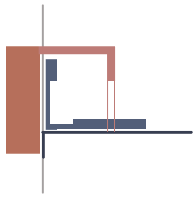
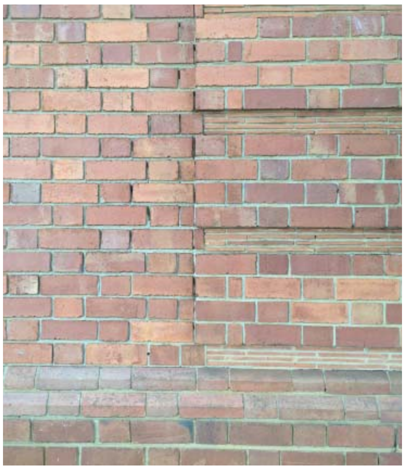
5. DESIGN ENRICHMENT

In this chapter the technology that is used to realise the spatial principles of Chapter 4 is elaborated on. Technology is unpacked in materials and composition. The Material Library Table onpg. 90 is a compilation of significant materials in the design and their intrinsic values. The table forms the vocabulary that articulates the relationship between the materiality of the spaces and their natural environment. These values range from the quantitive to the qualitative and are arranged in a manner that highlights each material's relation to the natural elements of water and the sun. Of this compilation of materials, concrete is elaborated on for its critical role as water container in the scheme and clay brick technology is further investigated for the value it adds to the relationship between city users and their natural environment. The pallet of materials are then brought into composition at critical points in the design to illustrate the concepts that drive the experience of and connections between the materials.

5.1. MATERIALS

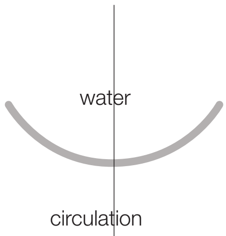
The **water plane** is a **monolithic concrete element**. The rationale of the water container gives form to its navigation which in turn conceals and erodes the container according to the programmes in its adjacent courtyards. A **brick skin mediates** the interstitial spaces between the courts, users and the water plane. The modular nature of the brick plane allows a plastic manipulation of the skin to facilitate interaction with the water reservoir and its users.





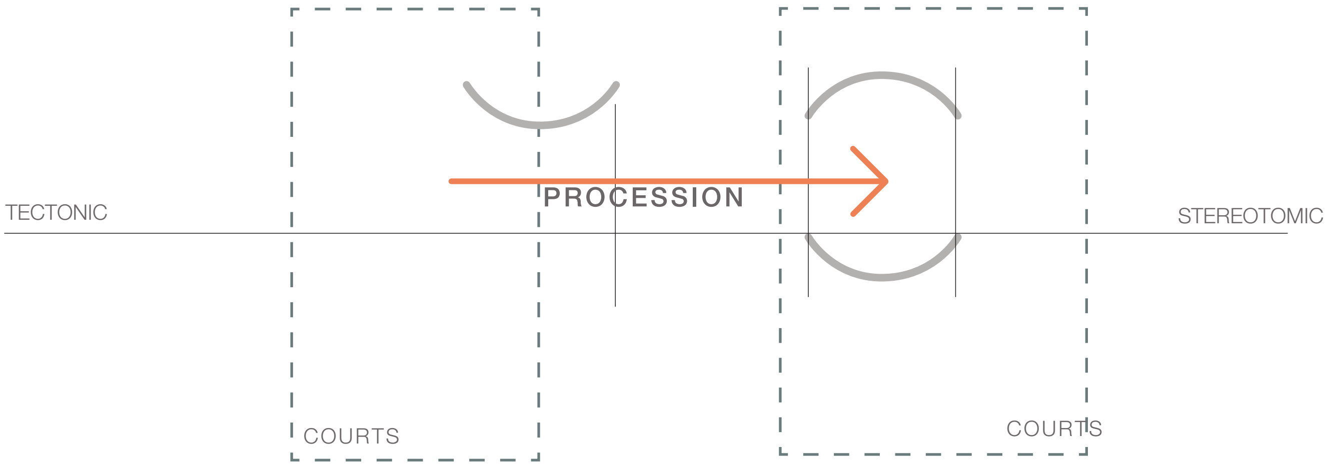
	C2	C3	C4	C5	C6	C7	C8	C9	C10
RA					SUN				
RB		WATER							
	MATERIAL	APPEARANCE AND TOUCH	PERMEABILITY	WATER VAPOUR RESISTANCE FACTOR	DENSITY KG/M3	THERMAL CONDUC-TIVITY W/(M K)	SPECIFIC HEAT CAPACITY J/(KG K)	THERMAL MASS (KJ/M3.K)	NOTES
R1				WATER VAPOUR IS TRANSPORTED THROUGH POROUS MATERIALS PREDOMINANTLY BY VAPOUR DIFFUSION.	A HIGH DENSITY INDICATES A HIGHER HEAT CONDUCTIVITY. LOW DENSITY MATERIALS MAY CONTAIN AIR WHICH HAVE A LOW CONDUCTIVITY.	THE RATE AT WHICH HEAT PASSES THROUGH A SPECIFIED MATERIAL.		THE ABILITY OF A MATERIAL TO STORE HEAT. BUILDING MASS PROVIDES THERMAL DAMPING	
R2	BITUMEN FELT/SHEET			50 000	1100	0.23	1000		
R3	**CONCRETE** MEDIUM DENSITY HIGH DENSITY REINFORCED (WITH 1% OF STEEL) REINFORCED (WITH 2% OF STEEL)	CONCRETE DARKENS TEMPORARILY IN COLOUR WHEN WET AND PERMANENT STAINING MAY BE CAUSED BY THE FLOW OF RAINWATER WHICH COLLECTS AND DEPOSISTS DIRT. WET CONCRETE'S TEXTURE REMAINS UNALTERED.	IT IS POROUS AND PERMEABLE. WATER COMPROMISES THE DURABILTY OF A CONCRETE STRUCTURE AND IS SUBJECT TO DETERIORATION WHEN WATER AND WATER BORNE CHEMICALS PENETRATES IT. CONCRETE IS WATERPROOFED WITH A BITUMINOUS LAYER.	100 120 130 130	1800 2400 2300 2400	1.15 2.0 2.3 2.5	1000	2060	CONCRETE IS STEREOTOMIC AND DOES NOT DISCLOSE ITS INNER WORKINGS. ITS SURFACE LAYER WITHOLDS AN UNDERSTANDING OF ITS COMPOSITION AND HOW IT WORKS AND PORTRAYS ITS CONGLOMERATE NATURE. THE QUALITY OF THE CONCRETE SURFACE CHARACTERISES THE SPACE AS A WHOLE AND IS PREDISPOSED TO THE ABSTRACT. CONCRETE IS MALLEABLE DURING CONCEPTION BUT TURNS INTO ROBUST MATERIAL WHEN CAST GIVING IT A SENSE OF PERMANENCE.
R4	**BRICK** FIRED CLAY MASONRY MORTAR	BRICK DARKENS TEMPORARILY IN COLOUR WHEN WET AND PERMANENT STAINING MAY BE CAUSED BY THE FLOW OF RAINWATER WHICH COLLECTS AND DEPOSISTS DIRT WHICH IS LESS OBVIOUS THAN ONCRETE DUE TO THE UNEVEN TEXTURE AND COLOURATION OF ITS SURFACE. ITS TEXTURE IS SUBSEQUENTLY UNAFFECTED BY WATER. SMOOTH BRICKS MAY BECOME SLIPPERY WHEN WET.	BRICK IS POROUS AND PER-MEABLE AND HAS GRADES OF EFFLORESENCE. THE AVERAGE WATER AB-SORPTION OF CLAY BRICKS IS BETWEEN 6-14%. BRICK CAN BE WATERPROOFED WHEN A SILICA FRIT IS APPLIED AS FLUID AFTER WHICH IT IS FIRED TO FORM A WATERPROOF PROTECTIVE LAYER OF GLAZED CERAMIC FROM.	16 20	1000-2400 250-2000	0.44	1000 1000	1360	BRICK MASONRY IS A WEAVED STERE-OTOMY WITH A NETWORK OF JOINTS IN THE IMAGE OF RHYTHMIC ROWS OF KNOTS. THIS GIVES IT A RICH TEXTURE DEFI NED BY THE LIGHT AND SHADOWS CAST ON THIS NETWORK OF COUNTLESS JOINTS. WHEN BRICK IS MADE FROM THE EARTH IT GIVES FORM TO, IT BECOMES OF THE PLACE AND A CONTEXTUAL INTERVENTION. THE FORM OF BRICK IS CHARACTERISED BY MOD-ULARITY AND STANDARDISATION, ITS SMALL

									AND STANDARDISATION. ITS SMALL FORMAT LENDS IT TO MANUAL IMPLEMENTATION.
R5	**FERROUS METALS** STEEL STAINLESS STEEL CAST IRON, WROUGHT IRON, COR-TEN	TREATED STEEL HAS NO DISCOLOURATION AS WATER DOESN'T PENETRATE THE MATERIAL. SMOOTH AND TREATED STEEL IS SLIPPERY WHEN WET. THE SOUND OF WATER MAY ALSO RESONATE ON THE MATERIAL. UNTREATED STEEL WIL CORRODE LEAVING A PATINA OF RUST AND A ROUGH WEATHERED SURFACE.	STEEL IS NON PERMEABLE BUT UNTREATED STEEL WIL CORRODE (DEGRADATION DUE TO OXIDATION WHEN THE STEEL IS EXPOSED TO OXYGEN IN THE PRESENCE OF WATER). WATERPROOFING AND CORROSION PROTECTION MEASURES FOR STEEL INCLUDE HOT DIP GALVANISING, ZINC DUSTING, POWDER COATING, COPPER OR BRASS PLATING, PAINTING AND BAKED ENAMEL.	INFINITY	7800 7900	50 17	450 500		STEEL TECHNOLOGY IS BASED ON THE LOGIC OF BEING REDUCED TO THE ESSENTIALS - THE SIMPLEST ECONOMIC FORMULA. IT IS BASED ON PRAGMATISM AND IS A TECHNOLOGY THAT IS STRONGLY ASSOCIATED WITH STRUCTURAL LOADBEARING (IT IS THE "HIDDEN AID" IN COMPOSITE CONSTRUCTION).
									ITS TIES WITH INDUSTRIALISATION MEANS THAT THE MATERIAL IS REGARDED AS UNNATURAL AND PREFABRICATED OFF-SITE, RENDERING IT AN A-CONTEXTUAL MATERIAL. ITS APPLICATION AND PRODUCTION IS BASED ON REPITITION AND STANDARDISATION AND IT IS CONSIDERED A COLD CLEAN AND PRECISE PERMANENT MATERIAL.
R6	**NON FERROUS METALS** ALUMINIUM ALLOYS COPPER ZINC TIN CHROMIUM (RESISTANT TO COR-ROSION)	ALLUMINIUM ALLOYS, ZINC AND CHROMIUM HAVE NO DISCOLOURATION. THE SOUND OF WATER MAY RESONATE ON THE MATERIAL. A GREEN-BLUE PATINA APPEARS ON THE SURFACE OF COPPER (AND BRASS WHICH IS AN ALLOY OF COPPER AND ZINC) OVER TIME.	WATER DOESN'T PENETRATE THE MATERIAL AND NO WATERPROOFING MEASURES ARE APPLIED.	INFINITY	2800 8900 7200	160 380 110	880 380 380		
R7	**TIMBER** SOFT WOOD 0.14 HARD WOOD 0.16 HARD BOARD 0.20	VARNISHED TIMBER WILL NOT DISCOLOUR WHEN WET AND IS SLIPPERY WHEN WET	TIMBER HAS A POROUS STRUCTURE THAT IS DEGRADED BY WATER THAT CAN LEAD TO ROT AND DECAY. WATERPROOFING TIMBER INCLUDES A SURFACE COATING (SEALANTS AND VARNISHES) THAT CAN PREVENT MOISTURE FROM ENTERING THE SURFACE OF THE TIMBER. ADEQUATE VENTILATION AND A VAPOUR BARRIER IS NECCESARY IN COLD INTERIOR ZONES TO PROTECT THE TIMBER AGAINST CONDENSATION.	50 50 200	450 500 700	0.12 0.13 0.18	1600		WOOD IS A NATURAL OR RAW PRODUCT WITH PROPERTIES OF IRREGULARITY. IT FINDS APPLICATION IN STANDARDISED AND PREFABRICATED PANELS OR BOARDS THAT LENDS IT A TECTONIC NATURE. THE MATERIAL IS SUPPLE/TENSILE QUALITY AND APPEALING HAPTIC QUALITY DUE TO ITS RESISTANCE TO HEAT TRANSFUSION. IT IS CONSIDERED A LIGHTWEIGHT MATERIAL AND CAN BE CONTEXTUAL WHEN INDIGENOUS TIMBER IS USED TO REFLECT ITS ENVIRONMENT.
R8	**GLASS** SODA LIME GLASS (IN-CLUDING FLOAT GLASS)	GLASS HAS NO DISCOLOURA-TION. VISIBILITY IS IMPAIRED WHEN IT IS WET AND IT IS EXTREMELY SLIPPERY WHEN WET. GLASS CAN INDICATE THE PRESENCE OF WATER IN OTHER PHYSICAL STATES SUCH AS CONDENSATION. THE SOUND OF WATER RESONATES ON THE MATERIAL WITH A DAMPLED EFFECT.	GLASS IS NON PERMEABLE AND WATERPROOF.	INFINITY	2500	1.0	750		GLASS REFLECTS OUR WORLD, ITS SURFACE STEPS BACK FROM ITS OWN BODY AND THE MATERIAL - DESPITE ITS TRANSPARANCY - AWAKENS THE IMPRESSION OF MYSTERIOUS DEPTH. IT IS THEREFORE TECTONIC AND STEREOTOMIC AT THE SAME TIME. ITS MAIN PURPOSE IS TO LET THROUGH LIGHT. IT IS TRANSPARENT, HARD AND PRECIOUS OR BRITTLE.



5.2. COMPOSITION

The materials are brought together at critical points in the compostion to illustrate the concepts that drive the experience of and connections between the materials. The composition characterises the form of spaces and guides the structure of the technology. The concept of composition is best described by the user's procession through the spaces in the scheme. The role that water plays in structuring the spaces is evident from Chapter 4. Now a tectonic skin, brick and concrete materialises the procession. In the procession, taken at any point in the design, the user's experience of the composition of materials can be placed on a spectrum which at one end, will start with the tectonic (or lightness) and end in the stereotimic (or heaviness). This spectrum also helps to give structure to the procession through space through the notion of moving from one extreme to another. This procession will see the relationship with water start from a formal one (water collection) to a haptic one (water use). To best illustrate these two spectrums and their spatial material implications, the diagram indicates how circulation is experienced at the concave form of water collection and threatment, and progresses to the convex form of spaces where water is used and touched.

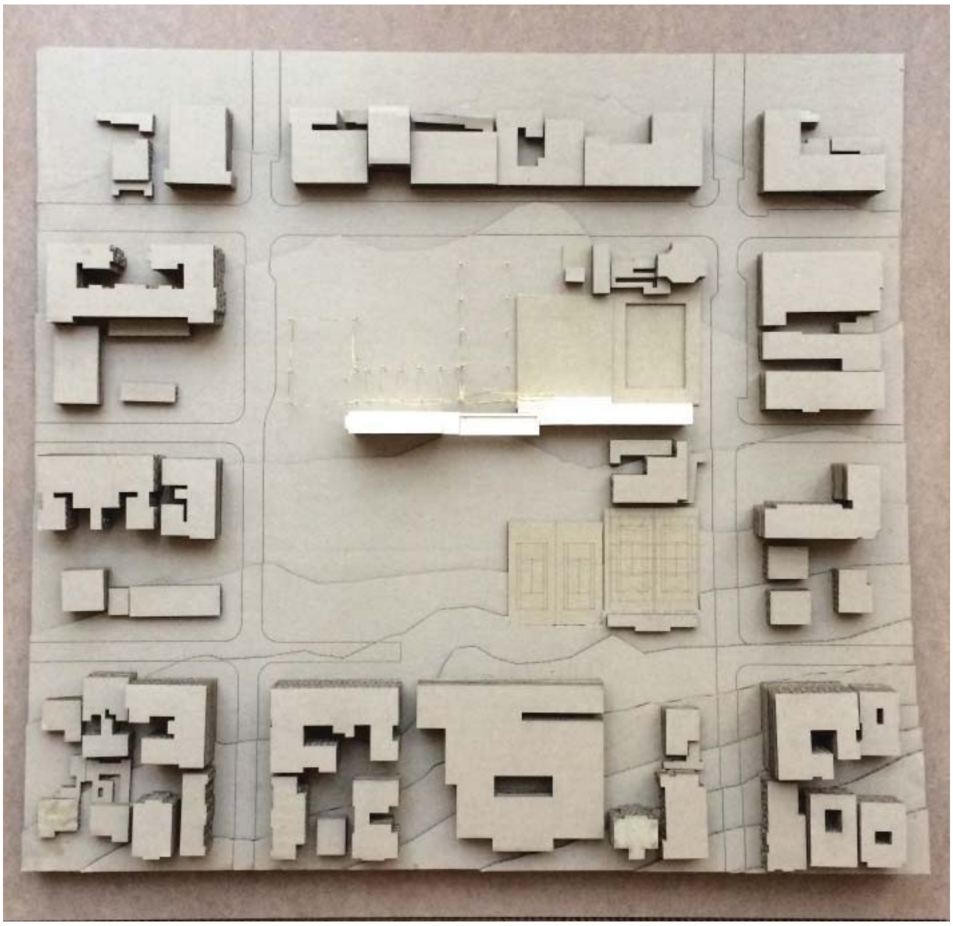


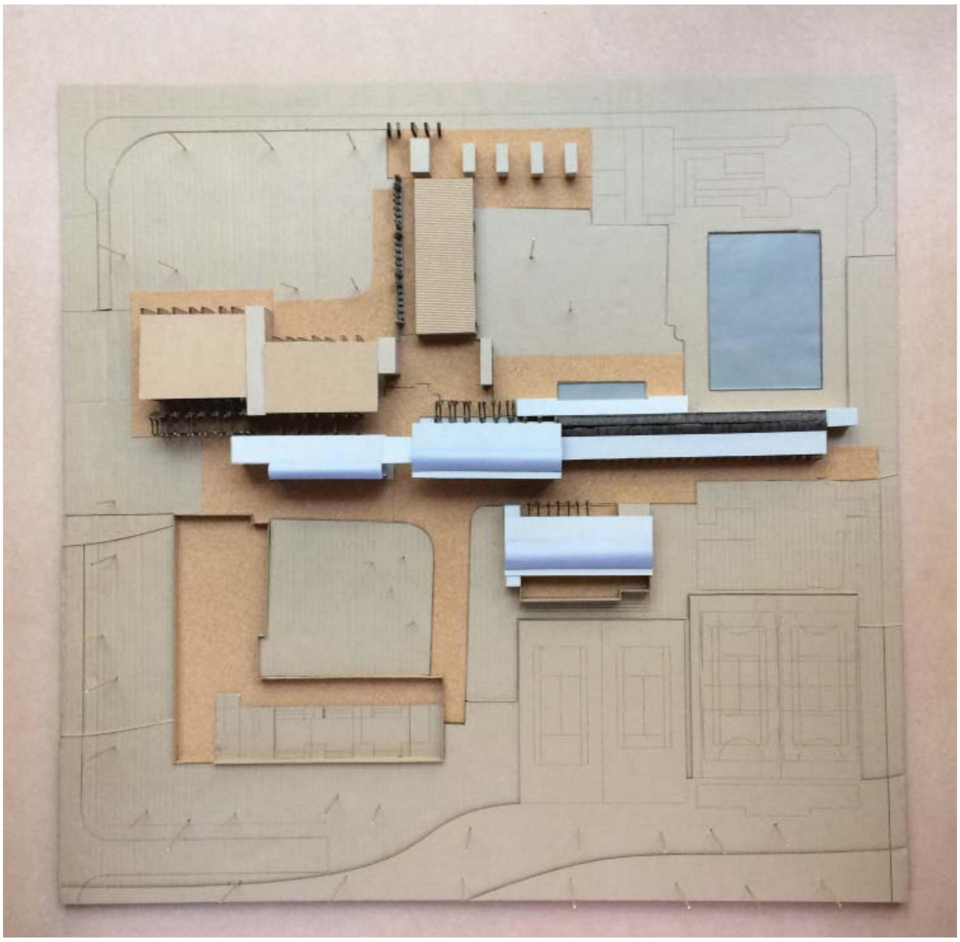
COMPOSITION OF MATERIALS

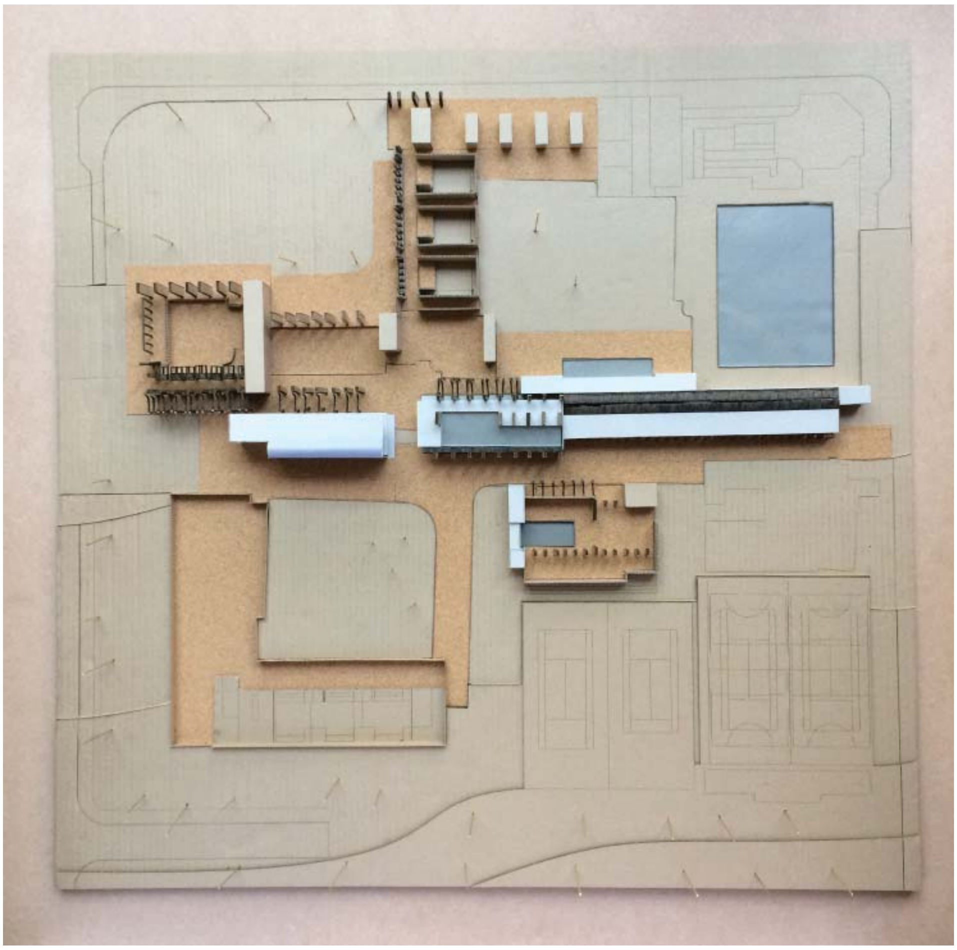
At hte beginning of this spectrum of composition, a tectonic structure frames the circulation that leads the user form the most public ends of the context to water spaces. The frame is a steel column and beam structure that allows a layered skin to protect the users from the natural environment. . The frame gives support to the concave form that transports roof water runoff to the reservoir. The convex steel bend forms the roof. The composition has a strong linear character and is based on repition. Its form scales the circulation routes with the larger presence of the structures surrrounding courts and scales it to a more intimate interor experinece.

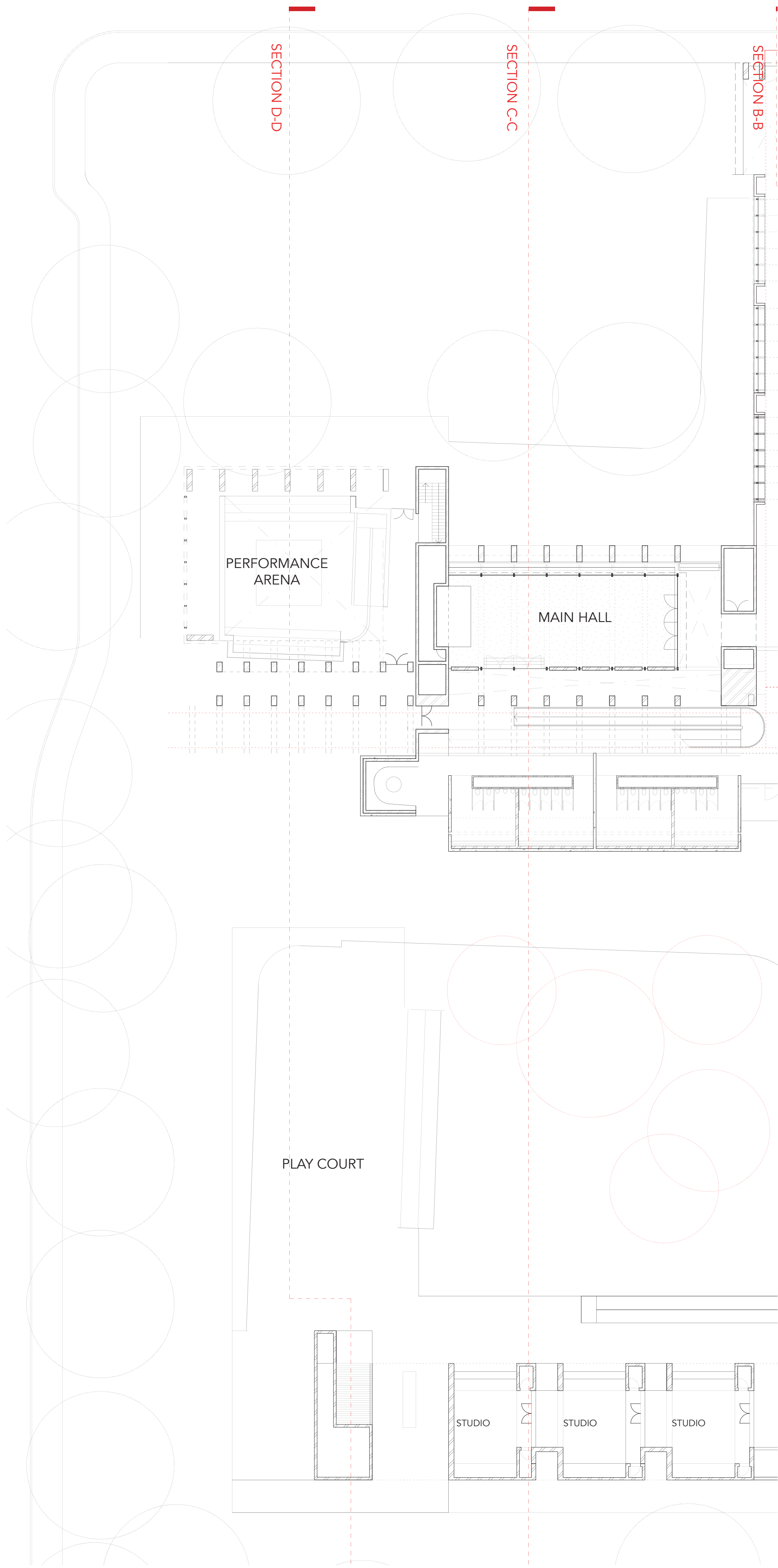
The next material in the procession of spaces is brick masonry. The connection between the steel circulation tectonic element and brickwork is expressed as being disconnected and dissimilar and achieved through shadow lines and convex turns and bends towards brickwork. Brickwork gives form to the interstices/conversion between circulation and water spaces. Brickwork is also an important contextual reference that it ties in with the historic masonry built fabric from the context. It acts as a lining membrane and finds application as a carpet that reaches out through the circulation arteries and courts. It also becomes a vertical lining membrane for intersitial programmes. Its structure consists of self supporting walls, reinforced walls and rectangular columns. These ranges of columns gives control over sight lines from the public courts and controlled overlooked views fom inside the spaces. The last and perhaps most prominent role of brick masonry is its connection with the next material in the procession composition - concrete. Here it acts as a mediating membrane between the user and concrete surfaces. It becomes a haptic membrane that brings concrete work to the scale of the individual. The membrane peels away from the concrete from where access to water is gained.

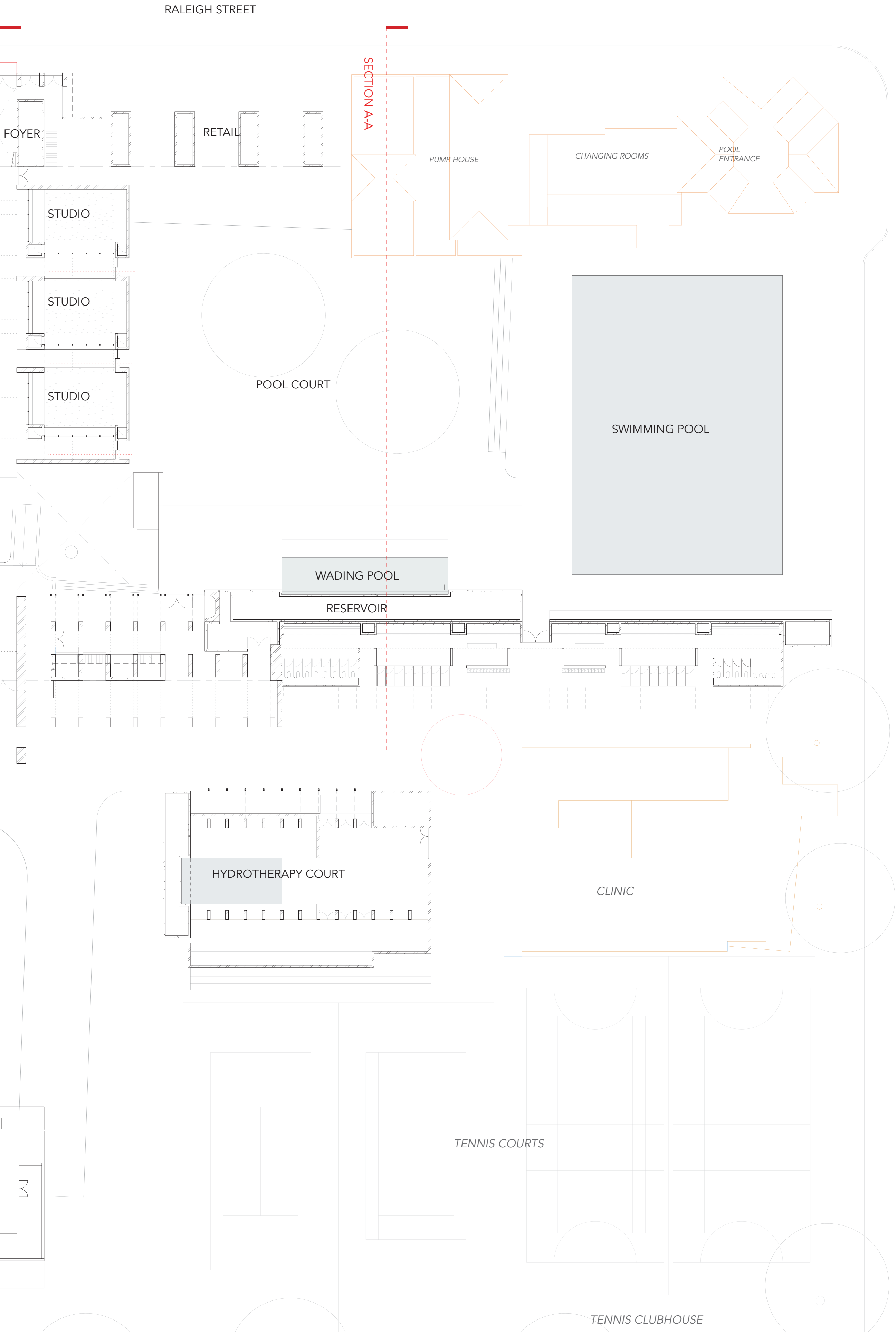
The final material that marks the destination in the composition of procession is oncrete. It is the functional and monolithic container for water and water-based use spaces. Its convex nature results in vaulted spaces. It is cast in situ that lends a sculptural nature to the most private spaces. inpenetrable nature. It is the central element to the design with astrong axis/alignment witht the east west street. Its exterior is rough bush-hammered appearance that transforms into smooth and polished surfaces on its interior.



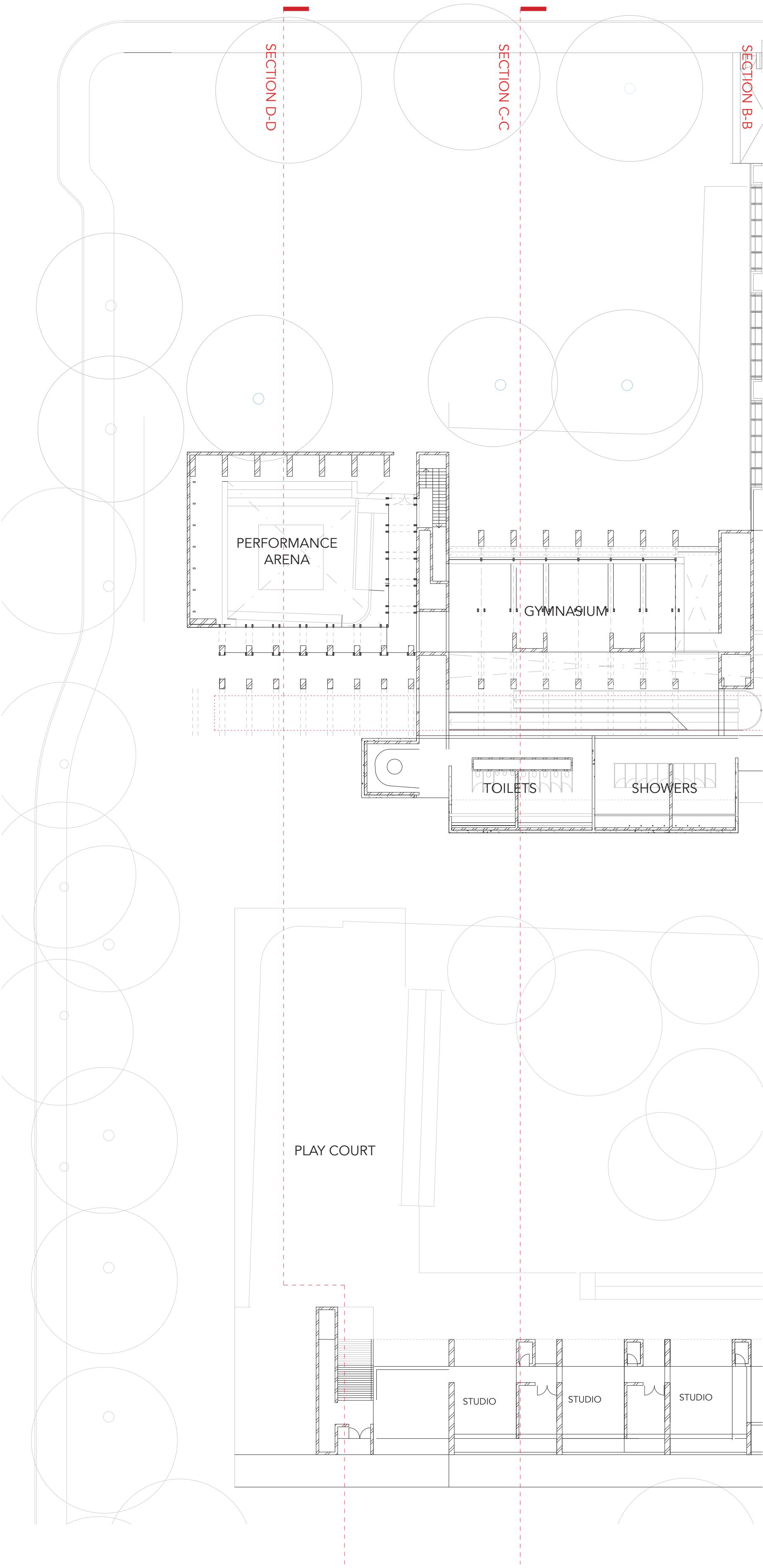


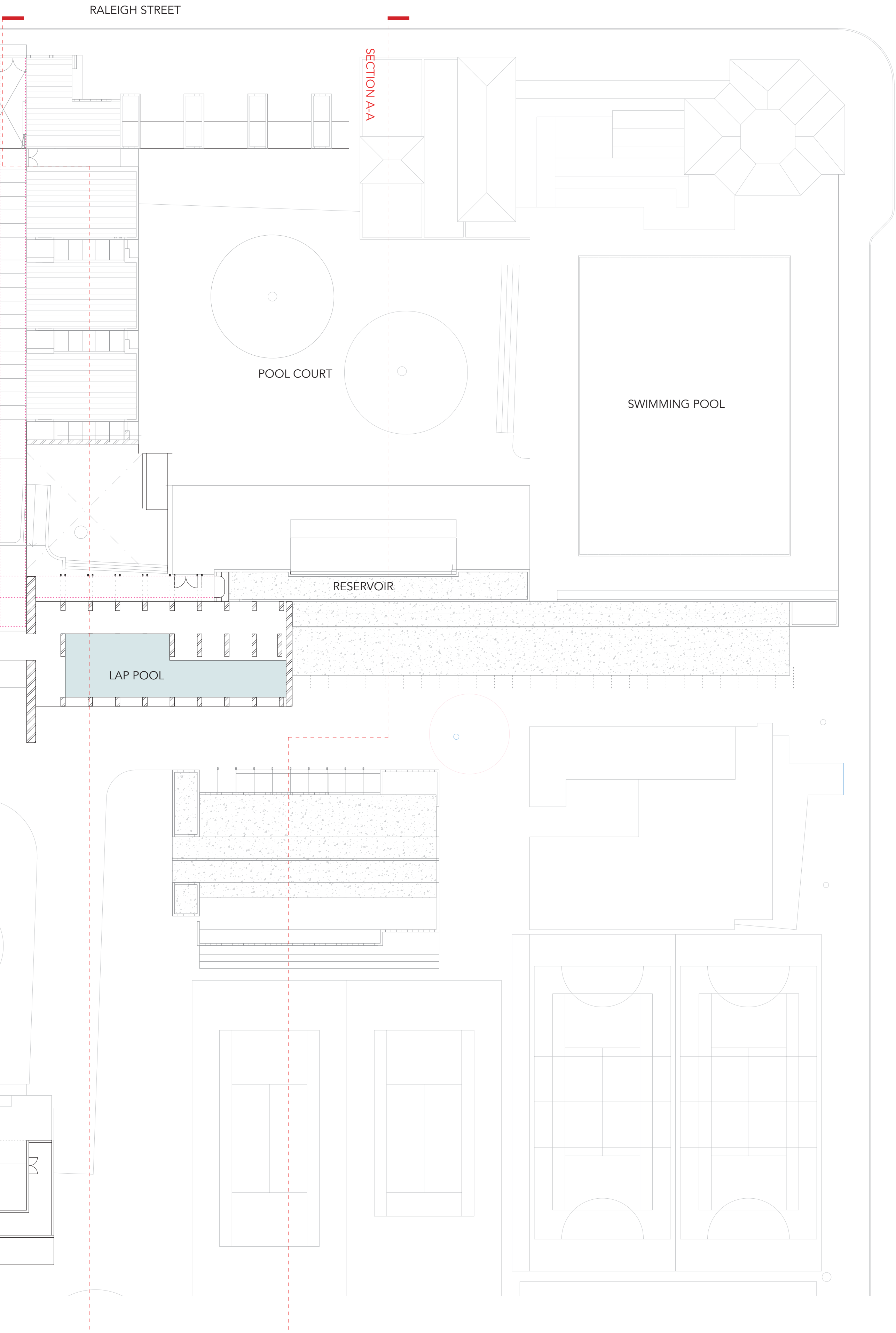



SECTION D-D
SECTION C-C
SECTION B-B
PERFORMANCE ARENA
MAIN HALL
PLAY COURT
STUDIO
STUDIO
STUDIO

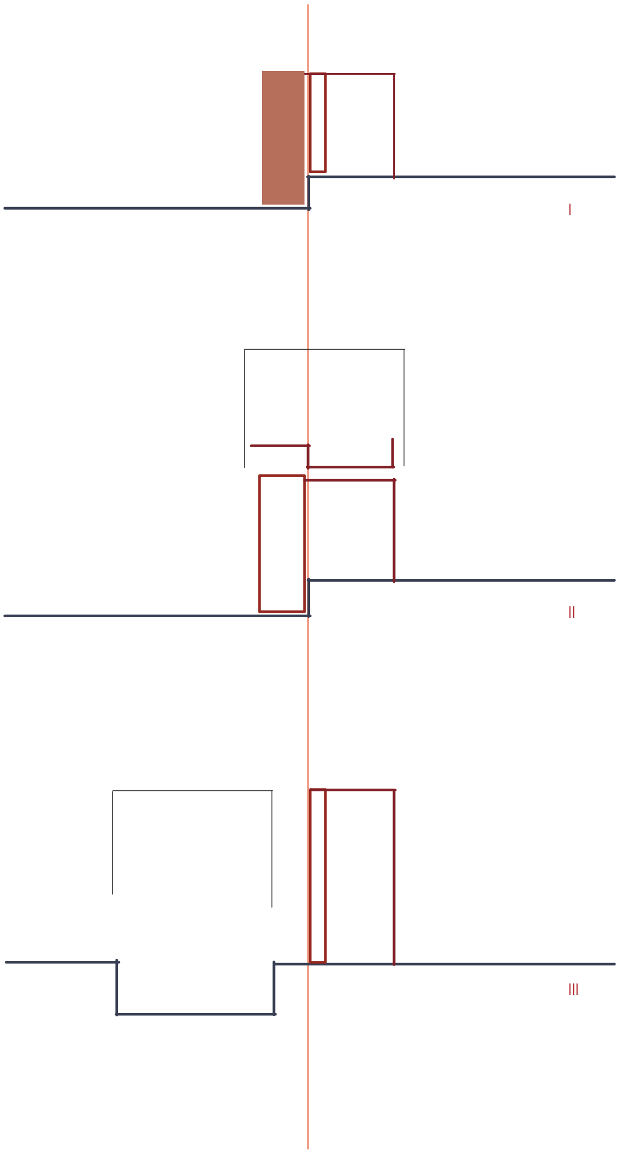


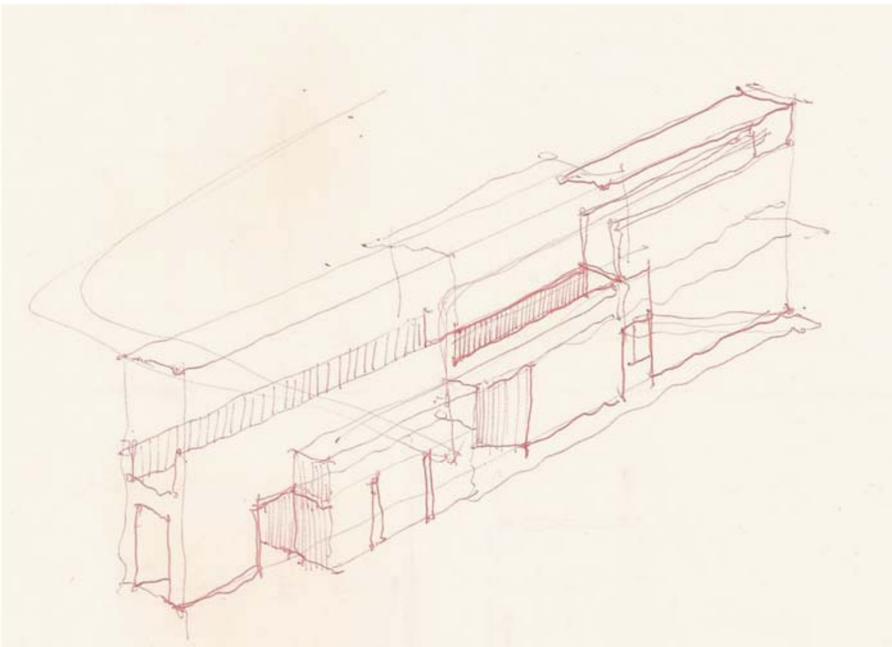
LOWER FLOOR LEVEL 1 1:200 NTS

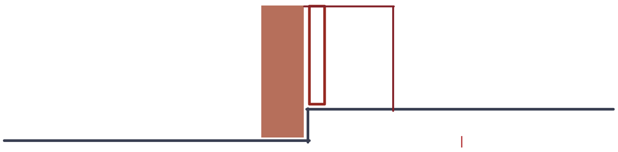

SECTION D-D
SECTION C-C
SECTION B-B
PERFORMANCE ARENA
GYMNASIUM
TOILETS
SHOWERS
PLAY COURT
STUDIO
STUDIO
STUDIO

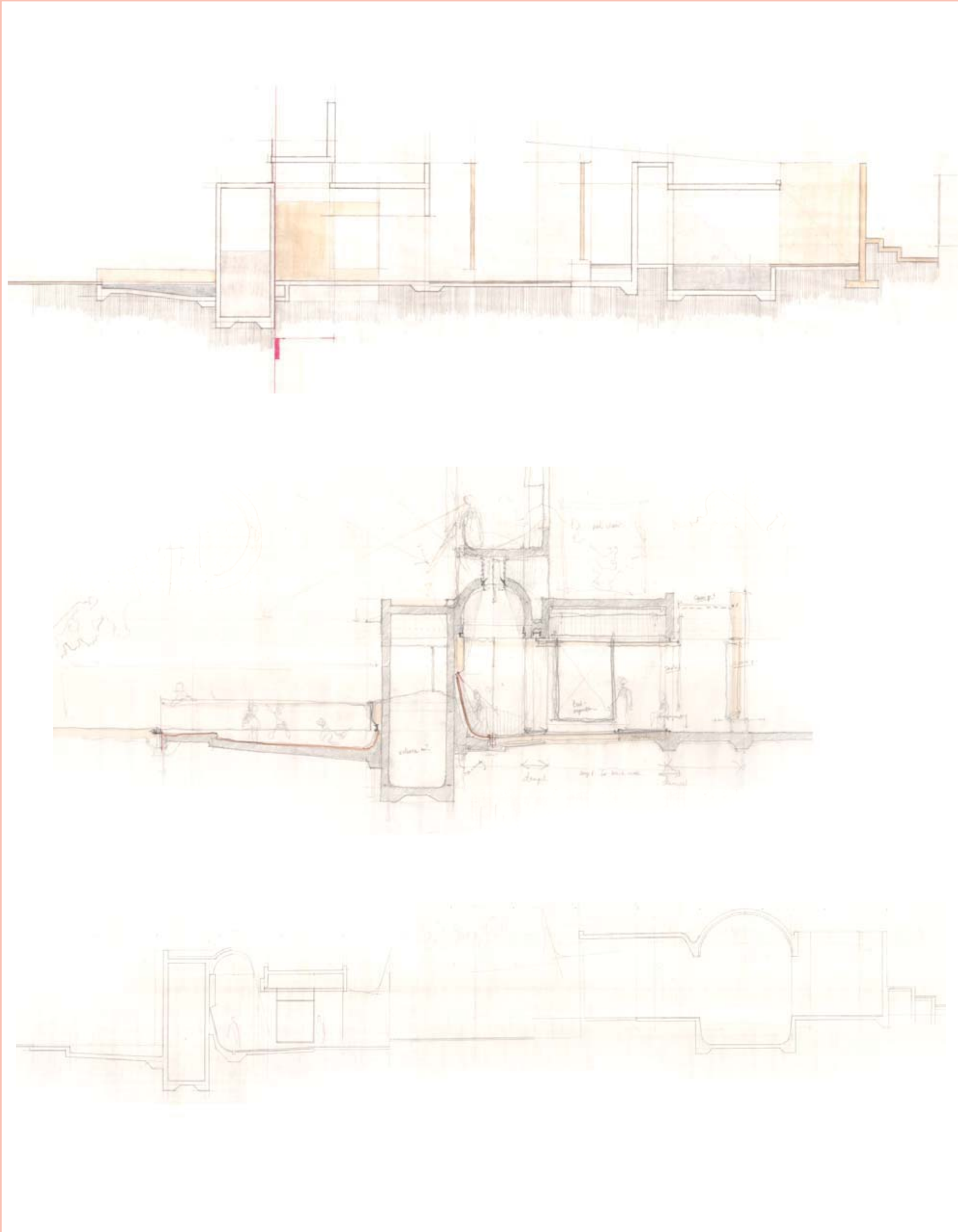


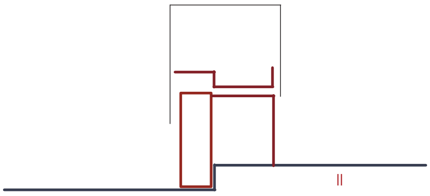
UPPER FLOOR LEVEL 1 1:200 NTS

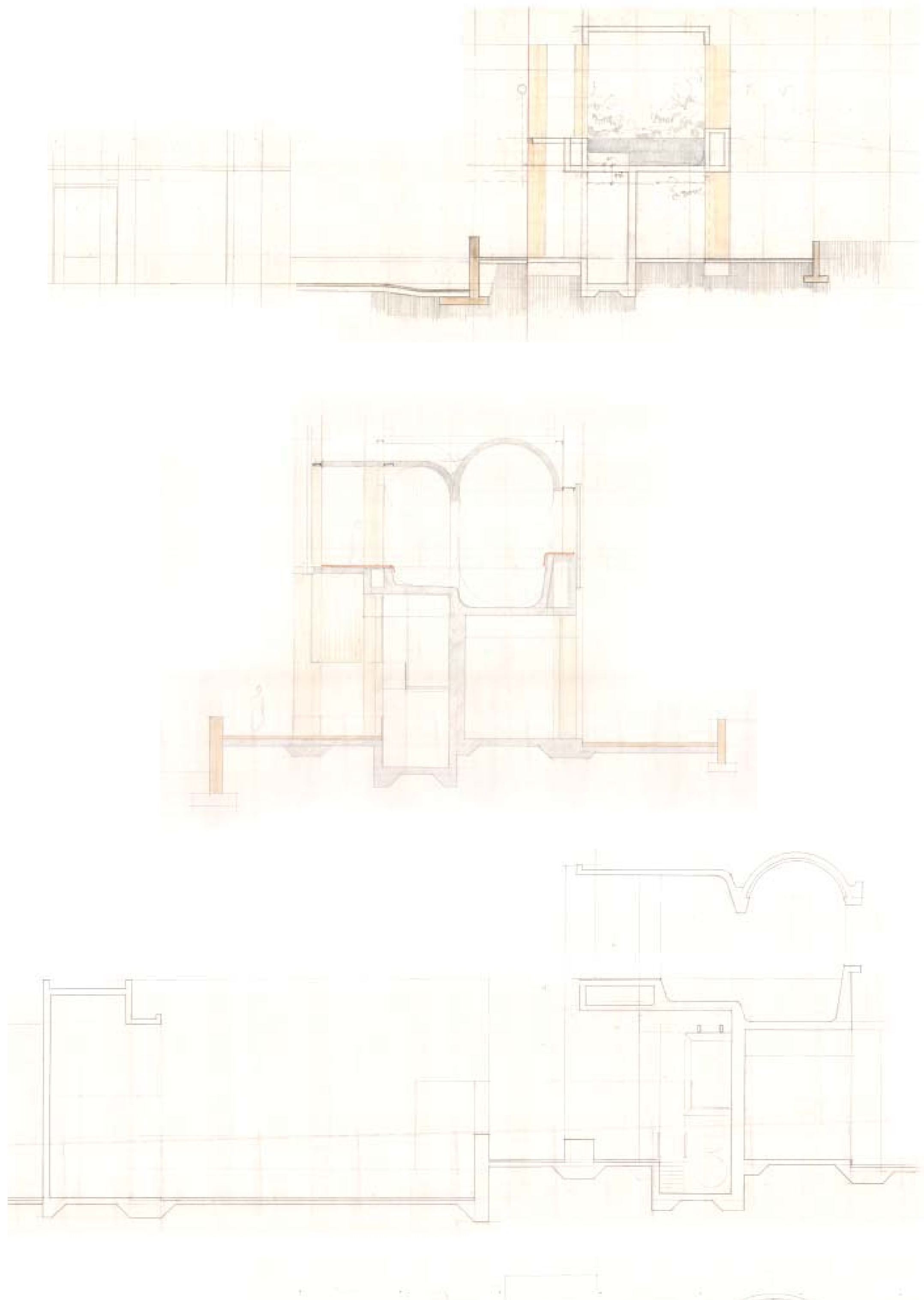

I
II
III

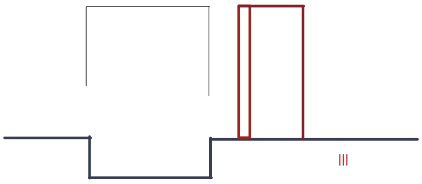


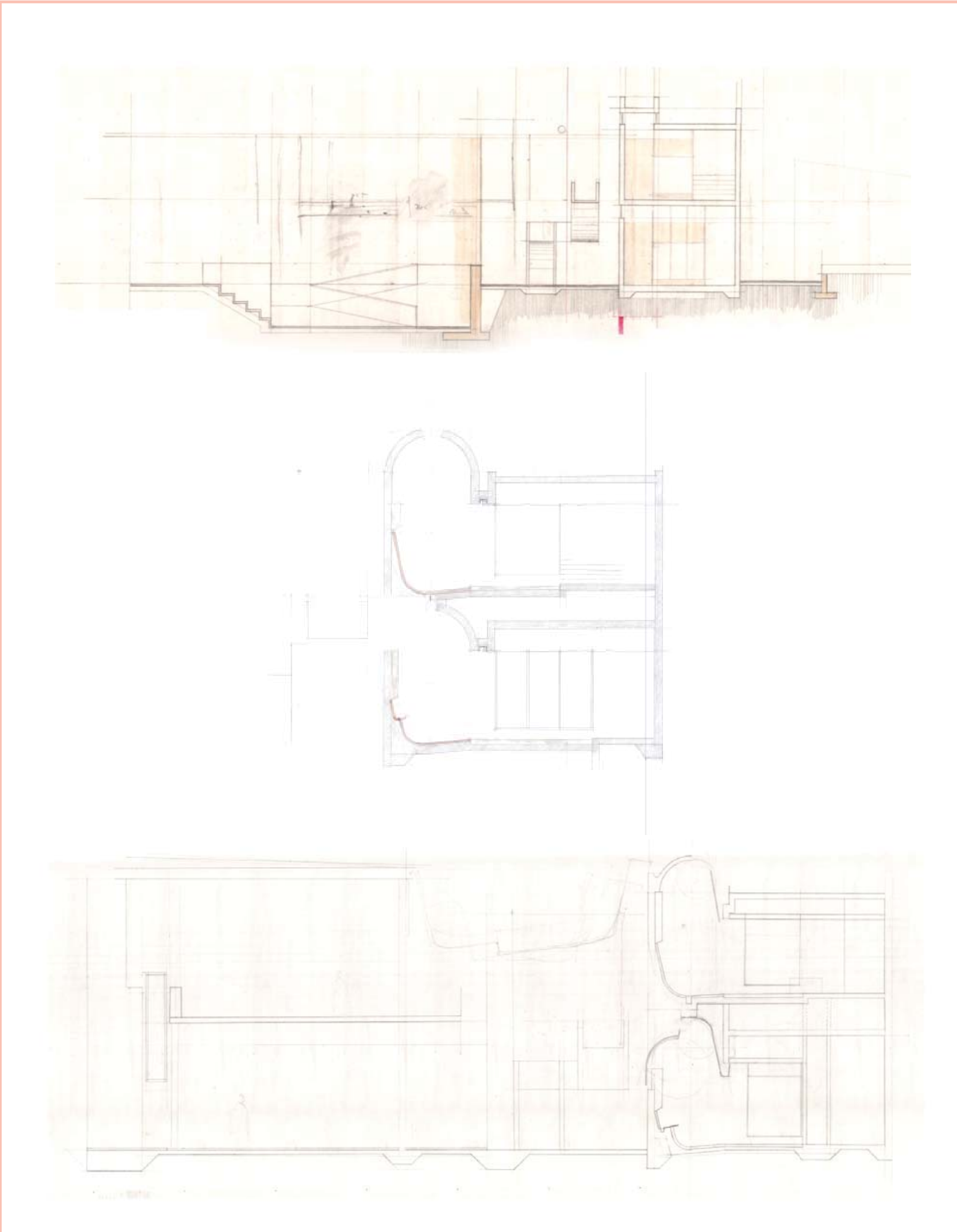


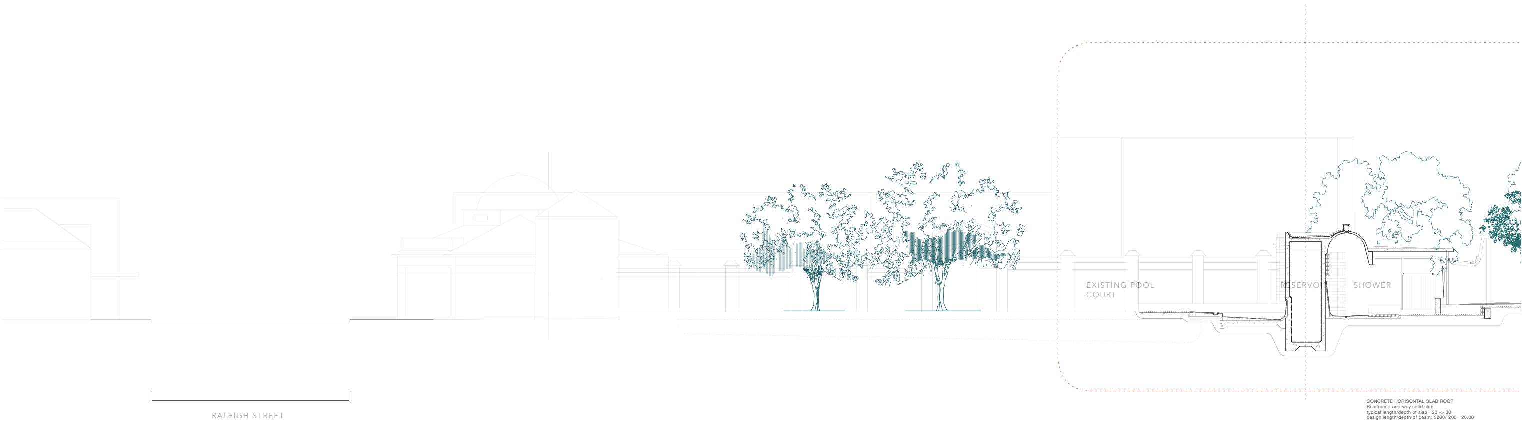


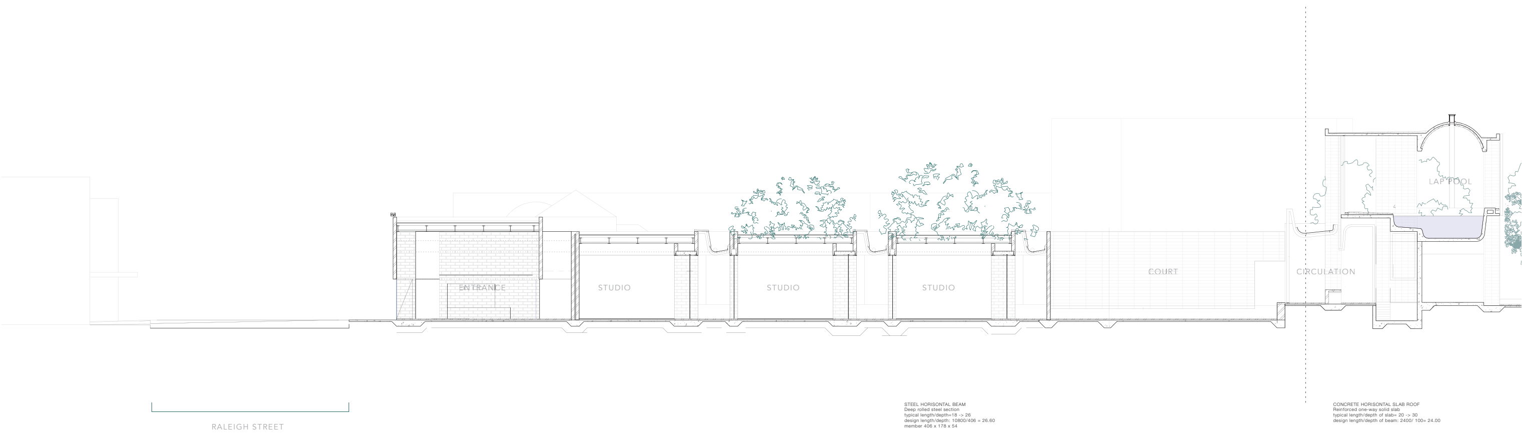


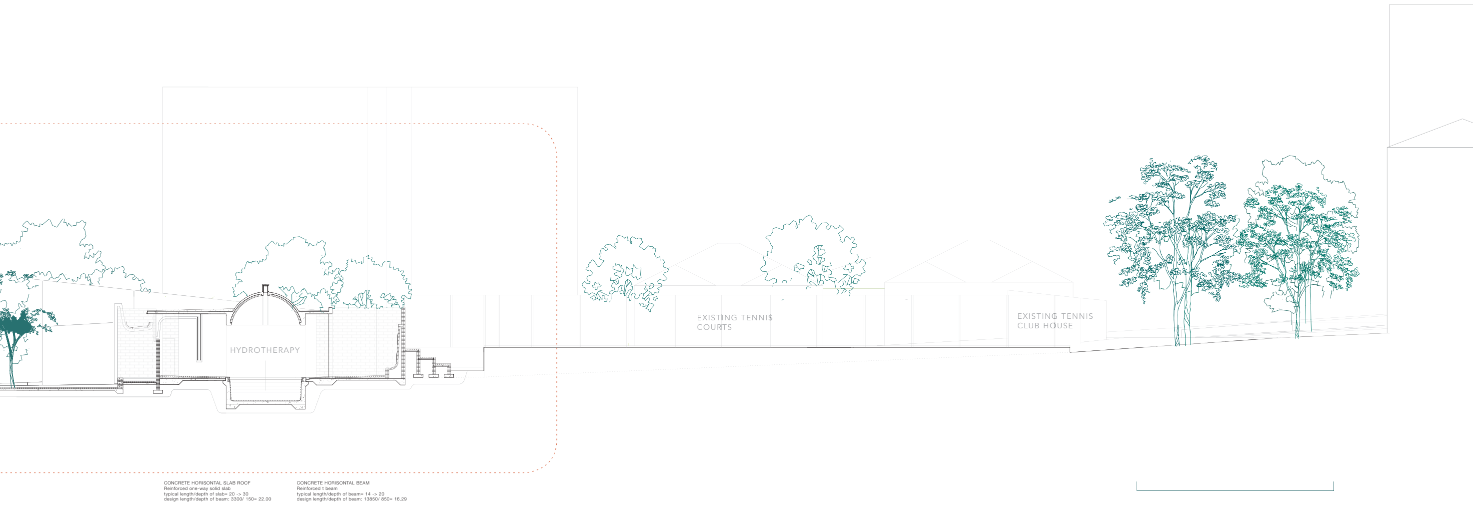



III




EXISTING POOL
COURT
SHOWER
RALEIGH STREET
CONCRETE HORISONTAL SLAB ROOF
Reinforced one-way solid slab
typical length/depth of slab= 20 -> 30
design length/depth of beam: 5200/ 200= 26.00

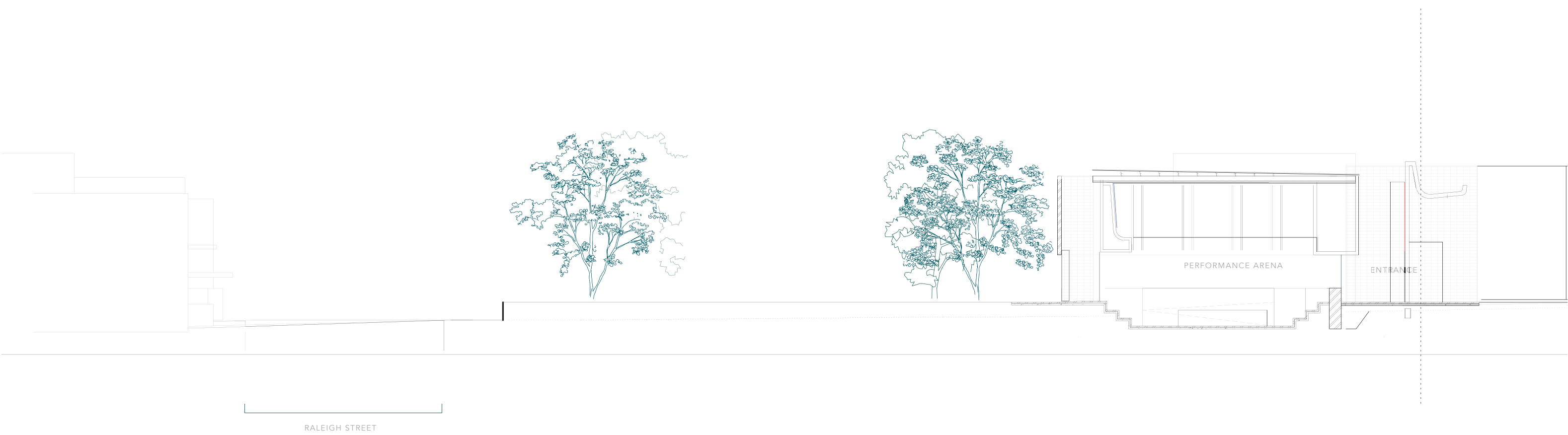

ENTRANCE
STUDIO
STUDIO
STUDIO
COURT
CIRCULATION
LAP POOL
RALEIGH STREET
STEEL HORISONTAL BEAM
Deep rolled steel section
typical length/depth=18 -> 26
design length/depth: 10800/406 = 26.60
member 406 x 178 x 54
CONCRETE HORISONTAL SLAB ROOF
Reinforced one-way solid slab
typical length/depth of slab= 20 -> 30
design length/depth of beam: 2400/ 100= 24.00

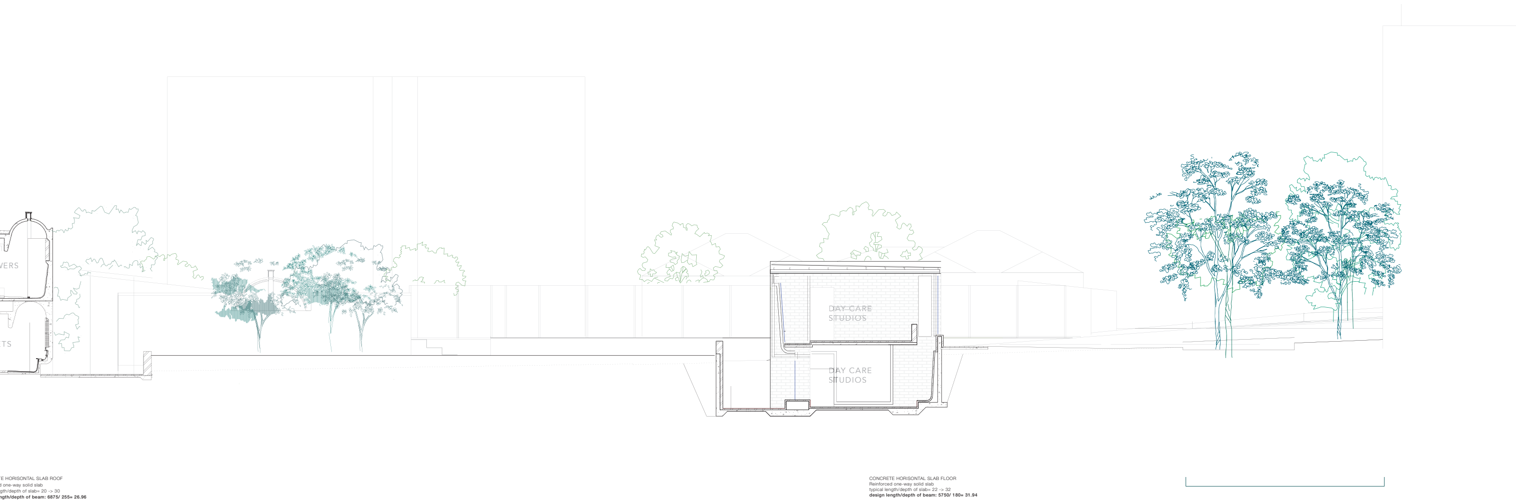


SECTION A-A 1:100 NTS

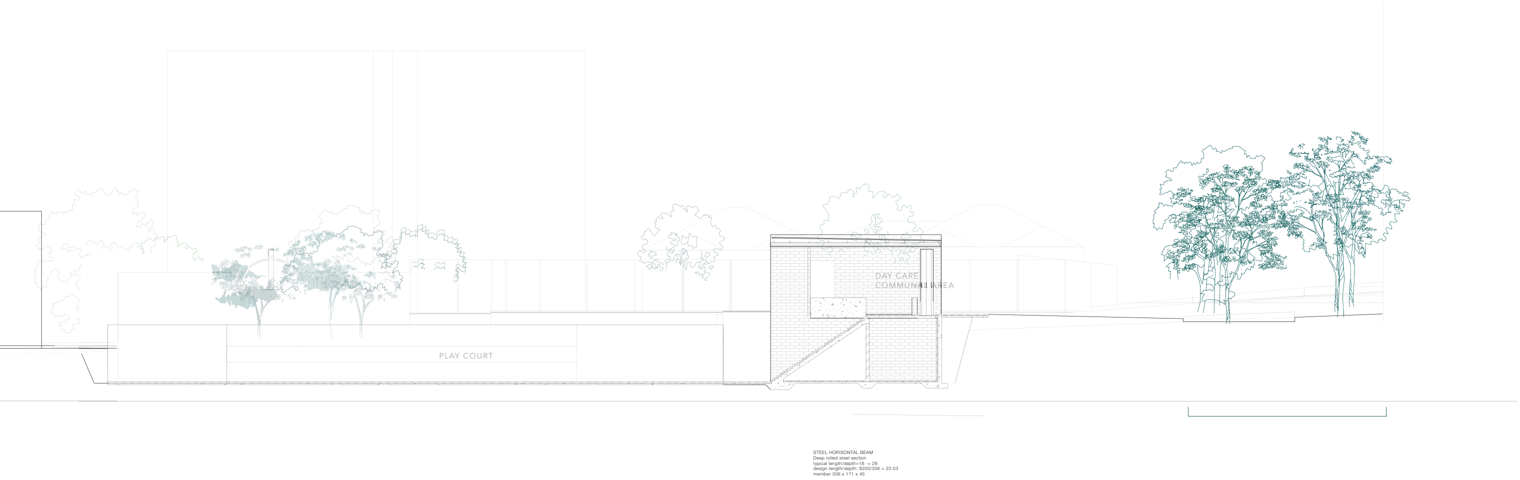
SECTION B-B 1:100 NTS


GYMNASIUM
MAIN HALL
CIRCULATION
RALEIGH STREET
STEEL HORISONTAL BEAM
Deep rolled steel section
typical length/depth=18 -> 26
design length/depth: 9650/406 = 23.76
member 406 x 178 x 54
STEEL VERTICAL SUPPORT
Rolled hollow steel section
typical length/depth=20 -> 35
design length/depth: 3900/200 = 19.5
member 200 x 100 x 4.5
CONCRETE HORISONTAL BEAM
Reinforced t beam
typical length/depth of beam= 14 -> 20
design length/depth of beam: 8450/ 800= 10.56
depth of concrete t beam excluding slab = 700
overcompensation for heavy gymnasium equioment
CONCRETE HORISONTAL SLAB FLOOR
Reinforced one-way solid slab
typical length/depth of slab= 22 -> 32
design length/depth of beam: 6875/ 255= 26.96

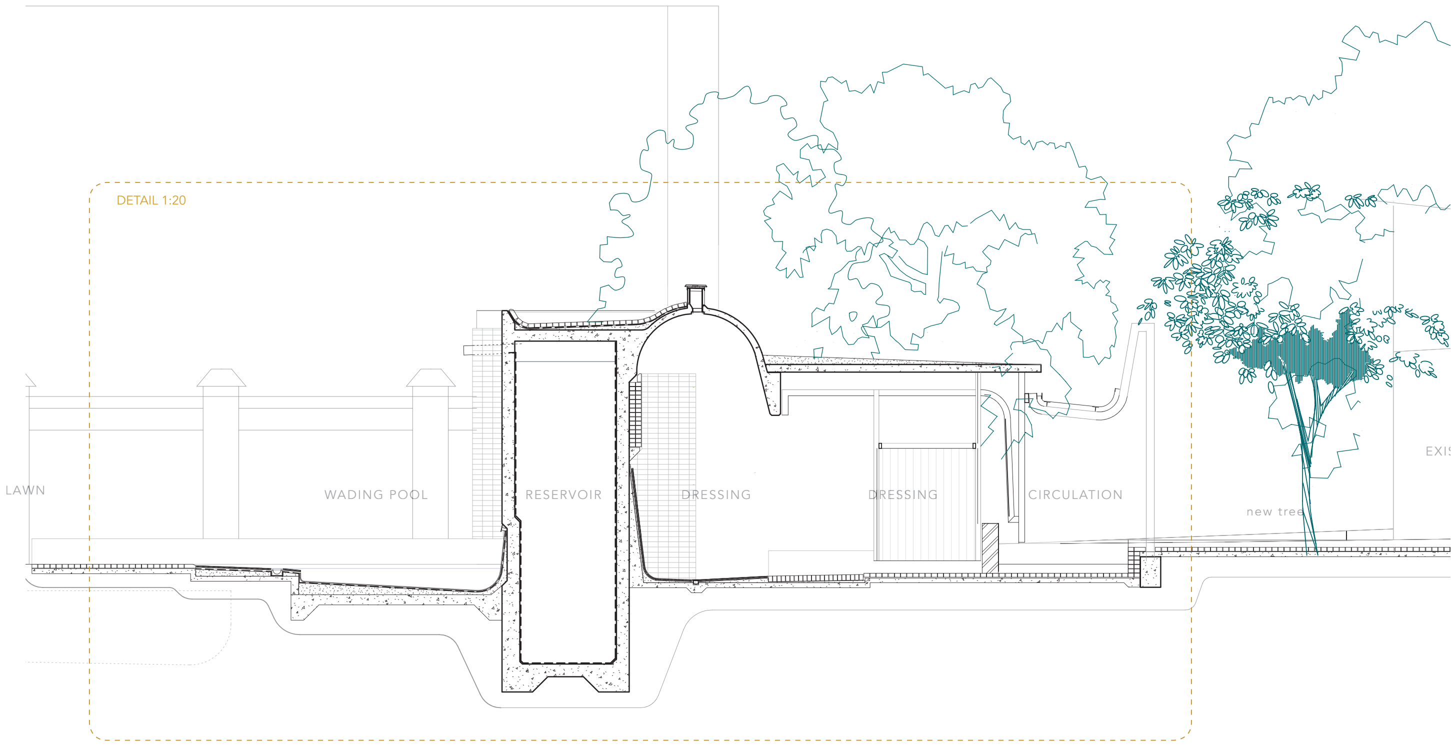

PERFORMANCE ARENA
ENTRANCE
RALEIGH STREET

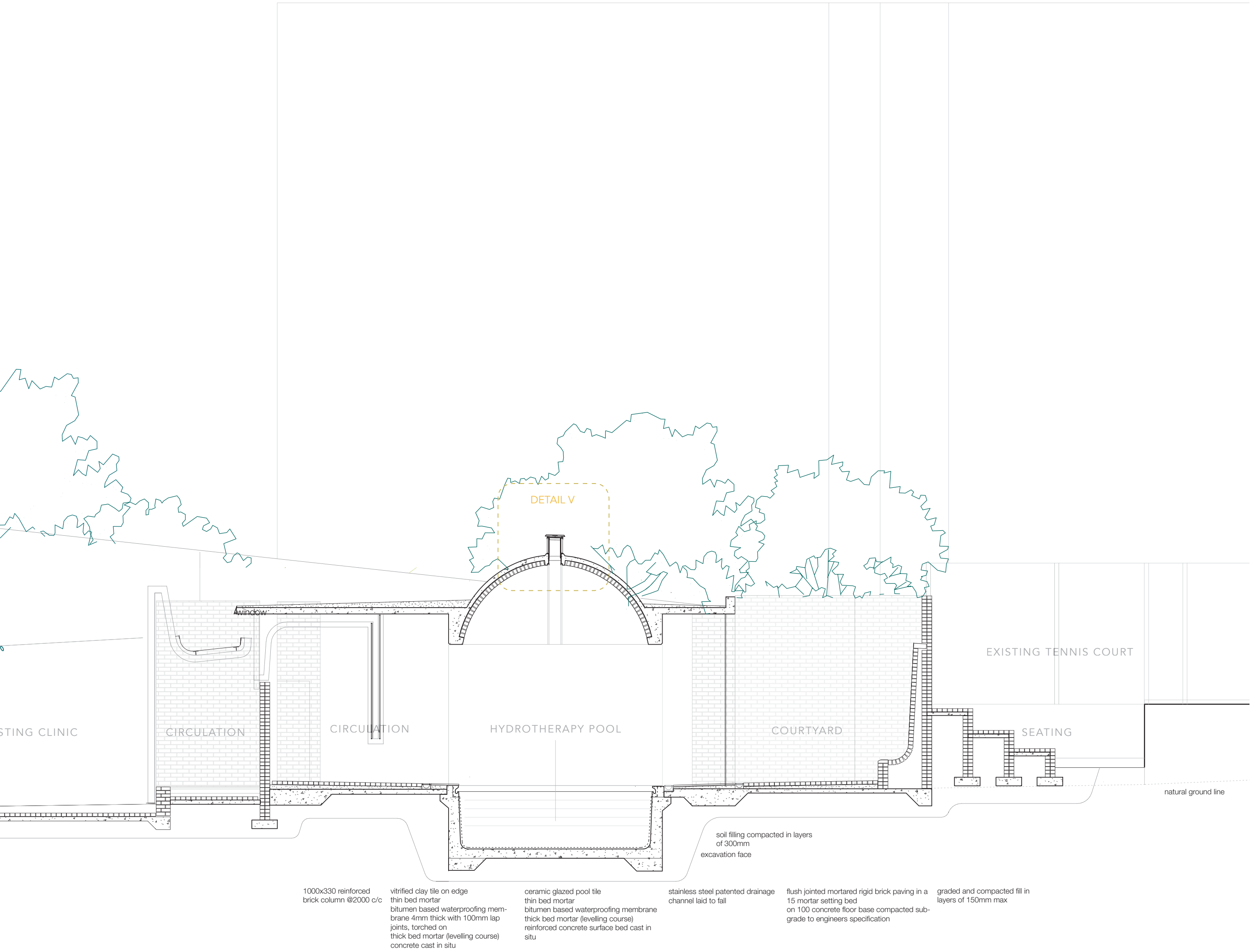


SECTION C-C 1:100 NTS

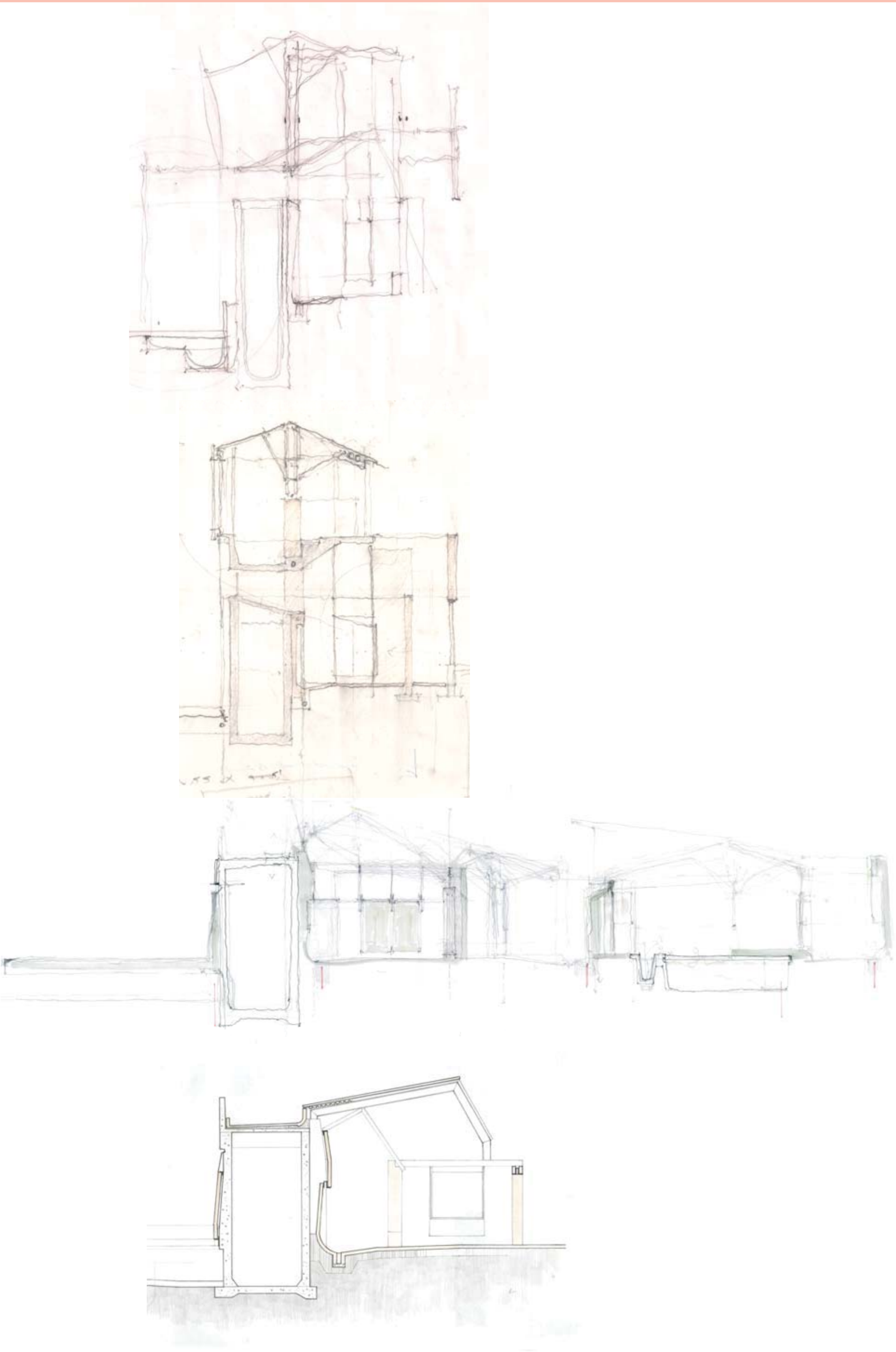


SECTION D-D 1:100 NTS

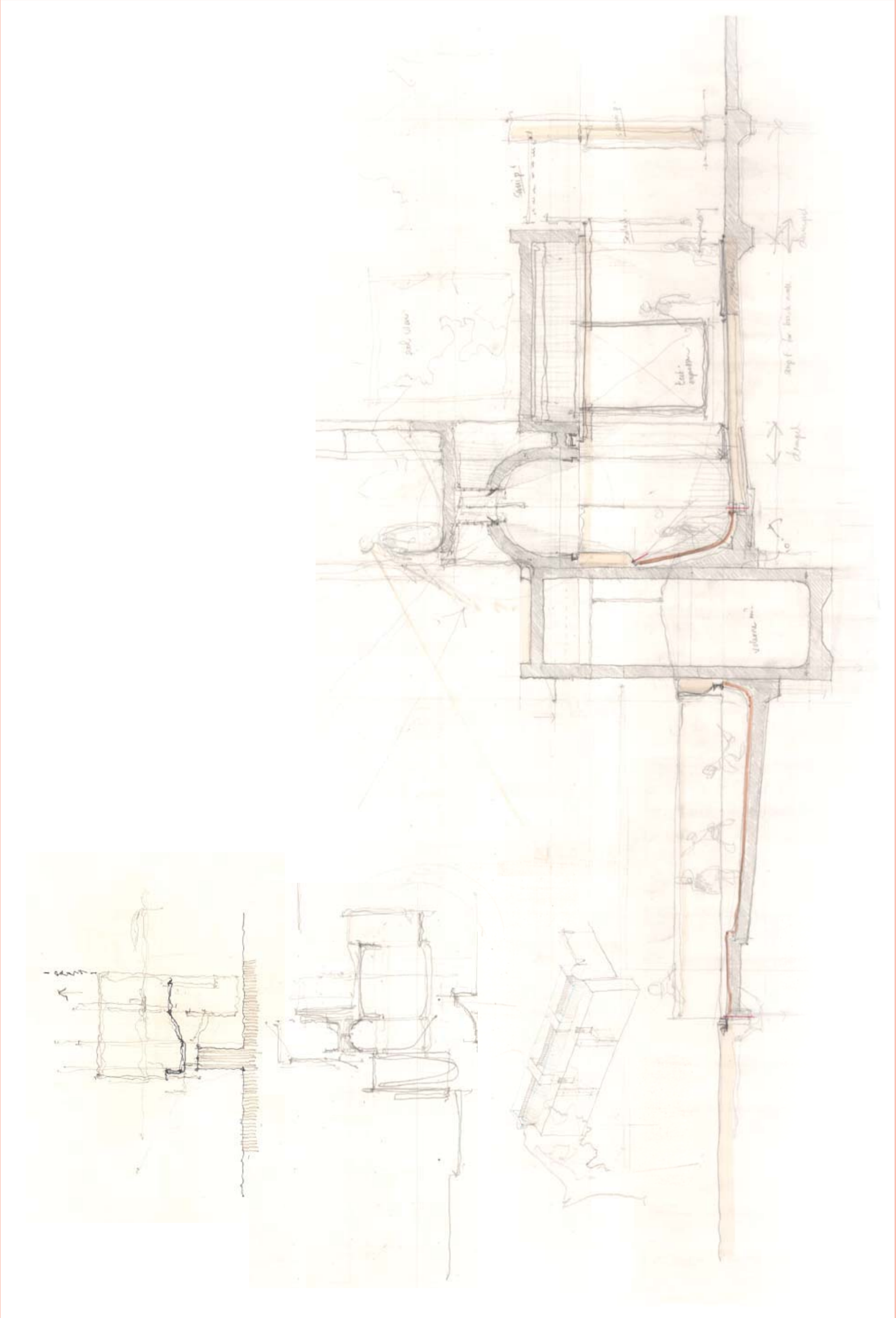

DETAIL 1:20
LAWN
WADING POOL
RESERVOIR
DRESSING
DRESSING
CIRCULATION
new tree



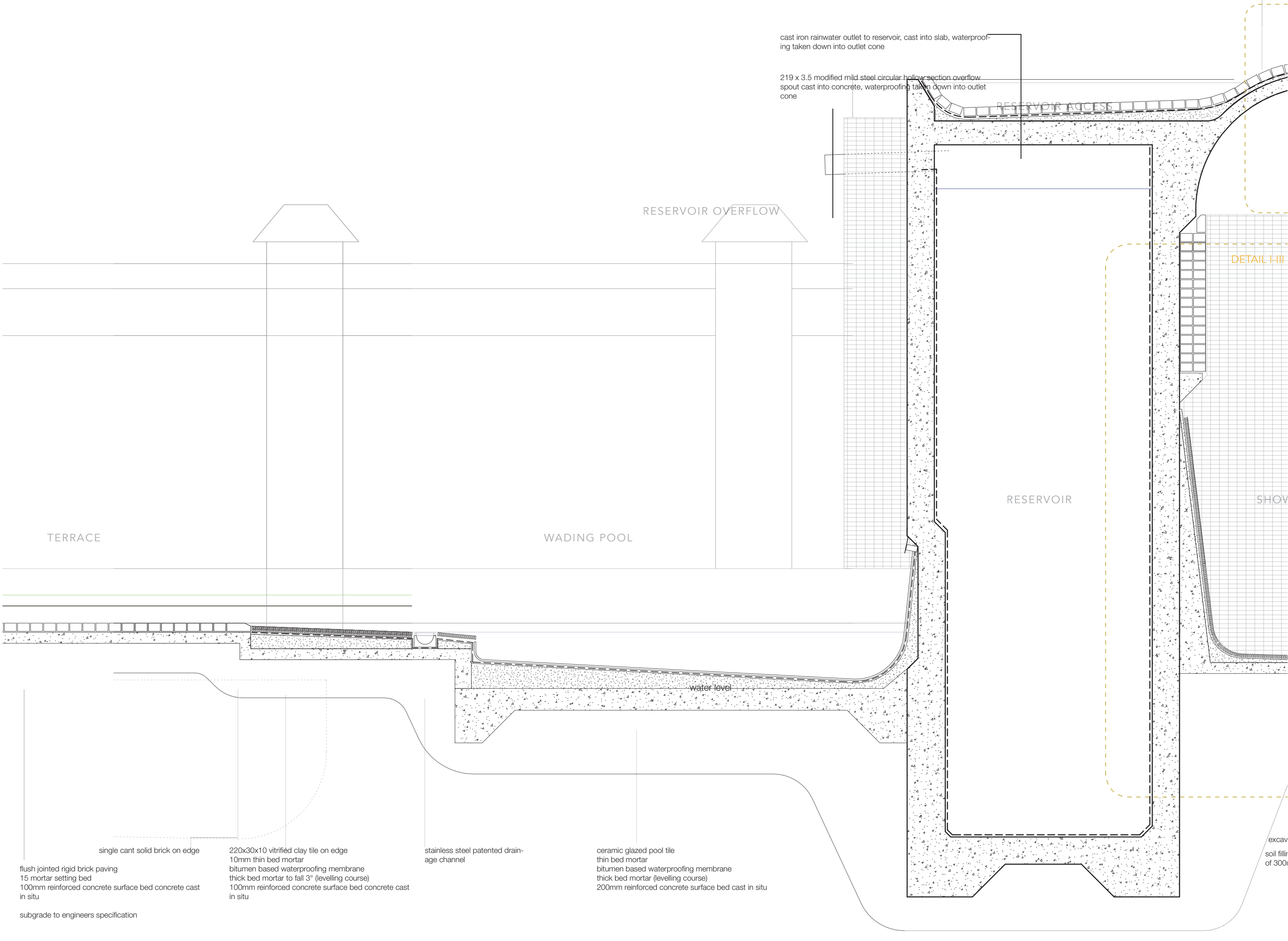
SECTION A-A 1:50 NTS



DEVELOPMENT OF THE 1:20 SECTION



DEVELOPMENT OF THE 1:20 SECTION


cast iron rainwater outlet to reservoir, cast into slab, waterproofing taken down into outlet cone
219 x 3.5 modified mild steel circular hollow section overflow spout cast into concrete, waterproofing taken down into outlet cone
RESERVOIR ACCESS
RESERVOIR OVERFLOW
DETAIL I-III
TERRACE
WADING POOL
RESERVOIR
water level
single cant solid brick on edge
flush jointed rigid brick paving
15 mortar setting bed
100mm reinforced concrete surface bed concrete cast in situ
subgrade to engineers specification
220x30x10 vitrified clay tile on edge
10mm thin bed mortar
bitumen based waterproofing membrane
thick bed mortar to fall 3° (levelling course)
100mm reinforced concrete surface bed concrete cast in situ
stainless steel patented drainage channel
ceramic glazed pool tile
thin bed mortar
bitumen based waterproofing membrane
thick bed mortar (levelling course)
200mm reinforced concrete surface bed cast in situ
250mm thick reinforced concrete reservoir cast in situ bituminous waterproofing lining
bush hammered exterior finish

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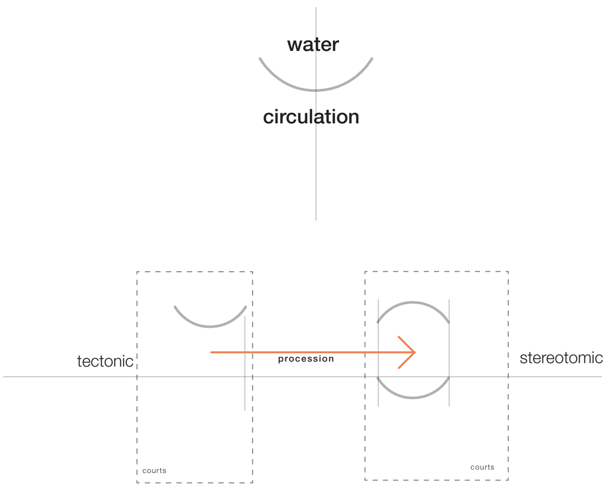
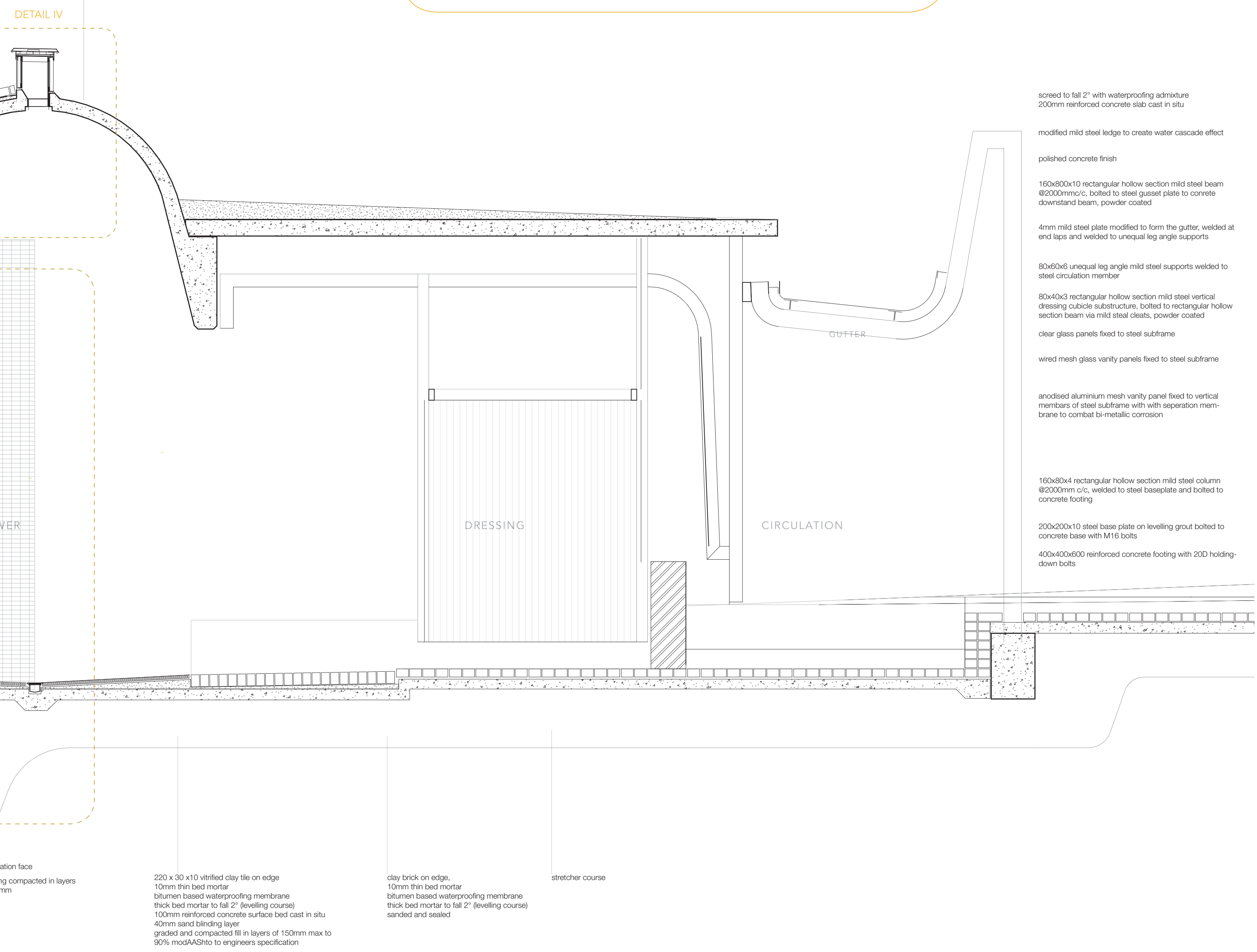
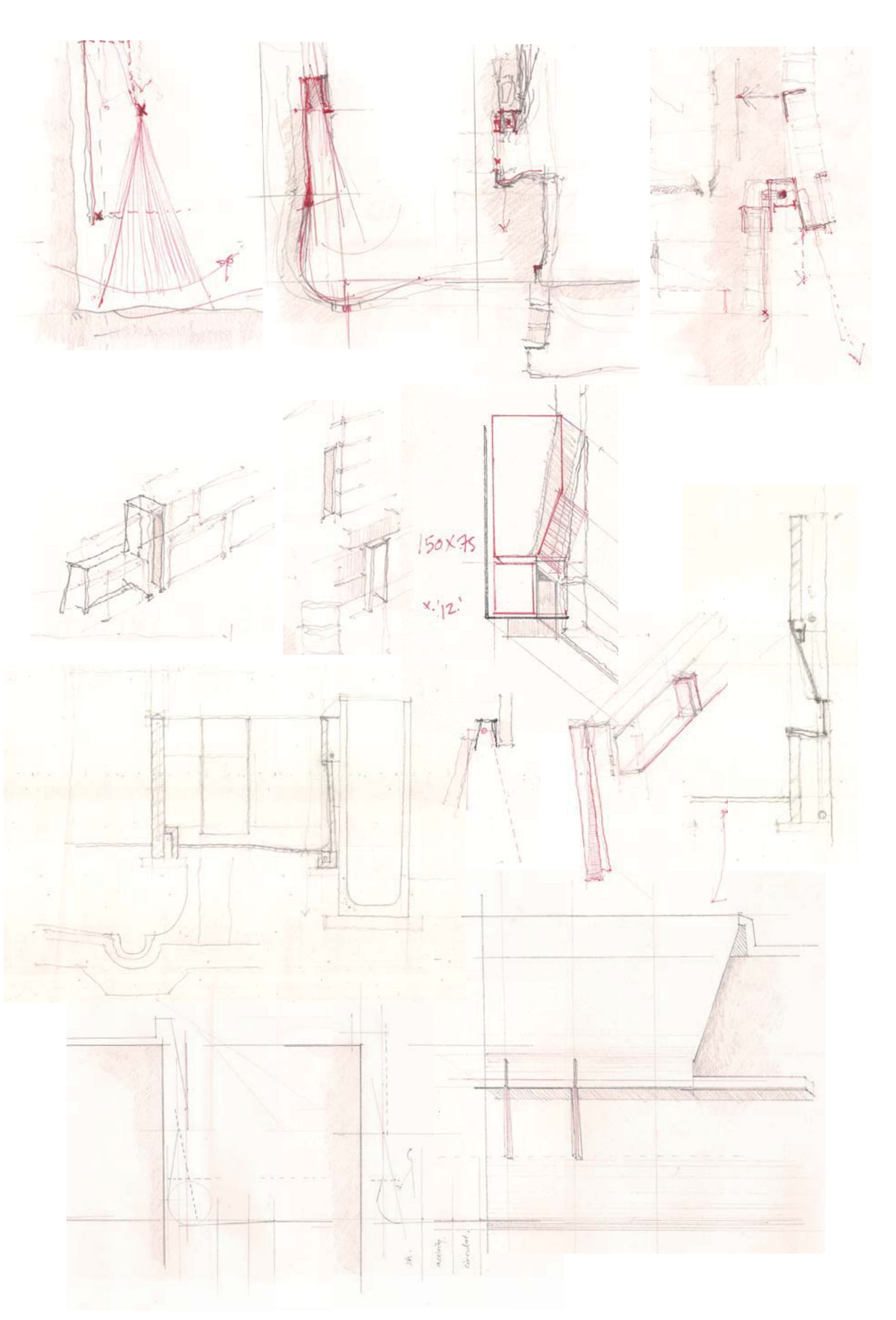
YUNIBESITHI YA PRETORIA

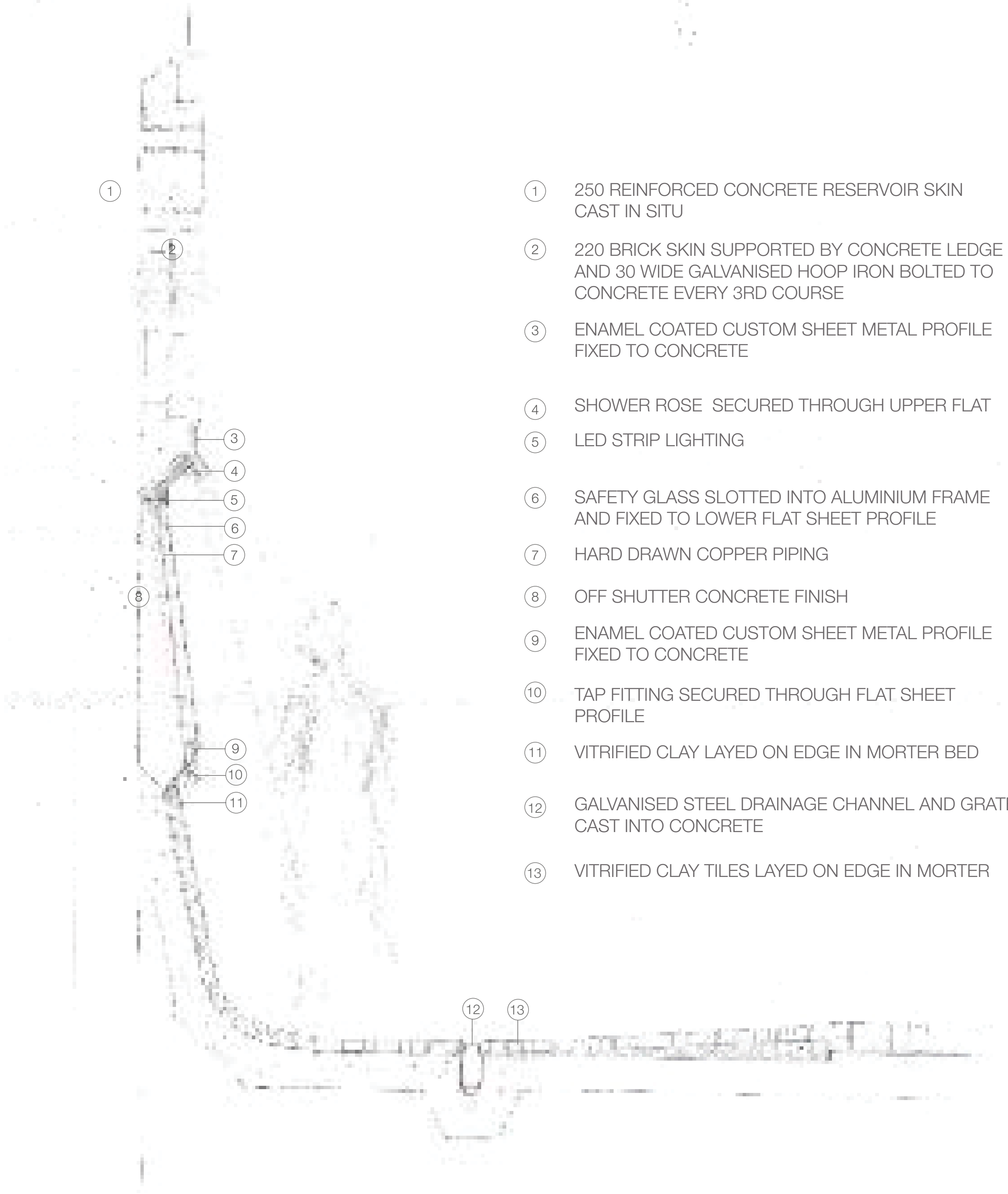
COMPOSITION





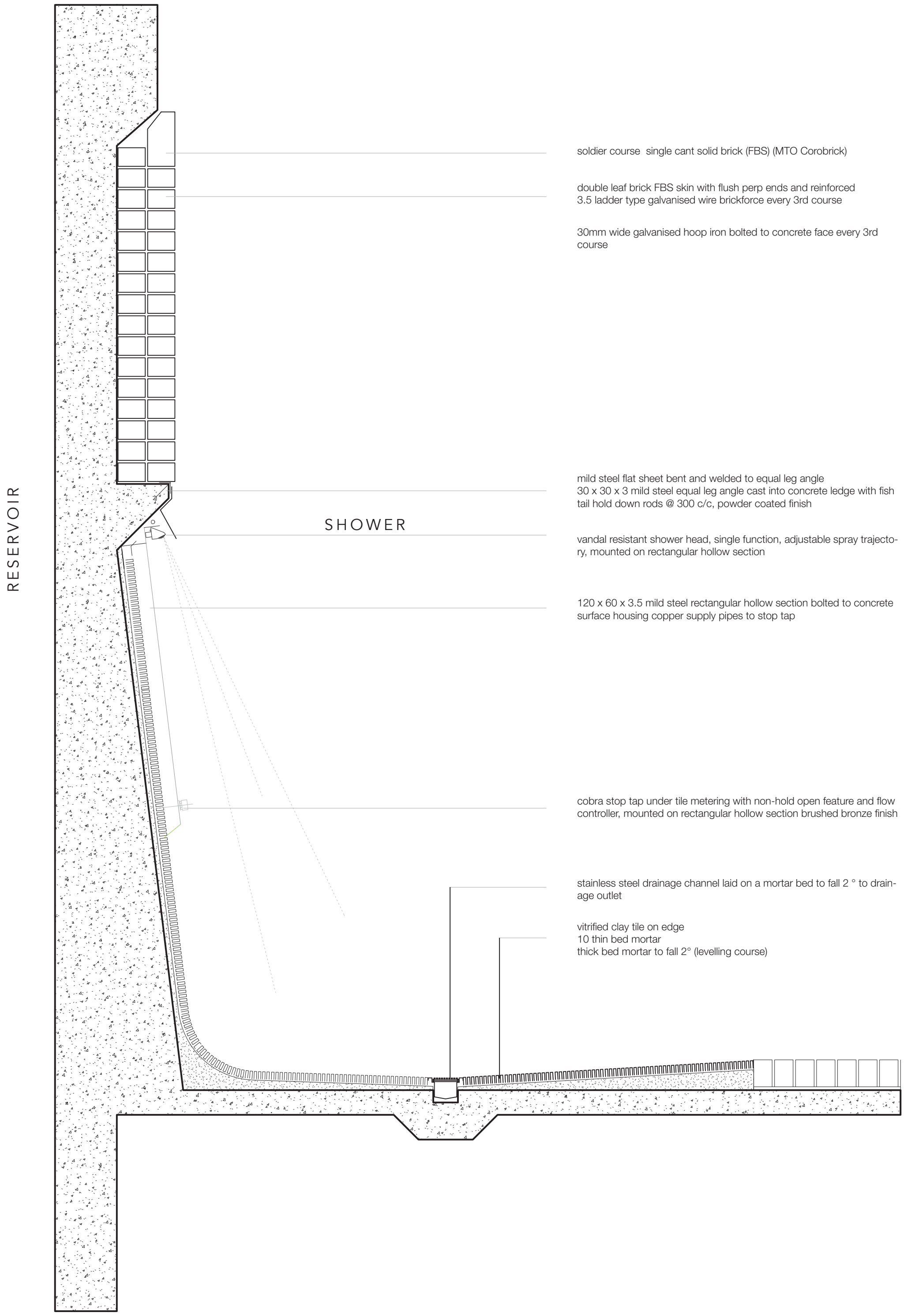
SECTION A-A 1:20 NTS

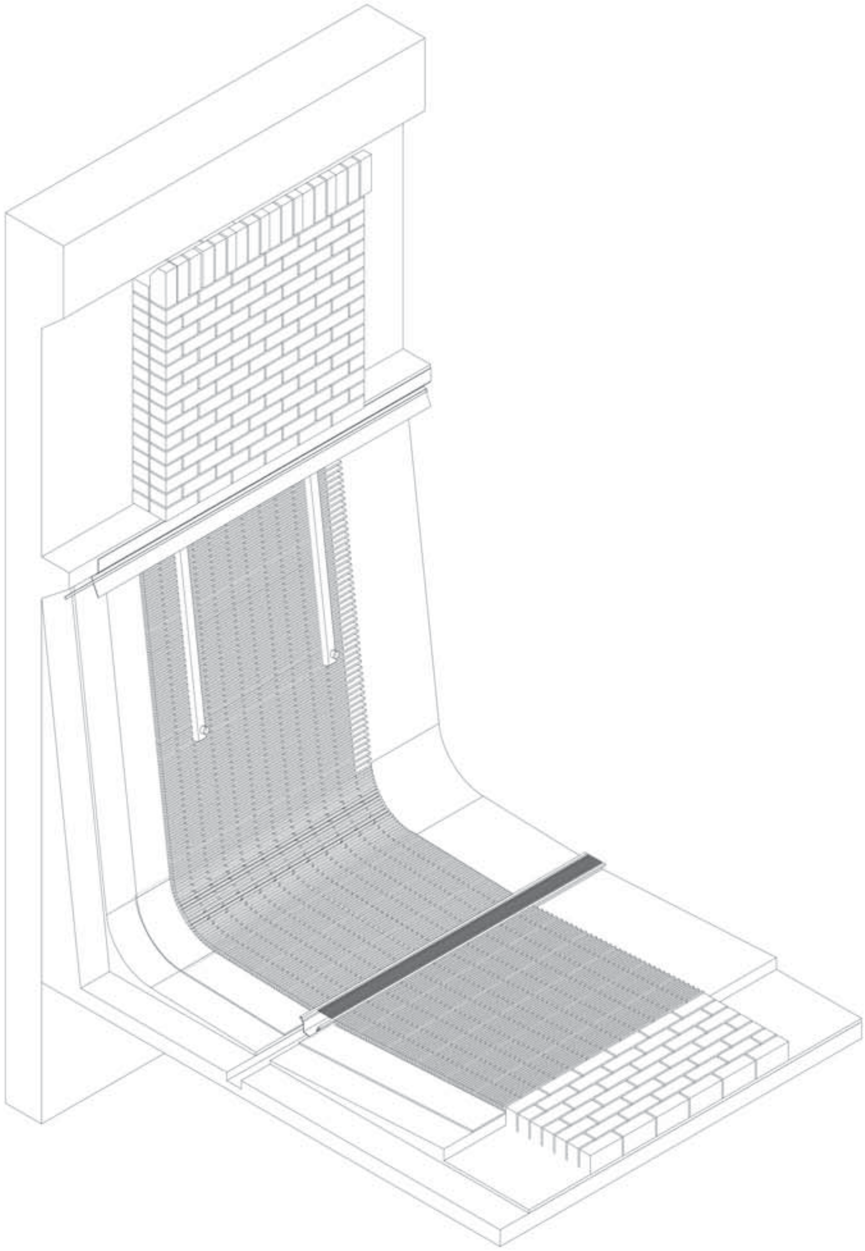

150X75
x.'12.'



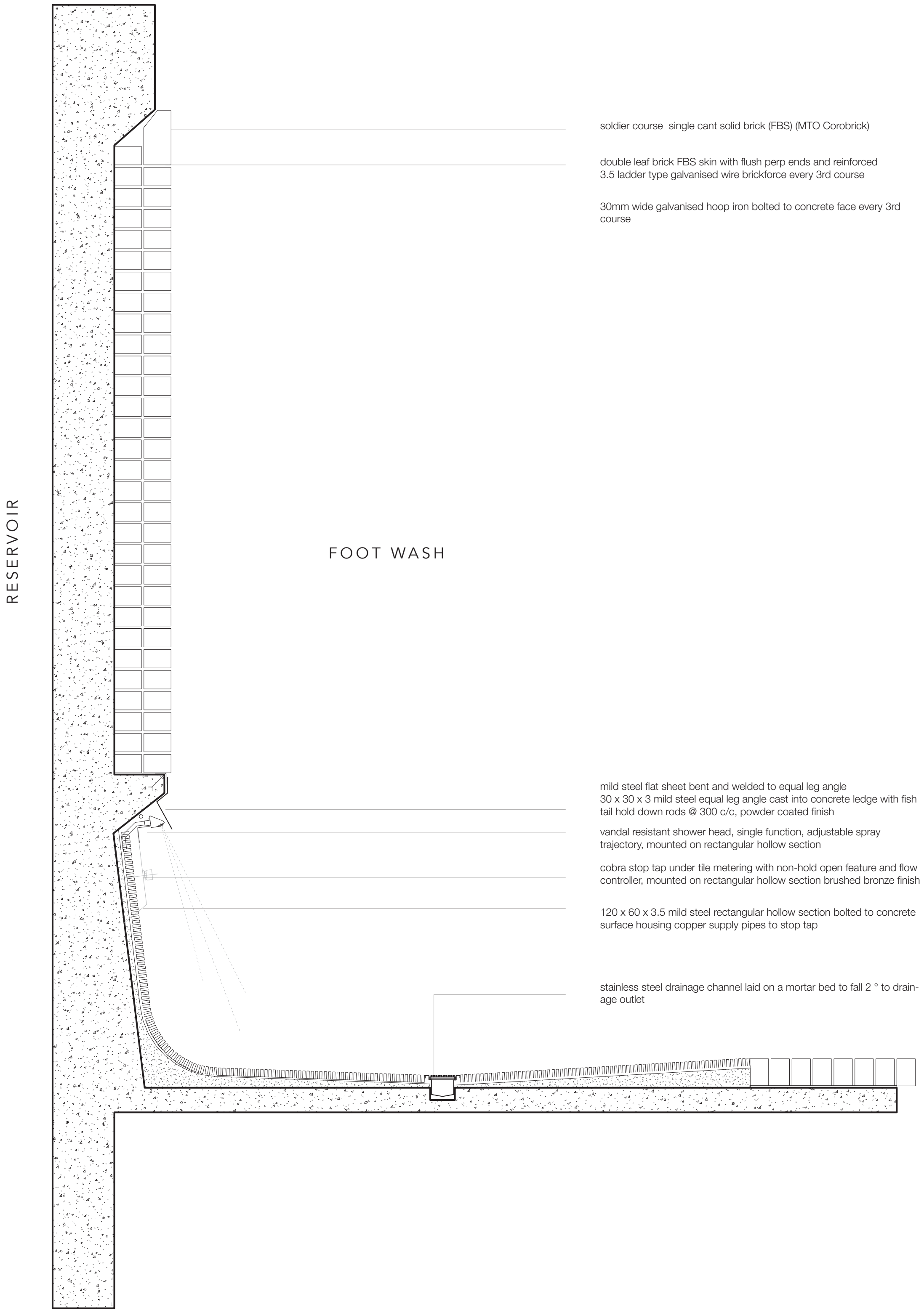
1. 250 REINFORCED CONCRETE RESERVOIR SKIN CAST IN SITU
2. 220 BRICK SKIN SUPPORTED BY CONCRETE LEDGE AND 30 WIDE GALVANISED HOOP IRON BOLTED TO CONCRETE EVERY 3RD COURSE
3. ENAMEL COATED CUSTOM SHEET METAL PROFILE FIXED TO CONCRETE
4. SHOWER ROSE SECURED THROUGH UPPER FLAT
5. LED STRIP LIGHTING
6. SAFETY GLASS SLOTTED INTO ALUMINIUM FRAME AND FIXED TO LOWER FLAT SHEET PROFILE
7. HARD DRAWN COPPER PIPING
8. OFF SHUTTER CONCRETE FINISH
9. ENAMEL COATED CUSTOM SHEET METAL PROFILE FIXED TO CONCRETE
10. TAP FITTING SECURED THROUGH FLAT SHEET PROFILE
11. VITRIFIED CLAY LAYED ON EDGE IN MORTER BED
12. GALVANISED STEEL DRAINAGE CHANNEL AND GRATE CAST INTO CONCRETE
13. VITRIFIED CLAY TILES LAYED ON EDGE IN MORTER

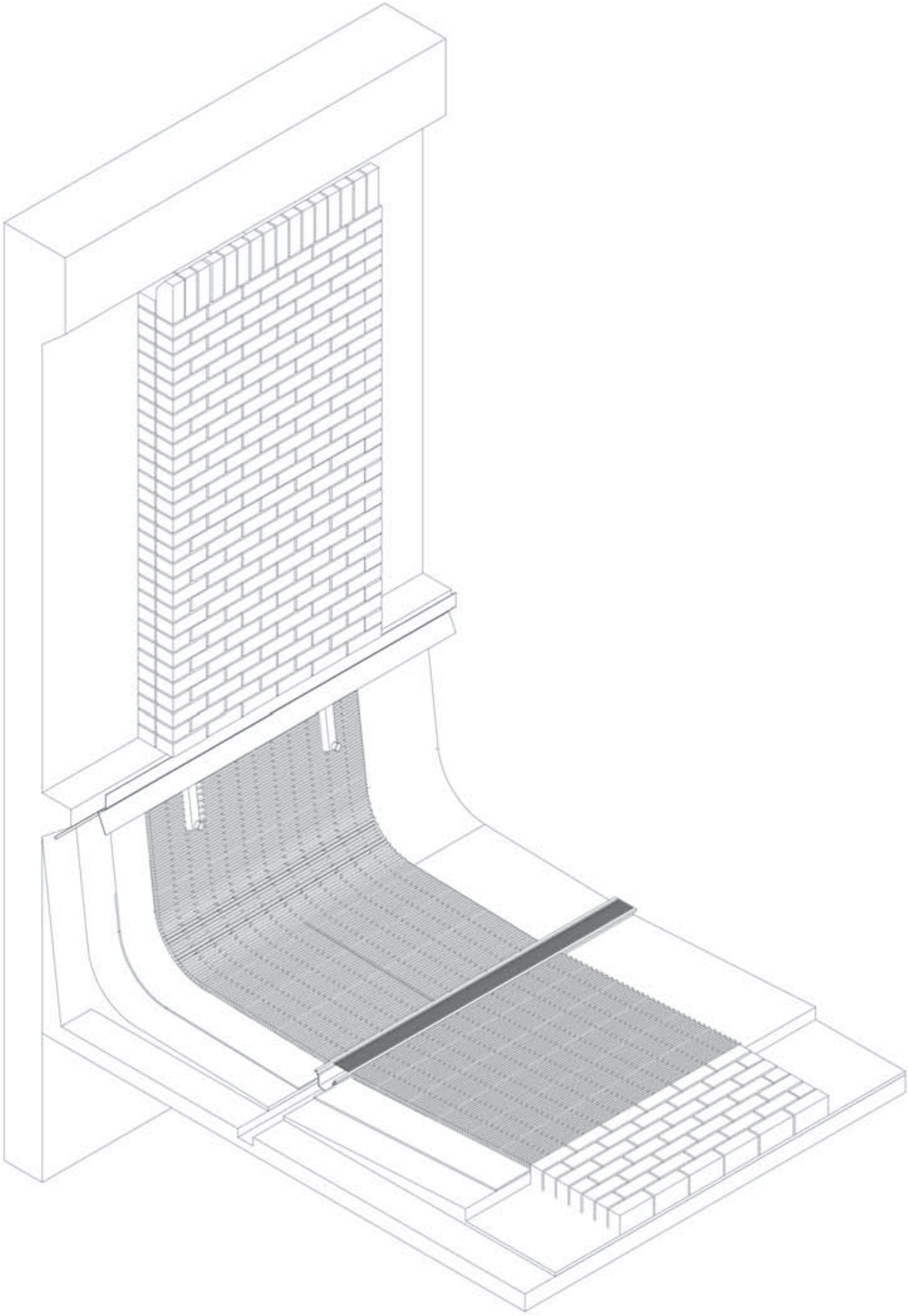
(1:10 TYPE) SHOWER DETAIL I NTS


RESERVOIR
SHOWER
soldier course single cant solid brick (FBS) (MTO Corobrick)
double leaf brick FBS skin with flush perp ends and reinforced 3.5 ladder type galvanised wire brickforce every 3rd course
30mm wide galvanised hoop iron bolted to concrete face every 3rd course
mild steel flat sheet bent and welded to equal leg angle
30 x 30 x 3 mild steel equal leg angle cast into concrete ledge with fish tail hold down rods @ 300 c/c, powder coated finish
vandal resistant shower head, single function, adjustable spray trajectory, mounted on rectangular hollow section
120 x 60 x 3.5 mild steel rectangular hollow section bolted to concrete surface housing copper supply pipes to stop tap
cobra stop tap under tile metering with non-hold open feature and flow controller, mounted on rectangular hollow section brushed bronze finish
stainless steel drainage channel laid on a mortar bed to fall 2 ° to drainage outlet
vitrified clay tile on edge
10 thin bed mortar
thick bed mortar to fall 2° (levelling course)

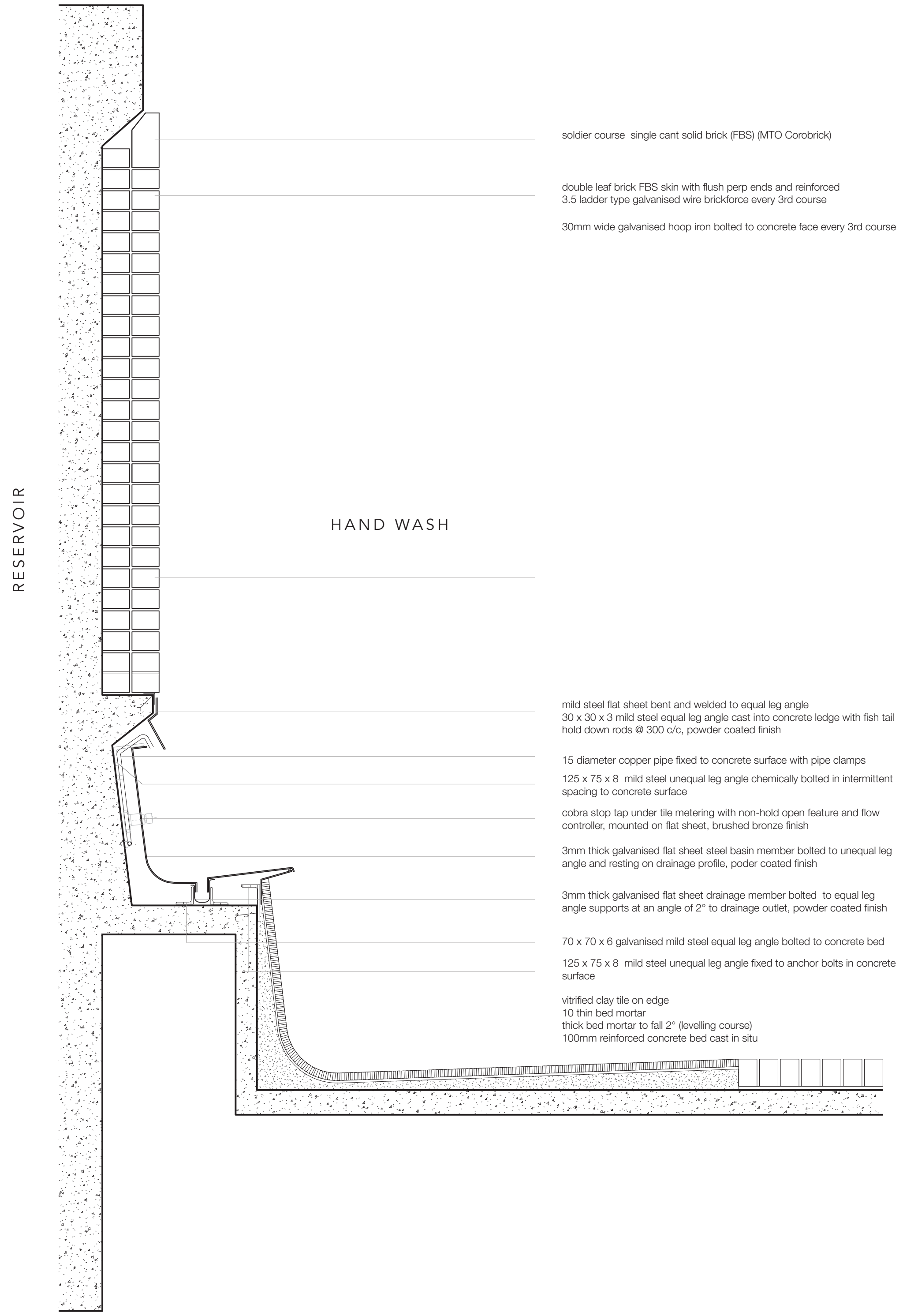


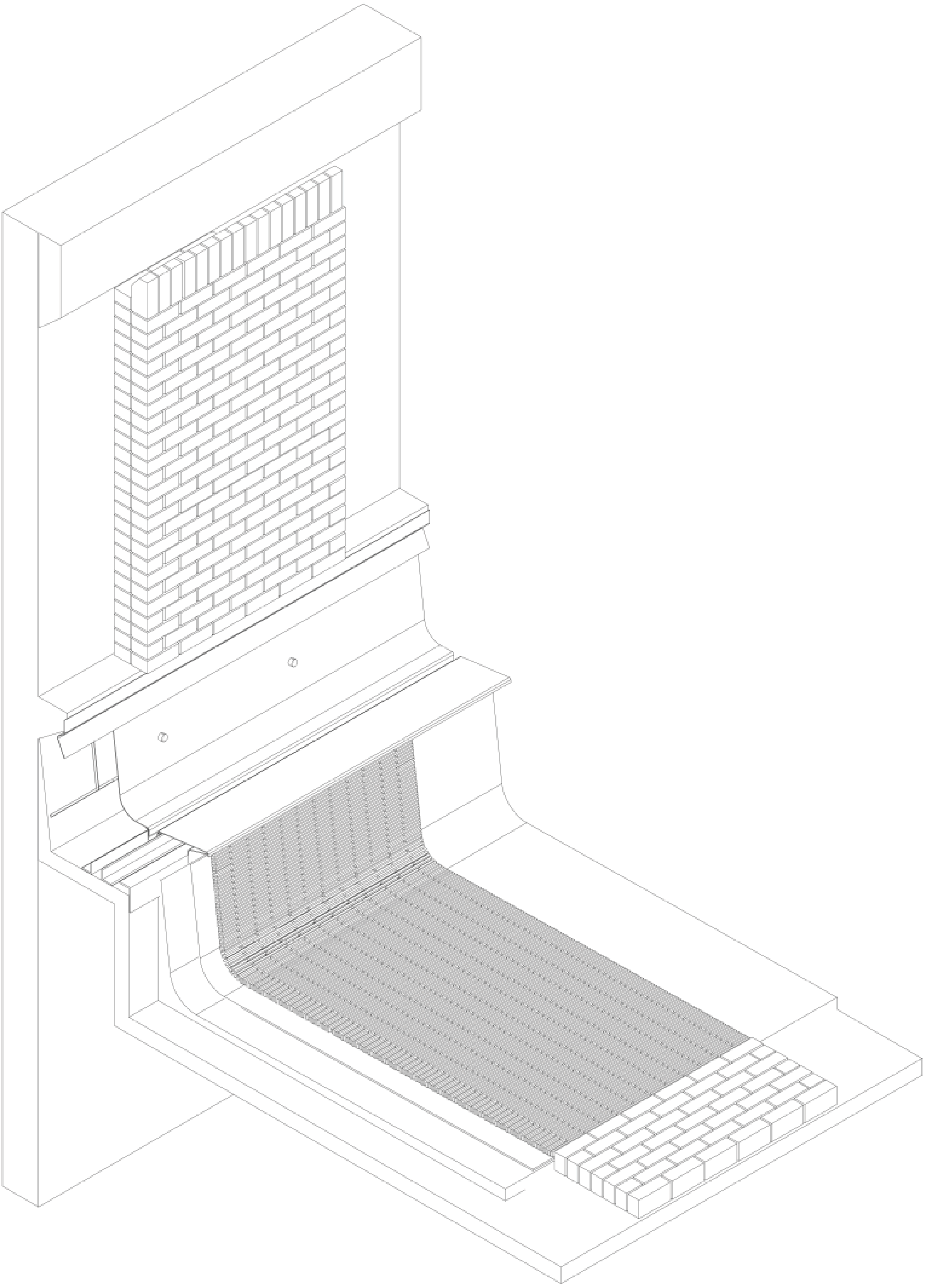
DETAIL I 1:10 NTS


soldier course single cant solid brick (FBS) (MTO Corobrick)
double leaf brick FBS skin with flush perp ends and reinforced 3.5 ladder type galvanised wire brickforce every 3rd course
30mm wide galvanised hoop iron bolted to concrete face every 3rd course
RESERVOIR
FOOT WASH
mild steel flat sheet bent and welded to equal leg angle
30 x 30 x 3 mild steel equal leg angle cast into concrete ledge with fish tail hold down rods @ 300 c/c, powder coated finish
vandal resistant shower head, single function, adjustable spray trajectory, mounted on rectangular hollow section
cobra stop tap under tile metering with non-hold open feature and flow controller, mounted on rectangular hollow section brushed bronze finish
120 x 60 x 3.5 mild steel rectangular hollow section bolted to concrete surface housing copper supply pipes to stop tap
stainless steel drainage channel laid on a mortar bed to fall 2 ° to drainage outlet

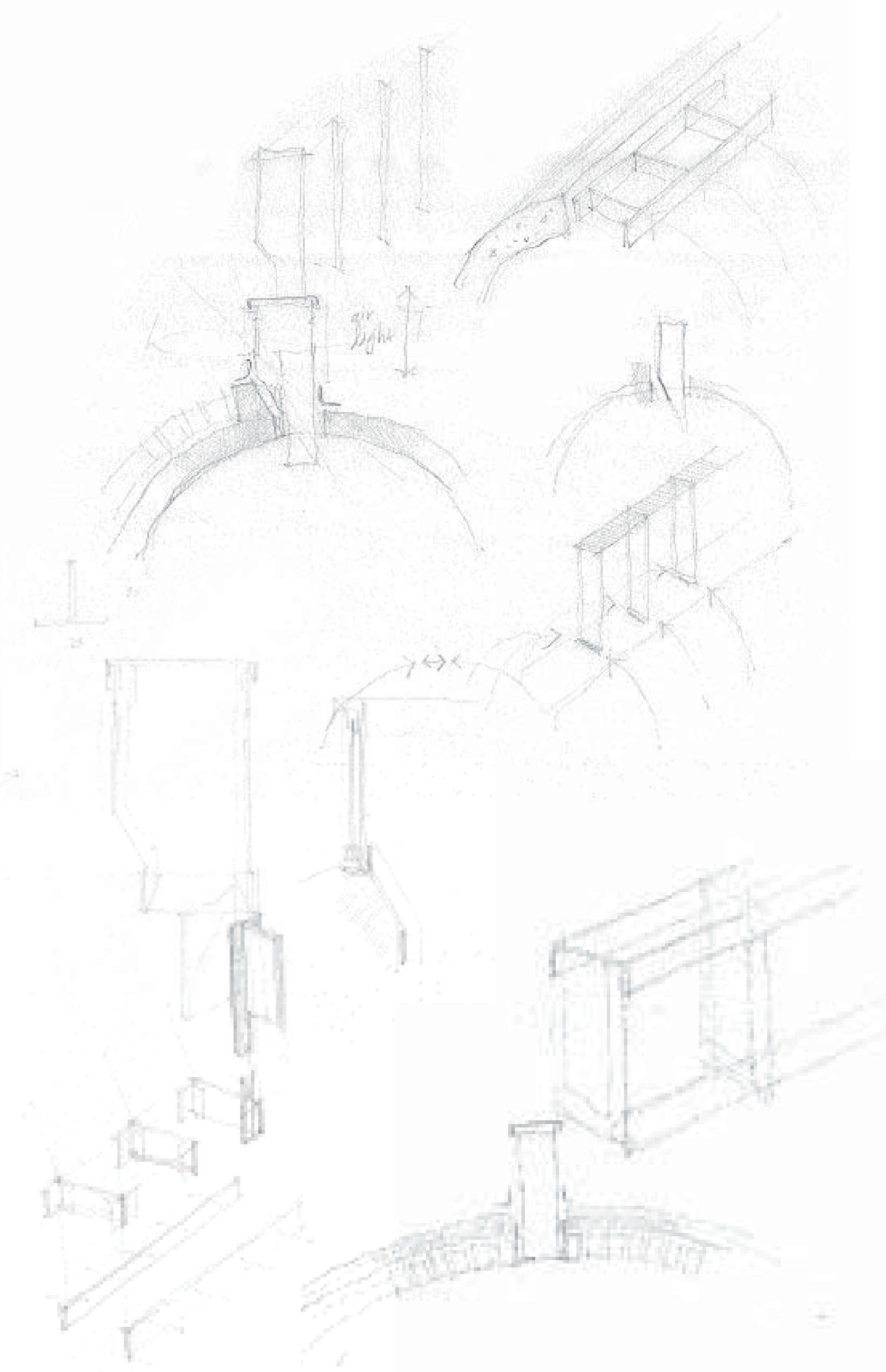


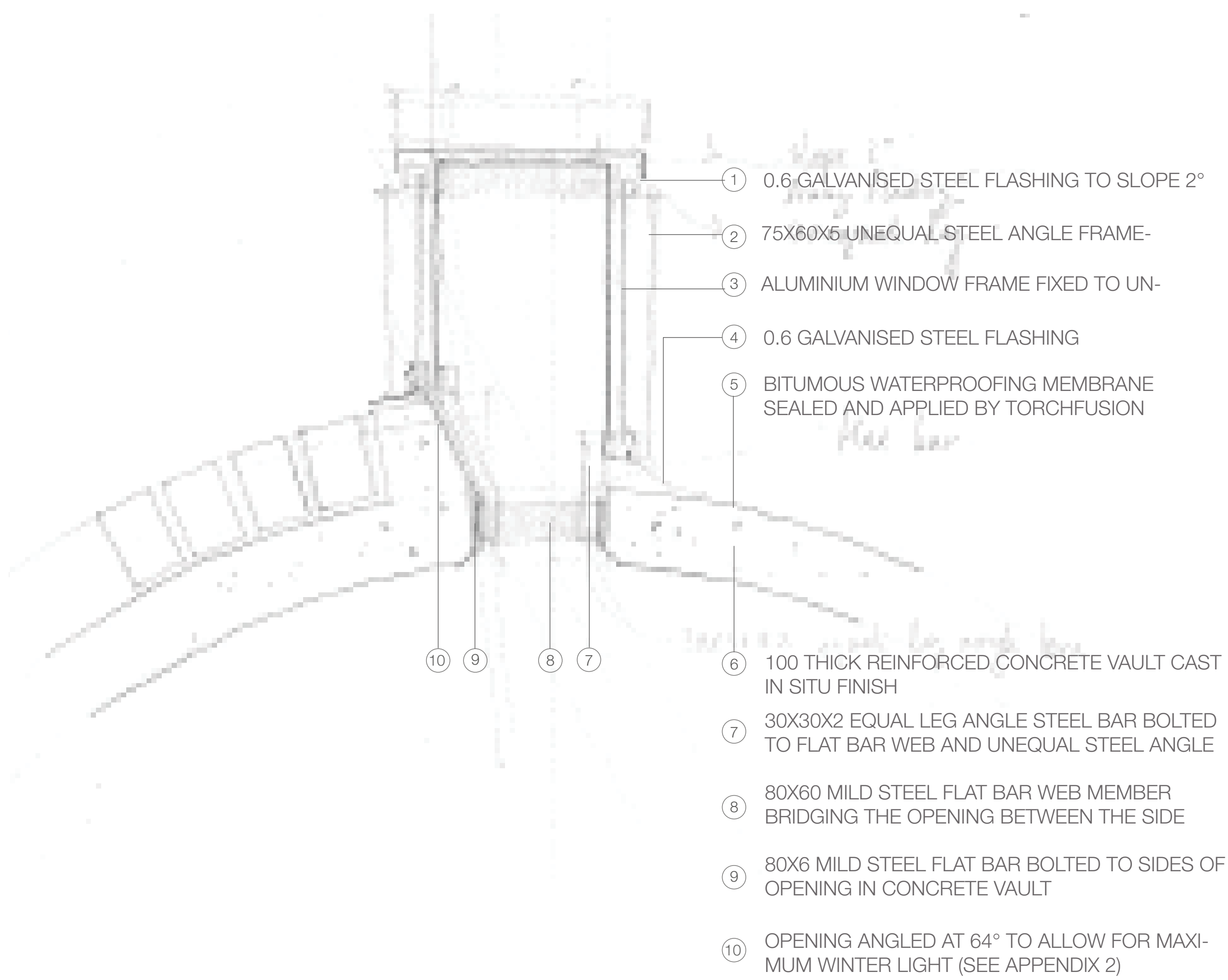
DETAIL II 1:10 NTS


soldier course single cant solid brick (FBS) (MTO Corobrick)
double leaf brick FBS skin with flush perp ends and reinforced 3.5 ladder type galvanised wire brickforce every 3rd course
30mm wide galvanised hoop iron bolted to concrete face every 3rd course
RESERVOIR
HAND WASH
mild steel flat sheet bent and welded to equal leg angle
30 x 30 x 3 mild steel equal leg angle cast into concrete ledge with fish tail hold down rods @ 300 c/c, powder coated finish
15 diameter copper pipe fixed to concrete surface with pipe clamps
125 x 75 x 8 mild steel unequal leg angle chemically bolted in intermittent spacing to concrete surface
cobra stop tap under tile metering with non-hold open feature and flow controller, mounted on flat sheet, brushed bronze finish
3mm thick galvanised flat sheet steel basin member bolted to unequal leg angle and resting on drainage profile, poder coated finish
3mm thick galvanised flat sheet drainage member bolted to equal leg angle supports at an angle of 2° to drainage outlet, powder coated finish
70 x 70 x 6 galvanised mild steel equal leg angle bolted to concrete bed
125 x 75 x 8 mild steel unequal leg angle fixed to anchor bolts in concrete surface
vitrified clay tile on edge
10 thin bed mortar
thick bed mortar to fall 2° (levelling course)
100mm reinforced concrete bed cast in situ

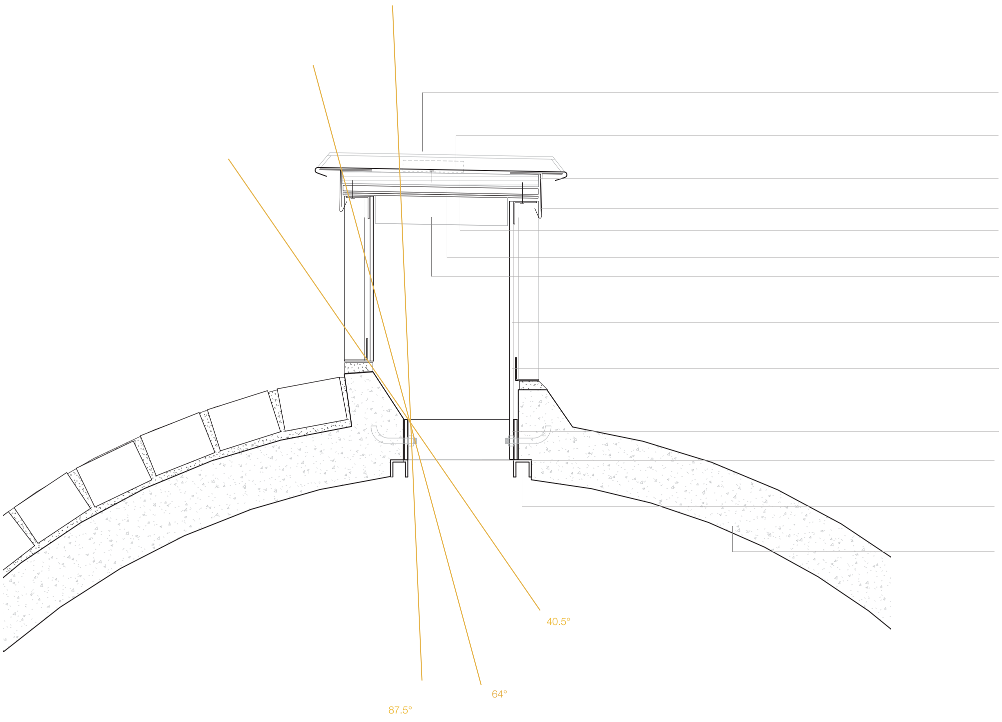


DETAIL III 1:10 NTS





(1:10 TYPE) SKYLIGHT DETAIL II NTS



0.45 Rheinzinc zinc sheet with standing seams folded over cleat and pinched seams

44 x 38 x 0.6 cleat at 300 c/c nailed to marine ply

layer of felt

starter clip

drip edge

25 marine plywood solid deck fixed to horizontal leg angle

vinyl faced gypsum ceiling panel nailed to plywood deck

50x50x3 mild steel equal leg angle horisontal member, welded to vertical leg angle, powder coated finish

50x50x3 mild steel equal leg angle vertical support welded to mild steel plate, powder coated

45x45x3 mild steel equal leg angle sill welded to vertical supports

levelling grout

700x8 mild steel plate bolted to concrete surface with pre-cast anchor bolts, powder coated

700x12x180 mild steel plate web member @ 900 c/c, welded to steel plate, powder coated

30x30x3 mild steel equal leg angle shadow line, welded to flat sheet, powder coated

100 reinforced concrete vault cast in situ*

brick on edge permanent vault shuttering with flush morter joints

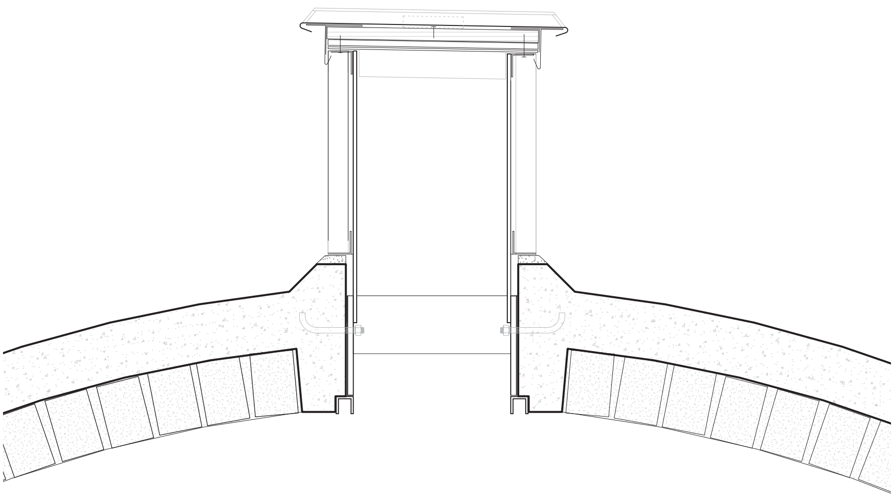
*Waterproofing Concrete Admixture

An integral crystalline waterproofing admix is added to the concrete mix at batching stage of the material mix to ratios ranging from 1-2% of the mixture. It consists of Portland cement, very fine treated silica sand and various active, proprietarychemicals. These active chemicals react with moisture and the chemical by-products of cement hydration

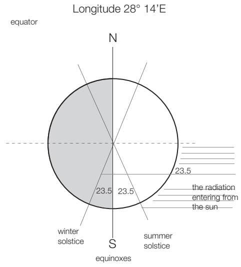
to cause a catalytic reaction that generates a non-soluble crystalline formation throughout the pores and capillary tracts of the concrete so that it becomes impermeable to water and other liquids.

Lafarge Ultra Waterproof Concrete
PENETRON ADMIX®
Xypex Admix C-1000/C-1000 NF
Krystol Internal Membrane™ (KIM®)
CHRYSO®CWA 10

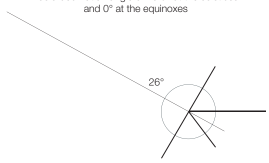
DETAIL IV 1:5 NTS



Johannesburg
Latitude 26° 08' S
Longitude 28° 14'E



The axis of the earth's rotation is tilted at an angle of 23.45° with respect to the plane of the orbit around the Sun. This forms an angular distance of the sun north or south of the earth's equator that is the angle of declination. The sun has a declination angle of 23.5° at the solstices and 0° at the equinoxes



The calculation for solar altitude at solar noon for Johannesburg:

22nd January Summer Solstice
64 + 23.5 = 87.5°

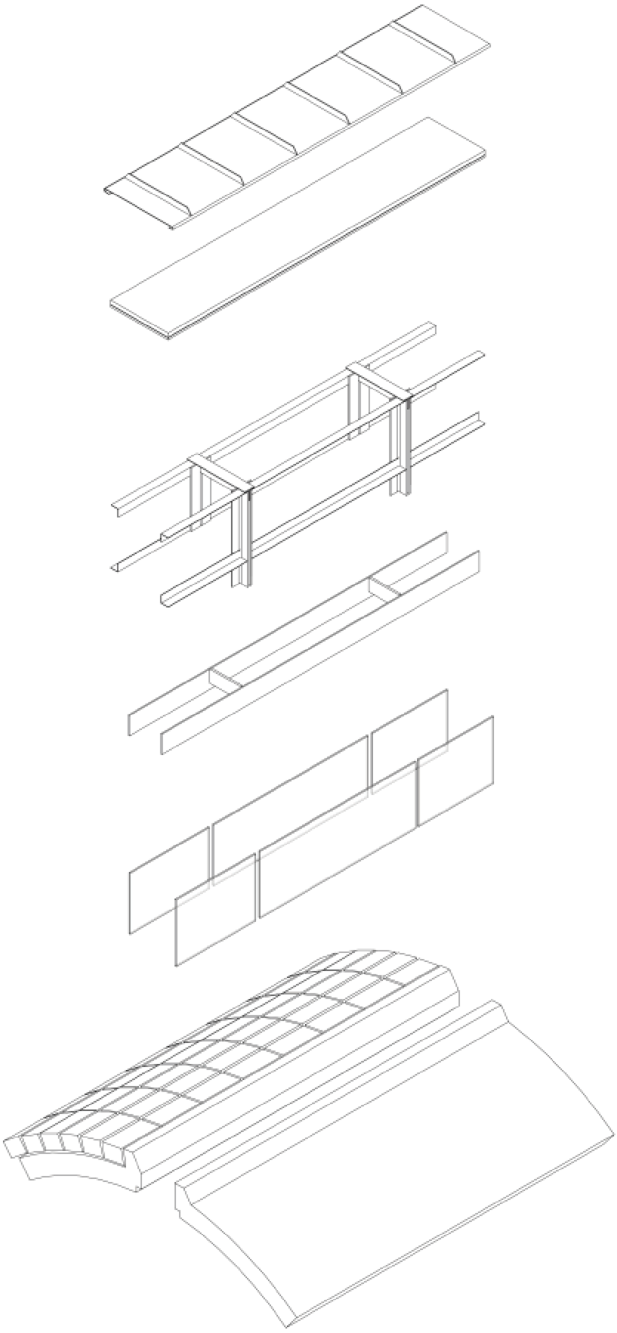
22nd March Equinox
90 - 26 = 64°

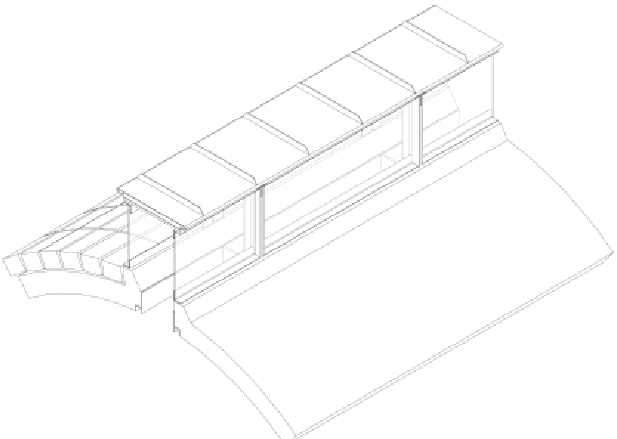
22nd June Winter Solstice
64 - 23.5 = 40.5°

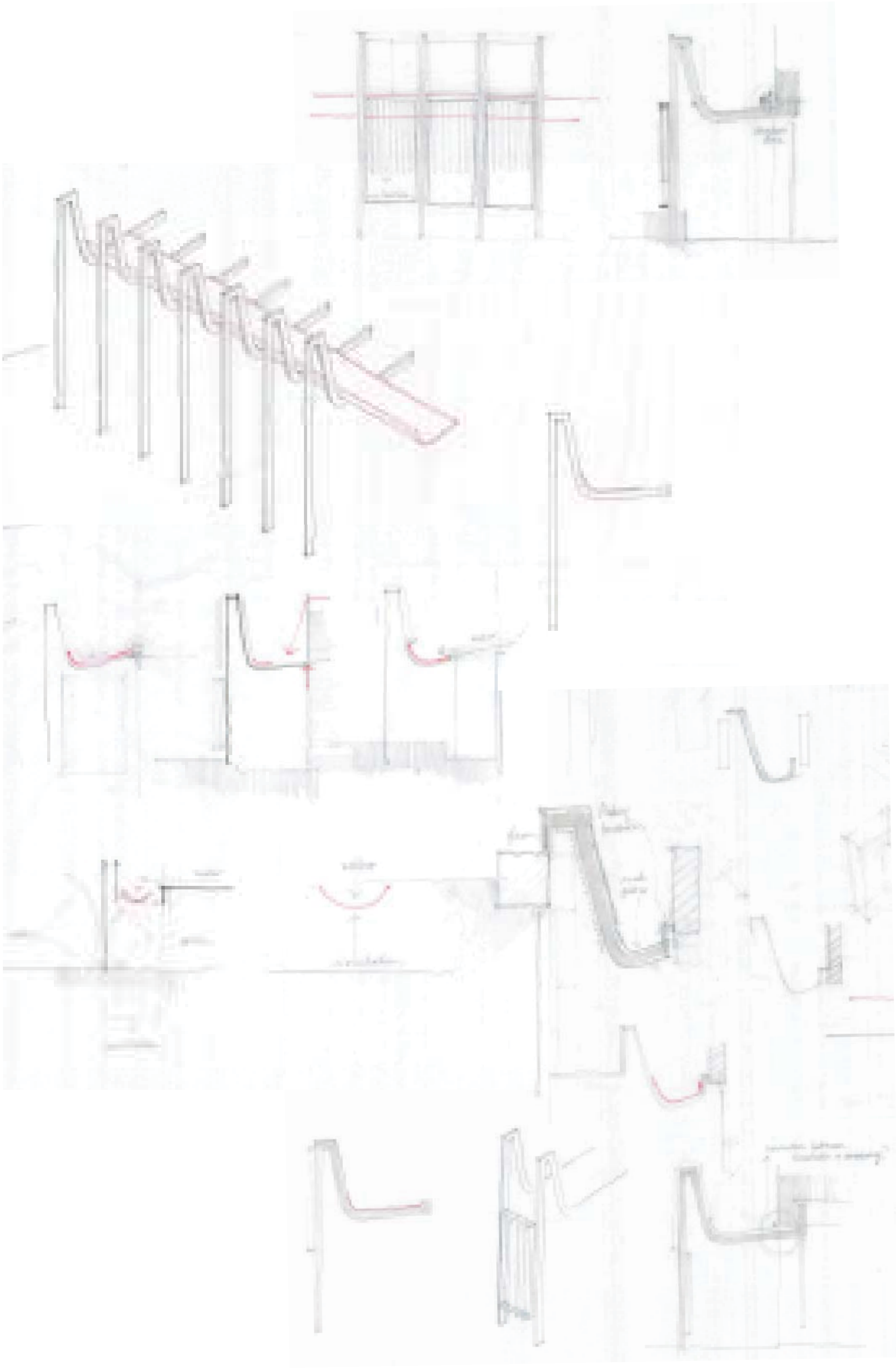
22nd September Equinox

90-26 = 64°

DETAIL V 1:5 NTS





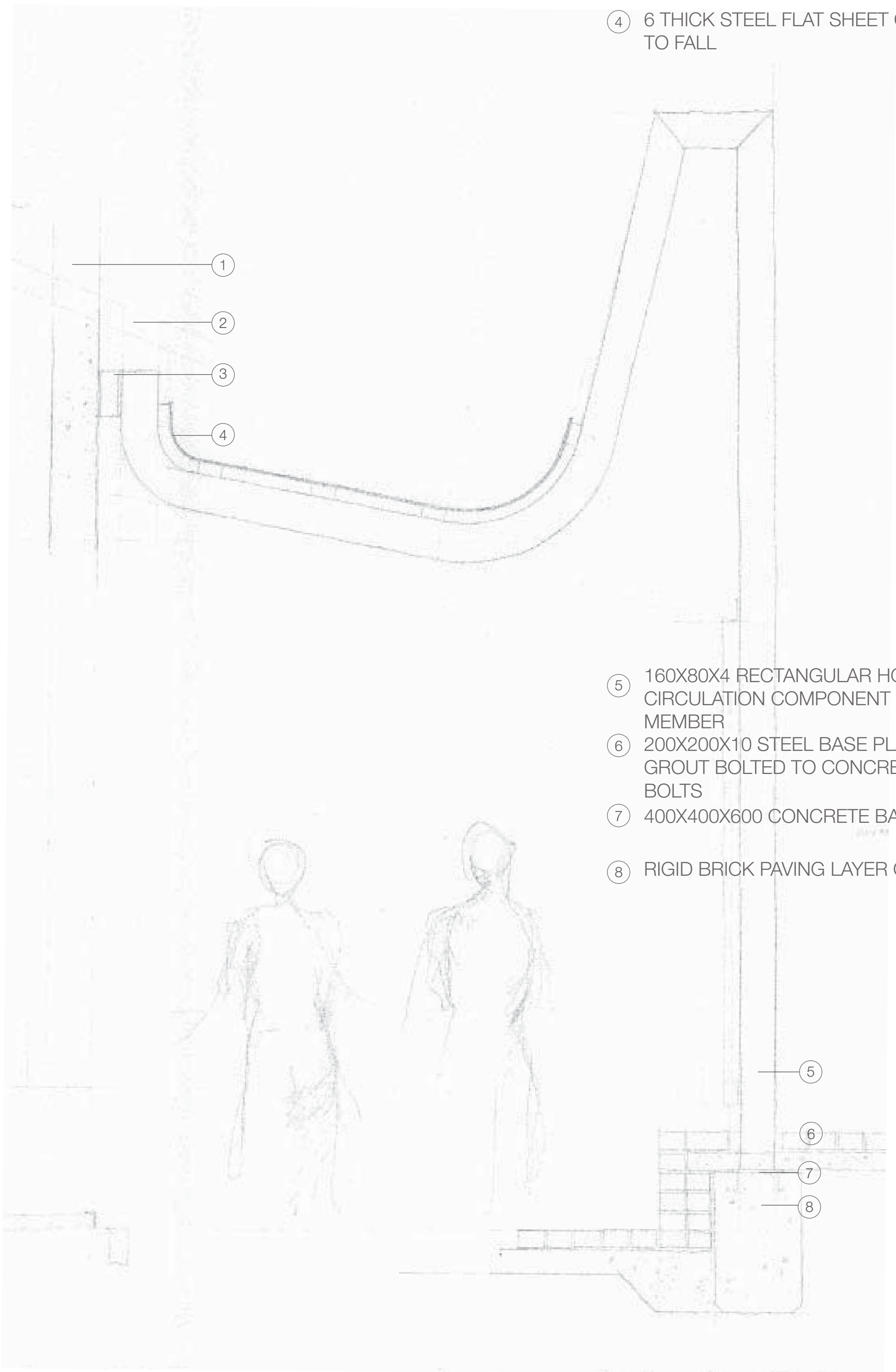


1 200 THICK REINFORCED CONCRETE

2 CIRCULAR MILD STEEL HOLLOW SECTION SPOUT

3 100X55X4 STEEL I-SECTION WEB MEMBER BOLTED TO

4 6 THICK STEEL FLAT SHEET CUSTOM PROFILE GUTTER TO FALL



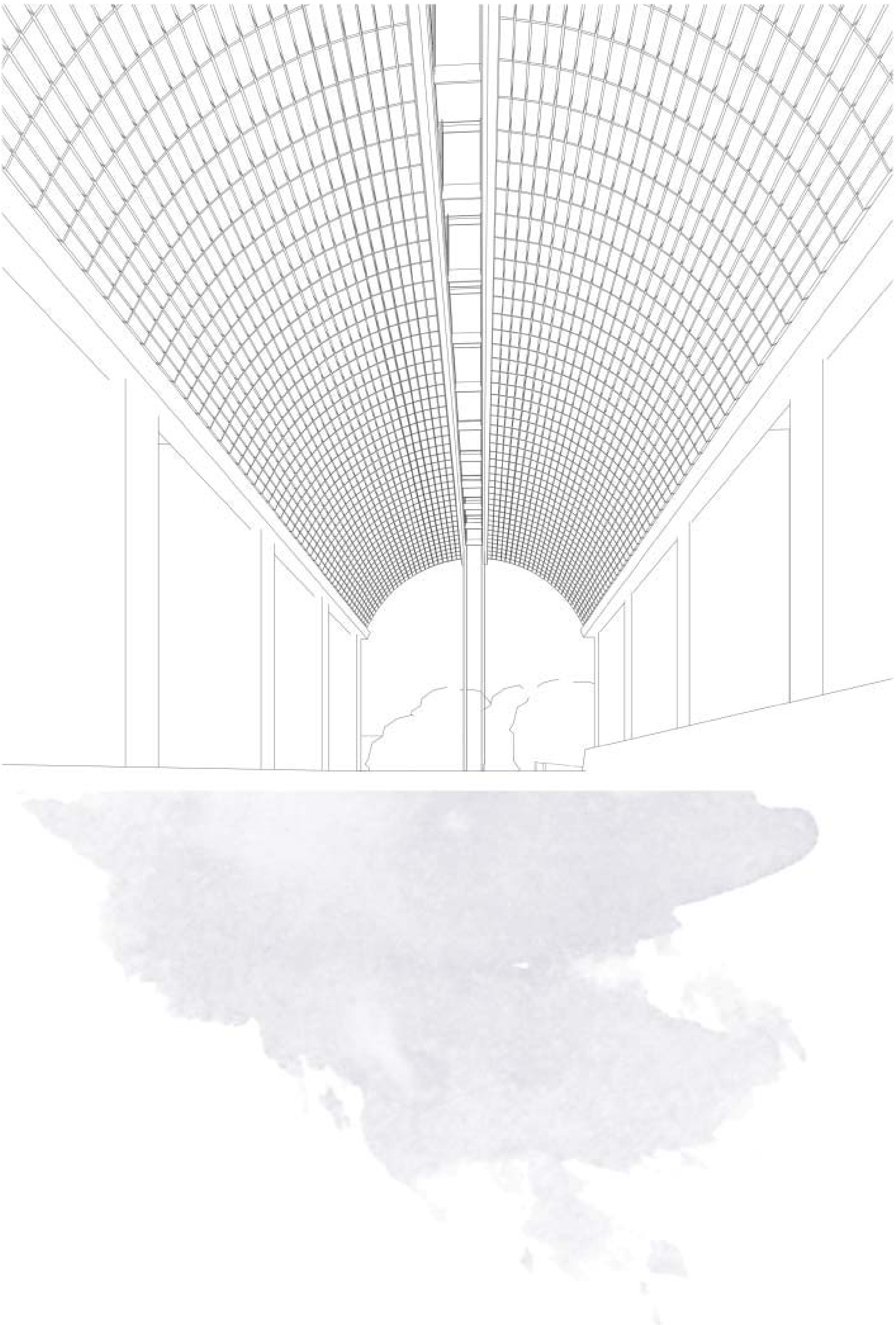
5 160X80X4 RECTANGULAR HOLLOW SECTION CIRCULATION COMPONENT WELDED TO WEB MEMBER

6 200X200X10 STEEL BASE PLATE ON LEVELLING GROUT BOLTED TO CONCRETE BASE WITH M16 BOLTS

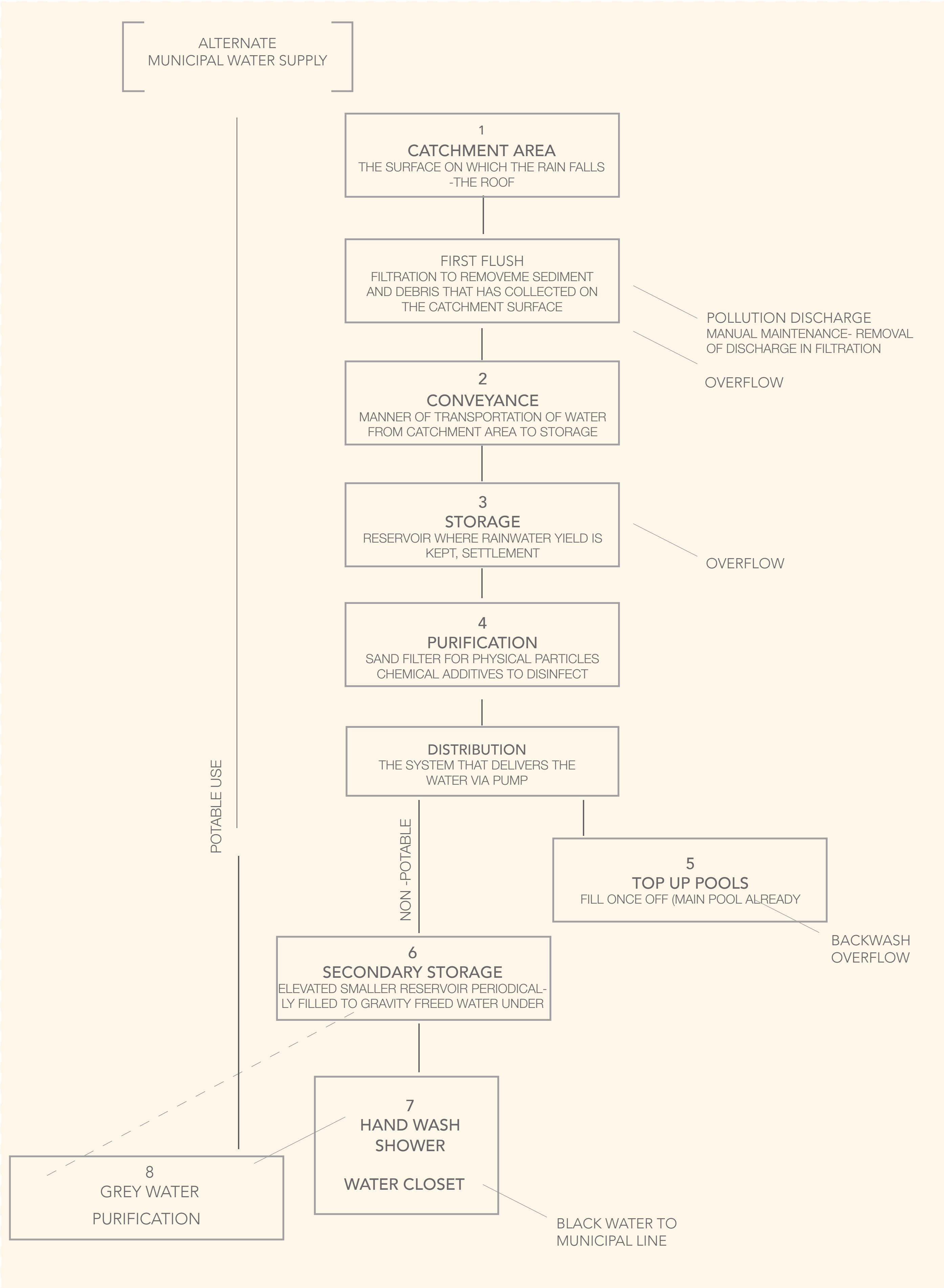
7 400X400X600 CONCRETE BASE

8 RIGID BRICK PAVING LAYER ON 100 CONCRETE BED

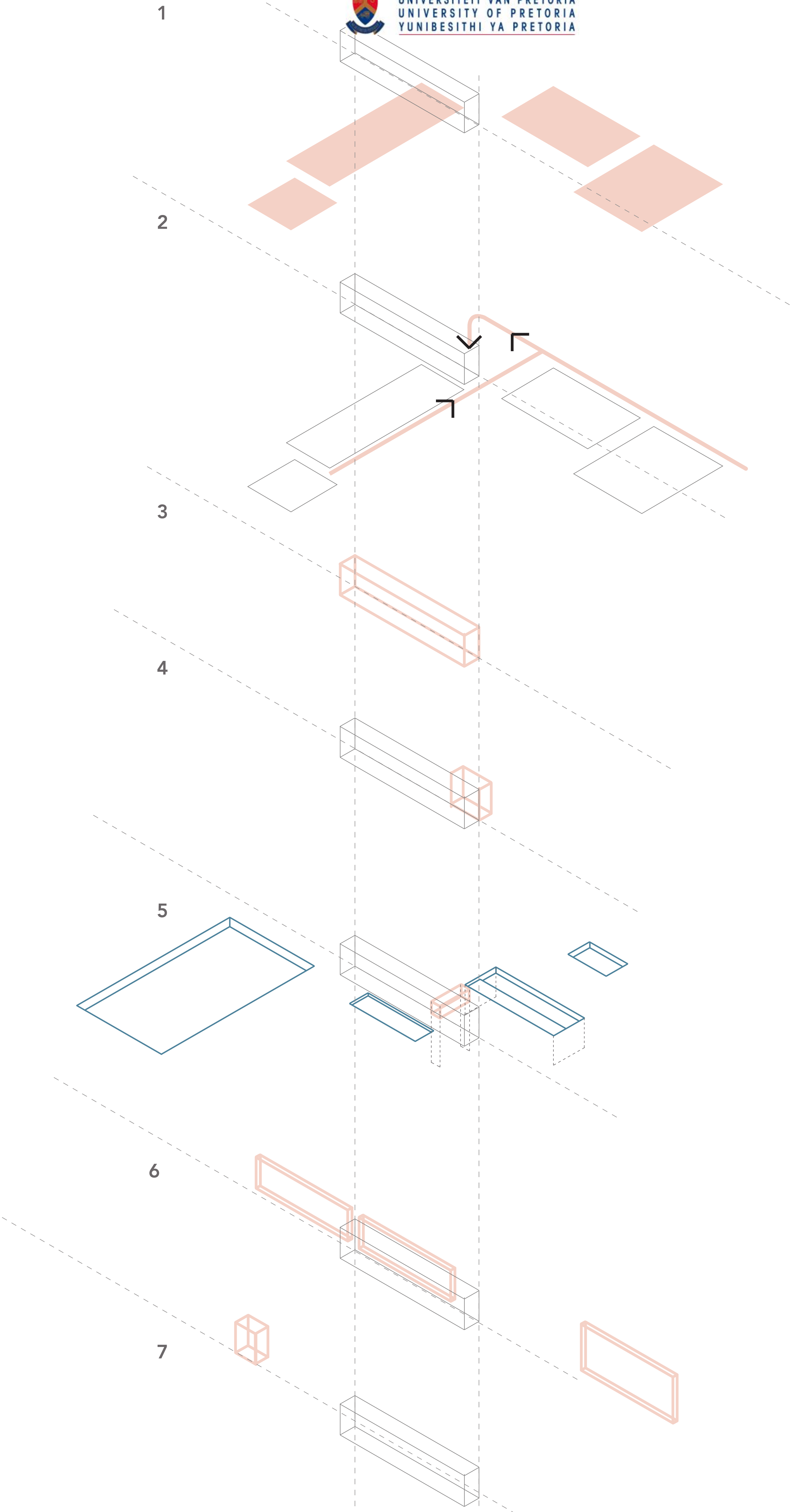
(1:10 TYPE) CIRCULATION DETAIL III NTS



WATER NETWORK



140


1
2
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4
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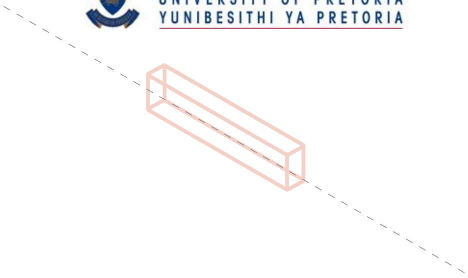
6
7



STORAGE

CALCULATING THE AMOUNT OF FACILITIES AND THEIR WATER DEMAND

UNDERSTANDING THE WATER DEMAND OF THE BUILDING

PROGRAMME	AREA (M^2)	WATER AREA	SANS OCCUPANCY	POPULATION	SERVICES									NOTES
					TOILETS			HAND WASH		CHANG-ING ROOMS		SHOW-ERS		
					MEN	(URINALS)	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	
STUDIOS	180		A3	36	1	2	3	2	2					1PERSON/ $5M^2$
MAIN HALL	200		A2	120	1	3	5	1	3					1PERSON/ M^2 OR CHAIR
					1	1	2	1	1					MAIN HALL PERSONNEL
PERFORMANCE	200		A2	120	1	3	5	1	3					
GYMNASIUM	210		A3	42	3	3	6	3	3	4	4			1PERSON/ $5M^2$ PEOPLE/HOUR
EXISTING POOL	2200	726		145	3	4	8	4	4	22	22	7	7	$5M^2$/PERSON STEADY STATE
POOL SURROUND	700		A5	70	2	2	5	3	3					
WADING POOL	300	70		23	1	1	2	2	2	4	4	2	2	$3M^2$/PERSON 9 PEOPLE/HOUR AND
INDOOR LAP POOL	110	150		28	2	2	3	3	3	4	4	2	2	$3M^2$/PERSON 10 PEOPLE/45MIN
HYDROTHERAPY	280	55		18	1	1	2	2	2	3	3	1	1	÷$3M^2$/PERSON 33 PEOPLE/HOUR
CARETAKER			H3	2	1		1	1	1			1	1	
OFFICES	100		G1	7	1	1	2	1	1					1PERSON/ $15M^2$
DAYCARE	300		A3	60	2	3	5	3	3					

POOL CAPACITY - BATHING LOAD FOR UN-PROGRAMMED RECREATIONAL SWIMMING A MINIMUM WATER AREA (OCCUPANCY RATIO) OF 3M2 PER BATHER SHOULD BE ALLOWED TO ENSURE PHYSICAL SAFETY PP 11 THE SPORT ENGLAND FACILITY PLANNING MODEL USES A FIGURE OF 6M2 PER BATHER
TABLE 8 PP48 CHANGING ROOMS AND SHOWERS

SOUTH AFRICAN NATIONAL STANDARD
SANS 10400-A:2010 EDITION 3 ISBN 978-0-626-25157-4

PART A: GENERAL PRINCIPLES AND REQUIREMENTS
SANS 10400-A: 2010 EDITION 3
A20 CLASSIFICATION AND DESIGNATION OF OCCUPANCIES
TABLE 1 - OCCUPANCY OR BUILDING CLASSIFICATION (PP43)
A21 POPULATION
POPULATION PER CLASS OF OCCUPANCY OF ROOM OR STOREY OR PORTION THEREOF
TABLE 2 - DESIGN POPULATION (PP 45)

PART P: DRAINAGE
SANS 10400-P: 2010 EDITION 3
THE MINIMUM NUMBER OF SANITARY FITTINGS TO BE PROVIDED IN ANY BUILDING
4.11 PROVISION OF SANITARY FIXTURES
FIXTURES PER TYPE OF OCCUPANCY AND POPULATION
TABLE 4 — PROVISION OF SANITARY FIXTURES (PP29)
TABLE 6 - PROVISION OF SANITARY FIXTURES FOR PERSONNEL (PP 31)
TABLE 7 - PROVISION OF SANITARY FIXTURES FOR PUBLIC, VIS-

POTENTIAL RAINWATER HARVESTING CAPAPCITY

TOTAL AREA OF THE ROOF (M²)	ANNUAL RAINFALL (MM)	POTENTIAL RAINFALL HARVESTING CAPACITY (L)	RUNOFF COEFFICIENT FOR A ROOF	ACTUAL RAINFALL HARVESTING CAPACITY (L)
A			C	
1670	0.714	1192 M3	0.9	1073 M3

	AVERAGE MONTHLY PRECIPITATION (MM)	AVERAGE MONTHLY PRECIPITATION (M)	ROOF YIELD (M3)
		P	P X A X C
JAN	126	0.126	189.378
FEB	90	0.090	135.270
MAR	91	0.091	136.773
APR	52	0.052	78.156
MAY	13	0.013	19.539
JUN	8	0.008	12.024
JUL	4	0.004	6.012
AUG	6	0.006	9.018
SEP	28	0.028	42.084
OCT	73	0.073	109.719
NOV	118	0.118	177.354
DEC	105	0.105	157.815

WATER CAPITA PER DAY FOR SHOWERS, WATER CLOSETS, URINALS AND HAND WASHING

PROGRAMME	**POPULA-TION**	**WATER USE (L)**							
	M + F	TOILETS			HAND WASH			SHOWER	
VISITORS	FREQUEN-CY USE PP PER DAY	0.25	0.75	0.85	0.75	0.85		0.75	
WATER USE PER APPLI-ANCE		6L	2L	6L	1.4L	1.4L		18 L	
		MALE	(URINALS)	FEMALE	MALE	FEMALE		M +F	
							TOTAL		SUM TOTAL
STUDIOS	36	27	27	92	19	21	186		186
MAIN HALL	120	90	90	306	63	71	620		620
PERFORMANCE ARENA	120	90	90	92	63	71	406		406
GYMNASIUM	42	32	32	214	22	25	324		324
EXISTING POOL COURT	145	109	109	372	77	87	754	1958	2712
POOL SURROUND	70	53	53	179	37	42	362		362
WADING POOL	23	17	17	61	13	14	123	311	434
INDOOR LAP POOL	28	21	21	71	15	17	145	378	523
HYDROTHERAPY	18	14	14	46	9	11	93	243	336
FULL TIME	FREQUEN-CY USE PP	1	2	3	3	3			
CARETAKER	2	6	4	18	4	4	36		
OFFICES	7	21	14	63	15	15	127		

DEMAND PER MONTH INDICATING THE SEASONAL INFLUENCES ON FREQUENCY AND CAPACITY FOR DIFFERENT PROGRMMES

		STUDIOS	MAIN HALL	PERFORMANCE ARENA	GYMNASIUM	EXISTING POOL COURT	POOL SURROUND/ COURT	WADING POOL	INDOOR LAP POOL	HYDROTHERAPY	CARETAKER	OFFICES	DAYCARE	WATER CAPITA A MONTH (L)	DEMAND PER MONTH (M3)
	WC UR HW	186	620	406	324	754	362	123	145	93	36	127	1092		
	SH					1958		311	378	243					
DAYS IN FULL CAPACITY USE PER MONTH	JAN	20	16	12	20	20	5	20	20	20	31	24	20	132.906	132.906
	FEB	20	16	12	20	16	5	16	16	16	28	24	20	116.85	116.85
	MAR	20	16	12	20	12	5	12	12	12	31	24	20	100.866	100.866
	APR	20	16	12	20		5		12	12	30	24	20	63.078	63.078
	MAY	20	16	12	20		5		12	12	31	24	20	63.114	63.114
	JUN	20	16	12	20		5		12	12	30	24	20	63.078	63.078
	JUL	20	16	12	20		5		12	12	31	24	20	63.114	63.114
	AUG	20	16	12	20		5		12	12	31	24	20	63.114	63.114
	SEP	20	16	12	20		5		12	12	30	24	20	63.078	63.078
	OCT	20	16	12	20	12	5	12	12	12	31	24	20	100.866	100.866
	NOV	20	16	12	20	16	5	16	16	12	30	24	20	116.85	116.85
	DEC	20	16	12	20	20	5	20	20	12	31	24	20	132.906	132.906

WATER BALANCE AND RESERVOIR SIZE

	ROOF YIELD (M3)	DEMAND PER MONTH (M3)	BALANCE
	P X A X C		
JAN	189.378	132.906	150.738
FEB	135.27	116.85	169.23
MAR	136.773	100.866	205.23
APR	78.156	63.078	220.215
MAY	19.539	63.114	176.64
JUN	12.024	63.078	125.586
JUL	6.012	63.114	68.484
AUG	9.018	63.114	14.388
SEP	42.084	63.078	-6.6.6
OCT	109.719	100.866	8.853
NOV	177.354	116.85	69.357
DEC	157.815	132.906	94.266

The reservoir size was determined by allowing a volume that will contain the maximum monthly water demand per month as well as the maximum amount of surplus water from the yearly water balance:

length x breadth x height

30m x 2.5m x 5m
375m³