
# Central Park

## Central Thermal Plant

## PA Report

**23rd January 2012**

# Central Park
# Central Thermal
# Plant Engineering
# Services PA Report

**23rd January 2012**
**SYD080740L**

Client

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| Issue/Status | Revision | Date Issued | Author | Checked | Approved | Comment |
|---|---|---|---|---|---|---|
| Draft | A | 8.04.2011 | DKF/RAB/JCD/CAV/SJ | RAB | RAB | For Comment |
| Issued for PA | B | 18.04.2011 | DKF/RAB/JCD/CAV/SJ | RAB | RAB | Minor Amendments |
| Issued for PA | C | 21.04.2011 | DKF/RAB/JCD/CAV/SJ | RAB | RAB | Minor Amendments |
| Revised | D | 23.01.2012 | DKF/RAB/JCD/CAV/SJ | RAB | RAB | Amended |

# 1 Introduction

## 1.1 The Overall Project

Central Park project is the former Carlton United Brewery (CUB) site in Chippendale, NSW.

*"On six hectares of a global city, Frasers Property is planning a high quality, sustainable, mixed use development including apartments, offices, shops, restaurants and open space. Underpinning this project will be exemplary social and environmental sustainability initiatives to create a people-centred, new destination for Sydney.*

*Key features of the Frasers Broadway development include:*

*- 6,000 square metres of a new inner-city square*

*- Two iconic buildings along Broadway by renowned international architects Jean Nouvel and Foster + Partners. This is an unparalleled investment and vote of confidence in the southern CBD*

*- Kensington Street will be transformed into a people-centred laneway, drawing on the best of Newtown and Darlinghurst, providing a vibrant space for shops, galleries, restaurants, cafes and bars. This initiative will commence immediately with the establishment of artists' studios on Kensington Street*

*- Car parks that are flexibly designed to be changed to other uses in the future, if needed*

*- Car share schemes and integration into the inner city bicycle network*

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*- Much needed office space, with a 40:60 split of commercial areas relative to residential*

*- Thirty-three heritage items are to be retained and restored*

*- Retail space is consolidated in the north eastern corner of the site, creating a community-scale retail precinct*

*Buildings heights are greatest close to the City and lower towards Chippendale, mediating between the City and inner residential areas, with close attention to solar access to the main community park.*

*This development will be at the forefront of environmental sustainability initiatives across the country. We are striving for the highest environmental rating across the entire precinct. The site will be the largest urban development in Australia to introduce on-site tri-generation (known as 'green transformers') for power, heating and cooling."1*

The site is bounded by Broadway Road to the north, Abercrombie Street to the west, O'Connor and Wellington Streets to the South and Kensington Street to the east.

## 1.2 Central Thermal Plant Development

The project involves the construction a new 2 level basement plant building known as the Central Thermal Plant, designed by PTW and collaboration with Tzannes Architects for the above ground interfaces. The Central Thermal Plant room will house the tri-generation and primary thermal plant that will serve the precinct.

The objectives of the Central Thermal Plant to house the Tri-Generation system and thermal plant for the project for the purposes of:

- Electricity supply to Central Thermal Plant.
- Provide cooling energy to the mechanical air conditioning systems serving the building blocks, through the distribution of chilled water from the Central Thermal Plant.
- Provide heating energy to the mechanical air conditioning systems serving the building blocks, through the distribution of heating hot water from the Central Thermal Plant.

- Provide hot water to the building blocks for domestic hot water needs including showering and wash basins through the distribution of hot water from the Central Thermal Plant.
- Reducing greenhouse gas emissions from the precinct operation.
- Meeting energy efficiency objectives for the precinct.

The building will be constructed on the Central Park precinct development in Chippendale, Sydney, NSW as described in Section 1.1 above.

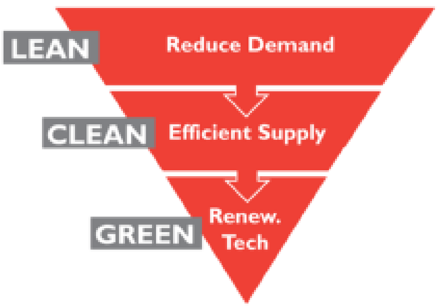
The design objective is to provide a facility which will be optimise for the reduction in the use of energy and water. The design will aim to reduce electricity consumption, which has a significant negative green house gas implication through the use of coal for electricity generation. Water usage for the Cooling Towers, the primary consuming element, will be minimised and replaced with recycled water provided by the recycled water treatment plant.

Low energy use and reduced water consumption will be achieved by the design of environmentally efficient systems with the capability to closely control operation

All building services systems will be designed to meet the Building Code of Australia and relevant associated Australian standards that are current at the time of this report.

### 1.3 Precinct Approach

The precinct design has followed the Lean, Clean and Green energy hierarchy, which prioritises energy reductions first through passive design and energy efficiency measures, then through large scale implementation of low carbon technologies such as the introduction of onsite generation through Tri-generation.




This three step process follows a common sense approach and understands the cost of carbon abatement through technology application, i.e. the hierarchy represented in the figure describes the most cost effective route to support the resource consumption aspirations for the wider Central Park precinct.

Therefore, a “passive design first” approach has been adopted for all buildings on site. The building envelope design considers passive design principles to minimise heating and cooling loads. The initiatives employed are as follows:

- Building elements meet or exceed the Deemed to Satisfy provision of the Building Code of Australia
- Extensive use of green walls and horizontal gardens to provide solar shading and facilitate natural ventilation
- Solar control glazing with low-e coating to reduce solar gains and minimise cooling demand; the low-e coating offers a good thermal performance, minimising heating demand
- External shading through the use of balconies and terraces to reduce solar gains
- Daylight penetration is maximised through careful design in order to reduce the need for artificial lighting; this is balanced with the glazing specification and façade design to ensure that the improved level of daylight does not impact on cooling loads

Whilst the passive measures applied have been outlined, this only goes partway to minimising energy consumption through the Lean step of the energy hierarchy. Energy efficiency measures have also been applied to further reduce energy demand. These energy efficiency measures include:

*Controls and management*

- All buildings include electrical sub-metering and a Building Management System (BMS) which monitors and records energy consumption from lighting and mechanical heating and cooling to ensure that high use areas are identified and addressed immediately, and systems are maintained when required

- Smart controls, such as timers and PIR sensors, ensure use of air-conditioning and lighting is minimised in unoccupied areas in buildings, e.g. common lobby areas in residential apartments and car parks
- Smart metering to provide real-time information to occupants about energy consumption and raise awareness
- Appropriate commissioning will be undertaken to ensure all mechanical systems will operate as efficiently as possible

*Artificial lighting and appliances*

- Energy efficient lights, such as T5 and LED fittings, are specified which not only reduce electricity demand but also reduce heat gains

Energy efficient appliances wherever these are installed and internal or external clothes lines and/or hoists to reduce the use of tumble driers lead to lower heat gains from equipment.

### 1.4 Technical Summary of the CTP

The 1.8MWe tri-generation plant produces electricity via the combustion of natural gas. The by-product of producing electricity via a gas engine is waste heat. The waste heat energy is in equal order of magnitude to the electrical energy produced. This waste heat is then converted into hot water and chilled water.

Chilled water is produced via the utilisation of absorption chillers within a central thermal plant which will meet the base off-peak mechanical load of the site. The central thermal plant will also have electric chillers for peak demand over and above that provided by the absorption chillers; these will be backed up with electric chillers, back up boilers and back up diesel generators.

The electricity produced will primarily be used the electric chillers (during peak demand periods) with any excess electricity being utilised by the other systems within the Central Thermal Plant. There will also be the option for future possible exportation of the electricity grid or to other sites within the precinct.

The chilled and hot water is to be reticulated to each building where heat exchangers will allow each building to make use of the services provided by the central thermal plant. Heat rejection for the central thermal plant will be provided by several banks of cooling towers located within the site. Thermal energy storage will also be employed to balance energy demand between peak and off-peak time, thus reducing the requirements for heat rejection.

The base building heating and cooling loads are to be provided by the Central Thermal Plant.

The central water treatment plant, that will supply the non-potable water to be utilised by the Central Thermal Plant, is to consist of a 1,000kL recycled water plant. The recycled water treatment plant is to utilise sewer mining to treat blackwater to a Grade A standard. This non potable water will be reticulated to each building to serve all of the non potable demands. Excess non potable water has the potential to be exported off site. Mains water will also be reticulated to each building to serve all potable demands.

The development of the Central Thermal Plant will emulate site wide environmental initiatives described in the previous section.

### 1.5 Green Star Rating

The central thermal plant design will not specifically target a Green Star rating as an appropriate tool is unavailable. The design will endeavor to emulate site wide building design performance and environmental initiatives.

## 1.6 License Consideration

### *1.6.1 AEMO License*

As embedded generation forms part of the CTP operation, a generator would normally be required to be registered with AEMO under the National Electricity rules if the total system rating exceeds 5MWe or is capable of synchronizing with the transmission system. As this total generating capacity of the CTP will be less than 5MWe and it is not intended that the system will export to the grid, the CTP at Central Park is automatically exempt.

### *1.6.2 Retail License for electricity*

As it is intended that the CTP will consume the electricity generated within the central plant itself, with limited export to base build provisions, the need for a retail license will be limited to a case where the operator may wish to export in the future, in which case this will be broached when appropriate.

### *1.6.3 Enviromental Protection Licence*

Clause 17 of Schedule 1 of the Protection of the Environment Operations Act (1997) states that an electricity generating works (which is a scheduled activity) in the forma of an internal combustion engine capable of burning more than 3 megajoules of fuel per second (which equates to approximately 1 MWe output) will require an Enviromental Licence. As such the proposal for a 1.8MWe cogeneration plant at Central Park CTP will require said licence.

## 1.7 Section 75W

The previous Project Application (MP08_0253) for blocks 1 and 4 originally contained the central thermal plant as part of the basement component.

This modification physically separates the central thermal plant from the basement structure so as to allow it to be constructed ahead of the block 1 and 4 basement.

Apart from some minor configuration to evaluate the central thermal plant as a stand-alone structure, there has been no change to the overall original design intent.

# 2 Mechanical Services

## 2.1 Referenced Documents

The mechanical services will be designed in accordance with the following code and authority requirements:

- Building Code of Australia 2010
- AS/NZS 1668.1-1998 and AS/NZS 1668.2-1991
- City of Sydney Council Requirements
- New South Wales Emission Guidelines
- AS 3666-2002
- AS/NZS 3000-2007

## 2.2 Tri-Generation

The CTP shall produce cooling and heating water by means of tri-generation. While natural gas reciprocating engines produce electricity, waste heat from gas engine shall be recovered as heating sources for the precinct space heating, domestic hot water and space cooling requirements. A tri-generation plant can have a much higher overall efficiency and less $CO_2$ emission than a conventional thermal plant.

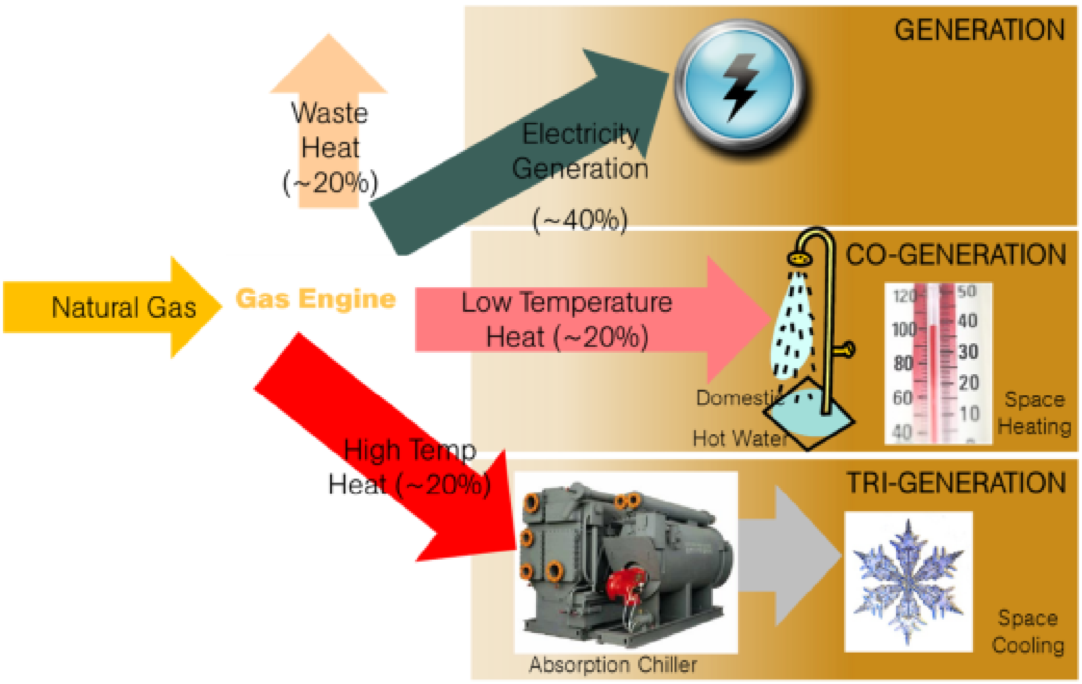



Figure 1 - Visual description of tri-generation

Heat will be recovered from both the exhaust (high grade heat) and jacket water (low grade heat) of the natural gas engines. Jacket water will be used for space heating and domestic hot water needs. Absorption chillers will be used to fully utilise the waste heat from the gas engines to produce chilled water.

The electricity generated by the gas engines will be used to drive conventional electrical chillers and auxiliary central equipment including primary, secondary and tertiary pumps and cooling towers.

The CTP will continuously supply chilled water for air-conditioning systems and hot water for space heating and domestic hot water to individual blocks located around the precinct. Distribution of each of these services will be provided via an external pipework reticulation network decoupled via heat exchangers from the Buildings around the site. The external piping network does not form part of this project submission

The follow parameters from the basis of the tri-generation system design to date:

- Peak Electrical Generation 1,800kWe
- Recoverable Waste Heat 1,620kWr

It is recommended that the tri-generation system design incorporates:

- One (1) 800kWe natural gas fire co-generation unit
- One (1) 1,000kWe natural gas fire co-generation unit

## 2.3 Central Chilled Water System

### *2.3.1 General Description*

Buildings around the precinct will be continuously supplied with chilled water by a central chilled water system from the CTP. The chilled water systems comprises of water cooled chillers optimally configured to achieve a high operational efficiency to suit the site wide energy targets.

The central chilled water plant will comprise of absorption chillers that utilise recovered heat from the gas engines through the Tri-generation process described in the previous section. Additional capacity will be provided by electrical chillers incorporated in the chilled water system that will generate cooling water by utilising electricity generated by the tri-generation gas engines.

### *2.3.2 Chilled Water System Capacity*

The total peak coincident cooling capacity of the plant will be in the order of 19,800 kW. This figure is constantly being reviewed and rationalised to reflect up to date building design data, changes to site massing and anticipated building loading. The peak cooling capacity is not expected to fluctuate more than ± 3%, henceforth not affecting the Central Thermal Plant planning.

### *2.3.3 Absorption Chillers*

It is anticipated through thermal analysis; the optimal output cooling load generated by the absorption chillers will be in the order of 1,200kWr of the total peak coincident cooling capacity. It is anticipated that two (2) LiBr absorption chillers will be installed within the central thermal plant.

Motorised valves will be installed on the flue of the gas engine before and after the absorption chiller. They will control the amount of exhaust delivered into or by-passed the absorption chiller or exhaust gas heat exchanger to vary the generated cooling water capacity.

### *2.3.4 Electric Chillers*

Electric chillers will provide redundancy within the central chilled water system and fulfill the site peak loads. It is anticipated through thermal analysis the optimal electric chiller arrangement is:

- Four (4) 4,800kWr variable speed centrifugal chillers
- Two (2) 1,750kWr variable speed screw chillers

The electric chillers will be optimally configured to achieve a high operational efficiency that matches the precinct demand. The number of electric chillers will ensure sufficient backup in case of breakdown and route maintenance.

The electrical chillers will have the ability to provide 100% cooling capacity backup in case gas supply to the tri-generation system fails.

The primary electric power to the electric chillers will be supplied by the gas engines under full load conditions and backed up by local diesel engines and electricity from the electrical network.

#### 2.3.5 Refrigerants

Refrigerants for the chillers will be of zero ODP and low GWP, in line with the Greenstar site ambitions

#### 2.3.6 Efficiency

All chillers will have a high coefficient of performance (COP) at full load condition as well as at part load conditions.

#### 2.3.7 System Pumping

Each chiller will be provided with dedicated primary chilled water and condenser water pumps. Primary chilled water and condenser water pump are driven by a variable speed drive (VSD) to provide energy saving variable flow rates.

### 2.4 Central Hot Water System

#### 2.4.1 General Description

Buildings around the precinct will be continuously supplied with hot water from the central hot water system component of the CTP. Hot water will be utilised for both domestic and space heating systems for residential, commercial and retail strata's.

The central hot water plant will utilise recovered waste heat from gas engines through the Tri-generation process described in ther previous sections. In the case when recovered waste heat from the gas engines is not available, hot water will be produced by backup high efficiency gas fired hot water heaters (boilers).

#### 2.4.2 Hot Water System Capacity

The total peak coincident heating load capacity of the plant will be in the order of 6,300. This figure is constantly being reviewed and rationalised to reflect up to date building design data, changes to site massing and anticipated building loading. The peak heating capacity is not expected to fluctuate more than ± 3%, henceforth not affecting the Central Thermal Plant Planning.

#### 2.4.3 Gas Engine Waste Heat

The primary heating source will be the recovered waste heat from gas engines. Heat recovered from the gas engine water jacket will be supplied through the hot water piping network to individual blocks at a temperature of 85 ºC. It is projected that the site demand for hot water for both space heating and domestic hot water will be generated through the tri-generation process.

#### 2.4.4 Hot Water Heaters

In case recovered waste heat from the gas engines is not available, hot water will be produced by approximately four (4) 1,800kWr high efficiency gas fired hot water heaters (boilers). Fume exhaust from the hot water heaters will be treated in compliance with regulatory requirements before being discharged into the outside atmosphere through flues.

#### 2.4.5 System Pumping

Each hot water heater will be provided with a dedicated primary hot water pump. Each hot water pump will be fitted with a VSD motor to maintain a desired flow rate and minimum head.

### 2.5 Central Condenser Water System

#### 2.5.1 General Description

A central condenser water system will be provided for heat rejection from the central thermal plant. Peak heat rejection is anticipated to be in the order of 25,100kWr. Besides chillers, the condenser water system can be shared by the gas engines and diesel engines for heat rejection. Cooling towers will be located on the roof of the existing heritage Irving Street Brewery building.

Modular multi-cell high efficiency, low noise, low water consumption cooling towers shall be used. The cooling towers will be sized such that the loss of any one cooling tower will not reduce the base condenser water system capacity.

The cooling towers will be provided with common headers, variable speed fans, balance lines and individual isolation.

Low TDS make-up water for cooling towers will be sources from the Recycled Water Treatment Plant (RWTP) and is backed by Sydney Water mains.

There is no dedicated tenant condenser water system for the precinct provided from the central thermal plant. Tenants will utilise the chilled water system for their own cooling purposes as required.

## 2.6 Thermal Energy Storage (TES)

### *2.6.1 General Description*

The simulated precinct cooling and heating load profiles detail that the load demands are constantly changing and peak loads occur in a short durations. It is possible to store the redundant thermal energy that is generated at the optimum efficiency of the tri-generation system and to use this during peak periods.

Both chilled water and hot water thermal storage will be provided as part of the Central Thermal Plant development.

The benefits of thermal energy storage (TES) include the reduction of the equipment size that is normally designed to satisfy peak demand, saving on equipment cost, space and stabilising equipment running. It also provides backup capacity during power failure. TES is applicable to both heating and cooling systems.

## 2.7 Central Thermal Plantroom Ventilation

### *2.7.1 General Description*

The tri-generation plant room is located at basement level. It will be fully ventilated by mechanical means (fans). The mechanical ventilation rate will be the greatest in the following considerations:

1. Minimum ventilation rate for plant rooms required by AS1668.2,
2. To meet the thermal heat dissipation requirements of the equipment within the plant room
3. To meet make-up air for combustion equipment including gas engines, diesel engines and boilers,

Supply air will be ducted via an intake located above ground within the Irving Street Brewery court yard. Exhaust/relief ventilation will be ducted from the Irving Street Brewery courtyard and discharged at roof level of Irving Str Brewery Building.

## 2.8 Flues and chimney

### *2.8.1 General Description*

Exhaust from the gas engines, diesel engines and hot water heaters (boilers) must be discharged into the outside atmosphere through a set of flues. In principle, the flues will be laid individually.

Exhaust from the gas engines will be discharged through the existing Irving Street Brewery Building chimney on site. Exhaust from the standby diesel engines and hot water heaters will be discharged to the roof of existing Irving Street Brewery Building through flues reticulated through shafts.

All plant emissions will be within the City of Sydney guidelines and endorsed by the State Department of Environment and Climate Change. Compliance with these guidelines will be determined through emission studies completed by a duly qualified specialist. Selective Catalytic Reduction devices (SCRs) will be utilised to reduce particle emissions to align with State policy if required.

## 2.9 Additional Considerations

### *2.9.1 Vibrations and Acoustics*

Equipment housed within the central thermal plant room will employ vibration mounts and flexible connections to avoid transmission of vibration to the structure and surroundings. Cooling towers located external to the central thermal plant will be housed within an acoustic enclosure and come complete with discharge silences to provide an appropriate level of acoustic treatment to comply with the relevant standards. Acoustic treatment will be reviewed by a duly qualified specialist. Plant design will ensure that the transmission of vibration and noise from central thermal plant equipment will be in line with City of Sydney guidelines to ensure amenity of residents within the central park development and surrounding.

### *2.9.2 Maintenance*

All equipment will undergo regular monthly maintenance in line with manufacturer's guidelines and industry best practice.

### *2.9.3 Fit for Purpose*

The mechanical systems are appropriate, energy efficient systems, employing some of the latest low carbon technologies commercially available.

### *2.9.4 Plant Access*

Primary equipment access to the tri-generation plant and the central thermal plant will be via an access hatch located in the Irving Street Brewery close to Carlton Street. A secondary smaller equipment access hatch will be provided within the larger hatch for the purpose of small plant replacement.

# 3 Electrical Services

The electrical services will be designed in accordance with the following code and authority requirements:

- Building Code of Australia 2010
- City of Sydney Council Requirements
- AS/NZS 3000
- AS/NZS 1680.0
- AS/NZS 1768
- AS/NZS 2293.1
- AS/NZS 2067
- Energy Australia Requirements

The building will be supplied via an Energy Australia High Voltage Connection (HVC) Kiosk located within the courtyard area above the Central Thermal Plant (CTP) area. The HVC will in turn supply an 11kV supply to the CTP Private Substation located on the upper most level of the CTP, which will house the required HV switchgear and Dry type Transformers to supply the CTP plant and associated building services.

The HVC will be enclosed within accessible palisade type fencing which is subject to approval from EA.

The main LV switchroom will be located directly below the Private HV substation.

Standby diesel generators will be provided within the CTP plant area to provide a back-up to the electrically driven chillers and associated system, including the essential building services loads.

The whole CTP is essentially a plant space; therefore Submains distribution shall be reticulated horizontally and vertically through the CTP areas on exposed containment.

All associated Distribution Boards and electrical panels shall be located within dedicated switchroom and / or cupboards.

A separate energy metering monitoring system will be provided for monitoring and reporting on the energy usage of the buildings, thus meeting the requirements of NABERS Energy and Green Star.

Lighting shall be provided by high efficiency light fittings generally utilising T5 fluorescent lamps or compact fluorescent lamps with electronic ballasts which will reduce the electrical consumption when compared to light fittings utilising T8 lamps. The lighting shall be controlled to allow for zoned switching to allow set back of lighting to areas of low usage.

Local switching will be used for plant areas due to the nature of the plant with occupancy sensor used within ancillary areas.

Emergency escape lighting and exit signs will be provided throughout the buildings to comply with BCA and AS 2293.

A conventional lightning protection system will be considered for the buildings as part of the earthing and in accordance with the requirements of AS/NZS 1768.

# 4 Communications Services

The communications services will be designed in accordance with the following code and authority requirements:

- Australian Communications and Media Authority Requirements
- AS/NZS 3000
- AS/ACIF S008
- AS/ACIF S009

The central thermal plant building will be provided with a fibre lead-in to the building distributor. Telecommunications backbone cabling will be provided from the Building Distributor to the office area and shall be utilized for communication and control through out the plant areas.

An access control system will be provided to control the building entry points for personnel.

CCTV monitoring may be provided to the cover the entrances to the CTP and to provide remote viewing access to essential equipment.

The CCTV coverage would be viewed local from the staff ancillary area with remote access to an off-site location.

# 5 Hydraulic Services

The Hydraulic services will be designed in accordance with the following code and authority requirements:

- Relevant Australian Standards
- Building Code of Australia 2010
- NSW Plumbing & Drainage Code of Practice
- Sydney Water Corporation requirements
- City of Sydney Council requirements
- Gas authority requirements
- Green Building Council of Australia

Amenity sewer provisions within the Central Thermal Plant will reticulate to an in-ground sewer pump out pit that will be discharged to the Recycled Water treatment plant located below Block 2.

New water service connections will be extended from site infrastructure. Cold water pump sets will be provided to reticulate cold water as required. In addition to an authority meter, private sub-meters will be installed to monitor the individual usages within the building zones.

Non Potable Cold Water (NPCW) service connections will be extended from site infrastructure to serve non-potable water uses within the Central Thermal Plant. Pump sets will be provided to reticulate NPCW water as required.

Domestic hot water heat exchangers will be located locally to serve local requirements. The heat exchangers will be powered from site infrastructure district heating supply.

A metered gas services will be provided to serve the Tri-generation plant from the authority gas main.

Localised sub-terranian drainage will be provided to de-water and reduce ground water pressure applied upon sub-ground level structures. The collected water will be collected in an in-ground sump and be conveyed to the recycled treatment plant (subject to analysis).

All sanitary fixtures and tap ware will be minimum 5 Star Wells rated. Shower heads shall be 3 star WELLS rated.

# 6 Fire Services

Fire services for this building will be provided in accordance with the Building Code of Australia, relevant Australian Standards, and the fire safety engineered solution. Services shall include:

- Fire Sprinkler System
- Fire Hydrant System
- Smoke Detection and Alarm System
- Smoke Hazard Management System
- Building Occupant Warning System
- Portable Fire Extinguishers

### Design Criteria

The Design Criteria forming the basis of the Fire Services design will comprise:

| Fire Services System | BCA requirement | Australian Standard |
|---|---|---|
| Smoke Detection and Alarm System | BCA Spec E2.2a Clause 4 | AS1670.1-2004 |
| Smoke Hazard Management System | BCA Spec E2.2a Clause 5 | AS1668.1-1998 |
| Building Occupant Warning System | BCA Spec E2.2a Clause 6 | AS1670.1-2004 |
| Fire Sprinkler System | BCA Spec E1.5 | AS2118.1-1999 |
| Fire Hydrants | BCA Spec E1.3 | AS2419.1-2005 |
| Portable Fire Extinguishers | BCA E1.6 | AS2444-2001 |

A Fire Indicator Panel for both the CTP building and the Irving Street Brewery building will be provided at the ground level entry to the CTP building, adjacent to the brigade booster enclosure, and will be connected to an approved monitoring company to notify fire brigade in the event of a fire alarm. The main fire panel will be interfaced with a brigade repeater panel at the main entry to the Brewery building.

A Fire Fan Control Panel will be integrated into the main fire panel to allow manual operation of the fire fans in the Brewery building by the brigade.

An analogue addressable looped smoke detection system will be provided to serve the CTP building. Smoke detection will be provided throughout to provide smoke hazard management and building services shutdown.

Occupant warning will be provided throughout the CTP building to allow controlled evacuation of the building during a fire condition, and operating from the main fire panel.

A sprinkler system will be provided to serve both the CTP building and the Irving Street Brewery building. Sprinkler protection will be provided throughout the CTP building to the following design criteria;

- Plant areas - Ordinary Hazard Class 1 OH1

(note – the sprinkler system infrastructure will be designed to provide OH3 protection to the Brewery building, as the highest demand area)

A grade 3 water supply will be provided to serve the sprinkler system, comprising of a dedicated townsmain connection, and an automatic booster pump. The booster pump and the sprinkler control valves will be located in a dedicated fire services plant room at B1 level of the CTP building with direct access to open space via a fire stair. A brigade booster enclosure will be provided within the façade of the CTP building entry stair structure, located at ground level adjacent to Carlton Street.

A fire hydrant system will be provided to serve both the CTP building and the Irving Street Brewery building. Hydrant coverage will be provided throughout the CTP building, with hydrant outlets located within fire stairs and additional hydrants provided on floors to ensure adequate coverage.

A water supply will be provided to serve the hydrant system, comprising of a dedicated townsmain connection, and an automatic booster pump. The booster pump will be located in a dedicated fire services plant room at B1 level of the CTP building with direct access to open space via a fire stair. A brigade booster enclosure will be provided within the façade of the CTP building entry stair structure, located at ground level adjacent to Carlton Street.

Portable fire extinguishers to suit the relevant risk and associated signage will be provided throughout all areas of the building.