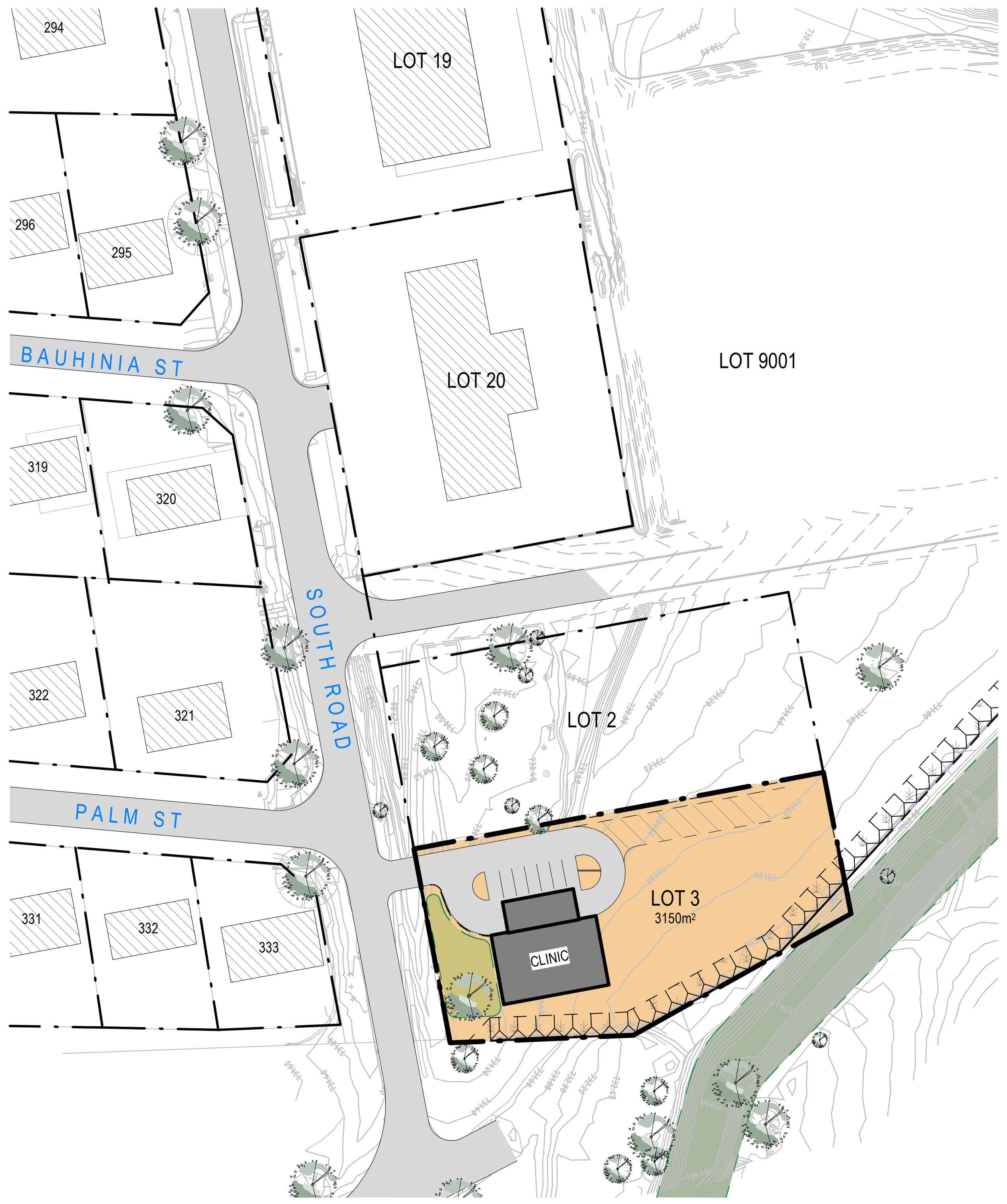
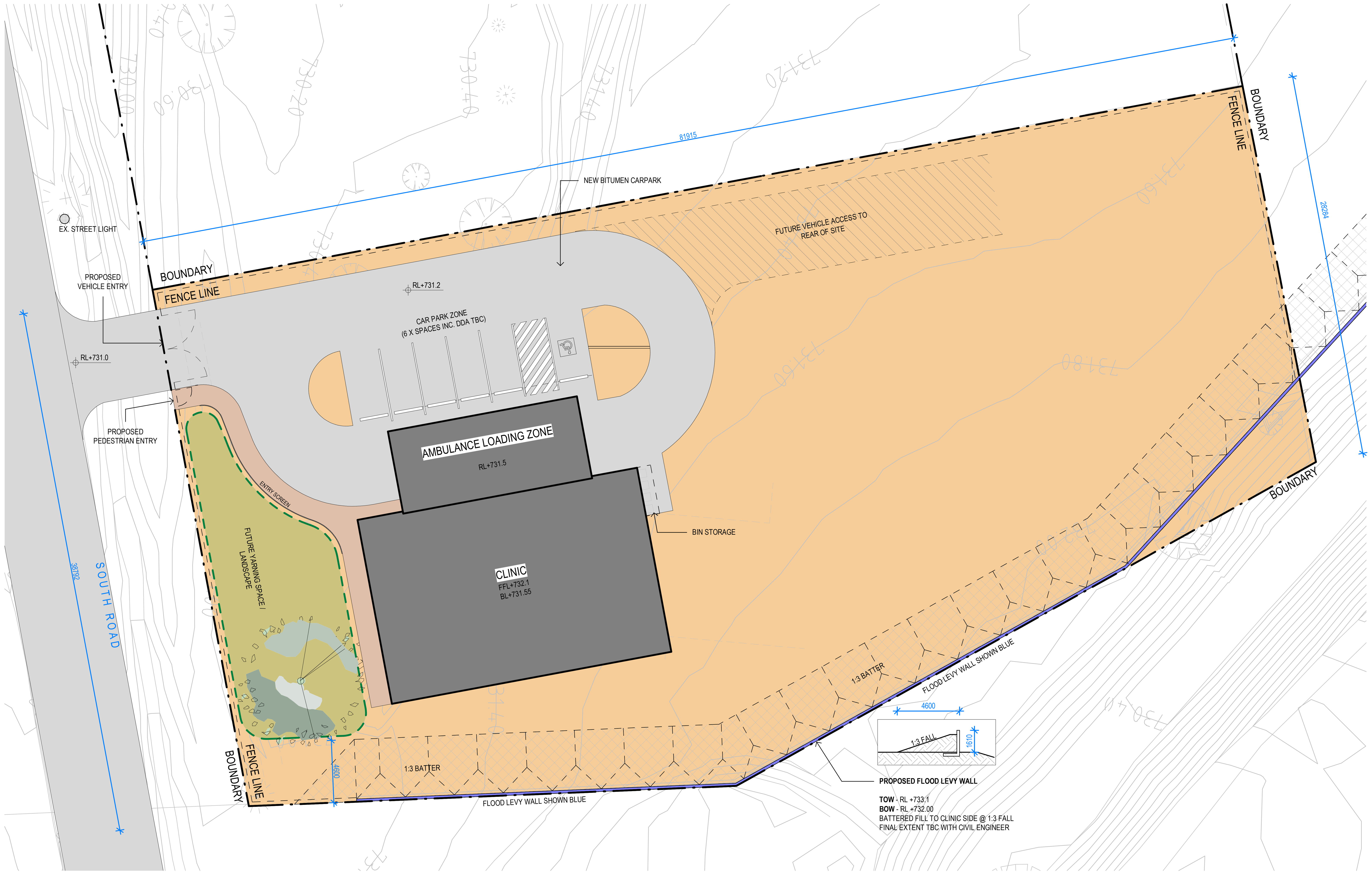
LOCATION PLAN

NTS



CONTEXT PLAN

1 : 1000



SITE PLAN

1 : 200

SITE PLAN LEGEND

- PROPOSED BUILDING / EXTENT OF BENCHED PAD
- CARPARK / DRIVEWAY
- POTENTIAL LANDSCAPE ZONE
- ADDITIONAL CARPARK ZONE

PLOT FILE LOCATION: Z:\Projects\2436_Tom Price\10 Revit\2436_Tom Price_Clinic_ARCH_R24.rvt

PLOT FILE DATE/TIME: 3/10/2025 5:38:05 PM

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A1	27/06/2025	FOR APPROVAL	JM
A2	05/09/2025	FOR APPROVAL	JM
A3	03/10/2025	FOR APPROVAL	JM

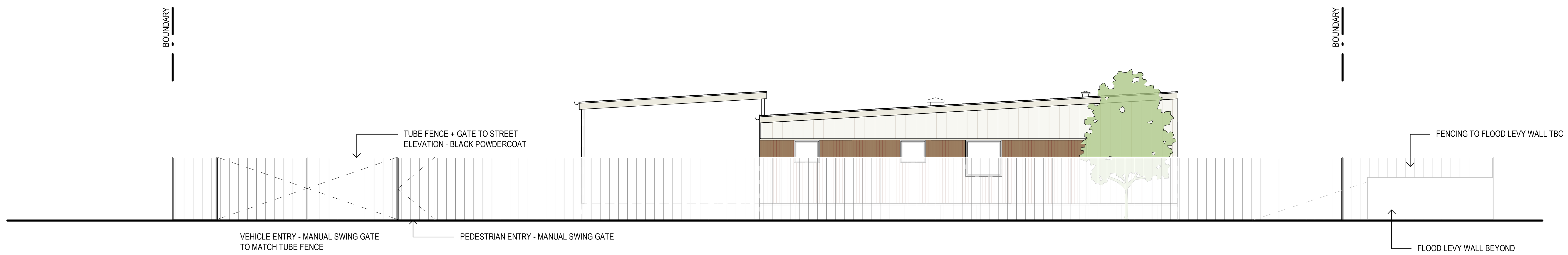
DRAWN **SW** CHECKED **JM**

JOB **2436**
PROJECT **TOM PRICE RENAL DIALYSIS CLINIC**
ADDRESS **LOT 3, SOUTH RD, TOM PRICE, WA 6751**
CLIENT **PAHA**

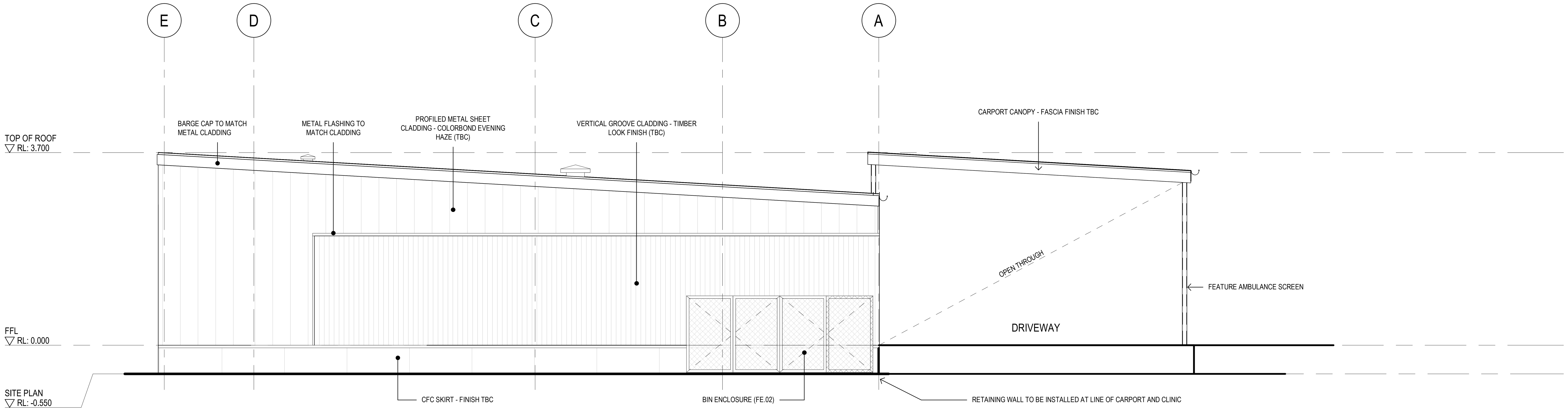
DRAWING **SITE PLAN**

DD1001 A3
FOR REFERENCE

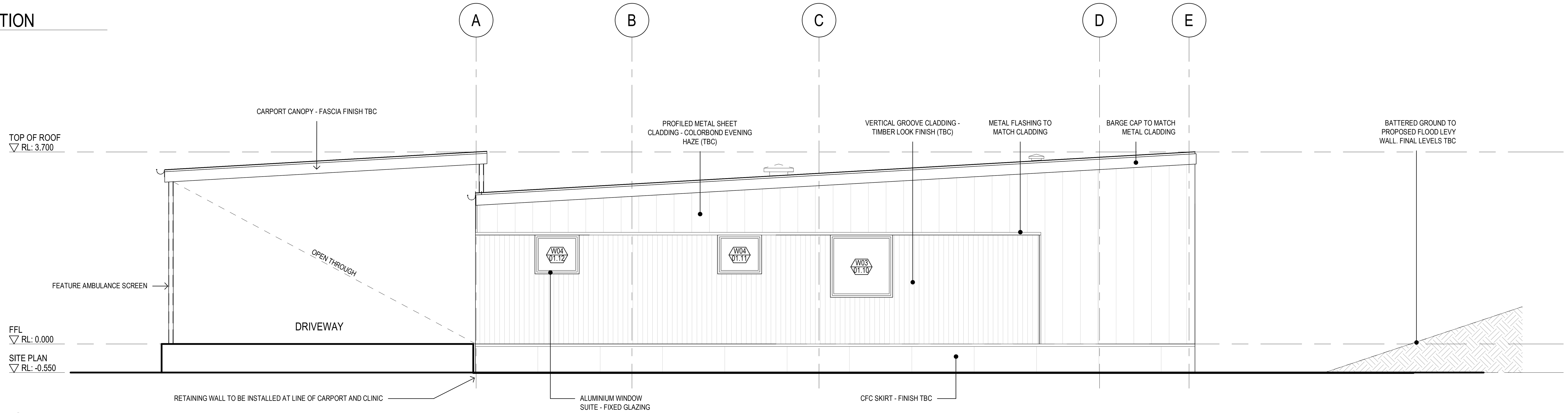
DATE **03/10/2025** SCALE **As indicated** SHEET **A1**



1 SOUTH ROAD STREET ELEVATION
DD2101 1 : 100



E2 ELEVATION
DD2101 1 : 50



E3 ELEVATION
DD2101 1 : 50

PLOT FILE LOCATION: Z:\Projects\2436_Tom Price\10 Revit\2436_Tom Price_Clinic_ARCH_R24.rvt

PLOT FILE DATE/TIME: 3/10/2025 5:38:11 PM

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DRAWN SW CHECKED JM

JOB 2436
PROJECT TOM PRICE RENAL DIALYSIS CLINIC
ADDRESS LOT 3, SOUTH RD, TOM PRICE, WA 6751
CLIENT PAHA

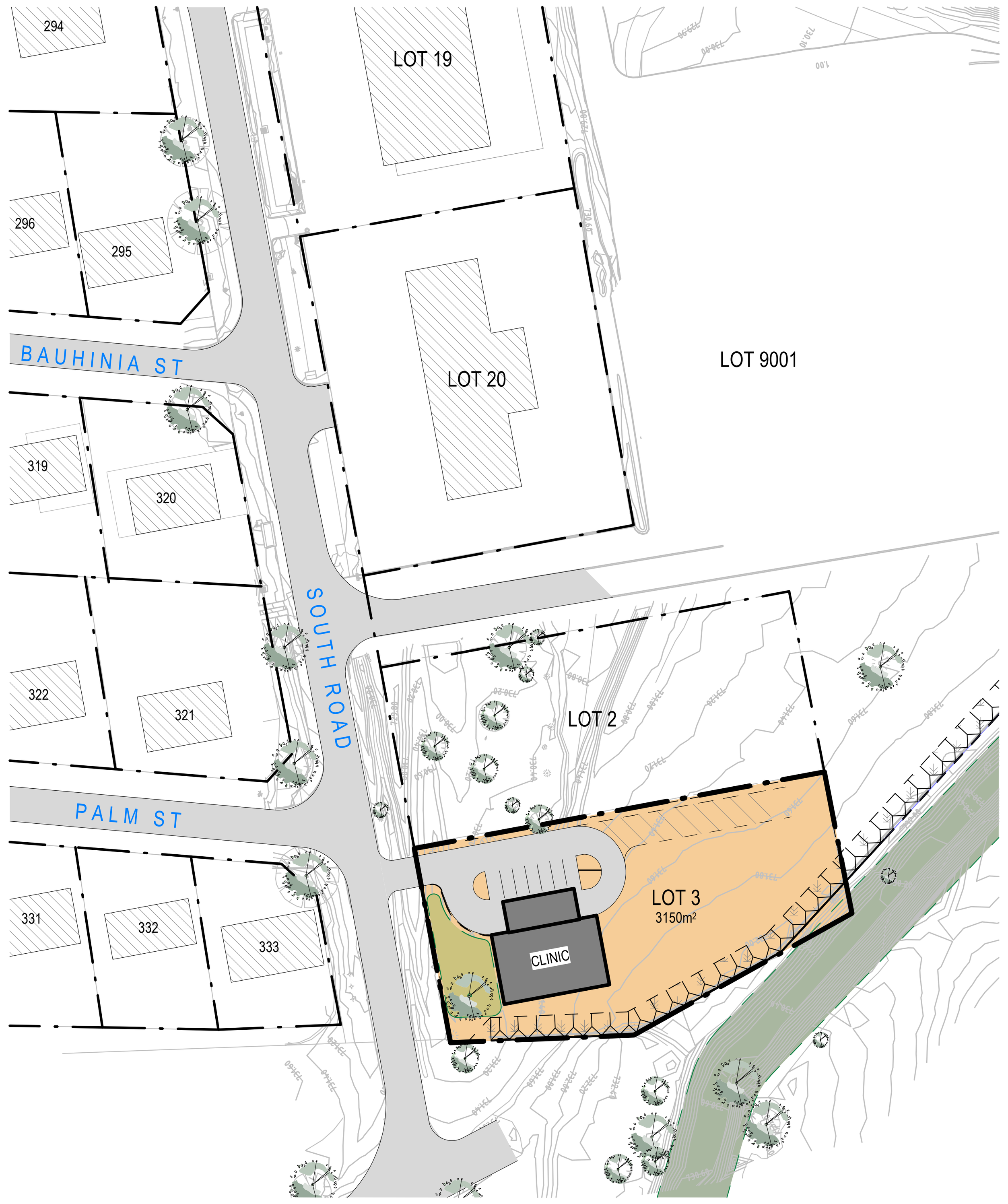
DRAWING ELEVATIONS - CLINIC - SHEET 01

DD3101 A3
FOR APPROVAL

DATE 03/10/2025 SCALE As indicated SHEET A1

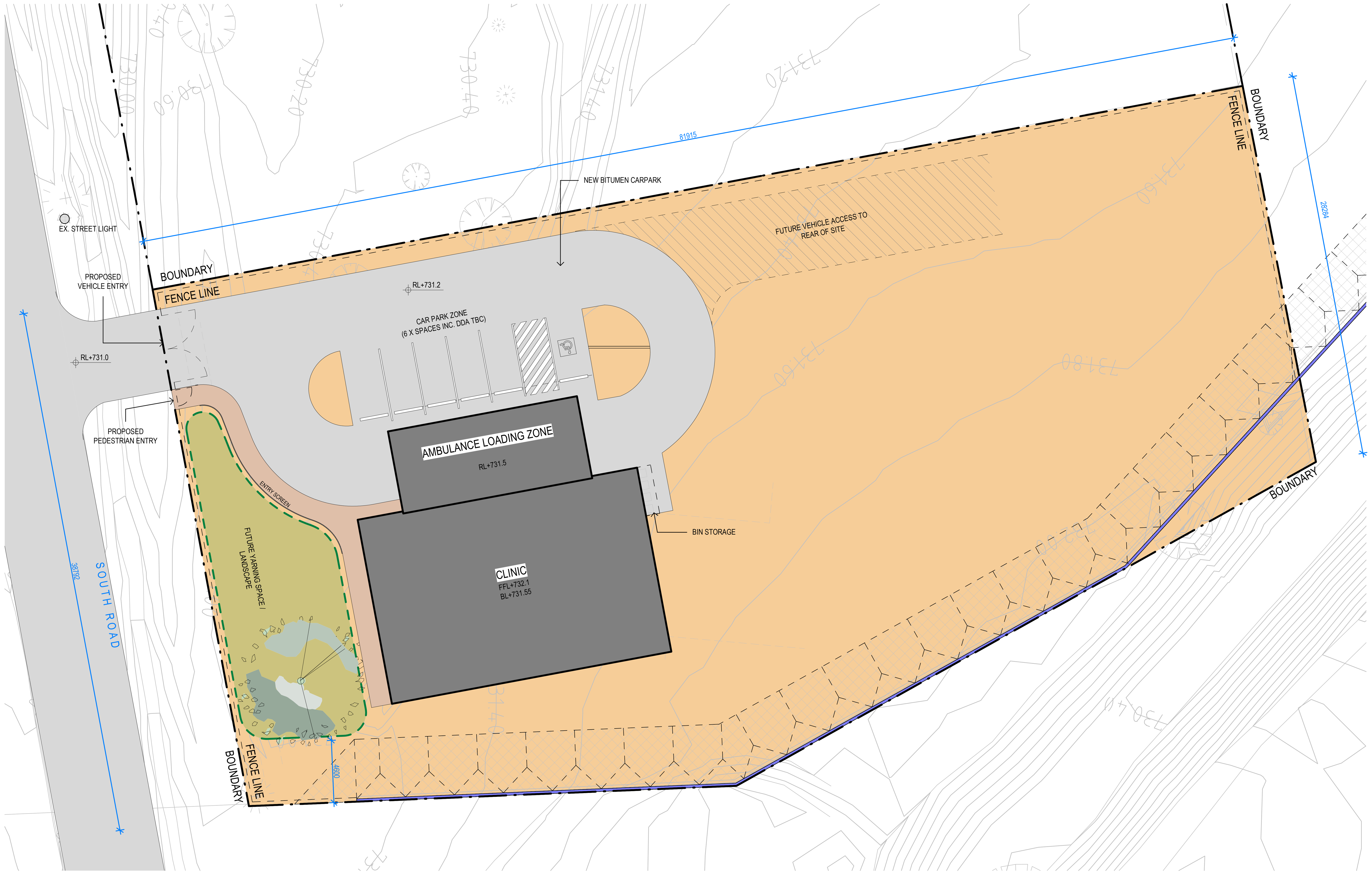
LOCATION PLAN

NTS



CONTEXT PLAN

1 : 1000



SITE PLAN

1 : 200

SITE PLAN LEGEND

- PROPOSED BUILDING / EXTENT OF BENCHED PAD
- CARPARK / DRIVEWAY
- POTENTIAL LANDSCAPE ZONE
- ADDITIONAL CARPARK ZONE

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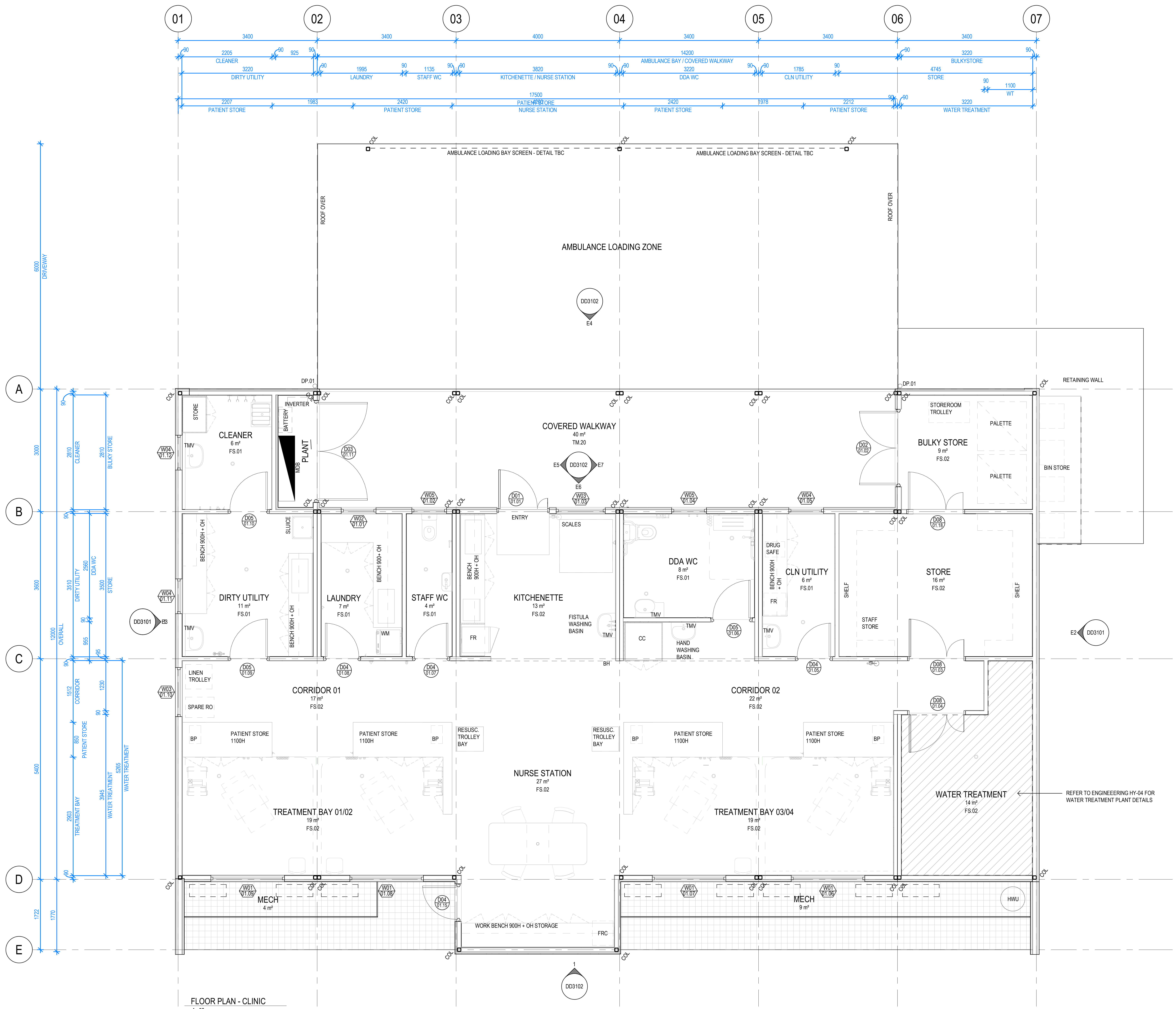
ADDRESS LOT 3, SOUTH RD, TOM PRICE, WA 6751

DRAWING SITE PLAN

DRAWN SW CHECKED JM CLIENT PAHA

SD1001 A2
FOR REFERENCE

DATE 05/09/2025 SCALE As indicated SHEET A1



FLOOR PLAN - CLINIC
1 : 50

AREA SCHEDULE

BUILDING FOOTPRINT	236m²
OUTDOOR FOOTPRINT	40m²
OVERALL FOOTPRINT	**286m²**

LEGEND

FP	FEED PUMP
FW	FLOOR WASTE
FE	FIRE EXTINGUISHER (DRY)
TMV	THERMOSTATIC MIXING VALVE
CC	COMMS CABINET
FR	FRIDGE
FRC	FIRE RATED CABINET (RECORDS CUPBOARD)
DS	DRUG SAFE
WM	WASHING MACHINE

PLOT FILE LOCATION: Z:\Projects\2436_Tom Price\10 Revit\2436_Tom Price_Clinic_ARCH_R24.rvt

PLOT FILE DATE/TIME: 11/09/2025 11:43:50 AM

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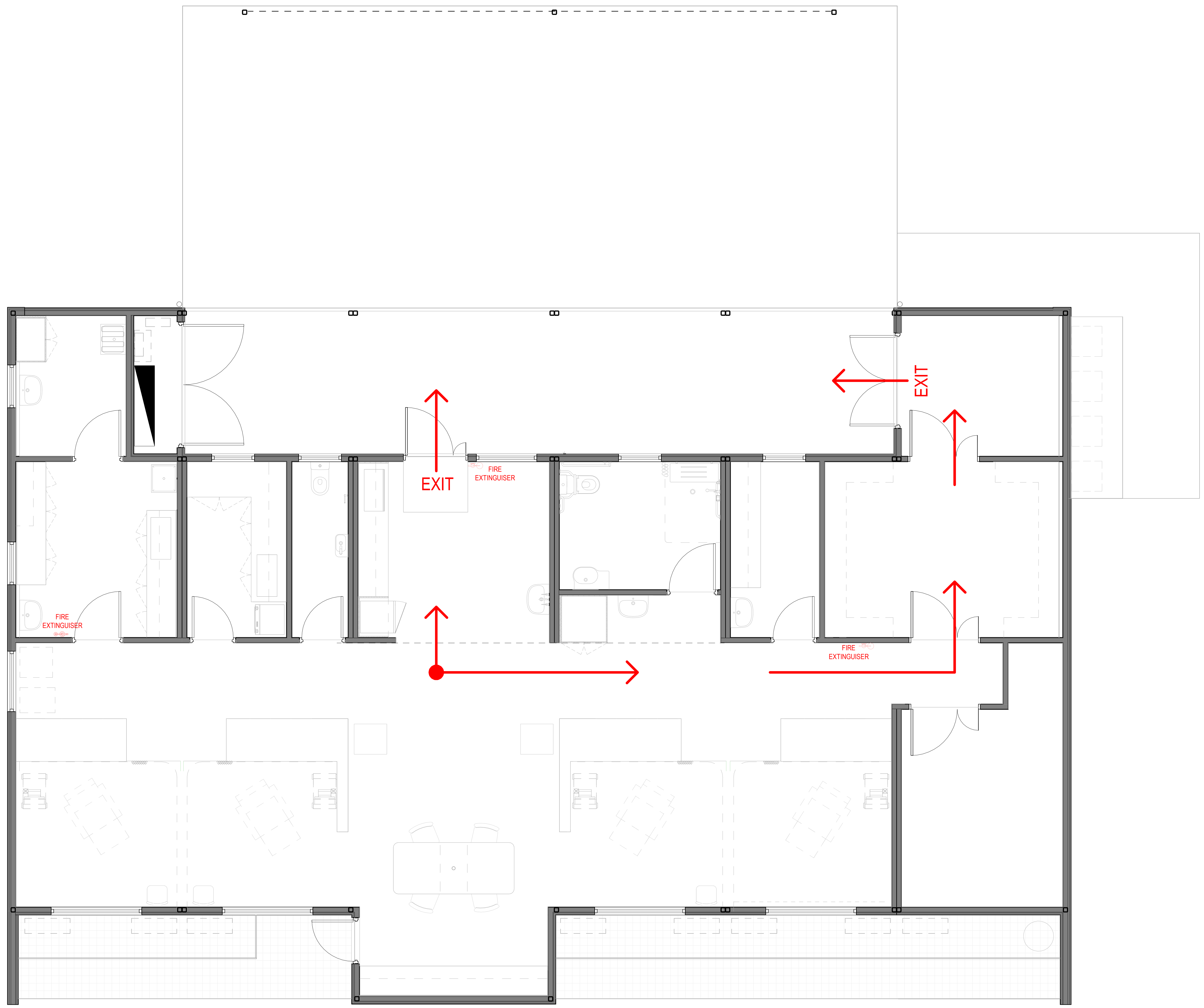
JOB **2436**
PROJECT **TOM PRICE RENAL DIALYSIS CLINIC**
ADDRESS **LOT 3, SOUTH RD, TOM PRICE, WA 6751**
CLIENT **PAHA**

DRAWING **FLOOR PLAN**

DD2101 A2
FOR APPROVAL

DATE **05/09/2025** SCALE **1 : 50** SHEET **A1**



1 EVACUATION FLOOR PLAN - CLINIC 1 : 50

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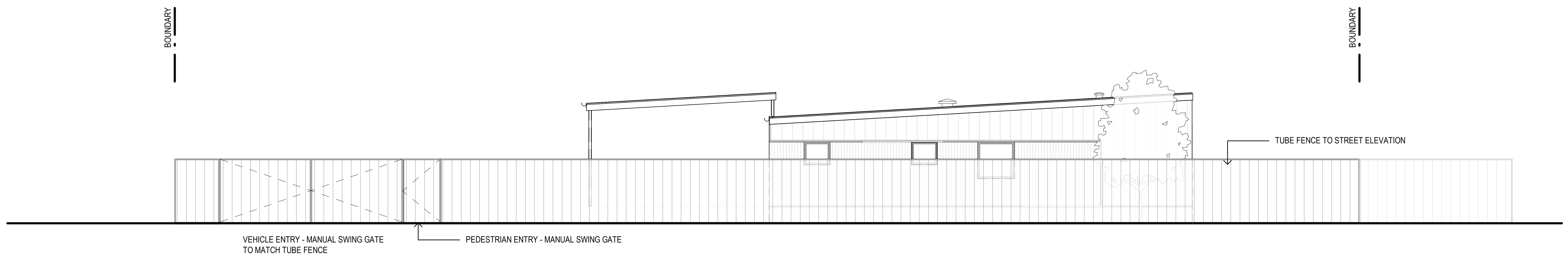
JOB **2436**
PROJECT **TOM PRICE RENAL DIALYSIS CLINIC**
ADDRESS **LOT 3, SOUTH RD, TOM PRICE, WA 6751**
CLIENT **PAHA**

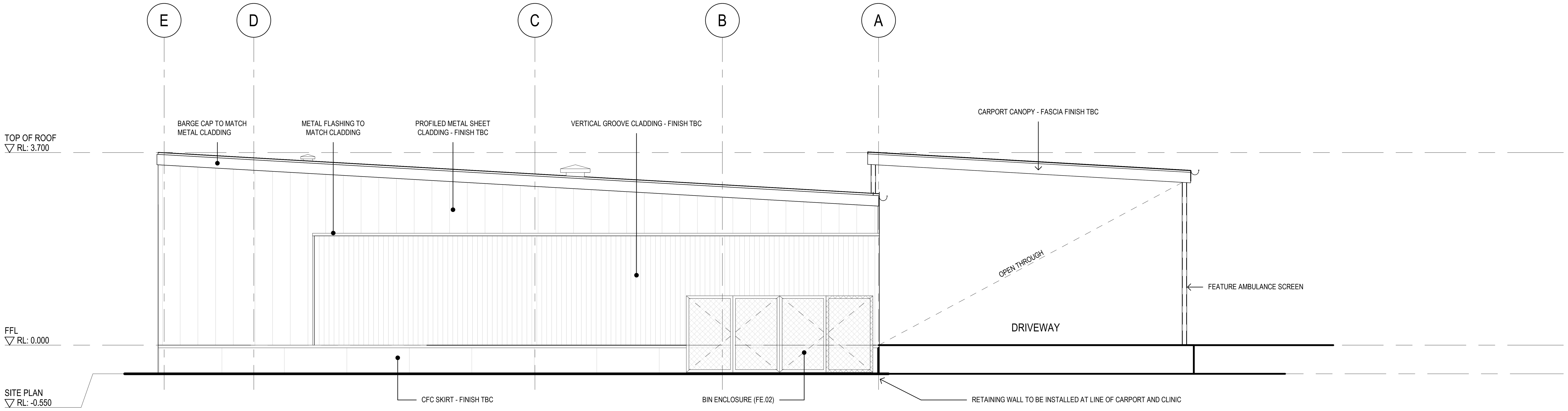
DRAWING **FLOOR PLAN - EVACUATION**

ASK002 A2
FOR APPROVAL

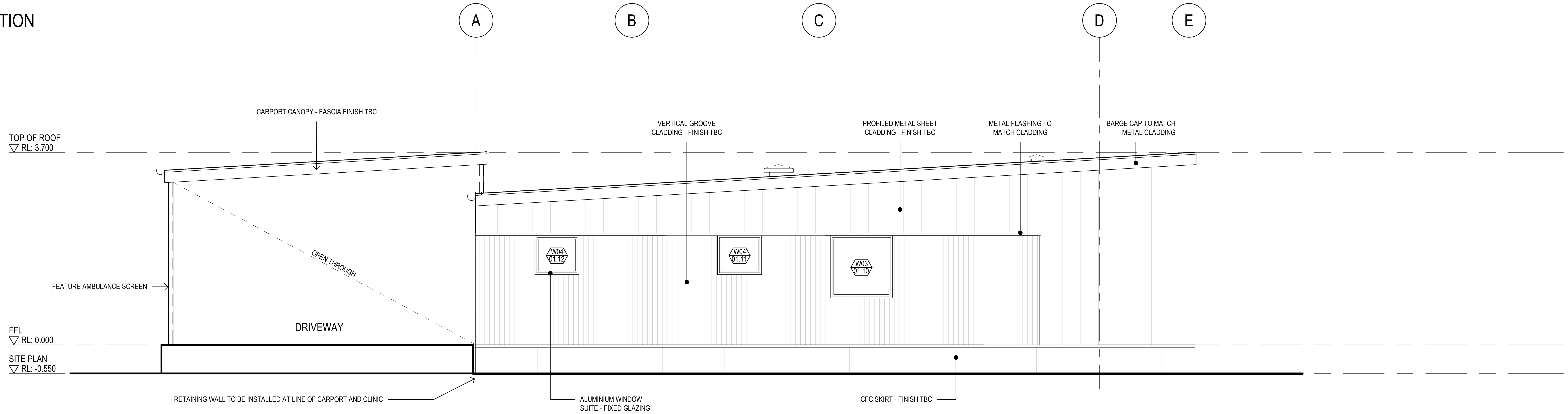
DATE **05/09/2025** SCALE **1 : 50** SHEET **A1**



1 SOUTH ROAD STREET ELEVATION
DD2101
1 : 100



E2 ELEVATION
DD2101
1 : 50



E3 ELEVATION
DD2101
1 : 50

PLOT FILE LOCATION: Z:\Projects\2436_Tom Price\10 Revit\2436_Tom Price_Clinic_ARCH_R24.rvt
PLOT FILE DATE/TIME: 16/09/2025 1:33:01 PM

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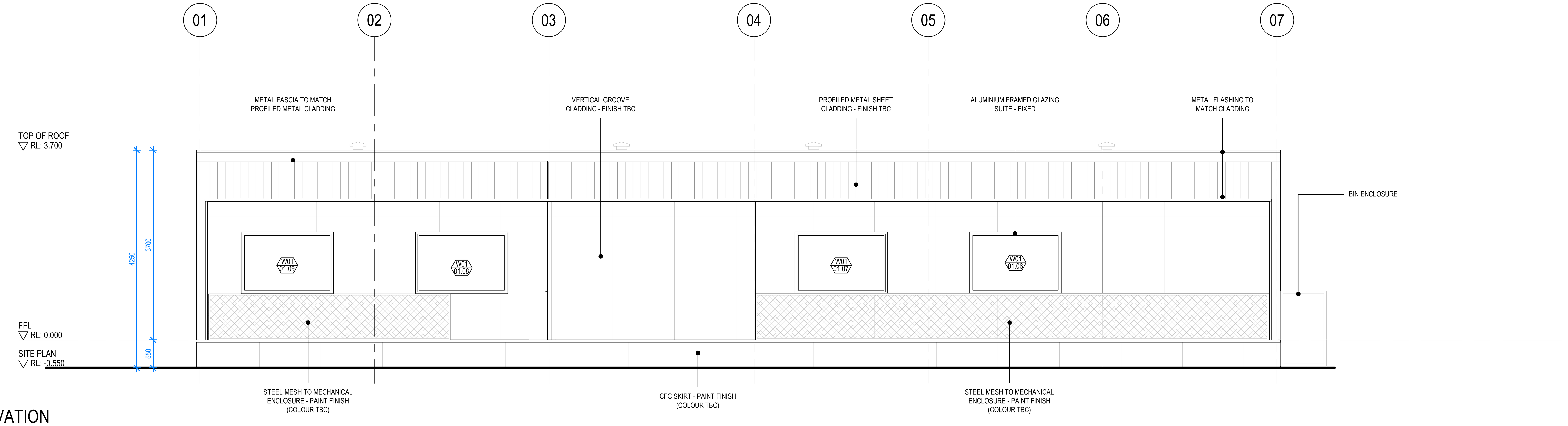
CLIENT PAHA

DRAWING ELEVATIONS - CLINIC - SHEET 01

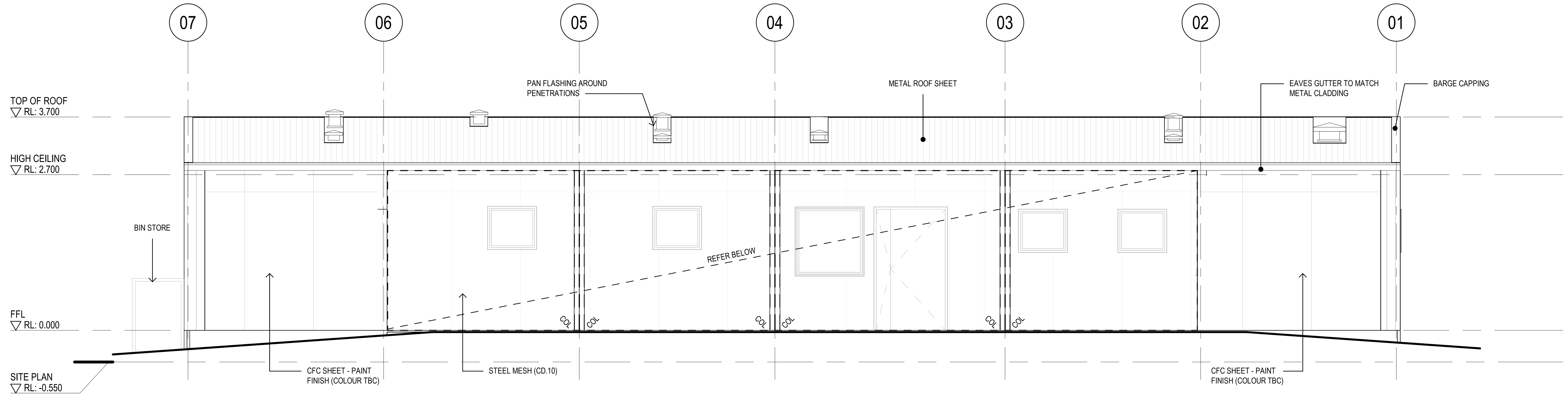
DRAWN SW CHECKED JM

DD3101 A2
FOR APPROVAL

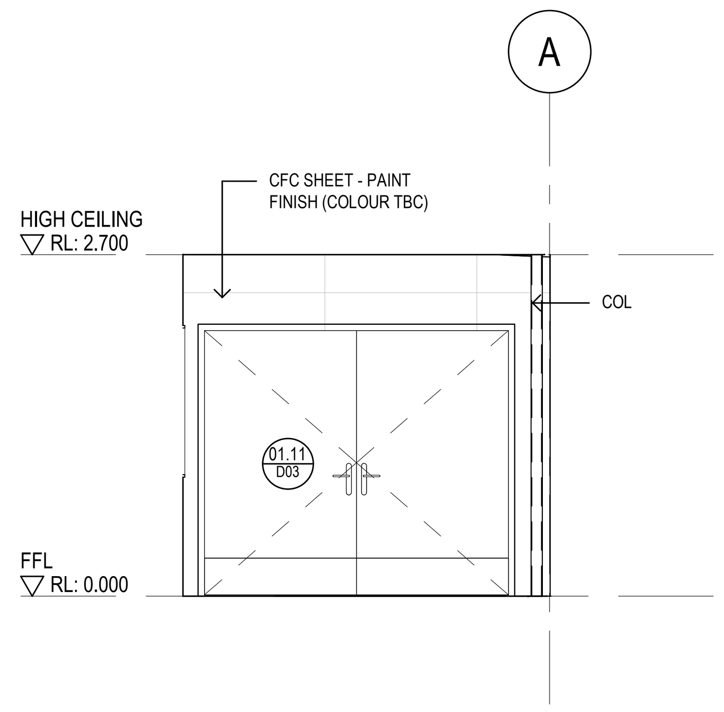
DATE 05/09/2025 SCALE As indicated SHEET A1



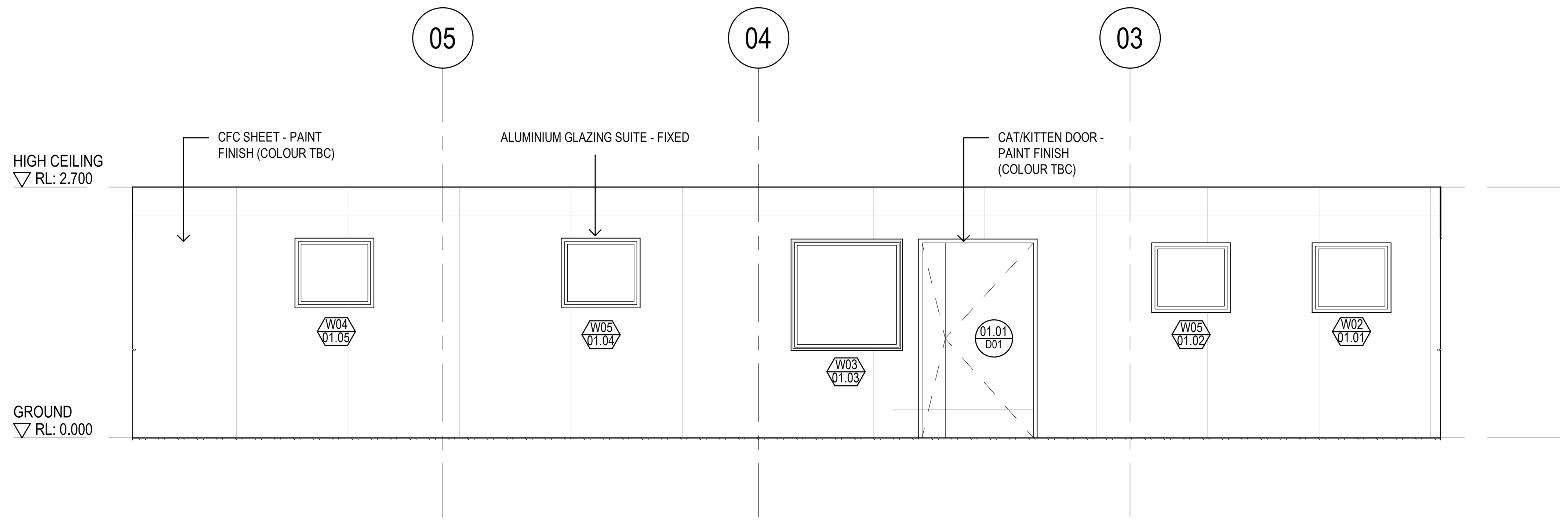
1 ELEVATION
DD2101 1 : 50



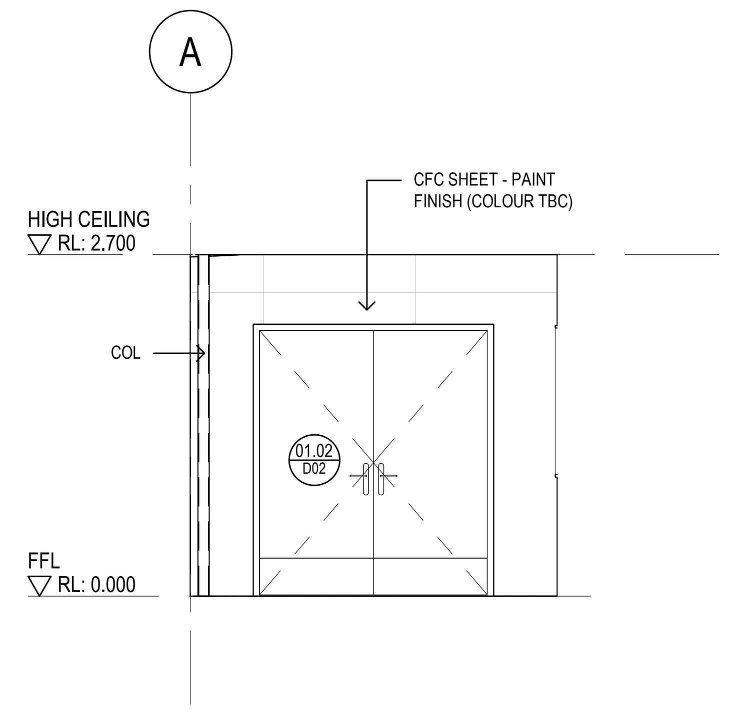
E4 ELEVATION
DD2101 1 : 50



E5 ELEVATION
DD2101 1 : 50



E6 ELEVATION
DD2101 1 : 50



E7 ELEVATION
DD2101 1 : 50

PLOT FILE LOCATION: Z:\Projects\2436_Tom Price\10 Revit\2436_Tom Price_Clinic_ARCH_R24.rvt

PLOT FILE DATE/TIME: 5/09/2025 4:59:34 PM

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A2	05/09/2025	FOR APPROVAL	JM

DRAWN SW CHECKED JM

JOB 2436
PROJECT TOM PRICE RENAL DIALYSIS CLINIC
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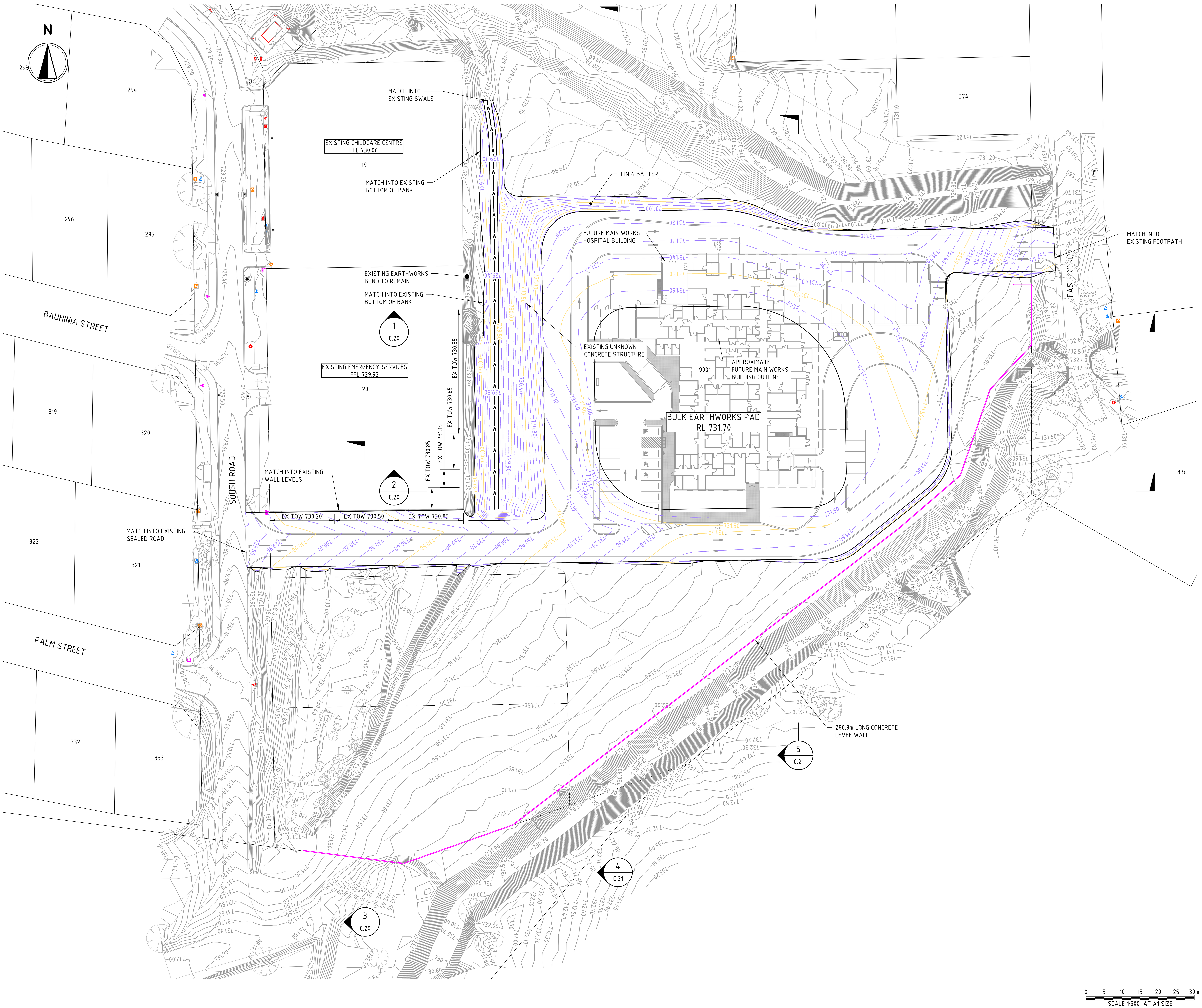
CLIENT PAHA

DRAWING ELEVATIONS - CLINIC - SHEET 02

DD3102 A2
FOR APPROVAL

DATE 05/09/2025 SCALE 1 : 50 SHEET A1



NOTES

1. DO NOT SCALE DRAWINGS.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

LEGEND

- CADASTRAL BOUNDARY
- PROPOSED CADASTRAL BOUNDARY
- RETAINING WALL
- NEW SWALE
- BULK EARTHWORKS CONTOURS - MAJOR (0.5m INTERVALS) — 731.50
- BULK EARTHWORKS CONTOURS - MINOR (0.1m INTERVALS) — 731.60
- EXISTING CONTOURS (0.1m INTERVALS) — 730.40

REV	DATE	DESCRIPTION	RVD
3	23.06.25	RE-ISSUED FOR TENDER	LH
2	16.05.25	RE-ISSUED FOR TENDER	LH
1	06.05.25	RE-ISSUED FOR TENDER	LH
0	12.12.24	ISSUED FOR TENDER	LH

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BG&E DOCUMENT No: P24172

Government of **Western Australia**
Department of **Finance**
Buildings and Contracts

CIVIL

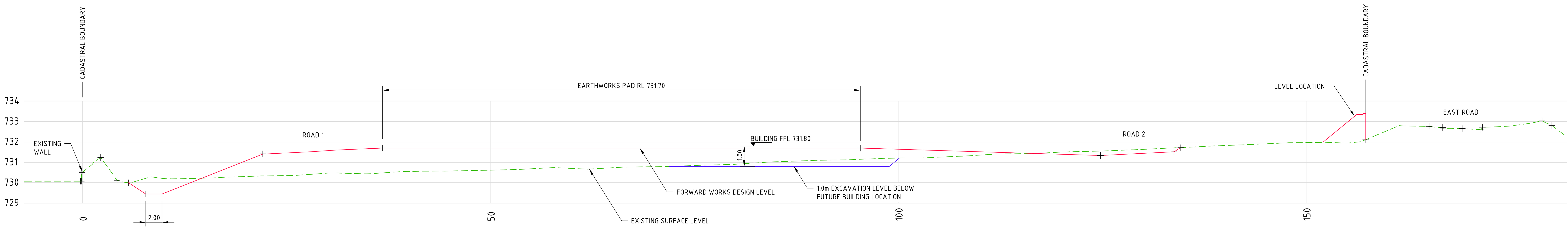
TOM PRICE HOSPITAL REDEVELOPMENT
FORWARD WORKS
BULK EARTHWORKS PLAN

DRAWN JS	DESIGNED LG	REDUCTION 0 25	
CHECKED LH	PRINCIPAL		
APPROVED LH			
SCALE 1:500	DATE 19.11.24	DRAWING No. C.11	3
DF PROJ No. 15063	DF FILE No.		

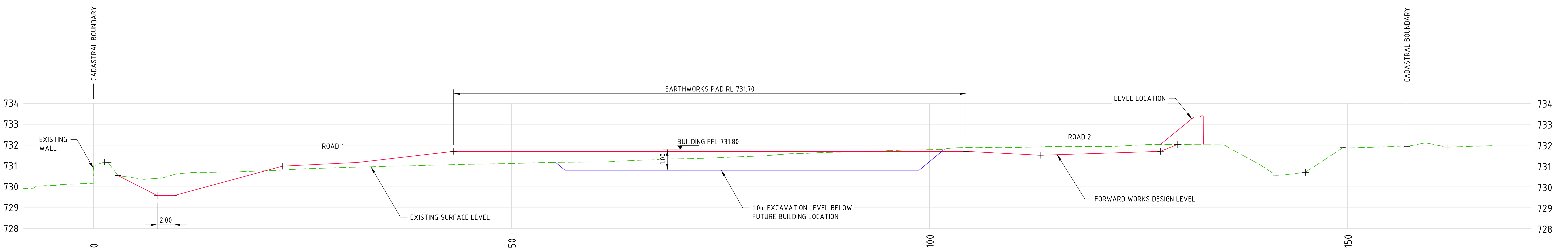
THIS IS A CADD DRAWING
DO NOT AMEND MANUALLY

NOTES

1. DO NOT SCALE DRAWINGS.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.



SECTION 1
SCALE 1:250H, 1:100V C.11



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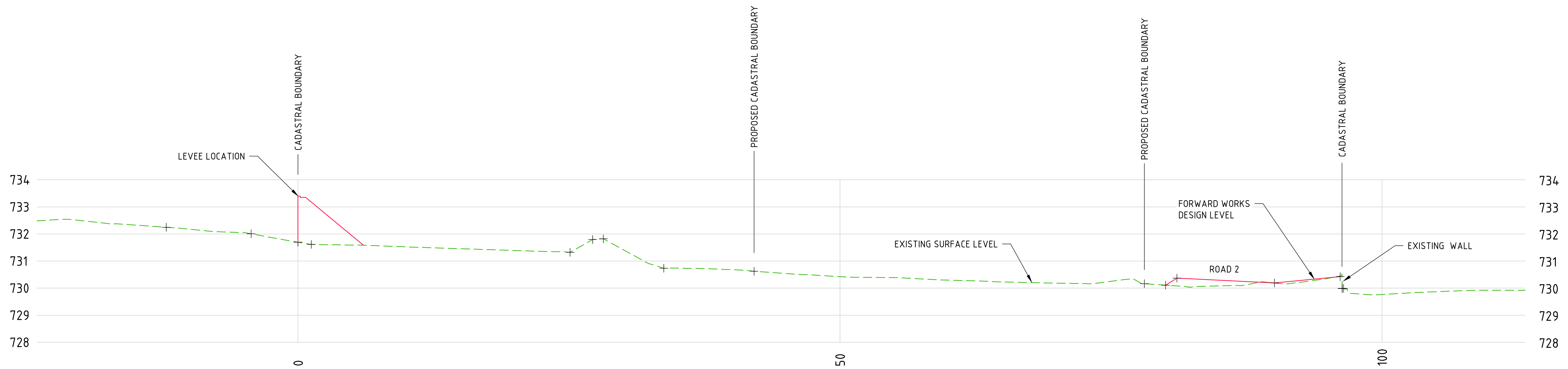
SCALE 1:250H, 1:100V C.11



SECTION 3
SCALE 1:250H, 1:100V C.11

REV	DATE	DESCRIPTION	RVD
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2	06.05.25	RE-ISSUED FOR TENDER	LH
1	09.01.25	RE-ISSUED FOR TENDER	LH
0	12.12.24	ISSUED FOR TENDER	LH

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Buildings and Contracts

CIVIL

TOM PRICE HOSPITAL REDEVELOPMENT

FORWARD WORKS
CROSS SECTIONS
SHEET 1

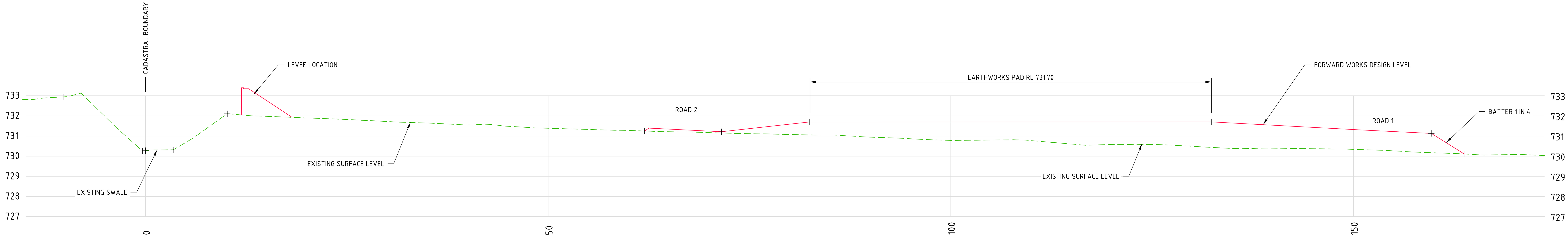
DRAWN	JS	DESIGNED	LG	REDUCTION
CHECKED	LH	PRINCIPAL		0 25
APPROVED	LH			
SCALE	1:250H, 1:100V	DATE	28.11.24	DRAWING No.
DF PROJ No.	15063	DF FILE No.		C.20 3

0 2.5 5.0 7.5 10 12.5 15m
SCALE 1:250 AT A1 SIZE

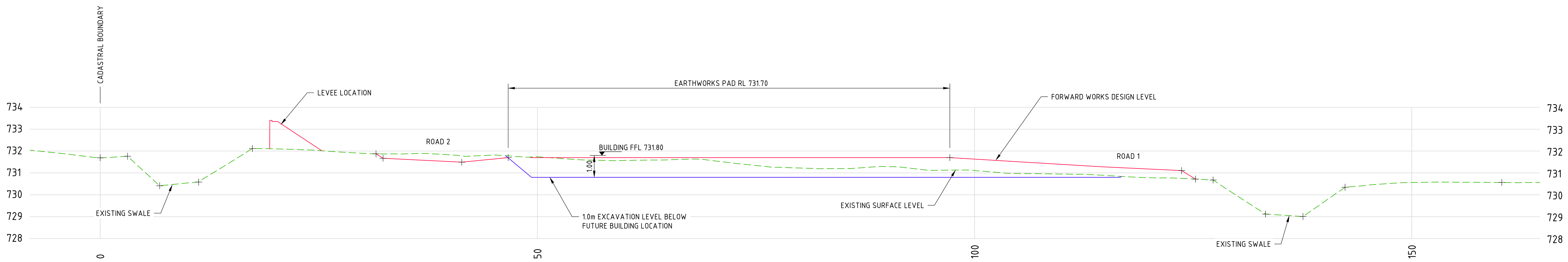
0 1 2 3 4 5 6m
SCALE 1:100 AT A1 SIZE

NOTES

1. DO NOT SCALE DRAWINGS.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.



SECTION 4
SCALE 1:250H, 1:100V
C.11



SECTION 5
SCALE 1:250H, 1:100V
C.11

REV	DATE	DESCRIPTION	RVD
2	23.06.25	RE-ISSUED FOR TENDER	LH
1	09.01.25	RE-ISSUED FOR TENDER	LH
0	12.12.24	ISSUED FOR TENDER	LH

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CIVIL
TOM PRICE HOSPITAL REDEVELOPMENT
FORWARD WORKS
CROSS SECTIONS
SHEET 2

DRAWN JS	DESIGNED LG	REDUCTION 0 25		
CHECKED LH	PRINCIPAL			
APPROVED LH				
SCALE 1:250H, 1:100V	DATE 28.11.24	DRAWING No. C.21 2		
DF PROJ No. 15063	DF FILE No.			

THIS IS A CADD DRAWING
DO NOT AMEND MANUALLY

0 2.5 5.0 7.5 10 12.5 15m
SCALE 1:250 AT A1 SIZE

0 1 2 3 4 5 6m
SCALE 1:100 AT A1 SIZE

1.0 GENERAL

1.01 TECHNICAL SPECIFICATIONS OR SPECIFIC INSTRUCTIONS ON DRAWINGS TAKE PRECEDENCE OVER THESE NOTES.

1.02 THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL AND OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. REFER ANY DISCREPANCY TO THE SUPERINTENDENT BEFORE PROCEEDING WITH THE WORK. CONSTRUCTION FROM THESE DRAWINGS, AND THEIR ASSOCIATED CONSULTANTS' DRAWINGS, IS NOT TO COMMENCE UNTIL APPROVED BY THE LOCAL AUTHORITIES.

1.03 ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT AND CURRENT AUSTRALIAN STANDARDS AND WITH BYLAWS AND ORDINANCES OF THE RELEVANT BUILDING AUTHORITIES EXCEPT WHERE SPECIFICALLY VARIED BY THE PROJECT SPECIFICATION.

1.04 VERIFY ALL DIMENSIONS RELEVANT TO SETTING OUT & OFF-SITE WORK BEFORE CONSTRUCTION & FABRICATION COMMENCES. DIMENSIONS ARE NOT TO BE INFERRED BY SCALING FROM THE DRAWINGS.

1.05 DURING CONSTRUCTION THE STRUCTURE, AND ANY ASSOCIATED EXCAVATIONS, SHALL BE MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVERSTRESSED. TEMPORARY BRACING SHALL BE PROVIDED BY THE BUILDER TO KEEP THE WORKS AND EXCAVATIONS STABLE AT ALL TIMES. THE CONTRACTOR SHALL ENGAGE A PROFESSIONAL ENGINEER TO CERTIFY STRUCTURAL ADEQUACY OF TEMPORARY WORKS.

1.06 UNLESS NOTED OTHERWISE, ALL DIMENSIONS ARE IN MILLIMETERS (mm) AND ALL LEVELS ARE IN METRES (m) TO AUSTRALIAN HEIGHT DATUM (AHD).

1.07 ALL PROPRIETARY ITEMS (E.G. ANCHORS, GROUT, SURFACE TREATMENT ETC) SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE PRODUCT MANUFACTURER RECOMMENDATIONS UNO.

1.08 ALL ABBREVIATIONS ARE IN ACCORDANCE WITH AS 1100. ADDITIONAL ABBREVIATIONS USED ARE AS FOLLOWS:

COS	CHECK ON SITE
CRS	CENTRES
BTM	BOTTOM
EW	EACH WAY
EF	EACH FACE
UNO	UNLESS NOTED OTHERWISE
U/S	UNDERSIDE
GL	GROUND LINE
RL	REDUCED LEVEL
FFL	FINISHED FLOOR LEVEL
SSL	STRUCTURAL SLAB LEVEL
TME	TO MATCH EXISTING
NSOP	NOT SHOWN ON PLAN

2.0 DESIGN DATA

2.01 THE STRUCTURAL COMPONENTS DETAILED ON THESE DRAWINGS HAVE BEEN DESIGNED IN ACCORDANCE WITH THE RELEVANT AUSTRALIAN STANDARDS INCLUDING, BUT NOT LIMITED TO LOCAL GOVERNMENTS.

AS/NZS 1170.0 - 2002 GENERAL PRINCIPLES
.1 - 2002 PERMANENT, IMPOSED & OTHER ACTIONS
.2 - 2011 WIND ACTIONS
.4 - 2007 EARTHQUAKE LOADS
AS 3600 - 2018 CONCRETE STRUCTURES
AS 4678 - 2002 EARTH RETAINING STRUCTURES

2.05 CONCRETE DURABILITY DESIGN BASED ON THE FOLLOWING EXPOSURE CLASSIFICATIONS FROM AS 3600
- EXTERIOR ENVIRONMENTS: A2

5.0 REINFORCEMENT

5.01 REINFORCEMENT SYMBOLS:

N DENOTES GRADE 500N DEFORMED BARS TO AS4671.

SL & RL DENOTES GRADE 500L DEFORMED BAR WELDED MESH TO AS 4671 SQUARE & RECTANGULAR MESH RESPECTIVELY.

R DENOTES GRADE 250 HOT ROLLED PLAIN BARS TO AS 4671.

NUMBER OF BARS IN GROUP
BAR GRADE AND TYPE
17N20-250 [1000]
LENGTH IN mm (EXCLUDING COGS)
NOMINAL BAR SIZE IN mm
BAR SPACING IN mm

5.02 THE FIGURES FOLLOWING THE MESH SYMBOL SL, RL AND TM IS THE REFERENCE NUMBER FOR MESH TO AS 4671.

5.03 ALL REINFORCEMENT SHALL BE FIRMLY SUPPORTED ON PLASTIC CHAIRS (NO METAL CHAIRS PERMITTED) AT NOT GREATER THAN 1 METRE CENTRES BOTH WAYS. BARS SHALL BE TIED AT ALTERNATE INTERSECTIONS.

5.04 REINFORCEMENT IS REPRESENTED DIAGRAMMATICALLY AND NOT NECESSARILY IN TRUE PROJECTION.

5.05 SPLICES IN REINFORCEMENT SHALL BE MADE ONLY IN POSITIONS SHOWN OR OTHERWISE APPROVED IN WRITING BY THE ENGINEER.

5.06 LAPS SHALL BE IN ACCORDANCE THE FOLLOWING UNLESS NOTED OTHERWISE IN THE DRAWINGS:

BAR	LAP LENGTH (mm)
N12	500

5.08 SITE BENDING OF DEFORMED REINFORCING BARS SHALL BE DONE USING MECHANICAL BENDING TOOLS WITHOUT HEATING.

5.09 WELDING OF REINFORCEMENT SHALL NOT BE PERMITTED UNLESS SHOWN ON THE STRUCTURAL DRAWINGS OR APPROVED BY THE ENGINEER.

5.10 JOGGLES TO BARS SHALL BE 1 BAR DIAMETER OVER A LENGTH OF 12 BAR DIAMETERS.

5.11 WHERE TRANSVERSE TIE BARS ARE NOT SHOWN PROVIDE N12-300 SPLICED WHERE NECESSARY AND LAP WITH MAIN BARS 500mm U.N.O.

5.12 ALL STANDARD HOOKS & COGS SHALL BE TO THE REQUIREMENTS OF AS 3600 U.N.O.

5.13 CLEAN REINFORCEMENT FREE FROM LOOSE RUST, DIRT & GREASE BEFORE CONCRETING.

6.0 CONCRETE

6.01 ALL WORKMANSHIP AND MATERIALS SHALL COMPLY WITH AS 3600 AND ITS REFERENCED CODES.

6.02 ALL CONCRETE SHALL BE PRE-MIXED AND COMPLY WITH AS1379.

6.03 CONCRETE MIX PERFORMANCE CRITERIA:

ELEMENT	CONC. GRADE	TARGET SLUMP (mm)	CEMENT TYPE	MAX. AGGREGATE SIZE (mm)	COMMENTS
LEVEE WALL	N32	100	GB	20	

ADDITIONAL REQUIREMENTSFOR SPECIAL-CLASS CONCRETE ARE INCLUDED IN THE PROJECT SPECIFICATION.

6.06 CLEAR COVER TO REINFORCEMNT TO BE AS FOLLOWS UNLESS SHOWN OTHERWISE ON THE DRAWINGS.

ELEMENT	COVER
LEVEE WALL AND FOOTING	35 TOP BTM AND SIDES GENERALLY 45 WHERE CAST AGAINST GROUND

NOTE: ELEMENTS REQUIRING ADDITIONAL COVER FOR FIRE RESISTANCE AND DURABILITY ARE SHOWN ON THE DRAWINGS.

6.07 CONCRETE SIZES SHOWN DO NOT INCLUDE THICKNESS OF APPLIED FINISHES.

6.08 MAINTAIN COVER TO REINFORCEMENT AT ALL CHAMFERS, DRIP GROOVES, REGLETS ETC.

6.11 CONSTRUCTION JOINTS ARE TO BE PROPERLY FORMED AND WHERE NOT SHOWN SHALL BE LOCATED TO THE APPROVAL OF THE ENGINEER.

6.12 ALL CONCRETE SHALL BE COMPACTED USING MECHANICAL VIBRATION. WHERE POSSIBLE PLACE SLABS ON GROUND USING VIBRATING SCREEDS.

6.13 SURFACE FINISHES TO ALL CONCRETE MEMBERS SHALL BE CLASS 3 FOR EXPOSED CONCRETE FACES.

6.14 COMMENCE CURING IMMEDIATELY AFTER THE CONCRETE HAS ACHIEVED ITS FINAL SET FOR 7 DAYS. CONCRETE SHALL BE CURED BY KEEPING SURFACES CONTINUOUSLY MOIST, OR BY APPLICATION OF SPRAYED MEMBRANE-FORMING CURING COMPOUND IN ACCORDANCE WITH AS 3799.

TPHR

LEVEE STRUCTURE_C

BG&E
16/07/2025

REV	DATE	DESCRIPTION	RVD
1	23.06.25	RE-ISSUED FOR TENDER	LH
0	09.01.25	ISSUED FOR TENDER	LH

REVISIONS

Perth *Office—*
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BG&E DOCUMENT No: P24172

Government of **Western Australia**
Department of **Finance**
Buildings and Contracts

CIVIL

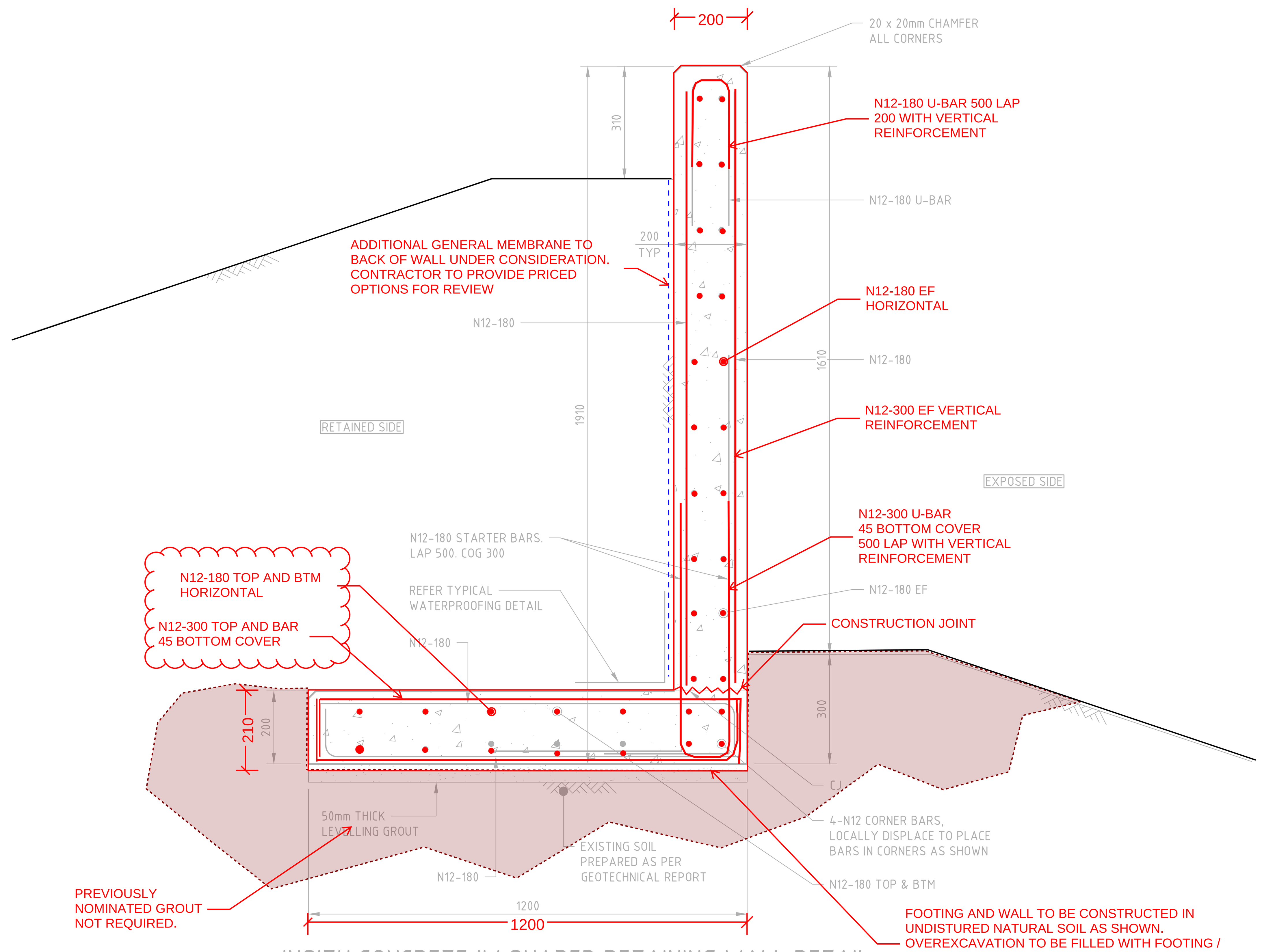
TOM PRICE HOSPITAL REDEVELOPMENT
FORWARD WORKS
LEVEE NOTES

DRAWN JS	DESIGNED LG	REDUCTION 0 25	
CHECKED LH	PRINCIPAL		
APPROVED LH			
SCALE NTS	DATE 06.01.25	DRAWING No. C.25 1	
DF PROJ No. 15063	DF FILE No.		

THIS IS A CADD DRAWING
DO NOT AMEND MANUALLY

NOTES

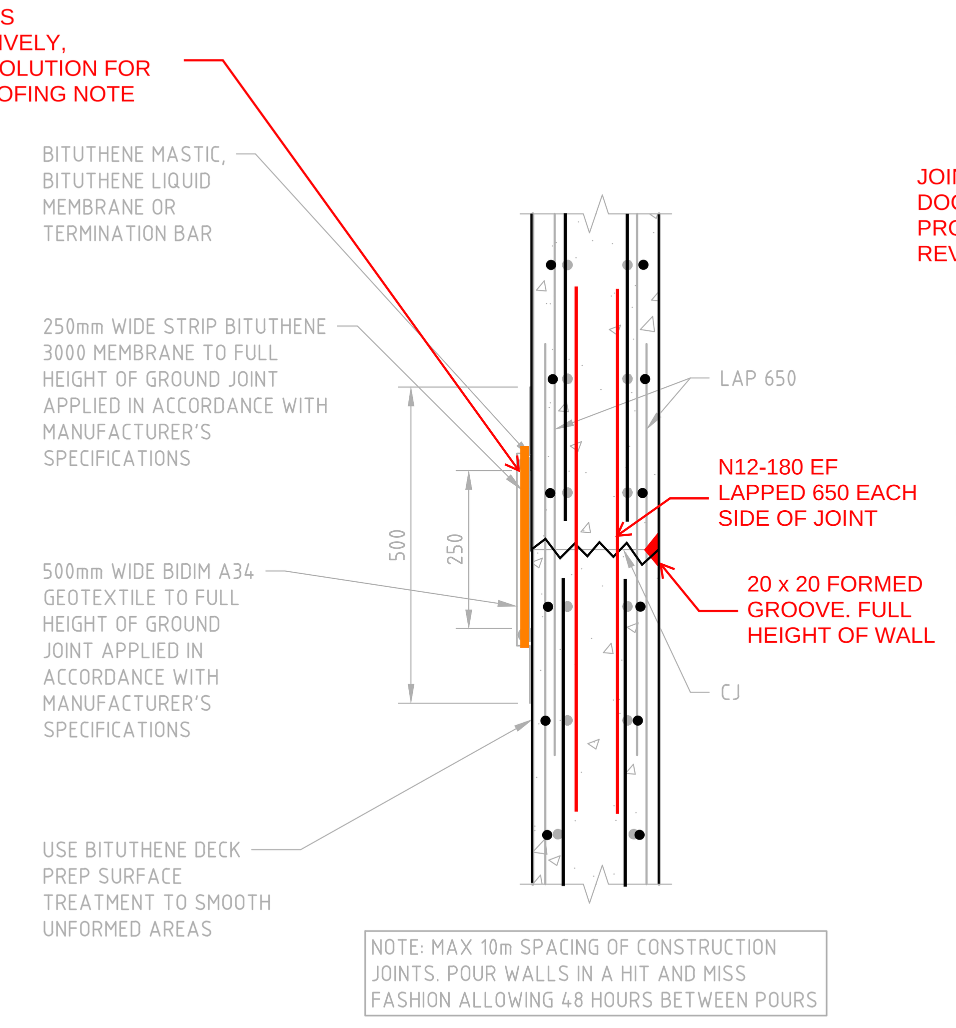
1. DO NOT SCALE DRAWINGS.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.



INSITU CONCRETE 'L' SHAPED RETAINING WALL DETAIL

SCALE 1:10

LEVEE WALL - TYPICAL SECTION

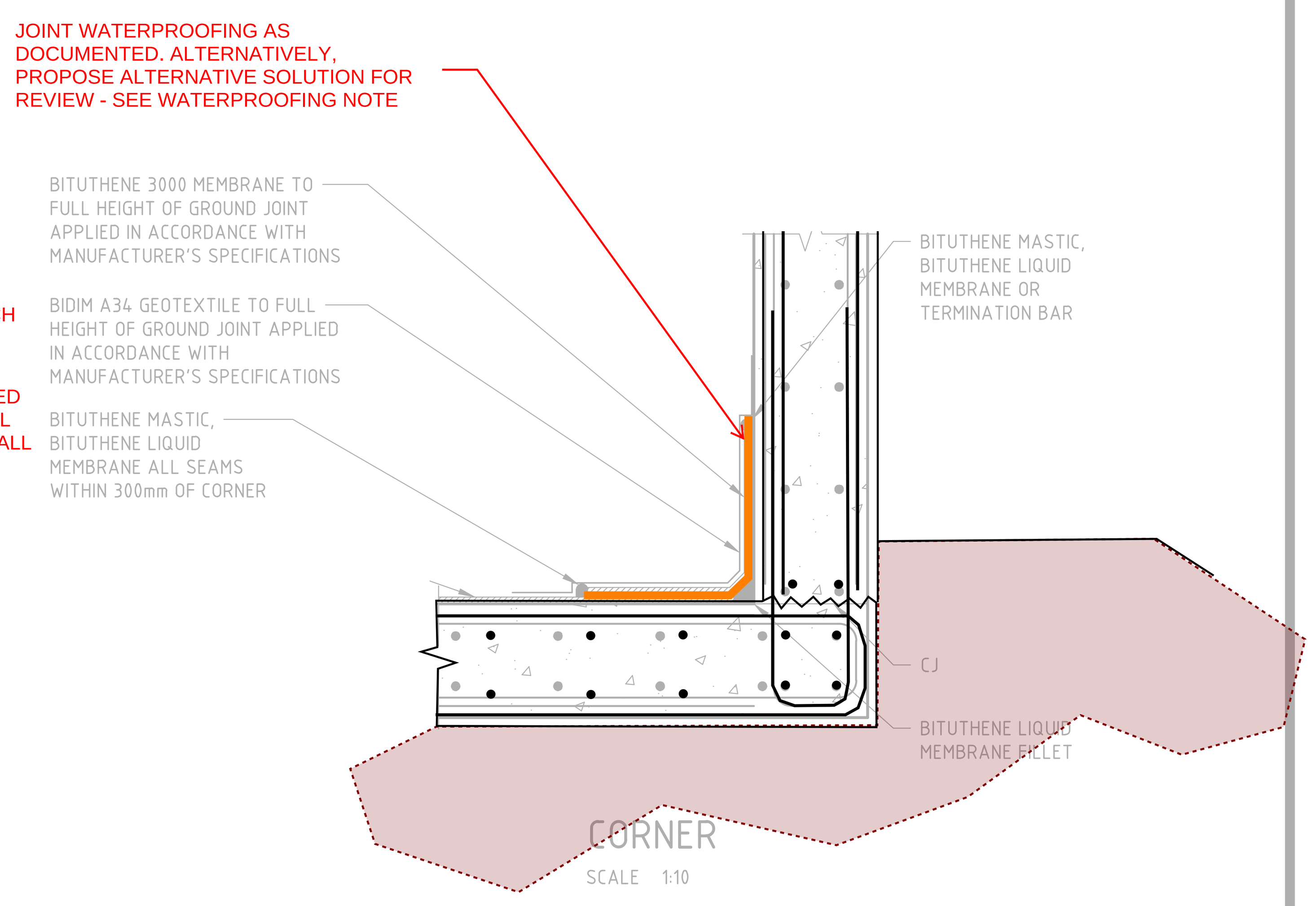


STRAIGHT WALL

SCALE 1:10

WALL CONSTRUCTION JOINT - PLAN DETAIL

NOTE: FOOTING CONSTRUCTION JOINTS TO ALIGN WITH WALL JOINTS. REINFORCEMENT ACROSS FOOTING JOINTS AS PER WALL DETAIL



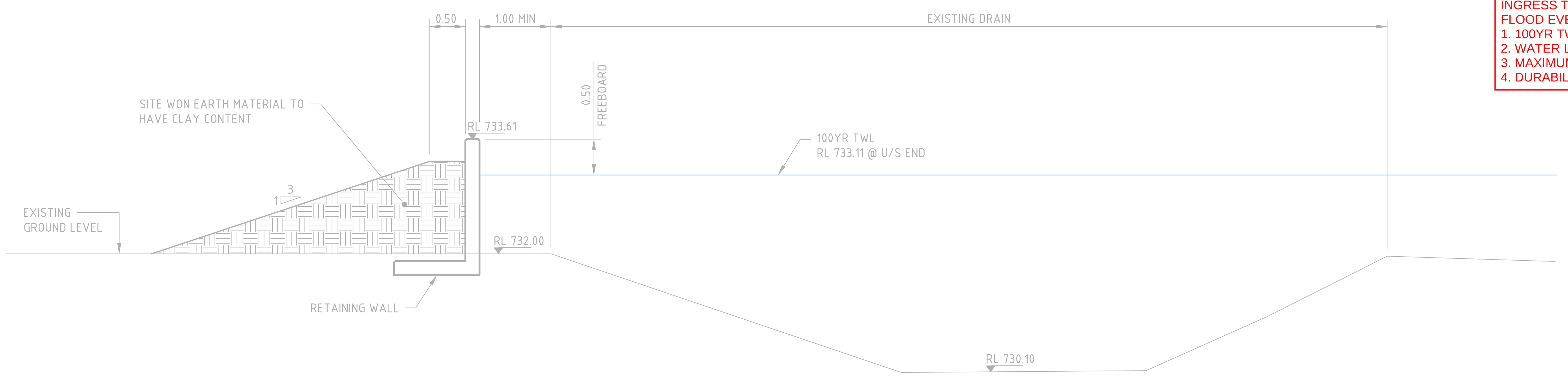
CORNER

SCALE 1:10

BASE CONSTRUCTION JOINT - DETAIL

WATERPROOFING NOTE

INSITU CONCRETE LEVEE WALL AND FOOTING SYSTEM HAS BEEN DESIGNED AS FULLY RESTRAINED.
ALTERNATIVE JOINT WATERPROOFING SOLUTIONS WILL BE CONSIDERED.
WATERPROOFING PERFORMANCE REQUIREMENTS ARE TO PREVENT WATER INGRESS THROUGH CONCRETE JOINTS WHEN SUBJECTED TO THE FOLLOWING FLOOD EVENT:
1. 100YR TWL RL 733.11 AS SHOWN
2. WATER LEVEL MAINTAINED FOR 6 HOUR DURATION
3. MAXIMUM WATER FLOW RATE OF 2 m/s
4. DURABILITY EQUIVALENT OR BETTER TO THAT NOMINATED



TYPICAL CROSS SECTION THROUGH LEVEE

SCALE 1:50

TPHR
LEVEE STRUCTURE_D
BG&E
22/07/2025

0 100 200 300 400 500 600mm
SCALE 1:10 AT A1 SIZE

0 0.5 1.0 1.5 2.0 2.5 3.0m
SCALE 1:50 AT A1 SIZE

REV	DATE	DESCRIPTION	RVD
2	23.06.25	RE-ISSUED FOR TENDER	LH
1	09.01.25	RE-ISSUED FOR TENDER	LH
0	12.12.24	ISSUED FOR TENDER	LH

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BG&E DOCUMENT No: P24172

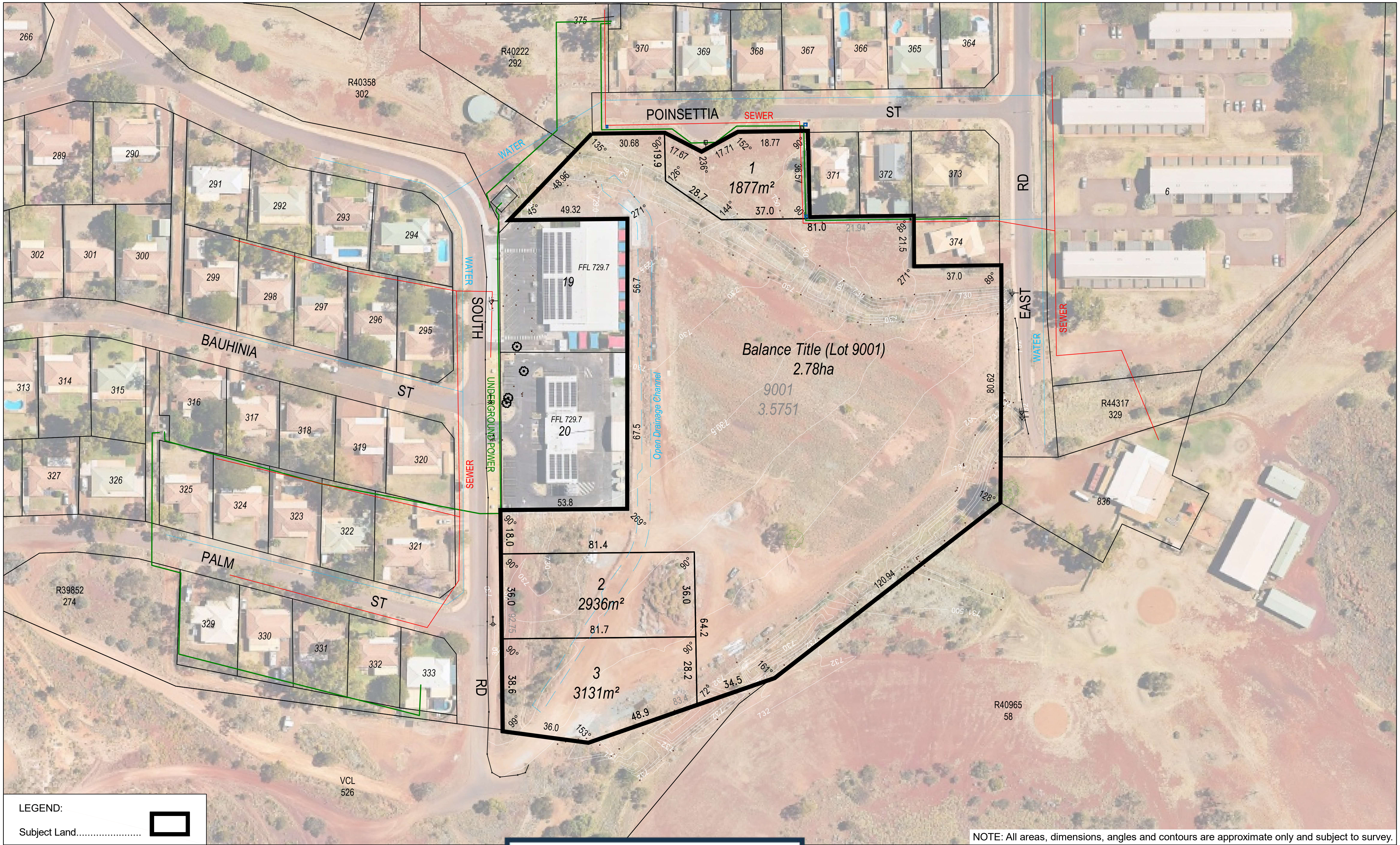
Government of Western Australia
Department of Finance
Buildings and Contracts

CIVIL

TOM PRICE HOSPITAL REDEVELOPMENT
FORWARD WORKS
LEVEE DETAILS AND TYPICAL CROSS SECTION

DRAWN JS	DESIGNED LG	REDUCTION 0 25
CHECKED LH	PRINCIPAL	
APPROVED LH		
SCALE AS SHOWN	DATE 10.12.24	DRAWING No. C.30 2
DF PROJ No. 15063	DF FILE No.	

THIS IS A CADD DRAWING
DO NOT AMEND MANUALLY



PROPOSED FREEHOLD SUBDIVISION

LOT 9001 (No. 17) SOUTH ROAD
TOM PRICE
Shire of Ashburton

DEPARTMENT OF PLANNING, LANDS AND HERITAGE

DATE	FILE
20-Aug-2024	200687

NORTH

0 10 20 30 40 50 60 70 80 90m

SCALE 1:1500
ORIGINAL PLAN SIZE: A3
DATE: 3rd JULY 2024

LK ADVISORY
Urban & Regional Planning| Strategy| Policy| Governance| Performance
t. (08) 6500 7800
w. lkadvisory.com.au
o. Suite 3, 1 Wexford Street, Subiaco WA 6008
p. PO Box 244, Applecross WA 6953

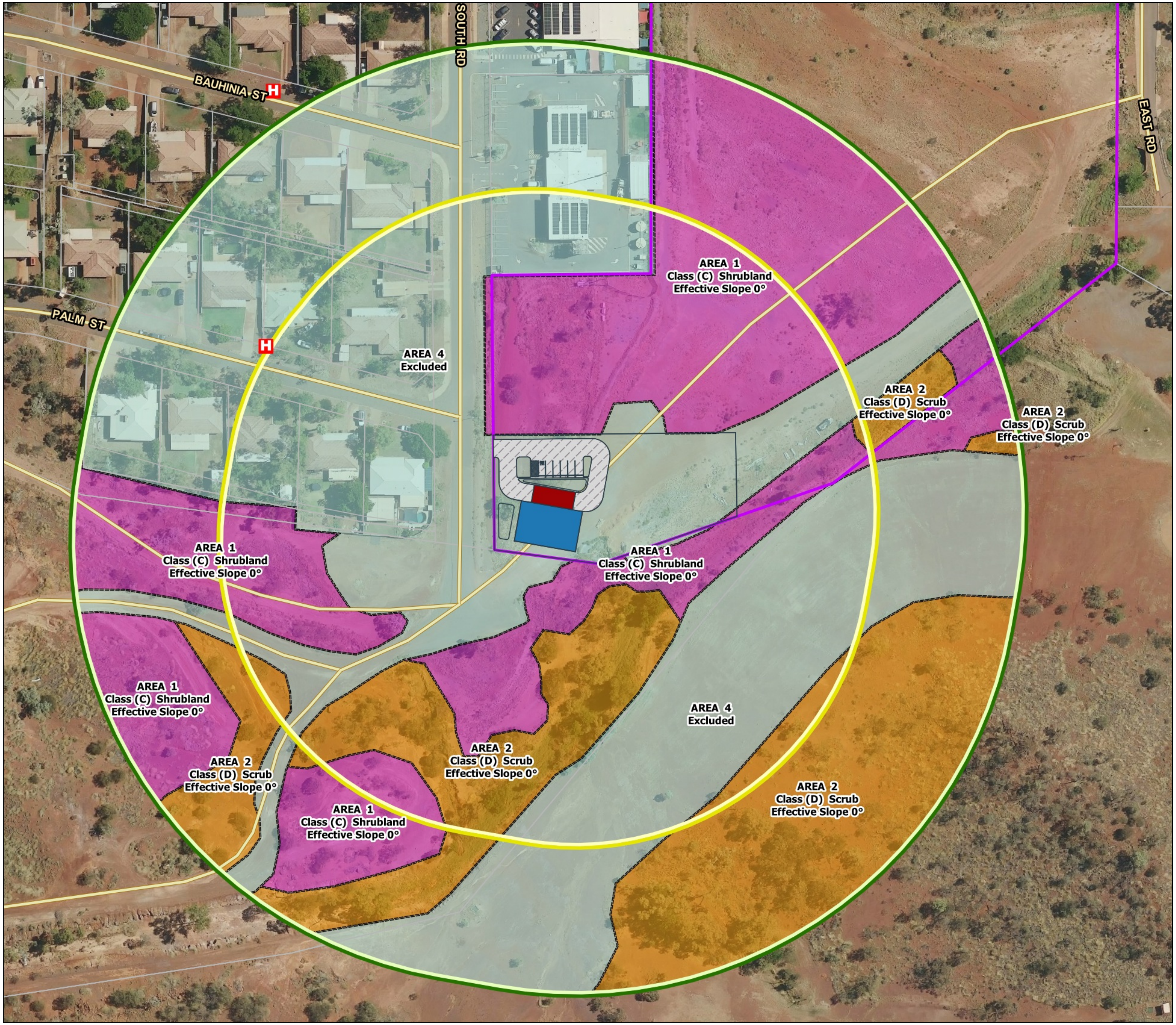


Figure 3.1.1

Classified Vegetation & Topography (Post Dev)

Lot 9001 on Plan 420121, Area: 3.5751ha
17 South Street,
Tom Price
SHIRE OF ASHBURTON

------ LEGEND ------

Subject Site
Cadastral

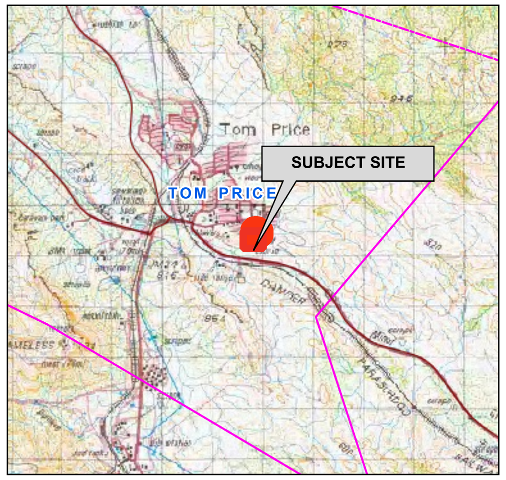
Buildings
Ambulance Loading Zone
Clinic
Driveway

Classified vegetation
Shrubland
Scrub
Excluded 2,2,3,2 (f)

0 20 40 60 80

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Joy 25-06-2025
SCALE (A3): 1 : 1200

250550_Fig 3-1-1_Post Veg_Lot 3 South Road Tom Price.qgz

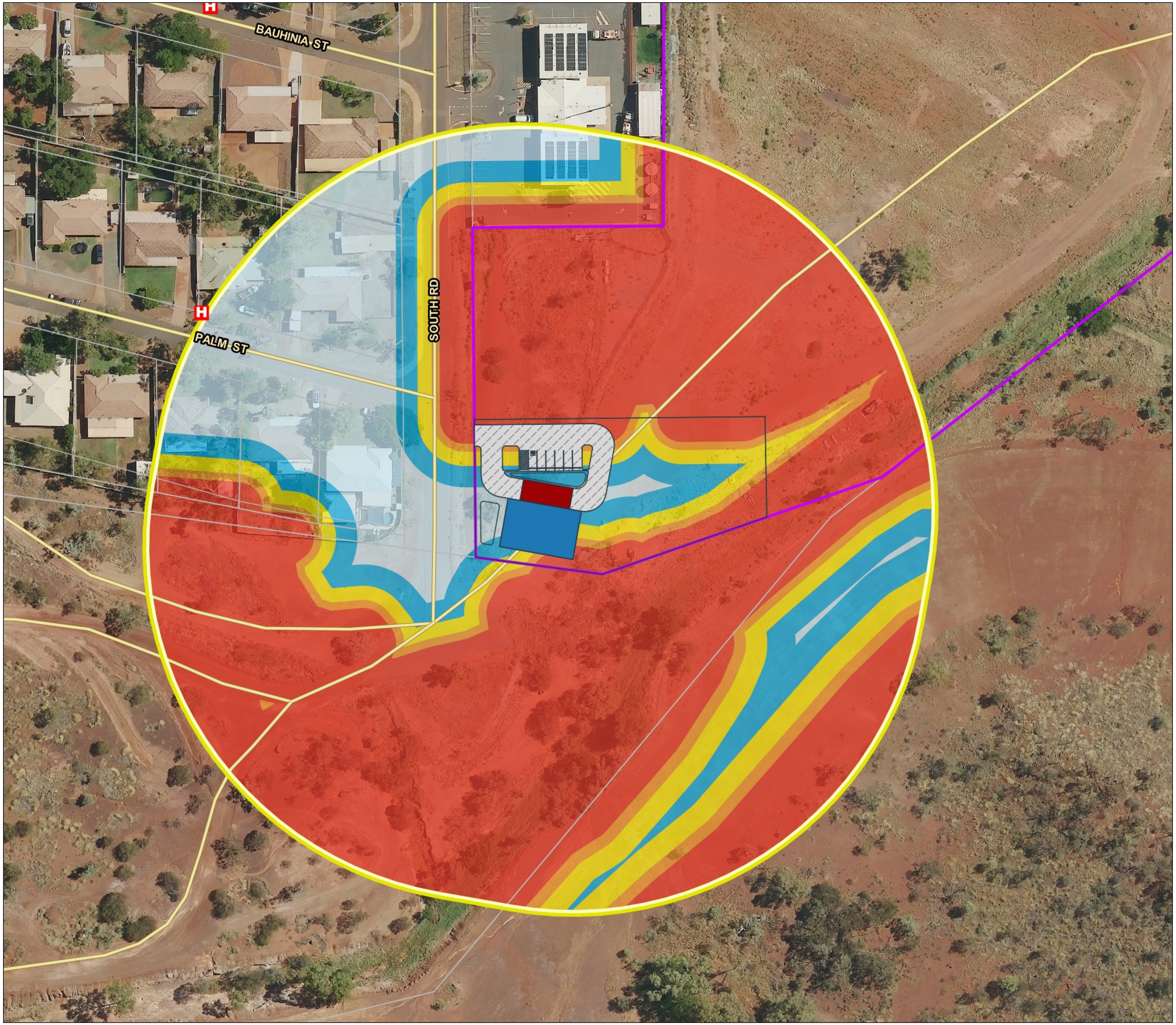


Figure 3.2

BAL Contour Map

Lot 9001 on Plan 420121, Area: 3.5751ha
17 South Street,
Tom Price
SHIRE OF ASHBURTON

------ LEGEND ------

Subject Site
Cadastral

Buildings

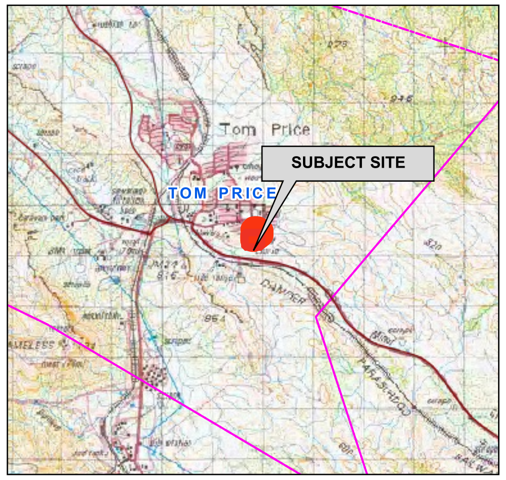
Ambulance Loading Zone
Clinic
Driveway

Bushfire Attack Levels

BAL-FZ
BAL-40
BAL-29
BAL-19
BAL-12.5

0 20 40 60
Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

BUSHFIRE PRONE PLANNING

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Joy 25-06-2025
SCALE (A3): 1 : 1000

Disclaimer and Limitation: This map has been prepared for bushfire management planning purposes only. All depicted areas, contours and any dimensions shown are subject to survey. Bushfire Prone Planning does not guarantee that this map is without flaw of any kind and disclaims all liability for any errors, loss or other consequence which may arise from relying on any information depicted.

250550_Fig 3-2_BAL_Lot 3 South Road Tom Price.qgz

TOM PRICE HEALTH SERVICE

FLOODING DIAGRAMS

20/05/2025

Government of **Western Australia**
Department of **Finance**

Government of **Western Australia**
WA Country Health Service

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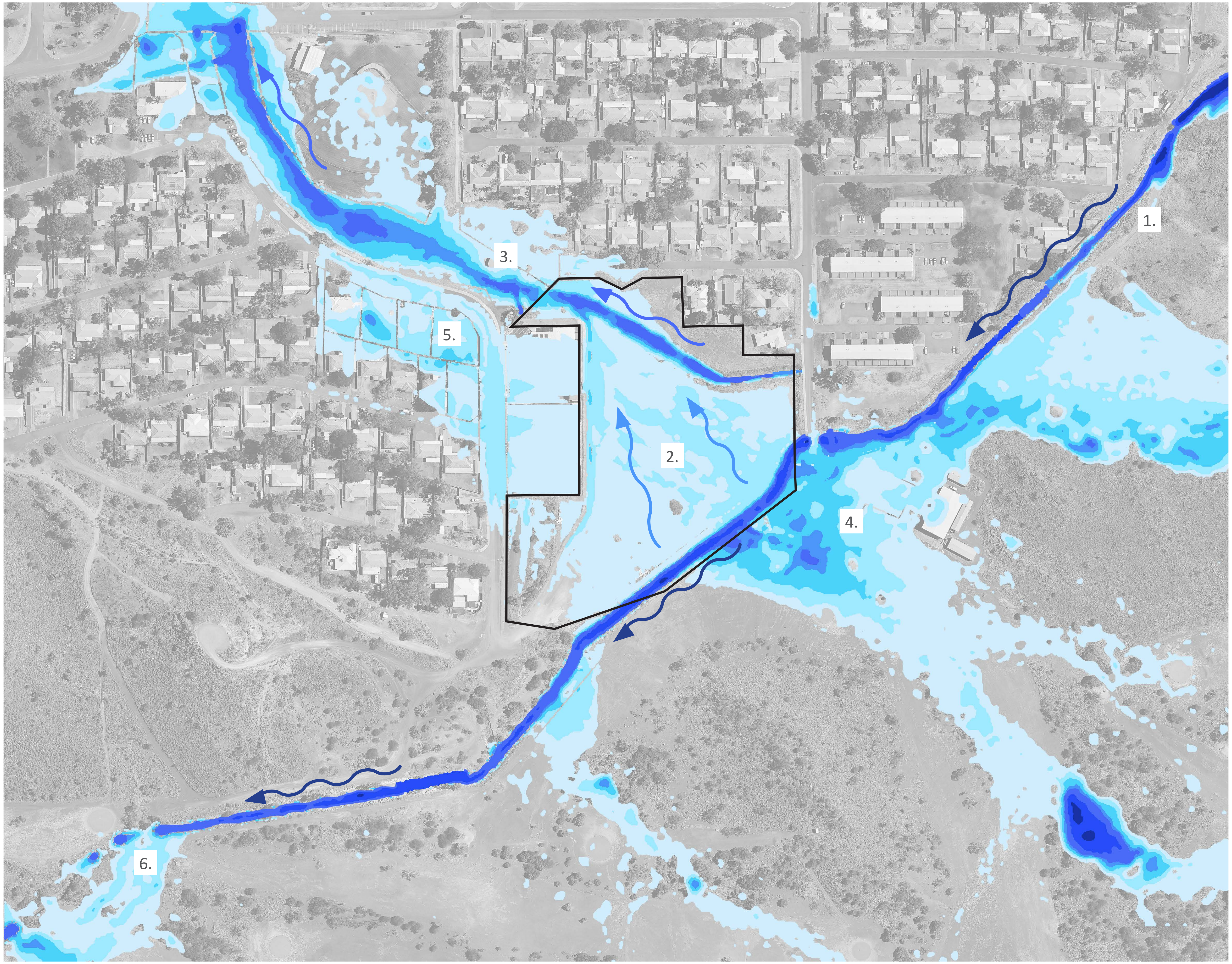
FLOODING CONDITIONS - EXISTING



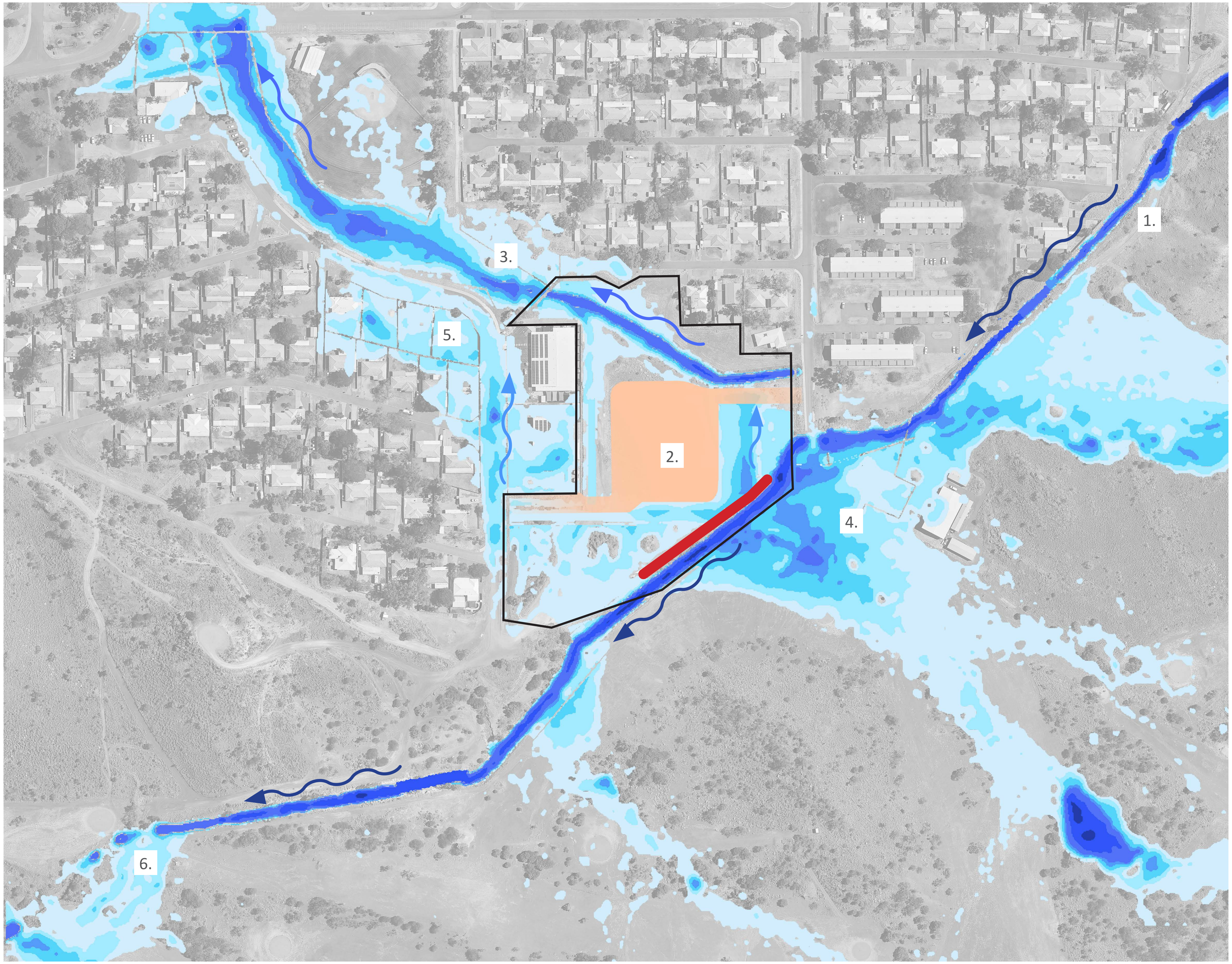
LEGEND

- PROJECT SITE
- 50 - 250mm DEPTH
- 250 - 500mm DEPTH
- 500 - 750mm DEPTH
- 750 - 1000mm DEPTH
- 1000 - 1500mm DEPTH
- 1500 - 2000mm DEPTH
- 1500 - 2000mm DEPTH
- DIRECTION OF WATER FLOW

NOTES

1. Primary Swale: Water flows from east of town through informal swale system to edge of townsite.
2. Project Site: Main Stormwater swale overtops and water flows through the site to the north / north-west and into secondary swale.
3. Secondary Swale: Water from secondary swale flows through town in north-west direction
4. Mountain View Sporting Club: Flooding to Sports Club
5. South Road and surrounds: Minor flooding to housing and South Road
6. Downstream: Primary swale ends and water spreads out

FLOODING CONDITIONS - LOCALISED LEVEE



LEGEND

- PROJECT SITE
- 50 - 250mm DEPTH
- 250 - 500mm DEPTH
- 500 - 750mm DEPTH
- 750 - 1000mm DEPTH
- 1000 - 1500mm DEPTH
- 1500 - 2000mm DEPTH
- 1500 - 2000mm DEPTH
- DIRECTION OF WATER FLOW
- LEVEE WALL
- SITE FILL (APPROX. MAX. 1.5m) - INDICATIVE ONLY

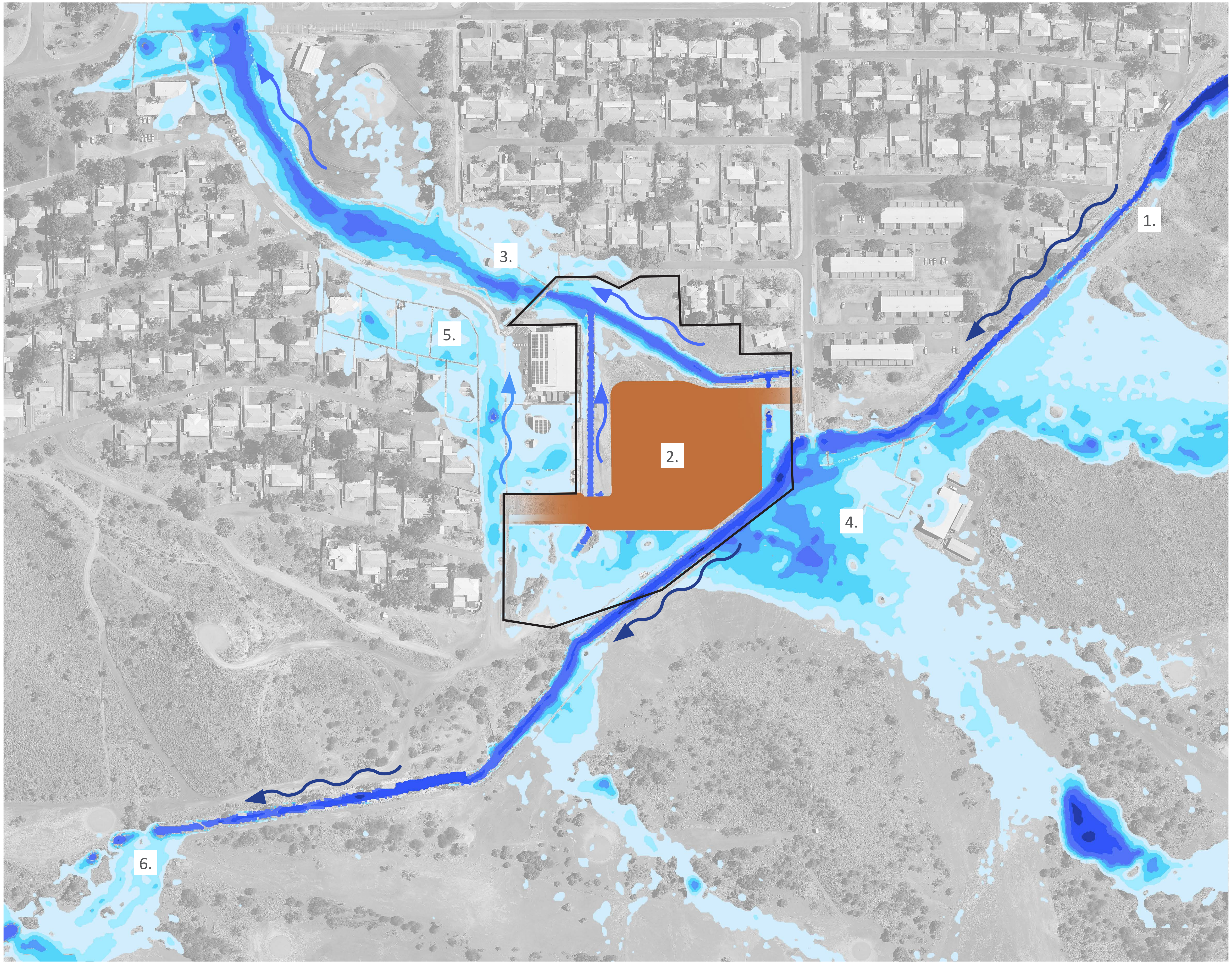
NOTES

1. Primary Swale: No notable change.
2. Project Site: Water flows around levee wall and around building pad (indicative).
3. Secondary Swale: Slight decrease in level of water from Secondary Swale and into townsite.
4. Mountain View Sporting Club: Increase in flooding
5. South Road and surrounds: Slight decrease in extent of flooding to housing and sligth increase of depth of flooding on South Road.
6. Downstream: No change

SUMMARY

Option not pursued due to inadequate protection to Health Services and flooding to access via South Road.

FLOODING CONDITIONS - RAISED PAD



LEGEND

- PROJECT SITE
- 50 - 250mm DEPTH
- 250 - 500mm DEPTH
- 500 - 750mm DEPTH
- 750 - 1000mm DEPTH
- 1000 - 1500mm DEPTH
- 1500 - 2000mm DEPTH
- 1500 - 2000mm DEPTH
- DIRECTION OF WATER FLOW
- SITE FILL (APPROX. MAX. 3.0m) - INDICATIVE ONLY

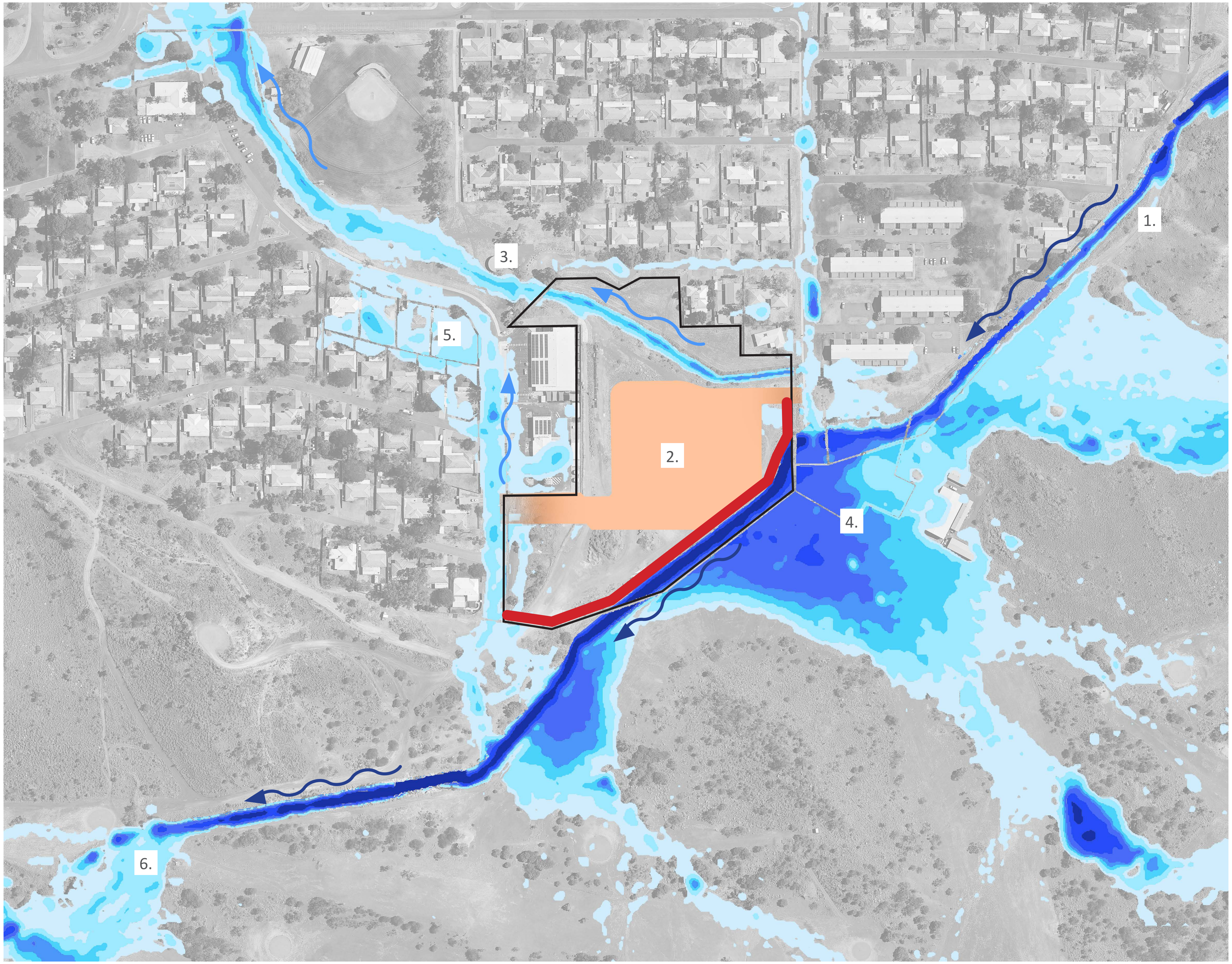
NOTES

1. Primary Swale: Slight increase in level of water
2. Project Site: Water flows Waround building pad (indicative).
3. Secondary Swale: Slight decrease in level of water from Secondary Swale and into townsite.
4. Mountain View Sporting Club: Increase in flooding to Sports Club
5. South Road and surrounds: Slight decrease in extent of flooding to housing and sligth increase of depth of flooding on South Road.
6. Downstream: No change

SUMMARY

Option not pursued due to unacceptably high negative impacts on direct surrounds (including St Johns & PAHA sites).

FLOODING CONDITIONS - FULL LEVEE



LEGEND

- PROJECT SITE
- 50 - 250mm DEPTH
- 250 - 500mm DEPTH
- 500 - 750mm DEPTH
- 750 - 1000mm DEPTH
- 1000 - 1500mm DEPTH
- 1500 - 2000mm DEPTH
- 1500 - 2000mm DEPTH
- DIRECTION OF WATER FLOW
- LEVEE WALL
- SITE FILL - INDICATIVE ONLY

NOTES

1. Primary Swale: Increase in level of water
2. Project Site: Water generally diverted around site, some water flowing down East road and then through secondary swale.
3. Secondary Swale: Significant decrease in level of water from Secondary Swale and into townsite.
4. Mountain View Sporting Club: Significant increase in flooding to Sports Club
5. South Road and surrounds: Decrease in depth and extent of flooding to housing and increase in extents of flooding on South Road.
6. Downstream: Slight increase in flooding extents

SUMMARY

Selected option due to protection provided to Health Services and net positive impact on surrounds.

NOTE:
AHD DATUM BASED ON SSM MOUNT BRUCE 42 BY GPS.

NOTE:
PLEASE REFER TO THE DIGITAL DATA FILE FOR ADDITIONAL SPATIAL INFORMATION.

RM SURVEYS
LICENSED SURVEYORS

PHONE: 08 9457 7900
EMAIL: INFO@RMSURVEYS.COM.AU
WEBSITE: RMSURVEYS.COM.AU

Endorsed by

SCALE 1:400
ALL DISTANCES IN METRES
PAPER SIZE A0

SURVEYOR	VERTICAL DATUM
BP	AHD
SURVEY DATE	HORIZONTAL DATUM
07/10/2024	TOM PRICE 2020

CLIENT:
IREDALE PEDERSON HOOK ARCHITECTS

REV	DESCRIPTION	DRN	CKD	APP	DATE
0	INITIAL ISSUE	AS	JX	MD	30/10/2024

FEATURE AND CONTOUR SURVEY
TOM PRICE HEALTH CENTRE
SOUTH ROAD, TOM PRICE
SHIRE OF ASHBURTON

JOB No.	DRAWING No.	REV
IPH-TPHC	IPH-TPHC-DW-002	0

76 McLaren Street
Adelaide SA 5000
(08) 7078 8110
hello@das-studio.com.au
das-studio.com.au

das studio

Shire of Ashburton
Lot 246, Poinciana Street
Tom Price, WA, 6751

Date: 10/09/2025

Re. New Renal Dialysis Clinic – Planning Statement

Dear Shire of Ashburton Planning Team,

Please refer to the below for a summary of the proposal and its compliance with the Shire of Ashburton Local Planning Scheme No. 7 to accompany the attached Development Application –

PROPOSED LAND USE

The Pilbara Aboriginal Health Alliance (PAHA) propose to build a new Renal Dialysis Clinic to Lot 3 as defined on the 'Proposed Freehold Sub Division Survey' attached to this letter.

The clinic is to be operated by Purple House on behalf of PAHA and will look to operate as a 4x Chair clinic with a single session per day, seeing a maximum of 4x patients undergo dialysis treatment per day.

For the purpose of NCC BCA review, the Dialysis Unit is considered to be a Class 5 building – nominally a Day Clinic. Further detail of this can be found in the NCC Report attached to this email.

As per current zone mapping, the current Lot is listed as a residential zone with R30 requirements. However for the purpose of this application all design has been carried out based on the proposal being considered appropriate land use following prior feedback and advice from the Shire of Ashburton, precedent neighbouring developments and on-going discussions with the Stakeholder group. As such, R30 requirements have not been considered for this application.

PROJECT DURATION

Project Timeline: Expected 12 month timeline to completion.

Clinic Hours of Operation: 7am to 3pm Monday to Saturday.

ON SITE CAR PARKING

With there not being a definitive land use that can be directly defined within the Shire of Ashburton Planning Scheme No. 7, the car parking numbers proposed have been developed based on precedent projects and proposed functional use of the building. The following assumptions are what we have used to define the proposed number:

- 1 park per staff member. Maximum of 2x staff ever to be operating on site at any one time.
- Maximum of 4 patients where typically transport to and from the clinic is arranged on behalf of the PH staff/ nurses
- Allowance for 1 park per patient for 75% of patients based on precedent data from existing, similar clinics operated by Purple House.

If it is deemed necessary that further parking is required for operation, provision has been allowed to the rear of the site for overflow parking – this number is currently undetermined.

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Adelaide SA 5000

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dasstudio

PLANNING SCHEME COMPLIANCE

Upon reviewing the Planning Scheme no.7, we have identified the below items as key considerations to ensure compliance moving forward

Landscaping, screening and fencing – refer to Site plan for further details regarding size of proposed landscaping works and extent of fencing, vehicle entries and gated pedestrian entry. Final landscaping scheme is still to be determined however any proposals still to be determined will comply with the definitions under 6.19 of the SOA Planning Scheme No. 7.

Flood and Storm – the proposed design has been coordinated with on going flood mitigation works that encompasses the entirety of Lot 9001. All flood mitigation proposals will continue to be reviewed and amended as required where viable to align with these on-going works.

Please do not hesitate to contact us with any queries regarding the above.

We look forward to hearing from you soon.

Kind regards,

Josh McCallum
Senior Architect

Das Studio

Tom Price Health Service Redevelopment – Detailed Flood Risk Assessment

Prepared for Department of Finance

20/02/25
Project Number BGE-P24172
Version B

OPPORTUNITIES THROUGH EXCELLENCE
bgeeng.com

BG&E

Contents

Document Control				
Revision	Date	Prepared	Reviewed	Approved
B	19/02/25	Brett Stinton	Ivan Varga	

1. Introduction

1.1 General

The existing Tom Price Hospital, built in the late 1961s, does not meet the guidelines in terms of space and optimal functional arrangements. The Department of Finance has decided to replace the facility with a new one to meet the clinical service delivery standards. The new facility aims at developing an asset that meets the health and related needs of the community in the long term.

BG&E has been engaged by the Department of Finance to undertake a detailed flood assessment to inform the forward works package associated with the proposed Tom Price Health Service Redevelopment. The forward works package involves bulk earthworks associated with the building pad, access roads, and flood mitigation works. Further design works will be required for the development itself.

1.2 Scope of Works

The following scope of works have been undertaken as part of the waterways assessment:

- Background review of available documents and data.
- Liaise with relevant stakeholders to obtain any previous studies or flow estimates (DWER, Shire of Ashburton, Main Roads WA, etc).
- Hydrology assessment to estimate design flows at site and validation of hydrological inputs.
- Hydraulic modelling to simulate the existing and forward works design scenarios to estimate flood extents, levels, velocities, and hazard categories for a range of flood events.
- Review the proposed mitigation design option from the concept design stage and update (where required) the proposed option and provide recommendations.
- Identify any potential impacts to existing flood behaviour by comparing the existing and forward works design scenario results.

Figure 1-1 shows the location of the proposed hospital site within the town of Tom Price.

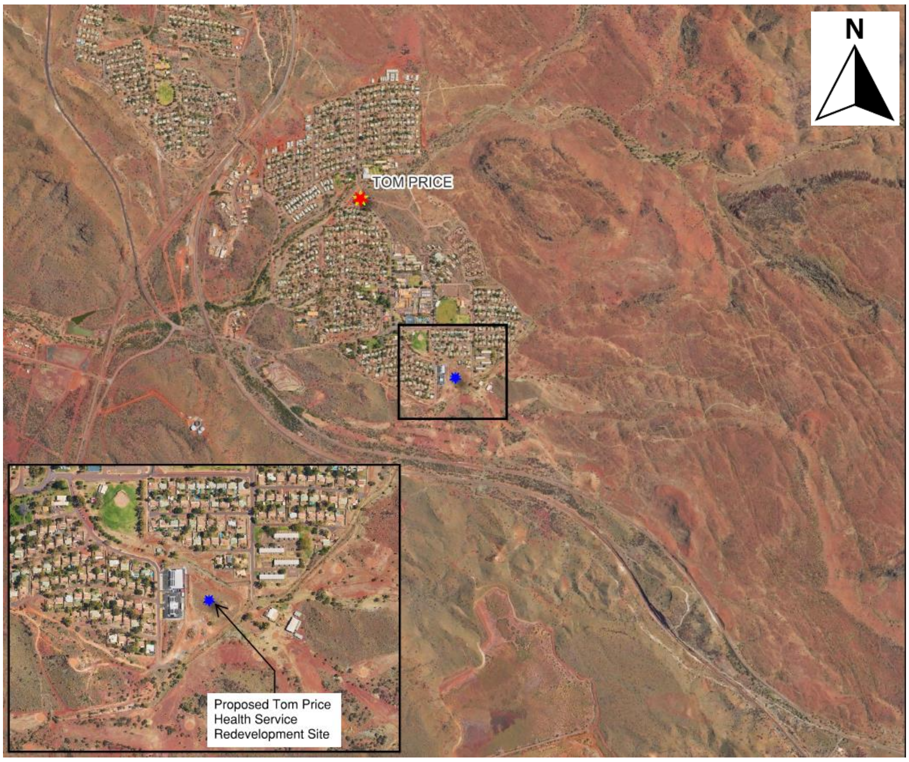


Figure 1-1: Locality Plan

1.3 Topography Data

The following datasets were used for the flood assessment (in order of priority):

- Site Survey 1m DEM 2024 - Covers the proposed hospital site, recent DFES and childcare developments, the northern and southern drainage channels, and adjacent South Road and East Road
- Landgate 1m DEM 2022 – Adopted for areas outside the site survey. Covers the upstream catchments and town of Tom Price

The datasets were blended at the interface along the diversion drain. The Landgate 1m DEM is not as accurate as site survey or LiDAR survey. The DEM provides a reasonable match to the site survey along the northern and southern channels (refer Figure 1-2, however is less accurate in the developed areas of town (generally downstream of the site) particularly around buildings and roads. The model will have less accuracy in these areas.

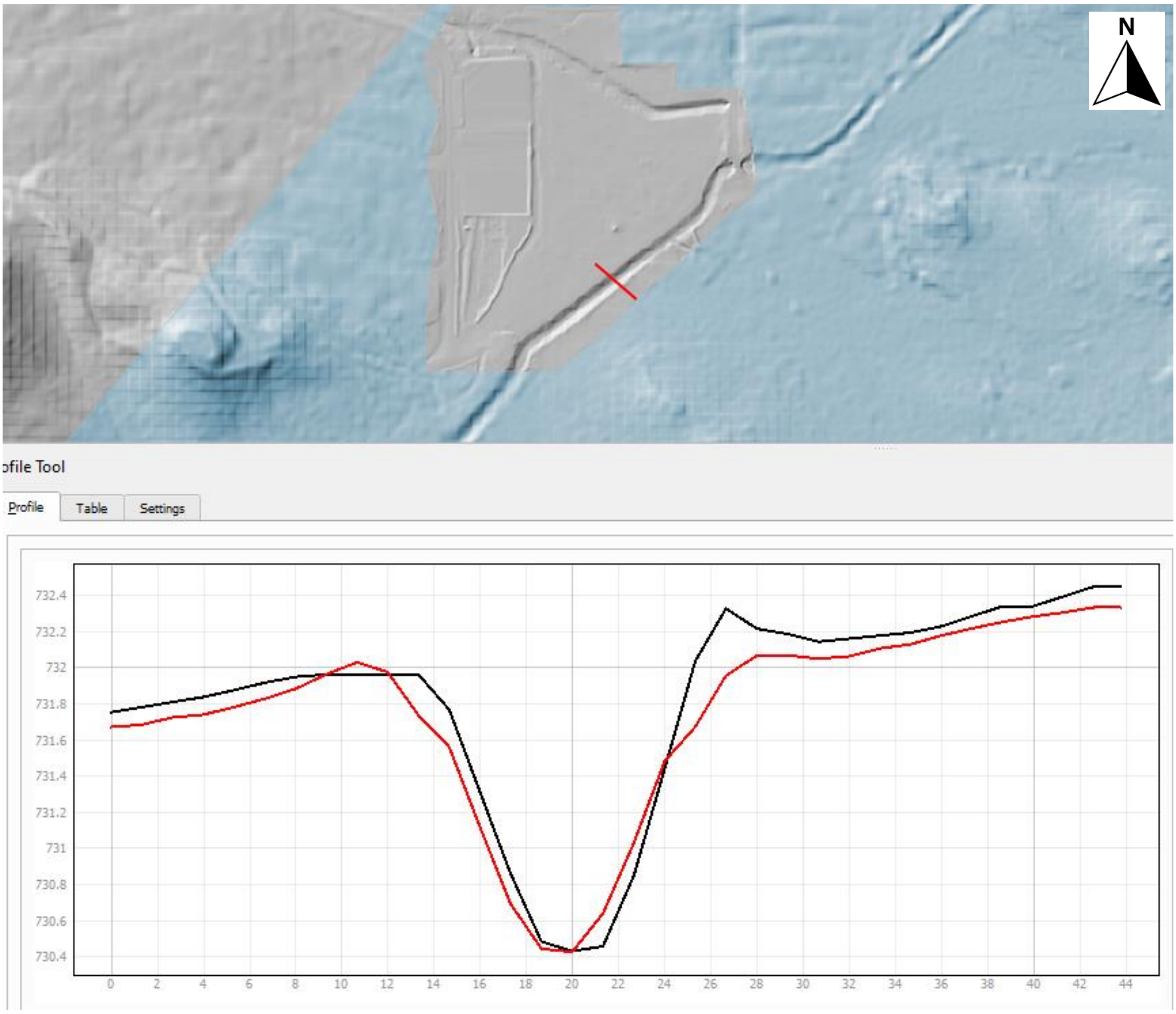


Figure 1-2: Comparison of Landgate DEM with site survey at southern channel

1.4 Terminology

Annual Exceedance Probability (AEP) terminology has been adopted for consistency with recommended probability terminology in the 2019 edition of the Australian Rainfall and Runoff (ARR2019) guideline. AEP is the probability or likelihood of an event occurring or being exceeded within any given year, usually expressed in percentage.

Average Recurrence Interval (ARI) terminology is no longer recommended by ARR2019. Table 1-1 shows the relationship between AEP and ARI.

Annual Exceedance Probability* (AEP)	1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 500
Average Recurrence Interval (ARI)	5 year	10 year	20 year	50 year	100 year	500 year

Table 1-1: Probability Terminology

** Values for ARI have been rounded up to the nearest whole number for simplicity*

1.5 Previous Studies

This section outlines previous study reports at the proposed hospital site.

***Lot 314 South Road, Tom Price - Flood Study and Preliminary Contaminated Land Assessment* (Golder, July 2021)**

A concept flood study was undertaken by Golder which estimates preliminary 1 in 100 and 1 in 500 AEP flood levels for existing and post-development scenarios associated with the development of Lots 400 and 46 South Road (the DFES and childcare centre developments which have been constructed). The hospital development was not considered as part of the flood study.

A site specific hydrological and hydraulic model was developed using XPSTORM software to understand the design flows at site and potential flooding risks. The report presented the flood depth maps, and velocity maps based on the assessment.

The study estimated design flows using regional parameters. However, the flows were not validated against site data (including the downstream flow gauge) or alternative methods. The hydraulic model was limited to the project boundary due to survey limitations. The study recommended a detailed flood assessment and extending the model upstream to capture potential break out flow and downstream where flood behaviour may impact flooding at the site.

***Tom Price Health Service Redevelopment - Civil and Structural PDP Report* (BPA Engineering, August 2021)**

This report was prepared to identify existing site conditions, assist with identifying a preferred location for the hospital on the site, and provide preliminary advice on civil and structural design solutions. Three (3) potential locations were investigated for the hospital on the site. Option 3 was deemed the most suitable and viable option. A sketch of Option 3 is shown in Figure 1-3 which incorporates a finished floor level (FFL) of 731.8 m AHD and raising the existing bund along the northern side of the diversion drain by approximately 0.5 m to divert runoff away from the hospital pad. Flood modelling of the hospital development does not appear to have been carried out, instead flood levels were based on the Golder (2021) report.

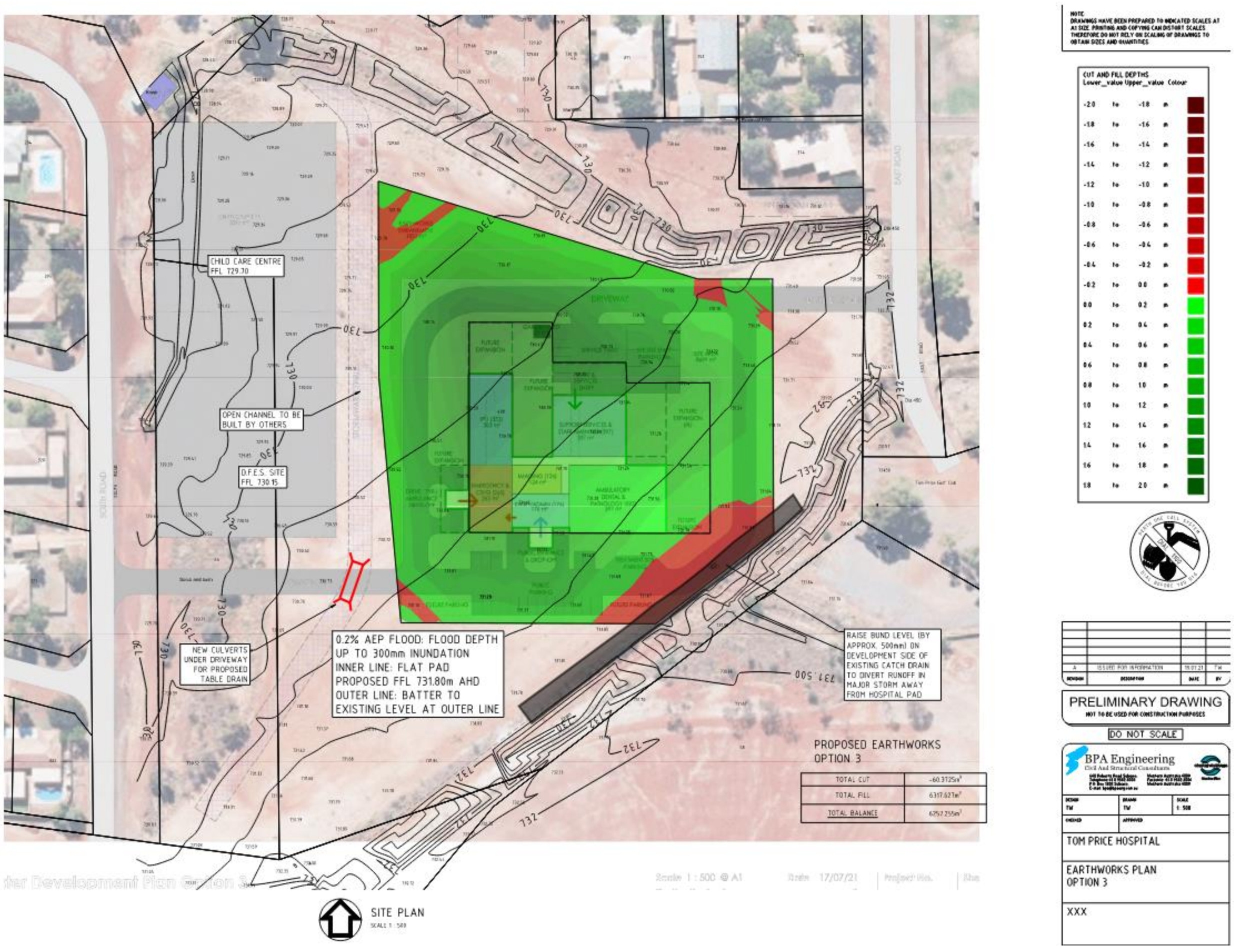


Figure 1-3: Earthworks Plan for Option 3 (Preferred)

***Tom Price Flood Modelling* (GHD, August 2024)**

A flood model was developed by GHD for Tom Price as part of development of significant projects in the town over the next few years. The study aims at understanding the existing flood behaviours on site, identifying flood hazards and exploring opportunities to mitigate flooding risks.

A RORB rainfall-runoff model has been developed as part of the study and the flows from the model are inputted as inflow hydrographs into the 2D model. The 2D model has direct rainfall within the model domain along with RORB inflows at the model boundaries. The study also considered the effects of climate change on the flows and flood depths.

1.6 Design Criteria

Section 4.4.4 of the Project Definition Plan (PDP) (Department of Finance, 2021) states:

'A Flood Study (included in the Civil & Structural Report, Appendix G) was conducted in July 2021 for the purposes of this PDP. Based on the Flood Study:

- *The floor levels of the proposed new hospital are to be 300mm above the 1:100year flood level (which equates to the 1:500year flood level).*
- *The required floor levels will be achieved by creating a raised building pad using imported engineered fill. The pad will be shaped to minimise the extent of engineered fill required.*
- *Some modification to the existing stormwater channels will be required including new culverts under the entrance road (over stormwater swale), enlargement of drainage channel, and raising of bund level (to*

south-eastern channel). Allowances included in cost plan, final extent of modification to be determined during design phases.'

Given the ambiguities in the above design criteria and the vulnerability of the hospital, BG&E requested clarification of the flood immunity criteria from the Department of Finance who confirmed that:

'The finished floor level of the hospital shall be based on achieving the 0.5m freeboard to the 1 in 100year flood level for the 2110 climate change scenario'.

This criteria was based on the requirements from the following documents:

Section 9.3.2 of the *Building Guidelines – Western Australian Health Facility Guidelines for Engineering Services* (Department of Health) which states:

'Design of Facilities required to comply with clauses 6.1.2 or 6.1.3 shall be designed to cope with 100-year Annual Recurrence Interval storm conditions and 100-year ARI storm surge event in coastal plans and shall place buildings at least 500 mm above this level so determined or as designated by the Local Authority. Other Facilities shall comply with requirements of Local Government Authority (Comment – Australian Runoff and Rainfall (ARR) required > 300mm above FFL, take into account high tides with cyclonic storm surge).'

Section 1.1 of the *Maintenance Minimisation Manual* (Department of Finacne, Oct 2024) which states:

'It is recommended that for future critical and emergency response infrastructure should have a finished floor level above the 1% annual probability or 100-year average recurrence interval for flood/storm event. Consider provision of a factor of safety of finished floor level a minimum 0.5m above the predicted design inundation for 2110.'

1.7 Climate Change

The impact of climate change was assessed based on the recommendations of Australian Rainfall & Runoff (ARR) version 4.2. ARR recognises that the design rainfall data published by the Bureau of Meteorology in 2016 represents the 1961 to 1990 climate scenario (time horizon). ARR recommends increases to design rainfall depths to account for climate change for various time horizons. For this project the following was used:

- Initial modelling – based on BoM 2016 design rainfall (1961 to 1990 time horizon)
- Flood impacts – based on the 2030 time horizon (after construction)
- Flood immunity – based on the 2100 time horizon (as per Department of Finance design criteria)

1.8 Software

The following specialist software packages were used for this investigation:

- TUFLOW FLIKE v5.0.306.0

FLIKE is an extreme value analysis package that calculates the probability of flood events based on historical records. It is fully compliant with the recommendations in ARR2019.

- RORB v6.45

RORB is a general runoff and streamflow routing program used to calculate flood hydrographs from rainfall and other channel inputs. It subtracts losses from rainfall to produce rainfall-excess and routes this through catchment storage to produce the hydrograph.

- QGIS v3.22.9

QGIS is an open-source Geographic Information System (GIS) licensed under the GNU General Public License. For this project it was used for data management and pre- and post-processing of TUFLOW models.

- TUFLOW v2023-03-AE

TUFLOW is a computational engine that provides 1-dimensional (1D) and 2-dimensional (2D) solutions for the free-surface flow equations to simulate the flood and tidal wave propagation. TUFLOW is highly suitable for modelling flooding in rivers and creeks.

1.9 Stakeholder Consultation

1.9.1 Shire of Ashburton

A meeting was held between BG&E and representatives from the Shire of Ashburton (the Shire) on 16 October 2024 to discuss the project and any available data which may assist. The Shire confirmed that:

- The perimeter diversion drain to the east of the town has not been designed for any specific flood event. Overtopping of the drain has occurred resulting in flooding within the town. Bunds along the drain have been upgraded following flooding.
- There was no specific anecdotal evidence of flooding of the hospital site.
- A draft flood study for Tom Price was being completed, however further topographic survey was being collected. The draft study report was provided several weeks after the meeting.

Various other meetings have been held between the Department of Finance and the Shire to discuss the hospital development. It is understood the Shire is currently planning future developments to the south-west corner of the site. The design of these developments is occurring concurrently with the hospital project and further coordination will be required.

1.9.2 Department of Water & Environmental Regulation

A meeting was held with the Department of Finance and the Department of Water & Environmental Regulation (DWER) on 13 December 2024 to discuss preliminary findings of the flood modelling. Terry Kefalianos (Senior Engineer – Urban Water) from DWER summarised recommendations in an email on the same day.

"Following up from our meeting this morning regarding Tom Price Hospital and the potential use of a flood levee, I note that DWER received the information yesterday and we are currently evaluating a number of competing state priorities, so we have only been able to give a quick high level response. The key recommendations we would like to note from the meeting are as follows.

- *Flood levees pose a unique hazard to human life and that hazard should be explicitly evaluated.*
- *DWER has a published guidance note on spoil banks and flood levees which outlines the Departments position on the use of levees and can provide a starting point for evaluation.*
- *The Department views flood levees as a tool of last resort to manage flood risk for existing communities where the impact of relocating people and infrastructure is unpalatable. Given that we are dealing with an existing community, it is recommended that you ensure you have a documented defensible position on site selection and why there was no other viable option but the use of a flood levee.*
- *The probability of a levee failure can not be reliably quantified and levee failure should be assessed based on consequences and hazards. We recommend a minimum 50m buffer between the levee and the hospital to account for hazards that cannot be reasonably represented by a numerical flood model. The hazard assessment should evaluate the consequences of a levee breach while upstream floodwaters are at the levee crest level. The design of the hospital should appropriately respond to the potential hazards of failure. The Department's concern is on ensuring the safety of human life.*
- *Governance of the flood levee should be addressed including the ongoing surveillance, maintenance, operation and emergency response.*
- *The proposal should not have detrimental flood impacts on other landowners."*

The hospital building is much closer to the proposed levee than the 50 m buffer recommended by DWER. A detailed hazard assessment has yet to be carried out (refer Section 4.2). The levee guidance note published by DWER and the Water Corporation is attached in Appendix A.

2. Hydrology

The town of Tom Price is located at the headwaters of the Hardey River catchment in the Pilbara region. The catchments upstream of the site are relatively small (less than 5 km²) and convey runoff to the existing diversion drain the runs along the eastern side of the town and along the southern boundary of the site (Figure 2-1).

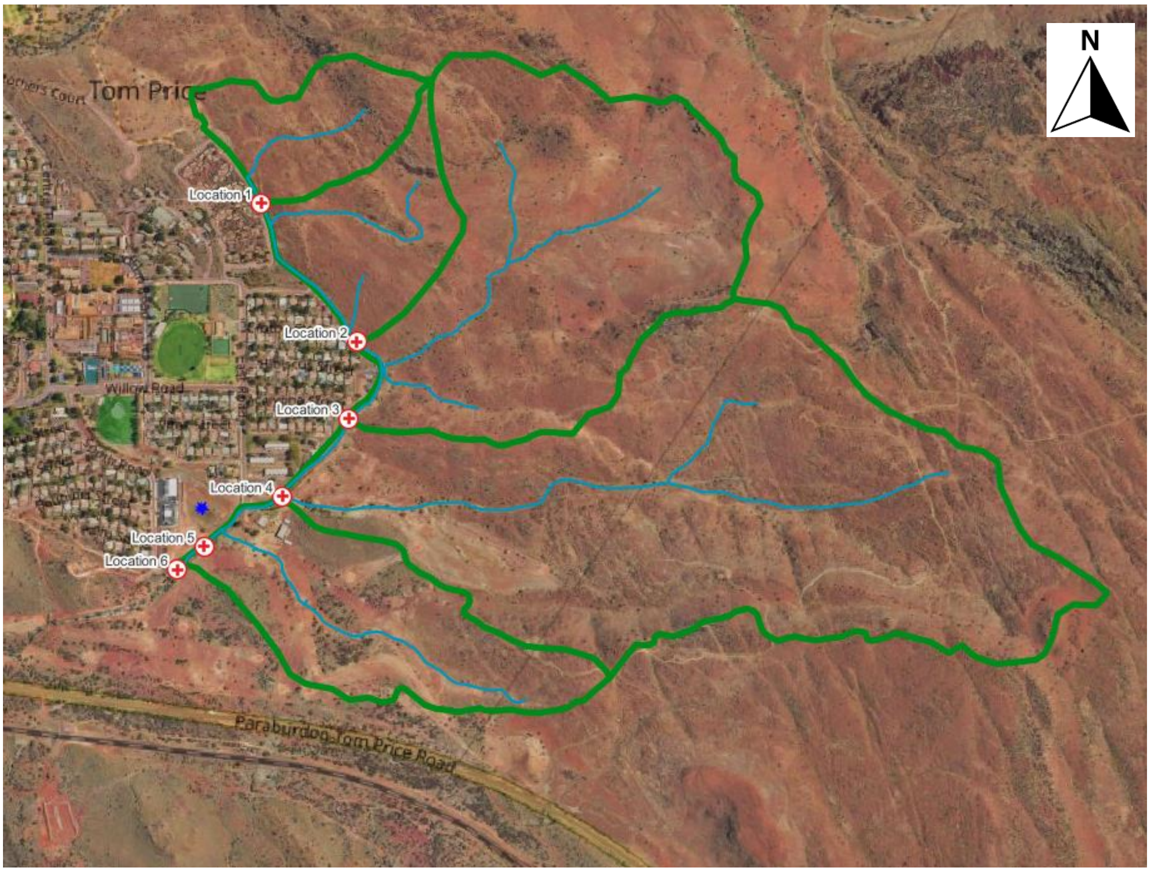


Figure 2-1: Local RORB Flow Locations

The methodology used to estimate design flows at the site is summarised below:

- Carried out flood frequency analysis using historical peak flows from the Mt Samson streamflow gauge (706207) on Hardey River (downstream of the town).
- Developed a regional RORB rainfall-runoff model for the 250 km² Mt Samson catchment which was calibrated to the flood frequency analysis by adjusting rainfall losses.
- Developed a local RORB model for catchments upstream of the hospital site adopting the calibrated rainfall losses from the Mt Samson RORB model.
- Assessed the local RORB model peak flows against regional peak flow estimation methods suitable for the Pilbara region (RFFE, RFFP etc).

Full details are included in Appendix B. Table B-5 summarises the RORB design flows for a range of design events at each location. These flows are based on rainfall data published by BoM in 2016, which reflects the 1961 to 1990 time horizon.

Location	Flows (m³/s)				
	1 in 10 AEP	1 in 20 AEP	1 in 50 AEP	1 in 100 AEP	1 in 500 AEP
Location 1	0.9	1.2	1.6	1.9	3.2
Location 2	1.6	2.1	2.3	2.9	5.6
Location 3	5.1	7.1	7.3	9.9	18.6

Location	Flows (m^3/s)				
	1 in 10 AEP	1 in 20 AEP	1 in 50 AEP	1 in 100 AEP	1 in 500 AEP
Location 4	9.2	12.9	15.7	19.3	35.2
Location 5 (site)	10.4	14.5	17.3	21.8	39.4
Location 6	10.7	14.7	16.9	21.8	39.5

Table 2-1: Local RORB Peak Flows (1961-1990)

3. Hydraulic Modelling

3.1 Model Setup

A 2D model has been developed for the flood assessment at the proposed site for both baseline and design scenarios. The 2D model domain and model setup are shown in Appendix C. Key inputs/parameters are summarised in Table 3-1.

Input	Description
Model Version	2023-03-AE
Scheme / Hardware	HPC/ GPU with SGS
Topography	1m Landgate Data (2022) and 1m DEM topographic dataset (2024)
Topography Modifications	Obvious triangulation errors were manually adjusted
	Ridge lines used to enhance the levee and road levels in both existing and design scenarios. Irregularities/Unrealistic undulations in the channel smoothened out using ZSH polygons.
	Ridge lines used for highway and rail line located at the southern side of the model within the model domain
Manning's Roughness	Roads – 0.020 Culverts – 0.024 (CSPs) Cleared areas – 0.030 Waterways/channel, minimal vegetation – 0.030 Open pervious areas, moderate vegetation – 0.050 Residential areas – 0.050 Dense vegetation – 0.070
Model Resolution	5m cell resolution with SGS at a sample distance of 1m
Boundary Conditions	Inflows • A time varying discharge boundary (QT) has been adopted for the inflow from catchment A1 on the western side of the model. A steady state hydrograph has been adopted for this inflow. • Direct Rainfall approach for the southern area of the model. The rainfall data for the ensemble runs were extracted from ARR plugin in QGIS. The losses applied corresponds to the calibrated losses from the RORB model. Losses were applied to the rainfall via the materials file.
	Outflows - Water level versus flow (HQ) with bed slope has been adopted at the outflow boundary in the 2D model. The grade of the channel has been extracted from the survey data.
Simulation Time	Simulation times based on storm duration from 8 hours to 30 hours.
Structures	• Existing Culverts - Modelled as 1d network lines and have been linked to the 2D domain • Culverts within the town in the vicinity of the town were modelled based on the latest 2024 topographic survey information. • Main Roads culverts in the model were estimated based on aerial imagery and terrain data assessment in the absence of other information. • Culvert details under the rail line has been supplied by Rio Tinto

Table 3-1: TUFLOW Model Inputs

3.2 Preliminary Existing Scenario

The existing scenario was initially modelled using field survey that was several years old and the inputs detailed in Table 3-1.

3.2.1 Model Validation

Flows from the 2D model were validated against flows from the local RORB model. Since the RORB model does not allow for breakout from the perimeter diversion drain, an artificial levee was included along the drain in the 2D model to prevent breakout flow. This ensured that the total flows at selected locations have been compared in both models. Initially rainfall was only applied to the catchments upstream of the site.

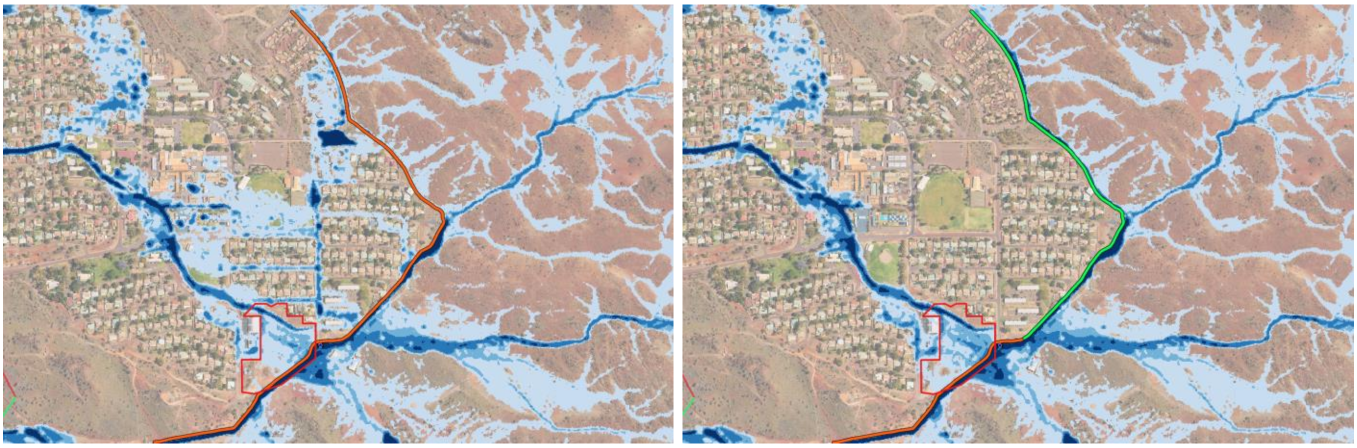


Figure 3-1: Existing informal bund along diversion drain (shown in orange) versus artificial levee scenario (shown in green)

Flows extracted from RORB and TUFLOW for a range of flood events are provided in Appendix C. There is a good match between the models at the hospital site with the flows generally differing from each other within the range of 5-10% with similar critical storm durations.

3.2.2 Preliminary Results

Flood risk to the existing site from the diversion drain was assessed for a range of flood events from 1 in 10 to 1 in 500 AEP for the 1961 to 1990 time horizon. The modelling results showed that the existing diversion drain overtops at multiple locations upstream of the site before it reaches the culverts under East Road. The Shire has confirmed that the diversion drain and associated bunds was not designed to a specific flow or flood event, and that overtopping upstream of the site has occurred previously.

At the hospital site the existing diversion drain is approximately 3 m wide at the base and 1.8 m deep. The site is at risk of flooding due to overtopping of the diversion drain in relatively frequent events such as 1 in 10 AEP (a 10% chance every year), not just the 1 in 100 AEP event as shown in Figure 3-2.

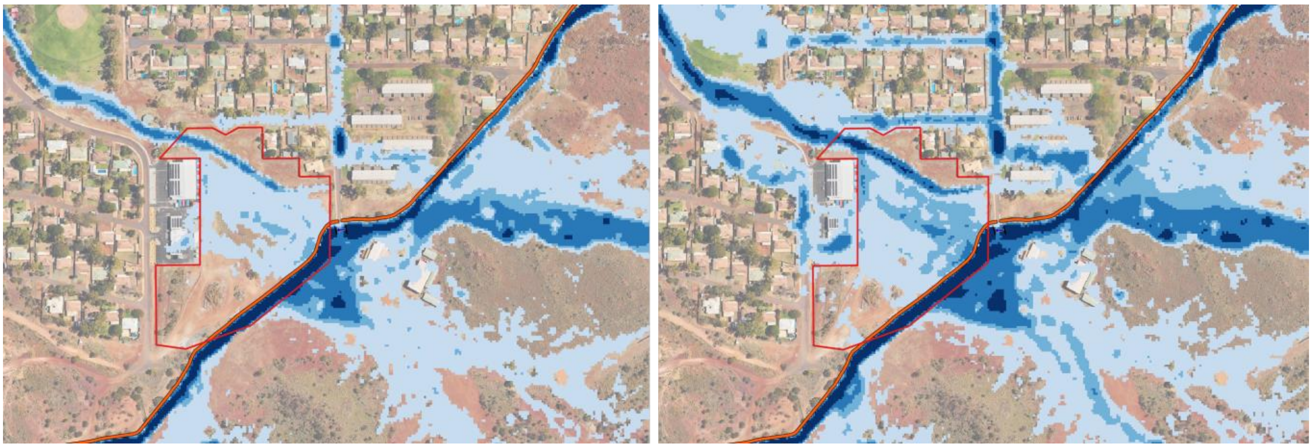


Figure 3-2: 1 in 10 and 1 in 100 AEP flood extent mapping for the existing scenario (1961-1990)

For the hospital building to achieve 0.5 m freeboard above existing flood levels in the diversion drain, the finished floor level (FFL) would need to be approximately 732.7 m AHD (1 m higher than the concept level of 731.8 m AHD) ignoring the impacts of climate change. This would result in several metres of fill to the north of the site (which is lower than the bank of the drain) and the hospital FFL would be significantly higher than the adjacent DFES and childcare centre buildings. Placing fill within the site would also divert runoff and increase flood levels. For these reasons, achieving flood immunity using only fill is not considered practical.

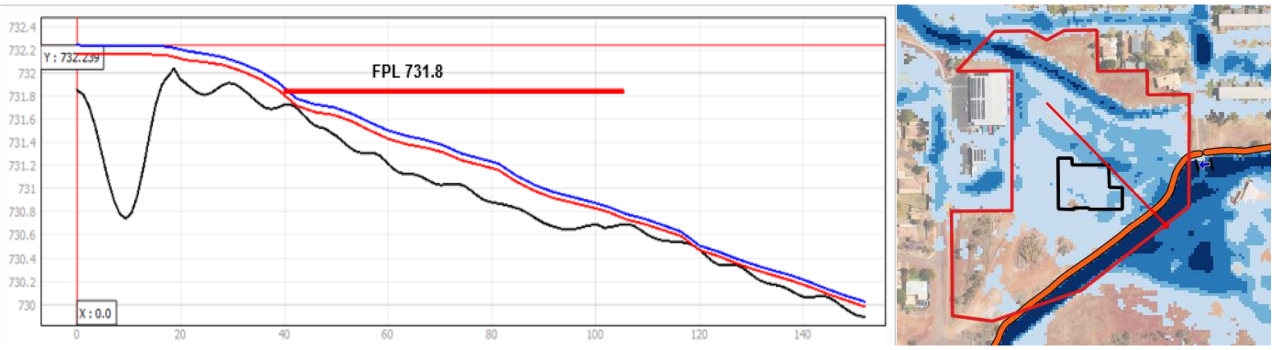


Figure 3-3: Profile showing existing 1 in 100 and 1 in 500 AEP flood levels and the proposed FFL of 731.8 m AHD

3.3 Preliminary Design Options

Several alternative design options were investigated, all of which rely on a levee to some extent to protect the hospital development. DWER views flood levees as a tool of last resort to manage flood risk for existing communities where the impact of relocating people and infrastructure is unpalatable (Section 1.9.2). Relying on a levee to protect the site has inherent risk given the potential for settlement, failure, unintentional removal etc. Any levee needs to be a designed as a permanent structure which is inspected and maintained.

For each of these options the earthworks surface was based on the recommended option from the PDP phase. Design of culverts or additional drains within the site was not included. No allowance was made for climate change at the time this modelling was carried out (the design criteria had not been confirmed), however the 1 in 500 AEP was used to approximate a 1 in 100 AEP event under a future climate scenario.

Given the vulnerability of the hospital development, a conservative approach was taken assuming the upstream diversion channel and bunds may be upgraded in the future which would increase runoff towards the hospital site. To simulate this, an artificial levee along the upstream channel was included in the model to convey all runoff towards the hospital site (Figure 3-1).

3.3.1 Design Option 1 – Partial levee along diversion drain

This was the recommended option from the PDP phase which incorporated a partial bund between the diversion drain and hospital (approx. 0.5 m high) as shown in Section 1.5. A higher levee was included in the model to prevent overtopping. The flood model demonstrated that:

- The levee does not sufficiently divert flows away from the hospital building, with floodwaters extending around the hospital side of the levee. The FFL would need to be increased at least 0.5 m to meet the flood immunity criteria however additional fill within the site would likely increase flood levels further.
- Flooding occurs over both hospital access roads from South Rd and East Rd. Drains and culverts would be required either side of the hospital (not modelled) to prevent flooding of these roads.
- There is a potential that the levee results in additional flow and increased flood levels to the west of the site along South Road.

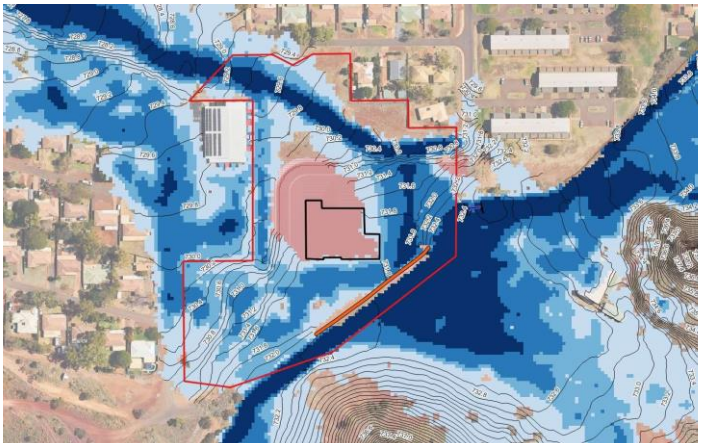


Figure 3-4: Design Option 1 – Partial levee (PDP preferred option) 1 in 500 AEP flood extent (1961-1990 climate scenario)

3.3.2 Design Option 2 – Extended Levee

This option involved extending the levee around the southern and eastern side of the hospital road. The extended levee is effective in reducing flood levels adjacent to the hospital building, however this option would require drains and culverts either side of the development to prevent flooding of the access roads from South Rd and East Rd (which may not be possible). There is also a potential for increased flood levels along South Rd and East Rd due to flow being diverted by the levee.

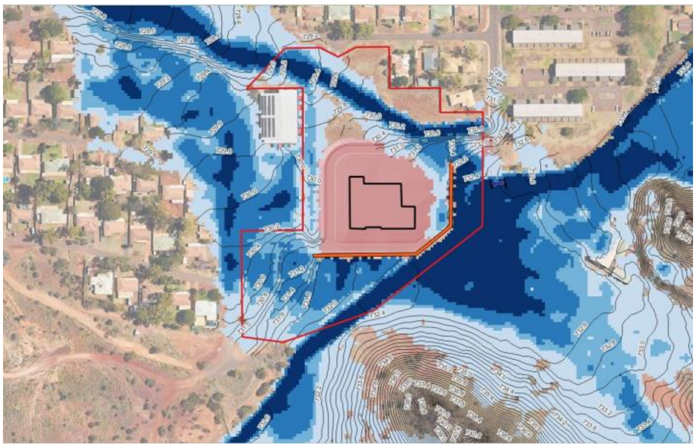


Figure 3-5: Design Option 2 – Extended levee 1 in 500 AEP flood extent (1961-1990 climate scenario)

3.3.3 Design Option 3 – Full Levee

Design Option 3 incorporates a full levee which extends to East Rd to prevent as much as practical any breakout flow through the site from the diversion drain. Some breakout flow is still seen to occur at the eastern end of the levee along East Rd and at the western end of the levee along South Rd. Extending the levee to the west has the potential to provide protection to the south-west portion of the site, where future development is planned.

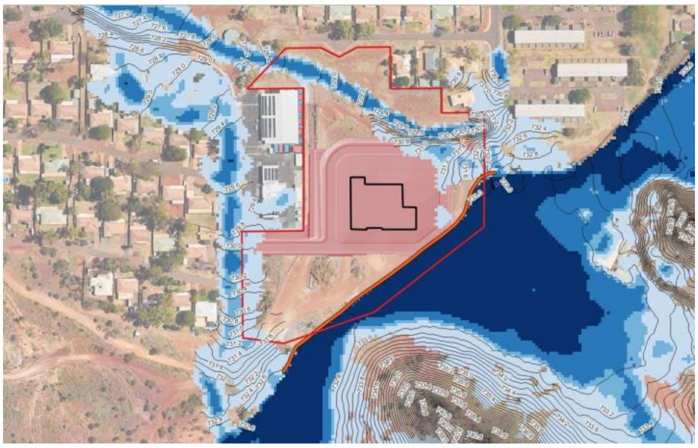


Figure 3-6: Design Option 3 – Full levee 1 in 500 AEP flood extent (1961-1990 climate scenario)

3.3.4 Preferred Design option

These findings were presented to the Department of Finance who confirmed that Design Option 3 (full levee) was the preferred option, and that the flood immunity design criteria shall be based on achieving a minimum 0.5 m freeboard above the 1 in 100 AEP event under the 2100 climate scenario (discussed in Section 1.6).

3.4 Updated Existing Scenario

Several updates were made to the TUFLOW model to better understand potential impacts to existing flood behaviour, and reflect the revised flood immunity criteria, including:

- incorporated more recent site survey.
- extended the model further downstream to assess potential impacts to flood behaviour due to the levee design.
- included rainfall within the site and southern section of the town.
- updated rainfall inputs to reflect current climate guidance in ARR2019. Temperature projections were based on the high (SSP3-7.0) emissions pathway.

The updated model extent is shown in Figure 3-7. The model is suitable for assessing flood behaviour in the vicinity of the hospital site, however flood behaviour further away from the site is indicative only given these areas are not represented in detail.

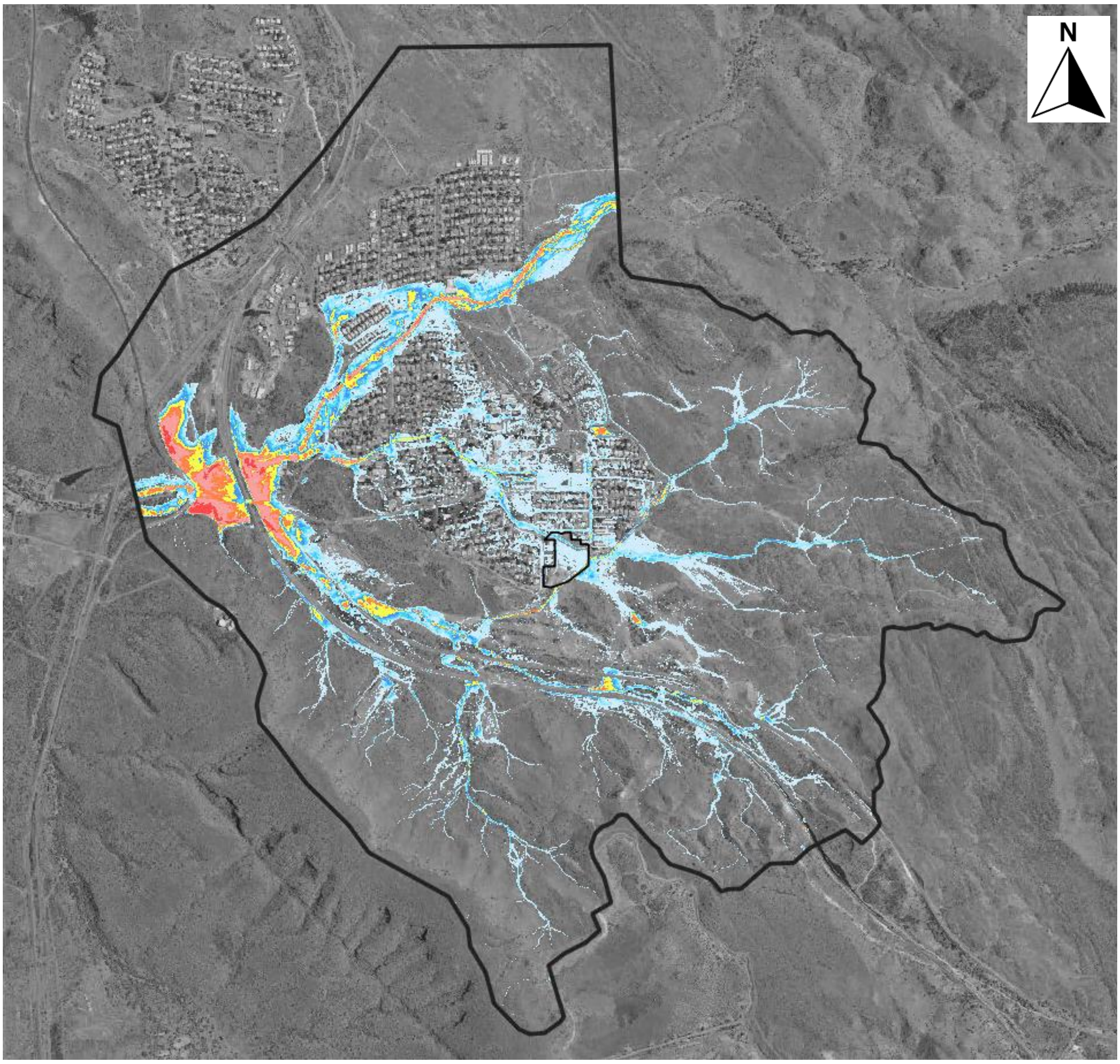


Figure 3-7: Updated TUFLOW model extent

Ensemble simulations were carried out for the 60 min to 360 min duration storm events. The 60 min storm duration was critical for the site and surrounding area, with temporal pattern 4 resulting in median flood levels along the diversion drain and most of the site. The current climate and future climate scenarios were based on the 2030 and 2100 time horizons respectively.

For the 2030 time horizon, the 1 in 100 AEP peak flow upstream of the site is approximately 24 m^3/s with 9 m^3/s overtopping the diversion drain and flowing through the site, and 15 m^3/s continuing along the diversion drain to the west. The existing 2xDN900 culverts in East Rd have a capacity of approximately 2 m^3/s, much less than the drain itself, having limited impact during a flood event. The depth of flow in the diversion drain is between 1 and 2 m. Flood depths within the site are generally shallow (less than 0.2 m) with higher depths in the drains/swales to the north and west.

South Rd (which is approximately 1 m lower than the proposed hospital building area) acts as an overland flowpath conveying runoff in a northerly direction from several residential properties to the west. The northern drain collects runoff from several residential properties to the north of the site. As such, the hospital site itself is not considered at risk of flooding from local urban areas. Rainfall which falls directly on the site will be managed via site stormwater drainage which will be designed as part of the development.

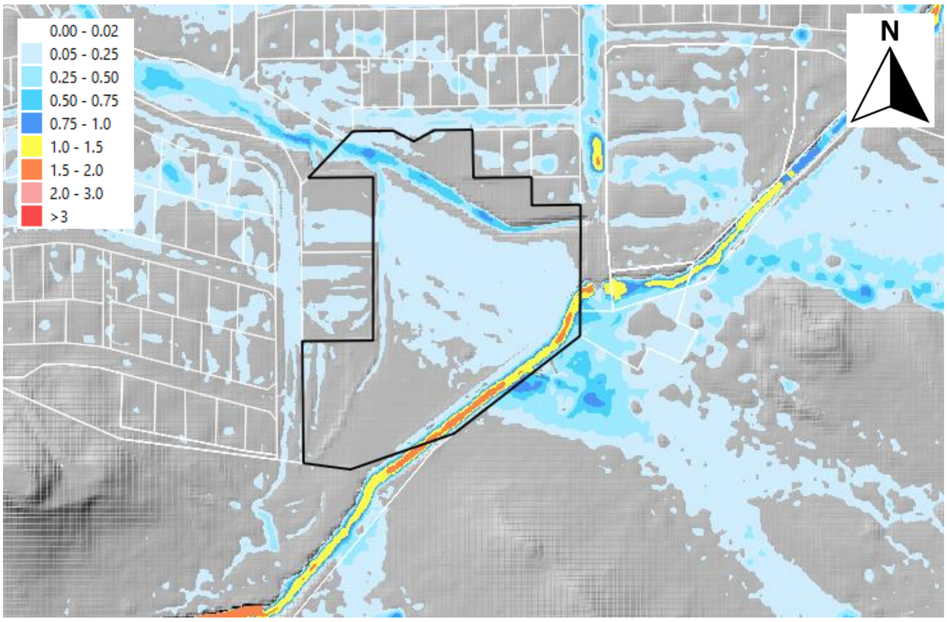


Figure 3-8: Existing scenario 1 in 100 AEP peak flood depths (2030 time horizon)

3.5 Forward Works Design Scenario

A design surface for the forward works package was prepared by BG&E which included a levee with a crest level of 733.4 m AHD (approx. 1.4 m high) based on the preliminary flood modelling of Design Option 3 (full levee). The earthworks pad for the hospital building maintains a finished level of 731.8 m AHD. The eastern end of the levee was realigned in the flood model to extend to the hospital access road to minimise runoff entering the site from East Rd (Figure 3-9).

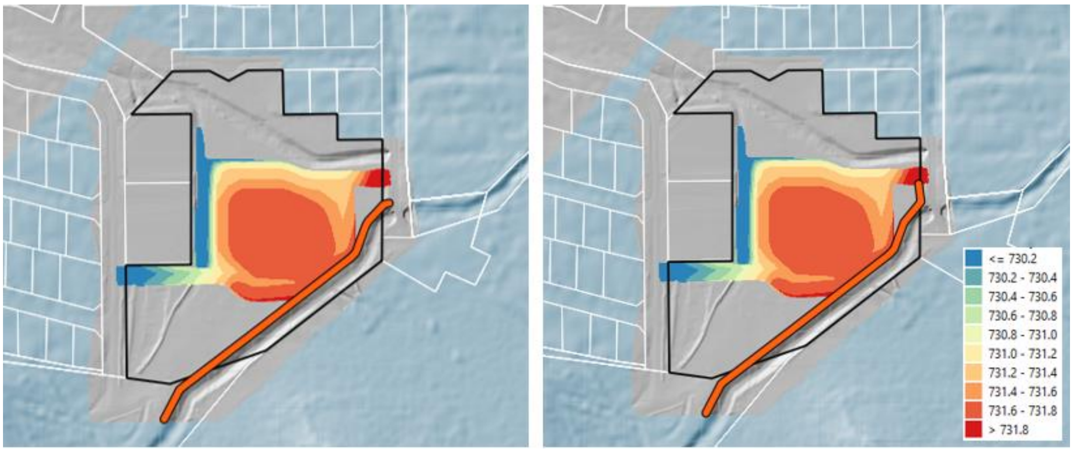


Figure 3-9: Forward works design surface with tender design levee (left) and modelled levee (right)

3.5.1 Flood Immunity

As outlined in Section 1.6, the Department of Finance nominated that *'The finished floor level of the hospital shall be based on achieving the 0.5m freeboard to the 1 in 100year flood level for the 2110 climate change scenario'.* Flood immunity of the proposed levee and hospital building was assessed based on the 2100 time horizon (data for the 2110 time horizon is not available in ARR2019). The model was updated to include the forward works design earthworks (access roads, building pad, levee etc.) and the artificial levee upstream of the site (discussed in Section 3.2.1) as a conservative approach to allow for potential future upgrades to the diversion drain.

Ensemble simulations were carried out for the 60 min to 360 min duration storm events. The 60 min storm duration was critical for the site and surrounding area, with temporal pattern 4 resulting in median flood levels along the diversion drain and most of the site.

The 1 in 100 AEP peak flow upstream of the site is approximately 51 m³/s, more than double the flow from the 2030 time horizon. This increase is attributed to increased rainfall intensity due to climate change between 2030 and 2100, and the conservative approach of ignoring potential breakout flow from the diversion drain upstream when considering flood immunity. The peak flood level for the 1 in 100 AEP event at the eastern end of the levee is 733.11 m AHD, reducing to 732.85 m AHD at the western end of the levee. The forward works design currently incorporates a levee crest of 733.4 m AHD, which would need to be increased approximately 0.2 m to 733.61 m AHD to achieve 0.5 m freeboard.

Approximately 2 m³/s enters the site at the eastern end of the levee via East Rd, resulting in shallow flood depths of less than 0.1 m at the low point of the hospital access road before entering the drain to the north of the site. Freeboard to the hospital FFL at this location is approximately 0.4 m (slightly less than the 0.5 m criteria). The risk of flooding to the hospital building due to runoff from East Rd is considered low given the shallow depth and unrestricted flowpath to the northern drain which is approximately 2 m lower than the hospital FFL. It is expected that the access road design can be refined during detailed design to achieve 0.5 m freeboard.

Approximately 5 m³/s overtops the diversion drain at the western end of the levee to South Rd. The hospital building FFL is at least 1 m above South Rd which provides a shallow overland flowpath to the north away from the hospital site.

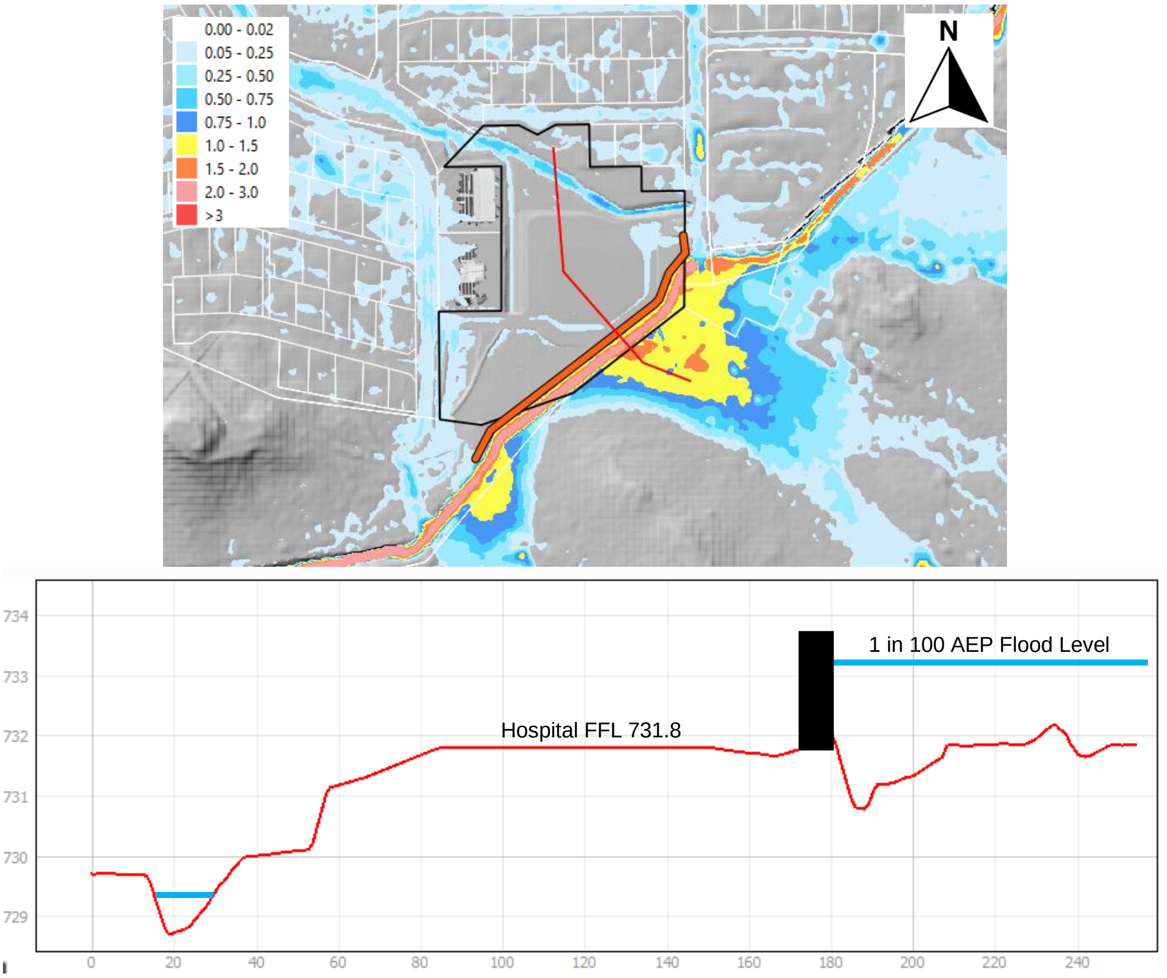


Figure 3-10: Forward works design scenario 1 in 100 AEP flood depths (m) (2100 time horizon) and profile

Flood velocities in the diversion drain are less than 2 m/s (often used as a threshold for scour), except for a very localised area (Figure 3-11). Further advice is recommended from a geotechnical or geomorphological consultant to ensure any potential risk of scour in the diversion drain and levee is mitigated.

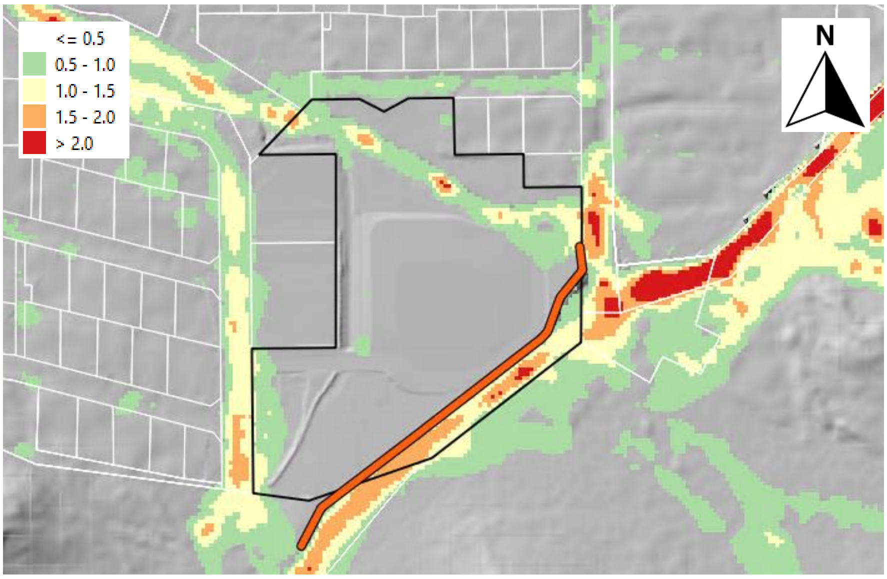


Figure 3-11: Forward works design scenario 1 in 100 AEP peak velocities (m/s) (2100 time horizon)

3.5.2 Impact Assessment

The flood impact assessment was based on the 2030 time horizon without the artificial levee along the upstream diversion drain. This scenario best reflects conditions once the hospital is built. The main areas sensitive to changes in flood behaviour are as follows:

- Residential and commercial areas to the north, east, and west of the site
- Mountain View Golf Club to the south of the site (Council asset)
- Tom Price–Paraburdoo Road (Main Roads asset) downstream of the diversion channel
- Railway downstream of the diversion channel (Rio Tinto asset)

Flood level difference (afflux) mapping for the 1 in 20 and 1 in 100 AEP events is shown in Figure 3-12 and Figure 3-13. A positive (red) value represents an increase in flood level, whereas a negative (blue) value represents a decrease. Any change in flood level less than 25 mm is not shown.

Figure 3-12: 1 in 20 AEP flood level differences (m) (2030 time horizon)

Figure 3-13: 1 in 100 AEP flood level differences (m) (2030 time horizon)

3.5.2.1 Adjacent development

As expected, the proposed levee reduces flows and flood levels downstream of the site through the town. No adverse impacts are shown along South Rd. A localised increase of 120 mm and 230 mm is shown for the 1 in 20 and 1 in 100 AEP respectively at the East Rd culverts where the road is overtopping immediately upstream of the levee.

3.5.2.2 Mountain View Golf Club

The Mountain View Golf Club is located to the south of the proposed levee. Increased flood levels of up to 130 mm and 250 mm for the 1 in 20 and 1 in 100 AEP events respectively are shown to occur within the course itself, with negligible change to flood extent. The buildings near East Rd appear to be elevated above the 1 in 100 AEP flood level based on Landgate topography data, however floor level survey would be required to confirm.

3.5.2.3 Tom Price-Paraburdoo Road

The model shows an increase in flows and flood levels along the diversion drain, extending to Tom Price-Paraburdoo Rd where afflux is less than 50 mm. Austroads (2023) does not include recommended afflux criteria for road infrastructure, however based on previous experience with Main Roads WA, increases in flood levels of up to 50 mm is likely to be considered negligible. The road itself is overtopping in these events, with no change to road serviceability.

Section 6.10.1 of *Guide to Road Design Part 5: Drainage – General and Hydrology Considerations* (Austroads, 2023) recommends some acceptable impacts for major transport infrastructure. In the absence of any project specific or stakeholder criteria, changes in flood behaviour could be reviewed against these criteria. While Austroads (2023) also includes recommendations for other impacts (flood duration, velocities etc) only change in flood levels (afflux) has been considered at this stage.

	Residential buildings (mm)*	Residential yards (mm)	Industrial and Commercial buildings (mm)	Industrial and commercial yard (mm)	Non habitable structures (sheds)	Agricultural (mm)**	Open Space/ Forest (mm)***
Flood Levels	25 (general) 10-20 (sensitive receivers including hospitals, schools and critical infrastructure)	50	50	100	100	200-400	400

Figure 3-14: Acceptable increase in flood levels (afflux) (Austroads, 2023)

The Department of Finance and the Shire need to determine whether the above change in design flood levels are considered acceptable.

4. Conclusions and Recommendations

4.1 Conclusions

4.1.1 Existing Site

At the hospital site the existing diversion drain which runs along the eastern side of the town is approximately 3 m wide at the base and 1.8 m deep. The site is at risk of flooding due to overtopping of the diversion drain in relatively frequent flood events such as 1 in 10 AEP (a 10% chance every year) as well as the 1 in 100 AEP event. Flood depths within the site are generally shallow (less than 0.2 m) with higher depths in the drains/swales to the north and west. South Rd (which is approximately 1 m lower than the proposed hospital building area) acts as an overland flowpath conveying runoff in a northerly direction from the properties to the west.

4.1.2 Preliminary Options

The Department of Finance requires that *'The finished floor level of the hospital shall be based on achieving the 0.5m freeboard to the 1 in 100year flood level for the 2110 climate change scenario'.* Filling of the site to achieve the flood immunity criteria is not considered practical (Section 3.2.2). Preliminary flood modelling was carried out for several levee options (Section 3.3). The Department of Finance confirmed that the full levee option was preferred which was incorporated into the forward works design.

4.1.3 Forward Works Design

Modelling of the forward works design was carried out with an adjusted levee alignment near East Rd to minimise breakout around the end of the levee.

4.1.3.1 Flood Immunity

The 1 in 100 AEP peak flow upstream of the site for the 2100 time horizon is approximately 51 m^3/s, more than double the flow from the 2030 time horizon. This increase is attributed to increased rainfall intensity due to climate change, and the conservative approach of ignoring potential breakout flow from the diversion drain upstream when considering flood immunity.

The peak flood level for the 1 in 100 AEP event at the eastern end of the levee is 733.11 m AHD, reducing to 732.85 m AHD at the western end of the levee. The forward works design currently incorporates a levee crest of 733.40 m AHD, which would need to be increased approximately 0.2 m to 733.61 m AHD to achieve 0.5 m freeboard.

Approximately 2 m^3/s enters the site at the eastern end of the levee via East Rd, resulting in shallow flood depths of less than 0.1 m at the low point of the hospital access road before entering the northern drain. Freeboard to the hospital FFL at this location is approximately 0.4 m (slightly less than the 0.5 m criteria). It is expected that the access road design can be refined during design of the hospital development to achieve 0.5 m freeboard.

4.1.3.2 Impact Assessment

Potential changes to 1 in 20 and 1 in 100 AEP flood levels were estimated based on the 2030 time horizon, which showed:

- the proposed levee reduces flows and flood levels to the north of the site within the town. No adverse impacts are shown along South Rd, with a localised increase of up to 230 mm at the East Rd drain crossing at the levee.
- increased flood levels of up to 250 mm are shown to occur within the Mountain View Golf Club which is located to the south of the proposed levee. Floor level survey would be required to confirm freeboard available to the existing buildings (which appear to be above 1 in 100 AEP flood levels).

- minor increases in flood levels of less than 50 mm are shown at Tom Price-Paraburdoo Road. Based on previous experience with Main Roads WA, increases in flood levels of up to 50 mm is likely to be considered negligible. The road itself is overtopping in these events, with no change to road serviceability.

In the absence of project specific criteria, Austroads (2023) includes some recommendations for acceptable flood impacts. The Department of Finance and the Shire need to determine whether the above impacts are acceptable.

4.2 Recommendations

This assessment has been based on certain assumptions (levee intact, channel clearance maintained, no scouring, no connecting of in-ground pipework across the channel etc). As outlined in the levee guidance note in Appendix A and consultation with DWER, levees are considered a tool of last resort to manage flood risk for existing communities. DWER and the Water Corporation do not support the use of flood levee structures to enable development of a floodplain and knowingly put people into a flood risk area. It is understood that further consultation between the Department of Finance the Shire is being carried out to discuss flood management for the hospital and adjacent developments within the site.

The forward works design is currently documented for the purpose of pricing and stakeholder review. Prior to finalising the design, the following works are recommended:

- A detailed risk and hazard assessment should be carried out (as recommended by DWER) to assess potential consequences to the hospital and surrounding area associated with levee failure or overtopping. This will require input from key stakeholders to ensure residual risks and responsibilities are fully understood. The scope of the hazard assessment will need to be confirmed, but is expected to include:
    - Hydraulic modelling to understand flood behaviour in the event the assumptions in this report are not achieved (diversion drain was blocked, the levee was to overtop or fail etc).
    - Identify consequences associated with each scenario.
    - Identify potential measures which could be incorporated into the design to eliminate or reduce this risk.
    - Assign responsibilities for any residual risks associated with the design.
    - Other measures (raised building pad, bunds, drained pavements etc) could be reviewed to manage water impacting the hospital site.
- The Department of Finance should have a documented defensible position on site selection and why there was no other viable option but the use of a flood levee (as recommended by DWER).
- Further consultation should be carried out between the Department of Finance and the Shire to ensure:
    - the design has considered future development within the site (progressing in parallel).
    - governance and ownership of the flood levee is addressed including ongoing surveillance, maintenance, operation and emergency response.
    - changes in flood behaviour are acceptable.
- Geotechnical/geomorphological advice should be sought regarding potential for scour of the existing diversion channel and risk to the stability of the levee over time.
- The alignment and crest level of the proposed levee should be reviewed to minimise breakout flow to the site via East Rd and achieve the freeboard criteria (the levee crest would need to be increased by approximately 0.2 m to achieve 0.5 m freeboard).
- Further flood modelling be carried out during design of the hospital to ensure the flood immunity criteria is met near East Rd where some overtopping of the access road occurs.

This report was prepared to support the forward works design for the hospital development. Future updates to the flood model and report will be required as the development progresses to reflect changes to the design which may impact the results in this report.

Appendices

Appendix A – Levee Guidance Note

Drainage for Liveability

Spoil Banks and Flood Levees

Purpose

This guidance note outlines the Water Corporation and the Department of Water and Environmental Regulation's position with respect to development within drainage districts in the vicinity of open drains with spoil banks, and proposals for flood protection works comprising levees on or near Water Corporation assets. It presents advice to existing landowners and proponents of development that may be in the vicinity of these assets.

Rural drainage network and spoil banks

There is a long history of drainage for agriculture in the southwest of Western Australia. Flat landscapes with groundwater at or near the surface are abundant in the southwest and provide valuable land and water for agricultural activities. Frequent inundation by surface water or groundwater can cause damage to homes and rural property.

A rural drainage network was constructed in the southwest to manage and convey inundation and discharge water from agricultural land. The network was constructed in the early to mid-1900s to prevent extended periods of inundation and was not intended to manage flood risk to protect property or life.

Along the banks of the drains throughout much of the rural drainage network are spoil banks. Spoil banks are stockpiles of excess excavation material from construction and maintenance activities. These banks have been constructed without any control in material selection, placement, or compaction. The spoil banks may be isolated or continuous stockpiles of material along the rural drains. These banks will influence the flood behaviour around the drains and failure may result in inundation of adjacent property.

Flood levees

Flood levees alter the flood waters in drainage and river systems to reduce the frequency of surrounding land being inundated. Failure of flood levees may result in rapid inundation of surrounding land, damage to infrastructure and the environment, and potential loss of life.

Flood levees are complex, engineered structures designed to contain or redirect flood waters. Flood levees require advanced flood modelling, engineering design, controlled construction, ongoing maintenance, and emergency management to ensure they provide the intended protection to the community.

Australian floodplain management industry practice considers levees as a tool of last resort to manage flood risk for existing communities where the impact of relocating people and infrastructure is unpalatable. The Department of Water and Environmental Regulation and Water Corporation do not support the use of flood levee structures to enable development of a floodplain and knowingly put people into a flood risk area.

Assessment of flooding and associated consequences

Development proposals in rural areas should be discussed with the Water Corporation and the Department of Water and Environmental Regulation early in the land planning process to determine if local or regional drainage, or potential spoil bank failures pose flood consequences. Where potential flooding is identified, Water Corporation and Department of Water and

Environmental Regulation will provide guidance on the appropriate methodology to assess flood extent and associated consequences.

The assessment of spoil bank failure is a complex matter, and the precise methodology is dependent on factors such as hydrology, hydraulics, geotechnical conditions and adjacent landform. In some instances, the Water Corporation or the Department of Water and Environmental Regulation may have identified the approach for assessing failure in a particular catchment while in other instances information may be limited.

The relatively sparse nature of people and property in a rural setting means that the consequences of spoil bank failure are generally considered manageable. When considering rural development the consequences of spoil bank or levee bank failure should be considered.

Guiding principles

The Water Corporation and Department of Water and Environmental Regulation agree on the following guiding principles for development in and around spoil banks in a rural drainage network and the use of flood levees:

- Proponents should contact Water Corporation and Department of Water and Environmental Regulation early in the land planning process to discuss the existing drainage network, its function, and any constraints associated with the drainage network that may impact the proposed development.
- Potential flooding, including consequences of spoil bank or levee bank failure drive decision making and need to be assessed and mitigated in any proposed development.
- Spoil banks along rural drains are not flood levees and cannot be relied upon to provide flood protection.
- Spoil banks cannot be remediated or adapted to provide flood protection as they have not been designed, constructed or maintained for that purpose.
- Flood protection levees should not be used to facilitate new urban development. Flood levees are inherently dangerous and should only be used to protect communities who are already in danger, not as a justification to develop the floodplain and deliberately place people in harm's way.

Contact Details

Department of Water and Environmental Regulation
www.wa.gov.au/dwer
6364 7600

Water Corporation
www.watercorporation.com.au
9420 2420

Appendix B – Hydrology

The town of Tom Price is located at the headwaters of the Hardey River catchment. The catchments upstream of the site are relatively small (less than 5 km^2) and convey runoff to the existing diversion drain the runs along the eastern side of the town and along the southern boundary of the site.

The methodology adopted for to estimate design flows at the site is summarised below:

- Carried out flood frequency analysis using historical peak flows from the Mt Samson streamflow gauge (706207) on Hardey River (downstream of the town).
- Developed a regional RORB rainfall-runoff model for the 250 km^2 Mt Samson catchment which was calibrated to the flood frequency analysis by adjusting rainfall losses
- Developed a local RORB model for catchments upstream of the hospital site adopting the calibrated rainfall losses from the Mt Samson RORB model.
- Assessed the local RORB model peak flows against regional peak flow estimation methods suitable for the Pilbara region (RFFE, RFFP etc).

B.1 Hardey River – Mt Samson

There is a streamflow gauging station on Hardey River downstream of Tom Price at Mt Samson which is currently inactive (1966-2001). Gauging station details are summarised in Table B-1.

Site	706207
River	Hardey
Station Name	Hardey River - Mt Samson
Catchment Area (km^2)	250
Period of Record	09 Dec 1966 – 23 May 2001 (36 years)
Maximum Recorded Flow (m^3/s)	657

Table B-1: Gauging Station Details

Figure B-1 shows the gauge quality data as received from the Department of Water and Environmental Regulation (DWER) for gauge 706207.

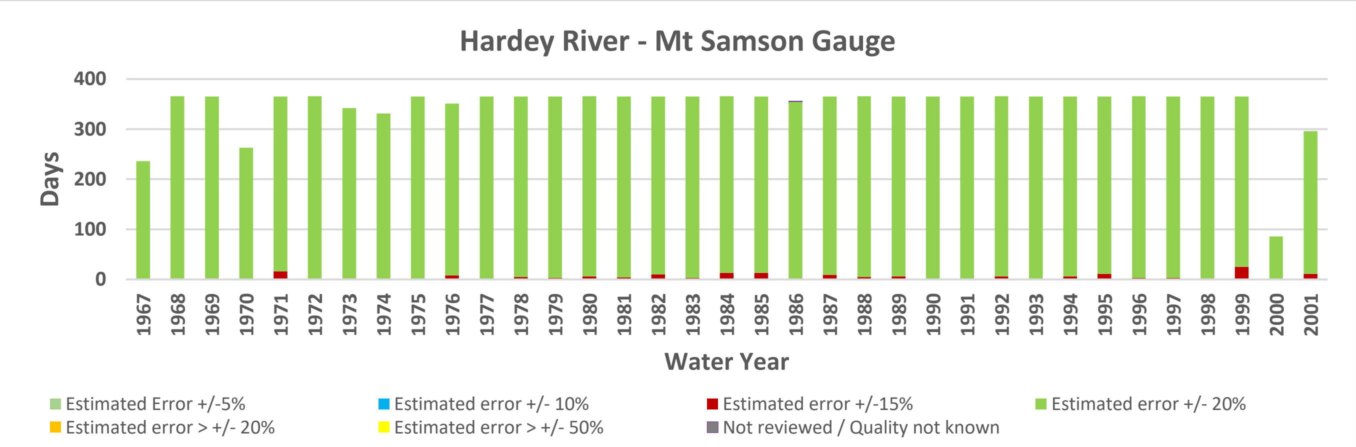


Figure B-1: Gauge Data Quality at Stream Gauge 706207

Flood Frequency Analysis

Flood frequency analysis is a technique that makes use of information on past floods to estimate probabilities associated with future floods of various magnitudes. The highest flow recorded at the streamflow gauging station in each water year (August of one year to July of the next year) was used to develop the annual flood series. TUFLOW FLIKE was used to carry out the flood frequency analysis at the gauge.

Figure B-2 shows the maximum recorded flows for the 36 years of available data, from 1966 to 2001 at Mt Samson gauge.

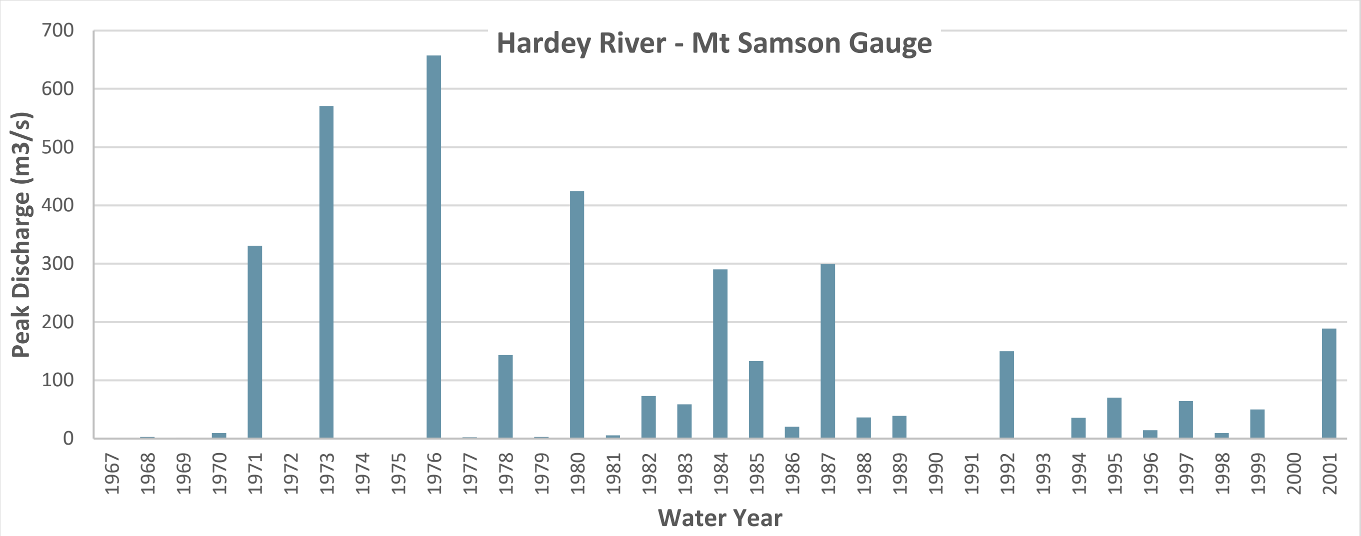


Figure B-2: Recorded Maximum Annual Flows at 706207 (Hardey River – Mt Samson)

Two frequency distribution methods have been adopted for the analysis - Log Pearson III and GEV. The Log-Pearson III distribution was observed to fit the data better compared to GEV distribution for the gauging station.

Additional analysis has been carried out to test the sensitivity of flows to censoring. The Multiple Grubbs Beck test, which is an in-built censoring feature in FLIKE was used for this assessment however it does not censor zero flows. It was found that the Multiple Grubbs Beck test combined with manual censoring of zero flows provided the most realistic flow predictions with gradual increase in flows with higher AEP events. In addition, in the absence of threshold value output from Multiple Grubbs Beck test, flow values less than 1 m^3/s were censored along with the zero flows while fitting the curve. The Log Pearson III fit for the gauge is shown in Figure B-3.

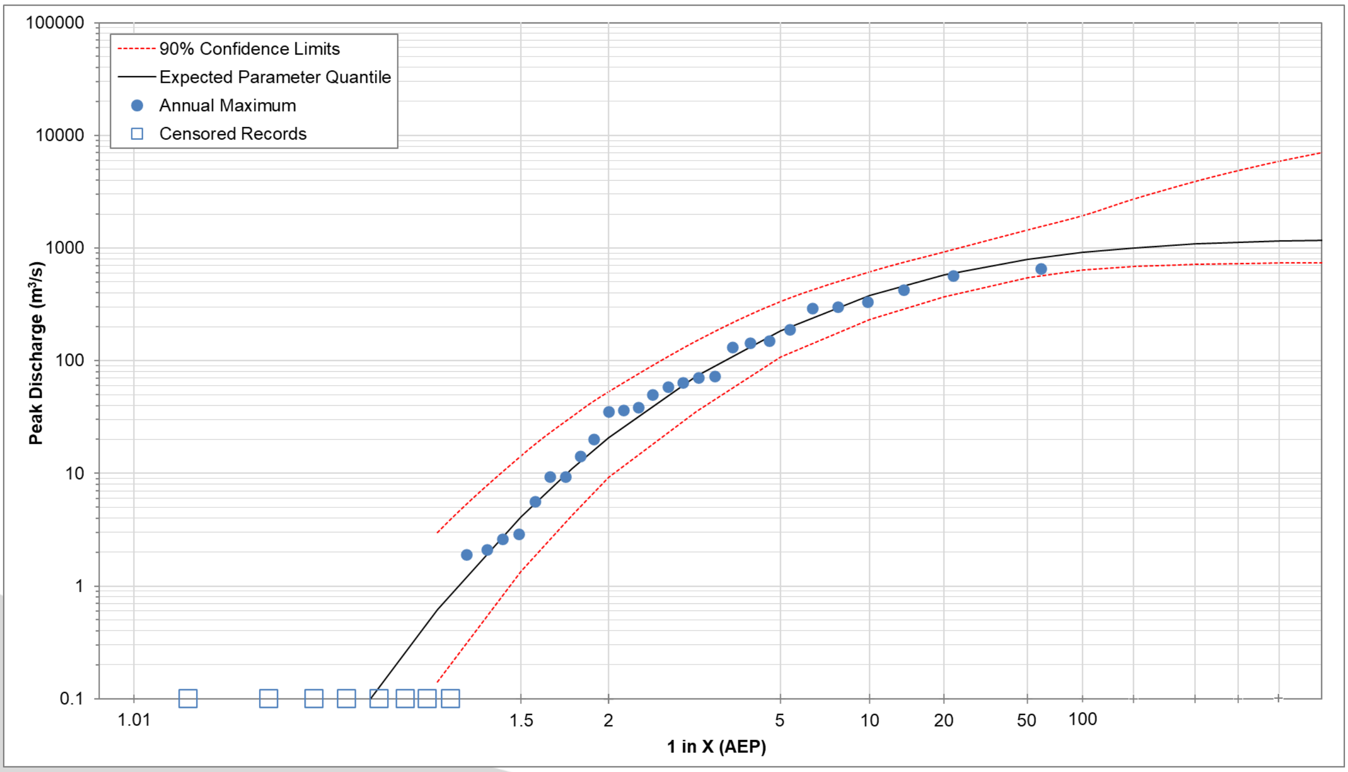


Figure B-3: Log-Pearson III fit at 706207 (Hardey River – Mt Samson)

Table B-2 summarises the adopted FFA flows at the Mt Samson gauge.

AEP	Adopted FFA Flows (m^3/s)
1 in 5	184
1 in 10	379
1 in 20	576
1 in 50	792
1 in 100	915

Table B-2: Flood Frequency Analysis Peak Flow Estimates

Rainfall Runoff Modelling (RORB)

Two RORB models were developed for the hydrological assessment. Figure 3 and Figure 4 in Appendix B show the RORB catchment plan for both the models.

1. Mt Samson RORB model to estimate losses in the Hardy River catchment
2. Localised RORB model to estimate design flows at and near the site

Design rainfall inputs and temporal patterns for the runs were derived from the ARR2019 Data Hub. Median pre-burst patterns were applied to the runs at all crossings for all AEP events.

The default value of 0.8 was adopted for the routing parameter *m*. The k_c parameter was calculated based on a recommended C value at Mt Samson gauge from a previous study conducted by Department of Water and Environmental Regulation (DWER). The DWER study recommended a $C_{0.8}$ value of 0.47 for the Mt Samson gauge catchment. This value has been adopted for the calculation of K_c for both the models.

$$k_c = C_{0.8} * d_{av}$$

where, $C_{0.8}$ = Lag parameter

d_{av} = Average flow distance in the channel network of all the sub-area inflows i.e. the average distance from the sub-area inputs to the model outlet.

The run-off routing simulations were carried out using RORB which includes post-processing tools to summarise the results of several hundred ensemble simulations. For each AEP event, the critical duration was selected from the maximum of the median temporal pattern peak flows for each duration.

A rainfall-runoff model has been built for Mt Samson gauge catchment that measures around 250 km^2 in area. The town of Tom Price is located on the upstream end of the gauge catchment and only forms 3% of the total catchment area. It is to be noted that impervious areas within the town area have been included in the RORB model for required sub-catchments. The model was run using areal temporal patterns for durations from 1 hour to 12 hours.

Table B-3 summarises the RORB catchments and main input parameters in the model. Model geometry is shown in Figure B-4.

Parameter	Description
Main Catchment Area (km^2)	250.3
Subareas (No)	9
Subareas (km^2)	18-33 km^2
k_c and m	7.3 and 0.8

Table B-3: Adopted RORB Input Parameters: Mt Samson RORB model

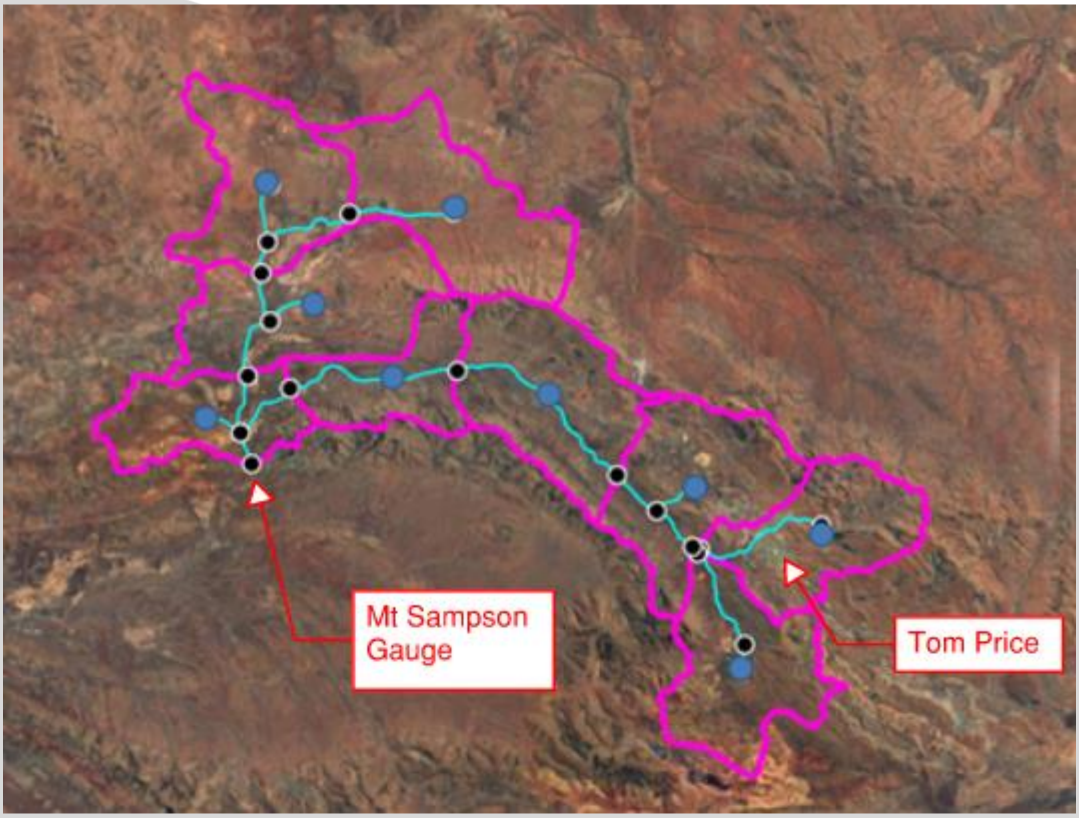


Figure B-4: Mt Samson RORB model geometry

<u>Rainfall Losses</u>

Several iterations were carried out with varying initial and continuing losses to calibrate the RORB model to flood frequency analysis flows. Although the 1% AEP event is of main interest, intermediate AEP events ranging from 10% to 2% have been considered while calibrating the model.

Losses extracted from ARR data hub tested along with various other combinations of losses and flows were compared for events from 10% to 1% for the iterations. It is to be noted that a constant loss approach has been adopted, i.e., varying losses were not applied for each AEP event considered in the calibration process.

The following trials were run:

- IL = 58 mm and CL = 6.7 mm/hr (ARR data hub losses)
- IL = 30 mm and CL = 5.0 mm/hr
- IL = 35 mm and CL = 6.0 mm/hr
- IL = 35 mm and CL = 6.7 mm/hr

Table B-4 shows the summary of trial runs and summary of flows corresponding to each run.

AEP	FFA Flows (m^3/s)	RORB Flows (m^3/s)			
		IL=58 and CL=6.7	IL=30 and CL=5.0	IL=35 and CL=6.0	IL=35 and CL=6.7
1 in 10	379	170	424	343	303
1 in 20	576	413	636	573	528
1 in 50	793	742	886	847	803
1 in 100	915	1,020	1,110	1,050	1,020

Table B-4: RORB Model Calibration: Summary of Run Iterations

The ARR losses of 58 mm and 6.7 mm/hr underestimates flows in the 1 in 10 and 1 in 20 AEP events compared to the flood frequent analysis. The 1 in 100 AEP was not very sensitive to the various loss combinations run with change in flows within the range of 10%. The decrease in losses seems to have significant impact on the more frequent AEP events. Therefore, on selecting the losses, a combination that matches the RORB flows to FFA flows for majority of the events ranging from 1 in 10 to 1 in 100 AEP has been considered.

Loss values of IL=35 mm and CL=6.0 mm/hr produced comparable flows to the flood frequency analysis across all AEPs and have been adopted.

B.2 Local Catchments

Details of local upstream catchments in the vicinity of the town that drains into the study area is summarised in Table B-5 and shown in Figure B-5.

Catchment	Catchment size (km^2)	Mainstream Length (km)	Equal area slope (m/km)	Centroid Latitude (°S)	Centroid Longitude (°E)	Outlet Latitude (°S)	Outlet Longitude (°E)
A1	20.9	6.30	38.7	22.686	117.796	22.679	117.816
A2	2.02	2.18	87.7	22.698	117.801	22.696	117.808
A3	0.38	1.27	69.4	22.700	117.798	22.701	117.802

Table B-5: Local Catchments Details

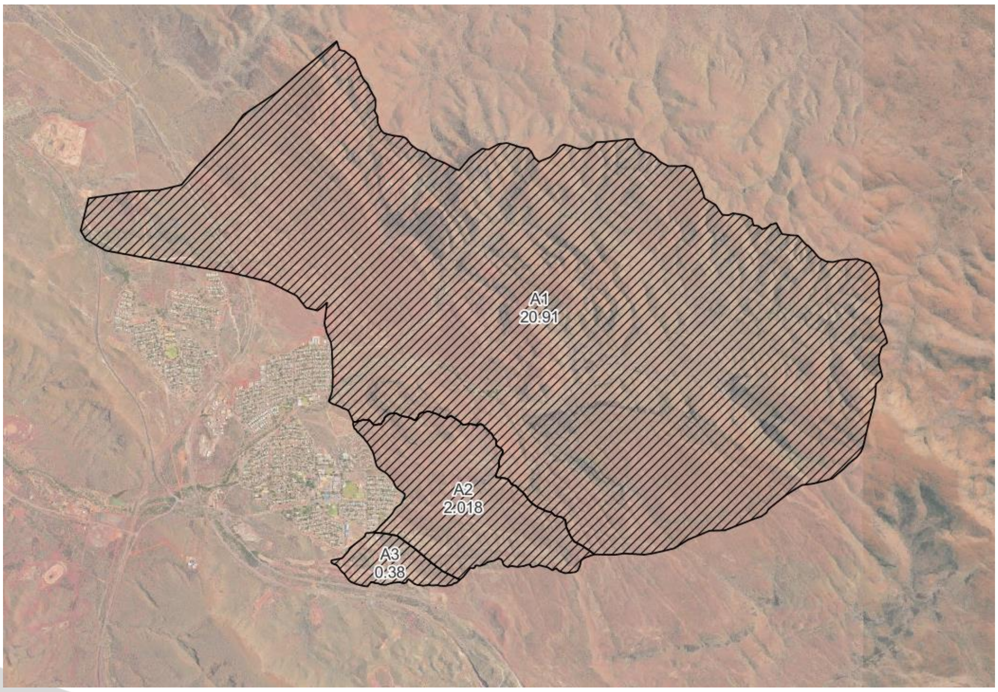


Figure B-5: Local catchments upstream of Tom Price

Catchments A2 and A3 convey runoff from the hills to a drain that runs along the eastern boundary of the town. It is understood from the previous studies that the breakout flow from the drain causes potential risks of flooding on site. Catchment A1 discharges into a creek that runs within the town. Although, there is sufficient grade difference between the proposed hospital site and the main creek, flows from Catchment A1 have been considered in the study to demonstrate no impacts to proposed site due to other areas in town further to the west.

A local RORB rainfall-runoff model was developed to estimate design flows from small catchments upstream of the hospital site. Peak flows from the RORB model were compared with several other peak flow estimation methods applicable to the Pilbara region.

Rainfall Runoff Modelling (RORB)

A local RORB model was developed for the catchments draining to the eastern drain adjacent to the proposed hospital site. Local catchments A2 and A3 have been included in the model and were further split to sub-areas based on the discharge locations along the drain. The model was run using point temporal patterns for durations from 1 hour to 12 hours. Table B-6 summarises the inputs in the model.

Parameter	Description
Catchment Area (km^2)	2.3
Sub-areas (No)	22
Sub-areas (km^2)	0.03-19 km^2
k_c and m	0.66 and 0.8
IL and CL	35 mm and 6 mm/hr

Table B-6: Local RORB Input Parameters

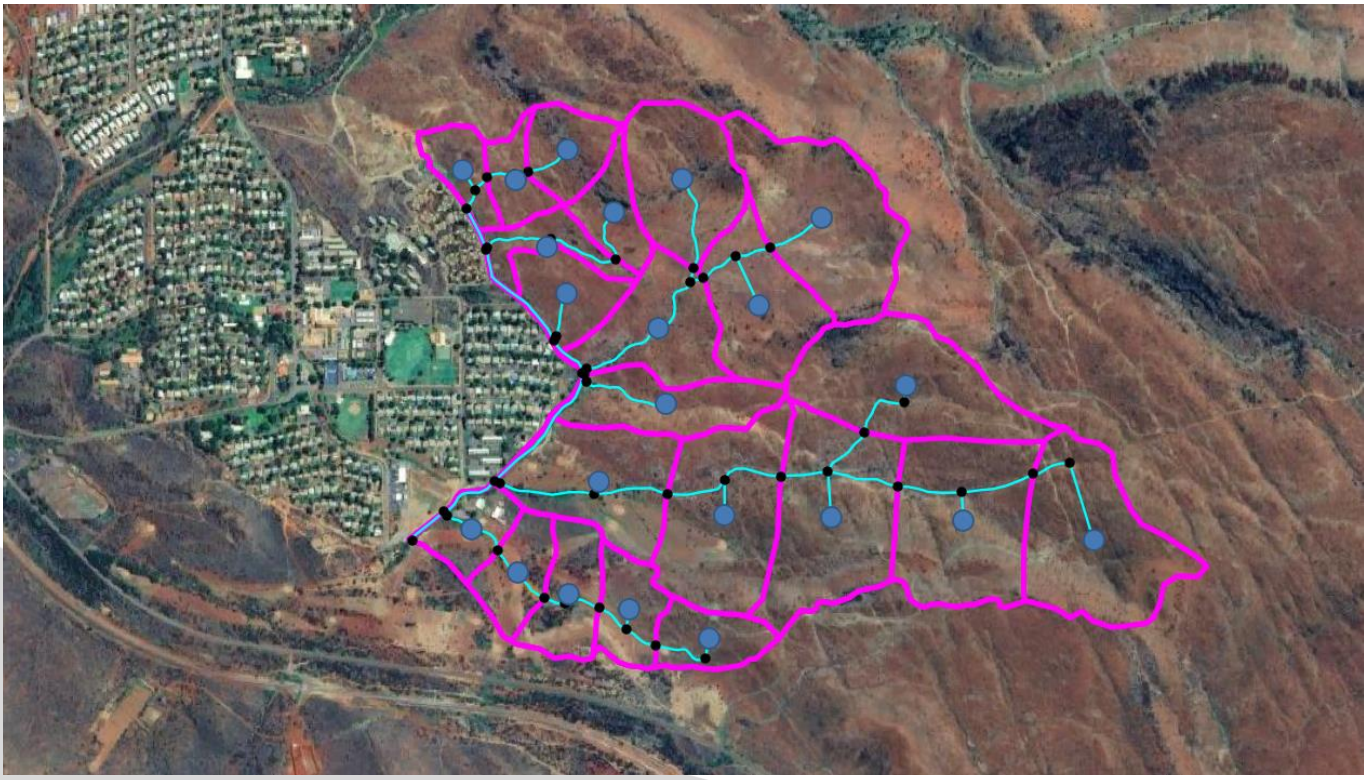


Figure B-6: Local RORB model geometry

The catchments ultimately drain to the existing diversion drain the runs along the eastern side of the town and then further down to the south. For validation of flows against the 2D model, flows have been extracted at selected locations as shown in Figure B-7 along the drain. The proposed hospital site is located near the RORB model outlet location.

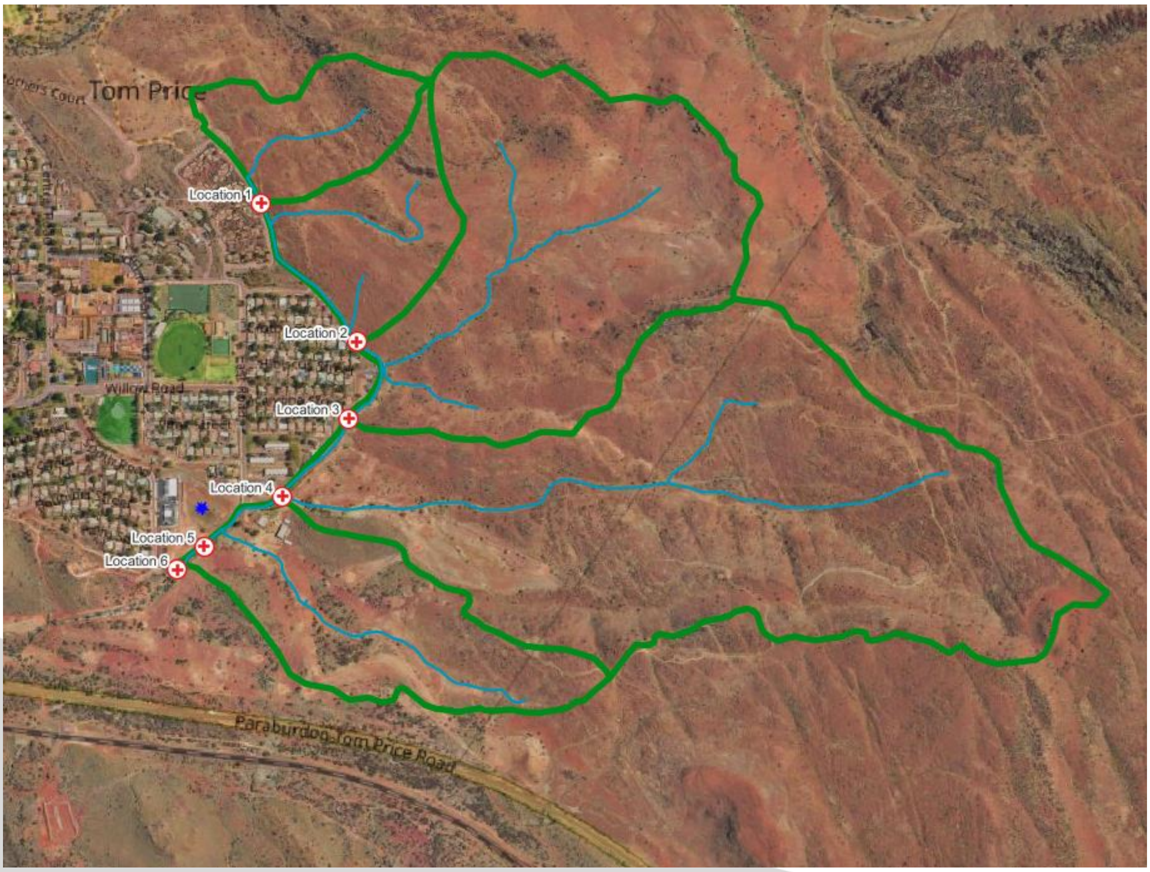


Figure B-7: Local RORB Flow Locations

Table B-6 summarises peak flows at locations 1-6 for events ranging from 1 in 10 to 1 in 500 AEP.

Location	Flows (m^3/s)				
	1 in 10 AEP	1 in 20 AEP	1 in 50 AEP	1 in 100 AEP	1 in 500 AEP
Location 1	0.9	1.2	1.6	1.9	3.2
Location 2	1.6	2.1	2.3	2.9	5.6
Location 3	5.1	7.1	7.3	9.9	18.6
Location 4	9.2	12.9	15.7	19.3	35.2
Location 5 (site)	10.4	14.5	17.3	21.8	39.4
Location 6	10.7	14.7	16.9	21.8	39.5

Table B-7: Local RORB Peak Flows

The rainfall-runoff model assumes that there are no breakout flows along the existing drain and outputs the total flow along the drain at each location. These flows were then validated against the direct rainfall TUFLOW model and is provided in detail in Section 3.2.1.

<u>Sensitivity Runs</u>

Sensitivity testing has been caried out for the local catchments model to understand how sensitive the flows are to varying initial and continuing losses. The test runs were done by altering either of the losses, i.e., initial losses were changed for the same continuing loss and vice versa.

The design flows with ARR losses for the region (57 mm, 8.0 mm/hr) resulted in a decrease in flows by 17%. Various runs were simulated by decreasing the initial loss from 35 mm to 0 mm. This has been observed to increase the flows by 25-65% while varying continuing loss only resulted in 5-20% increase in flows.

Regional Peak Flow Estimation Methods

Rational and Index Flood Methods (ARR1987)

The 1987 edition of Australian Rainfall and Runoff (ARR1987) has divided Western Australia into several regions and provides recommendations on the use of the Rational and Index Flood methods to estimate peak flows from ungauged catchments. Design equations for the Pilbara region have been adopted and the results are shown in Table B-8. This method of flow estimation in the Pilbara region only estimates the flows for events up to 2% AEP. Index flood method flows are summarised in Table B-9.

Catchment	1 in 5 AEP	1 in 10 AEP	1 in 20 AEP	1 in 50 AEP	1 in 100 AEP
A1	49.7	89.6	175.4	311.9	n/a
A2	10.4	18.4	34.5	60.0	n/a
A3	3.3	5.9	10.5	18.3	n/a

Table B-8: Rational Method (ARR1987) Peak Flow Estimates (m^3/s)

Catchment	1 in 5 AEP	1 in 10 AEP	1 in 20 AEP	1 in 50 AEP	1 in 100 AEP
A1	40.8	70.8	118.4	216.7	n/a
A2	7.6	12.4	19.0	31.7	n/a
A3	2.3	3.5	5.2	8.1	n/a

Table B-9: Index Flood Method (ARR1987) Peak Flow Estimates [m^3/s]

Pilbara Regional Flood Frequency Analysis (Davis and Yip)

The Davies and Yip method serves as the ARR1987 Index Flood method for Pilbara region with updated flow measurements up to 2012. This method benefits over the other methods for the region (e.g. Flavell) as it covers larger geographical area (Indian Ocean Drainage Division). It also provides different equations for varying ranges of catchment sizes (<1000 / 1000 – 10000 / > 100000 sq.km). Table B-10 summarises the design peak flow values for the catchments.

Catchment	1 in 5 AEP	1 in 10 AEP	1 in 20 AEP	1 in 50 AEP	1 in 100 AEP
A1	28.0	48.0	73.0	118.0	165.0
A2	6.0	11.0	16.0	26.0	36.0
A3	2.1	3.6	5.4	8.7	12.2

Table B-10: Davies and Yip Peak Flow Estimates (m^3/s)

Regional Flood Frequency Procedure (RFFP)

The RFFP2000 method was developed by David Flavell and published in the technical paper *Design flood estimation in Western Australia* (Flavell, D. 2012). The method is based on data from 15 gauging stations in the Pilbara region with areas ranging from 52 km^2 to 7,900 km^2.

The Pilbara RFFP2000 was peer reviewed by Dr Bryson Bates of CSIRO, who concluded that "*In practice the design flood estimates obtained by the regional flood frequency procedure proposed by David Flavell Pty Ltd should be more reliable than the methods described in the third edition of Australian Rainfall and Runoff*". Table B-11 provides estimated design peak flow values.

Catchment	1 in 5 AEP	1 in 10 AEP	1 in 20 AEP	1 in 50 AEP	1 in 100 AEP
A1	41.0	56.0	87.3	156.8	243.4
A2	7.3	10.7	16.2	28.2	43.0
A3	1.2	2.0	3.6	6.0	9.1

Table B-11: RFFP Peak Flow Estimates (m^3/s)

Regional Flood Frequency Estimation (RFFE) Method (ARR2019)

As part of the 2019 edition of Australian Rainfall and Runoff (ARR2019), a revised flood estimation methodology was developed for Australia, including Western Australia. The Regional Flood Frequency Estimation (RFFE) method provides an online tool, whereby peak flows are estimated based on the location of the catchment and the area using data from nearby gauges. RFFE results for the catchments are shown in Table B-12.

Catchment	1 in 5 AEP	1 in 10 AEP	1 in 20 AEP	1 in 50 AEP	1 in 100 AEP
A1	12.2	19.9	28.9	42.0	52.4
A2	3.4	5.5	8.0	11.6	14.5
A3	1.3	2.1	3.1	4.5	5.6

Table B-12: RFFE (2016) Peak Flow Estimates (m^3/s)

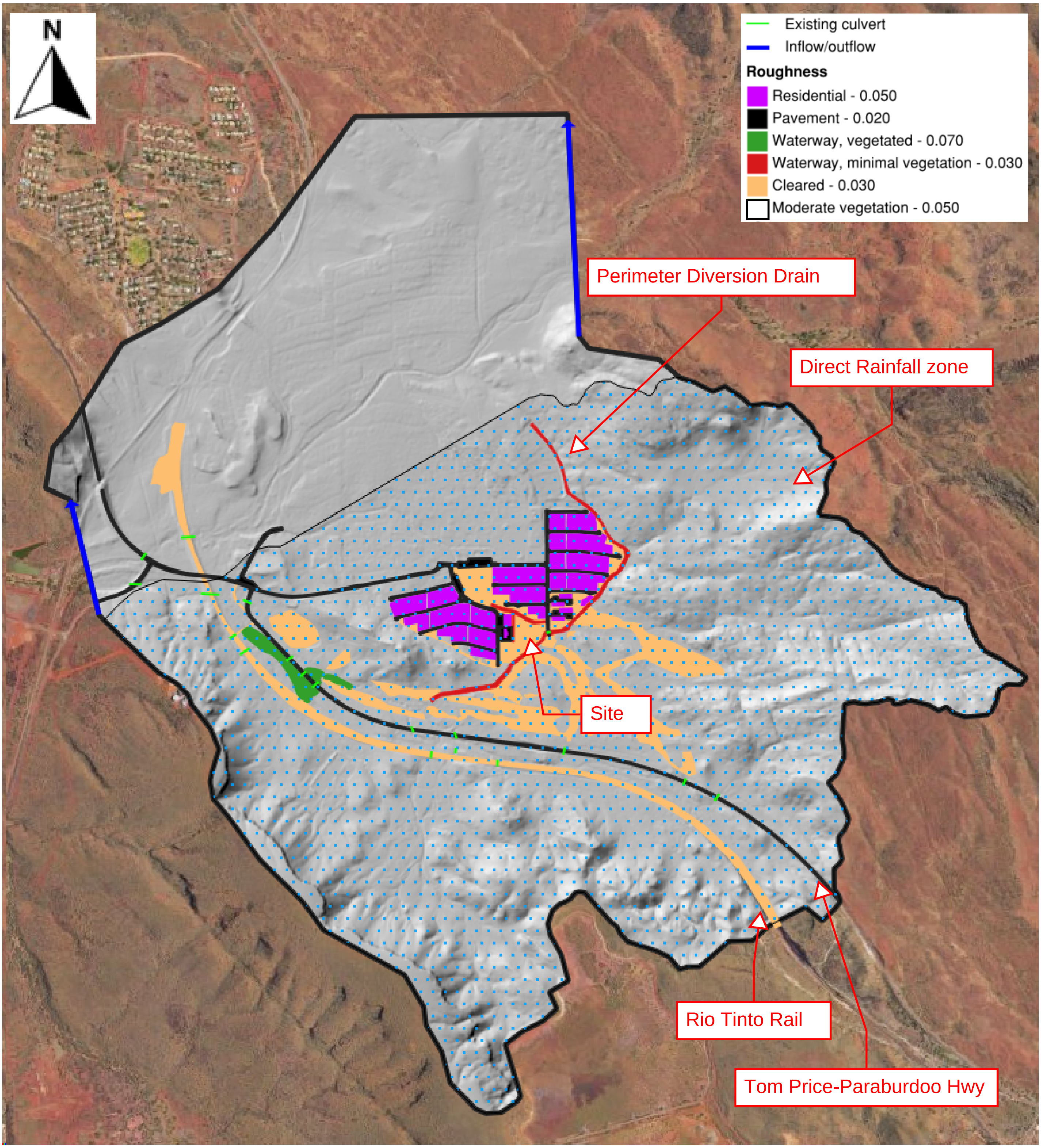
The RFFE method was updated in 2021 to incorporate additional historical flow data. Results from the RFFE 2021 version are shown in Table B-

Catchment	1 in 5 AEP	1 in 10 AEP	1 in 20 AEP	1 in 50 AEP	1 in 100 AEP
A1	7.1	8.4	9.4	10.6	11.4
A2	2.1	2.5	2.8	3.1	3.4
A3	0.9	1.2	1.5	1.8	2.0

Table B-13: RFFE (2021) Peak Flow Estimates (m^3/s)

The regional methods result in a wide range of flow estimates, with the 1 in 50 AEP flow for catchment A2 (upstream of the site) ranging between 4 m^3/s (RFFE v2021) to 60 m^3/s (ARR1987 Rational Method). The equivalent 1 in 50 AEP flow from RORB is 16 m^3/s which is within the range of the regional methods. Further validation was carried out with the TUFLOW model which resulted in similar flows.

Appendix C – TUFLOW Model Setup & Flows



TUFLOW Model Configuration

Catchment ID	0.5% AEP							1% AEP						
	RORB			TUFLOW			Difference	RORB			TUFLOW			Difference in flows
	Peak Flow (m3/s)	*Tc (hrs)*	*Temp. P*	*Peak Flow (m3/s)*	*Tc (hrs)*	*Temp. P*		*Peak Flow (m3/s)*	*Tc (hrs)*	*Temp. P*	*Peak Flow (m3/s)*	*Tc (hrs)*	*Temp. P*	
Cat A1	2.6	1	1	2.24	1	5	*0.34*	1.9	1	24	1.5	1	4	*0.48*
Cat A2	4.0	1	1	5.01	1	4	*-1.05*	2.9	1	24	2.8	4.5	4	*0.05*
Cat A3	13.4	1	1	16.29	1	5	*-2.88*	9.9	1	24	10.1	4.5	4	*-0.23*
Cat A4	24.3	1	1	39.36	1	5	*-15.06*	19.3	4.5	27	23.1	1	4	*-3.88*
Cat A5	26.9	1	1	31.85	1	4	*-4.98*	21.8	4.5	27	20.8	6	1	*0.98*
Model Outlet	26.7	1	1	31.41	1	4	*-4.76*	21.8	4.5	27	20.7	6	1	*1.09*

Catchment ID	2% AEP							5% AEP						
	RORB			TUFLOW			Difference	RORB			TUFLOW			Difference in flows
	Peak Flow (m3/s)	*Tc (hrs)*	*Temp. P*	*Peak Flow (m3/s)*	*Tc (hrs)*	*Temp. P*		*Peak Flow (m3/s)*	*Tc (hrs)*	*Temp. P*	*Peak Flow (m3/s)*	*Tc (hrs)*	*Temp. P*	
Cat A1	1.6	1	24	1.09	1	7	*0.50*	1.2	3	17	1.08	4	5	*0.08*
Cat A2	2.3	1.5	25	2.28	6	1	*0.06*	2.1	3	17	2.27	4	5	*-0.15*
Cat A3	7.3	1	24	7.77	6	1	*-0.43*	7.1	3	17	7.67	4	5	*-0.58*
Cat A4	15.7	4.5	27	18.11	4.5	7	*-2.45*	12.9	3	14	17.52	4	5	*-4.61*
Cat A5	17.3	4.5	27	16.23	6	1	*1.07*	14.5	3	13	15.54	4	5	*-1.06*
Model Outlet	16.9	4.5	27	16.21	6	1	*0.71*	14.7	3	13	15.56	4	5	*-0.87*

Catchment ID	10% AEP						
	RORB			TUFLOW			Difference in flows
	Peak Flow (m3/s)	*Tc (hrs)*	*Temp. P*	*Peak Flow (m3/s)*	*Tc (hrs)*	*Temp. P*	
Cat A1	0.9	3	17	0.84	4	5	*0.07*
Cat A2	1.6	3	15	1.70	4	5	*-0.13*
Cat A3	5.1	3	15	5.92	4	5	*-0.81*
Cat A4	9.2	3	17	14.29	4	5	*-5.09*
Cat A5	10.4	3	17	12.02	4	5	*-1.60*
Model Outlet	10.7	3	17	12.02	4	5	*-1.32*

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Performance Based Design Brief Flood Protection of Tom Price Hospital

Prepared for Department of Finance

May 2025
Project Number P24172
Version C

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Contents

Document Control				
Revision	Date	Prepared	Reviewed	Approved
A	15/04/2025	Lachlan Harris	Brett Stinton	-
B	05/05/2025	Lachlan Harris	Brett Stinton	-
C	16/05/2025	Lachlan Harris	Brett Stinton	-

1. Introduction

1.1 Project Overview

The existing Tom Price Hospital, built in the late 1960s, does not meet the WA Health Facility Guidelines in terms of space and optimal functional arrangements. The Department of Finance has decided to replace the existing facility with a new health care facility to meet the clinical service delivery standards. The new facility aims at developing an asset that meets the health and related needs of the community in the long term. The new facility is proposed on a greenfield site located at the southern end of the town between South Road and East Road at 17 South Road, Tom Price as shown in the locality plan below.

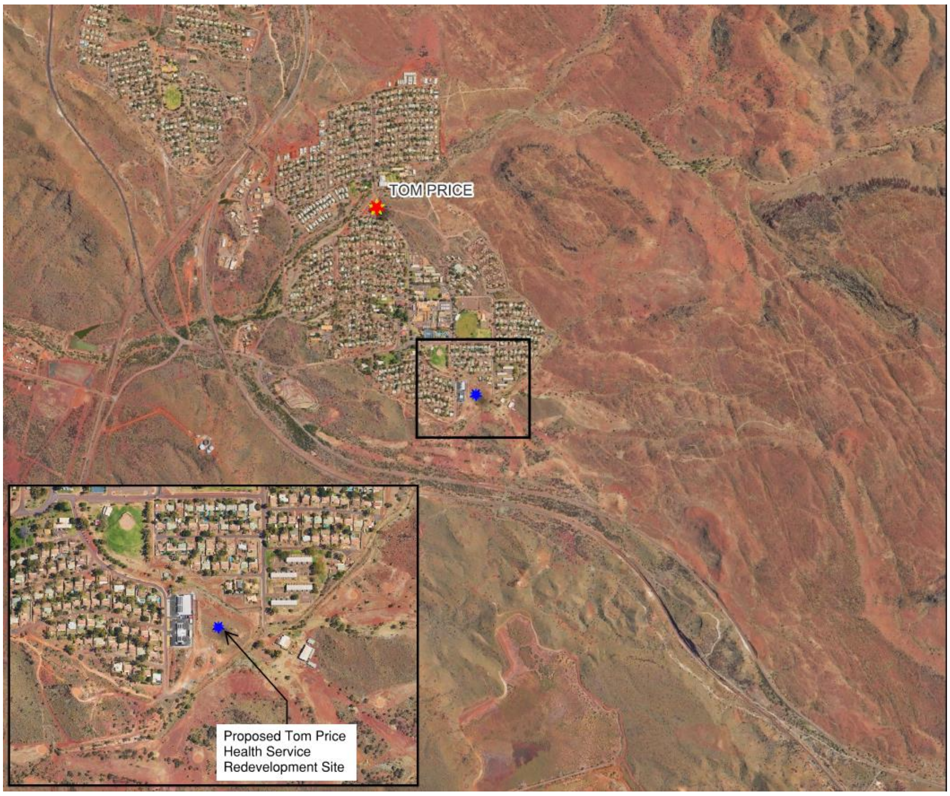


Figure 1: Locality Plan

1.2 Purpose

This Building Code Performance Brief has been completed to support a performance-based approach to meeting the National Construction Code (NCC) 2022 requirement for flood protection of new buildings.

The NCC sets various Performance Requirements which must be satisfied. Performance Requirements are satisfied by one of the following:

(1) A Performance Solution
(2) A Deemed-to-Satisfy Solution - a more detailed option which is described in the NCC.
(3) A combination of (1) and (2).

A Performance Solution is achieved by demonstrating—

(a) compliance with all relevant Performance Requirements; or
(b) the solution is at least equivalent to the Deemed-to-Satisfy Provisions.

This document describes how it is proposed to develop a performance solution and demonstrate its compliance. Included in the following sections are:

- Stakeholders identified in the Performance Solution
- Description of the project and context of the particular aspect of the design being considered
- Description of the proposed solution
- Relevant NCC Performance Requirements
- Agree the proposed analytical assessment processes
- Agreed acceptance criteria
- Any further supporting evidence required.

1.3 Key Stakeholders

Key stakeholders for this project have been identified as:

Stakeholder	Representative	Role
Milestone Building Certifier	David Cooley	Certifier
Department of Finance	Griselda Fernandez	Project Manager
Department of Health	TBC	Building Owner
WA Country Health Service	TBC	Building Operator
Shire of Ashburton	TBC	Local Government Authority
Iredale Pederson Hook Architects	Finn Pedersen / Takara Putland	Director / Project Architect
BG&E	Lachlan Harris	Civil Engineer
Cooper & Oxley	Nathan Hampel	ECI Contractor

With split of responsibility for the asset proposed as the following:

Item	Stakeholder Ownership	Comments
Ownership	Department of Health	A single stakeholder is to own the entire levee structure and the land it occupies. This ownership is to be reflected in land ownership, through easements captured in the site's Certificate of Title if required. The levee must be constructed prior to the construction of the Hospital or any of the other subdivision sites to protect the facility both during Construction and post-occupancy.
Monitoring	Department of Health	Operational Procedures are to be put in place and captured in the Performance Solution for high risk weather events (to be defined). These event shall trigger the checking of the conditions of the levee by a suitably qualified person, both before and after an event. Additionally, regular scheduled checks and surveys of the levee shall be undertaken by a suitably qualified person.
Maintenance	TBC – TO BE ALLOCATED AS PART OF PERFORMANCE SOLUTION	Following the above monitoring, maintenance work and repairs must be undertaken by suitably qualified Contractors, using methodologies specified by a suitably qualified Civil Engineer. This is to occur in a timely manner to avoid minor damage to be worsened by a series of weather events.
In perpetuity management	TBC – TO BE ALLOCATED AS PART OF PERFORMANCE SOLUTION	If the Hospital facilities were to be shut down in the future (e.g. after it's 50-year design life), all of the above items will need to be maintained in perpetuity as the levee wall will form part of the overall flooding defences for the town. The site fill added for the Hospital will worsen the flooding to the surrounds without the levee. The ownership of this may be required to change to a different Stakeholder depending on the scenario.
Documented Responsibilities	-	All of the above allocation of Stakeholder ownership, responsibility and associated procedures are to be captured in a legally binding and formal manner.

2. Project Description

2.1 Site Location/Context

The site proposed for the new hospital development is located between South Road and East Road at the southern end of the Tom Price township and will be located adjacent the existing Tom Price SES, Volunteer Bushfire Brigade and Childcare facility.

The site is bordered to the north by an existing open channel conveying local flows from the surrounding land from south-east to north-west. It is also bordered by a much larger open channel to the south which conveys surface drainage flows from a much larger catchment to the east town site around the town, providing some level of protection of the town in small to medium sized rainfall events.

Based on completed hydraulic modelling this existing large open channel provides protection for rainfall events smaller than then 10% Annual Exceedance Probability (AEP) event, but for the 10% AEP and larger rainfall events, the top bank of the channel is overtopped and surface flows leaves the channel, flowing north through the site.

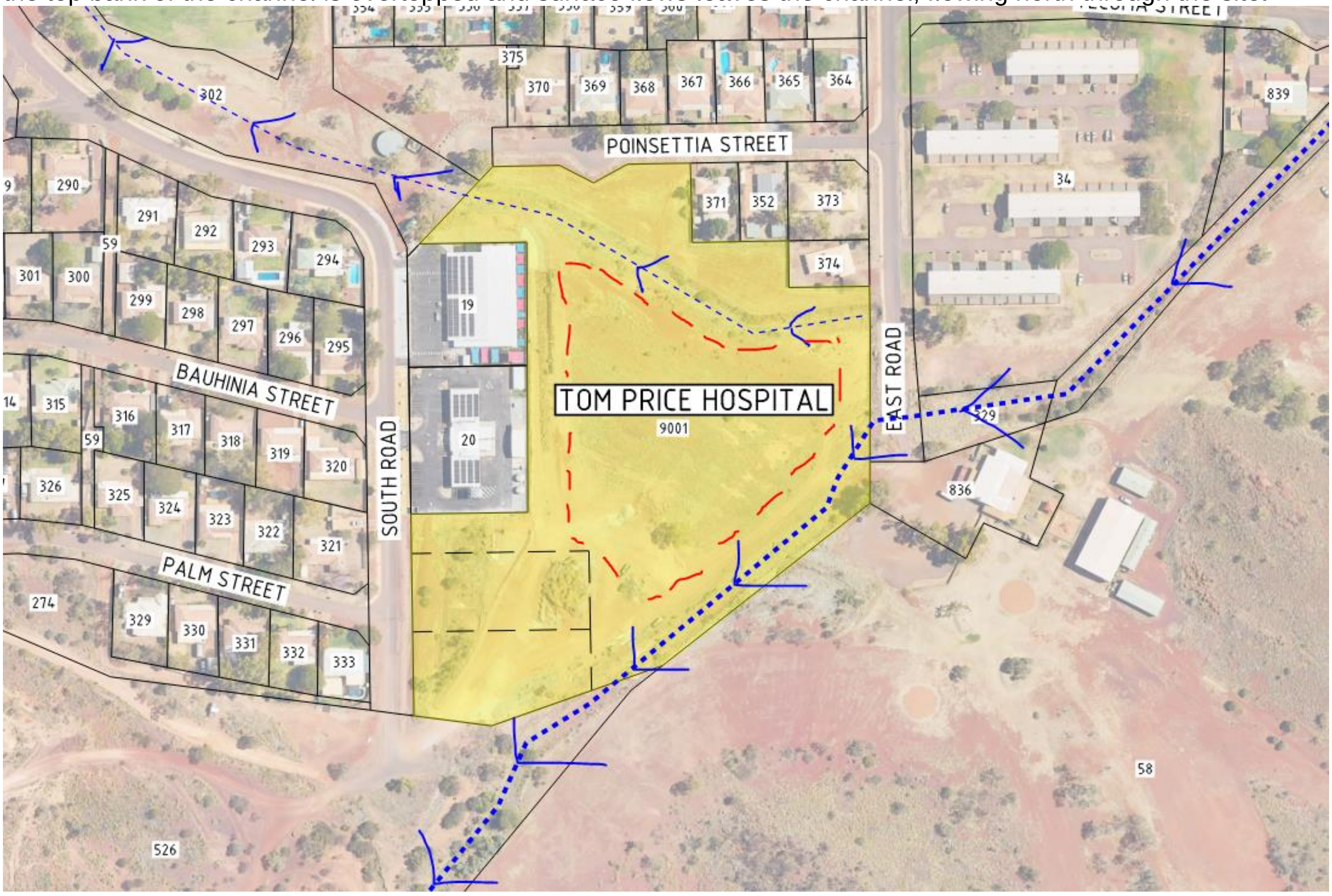


Figure 2: Site Plan

2.2 Existing Constraints and Issues

The large open drainage channel to the southern side of the site, as seen in the site plan above, is approximately 3m wide at the base and 1.8m deep. The existing topography of the site has the high point at the edge of this channel with the surface grading down towards the north-west as shown in the section below (taken south to north). What this means is when there is break out flow or overtopping from the southern channel, it flows across the hospital site towards the northern channel and then through the town.

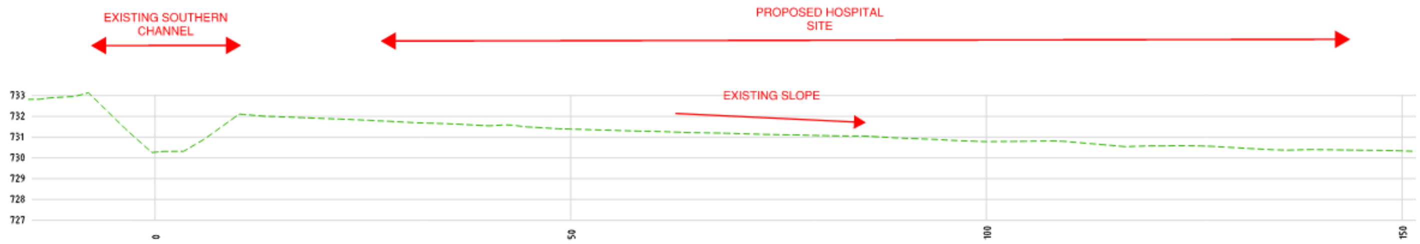


Figure 3: Site Section

2.3 Flood Prone Mapping

While there is no available flood prone or flood hazard mapping for the town, based on the BG&E completed flood modelling the site would fall within an area considered high risk of flooding.

2.4 Proposed Modelling to Mitigate Flood Risk

BG&E completed flood modelling of the area, for both pre-development and post-development scenarios, with a focus on the proposed hospital site. Modelling undertaken along with conclusions determined are detailed in report P24172-REP-W-001. As a summary to this report, it was found the southern channel will see breakout flow due to overtopping in relatively frequent flood events such as 10% AEP (a 10% chance every year) as well as the 1% AEP event. Based on the existing topography in the pre-development case, surface flows would generally have shallow depths across the site (less than 0.2m).

It was found however, locating the hospital building in this area will have a negative impact on depths in these events as the available width for flows to be conveyed is significantly decreased. The breakout or overtopping flow would be channelled around the building, leading to a decrease in flow width and consequently, and increase in flow depth for the surrounds which is a worse outcome and not desirable. Therefore, engineering solutions are required to both protect the proposed hospital development as well as existing surrounding land uses from any increase in flooding depth or to protect from flooding in its entirety making this option unsuitable.

A copy of report P24172-REP-W-001 is available in Appendix A.

3. BCA Performance Requirements

3.1 NCC Assessment Methods

As above, a Performance Solution is achieved by demonstrating (a) compliance with all of the relevant Performance Requirements or (b) the solution is at least equivalent to the Deemed to Satisfy Provisions. A Performance Solution must be shown to comply with the relevant Performance Requirements through one or a combination of the following Assessment Methods:

(a) Evidence of suitability in accordance with Part A5 that shows the use of a material, product, plumbing and drainage product, form of construction or design meets the relevant Performance Requirements.

(b) A Verification Method including the following:

(i) The Verification Methods provided in the NCC.

(ii) Other Verification Methods, accepted by the appropriate authority that show compliance with the relevant Performance Requirements.

(c) Expert Judgement.

(d) Comparison with the Deemed-to-Satisfy (DtS) Provisions.

In this case, it will be a combination of Expert Judgement and Comparison with the DtS provisions.

3.2 BCA Deemed to Comply Requirement

The deemed to satisfy requirements of NCC 2022, Volume One, Clause B1D6 entitled Construction of Buildings in Flood Hazard Areas applies to residential type uses, but also to Class 9a Health Care buildings. This Clause in NCC 2022 provides that a building in a flood hazard area must comply with the Australian Building Codes Board (ABCB) 'Standard for Construction of Buildings in Flood Hazard Areas'.

In turn the ABCB Standard defines terms such as 'defined floor level', 'flood hazard' and 'flood hazard levels'. and to meet this requirement 2 pathways are available:

1.10 Design pathways

The Standard provides two pathways for compliance as follows:

(a) Compliance with Clauses 2.3 to 2.10 of this Standard.

(b) Formulating a Performance Solution which complies with the NCC Performance Requirements. This involves the application of engineering practice from first principles in combination with appropriate design considerations as an alternative to the requirements of Clauses 2.3 to 2.10 of this Standard. A Performance Solution requires designers to apply professional judgment on all design issues.

The **NCC 2022 Deemed to Satisfy Clause** is:

B1D6 **Construction of buildings in flood hazard areas**

[2019: B1.6]

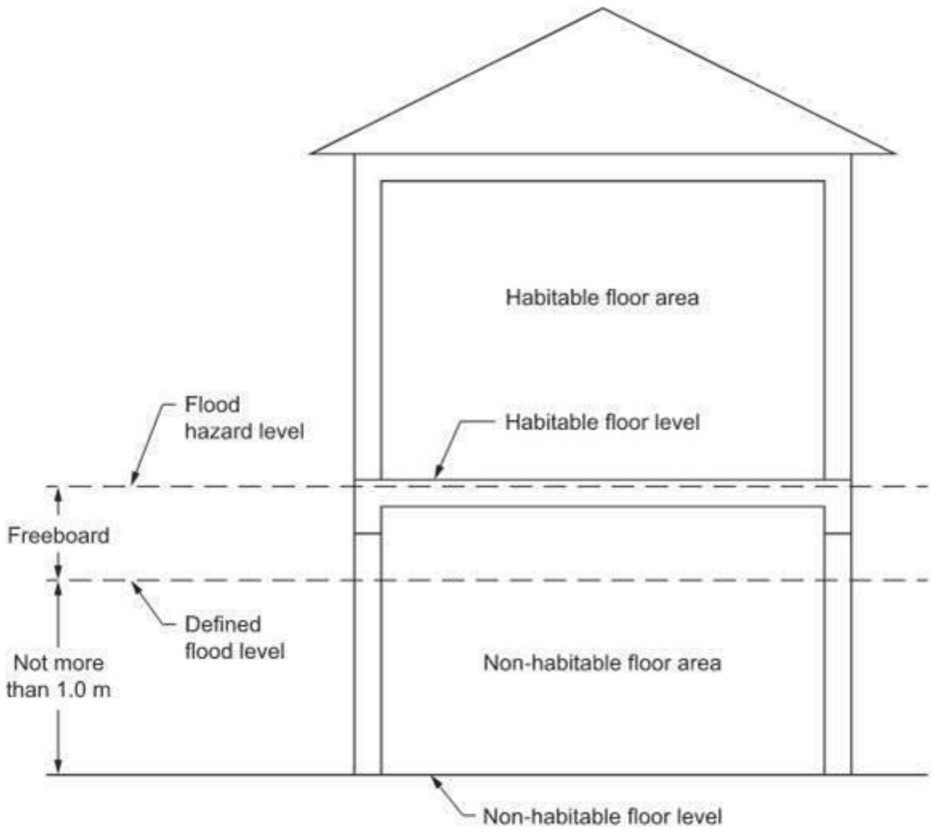
(1) A building in a *flood hazard area* must comply with the ABCB Standard for Construction of Buildings in Flood Hazard Areas.

(2) The requirements of (1) only apply to a Class 2 or 3 building, Class 9a *health-care building*, Class 9c building or a Class 4 part of a building.

Within the Australian Building Codes Board Standard for Construction of Buildings in Flood Hazard states, the **BCA definitions** on ‘defined floor level’, ‘flood hazard’ and ‘flood hazard levels’:

Defined flood level (DFL): The flood level associated with a *defined flood event* relative to a specified datum (see Figure 3).

Figure 3: **Identification of defined flood level, flood hazard level and freeboard**



Flood hazard area: The *site* (whether or not mapped) encompassing land lower than the *flood hazard level* which has been determined by the *appropriate authority*.

Flood hazard level (FHL): The flood level used to determine the height of floors in a building and represents the *defined flood level* plus the *freeboard* (see Figure 3).

For this project we are not able to meet the DtS Clause because the building will be designed such that the FFL will be below the flood hazard level.

The **NCC 2022 Performance Solution** that applies and needs to be justified relates to each of the following items:

B1P4 Buildings in flood areas

[2019: BP1.4]

(1) A building in a *flood hazard area*, must be designed and constructed, to the degree necessary, to resist flotation, collapse or significant permanent movement resulting from the action of hydrostatic, hydrodynamic, erosion and scour, wind and other actions during the *defined flood event*.

(2) The actions and requirements to be considered to satisfy (1) include but are not limited to—

- (a) flood actions; and
- (b) elevation requirements; and
- (c) foundation and footing requirements; and
- (d) requirements for enclosures below the *flood hazard level*; and
- (e) requirements for structural connections; and
- (f) material requirements; and
- (g) requirements for utilities; and
- (h) requirements for occupant egress.

Applications

B1P4 only applies to—

- (a) a Class 2 or 3 building or a Class 4 part of a building; and
- (b) a Class 9a *health-care building*; and
- (c) a Class 9c building.

Further the Department of Finance requires that 'The finished floor level of the hospital shall be based on achieving the 0.5m freeboard to the 1 in 100year flood level for the 2110 climate change scenario'.

4. Assessment Methodology

4.1 Solution Details

Filling of the site to achieve the flood immunity criteria is not considered practical and in isolation would have an unacceptable negative impact on the existing surrounding land uses due to the increase in Top Water Level (TWL) of the 1% AEP on those properties.

The proposed solution to achieve compliance with the NCC 2022 is to provide an in-situ concrete wall of an appropriate height and length as determine through detailed flood modelling, forming a levee between the site and the existing southern open drainage channel to prevent any overtopping of this channel from flowing through the site.

The concrete levee wall is sized in width and length to achieve the 0.5m freeboard to the 1 in 100year flood level for the 2110 climate change scenario (design event) in accordance with Department of Finance requirements which exceed the NCC 2022 and ABCB 'Standard for Construction of Buildings in Flood Hazard Areas' minimum requirements.

Figure 1: Levee Location Plan

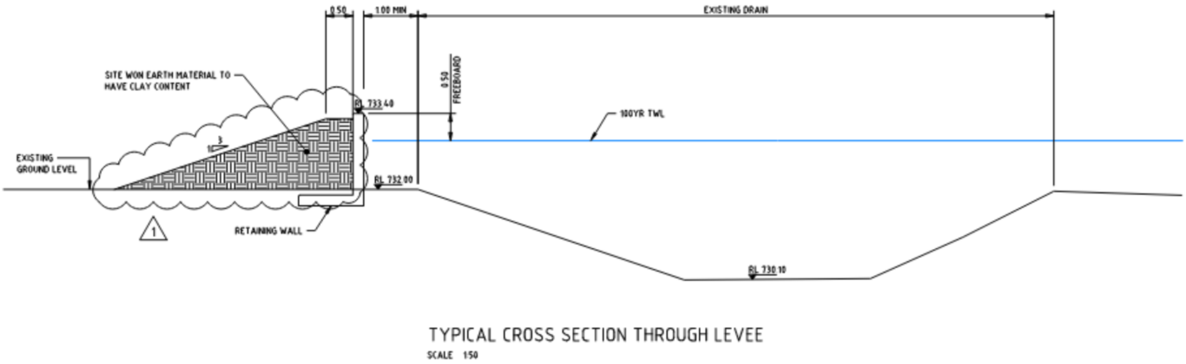


Figure 2: Typical Levee Cross Section

This solution has several benefits:

- Provides a ‘dry’ hospital site in major events and will also allow for access to the hospital from South and East roads in the design event, as the levee also diverts flood waters away from the access roads.
- Provides an overall flood protection/mitigation solution for the subdivision, currently being undertaken by the Shire of Ashburton, which includes the hospital site, a future dialysis clinic and third development lot.
- Reduces flooding TWL within the town as it directs more flow south and past the town, so residential and other community existing land uses have better immunity in flood events also.

4.2 Secondary Measures

To mitigate the residual risk of flood water breaking through, over or around the proposed levee additional measure are to be considered and incorporated where possible in the hospital building design with these including:

- Site grading around the hospital to be completed to direct surface runoff away from the building and into adjacent drainage swales to convey local surface runoff to the north of the site and into the existing open drainage channel;
- Mechanical and electrical plant susceptible to water to be located off the ground at a determined appropriate height and in protected locations (they proposed in the north-west corner shielded by the building);
- Designing structural building elements to withstand flooding flows in accordance with the NCC requirements;
- Doors and building openings to be located away from the direction break out flows where possible or some protection in way of low walls or landscape treatments;

4.3 Final Report

This Performance Based Design Brief has been prepared to document the agreed scope, technical basis, and acceptance criteria for a proposed performance solution ensuring that the design process and outcomes meet the requirements of the NCC (National Construction Code).

A final Performance 'Report' will be prepared to demonstrate the quantification (modelling / testing) of the design principles outlined in the Brief.

Further as part of the design process to detail the levee wall, a detailed risk and hazard assessment will be carried out (as recommended by Department of Water and Environmental Regulation (DWER)) to assess potential consequences to the hospital and surrounding area associated with levee failure or overtopping. This will require input from key stakeholders to ensure residual risks and responsibilities are fully understood. The scope of the hazard assessment will need to be confirmed, but is expected to include:

- Hydraulic modelling to understand flood behaviour in the event the assumptions in this report are not achieved (diversion drain was blocked, the levee was to overtop or fail etc).
- Identify consequences associated with each scenario.
- Identify potential measures which could be incorporated into the design to eliminate or reduce this risk.
- Assign responsibilities for any residual risks associated with the design.
- Ongoing review of the flood mitigation strategy following completion of the development (and post rain events) to validate the computer modelling and to determine if improvements should be undertaken i.e. develop maintenance regime.
- Other measures (raised building pad, bunds, drained pavements etc) could be reviewed to manage water impacting the hospital site.

Further to this included in the final report geotechnical/geomorphological advice should be sought regarding potential for scour of the existing diversion channel and risk to the stability of the levee over time with recommendations from this advice included in the final design solution.

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