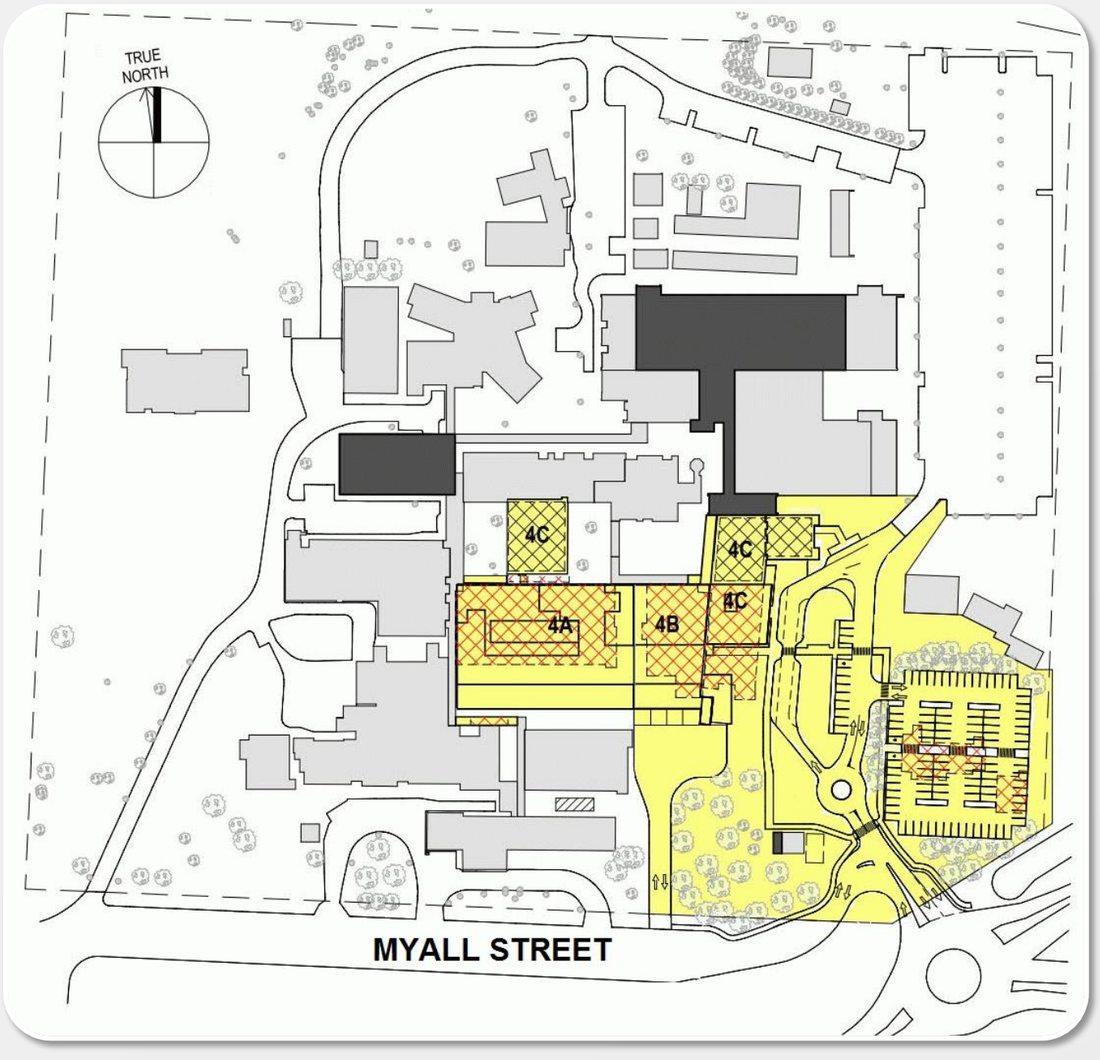
DUBBO HEALTH SERVICE REDEVELOPMENT – STAGES 3 & 4

STORMWATER MANAGEMENT REPORT



Prepared for: Health Infrastructure NSW
By: **en**struct group pty ltd
Revision: G
November 2016

DUBBO HEALTH SERVICE REDEVELOPMENT
STAGES 3 & 4
STORMWATER MANAGEMENT REPORT

ISSUE AUTHORISATION

Document Title:	Dubbo Health Service Redevelopment – Stages 3 & 4 Stormwater Management Report
Document Number:	00-C-RP-002
Project Reference:	5196
Prepared For:	Health Infrastructure NSW
Date:	November 2016
Author:	Isaac Yip
Reviewer:	Geoff Herman

Rev	Date	Purpose of Issue / Nature of Revision	Prepared by	Reviewed by	Issue Authorise by
A	29/07/16	Early Contractor Involvement	IY	GH	GH
B	05/09/16	Early Contractor Involvement – Stage 4	IY	GH	GH
C	24/10/16	DRAFT Schematic Design Issue	IY	GH	GH
D	11/11/16	Schematic Design Issue	IY	GH	GH
E	17/11/16	Schematic Design Issue	IY	GH	GH
F	30/11/16	Schematic Design Issue for SSD	IY	GH	GH
F	08/12/16	Schematic Design Issue for SSD	IY	GH	GH

This Report is given for the benefit of:
NSW Health and Health Infrastructure (ABN 89 600 377 397); and
Any Tenderer (meaning any tenderer whether as an individual, an entity, a joint venture, a partnership or a consortium) to NSW Health or Health Infrastructure for the provision of works or services in any way in connection with the Project.

Executive Summary

This report has been prepared to discuss the existing site drainage infrastructure and the impacts of the proposed Stage 3 and 4 State Significant Development (SSD) application works. The Stage 3 and 4 Review of Environmental Factors (REF) works are not included in the SSD scope of works. In other words, SSD is included in the scope of this report and REF is not included. For discussion purposes, REF works are taken to be existing and complete at the commencement of SSD works.

The strategic plan for the management of stormwater drainage is to generally maintain the existing catchment layout by retaining as much existing infrastructure as possible, whilst introducing on-site detention where impervious surface areas are significantly increased or where it becomes appropriate to divert catchment flows to locations where they can be more efficiently controlled. Due to increased impervious catchment areas associated with the proposed Stage 3 & 4 SSD works, an assessment of corresponding stormwater detention requirements has been undertaken, and augmentation of existing storage and drainage systems is proposed to accommodate the intended changes associated with the hospital layout. This includes an additional 300m3 of detention storage and has been sized to correspond with restricted flows into the Myall Street drainage system. This proposal has been discussed with Council engineers and approval in principle has been obtained.

Where additional buildings are proposed, new dedicated drainage will be required and in particular this will include runoff from new building roof areas, car parks and access roads.

The main new road infrastructure is associated with access to the main entrance drop off area and an additional car park is to be provided on the east side of the entry road. A new roundabout is proposed to manage traffic flows near this location. In addition, minor areas of resurfacing and pavement construction will be undertaken in the vicinity of the new building envelopes. Earthworks associated with the detention tank system on the western side of the entry road are to be included in Stage 3 & 4 SSD works.

Contents

1 Introduction

enstruct group have been engaged by Health Infrastructure NSW as civil and structural engineering consultant for the proposed works to the Dubbo Health Service Redevelopment associated with the existing hospital premises.

This report has been prepared to discuss the existing site civil drainage infrastructure and the impacts of the proposed Stage 3 & 4 SSD on the existing stormwater service.

2 Project Overview

2.1 Redevelopment Stages 1 & 2 (works already complete)

The civil works for Stages 1 & 2 involved the following works:

- New Car Park on Eastern Boundary;
- New link road;
- New stormwater drainage network for the eastern car park including an underground onsite stormwater detention tank;
- Extension to the existing detention basin on the western bank;
- Stormwater drainage for the new main building;
- Bulk Earthworks for the new building;
- Re-grading of existing roads and footpaths surrounding the new building

These works were undertaken in two stages, early works and main works. The early works package included the new link road, the eastern car parking and the bulk earthworks for the main building. The main works concentrated on the areas near the new main building.

2.2 Redevelopment Stages 3 & 4

2.2.1 Stages 3 & 4 REF Works (not included in SSD application works)

The proposed Stage 3 development primarily involved the construction of a new storey on top of the recently-constructed hospital building installed during Stages 1 & 2, new oncology building works and refurbishment of an existing building for relocated medical records. Additionally, there was some demolition associated with part of the existing new hospital building to enable services reticulation.

2.2.2 Stages 3 & 4 SSD Works

The Dubbo Health Service Redevelopment Stage 4 project scope is described as follows:

- Stage 4 – Site preparation works
  - Demolition of George Hatch and Existing Nurses Administration
  - Demolition of Existing Surgical Ward (‘S’ Block)
  - New Construction – Temporary Corridor Bypass Link
  - New Construction – 1 x permanent corridor bypass link south
- A new 3-storey clinical building comprising:
  - Ground Level
    - Medical Imaging
    - Emergency Department, including Short Stay Unit

    - A refurbished and expanded Main Entry
  - Level 1
    - Renal Dialysis Unit
    - Ambulatory Care Services
  - Level 2
    - 20 bed CCU/ Cardiovascular/ Stroke Unit
    - 12 bed ICU
    - Cardiovascular Suite
  - Level 3 – Plant Area

- Other associated works
  - Expansion of on grade car parking facilities and improved access and wayfinding.
  - Dedicated ambulance access off Myall Street
  - Amendments to the Cobbora Road roundabout to facilitate entry to the Hospital
  - Demolition of Playmates/Doctors Accommodation
  - Demolition of external component of existing Ambulatory Care Unit
  - Landscaping including tree removal and other public domain works
  - Upgrades of related engineering services infrastructure supporting Stages 4.
- Refurbishment of the two ICU ensuites within the medical inpatient ward (G-ward).

The scope of works for Stage 3 & 4 SSD will include demolition of a number of existing buildings around the campus and construction of a new emergency department and front-of-house building. Additional car parking infrastructure will be provided to service this development.

To collect runoff from the new buildings it will be necessary to install auxiliary stormwater systems which will convey water away from the site. Where possible this will be connected into existing systems and this is discussed in more detail later in the report.

3 Site Description

3.1 Site Topography

The site generally falls from the northeast to the west (rail corridor) and the south (Myall Street). There is a gradual fall of between 1% and 5% through the area of development being the centre and the east of the site, with the zone along the western and southern boundary being much steeper, from 5% up to around 60% (1 in 1.6) near the existing stormwater detention basin.

The levels on site vary between RL281.50 at the highest point (east) and about RL264.75 at the lowest point (west). Currently the main entrance to the hospital is located at RL277.15. The Stage 1 & 2 works were cut into the existing site slope with the main building being excavated about two metres into the hillside.

4 Survey and Geotechnical Investigation

4.1 Site Survey

A survey was undertaken for the previous stages of the project. This survey was used for the design of the Stage 1 and 2 works, and later updated. The survey information is referenced below.

Surveyor Name:	Imrie, Astley & Associates Land & Engineering Surveyors
Surveyor Contact Details:	1st Floor, 64 Talbragar St, Dubbo NSW 2830 (02) 6882 4833
Job No:	15 - 319
Original Survey Date:	29/02/2012 Revised on 13/03/2014 Issued as new project on 12/02/2016
Drawing Numbers:	DWG 15-319 DBH_SHEET 1 Revision 1 DWG 15-319 DBH_SHEET 2 Revision 1 DWG 15-319 DBH_SHEET 3 Revision 1 DWG 15-319 DBH_SHEET 4 Revision 1 DWG 15-319 DBH_SHEET 5 Revision 1 DWG 15-319 DBH_SHEET 6 Revision 1

4.2 Site Geotechnical Investigation

A Geotechnical Investigation was undertaken for Stages 3 & 4 of the development. The geotechnical report information is referenced below.

Geotechnical Name:	Douglas Partners
Geotechnical Contact Details:	96 Hermitage Rd West Ryde NSW 2114 (02) 9809 0666
Project Reference:	72811.03
Report Date:	June 2016

5 Site Geology

The following is an extract derived from the geotechnical report for the site.

The southern portion of the hospital grounds appears to be underlain by typically very stiff to hard residual clayey soils overlying extremely weathered basalt. The soils and weathered rock contain gravels in varying proportions. Basalt often weathers inconsistently such that the depth of stronger rock may vary significantly over short distances.

The northern and western portions of the hospital grounds appear to be underlain by typically very stiff to hard residual clayey soils overlying extremely weathered sandstone. Numerous gravelly layers were also encountered in this soil profile. All soils appear to be moderately to highly plastic and moderately dispersive.

Free groundwater was not observed in any of the boreholes at the time of the field work and is therefore likely to be deeper than 5 m below the ground surface.

6 Stormwater Drainage

6.1 Existing Drainage Infrastructure

6.1.1 Pre Stage 1 & 2

Prior to the development of Stages 1 & 2 on the site the stormwater drainage was divided into three systems:

- Eastern Catchment
- Western Catchment
- Southern Catchment

The eastern catchment was drained by directing stormwater runoff to a series of grated inlet pits with the underground pipes being directed to a main stormwater line running south along the main hospital entry road and connecting to the Council stormwater network at the southeast corner of the site near the main vehicular entry in Myall St.

View from hospital main entrance towards original car park with stormwater pit in foreground

The Council stormwater drainage system is located in Myall St at the south of the site and drains across Myall St towards a series of detention basins and street drainage in Cobbora Rd (Golden Hwy). Additional street drainage is located near the railway corridor at the southwest corner of the site and discharges into the Council stormwater drainage channel on the western side of the railway corridor which drains to the north. Main Council drainage lines are indicated on a markup plan in Appendix A.

The western catchment was drained by directing stormwater runoff to a series of grated inlet pits with the underground pipes being directed to three main stormwater lines running west which discharge to the embankment on the western side of the site adjacent to the railway corridor. Two of the pipes discharge directly towards the existing railway swale or earth channel, with the third, northern pipe discharging into a detention basin in the northwest area of the site. This basin then discharges onto the western embankment of the site and down to the railway swale.

View from Rail Corridor looking South East towards the hospital

View from North West section of the ring road towards the detention basin and rail corridor

View along the Rail Corridor swale with the hospital to the left of the picture

At the time of inspection during the initial phases of the Stage 1 & 2 project, the following characteristics of the railway swale were identified:

- Fall of drainage channel minimal with ponding water observed;
- Significant blockage of the channel at locations due to vegetation growth;
- Culverts appear to be undersized with scouring at base of culverts observed in a number of locations;
- Properties to the west of the drainage channel are lower than the channel so any overflow from the upper edge of the channel will result in discharge onto these properties.

As this drainage channel is part of the Council stormwater system, the maintenance and sizing of this channel is the responsibility of the Council and did not form part of works in Stages 1 & 2.

The southern catchment discharged into the Myall Street Council drainage system.

6.1.2 Post Stage 1 & 2

As part of the design works undertaken during the Stage 1 & 2 project the stormwater drainage for the eastern and western catchments of the site were altered.

The eastern catchment became more impermeable with the increase in car parking extent and the introduction of the Stage 2 building. The increase in impermeable area resulted in an increase in the discharge flows from the catchment and as such meant that the Council had the opportunity to impose their design requirements on any new works installed as part of the Review of Environmental Factors (REF) process.

To attenuate the stormwater runoff flows from the eastern catchment a new on-site detention (OSD) tank was constructed adjacent to the fire hydrant pump house to the left of the main access road. This tank was designed to attenuate the proposed 20 year design flows back to the existing 5 year design flows to meet Council's development control plan requirements. The detention tank discharged runoff into the Council street system draining to Cobbora Rd, but Council has previously expressed some concern about the available capacity in this system, and would be unlikely to permit additional future flows into this same system (refer to plan in Appendix A).

Detention Tank during construction

The total extent of the western catchment decreased following development of Stage 1 & 2. However, the paved northern section of the ring road meant that the runoff flows would increase in the northern region of the catchment. To ensure that the discharge attenuation was maintained, the existing detention basin in the north western slope was upgraded to allow for the increased volumetric requirement.

Detention Basin on Western Catchment

At present there are five existing drainage catchments directed to separate pipe outlet locations (including two detention storages). Proposed catchment modifications to these existing catchments are indicated in Appendix B.

6.2 Impact of Stage 3 & 4 REF Works on Existing Stormwater Drainage Network

The impact of Stage 3 & 4 REF works on the existing stormwater drainage network was largely minimal as the works predominantly involved vertical expansion of an existing building which was already served by stormwater drainage installed as part of Stage 1 & 2 works. As such, the modifications required were limited to connecting new downpipes to the existing above ground downpipes or underground stormwater pipes as necessary. The overall drainage regime was not intended to be significantly altered, and the drainage modification works were not associated with the necessity for any substantial stormwater amplification works.

6.3 *Impact of Stage 3 & 4 SSD Works on Existing Stormwater Drainage Network*

The works involved with Stage 3 & 4 SSD will require demolition of several existing hospital buildings to make space for new buildings. It is anticipated that the demolition works will also involve grubbing out the existing stormwater infrastructure serving these buildings as well as in areas to be occupied by future development. Proposed infrastructure will be required to service the new building development and ensure continuity of stormwater drainage to affected upstream areas.

In association with the catchment modifications indicated in Appendix B, the existing 675mm pipe connection from the existing detention tank is to be maintained as an overflow pipe instead of serving as a primary drainage line. New detention storage is to be introduced in association with earthworks near the Myall Street frontage, with restricted pipe flows being directed in a westerly direction to a new stormwater main extension along Myall Street. This is consistent with Council's previously expressed concerns regarding the available limited capacity of the Cobbora Rd drainage system. It is noted that additional impervious catchment areas are to be created by the proposed carparks and that the shallow existing pipe and underground flow capacity in Myall Street corresponds to a considerable detention storage volume due to a low permissible discharge capacity. The proposed detention volume is 300m3 and is calculated to be adequate to reduce proposed 20 year storm runoff down to existing 5 year storm runoff values in accordance with Dubbo City Council Development Control Plan 2013, and is also consistent with detention strategies for commercial or industrial developments.

In the event that future additional areas of new car parking are required in the southwest areas of the hospital site, dedicated drainage servicing these new areas will also be required. This is anticipated to include new underground stormwater pipes, drainage downpipes, gullies and kerb inlet pits as well as a new connection to the Myall Street drainage line.

A proposed staging plan and architectural external layout of the intended Stage 3 & 4 SSD works are included in Appendices C and D.

The proposed stormwater concept drawings are included in Appendix H.

Construction of new roads and car parks will entail approximately 1,800 m^3 of cut (including topsoil stripping); 1,600 m^3 of fill and 2,300 m^3 of pavement material (for 4,800 m^2 of car parks and 3,300 m^2 of roads). Some of the topsoil may be suitable for reuse in new landscape areas and some excavated material may be suitable for reuse in general fill areas.

6.4 *Flooding Impact*

As part of the Stage 1 & 2 works an assessment into the impact of flooding on the site was undertaken. Reference was made to the Dubbo City Council Flood Prone Areas Report G2.2, with the results summarised in the table below.

Location	FSRL (1 in 100 Year Flood)	FPL (1 in 100 year flood + 500mm)	PMF
Erskine Street	262.30m	262.80m	266.00m
River Street	262.00m	262.50m	265.70m

Flood Levels in the Vicinity of the Site

FSRL: Flood Study Reduced Level

FPL: Flood Planning Level

PMF: Probable Maximum Flood

The lowest ground level obtained from the site survey indicates that at the northwest corner of the site the existing site levels are at approximately RL264.75. This indicates that this corner of the site will be flood affected during an extreme PMF flood event. However, the proposed development of the site will occur at a considerably higher level as the site falls considerably to the west of the site.

The levels on the site in the areas where development is proposed are in the vicinity of RL275.00 which is at least nine metres above the PMF levels associated with the site. Council's Local Environmental Plan (LEP) 2011 includes flood planning maps which appear to adopt 100 year flood levels as the standard for floor level protection purposes, rather than the more severe PMF event. Extracts from the LEP maps are included in Appendix E.

No works are proposed in the areas of the site which could be potentially affected by the flood plain and as such, provided the discharge flows from the development are not increased, no adverse effects will be caused by the development on the existing flood levels upstream or downstream from the site.

6.5 *Integrated Water Cycle Management relating to Site Stormwater*

Based on the Hydraulic and Fire Services Master Plan Report prepared by Northrop Consulting Engineers (Ref: 141235) dated 27.11.14, potable water is provided to the existing hospital site via three water mains located in adjacent roadways, and two sewer mains currently serve the sanitary drainage system. It is also noted that no rainwater tank storage is proposed in Stage 3 & 4 SSD works, following directions from NSW Health's Expert Reference Group. Prior to development works, stormwater runoff typically drains into and across existing pervious surfaces, but this natural infiltration process is altered when new impervious roads, paths and roof areas are constructed, intercepting rainfall and directing it into formal drainage systems such as pipes and street gutters. The desirable management of this water movement typically aims to

- maintain natural runoff and soil infiltration in landscaped areas wherever possible, and where structures are not adversely impacted by subsurface flows
- reduce the environmental impact of concentrated flows generated from impervious areas by
  - a) capturing pollutants conveyed from those areas
  - b) conserving water usage within buildings by installing water efficient fixtures and fittings
  - c) reducing peak discharge with detention storage (draining a lower flow over a longer period)
  - d) harvesting rainwater where storage space is available and practical, but this may entail electrical loading for a pump system to ensure adequate flow and pressure is available
  - e) recycling water where practical, noting that treatment or filtration can be cost prohibitive, particularly where potable supplies of good quality are already available

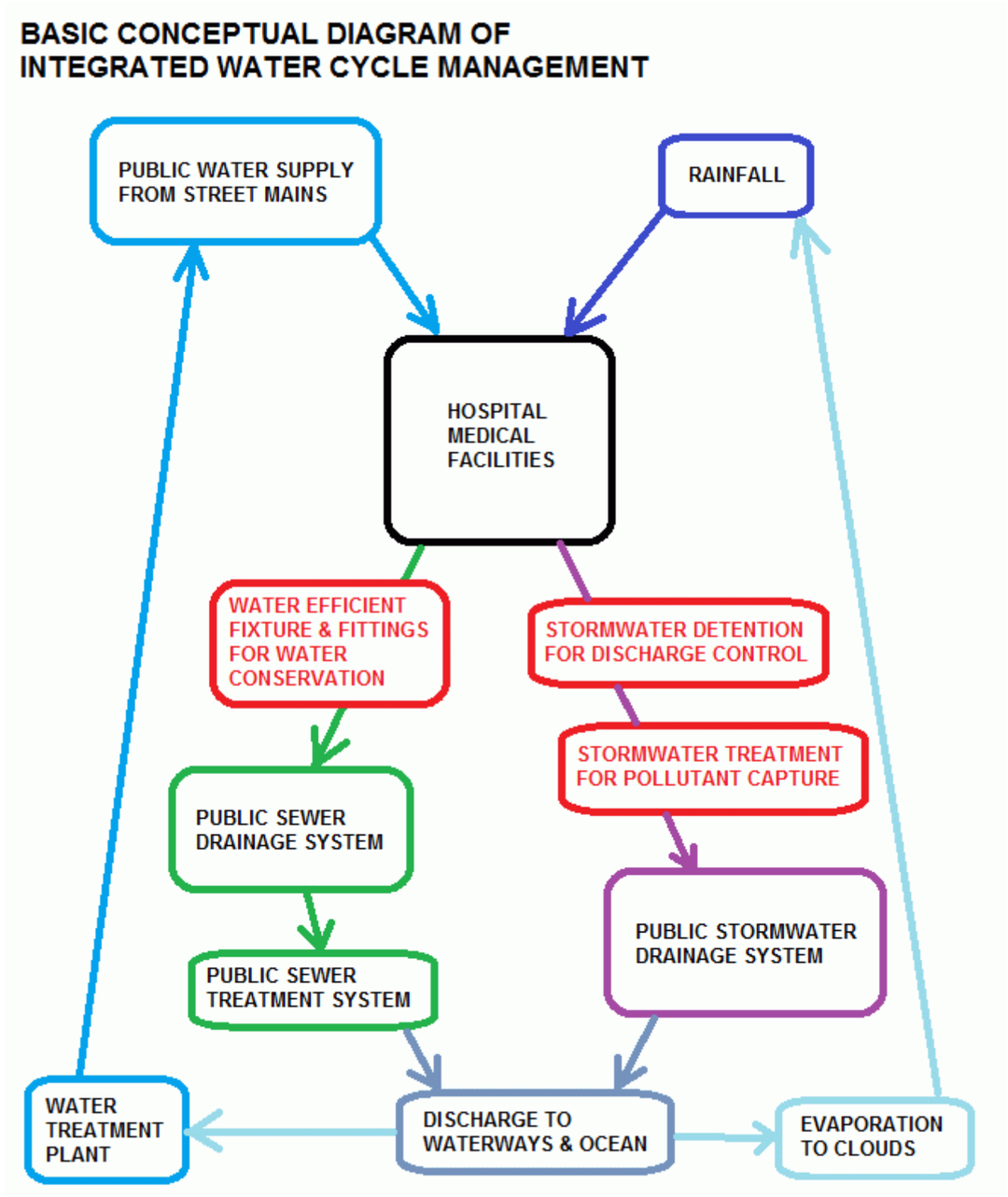
For the Stage 3 & 4 SSD integrated water cycle management plan, reference should be made to the Ecologically Sustainable Design (ESD) report or Environmental Impact Statement (EIS), as applicable. In relation to the site stormwater management proposal, the following measures are intended to be undertaken:

i) Proposed stormwater treatment device to capture pollutants such as oil & grease from carparks

ii) Proposed fixture tapware to be selected in accordance with Water Efficiency Labelling & Standards (WELS) scheme to minimise water usage

iii) Proposed stormwater detention storage with restrictive orifice control to reduce peak discharge from site

This conceptual arrangement is shown diagrammatically as follows.



6.6 *Water Quality Impact*

It is understood that no existing stormwater pollution control devices have been installed on the main pipe systems draining the hospital site during previous stages of construction. Correspondence issued by the Western Plains Regional Council on 12th July 2016 indicates that the stormwater management proposal should address water quality issues related to carpark discharge and gross pollutants conveyed by stormwater runoff. The potential for sediment laden flows exists during temporary construction works associated with demolition and earthmoving equipment, as well as the continuing operation of the medical facility following the completion of construction.

Concentrated stormwater flows have a tendency to cause the erosion of soil, particularly where ground disturbance has occurred and where landscaping no longer provides stability or protection at the ground surface. The excessive accumulation of soil in constricted or depressed areas can result in undesirable sediments and the overflow of dirt particles onto adjacent paths and roadways. During construction works the control of potential erosion and sediment problems is typically addressed by temporary sediment fencing and locally excavated basins, and the proposed arrangement of these measures is included in the erosion and sediment control plans (Refer to Appendix G). A staging sequence is also intended to maintain vehicular access beside construction areas, particularly where critical access to the ambulance bay is needed. Where the site area of disturbance exceeds 2500m2 the layout can also be referenced as a soil and water management plan, which addresses the anticipated movement of soil and water across the site works and seeks to contain sediment within the development to avoid soil deposits on the adjacent public roadways or pedestrian paths.

Various types of contaminants have the potential to be collected in the stormwater drainage and detention system. Gross pollutants comprise larger pollutant items such as litter, plastic bags, drink cans and cigarette butts. Sediments can range from coarse grained particles down to fine grained particles which only tend to settle when stormwater velocity is reduced and where the path of flow allows time for sediment to be captured. Oils and grease from vehicular traffic in driveway and carparks are included in a range of substances called petroleum hydrocarbons and these often float rather than sinking to the bottom of a treatment device. A circular settling tank configuration is commonly adopted for stormwater treatment purposes and it is proposed that a proprietary device such as a Humeceptor will be installed to capture sediment and hydrocarbons from site discharge flows. An additional galvanised steel debris screen is to be installed at the outlet from the detention tank, together with a local silt trap at the base of the tank slab.

Both the temporary sediment control and permanent stormwater treatment measures will serve to improved the quality of untreated runoff currently discharging from the site and are considered to be consistent with the objectives of minimising impact on receiving waters.

The conceptual arrangement of a Humeceptor unit is shown diagrammatically as follows.

System operation

The HumeCeptor® stormwater treatment system slows incoming stormwater to create a non-turbulent treatment environment, allowing free oils and debris to rise and sediment to settle. Each HumeCeptor® system maintains continuous positive treatment of TSS, regardless of flow rate, treating a wide range of particle sizes, as well as free oils, heavy metals and nutrients that attach to fine sediment.

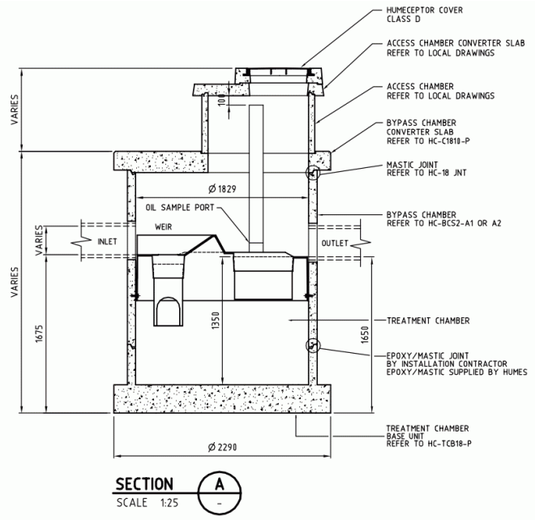
The HumeCeptor® system's patented scour prevention technology ensures pollutants are captured and contained during all rainfall events.

Figure 1 – HumeCeptor® system operation during design flow conditions

Table 1 – HumeCeptor® system performance summary

Pollutant	Average removal efficiency	Details
TSS	80%	Laboratory and field results, stable, hardstand, roads, commercial and industrial sites
TN	53%	Field results
TP	37%	Field results
Chromium	44%	Field results
Copper	29%	Field results
TPH	65%	<10 ppm inflow concentration
	95%	10 ppm - 50 ppm inflow concentration (typical stormwater)
	99%	>500 ppm inflow concentration (emergency spills)

GOOD CAPTURE PERFORMANCE FOR TOTAL PETROLEUM HYDROCARBONS (OIL, GREASE FROM CARPARKS)

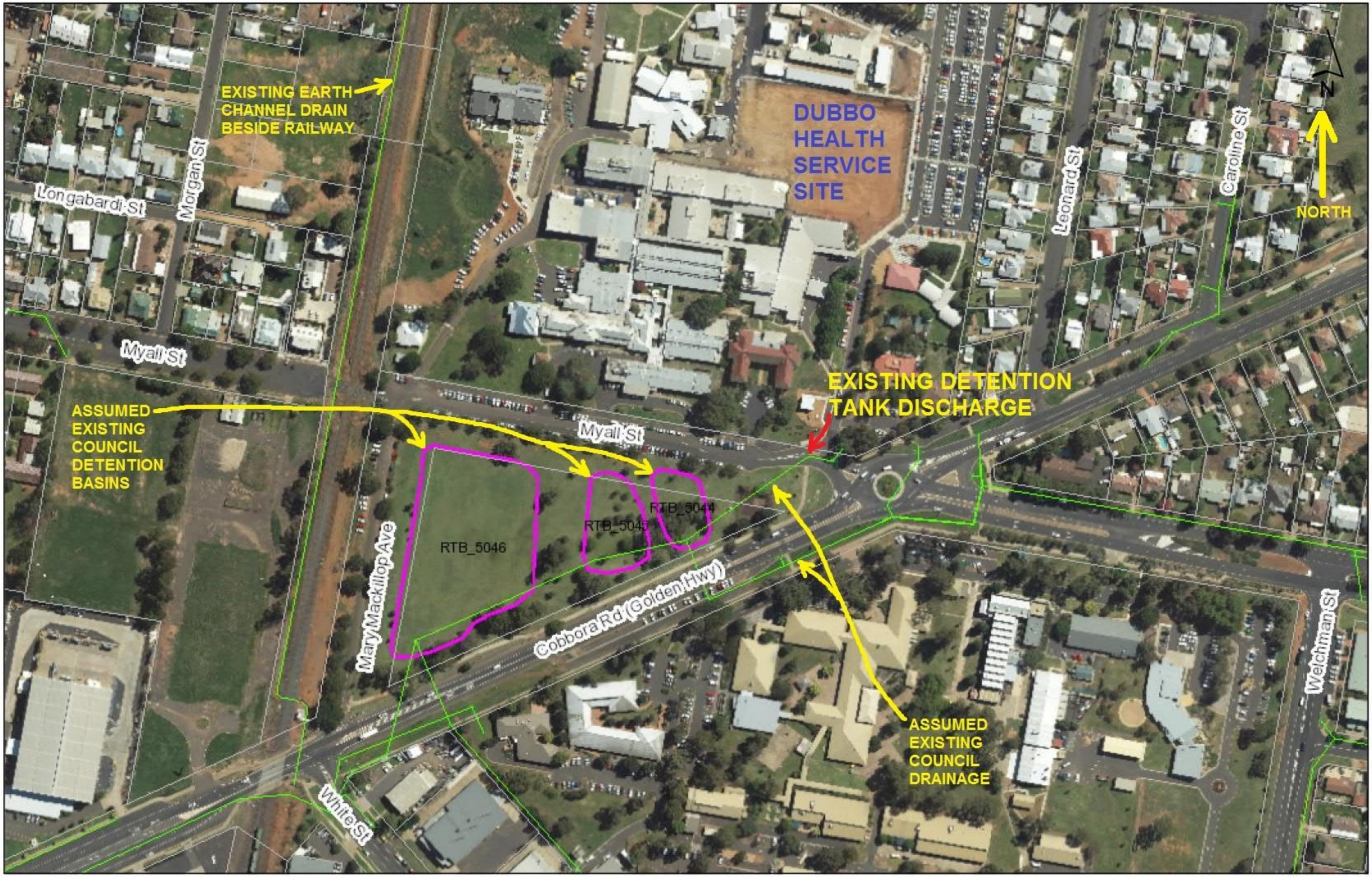


Pollutant Capture:

The Dubbo Council Development Control Plan 2013 does not specify particular pollutant target performance values to be achieved, but indicates that litter from carpark and hardstand areas should be intercepted. To comply with this requirement, the following devices are proposed:

A galvanised steel debris screen fitted over the proposed detention tank outlet will collect large gross pollutants (e.g. plastic bottles, aluminium cans, twigs) using Weldlok A40/203 grating with nominal 100mm x 40mm openings. Smaller gross pollutants (e.g. cigarette butts, plastic bags) will be captured by the Humeceptor settling tank. Finer particles in total suspended solids (TSS) can be captured with 80% removal efficiency. Nutrients such as total nitrogen (TN) and total phosphorus (TP) can be captured with 53% and 37% removal efficiency respectively. Metals such as chromium and copper can be captured with 44% and 29% removal efficiency respectively. Total petroleum hydrocarbons (TPH) can be captured with various inflow concentrations (or parts per million) with up to 99% efficiency, which is particularly beneficial for carpark or roadway surfaces.

APPENDIX A
EXISTING COUNCIL DRAINAGE



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0 40 80 160 240 320

Meters

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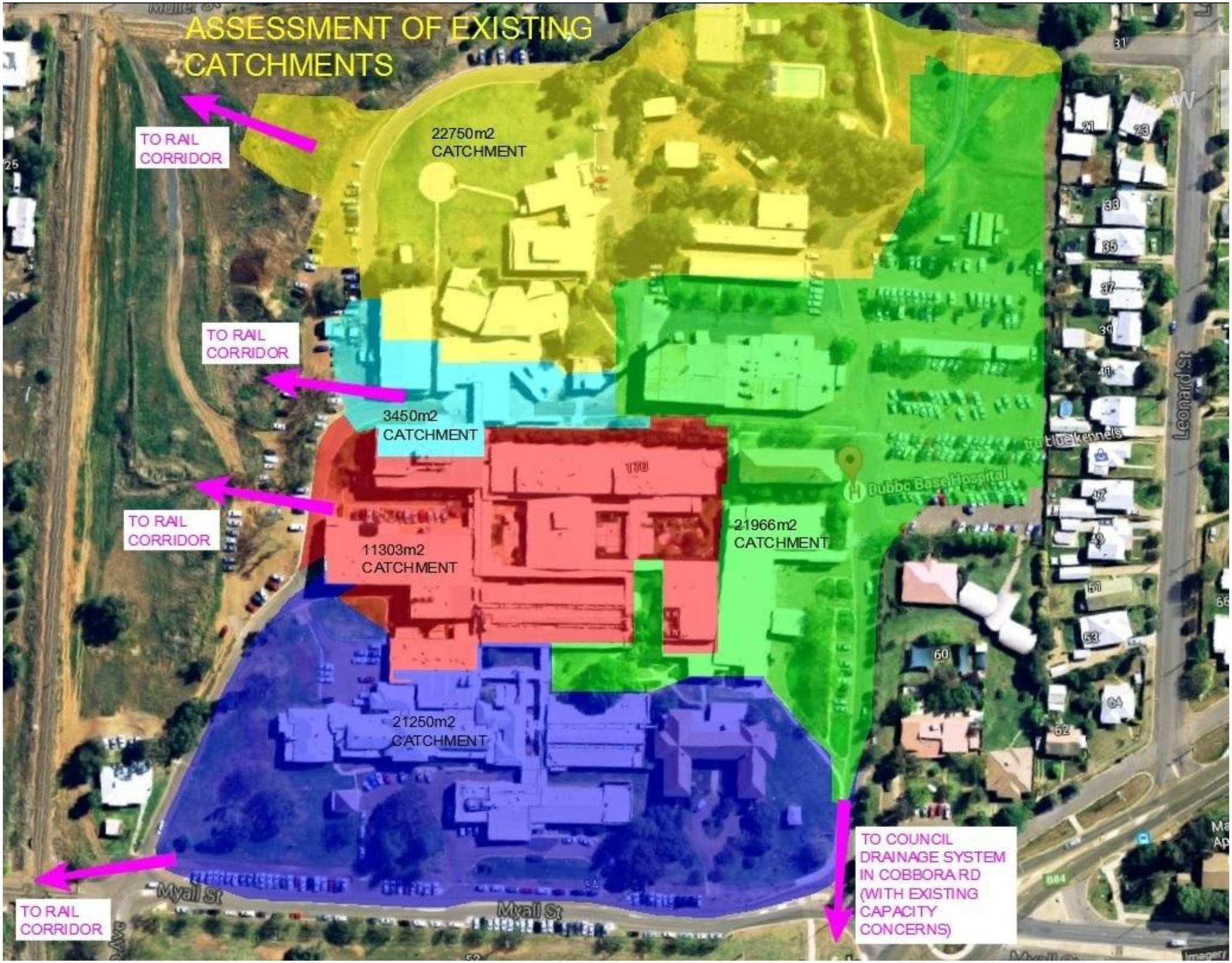
Friday, July 1, 2016

APPENDIX B
EXISTING & PROPOSED DRAINAGE CATCHMENTS

ASSESSMENT OF EXISTING CATCHMENTS



ASSESSMENT OF PROPOSED CATCHMENTS

TO RAIL CORRIDOR

22750m2 CATCHMENT

TO RAIL CORRIDOR

3450m2 CATCHMENT

TO RAIL CORRIDOR

9080m2 CATCHMENT

36143m2 CATCHMENT

15389m2 CATCHMENT

TO RAIL CORRIDOR

TO MYALL ST DRAINAGE & RAIL CORRIDOR

Myall St

Leonard St

Dubbo Base Hospital

APPENDIX C
PROPOSED BUILDING STAGING PLAN