VICTORIA CIRCLE DEVELOPMENT PROJECT

ENERGY CENTRE OUTLINE SUMMARY

Revision 02

Prepared for
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AUTHORISATION

Current Revision	Date	Page(s) affected	Prepared	Checked	Approved
2	Mar '13	All	TOM HITCHMAN	TONY GOLLOGLY	TONY GOLLOGLY

REVISION HISTORY

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1	Feb '13	All	DRAFT
2	Mar '13		PDHU annual heat demand figure included All changes in red

CONTENTS

1. Introduction

This report has been produced to satisfy Section 106 of the planning requirements for the Victoria Circle development. The following description provides a brief summary of the Energy Centre facility and the services provided. A full schedule of Energy Centre plant and plant layout have been appended to this report.

2. Energy Centre Summary

The Victoria Circle (VC) Energy Centre is located in the level 1 basement area, at the back of the adjacent vehicle access ramp. The energy centre facility will house the low carbon and traditional energy plant / systems that will provide the electrical, heating and cooling supplies to the overall VC development.

These supplies are to be provided by the following primary plant solutions:

- 2No Gas fired combined heat and power (CHP) engines.
- 3No 2500kW dual fuel boilers.
- 2No 140m^3 thermal storage vessels.
- 1000kWch single effect absorption chiller.
- 2No 1000kW LV water cooled variable speed electric screw chillers.
- 2No 2500kW HV water cooled fixed speed electric centrifugal chillers.

2.1 Energy Loads to be Served

The Energy Centre shall primarily serve the VC Development (comprising buildings 5, 6a, 6b, 7a, 7b&c and common basement) with heating supply connections provided to the adjacent Portland House development and the existing Pimlico District Heating Undertaking (PDHU).

The following table provides an outline summary of the services to be provided from the energy centre:

Item	Building							
	Landlord Basement	5	6a	6b	7a	7b &c	Portland House	PDHU
The following services shall be provided from the energy centre:								
Heating	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cooling	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Power	Yes	No	No	No	No	No	No	No
Standby Power	Yes	No	Yes	Yes	Yes	Yes	No	No
The following shall be provided with alternate power supplies for Life Safety systems	Yes	Yes	Yes	Yes	Yes	Yes	Yes	n/a

Table 2.1

2.2 Heating & Cooling Demands

The following table provides a summary of the heating and cooling loads supplied by the VC Energy Centre:

	Portland House	5	6a	6b	7a	7b7c	PDHU	Total
Total area (m^2)	31,200	20,614	15,239	28,043	43,414	9,798	-	**138,308 m^2**
HEATING DEMANDS								
Peak Heating (kW)	1,600	750	1,219	1,808	2,999	363	1,800*	**11,169 kW (undiversified, including basement) 7,500 kW (diversified)**
Basement heating (kWth)	n/a	580 + 50					n/a	**630 kW**
Annual Heating (MWhth p.a.)	1,417	943	257	585	550	244	Up to 10,000*	**3,996 MWh (Excluding PDHU)** **Up to 13,966 MWh (Including PDHU)**
COOLING DEMANDS								
Peak Cooling (kWth)	n/a	1,400	916	1,647	2,929	450	n/a	**7,342 kW (undiversified, excluding basement) 7,000 kW (diversified)**
Basement cooling (kWth)	n/a	310 + 50					n/a	**360 kW**
Annual Cooling (MWhth p.a.)	n/a	402	496	1,418	1,494	167	n/a	**4,176 MWh (Including basement)**

Table 2.2

*The supply of heat from VC to PDHU is subject to further discussion with the GLA and PDHU and is dependent on the agreed operation of the existing PDHU CHP plant and the potential heat supply from the Whitehall District Heating Scheme (WDHS). The total annual heat supply from the VC development to PDHU has been calculated to be between approximately 4,000 MWh p.a. and 10,000 MWh p.a. depending on the proportion of heat supplied by both the WDHS and the existing PDHU CHP plant.

2.3 Power Generation and District Heating System

The CHP engines will operate all year round generating electricity at high voltage (HV), which will supply the energy centre parasitic requirements and the basement area ancillary loads, with the remaining surplus being exported to the UKPN network via the basement HV switchroom. Heat will be reclaimed from the engine circuit lube oil, jacket and exhaust. Heat recovered from the CHP engines shall take precedence in the supply of heat to maximise carbon savings.

The District Heating (DH) network serving the VC development shall be variable flow, controlled to suit customer demand. When the customer demand is lower than the heat output from the CHP engines, the extra heat will be diverted to the nominal 280m^3 thermal storage facility. Once the customer demand rises above the output of the CHP engines, the thermal storage facility will discharge to supplement the heat being provided by the engines, removing the need for operation of the traditional boiler plant. Once the thermal storage facility is fully discharged, then the boilers will eventually operate to supplement the CHP engines during the higher demand periods. The boilers will also operate as resilience standby if the CHP engines are unavailable and are also dual fuel type to maintain heating supplies during any period of gas interruption.

Over and above the heating supply to the overall VC development, to maximise efficiency and carbon savings from extended CHP engine operation, the energy centre will also provide a heating supply to the Portland House development (via the VC DH network) and PDHU. Both will require a buried infrastructure supply, with the proposed interface with PDHU being about 1km to the south of the VC development.

The DH network system shall operate at the following temperatures:

Flow Temperature	95°C
Return Temperature	55 - 75°C (dependent on load served)

2.4 District Cooling System

During the summer periods the high temperature heat reclaim from the engine exhausts will be used to drive a single effect absorption chiller, which when available, will take precedence as the base load supply for the overall VC development comfort cooling requirements. As demand rises above the output of the absorption chiller, the electric chiller units will be enabled to supplement the supply. The electric chillers shall be sized to provide the full site cooling load and will also operate as resilience standby if the absorption chiller is unavailable.

The District Cooling (DC) network serving the VC development shall be variable flow, controlled to suit customer demand.

The DH network system shall operate at the following temperatures:

Flow Temperature	6°C
Return Temperature	12°C

2.5 Heat Rejection System

The heat rejection requirements of the chiller plant and low grade engine circuits will be provided from a pumped condenser water system, which will provide flow to remote adiabatic type blast air coolers which will be located on the roof areas of buildings 5, 6a, 6b and 7a. The Energy Centre and its supply systems have been designed such that the ongoing operation can be carried out by a third party energy supply company (ESCo) if

required. In line with this the power and water supplies to the roof mounted adiabatic blast coolers and the external customer substations, will be provided from the energy centre in order that they can be fully metered and assessed as an Energy Centre parasitic demand. In line with this the gas and water supplies to the energy centre will be from separately metered incoming supplies to the development.

The condenser water system shall operate at the following temperatures:

Min/Max Flow Temperature	24/35°C
Min/Max Return Temperature	18/29°C

The operation of the condenser water system shall be optimised to minimise the power and water consumption of the heat rejection plant and to maximise the efficiency of the water cooled chillers.

2.6 Standby Power Generation

In the case of loss of power to the VC development, the energy centre will be provided with an HV connection from the standby generator plant, which will be sized to allow for continued operation of the heating and cooling supplies at peak demand periods. At such time, the CHP engines will not operate.

2.7 Ventilation Systems

Supply air to the energy centre, for plant combustion and cooling requirements will be drawn from the main ramp area by the individual systems. Individual extract systems will be sized on worst case for general extract or smoke extract requirement. These extract systems along with the combustion plant exhaust flues will be routed through the general basement area and up the building risers for outlet termination. The flues will rise through building 7a and terminate at the level 18 roof level for maximum dispersion of pollutants.

2.8 Welfare Area Services Provision

The Energy Centre will also include for a facilities / welfare area in south east corner, comprising a control room, tea station, shower / locker room and toilet. These will be heated and cooled as required from the energy centre systems and be complete with ventilation and smoke extract systems.

2.9 Control Systems

Each packaged item of plant shall be supplied with a standalone PLC control system for the control and monitoring of all operational parameters. This shall apply to the following plant items:

- CHP engines
- Boilers
- Absorption Chiller
- Electric Chillers
- Adiabatic Coolers
- Pressurisation & Degassing Packages
- Side Stream Filtration Units

- Dosing Packages

A PLC based Energy Centre Plant Control System (PCS) shall be provided for remote control, monitoring, metering and alarm notification of the Energy Centre plant, systems and environmental conditions. The PCS shall be used for the following control functions:

- Boiler sequencing
- Chiller sequencing
- Adiabatic cooler sequencing
- Thermal store charge/discharge control
- DH and DC Network pump start/stop, demand based speed control and changeover
- Boiler shunt pump start/stop, demand based speed control and changeover
- Electric chiller shunt pump start/stop, demand based speed control and changeover
- Absorption chiller shunt pump start/stop and changeover
- Supply & extract fan start/stop, speed control and changeover
- Welfare Area AHU start/stop and supply air temperature control
- Welfare Area FCU start/stop and room temperature control

The PCS shall be overridden by the Energy Centre life safety systems.

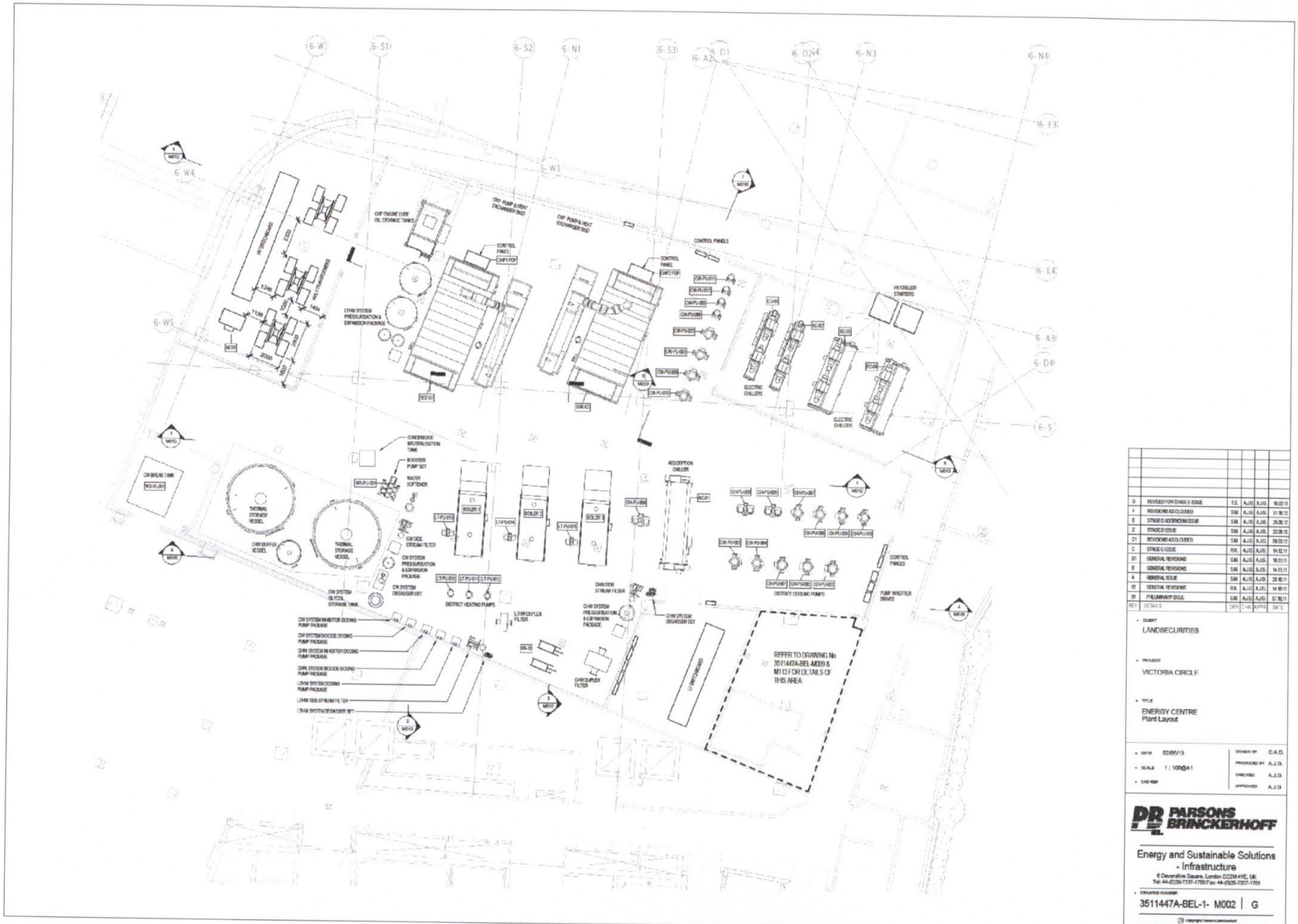
APPENDIX A: Energy Centre Plant, Equipment and Systems Schedule

Item	No. off	Duty (each)	Details
Main Plant:			
CHP Engine Package	2	1,500 kWe	Min Full Load Electrical Efficiency = 40%
Gas Boiler	3	2,500 kWth	Min Efficiency = 85% (GCV)
Thermal Storage Vessel	2	140m^3	
Single Effect Absorption Chiller	1	1,000 kWch	
Electric Chiller (LV)	2	1,000 kWch	Min System Seasonal Energy Efficiency ratio (SSEER) = 8.4
Electric Chiller (HV)	2	2,500 kWch	
Heat Rejection (Adiabatic)	-	-	*External to Energy Centre*
Ancillary LTHW Equipment:			
District Heating Network Pumps	3	-	Each 50% duty, Variable Speed
CHP Engine Shunt Pump	2	-	Variable Speed
Boiler Shunt Pumpsets	3	-	Duty/Standby, Variable Speed
Pressurisation & Expansion Package	1	-	
Sidestream Filtration Package	1	-	10% of DH Flow
Duplex Filtration Unit	1	-	
Degasser Package	1	-	
System Dosing Package	1	-	
Energy Meter	7	-	
Three Port Control Valves	6	-	
Mechanical Link Control Valve	1	-	Thermal Storage Flow Control
System Pipework and Fittings within Energy Centre	1	-	Inc. Insulation, supports etc.
Ancillary CHW Equipment:			
District Cooling Network Pumps	3	-	Each 50% duty, Variable Speed
Electric Chiller Shunt Pumpsets	4	-	Duty/Standby, Variable Speed
Absorption Chiller Shunt Pumpset	1	-	Duty/Standby, Variable Speed
Pressurisation & Expansion Package	1	-	Inc. Expansion Vessels
Sidestream Filtration Package	1	-	5% of DC Flow
Duplex Filtration Unit	1	-	
Degasser Package	1	-	
System Dosing Package	2	-	
Energy Meter	6	-	
System Pipework and Fittings within Energy Centre	1	-	Inc. Insulation, supports etc.
Ancillary Condenser Equipment:			
Electric Chiller Shunt Pumpsets	4	-	Duty/Standby, Variable Speed
Absorption Chiller Shunt Pumpset	1	-	Duty/Standby, Variable Speed
CHP Engine Shunt Pump	2	-	Variable Speed
Pressurisation & Expansion Package	1	-	Inc. Expansion Vessels
Sidestream Filtration Package	1	-	5% of DH Flow
Duplex Filtration Unit	1	-	
Degasser Package	1	-	
System Dosing Package	3	-	
Three Port Control Valves	1	-	

Item	No. off	Duty (each)	Details
Ancillary Water System Equipment:			
Break Tank (Type A/B)	1	-	Nominal 15m^3
Water Softening Package	1	-	
HWS Interface Package	1	-	Nominal 50kW
Water Meter	6	-	
Package booster set	1	-	
System Pipework and Fittings within Energy Centre	1	-	Inc. Insulation, supports etc.
Ancillary Gas System Equipment:			
Slam Shut Valves	6	-	
Gas Alarm System	1	-	
System Pipework and Fittings within Energy Centre	1	-	Inc. Insulation, supports etc.
Boiler Back-up Oil System:			
Storage, metering and shut off control	*1*	-	*External to Energy Centre*
Oil transfer pump set package	*1*	-	*External to Energy Centre*
System Pipework and Fittings within Energy Centre	1	-	Inc. Insulation, supports etc.
Ventilation Systems:			
CHP Engine Enclosure Supply System	2	-	
CHP Engine Enclosure Extract System	2	-	Ductwork system extends beyond Energy centre
Main Plant Area Supply System	1	-	
Main Plant Area Extract System	1	-	Fire rated. Ductwork system extends beyond Energy centre
HV Switchroom Extract System	1	-	Fire rated. Ductwork system extends beyond Energy centre
HV Chiller Area Extract System	1	-	Fire rated. Ductwork system extends beyond Energy centre
Welfare Area Supply System	1	-	Fire rated.
Welfare Area Extract System	1	-	Fire rated. Ductwork system extends beyond Energy centre
Flue Systems:			
CHP Engine Flue System (Nominal ø500mm)	2	-	Flues extend beyond Energy Centre
Boiler Flue System (Nominal ø500mm)	3	-	Flues extend beyond Energy Centre
Electrical Systems:			
Lighting System	1	-	
Emergency Lighting System	1	-	
Small Power Systems	1	-	
HV Switchgear	1	-	
Chiller HV Starters	2	-	
HV System Cabling	1	-	Inc. rack & supports etc.
Transformers	3	1.6 MVA	
LV Switchgear	2	-	
LV System Cabling and Components	1	-	Inc. rack & supports etc.
Other Systems:			
Overall EC and Supply Network BMS & Controls System	1	-	Including hard wired links to all

Item	No. off	Duty (each)	Details
			customer interface points.
Nominal HWS & CWS for EC Mess and Toilets etc.	1	-	
Fire Alarm System	1	-	
Above Ground Drainage Systems	1	-	
Sprinkler System to Main Plant Area	1	-	

APPENDIX B: Energy Centre Plant Layout



G	REVISED FOR STAGE G ISSUE	T.S.	A.J.G	A.J.G	16.03.13
F	REVISIONS AS CLOUDED	S.M.	A.J.G	A.J.G	01.10.12
E	STAGE E ADDENDUM ISSUE	S.M.	A.J.G	A.J.G	29.08.12
D	STAGE D ISSUE	S.M.	A.J.G	A.J.G	22.08.12
D1	REVISIONS AS CLIENTS	S.M.	A.J.G	A.J.G	09.03.12
C	STAGE C ISSUE	R.K.	A.J.G	A.J.G	14.02.11
B1	GENERAL REVISIONS	S.M.	A.J.G	A.J.G	18.11.11
B	GENERAL REVISIONS	S.M.	A.J.G	A.J.G	14.11.11
A	GENERAL ISSUE	S.M.	A.J.G	A.J.G	28.10.11
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P1	PRELIMINARY ISSUE	S.M.	A.J.G	A.J.G	07.10.11
REV	DETAILS	DRN	CHK	APPVD	DATE

- CLIENT: LANDSECURITIES
- PROJECT: VICTORIA CIRCLE
- TITLE: ENERGY CENTRE Plant Layout
- DATE: 02/05/13
- SCALE: 1 : 100@A1
- CAD REF:

DRAWN BY C.A.D.
PRODUCED BY A.J.G.
CHECKED A.J.G.
APPROVED A.J.G

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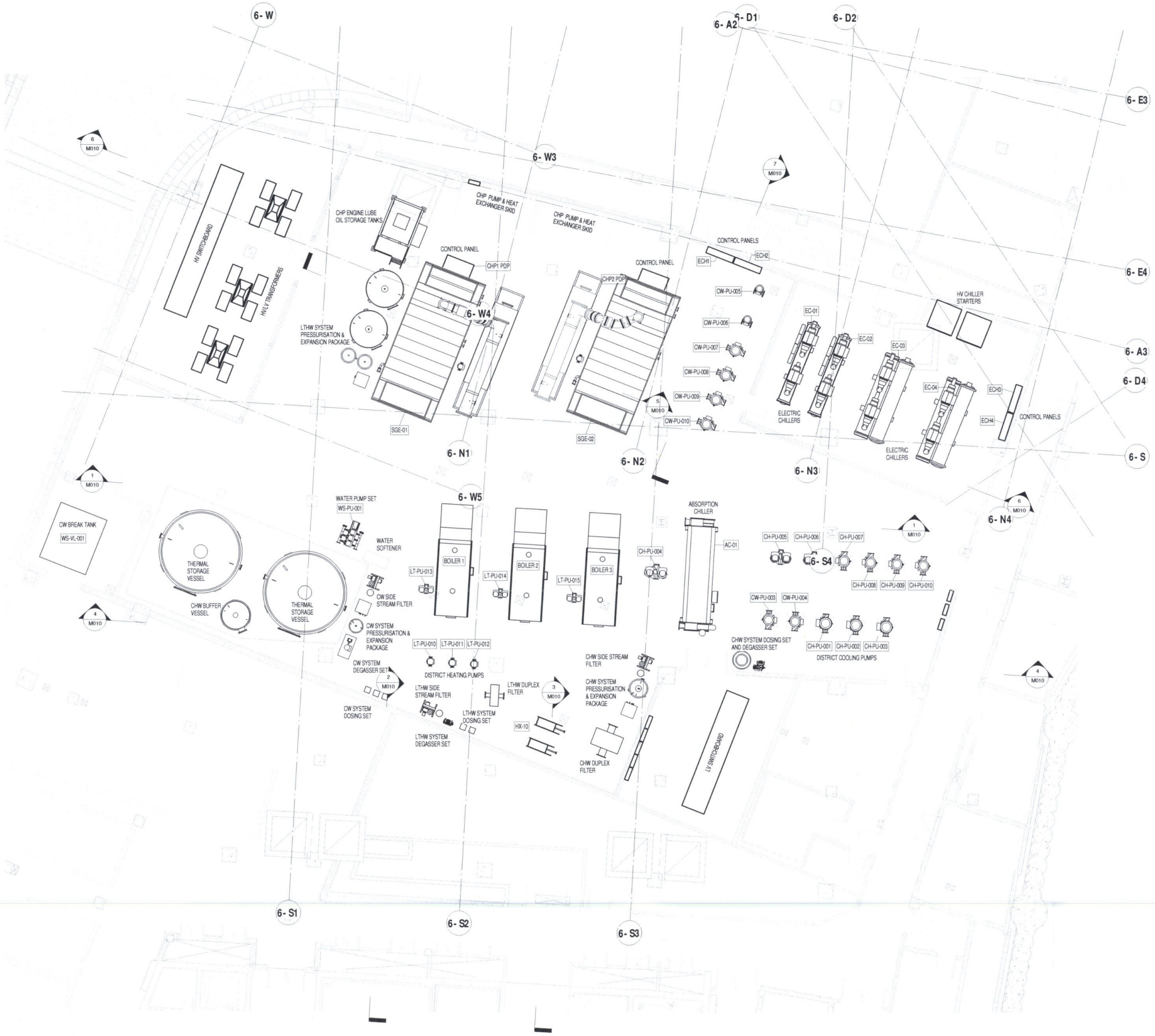
- DRAWING NUMBER: 3511447A-BEL-1- M002 | G

Appendix 8 – Item 2.6 – 3511447A-BEL-1-M002 - Energy Centre Plant Layout



REV.	DETAILS	DRN	CHK	APPR	DATE
0	INFORMATION ISSUE	T.S.	T.H.	T.G.	11.03.13

- CLIENT
  LANDSECURITIES
- PROJECT
  VICTORIA CIRCLE
- TITLE
  ENERGY CENTRE
  Plant Layout

- DATE 02/05/13
- SCALE 1 : 100@A1
- CAD REF

DRAWN BY	C.A.D.
PRODUCED BY	A.J.G.
CHECKED	A.J.G.
APPROVED	A.J.G

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- DRAWING NUMBER
  3511447A-BEL-1- M002 | 0

Project Management Initials: Designer: GL Checked: DTE Approved: NB ISO A1 594mm x 841mm

PIPEWORK FOR FUTURE CONNECTION TO PORTLAND HOUSE

CONNECTION POINT TO BUILDING PIPEWORK

CONNECTION TO PDHU

PROVISIONAL ROUTE OF CONNECTION TO PDHU

District and Circle Line Platform Level

East Bound Platform

West Bound Platform

LB

$SubstituteMe$

AECOM

PROJECT

VICTORIA CIRCLE

CLIENT

LandSecurities

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1. THE PIPEWORK ROUTES INDICATED ON THIS DRAWING ARE INDICATIVE ONLY AND SUBJECT TO DETAIL DEVELOPMENT BY PETER BRETT ASSOCIATES

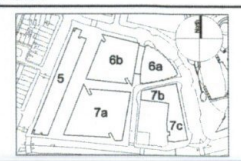
STATUS

STAGE E

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	APR '13	UPDATED

KEY PLAN



PROJECT NUMBER

60194454

SHEET TITLE

EXTERNAL SITE
DISTRICT HEATING

SHEET NUMBER

AECOM-SKETCH-0154