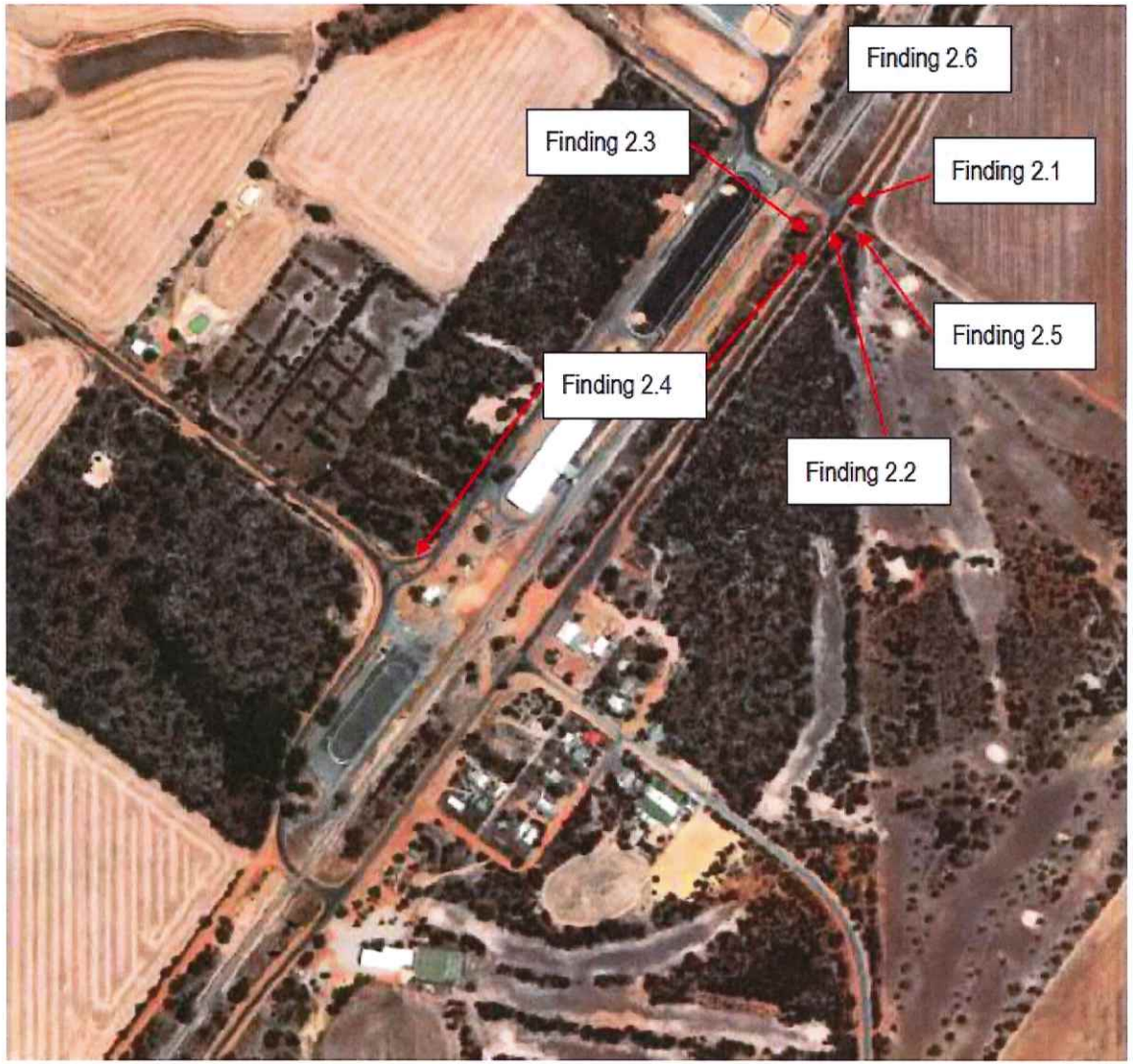


Figure 1: Location of Road Safety Audit Report Findings

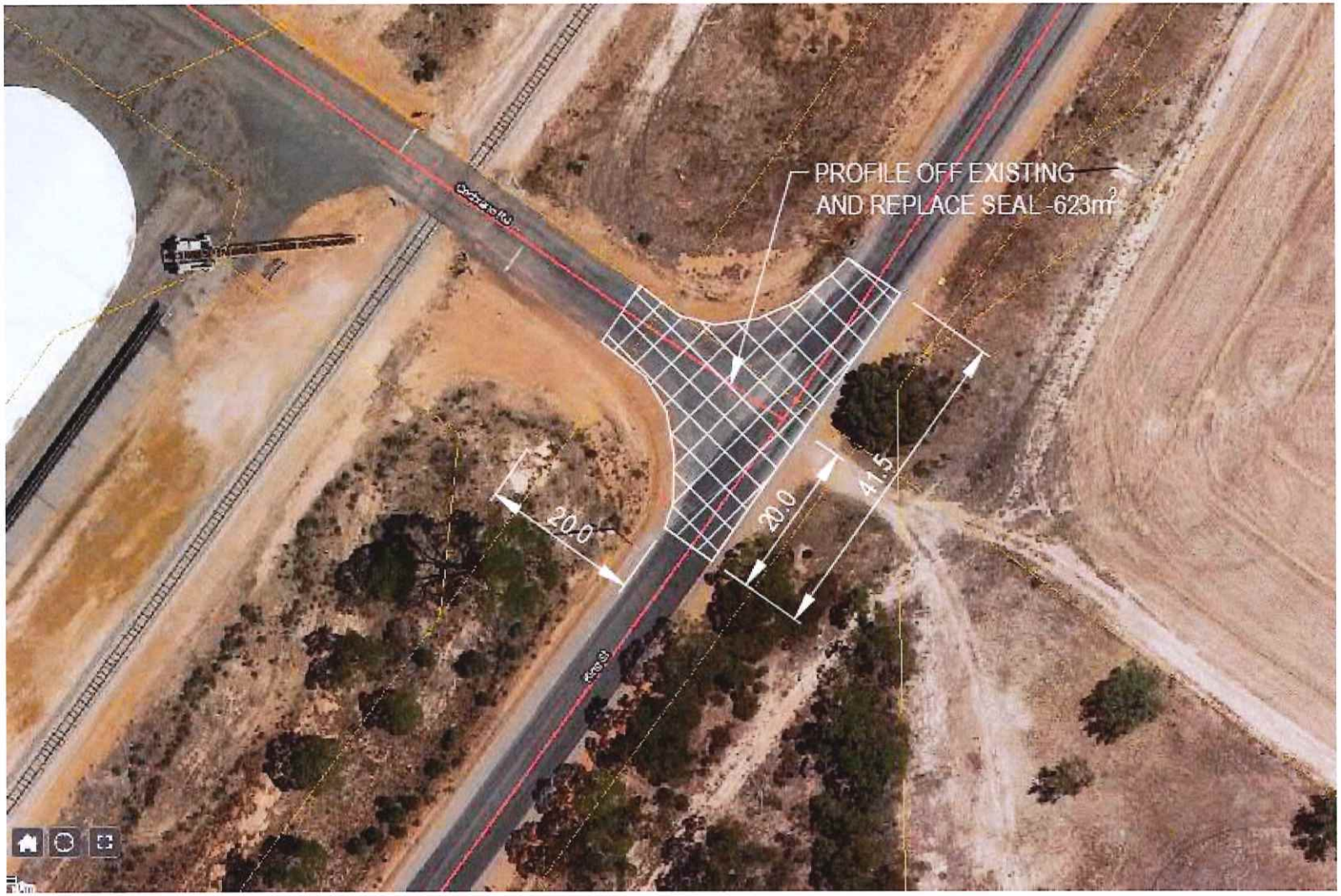


Figure 2: Site Exit at Cochrane Rd & King St intersection – Estimated Area of Seal Defects

Figure 3: Site Exit at Cochrane Rd & King St intersection – Required Line of Sight: 300 metres north.

Figure 4: Site Exit at Cochrane Rd & King St intersection – Required Line of Sight: 256 metres south

CBH GROUP

Planning Report

20 May 2022

Stuart Taylor, Chief Executive Officer
Shire of Wongan-Ballidu
Via email: shire@wongan.wa.gov.au

Dear Stuart,

LOT 2 COCHRANE ROAD, CADOUX, WA, 6466
APPROVED UPGRADES & ADDITIONS TO CBH'S EXISTING GRAIN HANDLING & STORAGE FACILITY IN CADOUX (A1600/P490)

In relation to Council Resolution 100322 from the Council Meeting held on 23 March 2022, please find below CBH's response to conditions 4 and 6.

Condition 4

4. *Prior to occupation of the development, all stormwater drainage works must be completed in accordance with the approved Stormwater Management Plan referenced in Condition 1 above and maintained thereafter for the life of the development in accordance with the local government's requirements.*

Please be advised that the location of the drainage basin is being relocated from the north-eastern side of the existing dam to the south western side of the existing dam. The attached Stormwater Management Plan reflect the new location of the basin. Please also find attached the revised agreement with the adjacent landowner regarding the location change of the basin.

Clause 77(3) of the *Planning and Development (Local Planning Scheme) Regulations 2015* states that *the local government may waive or vary a requirement in Part 8 or this Part in respect of an application if the local government is satisfied that the application relates to a minor amendment to the development approval.* CBH are hopeful that the Shire will constitute this amendment to be minor amendment and therefore not require an amended DA for the works.

Condition 6
The applicant shall prepare a deed of agreement with the local government for execution by no later than 30 June 2022 to:

i. address the six (6) findings and associated recommendations in the Road Safety Audit report, including all works referenced in the 'Additional Road Upgrade Information' dated 25 February 2022 as agreed following further discussion and negotiation; and

ii. *provide for the preparation and implementation of an interim Traffic Management Plan prior to commencement of the 2022/23 harvest period which shall include the installation of Variable Message Sign Boards in appropriate locations along Dowerin-Kalannie Road and King Street near the Cochrane Road and King Street intersection in accordance with Main Roads WA standards and procedural requirements for signs of this type with the following messages to be displayed on-screen to alert motorists to the potential safety risks associated with heavy vehicle movements at the Cochrane Road and King Street intersection until the various upgrade works required pursuant to the deed of agreement are completed in their entirety:*

The deed of agreement required by this condition shall confirm each party's role, responsibilities and obligations and provide for the sharing of all associated costs, including preparation of the deed, on a 50/50 basis.

Please find attached the revised Traffic Impact Statement and associated Technical Note which addresses items 2.3 and 2.6 of the Road Safety Audit (RSA) that was presented to Council. Item 2.3 from the RSA relates to the sight distance issue as a result of the vegetation and item 2.6 from the RSA relates to the speed limit change to 70km/hr. The revised Traffic Impact Statement demonstrates that items 2.3 and 2.6 can be closed out with no further action.

CBH is seeking confirmation from the Shire that the above items from the RSA can be closed out without further actions. This will enable CBH to start drafting the deed of agreement with the four findings that remain outstanding. If the Shire agrees that items 2.3 and 2.6 of the RSA can be closed out, it is also likely that Condition 6(ii) might not be necessary. CBH is seeking confirmation from the Shire if Condition 6(ii) can also be closed out without further action.

Should you have any questions in relation to the above, please contact Giselle Alliex on 0434 984 961 or Giselle.alliex@cbh.com.au

Yours Sincerely,

Giselle Alliex

Giselle Alliex
Lead Planning & Approvals – Government & Industry Relations

Stormwater Management Plan

Project:	Cadoux Site Expansion: Stormwater Management Plan
Client:	CBH
Author:	R. Needham
Date:	2nd May 2022
Shawmac Document #:	2006010-REP-003
CBH Document #:	370-2915-CI-RPT-0001

CONSULTING CIVIL AND TRAFFIC ENGINEERS
1 ST. FLOOR, 908 ALBANY HIGHWAY, EAST VICTORIA PARK WA 6101.
PHONE|+61 8 9355 1300
EMAIL| admin@ shawmac.com.au

Document Status: Client Review

Version	Prepared By	Reviewed By	Approved By	Date
A	R. Needham	J. Bridge	R. Needham	06-10-21
B	R. Needham		R. Needham	13-12-2021
C	R. Needham		R. Needham	02-05-22

Disclaimer

File Reference: Y:\Jobs Active 2020\CE - Roads and Drainage\CBH_Cadoux PFS_IFT & IFC Design_2006010\3. Documents\3.3 Design Report\IFC Drainage\2006010-REP-003.docx

Contents

Figures

Tables

1. Introduction

1.1. The Project

CBH are currently progressing planning for a permanent expansion in Open Bulkhead (OBH) storage at their existing Cadoux Site (within Lot 2).

CBH propose to add an additional 78,600t of storage by constructing 2x new bulkheads (OBH06/07) in the presently vacant northern portion of the site. In addition to this, CBH also propose to undertake a number of upgrades to the site including the construction of pavement widening for bypass lanes and drainage improvements. Refer to **Appendix A – CBH Concept Design** for full details of the proposal.

Figure 1 shows the existing site and the location of the proposed new bulkheads.

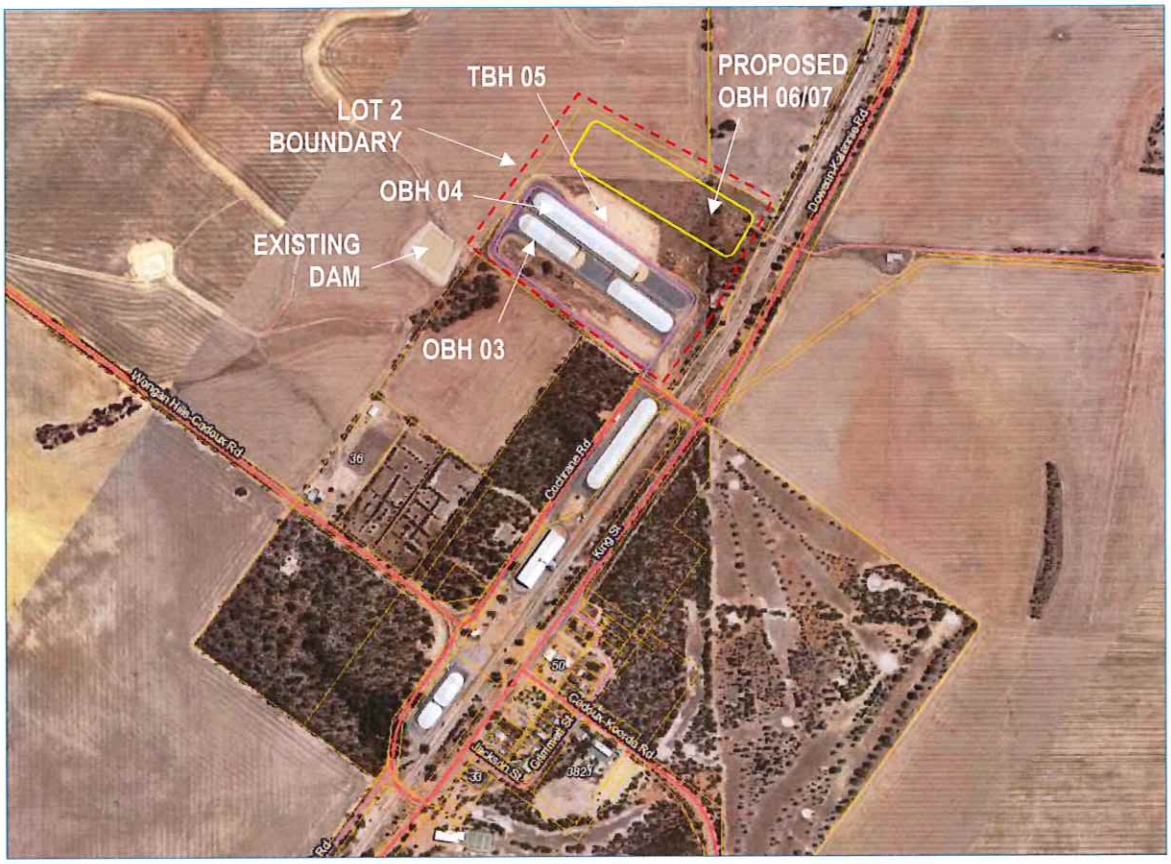


Figure 1: Existing Site

Shawmac have been commissioned by CBH to prepare the detailed designs for the works including drainage.

1.2. Purpose

The purpose of this report is to document the drainage design philosophy and outcomes for Shire of Wongan-

Ballidu review and approval.

Refer to **Appendix B – Earthworks and Drainage Drawing** for details of the drainage design

1.3. Previous Works

This report should read in conjunction with the Stormwater Management Plan for the existing site (2006010-TN-001, Shawmac 2021).

2. Existing Situation

2.1. Site Characteristics

Lot 2 is currently occupied by permanent OBH's 03/04 and the temporary OBH (THB99/OBH05) which is to be retained. CBH has recently constructed an additional temporary OBH (TBH07) in the northern portion of the site, for the 2021 harvest. It is understood that TBH07 will be removed after its use for the 2021 harvest.

The northern and north-western portion of the site (notwithstanding the TBH07 construction) is vacant and mostly cleared of all natural vegetation except for some low shrubs and grass. The northernmost tip of the site is completely cleared and used for cropping.

On the eastern corner of the site within the adjacent farm there is a dam which receives all stormwater from the existing CBH infrastructure within Lot 2. CBH have an agreement with the adjacent landowner to maintain the use of this dam (refer to the existing site SWMP 2006010-TN-001 for further details).

2.2. Geotechnical

CBH commissioned Galt to undertake a geotechnical investigation on the site to support the expansion works.

Galt undertook 9 test pits across the expansion area and within proposed drainage basins internal to the site, on the 18th and 19th of January 2021.

Galt described the site as typically consisting of:

- Silty SAND extending from surface to depths ranging from 0.1 to 0.6m; overlying
- Sandy CLAY/Clayey SAND extending to depths ranging from 1.5m to the maximum depth investigated of 3.7; overlying
- Inferred ROCK (possibly laterite or weathered igneous rock).

Permeability testing was not undertaken, but Galt expect that the sandy clay soils are likely to have very low permeability and recommend that for the purposes on drainage design, the soils are considered practically impermeable.

Galt further recommended the use of subsoil drains to direct subsurface water away from pavements and structures. Groundwater was not encountered in any of the test pits, however Galt noted that it is likely that runoff will perch on the rock or clayey soils during wetter times of the year.

2.3. Environmental

As the surrounding land is almost completely cleared for cropping, there are no particular environmental concerns. The site ultimately forms part of the catchment of Mortlock Creek which discharges to Lake Hinds, however this is located some 50km to the west and the wider catchment is similarly clear for cropping.

2.4. Terrain

The natural terrain predominately falls from east to west at a grade of about 1%-1.5%. Lot 2 falls from a high of 374m AHD in the eastern corner to a low of 365m AHD in the western corner.

Figure 2 shows the natural terrain surrounding the site (2m contours).

Figure 2: Existing Site

2.5. Surface Water Catchments

As discussed previously, the existing site falls east to west and all surface water runoff from CBH infrastructure is directed to the existing dam in the adjacent farm. The dam is understood to originally have had a 10,000m^3 capacity and CBH have an agreement in place with the landowner for its ongoing operation. Survey undertaken in March 2022 suggests that the dam only has a capacity of 7,077m^3 and some of the original capacity has likely been lost due to sedimentation.

The existing railway line and Dowerin-Kalannie Road separates the site from higher ground to the east, however, a number of culverts have been installed which provide flow paths from the eastern catchments. **Figure 3** below shows the existing external catchments to the east of the site and the approximate location of the existing culverts.

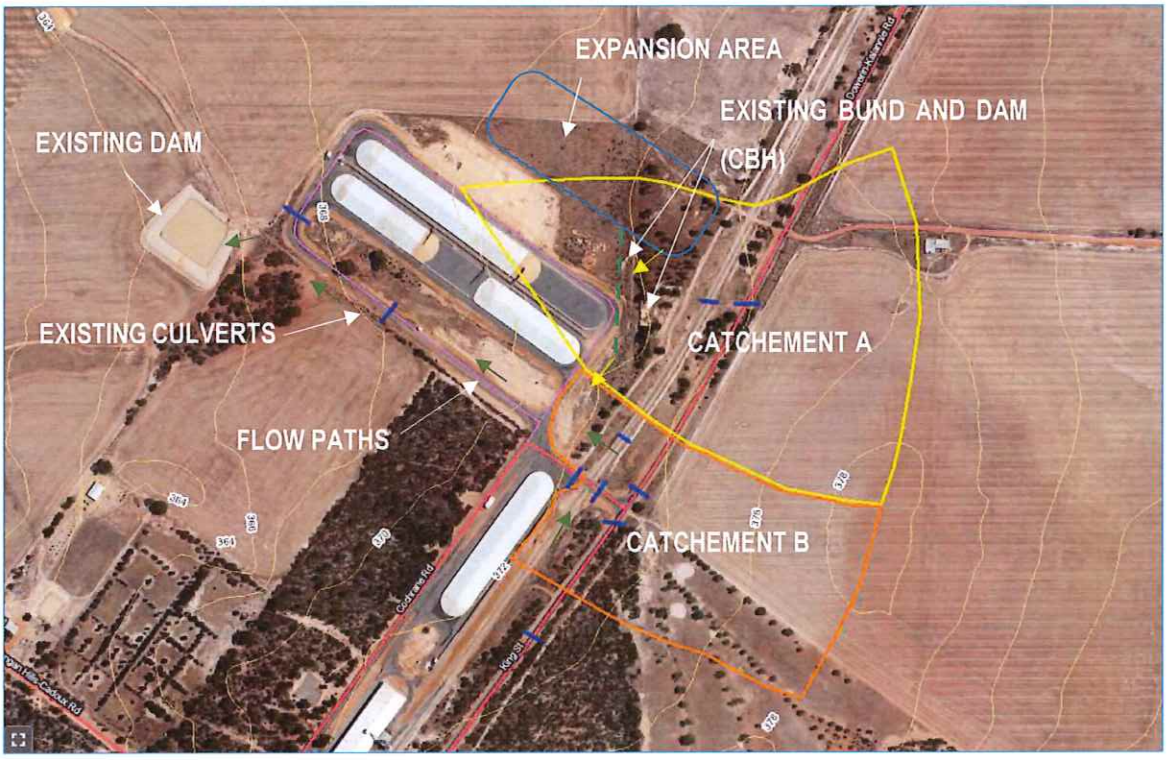


Figure 3: Existing External Catchments

At present, Catchment B is intercepted by CBH's open drains and culverts, ultimately also discharging into the dam. Catchment A however is detained at the western interface of CBH's site due to the installation of a dam (CBH) and bund. Catchment A will ultimately overtop the bund towards Catchment B and the private dam, however it is expected that this would only occur in large events.

The bund will need to be removed to facilitate the construction of the expansion works and Catchment A will be intercepted by the table drains installed as part of the expansion. In effect, this will result in a direct flow path from Catchment A to the private dam.

An XP-STORM model was built to reflect the existing situation and the resultant flow rates and volumes into the dam were estimated as shown in **Table 1** over. Note the events assessed reflect the new ARR (2019) terminology; the 63% AEP and 5% AEP events are approximately equal to the 1 year ARI and 20 year ARI, respectively.

Note that the model of the existing situation incorporates a conservative assumption that no flow from Catchment A occurs during these events. This assumption was made for two reasons. Firstly, and as discussed previously, it is only expected that Catchment A would overtop towards Catchment B in larger events. The informal arrangement of the bund and dam (which may be changed on site from time to time) is difficult to appreciate and model with accuracy and as such there is low confidence in what this 'larger event' would be. Secondly, the assumption reflects what would be regularly observed on site (e.g. day to day in an average winter). A less conservative assumption would result in larger discharges post the expansion works which may not meet the

expectations of the adjacent landowner.

Table 1: Estimated Existing Discharge to Dam

Item	63% AEP	5% AEP
Peak Flow	0.20m³/s	0.52m³/s
Max Volume	1,182m³	7,190m³

For both events, the maximum discharge volume does not exceed the original 10,000m3 capacity of the dam, however the current capacity of 7,077m³ will likely be exceeded in the 5% AEP event. It should be noted that the maximum volumes are calculated for a single event. Given the poor permeability of the natural soils, it is likely that the dam would hold water for a considerable period after a rainfall event. Should another event occur soon after, it is possible that the dam would have insufficient effective capacity and overtopping would occur.

3. Stormwater Management Strategy

3.1. Design Criteria

The design criteria adopted is in accordance with CBH's Design Specification (TS10A). The key requirements of these specifications are:

- Adequately protect the site from inundation and flooding both from internal catchments and external upstream catchments;
- Adequately capture and transfer stormwater runoff internally from hardstands, roads and grain storage areas for the 1:20 year ARI year event, through open drains and culverts to retention basins for attenuation and controlled outflow;
- Provide detention storage and controlled overflow pathway discharge for 1:20 year storm event or local authority requirements, whichever is greater;
- Manage, control and convey the design ARI event post development event with a free-board of 300 mm. (Consideration may be given to a reduction to 150mm when flooding does not present a risk to infrastructure and operations);
- Implement road kerb with stone pitching spillway as erosion control measure, where required;
- Provide scour protection if flow velocity is higher than 2 m/s in unlined drains;
- Surface water to be graded to fall away from grain pits to prevent ingress of water into pits;
- Surface water runoff to retention basins is to be controlled by means of drains, kerb with stone pitched spillways and/or earth bunds directing the flow towards the inlet of the retention basins.

In addition, the following site-specific requirements have been adopted:

- A new dam is to be constructed and linked to the existing dam to cater for the criteria 5% AEP event due to the additional catchment area and the reduced capacity of the original dam.
- Peak discharge from the site is not to exceed the existing 5% AEP peak pf 0.52m^3/s.
- Basins within the CBH site are to be free draining to ensure that storage capacity is restored between rainfall events.

3.2. Adopted Approach

In general, the adopted approach involves the construction of open drains and culverts to direct runoff from all areas of the site towards a new basin in the western corner of the site which has an outlet to the existing dam in the neighbouring land which will be enlarged.

The diversion of Catchment A and the construction of the new expansion works pavements and bulkheads will result in substantially increased flows towards the dam and the neighbouring land. To manage this, a drainage

basin is proposed to be installed immediately upstream of the dam, within the CBH boundary. All runoff from the existing OBH03/04, the new bulkheads OBH05/06 and pavement areas as well as the existing external catchments will be diverted to the new basin. The basin and its outlet have been designed to ensure that outflow rates do not exceed the existing peak of 0.52m³/s.

Due to poor permeability characteristics of the site, the basins within the CBH site have been designed to be free draining so that storage capacity will be restored between rainfall events. This will involve the installation of a culvert at the basin floor with an outlet towards the existing dam in the neighbouring land. As runoff is not being retained within the CBH site, the total volume of stormwater leaving the site will increase significantly and will exceed the capacity of the existing dam. Accordingly, CBH have arranged for approval with the adjacent landowner to construct an additional dam to cater for the full 5% AEP event (notionally an extra 14,984m³). The existing dam will be retained and a high level overflow channel will link the existing dam with the proposed dam. The existing dam will fill as a priority, and the new dam will only begin to fill once the existing is full.

Due to the lack of a natural channel to discharge into, the dam has been designed to hold water without controlled release. The dam has been sized for the critical 5% AEP event (48hr, 92.2mm) which is equivalent to about 7 weeks of average winter rainfall for Cadoux. It should be noted that as there will be negligible water leaving the dam through infiltration or evaporation, the dam will continue to hold water and in case of higher-than-average rainfall or multiple significant rainfall events, the dam could overtop. There is an existing open channel which links the top of the existing dam with another dam further down slope to the west. Provision has been made for a controlled overflow from the proposed dam to this existing open channel. However, the capacity of the existing channel is not known and there is potential for overflow to cause damage to the surrounding land. CBH should ensure that the adjacent landowner is aware and accepting of this risk. CBH should also ensure that the water level is monitored, and provision be made to pump water out prior to and during winter.

Subsoil drainage has been proposed on the upstream side of new pavement areas including below the table drain on the eastern boundary of the site and below the unsealed emergency OBH/05 to protect the upgraded DOG road (between OBH04 & OBH05). The subsoil drainage will be installed at a minimum cover of 300mm in un-trafficable areas (below table drains) or 750mm in unsealed trafficable areas (OBH/05). As no groundwater monitoring has been undertaken and no groundwater was encountered during the geotechnical investigation, the optimal level for subsoils to be installed at to intercept groundwater is not known and it would be possible for groundwater to travel below the subsoil invert and affect pavement or infrastructure further down slope. It should also be noted that the subsoil layout has been designed with the intent of protecting new pavement areas only.

Pavement drains have typically been designed at a minimum 1%, except for along the new DOG road which has only achieved 0.6% due to the existing levels along OBH04. This pavement drain provides sufficient capacity to prevent spill over into OBH04 during the design event and the pavement surfacing design should provide adequate waterproofing. However the low longitudinal grade is undesirable and adds to the risk of water ingress into the

pavements. Particular attention should be paid during construction to ensure that:

- Subgrades and pavement layers have dried back sufficiently prior to sealing;
- The sealing and jointing provide adequate waterproofing.
- The levels are constructed to the design.

3.3. Stormwater Quantity

3.3.1. Modelling Assumptions

An XPSTORM model was built for the expansion design based on the following assumptions:

- Allowance has been made for Catchment A to be intercepted by the site drains and to continue through to the basins and dam.
- Design rainfalls and temporal patterns are based on ARR 2019.
- Infiltration losses have been assumed as follows:
    - External pervious areas – 35mm initial loss, 0mm continuing loss (in accordance with ARR 2019 recommendations for the region).
    - Internal pervious areas (e.g. swales and basins) – 5mm initial loss, 0mm continuing loss (assumed).
    - Internal impervious areas (e.g. new/existing pavements) – nil losses (assumed).
- A nominal 100mm/day infiltration rate from the dam as been applied to account for some losses due to seepage and evaporation.
- The existing dam parameters are as follows:
    - Base level of 361.82m AHD
    - Base area of 1,342m^2
    - Top level of 364.66m AHD
    - Top area of 3,642m^2
    - Maximum storage depth of 2.84m
    - Storage volume of 7,077m^3
- The new dam parameters are as follows:
    - Base level of 361.85m AHD
    - Base area of 10,616m^2
    - Top level of 363.5m HAD
    - Top area of 12,902m^2
    - Maximum storage depth of 1.3m
    - Storage volume of 14,984m^3
- Model outcomes reflect the median event from the hydraulic model.

- Culvert entry/exit loss coefficients are assumed as 0.5/1.0 respectively.
- Mannings 'n' values assumed as follows:
    - Pavement drains – 0.016
    - Table/open drains – 0.025
    - Culverts (RCP) – 0.014

3.3.2. Model Outcomes

Table 2 provides a comparison between the existing and post-expansion flow rates and volumes from the basin outlet into the dam. As shown, the maximum discharge rate does not exceed the existing rate, and the estimated discharge volume approaches, but is below the nominal 18,700m³ to be provided after enlarging the dam.

As shown, the expected TWL in the dam is below the base of the internal basins and will allow these to drain freely. CBH should confirm with Shawmac the proposed dimensions and levels of the dam prior to construction to ensure they are compatible with the modelling.

Table 2: Comparison in Discharge to Dams

Item	Existing	Post-expansion	
		Existing	Proposed
Peak Flow from site	0.52m³/s	0.44m³/s	
Max Volume	7,190m³	7,077m³	14,614m³
TWL	N/A	364.80[1]	363.12
Max Water Depth	N/A	2.98	1.27

[1] Reflects depth of water in overflow channel

Table 3 provides a summary of the modelling outcomes for the two internal basins which are separated by the bypass lane and linked by culvert A. Note that the top level, maximum depth and freeboard reflect potential storage up to the lowest adjacent pavement surface.

Table 3: Basin Design Outcomes

Element	West	East
Base Level	365.19	365.19
Top Level	367.27	367.70
Max Depth	2.01	2.51
Base Area	1,240m²	801m²
Top Area	2,196m²	4,140m²
Max Volume	3,453m³	3,942m³
TWL	366.88	367.08
Max Stored Depth	1.69	1.89m
Freeboard	0.39	0.62
Max Stored Volume	2,789m³	2,297m³

Table 4 provides a summary of the culvert modelling outcomes. Note that Culvert J is proposed to be relief only, in case of blockage along the pavement drain and this has not been modelled. All culverts are to have outlet rock protection in accordance with CBH's standard details.

Table 4: Culvert Design Outcomes

Culvert	Type	U/S Shoulder or Ground Level	HW Level	Freeboard to U/S	Max Flow (m^3/s)	Max Velocity (m^3/s)
A	600 RCP	367.70	367.25	0.45	0.47	1.66
B	3x600 RCP	368.01	367.44	0.57	1.17	1.66
C	600 RCP	369.47	368.70	0.77	0.22	1.00
D	450 RCP	373.23	371.73	1.50	0.11	2.27
E	450 RCP	371.53	370.58	0.95	0.08	0.96
F	2x 600 RCP	369.94	369.57	0.37	0.87	1.55
G	525 RCP	367.20	366.83	0.37	0.39	3.42
H	2x 525 RCP	369.03	368.63	0.40	0.97	2.22
I	600 RCP	370.06	369.32	0.74	0.62	2.34

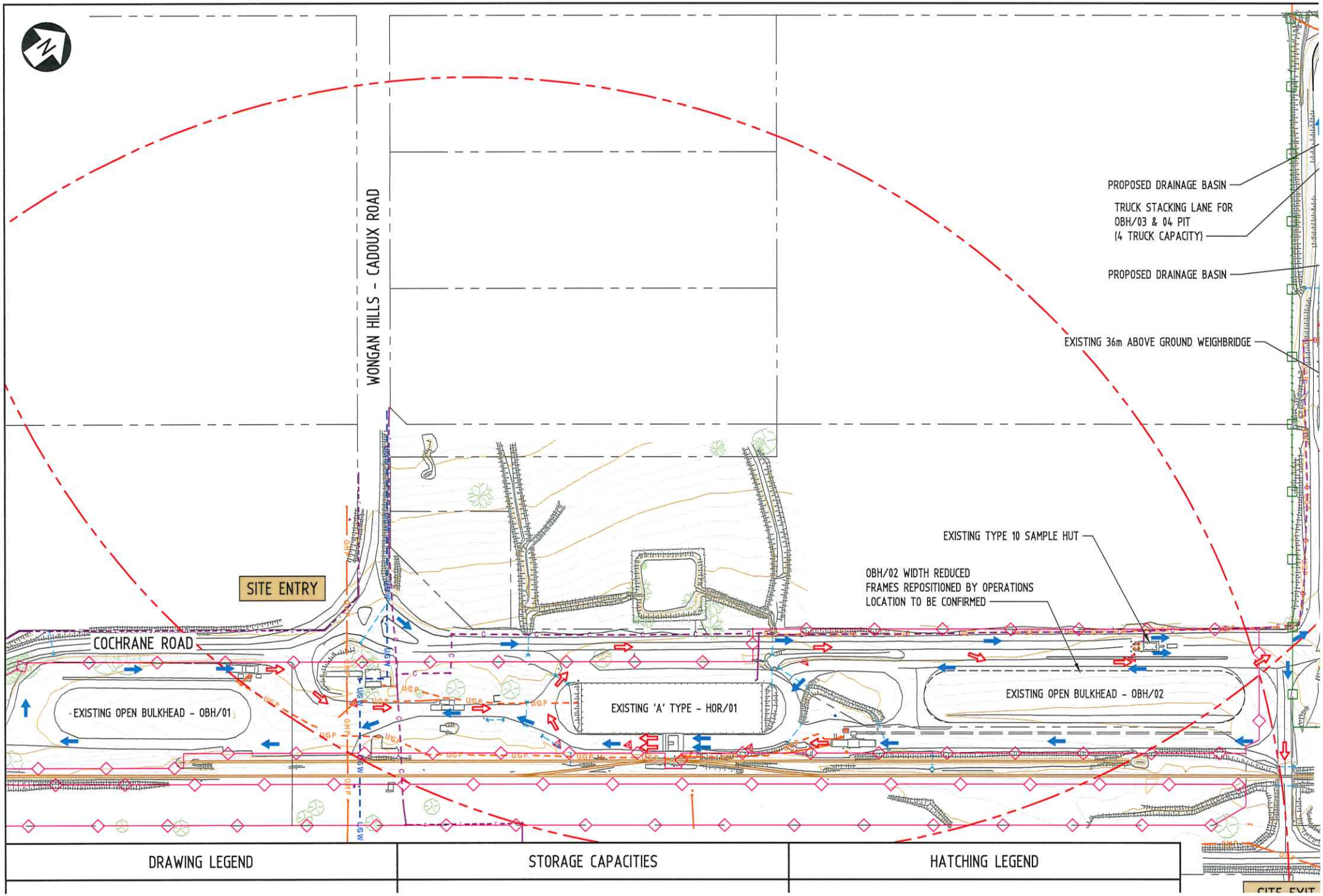
Table 5 provides a summary of the modelling outcomes of the pertinent open drains within the site. There are drains with calculated velocities over 2.0m/s which would normally warrant scour protection. In this instance the velocities are only marginally over 2.0m/s and it is not considered that scour protection is essential, however consideration will be made to slightly enlarging the cross section at the next design stage.

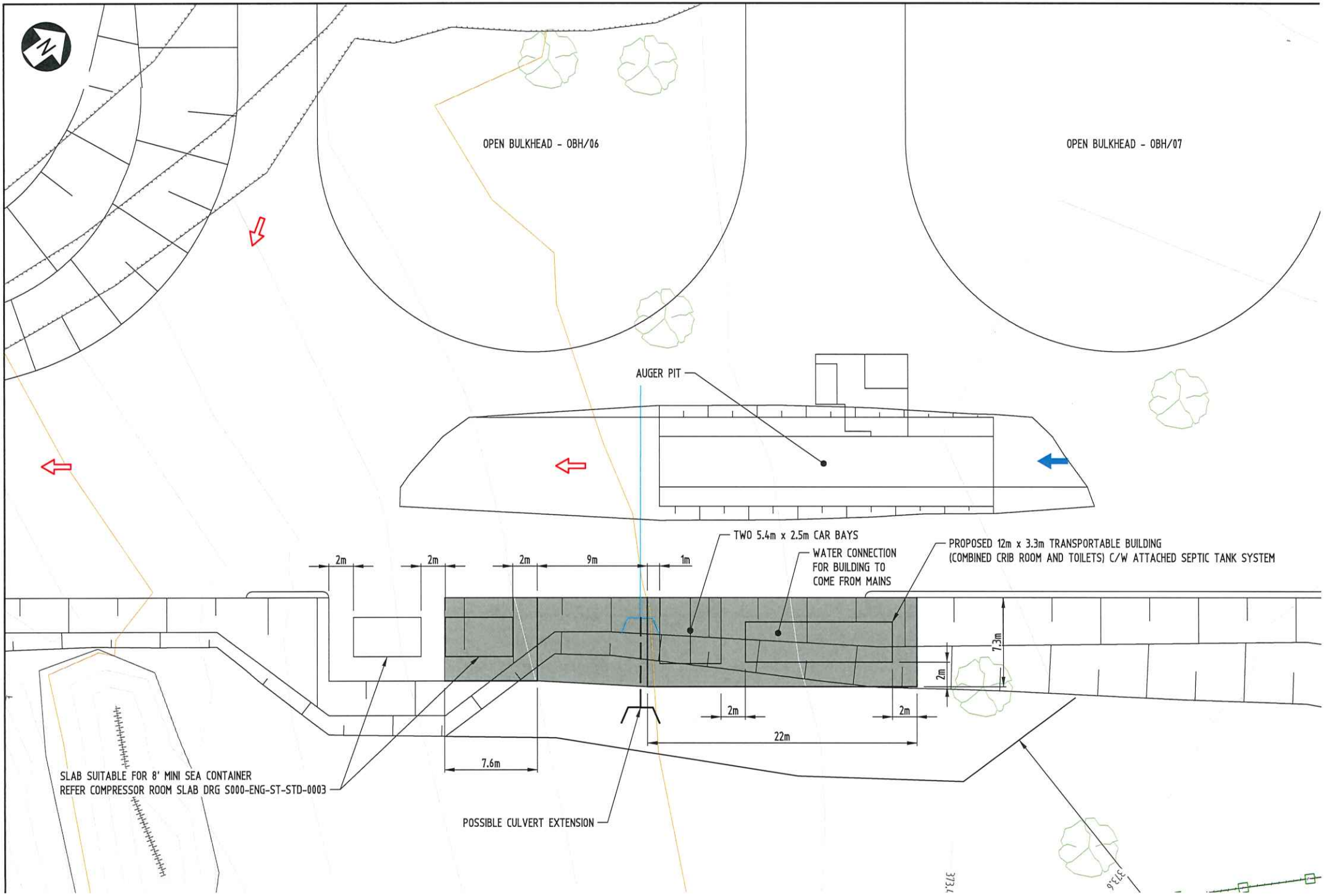
Table 5: Open Drain Design Outcomes

Drain	Description	Max Flow	Max Velocity	Max Depth
A	Outlet from Basin to Dam	0.40	2.08	N/A*
B	Inlet to Culvert B	1.17	1.38	0.56
C	DOG road pavement drain	0.19	0.46	0.10
D	Inlet to Culvert C	0.22	0.71	0.59
E	Inlet to Culvert I	0.64	1.23	0.58
F	Conveyor Road pavement drain	0.20	0.63	0.09
G	Inlet to Culvert D	0.08	0.57	0.18
H	Inlet to Culvert F	0.49	1.07	0.66
I	Inlet to East Basin	1.27	2.01	N/A*

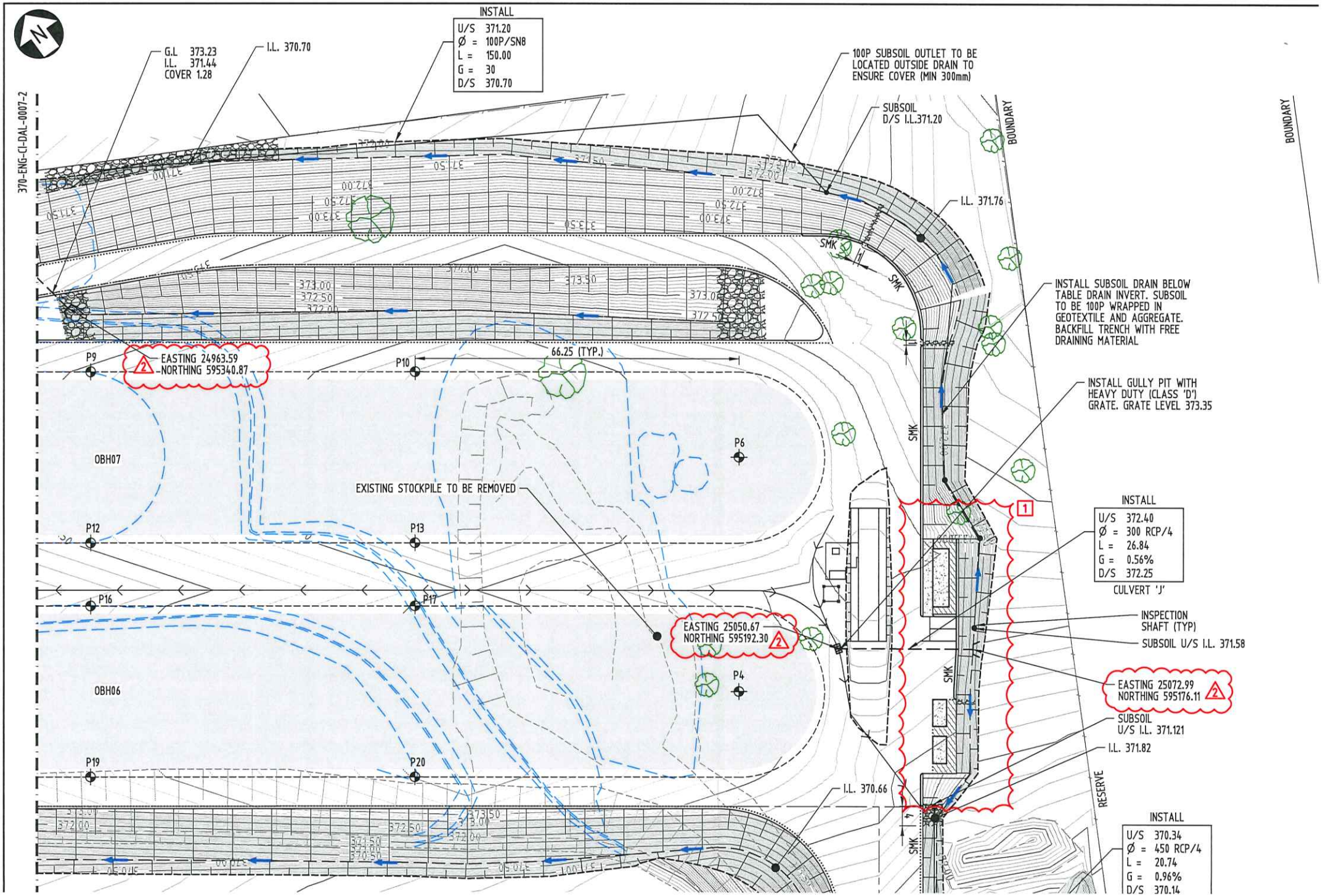
* N/A as governed by tailwater in dam/basin

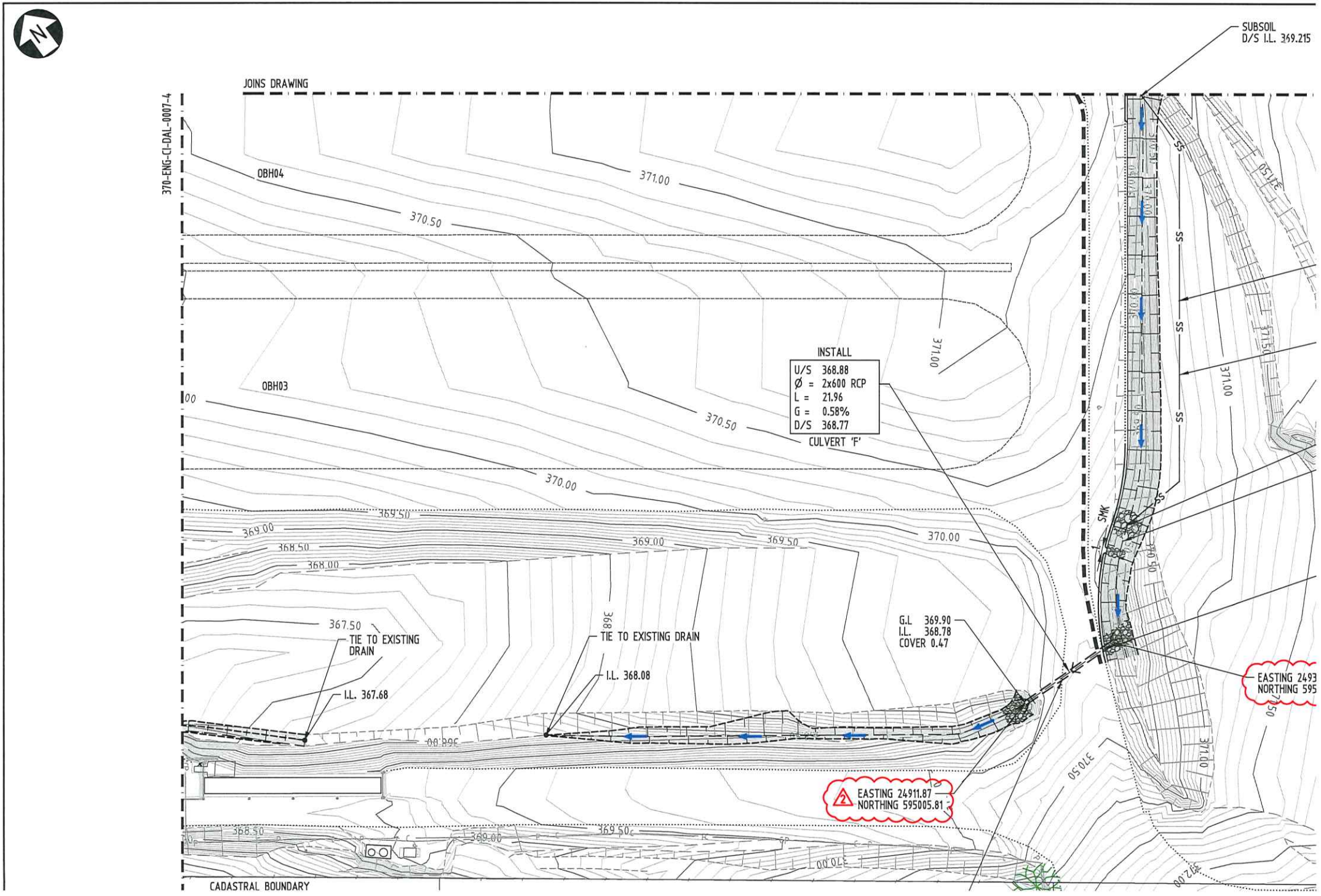
Appendix A – CBH Concept Design


WONGAN HILLS - CADOUX ROAD
PROPOSED DRAINAGE BASIN
TRUCK STACKING LANE FOR
OBH/03 & 04 PIT
(4 TRUCK CAPACITY)
PROPOSED DRAINAGE BASIN
EXISTING 36m ABOVE GROUND WEIGHBRIDGE
EXISTING TYPE 10 SAMPLE HUT
OBH/02 WIDTH REDUCED
FRAMES REPOSITIONED BY OPERATIONS
LOCATION TO BE CONFIRMED
SITE ENTRY
COCHRANE ROAD
EXISTING OPEN BULKHEAD - OBH/01
EXISTING 'A' TYPE - HOR/01
EXISTING OPEN BULKHEAD - OBH/02
DRAWING LEGEND
STORAGE CAPACITIES
HATCHING LEGEND


OPEN BULKHEAD - OBH/06
OPEN BULKHEAD - OBH/07
AUGER PIT
TWO 5.4m x 2.5m CAR BAYS
WATER CONNECTION FOR BUILDING TO COME FROM MAINS
PROPOSED 12m x 3.3m TRANSPORTABLE BUILDING (COMBINED CRIB ROOM AND TOILETS) C/W ATTACHED SEPTIC TANK SYSTEM
2m
2m
2m
9m
1m
7.3m
2m
2m
2m
22m
7.6m
SLAB SUITABLE FOR 8' MINI SEA CONTAINER
REFER COMPRESSOR ROOM SLAB DRG S000-ENG-ST-STD-0003
POSSIBLE CULVERT EXTENSION
3737
3736

Appendix B – Earthworks and Drainage Drawing


370-ENG-CI-DAL-0007-2
INSTALL
U/S 371.20
Ø = 100P/SN8
L = 150.00
G = 30
D/S 370.70
G.L 373.23
I.L. 370.70
I.L. 371.44
COVER 1.28
100P SUBSOIL OUTLET TO BE LOCATED OUTSIDE DRAIN TO ENSURE COVER (MIN 300mm)
SUBSOIL
D/S I.L.371.20
BOUNDARY
I.L. 371.76
SMK
INSTALL SUBSOIL DRAIN BELOW TABLE DRAIN INVERT. SUBSOIL TO BE 100P WRAPPED IN GEOTEXTILE AND AGGREGATE. BACKFILL TRENCH WITH FREE DRAINING MATERIAL
INSTALL GULLY PIT WITH HEAVY DUTY (CLASS 'D') GRATE. GRATE LEVEL 373.35
P9
EASTING 24963.59
NORTHING 595340.87
P10
66.25 (TYP.)
P6
OBH07
EXISTING STOCKPILE TO BE REMOVED
P12
P13
P16
P17
EASTING 25050.67
NORTHING 595192.30
P4
OBH06
P19
P20
INSTALL
U/S 372.40
Ø = 300 RCP/4
L = 26.84
G = 0.56%
D/S 372.25
CULVERT 'J'
INSPECTION SHAFT (TYP)
SUBSOIL U/S I.L. 371.58
EASTING 25072.99
NORTHING 595176.11
SUBSOIL
U/S I.L. 371.121
I.L. 371.82
I.L. 370.66
RESERVE
INSTALL
U/S 370.34
Ø = 450 RCP/4
L = 20.74
G = 0.96%
D/S 370.14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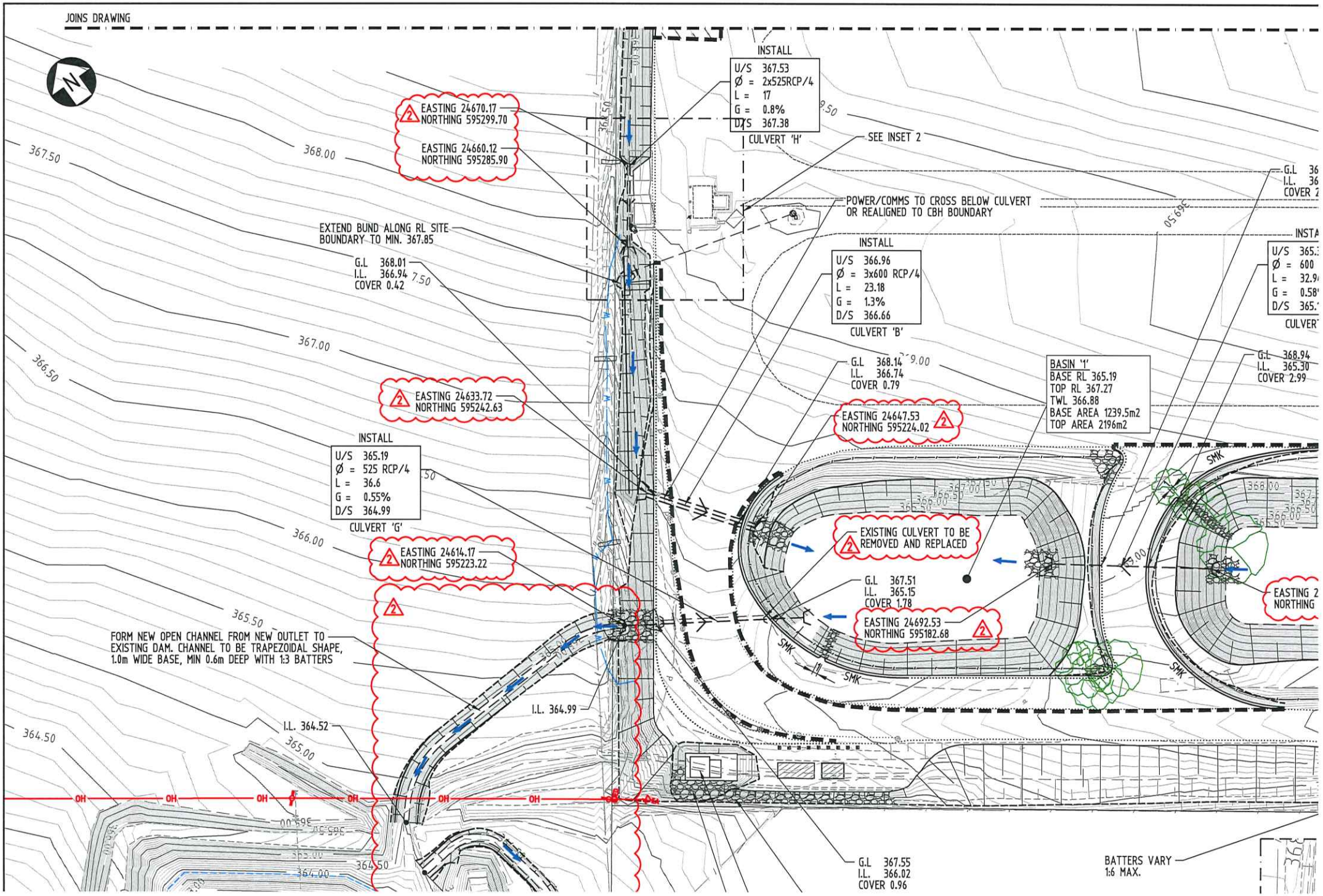
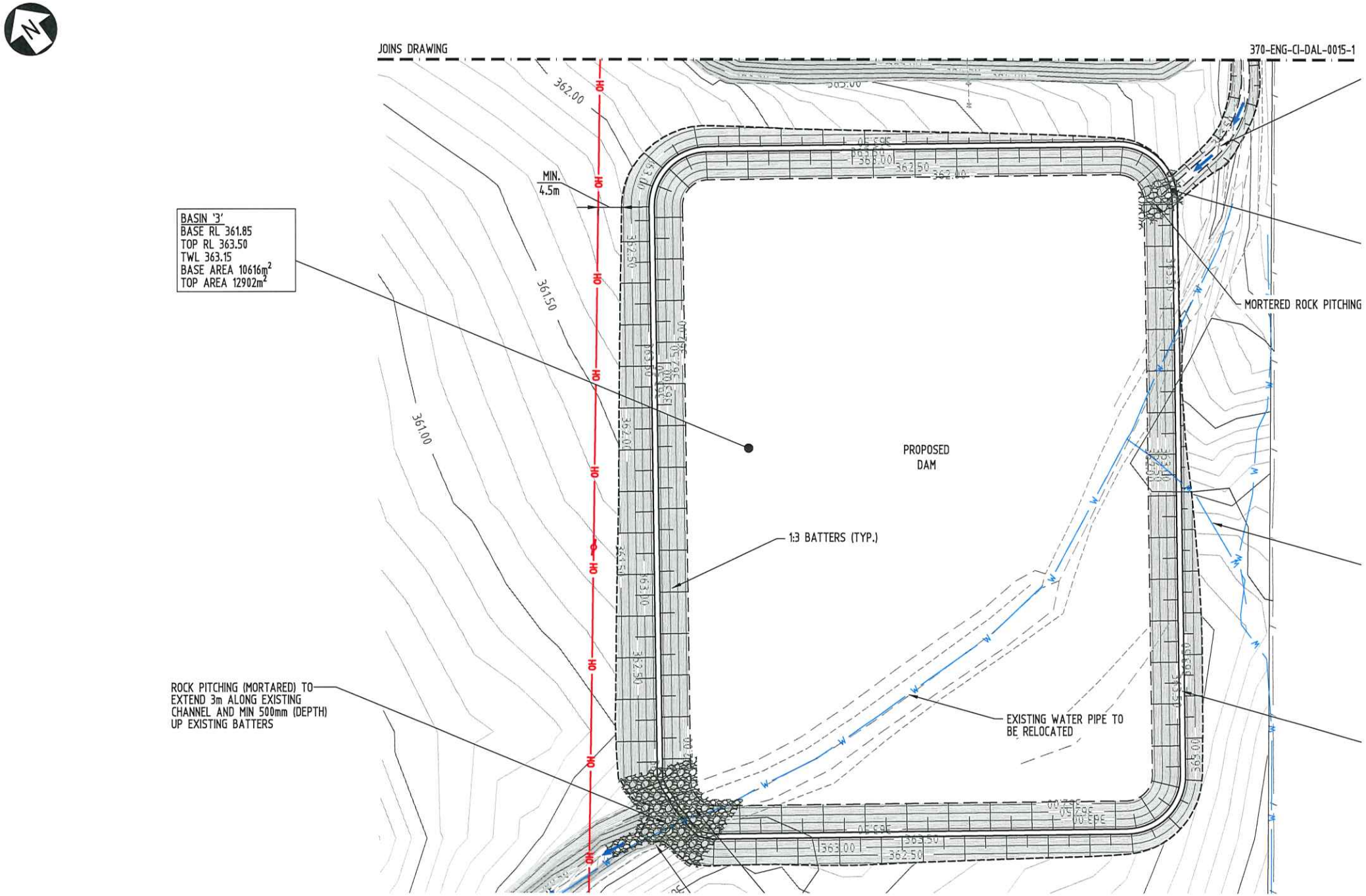
JOINS DRAWING
SUBSOIL
D/S I.L. 369.215
OBH04
OBH03
371.00
370.50
370.00
369.50
369.00
368.50
368.00
367.50
INSTALL
U/S 368.88
Ø = 2x600 RCP
L = 21.96
G = 0.58%
D/S 368.77
CULVERT 'F'
TIE TO EXISTING DRAIN
I.L. 367.68
TIE TO EXISTING DRAIN
I.L. 368.08
G.L 369.90
I.L. 368.78
COVER 0.47
SMK
SS
EASTING 24911.87
NORTHING 595005.81
EASTING 2493
NORTHING 595
CADASTRAL BOUNDARY


JOINS DRAWING
N
EASTING 24670.17
NORTHING 595299.70
EASTING 24660.12
NORTHING 595285.90
INSTALL
U/S 367.53
Ø = 2x525RCP/4
L = 17
G = 0.8%
D/S 367.38
CULVERT 'H'
SEE INSET 2
POWER/COMMS TO CROSS BELOW CULVERT
OR REALIGNED TO CBH BOUNDARY
EXTEND BUND ALONG RL SITE
BOUNDARY TO MIN. 367.85
G.L 368.01
I.L. 366.94
COVER 0.42
INSTALL
U/S 366.96
Ø = 3x600 RCP/4
L = 23.18
G = 1.3%
D/S 366.66
CULVERT 'B'
G.L 368.14
I.L. 366.74
COVER 0.79
EASTING 24647.53
NORTHING 595224.02
BASIN '1'
BASE RL 365.19
TOP RL 367.27
TWL 366.88
BASE AREA 1239.5m2
TOP AREA 2196m2
G.L 368.94
I.L. 365.30
COVER 2.99
EASTING 24633.72
NORTHING 595242.63
INSTALL
U/S 365.19
Ø = 525 RCP/4
L = 36.6
G = 0.55%
D/S 364.99
CULVERT 'G'
EASTING 24614.17
NORTHING 595223.22
EXISTING CULVERT TO BE
REMOVED AND REPLACED
G.L 367.51
I.L. 365.15
COVER 1.78
EASTING 24692.53
NORTHING 595182.68
SMK
FORM NEW OPEN CHANNEL FROM NEW OUTLET TO
EXISTING DAM. CHANNEL TO BE TRAPEZOIDAL SHAPE,
1.0m WIDE BASE, MIN 0.6m DEEP WITH 1:3 BATTERS
I.L. 364.99
I.L. 364.52
OH
G.L 367.55
I.L. 366.02
COVER 0.96
BATTERS VARY
1:6 MAX.
367.50
368.00
367.00
366.50
366.00
365.50
365.00
364.50
364.00


JOINS DRAWING
370-ENG-CI-DAL-0015-1
BASIN '3'
BASE RL 361.85
TOP RL 363.50
TWL 363.15
BASE AREA 10616m²
TOP AREA 12902m²
MIN. 4.5m
PROPOSED DAM
1:3 BATTERS (TYP.)
MORTERED ROCK PITCHING
ROCK PITCHING (MORTARED) TO EXTEND 3m ALONG EXISTING CHANNEL AND MIN 500mm (DEPTH) UP EXISTING BATTERS
EXISTING WATER PIPE TO BE RELOCATED
362.00
361.50
361.00
363.00
362.50

CONSTRUCTION AND ACCESS LICENCE is made the 16th day of May 2022

BETWEEN:

P.V.J. NOMINEES PTY LTD of Post Office Box 15, Cadoux, WA 6466 ("**Landholder**")

AND:

CO-OPERATIVE BULK HANDLING LIMITED of Level 6, 240 St Georges Terrace, Perth, Western Australia 6000 ("**CBH**")

RECITALS:

A. CBH is the registered proprietor of the land located at Lot 2 on Deposited Plan 65578 Cochrane Road, Cadoux, WA 6466 (**CBH Site**).

B. The Landholder is the registered proprietor of the land adjoining the CBH Site, located at Lot 9001 on Deposited Plan 65578 Wongan Hills – Cadoux Road, Cadoux, WA 6466 (the **Land**).

C. CBH will construct a dam on the Dam Area to assist with the capture of water run-off from the CBH Site (the **Dam**).

D. The Landholder requires access to the Dam in order to extract water from it.

E. In consideration for CBH paying for the construction of the Dam and granting the Landholder the right to extract and use the water from the Dam, the Landholder:

   a. provides CBH a licence to access the Land in order to construct the Dam at CBH's cost; and

   b. agrees to indemnify CBH in accordance with this licence.

F. Upon CBH's completion of construction of the Dam on the Dam Area, the Landholder shall be responsible for the care and maintenance of the Dam, including controlling safe access to the Dam and ensuring the Dam is operated safely and maintained in a safe condition.

THIS AGREEMENT WITNESSES that:

2. DEFINTIONS

a. **CBH Indemnified Parties** means:

   i. CBH and its officers, directors, employees, agents and contractors; and

   ii. each Related Body Corporate and their officers, directors, employees, agents and contractors.

b. **CBH Site** has the meaning given in Recital A.

c. **Dam** has the meaning given to it in Recital C.

d. **Dam Area** means the area on the Land as identified in the plan at Annexure A on which the Dam will be constructed.

e. **Expiry Date** means the date that is ten years after the Commencement Date.

f. **Landholder** means P.V.J. Nominees Pty Ltd and includes the Landholder Personnel.

g. **Land** has the meaning given to it in Recital B.

h. **Law** means:

   i. federal, state and local government legislation including regulations and by-laws;

   ii. common law, equity or any other legal theory;

   iii. Authority requirements, consents and approvals (including conditions in connection with any consents and approvals); and

   iv. guidelines of Authorities with which a person is legally required to comply.

i. **Loss** means includes any loss, claim, liability, damage, cost or expense (whether in the nature of economic loss, loss of profits or otherwise).

j. **Personnel** means the directors, officers, employees, agents, contractors, licensees, assignees and invitees of a party.

k. **Related Body Corporate** has the meaning given to that expression in the Corporations Act 2001.

l. **Term** has the meaning given to it clause 4.a.

m. **Works** means all works associated with the construction of the Dam.

3. Interpretation

a. Headings are for convenience only and do not affect the interpretation of this agreement.

b. In this agreement, unless the context otherwise requires:

c. words importing the singular include the plural and vice versa;

d. a reference to a clause, party, attachment or schedule is a reference to a clause of, and a party, attachment and schedule to, this agreement;

e. a reference to this agreement includes any attachment or schedule;

f. a reference to a right includes a remedy, power, authority, discretion or benefit;

g. a reference to an agreement or document is to the agreement or document as amended, varied, supplemented, novated or replaced from time to time, except to the extent prohibited by this agreement;

h. a reference to a party to this agreement or another agreement or document includes the party's successors, permitted substitutes and assigns (and, if applicable, the party's legal personal representatives);

i. a reference to legislation or to a provision of legislation includes a modification or re-enactment of it, a legislative provision substituted for it and a regulation or statutory instrument issued under it;

j. a reference to conduct includes, but is not limited to, an omission, statement and undertaking, whether or not in writing;

k. a reference to an agreement includes any undertaking, agreement, agreement and legally enforceable arrangement whether or not in writing;

l. a reference to 'including' means 'including but not limited to' and 'include' and 'includes' have corresponding meanings;

m. a reference to anything (including, but not limited to, any right) includes a part of that thing but nothing in this clause 3(m) implies that performance of part of an obligation constitutes performance of the obligation;

n. no provision of this agreement will be construed adversely to a party solely on the ground that the party was responsible for the preparation of this agreement;

o. an expression importing a natural person includes any company, partnership, joint venture, association, corporation or other body corporate and any government agency; and

p. a reference to a person includes that person's successors and legal personal representatives.

4. TERM

a. The Agreement takes effect on the date of execution and ends on the Expiry Date (the **Term**).

b. If CBH continues to require access to the Land after the Expiry Date, CBH does so on the same terms as are in this licence immediately before the Expiry Date. CBH may end that licence on any day by giving at least 10 Business Days' notice to the Landholder.

5. CONDITIONS ATTACHING TO LICENCE

a. In consideration for CBH paying for the construction of the Dam and granting the Landholder the right to extract and use the water from the Dam, the Landholder grants CBH a licence to access, occupy and use the Land for the Term.

b. The right of access provided in clause 5(a) shall confer on CBH a right to access to the Land as is necessary to enable CBH to:

    i. carry out the Works on the Land; and

ii. extract and use water from the Dam for CBH business purposes.

c. The Landholder must provide CBH Personnel with reasonable access to the Land for the purpose of carrying out the construction of the Dam and to extract and use water from the Dam for CBH business purposes.

d. The licence:

i. does not create an interest in the Land for CBH; and

ii. confers no right of exclusive occupation of the Land to CBH; and

iii. does not require CBH to make good any part of the Land on the expiry of the Term or on termination of the licence.

e. The Landholder must notify CBH if it proposes to sell the Land and if any offer is made for the Land.

f. Any agreement between the Landholder and a purchaser of the Land must include a requirement to novate this agreement to the purchaser of the Land.

6. LANDHOLDER'S RELEASE AND INDEMNITY

a. The Landholder and the Landholder Personnel occupies and uses the Dam and the Dam Area at its own risk.

b. Any of the Landholder's property and equipment that is located within the Dam Area remains at the Landholder's risk at all times.

c. The Landholder releases, to the full extent permitted by Law, the CBH Indemnified Parties from all claims, demands, writs, summonses, actions, suits, proceedings, judgements, orders, decrees, liabilities, damages, costs, losses and expenses of any nature arising out of or in any way connected with access to the Dam and the Landholder's use of the Dam and the Dam Area, including involving the quality or condition of water from the Dam.

d. The Landholder agrees to indemnify and hold harmless, the CBH Indemnified Parties from and against all claims, demands, writs, summonses, actions, suits, proceedings, judgements, orders, decrees, liabilities, damages, costs, losses and expenses of any nature which the CBH Indemnified Parties may suffer or incur in connection with:

(a) loss of life;

(b) personal injury or illness; or

(c) damage to property or the environment;

arising from or in any way connected with the use of the Dam and the Dam Area by the Landholder or the Landholder Personnel, or access

to the Dam and the Dam Area by a third party, other than to the extent such loss or damage is caused or contributed to by CBH's negligence or wilful default.

7. CARE OF WORKS

CBH shall be responsible for the care of:

a. the whole of the Works for the Term; and

b. CBH's property and equipment until it is removed from the Land.

8. INSURANCE

a. Each party must procure and maintain the following insurances for the duration of the licence:

   i. public liability insurance with a limit of not less than $20,000,000 per occurrence;

   ii. motor vehicle third party liability insurance with a limit of not less than $20,000,000 per occurrence; and

   iii. workers compensation and employer's indemnity insurance as required by law.

b. If the Landholder maintains livestock insurance, the policy must be endorsed to provide a waiver of the insurers rights of subrogation against CBH in respect of claims arising out of or in any way connected with the Landholder's use of the Dam and the Dam Area, including involving the quality or condition of water from the Dam.

c. The Landholder must at the request of CBH provide copies of certificates of currency in respect of the insurances required to be taken out by the Landholder.

9. EXPANSION

a. CBH may make or allow to be made alterations to the Dam and Dam Area and perform additional works on the Dam.

b. Prior to CBH commencing construction or performing any works pursuant to clause aa, CBH must consult with the Landholder and submit drawings and specifications in respect of those works to the Landholder.

10. CARE AND MAINTENANCE OF THE DAM

a. CBH shall provide written notice to the Landholder within seven (7) days of completion of construction of the Dam.

b. Upon receipt of the notice in clause 10(a) above, the Landholder shall be solely responsible for the care and maintenance of the Dam, including and not limited to controlling safe access to the Dam and ensuring the Dam is operated and maintained in a safe condition.

11. CONFIDENTIALITY

CBH and the Landholder agree to keep the existence of, and terms of, this agreement confidential unless otherwise compelled by law.

12. COUNTERPARTS

This agreement may be signed in any number of counterparts (including by facsimile) and all such counterparts taken together shall be deemed to constitute one and the same document.

13. GENERAL

a. This agreement will be governed by and construed in accordance with the laws for the time being in force in Western Australia.

b. A variation of this agreement must be in writing and signed by the parties.

c. This agreement replaces any previous agreement, representation, warranty or understanding between the parties concerning its subject matter and contains the whole agreement between the parties.

d. Each party must execute and do all acts and things necessary or desirable to implement and give full effect to the provisions and purpose of this agreement.

EXECUTED by the parties as an Agreement

Landholder

EXECUTED by

P.V.J NOMINEES PTY LTD in accordance with section 127(1) of the *Corporations Act 2001* (Cth) by authority of its directors:

[redacted]

18-May-2022

.....

Signature of director

BRYCE MACNAMARA

.....

Name of director (block letters)

[redacted]

17-May-2022

.....

Signature of director/company secretary*

*delete whichever is not applicable

AMANDA MACNAMARA

.....

Name of director/company secretary* (block letters)

*delete whichever is not applicable

CBH

Signed by an authorised representative of CO-OPERATIVE BULK HANDLING LIMITED (ABN 29 256 604 947) in the presence of:

[redacted]

Signature of witness

18-May-2022

Chris Ong

Name of witness

[redacted]

Signature of authorised representative

18-May-2022

Nick Chandler

Name of authorised representative

Technical Note

Subject: CBH Cadoux Site – Road Safety Audit Findings Close Out	
Date: 21st April 2022	
Author: R. Needham	Reviewer: J. Bridge
Client: CBH	

1. Background

1.1. Purpose

The purpose of this technical note is to address the requirements of the Shire of Wongan-Ballidu's Development Approval for CBH's proposed expansion of their existing Cadoux Site. Specifically, this technical note aims to partially address DA Condition 6(i) as it relates to items 2.3 and 2.6 of the Road Safety Audit (RSA) prepared by Shawmac in June 2021.

Item 2.3 of the RSA relates to the potential obstruction of sight lines from the CBH site access due to roadside vegetation. Item 2.6 relates to a suggestion to extend the existing 70km/h speed zone (which ends approximately 160m south of the CBH access) further north, past the CBH access.

This Technical Note should be read in conjunction with the Traffic Impact Statement (2012020-TIS-002 Rev D, 21.04.22) prepared to support the proposed expansion of the Cadoux site.

2. RSA Item 2.3 – Sight Distances

2.1. Standards

The SISD measurements were undertaken in accordance with Austroads Guide to Road Design (AGRD) Part 4A – Unsignalised and Signalised intersections. **Figure 1** shows a diagrammatic representation of the SISD concept contained in AGRD Part 4A.

Reference has also been made to Entering Sight Distance (ESD). ESD is defined in MRWA's Standard RAV Route Assessment Guidelines (RAV Guidelines) and utilises an eye height of 2.4m and an object height which considers all traffic (1.25m would be appropriate, as per SISD requirements), with the same horizontal positions as shown in **Figure 1**. According to MRWA's RAV Guidelines, ESD is the sight distance required to see a sufficient gap in oncoming traffic that will allow a RAV to clear the intersection safely. ESD requirements are less onerous than SISD requirements.

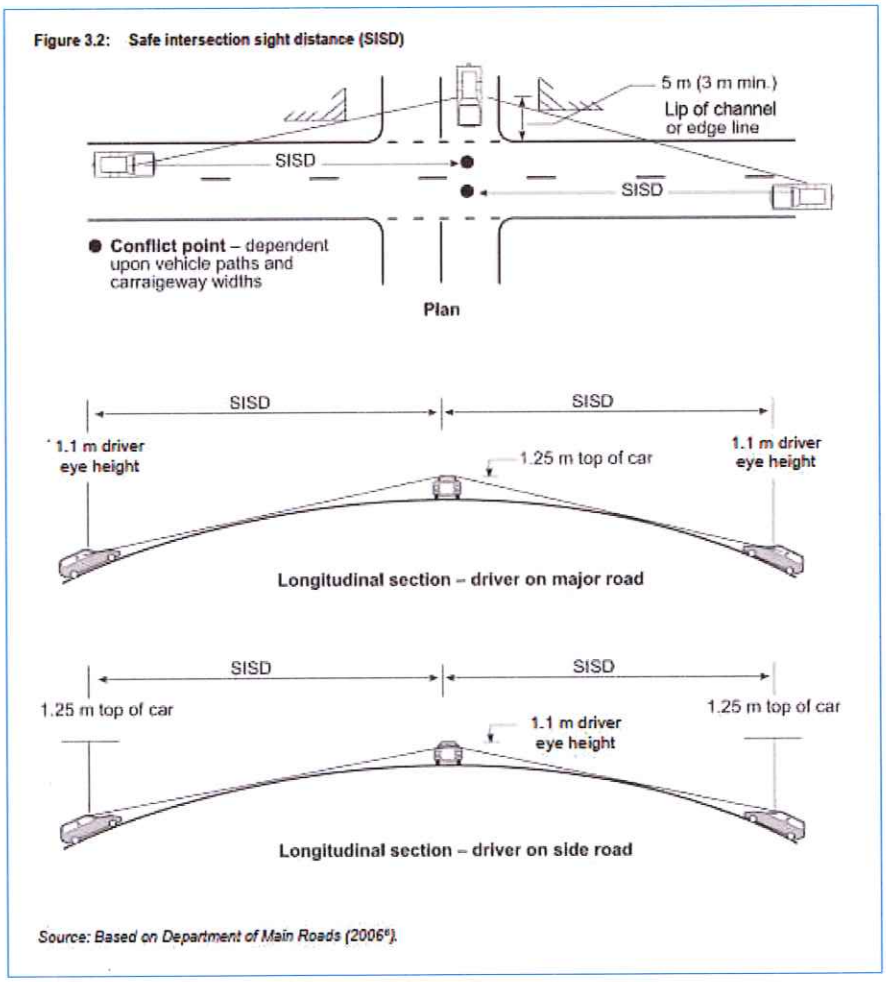


Figure 1: SISD Diagram (AGRD Part 4A)

2.2. Sight Distance Measurements

2.2.1. Methodology

SISD measurements were taken on site by two Shawmac staff members on the morning of March 24, 2022. One staff member positioned themselves in the centre of the exit lane within the CBH access, 3m back from the edge of Dowerin-Kalannie Road traffic lane, whilst the other drove a passenger car along Dowerin-Kalannie Road towards the CBH access.

At the point that the passenger car became visible from the CBH access (at an eye height of 1.1m), the car was parked off the edge of the carriageway. Sight distance between the access and the car was then measured using a range finder and verified with measuring wheel.

2.2.2. Results

Figure 2 and **Figure 3** show the plan view of the available sight distance in each direction.

Figure 4 through **Figure 8** show photographs of the site lines to and from the site access in each direction. As shown, both views are partially obstructed by vegetation and signage, but the maximum available sight distance is significant.

Towards the north, there is a minor obstruction to the sight line caused by the trunk of a tree. Refer to **Figure 7** and **Figure 8** which shows that the tree trunk is not wide enough to fully obscure the view of the car or the intersection, and there is a completely clear line of sight available immediately after the tree is passed.

Towards the south, the sight line is partially obstructed by a speed zone sign, a warning sign and some low shrubs. Refer to **Figure 4** and **Figure 5** which show that the maximum line of sight is available approximately 765m away, behind the signs and over/behind the shrubs. As an oncoming vehicle moves towards the intersection the view becomes partly obscured by the signage. As shown in **Figure 6** full visibility is again available approximately 284m from the site access.

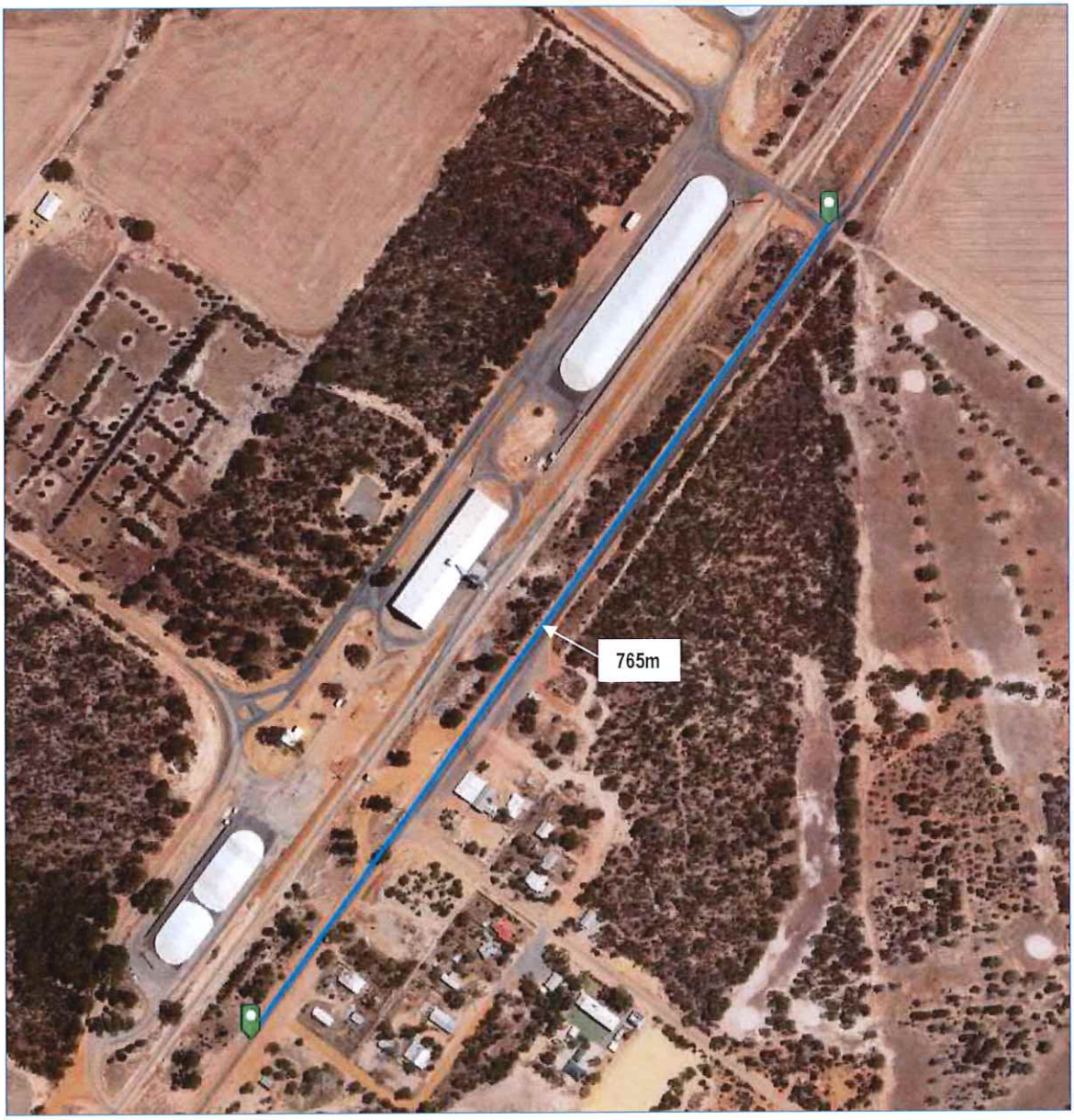


Figure 2: SISD to South

Figure 3: SISD to North

Figure 4: Approaching Vehicle Sight Distance Looking from South to CBH Access

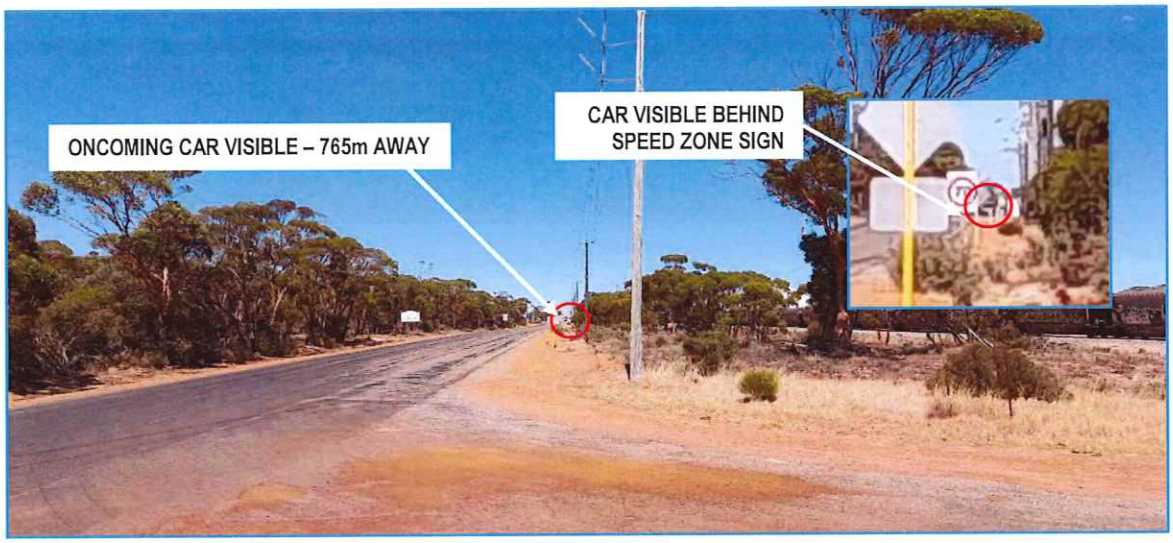


Figure 5: Sight Distance Looking from CBH Access to South (maximum)

Figure 6: Sight Distance Looking from CBH Access to South (intermediate)

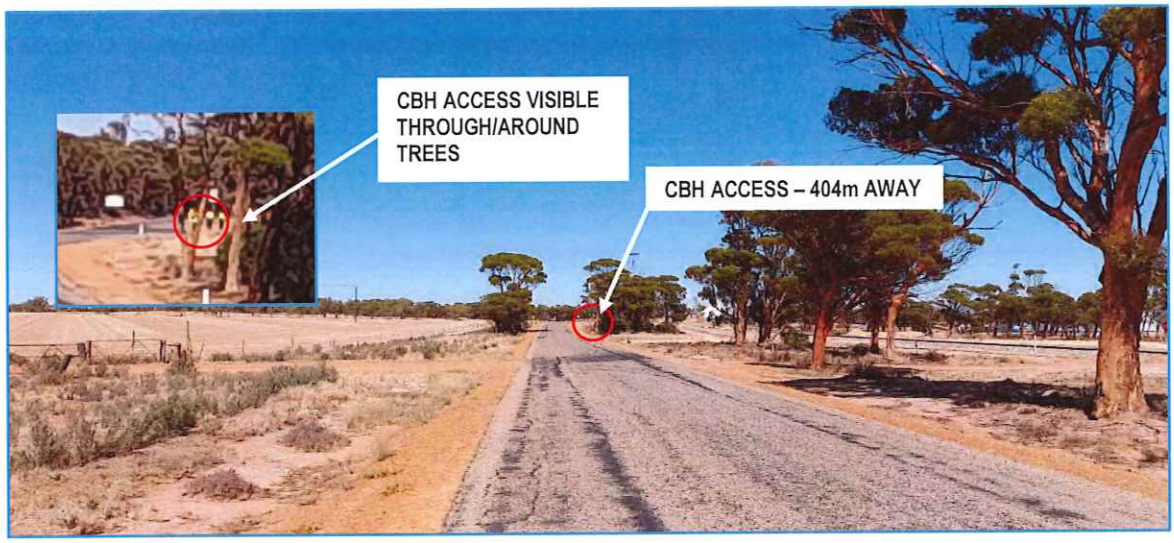


Figure 7: Approach Vehicle Sight Distance Looking from North to CBH Access

Figure 8: Sight Distance Looking from CBH Access to North

2.3. Sight Distance Requirements

2.3.1. Safe Intersection Sight Distance

Based on the existing 110km/h speed zone for southbound traffic (100km/h max truck speed) and a conservative 90km/h estimate of operating speed for northbound traffic within the 70km/h speed zone (which ends 160m south of the site access), the SISD requirements in accordance with AGRD Part 4A are shown in **Table 1**.

As shown, the available SISD comfortably exceeds the requirements (noting the partial obstruction due to trees and signs).

Table 1: SISD at the Site Exit

Location	Vehicle Type	Design Speed (km/h) (NB / SB)	Coefficient of Deceleration	Decision Time (s)	Longitudinal Grade (NB / SB)[1]	Required SISD for NB / SB Traffic (m)	Available SISD (m) NB	Available SISD (m) SB
Site Exit	Trucks	90 / 100	0.28	3+2.5	-2% / -2%	260 / 304	765[2]	404
	Cars	90 / 110	0.36	3+2.5	-2% / -2%	231 / 307	765[2]	404

[1] Positive for through traffic travelling uphill and negative for through traffic travelling downhill. Grades are conservative estimates based on google street view as no survey was available.
[2] Partially obstructed by road signage. Refer **Figure 6** which shows an intermediate view 284m from the site access.

2.3.2. Entering Sight Distance

Based on the statutory maximum speed of 100km/h for heavy vehicles for southbound traffic and the estimated 90km/h operating speed for northbound traffic (accelerating after leaving the 70km/h speed zone), the ESD requirements in accordance with MRWA's Standard RAV Route Assessment Guidelines are shown in **Table 2**.

As shown, the available ESD comfortably exceeds the requirements (noting the partial obstruction due to trees and signs).

Table 2: RAV Vehicle ESD at Site Exit

Location	Design Speed (km/h) (NB / SB)	Coefficient of Deceleration	Reaction Time (s)	Longitudinal Grade (NB / SB)[1]	Required ESD for NB / SB Traffic (m)	Available ESD (m) NB	Available ESD (m) SB
Site Exit	90 / 100	0.28	4.0s	-2% / -2%	223 / 263	765[2]	404

[1] Positive for through traffic travelling uphill and negative for through traffic travelling downhill. Grades are estimated based on google street view as no survey was available.
[2] Partially obstructed by road signage. Refer **Figure 6** which shows and intermediate view 284m from the site access.

2.4. Findings

As shown in **Table 1** and **Table 2**, the available sight distance on site exceeds the SISD and ESD requirements. It is noted that the SISD sight line is partially obstructed by trees and signage, but there is no obstruction to the less onerous ESD sight line. In accordance with the RAV guidelines, this means that in the worst case, there will be adequate time/sight distance available for a RAV vehicle to clear the intersection safely.

It is also relevant to note that the CBH site has been operating under the same conditions for many years and there is no crash history at or near the intersection.

Accordingly, it is considered that the sight distance available to/from the site access is adequate and it is suggested that item be closed out with no further action required.

3. RSA Item 2.6 – Speed Zone

The RSA undertaken by Shawmac's Road Safety team in May 2021 identified that the speed zoning along Dowerin-Kalannie Road/King Street changes from 70km/h to 110km/h approximately 160m south of the CBH access. The RSA suggested that it would be sensible to shift the location of the speed zone further north so that the CBH access is located within the 70km/h zone, thereby reducing the risk of crashes associated with vehicles turning into/out of the CBH site.

It should be noted that this RSA finding is a stand-alone suggestion and is not directly related to the previously discussed sight distance finding. However, should the speed zoning change, the sight distance requirements would change in turn.

It is understood that MRWA (as the approving authority for speed zoning) have been approached to consider the speed zoning change, but this has been rejected. As such, the RSA recommendation cannot be actioned. Further, with consideration to the absence of any crash history within the vicinity of the access, and the adequate sight distance available, the application of the speed zone change does not appear to be a critical and the RSA accordingly has not applied an 'IMPORTANT' annotation to the finding.

Therefore, it is suggested that this item be closed out with no further action required.

Traffic Impact Statement

Project:	CBH Cadoux Grain Facility – Proposed Upgrade
Client:	CBH
Author:	R. Needham
Doc No:	2012020-TIS-002
Revision:	D

CONSULTING CIVIL AND TRAFFIC ENGINEERS
1 ST. FLOOR, 908 ALBANY HIGHWAY, EAST VICTORIA PARK WA 6101.
PHONE|+61 8 9355 1300
FACSIMILE| +61 8 9355 1922
EMAIL| admin@ shawmac.com.au

Document Status

Revision	Prepared By	Reviewed By	Approved By	Issue	Date
A	K LI	R. Needham	R. Needham	Client Review	27.01.21
B	R. Needham		R. Needham	Shire Review	18.10.21
C	K LI	R. Needham	R. Needham	Updated Site Plan	07.12.21
D	R. Needham		R. Needham	Shire Approval	21.04.22

Disclaimer

File Reference: Y:\Jobs Active 2020\CE - Roads and Drainage\CBH_Cadoux TIS_2012020\3. Documents\3.6 TIS\2012020-TIS-002\2012020-TIS-002_D.docx

Contents

Figures

Tables

Glossary of Terms

Abbreviations

AADT	Annual Average Daily Traffic
ASD	Approach Sight Distance
AWT	Average Weekly Traffic
BAL	Basic Left Turn Treatment
BAR	Basic Right Turn Treatment
AUL	Auxiliary Left Turn Treatment
AUR	Auxiliary Right Turn Treatment
CHL	Channelised Left Turn Treatment
CHR	Channelised Right Turn Treatment
ESD	Entering Sight Distance
Km	Kilometre
Km/h	Kilometres per Hour
MRWA	Main Roads Western Australia
RAV	Restricted Access Vehicle
SISD	Safe Intersection Sight Distance
SLK	Straight Line Kilometre
TIS	Traffic Impact Statement
TIA	Traffic Impact Assessment
Vpd	Vehicles per Day
Vph	Vehicles per Hour

1. Introduction

1.1. Background

CBH are proposing to upgrade the existing grain storage facility in Cadoux to increase the storage capacity of the facility by approximately 78,600t to a total of 223,875t through the construction of two new Open Bulkheads (OBH 06 and 07). Shawmac has been engaged by CBH to prepare a Transport Impact Statement for the proposed upgrade.

The CBH Cadoux site is located as shown in **Figure 1**. The proposed storage bulkheads are located within Lot 2 in the north of the site. An aerial view of the site with indication of the existing Lot 2 bulkheads are shown in **Figure 2**.

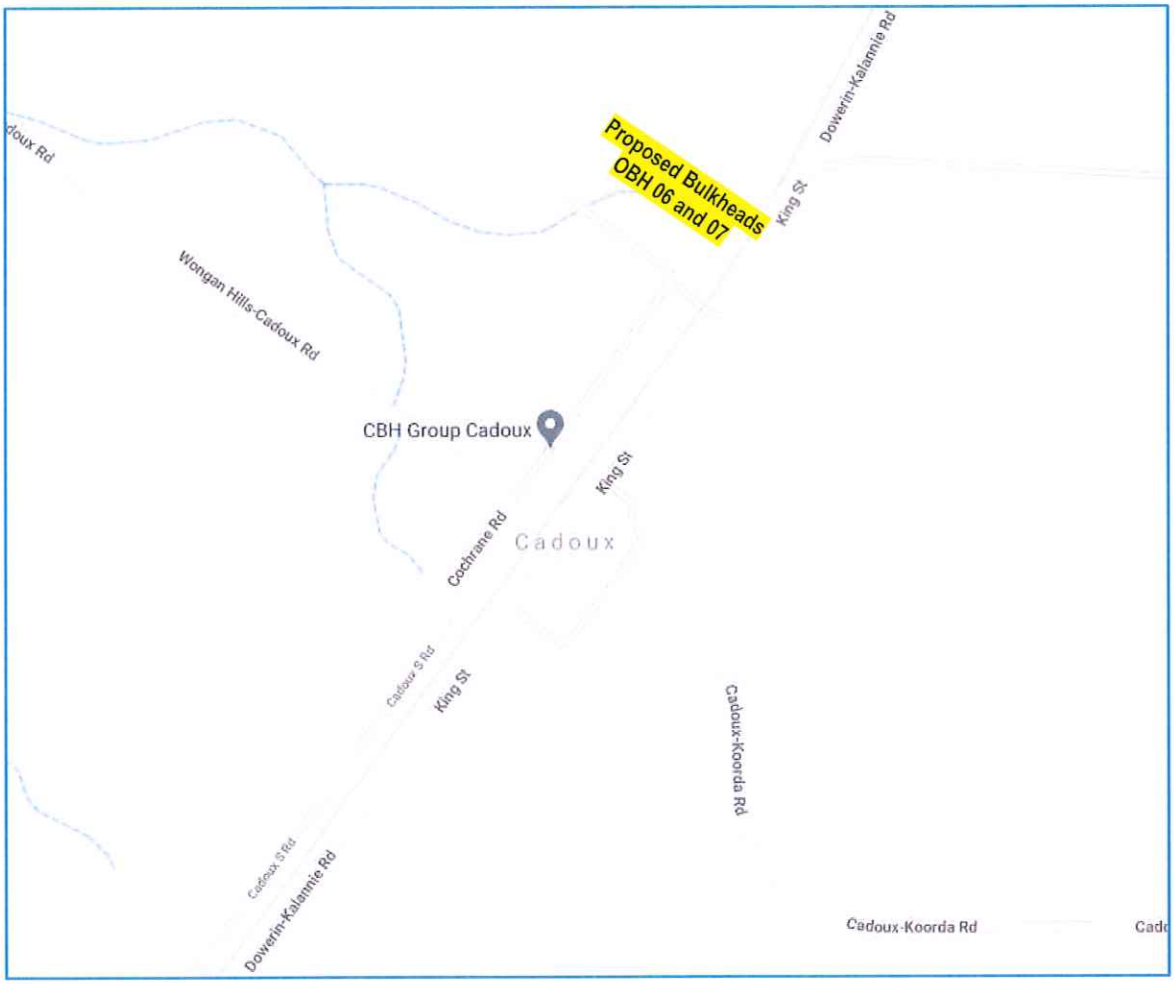


Figure 1: Project Location

Figure 2: Aerial View

1.2. Previous TIS

Prior to commencement of this TIS, a separate study (2012020-TIS-001) was undertaken to investigate the traffic impact of the existing bulkheads within Lot 2 (OBH03/04 and TBH99). The key assumptions and findings of the study are listed below:

- As the site is already in operation, it is difficult to assess the impacts to traffic that the operation of OBH 03/04 and TBH 99 has on the surrounding road network, especially since the available traffic count data is limited (defining the background traffic prior to the construction of OBH 03/04 and TBH 99 would not be possible with any accuracy). The assessment was based on the assumption that the full site has potential to increase its current utilisation from 79.6% to 90%;
- The estimated traffic generation can be accommodated within the capacity of the adjacent road network;
- The available Safe Intersection Sight Distance (SISD) and Entering Sight Distance (ESD) at the site exit

are below the minimum requirements as per Austroads Guide to Road Design Part4A and MRWA's RAV Assessment Guideline. A Road Safety Audit (RSA) was recommended to further confirm the adequacy of the sight distance and/or provide recommendations to achieve minimum requirements;

- Based on the swept path assessment, the left turn movements at the site exit will not be lane correct and RAV 5-7 template turning towards both sides of King Street have minimal clearance to the intersection edge of seal. The non-lane correct movement is deemed acceptable if minimum sight distance is achieved.

1.3. Road Safety Audit

Following the recommendations contained in the previous TIS, an RSA was undertaken by Shawmac's Road Safety team on the site entry and exit. The RSA provided the following pertinent findings and recommendations:

i. Vegetation adjacent to the intersection adversely impacts on sight distance and may obscure a driver's vision of vehicles on the through road. This may increase the risk of right angle or right turn through crashes resulting in serious or fatal injury to vehicle occupants. It was recommended that vegetation within the sight triangles be removed to achieve the required sight lines.

ii. The Dowerin-Kalannie Road southbound approach to the CBH site exit is derestricted at 110km/h and the speed is reduced to 70km/h after Cochrane Road. It was recommended that the 70km/h speed zone location be extended prior to the CBH site exit.

1.4. Sight Distance Measurements

A site inspection was undertaken on the 24th of March 2022 to accurately assess the available sight distances and verify the degree to which the adjacent vegetation compromises sight distance. Sight distance measurements were undertaken as described in Austroads Guide to Road Design Part4A using 2x personnel (1x in a car), handheld GPS, range finder and measuring wheel. The results of this assessment are reflected in **Section 4.5**.

2. Existing Situation

2.1. Road Network

The layout and hierarchy of the existing local road network according to the Main Roads WA Road Information Mapping System is shown in **Figure 3**.

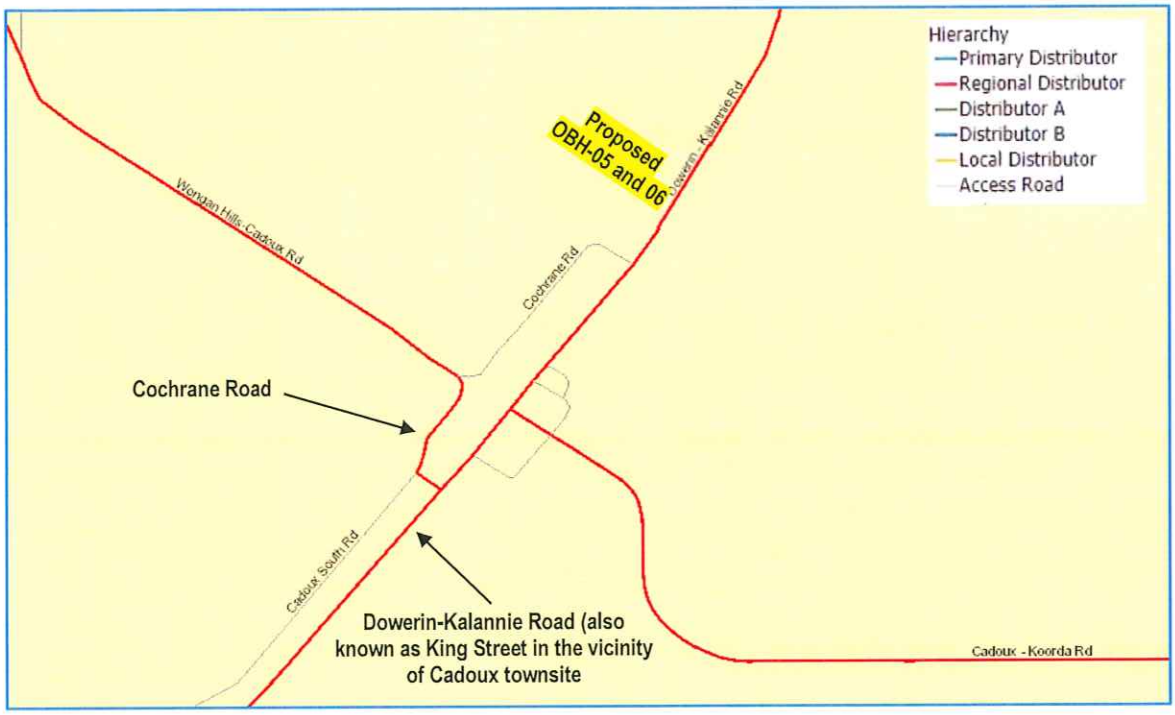


Figure 3: Adjacent Road Network

2.2. Carriageway Width and Cross Section

The carriageway and configuration of surrounding roads is summarised in **Table 1**.

Table 1: Road Configuration

Road and Location	Road Type	Cross Section	Carriageway Width (Approx.)	Sealed Pavement Width (Approx.)
Wongan Hills-Cadoux Road	Regional Distributor	Two-lane single carriageway	8.0m	6.0m
Dowerin-Kalannie Road (King Street)	Regional Distributor		8.0m	6.1m
Cadoux-Koorda Rd	Regional Distributor		8.0m	6.0m
Cadoux South Road	Access Road		8.0m	Unsealed
Cochrane Road (NE)	Regional Distributor		8.0m	6.1m

2.3. Traffic Volumes

The latest traffic count data for Wongan Hills-Cadoux Road and Cadoux-Koorda Road was sourced from MRWA trafficmap. Traffic data for Dowerin-Kalannie Road (King Street) was requested from the Shire of Wongan-Ballidu for the previous TIS, however the nearest count site is at SLK 43.08 which is more than 38 km from the CBH site and therefore the data is not considered relevant. For the purpose of this assessment, it is assumed that traffic volume of Dowerin-Kalannie Road is equivalent to 150% of Cadoux-Koorda Road volume.

Traffic count data for Cochrane Road is not available from either MRWA or the Shire of Wongan-Ballidu and is assumed at 50% of the Wongan-Hills-Cadoux Road/Cadoux-Koorda Road volume, with approximately the same proportion of heavy vehicles.

The available and assumed traffic data are summarised in **Table 2** and **Table 3**.

Table 2: Daily Traffic Volumes

Road	Location	Daily	% HV	Data Source
Wongan Hills-Cadoux Road	West of Mincherton Rd	83	31.3	MRWA 2020*
Cadoux-Koorda Road	East of Grimmett St	84	29.8	MRWA 2020*
Dowerin-Kalannie Road (King Street)	N/A	126	N/A	Assumed
Cochrane Road	N/A	42	30	Assumed

Table 3: Peak Hour Traffic Volumes

Road / Direction		Location	Overall Peak Hour	Data Source
Wongan Hills-Cadoux Road	EB	West of Mincherton Rd	8	MRWA 2020
Wongan Hills-Cadoux Road	WB	West of Mincherton Rd	5	MRWA 2020
Cadoux-Koorda Road	EB	East of Grimmett St	6	MRWA 2020
Cadoux-Koorda Road	WB	East of Grimmett St	6	MRWA 2020
Dowerin-Kalannie Road	NB	N/A	9	Assumed
Dowerin-Kalannie Road	SB	N/A	9	Assumed
Cochrane Road	EB	N/A	4	Assumed
Cochrane Road	WB	N/A	4	Assumed

Note that it is unknown if any of the data was recorded during the campaign period of the CBH site. For the purposes of this assessment, it is assumed that the traffic count does not include existing CBH traffic occurring during the campaign period.

2.4. RAV Status

As per MRWA HVS network mapping tool:

- Wongan Hills-Cadoux Road is categorised under Tandem Drive RAV 6.1 and Tri-Drive 2.1 network with no conditions;
- Dowerin-Kalannie Road (King Street) is categorised under Tandem Drive RAV 6.1 and Tri-Drive 1.1 network. The following conditions apply to the RAV 6.1 network from SLK 3.95 to 4.27 of Dowerin-Kalannie Road:
    - No operation during School Bus hours. Transport Operators are to contact the local schools to obtain school bus hours;
    - All operators must carry current written approval from the road asset owner permitting use of the road;
- Cadoux-Koorda Road is categorised under Tandem Drive RAV 6.1 and Tri-Drive 2.1 network with no conditions;
- Cochrane Road southwest of Wongan Hills-Cadoux Road is categorised under Tandem Drive RAV 6.1 and Tri-Drive 2.1 network with no conditions;
- Cochrane Road northeast of Wongan Hills-Cadoux Road is categorised under Tandem Drive RAV 6.1 and Tri-Drive 1.1 network with no conditions;
- Cadoux South Road southwest of Wongan Hills-Cadoux Road has no RAV network status.

Figure 4 shows the Tandem Drive RAV 6.1 network for the road network in the vicinity of the sites.

Figure 4: Tandem Drive RAV Network (North)

2.5. Speed Limit

As per MRWA Road Information Mapping System, the majority of the surrounding roads are operating under 110 km/hr speed limit outside of Cadoux Townsite and 70 km/hr adjacent to the townsite. There is a short section of Cadoux-Koorda Road operating under 40km/hr speed limit. The speed limit of the adjacent road network is shown in **Figure 5**.

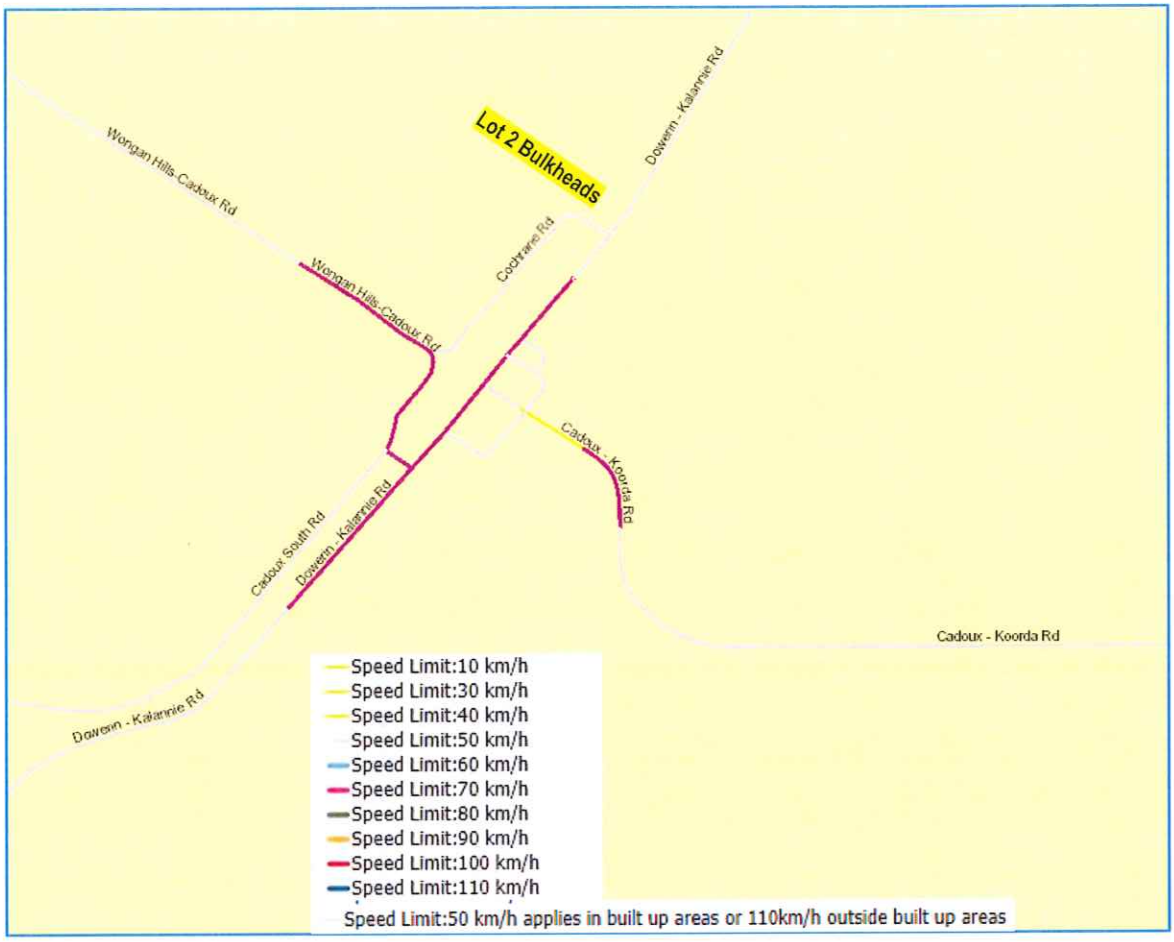


Figure 5: Speed Zoning

2.6. Crash History

Crash data for the surrounding roads was sourced from MRWA's Crash Analysis Reporting System (CARS) for the 5-year period ending 31/12/2019. The report is summarised in **Table 4**.

Table 4: Crash History

Location	Number of Crashes	MR Nature and Location	Severity
Wongan Hills-Cadoux Road SLK 0.00-0.70	0	N/A	N/A
Dowerin-Kalannie Road (King Street) SLK 3.98-4.82	0	N/A	N/A
Cadoux-Koorda Rd SLK 0.00-0.20	0	N/A	N/A
Cadoux South Road SLK 0.00-0.20	0	N/A	N/A
Cochrane Road SLK 0.00-0.70	0	N/A	N/A

As shown, there have been no crashes recorded.

2.7. Changes to Surrounding Transport Networks

There are no known changes to the adjacent network that have the potential to affect the assessment.

3. Transport Logistics

3.1. Development Details

The existing and proposed CBH storage bulkheads are listed below in **Table 5**.

Table 5: Existing Site Storage

Site Storage	Capacity	Location
A type Storage HDR/01	19,100t	Reserve 32966 (Main Site)
INT STEEL FRAME OBH (01)	10,000t	Reserve 32966 (Main Site)
INT STEEL FRAME OBH (02)	22,175t	Reserve 32966 (Main Site)
LOW STEEL FRAME OBH (03)	35,000t	Lot 2
LOW STEEL FRAME OBH (04)	35,000t	Lot 2
INT STEEL FRAME OBH (Temporary) (99)	24,000t	Lot 2
Existing Total	145,275t	
INT STEEL FRAME OBH (06)	39,300t	Lot 2
INT STEEL FRAME OBH (07)	39,300t	Lot 2
Proposed Total	223,875t	

CBH has provided the traffic data for 5-year average of grain receival. Based on that data there is an average of 44 truckloads per day, with an average 39-tonne payload, over a 65 day campaign period. This equates to a total of 1716 tonnes received each day and 111,540t over the entire campaign. As the site has a total capacity of 145,275 tonnes, it is operating at 76.8% utilisation.

This assessment assumes that the existing site is able to achieve 90% utilisation. CBH have advised that sites generally operate at around 85% utilisation which accounts for loss by division/loss by commodity.

For the purposes of this assessment, the total tonnage capacity after the addition of new OBH's 06/07 is therefore 201,488t (90% of 223,875t).

3.2. Haulage Route

CBH have advised that the origin direction split to/from the Cadoux site is 42% north, 14% south, 12% east and 32% west. The site entry is located at the intersection of Wongan Hills-Cadoux Road and Cochrane Road and the site exit is located on King Street.

For the purposes of this assessment, it is assumed that:

- 100% of vehicles with northern origins (42% of total) travel south along Dowerin-Kalannie Road/King Street, make a right turn into Cochrane Road, and make a right turn into the CBH site.
- 100% of vehicles with western origins (32% of total) travel east along Wongan Hills-Cadoux Road and make a left turn into the CBH site.
- 100% of vehicles with eastern origins (12% of total) travel west along Cadoux-Koorda Road, make a left turn onto King Street, a right turn onto Cochrane Road and a right turn into the CBH site.
- 100% of vehicles with southern origins (14% of total) travel north along Dowerin/Kalannie Road/King Street, make a left turn into Cochrane Road and a right turn into the CBH site.

Given the layout of the existing road network, exit movements are assumed to be the opposite of those described above.

The movements are shown in **Figure 6**.

Figure 6: Haulage Route

3.3. Operating Hours and Receival Period

The campaign period for receival of grains will start mid-October and last 2-3 months. Based on 5-year average data, the total number of days for grain receival is 65 days. It is noted that the amount of daily receival varies depending on the supply. The past 5-year average daily receival across the whole site (based on average 111,540 tonnes received per year or 76.8% utilisation) is 44 truckloads per day, but the peak could be up to 122 truckloads per day.

CBH propose to operate the site 12 hours a day (6 AM to 6 PM) and Monday to Sunday with minor variations of start and finish times.

3.4. Proposed Haulage Vehicle

It is understood that haulage trucks for grain delivery are no larger than RAV 6 trucks which are up to 36.5m in length, as per the surrounding RAV network permissions. Refer **Figure 7** for typical configurations of the RAV 6 vehicles.

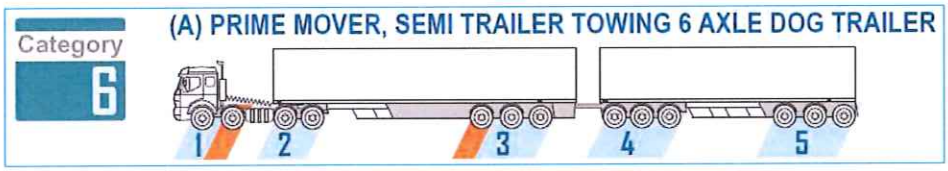


Figure 7: Typical Tandem Drive RAV 6 Trucks

Based on the 5-year average data, the average amount of material delivered to the site per trip is 39 tonnes, which is much lower than the maximum capacity of RAV trucks.

3.5. Traffic Generation

In order to assess the traffic impact of the existing bulkheads, the traffic generation based on the 5-year average data (76.8% utilisation) was compared to the traffic generation for the existing, additional and ultimate capacity assuming 90% utilisation as shown in **Table 6**.

For in-loading, based on the 39-tonne average truck payload and additional 70,740-tonne effective capacity (90% of the additional 78,600 proposed), 1,813 round trips would be generated over the campaign period. Taking into account the ratio between total tonnage and the number of average/peak daily truckloads as noted in **Section 3.3**, this could generate an average of 28 roundtrips per day or up to 77 roundtrips during peak days.

For out-loading traffic, which occurs throughout the year depending on demand, 10 truckloads per day has been assumed as per CBH TS10A – Design Specification for existing and proposed. For the purposes of this assessment, it is assumed that the out-loading vehicle trips are included in the latest traffic count and the additional capacity (from Lot 2) is not expected to alter the out-loading traffic volume.

Table 6: Transport Metrics

Criteria	Existing (76.8% Utilisation)	Existing (90% Utilisation)	Proposed Upgrade	Ultimate
Effective Site Capacity	111,540 tonnes	130,748 tonnes	70,740 tonnes	201,488 tonnes
In-Loading				
Truckloads per day during harvest period (average)	44	52	28	80
Truckloads per day (peak of harvest period)	122	143	77	220
Out-Loading				
Truckloads per day (maximum)	10		10	

Table 7 shows the direction split of movements based on the predicted **peak** daily movements after the construction of the proposed upgrade, operating at 90% utilisation.

Table 7: Harvest Truck Movement Direction Split

Direction	Totals[1]
Total Movements	220
North (42%)	92
South (14%)	31
East (12%)	27
West (32%)	70

[1] Figures may not sum due to rounding

Figure 8 shows the predicted harvest period traffic distribution to the surrounding road network.

Figure 8: Harvest Period Movement Volumes

This volume of traffic is considered to be low and can be accommodated within the existing capacity of the road network.

4. Traffic Impact Assessment

4.1. Assessment Years

The development is assessed based on current network condition (2020).

4.2. Road Minimum Widths

The sealed widths of the surrounding roads were checked against the Rural Road Minimum Width in accordance with Appendix A of the MRWA RAV assessment guideline. The comparison is shown below in **Table 8**.

Table 8: Rural Road Minimum Width

Road	Location	Existing AADT (No CBH traffic)	Proposed AADT (Peak)	Speed (RAV)	RAV Status	Required Minimum Seal	Existing Sealed Width
Wongan Hills-Cadoux Road	NE of CBH site	83	223	100 km/hr	RAV 6	6.0m	6.0m
King Street	South of Site Exit	126	346	100 km/hr	RAV 6	6.0m	6.1m
Dowerin-Kalannie Road	North of Site Exit	126	306	100 km/h	RAV 6	6.0m	6.5m
Dowerin-Kalannie Road	South of Cochrane Road	126	188	70 km/h	RAV 6	5.7m	7.0m
Cadoux-Koorda Road	East of Dowerin-Kalannie Road	84	138	70 km/h	RAV 6	3.4m	6.4m
Cochrane Road	SW of Wongan Hills-Cadoux Road	42	192	70 km/h	RAV 6	5.7m	6.1m

As shown, all of the existing roads have appropriate seal widths for the anticipated future traffic.

4.3. Road Safety

The crash history of the adjacent road network (as previously outlined in **Section 2.6**) does not suggest any particular safety issues (there have been no crashes recorded) in the existing road network. The additional traffic movements generated by the existing Lot 2 bulkheads is not considered to increase the likelihood of crashes to unacceptable levels.

4.4. Swept Path Assessment

Sight distance and vehicle turning movements at the intersections have been assessed in the TIS (Doc No.2012020-TIS-001) for the existing bulkheads OBH 03/04 and TBH 99 on Lot 2. The key findings of assessment are discussed in **Section 1.2**

The swept assessment showed some vehicle tracking over the King Street/Dowerin Kalannie Road centreline and concluded that this was acceptable provided adequate sight distance is available.

4.5. Sight Distance

As discussed in **Section 1.2**, the previous TIS identified potential deficiencies in the available sight distance at the site exit. An RSA was completed which suggested the removal of vegetation was required to facilitate the appropriate sight distance and that consideration should be given to extending the 70km/h speed zone. Accurate measurements were later taken on site to confirm the present maximum available sight distance and the degree to which sight distances were obstructed.

Based on the existing 110km/h speed zone for southbound traffic (100km/h max truck speed) and estimated 90km/h operating speed for northbound traffic (accelerating after leaving the 70km/h speed zone), the SISD and ESD requirements are shown in **Table 9** and **Table 10**.

Figure 9 through **Figure 13** show the available sight distances to and from the site access in each direction. As shown, both views are partially obstructed by vegetation and signage, however the maximum available sight distance in each direction is significantly greater than the minimum requirements.

Towards the north, there is a minor obstruction to the sight line caused by the trunk of a tree. Refer to **Figure 12** and **Figure 13** which shows that the tree trunk is not wide enough to fully obscure the view of the car or the intersection, and there is a completely clear line of sight available immediately after the tree is passed.

Towards the south, the sight line is partially obstructed by a speed zone sign, a warning sign and some low shrubs. Refer to **Figure 9** and **Figure 10** which show that the maximum line of sight is available approximately 765m away, behind the signs and over/behind the shrubs. As an oncoming vehicle moves towards the intersection the view becomes partly obscured by the signage. As shown in **Figure 11** full visibility is again available approximately 284m from the site access.

It should also be emphasised that Dowerin-Kalannie Road is relatively flat and straight past the CBH site, and excellent Entering Sight Distance is available along this alignment. In accordance with MRWA's RAV Guidelines, the ESD is the sight distance required to see a sufficient gap in oncoming traffic that will allow a RAV to clear the intersection safely. ESD requirements are less onerous than SISD requirements.

Based on these measurements and the lack of any crash history whilst the CBH site has been operating, it is considered that the sight distance available to/from the site access is adequate.

Table 9: SISD at the Site Exit

Location	Vehicle Type	Design Speed (km/h) (NB / SB)	Coefficient of Deceleration	Decision Time (s)	Longitudinal Grade (NB / SB)[1]	Required SISD for NB / SB Traffic (m)	Available SISD (m) NB	SB
Site Exit	Trucks	90 / 100	0.28	3+2.5	-2% / -2%	260 / 304	765[2]	404
	Cars	90 / 110	0.36	3+2.5	-2% / -2%	231 / 307	765[2]	404

[1] Positive for through traffic travelling uphill and negative for through traffic travelling downhill. Grades are conservative estimates based on google street view as no survey was available.
[2] Partially obstructed by road signage. Refer **Figure 11** which shows and intermediate view 284m from the site access.

Table 10: RAV Vehicle ESD at Site Exit

Location	Design Speed (km/h) (NB / SB)	Coefficient of Deceleration	Reaction Time (s)	Longitudinal Grade (NB / SB)[1]	Required ESD for NB / SB Traffic (m)	Available ESD (m) NB	SB
Site Exit	90 / 100	0.28	4.0s	-2% / -2%	223 / 263	765[2]	404

[1] Positive for through traffic travelling uphill and negative for through traffic travelling downhill. Grades are conservative estimates based on google street view as no survey was available.
[2] Partially obstructed by road signage. Refer **Figure 11** which shows and intermediate view 284m from the site access.

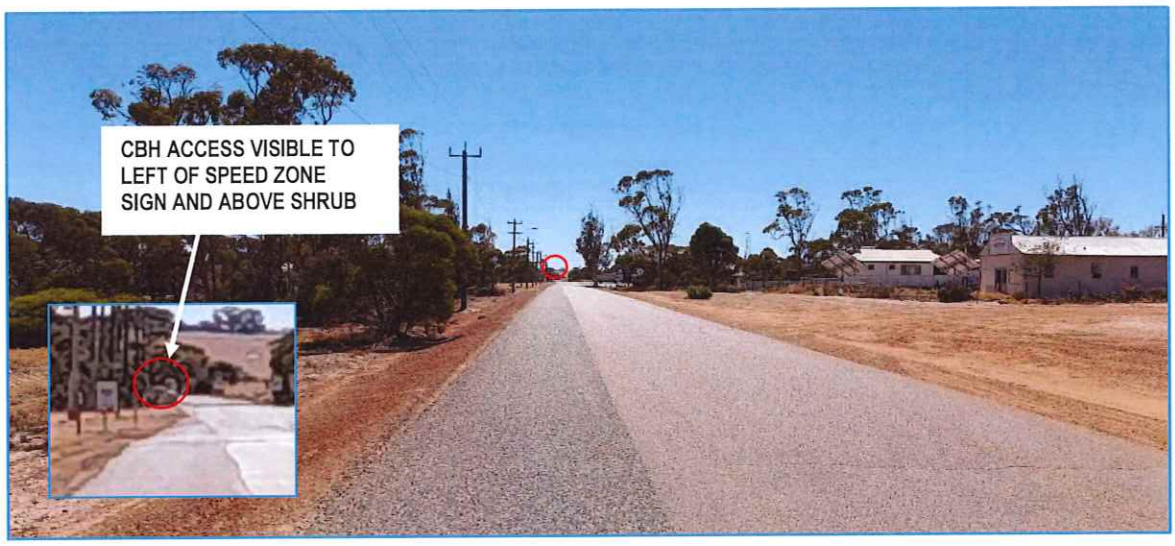


Figure 9: Sight Distance Looking from South to CBH Access

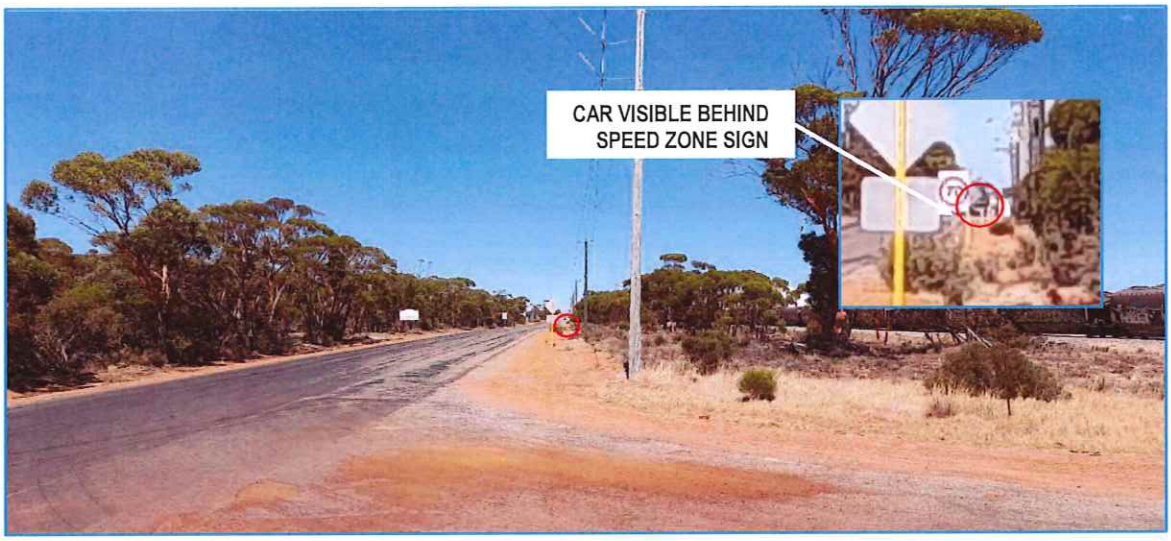


Figure 10: Sight Distance Looking from CBH Access to South (maximum)

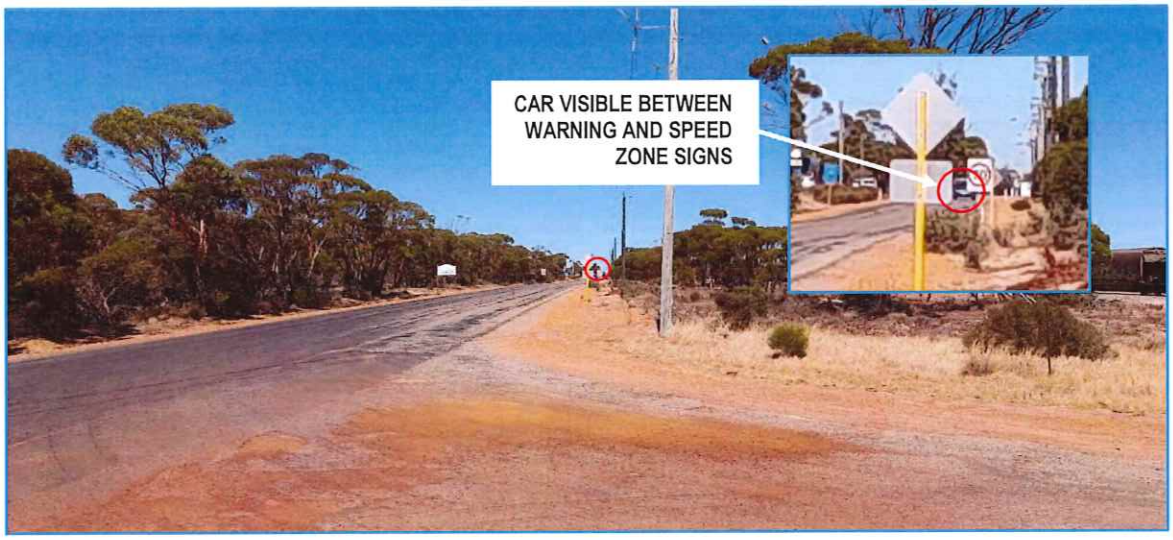


Figure 11: Sight Distance Looking from CBH Access to South (intermediate)

Figure 12: Sight Distance Looking from North to CBH Access

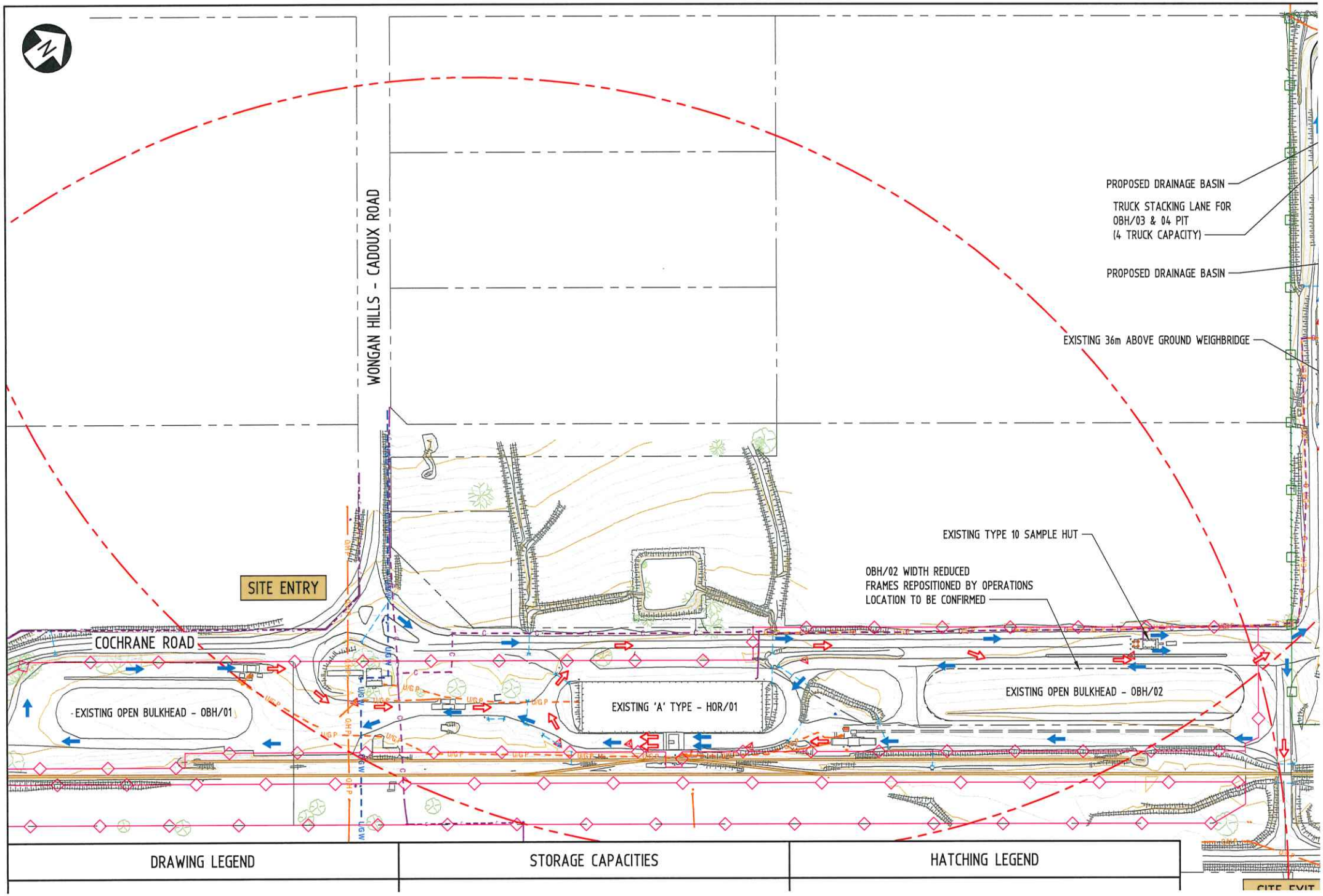
Figure 13: Sight Distance Looking from CBH Access to North

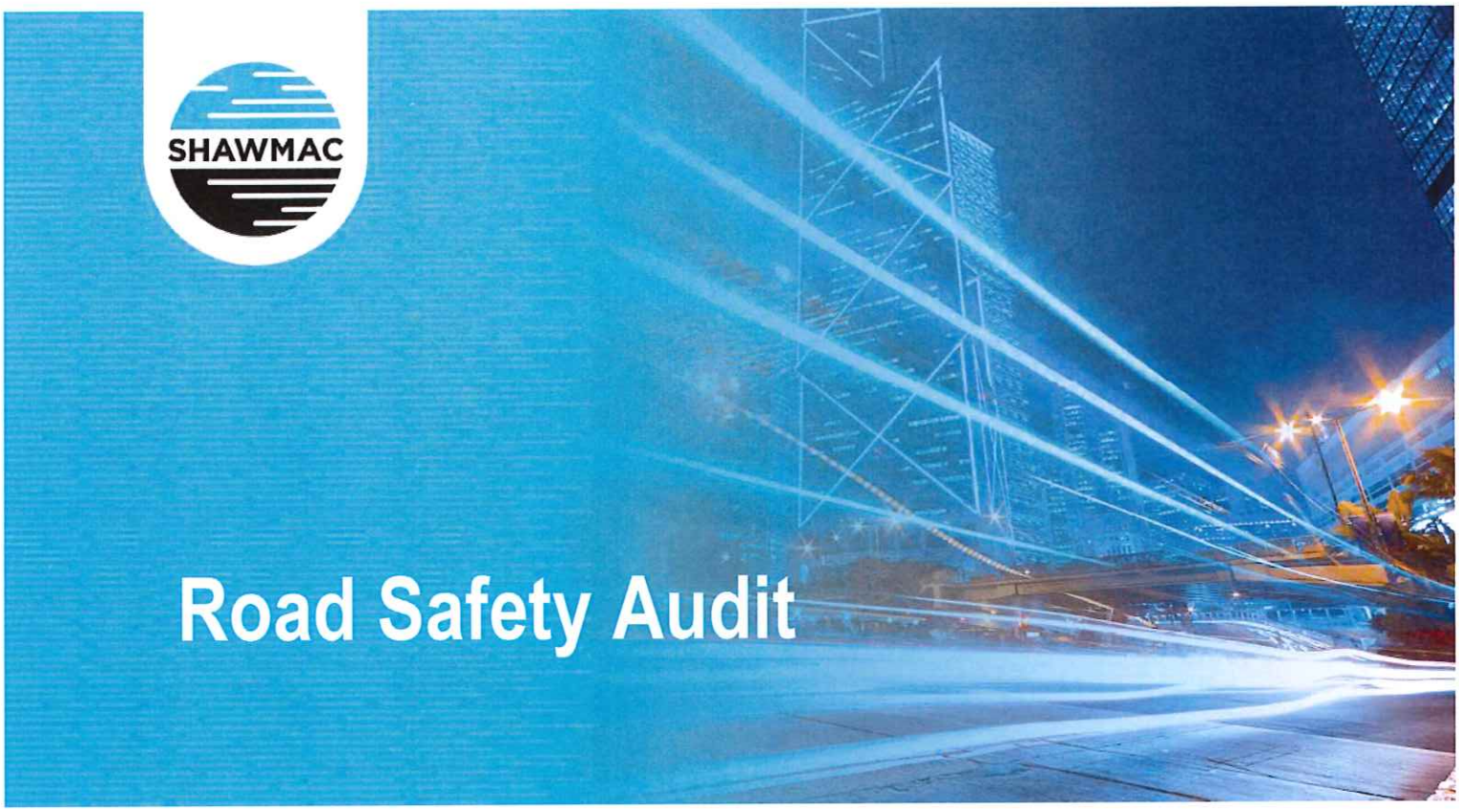
5. Conclusions

This Transport Impact Statement for the proposed bulkheads on Lot 2 of Cadoux storage site concluded the following:

- The estimated traffic generation can be accommodated within the capacity of the adjacent road network.
- The additional traffic generated by the site is not considered to increase the likelihood of crashes to unacceptable levels.
- The sealed widths of the surrounding road are equal to or above the minimum road width for their relative RAV categories.
- Accurate sight distance measurements taken on site, combined with the lack of crash history suggest that there is adequate sight distance to and from the site access despite partial obstruction from signage and vegetation.
- The swept path assessment for the designated movements at the site entry can be completed satisfactorily. The left turn movements at the site exit will not be lane correct and RAV 5-7 template turning towards both sides of King Street have minimal clearance to the edge of seal. The non-lane correct movements are deemed acceptable due to the available sight distance.

Appendix A – CBH Concept Plan


WONGAN HILLS - CADOUX ROAD
PROPOSED DRAINAGE BASIN
TRUCK STACKING LANE FOR OBH/03 & 04 PIT (4 TRUCK CAPACITY)
PROPOSED DRAINAGE BASIN
EXISTING 36m ABOVE GROUND WEIGHBRIDGE
EXISTING TYPE 10 SAMPLE HUT
OBH/02 WIDTH REDUCED
FRAMES REPOSITIONED BY OPERATIONS
LOCATION TO BE CONFIRMED
SITE ENTRY
COCHRANE ROAD
EXISTING OPEN BULKHEAD - OBH/01
EXISTING 'A' TYPE - HOR/01
EXISTING OPEN BULKHEAD - OBH/02
DRAWING LEGEND
STORAGE CAPACITIES
HATCHING LEGEND



Road Safety Audit

Project:	CBH– Cadoux Grain Facility Proposed Upgrade
Author:	Richard Jois
Date:	10/06/21
Reference:	100621_01

CONSULTING CIVIL AND TRAFFIC ENGINEERS
1 ST. FLOOR, 908 ALBANY HIGHWAY, EAST VICTORIA PARK WA 6101.
PHONE|+61 8 9355 1300
FACSIMILE| +61 8 9355 1922
EMAIL| admin@ shawmac.com.au

Contents

Safety Audit Document Control Sheet

Project Location:	Wongan Hills-Cadoux Road and Cochrane Road intersection
Audit Stage:	Road Safety Inspection
Prepared for:	Shire of Wongan-Ballidu
Prepared by 1:	Richard Jois
Prepared by 2:	Shawmac
Audit Team Leader:	Richard Jois
Audit Team Leader Organisation:	Shawmac
Audit Reference:	100621_01
Report Issue Date:	10/06/21

File Reference: Z:\Jobs Active 2021\T&T - Road Safety\CBH_Cadoux RSA_2105025\CBH_ Cadoux RSA-Final.docx

1 Introduction

1.1 Scope of the Inspection

A Road Safety Audit is a formal examination of an existing road or road related area in which an independent, qualified team report on the crash potential and likely safety performance of the location.

This Road Safety Inspection has been conducted following the general principles detailed in *Austroads Guide to Road Safety Part 6: Road Safety Audit* and in accordance with the requirements contained in the Main Roads Western Australia Policy and Guidelines for Road Safety Audit.

This report results from a request for a Road Safety Inspection for the CBH– Cadoux Grain Facility Proposed Upgrade.

The Road Safety Audit was undertaken by Richard Jois and Tony Shaw from Shawmac with reference to the details provided by the client.

The Road Safety Audit comprised an examination of the documents provided by CBH and a site inspection.

Documents Reviewed:

N/A

All the findings described in Section 2 of this report are considered by the inspection team to require action in order to improve the safety of the existing road environment and to minimise the risk of crash occurrence and reduce potential crash severity.

The inspection team has examined and reported only on the road safety implications of the road infrastructure as presented.

1.2 The Audit Team

Auditor No.	Name	Role	Organisation
00143	Richard Jois	Audit Team Leader	Shawmac Pty Ltd
0023	Tony Shaw	Audit Team Member	Shawmac Pty Ltd
0942T	Anthony Anastas	Audit Team Member	Shawmac Pty Ltd.

The inspection team visited the site on 12/05/21 at 12:00pm. At the time of the site visit the weather was fine and the existing road surface was dry.

1.3 Specialist Advisors

No specialist advisors were present at the audit.

1.4 Safe System Findings

The aim of Safe System Findings is to focus the Road Safety Audit process on considering safe speeds and by providing forgiving roads and roadsides. This is to be delivered through the Road Safety Audit process by accepting that people will always make mistakes and by considering the known limits to crash forces the human body can tolerate. This is to be achieved by focusing the Road Safety Audit on particular crash types that are known to result in higher severity outcomes at relatively lower speed environments to reduce the risk of fatal and serious injury crashes.

The additional annotation "IMPORTANT" is used to provide emphasis to any road safety audit finding that has the potential to result in fatal or serious injury or findings that are likely to result in the following crash types above the related speed environment: head-on (>70 km/h), right angle (>50 km/h), run off road impact object (>40 km/h), and crashes involving vulnerable road users (>30 km/h), as these crash types are known to result in higher severity outcomes at relatively lower speed environments.

The exposure and likelihood of crash occurrence has been considered for all findings deemed "IMPORTANT" and evaluated based on theauditor's professional judgement considering factors such as traffic volumes and movements, speed environment, crash history and the road environment. The likelihood of crash occurrence has been designated either "VERY HIGH", "HIGH", "MODERATE" or "LOW" and this additional annotation has been displayed following the "IMPORTANT" annotation on applicable findings.

1.5 Previous Safety Inspections

No earlier Road Safety Audit was identified

1.6 Background Data

1.6.1 Road configuration

Wongan Hills-Cadoux Road is a Regional Distributor undivided road with one lane in each direction. Cochrane Road is an undivided Access Road with one lane in each direction. King Streetis a Regional Distributor undivided road with one lane in each direction.

1.6.2 Crash History

There were no recorded crashes at the Wongan Hills-Cadoux Road / Cochrane Road intersection and King Street / Cochrane Road intersection for the 5-year period ending December 2020.

1.6.3 Traffic and Speed Data

Wongan Hills-Cadoux Road has a combined traffic volume of 75 vpd. there were no traffic volume data available on MRWA TrafficMap for Cochrane Road and King Street but are expected to have low volumes.

Wongan Hills-Cadoux Road is posted at 70km/h, Cochrane Road is posted at20km/h and King Street is posted derestricted at 110km/h prior to the intersection and 70km/h past the intersection.

1.6.4 Appendices

Appendix A – Road Safety Inspection Findings Location Plan

Appendix B – Road Safety Inspection Photographs

Appendix C –Crash Reports

Appendix D – Documents Reviewed

Appendix E – Corrective Action Report (CAR)

2 Items Raised in this Audit

2.1 Finding – Unprotected Culvert

An unprotected culvert is located at the intersection and within the clear zone on the King Street northern leg.

Justification of the finding

Should a vehicle inadvertently leave the roadway in the section of road adjacent to the unprotected culvert headwall a driver is likely to experience loss of control with the resultant crash causing serious or fatal injury. *Austroads Guide to Road Design Part 6* indicates that the ends of culverts that cross under the road or are located parallel to the road constitute hazards if they are within the area of interest (e.g. clear zone). Road design should aim to eliminate all non-essential drainage features. Where drainage features are unavoidable, they should be designed as follows:

Perpendicular to the road (headwall treatment) – culverts that run perpendicular to the road (i.e. run under the road) should be designed to be traversable (Figure 4.2) or present a minimal obstruction to an errant vehicle. The slope of the fill batter should be drivable or be shielded with an appropriate road safety barrier. Alternatively, the culvert can be extended to a location further from the travelled way where the end is less likely to be impacted by errant vehicles.

Recommendation

Extend the culvert outside of the clear zone at the intersection.

[IMPORTANT | LOW]

2.2 Finding – Rough Road Surface

There is evidence of pavement deterioration at the intersection due to trucks turning.

Justification of the finding

Flushing of the bitumen seal may result in reduced skid resistance and lower side friction which may contribute to loss of control where vehicles enter or exit the Cochrane Road and King Street intersection. Additionally, if intervention does not occur in an appropriate time frame, pavement defects may deteriorate to an extent that they adversely impact on vehicles being able to traverse the road safely.

Austroads Guide to Road Safety Part 9: Roadside Hazard Management indicates that a road surface needs to be constructed and maintained to a sufficient standard to ensure adequate skid resistance. Skid resistance is the frictional resistance provided by the pavement to vehicle tyres during braking or cornering manoeuvres, normally measured on wet surfaces. Situations where a pavement can hold water instead of draining properly can contribute to vehicles aquaplaning.

Recommendation

Repair the defects and undertake ongoing routine maintenance to ensure that pavement defects are corrected at an appropriate intervention level.

2.3 Sight Distance - Vegetation

Vegetation adjacent to the intersection adversely impacts on sight distance and may obscure a driver's vision of vehicles on the through road. This may increase the risk of right angle or right turn through crashes resulting in serious or fatal injury to vehicle occupants.

Justification of the finding

Vegetation adjacent to the intersection obstructs sight lines thereby increasing the risk to road users. Substandard sight distance may increase the risk of right angle or right turn through crashes and subsequent injury to vehicle occupants.

Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections indicates that Safe Intersection Sight Distance (SISD) is the minimum distance which should be provided on the major road at any intersection. Using an operating speed of 70km/h and a reaction time 2.0 seconds the required Safe Intersection Sight Distance is 178m measured 5 m back from the holding line on the side road.

Recommendation

Remove vegetation from within the required sight triangles so as to provide SISD in accordance with Austroads Guide to Road Design.

[IMPORTANT | LOW]

2.4 Finding – Missing Pavement Markings and Signs at Both Intersections

There are missing pavement markings and signs on both intersections audited.

Justification of the finding

Lack of intersection controls may result in a driver failing to recognise the road environment particularly at night or in inclement conditions. This may increase the risk of crashes with resultant injury to vehicle occupants.

Australian Standard AS 1742.2 indicates that system of clear and effective pavement markings and signage is essential for the proper guidance and control of vehicles at intersections.

Recommendation

Install pavement markings and signage compliant with AS 1742.2 at both intersections.

[IMPORTANT | LOW]

2.5 Finding - Terminating Road Signage

No signage is provided opposite the terminating leg of the "T" junction at the Cochrane Road and King Street Intersection.

Justification of the finding

There is a risk of vehicles overshooting the intersection on account of the lack of hazard boards opposite the terminating leg of the intersection. This may increase the risk of rear end or right-angle crashes. *Australian Standard 1742.2-2009 Traffic Control Devices for General Use* indicates that sight boards comprising Unidirectional Hazard markers should be erected to face the stem of a T-intersection where approach speeds are high on the terminating leg of the intersection, and where standard intersection signposting would not provide sufficient warning of the intersection.

Recommendation

Review the need to provide terminating signage and if warrants are met make provision for hazard boards.

2.6 Finding – High Speed Approach to Intersection

King Street southbound intersection approach is derestricted at 110km/h with the speed reduced to 70km/h after Cochrane Road.

Justification of the finding

It is assumed that the 70km/h speed zone reduction was implemented to reduce the crash risks due to turning vehicles in/out of the intersections in that vicinity.

Austroads *(2014b)* stipulates that a reduction in speed limits at intersections could be considered as a temporary treatment along major road approaches where the following criteria are met:

- located on outer-metropolitan, semi-rural and rural arterials
- have high volumes of traffic
- have high speed limits (> 80 km/h)
- are at-grade, sign or signal controlled
- experienced at least one of the following
  - significant increase in crashes due to growth in traffic volumes
  - permanent increase in complexity of traffic movements
  - permanent change in the surrounding road environment over a period of time (e.g. increased direct access)
  - current function of the intersection exceeds its original rural function, but an upgrade would not be cost-effective in the short- to medium-term.

Recommendation

Extend the 70km/h speed zone to a location prior to the Cochrane Road and King Street Intersection.

3 Road Safety Inspection Team Statement

I hereby certify that the inspection team have examined the identified location in undertaking this Road Safety Audit. I also confirm that this inspection has been conducted following the general principles detailed in *Austroads Guide to Road Safety Part 6: Road Safety Audit*and in accordance with Main Roads Policy and Guidelines for Road Safety Audit.

The inspection has been carried out for the sole purpose of identifying any features of the existing road environment which could be altered or removed to improve the safety of the road infrastructure. The identified issues have been noted in this report. The accompanying findings and recommendations are put forward for consideration by the asset owner for implementation.

Audit Team Leader

Richard Jois

Shawmac

10/06/21

4 Appendix A – Road Safety Inspection Findings LocationPlan

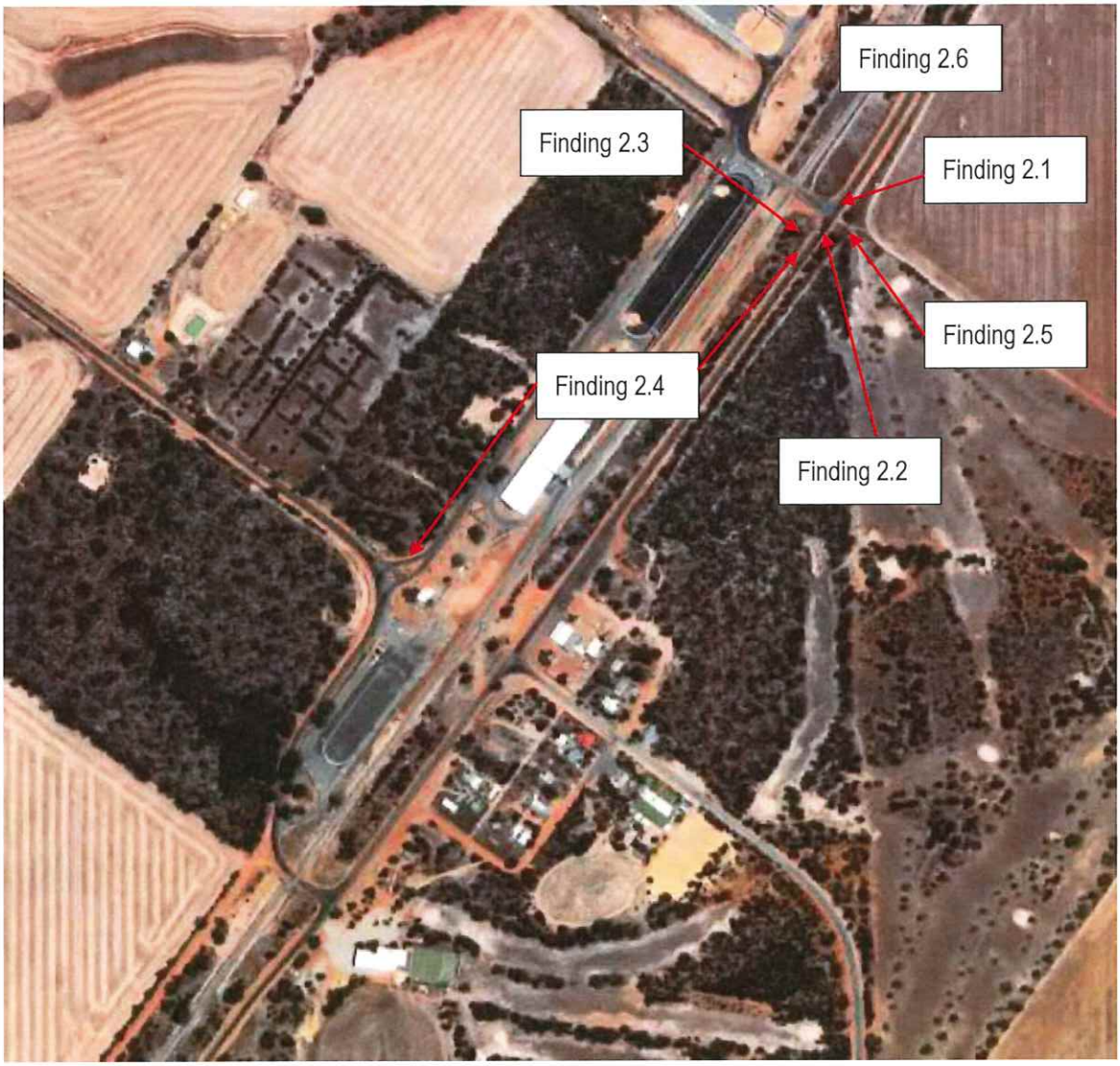


Figure 1: Location of Findings

5 Appendix B – Audit Photographs

Figure 2: Finding 2.2, 2.3

Figure 3: Finding 2.5

Figure 4: Finding 2.1

Figure 5: Finding 2.4

6 Appendix C – Crash Report

No crash data available.

7 Appendix D – Documents Reviewed

2012020-TIS-002_A

8 Appendix E– Corrective Action Report

Corrective Action Report –CBH Cadoux

Ref	Findings and Recommendations	Project Manager		
		Agree / Disagree	Reason for Disagreeing	Proposed Action and Comments
2.1	**Finding – Unprotected Culvert** An unprotected culvert is located at the intersection and within the clear zone on the King Street northern leg. **Justification of the finding** Should a vehicle inadvertently leave the roadway in the section of road adjacent to the unprotected culvert headwall a driver is likely to experience loss of control with the resultant crash causing serious or fatal injury. *Austroads Guide to Road Design Part 6* indicates that the ends of culverts that cross under the road or are located parallel to the road constitute hazards if they are within the area of interest (e.g. clear zone). Road design should aim to eliminate all non-essential drainage features. Where drainage features are unavoidable, they should be designed as follows: Perpendicular to the road (headwall treatment) – culverts that run perpendicular to the road (i.e. run under the road) should be designed to be traversable (Figure 4.2) or present a minimal obstruction to an errant vehicle. The slope of the fill batter should be drivable or be shielded with an appropriate road safety barrier. Alternatively, the culvert can be extended to a location further from the travelled way where the end is less likely to be impacted by errant vehicles. **Recommendation** Extend the culvert outside of the clear zone at the intersection. [IMPORTANT | LOW]			

Ref	Findings and Recommendations	Project Manager		
		Agree / Disagree	Reason for Disagreeing	Proposed Action and Comments
2.2	**Finding – Rough Road Surface** There is evidence of pavement deterioration at the intersection due to trucks turning. **Justification of the finding** Flushing of the bitumen seal may result in reduced skid resistance and lower side friction which may contribute to loss of control where vehicles enter or exits the Cochrane Road and King Street intersection. Additionally, if intervention does not occur in an appropriate time frame, pavement defects may deteriorate to an extent that they adversely impact on vehicles being able to traverse the road safely. *Austroads Guide to Road Safety Part 9: Roadside Hazard Management* indicates that a road surface needs to be constructed and maintained to a sufficient standard to ensure adequate skid resistance. Skid resistance is the frictional resistance provided by the pavement to vehicle tyres during braking or cornering manoeuvres, normally measured on wet surfaces. Situations where a pavement can hold water instead of draining properly can contribute to vehicles aquaplaning. **Recommendation** Repair the defects and undertake ongoing routine maintenance to ensure that pavement defects are corrected at an appropriate intervention level.			

Ref	Findings and Recommendations	Project Manager		
		Agree / Disagree	Reason for Disagreeing	Proposed Action and Comments
2.3	**Sight Distance - Vegetation** Vegetation adjacent to the intersection adversely impacts on sight distance and may obscure a driver's vision of vehicles on the through road. This may increase the risk of right angle or right turn through crashes resulting in serious or fatal injury to vehicle occupants. **Justification of the finding** Vegetation adjacent to the intersection obstructs sight lines thereby increasing the risk to road users. Substandard sight distance may increase the risk of right angle or right turn through crashes and subsequent injury to vehicle occupants. *Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* indicates that Safe Intersection Sight Distance (SISD) is the minimum distance which should be provided on the major road at any intersection. Using an operating speed of 70km/h and a reaction time 2.0 seconds the required Safe Intersection Sight Distance is 178m measured 5 m back from the holding line on the side road. **Recommendation** Remove vegetation from within the required sight triangles so as to provide SISD in accordance with Austroads Guide to Road Design. [IMPORTANT | LOW]			

Ref	Findings and Recommendations	Project Manager		
		Agree / Disagree	Reason for Disagreeing	Proposed Action and Comments
2.4	**Finding – Missing Pavement Markings and Signs at Both Intersections** There are missing pavement markings and signs on both intersections audited. **Justification of the finding** Lack of intersection controls may result in a driver failing to recognise the road environment particularly at night or in inclement conditions. This may increase the risk of crashes with resultant injury to vehicle occupants. *Australian Standard AS 1742.2* indicates that system of clear and effective pavement markings and signage is essential for the proper guidance and control of vehicles at intersections. **Recommendation** Install pavement markings and signage compliant with AS 1742.2 at both intersections. [IMPORTANT | LOW]			
2.5	**Finding - Terminating Road Signage** No signage is provided opposite the terminating leg of the "T" junction at the Cochrane Road and King Street Intersection. **Justification of the finding** There is a risk of vehicles overshooting the intersection on account of the lack of hazard boards opposite the terminating leg of the intersection. This may increase the risk of rear end or right-angle crashes. *Australian Standard 1742.2-2009 Traffic Control Devices for General Use* indicates that sight boards comprising Unidirectional Hazard markers should be erected to face the stem of a T-intersection where approach speeds are high on the terminating leg of the intersection, and where standard intersection signposting would not provide sufficient warning of the intersection. **Recommendation** Review the need to provide terminating signage and if warrants are met make provision for hazard boards.			

Ref	Findings and Recommendations	Project Manager		
		Agree / Disagree	Reason for Disagreeing	Proposed Action and Comments
2.6	**Finding – High Speed Approach to Intersection** King Street southbound intersection approach is derestricted at 110km/h with the speed reduced to 70km/h after Cochrane Road. **Justification of the finding** It is assumed that the 70km/h speed zone reduction was implemented to reduce the crash risks due to turning vehicles in/out of the intersections in that vicinity. Austroads *(2014b)* stipulates that a reduction in speed limits at intersections could be considered as a temporary treatment along major road approaches where the following criteria are met: located on outer-metropolitan, semi-rural and rural arterials have high volumes of traffic have high speed limits (> 80 km/h) are at-grade, sign or signal controlled experienced at least one of the following significant increase in crashes due to growth in traffic volumes permanent increase in complexity of traffic movements permanent change in the surrounding road environment over a period of time (e.g. increased direct access) current function of the intersection exceeds its original rural function, but an upgrade would not be cost-effective in the short- to medium-term. **Recommendation** Extend the 70km/h speed zone to a location prior to the Cochrane Road and King Street Intersection.			

Corrective Action Report – CBH Cadoux

NOTE:

- This Corrective Action Report is to be read in conjunction with the full Road Safety Audit Report and its findings and recommendations.
- The asset owners (MRWA and/or LGA) **must** be informed of these findings, recommendations and proposed actions.
- Items not under the responsibility of this project representative must be forwarded to the persons / agencies that are responsible.

These findings and recommendations have been considered, and the actions listed will be taken accordingly.

Responsible Project Representative	Company / Agency / Division	Position	Date

Asset Owner Representative	Company / Agency / Division	Position	Date

Additional Road Upgrade Information from CBH – 25 February 2022

CBH are willing to consider possible 50/50 share if the works are limited to the six (6) items recommended in the Road Safety Audit (RSA) report including the clearing or "trimming only" of vegetation to provide safe intersection site distances. CBH has consulted Shawmac Consulting Civil and Traffic Engineers, who are the Road Safety Auditors and also our civil designer, and below are further details from them on the 6 recommendations within the RSA report. Shire to be responsible for any regulatory approvals required for executing these 6 recommendations.

RSA Finding	Works Required	Quantities	Comments
2.1 - Unprotected Culvert (see Figure 1 below for location)	Culvert headwall on north bound lane of King Street is approx. 1.5m from edge of seal. South bound lane headwall is approx. 2.0m from edge of seal. Clear zone required for 110km/h is 8m. Extend north bound culvert by 6.5m, south bound by 6m, backfill and compact. Existing headwalls can be retained if in suitable condition.	12.5m total culvert extension length, provision for 2x headwall replacements, allow 30m^3 sand for bedding and backfill.	**Shawmac:** Existing culvert dia. is unknown – need to confirm with Shire on-site. **CBH:** Agrees with Shawmac's comments and will consider 50/50 split on cost of these works; Shire to execute and manage the works and contractor. Shire also to be responsible for any regulatory approvals required.
2.2 - Rough Road Surface (see Figure 1 below for location)	Repair pavement defects – flushing/bleeding seal and potentially deteriorated pavements.	See Figure 2 below Profile 50mm and reseal & asphalt (Intersection Mix) the Site Exit at the Cochrane Rd & King St intersection, estimated 623m^2	**Shawmac:** Extent of defects needs to be confirmed on site **CBH:** Agrees with Shawmac's comments and will consider 50/50 split on cost of these works if extent of the defects do not surpass 50m in any direction from the Site Entry and Site Exit. Shire executes and manages the works and Contractor. Shire also to be responsible for any regulatory approvals required.

RSA Finding	Works Required	Quantities	Comments
2.3 - Sight Distance (Vegetation) (see Figure 1 below for location)	TBC on site - likely trimming of vegetation only	TBC	**Shawmac:** Sight line sketches are provided below in Figures 2 & 3 (300m required to the north, 256m to the south). The sight lines do clip the vegetation based on an aerial view available to us, but it may not be an issue on site (to be confirmed on site). Trimming acceptable as long as a clear line of sight is provided. Coordinates are: Eye location – 117.139, -30.765 To south – 117.137, -30.767 To north – 117.141, -30.763 **CBH:** CBH will peg out the coordinates. A site assessment on the line-of-sight will be required with a Shire Representative. Best case, only "tree trimming" activities are required to provide the line of sight. Shire executes and manages the works and Contractor. Shire also to be responsible for any regulatory approvals required.
2.4 - Pavement Marking and Signage (see Figure 1 below for location)	N/A	N/A	**Shawmac:** Pavement marking and signage at the Cochrane Road and King Street intersection is not required in accordance with AS1742.2 given this is a tee intersection and the priorities are clear. Recommended that "trucks entering" warning signage is applied to the major road, however in accordance with AS1742.2 this could be temporary signage during harvest periods. **CBH:** Permanent solution required at the Cochrane Road and King Street intersection as well as the Cochrane Road and Wongan Hills-Cadoux Road intersection as trucks enter and exit the site during most parts of the year for out-loading activities, not just harvest periods (in-loading). CBH willing to bear 50% of the cost of these works. Shire executes and manages the works

RSA Finding	Works Required	Quantities	Comments
			and Contractor. Shire also to be responsible for any regulatory approvals required.
2.5 - Terminating Road Signage (see Figure 1 below for location)	N/A	N/A	**Shawmac:** Not required - As per AS 1742.2, a sight board would only be required at the Cochrane Road and King Street intersection if approach speeds on terminating leg are high which is not the case for vehicles exiting the CBH site. **CBH:** Agrees with Shawmac's comments i.e. the signage not required upon engineering review.
2.6 - Speed Limit Change to 70km/h (see Figure 1 below for location)	N/A	N/A	**Shawmac:** Understood MRWA is not supportive of this. Consideration could be provided to implementing a temporary reduced speed zone during harvest periods under a Traffic Management Plan. **CBH:** CBH happy for Shire to consult MRWA (if required) for approval of temporary speed limit change during harvest periods only.