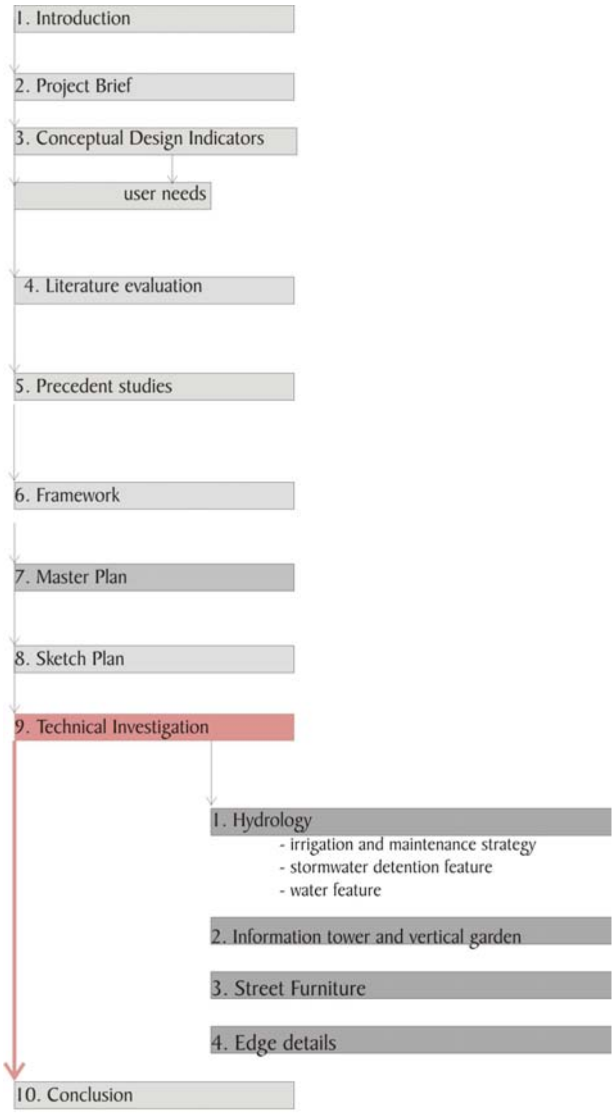

1. Introduction
2. Project Brief
3. Conceptual Design Indicators
user needs
4. Literature evaluation
5. Precedent studies
6. Framework
7. Master Plan
8. Sketch Plan
9. Technical Investigation
1. Hydrology
- irrigation and maintenance strategy
- stormwater detention feature
- water feature
2. Information tower and vertical garden
3. Street Furniture
4. Edge details
10. Conclusion

9. TECHNICAL INVESTIGATION

The technical investigation will be discussed along the following categories:

1. Hydrology and systems
   - Maintenance strategy
   - Stormwater detention facility
   - Water feature
2. Vertical garden and kiosk
3. Street furniture
4. Edge details

9.1 Hydrology

The hydrology consists of three systems:

1. The retention of stormwater for irrigational purposes (Refer to Master Plan)
2. Stormwater dentention structures that double up as sunken seating areas (in Dr. Savage Plaza)
3. Water feature (Dr. Savage Plaza)

9.1.1 Irrigation and maintenance strategy

The success of the open space system is closely related to adequate maintenance. The proposed spaces will require lots of water. Stormwater will be used to irrigate the site. The following options were considered:

- Detaining water as it enters the site and gravity feeding it towards the open spaces
- Treating the water in an open system while it filters through the site.
- Using the existing stormwater network and storing the water in low lying areas.

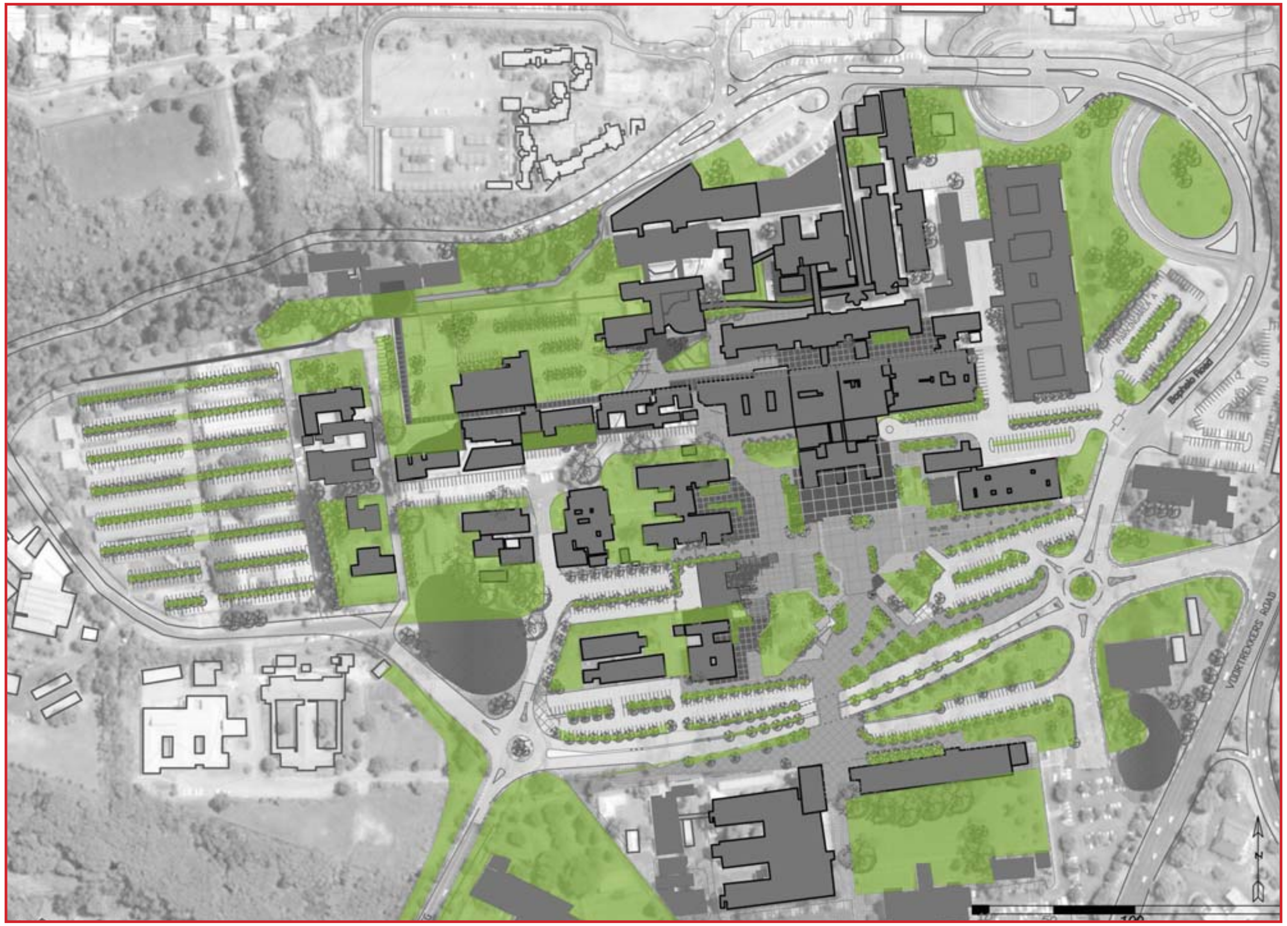


Fig. 9.1: Areas zoned in the restorative open space framework which would require water for irrigational purposes. (Author, 2008)

The third option was identified as the most feasible for the site. To determine if enough water would be available, the process below was followed:

1. Determining the catchment areas.
2. Determining the amount of water needed for irrigation purposes per time period ,per catchment area. (based on type of coverage and average water requirement of 25mm per week).
3. Determining the amount of water available per catchment area.
4. Compile a monthly balance sheet of the water available.

From the above steps of the process, it was determined that two irrigation dams should be adequate for the storage of water. The dams should be located close to the lowest point of the main stormwater pipe, and preferably on under-utilised land.

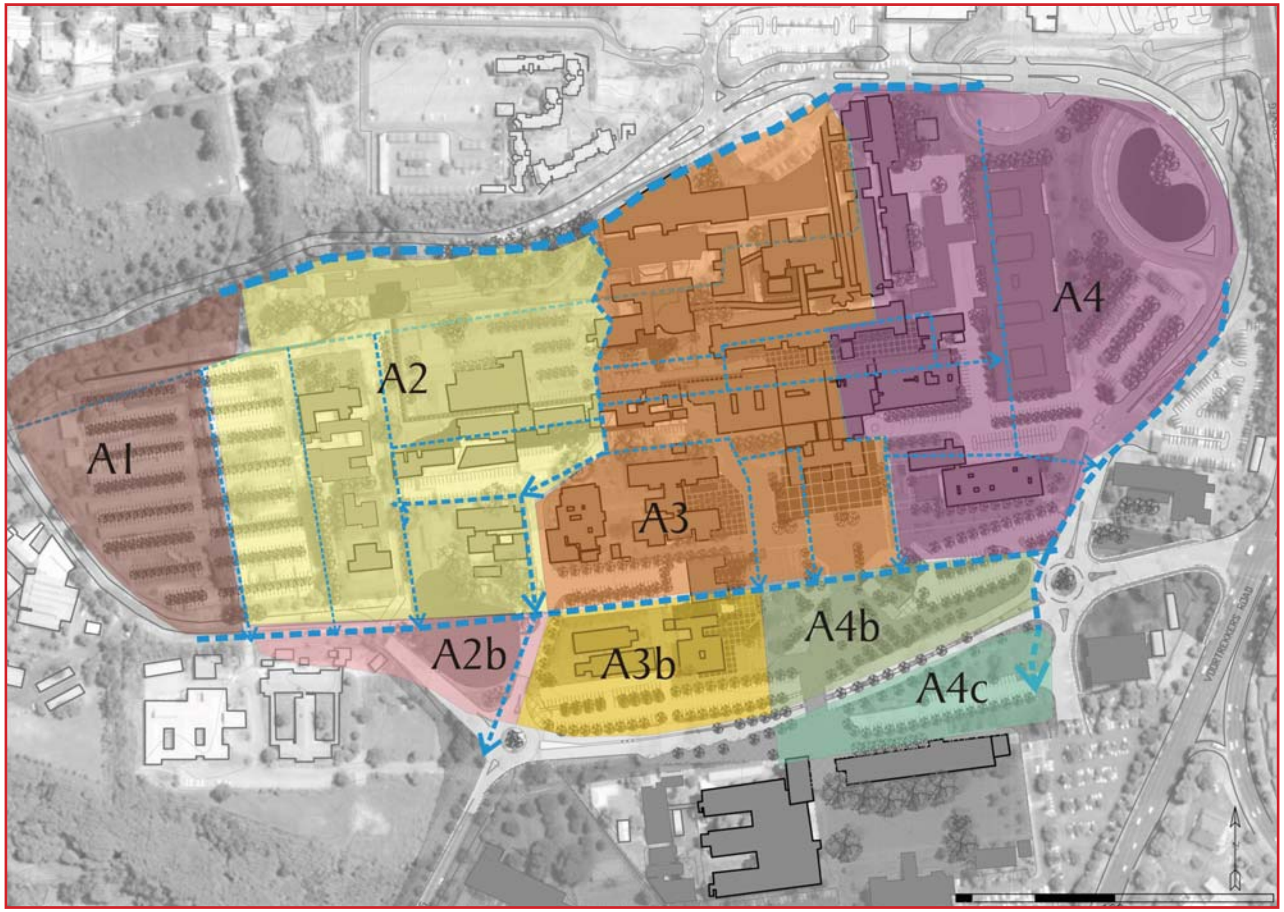


Fig.9.2: Existing Stormwater drainage network and catchment areas. (Author, 2008)

Dam	Catchments	Combined areas	Area to be irrigated	Volume needed per week	Volume needed per month	Volume need per year	Volume need per day m3
Dam 1	A1 + A2	78089	11638	131.5	1260	15129	41.6
Dam 2	A3 + A4 + A4b	125911	12542	335.7	1342	16297	44.6

Table 2: Water requirements for maintenance strategy (Author, 2008)

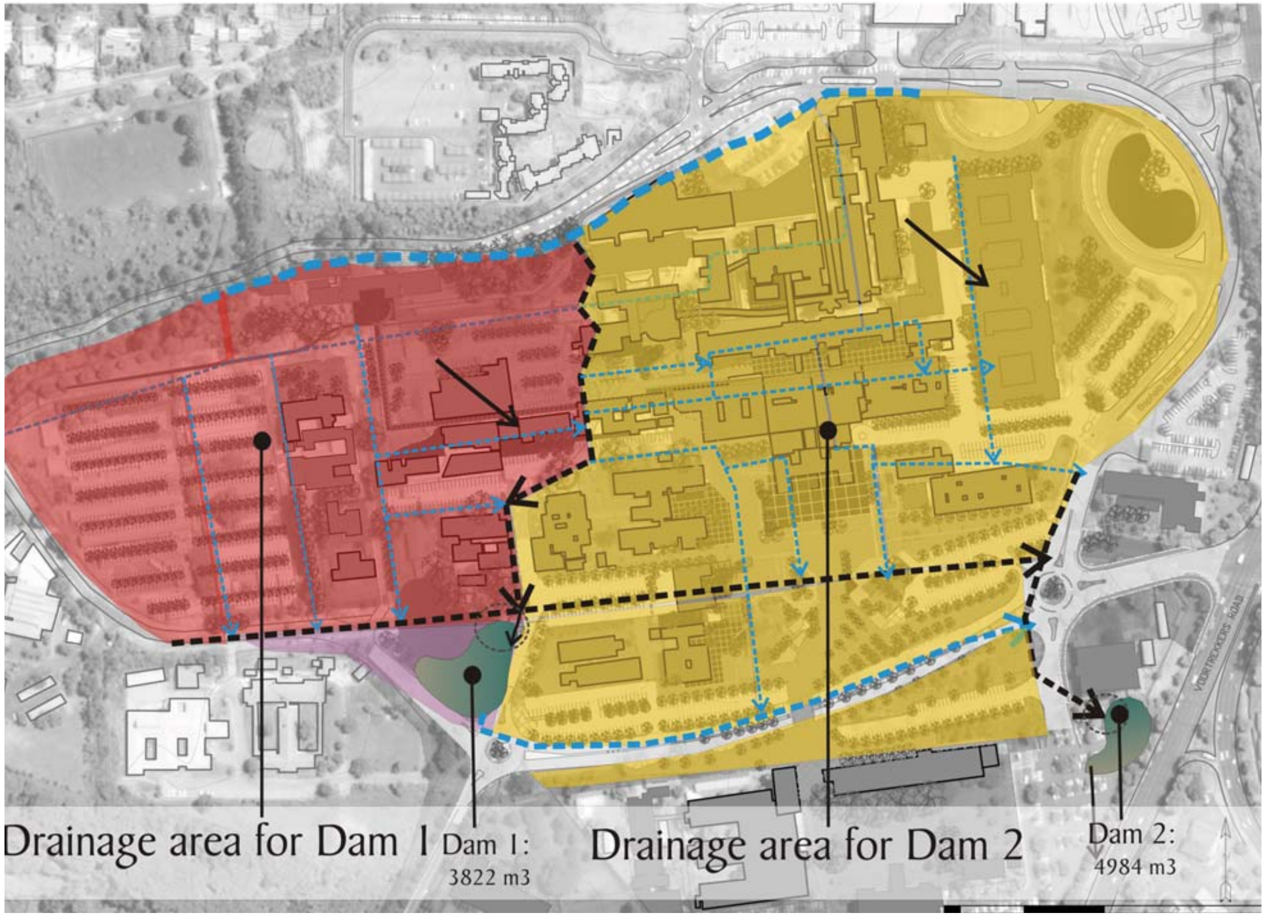


Fig.9.3: Existing Location of dams with associated catchment regions (Author, 2008)

In order to determine the volume of the respective dams, the following steps were taken:

1. Determining the combined catchment area for each dam.
2. Assuming a surface area for the dam.
3. Determining the rainfall spread. The mean annual precipitation for the sub-catchment area is 683mm. The inflow for the dam was calculated by determining the rainfall spread per month (rain on the dam; and rain that enters the dam via stormwater system). The spread takes into account water losses due to evaporation.
4. Determining the extent of evaporation The mean annual evaporation (MAE) for the area is 1600mm and this was taken into account during calculations.
5. Determining the runoff factor, which is 0.85.
6. Determining abstraction/outflows This is based on the amount of water needed for the ring system per week.
7. Calculating the proposed volume is the amount of excess water that needs to be stored to ensure that there is always enough water during the drier seasons.
8. Designing ege details according to conditions. Edge details are dependant on the slope at which the stormwater

pipe system enters the dam area. The pipe cannot enter the dam at a level that is lower than the water level. This results in a large transitional area and gradual slope. Thus the maximum capacity which the dams have to provide for are as follows:

Dam 1 = 3822.7m3

Dam 2 = 4984 m3

Also refer to Table 2. p 143.

9.1.1 a) Irrigation system

The stormwater drainage network is used to convey the water to the low lying areas. Water enters each dam via a stormwater inlet. Water will be filtered and pumped through a series of alternating smaller closed ring systems. Each dam's ring systems is operated with one pump, seperated by a manifold and valve. With this strategy, a smaller pump can be used and maintenance of the system is easier. The system will, however, have many valves in different areas; so that overlapping systems can be used optimally. This means that all ring systems will not neccessarily commence at the pump chamber, a section of one ring can be used reach another ring system.

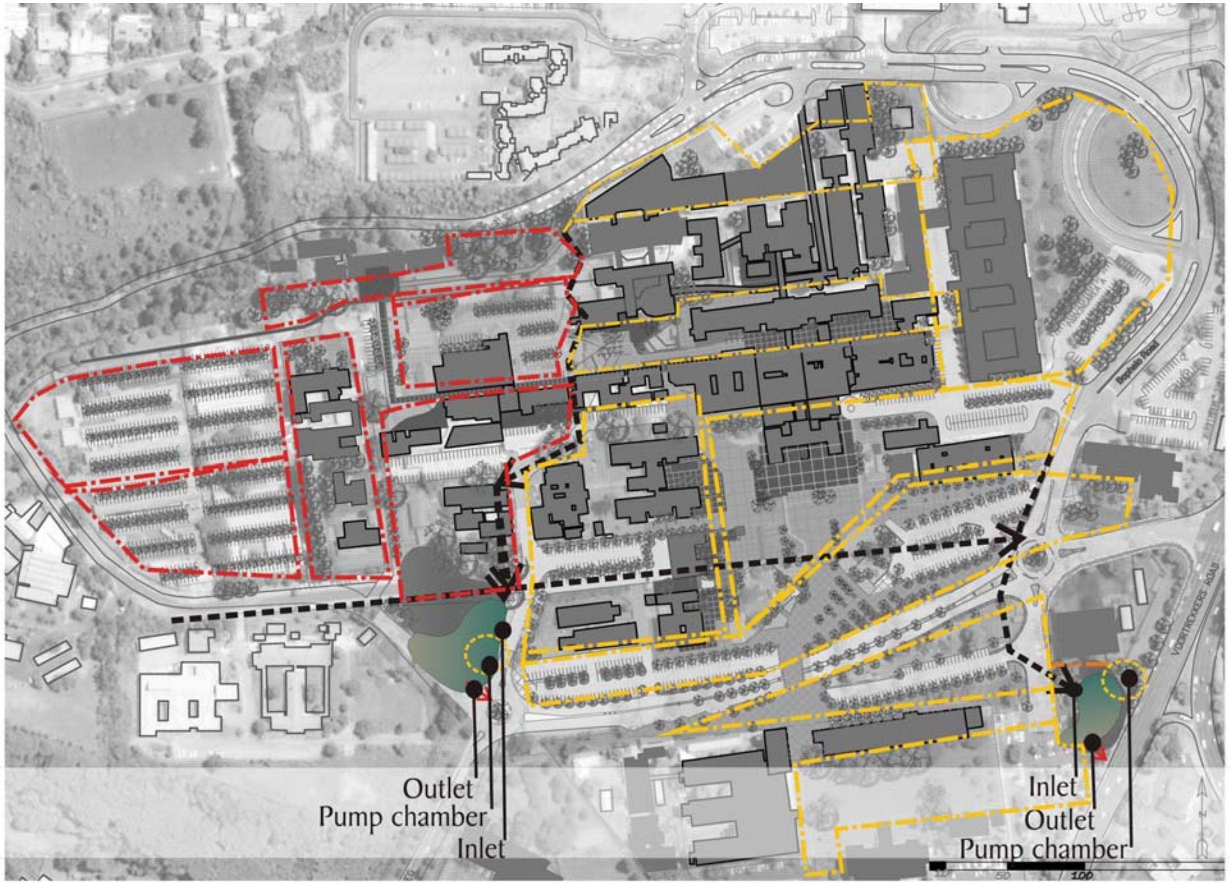


Fig. 9.4: Conceptual placement of irrigation zones . These should be connected through a series of valves to the pump and to other rings to form a network of overlapping ring systems. (Author, 2008)

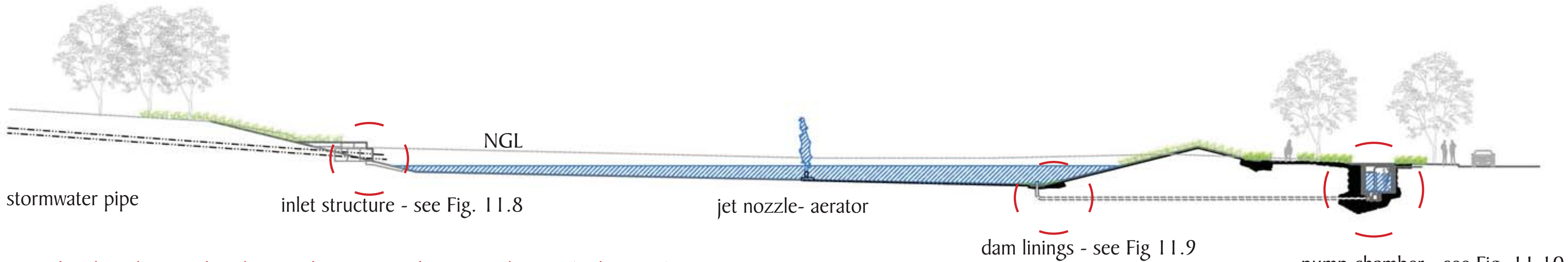


Fig. 9.5: Typical north-south section through Dam 1 during spring and autumn. Scale 1:500 (Author, 2008)

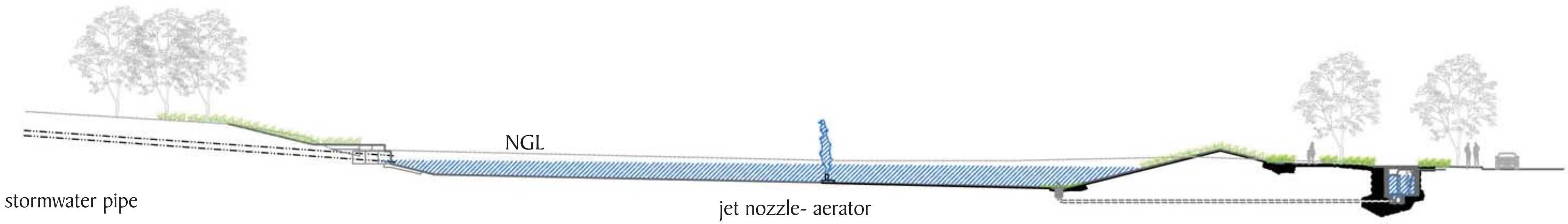


Fig. 9.6: Typical north-south section through Dam 1 during summer. Scale 1:500 (Author, 2008)

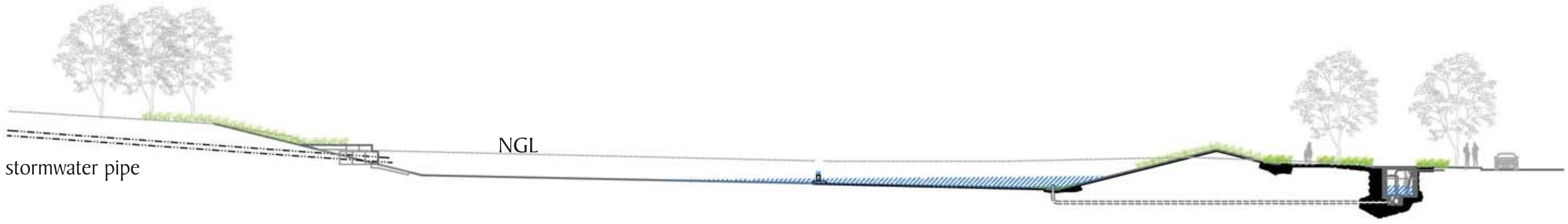


Fig. 9.7: Typical north-south section through Dam 1 during winter. Scale 1:500 (Author, 2008)

9.1.1b) Inflow and outflow

Although the dams were designed to accomodate all the stormwater that the network could contain up to the point of inlet into the dam, each dam should also have an overflow structure to deal with excess water in case of emergency. Such an overflow structure should be located at a high point in the dam wall and be connected to the main stormwater network downstream of the dam. The overflow structure was not detailed.

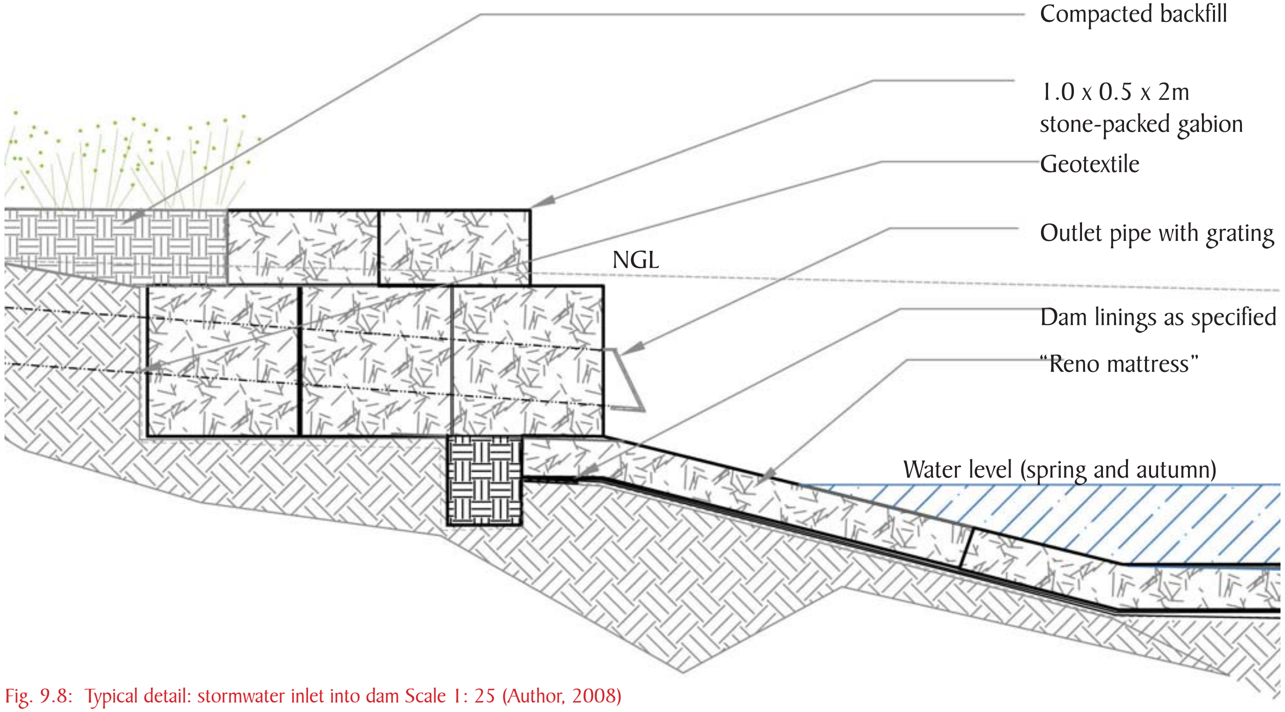
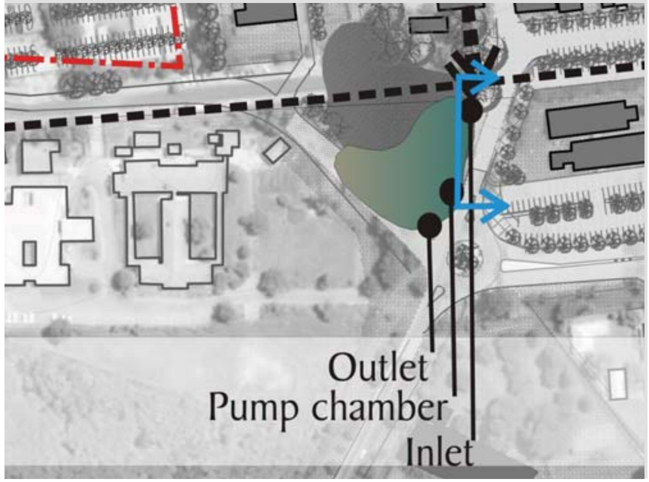


Fig. 9.8: Typical detail: stormwater inlet into dam Scale 1: 25 (Author, 2008)



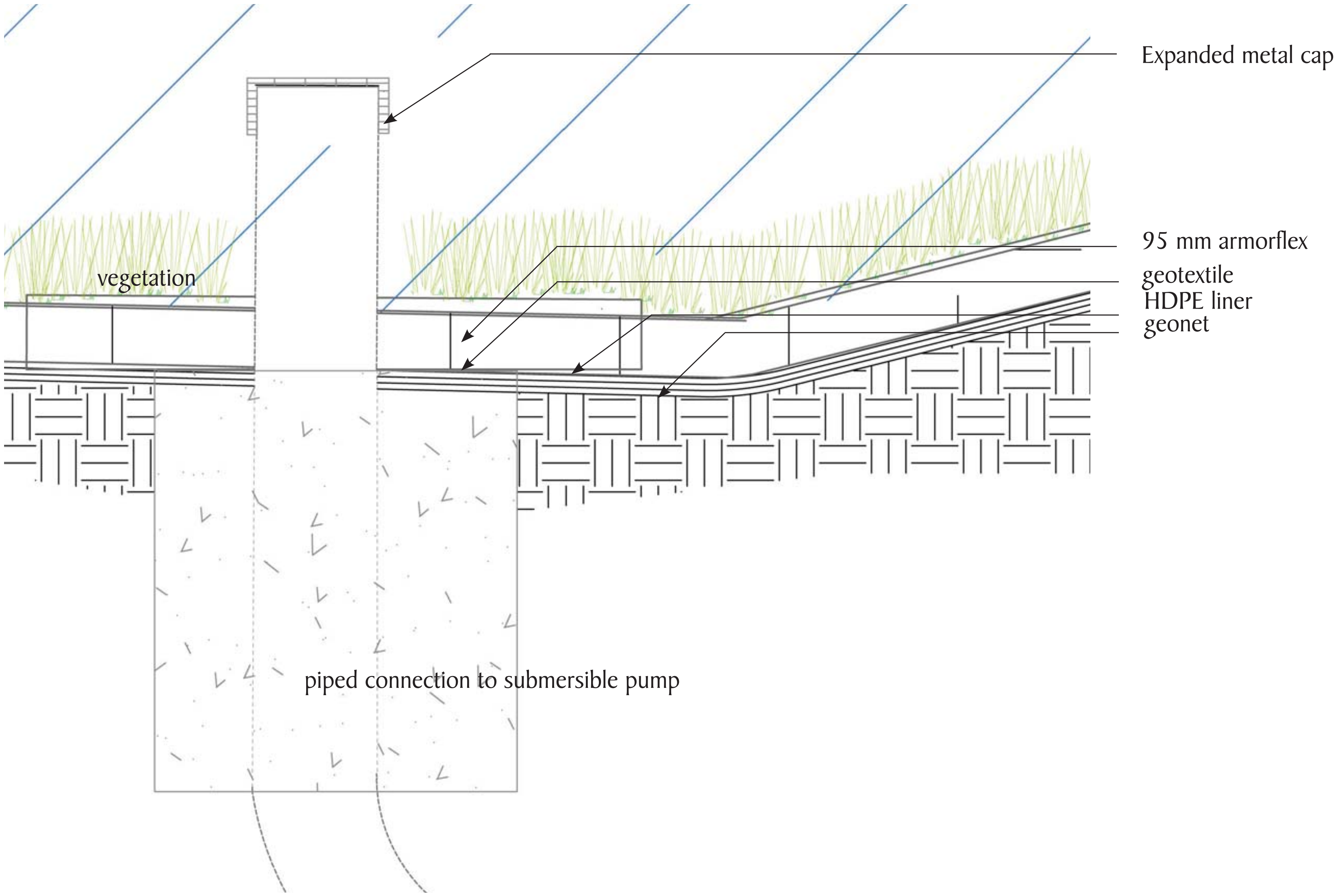


Fig. 9.9: Section through dam linings Scale 1:10 (Author, 2008)

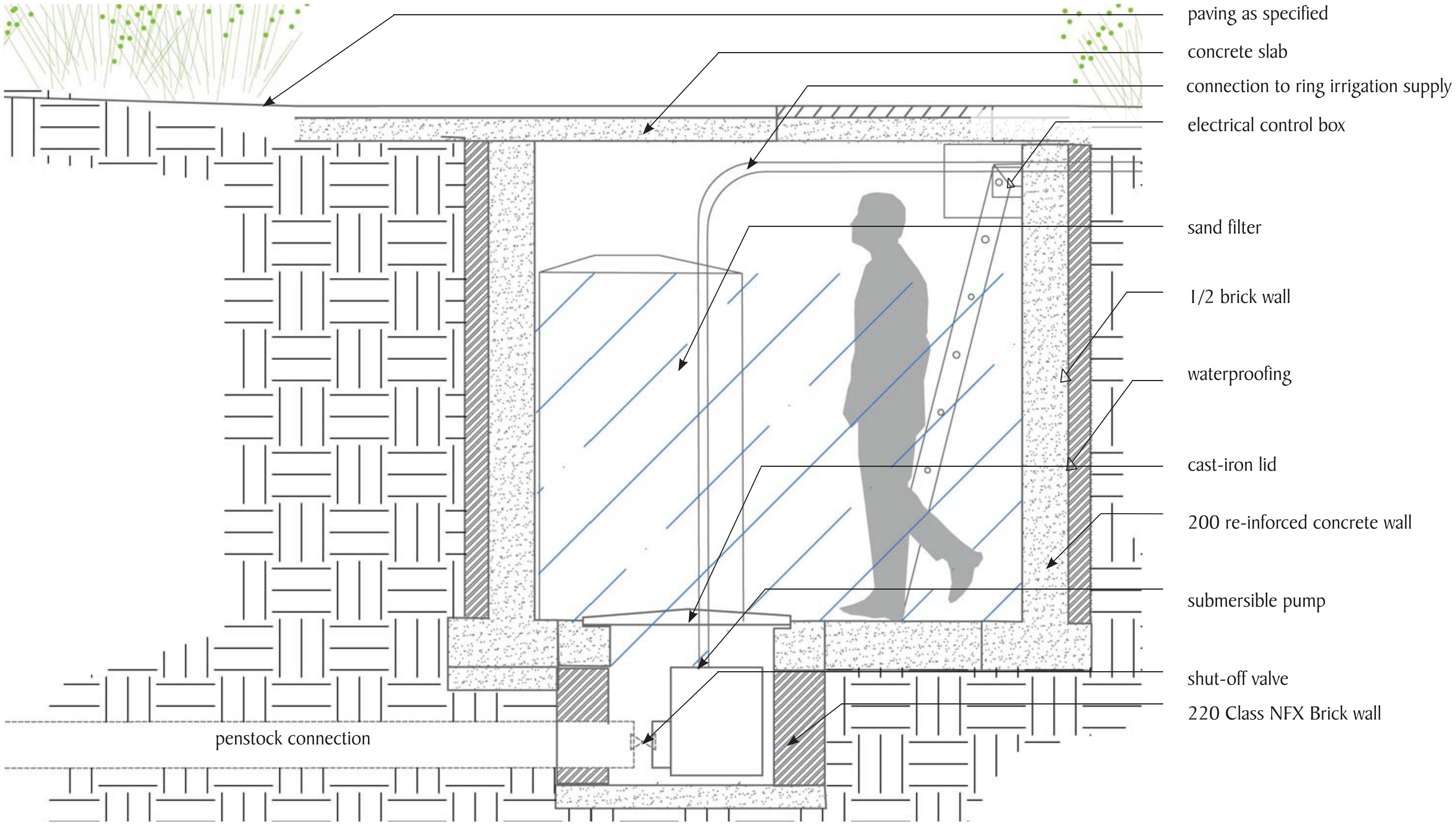


Fig. 9.10: Section through pump chamber. Scale 1: 25 (Author, 2008)

9.1.2 Stormwater detention feature

Sunken seating areas act as a stormwater dentention features during the rainy season. Rainwater is channelled in furrows towards beds of crushed rock. The water drains through the medium and through the wire mesh and steel structure packed with crushed rock. Infiltration is prevented through an impermeable poly-olephyn layer. Water trickles slowly through the wall, over the little weir and into the channel that slopes at 4 % towards a series of sunken areas. The system is conceptually divided into three parts:

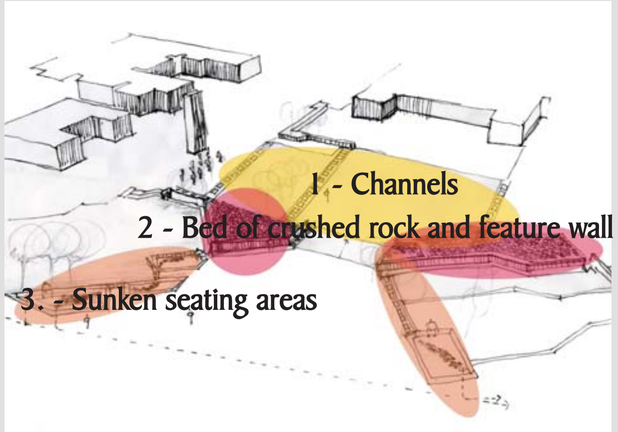


Fig. 9.11 Components of the stormwater detemtion system. (Author, 2008)

1. Channels
- The size of the channels was determined and verified using the Manning equation.
- The time of concentration (Tc) for water reaching the bed of crushed rock was determined with the Kirpich formula: 3.7 minutes
- Q = 0.013m3/s

2. Bed of crushed rock and feature wall
- The depth of the bed is related to the maximum level difference which could be achieved between the upper and the lower terrace.

3. Sunken seating areas/detention structures
- The sunken area is graded to form a slight channel that flows from one detention facility towards the next. A drain is located on the highest point of the lowest step of the sunken seating area to cut-off excess water, from where it enters the existing stormwater system.
- Surface characteristics of the sunken seating areas were chosen to present different effects according to different amounts of rainfall.

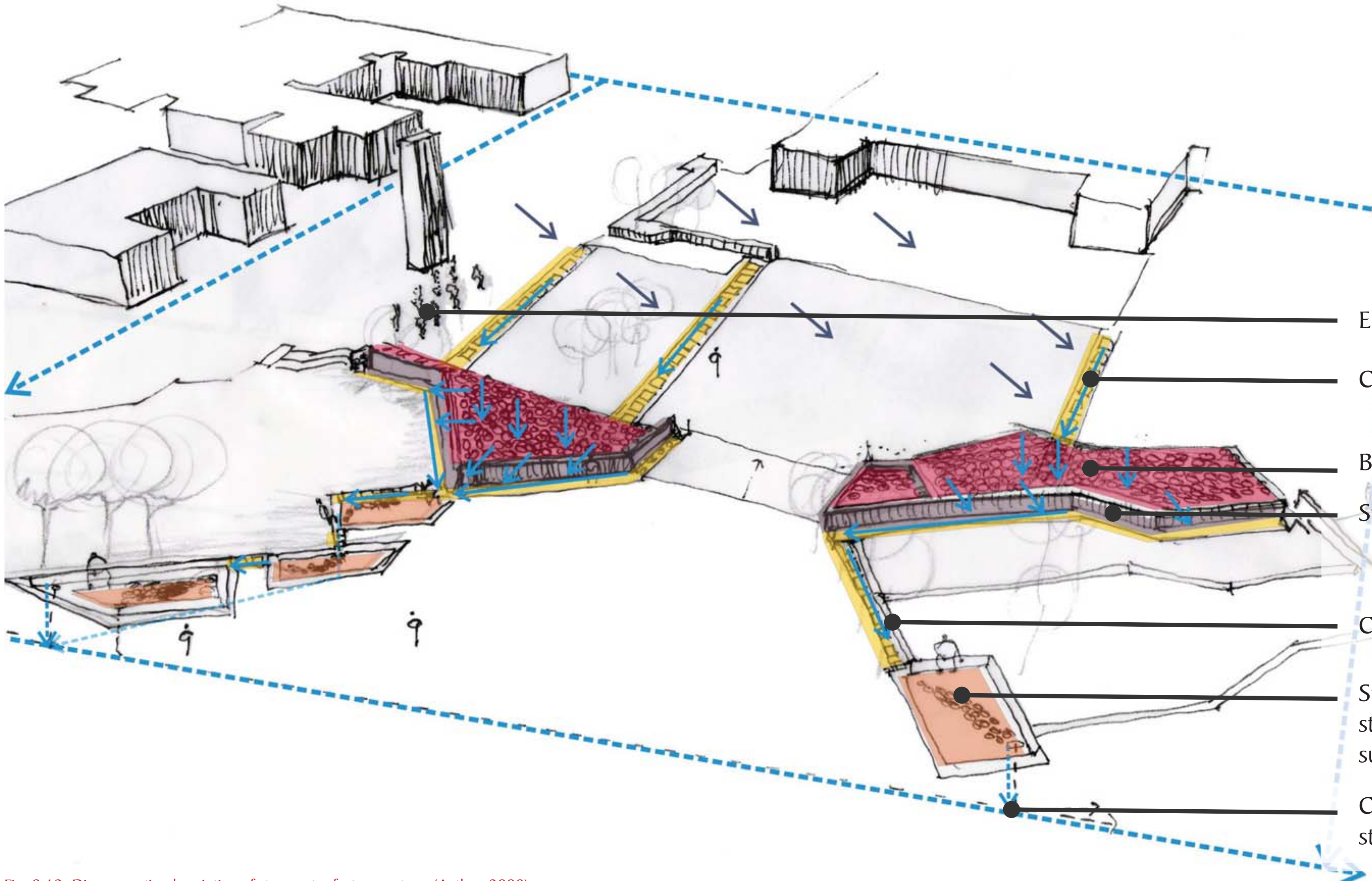


Fig. 9.12: Diagrammatic description of stormwater feature-system. (Author, 2008)

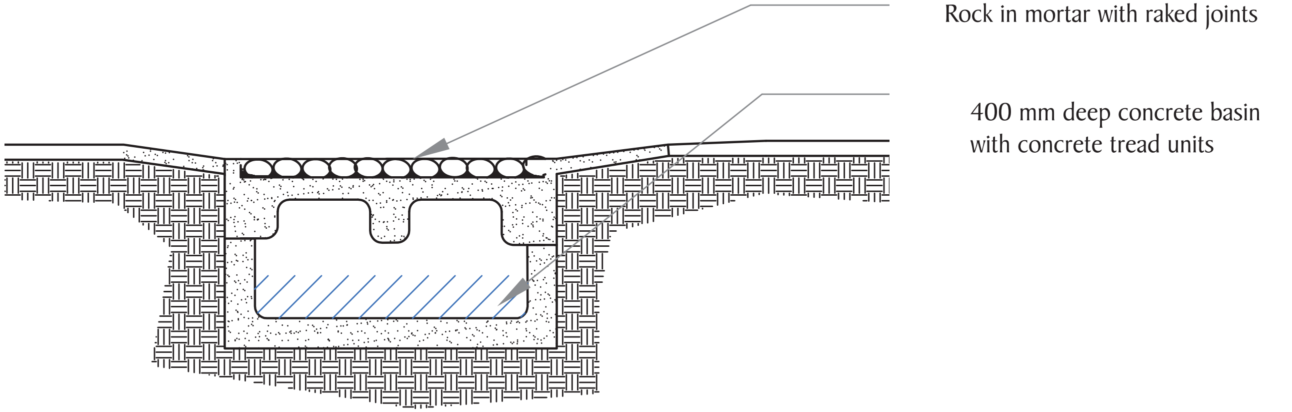
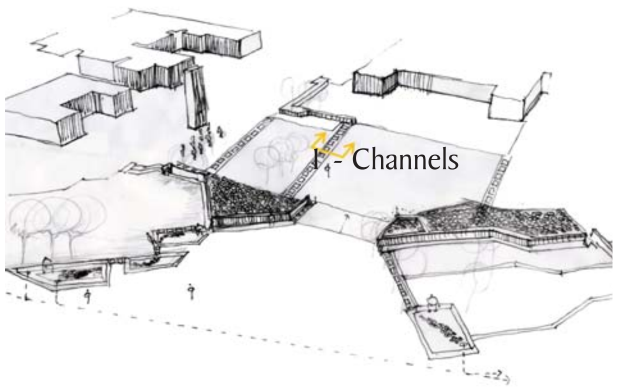


Fig. 9.13: Typical section of drainage channels toward stormwater feature. (Author, 2008) Scale 1: 25



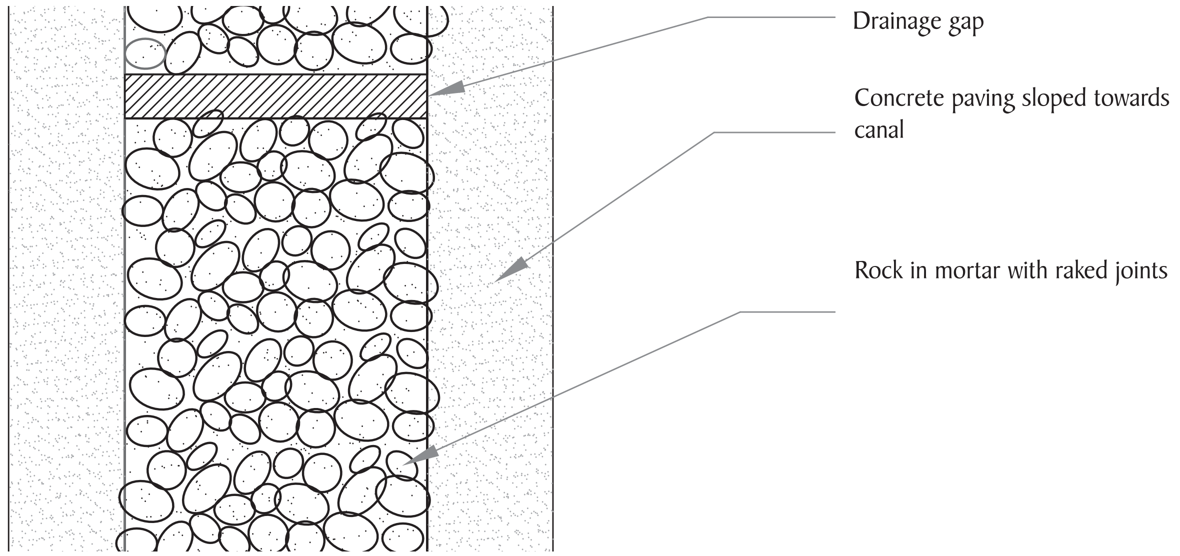
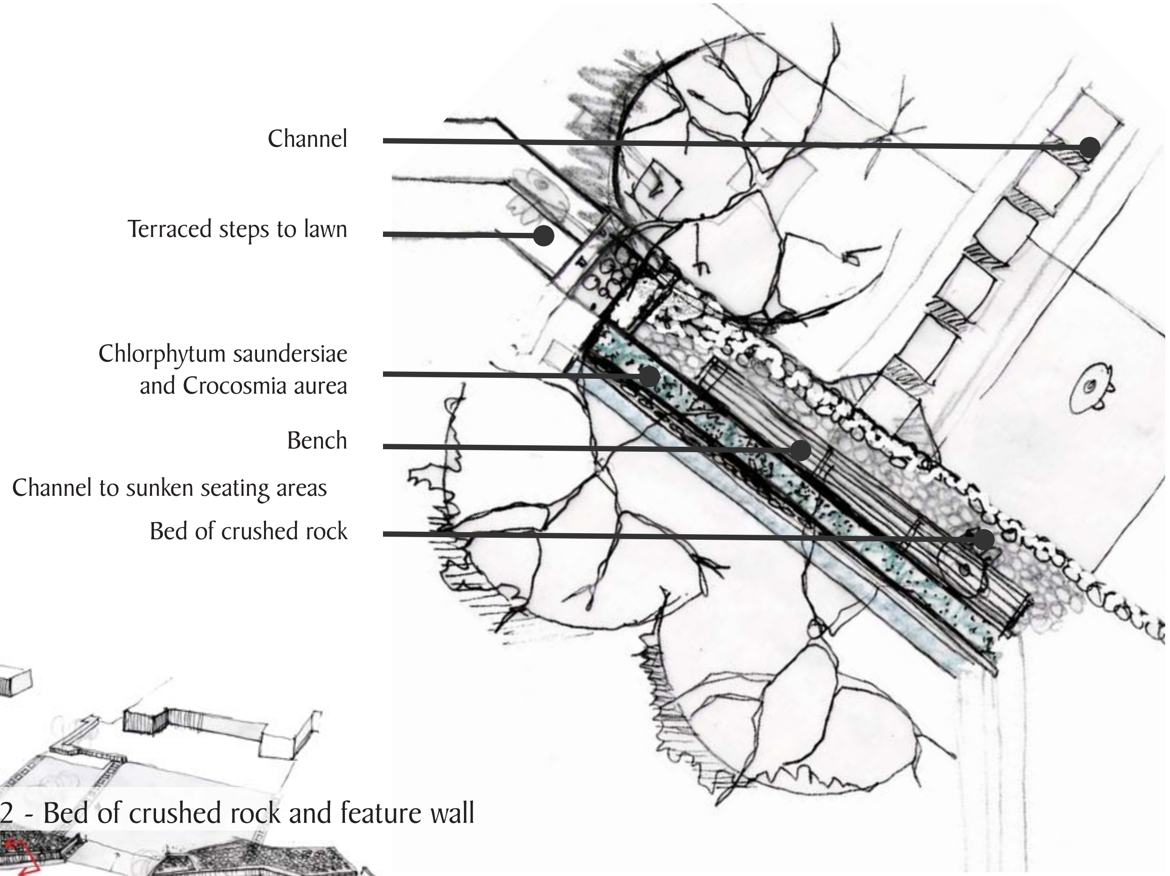


Fig. 9.14: Plan of drainage channels toward stormwater feature. (Author, 2008) Scale 1: 25



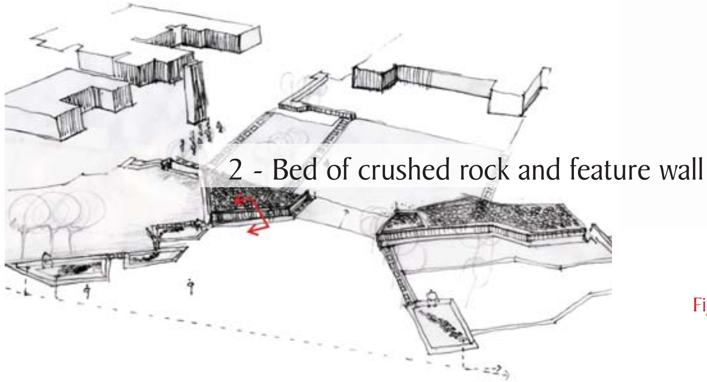


Fig. 9.15: Plan of the feature wall. (JAuthor, 2008)

Fig. 9.16: Rock-filled wiremesh and steel strcture. (Author, 2008)

Fig. 9.17: Stone clad walls and veldgrass. (JAuthor, 2008)

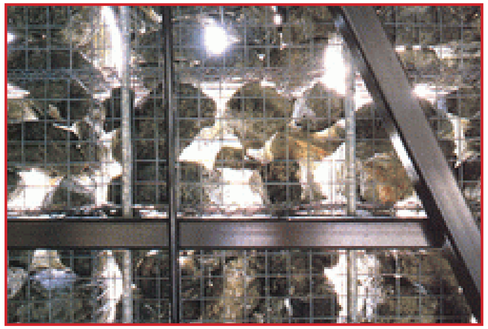


Fig. 9.18: Rock-filled wiremesh and steel strcture. (Asensio, 2005)

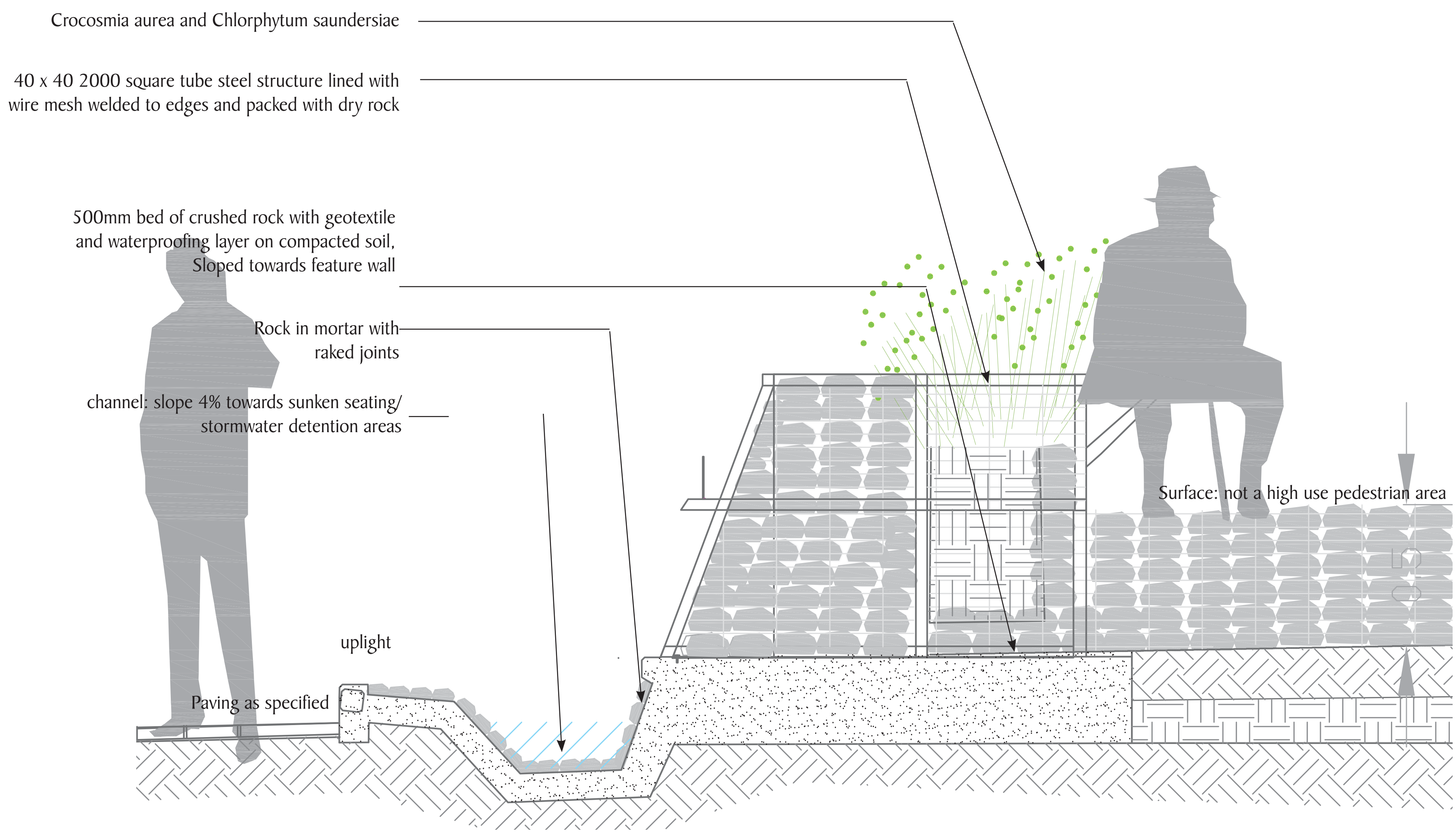


Fig. 9.19: Section through stone packed wire-mesh and steel structure: feature wall (Author, 2008) Scale 1: 20

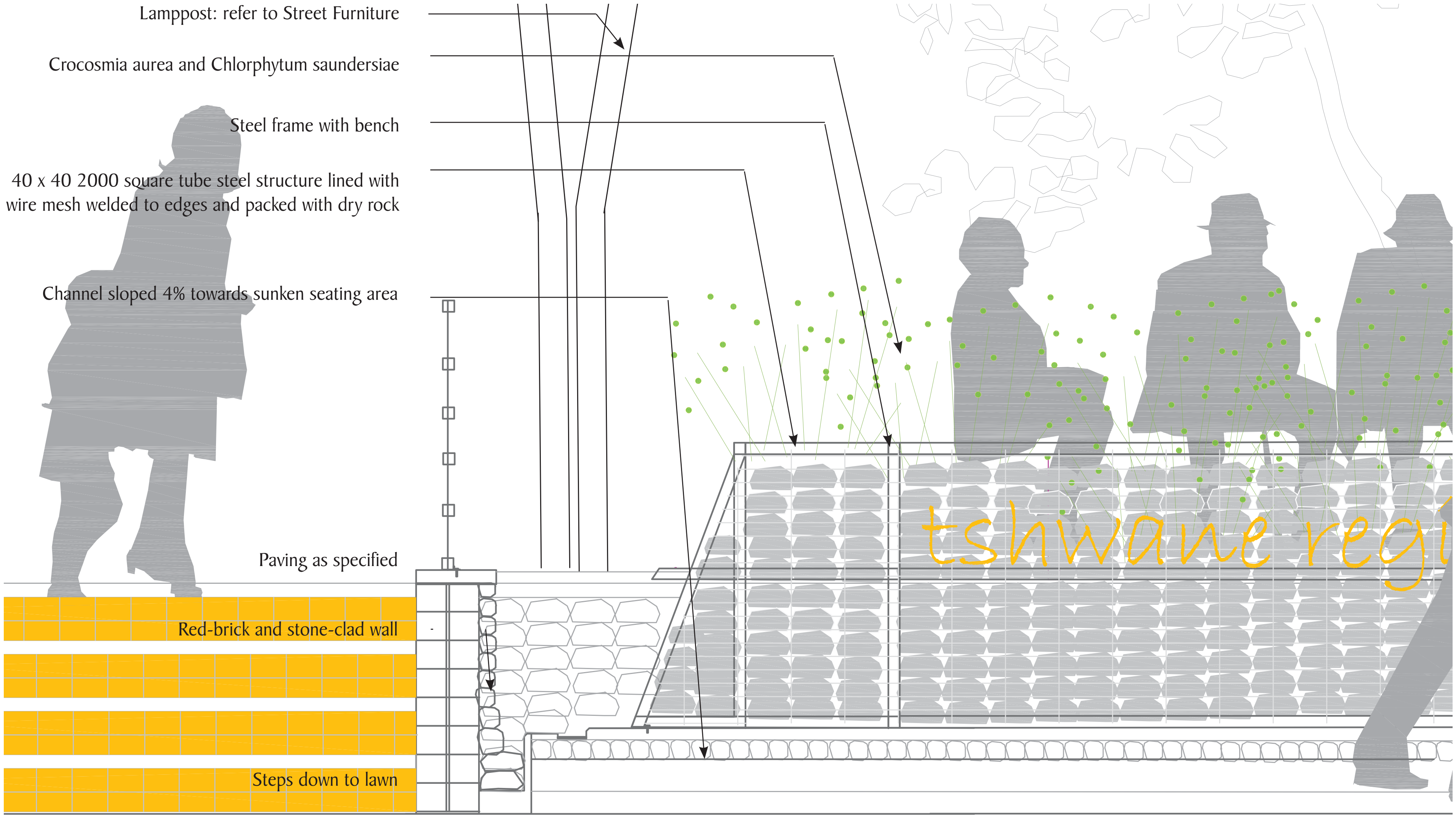


Fig. 9.20: Elevation of feature wall connection to walls, steps and ramps. (Author, 2008) Scale 1: 20

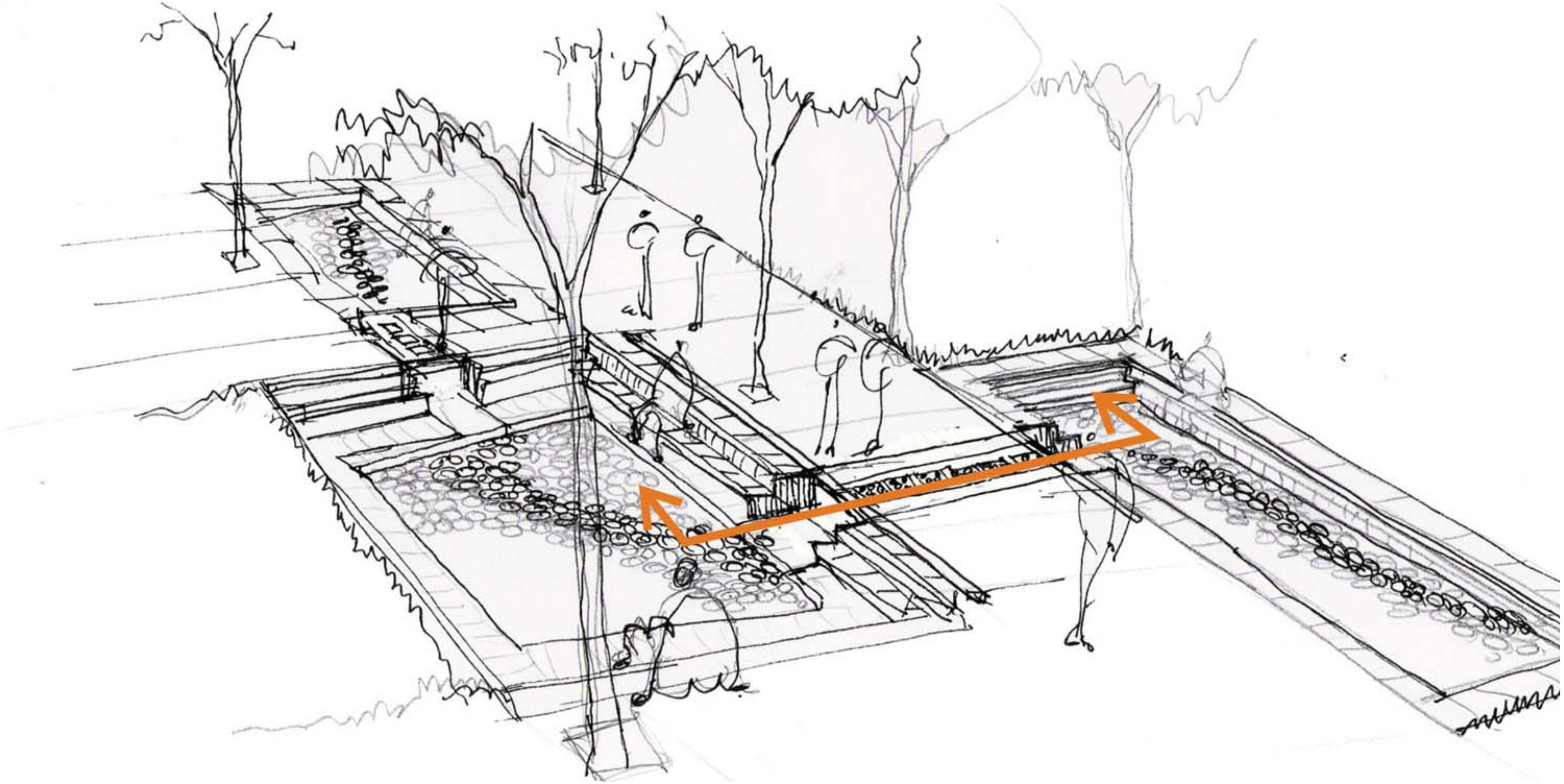


Fig. 9. 21: Perspective of sunken seating areas: channels. (Author, 2008) Scale 1: 20

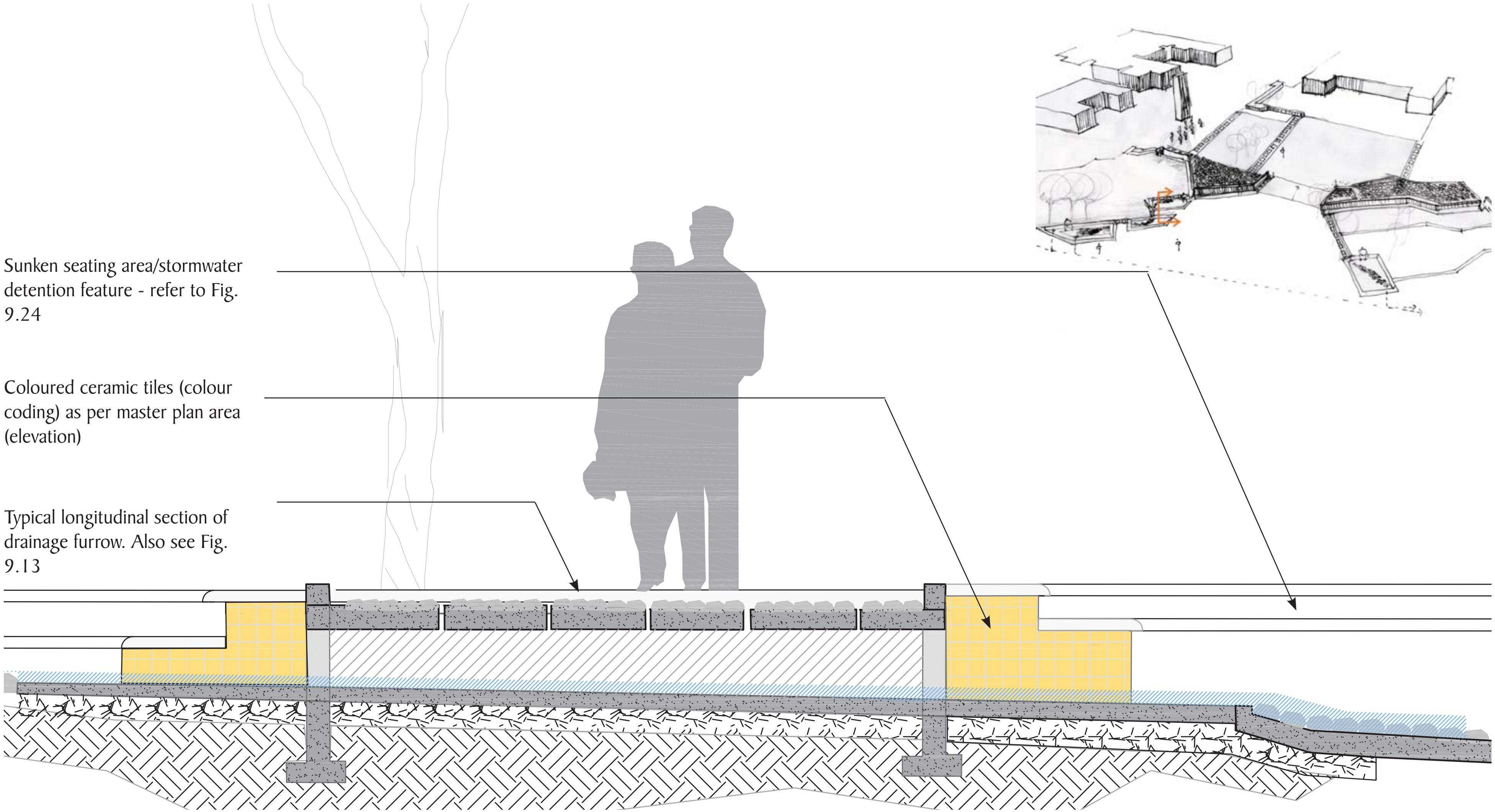


Fig. 9. 22: Drainage of water from one detention structure to the next. (Author, 2008) Scale 1: 20

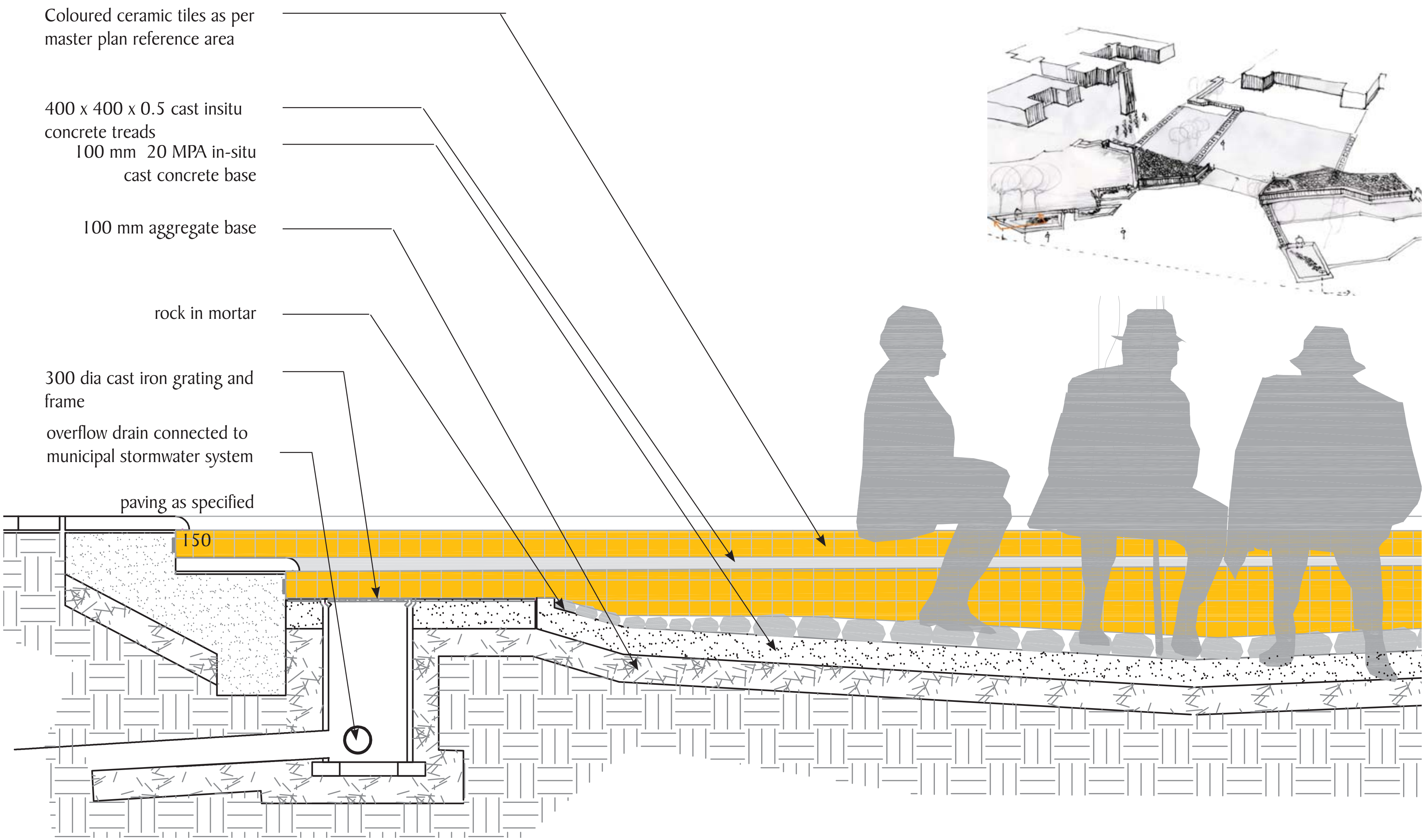


Fig. 9. 23: Sunken seating area and stormwater detention structure. (Author, 2008) Scale 1: 20

9.1.2 Water feature

An erratic fountain with 12 spouts is one of the main features of the transitional terrace. The spouts are connected in a circular fashion with a distributor pipe which runs through a series of channels. A suction pipe with chlorine tablets in the suction strainer will purify the water, before it is pumped through a centrifugal pump and 150 kg sand filter that is located in a pump room. The pump room is accessible from the service area of the information tower. (Refer to section 9.2, Fig. 9.30) The system is activated with an electrical control panel inside the pump chamber.

- The volume of the water in the channels is 0.5 m3 per channel or 3.5m3 in total
- The volume of the water in the air = 0.37m3

Therefore the total system requirement, with allowance for the difference between static and operating levels is 7m3. A 0.75 kwH pump should be adequate.

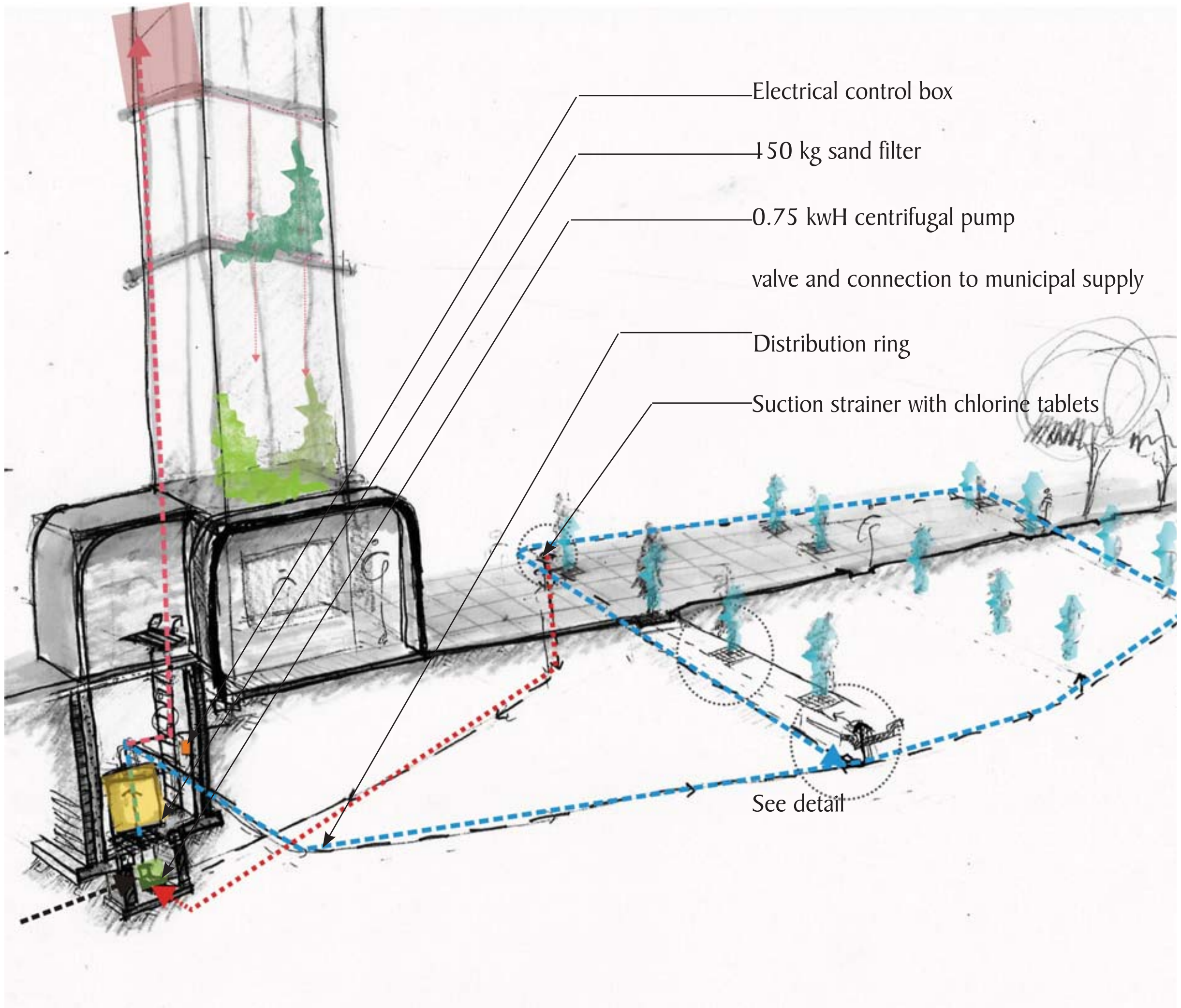


Fig. 9. 24: Erratic fountain supply system. (Author, 2008)

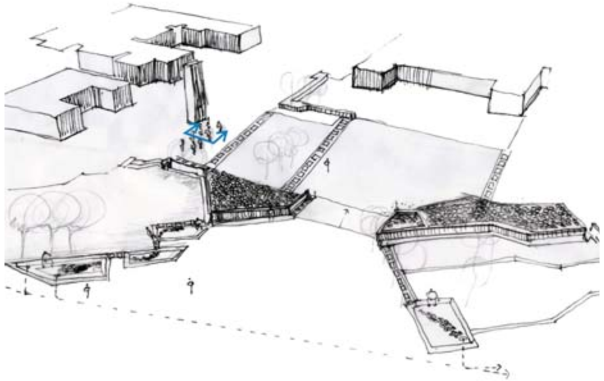


Fig. 9.26: Interactive water features. (Asensio, 2005)

Fig. 9.27: Feature lighting (Asensio, 2005)

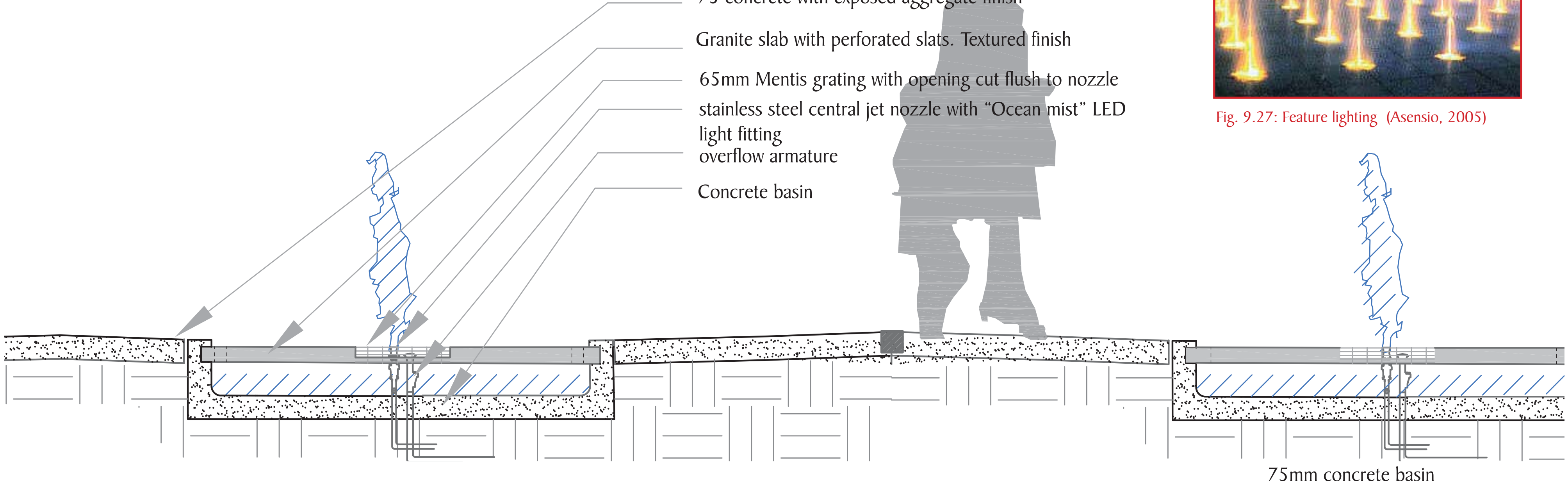
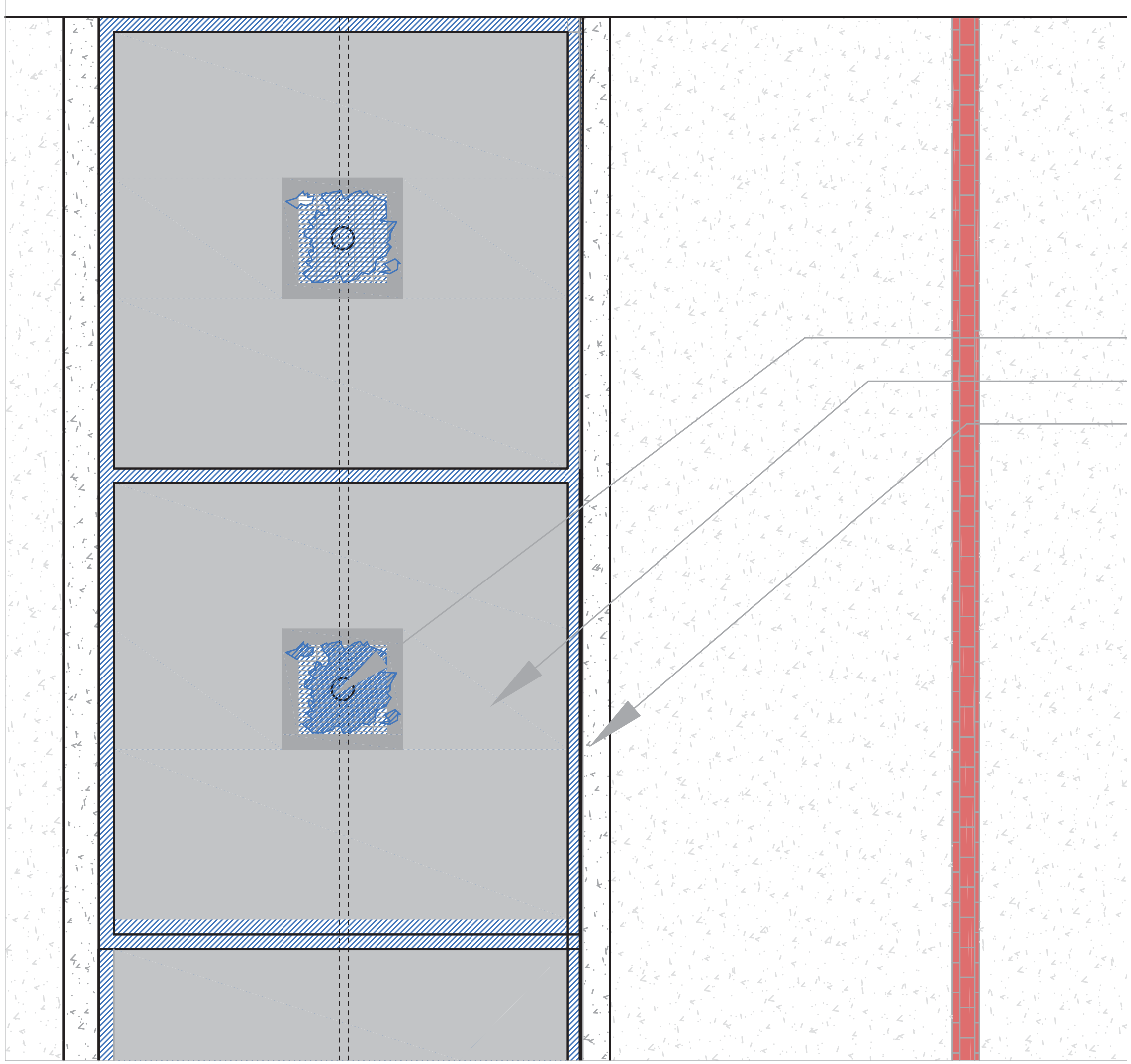


Fig. 9. 25: Typical section of erratic fountain. (Author, 2008) Scale 1: 25



Mentis grating cut flush to stainless steel nozzle

Dark granite with texturised (non-slippery) finish and perforated slats.

75 concrete with exposed aggregate finish and red-brick detail

Fig. 9. 28: Plan - Erratic fountain. (Author, 2008) Scale 1: 25

9.2 Vertical garden and information kiosk

The vertical garden in the information tower is fed by a pump system from the same pump chamber as the erratic fountain, toward a tank on the top of the tower. This results in a pressure of 1.2 bar, which is adequate for drip irrigation of the plants on the platforms containing growth medium.

Each of the three vegetated levels will contain approximately 2.3 m3 of growth medium. Pre-cast containers containing the soil are placed on a steel platform. The plants will require 0.15m3 of water per level per week. Therefore a tank with a capacity of 500l should be adequate.

Fig. 9.29: Vertical vegetation strcture. (Abelho, 2007)

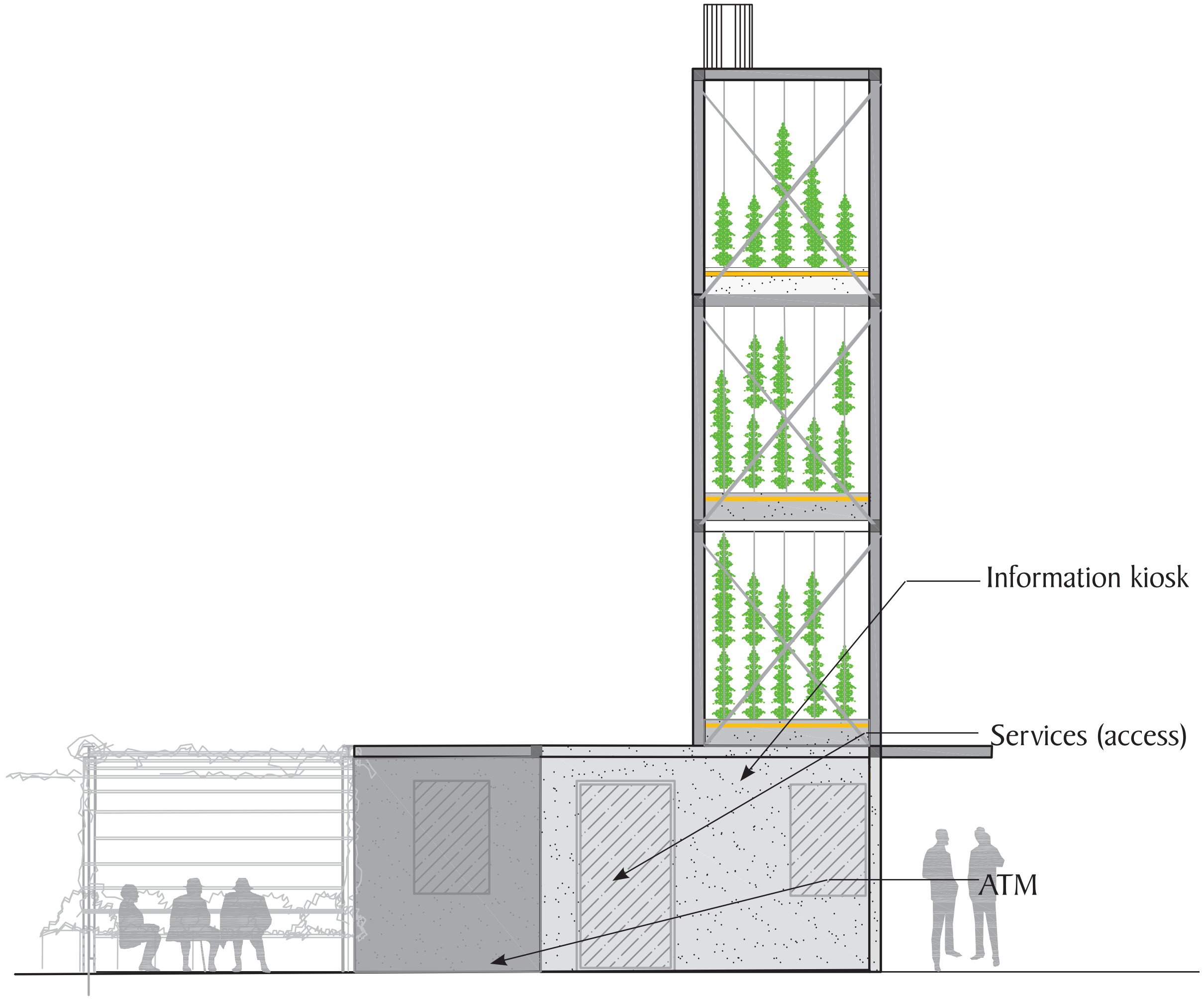


Fig. 9.30 : Green tower and information kiosk. Southern elevation. (Author, 2008) Scale 1: 20

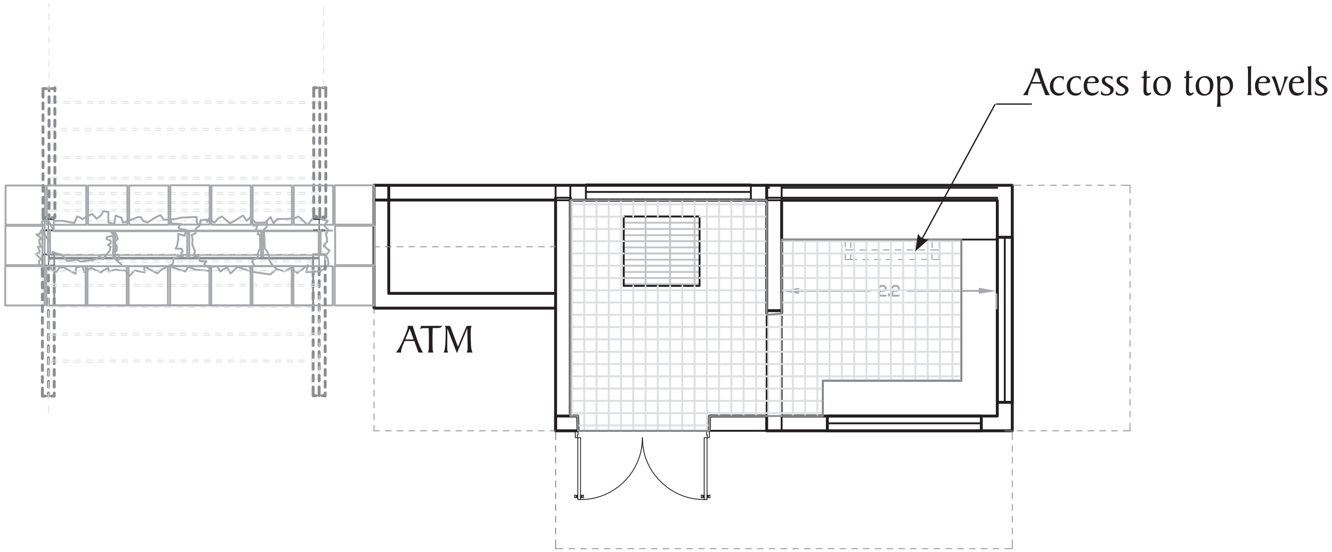


Fig. 9.31 : Diagrammatic plan view; information kiosk (Author, 2008) Scale: Not to scale

Fig. 9.32: Thunbergia alata (Joffe, 2001)

Fig. 9.33 Senecio macroglossus (Joffe, 2001)

Fig. 9.34: Clemantis bracheata (Joffe, 2001)

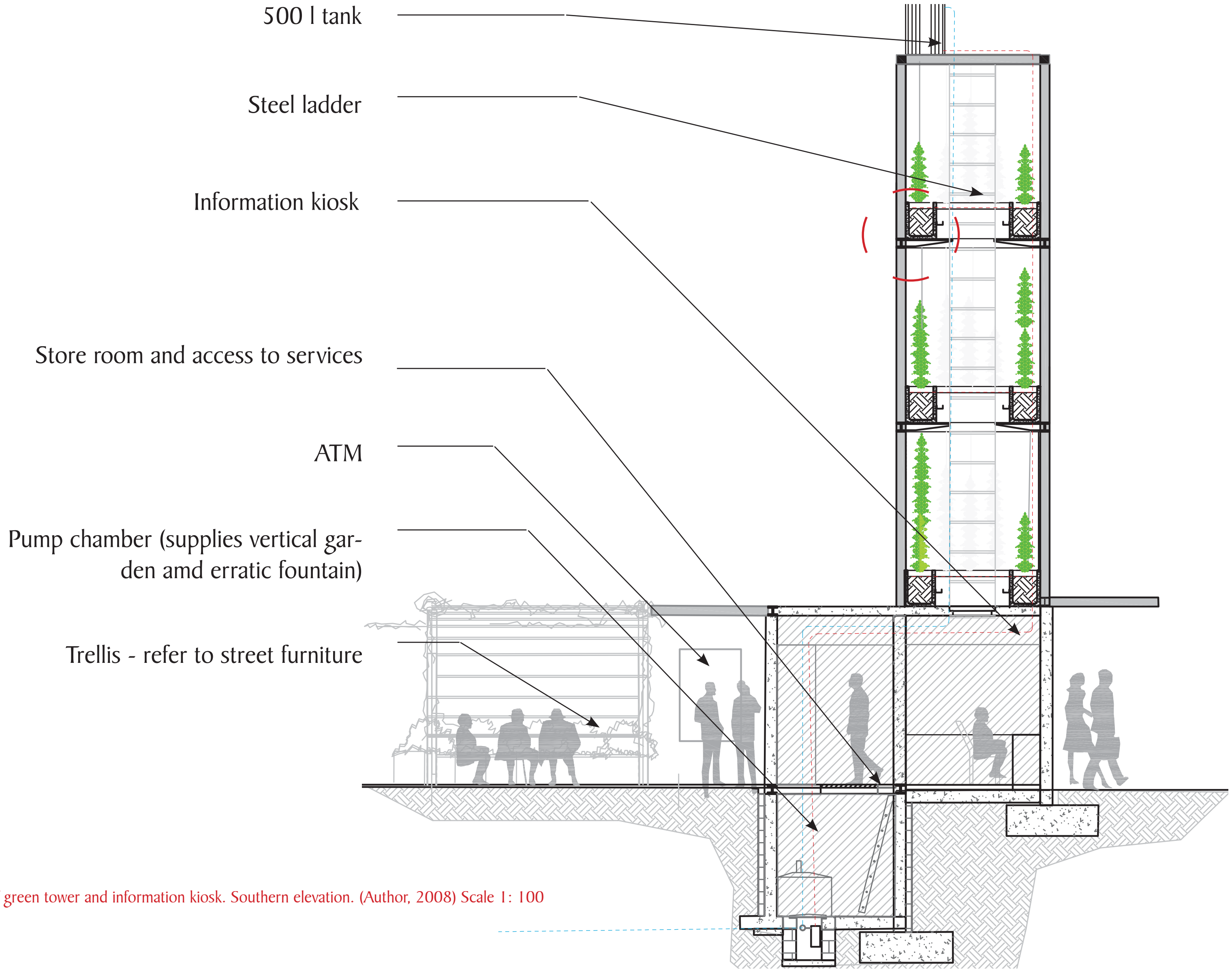


Fig. 9.35 : Section of green tower and information kiosk. Southern elevation. (Author, 2008) Scale 1: 100

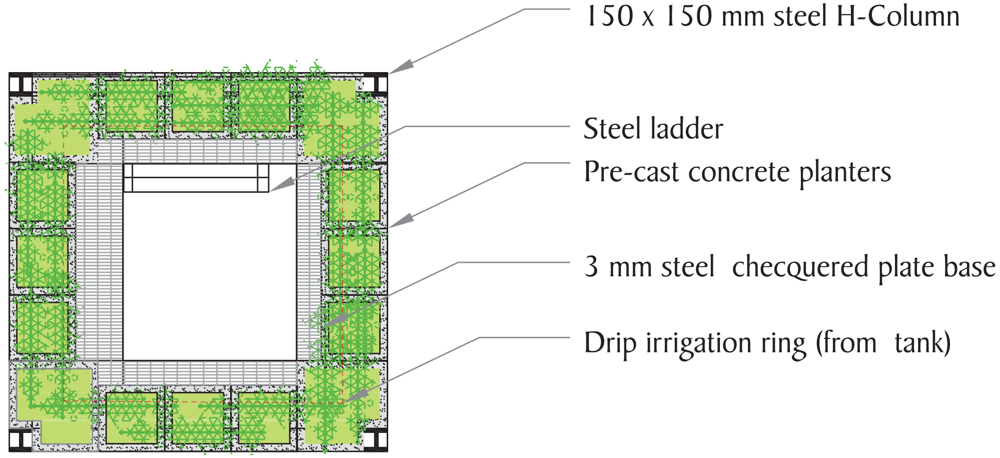


Fig. 9.36 : Plan view of green plarforms (Author, 2008) Scale 1: 50

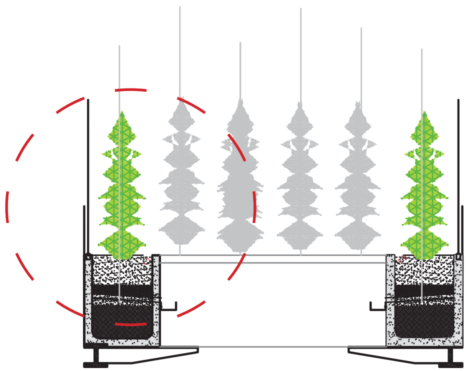


Fig. 9.387: Section: Green platform(Author, 2008) Scale 1: 50

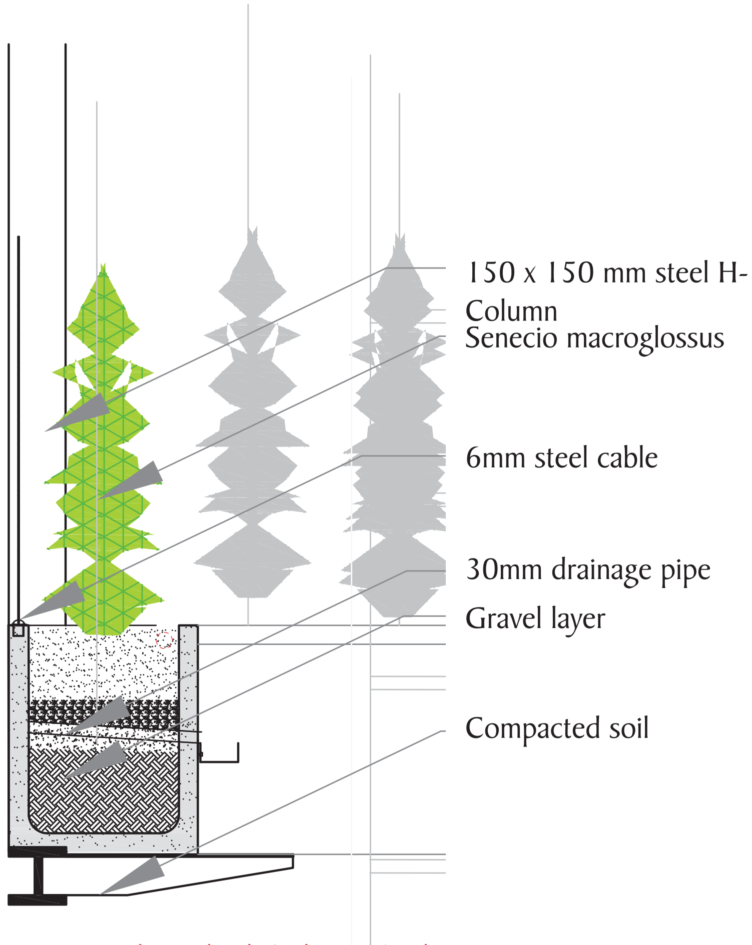


Fig. 9.38 : Detail: Vertical garden(Author, 2008) Scale 1: 20

9.3 Street furniture

Design guidelines were listed in Chapter 8. The design palette will be used to strengthen the imageability of particularly the Dr. Savage Plaza, but also the Hospital Hill in general. Material use include; polished concrete, standard steel H-profiles, galvanised afterwards, and galvanised IBR sheet metal. The range includes a bollard, bollard with light, bench, bench with backrest, shelter, shade structure and trade stall.

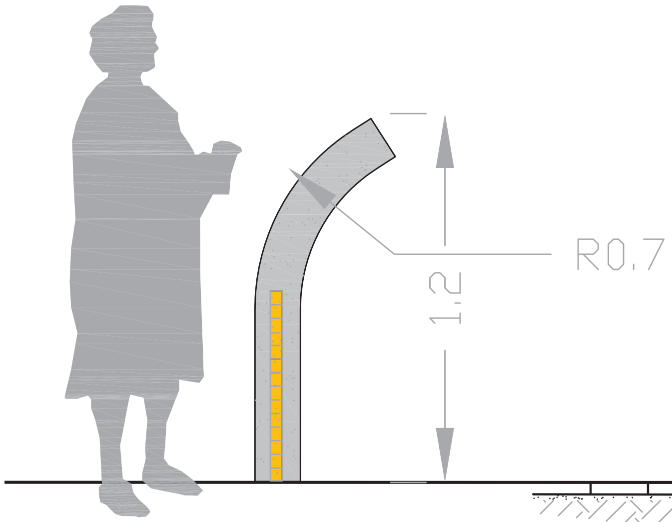


Fig. 9.39 Bollard without light Elevation. Scale 1:25 (Author, 2008)

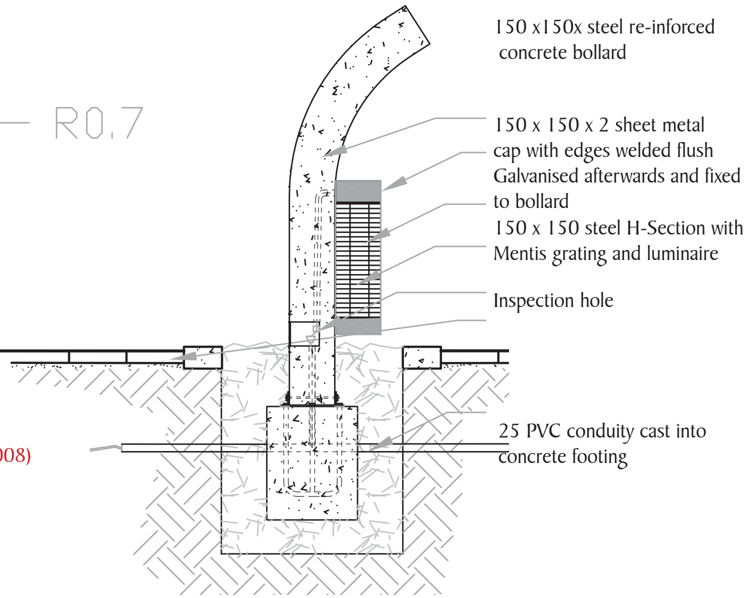


Fig. 9.40: Bollard with light Plan Scale 1:25 (Author, 2008)

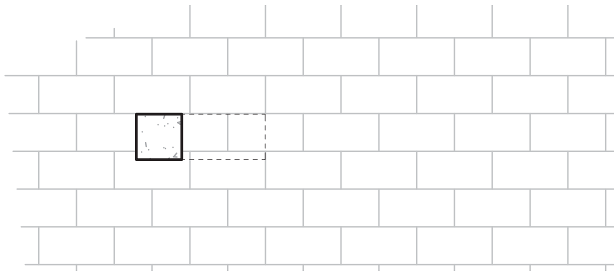


Fig. 9.41: Bollard without light Plan. Scale 1:25 (Author, 2008)

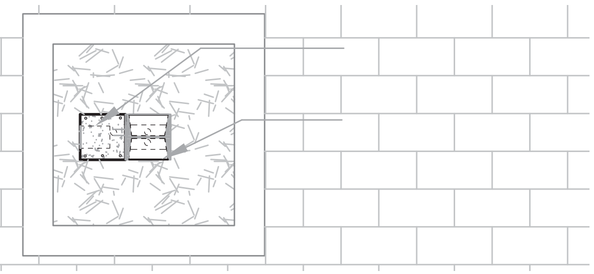


Fig. 9.42: Bollard with light Plan. Scale 1:25 (Author, 2008)

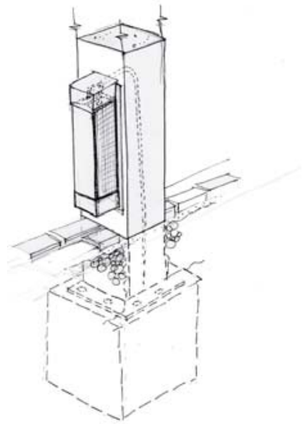


Fig. 9.43: Bollard with light, sectional perspective.
Scale: not to scale (Author, 2008)

Fig. 9.44: Coloured, glazed ceramic tiles in concrete
Scale: not to scale (Author, 2008)

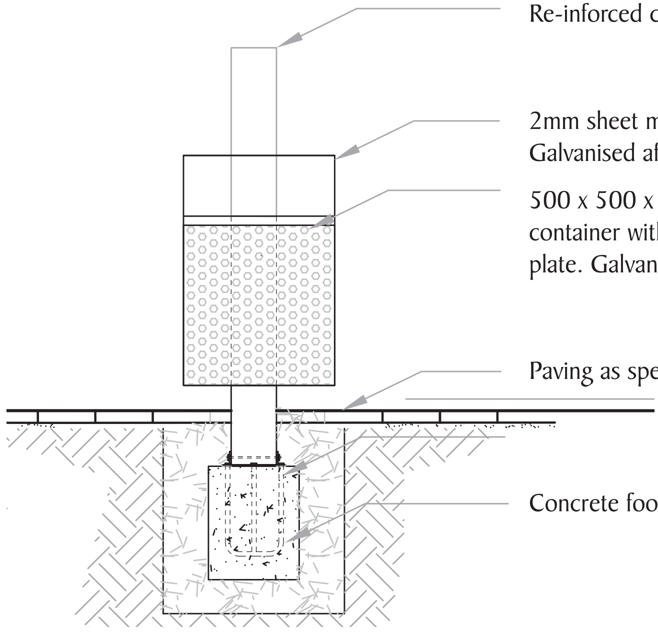


Fig. 9.45: Litter Bin
Part elevation. Scale: 1:25 (Author, 2008)

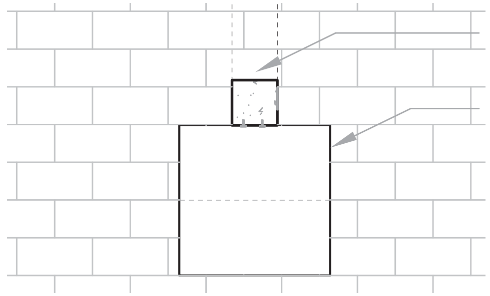


Fig. 9.46: Litter Bin Plan. Scale: 1:25 (Author, 2008)

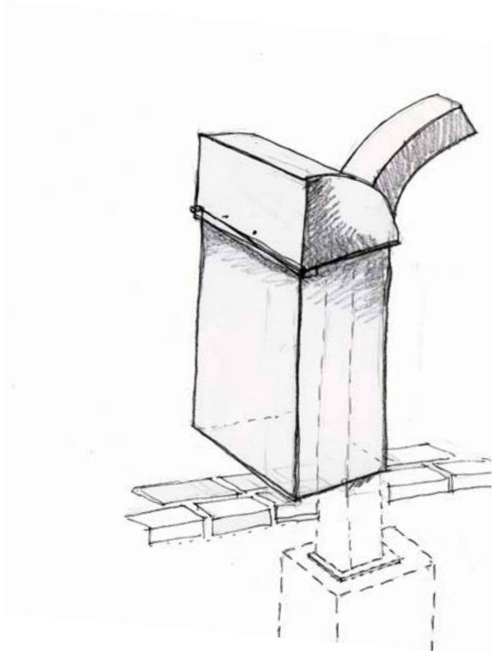


Fig. 9.47: Litter Bin. Perspective.
Scale: not to scale (Author, 2008)

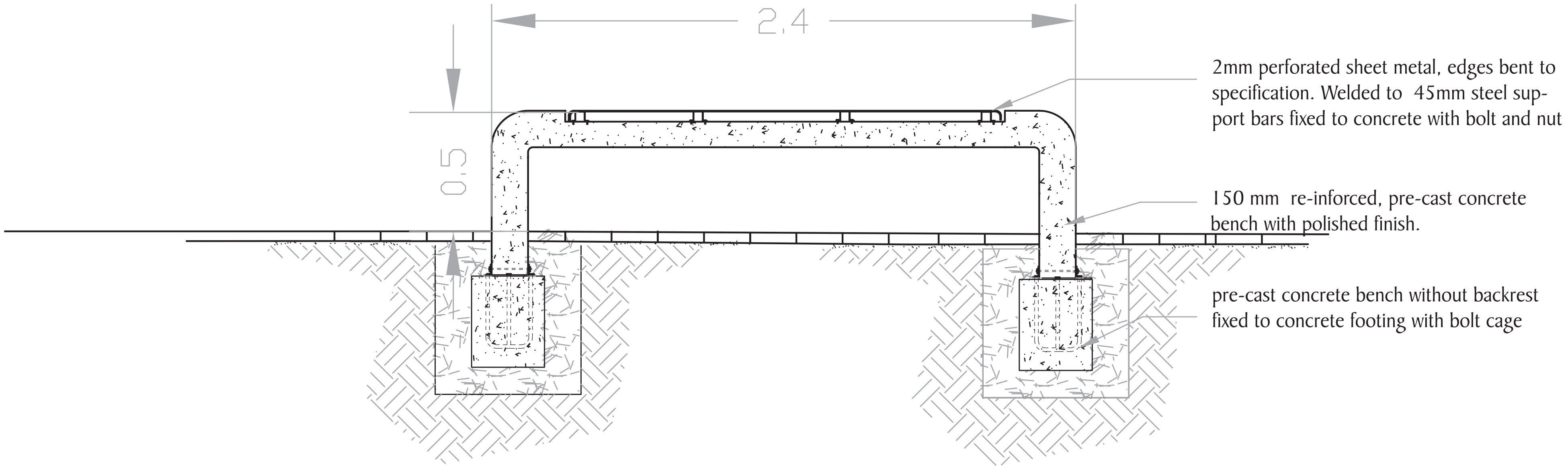


Fig. 9.48: Bench without backrest Part elevation. Scale 1:25 (Author, 2008)

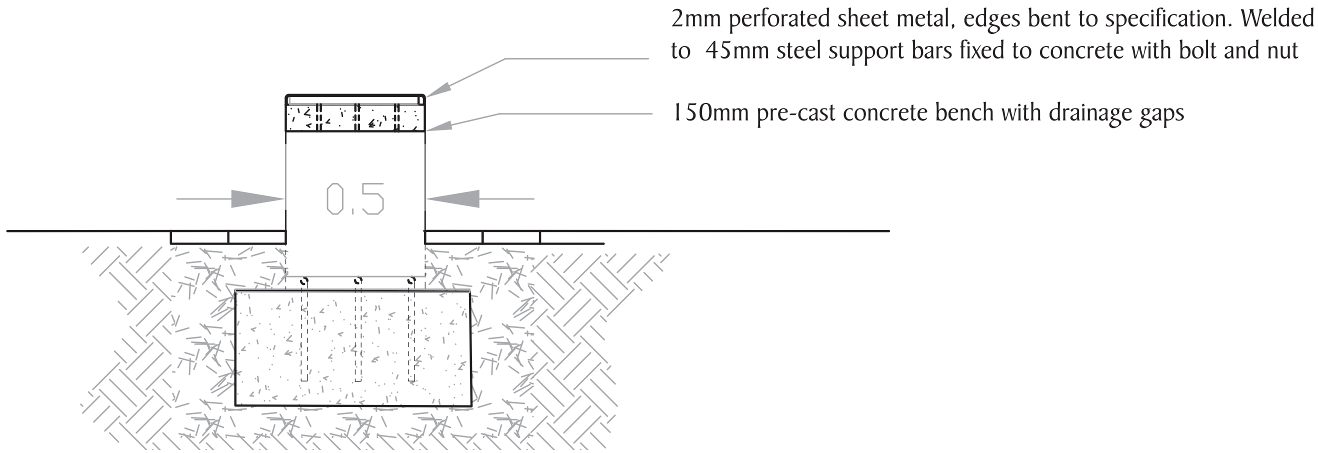
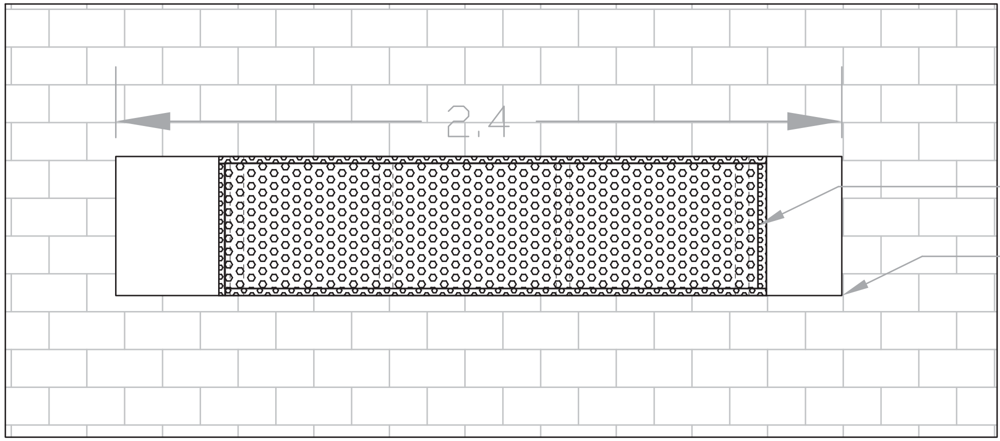


Fig. 9.49: Bench without backrest. Section. Scale 1:25 (Author, 2008)



2mm perforated sheet metal, edges bended to specification. Welded to 45mm steel support bars fixed to concrete with bolt and nut

150 mm re-inforced, pre-cast concrete bench with polished finish.

Fig. 9.50: Bench without backrest. Plan. Scale:1:25 (Author, 2008)

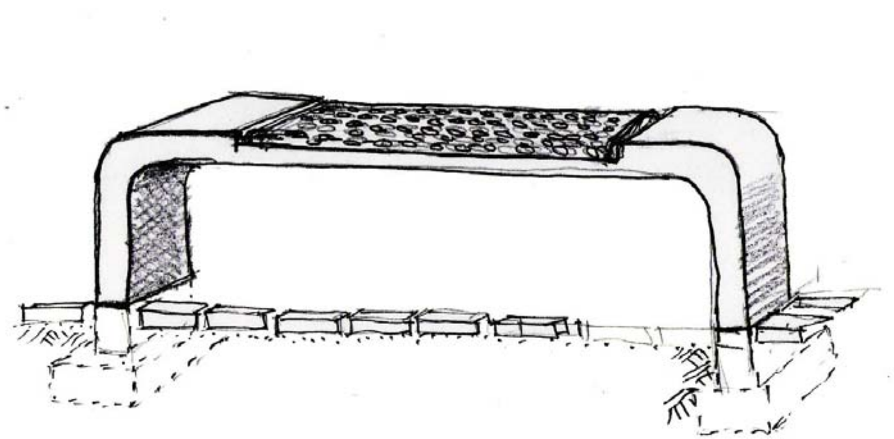


Fig. 9.51: Bench without backrest. Perspective. (Author, 2008)

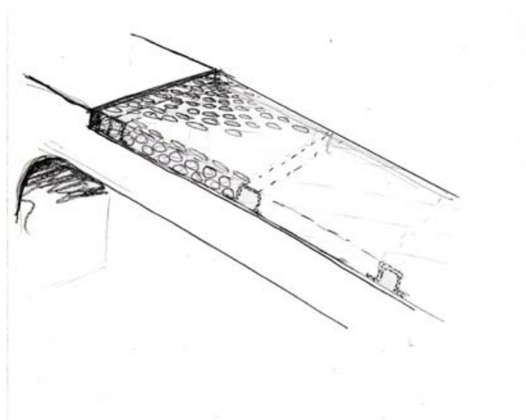


Fig. 9.52: Bench without backrest. Detail. (Author, 2008)

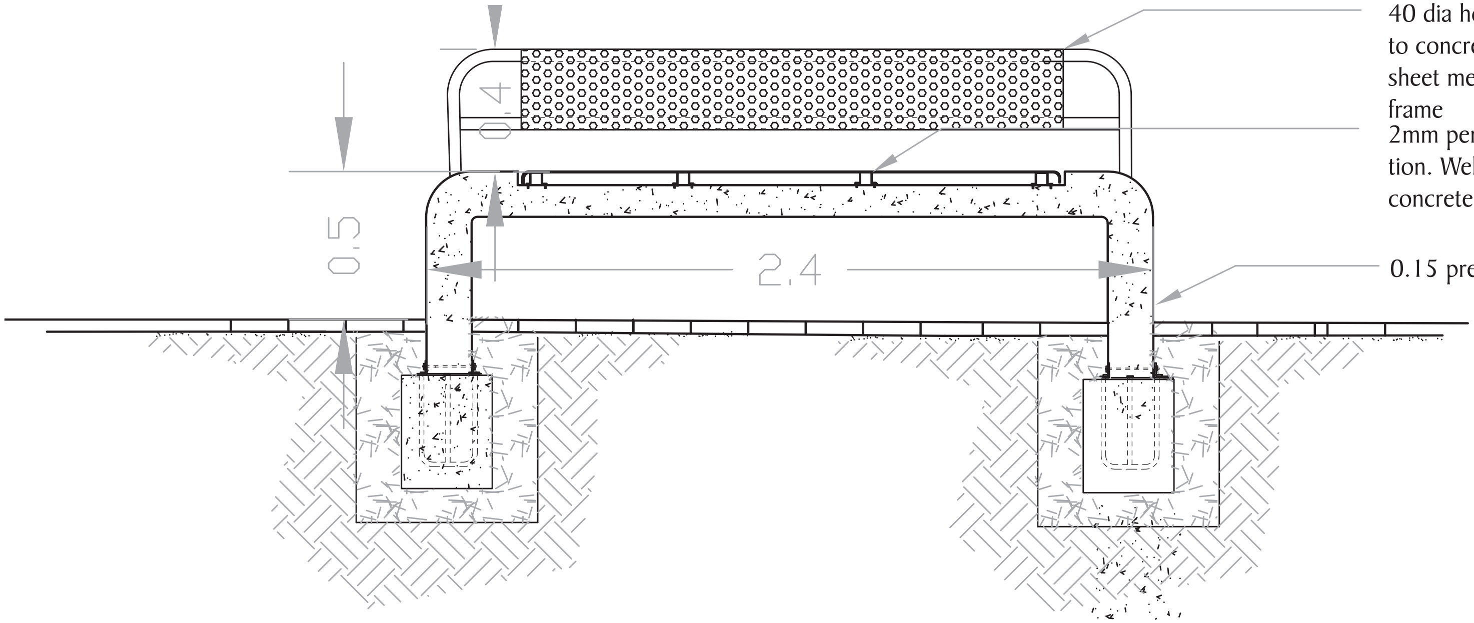


Fig. 9.53: Bench with backrest Part elevation. Scale 1:25 (Author, 2008)

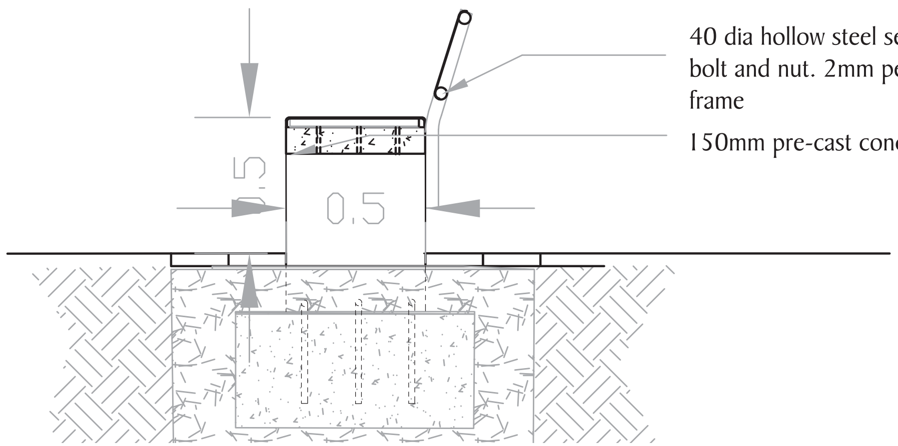


Fig. 9.54: Bench with backrest. Section. Scale 1:25 (Author, 2008)

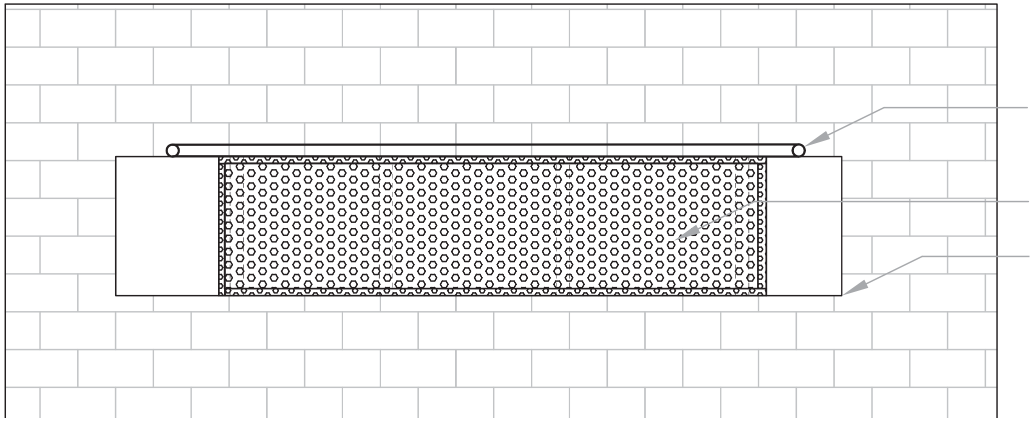


Fig. 9.55: Bench without backrest. Plan. Scale:1:25 (Author, 2008)

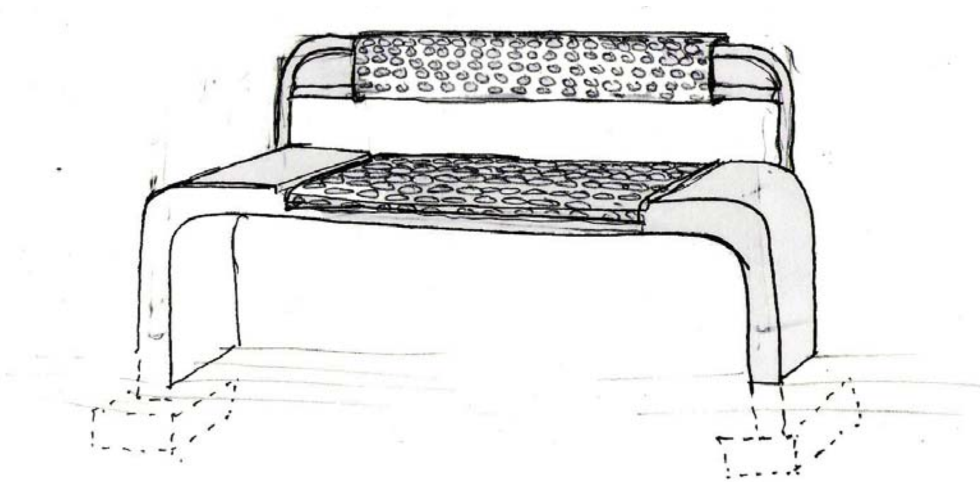


Fig. 9.56: Bench without backrest. Perspective. (Author, 2008)

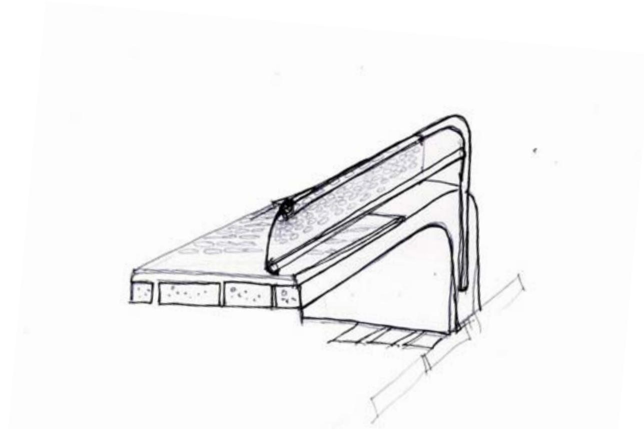
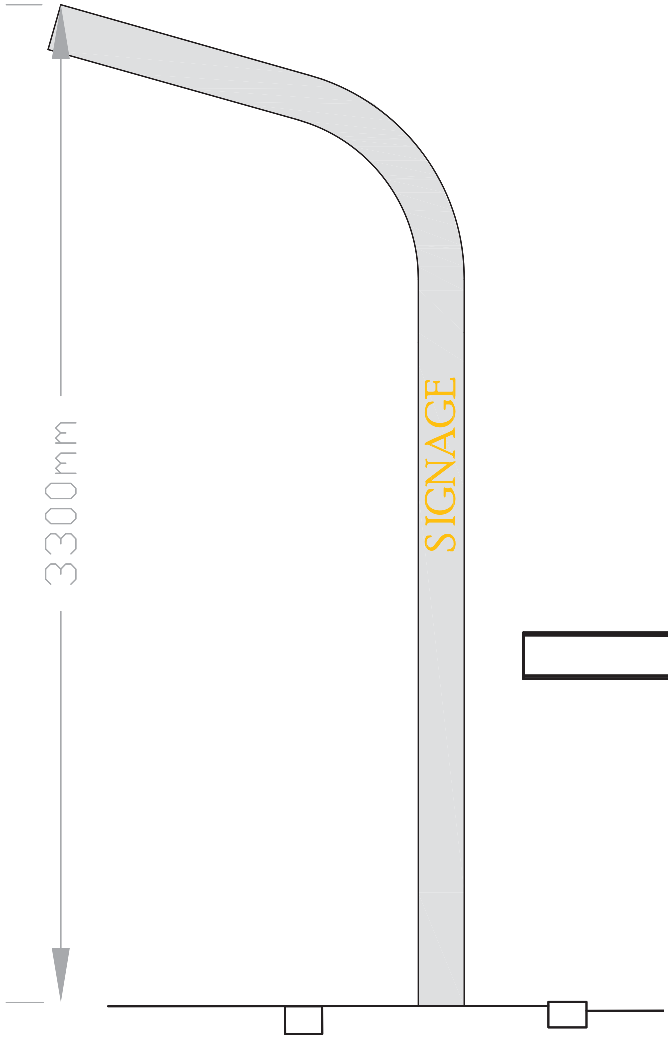


Fig. 9.57: Bench without backrest. Detail. (Author, 2008)



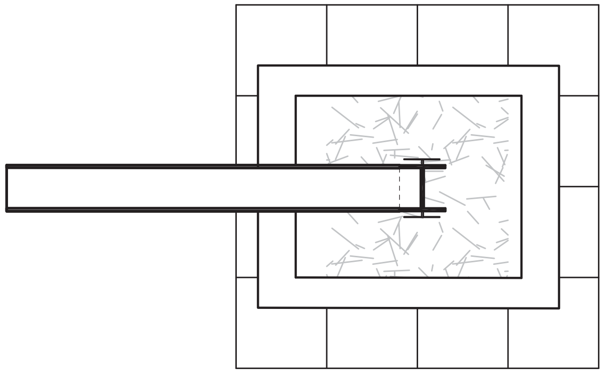


Fig. 9.59: Lamp Post. Plan Elevation. Scale 1:25 (Author, 2008)

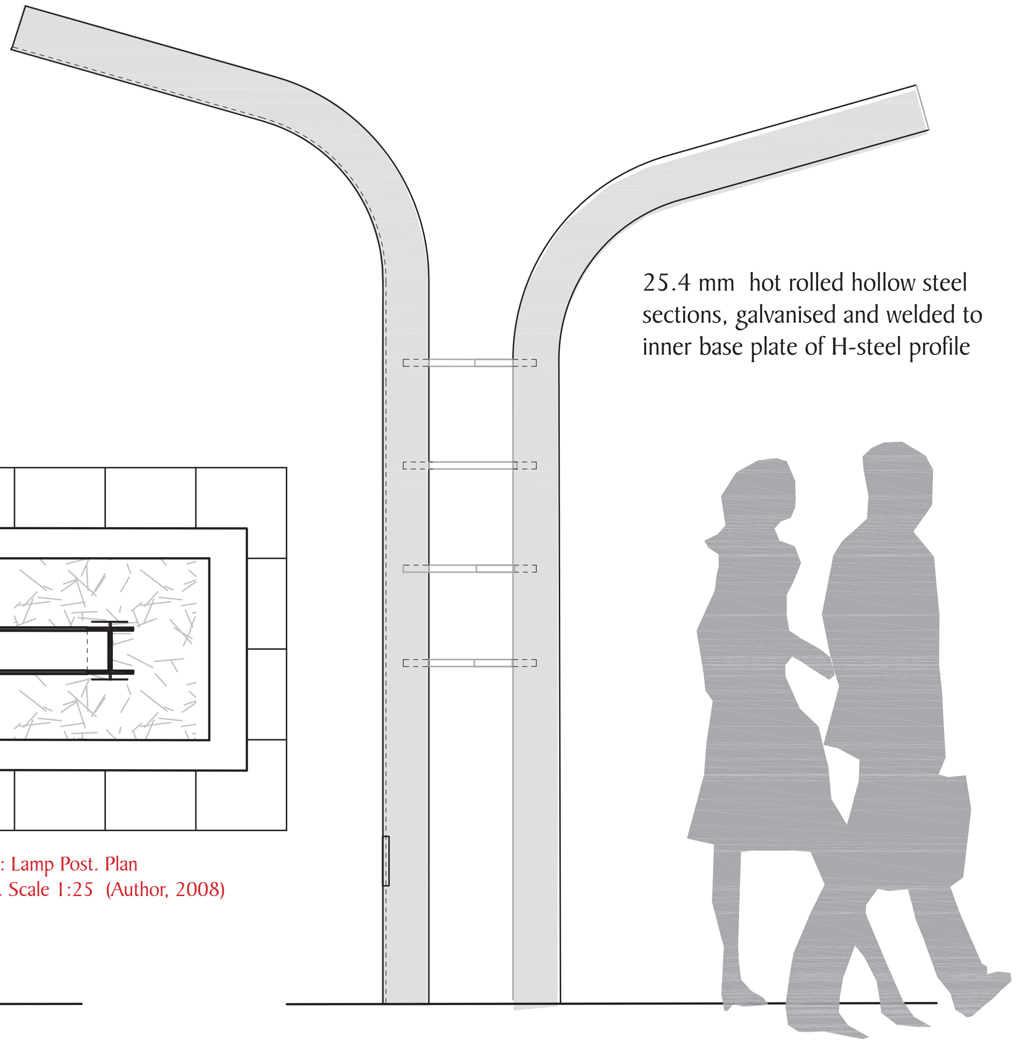


Fig. 9.58: Lamp Post. Elevation. Scale 1:25 (Author, 2008)

Fig. 9.60: Lamp Post (double option in high-use areas) Elevation. Scale 1:25 (Author, 2008)

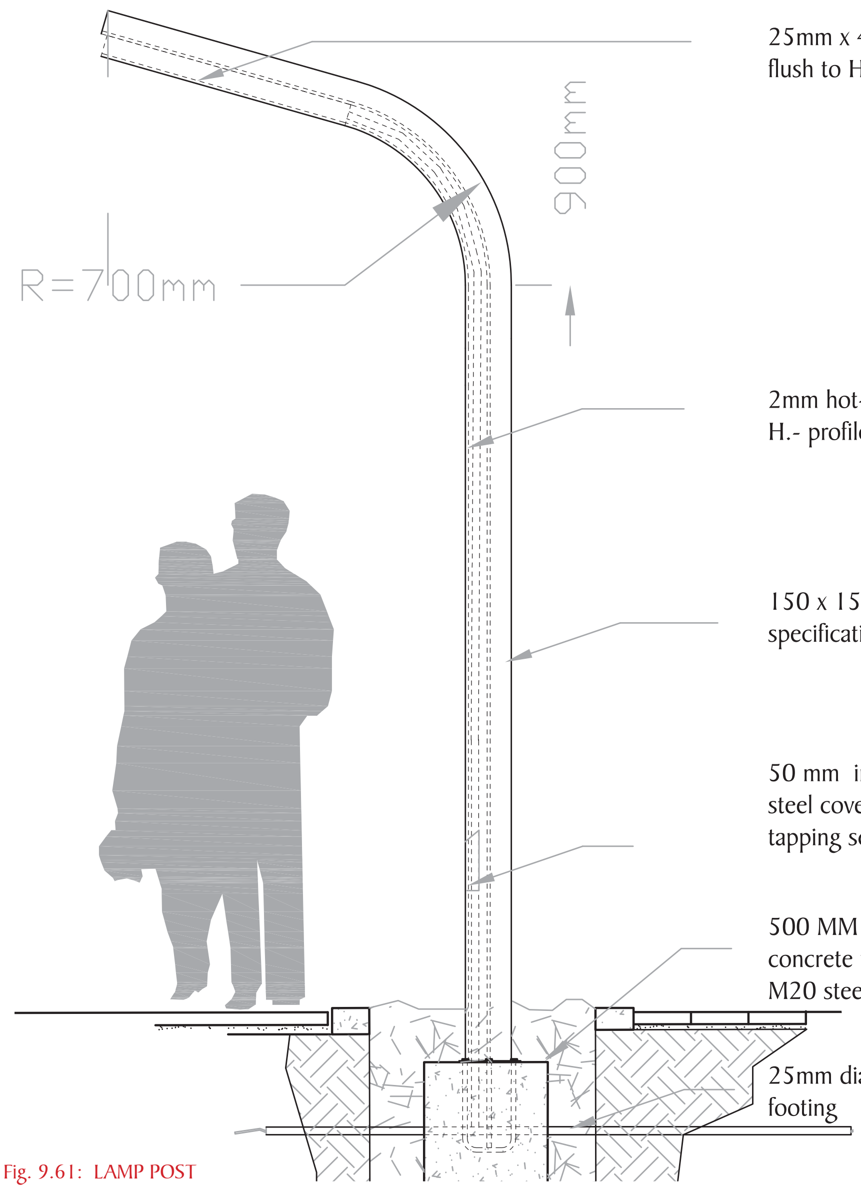


Fig. 9.61: LAMP POST
Section Scale 1:25 (Author, 2008)

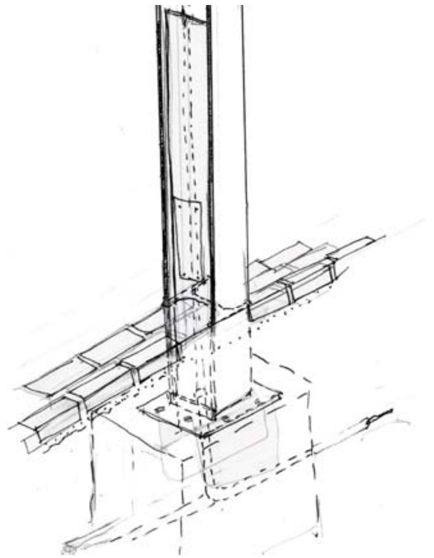


Fig. 9.62: Inspection hole and conduit channeled behind 2mm steel flange welded to inside of H-Section. Scale: Not to scale (Author, 2008)

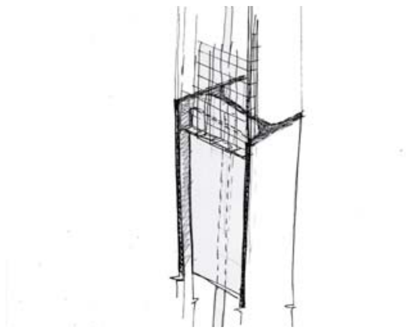


Fig. 9.63: Mentis grating bent to specification andwelded flush to outer edge of H-profile and overlapping flange by 50 mm. Scale: Not to scale (Author, 2008)

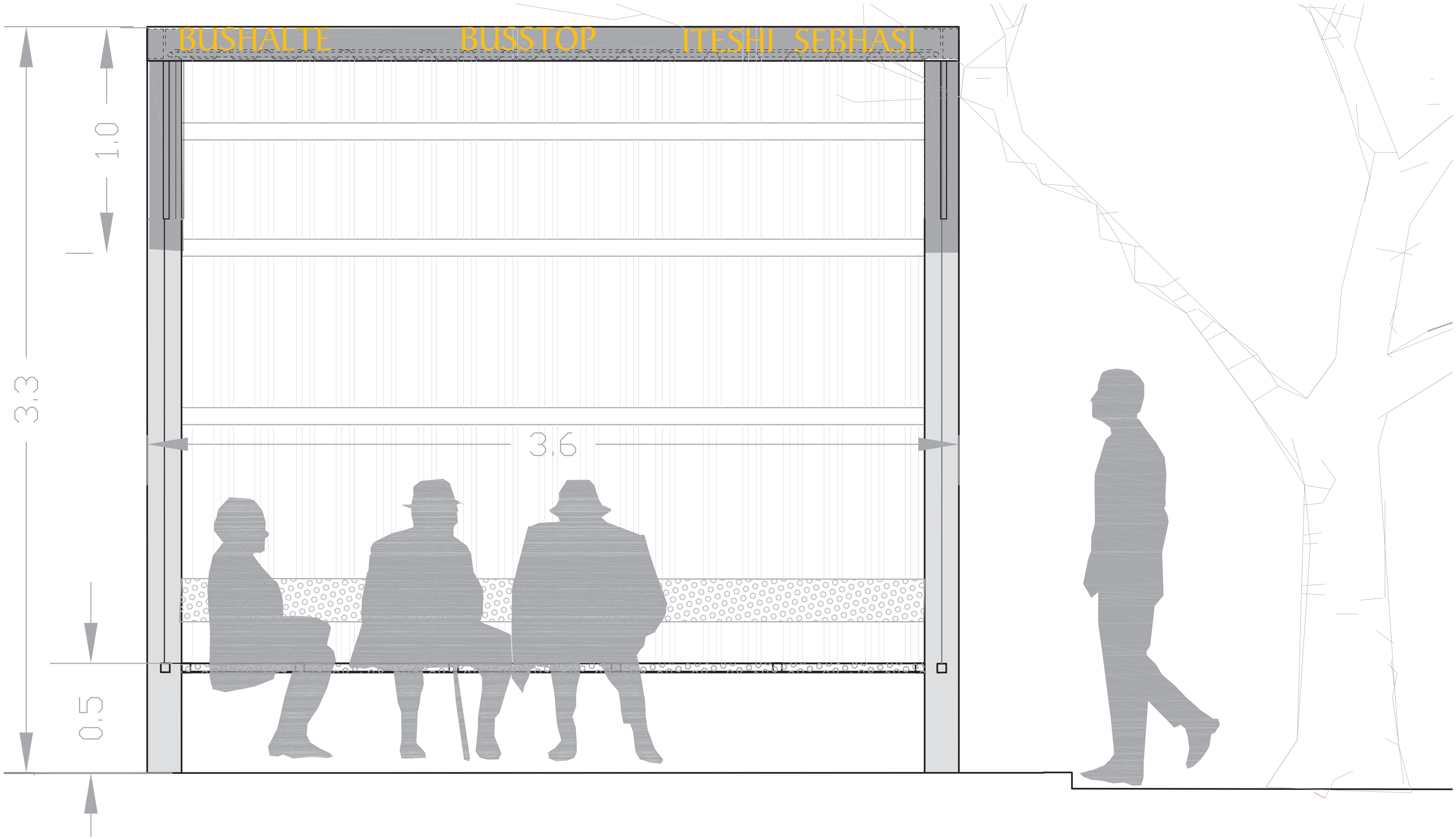


Fig. 9.64: Shelter. Elevation. Scale 1:25 (Author, 2008)

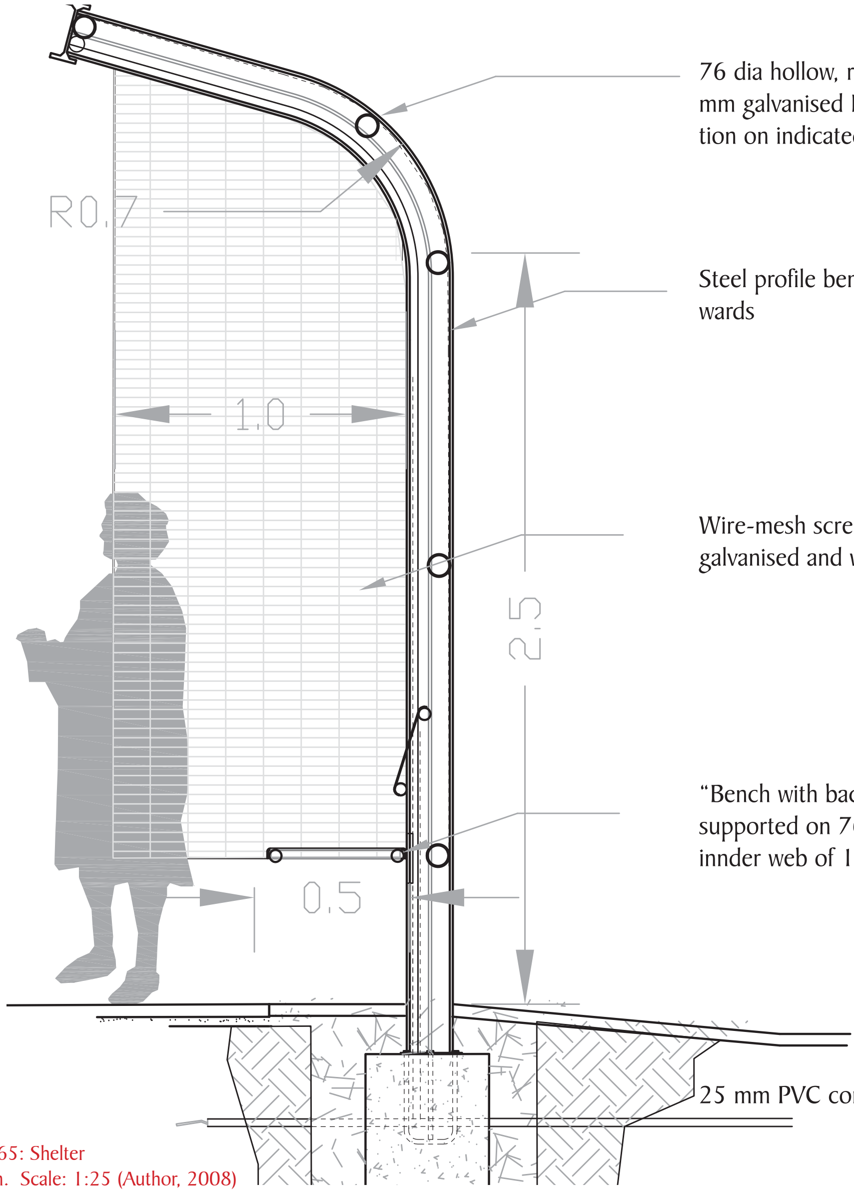


Fig. 9.65: Shelter
Section. Scale: 1:25 (Author, 2008)

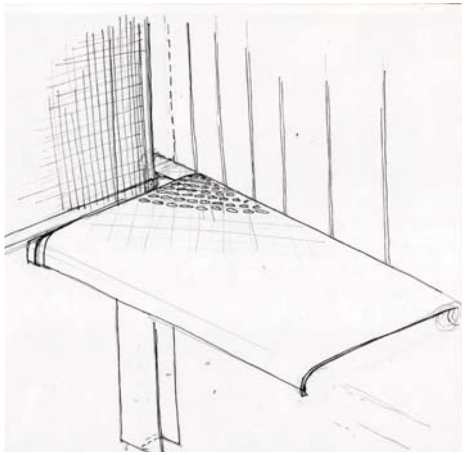


Fig. 9.66: Steel bench. 76 dia round, hollow steel sections welded to main structure with 2mm perforated metal sheet seating bended to specification and, weldedto frame frame. Galvanised afterwards.
Scale: Not to scale (Author, 2008)

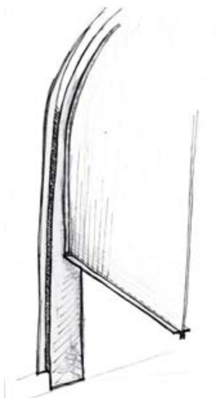


Fig. 9.67 Connection between H-profile (main structure), IBR-sheeting and wire-mesh screen. Scale: Not to scale (Author, 2008)

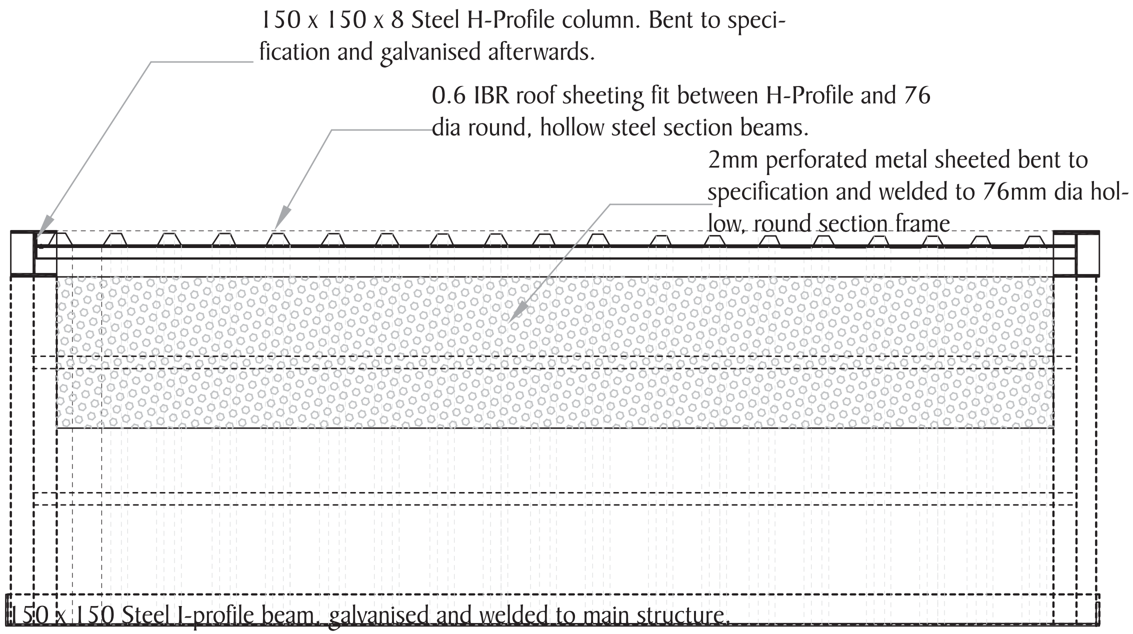


Fig. 9.68: Shelter
Plan view. Scale 1:25 (Author, 2008)

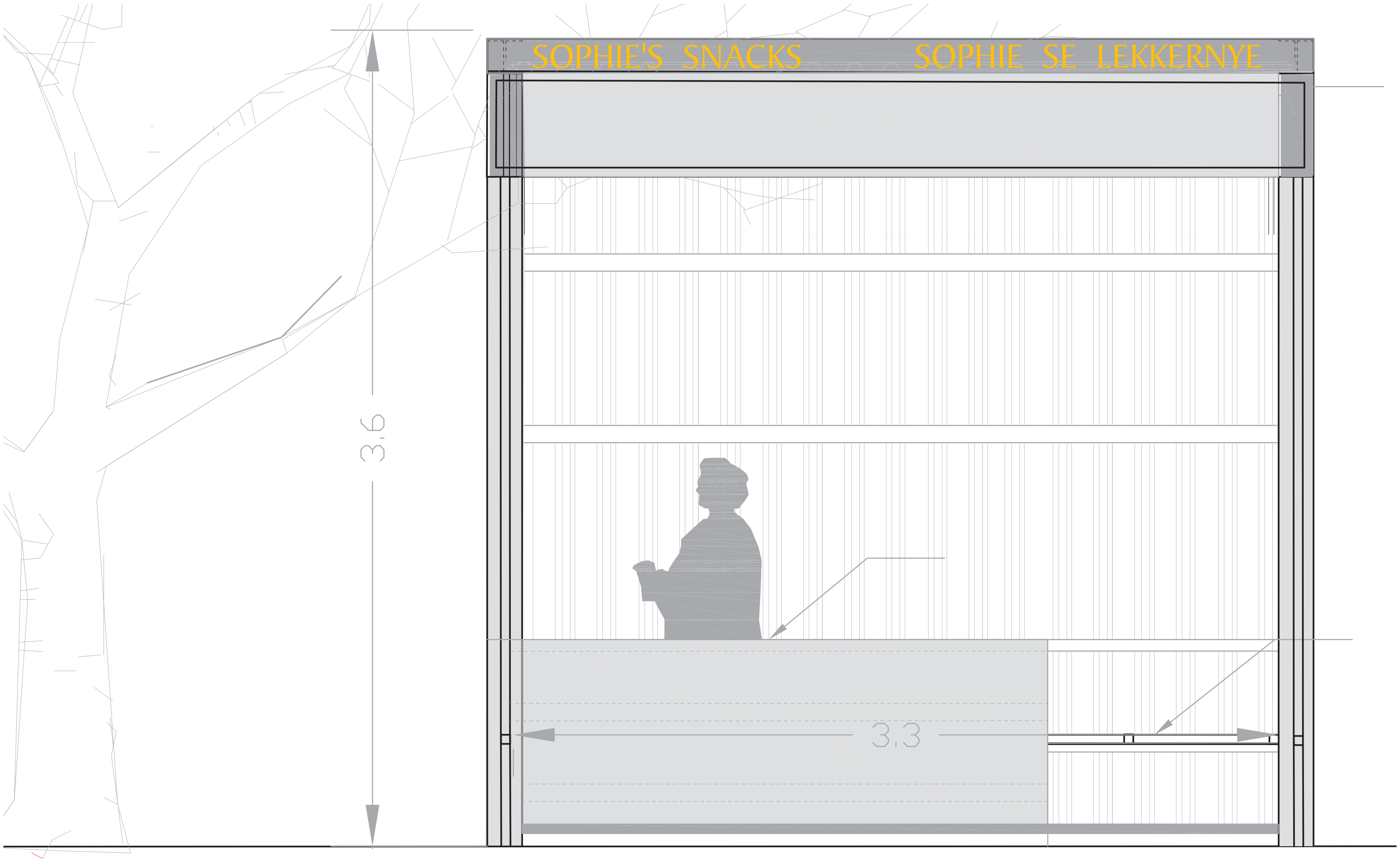


Fig. 9.69: Trade stall
Elevation. Scale 1:25 (Author, 2008)

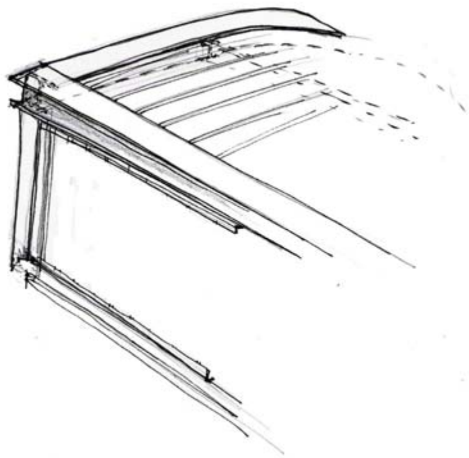


Fig. 9.70: Fixing of IBR sheeting to main steel structure. View from outside
Scale : not to scale (Author, 2008)

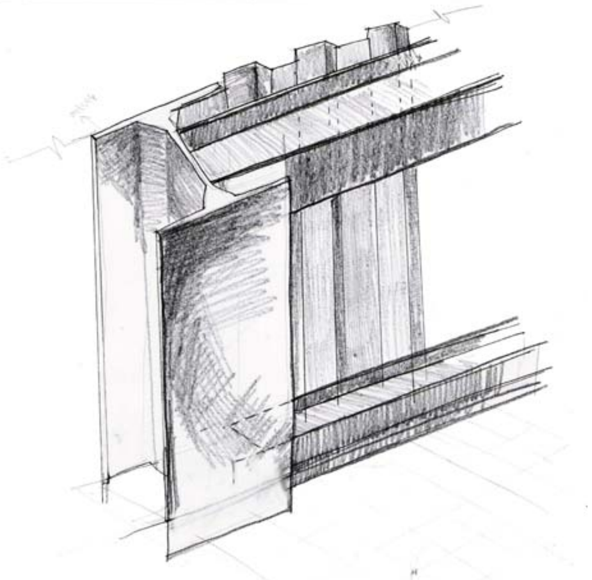


Fig. 9.71: Fixing of IBR sheeting to main steel structure. View from inside
Scale : not to scale (Author, 2008)

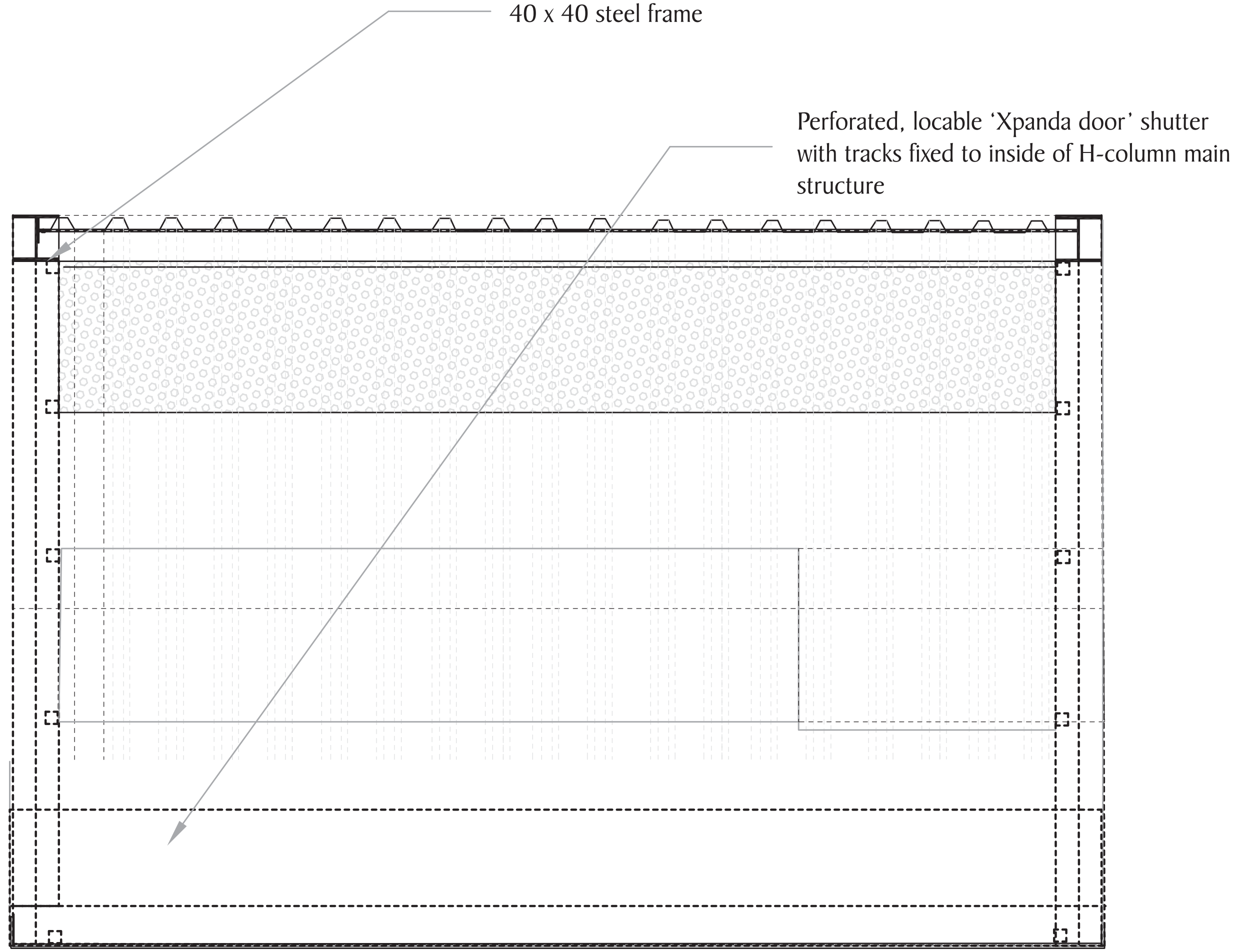


Fig. 9.72: Trade stall
Plan. Scale 1: 25 (Author, 2008)

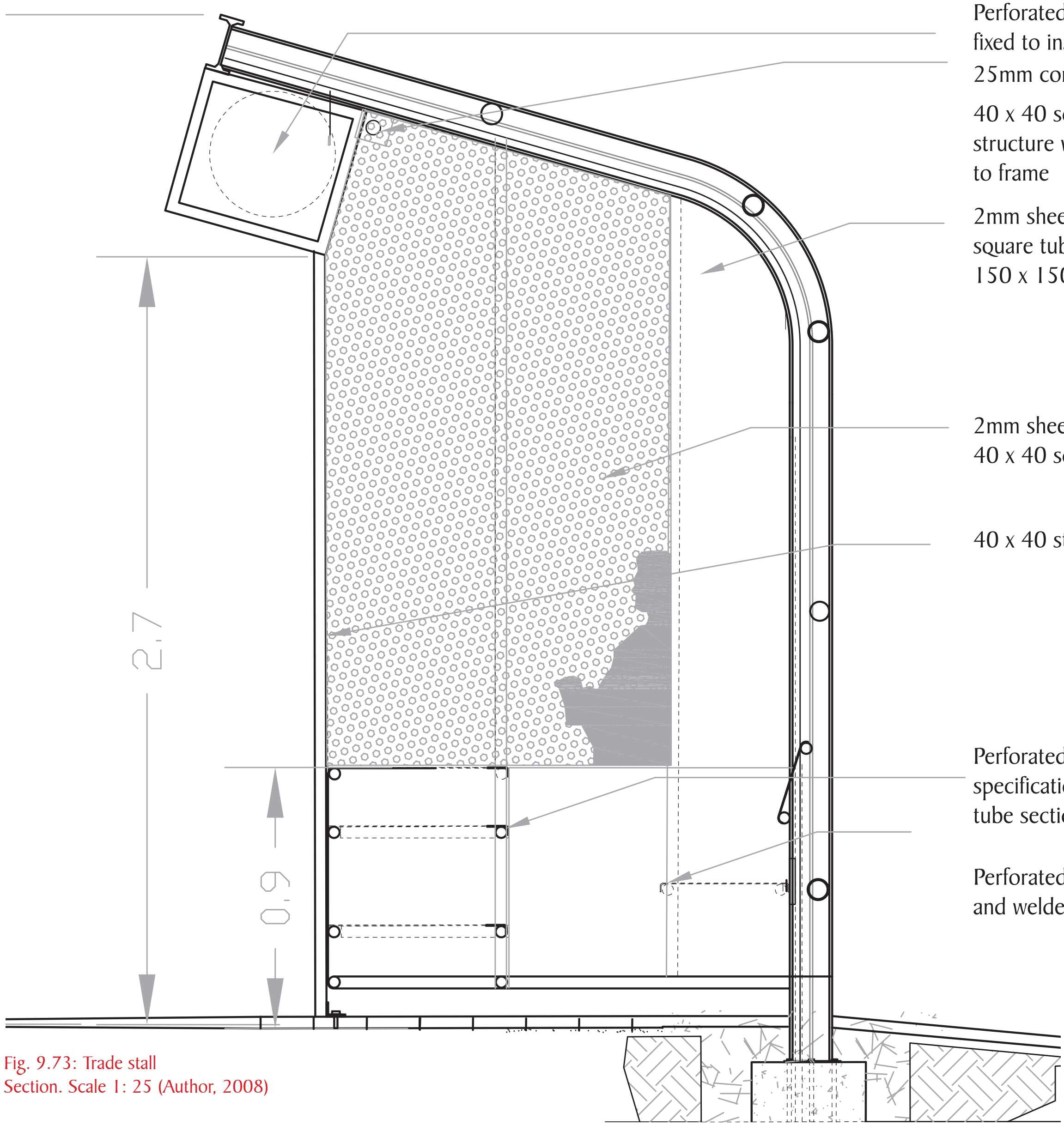


Fig. 9.73: Trade stall
Section. Scale 1: 25 (Author, 2008)

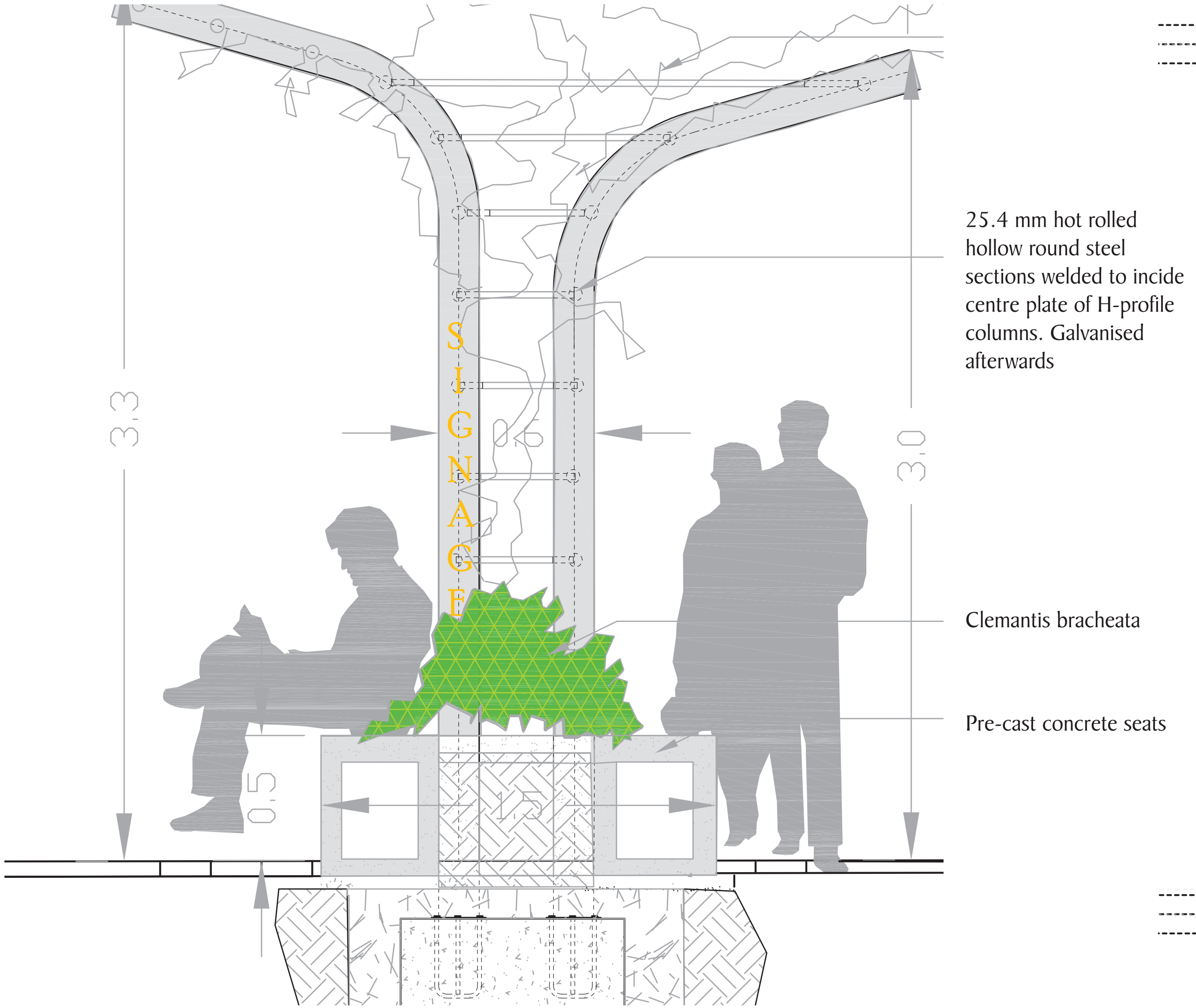


Fig. 9.74: Trellis
Section. Scale 1:25 (Author, 2008)

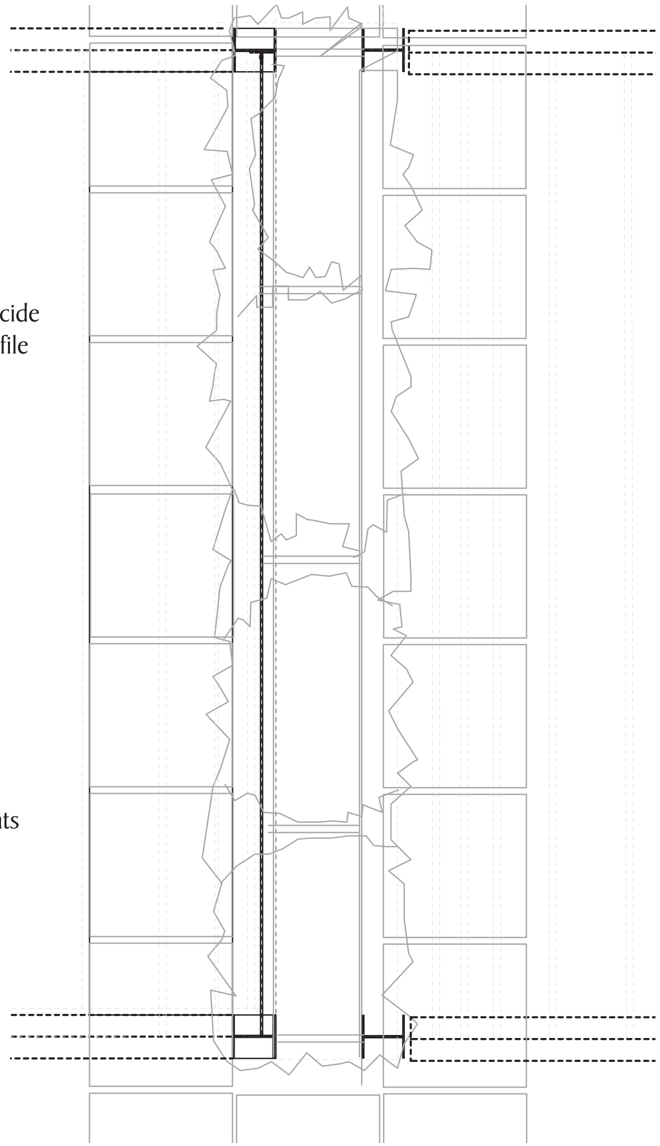


Fig. 9.75: Trellis
Plan view. Scale 1:25 (Author, 2008)

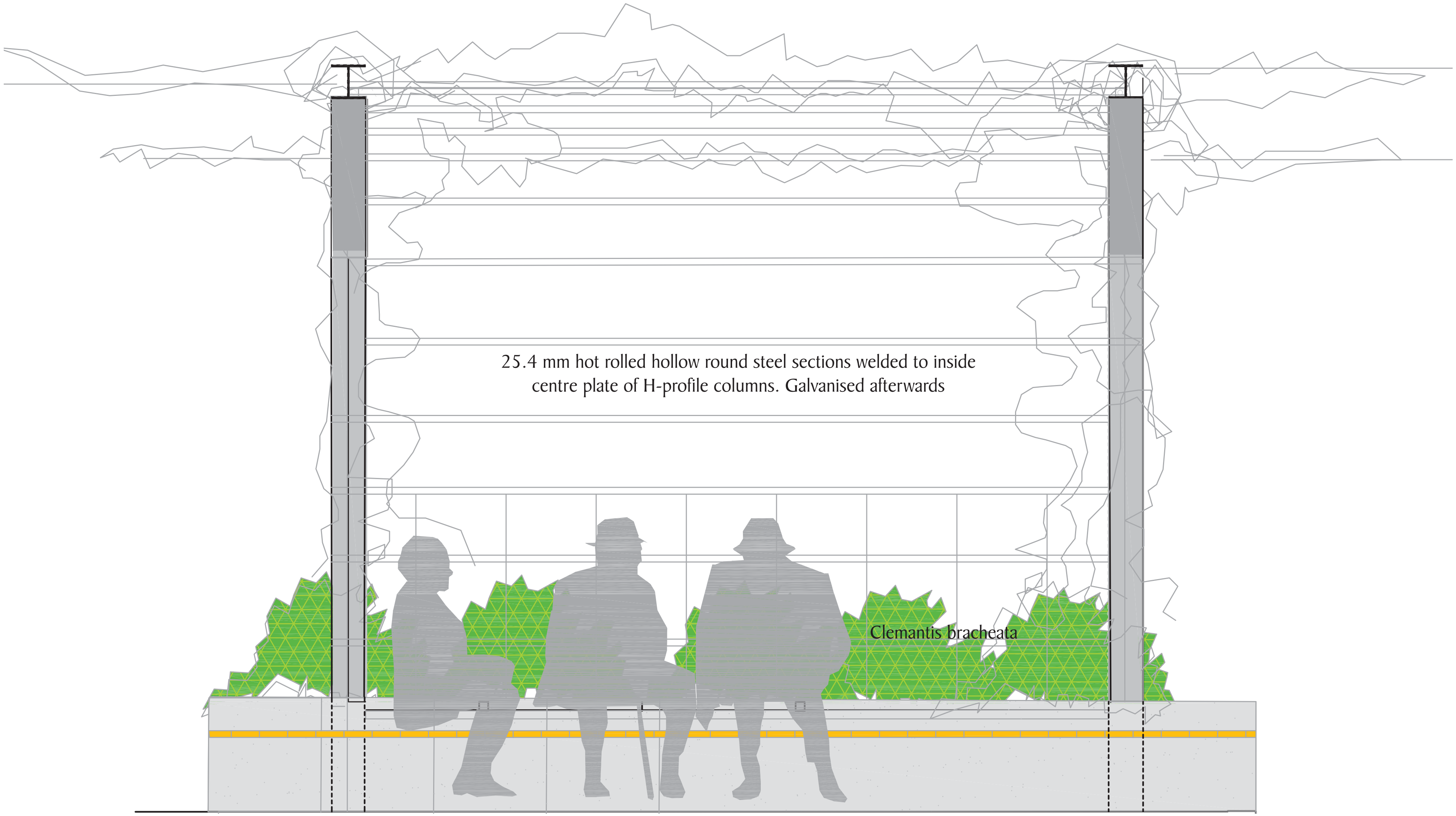


Fig. 9.76: Trellis. Elevation. Scale 1:25 (Author, 2008)

9.4 Edge details

Pre-cast concrete edges are used in most of the step details. The facing of the riser alternates between redbrick close to building edges, and dry packed stone in the terraced lawn areas leading up to the feature wall, which is constructed of the same material. The plinth in front of the main entrance to the T.R.H is constructed from redbrick.

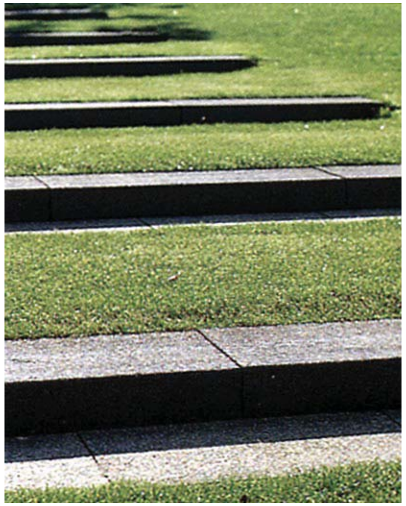


Fig. 9.76 Stepped lawn (Baumeester, 2007)

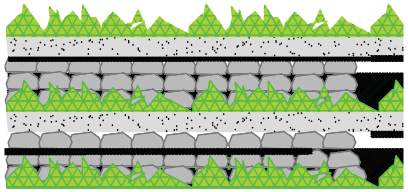


Fig. 9.77 Terraced lawn seating.
Elevation. (Author, 2008)

Fig. 9.78: Stone packed retaining wall (Asensio 2005)

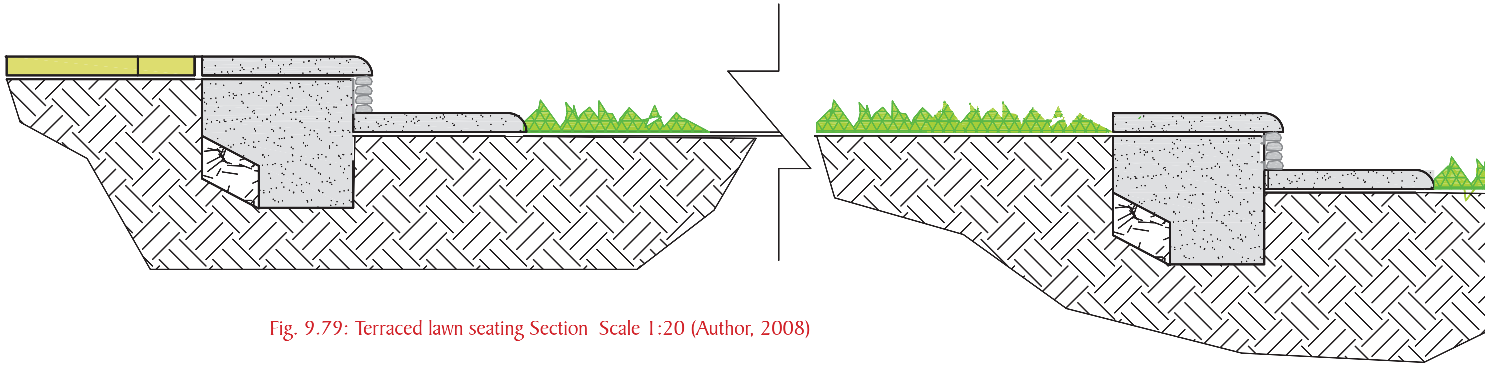


Fig. 9.79: Terraced lawn seating Section Scale 1:20 (Author, 2008)

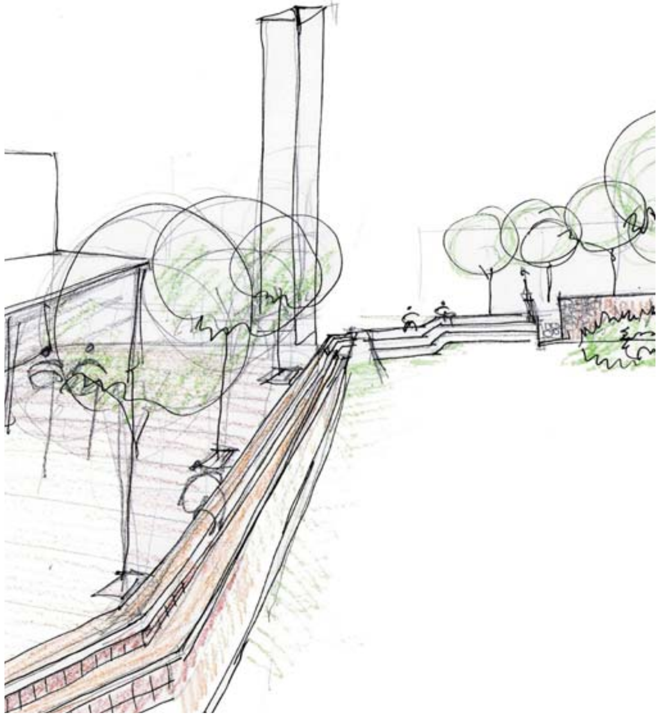


Fig. 9.81: Red- brick seating walls
Not to scale. (Author, 2008)

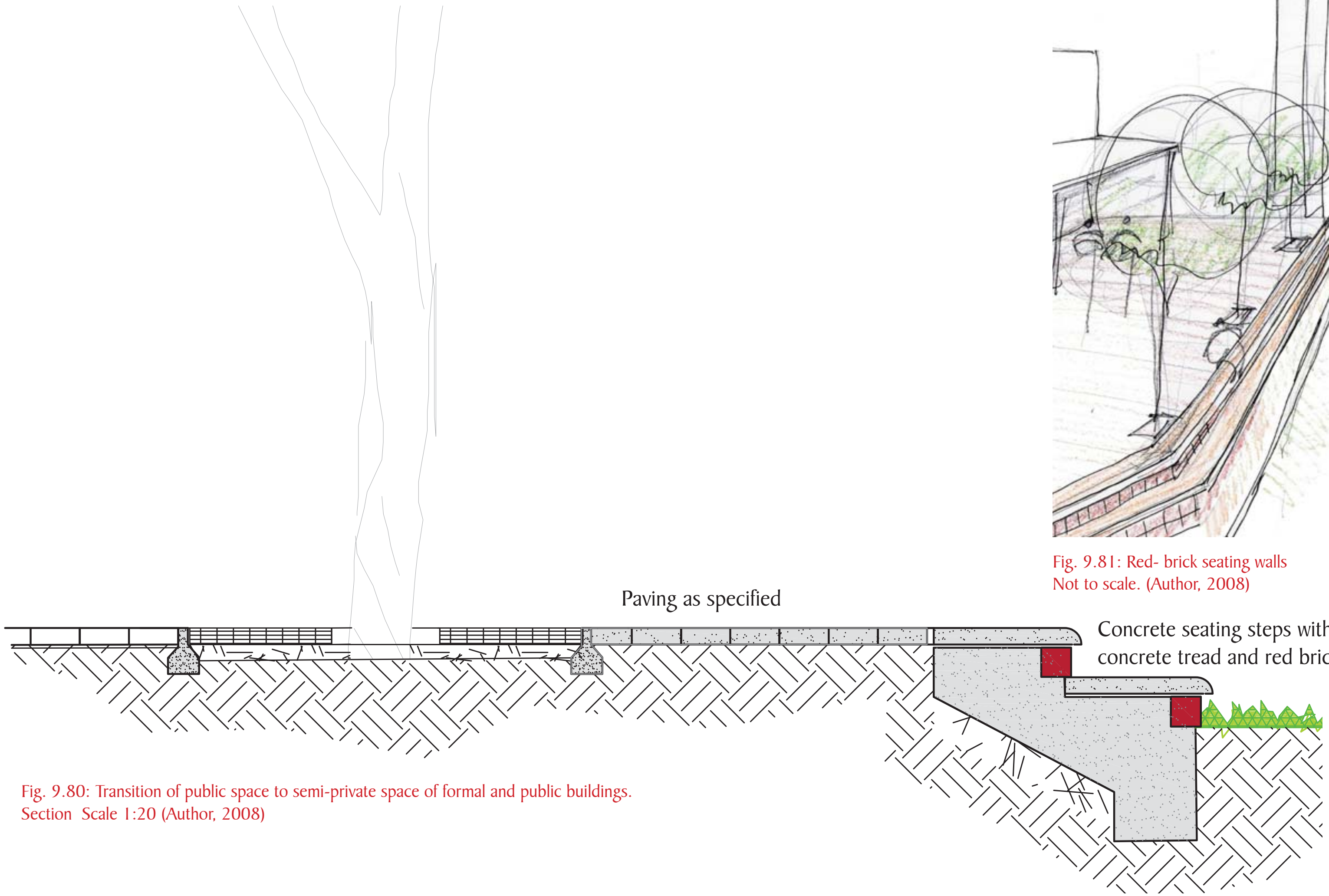


Fig. 9.80: Transition of public space to semi-private space of formal and public buildings.
Section Scale 1:20 (Author, 2008)

Fig. 9.82: Perspective of plinth and seating areas of main admin building (Author, 2008)

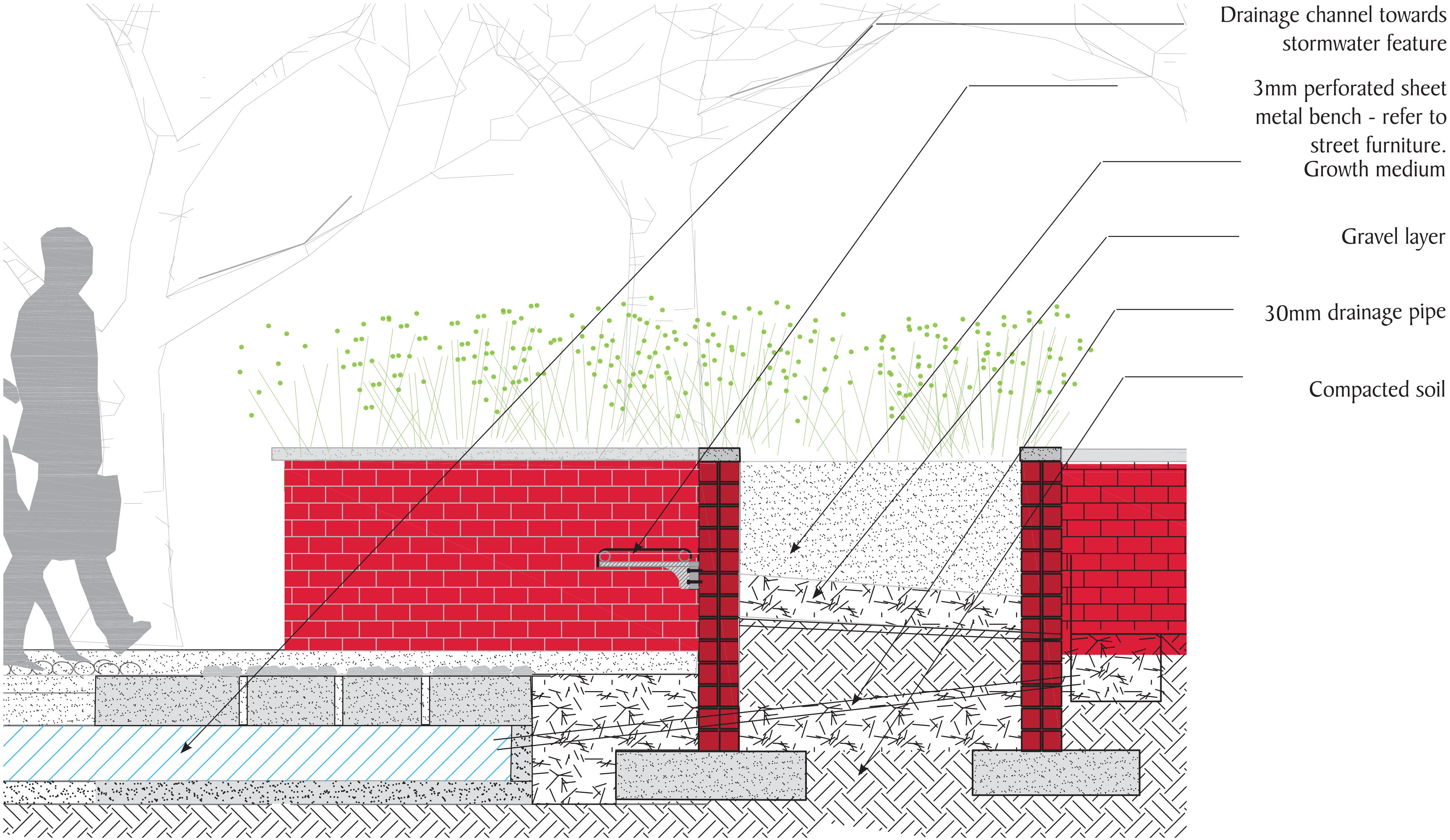


Fig. 9.83: Plinth to Main Administration building Section Scale 1:25 (Author, 2008)