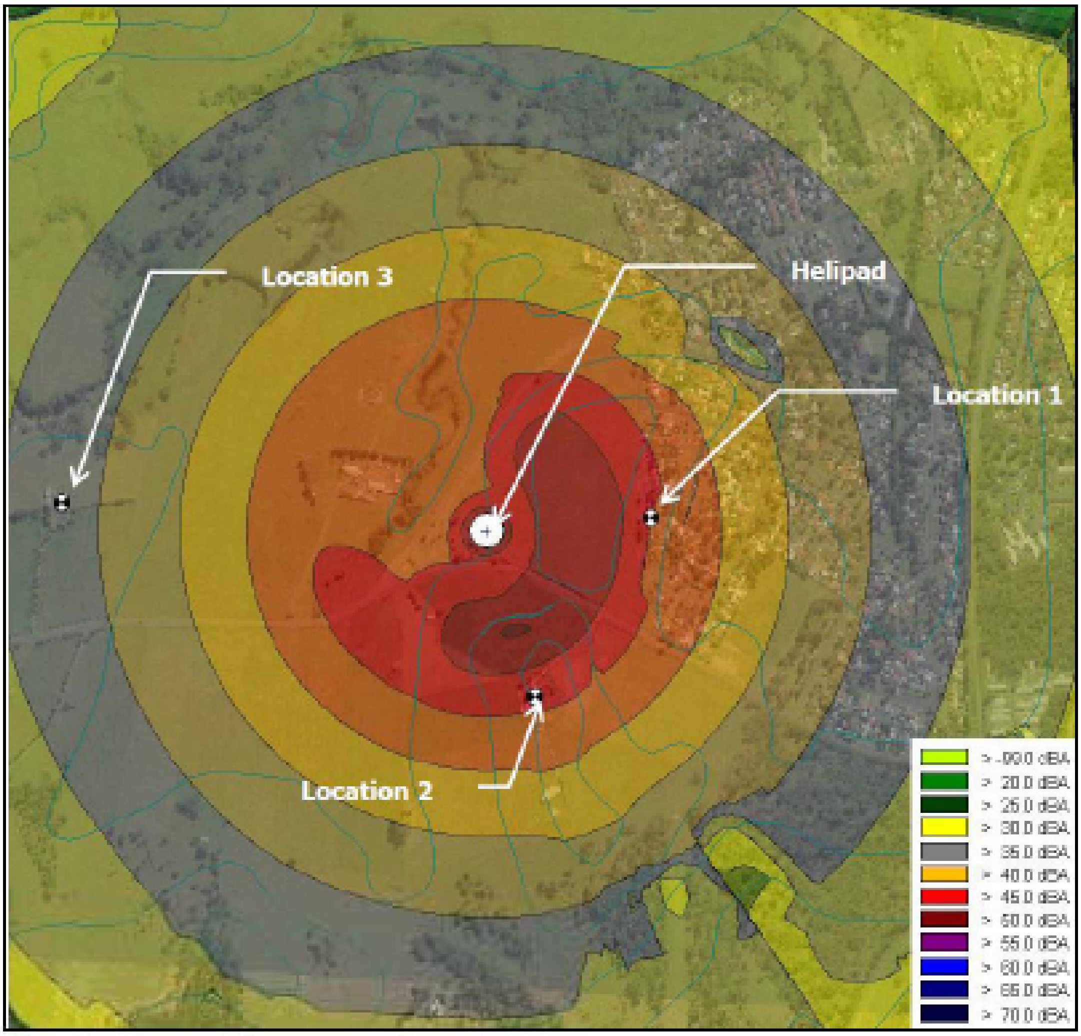
Figure 30 – Noise Contours from the Operation of a Helicopter at the Helipad



Wilkinson Murray predicted the following noise level at residence associated with operations of the Helipad (see **Table 6.13**).

Table 6.13 – Noise Levels from a Helicopter on the Helipad

Receiver	Predicted Noise Level dBA	External Sleep Arousal Noise Criterion dBA
Location 1 – Goolagong Street Residences	67	75-80
Location 2 – SE Residence	67	75-80
Location 3 – Western Residence	57	75-80

(Source: Wilkinson Murray (2009))

The report concluded that:

> *A review of predicted maximum noise levels associated with the helipad indicates operations at the helipad are unlikely to cause sleep awakening reactions.*

Noise Impacts from Helicopters in the Air

Wilkinson Murray (2009) have predicted that helicopter noise levels at residences based on the proposed flight path and for two helicopter models that have similar features to the proposed helicopter models for the hospital.

The maximum number of flights per day has been established as 2 at all residences, with the exception of the one residence to the SE, in order to achieve a 24 hour noise objective of 40 dBA. In these cases noise associated with helicopters can be classified as not significant.

The maximum number of return flights per day at the SE residence has been established as 12 in order to achieve a 24 hour noise objective of 60 dBA.

The assessment concluded that:

> *A review of the predicted in-flight noise levels at identified receivers indicates that the greatest exposure of noise from helicopters with be at the residence to the SE of the helipad. This is due the close proximity of this residence to the proposed southern flight path.*

The assessment also suggested that:

> *Maximum passer-by noise levels will occur when the helicopter flies over the SE residence. Maximum external noise levels of between 80 to 88 dBA are predicted from INM noise data. Therefore sleep disturbance is likely at this residence during a helicopter flyover during the night period.*

Construction Noise Impact

Noise sources that are likely to be associated with the construction of the project are.

- Bulldozer with ripper
- Front End Loader
- Excavator
- Bogie (Dump) Truck
- Crane
- Power Tools
- Concrete Trucks
- Concrete Pumps
- Generators

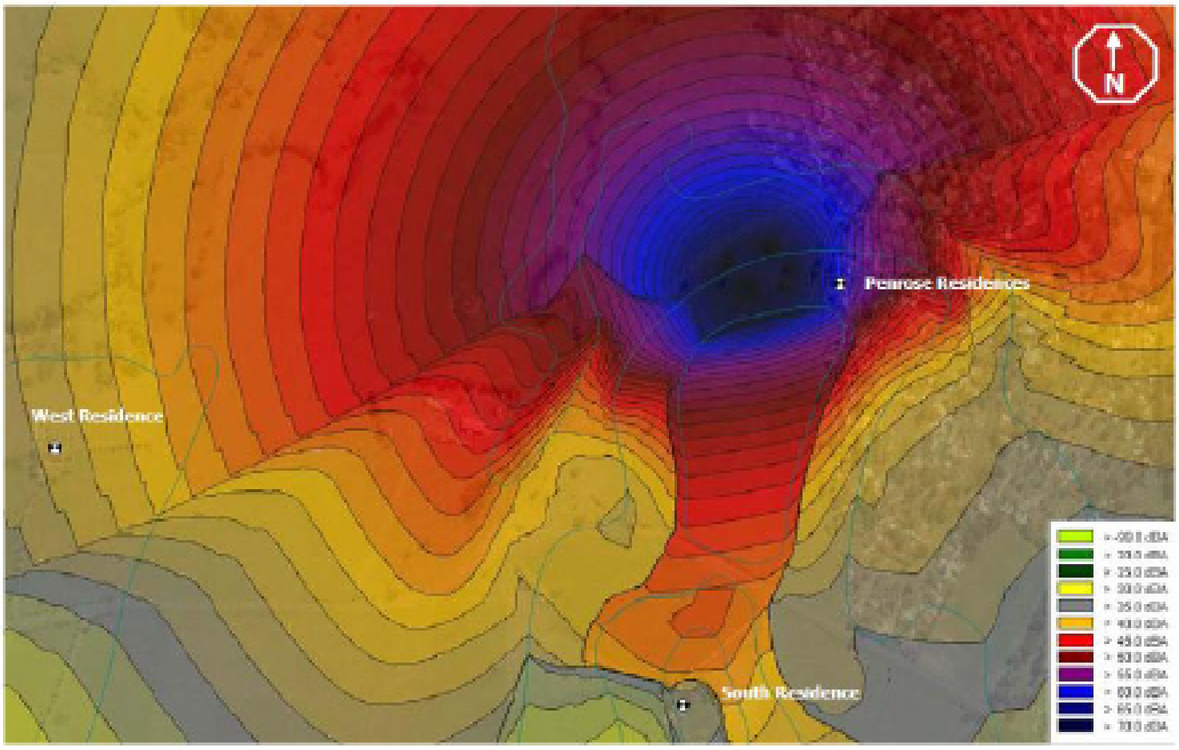
The sound power level of each of the source is identified in Table 5.1 of the construction noise assessment.

Noise prediction modelling was carried out to assess the potential impacts for the different stages of the construction of IIHP – site excavation, structure and site fit out. The modelling results indicate compliance with the established construction noise objective at receivers that are remote from the site that is the single residences to the West and South.

In the case of residences to the east which are in relatively close proximity to residences an exceedance of the established construction noise goal of up to 10 dBA is predicted.

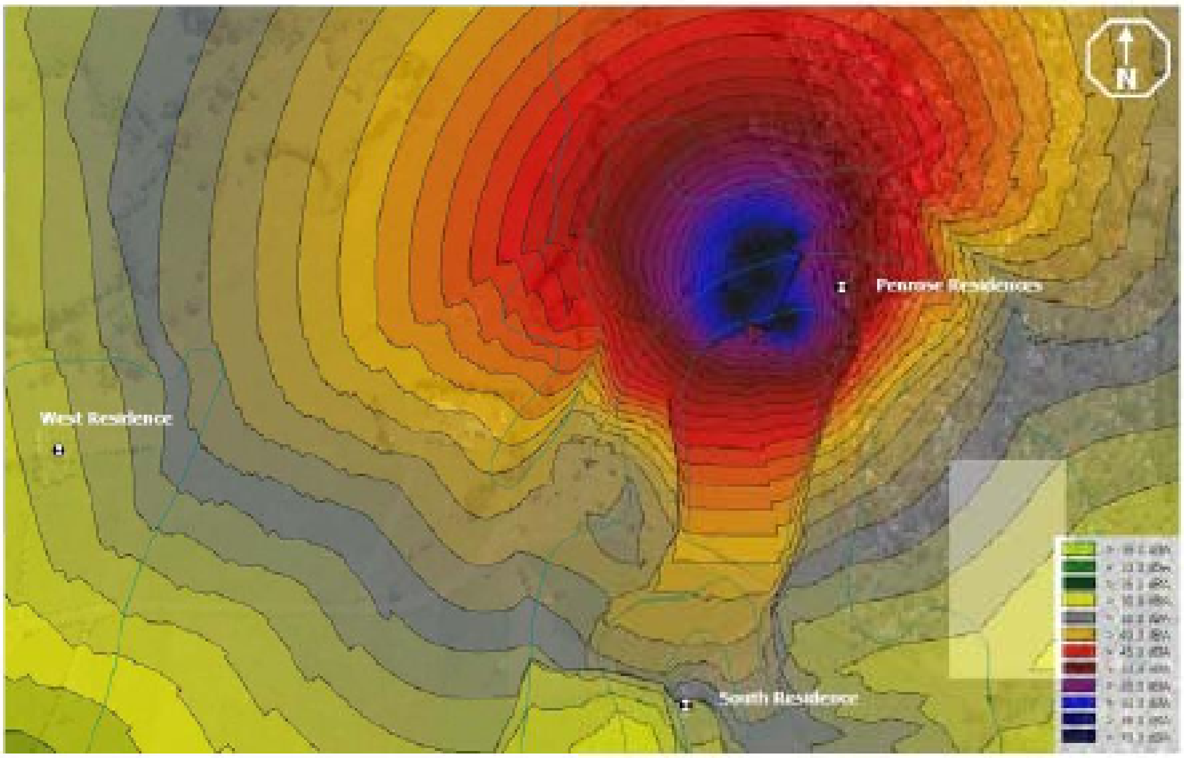
It is noted that there is less shielding provided by surrounding industrial buildings in the direction of these residences. These are shown in the **Figures 31-33**.

Figure 31 - Noise Contours from Site Excavation



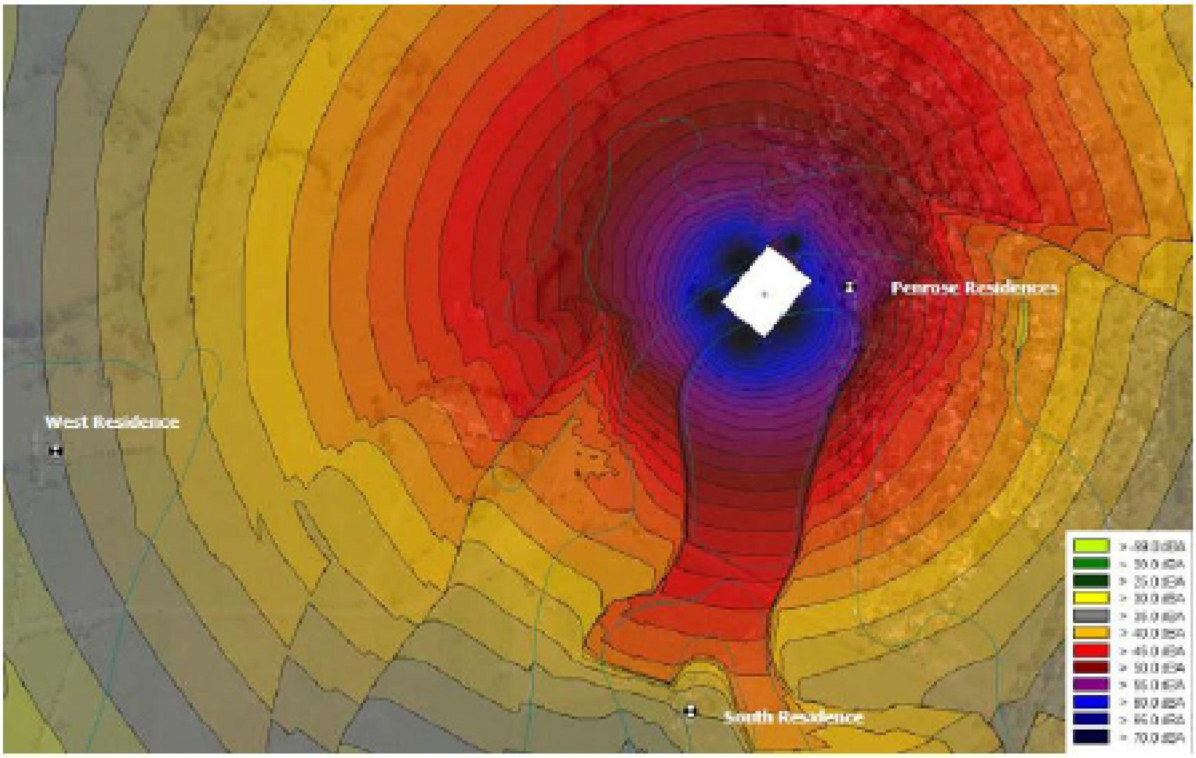
Source: Wilkinson Murray 2009

Figure 32 - Noise Contours from Structure



Source: Wilkinson Murray 2009

Figure 33- Noise Contours from Fitout



Source: Wilkinson Murray 2009

6.12.4 Mitigation Measures

Helicopter

Wilkinson Murray proposes the following noise control measures to minimise the potential noise impacts on the residence south east of the site:

- *Minimise the use of the southern flight path.*
- *Change the southern flight route so that the approach is from the south west. This would require review by the helicopter consultant for feasibility both from a flight route and helipad design perspective.*

The flight path has not been confirmed as it is subject to future project application. The above recommendations have been incorporated into the Statement of Commitments to inform the future flight path design.

Construction

Wilkinson Murray proposes a range of mitigation measures on construction management, including:

- Plant Noise Audit
- Instructions to Operator
- Equipment Selection
- Site Noise Planning

- Development of a noise and vibration management plan

6.13 Water Cycle Management

DGRs Requirements

Drainage, Stormwater and Groundwater Management

- *Address flooding, drainage and stormwater management issues, including: on-site detention of stormwater, water sensitive urban design and drainage infrastructure;*
- *Fully assess the existing groundwater features, including existing licences on site, and identify potential impacts on groundwater including any works likely to intercept, connect with or infiltrate the groundwater, measures to manage or mitigate and impacts, as well as impact in existing groundwater users.*

La Vie has commissioned Martens and Associates to undertake a Stormwater Management Strategy to address the requirements in the DGRs. The full report is provided in the separate volume.

6.13.1 Existing Environment

Existing Drainage
The site is currently characterised by open grassland. There are no surface drainage channels on the site nor there any indications of springs or seepage at the time of inspection. Runoff drains from the centre of the site towards the boundaries as sheet flow following natural contours.

Mullet Creek, which drains mostly north-east, passes by the site approximately 400 m to the north and downstream collects Dapto Creek, Forest Creek, Robins Creek and Reed Creek before discharging into Lake Illawarra approximately 5 km north-east of the site.

Rainfall
Martens (2009a) reports an annual rainfall of 1,278mm in the Huntley, and is distributed throughout the year as shown in Table 6.14.

Table 6.14 – Mean Monthly Rainfall Data from Port Kembla Signal Station

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rainfall (mm)	116	158	183	93	89	140	63	88	55	108	94	90	**1,278**

(Source: BoM 2009)

Groundwater

Martens (2009) has undertaken investigation on the existing groundwater conditions. Martens suggested that:

Site subsurface investigations to maximum depth 3.0 m / into bedrock did not encounter groundwater. Ephemeral groundwater is likely to collect at the soil / rock interface after periods of substantial or prolonged rainfall.

Water Quality – Mullet Creek

Martens (2009a) has carried out review on the following studies:

- *Wollongong Wide Water Quality Monitoring Program (2002-2006), Wollongong City Council*
- *Monitoring of Water Quality in the West Dapto Release Area (2006), Wollongong City Council*

The studies found that Mullet Creek catchment is considered to be moderately disturbed. Within the reaches of Mullet Creek, nitrogen, phosphorous and dissolved oxygen concentrations frequently failed the ANZECC (2000) guidelines across the majority of the study area.

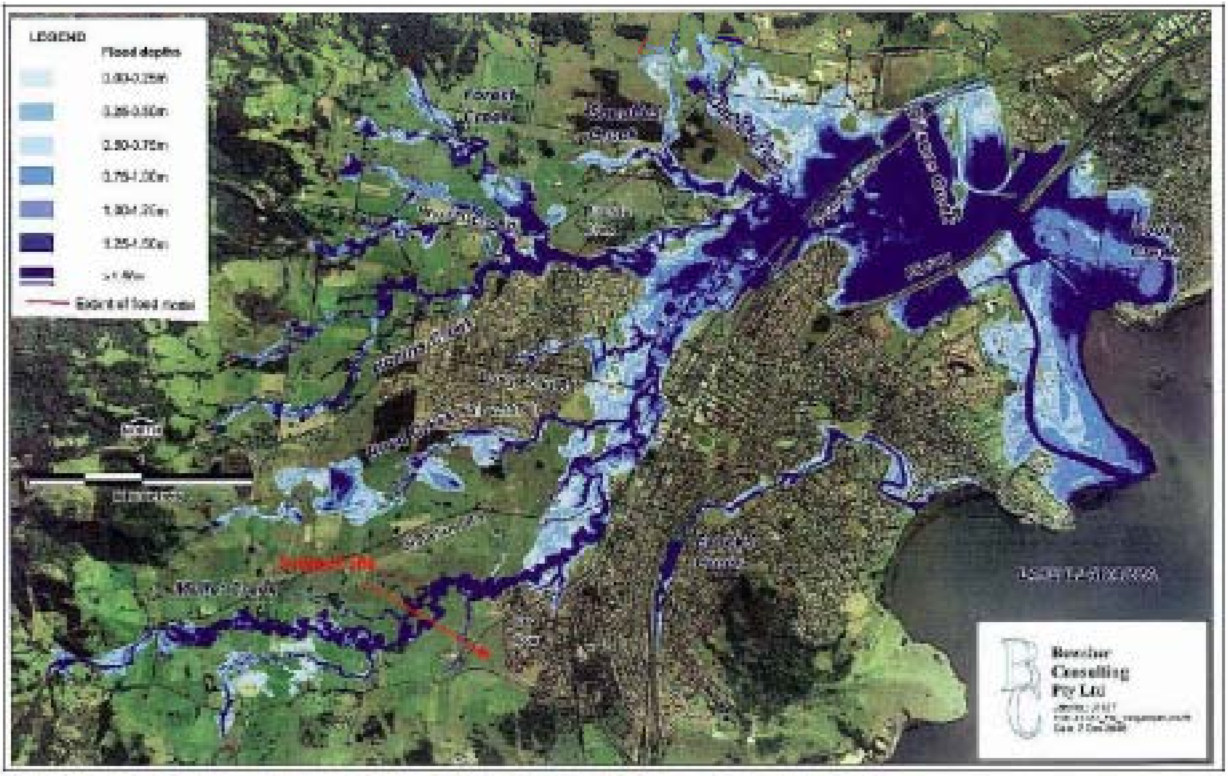
Water Quality – Lake Illawarra

Mullet Creek comprises approximately 32% of Lake Illawarra catchment and contributes large amounts of nutrients and suspended solids into the lake. The West Dapto release area water quality study (WCC, 2006) found that average total suspended solids were low at downstream sites along Mullet Creek (<11 mg/L) but total phosphorous and total nitrogen exceeded the ANZECC (2000) water quality guidelines for protection of slightly, moderately disturbed aquatic ecosystems (estuaries).

Flooding

Martens (2009a) has reviewed the most recent Floodplain Risk Management Study completed in the Mullet Creek catchment (Bewsher Consulting Pty Ltd, 2007), and confirmed that the subject site is outside of the extent of the 1% AEP flood event. This is shown in **Figure 31**.

Figure 34 – Mullet Creek Flood Study



(Source: Bewsher Consulting Pty Ltd (2007))

6.13.2 Stormwater Quantity Management

Martens (2009a), has developed a concept stormwater management system for the whole site and a concept stormwater management plan for Stage 1. The concept is based on Wollongong City Council's *Urban Drainage Design Manual* and *On-site Stormwater Detention Code (2006)*, and is designed to meet the following objectives:

- Stormwater from the 10 year ARI design storm event is to be collected and conveyed by a piped drainage system (including gutters);
- Overland flow paths/drainage routes are to convey major storm flows when the capacity of the piped system is exceeded, up to the 100 year ARI design storm event; and
- For all design storm events up to the 100 year ARI event, post development peak stormwater discharges should not exceed pre-development peak discharges in downstream areas.

Post development, the site can be divided into three catchments, each with area available for an on-site detention (OSD) structure at its low point.

Martens (2009a) has designed an on-site detention structure per catchment area as the primary mechanism for control of peak stormwater discharge from the site post development. The approximate locations of the proposed detention structures are shown on the site plan in Attachment A of the Stormwater Management Report (in separate volume), as well as the basic preliminary design specifications

The design was tested using DRAINS modelling for the pre and post development scenarios. The results are summarised in **Table 6.15**.

Table 6.15 – DRAINS flow model results – peak discharge (m^3/sec) during 100yr ARI storm

Channel	C1	C2	C3	OSD objective achieved?
Pre-Development	0.72	2.55	1.51	**5.23**
Post-Development Piped discharge	0.72	2.55	1.51	Yes
Post-Development Overland flow discharges	0	0.38	0.02	
Total	0.72	2.93	1.53	**5.18**

Source: Martens (2009)

The results indicate that a peak stormwater discharge of 5.23 m^3/sec occurs at the site in its current state, prior to any development, during the 100 year ARI storm event. Under post-development site conditions, with the proposed stormwater detention structures in place, peak stormwater discharges during the design storm event (100 year ARI) can be limited to less than 5.23 m^3/sec. The proposed stormwater management system can achieve the on-site detention objective for the site.

Proposed On Site Detention System

Total on-site detention (OSD) required for the proposed development is 3.128ML. Martens (2009) recommend construction of three detention structures in phases as shown in **Table 6.16**, and illustrates in Attachment A of the report.

The proposed OSD will be discharged to the existing drainage system in Avondale Road and Goolagong Street.

Table 6.16 – Proposed OSD structure construction phases and discharge location

Stage	OSD Structure	Discharge Location
1	Construct OSD 1 to serve Stages 1 – 4.	Avondale Road drainage system
2	Use OSD 1.	Avondale Road drainage system
3	Use OSD 1.	Avondale Road drainage system
4	Use OSD 1.	Avondale Road drainage system
5	Construct OSD 2 to serve Stage 5 and ultimately 8A.	Avondale Road drainage system
6	Construct OSD 3 to serve Stages 6, 7 and 8B.	Goolagong Street drainage system
7	Use OSD 3.	Goolagong Street drainage system
8A	Use OSD 2.	Goolagong Street drainage system
8B	Use OSD 3.	Avondale Road drainage system

6.13.3 Stormwater Quality Management

Martens (2009a) has developed three separate treatment train processes for the three sub catchments. In general each process incorporates the following the following structures:

- All roof areas directed to rainwater tanks
- Rainwater tanks are used for irrigation of site landscaping areas
- Roads, above ground parking and landscaped areas directed to small gross pollutant trap (GPT)
- All parking areas also to oil/water separator
- Overflow from rainwater tanks and GPT and oil/water separator outlets to go to wetland basin or bio-retention basin
- OSD outlet to Avondale Road or Goolagong Street drainage system.

Martens (2009a), has undertaken MUSIC modelling to assess the stormwater quality outcome post development. The modelling results are summarised in Table 6.17.

Table 6.17 – MUSIC Water Quality Modelling Results Presented as Mean Annual Pollutant Loads at the Receiving Node

Parameter (kg/yr)	Pre Development	Post Development Untreated	Post Development Treated
Total Nitrogen (TN)	106	145	71
Total Phosphorous (TP)	14.1	17.10	6.34
Total Suspended Solid (TSS)	4,860	7,610	2,090

(Source: Martens (2009a))

The results of the MUSIC modelling demonstrate that, when managed appropriately through the implementation of water quality control structures/devices, the proposed development will lead to improved post-development stormwater pollutant loads coming from the site.

Proposed Stormwater Management Measures

The proposed development would incorporate a range of stormwater management devices as recommended by Martens (2009). The treatment train system would ensure the stormwater quality is improved. The proposed systems are summarised in **Table 6.18**, followed by description of the treatment train methods.

Table 6.18 – Proposed Stormwater Management Measures per Building

Stage	Treatment Train Type	Roof Area (m^2)	Rainwater Tank Volume (kL)	Landscaping Area (ha)	Mean Daily Rainwater Demand (kL/day)
1	A	5,893	100	0.08	1.29
2	A	1,685	50	0.05	0.78
3	A	4,804	100	0.11	1.81
4	A	1,042	100	0.08	1.29
5	B	18,828	250	0.30	4.89
6	C	2,064	250	0.82	13.55
7	C	3,395	250	0.82	13.55
8A	B	4,751	250	0.59	9.78
8B	C	21 x 133 = 2,793	250	0.41	6.78

Treatment Train 'A' (catchment 1) includes the following components:

1. All roof areas directed to rainwater tanks
2. Rainwater tanks are used for irrigation of site landscaping areas
3. Roads, above ground parking and landscaped areas directed to small gross pollutant trap (GPT)
4. All parking areas also to oil/water separator
5. Overflow from rainwater tanks and GPT and oil/water separator outlets to go to underground OSD tank
6. OSD outlet to Avondale Road drainage system.

Treatment Train 'B' (catchment 2) includes the following components:

1. All roof areas directed to rainwater tanks
2. Rainwater tanks are used for irrigation of site landscaping areas
3. Roads, above ground parking and landscaped areas directed to small gross pollutant trap (GPT)
4. All parking areas also to oil/water separator
5. Overflow from rainwater tanks and GPT and oil/water separator outlets to go to wetland basin
6. OSD outlet to Avondale Road drainage system.

Treatment Train 'C' (catchment 3) includes the following components:

1. All roof areas directed to rainwater tanks
2. Rainwater tanks are used for irrigation of site landscaping areas
3. Roads, above ground parking and landscaped areas directed to small gross pollutant trap (GPT)
4. All parking areas also to oil/water separator
5. Overflow from rainwater tanks and GPT and oil/water separator outlets to go to bio-retention basin
6. OSD outlet to Goolagong Street drainage system.

6.14 Waste Management

A waste management plan has been prepared to guide the future management of waste generated in IIHP. This is included in the separate volume.

The plan identified the following waste generation:

- Chemical Waste
- Clinical waste
- Pharmaceutical Waste
- Liquid Waste
- Cytotoxic Waste

- Organic Products
- Recyclable Products
- General Waste

6.14.1 Waste Removal and Management

Table 6.19 summarises the proposed waste removal mechanism:

Table 6.19– Waste Removal and Management

Waste Category	Removal Mechanisms
Clinical Wastes	• An accredited contractor is engaged to remove and dispose of clinical waste and medical sharps in accordance with the required State, Environment Protection and Commonwealth Regulations. • A certificate recording the volume of waste transported and disposed is provided to the facility by the external contractor. • Sterihealth has been audited by HICMR – Infection Control consultants
General Waste	• Removed by Wollongong Council or private contractors.
Cardboard and Paper Waste	• Removed x 2 weekly by Amcor or a suitably qualified company.
Out of Date Drugs	Out of date drugs will be destroyed in accordance with O H & S Standards. Narcotics will be destroyed as per NSW Health and Pharmaceutical Branch Guidelines in the presence of a Police Officer or Inspector from the Pharmaceuticals Branch as per the Poisons and Therapeutic Goods Regulation 2008, Part IV, Division 7, Clauses 125-128.