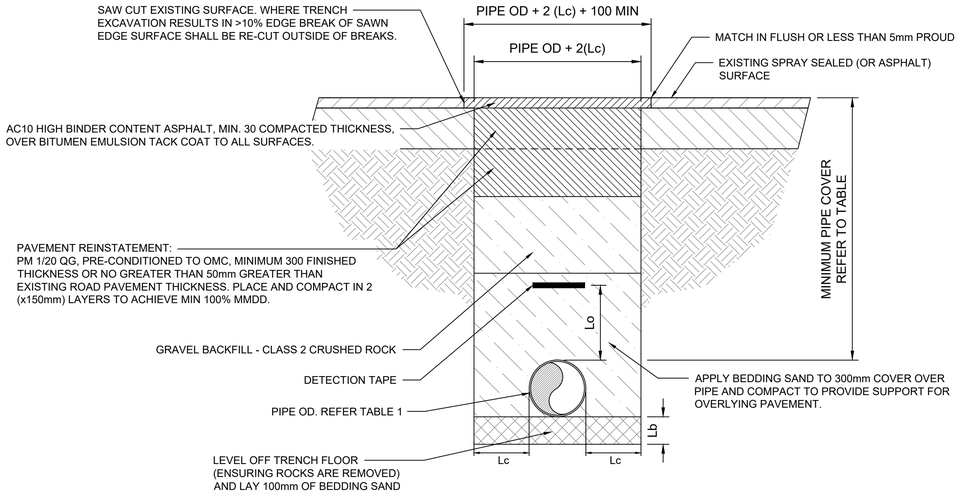
Project: Bowen Pipeline
Job ref: 5676
Client: Bowen Pipeline Company

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Scale @A3: 1:4000

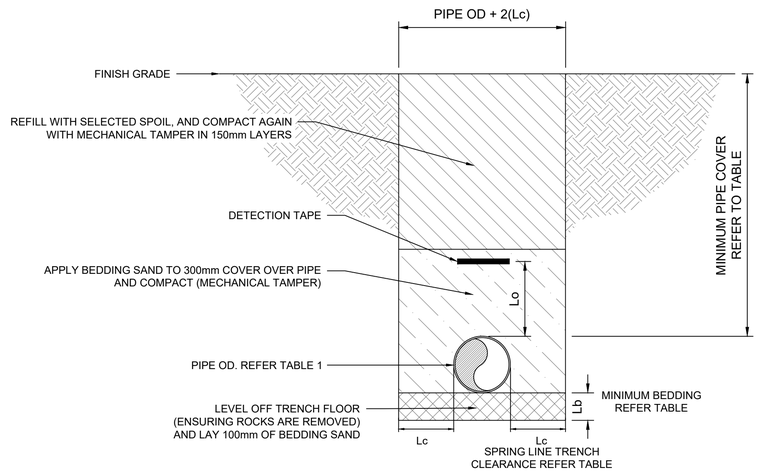
Revision	Drawn By	Date
A	TE	02/09/2025
B	TE	03/09/2025

Legend
- Pipeline
- Pipeline Corridor
- Railways
- Roads
- Land Parcels

N



ROAD CROSSING BY TRENCH
TYPICAL INSTALLATION DETAIL
NOT TO SCALE



PIPELINE IN ROAD RESERVE/ WITHIN PROPERTY BOUNDARIES TRENCH
TYPICAL INSTALLATION DETAIL
NOT TO SCALE

MINIMUM PIPE COVER	
LOCATION	MINIMUM COVER #
NON ROADWAYS - GENERAL -INDUSTRIAL / COMMERCIAL	 450 600
SEALED ROADS	600
MAJOR ROADWAYS/ EMBANKEMENTS	750
HIGHWAYS	1500

BACKFILL AND BEDDING DIMENSIONS TO AS/NZS 2566.1			
NOMINAL DIAMETER(DM)	MINIMUM CLEARANCE (Lc)	MINIMUM OVERLAY (Lo)	MINIMUM BEDDING (Lb)
> 150 - ≤ 300	150	150	100
> 300 - ≤ 450	200	150	100
> 450 - ≤ 900	300	150	150
> 900 - ≤ 1800	350	200	150

NOTE: TRENCH DIMENSIONS AS PER CODE WAT-120001 TRENCH WIDTH TO BE SUFFICIENT TO SAFELY LAY THE PIPE AND COMPACT THE SIDE SUPPORT ZONE. LABEL DIAMETER AS HIGHLIGHTED, KEEP MINIMUM BEDDING AS 100mm FOR ALL OPTIONS.

PLANS AND DOCUMENTS
referred to in the
SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

Smart Approved WaterMark

NOTE:
1. FOR DEPTHS EQUAL TO OR GREATER THAN 1.5 M, TRENCHES MUST BE SHORED AS SPECIFIED BY SAFE WORK AUSTRALIA, EXCAVATION WORK CODE OF PRACTICE.
2. UNLESS STATED OTHERWISE, PIPE WORK LAID IN ROADS TO BE SEALED LATER TO HAVE A MINIMUM DEPTH OF 600mm FROM BOX-OUT OF THE ROAD.

PRELIMINARY
NOT FOR CONSTRUCTION

REV	ISSUED	D.DWN	APRVD	REVISION DESCRIPTION
02	15/02/2024	MG	DM	FINAL ISSUE
01	18/12/2023	MG	DM	PRELIMINARY DRAFT ISSUE

admin@pinionadvisory.com
1300 746 466
pinionadvisory.com
pinion ADVISORY
agribusiness, water & environment

Bowen Pipeline Company

KBR

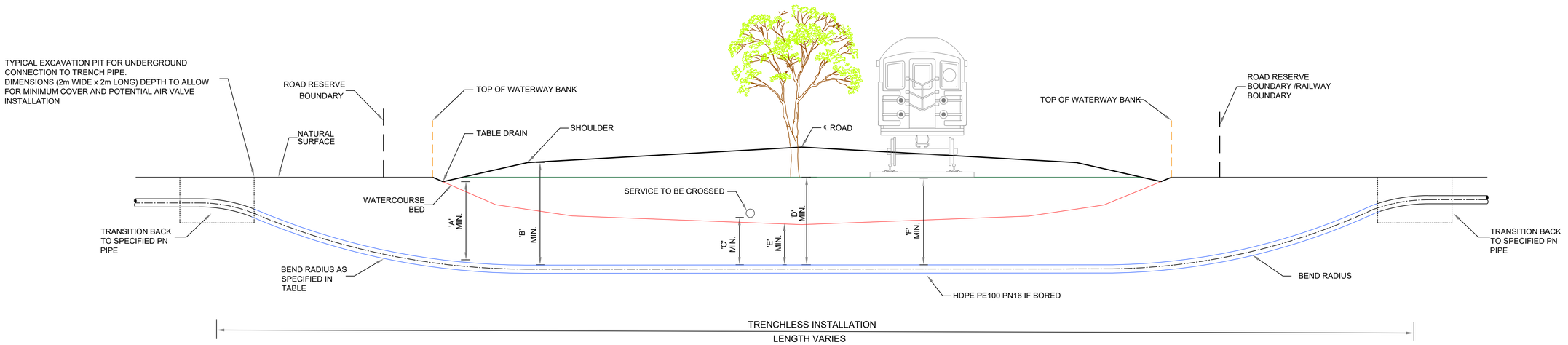
SURVEY INFORMATION: MGA ZONE 55K; ALL LEVELS ARE TO AHD
REFERENCED PLANS: -

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The arrangement and general details as shown on this drawing are essentially diagrammatic and must be applied to the circumstances as found on site.

DES./DRAWN: MG
CHECKED: BL
APPROVED: DM
DATE: 09/11/2023
PROJECT REF.: 27KBR0BOWENP2

CLIENT: BOWEN PIPELINE COMPANY DETAILED BUSINESS CASE
PROJECT: TYPICAL INSTALLATION DETAILS PIPE TRENCH BACKFILL
DRAWING No. 130-001
SHEET 1 OF 5
REVISION 02

Drawing file: 27KBR0BOWENP2-130 (INSTALLATION DETAILS) review.dwg - Saved at: 14/2/2024 8:51:10 AM - Plotted at:15/2/2024 8:53:44 AM - Original Size: ANSI A (8.50 x 11.00 Inches)



VERTICAL CLEARANCES			
TYPE	DIMENSION	LOCATION	MINIMUM CLEARANCE (mm)
ROAD CROSSING	'A'	TABLE DRAIN	900
	'B'	ROAD SHOULDER	1500
SERVICE CROSSING	'C'	BOTTOM OF SERVICE	SERVICE DEPENDENT- SEE TABLE
TREE CROSSING	'D'	BASE OF TREE	2000
WATERCOURSE	'E'	LOWEST POINT	2000
RAILWAY	'F'	UNDERNEATH TRACKS TO BE DETERMINED WITH RAILWAYS OWNER	

SERVICES CROSSINGS		
TYPE	MIN HORIZONTAL CLEARANCE	MIN VERTICAL CLEARANCE
WATER MAIN >DN375	600	300
WATER MAIN ≤DN375	300	150
GAS MAINS	300	150
TELECOMMUNICATION	300	150
ELECTRICAL	500	225
SEWERS GRAVITY	1000	500

HDD CONSTRUCTIBLITY & COST CATEGORIES		
CATEGORY	LENGTH (m)	COUNT
SMALL	20	52
MEDIUM	40	25
LARGE	100	6
	TOTAL	83

BENDING RADIUS	
PIPE SIZE SDR	MIN BEND RADIUS (X DN)
9	12
11	15
13.6	21
17/17.6	25
21	35
26	45
33	65

NOTE: WHERE THE REQUIRED BEND RADIUS IS LESS THAN THE MANUFACTURER'S SPECIFIED MINIMUM RADIUS FORMED BENDS SHALL BE USED TO PREVENT UNDUE STRESSES IN THE PIPELINE.

PLANS AND DOCUMENTS referred to in the SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

Smart Approved WaterMark

PRELIMINARY
NOT FOR CONSTRUCTION

REV	ISSUED	D.DWN	APRVD	REVISION DESCRIPTION
02	15/02/2024	MG	DM	FINAL ISSUE
01	18/12/2023	MG	DM	PRELIMINARY DRAFT ISSUE

admin@pinionadvisory.com
1300 746 466
pinionadvisory.com
pinion ADVISORY
agribusiness, water & environment

Bowen Pipeline Company

KBR

SURVEY INFORMATION:
MGA ZONE 55K
ALL LEVELS ARE TO AHD
-

REFERENCED PLANS:
-

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The arrangement and general details as shown on this drawing are essentially diagrammatic and must be applied to the circumstances as found on site.

DES./DRAWN: MG
CHECKED: BL
APPROVED: DM
DATE: 09/11/2023
PROJECT REF.: 27KBR0BOWENP2

CLIENT: BOWEN PIPELINE COMPANY DETAILED BUSINESS CASE

PROJECT: TYPICAL INSTALLATION DETAILS HORIZONTAL DIRECTIONAL DRILL

DRAWING No. 130-004
SHEET 4 OF 5
REVISION 02

Drawing file: 27KBR0BOWENP2-130 (INSTALLATION DETAILS) review.dwg - Saved at: 14/2/2024 8:51:10 AM - Plotted at:15/2/2024 9:01:27 AM - Original Size: ANSI A (8.50 x 11.00 Inches)

NORTH

BURDEKIN RIVER

BRUCE HWY

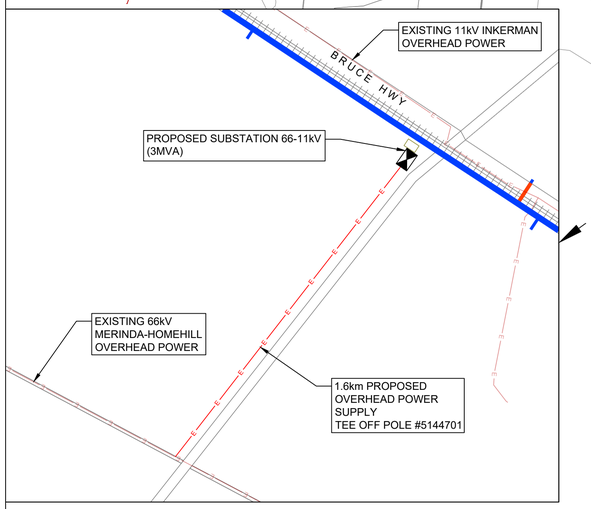
OVERALL PIPELINE PLAN
SCALE 1:150,000 @ A1

LEGEND
- MAINLINES
- SPUR PIPELINES
- PROPOSED ELECTRICAL SUPPLY LINE
- EXISTING ELECTRICAL
- PROPERTY BOUNDARIES

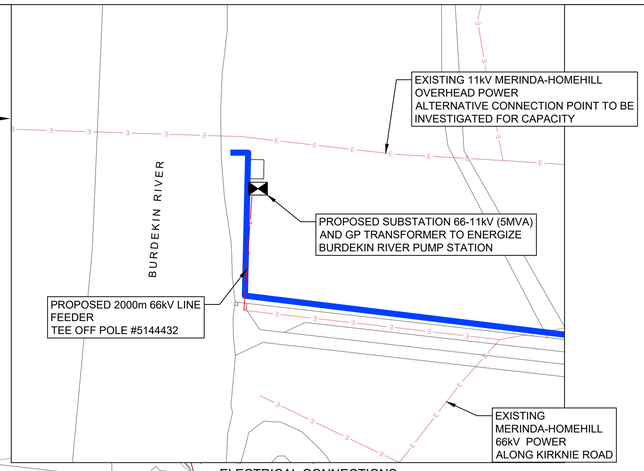
PLANS AND DOCUMENTS referred to in the SDA APPROVAL

Queensland Government

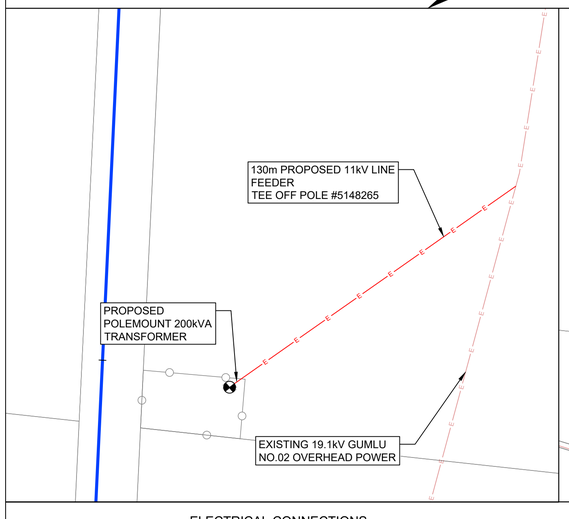
SDA approval: AP2025/009



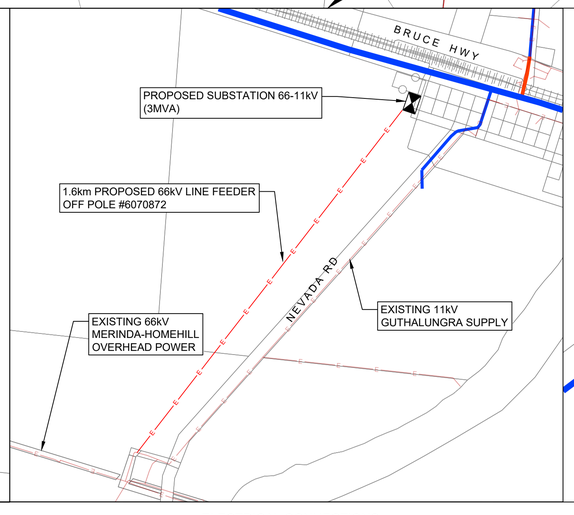
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INKERMAN PUMP STATION
SCALE 1:8,000 @ A1



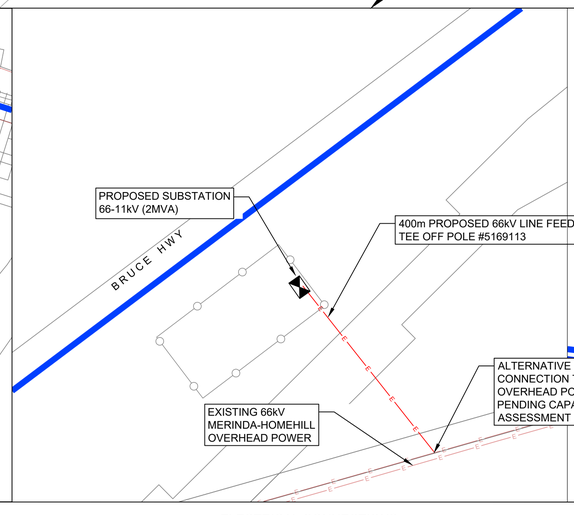
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BURKEDIN RIVER PUMP STATION
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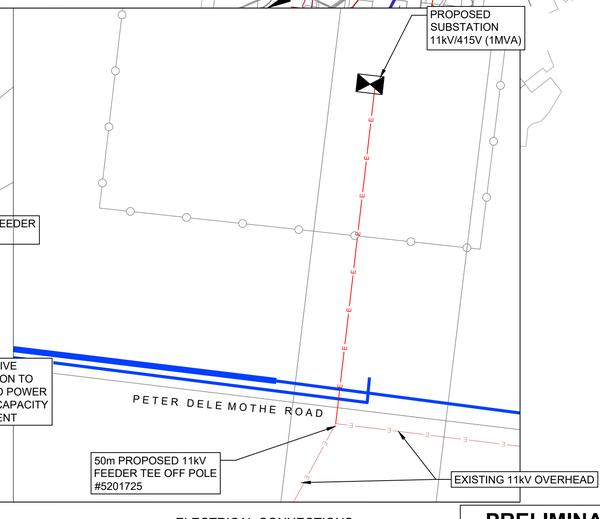
ELECTRICAL CONNECTIONS
TONDARA RD BOOSTER PUMP STATION
SCALE 1:10,000 @ A1



ELECTRICAL CONNECTIONS
GUTHALUNGA PUMP STATION
SCALE 1:4,000 @ A1



ELECTRICAL CONNECTIONS
SALISBURY PLAINS PUMP STATION
SCALE 1:1,000 @ A1



ELECTRICAL CONNECTIONS
DELTA PUMP STATION
SCALE 1:800 @ A1

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REV	ISSUED	D.DWN	APRVD	REVISION DESCRIPTION
02	14/02/2024	BL	DM	FINAL ISSUE
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Bowen Pipeline Company

KBR

SURVEY INFORMATION: MGA ZONE 55K; ALL LEVELS ARE TO AHD

REFERENCED PLANS: -

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PROJECT REF.:	27KBR0BOWENP2

CLIENT: BOWEN PIPELINE COMPANY DETAILED BUSINESS CASE

PROJECT: BOWEN PIPELINE PROPOSED ELECTRICAL CONNECTION OVERVIEW

DRAWING No. 100-004 | SHEET 1 OF 1 | REVISION 02

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PROPOSED LEGEND

- PIPELINE
- HORIZONTAL DIRECTIONAL DRILL
- PIPE CHANGE
- ISOLATION VALVE
- AV — AIR VALVE
- ScV — SCOUR VALVE
- M — METER ASSEMBLY

EXISTING LEGEND

- PROPERTY BOUNDARY
- RAILWAY
- WATERCOURSE
- E — E — ELECTRICAL

NOTE: ALL SERVICES ARE APPROXIMATE ONLY AND SHOULD BE LOCATED ON SITE PRIOR TO CONSTRUCTION
CAUTION: PRIVATE SERVICES PRESENT AROUND ALL PADDOCK BOUNDARIES

SALISBURY PLAINS PUMP STATION DUTY

FLOWRATE	TOTAL HEAD	TOTAL ABSORBED POWER
132 ML/day	37m	884 kW

SALISBURY FACILITY SITE
TOTAL AREA: 2 Ha
ACCESS TRACK AREA: TBC
TOTAL LENGTH OF SECURITY FENCE: 600m
PUMP STATION FOOTPRINT: 685m²

BRUCE HWY

DISCHARGE PIPE TO DELTA PUMP STATION DN1400 PE100 PN8

NORMALLY CLOSED BYPASS ISOLATION VALVE

INTERNAL MECHANICAL PUMP STATION DETAIL REFER TO DWG No. 124-102

SUBSTATION REFER TO DWG No. 100-004 FOR DETAILS

RING TANK STORAGE INLET/ OUTLET PIPE

LOCATION OF RING TANK REFER TO DWG No. 110-007

COMMON OUTLET FROM BALANCE STORAGE TANKS DN1400 PE100 PN8

COMMON INLET WITH CONTROL VALVE DN1400 PE100 PN8

PIPELINE FROM GUTHALUNGRA PUMP STATION DN1400 PE100 PN8

3m WIDE ACCESS TRACK DESIGNED TO ALLOW FOR A SERVICE VEHICLE (8.8m LONG)

BRUCE HWY TO BE ACCESSED VIA TRACK TO THE WEST

DOUBLE GATE

400m PROPOSED ELECTRICAL SUPPLY FROM NEARBY 66kV POWER LINES REFER TO DWG No. 100-004 FOR FULL EXTENT

OVERFLOW DIRECTED TO NEARBY CULVERT TO FALL WITH NATURAL GROUND

MINOR CIVIL WORKS REQUIRED TO REDIRECT WATERCOURSE AROUND FACILITY

2 X 1.2ML BALANCE TANKS 14.0m (DIA) x 11.0m (HEIGHT) REFER TO DWG. 141-103

SECURITY FENCE

38m

18m

200m

100m



PHOTO 1: EXISTING GROUND CONDITIONS AND FENCELINE

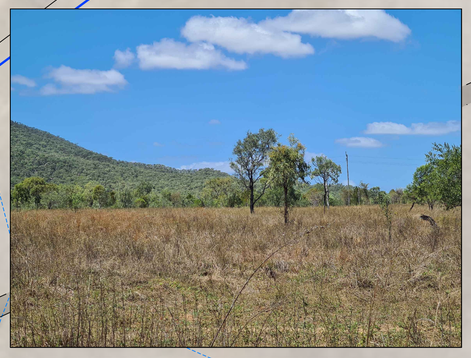


PHOTO 2: NEARBY ELECTRICAL SUPPLY ON PROPERTY

PLANS AND DOCUMENTS referred to in the SDA APPROVAL

SDA approval: AP2025/009

Queensland Government

PRELIMINARY
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-5 0 5 10 15 20 25 50m
SCALE 1: 500 ORIGINAL SIZE A1

REV	ISSUED	D.DWN	APRVD	REVISION DESCRIPTION
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SURVEY INFORMATION: MGA ZONE 55K ALL LEVELS ARE TO AHD

REFERENCED PLANS: -

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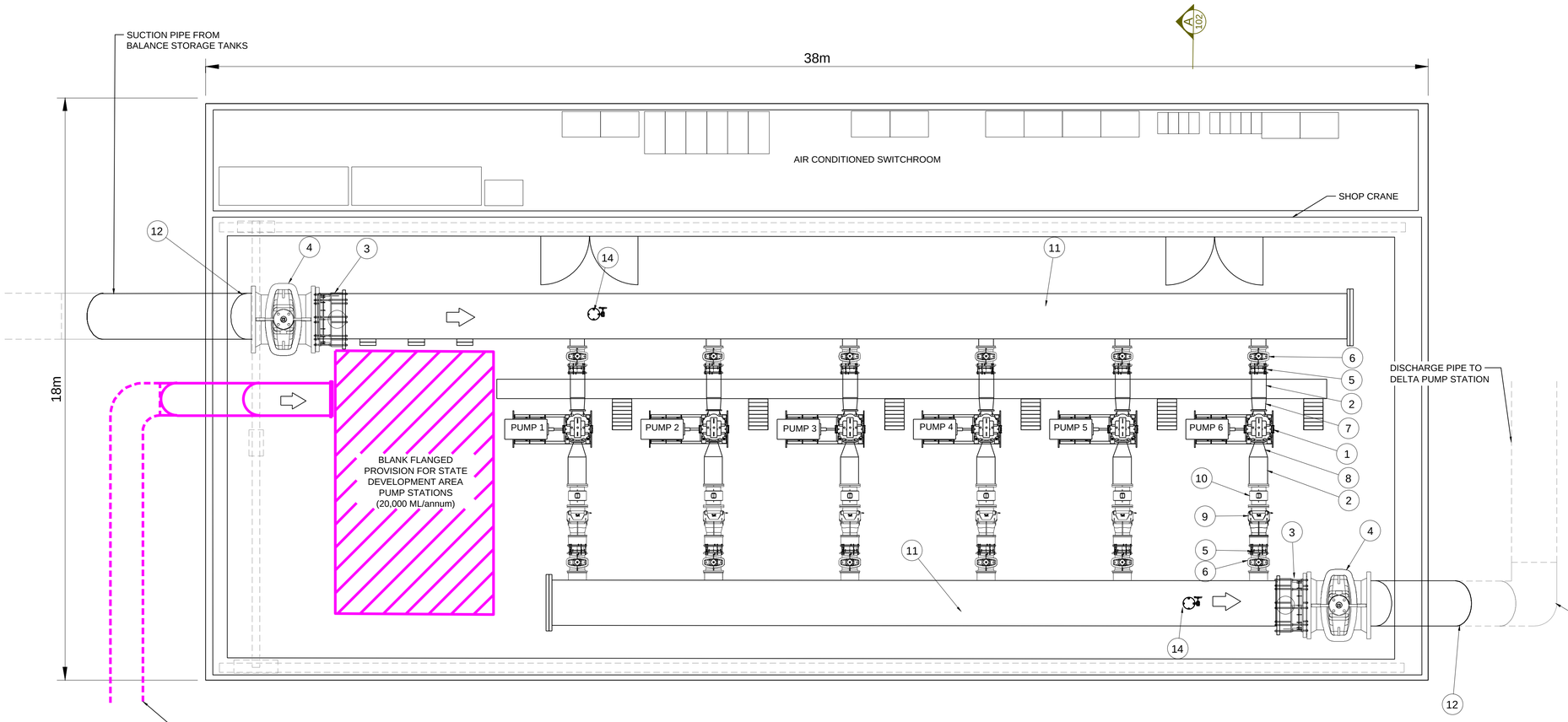
DES./DRAWN:	QM
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APPROVED:	DM
DATE:	24/10/2023
PROJECT REF:	27KBR0BOWENP2

CLIENT: BOWEN PIPELINE COMPANY DETAILED BUSINESS CASE

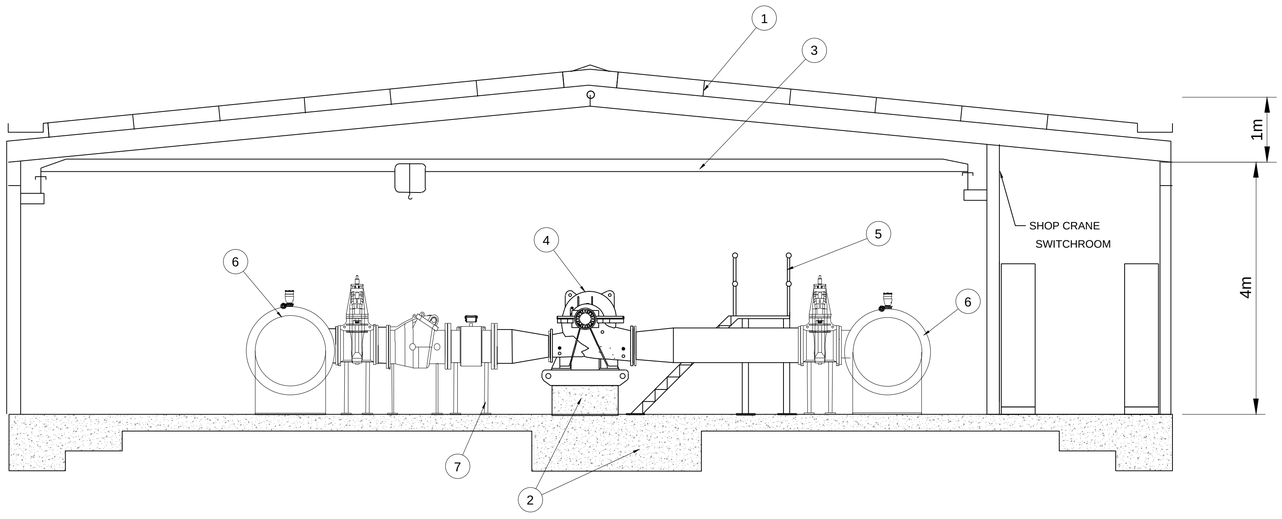
PROJECT: SALISBURY PLAINS PUMP STATION GENERAL ARRANGEMENT

DRAWING No. 124-101 | SHEET 1 OF 2 | REVISION 02

Drawing file: 27KBR0BOWENP2-124 (SALISBURY PLAINS CIVIL)_review.dwg - Saved at: 15/2/2024 8:43:35 AM - Plotted at:15/2/2024 9:38:47 AM - Original Size: ANSI A (8.50 x 11.00 Inches)



OVERALL SITE PLAN
TYPICAL INSTALLATION DETAIL
SCALE 1:80 (A1)



SECTION A
TYPICAL INSTALLATION DETAIL
SCALE 1:50 (A1)

SALISBURY PLAINS PUMP STATION
PUMP DUTY

	DUTY	NOMINAL POWER
PUMP 1	26.4 ML/day @37m	200 kW
PUMP 2	26.4 ML/day @37m	200 kW
PUMP 3	26.4 ML/day @37m	200 kW
PUMP 4	26.4 ML/day @37m	200 kW
PUMP 5	26.4 ML/day @37m	200 kW
PUMP 6	26.4 ML/day @37m	200 kW

NOTES:
1: DUTY-ASSIST-STANDBY PUMP OPERATION
2: PRESSURE RATING PN8 (MIN)
3: ABOVE GROUND PIPEWORK MILD STEEL HOT DIP GALVANIZED
4: PUMP DUTIES TO BE CONFIRMED DURING DETAILED DESIGN

OVERALL SITE PLAN - PIPE & FITTINGS SCHEDULE

ITEM	DESCRIPTION
1	PUMPS
2	MS HDG PIPE (LENGTH TO SUIT)
3	DN1400 DISMANTLING JOINT
4	DN1400 ISOLATION VALVE
5	DN450 DISMANTLING JOINT
6	DN450 ISOLATION VALVE
7	DN450-DN300 REDUCER
8	DN450-DN250 REDUCER
9	DN450 CHECK VALVE
10	DN450 FLOW METER
11	DN1400 PIPE HEADER MANIFOLD
12	DN1400 LR 45 ELBOW
13	DN1400 LR 90 ELBOW
14	DN100 AIR RELEASE VALVE C/W ISOLATION VALVE

PLANS AND DOCUMENTS
referred to in the
SDA APPROVAL

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SDA approval: AP2025/009

SECTION A - PIPE & FITTINGS SCHEDULE

ITEM	DESCRIPTION
1	INDUSTRIAL SHED
2	REINFORCED CONCRETE SLAB & MOUNTING PLINTH
3	SHOP CRANE
4	PUMP (SEE PUMP DUTY TABLE)
5	WALKWAY
6	DN1400 HEADER PIPE
7	PIPE SUPPORT (TYPICAL)

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DATE:	24/10/2023
PROJECT REF.:	27KBR0BOWENP2

CLIENT: BOWEN PIPELINE COMPANY
DETAILED BUSINESS CASE

PROJECT: SALISBURY PLAINS PUMP STATION
CROSS SECTIONS & DETAILS

DRAWING No. 124-102 | SHEET 2 OF 2 | REVISION 02

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SDA approval: AP2025/009

Bowen Pipeline
Ecological Assessment Report

Prepared for Bowen Pipeline Company Pty Ltd
28 February 2024

Job 8704

saunders havill group

Land and environment consultants

Bushfire management plan

Bowen Pipeline Project | Burdekin pump station | Barry Road | Kirknie | Queensland
Prepared for Bowen Pipeline Company Pty Ltd | 28 March 2024

PLANS AND DOCUMENTS
referred to in the
SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

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Suite 5, 66 Bay Terrace
Wynnum Queensland 4178
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Bushfire management plan

Final

Report 23116 | Bowen Pipeline Company Pty Ltd | 28 March 2024

Approved by Robert Janssen

Position Managing principal

Signature 

Date 28 March 2024

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Document control

Version	Date	Prepared by	Reviewed by
Draft	21 December 2023	R. Janssen	LEC
Final	28 March 2024	R. Janssen	LEC

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Appendix

Appendix 1 Site plan and intake structure arrangement plan

Appendix 2 Radiant heat exposure assessment

Appendix 3 Bushfire overlay code assessment

Disclaimer

Notwithstanding the precautions adopted in this report, it should always be remembered that bushfires burn under a range of conditions. An element of risk, no matter how small always remains, and although AS 3959-2018 is designed to improve the performance of such buildings, there can be no guarantee, because of the variable nature of bushfires, that any building will withstand bushfire attack on every occasion.

It should be noted that upon lodgement of a development proposal, State Government, council and/or the fire service may recommend additional construction requirements.

Although every care has been taken in the preparation of this report, Land and Environment Consultants Pty Ltd accept no responsibility resulting from the use of the information in this report.

1 Introduction

Land and Environment Consultants Pty Ltd (**LEC**) was engaged to prepare a bushfire management plan (**BMP**) for the Burdekin pump station component (**proposed Burdekin pump station**) of the Bowen pipeline project, located at lot 57/SP236356 (**the site**) which is accessed from Barry Road, Kirknie.

A ministerial infrastructure designation (**MID**) is being sought for the Bowen pipeline project in accordance with the Queensland *Planning Act 2016.*

The site is identified as a bushfire hazard area by the Queensland State Planning Policy (**SPP**) *Bushfire prone area map* (**SPP bushfire prone area map**). As a result, compliance with the example bushfire overlay code (**Bushfire overlay code**) in the *Natural Hazards, Risk and Resilience – Bushfire, State Planning Policy State Interest guidance material* (DSDMIP 2019) (**SPP guidance material – bushfire***)* is relevant to the proposed Burdekin pump station component of the MID being sought for the Bowen pipeline project.

This BMP has been prepared in accordance with *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience – Bushfire'* (QFES 2019a) (**Bushfire resilient communities**) which was prepared by the Queensland Fire and Emergency Services (**QFES**) to provide technical guidance for the implementation of the SPP guidance material – bushfire.

This BMP documents the bushfire hazard assessment of the site and demonstrates how the proposed Burdekin pump station will comply with the Bushfire overlay code. It includes:

- an introduction (this section) and description of methods and information resources used for the preparation of this BMP;
- description of the site and proposed Burdekin pump station;
- bushfire hazard assessment;
- identification of bushfire hazards associated with the site and proposed Burdekin pump station;
- radiant heat exposure assessment;
- a plan for mitigating bushfire hazards; and
- assessment of the proposed Burdekin pump station against the Bushfire overlay code.

1.1 Method

To meet requirements of the SPP guidance material – bushfire and Bushfire resilient communities, the following tasks were undertaken:

- review of the SPP bushfire prone area map in the SPP interactive mapping system (DSDILGP 2023) and the Queensland regional ecosystem map, vegetation hazard class (**VHC**) map and severe fire weather map in the QFES online mapping system (QFES 2023) (**Catalyst**);
- review of fire history data in the North Australia and Rangelands Fire Information online mapping system (DISER 2023) (**NAFI**);
- inspection of land within 100 metres (**m**) of the proposed Burdekin pump station for vegetation characteristics, current land management practices, slope and evidence of previous fires;
- bushfire hazard assessment in accordance with the method in Bushfire resilient communities;
- radiant heat exposure assessment using the Fire Protection Association of Australia *BAL calculator V4.9* (**BAL calculator**) which models the 'method 2' bushfire attack level assessment procedure in the *Australian Standard* (AS 3959-2018) *Construction of buildings in bushfire prone areas;* and
- assessment of the proposed Burdekin pump station against the Bushfire overlay code.

Aerial imagery of the site and measuring tools were accessed online from Google Earth and the Queensland Globe to assist with validating observations and measurements made during the site assessment.

1.2 Suitably qualified person

This BMP was prepared by Robert Janssen who is a suitably qualified and experienced bushfire management consultant.

Robert is the managing principal at LEC and has over 25 years of experience in bushfire planning and operations. He has prepared BMPs for residential, commercial and industrial property developments, utilities, government facilities and conservation estates.

Robert's formal qualifications as an environmental scientist and consulting experience are coupled with 10 years of experience as a nationally accredited fire-fighter with the national parks and wildlife service in New South Wales and Queensland.

2 Description of the site and proposed Burdekin pump station

This chapter provides a description of the site and proposed Burdekin pump station.

2.1 Site description

The location of the site is shown in Figure 2.1. The site is 8.34 hectares (**ha**) and has frontage to Barry Road along its southern boundary.

The site is cleared of bushland vegetation and currently used for cropping.

The northern and eastern boundaries of the site adjoin land used for cropping. The southern boundary adjoins Barry Road and a combination of grassland and bushland vegetation. The western boundary adjoins an embankment of the Burdekin River which has bushland vegetation.

2.2 Proposed Burdekin pump station

The Bowen pipeline project is a 114 kilometre (**km**) pipeline from the Burdekin River to south-west of Bowen. It will include four pump stations along the pipeline, one of which is the proposed Burdekin pump station.

The site plan and intake structure arrangement plan for the proposed Burdekin pump station are provided in Appendix 1. They show the proposed layout of the pump station, intake structure, access pad to submersible pumps and valve pit, control building and switch room, substation, access tracks and coffer dam.

Access and egress for the proposed Burdekin pump station is via Barry Road.

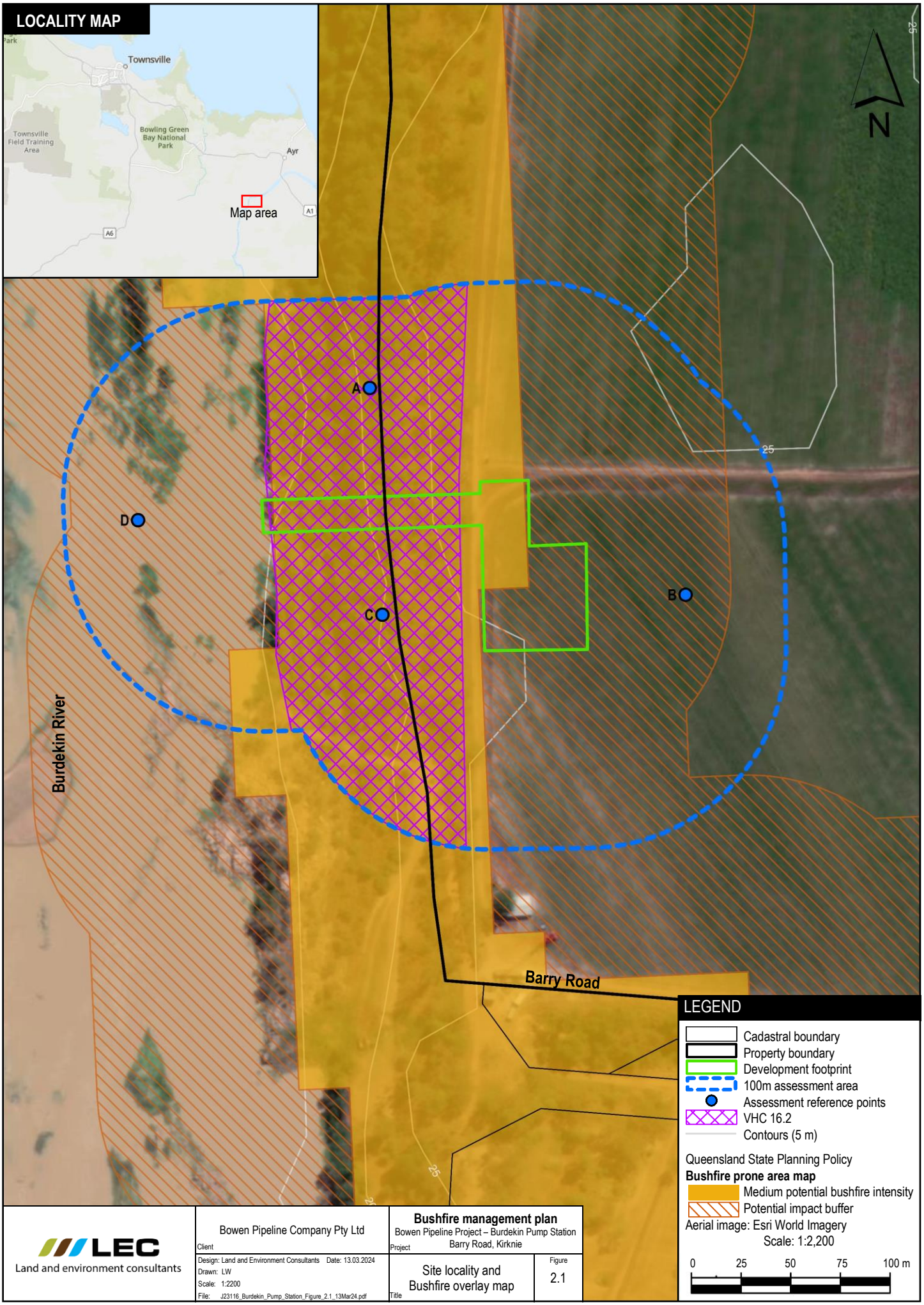
The proposed Burdekin pump station will be occasionally occupied by people.

2.3 State Planning Policy bushfire prone area map

The SPP bushfire prone area map for the site is shown in Figure 2.1 and indicates the site is affected by the potential impact buffer from the medium potential bushfire intensity area which is associated with the bushland vegetation on the embankment of the Burdekin River.

Verification of the bushfire prone areas shown in the SPP bushfire prone area map is provided via the bushfire hazard assessment in Chapter 3.

Please note, in this BMP the terms ‘bushfire prone area’ and ‘bushfire hazard area’ have the same meaning. Both terms mean an area of vegetation that is determined to have a potential bushfire intensity ≥ 4,000 kilowatts/m (**kW/m**) and the land within 100 m of this vegetation.



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Client	Bowen Pipeline Company Pty Ltd
Project	**Bushfire management plan** Bowen Pipeline Project – Burdekin Pump Station Barry Road, Kirknie
Design: Land and Environment Consultants Date: 13.03.2024 Drawn: LW Scale: 1:2200 File: J23116_Burdekin_Pump_Station_Figure_2.1_13Mar24.pdf	Figure 2.1
Title	Site locality and Bushfire overlay map

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3 Bushfire hazard assessment

This chapter provides details about the desktop review, site inspection and bushfire hazard assessment.

3.1 Severe fire weather

The severe fire weather map in Catalyst indicates the 5 % annual exceedance probability forest fire danger index (**FFDI**) for the site is 59. This FFDI value has been used for the potential bushfire intensity calculations in Section 3.4 and the radiant heat exposure assessment in Section 5.3.

3.2 Fire history

Fire history data in NAFI indicates that no fires have occurred within 1 km of the site during the past 20 years.

3.3 Site inspection

LEC inspected land within 100 m of the proposed Burdekin pump station on 18 November 2023. Observations were recorded about current land use and management, vegetation characteristics, the slope of land and evidence of previous fires.

The locations of assessment reference points used for the bushfire hazard assessment are shown in Figure 2.1. Table 3.1 provides a summary of observations from the site inspection and notes about the bushfire hazard assessment of assessment reference points. Examples of bushland vegetation within the assessment area are shown in Photographs 3.1-3.3.

Table 3.1 Site observations

Assessment reference point	Catalyst VHC	Ground truthed VHC	Notes
A	VHC 16.2 *Eucalyptus dominated woodland on drainage lines and alluvial plains* (**VHC 16.2**) and VHC 16.3 *Shrubland associated with eucalyptus woodlands on drainage lines* (**VHC 16.3**).	VHC 16.2	A 100+ m wide corridor of bushland vegetation on the embankment of the Burdekin River.
B	VHC 38.5 *Discontinuous irrigated cropping and horticulture* (**VHC 38.5**).	VHC 38.4 *Continuous dryland cropping and horticulture* (**VHC 38.4**).	Land used for cropping.
C	VHC 16.2 and VHC 16.3	VHC 16.2	A 100+ m wide corridor of bushland vegetation on the embankment of the Burdekin River.
D	VHC 43.6 *Water bodies or very low vegetation cover* (**VHC 43.6**)	VHC 43.6	Burdekin River.



Photograph 3.1 VHC 16.2 at A and C



Photograph 3.2 VHC 38.4 at B



Photograph 3.3 VHC 43.6 at D

3.4 Potential bushfire intensity calculations

The potential bushfire intensity of assessment reference points was determined using the Queensland Public Safety Business Agency *Potential Bushfire Intensity Calculator* (version November 2014) which is an Excel spreadsheet calculator that models the bushfire hazard assessment method in Bushfire resilient communities.

Bushfire resilient communities define bushfire hazard classes as follows:

- very high – potential bushfire intensity > 40,000 kW/m;
- high – potential bushfire intensity 20,000-40,000 kW/m;
- medium – potential bushfire intensity 4,000-20,000 kW/m; and
- non-bushfire hazard – potential bushfire intensity < 4,000 kW/m.

Results of the potential bushfire intensity calculations which determine the bushfire hazard class of assessment reference points shown in Figure 2.1 are presented in Table 3.2.

Table 3.2 Potential bushfire intensity

Assessment reference point	VHC	Potential fuel load (tonnes/ha)[1]	Slope (°)	Potential bushfire intensity (kW/m)	Bushfire hazard class
A	VHC 16.2	11.6	16	14,592	Medium
B	VHC 38.4	3.8	1	566	Non-bushfire hazard class
C	VHC 16.2	11.6	16	14,592	Medium
D	VHC 43.6	0	0	0	Non-bushfire hazard class

Notes 1 Potential fuel load taken from Bushfire resilient communities.

3.5 Bushfire hazard areas

Results of the potential bushfire intensity calculations in Table 3.2 confirm the site is within a bushfire hazard area, ie medium potential bushfire intensity area at assessment reference points A and C, shown in Figure 2.1. Therefore, compliance with the Bushfire overlay code is relevant to the proposed Burdekin pump station component of the MID being sought for the Bowen pipeline project.

4 Bushfire hazards associated with the site

This chapter identifies bushfire hazards associated with the site.

4.1 Fire danger season

The fire danger season at the site starts in August, peaks in September and will begin to fall when consistent summer rainfall occurs. Typically, the worst fire weather conditions will be experienced during the fire danger season when the wind direction is from the north or west.

An FFDI of 59 will be associated with hot, dry and windy conditions. If a bushfire starts and takes hold under these conditions, it will be difficult to control and fast moving in large areas of bushland vegetation.

4.2 Fire history

As discussed in Section 3.2, fire history data indicates no fires have occurred within 1 km of the site during the past 20 years. On this basis, it is considered unlikely the proposed Burdekin pump station will be directly exposed to bushfire attack in the future.

4.3 Potential directions of bushfire attack

Although unlikely, the proposed Burdekin pump station could be exposed to bushfire attack from assessment reference points A and C, shown in Figure 2.1, where hazardous vegetation occurs.

Although assessment reference point B is identified as a non-bushfire hazard class in Section 3.4, VHC 38.4 which occurs in this area is identified in Bushfire resilient communities as having continuous fuel and being grassfire prone. Therefore, it is considered relevant that this BMP considers grassfire attack from this area.

Bushfire and grassfire attack scenarios on the proposed Burdekin pump station are further analysed in Section 5.3.

4.4 Potential bushfire hazards from adjacent land use

The fire history data indicates the adjacent land uses, ie cropping and livestock grazing, are not a bushfire hazard to the proposed Burdekin pump station.

4.5 Water and access for emergency services

The site is accessible via public roads which can accommodate emergency service vehicles, but it does not have access to a mains water supply or a reticulated hydrant system.

5 Bushfire hazards associated with the proposed Burdekin pump station

This chapter identifies potential bushfire hazards associated with the proposed Burdekin pump station.

5.1 Siting and design

The proposed Burdekin pump station will be designed to mitigate the risk of bushfire hazards determined by the bushfire hazard assessment in this BMP:

- an asset protection zone (**APZ**) will be formalised around infrastructure to ensure that it is maintained in perpetuity;
- an appropriately designed fire-fighter water supply outlet point will be provided adjacent to an access road; and
- access roads will be designed to provide efficient access and egress for emergency services and occupants.

5.2 Land uses

The proposed Burdekin pump station does not involve vulnerable uses, community infrastructure for essential services or the storage or handling of hazardous materials in the context of bushfire hazard which are defined in Table 7 of the SPP guidance material – bushfire.

5.3 Radiant heat exposure

The Bushfire overlay code provides guidance about the acceptable level of radiant heat exposure for development within bushfire hazard areas. It requires development to be setback from hazardous vegetation by a distance which achieves a radiant heat flux level ≤ 29 kW/m^2 at the development footprint of buildings and infrastructure.

As discussed in Section 4.3, although unlikely, the proposed Burdekin pump station could be exposed to bushfire attack from assessment reference point A and C, shown in Figure 2.1, and grassfire attack from assessment reference points B. The radiant heat profile of these bushfire and grassfire attack scenarios were analysed using the BAL calculator. Inputs used in the BAL calculator and results are provided in Appendix 2.

Results of the radiant heat exposure assessment in Appendix 2 have been used in Section 6.1 to specify the width of the setback from hazardous vegetation, ie the APZ, to achieve a radiant heat flux level ≤ 29 kW/m^2 at the development footprint of buildings and infrastructure.

6 Bushfire mitigation plan

This chapter identifies mitigation measures that must be implemented as part of the proposed Burdekin pump station to comply with the Bushfire overlay code.

It is the total of the mitigation measures in this chapter that will reduce the risk of bushfire hazard to a tolerable level. Failure to implement all actions in their entirety could result in an increased level of exposure to bushfire hazards.

6.1 Asset protection zone

An APZ must be established and maintained around the development footprint of buildings and infrastructure as shown in Figure 6.1.

The APZ must be identified in site plans and survey plans.

The APZ must consist of hardstand areas, ie gravel, asphalt or concrete, or grass which is maintained at a nominal height of 10 centimetres.

Woody regrowth, ie trees or shrubs, weeds and vegetation debris must be removed from the APZ at regular time intervals during the calendar year.

6.2 Fire-fighter water supply

A fire-fighter water supply outlet point must be provided adjacent to an access road within the site. It is anticipated that it will be connected to a water reservoir within the pump station infrastructure. However, if this is not possible, the outlet point must be connected to a dedicated on-site fire-fighter water supply tank which is made from concrete or metal and has a minimum capacity of 20,000 litres.

If a fire-fighter water supply tank is required, it must be kept full of water and must not be used for activities other than bushfire management.

We recommend contacting the local Rural Fire Brigade (**RFB**) to confirm the standard local RFB fittings which should be used at the fire-fighter water supply outlet point.

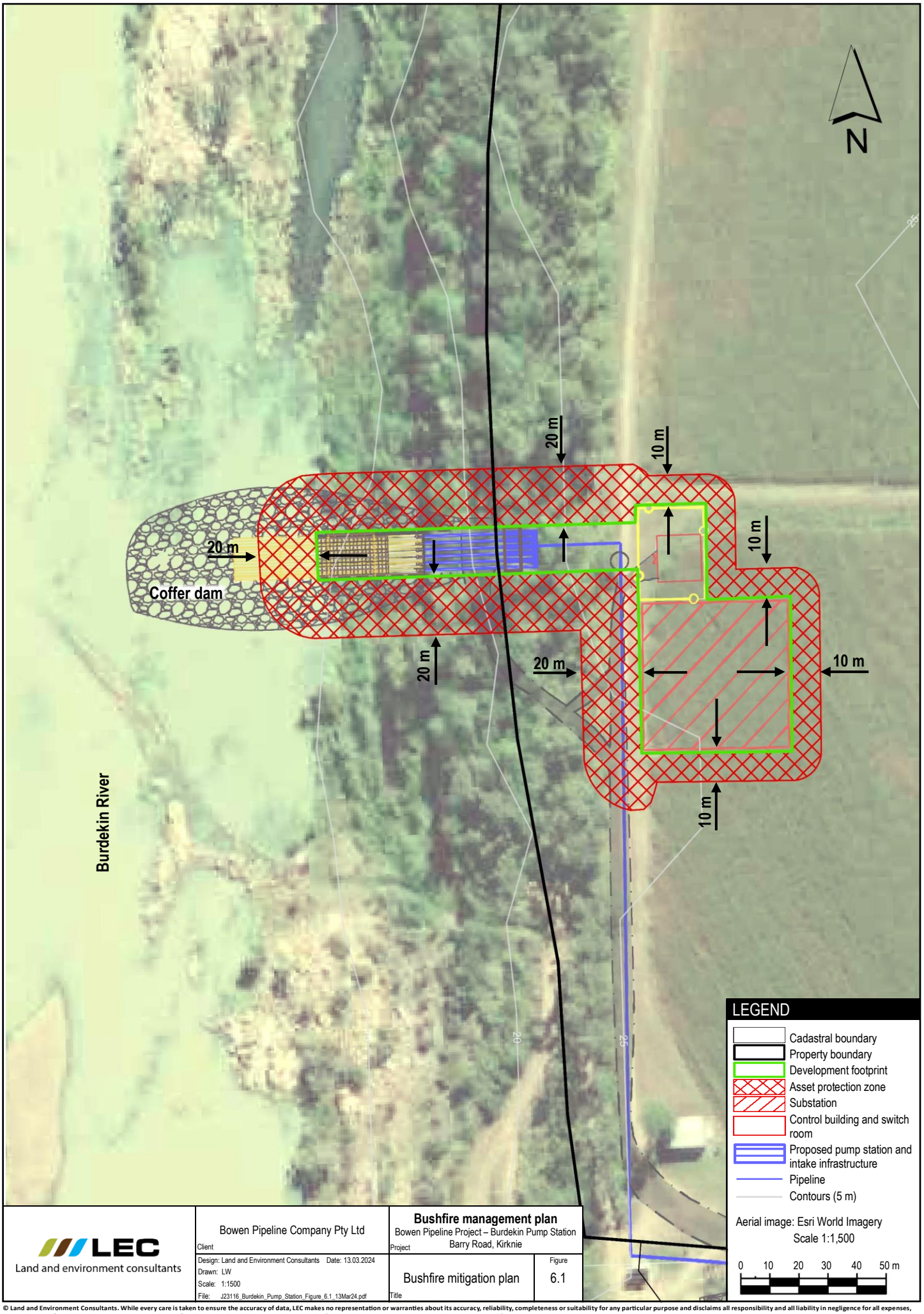
All above ground pipes, valves and fittings used for the fire-fighter water supply outlet point must be made of metal.

A hardstand area which is designed for a heavy rigid RFB vehicle to park must be located within 4 m of the fire-fighter water supply outlet point.

The fire-fighter water supply outlet point must be identified by reflective wayfinding signage which is installed along the access road.

6.3 Access and egress

The access road must be designed and constructed to accommodate a heavy rigid RFB vehicle in accordance with the design guidelines in *Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots* (QFES 2019b) which defers to the *Road Planning and Design Manual – 2nd Edition* (DTMR 2013) for load bearing capacity, geometry and turning radii.



LEC
Land and environment consultants

Client: Bowen Pipeline Company Pty Ltd	Project: **Bushfire management plan** Bowen Pipeline Project – Burdekin Pump Station Barry Road, Kirknie	
Design: Land and Environment Consultants Date: 13.03.2024 Drawn: LW Scale: 1:1500 File: J23116_Burdekin_Pump_Station_Figure_6.1_13Mar24.pdf	Title: Bushfire mitigation plan	Figure: 6.1

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7 Conclusion

This BMP was prepared by a suitably qualified person and is in general accordance with the SPP guidance material – bushfire and Bushfire resilient communities.

A bushfire hazard assessment determined the site is affected by bushfire hazard and the proposed Burdekin pump station component of the MID being sought for the Bowen pipeline project is subject to compliance with the Bushfire overlay code.

Mitigation measures that must be implemented as part of the proposed Burdekin pump station are specified in Chapter 6. With the implementation of these mitigation measures the proposed Burdekin pump station is considered compliant with the Bushfire overlay code as demonstrated in Appendix 3.

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Queensland Department of State Development, Infrastructure, Local Government and Planning (DSDILGP 2023) *State Planning Policy Interactive Mapping System*, accessed online at https://spp.dsdip.esriaustraliaonline.com.au/geoviewer/map/planmaking, December 2023

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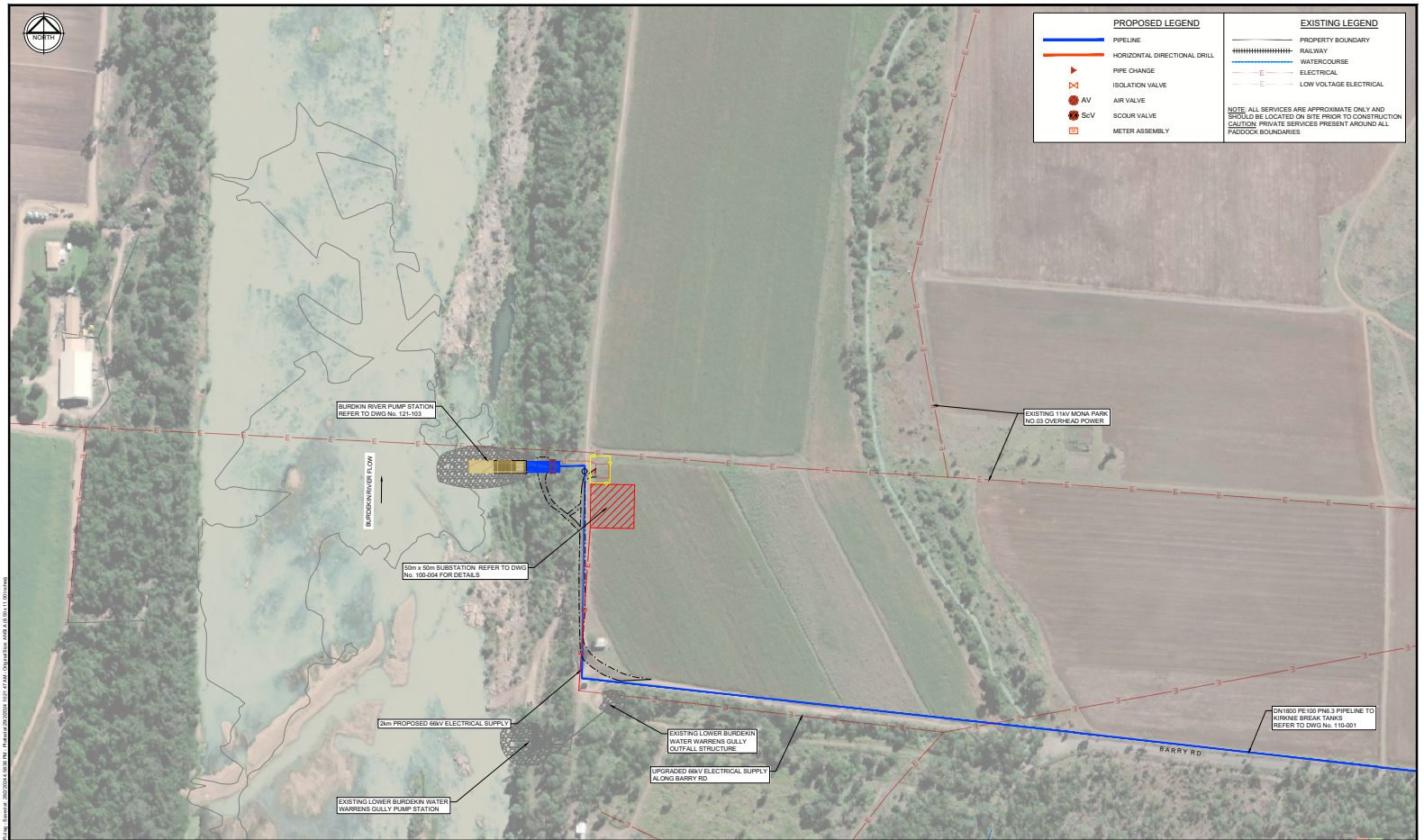
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Queensland Fire and Emergency Services (QFES) 2023, *Catalyst – Sustainable development mapping system*, QFES Sustainable Development Unit, accessed online at https://catalyst.qfes.qld.gov.au/sdu/ via user login, December 2023

Standards Australia Limited (Standards Australia) 2018, *Australian Standard 3959-2018 Construction of buildings in bushfire prone areas*, Fourth edition, November 2018

Appendix 1 Site plan and intake structure arrangement plan



PLAN VIEW
SCALE 1:2000 (A1)

PRELIMINARY
NOT FOR CONSTRUCTION

REV	ISSUED	D.DWN	APRVD	REVISION DESCRIPTION
03	28/02/2024	BL	DM	CLIENT AMENDMENTS FOR SUBMISSION
02	15/02/2024	BL	DM	FINAL ISSUE
01	18/12/2023	BL	DM	PRELIMINARY DRAFT ISSUE

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Bowen Pipeline Company

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SURVEY INFORMATION: MGA ZONE 55K
ALL LEVELS ARE TO AHD

REFERENCED PLANS:

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The arrangement and general details as shown on this drawing are essentially diagrammatic and must be applied to the circumstances as found on site.

DES./DRAWN:	QM
CHECKED:	BL
APPROVED:	DM
DATE:	24/10/2023
PROJECT REF:	27KBRBOWENP2

CLIENT: **BOWEN PIPELINE COMPANY**
DETAILED BUSINESS CASE

PROJECT:
BURDEKIN RIVER PUMP STATION
GENERAL ARRANGEMENT

DRAWING No. 121-101 | SHEET 1 OF 3 | REVISION 03

Drawing File: J:\PROJECTS\27KBRBOWENP2\121-101 &GA.dwg, Layout:A1, 28/02/2024 4:09:56 PM, Plotted:28/02/2024 10:21:47 AM, Orig.Size:841mm, ANSI A (ll) 34 x 11.00(inches)



PHOTO 1: EXAMPLE OF COFFER DAM AND INTAKE STRUCTURE BEING CONSTRUCTED UPSTREAM OF SITE



PHOTO 2: EXAMPLE OF INTAKE STRUCTURE AND VALVE PIT BEING CONSTRUCTED UPSTREAM OF SITE



PHOTO 3: EXAMPLE OF INTAKE STRUCTURE AND VALVE PIT BEING CONSTRUCTED UPSTREAM OF SITE

NORTH

BURDEKIN RIVER FLOW

RIP-RAP WITH GEOTEXTILE FINISHED SURFACE TO SUIT RIVER BANK

ACCESS PAD TO SUBMERSIBLE PUMPS AND VALVE PIT

VALVE ACCESS PIT. TO BE ACCESSIBLE AT REASONABLE WATER LEVEL. FINISHED LEVEL TBC AT DETAILED DESIGN

MANIFOLD WITH INDIVIDUAL ISOLATION VALVES

PROPOSED PUMP STATION AND INTAKE STRUCTURE. REFER TO DWG 131-102

PROPOSED ELECTRICAL CONDUIT

EXISTING 11kV OVERHEAD ELECTRICAL

CONTROL BUILDING AND SWITCHROOM ON SILTS ABOVE FLOOD LEVEL

FLOWMETER PIT

CONSTRUCTION COFFER DAM, DEPTH TO MATCH EXISTING SURFACE 4,500m² AREA

TEMPORARY ACCESS TRACK/ HARDSTAND PAVEMENT, APPROX. 3m WIDE 250m² AREA

DN1800 PE100 PN6.3 MAINLINE TO KIRKNIE BREAK TANKS

PROPOSED 50m x 50m SUBSTATION REFER TO DWG No. 121-101

ACCESS TRACK TO MATCH EXISTING HEADLAND

PROPOSED LEGEND

- PIPELINE
- HORIZONTAL DIRECTIONAL DRILL
- PIPE CHANGE
- ISOLATION VALVE
- AV AIR VALVE
- ScV SCOUR VALVE
- METER ASSEMBLY

EXISTING LEGEND

- PROPERTY BOUNDARY
- RAILWAY
- WATERCOURSE
- ELECTRICAL

NOTE: ALL SERVICES ARE APPROXIMATE ONLY AND SHOULD BE LOCATED ON SITE PRIOR TO CONSTRUCTION CAUTION: PRIVATE SERVICES PRESENT AROUND ALL PADDOCK BOUNDARIES

-5 0 5 10 15 20 25 50m

SCALE 1: 500 ORIGINAL SIZE: A1

OVERALL PLAN VIEW
GENERAL ARRANGEMENT OF HEADWORKS
SCALE 1:500 (A1)

CONCRETE HEAD WALL WITH HAND RAILING

HARDSTAND AREA FOR ACCESS TO PUMPS AND VALVE PIT

ACCESS VALVE PIT WITH COVER AND HANDRAILS. REFER TO DWG 131-102.

6 x SUBMERSIBLE PUMPS WITH 720kW MOTORS EACH. REFER TO DWG131-102.

CONTROL BUILDING. REFER TO DWG. 131-102.

ASSUMED FLOOD LEVEL 26.0m

G.L 24.0 m

HEADWALL SCREEN, TO PREVENT FISH AND DEBRIS ENTERING PUMPING CHAMBER

EXTENT OF COFFER DAM FOR CONSTRUCTION APPROXIMATELY 10m OFFSET FROM APRON.

40m OF DN1800 PE100 PN8.0 PIPELINE TOP OF BANK

SUMMER LOW W.L 8.2 m

DN1800 MANIFOLD TO SINGLE PIPELINE

IL 5.7 m

6 x DN750 PE100 PN12.5 PUMP DISCHARGE

APPROXIMATELY 65m

CONCRETE FILL WALL AND TRENCH AROUND BOX

SECTION VIEW A
GENERAL ARRANGEMENT OF HEADWORKS
NTS

BURDEKIN RIVER PUMP STATION DUTY

FLOWRATE	TOTAL HEAD	TOTAL ABSORBED POWER
311 ML/day	70m	3,615 kW

PRELIMINARY
NOT FOR CONSTRUCTION

REV	ISSUED	D.DWN	APRVD	REVISION DESCRIPTION
03	29/02/2024	BL	DM	CLIENT AMENDMENTS FOR SUBMISSION
02	15/02/2024	BL	DM	FINAL ISSUE
01	16/12/2023	BL	DM	PRELIMINARY DRAFT ISSUE

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CHECKED:	BL
APPROVED:	DM
DATE:	24/10/2023
PROJECT REF:	27KBRBOWENP2

CLIENT: **BOWEN PIPELINE COMPANY**
DETAILED BUSINESS CASE

PROJECT: BURDEKIN RIVER PUMP STATION
INTAKE STRUCTURE ARRANGEMENT

DRAWING No. 121-103 | SHEET 3 OF 3 | REVISION 03

Drawing No. - 27KBRBOWENP2-121-101 (A1H-100) - BURDEKIN.dwg - Scale:nil - 05/03/2024 6:09:56 PM - Plotted:05/03/2024 10:03:34 AM - Plotted By:- AHD A1 (594 x 841mm)

Appendix 2 Radiant heat exposure assessment

Bushfire attack from VHC 16.2

- Forest fire danger index - 59
- Vegetation - VHC 16.2 *Eucalyptus dominated woodland on drainage lines and alluvial plains*
- Understorey fuel load – 11.1 tonnes/hectare (**t/ha**)
- Total fuel load – 11.6 t/ha
- Effective slope – 16° down slope
- Site slope – 0° slope
- Flame width – 100 m
- Flame temperature – 1,090 Kelvin (**K**)

Note Inputs used for the radiant heat exposure assessment are in accordance with Section 7.3 of *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience – Bushfire 2019* (**Bushfire resilient communities**).

FLAMESOL
FPA AUSTRALIA

Calculated December 8, 2023, 4:58 pm (MDc v.4.9)

J23116

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	59	Rate of spread	2.37 km/h
Vegetation classification	Woodland	Flame length	16.79 m
Understorey fuel load	11.1 t/ha	Flame angle	52 °, 62 °, 70 °, 74 °, 76 ° & 82 °
Total fuel load	11.6 t/ha	Elevation of receiver	6.61 m, 7.41 m, 7.89 m, 8.07 m, 8.15 m & 8.31 m
Vegetation height	n/a	Fire intensity	14,206 kW/m
Effective slope	16 °	Transmissivity	0.868, 0.848, 0.82, 0.794, 0.781 & 0.722
Site slope	0 °	Viewfactor	0.6025, 0.4491, 0.3039, 0.2064, 0.1678 & 0.0454
Flame width	100 m	Minimum distance to < 40 kW/m²	13.8 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	18.4 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	26.6 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	37 m
		Minimum distance to < 10 kW/m²	43.5 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Grassfire attack from VHC 38.4

- Forest fire danger index – 59
- Equivalent grassfire danger index - 88
- Vegetation – VHC 38.4 *Continuous dryland cropping and horticulture*
- Understorey fuel load – 3.8 t/ha
- Total fuel load – 3.8 t/ha
- Effective slope – 1° slope
- Site slope – 0° slope
- Flame width – 100 m
- Flame temperature – 1,090 K

Note Inputs used for the radiant heat exposure assessment are in accordance with Section 7.3 of Bushfire resilient communities.

FLAMESOL
FPA AUSTRALIA

Calculated March 28, 2024, 10:26 am (MDc v.4.9)

J23116

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Grassland Fire Danger Index	88	Rate of spread	12.25 km/h
Vegetation classification	Grassland	Flame length	5.84 m
Understorey fuel load	3.8 t/ha	Flame angle	54 °, 64 °, 73 °, 78 °, 80 ° & 86 °
Total fuel load	3.8 t/ha	Elevation of receiver	2.36 m, 2.62 m, 2.79 m, 2.85 m, 2.87 m & 2.91 m
Vegetation height	n/a	Fire intensity	24,065 kW/m
Effective slope	1 °	Transmissivity	0.89, 0.881, 0.866, 0.848, 0.837 & 0.762
Site slope	0 °	Viewfactor	0.5846, 0.4296, 0.2858, 0.193, 0.1561 & 0.043
Flame width	100 m	Minimum distance to < 40 kW/m²	4.9 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	6.7 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	10.1 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	14.9 m
		Minimum distance to < 10 kW/m²	18.3 m

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

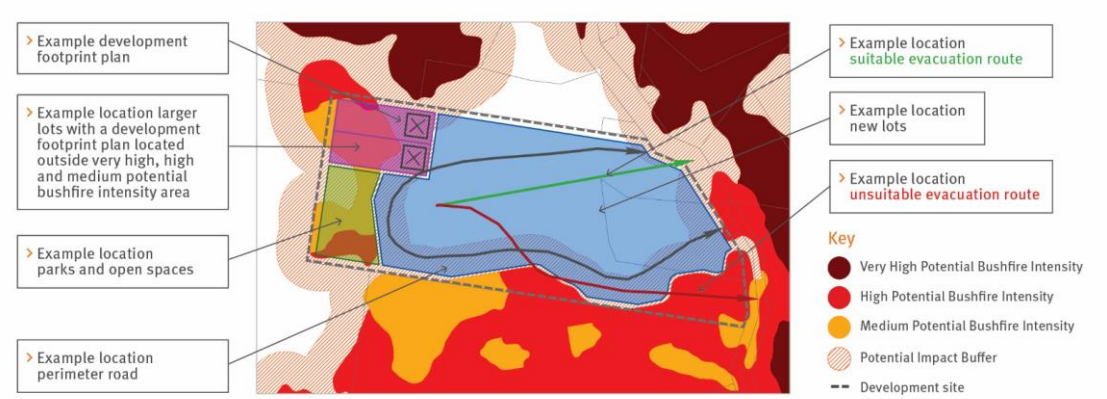
Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Appendix 3 Bushfire overlay code assessment

Performance outcomes	Acceptable outcomes	Compliance assessment
Section A **Reconfiguring a lot (RaL) – where creating lots of more than 2,000 square metres**		
PO1 The subdivision layout: (a) enables future buildings to be located away from slopes and land forms that expose people or property to an intolerable risk to life or property; and (b) facilitates emergency access and operational space for firefighters in a reduced fuel area between future buildings and structures and hazardous vegetation, that reduce risk to an acceptable or tolerable level. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	**AO1.1** A development footprint plan is identified for each lot that avoids ridgelines, saddles and crests where slopes exceed 15 per cent.	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.
	AO1.2 A development footprint plan is identified for each lot that is separated from the closest edge to the adjacent mapped medium, high or very high potential bushfire intensity area by: (a) a distance that is no closer than the distances specified in Table 5 at all development footprint plan boundaries; or (b) a distance that achieves a radiant heat flux level of 29 kW/m2 or less at all development footprint plan boundaries. Note – This separation area is often termed an asset protection zone. Note – The radiant heat flux levels can be established by undertaking a bushfire hazard assessment in accordance with the methodology in the QFES Bushfire resilient communities document.	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.
PO2 The subdivision layout enables: (a) future buildings to be located as close as possible to property entrances to facilitate safe evacuation during a bushfire event; and (b) future site access to be located and designed to allow safe evacuation of the site by occupants and maintain access by emergency services under critical event conditions.	**AO2** A development footprint plan is identified for each lot that: (a) is located within 60 metres of the street frontage; and (b) sited to enable a route between the development footprint plan and the street frontage with a gradient that does not exceed of 12.5 per cent.	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.
Section B		
Reconfiguring a lot (RaL) – where creating lots of 2,000 square metres or less		
PO3 The subdivision layout: (a) avoids creating lots on slopes and land forms that expose people or property	**AO3.1** The subdivision layout results in lots that are sited so that they are separated from the closest edge to the adjacent mapped medium,	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.

Performance outcomes	Acceptable outcomes	Compliance assessment
to an intolerable risk to life or property; and (b) facilitates emergency access and operational space for firefighters in a reduced fuel area between future buildings and structures and hazardous vegetation, that reduce risk to an acceptable or tolerable level. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient communities* document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	high or very high potential bushfire intensity area by: (a) a distance that is no closer than the distances specified in Table 5 at all lot boundaries; or : (b) a distance that achieves a radiant heat flux level of 29 kW/m^2 or less: (i) at the building envelope, if identified at RaL stage; or (ii) where a building envelope is not identified, at all lot boundaries. Note – This separation area is often termed an asset protection zone. Note – The radiant heat flux levels can be established by undertaking a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document. Note – For staged developments, temporary separation areas may be absorbed as part of subsequent stages. Note - Existing cleared areas external to the site may only be used in calculating necessary separation where tenure ensures that the land will remain cleared of hazardous vegetation (for example the land is a road, watercourse or highly managed park in public ownership).	
	AO3.2 The subdivision layout does not create lots that are within bushfire prone areas and on ridgelines, saddles and crests where slopes exceed 15 per cent (roads and parks may be located in these areas).	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.
Section C		
Reconfiguring a lot (RaL) – where creating more than 20 lots		
PO4 The subdivision layout is designed to minimise the length of the development perimeter and number of lots exposed to hazardous vegetation. Note – For example, avoid finger-like subdivision patterns or substantive vegetated corridors between lots.	**AO4** No acceptable outcome is prescribed	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.

Performance outcomes	Acceptable outcomes	Compliance assessment
PO5 The subdivision layout provides for adequate access and egress and safe evacuation routes, to achieve an acceptable or tolerable risk to people.	**AO5.1** The subdivision layout: (a) avoids the creation of bottle-neck points in the movement network within the development (for example, avoids hourglass patterns); and (b) ensures the road network has sufficient capacity for the evacuating population.	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.
	AO5.2 The subdivision layout ensures evacuation routes: (a) direct occupants away from rather than towards or through areas with a greater potential bushfire intensity; and (b) minimise the length of route through bushfire prone areas. Refer Figure 5.	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.
 *Figure 5 – Subdivision layout and evacuation routes*		
PO6 The subdivision layout provides adequate buffers between hazardous vegetation and development. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient*	**AO6.1** The subdivision layout results in an asset protection zone being located to create a separation area from adjacent mapped medium, high or very high potential bushfire intensity areas.	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.
	AO6.2 The asset protection zone is comprised of: (a) parks and open spaces; and/or (b) lots greater than 2000 square metres; and/or (c) public roads (termed perimeter roads). Note – Parks and open space may be	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.

Performance outcomes	Acceptable outcomes	Compliance assessment
communities document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	located within the mapped medium, high and very high potential bushfire intensity areas to create a separation between the development and the balance of the bushfire prone area. Note – Portions of lots greater than 2000 square metres may be located within the mapped medium, high and very high potential bushfire intensity areas. Refer Figure 5.	
	AO6.3 Where the asset protection zone includes lots greater than 2000 square metres a development footprint plan is identified for each lot that is located in accordance with AO1.2.	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.
PO7 Parks or open space provided as part of the asset protection zone do not create additional bushfire prone areas. Note –The undertaking of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	**AO7** Where the asset protection zone includes parks or open spaces, they: (a) comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, cultivated gardens and nature strips; or (b) are designed to ensure a potential available fuel load is maintained at less than eight tonnes/hectare in aggregate and with a fuel structure that remains discontinuous. Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-cropped grass to a nominal height of 10 centimetres.	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.
PO8 Perimeter roads are accessible for fire-fighting vehicles, to facilitate emergency access and operational space for fire- fighting, maintenance works and hazard reduction activities.	**AO8.1** Where the asset protection zone includes a perimeter road it: (a) has a two-lane sealed carriageway clear of hazardous vegetation; and (b) is connected to the wider public road network at both ends and at intervals of no more than 200 metres; and (c) does not include design elements that may impede access for fire-fighting and	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.

Performance outcomes	Acceptable outcomes	Compliance assessment
	maintenance for fire- fighting purposes (for example traffic calming involving chicanes).	
	AO8.2 Where the subdivision contains a reticulated water supply, the road network and fire hydrants are designed and installed in accordance with: (a) *Fire Hydrant and Vehicle Access Guidelines for residential, commercial and industrial lots*, Queensland Fire and Emergency Services, 2015, unless otherwise specified by the relevant water entity; and (b) the *Road Planning and Design Manual 2nd edition*, Department of Transport and Main Roads, 2013.	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.
Section D		
Reconfiguring a lot (RaL) – where creating additional lots for the purpose of residential development and a reticulated water supply is not provided.		
PO9 The subdivision layout provides for perimeter roads or fire trail and working areas that are accessible by the type of fire-fighting vehicles servicing the area, to facilitate emergency access and operational space for fire-fighting, maintenance works and hazard reduction activities.	**AO9.1** The subdivision layout includes: (a) a fire trail and working area designed and constructed in accordance with the design parameters in Table 6 that separates the residential lot or development footprint plan from adjacent mapped medium, high or very high potential bushfire intensity areas; or (b) a perimeter road designed and constructed in accordance with AO8.1. Refer Figure 6.	**Not applicable** The proposed Burdekin pump station does not involve the reconfiguring a lot.

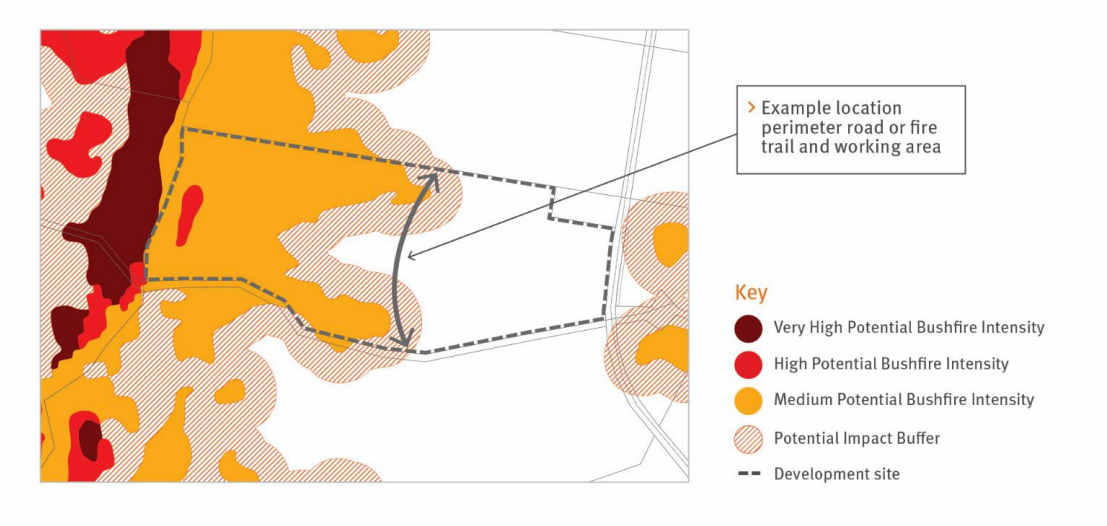
<table>
<tr><th>Performance outcomes</th><th>Acceptable outcomes</th><th>Compliance assessment</th></tr>
<tr><td colspan="3"> 

Figure 6 – Siting of fire trail and working area</td></tr>
<tr><td colspan="3">Section E</td></tr>
<tr><td colspan="3">Material change of use</td></tr>
<tr><td rowspan="2">PO10
Site layout achieve an acceptable or tolerable risk to people.
Landscape or open space provided as part of the development:
(a) acts as a buffer between hazardous vegetation and development; and
(b) does not create additional bushfire prone areas.
Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment in accordance with the methodology in the QFES Bushfire resilient communities document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.</td><td>AO10.1
Site layout places the landscape and open spaces within the site between premises and adjacent mapped medium, high or very high potential bushfire intensity areas.
Refer Figure 7.</td><td>Complies with PO10
Section 6.1 of the bushfire management plan (BMP) requires an asset protection zone (APZ) to be established around the development footprint of buildings and infrastructure.
The APZ will provide a buffer between hazardous vegetation and development and will not create additional bushfire prone areas.</td></tr>
<tr><td>AO10.2
This landscaping and open space comprises protective landscape treatments that:
(a) comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses and cultivated gardens; or
(b) are designed to ensure a potential available fuel load is maintained at less than 8 tonnes/hectare in aggregate and that fuel structure remains discontinuous.
Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-</td><td>Complies with PO10
Refer to the above response.</td></tr>
</table>

Performance outcomes	Acceptable outcomes	Compliance assessment
	cropped grass to a nominal height of 10 centimetres.	

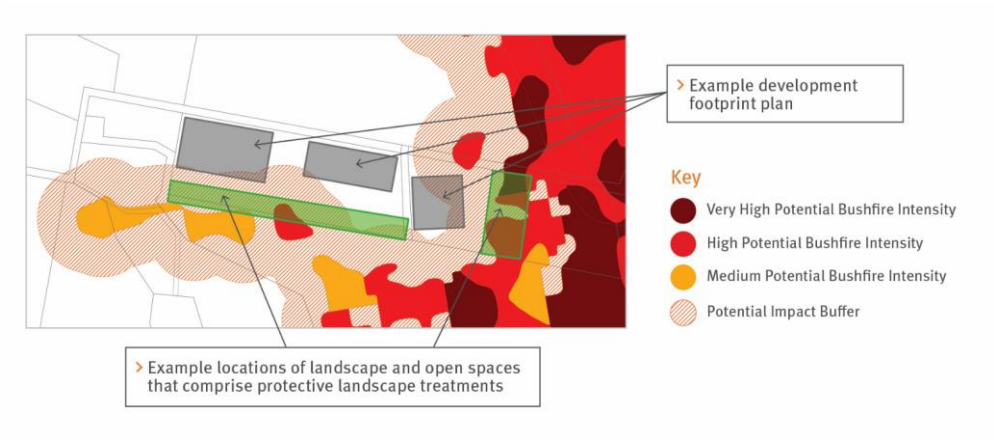


Figure 7 – Siting of protective landscape treatments

PO11 The development establishes evacuation areas, to achieve an acceptable or tolerable risk to people.	**AO11** If in an isolated location, development establishes direct access to a safe assembly/evacuation area. Note – Guidance on identifying safe evacuation areas is contained in the QFES *Bushfire resilient communities* document.	**Not applicable** The proposed Burdekin pump station will not be permanently occupied.
PO12 If on a lot of over 2,000 m^2, where involving a new premises or an existing premises with an increase in development footprint, development: (a) locates occupied areas as close as possible to property entrances to facilitate safe evacuation during a bushfire event; and (b) ensures vehicular access is located and designed to allow safe evacuation of the site by occupants and maintain access by emergency services under critical event conditions	**AO12** No acceptable outcome is prescribed.	**Complies with PO12** Section 6.3 of the BMP requires access roads to be designed and constructed to accommodate a heavy rigid Rural Fire Brigade (**RFB**) vehicle in accordance with *Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots 2019*) which defers to the *Road Planning and Design Manual – 2nd Edition 2013* for load bearing capacity, geometry and turning radii.
PO13 Development is located within a reticulated water supply area or includes a dedicated static water supply that is available solely for fire-fighting purposes and can be accessed by fire-fighting vehicles. Note – Swimming pools, farm ponds and dams are not considered reliable sources of static water supply in Queensland due	**AO13** No acceptable outcome is prescribed	**Complies with PO13** The proposed Burdekin pump station will include a dedicated fire-fighter water supply that is accessible to the RFB personnel and vehicles. Design specifications for the fire-fighter water supply are provided in Section 6.2 of the BMP.

Performance outcomes	Acceptable outcomes	Compliance assessment
to regular drought events. Note for Local Government – Information on how to provide an appropriate static water supply, may form a condition of a development approval. For further information on preferred solutions refer to the QFES *Bushfire resilient communities* document.		
PO14 Vulnerable uses listed in Table 7 are not established or intensified within a bushfire prone area unless: (a) there is an overriding need in the public interest for the new or expanded service the development provides; and (b) there are no other suitable alternative locations within the required catchment; and (c) site planning can appropriately mitigate the risk (for example, siting ovals for an educational establishment between the hazardous vegetation and structures. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome	**AO14.1** No acceptable outcome is prescribed.	**Complies with PO14** The proposed Burdekin pump station does not involve a vulnerable use.
PO15 Community infrastructure providing essential services listed in Table 7 are not established within a bushfire prone area unless: (a) there is an overriding need in the public interest for the new or expanded service the development provides (for example, there are no other suitable alternative locations that can deliver the required level of service or meet emergency service response times during and immediately after a bushfire event); and (b) the infrastructure can function effectively during and immediately after a bushfire event. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in	**AO15** No acceptable outcome is prescribed.	**Complies with PO15** The proposed Burdekin pump station does not involve community infrastructure providing essential services.

Performance outcomes	Acceptable outcomes	Compliance assessment
demonstrating compliance with this performance outcome.		
PO16 Development avoids or mitigates the risks to public safety and the environment from the manufacture or storage of materials listed in Table 7 that are hazardous in the context of bushfire to an acceptable or tolerable level. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome. Editor's note – In addition to the requirements of this code the *Work Health and Safety Act 2011* and associated Regulation and Guidelines, the *Environmental Protection Act 1994* and the relevant building assessment provisions under the *Building Act 1975* contain requirements for the manufacture and storage of hazardous substances. Information is provided by Business Queensland on the requirements for storing and transporting hazardous chemicals, available at: www.business.qld.gov.au/running-business/protecting-business/risk-management/hazardous-chemicals/storing-transporting.	**AO16** No acceptable outcome is prescribed.	**Complies with PO16** The proposed Burdekin pump station does not involve the manufacture or storage of materials that are hazardous in the context of bushfire.
Section F		
Where involving an asset protection zone		
PO17 Asset protection zones are designed and managed to ensure they do not increase the potential for bushfire hazard. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	**AO17.1** Landscaping treatments within any asset protection zone comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks. Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-cropped grass to a nominal height of 10 centimetres. OR	**Complies with AO17.1** Specifications for the design and maintenance of APZ are provided in Section 6.1 of the BMP and will result in a low level of discontinuous bushfire and grass fire fuel.
	AO17.2 Landscaping management within any asset protection zone maintains a: (a) potential available fuel load	**Complies with AO17.2** Refer to response to AO17.1.

Performance outcomes	Acceptable outcomes	Compliance assessment
	which is less than eight tonnes/hectare in aggregate; and (b) fuel structure which is discontinuous. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome.	
Section G		
Where planning provisions or conditions of approval require revegetation or rehabilitation		
PO18 Revegetation or rehabilitation areas are designed and managed to ensure they do not result in an unacceptable level of risk or an increase in bushfire intensity level. Note – The undertaking of a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	**AO18.1** Required revegetation or rehabilitation: (a) is located outside of any asset protection zone; or (b) maintains a potential available fuel load which is less than eight tonnes/hectare in aggregate and fuel structure which is discontinuous. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with acceptable outcome (b).	**Not applicable** The proposed Burdekin pump station does not include revegetation or rehabilitation.
	AO18.2 Revegetation or rehabilitation of areas located within mapped medium, high or very high potential bushfire intensity areas, revegetate and rehabilitate in a manner that maintains or reduces the existing fuel load. OR Revegetation or rehabilitation of areas located within the mapped potential impact buffer area, revegetate and rehabilitate in a manner that maintains or reduces the existing fuel load. Note – The preparation of a vegetation management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome.	**Not applicable** The proposed Burdekin pump station does not include revegetation or rehabilitation.

Table 6 – Fire trail and working area design parameters

Parameter	Provisions
Width	Contains a width of at least 20 metres including: 1. A trafficable area (cleared and formed);

Parameter	Provisions
	a. with a minimum width of 4 metres than can accommodate a rural firefighting vehicle b. with no less than 4.8 metres vertical clearance from canopy vegetation c. with no adjacent inhibiting embankments or retaining walls 2. A working area each side of the trafficable area: a. with a minimum width of 3 metres each side b. cleared of all flammable vegetation greater than 10 centimetres in height 3. The balance (i.e. 10 metre width) managed vegetation area: a. sited to separate the trafficable area from adjacent mapped medium, high or very high potential bushfire intensity areas managed vegetation b. comprising managed vegetation clear of major surface hazards.
Access	Access is granted in favour of the local government and Queensland Fire and Emergency Services Note – this access is commonly granted in the form of a easement that is to be maintained by the grantor.
Egress	Contains trafficable vehicle routes in to low hazard areas, every 200 metres

Table 7 – Vulnerable uses, community infrastructure for essential services and materials that are hazardous in the context of bushfire hazard

Group	Uses
Vulnerable uses	*childcare centre, community care centre, detention facility, educational establishment, hospital, nature-based tourism, relocatable home park, rooming accommodation, residential care facility, resort complex, retirement facility, tourist park*
Community infrastructure for essential services	*educational establishment, emergency services, hospital*
Hazardous materials in the context of bushfire hazard	Hazardous chemicals that are present at the levels or in the quantities that would constitute the use being a hazardous chemical facility Hazardous materials that are present in the quantities in the Work Health and Safety Regulation, schedule 15

Land and environment consultants

Bushfire management plan

Bowen Pipeline Project | Kirknie break tanks | Heatley Road | Kirknie | Queensland
Prepared for Bowen Pipeline Company Pty Ltd | 22 May 2024

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Bushfire management plan

Final

Report 23116 | Bowen Pipeline Company Pty Ltd | 22 May 2024

Approved by Robert Janssen

Position Managing principal

Signature 

Date 22 May 2024

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

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Document control

Version	Date	Prepared by	Reviewed by
Draft	24 April 2024	R. Janssen	LEC
Final	22 May 2024	R. Janssen	LEC

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Appendix

Appendix 1 Site plan

Appendix 2 Radiant heat exposure assessment

Appendix 3 Bushfire overlay code assessment

Disclaimer

Notwithstanding the precautions adopted in this report, it should always be remembered that bushfires burn under a range of conditions. An element of risk, no matter how small always remains, and although AS 3959-2018 is designed to improve the performance of such buildings, there can be no guarantee, because of the variable nature of bushfires, that any building will withstand bushfire attack on every occasion.

It should be noted that upon lodgement of a development proposal, State Government, council and/or the fire service may recommend additional construction requirements.

Although every care has been taken in the preparation of this report, Land and Environment Consultants Pty Ltd accept no responsibility resulting from the use of the information in this report.

1 Introduction

Land and Environment Consultants Pty Ltd (**LEC**) was engaged to prepare a bushfire management plan (**BMP**) for the proposed Kirknie break tanks component (**proposed Kirknie break tanks**) of the Bowen pipeline project, located in the south-eastern corner of lot 3/RP867595 (**the site**) which is accessed from Old Fort Road, Kirknie.

A ministerial infrastructure designation (**MID**) is being sought for the Bowen pipeline project in accordance with the Queensland *Planning Act 2016.*

The site is identified as a bushfire hazard area by the Queensland State Planning Policy (**SPP**) *Bushfire prone area map* (**Bushfire prone area map**). As a result, compliance with the example bushfire overlay code (**Bushfire overlay code**) in the *Natural Hazards, Risk and Resilience – Bushfire, State Planning Policy State Interest guidance material* (DSDMIP 2019) (**SPP guidance material – bushfire***)* is relevant to the proposed Kirknie break tanks component of the MID being sought for the Bowen pipeline project.

This BMP has been prepared in accordance with *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience – Bushfire'* (QFES 2019a) (**Bushfire resilient communities**) which was prepared by the Queensland Fire and Emergency Services (**QFES**) to provide technical guidance for the implementation of the SPP guidance material – bushfire.

This BMP documents the bushfire hazard assessment of the site and demonstrates how the proposed Kirknie break tanks will comply with the Bushfire overlay code. It includes:

- an introduction (this section) and description of methods and information resources used for the preparation of this BMP;
- description of the site and proposed Kirknie break tanks;
- bushfire hazard assessment;
- identification of bushfire hazards associated with the site and proposed Kirknie break tanks;
- radiant heat exposure assessment;
- a plan for mitigating bushfire hazards; and
- assessment of the proposed Kirknie break tanks against the Bushfire overlay code.

1.1 Method

To meet requirements of the SPP guidance material – bushfire and Bushfire resilient communities, the following tasks were undertaken:

- review of the Bushfire prone area map in the SPP interactive mapping system (DSDILGP 2024) and the Queensland regional ecosystem map, vegetation hazard class (**VHC**) map and severe fire weather map in the QFES online mapping system (QFES 2024) (**Catalyst**);
- review of fire history data in the Queensland Globe (DR 2024);
- inspection of land within 100 metres (**m**) of the proposed Kirknie break tanks for vegetation characteristics, current land management practices, slope and evidence of previous fires;
- bushfire hazard assessment in accordance with the method in Bushfire resilient communities;
- radiant heat exposure assessment using the Fire Protection Association of Australia *BAL calculator V4.9* (**BAL calculator**) which models the 'method 2' bushfire attack level assessment procedure in the *Australian Standard* (AS 3959-2018) *Construction of buildings in bushfire prone areas;* and
- assessment of the proposed Kirknie break tanks against the Bushfire overlay code.

Aerial imagery of the site and measuring tools were accessed online from Google Earth and the Queensland Globe to assist with validating observations and measurements made during the site assessment.

1.2 Suitably qualified person

This BMP was prepared by Robert Janssen who is a suitably qualified and experienced bushfire management consultant.

Robert is the managing principal at LEC and has over 25 years of experience in bushfire planning and operations. He has prepared BMPs for residential, commercial and industrial property developments, utilities, government facilities and conservation estates.

Robert's formal qualifications as an environmental scientist and consulting experience are coupled with 10 years of experience as a nationally accredited fire-fighter with the national parks and wildlife service in New South Wales and Queensland.

2 Description of the site and proposed Kirknie break tanks

This chapter provides a description of the site and proposed Kirknie break tanks.

2.1 Site description

The location of the site is shown in Figure 2.1. It is 1,600 m^2 and is accessed from Old Fort Road, which is a gravel track.

There is no reliable water at the site which is surrounded by bushland vegetation.

2.2 Proposed Kirknie break tanks

The Bowen pipeline project is a 114 kilometre (**km**) pipeline from the Burdekin River to south-west of Bowen. The proposed Kirknie break tanks is located between the Burdekin River pump station and the Inkerman pump station and will ensure zero backflow into the pipeline system. The site plan for the proposed Kirknie break tanks is provided in Appendix 1.

The proposed Kirknie break tanks consist of two 1.8 mega litre (ML) break tanks, level indicator transducers and power supply which will be located within a fenced compound.

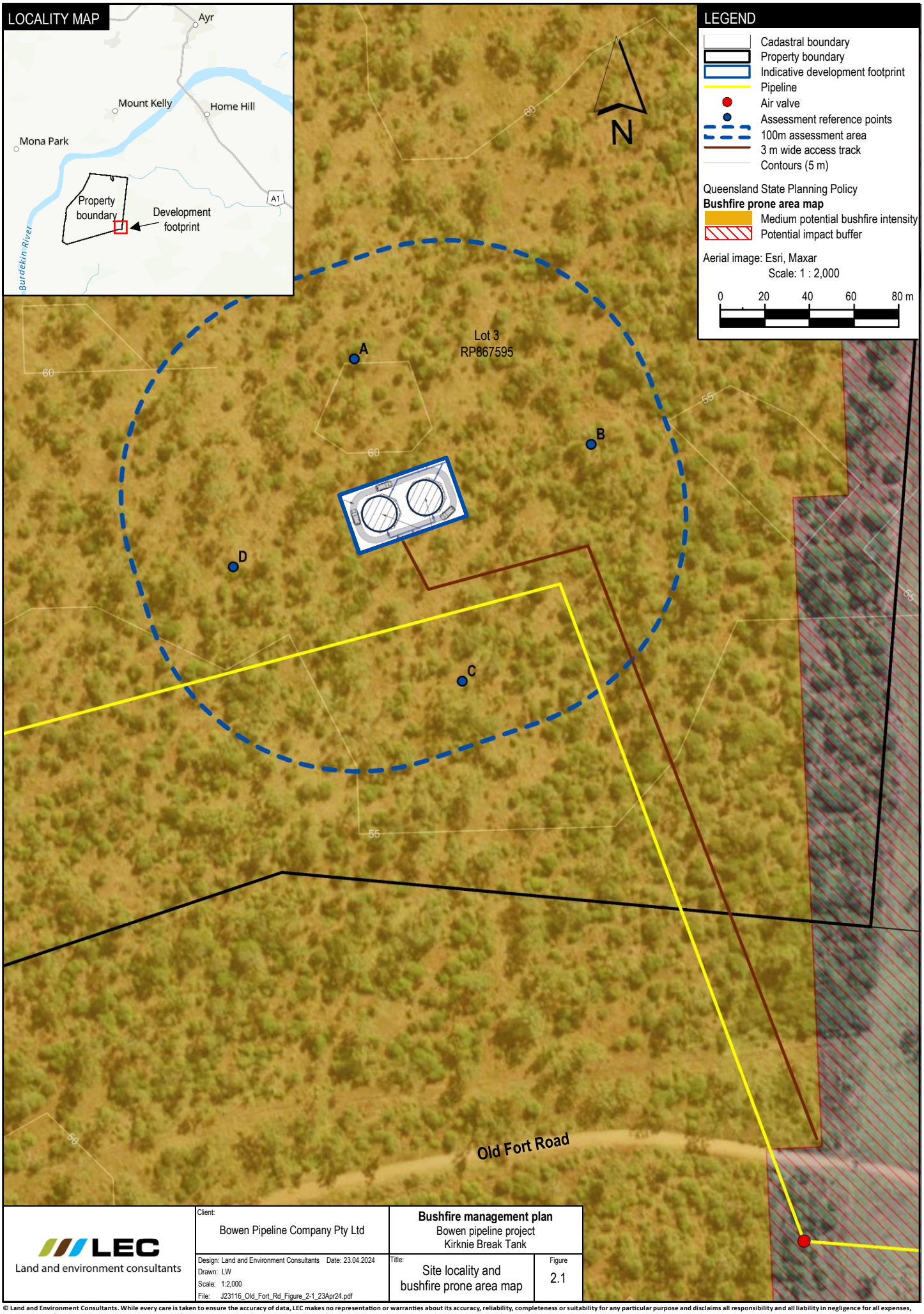
The proposed Kirknie break tanks will be accessed via a new 400 m long vehicle access track from Old Fort Road. The service vehicle access track will extend into the fenced compound and around the break tanks.

2.3 Bushfire prone area map

The Bushfire prone area map for the site is shown in Figure 2.1 and indicates the proposed Kirknie break tanks are affected by a medium potential bushfire intensity area.

Verification of the bushfire prone areas shown in the Bushfire prone area map is provided via the bushfire hazard assessment in Chapter 3.

Please note, in this BMP the terms ‘bushfire prone area’ and ‘bushfire hazard area’ have the same meaning. Both terms mean an area of vegetation that is determined to have a potential bushfire intensity ≥ 4,000 kilowatts/m (**kW/m**) and the land within 100 m of this vegetation.



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Client: Bowen Pipeline Company Pty Ltd	**Bushfire management plan** Bowen pipeline project Kirknie Break Tank	
Design: Land and Environment Consultants Date: 23.04.2024 Drawn: LW Scale: 1:2,000 File: J23116_Old_Fort_Rd_Figure_2-1_23Apr24.pdf	Title: Site locality and bushfire prone area map	Figure 2.1

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3 Bushfire hazard assessment

This chapter provides details about the desktop review, site inspection and bushfire hazard assessment.

3.1 Severe fire weather

The severe fire weather map in Catalyst indicates the 5 % annual exceedance probability forest fire danger index (**FFDI**) for the site is 58. This FFDI value has been used for the potential bushfire intensity calculations in Section 3.4 and the radiant heat exposure assessment in Section 5.3.

3.2 Fire history

Fire history data indicates that numerous fires have occurred within 1 km of the site during the past 20 years.

3.3 Site inspection

LEC inspected land within 100 m of the proposed Kirknie break tanks on 30 March 2024. Observations were recorded about current land use and management, vegetation characteristics, the slope of land and evidence of previous fires.

The locations of assessment reference points used for the bushfire hazard assessment are shown in Figure 2.1. Table 3.1 provides a summary of observations from the site inspection and notes about the bushfire hazard assessment of assessment reference points. An example of the bushland vegetation within the assessment area is shown in Photograph 3.1.

Table 3.1 Site observations

Assessment reference point	Catalyst VHC	Ground truthed VHC	Notes
A	VHC 18.2 *Dry eucalyptus woodlands on sand or depositional plains* (**VHC 18.2**)	VHC 18.2	Bushland vegetation
B	VHC 18.2	VHC 18.2	Bushland vegetation
C	VHC 18.2	VHC 18.2	Bushland vegetation
D	VHC 18.2	VHC 18.2	Bushland vegetation



Photograph 3.1 Example of VHC 18.2 at assessment reference points A, B, C and D

3.4 Potential bushfire intensity calculations

The potential bushfire intensity of assessment reference points was determined using the Queensland Public Safety Business Agency *Potential Bushfire Intensity Calculator* (version November 2014) which is an Excel spreadsheet calculator that models the bushfire hazard assessment method in Bushfire resilient communities.

Bushfire resilient communities define bushfire hazard classes as follows:

- very high – potential bushfire intensity > 40,000 kW/m;
- high – potential bushfire intensity 20,000-40,000 kW/m;
- medium – potential bushfire intensity 4,000-20,000 kW/m; and
- non-bushfire hazard – potential bushfire intensity < 4,000 kW/m.

Results of the potential bushfire intensity calculations which determine the bushfire hazard class of assessment reference points shown in Figure 2.1 are presented in Table 3.2.

Table 3.2 Potential bushfire intensity

Assessment reference point	VHC	Potential fuel load (tonnes/ha)[1]	Slope (°)	Potential bushfire intensity (kW/m)	Bushfire hazard class
A	VHC 18.2	14.4	1	4,662	Medium
B	VHC 18.2	14.4	1	4,662	Medium
C	VHC 18.2	14.4	1	4,662	Medium
D	VHC 18.2	14.4	1	4,662	Medium

Notes 1 Potential fuel load taken from Bushfire resilient communities.

3.5 Bushfire hazard areas

Results of the potential bushfire intensity calculations in Table 3.2 confirm the proposed Kirknie break tanks is within a bushfire hazard area, ie a medium potential bushfire intensity area. Therefore, compliance with the Bushfire overlay code is relevant to the proposed Kirknie break tanks component of the MID being sought for the Bowen pipeline project.

4 Bushfire hazards associated with the site

This chapter identifies bushfire hazards associated with the site.

4.1 Fire danger season

The fire danger season at the site starts in August, peaks in September and will begin to fall when consistent summer rainfall occurs. Typically, the worst fire weather conditions will be experienced during the fire danger season when the wind direction is from the north or west.

An FFDI of 58 will be associated with hot, dry and windy conditions. If a bushfire starts and takes hold under these conditions, it will be difficult to control and fast moving in large areas of bushland vegetation.

4.2 Fire history

As discussed in Section 3.2, fire history data indicates fires have occurred within 1 km of the site during the past 20 years. On this basis, it is considered likely the proposed Kirknie break tanks will be exposed to bushfire attack in the future.

4.3 Potential directions of bushfire attack

The proposed Kirknie break tanks could be exposed to bushfire attack from all directions, ie assessment reference points A, B, C, and D, shown in Figure 2.1, where hazardous vegetation occurs.

4.4 Potential bushfire hazards from adjacent land use

The fire history data indicates the adjacent land uses, ie cropping and livestock grazing, are a potential bushfire hazard to the proposed Kirknie break tanks. These land uses could involve hot works which has potential to cause an unplanned bushfire ignition.

4.5 Water and access for emergency services

The public road access to the site is via a gravel track which has limited wayfinding signage. This situation could make it difficult for out of area fire-fighters to efficiently navigate to the site.

The site does not have access to a reliable water supply for fire-fighting.

5 Bushfire hazards associated with the proposed Kirknie break tanks

This chapter identifies potential bushfire hazards associated with the proposed Kirknie break tanks.

5.1 Siting and design

The proposed Kirknie break tanks will be designed to mitigate the risk of bushfire hazards determined by the bushfire hazard assessment in this BMP:

- an asset protection zone (**APZ**) will be formalised around infrastructure to ensure that it is maintained in perpetuity;
- an appropriately designed fire-fighter water supply outlet point will be provided adjacent to an access road; and
- access roads will be designed to provide efficient access and egress for emergency services.

5.2 Land uses

The proposed Kirknie break tanks do not involve vulnerable uses, community infrastructure for essential services or the storage or handling of hazardous materials in the context of bushfire hazard as defined in Table 7 of the SPP guidance material – bushfire.

5.3 Radiant heat exposure

The Bushfire overlay code provides guidance about the acceptable level of radiant heat exposure for development within bushfire hazard areas. It requires development to be setback from hazardous vegetation by a distance which achieves a radiant heat flux level ≤ 29 kW/m^2 at the development footprint of buildings and infrastructure.

As discussed in Section 4.3, the proposed Kirknie break tanks could be exposed to bushfire attack from all directions, ie assessment reference point A, B, C, and D, shown in Figure 2.1. The radiant heat profile of these bushfire attack scenarios was analysed using the BAL calculator. Inputs used in the BAL calculator and results are provided in Appendix 2.

Results of the radiant heat exposure assessment in Appendix 2 have been used in Section 6.1 to specify the width of the setback from hazardous vegetation, ie the APZ, to achieve a radiant heat flux level ≤ 29 kW/m^2 at the development footprint of infrastructure.

6 Bushfire mitigation plan

This chapter identifies mitigation measures that must be implemented as part of the proposed Kirknie break tanks to comply with the Bushfire overlay code.

It is the total of the mitigation measures in this chapter that will reduce the risk of bushfire hazard to a tolerable level. Failure to implement all actions in their entirety could result in an increased level of exposure to bushfire hazards.

6.1 Asset protection zone

An 8 m wide APZ must be established and maintained around infrastructure within the compound fence as shown in Figure 6.1. The position of the compound fence must be adjusted to fully contain the APZ.

The APZ must be identified in site plans and survey plans.

The APZ must consist of hardstand areas, ie gravel, asphalt or concrete, or grass which is maintained at a nominal height of 10 centimetres.

Woody regrowth, ie trees or shrubs, weeds and vegetation debris must be removed from the APZ at regular time intervals during the calendar year.

6.2 Access and egress

The access track must be designed and constructed to accommodate a heavy rigid RFB vehicle in accordance with the design guidelines in *Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots* (QFES 2019b) which defers to the *Road Planning and Design Manual – 2nd Edition* (DTMR 2013) for load bearing capacity, geometry and turning radii.

The access tracks must have a trafficable surface width of at least 3.5 m.

A reversing bay turnaround area measuring 6 m wide and 8 m deep must be located on the access track outside of the compound fence. It will provide a turnaround area for fire-fighters who do not have access to the turnaround within the site compound and a hardstand area to access the fire-fighter water supply outlet point specified in Section 6.3.

A passing bay with a widened trafficable surface width of at least 6 m for a length of at least 20 m must be installed at the mid-point of the access track from Old Fort Road.

6.3 Fire-fighter water supply

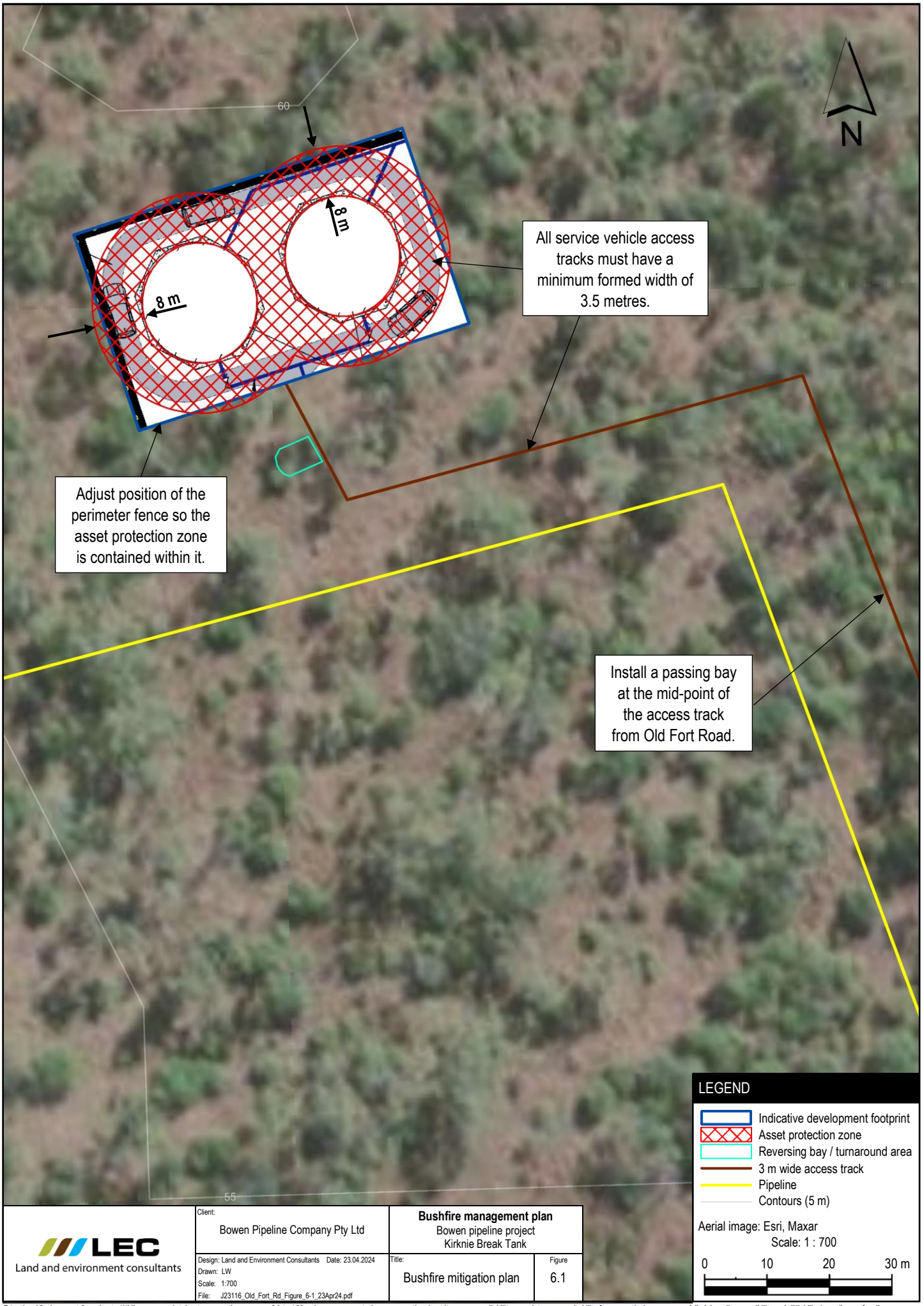
A fire-fighter water supply outlet point must be provided within 4 m of the reversing bay turn around area specified in Section 6.2. It is anticipated that it will be connected to a water reservoir or pipeline within the site's infrastructure. However, if this is not possible, the outlet point must be connected to a dedicated on-site fire-fighter water supply tank which is made from concrete or metal and has a minimum capacity of 10,000 litres.

If a fire-fighter water supply tank is required, it must be kept full of water and must not be used for activities other than bushfire management.

We recommend contacting the local Rural Fire Brigade (**RFB**) to confirm the standard local RFB fittings which should be used at the fire-fighter water supply outlet point.

All above ground pipes, valves and fittings must be made of metal.

The fire-fighter water supply outlet point must be identified by reflective wayfinding signage which is installed along the access track.



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Client: Bowen Pipeline Company Pty Ltd

Bushfire management plan
Bowen pipeline project
Kirknie Break Tank

Design: Land and Environment Consultants Date: 23.04.2024
Drawn: LW
Scale: 1:700
File: J23116_Old_Fort_Rd_Figure_6-1_23Apr24.pdf

Title: Bushfire mitigation plan

Figure: 6.1

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7 Conclusion

This BMP was prepared by a suitably qualified person and is in general accordance with the SPP guidance material – bushfire and Bushfire resilient communities.

A bushfire hazard assessment determined the site is affected by bushfire hazard and the proposed Kirknie break tanks component of the MID being sought for the Bowen pipeline project is subject to compliance with the Bushfire overlay code.

Mitigation measures that must be implemented as part of the proposed Kirknie break tanks are specified in Chapter 6. With the implementation of these mitigation measures the proposed Kirknie break tanks is considered to be compliant with the Bushfire overlay code as demonstrated in Appendix 3.

References

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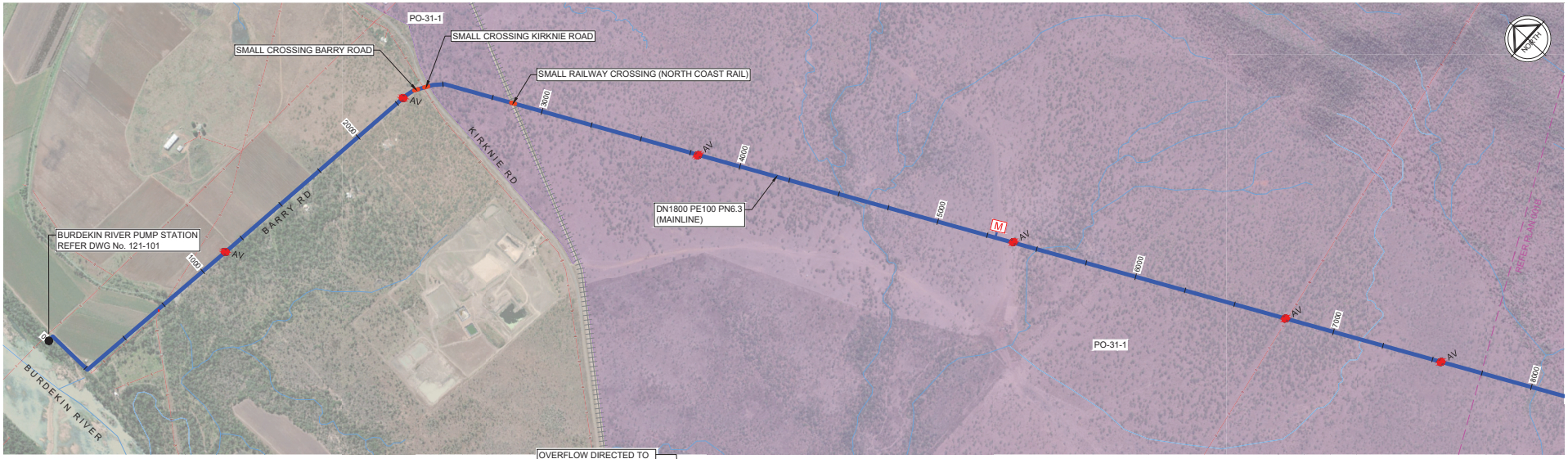
Queensland Fire and Emergency Service (QFES) 2019a, *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience – Bushfire'*, October 2019

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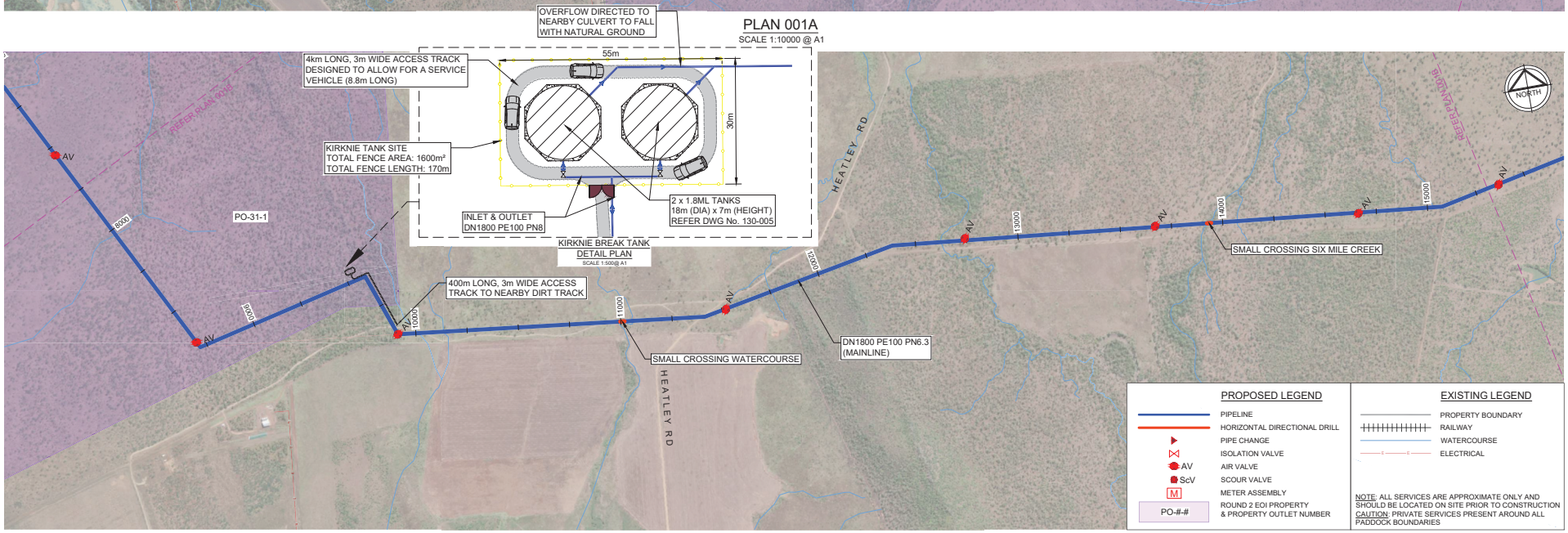
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Appendix 1 Site plan



PLAN 001A
SCALE 1:10000 @ A1



PLAN 001B
SCALE 1:10000 @ A1

PROPOSED LEGEND	
	PIPELINE
	HORIZONTAL DIRECTIONAL DRILL
	PIPE CHANGE
	ISOLATION VALVE
AV	AIR VALVE
ScV	SCOUR VALVE
M	METER ASSEMBLY
PO-#-#	ROUND 2 EOI PROPERTY & PROPERTY OUTLET NUMBER

EXISTING LEGEND	
	PROPERTY BOUNDARY
	RAILWAY
	WATERCOURSE
	ELECTRICAL

NOTE: ALL SERVICES ARE APPROXIMATE ONLY AND SHOULD BE LOCATED ON SITE PRIOR TO CONSTRUCTION
CAUTION: PRIVATE SERVICES PRESENT AROUND ALL PADDOCK BOUNDARIES

PRELIMINARY
NOT FOR CONSTRUCTION

-100 0 100 200 300 400 500 1000m
SCALE 1: 10000 ORIGINAL SIZE A1
SCALE 1: 20000 SIZE A3

REV	ISSUED	D.DWN	APRVD	REVISION DESCRIPTION
03	28/02/2024	JT	BL	CLIENT AMENDMENTS FOR SUBMISSION
02	15/02/2024	JT	BL	FINAL ISSUE
01	18/12/2023	JT	BL	PRELIMINARY DRAFT ISSUE

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agribusiness, water & environment

Bowen Pipeline Company

KBR

SURVEY INFORMATION: MGA ZONE 55K ALL LEVELS ARE TO AHD
REFERENCED PLANS:

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The arrangement and general details as shown on this drawing are essentially diagrammatic and must be applied to the circumstances as found on site.

DES./DRAWN:	JT
CHECKED:	BL
APPROVED:	DM
DATE:	24/10/2023
PROJECT REF.:	27KBR0BOWENP2

CLIENT: BOWEN PIPELINE COMPANY
DETAILED BUSINESS CASE

PROJECT: PIPELINE PLANS
MAINLINE

DRAWING No. 110-001 | SHEET 1 OF 8 | REVISION 03

Drawing file: 27KBR0BOWENP2-110[2] (PIPELINES)-NO SOLVAR & UPDATED ALIGNMENT.dwg - Saved at: 1/3/2024 9:16:25 AM - Plotted at:1/3/2024 10:29:49 AM - Original Size: ISO full bleed A1 (841.00 x 594.00 MM)

Appendix 2 Radiant heat exposure assessment

Bushfire attack through VHC 18.2

- Forest fire danger index - 58
- Vegetation - VHC 18.2 – *Dry eucalypt woodlands on sand or depositional plains*
- Understorey fuel load – 10.4 tonnes/hectare (**t/ha**)
- Total fuel load –11 t/ha
- Effective slope – 1° slope
- Site slope – 0° slope
- Flame width – 100 m
- Flame temperature – 1,090 Kelvin (**K**)

Note Inputs used for the radiant heat exposure assessment are in accordance with Section 7.3 of *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience – Bushfire 2019* (**Bushfire resilient communities**).



Calculated April 23, 2024, 10:25 am (MDc v.4.9)

J23116

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	58	Rate of spread	0.77 km/h
Vegetation classification	Woodland	Flame length	6.36 m
Understorey fuel load	10.4 t/ha	Flame angle	54 °, 64 °, 73 °, 78 °, 80 ° & 85 °
Total fuel load	11 t/ha	Elevation of receiver	2.57 m, 2.85 m, 3.04 m, 3.11 m, 3.13 m & 3.16 m
Vegetation height	n/a	Fire intensity	4,407 kW/m
Effective slope	1 °	Transmissivity	0.889, 0.879, 0.863, 0.844, 0.833 & 0.758
Site slope	0 °	Viewfactor	0.5888, 0.4294, 0.2881, 0.194, 0.1572 & 0.0432
Flame width	100 m	Minimum distance to < 40 kW/m²	5.3 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	7.3 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	10.9 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	16.1 m
		Minimum distance to < 10 kW/m²	19.8 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

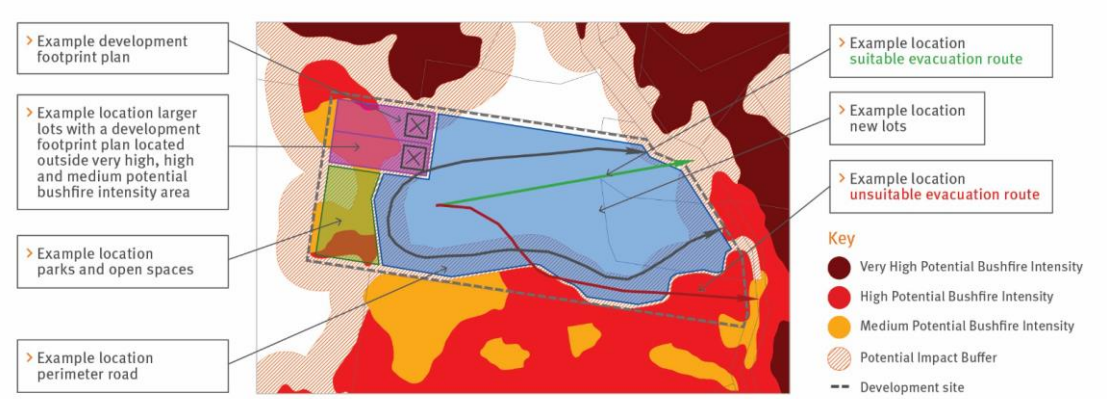
Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Appendix 3 Bushfire overlay code assessment

Performance outcomes	Acceptable outcomes	Compliance assessment
Section A **Reconfiguring a lot (RaL) – where creating lots of more than 2,000 square metres**		
PO1 The subdivision layout: (a) enables future buildings to be located away from slopes and land forms that expose people or property to an intolerable risk to life or property; and (b) facilitates emergency access and operational space for firefighters in a reduced fuel area between future buildings and structures and hazardous vegetation, that reduce risk to an acceptable or tolerable level. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	**AO1.1** A development footprint plan is identified for each lot that avoids ridgelines, saddles and crests where slopes exceed 15 per cent.	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.
	AO1.2 A development footprint plan is identified for each lot that is separated from the closest edge to the adjacent mapped medium, high or very high potential bushfire intensity area by: (a) a distance that is no closer than the distances specified in Table 5 at all development footprint plan boundaries; or (b) a distance that achieves a radiant heat flux level of 29 kW/m2 or less at all development footprint plan boundaries. Note – This separation area is often termed an asset protection zone. Note – The radiant heat flux levels can be established by undertaking a bushfire hazard assessment in accordance with the methodology in the QFES Bushfire resilient communities document.	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.
PO2 The subdivision layout enables: (a) future buildings to be located as close as possible to property entrances to facilitate safe evacuation during a bushfire event; and (b) future site access to be located and designed to allow safe evacuation of the site by occupants and maintain access by emergency services under critical event conditions.	**AO2** A development footprint plan is identified for each lot that: (a) is located within 60 metres of the street frontage; and (b) sited to enable a route between the development footprint plan and the street frontage with a gradient that does not exceed of 12.5 per cent.	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.
Section B		
Reconfiguring a lot (RaL) – where creating lots of 2,000 square metres or less		
PO3 The subdivision layout: (a) avoids creating lots on slopes and land forms that expose people or property	**AO3.1** The subdivision layout results in lots that are sited so that they are separated from the closest edge to the adjacent mapped medium,	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.

Performance outcomes	Acceptable outcomes	Compliance assessment
to an intolerable risk to life or property; and (b) facilitates emergency access and operational space for firefighters in a reduced fuel area between future buildings and structures and hazardous vegetation, that reduce risk to an acceptable or tolerable level. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient communities* document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	high or very high potential bushfire intensity area by: (a) a distance that is no closer than the distances specified in Table 5 at all lot boundaries; or : (b) a distance that achieves a radiant heat flux level of 29 kW/m^2 or less: (i) at the building envelope, if identified at RaL stage; or (ii) where a building envelope is not identified, at all lot boundaries. Note – This separation area is often termed an asset protection zone. Note – The radiant heat flux levels can be established by undertaking a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document. Note – For staged developments, temporary separation areas may be absorbed as part of subsequent stages. Note - Existing cleared areas external to the site may only be used in calculating necessary separation where tenure ensures that the land will remain cleared of hazardous vegetation (for example the land is a road, watercourse or highly managed park in public ownership).	
	AO3.2 The subdivision layout does not create lots that are within bushfire prone areas and on ridgelines, saddles and crests where slopes exceed 15 per cent (roads and parks may be located in these areas).	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.
Section C		
Reconfiguring a lot (RaL) – where creating more than 20 lots		
PO4 The subdivision layout is designed to minimise the length of the development perimeter and number of lots exposed to hazardous vegetation. Note – For example, avoid finger-like subdivision patterns or substantive vegetated corridors between lots.	**AO4** No acceptable outcome is prescribed	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.

Performance outcomes	Acceptable outcomes	Compliance assessment
PO5 The subdivision layout provides for adequate access and egress and safe evacuation routes, to achieve an acceptable or tolerable risk to people.	**AO5.1** The subdivision layout: (a) avoids the creation of bottle-neck points in the movement network within the development (for example, avoids hourglass patterns); and (b) ensures the road network has sufficient capacity for the evacuating population.	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.
	AO5.2 The subdivision layout ensures evacuation routes: (a) direct occupants away from rather than towards or through areas with a greater potential bushfire intensity; and (b) minimise the length of route through bushfire prone areas. Refer Figure 5.	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.
 *Figure 5 – Subdivision layout and evacuation routes*		
PO6 The subdivision layout provides adequate buffers between hazardous vegetation and development. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient*	**AO6.1** The subdivision layout results in an asset protection zone being located to create a separation area from adjacent mapped medium, high or very high potential bushfire intensity areas.	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.
	AO6.2 The asset protection zone is comprised of: (a) parks and open spaces; and/or (b) lots greater than 2000 square metres; and/or (c) public roads (termed perimeter roads). Note – Parks and open space may be	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.

Performance outcomes	Acceptable outcomes	Compliance assessment
communities document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	located within the mapped medium, high and very high potential bushfire intensity areas to create a separation between the development and the balance of the bushfire prone area. Note – Portions of lots greater than 2000 square metres may be located within the mapped medium, high and very high potential bushfire intensity areas. Refer Figure 5.	
	AO6.3 Where the asset protection zone includes lots greater than 2000 square metres a development footprint plan is identified for each lot that is located in accordance with AO1.2.	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.
PO7 Parks or open space provided as part of the asset protection zone do not create additional bushfire prone areas. Note –The undertaking of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	**AO7** Where the asset protection zone includes parks or open spaces, they: (a) comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, cultivated gardens and nature strips; or (b) are designed to ensure a potential available fuel load is maintained at less than eight tonnes/hectare in aggregate and with a fuel structure that remains discontinuous. Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-cropped grass to a nominal height of 10 centimetres.	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.
PO8 Perimeter roads are accessible for fire-fighting vehicles, to facilitate emergency access and operational space for fire- fighting, maintenance works and hazard reduction activities.	**AO8.1** Where the asset protection zone includes a perimeter road it: (a) has a two-lane sealed carriageway clear of hazardous vegetation; and (b) is connected to the wider public road network at both ends and at intervals of no more than 200 metres; and (c) does not include design elements that may impede access for fire-fighting and	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.

Performance outcomes	Acceptable outcomes	Compliance assessment
	maintenance for fire- fighting purposes (for example traffic calming involving chicanes).	
	AO8.2 Where the subdivision contains a reticulated water supply, the road network and fire hydrants are designed and installed in accordance with: (a) *Fire Hydrant and Vehicle Access Guidelines for residential, commercial and industrial lots*, Queensland Fire and Emergency Services, 2015, unless otherwise specified by the relevant water entity; and (b) the *Road Planning and Design Manual 2nd edition*, Department of Transport and Main Roads, 2013.	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.
Section D		
Reconfiguring a lot (RaL) – where creating additional lots for the purpose of residential development and a reticulated water supply is not provided.		
PO9 The subdivision layout provides for perimeter roads or fire trail and working areas that are accessible by the type of fire-fighting vehicles servicing the area, to facilitate emergency access and operational space for fire-fighting, maintenance works and hazard reduction activities.	**AO9.1** The subdivision layout includes: (a) a fire trail and working area designed and constructed in accordance with the design parameters in Table 6 that separates the residential lot or development footprint plan from adjacent mapped medium, high or very high potential bushfire intensity areas; or (b) a perimeter road designed and constructed in accordance with AO8.1. Refer Figure 6.	**Not applicable** The proposed Kirknie break tanks does not involve the reconfiguring a lot.

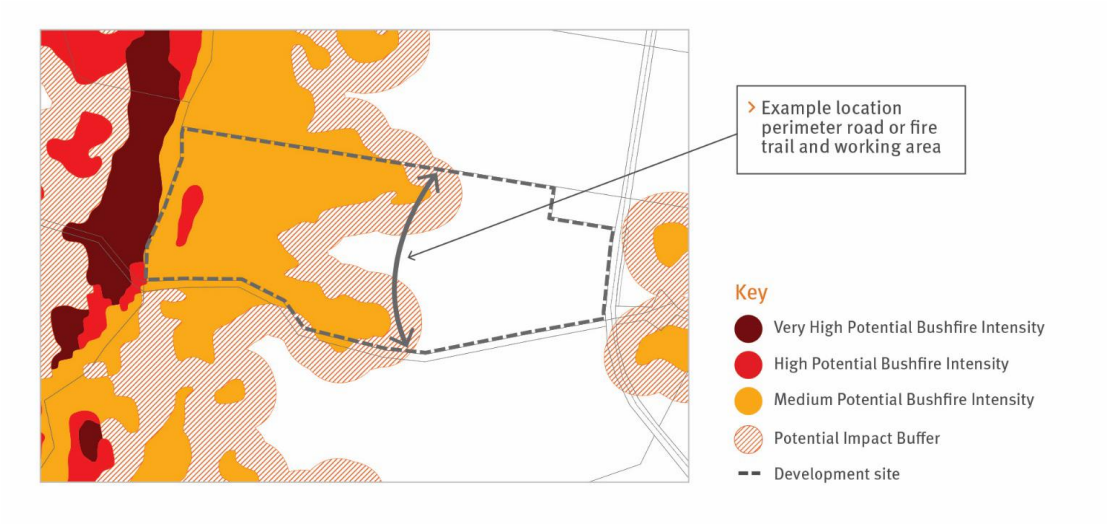
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<tr><th>Performance outcomes</th><th>Acceptable outcomes</th><th>Compliance assessment</th></tr>
<tr><td colspan="3"> 

Figure 6 – Siting of fire trail and working area</td></tr>
<tr><td colspan="3">Section E</td></tr>
<tr><td colspan="3">Material change of use</td></tr>
<tr><td rowspan="2">PO10
Site layout achieve an acceptable or tolerable risk to people.
Landscape or open space provided as part of the development:
(a) acts as a buffer between hazardous vegetation and development; and
(b) does not create additional bushfire prone areas.
Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment in accordance with the methodology in the QFES Bushfire resilient communities document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.</td><td>AO10.1
Site layout places the landscape and open spaces within the site between premises and adjacent mapped medium, high or very high potential bushfire intensity areas.
Refer Figure 7.</td><td>Complies with PO10
Section 6.1 of the bushfire management plan (BMP) requires an asset protection zone (APZ) to be established and maintained around infrastructure within the compound fence.
The APZ will provide a buffer between hazardous vegetation and development and will not create additional bushfire prone areas.</td></tr>
<tr><td>AO10.2
This landscaping and open space comprises protective landscape treatments that:
(a) comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses and cultivated gardens; or
(b) are designed to ensure a potential available fuel load is maintained at less than 8 tonnes/hectare in aggregate and that fuel structure remains discontinuous.
Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-</td><td>Complies with PO10
Refer to the above response.</td></tr>
</table>

Performance outcomes	Acceptable outcomes	Compliance assessment
	cropped grass to a nominal height of 10 centimetres.	

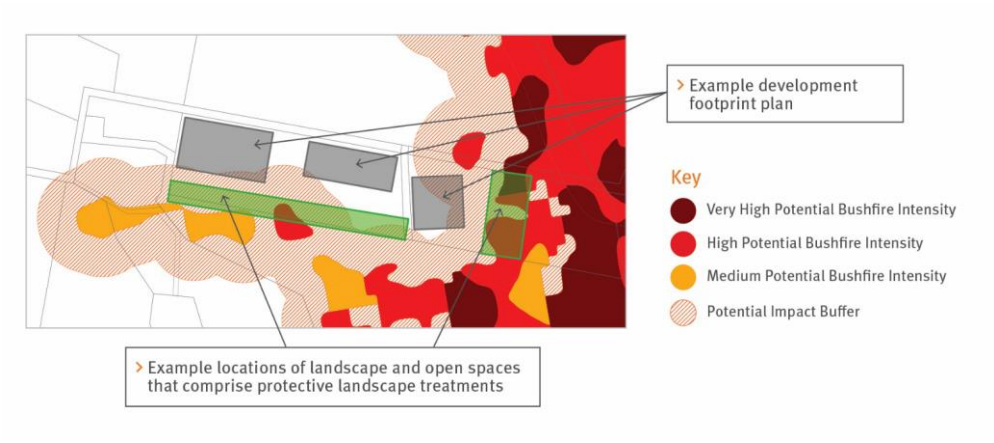


Figure 7 – Siting of protective landscape treatments

PO11 The development establishes evacuation areas, to achieve an acceptable or tolerable risk to people.	**AO11** If in an isolated location, development establishes direct access to a safe assembly/evacuation area. Note – Guidance on identifying safe evacuation areas is contained in the QFES *Bushfire resilient communities* document.	**Not applicable** The proposed Kirknie break tanks will not be permanently occupied.
PO12 If on a lot of over 2,000 m^2, where involving a new premises or an existing premises with an increase in development footprint, development: (a) locates occupied areas as close as possible to property entrances to facilitate safe evacuation during a bushfire event; and (b) ensures vehicular access is located and designed to allow safe evacuation of the site by occupants and maintain access by emergency services under critical event conditions	**AO12** No acceptable outcome is prescribed.	**Complies with PO12** Section 6.2 of the BMP requires access roads to be designed and constructed to accommodate a heavy rigid Rural Fire Brigade (**RFB**) vehicle in accordance with *Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots 2019* which defers to the *Road Planning and Design Manual – 2nd Edition 2013* for load bearing capacity, geometry and turning radii.
PO13 Development is located within a reticulated water supply area or includes a dedicated static water supply that is available solely for fire-fighting purposes and can be accessed by fire-fighting vehicles. Note – Swimming pools, farm ponds and dams are not considered reliable sources of static water supply in Queensland due	**AO13** No acceptable outcome is prescribed	**Complies with PO13** The proposed Kirknie break tanks will include a dedicated fire-fighter water supply that is accessible to the RFB personnel and vehicles. Design specifications for the fire-fighter water supply are provided in Section 6.3 of the BMP.

Performance outcomes	Acceptable outcomes	Compliance assessment
to regular drought events. Note for Local Government – Information on how to provide an appropriate static water supply, may form a condition of a development approval. For further information on preferred solutions refer to the QFES *Bushfire resilient communities* document.		
PO14 Vulnerable uses listed in Table 7 are not established or intensified within a bushfire prone area unless: (a) there is an overriding need in the public interest for the new or expanded service the development provides; and (b) there are no other suitable alternative locations within the required catchment; and (c) site planning can appropriately mitigate the risk (for example, siting ovals for an educational establishment between the hazardous vegetation and structures. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome	**AO14.1** No acceptable outcome is prescribed.	**Complies with PO14** The proposed Kirknie break tanks does not involve a vulnerable use.
PO15 Community infrastructure providing essential services listed in Table 7 are not established within a bushfire prone area unless: (a) there is an overriding need in the public interest for the new or expanded service the development provides (for example, there are no other suitable alternative locations that can deliver the required level of service or meet emergency service response times during and immediately after a bushfire event); and (b) the infrastructure can function effectively during and immediately after a bushfire event. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in	**AO15** No acceptable outcome is prescribed.	**Complies with PO15** The proposed Kirknie break tanks does not involve community infrastructure providing essential services.

Performance outcomes	Acceptable outcomes	Compliance assessment
demonstrating compliance with this performance outcome.		
PO16 Development avoids or mitigates the risks to public safety and the environment from the manufacture or storage of materials listed in Table 7 that are hazardous in the context of bushfire to an acceptable or tolerable level. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome. Editor's note – In addition to the requirements of this code the *Work Health and Safety Act 2011* and associated Regulation and Guidelines, the *Environmental Protection Act 1994* and the relevant building assessment provisions under the *Building Act 1975* contain requirements for the manufacture and storage of hazardous substances. Information is provided by Business Queensland on the requirements for storing and transporting hazardous chemicals, available at: www.business.qld.gov.au/running-business/protecting-business/risk-management/hazardous-chemicals/storing-transporting.	**AO16** No acceptable outcome is prescribed.	**Complies with PO16** The proposed Kirknie break tanks does not involve the manufacture or storage of materials that are hazardous in the context of bushfire.
Section F		
Where involving an asset protection zone		
PO17 Asset protection zones are designed and managed to ensure they do not increase the potential for bushfire hazard. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	**AO17.1** Landscaping treatments within any asset protection zone comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks. Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-cropped grass to a nominal height of 10 centimetres. OR	**Complies with AO17.1** Specifications for the design and maintenance of APZ are provided in Section 6.1 of the BMP and will result in a low level of discontinuous bushfire and grass fire fuel.
	AO17.2 Landscaping management within any asset protection zone maintains a: (a) potential available fuel load	**Complies with AO17.2** Refer to response to AO17.1.

Performance outcomes	Acceptable outcomes	Compliance assessment
	which is less than eight tonnes/hectare in aggregate; and (b) fuel structure which is discontinuous. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome.	
Section G		
Where planning provisions or conditions of approval require revegetation or rehabilitation		
PO18 Revegetation or rehabilitation areas are designed and managed to ensure they do not result in an unacceptable level of risk or an increase in bushfire intensity level. Note – The undertaking of a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	**AO18.1** Required revegetation or rehabilitation: (a) is located outside of any asset protection zone; or (b) maintains a potential available fuel load which is less than eight tonnes/hectare in aggregate and fuel structure which is discontinuous. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with acceptable outcome (b).	**Not applicable** The proposed Kirknie break tanks does not include revegetation or rehabilitation.
	AO18.2 Revegetation or rehabilitation of areas located within mapped medium, high or very high potential bushfire intensity areas, revegetate and rehabilitate in a manner that maintains or reduces the existing fuel load. OR Revegetation or rehabilitation of areas located within the mapped potential impact buffer area, revegetate and rehabilitate in a manner that maintains or reduces the existing fuel load. Note – The preparation of a vegetation management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome.	**Not applicable** The proposed Kirknie break tanks does not include revegetation or rehabilitation.

Table 6 – Fire trail and working area design parameters

Parameter	Provisions
Width	Contains a width of at least 20 metres including: 1. A trafficable area (cleared and formed);

Parameter	Provisions
	a. with a minimum width of 4 metres than can accommodate a rural firefighting vehicle b. with no less than 4.8 metres vertical clearance from canopy vegetation c. with no adjacent inhibiting embankments or retaining walls 2. A working area each side of the trafficable area: a. with a minimum width of 3 metres each side b. cleared of all flammable vegetation greater than 10 centimetres in height 3. The balance (i.e. 10 metre width) managed vegetation area: a. sited to separate the trafficable area from adjacent mapped medium, high or very high potential bushfire intensity areas managed vegetation b. comprising managed vegetation clear of major surface hazards.
Access	Access is granted in favour of the local government and Queensland Fire and Emergency Services Note – this access is commonly granted in the form of a easement that is to be maintained by the grantor.
Egress	Contains trafficable vehicle routes in to low hazard areas, every 200 metres

Table 7 – Vulnerable uses, community infrastructure for essential services and materials that are hazardous in the context of bushfire hazard

Group	Uses
Vulnerable uses	*childcare centre, community care centre, detention facility, educational establishment, hospital, nature-based tourism, relocatable home park, rooming accommodation, residential care facility, resort complex, retirement facility, tourist park*
Community infrastructure for essential services	*educational establishment, emergency services, hospital*
Hazardous materials in the context of bushfire hazard	Hazardous chemicals that are present at the levels or in the quantities that would constitute the use being a hazardous chemical facility Hazardous materials that are present in the quantities in the Work Health and Safety Regulation, schedule 15

Land and environment consultants

Bushfire management plan

Bowen Pipeline Project | Laydown area 3 | Balaam Road | Bowen | Queensland
Prepared for Bowen Pipeline Company Pty Ltd | 22 May 2024

Land and Environment Consultants Pty Ltd
Suite 5, 66 Bay Terrace
Wynnum Queensland 4178
T: 07 2112 5692
E: info@landeconsultants.com.au

Bushfire management plan

Final

Report 23116 | Bowen Pipeline Company Pty Ltd | 22 May 2024

Approved by Robert Janssen

Position Managing principal

Signature 

Date 22 May 2024

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Document control

Version	Date	Prepared by	Reviewed by
Draft	24 April 2024	R. Janssen	LEC
Final	22 May 2024	R. Janssen	LEC

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Appendix

Appendix 1 Site plan

Appendix 2 Bushfire overlay code assessment

Disclaimer

Notwithstanding the precautions adopted in this report, it should always be remembered that bushfires burn under a range of conditions. An element of risk, no matter how small always remains, and although AS 3959-2018 is designed to improve the performance of such buildings, there can be no guarantee, because of the variable nature of bushfires, that any building will withstand bushfire attack on every occasion.

It should be noted that upon lodgement of a development proposal, State Government, council and/or the fire service may recommend additional construction requirements.

Although every care has been taken in the preparation of this report, Land and Environment Consultants Pty Ltd accept no responsibility resulting from the use of the information in this report.

1 Introduction

Land and Environment Consultants Pty Ltd (**LEC**) was engaged to prepare a bushfire management plan (**BMP**) for proposed laydown area 3 (**proposed laydown area**) of the Bowen pipeline project, located within unallocated land associated with Balaam Road, Bowen (**the site**).

A ministerial infrastructure designation (**MID**) is being sought for the Bowen pipeline project in accordance with the Queensland *Planning Act 2016.*

The site is identified as a bushfire hazard area by the Queensland State Planning Policy (**SPP**) *Bushfire prone area map* (**Bushfire prone area map**). As a result, compliance with the example bushfire overlay code (**Bushfire overlay code**) in the *Natural Hazards, Risk and Resilience – Bushfire, State Planning Policy State Interest guidance material* (DSDMIP 2019) (**SPP guidance material – bushfire***)* is relevant to the proposed Laydown area component of the MID being sought for the Bowen pipeline project.

This BMP has been prepared in accordance with *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience – Bushfire'* (QFES 2019a) (**Bushfire resilient communities**) which was prepared by the Queensland Fire and Emergency Services (**QFES**) to provide technical guidance for the implementation of the SPP guidance material – bushfire.

This BMP documents the bushfire hazard assessment of the site and demonstrates how the proposed laydown area will comply with the Bushfire overlay code. It includes:

- an introduction (this section) and description of methods and information resources used for the preparation of this BMP;
- description of the site and proposed laydown area;
- bushfire hazard assessment;
- identification of bushfire hazards associated with the site and proposed laydown area;
- a plan for mitigating bushfire hazards; and
- assessment of the proposed laydown area against the Bushfire overlay code.

1.1 Method

To meet requirements of the SPP guidance material – bushfire and Bushfire resilient communities, the following tasks were undertaken:

- review of the Bushfire prone area map in the SPP interactive mapping system (DSDILGP 2024) and the Queensland regional ecosystem map, vegetation hazard class (**VHC**) map and severe fire weather map in the QFES online mapping system (QFES 2024) (**Catalyst**);
- review of the fire scar mapping in the Queensland Globe (DR 2024);
- inspection of land within 100 metres (**m**) of the proposed laydown area for vegetation characteristics, current land management practices, slope and evidence of previous fires;
- bushfire hazard assessment in accordance with the method in Bushfire resilient communities; and
- assessment of the proposed laydown area against the Bushfire overlay code.

Aerial imagery of the site and measuring tools were accessed online from Google Earth and the Queensland Globe to assist with validating observations and measurements made during the site assessment.

1.2 Suitably qualified person

This BMP was prepared by Robert Janssen who is a suitably qualified and experienced bushfire management consultant.

Robert is the managing principal at LEC and has over 25 years of experience in bushfire planning and operations. He has prepared BMPs for residential, commercial and industrial property developments, utilities, government facilities and conservation estates.

Robert's formal qualifications as an environmental scientist and consulting experience are coupled with 10 years of experience as a nationally accredited fire-fighter with the national parks and wildlife service in New South Wales and Queensland.

2 Description of the site and proposed laydown area

This chapter provides a description of the site and proposed laydown area.

2.1 Site description

The location of the site is shown in Figure 2.1. The site is 2 hectares (**ha**) and adjoins the Bruce Highway and Balaam Road along its northern and western boundaries.

The site consists of bushland vegetation and is adjacent to cropping land to the north, east and west and bushland vegetation to the south.

2.2 Proposed laydown area

The Bowen pipeline project is a 114 kilometre (**km**) pipeline from the Burdekin River to south-west of Bowen. The proposed laydown area is located near Bowen and between the Salisbury Plains pump station and Delta pump station. The site plan for the proposed laydown area is provided in Appendix 1.

The proposed laydown area is temporary infrastructure that will involve layout yards, a pipe manufacturing facility and ancillary items. Activities at the site may include hot works and storage and handling of hazardous chemicals.

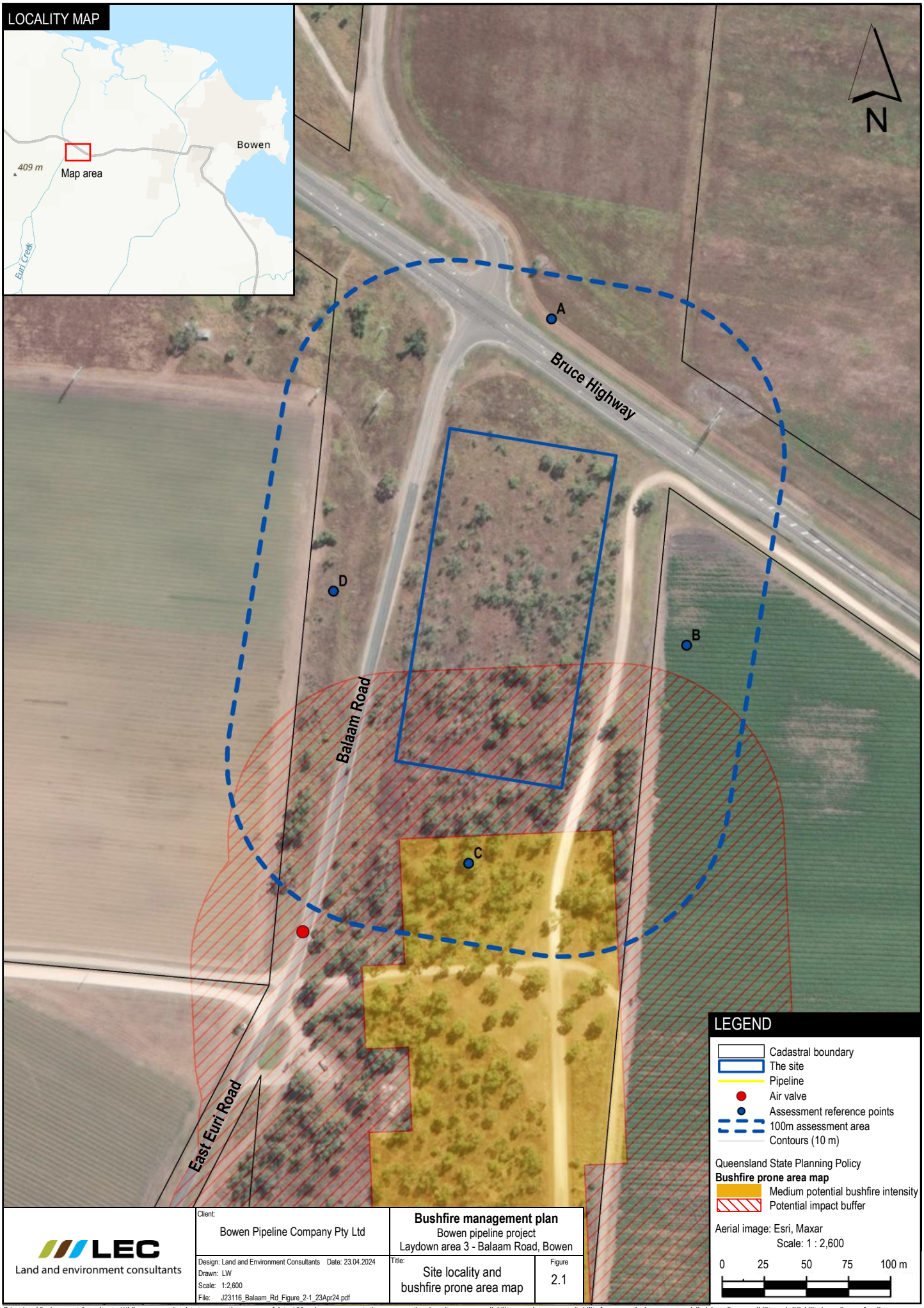
Access to the proposed laydown area will be via Balaam Road.

2.3 Bushfire prone area map

The Bushfire prone area map for the site is shown in Figure 2.1 and indicates the site is affected by the potential impact buffer from the medium potential bushfire intensity area.

Verification of the bushfire prone areas shown in the Bushfire prone area map is provided via the bushfire hazard assessment in Chapter 3.

Please note, in this BMP the terms ‘bushfire prone area’ and ‘bushfire hazard area’ have the same meaning. Both terms mean an area of vegetation that is determined to have a potential bushfire intensity ≥ 4,000 kilowatts/m (**kW/m**) and the land within 100 m of this vegetation.



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Client: Bowen Pipeline Company Pty Ltd

Bushfire management plan
Bowen pipeline project
Laydown area 3 - Balaam Road, Bowen

Design: Land and Environment Consultants Date: 23.04.2024
Drawn: LW
Scale: 1:2,600
File: J23116_Balaam_Rd_Figure_2-1_23Apr24.pdf

Title: Site locality and bushfire prone area map

Figure 2.1

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3 Bushfire hazard assessment

This chapter provides details about the desktop review, site inspection and bushfire hazard assessment.

3.1 Severe fire weather

The severe fire weather map in Catalyst indicates the 5 % annual exceedance probability forest fire danger index (**FFDI**) for the site is 59. This FFDI value has been used for the potential bushfire intensity calculations in Section 3.4.

3.2 Fire history

Fire scar mapping in the Queensland Globe indicates numerous fires have occurred within 1 kilometre (**km**) of the site during the past 20 years.

3.3 Site inspection

LEC inspected land within 100 m of the site on 30 March 2024. Observations were recorded about current land use and management, vegetation characteristics, the slope of land and evidence of previous fires.

The locations of assessment reference points used for the bushfire hazard assessment are shown in Figure 2.1. Table 3.1 provides a summary of observations from the site inspection and notes about the bushfire hazard assessment of assessment reference points. Examples of vegetation within the assessment areas are provided in Photographs 3.1-3.4.

Table 3.1 Site observations

Assessment reference point	Catalyst VHC	Ground truthed VHC	Notes
A	VHC 38.5 *Discontinuous irrigated cropping and horticulture* (**VHC 38.5**)	VHC 38.4 *Continuous dryland cropping and horticulture* (**VHC 38.4**)	Grassland on the verges of the Bruce Highway and land used for cropping.
B	VHC 38.5	VHC 38.4	Land used for cropping.
C	VHC 9.2 *Moist to dry eucalypt woodland on coastal lowlands and ranges* (**VHC 9.2**)	VHC 9.2	100+ m wide corridor of bushland vegetation.
D	VHC 38.5	VHC 38.4	Grassland on the verges of Balaam Road and land used for cropping.



Photograph 3.1 VHC 38.4 at A



Photograph 3.2 VHC 38.4 at B



Photograph 3.3 VHC 9.2 at C



Photograph 3.4 VHC 38.4 at D

3.4 Potential bushfire intensity calculations

The potential bushfire intensity of assessment reference points was determined using the Queensland Public Safety Business Agency *Potential Bushfire Intensity Calculator* (version November 2014) which is an Excel spreadsheet calculator that models the bushfire hazard assessment method in Bushfire resilient communities.

Bushfire resilient communities define bushfire hazard classes as follows:

- very high – potential bushfire intensity > 40,000 kW/m;
- high – potential bushfire intensity 20,000-40,000 kW/m;
- medium – potential bushfire intensity 4,000-20,000 kW/m; and
- non-bushfire hazard – potential bushfire intensity < 4,000 kW/m.

Results of the potential bushfire intensity calculations which determine the bushfire hazard class of assessment reference points shown in Figure 2.1 are presented in Table 3.2.

Table 3.2 Potential bushfire intensity

Assessment reference point	VHC	Potential fuel load (tonnes/ha)[1]	Slope (°)	Potential bushfire intensity (kW/m)	Bushfire hazard class
A	VHC 38.4	3.8	1	566	Non-bushfire hazard class
B	VHC 38.4	3.8	1	566	Non-bushfire hazard class

Table 3.2 Potential bushfire intensity

Assessment reference point	VHC	Potential fuel load (tonnes/ha)[1]	Slope (°)	Potential bushfire intensity (kW/m)	Bushfire hazard class
C	VHC 9.2	17.2	1	11,595	Medium
D	VHC 38.4	3.8	1	566	Non-bushfire hazard class

Notes 1 Potential fuel load taken from Bushfire resilient communities.

3.5 Bushfire hazard areas

Results of the potential bushfire intensity calculations in Table 3.2 confirm the proposed laydown area is within a bushfire hazard area, ie medium potential bushfire intensity area. Therefore, compliance with the Bushfire overlay code is relevant to the proposed laydown area component of the MID being sought for the Bowen pipeline project.

4 Bushfire hazards associated with the site

This chapter identifies bushfire hazards associated with the site.

4.1 Fire danger season

The fire danger season at the site starts in August, peaks in September and will begin to fall when consistent summer rainfall occurs. Typically, the worst fire weather conditions will be experienced during the fire danger season when the wind direction is from the north or west.

An FFDI of 59 will be associated with hot, dry and windy conditions. If a bushfire starts and takes hold under these conditions, it will be difficult to control and fast moving in large areas of bushland vegetation.

4.2 Fire history

As discussed in Section 3.2, fire history data indicates numerous fires have occurred within 1 km of the site during the past 20 years. On this basis, it is considered possible the proposed laydown area could be exposed to bushfire attack in the future.

4.3 Potential directions of bushfire attack

The proposed Laydown area could be exposed to bushfire attack from assessment reference point C, shown in Figure 2.1, where hazardous vegetation occurs.

Although assessment reference points A, B and D are identified as a non-bushfire hazard class in Section 3.4, VHC 38.4 which occurs in these areas is identified in Bushfire resilient communities as having continuous fuel and being grassfire prone. Therefore, it is considered relevant that this BMP considers grassfire attack from these areas.

Bushfire and grassfire attack scenarios on the proposed laydown area are further analysed in Section 5.3.

4.4 Potential bushfire hazards from adjacent land use

The fire history data indicates the adjacent land use, ie cropping, is a potential bushfire hazard to the proposed laydown area. This land use could involve hot works which has potential to cause an unplanned bushfire ignition.

4.5 Water and access for emergency services

The site is accessible via public roads which can accommodate emergency service vehicles. It does not have access to a reliable water supply for fire-fighting.

5 Bushfire hazards associated with the proposed laydown area

This chapter identifies potential bushfire hazards associated with the proposed laydown area.

5.1 Siting and design

The proposed laydown area will be designed and operated to mitigate the risk of bushfire hazards determined by the bushfire hazard assessment in this BMP:

- an asset protection zone (**APZ**) will be formalised around storage and activity areas within the site;
- an appropriately designed fire-fighter water supply outlet point will be provided; and
- access will be provided for emergency service vehicles.

5.2 Land uses

The proposed laydown area does not involve vulnerable uses or community infrastructure for essential services as defined in Table 7 of the SPP guidance material – bushfire.

The proposed laydown area may include the storage and handling of hazardous chemicals. However, it is unlikely to be in volumes which would be consistent with the storage or handling of hazardous materials in the context of bushfire hazard as defined in Table 7 of the SPP guidance material – bushfire.

Manufacturing activities may involve hot works which have potential to cause a bushfire ignition.

5.3 Radiant heat exposure

The Bushfire overlay code provides guidance about the acceptable level of radiant heat exposure for development within bushfire hazard areas. It requires development to be setback from hazardous vegetation by a distance which achieves a radiant heat flux level ≤ 29 kW/m^2 at the development footprint.

Given the proposed laydown area is temporary infrastructure, an alternative solution to the Bushfire overlay code is proposed in this BMP. The alternative solution involves establishing an APZ with a nominal cleared width of 8 m around the perimeter of the proposed laydown area.

The APZ will minimise the impact of bushfire attack on storage and activity areas within the site and provide a defendable space for fire-fighters to operate. It will also assist with preventing activities within the site from causing a bushfire ignition.

6 Bushfire mitigation plan

This chapter identifies mitigation measures that must be implemented as part of the proposed laydown area to comply with the Bushfire overlay code.

It is the total of the mitigation measures in this chapter that will reduce the risk of bushfire hazard to a tolerable level. Failure to implement all actions in their entirety could result in an increased level of exposure to bushfire hazards.

6.1 Asset protection zone

An APZ must be established and maintained around the perimeter of the proposed laydown area as shown in Figure 6.1.

For the duration of the proposed laydown area's use, the APZ must have a mineral earth surface and be maintained free or weeds, grass or woody regrowth.

Storage or parking must not occur within the APZ.

6.2 Fire-fighter water supply

A dedicated fire-fighter water supply tank must be provided within the proposed laydown area. It must have a minimum capacity of 10,000 litres.

We recommend contacting the local Rural Fire Brigade (**RFB**) to confirm the standard local RFB fittings which should be used at the fire-fighter water supply outlet point.

A hardstand area which is designed for a heavy rigid RFB vehicle to park must be provided within 4 m of the fire-fighter water supply outlet point.

The fire-fighter water supply tank must be kept full of water and must not be used for activities other than bushfire management.

The fire-fighter water supply outlet point must be identified by reflective wayfinding signage which is installed along the driveway.

6.3 Access and egress

Driveways must be designed and constructed to accommodate a heavy rigid RFB vehicle in accordance with the design guidelines in *Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots* (QFES 2019b) which defers to the *Road Planning and Design Manual – 2nd Edition* (DTMR 2013) for load bearing capacity, geometry and turning radii.

6.4 Administrative controls

Activities at the proposed laydown area must be in accordance with QFES advice and warnings which are accessible online at https://www.qfes.qld.gov.au/Current-Incidents, via QFES social media, ie QFES Facebook and QFES X, or the local radio station.

Hot works must be performed in accordance with a hot works permit system.

Storage or handling of hazardous chemicals must be in accordance with *Managing risks of hazardous chemicals in the workplace – Code of Practice* (SWA 2020), applicable safety data sheets, and otherwise in accordance with Queensland *Work Health and Safety Act 2011* and its regulations.



LEC
Land and environment consultants

Client:
Bowen Pipeline Company Pty Ltd

Bushfire management plan
Bowen pipeline project
Laydown area 3 - Balaam Road, Bowen

Design: Land and Environment Consultants Date: 23.04.2024
Drawn: LW
Scale: 1:1,000
File: J23116_Balaam_Rd_Figure_6-1_23Apr24.pdf

Title:
Bushfire mitigation plan

Figure
6.1

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7 Conclusion

This BMP was prepared by a suitably qualified person and is in general accordance with the SPP guidance material – bushfire and Bushfire resilient communities.

A bushfire hazard assessment determined the site is affected by bushfire hazard and the proposed laydown area component of the MID being sought for the Bowen pipeline project is subject to compliance with the Bushfire overlay code.

Mitigation measures that must be implemented as part of the proposed laydown area are specified in Chapter 6. With the implementation of these mitigation measures the proposed laydown area is considered compliant with the Bushfire overlay code as demonstrated in Appendix 2.

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Queensland Department of Resources (DR) 2024, *Queensland Globe*, accessed online at https://qldglobe.information.qld.gov.au/, February 2024

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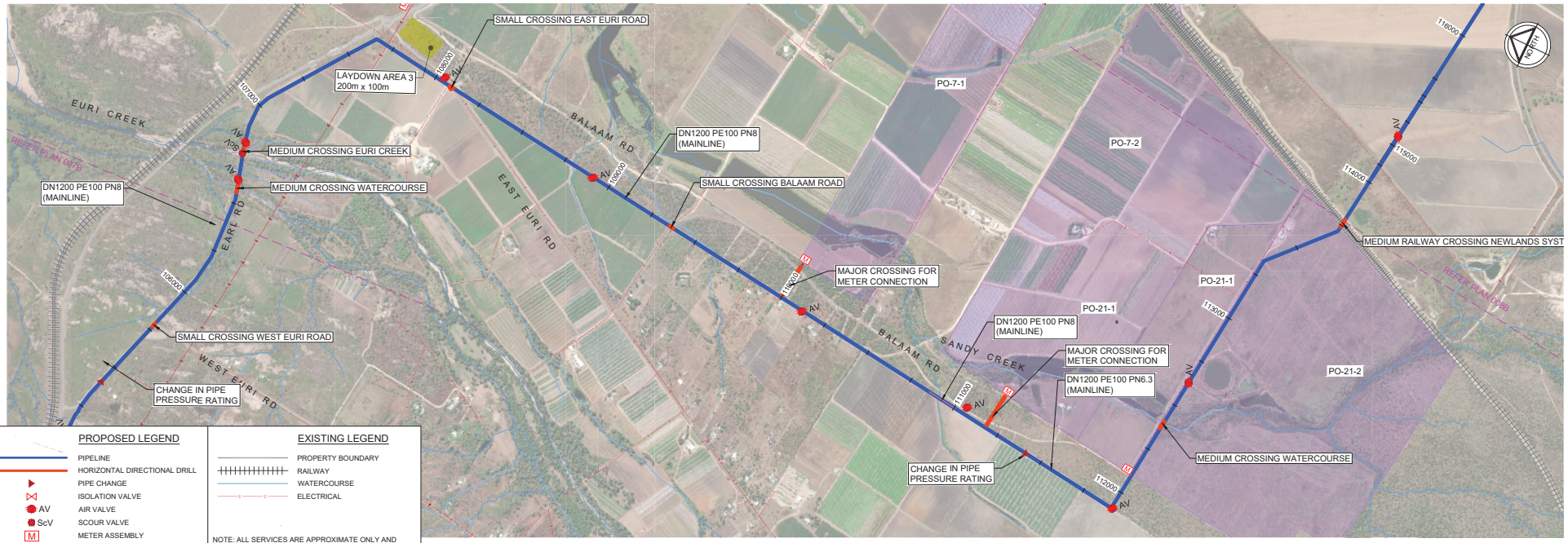
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Appendix 1 Site plan



PROPOSED LEGEND

- PIPELINE
- HORIZONTAL DIRECTIONAL DRILL
- PIPE CHANGE
- ISOLATION VALVE
- AV AIR VALVE
- ScV SCOUR VALVE
- M METER ASSEMBLY
- PO-#-# ROUND 2 EOI PROPERTY & PROPERTY OUTLET NUMBER

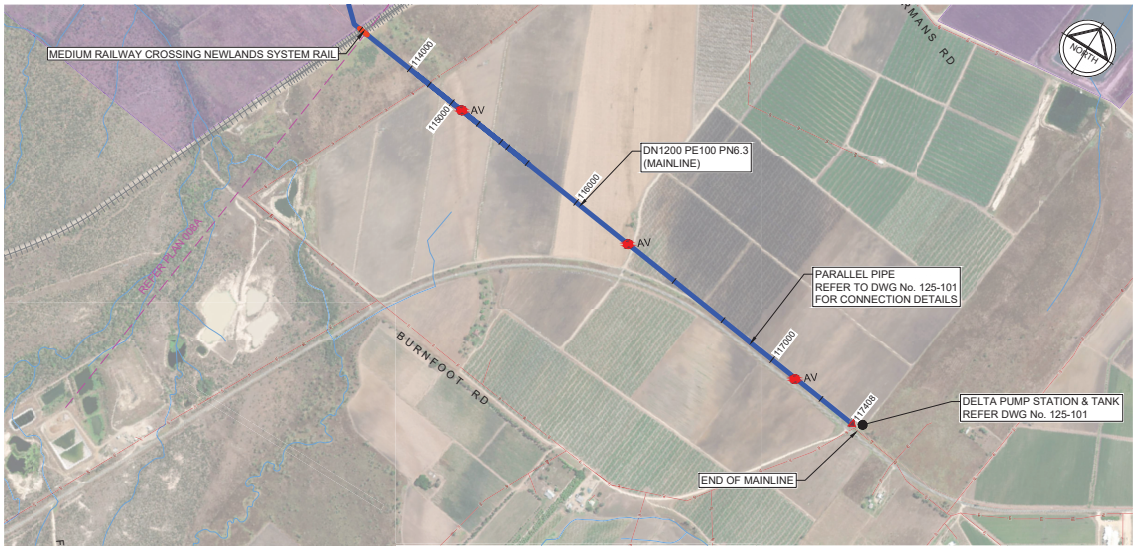
EXISTING LEGEND

- PROPERTY BOUNDARY
- RAILWAY
- WATERCOURSE
- ELECTRICAL

NOTE: ALL SERVICES ARE APPROXIMATE ONLY AND SHOULD BE LOCATED ON SITE PRIOR TO CONSTRUCTION
CAUTION: PRIVATE SERVICES PRESENT AROUND ALL PADDOCK BOUNDARIES

PLAN 008A

SCALE 1:10000 @ A1



PLAN 008B

SCALE 1:10000 @ A1

PRELIMINARY
NOT FOR CONSTRUCTION

-100 0 100 200 300 400 500 1000m

SCALE 1: 10000 ORIGINAL SIZE A1
SCALE 1: 20000 SIZE A3

REV	ISSUED	D.DWN	APRVD	REVISION DESCRIPTION
03	28/02/2024	JT	BL	CLIENT AMENDMENTS FOR SUBMISSION
02	15/02/2024	JT	BL	FINAL ISSUE
01	18/12/2023	JT	BL	PRELIMINARY DRAFT ISSUE

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Bowen Pipeline Company

KBR

SURVEY INFORMATION: MGA ZONE 55K
ALL LEVELS ARE TO AHD

REFERENCED PLANS:

DES./DRAWN: JT
CHECKED: BL
APPROVED: DM
DATE: 24/10/2023
PROJECT REF.: 27KBR0BOWENP2

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CLIENT: BOWEN PIPELINE COMPANY
DETAILED BUSINESS CASE

PROJECT: PIPELINE PLANS
MAINLINE

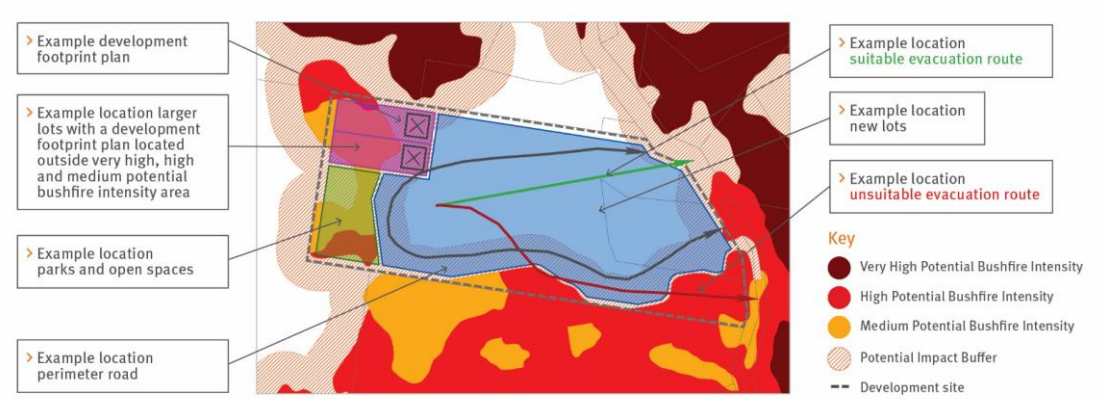
DRAWING No. 110-008
SHEET 8 OF 8
REVISION 03

Drawing File: 27KBR0BOWENP2-110[8]-(PIPELINES)-NO SCALE LOCKED ALIGNMENT.dwg, Saved at: 5/3/2024 12:19:16 PM, Plotted at 6/3/2024 10:19:11 AM, Original Size: ISO full bleed A1 (841.00 x 594.00 MM)

Appendix 2 Bushfire overlay code assessment

Performance outcomes	Acceptable outcomes	Compliance assessment
Section A **Reconfiguring a lot (RaL) – where creating lots of more than 2,000 square metres**		
PO1 The subdivision layout: (a) enables future buildings to be located away from slopes and land forms that expose people or property to an intolerable risk to life or property; and (b) facilitates emergency access and operational space for firefighters in a reduced fuel area between future buildings and structures and hazardous vegetation, that reduce risk to an acceptable or tolerable level. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	**AO1.1** A development footprint plan is identified for each lot that avoids ridgelines, saddles and crests where slopes exceed 15 per cent.	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.
	AO1.2 A development footprint plan is identified for each lot that is separated from the closest edge to the adjacent mapped medium, high or very high potential bushfire intensity area by: (a) a distance that is no closer than the distances specified in Table 5 at all development footprint plan boundaries; or (b) a distance that achieves a radiant heat flux level of 29 kW/m2 or less at all development footprint plan boundaries. Note – This separation area is often termed an asset protection zone. Note – The radiant heat flux levels can be established by undertaking a bushfire hazard assessment in accordance with the methodology in the QFES Bushfire resilient communities document.	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.
PO2 The subdivision layout enables: (a) future buildings to be located as close as possible to property entrances to facilitate safe evacuation during a bushfire event; and (b) future site access to be located and designed to allow safe evacuation of the site by occupants and maintain access by emergency services under critical event conditions.	**AO2** A development footprint plan is identified for each lot that: (a) is located within 60 metres of the street frontage; and (b) sited to enable a route between the development footprint plan and the street frontage with a gradient that does not exceed of 12.5 per cent.	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.
Section B		
Reconfiguring a lot (RaL) – where creating lots of 2,000 square metres or less		
PO3 The subdivision layout: (a) avoids creating lots on slopes and land forms that expose people or property	**AO3.1** The subdivision layout results in lots that are sited so that they are separated from the closest edge to the adjacent mapped medium,	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.

Performance outcomes	Acceptable outcomes	Compliance assessment
to an intolerable risk to life or property; and (b) facilitates emergency access and operational space for firefighters in a reduced fuel area between future buildings and structures and hazardous vegetation, that reduce risk to an acceptable or tolerable level. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient communities* document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	high or very high potential bushfire intensity area by: (a) a distance that is no closer than the distances specified in Table 5 at all lot boundaries; or : (b) a distance that achieves a radiant heat flux level of 29 kW/m^2 or less: (i) at the building envelope, if identified at RaL stage; or (ii) where a building envelope is not identified, at all lot boundaries. Note – This separation area is often termed an asset protection zone. Note – The radiant heat flux levels can be established by undertaking a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document. Note – For staged developments, temporary separation areas may be absorbed as part of subsequent stages. Note - Existing cleared areas external to the site may only be used in calculating necessary separation where tenure ensures that the land will remain cleared of hazardous vegetation (for example the land is a road, watercourse or highly managed park in public ownership).	
	AO3.2 The subdivision layout does not create lots that are within bushfire prone areas and on ridgelines, saddles and crests where slopes exceed 15 per cent (roads and parks may be located in these areas).	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.
Section C		
Reconfiguring a lot (RaL) – where creating more than 20 lots		
PO4 The subdivision layout is designed to minimise the length of the development perimeter and number of lots exposed to hazardous vegetation. Note – For example, avoid finger-like subdivision patterns or substantive vegetated corridors between lots.	**AO4** No acceptable outcome is prescribed	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.

Performance outcomes	Acceptable outcomes	Compliance assessment
PO5 The subdivision layout provides for adequate access and egress and safe evacuation routes, to achieve an acceptable or tolerable risk to people.	**AO5.1** The subdivision layout: (a) avoids the creation of bottle-neck points in the movement network within the development (for example, avoids hourglass patterns); and (b) ensures the road network has sufficient capacity for the evacuating population.	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.
	AO5.2 The subdivision layout ensures evacuation routes: (a) direct occupants away from rather than towards or through areas with a greater potential bushfire intensity; and (b) minimise the length of route through bushfire prone areas. Refer Figure 5.	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.
 *Figure 5 – Subdivision layout and evacuation routes*		
PO6 The subdivision layout provides adequate buffers between hazardous vegetation and development. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient*	**AO6.1** The subdivision layout results in an asset protection zone being located to create a separation area from adjacent mapped medium, high or very high potential bushfire intensity areas.	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.
	AO6.2 The asset protection zone is comprised of: (a) parks and open spaces; and/or (b) lots greater than 2000 square metres; and/or (c) public roads (termed perimeter roads). Note – Parks and open space may be	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.

Performance outcomes	Acceptable outcomes	Compliance assessment
communities document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	located within the mapped medium, high and very high potential bushfire intensity areas to create a separation between the development and the balance of the bushfire prone area. Note – Portions of lots greater than 2000 square metres may be located within the mapped medium, high and very high potential bushfire intensity areas. Refer Figure 5.	
	AO6.3 Where the asset protection zone includes lots greater than 2000 square metres a development footprint plan is identified for each lot that is located in accordance with AO1.2.	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.
PO7 Parks or open space provided as part of the asset protection zone do not create additional bushfire prone areas. Note –The undertaking of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	**AO7** Where the asset protection zone includes parks or open spaces, they: (a) comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, cultivated gardens and nature strips; or (b) are designed to ensure a potential available fuel load is maintained at less than eight tonnes/hectare in aggregate and with a fuel structure that remains discontinuous. Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-cropped grass to a nominal height of 10 centimetres.	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.
PO8 Perimeter roads are accessible for fire-fighting vehicles, to facilitate emergency access and operational space for fire- fighting, maintenance works and hazard reduction activities.	**AO8.1** Where the asset protection zone includes a perimeter road it: (a) has a two-lane sealed carriageway clear of hazardous vegetation; and (b) is connected to the wider public road network at both ends and at intervals of no more than 200 metres; and (c) does not include design elements that may impede access for fire-fighting and	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.

Performance outcomes	Acceptable outcomes	Compliance assessment
	maintenance for fire- fighting purposes (for example traffic calming involving chicanes).	
	AO8.2 Where the subdivision contains a reticulated water supply, the road network and fire hydrants are designed and installed in accordance with: (a) *Fire Hydrant and Vehicle Access Guidelines for residential, commercial and industrial lots*, Queensland Fire and Emergency Services, 2015, unless otherwise specified by the relevant water entity; and (b) the *Road Planning and Design Manual 2nd edition*, Department of Transport and Main Roads, 2013.	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.
Section D		
Reconfiguring a lot (RaL) – where creating additional lots for the purpose of residential development and a reticulated water supply is not provided.		
PO9 The subdivision layout provides for perimeter roads or fire trail and working areas that are accessible by the type of fire-fighting vehicles servicing the area, to facilitate emergency access and operational space for fire-fighting, maintenance works and hazard reduction activities.	**AO9.1** The subdivision layout includes: (a) a fire trail and working area designed and constructed in accordance with the design parameters in Table 6 that separates the residential lot or development footprint plan from adjacent mapped medium, high or very high potential bushfire intensity areas; or (b) a perimeter road designed and constructed in accordance with AO8.1. Refer Figure 6.	**Not applicable** The proposed laydown area does not involve the reconfiguring a lot.

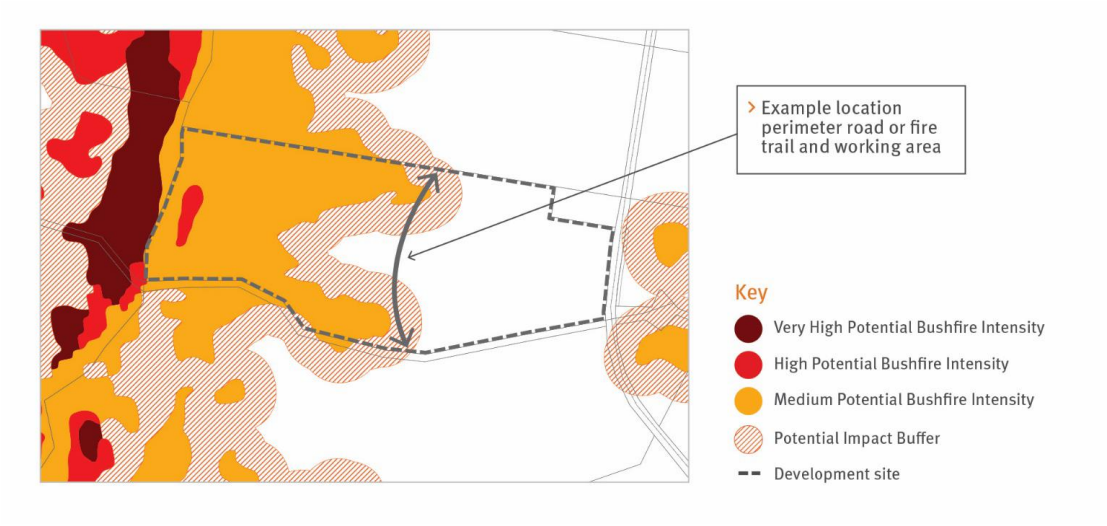
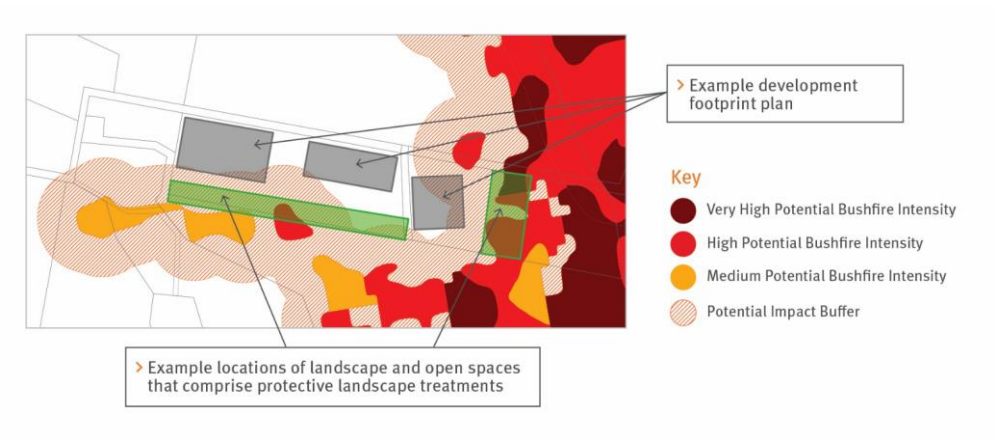
<table>
<tr><th>Performance outcomes</th><th>Acceptable outcomes</th><th>Compliance assessment</th></tr>
<tr><td colspan="3"> 

Figure 6 – Siting of fire trail and working area</td></tr>
<tr><td colspan="3">Section E</td></tr>
<tr><td colspan="3">Material change of use</td></tr>
<tr><td rowspan="2">PO10
Site layout achieve an acceptable or tolerable risk to people.
Landscape or open space provided as part of the development:
(a) acts as a buffer between hazardous vegetation and development; and
(b) does not create additional bushfire prone areas.
Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment in accordance with the methodology in the QFES Bushfire resilient communities document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.</td><td>AO10.1
Site layout places the landscape and open spaces within the site between premises and adjacent mapped medium, high or very high potential bushfire intensity areas.
Refer Figure 7.</td><td>Complies with PO10
Section 6.1 of the bushfire management plan (BMP) requires an asset protection zone (APZ) to be established around the proposed laydown area.
The APZ will provide a buffer between hazardous vegetation and activities within the proposed laydown area and will not create additional bushfire prone areas.</td></tr>
<tr><td>AO10.2
This landscaping and open space comprises protective landscape treatments that:
(a) comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses and cultivated gardens; or
(b) are designed to ensure a potential available fuel load is maintained at less than 8 tonnes/hectare in aggregate and that fuel structure remains discontinuous.
Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-</td><td>Complies with PO10
Refer to the above response.</td></tr>
</table>

Performance outcomes	Acceptable outcomes	Compliance assessment
	cropped grass to a nominal height of 10 centimetres.	
 *Figure 7 – Siting of protective landscape treatments*		
PO11 The development establishes evacuation areas, to achieve an acceptable or tolerable risk to people.	**AO11** If in an isolated location, development establishes direct access to a safe assembly/evacuation area. Note – Guidance on identifying safe evacuation areas is contained in the QFES *Bushfire resilient communities* document.	**Not applicable** The proposed laydown area will not be permanently occupied.
PO12 If on a lot of over 2,000 m^2, where involving a new premises or an existing premises with an increase in development footprint, development: (a) locates occupied areas as close as possible to property entrances to facilitate safe evacuation during a bushfire event; and (b) ensures vehicular access is located and designed to allow safe evacuation of the site by occupants and maintain access by emergency services under critical event conditions	**AO12** No acceptable outcome is prescribed.	**Complies with PO12** Section 6.3 of the BMP requires driveways to be designed and constructed to accommodate a heavy rigid Rural Fire Brigade (**RFB**) vehicle in accordance with *Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots 2019* which defers to the *Road Planning and Design Manual – 2nd Edition 2013* for load bearing capacity, geometry and turning radii.
PO13 Development is located within a reticulated water supply area or includes a dedicated static water supply that is available solely for fire-fighting purposes and can be accessed by fire-fighting vehicles. Note – Swimming pools, farm ponds and dams are not considered reliable sources of static water supply in Queensland due	**AO13** No acceptable outcome is prescribed	**Complies with PO13** The proposed laydown area will include a dedicated fire-fighter water supply that is accessible to the RFB personnel and vehicles. Design specifications for the fire-fighter water supply are provided in Section 6.2 of the BMP.

Performance outcomes	Acceptable outcomes	Compliance assessment
to regular drought events. Note for Local Government – Information on how to provide an appropriate static water supply, may form a condition of a development approval. For further information on preferred solutions refer to the QFES *Bushfire resilient communities* document.		
PO14 Vulnerable uses listed in Table 7 are not established or intensified within a bushfire prone area unless: (a) there is an overriding need in the public interest for the new or expanded service the development provides; and (b) there are no other suitable alternative locations within the required catchment; and (c) site planning can appropriately mitigate the risk (for example, siting ovals for an educational establishment between the hazardous vegetation and structures. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome	**AO14.1** No acceptable outcome is prescribed.	**Complies with PO14** The proposed laydown area does not involve a vulnerable use.
PO15 Community infrastructure providing essential services listed in Table 7 are not established within a bushfire prone area unless: (a) there is an overriding need in the public interest for the new or expanded service the development provides (for example, there are no other suitable alternative locations that can deliver the required level of service or meet emergency service response times during and immediately after a bushfire event); and (b) the infrastructure can function effectively during and immediately after a bushfire event. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in	**AO15** No acceptable outcome is prescribed.	**Complies with PO15** The proposed laydown area does not involve community infrastructure providing essential services.

Performance outcomes	Acceptable outcomes	Compliance assessment
demonstrating compliance with this performance outcome.		
PO16 Development avoids or mitigates the risks to public safety and the environment from the manufacture or storage of materials listed in Table 7 that are hazardous in the context of bushfire to an acceptable or tolerable level. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome. Editor's note – In addition to the requirements of this code the *Work Health and Safety Act 2011* and associated Regulation and Guidelines, the *Environmental Protection Act 1994* and the relevant building assessment provisions under the *Building Act 1975* contain requirements for the manufacture and storage of hazardous substances. Information is provided by Business Queensland on the requirements for storing and transporting hazardous chemicals, available at: www.business.qld.gov.au/running-business/protecting-business/risk-management/hazardous-chemicals/storing-transporting.	**AO16** No acceptable outcome is prescribed.	**Complies with PO16** The proposed laydown area does not involve the manufacture or storage of materials that are hazardous in the context of bushfire. However, hazardous chemicals could be stored and handled at the site. Section 6.4 of the BMP requires the storage or handling of hazardous chemicals to be in accordance with *Managing risks of hazardous chemicals in the workplace – Code of Practice 2020*, applicable safety data sheets, and otherwise in accordance with Queensland *Work Health and Safety Act 2011* and its regulations.
Section F		
Where involving an asset protection zone		
PO17 Asset protection zones are designed and managed to ensure they do not increase the potential for bushfire hazard. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	**AO17.1** Landscaping treatments within any asset protection zone comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks. Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-cropped grass to a nominal height of 10 centimetres. OR	**Complies with AO17.1** Specifications for the design and maintenance of APZ are provided in Section 6.1 of the BMP and will result in a low level of discontinuous bushfire and grass fire fuel.
	AO17.2 Landscaping management within any asset protection zone maintains a: (a) potential available fuel load	**Complies with AO17.2** Refer to response to AO17.1.

Performance outcomes	Acceptable outcomes	Compliance assessment
	which is less than eight tonnes/hectare in aggregate; and (b) fuel structure which is discontinuous. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome.	
Section G		
Where planning provisions or conditions of approval require revegetation or rehabilitation		
PO18 Revegetation or rehabilitation areas are designed and managed to ensure they do not result in an unacceptable level of risk or an increase in bushfire intensity level. Note – The undertaking of a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	**AO18.1** Required revegetation or rehabilitation: (a) is located outside of any asset protection zone; or (b) maintains a potential available fuel load which is less than eight tonnes/hectare in aggregate and fuel structure which is discontinuous. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with acceptable outcome (b).	**Not applicable** The proposed laydown area does not include revegetation or rehabilitation.
	AO18.2 Revegetation or rehabilitation of areas located within mapped medium, high or very high potential bushfire intensity areas, revegetate and rehabilitate in a manner that maintains or reduces the existing fuel load. OR Revegetation or rehabilitation of areas located within the mapped potential impact buffer area, revegetate and rehabilitate in a manner that maintains or reduces the existing fuel load. Note – The preparation of a vegetation management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome.	**Not applicable** The proposed laydown area does not include revegetation or rehabilitation.

Table 6 – Fire trail and working area design parameters

Parameter	Provisions
Width	Contains a width of at least 20 metres including: 1. A trafficable area (cleared and formed);

Parameter	Provisions
	a. with a minimum width of 4 metres than can accommodate a rural firefighting vehicle b. with no less than 4.8 metres vertical clearance from canopy vegetation c. with no adjacent inhibiting embankments or retaining walls 2. A working area each side of the trafficable area: a. with a minimum width of 3 metres each side b. cleared of all flammable vegetation greater than 10 centimetres in height 3. The balance (i.e. 10 metre width) managed vegetation area: a. sited to separate the trafficable area from adjacent mapped medium, high or very high potential bushfire intensity areas managed vegetation b. comprising managed vegetation clear of major surface hazards.
Access	Access is granted in favour of the local government and Queensland Fire and Emergency Services Note – this access is commonly granted in the form of a easement that is to be maintained by the grantor.
Egress	Contains trafficable vehicle routes in to low hazard areas, every 200 metres

Table 7 – Vulnerable uses, community infrastructure for essential services and materials that are hazardous in the context of bushfire hazard

Group	Uses
Vulnerable uses	*childcare centre, community care centre, detention facility, educational establishment, hospital, nature-based tourism, relocatable home park, rooming accommodation, residential care facility, resort complex, retirement facility, tourist park*
Community infrastructure for essential services	*educational establishment, emergency services, hospital*
Hazardous materials in the context of bushfire hazard	Hazardous chemicals that are present at the levels or in the quantities that would constitute the use being a hazardous chemical facility Hazardous materials that are present in the quantities in the Work Health and Safety Regulation, schedule 15

BOWEN PIPELINE PROJECT

BOWEN TO KIRKNIE
FLOOD STUDY & IMMUNITY ASSESSMENT



PLANS AND DOCUMENTS
referred to in the
SDA APPROVAL

Queensland Government

SDA approval: AP2025/009

CLIENT: BOWEN PIPELINE COMPANY

DOCUMENT NUMBER: R3280

VERSION: B

DATE: 15-03-2024

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1 INTRODUCTION

Topo were engaged by Bowen Pipeline Company to undertake a Flood Study and asses the flood immunity requirements for pump stations and infrastructure associated with the Bowen Pipeline Project. The Bowen Pipeline Project is a 116 km underground water pipeline commencing 16 km upstream from Home Hill (Burdekin River) moving south to Bowen.

1.1. GUIDELINES

This assessment has been prepared in accordance with:

- *Whitsunday Regional Council Planning Scheme* (2023),
- *The Queensland Urban Drainage Manual* (IPWEAQ, 2017), and
- *Australian Rainfall and Runoff* (Geoscience Australia, 2019).

1.1.1. FLOOD IMMUNITY REQUIREMENTS

Reference is made to the Whitsunday Regional Council Planning Scheme – Schedule 6 – October 2023 (V4.7) and the Whitsunday Regional Council Planning Scheme – Part 8 – October 2023 (V4.7). Based on Section SC6.5.4.2, the Defined Flood Event (DFE) is the year 2100 1 % AEP critical duration event. In addition, *Table 8.2.9.3.3 Flood immunity for community infrastructure and services* identifies the 1 % AEP flood event is assumed to be the required level of immunity for this type of infrastructure.

SC6.5.4.2 Preparing a Flood hazard assessment report

(1) The Flood hazard assessment report is to include the following key elements:

(a) assessment of the flood risk and implications up to and in excess of the defined flood event at the year 2100; the flood risk does not stop at the defined flood event so the suitability of a land use must consider the implications of larger floods, particularly in regard to the risk to people. The following should be identified:

(i) the potential impacts of flood hazard on the development;
(ii) the potential impacts of the development on flood hazard;
(iii) the location and height of buildings, particularly habitable floor areas;
(iv) the location and design of plant and equipment, including electrical fittings; and
(v) impact of increases in rainfall intensity at 2100 in regard to safety and property damage;
(vi) in the case of overland flow flooding a severe storm impact assessment being provided in accordance with Queensland Urban Drainage Manual;
(vii) as relevant, include accurate hydrological and hydraulic modelling for the waterway network and assessment of existing flooding and flood levels of major water systems, including modelling of the 50%, 10%, 1%, 0.5% and 0.2% AEP flood events and the Probable Maximum Flood (PMF);
(viii) address the potential impacts of climate change, including the projected sea level rise of 0.8m; and
(ix) the 1% AEP flood event at the year 2100 to inform the DFE;

Development	Level of immunity Annual exceedance probability (AEP)
Development involving: (a) emergency/evacuation shelters; (b) the storage of valuable records or items of historic/cultural significance (e.g. libraries, galleries); (c) telecommunication facilities; (d) substations; (e) water treatment plants; (f) regional fuel storage; and (g) food storage warehouses.	0.5% AEP flood event
Development involving: (a) Sewerage treatment plants (requiring licensing as an environmentally relevant activity). (b) cemetery and crematorium (c) waste management facilities (d) sporting facility, community centre, meeting hall (where not used as an evacuation or recovery facility) (e) storage and works depots and similar facilities, including administrative facilities associated with the provision or maintenance of the community infrastructure mentioned in this part	1% AEP flood event

1.2. REVISION

VERSION	DATE	AUTHOR	REVIEWED	APPROVED
A	12/03/2024	BS	SC	SC
B	13/03/2024	BS	SC	SC

2 PROJECT OVERVIEW

The pipeline will generally run adjacent to the Bruce Highway, mainly on private land and unformed road reserves. The Project will utilise world class Australian technology for the onsite extrusion of the High-Density Polyethylene (HDPE) pipe in 100+ metre lengths. The project will allow the creation of a reliable, secure water supply to an area that produces one-fifth of Australia's vegetables and is Australia's largest winter vegetable growing area.

Figure 1 presents the project alignment and location of key infrastructure.



Figure 1 – Concept Alignment Layout Plan (Extract from Drawing No. 8704 E BP001 Sheet 00 Rev I))

2.1. KEY INFRASTRUCTURE LOCATIONS

This flood assessment is focussed on five (5) key infrastructure areas, these being:

1. Kirknie Intake,
2. Inkerman Pump Station,
3. Guthalungra Pump Station & Tank,
4. Salisbury Plains Pump Station & Tank, and
5. Delta Pump Station & Tank.

2.2. CLIMATE DATA

The Bowen Airport gauging station (Station 033257) provides 27 years of climate data, reporting an annual average rainfall depth of 895 mm (for years between 1987 and 2015). Based on the historic climate data, the region is subject to a distinct wet season between January and February, with 60 % of annual rainfall typically occurring in this 3 month period. Rainfall is reduced through the remainder of the year, with significantly lower monthly averages observed from June to October. The maximum Mean Monthly Rainfall was 221 mm in February, while the lowest Mean Monthly Rainfall is typically observed in September, with only 1.2 % of the annual average rainfall occurring.

The maximum Mean Maximum Temperature is 31.5 °C historically occurs in January while the lowest Mean Minimum Temperature is 13.4 °C, historically occurring in July. Further details are provided in Table 1 and plotted as Figure 2 and Figure 3.

Table 1 – Historical Climate Statistics

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Mean rainfall (mm)	179	221.1	118.5	62.2	41.1	23.3	19.6	23	10.6	12.1	52	141.4
Median rainfall (mm)	127.1	159.8	60.4	19.8	18.7	14.6	3.7	4.4	2.3	3.9	22	89.2
Mean maximum temperature (°C)	31.5	31.3	30.8	29.3	27.1	24.9	24.5	25.4	27.4	29.2	30.4	31.3
Mean minimum temperature (°C)	23.8	23.8	22.8	20.8	17.8	15	13.4	14.2	16.5	19.8	22.2	23.4

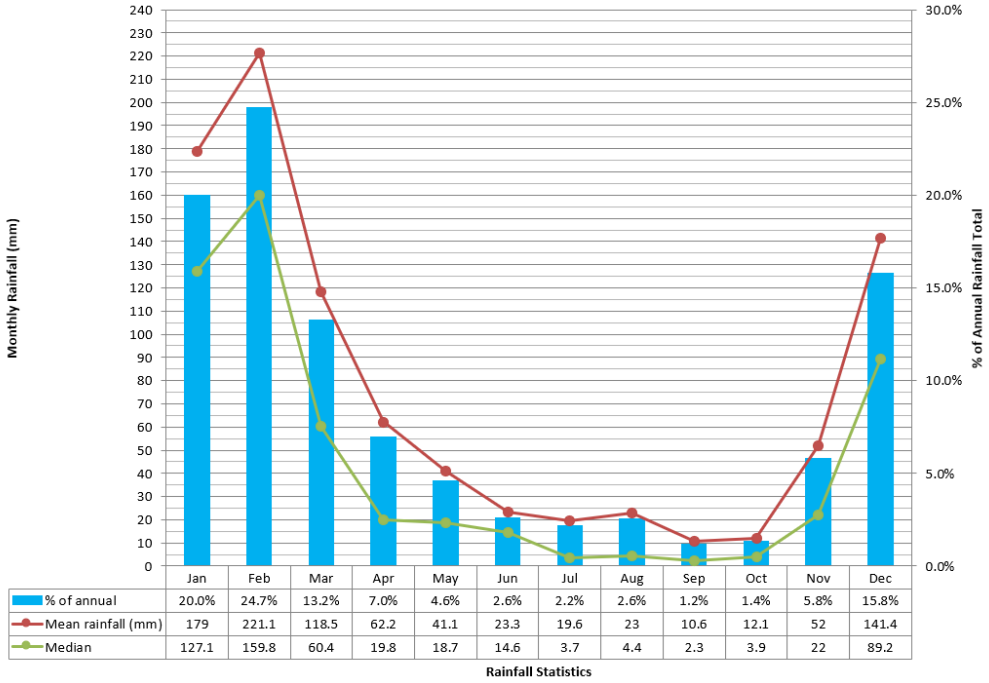


Figure 2 – Historic rainfall data for Bowen Airport – Station 033257 (Source: BoM)

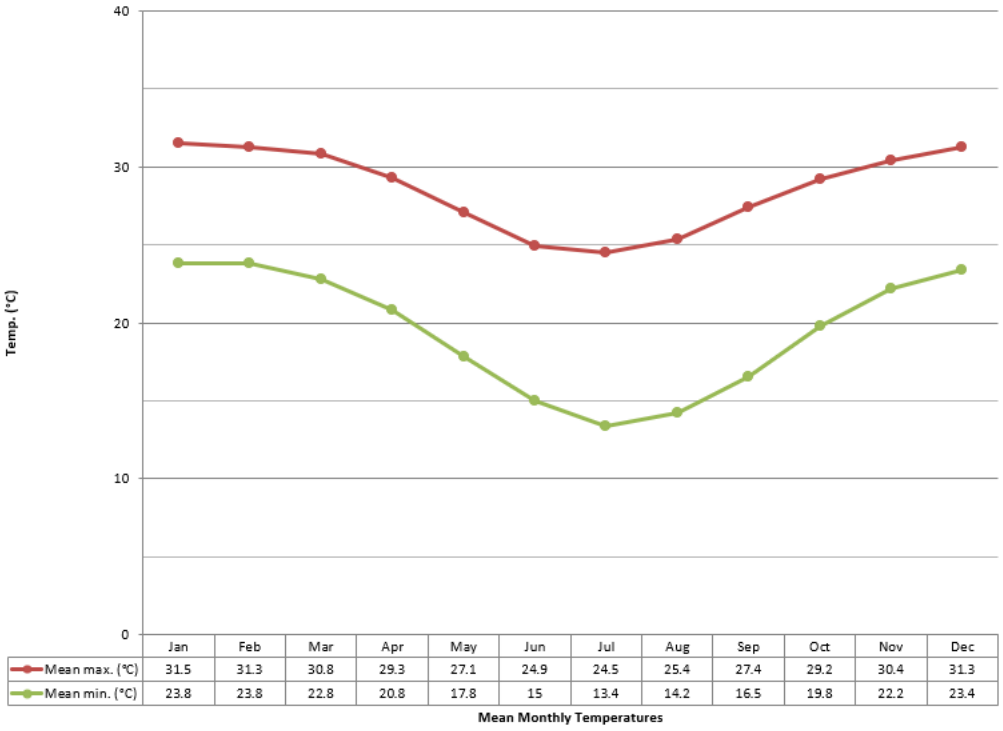


Figure 3 – Historic temperature data for Bowen Airport – Station 033257 (Source: BoM)

3 DEFINED FLOOD LEVELS

The peak water level associated with the 1 % Annual Exceedance Probability (AEP) event is classified as the Defined Flood Level (DFL). Flood searches were undertaken for the key infrastructure locations, with the DFL found to be available from both Whitsunday Regional Council (WRC) and the Burdekin Shire Council (BSC) Interactive mapping/Flood Mapping websites and purchased flood searches. The DFL was freely available from WRC for the Delta and the Guthalungra Pump Station & Tank. An additional a flood search was purchased from BSC for the Kirknie Intake. Details of the flood searches and assumptions made in relation to determining the DFL for each location are presented in Section 3.1 to 3.3.

For the remaining infrastructure locations (i.e. the Inkerman Pump Station and Salisbury Plains Pump Station & Tank) flood search data was not available and flood modelling was undertaken to assess the DFL for these locations. Refer to Section 4 for details in relation to the hydrologic and hydraulic modelling undertaken at each of these locations.

3.1. DELTA PUMP STATION & TANK

The Delta pump station and tank is to be constructed at 700 Bowen Developmental Road (Lot 94 on HR1038). Flood mapping for this property, reproduced as Figure 4, indicates the full site is subject to inundation during the 1 % AEP event. The flood search from the WRC mapping service identifies the DFL, or 1 % AEP peak water level 25.0 m AHD. This presents the maximum flood level on the site.

Review of the property extents and topography reveals the maximum elevation of Lot 94 is located on the southern boundary near the minor watercourse, with the remainder of the lot falling in a north-north-westerly direction. Figure 5 illustrates the location of the maximum elevation of 24.91 m AHD, along with 0.25 m contours generated from LIDAR data across the site. At the location of the proposed Delta Pump Station and Tank, the ground level is approximately 20.7 m AHD.

However, given the DFL of 25.0 m AHD for the lot is provided as the maximum water level, it is concluded this occurs at the point of maximum elevation, in this case representing a flood depth of approximately 0.1 m. The flooding is assumed to be associated with overtopping of the banks of the minor waterway south of the site. To gain a greater understanding of the flow regime, flood searches were undertaken for the adjacent properties. The details of these flood searches are provided in Appendix A, as well as being summarised in below:

- Lot 2 on RP714956 26.50 m AHD
- Lot 1 on RP714956 25.75 m AHD
- Lot 24 on K12437 25.50 m AHD
- Lot 94 on HR1038 25.00 m AHD
- Lot 159 on HR1290 22.50 m AHD
- Lot 150 on HR1222 21.25 m AHD
- Lot 31 on SP22001 19.25 m AHD
- Lot 2 on RR739183 17.25 m AHD
- Lot 3 on RR742540 17.75 m AHD

Using GIS, these DFLs were mapped to create the water surface profile across the site and adjacent properties. The results of this mapping are presented as Figure 6, along with the longitudinal profile of the site and the re-created water surface. Based on this assessment, the DFL at the location of the proposed Delta Pump Station and Tank is 21.9 m AHD.

The ground level at this location is approximately 20.7 m AHD. Therefore, for the 1 % AEP event, flood depths of approximately 1.2 m could be expected through the site of the proposed infrastructure and will need to be factored into the design and floor levels for control rooms etc.

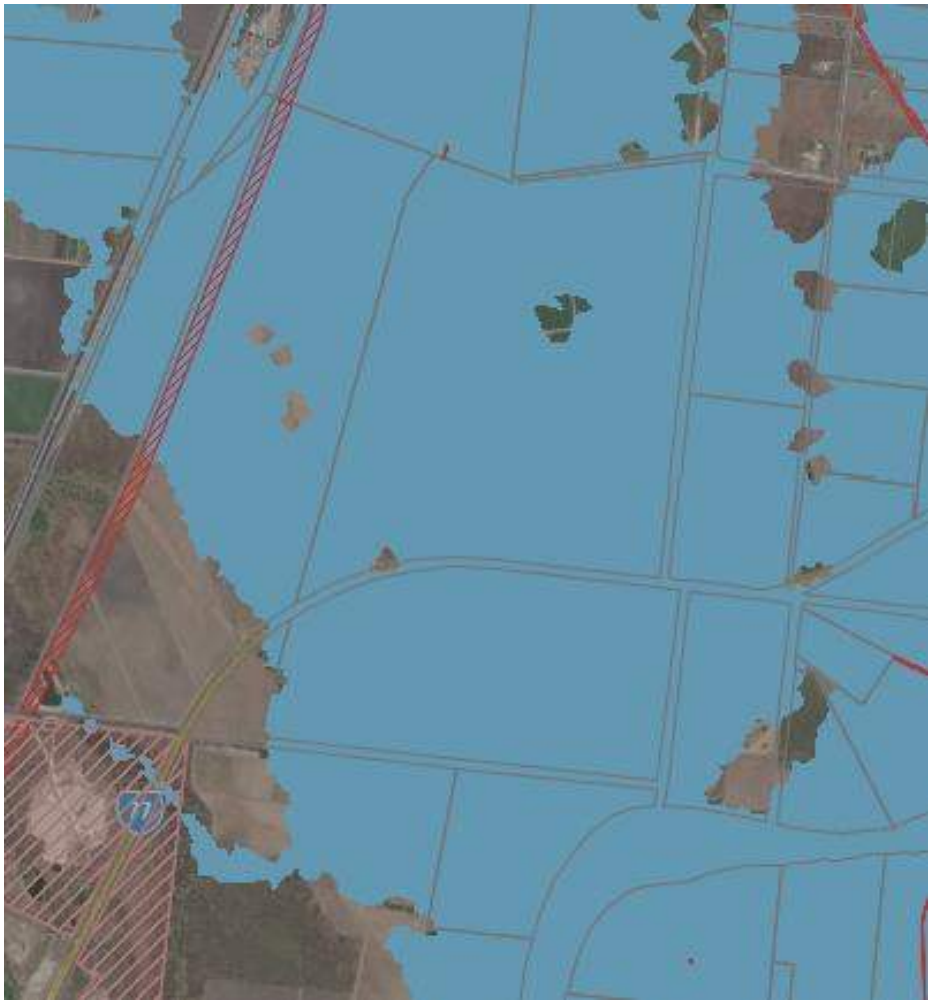


Figure 4 – WRC Flood Mapping Extract



Figure 5 – Lot 94 HR1038 Maximum Elevation

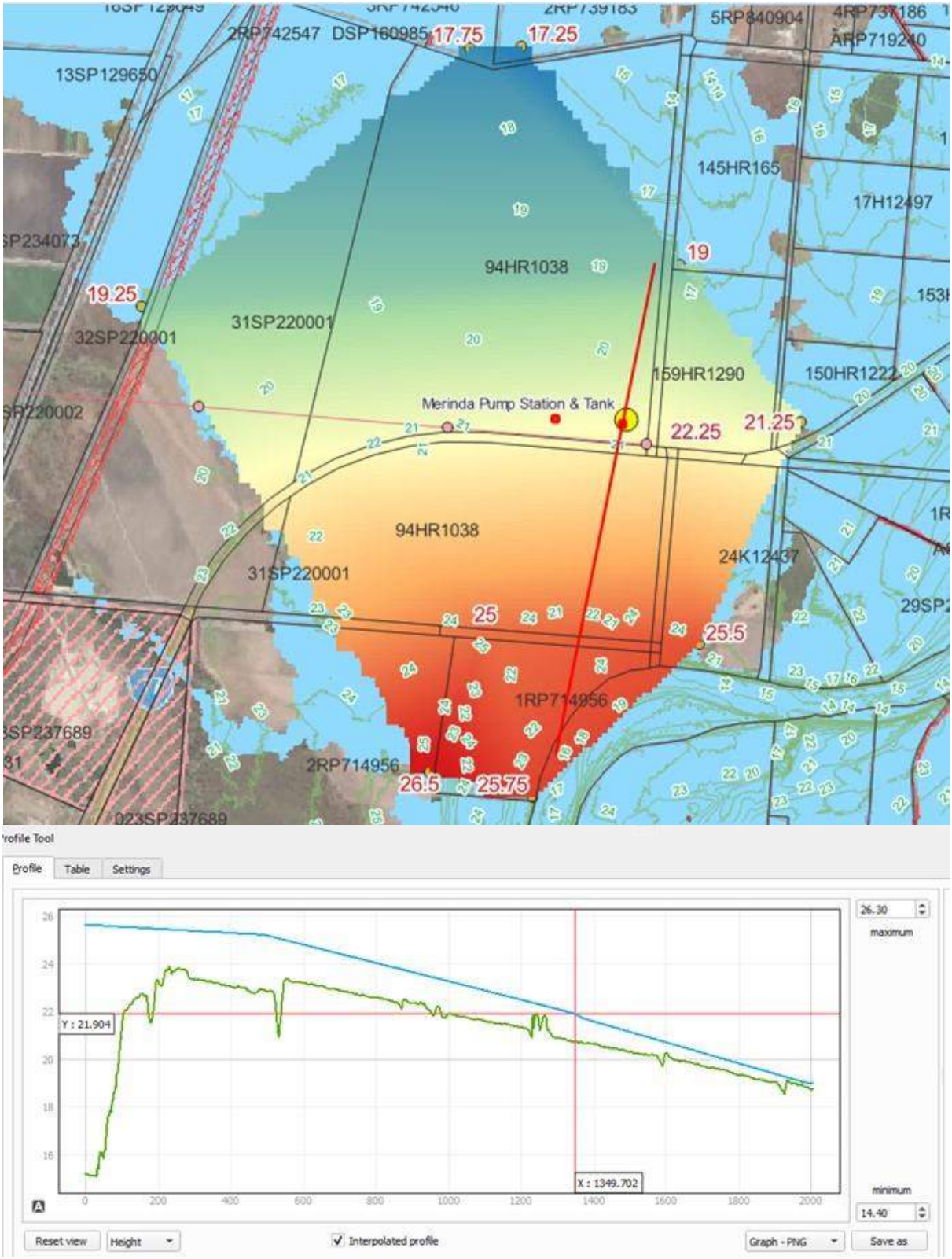


Figure 6 – Lot 94 Inundation Mapping & Longitudinal Profile

3.2. GUTHALUNGRA PUMP STATION & TANK

The flood search from WRC mapping service identifies the DFL, or 1 % AEP peak water level for Lot 38 on SB445 (the closest flood affected property) as being 14.25 m AHD. Figure 7 presents an extract of the flood search.

Review of topographic data along the eastern boundary of Lot 38 indicates levels range from approximately 15 m AHD in the south to approximately 8.5 m AHD in the north. The pump station and associated infrastructure at Guthalungra are proposed at elevation of approximately 13.1 m AHD on Lot 28 SB505, west of Nevada Road. While this is lower than the reported DFL for Lot 38, review of LIDAR data reveals a gully between Nevada Road and the Elliot River. In the event of flooding associated with storms greater than the 1 % AEP event that overtop the banks of the Elliot River, this gully will convey these over-bank flows in a northerly direction towards the Nevada Road/Bruce Highway intersection and Bruce Highway culvert crossing. It is therefore concluded there is no risk for the proposed Guthalungra infrastructure from flood waters associated with the Elliot River, up to the Defined Flood Event.

An extract from the WRC flood mapping (Planning Scheme Interactive Mapping) has been provided as Figure 8 to illustrate the separation of the Elliot River flood waters and the proposed infrastructure at Guthalungra (Lot 28 SB505).

Review of LIDAR data for Lot 28 in the vicinity of the proposed pump station indicates it is in a catchment of approximately 170 ha that directs runoff to culverts under the railway line and Bruce Highway. The invert level of the railway line culvert is approximately 10.9 m AHD, and the ground level of the western boundary of the existing residential lots is approximately 13.1 to 13.4 m AHD. Figure 9 provides further details in relation to these levels and the catchment. Given the ground level of the proposed pump station (18.5 m AHD) provides approximately 5 m freeboard to the residential lots, it is concluded the works provide at least 5 m freeboard to the 1 % AEP event and are therefore suitably located.

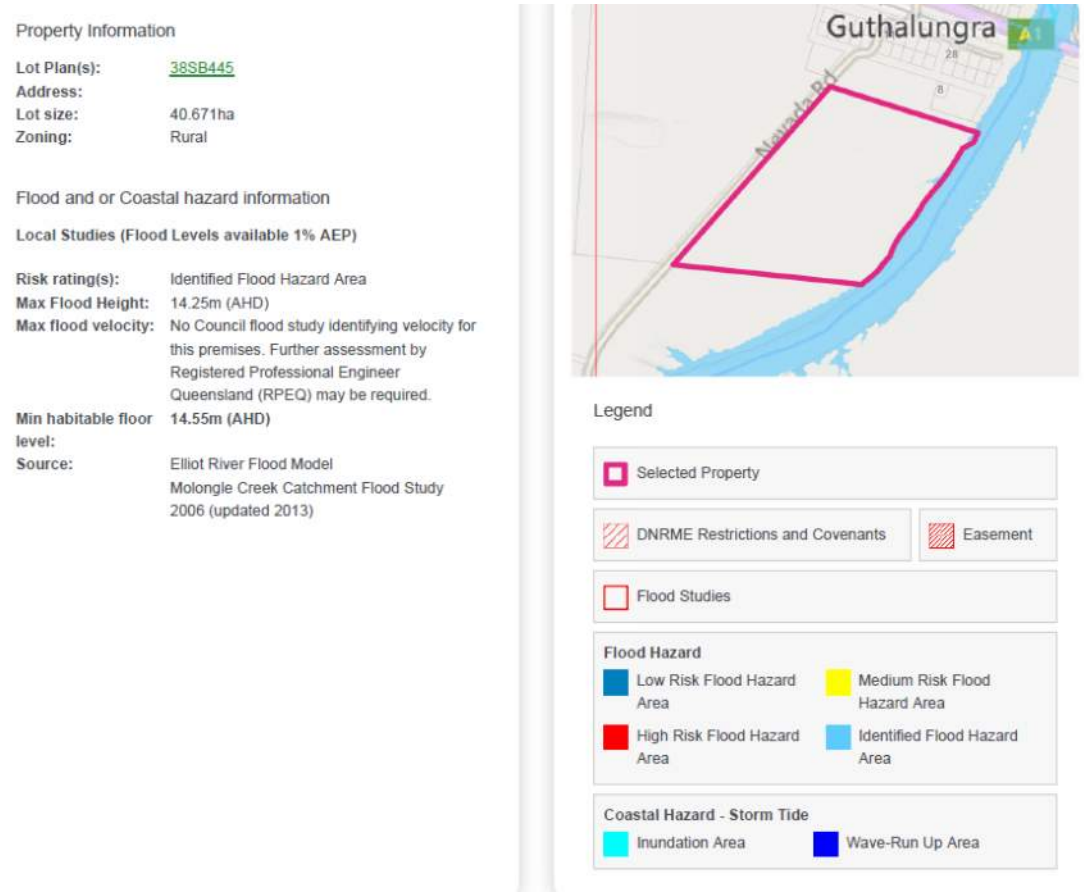


Figure 7 – Flood Search Extract for Guthalungra Pump Station & Tank

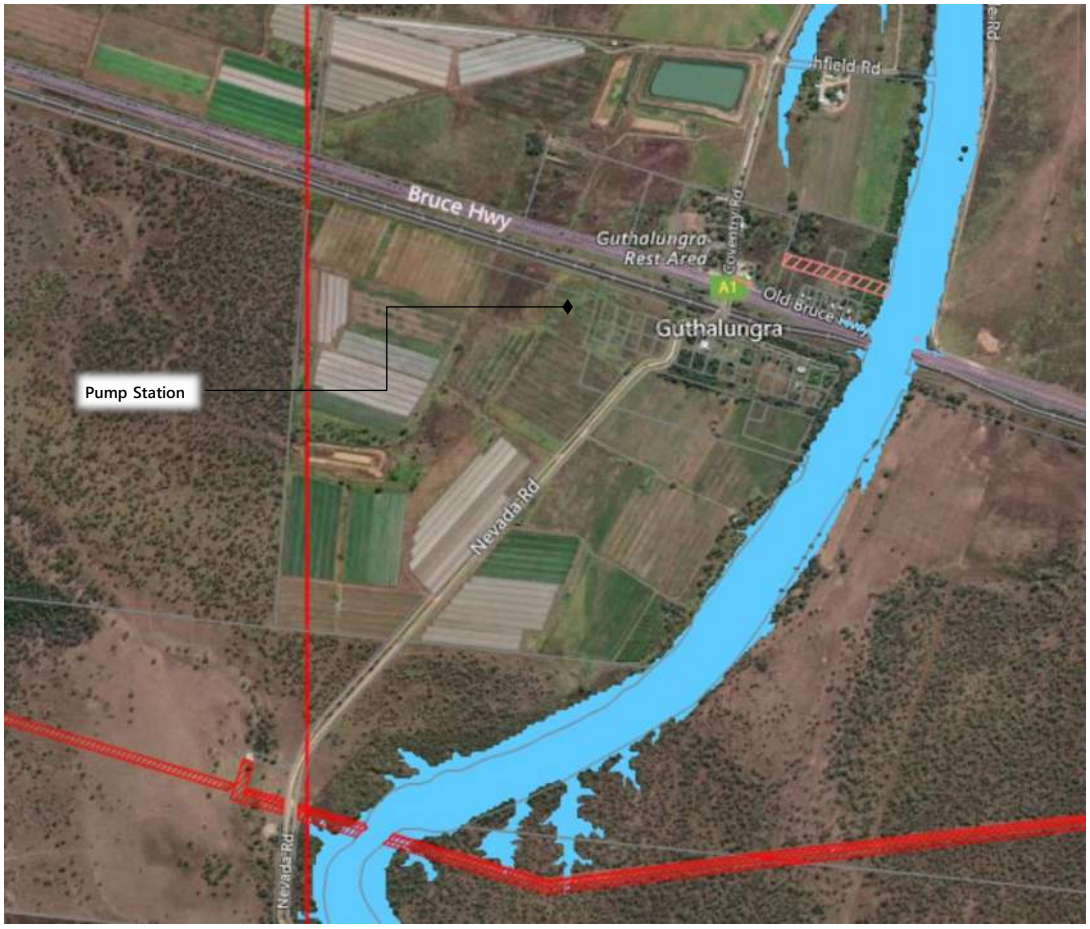


Figure 8 – Whitsunday Regional Council Interactive Mapping – Guthalungra

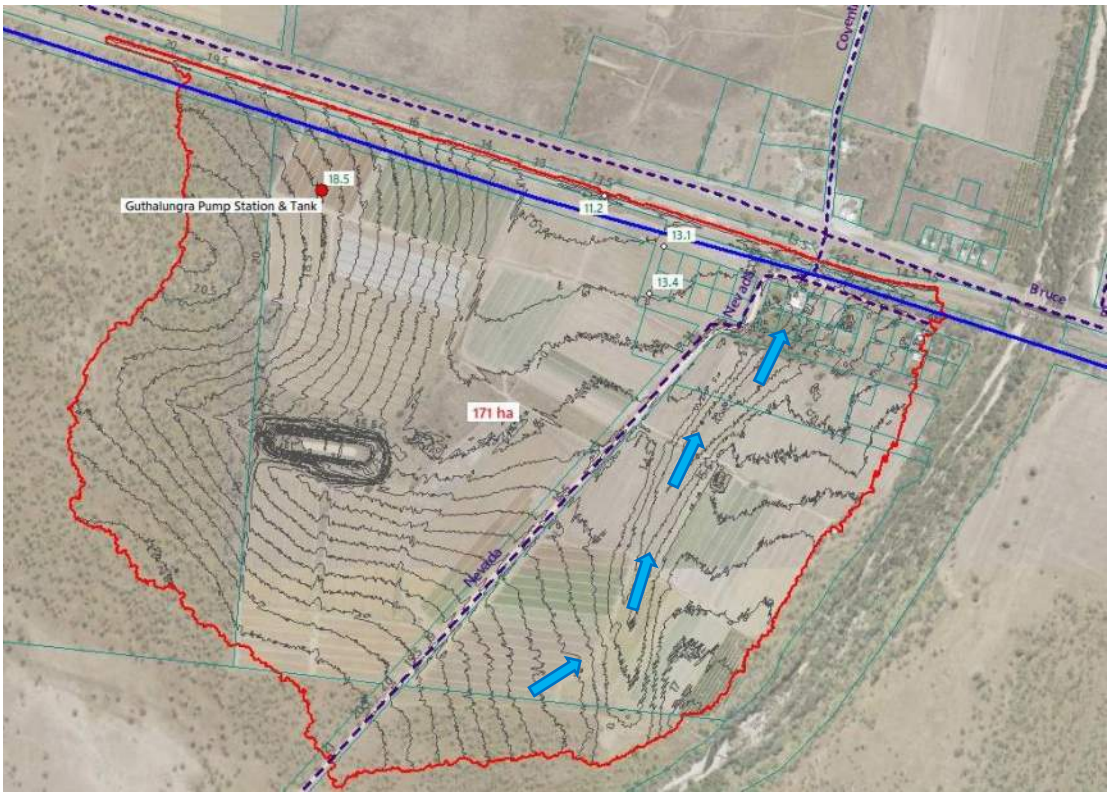


Figure 9 – Guthalungra Site Levels & Catchment Analysis -

3.3. KIRKNIE INTAKE LOCATION

A flood search for the Lot 7 SP250556 was purchased from the BSC to determine the DFL for the Kirknie Intake. The provided flood search was for Lot 8 on RP908773 to the north. The DFL for Lot 8 on RP908773 is reported to be 23.2 m AHD, and again this represents the maximum flood level on the site. A copy of the BSC Flood Certificate is included as Appendix B.

Further discussion with council officers and review of the Burdekin Shire Planning Scheme Flood Hazard Overlay Map (a) revealed the flood modelling for the Burdekin River from which the DFLs are extracted does not cover the site. Two separate models have been developed for the river, but neither cover the location of the proposed Kirknie Intake. The extents of the models and intake location are illustrated in Figure 10. It is therefore not possible to obtain the DFL for the proposed works from flood searches.

3.3.1. LIDAR ASSESSMENT

3.3.1.1. BURDEKIN 2009

The Burdekin 2 km LIDAR tiles (2009) were analysed to provide an indication of the Hydraulic Grade Line (HGL) along the river between the intake and the location of the flood search provided for Lot 8. The LIDAR data suggests a longitudinal grade (assumed to be consistent with the HGL under flood conditions) of 0.01 %.

3.3.1.2. BURDEKIN 2011

The Burdekin 1 km LIDAR tiles (2011), in conjunction with the Burdekin Shire Planning Scheme Flood Hazard Overlay Map (a) were analysed to estimate the peak water level at the extents of the modelling undertaken for the Burdekin River upstream of the intake. For the Extreme Flood Hazard, the estimated peak water level is 26.4 m AHD. This location is approximately 1,460 m upstream of the proposed intake location, so assuming the hydraulic grade line under flood conditions of 0.01 % (as per Section 3.2.1.1), the estimated flood level is 26.2 m AHD.

3.3.2. SUNWATER & LOWER BURDEKIN WATER INFRASTRUCURE

Further advice from BSC provided the following details:

> "*…the original Sunwater pump station site on Barry Road is 25.5m AHD*" (per email dated 12 December 2023).

It is understood works undertaken by Lower Burdekin Water in 2023 to upgrade the pump station involved raising the control room floor level to 26 m AHD. As part of the works proposed for the Kirknie Intake, the flood level is assumed to be 26.0 m AHD and the control room floor will provide freeboard to this. Refer to Figure 11 for further details.

This is considered appropriate to demonstrate an acceptable level of flood immunity for the proposed infrastructure, and further assessment of the flood regime will be undertaken (if required) during the detailed design phase of the project.

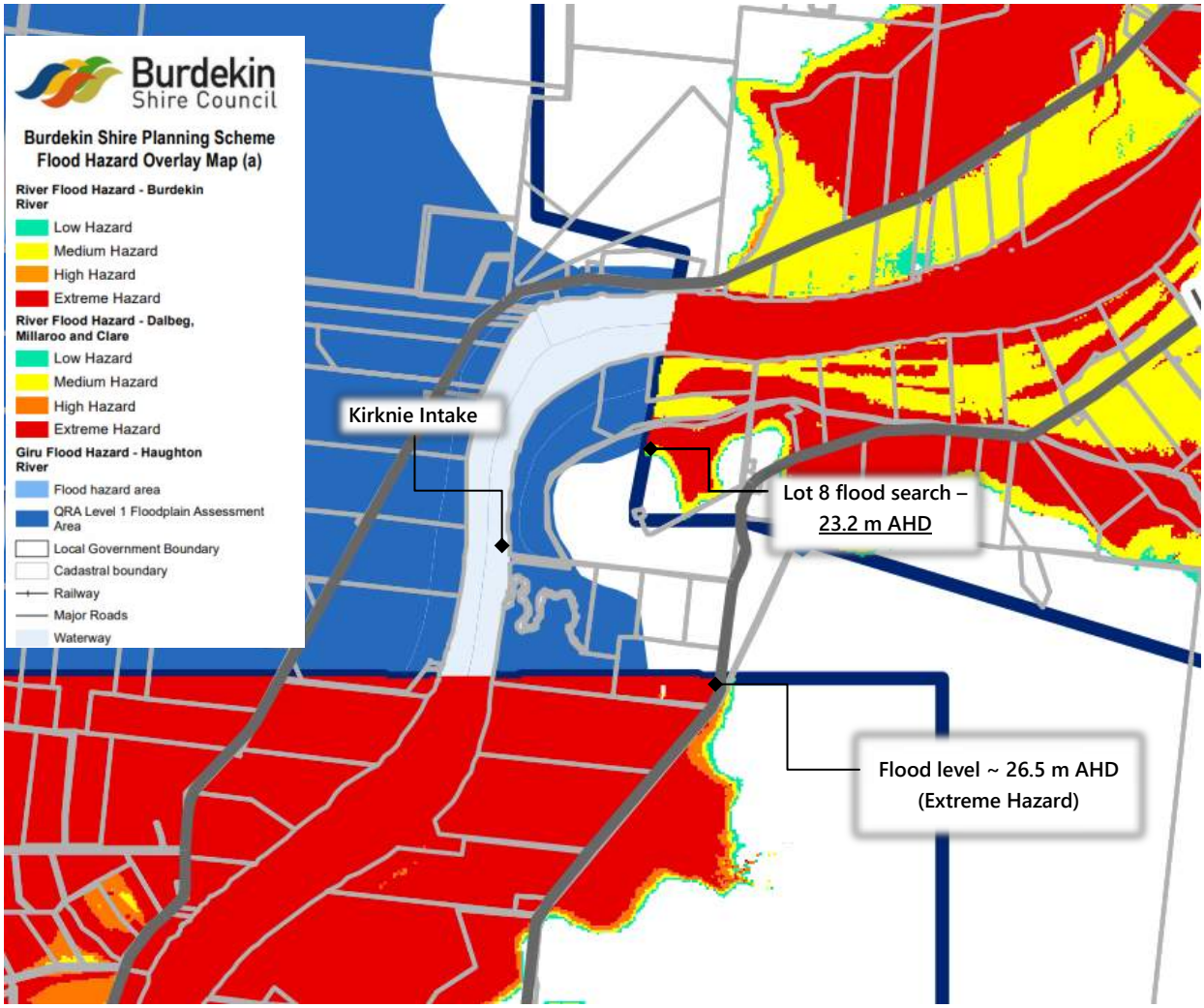


Figure 10 – BSC Flood Hazard Overlay – Data gap (Burdekin Shire Planning Scheme Flood Hazard Overlay Map (a))

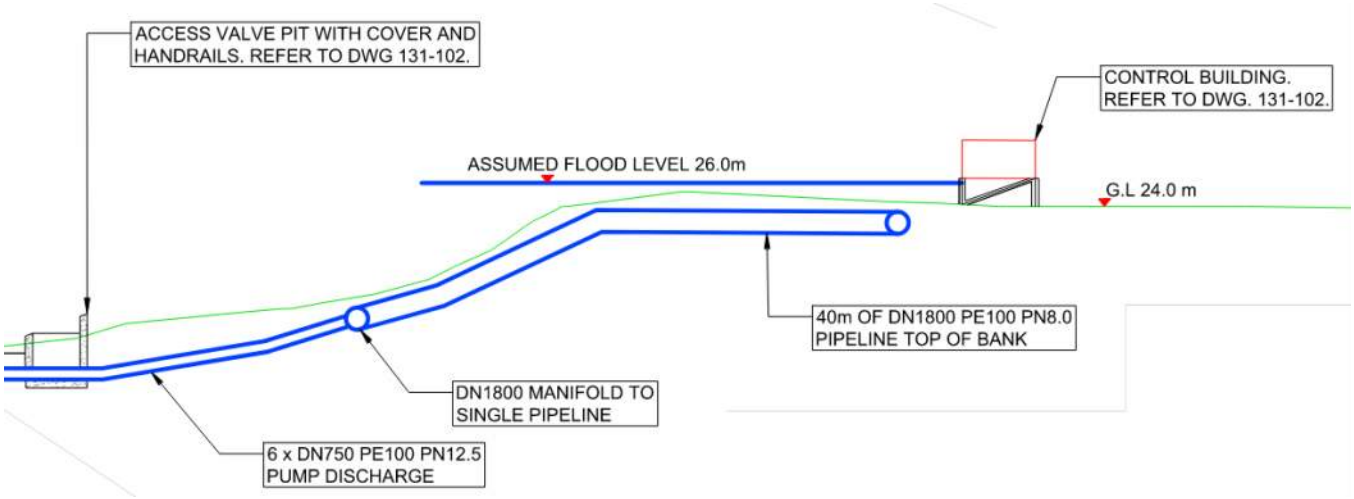


Figure 11 –Kirknie Intake Structure Arrangement (Extract Pinion Drawing No. 121-003 Sheet 3 of 3, Rev 03)

4 HYDROLOGIC & HYDRAULIC MODELLING

As previously noted, no flood search records are available for the sites at Inkerman and Salisbury Plains. For these locations, hydrologic and hydraulic modelling was undertaken to assess the flow regime and determine the DFL (i.e. the 1 % AEP peak water levels) in the vicinity of the proposed infrastructure.

Details of the modelling undertaken are provided as:

- Appendix C for Inkerman, and
- Appendix D for Salisbury Plains

4.1. INKERMAN DFL

Review of LIDAR data indicates the ground level of the proposed pump station is approximately 15.3 m AHD. This location is located approximately 200 m north-west of the nearest flood waters associated with the 1 % AEP event. An extract from the peak water level map for the site is provided as Figure 12. Based on the modelling undertaken, the 1 % AEP peak water level and therefore the DFL is nominated as 12.51 m AHD.

The pump station and control room provide approximately 2.8 m freeboard to the DFL.

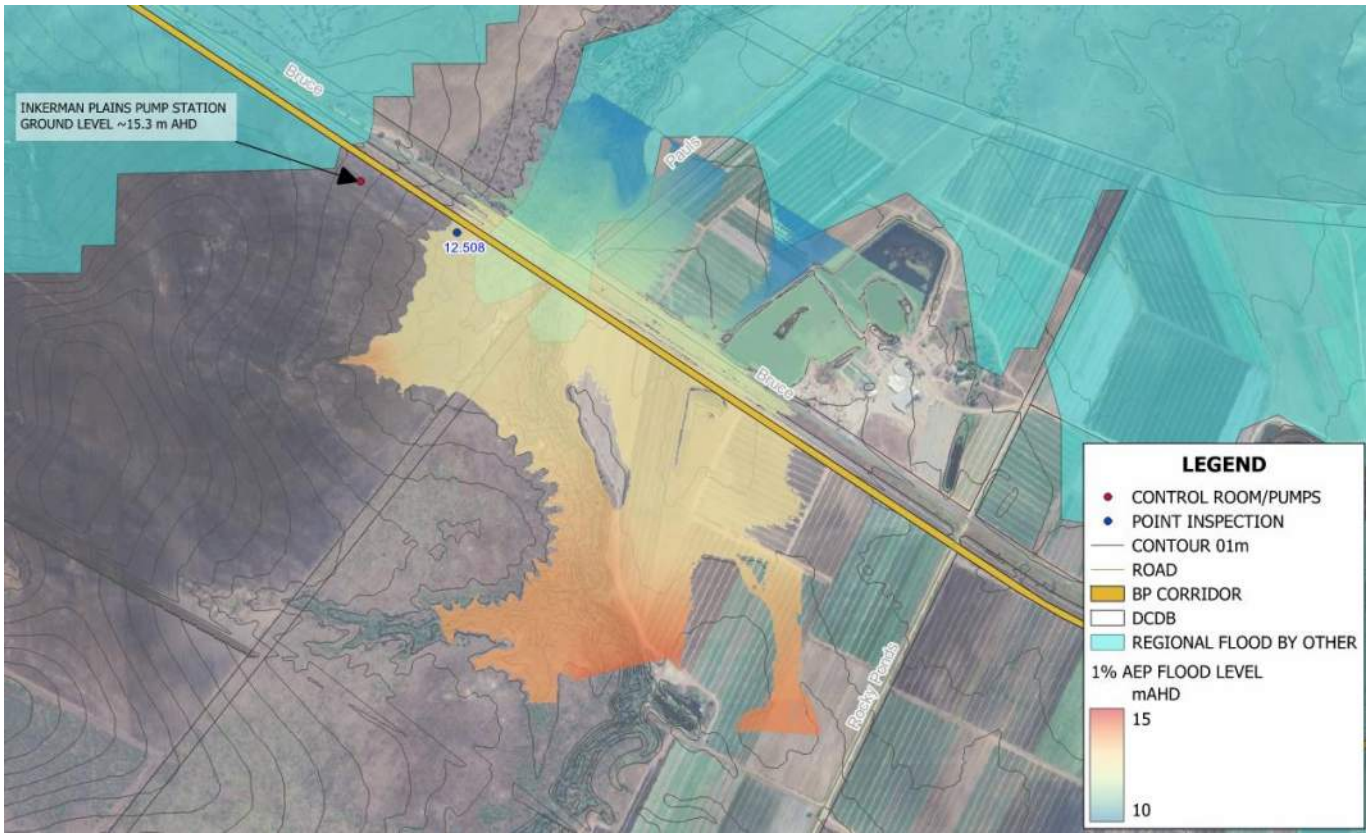


Figure 12 – Inkerman 1 % AEP Peak Water Level

4.2. SALISBURY PLAINS

Review of LIDAR data indicates the proposed pump station is proposed between two drainage lines at a ground level of approximately 27.1 m AHD. An extract from the peak water level map for the site is provided as Figure 12.

Based on the modelling undertaken, the 1 % AEP peak water level for the flowpath to the west is 26.91 m AHD, while for the flow path to the east the 1 % AEP peak water level is 26.86 m AHD. Therefore, the DFL is nominated as 26.91 m AHD.

At ground level, the pump station and control room provide approximately 0.2 m freeboard to the DFL.

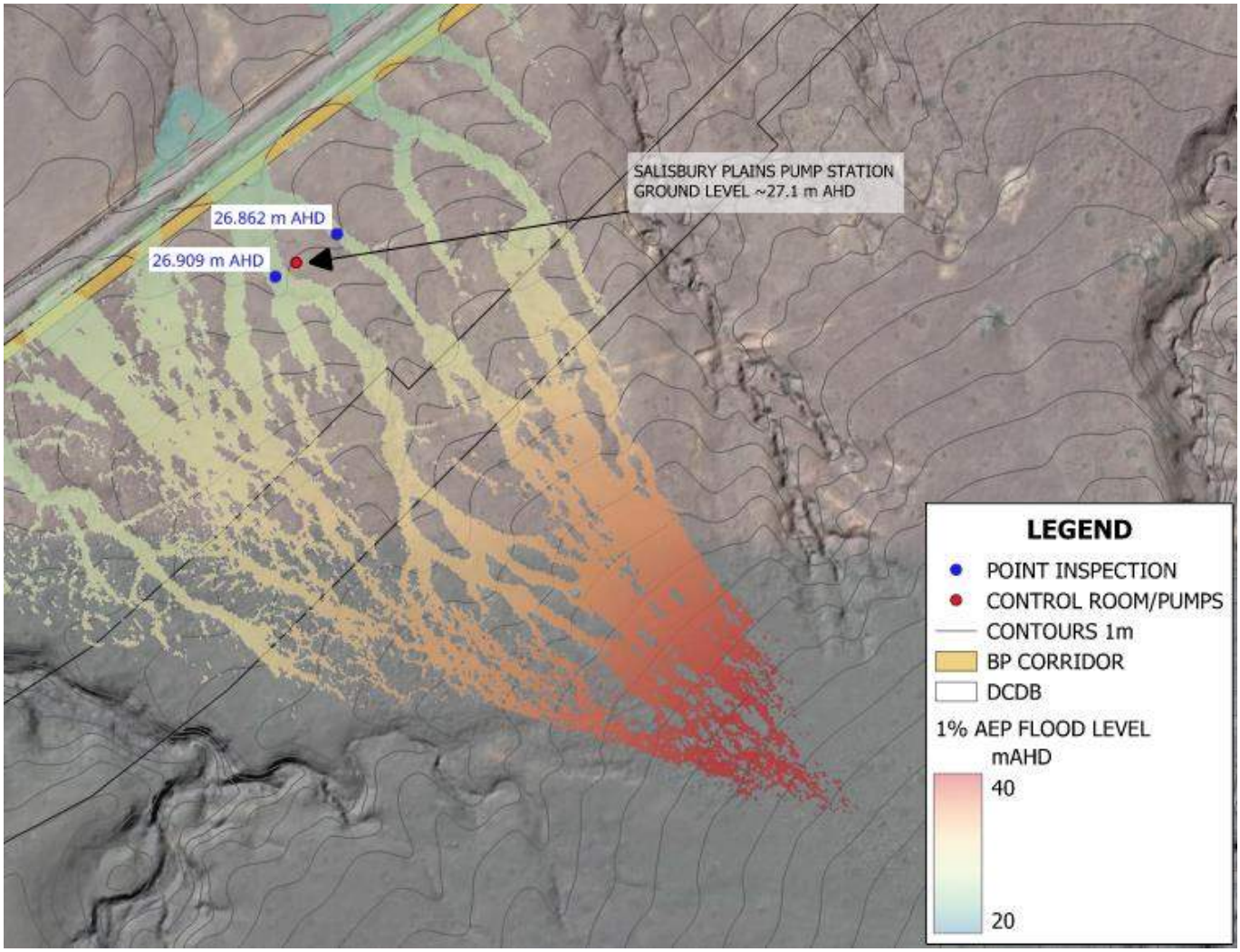


Figure 13 – Salisbury Plains 1 % AEP Peak Water Level

5 SUMMARY

Based on the modelling undertaken as part of this assessment and flood search details provided herein, the Defined Flood Levels summarised in Table 2 are proposed for the locations under consideration. It has been shown that all locations either:

- Provide flood immunity to the DFL/1 % AEP event, or
- Can easily be constructed to achieve the required level of immunity without loss of floodplain storage, or adverse impacts being caused for adjoining properties, roadway or rail infrastructure.

Table 2 – Defined Flood Level Summary

LOCATION	DFL (m AHD)	SOURCE
Kirknie Intake	26.0	Flood Search, interpolation and adjacent infrastructure
Inkerman Pump Station	12.51	Flood modelling
Guthalungra Pump Station & Tank	n/a -infrastructure provides at least 5 m freeboard to the residential lots	Flood Search, review of topography & cadastral boundaries
Salisbury Plains Pump Station & Tank	26.91	Flood modelling
Delta Pump Station & Tank	21.9	Flood Search & interpolation

6 RECOMMENDATIONS

While all proposed infrastructure associated with the Delta is considered to be capable of providing flood immunity through the structures being raised off the ground, locating the works further west to a higher point within the property has the potential to reduce the flood depths by approximately 0.5 m. It is recommended during the detailed design phase that this location be assessed and if possible, works moved to the west by approximately 250 m.

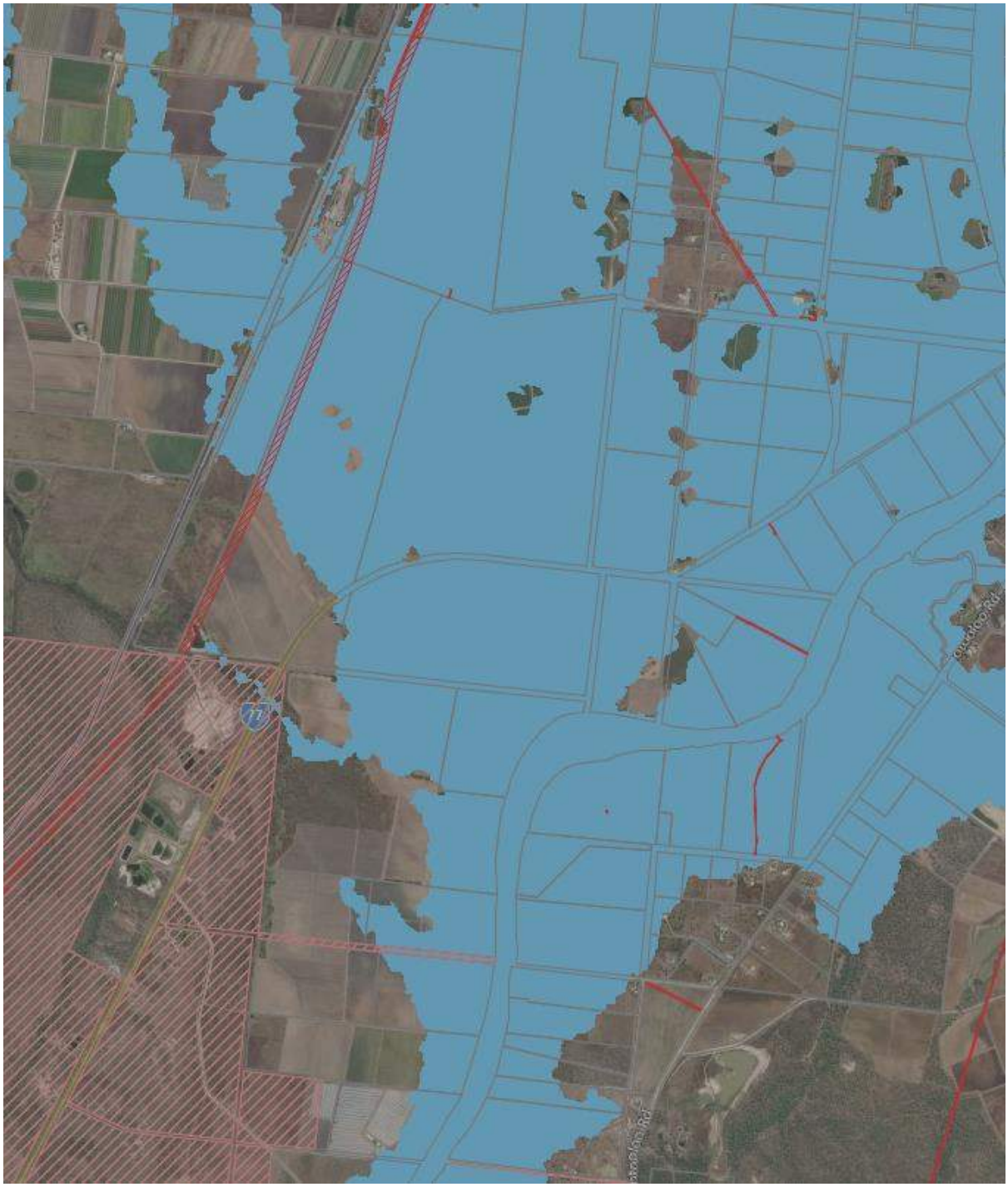
7 CERTIFICATION

This report and associated modelling have been prepared by Steven Chamberlain of Topo (RPEQ 15,545).

Signature: _____ Date: 15-03-2024

APPENDIX A

- DELTA FLOOD SEARCHES



Property Information

Lot Plan(s): 32SP220001
Address: 751 Bowen Developmental Road
Lot size: 58.28ha
Zoning: Rural

Flood and or Coastal hazard information

Local Studies (Flood Levels available 1% AEP)

Risk rating(s): Identified Flood Hazard Area
Max Flood Height: 19.25m (AHD)
Max flood velocity: No Council flood study identifying velocity for this premises. Further assessment by Registered Professional Engineer Queensland (RPEQ) may be required.
Min habitable floor level: **19.55m (AHD)**
Source: Bowen Local Catchment Study 2015
Don River Flood Risk and Mitigation Study 2014



Legend

- Selected Property
- DNRME Restrictions and Covenants
- Easement
- Flood Studies

Flood Hazard

- Low Risk Flood Hazard Area
- Medium Risk Flood Hazard Area
- High Risk Flood Hazard Area
- Identified Flood Hazard Area

Coastal Hazard - Storm Tide

- Inundation Area
- Wave-Run Up Area

Property Information

Lot Plan(s): 24K12437
Address: 565 Bowen Developmental Road
Lot size: 33.589ha
Zoning: Rural

Flood and or Coastal hazard information

Local Studies (Flood Levels available 1% AEP)

Risk rating(s): Identified Flood Hazard Area
Max Flood Height: 25.50m (AHD)
Max flood velocity: No Council flood study identifying velocity for this premises. Further assessment by Registered Professional Engineer Queensland (RPEQ) may be required.
Min habitable floor level: **25.80m (AHD)**
Source: Bowen Local Catchment Study 2015
Don River Flood Risk and Mitigation Study 2014



Legend

- Selected Property
- DNRME Restrictions and Covenants
- Easement
- Flood Studies

Flood Hazard

- Low Risk Flood Hazard Area
- Medium Risk Flood Hazard Area
- High Risk Flood Hazard Area
- Identified Flood Hazard Area

Coastal Hazard - Storm Tide

- Inundation Area
- Wave-Run Up Area

Property Information

Lot Plan(s): 151H12497
Address: 454 Bowen Developmental Road
Lot size: 16.187ha
Zoning: Rural

Flood and or Coastal hazard information

Local Studies (Flood Levels available 1% AEP)

Risk rating(s): Identified Flood Hazard Area
Max Flood Height: 20.00m (AHD)
Max flood velocity: No Council flood study identifying velocity for this premises. Further assessment by Registered Professional Engineer Queensland (RPEQ) may be required.
Min habitable floor level: **20.30m (AHD)**
Source: Bowen Local Catchment Study 2015
Don River Flood Risk and Mitigation Study 2014



Legend

- Selected Property
- DNRME Restrictions and Covenants
- Easement
- Flood Studies

Flood Hazard

- Low Risk Flood Hazard Area
- Medium Risk Flood Hazard Area
- High Risk Flood Hazard Area
- Identified Flood Hazard Area

Coastal Hazard - Storm Tide

- Inundation Area
- Wave-Run Up Area

Property Information

Lot Plan(s): 150HR1222
Address:
Lot size: 13.245ha
Zoning: Rural

Flood and or Coastal hazard information

Local Studies (Flood Levels available 1% AEP)

Risk rating(s): Identified Flood Hazard Area
Max Flood Height: 21.25m (AHD)
Max flood velocity: No Council flood study identifying velocity for this premises. Further assessment by Registered Professional Engineer Queensland (RPEQ) may be required.
Min habitable floor level: **21.55m (AHD)**
Source: Bowen Local Catchment Study 2015
Don River Flood Risk and Mitigation Study 2014



Legend

- Selected Property
- DNRME Restrictions and Covenants
- Easement
- Flood Studies

Flood Hazard

- Low Risk Flood Hazard Area
- Medium Risk Flood Hazard Area
- High Risk Flood Hazard Area
- Identified Flood Hazard Area

Coastal Hazard - Storm Tide

- Inundation Area
- Wave-Run Up Area

Property Information

Lot Plan(s): 1RP714956
Address: 99 Burnfoot Road
Lot size: 34.322ha
Zoning: Rural

Flood and or Coastal hazard information

Local Studies (Flood Levels available 1% AEP)

Risk rating(s): Identified Flood Hazard Area
Max Flood Height: 25.75m (AHD)
Max flood velocity: No Council flood study identifying velocity for this premises. Further assessment by Registered Professional Engineer Queensland (RPEQ) may be required.
Min habitable floor level: **26.05m (AHD)**
Source: Bowen Local Catchment Study 2015
Don River Flood Risk and Mitigation Study 2014



Legend

- Selected Property
- DNRME Restrictions and Covenants
- Easement
- Flood Studies

Flood Hazard

- Low Risk Flood Hazard Area
- Medium Risk Flood Hazard Area
- High Risk Flood Hazard Area
- Identified Flood Hazard Area

Coastal Hazard - Storm Tide

- Inundation Area
- Wave-Run Up Area

Property Information

Lot Plan(s): 3RP742546
Address:
Lot size: 126.736ha
Zoning: Rural

Flood and or Coastal hazard information

Local Studies (Flood Levels available 1% AEP)

Risk rating(s): Identified Flood Hazard Area
Max Flood Height: 17.75m (AHD)
Max flood velocity: No Council flood study identifying velocity for this premises. Further assessment by Registered Professional Engineer Queensland (RPEQ) may be required.
Min habitable floor level: **18.05m (AHD)**
Source: Bowen Local Catchment Study 2015
Don River Flood Risk and Mitigation Study 2014



Legend

- Selected Property
- DNRME Restrictions and Covenants
- Easement
- Flood Studies

Flood Hazard

- Low Risk Flood Hazard Area
- Medium Risk Flood Hazard Area
- High Risk Flood Hazard Area
- Identified Flood Hazard Area

Coastal Hazard - Storm Tide

- Inundation Area
- Wave-Run Up Area

Property Information

Lot Plan(s): 2RP739183
Address: 127 Hermans Road
Lot size: 128.6ha
Zoning: Rural

Flood and or Coastal hazard information

Local Studies (Flood Levels available 1% AEP)

Risk rating(s): Identified Flood Hazard Area
Max Flood Height: 17.25m (AHD)
Max flood velocity: No Council flood study identifying velocity for this premises. Further assessment by Registered Professional Engineer Queensland (RPEQ) may be required.
Min habitable floor level: **17.55m (AHD)**
Source: Bowen Local Catchment Study 2015
Don River Flood Risk and Mitigation Study 2014



Legend

- Selected Property
- DNRME Restrictions and Covenants
- Easement
- Flood Studies

Flood Hazard

- Low Risk Flood Hazard Area
- Medium Risk Flood Hazard Area
- High Risk Flood Hazard Area
- Identified Flood Hazard Area

Coastal Hazard - Storm Tide

- Inundation Area
- Wave-Run Up Area

Property Information

Lot Plan(s): 145HR165
Address:
Lot size: 39.093ha
Zoning: Rural

Flood and or Coastal hazard information

Local Studies (Flood Levels available 1% AEP)

Risk rating(s): Identified Flood Hazard Area
Max Flood Height: 19.00m (AHD)
Max flood velocity: No Council flood study identifying velocity for this premises. Further assessment by Registered Professional Engineer Queensland (RPEQ) may be required.
Min habitable floor level: **19.30m (AHD)**
Source: Bowen Local Catchment Study 2015
Don River Flood Risk and Mitigation Study 2014



Legend

- Selected Property
- DNRME Restrictions and Covenants
- Easement
- Flood Studies

Flood Hazard

- Low Risk Flood Hazard Area
- Medium Risk Flood Hazard Area
- High Risk Flood Hazard Area
- Identified Flood Hazard Area

Coastal Hazard - Storm Tide

- Inundation Area
- Wave-Run Up Area

Property Information

Lot Plan(s): 159HR1290
Address: 536 Bowen Developmental Road
Lot size: 32.331ha
Zoning: Rural

Flood and or Coastal hazard information

Local Studies (Flood Levels available 1% AEP)

Risk rating(s): Identified Flood Hazard Area
Max Flood Height: 22.25m (AHD)
Max flood velocity: No Council flood study identifying velocity for this premises. Further assessment by Registered Professional Engineer Queensland (RPEQ) may be required.
Min habitable floor level: **22.55m (AHD)**
Source: Bowen Local Catchment Study 2015
Don River Flood Risk and Mitigation Study 2014



Legend

- Selected Property
- DNRME Restrictions and Covenants
- Easement
- Flood Studies

Flood Hazard

- Low Risk Flood Hazard Area
- Medium Risk Flood Hazard Area
- High Risk Flood Hazard Area
- Identified Flood Hazard Area

Coastal Hazard - Storm Tide

- Inundation Area
- Wave-Run Up Area

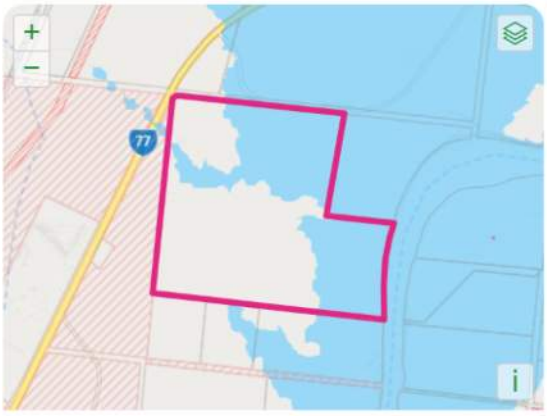
Property Information

Lot Plan(s): 2RP714956
Address: 113 Burnfoot Road
Lot size: 151.808ha
Zoning: Rural

Flood and or Coastal hazard information

Local Studies (Flood Levels available 1% AEP)

Risk rating(s): Identified Flood Hazard Area
Max Flood Height: 26.50m (AHD)
Max flood velocity: No Council flood study identifying velocity for this premises. Further assessment by Registered Professional Engineer Queensland (RPEQ) may be required.
Min habitable floor level: **26.80m (AHD)**
Source: Bowen Local Catchment Study 2015
Don River Flood Risk and Mitigation Study 2014



Legend

- Selected Property
- DNRME Restrictions and Covenants
- Easement
- Flood Studies

Flood Hazard

- Low Risk Flood Hazard Area
- Medium Risk Flood Hazard Area
- High Risk Flood Hazard Area
- Identified Flood Hazard Area

Coastal Hazard - Storm Tide

- Inundation Area
- Wave-Run Up Area

Property Information

Lot Plan(s): 159HR1290
Address: 536 Bowen Developmental Road
Lot size: 32.331ha
Zoning: Rural

Flood and or Coastal hazard information

Local Studies (Flood Levels available 1% AEP)

Risk rating(s): Identified Flood Hazard Area
Max Flood Height: 22.25m (AHD)
Max flood velocity: No Council flood study identifying velocity for this premises. Further assessment by Registered Professional Engineer Queensland (RPEQ) may be required.
Min habitable floor level: **22.55m (AHD)**
Source: Bowen Local Catchment Study 2015
Don River Flood Risk and Mitigation Study 2014



Legend

- Selected Property
- DNRME Restrictions and Covenants
- Easement
- Flood Studies

Flood Hazard

- Low Risk Flood Hazard Area
- Medium Risk Flood Hazard Area
- High Risk Flood Hazard Area
- Identified Flood Hazard Area

Coastal Hazard - Storm Tide

- Inundation Area
- Wave-Run Up Area

APPENDIX B

- KIRKNIE INTAKE FLOOD SEARCH

1% AEP Flood Certificate

Q100Cert23/0034

Address all communications to
The Chief Executive Officer

PO Box 974, Ayr Qld 4807
T (07) 4783 9800 | **F** (07) 4783 9999
enquiries@burdekin.qld.gov.au

Enquiries to: Allan Smith
Our reference: 1082

07/12/2023

Topo Group Pty Ltd
Unit 7
16 Innovation Parkway
BIRTINYA QLD 4575

Burdekin Shire Council provides this certificate using mapping data supplied by consultants Engeny Water Management and extracted from the Burdekin Shire Flood Study (June 2012) for the below property as requested.

Property Address:	5 Piva Road KIRKNIE QLD 4806
Legal Description:	Lot 8 RP908773
Q100 (1% AEP) Level:	23.2m AHD

Terms and Conditions

The information provided is subject to the following terms and conditions:

1. Council does not under any circumstances accept or admit liability in any way for an incorrect interpretation of the information derived from the mapping. It is the recipients' responsibility to verify the land height. *Please note there can be anomalies in flow depth across the flooded area, due to variations in flow restrictions, flow velocity and direction. The information is provided as a guide only and recipients are advised to seek professional assistance to interpret the data for their requirements.*

2. Council supplies this information with the understanding that the applicant will employ the services of a competent person to accurately provide the correct land height information to use in conjunction with the minimum floor level provided.

3. Floods greater than the level indicated can occur. Flood extents may vary between floods with the same gauge height due to factors such as duration of flooding, source of runoff and rate of rise of flood and changed flood plain topography. Flood extents should only be taken as indicative for the shown gauge height.

4. Local increases of peak storm tides, depths and-or velocities from local factors such as drain blockages and obstructions to overland flow paths such as fences, building and cars may also affect the level of flood water.

Document Set ID: 1787601
Version: 1, Version Date: 07/12/2023

5. The mapping used to provide the above level has been prepared using the best available data and computer modelling and mapping techniques at the time, however, the accuracy of this system is not absolute and reflects only the accuracy of the data and the techniques used.

6. The level provided for this certificate is the highest Q100 (1%AEP) level from either a River Flood Model or Localised Flooding Model.

7. Burdekin Shire Council does not accept liability for any loss caused or arising from reliance on information provided on this certificate.

8. The information provided in this certificate is to be used to comply with Council's **Floor heights for Buildings with Habitable Rooms Policy.**

Yours faithfully,



Allan Smith
Building Certifier

APPENDIX C

- INKERMAN FLOOD STUDY

BOWEN PIPELINE PROJECT

INKERMAN FLOOD STUDY



CLIENT: BOWEN PIPELINE COMPANY

DOCUMENT NUMBER: R3290

VERSION: B

DATE: 15-03-2024

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1 INTRODUCTION

Topo were engaged by Bowen Pipeline Company to undertake a Flood Study and assess the flood immunity requirements for pump stations and infrastructure associated with the Bowen Pipeline Project. The Bowen Pipeline Project is a 116 km underground water pipeline commencing 16 km upstream from Home Hill (Burdekin River) moving south to Bowen.

Flood search data was not available for the Inkerman site, so this assessment has been undertaken to identify the peak water level associated with the 1 % Annual Exceedance Probability (AEP) event and determine the Defined Flood Level. The works proposed at Inkerman are summarised in Appendix A.

1.1. GUIDELINES

This assessment has been prepared in accordance with:

- *The Queensland Urban Drainage Manual* (IPWEAQ, 2017), and
- *Australian Rainfall and Runoff* (Geoscience Australia, 2019).

1.2. REVISION

VERSION	DATE	AUTHOR	REVIEWED	APPROVED
A	12/03/2024	BS	SC	SC
B	15/03/2024	BS	SC	SC

2 HYDROLOGIC MODELLING

2.1. METHODOLOGY

Hydrologic modelling was undertaken using the XP-Storm software. The model represents the sub-catchments as a network of nodes linked by 1D sections extracted from LIDAR data. Each node is defined by its fraction impervious and average catchment slope. The net rainfall is routed through the network after appropriate losses (initial and continuing) and roughness factors are applied, resulting in a surface runoff hydrograph for each sub-catchment.

2.2. HYDROLOGY

The XP-Storm runoff-routing model has been used to estimate design flood discharges within the study area. The XP-Storm model was used to estimate the 1 % Annual Exceedance Probability (AEP) storm event for the 10 minute to 3 hour storm durations. The modelling undertaken as part of this assessment applies the Australian Rainfall and Runoff (ARR) 2019 hydrology. The XP-Storm Generator has been used, in conjunction with the Bureau of Meteorology (BOM) Intensity–Frequency–Duration (IFD) program and the ARR Data Hub to generate the rainfall intensities and temporal patterns for the site. By applying the ARR 2019 hydrologic methods, we have ensured this study is providing the best available information on design flood estimation.

2.3. RAINFALL DATA

Obtaining an estimated rainfall depth for a specified probability is an essential component of the design of infrastructure including. Design rainfalls are a probabilistic or statistically-based estimate of the likelihood of a specific rainfall depth being recorded at a particular location within a defined duration. This is generally classified by an AEP or Exceedances per Year (EY). Design rainfalls are therefore not real rainfall events, rather they are values that are probabilistic in nature.

The 2016 IFD design rainfalls are provided for use in conjunction with the 2019 edition of *Australian Rainfall and Runoff* (2019) http://arr.ga.gov.au/arr-guideline . Table 1 presents the AEP and EY rainfall data for the site with values reported in mm/hr.

Table 1 – BOM Intensity Frequency Duration Data (mm/hr)

Duration in min	63.20% AEP	50 % AEP	20 % AEP	10% AEP	5% AEP	2% AEP	1% AEP
10	93.8	107	148	174	198	228	250
15	81.1	92.7	128	150	171	197	216
20	71.9	82.3	113	133	151	175	191
25	65	74.4	103	120	137	158	173
30	59.5	68.2	94	110	126	145	159
45	48.1	55.1	76.4	90	103	118	130
60	40.7	46.8	65.2	77	88	102	112
90	31.8	36.7	51.4	61	70.1	81.5	89.9
120	26.4	30.5	43.2	51.4	59.3	69.3	76.7
180	20.1	23.4	33.5	40.1	46.5	54.9	61.2
270	15.2	17.8	25.8	31.2	36.4	43.4	48.8
360	12.5	14.6	21.4	26.1	30.6	36.7	41.5
Grid cell:		Latitude	-19.8375(S)		Longitude	147.5875(E)	

2.4. CATCHMENT CHARACTERISTICS

The representation of a catchment in a flood hydrograph estimation model is, by necessity, highly conceptualised and aims to represent those features and characteristics most influential in determining the overall flood response of the catchment. The distribution of storm rainfall over different parts of the catchment and the flood response to it may vary considerably, depending on the details of topography, vegetation cover, land use and drainage network characteristics. A catchment of approximately 2,070 ha has been identified as part of this assessment and has been further sub-divided to enable the flood regime of the site to be accurately determined. 32 sub-catchments have been delineated, as illustrated in Figure 1 and summarised in Table 2.

2.4.1. HYDROLOGIC MODELLING ROUGHNESS COEFFICIENTS

For hydrological purposes within XP-SWMM, Manning's n roughness values have been applied to represent the catchment. These values have been varied and defined for the pervious and impervious portions of the catchment. The following values have been adopted and while conservative for the pervious (vegetated) areas, are shown to correlate well with the results of the Regional Flood Frequency Estimates (RFFE). Refer to Section 2.5 for further discussion in relation to these assumptions.

- Impervious n = 0.014
- Pervious n = 0.045 (average grass)

2.4.2. RAINFALL LOSSES FOR XP-SWMM

Initial Loss (IL) and Continuing Loss (CL) rates applied to the modelling are summarised below. The loss rates are high, but it is noted there is a high pre-burst rainfall depth at this location and therefore the initial loss is alos quite high. These adopted loss rates are consistent with the ARR DataHub recommendations and RFFE assumptions. Again, the adopted values have been reduced to assist in achieving greater correlation with the results of the RFFE as detailed in Section 2.5.

- Initial Loss, impervious IL = 1 mm CL = 0 mm/hr
- Initial Loss, pervious IL = 57 mm CL = 5.6 mm/hr

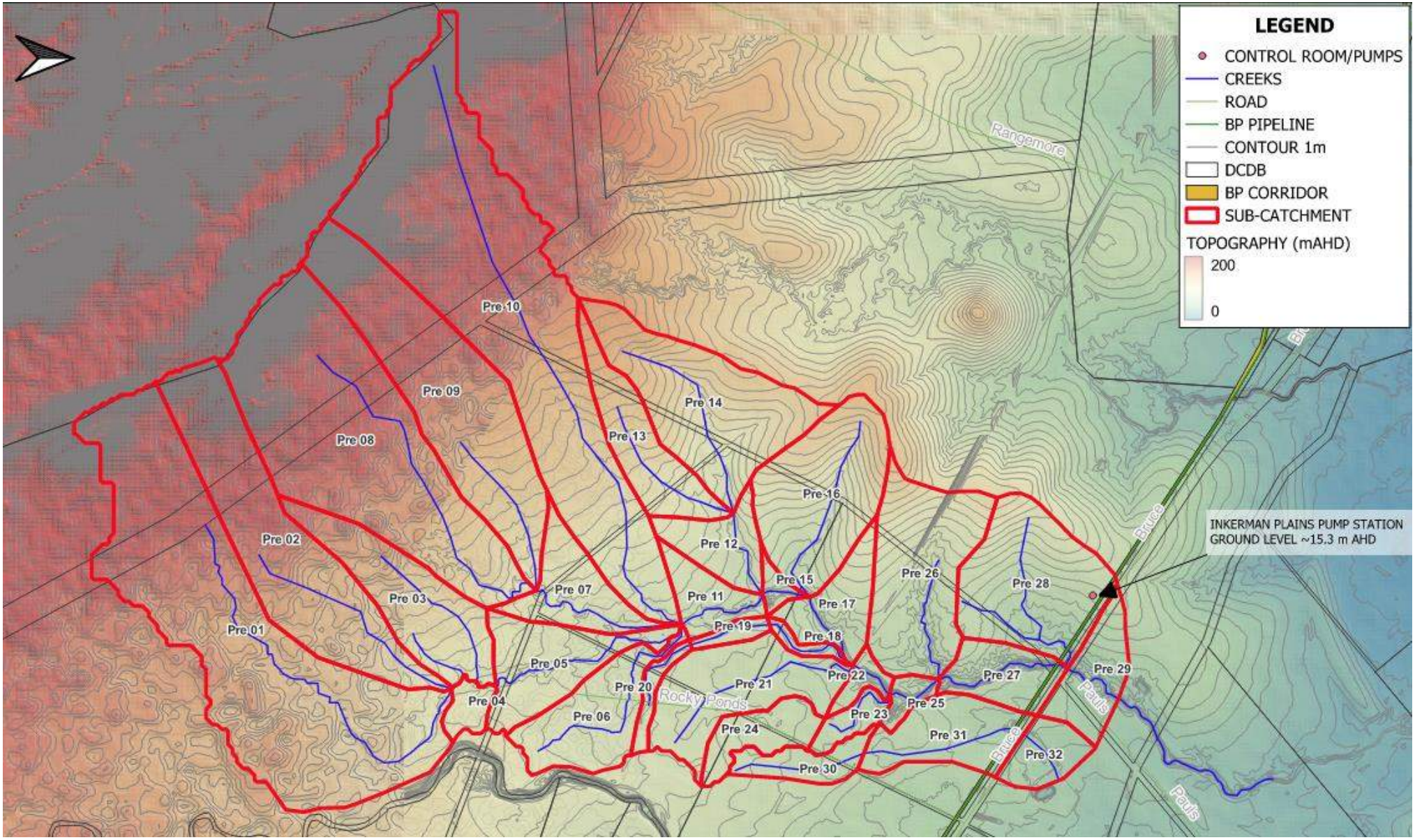


Figure 1 – Inkerman Catchment Plan

Table 2 – Catchment Details Applied to Hydrologic Assessment

CATCH ID	IMPERVIOUS AREA (ha)	PERVIOUS AREA (ha)	FRACTION IMPERVIOUS	SLOPE(%)
Pre 01	14.639	278.137	5	2
Pre 02	6.821	129.601	5	2
Pre 03	3.604	68.483	5	1
Pre 04	0.548	10.405	5	1
Pre 05	2.738	52.022	5	0.4
Pre 06	2.709	51.465	5	0.3
Pre 07	2.079	39.493	5	1
Pre 08	11.135	211.566	5	5
Pre 09	7.418	140.942	5	5
Pre 10	15.545	295.354	5	4
Pre 11	1.233	23.435	5	1
Pre 12	1.520	28.888	5	1
Pre 13	2.463	46.790	5	1
Pre 14	5.998	113.960	5	1
Pre 15	0.310	5.883	5	1
Pre 16	4.512	85.721	5	1
Pre 17	1.668	31.699	5	1
Pre 18	0.285	5.412	5	1
Pre 19	0.343	6.519	5	0.1
Pre 20	0.451	8.561	5	0.1
Pre 21	3.571	67.840	5	0.1
Pre 22	0.456	8.672	5	1
Pre 23	0.615	11.677	5	1
Pre 24	1.329	25.255	5	0.1
Pre 25	0.439	8.339	5	1
Pre 26	4.825	91.680	5	1
Pre 27	1.611	30.610	5	1
Pre 28	4.328	82.228	5	1
Pre 29	1.898	36.067	5	0.4
Pre 30	1.053	36.067	5	03
Pre 31	2.338	20.004	5	0.3
Pre 32	1.106	44.428	5	0.4

2.5. MODEL CALIBRATION / PEAK FLOW RATE COMPARISON

A comparison of the peak flow rates provided by the XP-Storm model and the results of the RFFE model has been undertaken. The RFFE technique is based on data from 853 gauged catchments and transfers flood frequency characteristics from a group of gauged catchments to the location of interest. The method ensures that design flood discharge estimates are consistent with the gauged records and with results for other ungauged catchments in a region.

The results of this comparison are summarised in Table 3.

Table 3 – Rational Method vs RFFE Peak Flow Comparison

AEP EVENT	RFFE (m^3/s)	XP (m^3/s)	DURATION/STORM NO.	DIFFERENCE
10 %	156	175	3h-10	19
2 %	273	278	3h-4	5
1 %	332	319	3h-8	-13

3 HYDRAULIC MODELLING

TUFLOW was used to undertake hydraulic modelling, utilising the design hydrographs from XP discussed in Section 2 as inputs into the hydraulic model. External catchments were applied to the model at relevant locations within the TUFLOW model as flow area polygons, as illustrated in Figure 2. Additional details in relation to the TUFLOW model are summarised below.

- LIDAR data from the Elvis - Elevation and Depth - Foundation Spatial Data website was applied to create the surface file over the site and surrounding areas.
- Manning's n roughness values across the site as described in Section 3.2.
- Critical duration design hydrographs for the external catchments are applied to the model at the respective upstream boundary locations. The hydrographs are applied to the invert of drainage line as Flow v Time hydrographs (QT lines), with the depth and velocity of flow being determined by the surface file and roughness factors at the particular location.
- Critical duration design hydrographs for the site catchments are applied at the respective catchment centroids as Flow vs Time (SA) polygons.
- A cell size of 2 m was applied to the simulation area.
- A free-flowing Flow versus Height (QH) boundary at the downstream model extent. Note, there is no impacts of any external regional flooding from downstream areas and therefore for then use of the QH boundary is appropriate.
- Initial water levels applied to farm dams so the storage volume associated with them is removed from the model.

3.1. BRUCE HIGHWAY CROSSING

No details were available at the time of preparing this assessment for the drainage infrastructure crossing of the Bruce Highway. Based on best estimates of this In lieu of these details, a 1D link was extracted from the topographic data and applied to the assessment. A 50 % blockage factor was applied to the modelling and for the results presented herein.

3.2. ROUGHNESS COEFFICIENTS (2D MODELLING)

The following values have been adopted and applied to the surface for the existing scenario:

- Road n = 0.015
- Scattered trees and grass (majority of site) n = 0.06
- Drainage lines n = 0.08

The TUFLOW model feature map is provided as Figure 2, including the 1D elements representing the culverts, RoG extents and downstream boundary location.

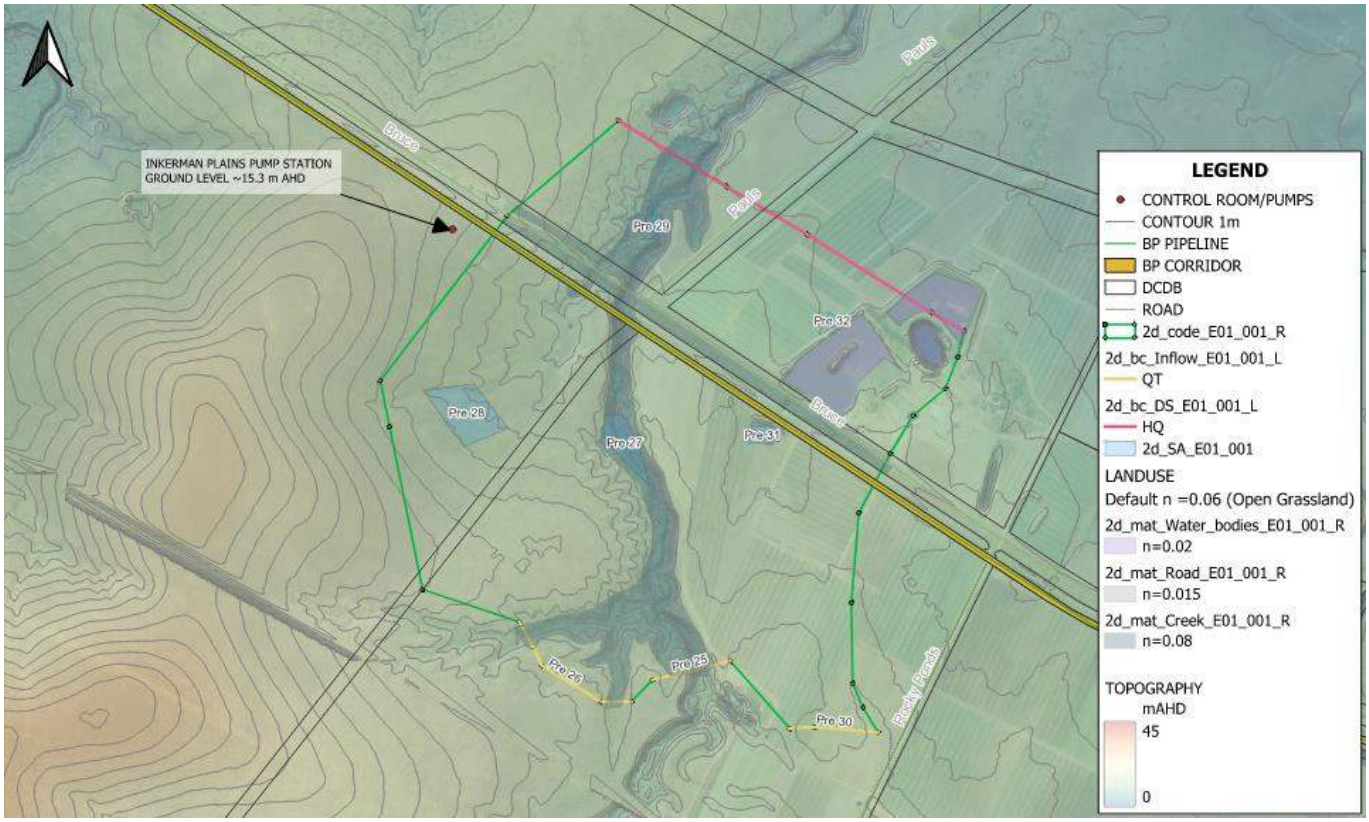


Figure 2 - TUFLOW Feature Map

3.3. RESULTS

The results of the flood model for the pre-development scenario have been extracted for the 1 % AEP for the critical storm durations. The full set of flood maps is provided within Appendix B including:

- Peak Water Level,
  - 1 m water level contours
- Maximum Depth
- Maximum Velocity, and
- Hazard
  - Hazard mapping is represented as the velocity-depth product.

A full set of plans, including catchment map, TUFLOW model features and flood maps is included as Appendix B.

3.3.1. DEFINED FLOOD LEVEL (DFL)

An extract from the peak water level map for the site is provided as Figure 3. Based on the modelling undertaken, the 1 % AEP peak water level and therefore DFL is nominated as 12.51 m AHD. It is noted the existing ground level at this location is approximately 15.3 m AHD, so there is expected to be no issues with flooding for the proposed infrastructure, up to and including the 1 % AEP and slightly beyond.

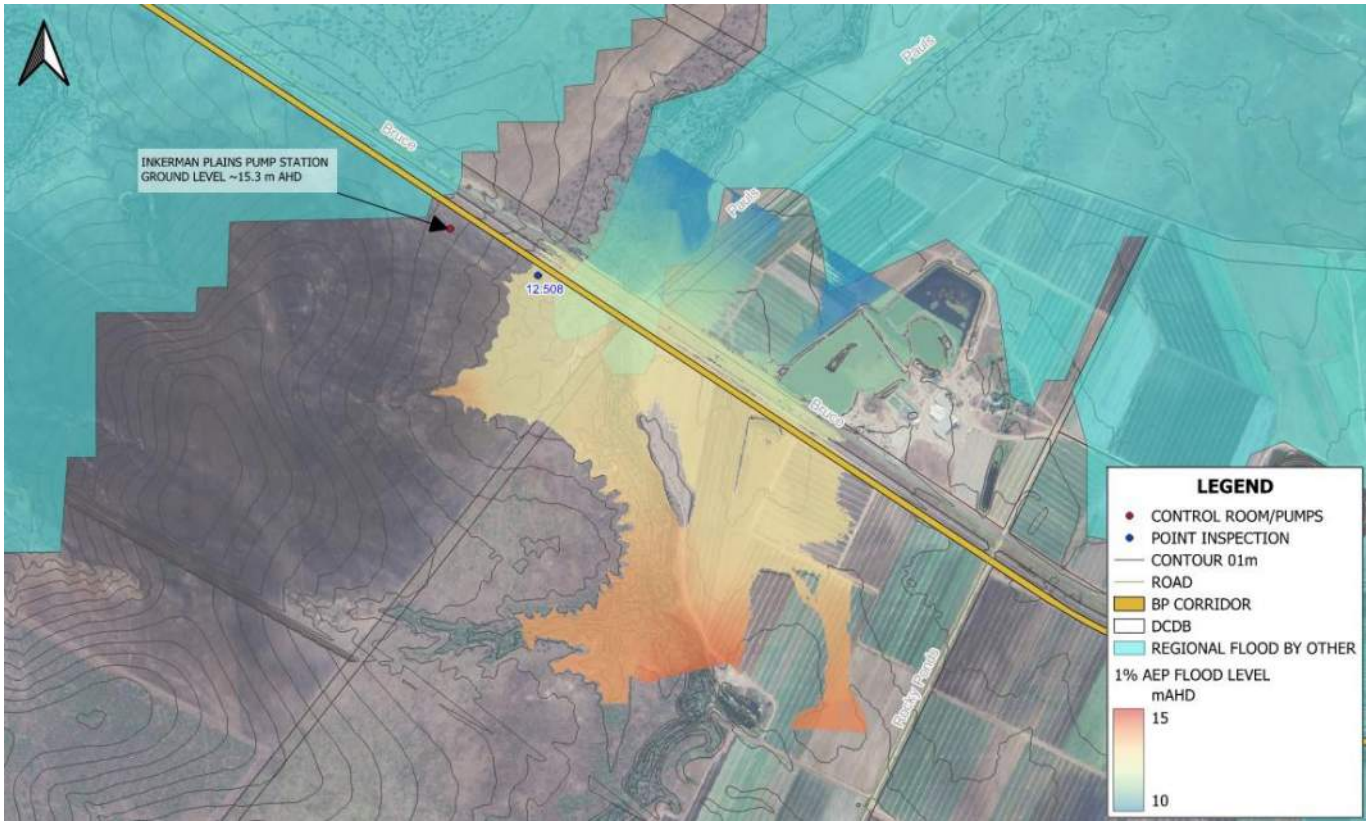


Figure 3 – 1 % AEP Peak Water Level

4 CERTIFICATION

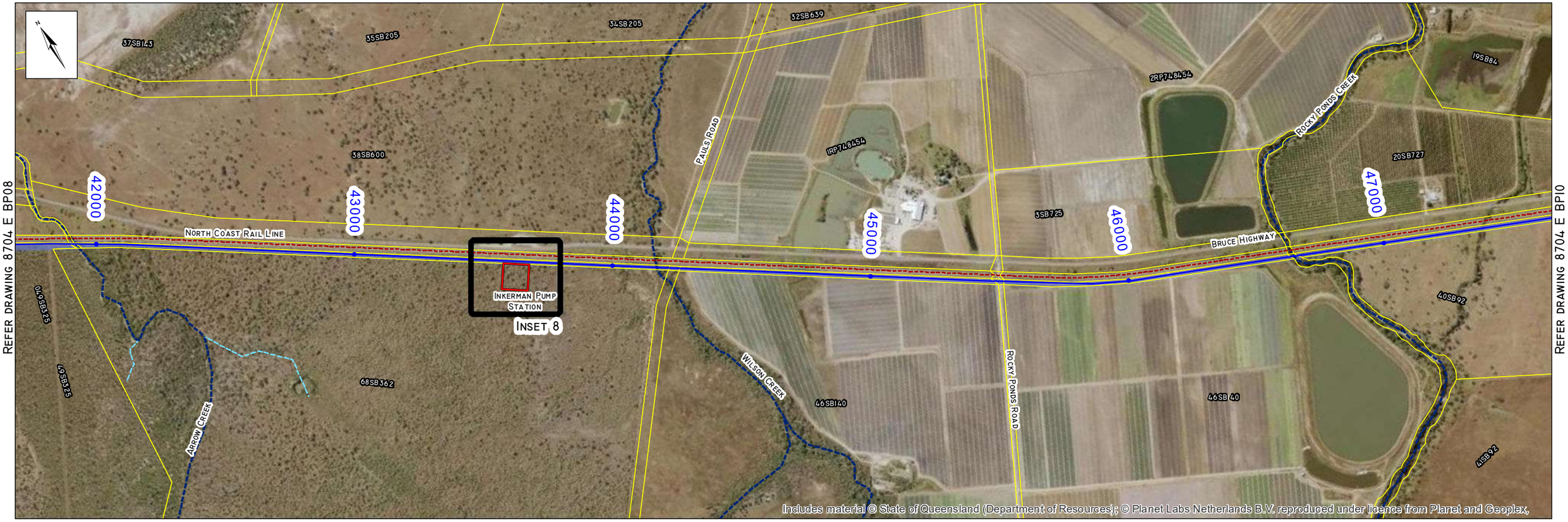
This report and associated modelling have been prepared by Steven Chamberlain of Topo (RPEQ 15,545).

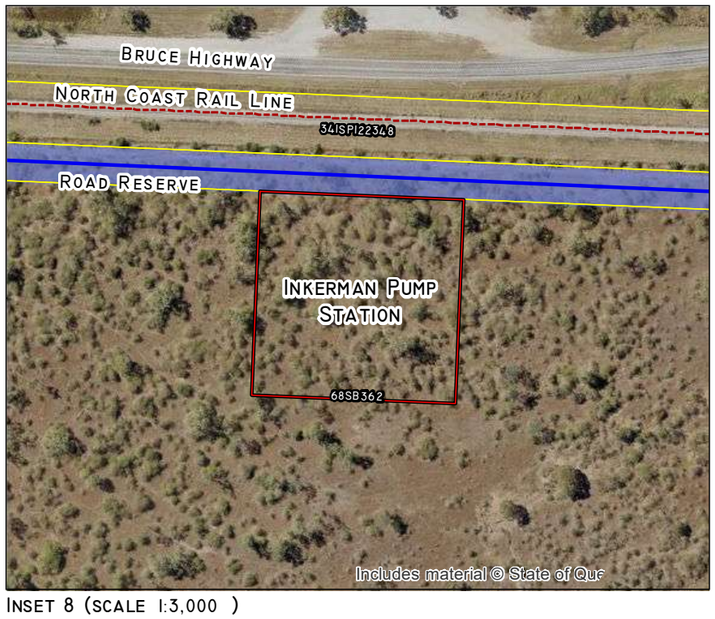
Signature: _____ Date: 15-03-2024

APPENDIX A

- PROPOSED DEVELOPMENT LAYOUT

Concept Alignment Layout Plan - Sheet 9





INSET 8 (SCALE 1:3,000)

Legend

- Concept pipeline alignment
- Extent of pipeline corridor
- Qld DCDB
- North Coast Rail network
- Minor waterway
- Major waterway

PO Box 456, Hamilton Central, Qld 4007
Seanb@bowenpipeline.com.au

Project

Bowen Pipeline Project

Drawing Details

1:15,000 @A3

0 100 200 400 600 800 m

Coordinate System: GDA2020 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA2020

Note

This plan has been prepared as a desktop assessment tool. The information on this plan is not suitable for any other purpose. The Bowen Pipeline Company Pty Ltd cannot accept responsibility for any use of or reliance upon the content of this plan by any third party. This note is an integral part of this plan and any reproduction of this plan without this note being included in full will render the information shown invalid and not suitable for use.

Layer Sources
© State of Queensland 2024. Updated data available at http://qldspatial.information.qld.gov.au/catalogue//

Version	Description	Date	Drawn	Checked
A	2021 August updates	3/09/2021	TC	SB
B	2021 September updates	7/09/2021	TC	SB
C	Intake location update	1/08/2022	TC	SB
D	Intake location update	15/08/2022	TC	SB
E	2023 March updates	22/03/2023	TC	SB
F	2023 November updates	3/11/2024	TC	SB
G	2023 December updates	6/02/2024	TC	SB
H	Intake location update	23/02/2024	TC	SB

Drawing Name: 8704 E BP09 H

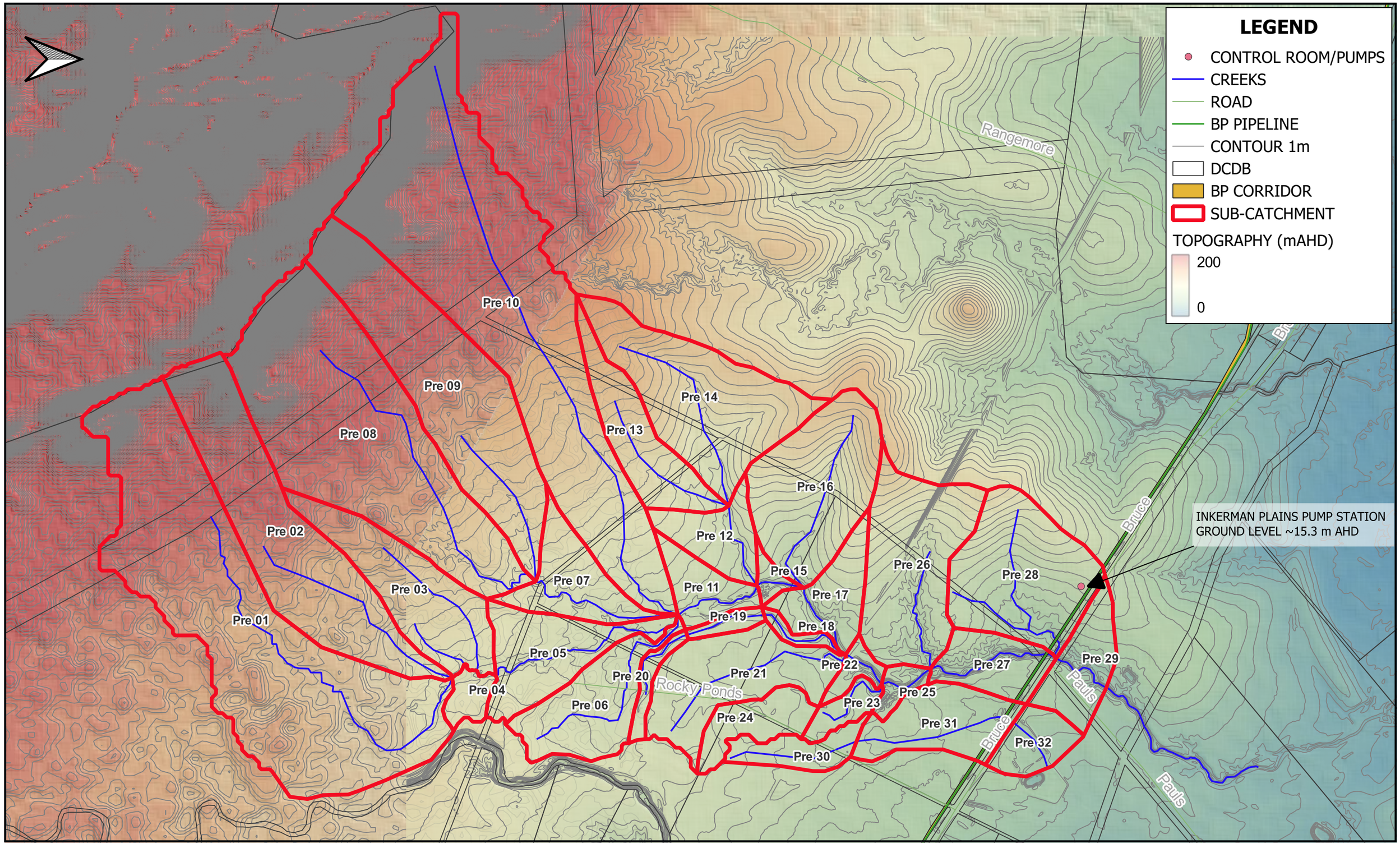
Sheet No.: 09

Version: H

Project No.: 8704

APPENDIX B

- MODEL SETUP & FLOOD MAPS



TOPO
Topo Group Pty Ltd.
Unit 7, 16 Innovation Parkway
Birtinya, Queensland. 4575.

REV.		DATE
A		12/03/24

0 0.25 0.5 0.75 1 1.25 1.5 1.75 2 km

1:25,000 (A3)

COORDINATE SYSTEM: GDA 2020/MGA ZONE 55

PROJECT: BOWEN PIPELINE PROJECT	DATE: MAR 2024
CLIENT: BOWEN PIPELINE COMPANY	PROJECT: 23-0290
FIGURE: INKERMAN SITE - CATCHMENT PLAN	DRAWING: #C01



TOPO
Topo Group Pty Ltd.
Unit 7, 16 Innovation Parkway
Birtinya, Queensland. 4575.

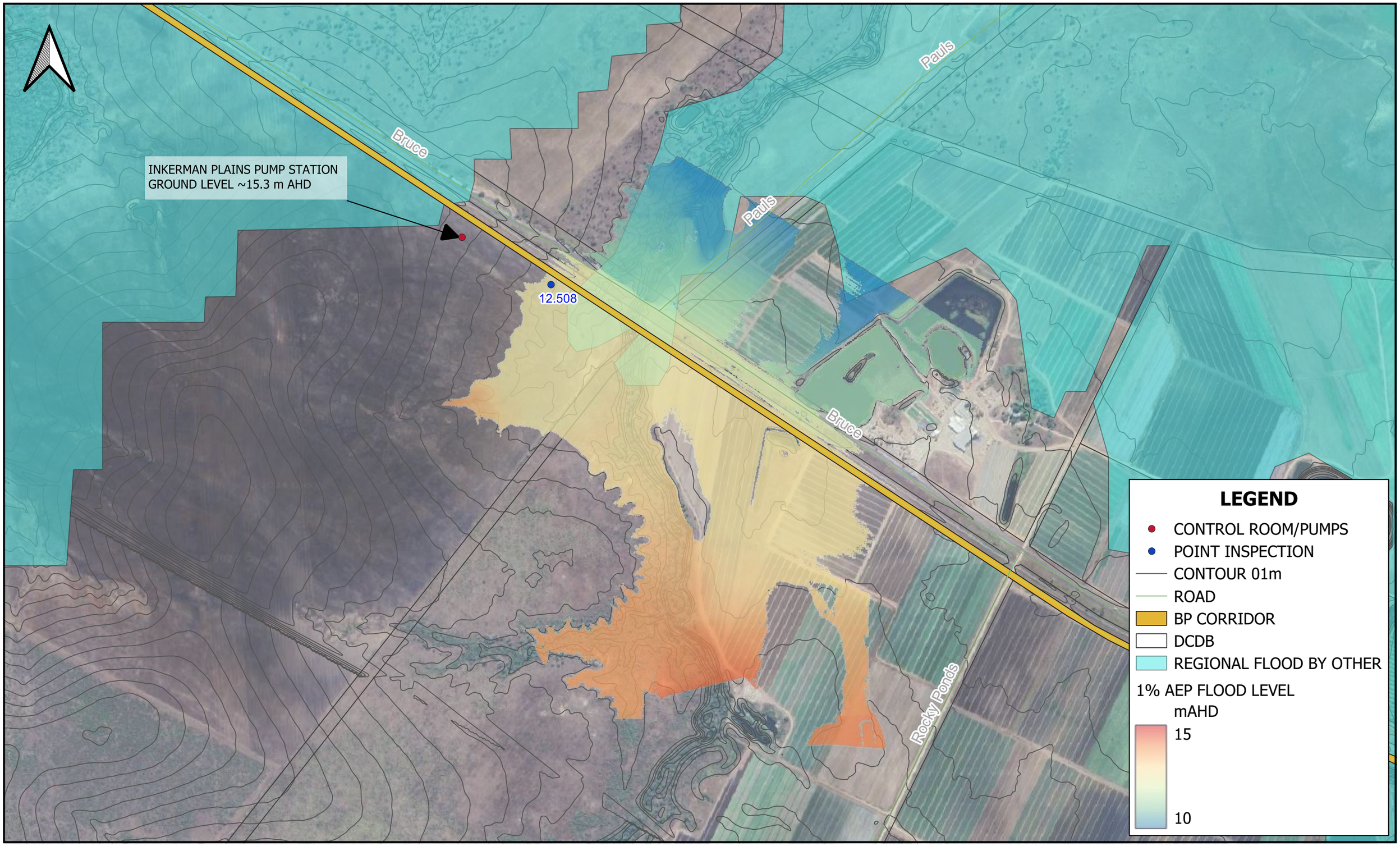
REV.		DATE
A		12/03/24

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COORDINATE SYSTEM: GDA 2020/MGA ZONE 55

PROJECT: BOWEN PIPELINE PROJECT	DATE: MAR 2024
CLIENT: BOWEN PIPELINE COMPANY	PROJECT: 23- 0290
FIGURE: INKERMAN SITE - TUFLOW CONFIGURATION	DRAWING: #C02



TOPO
Topo Group Pty Ltd.
Unit 7, 16 Innovation Parkway
Birtinya, Queensland. 4575.

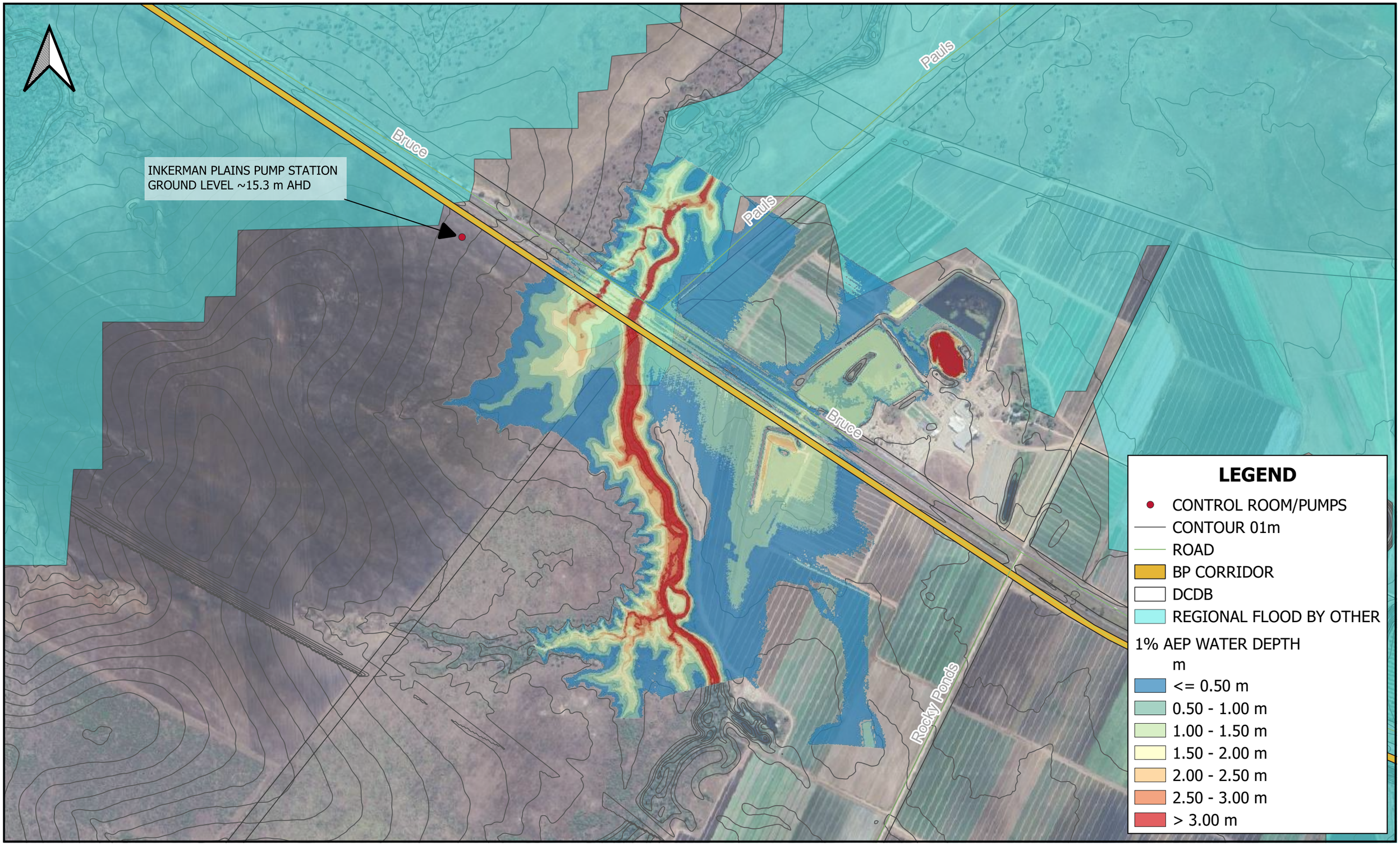
REV.		DATE
A		12/03/24

0 0.2 0.4 0.6 0.8 km

1:10,000 (A3)

COORDINATE SYSTEM: GDA 2020/MGA ZONE 55

PROJECT: BOWEN PIPELINE PROJECT	DATE: MAR 2024
CLIENT: BOWEN PIPELINE COMPANY	PROJECT: 23- 0290
FIGURE: INKERMAN SITE - 1% AEP PEAK WATER LEVEL	DRAWING: #C03



TOPO
Topo Group Pty Ltd.
Unit 7, 16 Innovation Parkway
Birtinya, Queensland. 4575.

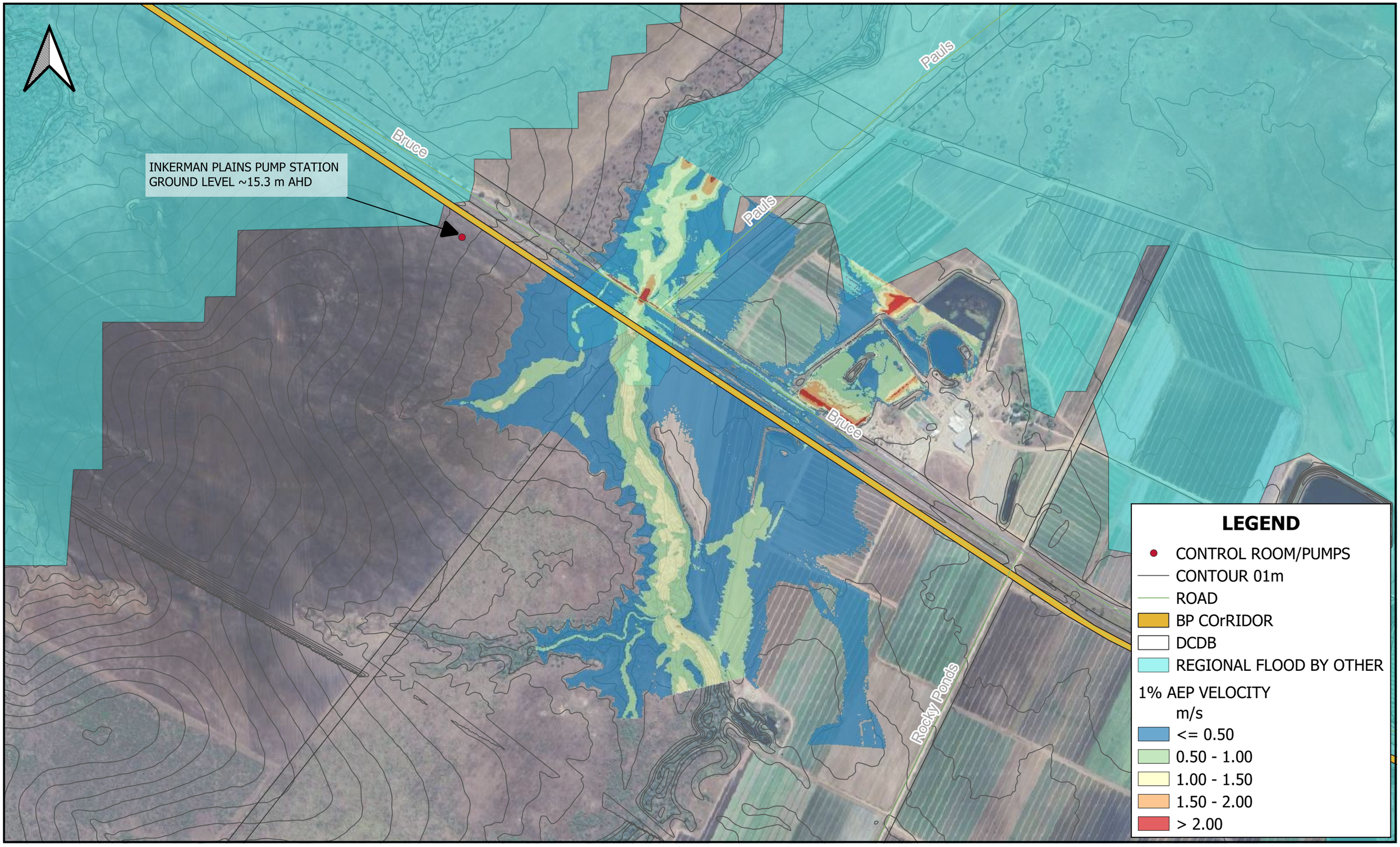
REV.		DATE
A		12/03/24

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1:10,000 (A3)

COORDINATE SYSTEM: GDA 2020/MGA ZONE 55

PROJECT: BOWEN PIPELINE PROJECT	DATE: FEB 2024
CLIENT: BOWEN PIPELINE COMPANY	PROJECT: 23- 0290
FIGURE: INKERMAN SITE - 1% AEP MAXIMUM DEPTH	DRAWING: #C04



TOPO
Topo Group Pty Ltd.
Unit 7, 16 Innovation Parkway
Birtinya, Queensland. 4575.

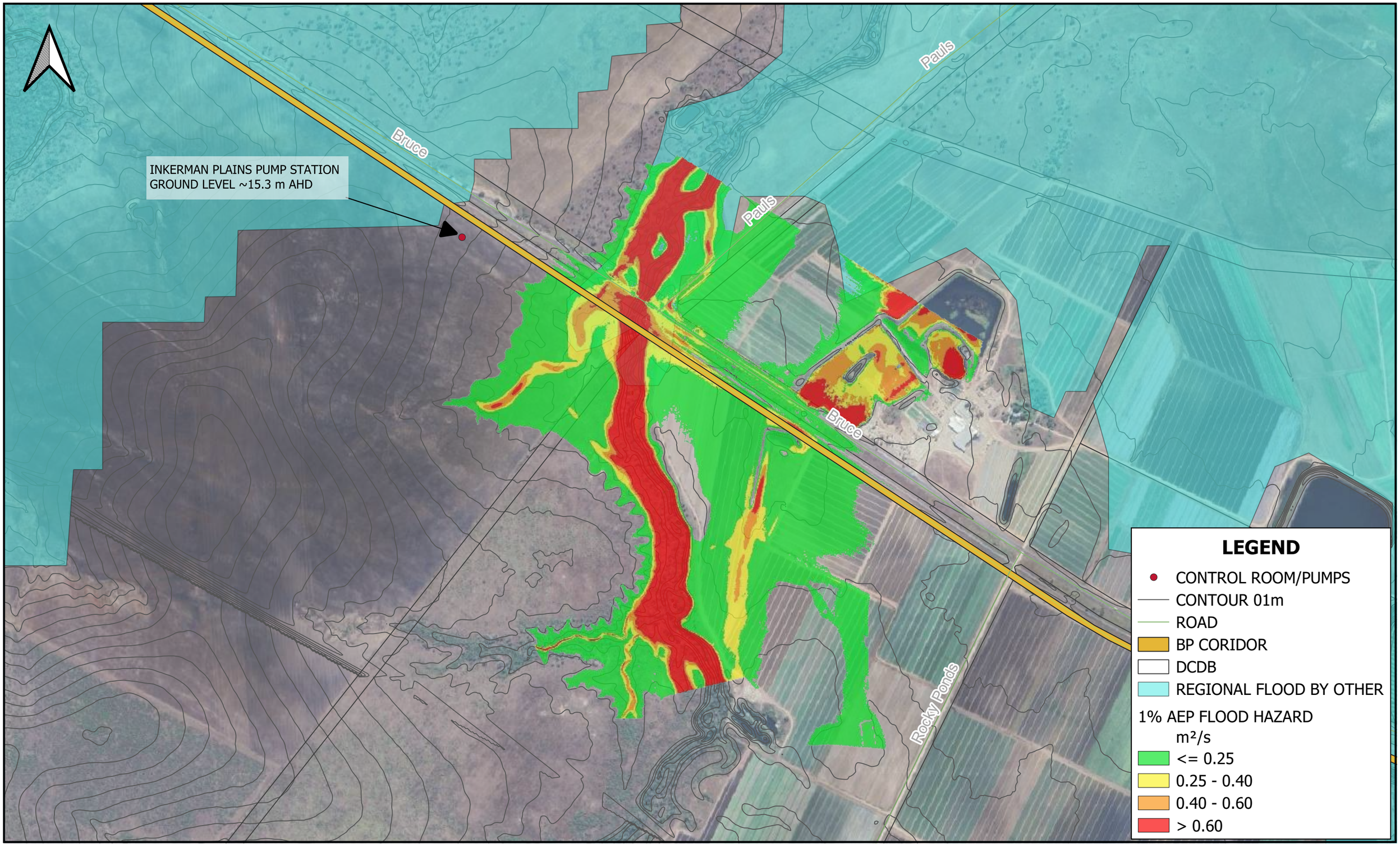
REV.		DATE
A		12/03/24

0 0.2 0.4 0.6 0.8 km

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COORDINATE SYSTEM: GDA 2020/MGA ZONE 55

PROJECT: BOWEN PIPELINE PROJECT	DATE: MAR 2024
CLIENT: BOWEN PIPELINE COMPANY	PROJECT: 23- 0290
FIGURE: INKERMAN SITE - 1% AEP MAXIMUM VELOCITY	DRAWING: #C05



TOPO
Topo Group Pty Ltd.
Unit 7, 16 Innovation Parkway
Birtinya, Queensland. 4575.

REV.		DATE
A		12/03/24

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1:10,000 (A3)

COORDINATE SYSTEM: GDA 2020/MGA ZONE 55

PROJECT: BOWEN PIPELINE PROJECT	DATE: MAR 2024
CLIENT: BOWEN PIPELINE COMPANY	PROJECT: 23- 0290
FIGURE: INKERMAN SITE - 1% AEP FLOOD HAZARD DxV	DRAWING: #C06

APPENDIX D

- SALISBURY PLAINS FLOOD STUDY

BOWEN PIPELINE PROJECT

SALISBURY PLAINS FLOOD STUDY



CLIENT: BOWEN PIPELINE COMPANY

DOCUMENT NUMBER: R3291

VERSION: B

DATE: 15-03-2024

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1 INTRODUCTION

Topo were engaged by Bowen Pipeline Company to undertake a Flood Study and assess the flood immunity requirements for pump stations and infrastructure associated with the Bowen Pipeline Project. The Bowen Pipeline Project is a 116 km underground water pipeline commencing 16 km upstream from Home Hill (Burdekin River) moving south to Bowen.

Flood search data was not available for the Salisbury Plains site, so this assessment has been undertaken to identify the peak water level associated with the 1 % Annual Exceedance Probability (AEP) event and determine the Defined Flood Level. The works proposed at Salisbury Plains are summarised in Appendix A.

1.1. GUIDELINES

This assessment has been prepared in accordance with:

- *The Queensland Urban Drainage Manual* (IPWEAQ, 2017), and
- *Australian Rainfall and Runoff* (Geoscience Australia, 2019).

1.2. REVISION

VERSION	DATE	AUTHOR	REVIEWED	APPROVED
A	12/03/2024	BS	SC	SC
B	15/03/2024	BS	SC	SC

2 HYDROLOGIC MODELLING

2.1. METHODOLOGY

Hydrologic modelling was undertaken using the XP-Storm software. The model represents the sub-catchments as a network of nodes linked by 1D sections extracted from LIDAR data. Each node is defined by its fraction impervious and average catchment slope. The net rainfall is routed through the network after appropriate losses (initial and continuing) and roughness factors are applied, resulting in a surface runoff hydrograph for each sub-catchment.

2.2. HYDROLOGY

The XP-Storm runoff-routing model has been used to estimate design flood discharges within the study area. The XP-Storm model was used to estimate the 1 % Annual Exceedance Probability (AEP) storm event for the 10 minute to 3 hour storm durations. The modelling undertaken as part of this assessment applies the Australian Rainfall and Runoff (ARR) 2019 hydrology. The XP-Storm Generator has been used, in conjunction with the Bureau of Meteorology (BOM) Intensity–Frequency–Duration (IFD) program and the ARR Data Hub to generate the rainfall intensities and temporal patterns for the site. By applying the ARR 2019 hydrologic methods, we have ensured this study is providing the best available information on design flood estimation.

2.3. RAINFALL DATA

Obtaining an estimated rainfall depth for a specified probability is an essential component of the design of infrastructure including. Design rainfalls are a probabilistic or statistically-based estimate of the likelihood of a specific rainfall depth being recorded at a particular location within a defined duration. This is generally classified by an AEP or Exceedances per Year (EY). Design rainfalls are therefore not real rainfall events, rather they are values that are probabilistic in nature.

The 2016 IFD design rainfalls are provided for use in conjunction with the 2019 edition of *Australian Rainfall and Runoff* (2019) http://arr.ga.gov.au/arr-guideline . Table 1 presents the AEP and EY rainfall data for the site with values reported in mm/hr.

Table 1 – BOM Intensity Frequency Duration Data (mm/hr)

Duration in min	63.20% AEP	50 % AEP	20 % AEP	10% AEP	5% AEP	2% AEP	1% AEP
10	93.8	107	148	174	198	228	250
15	81.1	92.7	128	150	171	197	216
20	71.9	82.3	113	133	151	175	191
25	65	74.4	103	120	137	158	173
30	59.5	68.2	94	110	126	145	159
45	48.1	55.1	76.4	90	103	118	130
60	40.7	46.8	65.2	77	88	102	112
90	31.8	36.7	51.4	61	70.1	81.5	89.9
120	26.4	30.5	43.2	51.4	59.3	69.3	76.7
180	20.1	23.4	33.5	40.1	46.5	54.9	61.2
270	15.2	17.8	25.8	31.2	36.4	43.4	48.8
360	12.5	14.6	21.4	26.1	30.6	36.7	41.5
Grid cell:		Latitude	-19.8375(S)		Longitude	147.5875(E)	

2.4. CATCHMENT CHARACTERISTICS

The representation of a catchment in a flood hydrograph estimation model is, by necessity, highly conceptualised and aims to represent those features and characteristics most influential in determining the overall flood response of the catchment. The distribution of storm rainfall over different parts of the catchment and the flood response to it may vary considerably, depending on the details of topography, vegetation cover, land use and drainage network characteristics. A catchment of approximately 360 ha has been identified as part of this assessment and has been further sub-divided to enable the flood regime of the site to be accurately determined. 23 sub-catchments were delineated as illustrated in Figure 1. However, as the assessment continued and further details were provided, it became clear that a number of these catchments would not contribute to the flooding over the proposed works area. The catchments applied to the hydraulic modelling are highlighted in Figure 1.

2.4.1. HYDROLOGIC MODELLING ROUGHNESS COEFFICIENTS

For hydrological purposes within XP-SWMM, Manning's n roughness values have been applied to represent the catchment. These values have been varied and defined for the pervious and impervious portions of the catchment. The following values have been adopted and while conservative for the pervious (vegetated) areas, are shown to correlate well with the results of the Rational Method comparison. Refer to Section 2.5 for further discussion in relation to these assumptions.

- Impervious n = 0.014
- Pervious n = 0.045 (average grass)

2.4.2. RAINFALL LOSSES FOR XP-SWMM

Initial Loss (IL) and Continuing Loss (CL) rates applied to the modelling are summarised below. The loss rates are high, but it is noted there is a high pre-burst rainfall depth at this location and therefore the initial loss is also quite high. These adopted loss rates are consistent with the ARR Data Hub recommendations.

- Initial Loss, impervious IL = 1 mm CL = 0 mm/hr
- Initial Loss, pervious IL = 57 mm CL = 5.6 mm/hr

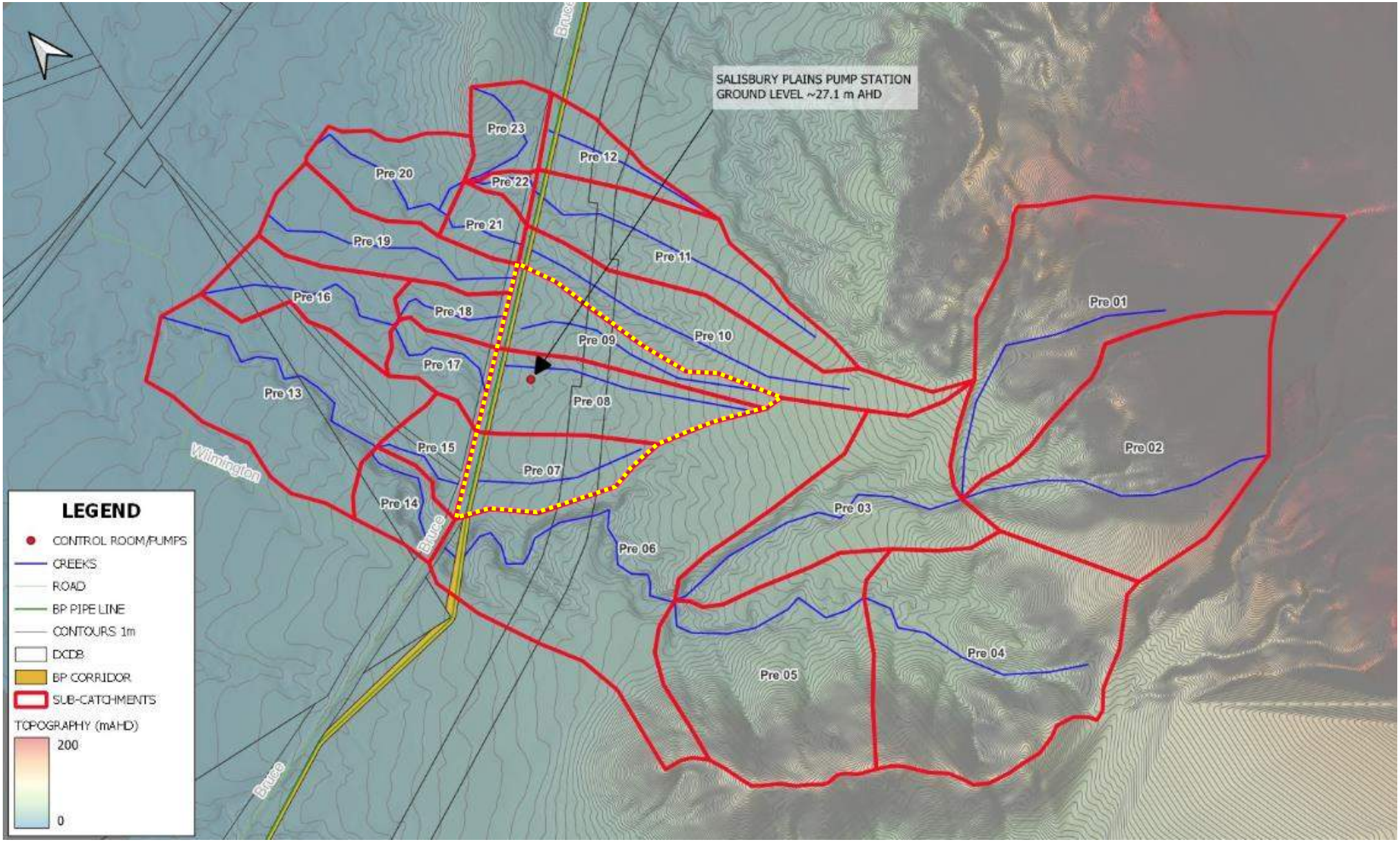


Figure 1 – Salisbury Plains Catchment Plan

Table 2 – Catchment Details Applied to Hydrologic Assessment

CATCH ID	IMPERVIOUS AREA (ha)	PERVIOUS AREA (ha)	FRACTION IMPERVIOUS	SLOPE (%)
PRE 07	0.476	9.044	5	5
PRE 08	0.665	12.644	5	5
PRE 09	0.454	8.631	5	3

2.5. RATIONAL METHOD COMPARISON

A comparison of the peak flow rates provided by the XP-Storm model and the Rational Method has been undertaken. The results of this comparison of 1 % AEP event are summarised in Table 3.

Table 3 – Rational Method vs XP-SWMM Peak Flow Comparison

CATCHMENT	RATIONAL METHOD (m^3/s)	XP (m^3/s)	DURATION/STORM NO.	DIFFERENCE
PRE 07	3.616	3.215	45min_8	-11.1
PRE 08	4.715	4.159	45min_9	-11.8
PRE 09	3.148	2.740	1hr_8	-12.9

3 HYDRAULIC MODELLING

TUFLOW was used to undertake hydraulic modelling, utilising the design hydrographs from XP discussed in Section 2 as inputs into the hydraulic model. External catchments were applied to the model at relevant locations within the TUFLOW model as flow area polygons, as illustrated in Figure 2. To ensure an accurate flow regime through the site was obtained, the rain-on-grid (ROG) model was applied. Additional details in relation to the TUFLOW model are summarised below.

- LIDAR data from the Elvis - Elevation and Depth - Foundation Spatial Data website was applied to create the surface file over the site and surrounding areas.
- Manning's n roughness values across the site as described in Section 3.2.
- A cell size of 2 m was applied to the simulation area.
- A free-flowing Flow versus Height (QH) boundary at the downstream model extent. Note, there is no impacts of any external regional flooding from downstream areas and therefore for then use of the QH boundary is appropriate.
- Initial water levels applied to farm dams so the storage volume associated with them is removed from the model.

3.1. BRUCE HIGHWAY CROSSING

No details were available at the time of preparing this assessment for the drainage infrastructure crossings of the Bruce Highway. Based on an assessment of the LIDAR data and aerial photography, 7 crossing locations were identified as needing to be taken into consideration. Refer to Figure 2 and Appendix B for further details in relation to the topography in these locations. Table 4 provides a summary of the culvert details that were applied to the modelling as 1D links. Inlet and exit losses of 0.5 and 1.0 respectively were applied to these structures.

3.2. ROUGHNESS COEFFICIENTS (2D MODELLING)

The following values have been adopted and applied to the surface for the existing scenario:

- Road n = 0.015
- Scattered trees and grass (majority of site) n = 0.06
- Drainage lines n = 0.045 to 0.060



Figure 2 – Bruce Highway Culvert Locations

Table 4 – Estimated Culvert Sizes

LOCATION	ESTIMATED WIDTH (m)	SIZE (m)/SHAPE	NUMBER
1	~1	1.2 Circular	1
2	~2	0.9 Circular	2
3	~2	1.2 Circular	2
4	~2	0.9 Circular	1
5	~1	0.75 Circular	1
6	~1	0.9 Circular	1
7	~1	0.75 Circular	1

The TUFLOW model feature map is provided as Figure 3, including the 1D elements representing the culverts, RoG extents and downstream boundary location.

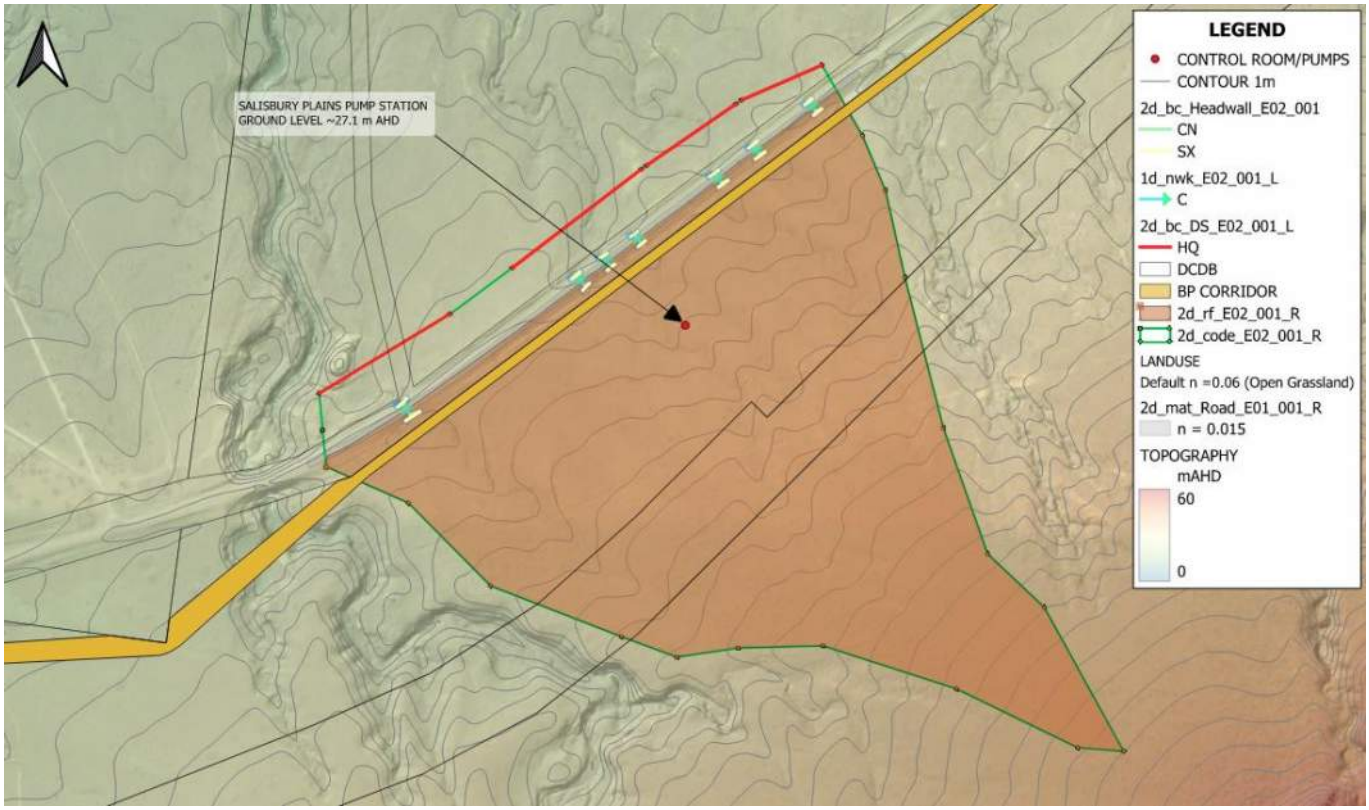


Figure 3 - TUFLOW Feature Map

3.3. RESULTS

The results of the flood model for the pre-development scenario have been extracted for the 1 % AEP for the critical storm durations. The full set of flood maps is provided within Appendix C including:

- Peak Water Level,
- Maximum Depth
- Maximum Velocity, and
- Hazard
    - Hazard mapping is represented as the velocity-depth product.

A full set of plans, including catchment map, TUFLOW model features and flood maps is included as Appendix C.

3.3.1. DEFINED FLOOD LEVEL (DFL)

An extract from the peak water level map for the site is provided as Figure 4. Based on the modelling undertaken, the peak water level is approximately 26.91 m AHD, and has been nominated as the DFL. It is noted the existing ground level at this location is 27.1 m AHD, so there is expected to be no issues with flooding for the proposed infrastructure, up to and including the 1 % AEP and slightly beyond.

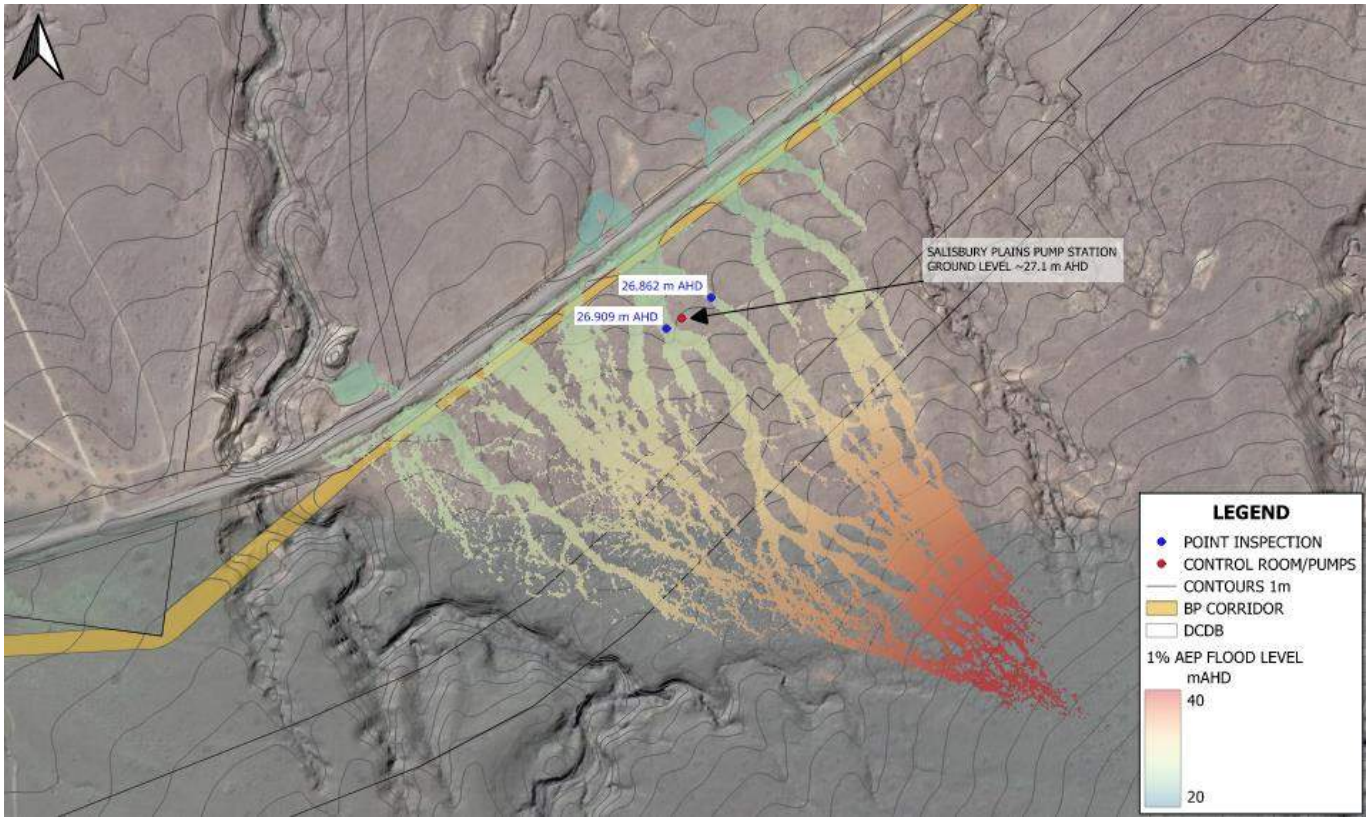


Figure 4 – 1 % AEP Peak Water Level

4 CERTIFICATION

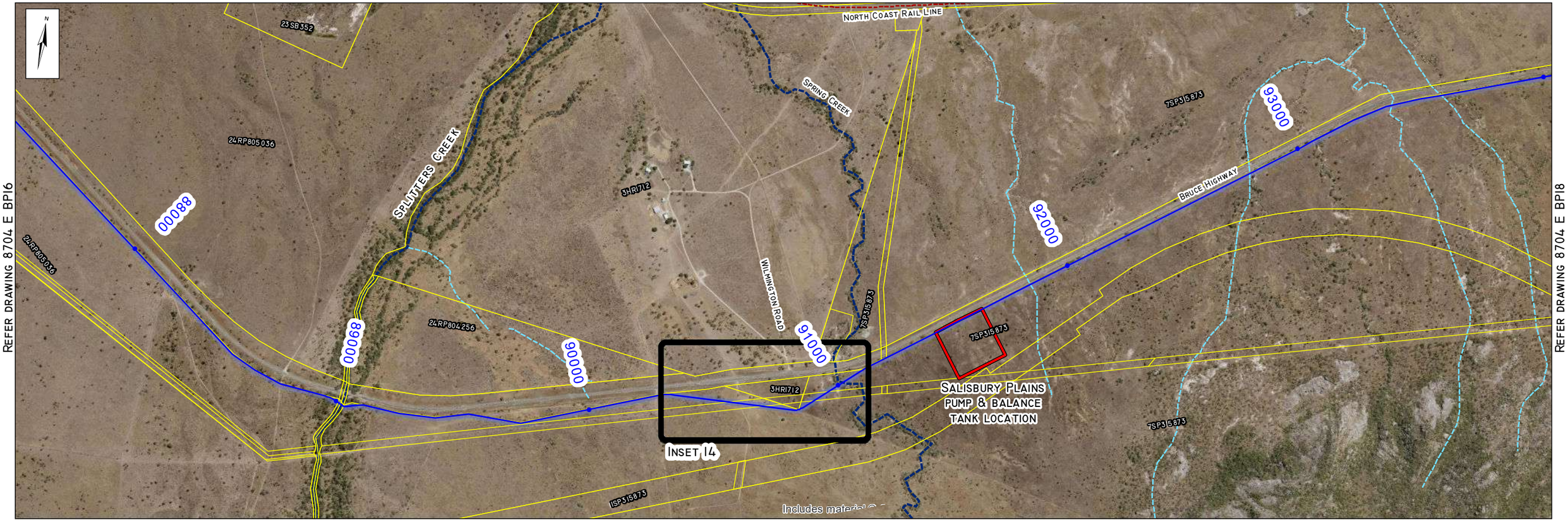
This report and associated modelling have been prepared by Steven Chamberlain of Topo (RPEQ 15,545).

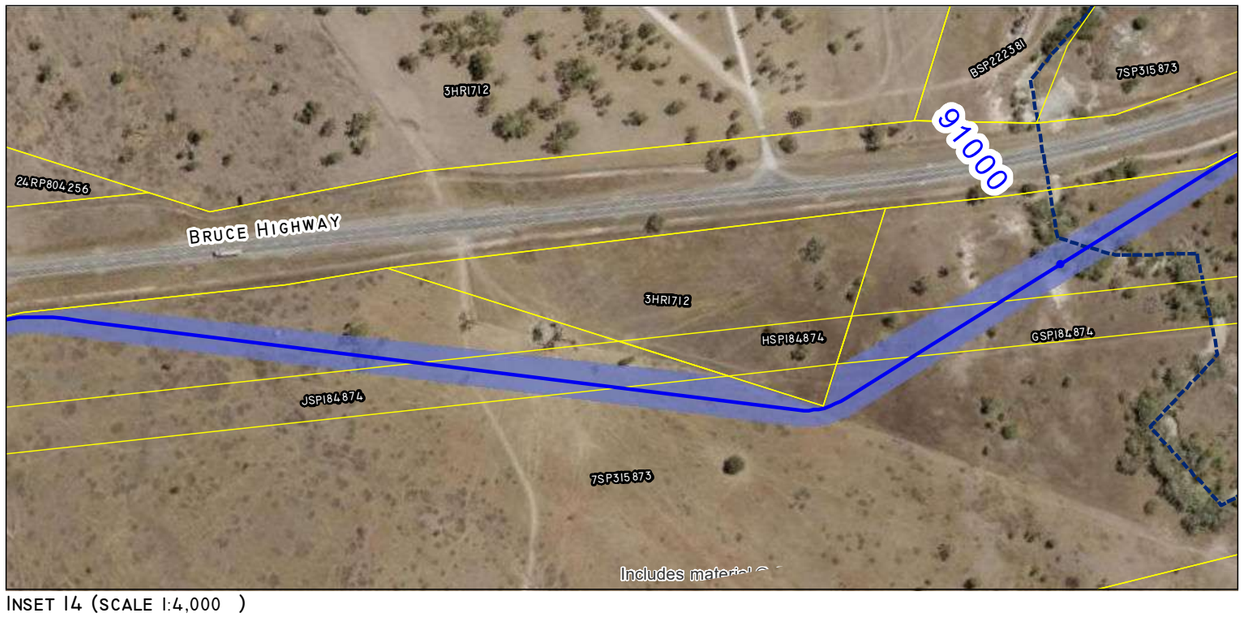
Signature: _____ Date: 15-03-2024

APPENDIX A

- PROPOSED SITE LAYOUT

Concept Alignment Layout Plan - Sheet 17





Inset 14 (scale 1:4,000)

Legend

- Concept pipeline alignment
- Extent of pipeline corridor
- Qld DCDB
- North Coast Rail network
- Minor waterway
- Major waterway

Bowen Pipeline Company

PO Box 456, Hamilton Central, Qld 4007
Seanb@bowenpipeline.com.au

Project

Bowen Pipeline Project

Drawing Details

1:15,000 @A3

0 100 200 400 600 800 m

Coordinate System: GDA2020 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA2020

Note

This plan has been prepared as a desktop assessment tool. The information on this plan is not suitable for any other purpose. The Bowen Pipeline Company Pty Ltd cannot accept responsibility for any use of or reliance upon the content of this plan by any third party. This note is an integral part of this plan and any reproduction of this plan without this note being included in full will render the information shown invalid and not suitable for use.

Layer Sources
© State of Queensland 2024. Updated data available at http://qldspatial.information.qld.gov.au/catalogue//

Version	Description	Date	Drawn	Checked
B	2021 September updates	7/09/2021	TC	SB
C	2021 November updates	5/11/2021	TC	SB
D	Intake location update	16/08/2022	TC	SB
E	TMR RFI	28/11/2022	TC	SB
F	2023 March updates	22/03/2023	TC	SB
G	2023 November updates	6/11/2023	TC	SB
H	2023 December updates	6/02/2024	TC	SB
I	Intake Location Update	23/02/2024	TC	SB

Drawing Name: 8704 E BP17 1

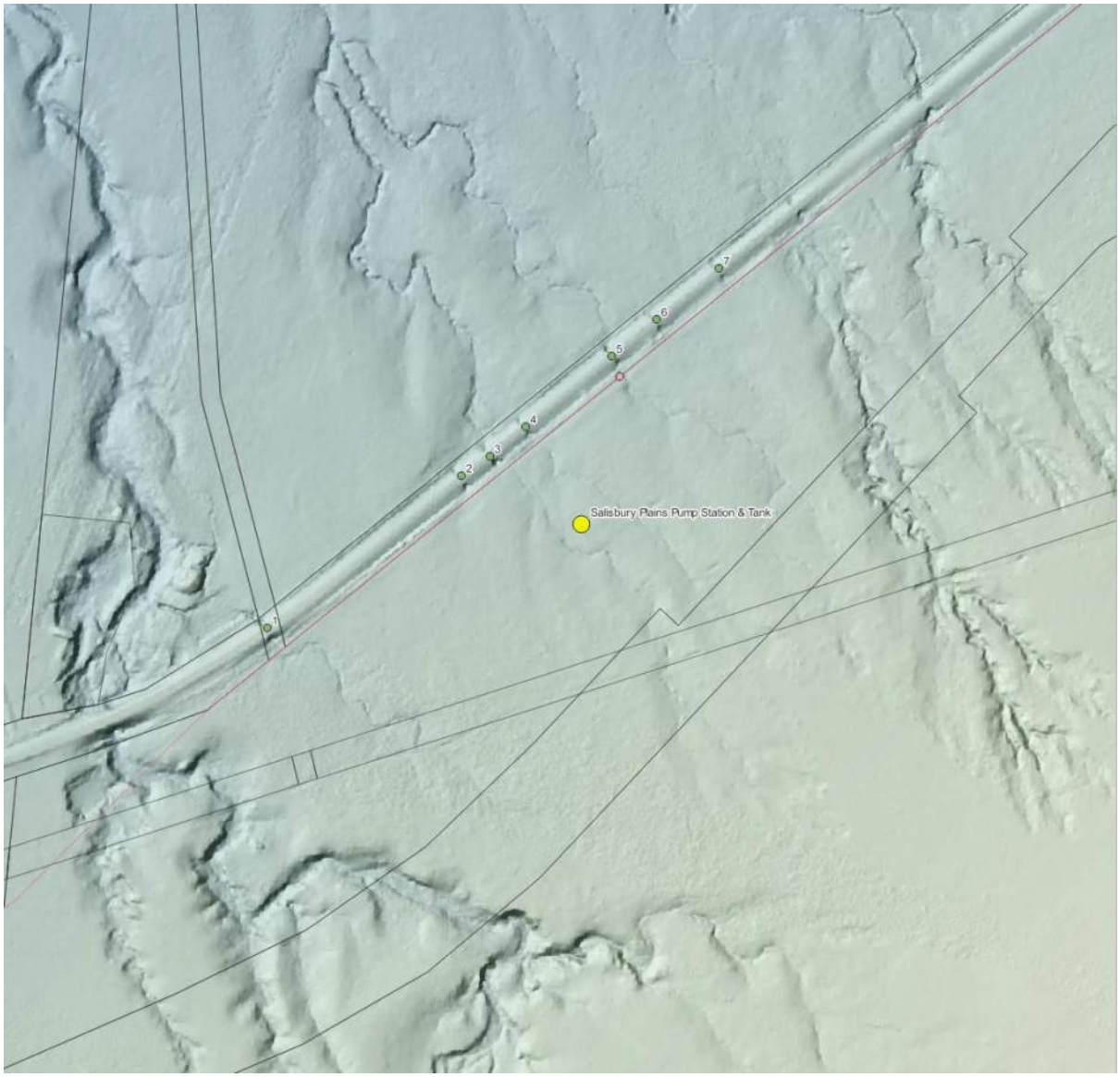
Sheet No.: 17

Version: 1

Project No.: 8704

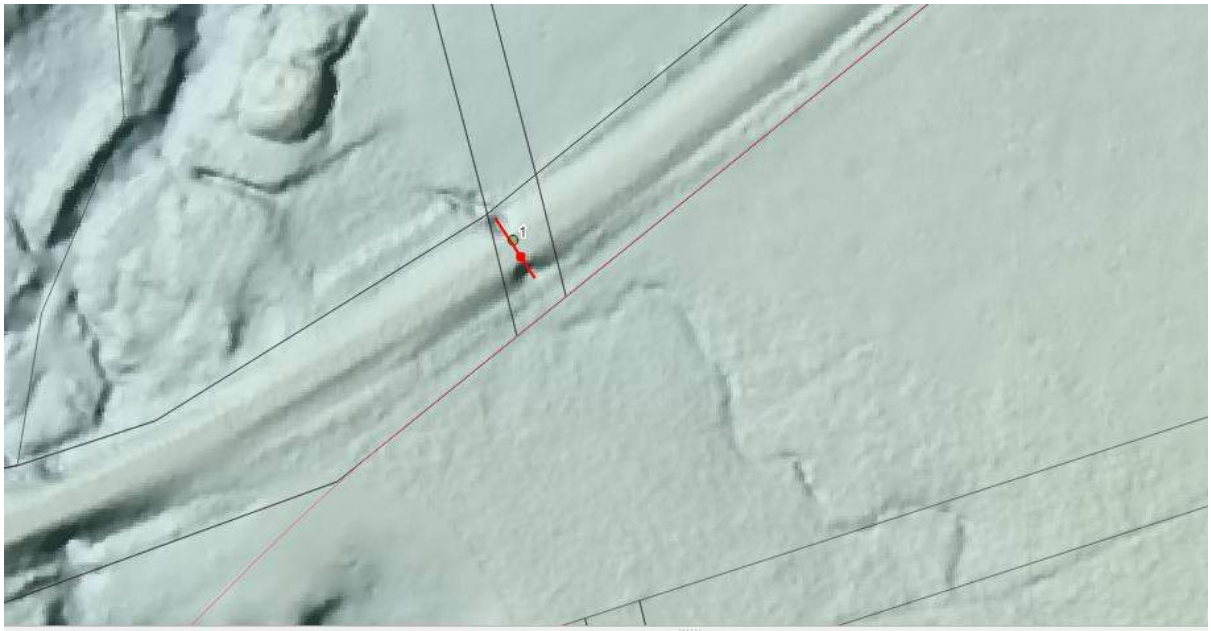
APPENDIX B

- CULVERT ASSUMPTIONS



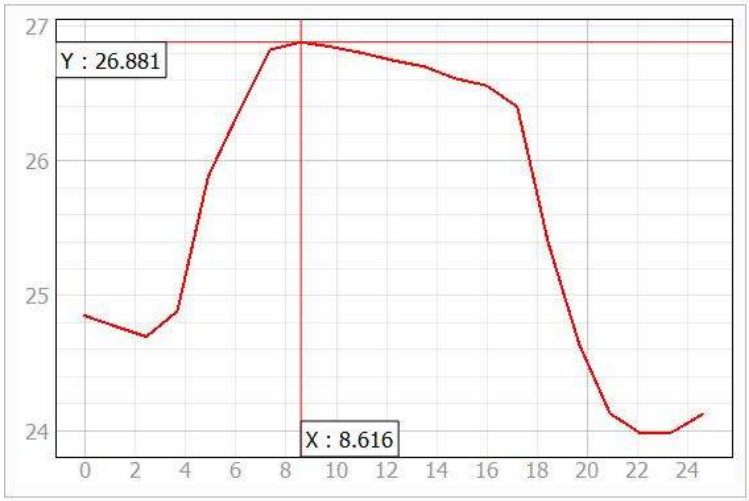
Estimated culvert sizes

Culvert	Width (from QLD Globe)	Size (m)	# of
1	~1m	1.2m Circular	1
2	~2m	0.9 C	2
3	~2m	1.2 C	2
4	~2m	0.9 C	1
5	~1m	0.75 C	1
6	~1m	0.9 C	1
7	~1m	0.75 C	1



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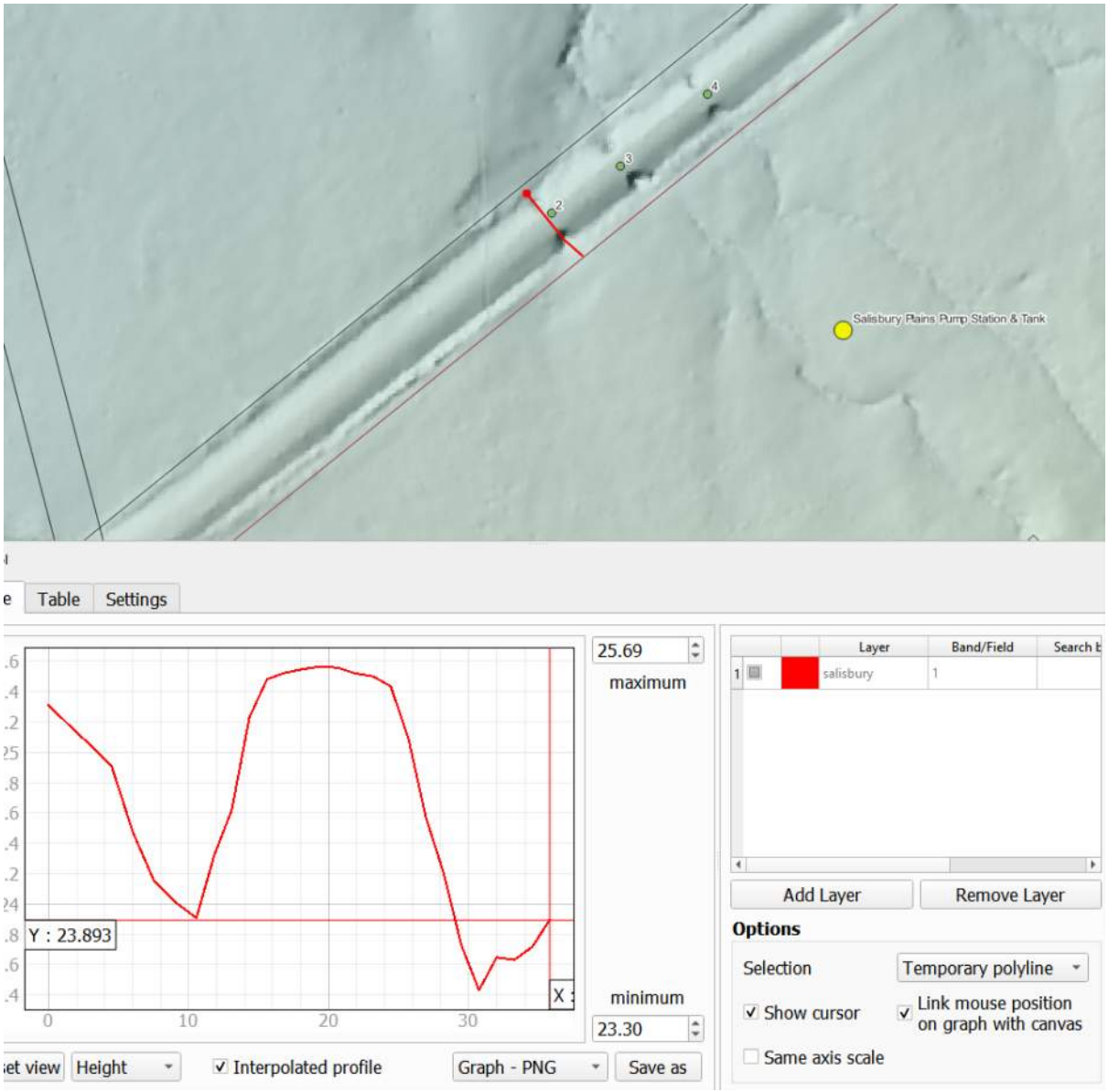
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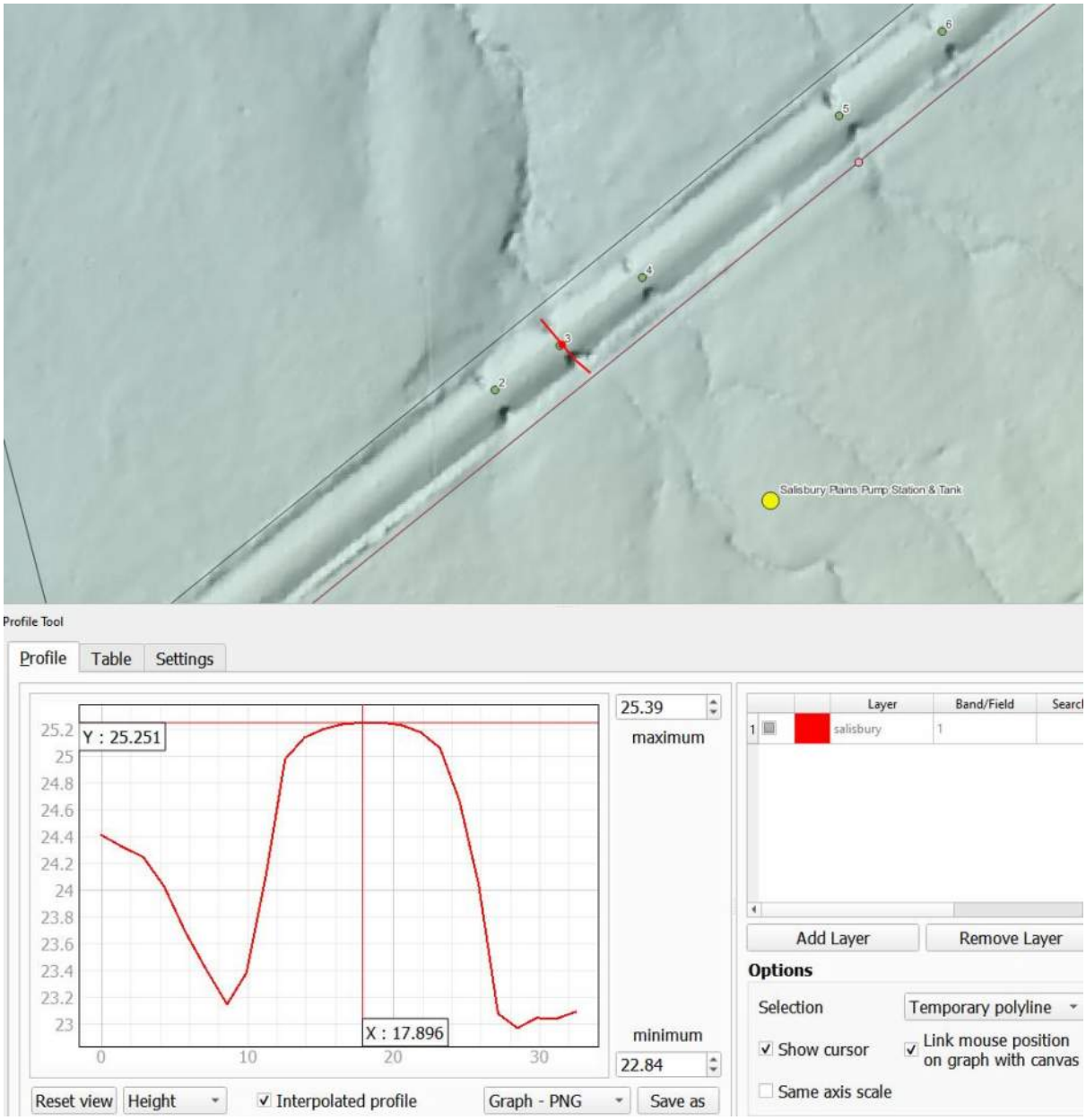
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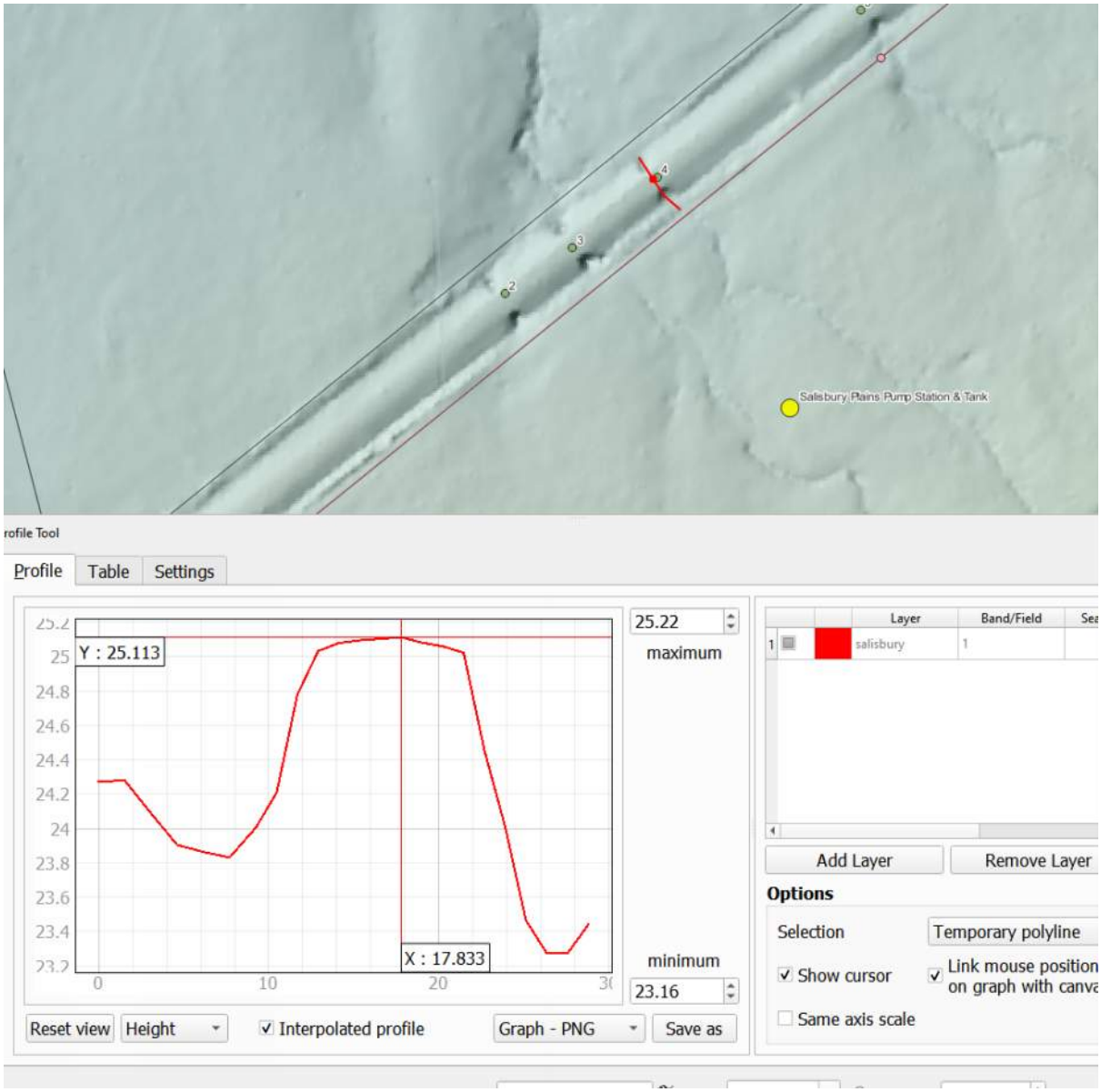
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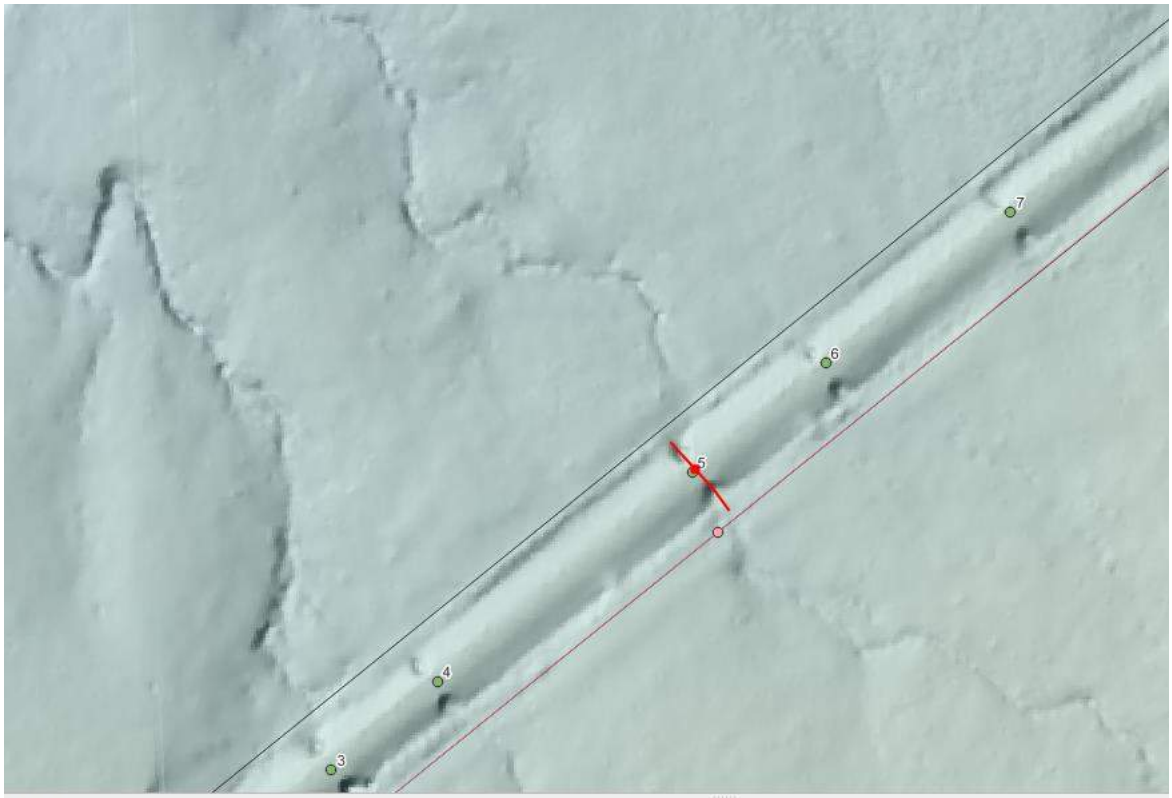
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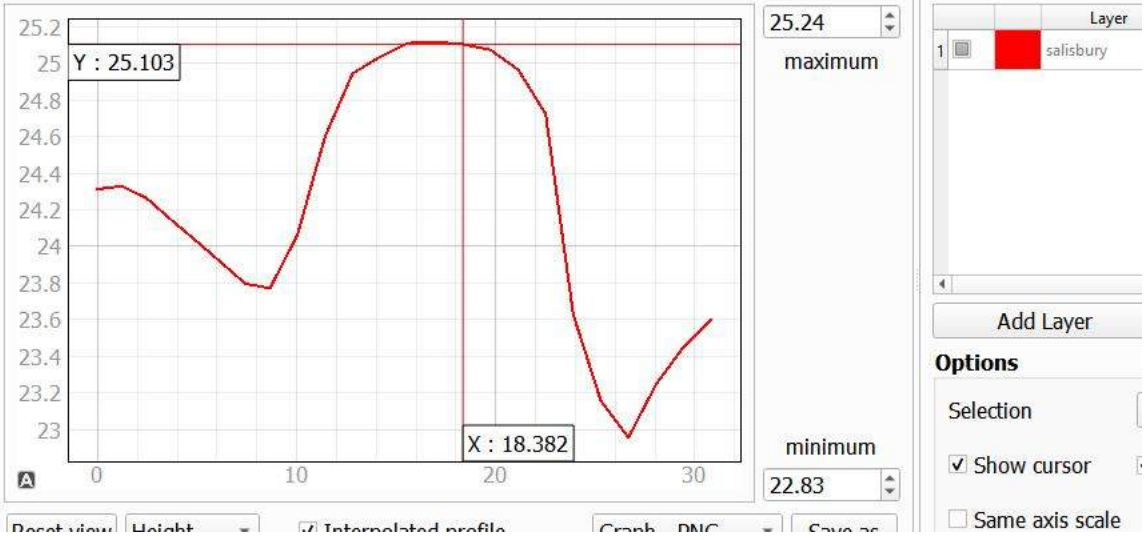

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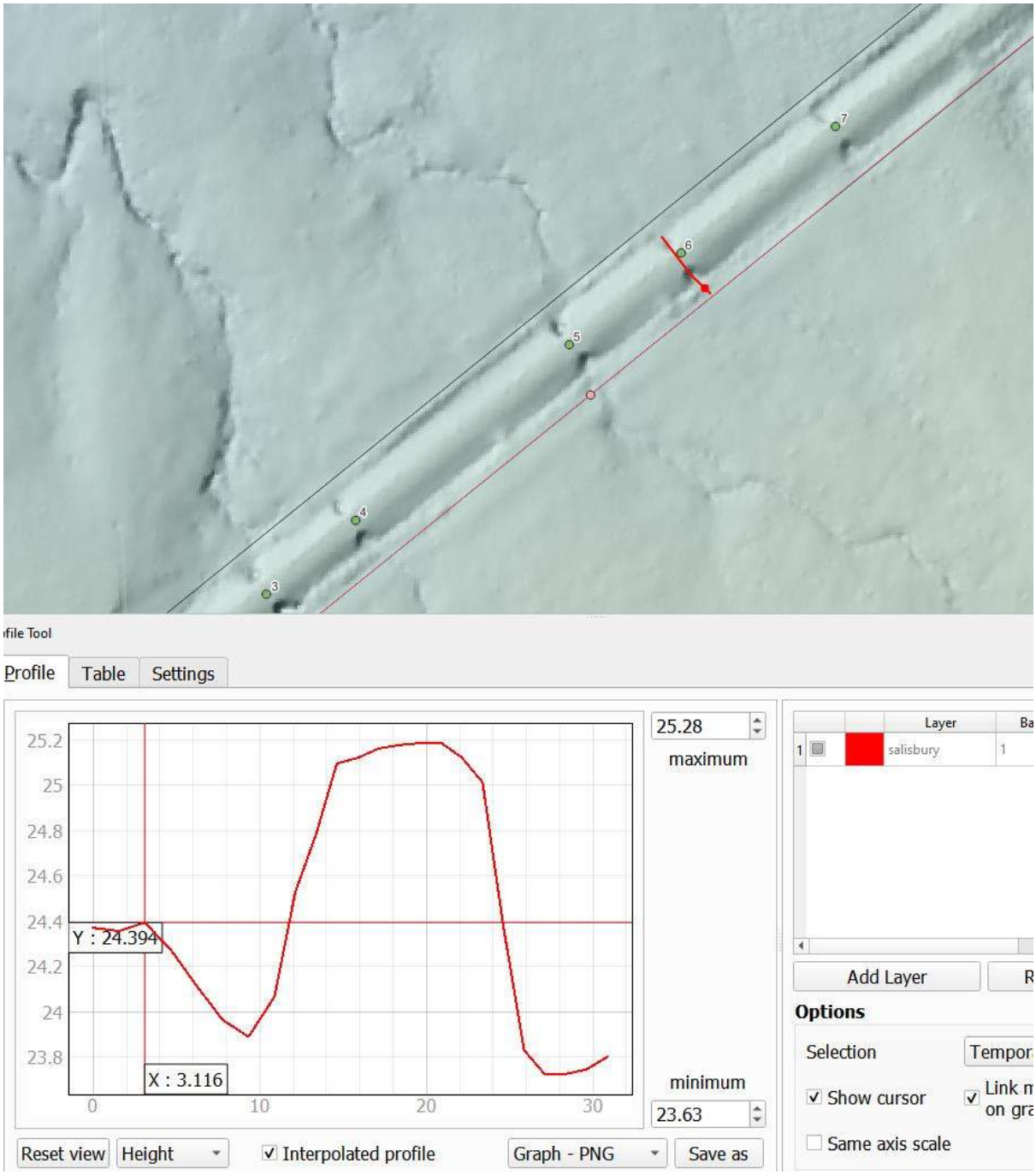

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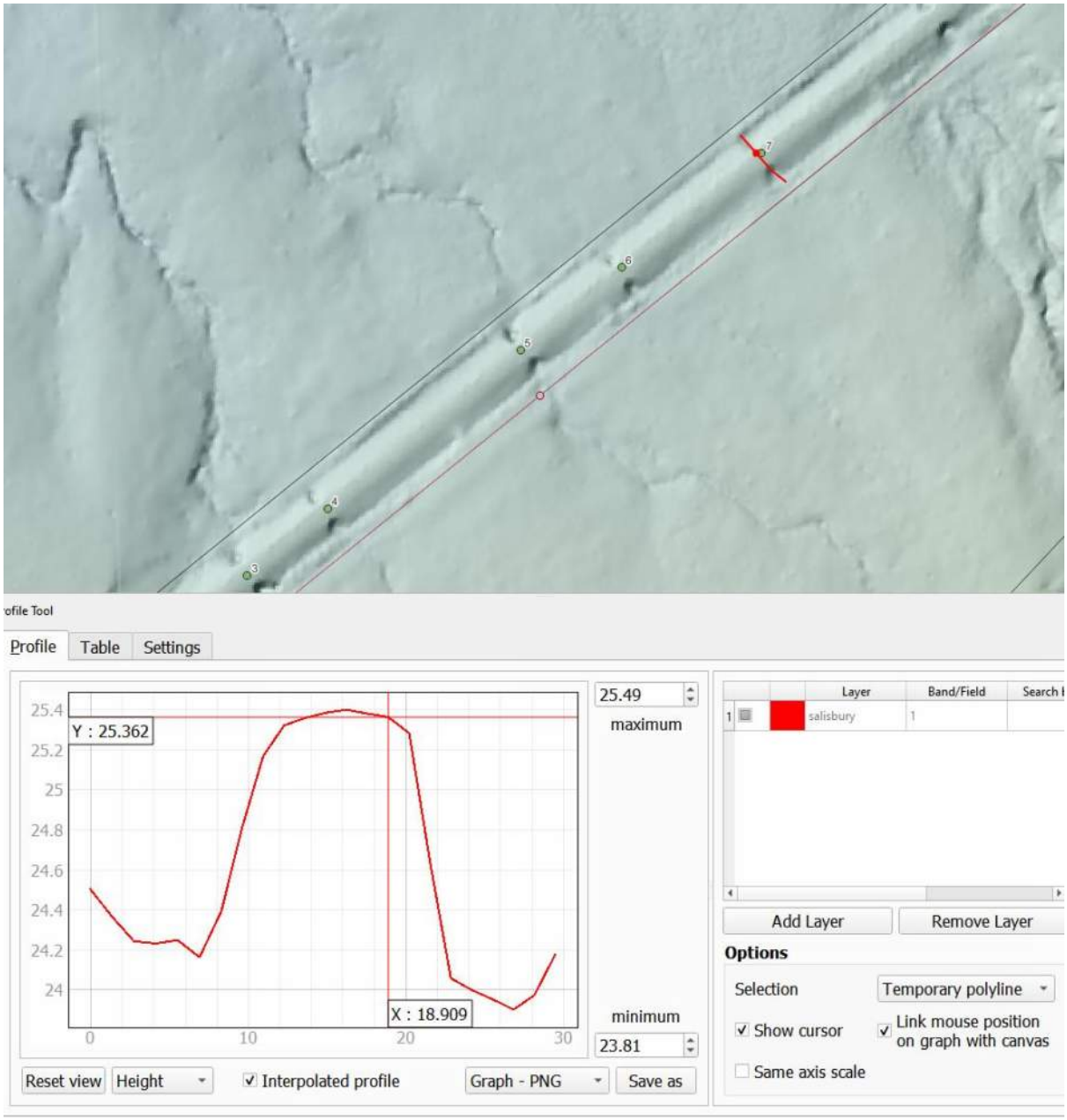


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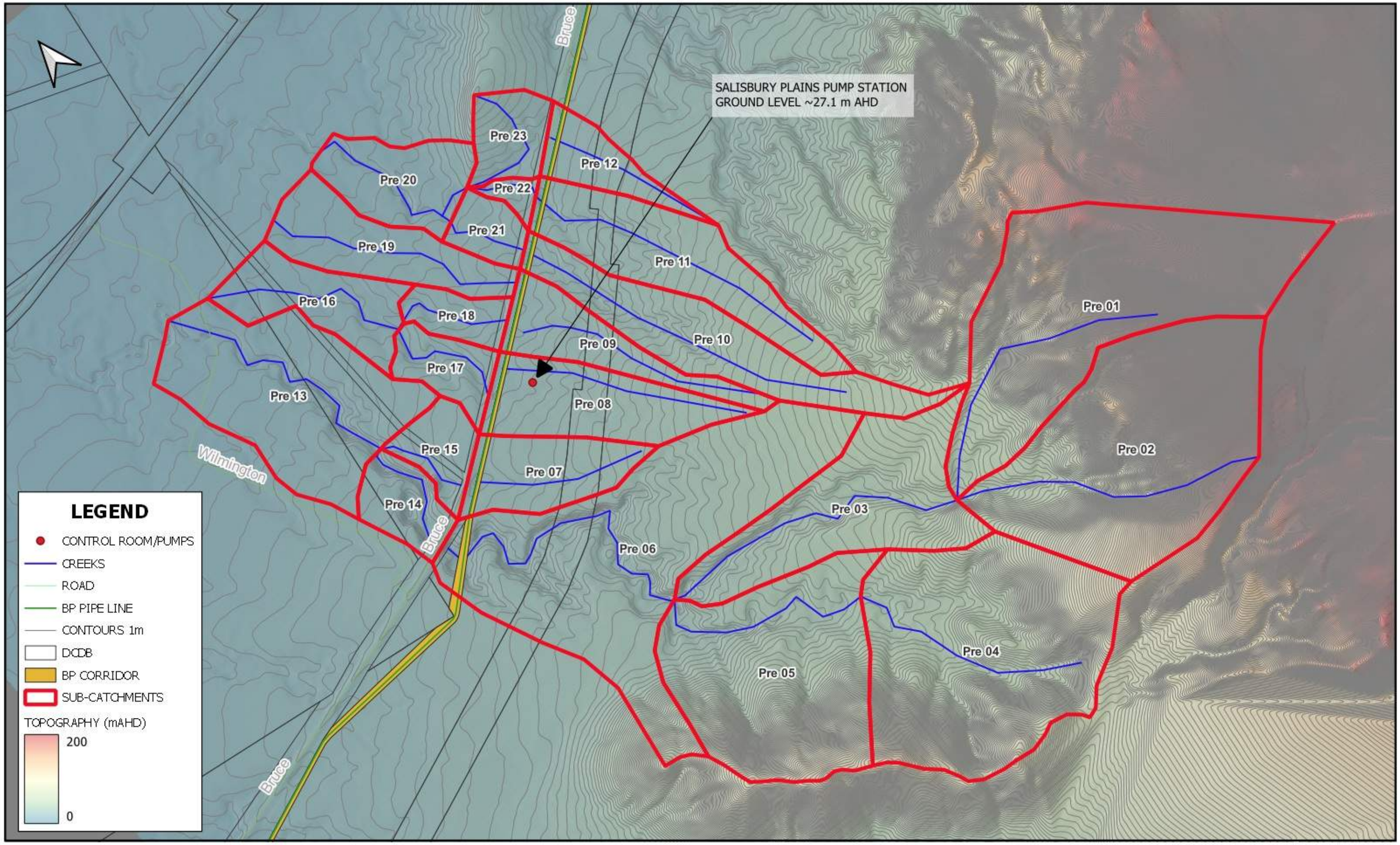



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Same axis scale

APPENDIX C

- MODEL SETUP & FLOOD MAPS



TOPO
Topo Group Pty Ltd.
Unit 7, 16 Innovation Parkway
Birtinya, Queensland. 4575.

REV.		DATE
A		13/03/24

0 0.2 0.4 0.6 0.8 km

1:10,000 (A3)

COORDINATE SYSTEM: GDA 2020/MGA ZONE 55

PROJECT: BOWEN PIPELINE PROJECT	DATE: Mar 2024
CLIENT: BOWEN PIPELINE COMPANY	PROJECT: 23- 0290
FIGURE:SALISBURY SITE - CATCHMENT PLAN	DRAWING: #D01

SALISBURY PLAINS PUMP STATION
GROUND LEVEL ~27.1 m AHD

LEGEND

- CONTROL ROOM/PUMPS
- CONTOUR 1m

2d_bc_Headwall_E02_001
- CN
- SX

1d_nwk_E02_001_L
- C

2d_bc_DS_E02_001_L
- HQ
- DCDB
- BP CORRIDOR

- 2d_rf_E02_001_R
- 2d_code_E02_001_R

LANDUSE
Default n =0.06 (Open Grassland)

2d_mat_Road_E01_001_R
- n = 0.015

TOPOGRAPHY
mAHD
60
0

TOPO
Topo Group Pty Ltd.
Unit 7, 16 Innovation Parkway
Birtinya, Queensland. 4575.

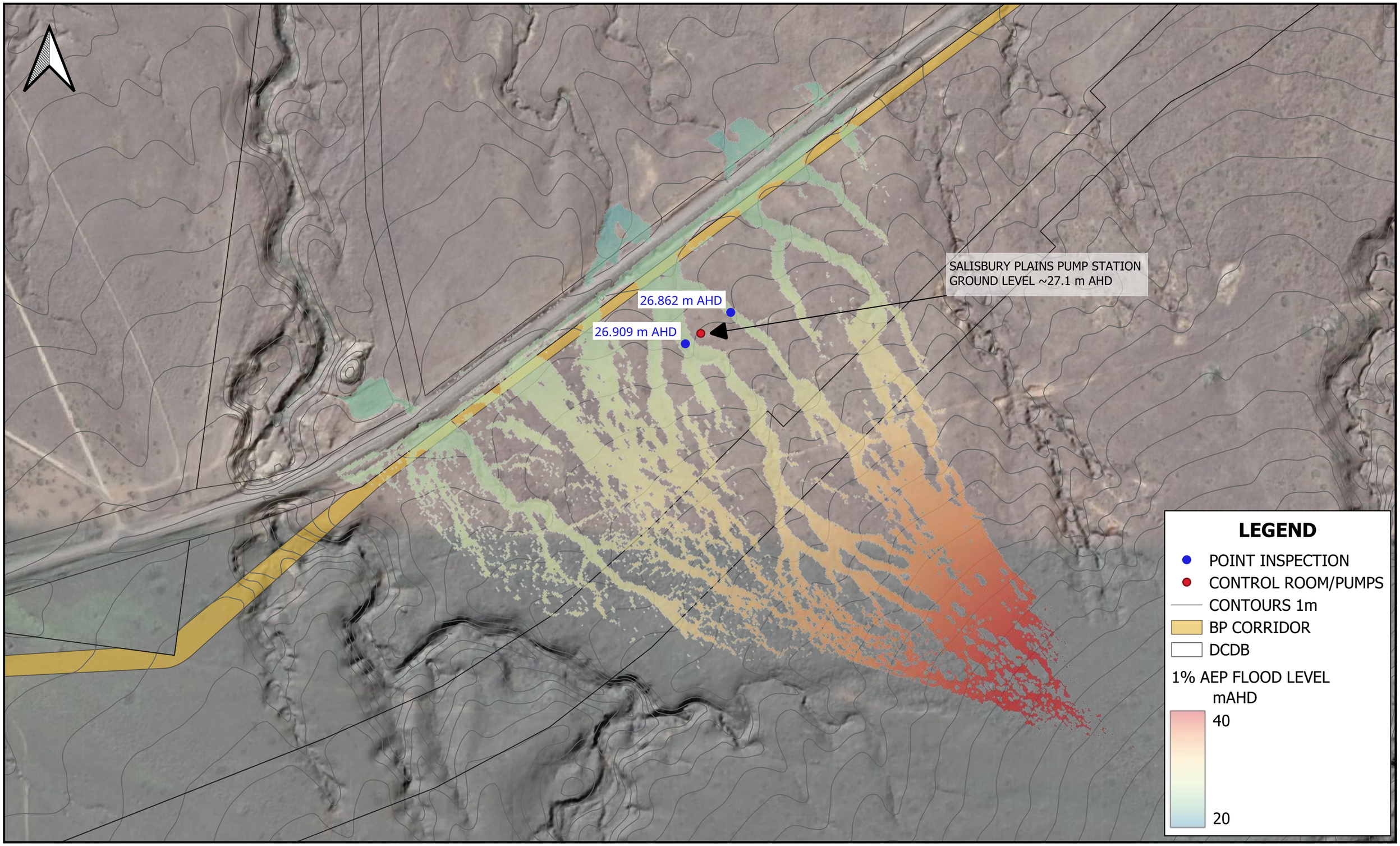
REV.		DATE
A		13/03/2024

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1:4,000 (A3)

COORDINATE SYSTEM: GDA 2020/MGA ZONE 55

PROJECT: BOWEN PIPELINE PROJECT	DATE: MAR 2024
CLIENT: BOWEN PIPELINE COMPANY	PROJECT: 23- 0290
FIGURE: SALISBURY SITE - TUFLOW CONFIGURATION	DRAWING: #D02



TOPO
Topo Group Pty Ltd.
Unit 7, 16 Innovation Parkway
Birtinya, Queensland. 4575.

REV.		DATE
A		13/03/2024

0 50 100 150 200 250 300 m

1:4,000 (A3)

COORDINATE SYSTEM: GDA 2020/MGA ZONE 55

PROJECT: BOWEN PIPELINE PROJECT	DATE: MAR 2024
CLIENT: BOWEN PIPELINE COMPANY	PROJECT: 23- 0290
FIGURE: SALISBURY SITE - 1% AEP PEAK WATER LEVEL	DRAWING: #D03

SALISBURY PLAINS PUMP STATION
GROUND LEVEL ~27.1 m AHD

LEGEND

- CONTROL ROOM/PUMPS
- CONTOURS 1m
- BP CORRIDOR
- DCDB

1% AEP FLOOD DEPTH
m

- <= 0.50 m
- 0.50 - 1.00 m
- 1.00 - 1.50 m
- 1.50 - 2.00 m
- 2.00 - 2.50 m
- 2.50 - 3.00 m
- > 3.00 m

TOPO
Topo Group Pty Ltd.
Unit 7, 16 Innovation Parkway
Birtinya, Queensland. 4575.

REV.		DATE
A		13/03/2024

0 50 100 150 200 250 300 m

1:4,000 (A3)

COORDINATE SYSTEM: GDA 2020/MGA ZONE 55

PROJECT: BOWEN PIPELINE PROJECT	DATE: MAR 2024
CLIENT: BOWEN PIPELINE COMPANY	PROJECT: 23- 0290
FIGURE: SALISBURY SITE - 1% AEP MAXIMUM DEPTH	DRAWING: #D04

SALISBURY PLAINS PUMP STATION
GROUND LEVEL ~27.1 m AHD

LEGEND

- CONTROL ROOM/PUMPS
- CONTOURS 1m
- BP CORRIDOR
- DCDB

1% AEP FLOOD VELOCITY
m/s

- <= 0.50
- 0.50 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- > 2.00

TOPO
Topo Group Pty Ltd.
Unit 7, 16 Innovation Parkway
Birtinya, Queensland. 4575.

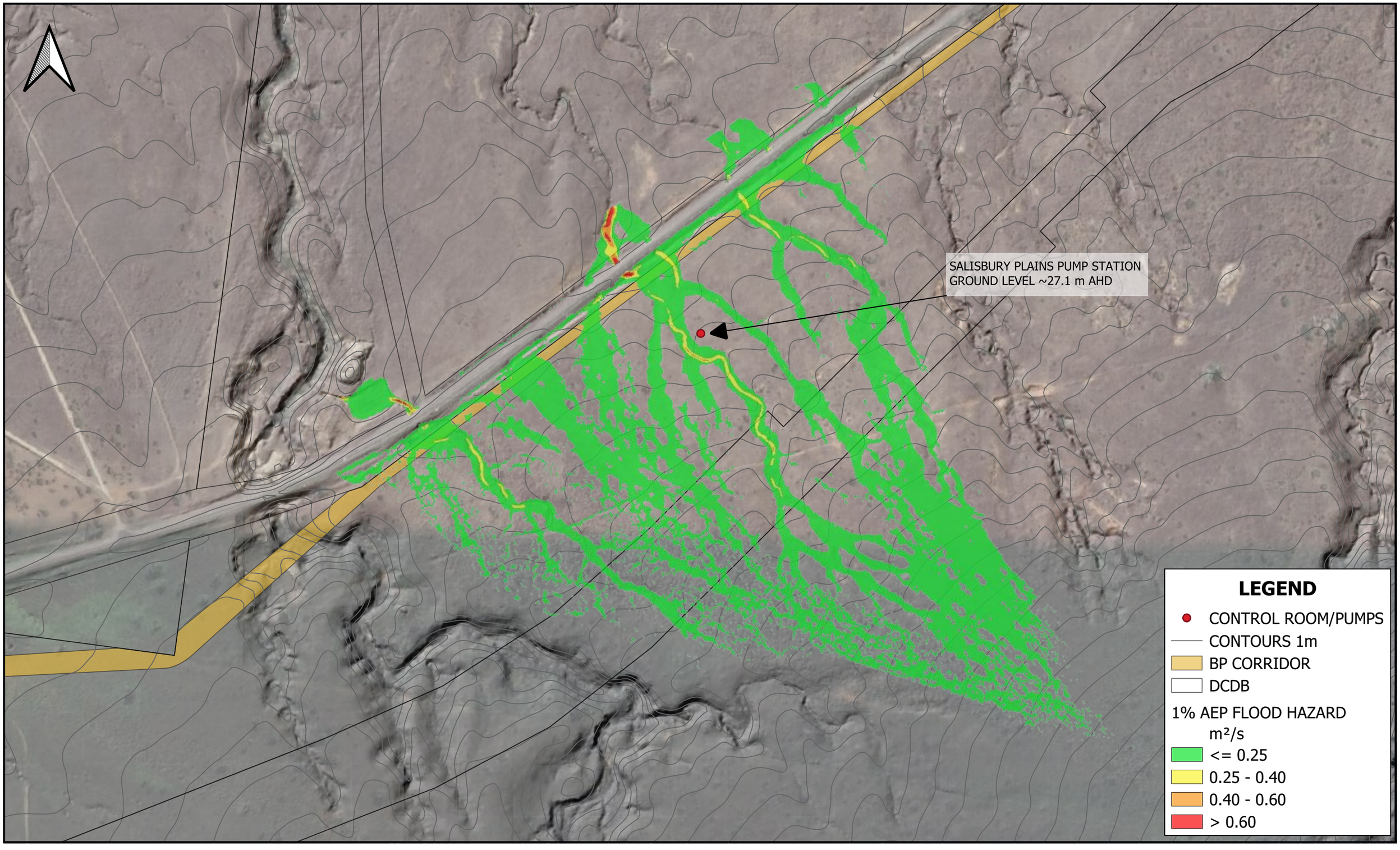
REV.		DATE
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1:4,000 (A3)

COORDINATE SYSTEM: GDA 2020/MGA ZONE 55

PROJECT: BOWEN PIPELINE PROJECT	DATE: MAR 2024
CLIENT: BOWEN PIPELINE COMPANY	PROJECT: 23- 0290
FIGURE: SALISBURY SITE - 1% AEP MAXIMUM VELOCITY	DRAWING: #D05



TOPO
Topo Group Pty Ltd.
Unit 7, 16 Innovation Parkway
Birtinya, Queensland. 4575.

REV.		DATE
A		13/03/2024

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1:4,000 (A3)

COORDINATE SYSTEM: GDA 2020/MGA ZONE 55

PROJECT: BOWEN PIPELINE PROJECT	DATE: MAR 2024
CLIENT: BOWEN PIPELINE COMPANY	PROJECT: 23- 0290
FIGURE: SALISBURY SITE - 1% AEP FLOOD HAZARD DxV	DRAWING: #D06