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Nunduk Retreat and Spa

Integrated Water Cycle Management Strategy

PREPARED FOR:

Seacombe West Pty Ltd

DOCUMENT HISTORY

Revision	Prepared By	Verified By	Date
P1	PH	CJA	11 / 09 / 2017
A	PH	CJA	25/09/2017
B	PH	CA	12/01/2018
C	PH	CA	22/02/2018
D	PH	CA	26/03/2108

Current Revision

Final

Revision: D

Date: 26/03/2018

CJ ARMS

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Nunduk Retreat and Spa located on the southern shores of Lake Wellington in the Gippsland Lakes aims to be the Australia's first regenerative development. The Nunduk Retreat will feature a high-end luxury accommodation (36 rooms), a restaurant and spa complex and secluded villas (total 45 rooms) located a short distance from the Central Retreat. The Central Retreat itself will be totally self-sufficient for water and energy. As part of the regenerative approach the development will provide resources back to the environment for ecological and environmental purposes.

The water balance for the site showing peak daily demands and annual demands based on assumed occupancy is tabulated below. Potable demands included all water demands apart from irrigation. This integrated water strategy in this report has considered expected peak occupancy, however, during the detailed design a staged solution would be considered based on the lower occupancy expected in the first five years (refer chart 18, Tourism Product Evaluation Report August 2017 Westerlund Global).

Geothermal services including geothermal water supply and return to the Retreat and the villas will be provided by a separate operator and are excluded from the scope of this report.

Table 1: Peak water demands for Nunduk Retreat and Spa

Total Peak Water Demands*	Villas only L/day	Central Retreat (including staff) L/day	Total Retreat L/day	Total Retreat L/year
Potable demands	20,198	17,336	37,534	8,645,599
Retreat irrigation	-	15,001	15,001	2,040,163
Total peak daily water demands	**20,198**	**32,338**	**52,536**	**10,685,762**

* Excluding geothermal water demands for hot spa pools.

As there are no authority services to the site, rainwater is considered the most desirable water source to meet demands. Collection of rainwater from the Central Retreat roof, infrastructure zone roof and villa roofs (total roof catchment of 18500 m^2) into a rainwater storage tanks (total storage volume = 1,500 kL) will provide an average of 88% of the Nunduk Retreat and Spa water demands (excludes irrigation and spa water demands).

Backup potable water supply to the Central Retreat and villas will be provided through desalination of groundwater extracted on site. It is assumed that the desalination plant will be able to provide up to 40 kL per day (1 peak days water requirements not including irrigation) and will be powered by renewable energy (with battery or other backup). Inclusion of irrigation demands will require additional capacity for desalination up to a total of 55 kL/day. A 200 kL desalinated water tank will provide 4 days storage.

Wastewater will be collected from the Central Retreat and villas using localised pump wells and a small-bore pressure sewer network and reticulated to the wastewater treatment plant. The wastewater will be treated to equivalent of class C (EPA-Vic) using passive reedbed treatment technology which uses very little power and treats sludge and water in one system. Reuse water will be further treated through an open water wetland and storage dam and piped to the adjacent farm for irrigation of pasture. Winter storage will be provided to prevent over irrigation in winter months, retention for pathogen removal and this will double as ecological fresh water wetland habitat.

The solids are composted in-situ within the treatment system and will be harvested on a 5-10 year basis and stockpiled for 3 years (as per EPA guidelines) prior to reuse on the farm for soil improvement.

In terms of stormwater management, it is unlikely that significant runoff will occur due the permeable nature of the existing sandy ground, however, water from pavements and other hardstand will be directed to stormwater treatment systems to prevent high nutrient and sediment concentration entering waterways, natural wetlands and groundwater.

The water services provided in this development are governed by a number of authorities and regulations and these are outlined in Section 5.

The water strategy proposed allows Nunduk Retreat and Spa to:

- be self-sufficient in water supply
- maximise rainwater use on the site
- be net positive in water supply with export to the adjacent farm
- provide water back to the ecology of the site in provision of freshwater wetland habitat as part of the winter storage strategy
- provide beneficial use of nutrients from the wastewater, which would normally be wasted, to grow pasture on the adjacent farm by using treated wastewater for irrigation
- ensures a low carbon footprint through the use of green renewable energy for the desalination process and all pumping requirements and passive reedbeds for wastewater treatment

The water and wastewater strategy is summarised in the following table and schematically in Figure 1.

Table 2: Integrated Water Cycle Management Strategy Summary

	Central Retreat	Villas
Potable water supply	17.3 kL/day (peak) Rainwater collection from Central Retreat roof, infrastructure zone roof, and villa roofs (total 18500 m^2) into 1,500 kL rainwater tank (with filtration and UV disinfection) provides an average of 88% of Total Retreat demands (including Villas but not including Retreat landscape irrigation or spa water requirements) Backup potable water supply is solar powered desalinated groundwater (peak 40 kL/day desalination plant, 200 kL clean water storage – 4 peak days))	20.2 kL/day (peak) Rainwater collection and harvesting - refer Central Retreat for details Backup supply is from desalinated ground water – refer Central Retreat for details
Retreat irrigation water supply	15 kL/day (peak) Solar powered desalination of groundwater (requires additional desalination capacity above that required for potable water supply alone)	n/a
Wastewater	Pumpwells and small-bore sewer network reticulated back to natural passive wastewater treatment system treating water to equivalent of Class C (EPA-Vic)	As per Central Retreat
Reuse water	100% of the treated wastewater will used on the adjacent farm for irrigation of pasture. Winter storage/freshwater wetland (estimated 4.8ML) - to be confirmed by LCA	No reuse water will be provided to the Central Retreat or villas
Fire service	A dedicated 500 kL water storage tank and diesel pumps (with backup) will provide water to the Central Retreat and the villas for fire-fighting services.	As per Central Retreat

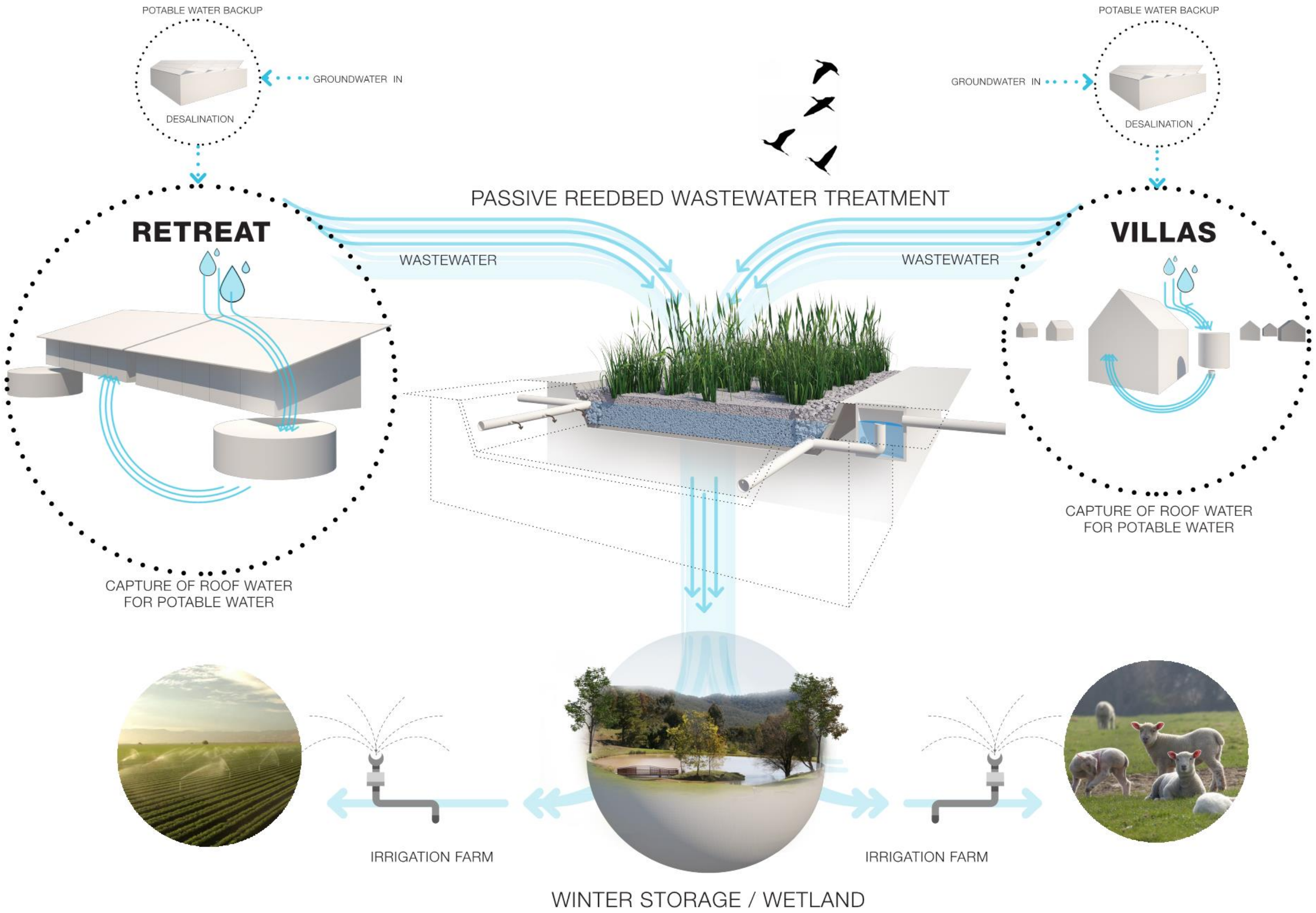


Figure 1: Schematic of Water Flows for the Nunduk Retreat and Spa

1 INTRODUCTION

Nunduk Retreat and Spa Development is located at the western end of the Gippsland Lakes on the southern shore of Lake Wellington in Victoria and aims to become Australia's first Regenerative Development. The opening of the Gippsland Lakes system to Bass Strait in the late 1800s at Lakes Entrance has over a period of years resulted in significant degradation of low lying land around Lake Wellington due to inundation with salt water. Many freshwater wetlands around the shores of Lake Wellington that were once important habitat for local and migratory birds have also become saline and bird numbers have declined.

The Nunduk Retreat and Spa Development aims to develop this degraded land and, in the process, regenerate the biodiversity of the site, improve the ecological health along with creating a vibrant community to reinvigorate the area from a social and economic viewpoint. Whilst many of the common sustainability approaches and rating tools for developments seek to do "less harm" to the environment, the regenerative approach aims to improve the site in all aspects to the benefit of Lake Wellington and the broader community.

1.1 The Development

Nunduk Retreat and Spa
Central Retreat - 36 rooms
Villas – Total of 45 rooms
Restaurant/Bar
Spa facilities
Open water body

1

1.2 The Site

The Nunduk Retreat and Spa site is situated approximately half way between Sale and Loch Sport on the southern shores of Lake Wellington in the Gippsland Lakes, Victoria (refer Figure 2). It is located on Wellington Park on Longford-Loch Sport Road which is predominantly farm land used for grazing sheep and cropping with some pockets of remnant native vegetation. The site is largely flat with low lying ground close to Lake Wellington being highly degraded by salt incursion through salt water flooding events. Large areas of native vegetation and grassland have suffered because of these events and a large portion of the saline areas are overrun with “pigface” and “samphire”. In some areas, the salt levels are so high that no plants will grow and broad un-vegetated areas and salt pans have developed.

Figure 2: Site location

All buildings onsite will be raised above the 100-year flood level. Access to the site will occur via existing road from the Longford-Loch Sport Road.

An aspiration for the development is that not only will it be self-sustainable in water and energy, but that it will have plentiful energy and water supplies. To this end the site needs to provide all its own potable (drinking) water and treat all its own wastewater (sewage). In keeping with the regenerative design, the development will also need to provide sufficient water to allow for irrigation where required. In addition, stormwater runoff will need to be managed and treated to prevent high nutrient and sediment entering waterways, natural wetlands and groundwater.

1.3 Methods and Approach

To develop this report, we have performed a desktop analysis of the site which included a site visit. We have looked at the history of the site and the lake and the weather and climate in the area including rainfall, temperature and wind. We've also looked at groundwater and lake water quality monitoring information, soil information and the location of authority services where present.

For our analysis, we also perform a water balance which includes a detailed analysis of the likely water demands for all activities based on the potential population and occupancy of the development plus other water uses within the development such as irrigation.

Using this information, we have analysed a number of options and developed an integrated water cycle management (IWCM) strategy.

2

2 SITE ANALYSIS

2.1 RAINFALL

Bureau of Meteorology (BOM) rainfall data for the site was analysed for a number of weather stations near the site as shown in Table 3. Local landforms and large water bodies can have a significant effect on the annual rainfall, however, in this case it appears the averages for each site are not so dissimilar. A number of the nearby weather stations closed many years ago and since climate change will have affected the most recent data we have chosen the East Sale Airport site which has a full set of up-to-date data to perform our water balance and rainfall capture analysis.

Table 3: Bureau of Meteorology Weather Stations located nearest the site

Site	Site no.	Distance from site (km)	Years of data	Completeness of data set	Average annual rainfall (mm)
East Sale Airport	85072	23 km	1943-2016 Active	Complete	598.1
Meerlieu	85167	13 km	1968-2016 Active	Largely complete	623.9
Seacombe	85135	1 km	1893-1930 Closed	Lots of missing data	477.1
Seacombe (Wellington Park)	85102	0 km	1953-1963 Closed	Largely complete	604.9
Dutson	85025	18 km	1900-1978 Closed	Largely complete	582.2

2

2.2 20 Year Rainfall Analysis (Jan 1997 – Dec 2016)

For the purposes of this study we have chosen the last 20 years of data (Jan 1997 – Dec 2016). This period includes a number of low rainfall drought years in order to take a conservative approach with our model. The average annual rainfall in this period is 519.9 mm/year.

BOM Site	Site No	Average annual rainfall, mm	Maximum annual rainfall, mm	Minimum annual rainfall, mm	Peak daily
East Sale Airport	85072	519.9	716.0	301.6	108.80

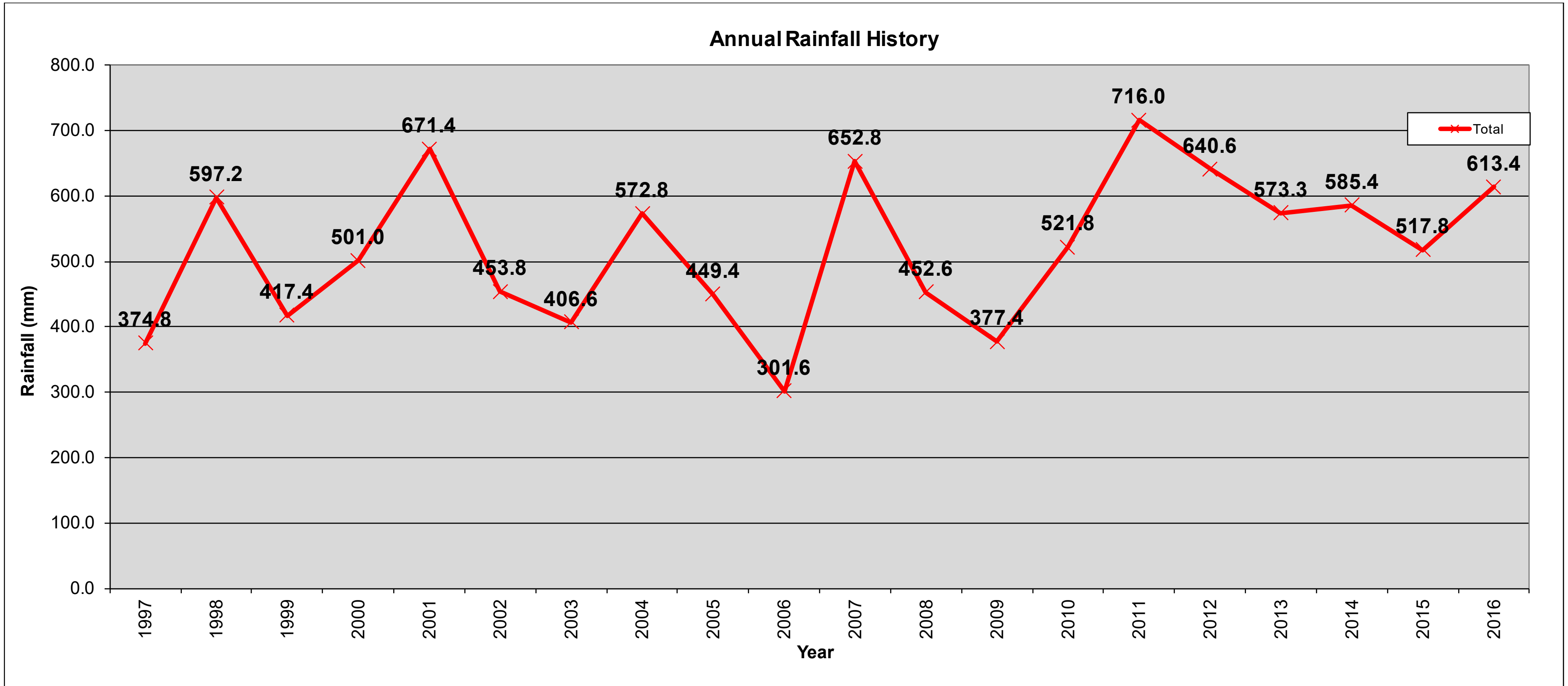


Figure 3: Annual rainfall for East Sale Airport (BOM station 085072) for the period Jan 1997 – Dec 2016

2.3 Authority Services

Whilst the development seeks to remain off the grid and not connected to any authority services a very brief preliminary investigation on authority services produced the following information.

There is authority power (electricity) which runs along Longford-Loch Sport Road evidenced by overhead power lines. Further enquiries to the electricity provider, Ausnet Services, would be required to establish the viability of connecting the development to this power supply should this become a preferred option.

There is no authority potable water supply in the vicinity of the development site. The nearby town of Loch Sport with over 2500 properties, relies on roof captured rainwater from each house for their potable water supply. The Nunduk Retreat and Spa will also need to be self-sufficient.

Recently a pressure sewer pipeline was installed along Longford-Loch Sport Road to provide the town of Loch Sport with a reticulated sewer system. This pipeline transfers the sewage from Loch Sport to Dutson Downs Sewage Treatment plant. We have no information on the ability of this pipeline to take additional sewage from the new development. In the current scheme Nunduk Retreat and Spa will not require connection to this pipeline.

2.4 Groundwater

There are a number of bores located on the site. Only one bore (ID 50876) is currently actively monitored and it is located close to Longford-Loch Sport Road. It is a deep bore taking water at approximately 60m below ground level and the reports indicate a total dissolved salt concentration of around 900 mg/L and an electrical conductivity (EC) of around 2000 µS/cm. Other bores located closer to the lake and the Retreat site are generally shallow (less than 10 m) and are more reflective of surface water conditions with higher levels and higher variability in EC and salt levels.

Anecdotally (personal communication with J. Troedel) the dissolved salt levels (TDS) in water extracted from bores located on Wellington Park are around 900 mg/L and on occasion this has been used as a back-up potable water supply for the farm house. The presence of dissolved iron (as ferrous ions) in the water causes staining in appliances and fixtures.

The Nunduk Retreat and Spa are planning on using groundwater as a supplementary water supply for the development to provide any shortfall in potable water supply after suitable desalination treatment. Desalination will be powered by renewable energy generated onsite. Disposal of concentrated brine generated by the desalination process will need to be considered.

2.5 Lake Water

Prior to the opening of the lakes to the sea at Lakes Entrance, Lake Wellington was predominantly a freshwater lake, however, since that time low freshwater river inflows and evaporation allow salt water to move back up into Lake Wellington via McLennan Strait. As such the levels of salt in the lake fluctuate from freshwater to brackish sea water; typically, low salinity in winter when rainfall flows are high enough to flush the salt water out and high salinity in summer when evaporation is increased and freshwater flows are low, although the actual levels of salt at any time are highly dependent on the actual weather conditions.

Data from the monitoring station (DEPI Site No. 226041) located on the site indicates maximum electrical conductivity of the water as 37,058 µS/cm and the minimum as 508 µS/cm over the period from 1992 – 2016. As a comparative indication the electrical conductivity of seawater is around 54,000 µS/cm. The salinity figures for this monitoring station monitored 1986-2010, and shown in Figure 4, indicate the historic salinity levels in the lake vary from around 1 ppt (part per thousand) to around 20 ppt compared to seawater which is around 28 ppt (or 28,000 ppm). The project is not considering any impact on Lake Wellington.

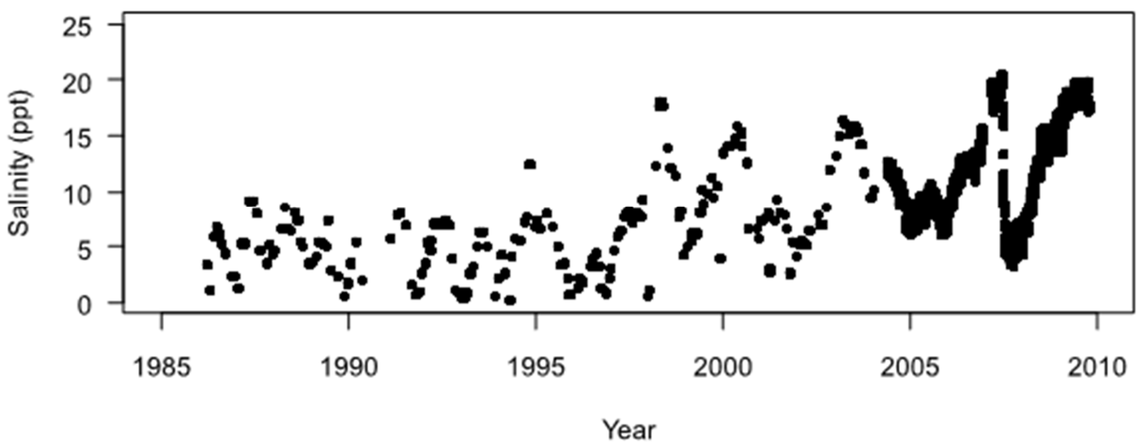


Figure 4: Measured salinity levels in Lake Wellington (DEPI Site No. 226041) site showing the cyclical nature of changes (Engineers Australia (Ed.), Proceedings of the 34th IAHR World Congress, pp 3207-3214, ISBN 978-0-85825-868-6, 2011) (ppt = parts per thousand)

2

2.6 Wetland Habitat

The Ramsar Convention has recognised almost all of the Gippsland Lakes as being of international importance for its wetlands and large bird populations and the largest single component in the Gippsland Lakes Ramsar site is Lake Wellington and its fringing wetlands and these are listed as important in "A Directory of Important Wetlands in Australia".

Research into the management of Lake Wellington suggests that under most scenarios investigated, and allowing for climate change, that the lake will become more saline over time, threatening the high value fringing wetlands which are predominantly freshwater (Engineers Australia (Ed.), Proceedings of the 34th IAHR World Congress, pp 3207-3214, ISBN 978-0-85825-868-6, 2011).

3 WATER BALANCE

3.1 Assumptions

A number of assumptions have been made in relation to the development in order to prepare the water balance including fixture flow rates and water usage patterns.

3.1.1 Population

For the purposes of the water balance, we have made some assumptions about the expected population of the site and these are listed in Table 4.

Table 4: Table of expected population at peak occupancy

Zone	Rooms/Villas	Peak Number of Persons	Total Population Equivalent
Central Retreat	36 rooms	1.5 per room	54
Villas (1, 2, 3 bedrooms)	45 rooms	1.7 per room	75
Staff (including accommodation)	-	25-50	30
Total	-	-	133

3.1.2 Occupancy

We have also made some assumptions about how the development might be occupied. We expect that there will be a seasonal dependence for the occupancy, however, the nature of the hot spa is likely to encourage winter visitors as well, so we have adopted a slightly lower seasonal dependence than might otherwise occur in this region for tourist visitors.

The population distribution used for modelling throughout the year is presented in Figure 5 which equates to an average annual occupancy of approximately 63%. This integrated water strategy in this report has considered expected peak occupancy, however, during the detailed design a staged solution would be considered based on the lower occupancy expected in the first five years (refer chart 18 – five year trading forecast, Tourism Product Evaluation Report August 2017 Westerlund Global).

Building Occupancy - how frequently is the building used?			
Operating months of the year		Operating days of week	
January	90%	Sunday	100%
February	90%	Monday	80%
March	80%	Tuesday	70%
April	75%	Wednesday	70%
May	70%	Thursday	70%
June	65%	Friday	80%
July	65%	Saturday	100%
August	70%	Percentage of months means % of days the building is occupied in that month.	
September	75%		
October	80%		
November	80%	Percentage of days means % of people/day (from above) in the building on that day.	
December	90%		

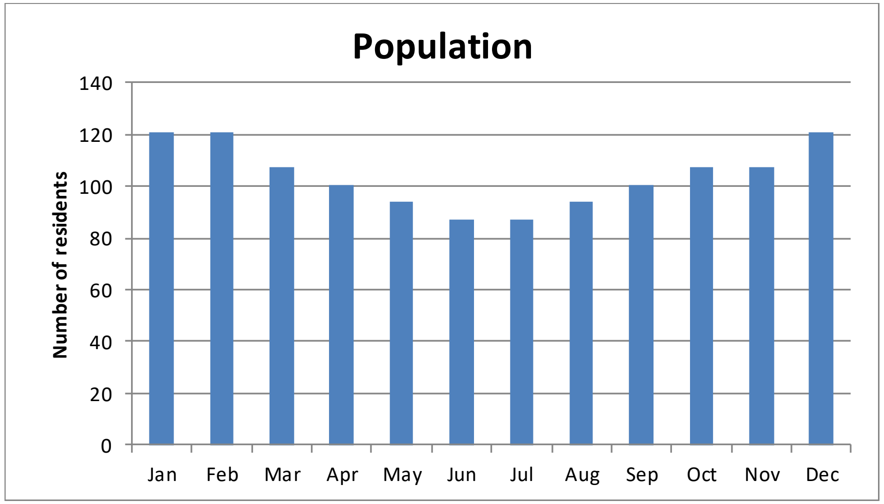


Figure 5: Assumed seasonal population distribution used in the water modelling

3.1.3 Roof collection areas

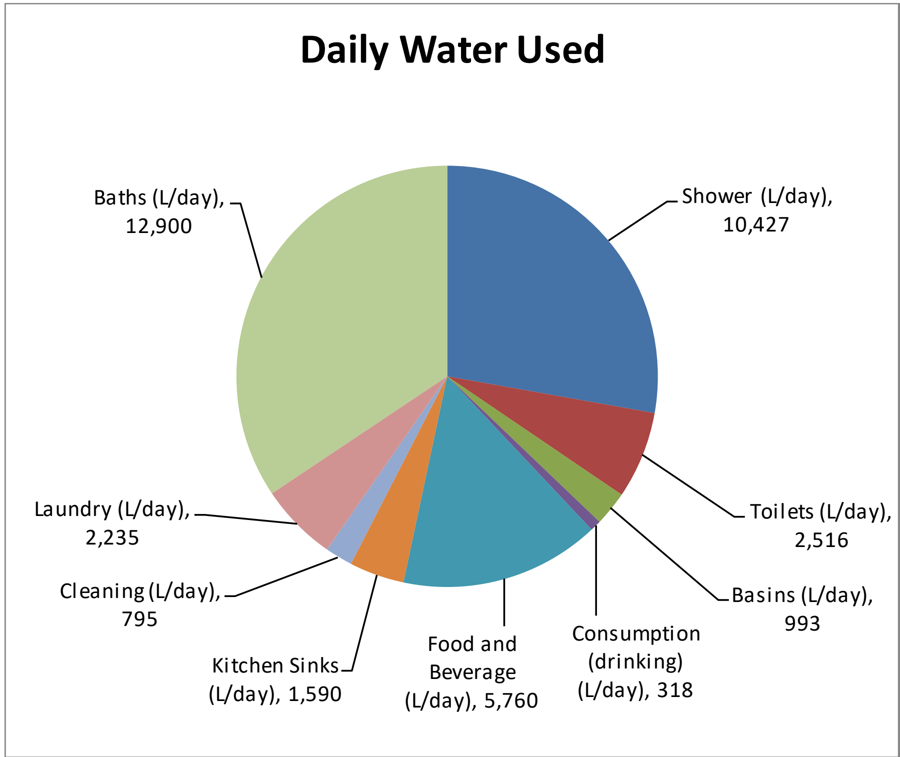
The Central Retreat has a roof area of 9,000 m^2, the villas a total roof area of 4,500 m2 and the infrastructure zone has an area of 5,000 m2 available for rainwater harvesting and which can provide a potential source of potable water supply. We have assumed an average irrigation demand of 2.0 ML/year for the Central Retreat which is primarily for the landscape which we understand to be indigenous drought tolerant species.

3

3.2 KEY FINDINGS OF THE WATER BALANCE

3.2.1 Water demands

For the purposes of this report, water demands for the hot spa pools have been excluded as we understand these are being supplied separately using geothermal water.



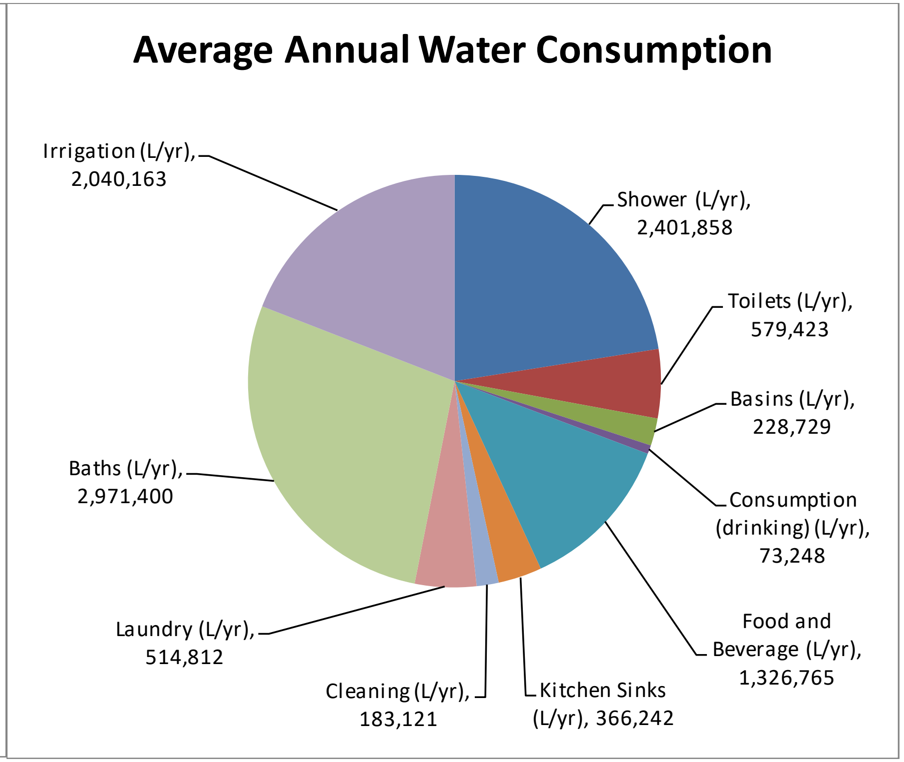


Figure 6: Peak daily and annual water demands for the Nunduk Retreat and Spa.

The peak daily and annual water demands for the development are presented in Figure 6. This graph demonstrates that, apart from irrigation, Bath and Shower demands are the greatest water demand, followed by Food and Beverage, Toilets, Laundry, and Kitchen Sinks. Irrigation is not presented in daily figures as this varies seasonally.

It is expected in this high-end luxury Retreat that water usage will be relatively high. The pattern of annual demands is similar to the daily demands with the inclusion of Retreat irrigation (which includes irrigation of the landscape). An irrigation volume of 2ML/yr has been allocated for the landscaped areas. The water demands have been characterised into potable and irrigation (non-potable) demands as shown in Table 5.

Table 5: Potable and non-potable demands

Potable Demands		Non-potable Demands
Drinking water	**Bath**	Irrigation
Shower	**Hand Basins**	
Food and Beverage	**Laundry**	
Kitchen Sinks	**Cleaningc**	
Toilet flushing		

Table 4 summarises the daily water demands and the split between the villas and the Central Retreat. The peak irrigation demand for the Retreat is 15,000 L/day, primarily for irrigation of the landscape.

Table 6: Summary of Peak water demands for the Retreat and Villas

Total Peak Water Demands*	Villas only L/day	Central Retreat (including staff) L/day	Total Retreat L/day	Total Retreat L/year
Potable demands	20,198	17,336	37,534	8,645,599
Retreat irrigation	-	15,001	15,001	2,040,163
Total peak daily water demands	**20,198**	**32,338**	**52,536**	**10,685,762**

* Excluding geothermal water demands for hot spa pools.

3

3.2.2 Wastewater Production

The daily wastewater production for the entire Nunduk Retreat and Spa (including villas) is presented in Table 7. There is a peak of 36,488 L/day of wastewater available to treat for reuse.

Treated wastewater (reuse water) could be used to provide for all the non-potable demands for the Retreat including toilet flushing and irrigation demands. Unfortunately, the extra infrastructure, higher level of treatment required (including strict authority requirements for toilet reuse) and risk of nutrient discharge to groundwater and the lake through irrigation make this option cost prohibitive.

However, the farm located adjacent to the development has a requirement for irrigation water so the treated wastewater will be provided for beneficial reuse on the farm which will make use of both the water the and nutrients to provide pasture and grow fodder for stock (sheep). The irrigation will be managed in line with EPA requirements.

Table 7: Daily wastewater production

Daily Water Estimates	Daily Water Used	Daily Wastewater Discharged
Shower (L/day)	10,427	10,427
Toilets (L/day)	2,516	2,516
Basins (L/day)	993	993
Consumption (drinking) (L/day)	318	0
Food and Beverage (L/day)	5,760	5,184
Kitchen Sinks (L/day)	1,590	1,590
Cleaning (L/day)	795	755
Laundry (L/day)	2,235	2,123
Baths (L/day)	12,900	12,900
Total Occupant Peak (L/day)	**37,534**	**36,488**

The total annual production of wastewater is 8,404,777 L/year.

3.2.3 Water sources

It is envisaged that this development will be self-sufficient in water supply. To achieve that the development needs to provide all its water requirements from the site.

1.1.1.1 Rainfall

Given the average annual rainfall of approximately 520 mm/year, collection of rainwater is an option to provide potable water for the site. Rainwater collection from the Central Retreat roof (area 9,000 m^2), infrastructure zone roof (area 5,000 m^2) and Villa roofs (area 4,500 m2) into 1,500 kL of combined storage will capture and average of 89% of the rainfall and provide, on average, approximately 88% of the demands for the Central Retreat (including Villas but not including irrigation or spa water requirements).

1.1.1.2 Stormwater

Due to the porosity of the ground onsite, which limits the amount of hard stand exposed to the rain, it is expected that stormwater runoff will not be a contributor to site water supplies. However, stormwater runoff will be managed and treated to prevent high nutrient and sediment entering waterways, natural wetlands and groundwater.

1.1.1.3 Groundwater

There are two sources of groundwater on the site: one is geothermal water from a deep aquifer (1 km deep) and the other is groundwater from around 90-100 m deep. The former will be used to supply hot water for the spa in the Retreat by a geothermal contractor and falls outside the scope of this report. The development is planning on using groundwater as a supplementary water supply for the development (for the 12 % potable water requirements and spas). Suitable desalination treatment, powered by renewable energy generated onsite, will be required.

1.1.1.4 Lake Water (Lake Wellington)

As note in Section 2.5, the salt levels (i.e. TDS) ranges from around 5,000 ppm to around 20,000 ppm and varies seasonally. There is no requirement of water from the lake and there will be no environmental impact on Lake Wellington.

3

1.1.1.5 Reuse Water

Reuse of treated wastewater for the Retreat's non-potable water demands (currently toilet flushing and irrigation) is not cost effective due to the significant costs of authority approvals and additional treatment that would be required to provide Class A water. The wastewater from the Retreat and villas will be treated to Class C equivalent quality and supplied to the adjacent farm for irrigation of pasture. A winter storage will be required to enable storage of treated wastewater over the winter period when irrigation on the farm may not be required. An LCA and Recycled Water Management Plan will be prepared to ensure safe use of treated wastewater.

4

4 WATER SERVICES APPROACH

4.1 Water supply to Central Retreat and Villas

Rainwater will be collected from the Central Retreat roof (9,000 m^2), the infrastructure zone roof (approximately 5000 m^2) and the Villa roofs (4500 m^2 total) and used for potable water supply to the entire Retreat. A 1,500 kL rainwater storage tank (s) will capture 89% of the rainfall and can provide an average of 88% of total Retreat's potable water demands (not including irrigation and spa requirements).

The desalination of groundwater will be the supporting source of potable water for the Retreat. Potable water treatment (desalination) will be powered using renewable energy (solar) and will occur in the Infrastructure Zone and reticulated to the Retreat using an inground pipe network. The desalination plant has been sized at 40 kL/day to provide treatment of the daily requirement. A 200 kL potable water storage tank is provided to buffer demand and provide sufficient water (4 days of peak demand) in the event of treatment plant shut down due to equipment failure or maintenance requirements.

4.2 Wastewater treatment

Localised pumpwells and small-bore sewer pipe will collect wastewater from the Central Retreat and villas and pump it to the wastewater treatment system for treatment. Smart control of the pumpwells will enable management of peak flows.

Wastewater treatment will be performed using a passive reedbed technology in which raw sewage is treated using vegetated constructed wetlands. This treatment method minimises energy use, maintenance and ongoing cost of operations. The wastewater treatment reedbeds will cover an area of approximately 600 - 800 sqm, planted with indigenous reeds from the local area.

After some coarse screening to remove large solids materials, the remaining solids are removed in the first stage reedbed which dries and stabilises the sludge whilst also removing BOD and converting ammonia to less harmful forms of nitrogen. The second stage removes most of the remaining BOD and oxidises other contaminants. The entire process is natural, aerobic and nutrients are deliberately retained for the purposes of irrigation of farm pastures. The system will produce the equivalent of Class C water (EPA-Vic).

A winter storage dam (estimated volume) 4.8 ML will be provided and will be planted out with wetland plants to provide a double use of space as a freshwater wetland environment improving biodiversity, providing water for ecology, and partly replacing lost wetland habitat. The storage will allow for winter storage of treated effluent (estimated at 2.5 ML), an allowance for the 90%ile winter rainfall (1.3 ML), and 1 ML permanent water to allow for pathogen and helminth removal (minimum 25 days retention) at peak flow rates – also providing permanent water for wetland. A land capability assessment (LCA) will confirm the minimum winter storage provision, however, it is anticipated that the estimate volume will be greater than that required.

Both the passive treatment and the winter storage dam will be protected from the 100-year ARI flood by an earthen berm surrounding each structure. Mechanical equipment (i.e. screening, disinfection, control and monitoring equipment) will be installed in the infrastructure zone and located above the 100-year ARI flood level.

Treated water will be provided to the adjacent farm (with appropriate agreements) for irrigation of pasture and production of fodder crops.

4.3 Fire Services

A dedicated 500 kL water storage tank and diesel pumps (with backup) will provide water to the Retreat and the villas for fire-fighting services.

4.4 Summary Water Supply

Table 8: Summary of water supply source volumes for Retreat

Water supply (expected annual average)	Central Retreat and Villas	Retreat Irrigation	Total Retreat
Rainwater, L/annum	7,582,190	-	7,582,190
Desalinated water, L/annum	1,063,409	2,040,163	3,103,572
Total, L/annum	8,645,599	2,040,163	10,685,762

The expected annual water supply from all sources is shown in Table 8. The data for the Central Retreat and Villas and represented in Figure 7 shows that on average around 88% of the water supply for the total Nunduk Retreat and Spa will come from rainwater and the remaining 12% will be supplied through desalination of groundwater (not including irrigation or spa water requirements).

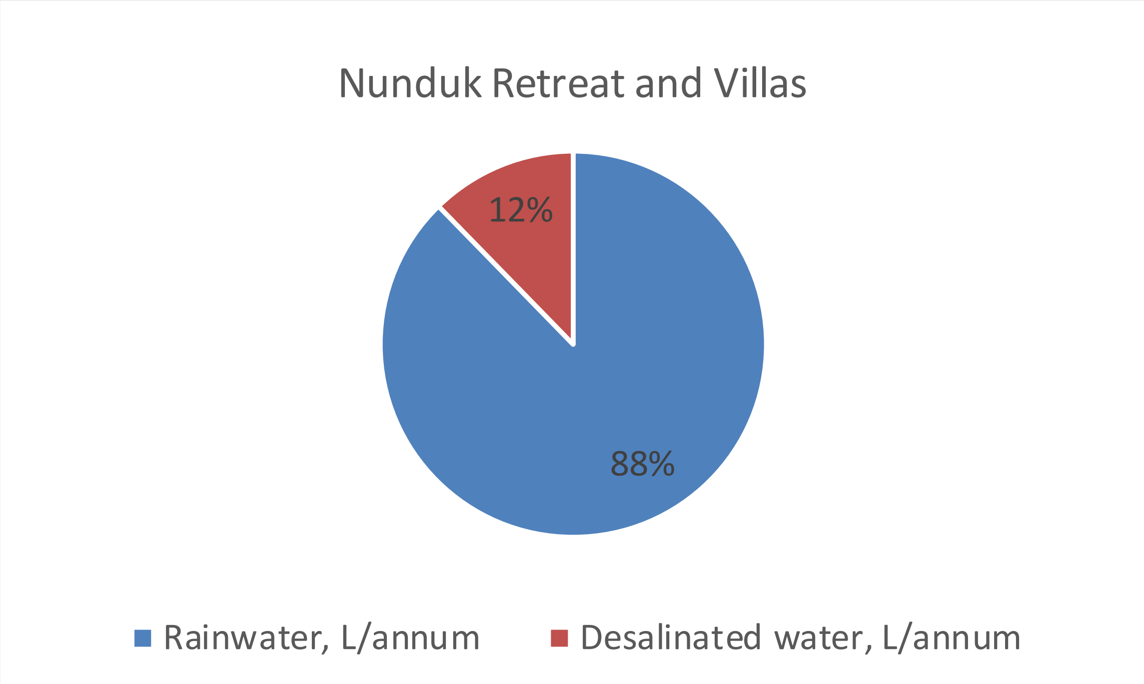
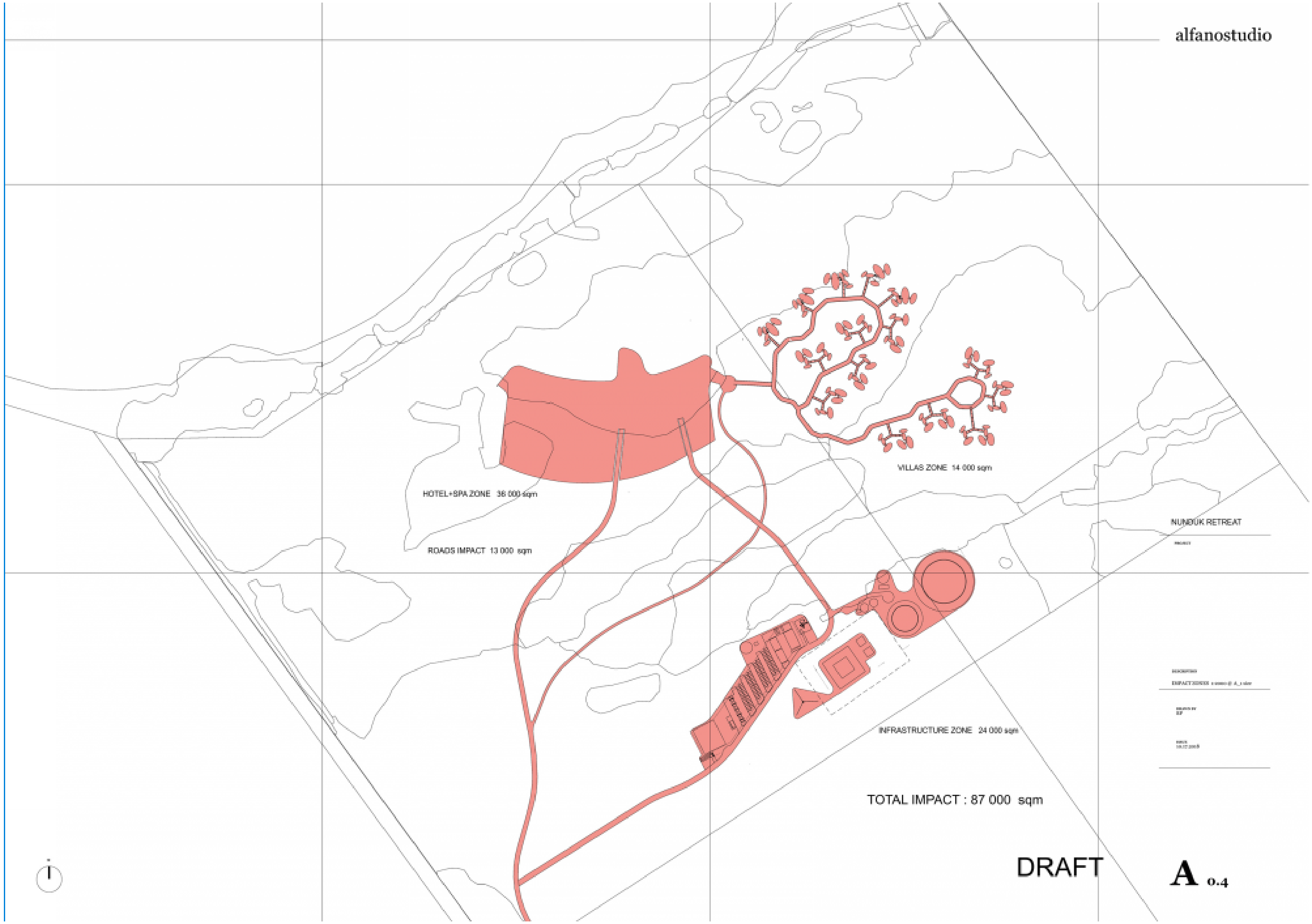


Figure 7: Total Nunduk Spa Retreat and Villas water supply by source (not including irrigation or spa demands)

4.5 PROPOSED SITE LAYOUT



5 REGULATORY CONTEXT

5.1 Regulations

The following authorities and regulatory policies may apply to water management on this site.

5.1.1 Authorities

- Wellington Shire Council
- West Gippsland Catchment Management Authority
- Gippsland Water
- Victorian EPA
- Southern Rural Water

5.1.2 Policies and Regulations

- National
    - Environment Protection and Biodiversity Conservation Act 1999
    - Biosecurity Act 2015
    - National Environment Protection Measures (Implementation) Act 1998
    - National Water Commission Act 2004
    - Water Act 2007
    - National Water Quality Management Strategy – Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1) Document 21. 2006.
    - AS/NZ 1547-2012 – Onsite Domestic Wastewater Management
- Victoria
    - Environment Protection Act 1970
    - Environment Protection (Amendment) Act 2006
    - Catchment and Land Protection Act 1994 (CaLP Act)
    - Flora and Fauna Guarantee Act 1988

- Water Act 1989
- The Safe Drinking Water Regulations 2015
- Water For Victoria
- Public Health and Wellbeing Act 2008
- State environment protection policies Waters of Victoria (SEPP WoV)
- EPA works approval http://www.epa.vic.gov.au/our-work/licences-and-approvals/works-approvals

5.2 Guidelines and Codes of Practice

- Australian Drinking Water Guidelines (2011) - updated 2016
- EPA Code of Practice for Small Wastewater Treatment Plants (Publication500) June 1997
- EPA Guidelines for Wastewater Irrigation, Publication 168, revised 1991
- EPA Code of practice – onsite wastewater management (publication 891.4)
- EPA Guidelines for environmental management - use of reclaimed water (publication 464.1)
- EPA Guidelines for environmental management: dual pipe water recycling schemes – health and environmental risk management (publication 1015)
- EPA Guidelines for environmental management – disinfection of treated wastewater (publication 730)
- EPA's works approval assessment process - Information bulletin
- DHS Guidelines for validating treatment processes for pathogen reduction: supporting Class A recycled water schemes in Victoria
- DSE Rainwater use in and around the home, 2006
- CSIRO 1999 Urban stormwater best practice environmental management guidelines(BPEMG)

5.3 Recycling wastewater

In general recycling wastewater for internal uses such as toilet flushing and external uses like irrigation will come under a number of jurisdictions and be subject to a number of controls. Primarily the purpose of all the regulations and controls is protection of human health and protection of the environment and this may be achieved in a number of ways.

Treating >5000 L/day of wastewater onsite and discharging treated wastewater to the environment as is proposed at Nunduk Retreat and Spa will trigger an EPA works approval process. Due to the stringent requirements for validation of Class A recycled water schemes and the cost of additional infrastructure and treatment, treated wastewater will not be used for toilet flushing or any other purpose in the Retreat or villas. As part of the overall recycled water scheme works approval an environmental improvement plan (EIP) will also be prepared.

5.4 Irrigation of Treated Wastewater

In consideration of the sensitivity of the lake water to nutrient loading and contamination the reuse of treated wastewater for irrigation of the Retreat has not been proposed.

A Land Capability Assessment (LCA) will confirm the minimum irrigation areas, winter storage volume and the appropriate way to irrigate the wastewater on the farm in a sustainable manner whilst avoiding environmental risks such as nutrient overload and groundwater contamination. The LCA will take into account hydraulic restraints, based on climate and rainfall, and nutrient restraints. Dissolved salts (TDS) may also be a limiting factor on irrigation. Irrigation of the farm will comply with LCA requirements and irrigation areas will exceed minimum irrigation areas required by the LCA.

In addition, treated wastewater used for irrigation of pasture for cattle grazing may require additional controls (AGWR, Document 21) including:

- Secondary Treatment >25 days lagoon detention or equivalent filtration process and disinfection
- Buffer distances 25-30 m buffer distance from nearest public access (greater is better).
- Withholding periods – exclude grazing for 5 days
- Reuse water cannot be used with pigs
- Extra controls may be necessary in the case of dairy cattle

Winter storage of 4.8 ML is being provided to account for 2.5 ML of winter storage of treated wastewater, 1 ML of detention (>25 days detention), and 1.3 ML to allow for 90%ile rainfall directly on storage dam.

6

6 SUMMARY AND CONCLUSION

6.1 Summary of Water Supply and Wastewater Services

	Central Retreat	Villas
Potable water supply	17.3 kL/day (peak) Rainwater collection from Central Retreat roof, infrastructure zone roof, and villa roofs (total catchment area 18500 sqm) into 1,500 kL rainwater tank (with filtration and UV disinfection) provides an average of 88% of entire Retreat demands (including Villas but not including Retreat landscape irrigation or spa water requirements) Backup potable water supply is solar powered desalinated ground water (peak 40 kL/day desalination plant, 200 kL clean water storage – 4 peak days)	20.2 kL/day (peak) Rainwater collection and harvesting - refer Central Retreat for details Backup supply is from desalinated ground water – refer Central Retreat for details
Retreat irrigation water supply	15 kL/day (peak) Solar powered desalination of groundwater (requires additional desalination capacity above that required for potable water supply)	n/a
Wastewater	Pumpwells and small-bore sewer network reticulated back to natural passive wastewater treatment system treating water to equivalent of Class C (EPA-Vic)	As per Central Retreat
Reuse water	100% of the treated wastewater will used on the adjacent farm for irrigation of pasture. Winter storage/freshwater wetland (estimated 4.8ML) - to be confirmed by LCA	No reuse water will be provided to the Central Retreat or villas
Fire service	A dedicated 500 kL water storage tank and diesel pumps (with backup) will provide water to the Central Retreat and the villas for fire-fighting services.	As per Central Retreat

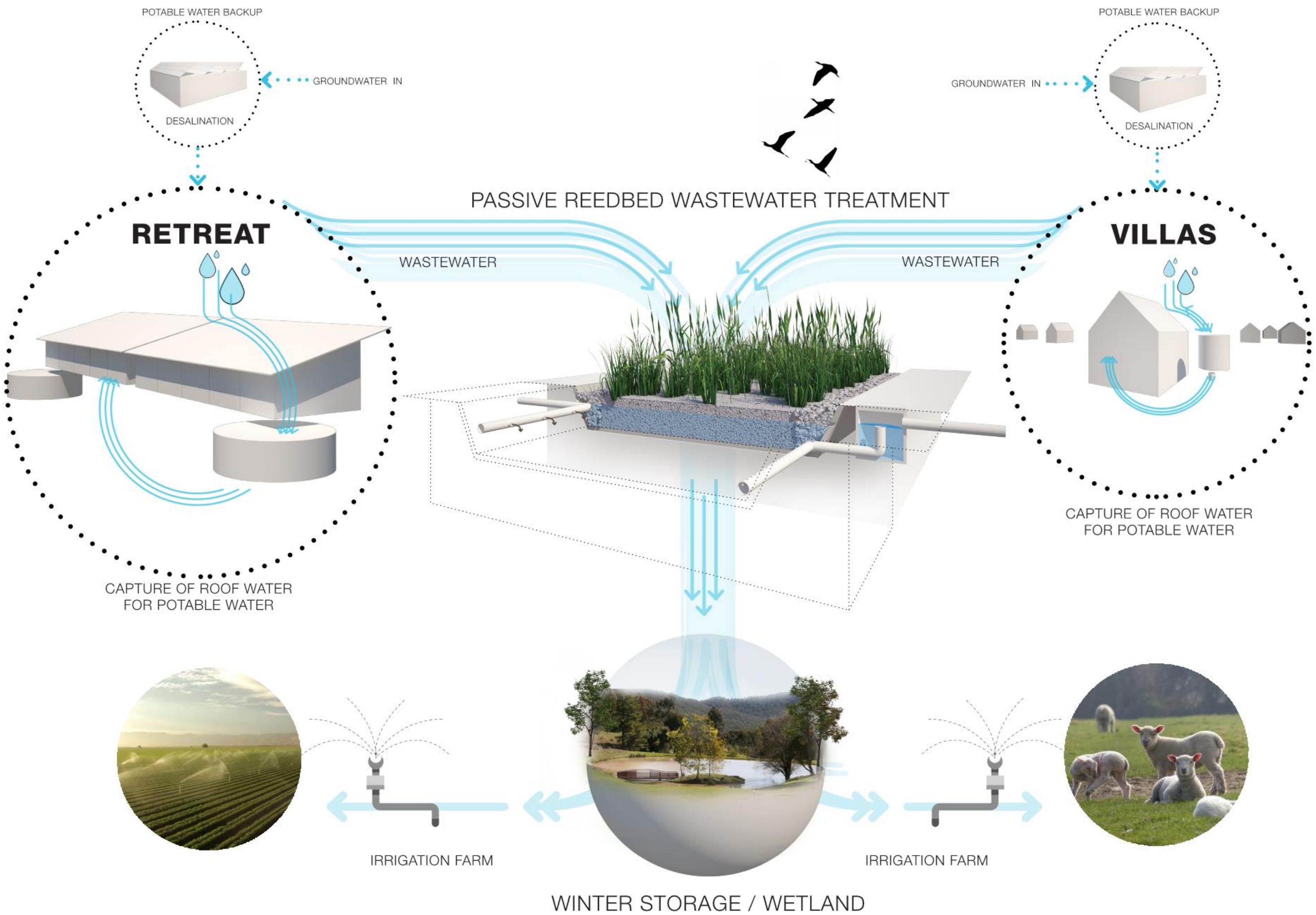


Figure 8: Water and wastewater services strategy schematic