Taronga Zoo Reptile & Amphibian Conservation Centre

SERVICES CONCEPT DESIGN REPORT

Client:
Taronga Conservation Society Australia

Document No.
TZ RACC CONCEPT DESIGN REPORT

REPORT INFORMATION

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1 Introduction

1.1 Brief

LCI Consultants have been engaged to prepare a Concept Design for the required services for the proposed new reptile and amphibian conservation centre (RACC) to be built at the Taronga Zoo.

The design is based on preliminary and concept information provided by Taronga staff and design consultants.

The brief includes:

a) Water systems
b) Electrical systems
c) HVAC systems
d) Fire Systems

1.2 Design Basis

In preparing this concept design, the following documents and information were used as the "basis of design":

1) Architectural plans and elevations prepared by Design Worldwide Partnership (DWP)
2) Room Datasheets completed by Taronga staff.
3) General discussions during meetings.
4) Site inspections and briefings with Taronga staff

1.3 Design Imperatives

The major design imperative is animal welfare. Many exhibits are animals that are rare or endangered and it is essential to provide strict environmental conditions to suit each animal's natural habitat.

Secondary imperatives include guest comfort, keeper operability, and energy efficiency, each of which should be maximised within the constraints of the major imperative.

2 Water Systems

Taken as a whole, the various competing requirements for water systems leads to a determination that three distinct and separate water systems are required. They are:

- Potable Water
- Dechlorinated Water
- Reverse Osmosis Water

The Room Datasheets were used to determine the required water service, treatment system and filling/draining requirements for each pool in each exhibit, and the result of this analysis is included in Appendix A of this report. Pool characteristics were collated so that each pool can be classified into five distinct pool "types":

- **Type 1** – Small pool, potable water feed, no filtration required.
- **Type 2 –** Large pool, potable water feed, pressure filtration plant located in plant room.
- **Type 3** – Small pool, potable water feed, filtration provided by plug-in filtration equipment located locally to the pool ("Eheim" type filter/pump units).
- **Type 4** – Small pool, dechlorinated water feed, filtration provided by plug-in filtration equipment located locally to the pool ("Eheim" type filter/pump units).
- **Type 5** – Large pool, dechlorinated water feed, pressure filtration plant located in plant room.

The design of the life support systems is provided by Advanced Aquarium Technologies Pty Ltd.

In summary, the general requirements for each system are:

No.	System Name	Application
1	Potable Water	Most enclosures with pools and staff amenities
2	Dechlorinated Water	Most Amphibians and pools where fish may be added
3	RO Water	Frogs & tadpoles pools, and misting sprays

This incoming water supply will be split into four sub-systems:

- Services water to Back of House (BOH).
- Potable water to Type 1 and Type 3 pools.
- Potable water feed to dechlorinated water plant located in plant room.
- Potable water feed to Potable Water Supply Tanks located in plant room.

- Potable Water Feed to Reverse Osmosis Plant located in plant room.

The incoming main and each of the subsystems will be fitted with flow monitoring devices that will report instantaneous and totalised flow to the facility's PLC/SCADA system and site-wide EMS/BMS. This information will be used for ESD reporting.

To allow future flexibility, the design includes the provision of five water manifolds that will run adjacent to each exhibit room, with tee-off connections as required. If the facility is re-configured in the future, and the exhibit room requirements change, it will be a simple matter of teeing into the appropriate manifold and running small-bore piping into the exhibit room to achieve the new configuration.

The water manifolds are as follows:

- Potable Water Pressure Manifold.
- Dechlorinated Water Pressure Manifold.
- Dechlorinated Water Supply Manifold.
- Potable Water Supply Manifold.
- RO Water Pressure Manifold.

As normal operations will include regular draining and washdown/hose-down of the exhibit pools, a drain manifold will be provided to run adjacent to all exhibit rooms. Each pool/exhibit will be provided with a minimum 50mm diameter drain line to connect to the drain manifold via a manually operated valve located adjacent to each pool. Floor drains and pool overflow connections will also be connected to the drain manifold but will not be able to be isolated.

The drain manifold will also collect the drains/discharges from the BOH areas and the backwash water from filters and the RO units. The drain will then discharge via a line to the sewer connection. The design includes a 4,000 litre collection tank and a pair of duty/standby discharge pumps in case gravity flow cannot provide the required peak flow.

To ensure water availability and to allow pumping flexibility, a number of water supply tanks have been included in the design. The tanks are:

- Dechlorinated Water Storage Tank
- Potable Water Supply Tanks
- RO Treated Water Storage Tank
- Backwash Water Holding Tank

3 Electrical Systems

The RACC facility will be supplied with electrical power from the existing Taronga power distribution system's substation 7, located to the north of the proposed facility. The total estimated load (maximum demand) is 272kW or approximately 589Amps per phase, which can potentially be provided via a new underground submains feeders installed in conduits, via the pathway within the zoo.

The electrical load for the facility consists of the following main groupings:

No.	Equipment/Devices	Rating (kW)
1	Water Treatment Plant	15
2	Humidification	40
3	HVAC System	75
4	Exhibit General Lighting & GPOs	77
5	General Lighting & GPOs	65
	Total	**272**

The main incomer and load group nominated in the above list will be fitted with energy monitoring devices which will report instantaneous and totalised energy usage to the facility's PLC/SCADA system and site-wide EMS/BMS for use in future ESD reporting.

The Water Treatment Plant loads are to be confirmed by AAT.

The total load for the ventilation system is estimated to be 75kW. A summary table is below, and details of the system can be found in section 4 of this document.

The Room Datasheets were used to construct a table of requirements for general purpose outlets (GPOs) and lights required for the facility. The design has assumed that high efficiency LED lighting will be used throughout for general lighting requirements.

A solar calendar (sunrise and sunset times) will be used to trigger dawn and twilight lighting scenes for the exhibit spaces, and to switch on and off dedicated outlets for heating lamps. Nocturnal animal exhibits will be switched on a sunrise/sunset-plus-twelve-hours scheme to preserve seasonal changes in lengths of solar days.

4 Mechanical Systems

The animal exhibit rooms have a wide range of temperature and humidity requirements which differ significantly from the air conditioned personnel areas.

The exhibit and conservation areas design is based on four 100% outdoor air chilled water air handling installed in the plant room and ducted to the required areas. Each of the animal exhibits shall be provided with dedicated cooling and heating coils, VAV terminal units and humidifiers. Dedicated fan coil units shall be provided to high load exhibits and dedicated back of house and front of house areas.

Mechanical ventilation, will be provided for enclosed areas in accordance with applicable standards and regulations.

The schedule of exhibit environmental requirements are included in the Appendix.

The HVAC concept drawings are included in the Appendix contains a preliminary layout of RACC plant area and schematics.

6 Fire Services

6.1 Key design criteria

Building to be provided with the following systems

- A Fire Detection and Alarm System
- Fire Hydrant System
- Fire Hose Reel System
- Fire Extinguishers

Applicable Standards & Codes

- All works within the building to be designed and installed the following requirements:
  - Hydrant system – BCA E1.3 and AS2419.1-2005
  - Hose reel system – BCA E1.4 and AS2441.1-2005
  - Portable fire extinguishers – BCA E1.6 and AS2444-2001
  - Fire detection and alarm system – BCA E2.2 and AS 1670.1-2018

Key assumptions/departures

- The fire hydrant system will be feed from the sitewide infrastructure
- The booster not being within site of the building main entry to be addressed by a performance solution.
- Fire Hose Reel system to be fed from the domestic water supply

7 Site Infrastructure

Refer to the separate TZ RACC Site Infrastructure report for details of connections of the new facility to the electrical, hydraulic, and fire services infrastructure.

8 Appendices

8.1 Appendix A – Exhibit Water Requirements Summary

Exhibit Water Requirements are documented by AAT Australian Aquarium Technologies Pty Ltd.

8.2 Appendix B – Misting & Spray System Summary

Description	Area Number	Datasheet Page	Pool Volume (m3)	Misting/ Spraying	No. of Nozzles	Misting Flow (Litres/hour)
Komodo Dragon	EX01	48	10	Y	10	50
Veiled Chameleon	EX02	51	0.025	Y	1	5
Unknown - Fallax Murphy Frog?	EX03	54	0.025	Y	1	5
Fijian Crested Iguana	EX04	57	0.75	Y	2	10
Plumed Basilisk	EX05	59	1	Y	4	20
Gila Monster	EX06	62	0.025	N	0	0
Green Tree Monitor	EX07	64	0.75	Y	4	20
Frilled lizard	EX08	66	0.025	N	0	0
Eastern pilbara spiny-tailed skink	EX09	68	0.025	N	0	0
Shingleback skink	EX10	70	0.025	N	0	0
Slater's skink	EX11	72	-	N	0	0
Rusty desert monitor	EX12	74	0.025	N	0	0
Boyd's Forest Dragon	EX13	76	0.75	Y	1	5
Red-barred dragon	EX14	78	0.025	N	0	0
Grassland earless dragon	EX15	80	0.025	N	1	5
Tuatara	EX16	82	0.025	N	2	10
Reticulated Python	EX17	84	-	Y	4	20
Monocled Cobra	EX18	86	0.025	Y	2	10
Eastern Diamondback Rattlesnake	EX19	88	0.025	Y	2	10
Scrub python	EX21	90	0.25	Y	4	20
Green Python + White Lipped Tree Frog	EX22	92	0.5	Y	1	5
Black-headed python	EX23	94	0.025	N	0	0
Centralian Carpet Python	EX24	97	0.025	N	1	5
Broad-headed Snake	EX25	100	0.025	N	2	10
Coastal taipan	EX26	102	0.025	Y	6	30
Inland Taipan	EX27	104	0.025	N	0	0
Red-bellied Black Snake	EX28	106	0.1	Y	2	10
Pygymy python	EX29	108	0.025	N	0	0

Description	Area Number	Datasheet Page	Pool Volume (m3)	Misting/ Spraying	No. of Nozzles	Misting Flow (Litres/hour)
Eyelash Viper / small viper (Alternative find SE species)	EX30	110	0.025	Y	1	5
Elongated or Star Tortoises	EX31	112	0.025	N	0	0
Chinese Three-striped Box Turtle	EX32	116	0.75	Y	1	5
Aligator Snapping Turtle	EX33	-	-	-	0	0
Turtles	EX36	119	8	Y	6	30
Mertons Water Monitor	EX37	121	2	Y	6	30
Philippine Crocodile	EX38	123	75	Y	20	100
Red-eyed tree frog	EX39	125	0.25	Y	1	5
Corroboree Frog	EX40	127	0	Y	1	5
Yellow-spotted Bell Frog	EX41	129	0.75	Y	1	5
Riverine Frog	EX42	130	0.25	Y	1	5
Rhino Iguana	EX43	131	0.25	Y	8	40
Radiated Tortoise	EX44	131	0.25	N	0	0
				Total	**96**	**480**

8.3 Appendix C – Exhibit GPO & Lighting Summary

Description	Area Number	Datasheet Page	Double GPOs	AS3000 Max Demand (kW)	Lights	Light Circuits Max Deman (kW)	Total MD (kW)	3-phase current (A)
Back of House – Ground Floor								
Staff Room & Kitchen	BOH01	2	12	2.1	10	0.15	2.25	3.13
Staff Office 1	BOH02	4	6	1.5	4	0.06	1.56	2.17
Staff Office 2	BOH03	6	2	1.1	5	0.075	1.175	1.63
Staff Amenities	BOH04	8	2	1.1	6	0.09	1.19	1.65
Loading Dock	BOH05	10	1	1	2	0.03	1.03	1.43
Bulk Store	BOH06	12	1	1	2	0.03	1.03	1.43
Waste Store	BOH07	14	1	1	2	0.03	1.03	1.43
Chemical Store	BOH08	16	1	1	2	0.03	1.03	1.43
Holding General	BOH09	18	30	3.9	10	0.15	4.05	5.63
Holding Frogs + Tadpoles	BOH10	20	16	2.5	6	0.09	2.59	3.60
Holding Venomous	BOH11	22	16	2.5	6	0.09	2.59	3.60
Holding Tropical	BOH12	24	16	2.5	6	0.09	2.59	3.60
Holding Aquatic Room	BOH13	26	16	2.5	6	0.09	2.59	3.60
Holding Incubator Room	BOH14	28	10	1.9	4	0.06	1.96	2.72
Large Reptile Densx2	BOH15	30	6	1.5	6	0.09	1.59	2.21
Northern Corroboree Frog Conservation Room	BOH16	32	20	2.9	10	0.15	3.05	4.24
Southern Corroboree Frog Conservation Room	BOH17	34	20	2.9	10	0.15	3.05	4.24
Yellow Spotted Bell Frog Conservation Room	BOH18	36	20	2.9	10	0.15	3.05	4.24
Food Prep Area	BOH19	38	8	1.7	6	0.09	1.79	2.49
Workshop	BOH20		4	1.3	6	0.09	1.39	1.93

Description	Area Number	Datasheet Page	Double GPOs	AS3000 Max Demand (kW)	Lights	Light Circuits Max Deman (kW)	Total MD (kW)	3-phase current (A)
General Store	BOH21	42	4	1.3	6	0.09	1.39	1.93
External Sunning Aviaries	BOH22	44	2	1.1	4	0.06	1.16	1.61
Plant Room	BOH23	47	10	1.9	30	0.45	2.35	3.26
Species Exhibit Areas								
Komodo Dragon	EX01	48	3	1.2	6	0.09	1.29	1.79
Veiled Chameleon	EX02	51	3	1.2	2	0.03	1.23	1.71
Unknown - Fallax Murphy Frog?	EX03	54	3	1.2	2	0.03	1.23	1.71
Fijian Crested Iguana	EX04	57	3	1.2	4	0.06	1.26	1.75
Plumed Basilisk	EX05	59	3	1.2	4	0.06	1.26	1.75
Gila Monster	EX06	62	3	1.2	4	0.06	1.26	1.75
Green Tree Monitor	EX07	64	3	1.2	4	0.06	1.26	1.75
Frilled lizard	EX08	66	3	1.2	4	0.06	1.26	1.75
Eastern pilbara spiny-tailed skink	EX09	68	3	1.2	2	0.03	1.23	1.71
Shingleback skink	EX10	70	3	1.2	2	0.03	1.23	1.71
Slater's skink	EX11	72	3	1.2	2	0.03	1.23	1.71
Rusty desert monitor	EX12	74	3	1.2	2	0.03	1.23	1.71
Boyd's Forest Dragon	EX13	76	3	1.2	2	0.03	1.23	1.71
Red-barred dragon	EX14	78	3	1.2	2	0.03	1.23	1.71
Grassland earless dragon	EX15	80	3	1.2	2	0.03	1.23	1.71
Tuatara	EX16	82	3	1.2	6	0.09	1.29	1.79
Reticulated Python	EX17	84	3	1.2	10	0.15	1.35	1.88
Monocled Cobra	EX18	86	3	1.2	6	0.09	1.29	1.79
Eastern Diamondback Rattlesnake	EX19	88	3	1.2	6	0.09	1.29	1.79
Scrub python	EX21	90	3	1.2	6	0.09	1.29	1.79

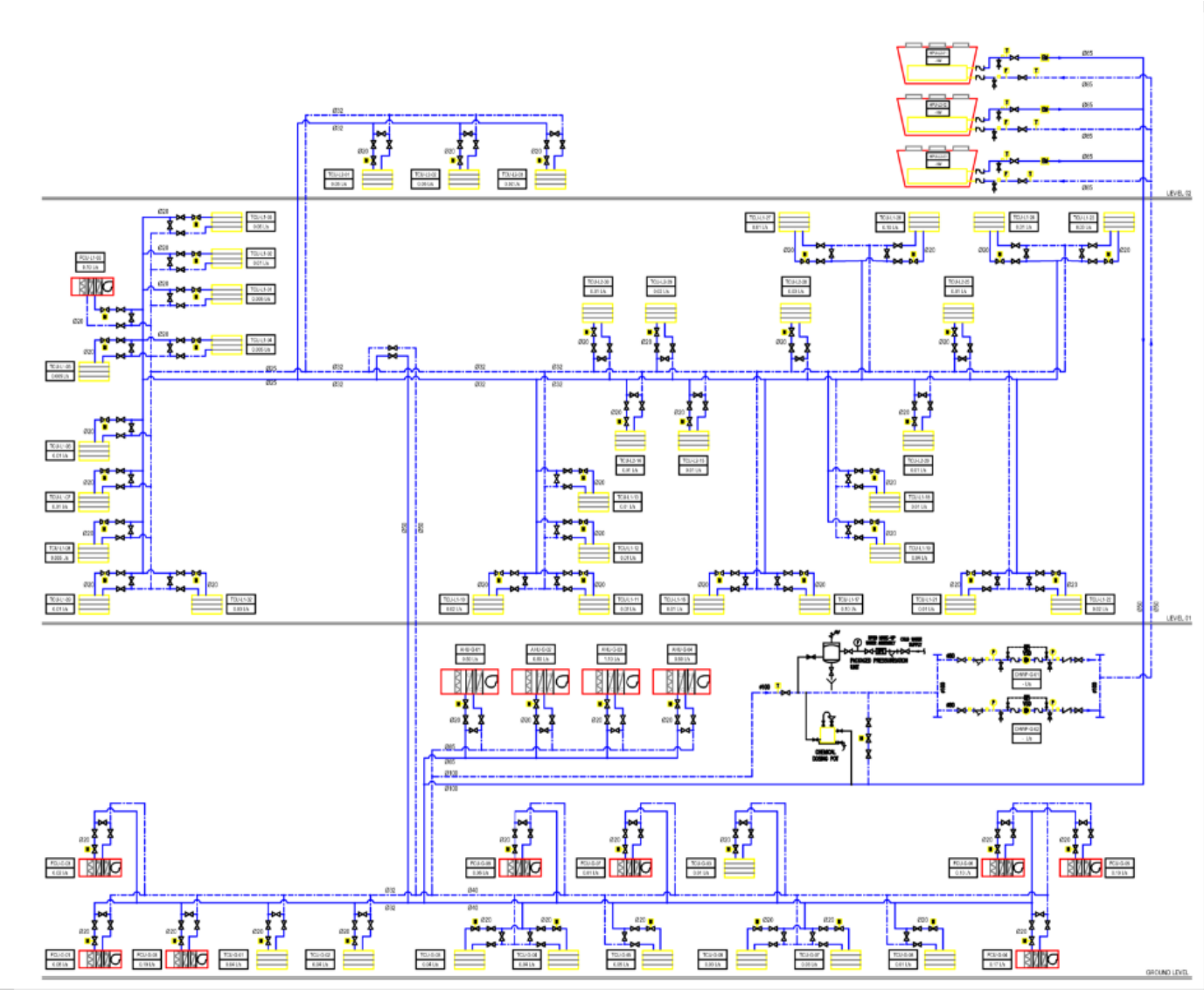
Description	Area Number	Datasheet Page	Double GPOs	AS3000 Max Demand (kW)	Lights	Light Circuits Max Deman (kW)	Total MD (kW)	3-phase current (A)
Green Python + White Lipped Tree Frog	EX22	92	3	1.2	2	0.03	1.23	1.71
Black-headed python	EX23	94	3	1.2	6	0.09	1.29	1.79
Centralian Carpet Python	EX24	97	3	1.2	6	0.09	1.29	1.79
Broad-headed Snake	EX25	100	3	1.2	2	0.03	1.23	1.71
Coastal taipan	EX26	102	3	1.2	6	0.09	1.29	1.79
Inland Taipan	EX27	104	3	1.2	6	0.09	1.29	1.79
Red-bellied Black Snake	EX28	106	3	1.2	6	0.09	1.29	1.79
Pygymy python	EX29	108	3	1.2	2	0.03	1.23	1.71
Eyelash Viper / small viper	EX30	110	3	1.2	2	0.03	1.23	1.71
Elongated or Star Tortoises	EX31	112	3	1.2	6	0.09	1.29	1.79
Chinese Three-striped Box Turtle	EX32	116	3	1.2	2	0.03	1.23	1.71
Aligator Snapping Turtle	EX33	-	3	1.2	2	0.03	1.23	1.71
Turtles	EX36	119	3	1.2	6	0.09	1.29	1.79
Mertons Water Monitor	EX37	121	3	1.2	10	0.15	1.35	1.88
Philippine Crocodile	EX38	123	6	1.5	20	0.3	1.8	2.50
Red-eyed tree frog	EX39	125	3	1.2	2	0.03	1.23	1.71
Corroboree Frog	EX40	127	3	1.2	2	0.03	1.23	1.71
Yellow-spotted Bell Frog	EX41	129	3	1.2	2	0.03	1.23	1.71
Riverine Frog	EX42	130	3	1.2	2	0.03	1.23	1.71
Rhino Iguana	EX43	131	3	1.2	10	0.15	1.35	1.88
Radiated Tortoise	EX44	131	3	1.2	10	0.15	1.35	1.88
		Total	**350**	**92.6**	**349**	**5.235**	**97.835**	**135.88**

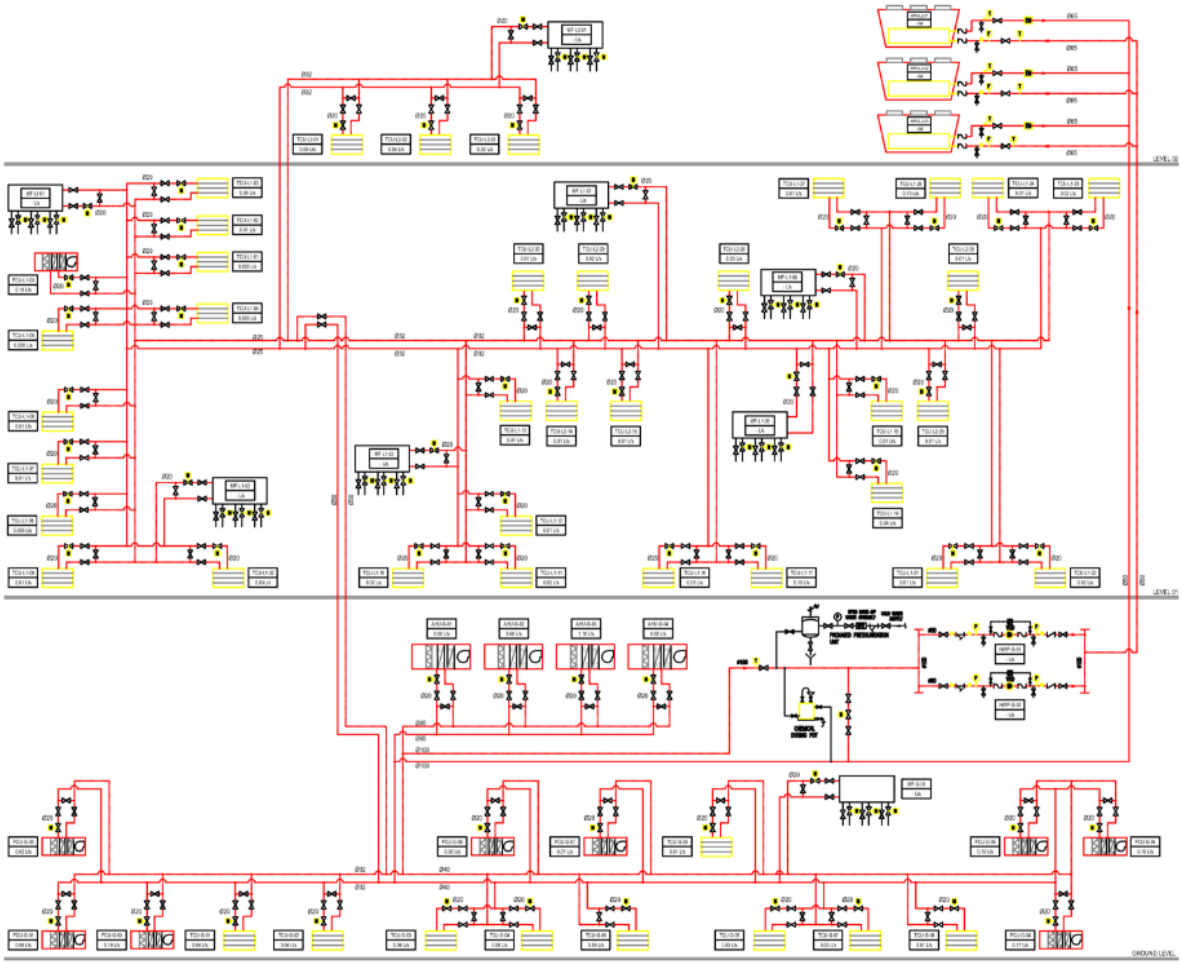
8.4 Appendix D – Internal Mechanical Design Criteria

Level	Area Name	Area sqm	Exhibit Type	Location	Occupancy ppl	Room Temp Summer °C Day	Summer °C Night	Winter °C Day	Winter °C Night	Room RH Summer %	Winter %	Exhaust ACH/hr	Supply ACH/hr	In-slab Floor Heating @35C surface temp	sqm	Water Feature Heating HEX to enclosure, SP 26-32C	UV Lighting W of lights or heat bulbs
Ground Floor																	
G	Bulk Store	6.2		BOH	-	-		-		-	-	to AS1668.2	-	N/A			N/A
G	Quiet Room	11.6		BOH	3	25		21		NC	NC	-	to AS1668.2	N/A			N/A
G	Amenities	12.6		BOH	-						-	to AS1668.2		N/A			N/A
G	Workshop	15.5		BOH	2	25		21		NC	NC	to AS1668.2	to AS1668.2	N/A			N/A
G	Corridor 1 and Lockers	20.2		BOH	-	-		-		-	-	-	to AS1668.2	N/A			N/A
G	Corridor 2	72.1		BOH	-	-		-		-	-	-	to AS1668.2	N/A			N/A
G	Staff Room and Kitchen	37.6		BOH	15	25		21		NC	NC	-	to AS1668.2	N/A			N/A
G	Comms Room	6				21		21		NC	NC	-		N/A			N/A
G	Plant	120		BOH	-	-		-		-	-	to AS1668.2	to AS1668.2	N/A			N/A
G	Holding Tropical	22.2		BOH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	6	N/A			N/A
G	Holding Venomous	22.1		BOH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	6	N/A			N/A
G	NC Frog Cons	19.2		EXH	0	12-30 (4 daily settings)	4-20 (4 daily settings)	4-30 (4 daily settings)	4-24(4 daily settings)	90% max	50% min	-	12	N/A			N/A
G	YS Bell Frog Cons	17.9		EXH	0	12-30 (4 daily settings)	4-20 (4 daily settings)	4-30 (4 daily settings)	4-24(4 daily settings)	90% max	50% min	-	12	N/A			N/A
G	SC Frog Cons	20.1		EXH	0	12-30 (4 daily settings)	4-20 (4 daily settings)	4-30 (4 daily settings)	4-24(4 daily settings)	90% max	50% min	-	12	N/A			N/A
G	Holding Frogs + Tadpole	22		BOH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	6	N/A			N/A
G	Holding Aquatic	18		BOH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	6	N/A			N/A
G	General Holding	48		BOH	20	24-32	16-24	24-30	16-24	90% max	50% min	-	6	N/A			N/A
G	General Store	20.7		BOH	-	-		-		-	-	to AS1668.2	-	N/A			N/A
G	Large reptile dens	4.6		BOH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	6	to 1/2 of enclosure	2.3		N/A
G	Large reptile dens	4.9		BOH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	6	to 1/2 of enclosure	2.5		N/A
G	Holding Incubator	9		BOH	0	25	25	20	20	NC	NC	-	6	N/A			N/A
G	Food Prep Room	20		BOH	6	25	20	25	20	NC	NC	to AS1668.2	to AS1668.2	N/A			N/A
Level 1																	
1	Green Tree Monitor	15.1	Rainforest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of exhibit	5.0	TBC by LSS	2500
1	Merten's Water Monitor	20.6	Tropical Waterway	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	no		TBC by LSS	4000
1	Alligator Snapping Turtle	11.7	Freshwater body	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	no		TBC by LSS	2500
1	Plumed Basilisk	10.2	Rainforest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of exhibit	3.4	TBC by LSS	2500
1	Eyelash Viper	4.7	Rainforest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of exhibit	1.6	no	1500
1	Fijian Crested Iguana	6	Rainforest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of exhibit	2.0	TBC by LSS	1500
1	Star Tortoises	4.2	Dry Forest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of exhibit	1.4	no	2500
1	Scrub python	14.5	Rainforest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of exhibit	4.8	TBC by LSS	2500
1	Green Python + White Lipped Tree Frog	3	Rainforest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	no		TBC by LSS	1000
1	Boyd's Forest Dragon	2.5	Rainforest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of exhibit	0.8	TBC by LSS	1000
1	Chinese Three-striped Box	3.8	Rainforest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of land area of exhibit (1/6 overall)	0.6	TBC by LSS	1000
1	Elongated Tortoises	8	Rainforest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of exhibit	2.7	no	2500
1	Asian Snake	6.2		EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of exhibit	2.1	no	2500
1	Gila Monster	5.1	Desert	EXH	0	24-32	16-24	24-30	16-24	90% max	30% min	-	12	to 1/3 of exhibit	1.7	no	2500
1	Red-barred dragon	1.4	Desert	EXH	0	24-32	16-24	24-30	16-24	90% max	30% min	-	12	to 1/3 of exhibit	0.5	no	500
1	Rusty desert monitor+EP spiny-tailed skink	3.7	Desert	EXH	0	24-32	16-24	24-30	16-24	90% max	30% min	-	12	to 1/3 of exhibit	1.2	no	1000
1	Shingleback skink	5.6	Desert	EXH	0	24-32	16-24	24-30	16-24	90% max	30% min	-	12	to 1/3 of exhibit	1.9	no	1500
1	Black-headed python	8.8	Desert	EXH	0	24-32	16-24	24-30	16-24	90% max	30% min	-	12	to 1/3 of exhibit	2.9	no	2500
1	Inland Taipan	7.3	Desert	EXH	0	24-32	16-24	24-30	16-24	90% max	30% min	-	12	to 1/3 of exhibit	2.4	no	2500
1	Centralian Carpet Python	10.1	Desert	EXH	0	24-32	16-24	24-30	16-24	90% max	30% min	-	12	to 1/3 of exhibit	3.4	no	2500
1	Frilled lizard	9	Tropical Open Forest	EXH	0	24-32	16-24	24-30	16-24	90% max	30% min	-	12	to 1/3 of exhibit	3.0	no	2500
1	Rhino Iguana	29.8	Dry Forest	EXH	0	24-32	16-24	24-30	16-24	90% max	30% min	-	12	to 1/3 of exhibit	9.9	no	4000
1	Gecko	1.2	Desert	EXH	0	24-32	16-24	24-30	16-24	90% max	30% min	-	12	to 1/3 of exhibit	0.4	no	500
1	Pygymy python	1.4	Desert	EXH	0	24-32	16-24	24-30	16-24	90% max	30% min	-	12	to 1/3 of exhibit	0.5	no	500
1	BOH	7.3		BOH	0	25	25	20	20	NC	NC	-	to AS1668.2	N/A			N/A
1	Riverine Frog	1.1	Grassland	EXH	0	24-32	16-24	24-30	16-24	90% max	40% min	-	12	no		TBC by LSS	500
1	Yellow Spotted Bell Frog	1.1	Grassland	EXH	0	24-32	16-24	24-30	16-24	90% max	40% min	-	12	no		TBC by LSS	500
1	Corroboree Frog	1.1	Alpine	EXH	0	20	14-24	20-24	14-24	90% max	40% min	-	12	no		no	500
1	Grassland earless dragon	1.1	Grassland	EXH	0	24-30	14-24	24-28	11-24	90% max	30% min	-	12	to 1/3 of exhibit	0.4	no	500
1	Red-eyed tree frog	1.1	Forest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	no		TBC by LSS	500
1	Fallax Frog	1	Forest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	no		TBC by LSS	500
1	Reticulated Python	29.6	Forest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of exhibit	9.9	TBC by LSS	4000
1	Tuatara	11.3	Forest	EXH	0	20-28	14-24	24-28	16-24	90% max	50% min	-	12	to 1/3 of exhibit	3.8	no	2500
1	Eastern Diamondback Rattlesnake	9.5	Forest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of exhibit	3.2	no	2500
1	Monocled Cobra	9.8	Forest	EXH	0	24-32	16-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of exhibit	3.3	no	2500
1	Back Of House/ Staff	108		BOH	10	25	25	20	20	NC	NC	-	to AS1668.2	N/A			N/A
1	Public Walkway											NV	NV	N/A			N/A
Level 2																	
2	Bellinger River Turtle	10		EXH	0	24-32	20-24	24-30	16-24	90% max	50% min	-	12	no		TBC by LSS	2500
2	Broad-headed snake	2.1		EXH	0	24-32	20-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of exhibit	0.7	no	500
2	DA Snake	2.2		EXH	0	24-32	20-24	24-30	16-24	90% max	50% min	-	12	to 1/3 of exhibit	0.7	no	500
2	BOH	28.5		BOH	0	25	25	20	20	NC	NC	-	to AS1668.2	N/A			N/A

BOH – Back of House
EXH - Exhibit
NC – Not Controlled
NV - Naturally Ventilated
NA - Not applicable

8.5 Appendix E – HVAC Systems Schematics





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