BRIDGING TRADITION AND GROWTH

SUSTAINING SYLHET

JASPER AMBAGTS

CONTEXT

CONTEXT

SITE ANALYSIS



CONTEXT

SITE ANALYSIS



CONTEXT

SITE ANALYSIS



CONTEXT

SITE ANALYSIS



CONTEXT

TRANSFORMATION BADAGHAT ROAD





CONTEXT

SITE ANALYSIS



CONTEXT

STORIES

1:1500



STORIES

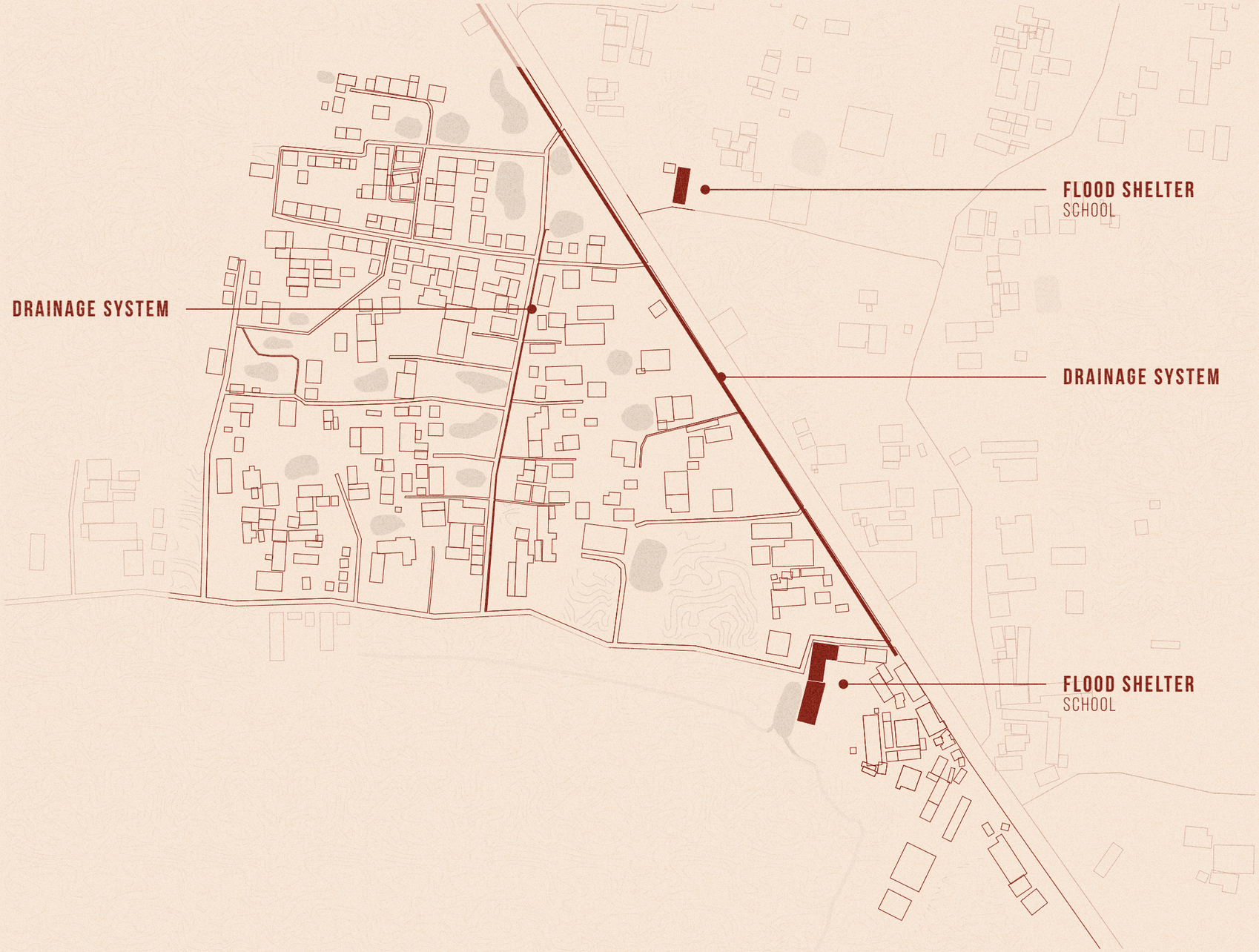
= 1 STORY

= 2+ STORIES

CONTEXT

WATER MANAGEMENT

1:1500



CONTEXT

WATER MANAGEMENT



FLOOD SHELTER



CONCRETE DRAINAGE SYSTEM

RESEARCH

PROBLEM STATEMENT



URBAN EXPANSION IN SYLHET: GROWTH AT A COST

RESEARCH
MATERIALS



MUD HOUSES



BAMBOO HOUSES

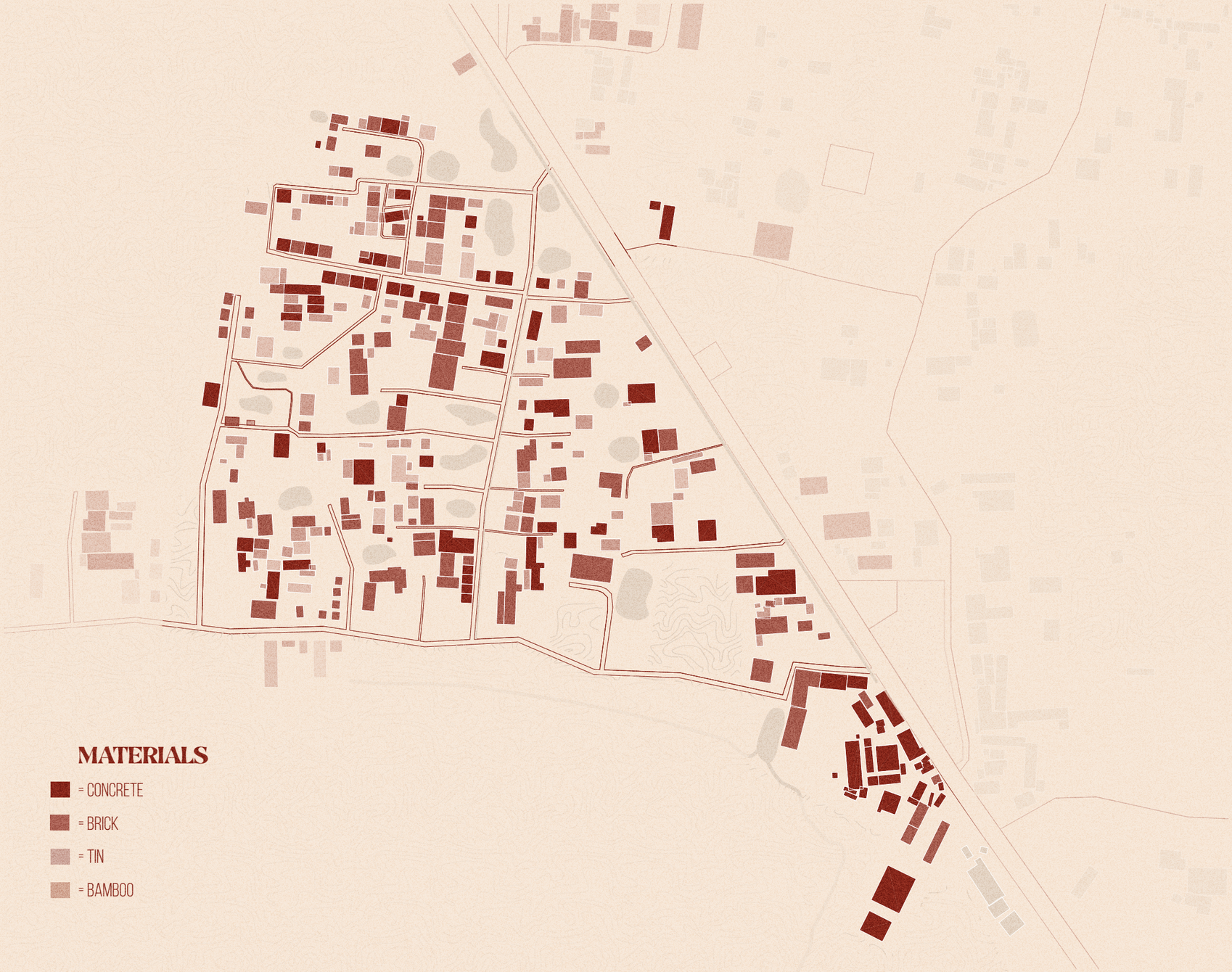


CONCRETE HOUSES

RESEARCH

MATERIALS

1:1500



"VILLAGERS HAVE AN **INCREASING DESIRE** TO BUILD HOMES OUT OF **BRICKS** AND **CONCRETE.** THIS TREND COULD HAVE A **SERIOUS IMPACT** ON THE **ENVIRONMENT.**"

"ANOTHER EFFECT IS THE **LOSS** OF **CULTURAL** AND **REGIONAL IDENTITY.**"

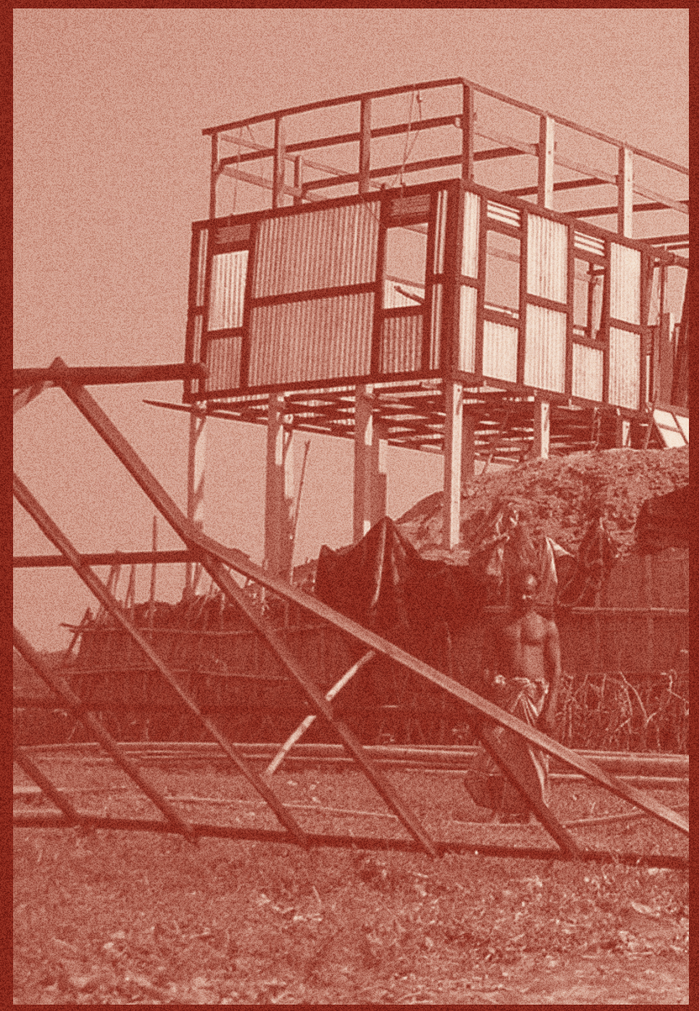
- ANNA HERINGER (2001) - RUDRAPUR VILLAGE STUDY

RESEARCH

VERNACULAR ARCHITECTURE



DESIGN STRATEGIES

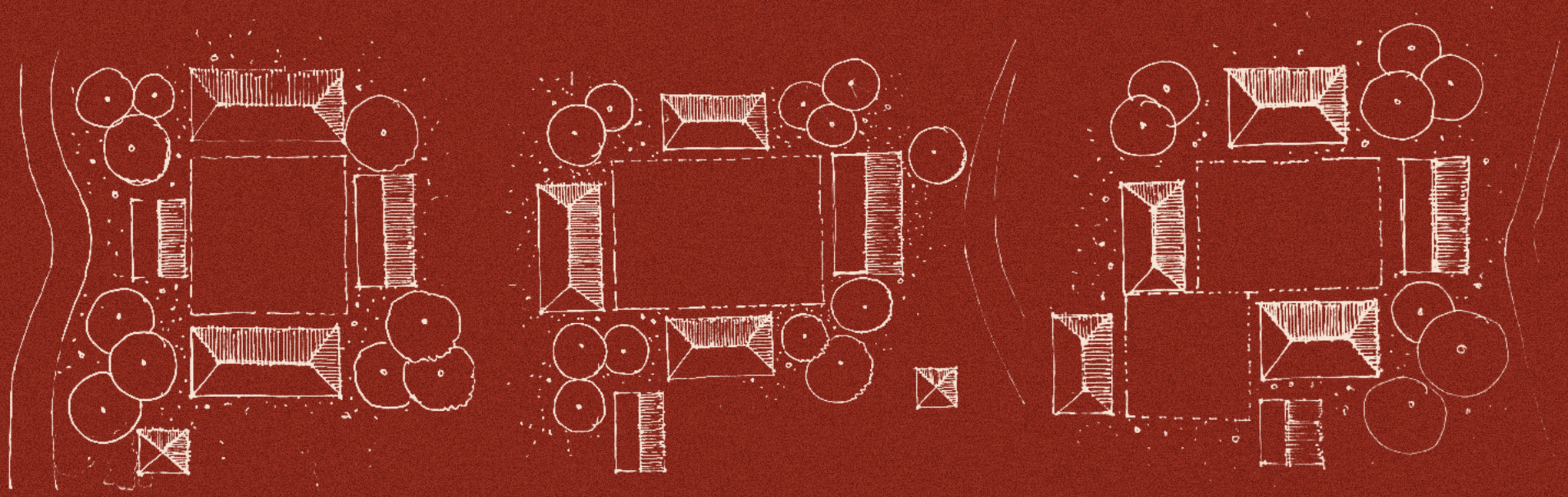


INDIGENOUS TECHNIQUES



MATERIAL EFFICIENCY

DESIGN STRATEGIES



SQUARE COURTYARD

RECTANGULAR COURTYARD

INTERLOCKING COURTYARD

DIFFERENT TYPES OF THE COURTYARD IN BANGLADESH – RAHMAN, R. (2017)

MUD/EARTH - MATERIAL EFFICIENCY



LOW EMBODIED ENERGY

MUD CONSTRUCTION HAS A MUCH LOWER EMBODIED ENERGY THAN BRICKS OR CEMENT.

THERMAL COMFORT

STUDIES SHOW THAT MUD HOUSES REMAIN COOLER IN SUMMER AND WARMER IN WINTER COMPARED TO CONCRETE OR BRICK HOUSES

REPAIRABILITY

MUD STRUCTURES CAN BE EASILY MAINTAINED AND REPAIRED USING LOCAL KNOWLEDGE AND TOOLS

RESEARCH

BAMBOO - MATERIAL EFFICIENCY



FLEXIBILITY AND STRENGTH

IDEAL FOR FLOOD-PRONE AND SEISMIC AREAS DUE TO ITS FLEXIBILITY AND HIGH STRENGTH-TO-WEIGHT RATIO

RAPID RENEWABILITY

GROWS QUICKLY, MAKING IT A SUSTAINABLE AND REGENERATIVE RESOURCE

USE IN STRUCTURES

TRADITIONALLY USED IN STILT HOMES AND CHANG GHARS (RAISED PLATFORMS) TO RESIST FLOODING AND FACILITATE AIRFLOW

RESEARCH

PLOT BASED DEVELOPMENT





PLOT BASED DEVELOPMENT



RESEARCH

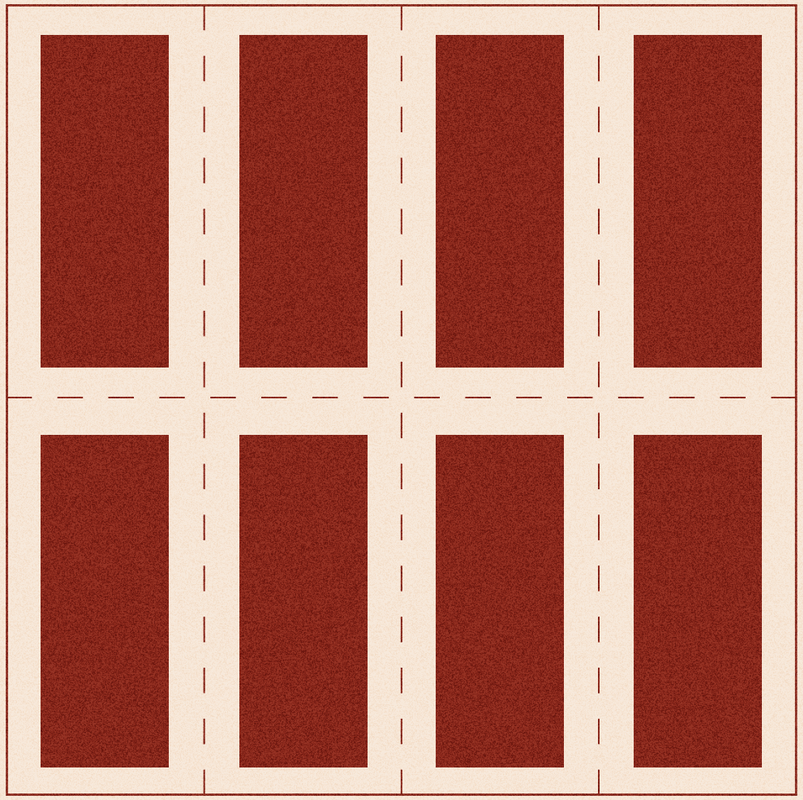
PLOT BASED DEVELOPMENT



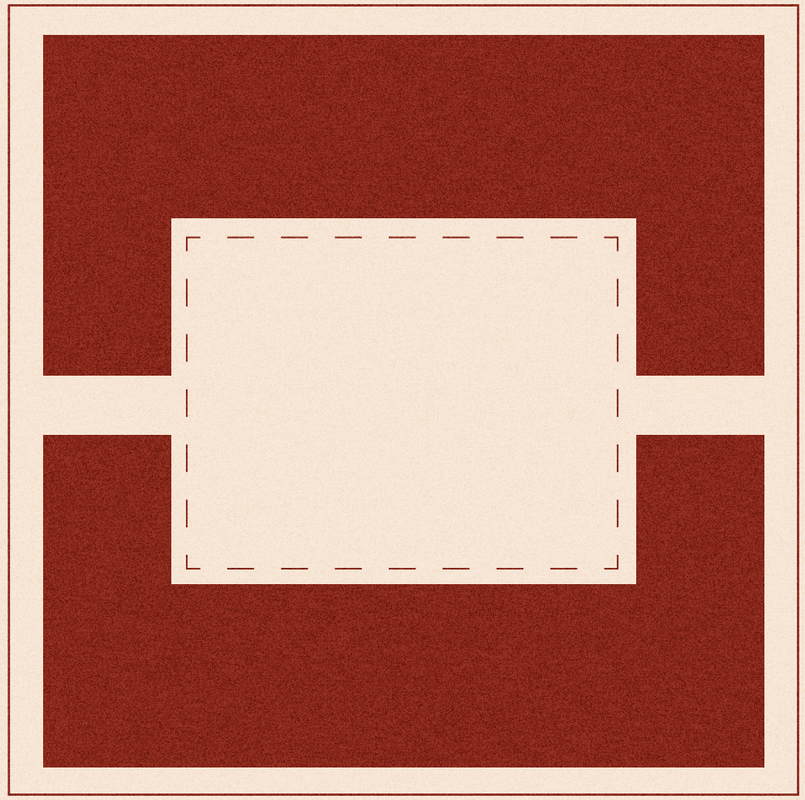


DHAKA

PLOT BASED DEVELOPMENT

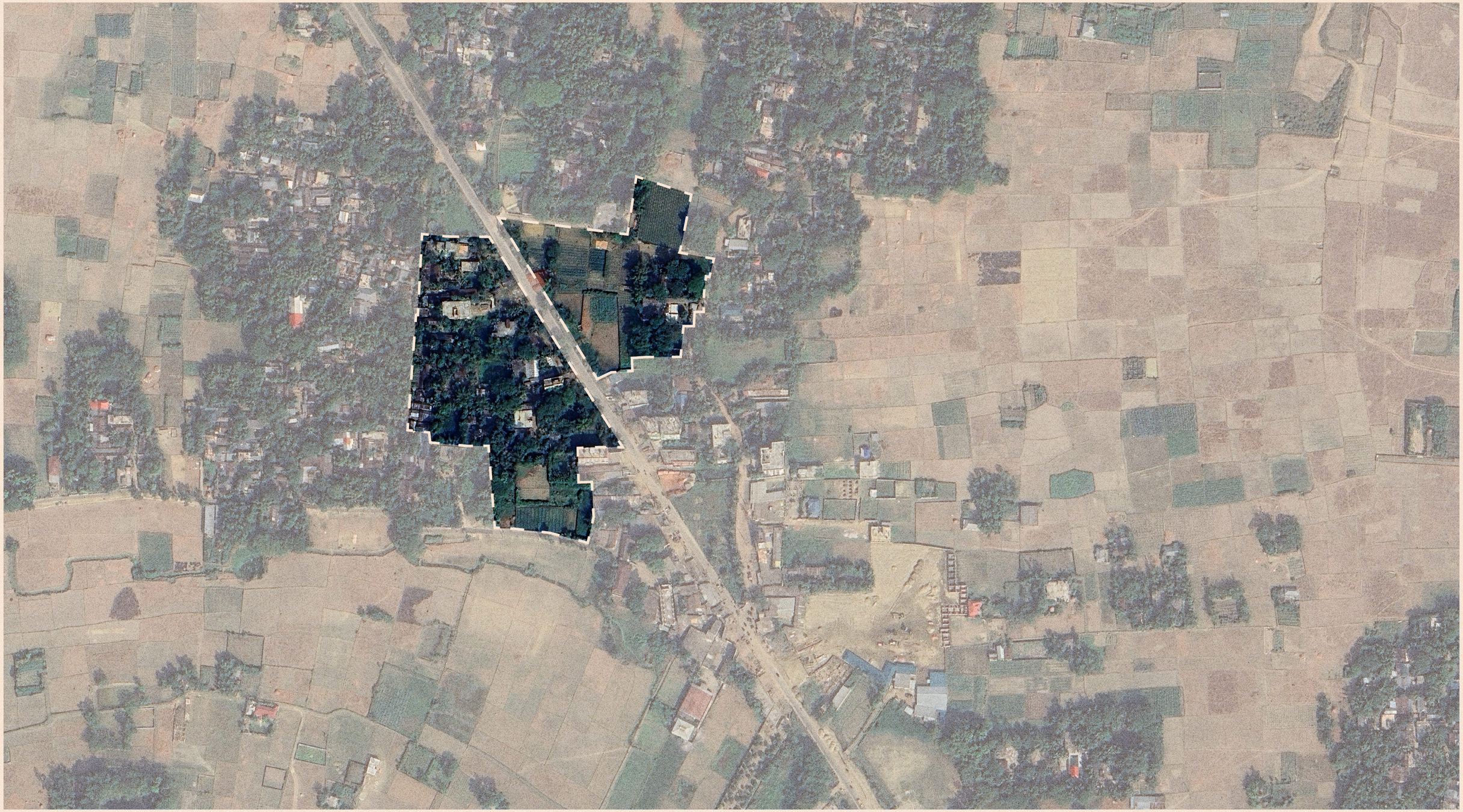


SMART URBAN PLANNING



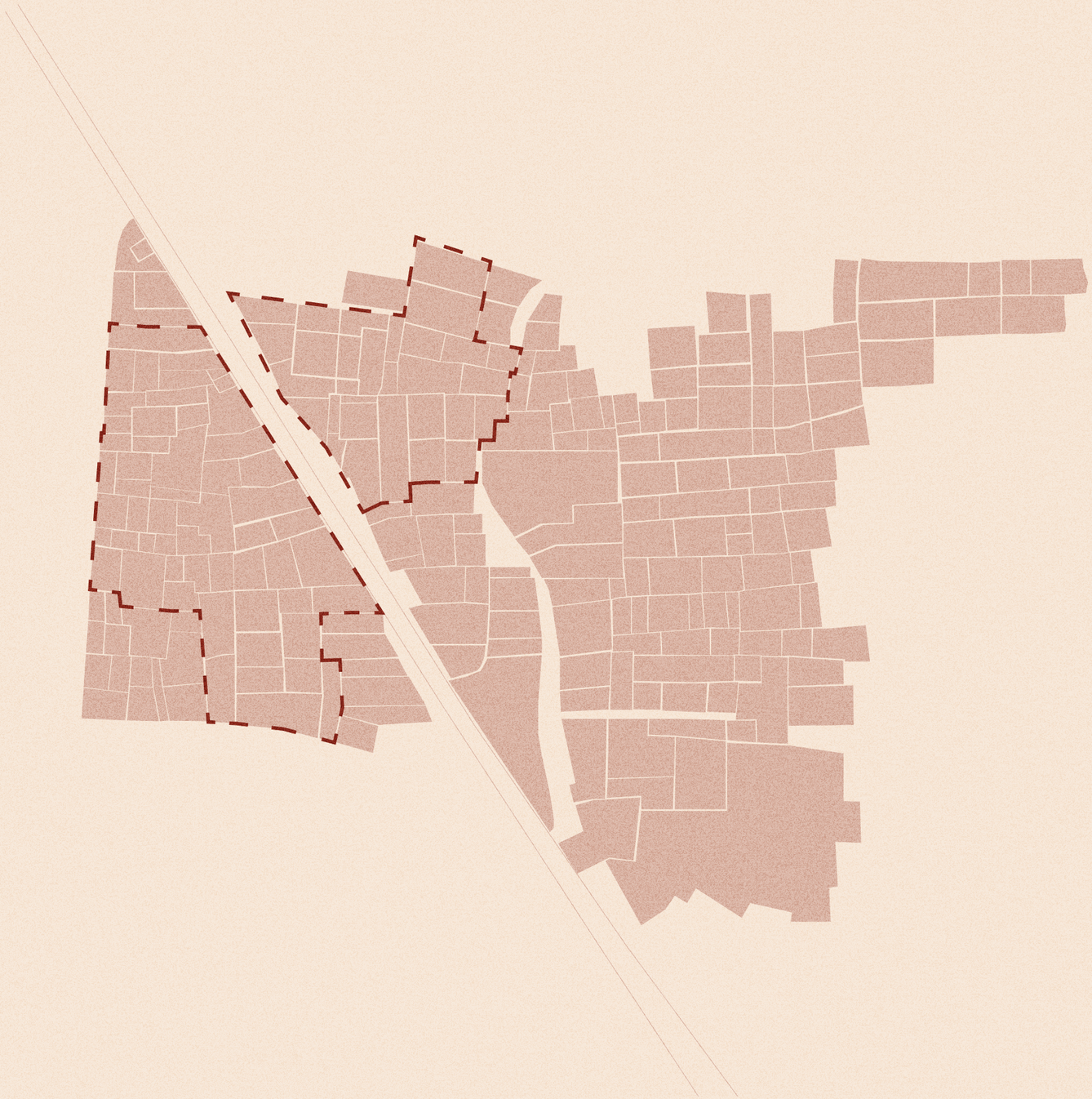
STRATEGY

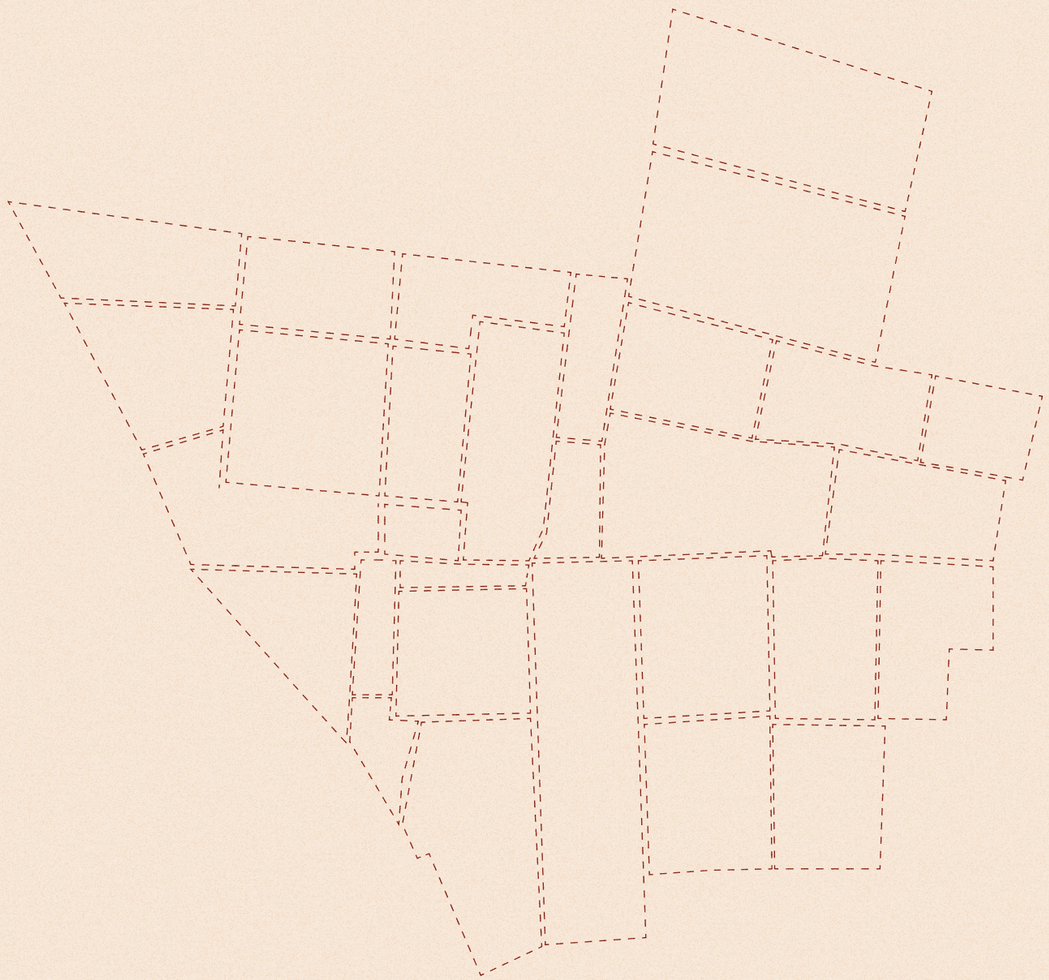
POTENTIAL AREA



STRATEGY

LAND OWNERSHIP





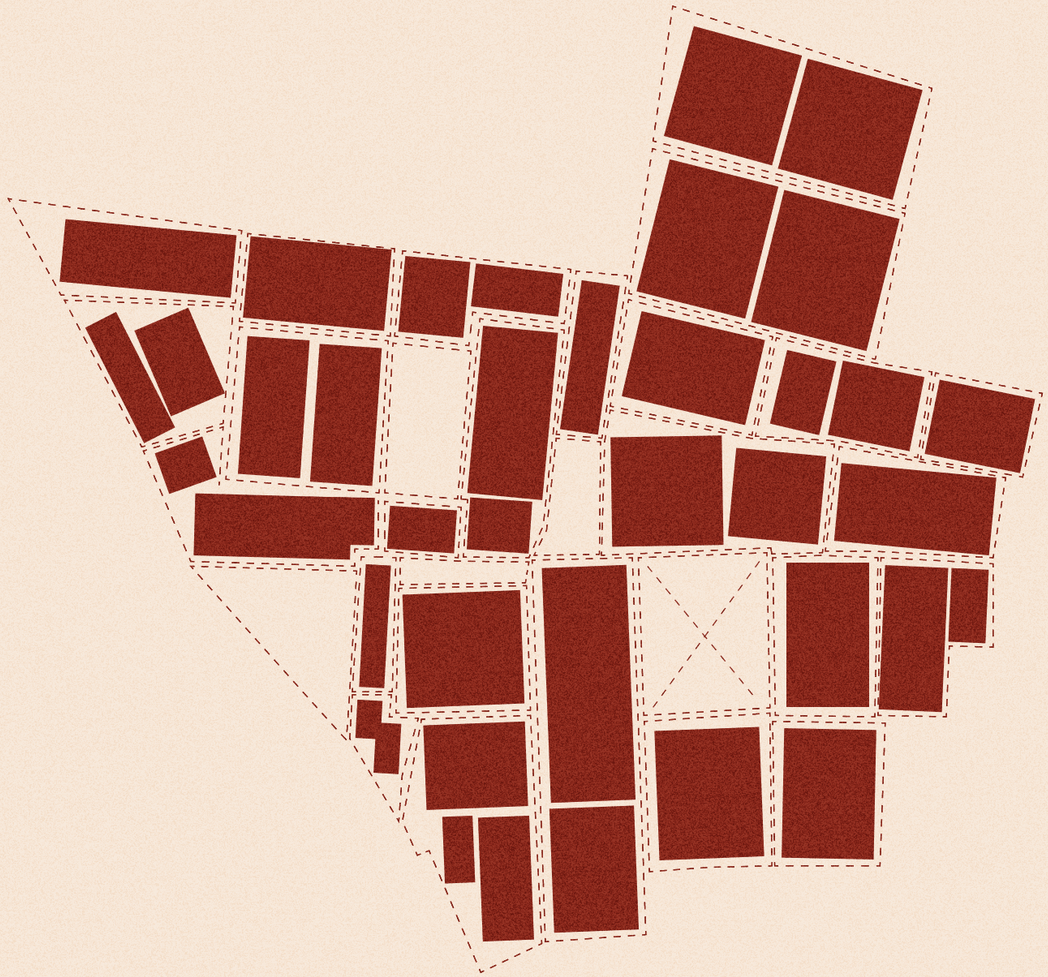
ABACUS
BASE SITUATION

AREA: 1.75 HA

FSI: 0.04

GSI: 0.04

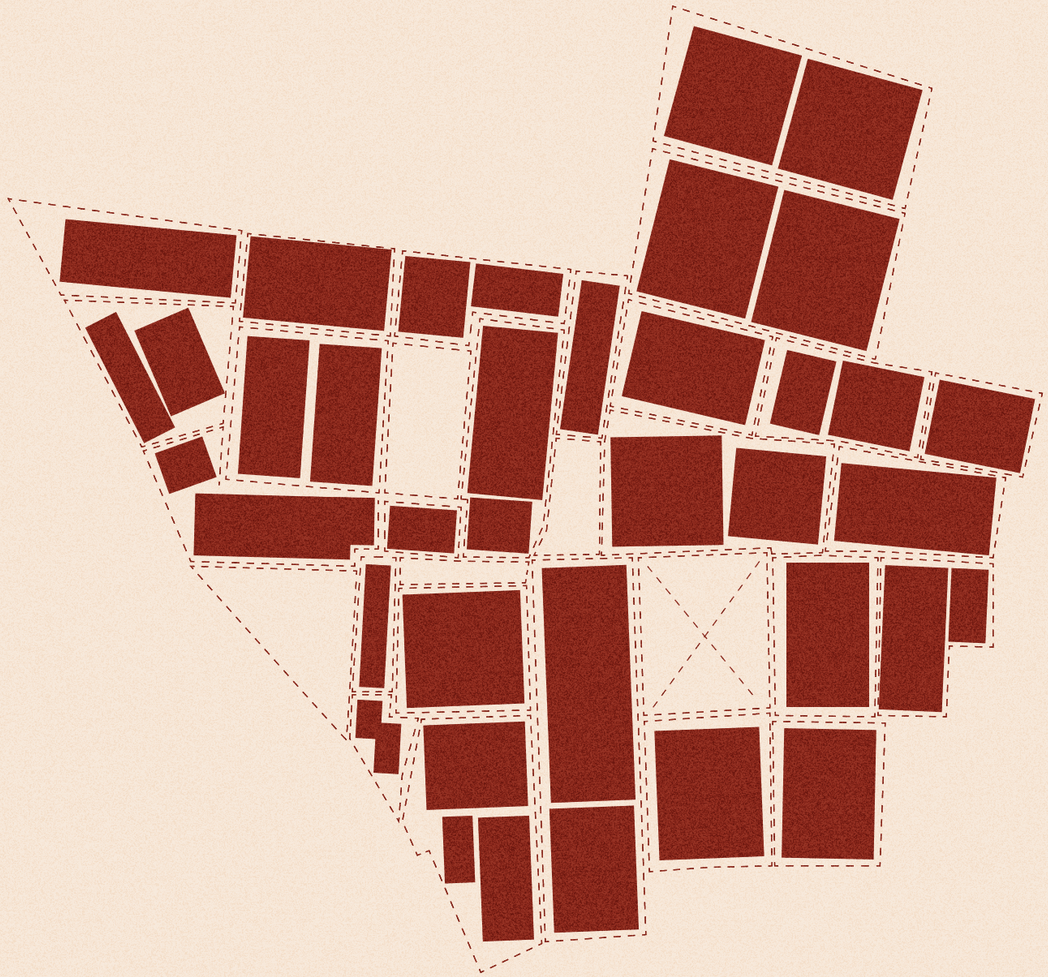
URBAN FABRIC DEVELOPMENT



IF NOTHING IS DONE

– FAST PLOT-BASED DEVELOPMENT

- 30% PLOTS UNDEVELOPABLE (LANDLOCKED)
- BUILDING HEIGHT:
  7 FLOORS AVERAGE



ABACUS

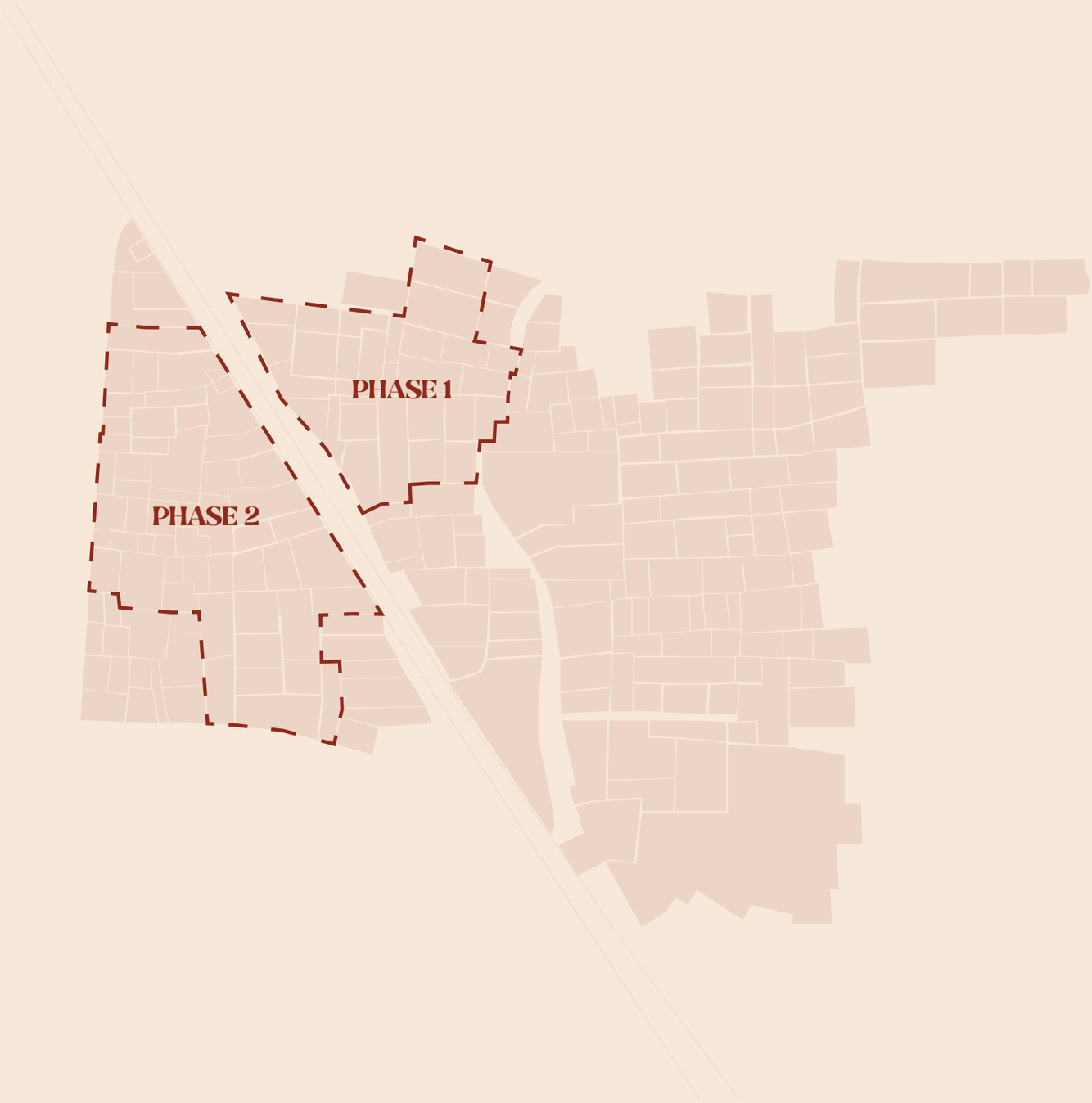
IF NOTHING IS DONE

AREA: 1.75 HA

FSI: 3.19

GSI: 0.74

URBAN FABRIC DEVELOPMENT



BASE SITUATION

PHASE 1

AREA: 1.75 HA
FSI: 0.04
GSI: 0.04

PHASE 2

AREA: 1.98 HA
FSI: 0.21
GSI: 0.18

TOTAL

AREA: 3.90 HA
FSI: 0.10
GSI: 0.09

IF NOTHING IS DONE

PHASE 1

AREA: 1.75 HA
FSI: 3.19
GSI: 0.74

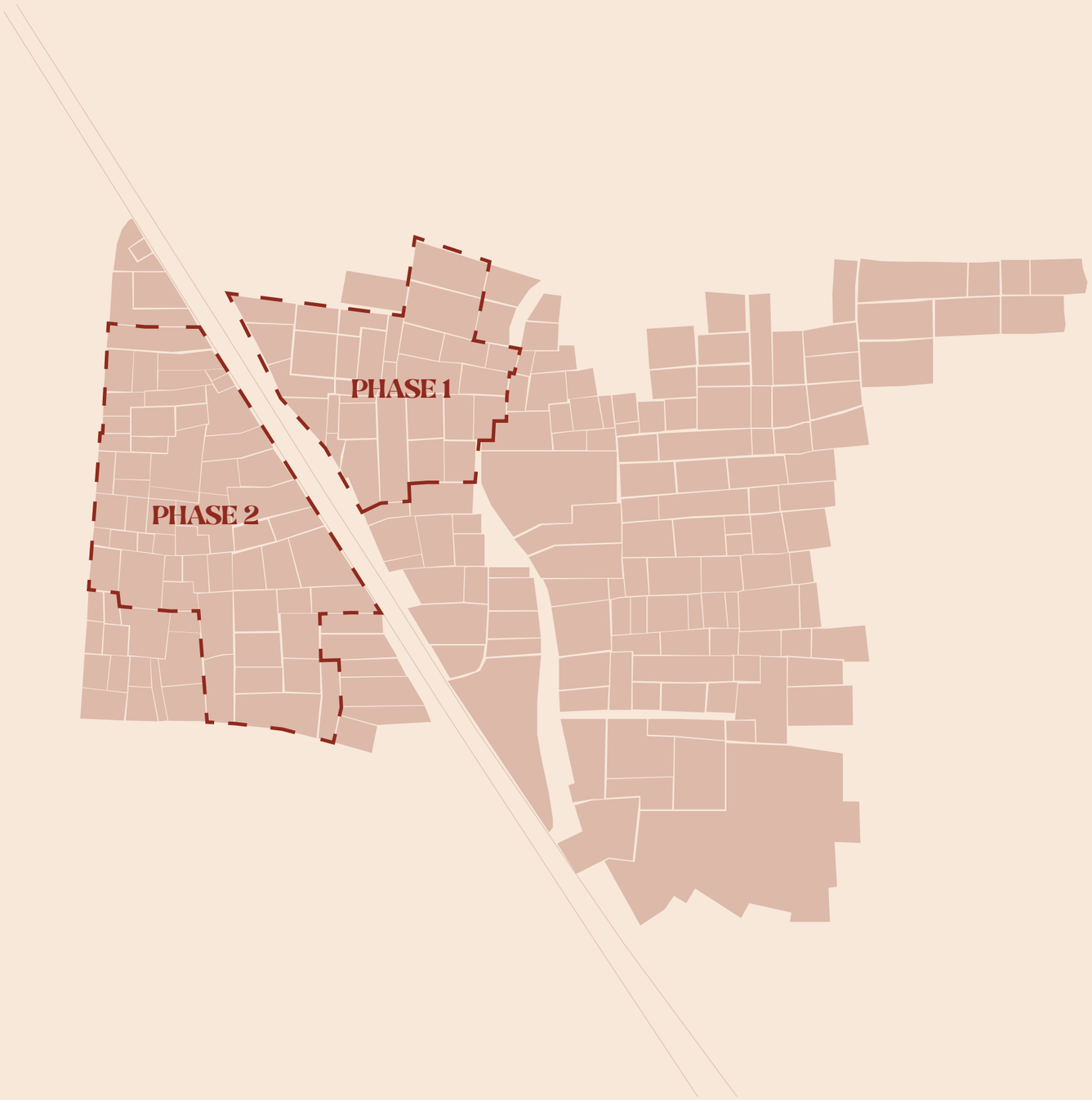
PHASE 2

AREA: 1.98 HA
FSI: 0.76
GSI: 0.64

TOTAL

AREA: 3.90 HA
FSI: 1.47
GSI: 0.72

URBAN FABRIC DEVELOPMENT



PHASE 1

RAPIDLY DENSIFIES, RISKING OVERBUILT **CHAOS** AND INFRASTRUCTURE **FAILURE**

PHASE 2

REMAINS LOW-DENSITY AND UNDER-DEVELOPED DUE TO **SOCIO-ECONOMIC CONSTRAINTS**

TOTAL

URBAN FABRIC BECOMES **INCOHERENT** AND **UNEQUAL**, WITH HEAVY PRESSURE ON INFRASTRUCTURE

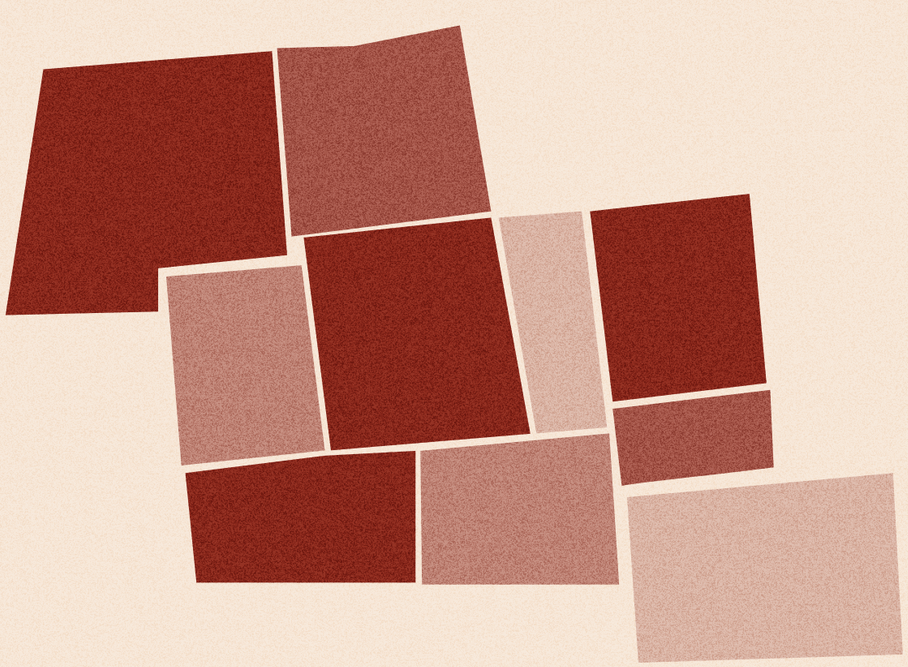
RESEARCH QUESTION

"HOW CAN SUSTAINABLE **URBAN EXPANSION** STRATEGIES, BE IMPLEMENTED TO BALANCE **ECONOMIC** GROWTH, **ENVIRONMENTAL** CONSERVATION, AND **CULTURAL** PRESERVATION IN RAPIDLY GROWING CITIES LIKE SYLHET?"

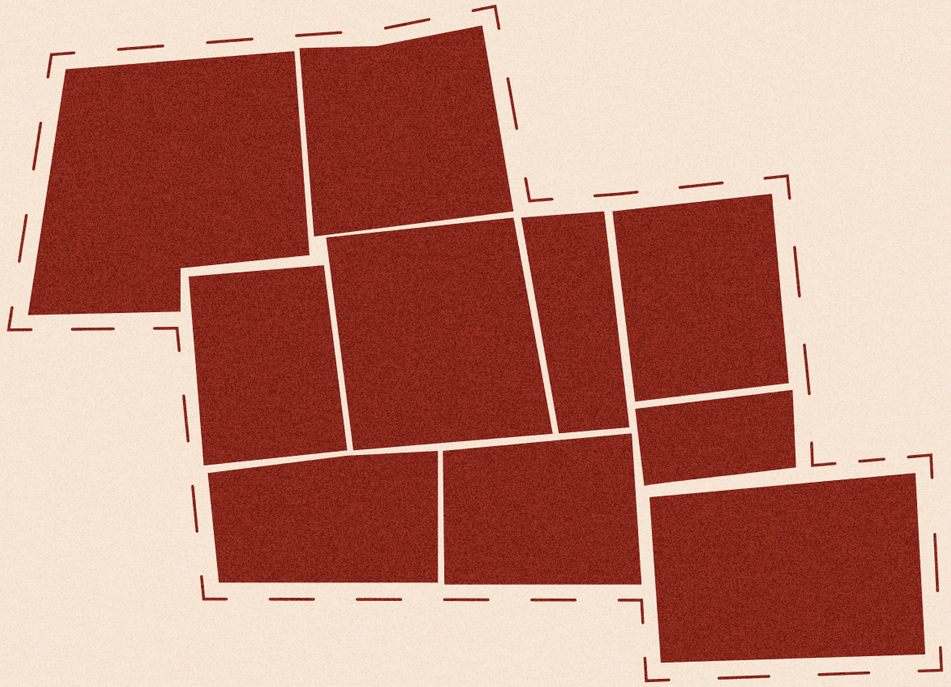
MASTERPLAN

STRATEGY

COMMUNITY LAND TRUST



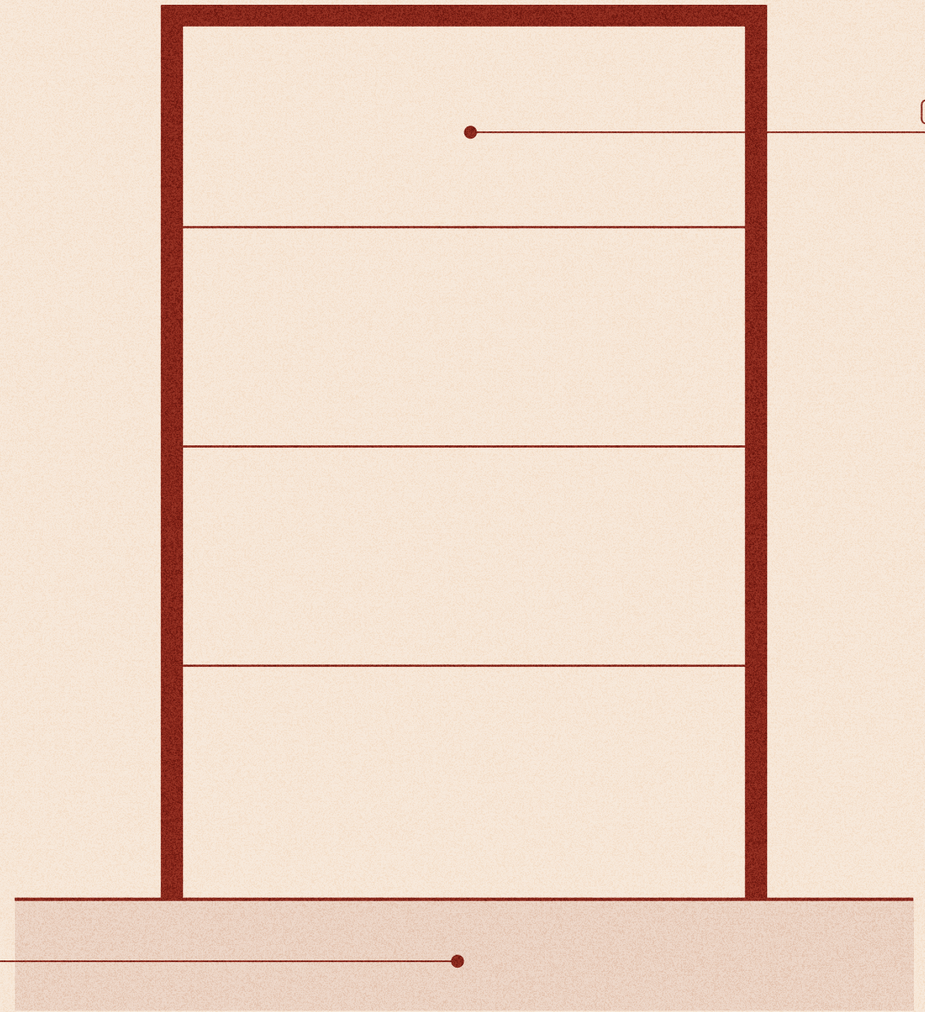
SMALL AND **INDIVIDUALLY** OWNED PLOTS



COMBINING INTO **1 SINGLE LANDHOLDING**
VIA **COMMUNITY LAND TRUST**

STRATEGY

COMMUNITY LAND TRUST



OWNED BY

INDIVIDUAL FAMILIES

- ENGAGE IN COMMUNITY
- MAINTENANCE OF PROPERTY

COMMUNITY LAND TRUST

BOARD OF DIRECTORS

- LAND ACQUISITION
- DEVELOPMENT & MANAGEMENT
- ENVIRONMENTAL AND SOCIAL IMPACT
- FINANCES

OWNED BY

VILLAGERS MAINTAIN A **SHARE** IN THE CLT

PROFITS ARE REINVESTED INTO THE **COMMUNITY**

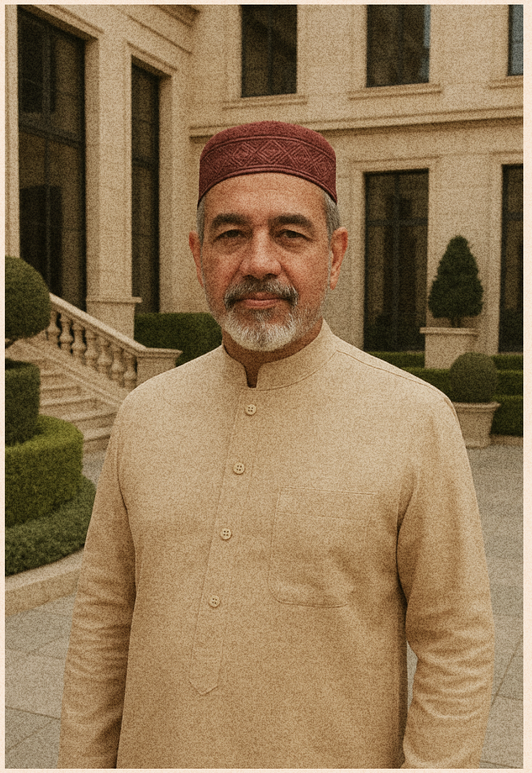
TARGET GROUPS



LOW INCOME



MID INCOME



HIGH INCOME

LOW INCOME



INFORMAL, LABOR-INTENSIVE JOBS

- AGRICULTURAL LABORERS
- DOMESTIC WORKERS
- SMALL TRADERS AND HAWKERS
- HANDICRAFTS AND ARTISANS

LARGE HOUSEHOLDS

- 5 TO 7 MEMBERS
- TWO TO THREE GENERATIONS LIVING UNDER THE SAME ROOF

BAD LIVING CONDITIONS

- LIMITED PROTECTION FROM FLOODS AND STORMS
- LACK OF PROPER SANITATION



VILLAGE HOUSE IN SHONATOLA

MIDDLE INCOME



STABLE AND DIVERSIFIED INCOME

- SMALL BUSINESS OWNERS
- SALARIED EMPLOYEES
- SKILLED LABORERS
- REMITTANCE EARNERS

MEDIUM-SIZED HOUSEHOLDS

- 4 TO 6 MEMBERS
- NUCLEAR FAMILY

IMPROVED LIVING CONDITIONS

- MORE DURABLE HOUSING
- BETTER HYGIENE PRACTICES
- ACCESS TO TECHNOLOGY

STRATEGY

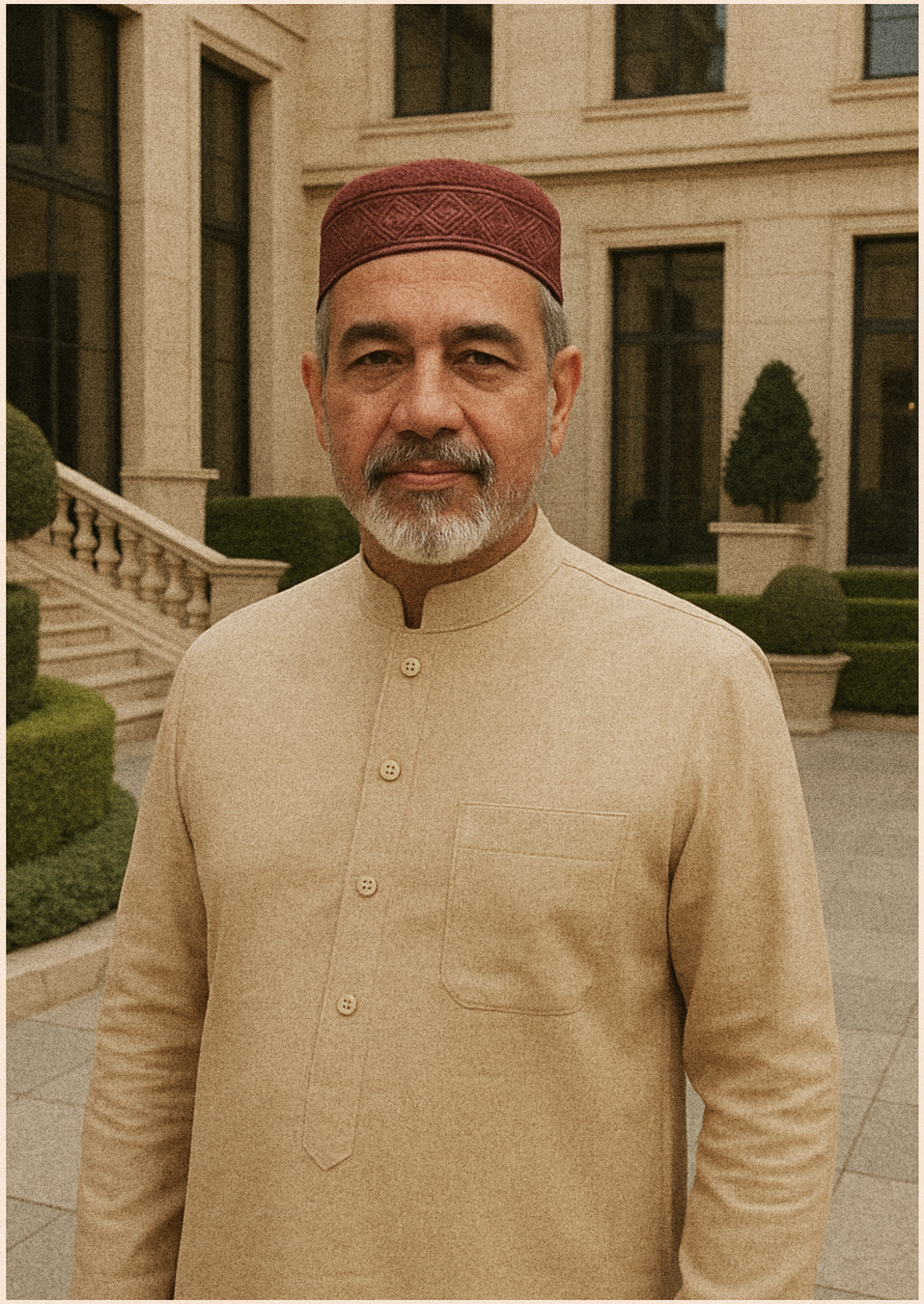
MIDDLE INCOME





CASE STUDY – KAZEDEWAN APARTMENT BUILDING

HIGH INCOME



HIGH-YIELD INCOME SOURCES

- LARGE-SCALE LANDOWNERS
- BUSINESS OWNERS
- SALARIED PROFESSIONALS

MEDIUM-SIZED HOUSEHOLDS

- 4 TO 5 MEMBERS
- WELL-EDUCATED NUCLEAR FAMILY

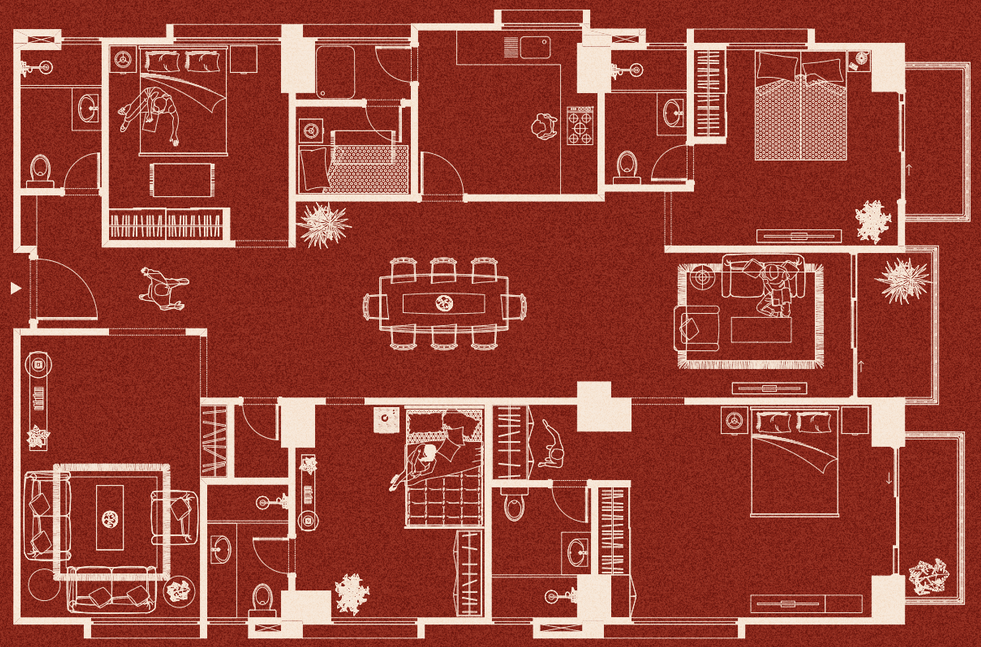
COMFORTABLE LIVING CONDITIONS

- MULTI-STORIED STRUCTURES
- EQUIPPED WITH MODERN AMENITIES AND UTILITIES

STRATEGY

HIGH INCOME

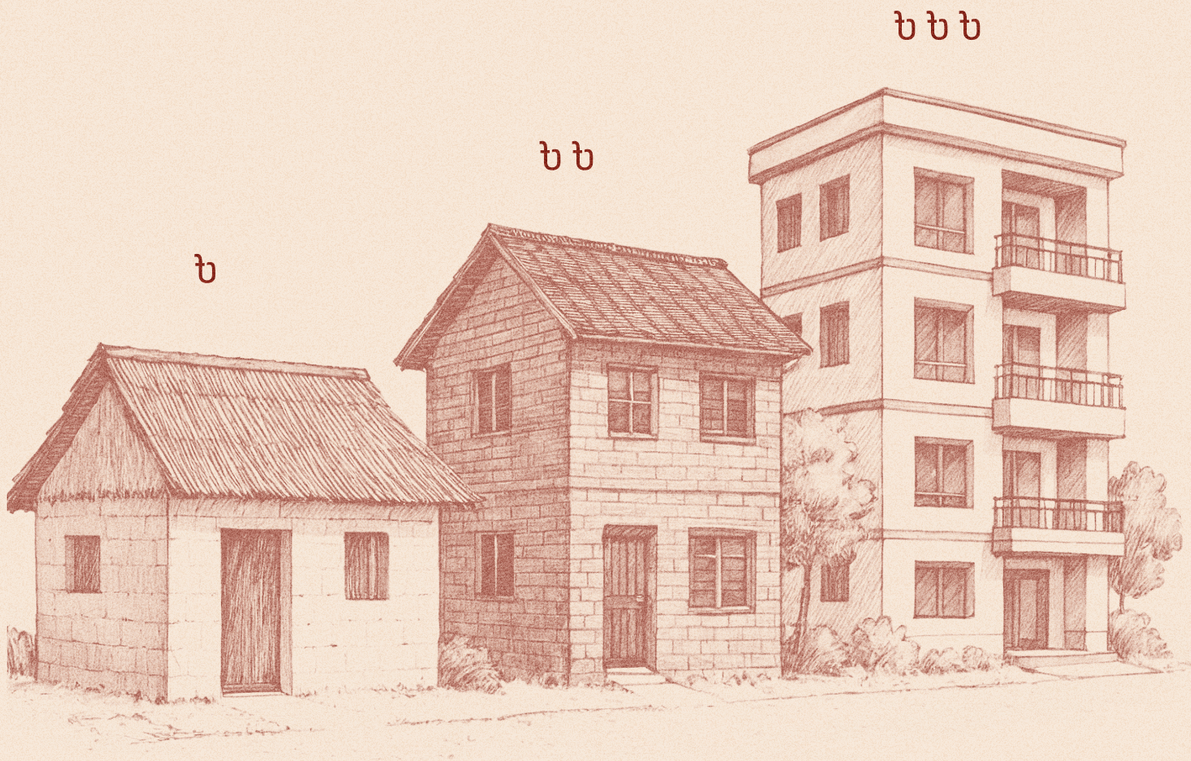




CASE STUDY – DREAM VALLEY APARTMENT BUILDING

STRATEGY

CROSS-SUBSIDIZATION



HIGH INCOME

- PAY HIGHER PRICES FOR LAND, SERVICES, OR HOUSING UNITS

LOW INCOME

- SUBSIDIZE AFFORDABLE HOUSING FOR LOW-INCOME FAMILIES

BENEFITS

- ENSURES MIXED-INCOME COMMUNITIES
- REDUCES URBAN OR RURAL INEQUALITY

MASTERPLAN

MASTERPLAN SITE

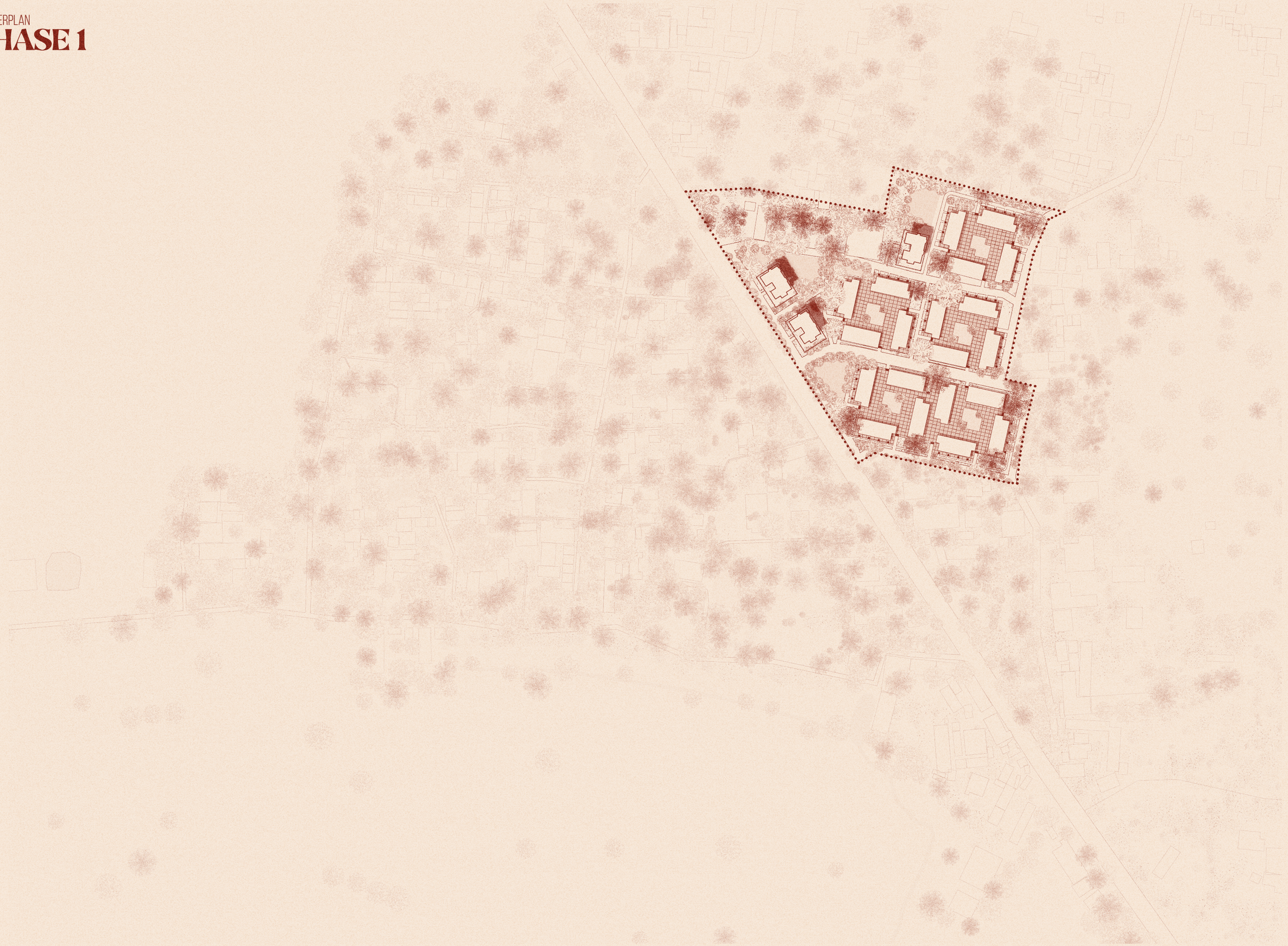
1:1500



MASTERPLAN

PHASE 1

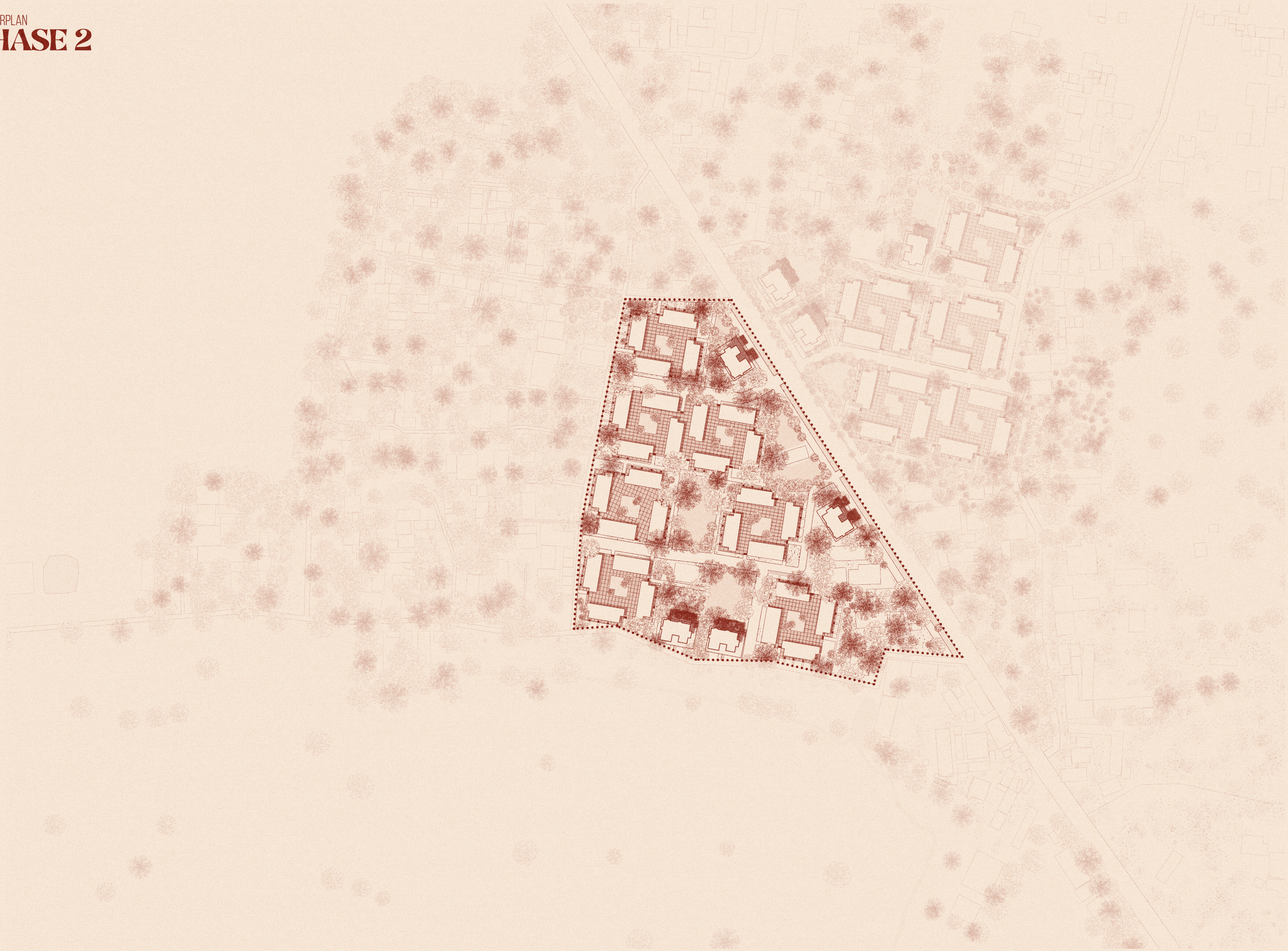
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MASTERPLAN

PHASE 2

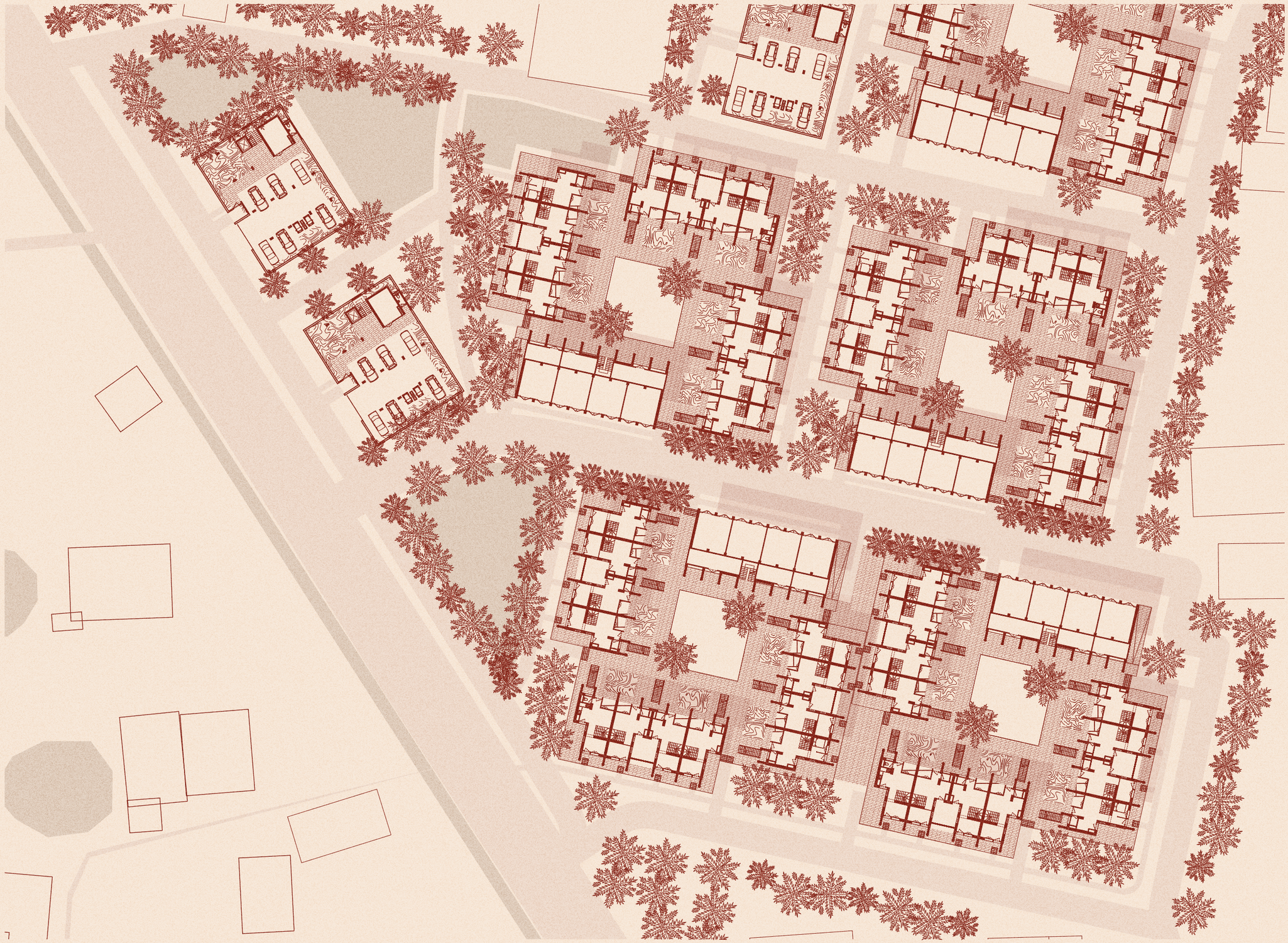
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MASTERPLAN

GROUND FLOOR PLAN - PHASE 1

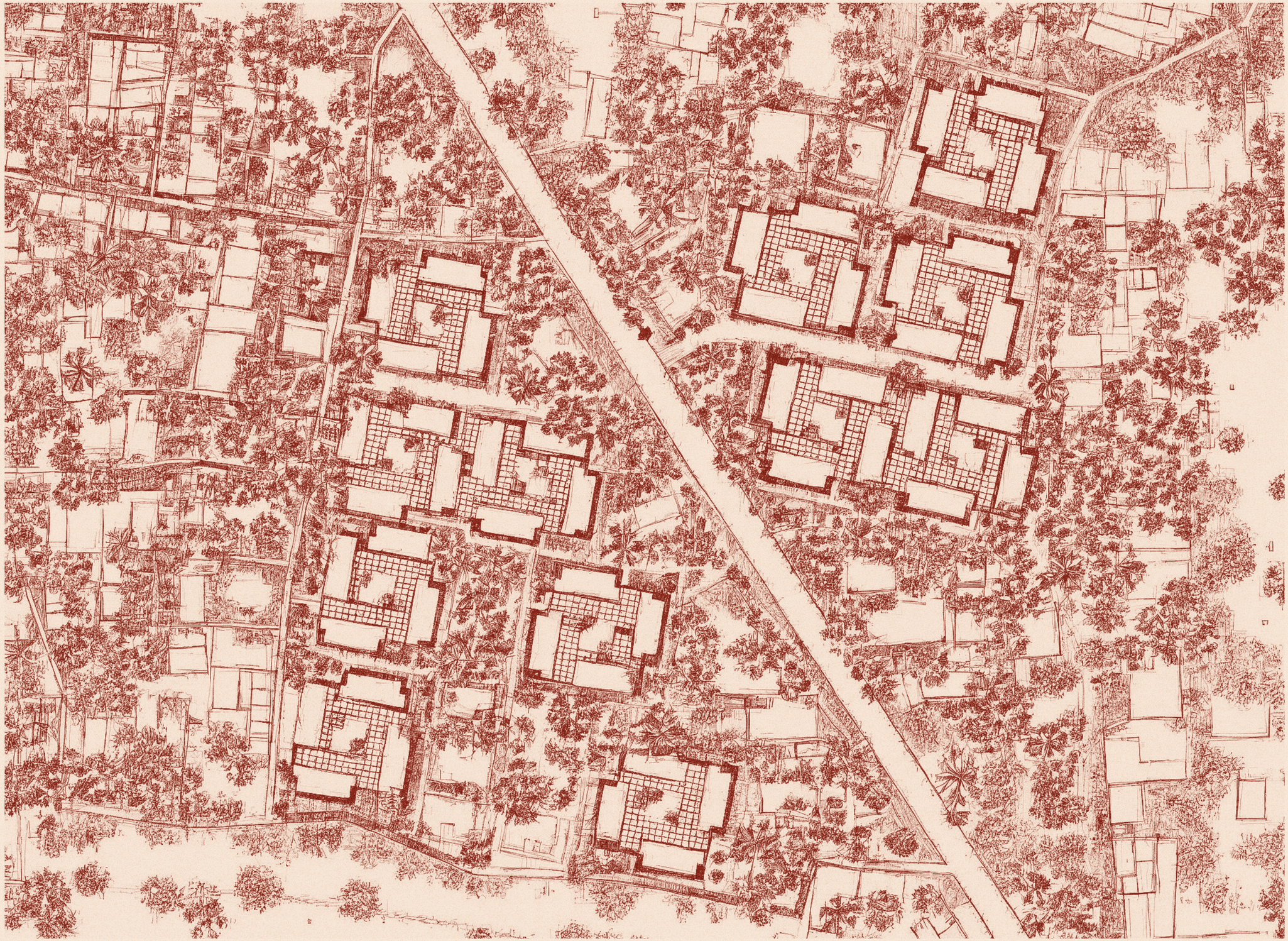
1:500



MASTERPLAN

FINAL PHASE

1:1000



MASTERPLAN

ROAD NETWORK

1:1000

HIERACHY

= BADAGHAT ROAD

= LEVEL 01

= LEVEL 02

= LEVEL 03



DESIGN

STREET PROFILE LEVEL 0

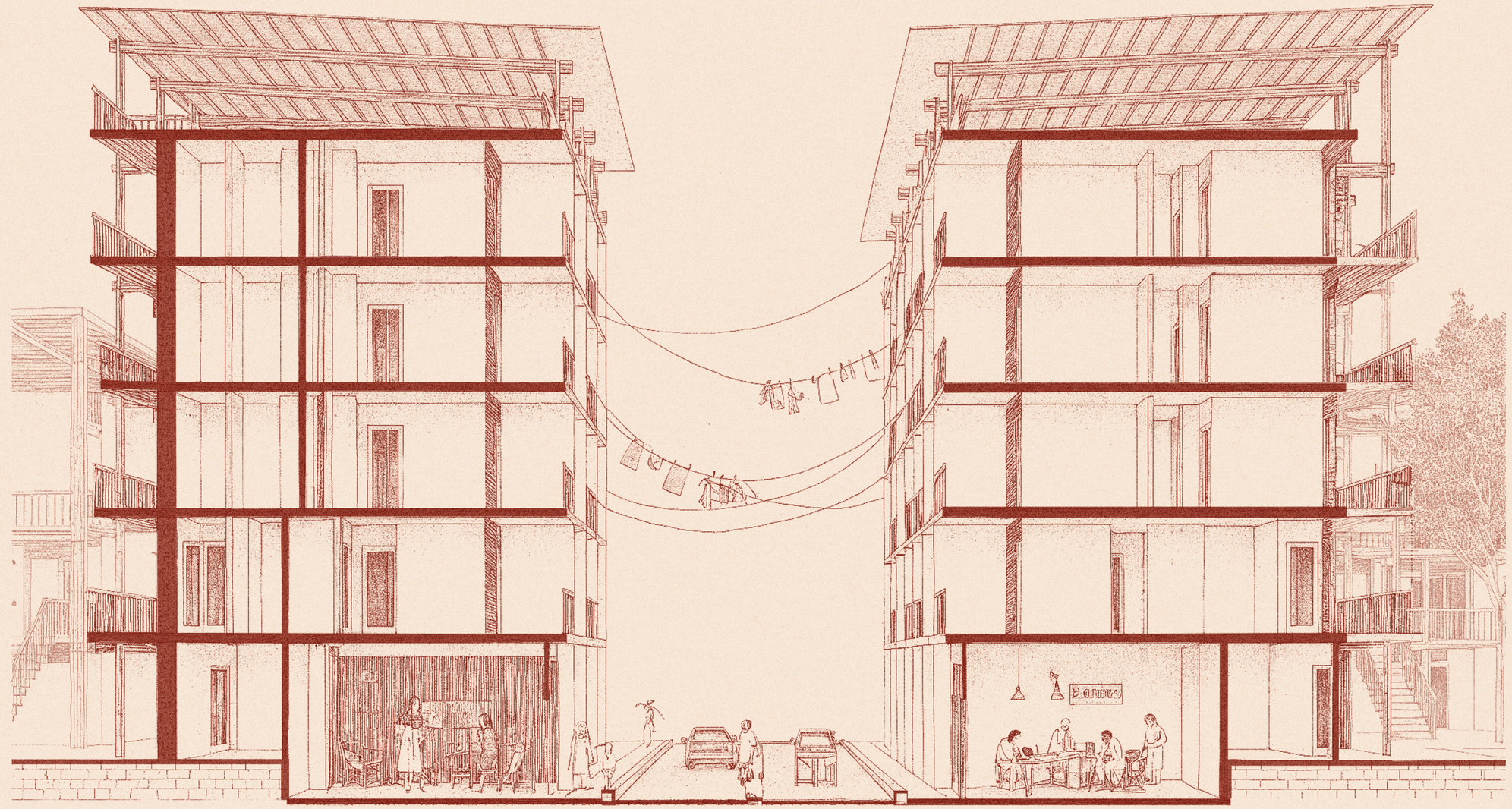
1:200



DESIGN

STREET PROFILE LEVEL 1

1:100



MIXED-INCOME
CLUSTER

PLINTH
COMMERCIAL

300 MM
DRAINAGE

1.200 MM
SIDEWALK

6.250 MM
LEVEL 1 ROAD

300 MM
DRAINAGE

1.200 MM
SIDEWALK

PLINTH
COMMERCIAL

MIXED-INCOME
CLUSTER

DESIGN

STREET PROFILE LEVEL 2

1:100



MIXED-INCOME
CLUSTER

PLINTH
PRIVATE

1.800 MM
TRANSITION

1.200 MM
SIDEWALK

300 MM
DRAINAGE

2.800 MM
LEVEL 2 ROAD

300 MM
DRAINAGE

1.200 MM
SIDEWALK

1.800 MM
TRANSITION

PLINTH
COMMERCIAL

MIXED-INCOME
CLUSTER

MASTERPLAN

WATER MANAGEMENT

1:1000



MASTERPLAN

WATER MANAGEMENT

1:1000



MASTERPLAN

ROAD HIERACHY X WATER MANAGEMENT



MASTERPLAN
ABACUS



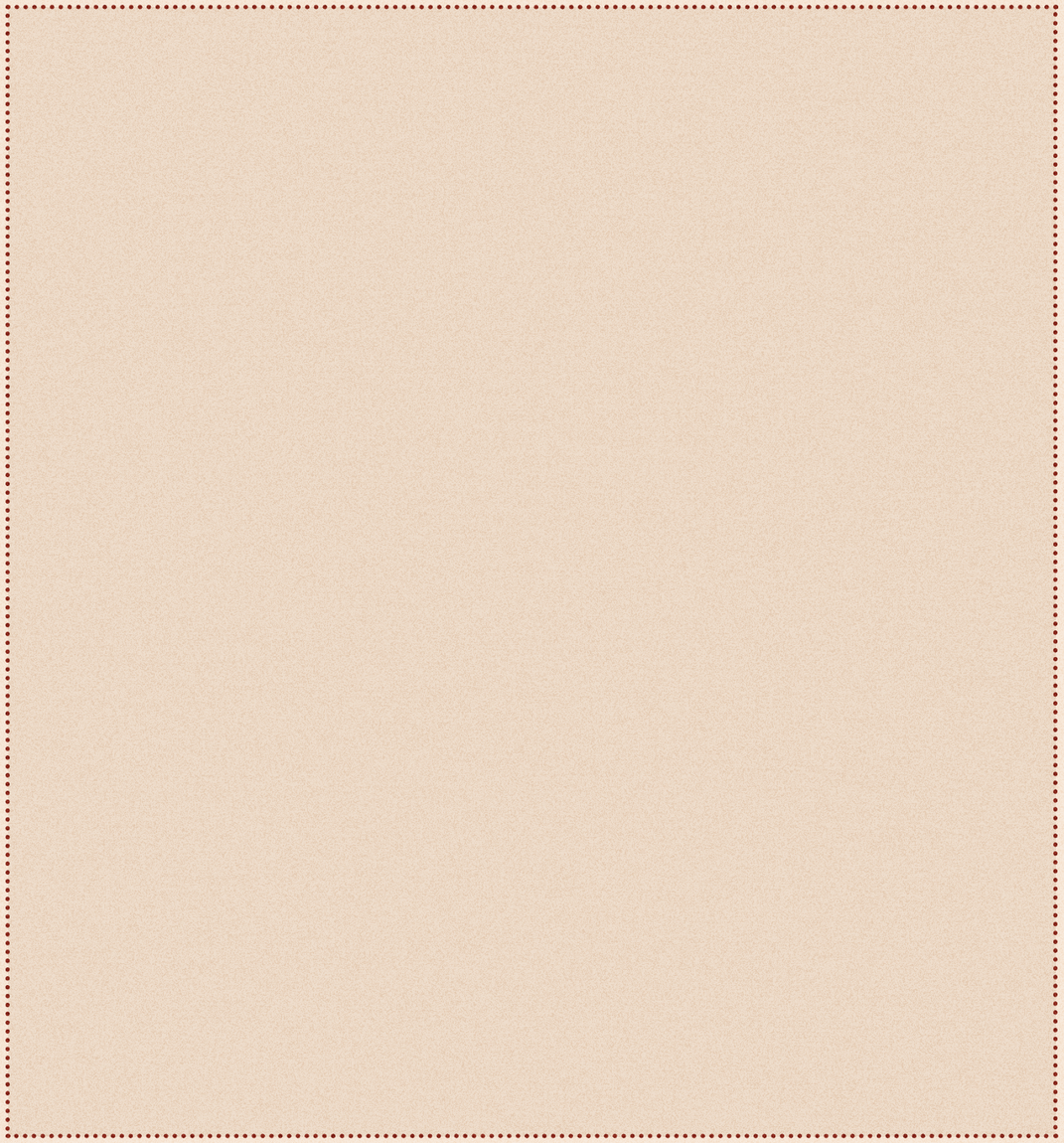
STATISTICS
MASTERPLAN

PHASE 1		PHASE 2		TOTAL	
AREA:	1.75 HA	AREA:	1.98 HA	AREA:	3.90 HA
FSI:	1.14	FSI:	1.40	FSI:	1.62
GSI:	0.26	GSI:	0.29	GSI:	0.28

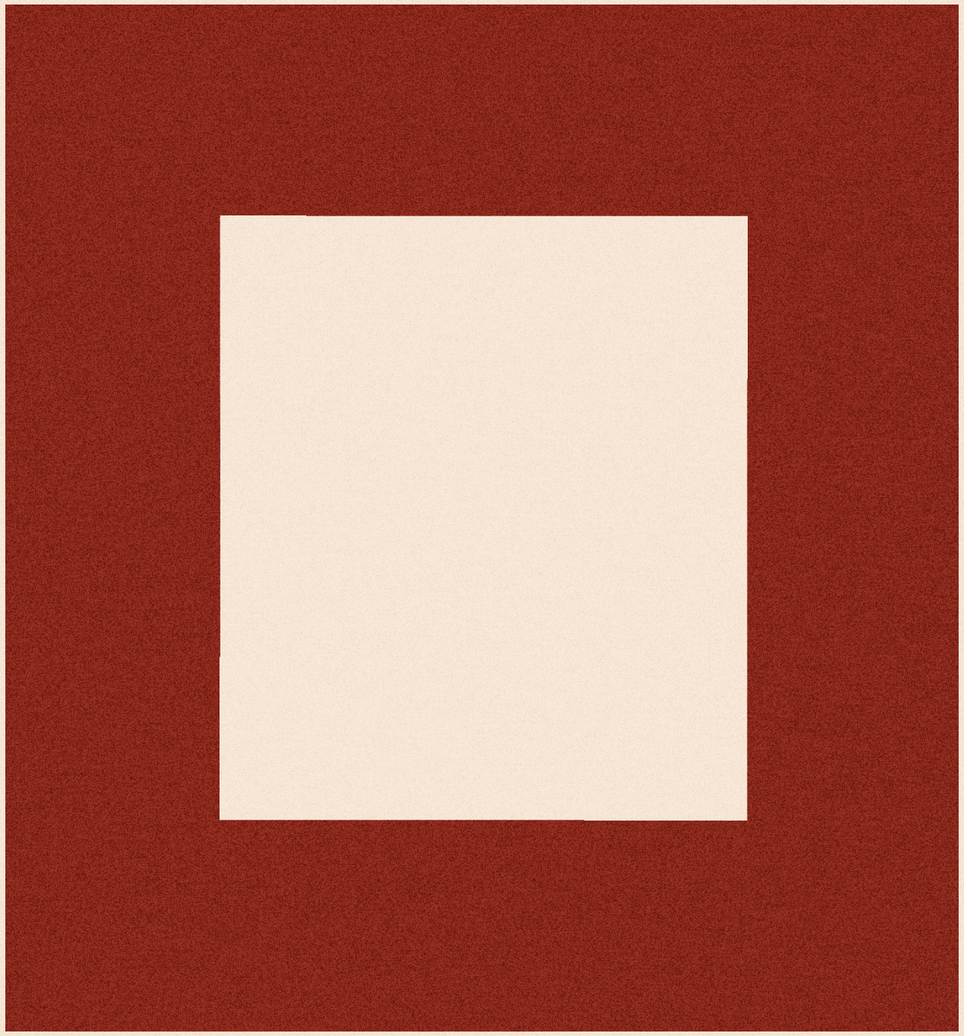
STATISTICS
IF NOTHING IS DONE

PHASE 1		PHASE 2		TOTAL	
AREA:	1.75 HA	AREA:	1.98 HA	AREA:	3.90 HA
FSI:	3.19	FSI:	0.76	FSI:	1.47
GSI:	0.74	GSI:	0.64	GSI:	0.72

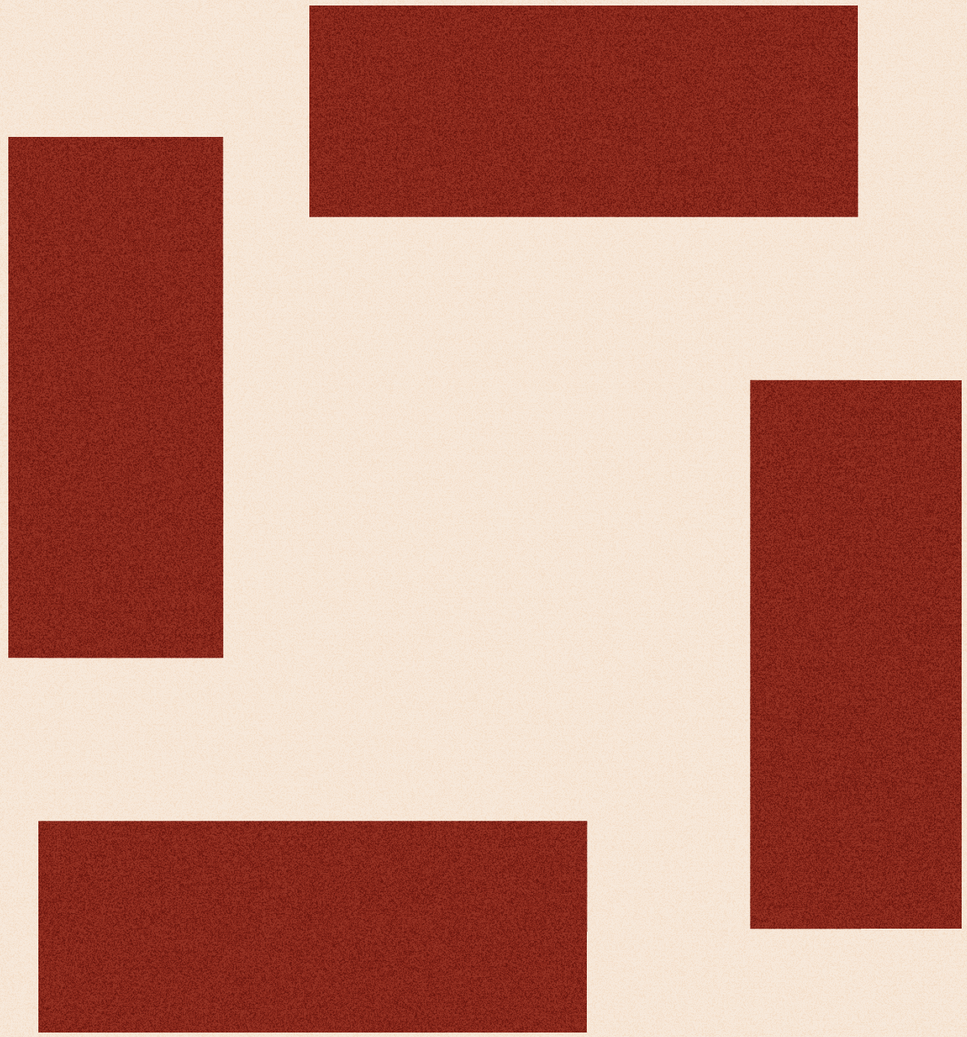
DESIGN



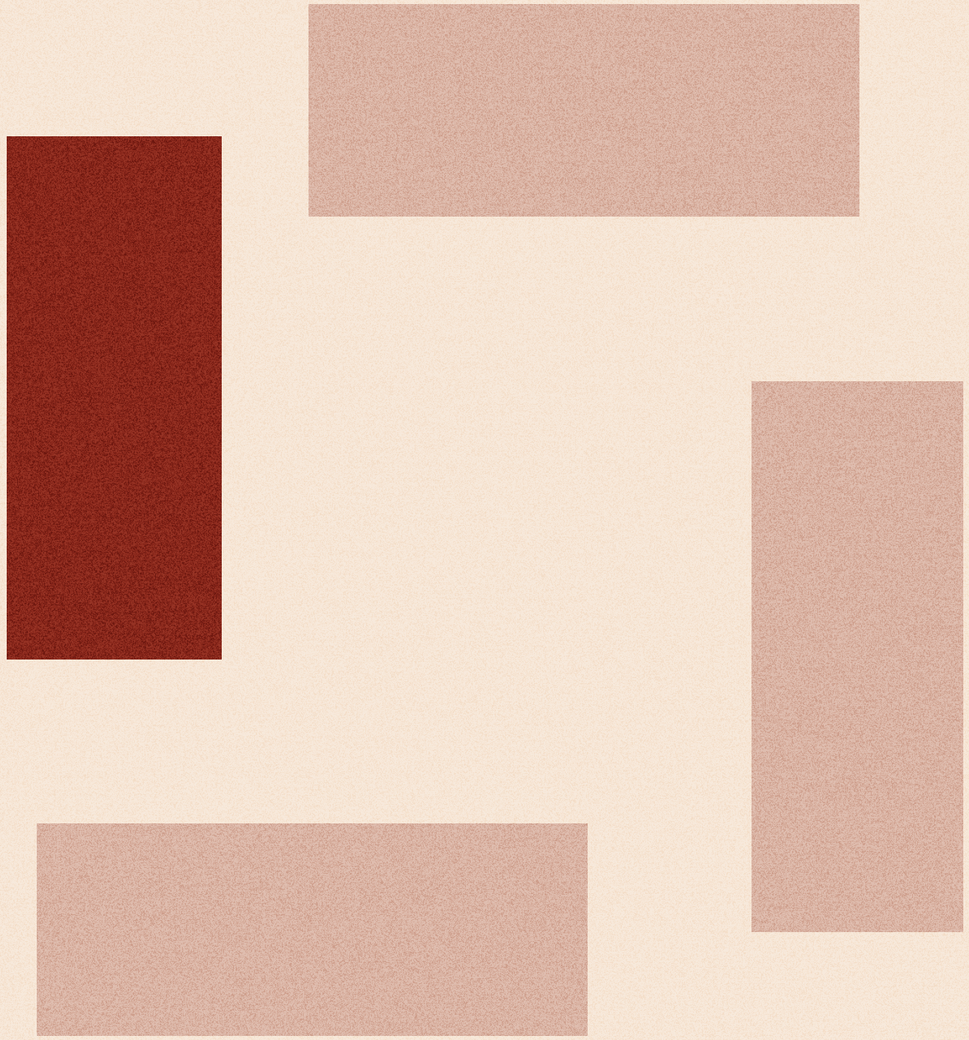
STEP 0 – CLUSTER DESIGN



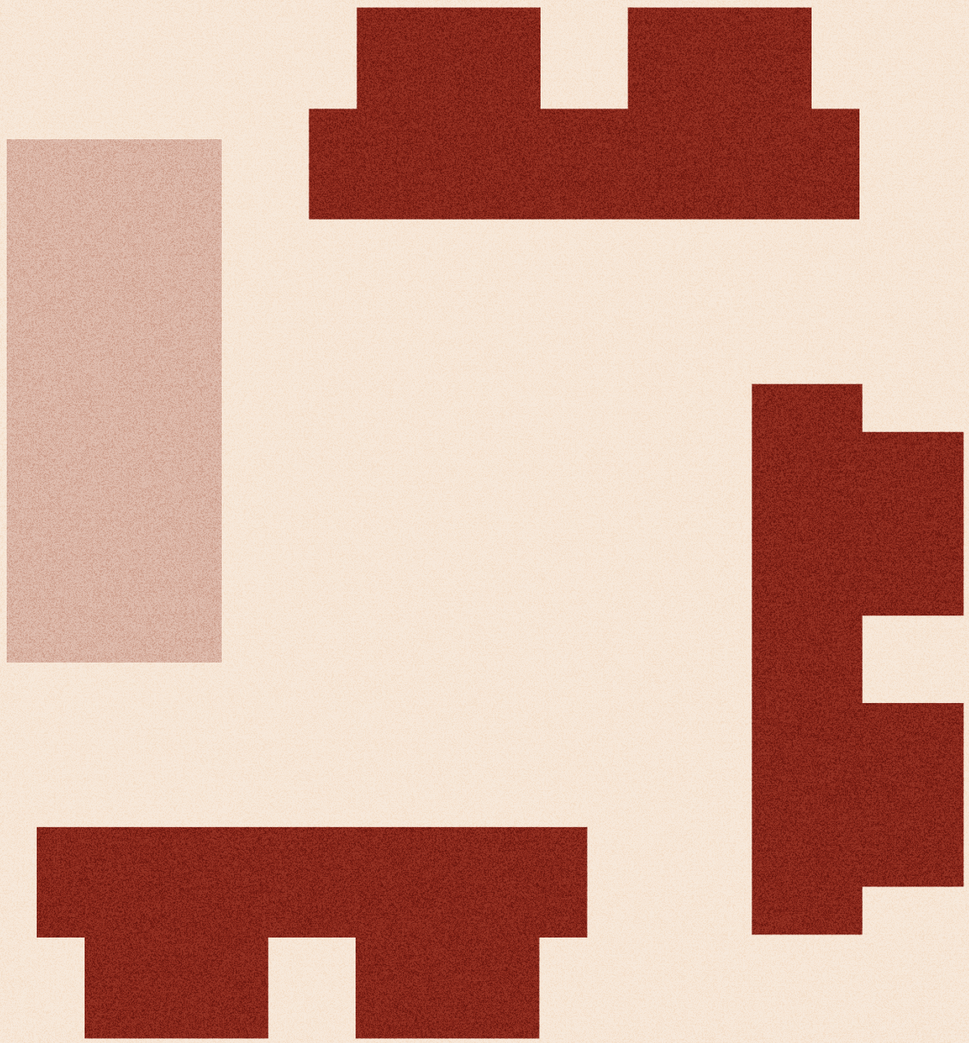
STEP 1 – COURTYARD



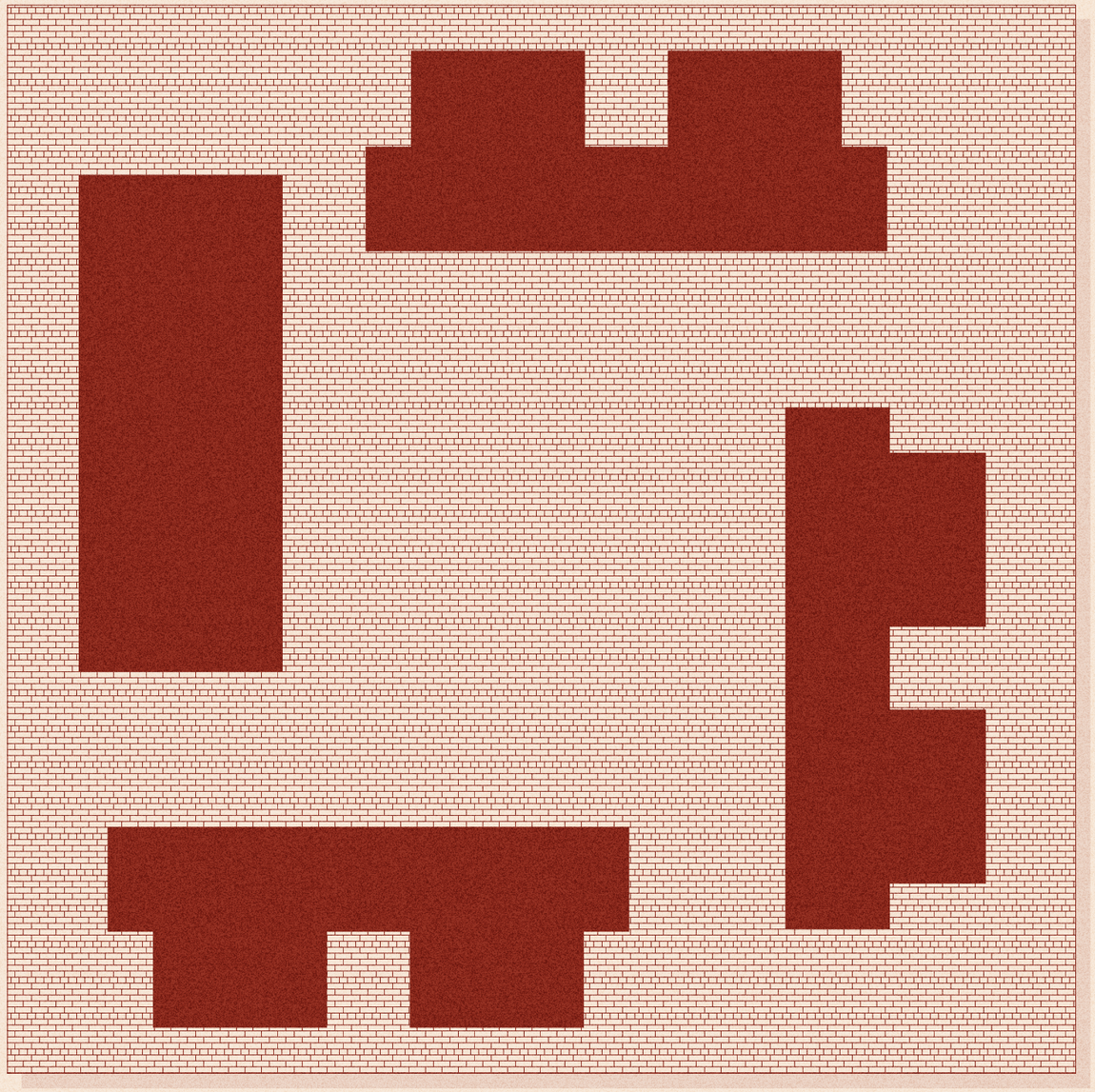
STEP 2 – TURBINE CONFIGURATION



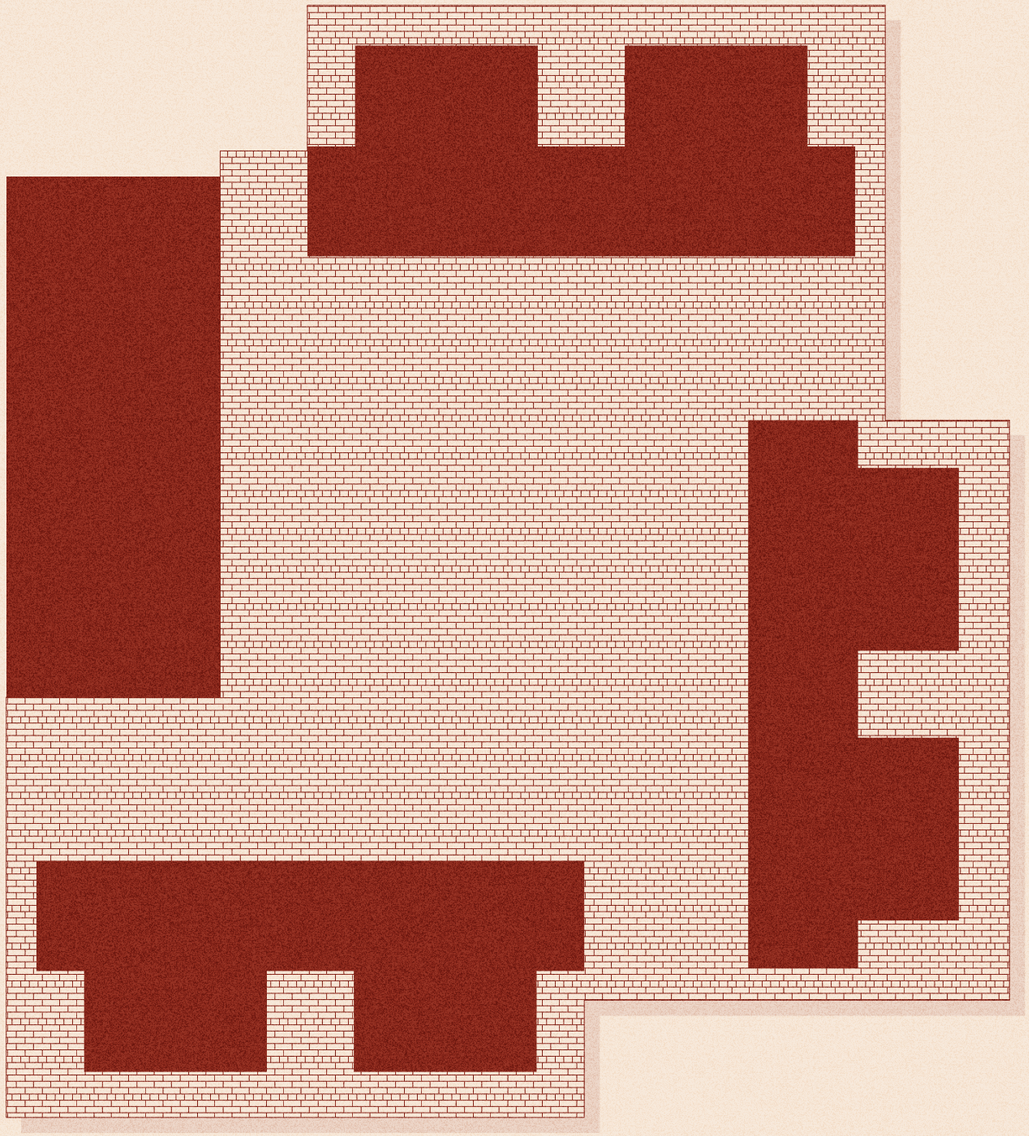
STEP 3 – DEFINE MIDDLE INCOME BUILDING



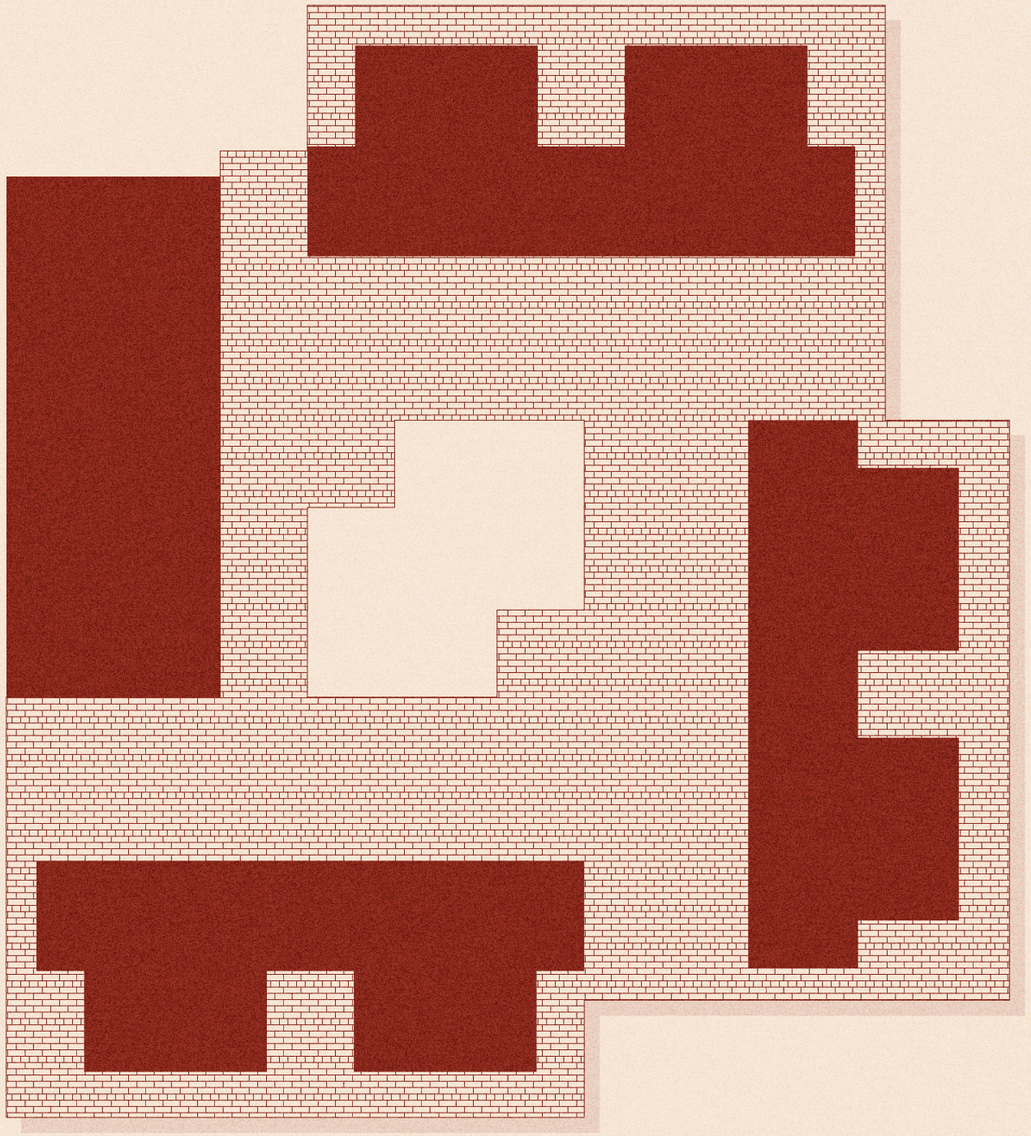
STEP 4 – DEFINE LOW INCOME BUILDINGS



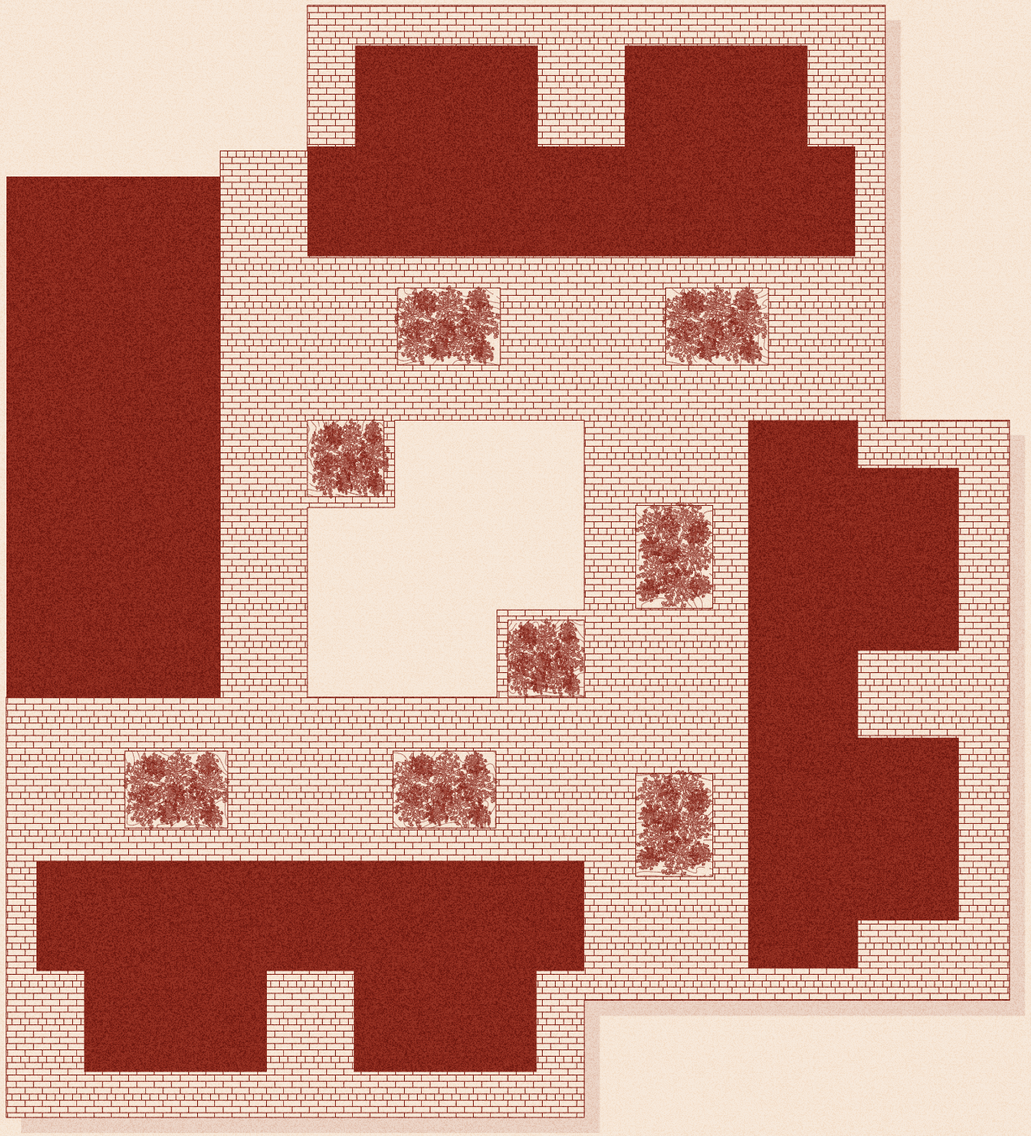
STEP 5 – RAISE PLINTH



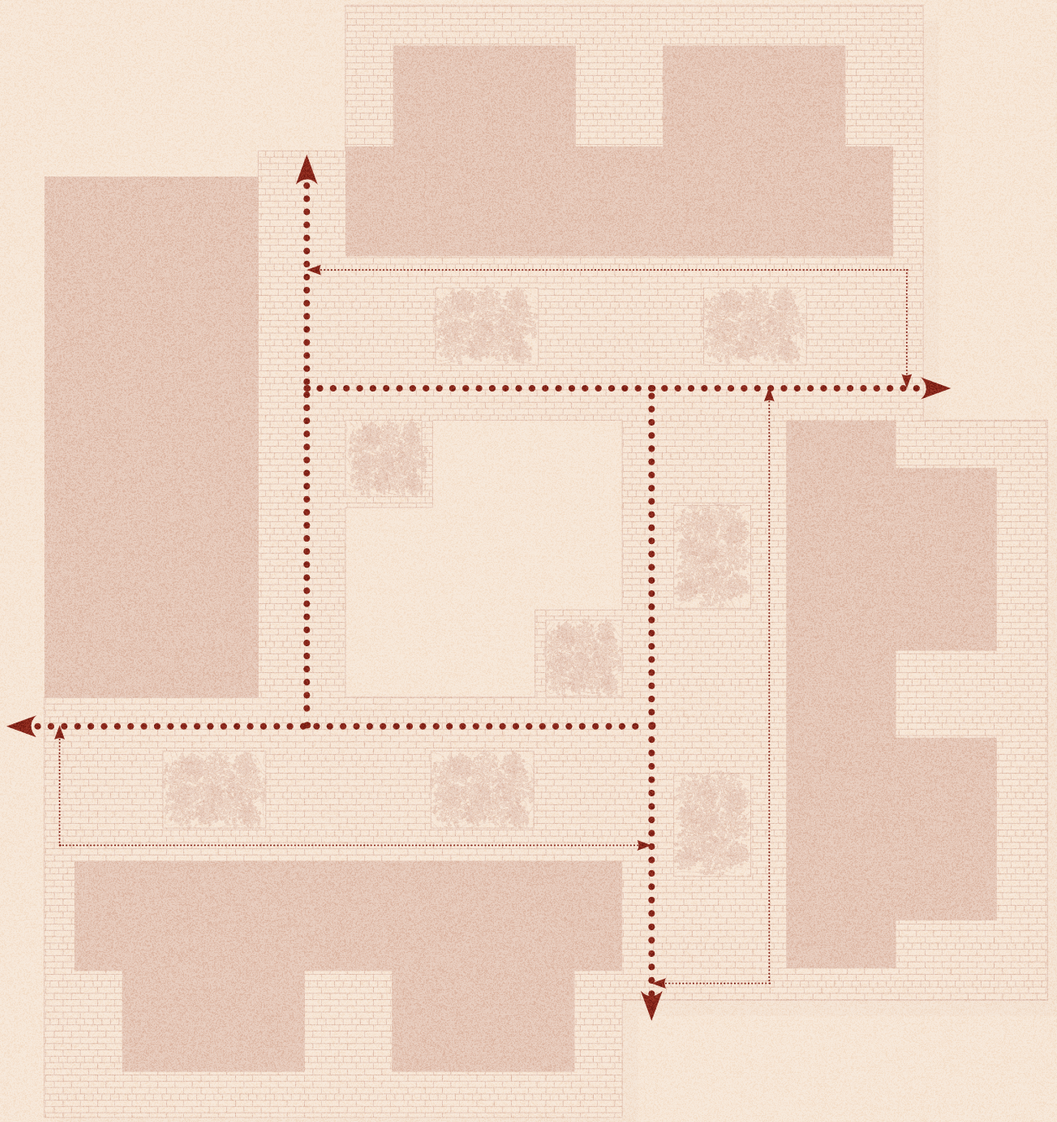
STEP 6 – ADJUST AND DEFINE PLINTH



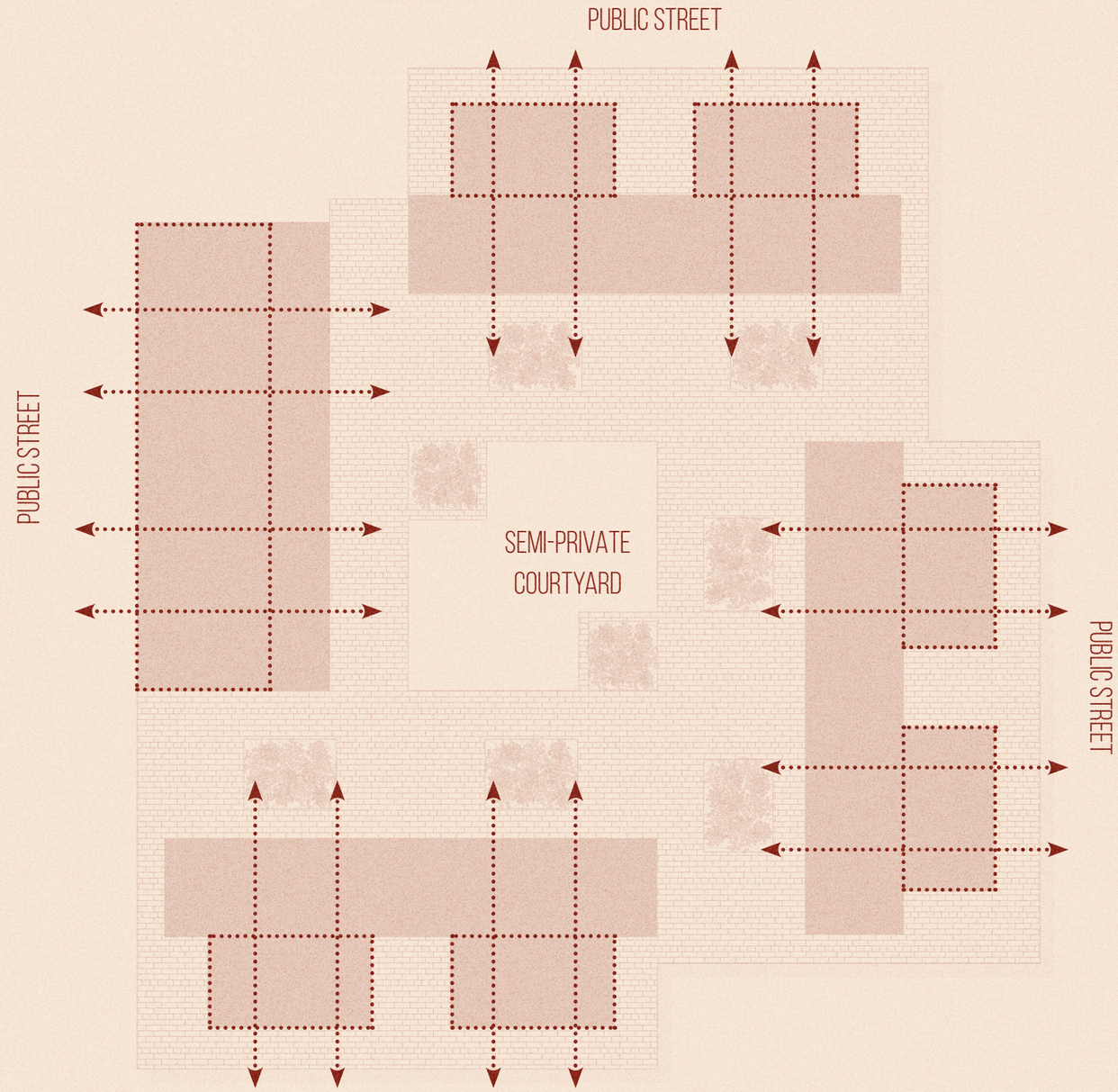
STEP 7 – ADD WATER POND



STEP 8 – ADD VEGETATION AREAS



STEP 9 – DEFINE MAIN ROUTING



STEP 10 – PRIVATE/PUBLIC TRANSITION

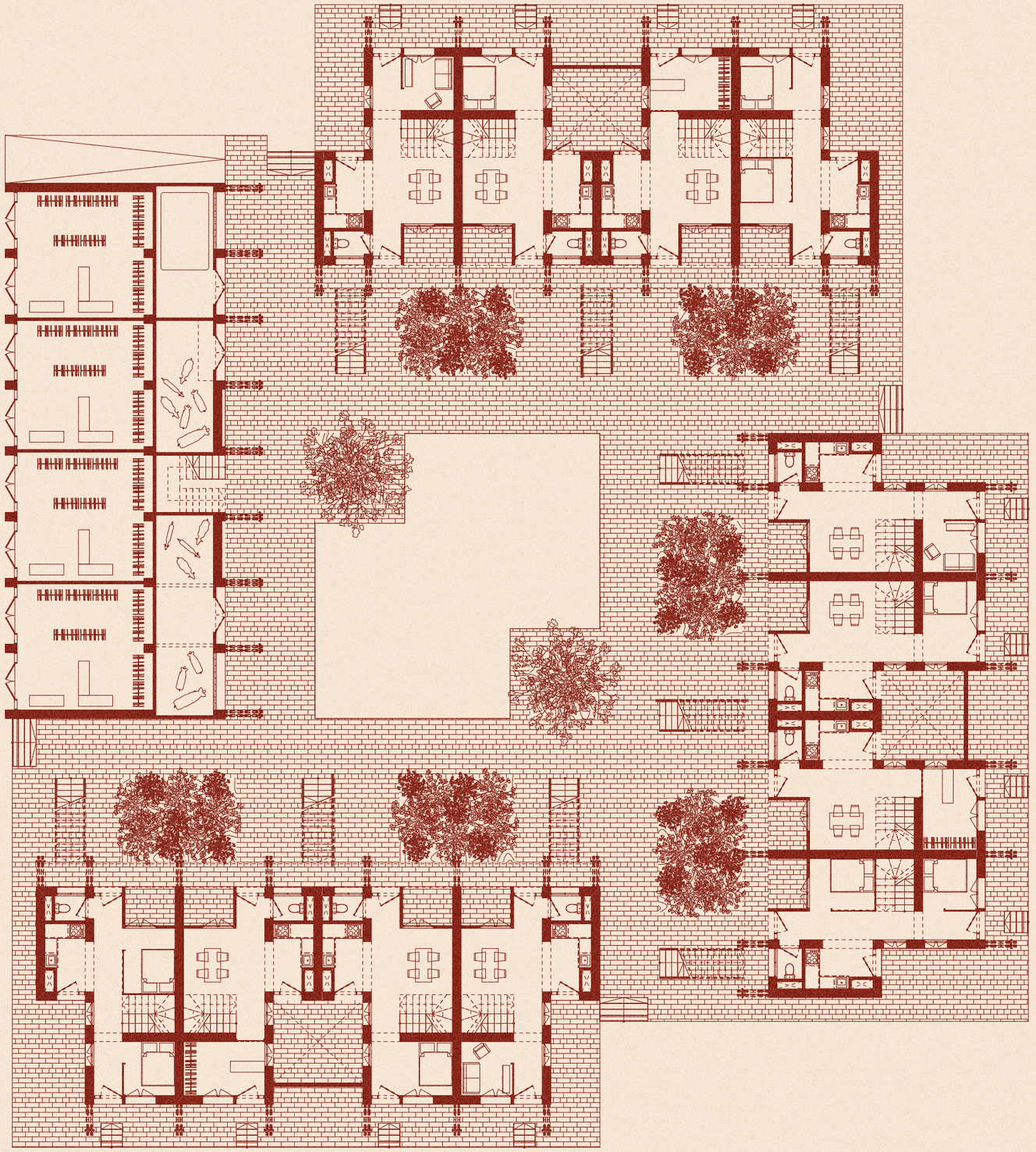
DESIGN

CLUSTER

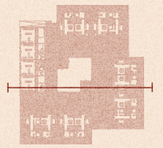
ONE MIDDLE INCOME
8 DWELLINGS
THREE LOW INCOME
24 DWELLINGS

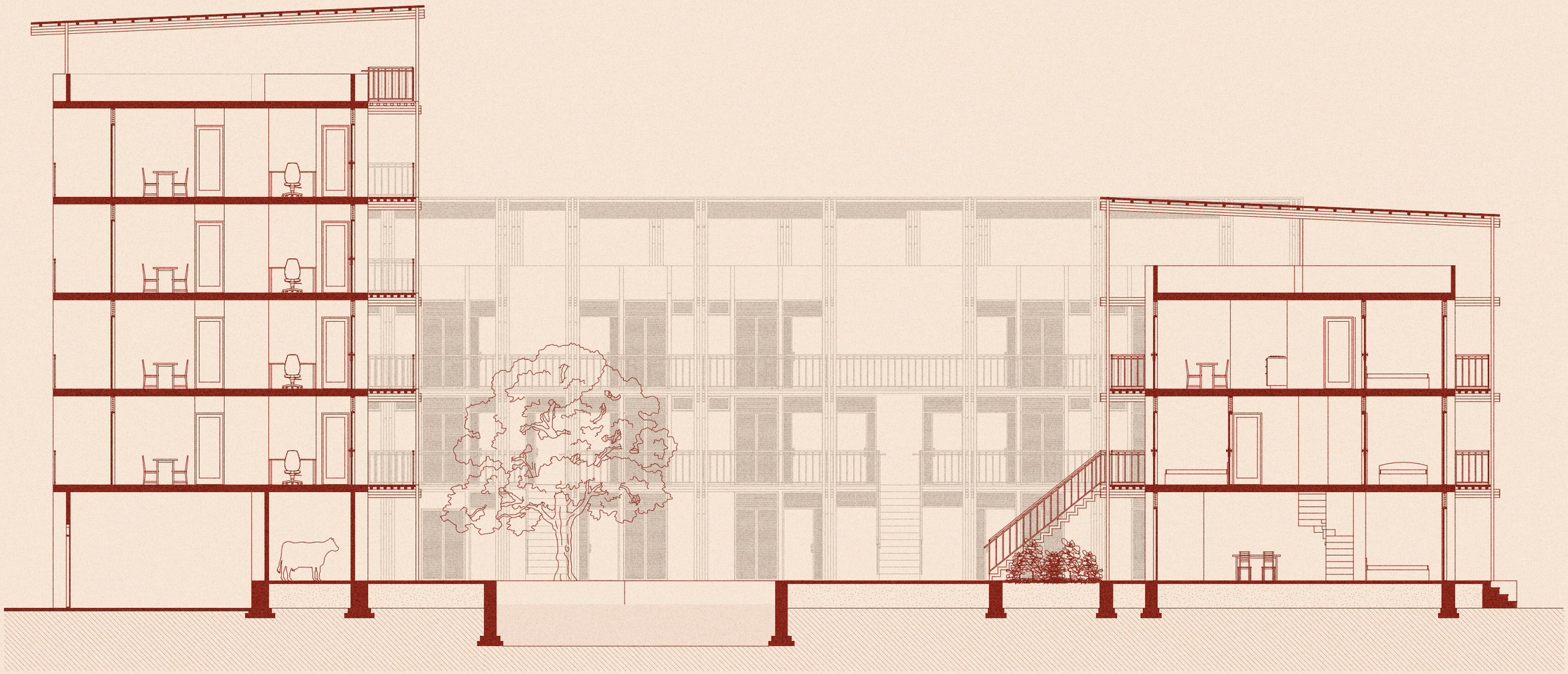


DESIGN
CLUSTER
1:200



DESIGN
SECTION
1:100

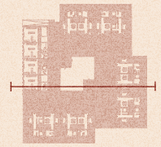




DESIGN

SECTION

1:100





COMMUNAL ROOFTOPS



LOW-INCOME

- TOP FLOOR APARTMENTS SHARE THE ROOFTOPS
- EXTENSION OF THEIR DWELLING
- FLEXIBLE USAGE
    - DRYING CLOTHES, SITTING, GARDENING
    - OPTIONAL ENCLOSURES FOR PRIVATE SPACE (E.G., BAMBOO PARTITIONS)
    - ADAPTABLE OVER TIME TO RESIDENTS' CHANGING NEEDS

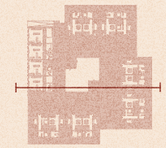
MIDDLE & HIGH INCOME

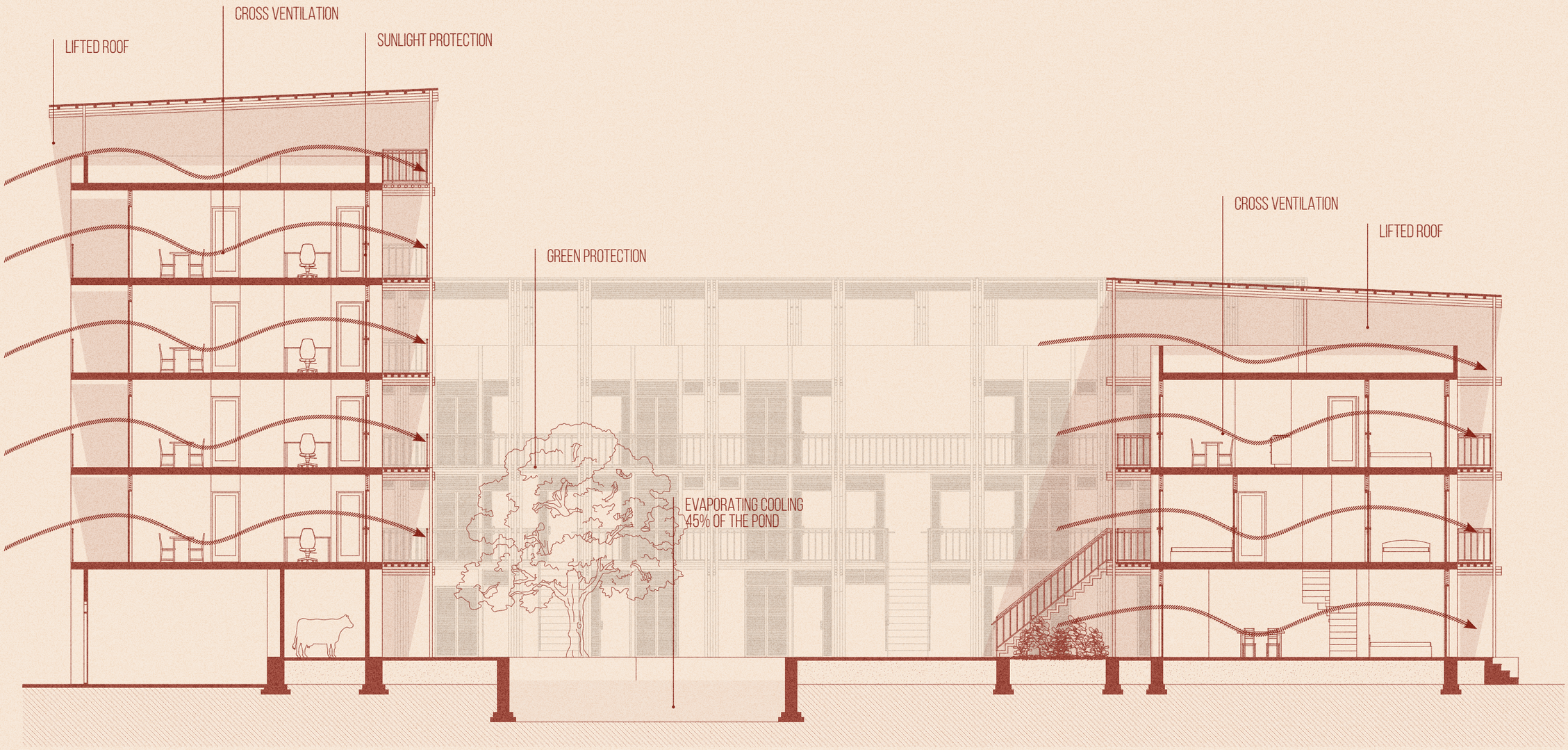
- FULLY COMMUNAL ROOFTOP FOR ALL RESIDENTS
- SIMPLE AND OPEN DESIGN ENCOURAGES SHARED USE
    - EVENING TEA, SMALL GATHERINGS, POTTED GARDENS, FRESH AIR

DESIGN

CLIMATE MANAGEMENT

1:100

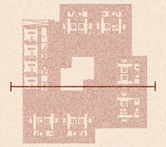


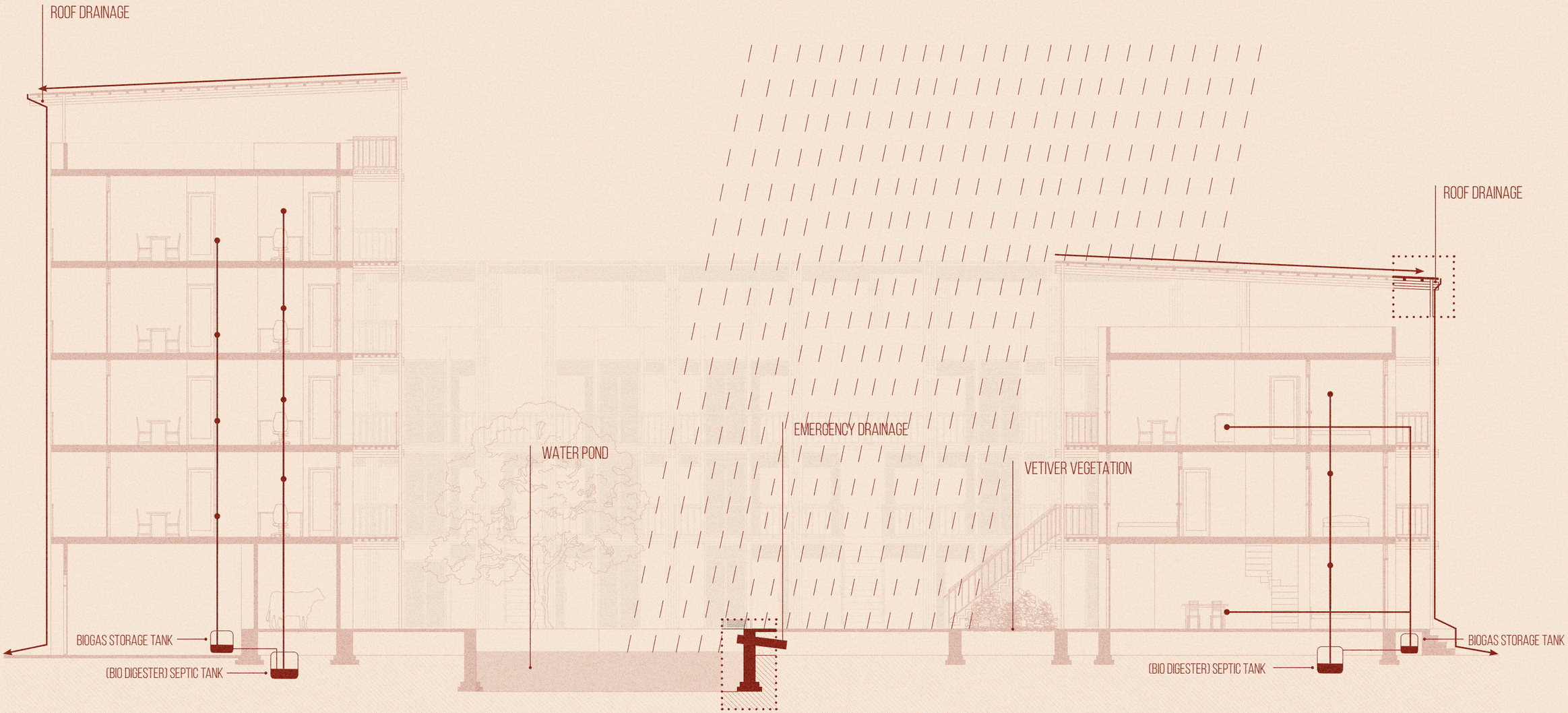


DESIGN

WATER MANAGEMENT

1:100

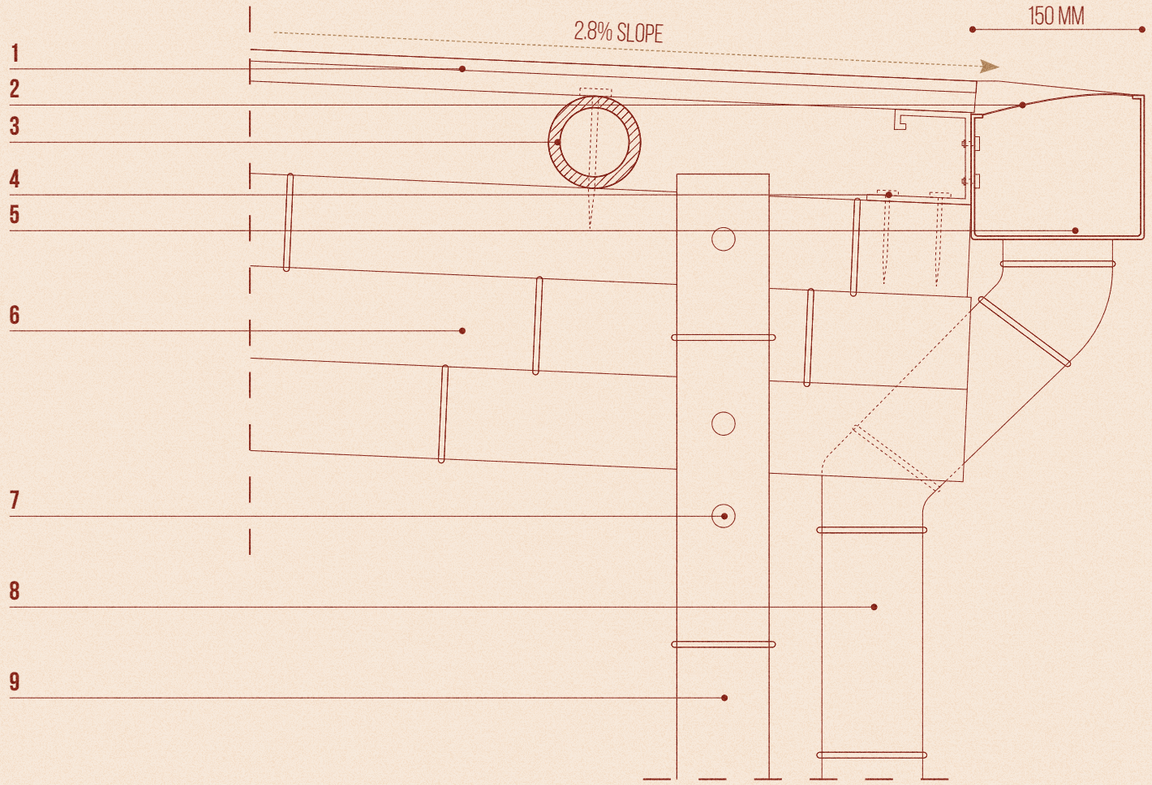




DESIGN

EAVES DETAIL

1.	CORRIGATED IRON SHEET	
2.	GALVANIZED METAL MESH	
3.	HORIZONTAL BAMBOO UNDERCONSTRUCTION	Ø 80 MM
4.	BOLT	
5.	RAIN GUTTER - CI SHEET	150 X 125 MM
6.	BAMBOO BEAM - 3 CONNECTED BAMBOO BEAMS	3 X Ø 80 MM
7.	BAMBOO WOOD NAIL	
8.	GALVANIZED IRON (GI) PIPE	Ø 90 MM
9.	BAMBOO COLUMN	Ø 80 MM

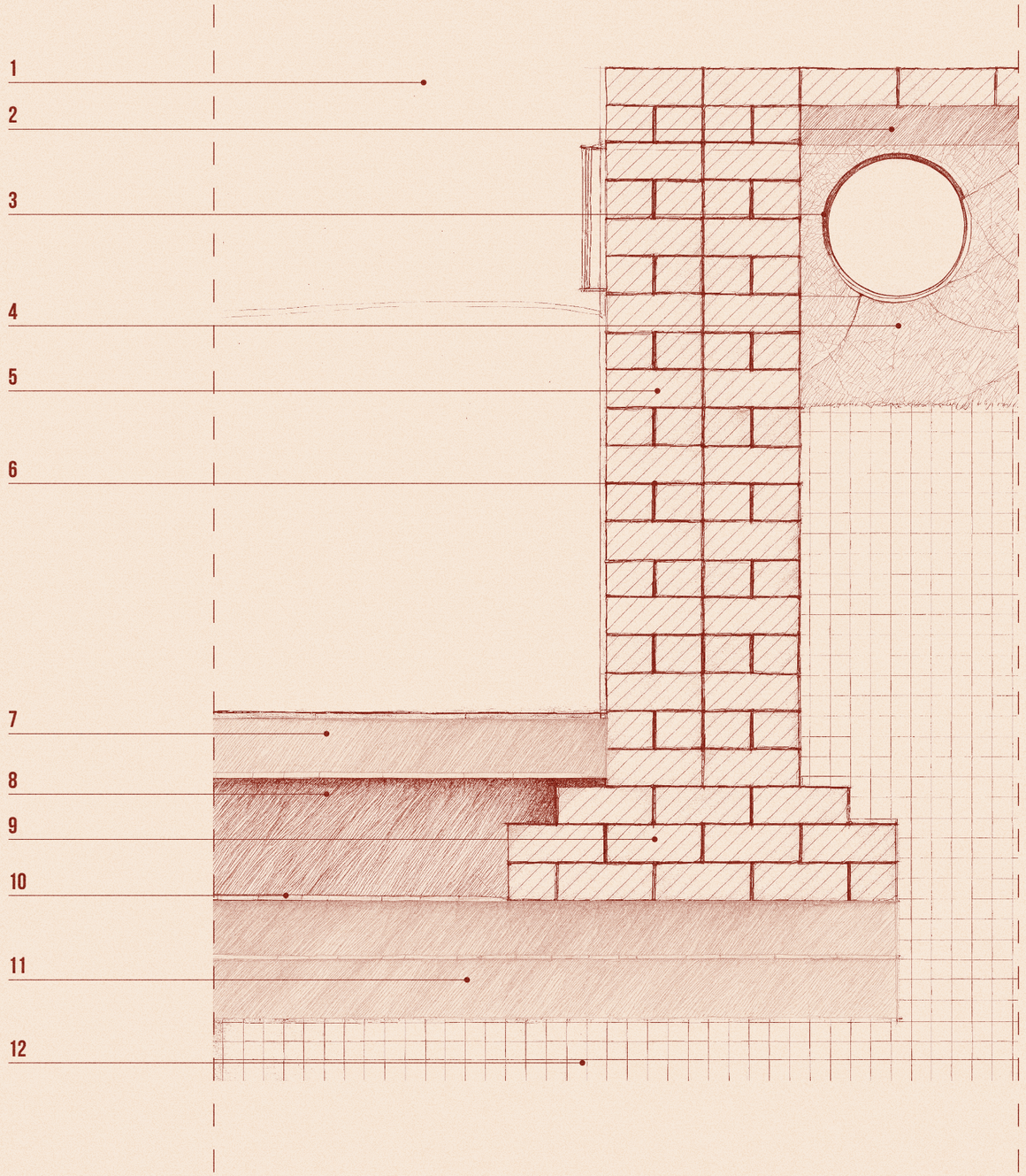


DESIGN

WATER POND DETAIL

1:10

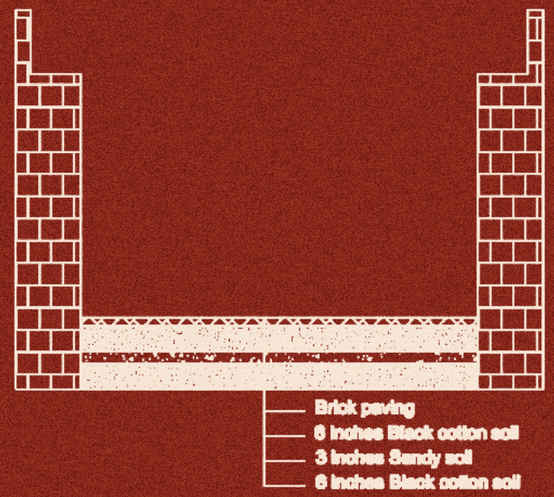
1.	WATER POND	
2.	COMPRESSED SAND	
3.	PVC DRAINAGE PIPE	Ø 300MM
4.	GRAVEL WASTE & BRICK BATS	
5.	FIRED BRICK	90 X 240 X 115 MM
6.	LIME MORTAR	
7.	COMPACTED CLAY-SAND MIX 70% / 30%	150 MM
8.	COMPACTED CLAY LAYER	300 MM
9.	FIRED BRICK FOUNDATION	
10.	GEOTEXTILE (NON-WOVEN)	
11	COMPACTED SUBGRADE	2 X 150 MM



DESIGN

WATER POND DETAIL





DESIGN

(BIO DIGESTER) SEPTIC TANK



STATUS

77,500 DIGESTERS HAVE BEEN INSTALLED, MOSTLY IN RURAL HOUSEHOLDS.

BENEFITS

REDUCES CO_2 EMISSIONS.
BIO-SLURRY, A VALUABLE FERTILIZER
REDUCES DEPENDENCY ON UNRELIABLE GAS GRIDS IN RURAL AREAS

FEASIBLE IN SHONATOLA

BIOGAS DIGESTERS CAN TREAT BLACKWATER (FROM TOILETS)
PRODUCE ENERGY + BIO-FERTILIZER.

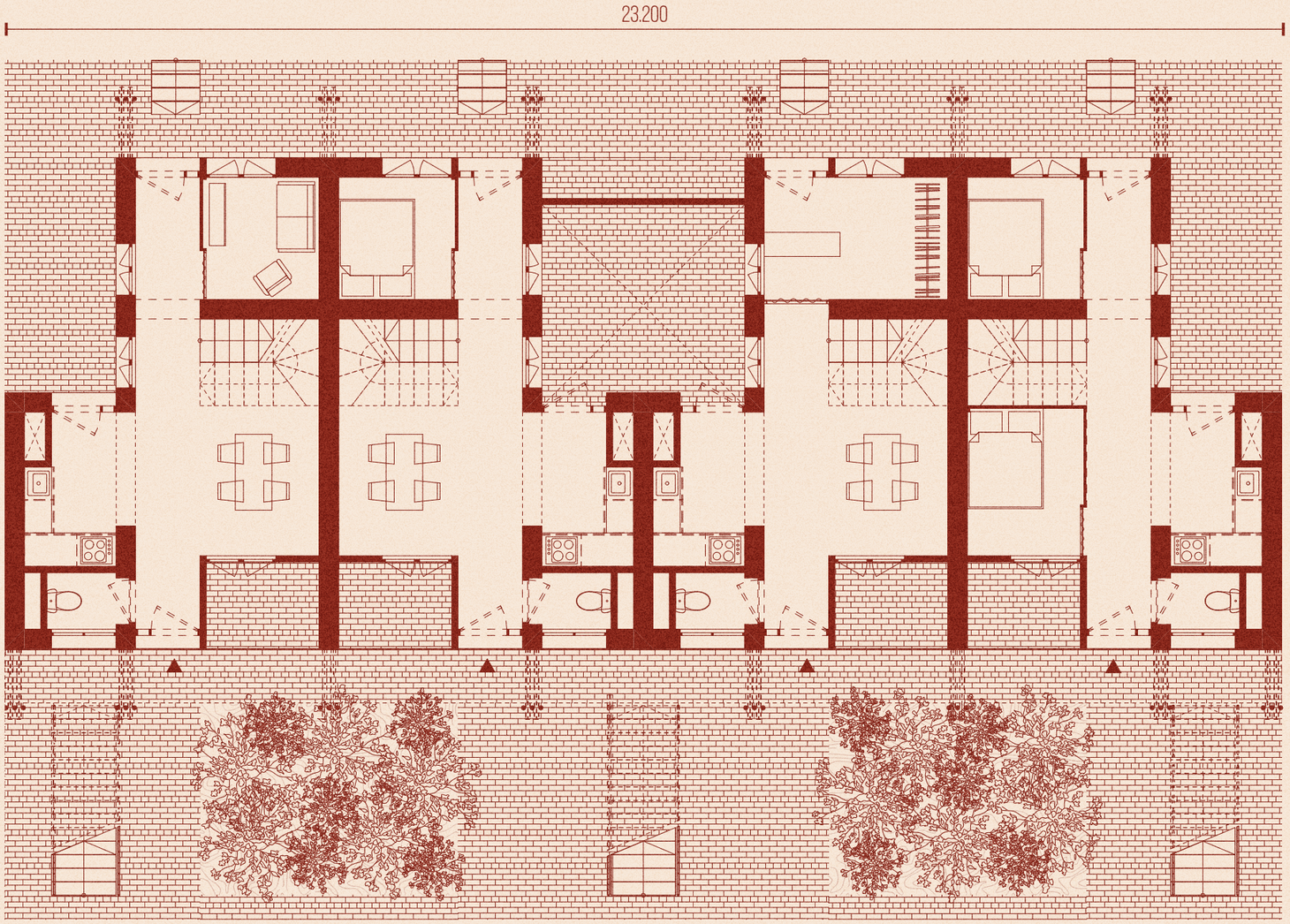
REVIEW OF BIOGAS DIGESTER TECHNOLOGY IN RURAL BANGLADESH – E.U. KHAN & A.R. MARTIN

DESIGN

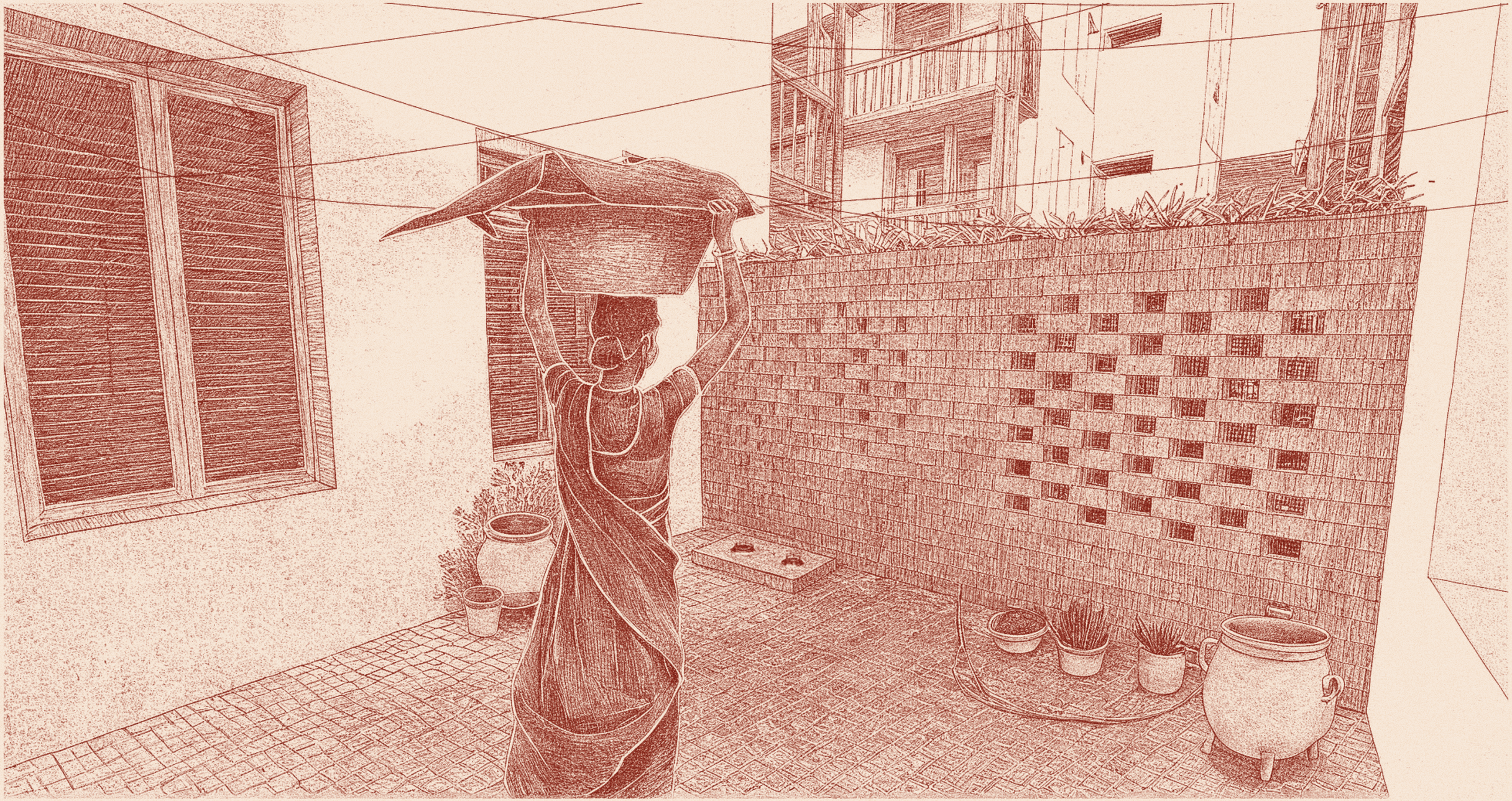
LOW INCOME - GROUND FLOOR

1:100





PRIVATE COURTYARD DUPLEX DWELLING



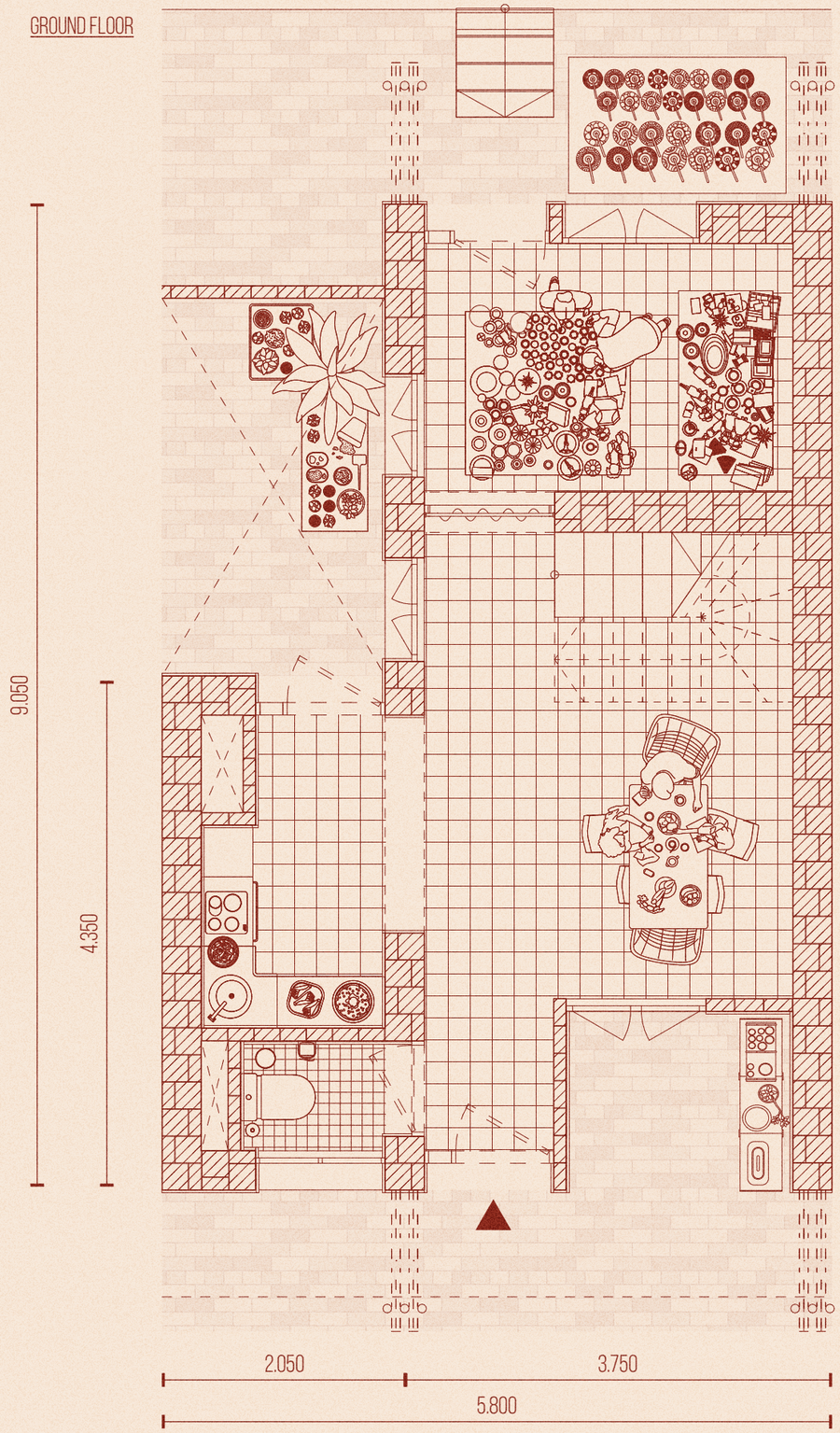
DESIGN

DUPLEX LOW INCOME

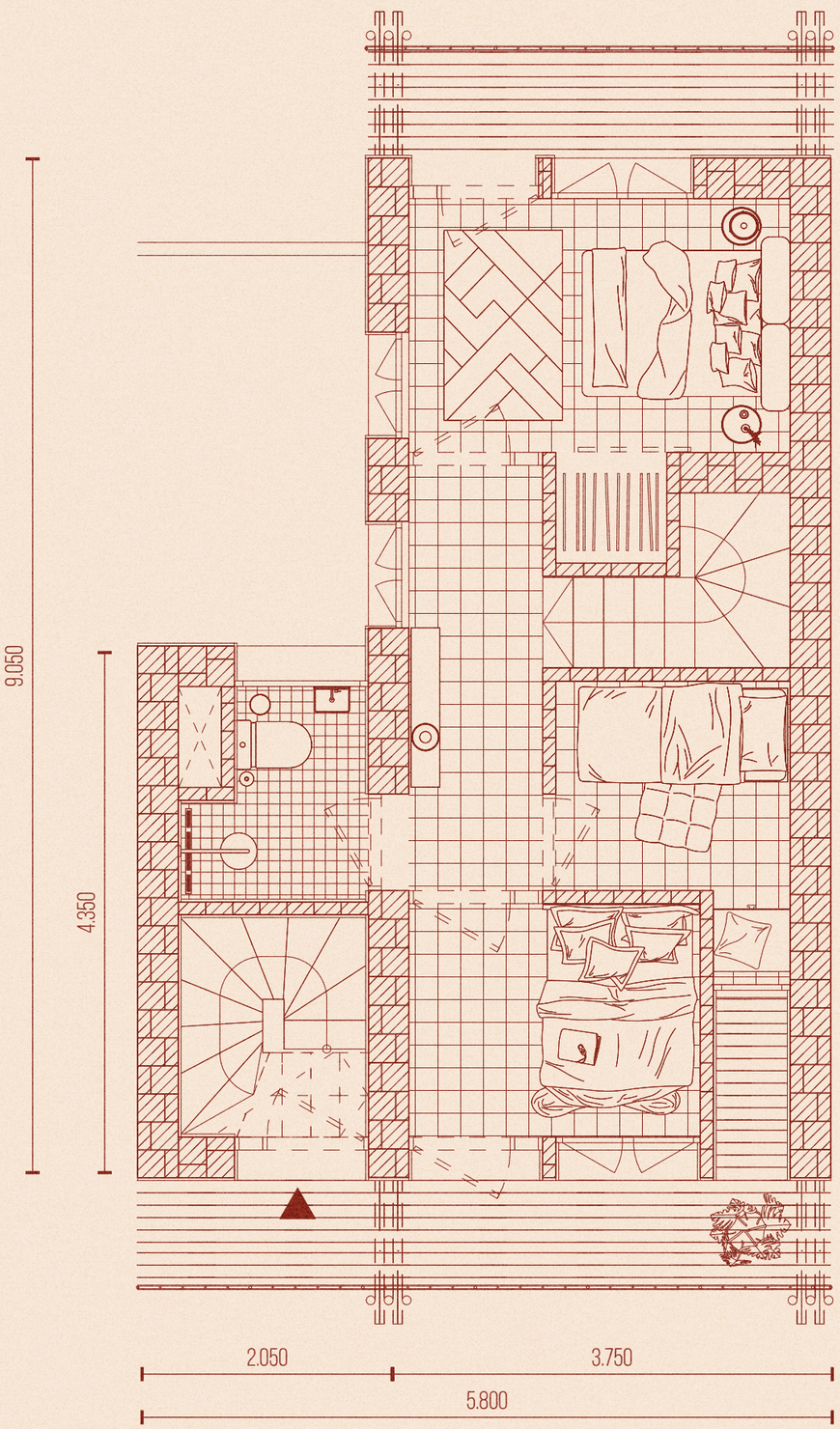
1:50

65 M²

GROUND FLOOR



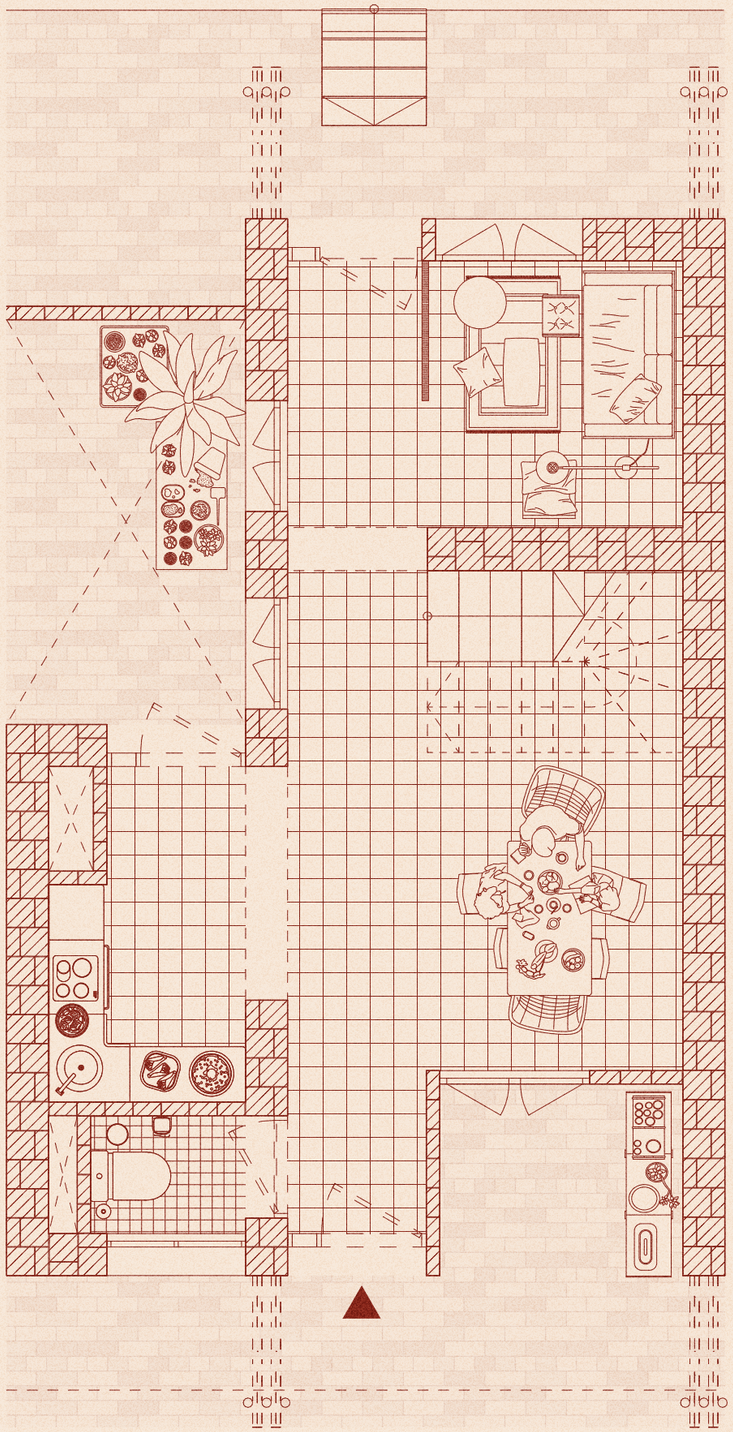
FIRST FLOOR

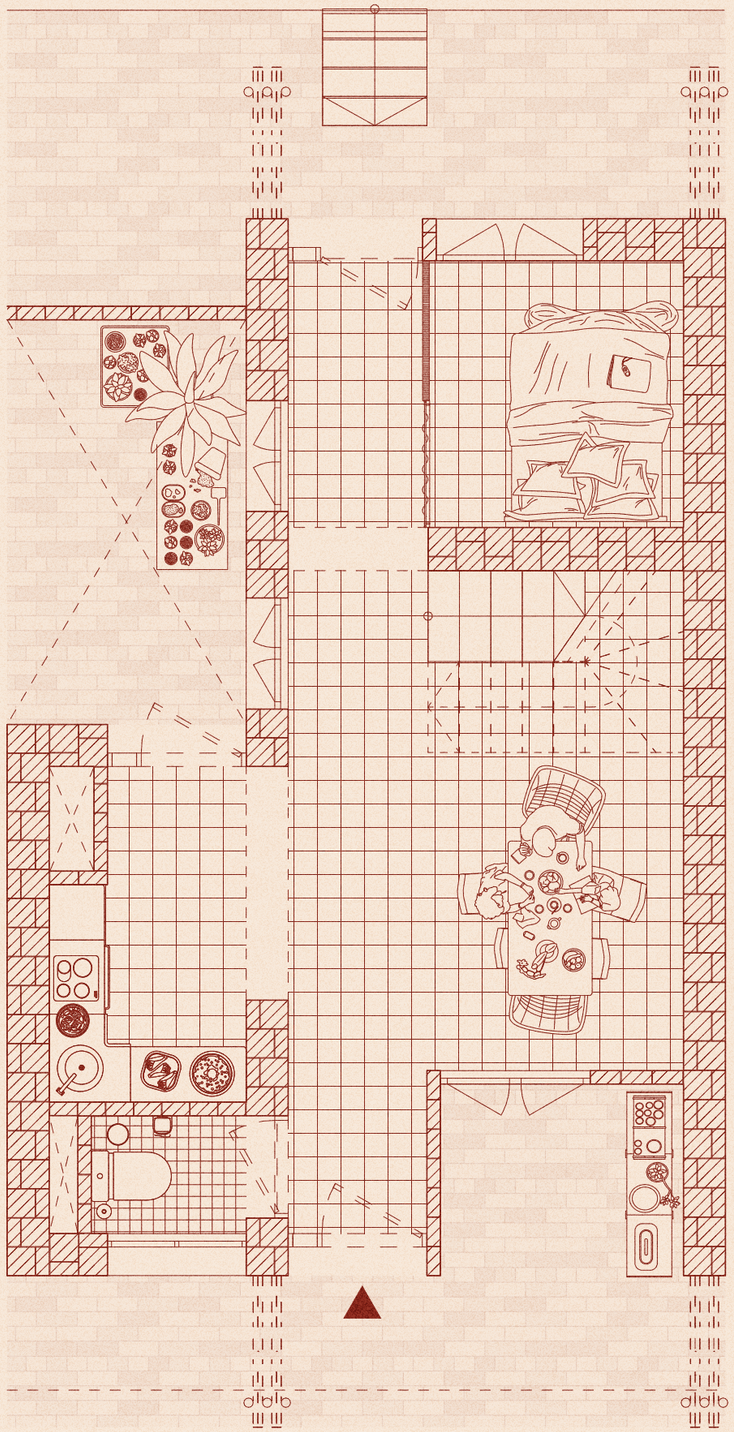


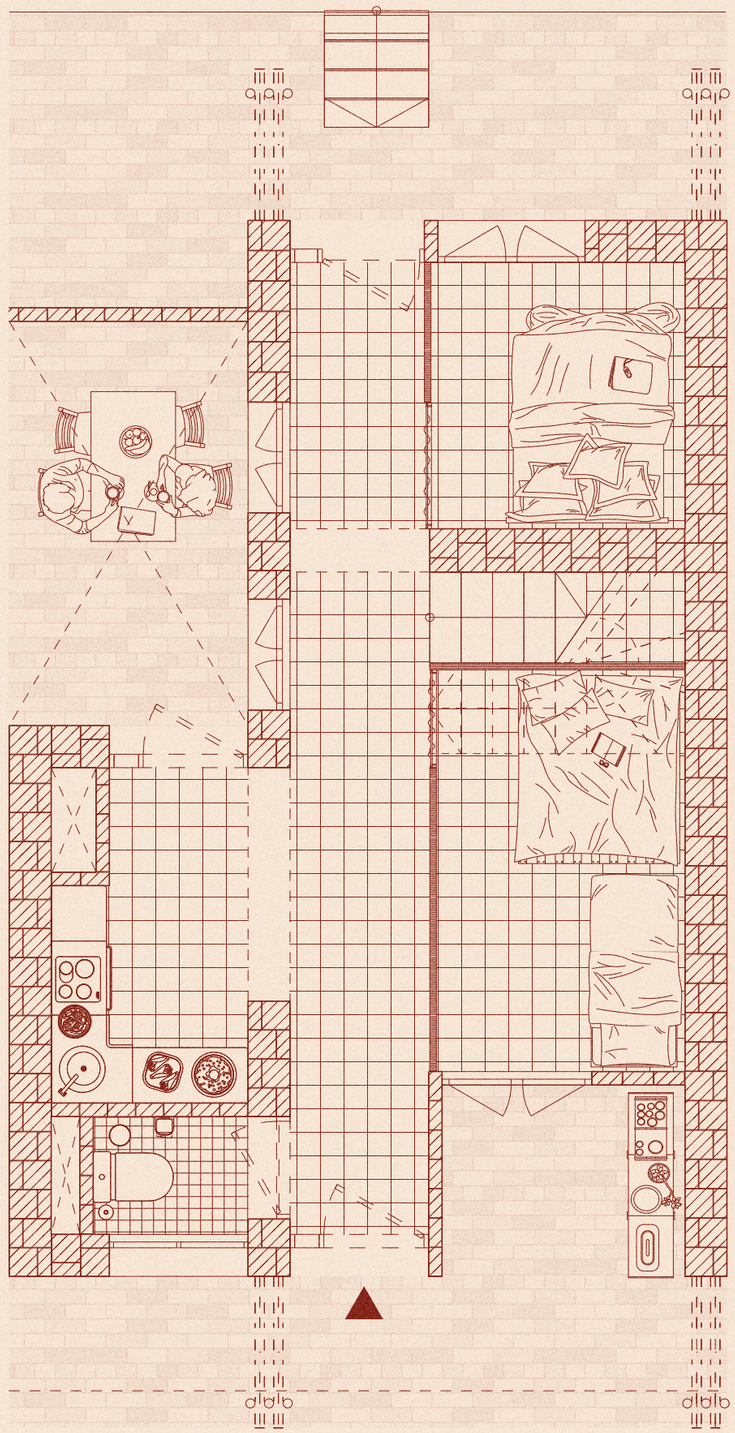
DESIGN

GROUND FLOOR VARIATIONS DUPLEX DWELLING

1:50









DESIGN

CLUSTER COURTYARD



DESIGN

ELEVATION LOW INCOME - COURTYARD SIDE

1:100



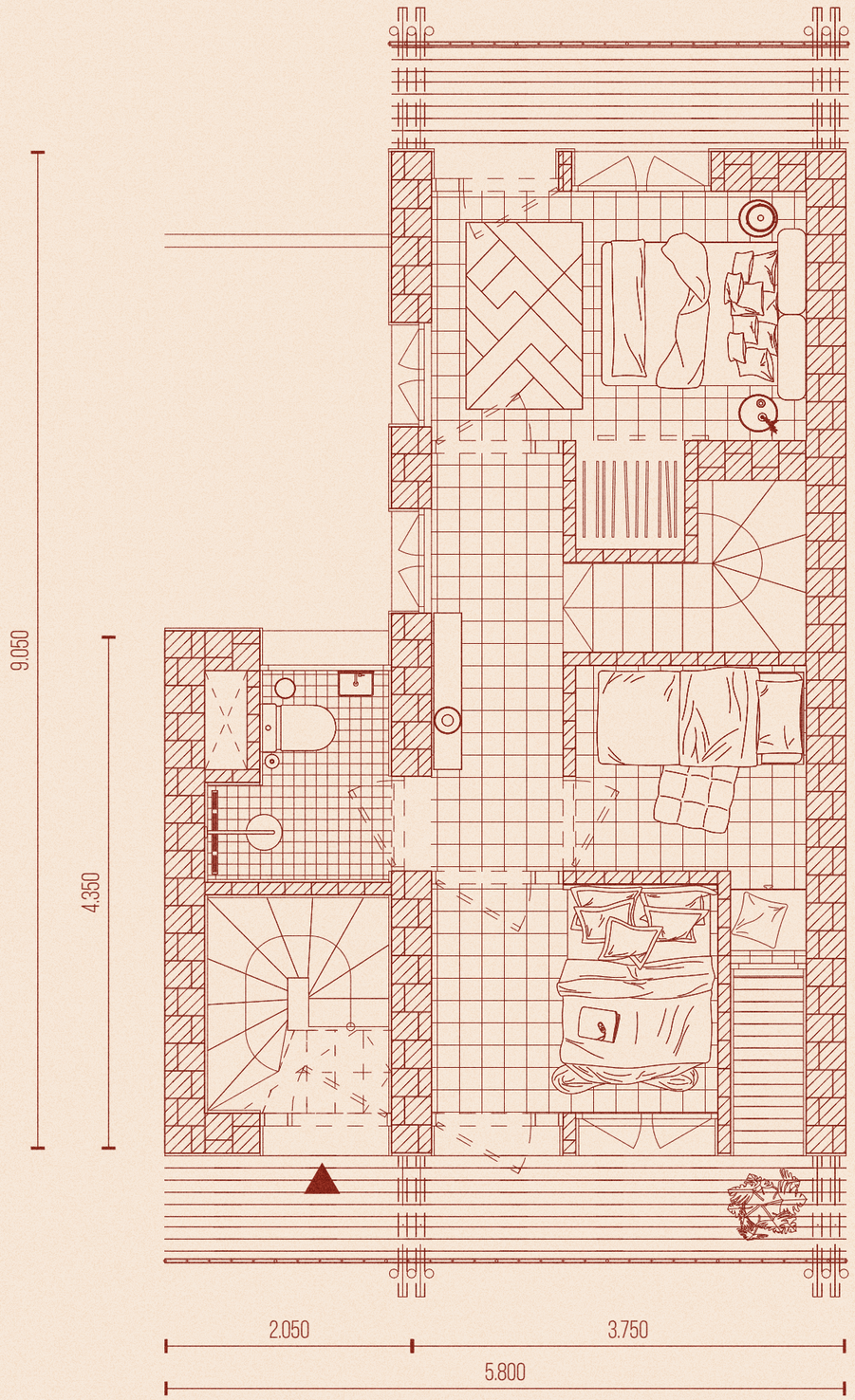
DESIGN

FIRST FLOOR SINGLE FLOOR APARTMENT

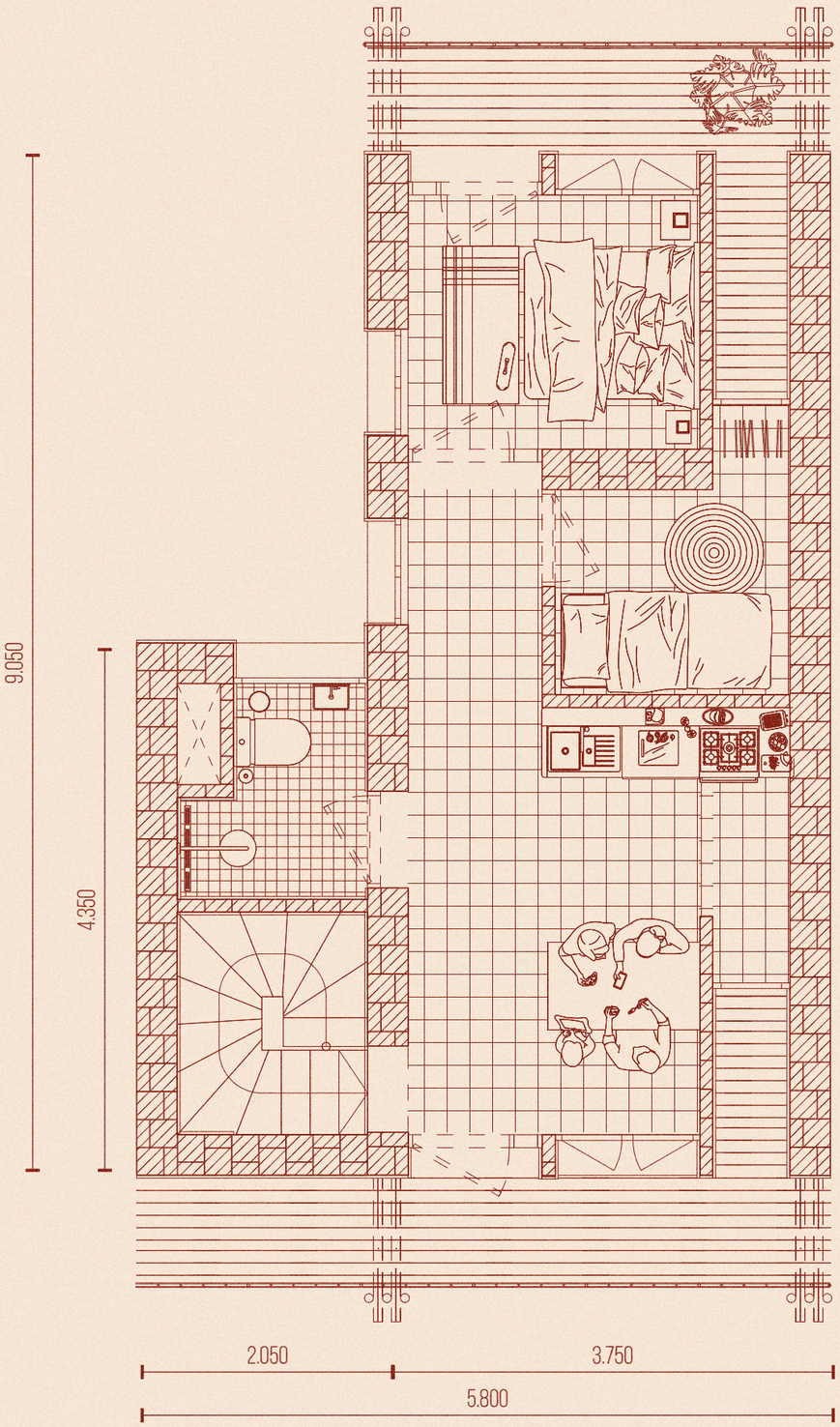
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38 M²

FIRST FLOOR



SECOND FLOOR



DESIGN

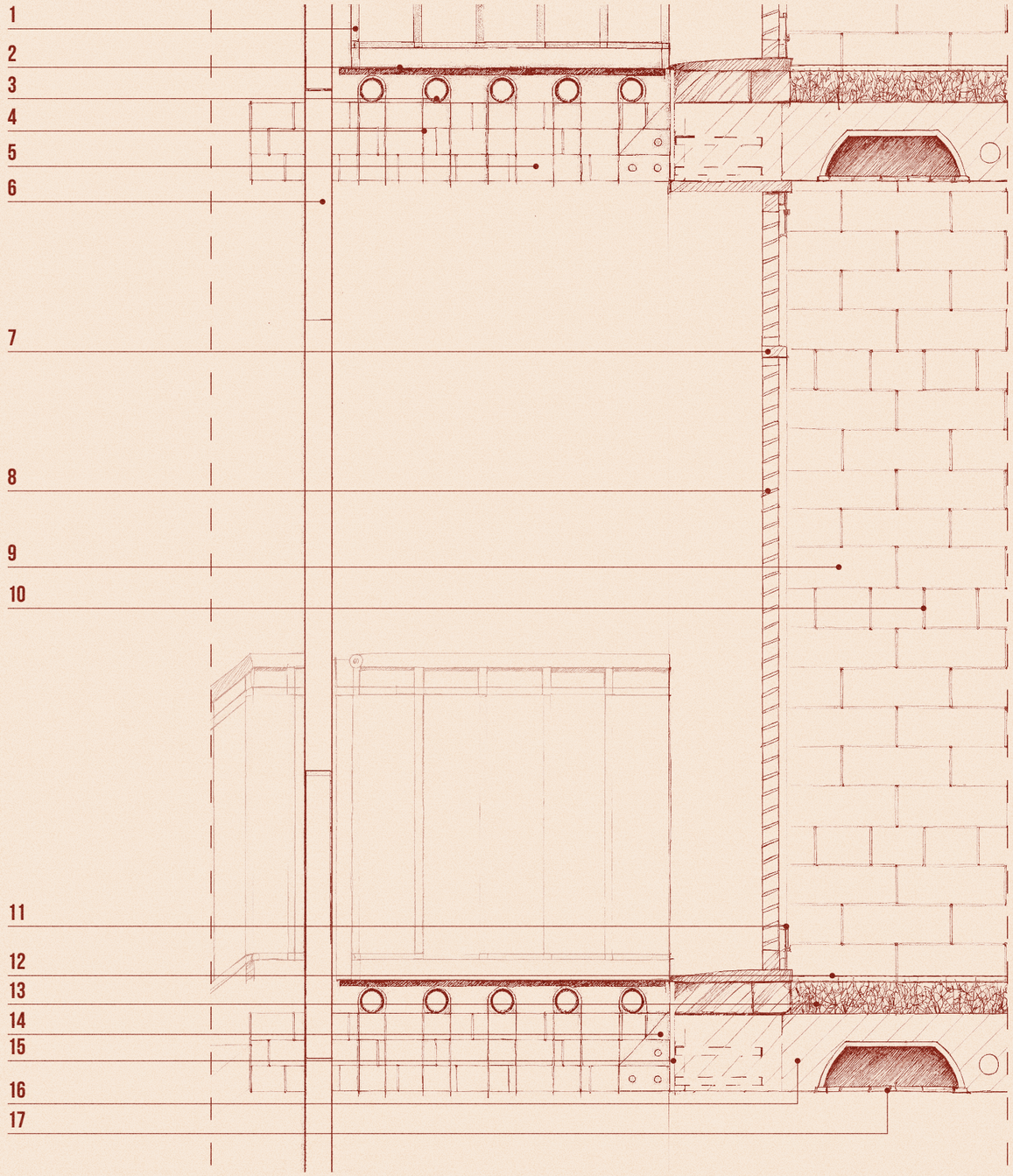
ELEVATION LOW INCOME – PUBLIC STREET SIDE

1:100



DESIGN
DETAIL
1:10

1.	BAMBOO RAILING	Ø 50 MM
2.	BAMBOO PLANKS	40 X 150 MM
3.	HORIZONTAL BAMBOO UNDERCONSTRUCTION	3 X Ø 80 MM
4.	JUTE ROPE CONNECTION	
5.	BAMBOO BEAM - 3 CONNECTED BAMBOO BEAMS	
6.	BAMBOO COLUMN	Ø 80 MM
7.	GAMAR TIMBER FRAME	
8.	WOVEN BAMBOO SHUTTER PANELS	
9.	CEB	90 X 240 X 240 MM
	COMPRESSED EARTH BLOCK	90 X 240 X 115 MM
10.	EARTH MORTAR	
11.	HINGE	
12.	OXIDE FLOORING	12 MM
13.	COMPRESSED SAND	
14.	METAL U-CONNECTION	
15.	LIME PLASTER	
16.	CONCRETE FILLER SLAB	240 MM
17.	CLAY POTS (FILLER ELEMENTS)	Ø 450 MM





DESIGN

MATERIAL OBJECTIVES

BALANCE



AVAILABLE

AFFORDABLE

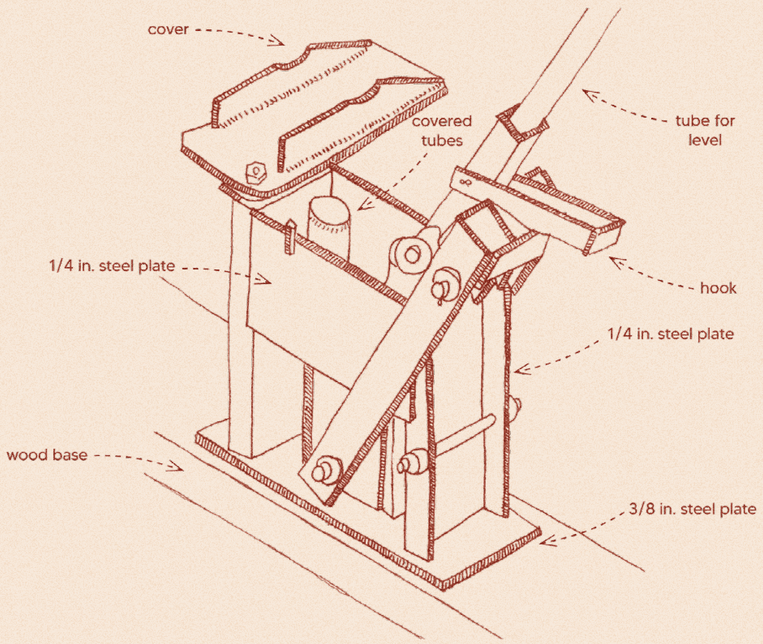
SUSTAINABLE

COMPRESSED EARTH BRICKS

CONSTRUCTION & PARTITION WALLS

+ GREAT LOADBEARING CAPACITY
+ LOW LABOUR-INTENSITY
+ FLEXIBLE DIMENSIONS OF PRODUCED BLOCKS
+ AIR DRYING PROCESS REQUIRES LITTLE SPACE
+ PRESSING MACHINE CAN SERVE FOR A LONG TIME

- HIGH STARTING COST DUE TO NECESSARY INVESTMENT INTO PRESSING MACHINE (AVERAGE COST OF A MANUAL COMPRESSION MACHINE: 70.000 BDT)

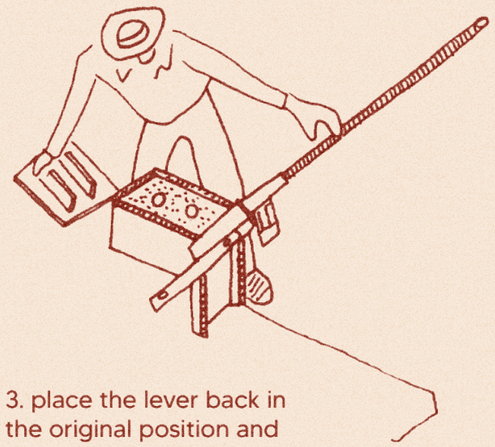




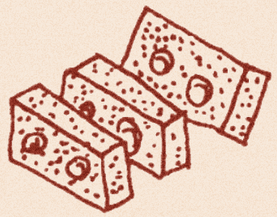
1. fill the mold with the wet mixture, close the cover and place the lever in a vertical position

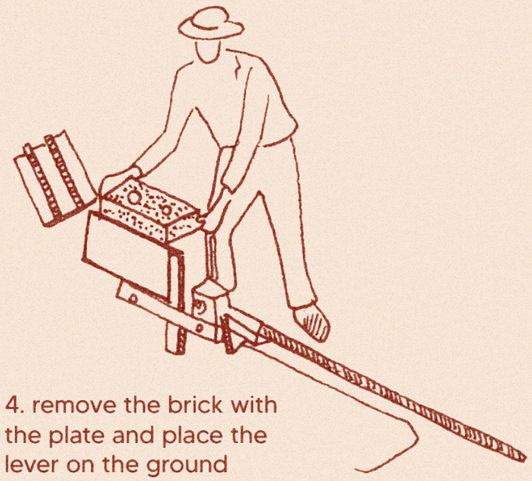


2. remove the hook to free the level and lower the lever to press the mixture



3. place the lever back in the original position and open the cover





4. remove the brick with the plate and place the lever on the ground

5. place the brick on its side on flat ground and remove the plate

BAMBUSA BALCOOA

CONSTRUCTION & SCAFFOLDING
WATER RESISTANT
EXTREMELY DURABLE

ANNUAL YIELD (PER HA): 10–30 TONNES
GROWTH PERIOD: MAY – NOV
HARVEST CYCLE: 4–6 YEARS
COMPRESSIVE STRENGTH: 57.3 MPA
DENSITY LOOSE: 950 KG/M^3
THERMAL CONDUCTIVITY: 0.165–0.20
CARBON CAPTURE (PER HA): 12–18 TONNES
LIFE SPAN: 25–30 YEARS

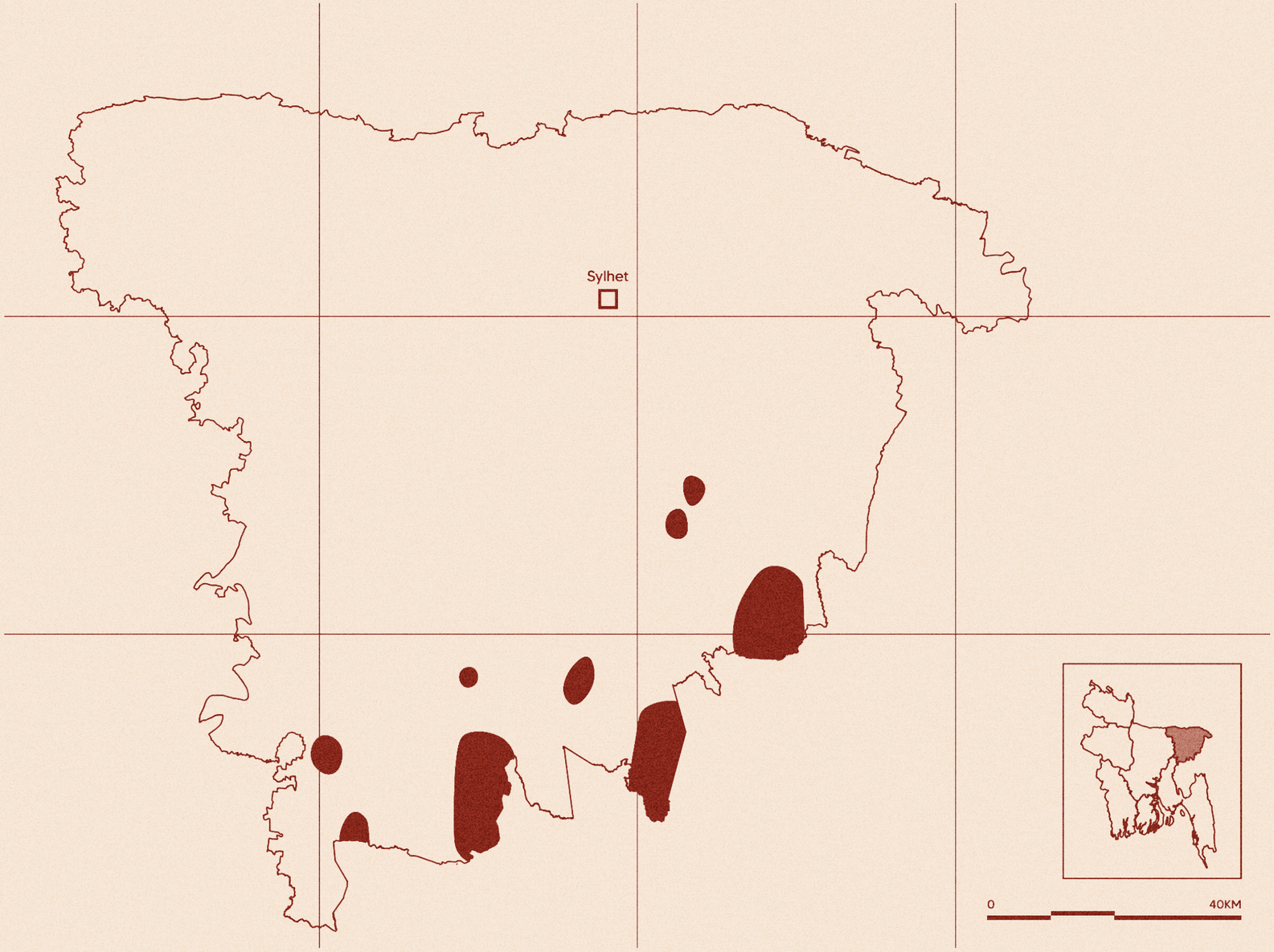
160-210 TK / CULM
$ 1.50-2.00 / CULM

MELOCANNA BACCIFERA

NON-LOAD-BEARING STRUCTURES & MATS
WATER RESISTANT
DURABLE

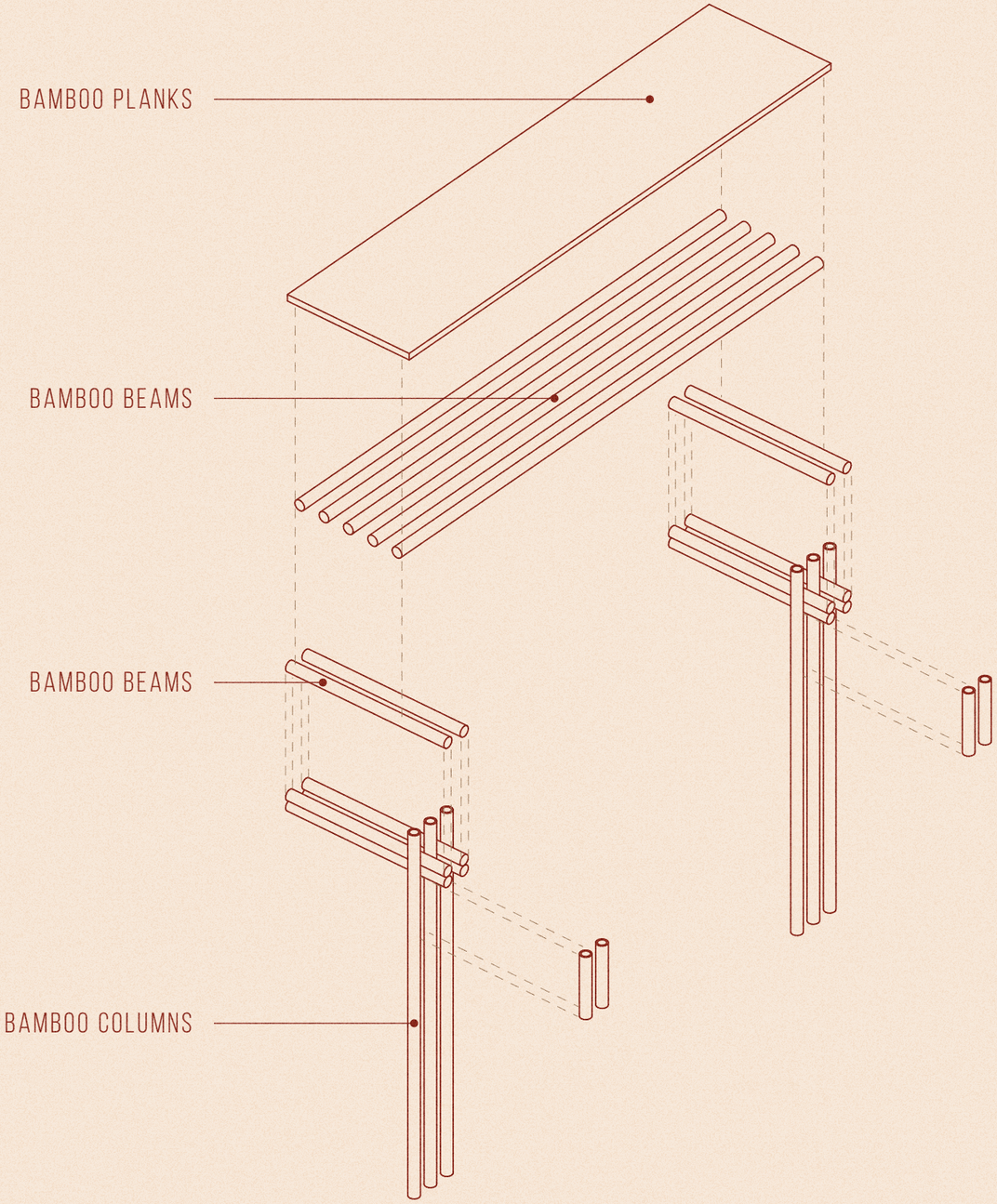
ANNUAL YIELD (PER HA): 6–8 TONNES
GROWTH PERIOD: MAY – NOV
HARVEST CYCLE: 3–4 YEARS
COMPRESSIVE STRENGTH: 64.7 MPA
DENSITY LOOSE: 700 KG/M^3
THERMAL CONDUCTIVITY: 0.12–0.15
CARBON CAPTURE (PER HA): 6–10 TONNES
LIFE SPAN: 8–12 YEARS

80-140 TK / CULM
$ 0.75-1.30 / CULM



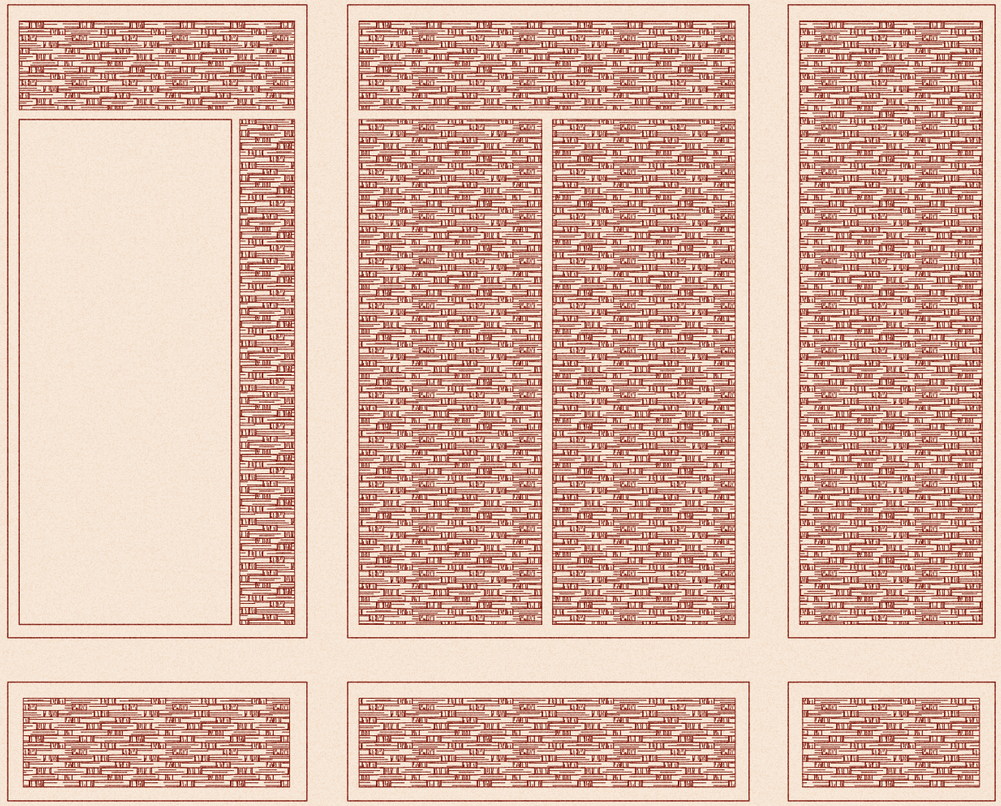
BAMBOO GROWTH FOR CONSTRUCTION SYLHET DIVISION 2023

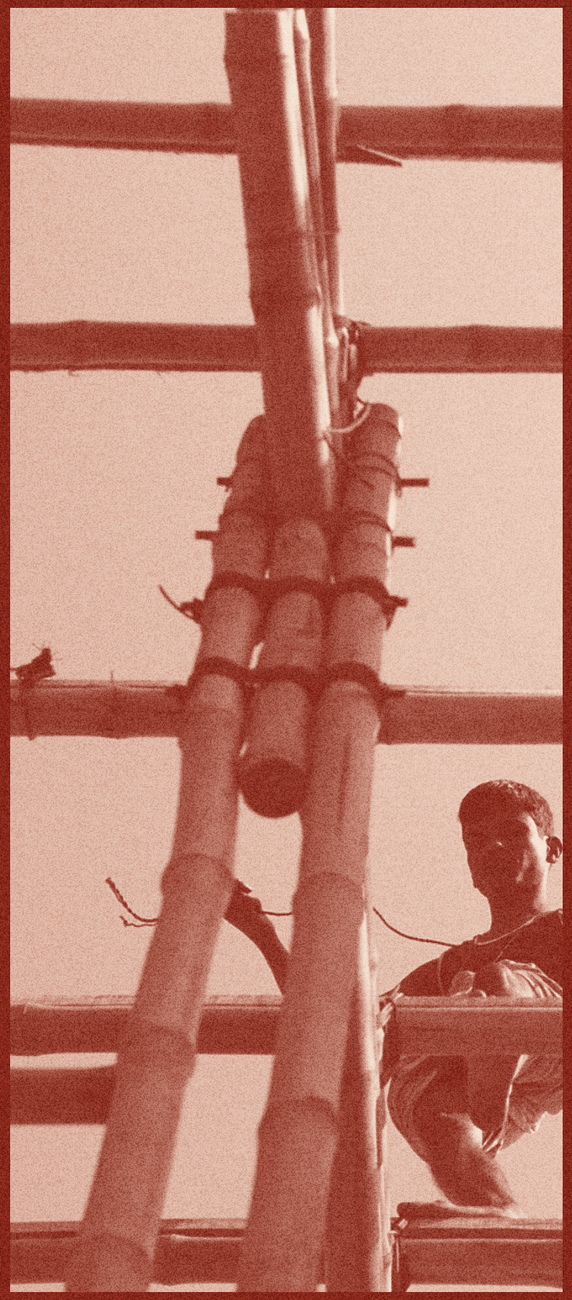
APPLICATION - BAMBUSA BALCOOA

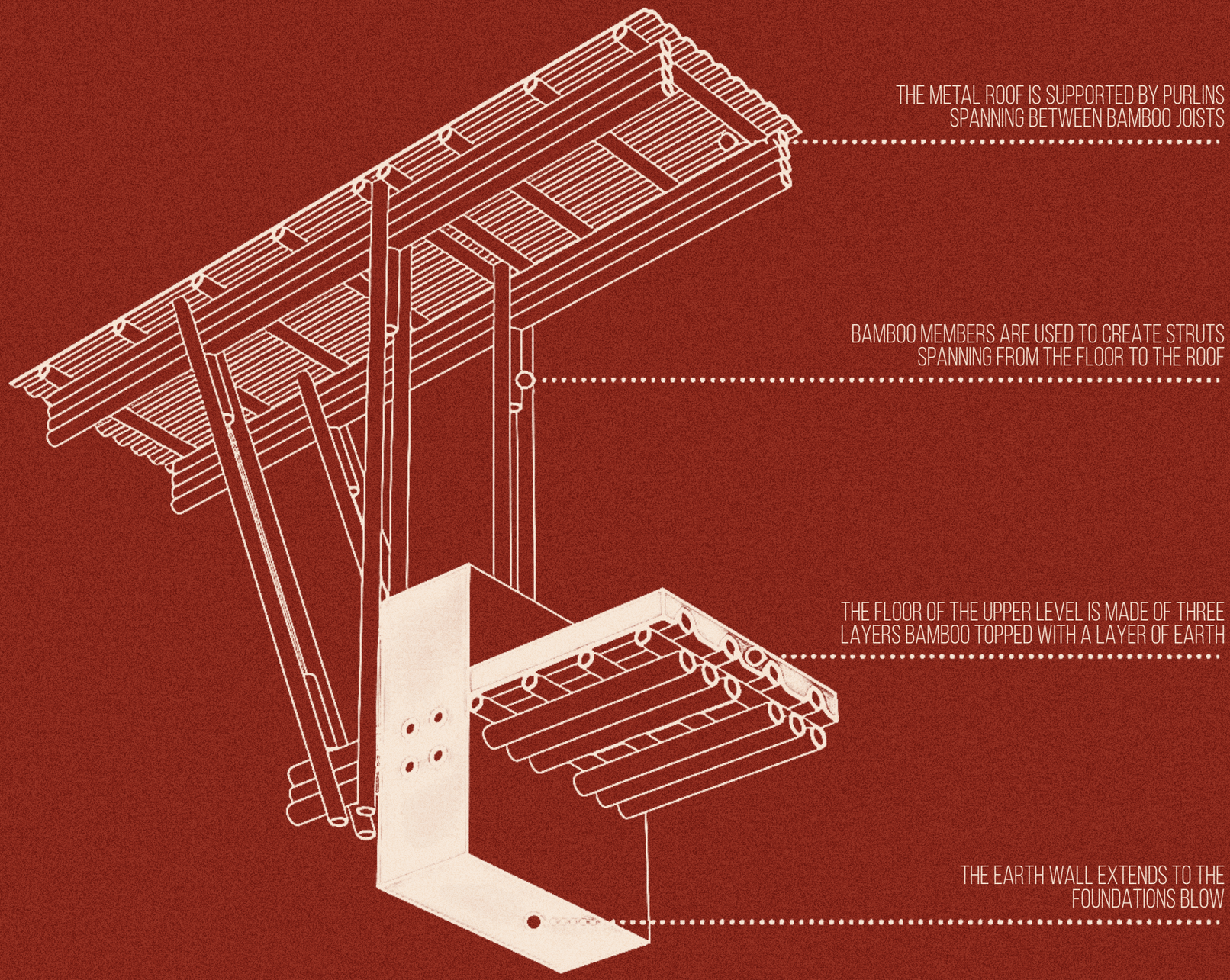


APPLICATION - MELOCANNA BACCIFERA

WOVEN BAMBOO SHUTTER PANELS

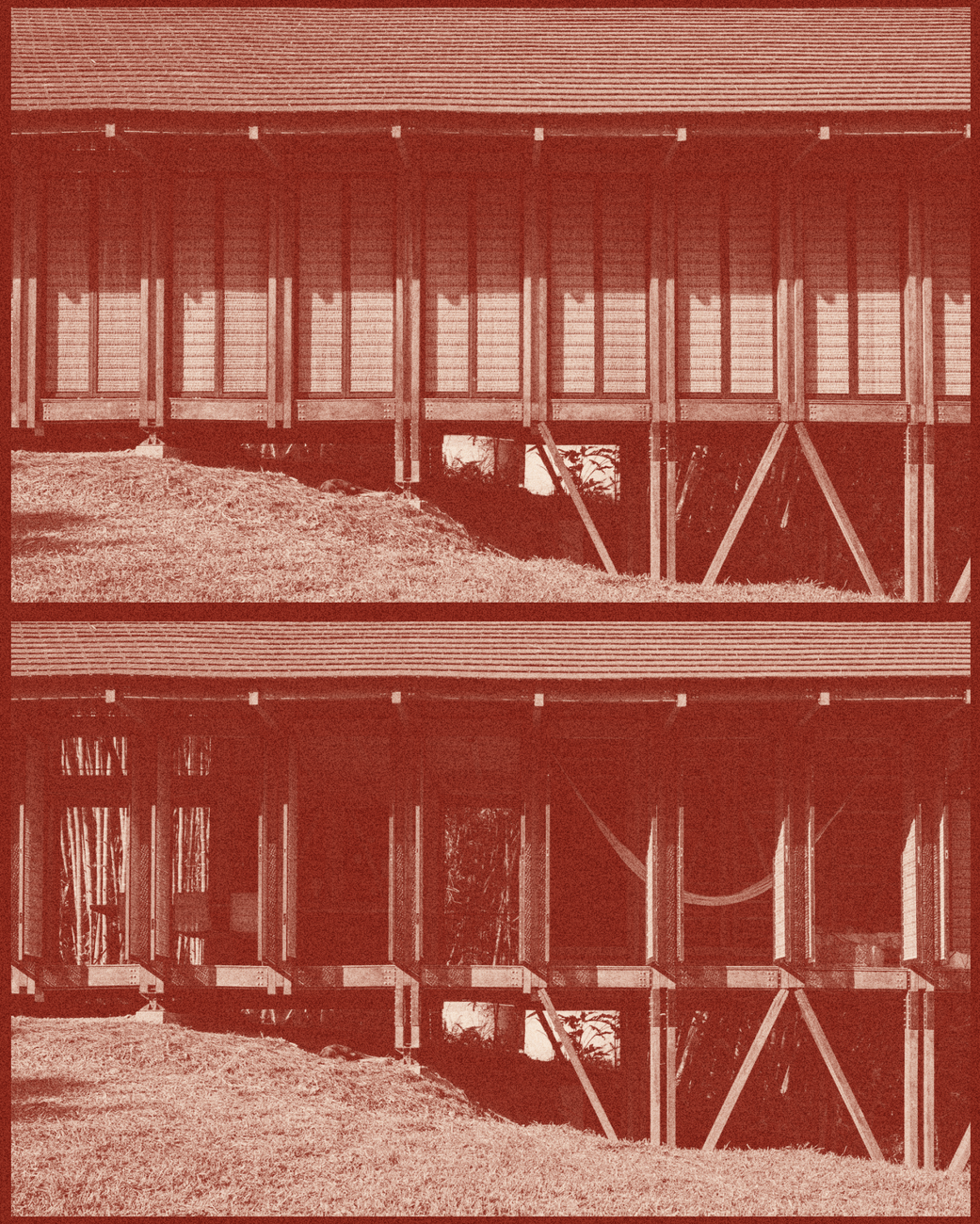






CASE STUDY – HANDMADE SCHOOL- ANNA HERINGER + EIKE ROSWAG





CASE STUDY – WOVEN HOUSE / SANTIAGO PRADILLA + ZULOARK

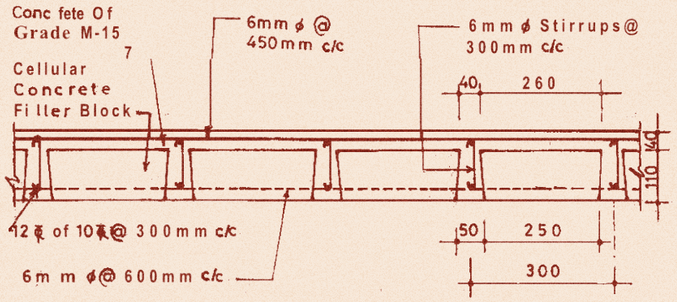
FILLER SLAB

FILLER SLAB

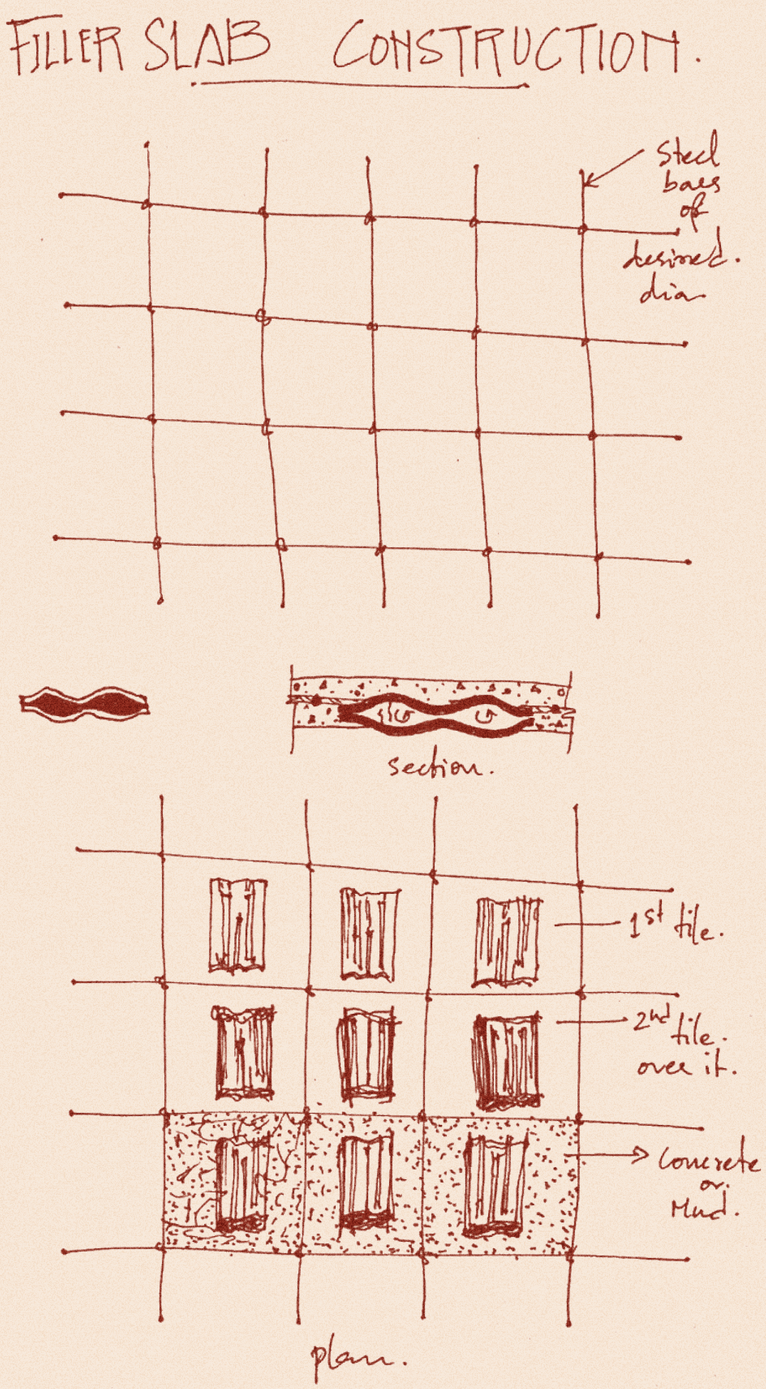
COST-EFFICIENT SLAB SYSTEM
REDUCED CEMENT & STEEL USE
THERMALLY INSULATIVE

TYPICAL THICKNESS: 150–250 MM
MATERIALS USED: CONCRETE + CLAY
LOAD CAPACITY: ~3–5 KN/M² (SUITABLE FOR RESIDENTIAL USE)
COMPRESSIVE STRENGTH (CONCRETE): ~20–25 MPA
DENSITY: ~2,200 KG/M³
THERMAL CONDUCTIVITY: ~0.4–0.7 W/MK
CEMENT SAVINGS: ~25–35%
STEEL SAVINGS: ~20–25%
LIFE SPAN: 40–60 YEARS

~500–800 TK / M² INSTALLED
$4.50–7.50 / M²







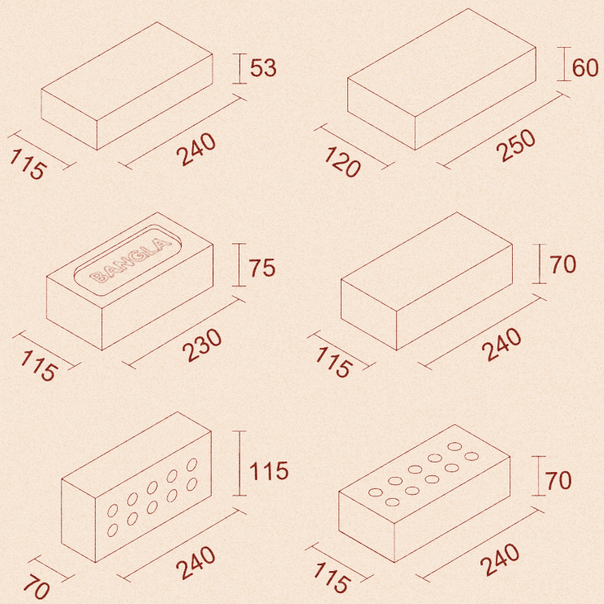
FIRED BRICKS

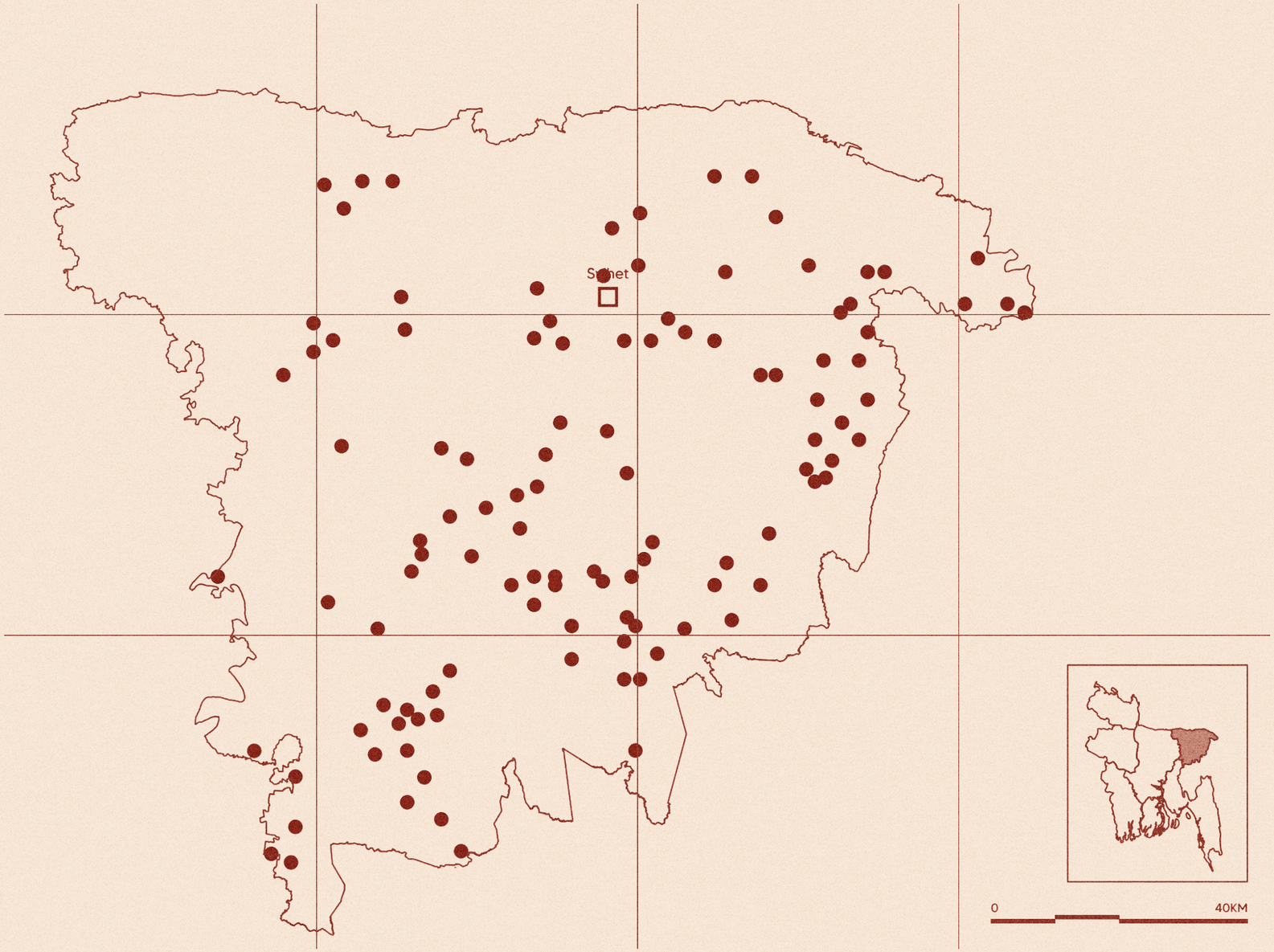
FIRED BRICK

RAISED PLINTH
WATER RESISTANT
DURABLE

ANNUAL PRODUCTION: ~25 BILLION BRICKS
RAW MATERIAL: CLAY (TOPSOIL)
PRODUCTION SEASON: NOV – APRIL
FIRING TEMPERATURE: 600–1100°C
COMPRESSIVE STRENGTH: 10–20 MPA
DENSITY: ~1,600–1,900 KG/M^3
THERMAL CONDUCTIVITY: 0.6–1.0 W/MK
CARBON EMISSIONS: ~200–400 KG CO_2 / 1,000 BRICKS
LIFE SPAN: 30–50 YEARS (IF WELL MAINTAINED)

6–10 TK / BRICK
$0.06–0.10 / BRICK





BRICK KILN LOCATIONS WITHIN SYLHET DIVISION

CEB VS. FIRED BRICKS

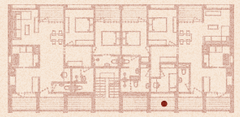


	CEB	FIRED BRICK
ENVIRONMENTAL IMPACT	A	D
THERMAL COMFORT	A	C
WATER RESISTANCE	B-C	A
COST & AVAILABILITY	B	B
CULTURAL PERCEPTION	C	A

(A = EXCELLENT, B = GOOD, C = FAIR, D = POOR)

DESIGN

COURTYARD MID INCOME GALLERY

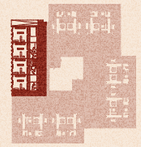




DESIGN

TYPICAL FLOOR MID INCOME

1:100



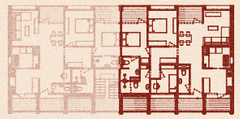


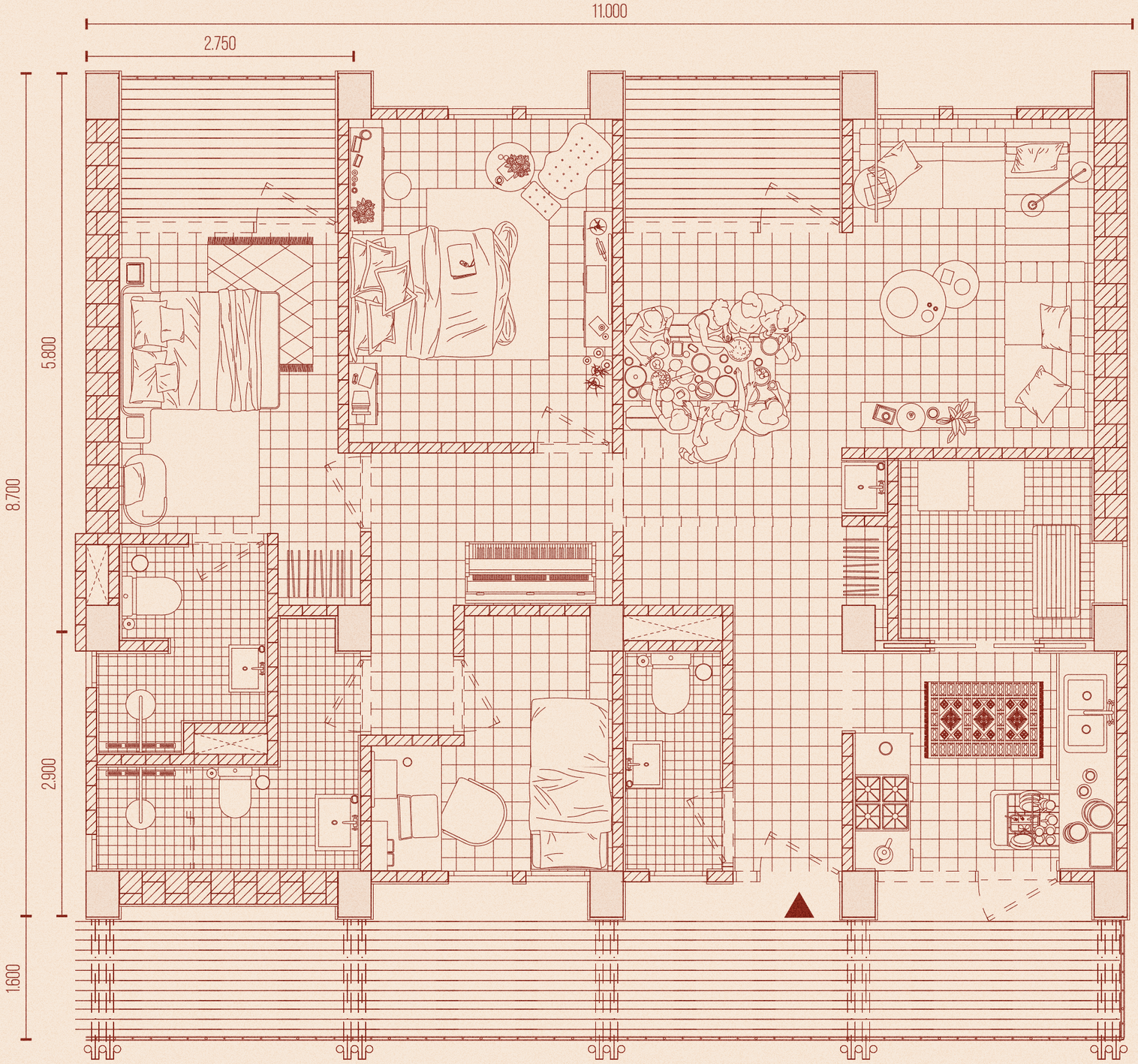
DESIGN

TYPICAL DWELLING MID INCOME

1:50

90 M²







DESIGN

ELEVATION MID INCOME PUBLIC STREET SIDE

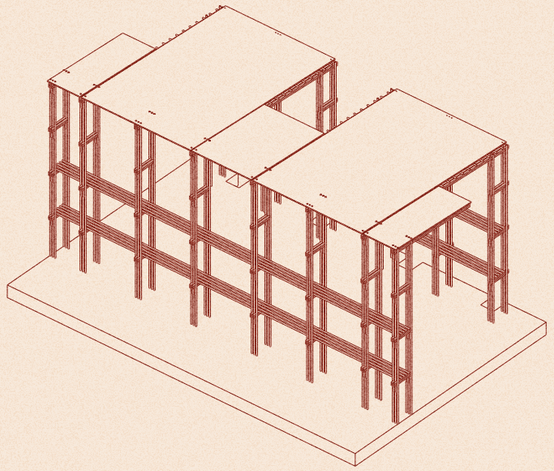
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DESIGN
CONSTRUCTION

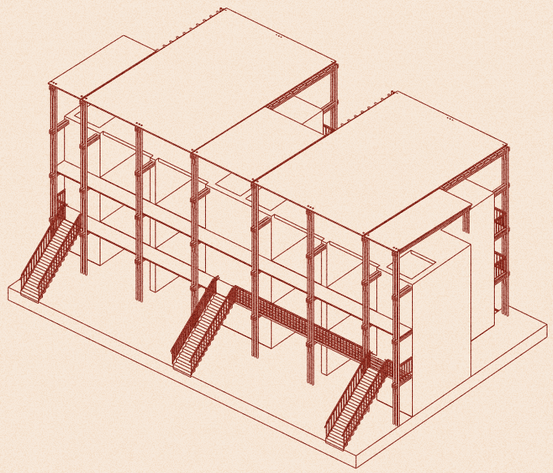
LOW INCOME

1



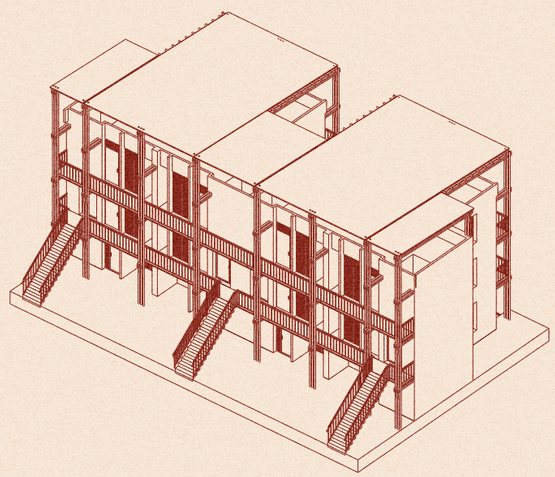
RAISE PLINTH
ROOF CONSTRUCTION
INCL. TEMPORARY COLUMNS

2



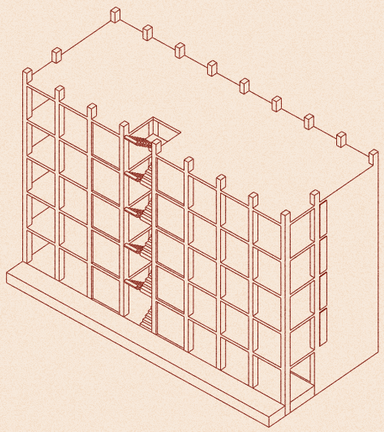
CEB CONSTRUCTION
PLASTER WITH LIME
FILLER SLAB FLOOR ELEMENTS

3

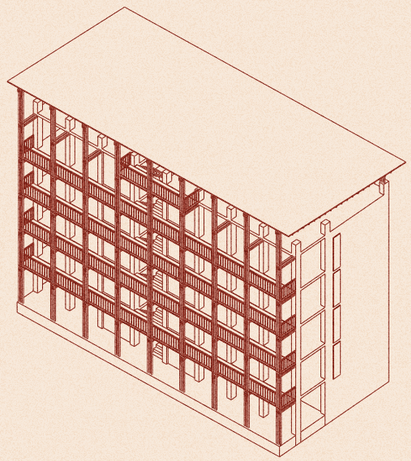


INSTALL INTERNAL ELEMENTS
WINDOWS/DOOR INSTALLATION
FINISHING TOUCHES

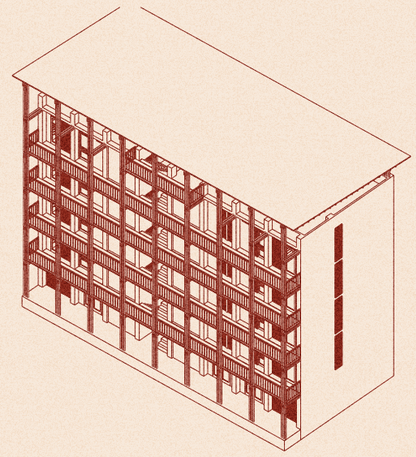
MIDDLE INCOME



RAISED PLINTH
CONCRETE CONSTRUCTION
FILLER SLAB FLOOR ELEMENTS



BAMBOO CONSTRUCTION
ROOF CONSTRUCTION
INCL. CI SHEET

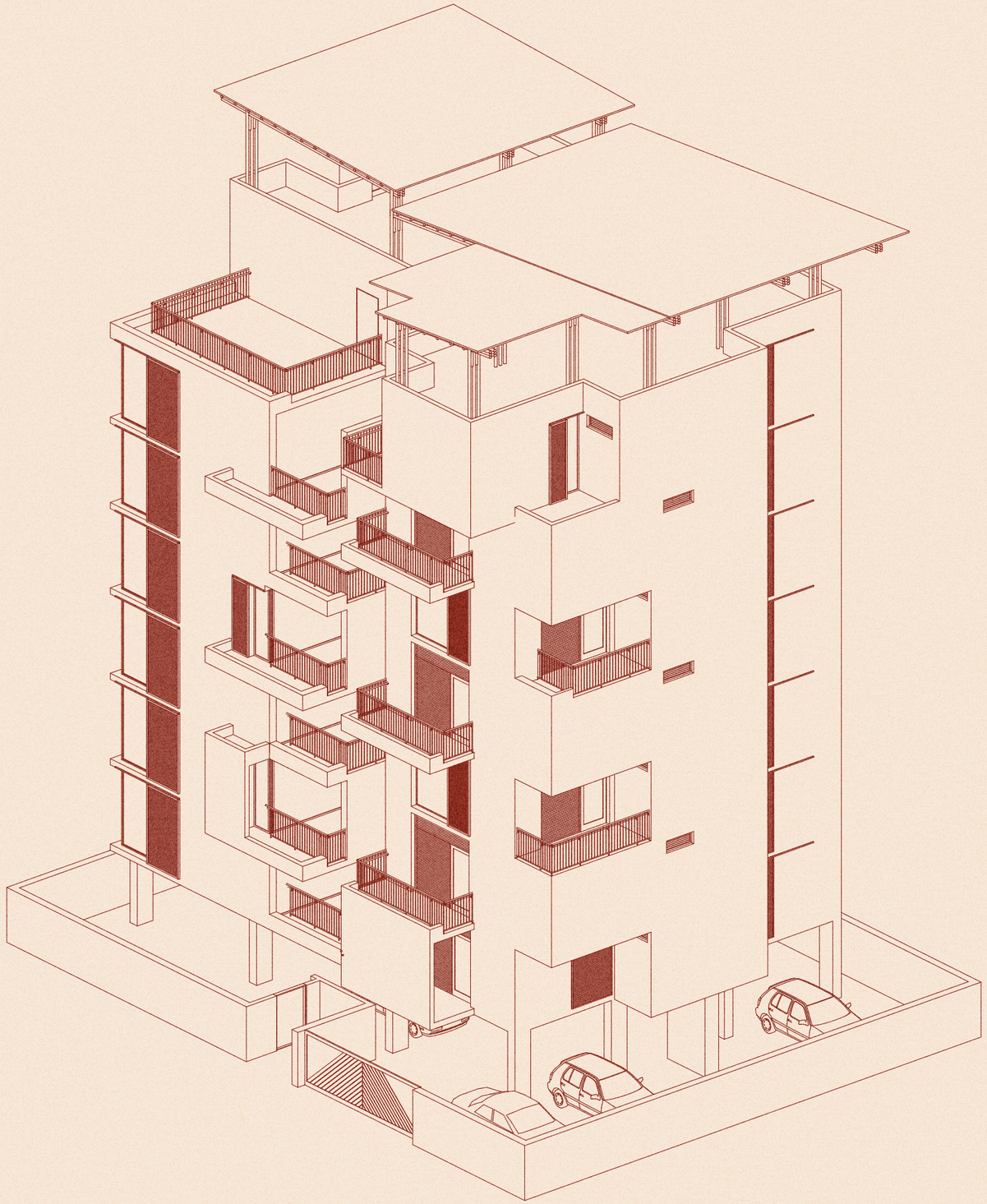


CEB WALLS
PLASTER WITH LIME
WINDOWS/DOOR INSTALLATION

DESIGN

HIGH INCOME

7 TO 9 APARTMENTS



DESIGN

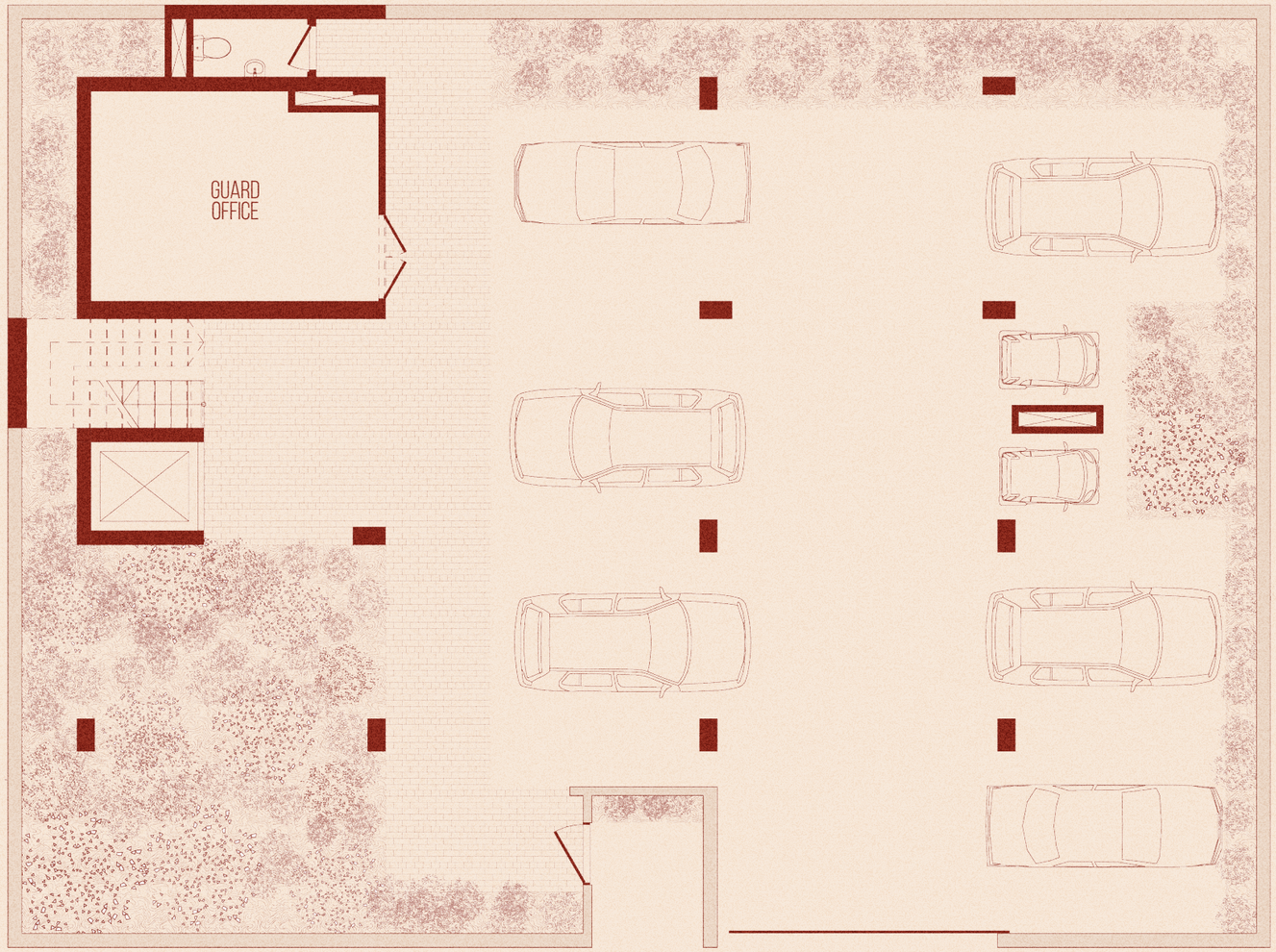
STREET VIEW HIGH INCOME



DESIGN

GROUND FLOOR HIGH INCOME

1:100

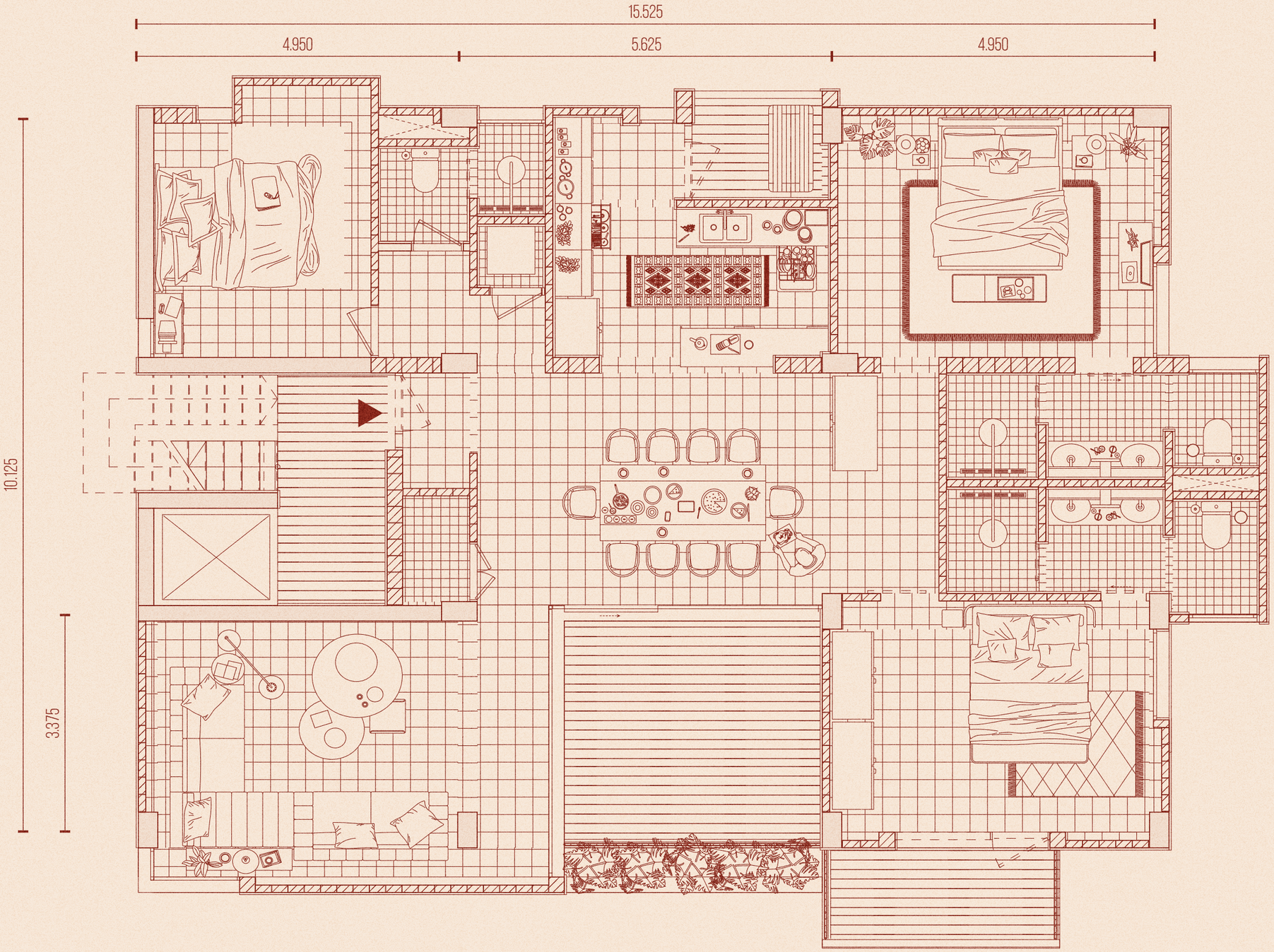


DESIGN

TYPICAL DWELLING HIGH INCOME

1:100

150 M²

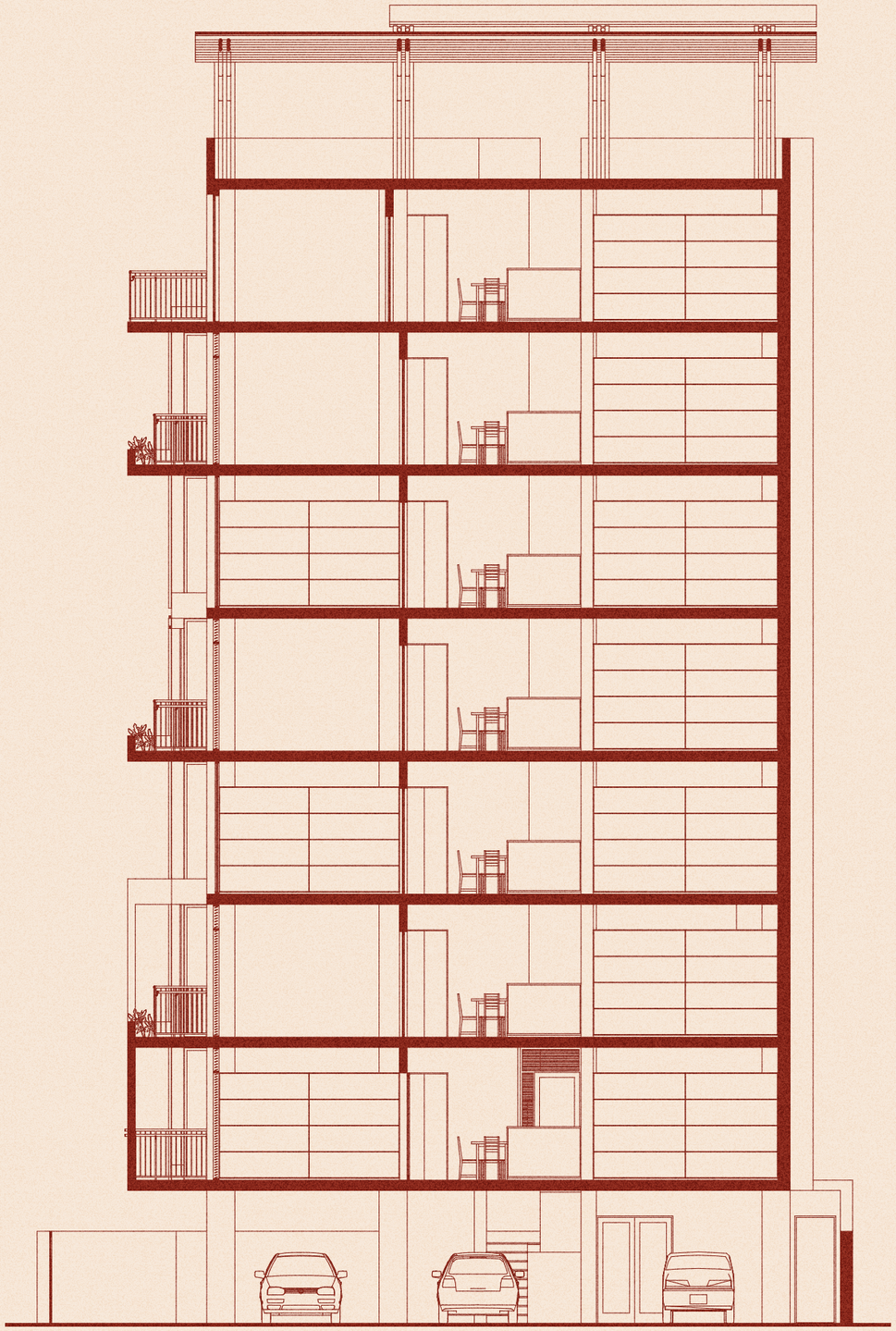


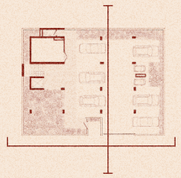
DESIGN

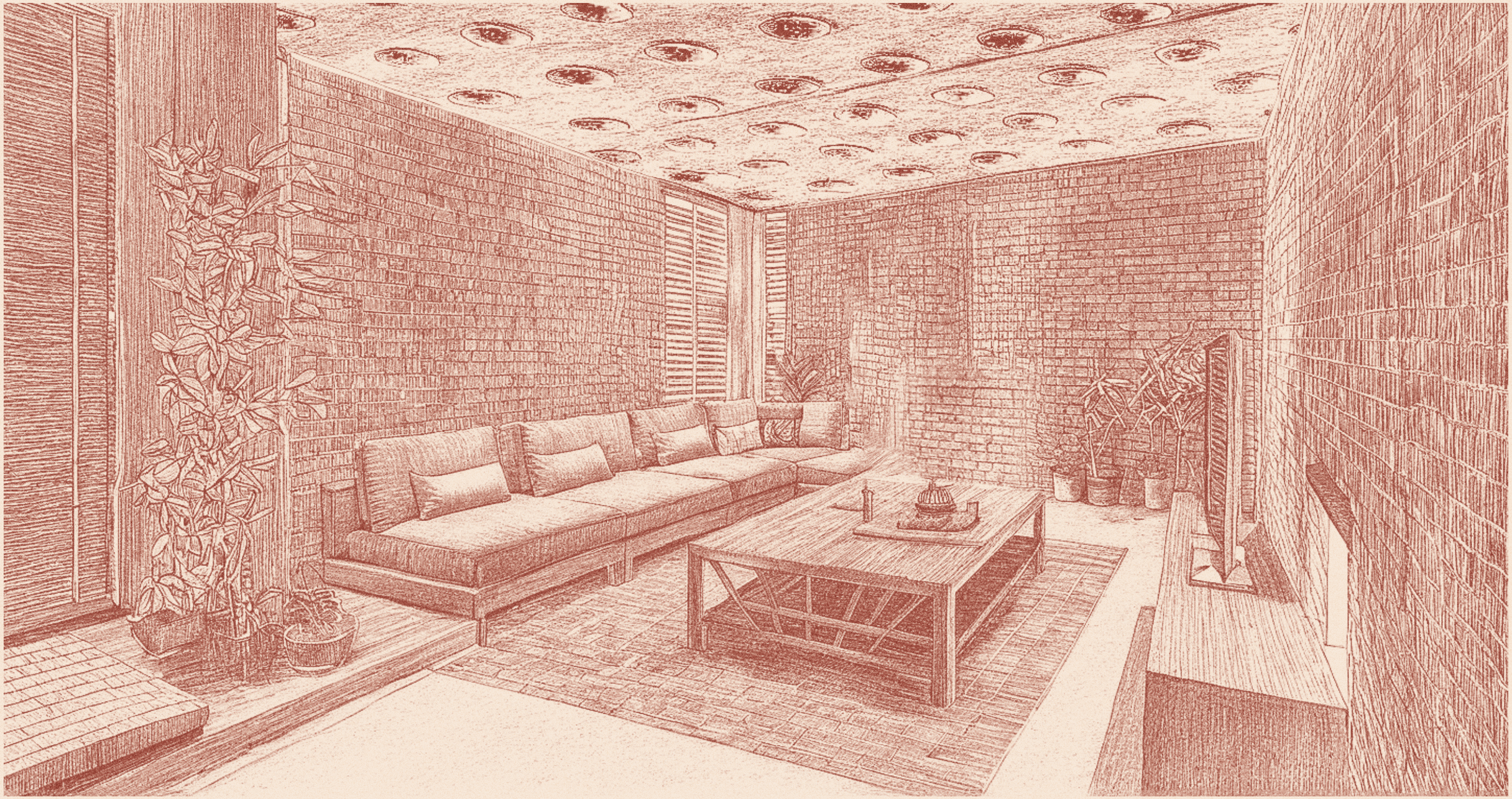
ELEVATION HIGH INCOME

1:100









LONG-TERM USE





