SITE PLAN
PROJECT FINISHES / SPECIFICATION

SITE WORKS

CONCRETE

GREY CONCRETE - BROOM SWEPT (LIGHT).
CONFIRM EXTENT OF SURROUNDING PATHS WITH CIVIL DRAWINGS & SITE PLANS

PLUMBING FIXTURES & DRAINAGE

FIXTURES

HOSE COCKS - BRASS HOSECOCK WITH DUEL CHECK VALVE. MOUNT 900mm ABOVE FFL. REFER TO PLANS FOR LOCATIONS

300 x 300 GALV STEEL GRATE TO ALL DOWNPIPES. SCREW FIXED DOWN THROUGH SLAB.

PROVIDE 90dia SLEAVED SLOTTED AGG DRAIN BEHIND RETAINING WALLS NOTED.

BLOCKWORK / LINING/ CLADDING

BLOCK WORK

190mm GREY BLOCKWORK - PAINT FINISH. (ALLOW TWO COLOURS).

BLOCKWORK TO FIELD SIDE TO BE LEFT FLUSH JOINTED

STEEL WORK

GENERAL

ALL EXPOSED STEELWORK TO BE AS PER STRUCTURAL ENGINEERING DETAILS. ALL EXPOSED STEEL (COLUMNS, BEAMS ETC) TO BE HOT DIP GALV FINISH (UNLESS NOTED OTHERWISE)

ELECTRICAL

GENERAL

REFER TO ELECTRICAL DRAWINGS / SPECIFICATION

DOORS & WINDOW

GATES

REFER TO CHAIN MESH DETAILS

PAINTING

GENERAL

PAINT SYSTEM. PROVIDE STAINS, PRIMERS, SEALERS & UNDERCOATS WHICH ARE SUITABLE FOR THE SUBSTRATE AND RE COMPATIBLE WITH THE FINISH COAT AND EACH OTHER. ALL PAINTED SURFACES TO HAVE TWO COATS. PROVIDE DULUX OR APPROVED EQUAL.

BLOCKWORK

GRIND WALL BLOCKWORK TO SMOOTH EDGES.
1 COAT PRIMER
2 COATS DULUX WEATHERSHIELD (TWO COLOURS)

STRUCTURAL STEEL

HOT DIP GALV FINISH

TANKING

PROVIDE SIKA SIKALASTIC 1K (OR APPROVED EQUAL) TO EXPOSED BLOCKS WALLS AND BACKED FILLED AREAS REQUIRING TANKING / WATERPROOFING.

FIELD KERBING

a) PAINT TOP, FACE & BASE OF CHANNEL OF KERBS TO TURF EDGE AND SIMILAR TO KERB STORMWATER GULLY PITS WITH JOTUN JOTACOTE 605 TWO PACK EPOXY COATING
b) APPLY A TOP COAT OF FLEXIBITHANE TO ABOVE AREAS NOTED.

BLOCK WALLS TO FIELD

BLOCKWORK TO BE LEFT FLUSH JOINTED

CLEAN BLOCKWORK FACE AND RUBBED WITH A CONCRETE RUBBING BLOCK TO SMOOTH AN ROUGH BITS

ANY IMPERFECTIONS TO BE FILLED WITH ACRAPATCH (WITH ADDED GP CEMENT (REFER TO PRODUCT SPECS)

PRIME WITH 1 COAT DULUX ACRATEX GREEN RENDER PRIMER (OR APPROVED EQUAL)

ONCE PRIMED - OVERCOATE WITH 2 COATS DULUX ACRASHIELD. SPRAVED THAN BACK ROLLED WITH TICK NAP ROLLER. (OR APPROVED EQUAL)

ALL TURF SURROUND FENCING POSTS, RAILS, FITTINGS & GATES TO BE PAINTED AS PER SPEC PRIOR TO ERRECTION ON SITE, ONLY MINOR TOUCH UP OF PAINT WORK AFTER ERECTION.

GENERAL

STAIR NOSING

PROVIDE TREDSAFE (OR APPROVED EQUAL) AA125 STAIR NOSING WITH SELECTED COLOUR INSERT. TO COMPLY WITH AS1428.1

TACTILE INDICATORS

PROVIDE TACTILE SYSTEMS AUSTRALIA (OR APPROVED EQUAL) STAINLESS STEEL WITH POLYURETHANE INFILL TACTILE INDICATORS. WDSP-13S-TSA (COLOUR TO BE CONFIRMED).

ARTIFICAL GRASS

PROVIDE ARTIFICIAL TURF FIELD TURF AUSTRALIA SUMMER PRESTIGE 40mm. FIX IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS

SIGNAGE

PROVIDE 2No. PROJECT SIGNAGE (ONE ON WATER STREET, ONE ON MASON STREET) APPROX 3.0m WIDE x 2m HIGH. CONTRACTOR TO SUBMIT SIGN WRITTING PROOF FOR APPROVAL PRIOR TO MANUFACTURING. SIGN TO BE ERRECTED AT START OF THE PROJECT. SIGNAGE TO BE CONFIRMED BY

FENCING - NEW FIELD

GENERAL

PROVIDE CHAINWIRE (PVC COATED) FENCE. REFER TO DETAILS

GALVANIZED COATINGS
ALL FERROUS MATERIALS SHALL HAVE COATINGS OF ZINC COMPLY WITH AS1650. THE COATING FOR WIRE SHALL BE TYPE A (HEAVY GALVANIZED)

WIRE
ALL WIRE SHALL BE MANUFACTURES FROM STEEL HAVING A TENSILE STRENGTH NOT LESS THAN 370MPa NOR MORE THAN 550MPA. PVC COATED THROUGHOUT

FITTINGS
ALL CLAMPS, PIPE FITTINGS, HINGES, BOLTS, NUTS AND ANY OTHER METAL PARTS SHALL BE MANUF. FROM PLAIN CARBON STEEL OR MALLEABLE CAST IRON & GALV

FOOTINGS
ALL FOOTINGS TO BE READY MIX CONCRETE 20MPa TO BE USED. REFER TO STRUCTURAL ENGINEERING DETAILS

STEEL TUBES
ALL TUBES TO COMPLY WITH AS1074

RAILS
RAILS SHALL BE STRAIGHT AND FREE FROM JOINTS, SIZE TO BE 40mm NB - UNLESS NOTED OTHERWISE. MEDIUM GALV BOTTOM RAIL LOCATION TO BE MAXIMUM 50mm ABOVE TOP OF KERB OR TOP OF EXTERNAL WALL.

GATE
GATES SHALL BE FABRICATED OUT OF 30NB PIPE FOR POSTS & RAILS AND 25NB FOR BRACING MEMBERS

POSTS
POST SHALL BE MEDIUM GALV & STRAIGHT AND FREE FROM JOINTS, SIZE TO BE 50mm. MAX SPACING 3.0m. SUPPLY CAPS TO ALL POSTS

BRACING STAYS
BRACING STAYS SHALL BE PROVIDED WITHOUT JOINTS AND SHALL BE 40mm NOMINAL BORE MEDIUM

CHAIN WIRE
CHAIN WIRE TO BE MANUF. FROM 3.15 DIA WIRE FOR HEAVY GALV CHAIN WIRE TO FORM A UNIFORM 50mm MESH. CHAIN WIRE WHERE NOTED TO HAVE BARBED SELVEDGE TOP AND KNUCKLED SELVEDGE BOTTOM. PVC COATED THROUGHOUT. GREEN FINISH THROUGHOUT FOR EXTERNAL FENCE AND FIELD SURROUND FENCE TO BE KNUCKLED SELVEDGE TOP & BOTTOM. BLACK POSTS

SUPPORT CABLES
2 SUPPORT CABLE SHALL BE 4mm SPIRAL TENSION CABLE FOR EXTERNAL FENCE

LACING AND TIE WIRE
LACING AND TIE WIRE SHALL BE 2.00mm DIA WIRE. THE FOLLOWING IS MINIMUM STANDARD REQUIRED
a. GATES - ALL DIAMONDS LACED RAILS AND RESTS
b. POSTS - TIES AT 300mm CENTRES
c. TOP & BOTTOM RAILS - TOTALLY LACED EACH DIAMOND
d. ALL OTHER SUPPORT CABLES - CLIPS OR TIE WIRE AT 500mm INTERVALS.

NYLON NETS

NYLON NETTING SPEC.
1. 60ply 45mm UV TREATED BLACK NYLON NETTING COMPLETE WITH 10mm OVERLOCKED ROPED EDGES ALL ROUND FOR EACH REQUIRED AREA

2. FIXING ON NETTING TO FIELD SIDE. PROVIDE 3off SUPPORT CABLES INTERNALLY ARE 6mm STAINLESS STEEL COMPLETE WITH HYDRAULIC SWAG AND THIMBLES, EYES & TURN BUCKLES

3. MAIN SUPPORT POST AND RAILS STRUCTURE ARE GALV PIPE PAINTED BLACK AS PER ENGINEERING DESIGN

4. FIXING OF NETTING TO 6mm SUPPORT CABLES ARE 6mm STAINLESS STEEL SNAP HOOKS AT 1m CENTRES

5. FIXING OF NETTING TO POST AND RAILS ARE BY 'P' CLIPS OR 6mm WIDE STAINLESS CABLE TIES AT 500mm CENTERS

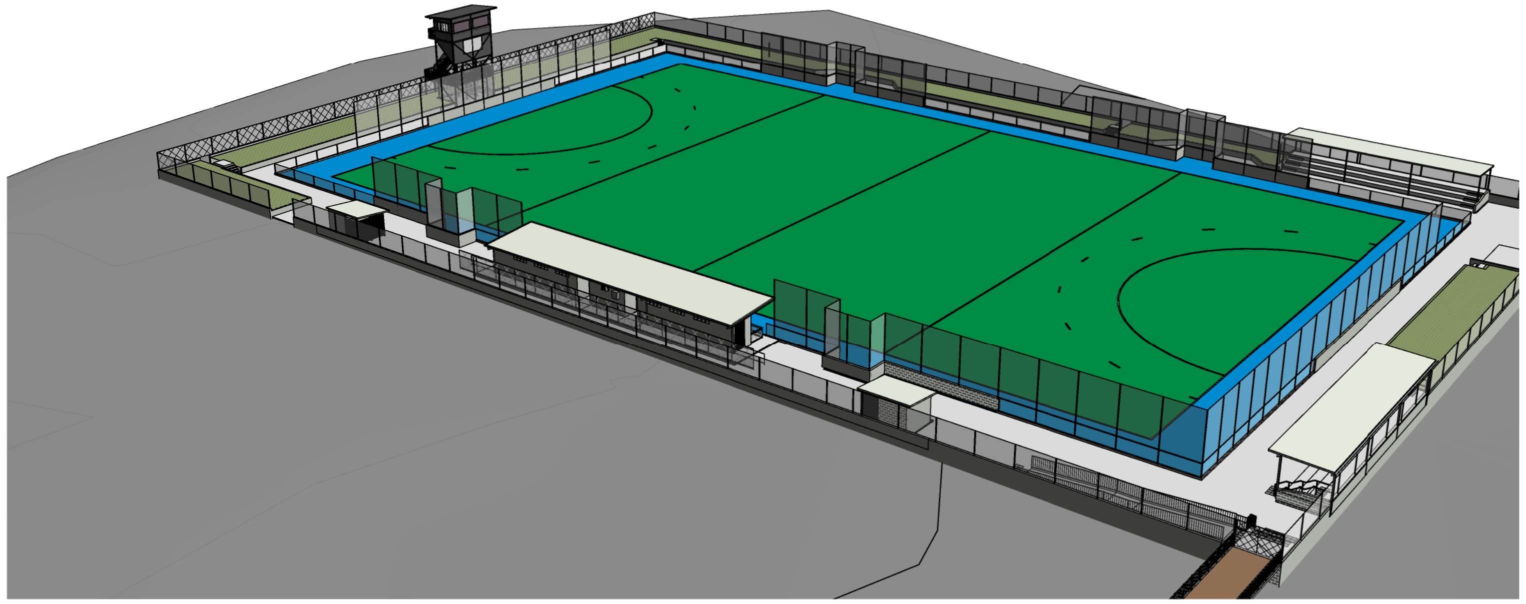
FENCING EXISTING FIELD

SUPPLY ADDITIONAL POSTS, RAILS, GATES & GALV CHAINWIRE AS PER DETAILED DRAWINGS.

LOCK SCHEDULES

MASTER KEY SYSTEM TO ALL DOORS / GATES. HARDWARE SPEC BY OTHERS.

PROJECT
KALKA SHADES REDEVELOPMENT
FUNDING
AUSTRALIAN GOVERNMENT (+LOGO)
QUEENSLAND GOVERNMENT (+LOGO)
ROCKHAMPTON REGIONAL COUNCIL (+LOGO)
ROCKHAMPTON HOCKEY ASSOCIATION (+LOGO)
HEAD CONTRACTOR
TBC (+ CONTACT NUMBER)
LEAD CONSULTANTS
CIVIL - CALIBRE GROUP
BUILDING DESIGNER - DEZIGN ELEMENTS
STRUCTURAL - JS2
ELECTRICAL - ANDERSON CONSULTANTS
BUILDING HYDRAULICS - CALIBRE GROUP
FIELD IRRIGATION - HYDROPLAN



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Dated: 26 June 2018

COLOUR SCHEDULE - SITE PLAN

FENCES / FENCE POSTS / SUPPORTS	
INTERNAL FENCES TO FIELD	BLACK
NYLON FENCE TO FIELD	BLACK
EXTERNAL COMPOUND CHAIN WIRE FENCE NEW FIELD	GREEN
FENCE TO EXISTING FIELD	REUSE EXISTING GALV CHAIN WIRE
BLOCK WORK	
BLOCKWORK TO INTERNAL PATHS	NATURAL FINISH. SMOOTH SURFACE
EXTERNAL BLOCKWORK TO COMPOUND	WATERPROOFED. PAINTED TO MATCH COLORBOND 'MANGROVE'
BLOCKWORK TO FIELD (EG BEHIND GOALS)	PAINT TO MATCH COLORBOND 'GULLY' (REFER PAINTING SPEC'S)
GENERAL	
STAIR NOSING	YELLOW
TACTILES	STAINLESS STEEL WITH YELLOW INSERTS
HANDRAILS	HOT DIPPED GALV FINISH. NO PAINT.
FIELD KERBING	GREY

DO NOT SCALE DRAWING
ALL DIMENSION IN MILLIMETERS

REVISIONS

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A	PRELIM TENDER	10.05.18
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LEGEND

COL	COLUMN
DP	DOWN PIPE
SK	SINK
ST	STEP
DF	DRINK FOUNTAIN
HC	HOSE COCK
FI	FIELD INLET
DB	DISTRIBUTION BOARD
COMM	COMMUNICATION CABINET
AC	AIR CONDITIONER
FR	FRIDGE
LB	LOUVRE BLOCK
NB	NOMINAL BORE
GALV	GALVANIZED
MH	MAN HOLE
AH	ACCESS HATCH

ISSUED FOR
FOR TENDER

Project Details:
SITE PLANS
RRC & RHA
KALKA SHADES REDEVELOPMENT

Drawing Title:
SITE PLAN - PROJECT SPECIFICATIONS

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QBCC No: 1247120 BDAQ No: 0001677

Scale:	As indicated	Rev:
Date:	MAR 2018	B
Drawn:	NJB	
Project No: 18_004	Drawing No: S-01	

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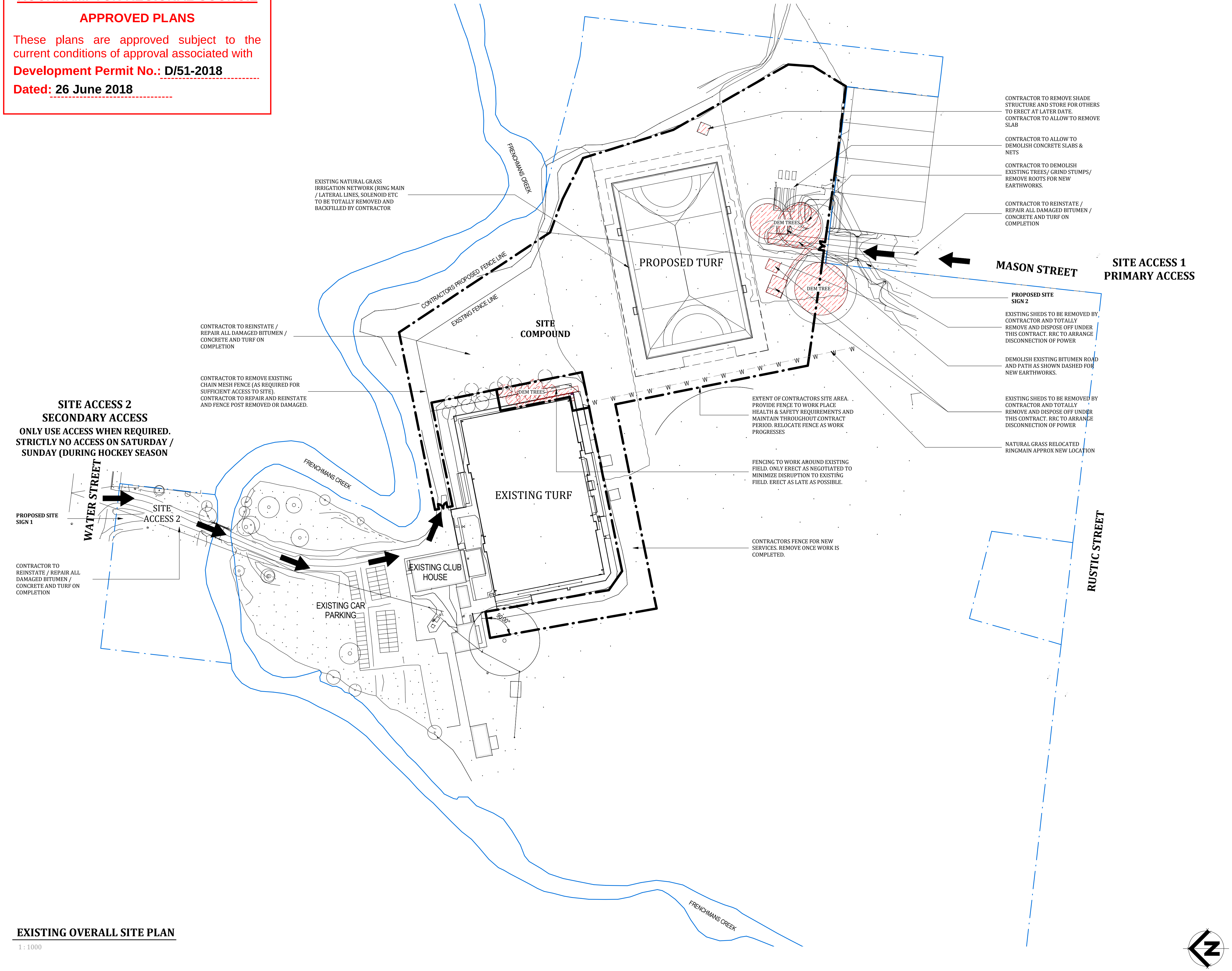

SITE ACCESS 1
PRIMARY ACCESS

SITE ACCESS 2
SECONDARY ACCESS
ONLY USE ACCESS WHEN REQUIRED.
STRICTLY NO ACCESS ON SATURDAY / SUNDAY (DURING HOCKEY SEASON

CONTRACTOR TO REMOVE SHADE STRUCTURE AND STORE FOR OTHERS TO ERECT AT LATER DATE. CONTRACTOR TO ALLOW TO REMOVE SLAB

CONTRACTOR TO ALLOW TO DEMOLISH CONCRETE SLABS & NETS

CONTRACTOR TO DEMOLISH EXISTING TREES/ GRIND STUMPS/ REMOVE ROOTS FOR NEW EARTHWORKS.

CONTRACTOR TO REINSTATE / REPAIR ALL DAMAGED BITUMEN / CONCRETE AND TURF ON COMPLETION

EXISTING SHEDS TO BE REMOVED BY CONTRACTOR AND TOTALLY REMOVE AND DISPOSE OFF UNDER THIS CONTRACT. RRC TO ARRANGE DISCONNECTION OF POWER

DEMOLISH EXISTING BITUMEN ROAD AND PATH AS SHOWN DASHED FOR NEW EARTHWORKS.

EXISTING SHEDS TO BE REMOVED BY CONTRACTOR AND TOTALLY REMOVE AND DISPOSE OFF UNDER THIS CONTRACT. RRC TO ARRANGE DISCONNECTION OF POWER

NATURAL GRASS RELOCATED RINGMAIN APPROX NEW LOCATION

EXISTING NATURAL GRASS IRRIGATION NETWORK (RING MAIN / LATERAL LINES, SOLENOID ETC TO BE TOTALLY REMOVED AND BACKFILLED BY CONTRACTOR

CONTRACTOR TO REINSTATE / REPAIR ALL DAMAGED BITUMEN / CONCRETE AND TURF ON COMPLETION

CONTRACTOR TO REMOVE EXISTING CHAIN MESH FENCE (AS REQUIRED FOR SUFFICIENT ACCESS TO SITE). CONTRACTOR TO REPAIR AND REINSTATE AND FENCE POST REMOVED OR DAMAGED.

EXTENT OF CONTRACTORS SITE AREA. PROVIDE FENCE TO WORK PLACE HEALTH & SAFETY REQUIREMENTS AND MAINTAIN THROUGHOUT CONTRACT PERIOD. RELOCATE FENCE AS WORK PROGRESSES

FENCING TO WORK AROUND EXISTING FIELD. ONLY ERECT AS NEGOTIATED TO MINIMIZE DISRUPTION TO EXISTING FIELD. ERECT AS LATE AS POSSIBLE.

CONTRACTORS FENCE FOR NEW SERVICES. REMOVE ONCE WORK IS COMPLETED.

CONTRACTOR TO REINSTATE / REPAIR ALL DAMAGED BITUMEN / CONCRETE AND TURF ON COMPLETION

EXISTING OVERALL SITE PLAN

1 : 1000

DO NOT SCALE DRAWING
ALL DIMENSION IN MILLIMETERS

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REVISIONS

Rockhampton Regional Council

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FOR TENDER

Project Details:
SITE PLANS
RRC & RHA
KALKA SHADES REDEVELOPMENT

Drawing Title:
EXISTING OVERALL SITE PLAN

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BUILDING DESIGNERS
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QBCC No: 1247120 BDAQ No: 0001677

Scale: 1 : 1000
Date: MAR 2018
Drawn: NJB
Rev: B
Project No: 18_004
Drawing No: S-02
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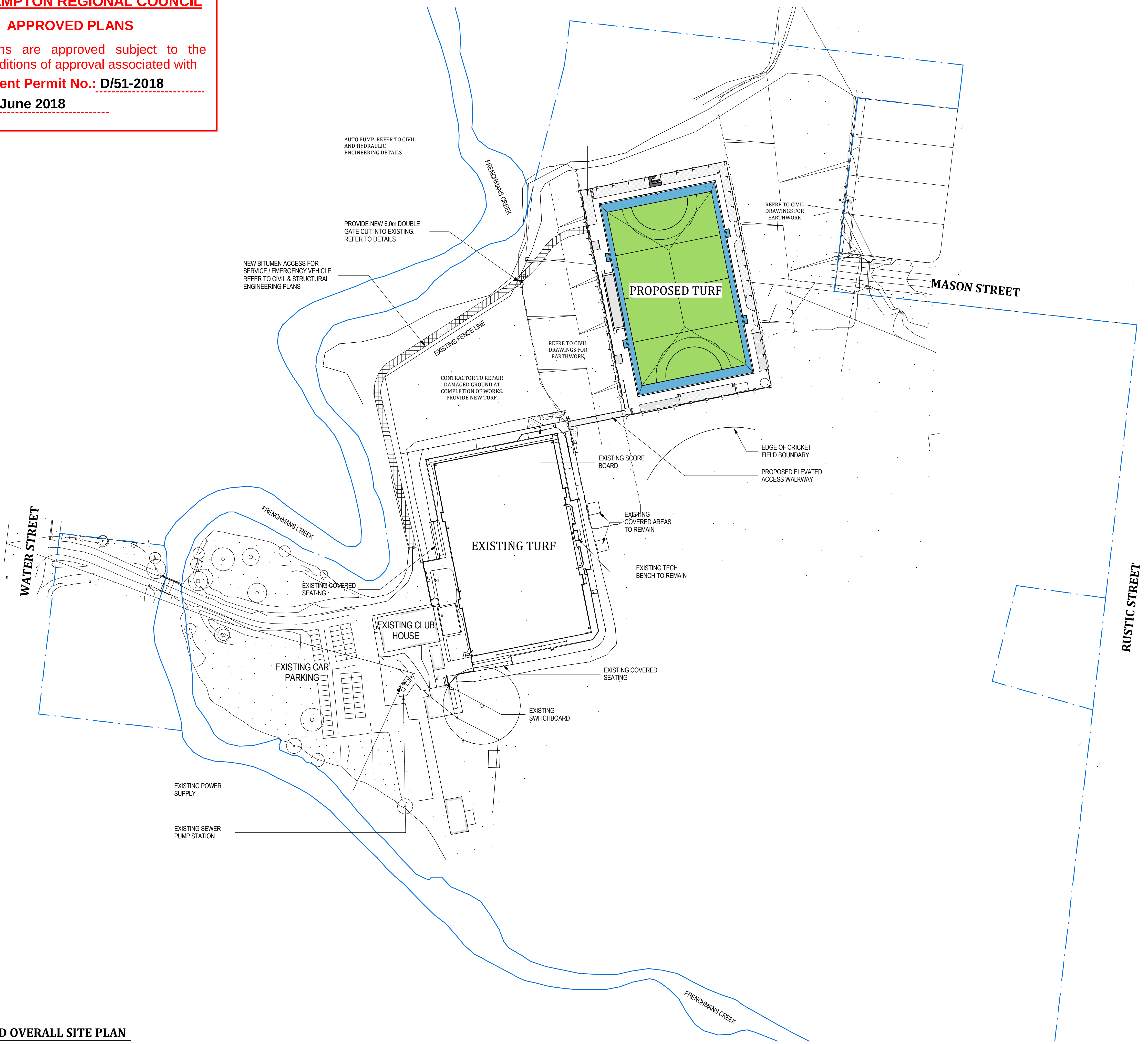

PROPOSED OVERALL SITE PLAN

1 : 1000

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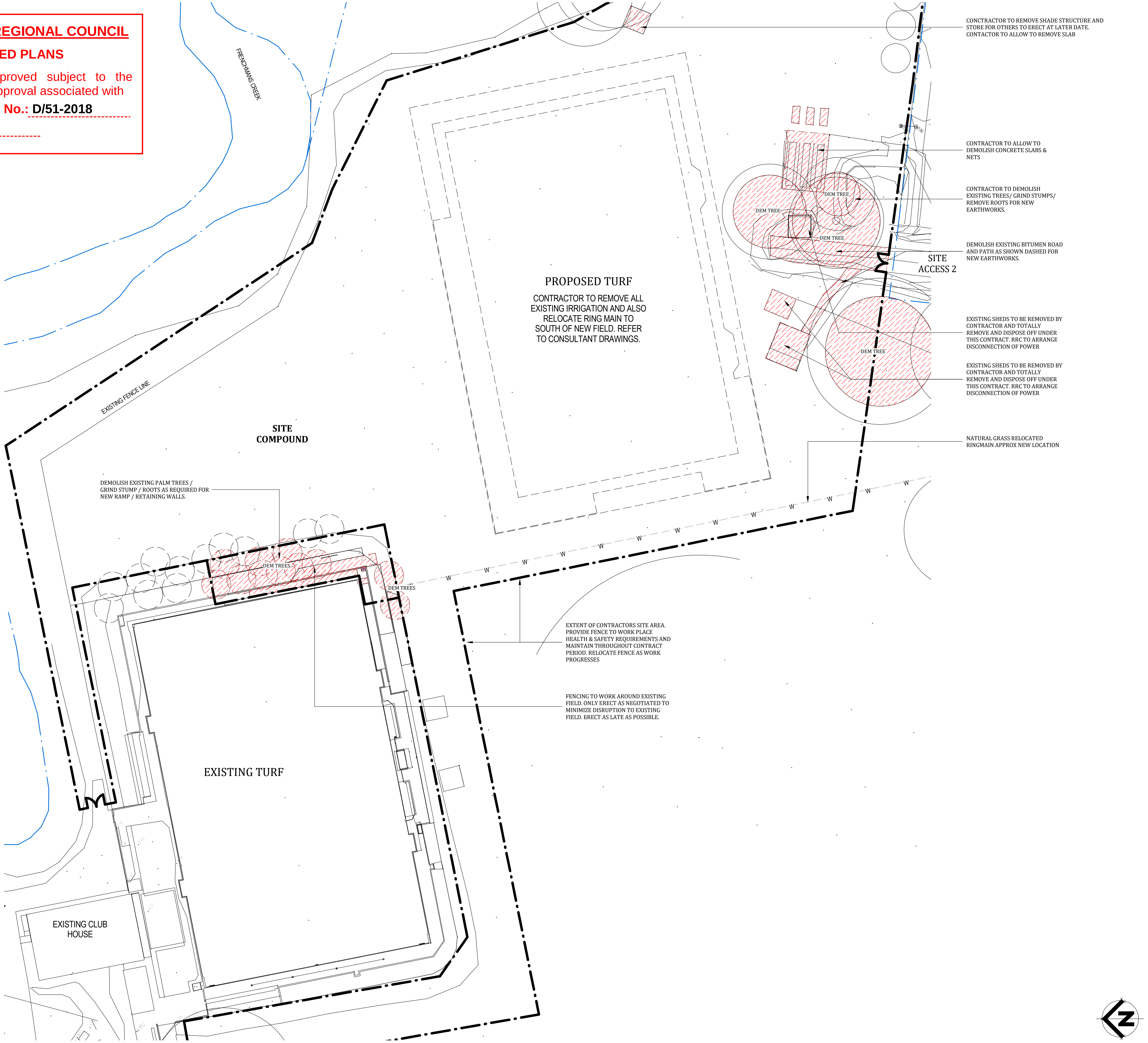

CONTRACTOR TO REMOVE ALL EXISTING IRRIGATION AND ALSO RELOCATE RING MAIN TO SOUTH OF NEW FIELD. REFER TO CONSULTANT DRAWINGS.

CONCTRACTOR TO REMOVE SHADE STRUCTURE AND STORE FOR OTHERS TO ERECT AT LATER DATE. CONTACTOR TO ALLOW TO REMOVE SLAB

CONTRACTOR TO ALLOW TO DEMOLISH CONCRETE SLABS & NETS

CONTRACTOR TO DEMOLISH EXISTING TREES/ GRIND STUMPS/ REMOVE ROOTS FOR NEW EARTHWORKS.

DEMOLISH EXISTING BITUMEN ROAD AND PATH AS SHOWN DASHED FOR NEW EARTHWORKS.

EXISTING SHEDS TO BE REMOVED BY CONTRACTOR AND TOTALLY REMOVE AND DISPOSE OFF UNDER THIS CONTRACT. RRC TO ARRANGE DISCONNECTION OF POWER

EXISTING SHEDS TO BE REMOVED BY CONTRACTOR AND TOTALLY REMOVE AND DISPOSE OFF UNDER THIS CONTRACT. RRC TO ARRANGE DISCONNECTION OF POWER

NATURAL GRASS RELOCATED RINGMAIN APPROX NEW LOCATION

DEMOLISH EXISTING PALM TREES / GRIND STUMP / ROOTS AS REQUIRED FOR NEW RAMP / RETAINING WALLS.

EXTENT OF CONTRACTORS SITE AREA. PROVIDE FENCE TO WORK PLACE HEALTH & SAFETY REQUIREMENTS AND MAINTAIN THROUGHOUT CONTRACT PERIOD. RELOCATE FENCE AS WORK PROGRESSES

FENCING TO WORK AROUND EXISTING FIELD. ONLY ERECT AS NEGOTIATED TO MINIMIZE DISRUPTION TO EXISTING FIELD. ERECT AS LATE AS POSSIBLE.

EXISTING SITE PLAN

1 : 500

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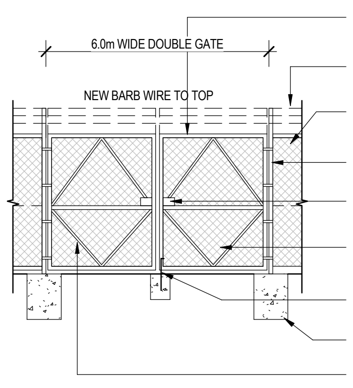
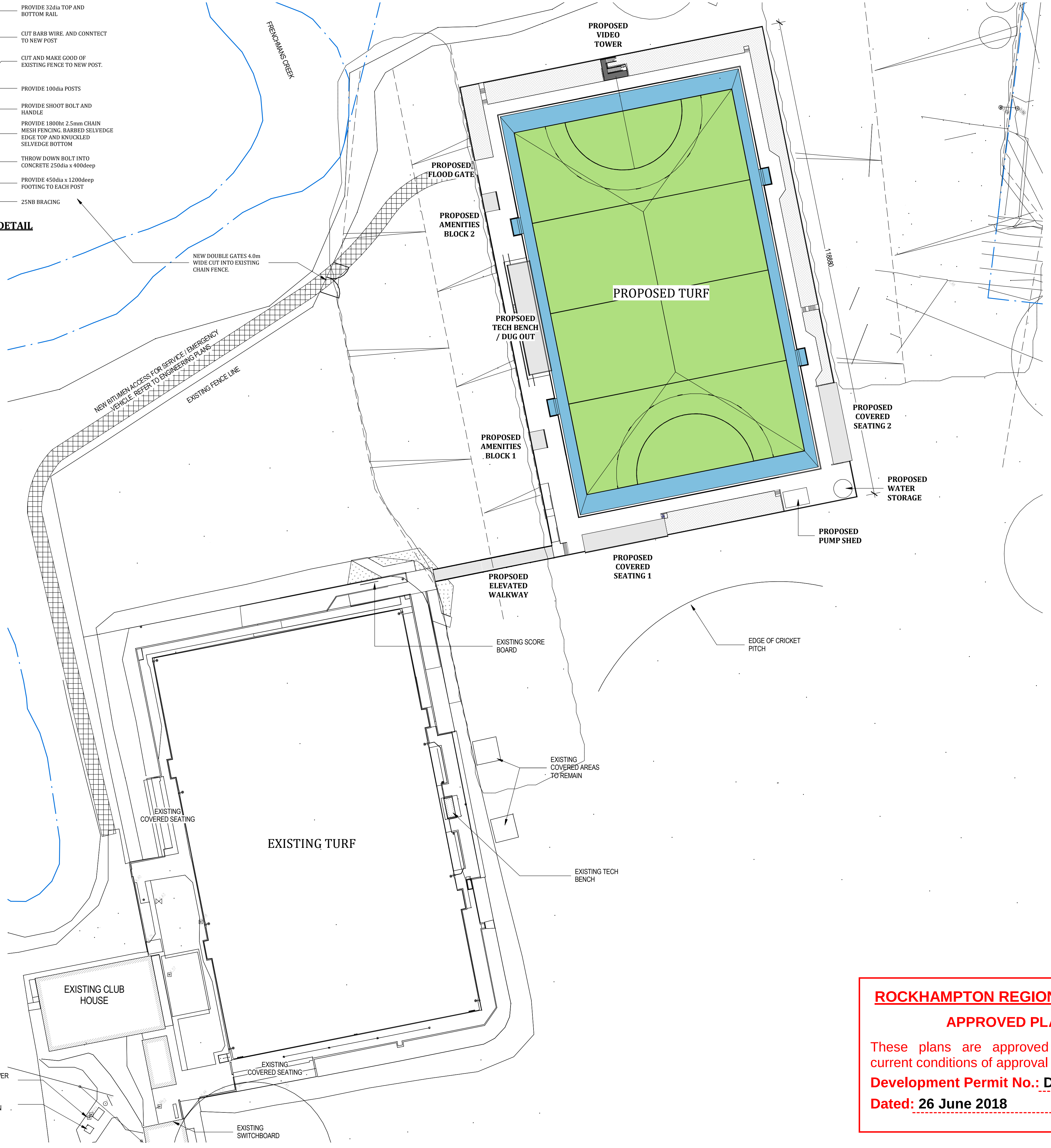


DOUBLE GATE INTO EXISTING DETAIL



PROPOSED SITE PLAN

1 : 500

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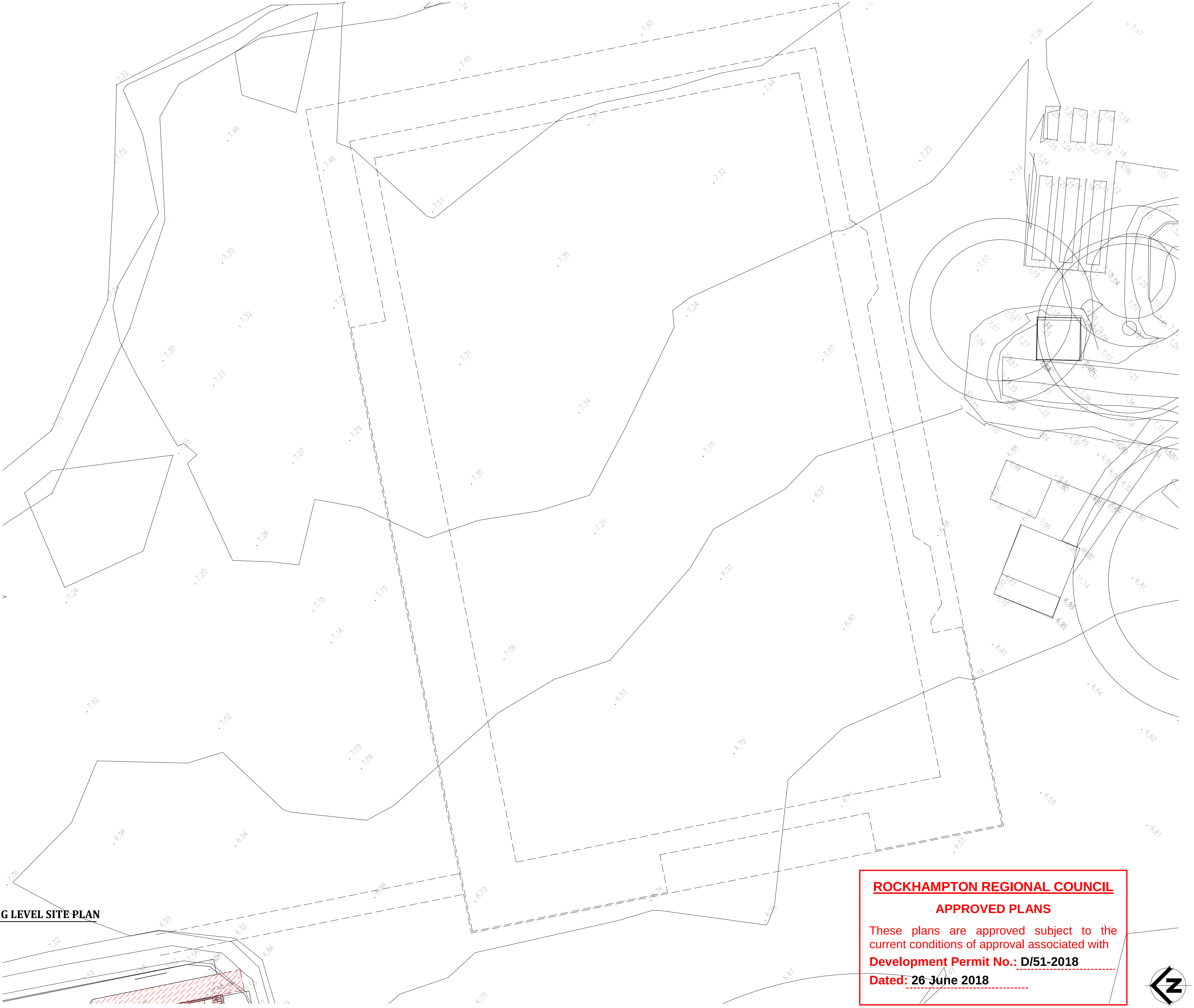

EXISTING LEVEL SITE PLAN

1 : 250

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EXISTING LEVEL PLAN

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Project No: 18_004	Drawing No: S-06

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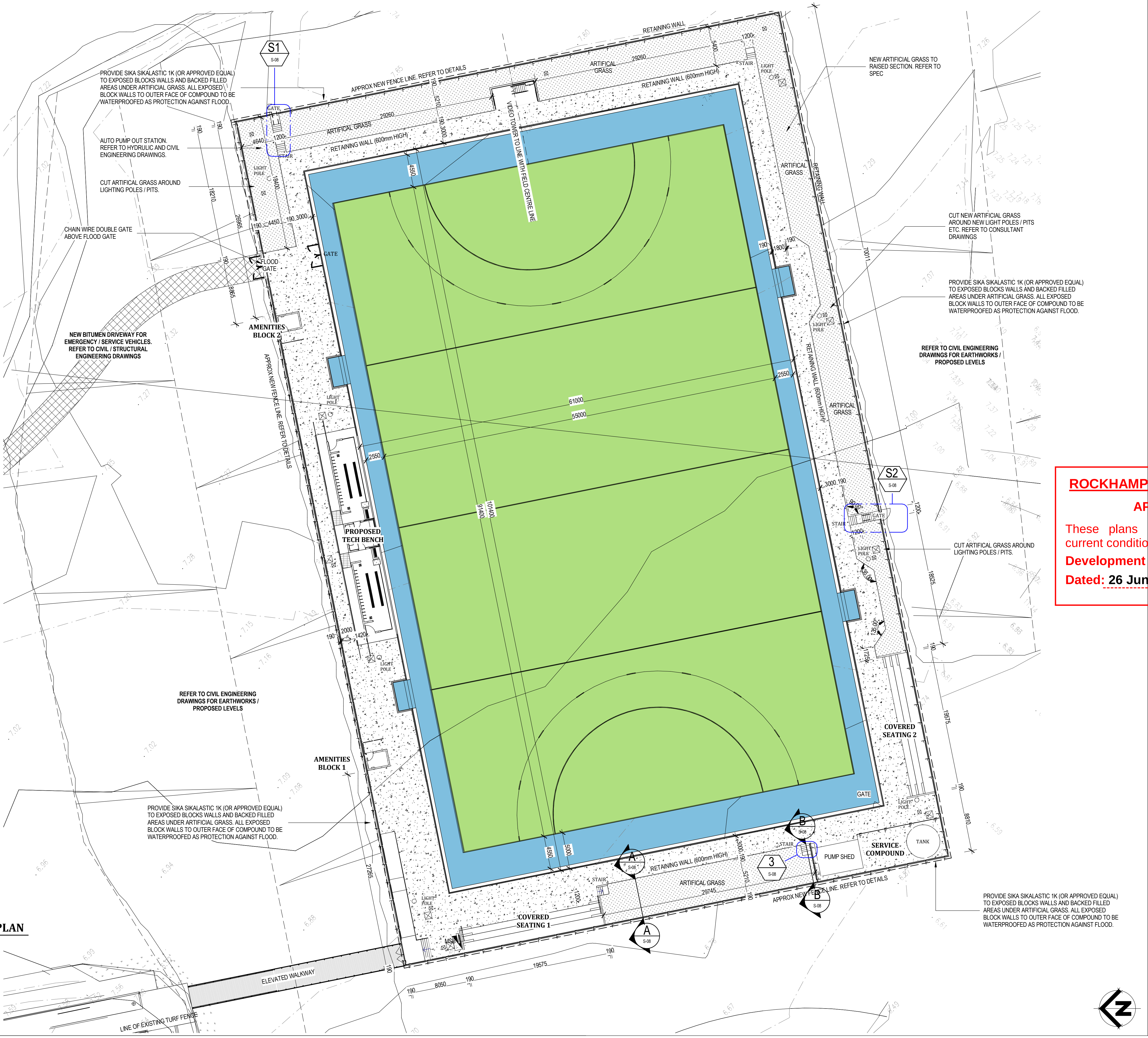

PROPOSED PART SITE PLAN

1 : 250

DO NOT SCALE DRAWING
ALL DIMENSION IN MILLIMETERS

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Project Details:

SITE PLANS
RRC & RHA
KALKA SHADES REDEVELOPMENT

Drawing Title:

PROPOSED PART SITE PLAN

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Project No:	18_004	Drawing No: S-07

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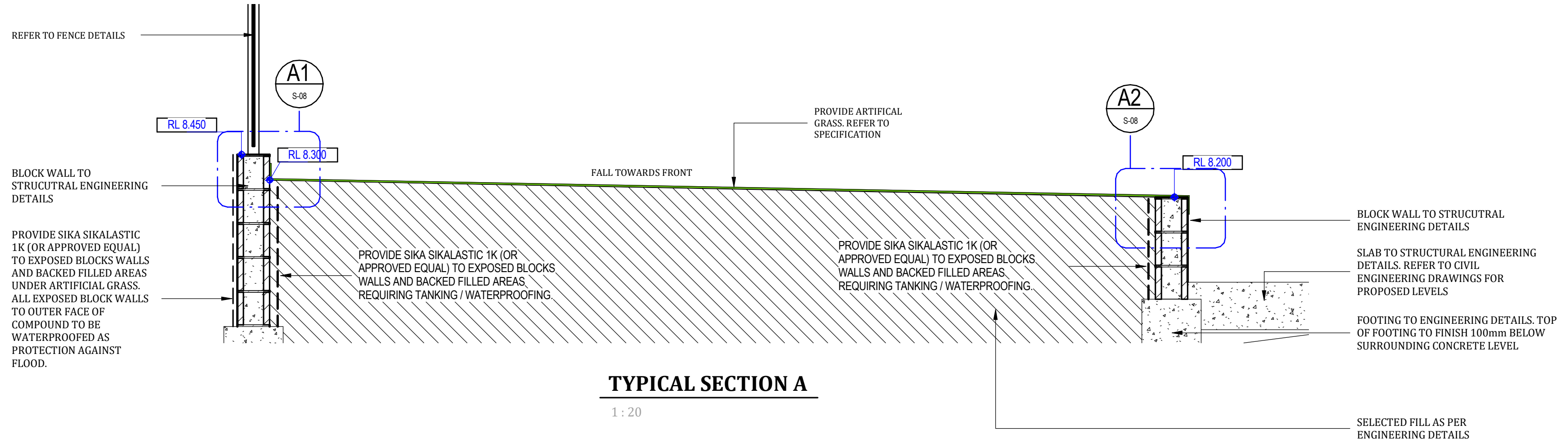
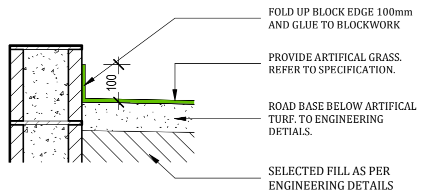


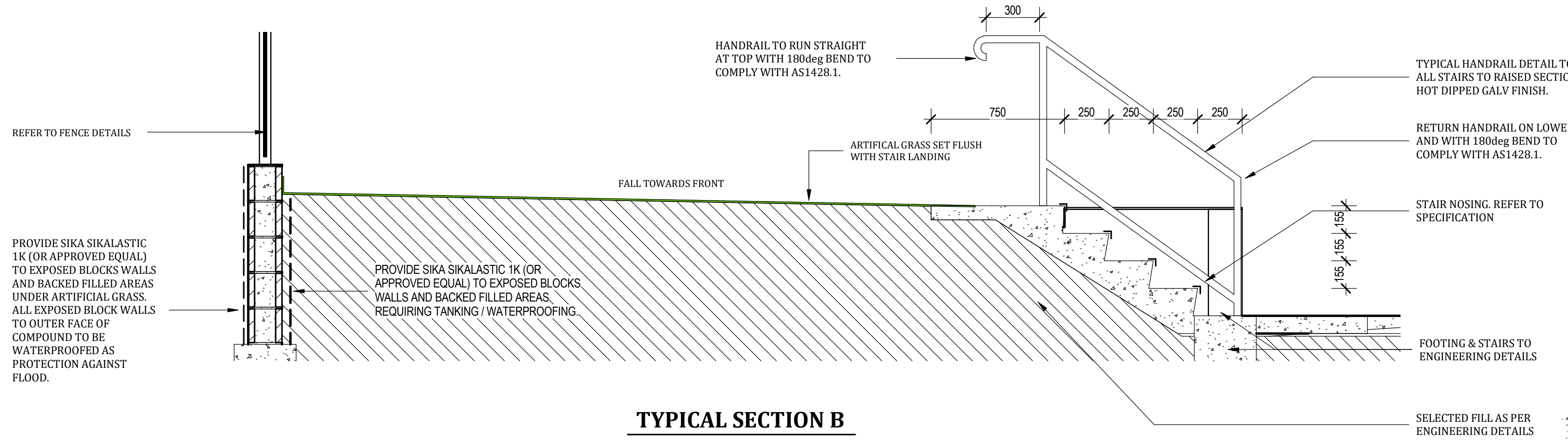
TYPICAL SECTION A

1 : 20



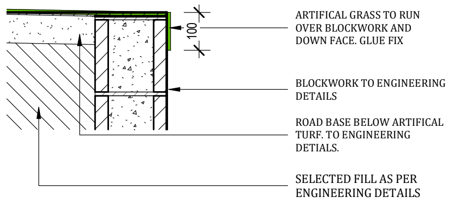
DETAIL A1

1 : 10



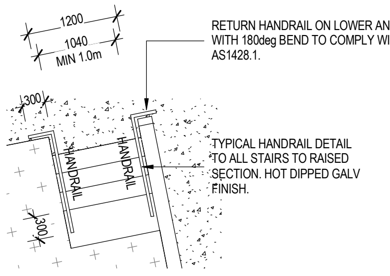
TYPICAL SECTION B

1 : 20



DETAIL A2

1 : 10

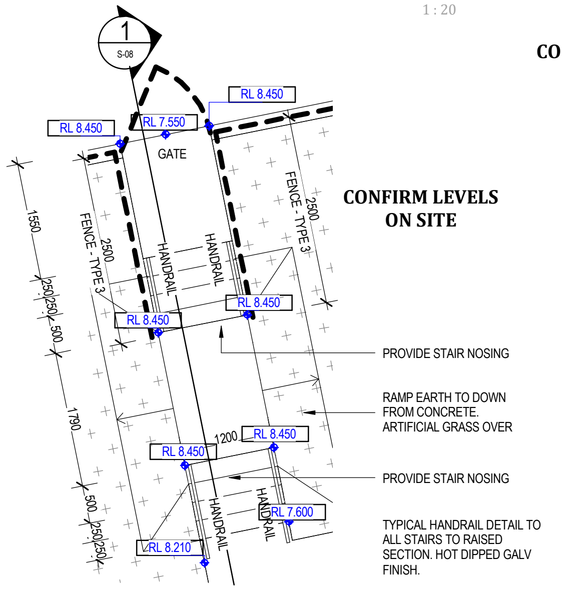


3 - TYPICAL STAIR TO RAISED AREA

1 : 50

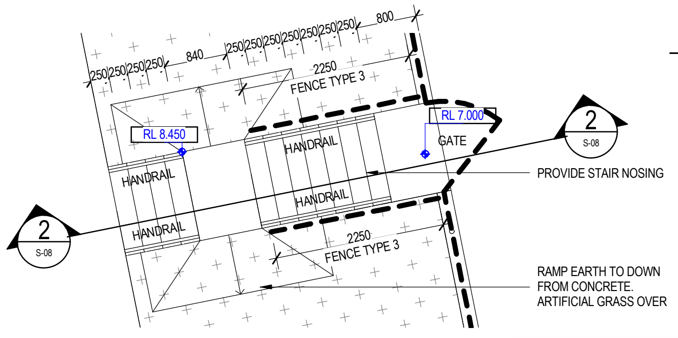
NO STAIR WELL SECTION

CONFIRM LEVELS ON SITE



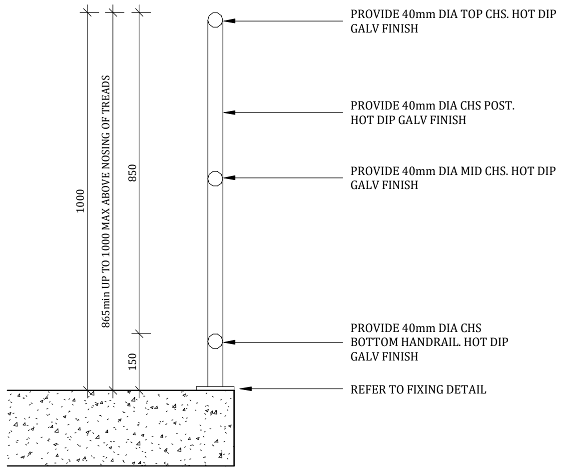
EXTERNAL STAIR 1

1 : 50



EXTERNAL STAIRS 2

1 : 50



HANDRAIL - EXTERNAL STAIRS

1 : 10

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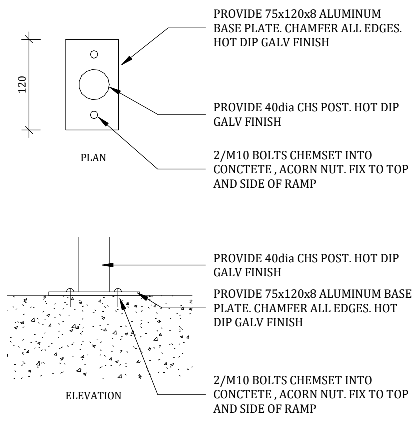
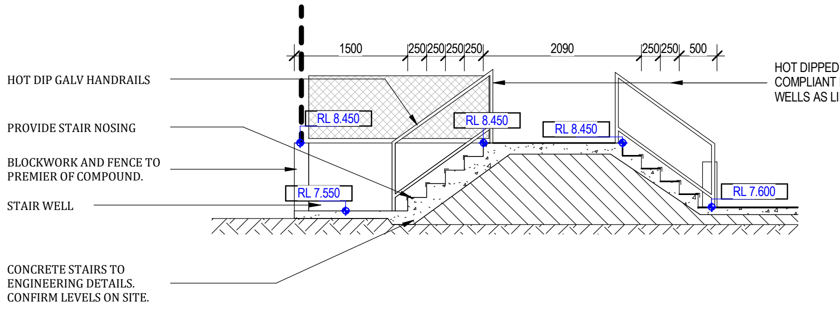


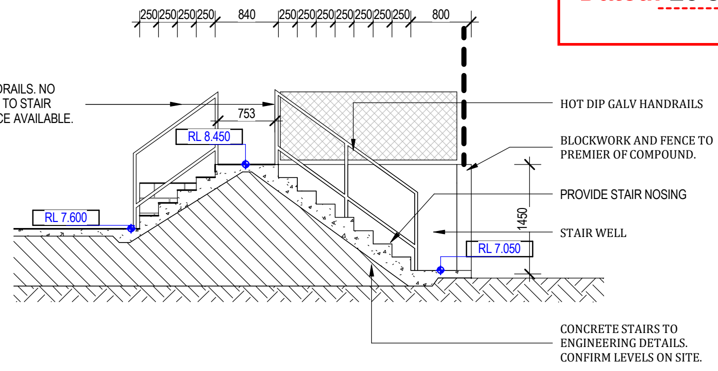
HANDRAIL FIXING DETAIL - EXTERNAL

1 : 5



EXTERNAL STAIR 1 SECTION

1 : 50



EXTERNAL STAIR 2 SECTION

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B	TENDER ISSUE	14.05.18

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Rockhampton Regional Council

ISSUED FOR
FOR TENDER

Project Details:
SITE PLANS
RRC & RHA
KALKA SHADES REDEVELOPMENT

Drawing Title:
SECTIONS & DETAILS

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QBCC No: 1247120 BDAQ No: 0001677

Scale: As indicated
Date: MAR 2018
Drawn: NJB
Rev: B
Project No: 18_004
Drawing No: S-08
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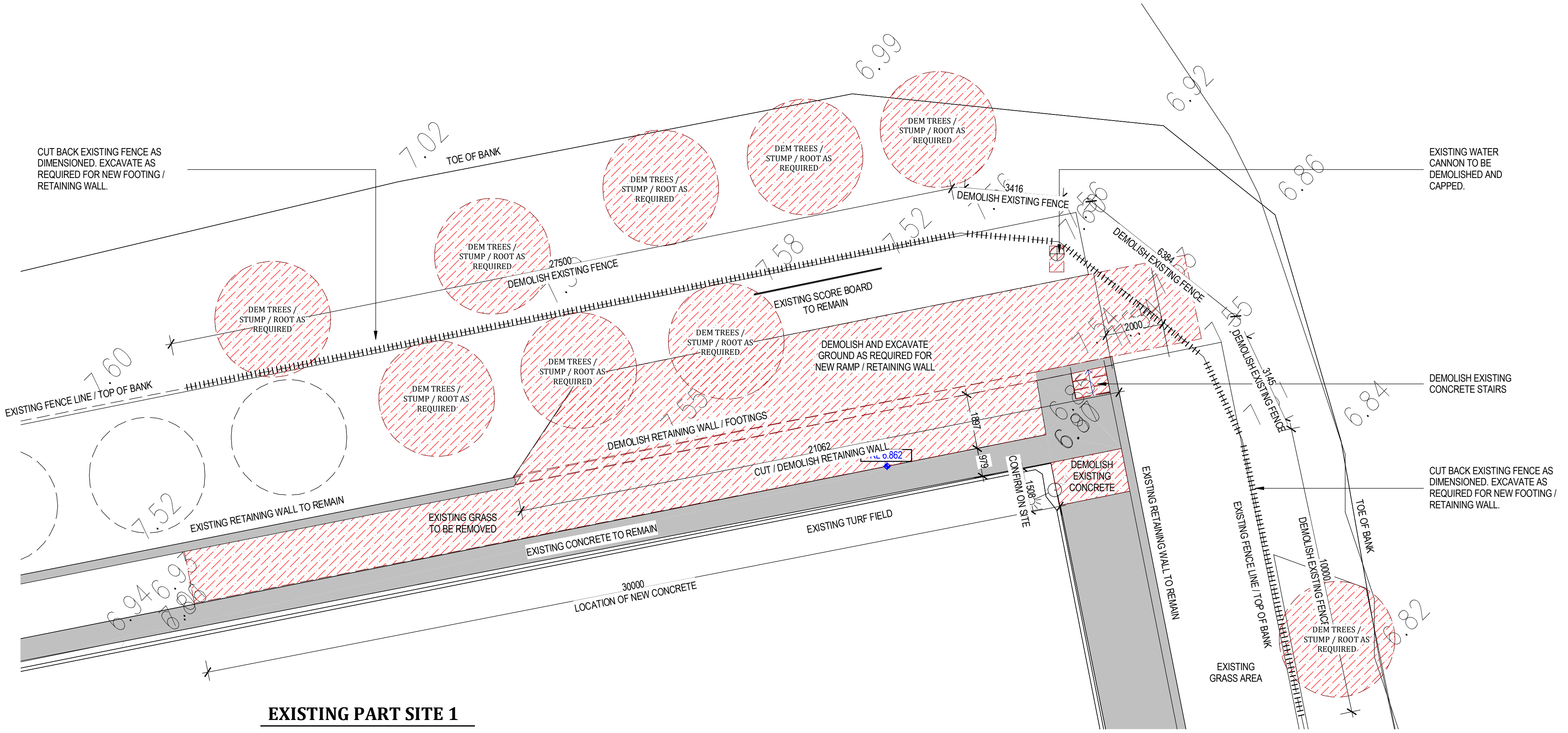

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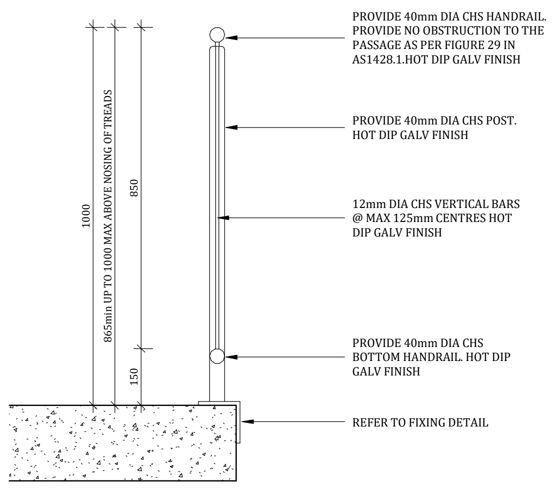

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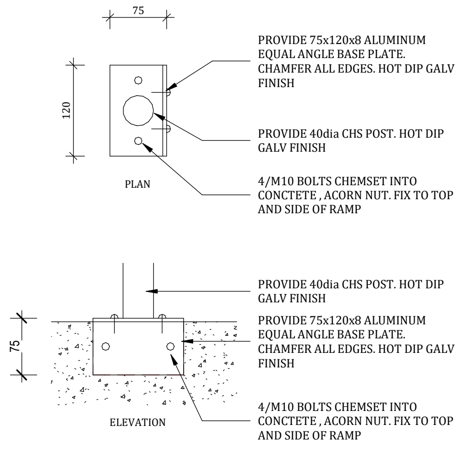

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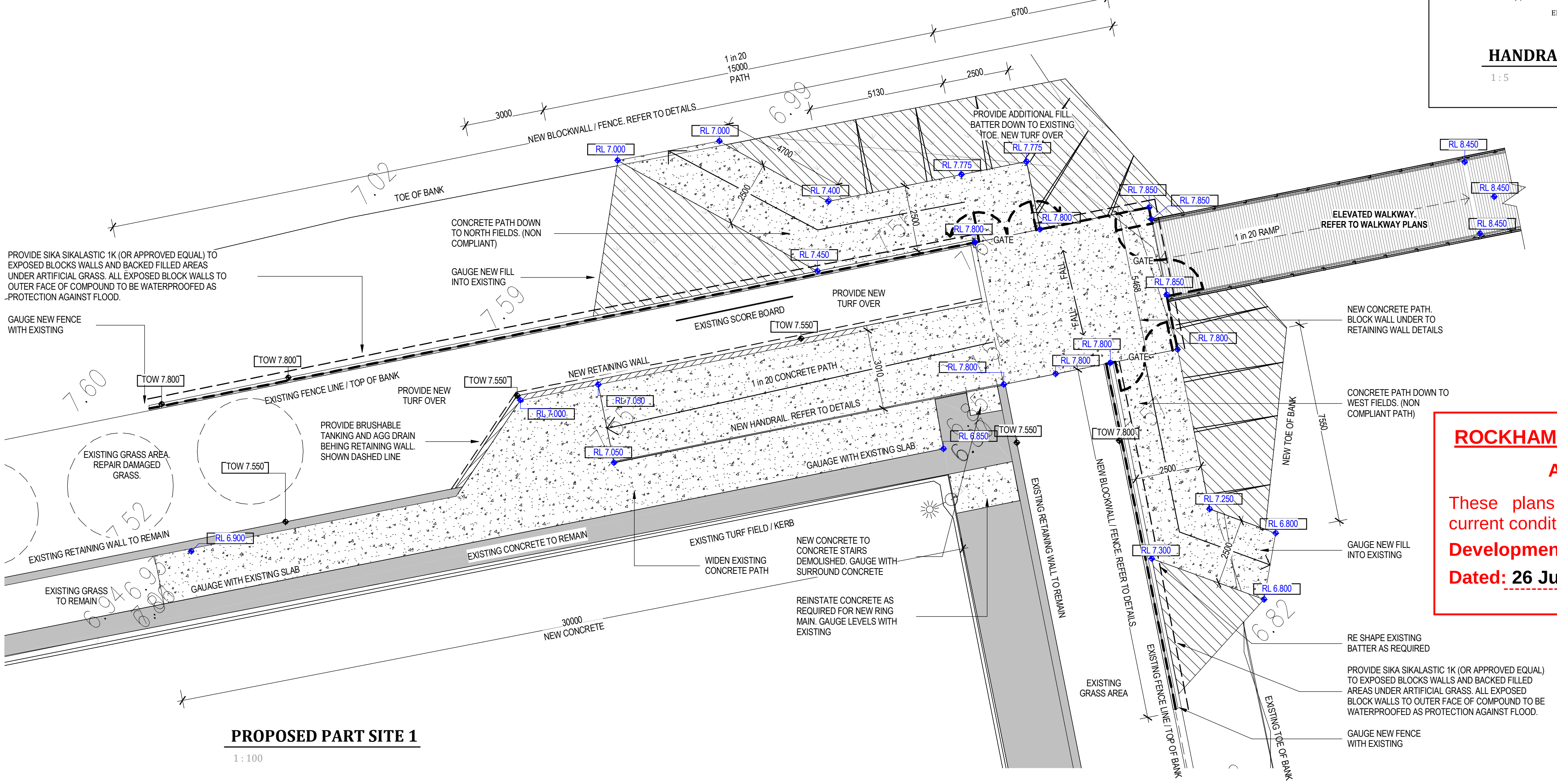

PROPOSED PART SITE 1

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ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/51-2018

Dated: 26 June 2018

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KALKA SHADES REDEVELOPMENT

Drawing Title:

PROPOSED PART SITE PLAN 1

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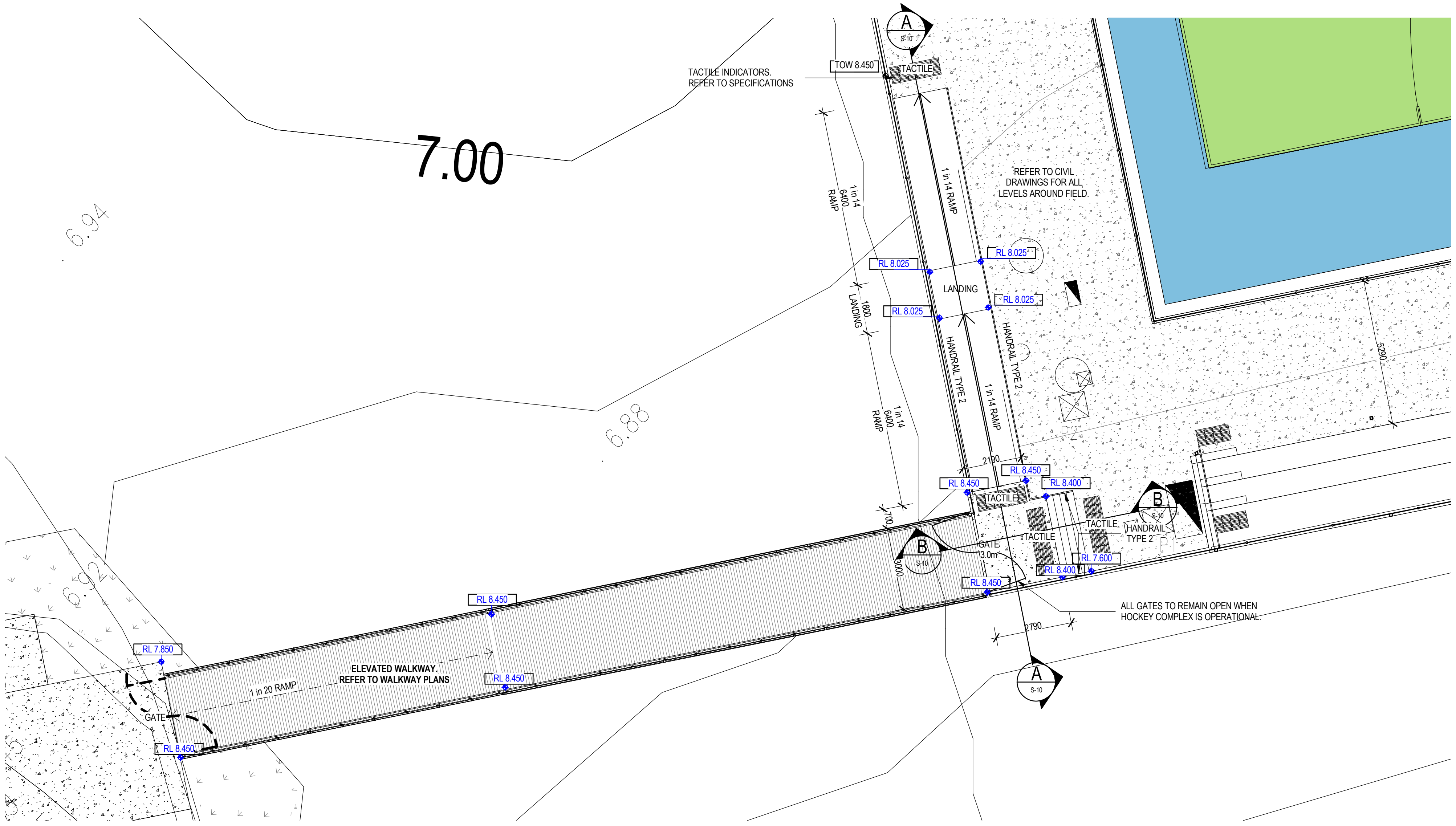

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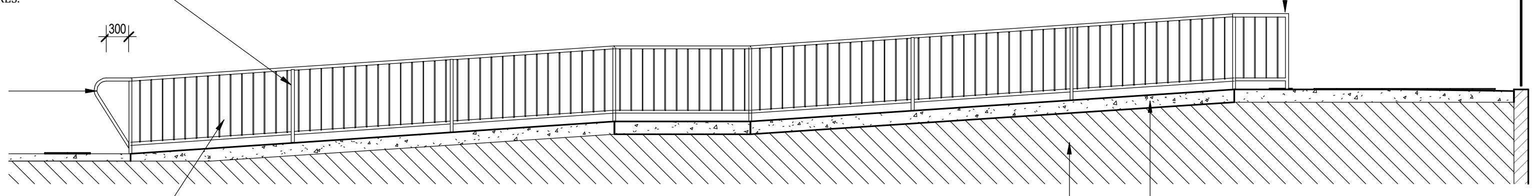

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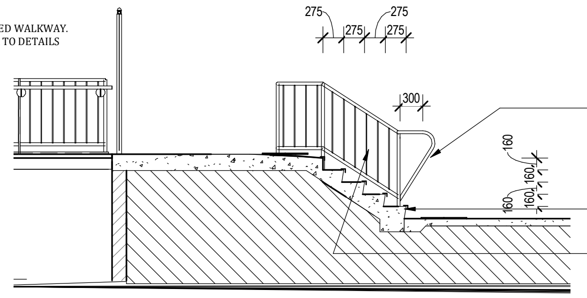

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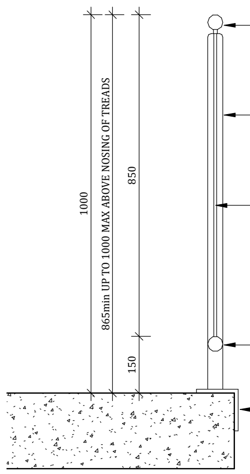

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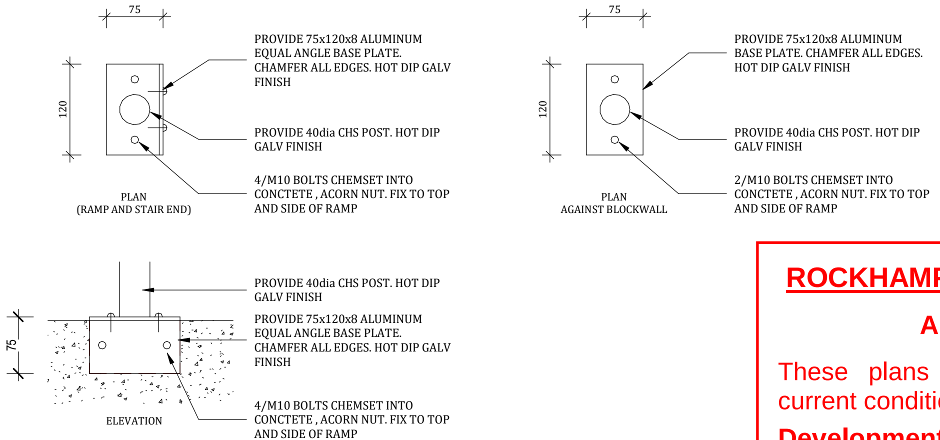

HANDRAIL FIXING DETAIL (TYPE 2)

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Butler Partners
geotechnical • geo-environmental • groundwater

Geotechnical Investigation
Proposed Hockey Field
Kalka Shades, North Rockhampton

Prepared for
Calibre Consulting Pty Ltd
Project No. R18-107A

26 April 2018

ROCKHAMPTON REGIONAL COUNCIL
APPROVED PLANS
These plans are approved subject to the current conditions of approval associated with
Development Permit No.: D/51-2018
Dated: 26 June 2018

Butler Partners
geotechnical • geo-environmental • groundwater

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Proposed Hockey Field
Kalka Shades, North Rockhampton
Project No.: R18-107A
26 April 2018

TABLE OF CONTENTS

TABLES:

ATTACHMENTS:

BUTLER PARTNERS (REGIONAL) PTY LTD

www.butlerpartners.com.au

SECTION 1 - INTRODUCTION

1.1 Project

It is understood that the construction of a new hockey field and associated infrastructure is proposed at Kalka Shades, North Rockhampton. The proposed development is understood to comprise a new synthetic turf hockey field to the north-east of the existing hockey field, a single-storey clubhouse, two lighting towers and an access road adjacent to Frenchman's Creek.

The location and extent of the site are shown approximately on Drawing No. 1, attached.

1.2 Proposed Scope of Work

Based on prior knowledge of the general area, the subsurface conditions at the site were anticipated to generally comprise surface layers of fill, underlain by alluvial clay/sand mixtures, potentially underlain by weathered rock. Shallow groundwater was not envisaged.

For the scope of the proposed development it was requested by Calibre Consulting Pty Ltd (Calibre) to undertake geotechnical investigation of the site by drilling and sampling four bores to 4m to 6m depth (or prior refusal) at Calibre nominated locations. An additional two shallow bores were requested for bulk sampling of the proposed subgrade; one along the proposed access road and one within the proposed hockey field.

Using the results of the proposed fieldwork and laboratory testing outcomes, it was proposed that a report would be produced to provide geotechnical design information on each of the following topics, as appropriate:

- subsurface conditions;
- site preparation and earthworks;
- excavatability;
- erosion and sediment control parameters;
- retaining wall design parameters;
- reactive soil movement,
- site trafficability after disturbance;
- stability criteria for open excavation;
- groundwater observations;
- suitable alternative foundation types;
- work bearing pressures;
- pavement and slab subgrade properties; and
- anticipated construction aspects.

1.3 Commission

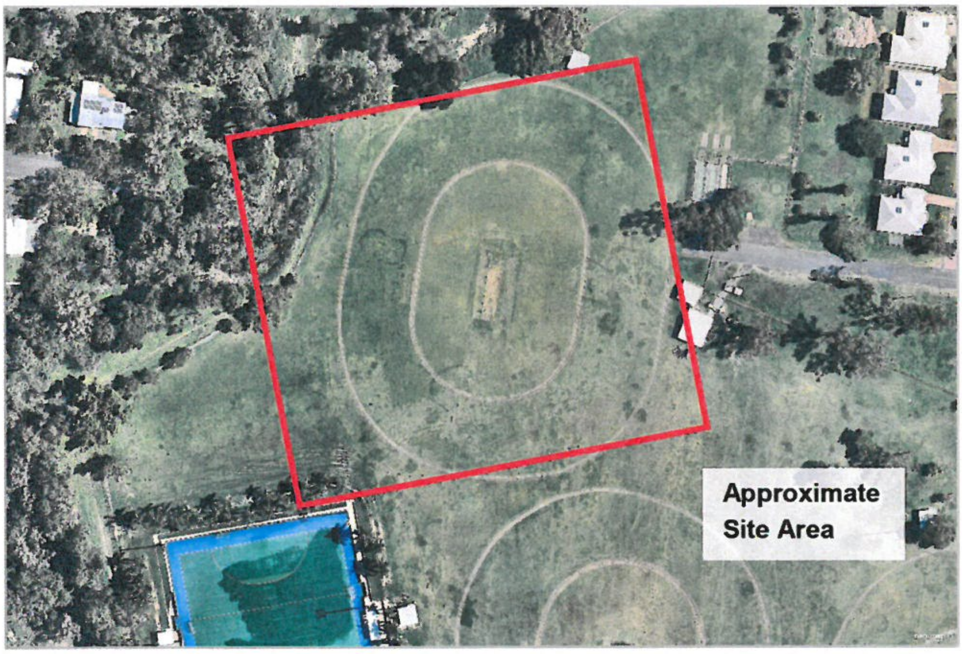
Based on the nominated scope of investigation work, a fee to undertake geotechnical investigation of the site was presented in a proposal on 2 February 2018. Butler Partners (Regional) Pty Ltd (Butler Partners) was subsequently commissioned by Calibre to conduct the investigation as proposed.

SECTION 2 - THE SITE

2.1 Site Description

At the time of the investigation, the development area was part of the existing Kalka Shades sporting field complex, comprising five grass cricket fields and one existing turf hockey field and clubhouse at the western side of the site. Frenchman's Creek runs adjacent to the western side of the field, from the north to the south east. An existing grandstand structure and a storage shed were situated adjacent to the north-eastern boundary of the site. Vegetation generally comprised well-kept grass with isolated patches of bare earth and small to medium sized trees and shrubs scattered around the edges of the site.

Ground surface levels across the development area sloped very gently downward to the south, from a high of approximately RL7.5m at the northern end, to a low of approximately RL6.5m at the southern end. A relatively recent aerial photograph of the site is presented in Photograph 1, with the approximate site boundary outlined in red.



Photograph 1: Aerial view of the site taken on 26 October 2017 (Nearmap image)

2.2 Geology

Reference to the Geological Survey of Queensland's 1:100,000 series Rockhampton Sheet indicates that the site is mapped in an area of Quaternary Fitzroy flood plain alluvium (comprising silt, clay, sand and gravel).

SECTION 3 - FIELDWORK

3.1 Drilling and Sampling Methods

The investigation comprised the drilling and sampling of four bores (Bores 1 to 4) to between 4.45m and 5.90m depth, with a 4wd-mounted Drill Man GT10, using solid flight auger drilling techniques. Strata identification was based on inspection of the materials recovered on the augers, supplemented by the inspection of 'disturbed' Standard Penetration Test (SPT) samples and 'undisturbed' 50mm diameter tube samples. Hand 'pocket' penetrometer readings were taken in the ends of the undisturbed tube samples in cohesive strata to assist with the assessment of soil strength.

Two additional 'shallow' bores were drilled to recover bulk samples of proposed subgrade material along the proposed access road and within the new hockey field for laboratory testing of soaked CBR.

On completion of drilling, the bores were backfilled with drill spoil and surface plugged.

3.2 Bore Locations and Supervision

Bore locations were set-out from co-ordinates provided by Calibre using a hand-held GPS unit and their approximate locations are shown on Drawing No. 1 attached. The ground surface level at each bore location was interpolated from survey information provided by Calibre on an unreferenced plan, received on 3 April 2018.

An experienced geotechnical engineer set out the bore locations, logged the stratigraphy encountered in the bores, directed the insitu sampling and testing program and supervised the field work.

SECTION 4 - INVESTIGATION RESULTS

4.1 Reports

The subsurface conditions encountered at the bore locations are given on the Bore Report sheets included in Appendix A, using classification and descriptive terms defined in the accompanying notes. Laboratory test result report sheets are included in Appendix B.

4.2 Subsurface Conditions

For a description of the stratigraphy encountered at each bore, the Bore Report sheets should be consulted. However, in broad summary, the subsurface conditions encountered in the bores generally comprised surface layers of silty clay fill to between 0.5m and 0.9m depth, underlain by firm to very stiff gravelly/sandy/silty clay. In Bore 4, a layer of medium dense clayey/sandy gravel was encountered in the clays between 1.4m and 3.6m depth.

'Strength inversions' (i.e. 'weak' material underlying 'stronger' material) were encountered in three bores. For example, in Bore 1, very stiff sandy silty clay was underlain at 4m depth by stiff sandy silty clay; in Bore 2, very stiff silty clay was underlain at 2m depth by stiff sandy clay; and in Bore 3, very stiff gravelly clay was underlain at 3m by stiff silty clay.

4.3 Groundwater

Free groundwater was encountered in all bores during drilling at the depths/reduced levels indicated in Table 1.

Table 1: Groundwater Observations

Bore	Date	Groundwater Observations	
		Depth (m)	Reduced Level (m)
1	9 March 2018	3.4	RL3.6
2		1.8	RL5.1
3		2.7	RL4.5
4		1.6	RL5.9

Groundwater levels would be expected to be affected by seasonal and prevailing weather conditions. If construction is to be undertaken at a significant time following this investigation and/or following significant 'wet' weather, it would be prudent to confirm groundwater levels.

4.4 Laboratory Testing

Selected samples recovered from the bores were submitted to Butler Partners' NATA accredited Rockhampton geotechnical testing laboratory for assessment of erosion and sediment control parameters, particle size distribution, plasticity, shrink-swell index and soaked CBR. The test results are summarised and discussed in the following sections.

It should be noted that sample descriptions provided in the laboratory results summary tables (and the laboratory test result sheets) are based on the inspection of each individual laboratory test sample only. No allowance has been made in sample descriptions for sampling, sub-sampling or test methodology in determination of the mass material properties. Estimates of mass material properties are provided on each individual Bore Report sheet and as such, the laboratory test results should be read in conjunction with the relevant Bore Report sheets.

4.4.1 Erosion and Sediment Control Parameters

Two samples of fill and one sample of silty clay were tested to determine the Emerson Class Number, pH and electrical conductivity and a summary of the reported test results is presented in Table 2. The Emerson Class Number results indicate that the samples tested had a low potential for dispersion, using distilled water.

Table 2: Summary of Reported Emerson Class, pH and Conductivity Test Results

Bore	Depth (m)	Sample Description	Emerson Class No.	pH	Electrical Conductivity (mS/cm)
CBR 2	0.2 – 0.6	Fill – Silty Clay	4	6.0	0.14
3	0.5 – 0.95	Silty Clay	4	7.7	0.22
4	0.5 – 0.95	Fill – Silty Clay	4	5.0	0.29

4.4.2 Particle Size Distribution

Two selected samples of soil and one sample of fill were tested for measurement of particle size distribution using wash sieve grading techniques and the reported results are summarised in Table 3.

Table 3: Summary of Reported Particle Size Distribution Test Results

Bore	Depth (m)	Sample Description	Sample Moisture Content (%)	Gravel Fraction(1) (%)	Sand Fraction(2) (%)	Silt and Clay Fraction(3) (%)
CBR 2	0.2 – 0.6	Fill – Silty Clay	21.4	1	18	81
1	4.0 – 4.45	Sandy Clay	23.4	3	45	52
4	1.5 – 1.95	Clayey Sandy Gravel	9.4	43	30	27

(1) Particle size <60mm, >2mm; (2) Particle size (approximately) <2mm, >0.075mm; (3) Particle size (approximately) <0.075mm

4.4.3 Plasticity

One selected sample of soil and one sample of fill were tested for measurement of plasticity using Atterberg limit and linear shrinkage test methods. The reported test results are summarised in Table 4, together with the soil classification and indicate that the samples tested were of high plasticity.

Table 4: Summary of Reported Plasticity Test Results

Bore	Depth (m)	Sample Description	Sample Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Classification(1)
CBR 2	0.2 – 0.6	Fill – Silty Clay	21.4	53	16	37	14.0	CH
3	0.5 – 0.95	Silty Clay	21.8	52	15	37	13.0	CH

(1) Australian Standard AS1726-1993, *Geotechnical site investigations*

4.4.4 Shrink-Swell Index

Two undisturbed samples of clay soil were tested to assess shrink-swell index (I_{ss}) using the methods given in Australian Standard AS1289.7.1.1 – 1992. The reported test results are presented in Table 5, and indicate the sample tested showed potential for moderate to high shrink-swell movements associated with moisture content/suction variation.

Table 5: Summary of Shrink-Swell Test Results

Bore	Depth (m)	Sample Description	Sample Moisture Content (%)	Shrinkage (%)	Swell (%)	Iss (% per pF)
2	1.5 – 1.9	Silty Clay	18.7	4.0	2.9	3.0
3	1.5 – 1.7	Gravelly Clay	18.7	3.0	2.3	2.3

4.4.5 Compaction Properties

Two selected bulk samples recovered were tested to determine (Standard) laboratory moisture-density relationship and the maximum dry density (MDD) and optimum moisture content (OMC) results for the samples tested are summarised in Table 6. The results of the moisture-density testing indicates that the (insitu) moisture contents of the samples tested were between approximately 2.2% and 2.4% 'wet' of Standard OMC, at the time of sampling.

Table 6: Summary of Moisture-Density Relationship Results

Bore	Depth (m)	Sample Description	Sample Moisture Content (%)	Standard Compaction	
				Maximum Dry Density (t/m^3)	Optimum Moisture Content (%)
CBR 1	0.1 – 0.5	Gravelly Silty Clay	23.2	1.62	21.0
CBR 2	0.2 – 0.6	Fill – Silty Clay	21.4	1.59	19.0

4.4.6 California Bearing Ratio

Two bulk samples recovered were tested for measurement of soaked CBR using the test method given in Australian Standard AS1289.6.1.1 - 1998. The samples were recompacted using Standard compactive effort at approximately OMC, then soaked under a surcharge loading of 4.5kg for four days. A summary of the reported results is presented in Table 7.

Table 7: Summary of California Bearing Ratio Test Results

Bore	Depth (m)	Sample Description	Sample Moisture Content (%)	Sample Preparation		Swell (%)	CBR (%)
				Dry Density (t/m^3)	Moisture Content (%)		
CBR 1	0.1 – 0.5	Gravelly Silty Clay	23.2	1.54	21.2	4.0	6
CBR 2	0.2 – 0.6	Fill – Silty Clay	21.4	1.51	19.4	2.0	6

SECTION 5 - GEOTECHNICAL DESIGN DISCUSSION

5.1 Ground Model

The results of the investigation indicated that the ground conditions (at the bore locations) generally comprised layers of silty clay fill to between 0.5m and 0.9m depth, underlain by gravelly/sandy/silty clay. A layer of clayey/sandy gravel was encountered between 1.4m and 3.6m depth in one bore. Strength inversions with depth were encountered in three bores. In these ground conditions, geotechnical design will need to consider (at least) the following key issues:

- subsurface conditions;
- variations in ground conditions across the site and with depth;
- presence of strength inversions;
- presence, uniformity and placement of existing fill;
- earthworks and site preparation;
- excavatability;
- erosion and sediment control parameters;
- site trafficability after disturbance of the site;
- reactive soil movement;
- stability criteria for open excavation;
- retaining wall design parameters;
- suitable alternative foundation types;
- working bearing pressures;
- pavement and slab subgrade properties; and
- anticipated construction aspects.

Discussion of geotechnical design parameters, as well as design and construction recommendations and suggestions are detailed in the following sections.

5.2 Earthworks

5.2.1 Existing Fill

Where existing fill is present along the site, supporting documentation should be obtained and checked to confirm that the fill has been placed in a controlled manner to a specification that is appropriate for the proposed development. If documentation does not exist (or the specification used for filling is not appropriate for the proposed development) then it is suggested that the existing fill be assumed to be 'uncontrolled'.

To minimise the risk of potentially adverse settlement due to poorly compacted zones or inclusions of deleterious material occurring, it is recommended that all uncontrolled fill present in settlement sensitive areas be removed and replaced/recompacted with controlled fill of low 'reactivity', unless settlement sensitive elements of the development can be supported on suitable material located below the fill.

5.2.2 Site Preparation

Site preparation in areas of future settlement sensitivity should involve removal of any existing uncontrolled fill, unsuitable materials, vegetation, topsoils and any trees or large shrubs (if present), as far in advance of construction as possible (refer Section 5.5)

Following site stripping (and excavation, as required), the exposed subgrade in areas to be developed should be uniformly compacted to the relevant (Standard) dry density ratio indicated in Table 8. 'Soft spots' could be expected in the subgrade, which should be either tyned, dried then recompacted, or excavated and replaced with compacted select fill. It is anticipated that use of a coarse granular fill ('bridging') layer may be required in the base of soft-spot excavations to provide a relatively solid base to compact over. Placement of the bridging layer and all soft spot excavations should be conducted under the supervision of an experienced engineer.

Care will be required to ensure that the effect of site earthworks does not impact adversely upon adjacent services and structures etc. (e.g. as potential settlements induced by vibratory compaction, etc.). It is also recommended that dilapidation surveys of adjacent structures and services (if applicable), etc. be undertaken prior to construction commencing on site.

5.2.3 Excavatability

Bulk and confined excavation of the fill and soils encountered in the bores should be readily removed using a large hydraulic excavator.

All confined excavations into which personnel entry is envisaged should be fully supported or battered/benched to a stable angle to ensure personnel safety.

5.2.4 Temporary Batter Stability

Stable (cut) batter angles will need to be properly assessed once earthworks design and procedures have been finalised. As a preliminary guide, the slope batter angles given in Table 8 are suggested for dry, unsurcharged batters, up to 2m to 3m in height, where some movement behind batter crests is acceptable and the slopes are dewatered.

Table 8: Maximum Temporary Unprotected Dry Cut Batter Slopes to 2m to 3m Depth

Material	Strength	Temporary Batter$^{(1)}$
Existing Fill	-	1V:3H (highly variable)$^{(2)}$
Gravelly/Sandy/Silty Clays	firm stiff very stiff	1V:2.5H$^{(2)}$ 1V:1.5H$^{(2)}$ 1V:1H$^{(2)}$
Sandy/Clayey Gravels	medium dense	1V:2H$^{(2)}$

(1) Not underlain by 'softer' materials and subject to confirmation by engineering analysis and inspection during construction
(2) Flatter if 'wet'

The batter angles given in Table 8 are based on the assumption that batter faces are protected from erosion and that drainage is designed to keep surface and groundwater away from the slopes. If free water is allowed to emanate from batter faces, slopes are likely to be unstable at the nominated batter slopes.

If insufficient space exists for the construction of cut batters at the slopes given in Table 8, or potential uncontrolled crest movement cannot be accepted, the excavation sides will need to be supported in order to prevent instability/control movement.

5.2.5 Fill Compaction

Any fill required to support structure loads and/or movement sensitive on-ground slabs etc., should be 'controlled', i.e. placed in layers having a loose thickness of not more than 250mm and uniformly compacted to the relevant (Standard) dry density ratio nominated in Table 9. Use of reactive fill should be avoided.

Table 9: Minimum Compaction Requirements

Description	Minimum Dry Density Ratio
General Fill (non-structural support)	95% (Standard compaction)
Pavements - >500mm below subgrade level - top 500mm of subgrade	98% (Standard compaction) 100% (Standard compaction)

To assist with the achievement of adequate control over fill placement, geotechnical testing as set out in Section 8 of Australian Standard AS3798 – 2007 *Guidelines on earthworks for commercial and residential developments* would be required. It is recommended that any earthworks in areas where future settlement control is required (and for all fill required to support floor slabs, foundations, etc.) should be undertaken under 'Level 1' geotechnical supervision and testing.

5.2.6 Trafficability

It is anticipated that site trafficability for rubber tyred plant will be difficult to impossible in 'wet' conditions and consideration should be given to placement of a coarse (free draining) granular working surface to enable trafficing of any sections of the site requiring all weather access. The required layer thickness will depend on the type of plant proposed to traffic the site and should be determined on a case-by-case basis. However, a layer thickness of approximately 0.15m is anticipated for 'light' equipment.

5.3 Site Drainage

During construction, the site should be graded such that water is readily shed and does not collect and pond over the site, otherwise softening of the subgrade will occur, especially under trafficing of construction plant and heavy vehicles.

5.4 Retaining Walls

An estimate of 'unsurcharged' retaining wall pressures can be obtained for 'flexible' and 'rigid' walls (up to 2m to 3m high) under drained conditions, retaining horizontal material, by using a triangular pressure distribution in conjunction with the parameters given in Table 9.

Table 10: Retaining Wall Design Parameters

Material Type	Strength/Density	Total Weight (t/m^3)	Flexible Wall 'Active' Pressure Coefficient (k_a)	Rigid Wall 'At Rest' Pressure Coefficient (k_o)
Sandy/Silty Clay	firm to very stiff	1.9	0.40	0.60
Clayey/Sandy Gravel	medium dense	2.0	0.30	0.50

Due allowance must be included in wall design for groundwater pressure, back fill compaction, surcharge effects from adjacent structures and/or construction loading, the effects of sloping retained materials, reactive soil/fill pressures etc. Even if a drainage system is installed behind retaining walls, consideration should be given to the potential for water pressures to act on the wall as elevated groundwater levels may occur during or following prolonged 'wet' weather, or from blocked drainage etc. Drain design should incorporate free draining backfill and slotted pipe discharging into a sealed disposal system.

5.5 Soil Reactivity and Shrink-Swell Movements

5.5.1 Estimated Magnitude

The magnitude of potential reactive soil movements can be estimated using the following equation (from Australian Standard AS2870-2011 *Residential slabs and footings*), and parameters for the subject site selected based on recommendations in AS2870, results of the laboratory testing and published information:

$$y_s = \frac{1}{100} \sum_{n=1}^{N} \left(\alpha . I_{ss} . \overline{\Delta u} . h \right)_n$$

where y_s is the characteristic surface movement, in millimetres;

α is the lateral restraint factor;

I_{ss} is the shrink-swell index (taken as approximately 2.5% per pF to 3.0% per pF for the site clays, based on shrink-swell laboratory test results and past experience);

$\overline{\Delta u}$ is the soil suction change averaged over the thickness of the layer under consideration (estimated as 1.2pF in Rockhampton);

h is the thickness of layer under consideration, in millimetres; and

N is the number of soil/fill layers within the depth of suction change (2.3m in Rockhampton).

Based on a shrink-swell index range of 2.5% per pF to 3.0% per pF for the site clays, the potential characteristic surface movement values for the natural site soils (with all uncontrolled fill removed) have been calculated to be approximately 41mm to 49mm using the methods and parameters discussed above, assuming normal seasonal moisture/suction variations. Notwithstanding the magnitude of the calculated characteristic surface movement value, the site would be classified as Class ‘P’ because of the presence of the existing site fill; however, if all uncontrolled fill is removed, the site could be re-classified as Class ‘H1’ (Highly Reactive).

5.5.2 Design Considerations

The characteristic surface movement values presented above are based on normal seasonal moisture/suction variations. If trees and large shrubs are subsequently planted close to the development, significantly greater movements than those nominated above may occur due to an increased soil suction magnitude and depth. Consideration should be given to constructing root barriers around trees in order to minimise future potential soil drying or footing damage by roots from trees (if any), which may be present close to buildings.

Use of reactive materials for fill should be avoided. However, if their use cannot be avoided then the calculated characteristic surface movement value would increase significantly. It should be carefully noted that the calculated surface movement values given above do not include any allowance for ‘abnormal’ influences such as vegetation effects. It is strongly recommended that the estimated characteristic surface movement values given above for the site be recalculated once site earthworks design is completed.

It is considered that the following issues must be carefully considered in design:

- Where controlled fill is placed over a natural soil subgrade, higher characteristic movements than those nominated above could potentially occur (as the ratio of lateral restrained to unrestrained movement will increase), particularly if the fill reactivity is greater than that of the existing site soils. If filling of the site is proposed, a revised site classification should be considered, which takes into account the actual reactivity, compaction and depth of fill used.

- Vegetation (particularly large trees) has the potential to significantly increase soil suction change magnitude and depth ($\overline{\Delta u}$ and Hs respectively in the equation above), which leads to a significant increase in potential reactive soil movements adjacent to any existing (or proposed) tree locations. If trees are to be planted 'close' to proposed buildings/structures in the future, consideration should be given to constructing root barriers around the trees, and footing design must allow for potentially (significantly) higher reactive soil movements than are nominated above.
- Abnormal subgrade moisture variations could potentially result in adverse, non-uniform reactive movements that are significantly greater than those nominated above for 'normal' seasonal moisture changes. The risk of 'abnormal' movement occurring could be reduced by ensuring over-watering of gardens, ponding water, broken/leaking pipes, 'close' planting of trees/shrubs, etc. does not occur.
- Significantly increased differential reactive movements could occur across proposed buildings/structures, if the subgrade partly comprises natural soils and controlled fill.

'Good practice' should be adopted in project design and detailing if control of reactive ground movement is desired. In particular, the following are recommended:

- trees/shrubs should not be planted closer than 1.5 times their mature height to movement sensitive features (unless significantly greater reactive movements than those estimated above are designed for);
- subgrade moisture content should not be allowed to change during or following construction;
- site grades should be designed to readily shed water and prevent ponding around footings and other movement sensitive areas;
- services should be designed to be flexible and to prevent any leakage and to rapidly promote removal of fluid if leakage does occur; and
- proposed buildings/structures should be made as flexible as possible, with regular full height movement control joints, flexible in-fill above windows and doors etc.

5.6 Foundations

Suitable foundations for proposed buildings (e.g. clubhouse), lighting towers, retaining walls, etc. will be dependent upon structural loadings, tolerance of buildings/structures to movement (including settlements under structural loads and shrink-swell movements), type and magnitude of loads, etc.

To minimise the risk of unacceptable differential movements, it is recommended that all foundations for individual structures be supported in similar quality materials (e.g. footings should not found partly in 'firm' clays and partly in 'stiff' clays, unless potential differential settlements can be tolerated or designed for).

It is considered that local variations in soil strength (and depth) will occur over the site and it is suggested that a 'flexible' approach be adopted to the foundation design, construction methodology and costing, so that footing sizes/founding depths can be readily adjusted as required during construction, without cost/time penalties being incurred.

An experienced geotechnical engineer should inspect all foundation excavations prior to casting to ensure bearing capacity at foundation level is adequate and to confirm final foundation dimensions. All foundation excavations should be clean, dry and free of loose/softened materials immediately prior to casting.

5.6.1 Pad and Strip Footings

Maximum allowable working bearing pressures for pad or strip footings are given in Table 11; ultimate values can be determined by multiplying the working stress values by 2.5.

Table 11: Maximum Working Stress Design Parameters for Pad and Strip Footings

Material	Strength	Maximum Working Bearing Capacity[(1)] (kPa)
Existing Fill	-	not recommended
Gravelly/Sandy/Silty Clay	firm	50 (not recommended)
	stiff	100
	very stiff	150
Clayey/Sandy Gravel	medium dense	100[(2)]

(1) No underlying 'softer' material

(2) Preliminary only – subject to footing dimensions, depth and groundwater level

5.6.2 Raft

It is considered that the stiff to very stiff clays and medium dense clayey/sandy gravels encountered in the bores may be suitable to support a raft foundation, subject to the required working bearing pressure, and the distribution of structural load over the site. If any 'soft spots' or firm/loose layers are encountered at raft subgrade level, they will probably require excavation and replacement with Level 1 controlled select fill; geotechnical assessment would be required to confirm the uniformity of the soils at raft founding level and the extent/depth of any 'soft' areas.

For the preliminary assessment of raft performance, the parameters presented in Table 12 could be used, which have been based on the results of this investigation, past experience and published correlations; the Table 12 parameters do not include allowance for reactive ground movement. Detailed analysis will be required to confirm that a raft option is feasible for proposed structures, which must also include allowance for reactive ground movement.

Table 12: Estimated Settlement Modulus and Poisson's Ratio Values

Material	Strength	Settlement Modulus (E) (MPa)	Poissons Ratio (v)
Existing Fill	-	1 – 8	0.25
Gravelly/Sandy/Silty Clay	firm	4 – 10	
	stiff	8 – 20	
	very stiff	15 – 40	
Clayey/Sandy Gravel	medium dense	20 – 50	

5.6.3 Bored Piles

5.6.3.1 Vertical Loading

If bored pile foundations are required to provide support for structures, the effect of group action should be considered where piles are to act in groups, and an overall foundation capacity of less than the sum of individual pile capacities could result where piles are closely spaced.

Based on the ground conditions encountered in the bores (i.e. clay/gravel soils and shallow groundwater), it is considered that bored pile construction could be difficult and provision should be allowed in timing/pricing for the use of temporary steel liners, temporary dewatering and tremmie placement of concrete for bored piles. If use of bored piles is envisaged it would be considered prudent to undertake full size trial bored pile excavations prior to final adoption to confirm constructability and likely final design bearing stresses.

Maximum allowable working pressure values for bored pile design are given in Table 13 for 'dry' construction. Ultimate failure values can be determined by multiplying the working stress values by 2.5.

Table 13: Maximum Working Bearing Pressures for Bored Cast-Insitu Piles

Founding Material	Strength	Maximum Allowable Working Bearing Pressure (kPa)	
		Shaft	Base[(1)]
Existing Fill	-	not recommended	not recommended
Gravelly/Sandy/Silty Clay	firm stiff very stiff	5 10 15	not recommended 150 200
Clayey/Sandy Gravel	medium dense	10	150

(1) Minimum embedment of four times pile diameter into founding materials and no underlying 'softer' material

The design of piles and ground beams must allow for potential uplift due to reactive soils, if moisture content/suction change is possible in reactive founding materials. Even if moisture change is effectively prevented, some movement will occur in controlled reactive clays during moisture content equilibration.

5.6.3.2 Lateral Loading

Broms[1] method of calculating lateral capacity of piles could be used to assess the lateral resistance capacity for single piles. The lateral resistance capacity from the fill encountered in the bores should be neglected unless the fill is controlled. The soil parameters presented in Table 14 could be used with this method.

Table 14: Soil Parameters for Calculation of Lateral Load Capacity of Piles

Material	Strength	Undrained Cohesion (C_u)	Angle of Shearing Resistance (ϕ)	Total Bulk Density	Passive Earth Pressure Coefficient (Kp)
Existing Fill	-	Unreliable	Unreliable	19kN/m^3	unreliable
Silty/Sandy/Gravelly Clay	firm stiff very stiff	35kPa 50kPa 100kPa	- - -	19kN/m^3 20kN/m^3 20kN/m^3	2.0 2.1 2.2
Clayey/Sandy Gravel	medium dense	-	32°	21kN/m^3	3.0

A material factor of 0.4 applied to the shear strength (calculated using the undrained cohesion and angle of internal friction values nominated in Table 14 for the 'natural' soils) is suggested for assessment of design lateral capacity of piles. Extreme care should be exercised with the use of any uncontrolled fill in the calculation of vertical and/or lateral capacity of foundations (it is strongly suggested that the fill not be considered unless it was placed under Level 1 control to an acceptable specification).

5.6.3.3 Uplift Capacity

Assessment of the uplift capacity of single pile foundations could be based on the lesser of the following:

- 75% of the shaft adhesion values presented in Table 13 (ignoring the fill material), or
- A 'cone of uplift' with a cone apex angle of 45° and adopting a buoyant unit weight of 8kN/m^3.

It will be necessary to carefully consider the spacing and size of pile groups as the uplift capacity of a group of 'closely' spaced piles would be expected to be less than the sum of the individual pile capacities.

---

[1] Broms, B Lateral Resistance of Piles in Cohesive Soils, *Journal of the Soil Mechanics Division*, American Society of Civil Engineers, Vol. 90, No. SM2, Vol 90, 1964, pp.27-63

5.7 On-Ground Slab and Pavement Subgrade Properties

Subgrade properties are expected to vary across the site following earthworks, and detailed assessment/testing will be required at the time of construction in order to confirm design values. For the purposes of the initial costing and preliminary design of on-ground slabs and pavements, cast over a natural soil or controlled fill subgrade, could be carried out using the preliminary subgrade parameters presented in Table 15, provided that the subgrade is prepared in accordance with Section 5.2.2.

Table 15: Preliminary Subgrade Design Values

Subgrade Type	CBR (%)	Modulus of Subgrade Reaction(1) (kPa/mm)
Silty Clay (natural or controlled fill)	2 – 6	20 – 40
Sandy/Gravelly Clay (natural or controlled fill)	3 – 8	25 – 45
Clayey/Sandy Gravel	10 – 20	55 – 70

(1) For transient loading only – sustained loads may cause consolidation settlement and appropriate design values must be determined by analysis

If reactive ground movement can occur, it is suggested that on-ground slabs be fully dowelled (and joints between slabs sealed to control differential movements and minimise under-slab moisture changes) and should be detailed to enable movement, independent of foundations, fixtures, etc.

BUTLER PARTNERS (REGIONAL) PTY LTD

Reviewed by:
BRUCE BUTLER
Senior Principal

JENNY SALAS
Geotechnical Engineer

NICK BLOXSOM
Senior Geotechnical Engineer

Important Information about Your
Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

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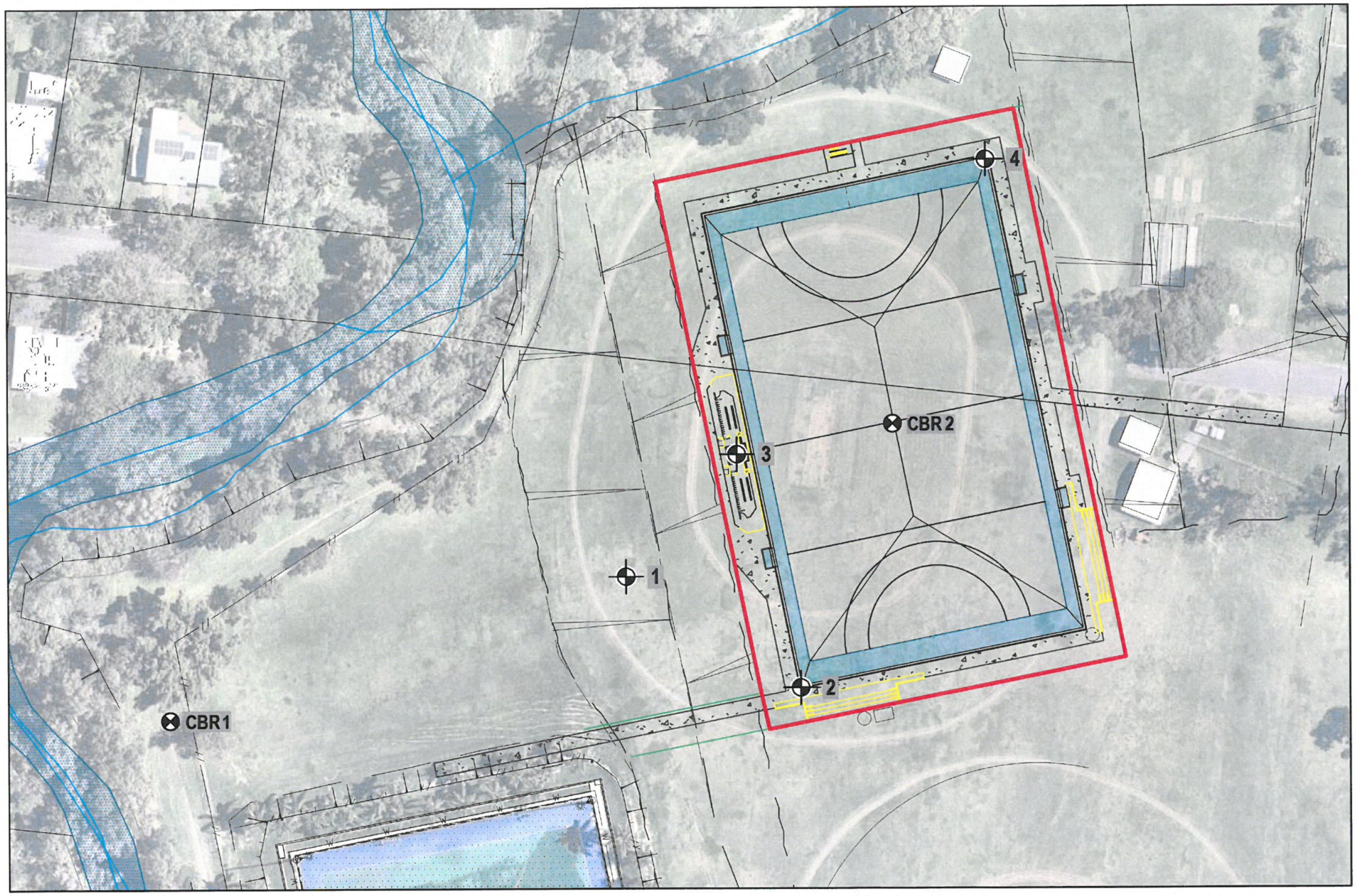


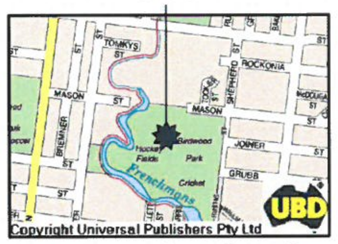
LEGEND

1	Bore
🟥	Proposed Hockey Field Site
⊗ CBR	California Bearing Ratio Test

Reference: Nearmap image, dated 26 October 2017

File Location: Rockhampton\Projects\2017series\R18-107A\R18-107A.dwg

Site



UBD Reference: Map 7 Grid D12 (ACS,v6) nts

Proposed Hockey Field
Kalka Shades, North Rockhampton

Locality Plan and Test Locations

CLIENT: **Calibre Consulting Pty Ltd**

SCALE AT A4:
0 10 20 30 40m
1:1000

DATE: FEBRUARY 2018
DRAWN: AD
APPROVED:
PROJECT No: R18-107A
DRAWING No: 1 REV: A

APPENDIX A

BORE REPORT SHEETS WITH EXPLANATORY NOTES

BORE REPORT

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Client: Calibre Consulting Pty Ltd
Project: Proposed Hockey Field
Location: Kalka Shades, North Rockhampton
Project No: R18-107A

BORE 1

Page No: 1 of 1
Date: 9 March 2018
Ground Surface Level: RL7.0m*

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Test Results
0	***FILL*** - silty clay, dark brown	7.0	▨	S	0.5 0.95	4,6,9 N=15
1	***SILTY CLAY (CH)*** - stiff, dark brown mottled pale brown, trace fine grained sand	6.0	▨	S	1.5 1.95	4,6,8 N=14
2		5.0	▨			
3	***SANDY CLAY (CI)*** - very stiff, brown, fine to coarse grained sand	4.0	▨	U	3.0 3.3	pp=380
4	-stiff, grey mottled orange	3.0	▨	S	4.0 4.45	2,5,6 N=11
	End of Bore at 4.45 m					
5		2.0				
6		1.0				

U	**Undisturbed Tube Sample (50mm dia)**	**S**	**Standard Penetration Test (SPT)**	**E**	**Environmental Sample**	**Is(50)**	**Point Load Test Result (MPa)**
D	**Disturbed Sample**	**HB**	**SPT Hammer Bouncing**	**Up**	**Pushtube Sample**	**(d)**	**Diametral Test**
B	**Bulk Sample**	**( )**	**No Sample Recovery**	**C**	**NMLC Coring**	**(a)**	**Axial Test**
pp	**Pocket Penetrometer Test (kPa)**	**V**	**Vane Shear Strength, Uncorrected (kPa)**			**(i)**	**Lump Test**

Rig: 4WD Drill Man GT10

Logged by: NB/JS

Drilling Method: Auger

Groundwater: Free groundwater encountered at 3.4m

Remarks: *Approximate ground surface level interpolated from an unreferenced plan provided by Calibre Consulting Pty Ltd, recieved on 3 April 2018.

BORE REPORT

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Client: Calibre Consulting Pty Ltd
Project: Proposed Hockey Field
Location: Kalka Shades, North Rockhampton
Project No: R18-107A

BORE 2

Page No: 1 of 1
Date: 8 March 2018
Ground Surface Level: RL6.9m*

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Test Results
0	***FILL*** - silty clay, dark brown	6.9				
				S	0.5 0.95	3,3,4 N=9
1	***SILTY CLAY (CH)*** - stiff, brown-orange, trace fine grained sand	6.0		D	1.2 1.5	
	-very stiff			U	1.5 1.9	pp=450
2	***SANDY CLAY (CI)*** - stiff, pale brown, with fine to medium grained gravel	5.0				
3		4.0		S	3.0 3.45	4,5,8 N=13
4		3.0		D	4.0 4.	
	SILTY CLAY (CI) - stiff, grey-mottled orange, trace fine grained sand			U	4.5 4.9	pp=180
5		2.0		D	5.0 5.3	
				S	5.5 5.95	3,5,6 N=11
6	End of Bore at 5.95 m	1.0				

U	Undisturbed Tube Sample (50mm dia)	S	Standard Penetration Test (SPT)	E	Environmental Sample	Is(50)	Point Load Test Result (MPa)
D	Disturbed Sample	HB	SPT Hammer Bouncing	Up	Pushtube Sample	(d)	Diametral Test
B	Bulk Sample	( )	No Sample Recovery	C	NMLC Coring	(a)	Axial Test
pp	Pocket Penetrometer Test (kPa)	V	Vane Shear Strength, Uncorrected (kPa)			(i)	Lump Test

Rig: 4WD Drill Man GT10

Logged by: NB/JS

Drilling Method: Auger

Groundwater: Free groundwater encountered at 1.8m

Remarks: *Approximate ground surface level interpolated from an unreferenced plan provided by Calibre Consulting Pty Ltd, recieved on 3 April 2018.

BORE REPORT

Client: Calibre Consulting Pty Ltd
Project: Proposed Hockey Field
Location: Kalka Shades, North Rockhampton
Project No: R18-107A

BORE 3

Page No: 1 of 1
Date: 9 March 2018
Ground Surface Level: RL7.2m*

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Test Results
0		7.2				
	FILL - silty clay, dark brown					
	SILTY CLAY (CH) - firm, dark brown, trace fine grained sand			S	0.5 0.95	1,3,3 N=6
1		6.0				
	GRAVELLY CLAY (CI) - very stiff, brown-orange, fine to medium grained gravel			U	1.5 1.7	pp=500
2		5.0				
	- coarse grained gravel					
3	***SILTY CLAY (CI)*** - stiff, dark brown, with fine to medium grained gravel	4.0		S	3.0 3.45	3,4,5 N=9
4		3.0				
				U	4.5 4.8	pp=220
	End of Bore at 4.8 m					
5		2.0				
6						

U	**Undisturbed Tube Sample (50mm dia)**	**S**	**Standard Penetration Test (SPT)**	**E**	**Environmental Sample**	**Is(50)**	**Point Load Test Result (MPa)**
D	**Disturbed Sample**	**HB**	**SPT Hammer Bouncing**	**Up**	**Pushtube Sample**	**(d)**	**Diametral Test**
B	**Bulk Sample**	**( )**	**No Sample Recovery**	**C**	**NMLC Coring**	**(a)**	**Axial Test**
pp	**Pocket Penetrometer Test (kPa)**	**V**	**Vane Shear Strength, Uncorrected (kPa)**			**(i)**	**Lump Test**

Rig: 4WD Drill Man GT10

Logged by: NB/JS

Drilling Method: Auger

Groundwater: Free groundwater encountered at 2.7m

Remarks: *Approximate ground surface level interpolated from an unreferenced plan provided by Calibre Consulting Pty Ltd, recieved on 3 April 2018.

BORE REPORT

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Client: Calibre Consulting Pty Ltd
Project: Proposed Hockey Field
Location: Kalka Shades, North Rockhampton
Project No: R18-107A

BORE 4

Page No: 1 of 1
Date: 8 March 2018
Ground Surface Level: RL7.5m*

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Test Results
0	***FILL*** - silty clay, dark brown	7.5 7.0		S	0.5 0.95	6,8,9 N=17
1	***SILTY CLAY (CI)*** - stiff, brown, with fine to medium grained sand					
	CLAYEY SANDY GRAVEL (GC) - medium dense, brown, fine to medium grained gravel, angular	6.0		D S	1.4 1.5 1.95	6,10,10 N=20
2		5.0				
3	***SANDY GRAVEL (GC)*** - medium dense, brown, fine to medium grained gravel	4.0		S	3.0 3.45	7,10,4 N=14
	SILTY CLAY (CI) - stiff, dark grey, with medium to coarse grained sand					
4		3.0		D S	4.0 4.5 4.95	3,4,4 N=8
5	- pale brown, trace fine grained sand	2.0		U	5.6 5.9	pp=180
6	End of Bore at 5.9 m					

U	Undisturbed Tube Sample (50mm dia)	S	Standard Penetration Test (SPT)	E	Environmental Sample	Is(50)	Point Load Test Result (MPa)
D	Disturbed Sample	HB	SPT Hammer Bouncing	Up	Pushtube Sample	(d)	Diametral Test
B	Bulk Sample	( )	No Sample Recovery	C	NMLC Coring	(a)	Axial Test
pp	Pocket Penetrometer Test (kPa)	V	Vane Shear Strength, Uncorrected (kPa)			(i)	Lump Test

Rig: 4WD Drill Man GT10

Logged by: NB/JS

Drilling Method: Auger

Groundwater: Free groundwater encountered at 1.6m

Remarks: *Approximate ground surface level interpolated from an unreferenced plan provided by Calibre Consulting Pty Ltd, recieved on 3 April 2018.

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Notes on Description and Classification of Soil

The methods of description and classification of soils used in this report are generally based on Australian Standard AS1726-1993 *Geotechnical Site Investigations.*

Soil description is based on an assessment of disturbed samples, as recovered from bores and excavations, or from undisturbed materials as seen in excavations and exposures or in undisturbed samples. Descriptions given on report sheets are an interpretation of the conditions encountered at the time of investigation.

In the case of cone or piezocone penetrometer tests, actual soil samples are not recovered and soil description is inferred based on published correlations, past experience and comparison with bore and/or test pit data (if available).

Soil classification is based on the particle size distribution of the soil and the plasticity of the portion of the material finer than 0.425mm. The description of particle size distribution and plasticity is based on the results of visual field estimation, laboratory testing or both. When assessed in the field, the properties of the soil are estimated; precise description will always require laboratory testing to define soil properties.

Where soil can be clearly identified as FILL this will be noted as the main soil type followed by a description of the composition of the fill (e.g. FILL – yellow-brown, fine to coarse grained gravelly clay fill with concrete rubble). If the soil is assessed as possibly being fill this will be noted as an additional observation.

Soils are generally described using the following sequence of terms. In certain instances, not all of the terms will be included in the soil description.

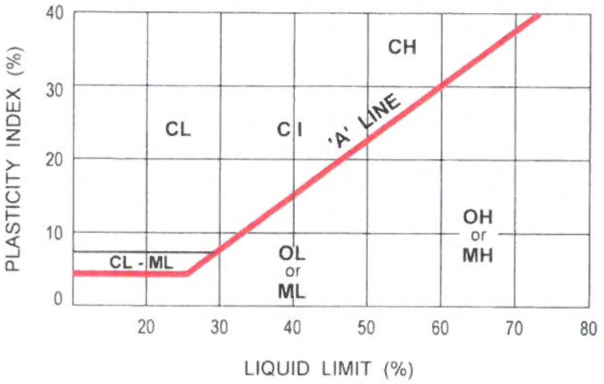
MAIN SOIL TYPE (CLASSIFICATION GROUP SYMBOL)
- strength/density, colour, structure/grain size, secondary and minor components, additional observations

Information on the definition of descriptive and classification terms follows.

SOIL TYPE and CLASSIFICATION GROUP SYMBOLS

	Major Divisions	Particle Size	Classification Group Symbol	Typical Names
COARSE GRAINED SOILS (more than half of material is larger than 0.075 mm)	BOULDERS	> 200mm		
	COBBLES	63 – 200mm		
	GRAVELS (more than half of coarse fraction is larger than 2.36mm)	Coarse: 20 – 63mm Medium: 6 – 20mm Fine: 2.36 – 6mm	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels.
			GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (more than half of coarse fraction is smaller than 2.36mm)	Coarse: 0.6 – 2.36mm Medium: 0.2 – 0.6mm Fine: 0.075 – 0.2mm	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands.
			SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (more than half of material is smaller than 0.075 mm)	SILTS & CLAYS (liquid limit <50%)		ML	Inorganic silts and very fine sands, silty/clayey fine sands or clayey silts with low plasticity.
			CL and CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS & CLAYS (liquid limit >50%)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils.
			CH	Inorganic clays of high plasticity.
			OH	Organic clays of medium to high plasticity, organic silts.
	HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.

PLASTICITY CHART FOR CLASSIFICATION OF FINE GRAINED SOILS



(Reference: Australian Standard AS1726-1993 *Geotechnical site investigations*)

DESCRIPTIVE TERMS FOR MATERIAL PROPORTIONS

Coarse Grained Soils		Fine Grained Soils	
% Fines	**Modifier**	**% Coarse**	**Modifier**
< 5	Omit, or use 'trace'	< 15	Omit, or use trace.
5 – 12	Describe as 'with clay/silt' as applicable.	15 – 30	Describe as 'with sand/gravel' as applicable.
> 12	Prefix soil as 'silty/clayey' as applicable	> 30	Prefix soil as 'sandy/gravelly' as applicable.

STRENGTH TERMS – COHESIVE SOILS

Strength Term	Undrained Shear Strength	Field Guide to Strength
Very soft	< 12kPa	Exudes between the fingers when squeezed in hand.
Soft	12 – 25kPa	Can be moulded by light finger pressure.
Firm	25 – 50kPa	Can be moulded by strong finger pressure.
Stiff	50 – 100kPa	Cannot be moulded by fingers, can be indented by thumb.
Very stiff	100 – 200kPa	Can be indented by thumb nail.
Hard	> 200kPa	Can be indented with difficulty by thumb nail.

DENSITY TERMS – NON COHESIVE SOILS

Density Term	Density Index	SPT "N"	CPT Cone Resistance
Very loose	< 15%	0 – 5	0 – 2MPa
Loose	15 – 35%	5 – 10	2 – 5MPa
Medium dense	35 – 65%	10 – 30	5 – 15MPa
Dense	65 – 85%	30 – 50	15 – 25MPa
Very dense	> 85%	> 50	> 25MPa

COLOUR

The colour of a soil will generally be described in a 'moist' condition using simple colour terms (eg. black, grey, red, brown etc.) modified as necessary by "pale", "dark", "light" or "mottled". Borderline colours will be described as a combination of colours (eg. grey-brown).

EXAMPLE

e.g. CLAYEY SAND (SC) – medium dense, grey-brown, fine to medium grained with silt.

Indicates a medium dense, grey-brown, fine to medium grained clayey sand with silt.

APPENDIX B

LABORATORY TEST RESULT REPORTS

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Rockhampton Laboratory
246 Kent Street
Rockhampton Queensland 4700
Telephone: 61 (07) 4927 1400

Moisture Content Report

Client :	**Calibre Consulting Pty Ltd**	Report Number:	**R18-107A - 1/1**
Address :	**PO Box 1580, Rockhampton, QLD, 4700**	Report Date :	**26/03/2018**
Project Name :	**Proposed Hockey Field**	Order Number :	
Project Number :	**R18-107A**	Test Method :	**AS1289.2.1.1**
Location:	**Kalka Shades , North Rockhampton**	**Page 1 of 2**	

Sample Number :	R18-1420	R18-1421	R18-1422	R18-1423
Test Number :	-	-	-	-
Sampling Method :	AS1289.1.2.1 (6.5.3)	AS1289.1.2.1 (6.5.3)	AS1289.1.2.1 (6.5.3)	AS1289.1.2.1 (6.5.3)
Date Sampled :	9/03/2018	9/03/2018	9/03/2018	8/03/2018
Date Tested :	16/03/2018	16/03/2018	16/03/2018	16/03/2018
Material Type :	-	-	-	-
Material Source :	Insitu	Insitu	Insitu	Insitu
Lot Number :	-	-	-	-
Sample Location :	Bore No.: CBR #1 Depth: 0.1 - 0.5m	Bore No.: CBR #2 Depth: 0.2 -0.6m	Bore No.: 1 Depth: 4.0 - 4.45m	Bore No.: 2 Depth: 1.5 - 1.9m
Oven Temperature (°C) :	105-110	105-110	105-110	105-110
Soil Description :	Gravelly Silty Clay	Fill - Silty Clay	Sandy Silty Clay	Silty Clay
Moisture Content (%) :	**23.2**	**21.4**	**23.4**	**18.7**
Remarks :				

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Moisture Content Report

Client :	**Calibre Consulting Pty Ltd**	Report Number:	**R18-107A - 1/1**
Address :	**PO Box 1580, Rockhampton, QLD, 4700**	Report Date :	**26/03/2018**
Project Name :	**Proposed Hockey Field**	Order Number :	
Project Number :	**R18-107A**	Test Method :	**AS1289.2.1.1**
Location:	**Kalka Shades , North Rockhampton**	**Page 2 of 2**	

Sample Number :	R18-1424	R18-1425	R18-1426	R18-1427
Test Number :	-	-	-	-
Sampling Method :	AS1289.1.2.1 (6.5.3)	AS1289.1.2.1 (6.5.3)	AS1289.1.2.1 (6.5.3)	AS1289.1.2.1 (6.5.3)
Date Sampled :	9/03/2018	9/03/2018	8/03/2018	8/03/2018
Date Tested :	16/03/2018	16/03/2018	16/03/2018	16/03/2018
Material Type :	-	-	-	-
Material Source :	Insitu	Insitu	Insitu	Insitu
Lot Number :	-	-	-	-
Sample Location :	Bore No.: 3 Depth: 0.5 - 0.95m	Bore No.: 3 Depth: 1.5 - 1.7m	Bore No.: 4 Depth: 0.5 - 0.95m	Bore No.: 4 Depth: 1.5 - 1.95m
Oven Temperature (°C) :	105-110	105-110	105-110	105-110
Soil Description :	Silty Clay	Gravelly Clay	Fill - Silty Clay	Clayey Sandy Gravel
Moisture Content (%) :	**21.8**	**18.7**	**15.8**	**9.4**
Remarks :				

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EMERSON CLASS NUMBER TEST REPORT

Test Procedure: AS1289.3.8.1

pH TEST REPORT

Test Procedure: AS1289.4.3.1

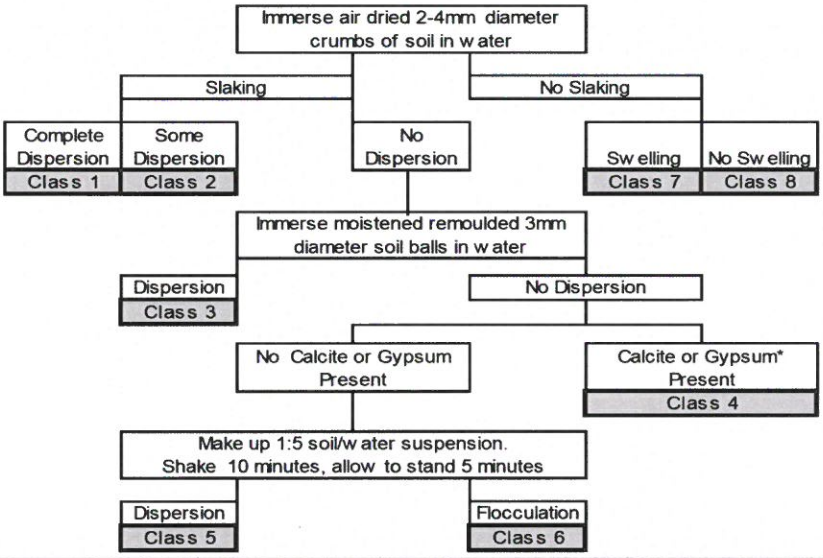
CONDUCTIVITY REPORT

Soil Chemical Methods, Rayment & Lyons

Client:	Calibre Consulting Pty Ltd	Report No.:	R18-107A_ECN_R1421-1426
Project:	Proposed Hockey Field	Tested by:	NW
Location:	Kalka Shades, North Rockhampton	Date:	23/03/2018
		Checked by:	AE
Project No:	R18-107A	Date:	26/03/2018

THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL

Determination of Emerson Class Number



Sample Number:	R1421	R1424	R1426		
Sampling Method:					
AS1289.1.2.1	Clause 6.5.3	Clause 6.5.3	Clause 6.5.3		
Bore:	CBR#2	3	4		
Depth (m):	0.2-0.6	0.5-0.95	0.5-0.95		
Date Sampled:	9/03/2018	9/03/2018	8/03/2018		
Sample Description:	Fill - Silty Clay	Silty Clay	Fill - Silty Clay		
Water Type:	Distilled	Distilled	Distilled		
Water Temperature (^{o}C):	21.0	21.0	20.4		
Emerson Class Number	4	4	4		
pH	6.0	7.7	5.0		
Conductivity (mS/cm)	0.14	0.22	0.29		

Comments:

Disclaimer:- Conductivity method is not NATA accredited

Authorised Signatory

Dwain Carolan

Date 26/03/2018

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Particle Size Distribution Report

Client :	**Calibre Consulting Pty Ltd**	Report Number:	**R18-107A - 2/1**
Address :	**PO Box 1580, Rockhampton, QLD, 4700**	Report Date :	**26/03/2018**
Project Name :	**Proposed Hockey Field**	Order Number :	
Project Number :	**R18-107A**	Test Method :	**AS1289.3.6.1**
Location:	**Kalka Shades , North Rockhampton**		**Page 1 of 3**

Sample Number :	R18-1421	
Sampling Method :	AS1289.1.2.1 (6.5.3)	
Sampled By :	Nick Bloxsom	
Date Sampled :	9/03/2018	
Date Tested :	23/03/2018	
Material Type :	-	
Material Source :	Insitu	
Remarks :		

SAMPLE LOCATION

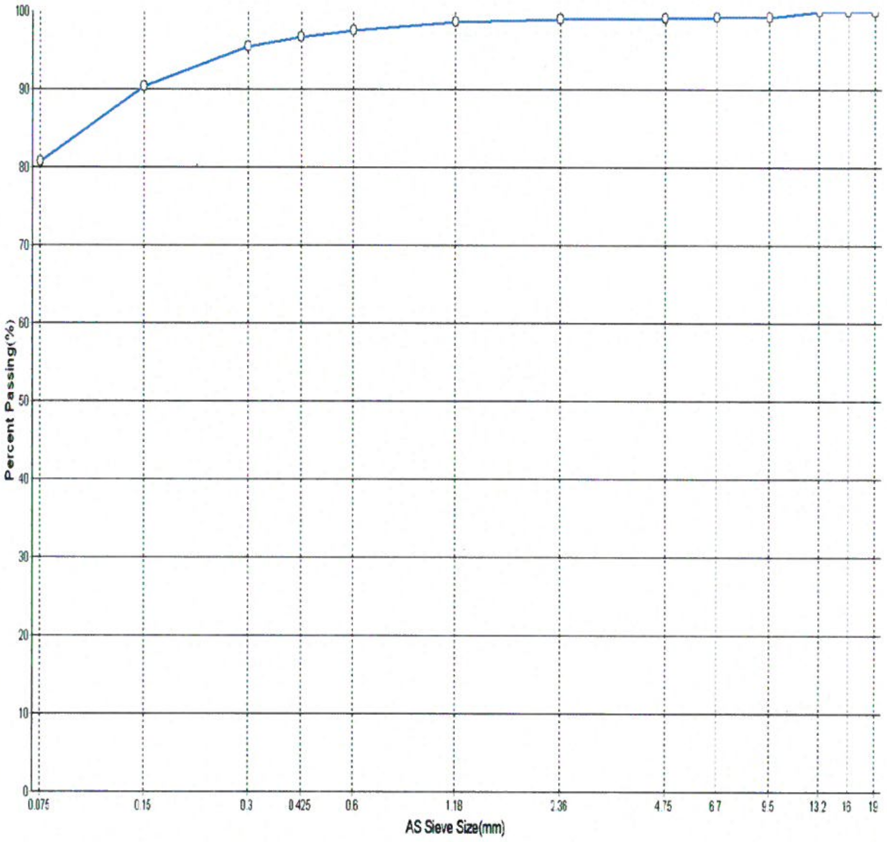
Bore No.: CBR #2

Depth: 0.2 -0.6m

Fill - Silty Clay

Test Number :	-
Lot Number :	-
Specification Number :	-

AS Sieve Size(mm)	Percent Passing	Specification Limits
100		
75		
63		
53		
37.5		
26.5		
19.0	**100**	
16.0	**100**	
13.2	**100**	
9.5	**99**	
6.7	**99**	
4.75	**99**	
2.36	**99**	
1.18	**99**	
0.600	**98**	
0.425	**97**	
0.300	**96**	
0.150	**90**	
0.075	**81**	



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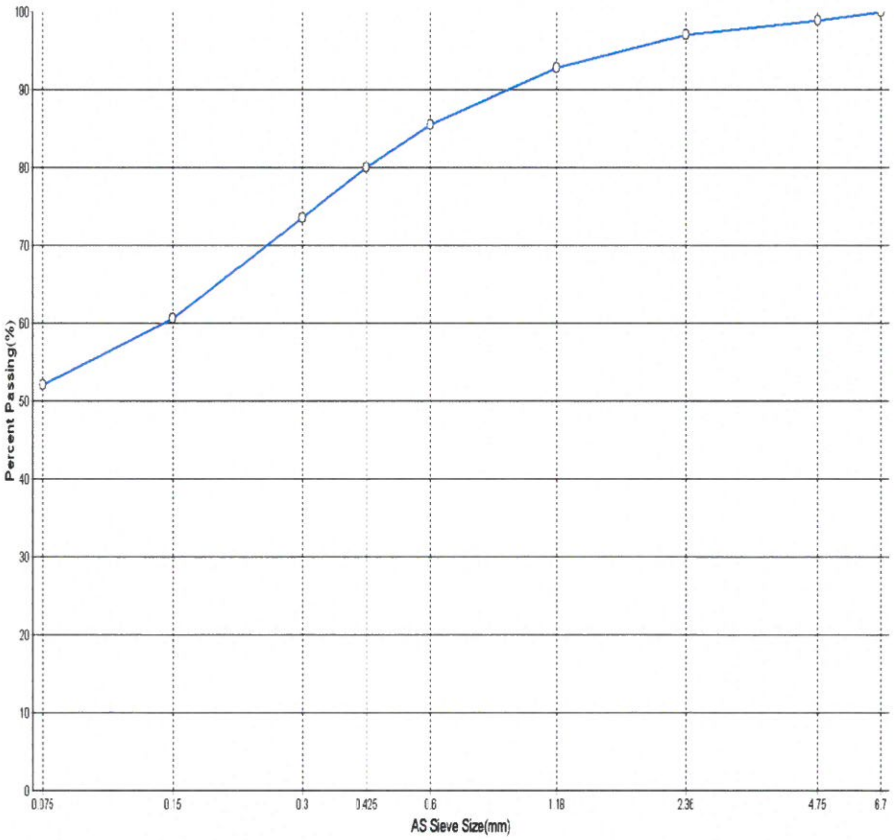
Particle Size Distribution Report

Client :	**Calibre Consulting Pty Ltd**	Report Number:	**R18-107A - 2/1**
Address :	**PO Box 1580, Rockhampton, QLD, 4700**	Report Date :	**26/03/2018**
Project Name :	**Proposed Hockey Field**	Order Number :	
Project Number :	**R18-107A**	Test Method :	**AS1289.3.6.1**
Location:	**Kalka Shades , North Rockhampton**		**Page 2 of 3**

Sample Number :	R18-1422	SAMPLE LOCATION	
Sampling Method :	AS1289.1.2.1 (6.5.3)	**Bore No.: 1**	
Sampled By :	Nick Bloxsom	**Depth: 4.0 - 4.45m**	
Date Sampled :	9/03/2018		
Date Tested :	20/03/2018	**Sandy Clay**	
Material Type :	-	Test Number :	-
Material Source :	Insitu	Lot Number :	-
Remarks :		Specification Number :	-

AS Sieve Size(mm)	Percent Passing	Specification Limits
100		
75		
63		
53		
37.5		
26.5		
19.0		
16.0		
13.2		
9.5		
6.7	**100**	
4.75	**99**	
2.36	**97**	
1.18	**93**	
0.600	**86**	
0.425	**80**	
0.300	**73**	
0.150	**61**	
0.075	**52**	



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Particle Size Distribution Report

Client :	**Calibre Consulting Pty Ltd**	Report Number:	**R18-107A - 2/1**
Address :	**PO Box 1580, Rockhampton, QLD, 4700**	Report Date :	**26/03/2018**
Project Name :	**Proposed Hockey Field**	Order Number :	
Project Number :	**R18-107A**	Test Method :	**AS1289.3.6.1**
Location:	**Kalka Shades , North Rockhampton**		**Page 3 of 3**

Sample Number :	R18-1427
Sampling Method :	AS1289.1.2.1 (6.5.3)
Sampled By :	Nick Bloxsom
Date Sampled :	8/03/2018
Date Tested :	20/03/2018
Material Type :	-
Material Source :	Insitu
Remarks :	

SAMPLE LOCATION

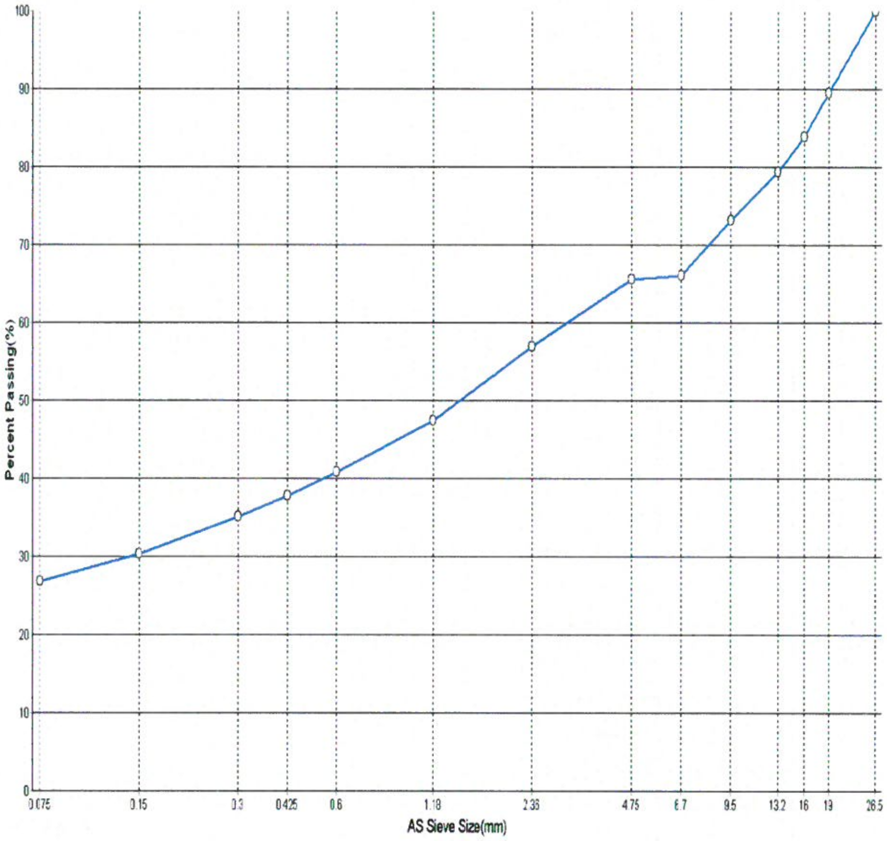
Bore No.: 4

Depth: 1.5 - 1.95m

Clayey Sandy Gravel

Test Number :	-
Lot Number :	-
Specification Number :	-

AS Sieve Size(mm)	Percent Passing	Specification Limits
100		
75		
63		
53		
37.5		
26.5	**100**	
19.0	**90**	
16.0	**84**	
13.2	**79**	
9.5	**73**	
6.7	**66**	
4.75	**66**	
2.36	**57**	
1.18	**47**	
0.600	**41**	
0.425	**38**	
0.300	**35**	
0.150	**30**	
0.075	**27**	



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Atterberg Limits Report

Client :	**Calibre Consulting Pty Ltd**	Report Number:	**R18-107A - 3/1**
Address :	**PO Box 1580, Rockhampton, QLD, 4700**	Report Date :	**26/03/2018**
Project Name :	**Proposed Hockey Field**	Order Number :	
Project Number :	**R18-107A**	Test Method :	**AS1289.3.1.2, 3.2.1, 3.3.1 & 3.4.1**
Location:	**Kalka Shades , North Rockhampton**	**Page 1 of 1**	

Sample Number :	R18-1421	R18-1424		
Test Number :	-	-		
Date Sampled :	9/03/2018	9/03/2019		
Date Tested :	22/03/2018	22/03/2018		
Sampled By :	Nick Bloxsom	Nick Bloxsom		
Sampling Method :	AS1289.1.2.1 (6.5.3)	AS1289.1.2.1 (6.5.3)		
Material Source :	Insitu	Insitu		
Material Type :	-	-		
Sample Location :	Bore No.: CBR #2 Depth: 0.2 -0.6m Fill - Silty Clay	Bore No.: 3 Depth: 0.5 - 0.95m Silty Clay		
Lot Number :	-	-		
Moisture Method :	AS1289.2.1.1	AS1289.2.1.1		
Sample History :	Oven Dried	Oven Dried		
Sample Preparation :	Dry	Dry		
Notes :	Some Curling Occured	Some Curling Occured		
Mould Length (mm) :	250.3	250.0		
Liquid Limit (%) :	53	52		
Plastic Limit (%) :	16	15		
Plasticity Index (%) :	37	37		
Linear Shrinkage (%) :	14.0	13.0		
SPECIFICATION DETAILS				
Specification Number :				
Liquid Limit - Max :				
Plasticity Index - Max :				
Linear Shrinkage - Max :				
Remarks :	-			

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Shrink Swell Index Report

Client :	**Calibre Consulting Pty Ltd**	Report Number:	**R18-107A - 5/1**
Address :	**PO Box 1580, Rockhampton, QLD, 4700**	Report Date :	**28/03/2018**
Project Name :	**Proposed Hockey Field**	Order Number :	
Project Number :	**R18-107A**	Test Method :	**AS1289.7.1.1**
Location:	**Kalka Shades , North Rockhampton**	**Page 1 of 1**	

Sample Number :	R18-1423	R18-1425		
Test Number :	-	-		
Sampling Method :	AS1289.1.2.1 (6.5.3)	AS1289.1.2.1 (6.5.3)		
Sampled By :	Nick Bloxsom	Nick Bloxsom		
Date Sampled :	8/03/2018	9/03/2018		
Date Tested :	14/03/2018	14/03/2018		
Material Type :	-	-		
Material Source :	Insitu	Insitu		
Sample Location :	Bore No.: 2 Depth: 1.5 - 1.9m	Bore No.: 3 Depth: 1.5 - 1.7m		
Inert Material Estimate (%) :	0	0		
PP before (kPa) :				
PP after (kPa) :				
Shrinkage Moisture Content (%) :	18.4	18.8		
Shrinkage (%) :	**4.0**	**3.0**		
Swell Moisture Content Before (%) :	18.6	18.7		
Swell Moisture Content After (%) :	20.0	19.7		
Swell (%) :	**2.9**	**2.3**		
Unit Weight (t/m^3) :	1.9	1.97		
Shrink Swell Index Iss (%) :	**3.0**	**2.3**		
Visual Classification :	Silty Clay	Gravelly Clay		
Cracking :	Minor	Minor		
Crumbling :	Nil	Nil		
Remarks :				

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California Bearing Ratio Report (1 Point)

Client :	**Calibre Consulting Pty Ltd**	Report Number:	**R18-107A - 4/1**
Address :	**PO Box 1580, Rockhampton, QLD, 4700**	Report Date :	**27/03/2018**
Project Number :	**R18-107A**	Order Number :	
Project Name :	**Proposed Hockey Field**	Test Method :	**AS1289.6.1.1**
Location:	**Kalka Shades , North Rockhampton**		**Page 1 of 2**

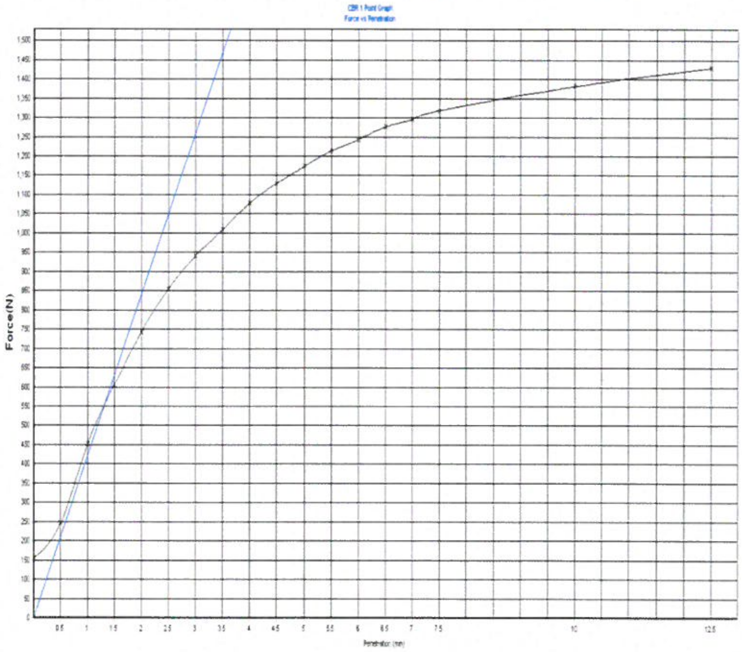
Sample Number :	R18-1420
Date Sampled :	9/03/2018
Date Tested :	23/03/2018
Sampled By :	Nick Bloxsom
Sampling Method :	AS1289.1.2.1 (6.5.3)
Material Source :	Insitu
Material Type :	-
Remarks :	

SAMPLE LOCATION

Bore No.: CBR #1
Depth: 0.1 - 0.5m

Lot Number : -
Test Number : -

Moisture Method :	AS1289.2.1.1
Maximum Dry Density (t/m³) :	1.62
Optimum Moisture Content (%) :	21.0
Compactive Effort :	Standard
Nominated Percentage of MDD :	95
Nominated Percentage of OMC :	100
Achieved Percentage of MDD :	95
Achieved Percentage of OMC :	101.0
Dry Density Before Soak (t/m³) :	1.54
Dry Density After Soak (t/m³) :	1.48
Moisture Content Before Soak (%) :	21.2
Moisture Content After Soak (%) :	25.1
Density Ratio After Soak (%) :	91
Field Moisture Content (%) :	16.5
Top Moisture Content - After Penetration (%) :	24.0
Total Moisture Content - After Penetration (%) :	23.0
Soak Condition :	Soaked
Soak Period (days) :	4
Swell (%) :	4.0
CBR Surcharge (kg) :	4.5
Oversize (%) :	-
Oversize Material Replaced (%) :	-



Bearing Ratio 2.5mm (%) :	6
Bearing Ratio 5.0mm (%) :	**6**
CBR Value (%) :	**6**

Site Selection :	-
Soil Description :	Gravelly Silty Clay

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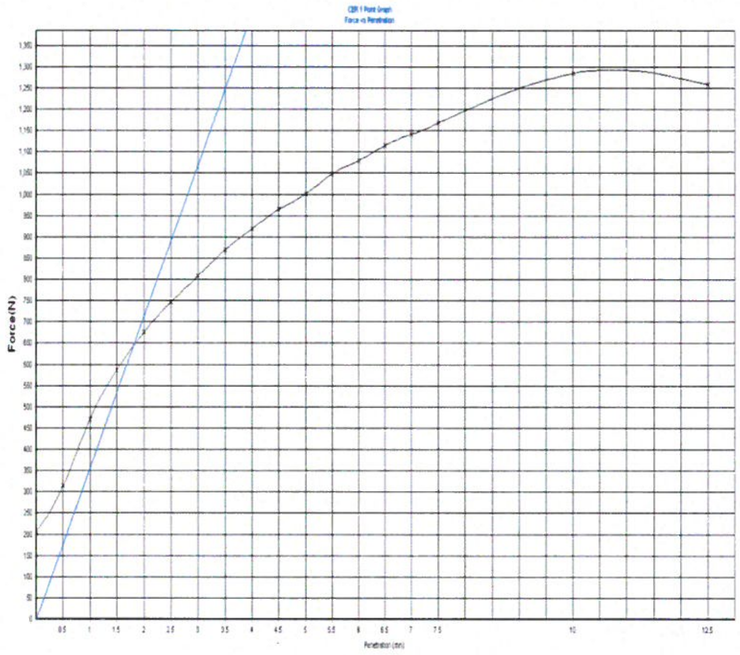
California Bearing Ratio Report (1 Point)

Client :	**Calibre Consulting Pty Ltd**	Report Number:	**R18-107A - 4/1**
Address :	**PO Box 1580, Rockhampton, QLD, 4700**	Report Date :	**27/03/2018**
Project Number :	**R18-107A**	Order Number :	
Project Name :	**Proposed Hockey Field**	Test Method :	**AS1289.6.1.1**
Location:	**Kalka Shades , North Rockhampton**		**Page 2 of 2**

Sample Number :	R18-1421	SAMPLE LOCATION
Date Sampled :	9/03/2019	Bore No.: CBR #2
Date Tested :	23/03/2018	Depth: 0.2 -0.6m
Sampled By :	Nick Bloxsom	
Sampling Method :	AS1289.1.2.1 (6.5.3)	
Material Source :	Insitu	Lot Number : -
Material Type :	-	Test Number : -
Remarks :		

Moisture Method :	AS1289.2.1.1
Maximum Dry Density (t/m³) :	1.59
Optimum Moisture Content (%) :	19.0
Compactive Effort :	Standard
Nominated Percentage of MDD :	95
Nominated Percentage of OMC :	100
Achieved Percentage of MDD :	95
Achieved Percentage of OMC :	102.0
Dry Density Before Soak (t/m³) :	1.51
Dry Density After Soak (t/m³) :	1.48
Moisture Content Before Soak (%) :	19.4
Moisture Content After Soak (%) :	26.3
Density Ratio After Soak (%) :	93
Field Moisture Content (%) :	23.2
Top Moisture Content - After Penetration (%) :	23.3
Total Moisture Content - After Penetration (%) :	22.2
Soak Condition :	Soaked
Soak Period (days) :	4
Swell (%) :	2.0



CBR Surcharge (kg) :	4.5	Bearing Ratio 2.5mm (%) :	6
Oversize (%) :	-	Bearing Ratio 5.0mm (%) :	**5**
Oversize Material Replaced (%) :	-	**CBR Value (%) :**	**6**

Site Selection :	-
Soil Description :	Fill - Silty Clay

NATA
WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025. - Testing

Certified System
Quality
ISO 9001
SAI GLOBAL

APPROVED SIGNATORY

Joshua Hamilton - Senior Technician
NATA Accreditation Number :
19665

Document Code RF ISO 39-2

Kalka Shades Flood Assessment
Rockhampton Regional Council
01-Feb-2018

Kalka Shades Hockey Complex

Second Field Flood Impact Assessment

ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: **D/51-2018**

Dated: **26 June 2018**

Kalka Shades Hockey Complex

Second Field Flood Impact Assessment

Client: Rockhampton Regional Council

ABN: 59 923 523 766

Prepared by

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01-Feb-2018

Job No.: 60534898

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Quality Information

Document	Kalka Shades Hockey Complex
Ref	60534898
Date	01-Feb-2018
Prepared by	Richard Corbett
Reviewed by	Ben McMaster

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
0	22-Jan-2018	Draft for Client Review	Ben McMaster Rockhampton Office Manager	Original Signed
A	1-Feb-2018	Final Issue	Ben McMaster Rockhampton Office Manager	

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1.0 Introduction

1.1 Background

In February 2016 Rockhampton Regional Council (RRC) engaged AECOM Australia Pty Ltd (AECOM) to undertake a preliminary flood impact assessment for a second field at the Kalka Shades Hockey Complex, located off Water Street, Koongal. The preliminary assessment was delivered in April 2016, the findings of which can be reviewed in AECOM letter RL44/16 (dated 15 April 2016).

Following delivery of the preliminary flood impact assessment, the Rockhampton Hockey Association (RHA) decided to investigate alternative sites for the complex, mainly due to predicted local catchment flood impacts. This investigation did yield an alternative site, in Parkhurst, which was progressed by RHA to the point where final design and costings were estimated. This site however was also found to be unsuitable, due to the large cost of developing two new fields to achieve RHAs desired level of service. RHA undertook further discussions with RRC and ultimately made the decision to further investigate development of the Kalka Shades complex.

AECOM are currently undertaking the Floodplain Management Services (FMS) project for RRC. Within the FMS project, AECOM have recently developed updated direct rainfall TUFLOW hydraulic models for local catchments within the Rockhampton area. This includes the Frenchmans Creek and Thozets Creek catchments, which encompasses the Kalka Shades complex.

Following discussions between RRC and AECOM it was agreed that the latest hydraulic model would provide a better representation of the existing and proposed conditions at the Kalka Shades complex, when compared to the previous hydraulic model used for the preliminary assessment in April 2016.

1.2 Project Objectives

The key objectives of this project are to:

- Update predicted impacts of the proposed Kalka Shades development, using the latest hydraulic modelling available for the catchment.
- Further refine flood mitigation options, to reduce potential hydraulic impacts to an acceptable level.
- Assess whether improved local catchment flood immunity can be achieved for the existing field, with the implementation of reasonable mitigation works to offset impacts to an acceptable level.

1.3 Report Structures

The structure of this report is as follows:

- Section 2.0 describes the Frenchmans Creek and Thozets Creek Local Catchment Flood Study (AECOM, 2017) which has been adopted for this project.
- Section 3.0 describes the hydraulic model development and results.
- Section 3.6 presents project conclusions and recommendations.
- Section 5.0 presents the references used during the project.

1.4 Notes on Flood Frequency

The frequency of flood events is generally referred to in terms of their Annual Exceedance Probability (AEP) or Average Recurrence Interval (ARI). For example, for a flood magnitude having 5% AEP, there is a 5% probability that there will be floods of equal or greater magnitude each year. The correspondence between the two systems is presented in the ensuing table.

Table 1 AEP to ARI Comparison

Annual Exceedance Probability (AEP) %	Average Recurrence Interval (ARI) Years
63 (1 EY)	1
39	2
18	5
10	10
5	20
2	50
1	100
0.5	200

In this report, the AEP terminology has been adopted to describe the frequency of flooding.

1.5 Limitations and Exclusions

The following limitations apply to this study:

- All design flood events were assessed for a single critical duration, based on an analysis of multiple storm durations for the 1% AEP event, which was completed in the Frenchmans Creek and Thozets Creek Baseline Flood Assessment (AECOM, 2017).
- Aerial survey data (in the form of LiDAR) used to develop the topography for the hydraulic model has a vertical accuracy of ± 0.15 m on clear, hard surfaces and a horizontal accuracy of ± 0.45 m.
- Assessment of the probability of coincident local rainfall and Fitzroy River flood events has not been undertaken.
- The hydraulic model has been calibrated to a single historical event, being the local flood event which occurred as a result of TC Marcia in February 2015. The model has been validated to two other local flood events, namely Ex-TC Debbie in March 2017 and Ex-TC Oswald in January 2013.
- Fitzroy River hydraulic impact assessment has not been carried out due to the project site being located in a storage area of the floodplain. Hydraulic impacts due to Fitzroy River flooding are not anticipated.
- Hydrologic and hydraulic modelling is based on methods and data outlined in Australian Rainfall and Runoff (AR&R) 1987. The 1987 revision has been adopted as per Council's request. Refer to the ARR, Data Management and Policy Review (AECOM, 2017) for details surrounding changes recommended in the 2016 revision.
- **Assessment of hydraulic impacts associated with Council's preferred design scenario (D16) has been undertaken for the 63%, 39%, 18%, 10%, 5%, 2% and 1% AEP's.**
- Any use which a third party makes of this document, or any reliance on or decision to be made based on it, is the responsibility of such third parties. AECOM accepts no responsibility for damages, if any, suffered by any third party as a result of decisions or actions made based on this document.
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AR&R Revision Project 15 outlines several fundamental themes which are also particularly relevant:

- All models are coarse simplifications of very complex processes. No model can therefore be perfect, and no model can represent all of the important processes accurately.
- Model accuracy and reliability will always be limited by the accuracy of the terrain and other input data.
- Model accuracy and reliability will always be limited by the reliability / uncertainty of the inflow data.
- A poorly constructed model can usually be calibrated to the observed data but will perform poorly in events both larger and smaller than the calibration data set.
- No model is ‘correct’ therefore the results require interpretation.
- A model developed for a specific purpose is probably unsuitable for another purpose without modification, adjustment, and recalibration. The responsibility must always remain with the modeller to determine whether the model is suitable for a given problem.

2.0 Frenchmans Creek and Thozets Creek Flood Study

2.1 Overview

In December 2016, RRC engaged AECOM to undertake the Floodplain Management Services (FMS) program for the 2017 calendar year. The FMS program entails the completion of a number of individual floodplain management projects including the Frenchmans Creek and Thozets Creek Local Catchment Study.

The key objectives of this project were:

- The development of a detailed hydraulic model based on current best practice procedures, capable of adequately simulating the flood characteristics and behaviour of the local catchment using the latest available data.
- The development of clear and easy to understand flood mapping products for use in future community education and awareness campaigns.
- Determination of key hydraulic controls within the study area which will later be used to inform mitigation options analysis.

The Frenchmans Creek and Thozets Creek Phase 1 Baseline Flood Study included the development of a TUFLOW model for the lower portion of the Frenchmans Creek and Thozets Creek local catchment. This model utilises a combination of runoff-routing and direct rainfall approaches in order to determine the overland flow paths and establish baseline flood extents and depths within the study area.

2.2 Model Description

The Baseline model which was developed for Frenchmans Creek and Thozets Creek Local Catchment Study has been adopted in its entirety for the Kalka Shades Hockey Complex Flood Assessment.

The following sub-sections describe the model set up and parameters.

2.2.1 Hydrologic Modelling Approach

The hydrology inputs for this model have been developed using both runoff routing for the broader catchment and direct rainfall.

An XP-Rafts model (version 2013) was developed for the upper portion of the Frenchmans Creek and Thozets Catchment by Aurecon in 2014. This model was provided by RRC and utilised to provide upper catchment inflows. An overview of the hydrologic model development can be reviewed in the Frenchmans Creek and Thozets Creek Hydrologic and Hydraulic Modelling Report (Aurecon, 2014).

Direct rainfall inputs were applied directly to the TUFLOW hydraulic model. This TUFLOW model generally covers the middle and lower catchment areas of Frenchmans Creek and Thozets Creek.

A full summary of the hydrology inputs for the Frenchmans Creek and Thozets Creek Local Catchment Study model can be found in the Frenchmans Creek and Thozets Creek Baseline Flood Study – Volume 1 Report (AECOM, 2017).

2.2.2 Hydraulic Model Development

The modelling platform which was used for the development of the Frenchmans Creek and Thozets Creek Local Catchment model was TUFLOW build version 2016-03-AE. Details regarding the model setup can be seen in Table 2.

Table 2 Hydraulic Model Setup Overview

Parameter	Frenchmans Creek and Thozets Creek Local Catchment Model
Completion Date	June 2017
AEP's Assessed	1EY, 39%, 18%, 10%, 5%, 2%, 1%, 0.2%, 0.05% AEP and PMF
Hydrologic Modelling	XP-RAFTS Inflow and Direct Rainfall Approach
IFD Input Parameters	Refer to Section Frenchmans Creek and Thozets Creek Baseline Flood Study – Volume 1 Report (AECOM, 2017)
Hydraulic Model Software	TUFLOW version 2016-03-AE-w64-iDP
Grid Size	3m
DEM (year flown)	2016
Roughness	Spatially varying and depth varying standard values – consistent with South Rockhampton Model and Frenchmans and Thozets Creek Hydrologic and Hydraulic Modelling Report (Aurecon, 2014).
Eddy Viscosity	Smagorinsky
Model Calibration	Calibrated to 2015 event, verified to 2013 and 2017 events.
Downstream Model Boundary	7 inflow boundary along the steep bushland boundaries, 2 rating curve boundary conditions along the western boundary, 1 tidal boundary on the south boundary.
Timesteps	1 second (3m 2D) and 0.5 second (1D)
Wetting and Drying Depths	Cell centre 0.0002 m
Sensitivity Testing	Stormwater Infrastructure Blockage, ±15% Hydraulic Roughness, Riverine and Local Catchment Coincident Event, Inlet Structure Dimensions and Climate Change

2.2.3 Hydraulic Model Overview

For full details of the hydraulic model setup and development refer to the Frenchmans Creek and Thozets Creek Baseline Flood Study – Volume 1 Report (AECOM, 2017).

3.0 Hydraulic Model Development

3.1 Baseline Model

The baseline model has been adopted entirely from the Frenchmans Creek and Thozets Creek Baseline Flood Study (AECOM, 2017) without any changes for the baseline scenario.

3.2 Initial Developed Case Modelling

3.2.1 Model Development

The following general methodology was undertaken to assess the proposed development:

- An initial set of Developed Case simulations were simulated for the 1% AEP critical duration event, including:
    - **D010** à Proposed development of second field, as per Calibre Consulting project R15041 drawings (Rev 2) dated April 2016, with no mitigation works included.
        - A copy of Calibre Consulting drawings has been provided in **Appendix A**.
    - **D011** à As per D010 configuration, with the inclusion of a 30m grassed swale on the eastern side of the second field.
    - **D012** à As per D011 configuration, with the addition of clearing / excavation works within Frenchmans Creek to the north and west of the existing field.
    - **D013** à As per D012 configuration, with the addition of a concrete barrier around the existing field to provide 1% AEP local catchment flood immunity.
- Results of the initial Developed Case scenarios were compared to the corresponding Baseline results, to establish the predicted changes in peak flood extents, peak flood height and peak depth averaged velocity.
- High level GIS mapping was produced for discussion with RRC.
    - The latest difference mapping was also compared to the April 2016 difference mapping, to confirm similar predicted flood impacts.
- The initial modelling results were used to further develop mitigation options.

Figure 1 shows the E2 Baseline topography, for easy comparison to Figure 2 to Figure 5 which provides the Developed Case topography for the D010 to D013 scenarios.

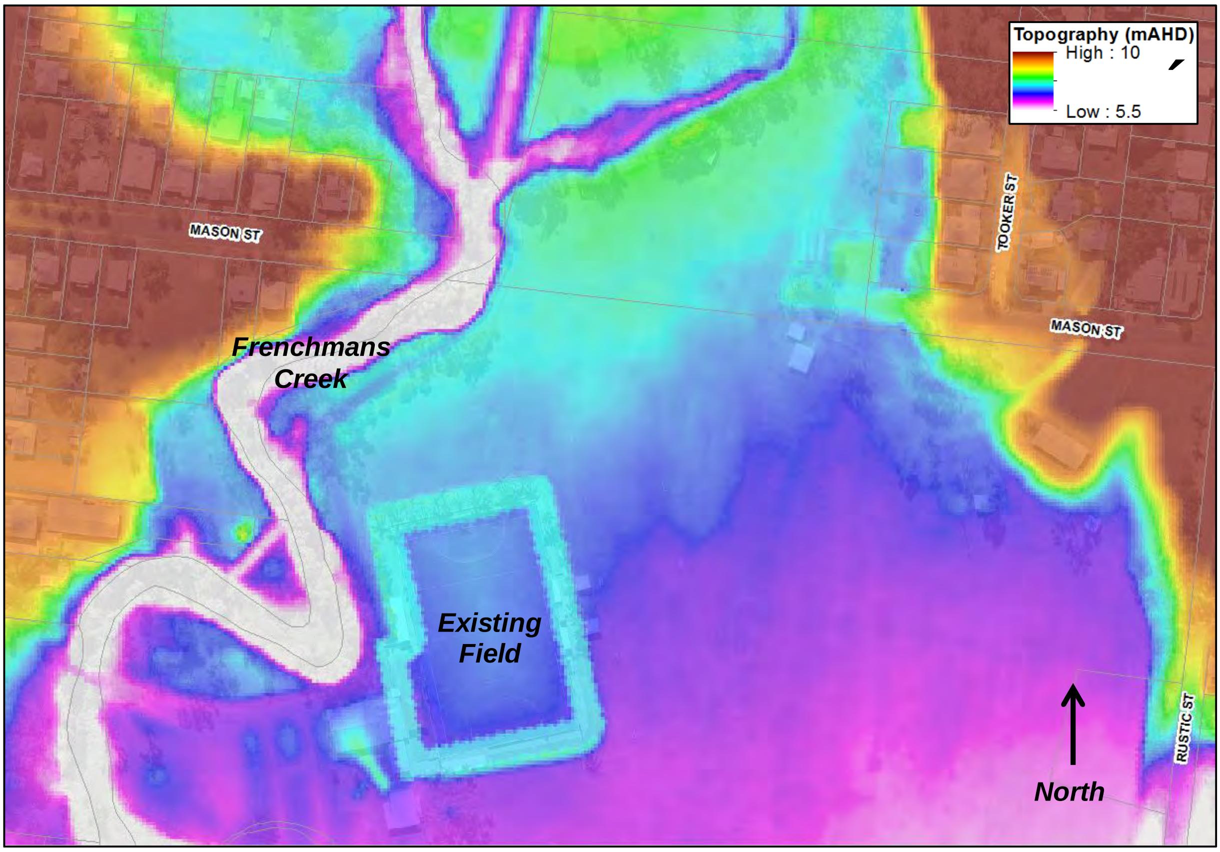

Figure 1 E2 Baseline Topography – Kalka Shades Complex

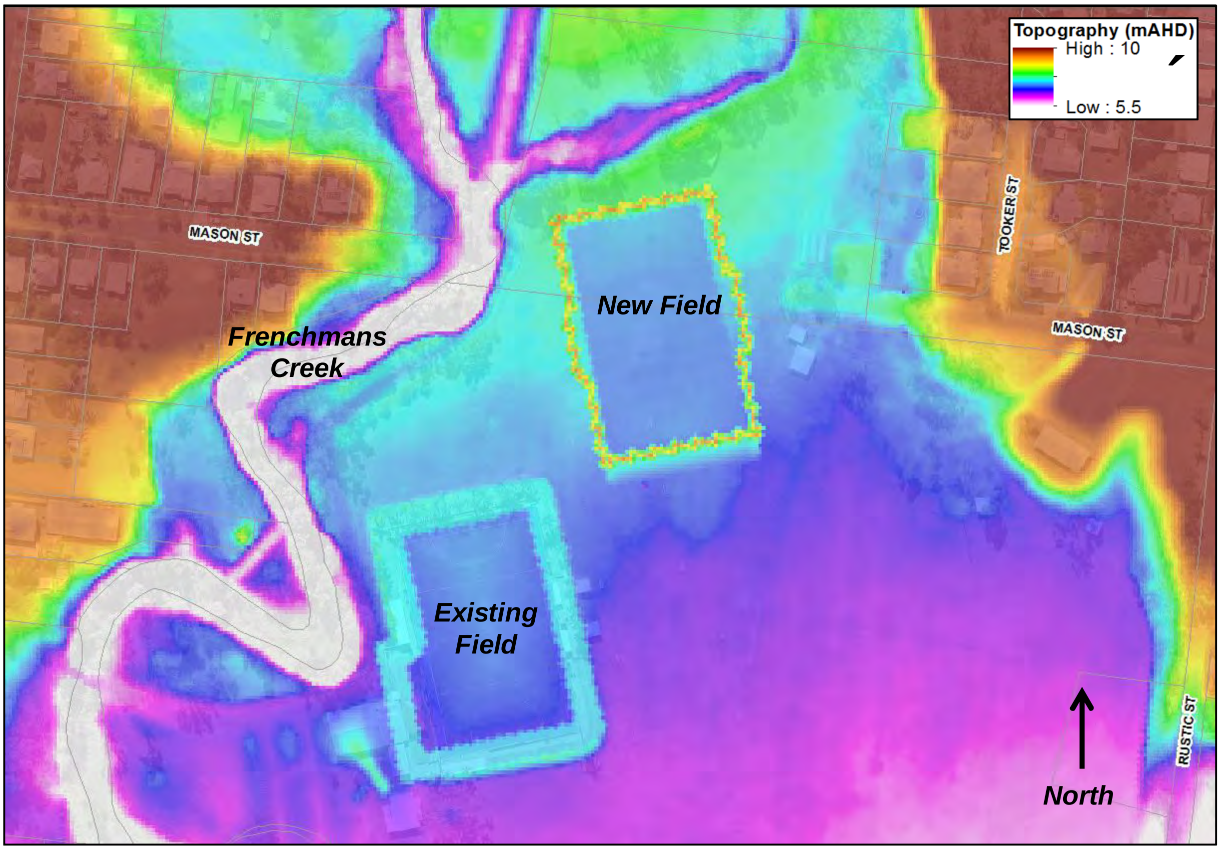

Figure 2 D010 Developed Case Topography – Kalka Shades Complex

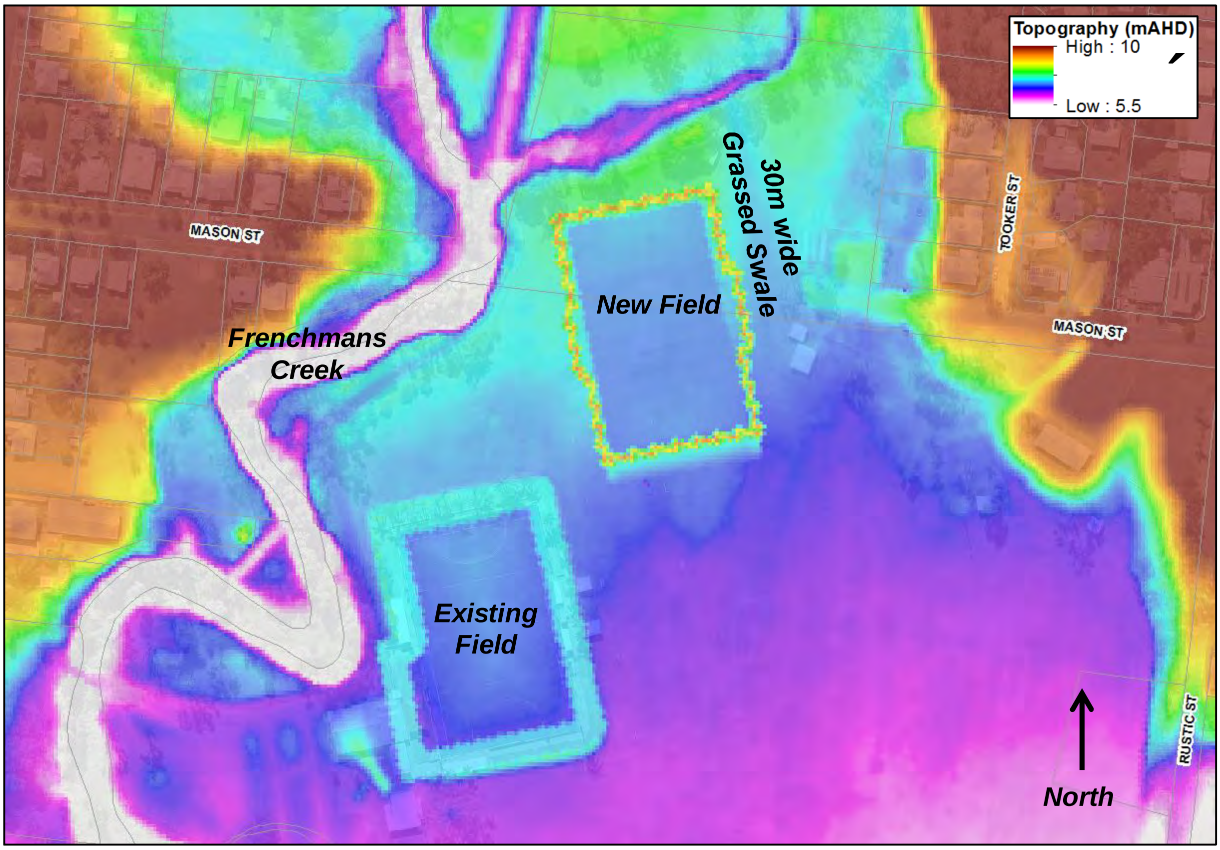

Figure 3 D011 Developed Case Topography – Kalka Shades Complex

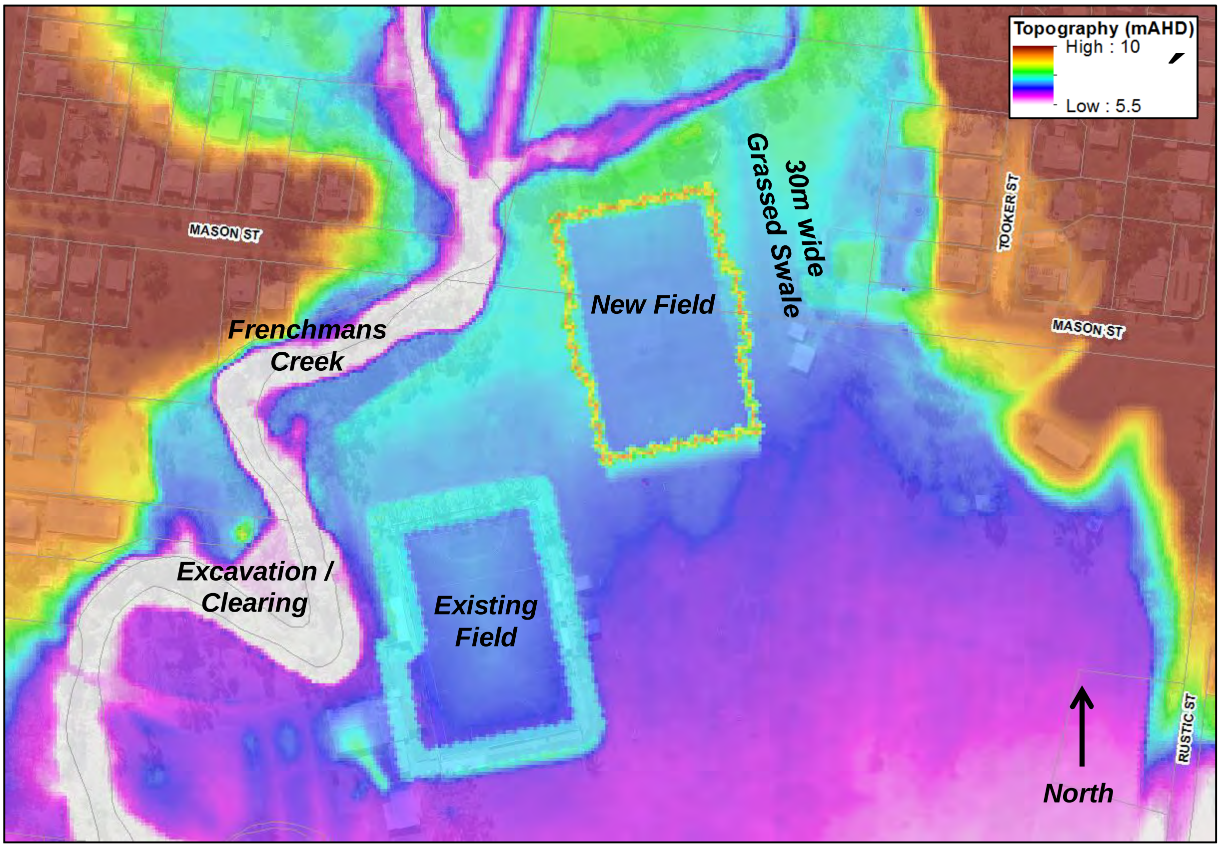

Figure 4 D012 Developed Case Topography – Kalka Shades Complex

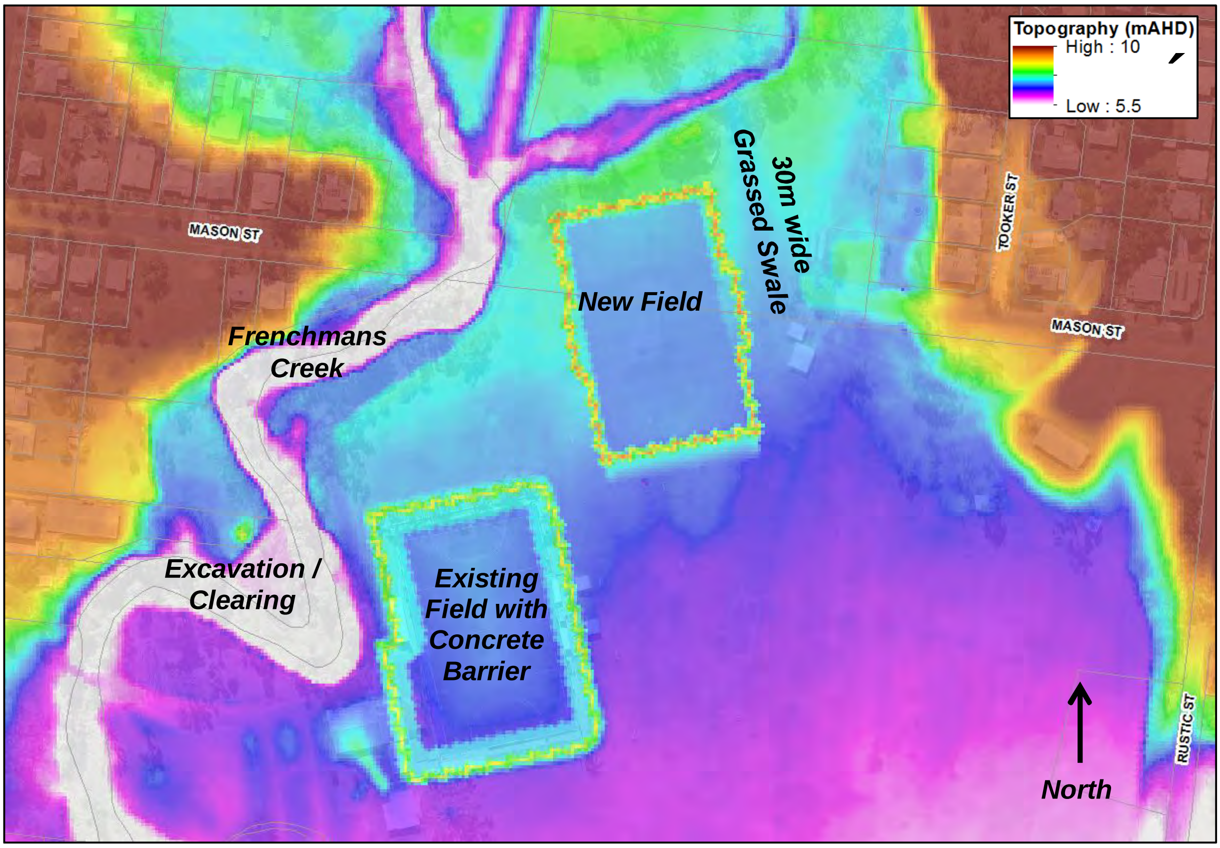

Figure 5 D013 Developed Case Topography – Kalka Shades Complex

3.2.2 Difference in PWSE (D010 to D013)

Figure 6 to Figure 9 show results of the D010 to D013 scenarios, along with a brief discussion on the performance of each configuration as compared to the E2 Baseline results.

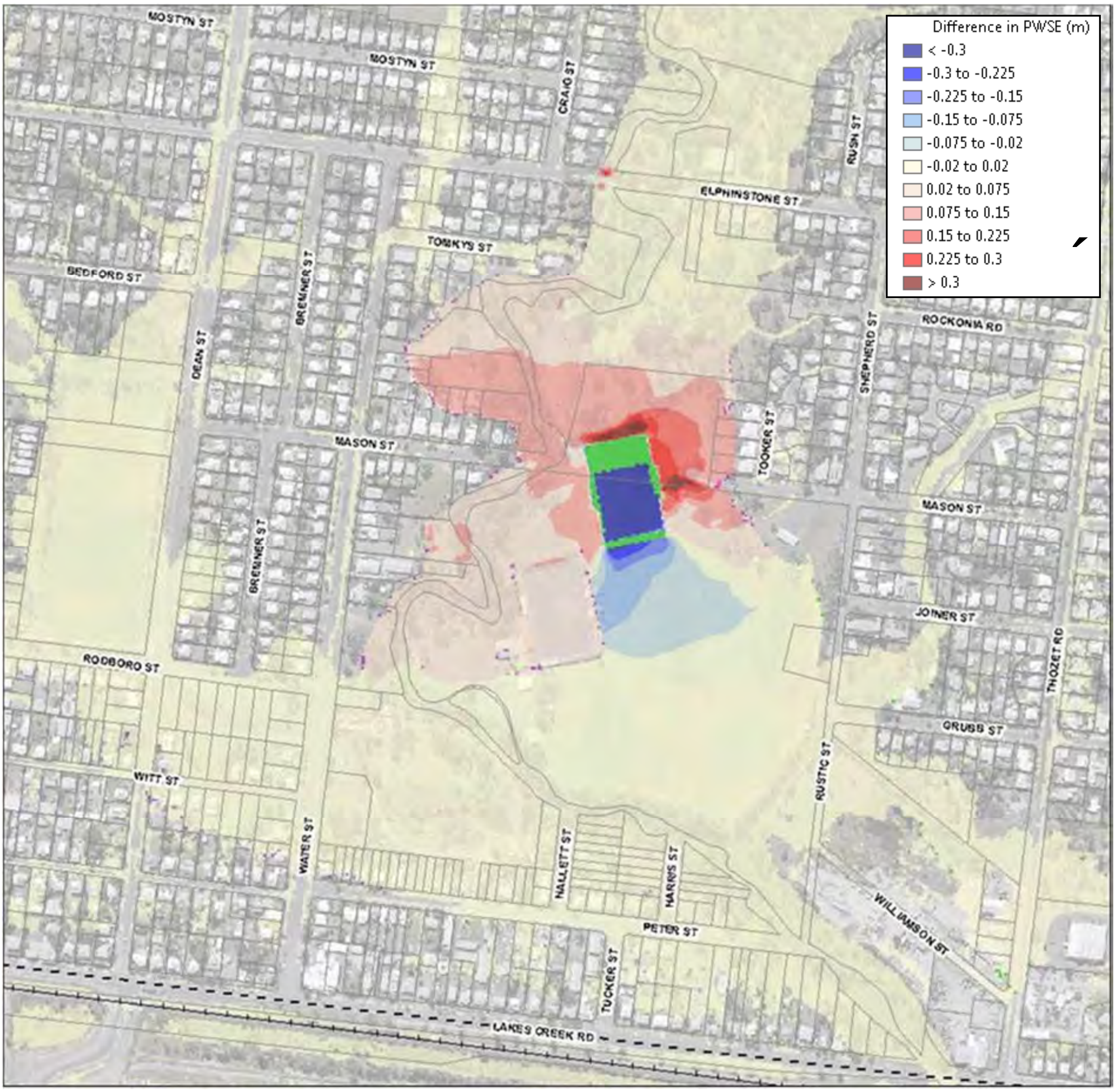

Figure 6 1% AEP 90 minute storm - D010 minus E2 (Baseline) Difference in PWSE

Comparison of the D010 Developed Case 1% AEP results to the E2 Baseline results show:

- Increases in Peak Water Surface Elevations (PWSE) upstream of the new and existing fields, extending north as far as Tomkys Street.
- A decrease in PWSE downstream of the new field.
- A negligible increase in flood extents.

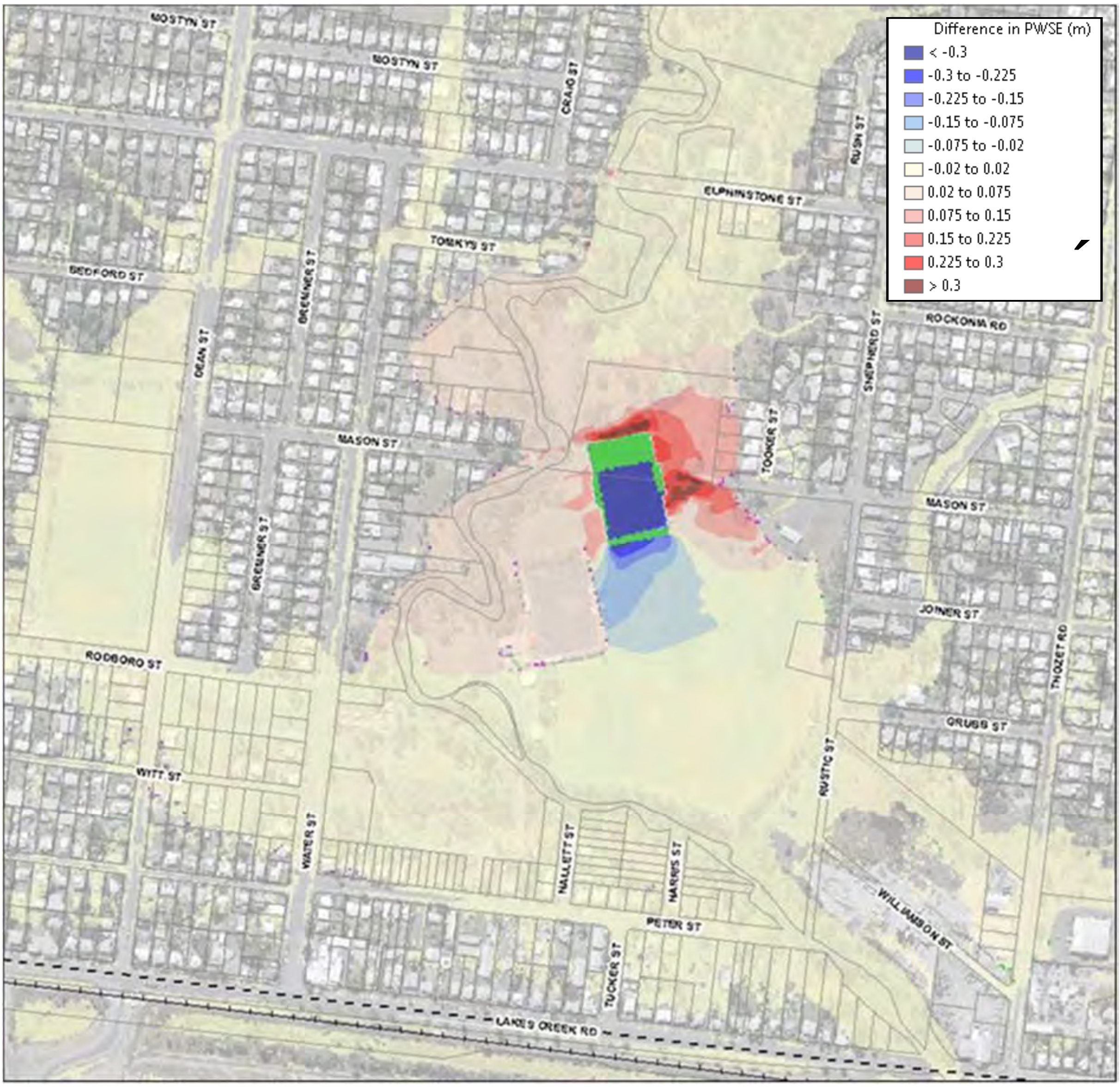

Figure 7 1% AEP 90 minute storm - D011 minus E2 (Baseline) Difference in PWSE

The difference in PWSE for the D011 Developed Case 1% AEP event, compared to the E2 Baseline results, shows:

- Increases in flood height upstream of the new and existing fields, extending north as far as Tomkys Street. The predicted increase in PWSE is, however, smaller compared to the predicted D010 scenario impact.
- A decrease in PWSE downstream of the new field.
- A negligible increase in flood extents.

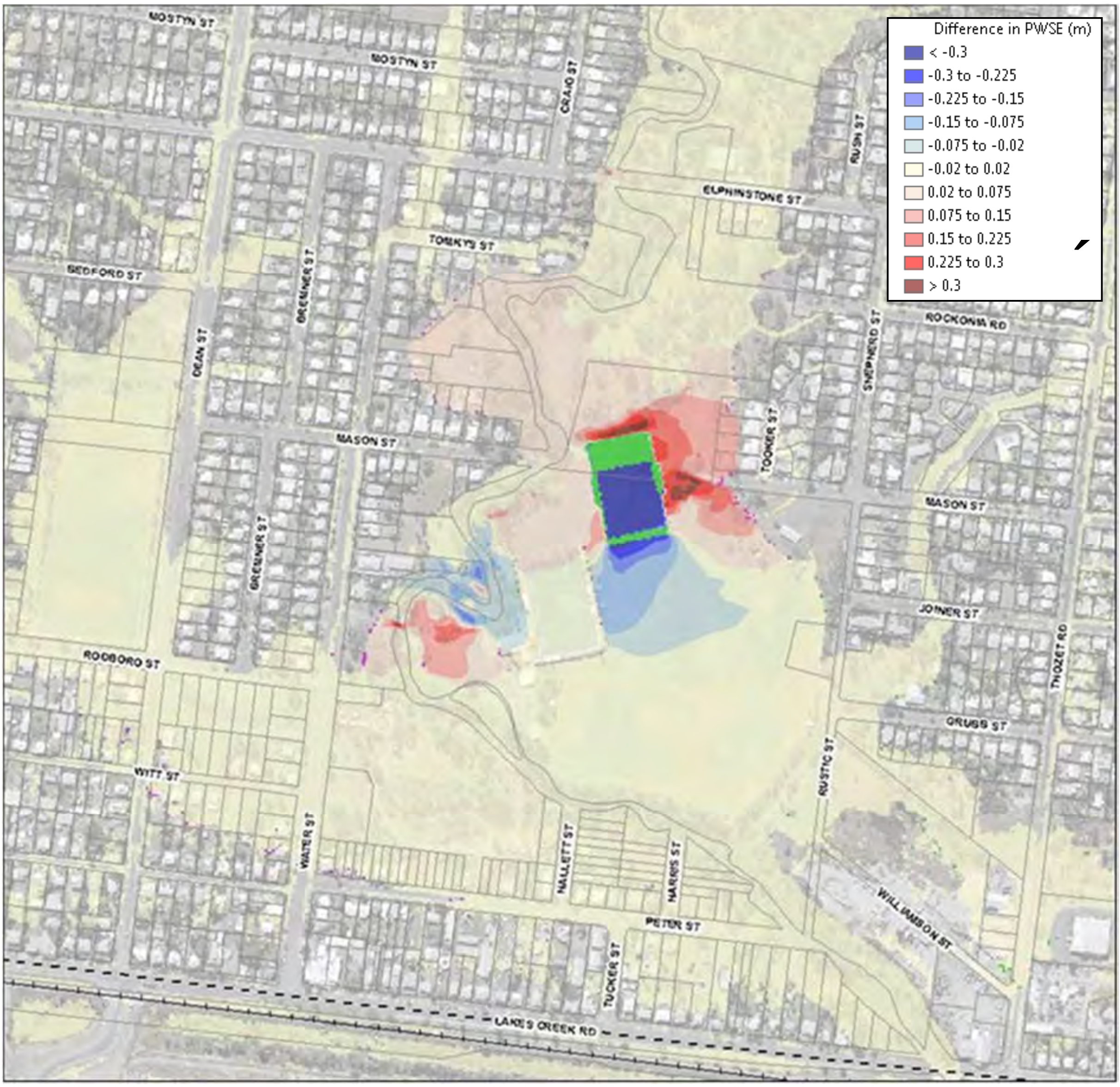

Figure 8 1% AEP 90 minute storm - D012 minus E2 (Baseline) Difference in PWSE

Comparison of the 1% AEP D012 Developed Case and E2 Baseline results shows:

- Predicted increases in PWSE have been further reduced upstream of the new and existing fields, when compared to the D011 scenario impact.
- A decrease in PWSE downstream of the new field.
- A negligible increase in flood extents.

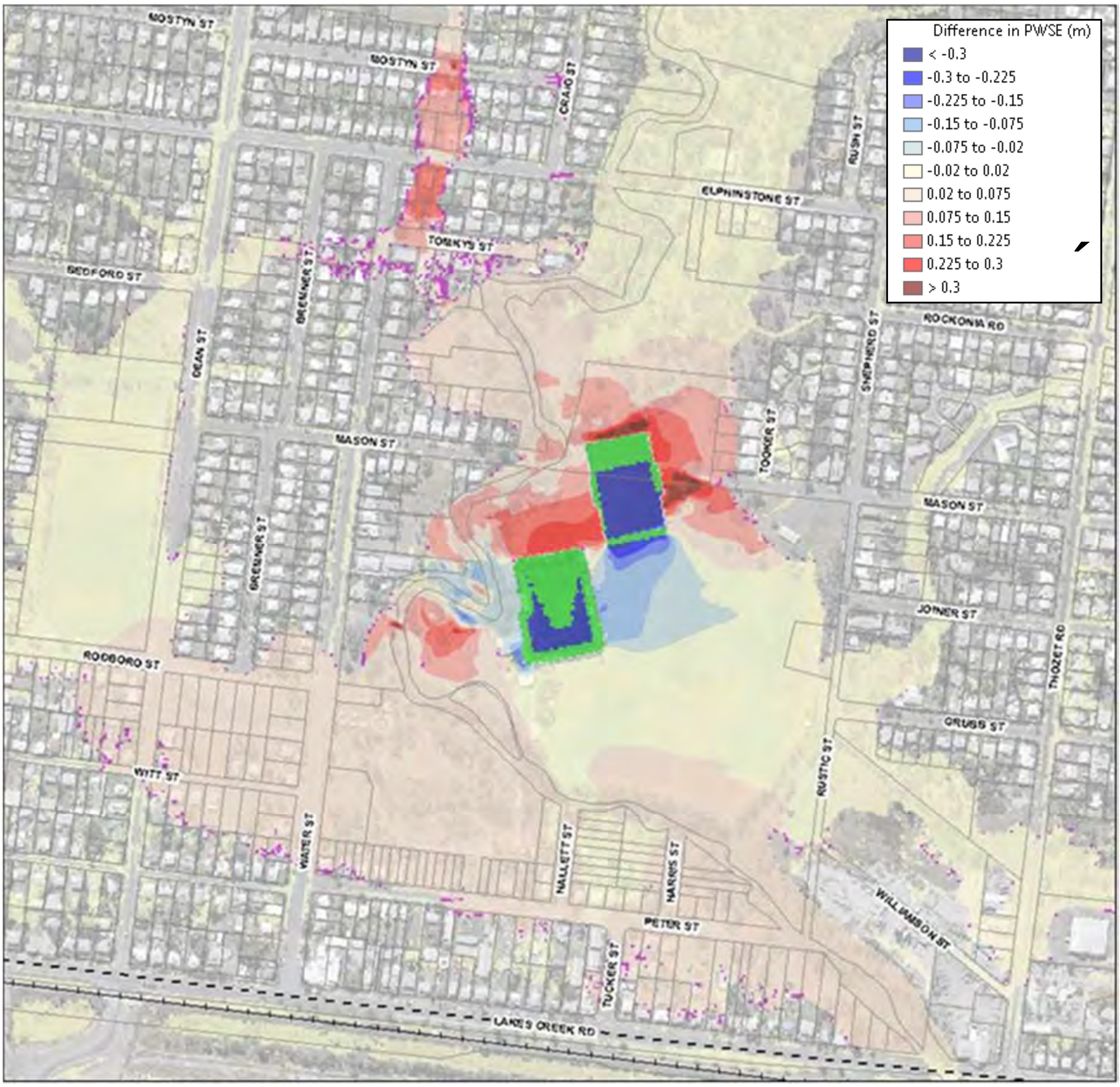

Figure 9 1% AEP 90 minute storm - D013 minus E2 (Baseline) Difference in PWSE

Figure 9 shows the following for the 1% AEP D013 Developed Case difference in PWSE, compared to the E2 Baseline results:

- Increases in PWSE upstream of the new and existing fields extending further north to Mostyn Street and further south to Lakes Creek Road.
- A decrease in PWSE downstream of the new and existing fields.
- Some increase in flood extents in the Tomkys Street and Mostyn Street areas.

The predicted increase in PWSE and flood extent appears to be due to increased tailwater levels downstream of the existing Tomkys Street breakout, resulting in flood waters being 'held up' to the north, south and west of the proposed development.

3.3 Mitigation Option Iteration 1

3.3.1 Model Development

Following completion of the initial Developed Case modelling, the results were used to further refine the proposed mitigation works. The analysis showed that the eastern swale was more effective in reducing flood impacts when compared to excavation / clearing works within Frenchmans Creek, leading to Mitigation Option Iteration 1:

- **D014** à As per D010 configuration, with the inclusion of a 80m wide grassed swale on the eastern side of the second field. This required removal of two existing sheds and the practice cricket nets.
- **D015** à As per D014 configuration, with the addition of a concrete barrier around the existing field to provide 1% AEP local catchment flood immunity.
    - The D015 scenario was not simulated, as the results of the D014 simulation were sufficient to inform future option development.

Figure 10 and Figure 11 show the topography for the D014 and D015 configurations respectively.

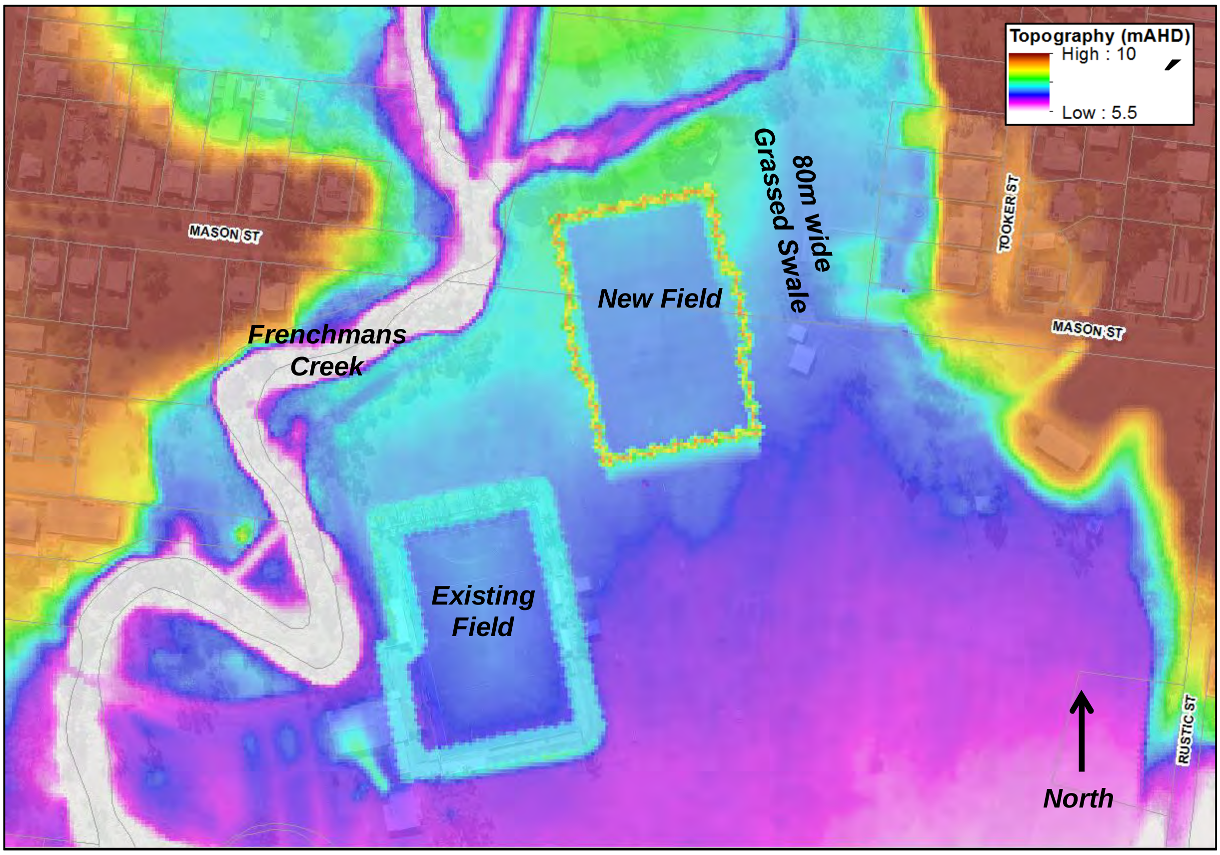

Figure 10 D014 Developed Case Topography – Kalka Shades Complex

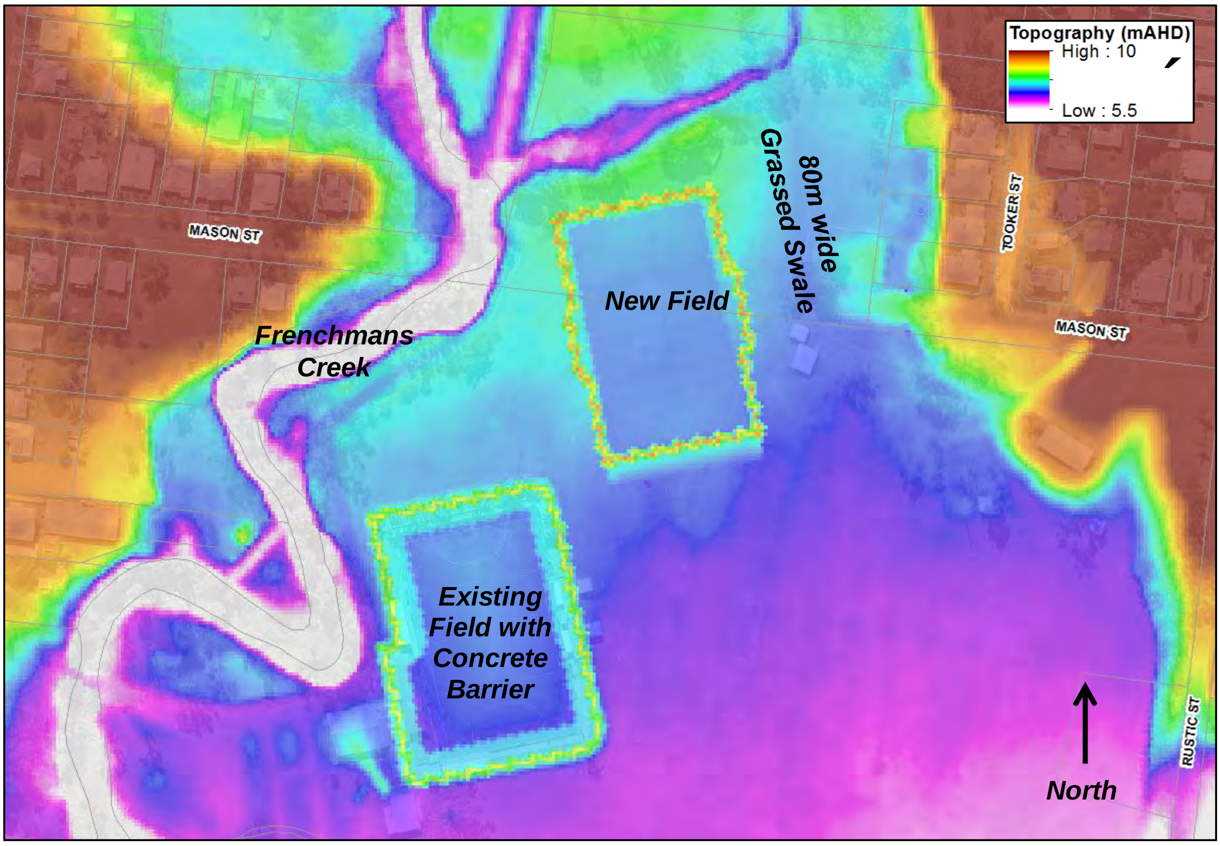

Figure 11 **D015 Developed Case Topography – Kalka Shades Complex**

3.3.2 Difference in PWSE (D014)

Figure 12 shows the difference in PWSE between D014 Developed Case and E2 Baseline, for the 1% AEP critical duration event. It can be seen that the D014 scenario has achieved the desired result in the area between Tomkys Street and Mason Street, where predicted impacts in private property are less than 20mm.

There remains however a predicted increase in PWSE of up to 52mm within private properties in Tooker Street. An associated decrease in PWSE is predicted downstream of the new field.

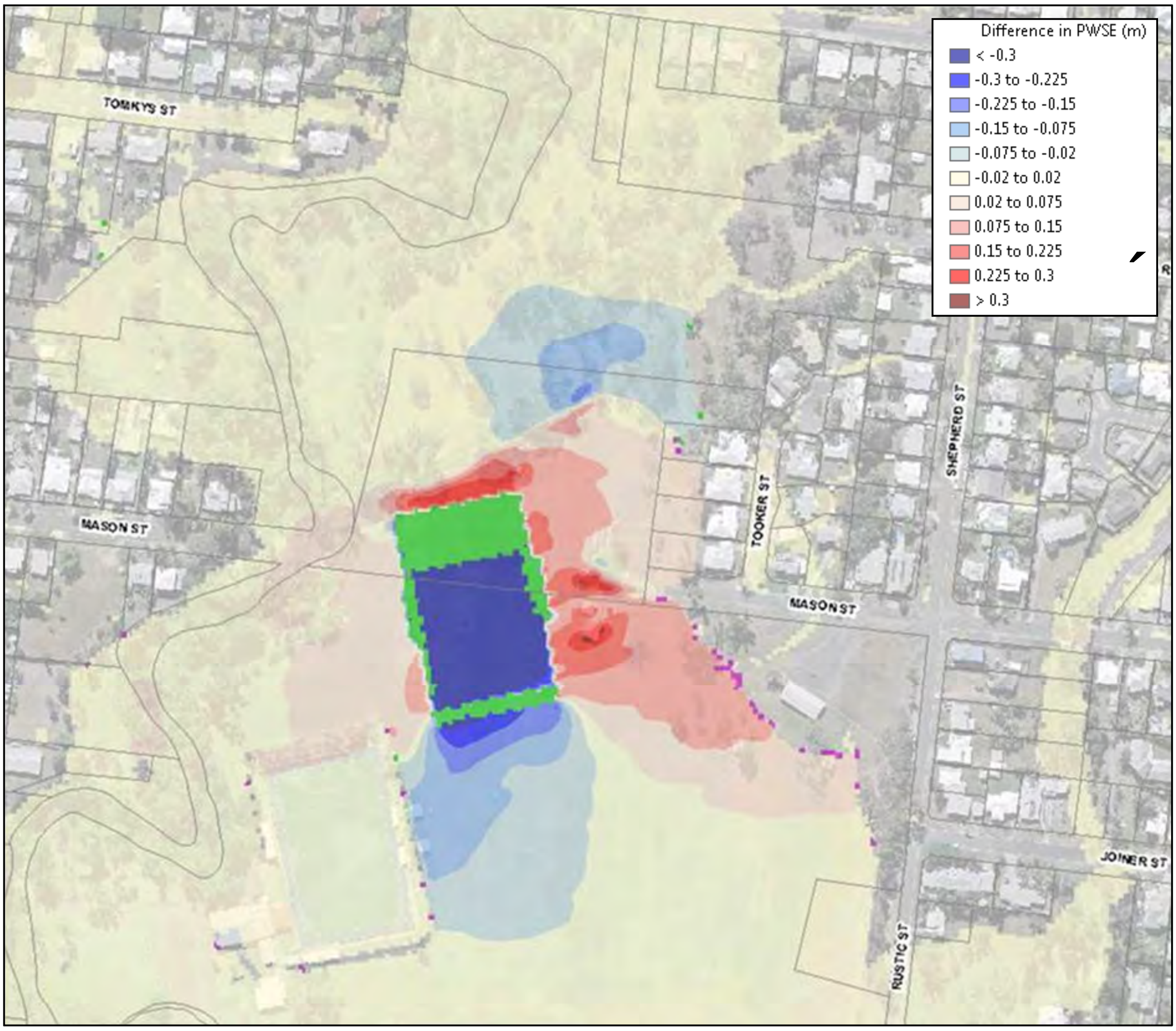

Figure 12 1% AEP 90 minute storm - D014 minus E2 (Baseline) Difference in PWSE

Due to the predicted impact within Tooker Street properties, further mitigation option development was requested by Council.

3.4 Mitigation Option Iteration 2

3.4.1 Model Development

While the D014 configuration did show a reduction in predicted flood impacts, discussions with Council identified a preference to reduce predicted impacts to less than 20mm within private property. Analysis of the D014 results showed an opportunity to further reduce predicted impacts through further refinement of the eastern channel, as follows:

- **D014a** à As per D014 configuration, with the removal of the existing earth mound within the proposed grassed swale behind Tooker Street properties.
- **D015a** à As per D014a configuration, with the addition of a concrete barrier around the existing field to provide 1% AEP local catchment flood immunity.
    - The D015a scenario was not simulated, as the results of the D014a simulation were sufficient to inform future option development.

The topography for scenarios D014a and D015a are provided in Figure 13 and Figure 14 respectively.

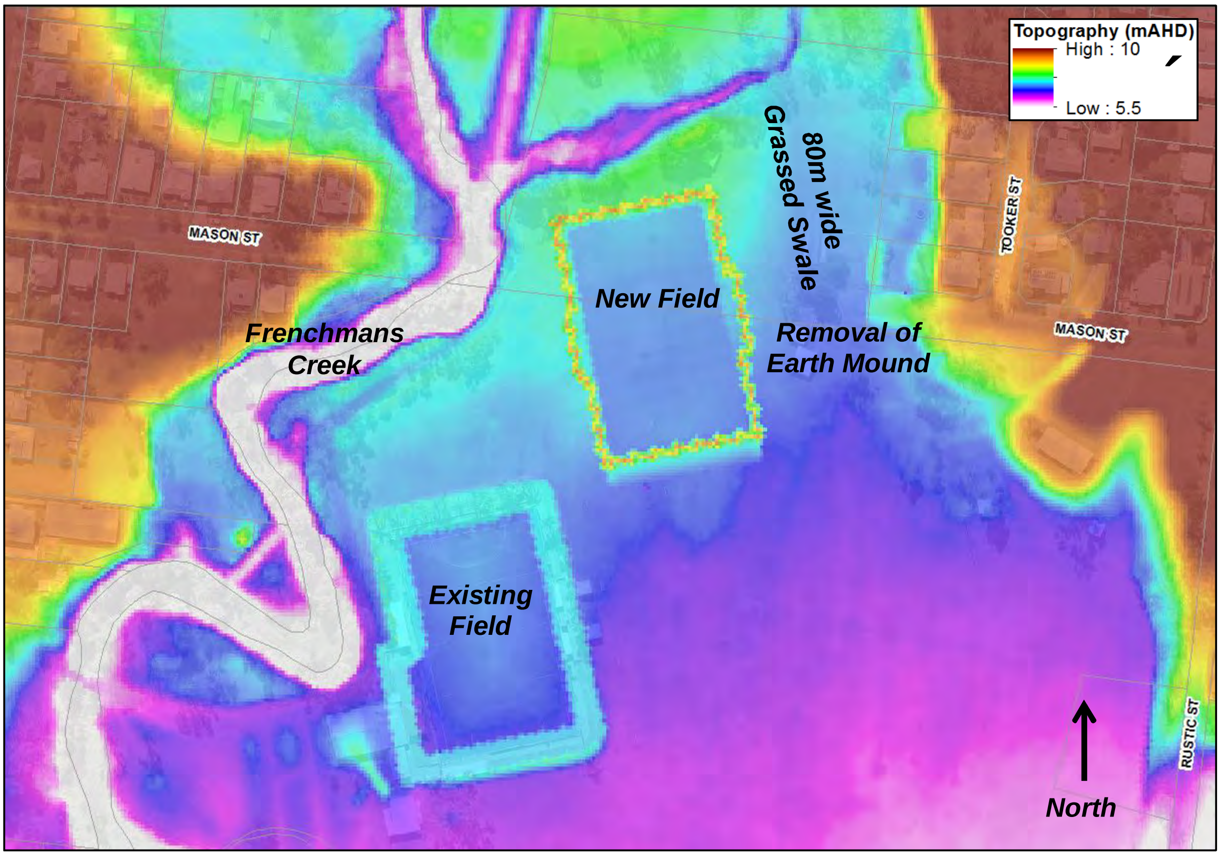

Figure 13 D014a Developed Case Topography – Kalka Shades Complex

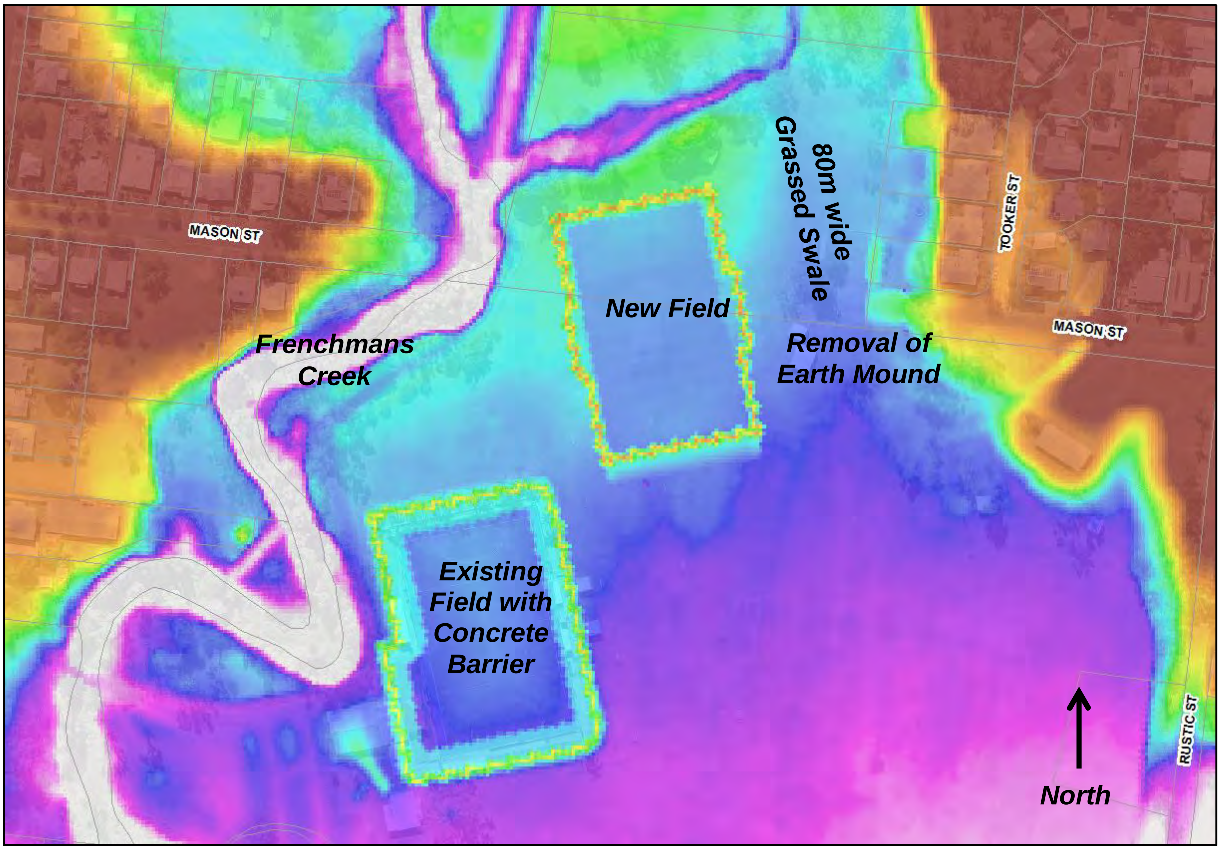

Figure 14 D015a Developed Case Topography – Kalka Shades Complex

3.4.2 Difference in PWSE (D014a)

The difference in PWSE between D014a Developed Case and E2 Baseline, for the 1% AEP critical duration event is provided in Figure 15. Removal of the mound within the 100m grassed swale for Developed Case D014a has achieved the desired result, where predicted impacts in private property are less than 20mm.

There remains a predicted increase in PWSE adjacent to the new field and south of Mason Street; however these are located within Council owned land. An associated decrease in PWSE is predicted north of Tooker Street and downstream of the new field.

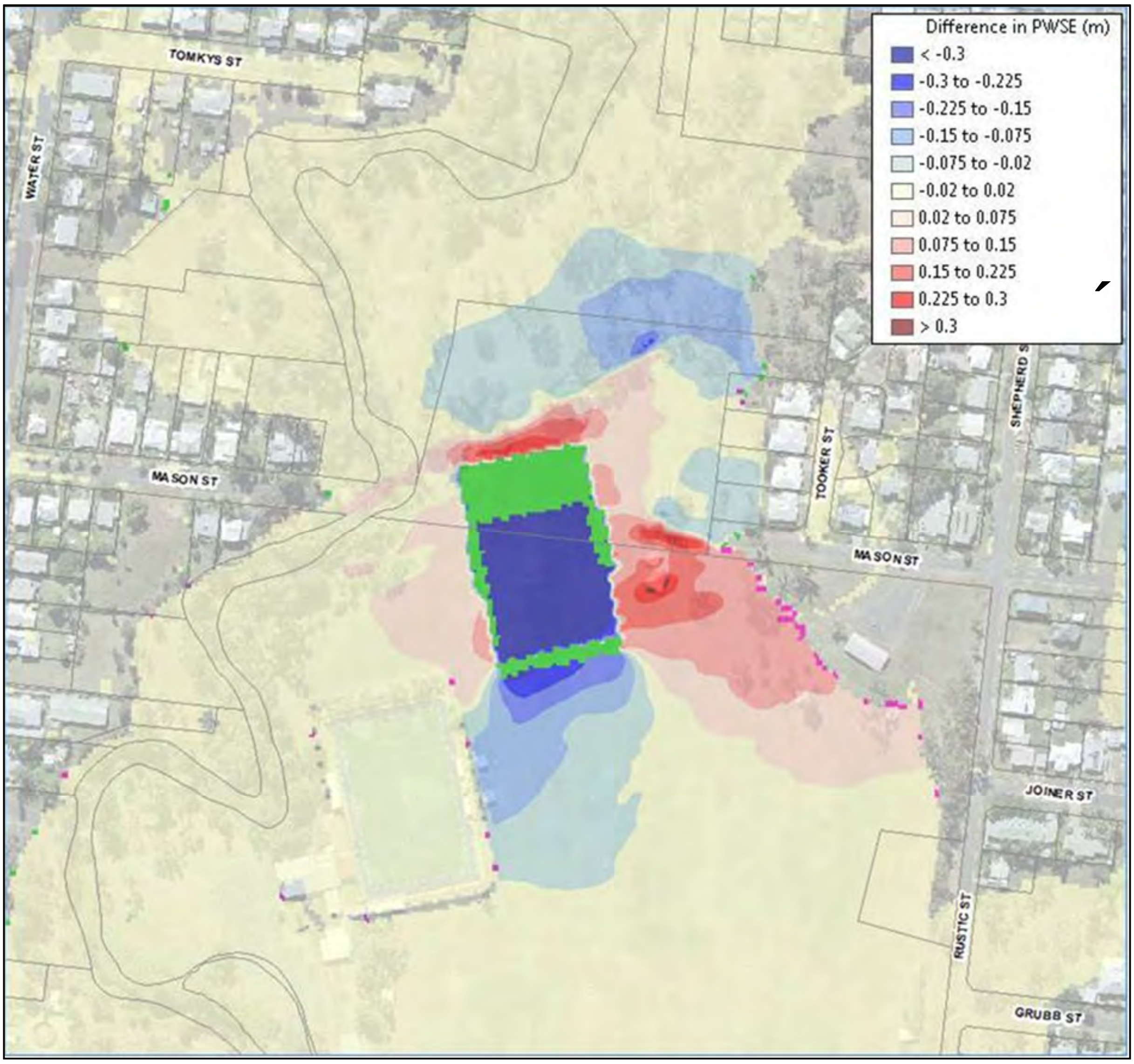

Figure 15 1% AEP 90 minute storm - D014a minus E2 (Baseline) Difference in PWSE

For the proposed second field development, the D014a configuration achieves Council's desired level of flood impact within private property. However it is unlikely the same configuration would continue to show predicted impacts of less than 20mm, if the existing field embankment were raised to improve current flood immunity.

Further mitigation option development was therefore undertaken, seeking to allow for the development of the new field plus augmentation of the existing field, whilst maintaining less than a 20mm increase in PWSE within private property.

3.5 Mitigation Option Iteration 3

With the D014a scenario achieving Council's desired outcome relating to predicted impacts within private property, the focus turned to improving the flood immunity of the existing hockey field. At present the existing field is predicted to have flood immunity between the 39% AEP and 18% AEP local catchment event.

The D013 scenario demonstrated that improving the existing field flood immunity to 1% AEP results in unacceptable impacts. The **D016** scenario therefore sought to improve the existing field flood immunity to 2% AEP. In addition, the D014a results identified an opportunity to further balance predicted impacts by relocating the proposed second field further to the east, thereby allowing flow between the fields.

- **D016** à Proposed second field moved 10m to the east, with the addition of a concrete barrier around the existing field to provide 2% AEP local catchment flood immunity (with no allowance for freeboard). Grassed swales provided on either side of new field (70m wide on eastern side and 30m on western side of new field).
    - This scenario also includes the removal of the Mason Street road embankment (10m length) and will necessitate removal of the existing power pole and overhead service line connected to the cricket shed (which is also being removed in this scenario).

Figure 16 shows the D016 topography and demonstrates the relocation of the second field and inclusion of grassed swales on either side of the new field.

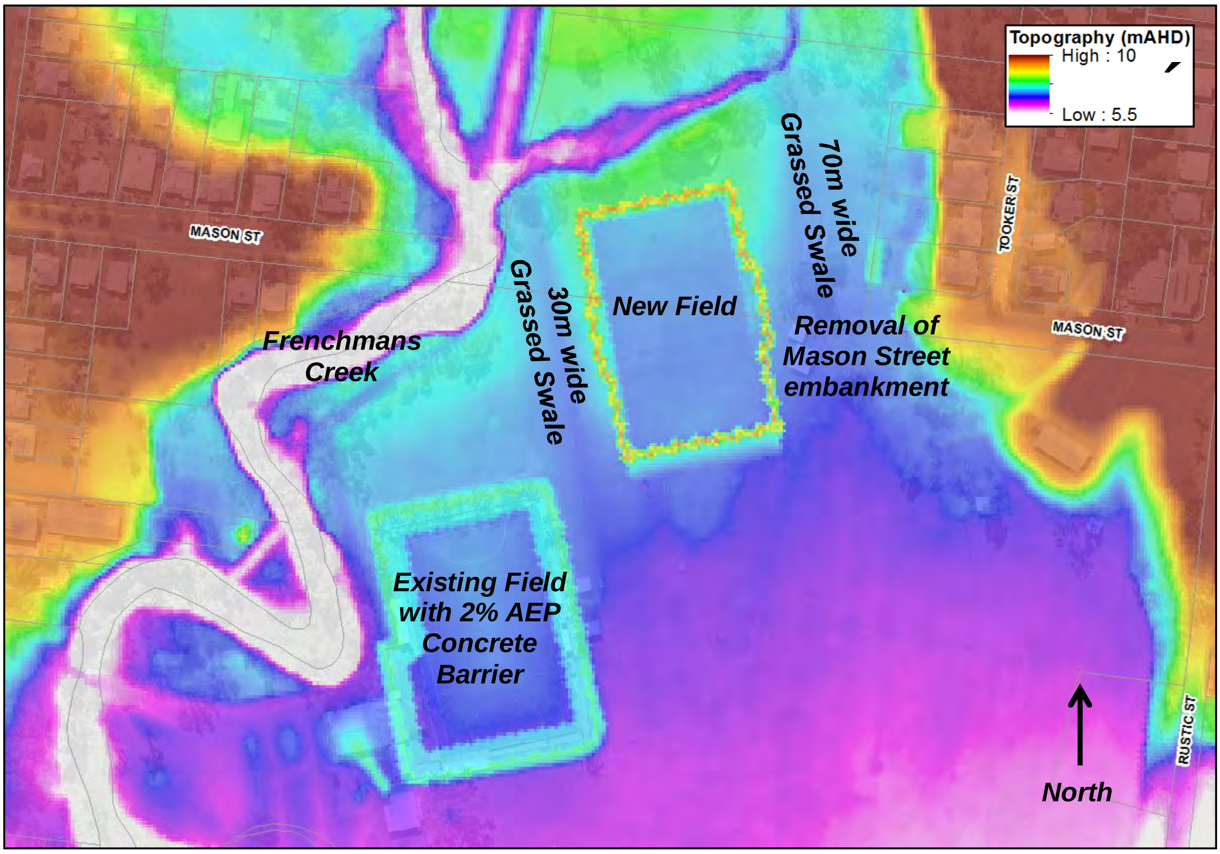

Figure 16 D016 Developed Case Topography – Kalka Shades Complex

The D016 scenario was selected as the final configuration for this assessment and was consequently simulated for the 63% AEP, 39% AEP, 18% AEP, 10% AEP, 5% AEP, 2% AEP and 1% AEP critical duration local catchment event.

3.5.1 Difference in PWSE (D016)

The following difference in PWSE mapping is included in **Appendix B**, for the critical storm duration:

- Map B1 à 63% AEP Difference in PWSE - D016 minus E2 (Baseline)
- Map B2 à 39% AEP Difference in PWSE - D016 minus E2 (Baseline)
- Map B3 à 18% AEP Difference in PWSE - D016 minus E2 (Baseline)
- Map B4 à 10% AEP Difference in PWSE - D016 minus E2 (Baseline)
- Map B5 à 5% AEP Difference in PWSE - D016 minus E2 (Baseline)
- Map B6 à 2% AEP Difference in PWSE - D016 minus E2 (Baseline)
- Map B7 à 1% AEP Difference in PWSE - D016 minus E2 (Baseline)

Figure 17 shows the difference in PWSE, for the 1% AEP critical storm event.

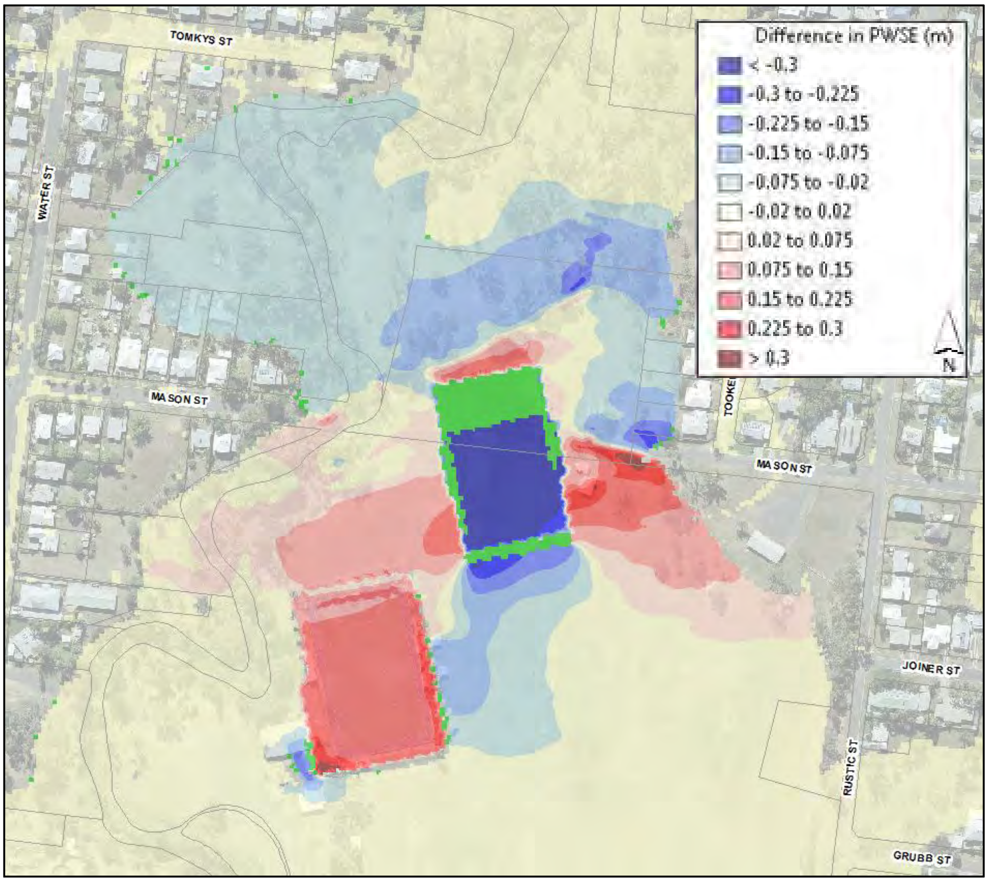

Figure 17 1% AEP 90 minute storm - D016 minus E2 (Baseline) Difference in PWSE

Review of the difference in PWSE mapping attached in Appendix B shows:

- Flood extents and flood depths are predicted to increase during frequent events (63% AEP and 39% AEP) on the eastern side of the new field, due to the proposed grass swale and reduction of the high bank of the upstream Frenchmans Creek anabranch.
- In general, flood levels are predicted to reduce to the north and west of the existing and new fields, as a result of the additional flow through the proposed grassed swales.
- An associated general increase in PWSE is predicted to the east and south of the existing and new fields.
- Increases in PWSE are reasonably well balanced on either side of the new field, during the 1% AEP event.

- In the 1% AEP event, predicted increases in PWSE are less than 20mm in private property and are reduced in some cases, with the exception of two private properties south of Mason Street (western spur), where predicted increases in PWSE are up to 32mm.
- The raised embankment / flood wall within the existing field results in increased PWSE within the field area during the 1% AEP event. This is due to the embankment being raised only to 2% AEP.
- The predicted reduction in Tooker Street properties during the 1% AEP event, is due to opening up the Mason Street road embankment.

3.5.2 Peak Depth Averaged Velocity (D016)

The following difference in Peak Depth Averaged Velocity (PDAV) mapping is included in **Appendix B**, for the critical storm duration:

- Map B8 à 63% AEP Difference in PDAV - D016 minus E2 (Baseline)
- Map B9 à 39% AEP Difference in PDAV - D016 minus E2 (Baseline)
- Map B10 à 18% AEP Difference in PDAV - D016 minus E2 (Baseline)
- Map B11 à 10% AEP Difference in PDAV - D016 minus E2 (Baseline)
- Map B12 à 5% AEP Difference in PDAV - D016 minus E2 (Baseline)
- Map B13 à 2% AEP Difference in PDAV - D016 minus E2 (Baseline)
- Map B14 à 1% AEP Difference in PDAV - D016 minus E2 (Baseline)

The PDAV maps for the 1% AEP baseline and D016 scenarios are also provided in **Appendix B**, for the critical storm duration:

- Map B15 à 1% AEP Baseline PDAV
- Map B16 à 1% AEP D016 PDAV

Figure 18 shows the difference in difference in PDAV, for the 1% AEP critical storm duration.

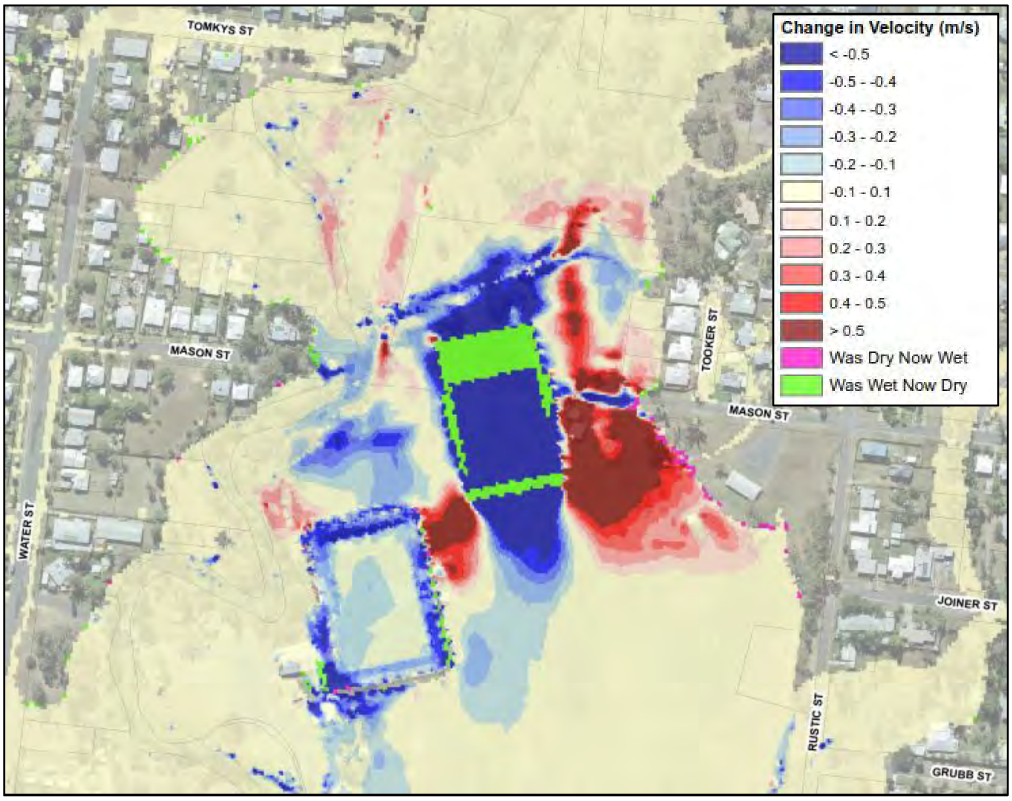

Figure 18 1% AEP 90 minute storm - D016 minus E2 (Baseline) Difference in Peak Depth Averaged Velocity

Review of the PDAV mapping attached in Appendix B shows:

- Generally PDAV is predicted to increase to the east and south of the new field, with an associated reduction predicted to the north and west of the complex.
- 1% AEP Baseline PDAV ranges from 1.2m/s to 1.6m/s at the proposed location of the new field.
- 1% AEP D016 PDAV reaches up to 2.2m/s in this same location.
- Assessment of erosion protection for new grassed swales and other disturbed areas has not been assessed. This should be investigated in more detail during a subsequent phase of the project using the velocity outputs provided in this report.

3.6 Hydraulic Model Development Summary

The following Developed Case scenarios have been simulated for the 1% AEP local catchment event, unless otherwise noted:

- **D010** à Proposed development of second field, as per Calibre Consulting project R15041 drawings (Rev 2) dated April 2016, with no mitigation works included.
- **D011** à As per D010 configuration, with the inclusion of a 30m grassed swale on the eastern side of the second field.
- **D012** à As per D011 configuration, with the addition of remediation works within Frenchmans Creek to the north and west of the existing field.
- **D013** à As per D012 configuration, with the addition of a concrete barrier around the existing field to provide 1% AEP local catchment flood immunity.
- **D014** à As per D010 configuration, with the inclusion of a 80m grassed swale on the eastern side of the second field.
- **D015** à As per D014 configuration, with the addition of a concrete barrier around the existing field to provide 1% AEP local catchment flood immunity.
- **D014a** à As per D014 configuration, with the removal of existing mound within the 80m grassed swale behind Tooker Street properties.
- **D015a** à As per D014a configuration, with the addition of a concrete barrier around the existing field to provide 1% AEP local catchment flood immunity.
- **D016** à Proposed second field moved 10m to the east, with the addition of a concrete barrier around the existing field to provide 2% AEP local catchment flood immunity (with no freeboard). Grassed swales provided on either side of new field, with removal of the existing mound behind Tooker Street properties and removal of the Mason Street road embankment (10m length).
  - Simulated for the 63% AEP, 39% AEP, 18% AEP, 10% AEP, 5% AEP, 2% AEP and 1% AEP critical duration local catchment event.

3.6.1 Key Findings

Analysis of the Developed Case modelling results reveals:

- Construction of the new field, with no mitigation works **(D010)**, increases flood heights by 75-150mm in the 1% AEP event within private properties along Tooker Street and Mason Street. Increased flood heights aren’t expected to affect any existing dwellings, and there is not expected to be a significant change in flood extent in the 1% AEP event.
- Inclusion of the open channel **(D011)** reduces impacts to the west of the new field but will not significantly benefit properties to the east (i.e. Tooker Street).
- Inclusion of significant excavation / clearing works within the creek **(D012)** doesn’t result in a significant further reduction when compared to D011 (open channel only). The works within the creek are expected to be very costly and will likely require significant environmental / cultural heritage approvals.

- Protection of the existing field for the 1% AEP event **(D013)** is expected to have significant hydraulic impacts, even with inclusion of the open channel and creek excavation / clearing works.
- For the **D014** 1% AEP event, the predicted private property flood impacts in the area between Tomkys Street and Mason Street has been reduced to less than 20mm. However, a predicted increase in PWSE of up to 52mm remains within Tooker Street private properties. An associated decrease in PWSE is predicted downstream of the new field.
- The (**D014a**) 1% AEP results show that further opening the 80m grassed swale has achieved RRC's desired result, where predicted impacts in private property are less than 20mm. There remains a predicted increase in PWSE adjacent to the new field and south of Mason Street; however these are located within Council owned land. An associated decrease in PWSE is predicted north of Tooker Street and downstream of the new field.
- As noted above, the **D015** and **D015a** scenarios were not modelled as the D014 and D014a configurations were sufficient to inform further mitigation option development.
- Results of the 1% AEP (**D016**) scenario (refer **Appendix B**) show predicted increases in PWSE are less than 20mm in private properties and are reduced in some cases, with the exception of two private properties south of Mason Street (western spur), where predicted increases in PWSE are up to 32mm. Increases in PWSE are reasonably well balanced on either side of the new field. The raised embankment around the existing field results in increased PWSE within the field area during the 1% AEP event. This is due to the embankment being raised only to 2% AEP. The predicted reduction in Tooker Street properties is likely due to opening up the road embankment.

4.0 Conclusion

4.1 Preferred Mitigation Option (D016)

As shown in Section 3.6 a number of Developed Case scenarios have been assessed, to assist Council understand the predicted flood impacts of the proposed Kalka Shades development, as well as the benefits of potential mitigation options.

Ultimately Council made the decision to progress with scenario D016 as the preferred Development configuration and flood mitigation strategy. The D016 Scenario includes:

- Proposed second field moved 10m to the east, with a minimum top of embankment elevation of 8.15mAHD to provide 1% AEP local catchment flood immunity. Provision for freeboard should be confirmed by RRC in the subsequent phase of the project.
- A concrete barrier around the existing field to provide 2% AEP local catchment flood immunity. A minimum top of barrier elevation of 7.8mAHD will be required. Freeboard has not been included to minimise afflux in larger magnitude flood events.
  - Table 3 shows the predicted PWSE upstream of the existing hockey field, for a range of historic local catchment flood events and the 1% AEP Fitzroy River design flood event. It can be seen that the proposed concrete barrier around the existing field is higher than all events shown.

Table 3 Predicted PWSE upstream of the existing hockey field (range of events)

Event	PWSE upstream of Existing Hockey Fields (mAHD)
Jan 2013 Local Catchment (Ex. TC Oswald)	7.54
Feb 2015 Local Catchment (TC Marcia)	7.70
Mar 2017 Local Catchment (Ex. TC Debbie)	7.47
1% AEP Fitzroy River Flood	7.70
Existing Field Raised Embankment	**7.80**

- Grassed swales provided on either side of the new field, with the following general arrangement (to be confirmed by the civil design consultant):
  - Eastern Channel à V-Drain shape; Depth at northern end = 600mm; Width = 45m to 70m; Longitudinal Grade = 0.5%; Excavation Volume = approximately 2,000m^3.
  - Western Channel à V-Drain shape; Depth at northern end = 500mm; Width = 30m to 40m; Longitudinal Grade = 0.3%; Excavation Volume = approximately 870m^3.
- Removal of the Mason Street road embankment (approximately 10m length).
- Removal of the existing cricket sheds on Mason Street.
- Removal of the existing power pole and overhead service line connected to the Mason Street cricket sheds.

The mapping attached in Appendix B shows the D016 scenario difference in PWSE and difference in PDAV across the range of events assessed. The mapping generally shows:

- Increased flood extents and flood depths during frequent events (63% AEP and 39% AEP) on the eastern side of the new field. This is due to the proposed grass swale and reduction of the high bank of the upstream Frenchmans Creek anabranch.
- Flood levels are predicted to reduce to the north and west of the existing and new fields, as a result of the additional flow through the proposed grassed swales. An associated general increase in PWSE is predicted to the east and south of the existing and new fields.

- Increases in PWSE are reasonably well balanced on either side of the new field, during the 1% AEP event. In the 1% AEP event, predicted increases in PWSE are less than 20mm in private property and are reduced in some cases, with the exception of two private properties south of Mason Street (western spur), where predicted increases in PWSE are up to 32mm.
- The raised embankment / flood wall within the existing field results in increased PWSE within the field area during the 1% AEP event. This is due to the embankment being raised only to 2% AEP.
- Generally PDAV is predicted to increase to the east and south of the new field, with an associated reduction predicted to the north and west of the complex.
- 1% AEP Baseline PDAV ranges from 1.2m/s to 1.6m/s at the proposed location of the new field. 1% AEP D016 PDAV reach up to 2.2m/s in this same location. Assessment of erosion protection for new grassed swales and other disturbed areas has not been assessed. This should be investigated in more detail during a subsequent phase of the project using the velocity outputs provided in this report.

4.2 Residual Project Risks

Although the proposed D016 configuration is predicted to offset the majority of flood impacts, there remain a number of residual risks arising from the project:

- The predicted flow velocity under the proposed clubhouse may result in pier scour, which has not been assessed at this stage. It is recommended a pier scour assessment be completed in subsequent stages of the project.
- It is assumed the proposed clubhouse floor level is above the 1% AEP Developed Case Local Catchment flood level, with allowance for freeboard. Should this not be the case, predicted flood impacts would likely increase.
- The current development drawings, at the time of this report, show the proposed clubhouse within the western grassed swale (D016 scenario only). It is likely that sediment and debris deposition will occur under building, increasing the requirement for maintenance.
- The predicted increase in velocity between the two fields may require scour protection for the raised embankments around the existing and proposed fields. It is recommended a scour assessment be completed in subsequent stages of the project.
- The proposed swales will cut into the high bank of the upstream Frenchmans Creek anabranch. This may trigger statutory approvals. This should be investigated by RRC.
- No assessment of creek bank stability has been undertaken, nor has the design of bank protection works where the proposed swales will cut through the high bank. It is recommended this be completed in subsequent stages of the project.
- Proposed grassed swales have flat longitudinal grades, which divert flows from the creek to the floodplain. Longitudinal grades can’t be increased due to the constraints posed by the existing cricket facilities downstream of the hockey fields. Accumulation of sediment and debris may occur within the swales and downstream of their discharge point, requiring additional maintenance after flood events.
- The existing cricket fields are predicted to be inundated more frequently due to the inclusion of the grassed swales. Council should undertake consultation with the Rockhampton Cricket Association regarding the potential need for more frequent maintenance.
- The peak flood depths adjacent to the existing field are up to 1.0m in the 2% AEP local catchment event. Existing openings in the field embankment, to allow access for emergency vehicles and ingress/egress to the field area, will need to be closed off via flood gates or the like.
- While it is likely there would be negligible impact to flood storage during Fitzroy River flood events, this has not been formally assessed at this stage of the project.
- Internal drainage within the existing and new hockey fields has not been assessed. Final sizing and configuration of internal drainage systems are to be assessed by others.

4.3 Recommendations

It is recommended that:

- The findings of this report be discussed with Rockhampton Hockey Association (RHA) and other key stakeholders (i.e. Rockhampton Cricket Association).
- RRC's / RHA's engineering consultant undertake the following works:
  - a pier scour assessment for the proposed clubhouse,
  - review the need for protection works for the raised field embankments,
  - review the need for erosion protection for new grassed swales and other disturbed areas,
  - assess creek bank stability and bank protection requirements where the grassed swales are proposed,
  - investigate statutory approval requirements associated with all proposed works,
  - undertake final design of internal drainage system.

5.0 References

Calibre Consulting project R15041 drawings (Rev 2) dated April 2016 (refer **Appendix A**).

Australian Rainfall and Runoff (2012). *Project 15 – Two Dimensional Modelling in Urban and Rural floodplains - Stage 1& 2 Report*. Available at: http://arr.ga.gov.au/, accessed 13 March 2017.

Institution of Engineers Australia (1998), Australian Rainfall and Runoff – A Guide to Flood Estimation, Volumes 1 and 2.

BMT WBM (2016), TUFLOW User manual – Build 2016-03-AE.

Rockhampton Regional Council (2017), Frenchmans Creek and Thozets Creek– Baseline Flood Study – Volume 1 Report, prepared by AECOM, 2017.

Appendix A

Calibre Consulting Drawings

calibre
CONSULTING

PROPOSED SYNTHETIC TURF HOCKEY FIELD

KALKA SHADES, NORTH ROCKHAMPTON, QLD

LOCALITY PLAN
LOT 1 ON LN2893
N.T.S

ROCKHAMPTON REGIONAL COUNCIL

DRAWING LIST

No.	TITLE DESCRIPTION
GENERAL	
000	COVER SHEET
001	GENERAL NOTES SHEET 1 OF 2
002	GENERAL NOTES SHEET 2 OF 2
003	EXISTING SITE PLAN
004	PROPOSED SITE PLAN
EARTHWORKS	
100	BULK EARTHWORKS PLAN
SITE WORKS	
200	PROPOSED FIELD LAYOUT PLAN
201	SITE SECTIONS PLAN
202	TYPICAL DETAILS PLAN
STORMWATER	
300	STORMWATER LAYOUT PLAN SHEET 1 OF 2
301	STORMWATER LAYOUT PLAN SHEET 2 OF 2
302	STORMWATER LONGSECTIONS PLAN
303	STORMWATER CALCULATIONS TABLE
304	STORMWATER DETAILS PLAN
WATER	
400	WATER RETICULATION LAYOUT PLAN
SERVICES	
500	ELECTRICAL LAYOUT PLAN
EROSION AND SEDIMENT CONTROL	
600	CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN
601	POST CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

PRELIMINARY

ROCKHAMPTON
HOCKEY

PROPOSED SYNTHETIC TURF HOCKEY FIELD
KALKA SHADES, NORTH ROCKHAMPTON, QLD

Project No.:	Milestone:	Drawing No.:	Revision:
R15041	DESIGN	000	2

GENERAL

1.1. EXISTING SERVICES

THE BUILDER SHALL ESTABLISH THE EXTENT AND LOCATION OF ALL EXISTING SERVICES WITHIN THE WORKS AREA. ALL SERVICES SHALL BE PROTECTED AGAINST ACCIDENTAL DAMAGE DURING THE CONSTRUCTION OF THE WORKS. THE BUILDER SHALL BE RESPONSIBLE FOR ALL COSTS INCURRED DUE TO DAMAGE TO EXISTING SERVICES.

2.0. AS-CONSTRUCTED INFORMATION

IF REQUIRED, THE BUILDER SHALL PROVIDE LEVELS AND DIMENSION INFORMATION SUITABLE TO CONFIRM TO THE SATISFACTION OF THE SUPERINTENDENT THAT THE WORKS HAVE BEEN CONSTRUCTED TO THE LEVELS AND DIMENSIONS SHOWN ON THE DRAWINGS. THE BUILDER SHALL PROVIDE ALL AS-CONSTRUCTED INFORMATION NECESSARY FOR THE PREPARATION OF THE AS-CONSTRUCTED PLANS SUITABLE FOR COUNCILS SATISFACTION.

THE MINIMUM INFORMATION REQUIREMENTS ARE AS FOLLOWS:

2.1. ROAD AND DRAINAGE;
2.2. LOCATIONS OF MANHOLES, GULLY PITS AND CULVERTS;
2.3. INVERT LEVELS OF INLET AND OUTLET PIPES AT MANHOLES AND GULLY PITS ON LAYOUT PLAN;
2.4. INVERT LEVELS OF CULVERTS AND INLETS AND OUTLETS;
2.5. TOP OF MANHOLE AND GULLY PIT LEVELS AT THE CENTRE POINT ON LAYOUT PLAN;
2.6. INDICATE ACTUAL PIPE SIZES, CLASSES AND GRADES ON THE LAYOUT PLAN;
2.7. LOCATIONS OF ALL SERVICES INCLUDING WHERE THEY CROSS THE ROADS (E.G. ELECTRICITY, WATER, SEWER, TELSTRA, DRAINAGE PIPES).
2.8. LOCATION OF ALL STREET LIGHTING POLES, ELECTRICITY SERVICE TURRETS AND ELECTRICAL CONDUITS (INCLUDING SIZE AND NUMBER);
2.9. ALL DIMENSIONS SHALL BE PROVIDED IN METRES CORRECT TO 2 DECIMAL PLACES. ALL LEVELS SHALL BE ON AUSTRALIAN HEIGHT DATUM (AHD) IN METRES CORRECT TO 3 DECIMAL PLACES;
2.10. THE TEST RESULTS FOR THE DEPTH OF EACH PAVEMENT LAYER. TEST RESULTS AND THE LEVEL CORRELATION SHEET FOR THE SUBGRADE AND BASE ARE TO BE SUBMITTED TO THE ENGINEER PRIOR TO THE COUNCIL INSPECTION;
2.11. QUALITY ASSURANCE TESTING RESULTS FOR THE PAVEMENT AND ASPHALT;
2.12. THE "AS CONSTRUCTED" INFORMATION FOR ROADWORKS AND DRAINAGE SHALL BE PROVIDED WITHIN FOURTEEN (14) DAYS ON COMPLETION OF ROADWORKS AND DRAINAGE.

3.0. INSPECTIONS

A MINIMUM OF 24 HOURS NOTICE OF ALL REQUIRED INSPECTIONS SHALL BE GIVEN BY THE BUILDER TO THE SUPERINTENDENT. THE PRINCIPAL REQUIRES INSPECTIONS AT THE FOLLOWING STAGES OF CONSTRUCTION.

3.1. ROADWORKS AND STORMWATER DRAINAGE
3.2. AT SUBGRADE LEVEL
3.3. SUB-BASE LEVEL PRIOR TO KERBING
3.4. BASE COURSE PRIOR TO PRIMING & ASPHALT
3.5. ALL STORMWATER PIPES PRIOR TO BACKFILLING
3.6. ANY WORKS REQUIRING PLACEMENT OF REINFORCING STEEL.

CHECK LEVELS AND TESTING RESULTS WILL BE REQUIRED PRIOR TO INSPECTIONS WHERE APPLICABLE.

EARTHWORKS AND ROADWORKS

1.0. EARTHWORKS

1.1. TOPSOIL

THE BUILDER SHALL STRIP TOPSOIL FROM THE WHOLE OF THE EARTHWORKS AREA INCLUDING ANY AREAS OF ALLOTMENT FILL TO A DEPTH OF MINIMUM 100mm OR AS DIRECTED BY THE SUPERINTENDENT AND STOCKPILE IT IN THE NOMINATED STOCKPILE AREA PRIOR TO COMMENCING BULK EARTHWORKS. THE BUILDER SHALL BE REQUIRED TO CARRY OUT TEMPORARY STABILISING MEASURES TO MINIMISE THE TRANSPORTATION OF AIRBORNE MATERIAL THAT MAY CAUSE NUISANCE TO NEIGHBOURING PROPERTIES.

1.2. PAVEMENT BOX

THE BUILDER SHALL INITIALLY CONSTRUCT THE EARTHWORKS TO THE LEVEL OF THE UNDERSIDE OF THE PAVEMENT BOX AS SHOWN ON THE DRAWINGS. THE FOOTPATHS SHALL BE EXCAVATED AND OR FILLED TO THE LEVELS SHOWN ON THE DRAWINGS.

1.3. BULK FILLING

1.3.1. ROADS

PRIOR TO ANY FILLING THE AREA TO BE FILLED SHALL BE PROOF ROLLED BY FOUR PASSES OF A 10 TONNE MINIMUM STATIC MASS ROLLER. THE FINAL PASS SHALL BE TREATED AS TEST ROLLING IN ACCORDANCE WITH TESTING CLAUSE 5.4 OF AS 3798 WITH INSPECTION CARRIED OUT BY THE APPROVED GEOTECHNICAL TESTING AUTHORITY OR THE SUPERINTENDENT. THE COST OF PROOF AND TEST ROLLING SHALL BE DEEMED TO BE INCLUDED IN THE CONTRACT LUMP SUM. FILLING SHALL BE PLACED IN LAYERS OF NOT MORE THAN 200mm LOOSE THICKNESS AND COMPACTED TO A MINIMUM STANDARD MAXIMUM DRY DENSITY AS DETERMINED BY AS 1289, E1.1 AND SPECIFIED IN THIS SPECIFICATION. TEST FREQUENCY SHALL BE AS STATED IN THE QUALITY ASSURANCE TESTING TABLE A. AT ALL TIMES DURING BULK EARTHWORKS THE BUILDER SHALL ENSURE THAT THE WORKS ARE KEPT IN A STATE SO AS NOT TO ALLOW PONDING ON THE WORKS OR EROSION FROM THE WORKS IN THE EVENT OF RAIN. THE MOISTURE CONTENT OF THE FILL SHALL BE MAINTAINED AS CLOSE AS IS PRACTICAL TO OPTIMUM MOISTURE CONTENT DURING THE COMPACTION OF THE FILL.

1.3.2. BUILDING PADS

THE BUILDER SHALL BE REQUIRED TO PROVIDE CERTIFICATION THAT FILL DEEPER THAN 300mm PLACED ON THE BUILDING PAD HAS BEEN SUPERVISED IN ACCORDANCE WITH LEVEL 1 AS DEFINED BY AS3798. CERTIFICATION SHALL STATE THAT FILL IS SIMILAR TO THAT DEFINED IN SECTION 6.1.2 OF AS2870.1 AND CAN THUS BE CLASSIFIED AS "CONTROLLED FILL".

THE TESTING STRATEGY SHALL BE DEVELOPED IN ACCORDANCE WITH SECTION 8 OF AS3798 AND REQUIRES APPROVAL FROM THE SUPERINTENDENT PRIOR TO COMMENCEMENT OF FILLING. EVERY FIELD DENSITY TEST SHALL BE IDENTIFIED BY LOCATION AND LEVEL.

PAYMENT FOR GEOTECHNICAL TESTING ASSOCIATED WITH ALLOTMENT FILLING CERTIFICATION SHALL BE DEEMED TO BE INCLUDED IN THE TENDERED PRICE FOR EARTHWORKS.

1.4. DUST CONTROL

THE BUILDER SHALL ENSURE THAT DUST RESULTING FROM THE EARTHWORKS OPERATIONS IS KEPT TO A MINIMUM BY THE APPLICATION OF WATER TO THE WORKS AREA OR BY OTHER APPROVED METHODS AS DIRECTED BY THE SUPERINTENDENT DURING ALL PERIODS OF CONSTRUCTION.

1.5. WATER FOR CONSTRUCTION PURPOSES

THE PRINCIPAL SHALL NOT SUPPLY WATER FOR USE IN CONSTRUCTION OF THE WORKS. THE BUILDER SHALL MAKE HIS OWN ARRANGEMENTS FOR OBTAINING WATER FOR THESE PURPOSES. WATER CAN BE PURCHASED FROM ROCKHAMPTON REGIONAL COUNCIL WITH PRIOR CONSENT.

1.6. REPLACEMENT OF UNSOUND MATERIAL

IF DURING PROOF ROLLING OF THE FILL AREAS OR IN THE CONSTRUCTION OF CUTS, UNSOUND OR UNSUITABLE MATERIAL IS ENCOUNTERED WHICH IN THE OPINION OF THE SUPERINTENDENT IS NOT SUITABLE FOR INCLUSION IN THE FILL, THE BUILDER SHALL EXCAVATE AND REMOVE TO SPOIL AS DIRECTED ON SITE SUCH UNSUITABLE MATERIAL. THE BUILDER SHALL THEN REPLACE THE UNSOUND MATERIAL WITH SUITABLE MATERIAL DRAWN FROM THE CUTTING OPERATION ON SITE (IF AVAILABLE), OR FROM A SUITABLE SUPPLIER (MIN. CBR 15).

1.7. REPLACEMENT OF TOPSOIL

AT THE COMPLETION OF THE BULK EARTHWORKS, ROADWORKS AND SERVICES INSTALLATION AND FOLLOWING APPROVAL OF THE FINISHED SURFACE OF FOOTPATHS AND OTHER FILLED AREAS, THE BUILDER SHALL LIGHTLY TYNE UP THE FILL SURFACE AND REPLACES THE STOCKPILED TOPSOIL IN THE AREAS NOMINATED BY THE SUPERINTENDENT.

THE FINISHED SURFACE OF THE TOPSOIL SHALL BE LIGHTLY STATIC ROLLED AND WATERED TO PRODUCE AN EVEN SURFACE SUITABLE FOR SEEDING AND FERTILISING.

2.0. PAVEMENT

GRAVEL QUANTITIES ARE BASED ON AN ASSUMED THICKNESS OF PAVEMENT. THE ACTUAL THICKNESS WILL BE DIRECTED BY THE SUPERINTENDENT FOLLOWING RECEIPT OF SUBGRADE TESTING. THE QUANTITIES SHOWN MAY BE VARIED BY THE SUPERINTENDENT, BY REDUCING, INCREASING OR OMITTING ANY GRAVEL QUANTITY. PAYMENT WILL BE MADE AT THE RELEVANT RATES IN THE PRICED BILL OF QUANTITIES ON THE CALCULATED QUANTITIES BASED ON DESIGN THICKNESS DETERMINED AFTER SUBGRADE TESTING.

2.1. PAVEMENT MATERIAL

THE PAVEMENT MATERIAL SHALL BE WELL GRADED AND CONTAIN NO ORGANIC MATTER. ALL PAVEMENT MATERIAL MUST BE APPROVED BY THE ENGINEER PRIOR TO PLACEMENT. TEST RESULTS SHALL BE MADE AVAILABLE TO PROVE COMPLIANCE WITH THIS SPECIFICATION. THE BASE COURSE MATERIAL SHALL BE MR TYPE 2.1 AND THE SUB-BASE COURSE MATERIAL SHALL BE MR TYPE 2.3, OR 2.5 AS DEEMED IN THE PAVEMENT DESIGN

2.2. SERVICES

NO PAVING MATERIAL SHALL BE PLACED IN AN AREA UNTIL ALL SERVICE CONDUITS, DRAINAGE PIPES, WATER AND SEWERAGE ROAD CROSSING HAVE BEEN COMPLETED, TESTED AND BACKFILLED UNLESS APPROVED BY THE SUPERINTENDENT.

2.3. PAVEMENT COMPACTION

THE MINIMUM COMPACTION TEST REQUIREMENTS SHALL BE AS FOLLOWS:

AREA	MINIMUM COMPACTION REQUIREMENTS
BUILDING PADS	95%
SUBGRADE STANDARD	100%
SUB-BASE STANDARD	100%
BASE STANDARD	100%

2.4. PROOF ROLLING

AFTER COMPACTION OF THE SUBGRADE IS COMPLETED, THE SUBGRADE SHALL BE PROOF ROLLED IN THE PRESENCE OF THE ENGINEER/SUPERINTENDENT IF REQUIRED AND ANY AREAS OF UNSUITABLE MATERIAL SHALL BE REMOVED AS DIRECTED.

2.5. TOLERANCES

THE TOLERANCE REQUIREMENTS ON THE FINISHED SURFACE LEVEL OF ROADS AND KERB AND CHANNEL SHALL BE AS FOLLOWS:

SUBGRADE SURFACE:	+0mm TO -25mm
PAVEMENT THICKNESS:	+20mm TO -10mm
WEARING COURSE THICKNESS:	+10mm TO -0mm

FINISHED SURFACE
A) HORIZONTAL ALIGNMENT: ±50mm

B) VERTICAL/GEOMETRIC TOLERANCE
i) PRIMARY TOLERANCE: ±5mm
ii) DEVIATION FROM 3m STRAIGHT EDGE: ±5mm
iii) CROSSFALL: ±0.2%
IV) RATE OF CHANGE OF CROSSFALL: ±0.02% PER METRE.

KERB & CHANNEL DESIRABLE MINIMUM GRADE: 0.5%
KERB & CHANNEL ABSOLUTE MINIMUM GRADE: 0.25%
KERB & CHANNEL MAXIMUM PONDING DEPTH: 5mm

3.0. CONCRETE WORK

3.1. GENERAL

CONCRETE WORK NOT SPECIFICALLY COVERED IN THIS JOB SPECIFICATION SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE RELEVANT DRAWINGS AND/OR LOCAL AUTHORITY STANDARDS.

3.2. CAST INSITU

ALL CAST INSITU CONCRETE WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE RELEVANT AUSTRALIAN STANDARDS.

3.3. CONCRETE STRENGTH

ALL CONCRETE WORK SHALL BE CLASS N32 UNLESS OTHERWISE SPECIFIED.

4.0 JUNCTION WITH EXISTING ROADS

WHERE WORK UNDER THIS CONTRACT ABUTS THE EXISTING SURFACES, THE CONNECTION SHALL BE NEAT, SMOOTH AND WORKMANLIKE AND TO THE ENGINEER'S SATISFACTION. THE GRADING AND LEVELS AT SUCH JUNCTIONS AS SHOWN ON THE DRAWINGS ARE INDICATIVE ONLY AND SHALL BE CHANGED TO SUIT THE ACTUAL CONDITIONS IF AND AS MAY BE DIRECTED BY THE ENGINEER DURING CONSTRUCTION AND TO COUNCIL'S SATISFACTION.

5.0. TESTING

IN GENERAL TESTING WILL BE REQUIRED TO BE CARRIED OUT IN ACCORDANCE WITH THE ATTACHED TABLE A.

PRELIMINARY

REVISION	DATE	ISSUE DESCRIPTION	DRAWN	DESIGNED	CHECKED
1	01/2015	PRELIMINARY	PL	CS	CS
2	04/2016	FOR CO-ORDINATION	PL	JA	CS

CLIENT
ROCKHAMPTON HOCKEY ASSOCIATION

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ROCKHAMPTON SINGAPORE SUNSHINE COAST SYDNEY

PROJECT
PROPOSED SYNTHETIC TURF HOCKEY FIELD

KALKA SHADES, NORTH ROCKHAMPTON, QLD

PRELIMINARY
NOT FOR CONSTRUCTION PURPOSES

DRAWING TITLE
GENERAL NOTES SHEET 1 OF 2

PROJECT No.	DRAWING No.	REVISION
R15041	001	2

STORMWATER DRAINAGE

1.1. PIPES

ALL PIPES SHALL BE PRECAST CONCRETE PIPE MANUFACTURED TO COMPLY WITH AS4058:1992 OR FIBRE REINFORCED CONCRETE PIPES TO COMPLY WITH AS4139. ALL PRECAST CONCRETE PIPES SHALL BE CLASS 2 UNLESS NOTED OTHERWISE ON THE DRAWINGS. ALL PIPES SHALL HAVE FLUSH JOINTS AND BE INSTALLED WITH EXTERNAL RUBBER BANDS UNLESS NOTED OTHERWISE ON THE DRAWINGS.

ALL POLYVINYL CHLORIDE (UPVC) PIPES AND FITTINGS TO COMPLY WITH AS 1254, AS/NZS 1260, AS 1273, AS/NZS 1477, AS/NZS 2179.2 AND AS 2032.

ALL PIPES INSTALLED SHALL BE NEW AND FREE FROM ANY DAMAGE.

2.0. EXCAVATION AND BACKFILLING

THE PIPE TRENCHES SHALL BE EXCAVATED TO ALLOW A MINIMUM 100MM OF APPROVED BEDDING TO THE BOTTOM AND ALL SIDE AND TOP OF THE PIPE. ALL BEDDING, SURROUNDS, AND BACKFILL MATERIAL SHALL BE COMPACTED IN MAXIMUM 150MM LAYERS AND A MINIMUM 95% MAXIMUM DRY DENSITY AS DETERMINED BY AS 1289 E.1.1 OR DENSITY INDEX OF MINIMUM 70% AS DETERMINED BY AS 1289 E.G.1. ALL BACKFILL UNDER ROAD PAVEMENTS SHALL HAVE A MINIMUM OF 97% MAXIMUM DRY DENSITY AS DETERMINED BY AS 1289 E.1.1.

3.0. LAYING AND JOINTING

PIPE LAYING SHALL BEGIN AT THE DOWN STREAM END OF THE LINE WITH THE GROOVED ENDS OF THE PIPE FACING UPSTREAM. THE END OF THE PIPE SHALL BE CLEANED PRIOR TO THE INSTALLATION OF THE EXTERNAL RUBBER BAND. LIFTING HOLES IN PIPES SHALL BE SECURELY PLUGGED WITH MANUFACTURER PLUGS OR DRY PACK MORTAR PRIOR TO BACKFILLING. ALL DRAINAGE LINES SHALL BE CONSTRUCTED WITH A TOLERANCE OF ± 15mm IN LINE AND LEVEL FROM THE ALIGNMENT SHOWN ON THE DRAWINGS OVER ANY 30m LENGTH. ALL PIPES MUST FALL IN THE REQUIRED DIRECTION.

4.0. CONCRETE WORK

CONCRETE WORK, SIDE DRAINS, SEEPAGE DRAINS, AND OTHER ITEMS NOT SPECIFICALLY COVERED IN THIS JOBS SPECIFICATION SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE RELEVANT DRAWINGS AND/OR ATTACHED SPECIFICATION. SIDE DRAINS AND SEEPAGE DRAINS SHALL BE CONSTRUCTED WHERE SHOWN ON THE DRAWINGS OR WHERE DIRECTED BY THE SUPERINTENDENT.

4.1. CAST INSITU

ALL CAST INSITU CONCRETE WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE RELEVANT AUSTRALIAN STANDARDS. NOTWITHSTANDING ANYTHING TO THE CONTRARY, NO SEPARATE PAYMENT WILL BE MADE FOR REINFORCING STEEL AND THE COST SHALL BE DEEMED TO BE INCLUDED IN THE VARIOUS CONCRETE ITEMS.

ALL CONCRETE WORK SHALL BE CLASS N32 UNLESS OTHERWISE SPECIFIED.

5.0. INLETS

ALL ROAD GULLIES SHALL BE PRECAST CONCRETE PITS OR APPROVED EQUIVALENT AND SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS' SPECIFICATIONS. ANY INSITU CONCRETE WORK SHALL COMPLY WITH AS3600.

ALL FIELD GULLIES SHALL BE INSTALLED IN ACCORDANCE WITH THE DRAWINGS AND THE MANUFACTURERS' SPECIFICATIONS. ANY INSITU CONCRETE WORK SHALL COMPLY WITH AS3600.

6.0. KERB AND CHANNEL

ALL KERB AND CHANNEL SHALL BE INSTALLED WITH AN APPROVED SLIP FORM EXTRUDER TO THE SATISFACTION OF THE SUPERINTENDENT. THE KERB AND CHANNEL PROFILE AND OTHER KERB ONLY PROFILES SHALL COMPLY WITH THE DRAWINGS. THE EXTRUDED PROFILE SHALL HAVE TOOLED JOINTS AT MAXIMUM 5.0M CENTRES. ALL KERB AND CHANNEL SHALL BE SUBJECTED TO A WATER TEST WITHIN 24 HOURS OF PLACEMENT AND ANY SECTION PONDING GREATER THAN 5mm 20 MINUTES AFTER TESTING SHALL BE RECTIFIED IN AN APPROVED MANNER AND THE COST SHALL BE BORNE BY THE BUILDER. ALL WATER TESTING SHALL BE IN THE PRESENCE OF THE ENGINEER.

QUALITY ASSURANCE TESTING
TABLE A:

SUBGRADE

FIELD DENSITY
1 TEST PER 75m OF ROADWAY OR AS NOMINATED BY THE ENGINEER.
SOAKED CBR
1 ON EACH REPRESENTATIVE SAMPLE AS DIRECTED BY THE ENGINEER.
PREPARATION
INSPECTION AND APPROVAL BY ENGINEER PRIOR TO COMMENCEMENT OF PAVING.
SURVEY LEVELS
PROVIDED BY BUILDER AT DESIGN CHAINAGES PRIOR TO JOINT COUNCIL AND ENGINEER INSPECTION.

SUB-BASE

PARTICLE SIZE DISTRIBUTION
1 NO REQUIRED OF COMPACTED SAMPLE IF REQUESTED.
DISTRIBUTION
SAMPLE IF REQUESTED.
ATTERBERG LIMITS
1 NO REQUIRED OF COMPACTED SAMPLE IF REQUESTED.
SOAKED CBR1
1 PER SOURCE.
FIELD DENSITY
1 TEST PER 75m OF ROADWAY OR AS NOMINATED BY THE ENGINEER.
CONFIRMATION OF INSITU COMPACTED DEPTH BY LEVEL SURVEY PROVIDED BY THE BUILDER AT DESIGN CHAINAGES PRIOR TO INSPECTION BY ENGINEER.

BASE

PARTICLE SIZE DISTRIBUTION
1 NO REQUIRED OF COMPACTED SAMPLE IF REQUESTED.
ATTERBERG LIMITS
1 NO REQUIRED OF COMPACTED SAMPLE IF REQUESTED.
SOAKED CBR
1 PER SOURCE.
FIELD DENSITY
1 TEST PER 75m OF ROADWAY OR AS NOMINATED BY THE ENGINEER.
CONFIRMATION OF INSITU COMPACTED DEPTH BY LEVEL SURVEYPROVIDED BY THE BUILDER AT DESIGN CHAINAGES PRIOR TO INSPECTION BY ENGINEER.

BUILDING PAD

COMPACTION FIELD DENSITY TEST WITH LEVEL 1 SUPERVISION AS DEFINED IN AS 3798-1990 TESTING FREQUENCY AS DETERMINED BY AS 3798-1990 SECTION 8, BUT GENERALLY 1 PER 200mm LAYER OF 200M3 BY APPROVAL OF ENGINEER.

ASPHALT TESTS BY MANUFACTURER
AGGREGATE GRADING
BITUMEN CONTENT
COMPACTED DENSITY
MAXIMUM DENSITY
STABILITY
FLOW
STIFFNESS
VOIDS IN AGGREGATE
VOIDS FILLED
1 SERIES OF TESTS PER 1000m3 LAID.

STORMWATER

SAND BEDDING, ALIGNMENT AND LEVEL INSPECTION AND APPROVAL BY SUPERINTENDENT OF BEDDING AND LAYING OF STORMWATER PIPE. LEVELS SUPPLIED BY BUILDER AND APPROVED BY SUPERINTENDENT.

TRENCH BACKFILL

1 FIELD DENSITY TEST PER SECTION OF TRENCH.
AS-CONSTRUCTED SURVEY INFORMATION TO THE APPROVED OF THE SUPERINTENDENT.

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PROJECT
PROPOSED SYNTHETIC TURF HOCKEY FIELD
KALKA SHADES, NORTH ROCKHAMPTON, QLD

PRELIMINARY
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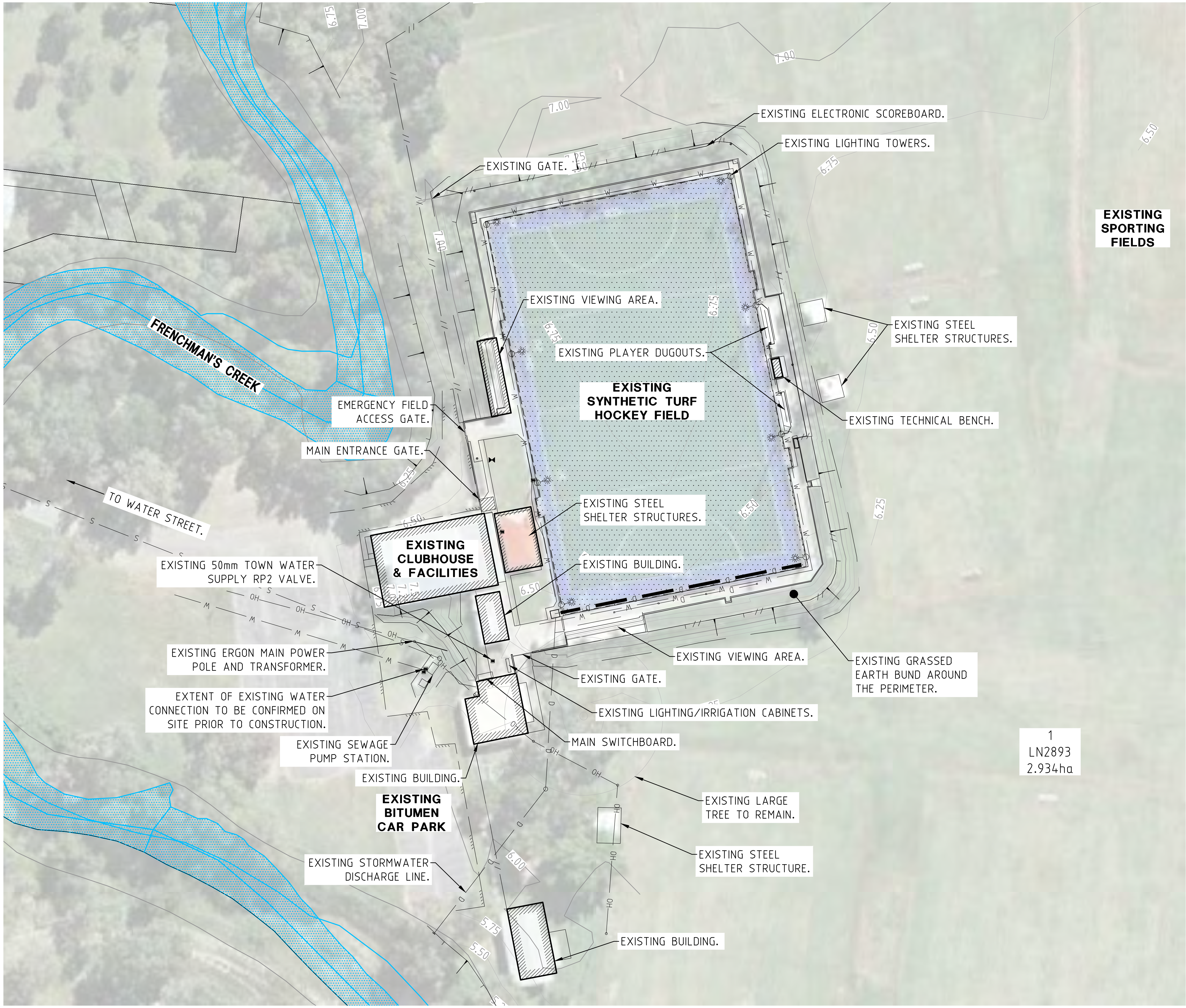
DRAWING TITLE
GENERAL NOTES
SHEET 2 OF 2

PROJECT No.	DRAWING No.	REVISION
R15041	002	2



N

LEGEND

═══════	EXISTING KERB AND CHANNEL
—— // ——	EXISTING CHAINWIRE FENCE
—— W ——	EXISTING WATER MAIN
—●— S ——	EXISTING SEWER & MANHOLE
—— D ——	EXISTING STORMWATER LINE
—— OH ——	EXISTING OVERHEAD ELECTRICAL
▨	EXISTING EDGE OF BUILDING
——┬——┬——	TOP OF BATTER
—— ——	TOE OF BATTER
▨	EXISTING WATERCOURSE
—— 7.00 ——	EXISTING CONTOURS
○	EXISTING TREE

NOTES

1. ALL BATTERS TO BE 1 ON 4 MAX UNLESS OTHERWISE SPECIFIED.
2. THE CONTRACTOR SHALL ESTABLISH THE EXTENT AND LOCATION OF ALL EXISTING SERVICES WITHIN OR ADJACENT TO THE WORKS AREA. ALL SERVICES SHALL BE PROTECTED AGAINST ACCIDENTAL DAMAGE DURING CONSTRUCTION OF THE WORKS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS INCURRED BY DAMAGE TO EXISTING SERVICES.

PRELIMINARY

0 2.5 10.0m
0 5.0 20.0m
1:500 (A1)
1:1000 (A3)

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PROJECT
PROPOSED SYNTHETIC TURF HOCKEY FIELD

KALKA SHADES, NORTH ROCKHAMPTON, QLD

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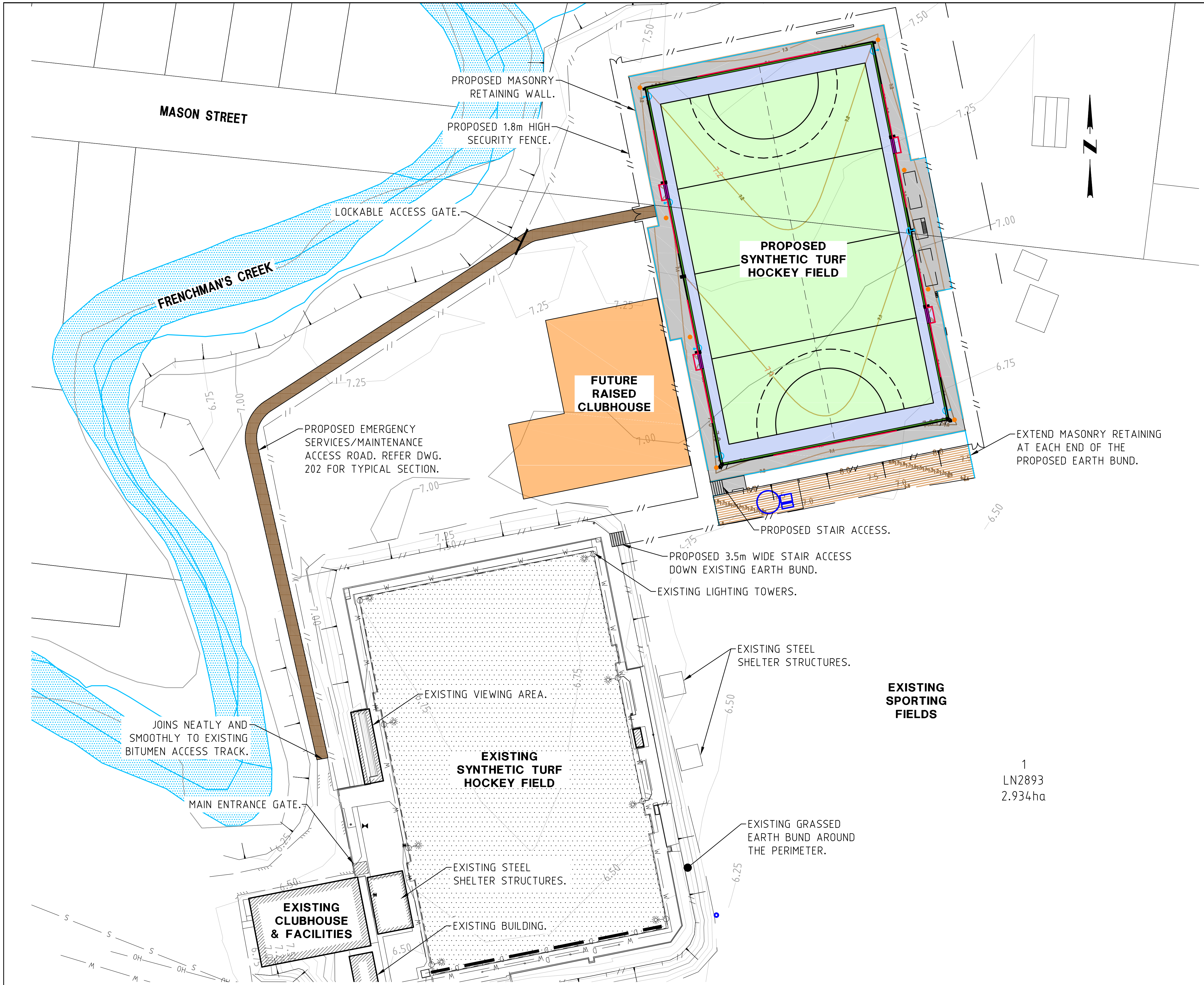
DRAWING TITLE
EXISTING SITE PLAN

PROJECT No.	DRAWING No.	REVISION
R15041	003	2



LEGEND

▬	PROPOSED BARRIER KERB & CHANNEL
▬	PROPOSED INVERT
⊥	TOP OF BATTER
⊤	TOE OF BATTER
―	PROPOSED CONCRETE BOUNDARY BARRIER
―	PROPOSED BUND RETAINING WALL
🟫	PROPOSED CONCRETE AREA
🟩	PROPOSED SYNTHETIC TURF PLAYING FIELD
🟦	PROPOSED SYNTHETIC TURF RUNOFF AREA
⚲	PROPOSED IRRIGATION WATER CANNON
●	PROPOSED LIGHTING TOWER
▨	EXISTING WATERCOURSE
7.00	EXISTING CONTOURS
7.00	PROPOSED CONTOURS

NOTES

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4. ALL PROVIDED LEVELS ARE TO THE FINISHED ASPHALT SURFACE OR LIP OF KERB.

PRELIMINARY

0 2.5 10.0m
0 5.0 20.0m
1:500 (A1)
1:1000 (A3)

REVISION	DATE	ISSUE DESCRIPTION	DRAWN	DESIGNED	CHECKED
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PROPOSED SYNTHETIC TURF HOCKEY FIELD

KALKA SHADES, NORTH ROCKHAMPTON, QLD

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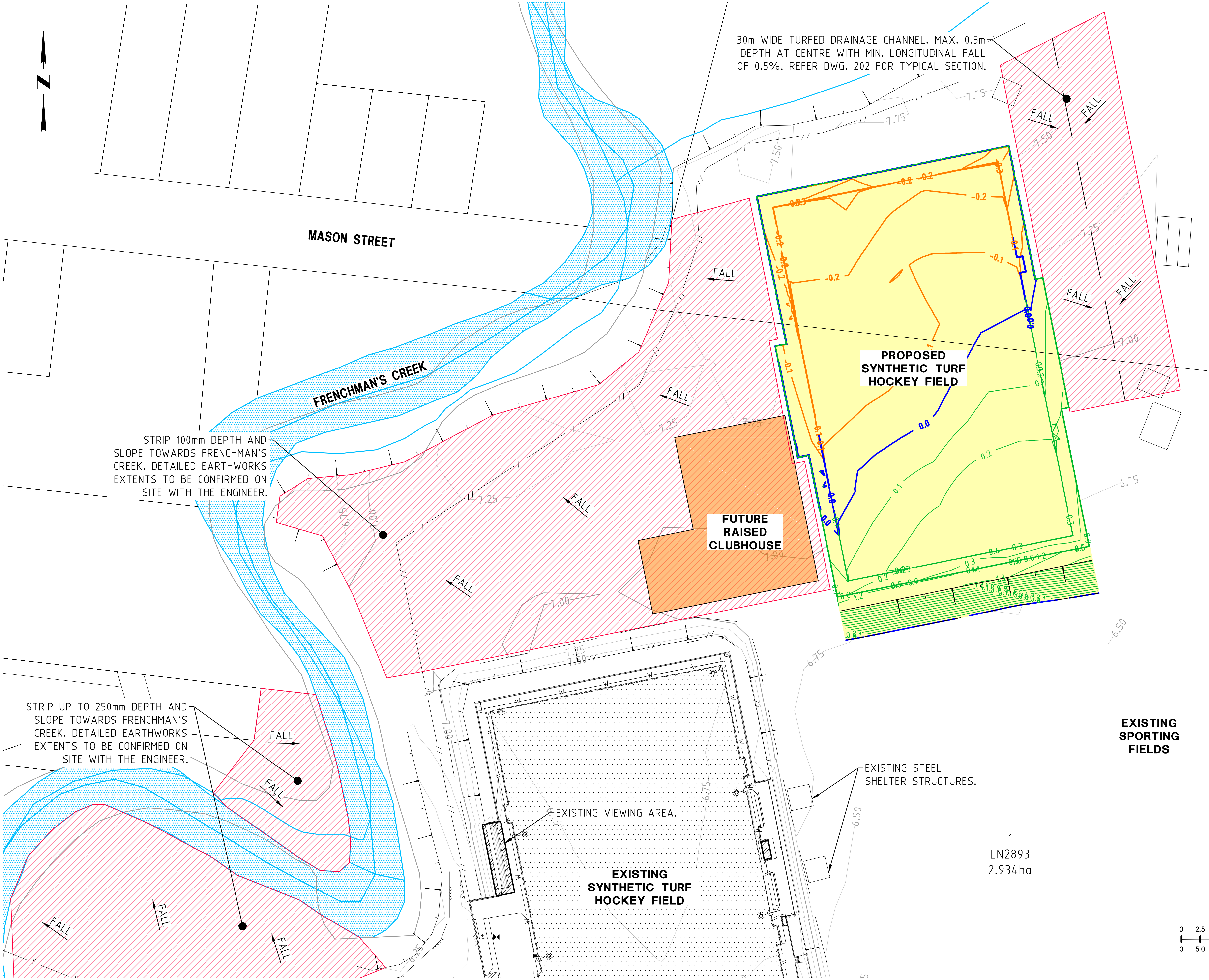
DRAWING TITLE
PROPOSED SITE PLAN

PROJECT No. R15041
DRAWING No. 004
REVISION 2



LEGEND

┬	TOP OF BATTER
┴	TOE OF BATTER
▨	EXISTING WATERCOURSE
🟨	PROPOSED FIELD WORKS AREA
🟥	EXTERNAL REMEDIATION EARTHWORKS
0.0	BALANCE CONTOURS
1.0	FILL CONTOURS
-1.0	CUT CONTOURS
7.00	EXISTING CONTOURS

NOTES

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PRELIMINARY

0 2.5 10.0m 1:500 (A1)
0 5.0 20.0m 1:1000 (A3)

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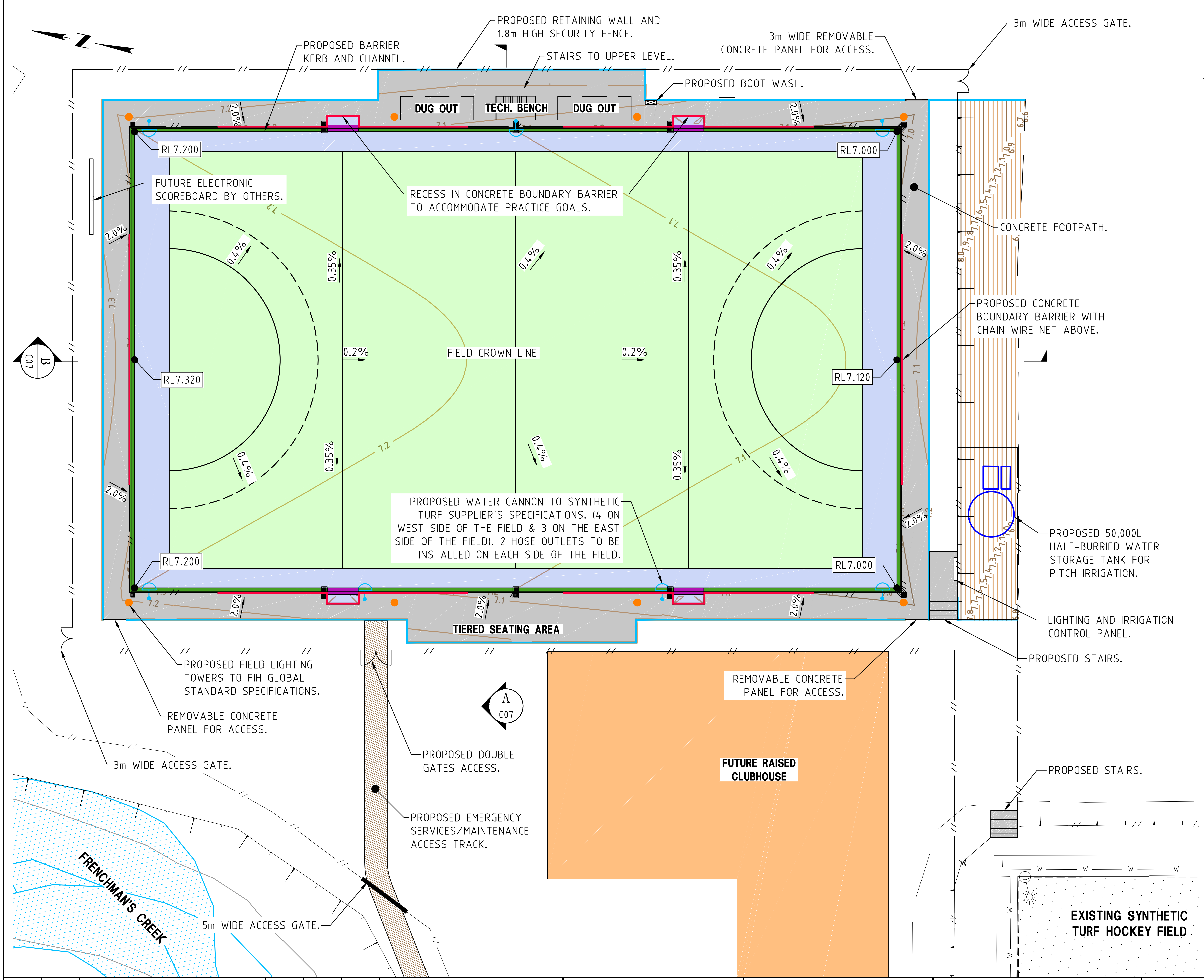
DRAWING TITLE

BULK EARTHWORKS PLAN

PROJECT No.	DRAWING No.	REVISION
R15041	100	2



LEGEND

🟩	PROPOSED BARRIER KERB & CHANNEL
🟪	PROPOSED INVERT
—//—	PROPOSED 1.8m HIGH SECURITY FENCE
┴	TOP OF BATTER
— —	TOE OF BATTER
🟥	PROPOSED CONCRETE BOUNDARY BARRIER
🟦	PROPOSED BUND RETAINING WALL
⍑	PROPOSED IRRIGATION WATER CANNON
●	PROPOSED LIGHTING TOWER
RL7.000 ●	DESIGN SURFACE LEVEL
▨	PROPOSED CONCRETE AREA
🟩	PROPOSED SYNTHETIC TURF PLAYING FIELD
🟦	PROPOSED SYNTHETIC TURF RUNOFF AREA
▨	EXISTING WATERCOURSE
7.00	PROPOSED CONTOURS

NOTES

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PRELIMINARY

0 1.25 5.0m
0 2.5 10.0m
1:250 (A1)
1:500 (A3)

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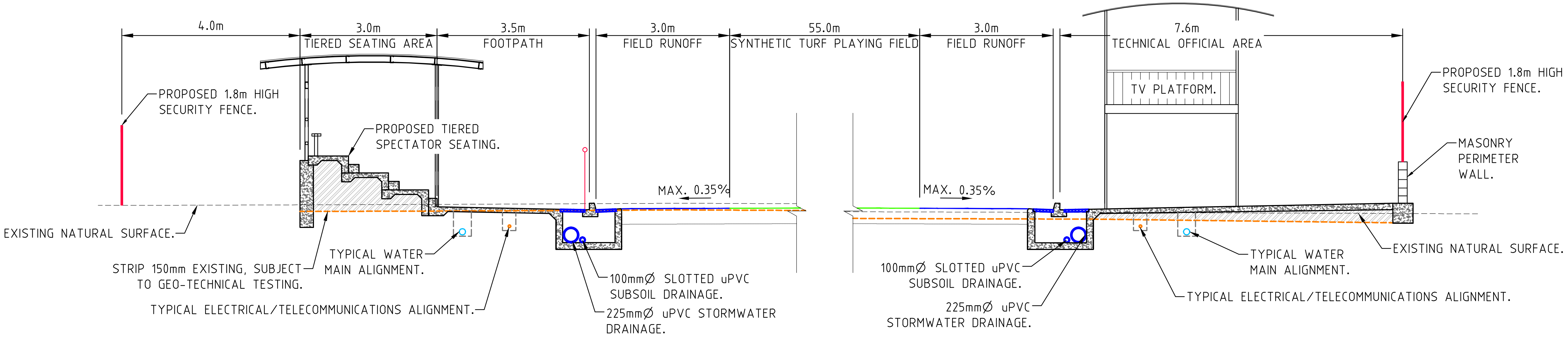
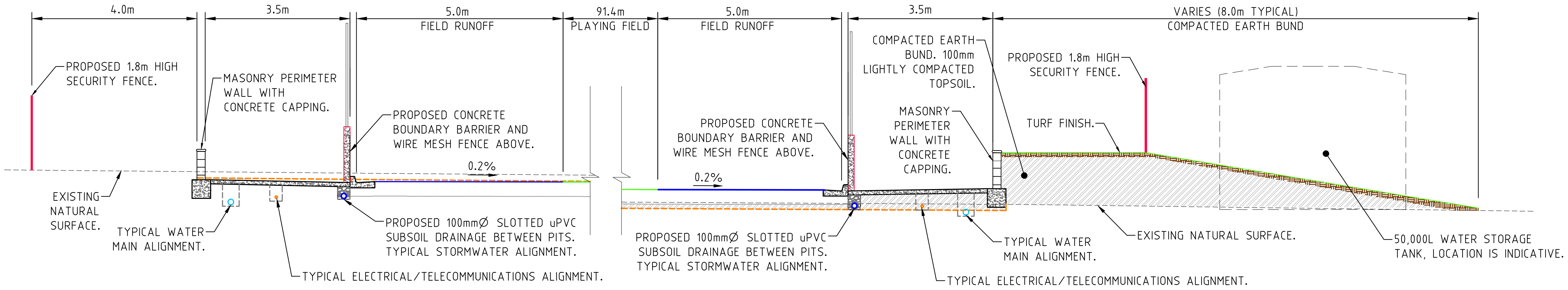
DRAWING TITLE
PROPOSED FIELD LAYOUT PLAN

PROJECT No.	DRAWING No.	REVISION
R15041	200	2



TYPICAL SECTION A-A
SCALE 1:100 (A3)



TYPICAL SECTION B-B
SCALE 1:100 (A3)

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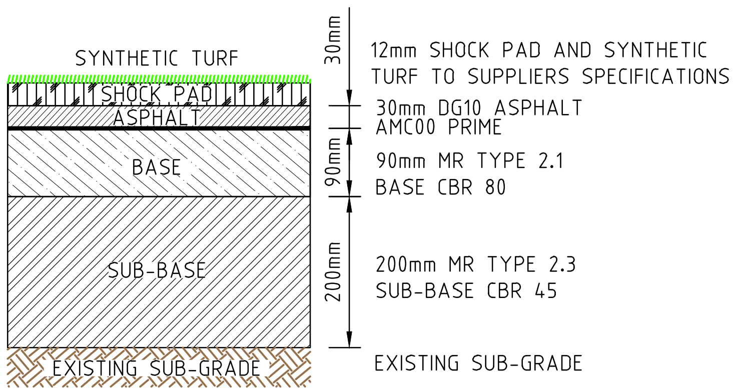
DRAWING TITLE
SITE SECTIONS PLAN

PROJECT No.	DRAWING No.	REVISION
R15041	201	2



TYPICAL PAVEMENT DETAIL

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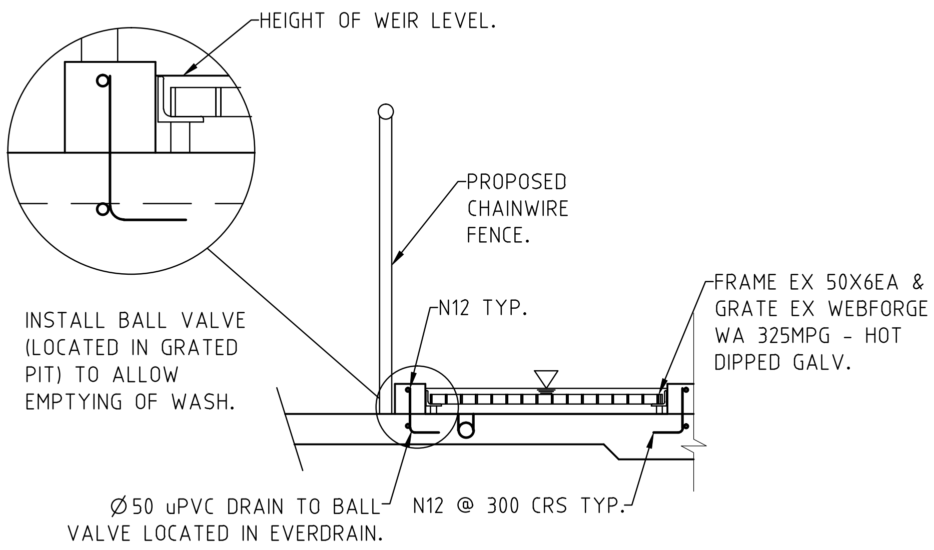

TYPICAL SECTION THRU BOOT WASH

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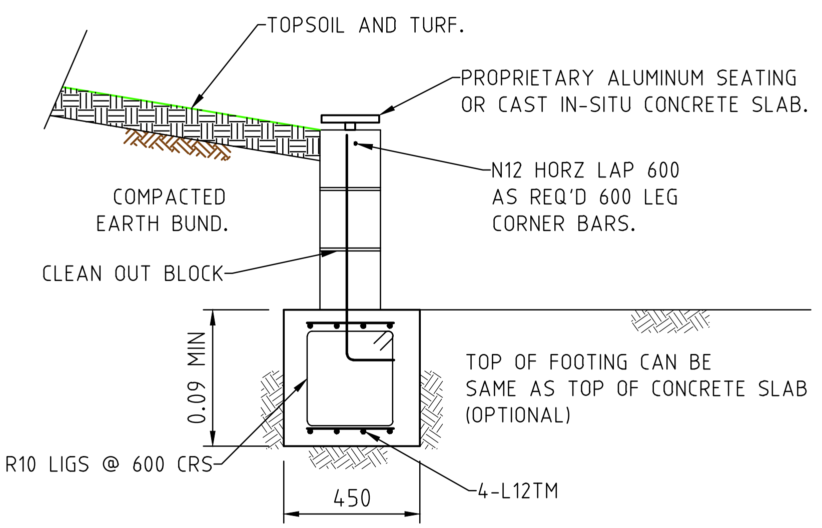

TYPICAL BUND WALL DETAIL

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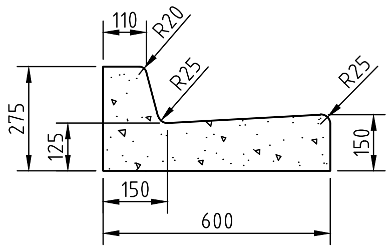
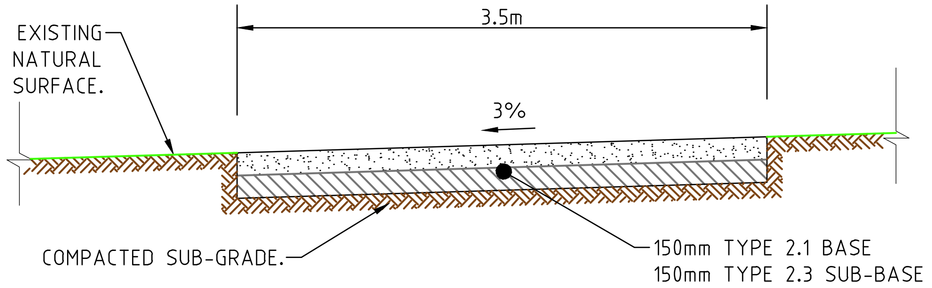


BARRIER KERB & CHANNEL DETAIL

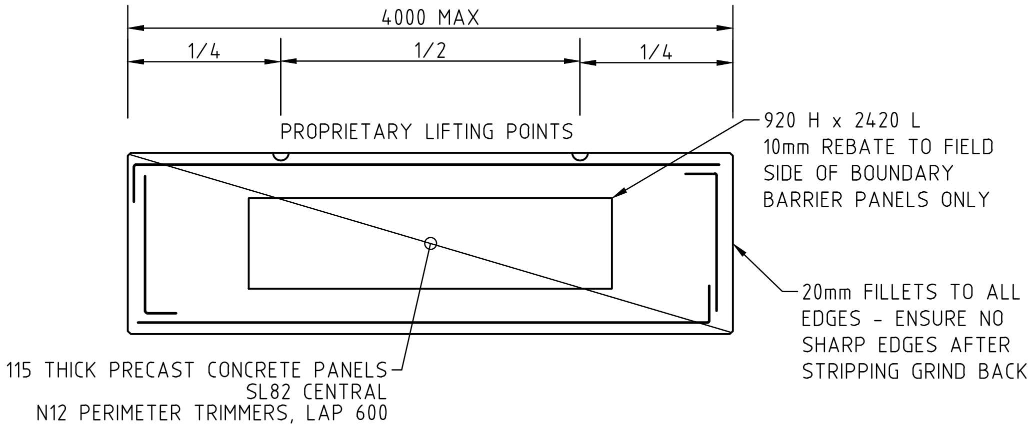
SCALE 1:20 (A3)



EMERGENCY SERVICES/MAINTENANCE ACCESS TRACK

TYPICAL SECTION

SCALE 1:50 (A3)



TYPICAL PRECAST CONCRETE PANELS

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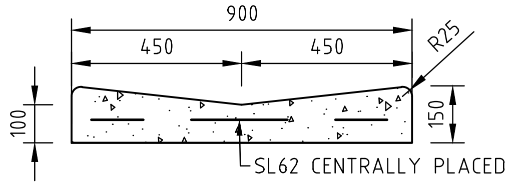
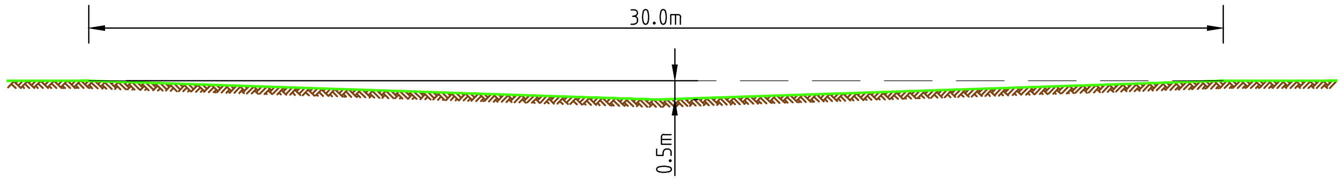


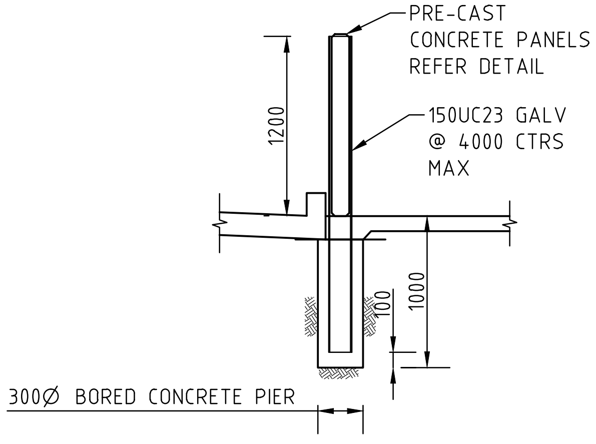
CONCRETE INVERT DETAIL

N.T.S



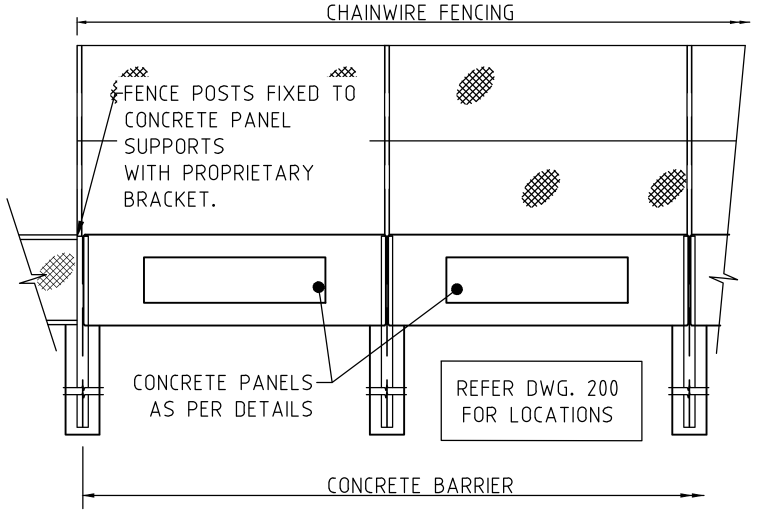
DRAINAGE CHANNEL TYPICAL SECTION

SCALE 1:100 (A3)



CONCRETE BOUNDARY BARRIER TYPICAL SECTION

SCALE 1:50 (A3)



CONCRETE BOUNDARY BARRIER TYPICAL DETAIL

SCALE 1:25 (A3)

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KALKA SHADES, NORTH ROCKHAMPTON, QLD

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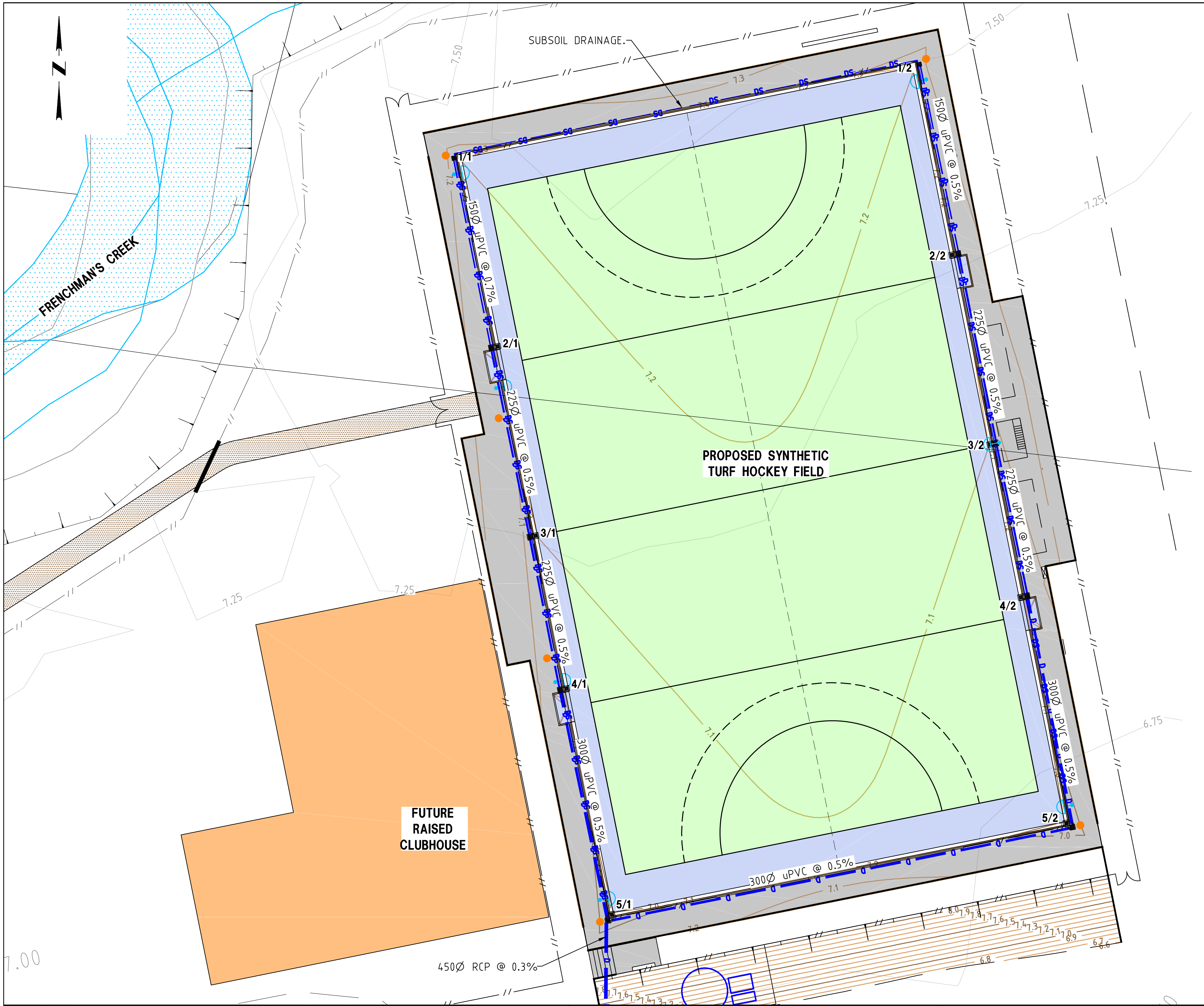
DRAWING TITLE
TYPICAL DETAILS PLAN

PROJECT No.	DRAWING No.	REVISION
R15041	202	2



LEGEND

—— D ——	EXISTING STORMWATER LINE
—— OH ——	EXISTING OVERHEAD ELECTRICAL
▨	EXISTING EDGE OF BUILDING
┬	TOP OF BATTER
——	TOE OF BATTER
⚲	PROPOSED IRRIGATION WATER CANNON
●	PROPOSED LIGHTING TOWER
━━	PROPOSED BUND RETAINING WALL
—— D ——	PROPOSED STORMWATER LINE
—— DS ——	PROPOSED SUB-SOIL DRAINAGE
▦ 1/1	PROPOSED STORMWATER INLET
—— // ——	PROPOSED 1.8m HIGH SECURITY FENCE
⬜	PROPOSED CONCRETE AREA
🟩	PROPOSED SYNTHETIC TURF PLAYING FIELD
🟦	PROPOSED SYNTHETIC TURF RUNOFF AREA
▒	EXISTING WATERCOURSE
—— 7.00 ——	EXISTING CONTOURS
—— 7.00 ——	PROPOSED CONTOURS

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PRELIMINARY

0 1.25 5.0m
0 2.5 10.0m

1:250 (A1)
1:500 (A3)

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CLIENT
ROCKHAMPTON HOCKEY ASSOCIATION

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BRISBANE CANBERRA NEW ZEALAND MELBOURNE PERTH
ROCKHAMPTON SINGAPORE SUNSHINE COAST SYDNEY

PROJECT
PROPOSED SYNTHETIC TURF HOCKEY FIELD

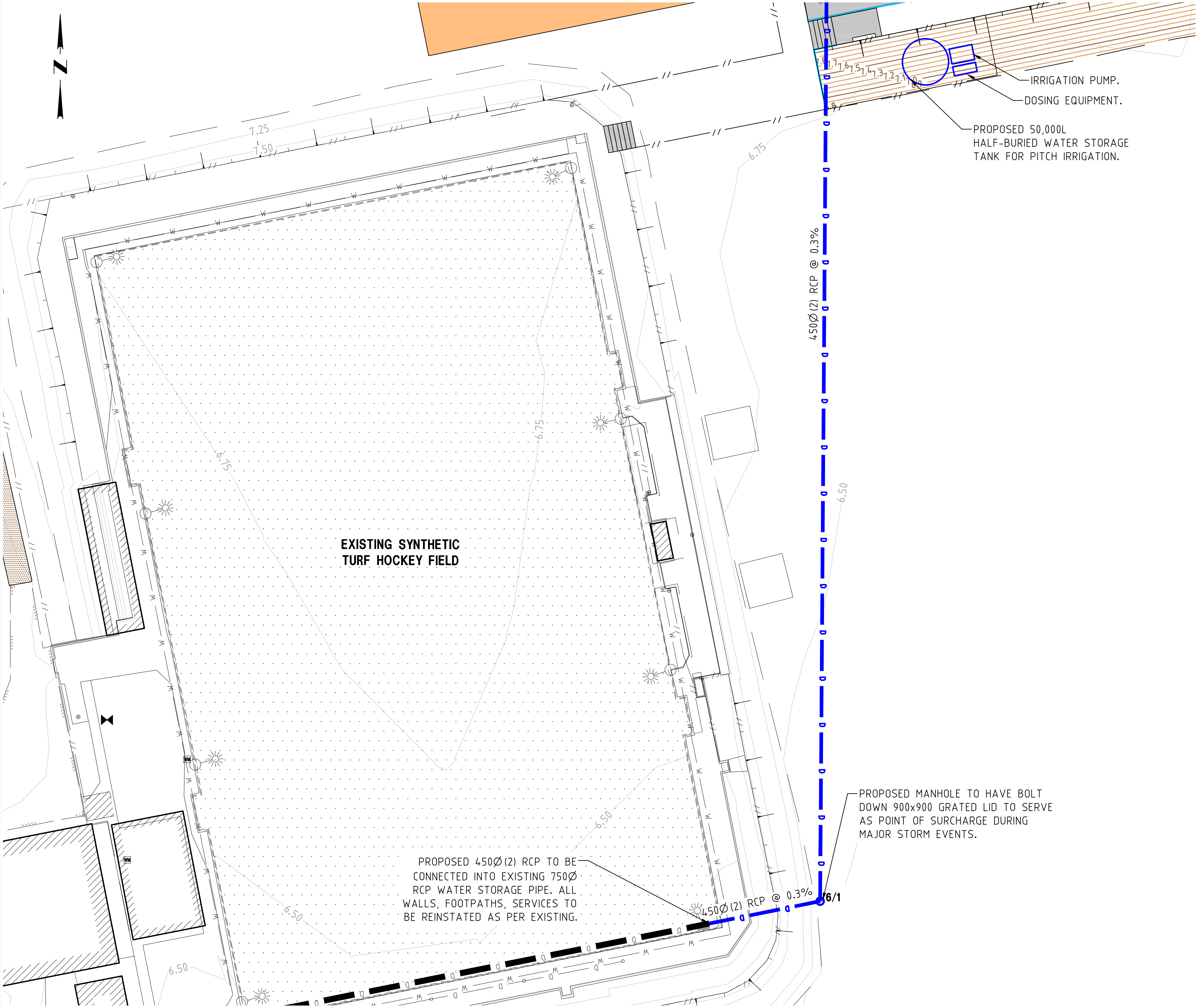
KALKA SHADES, NORTH ROCKHAMPTON, QLD

PRELIMINARY

NOT FOR CONSTRUCTION PURPOSES

DRAWING TITLE
STORMWATER LAYOUT PLAN
SHEET 1 OF 2

PROJECT No.	DRAWING No.	REVISION
R15041	300	2



LEGEND

—— D ——	EXISTING STORMWATER LINE
—— OH ——	EXISTING OVERHEAD ELECTRICAL
▨	EXISTING EDGE OF BUILDING
	TOP OF BATTER
	TOE OF BATTER
	PROPOSED IRRIGATION WATER CANNON
●	PROPOSED LIGHTING TOWER
▬	PROPOSED BUND RETAINING WALL
—— D ——	PROPOSED STORMWATER LINE
—— DS ——	PROPOSED SUB-SOIL DRAINAGE
▦ 1/1	PROPOSED STORMWATER INLET
—— // ——	PROPOSED 1.8m HIGH SECURITY FENCE
⬜	PROPOSED CONCRETE AREA
🟩	PROPOSED SYNTHETIC TURF PLAYING FIELD
🟦	PROPOSED SYNTHETIC TURF RUNOFF AREA
▨	EXISTING WATERCOURSE
—— 7.00 ——	EXISTING CONTOURS
—— 7.00 ——	PROPOSED CONTOURS

NOTES

1. ALL BATTERS TO BE 1 ON 4 MAX UNLESS OTHERWISE SPECIFIED.
2. THE CONTRACTOR SHALL ESTABLISH THE EXTENT AND LOCATION OF ALL EXISTING SERVICES WITHIN OR ADJACENT TO THE WORKS AREA. ALL SERVICES SHALL BE PROTECTED AGAINST ACCIDENTAL DAMAGE DURING CONSTRUCTION OF THE WORKS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS INCURRED BY DAMAGE TO EXISTING SERVICES.
3. WHERE WORK ABUTS EXISTING, ALL WORK SHALL BE NEAT, SMOOTH, WORKMANLIKE AND TO THE SUPERINTENDENTS SATISFACTION.
4. ALL PROVIDED LEVELS ARE TO THE FINISHED ASPHALT SURFACE OR LIP OF KERB.

PRELIMINARY

0 1.25 5.0m
0 2.5 10.0m
1:250 (A1)
1:500 (A3)

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PROJECT
PROPOSED SYNTHETIC TURF HOCKEY FIELD

KALKA SHADES, NORTH ROCKHAMPTON, QLD

PRELIMINARY

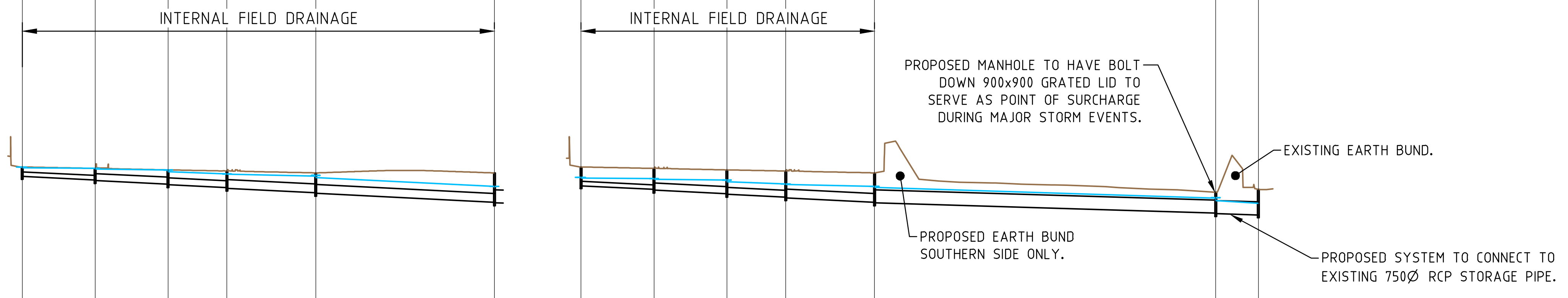
NOT FOR CONSTRUCTION PURPOSES

DRAWING TITLE
STORMWATER LAYOUT PLAN
SHEET 2 OF 2

PROJECT No.	DRAWING No.	REVISION
R15041	301	2

LEGEND

─── (brown)	SURFACE LEVEL
─── (blue)	HYDRAULIC GRADE LINE



DATUM RL -6.0

LINE 2

STRUCTURE NAME	1/2		2/2		3/2		4/2		5/2		5/1
STRUCTURE DESCRIPTION	300mmx300mm FIELD INLET BOTH SIDES 1200mmx300mm C.I.S PIT		300mmx300mm FIELD INLET BOTH SIDES 1200mmx300mm C.I.S PIT		300mmx300mm FIELD INLET BOTH SIDES 1200mmx300mm C.I.S PIT		300mmx300mm FIELD INLET BOTH SIDES 1200mmx300mm C.I.S PIT		300mmx300mm FIELD INLET BOTH SIDES 1200mmx300mm C.I.S PIT		300mmx300mm FIELD INLET BOTH SIDES 1600mmx600mm C.I.S PIT
PIPE SIZEmm (Class)		150(U)		225(U)		225(U)		300(U)		300(U)	
PIPE GRADE %		0.50%		0.50%		0.50%		0.50%		0.50%	
PIPE SLOPE 1 in X		200.00		200.00		200.00		200.00		200.00	
FULL PIPE FLOW VELOCITY (m/s)		0.27		0.45		0.85		0.73		1.14	
PART FULL FLOW VELOCITY (m/s)											
WATER LEVEL IN STRUCTURE	7.178		7.137		7.083		6.947		6.895		6.515
HYDRAULIC GRADE LEVEL	7.178	7.154 7.137		7.109 7.083		7.023 6.947		6.932 6.870		6.820 6.515	6.477
PIPE FLOW (Cumecs)		0.005		0.020		0.039		0.053		0.083	
PIPE CAPACITY AT GRADE (CUMECS)		0.014		0.045		0.045		0.084		0.084	
DEPTH TO INVERT		0.321 0.404		0.424 0.494		0.514 0.581		0.601 0.685		0.705 1.013	
INVERT LEVEL OF DRAIN		6.861 6.735		6.715 6.588		6.568 6.467		6.447 6.293		6.273 5.964	
DESIGN SURFACE LEVEL	7.182		7.139		7.082		7.048		6.978		6.977
SETOUT COORDINATES	E 248448.981 N 7413651.602		E 248454.036 N 7413626.863		E 248458.940 N 7413602.118		E 248463.033 N 7413582.159		E 248468.953 N 7413551.984		E 248408.318 N 7413539.781
RUNNING CHAINAGE	0.000	25.250	25.250	25.226	50.476	20.374	70.850	30.750	101.600	61.851	163.451

LINE 1

STRUCTURE NAME	1/1		2/1		3/1		4/1		5/1		6/1		7/1
STRUCTURE DESCRIPTION	300mmx300mm FIELD INLET BOTH SIDES 1200mmx300mm C.I.S PIT		300mmx300mm FIELD INLET BOTH SIDES 1200mmx300mm C.I.S PIT		300mmx300mm FIELD INLET BOTH SIDES 1200mmx300mm C.I.S PIT		300mmx300mm FIELD INLET BOTH SIDES 1200mmx300mm C.I.S PIT		300mmx300mm FIELD INLET BOTH SIDES 1600mmx600mm C.I.S PIT		STD MANHOLE		1050mm Diam Pit
PIPE SIZEmm (Class)		150(U)		225(U)		225(U)		300(U)		450(2)		450(2)	
PIPE GRADE %		0.50%		0.50%		0.50%		0.50%		0.30%		0.30%	
PIPE SLOPE 1 in X		200.00		200.00		200.00		200.00		333.33		333.33	
FULL PIPE FLOW VELOCITY (m/s)		0.27		0.45		0.85		0.73		1.00		1.00	
PART FULL FLOW VELOCITY (m/s)													
WATER LEVEL IN STRUCTURE	6.829		6.785		6.730		6.593		6.515		6.123		5.975
HYDRAULIC GRADE LEVEL	6.829	6.802 6.785		6.756 6.730		6.669 6.593		6.577 6.515		6.477 6.108		6.021 5.975	
PIPE FLOW (Cumecs)		0.005		0.020		0.039		0.053		0.159		0.159	
PIPE CAPACITY AT GRADE (CUMECS)		0.014		0.045		0.045		0.084		0.156		0.156	
DEPTH TO INVERT		0.651 0.734		0.754 0.823		0.843 0.910		0.930 1.013		1.033 0.719		0.739 0.888	
INVERT LEVEL OF DRAIN		6.532 6.405		6.385 6.259		6.239 6.137		6.117 5.964		5.944 5.589		5.569 5.525	
DESIGN SURFACE LEVEL	7.183		7.139		7.082		7.047		6.977		6.308		6.413
SETOUT COORDINATES	E 248388.200 N 7413639.370		E 248393.108 N 7413614.601		E 248398.158 N 7413589.887		E 248402.105 N 7413569.897		E 248408.318 N 7413539.781		E 248407.264 N 7413421.680		E 248392.888 N 7413418.301
RUNNING CHAINAGE	0.000	25.251	25.251	25.225	50.476	20.376	70.852	30.750	101.602	118.106	219.708	14.768	234.476

PRELIMINARY

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PROJECT
PROPOSED SYNTHETIC TURF HOCKEY FIELD

KALKA SHADES, NORTH ROCKHAMPTON, QLD

PRELIMINARY

NOT FOR CONSTRUCTION PURPOSES

DRAWING TITLE
STORMWATER LONGSECTONS PLAN

PROJECT No.	DRAWING No.	REVISION
R15041	302	2

LOCATION					TIME			SUB-CATCHMENT RUNOFF						INLET DESIGN							DRAIN DESIGN												HEADLOSSES											PART FULL		DESIGN LEVELS						
						tc	I	C10	C	A	C×A	+CA	Q					Qg	Qb		tc	I	+CA	Qt	Qm	Qs	Qp	L	S		V	T			V2/2g	Ku	hu	Kl	hl	Kw	hw	Sf	hf		Vp							
DESIGN ARI	STRUCTURE No.	DRAIN SECTION	SUB-CATCHMENTS CONTRIBUTING	LAND USE	SLOPE OF CATCHMENT	SUB-CATCHMENT TIME OF CONC.	RAINFALL INTENSITY	10yr RUNOFF CO-EFFICIENT	CO-EFFICIENT OF RUNOFF	SUB-CATCHMENT AREA	EQUIVALENT AREA	SUM OF (C × A)	SUB-CATCHMENT DISCHARGE	FLOW IN K&C (INC. BYPASS)	ROAD GRADE AT INLET	MINOR FLOW ROAD CAPACITY	INLET TYPE	FLOW INTO INLET	BYPASS FLOW	BYPASS STRUCTURE No.	CRITICAL TIME OF CONC.	RAINFALL INTENSITY	TOTAL (C × A)	MAJOR TOTAL FLOW	MAJOR SURFACE FLOW CAPACITY	MAJOR SURFACE FLOW	PIPE FLOW	REACH LENGTH	PIPE GRADE	PIPE / BOX DIMENSIONS (CLASS)	FLOW VELOCITY FULL (PIPE GRADE VELOCITY)	TIME OF FLOW IN REACH	STRUCTURE CHART No.	STRUCTURE RATIOS FOR 'K' VALUE CALCULATIONS	VELOCITY HEAD	U/S HEADLOSS COEFFICIENT	U/S PIPE STRUCT. HEADLOSS	LAT. HEADLOSS CO-EFFICIENT	LAT. PIPE STRUCT. HEADLOSS	W.S.E CO-EFFICIENT	CHANGE IN W.S.E	PIPE FRICTION SLOPE	PIPE FRICTION HEADLOSS (L × Sf)	DEPTH	VELOCITY	OBVERT LEVELS	DRAIN SECTION H.G.L	UPSTREAM H.G.L	LAT. H.G.L	W.S.E.	SURFACE OR K&C INVERT LEVEL	STRUCTURE No.
yrs					%	min	mm/h			ha	ha	ha	l/s	l/s	%	l/s		l/s	l/s		min	mm/h	ha	l/s	l/s	l/s	l/s	m	%	mm	m/s	min			m		m		m		m	%	m	m	m/s	m	m	m	m	m	m	
1 100	1/2	1/2 to 2/2	1/2			5.00 5.00	104 322		0.72 0.99	0.025 0.025	0.018 0.025	0.018 0.025	5 22	5	0.20		101	5	0	2/2	5.00 5.00	104 322	0.018 0.025	22			5 (Pipe flow= Grate flow)	25.250	0.50	150(U)	0.27 (0.73)	0.42		Qg 0.005 Qo 0.005 Do 150 CHRT 32: Vo2/2gDo 0.02 H/Do 0.90 Kg side flow 6.62 end flow 4.81	0.004	6.62	0.024			6.62	0.024	0.07	0.017			7.015 6.889	7.154 7.137	7.178		7.178	7.182	1/2
1 100	2/2	2/2 to 3/2	1/2;2/2			5.00 5.00	104 322		0.72 0.99	0.079 0.079	0.057 0.078	0.057 0.078	16 70	16	0.20		101	16	0	3/2	5.42 5.42	101 313	0.075 0.103	90			20 (Pipe flow= Sum upstr atten flows)	25.226	0.50	225(U)	0.45 (0.99)	0.42		Qg 0.016 Qo 0.020 Do 225 CHART 33 Angle 1 S/Do 2.5 Du/Do 0.67 Qg/Qo 0.76 K 2.17 S/Do 1.75 cor 0.57 Ku 2.74 Kw 2.74	0.010	2.74	0.028			2.74	0.028	0.10	0.026			6.956 6.830	7.109 7.083	7.137		7.137	7.139	2/2
1 100	3/2	3/2 to 4/2	1/2;2/2;3/2			5.00 5.00	104 322		0.72 0.99	0.095 0.095	0.068 0.094	0.068 0.094	20 84	20	0.20		101	20	0	4/2	5.84 5.84	99 304	0.143 0.197	166			39 (Pipe flow= Sum upstr atten flows)	20.374	0.50	225(U)	0.85 (0.99)	0.34		Qg 0.019 Qo 0.039 Do 225 CHART 33 Angle 1 S/Do 2.5 Du/Do 1.00 Qg/Qo 0.49 K 1.49 S/Do 2.13 cor 0.14 Ku 1.63 Kw 1.63	0.037	1.63	0.060			1.63	0.060	0.37	0.076			6.810 6.708	7.023 6.947	7.083		7.083	7.082	3/2
1 100	4/2	4/2 to 5/2	1/2;2/2;3/2;4/2			5.00 5.00	104 322		0.72 0.99	0.078 0.078	0.056 0.077	0.056 0.077	16 69	16	0.20		101	16	0	5/2	6.18 6.18	97 298	0.199 0.274	227			53 (Pipe flow= Sum upstr atten flows)	30.750	0.50	300(U)	0.73 (1.15)	0.51		Qg 0.015 Qo 0.053 Do 300 CHART 33 Angle 1 S/Do 2.5 Du/Do 0.75 Qg/Qo 0.28 K 0.31 S/Do 1.65 cor 0.25 Ku 0.56 Kw 0.56	0.027	0.56	0.015			0.56	0.015	0.20	0.062			6.751 6.597	6.932 6.870	6.947		6.947	7.048	4/2
1 100	5/2	5/2 to 5/1	1/2;2/2;3/2;4/2;5/2			5.00 5.00	104 322		0.72 0.99	0.166 0.166	0.120 0.164	0.120 0.164	35 147 FLOW WIDTH/DEPTH 0.010Dp m	35	0.00	344	17S0.15	35	0	5/1	6.69 6.69	94 289	0.319 0.438	352			83 (Pipe flow= Sum upstr atten flows)	61.851	0.50	300(U)	1.14 (1.15)	0.90			0.066	0.76	0.050			1.13	0.075	0.49	0.305			6.577 6.268	6.820 6.515	6.870		6.895	6.978	5/2
1 100	1/1	1/1 to 2/1	1/1			5.00 5.00	104 322		0.72 0.99	0.025 0.025	0.018 0.025	0.018 0.025	5 22	5	0.20		101	5	0	2/1	5.00 5.00	104 322	0.018 0.025	22			5 (Pipe flow= Grate flow)	25.251	0.50	150(U)	0.27 (0.73)	0.42		Qg 0.005 Qo 0.005 Do 150 CHRT 32: Vo2/2gDo 0.02 H/Do 0.75 Kg side flow 7.22 end flow 5.21	0.004	7.22	0.027			7.22	0.027	0.07	0.017			6.686 6.560	6.802 6.785	6.829		6.829	7.183	1/1
1 100	2/1	2/1 to 3/1	1/1;2/1			5.00 5.00	104 322		0.72 0.99	0.078 0.078	0.056 0.077	0.056 0.077	16 69	16	0.20		101	16	0	3/1	5.42 5.42	101 313	0.074 0.102	89			20 (Pipe flow= Sum upstr atten flows)	25.225	0.50	225(U)	0.45 (0.99)	0.42		Qg 0.016 Qo 0.020 Do 225 CHART 33 Angle 1 S/Do 2.5 Du/Do 0.67 Qg/Qo 0.76 K 2.17 S/Do 1.66 cor 0.67 Ku 2.84 Kw 2.84	0.010	2.84	0.029			2.84	0.029	0.10	0.026			6.627 6.501	6.756 6.730	6.785		6.785	7.139	2/1
1 100	3/1	3/1 to 4/1	1/1;2/1;3/1			5.00 5.00	104 322		0.72 0.99	0.095 0.095	0.068 0.094	0.068 0.094	20 84	20	0.20		101	20	0	4/1	5.84 5.84	99 304	0.142 0.196	166			39 (Pipe flow= Sum upstr atten flows)	20.376	0.50	225(U)	0.85 (0.99)	0.34		Qg 0.019 Qo 0.039 Do 225 CHART 33 Angle 1 S/Do 2.5 Du/Do 1.00 Qg/Qo 0.49 K 1.49 S/Do 2.03 cor 0.18 Ku 1.67 Kw 1.67	0.037	1.67	0.061			1.67	0.061	0.37	0.076			6.481 6.379	6.669 6.593	6.730		6.730	7.082	3/1
1 100	4/1	4/1 to 5/1	1/1;2/1;3/1;4/1			5.00 5.00	104 322		0.72 0.99	0.078 0.078	0.056 0.077	0.056 0.077	16 69	16	0.20		101	16	0	5/1	6.18 6.18	97 298	0.198 0.273	226			53 (Pipe flow= Sum upstr atten flows)	30.750	0.50	300(U)	0.73 (1.15)	0.51		Qg 0.015 Qo 0.053 Do 300 CHART 33 Angle 1 S/Do 2.5 Du/Do 0.75 Qg/Qo 0.28 K 0.31 S/Do 1.56 cor 0.28 Ku 0.59 Kw 0.59	0.027	0.59	0.016			0.59	0.016	0.20	0.062			6.421 6.268	6.577 6.515	6.593		6.593	7.047	4/1
1 100	5/1	5/1 to 6/1	1/2;2/2;3/2;4/2;5/2;1 /1;2/1;3/1;4/1;5/1			5.00 5.00	104 322		0.72 0.99	0.166 0.166	0.120 0.164	0.120 0.164	35 147 FLOW WIDTH/DEPTH 0.010Dp m	35	0.00	344	17S0.15	35	0		7.59 7.59	90 276	0.637 0.875	671			159 (Pipe flow= Sum upstr atten flows)	118.106	0.30	450(2)	1.00 (0.98)	1.97			0.051	0.74	0.038			0.74	0.038	0.31	0.369			6.394 6.039	6.477 6.108	6.515		6.515	6.977	5/1
1 100	6/1	6/1 to 7/1	1/2;2/2;3/2;4/2;5/2;1 /1;2/1;3/1;4/1;5/1														24				9.56 9.56	82 252	0.637 0.875	612			159 (Pipe flow= Sum upstr atten flows)	14.768	0.30	450(2)	1.00 (0.98)	0.25		Qo 0.159 Do 450 CHART 50 Du/Do1.00 alpha 76 K'w 0.29 Vu 1.00 WSE 0.10 Ku 1.70 Kw 1.99	0.051	1.70	0.087			1.99	0.102	0.31	0.046			6.019 5.975	6.021 5.975	6.108		6.123	6.308	6/1

STORMWATER CALCULATIONS TABLE

PRELIMINARY

REVISION	DATE	ISSUE DESCRIPTION	DRAWN	DESIGNED	CHECKED
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PROJECT
PROPOSED SYNTHETIC TURF HOCKEY FIELD

KALKA SHADES, NORTH ROCKHAMPTON, QLD

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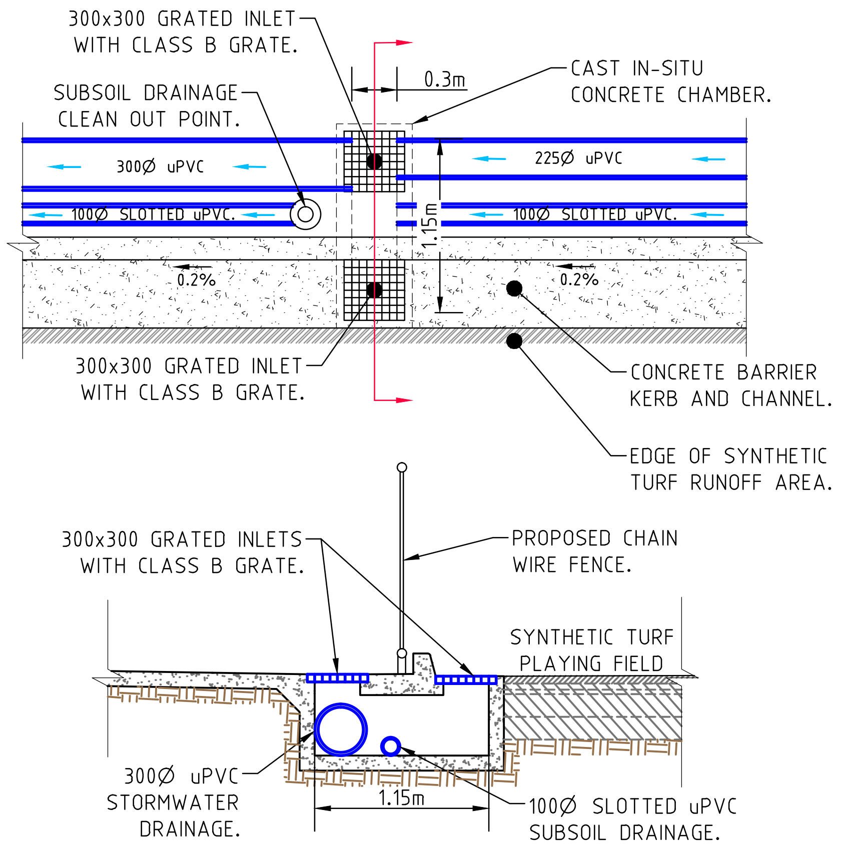
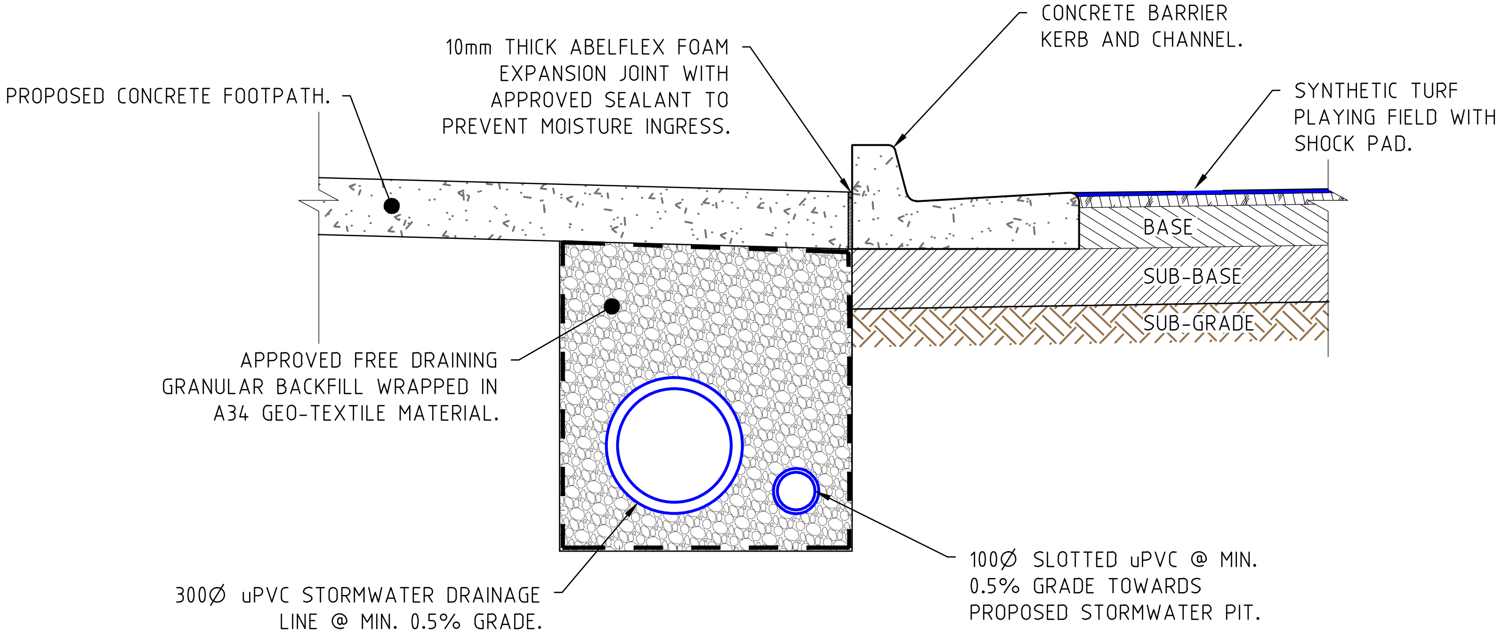
DRAWING TITLE
STORMWATER CALCULATION TABLE

PROJECT No.	DRAWING No.	REVISION
R15041	303	2



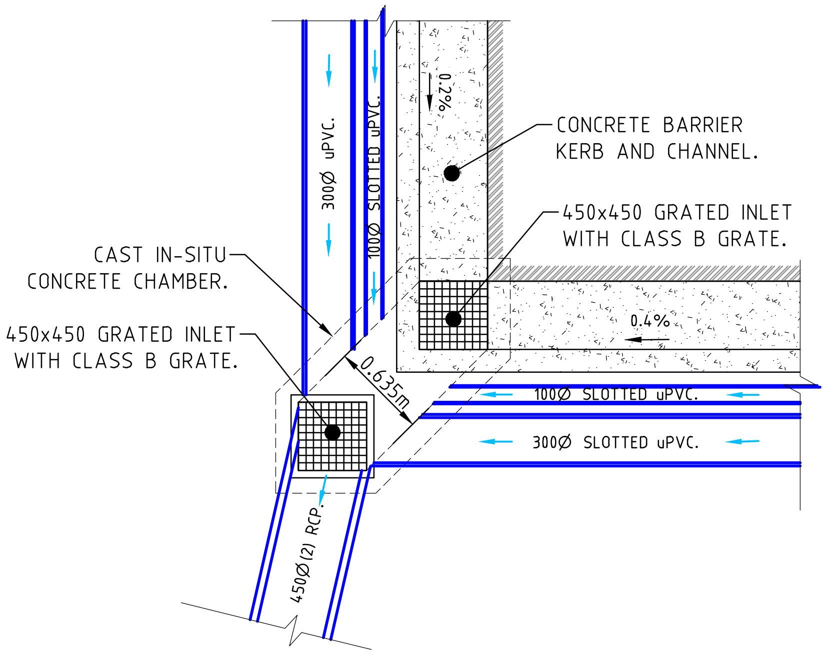
FIELD INLET TYPICAL DETAIL 1

SCALE 1:50 (A3)



STORMWATER TRENCH TYPICAL DETAIL

SCALE 1:20 (A3)



FIELD INLET TYPICAL DETAIL 2

SCALE 1:50 (A3)

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1	01/2016	PRELIMINARY	PL	CS	CS
2	04/2016	FOR CO-ORDINATION	PL	JA	CS

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PROJECT
PROPOSED SYNTHETIC TURF HOCKEY FIELD

KALKA SHADES, NORTH ROCKHAMPTON, QLD

PRELIMINARY

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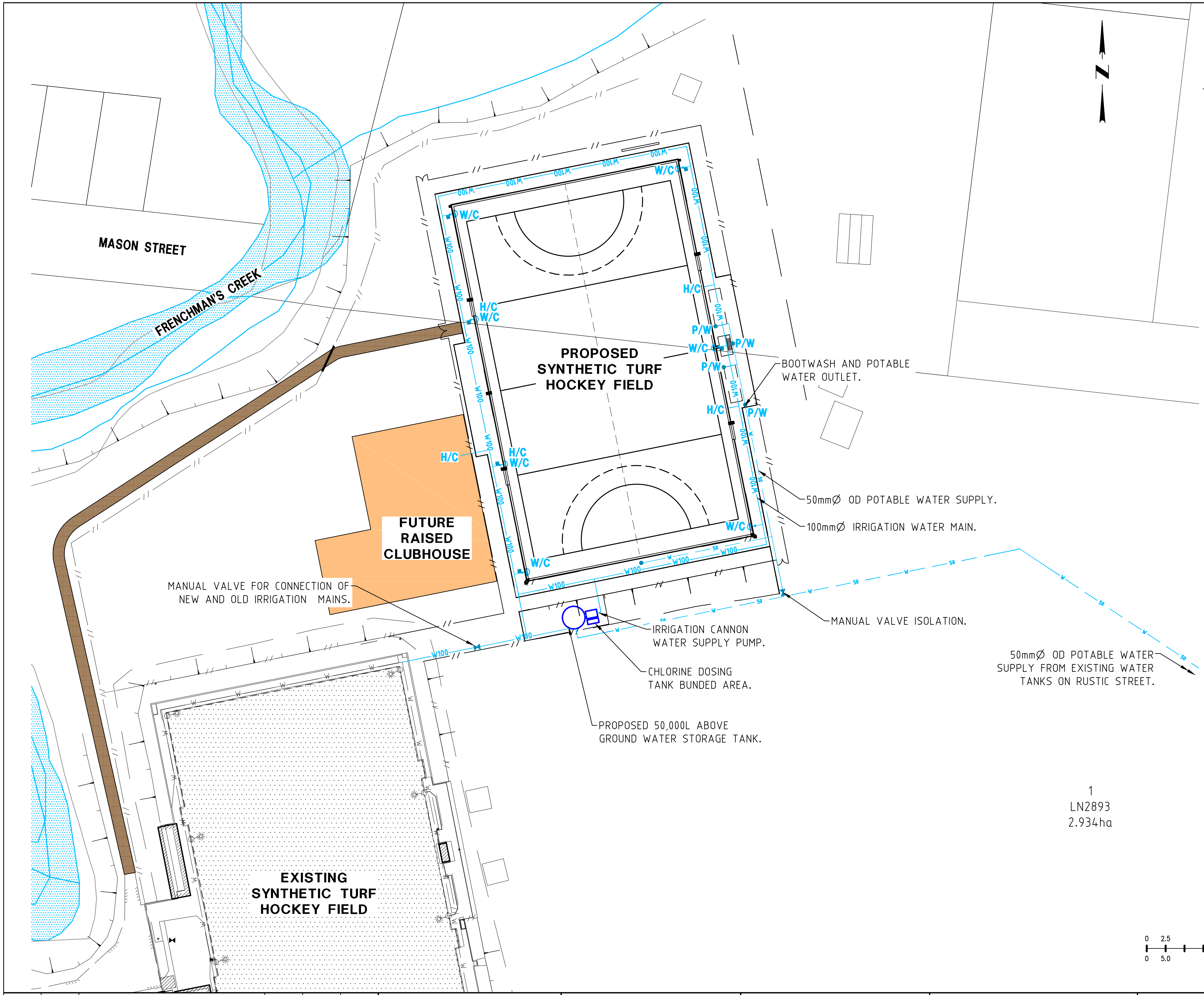
DRAWING TITLE
STORMWATER DETAILS PLAN

PROJECT No.	DRAWING No.	REVISION
R15041	304	2



LEGEND

— D — D —	EXISTING STORMWATER LINE
— OH — OH —	EXISTING OVERHEAD ELECTRICAL
▨	EXISTING EDGE OF BUILDING
— W — W —	EXISTING WATER MAIN
	TOP OF BATTER
	TOE OF BATTER
P/W	PROPOSED POTABLE WATER OUTLET
H/C	PROPOSED HOSE OUTLET
W/C	PROPOSED IRRIGATION WATER CANNON
⧓	PROPOSED WATER VALVE
— W100 — W100 —	PROPOSED 100mmØ IRRIGATION MAIN
— W — 50 —	PROPOSED 50mmØ POTABLE WATER MAIN
— // —	PROPOSED 1.8m HIGH SECURITY FENCE
━━	PROPOSED BUND RETAINING WALL
▨	EXISTING WATERCOURSE

NOTES

1. ALL BATTERS TO BE 1 ON 4 MAX UNLESS OTHERWISE SPECIFIED.
2. THE CONTRACTOR SHALL ESTABLISH THE EXTENT AND LOCATION OF ALL EXISTING SERVICES WITHIN OR ADJACENT TO THE WORKS AREA. ALL SERVICES SHALL BE PROTECTED AGAINST ACCIDENTAL DAMAGE DURING CONSTRUCTION OF THE WORKS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS INCURRED BY DAMAGE TO EXISTING SERVICES.
3. WHERE WORK ABUTS EXISTING, ALL WORK SHALL BE NEAT, SMOOTH, WORKMANLIKE AND TO THE SUPERINTENDENTS SATISFACTION.
4. ALL PROVIDED LEVELS ARE TO THE FINISHED ASPHALT SURFACE OR LIP OF KERB.

PRELIMINARY

REVISION	DATE	ISSUE DESCRIPTION	DRAWN	DESIGNED	CHECKED
1	01/2016	PRELIMINARY	PL	CS	CS
2	04/2016	FOR CO-ORDINATION	PL	JA	CS

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www.calibreconsulting.co
BRISBANE CANBERRA NEW ZEALAND MELBOURNE PERTH
ROCKHAMPTON SINGAPORE SUNSHINE COAST SYDNEY

PROJECT
PROPOSED SYNTHETIC TURF HOCKEY FIELD

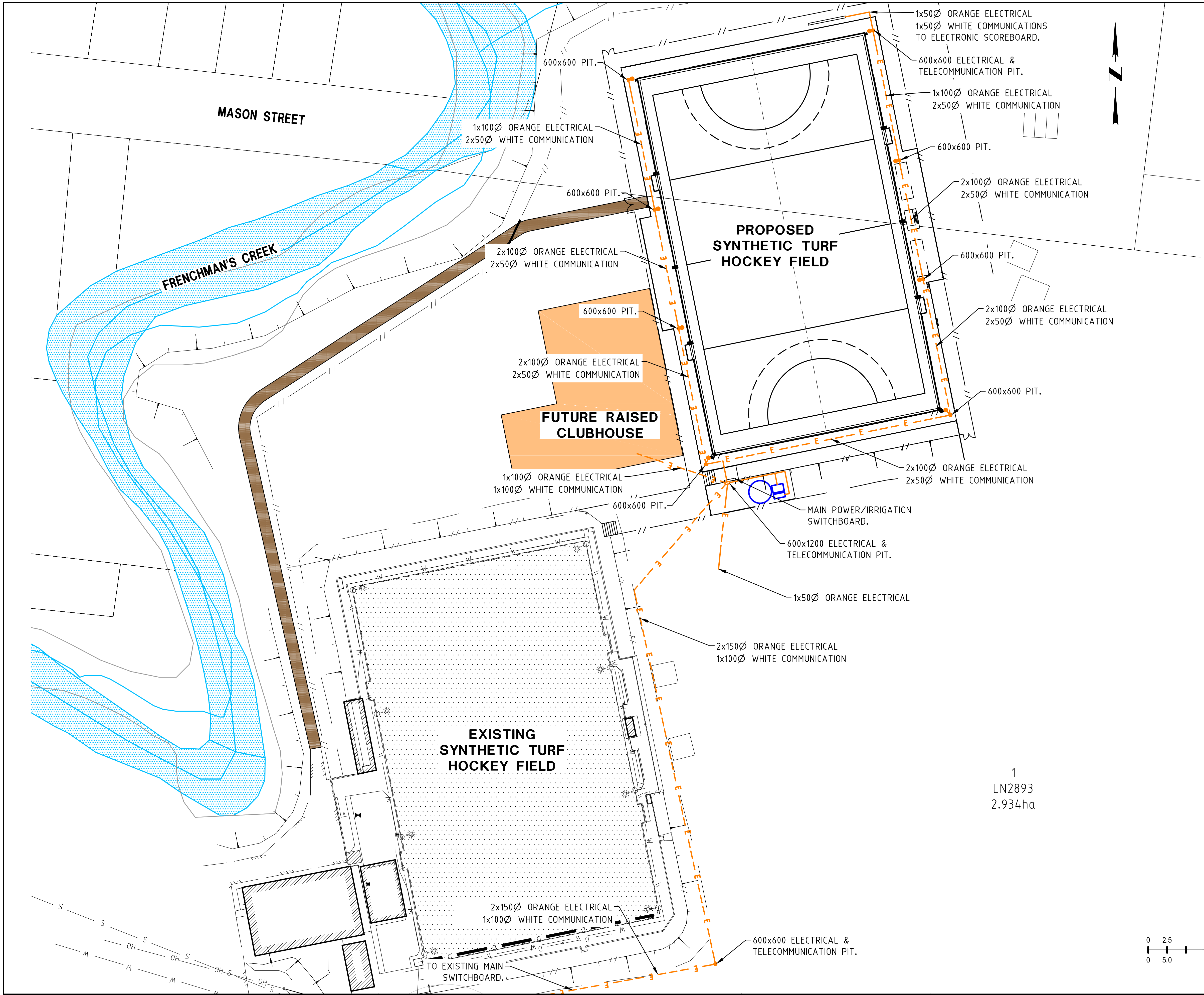
KALKA SHADES, NORTH ROCKHAMPTON, QLD

PRELIMINARY

NOT FOR CONSTRUCTION PURPOSES

DRAWING TITLE
WATER RETICULATION LAYOUT PLAN

PROJECT No.	DRAWING No.	REVISION
R15041	400	2



LEGEND

—— D ——	EXISTING STORMWATER LINE
—— OH ——	EXISTING OVERHEAD ELECTRICAL
▨	EXISTING EDGE OF BUILDING
—— W ——	EXISTING WATER MAIN
	TOP OF BATTER
	TOE OF BATTER
●	PROPOSED LIGHTING TOWER
— E —	PROPOSED UNDERGROUND ELECTRICAL
⊠	PROPOSED ELECTRICAL /COMMUNICATIONS PIT
—— // ——	PROPOSED 1.8m HIGH SECURITY FENCE
▬	PROPOSED BUND RETAINING WALL
▨	EXISTING WATERCOURSE

NOTES

1. ALL BATTERS TO BE 1 ON 4 MAX UNLESS OTHERWISE SPECIFIED.
2. THE CONTRACTOR SHALL ESTABLISH THE EXTENT AND LOCATION OF ALL EXISTING SERVICES WITHIN OR ADJACENT TO THE WORKS AREA. ALL SERVICES SHALL BE PROTECTED AGAINST ACCIDENTAL DAMAGE DURING CONSTRUCTION OF THE WORKS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS INCURRED BY DAMAGE TO EXISTING SERVICES.
3. WHERE WORK ABUTS EXISTING, ALL WORK SHALL BE NEAT, SMOOTH, WORKMANLIKE AND TO THE SUPERINTENDENTS SATISFACTION.
4. ALL PROVIDED LEVELS ARE TO THE FINISHED ASPHALT SURFACE OR LIP OF KERB.

PRELIMINARY

0 2.5 10.0m
0 5.0 20.0m
1:500 (A1)
1:1000 (A3)

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2	04/2016	FOR CO-ORDINATION	PL	JA	CS

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ROCKHAMPTON SINGAPORE SUNSHINE COAST SYDNEY

PROJECT
PROPOSED SYNTHETIC TURF HOCKEY FIELD

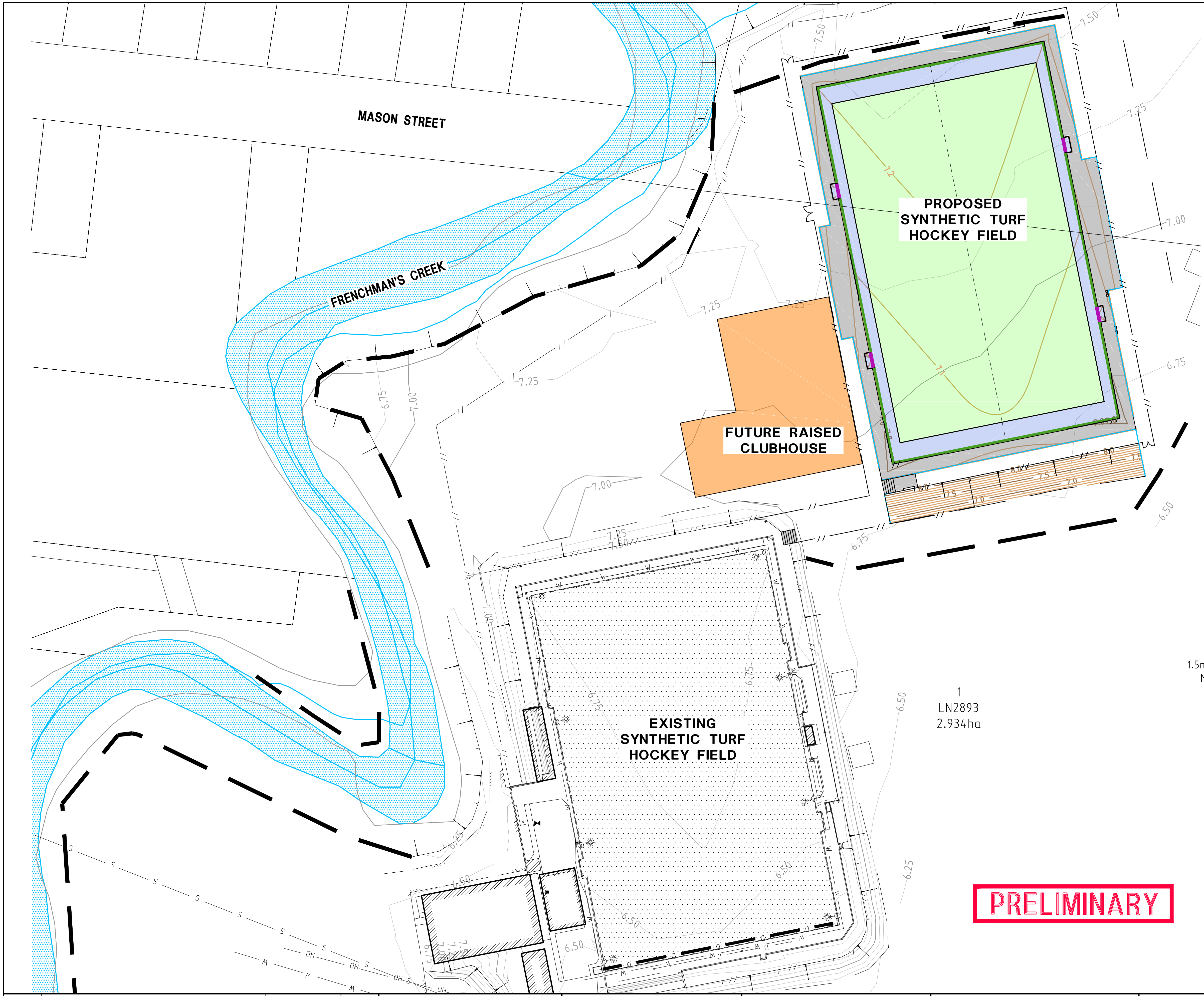
KALKA SHADES, NORTH ROCKHAMPTON, QLD

PRELIMINARY

NOT FOR CONSTRUCTION PURPOSES

DRAWING TITLE
ELECTRICAL LAYOUT PLAN

PROJECT No.	DRAWING No.	REVISION
R15041	500	2



LEGEND

—— D ——	EXISTING STORMWATER LINE
—— OH ——	EXISTING OVERHEAD ELECTRICAL
▨	EXISTING EDGE OF BUILDING
—— W ——	EXISTING WATER MAIN
——┬——	TOP OF BATTER
——╷——	TOE OF BATTER
—— // ——	PROPOSED 1.8m HIGH SECURITY FENCE
▬ ▬	PROPOSED SILT FENCE
🟦	EXISTING WATERCOURSE
—— 7.00 ——	EXISTING CONTOURS

NOTES

1. ALL BATTERS TO BE 1 ON 4 MAX UNLESS OTHERWISE SPECIFIED.
2. THE CONTRACTOR SHALL ESTABLISH THE EXTENT AND LOCATION OF ALL EXISTING SERVICES WITHIN OR ADJACENT TO THE WORKS AREA. ALL SERVICES SHALL BE PROTECTED AGAINST ACCIDENTAL DAMAGE DURING CONSTRUCTION OF THE WORKS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS INCURRED BY DAMAGE TO EXISTING SERVICES.
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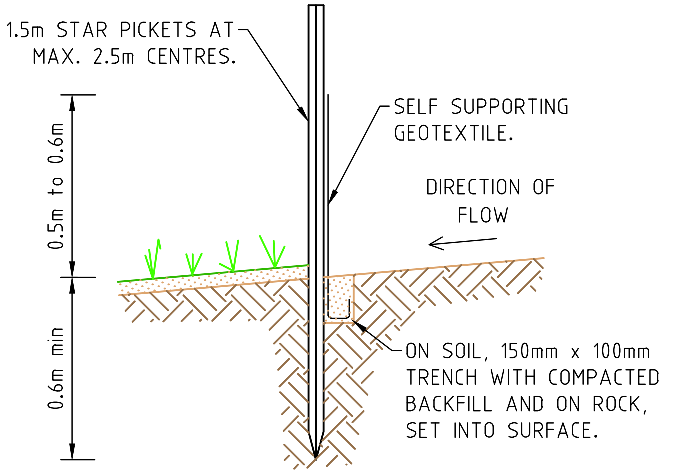
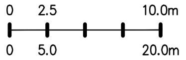


SILT FENCE DETAIL

N.T.S

PRELIMINARY



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1:1000 (A3)

REVISION	DATE	ISSUE DESCRIPTION	DRAWN	DESIGNED	CHECKED
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ROCKHAMPTON SINGAPORE SUNSHINE COAST SYDNEY

PROJECT
PROPOSED SYNTHETIC TURF HOCKEY FIELD

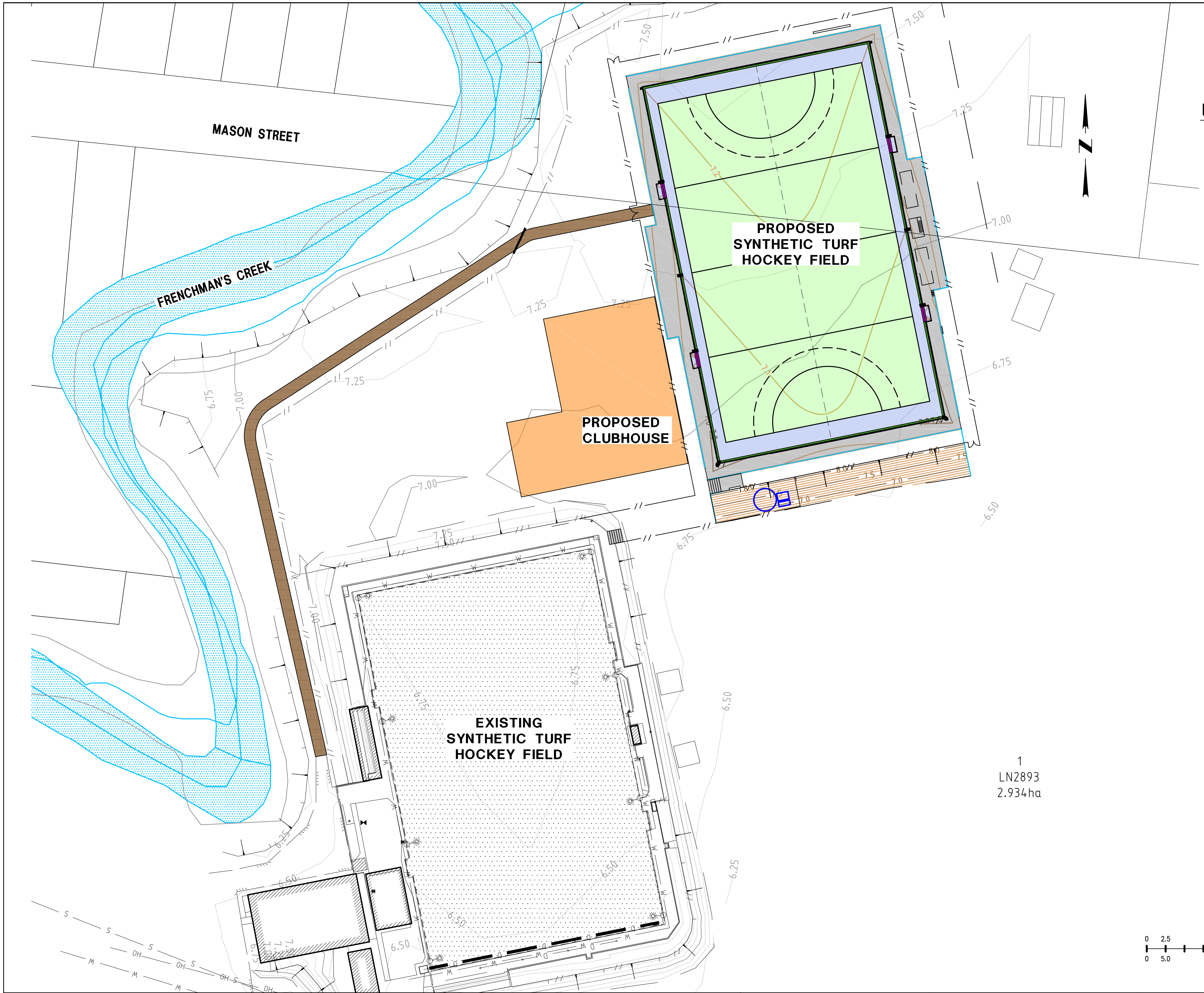
KALKA SHADES, NORTH ROCKHAMPTON, QLD

PRELIMINARY

NOT FOR CONSTRUCTION PURPOSES

DRAWING TITLE
CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

PROJECT No.	DRAWING No.	REVISION
R15041	600	2



LEGEND

▬	PROPOSED KERB & CHANNEL
▬	PROPOSED INVERT
—//—	PROPOSED 1.8m HIGH SECURITY FENCE
┬	TOP OF BATTER
— —	TOE OF BATTER
—	PROPOSED CONCRETE BOUNDARY BARRIER
—	PROPOSED BUND RETAINING WALL
⬜	PROPOSED CONCRETE AREA
🟩	PROPOSED SYNTHETIC TURF PLAYING FIELD
⬜	PROPOSED SYNTHETIC TURF RUNOFF AREA
▨	EXISTING WATERCOURSE
7.00	EXISTING CONTOURS
7.00	PROPOSED CONTOURS

NOTES

1. ALL BATTERS TO BE 1 ON 4 MAX UNLESS OTHERWISE SPECIFIED.
2. THE CONTRACTOR SHALL ESTABLISH THE EXTENT AND LOCATION OF ALL EXISTING SERVICES WITHIN OR ADJACENT TO THE WORKS AREA. ALL SERVICES SHALL BE PROTECTED AGAINST ACCIDENTAL DAMAGE DURING CONSTRUCTION OF THE WORKS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS INCURRED BY DAMAGE TO EXISTING SERVICES.
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4. ALL PROVIDED LEVELS ARE TO THE FINISHED ASPHALT SURFACE OR LIP OF KERB.

PRELIMINARY

0 2.5 10.0m
0 5.0 20.0m

1:500 (A1)
1:1000 (A3)

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PROJECT
PROPOSED SYNTHETIC TURF HOCKEY FIELD

KALKA SHADES, NORTH ROCKHAMPTON, QLD

PRELIMINARY

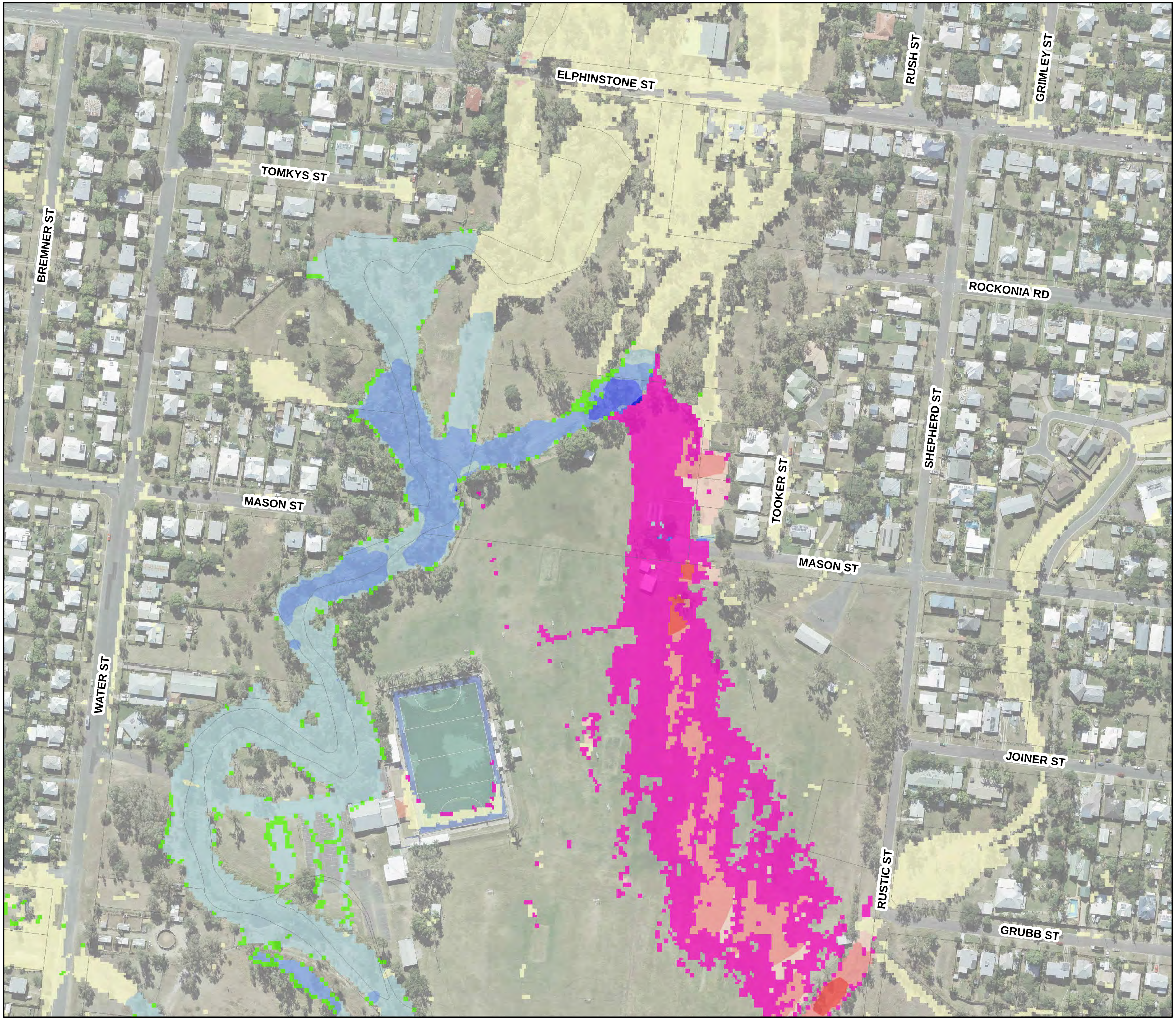
NOT FOR CONSTRUCTION PURPOSES

DRAWING TITLE
POST CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

PROJECT No.	DRAWING No.	REVISION
R15041	601	2

Appendix B

GIS Mapping



N

Rockhampton Regional Council

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 25 50 75 100 125 150
Metres

1:2,500
(when printed at A3)

AECOM
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LEGEND

☐ Cadastre

Difference in PWSE (m)

- 🟦 < -0.3
- 🟦 -0.3 to -0.225
- 🟦 -0.225 to -0.15
- 🟦 -0.15 to -0.075
- 🟦 -0.075 to -0.02
- 🟨 -0.02 to 0.02
- 🟥 0.02 to 0.075
- 🟥 0.075 to 0.15
- 🟥 0.15 to 0.225
- 🟥 0.225 to 0.3
- 🟥 > 0.3
- 🟪 Was Dry Now Wet
- 🟩 Was Wet Now Dry

Flood results are based on local catchment events

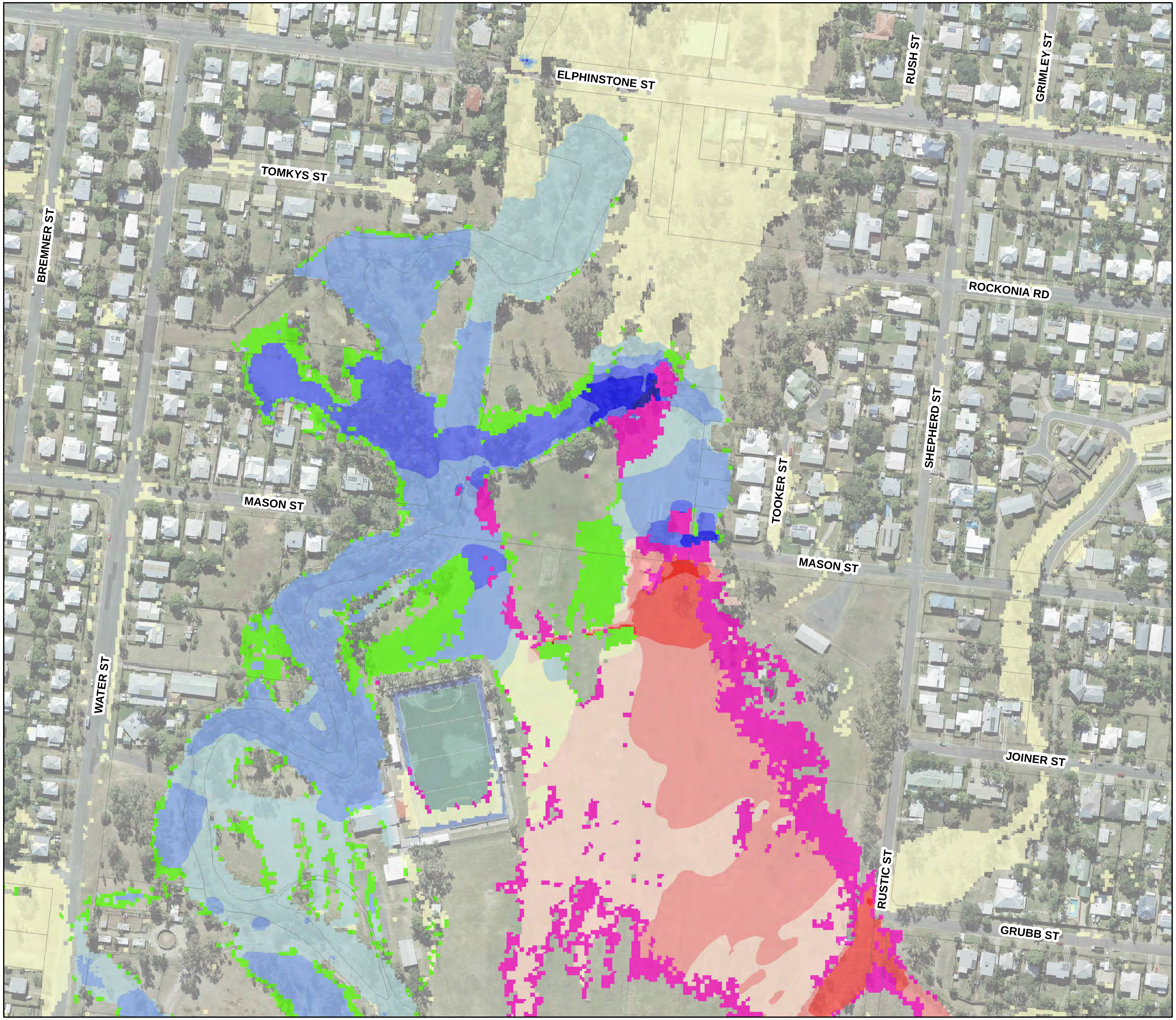
Data Sources:	Results Filtering:
DCDB (c) 2016 QLD Government Imagery (c) 2016 RRC	75mm Min. Depth

Frenchmans Creek & Thozets Creek Model
Difference in Peak Flood Heights
D016 minus Baseline

1 EY 90 min Storm Event

PROJECT ID	60534898
CREATED BY	huffm
LAST MODIFIED	19/01/2018
VERSION:	1

Map
B1



N

Rockhampton Regional Council

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 25 50 75 100 125 150
Metres

1:2,500
(when printed at A3)

AECOM
www.aecom.com

LEGEND

⬜ Cadastre

Difference in PWSE (m)

🟦 < -0.3
🟦 -0.3 to -0.225
🟦 -0.225 to -0.15
🟦 -0.15 to -0.075
🟦 -0.075 to -0.02
🟨 -0.02 to 0.02
🟥 0.02 to 0.075
🟥 0.075 to 0.15
🟥 0.15 to 0.225
🟥 0.225 to 0.3
🟥 > 0.3
🟪 Was Dry Now Wet
🟩 Was Wet Now Dry

Flood results are based on local catchment events

Data Sources:
DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

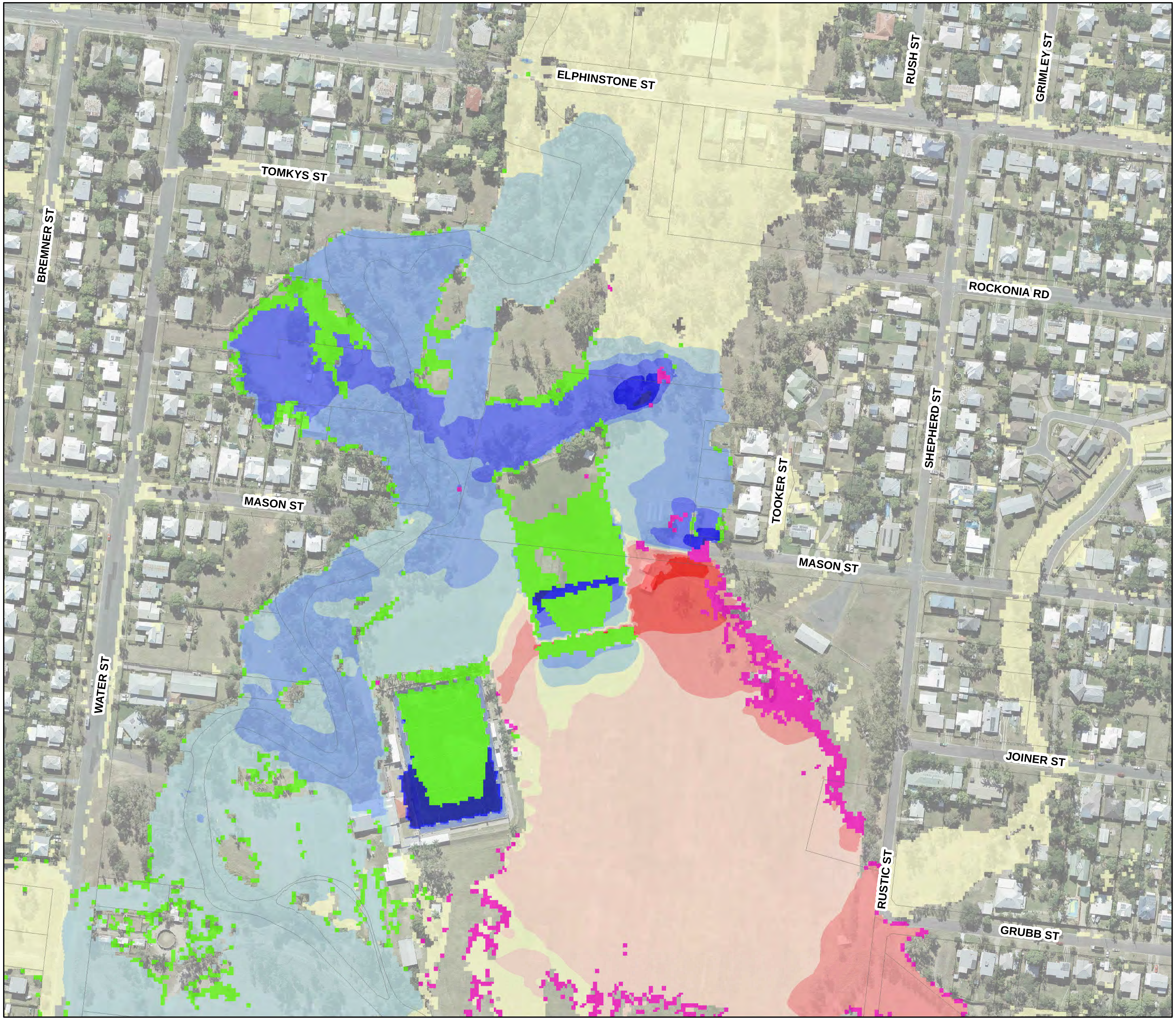
Results Filtering:
75mm Min. Depth

Frenchmans Creek & Thozets Creek Model
Difference in Peak Flood Heights
D016 minus Baseline

39% AEP 90 min Storm Event

PROJECT ID 60534898
CREATED BY huffm
LAST MODIFIED 19/01/2018
VERSION: 1

Map
B2



N

Rockhampton Regional Council

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 25 50 75 100 125 150
Metres

1:2,500
(when printed at A3)

AECOM
www.aecom.com

LEGEND

- ☐ Cadastre

Difference in PWSE (m)

- ■ < -0.3
- ■ -0.3 to -0.225
- ■ -0.225 to -0.15
- ■ -0.15 to -0.075
- ■ -0.075 to -0.02
- ■ -0.02 to 0.02
- ■ 0.02 to 0.075
- ■ 0.075 to 0.15
- ■ 0.15 to 0.225
- ■ 0.225 to 0.3
- ■ > 0.3
- ■ Was Dry Now Wet
- ■ Was Wet Now Dry

Flood results are based on local catchment events

Data Sources:
DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

Results Filtering:
75mm Min. Depth

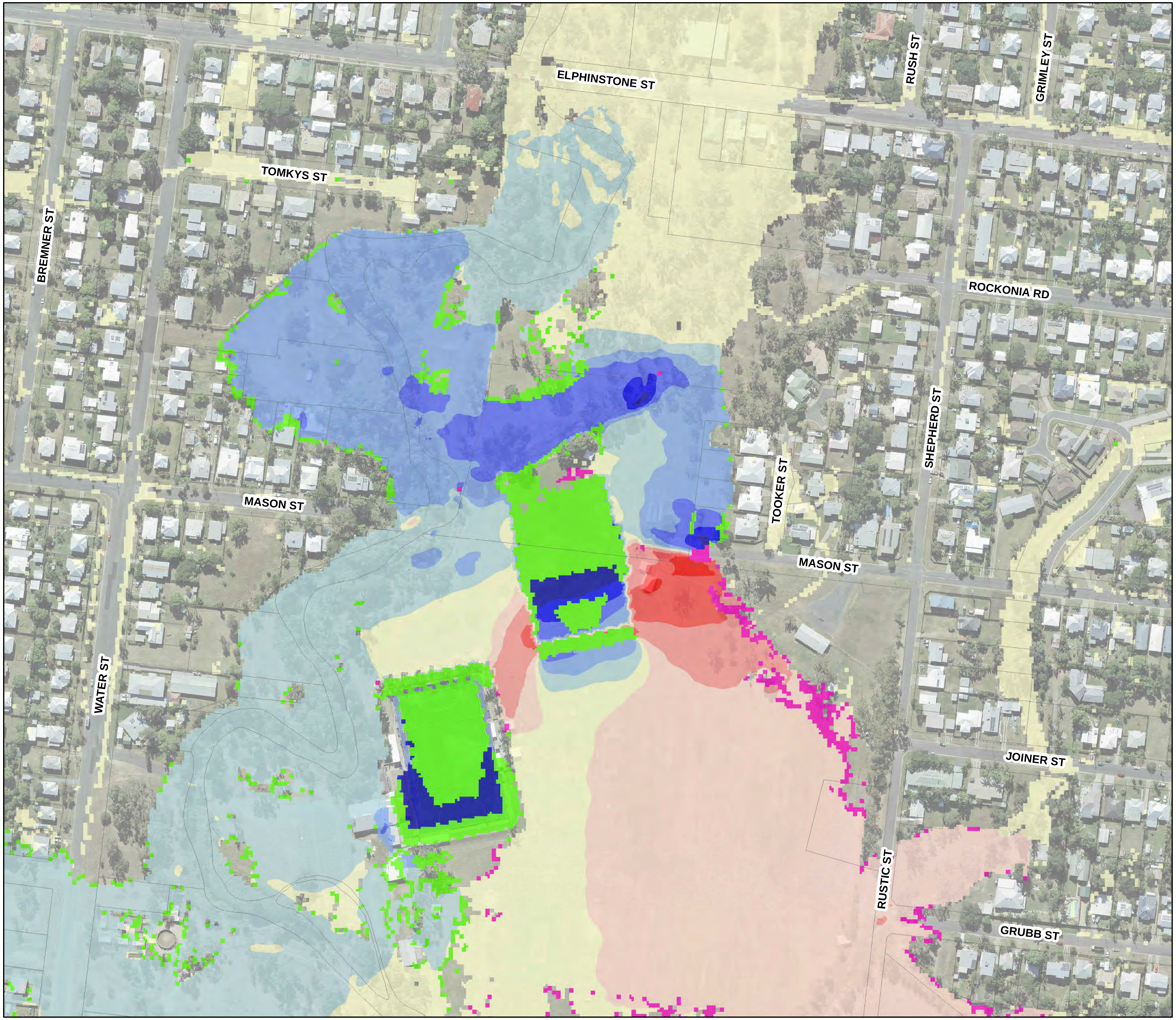
Frenchmans Creek & Thozets Creek Model
Difference in Peak Flood Heights
D016 minus Baseline

18% AEP 90 min Storm Event

PROJECT ID 60534898
CREATED BY huffm
LAST MODIFIED 19/01/2018
VERSION: 1

Map
B3

Filename: P:\605x\60534898\4. Tech Work Area\4.99 GIS\3. MXDs\Kalka Shades\Publishing\Figure B3_D016minusBC_18aep_Height.mxd



N

Rockhampton Regional Council

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 25 50 75 100 125 150
Metres

1:2,500
(when printed at A3)

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LEGEND

- ☐ Cadastre

Difference in PWSE (m)

- 🟦 < -0.3
- 🟦 -0.3 to -0.225
- 🟦 -0.225 to -0.15
- 🟦 -0.15 to -0.075
- 🟦 -0.075 to -0.02
- 🟨 -0.02 to 0.02
- 🟥 0.02 to 0.075
- 🟥 0.075 to 0.15
- 🟥 0.15 to 0.225
- 🟥 0.225 to 0.3
- 🟥 > 0.3
- 🟪 Was Dry Now Wet
- 🟩 Was Wet Now Dry

Flood results are based on local catchment events

Data Sources:
DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

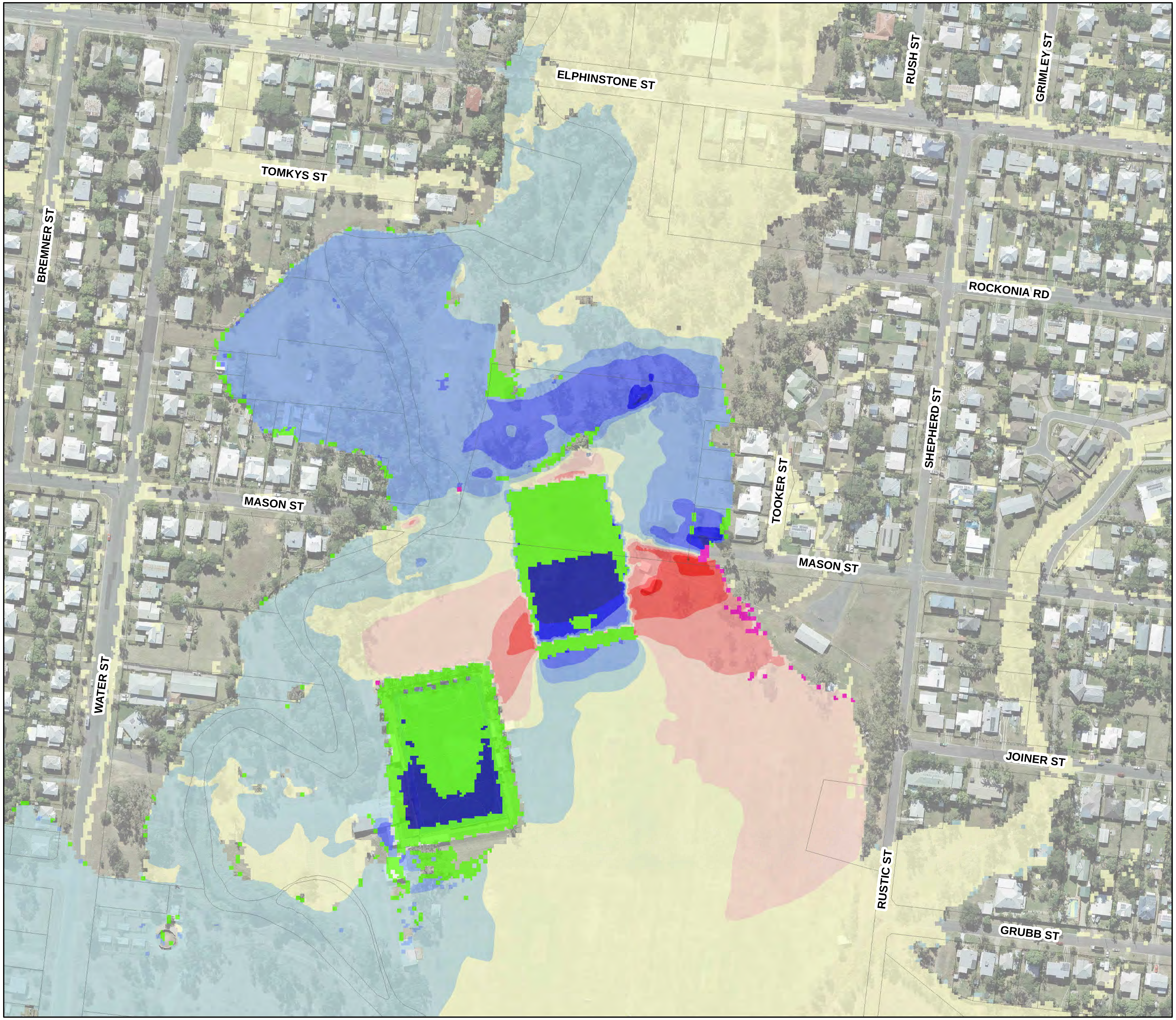
Results Filtering:
75mm Min. Depth

Frenchmans Creek & Thozets Creek Model
Difference in Peak Flood Heights
D016 minus Baseline

10% AEP 90 min Storm Event

PROJECT ID	60534898
CREATED BY	huffm
LAST MODIFIED	19/01/2018
VERSION:	1

Map
B4



N

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0 25 50 75 100 125 150
Metres

1:2,500
(when printed at A3)

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LEGEND

☐ Cadastre

Difference in PWSE (m)

- < -0.3
- -0.3 to -0.225
- -0.225 to -0.15
- -0.15 to -0.075
- -0.075 to -0.02
- -0.02 to 0.02
- 0.02 to 0.075
- 0.075 to 0.15
- 0.15 to 0.225
- 0.225 to 0.3
- > 0.3
- Was Dry Now Wet
- Was Wet Now Dry

Flood results are based on local catchment events

Data Sources:
DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

Results Filtering:
75mm Min. Depth

Frenchmans Creek & Thozets Creek Model
Difference in Peak Flood Heights
D016 minus Baseline

5% AEP 90 min Storm Event

PROJECT ID	60534898
CREATED BY	huffm
LAST MODIFIED	2/02/2018
VERSION:	1

Map
B5

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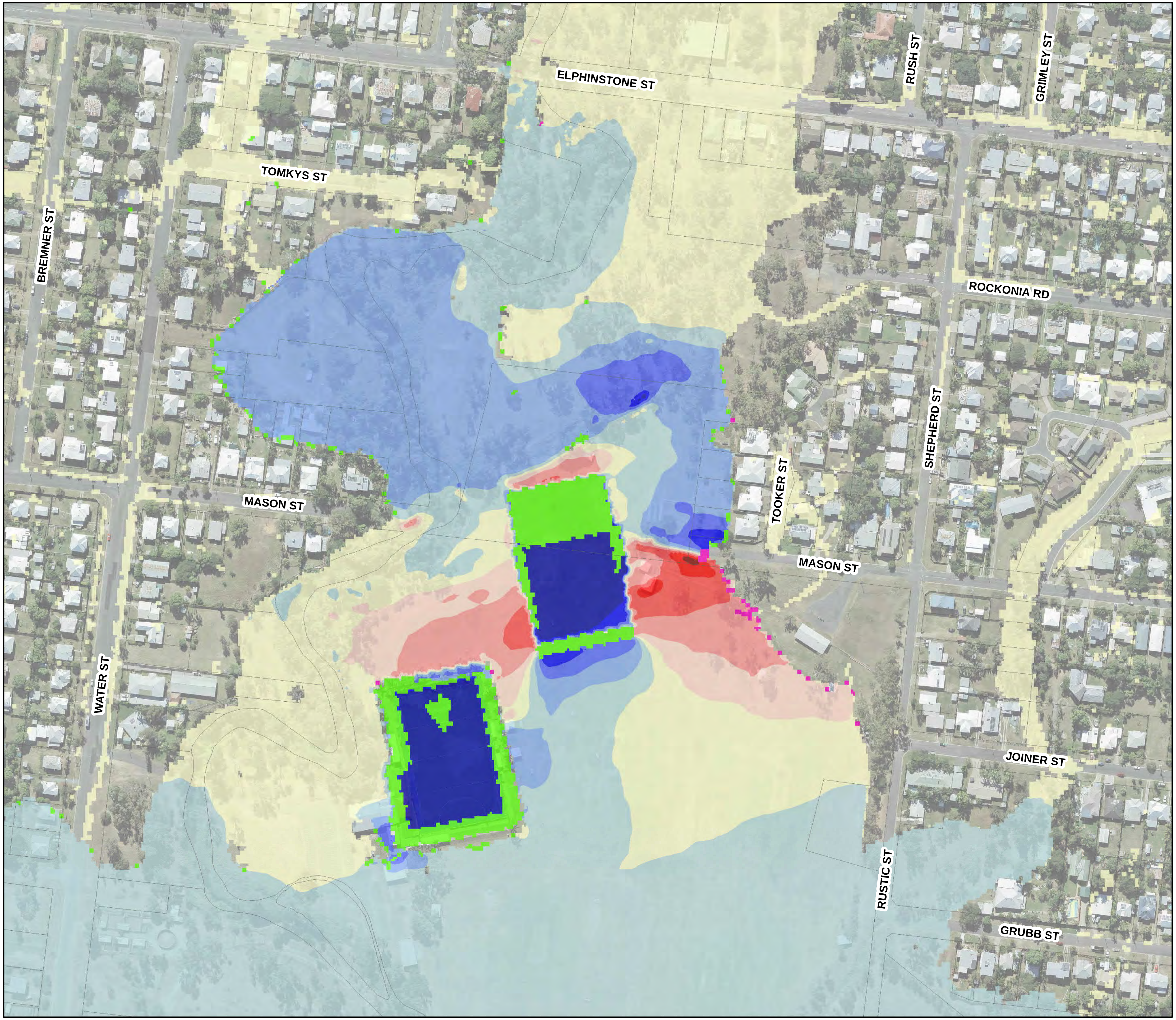

N

Rockhampton Regional Council

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 25 50 75 100 125 150
Metres

1:2,500
(when printed at A3)

AECOM
www.aecom.com

LEGEND

Cadastre

Difference in PWSE (m)

- < -0.3
- -0.3 to -0.225
- -0.225 to -0.15
- -0.15 to -0.075
- -0.075 to -0.02
- -0.02 to 0.02
- 0.02 to 0.075
- 0.075 to 0.15
- 0.15 to 0.225
- 0.225 to 0.3
- > 0.3
- Was Dry Now Wet
- Was Wet Now Dry

Flood results are based on local catchment events

Data Sources:
DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

Results Filtering:
75mm Min. Depth

Frenchmans Creek & Thozets Creek Model
Difference in Peak Flood Heights
D016 minus Baseline

2% AEP 90 min Storm Event

PROJECT ID 60534898
CREATED BY huffm
LAST MODIFIED 2/02/2018
VERSION: 1

Map
B6

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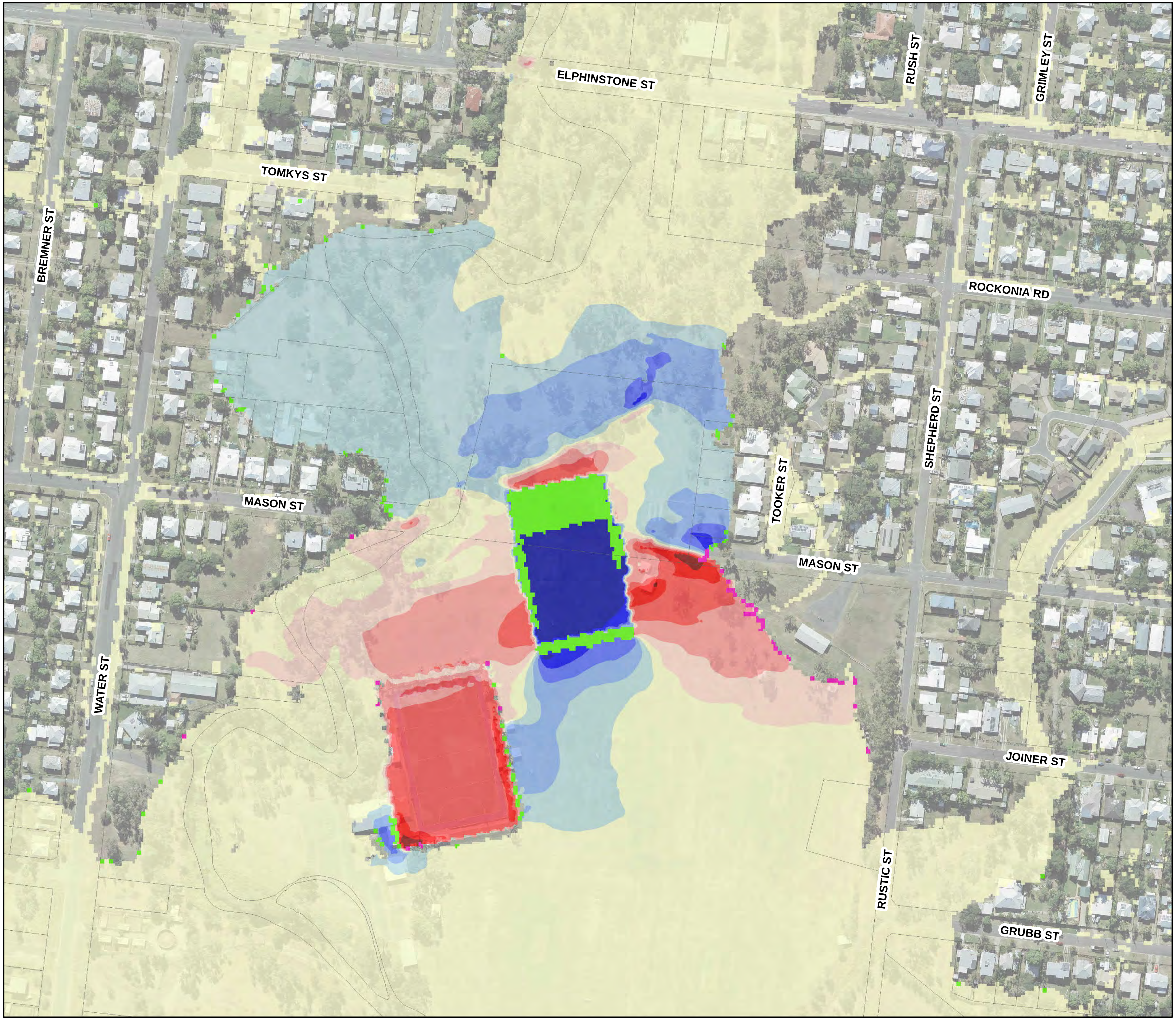

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1:2,500
(when printed at A3)

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LEGEND

☐ Cadastre

Difference in PWSE (m)

- ■ < -0.3
- ■ -0.3 to -0.225
- ■ -0.225 to -0.15
- ■ -0.15 to -0.075
- ■ -0.075 to -0.02
- ■ -0.02 to 0.02
- ■ 0.02 to 0.075
- ■ 0.075 to 0.15
- ■ 0.15 to 0.225
- ■ 0.225 to 0.3
- ■ > 0.3
- ■ Was Dry Now Wet
- ■ Was Wet Now Dry

Flood results are based on local catchment events

Data Sources:

DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

Results Filtering:

75mm Min. Depth

Frenchmans Creek & Thozets Creek Model
Difference in Peak Flood Heights
D016 minus Baseline

1% AEP 90 min Storm Event

PROJECT ID 60534898
CREATED BY huffm
LAST MODIFIED 19/01/2018
VERSION: 1

Map
B7

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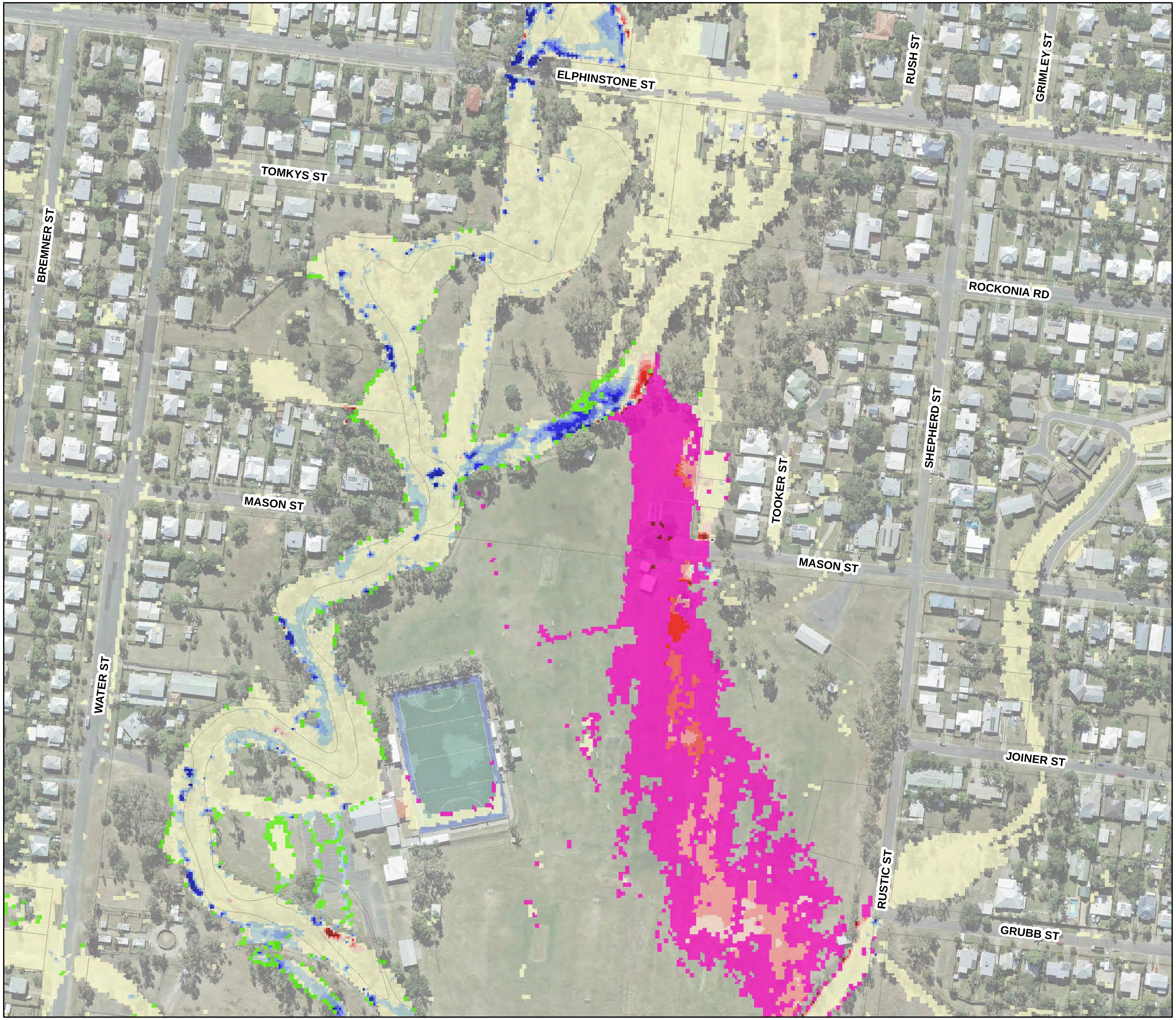

N

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DATUM GDA 1994, PROJECTION MGA ZONE 56

1:2,500
(when printed at A3)

AECOM
www.aecom.com

LEGEND

☐ Cadastre

Change in Velocity (m/s)

- 🟦 < -0.5
- 🟦 -0.5 - -0.4
- 🟦 -0.4 - -0.3
- 🟦 -0.3 - -0.2
- 🟦 -0.2 - -0.1
- 🟨 -0.1 - 0.1
- 🟥 0.1 - 0.2
- 🟥 0.2 - 0.3
- 🟥 0.3 - 0.4
- 🟥 0.4 - 0.5
- 🟥 > 0.5
- 🟪 Was Dry Now Wet
- 🟩 Was Wet Now Dry

Flood results are based on local catchment events

Data Sources:
DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

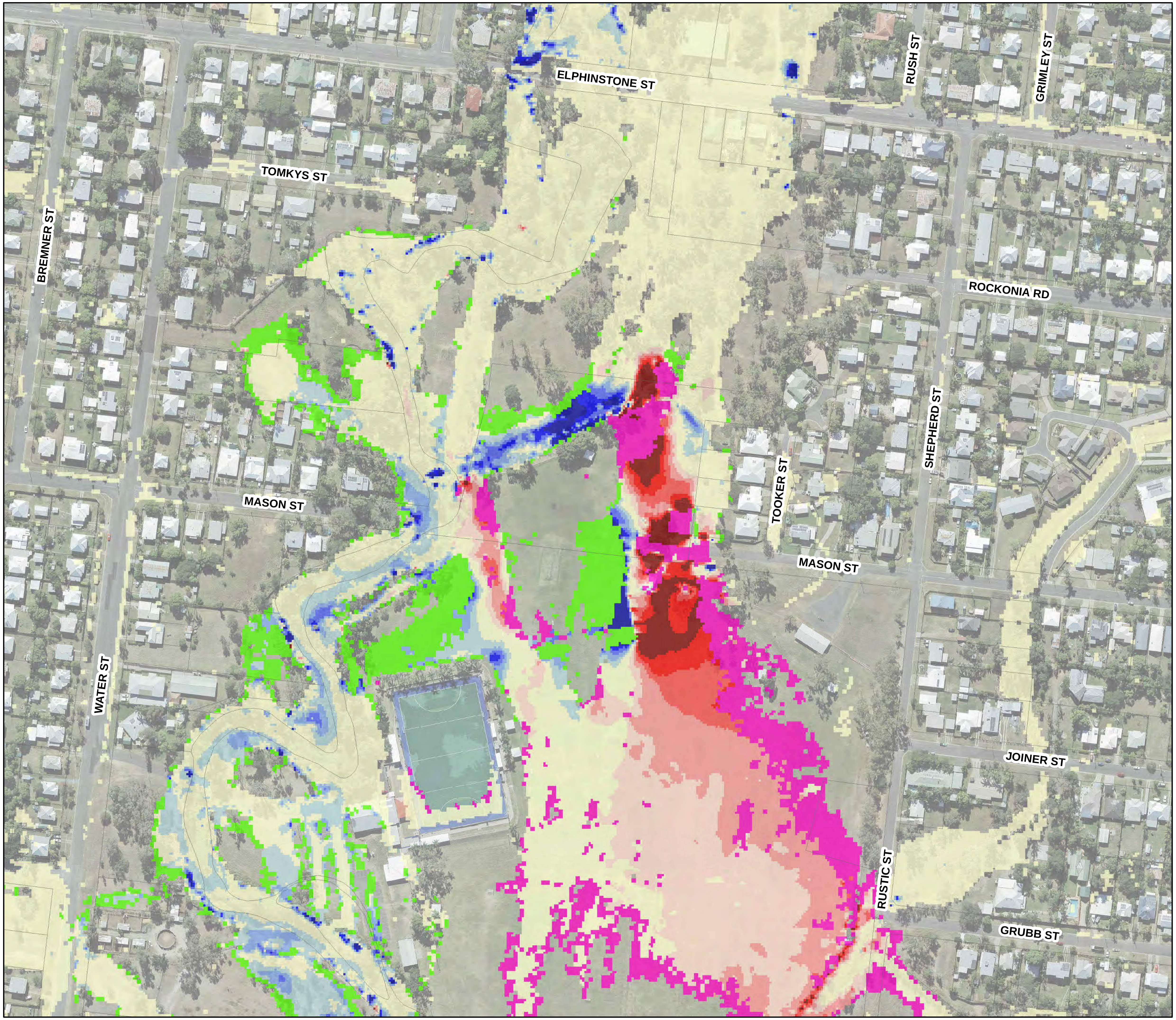
Results Filtering:
75mm Min. Depth

Frenchmans Creek & Thozets Creek Model
Difference in Peak Flood Velocities
D016 minus Baseline

1 EY 90 min Storm Event

PROJECT ID 60534898
CREATED BY huffm
LAST MODIFIED 19/01/2018
VERSION: 1

Map
B8



N

Rockhampton Regional Council

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 25 50 75 100 125 150
Metres

1:2,500
(when printed at A3)

AECOM
www.aecom.com

LEGEND

▭ Cadastre

Change in Velocity (m/s)

- 🟦 < -0.5
- 🟦 -0.5 - -0.4
- 🟦 -0.4 - -0.3
- 🟦 -0.3 - -0.2
- 🟦 -0.2 - -0.1
- 🟨 -0.1 - 0.1
- 🟥 0.1 - 0.2
- 🟥 0.2 - 0.3
- 🟥 0.3 - 0.4
- 🟥 0.4 - 0.5
- 🟥 > 0.5
- 🟪 Was Dry Now Wet
- 🟩 Was Wet Now Dry

Flood results are based on local catchment events

Data Sources:
DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

Results Filtering:
75mm Min. Depth

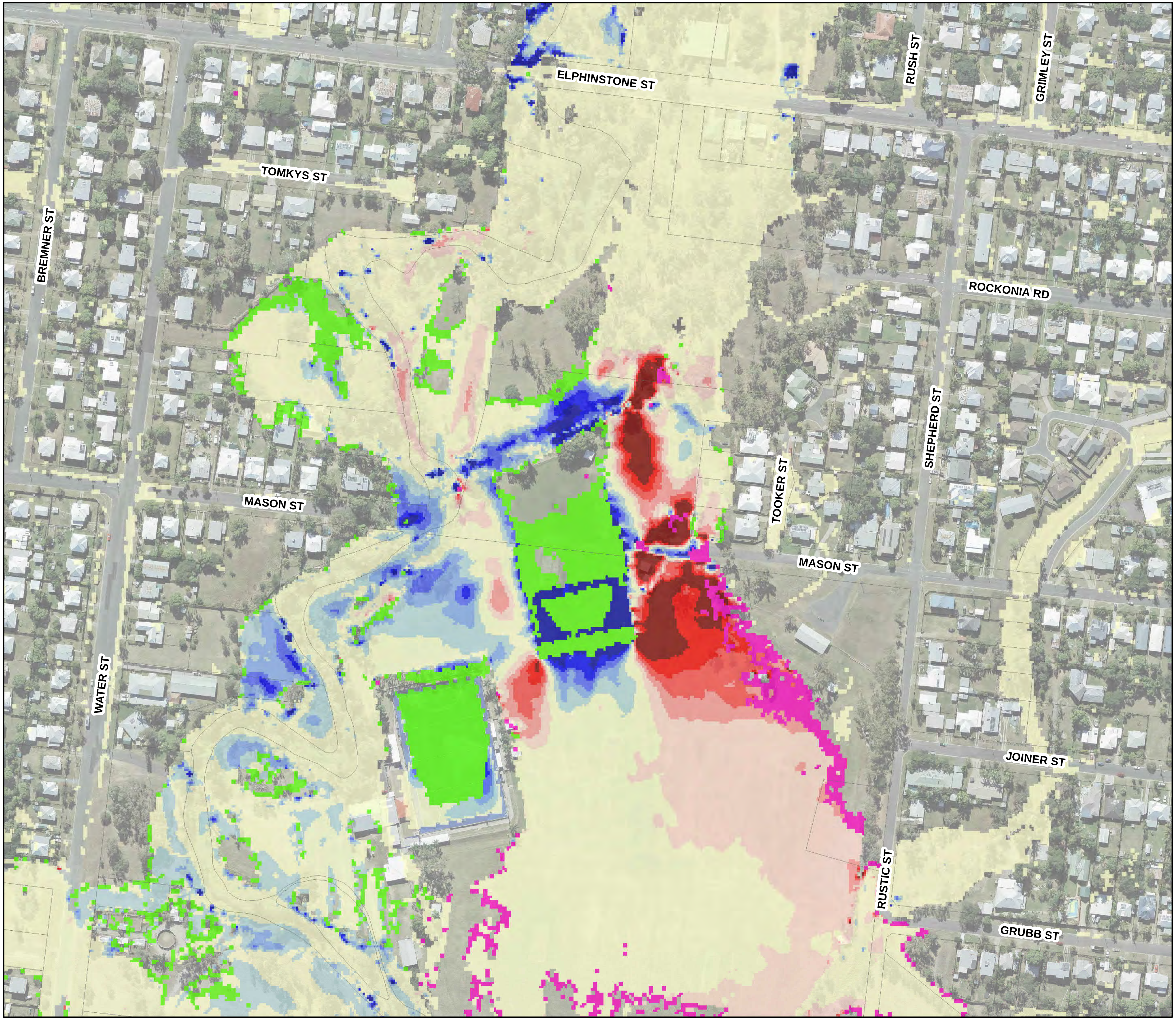
Frenchmans Creek & Thozets Creek Model
Difference in Peak Flood Velocities
D016 minus Baseline

39% AEP 90 min Storm Event

PROJECT ID 60534898
CREATED BY huffm
LAST MODIFIED 19/01/2018
VERSION: 1

Map
B9

Filename: P:\605x\60534898\4. Tech Work Area\4.99 GIS\3. MXDs\Kalka Shades\Publishing\Figure B9_D016minusBC_39aep_Velocity.mxd



N

Rockhampton Regional Council

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 25 50 75 100 125 150
Metres

1:2,500
(when printed at A3)

AECOM
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LEGEND

☐ Cadastre

Change in Velocity (m/s)

- 🟦 < -0.5
- 🟦 -0.5 - -0.4
- 🟦 -0.4 - -0.3
- 🟦 -0.3 - -0.2
- 🟦 -0.2 - -0.1
- 🟨 -0.1 - 0.1
- 🟥 0.1 - 0.2
- 🟥 0.2 - 0.3
- 🟥 0.3 - 0.4
- 🟥 0.4 - 0.5
- 🟫 > 0.5
- 🟪 Was Dry Now Wet
- 🟩 Was Wet Now Dry

Flood results are based on local catchment events

Data Sources:
DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

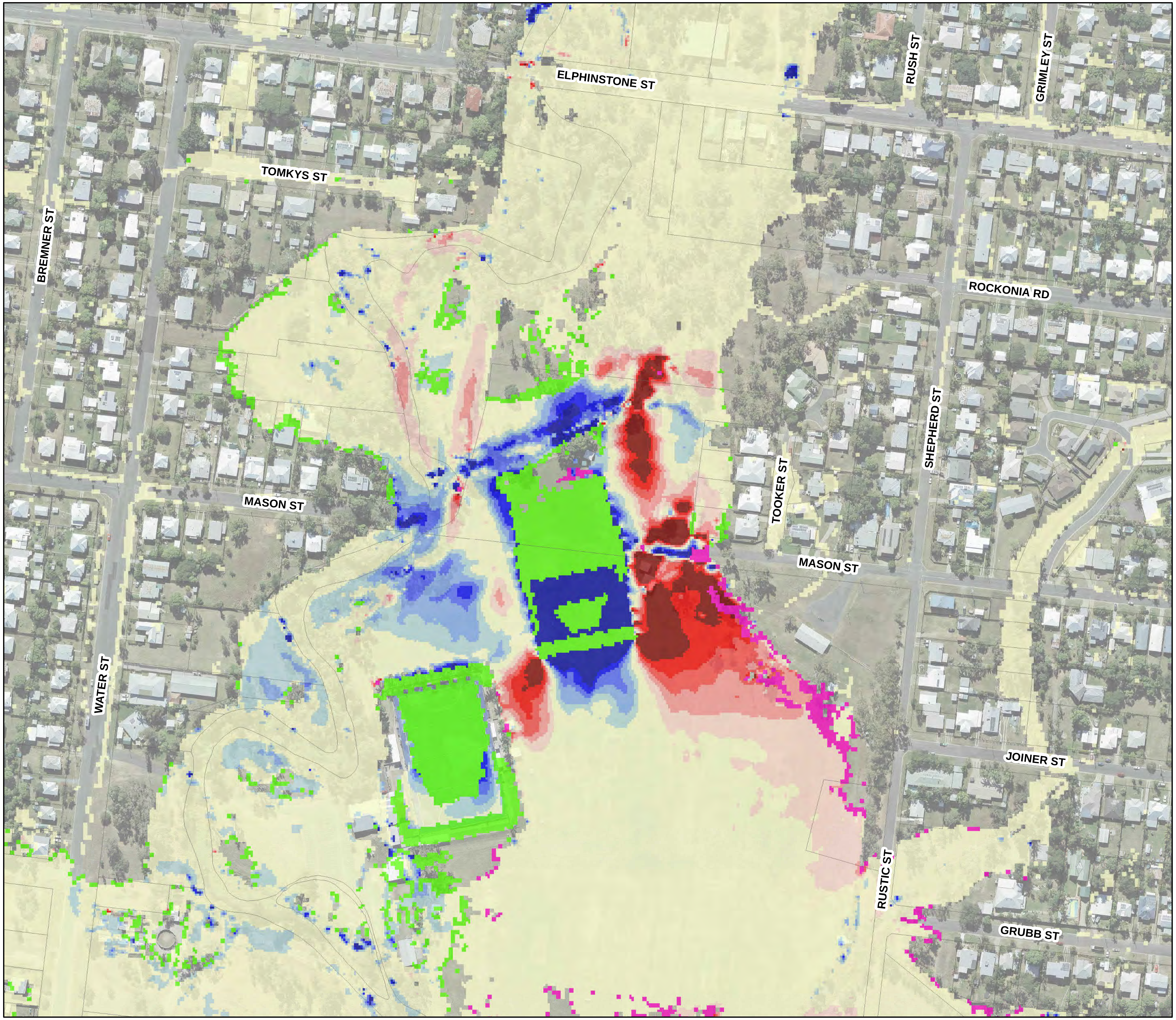
Results Filtering:
75mm Min. Depth

Frenchmans Creek & Thozets Creek Model
Difference in Peak Flood Velocities
D016 minus Baseline

18% AEP 90 min Storm Event

PROJECT ID 60534898
CREATED BY huffm
LAST MODIFIED 19/01/2018
VERSION: 1

Map
B10



N

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 25 50 75 100 125 150

Metres

1:2,500
(when printed at A3)

www.aecom.com

LEGEND

☐	Cadastre

Change in Velocity (m/s)

🟦	< -0.5
🟦	-0.5 - -0.4
🟦	-0.4 - -0.3
🟦	-0.3 - -0.2
🟦	-0.2 - -0.1
🟨	-0.1 - 0.1
🟥	0.1 - 0.2
🟥	0.2 - 0.3
🟥	0.3 - 0.4
🟥	0.4 - 0.5
🟥	> 0.5
🟪	Was Dry Now Wet
🟩	Was Wet Now Dry

Flood results are based on local catchment events

Data Sources:

DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

Results Filtering:

75mm Min. Depth

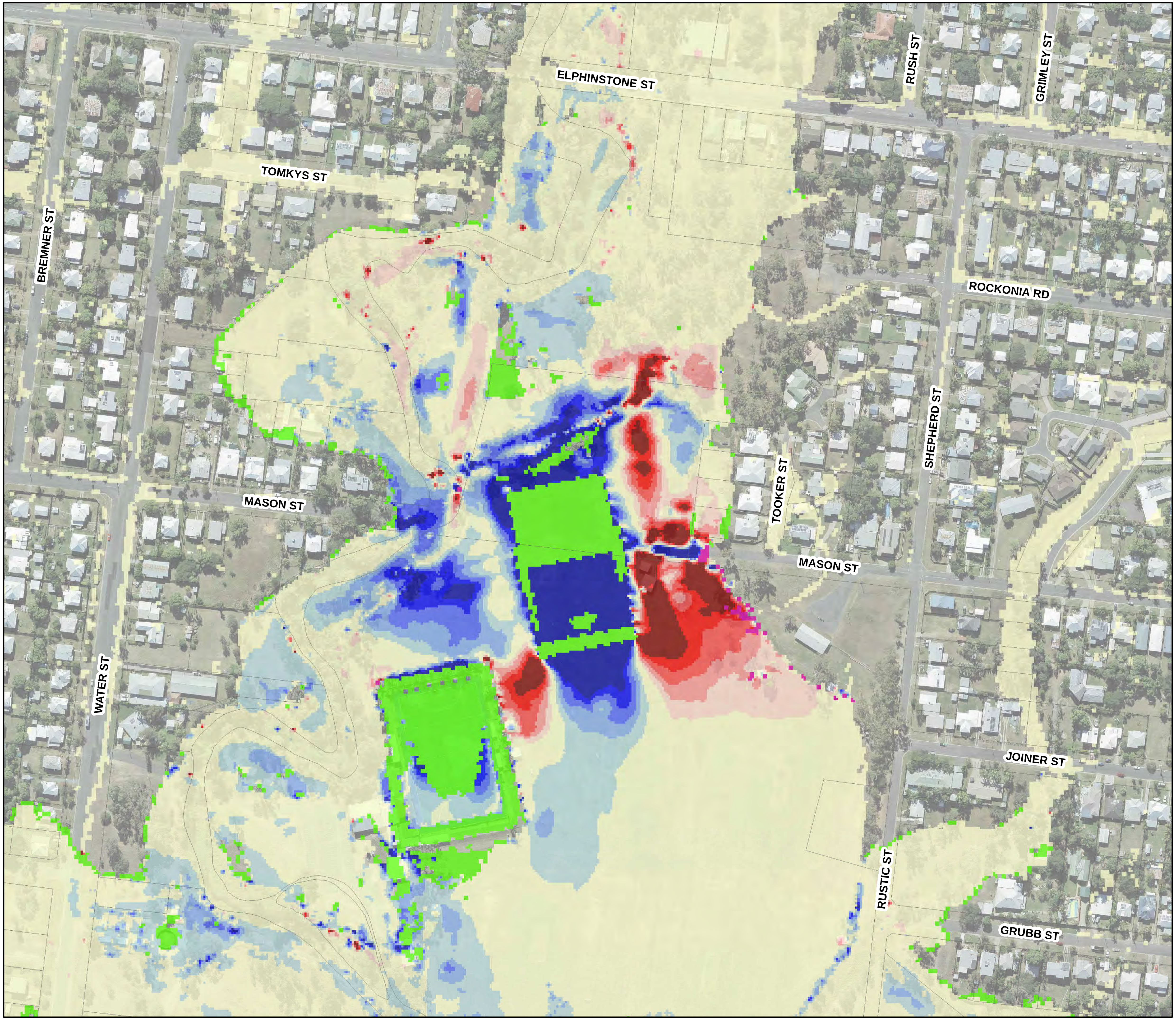
Frenchmans Creek & Thozets Creek Model
Difference in Peak Flood Velocities
D016 minus Baseline

10% AEP 90 min Storm Event

PROJECT ID 60534898
CREATED BY huffm
LAST MODIFIED 19/01/2018
VERSION: 1

Map
B11

Filename: P:\605x\60534898\4. Tech Work Area\4.99 GIS\3. MXDs\Kalka Shades\Publishing\Figure B11_D016minusBC_10aep_Velocity.mxd



Rockhampton Regional Council

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 25 50 75 100 125 150
Metres

1:2,500
(when printed at A3)

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LEGEND

- ▭ Cadastre

Change in Velocity (m/s)

- 🟦 < -0.5
- 🟦 -0.5 - -0.4
- 🟦 -0.4 - -0.3
- 🟦 -0.3 - -0.2
- 🟦 -0.2 - -0.1
- 🟨 -0.1 - 0.1
- 🟥 0.1 - 0.2
- 🟥 0.2 - 0.3
- 🟥 0.3 - 0.4
- 🟥 0.4 - 0.5
- 🟥 > 0.5
- 🟪 Was Dry Now Wet
- 🟩 Was Wet Now Dry

Flood results are based on local catchment events

Data Sources:
DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

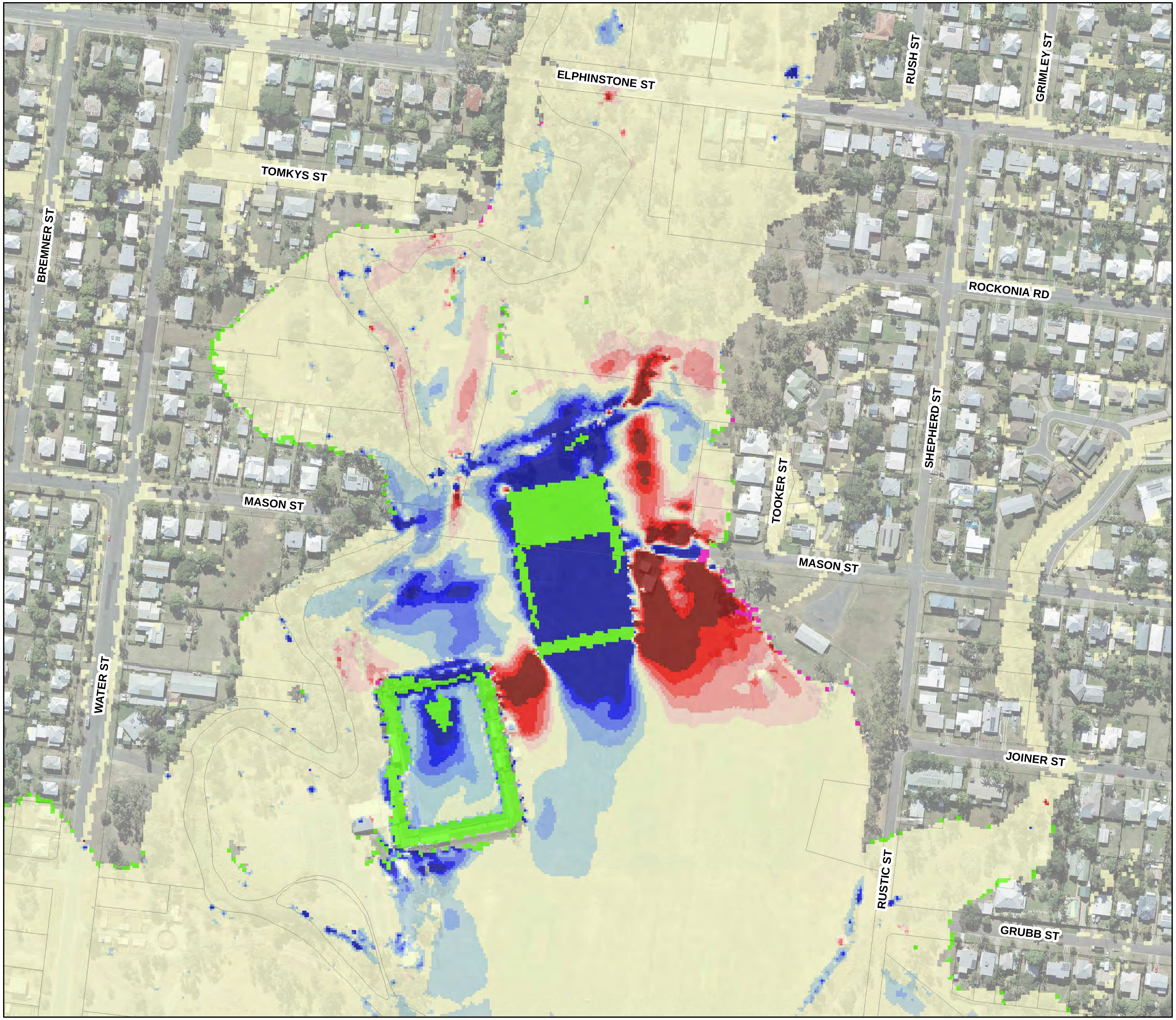
Results Filtering:
75mm Min. Depth

Frenchmans Creek & Thozets Creek Model
Difference in Peak Flood Velocities
D016 minus Baseline

5% AEP 90 min Storm Event

PROJECT ID	60534898
CREATED BY	huffm
LAST MODIFIED	2/02/2018
VERSION:	1

Map
B12



N

Rockhampton Regional Council

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 25 50 75 100 125 150
Metres

1:2,500
(when printed at A3)

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LEGEND

☐ Cadastre

Change in Velocity (m/s)

- 🟦 < -0.5
- 🟦 -0.5 - -0.4
- 🟦 -0.4 - -0.3
- 🟦 -0.3 - -0.2
- 🟦 -0.2 - -0.1
- 🟨 -0.1 - 0.1
- 🟥 0.1 - 0.2
- 🟥 0.2 - 0.3
- 🟥 0.3 - 0.4
- 🟥 0.4 - 0.5
- 🟥 > 0.5
- 🟪 Was Dry Now Wet
- 🟩 Was Wet Now Dry

Flood results are based on local catchment events

Data Sources:
DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

Results Filtering:
75mm Min. Depth

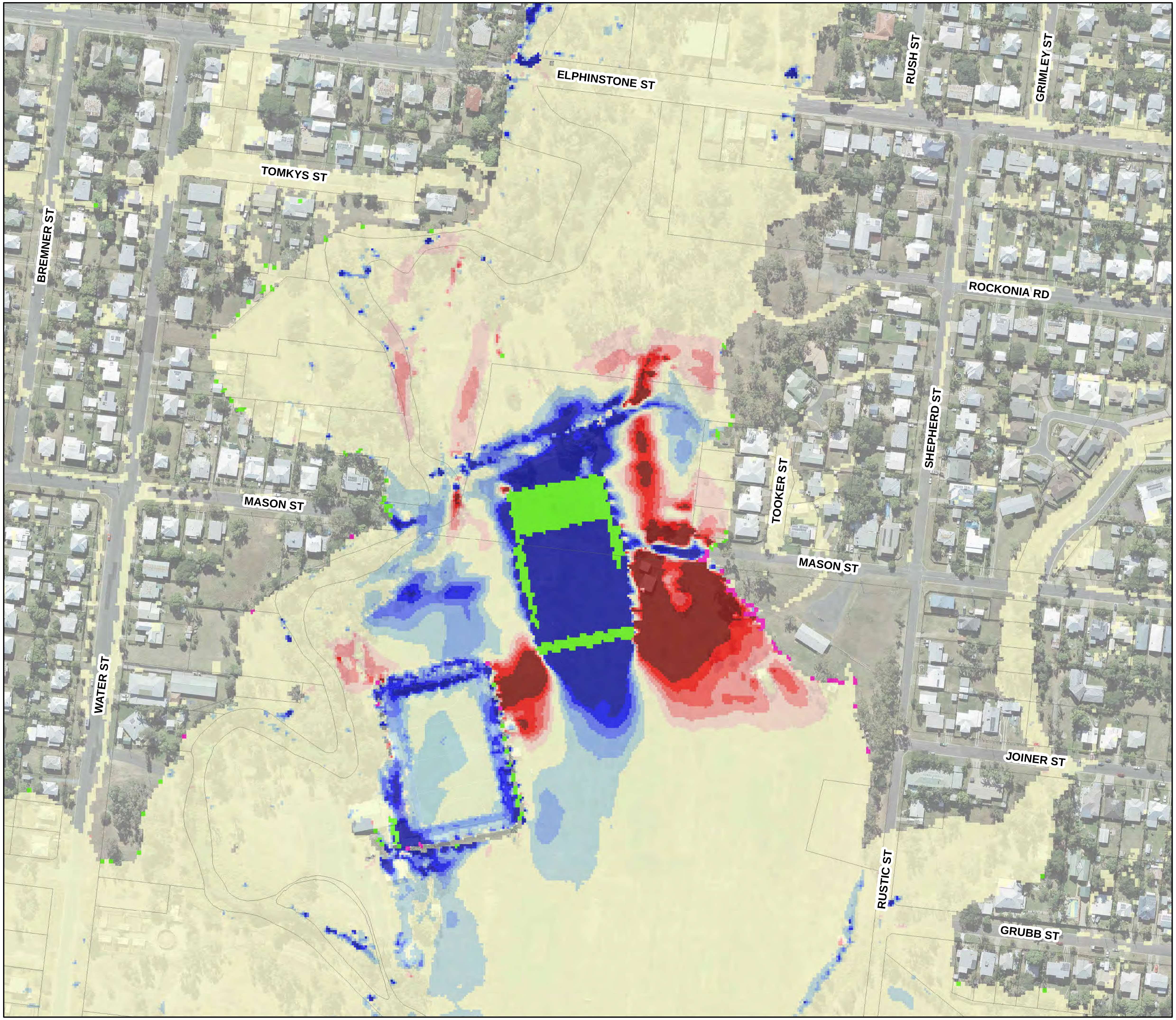
Frenchmans Creek & Thozets Creek Model
Difference in Peak Flood Velocities
D016 minus Baseline

2% AEP 90 min Storm Event

PROJECT ID	60534898
CREATED BY	huffm
LAST MODIFIED	2/02/2018
VERSION:	1

Map
B13

Filename: P:\605x\60534898\4. Tech Work Area\4.99 GIS\3. MXDs\Kalka Shades\Publishing\Figure B13_D016minusBC_2aep_Velocity.mxd



N

Rockhampton Regional Council

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 25 50 75 100 125 150
Metres

1:2,500
(when printed at A3)

AECOM
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LEGEND

☐ Cadastre

Change in Velocity (m/s)

- 🟦 < -0.5
- 🟦 -0.5 - -0.4
- 🟦 -0.4 - -0.3
- 🟦 -0.3 - -0.2
- 🟦 -0.2 - -0.1
- 🟨 -0.1 - 0.1
- 🟥 0.1 - 0.2
- 🟥 0.2 - 0.3
- 🟥 0.3 - 0.4
- 🟥 0.4 - 0.5
- 🟥 > 0.5
- 🟪 Was Dry Now Wet
- 🟩 Was Wet Now Dry

Flood results are based on local catchment events

Data Sources:
DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

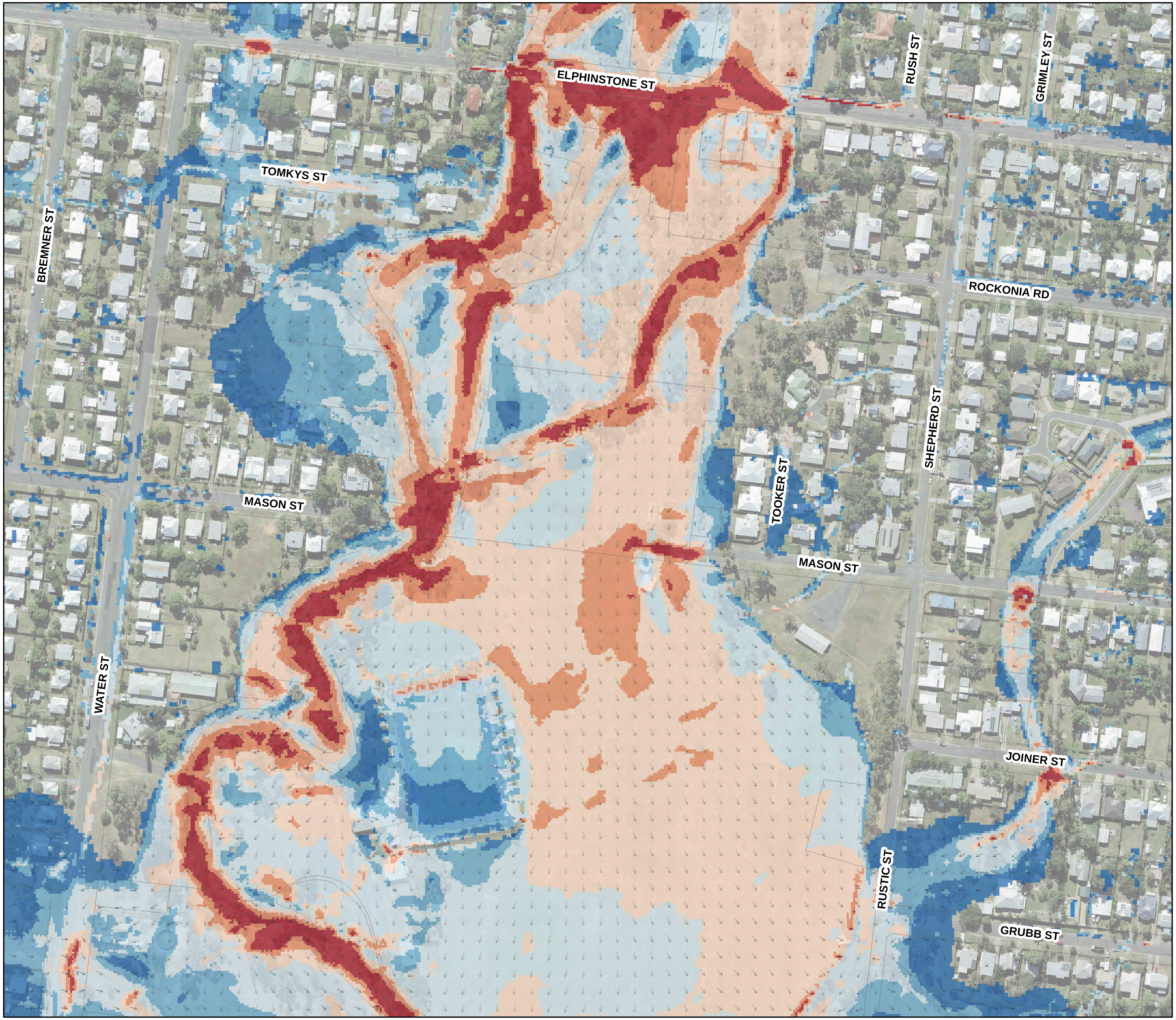
Results Filtering:
75mm Min. Depth

Frenchmans Creek & Thozets Creek Model
Difference in Peak Flood Velocities
D016 minus Baseline

1% AEP 90 min Storm Event

PROJECT ID 60534898
CREATED BY huffm
LAST MODIFIED 19/01/2018
VERSION: 1

Map
B14



Rockhampton Regional Council

1:2,500
(when printed at A3)

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LEGEND

↑ Flow Direction

☐ Cadastre

Peak Depth Averaged Velocity (m/s)

🟦	< 0.25
🟦	0.25 - 0.50
☐	0.51 - 1.00
☐	1.01 - 1.50
🟧	1.51 - 2.00
🟥	> 2.00

Flood results are based on local catchment events

Data Sources:

DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

Results Filtering:

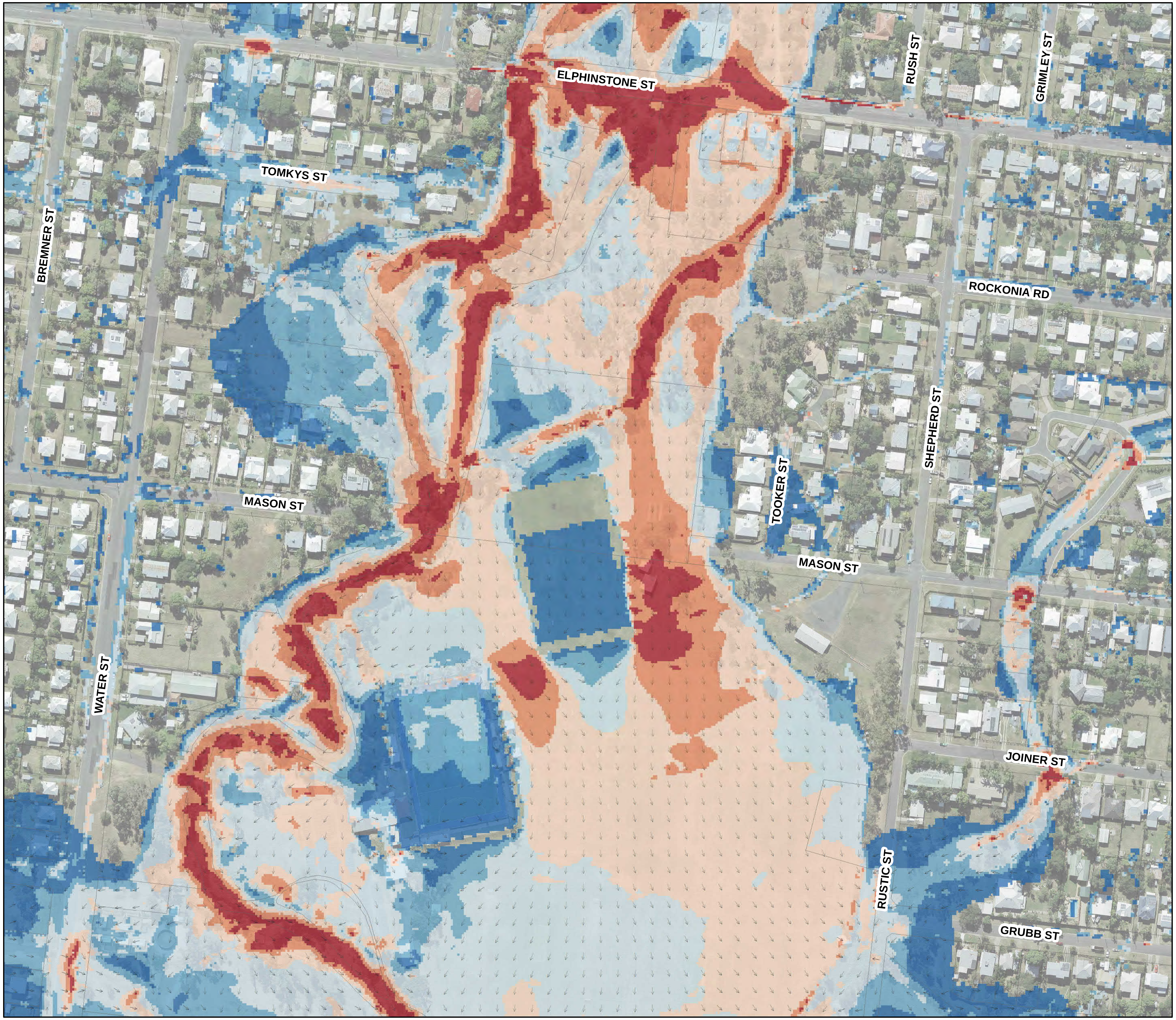
75mm Min. Depth

Frenchmans Creek & Thozets Creek Model Baseline Peak Depth Averaged Velocity

1% AEP 90 min Storm Event

PROJECT ID 60534898
CREATED BY maultbyj
LAST MODIFIED 22/01/2018
VERSION: 1

Map
B15



N

Rockhampton Regional Council

DATUM GDA 1994, PROJECTION MGA ZONE 56

0 25 50 75 100 125 150
Metres

1:2,500
(when printed at A3)

AECOM
www.aecom.com

LEGEND

↑ Flow Direction

☐ Cadastre

Peak Depth Averaged Velocity (m/s)

🟦	< 0.25
🟦	0.25 - 0.50
▨	0.51 - 1.00
▨	1.01 - 1.50
🟧	1.51 - 2.00
🟥	> 2.00

Flood results are based on local catchment events

Data Sources:
DCDB (c) 2016 QLD Government
Imagery (c) 2016 RRC

Results Filtering:
75mm Min. Depth

Frenchmans Creek & Thozets Creek Model D016 Peak Depth Averaged Velocity

1% AEP 90 min Storm Event

PROJECT ID 60534898
CREATED BY maultbyj
LAST MODIFIED 22/01/2018
VERSION: 1

Map
B16

Filename: P:\605x\60534898\4. Tech Work Area\4.99 GIS\3. MXDs\Kalka Shades\Publishing\Figure B16_1aep_Velocity.mxd