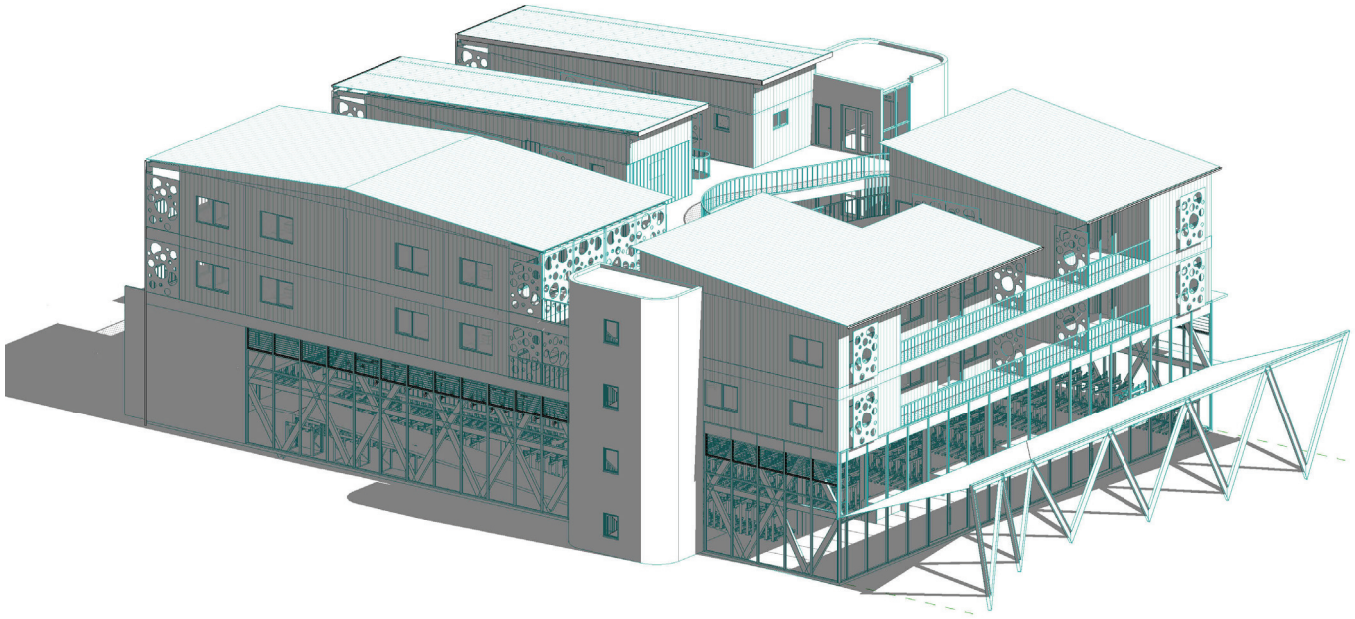
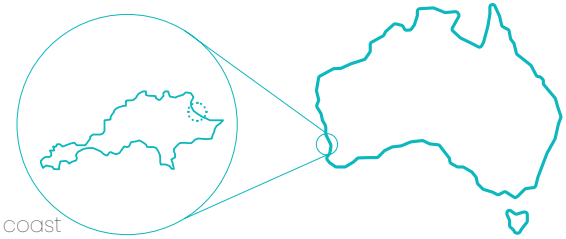
CONCEPT DESIGN VALIDATION REPORT



CONTENTS

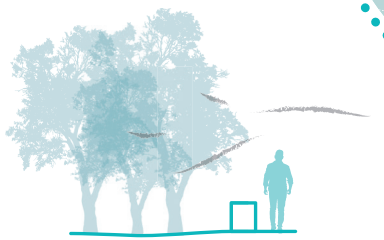
SITE RESPONSE



WADJEMUP ROTTNEST

Wadjemup or Rottnest Island is a small island off the coast of mainland Australia. The island is situated just 19km from Fremantle Port, close enough to be viewed from the mainland coast. The Island is primarily a tourist and holiday spot for both Australians and international visitors with beautiful beaches, rich ecosystems, and full of activities such as swimming and bike riding around the island.

However, the island was not always a holiday destination. The history of its use as a prison for Aboriginal men and boys is entrenched into the island and cannot be forgotten about.

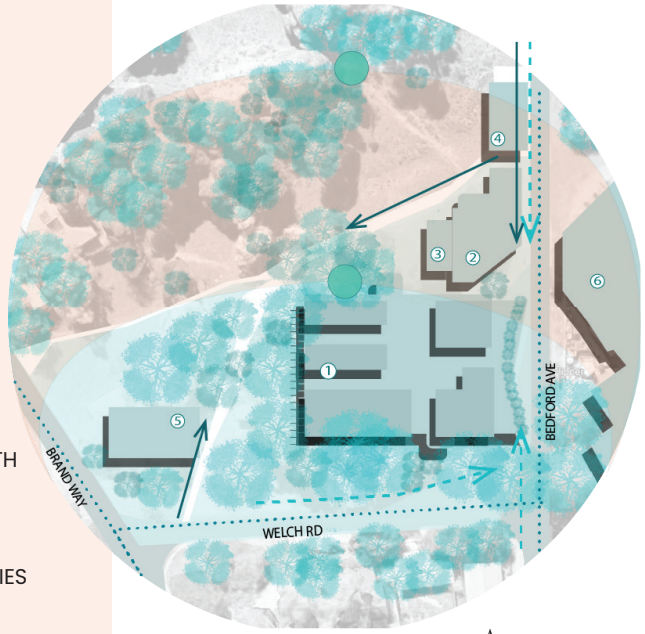


Over 370 Aboriginal men and boys died in custody during Rottnest's time as a prison between late 1830's to early 1930's. They were buried in unmarked graves on the island, making it the largest Aboriginal burial ground in Australia. The lack of acknowledgment of the burial grounds when first discovered was seen as very disrespectful by many.

Works began to protect and preserve the sacred site. Rather than an impervious barrier around the entire site, a low height and segmented rammed earth limestone wall was used instead, combined with a stabilised limestone path keeping the general public off the grounds with the visual delineation. With this non-obtrusive solution, the spirits of the land are able to flow freely through the site. This freedom of flow is an important concept to the Aboriginal people.

CONCEPT

The housing is short term accommodation for tourists as well as workers on the island. The concept behind the modular housing is Flow. The modules are focused on natural airflow both within and between structures. This allows the spirits of the land to pass through unobstructed, as well as allowing all units to have natural ventilation from all sides.



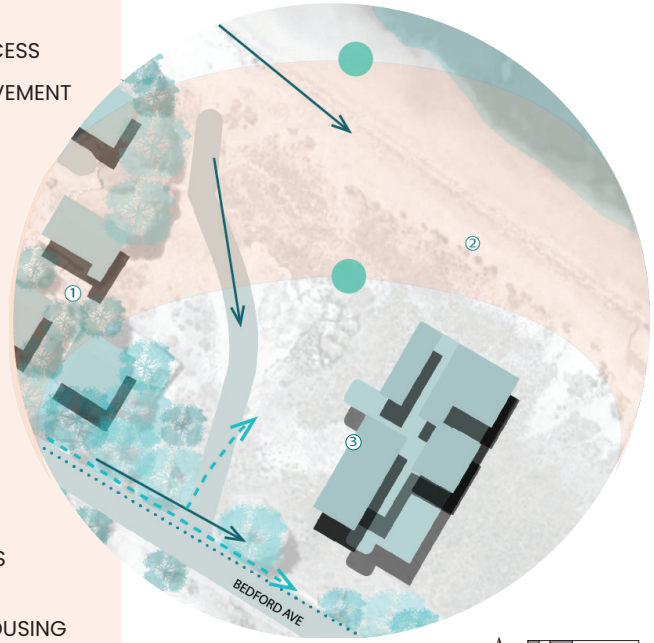
SITE A

① PEDAL & FLIPPER WITH HOUSING
② RESTAURANT/CAFE
③ BIKE STORAGE
④ END OF TRIP FACILITIES
⑤ WORKSHOP
⑥ ROTTNEST HOTEL

PEDESTRIAN ACCESS

BICYCLE ACCESS

VEHICLE MOVEMENT



SITE B

① ROTTNEST CHALETS
② SAND DUNES
③ RECONFIGURED HOUSING

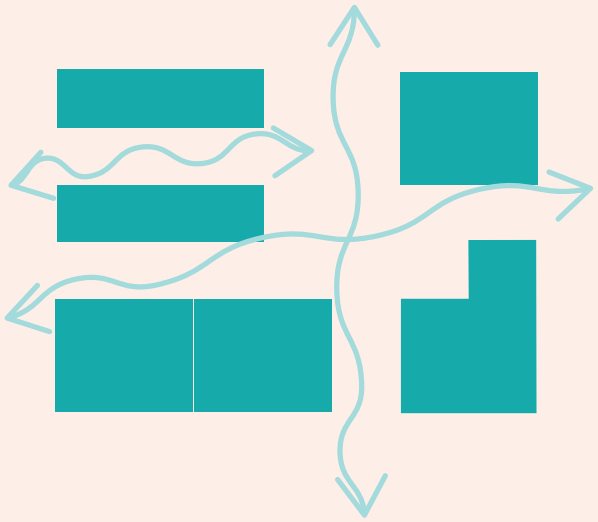
ARCHITECTURAL DESIGN

1x BED 1x BATH

2x BED 1x BATH

2x BED 2x BATH

3x BED 2x BATH



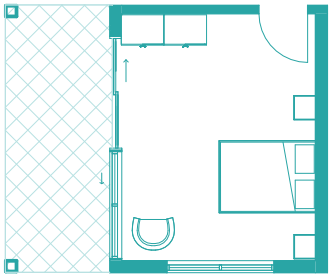
The housing is placed on top of the redeveloped two-storey Pedal & Flipper structure. The first level of housing consists of two of the 1xBed 1xBath modules, two of the 2xBed 1xBath modules, and one each of the 2xBed 2xBath and 3xBed 2xBath modules. Planters and communal spaces with tables, seating and barbecue facilities are located on the walkway between the modules. The second level of housing has the same configuration stacked directly on top, followed by roof modules for each apartment.

Fire escape stairs are located at each end of the whole structure, servicing all floors and allowing fast and safe exit in an emergency. A lift is located next to one of the stair cores and is for use by the residents only.

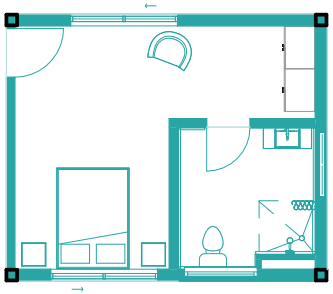
The housing modules are placed in a way that the main wind directions are able to freely flow through the structure, causing less obstruction and letting the spirits flow through.

This configuration allows each apartment to benefit from natural ventilation from all sides through the operable windows.

MODULE TYPES

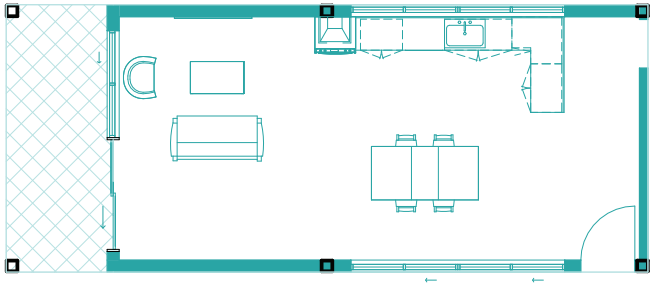


BED WITH BALCONY MODULE

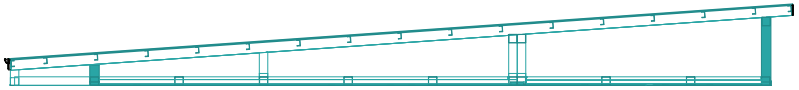


BED WITH ENSUITE MODULE

BED WITH BATH MODULE



LIVING MODULE



ROOF MODULE

The different apartments are made out of a combination of four different modules. Each apartment has a Living space module that is paired with different Bedroom modules to suit the apartment size and function. A separate roof module is fixed onto the topmost apartments.

The structural framing of each apartment is composed of steel SHS columns and beams with steel PFC joists and purlins.

The walls are constructed of prefabricated Structural Insulated Panels with a rigid insulating EPS core.

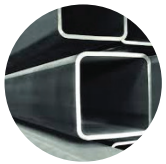
Each apartment has an acoustic vinyl floor finish, with ceramic tiles in the bathrooms and porcelain tiles for the external balcony.

The internal wall finish is plasterboard containing micro-encapsulated phase change materials, which aid in creating thermal comfort within the internal spaces.

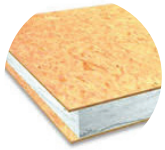
The external wall cladding is vertical profile Hardie fibrecement weatherboard. These boards are fixed to a castellated batten that allow ventilation and drainage through the cavity.

The roof material is lightweight colorbond TRIMDEK with building integrated photovoltaics. These solar cells are integrated into the roof system to generate electricity for the modules.

MATERIALS

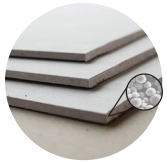


SHS STEEL
Structural Frame
- made from recycled steel
- highly strong and durable
- able to be melted and reusued in other forms without losing its strength



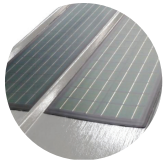
SIPS PANEL
Wall Material
- reduced thermal bridging
- energy efficient
- recyclable and constructed out of a significant amount of recycled materials
- quick to install

TIMBER-LOOK ACOUSTIC VINYL
Internal Floor Finish
- constructed from recycled materials
- lightweight
- Adhesive free and able to be reused
- can be recycled up to 10 times without losing performance
- Low carbon footprint



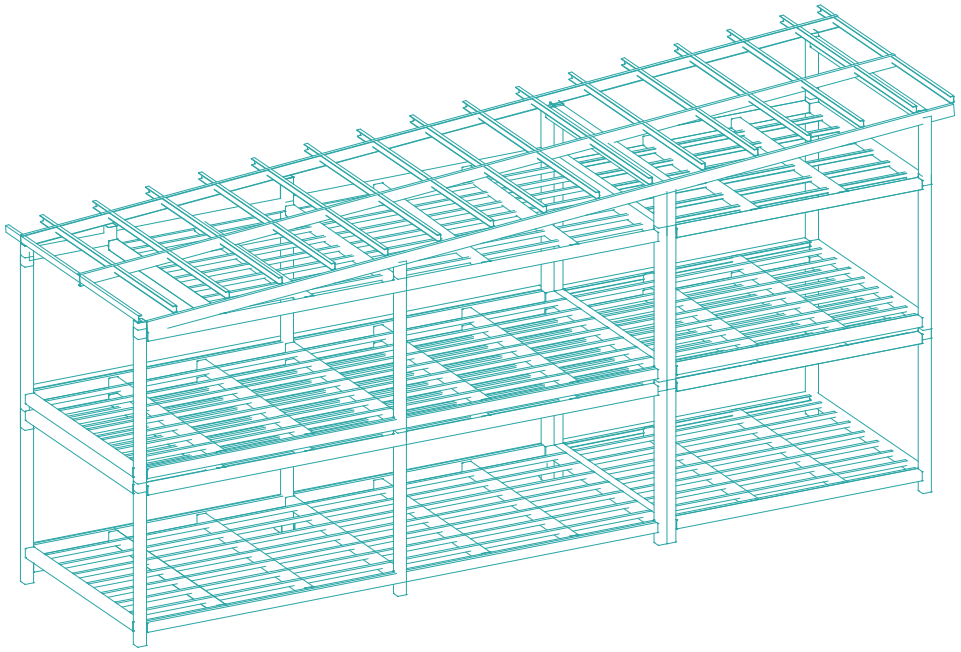
PLASTERBOARD WITH MICRO-ENCAPSULATED PCM
Internal Wall Cladding
-allows internal lightweight walls to achieve the same latent heat storage as high thermal mass walls such as brick or concrete

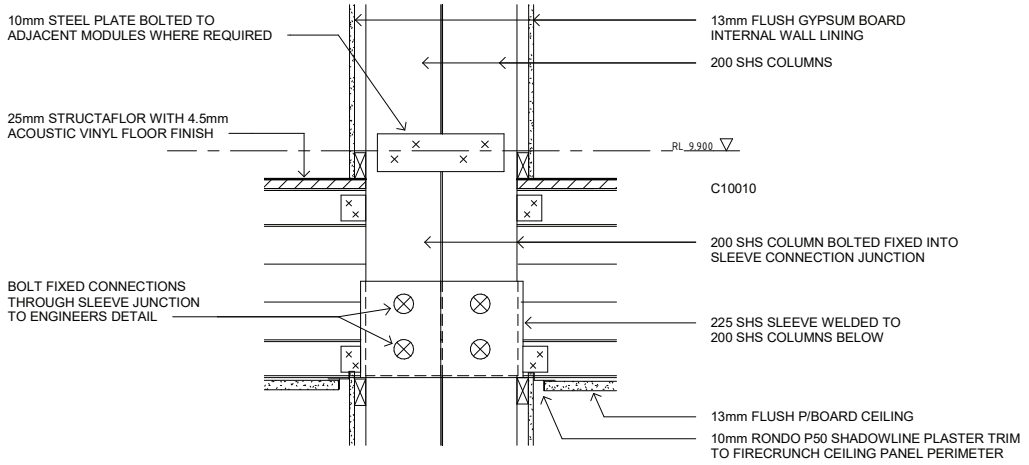
HARDIE OBLIQUE CLADDING
External Wall Cladding
- termite, rot and moisture resistant
- resistant to harsh coastal conditions
- FRL up to 60 minutes



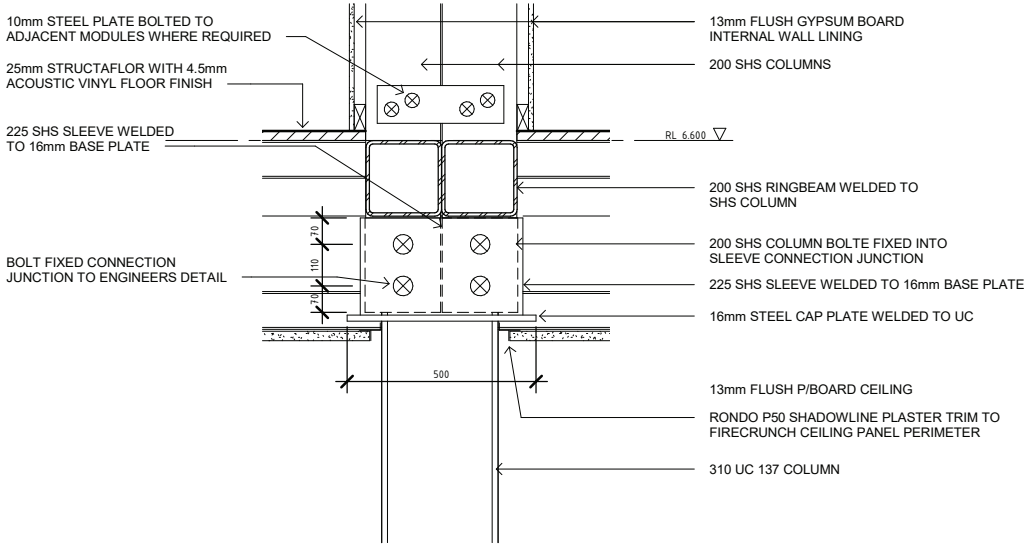
BIPV
Roof Material
- seamlessly integrated into the roof profile
- reduce the operating costs of the modules
- waste heat generated can be used to heat water

DESIGN FOR MANUFACTURE AND DISASSEMBLY





MODULE TO MODULE CONNECTION 1:20

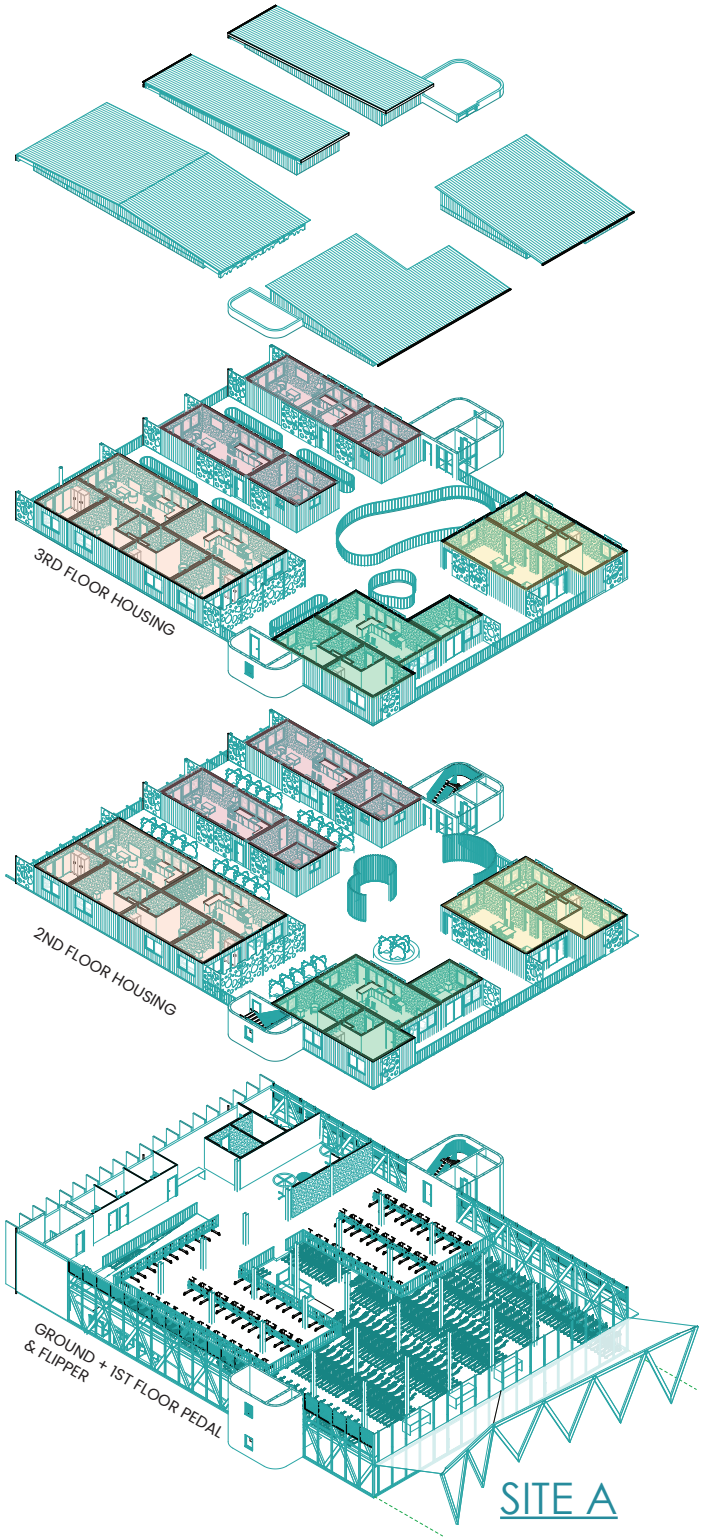


COLUMN TO MODULE CONNECTION 1:20

The modular apartments are constructed of 200 SHS steel beams and columns with 100 PFC floor and ceiling joists. The consistent use of these structural members allows each module to fit together easily and provides for flexibility in design combinations.

The modules are connected through a bolted sleeve system. The upper half of one module provides a welded 225 SHS sleeve on its extended columns that allow the lower half of another module to slot in and bolt together. This leaves space between ceiling and flooring of the modules for services.

When it is time for the modules to be relocated to Site B, they are simply unbolted and lifted onto a truck to be transported



SITE A

All modules are built to a 5mx6m grid. This allows for flexible rearrangement as even the walkway modules can be reused in a different configurement.

Due to the island nature of the sites, all modules will need to be shipped to the island and trucked to the site. The modules would be considered a wide load and will require an escort when transporting.

Given the size of the roads on Rottnest, a semi-trailer with a wide load (5m) would be able to transport the modules for relocation to Site B, provided that traffic management systems are in place.

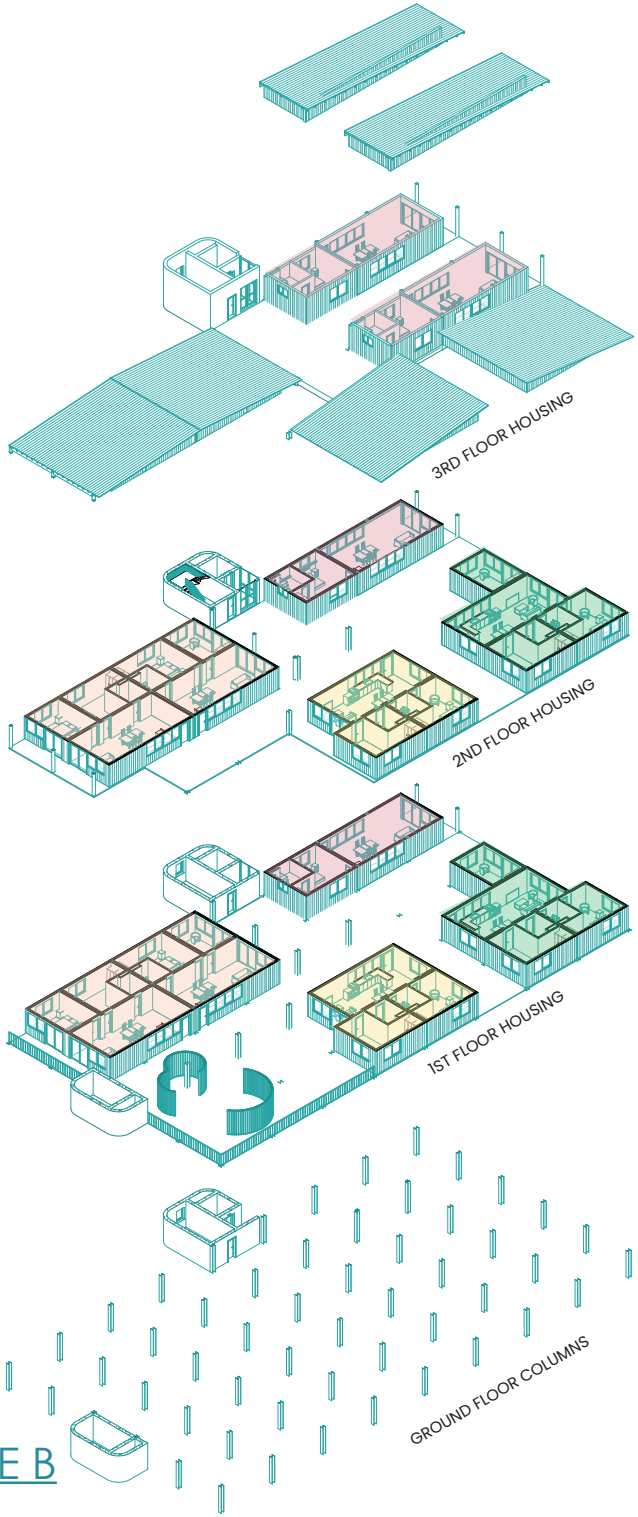
As Site B is essentially a sand dune, in order to protect the landscape the apartment modules rest on columns. These columns elevate the modules a full storey and allow for sand and wildlife to pass easily underneath.

1x BED 1x BATH

2x BED 1x BATH

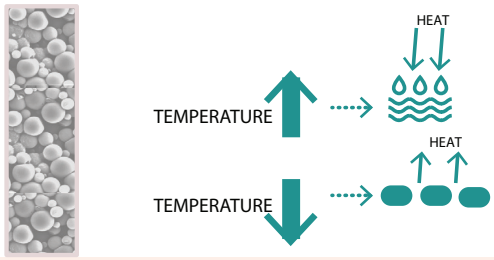
2x BED 2x BATH

3x BED 2x BATH



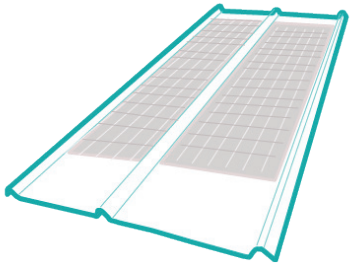
SITE B

SUSTAINABILITY PRINCIPLES - NET ZERO



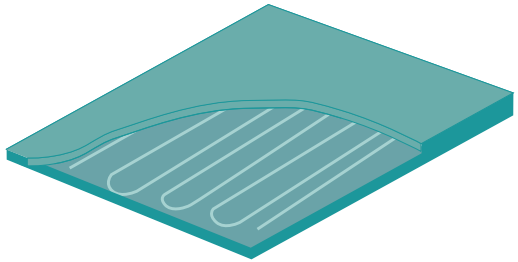
PHASE CHANGE MATERIALS (PCM)

The housing modules are composed of lightweight materials. By micro-encapsulating phase change materials into the internal plasterboard, the lightweight walls can achieve the same latent heat storage as high thermal mass materials such as masonry. With this the structures are able to stay cooler during the hot parts of the day and can give heat during the cooler night periods.



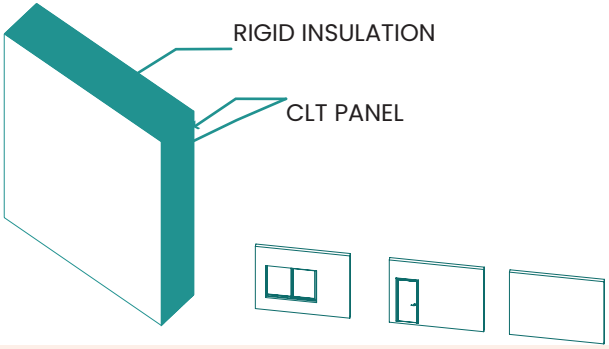
BUILDING INTEGRATED PHOTOVOLATAICS (BIPV)

BIPV is the integration of photovoltaics within the envelope of the building. The PV panels seamlessly integrate into the roofing system, making them ideal for individual roofing modules that may be detached and re-attached in a separate location. The PV system allows the modules to generate their own electricity to be stored in an on-site solar battery, and the waste heat generated can be used in heating water.



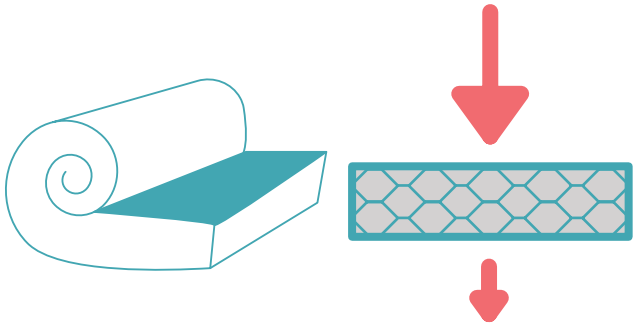
HYDRONIC UNDERFLOOR HEATING

Hydronic underfloor heating is a water based system that uses sealed pipes of heated water to radiate heat from underneath the floor material. This method of radiant heating allows for more evenly distributed thermal comfort. As a closed system, water is reused.
This heating method can be integrated with solar PV roof systems to heat the water and reduce operational costs.



STRUCTURAL INSULATED PANELS

Rigid insulation sandwiched between two sheets of cross-laminate timber allows the walls to be structural and load-bearing, and provide the bracing support that the aluminium framing is missing. SIPs also provide effective thermal performance, and are light and relatively inexpensive, making them a good material for fast construction.
The walls come in different types where they include windows or doors or neither in a standard size. This allows for flexibility in the design and more potentials for reconfiguration for different sites as walls can be replaced to provide the best suited external wall for the site and configuration.



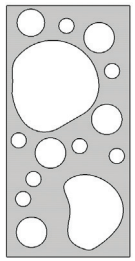
GLASSWOOL INSULATION

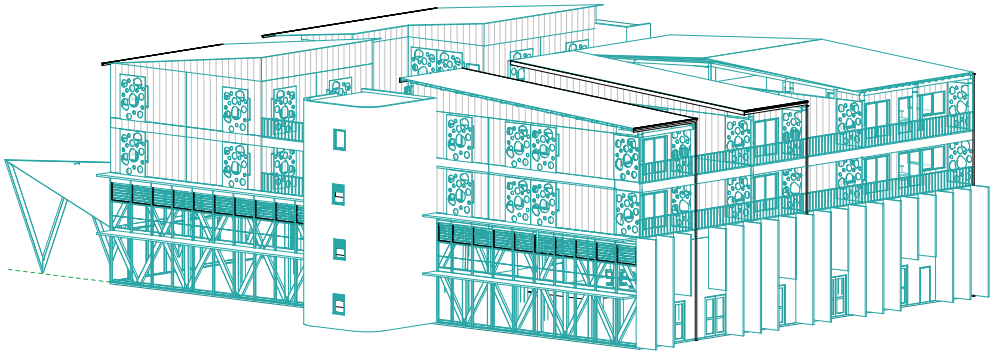
Glasswool insulation is produced from recycled glass that has been spun to create fibres, resulting in millions of tiny air pockets throughout the material. This means that heat is trapped inside the air pockets, rather than being conducted, allowing the internal spaces to be kept cool in summer and warmer in winter. The insulation is fire resistant and with high thermal and acoustic performance, and is 100% recyclable.

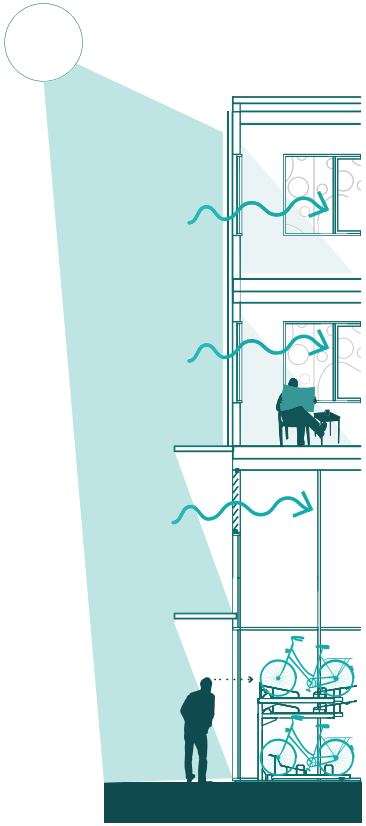
NATIVE FLORA

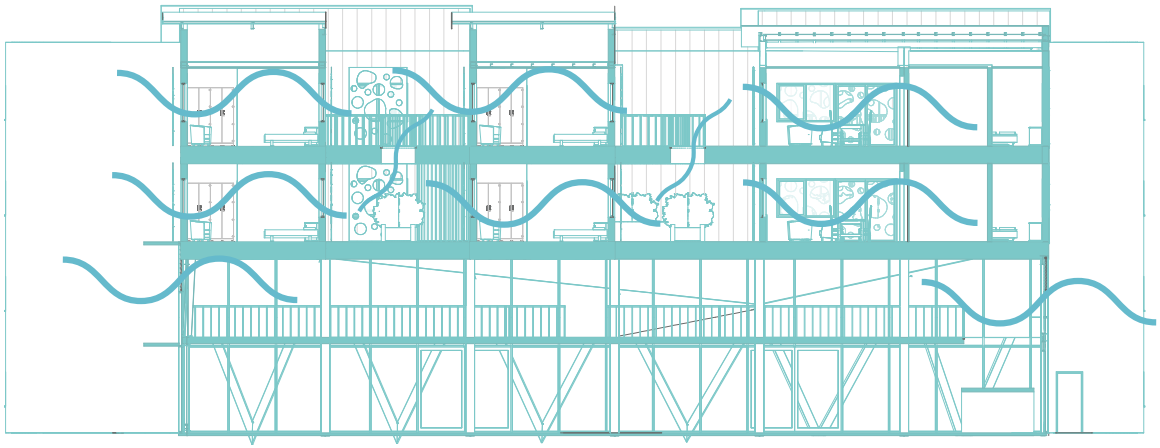
Planters located on the external walkways between the modules are filled with local native plants. Rottnest has such a rich and diverse ecosystem. Local fauna such as birds and insects can benefit from the inclusion of native nature that matches their surroundings.
The inclusion of nature within the structure creates a biophillic effect for the visitors, enhancing their stay at the apartments. Furthermore, native Australian flora require very little maintenance once established.

PASSIVE DESIGN









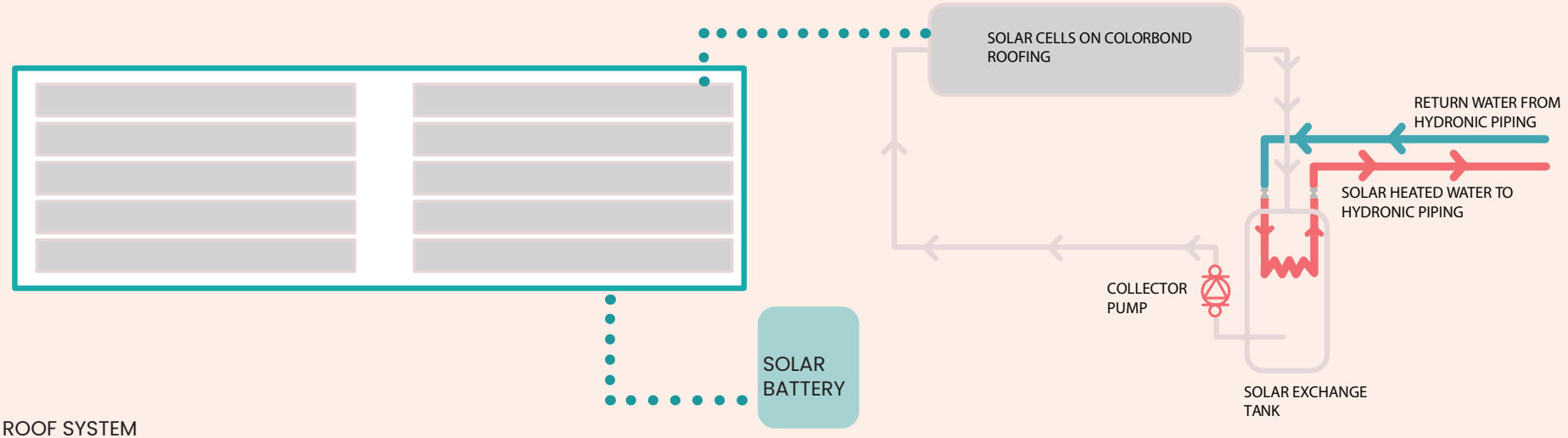
The facade screen is a perforated aluminium panel with larger, organically shaped perforations that prevent direct sunlight from entering into the living spaces while still allowing daylight, ventilation and access to views.

They are located on all facades except for the south, which does not receive any direct sunlight. They are positioned in front of windows in each module for both shading and privacy.

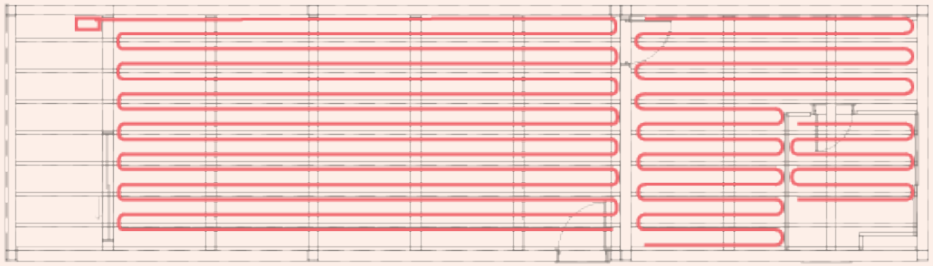
The design references the natural rock formations found in the shallows of the Rottnest beaches.

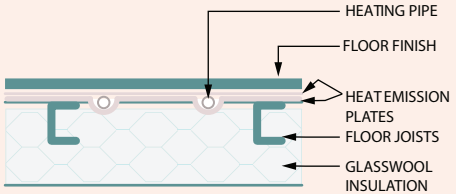
The spaced placement of each module allows for windows on all sides. Opposing windows throughout the modules allows for effective cross ventilation. This passive cooling effect, paired with Rottnest's cooler climate, the incorporation of PCM in the internal wall lining and the facade shading; results in very little need for auxiliary cooling methods, effectively reducing the operating costs of the apartments.

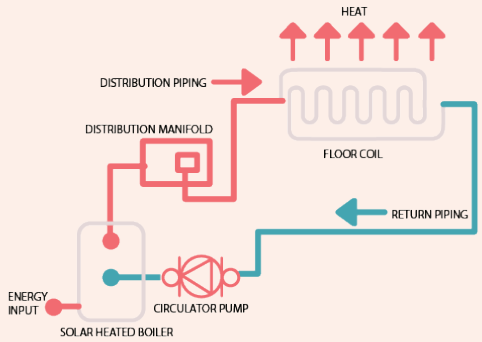
BUILDING SERVICES

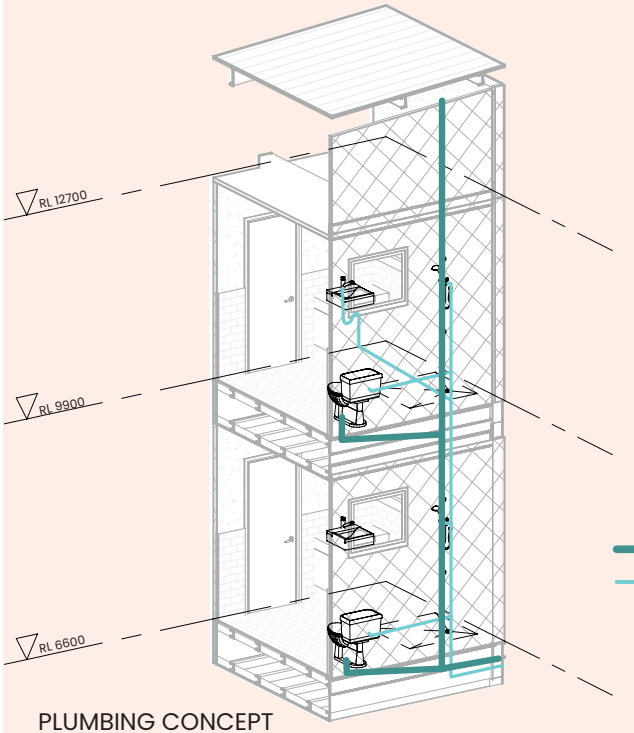


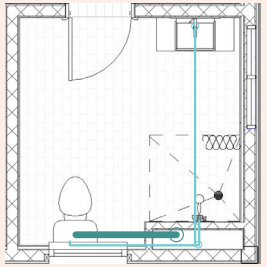
BIPV ROOF SYSTEM











All plumbing pipes travel vertically through a plumbing duct and exit horizontally towards the mechanical risers on the lower floor

PVC waste pipe

CPVC water pipe

PLUMBING CONCEPT

STRUCTURAL ENGINEERING ANALYSIS

module Dimensions		
length	6	m
width	5	m
height	3	m
area	30	m^2
perimeter	22	m
framing length	56	m

Module Dead Loads					Totals	
Total dead load of wall per m length of wall	=	0.92	kN/m	=	20.17	kN
Total dead load per m^2 floor	=	0.54	kPa	=	16.19	kN
Ceiling dead load per m2	=	0.31	kPa	=	9.19	kN
Framing dead load	=	0.52	kN/m	=	29.01	kN

Total dead load	=	74.55	kN
Allow 15% for additional weight	=	85.74	kN
	=	8.57	Tonnes

Wind Pressure on Accommodation Modules (kPa)		
	Ultimate	Serviceability
Windward	1.43	0.97
Leeward	-0.15	-0.10
Side wall	-0.34	-0.23
Roof	-0.74	-0.50

Floor Permanent Loading Summary			
Joist spacing	=	600	mm centres
Flooring dead load	=	0.51	kN/m^2
Dead load of joist	=	0.02	kN/m
Floor dead load (per joist)	=	0.31	kN/m
Total superimposed dead load (per joist)	=	0.32	kN/m
Total Flooring dead load (per m^2)	=	0.54	kN/ m^2

Wall Permanent Loading Summary			
Dead load wall material (per m length of wall)	=	0.80	kN/m
Total superimposed dead load (per m length of wall)	=	0.92	kN/m

[Note: wall height taken as 3m]

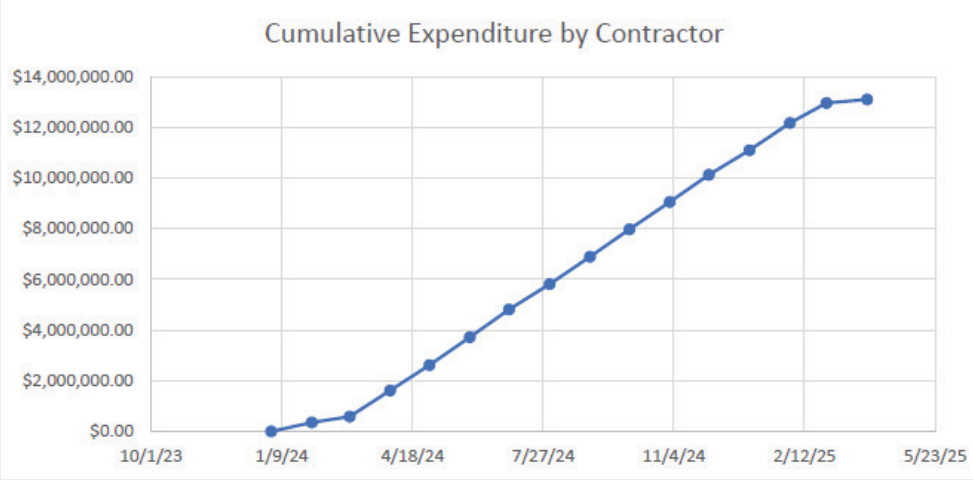
Ceiling Permanent Loading Summary			
Joist spacing	=	600	mm centres
Dead load of joist	=	0.02	kN/m
Dead load ceiling material (per joist)	=	0.17	kN/m
Total superimposed dead load (per joist)	=	0.19	kN/m
Total superimposed dead load (per m^2 of ceiling)	=	0.31	kN/ m^2

Roof Permanent Loading Summary			
purlin spacing	=	900	mm centres
Dead load of purlin	=	0.02	kN/m
Dead load roof load (per purlin)	=	0.04	kN/m
Total superimposed dead load (per purlin)	=	0.06	kN/m

Steel Framing Permanent Loading Summary			
200 SHS 9 permanent load	=	0.518	kN/m

CONSTRUCTION PROGRAMME AND COST

Category	breakdown	Rate $/sqm	Adjusted Rates	Cost
Preliminaries	Preliminaries	$ 274.25	$ 338.03	$ 1,115,490.11
	subtotal	$ 274.25	$ 338.03	$ 1,115,490.11
Substructure		$ -	$ -	$ -
	subtotal	$ -	$ -	$ -
super structure	upper floors	$ 263.25	$ 324.47	$ 1,070,748.48
	Columns	$ -	$ -	$ -
	stair case	$ 50.00	$ 61.63	$ 203,371.03
	Roof	$ 131.50	$ 162.08	$ 534,865.81
	external wallls	$ 396.00	$ 488.09	$ 1,610,698.57
	eternal doors	$ 37.75	$ 46.53	$ 153,545.13
	internal walls	$ 150.25	$ 185.19	$ 611,129.95
	internal Screens	$ 11.00	$ 13.56	$ 44,741.63
	internal doors	$ 41.25	$ 50.84	$ 167,781.10
	subtotal	$ 1,081.00	$ 1,332.39	$ 4,396,881.70
Finishes	Wall	$ 84.50	$ 104.15	$ 343,697.04
	Floor	$ 94.00	$ 115.86	$ 382,337.54
	Ceiling	$ 87.00	$ 107.23	$ 353,865.59
	subtotal	$ 265.50	$ 327.24	$ 1,079,900.18
Fittings	Fitments	$ 159.00	$ 195.98	$ 646,719.88
	Special	$ -	$ -	$ -
	subtotal	$ 159.00	$ 195.98	$ 646,719.88
Services	plumbing	$ 374.25	$ 461.28	$ 1,522,232.17
	Mechancical	$ 50.25	$ 61.94	$ 204,387.89
	Fire	$ 11.25	$ 13.87	$ 45,758.48
	Electrical	$ 127.75	$ 157.46	$ 519,612.98
	subtotal	$ 563.50	$ 694.54	$ 2,291,991.52
External Services	External Services	$ 11.25	$ 13.87	$ 45,758.48
	subtotal	$ 11.25	$ 13.87	$ 45,758.48
Contingency	Contingency	$ 63.25	$ 77.96	$ 257,264.35
	subtotal	$ 63.25	$ 77.96	$ 257,264.35
			Total Cost	$ 9,834,006.22



ID	Task	Total Time (working days)
1	**Prior to construction**	
2	Management Plan	2
4	Shop Drawings	50
6	**Fabrication**	
7	Fabrication grid AB	30
8	Fabrication grid BC	30
9	Fabrication grid CD	30
10	Fabrication grid DE	30
11	Fabrication grid EF	30
12	Fabrication grid FG	30
95	**Grid F/G**	
96	Mobilise Materials	10
97	Pedal & Flipper columns installed along grid F/G	3
98	Pedal & Flipper Beams and bracing installed along grid F/G	3
99	Lay modular ground floor slabs for grid F/G	5
100	Install 1st level of module apartments (including connections)	3
101	Install 2nd level of module apartments (including connections)	3
102	Install walkway framing & bracing	1
103	Install Roof modules (including connections) (grid F/G)	3
106	**Flooring**	
107	Install Floor joists for mezzanine and main walkway between modules	8
108	Install flooring materials for mezzanine and main walkway between modules	10
116	**Services**	
117	Install electrical services	10
119	Install water services	10
120	**Finishing**	
121	Apartment modules finishing	20
124	**Demobilisation**	
125	Demobilise Site EWP's	1
126	Demobilise Site offices	1
127	Demobilise crib rooms	1
130	Demobilise site fencing	1
131	**Hand-over**	

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