Attachment E GHD, 2023 CBESS Surface Water Management Plan

Synergy Collie Battery Energy Storage System

Surface Water Management Plan

SynergyRED

08 September 2023

→ The Power of Commitment

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Acknowledgement of Country

GHD and SynergyRED acknowledge Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience and deep connections to Country. We pay our respects to Elders of past, present and future, as they hold the memories, knowledges and spirit of Australia. GHD and SynergyRED are committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.

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Abbreviations

Table 1 Abbreviations Used

Abbreviation	Term Referred
ACH Act	*Aboriginal Cultural Heritage Act 2021*
AH Act	*Aboriginal Heritage Act 1972*
AEMO	Australian Energy Market Operator
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
APZ	Asset Protection Zone
ARR	Australian Rainfall and Runoff
AS	Australian Standard
ASRIS	Australian Soil Resource Information System
ASS	Acid Sulfate Soils
BAL	Bushfire attack level
BESS	Battery energy storage system
BC Act	*Biodiversity Conservation Act 2016*
bgl	Below ground level
BMP	Bushfire Management Plan
BoM	Bureau of Meteorology
BRMP	Bushfire Risk Management Plan
CAWS Act	*Country Areas Water Source Supply (CAWS) Act 1947*
CBESS	Collie Battery Energy Storage System
CIA	Coolangatta Industrial Estate
CMS	Control Monitoring System
CPS	Collie Power Station
CSIRO	Commonwealth Scientific and Industrial Research Organisation
dB	decibel
DBCA	Department of Biodiversity, Conservation and Attractions
DCP	Development Control Policy
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DDA	Due diligence assessment
DE	Development Envelope
DEA	Digital Earth Australia
DEM	Digital Elevation Model
DFES	Department of Fire and Emergency Services
DPLH	Department of Planning, Lands and Heritage
DMIRS	Department of Mines, Industry Regulation and Safety
DO	Dissolved oxygen
DWER	Department of Water and Environmental Regulation
EAW	Emergency Access Way

Abbreviation	Term Referred
EC	Electrical conductivity
EC Act	*Electricity Corporations Act 2005*
EGRC	Electricity Generation and Retail Corporation trading as 'Synergy'
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986 (WA)*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ETDS Act	*Electricity Transmission and Distribution Systems (Access) Act 1994*
EY	Exceedance per year
FES	*Fire and Emergency Services*
FSAR	Fire service access route
GPT	Gross Pollutant Trap
GW	Gigawatt
Ha	hectares
HVAC	heating, ventilation and air conditioning
IFD	Intensity-Frequency-Duration
ILUA	Indigenous Land Use Agreement
IUCN	International Union for Conservation of Nature
KV	Kilovolt
LGA	Local Government Authority
LiDAR	Light Detection and Ranging
LPP	Local Planning Policy
LPS6	Shire of Collie Local Planning Scheme No. 6
LVIA	Landscape and Visual Impact Assessment
MNES	Matters of National Environmental Significance
MRWA	Main Roads Western Australia
MWh	Megawatt hour
MW	Megawatts
NCC	National Construction Codes
O&M	Operations and Maintenance
PD Act	*Planning and Development Act 2005*
PECs	Priority Ecological Communities
PW Act	*Public Works Act 1902*
RDAP	Regional Development Assessment Panel
SIA	Strategic Industrial Area
SMP/SWMP	Stormwater Management Plan
SPP	State Planning Policy
SWIS	South-West Interconnected System
SynergyRED	Synergy Renewable Energy Developments Pty Ltd
TECs	Threatened Ecological Communities
TIS	Transport Impact Statement
WAPC	Western Australian Planning Commission

Abbreviation	Term Referred
WEM	Wholesale Energy Market
WP	Western Power
WoNS	Weeds of National Significance

Definitions

Table 2 Defined Terms

Term	Definition
Proposal	The Proposal comprises the installation of 500 MW/2000 MWh and infrastructure and approvals to support a potential expansion to 1000 MW/4000 MWh BESS, with a 330/33 kV BESS Substation and Switch yard adjacent to the existing Collie Power Station. The Proposal is inclusive of all associated infrastructure (i.e., switchyard, substation, transformers, control room, admin and O&M building, drainage, firewater and rainwater collection) as well as transmission line to Shotts Terminal.
Development Envelope	Extent of land that forms part of the Proposal comprising the BESS and all associated infrastructure, transmission line corridor and, proposed and optional laydown areas.
Development Site	All of the lot parcels intersecting with the Development Envelope.
Disturbance Footprint	The Disturbance Footprint is located within the Development Envelope and represents the extent of site works / disturbance that will occur as part of the Proposal.
BESS / CBESS / CBESS facility	The Battery Energy Storage System (BESS) is a type of energy storage system comprising rechargeable batteries and associated infrastructure used to import and export energy into the SWIS.
Inverter	The inverter can convert alternating current power (AC) to direct current (DC) (rectifying) to charge the BESS (storage), or convert DC power back to AC (inverting, or rectifying in reverse) to discharge the battery and provide AC power (generating).
BESS Switchyard & BESS Substation	The switchyard refers to the 330kV AC electrical infrastructure connecting the BESS facility (and Substation) to the 330kV transmission line to Shotts terminal. The BESS Substation converts electricity between 33kV AC and 330kV AC (the local grid connection voltage). The main 33kV / 330 kV step-up transformer/s are located within the Substation.
Shotts Terminal	Refers to Western Power's existing terminal at Lot 21 Salvation Road, Palmer.
BESS Switchrooms	The BESS Switchrooms from part of the BESS Substation and contain electrical equipment such as high voltage switchgear, communications equipment, control system and other auxiliary equipment such as HVAC, lighting, and fire protection systems necessary for the switchroom operation.
MW	MW means megawatts and is the measurement of the rated power capacity of a BESS, being the total possible instantaneous discharge and charge capability starting from a fully charged state.
MWh	MWh means megawatt-hours and is the measure of the storage duration of a BESS, being the amount of time energy can discharge at its power capacity before depleting its energy capacity.
Main BESS Area	The area within the DE that contains the proposed CBESS infrastructure excluding the transmission lines. This is the area between the wetland and the Collie River.
m^3/s	m^3/s means cubic meters per second and is a measurement of flow rate used in this study for rainfall runoff and peak flows.
µS/cm	µS/cm means microsiemens which is a measurement of electrical conductivity
Floodplain	A floodplain is a generally flat area of land adjacent to a channel. It has two (2) components: the floodway, which includes the main channel, and the flood fringe, which is the area outside of the floodway that usually has shallow inundation during large rainfall events.
TUFLOW / TUFLOW HPC	TUFLOW is a computer program for simulating depth-averaged, one and two-dimensional free-surface flows such as occurs from floods and tides, with the 2D solution occurring over a regular grid of square elements. This was the program used for the hydrological and hydraulic model of this study.
TUFLOW Flike	TUFLOW Flike is a flood frequency analysis toolkit that was used in determining design peak stream flows for Collie River.

Term	Definition
QGIS	QGIS is a geographic information system (GIS) application that allows viewing, editing, printing, and analysis of geospatial data.
IL and CL	Initial Loss and Continuing Loss are losses applied to rainfall in hydrologic modelling. This is a common modelling approach taken in hydrology. Values are often derived for use for rural catchments from a national datahub that has been prepared by Geoscience Australia.

1. Introduction

GHD acts on behalf of Synergy Renewable Energy Developments Pty Ltd (SynergyRED), the proponent of the proposed integrated Collie Battery Energy Storage System (CBESS) and associated infrastructure to be located adjacent the existing Collie Power Station at Boys Home Road, Palmer. SynergyRED is a wholly owned subsidiary of Synergy established to develop and manage renewable and energy storage assets. SynergyRED is developing this asset on behalf of Synergy, the ultimate expected asset owner.

The purpose of this Surface Water Management Plan (SWMP) is to outline the methodology and results of the flood risk assessment and the stormwater management measures proposed for the Proposal.

1.1 Previous Studies

A similar hydrological study, *Collie Battery Energy Storage System (BESS) Project Flood Risk Assessment* (Umwelt and Neoen 2022), was done for an adjacent site approximately 12 kilometres (km) northeast of Collie along Collie-Williams Road. GHD has used this study solely for relevant comparisons; no methodology or data were directly sourced for use in GHD's hydrological study.

1.2 Objectives

The objectives of this SWMP are as follows:

– Determine the floodplain extents of the Collie River located near the Proposal;
– Determine the floodplain extents at the wetland area located west of the Proposal;
– Assess the flood risks at the Proposal and at the adjacent wetland area;
– Provide flood maps at the Proposal and wetland area for maximum flood depths, water levels, and velocities;
– Provide a conceptual drainage arrangement for the Proposal (specifically at the CBESS facility) with sufficient basin capacities for stormwater and firewater; and
– Provide water management measures during the operation phase of the Proposal.

1.3 Scope and Limitations

This report has been prepared by GHD for SynergyRED and its related companies and may only be used and relied on by SynergyRED and its related companies for the purpose set out in this report.

GHD otherwise disclaims responsibility to any person other than SynergyRED and its related companies arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring after the date that the report was prepared.

GHD has prepared this SWMP relying on information provided by SynergyRED, government databases, and other consultants undertaking work within the study area. It is assumed that all provided information are reliable and up to date. The opinions, conclusions and any recommendations in this report are based on these assumptions. GHD disclaims liability arising from any of the assumptions being incorrect.

Limitations on the hydrological model:

– Discharge from the outflow pipe of the existing Collie Power Station is excluded from the model.

1.4 Accessibility of Documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

2. Land and Location

The Proposal is located within the Shire of Collie (the Shire), which includes the town of Collie and other small centres including Allanson, Cardiff, and Buckingham. The Development Site comprises four (4) land parcels described in detail in *Section 2.1 – Lot Details*. Within the wider Development Site, a Development Envelope (DE) describes the extent of land that forms part of the Proposal, including the CBESS facility and all associated infrastructure. The DE is located approximately 8 km to the north-east of the Collie townsite and comprises the land generally between the Collie Power Station and the Collie River.

The DE is intersected by Boys Home Road, which connects the broader Coolangatta Industrial Estate, and the Collie Power Station, to its main road access point and Collie-Williams Road; approximately 5 km to the east of the proposed development. Some formal (but mostly informal) access tracks and fire breaks provide connection to Coalfields Road, generally to the southeast of the DE. To the north of the DE is the Collie River and the wider Harris River State Forest. Across the Collie River is the Western Power operated Shotts Terminal, which is used for power transmission from both the Collie and Bluewaters Power Stations. The land generally to the east of the DE comprises the expansive Muja State Forest.

Further to the south of the DE is the Shotts Strategic Industrial Area (SIA). The SIA is located a similar distance east of Collie, along Coalfields Road. The SIA is part of a wider program by the State government to identify and promote areas for expanded industrial and economic development. A portion of the SIA was included in this SWMP scope. The regional context and local context are shown in Figures 1 and 2.

2.1 Lot Details

The DE comprises portions of the lots specified in Table 3 below. Only lots within the DE where approval is sought for development are described.

Table 3 Lots Description

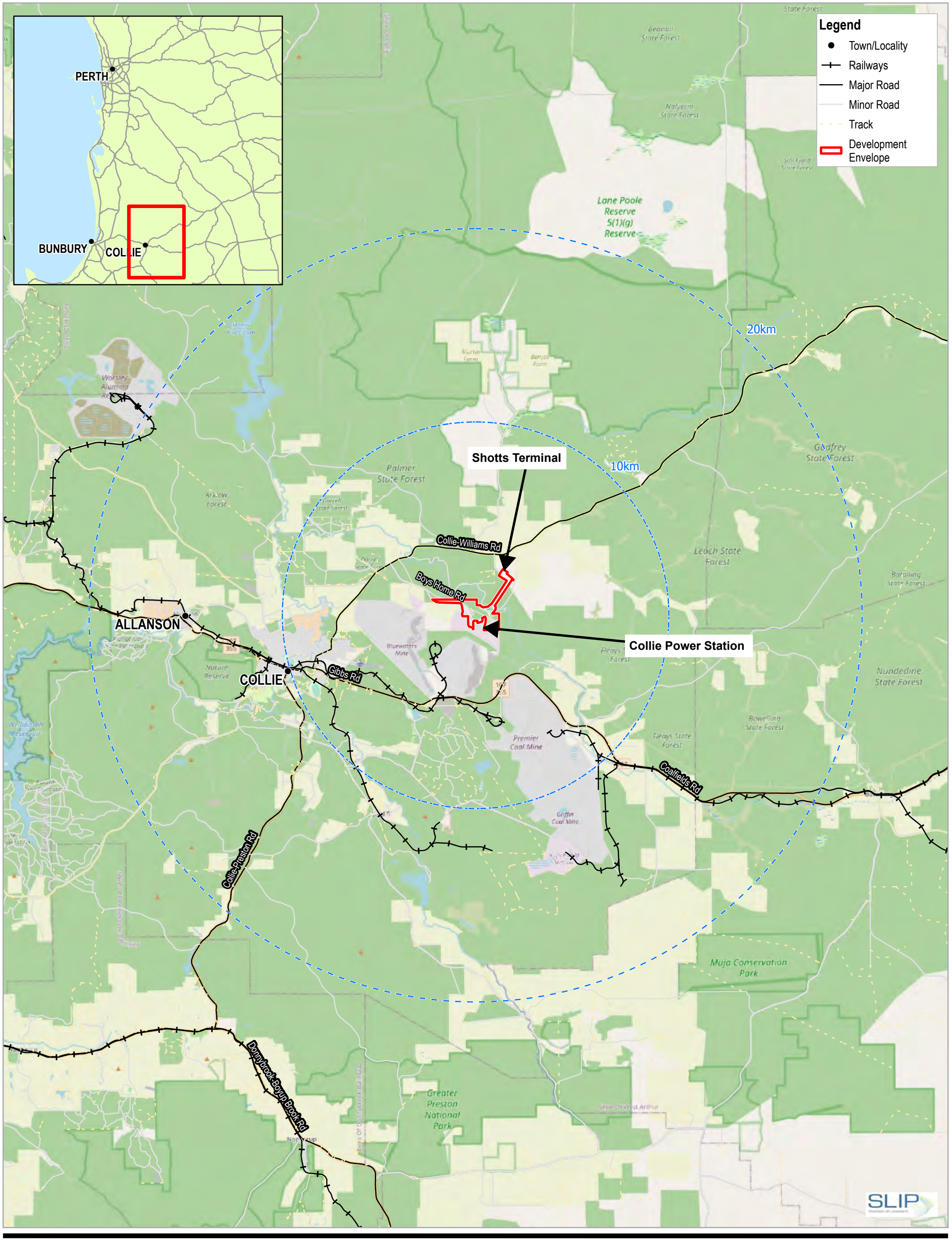
Landgate ID	Lot on Plan	Vol/Folio	Description	Registered Owner	Area
3722268	3001 on P051101	2684/108	296 Boys Home Road, Palmer	Electricity Generation & Retail Corporation	525.77 ha
4143625	113 on P070794	2912/613	N/A	Electricity Generation & Retail Corporation	585.06 ha
4007454	74 on P070698	2786/624	N/A	Electricity Generation & Retail Corporation	729.28 ha
3123670	N/A	N/A	Unallocated Crown Land	N/A	91.11 ha

All lots comprising the DE are owned in freehold by the EGRC, trading as 'Synergy', with the exception of a portion of Unallocated Crown Land, which forms the Collie River. Applicable easements are identified in Table 4. Additionally, Lot 21 on P059633 (Landgate ID 3863280) is excluded from the Development Application but is included in the SWMP scope.

Table 4 Notifications and Easements

Landgate ID	Type	Doc ID	Lot	Description
3722270 3722271	Easement	K499705	3001 on P051101	Easement to Electricity Networks Corporation for electricity transmission works.
3722272	Easement	K499709	3001 on P051101	Easement to Electricity Networks Corporation for access purposes.
4157041	Easement	B464442	113 on P70794	Easement to the State Energy Commission of Western Australia
4157046 3996627	Easement	K499705	113 on P70794 74 on P070698	Easement to Electricity Networks Corporation for electricity transmission works.

Native Title has been extinguished by the Gnaala Karla Booja Indigenous Land Use Agreement (ILUA).



Paper Size ISO A3

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Synergy Collie Battery Energy Storage System

Project No. **12599664**
Revision No. **B**
Date **31/05/2023**

Regional context

FIGURE 1

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6316000 6315000 6314000 6313000 6312000 6311000 6310000 6309000 6308000

Legend

- Railways
- Major Road
- Minor Road
- Track
- Major Waterways
- Development Envelope
- Works to Shotts Terminal are excluded from Development Application

Bingham River
Pollard Brook
Collie-Williams Rd
Collie River East Branch
Shotts Terminal
Bingham River
Collie River East Branch
Main BESS Area
Collie Power Station
Collie River East Branch
Coalfields Rd
SLIP

Paper Size ISO A3

0 0.25 0.5 0.75 1

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Synergy
Synergy Collie Battery Energy Storage System

Site Location

Project No. **12599664**
Revision No. **0**
Date **08/09/2023**

FIGURE 2

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Data source: Landgate_Subscription_ImageryWANow; Created by: rbrown3

3. Proposal Description

This report supports an environmental and planning approvals to commence development for a BESS facility located primarily on Lot 3001, comprising the installation of 500 MW/2000 MWh and infrastructure and approvals to support a potential expansion to 1000 MW/4000 MWh BESS, with a 330/33 kV BESS Substation and Switchyard adjacent to the existing Collie Power Station (the Proposal).

Environmental and development approval is sought for the Proposal of both the BESS facility and transmission line infrastructure connecting it to Shotts Terminal. Approval is sought with a period in which to commence substantial development of at least four (4) years.

Table 5 provides a summary of the key project elements that form the Proposal.

Table 5 Proposal Content Elements

Element	Maximum extent, capacity or range
Stage 1 BESS	656 battery enclosures / 164 Inverters (500 MW/ 2000 MWh)
Potential future expansion	Infrastructure and development footprint to support a possible future 500 MW / 2000 MWh
Emergency diesel generators	Sized to generate sufficient power for critical systems including safety systems, control and monitoring services, communications systems, security and access control systems, offices, and maintenance facilities, firefighting pumps, contaminated surface water control and pumping if required.
Cabling	Mostly underground with some above-ground at connection points
Switchyard & Substation	
Transformers	Up to 4 x 330/33 kV units
Switchrooms	Up to 4 x 33 kV units
WP Control room	One (1)
Site Facilities & Ancillary Infrastructure	
Buildings	Control rooms, switchrooms, security and operation and maintenance facilities.
Firewater tanks / volume (m^3)	2 / 900 kL (800 kL structural fire fighting. 100 kL bushfire fighting)
Staff / contractor parking	12 x bays incl. 1 x Universal bay
Drainage basin (detention water & firewater)	4 x basins
Transmission Line Corridor	
Towers / poles	10-15 x 30-60m tall transmission towers / poles
Line type	330 kV overhead transmission line
Alignment	Parallel to existing 330 kV line and easement

3.1 Construction

The initial stage of the Proposal is a 500 MW / 2,000 MWh BESS (Stage 1). A tee connection to the existing transmission line from Collie Power Station to Shotts Terminal will be constructed (to allow for staged energisation of the facility and early commissioning) and will also include the relocation of some existing transmission towers. Two new 330 kV overhead lines from Shotts Terminal to the BESS switchyard will also be constructed. The BESS Switchyard and BESS Substation will be sized to accommodate up to 4 x 300 MVA 330 kV / 33 kV transformers (Stage 2).

Construction of Stage 1 of the Proposal is summarised as follows:

– Expected 22 month construction period.
– Up to 800 persons on-site during the peak construction period

– Up to 7 days a week on a 6 am to 6 pm staggered shift arrangement.
– Elements of the construction workforce to arrive at the construction site via bus/coach operated from surrounding key towns of Collie, Australind and Bunbury. Bus service frequency is expected to range from 2 to 8 per day.
– Up to 250 on-site parking bays to accommodate the construction workforce.
– Delivery vehicles used to transport large and heavy equipment will mostly be semi-trailers with the occasional B-Double.

Similar construction characteristics are expected for construction of Stage 2.

3.2 Proposal Operation

Once commissioned, the Proposal will typically operate under the following characteristics:

– The CBESS facility is planned to be highly autonomous and operate 24/7, 365 days a year. Staffing on site at any given time is expected to be less than 20 personnel to support maintenance and essential site services including security.
– Major maintenance activities resulting in up to 50 persons present on-site.
– The forecast daily traffic generation during daytime operation will be approximately 20 vehicles per day.

3.3 Overall Proposal Layout

An overall Proposal Layout which illustrates the location of the Proposal components and Disturbance Footprint relative to the Development Envelope (DE) is shown on Figure 3.

Legend

- Development Envelope

Disturbance Footprint

- Existing borrow pit - option to landscape
- Temporary laydown area
- Optional temporary laydown area
- Collie BESS Disturbance Footprint
- No Clearing Area

Infrastructure

- BESS transmission line
- CPS transmission line
- Access and Internal Road
- Stage 1 Battery Yard
- Stage 2 Battery Yard
- BESS Asset Protection Zone
- Basin and Bioswale
- O&M area
- Switch Rooms and Control Room
- Switchyard & Substation

Shotts Terminal

Collie Power Station

SLIP

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Project Layout

Project No. **12599694**
Revision No. **1**
Date **01/09/2023**

FIGURE 3

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Print date: 04 Sep 2023 - 09:03

Data source: Landgate_Subscription_Imagery\WANow: World Topographic Map: Esri Community Maps Contributors, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS World Hillshade: Esri, Geoscience Australia, NASA, NGA, USGS. Created by: klabez

4. Site characteristics

4.1 Zoning and Existing Land Use

The portions of the DE are subject to various zoning under the Shire's Local Planning Scheme (LPS6), as follows:

– Lot 3001 being partially zoned 'Industrial Development' and 'Strategic Industry'.
– The portion of Lot 3001 zoned 'Industrial Development' also being subject to an 'ASR4' (Additional Development Requirement).
– Lots 74 and 113 being zoned 'Rural'.
– All lots being subject to Special Control Area 6 (SCA6).

Portions of the DE comprising the Collie River are reserved 'Drainage/Waterway' under the Shire's LPS6.

A large portion of the DE is comprised of cleared grassland, remnant plantation areas, cleared area for existing transmission lines connecting to the Western Power Shotts terminal, a disused borrow pit and areas of remnant scattered vegetation.

The DE has historically been used for agriculture purposes (predominately grazing). Portions of the DE north of the Collie River are still utilised for these purposes.

A small compound and building are located centrally on Lot 3001, comprising the 'Holista Colltech Rendering Facility'. The facility is currently subject to a lease, which is due to end on August 2024.

The topography of the DE is highest on Lot 3001, reaching a height of approximately 240 m AHD. The DE slopes downwards towards the Collie River, to a low point of approximately 200 m AHD, before rising back to 250 m AHD on Lot 74 on approach to Shotts Terminal.

4.2 Climate

The Shire of Collie is located within the South West region of Western Australia. This region has a temperate climate with dry, warm summers and wet, cold winters (Bureau of Meteorology, 2016). Winter rainfall generally occurs from April to October while summer rainfall occurs from November to March (Bureau of Meteorology, 2023).

The closest weather station to the Proposal is the Collie East Station (Site number 009994), located at Latitude 33.36 °S, Longitude 116.17 °E, with data from 2002-2023. Historical climate data are summarised below.

Table 6 Collie East Climate Averages

Site Name	Mean minimum temperature	Mean maximum temperature	Mean annual rainfall	Mean annual rainy days ≥1 mm
Collie East	4.2 °C (July) to 13.9 °C (February)	16.3 °C (July) to 31.0 °C (January)	726.6 mm	81.2

Table 7 Collie East Mean Monthly Rainfall

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean rainfall (mm)	17.1	12.1	19.1	41.6	94.9	104.1	134.7	113.9	89.1	40.8	25.5	18.8

4.3 Site Topography

The DE intersects with the Collie River and is nearby to the Bingham River branch. An area of wetland exists to the west of the DE, within the Development Site, which connects to the Collie River.

The terrain of the Development Site generally follows gradients towards these two major tributaries, as shown in Figure 4. Within the DE, the maximum elevation is approximately 240 m AHD.

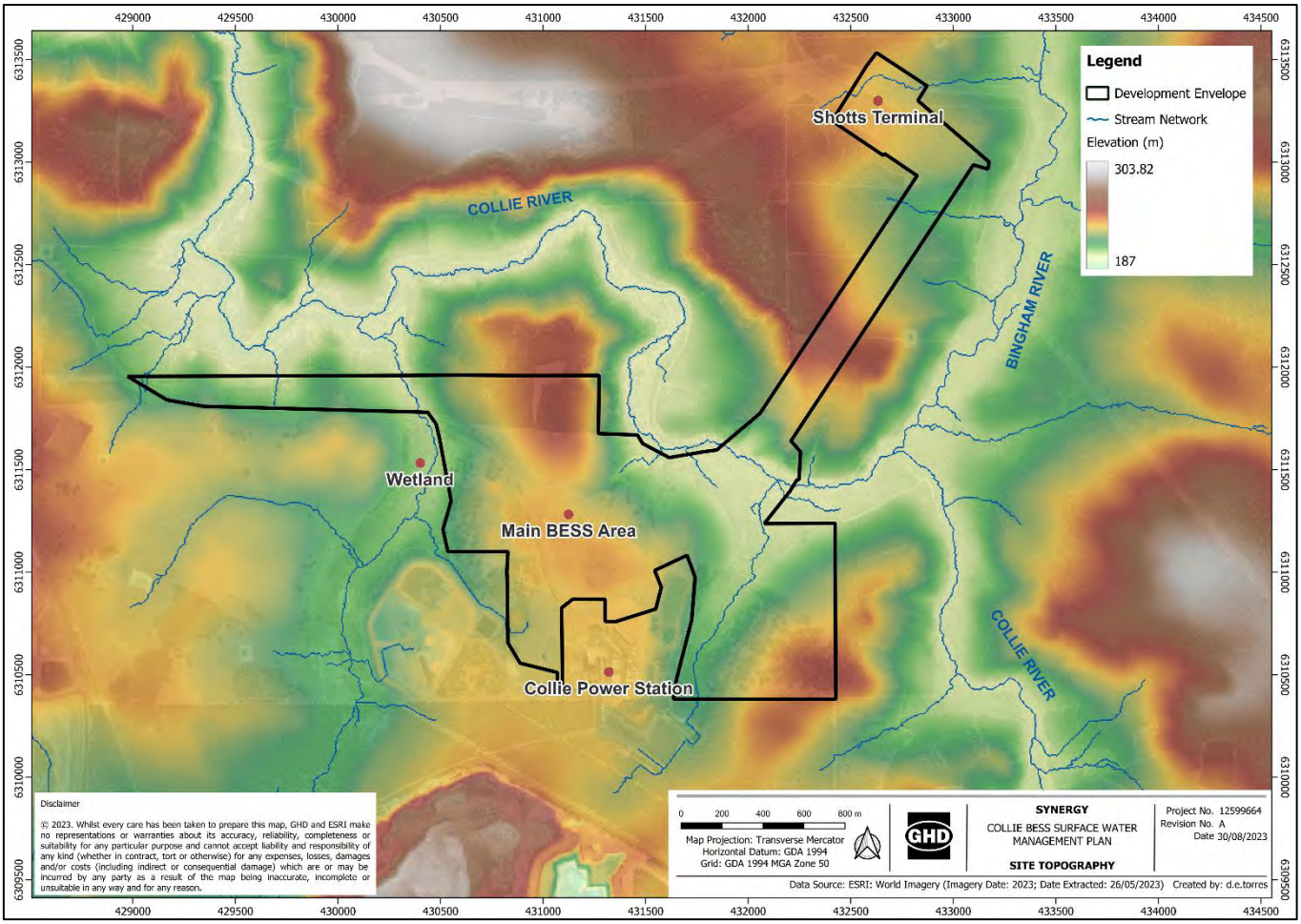


Figure 4 Site Topography

4.4 Site Conditions

4.4.1 Geotechnical

A geotechnical site investigation was undertaken in June 2023 with the report pending finalisation and will be available upon completion (expected in September 2023). However, the interpreted geology across the site generally comprises surficial topsoil, nominally 200mm to 300mm thick overlying colluvium (gravel with variable sand and silt content), which in turn overlies a profile of residual clayey soils derived from weathering of the underlying granite bedrock. Iron cemented soils (i.e., laterite) were locally intersected at some test locations during the recent site work, primarily within the southern BESS site.

4.4.2 Site Contamination

A Baseline Contamination Investigation (BCI) was undertaken by GHD to support the proposal. GHD undertook the investigation with reference to the DWER (2021) *Assessment and management of contaminated sites guidelines and National Environment Protection Council National Environment Protection (Assessment of Site Contamination) Measure*, as amended 2013 (ASC NEPM 1999). No contamination has been noted.

4.4.3 Acid Sulfate Soils

A review of the CSIRO Acid Sulfate Soils Risk Mapping (available through the Australian Soil Resource Information System [ASRIS]) indicated that there is an extremely low probability of Acid Sulfate Soils occurrence. The risk of Acid Sulfate Soils to offsite surrounding soils was also considered to be low.

Dewatering is not expected to be required so acid sulfate soils will not be disturbed within the BESS. However, should dewatering be required, an acid sulfate soil assessment will be undertaken beforehand. Disposal of water will not be by discharge to nearby waterways should dewatering be required.

4.4.4 Soil Permeability

According to available geological data/profiles published by Department of Mines, Industry Regulation and Safety (2023), soil conditions over the DE vary depending on elevation and proximity to the Collie River:

– Laterite gravel and sands apparent at the location of the CBESS facility and on upslopes away from the Collie River.
– A mix of various wet soils on the floodplain adjacent to the Collie River.

Sandy alluvial soils along the banks and riverbed of the Collie River also exist. With the CBESS facility areas, where the majority of the development is occurring, topsoils provided relatively high permeability with underlaying soils having varying permeability from moderate to low depending on the overall clay content or presence of cemented laterite.

4.4.5 Groundwater

The site is within the Collie Subarea of the Collie Groundwater Management Area (Department of Water and Environmental Regulation, 2023). It has the following aquifer levels:

– Level 1: Combined – Fractured Rock West – Alluvium
– Level 2: Combined – Fractured Rock West – Calcrete
– Level 3: Combined – Fractured Rock West – Palaeochannel
– Level 4: Combined – Fractured Rock West – Fractured Rock

Published groundwater data from the Department of Water and Environmental Regulation show a lack of updated groundwater investigations near the site.

4.5 Environmental and Heritage

4.5.1 Flora and Fauna

Biota (2023) completed a spring reconnaissance and targeted flora and vegetation survey (October 2022). The survey area was 375 ha, an area approximately three times greater than the Proposal disturbance footprint. This larger area of investigation provides for the assessment of potential direct and indirect impacts the Proposal may have on flora and vegetation communities. The survey reported that the majority of mapped flora and vegetation within the DE, is classed as ‘Degraded’ or ‘Completely Degraded’. These degraded areas comprised cleared land, cropping areas, buildings, roads, access tracks, dams, planted roadside verges and pine plantations.

The Proposal has an indicative disturbance footprint of approximately 131 ha. Infrastructure will be located within highly disturbed areas and require clearing of 8.5 ha of native vegetation. This native vegetation has been mapped as ‘Degraded’ to ‘Completely Degraded’ condition. All flora and vegetation mapped as Good to Excellent quality vegetation will be avoided.

It is anticipated that a Native Vegetation Clearing Permit will be required under Part V of the EP Act for clearing of native vegetation, unless exempt. Appropriate management of impacts to vegetation will be addressed through preparation of a Construction Environmental Management Plan (CEMP).

A fauna survey was conducted by Biota (2023) in October 2022, and included a targeted black cockatoo survey and a basic and targeted vertebrate fauna survey. Potential fauna habitat within the DE broadly aligns with the

extent and quality of remnant native vegetation types identified in the flora and vegetation survey. The survey found that the DE is completely cleared or highly modified, resulting in limited opportunities for fauna habitat. Five currently listed significant vertebrate species were recorded during the fauna survey, comprising:

– Chuditch/Western Quoll, Dasyurus geoffroii (Vulnerable; BC Act, EPBC Act).
– Western Falsistrelle bat, Falsistrellus mackenziei (Priority 4; BC Act).
– Forest Red-tailed Black Cockatoo, Calyptorhynchus banksii naso (Vulnerable, BC Act, EPBC Act).
– Carnaby's Black Cockatoo, Zanda latirostris (Endangered; BC Act, EPBC Act).
– Baudin's Black Cockatoo, Zanda baudinii (Endangered; BC Act, EPBC Act, IUCN Red List 'critically endangered').

During the fauna survey, foraging evidence of all three black cockatoo species were recorded, and observations were also made of all three species. The targeted survey identified potential and suitable nesting trees, foraging and breeding habitat for black cockatoos. Based on this assessment, the disturbance areas have been designed to avoid all black cockatoo habitat. While the Proposal is unlikely to impact significant fauna habitat, construction and operation of the Proposal has the potential to impact habitat sites in terms of:

– Earthworks and movement of vehicles and machinery (during construction)
– Noise and artificial light emissions
– Accidental bushfire caused by the operation of vehicles/plant/equipment, resulting in damage/loss of surrounding fauna habitats.

It is anticipated that a Native Vegetation Clearing Permit will be required under Part V of the EP Act for clearing of native vegetation, unless exempt. Appropriate management of impacts to fauna habitat are to be addressed through preparation of a CEMP.

4.5.2 Heritage

The DE is located on the traditional lands of the Wiilman, Noongar people. According to the DPLH's *Aboriginal Heritage Inquiry System*, there are four (4) identified Aboriginal cultural heritage places within the Development Site.

– Site 16713 Collie River Waugal: The Collie River intersects the DE, for the proposed transmission lines, which will be located within an existing transmission easement;
– Site 4797 Shotts 07: intersecting the southwestern extent of Lot 3001, but outside of the DE
– Site 15331 Shotts Graves: intersecting the southwestern extent of Lot 3001, but outside of the DE
– Site 4694 Spring: intersecting the Collie River and both Lot 74 and Lot 3001, but outside of the DE

A search of the State Heritage Office's Register of Heritage Places confirms that the Development Site contains no buildings or landmarks considered to be of European heritage significance.

4.6 Surface Water

The DE is located around the centre of the Collie River Basin of the South West Region, WA. It is within the Collie River Lower East Branch Subarea of the Collie Surface Water Management Area (Department of Water and Environmental Regulation, 2023).

4.6.1 Surface Water Quality

The Collie River has experienced significant modifications to the natural surface water flow regime due to land clearing from agriculture and mining and prolonged dewatering activities (DWER, 2023b). Observed water quality impacts attributed to this include increased volume and decreased duration of streamflow, river channel erosion and sedimentation, increased water salinity, and altered surface water-groundwater connectivity (DWER, 2023b).

A search of the DWER Water Information Reporting (WIR) database identified nine surface water monitoring locations in downstream and proximal to the Proposal. Three of these were reportedly included within the DWER Healthy Rivers Program (DWER 2023b). Details of available data for these locations are summarised in Table 8.

Table 8 Summary of Surface Water Monitoring Data proximal to the Proposal

Monitoring site	Water body	Location relative to site	No. records	Date assessed	Observations
Upstream					
6121269	Collie River	~ 290 m	1	February 2015	EC: 2077 µS/cm pH: 8.03 DO: 4.86 mg/L
6121272	Bingham River	~ 780 m	3	February 2015	EC: 4582 – 4583 µS/cm pH: 7.01 – 7.02 DO: 0.09 – 0.13 mg/L Sample comments identified a surface scum with a hydrocarbon odour.
Downstream					
6124037/ Upstream Coolangatta Gauging Station	Collie River	~ 420 m	4	February 2018 and March 2022	EC: 1497 – 3687 µS/cm pH: 7.39 DO: 4.76 – 7.04 mg/L
				February 2018	Three native species (Freshwater Cobbler, Smooth Marron, and South-west glass shrimp) and one exotic species (Redfin Perch) were observed during the assessment.
612001/ Coolangatta Farm Gauging Station	Collie River	~ 670 m	4211	May 1968 – October 2016	EC: 359 – 15,200 µS/cm pH: 6 – 11.5 DO: 3.8 – 10.57 mg/L
				January 2009	Five native species (Freshwater Cobbler, Gilgie, Nightfish, Smooth Marron, Western Minnow) and two exotic species (Eastern Gambusia, Redfin Perch) were observed during the assessment.
6142034/ Downstream Coolangatta Gauging Station	Collie River	~ 840 m	4	February 2018 and March 2022	EC: 1530 – 3737 µS/cm pH: 7.46 DO: 5.83 – 7.3 mg/L
				February 2018	Four native species (Blue-spot Goby, Freshwater Cobbler, Smooth Marron, and South-west glass shrimp) and two exotic species (Eastern Gambusia, Redfin Perch) were observed during the assessment.
Tributaries					
6121274	Collie River (Tributary)	~ 200 m	1	February 2015	EC: 2184 µS/cm pH: 8.08 DO: 2.58 mg/L
6121277	Collie River (Tributary)	~ 230 m	1	February 2015	EC: 12,020 µS/cm pH: 7.5 DO: 6.32 mg/L
6121278	Collie River (Tributary)	~ 200 m	1	February 2015	EC: 5651 µS/cm pH: 8 DO: 7.77 mg/L

5. Flood Risk Assessment

The nearest waterway to the Proposal is the Collie River and its proximity has made it crucial to determine the extents of its floodplain. This flood risk assessment involves a combined hydrologic and hydraulic model on TUFLOW using the 1% Annual Exceedance Probability (AEP) storm event as the critical event.

The scope of the model includes the Proposal (which includes the main BESS area below the Collie River, and the Shotts Terminal extending north of the DE) and the wetland to the west, as shown in the TUFLOW model study area in Figure 6.

5.1 Catchment Characteristics and Model Boundaries

To better understand the current hydrology of the site, catchment delineation was performed on QGIS using 1-second (2011) and 5 m (2015) digital elevation models obtained from Geoscience Australia. The catchments relevant to the site are mapped in Figure 5.

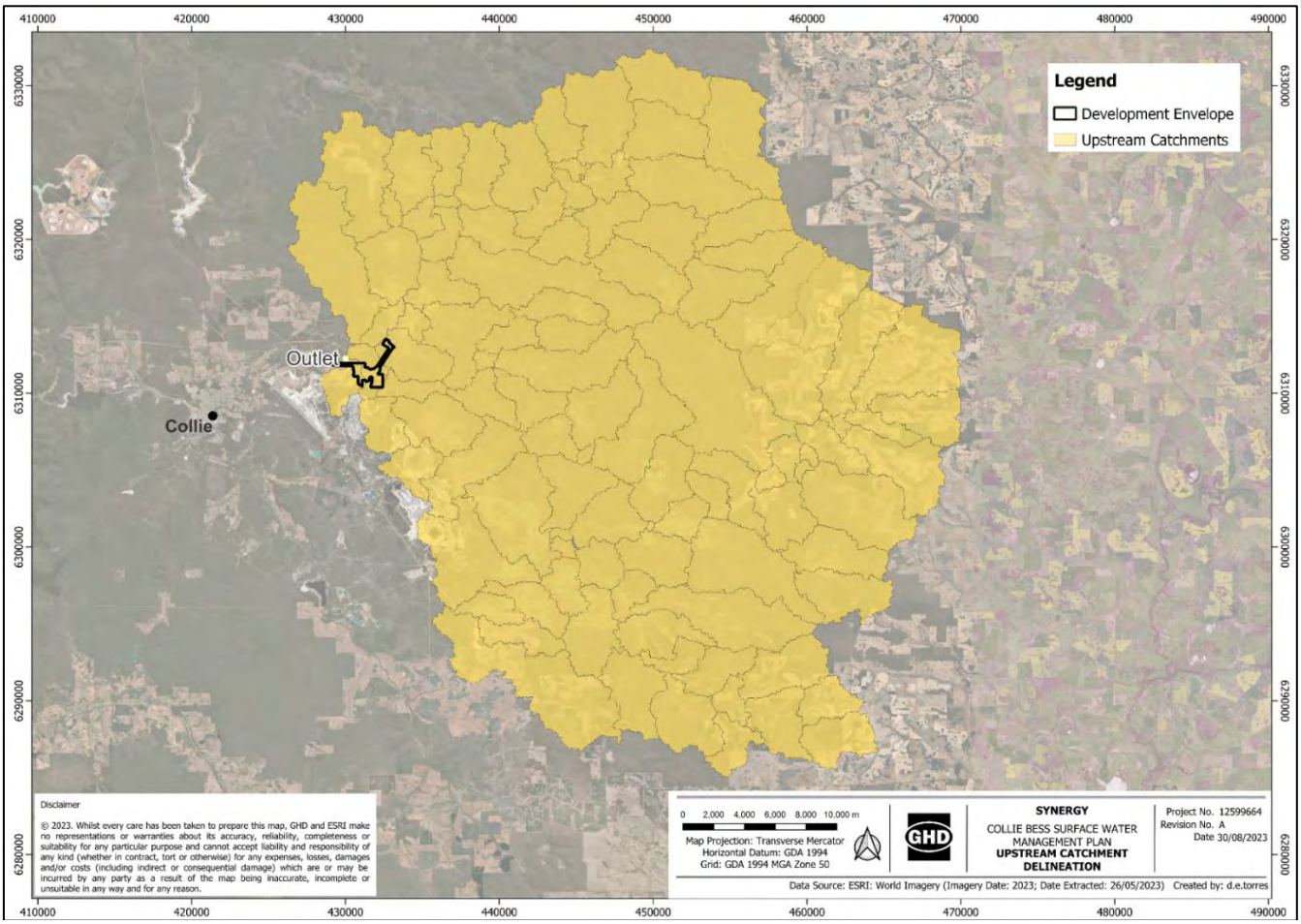
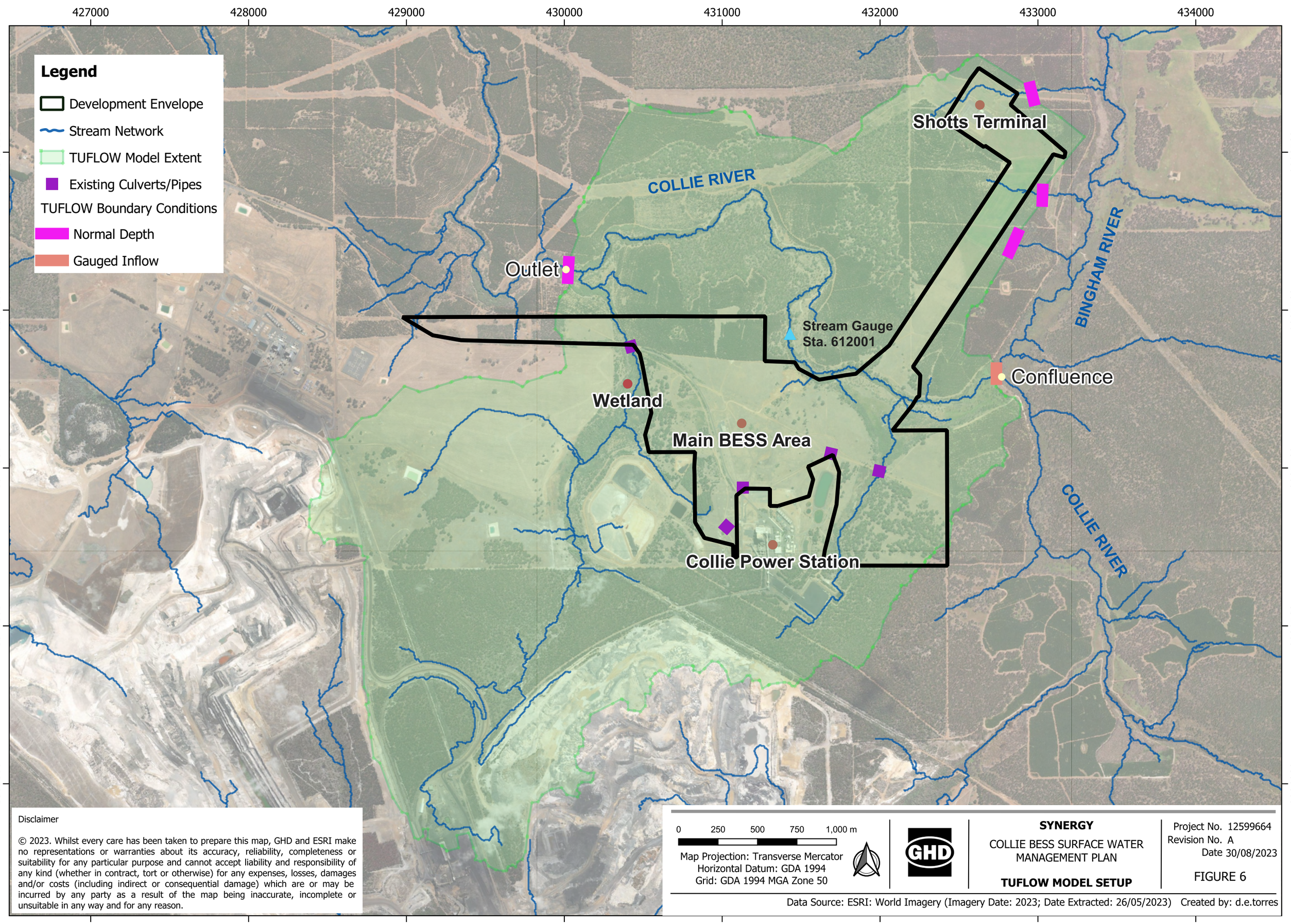


Figure 5 Upstream Catchment Delineation

Since the upstream catchment area is significantly large, and a detailed model is needed only at the Proposal premises, a smaller catchment with specific boundary conditions was set up, as shown in Figure 6.



0 250 500 750 1,000 m

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

SYNERGY

COLLIE BESS SURFACE WATER MANAGEMENT PLAN

TUFLOW MODEL SETUP

Project No. 12599664
Revision No. A
Date 30/08/2023

FIGURE 6

Data Source: ESRI: World Imagery (Imagery Date: 2023; Date Extracted: 26/05/2023) Created by: d.e.torres

The inflow boundary will be located immediately downstream of the confluence between Collie River and Bingham River. The inflow value will be the design peak stream flow, set as constant, based on expected peak stream flows using data from stream gauge sta. 612001. Flood frequency analysis was done to determine expected peak stream flow values, as discussed in Section 5.2. Since the distance between the boundary and stream gauge Sta. 612001 was negligible, the resulting design peak flows from the flood frequency analysis did not need to be rescaled for use in the model.

For the catchment outlet and other minor streams passing the model extent, normal depth boundary conditions were applied and were estimated using the natural slopes along the streams.

5.2 Flood Frequency Analysis

The nearest available stream gauge is the Collie River East – Coolangatta Farm Gauge (Sta. 612001), which has continuous flow record from May 1968 to March 2023. The data were obtained from the Bureau of Meteorology (BoM) and are shown in Figure 7.

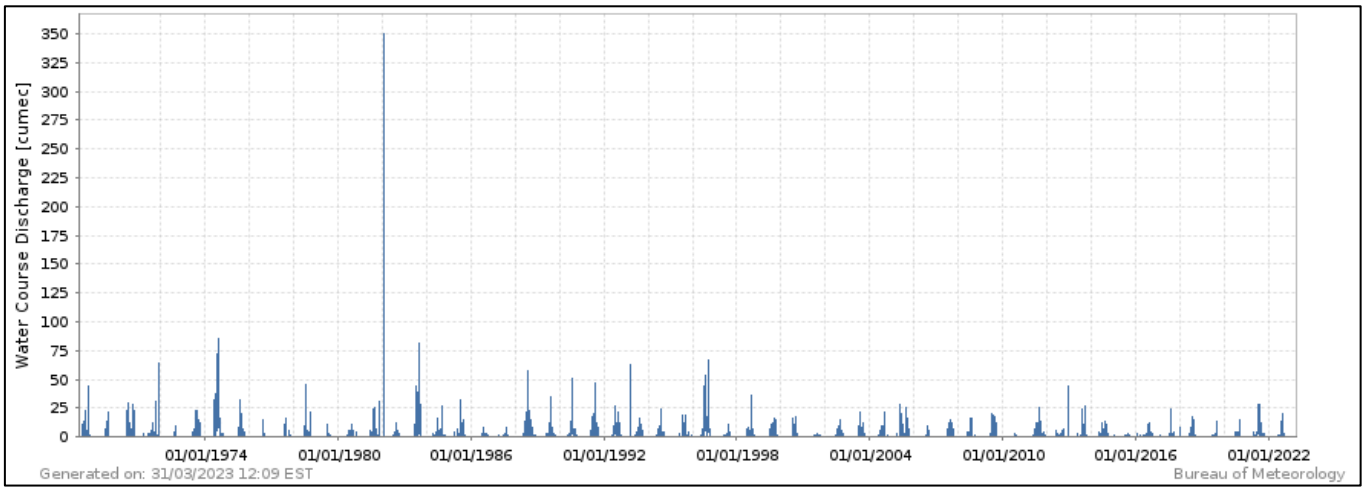


Figure 7 Collie River East – Coolangatta Farm Sta. 612001 Stream Gauge Data

The historical annual peak stream flows were summarised from the data, with 1968 and 2023 excluded as they were incomplete years. Based on the record, the highest peak stream flow was in 1982 at 350.56 m^3/s, and the lowest in 2015 at 2.32 m^3/s.

The flood frequency analysis was done using TUFLOW Flike, with the following specifications that were found to produce the best fit as shown in Figure 8:

– Inference method: Bayesian method
– Probability Model: Log Pearson III
– Plot scale: Log-normal
– Outliers: Censored three low outliers below a threshold of 7 m^3/s to avoid bias towards low flows

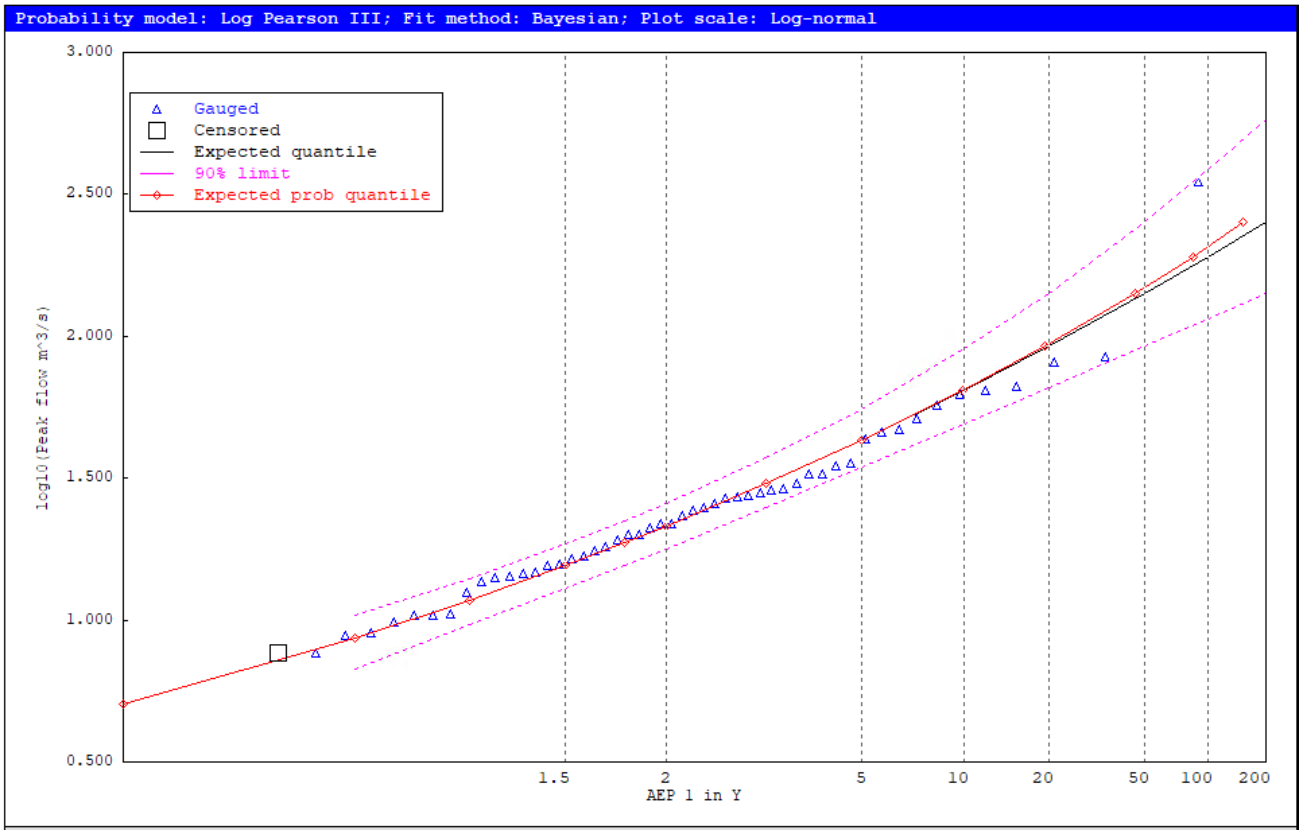


Figure 8 *Fitted Curve from the Flood Frequency Analysis of Sta. 612001 Stream Flows*

Table 9 lists the expected peak flows for each annual exceedance probability event, as well as their lower and upper limits. The design stream flow for a 1% AEP (1 in 100) storm event is 189.94 m^3/s. This will be used in hydraulic modelling.

Table 9 *Peak Flow Estimates and Probability Limits from the Flood Frequency Analysis*

AEP (1 in Y)	Expected Peak Flow (m^3/s)	5% Quantile Confidence Limits	95% Quantile Confidence Limits
5	43.07	34.44	55.5
10	64.61	49.2	90.3
20	92.26	66.19	142.1
50	141.09	92.59	253.2
100	189.94	115.46	385.1
200	251.87	141.44	581.4

5.3 Flood Mapping

5.3.1 Topography

A direct rainfall (rain-on-grid) hydraulic model was run using TUFLOW HPC with cell size: 5 m and SGS sample distance: 1 m. The topographic data used were a 1 m LiDAR grid (GHD, 2023) within the Proposal and a 5m Digital Elevation Model (Geoscience Australia, 2015), where else needed. Data extents are shown in Figure 9.

427000 428000 429000 430000 431000 432000 433000 434000

6313000
6312000
6311000
6310000
6309000

Legend

- Development Envelope
- Stream Network
- TUFLOW Model Extent

1m DEM
261.99
197.15

5m DEM
303.78
123.75

COLLIE RIVER
BINGHAM RIVER
COLLIE RIVER

Shotts Terminal
Outlet
Stream Gauge
Sta. 612001
Confluence
Wetland
Main BESS Area
Collie Power Station

0 250 500 750 1,000 m

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

GHD

SYNERGY

COLLIE BESS SURFACE WATER MANAGEMENT PLAN
DIGITAL ELEVATION MODEL EXTENTS

Project No. 12599664
Revision No. A
Date 30/08/2023

FIGURE 9

Data Source: ESRI: World Imagery (Imagery Date: 2023; Date Extracted: 26/05/2023) Created by: d.e.torres

5.3.2 Bed Roughness

The detailed Digital Earth Australia (DEA) Land Cover dataset (2020) for the site location was retrieved and used as a basis for assigning different roughness values to the terrain. Figure 10 shows the raw land cover map.

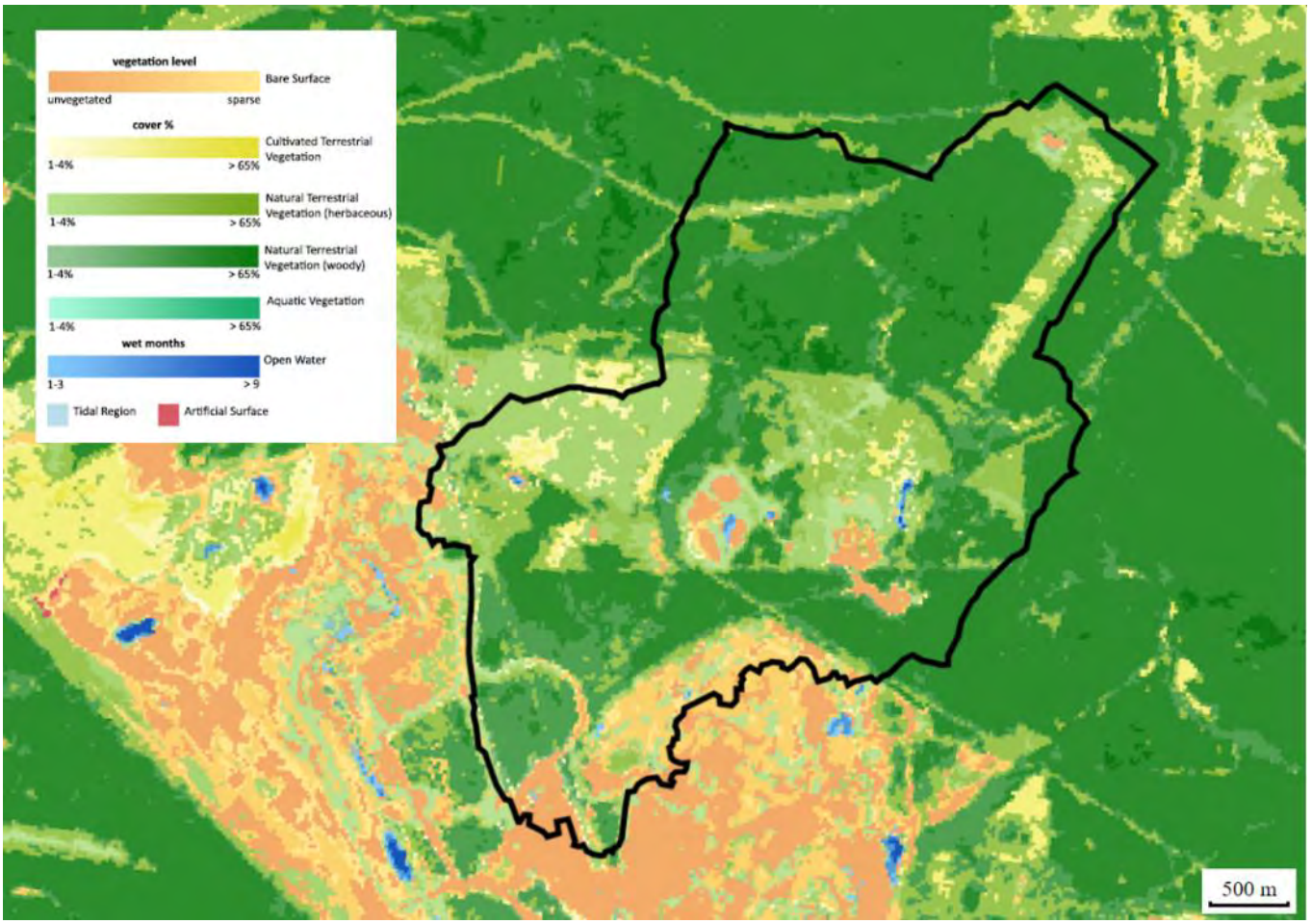


Figure 10 DEA Land Cover Map for Study Area

The Manning's n values were estimated using ARR Table 6.2.2. Valid Manning 'n' Ranges for Different Land Use Types of the Australian Rainfall and Runoff 2019 (Ball *et al.*, 2019), as listed in Table 10.

Table 10 Assigned Manning's n Values

ID	Manning's n	DEA Land Cover Description
14	0.065	Cultivated Terrestrial Vegetated: Herbaceous Closed (> 65 %)
15	0.06	Cultivated Terrestrial Vegetated: Herbaceous Open - 40 to 65 %
16	0.05	Cultivated Terrestrial Vegetated: Herbaceous Open - 15 to 40 %
17	0.04	Cultivated Terrestrial Vegetated: Herbaceous Sparse - 4 to 15 %
18	0.03	Cultivated Terrestrial Vegetated: Herbaceous Scattered - 1 to 4 %
27	0.065	Natural Terrestrial Vegetated: Woody Closed - > 65 %
28	0.06	Natural Terrestrial Vegetated: Woody Open - 40 to 65 %
29	0.05	Natural Terrestrial Vegetated: Woody Open - 15 to 40 %
30	0.04	Natural Terrestrial Vegetated: Woody Sparse - 4 to 15 %
31	0.03	Natural Terrestrial Vegetated: Woody Scattered - 1 to 4 %
32	0.065	Natural Terrestrial Vegetated: Herbaceous Closed (> 65 %)

ID	Manning's n	DEA Land Cover Description
33	0.06	Natural Terrestrial Vegetated: Herbaceous Open - 40 to 65 %
34	0.05	Natural Terrestrial Vegetated: Herbaceous Open - 15 to 40 %
35	0.04	Natural Terrestrial Vegetated: Herbaceous Sparse - 4 to 15 %
36	0.03	Natural Terrestrial Vegetated: Herbaceous Scattered - 1 to 4 %
69	0.045	Natural Aquatic Vegetated: Woody Open (15 to 40 %)
84	0.045	Natural Aquatic Vegetated: Herbaceous Open (15 to 40 %)
93	0.025	Artificial Surface
94	0.03	Natural Surface
95	0.05	Natural Surface: Sparsely vegetated
96	0.04	Natural Surface: Very sparsely vegetated
97	0.03	Natural Surface: Bare areas, unvegetated
99	0.02	Water: Water
100	0.02	Water: (Water) Tidal area
101	0.025	Water: Water - Perennial - > 9 months
102	0.03	Water: (Water) Non-perennial (7 to 9 months)
103	0.035	Water: Water - Non-perennial - 4 to 6 months
104	0.04	Water: Water - Non-perennial - 1 to 3 months

5.3.3 Rainfall

5.3.3.1 Rainfall Depths

Intensity-Frequency-Duration (IFD) rainfall depth data for the 1% Annual Exceedance Probability (AEP) were sourced from the Bureau of Meteorology, issued 17 April 2023, and are listed in Table 11. No areal reduction factors were applied or changes in depths for climate change factors.

Table 11 IFD Design Rainfall Depths

Duration	Annual Exceedance Probability (AEP)	Duration	Annual Exceedance Probability (AEP)
	1%		1%
5 min	13.9	**9 hour**	99.2
10 min	20.8	**12 hour**	113
15 min	25	**18 hour**	133
20 min	28	**24 hour**	148
25 min	30.3	**30 hour**	159
30 min	32.2	**36 hour**	168
45 min	36.7	**48 hour**	179
1 hour	40.3	**72 hour**	193
1.5 hour	46.3	**96 hour**	201
2 hour	51.5	**120 hour**	208
3 hour	60.6	**144 hour**	215
4.5 hour	72.3	**168 hour**	223
6 hour	82.4		

5.3.3.2 Temporal Patterns

Point temporal patterns for the site were obtained from the Australia Rainfall and Runoff (ARR) Data Hub. The corresponding data were for Southern and South Western Flatlands (West).

5.3.3.3 Pre-burst Depths

Median pre-burst depths were obtained from the Australia Rainfall and Runoff (ARR) Data Hub. The pre-burst depths were subtracted from the Storm Initial Loss with the equation: *Initial Loss = Storm Loss – Pre-burst.*

5.3.3.4 Regional Losses

The Initial Loss - Continuing Loss (ILCL) method was used for TUFLOW, with the following global storm losses:

– Storm Initial Loss = 30 mm

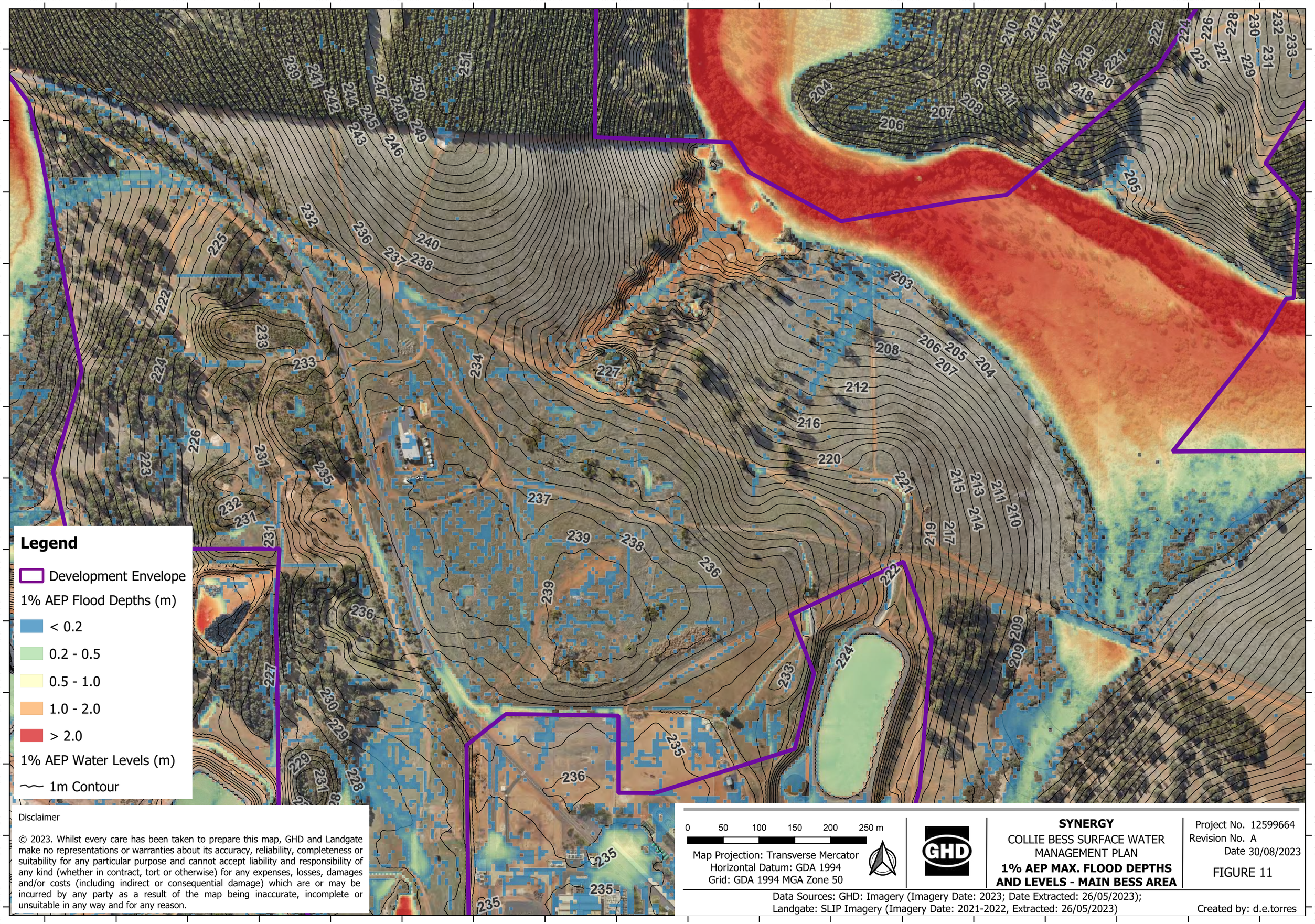
– Storm Continuing Loss = 3.5 mm/hr

The values used were sourced from the ARR Data Hub for approximate centroid (longitude 116.261 Latitude -33.338) of the CBESS facility.

5.3.4 Flood Mapping Results

The maximum flood depths, water levels, and velocities from the hydraulic modelling were analysed and mapped at the main BESS area and at the wetland area. Flood maps for maximum depths and water levels show the critical event flood depths and levels at each cell of the model, as the objective was to show all possible floodplain extents within and around the Proposal premises. For the flood velocity maps, values from the critical event nearest the main BESS area are shown. The critical duration was found to be a 9-hour storm for the 1% Annual Exceedance Probability (AEP).

Results show that the Collie River floodplain extends up to an elevation of approximately 203 mAHD, as shown in Figure 11. It is confirmed that the floodplain poses little risk to the proposed infrastructure at the main BESS facility which are located approximately 300m from the floodplain extents. However, consideration of the floodplain extents shall be made in the design and placement of transmission towers near the Collie River. The locations of existing towers near to the Collie River should be used as a guide to suitable elevations for the placement of towers near the river. Along the Collie River, flood depths reached a maximum of > 2.0 m. Minor ponding occurred at the main BESS area with maximum depths of 0.2 - 0.5 m, and average depths of < 0.2 m, as shown in Figure 11.



Disclaimer

0 50 100 150 200 250 m

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

GHD

SYNERGY

COLLIE BESS SURFACE WATER MANAGEMENT PLAN

1% AEP MAX. FLOOD DEPTHS AND LEVELS - MAIN BESS AREA

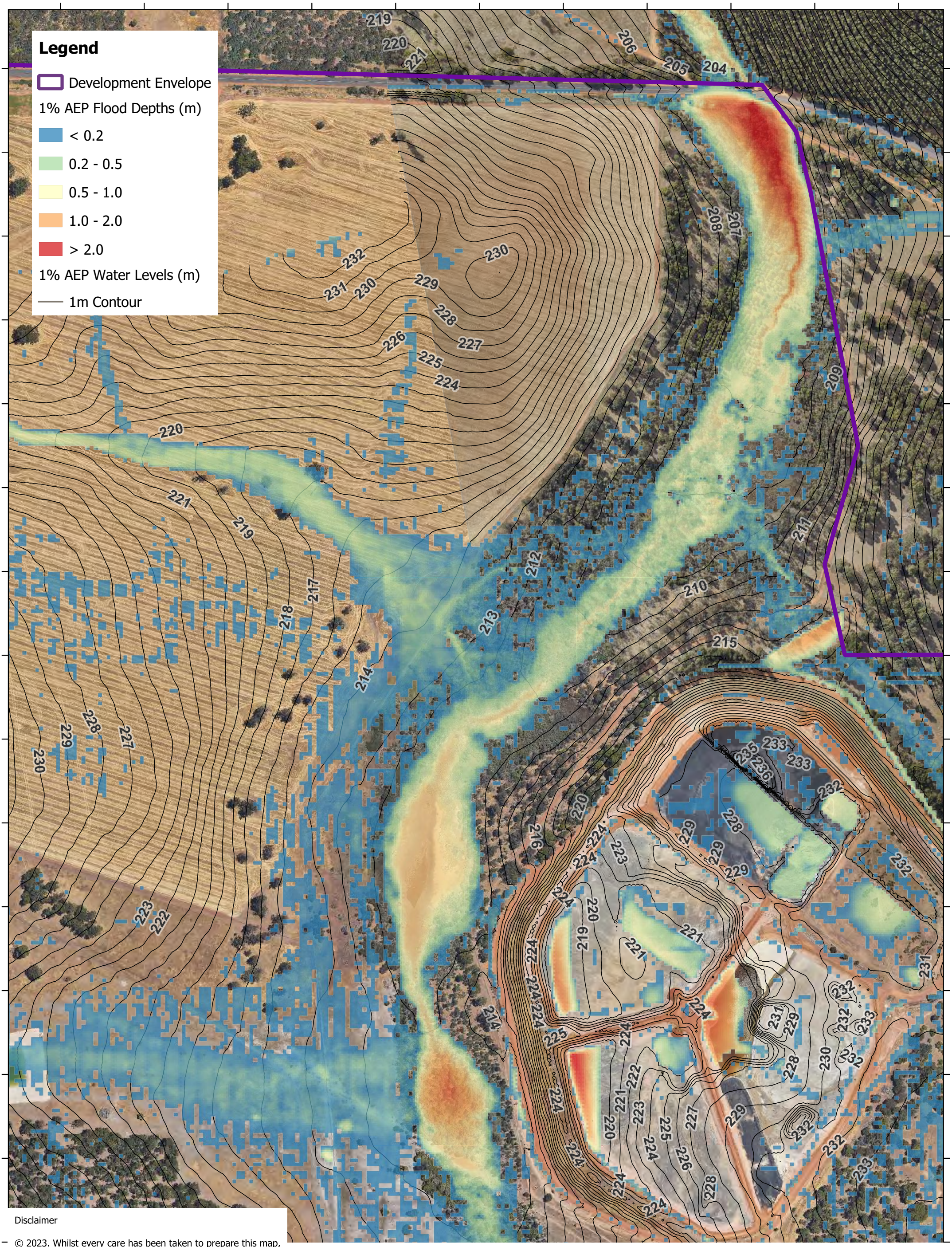
Project No. 12599664
Revision No. A
Date 30/08/2023

FIGURE 11

Data Sources: GHD: Imagery (Imagery Date: 2023; Date Extracted: 26/05/2023);
Landgate: SLIP Imagery (Imagery Date: 2021-2022, Extracted: 26/05/2023)

Created by: d.e.torres

For the wetland area, flows drain toward the northern direction, and the maximum flood depth has reached over 2.0 m, concentrated downstream as it approaches the Boys Home Road, as shown in Figure 12. There is an existing culvert at this location, but the accumulation of flood shows that it may be insufficient for a 1% AEP flood. Along the stream, flood depths reached a maximum of 0.5 - 1.0 m, with some areas reaching 1.0 - 2.0 m downstream. The floodplain extends to an elevation of approximately 212 mAHD at areas upstream and 207 mAHD downstream, and does not cover the whole wetland width.



Disclaimer

0 50 100 150 200 m

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

SYNERGY

COLLIE BESS SURFACE WATER MANAGEMENT PLAN

1% AEP MAX. FLOOD DEPTHS AND LEVELS - WETLAND AREA

Project No. 12599664
Revision No. A
Date 30/08/2023

FIGURE 12

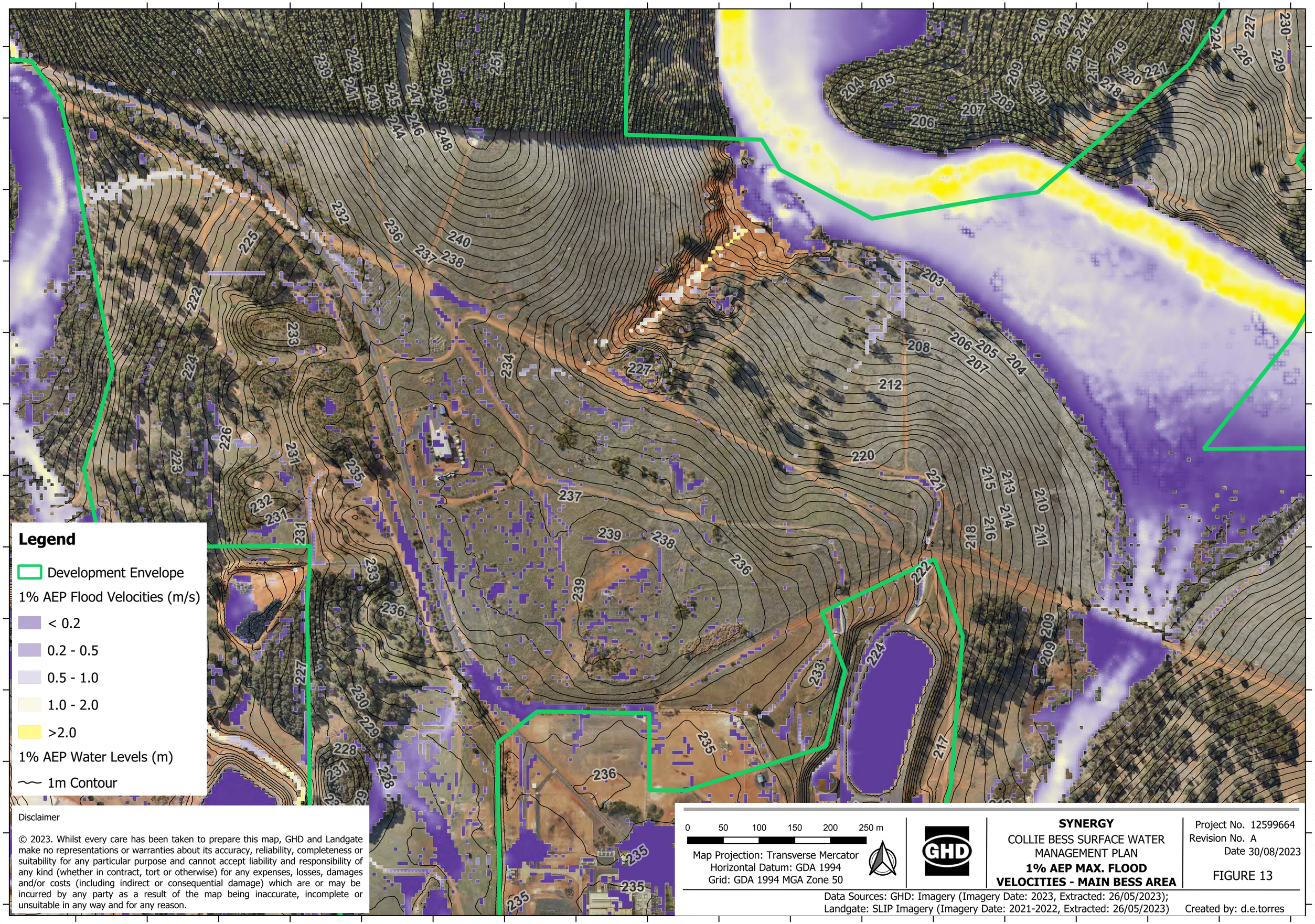
Data Sources: GHD: Imagery (Imagery Date: 2023, Extracted: 26/05/2023); Landgate: SLIP Imagery (Imagery Date: 2021-2022, Extracted: 26/05/2023)

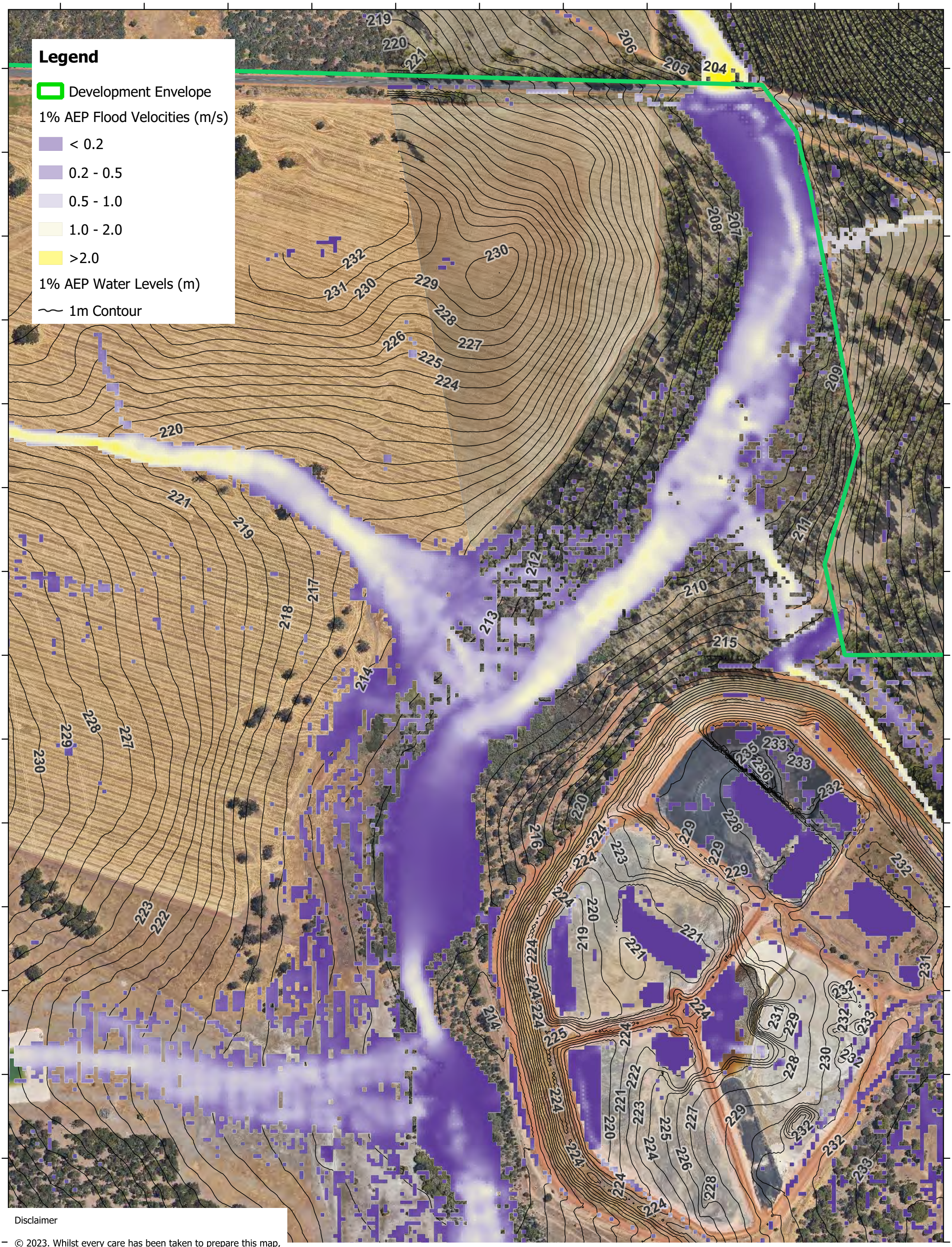
Created by: d.e.torres

Flood velocities along Collie River reached a maximum of > 2.0 m/s, while velocities along its floodplain reached a maximum of 0.5 - 1.0 m/s, as shown in Figure 13. Within the main BESS area where infrastructure will be built, velocities from minor ponding were < 0.2 m/s.

For the wetland area, flow velocities reached 1.0 - 2.0 m/s along the stream, as shown in Figure 14. Since there is accumulation of flood near the road, velocities at this location reached approximately 0.2 - 0.5 m/s upstream of the culvert, and > 2.0 m/s downstream of the culvert, on the other side of the road.

Flood maps for the full Proposal boundary, which includes the transmission line and Shotts Terminal located north of Collie River, can be found in Appendix A.





Disclaimer

0 50 100 150 200 m

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

SYNERGY

COLLIE BESS SURFACE WATER MANAGEMENT PLAN

1% AEP MAX. FLOOD VELOCITIES - WETLAND AREA

Project No. 12599664
Revision No. A
Date 30/08/2023

FIGURE 14

Data Sources: GHD: Imagery (Imagery Date: 2023, Extracted: 26/05/2023);
Landgate: SLIP Imagery (Imagery Date: 2021-2022, Extracted: 26/05/2023)

Created by: d.e.torres

6. Stormwater and Firewater Management

6.1 Surface Water Management Measures

Both construction and operational activities have the potential to impact stormwater volume and quality. In the event of fire at the CBESS facility, firewater is to be captured, removed from the facility and disposed offsite at an appropriate treatment facility. Internal and external runoff should be separated to minimise the volume of stormwater to manage. Based on this, a conceptual drainage arrangement was developed as follows:

– Internal runoff: Internal lined swales or pits and pipes, lined and unlined basins and bioswales to manage the discharge from the facility; and
– External runoff: Drains and swales designed to separate internal and external catchment runoff.

A conceptual layout of the CBESS facility and associated concept surface water management features as shown in Figure 15.

In the concept design phase, the following principles were used:

– Drains are to follow the natural topography wherever possible;
– Basins are to be placed at low elevations and adjacent to their corresponding catchments; and,
– Catchment areas are to be minimized using diversion swales for external runoff, to also minimize contamination of stormwater.

For the developed CBESS facility, any stormwater within the post-development areas is considered to be potentially contaminated with sediments and hydrocarbons, thus, requiring pre-treatment before discharging to the environment. Stormwater treatment will be via a treatment train to capture, filter, or treat pollutants using the following steps:

– For each catchment, water shall pass through a primary treatment gross pollutant trap (GPT) in order to screen solids or sediments before discharging into the basins. Remaining sediments will also settle in each basin. See Figure 15 for conceptual locations of GPTs.
– For the substation area in particular the transformers, there is a possible risk of contamination from oil within the transformers. An oil and water separator, a tertiary treatment GPT used for higher risk areas is proposed. Common devices used in include Puraceptor. This is proposed to be placed downstream of the transformer bunds.
– Basins are proposed to control discharge prior to any off facility discharge. These basins are to be lined when there is a risk of BESS (battery area) discharge to the basin as these basins are also used for containment of any firewater in the event of a battery area fire. It is understood an increased risk of heavy metal discharge in firewater runoff from the battery areas during this type of fire.
– Bioswales shall receive stormwater discharged from each basin. The bioswales are designed to target the management of nutrients during smaller frequent rainfall events as the proposed GPTs upstream of basins are not expected to provide the level of nutrient removal desired. The bioswales are also expected to serve as an erosion control device in larger events as they are to be installed to follow the natural topography creating a spreader weir, minimizing the concentration of discharge onto downstream surfaces. Conceptual bioswales were designed to have footprints equivalent to 2% of each catchment's impervious area and have been placed downstream of basins to ensure that they are not impacted by contaminated firewater under normal operating conditions. The bioswales comprise of a vegetated layer to further improve the quality of stormwater.

Each basin is proposed to have a multi-stage outlet, with a low-level outlet (equipped with a valve for those basins receiving battery area runoff), a mid-level orifices, a high-level spillway pit and finally an emergency overflow weir. The low-level valve controls are implemented in areas requiring battery area firewater control; the mid-level orifice controls stormwater; and the high-level spillway is for major event discharge with the emergency weir potentially activate in the event of extreme events or blockages within the other discharge points. All design of the basins and their controls are subject to detailed design, however it is proposed that the firewater control system will follow one of the following approaches:

a. Set the valve as closed by default, opening manually or automatically after each storm if no fire occurred, or

b. Set the valve as open by default, closing automatically if a fire control system is activated and only opening again once the firewater is removed from the basin.

Option B is the likely proposed option for operation however this will be confirmed during detailed design. In either case, if a fire occurred, the water will be contained in the basins and will be taken to a wastewater treatment facility, and not discharged to the local environment.

Wherever possible, management measures should be guided by the Stormwater Management Manual of Western Australia (2023).

Prior to the commencement of construction or ground disturbance activities, erosion and sediment control measures (such as sediment fences or other appropriate sediment control measures) will be installed around the perimeter of the site and on slopes subject to runoff to prevent the transport of soil and silt particles to of the Collie River.

6.2 General Design Principles

Building the CBESS facility on concrete pads would entail lesser pervious areas and increased runoff (peak and volumetrically) at the main BESS area if it was not controlled prior to discharge. The objective is to minimize environmental impact by ensuring that the post-development peak flows (m^3/s) into receiving waterways will be maintained from pre-development values. It is noted that volumetrically runoff from the site will be increased from predevelopment volumes given the significant increase in impervious surface areas reducing the potential for onsite infiltration to almost zero. Targeted onsite infiltration has been assessed a non-viable solution due to site geology and topographic constraints. Review of Figure 5 highlights the size of the proposal areas within the Collie River catchment upstream of the site, being below 1% of the total catchment areas, the total increase in the sites volumetric discharge due to the urbanisation will not result in any significant change to streamflow in the Collie River.

Each basin shall be designed to store both detention water (stormwater runoff) and contaminated firewater in the event of a fire event within the battery area. For the detention water, the *pre-development = post-development discharge rule* was followed. Pre-development runoff values for a 1% AEP critical event were calculated using a one-dimensional hydrologic model DRAINS which employed an initial and continuing loss hydrologic model. The minimum detention water volumes were determined by ensuring post-development runoff peak flows were equal or less than the pre-development peak flows.

For the contaminated firewater situation, the required volume for containment within the basins are based on the expected firewater supply volumes at the CBESS facility and a minor concurrent 6EY rainfall event with a similar duration of supply. The required full basin surface areas were then computed using a fixed total depth and side slope. Detailed parameters are discussed in Sections 6.3 and 6.4.

6.3 Catchments and Hydrology

6.3.1 Design Rainfall

With reference to *Section 5.3 Flood Mapping*, the same Intensity-Frequency-Duration (IFD) data, point temporal patterns, and pre-burst depths for a 1% AEP rainfall event were sourced from the Bureau of Meteorology (2023). The 6 EY (exceedance per year) rainfall was assessed for a 4.5-hour duration which has a depth of 15.5 mm based upon data sourced.

6.3.2 Catchments

Catchments for the local runoff were estimated based on the existing topography and the proposed pads for the CBESS facility. These were modelled in DRAINS. Basins were assigned to areas of low elevations, where possible, adjacent to the pads. Catchment areas for each basin were apportioned accordingly in order to minimize each required basin volume and area. Catchment areas were also minimized by placing conceptual pipes and swales at strategic locations that would control flows within the pads and divert any approaching runoff.

A total of four catchments were modelled, namely: NW, NE, S, and E, with their respective areas listed in Table 12.

Table 12 Catchment Areas for Local Runoff

Catchment	NW	NE	S	E
Area (ha)	4.25	8.20	1.90	7.35

6.3.3 Losses

The Initial Loss – Continuing Loss (ILCL) method was used for DRAINS, with the following losses:

– For impervious areas, gravel roadways, sealed roadways, battery areas, substations, buildings and sealed roads – Initial Loss: 1 mm, Continuing Loss: 0 mm/hr
– For pervious areas – Initial Loss: 30 mm, Continuing Loss: 3.5 mm/hr

The pervious area losses were sourced from the ARR Data Hub for approximate centroid (longitude 116.261 Latitude -33.338) of the CBESS facility. The impervious losses are the normal approach taken for urban catchments roadways.

6.4 Stormwater Modelling and Basin Design

6.4.1 Detention Water Volume

6.4.1.1 Pre-development

The model parameters used for pre-development catchments are as follows:

– Areas: as listed in Table 12
– Area classification: all 100% pervious as the site is generally undeveloped.
– Retardance coefficient, *n*: 0.08 to mimic runoff across the vegetated surface of the site
– Flow path lengths and slopes: estimated for each catchment based on available topographical information
– Outlets: at the target basin locations typically at existing catchment discharge points where possible

An ensemble run was done on DRAINS for the pre-development catchments and the critical 1% AEP storm runoff values are listed in Table 13, delineation of the catchments is shown in Figure 15.

Table 13 Pre-development Runoff Values

Catchment	NW	NE	S	E
Pre-dev. Runoff (m^3/s)	0.336	0.719	0.145	0.624

6.4.1.2 Post-development

To estimate the post-development runoff volumes, each catchment area was split into three (3) surfaces – gravel, road, and pervious. Preliminary detention basins were modelled to accept the post-development runoff volumes in order to estimate the required detention water volumes for a 1% AEP critical storm event. Surface areas were estimated as a percentage of the pre-development catchment areas.

The parameters used for post-development catchments are listed in Table 14.

Table 14 Post-Development Model Parameters

Catchment	Gravel	Road	Pervious
Area	Estimated for each surface per catchment		
Area Classification	100% Effective Impervious Area (EIA)	100% Effective Impervious Area (EIA)	100% Pervious Area (PA)
Flow path lengths and slopes	Estimated for each catchment		
Invert elevations	Estimated for each catchment		
Retardance coefficient, *n*	0.15	0.013	0.08

Each detention basin was configured in DRAINS with an orifice outlet and a discharge pipe of 10 m length and 1% slope. A fixed 1.5 m depth and 1:3 side slope were used in the model. Using the *pre-development = post-development discharge rule*, the minimum detention volumes were determined and are summarized in Table 15. Further development of this design is expected to occur during detailed design but a similar approach will be used.

Table 15 Post-development Runoff and Detention Water Volumes

Catchment	NW	NE	S	E
Post-Dev. Runoff (m^3/s)	0.326	0.614	0.138	0.605
Detention Water Volume (m^3)	803	1,498	325	1,451

During the flood risk assessment estimates of peak flow within the greater Collie River were presented within Table 9. These flows were expected to be approximately 190 m^3 /s for the mean 1% AEP peak streamflow within

the Collie River at the proposal location whereas the combined peak 1% AEP flow from the site presented in Table 15 are approximately 1.7 m^3/s, or less than 1% of peak streamflow predicted.

6.4.2 Contaminated Firewater Volume

The firewater requirement used in the design is a combination of the following:

– Firewater storage for each basin: 530 m^3 – two (2) hydrants at 10 L/s for 4 hours with two (2) battery units supply at 20 L/s for 2 hours
– A 6 Exceedances per Year (EY) event rainfall for 4.5 hours: 15.5 mm

The required contaminated firewater volume for each basin is listed in Table 16. It is a requirement for future design that upon a basin valve closing (removing the low flow outlet from operation) that all elevated outflow points are set at a level above this total Contaminated Firewater Volume thus preventing firewater discharge both due to full duration fire event but also a full duration fire event combined with the design rainfall event.

Table 16 Contaminated Firewater Volume Requirements

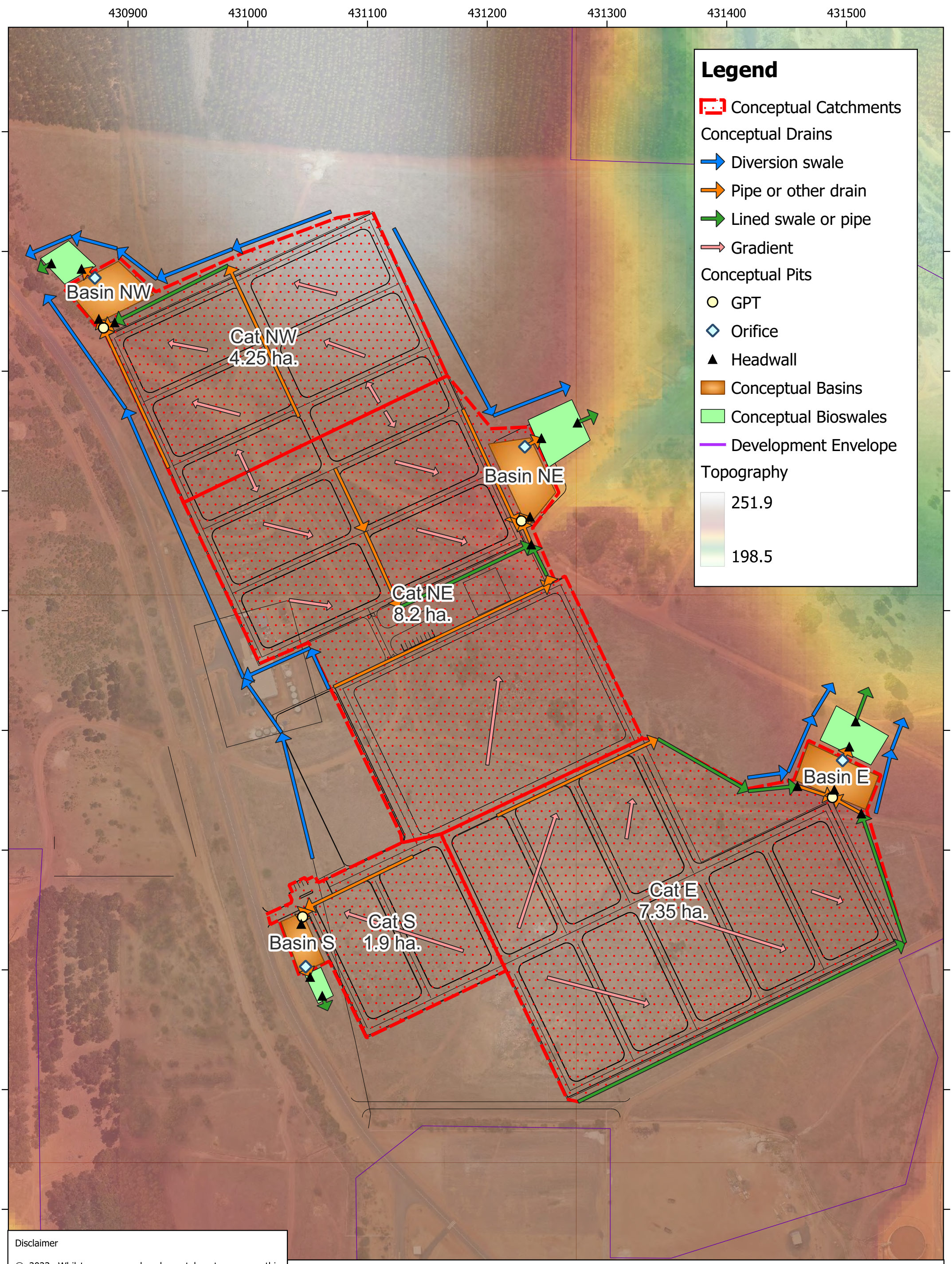
Catchment	NW	NE	S	E
Firewater fixed storage (m^3)	530	530	530	530
6EY 4.5 hr. rainfall (m^3)	658	1,271	294	1,139
Contaminated Firewater Volume (m^3)	1,188	1,801	824	1,669

6.4.3 Conceptual Basin Design

For the total basin, the volume was simply the detention water volume added to the contaminated firewater volume. Each basin surface area was determined using a fixed 2.5 m total depth, 1:3 side slope, and 0.3 m freeboard. The conceptual basin designs are summarized in Table 17 and are shown in Figure 15. It is expected that during detailed design some refinement of these volumes and areas of the basins will occur however the overall approach will be applied for each basin that is to receive potentially contaminated firewater from the battery area.

Table 17 Summary of Basin Design (Detention Water and Contaminated Firewater)

Basin	NW	NE	S	E
Catchment Area (ha)	4.25	8.20	1.90	7.35
Total Basin Volume (m^3)	1,992	3,299	1,150	3,120
Total Basin Volume with Freeboard (m^3)	2,387	3,892	1,409	3,687
Basin bottom area (m^2)	416	816	182	759
Basin water surface area (m^2)	1,252	1,898	812	1,812
Basin freeboard area (m^2)	1,383	2,058	918	1,968



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0 50 100 150 m

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

SYNERGY

COLLIE BESS SURFACE WATER MANAGEMENT PLAN

CONCEPTUAL DRAINAGE ARRANGEMENT

Project No. 12599664
Revision No. A
Date 30/08/2023

FIGURE 15

Data Source: Landgate: SLIP Imagery (Imagery Date: 2021-2022, Extracted: 26/05/2023)

Created by: d.e.torres

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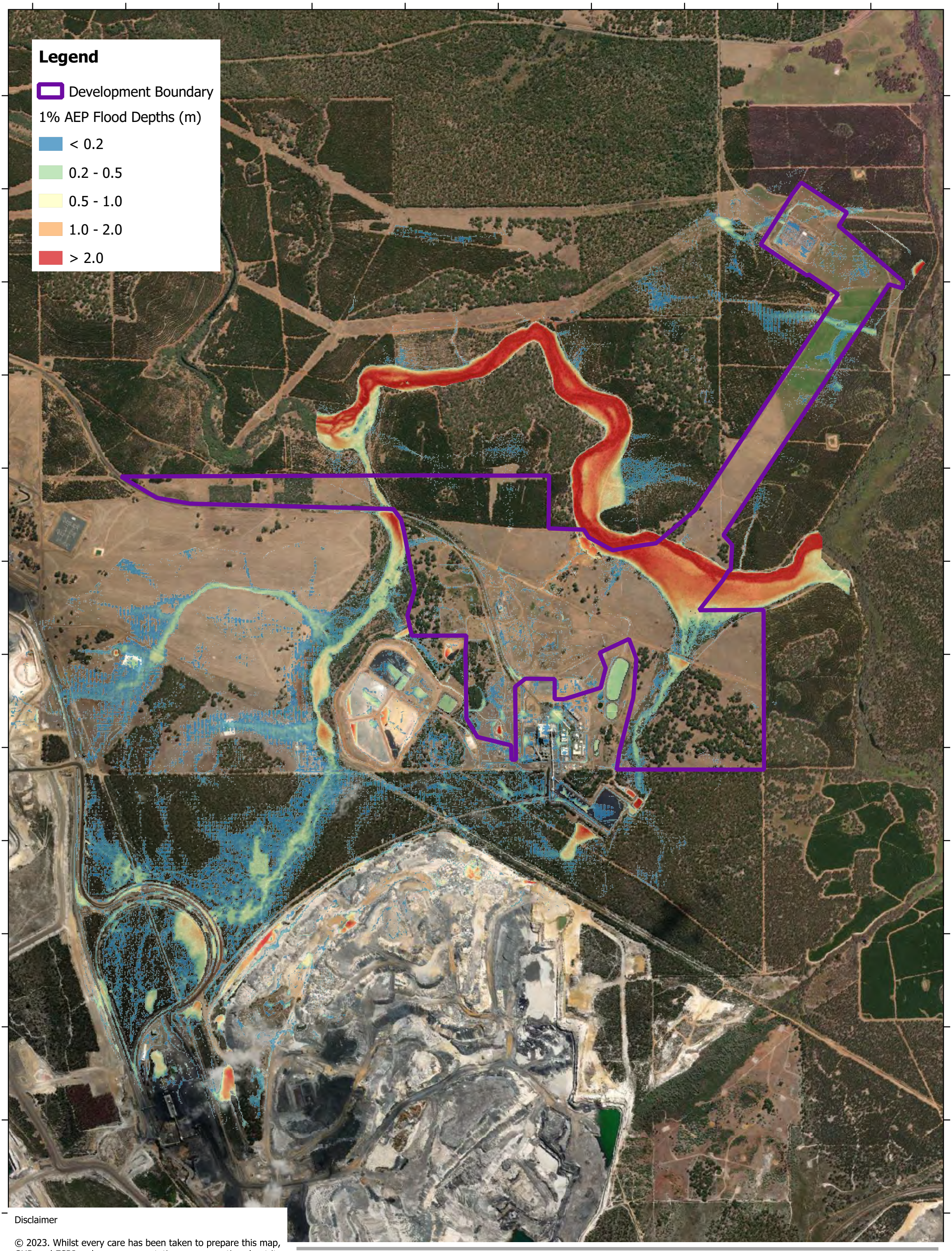
Appendices

Appendix A

Flood Maps for Full Proposal Boundary



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0 200 400 600 800 1,000 m

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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SYNERGY

COLLIE BESS SURFACE WATER MANAGEMENT PLAN

1% AEP MAX. FLOOD DEPTHS - FULL BOUNDARY

Project No. 12599664
Revision No. A
Date 30/08/2023

FIGURE A-1

Data Source: ESRI: World Imagery (Imagery Date: 2023; Date Extracted: 26/05/2023)

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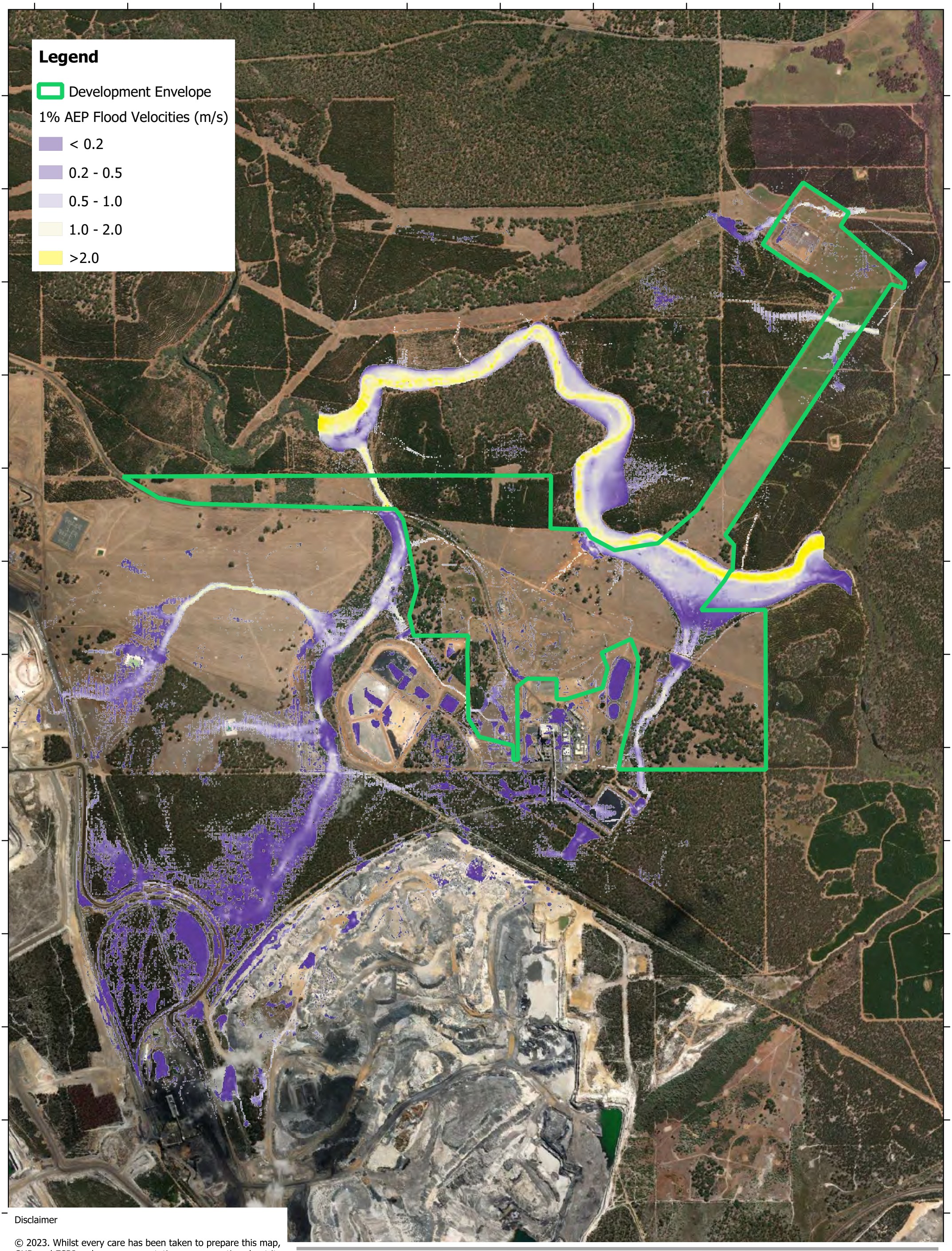

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0 200 400 600 800 1,000 m

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

SYNERGY

COLLIE BESS SURFACE WATER MANAGEMENT PLAN

1% AEP MAX. VELOCITIES - FULL BOUNDARY

Project No. 12599664
Revision No. A
Date 30/08/2023

FIGURE A-2

Data Sources: ESRI: World Imagery (Imagery Date: 2023, Extracted: 26/05/2023) Created by: d.e.torres

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