GEORGE FLOTH PTY. LIMITED
CONSULTING ENGINEERS *BRISBANE OFFICE*

HAMILTON HARBOUR
MIXED USE DEVELOPMENT

INTEGRATED WATER MANAGEMENT PLAN

Prepared By:

GEORGE FLOTH PTY. LIMITED
CONSULTING ENGINEERS *BRISBANE OFFICE*

Ground Floor, 42 Doggett Street
FORTITUDE VALLEY QLD 4006
PO BOX 2231, FORTITUDE VALLEY BC 4006

Telephone: (07) 3252 0977
Facsimile: (07) 3252 2499
Email: gfbris@gfbris.com
Web: www.gfbris.com

Prepared For:

LEIGHTON PROPERTIES

Devine LIMITED

In Joint Venture

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ACEA

HAMILTON HARBOUR MIXED USE DEVELOPMENT **08714**
INTEGRATED WATER MANAGEMENT PLAN

This register identifies each issue of and each amendment to this document by Revision No, Page No, the details of each amendment and date of issue.

AMENDMENT REGISTER

Rev. No	Section & Page No	Issue/Amendment	Author	Project Engineer	Checked	Date
P1		Draft	SE	SE	RH	01/10/08
P2	Minor amendment to all sections.	Draft	SE	SE	-	09/10/08
A	-	Issue to ULDA	SE	SE	RH	14/10/08
B	Section 3.1.4 updated, reference section updated and Appendix E added	Issue to ULDA	SE	SE	RH	22/10/08

CONTENTS

1.0 EXECUTIVE SUMMARY

This site based Integrated Water (resource) Management Plan (IWMP) has been prepared at the request of Devine/Leighton Properties Joint Venture for the Hamilton Harbour mixed use development situated at 485-489 Kingsford Smith Drive, Hamilton.

This IWMP report will form part of a Development Application (DA) package being produced for submission to the Urban Land Development Authority (ULDA).

When implemented, the IWMP will achieve the objectives being sought for Hamilton Harbour project. The primary objective of the IWMP is to:

- Minimise the impact of the urban development on the water cycle.

This primary objective will in turn be achieved through the following key principles:

- Reduction of the potable water supply to the site.
- Reduction of waste water discharge to the authority sewer infrastructure.
- Protecting stormwater quality generated from the site before discharge to the authority infrastructure.

The key principles will be achieved through the application of the following measures:

- High water efficient WELS rated fixtures.

- Providing alternative water source through collection and treatment of greywater (waste water from showers and basins from the residential buildings) for non-potable re-use for:
    - Toilet flushing within the commercial buildings.
    - Landscape irrigation.
    - External use.

- Rainwater use for swimming pool make-up.

- Improving the cycles of concentration of the cooling towers to six cycles of concentrations.

- Water demand monitoring and leak detection.

- Application of Water Sensitive Urban Design (WSUD) technologies such as rain water harvesting tank.

2.0 INTRODUCTION

Hamilton Harbour is a mixed use development project on a 21,000 m^2 redevelopment site. The site has three street frontages; Kingsford Smith Drive, Harbour Road and Hercules Street.

The proposed development (Refer to Appendix A) consists of:

- Two commercial buildings.
- Two residential buildings.
- Non-food retail outlets.
- Food retail outlets.
- Showrooms.
- Swimming pool and gym – residential recreational area.
- Ground level car parking.
- Two basement car parking levels.
- Park

Hamilton Harbour will be constructed in two stages with the first stage comprising of:

- Commercial Building 1
- Residential Building 1
- The showrooms and retail outlets
- Gymnasium
- The two basement car parking levels.

The remaining building elements are proposed to be built in the second stage.

The Hamilton Harbour joint venture team is committed to providing an Ecologically Sustainable Development for the community. The Green Star rating scheme, managed by the Green Building Council of Australia, will be used to guide the design processes to achieve a green building. The commercial building portions of the project are targeting a 5 Star rating using the Office Design Version 3 rating tool. The residential building portions of the project are also targeting a 5 Star rating using the Multi-Unit Residential PILOT rating tool. The 5 Star rating is equivalent to Australian Excellence.

The Green Star rating scheme addresses a wide spectrum of environmental components. One of them is Water. The IWMP would assist in achieving the targets set out for the development.

The sections that follow describe the IWMP and the measures adopted to achieve the objectives of the IWMP.

3.0 INTEGRATED WATER MANAGEMENT

The site has existing town water supplies on Kingsford Smith Drive, Harbour Road and Hercules Street. It is proposed to have two water connections to the site. One connection is proposed be from the main on Kingsford Smith Drive and the second connection from Hercules Street. Those two connections will provide a reliable water supply for domestic and fire services. It is proposed to have the main sewer connection point to the existing trunk sewer main on Kingsford Smith Drive. The stormwater connection is proposed be to a stormwater trunk main which would be diverted around the site.

The IWMP will manage and integrate those resources namely water, sewer and stormwater. Both stages of construction have been taken into consideration.

3.1 Potable Water Reduction Measures

As part of an overall ESD development four measures have been identified in order to minimise the potable water consumption. These are:

- Water Efficient Fixtures
- Providing alternative water supply other than potable water for toilet flushing within the two commercial buildings and for irrigation of Landscaping.
- Rainwater harvesting and reuse for swimming pool make-up.
- Water monitoring and leak detection.

3.1.1 Water Efficient Fixtures

At the time of writing, South East Queensland is under “High Level” water restrictions which require the residents to have a water consumption of 170 litres or less per person per day including external use.

To achieve this objective, high water efficient fixtures are recommended. As such, the tapwares are proposed to have the following WELS rating:

- Basins taps : 5 Star WELS rating i.e. an average flow rate of 4.5 litres/min
- Shower taps : 3 Star WELS rating with a 7.5 litres/mins flow restrictor
- WC : 4 Star WELS rating i.e. 6/3 litres dual flush

The table in appendix D provides a comparison between the high WELS rated fixtures and a standard WELS rated fixtures.

3.1.2 Non-Potable Water Supply from Grey Water Treatment

Landscaping is a very important aspect of the development and water is required to sustain the landscaping. The site is proposed to contain 5,380m^2 of landscaping and at 15mm weekly ongoing water requirement for established landscaping irrigation, this equates to 80,700 Litres of water required per week. Under current high level water restrictions, use of town water supply is not permitted except by manual hand held hose and is restricted to 30 minutes once a week. This method of irrigation would not be practical for the extent of landscaping and the associated water demand.

Changes to the Plumbing Laws earlier in the year, require that the commercial buildings 1 and 2 be supplied with an alternative water source to flush at least half of the total number of pedestals on the project. However, as part of an overall ESD development, all the pedestals in both commercial towers are proposed to be supplied with an alternative source. The daily water requirement for toilet flushing is estimated to be approximately 20,000 Litres (100,000 Litres per week based on five working days). Therefore the total weekly water requirement that needs to be sourced other than from the town water supply is 180,700 litres per week.

The two options available for sourcing this quantity of water are either from rainwater and/or treated grey water[1]. Following changes in the plumbing laws, treated grey water now has expanded uses as from 1st of January 2008. Therefore, with the legislative framework in place, the development is proposing to treat grey water to Class A quality as per the Queensland Plumbing and Wastewater Code to irrigate the

[1] Grey Water is the waste water from showers, basins and laundry.

landscaping and for toilet flushing. For this purpose, treated grey water has been preferred over rainwater mainly due to grey water being a more reliable source than rainwater.

From the water demand calculations, residential tower 1 will generate approximately 54,000 Litres of grey water per day (i.e. approximately 378,000 Litres per week) which will more than meet the requirement for landscaping irrigation and supply to the commercial pedestals. Depending on the usage pattern, the grey water treatment plant would therefore be sized on the water demand requirement i.e. to supply landscaping and the pedestals within the commercial buildings.

A town back-up supply would be installed to maintain continuous water supply to the commercial buildings only when the treatment plant is undergoing maintenance.

3.1.3 Rainwater Harvesting for Swimming Pool

It is proposed to have swimming pool within the development. The usage of the swimming pool would be more significant during the summer season (i.e. between October and March). The swimming pool has a surface area of $160m^2$ and it is estimated that the swimming pool will lose approximately 1600 litres of water daily due to mainly normal evaporation and backwash.

To compensate for the water loss, rainwater is proposed to be harvested and provided as the make-up supply for the swimming pool. The rainwater would be collected from the roofs of all buildings to maximise the catchment surface area and be stored in an underground water tank. Due to the unreliability of rainfall, it is proposed to have a 50,000 litres tank which is equivalent to four weeks of swimming pool make-up supply.

During winter when the pool would be less active, a pool blanket is proposed to be installed to minimise the evaporation from the pool.

3.1.4 Cooling Towers

Cooling towers have been adopted for the air conditioning system for the commercial buildings due to their high energy efficiency. However, cooling towers are large water users. During the cooling process water is consumed by evaporation, blow-down and drift. Therefore the make-up supply to the cooling towers needs to account for those three losses. The cycle of concentration[2] is used as a measure to check if water usage is optimised. Optimisation of water usage is achieved when the operation of the cooling towers achieves a minimum six cycles of concentration. This can been seen from a Water Use v/s cycles of concentration graph of a given cooling tower (Refer to Appendix E) where the water usage decreases considerably with increase of cycles of concentration from two to five and then the graph remains almost flat for cycles of concentration of six and greater. Therefore, the cooling tower water treatment system will be designed to achieve six or better cycles of concentration..

3.1.5 Monitoring and Leak Detection

The water requirement for the whole development including the commercial, residential and retail buildings would be in the order of 90ML per annum which is quite significant. Therefore, it is important to monitor usage patterns and water meters will be installed as follows for this purpose:

- Main water supply to each building component.
- Sub meters on each commercial floor.
- Sub meters to each apartment.
- Sub meters to each tenant.
- Sub meter to non-potable supply back – up to swimming pool and commercial buildings.

All the meters will have pulse outputs which will be wired back to the Building Management System (BMS). The water usage of individual sub meters will then be added and compared with the master meter consumption to detect any leakage.

The BMS system can also produce a graphical representation of the water usage pattern of the building occupants and anomalies in the usage pattern can be identified for investigation.

[2] Cycle of concentration = Volume of make up supply / (Volume of blow down + drift)

3.2 Water Sensitive Urban Design Measures

The objectives of Water Sensitive Urban Design (WSUD) principles are to:

- Reduce demand on the potable water requirement which has been addressed in section 3.1.
- Protect water quality of stormwater runoff from the site via source control.
- Minimise sewerage discharge from the site.

3.2.1 Water Quality of Stormwater Runoff

Urbanisation leads to changes to the quality of stormwater runoff discharged to the receiving waters. As such, the quality stormwater runoff needs to be addressed prior to leaving the site in order to protect the environment. The Brisbane City Council (BCC) Stormwater Management and Water Quality Guidelines (Draft 2002) have been used for that purpose[3].

The stormwater runoff has been subdivided into three source nodes based on the stormwater quality. These are:

- Roofs
- Ground level Podium
- Park

The stormwater from these source nodes has been modelled (Refer to Bornhorst and Ward Report) using the “Model for Urban Stormwater Improvement Conceptualisation” (MUSIC). Using a treatment train approach, it has been established that the water quality of the stormwater runoff will be controlled through:

- A rainwater tank
- Stormwater Quality Improvement Devices (SQID’s)

To achieve the Best Practice Stormwater Management:

- The roof source node is proposed to discharge via a rainwater tank Therefore, besides using the rainwater tank as storage tank for rain water collection, it would also been used as pollutant control.
- The ground level podium stormwater runoff is proposed to discharge through a gross pollutant trap (GPT) and,
- The park area stormwater runoff is proposed to discharge through a GPT and bio-retention system.

3.2.2 Quantity of Stormwater Runoff

Urbanisation also leads to changes to the quantity of stormwater runoff. However, in this case, the proposed site for the development has previously contained extensive hardstand areas and the new development has not increased the imperviousness of site. Therefore, there would be no net increase in stormwater discharge from the new development when compared with the pre-development situation (Referring to Bornhorst and Ward Report). Actually, there will be a slight decrease in the stormwater runoff from the site when compared to the pre-development situation due to the proposed 50,000 litres rainwater harvesting tank.

3.2.3 Reduction in Sewerage Discharges

Reduction in sewerage discharges will be achieved through:

- Water efficient fixtures
- Grey water collection and treatment

While reducing the potable water demand, water efficient fixtures will also reduce sewerage discharge. e.g. a standard 11 litres WC would discharge the same amount per flush where as 6/3 dual flush WC

[3] Bornhorst and Ward, September 2008, Engineering Report for Hamilton Harbour Development, Hamilton

cistern would discharge only 6 litres per full flush. This is a reduction of almost approximately 45% sewerage discharges.

Collection and the use of treated grey water not only reduce the potable consumption of the development but will also meet another objective. There will be a reduction in the waste water discharged to the council sewer infrastructure. The estimated use of grey water treated will be approximately 180,700 Litres per week for landscaping irrigation and commercial buildings' toilet flushing. This means that the total sewerage discharge would be reduced by 180,700 Litres per week or 9.4ML per annum.

4.0 CONCLUSION

Implementation of the measures described in the IWMP which are:

- High Water efficient fixtures.
- Collection and treatment of grey water.
- Use of treated grey water for landscaping.
- Use of treated grey water for toilet flushing in the commercial buildings.
- Adopting a six cycles of concentration for cooling towers.
- Best practice stormwater management.

will provide an Ecologically Sustainable Design for the development.

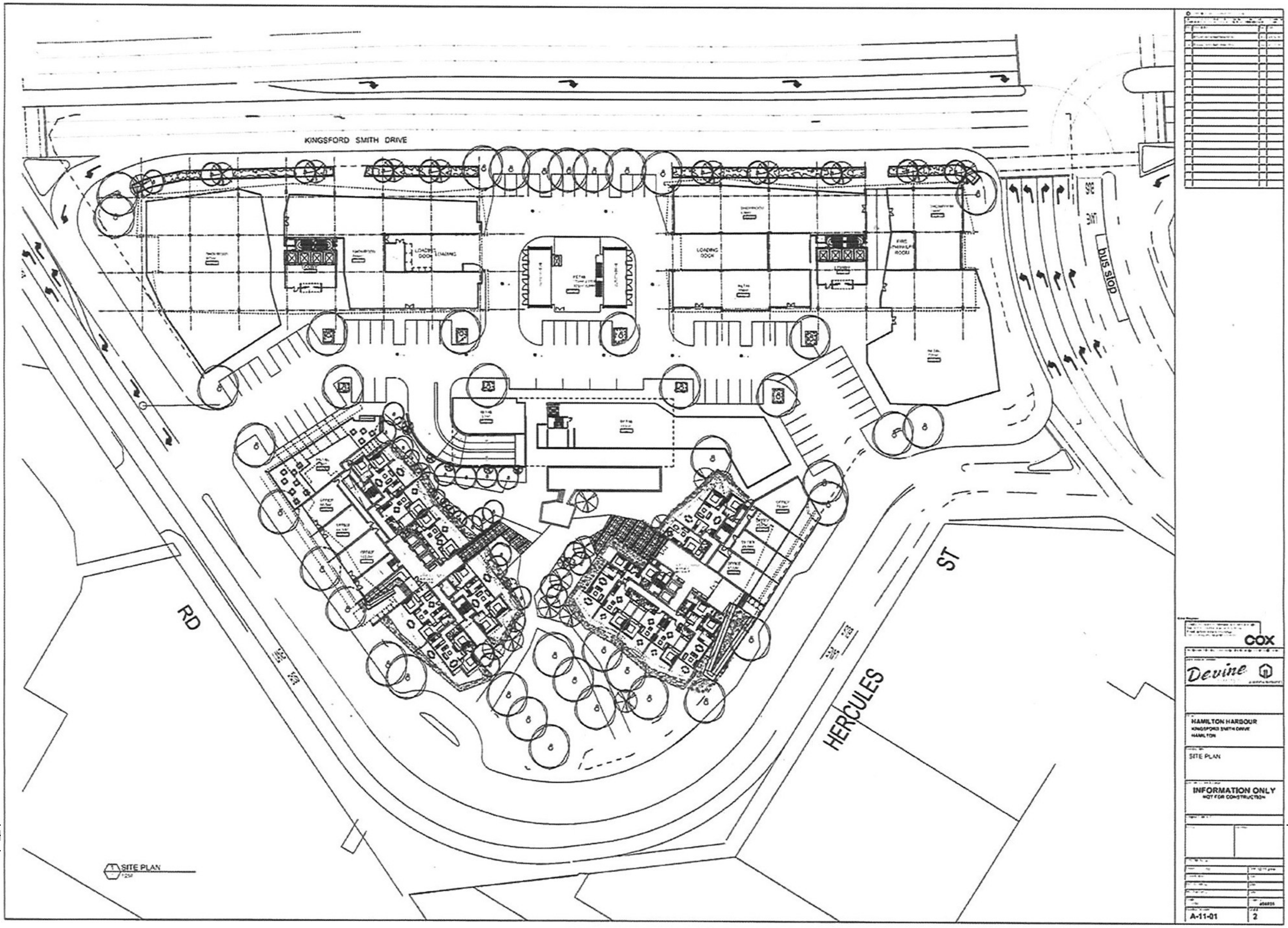
These measures will achieve the objectives being sought which are:

- Reduce the potable water consumption from the town water supply.
- Reduce the sewer discharge to Council sewer infrastructure.
- Protecting water stormwater quality runoff.

5.0 REFERENCES

- Water Sensitive Urban Design, Technical Design Guidelines fro South East Queensland, Version1 June 2006, Healthy Waterways.
- High Level Water Restriction, Residential and non-Residential, Queensland Water Commission (www.qwc.qld.gov.au)
- Bureau of Meteorology, Climate Statistics for Australian Locations, http://www.bom.gov.au/climate/averages/tables/cw_040223.shtml accessed on 30.09.2008
- Bornhorst and Ward, September 2008, Engineering Report for Hamilton Harbour Development, Hamilton.
- Average Domestic Water Usage Chart, http://www.thisplace.com.au/eco/tt_waterusage.htm accessed on 30.09.2008
- How to estimate water consumption savings for taps, toilets, showers and urinals, Brisbane City Council.
- Daisy Pool Covers, Evaporation, http://www.daisypoolcovers.com.au/pdf/FactSheet_1_Evaporation.pdf, accessed on 29.09.2008
- Conger. R, 2005, Plumbing System and Design, American Society of Plumbing Engineer, Chicago.

APPENDIX A
DEVELOPMENT SITE PLAN


KINGSFORD SMITH DRIVE
bus stop
RD
HERCULES
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SITE PLAN
COX
Devine
HAMILTON HARBOUR
SITE PLAN
INFORMATION ONLY
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2

APPENDIX B
ESTIMATED POPULATION

Table B.1 - Residential 1 - Estimation of Population

Bed type	Qty	Estimated No. of Residents per apartment	Total residents
1 bed Apartment/Studio	0	1	0
1 bed + study Apartment	65	2	130
2 beds Apartment	137	3	411
3 beds Apartment	20	4	80
Total Population - Residential 1			621

Table B.2 - Residential 2 - Estimation of Population

Bed type	Qty	Estimated No. of Residents per apartment	Total residents
1 bed/Studio Apartment	37	2	74
1 bed + study Apartment	60	2	120
2 beds Apartment	97	3	291
3 beds Apartment	0	4	0
Total Population - Residential 2			485

Table B.3 - Commercial Buildings and Retails - Estimation of Population

Building	Net Lettable Area	Estimated No. of Occupants per 15 m^2	Total Occupants
Commercial C1	16272	1	1085
Commercial C2	14967	1	998
Retails	-	-	50
Total Population			2133

APPENDIX C
WATER DEMAND

Water Demand

The water demand for the whole development has been estimated and the chart below represents the percentage consumption for the Residential towers, commercial buildings, retails and outdoor usage i.e. landscaping irrigation, cooling towers and swimming pool. The figures on top of the percent figure are the estimated water consumptions in litres.

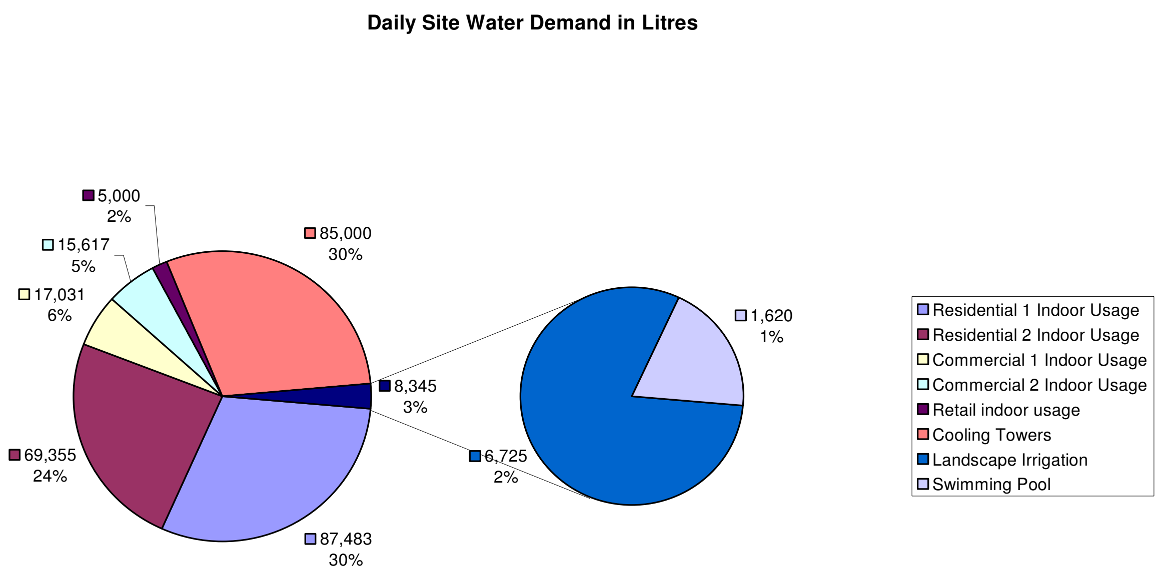


Chart 1- Daily Site Water Demand in Litres

The usage within each building especially the residential and commercial buildings has further been estimated. The usage within the residential buildings has been subdivided into:

- Shower (Average shower is 8 minutes)
- Bathroom tap
- Toilet Flushing
- Washing machine
- Dishwasher
- Other (cooking, drinking…)

While the usage within the commercial buildings has been subdivided into:

- Shower (Average shower is 4 minutes)
- Bathroom tap
- Toilet Flushing

Waterless urinal technology is being used on the project, therefore this component has been excluded from the chart.
The chart 2, 3, 4 and 5 shows the probable daily water consumption for Residential 1, 2 and commercial 1 and 2

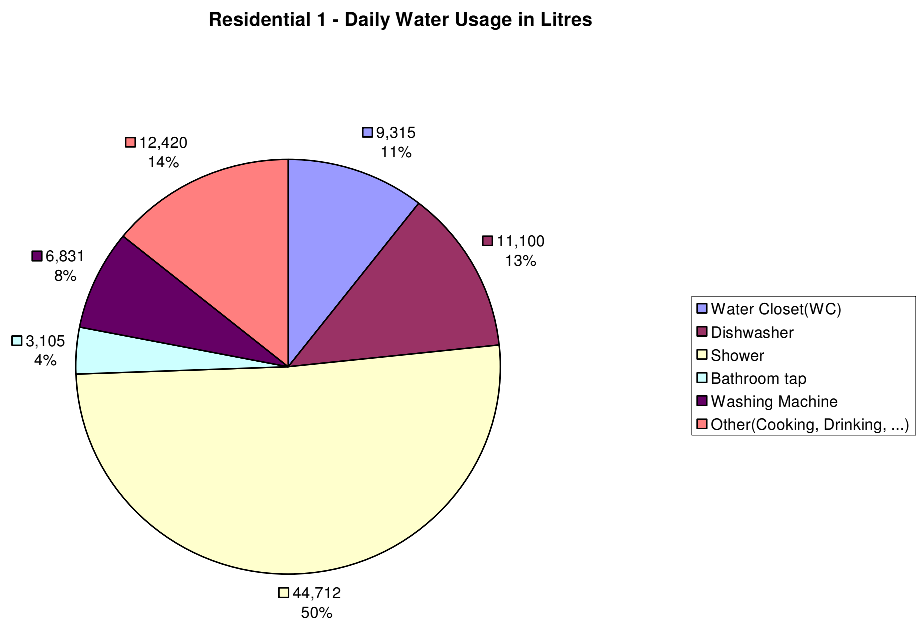


Chart 2 – Residential 1 Daily Water Usage in Litres

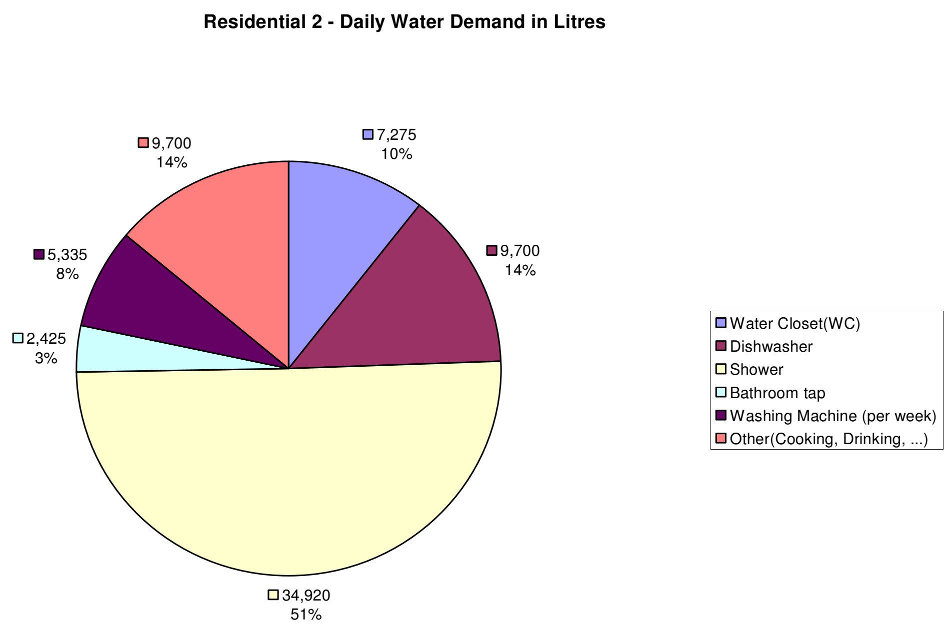


Chart 3 – Residential 2 Daily Water Usage in Litres

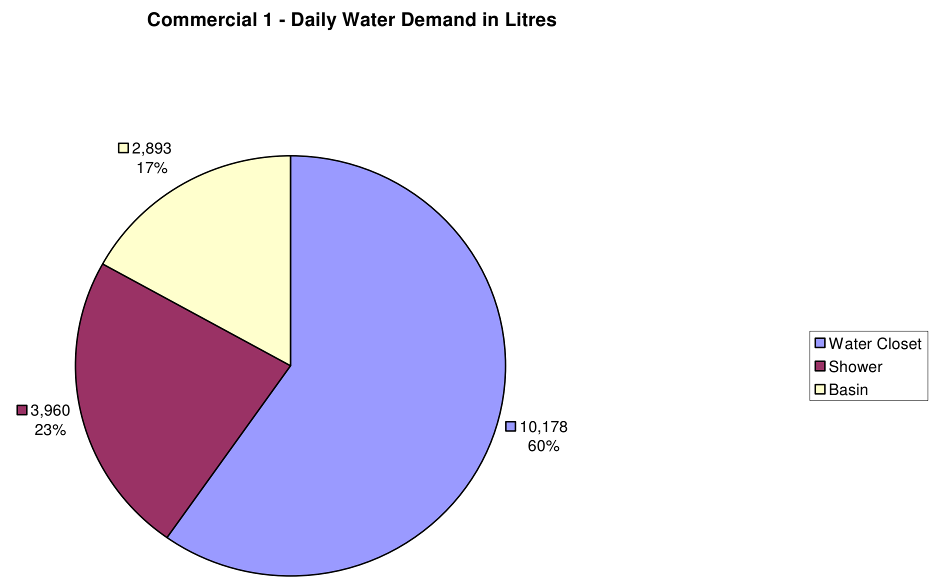


Chart 4 – Commercial 1 Daily Water Demand in Litres

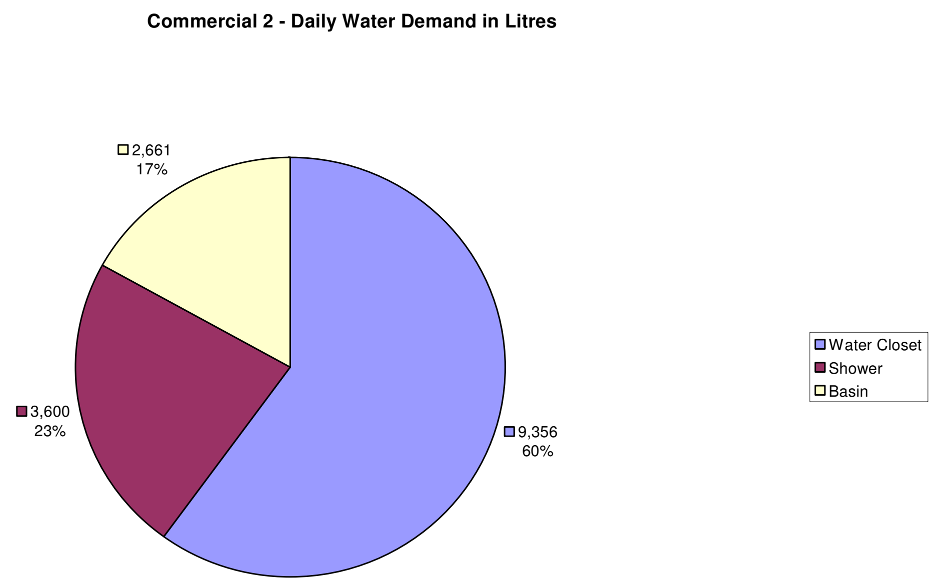


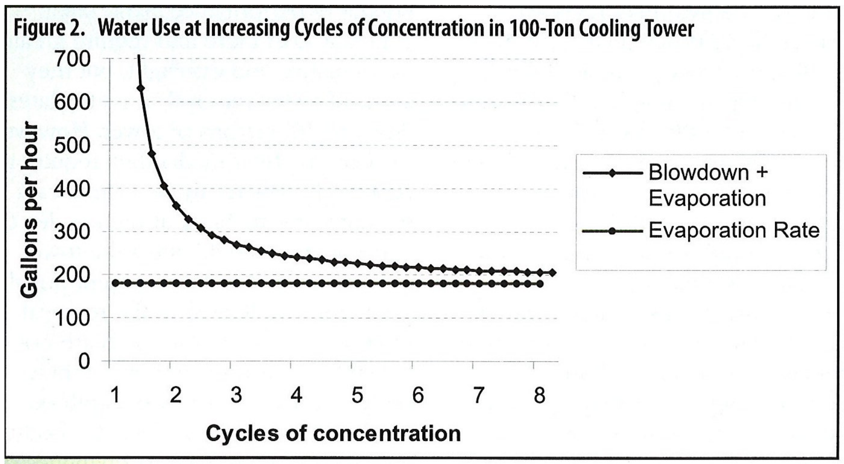
Chart 5 – Commercial 2 Daily Water Demand in Litres

APPENDIX D
COMPARISON BETWEEN WATER EFFICIENT FIXTURES AND STANDARD FIXTURES

Table D.1 - Residential Precinct: Average Domestic Water Usage

Fixtures	Type		Average flow rate (l/min) OR average consumption		Average total water used per day per person	
	Water Efficient	Normal fixtures	Water Efficient	Normal fixtures	Water Efficient	Standard fixtures
Shower (8 mins)	WELS rated 3 Star	Standard	7.5	15	60	120
Water Closet(WC)	WELS rated 4 Star	Standard(single flush)	6/3 dual flush	11	15	44
Washing Machine (per week)	Front Loading	Top Loading	80	150	11	21
Dishwasher	N/A	N/A	50	50	50	50
Bathroom basin's tap	WELS rated 5 Star	Standard	4	10	5	15
Other(Cooking, Drinking, ...)	N/A	N/A	20	20	15	15
Total average water consumption *with* and *without* water efficient fixtures					156	265

APPENDIX E
Water Use at Increasing Cycles of Concentration



Source: Conger.R, 2005, Plumbing System and Design, American Society of Plumbing Engineer, Chicago.