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Goodman International Limited

Oakdale Concept Plan

Preliminary Sewer Servicing Strategy

May 2008

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Executive Summary

Goodman International Ltd is proposing to develop approximately 421 hectares of land known as "Oakdale" within the precinct known as the Western Sydney Employment Hub.

A review of sewer servicing for the site has been conducted.

A detailed end-use water analysis has been carried out to determine the estimated sewerage system flows. A further water balance analysis has been conducted to develop a servicing solution that minimises potable water use and surplus recycled water volumes.

It is proposed to service the site by providing the following:

- Each of the lots or a group/cluster of lots will be serviced by their own dedicated sewage treatment system to treat all sewage to recycled water standards as defined by the NSW and ANZECC Guidelines. The recycled water would be used within each lot/cluster to service non-potable water end-uses. Any recycled water that may become surplus to the non-potable water demands would be disposed of by irrigation in an area allocated on each lot (where on-site systems are provided), or to a common irrigation area (where a cluster system is provided); and
- A collection system and emergency / buffer storage system will be located either on each lot (for on-site systems) or adjacent to the cluster treatment plant (for cluster systems).

The expected area required to dispose of any surplus recycled water by irrigation has been determined.

A number of further contingency measures are proposed to avoid any potential adverse impacts from the proposed sewer servicing strategy, including:

- A conservatively sized surplus recycled water irrigation area;
- Provision of suitable buffer distances to public areas and watercourses; and
- Emergency storage provisions to prevent system overflows while emergency response plans are effected.

1. Introduction

1.1 General

Goodman International Ltd is preparing a concept plan for the Oakdale development (herein known as "the site") in accordance with the provisions of Part 3A of the *Environmental Planning and Assessment Act 1979*.

For the purposes of the concept plan, the development site has been divided into the following 'precincts':

» Central Precinct – comprising Lot 2 DP 120673;

» South Precinct – comprising that part of Lot 82 DP 752041 east of Ropes Creek and Lot 87 DP 752041;

» West Precinct – comprising Lot 1 DP 120673 and that part of Lot 82 DP 752041 west of Ropes Creek; and

» East Precinct – comprising Lot 1 DP 843901, which is the site of an existing Austral Bricks quarry and brickmaking plant.

The location of the proposed development site is shown in Figure 1.

In terms of staging, it is likely that the Central Precinct would be developed first, and is therefore referred to in this report as 'Stage 1'. Indicative staging from Stage 1 would likely progress to the South Precinct ('Stage 2'), then the West Precinct ('Stage 3'), and finally the East Precinct ('Stage 4'). It is noted that the existing Austral quarry/brickmaking plant is planned to continue operating in accordance with existing approvals for the foreseeable future, and would only be developed following the cessation of quarrying/brickmaking and rehabilitation of the site.

The site forms part of the precinct known as the Western Sydney Employment Hub and is located within two local government areas being:

» Penrith City Council area; and

» Fairfield City Council.

GHD has been engaged by Goodman International Ltd to develop a preliminary sewer servicing strategy.

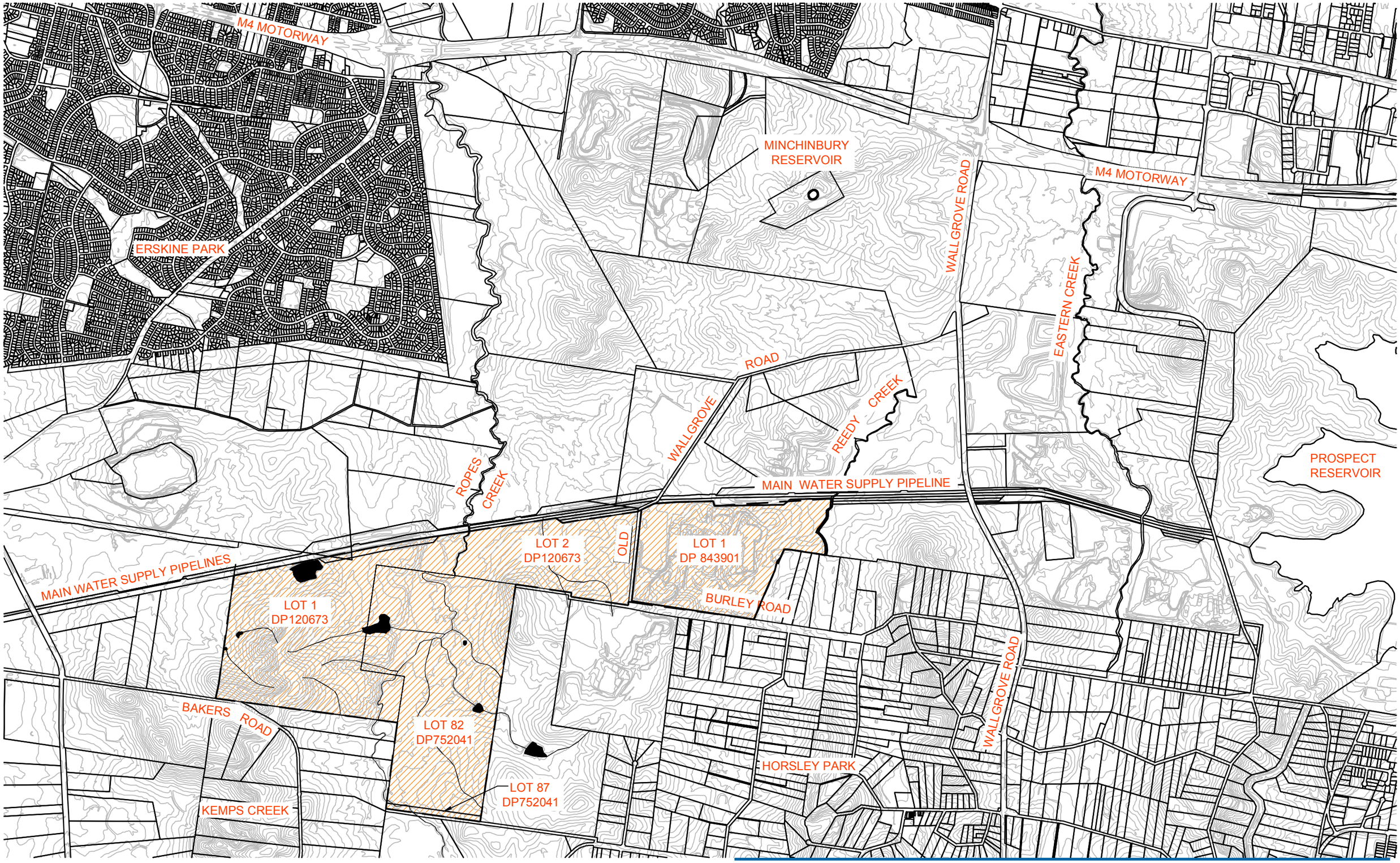
This report assesses opportunities, constraints and principles for managing sewage generated from the proposed development. Specific topics addressed include:

» Statutory and authority requirements;

» The description of the existing site, the proposed development and existing sewerage infrastructure;

» Potential impacts of the sewage generated by the proposed development; and

» Proposals for mitigation of potential adverse impacts of sewage generation;



LEGEND

PROPOSED DEVELOPMENT SITE

PROPOSED DEVELOPMENT SITE BOUNDRY

N

0 250 500 750m

SCALE 1:25000 AT ORIGINAL SIZE

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GOODMAN INTERNATIONAL LTD
OAKDALE CONCEPT PLAN

SITE LOCALITY PLAN

job no. | 21-15101
rev no. | B

scale | 1:25000 for A3 date | DECEMBER 2007

Figure 1

Level 6, 20 Smith St Parramatta NSW 1740 Australia PO Box 788 Parramatta NSW 2124 **T** 61 2 8898 8800 **F** 61 2 8898 8810 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Plot Date: 10 December, 2007 - 7:42 PM Cad File No: G:\21\15101\CADD\Drawings\21-15101-SEWER_FIG001.dwg

1.2 Scope of the Study

The scope of work for the study is defined as follows:

» Estimation of sewage generation rates for the proposed development;

» Site specific water balance analysis including review of greywater or blackwater recycling options;

» Review of existing sewerage infrastructure; and

» Development of a preferred sewer servicing strategy in conjunction with Goodman International Ltd.

2. Existing Site Conditions

2.1 Site Soil Characteristics

Douglas Partners (May 2007) has conducted a preliminary geotechnical assessment of the site although site-specific soil testing/test pitting has not been conducted at this point in time. The soil landscape at the site is described below.

Bannerman and Hazelton (1990) describe three soil landscapes across the development site:

- **South Creek Soil Landscape** – a fluvial soil landscape developed in floodplains, valley flats (slopes <5% and local relief <10 m) and drainage depressions with incised channels. The South Creek soils within the site are developed on alluvium derived from Wianamatta Group shales and are often very deep-layered sediments over bedrock or relict soils. Landscape limitations include flood hazard, waterlogging (seasonal or localised), permanently high water tables (localised) and high erosion hazard.
- **Blacktown Soil Landscape** – a residual soil landscape developed on a landscape typically comprising gently undulating rises with local relief to 30 m and slopes usually less than 5% on Wianamatta Group shales and Hawkesbury shales. The Blacktown soils are shallow to moderately deep (<1 m), red and brown podsolic soils on crests, upper slopes and well-drained areas. Deep (1.5 m – 3 m) yellow podsolic soils are located on lower areas and in areas of poor drainage. These soils are derived from weathering of the underlying (typically shaly) bedrock and are highly plastic, moderately reactive, of low soil fertility, poor soil drainage, localized salinity or sodicity and moderate erodibility.
- **Luddenham Soil Landscape** – an erosional soil landscape developed on undulating to rolling hills with local relief of 50 m to 80 m and slopes of 10% to 20% on Wianamatta Group shales, often associated with resistant sandstone bands. The Luddenham soils are shallow (<1 m), dark podsolic soils or massive earthy clays on crests; moderately deep (0.7 m to 1.5 m) yellow podsolic soils and prairie soils on lower slopes and drainage lines. The soils have highly plastic subsoils of moderately reactivity and low to moderate shrink-swell potential, low to moderate soil fertility and moderate erodibility.

The majority of the site consists of the Blacktown Soil Landscape. The higher areas of the site in the west consist of the Luddenham Soil Landscape and Ropes Creek and the land immediately adjacent consists of the South Creek Soil Landscape.

Douglas Partners report that very saline soils along poorly drained sections of Ropes Creek and tributary gullies are expected. Elsewhere, it is anticipated that most of the site will be classified as non or slightly saline with a scattering of moderately saline areas.

The expected site geology and potential for salinity of the development area's soil characteristics have been considered in estimating the land area requirements for surplus recycled water disposal.

2.2 Riparian Corridors

A riparian assessment conducted by GHD (December 2007) has categorised streams (defined as *protected waters* under the RFIA) across the site as shown in Appendix A. Broadly, the management constraints of each category are:

Category 1 – Core Riparian Zone (CRZ) of 40 m, consisting of local provenance native vegetation, with an additional riparian zone of 10 m;

Category 2 – CRZ of 20 m, consisting of local provenance native vegetation, with an additional riparian zone of 10 m; and

Category 3 – Riparian Zone minimum width of 10m from top of each bank and generally no vegetated buffer is required. All vegetation being restored will be of local provenance.

The riparian zones have been considered in confirming the availability of land for sewer servicing infrastructure, buffers and surplus recycled water disposal.

2.3 Existing Sewerage Infrastructure

The nearest existing sewerage infrastructure to the Stage 1-3 development area is a 525 mm diameter sewer carrier (Ropes Creek Carrier) located alongside Ropes Creek downstream of the proposed development area (approximately 1.3 km from the site).

The nearest existing sewerage infrastructure to the Stage 4 development area is the sewerage reticulation infrastructure associated with the M7 Business Hub immediately north of the Main Water Supply Pipelines. This existing development site drains to the Eastern Creek Carrier.

The proposed development site does not form part of any existing published Developer Servicing Plans (DSP). The proposed development site can be divided into three separate gravity catchments; the Ropes Creek, Kemps Creek and Reedy Creek catchments. Both Ropes Creek and Kemps Creek catchment drain naturally to the St Marys Sewage Treatment Plant (STP) while Reedy Creek drains naturally to the Quakers Hill STP.

The *Draft* St Marys Wastewater DSP (2006) has been reviewed and it is similar to previous issues of the DSP, in that no land south of the Main Water Supply Pipeline forms part of the catchment plan, and hence there are no system upgrades identified regarding the development of the site.

Sydney Water has indicated that there is no capacity within the current sewer system for the proposed development site and that major system augmentation/extension would be required for Sydney Water to service the site.

3. Proposed Development

3.1 Development Description

The site is proposed to be developed predominantly for light industrial type developments such as warehousing and logistics operations.

A concept master plan for Stages 1-3 of the development has been developed by Goodman International Ltd and is included in Appendix B.

The total gross land area of the proposed development site comprises of approximately 421 hectares. A breakdown of the development area is provided in Table 1.

Goodman International Ltd has supplied an approximate area for open space, roads and other requirements in order to calculate a net developable area.

Table 1 - Development Area Split

Development Area Identification	
Development Lot and ID identification	Area (hectare)
Lot 2 DP 120673 (Stage 1)	62
Lot 82 DP 752041 (Stage 2)	141
Lot 87 DP 752041 (Stage 2)	3
Lot 1 DP 120673 (Stage 3)	127
Lot 1 DP 843901 (Stage 4)	88
Total Gross Area (Stages 1 to 4)	**421**
Approximate area for roads, other services, stormwater infrastructure and open space	150-170
Net Development Area	**250-270* (Stage 1 to 4)**

* 270 hectares has been adopted for the purposes of this report

3.2 Typical Warehouse/Office Development

Goodman International Ltd has supplied GHD with a typical allotment layout with area breakdown (refer Figure 2). For the purposes of this assessment, it is assumed that the typical allotment break-up will apply to the entire development site.

Figure 2 - Generic Warehouse Facility (% of total lot area)

A generic proposed warehouse facility lot would occupy a footprint of 2.04 hectares or 20,425 m^2. The area breakdown of each 2.04 hectare generic proposed warehouse lot is shown in Table 2 .

Table 2 - Proposed Warehouse Facility – Area Breakdown

Portion of Generic Proposed Warehouse Facility	Area (m^2)
Warehouse	11,029.5
Office	1,225.5
Hardstand (including internal roads, footpaths, car parks)	6127.5
Garden / Landscaped Area	2042.5
Total Area of Generic Proposed Warehouse Facility	**20,425 m^2**

3.3 Staging of Development

The proposed development is to be progressively established with a number of defined stages proposed as shown in Table 3.

Table 3 – Development Staging

Stage	Lot Numbers	Indicative development timing
1	Lot2 DP120763	2 -3 years
2	Lots 82 and 87 DP7 52041	3 – 5 years
3	Lot 1 DP120679	> Year 5
4	Lot1 DP 843901	20 Years

3.4 Sewage Generation

For the purposes of calculating sewage generation rates it has been assumed that the proposed development will only consist of warehouses and office space. The sewage is therefore assumed to exclude any specific trade wastes and is expected to be of a domestic nature. Any developments involving trade waste streams would need to be assessed on a case-by-case basis.

A separate detailed water balance analysis has been conducted by GHD (December 2007). As part of this analysis a detailed end-use analysis was conducted for a “generic warehouse” to determine the sewage generation rates. The results were compared to actual water use data from similar light industrial developments in Western Sydney. A number of scenarios were modelled that provide an envelope of results considered to be the approximate lower and upper ends of sewage generation rates. Table 4 summarises the servicing options that were considered and their associated sewage generation rates.

Table 4 – Sewage Generation Rates

Option	Description	Sewage Generation (ML/yr)
Option 1a_Lots27_0_0	Lot Scale Servicing, with 27 equivalent persons per generic warehouse facility and 0% rainfall wet weather infiltration.	46
Option 1b_Lots55_1_3	Lot Scale Servicing, with 55 equivalent persons per generic warehouse facility and 1.3% rainfall wet weather infiltration.	110
Option 2_Clus27_1_3	Cluster Scale Servicing, with 27 equivalent persons per generic warehouse facility and 1.3% rainfall wet weather infiltration.	67
Option 3_Cent27_2_5	Centralised Scale Servicing, with 27 equivalent persons per generic warehouse	88

	facility and 2.5% rainfall wet weather infilt.	

It should be noted that although the results presented in Table 4 are for the generation rates based on the end-use analysis conducted by GHD the design of any sewage treatment infrastructure would be carried out in accordance with the relevant standards.

4. Proposed Sewer Servicing Strategy

4.1 Summary of Servicing Strategy

The proposed sewer servicing strategy has been developed after assessing a number of options that do not rely on a connection to the existing Sydney Water sewerage system. A multi-criteria sustainability analysis was performed in order to rank the servicing options. The options assessment was carried out predominately to assist Goodman International Ltd in the selection of their preferred strategy. The analysis forms part of the separate water balance report by GHD (December 2007). The following section outlines the proposed/preferred servicing strategy.

Stages 1 to 3 of the development site are proposed to be serviced by either individual allotment on-site treatment systems, or a “cluster” or “precinct” treatment system servicing a number of lots. It is proposed to treat sewage to recycled water standards as defined by the NSW Guidelines for Urban and Residential Use of Reclaimed Water, 1993 and the 2006 ANZECC Guidelines.

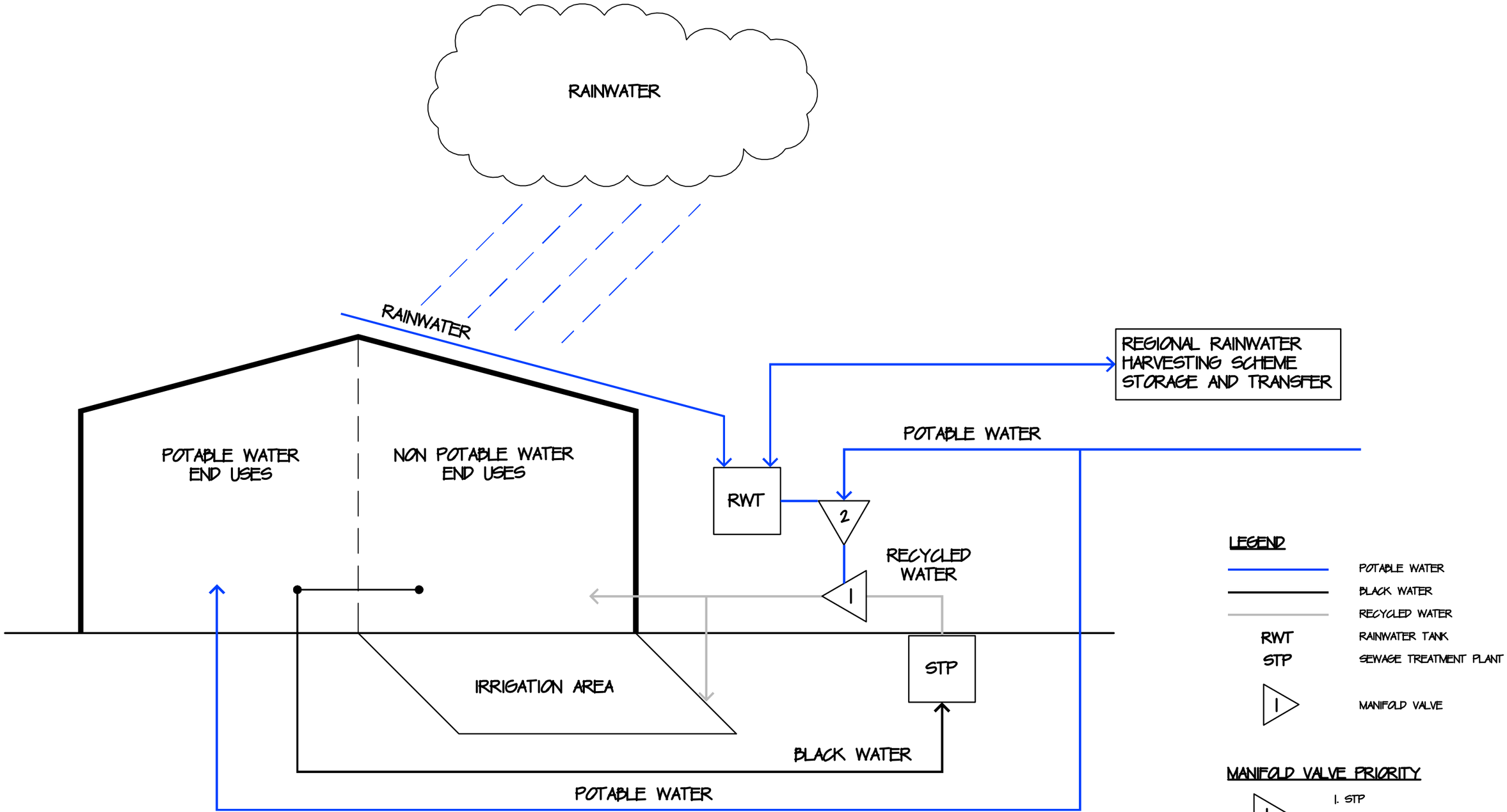
In summary, the following is proposed:

» Each of the lots or cluster of lots will be serviced by their own dedicated sewage treatment system to treat all sewage to NSW and ANZECC Guidelines recycled water standards. The recycled water would be used within each lot/cluster to service non-potable water end-uses, primarily including toilet flushing, air conditioning and garden watering. Any recycled water that may become surplus to the non-potable water demands would be disposed of by irrigation in a dedicated area allocated on each lot (where on-site systems are provided), or to a common irrigation area (where a cluster system is provided); and

» A collection system and emergency / buffer storage system will be located either on each lot (for on-site systems) or adjacent to the cluster treatment plant (for cluster systems).

Figure 3 shows a diagrammatic representation of the proposed sewer servicing strategy (lot scale).

Stage 4 could be serviced in a similar manner or potentially via a connection to the Eastern Creek Carrier (subject to Sydney Water approval). It should be acknowledged the time frame for Stage 4 is considerable and that the final strategy adopted for Stage 4 should be reviewed before its commencement.



LEGEND

- POTABLE WATER
- BLACK WATER
- RECYCLED WATER
- RWT — RAINWATER TANK
- STP — SEWAGE TREATMENT PLANT
- 1 — MANIFOLD VALVE

MANIFOLD VALVE PRIORITY

1
1. STP
2. RWT

2
2. RWT
3. POTABLE WATER

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GOODMAN INTERNATIONAL LTD
OAKDALE CONCEPT PLAN
PROPOSED SERVICING STRATEGY (LOT SCALE)
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Figure 03

Level 6, 20 Smith St Parramatta NSW 1740 Australia PO Box 788 Parramatta NSW 2124 **T** 61 2 8898 8800 **F** 61 2 8898 8810 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Plot Date: 10 December, 2007 - 7:43 PM Cad File No: G:\21\15101\CADD\Drawings\21-15101-SK006-SEWERFIG3.dwg

4.2 Servicing Issues / Impacts

Management of potential issues associated with the proposed sewage servicing strategy include:

» **Treatment type**: Tertiary treatment with disinfection (to recycled water standards as defined by the NSW and ANZECC Guidelines) and emergency storage to prevent overflows in the event of system failure or heavy rain is proposed in accordance with relevant guidelines to safeguard public health and the environment (refer Section 4.3).

» **Recycled water irrigation / disposal:** A suitable area to be set aside for recycled water irrigation / disposal for disposal and buffer zones relative to waterways. Details of irrigation area requirements (including any necessary soil data collection and nutrient modelling) are to be determined as part of the Development Application for each individual lot (refer Section 4.4). It is noted that all sewage from the development is to be treated to a recycled water standard as defined by the NSW Guidelines for Urban and Residential Use of Reclaimed Water, 1993 and the 2006 ANZECC Guidelines. Only recycled water that is surplus to the non-potable water demands will be managed through additional storage and/or irrigation disposal.

» **Environmental impacts**: Suitable buffers, emergency storage and a disposal/irrigation area that meets the minimum requirements and will prevent any adverse water quality, odour and/or land degradation issues (refer Section 4.4).

4.3 On-site Treatment Guidelines and Effluent Treatment Requirements

It is proposed to treat sewage to recycled water standards as defined by the NSW and ANZECC Guidelines. The recycled water will be suitable for open access urban and residential reuse as defined in these guidelines. Table 5 summarises the relevant effluent criteria necessary for recycled water standards based on the NSW Guidelines for Urban and Residential Use of Reclaimed Water, NSW Recycled Water Coordination Committee, May 1993 and the 2006 ANZECC Guidelines.

Table 5 – Effluent Criteria for Irrigation

Parameter	Level
Level of Treatment	Tertiary
BOD	<20 mg/L (secondary treatment)
SS (NFR)	<30 mg/L (secondary treatment)
Coliforms	<10 in 100ml (<2.5 in 100ml geometric mean at point of use)
Faecal Coliforms	<1 in 100ml

Parameter	Level
Turbidity	< 2NTU (geomeric mean) <5NTU (95%ile)
pH	6.5 – 8 (allowable range) 7 – 7.5 (desirable range)

Reclaimed water meeting the NSW and ANZECC guidelines may be suitable for:

- residential garden irrigation;
- toilet flushing;
- car washing and similar outdoor uses; and
- firefighting.

4.4 Onsite Treatment System Effluent Disposal by Irrigation

4.4.1 Buffer Zones

Irrigation areas are subject to buffer distances in order to protect the environment, community amenity and public health. Under the DEC guidelines (Environmental Guidelines for the Use of Effluent by Irrigation, 2004), the buffer distances showed in Table 6 are applicable for low strength effluent (i.e. effluent from municipal treatment plants with secondary treatment). These would be considered conservative when applied to the proposed development as the sewage is proposed to be treated to recycled water standards as defined by the NSW and ANZECC Guidelines:

Table 6 – Buffer Distance Requirements

Natural water bodies (e.g. rivers, lakes)	50m
Other waters (e.g. artificial waters, small streams, water distribution channels)	Site specific
Domestic well used for household water supply	Site specific
Town water supply bores	Site specific
Where spray irrigation gives rise to aerosols near houses, roads, public open spaces etc.	50m
Other sensitive areas (eg waters in drinking water catchments)	Site specific although it is noted that within the Sydney Drinking Water Catchment, the SCA would seek a buffer of 100m in the absence of other evidence of a neutral or beneficial effect on water quality.

Furthermore, such systems will need to be installed in accordance with the relevant Council requirements. Penrith City Council have published an On Site Sewage Management Strategy (June 2001) which lists recommended buffer distances consistent with the "Environmental and Health Protection guidelines – On Site Sewage Management for Single Households". These buffers are as shown in Table 7

Table 7 - On Site Systems Recommended Buffers

System	Recommended buffer distances
All land application systems	100m to permanent surface waters (e.g. rivers, streams, lakes etc.)
	250m to domestic groundwater well
	40metres to other waters (e.g. farm dams, intermittent waterways and drainage channels etc.)
Surface spray irrigation	6m if area up gradient and 3 metres if area down gradient of driveways and property boundaries
	15 metres to dwellings
	3 metres to paths and walkways
	6 metres to pools and recreational areas

Other buffers also apply to subsurface , drip and trickle irrigation as well as absorption systems.

4.4.2 Estimated Irrigation Area

A basic monthly irrigation water balance has been performed using the recycled water generation rates assuming the following:

- The crop of choice is pasture, for which the corresponding crop factors are adopted from the Environmental Guidelines: Use of Effluent by Irrigation (DEC, 1993).;
- As the geology at the site consists of clay soils (based on preliminary geotechnical review by Douglas Partners), GHD has adopted a medium to heavy clay indicative permeability rate of 60-500mm/day, which equates to a recommended design irrigation rate of 15mm/week (AS/NZS 1547:2000 On-site Domestic Wastewater Management). Generally the design irrigation rates range between 15-25 mm/week (depending on the type of clay strata);
- The evaporation rates used are based on average monthly gauging data from Prospect Reservoir gauging station (over a long term monitoring period). The evaporation rates ranged between 2-6 mm/day.

The irrigation areas (and associated storage volume) required to manage the surplus recycled water were modelled based on irrigation potential and an indicative nutrient balance (total nitrogen and total

phosphorous). The nutrient balance was based on typical effluent quality that can be expected by a Membrane Bioreactor (MBR) treatment system.

The irrigation area requirements based on the indicative nutrient balance are lower than the irrigation areas based on irrigation potential alone.

As such, adopting the indicative irrigation areas based on irrigation potential alone would be sufficient to ensure both:

» That the surplus recycled water does not cause detriment to the soil, surface water or groundwater;and

» Sufficient irrigation area (and associated storage volume) is available.

A summary of the adopted irrigation areas and associated storage results are shown in Table 8.

Table 8 - Adopted irrigation areas and associated storages

Option Scenario --->	**Option 1a- Lots, 27EP, 0.0% Inflow /Infiltration**	**Option 1b- Lots, 55EP, 1.3% Inflow /Infiltration**	**Option 2- Cluster, 27 EP, 1.3% Inflow /Infiltration**	**Option 3- Centralised, 27 EP, 2.5% Inflow/Infiltration**
Approximate Surplus Recycled Water Requiring Management (ML/year)	0	31	19	40
Approximate Irrigation Area (m^2)	0	350 m^2 (x132 lots) **= Total 50,000**	2,700 m^2 (x6 clusters) **= Total 16,000**	80,000 m^2 (x1) **=Total 80,000**
Approximate Storage Size (m^3) buffer required for surplus	0	40m^3 (x132) (total of 5,300)	1,290m^3 (x6) (total of 7,700)	9,900m^3 (x1) (total of 9,900

It should be noted that no central irrigation area will be allocated for lot-by-lot scale servicing, so while Table 8 identifies an additional 350 m^2 per lot of irrigation area being required for these purposes, this equates to an area that is approximately 2% of a generic 2 ha lot and as such would be managed within the bounds of the current 'lot'. Consideration will need to be given to buffer distances as well as flood

prone land when designing the individual lot layouts, albeit recognising that surplus effluent will be treated to a high standard.

The approximate irrigation area requirements can be accommodated either on an individual allotment or in a common disposal area for clustered lot servicing. Land is proposed to be made available for irrigation purposes including appropriate buffer including a 50m buffer zone to natural water bodies. As this is a greenfields site the provision of such buffers can be accommodated.

4.5 Emergency Storage

Emergency storage will be provided for the containment of sewage in the event of a system malfunction to allow sufficient time for repairs to be undertaken or pump-out by tanker to occur (including allowance for system malfunction on weekends or public holidays). For on-lot systems a volume equivalent to three days design wet weather flow is proposed. For a cluster system an emergency storage equivalent to one day of design wet weather flow is proposed. This will prevent any overflows to the environment in the event of mechanical or power failure in the treatment system.

It is noted that during major rainfall events, the emergency storage may be utilised to temporarily store surplus recycled water preceding disposal to the nominated irrigation area (as the irrigation area may be saturated and unable to be further irrigated). The nominated buffer storage volumes have been confirmed to adequately store expected maximum surplus recycled water volumes, however, actual storage requirements will need to be determined as part of the detailed design for associated with each lot's development application. The expected buffer storage requirements are shown in Table 8 for both the individual site based treatment systems and the cluster system.

4.6 Mitigation of Potential Environmental Issues

Potential environmental issues associated with the sewer servicing strategy will be mitigated as follows:

- **Odour Management**: Local treatment systems will be required to operate under an approved system management plan, including routine monitoring, scheduled maintenance and emergency response plan to avoid excess loading of organics and nutrients on the irrigation area or anaerobic conditions developing. The specific location of treatment systems will consider adequate buffers distances from work areas and public amenities. Proper operation of onsite treatment systems and provision of adequate buffers will prevent any odour impacts. It is noted that the utilisation of systems such as MBR's may include odour scrubbing which will eliminate the need for buffers to the treatment systems.
- **Soil Management**: A properly designed and maintained onsite treatment and recycled water irrigation / disposal system should not result in any adverse impacts on receiving soils. Only water of a NSW and ANZECC Guidelines recycled water standard will be applied to nominated (surplus recycled water) irrigation areas and gardens, significantly reducing risks of soil degradation. Allowance to provide adequate contingency for salt/nutrient assimilation and/or any unexpected waste atypically of that expected for domestic type sewage to avoid any land degradation due to excess

organics, nutrients, salt or other contaminants is required. This would be controlled through an Irrigation Management Plan or similar.

» **Water Quality Management for Adjacent Waterways**: A properly designed and maintained onsite treatment and recycled water irrigation / disposal system should not result in any adverse water quality impacts on adjacent waterways. Provision of suitable buffer distances and emergency storage and the provisions for a system management and emergency response plan will further serve to protect adjacent waterways.

4.7 Further Analysis

When the final details and the proposed staff numbers are determined and an appropriately sized onsite treatment system is selected, a Recycled Water Irrigation Management Plan should be prepared providing details regarding:

i) Landuse and population density limits for the development;

ii) The onsite treatment system design and location;

iii) The onsite treatment system operations and emergency response plan; and

iv) The nominated effluent disposal method, area, buffer storage design, location and appropriate detailed soil data analysis and/or nutrient/salt balance modelling for the proposed disposal area.

5. Conclusion

There is no existing Sydney Water sewerage infrastructure currently available to service the proposed development site.

Sewage generation rates have been estimated based on the assumption that the site will be developed as a light industrial precinct with sewage being domestic in nature only;

The proposed sewer servicing strategy consists of the following:

» Each of the lots or a group/cluster of lots will be serviced by their own dedicated sewage treatment system to treat all sewage to recycled water standards as defined by the NSW and ANZECC Guidelines. The recycled water would be used within each lot/cluster to service non-potable water end-uses. Any recycled water that may become surplus to the non-potable water demands would be disposed of by irrigation in an area allocated on each lot (where on-site systems are provided), or to a common irrigation area (where a cluster system is provided); and

» A collection system and emergency / buffer storage system will be located either on each lot (for on-site systems) or adjacent to the cluster treatment plant (for cluster systems).

The potential impacts of the proposed development are to be mitigated by providing the following:

» Conservatively sized disposal areas to manage surplus recycled water;

» Provision of suitable buffer distances to public areas and watercourses; and

» Emergency storage and Emergency Response Plan(s) to prevent system overflows (detailed in the Recycled Water Irrigation Management Plan).

6. References

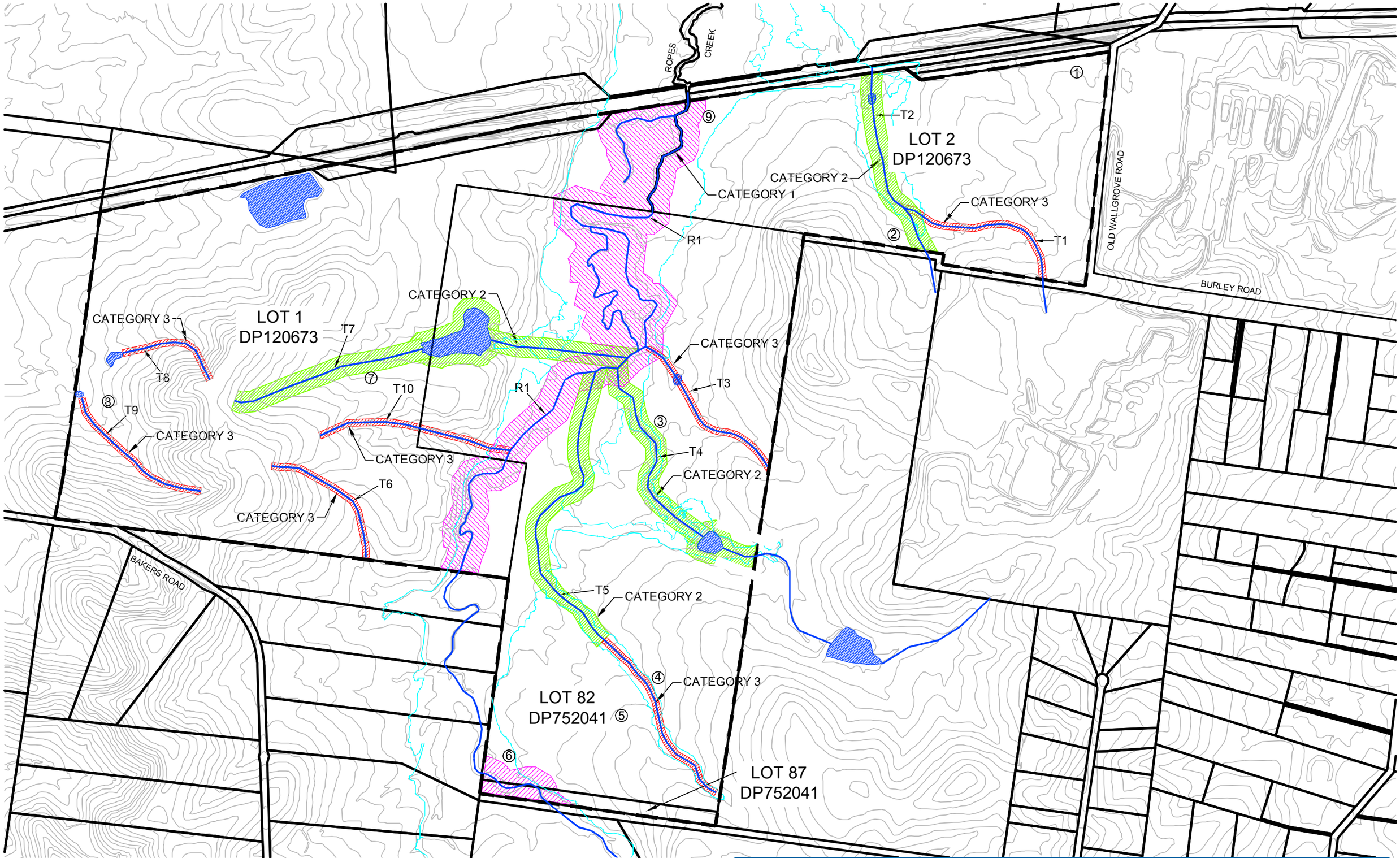
» Douglas Partners (May 2007), “Report on Preliminary Geotechnical Assessment, Proposed Ropes Creek “Southpipe” Development, Eastern Creek and Erskine Park”

» GHD Pty Ltd (December 2007), “Oakdale Concept Plan, Riparian Assessment”

» GHD Pty Ltd (December 2007), Oakdale Concept Plan, Water Balance Report Parts 1 and 2”

Appendix A

Watercourse Categorization and Riparian Corridors



LEGEND

- ROPES CREEK 100 YEAR FLOOD EXTENTS (APPROX)
- EXISTING DAMS
- LOT BOUNDRY
- SITE BOUNDRY
- CATEGORY 1 BUFFER
- CATEGORY 2 BUFFER
- CATEGORY 3 BUFFER
- ⑧ DNR SITE MEETING LOCATIONS
- T5 EXISTING WATERCOURSE & LABEL

N

0 100 200 300m
SCALE 1:10000 AT ORIGINAL SIZE

PRELIMINARY

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GOODMAN INTERNATIONAL LTD
OAKDALE CONCEPT PLAN
RIPARIAN BUFFERS
DRAFT ONLY

job no. | 21-15101
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Figure 1

scale | 1:10000 for A3 date | DECEMBER 2007

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Appendix B

Concept Plan for Stages 1-3

Site Area Schedule

	Total	Central/ South/ West	EAST
Total Land Area	421.3 ha	333.0 ha	88.3 ha
Less: Restricted Areas	(95.3 ha)	(89.4 ha)	(6.2 ha)
DEVELOPMENT Area	325.7 ha	243.6 ha	82.1 ha
Less: Regional infrastructure Regional Roads	(21.6 ha)	(21.6 ha)	(00.0 ha)
Gross ESTATE Land Area	304.1 ha	222.0 ha	82.1 ha
Less: Estate Allocations	(43.2 ha)	(38.7 ha)	(4.5 ha)
NETT DEVELOPMENT LOTS	260.9 ha	183.3 ha	77.6 ha

Breakdown of Central/ South/ West Precinct		
Central	South	West
61.2 ha	111.2 ha	160.6 ha
(9.0 ha)	(30.3 ha)	(50.1 ha)
52.2 ha	80.9 ha	110.5 ha
(5.5 ha)	(5.2 ha)	(10.9 ha)
46.7 ha	75.7 ha	99.6 ha
(6.7 ha)	(16.2 ha)	(15.8 ha)
40.0 ha	59.5 ha	83.8 ha

Regional Roads	Length (km)	New/extra Width
OAKDALE		
Old Wallgrove Road (S-W)	1.0	20.0
"Oakdale" new road - (incl. B1, B2, B3, B4 + B5)	4.0	40.0
Bakers Lane upgrade - (incl intersection)	1.1	20.0
Total	6.1	
N-S Connection - (incl. B6)	1.3	40.0
Note: M7 Hub		
Old Wallgrove Road (M7 Hub)	1.5	20.0

Goodman

M7 Hub

B1

B2

CENTRAL

EAST

Jokona Pty Ltd

WEST

B6

B3

Jacfin Land

CSR (PGH)

B4

B5

SOUTH

HORSLEY PARK

Legend

- Riparian Zone
- 1 in 100 Flood Zone
- Detention Basin Area
- Estate Park/ Amenities
- Service Station/ Convenience
- Infrastructure Service Zone
- Substation
- Electrical Easements
- Future Road Links

design+

Oakdale

Eastern Creek

Design Masterplan - Link Rd Option 1

0 200 1000

1:10000 @ A1
1:20000 @ A3

05 Nov 07 AL

SP SK36 (I)

GHD Pty Ltd ABN 39 008 488 373

10 Bond Street Sydney NSW 2000

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T: 2 9239 7100 F: 2 9239 7199 E: sydmail@ghd.com.au

Document Status

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