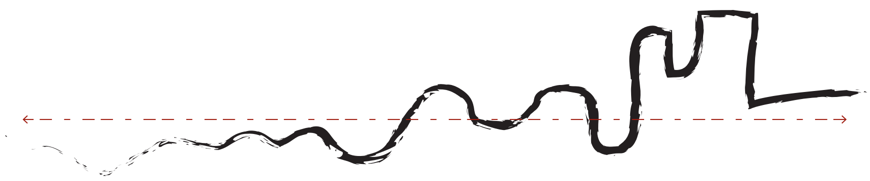
Figure 8.1: Top: Tectonic concept (Author 2019)

Figure 8.2: Bottom: Technical transitions (Author 2019)



Configure built environment to allow for better lived experiences

Techne'

08

Technical concept

Natural transition
As a result of the current disconnect between man and the Apies river, a new approach to building is required that will foster spiritual or productive connections with the natural landscape.

The concept of transconfiguration as a complete change in form or appearance into a more beautiful or spiritual state, has been implemented in the design as well as the technification of this project.

In conjunction with the three place-making design strategies, the intervention seeks to reconnect man with the Apies river by becoming a transitionary medium that facilitates a progression of man-made to natural, interactions with the landscape. As the users interact and move through the site, interactions with the natural landscape become more frequent and finally reaches a point where the user is completely immersed within the landscape - the structure, material palette, aesthetics and systems are used to achieve this.

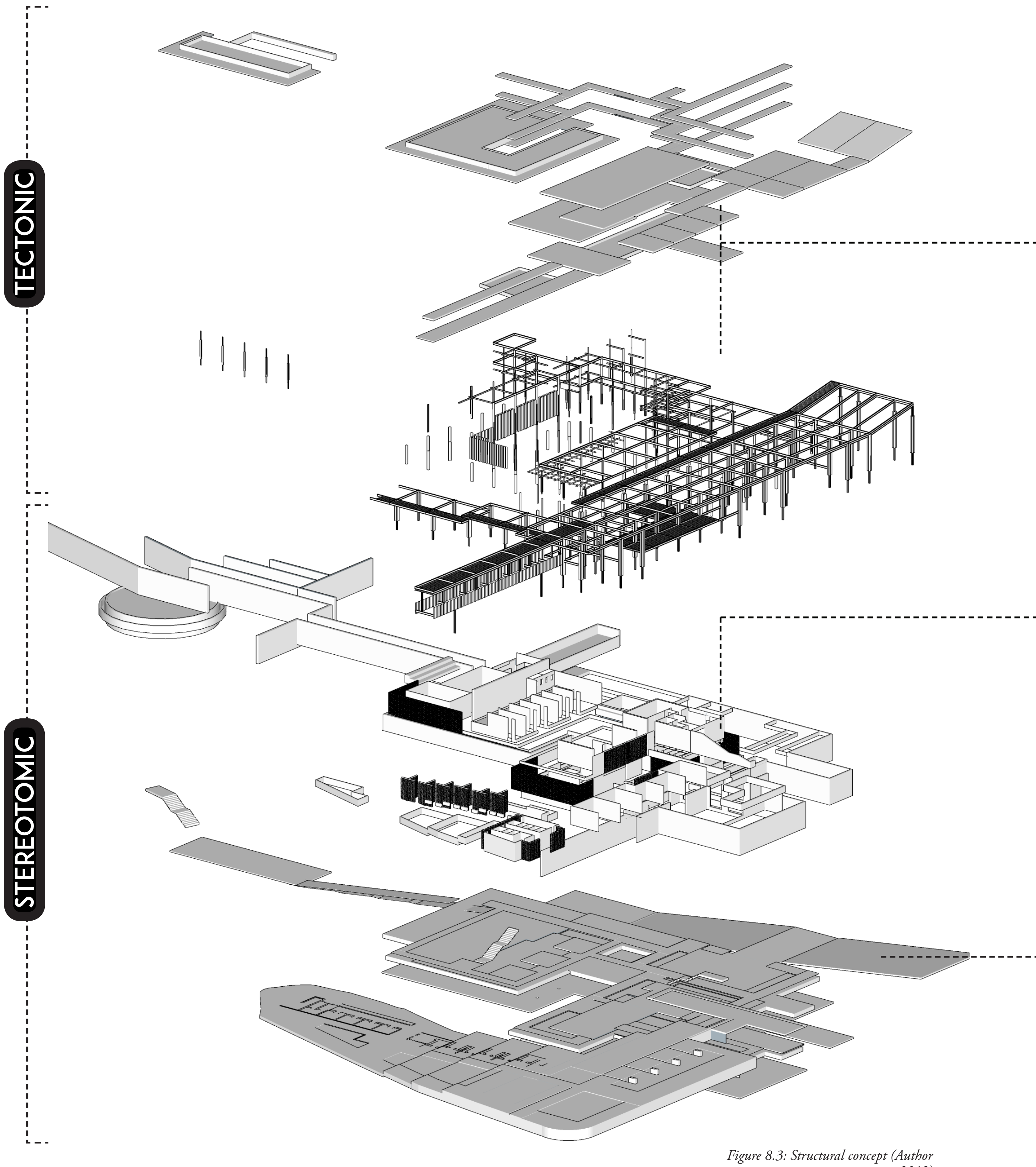
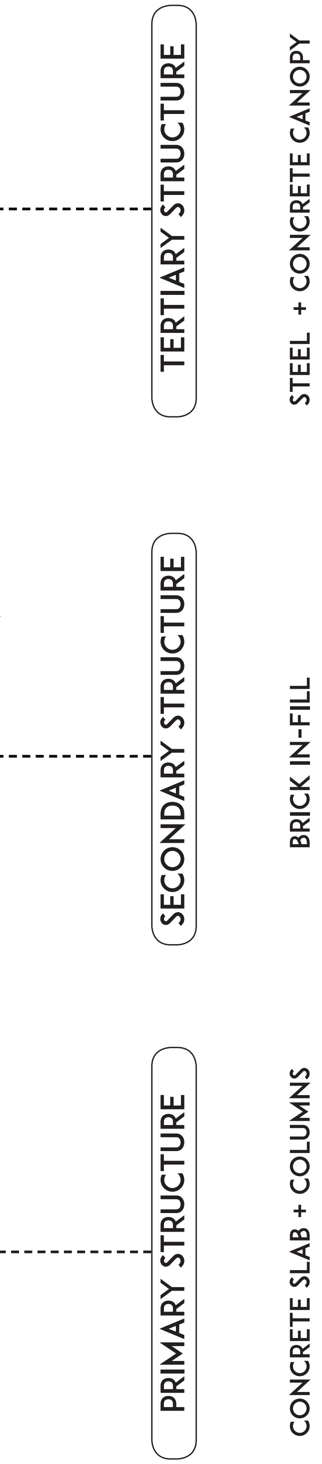


Figure 8.3: Structural concept (Author 2019)



Structure – Stereotomic/tectonic

In order to reconnect man and nature on a productive and spiritual level, the structure needs to be robust enough to allow for appropriation by both parties. A combination of stereotomic (concrete and brick) and tectonic (steel and timber) structures will be used to accommodate the everyday public activities whilst also allowing nature to appropriate the structure by becoming infrastructure for the plants to grow on, in and against.

The market space, situated on the periphery of the site, adopts a more stereotomic aesthetic as this area needs to be robust enough for the appropriation of humans and their everyday rituals relating to preparing and selling of food. It is also here where the stereotomics are more visible. There is a regression in the stereotomic visibility as one moves into the site towards the recreation space. This regression in visibility allows the structure of the building to adopt a more supporting role as infrastructure for the landscape. This reinforces the concept of transconfiguration as it allows the ville (built environment) to transform into a more spiritual state and re-establishes man's connection to nature and thus creating better lived experiences (cité).

The tectonic steel structure becomes lighter and assumes a more natural aesthetic as one moves from the market space towards the recreational space. The tectonic steel elements used in the market space is heavier and relates more to the stereotomic mass that surrounds it, but as you move closer to the recreational space the steel is cladded with wood to merge with the rest of the natural material pallet and eventually convey the idea that man is being completely immersed in the landscape.

Material & Aesthetics

Natural transition and change over time

The material choices also respond to the concept of natural transitions by progressively taking on more natural qualities as they are embedded deeper within the landscape and thus creating richer experiences. The figure below illustrates how materials such as brick or concrete can be altered to achieve the natural progression. The use of steel and timber is also welcomed as their properties that change over time (weathering or decaying), strengthens the concept.

This transition can best be illustrated through the use of more man-made materials such as concrete and steel in the market space and as one moves deeper within the site the material palette changes into more natural materials such as wood and stone. These transitions towards the natural, speak not only of the new relationship between building and landscape, but also creates a stronger connection between man and nature. The permeability of these materials increases as part of this transition which allows more natural daylighting and the opportunity of natural ventilation to occur.

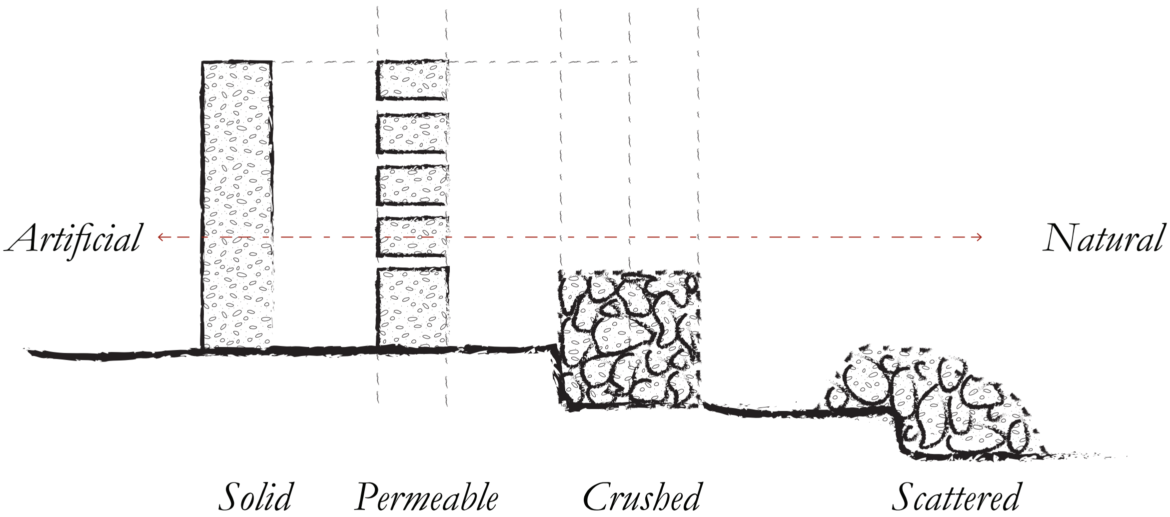


Figure 8.4: Material concept (Author 2019)

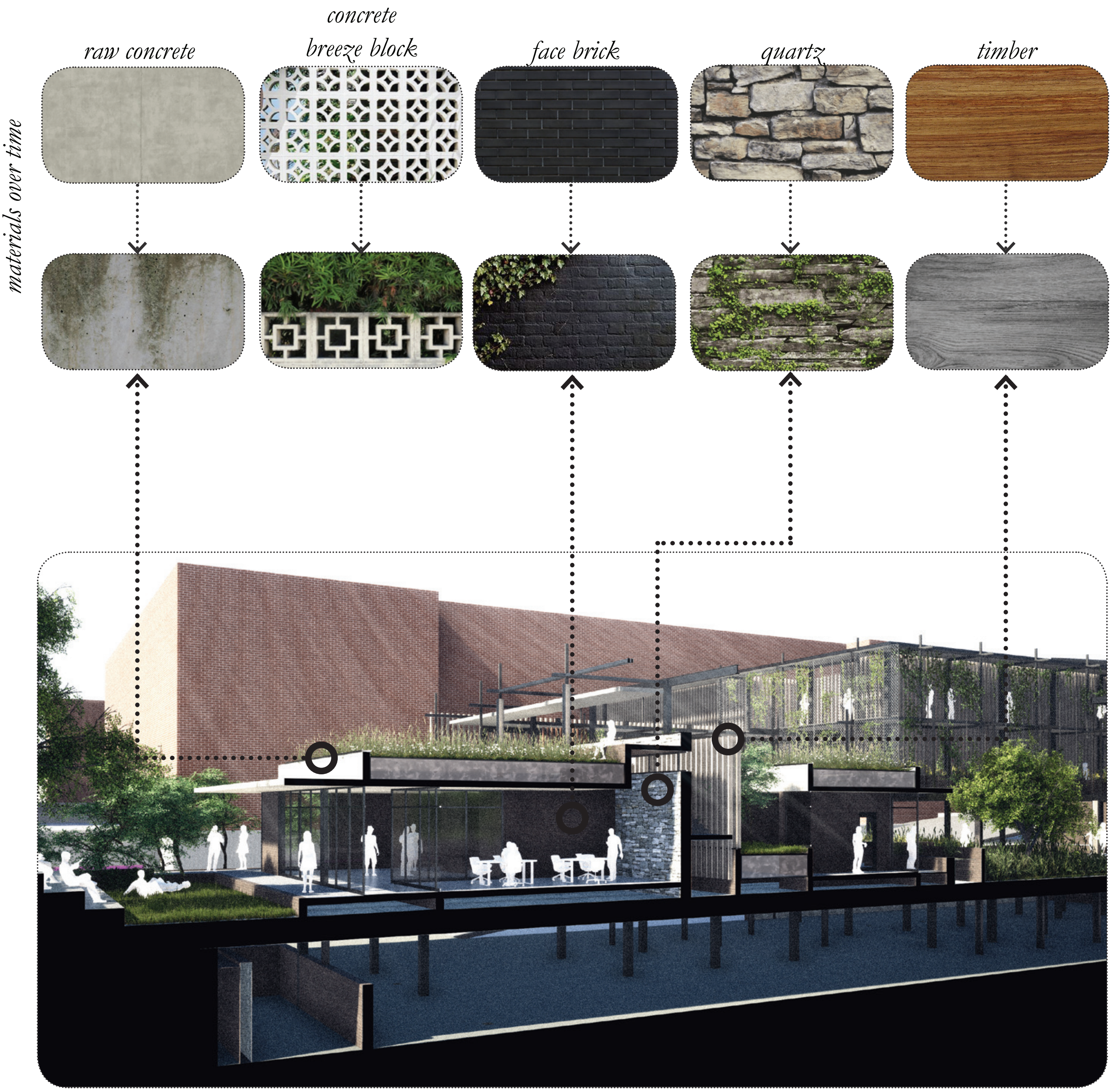


Figure 8.5: Top: Material palette (Author 2019)

Figure 8.6: Bottom: Section D (Author 2019)

Water harvesting and treatment systems

As described in the programme chapter, water is a resource that needs to be conserved. For this project to be sensitive to the current environmental condition, water will be harvested, treated, stored, reused as well as redistributed back into the city through the Apies river.

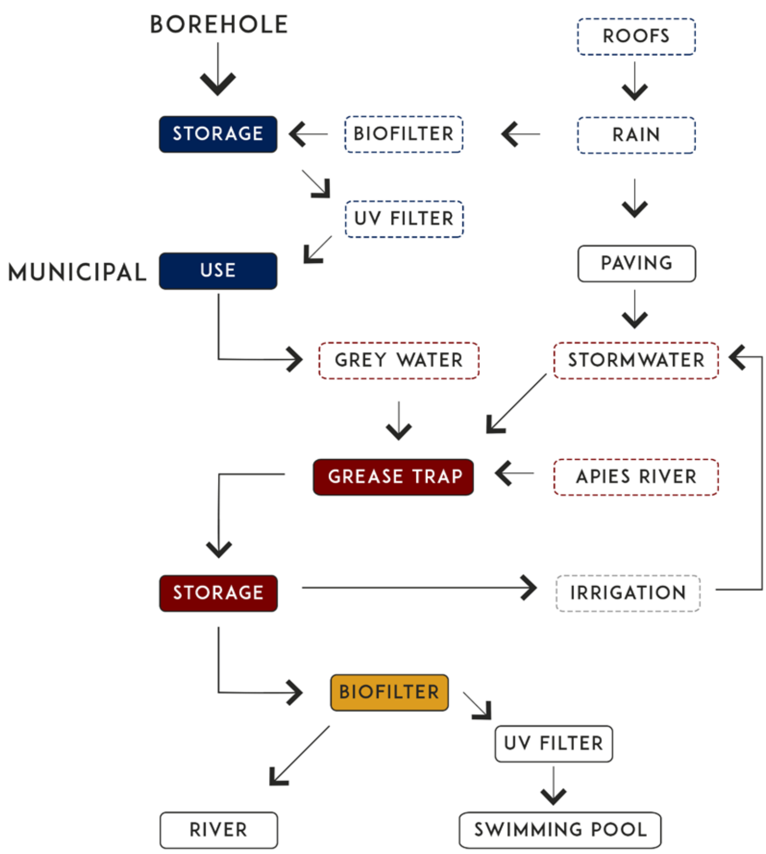
For water to be safely treated, storm and grey water will be harvested and treated separately from rain water. Storm water will be collected from surface runoff, stored in underground tanks together with greywater, then after it will be filtered and used for irrigation and flushing toilets. To successfully remove contaminants from wastewater, a five step process is necessary. The first step is to remove any floating debris from the storm water before it is enters the channels, this is done by simply covering the storm water channel with a mentis grid. The second and third step requires any suspended solids (heavier than water) and colloidal particles (lighter than water) to be removed. By running the wastewater (at this point it is both storm and grey water) through a grease trap, the sediments will fall to the bottom of the tank and the oils will stay at the top allowing clear affluent to pass through into a storage tank.

At this stage, the wastewater has a high nutrient level and can directly be used for the irrigation of plants but if not, the water will pass through a biofilter (in the form of a tiered wetland) where the substances are stripped by the microorganism within the filter as well aerated which turns the dissolved substances into a gas that escapes the water.

After the filtration process, the some of the water is stored to flush toilets but the rest is discharged back into the river and used for recreation purposes. The last step in the purification process is to remove any pathogens that are present through the use of a uv filter. Although the wastewater won't be made potable to an extend where it is consumed by people, it is recommend to run the water through a uv filter before it is used in the swimming pool.

The process to treat rainwater is simpler. The rainwater is collected from roofs, where it is then treated for dissolved substances through a biofilter. After filtration water is stored and pumped a pressure vessel when needed. Before the water reaches the tap, it goes through a UV filter, killing pathogens and making int potable.

Figure 8.7: Water treatment process (Author 2019)



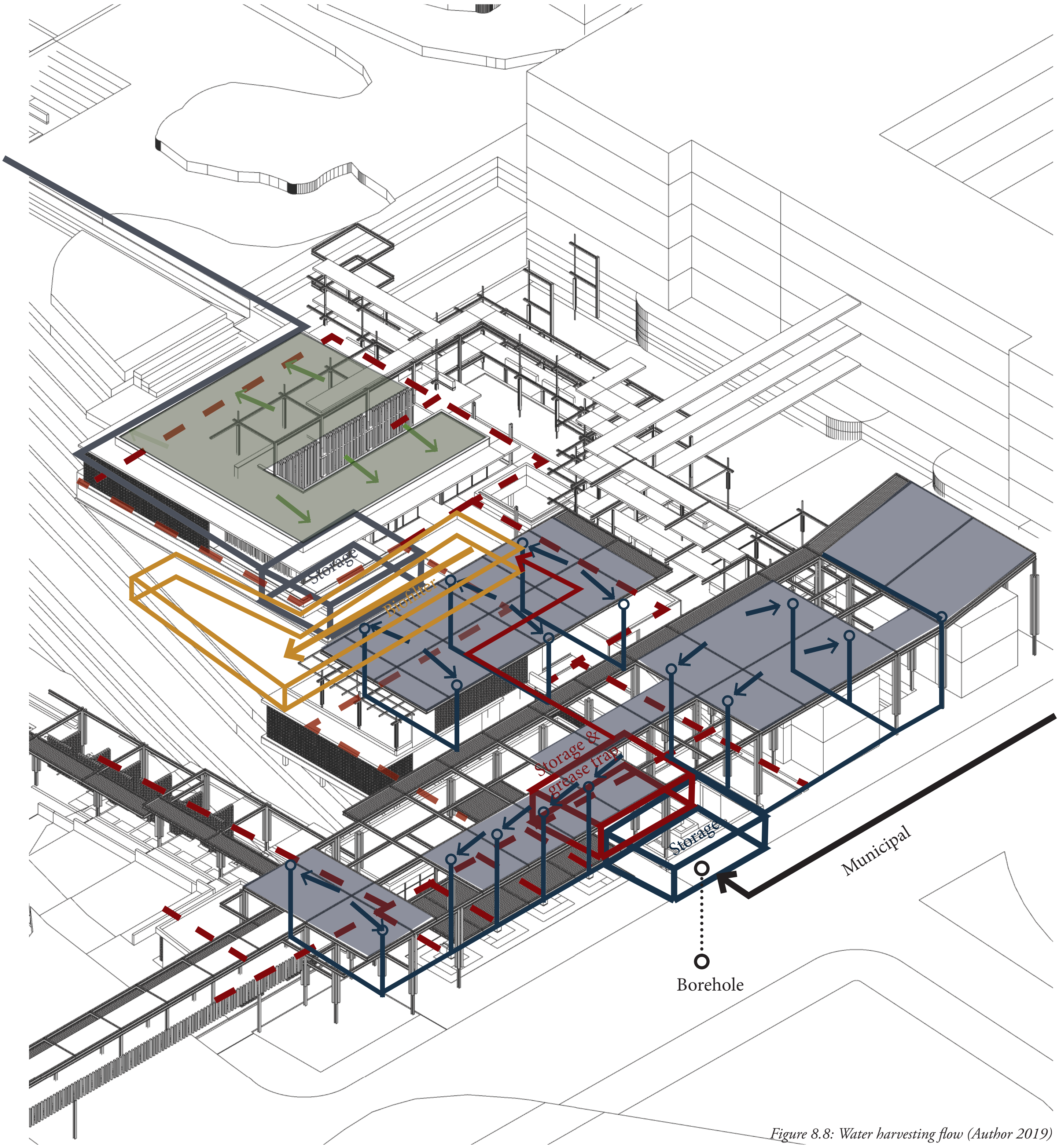
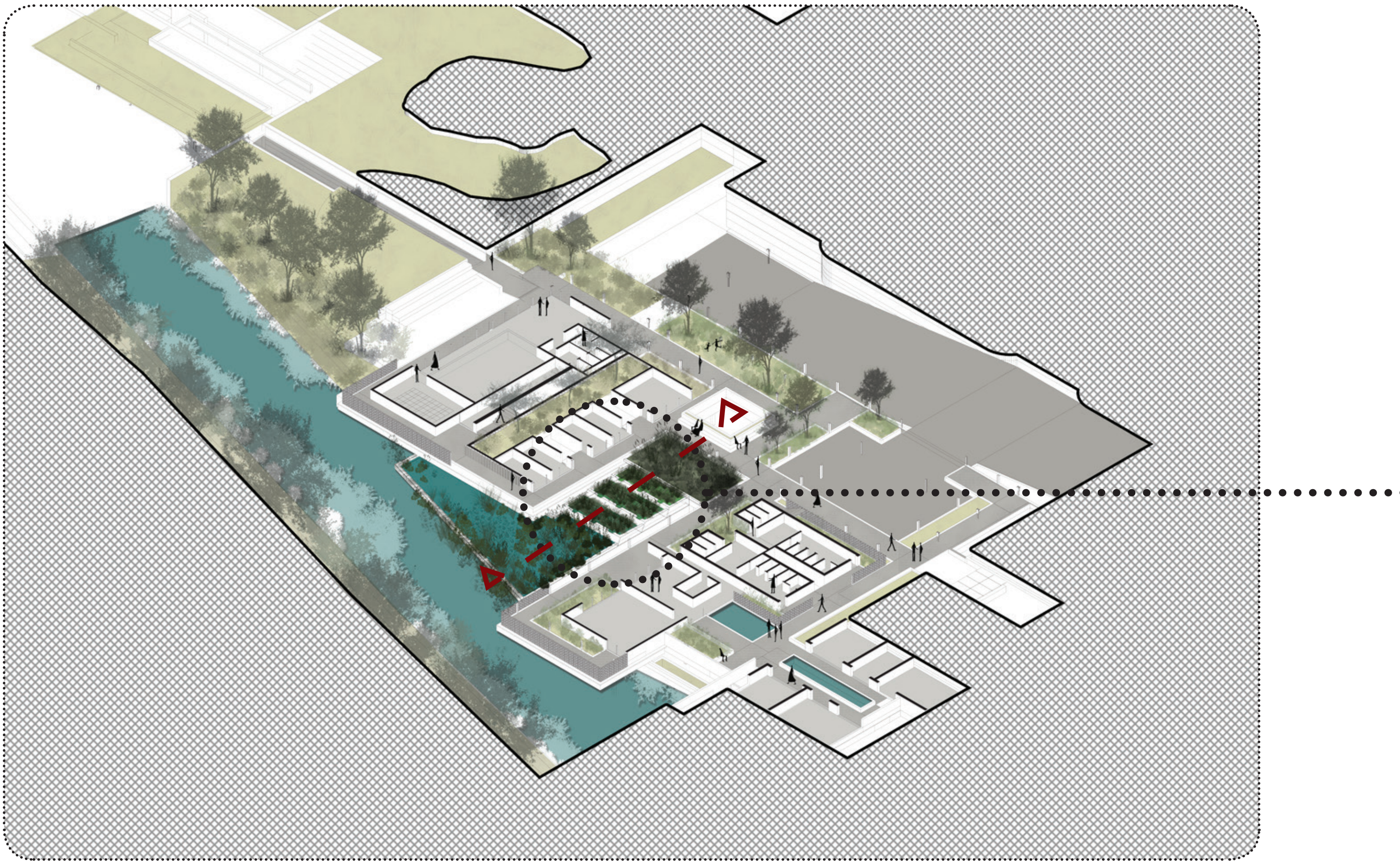
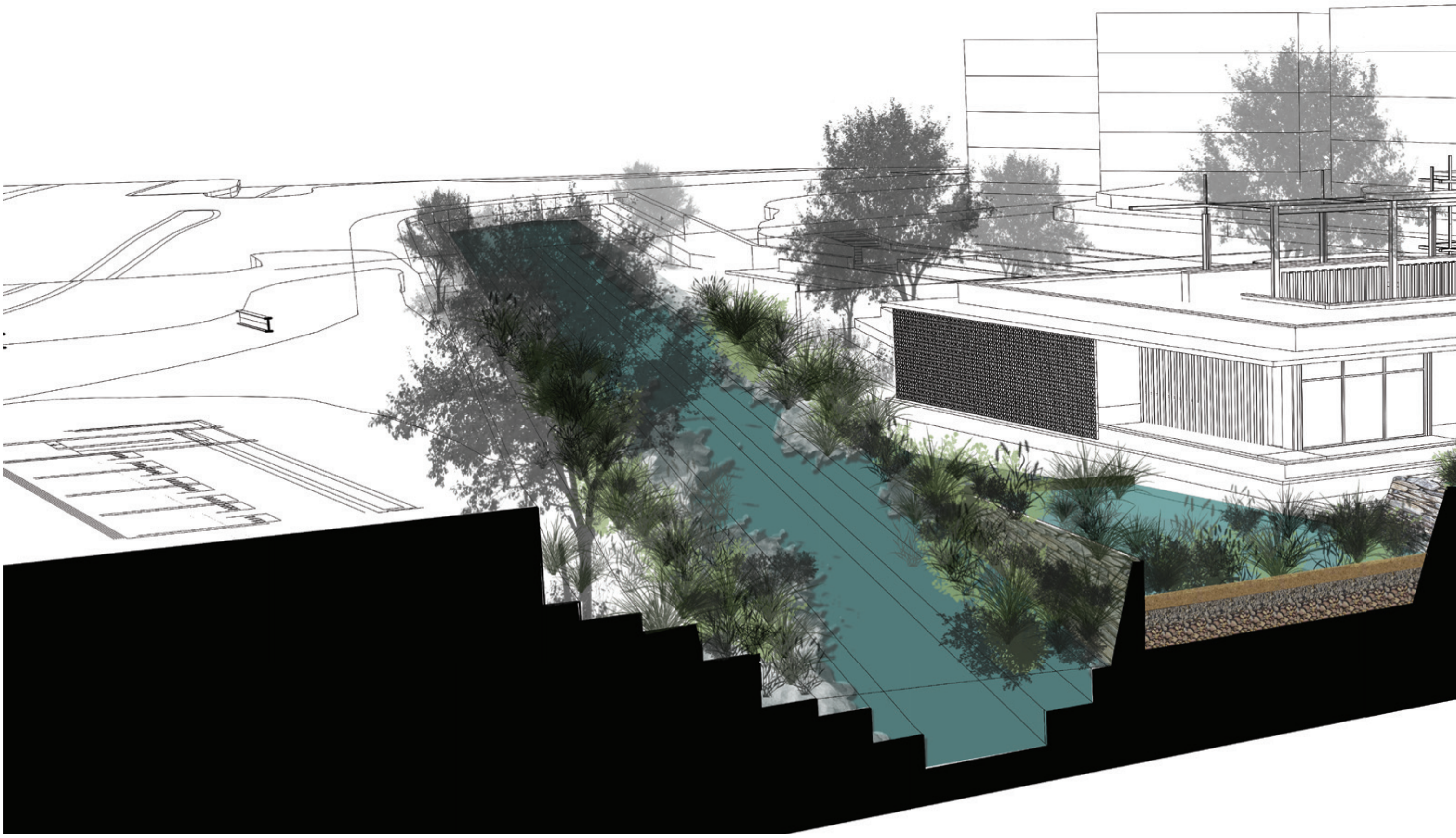


Figure 8.8: Water harvesting flow (Author 2019)





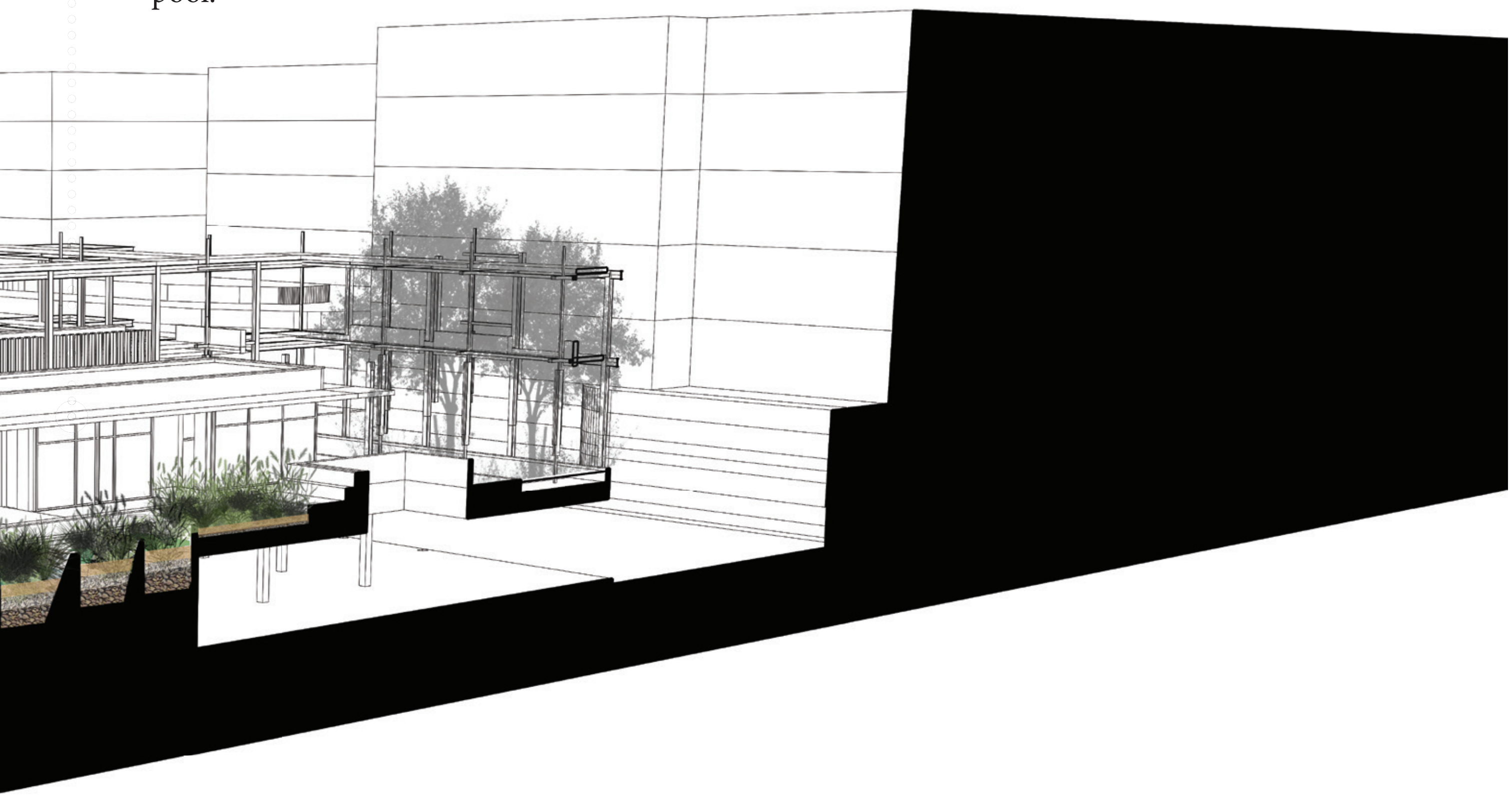
Constructed wetland - Wastewater treatment

The decision to use a tiered constructed wetland to treat wastewater is threefold, one it is a relatively low cost infrastructure (Pruned 2009), two it contributes towards the regenration of the Apies river and three is reinforces a visual and physical connection between man and the natural environment.

The wetland is step number four in the wastewater treatment process. After the wastewater has gone through the grease trap to remove any soaps or oils, the water is pumped to a trickle filter where the water will be gravity-fed and filtered through the wetland. To combat any bad odors, the water flow will not be on the surface but rather directed below a layer of gravel. Within the layers of sand and stone, microorganism extract the contaminants from the water. To further enhance the power of the biofiltration process, plants with phytoremediating qualities, will also be used to clean contaminates from the water (Pruned 2009). After the water has be treated, it is stored and used for either the flushing of toilets or recreation at the swimming pool.

Figure 8.9: Top left: Wetland section position (Author 2019)

Figure 8.10: Bottom: Section E - Wetland (Author 2019)



3. DEMAND (IRRIGATION AND DOMESTIC)

IRRIGATION DEMAND

	PLANTING AREA (M^2)	IRRIGATION DEPTH PER WEEK (M)	IRRIGATION DEPTH PER MONTH (M)	IRRIGATION DEMAND (M^3)
JANUARY	1 972 M^2	0,040 M	0,177 M	349 M^3
FEBRUARY	1 972 M^2	0,040 M	0,160 M	316 M^3
MARCH	1 972 M^2	0,040 M	0,177 M	349 M^3
APRIL	1 972 M^2	0,030 M	0,129 M	254 M^3
MAY	1 972 M^2	0,020 M	0,089 M	175 M^3
JUNE	1 972 M^2	0,020 M	0,086 M	169 M^3
JULY	1 972 M^2	0,020 M	0,086 M	169 M^3
AUGUST	1 972 M^2	0,020 M	0,089 M	175 M^3
SEPTEMBER	1 972 M^2	0,030 M	0,129 M	254 M^3
OCTOBER	1 972 M^2	0,040 M	0,177 M	349 M^3
NOVEMBER	1 972 M^2	0,040 M	0,171 M	338 M^3
DECEMBER	1 972 M^2	0,040 M	0,177 M	349 M^3
YEAR	**1 972 M^2 (AVERAGE)**	**0,032 M (AVERAGE)**	**1,646 M (TOTAL)**	**3 245 M^3 (TOTAL)**

DOMESTIC DEMAND

	NUMBER OF INDIVIDUALS	WATER / CAPITA / DAY (LITRES)	TOTAL WATER / MONTH (LITERS)	DOMESTIC DEMAND (M^3)
JANUARY	0	6 852 L	212 406 L	212 M^3
FEBRUARY	0	6 852 L	212 406 L	212 M^3
MARCH	0	6 852 L	212 406 L	212 M^3
APRIL	0	6 852 L	212 406 L	212 M^3
MAY	0	6 852 L	212 406 L	212 M^3
JUNE	0	6 852 L	212 406 L	212 M^3
JULY	0	6 852 L	212 406 L	212 M^3
AUGUST	0	6 852 L	212 406 L	212 M^3
SEPTEMBER	0	6 852 L	212 406 L	212 M^3
OCTOBER	0	6 852 L	212 406 L	212 M^3
NOVEMBER	0	6 852 L	212 406 L	212 M^3
DECEMBER	0	6 852 L	212 406 L	212 M^3
YEAR	**0 (AVERAGE)**	**40 L (AVERAGE)**	**212 406 L (TOTAL)**	**2 549 M^3 (TOTAL)**

434 PEOPLE PER DAY - 142 PERSONNEL ; 292 PUBLIC OCCUPANTS.

PUBLIC PEOPLE	APPLIANCES	LITRES/DAY /PERSON SERVED	TOTAL DEMAND PER DAY (LTR)
434	HANDWASHING: SPRAY TAPS	1	434
434	URINAL FLUSHING 8H DAY	3,7	1605,8
434	WC FLUSHING	5	2170
30	SHOWER WORKERS	34	1020
434	DRINKING	3	1302
64	FOOD PREP AND COOKING	5	320
	TOTAL LITERS PER DAY		6851,8
	TOTAL LITRES PERPERSON PER DAY		40

INCUBATOR OCCUPANTS	108
CAFÉ OCCUPANTS	83
MARKET OCCUPANTS	243

Figure 8.11: Water calculations (Author 2019)

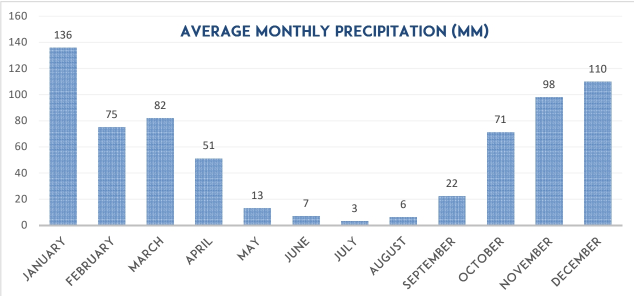
1. Climate Data

Place: Pretoria

Position: 26°11'S, 28°1'E
Height: 1330m
Period: 1961-1990

Descriptive text

	MONTH	Temperature: Highest Recorded	Average Daily maximum	Average Daily Minimum	Lowest Recorded	Precipitation: Average Monthly (mm)	Average number of Days >== 1mm	Highest 24hr rainfall (mm)
1.	January	36	29	18	8	136	14	160
2.	February	36	28	17	11	75	11	95
3.	March	35	27	16	6	82	10	84
4.	April	33	24	12	3	51	7	72
5.	May	29	22	8	-1	13	3	40
6.	June	25	19	5	-6	7	1	32
7.	July	26	20	5	-4	3	1	18
8.	August	31	22	8	-1	6	2	15
9.	September	34	26	12	2	22	3	43
10.	October	36	27	14	4	71	9	108
11.	November	36	27	16	7	98	12	67
12.	December	35	28	17	7	110	15	50
	YEAR	**36**	**25**	**12**	**-6**	**674**	**88**	**160**

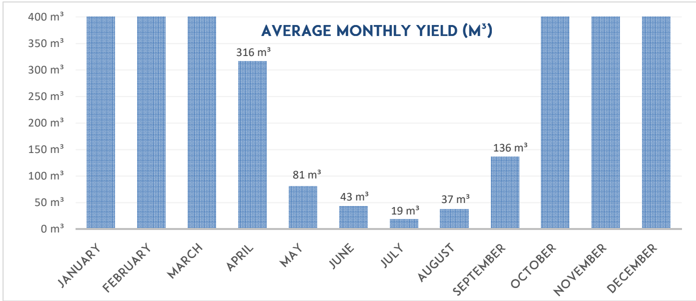


2. YIELD

YIELD (M³) = P X A X C (WHERE P=PRECIPITATION (M), A=AREA (M²), AND C=RUN-OFF COEFFICIENT)

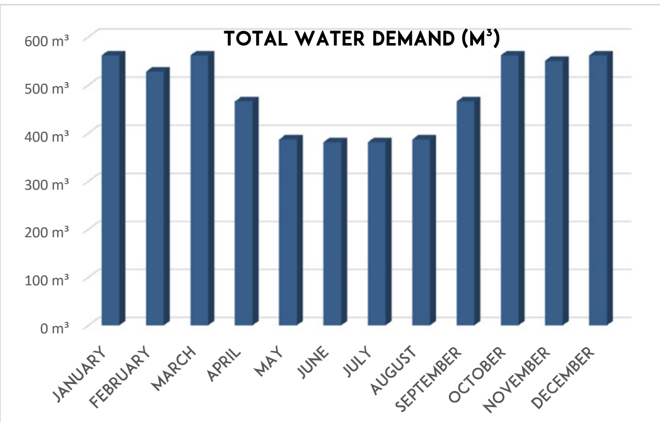
PER SURFACE (PER SURFACE)	AREA (M²)	RUN-OFF COEFFICIENT
ROOF MARKET	1 434,00 M²	0,9
ROOF CAFÉ	367,00 M²	0,9
ROOF WALKWAY	552,00 M²	0,9
PAVING	3 661,00 M²	0,9
GREEN ROOF	522,00 M²	0,4
LANDSCAPED AREA	1 450,00 M²	0,4
APIES RIVER		
TOTAL:	7 986,00 M²	0,78

	MONTH	PRECIPITATION AVERAGE MONTHLY (MM)	AREA	RUN-OFF COEFFICIENT	YIELD P(M) X A(M²) X C
1.	JANUARY	136 MM	7 986 M²	0,78	843 M³
2.	FEBRUARY	75 MM	7 986 M²	0,78	465 M³
3.	MARCH	82 MM	7 986 M²	0,78	509 M³
4.	APRIL	51 MM	7 986 M²	0,78	316 M³
5.	MAY	13 MM	7 986 M²	0,78	81 M³
6.	JUNE	7 MM	7 986 M²	0,78	43 M³
7.	JULY	3 MM	7 986 M²	0,78	19 M³
8.	AUGUST	6 MM	7 986 M²	0,78	37 M³
9.	SEPTEMBER	22 MM	7 986 M²	0,78	136 M³
10.	OCTOBER	71 MM	7 986 M²	0,78	440 M³
11.	NOVEMBER	98 MM	7 986 M²	0,78	608 M³
12.	DECEMBER	110 MM	7 986 M²	0,78	682 M³
	YEAR	674 MM	7 986 M²	0,78	4 180 M³



3. TOTAL DEMAND

	IRRIGATION DEMAND (M³)	DOMESTIC DEMAND (M³)	TOTAL WATER DEMAND
JANUARY	349 M³	212 M³	**562 M³**
FEBRUARY	316 M³	212 M³	**528 M³**
MARCH	349 M³	212 M³	**562 M³**
APRIL	254 M³	212 M³	**466 M³**
MAY	175 M³	212 M³	**387 M³**
JUNE	169 M³	212 M³	**381 M³**
JULY	169 M³	212 M³	**381 M³**
AUGUST	175 M³	212 M³	**387 M³**
SEPTEMBER	254 M³	212 M³	**466 M³**
OCTOBER	349 M³	212 M³	**562 M³**
NOVEMBER	338 M³	212 M³	**550 M³**
DECEMBER	349 M³	212 M³	**562 M³**
YEAR	3 245 M³ (TOTAL)	2 549 M³ (TOTAL)	**5 794 M³ (TOTAL)**

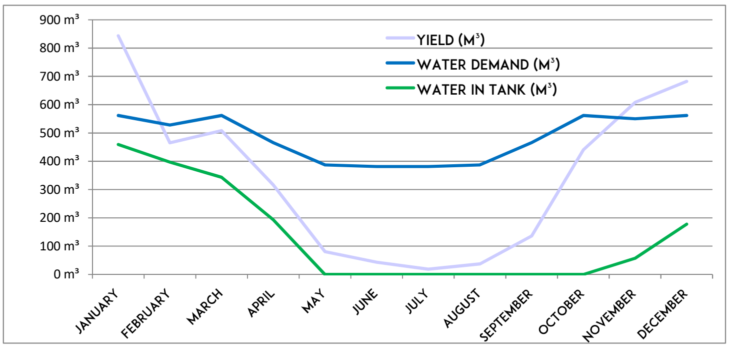


4. WATER BUDGET EXERCISE + SAFETY FACTOR + NUMBER OF TANKS NEEDED

	YIELD FROM ONSITE RUNOFF (M³)	DEMAND TOTAL ONSITE WATER DEMAND (M³)	MONTHLY BALANCE	WATER IN TANK/RESERVOIR (M³)
JANUARY	843 M³	562 M³	282 M³	**459 M³**
FEBRUARY	465 M³	528 M³	- 63 M³	**397 M³**
MARCH	509 M³	562 M³	- 53 M³	**343 M³**
APRIL	316 M³	466 M³	-1 50 M³	**194 M³**
MAY	81 M³	387 M³	-3 06 M³	**0 M³**
JUNE	43 M³	381 M³	-3 38 M³	**0 M³**
JULY	19 M³	381 M³	-3 63 M³	**0 M³**
AUGUST	37 M³	387 M³	-3 50 M³	**0 M³**
SEPTEMBER	136 M³	466 M³	-3 30 M³	**0 M³**
OCTOBER	440 M³	562 M³	-1 21 M³	**0 M³**
NOVEMBER	608 M³	550 M³	57 M³	**57 M³**
DECEMBER	682 M³	562 M³	120 M³	**178 M³**
YEAR	**9 974 M³ (TOTAL)**	**5 794 M³ (TOTAL)**	16 14 M³	

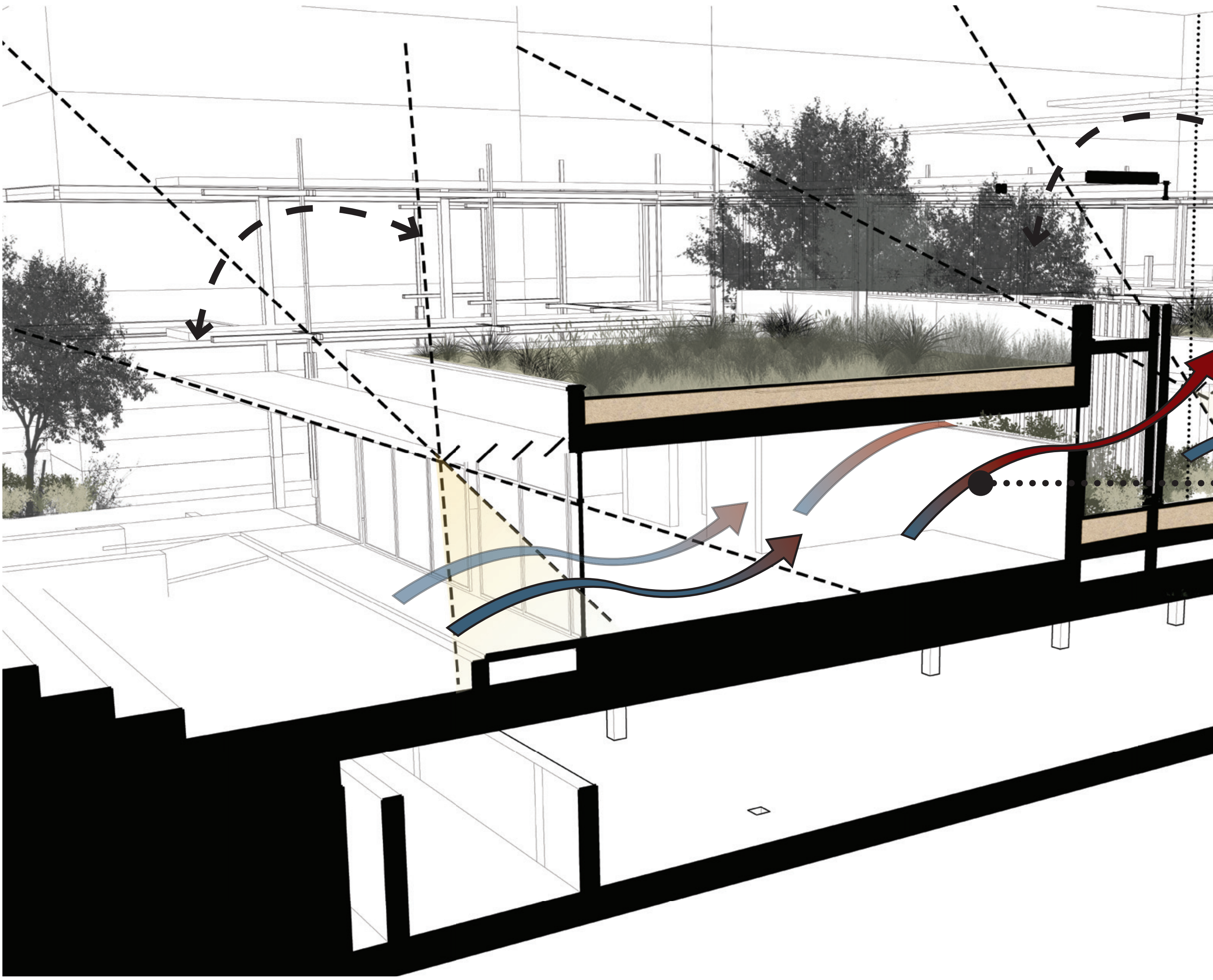
GREATEST VOLUME OF WATER IN TANK/RESERVOIR AT ANY TIME IS THE MINIMUM CAPACITY OF THE TANK	**459 M³**

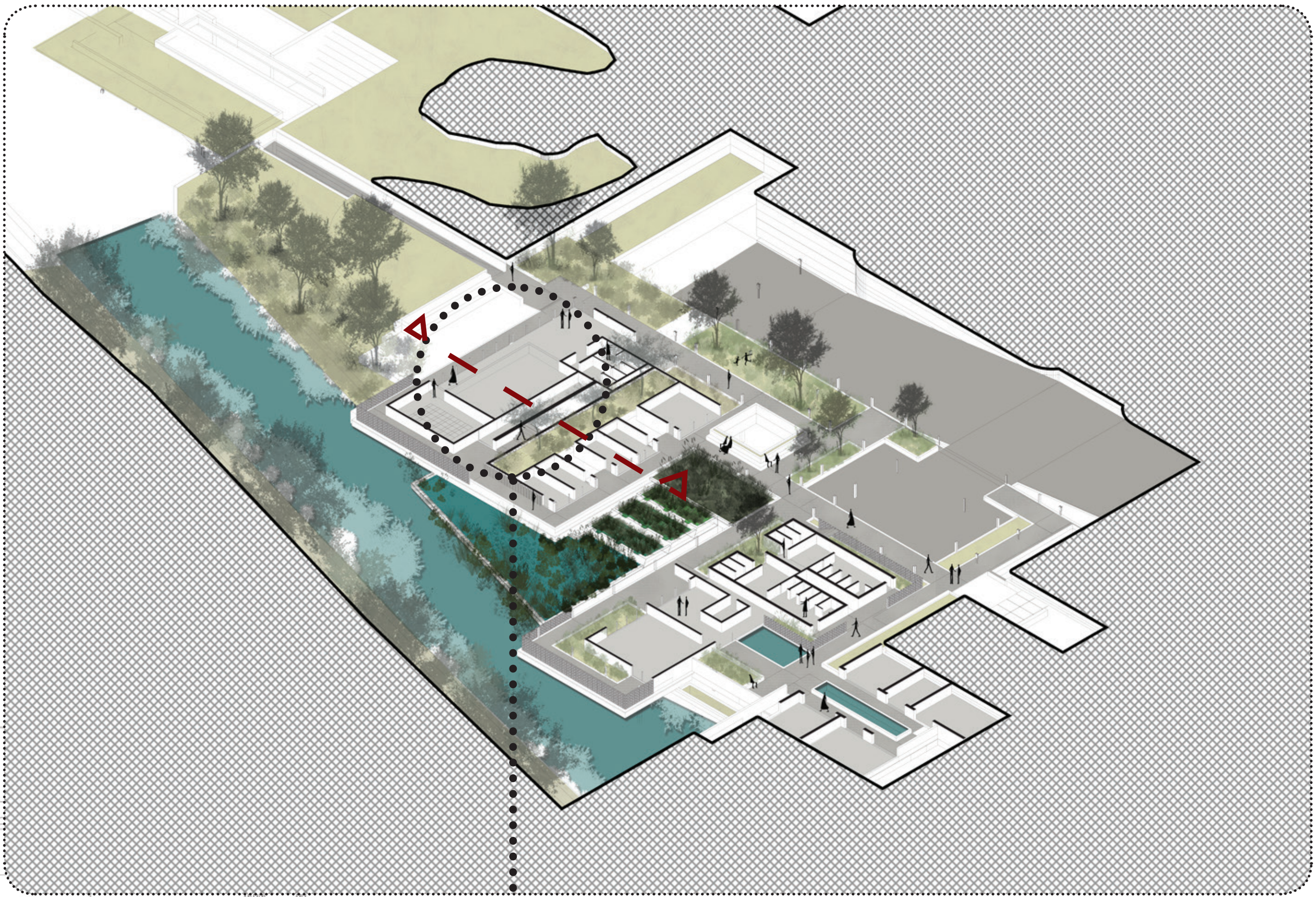
SAFETY FACTOR:	**1,5**	**FINAL TANK/RESERVOIR**	**689 M³**
PROPRIETORY TANK VOLUME: (E.G. JOJO TANKS)	**1 000 L 1 M³**	**NUMBER OF TANKS NEEDED**	**690**



Environment – Daylighting

As a response to optimise daylighting in all the spaces, all buidlings have been rotated to a north-south orientation. In the entrepreneurial training building, the depth of the spaces became an issue as they were too deep for natural light to penetrate. The floorplate had to be divided up with a courtyard to allow soft southern light to illuminate the seminar room. In both the seminar and studio spaces, overhangs and louvres are used to block harsh and direct sunlight. Through the use of the courtyard, the connection with the natural landscape is further enhanced by planting plants.





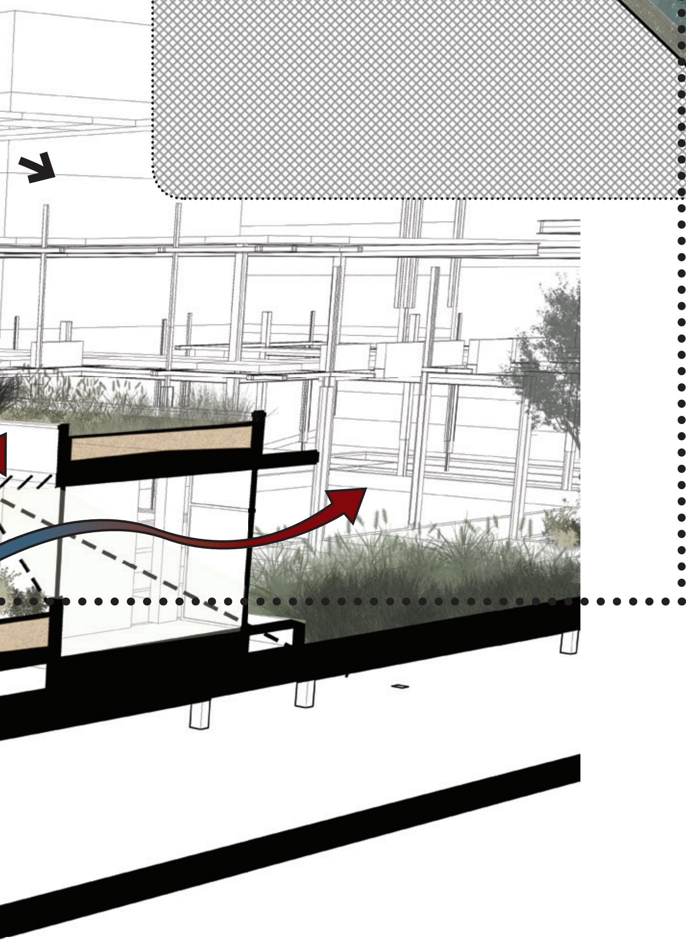


Figure 8.12: Top right: daylighting section position (Author 2019)

Figure 8.13: Bottom left: Section F - daylighting (Author 2019)

Ventilation (Passive thermal heating/ cooling)

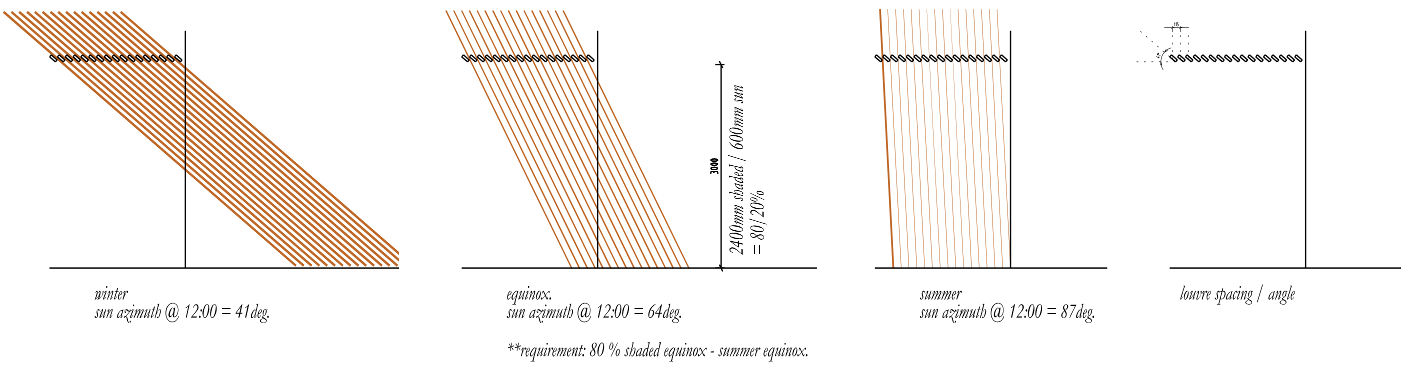
The combination of low occupancy at a time and a small building width (8,7m), the seminar room and studio spaces will make use of cross ventilation to regulate the temperature on a warm day.

During colder months, passive heating will be used to warm up the room. Overhangs and shading devices are used to keep out the hot summer and spring sun, but allow for autumn and winter sun to penetrate into the rooms. Where necessary, the shading louvre's angle is at 66 degrees and spaced at an interval to allow for optimum sun in the colder months.

Where the building is exposed to harsh western sun, a brise soleil brick and concrete screens are used to block most direct sunlight out.

Figure 8.14: Top: Sectional perspective of studio louvers (Author 2019)

Figure 8.15: Bottom: Louvre design diagramme (Author 2019)



Seminar room

Iteration 1

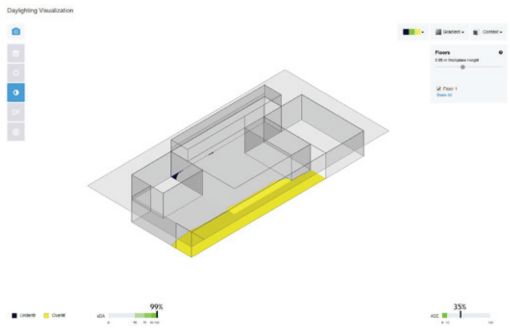


Figure 8.16: Seminar sDA iteration 1

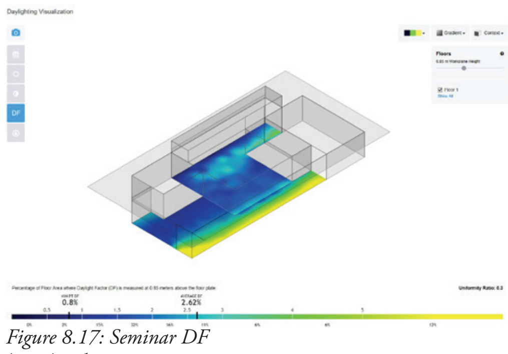


Figure 8.17: Seminar DF iteration 1

Iteration 2

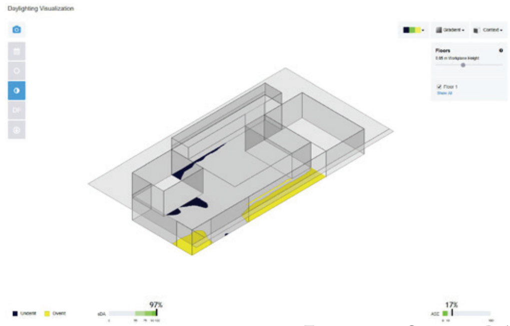


Figure 8.18: Seminar sDA iteration 2

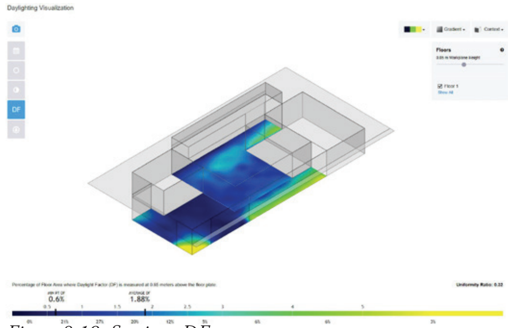


Figure 8.19: Seminar DF iteration 2

Iteration 3

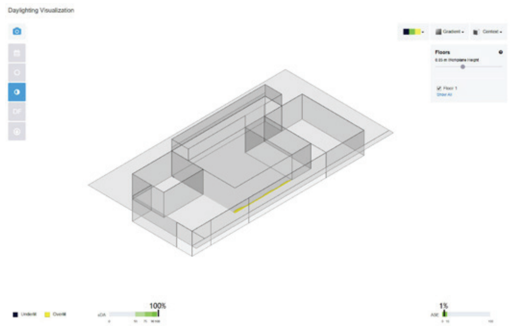


Figure 8.20: Seminar sDA iteration 3

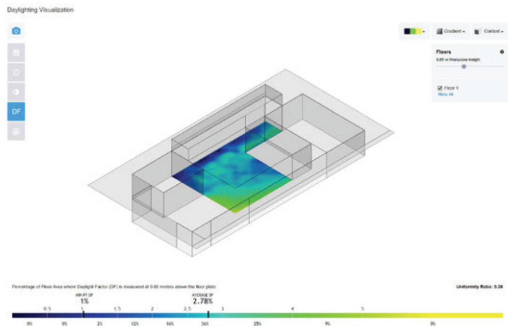


Figure 8.21: Seminar DF iteration 3

Studios

Iteration 1

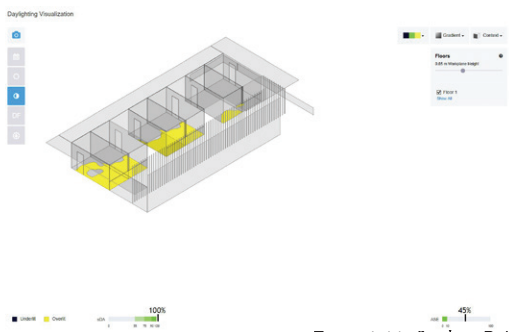


Figure 8.22: Studios sDA iteration 1

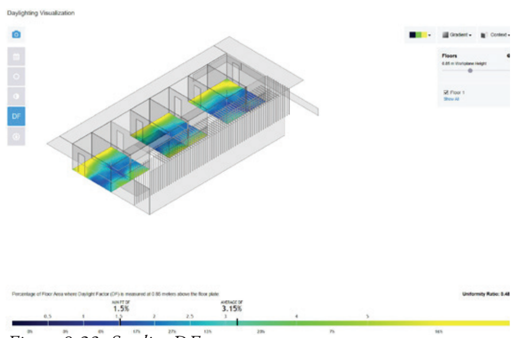


Figure 8.23: Studios DF iteration 1

Iteration 2

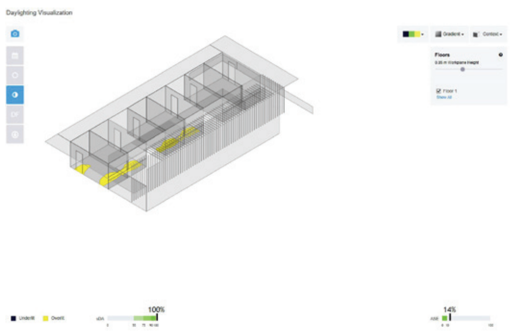


Figure 8.24: Studios sDA iteration 2

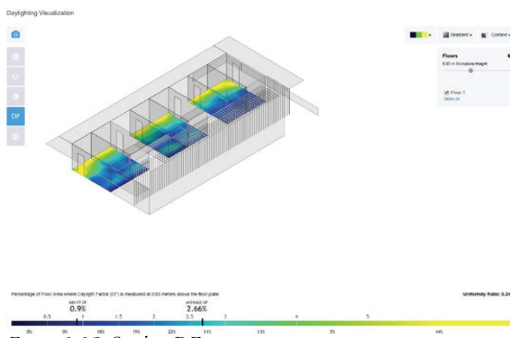
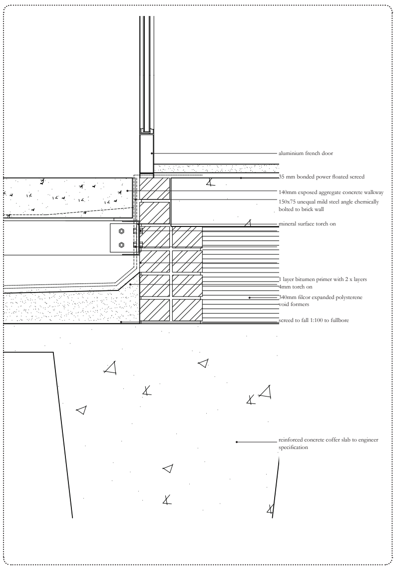


Figure 8.25: Studios DF iteration 2

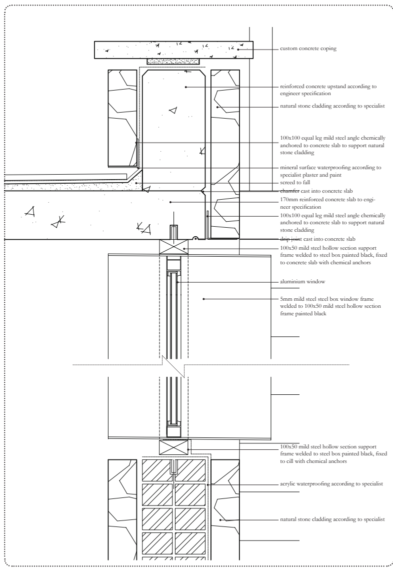
Figure 8.26: Detail A - Floor (Author 2019)

Figure 8.30: Bottom: Section C - 1:20 (Author 2019)

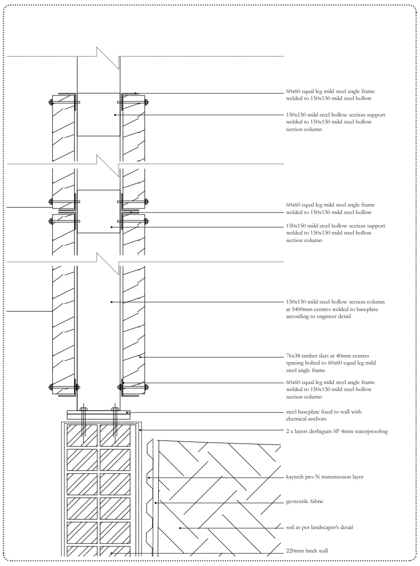


DETAIL A - FLOOR
- Scale 1:5 -

Figure 8.27: Detail B - Window (Author 2019)



DETAIL B - WINDOW
- Scale 1:5 -



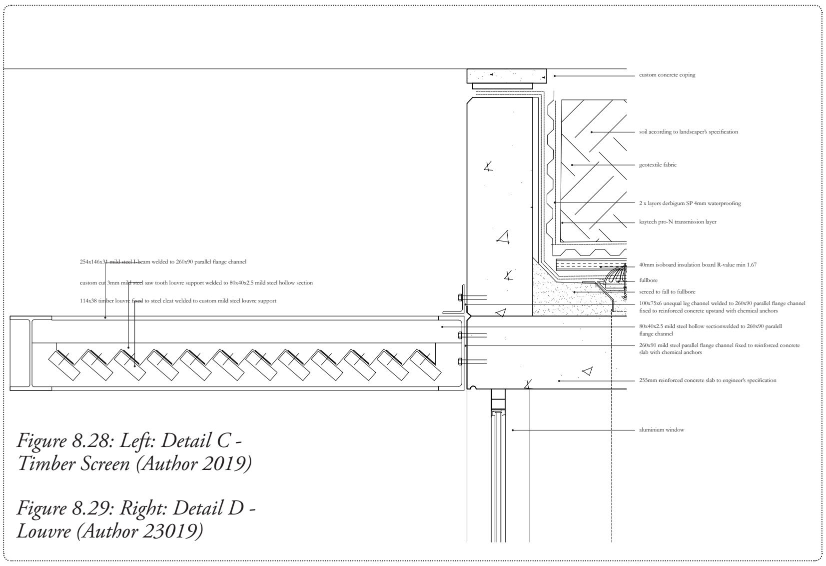
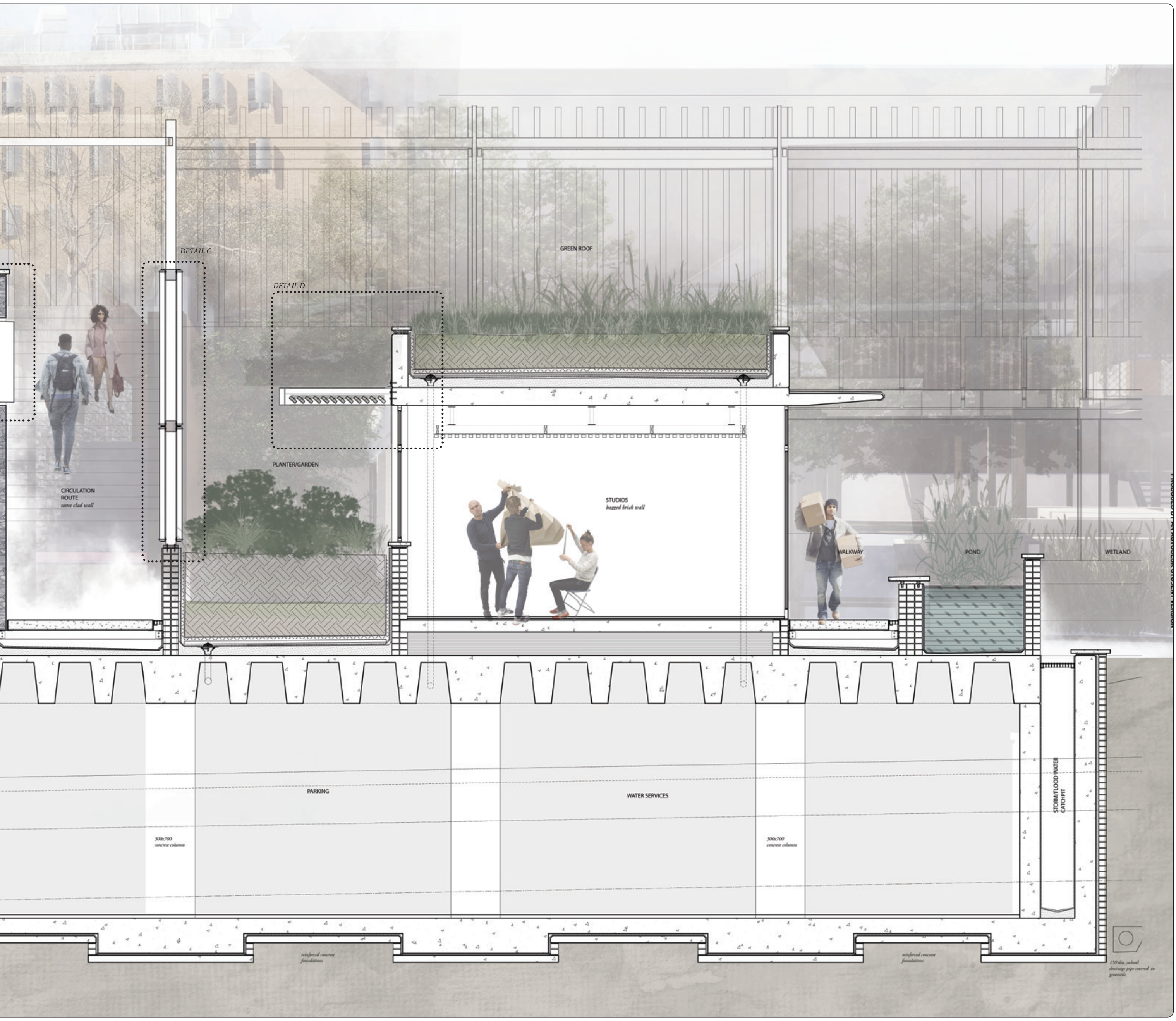


Figure 8.28: Left: Detail C - Timber Screen (Author 2019)

Figure 8.29: Right: Detail D - Louvre (Author 23019)

DETAIL C - BALUSTRADE + SCREEN
- Scale 1:5 -

DETAIL D - LOUVRE + TYPICAL GREEN ROOF
- Scale 1:5 -



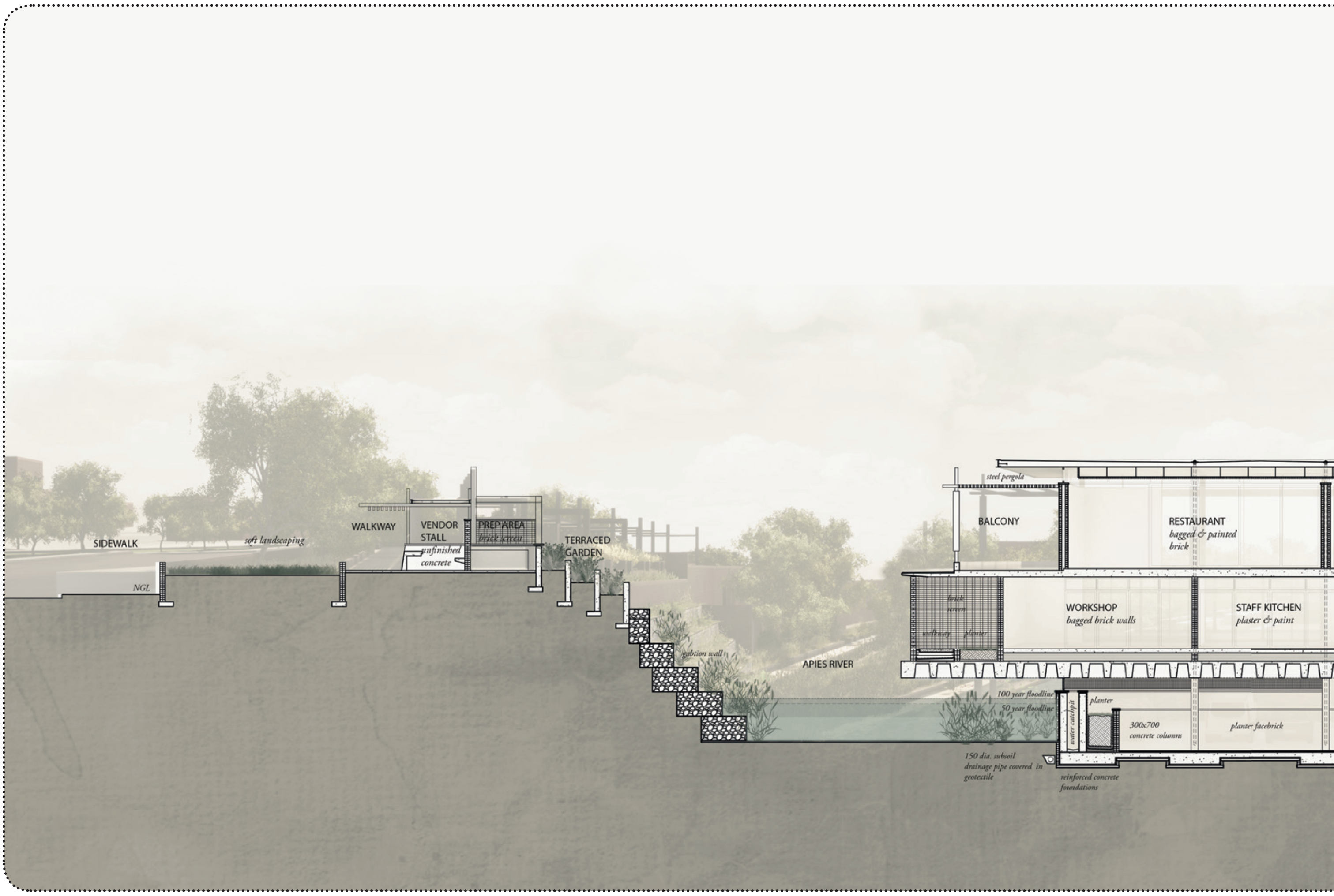
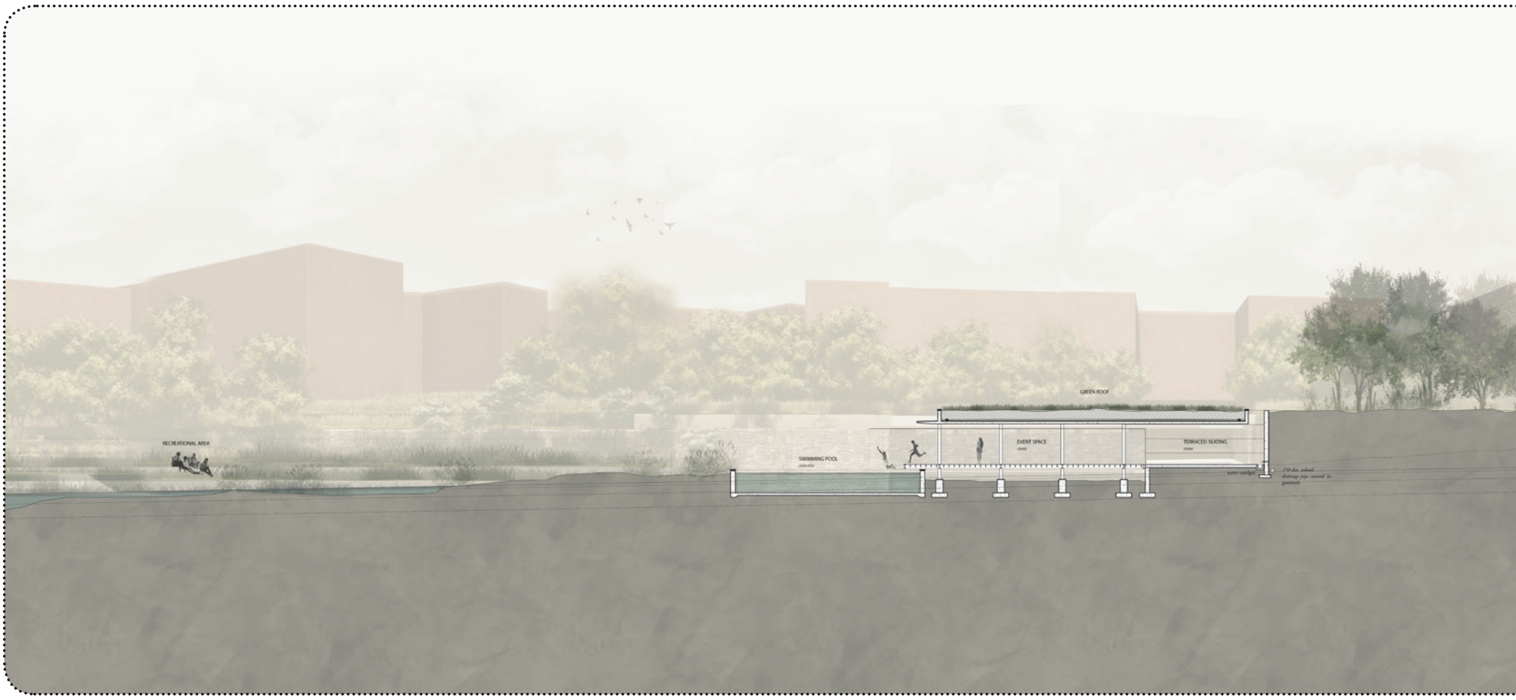
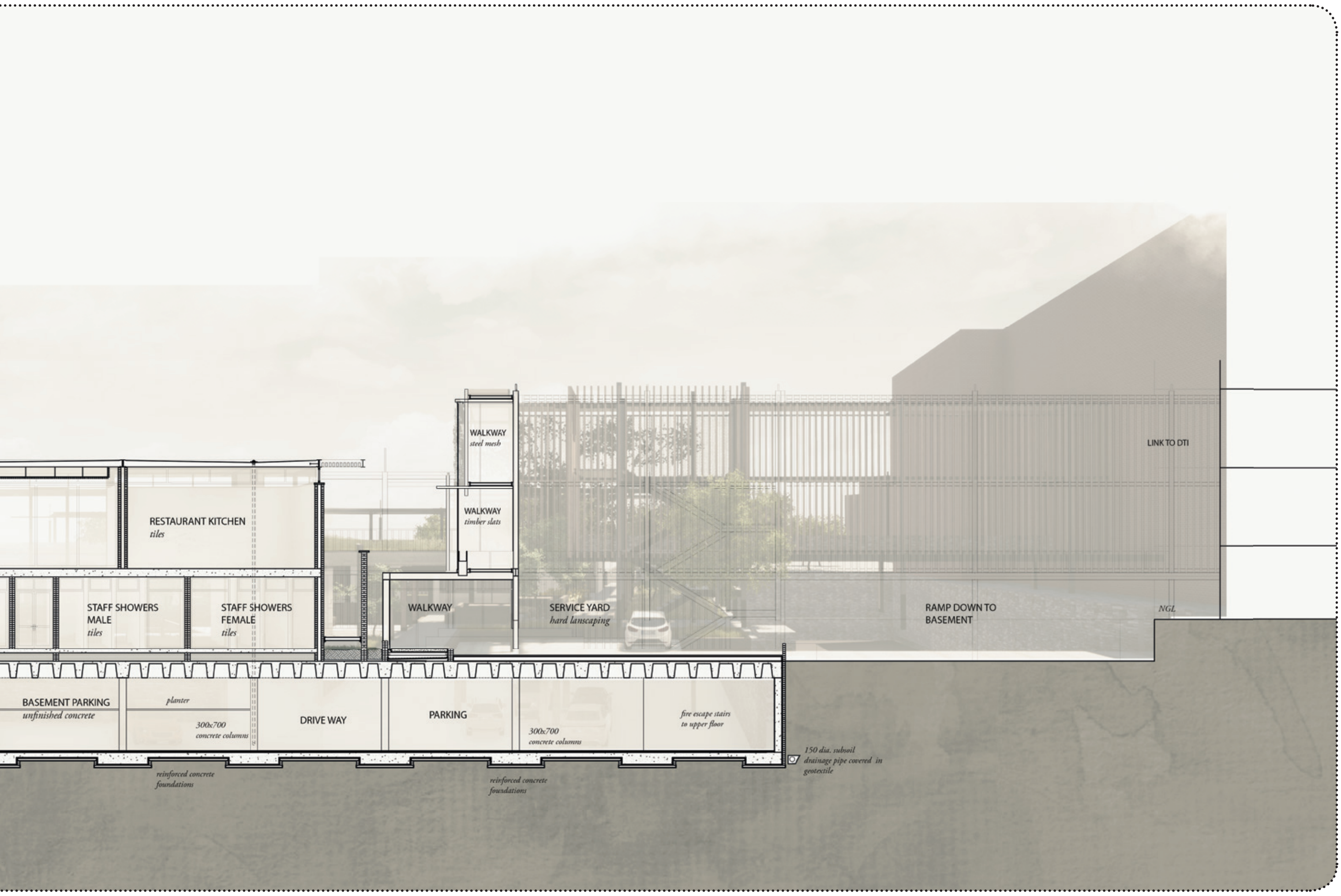


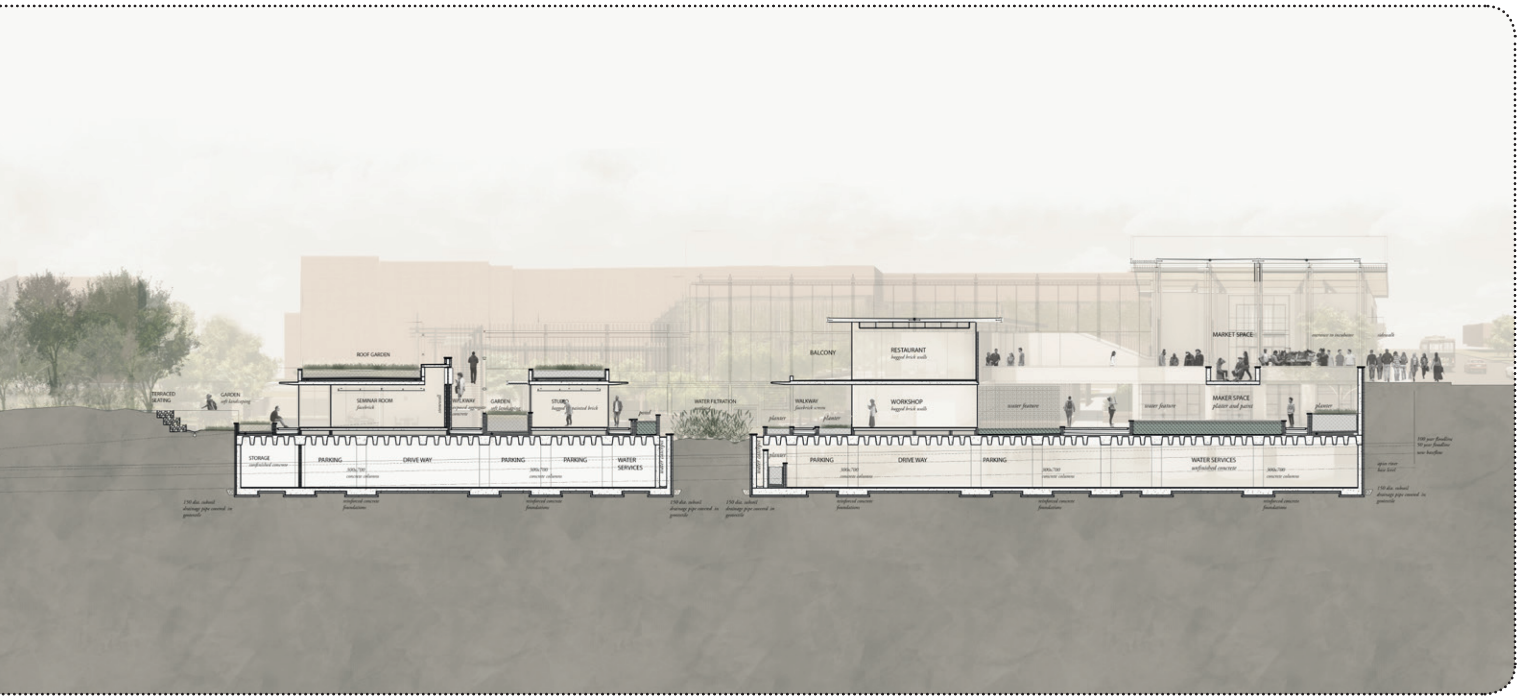
Figure 8.31: Top: Section B - 1:100 (Author 2019)

Figure 8.32: Bottom: Section A - 1:100 (Author 2019)





LATERAL SECTION BB - NTS



LONGITUDINAL SECTION AA - NTS

Final Model

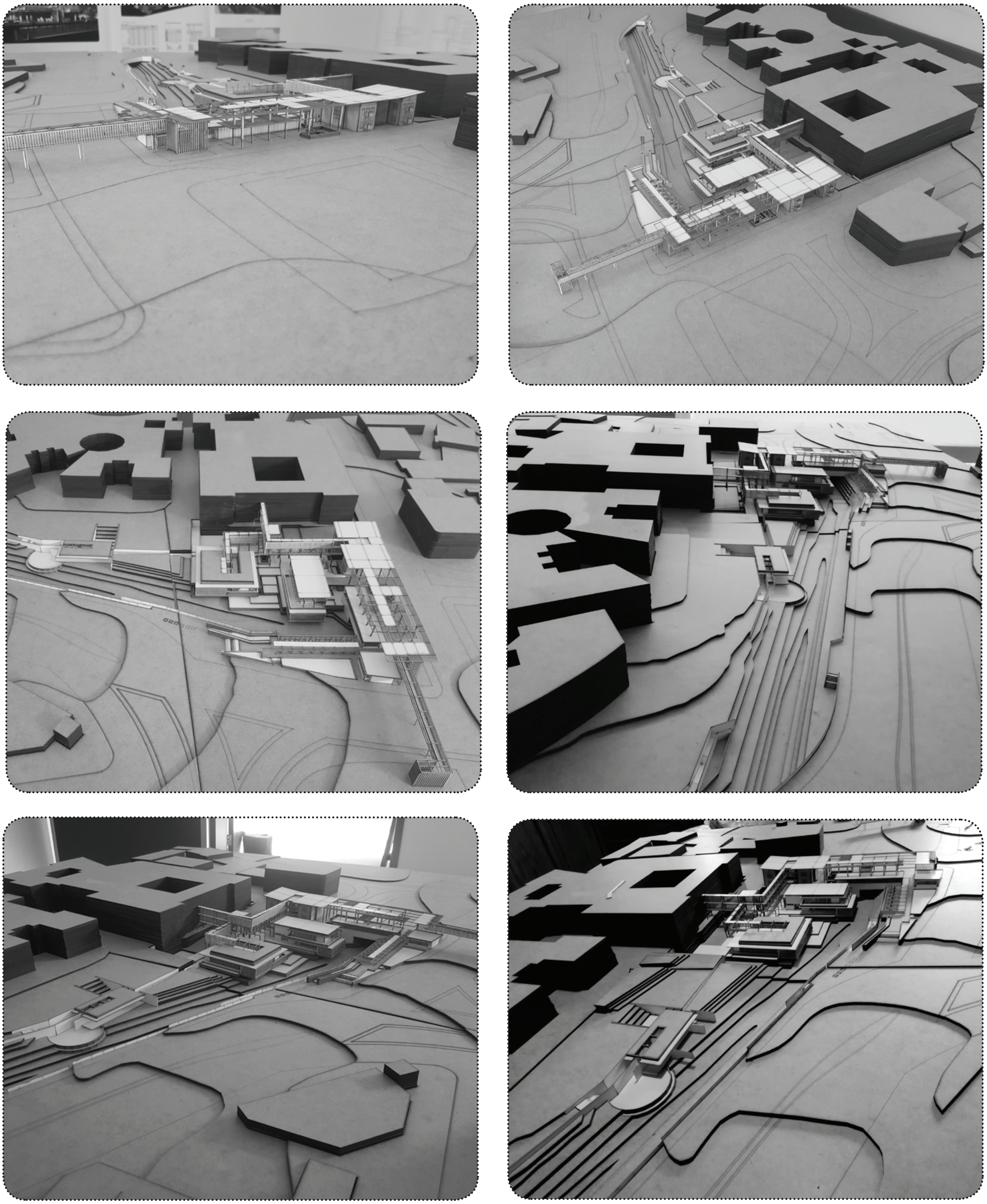


Figure 8.33: Photos by R Minnaar (edited by Author 2019)

Figure 8.34: Photos by R Minnaar (edited by Author 2019)