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## HYDRAULIC SERVICES CONCEPT REPORT

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### CENTRAL WEST REGIONAL ROAD / RAIL FREIGHT TERMINAL GREAT WESTERN HIGHWAY, BATHURST

#### Issue C

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**Client**  
SLOBOBAX P/L  
P.O Box 215  
TOONGABBIE NSW 2146

**Architect**  
Mellor Gray  
Suite 2, 142 Spit Road  
MOSMAN NSW 2088

T +61 02 9968 4788  
F +61 02 9968 4741

**Whipps-Wood Consulting**  
Lower Ground, 48 Alfred Street  
MILSONS POINT  
PO Box 558, Milsons Point  
NSW 1565

T +61 02 8923 8444  
F +61 02 8923 8484  
ABN 11 077 989 158

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P1	22/06/05	Preliminary Issue
P2	29/06/05	Preliminary Issue
A	05/07/05	Final
B	29/07/05	Overland flow assessment added
C	12/21/05	Revised Concept Report

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## **1 PURPOSE OF REPORT**

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This report has been prepared by Whipps-Wood Consulting on behalf of SLOBOBAX for the proposed Central West Regional Road/Rail Freight Centre.

The purpose of the report is to describe the in principle arrangements only related to the hydraulic services for the inclusion with the Concept submission for the aforementioned project. This report does not address issues associated with watercourse rehabilitation, riparian zones or vegetation management.

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## **2 SITE DESCRIPTION AND EXISTING SERVICES / FEATURES**

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It is proposed to develop a 30 hectare Greenfield site on the eastern approach to the Bathurst City Centre. The site is bounded on the Northern boundary by the Great Western Highway and the Southern boundary by the Great Western Railway.

In relation to topographical features an existing un-named watercourse dissects the site. The watercourse enters the site on the southeastern boundary and extends through to a mid point on the northern boundary

In addition, a drainage "ditch" is located on the northern boundary. The "ditch" extends from the northwestern boundary and intersects with the aforementioned un-named watercourse. At the point of intersection the un-named watercourse continues in a westerly direction then turns north and drains via a series of culverts beneath the Great Western Highway.

We have been advised by Bathurst City Council (BCC) and RTA officers that an easement (Road Reserve) for the Great Western Highway extends along the centre line of the drainage "ditch". The width of the easement has been based on an expected future duplication of the highway.

The following clauses identify the authorities services within the vicinity of the site.

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### **2.1 SEWER DRAINAGE**

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Two sewers traverse the site, one of which is a 375mm carrier main from the adjacent Raglan Industrial precinct. The other is a 150mm house service line, which services the adjoining property to the east of the subject site.

- **375mm Sewer Main**

A BCC sewer main is indicated on the survey drawings and essentially follows the route of the un-named watercourse. The main crosses the Great Western Highway adjacent to Ashworth Street then extends along the northern side of the highway toward the Bathurst City Centre.

BCC has advised that they do not permit the construction of structures over carrier mains. However, they will permit the construction of a hardstand surface over the main.

Should the sewer be located below a hardstand surface then a 2m wide section of concrete slab should be laid over the centre line of the sewer main, which is separate from the remainder of the slab, this enables BCC to remove the strip of concrete at a later date should maintenance be required. Should it be necessary to divert the sewer then council will require a detailed design and calculations.

In addition to the above BCC will require that a registered easement be created over the sewer main in favour of BCC.

- **150mm House Service line**

As noted above a 150mm house service line serves the adjoining property, which we are advised, is laid within an easement. Should it be necessary to divert the sewer line then the existing easement should be extinguished, following the consent of the adjoining property owners. Once this is complete a new easement should be registered over the route of the relocated sewer.

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## **2.2 WATER SERVICE**

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A BCC Carrier Water Main is located between the boundary of the subject property and the Great Western Highway. Council are unable to provide any details of flows or pressures in the main, however, pressure taken from a section of main located at the northern end of Ashworth Street indicated a reasonable flow and pressure.

In reviewing the project requirements it is recommended that allowance should be made for;

1. Potable water pumps
2. Fire hydrant storage tanks and pumps
3. Fire sprinkler storage tanks and pumps

The tank sizes are dependant upon the final calculated flows for the fire hydrant and sprinkler systems. A **preliminary** assessment of the water storage requirement for the site indicates:

- That for the fire hydrant service 2 x 150,000 litre tanks (effective storage) will be necessary.
- That for the fire sprinkler service 2 x 250,000 litres tanks (effective storage) will be necessary.

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## **2.3 GAS SERVICE**

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A gas main is located within the Great Western Highway and does not, on the information available, traverse or impede the proposed site.

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## **3 ITEMS OF SIGNIFICANCE**

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### **3.1 AUTHORITIES REQUIREMENTS**

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The most significant item in relation to the Hydraulic Services is the need to develop the project with due regards to the existing topographical features namely the un-named watercourse and to a lesser extent the aforementioned drainage "ditch".

Following consultations with the BCC it was deemed that the Department of Infrastructure, Natural Resources and Planning (DIPNR) would be the pre-eminent authority in relation to issues associated with development adjacent to the existing water courses and treatment of stormwater collected on site.

Following consultations with DIPNR officers a number of key issues were defined as being critical. The following outlines how each of these issues is to be addressed as part of the Concept submission.

## DIPNR Guidelines for Watercourse and Riparian Zone Planning and Design:

1. *Maintain or restore natural watercourse and riparian zone functions, being: natural stability for conveying flows, ecological interactions that benefit water quality, habitat provision (living and dead vegetation, litter layer, logs, topsoil, surface features), natural surface and sub-surface flows (seasonality, magnitude, duration, frequency, variability, rates of change, spatial extent, levels), lateral and longitudinal connectivity and other ecological interactions.*

In response to the specific issue related to the maintenance of the existing watercourse. It is proposed that the existing un-named watercourse remain predominately intact with the exception of a section of the watercourse, which extends along the northern boundary.

The current development scheme indicates that the section of watercourse along the northern boundary be conveyed through culverts, of sufficient capacity to maintain the stormwater flows and integrity of the watercourse. It is deemed necessary to construct the culverts in lieu of maintaining the watercourse line due to concerns related to safety. In consultations with the RTA it was noted that the Great Western Highway has been identified in future capital works for duplication. Once duplication is complete the edge of the road reserve would extend into the watercourse line, which would appear to be unacceptable.

With reference to the above it is also proposed that a section of drainage “ditch” also located on the Northern Boundary be reconstructed with Culverts to accommodate the concerns noted above and the proposed deceleration lane.

2. *Retain existing natural watercourse and riparian zone morphological features such as pools, riffles, channel form, benches, bars, meanders, floodplains, back-swamps, flood runners and bed and bank slopes.*

As previously noted it is proposed that the un-named watercourse, being the natural watercourse be substantially retained. This report does not identify landscape or vegetation proposals

3. *Watercourses must be able to convey flows based on roughness coefficients that mimic the ‘natural’ state – for most watercourses this will be a fully structured riparian forest vegetation scenario.*

The above item is noted and is to be adopted as part of the detailed design process

4. *Locate water quality controls and stormwater detention ponds out of watercourses and the riparian zone. Outlet structures are to be designed and constructed in accordance with the guideline *Stormwater Outlet Structures to Streams (for pipes, culverts, drains and spillways – Version 1)**

The above item is noted and is to be adopted as part of the detailed design process. The current development proposal locates the water quality ponds in accordance with the above criteria.

5. *Watercourses are to remain as natural open systems. Under no circumstances should they be degraded by piping, culverting, Channelising, pile or concrete walling or other inappropriate means.*

Where possible the above criterion has been included in the development proposal. However, as previously noted in certain situations as detailed it has not been possible. Where it is proposed to construct culverts in lieu of the watercourses the following DIPNR criterion is to be adopted:

- Outlet structure not to protrude beyond the stream bank and to align evenly with the bank
- Outlet structure to be located at the invert level of stream and to point downstream
- Avoid use of concrete headwalls – pipes/culverts to rest on, and to be packed in by, rip-rap
- Scour apron to be rip-rap and a cut off provided; flanks to be rip-rap and keyed in
- Stockpipe excavated litter layer, topsoil and subsoil separately for site rehabilitation

- Culverts must be able to convey flows based on roughness coefficients that mimic the 'natural' state

6. Avoid filling floodplains and so avoid increasing channel flow velocities and hence scour potential.

The development proposal indicates significant site works. However, to avoid increased flow velocities and scour potential, it has been proposed that stormwater be collected into a series of three ponds located around the site. The purpose of the ponds is to manage water quality and outflow.

In order to reflect predevelopment flows to the existing watercourse the following criteria has been used.

Assume a storage rate of 320 m<sup>3</sup>/ha with an outflow based on a 1 in 5 year pre-developed outflow.

<b>Preliminary calculation of stormwater detention requirements</b>			
<b>Site Area ha</b>	<b>Storage m<sup>3</sup>/ha</b>	<b>Total m<sup>3</sup></b>	
30	320	9600	
<b>Pond Dimensions</b>			
<b>No</b>	<b>Surface Area m<sup>2</sup></b>	<b>Max Depth m</b>	<b>Assumed Volume m<sup>3</sup></b>
1	3770	3	5655
2	1640	3	2460
3	1983	3	2974.5
<b>Total</b>			<b>11089.5 m<sup>3</sup></b>

The above estimations are approximate only, but form the basis of the proposed design to accommodate the DIPNR requirements.

In relation to potential scour at the connection point to the watercourse it is proposed to adopt the DIPNR scour protection guidelines as noted in item 8, following.

7. Maintain natural hydrological regimes
- Accommodate site hydrological conditions
  - Do not alter natural bank or floodplain flows
  - Do not increase water levels upstream
  - Do not increase velocities by constricting flows
  - Consider likelihood and location of structure overtopping, and use the least scour-producing option
  - Use a Manning's 'n' roughness value based on fully structured vegetation for the entire riparian zone

The response to this item is answered as part of the response to item 6 above.

8. Protect against scour
- Avoid damage to riparian vegetation and the need for extensive scour controls beneath the structure
  - If scour protection is necessary, use rip-rap consisting of hard and durable run-of-quarry rock, sized to resist predicted shear stresses. Rock must be angular and blocky and not flat, and placed over a bedding layer of angular cobbles, with geotextile underneath. Finished surfaces are to be evenly aligned with adjoining bed, bank and floodplain

profiles, and the flow capacity of the watercourses must not be restricted. All rock and cobbles are to be packed with topsoil, and crevasses planted with local native groundcover species, to further stabilize the works and to increase riparian zone values and functions.

- Mesh structures (mattresses and baskets), concrete, spray concrete, concrete grouting, crib walling, masonry, car tyres and the like should not be used as scour protection in watercourses

The above item is noted and is to be adopted as part of the detailed design process.

In addition to DIPNR, requirements of the Australian Rail Track Corporation (ARTC) are also relevant due to the proposed extension of a spur line from the Great Western Railway into the site.

The principle concern of the ARTC is as follows

All Stormwater should be directed away from the rail corridor

As previously mentioned the purpose of this report is to provide the principles, which will form the basis of the future detailed design. However, the diversion of stormwater from the rail corridor has been reviewed and the location of the proposed water quality ponds have been strategically positioned to accommodate the collection of stormwater from the areas adjacent to the rail corridor. In addition it is proposed that the hardstand areas grade at 1% away from the corridor.

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### **3.2 FLOOD MANAGEMENT**

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The Technical Services Section of Bathurst City Council confirmed that they have previously undertaken a 1:100 year flood study of the site.

Mr Wayne Sartori, from the technical services section confirmed that the site does not have a history of flooding from the un-named watercourse, and is not affected by flooding from the Macquarie River.

As stated in Councils original 1:100 year assessment, the upstream flow entering the site at the creek bed approximates 38 cubic metres per second (38,000 l/sec) and the downstream flow at the Great Western Highway boundary of the un-named watercourse bed approximates 40 cubic metres per second (40,000 l/sec).

The general fall across the site, along the line of the watercourse bed, varies, but averages 1.49% from southeast to north west.

The side walls of the un-named watercourse vary in fall between 10% and 4% generally, which equates to an average 1:100 year flood water depth of 690mm. (672-690mm upstream and 707-850mm downstream)

Floor levels of buildings, should generally be set at least 500mm above these levels, in relation to the fall of the un-named watercourse from southeast to northwest.

The above mentioned information is of a preliminary nature only, and is required to be substantiated by independent flood studies during the course of the construction certificate design process.

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### **3.3 RAINWATER HARVESTING**

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Due to the large roof areas proposed for the development it is envisaged that rainwater harvesting from roof areas be adopted as an integral part of the project. At this stage it is

assumed that rainwater would be used for irrigation and toilet flushing. Other uses for the collected water are yet to be fully assessed.

In principle it is proposed that the rainwater harvesting system consist of three separate collection facilities as follows;

- 1 million litre storage tank located adjacent to the main warehouses
- 300,000 litres of storage located adjacent to each of the highway uses/light industry precincts

In addition to the above water collected in the water quality ponds may also be utilized for irrigation purposes during the early stages of the project to assist with the establishment of the proposed revegetated areas.

A potable water connection will be provided to the rainwater harvesting tanks to enable top up during low rainfall periods, to ensure continuous supply

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### **3.4 WATER QUALITY**

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As noted in the DIPNR requirements the control of the water quality discharge to the existing watercourse is particularly important. To accommodate this requirement it is proposed that three ponds be created through the site, as previously noted. The purpose of the ponds is to manage water quality and outflow.

In relation to the specific item of water quality. The proposed development consists of considerable hardstand areas, which will generate significant stormwater flows. To accommodate the range of flows collecting into the ponds it is proposed that the following strategies be adopted.

- Establish water quality ponds designed to include Shoreline emergents, Deepwater emergents and submerged macrophytes.
- Install stormwater pollution devices and or gross pollutants traps at strategic locations on the stormwater drainage system to accommodate low flows. Higher flows would by-pass the devices and or traps and continue through to the water quality ponds.

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## **4 SUMMARY**

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The following is a summary of the proposed hydraulic design for the development.

1. It is proposed that the existing watercourses on site be substantially retained apart from a section of the un-named watercourse and a drainage ditch, which extends along the northern boundary adjacent to the Great Western Highway.

It is proposed that the section of un-named watercourse and the drainage ditch adjacent to the Great Western Highway be enclosed and replaced with culverts of sufficient size and capacity to accommodate the anticipated flows and mimic the state of nature all as required by DIPNR.

2. It is proposed that rainwater from roof areas be collected and used for toilet flushing, irrigation and any other usage as required on site. The rainwater collection system would consist of 1.6 million litres of storage over three collection areas.
3. Stormwater and overflow from the rainwater collection tanks is to be collected into a series of water quality ponds, which connect directly to the existing watercourses.

The ponds will be designed to restrict outflows to the watercourse and mimic the pre-developed flows. In addition, the ponds will incorporate water quality measures to control



the quality of discharge from the site. It is further proposed that stormwater pollution devices and or gross pollutants traps be installed along the route of the drainage system to assist with water quality in low flow situations.

The rail corridor is to be protected from stormwater flows grading hardstand areas away for the corridor and strategically locating storm water collection points.

4. It is proposed that water storage tanks be provided on site to accommodate the anticipated fire sprinkler and fire hydrant flow requirements. In principle it is proposed to provide 500,000 litres of storage for the fire sprinkler service and 300,000 litres for fire hydrant service. In addition it is also anticipated that domestic water pumps will be required.
5. The authorities sewer, gas and water mains have all be located around the site.

Two sewers traverse the site and it is proposed that these sewers be diverted, as necessary to accommodate the development.

In conclusion this report describes the in principle hydraulic design for the proposed development and has been prepared as a basis for the future detailed design. The design principles have been based on discussions with the various authority stakeholders and a review of the individual authority requirements.