Shaolin Tourist and Residential Development, Comberton Grange

Hydraulic Services Infrastructure Concept Report

Report No S.STF-0101-R01
Date 05/05/2010

engineering sustainable environments

REPORT AUTHORISATION

PROJECT: **SHAOLIN TOURIST AND RESIDENTIAL DEVELOPMENT, COMBERTON GRANGE HYDRAULIC SERVICES INFRASTRUCTURE CONCEPT REPORT**

REPORT NO: **S.STF-0101-R01**

Date	Rev	Comment	Prepared by	Checked by	Authorised by
05-05-10	A	Infrastructure Concept Report	SLB	MCA	
27-07-10	B	Infrastructure Concept Report	SLB	MCA	EMT
22-11-11	C	Revised Concept Report	SPM	PJ	AM
14-02-12	D	Final Issue	PJ	PJ	AM

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EXECUTIVE SUMMARY

The proposed Shaolin Tourist and Residential Development at Comberton Grange will consist of;

- A Buddhist Temple Sanctuary comprising of a walled complex of religious buildings and integrated residential accommodation;
- A 330 seat prayer or assembly hall
- A martial arts training facility for up to 300 students with teaching facilities, sporting field and accommodation;
- A Traditional Chinese Medicine (TMC) centre with associated health and wellness facilities;
- A four star Hotel and tourist cabins with initially 100 rooms and up to 250 rooms, with dining and conference facilities and associated staff accommodation;
- A Town Centre with food outlets, retail, commercial and community facilities;
- A convention facility for initially 300 people;
- Serviced apartments within the Town Centre;
- An external amphitheatre within the public domain for kung-fu displays and gatherings;
- A Visitor Information Centre with associated Cultural Museum, administrative facilities and golf cart hiring facilities;
- Residences of approximately 300 dwellings;
- Agricultural and herbal gardens integrated within the residential development;
- 18 hole golf course integrated within the northern development site with clubhouse;
- Chinese gardens encircling the existing lake near the quarry;

This report looks at the authority infrastructure available to service the proposed development, and the internal infrastructure required to sustain the development for both Hydraulic and Fire services.

External Infrastructure
Authority infrastructure services are available to the site, however in some cases, located some distance from the proposed development area.

The closest water main reticulates through the Eastern end of the site; the main is located approximately 4km from the intended development area.

The Council owned reticulated effluent management scheme and sewer pressure mains are located approximately 6km from the site.

The nearest Authority gas main is located approximately 6km from the site.

Stormwater is proposed to be captured, treated and reused on site, with surplus catchment to discharge to Currambene Creek and Georges Creek, which run through the site. Much of the creek system is surrounded by Natural Wetlands which are listed under the Commonwealth Directory of Important Wetlands; hence stormwater quality connecting to these systems is of the upmost importance.

Internal Infrastructure
Hydraulic and fire services required for the development will include;

- Sanitary plumbing, drainage and pumping
- Trade waste plumbing, drainage and pre treatment systems
- Stormwater collection, harvesting and reuse
- Stormwater and subsoil drainage, detention and filtration
- Potable cold water storage, pumping and reticulation
- Hot water generation and reticulation
- Fire hydrant and fire hose reel systems
- Natural gas service reticulation

Water Balance
In preparing recommendations for the design of proposed infrastructure services, and connection to authority services for the Shaolin Tourist and Residential Resort, consideration has been given to enhancing the sustainability of the development and minimising the impact on the surrounding environment and authority infrastructure. In order of preference, this will be achieved by implementing reduce, reuse and recycle strategies. Sustainable features for the development in consideration include;

- Minimising water use and waste output through selection of low demand fixtures and appliances,
- Recycling fire test water
- Selection of indigenous plants for landscaping where practical
- Rainwater harvesting, treatment and reuse
- Stormwater harvesting, treatment and reuse
- Black water harvesting, treatment and reuse
- Greywater water harvesting, treatment and reuse
- Supply of recycled water from Shoalhaven Water's `Reticulated Effluent Management Scheme' (REMS) recycled sewer main
- Water supply from ground water aquifers

CONTENTS

1 INTRODUCTION

The intention of this report is to investigate the following;

- Information regarding existing infrastructure available to service the Shaolin Tourist and Residential development site, through correspondence with relevant Authorities, for the following services;
    - Potable Water
    - Recycled Water
    - Fire Water
    - Sewer Drainage
    - Gas
- Forecast demands for Water and Sewer services based Equivalent Tenement (ET) assessments for the proposed development.
- Review of various options for on site or of site reuse and recycling opportunities, and commentary on suitability.
- Review of the adequacy of authority supply infrastructure required to support the proposed development.

1.1 PROPOSED DEVELOPMENT

The proposed Shaolin Tourist and Residential Development Comberton Grange South Nowra site will be located on a site, totalling 1248 hectares in area, with 79 hectares proposed for the development.

The proposed development is for a Shaolin Village which will be a high quality tourist and residential complex. The Village will accommodate:

- A Buddhist Temple Sanctuary comprising of a walled complex of religious buildings and integrated residential accommodation;
- A 330 seat prayer or assembly hall
- A martial arts training facility for up to 300 students with teaching facilities, sporting field and accommodation;
- A Traditional Chinese Medicine (TMC) centre with associated health and wellness facilities;
- A four star Hotel and tourist cabins with initially 100 rooms and up to 250 rooms, with dining and conference facilities and associated staff accommodation;
- A Town Centre with food outlets, retail, commercial and community facilities;
- A convention facility for initially 300 people;
- Serviced apartments within the Town Centre;
- An external amphitheatre within the public domain for kung-fu displays and gatherings;
- A Visitor Information Centre with associated Cultural Museum, administrative facilities and golf cart hiring facilities;
- Residences of approximately 300 dwellings;
- Agricultural and herbal gardens integrated within the residential development;
- 18 hole golf course integrated within the northern development site with clubhouse;

1.2 EQUIVALENT TENEMENT ASSESSMENT

For the purpose of estimating water and sewer demands for the proposed development, an Equivalent Tenement (ET) assessment has been projected.

Shoalhaven Water's *"Supplement to the Water Services Association of Australia Sewerage Code of Australia*" document, dated September 2011, notes the following definition for Equivalent Tenement (ET)

> *The equivalent hypothetical residential 1 lot tenement that would produce the same peak dry weather flow as that contributed by the area under consideration i.e. all zonings including residential, commercial and industrial. 1ET = 4EP*

Maximum development numbers as stated in the *"Environmental Assessment of the Shaolin Tourist and Residential Development Comberton Grange, South Nowra, NSW"* have been used.

Description	Unit	No	ET / Unit	Total ET
Buddhist Sanctuary Precinct				
Temple Sanctuary Residential	beds	50	0.25	12.5
Temple Sanctuary Auditorium - 300 seat	per 100 occupants	3	1	3
Precinct Total				**15.5**
Educational Precinct				
Kung Fu Academy - Students in Residence	beds	300	0.25	75
Kung Fu Academy - Staff in Residence	beds	30	0.4	12
Precinct Total				**87**
Wellness Precinct				
Clinics for traditional Chinese medicine practitioners, treatment areas	area (m2)	10,000	0.0048	47.6
Precinct Total				**47.6**
Hotel Precinct				
Hotel Guest Accommodation 500 guests	rooms	250	0.25	62.5
Hotel Staff Accommodation 30 staff	rooms	30	0.4	12
Precinct Total				**74.5**
Town Centre Precinct				
Convention Facility 600 seat	per 100 occupants	6	1	6
Town Centre Mixed Use	area (m2)	20,000	0.0048	95.2
Precinct Total				**101.2**
Information Precinct				
Information Centre, Museum, Administration & golf cart hire facilities	area (m2)	1,000	0.0048	4.8

Precinct Total				**4.8**
Heritage Precinct				
Cafe	area (m2)	150	0.01	1.5
Precinct Total				**1.5**
Residential Precinct				
Residential Dwellings	Single House	300	1	300
Precinct Total				**300**
Recreational Precinct				
Golf Course Clubhouse	area (m2)	300	0.01	3
Precinct Total				**3**
Total all Precincts				**635.1**

1.3 LIMITATIONS OF THE REPORT

Calculations and findings produced in this report have been sourced from Masterplan information.

Information regarding existing Authority Infrastructure is based on provided information from relevant authorities.

Projected water and sewer loads are based on industry standard benchmark data as published in the Water Services Association of Australia Design Guidelines and relevant Shoalhaven Water publications.

2 WATER SERVICES

2.1 AUTHORITY INFRASTRUCTURE

The potable cold water supply is proposed to be sourced from an existing authority 450mm trunk water main which services the Callala Beach and Callala Bay areas. The authority water main crosses the eastern end of the site, and is located approximately 4 km from the development area.

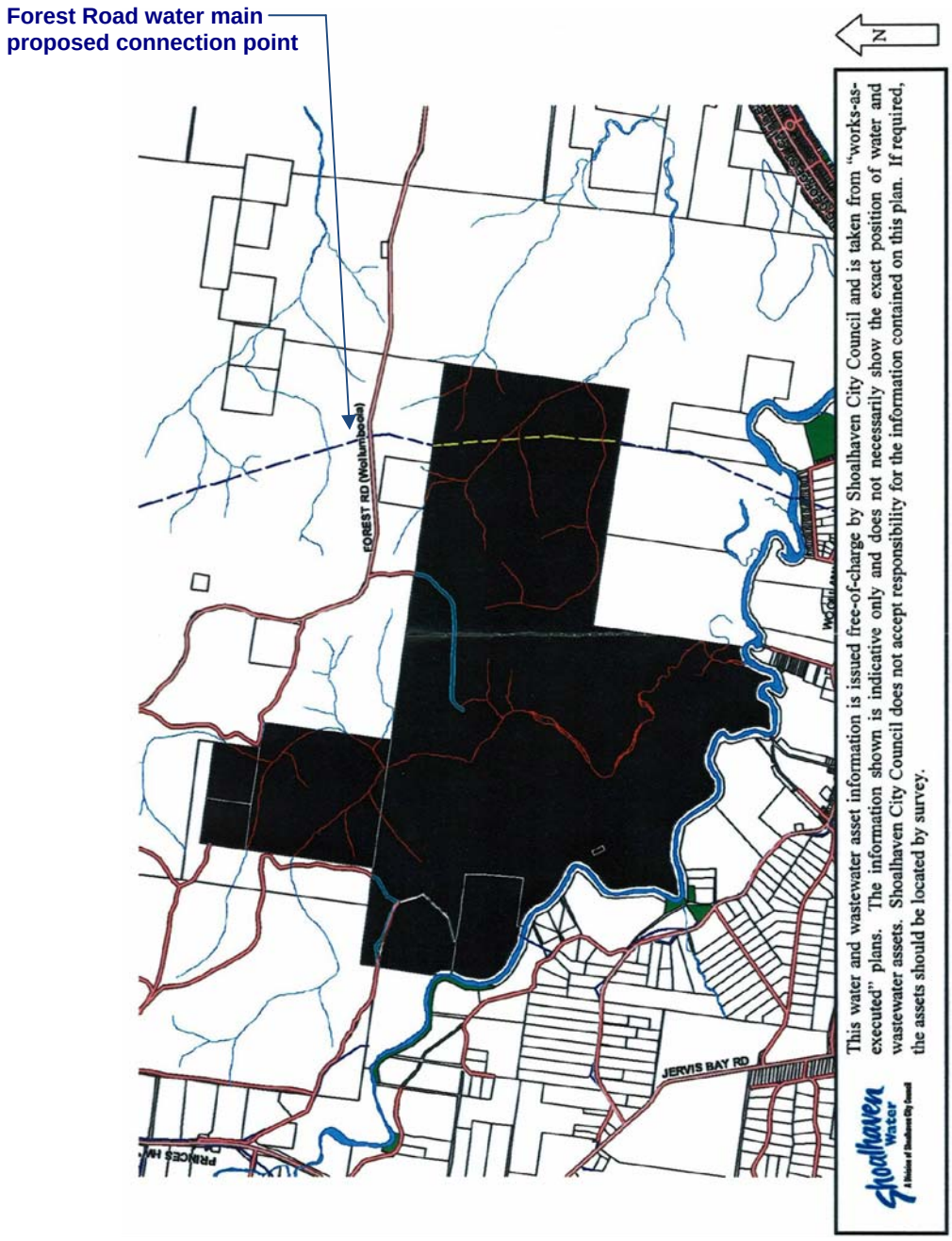


Fig 1. Shoalhaven Water – Water Main location Diagram

2.2 SITE WATER DEMAND

2.2.1 Built Environment Demand

With reference to the Shoalhaven City Council publication *"Development Servicing Plans for Water Supply Services*" November 2005, the following water demand assessment has been calculated based on the projected development ET.

Water Demand Projection		
Peak Instantaneous Demand (L/s)	95.27	0.15 L/s/ET
Average Day Demand (L)	435,013	250 kL/ET/yr average
Peak Day Demand (L)	1,270,238	2,000 L/d/ET
Peak day Demand over 24 hrs (L/s)	14.70	

2.2.2 Irrigation Demand

Shoalhaven Water's *"Supplement to the Water Services Association of Australia Sewerage Code of Australia*" document notes *"Fairways on golf courses are not provided with town water supply for irrigation purposes*". Therefore irrigation demands have been calculated separately, with the intention that captured and treated rainwater, stormwater or recycled water will be the source of supply for all site irrigation.

Projections assume 50 rain days / year not requiring irrigation.

Total demand for the site is tabled as follows;

Irrigation Water Demand Projection	
18 Hole Golf Course irrigation (L/d)	333,300
Site landscape irrigation and water features (L/d)	30,00
Total (L/d)	363,000

2.2.3 Potable vs. Non Potable Demands

Further consumption analysis has been undertaken to identify the proportion of the total demand that can be supplied with non potable water. There are a number of areas where use of non-potable, reclaimed, or recycled water will fulfil the requirements for water quality whilst reducing the demands on the authority infrastructure. The following applications have been identified for potable and non potable demands;

Potable: Ablutions (basin, bath, shower), domestic and commercial cooking and cleaning

Non Potable: WC flushing, domestic clothes washing, irrigation, mechanical cooling

Precinct	KL / Day avg	% Potable	Total Potable	% Non Potable	Total Non Potable
Buddhist Sanctuary Precinct	10.6	60%	6.4	40%	4.2
Educational Precinct	59.6	60%	35.8	40%	23.8
Wellness Precinct	32.6	80%	26.1	20%	6.5
Hotel Precinct	51.0	60%	30.6	40%	20.4
Town Centre Precinct	69.3	80%	55.5	20%	13.9
Information Precinct	3.3	80%	2.6	20%	0.7
Heritage Precinct	1.0	80%	0.8	20%	0.2
Residential Precinct	205.5	60%	123.3	40%	82.2
Recreational Precinct	2.1	80%	1.6	20%	0.4
Golf Course Irrigation	333.3	0%	-	100%	333.3
Site Landscape Irrigation	30.0	0%	-	100%	30.0
Total all Precincts	**798.3**	**35%**	**282.7**	**65%**	**515.6**

From this table it is noted that only 35% of the overall average day site water demand is required to be potable quality standard. This presents a significant opportunity for reclaimed and recycled water sources to supplement the site water demand, and reduce the demand of the potable authority water supply.

2.3 SITE POTABLE WATER SYSTEM

The proposed point of connection to the authority main will be adjacent to the trunk main crossing at Forest Road. The supply will extend to the site, reticulating adjacent to forest road for approximately 3 km, then along the site entrance road for approximately 1 km to the site boundary.

The site water meter and tank farm will be located within the site boundary. The incoming main will supply on site potable water and fire water storage tanks.

The site potable water storage reservoir will be sized to meet peak variations in demand. The storage reservoir will reduce peak loads on the authority supply, and provide back-up in the event of a loss of supply. The proposed storage capacity is one (1) day projected peak water demand supply, or 1,200 kL. The required flow rate for the potable water site supply will be approximately 15 l/s.

From the reservoir, potable water reticulation will serve all buildings proposed within the site via a series of ring main connections, in accordance with Local Water Authority Design Guidelines. The system will be designed to deliver a minimum of 150 kPa to all buildings. If this cannot be achieved via head pressure from the storage reservoir, booster pumps will be provided.

All residential, retail and commercial tenancies will be fitted with authority compliant metering and backflow prevention.

2.4 NON – POTABLE WATER SUPPLY

As noted above, approximately 65% of the total site water demand could potentially be provided from non potable water.

Shoalhaven Water produces irrigation standard quality recycled water from the various sewer treatment plants throughout the Shoalhaven council region. This recycled water is distributed throughout the precinct via the Reticulated Effluent Management Scheme (REMS). The REMS supply and is located approximately 4km from the proposed development.

A connection to the REMS supply is proposed for supply of non potable water to the site, primarily for irrigation of landscaping and the golf course, and potentially also for other non potable applications such as commercial precinct mechanical cooling and WC flushing across the development.

Further potential sources for non potable water include;

- Recycled fire test water
- Treated rainwater
- Treated Stormwater
- Treated Blackwater
- Treated Greywater
- Ground water aquifers

In order to identify preferred sources of non potable water, a detailed Water Cycle Management Plan will be undertaken through the design development phase of the project. The Integrated Water Cycle Management Plan will consider;

- Identification of non potable demands
- Assessment of required quality and quantity of non potable demands
- Identification of potential non potable water sources
- Assessment of quality, quantity and reliability of supply of non potable sources
- Assessment of costs associated with collection, storage and treatment of non potable water sources
- Assessment of various options for supply of non potable sources to non potable demands based on quality, quantity, reliability and whole of life cost

2.5 FIRE HYDRANT SYSTEM

Fire water will be supplied by the incoming site water main as noted in the Water Services section. Fire water storage equivalent to 4 hours of supply will be provided, in above ground tanks, located adjacent to the potable water storage tank farm. Anticipated fire water storage requirements for the site will be approximately 300,000 litres. Confirmation of the required size will be possible when proposed building configuration and sizes are finalised.

A 150mm Fire Hydrant ring main will reticulate throughout the development with up stand external hydrants and individual connections for large buildings.

A brigade booster assembly and on site booster pumps will be located adjacent the tank farm at the site boundary, in a position accessible to the fire brigade

2.6 HOT WATER SERVICE

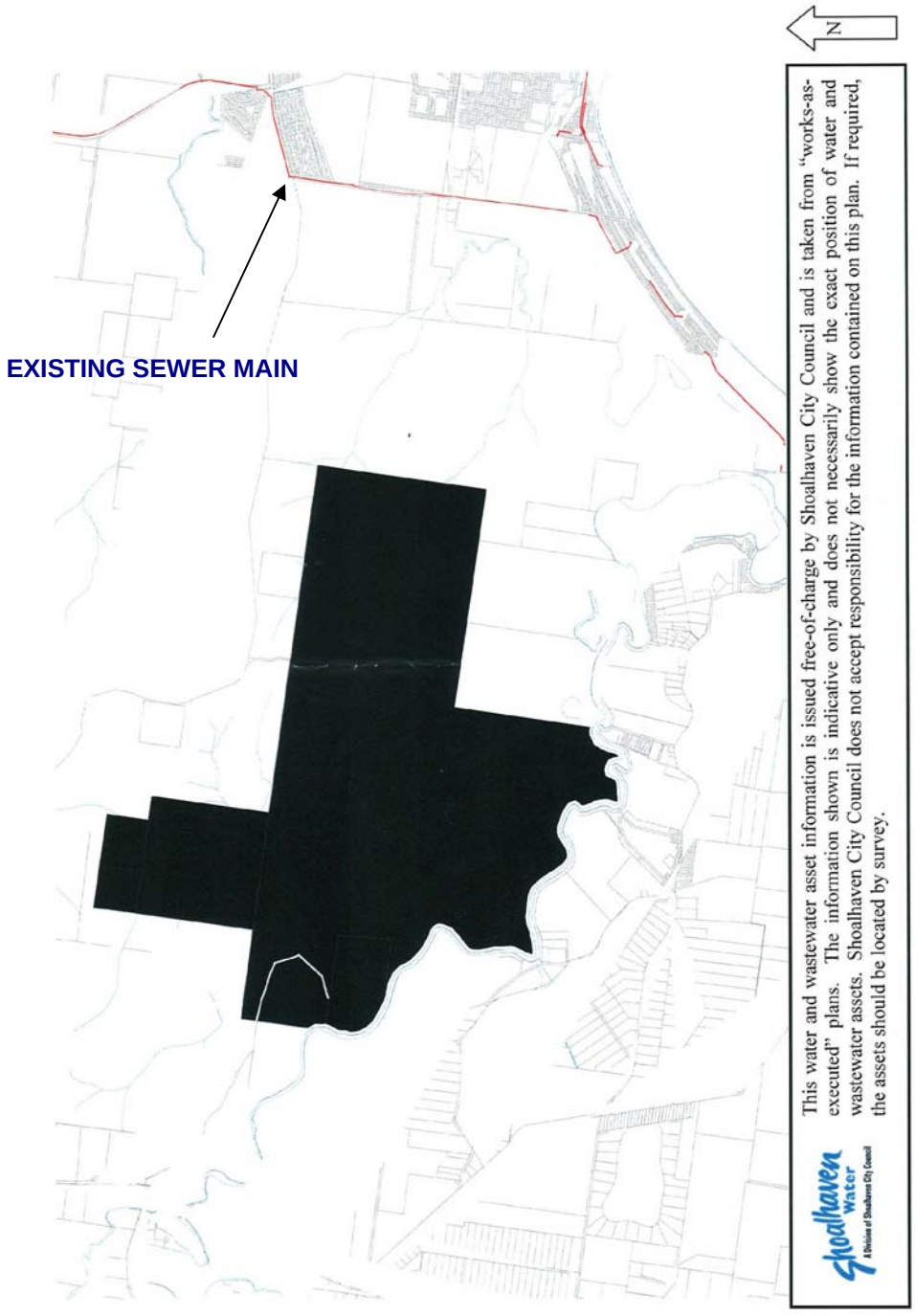
Central hot water systems shall be provided for each building, with an assessment of each buildings usage requirements taking place in order to select efficient systems.

In each case a pre-heat system shall be investigated in order to optimise efficiency and minimise power consumption demand. Generally solar pre-heat systems will be utilised where suitable. In areas where solar pre-heat is not suitable, alternative measures will be employed. Alternative options include waste heat from mechanical plant, geothermal and heat pumps.

3 SEWER SERVICES

3.1 AUTHORITY INFRASTRUCTURE

Shoalhaven Council's Sewer pressure main is located approximately 6km from the proposed development. Due to the distance and change in elevation, sewage from the site would need to extend to the Authority sewer main via sewer pumping stations.



3.2 SITE SEWER PROJECTED FLOW

With reference to Shoalhaven Water's *"Supplement to the Water Services Association of Australia Sewerage Code of Australia*", the following water demand assessment has been calculated based on the projected development ET.

Sewer Flow Projection		
ADWF (L/s)	5.27	Qa = 0.0083 L/s/ET (180 L/d/EP)
r	2.44	r = √1.74 + 56 / EP0.4
PDWF (L/s)	12.89	Qp = Qa x r
SA (L/s)	19.05	0.03 L/s/ET
PWWF (L/s)	31.94	PDWF + SA

3.1 SITE SEWER DRAINAGE SYSTEM

The proposed point of connection to the authority main will be adjacent to the pressure main crossing at Forest Road. The supply will extend to the site, reticulating adjacent to forest road for approximately 5 km, then along the site entrance road for approximately 1 km to the site boundary.

Sewer drainage infrastructure will be designed to reticulate on grade following natural contours to intermediate pump stations throughout the development, discharging to a main sewer pump station. The pump station and associated storage will be designed in accordance with WSA and Local authority requirements.

3.2 TRADE WASTE

Trade Waste Drainage will be required for all commercial food preparation areas. Development areas identified as requiring trade waste drainage and pre treatment systems include;

- Temple Sanctuary
- Kung Fu Academy
- Hotel
- Convention Facility
- Town Centre Food and Beverage Tenancies
- Golf Course Clubhouse

The arrangement and capacity of trade waste pre treatment systems required for the site will be determined on site activities are identified.

3.3 SEWER RECYCLING

As noted in the Non Potable Water Supply section, approximately 65% of the total site water demand could potentially be sourced from non potable water. Recycling sewer drainage is a potential source for non potable water supply. Site based recycling of sewer drainage has advantages and disadvantages as summarised below;

Advantages	**Disadvantages**
Environmental benefits of reduction in potable water demand	Significant capital set up cost
Ongoing cost savings through reduced potable water use	Significant ongoing maintenance and running costs
Reduced impact on authority infrastructure	Energy intensive operation
Potentially lower DSP contribution charges	Maintenance intensive operation
Potentially lower ongoing discharge to sewer charges	Recycled water use management plan required
Reliable quantity of supply	Ongoing testing and validation requirements
Predictable quality of supply	Disposal of waste by-product of recycling process
	Spatial requirement of recycling plant
	Potable water supply infrastructure cannot be reduced in case of recycling plant shutdown

A high level assessment of the suitability of a sewer recycling plant has been undertaken for this report.

There are advantages associated with the installation of a sewer treatment plant, including all mentioned in the above table, however, the preliminary findings indicate that a sewer treatment plant is not recommended for the development at this stage for the following reasons;

- Shoalhaven Water's REMS scheme performs the desired function of an on-site sewer recycling plant, on a municipal scale.
- High level whole of life (WOL) cost projections do not conclusively indicate any long term cost saving advantage in installing an on-site sewer treatment plant. Note however, at this early stage of cost assessment, many costs are assumed.
- A further factor to consider is that the client will be essentially responsible for the production of recycled water. Often a building or development asset owner is not comfortable with the ongoing responsibility of producing a product that is subject to the same validation and testing requirements of a water authority, particularly when a recycled water supply is available from the water authority.

4 STORMWATER DRAINAGE

Stormwater drainage infrastructure will be designed to adopt principals as set out in the WSUD section of the Environmental Assessment Report.

This presents various opportunities to supply a quality a relatively inexpensive non potable water source to a selection of various non potable demands. Consideration should be given however to the inconsistency of rainwater supply requiring large volumes of rainwater and stormwater storage.

Roof rainwater catchment for individual residential, commercial and civic buildings is proposed, to be reused for domestic applications such as toilet flushing, laundry and irrigation.

Site stormwater capture and treatment for reuse is also proposed. Stormwater catchment will be subject to higher levels of treatment than roof rainwater catchment due to the increased potential for contaminants from ground catchment areas, such as hydrocarbons washed off roadways, micro organisms in animal faecal waste, and nutrients from plant matter.

Dams or lakes incorporated into the site landscaping can serve as WSUD filtration areas, and stormwater storage.

Potential exists for ground water supply from aquifers located below the proposed site. Significant quantities of ground water (Coastal sands aquifers and Alluvial aquifers) below the site have a high yield water quality.

5 GAS SERVICES

Jemena is the gas authority for infrastructure surrounding the development site. Jemena have indicated the following options for gas supply to the site;

1. Supply from medium pressure network

    a) 6km of 160mm PE main to site 1 (Gimlet Road), or

    b) 7.5km (6km from site 1 plus 1.5km) of 160mm PE main to site 2 (Comberton Grange Road)

2. Supply from high pressure network

    a) 7.5km of 100mm ST main (MAOP 3MPa) to site 1 (Gimlet Road), or

    b) 9.0km (7.5km from site 1 plus 1.5km) of 100mm ST main (MAOP 3MPa) to site 2 (Comberton Grange Road)

Where costs are found prohibitive for such main extensions, tanks can be located on site which can be filled from trucks.

The space required for a suitable tank farm would be in the order of 20m x 10m. Such area would need to be located 20 metres away from buildings and bushland in a well ventilated area.

The site is a bushfire prone zone; hence fuel sources need to be kept a minimum 20m away.