

In order to access the development, it is proposed to traverse the existing watercourse. Calculations have been completed to size appropriate culverts to facilitate natural peak flows from the upstream catchment. Upstream catchment peak flows have been calculated using the Probabilistic Rational Method as well as a lumped node model in the runoff routing software XP-RAPTS. Table 1 below shows the results from both estimation methods.

Table 1 - upstream catchment peak flows

AEP	Probabilistic Method (m ³ /s)	Rational	XP-RAFTS (m ³ /s)	Average (m ³ /s)
10%	7.7		9.4	8.6
1%	22.2		16.6	19.4

To allow for access to and from the site during major flood events it is proposed to convey the 1% AEP storm event peak flow through a series of reinforced concrete box culvert's (RCBC's) beneath the access road. Culverts have been sized in accordance with Council's Stormwater Drainage Design Guidelines and the Hydraulics of Precast Concrete Conduits design manual by the Concrete Pipe Association of Australasia.

RCBC flow calculations:

depth (d) = 1.2 m

width (b) = 1.5 m

headwater depth (hw) = 1.5 m

$$hw / d = 1.25$$

$$q / b = 2.4 \text{ m}^3/\text{s}/\text{m}$$

$$q = 3.6 \text{ m}^3/\text{s}$$

Each proposed 1.2 m x 1.5 m RCBC will convey 3.6 m³/s. Therefore 6 RCBC's are required to convey the 1% AEP storm event. To facilitate the series of culverts, fill will be provided to raise the road level to approximately 1.7m above the creek invert, allowing for 1.5m headwater depth and 0.2m freeboard (CCC's engineering guidelines).

Stormwater Quality

Roadside swales are proposed along the internal unsealed access roads to treat stormwater runoff prior to discharging to the natural watercourse.

The proposed stormwater treatment train for the rest of site consists of:

- Stormwater runoff from impervious hardstand areas to be conveyed to sedimentation ponds or basins. Locations and configurations to be determined at CC stage. Due to the relatively small impervious area being proposed (approximately 2% of total site area) it is expected sedimentation ponds strategically placed downstream of the site will adequately polish stormwater runoff prior to discharging to the nearby watercourse.
- Roof-water runoff to be collected in reuse tanks and reticulated for toilet flushing throughout the site. A combined total of 50 kL for the Accommodation and Welcome Centre roof runoff is proposed. All down pipes are to be connected to a first flush device prior to tank inlets. Details and locations to be confirmed at CC stage.

- Overflow from the reuse tanks to be conveyed to the proposed sedimentation ponds. Excess runoff from sedimentation ponds to be discharged via levels spreaders to facilitate natural flow regimes towards the nearby natural watercourse.

Right of Access and Gillard's Road Extension

The existing Gillard's Road reserve (approximately 20m wide), currently acts as a stormwater overland flow path, conveying upstream catchment flow to an existing dam. The dam is predominately located in the lot to the north of the road reserve (Lot 822 DP 746940), however it appears to also extend into the western extent of the road reserve. We note the proposed road extension will therefore conflict with the existing dam, and as such, a portion of the dam will be required to be filled and/or relocated.

The existing gradients of the road reserve are suitable for the proposed road extension, and it is expected that only minor earthworks will be required to facilitate the new road. It is unlikely that any required batters will extend outside of the road reserve.

A table drain will be required on the southern side of the Gillard's Road extension. Preliminary modelling of this catchment was undertaken using the software XP-RAFTS, which indicates that approximately 1m³/s will be conveyed by the table drain for the 10% Average Exceedance Probability (AEP) storm event. It is proposed to continue the table drain through the Right of Access (R.O.A), and discharge it into the existing downstream creek, located within Lot 40, DP 755255.

We understand the proposed R.O.A. is to be 8m wide, with a minimum carriageway width of 5.5m. The R.O.A intercepts two stormwater overland flow paths, which currently convey stormwater to two first order creeks located within Lot 822 DP 746940, flowing west into Lot 40, DP 755255. To convey this upstream runoff the R.O.A will require a table drain on the eastern side of the road pavement.

The table drain and culverts are proposed to be located within the R.O.A with the later positioned directly downstream of the two existing dams located in Lot 822 DP 746940. Based on our preliminary modelling, Culvert 1 will be required to convey approximately 0.7m³/sec for the 10% AEP storm event. This can be achieved via a 600mm diameter Class 4 reinforced concrete pipe or alternatively a 600d x 900w reinforced concrete box culvert. To achieve sufficient inlet capacity to the culvert the adjacent road should be raised approximately 500mm above existing ground levels, and locally batter down at the inlet within the R.O.A. this will require battering into the adjacent lot to the west (Lot 40, DP 755255) for a width up to 4m.

Based on our preliminary modelling Culvert 2 will be required to convey approximately 0.4m³/s for the 10% AEP storm event. This can be achieved via a 450mm diameter Class 4 reinforced concrete pipe or alternatively a 300d x 900w reinforced concrete box culvert. Similar to Culvert 1, the adjacent road will need to be raised for the culvert, resulting in batters that extend into the adjacent lot. We note stormwater in major storms will overtop the proposed table drain and culverts, and flow over the proposed road pavement which is in accordance with Council and industry standards.

Due to the limited width of the R.O.A., and the existing site topography, it is likely that battering will be required into the adjacent lot to the west (Lot 40, DP 755255), for most of the R.O.A. to facilitate the new road and drainage infrastructure. The batter width will vary, but is unlikely to typically exceed 1m (except for the culvert locations as described above).

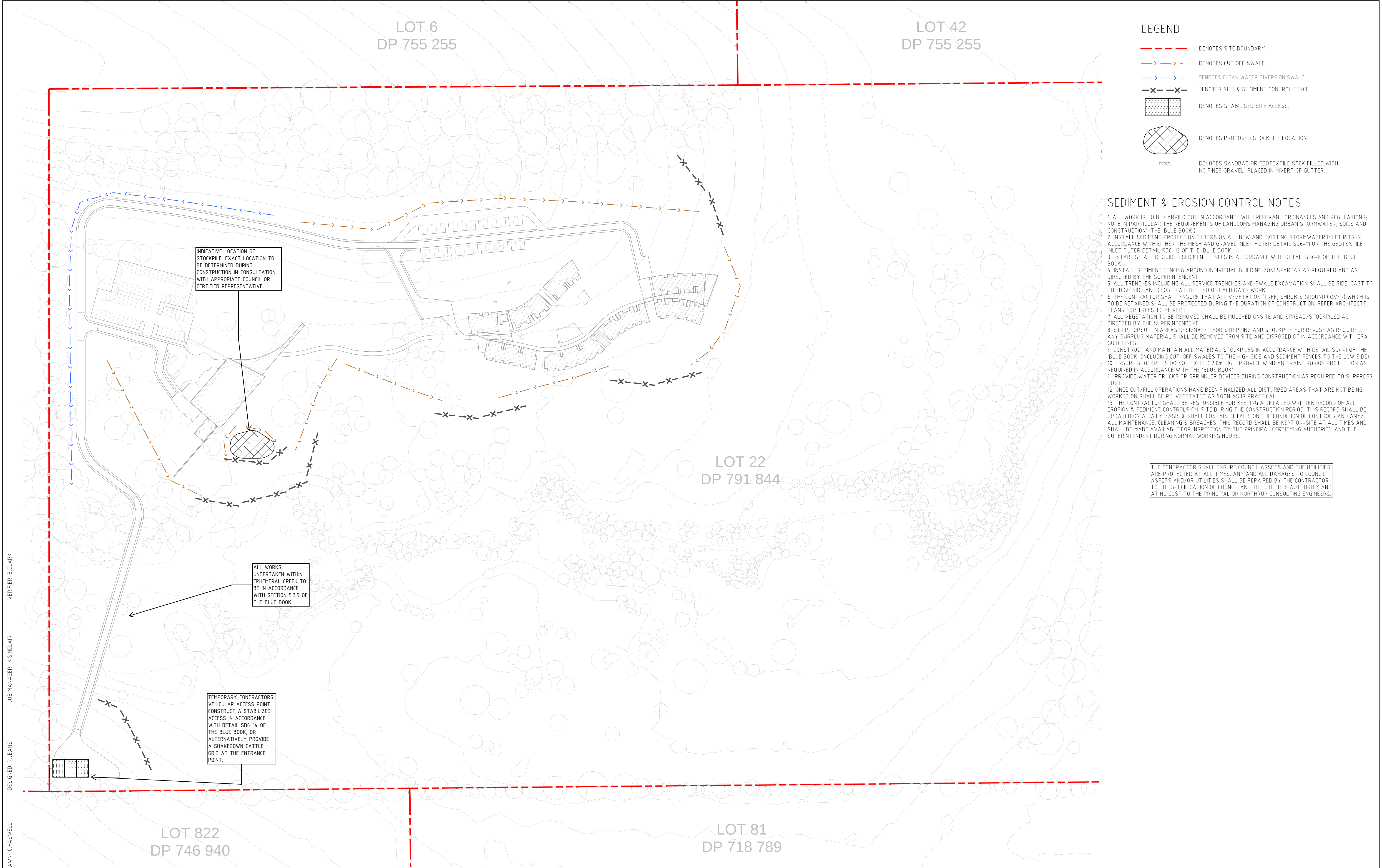
If a landscape buffer is provided to the west of the proposed access road, it will be need to be in the lot to the west of the R.O.A, as it is not feasible to fit this within the 8m wide section. Should this be provided, gaps will be required within this buffer at various locations to enable stormwater to pass through in major storm events.

Yours sincerely

Ross Jeans
Graduate Civil Engineer

Ben Clark
Principal / Senior Civil Engineer

Page 4 of 4

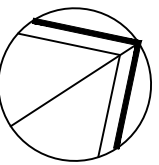


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DESIGNED: R JEANS
DRAWN: CHASWELL

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
A	ISSUED FOR APPROVAL	CH	BC	RJ	09.10.17

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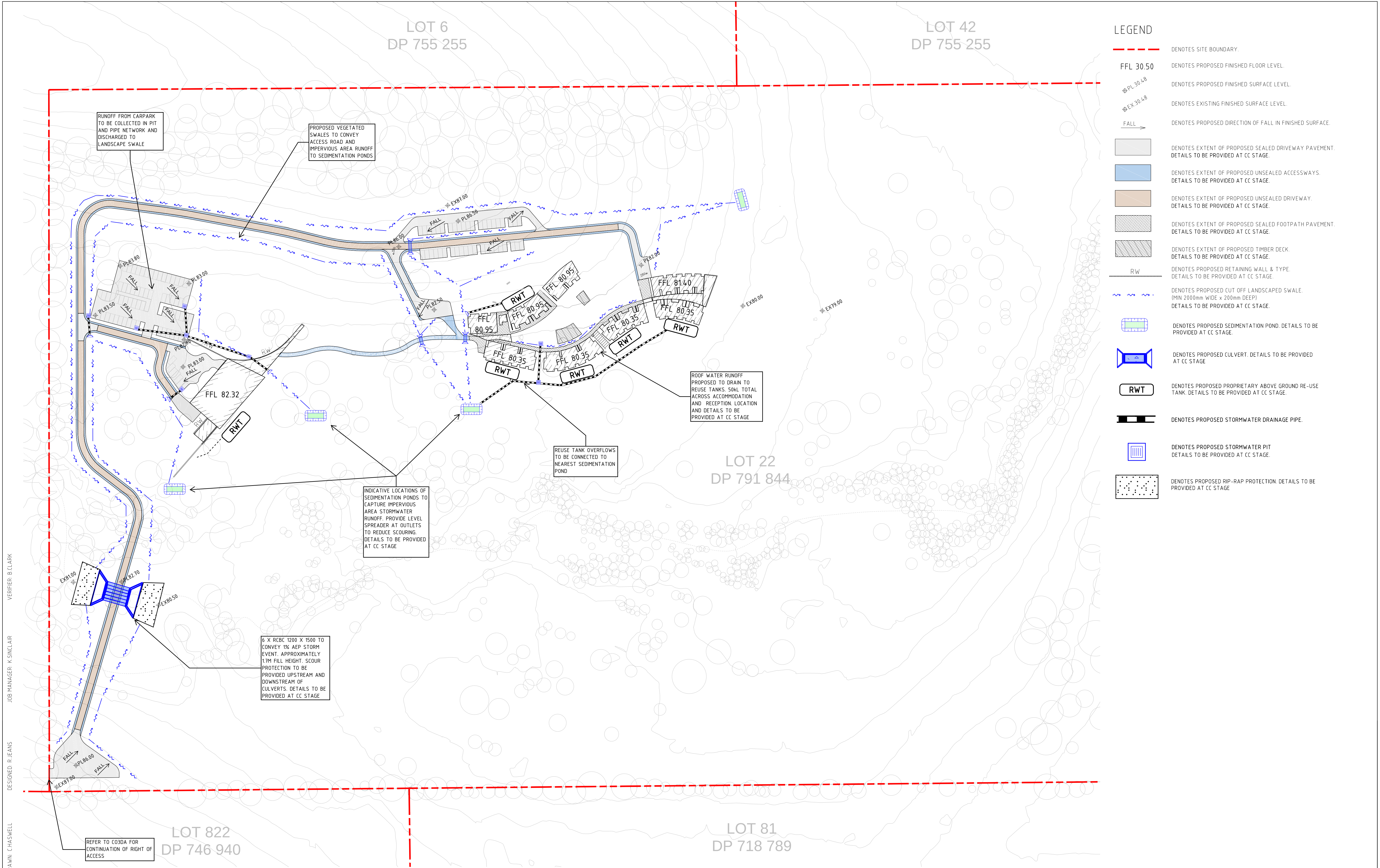
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PROJECT	H12 POKOLBIN
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DRAWING TITLE	EROSION AND SEDIMENT CONTROL PLAN
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JOB NUMBER	NL167098
DRAWING NUMBER	REVISION
C01DA	A
DRAWING SHEET SIZE = A1	

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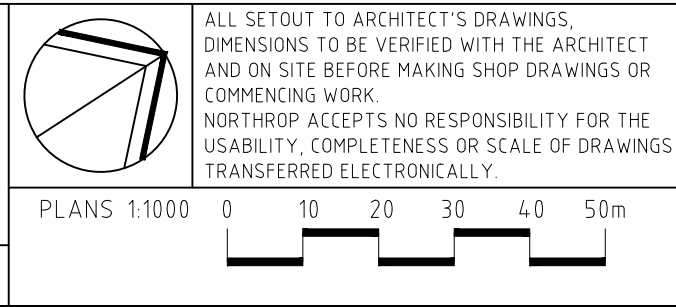


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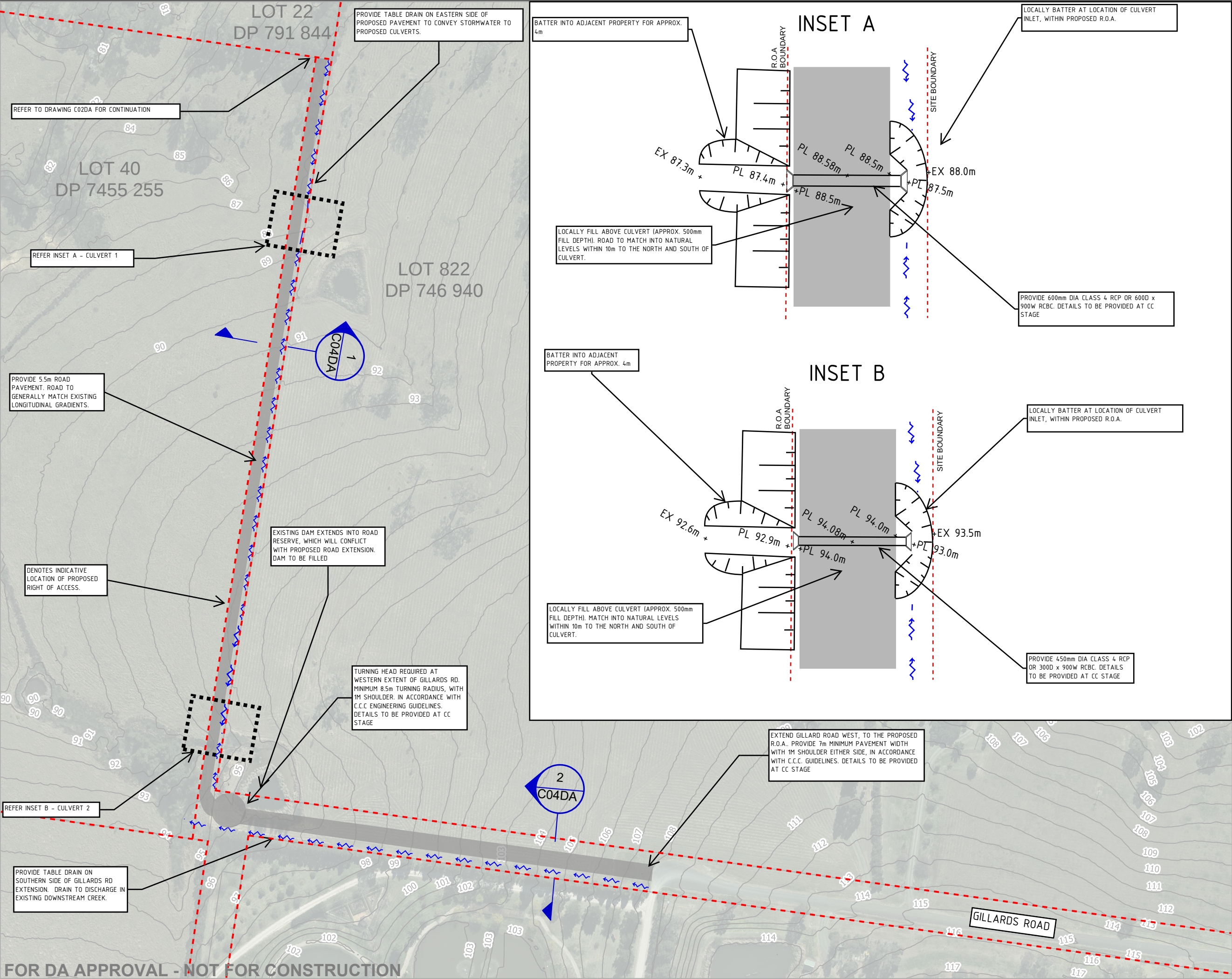
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PROJECT	H12 POKOLBIN
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DRAWING TITLE	STORMWATER MANAGEMENT AND LEVELS PLAN
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JOB NUMBER	NL167098
DRAWING NUMBER	C02DA
REVISION	A
DRAWING SHEET SIZE	A1

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Project	
H12 POKOLBIN	
Drawing Title	
C03DA - Rev A	
CIVIL WORKS PLAN FOR RIGHT OF ACCESS	
Date	
09.10.2017	
Additional Information	
	DENOTES PROPOSED TABLE DRAIN. DETAILS TO BE PROVIDED AT CC STAGE
	DENOTES SITE BOUNDARY OR R.O.A.
	DENOTES PROPOSED SITE LEVEL
	DENOTES EXISTING SITE LEVEL
	DENOTES INDICATIVE PROPOSED PAVEMENT EXTENT. DETAILS TO BE PROVIDED AT CC STAGE
	DENOTES PROPOSED CULVERT HEADWALL. DETAILS TO BE PROVIDED AT CC STAGE
Legend	
INSET 1:200	
PLAN	
Scale	
Newcastle Suite 4, 215 Pacific Hwy, Charlestown NSW 2290 P.O. Box 180, Charlestown NSW 2290 Ph (02) 4943 1777 Fax (02) 4943 1577 Email newcastle@northrop.com.au ABN 81 094 433 100	



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A	ISSUED FOR APPROVAL	KS	BC	KS	09.10.17	HEPHZIBAH HUNTER VALLEY PROPERTY PTY LTD	SPACKMAN MOSSOP MICHAELS				H12 POKOLBIN	ROAD CROSS SECTIONS	NL 167098	C04DA	A	
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