**Annexure 1**

Water Management Report (prepared by Steve Paul and Partners)

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# Hydraulic & Civil Services

# Water Management Report

# Commercial Development

# Potts Hill Business Park


**<u>Client:</u>**

Landcom – Greensquare Town Centre Office

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ZETLAND NSW 2017

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BSI
FS 521024

05th November 2008

File: MS080046 Water Management Report.docx

**Review and Approval Record:**

| Rev | Date | Description of Release | Prepared By | Reviewed By | Approved By |
|---|---|---|---|---|---|
| A | 24/10/08 | Draft Issue | JW | BM | |
| B | 28/10/08 | PA Issue | BM | RW | JW |
| C | 05/11/08 | Revised PA Issue | JW | | JW |
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# Contents

# 1 Introduction

## 1.1 Background

Landcom have commissioned Steve Paul & Partners (the Hydraulic & Civil Consultant) to prepare an Environmentally Sustainable Design (ESD) report for the proposed commercial development at Potts Hill Business Park, Potts Hill.

## 1.2 Aims

The aim of this report is to provide an outline of some environmentally sustainable design initiatives that may be considered for the project with regard to hydraulic & civil. Specifically this report identifies and evaluates measures for the reduction of energy and potable water consumption within the hydraulic & civil installation throughout the development.

## 1.3 Location

The proposed site is located in the suburb of Potts Hill within the Local Government Area of Bankstown. The site is bordered by residential development fronting Graf Ave, Potts Park and Rookwood Road to the east, Sydney Water Reservoir No. 1 to the North, Reservoir No. 2 and open space to the west and Brunker Road to the South.

## 1.4 Building Population

The Administration Building (GFA-Building 1) has a total area of 7,399$m^2$ this is combined over the three floors and has an estimated total population for 188 people.

The Vehicle Services Building (GFA-Building 2) has a total area of 4,160$m^2$ this is combined over the two floors and has an estimated total population for 67 people.

The high bay Warehouse Building (GFA-Building 3) has a total area of 3,306$m^2$. It is only expected that 6 people will populate this building.

We recognise that only building 1 is seeking a 4 star Greenstar rating however our modelling is based on water reduction of all three buildings. Total population for the site is estimated to be 261 people.

## 1.5 Briefing Documents

The engineering elements considered in this report are based on the following documents:

- Preliminary architectural drawings prepared by HBO + EMTB Consulting Pty Ltd.

# 2 ESD OPTIONS

## 2.1 Rainwater Collection & Re-Use

Stormwater harvesting refers to the collection of stormwater from the developments internal stormwater drainage system. Stormwater from the stormwater drainage system can be classified as either rainwater where the flow is from roof areas only or stormwater where the flow is from all areas of the development.

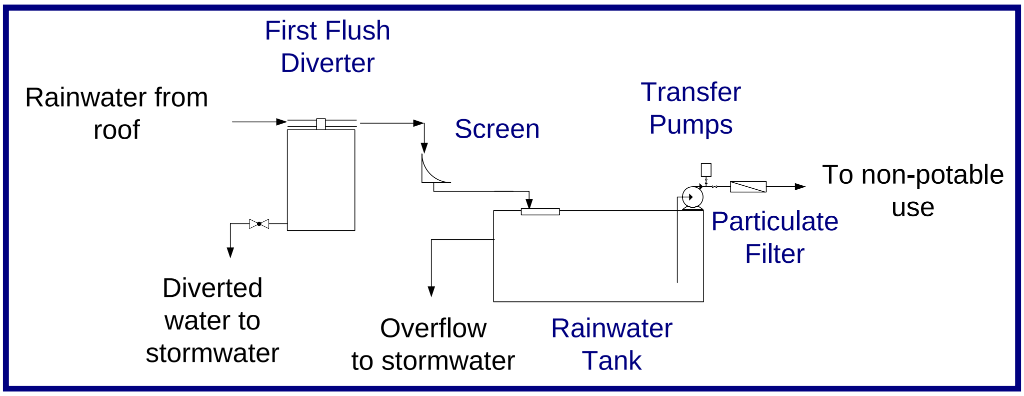
For the purposes of this commercial development, we refer to a rainwater harvesting system, where the following benefits can be achieved over a stormwater harvesting system;

- Rainwater collected from roof areas is generally less polluted than general stormwater drainage.

In general terms the rainwater harvesting system will be an in-line tank for the collection and storage of rainwater. At times when the rainwater storage tank is full rainwater can pass through the tank and continue to be discharged via gravity into the stormwater drainage system. Rainwater from the storage tank will be pumped for distribution throughout the development in a dedicated non-potable water reticulation system.

The collected rainwater is not classified in terms of water quality, but the use of rainwater for cooling tower make up water supply, toilet flushing and spray irrigation systems is recommended as safe practice by all Australian Health Departments. Rainwater falling on roofs is soft, clear and generally low in microbial and chemical contamination. Any contamination of rainwater generally occurs during collection and storage.

The use of simple and cost effective rainwater collection and treatment systems ensures reliable operation and water quality for non-potable use. An example of rainwater treatment technology is shown below.




A Rainwater Collection and Treatment System

The objective of rainwater treatment is to maintain a high quality of water in the rainwater storage tank. Rainwater treatment diverts or removes the following contaminants:

- Dust
- Leaves
- Grit and particles
- Hydrocarbons

The first 1-5 mm of rainfall falling on roof surfaces wash the majority of contaminants from the roof surface. A first-flush diverter is a collection tank that automatically diverts this contaminated water to the stormwater collection system. The remaining rainfall is directed to the rainwater tank for storage.

Screens are used to stop leaves and debris entering the rainwater tank. Finer screens are used to ensure that insects and animals do not enter the water storage. Depending on the application a tertiary filter may be used to remove grit and fine particles so these do not block irrigation nozzles or toilet inlet valves.

Rainwater harvesting systems can be considered to have the following advantages;

- Collected rainwater is of high quality allowing for uses including toilet flushing, cooling tower make up and un-controlled irrigation.
- Rainwater harvesting can provide a large reduction in potable water consumption.
- Rainwater harvesting is well suited to buildings where the available roof footprint is large for collection of the rainwater.
- Rainwater harvesting systems have a relatively low capital cost.
- Rainwater harvesting systems do not require specialized maintenance.

Rainwater harvesting systems can be considered to have the following disadvantages;

- Rainwater harvesting systems rely upon favorable climatic conditions.
- Rainwater harvesting systems are relatively inflexible as they rely on gravity discharge from the storage tank.
- Rainwater harvesting systems are relatively inefficient in terms of their spatial requirements due to the need to store larger volumes of rainwater allowing for periods of little or no rainfall.
- Rainwater harvesting systems require a potable cold water supply make up facility for periods when the storage has been exhausted.

## 2.2 Water Efficient Fixtures & Tapware

Water efficient fixtures and tapware refers to the selection and installation of fixtures and tapware throughout the development that will operate with a lower consumption of water than traditional fixtures and tapware.

In general terms the water efficient fixtures and tapware under consideration will include the following;

- Dual flush toilets
- Water efficient urinals
- Flow controlled tapware
- Electronic timed tapware

Water efficient fixtures & tapware can be considered to have the following advantages;

- Reduction in the consumption of water.
- Reduction in the size of reticulation pipework required to supply the fixtures and tapware.

Water efficient fixtures & tapware can be considered to have the following disadvantages;

- Capital cost in terms of some fixtures and tapware.

## 2.3 Solar Boosted Gas Hot Water

Solar boosted hot water refers to supplying the potable hot water service plant with an in-fill supply of water that has been pre-heated via the suns energy.

In general terms the solar boosted hot water plant will be located at roof level and consist of an array of solar panels connected into storage tanks. Water is circulated from the storage tanks throughout the solar panels during which period it is heated via the sun. The storage tanks then hold a volume of heated water which is fed into the traditional hot water plant in place of a straight cold water supply. Given that pre-heated water is entering the hot water plant, less energy is required to be provided by the hot water plant to raise water temperatures to the desired level. Hot water from the plant is then distributed throughout the development in a dedicated hot water reticulation system.

Solar boosted gas hot water can be considered to have the following advantages;

- Solar pre-heating is an endless and free source of energy.
- Solar boosted hot water plant does not require specialized maintenance.

- Solar boosted hot water is well suited to commercial buildings where the demand for hot water is relatively constant.

Solar boosted gas hot water can be considered to have the following disadvantages;

- The efficiency of solar boosted hot water is dependent upon of climatic conditions.
- The location of solar boosted hot water plant is relatively inflexible as it requires solar access.
- Solar boosted hot water plants are relatively inefficient in terms of their spatial requirements, as they effectively double the required plant footprint.
- Solar boosted hot water plants require large areas of roof for solar panel installation.
- Solar boosted hot water plants have a high capital cost.

## 2.4 Wet Fire Services Water Consumption

Wet fire service water consumption refers to the conservation of water during routine testing as is required for Essential Services maintenance and certification on an ongoing basis.

In general terms a reduction in wet fire services water consumption can be achieved by re-circulating the water during testing of pump sets for;

- Fire Hydrant Services
- Fire Sprinkler Services

# 3 BASE POTABLE WATER DEMAND

## 3.1 Indoor Potable Water Requirements

An employee in a typical office environment will use on average between 15 and 30 litres of potable water per working day. The water demand depends on the type of fittings used and the behaviour of the occupants. For the commercial development at Potts Hill Business Park, the base case indoor potable water demand has been modelled using the Potable Water Calculator from Version 3 of the Green Star Office Design tool. Specifically the model has been developed upon following information:

- Dual flush 6/3 litre toilets, having an average volume per flush of 4.5 litres.
- Standard single stall urinals, having an average volume per flush of 2.0 litres.
- WELS 3 star rated tapware, having a flow rate of 9.0 litres per minute.
- WELS 2 star rated showers, having a flow rate of 12.0 litres per minute.

The indoor potable water demand with these fittings is estimated to be 20.23 litres per person per day. At this level of consumption the development will achieve 1 point from an available 5 points on the Green Star Potable Water Calculator. Assuming 5 days per person over a 7 day week, this equates to 26.400kL per week of indoor potable water consumption throughout the development.

## 3.2 Outdoor Water Requirements

Water consumption within each landscape irrigation system varies depending upon the nature of the irrigation system, species of planting, and the prevailing climate. For the commercial development at Potts Hill Business Park, the base case outdoor potable water demand has been modelled using following information:

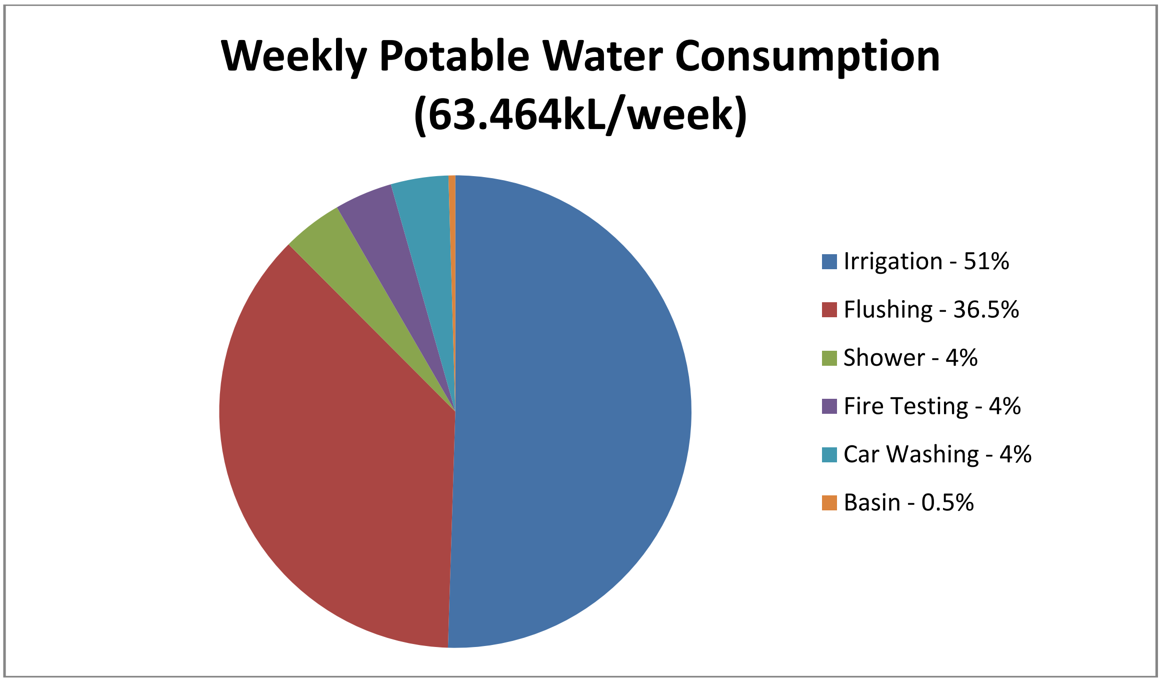
- Irrigation area 3,205m$^2$ requiring 10mm/m$^2$/week
- Vehicle washing for 25 vehicles per week allowing 100 litres per wash.
- Fire Hydrant & Fire Sprinkler system testing.

The average outdoor potable water demand with these parameters is estimated to be 37.064kL per week throughout the development.

## 3.3 Total Demand

Based on the estimated population of 261 people we have calculated an average water use of 63.464kL per week or 275.011KL per month which totals 3300.128kL each year.

This water usage is used throughout this report as a bench-mark to enable the water saving options to be compared to the Base Case scenario. The breakdown of weekly potable water use for Base Case is shown below;




Base Case Potable Cold Water Demand

# 4 Supply Options

For the Base Case model, all of the water consumed within the development is potable water drawn from Sydney Water's potable water supply. However as shown in the Base Case model, 91.5% of the water demand does not require water of potable standard. Rainwater or recycled water can be safely and reliably used for non-potable requirements such as irrigation and toilet flushing.

The water supply options considered for the commercial development at Potts Hill Business Park include:

- Mains water
- Rainwater collected from the roofs

## 4.1 Mains Water

Mains water is traditionally used to supply all of the water requirements of a building. Significant mains water savings can be achieved by using recycled water or rainwater for non-potable water requirements. A mains water connection is still required to supply the potable water requirements of the building and to provide a back-up water supply for non-potable use when required.

## 4.2 Rainwater

The use of rainwater reduces the mains water demand and the amount of stormwater runoff. By collecting the rainwater run-off from roof areas, rainwater tanks provide a valuable water source suitable for flushing toilets and landscape irrigation.

Rainfall for the commercial development at Potts Hill Business Park was estimated using data obtained from the Potts Hill Reservoir weather station monthly climate statistics. A monthly mass balance was then conducted that used the catchment area of the building to establish the average amount of water that rainfall would supply. Calculations were based on the following figures estimated from the architectural drawings.

A model was developed to assess the resource potential of rainwater harvesting within the development.

The following tables indicate volume in litres.

| | |
|---|---|
| **Weekly Indoor Consumption** | 26,400 |
| **Weekly Outdoor Consumption** | 37,064 |
| **Total Weekly Consumption** | 63,464 |
| **Total Monthly Consupmtion** | 275,011 |
| **10% Monthly Contribution** | 27,501 |
| **15% Monthly Contribution** | 41,252 |
| **20% Monthly Contribution** | 55,002 |
| **25% Monthly Contribution** | 68,753 |
| **50% Monthly Contribution** | 137,505 |
| **75% Monthly Contribution** | 206,258 |
| **100% Monthly Contribution** | 275,011 |

**TANK OPERATION FOR 91.5% REDUCTION IN POTABLE COLD WATER USAGE**

| | |
|---|---|
| **Total Roof Area** | 9,428 |
| **Catchment Percentage** | 63% |
| **Modelled Catchment** | 5,940 |
| **Tank Size** | 250,000 |

| Month | Rainfall | Collection | Consumption (91.5% of Total) | Balance | Tank |
|---|---|---|---|---|---|
| January | 88 | 522,688 | 251,635 | 271,053 | 250,000 |
| February | 93 | 554,762 | 251,635 | 303,127 | 250,000 |
| March | 99 | 586,242 | 251,635 | 334,607 | 250,000 |
| April | 88 | 523,282 | 251,635 | 271,647 | 250,000 |
| May | 82 | 485,863 | 251,635 | 234,228 | 250,000 |
| June | 87 | 513,779 | 251,635 | 262,144 | 250,000 |
| July | 67 | 397,956 | 251,635 | 146,321 | 250,000 |
| August | 59 | 347,469 | 251,635 | 95,834 | 250,000 |
| September | 50 | 296,388 | 251,635 | 44,753 | 250,000 |
| October | 63 | 374,197 | 251,635 | 122,562 | 250,000 |
| November | 70 | 413,993 | 251,635 | 162,358 | 250,000 |
| December | 71 | 424,090 | 251,635 | 172,455 | 250,000 |

The rainwater modeling revealed that the optimum tank size was approximately 250,000 litres to achieve a 91.5% reduction of the developments total potable cold water requirements throughout the year. This is allowing for one month storage in the case that no rain falls. In addition to the rain water tank, we will be allowing for a recycled water top-up provision for the tank when the water becomes available. This will allow the development to not use any potable water for the fixtures and systems we will be feeding, even in time of drought.

# 5 Improving Efficiency

## 5.1 Improving Water Efficiency

Water is required in an office development to service toilet flushing, urinal flushing, basins, showers and sinks as well as the irrigation of landscaped areas. The most effective way of reducing water consumption is to improve the efficiency of water use at these sources. A description of potential water saving devices is given below.

## 5.2 Urinals

Urinal flushing requirements accounts for approximately 11% of potable water use in the Base Case model for the commercial development at Potts Hill Business Park. Water use for urinal flushing can be reduced or even eliminated by using more water efficient urinals.

AAA rated urinal operate in the same way as traditional urinals, however due to improved design the volume of water required per flush is reduced from approximately 2 litres to 0.8 litres.

Waterless urinals function on gravity flow and use absolutely no water. As the urine flows into the drain insert it passes through a floating layer of blue-seal liquid that provides a barrier to odours. The urine under the blue-seal barrier overflows into the conventional drain line. The waterless urinal provides an odourless and touch-free hygienic operation. Installation costs of these units are considerably reduced as the system produces less waste and does not require water supply pipes.

The improvement in water efficiency through the use of more water efficient urinals is shown below;

| Urinal Type | Flush Volume | Estimated Demand |
|---|---|---|
| Standard | 2 | 6.981kL/week |
| AAA | 0.8 | 2.792kL/week |
| Waterless Urinal | 0 | 0.0kL/week |

Comparison of Water Savings from Urinals

AAA rated urinals reduce the water usage by 4.189kL/week when compared to the Base Case model. AAA rated urinals are recommended for incorporation into this development. Waterless urinals are not recommended for incorporation into this development based upon ongoing operational issues.

## 5.3 Dual-Flush Toilets

Toilet flushing requirements accounts for approximately 22% of potable water use in the Base Case model for the commercial development at Potts Hill Business Park. Water use for toilet flushing can be reduced by using more water efficient toilets.

Installing AAAA rated 4.5/3L toilets rather than the standard 6/3L dual-flush results in a 7% reduction in water demand. 4.5/3 L toilets have been widely used to conserve water in high-rise developments in Japan. In Australia they have currently only been installed at environmentally sustainable developments. The installation of 4.5/3 L toilets requires an alternative sanitary piping system that has a steeper gradient and uses smaller pipes as opposed to the traditional sanitary plumbing systems.

The improvement in water efficiency through the use of AAAA toilets is shown below;

| WSAA Rating | Flush Volume (full-flush/half-flush) | Estimated Demand |
|---|---|---|
| AAA | 6/3 | 13.934kL/week |
| AAAA | 4.5/3 | 12.959kL/week |

Comparison of Water Savings From Toilets

AAAA rated toilets reduce the water usage by 0.975kL/week when compared to the Base Case model. However due to the limitations of their technology, they are not recommended for incorporation into this development.

## 5.4 Flow Control For Tapware

Tapware requirements account for approximately 0.5% of potable water use in the Base Case model for the commercial development at Potts Hill Business Park. Water use for tapware can be reduced by using 4, 5 or 6 star WELS rated tapware.

Higher rated tapware reduce the amount of water used through the use of flow-reducers and tap aerators. Flow regulators maintain a defined flow rate independent from pressure variations. Aerators add air to the flow stream resulting in a spray like flow and reducing water usage.

The improvement in water efficiency through the use of flow controllers is shown below;

| WELS Rating For Tapware | Flow Rate L/min | Estimated Demand |
|---|---|---|
| 3 Star | 9.0 | 0.300kL/week |
| 4 Star | 7.5 | 0.250kL/week |
| 5 Star | 6.0 | 0.200kL/week |
| 6 Star | 4.5 | 0.150kL/week |

Comparison of Water Savings From Tapware

5 Star WELS rated basin tapware reduce the water usage by 0.100kL/week when compared to the Base Case model. They are a cost effective means of reducing potable water consumption, and are therefore recommended for incorporation into this development.

## 5.5 Flow Control For Showers

Shower requirements account for approximately 4% of potable water use in the Base Case model for the commercial development at Potts Hill Business Park. Water use for showers can be reduced by using 2 or 3 star WELS rated showers.

Higher rated showers reduce the amount of water used in showers through the use of flow-reducers and tap aerators. Flow regulators maintain a defined flow rate independent from pressure variations. Aerators add air to the flow stream resulting in a spray like flow and reducing water usage.

The improvement in water efficiency through the use of flow controllers is shown below;

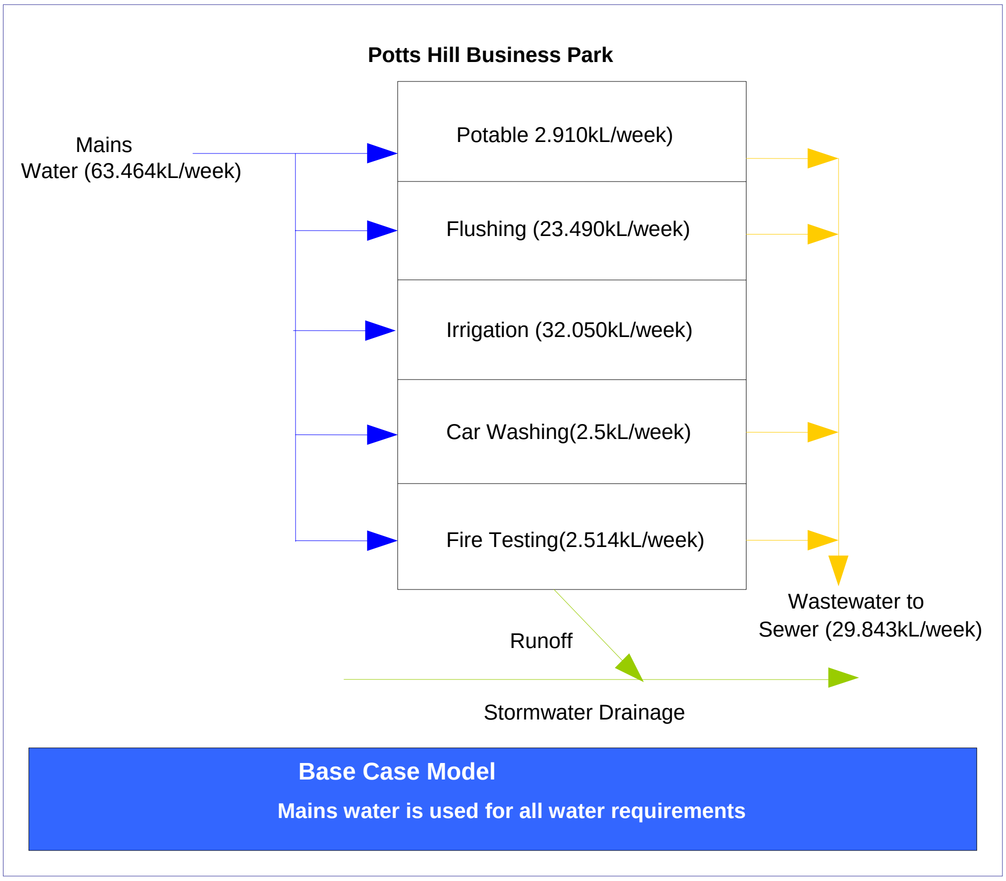
| WELS Rating For Showers | Flow Rate L/min | Estimated Demand |
|---|---|---|
| 2 Star | 12 | 2.000kL/week |
| 3 Star | 9 | 1.500kL/week |

Comparison of Water Savings From Showers

3 Star WELS rated shower tapware reduce the water usage by 0.500kL/week when compared to the Base Case model. They are a cost effective means of reducing potable water consumption, and are therefore recommended for incorporation into this development.

# 6 Base Case Evaluation

## 6.1 Schematic Diagram




## 6.2 Overview

- Potable water from the Authority mains is used for all purposes, including internal use and landscape irrigation
- All wastewater from the site is discharged to the sewer main
- Stormwater runoff from the roof and paved surfaces is directed to stormwater drains
- 6/3L dual flush toilets included
- 2L flush urinals included
- 3 Star WELS rated tapware included
- 2 Star WELS rated showers included

## 6.3 Environmental Criteria

| | |
|---|---|
| Potable water consumption | 63.464kL/week |

## 6.4 Green Star Assessment

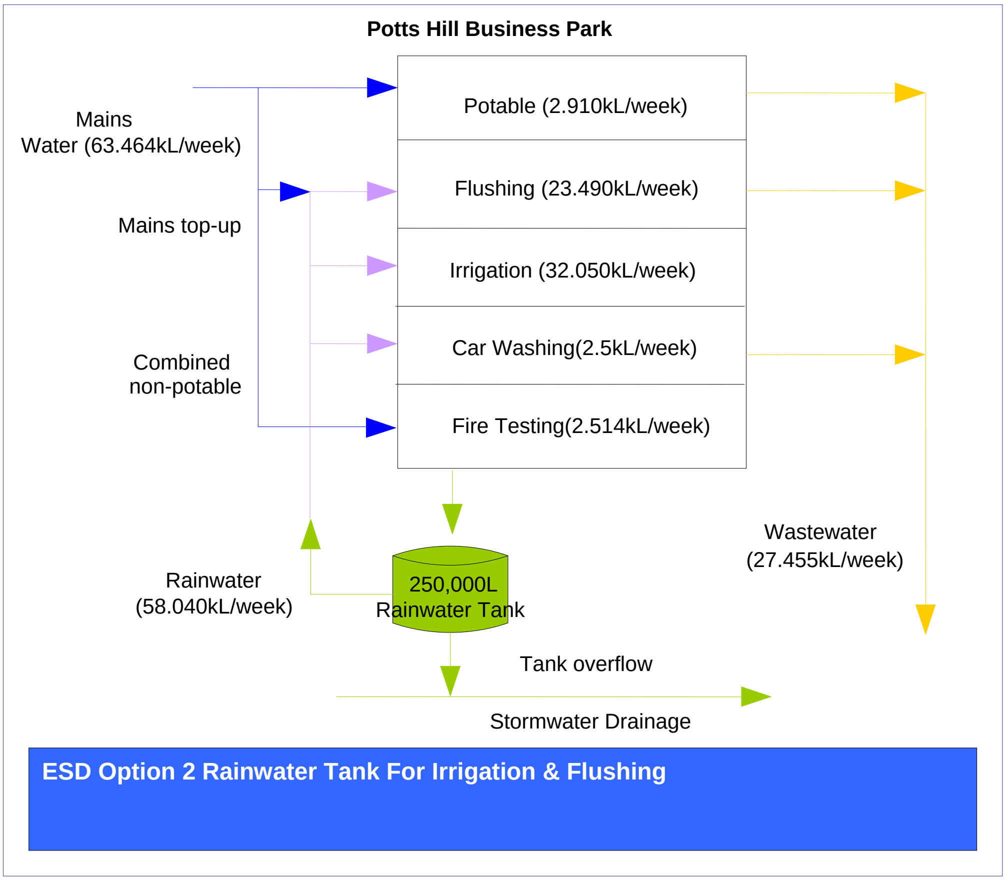
| | |
|---|---|
| WAT – 1 | 1 Point From 5 Available |
| WAT – 2 | 1 Point From 1 Available |
| WAT – 3 | 0 Points From 1 Available |
| WAT – 5 | 0 Point From 1 Available |
| **Totals** | **2 Points From 8 Available** |

## 6.5 Financial Assessment

This option is considered to be the base case for the development, and therefore does not reflect any additional cost for water management initiatives.

# 7 Greenstar Evaluation

## 7.1 Schematic Diagram




## 7.2 Overview

- Sydney Water mains water supply is used primarily for indoor potable requirements
- Rainwater is collected from the roofs and used for a 100% reduction in toilet flushing and landscape irrigation water requirements
- 6/3L dual flush toilets are included
- AAA Rated 0.8L per flush urinals included
- 5 Star WELS rated tapware included
- 3 Star WELS rated showers included

## 7.3 Environmental criteria

| | |
|---|---|
| Potable water consumption | 2.910kL/week<br>4.5% of base case model<br>Saving 60.554kL/week |
| Wastewater discharge | 27.455kL/week<br>92% of base case model<br>Saving 2.389kL/week |

## 7.4 Green Star Assessment

| | |
|---|---|
| WAT – 1 | 4 Points From 5 Available |
| WAT – 2 | 1 Point From 1 Available |

| | |
|---|---|
| WAT – 3 | 1 Points From 1 Available |
| WAT – 5 | 1 Point From 1 Available |
| **Totals** | **7 Points From 8 Available** |

## 7.5 <u>Financial Assessment</u>

**Cost of ESD Options**

| ESD Option | Cost |
|---|---|
| AAA Rated Urinals | Negligable |
| 5 Star WELS Rated Tapware | Negligable |
| 3 Star WELS Rated Showers | Negligable |
| 250,000L Rainwater Re-Use System | $150,000 |
| **Total Additional Cost** | **$150,000** |

**Savings in Consumables**

| Consumable | Reduced Daily Consumption | Rate | Annual Saving |
|---|---|---|---|
| 91% less Potable Water Consumption | 58.040kL/day | $1.339/kL | $28,366.18 |
| 8% less Wastewater Discharge | 2.389kL/day | $1.296/kL | $1,130.09 |
| **Total Savings** | | | **$29,496.27** |

**Payback Period**

Total cost of Rainwater Reuse System: $150,000.00
Total savings per annum: $29,496.27
Time in years to pay back Capital Cost: 5.1

# 8 Summary

## 8.1 ESD Options Summary Table

| ESD Option | Green Star Point (Water Categories) | Extra Over Cost | Annual Consumable Savings |
|---|---|---|---|
| Base Case | 5 | $0 | $0 |
| Greenstar Evaluation | 8 | $150,000 | $29,496.27 |

The assessment has revealed that simple options of tapware flow control as taken up in ESD option 1 can provide an additional Green Star point as well as annual water supply savings of $5,336. This option should be included within the project, irrespective of any other assessment criteria that may be applied to the project.

Depending upon the overall building Green Star rating to be achieved, it may be necessary to increase the points contribution provided by hydraulic and wet fire services. In this instance a rainwater re-use system is the best option to achieve an additional two points for the cost of $150,000. The addition of a rainwater re-use system may also provide significant market advantage to the development, as our current experience with similar projects is that rainwater re-use systems are being included to meet tenant expectations.