Appendix 15
Advice - Integrated Water Cycle Strategy

J Wyndham Prince

June 2008

Warner Industrial Park Concept Plan and Project Application

Precinct 14 WEZ

Sparks Rd and Hue Hue Rd
Warnervale
June 2008

80
TERRACE
TOWER
GROUP

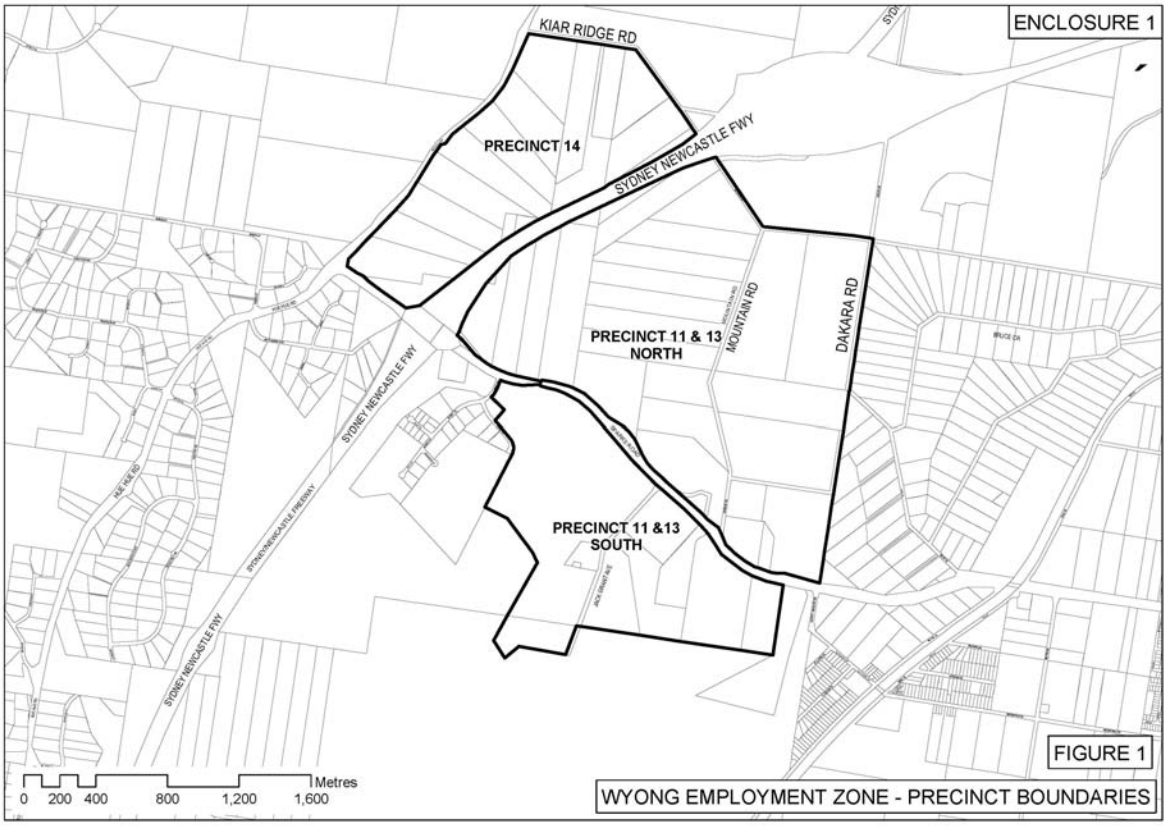
Warner Business Park Pty Ltd
Part of the Terrace Tower Group

Peter Andrews + Associates Pty Ltd
architecture planning urban design

Precinct 14 Wyong Employment Zone

Stormwater Management Strategy

Information on Porters Creek Hydrologic Indices



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Client: Warner Business Park Pty Ltd

Report By J. Wyndham Prince Pty Ltd
77 Union Road, Penrith NSW 2750
Tel (02) 4720 3300
Fax (02) 4721 7638

J.WYNDHAM PRINCE
CIVIL ENGINEERS & PROJECT MANAGERS

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1 INTRODUCTION

This report is intended to be read in conjunction with: *"Integrated Water Cycle Management Strategy Wyong Employment Zone (WEZ)" Ecological Engineering November, 2006; "Environmental Assessment – Warner Industrial Park" Peter Andrews + Associates June, 2008;* and *"Proposed Integrated Water Cycle Management Strategy Precinct 14 Wyong Employment Zone" J. Wyndham Prince 10 June, 2008* (copy attached).

Ecological Engineering Pty Ltd prepared a *"Modelling Rationale for the Porters Creek Stormwater Harvesting Strategy"* (May 2006) for Wyong Shire Council (WSC). This strategy aimed at protecting Porters Creek Wetland from the major threat of increased runoff generated from development in the catchment. (p.1) It formed the reference document for the *"Integrated Water Cycle Management Strategy: Wyong Employment Zone (WEZ)"* (November 2006) by Ecological Engineering (Eco Eng), which can be downloaded from the Department of Planning's website as it has been exhibited as part of the Wyong Employment Zone State Significant Site Application by Wyong Shire Council (http://www.planning.nsw.gov.au/assessingdev/wez.asp)

2 IWCMS SPECIFIC TO THE WEZ

A summary of each of the Integrated Water Cycle Management Strategy (IWCMS) elements for the WEZ follows. The page references in brackets refer to the particular pages within Chapter 5 (Eco Eng).

- Demand management (p.70) – Water efficient appliances within each building;
- Rainwater tanks (p.70) – Non-potable uses, sized at 65% of the non-potable demand;
- Structural Separation (p.75) – Disconnection of work areas from the stormwater system;
- Allotment Landscape Irrigation (p. 70) – 25% of allotment designated for tank water irrigation;
- Vegetated Swales (p.78) – For stormwater conveyance from hardstand areas to water treatment systems (e.g. constructed wetlands).
- Constructed Wetlands (p.79) – Water quality treatment of stormwater runoff will be mostly achieved through constructed wetland systems sized at 4% of the catchment area;
- Stormwater storage p.86) – Following treatment, stormwater will be temporarily stored (20 mm / catchment ha) within each Precinct of the WEZ to achieve the hydrologic objectives;
- 'Brickpits' Wetland & Storage (p.102) – Provide a central collection point for pumped flows from the temporary Precinct storages before delivery to the Link Road Pipeline;
- Link Road Pipeline (p.113) – Provides the mechanism by which stormwater, in excess of that required to preserve the hydrologic characteristics of Porters Creek Wetland, is delivered directly to the Wyong River where it will supplement the Gosford-Wyong potable water supply by 5 – 7 GL/year on average.
- Stream Disturbance Management (p.119) – Retardation of the 3-mth and 1.5-yr ARI flows into Buttonderry Creek.

These elements have been identified as the Key Components of the WEZ IWCMS within the *"Wyong Employment Zone – Draft Development Control Plan No. 88"* prepared by Wyong Shire Council and exhibited in 2008 (DCP).

3 ALTERNATIVE IWCMS PROPOSED FOR PRECINCT 14 OF THE WEZ

Implementation of the IWCMS as proposed by WSC is dependent on the acquisition of the Brickpits Storage and construction of the Link Road pipeline. Wyong Shire Council has provided an Interim Strategy (p.57 DCP and Chapter 6 Eco Eng) that provides for some development to proceed in the event that the construction of the Brickpits Regional Storage is delayed. This Interim Strategy requires that Upland Catchment (Precinct 14) which requires that for every hectare of land developed, 1 ha of land would have to be set aside as a Designated Irrigation Zone. However this is subject to the soils in the upland catchment having a *"saturated hydraulic conductivity of >3.6 mm/hr"* (p.74 Eco Eng).

Both the Link Road Pipeline and the Brickpits Regional Storage are not envisaged in the near future, and an Alternative Scheme, based on the technical aspects of each of the IWCMS elements, has been investigated. The Alternative Scheme proposes the use of the Precinct based storages to store the surplus treated stormwater prior to pumping directly to the Wyong River via a pipeline along Hue Hue Road, instead of the storing the surplus treated stormwater in the Brickpits Regional Storage prior to pumping directly to the Wyong River via the Link Road Pipeline.

To achieve the same objectives as those proposed in the IWCMS it is intended to incorporate the following strategies into each element of the Alternative Strategy:

- Demand management – water efficient appliances will be provided within each building as required on (p.51, DCP);
- Rainwater tanks – will be required for non-potable uses, sized at 65% of the non-potable demand for each building (p.51, DCP);
- Structural Separation – will be achieved using covered work areas, surface runoff directed to drainage systems incorporating best practice stormwater treatment measures;
- Allotment Landscape Irrigation and/or irrigation of public areas – this is subject to the soils within Precinct 14 being suited to irrigation practices eg hydraulic conductivity >3.6 mm/hr and no salinity and/or acid sulphate potential. Approximately 25% of the Precinct is to be retained as Open Space, and it is only the built environment that has the potential to alter the infiltration capacity of the remaining 75% of the catchment. Where infiltration is appropriate roof water, detained within the rainwater tanks, will be infiltrated in accordance with the Allotment Infiltration guidelines (Eco Eng pp 74 and 75) in order to maintain base flows within Buttonderry Creek;
- Vegetated swales – will form will be provided at a site level to direct surface runoff towards the local drainage and stormwater treatment systems. Swales are proposed as an element of the major drainage system to divert and convey runoff from the catchments upstream of Hue Hue Road around the development, thereby maintaining existing flow regimes within Buttonderry Creek;
- Constructed Wetlands – the location and scale of the constructed wetlands proposed for Precinct 14 are shown on the *"Enclosure 3 Wyong Employment Zone – Drainage & Water Quality Water Quality"* plan submitted by Wyong Shire Council in support of their application for recognition of the WEZ as a State Significant Site.

The area set aside in each sub-catchment as constructed wetlands and/or at source controls for the treatment of stormwater runoff will be in accordance with Table 5.2 (p.69 Eco Eng);

- Stormwater Storage – the location and scale of the temporary stormwater storages proposed for Precinct 14 are shown on the *"Enclosure 3 Wyong Employment Zone – Drainage & Water Quality Water Quality"* plan submitted by Wyong Shire Council in support of their application for recognition of the WEZ as a State Significant Site. The dimensions of temporary stormwater storages will be in accordance with Table 5.2 (p.69 Eco Eng). The proposed pump rates to the Hue Hue pipeline will comply with those in Table 5.7 (p.91, Eco Eng);

- Hue Hue Road Pipeline – this pipeline provides the alternative mechanism by which stormwater runoff, surplus to the hydrologic objectives for Buttonderry Creek and Porters Creek Wetland, will be delivered directly to the Wyong River (p.54, Eco Eng);

- Stream Disturbance Management – the extended detention storage available within the constructed wetlands and temporary stormwater storages will provide the retardation of site runoff to attenuate the 3-mth and 1.5-yr ARI flows into Buttonderry Creek (Tables 5.2 and 5.5 pp69 and 85, Eco Eng).

4 FURTHER INFORMATION ON THE HYDROLOGIC INDICES FOR BUTTONDERRY CREEK AND PORTERS CREEK WETLAND

The Department of Planning has requested the following information:

- *Baseline flow rate of water entering and exiting the wetland;*
- *An assessment of the expected changes post development in the flow rate of water entering and exiting the wetland;*
- *An assessment of the expected changes in the volume of water before and after the proposed diversion;*
- *An assessment of how the changes in the flow rates and volume will affect the ecological functioning of the wetland.*

In responding to this request it must be noted that Wyong Shire Council has initiated exhaustive investigations by Ecological Engineering to determine the hydrologic indices for Buttonderry Creek and Porters Creek Wetland – *"Water Sensitive Urban Design Solutions for Catchments above Wetlands"* (2005) and *"Modelling Rationale for the Porters Creek Stormwater Harvesting Strategy"* (May 2006). As a result of these investigations an *"Integrated Water Cycle Management Strategy Wyong Employment Zone (WEZ)"* (November 2006) was prepared as the basis for the *Wyong Employment Zone – Draft Development Control Plan No.88* (DCP), which articulates the guiding principles for development within the Wyong Employment Zone(WEZ).

Consequently, developments complying with the recommendations in *"Integrated Water Cycle Management Strategy Wyong Employment Zone (WEZ)* (November 2006), and the Draft DCP No.88 will achieve the objectives of the IWCMS namely:

- *Preservation of both the flooding and drying hydrology from the development area to the natural wetlands*
- *Preserving the natural overland flow into the adjacent habitats (ie. Dispersed sheet flow, natural riffles/channels).*
- *Preservation of the pre-development flows within Buttonderry Creek which influence stream disturbance (3mth and 1.5yr ARI); and*
- *Treating urban stormwater runoff as required by Council's Stormwater Management Plan (90% reduction in TSS, 50% reduction in TN and TP).*
- *Maximise capture and reuse of rainwater and minimise import of potable water.*

(Eco Eng p.3)

Precinct 14 of the WEZ is located at the top of the catchment and is in a position to proceed with development as soon as Development Approval is granted. At present development of the WEZ is unable to proceed until such time as ownership of the Brickpits Regional storage is secured, the Link Road Pipeline is constructed and the connecting infrastructure is installed, which is the subject of Section 94 funding. Although an Interim Strategy (p.57, DCP and Chapter 6 p.127, Eco Eng) has been proposed by WSC, if implemented, it will reduce the development potential of the site by 50%.

The alternative strategy being proposed utilises the same stormwater storage volumes, pump rates and treatment strategies proposed in the IWCMS. Only the method of disposal of the surplus stormwater runoff to the Wyong River has changed, namely:

- Use of the Precinct based Stormwater Storages in place of the proposed Regional based Brickpits Storage; and

- Substitution of the location of the Link Road pipeline with a pipeline along Hue Hue Road connecting Precinct 14 to the Wyong River in the same location as that proposed by the IWCMS.

In summary the Alternative IWCMS for Precinct 14 as proposed herein provides the same level of certainty of achieving the *preservation of both the flooding and drying hydrology* of Buttonderry Creek and Porters Creek Wetland as does the IWCMS articulated on page 24 of the Draft DCP No.88.

ATTACHMENT

"PROPOSED INTEGRATED WATER CYCLE MANAGEMENT STRATEGY PRECINCT 14 WYONG EMPLOYMENT ZONE" J.WYNDHAM PRINCE PTY LTD (10 JUNE 2008)

J. Wyndham Prince Pty. Ltd.

77 Union Road
PENRITH NSW 2750
P.O. BOX 4366
PENRITH WESTFIELD NSW 2750
DX 8032 PENRITH

ABN: 67 002 318 621
Telephone: (02) 4732 3366
Facsimile: (02) 4721 7638

Our Ref: 8141 IWCMS P14 WEZ
GH:gh

10 June 2008

Re: Proposed Integrated Water Cycle Management Strategy
Precinct 14 Wyong Employment Zone

Introduction

In May 2006 Ecological Engineering Pty Ltd prepared a *Modelling Rationale for the Porters Creek Stormwater Harvesting Strategy* for Wyong Shire Council (WSC). This strategy aimed at protecting Porters Creek Wetland from the major threat of increased runoff generated from development in the catchment. (p.1) It formed the basis for the *Integrated Water Cycle Management Strategy: Wyong Employment Zone (WEZ)* prepared by Ecological Engineering in November 2006 (IWCMS).

These 2 Strategic Documents form the basis for the management of stormwater runoff from developments occurring within the Wyong Employment Zone (WEZ). The objectives of the strategy are to

- *Protect the receiving wetlands and waterway ecosystems through:*
  - *Preservation of both the flooding and drying hydrology from the development area to the natural wetlands*
  - *Preserving the natural overland flow into the adjacent habitats (ie. Dispersed sheet flow, natural riffles/channels).*
  - *Preservation of the pre-development flows within Buttonderry Creek which influence stream disturbance (3mth and 1.5yr ARI); and*
  - *Treating urban stormwater runoff as required by Council's Stormwater Management Plan (90% reduction in TSS, 50% reduction in TN and TP).*
- *Maximise capture and reuse of rainwater and minimise import of potable water.*

(IWCMS p.3)

IWCMS Specific to the WEZ

The following initiatives have been identified as necessary components of the IWCMS for the WEZ if it is to compliment the regional objectives described above (IWCMS pp. 4-6):

- Demand management – Water efficient appliances within each building;
- Rainwater tanks – Non-potable uses, sized at 65% of the non-potable demand;
- Structural Separation – Disconnection of work areas from the stormwater system;
- Allotment Landscape Irrigation – 25% of allotment designated for tank water irrigation;
- Vegetated swales – For stormwater conveyance from hardstand areas to water treatment systems (e.g. constructed wetlands).
- Constructed Wetlands – Water quality treatment of stormwater runoff will be mostly achieved through constructed wetland systems sized at 4% of the catchment area;

- Stormwater storage – Following treatment, stormwater will be temporarily stored (20 mm / catchment ha) within each Precinct of the WEZ to achieve the hydrologic objectives;
- 'Brickpits' Wetland & Storage – Provide a central collection point for pumped flows from the temporary Precinct storages before delivery to the Link Road Pipeline;
- Link Road Pipeline – Provides the mechanism by which stormwater, in excess of that required to preserve the hydrologic characteristics of Porters Creek Wetland, is delivered directly to the Wyong River where it will supplement the Gosford-Wyong potable water supply by 5 – 7 GL/year on average.
- Stream Disturbance Management – Retardation of the 3-mth and 1.5-yr ARI flows into Buttonderry Creek.

"The majority of stormwater treatment is to be provided within the 'Public' realm through constructed wetlands delivered and managed by Council. This treatment model represents the least risk strategy for assuring treatment of stormwater, as it does not rely on individual allotment owners to manage the key stormwater treatment systems. This is particularly important considering the treated waters are to be harvested and transferred to the Link Road pipeline for discharge to Wyong River." (IWCMS p.6).

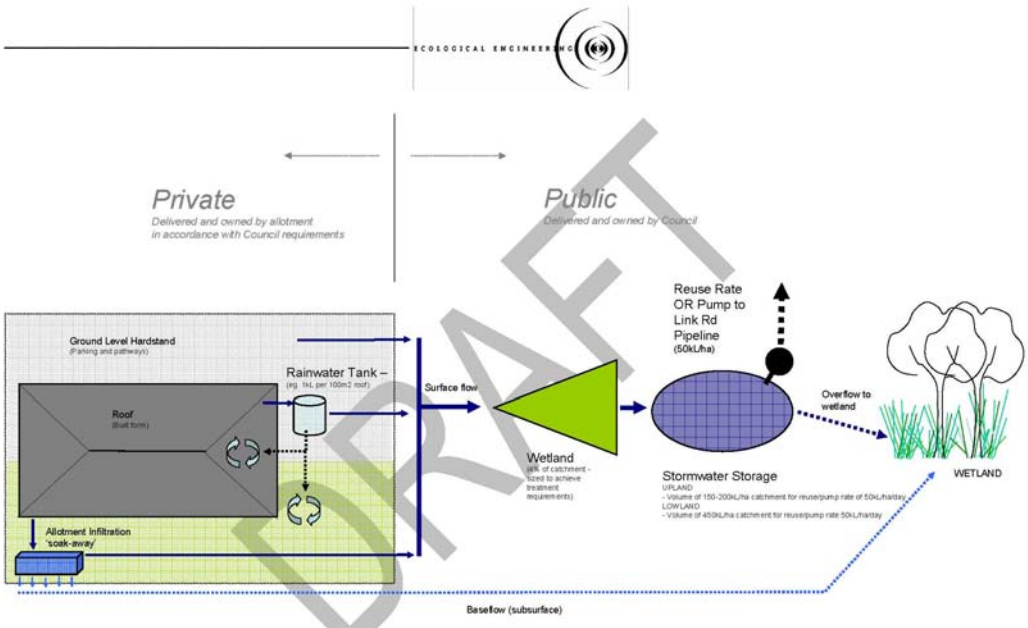

Figure 2 Conceptual Depiction of Porters Creek Wetland Stormwater Harvesting and Reuse Strategy

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Alternative IWCMS for Precinct 14 of the WEZ

Implementation of the IWCMS as proposed by WSC is dependent on the acquisition of the Brickpits Storage and construction of the Link Road pipeline. Both of which are not envisaged in the near future. In the meantime development within the WEZ is stymied until this infrastructure can be constructed.

To expedite the construction of the industrial development proposed for Precinct 14 of the WEZ an alternative scheme has been investigated. This alternative scheme aims to achieve the same objectives as those identified for the regional IWCMS but is utilises the on-site Stormwater Storages in place of the Brickpits Storages and delivers the surplus stormwater to the Wyong River via an alternative pipeline along Hue Hue Rd in lieu of Link Road. The key elements of this Alternative IWCMS include:

- Demand management – Water efficient appliances within each building;
- Rainwater tanks – Non-potable uses, sized at 65% of the non-potable demand;
- Structural Separation – Disconnection of work areas from the stormwater system;
- Allotment or Public Domain Landscape Irrigation – subject to detail design and may include tank water irrigation. Noting that approximately 25% of Warner Industrial Park is to be retained as open space which can be partly irrigated, and there is also potential to irrigate to road verges and thereby reduce the overall impact on site development yields;
- Vegetated swales – For stormwater conveyance from hardstand areas to water treatment systems (e.g. constructed wetlands).
- Constructed Wetlands – Water quality treatment of stormwater runoff will be mostly achieved through constructed wetland systems sized at 4% of their sub-catchment areas;
- Stormwater storage – Following treatment, stormwater will be temporarily stored (20 mm / catchment ha) within Precinct 14 before delivery to the Hue Hue Road alternative Pipeline to achieve the hydrologic objectives;
- Hue Hue Road Pipeline – Provides the mechanism by which excess stormwater from Precinct 14, is delivered directly to the Wyong River.
- Stream Disturbance Management – Retardation of the 3-mth and 1.5-yr ARI flows into Buttonderry Creek.

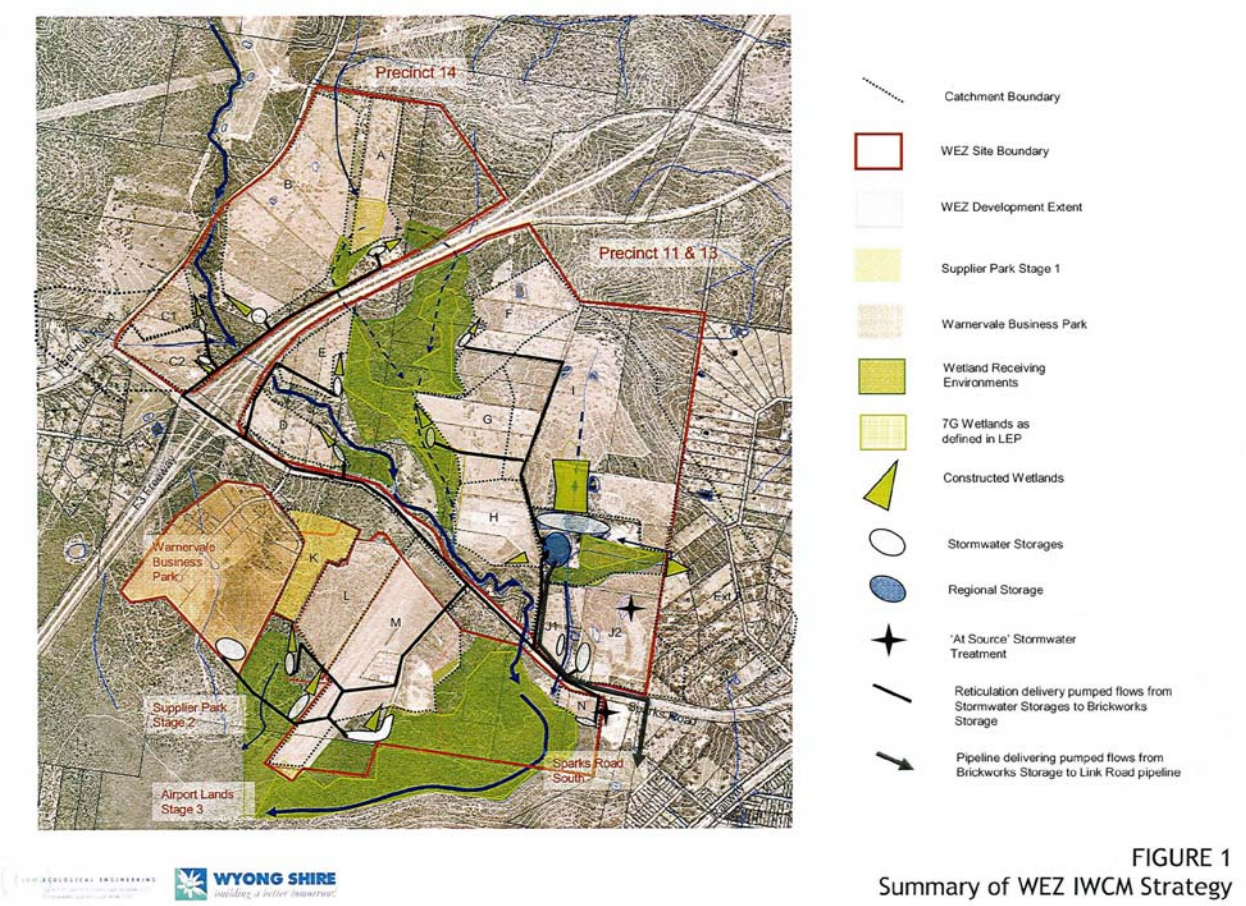

FIGURE 1
Summary of WEZ IWCM Strategy

The differences between the 2 Strategies is in the:

- Reliance on the Brickpits Storage by the regional IWCMS, and the reliance of the Precinct 14 IWCMS on the Precinct Storage for the temporary detention of surplus stormwater; and
- Construction of a pipeline from the Brickpits Storage along Link Road to deliver surplus stormwater runoff to the Wyong River, and the construction of a pipeline from the Precinct Storage along Hue Hue Road to the Wyong River.
- Irrigation to public domain and/or individual allotments subject to detail design.

WSC has undertaken an Environmental Risk Analysis into the efficacy of discharging the surplus upstream or downstream of Wyong Weir. At the time of writing no decision had been made on the preferred option. The Roads and Traffic Authority has indicated that it may be possible to accommodate the 250 mm dia Hue Hue Road stormwater pipeline within the existing conduits at the Alison Road and F3 overbridge. This provides the ability for the Hue Hue Road pipeline alternative to discharge either upstream or downstream of the Wyong Weir.

WSC has also required that the *"50% percentile wet weather flows nutrient concentrations entering wetland ecosystems should not exceed:*

- *0.09 mg/L for Total Phosphorus*
- *1.3 mg/L for Total Nitrogen"*

(IWCMS WEZ Nov 2006, p. 58)

The above pollutant concentrations coincide with the upper pollutant concentrations that may be expected from a Wetland Treatment System as determined on p.193 of the MUSIC manual. They were derived from research undertaken on a wetland system in Melbourne described as having a rapidly developing rural catchment, with a surface area representing approximately 0.5% of its contributing catchment area. Other research carried out by Hunter and Claus 1995 (Western Sydney) and Waters 2002 (Blue Haven) reported similar mean pollutant export concentrations from wetland treatment systems receiving runoff from urban catchments, with their surface areas representing approximately 2% of the contributing urban catchments.

WSC is still in the process of determining the appropriate stormwater discharge criteria for the Wyong River. However, we are confident that MUSIC modelling of Wetland Treatment Systems, with surface areas representing 4% of the Precinct 14 catchment area in combination with At Source treatment measures, will confirm compliance with mean discharge concentrations for Total Phosphorus of 0.09 mg/L and for Total Nitrogen of 1.3 mg/L. This is consistent with the approach required by Wyong Shire Council in demonstrating compliance with the IWCMS adopted for the WEZ.

The alternative strategy for Precinct 14, described herein, will discharge treated and attenuated environmental flows into Buttonderry Creek, with the surplus treated stormwater runoff discharged directly to the Wyong River via the Hue Hue Road pipeline. There will be no direct discharges to natural wetland ecosystems.

Costs Implications of the Hue Hue Road Pipeline Alternative (discharge below Wyong Weir)

Rising Main (250 UPVC)	$1,100,000
Pumps (x3) / Pump well	$340,000
Traffic Management	$30,000
Utility Adjustment Allowance	$200,000
Contingency (20%)	$334,000
Management & Design Costs	$200,000 (required for independent and integrated schemes)
Total Approximate Capital Cost	**$2,204,000**

NOTE: The preliminary sizing of the surplus stormwater storages and pump rates have been based on a total catchment area for Precinct 14 of 139 ha. This area includes open space, riparian corridors and stormwater storage surface areas. The Nett Developable Area anticipated by WSC for Precinct 14 is 58.57 ha. Consequently only the surplus stormwater runoff from the actual impervious areas within the developed landform of Precinct 14 will be required to be treated and pumped directly to the Wyong River (approx. 80 ha). This will greatly reduce storage volumes and pump rates resulting in a much lower construction cost.

Yours faithfully

J.WYNDHAM PRINCE P/L

Geoffrey J. Hunter
Senior Environmental Engineer