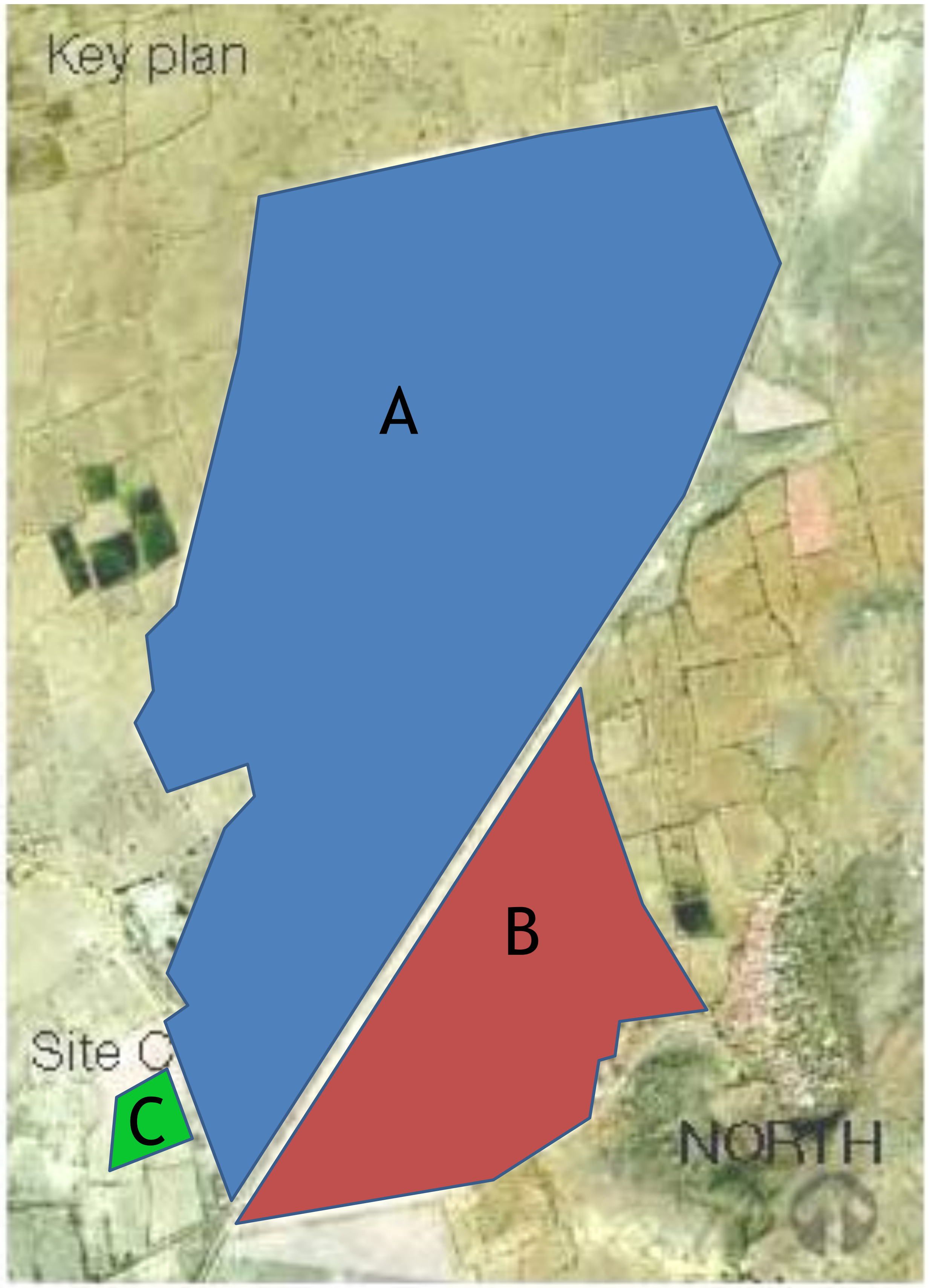
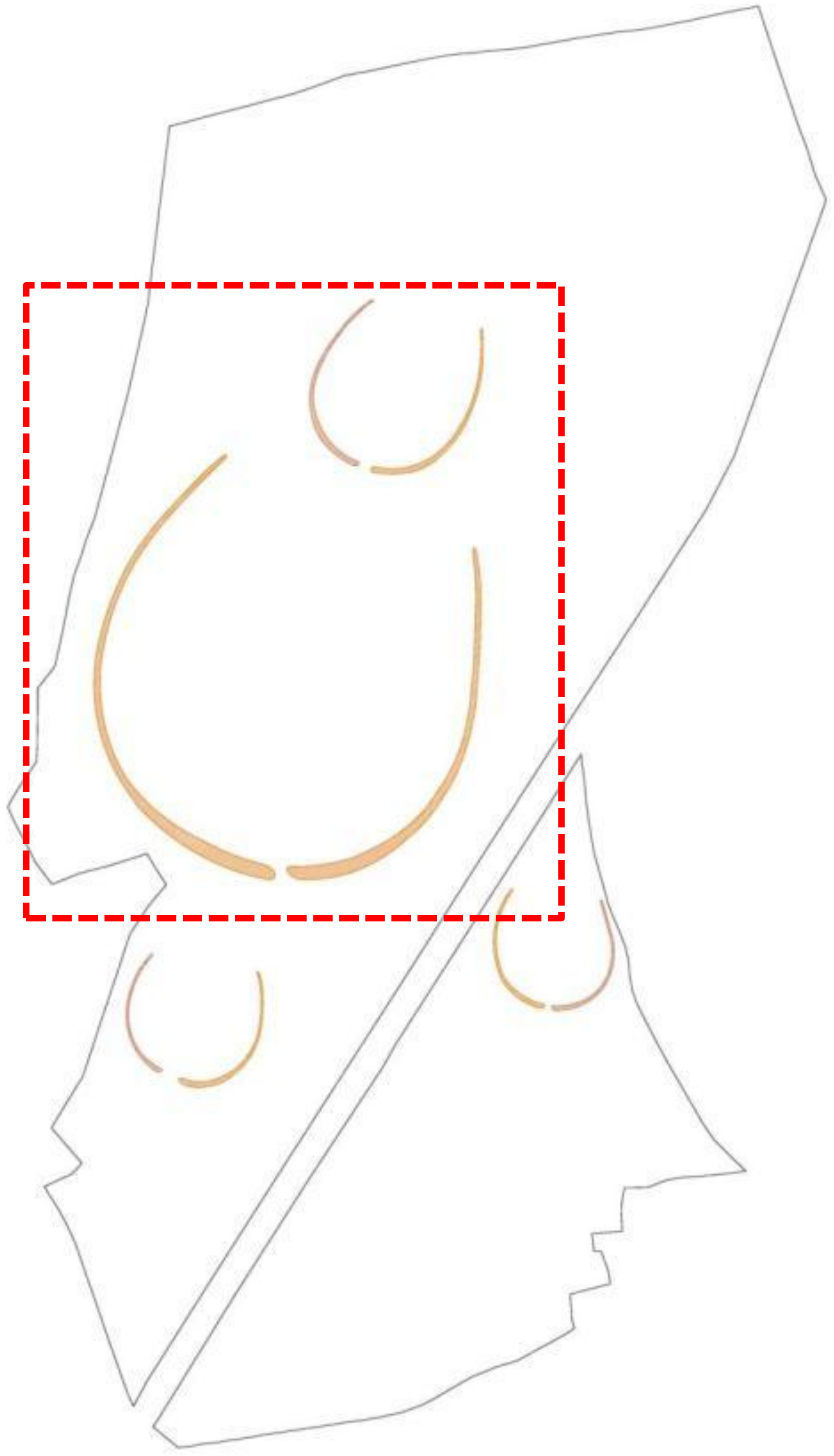
IIT Jodhpur
Campus Master Plan *Towards Net Zero*

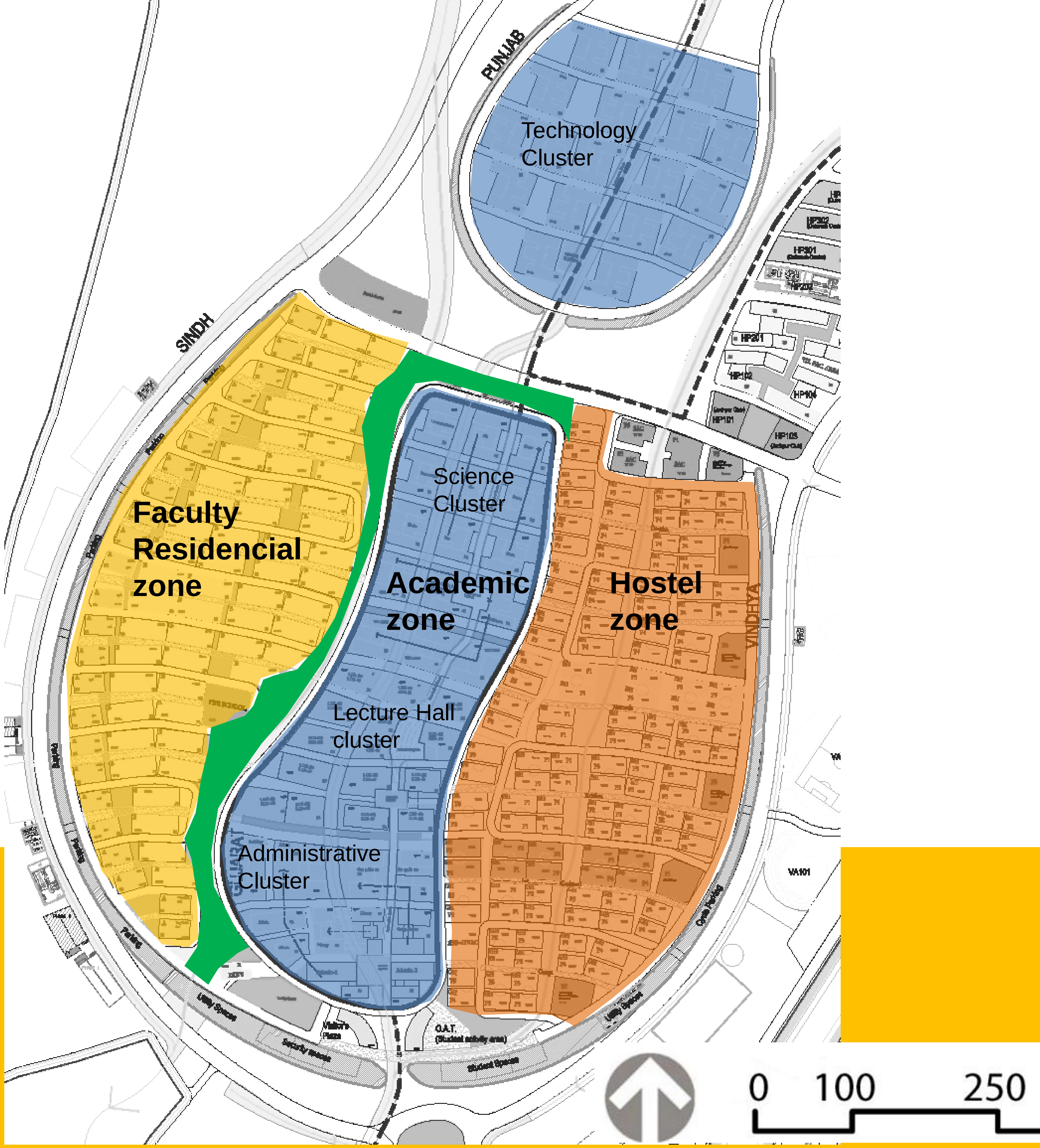


3 parts of the site

- The land proposed for the overall development is in three parts:

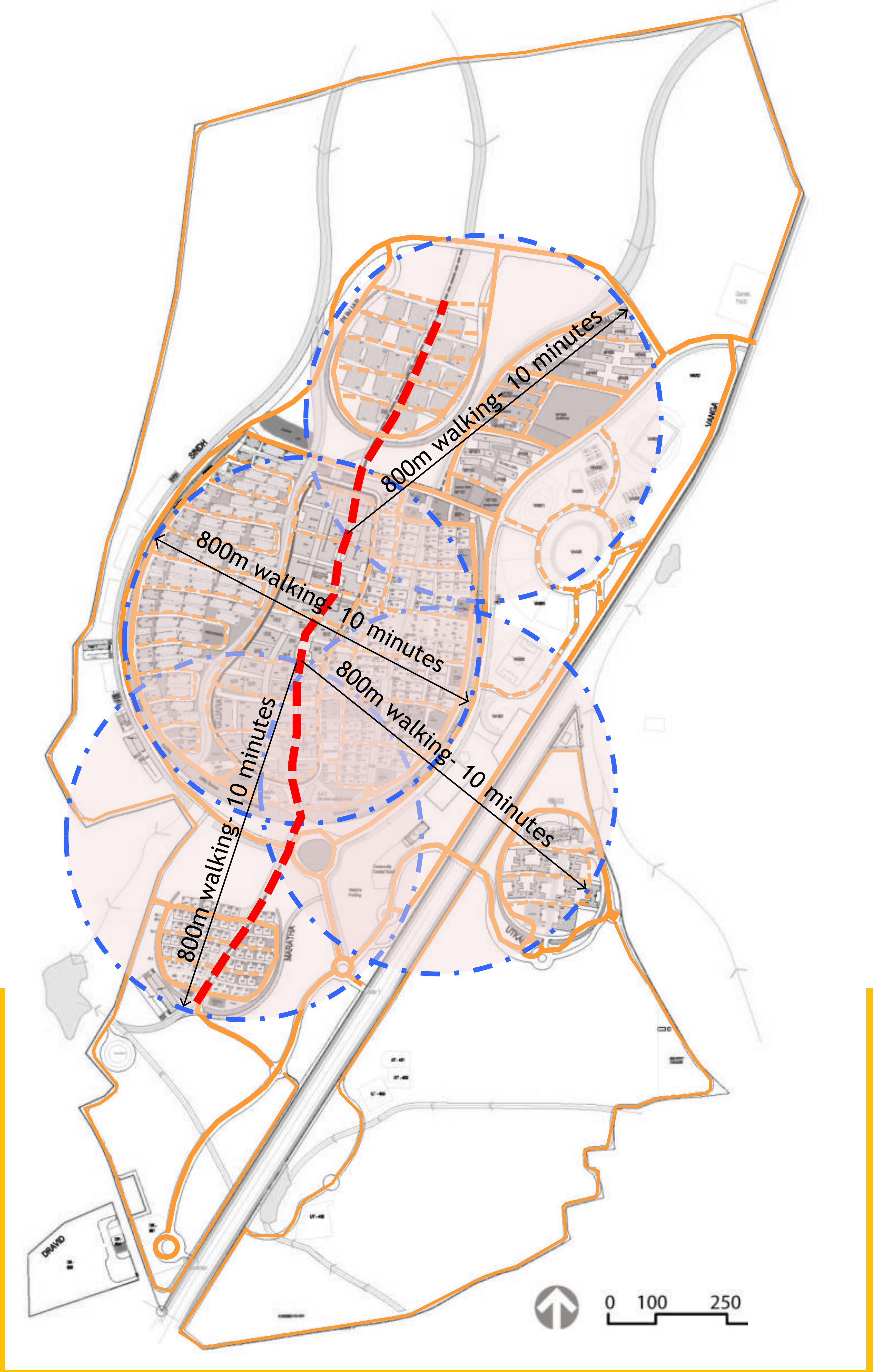
- Site A, which is about 266.68 hectares (659 acre) to the west of NH 65,
- Site B, of about 74.06 hectares (182 acre) to the east of NH 65
- Site C of about 4.0 hectares (10 acre) to the south of Site A.





Zones

- The main cluster separates into faculty residential, academic and hostel zones

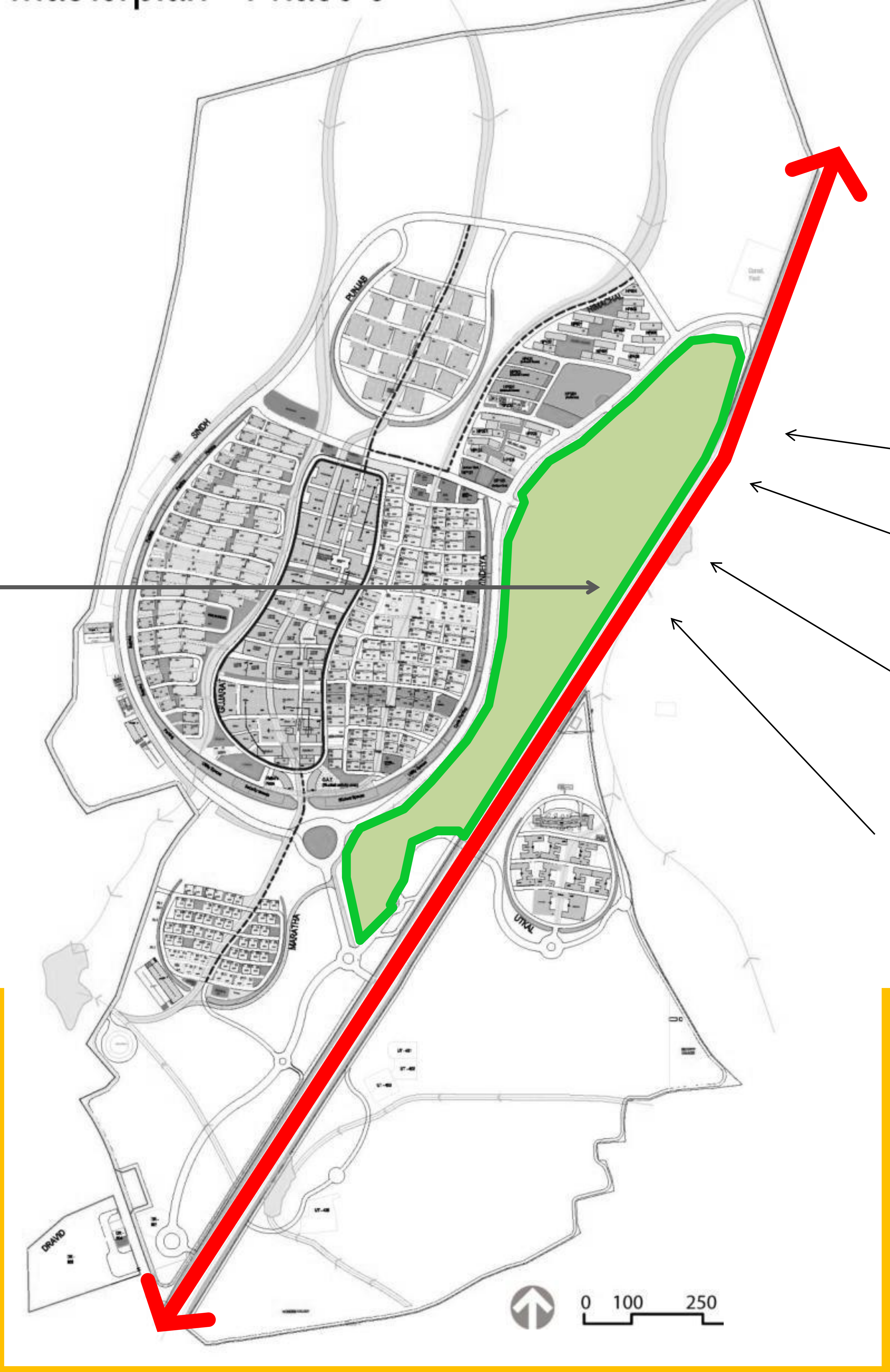


Central, shaded Cycling and Pedestrian Path

Walkability & Access

- **This has been done while keeping the accessibility for emergency vehicles, yet creating a walkable, cyclable campus where any functional area could be reached by anyone in a 10 minute trip with non-motorized transport**

Sports Area acts as noise buffer to Highway



Zones

- Sports zone creates a distance of the main cluster from the noisy highway

PHASE 1

PHASE 2

PHASE 3

PHASE 4

PHASE 5

Phasing

- Phasing has been done such that each functional group can be expanded nearly contiguously next to its given type in earlier phases

PHASE 1


PUNJAB
HIMACHAL
SINDH
VANGA
VINDHYA
GUJARAT
MARATHA
UTKAL
O.A.T.
0
100
250m

PHASE 2


PUNJAB
HIMACHAL
SINDH
VANGA
VINDHYA
GUJARAT
MARATHA
UTKAL

PHASE 3

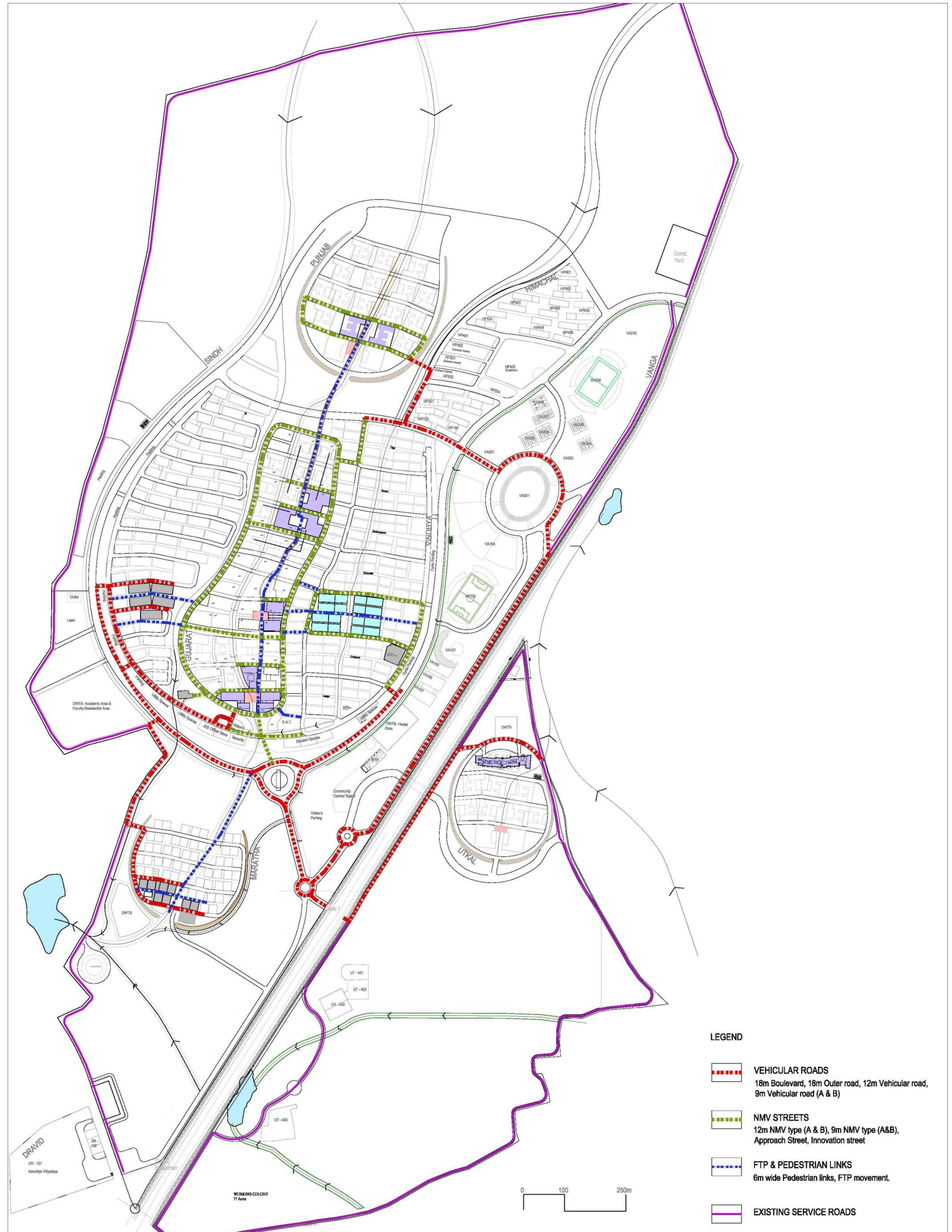
IIT Jodhpur, Rajasthan - CAMPUS MASTERPLAN

PHASE 4

IIT Jodhpur, Rajasthan - CAMPUS MASTERPLAN

PHASE 5

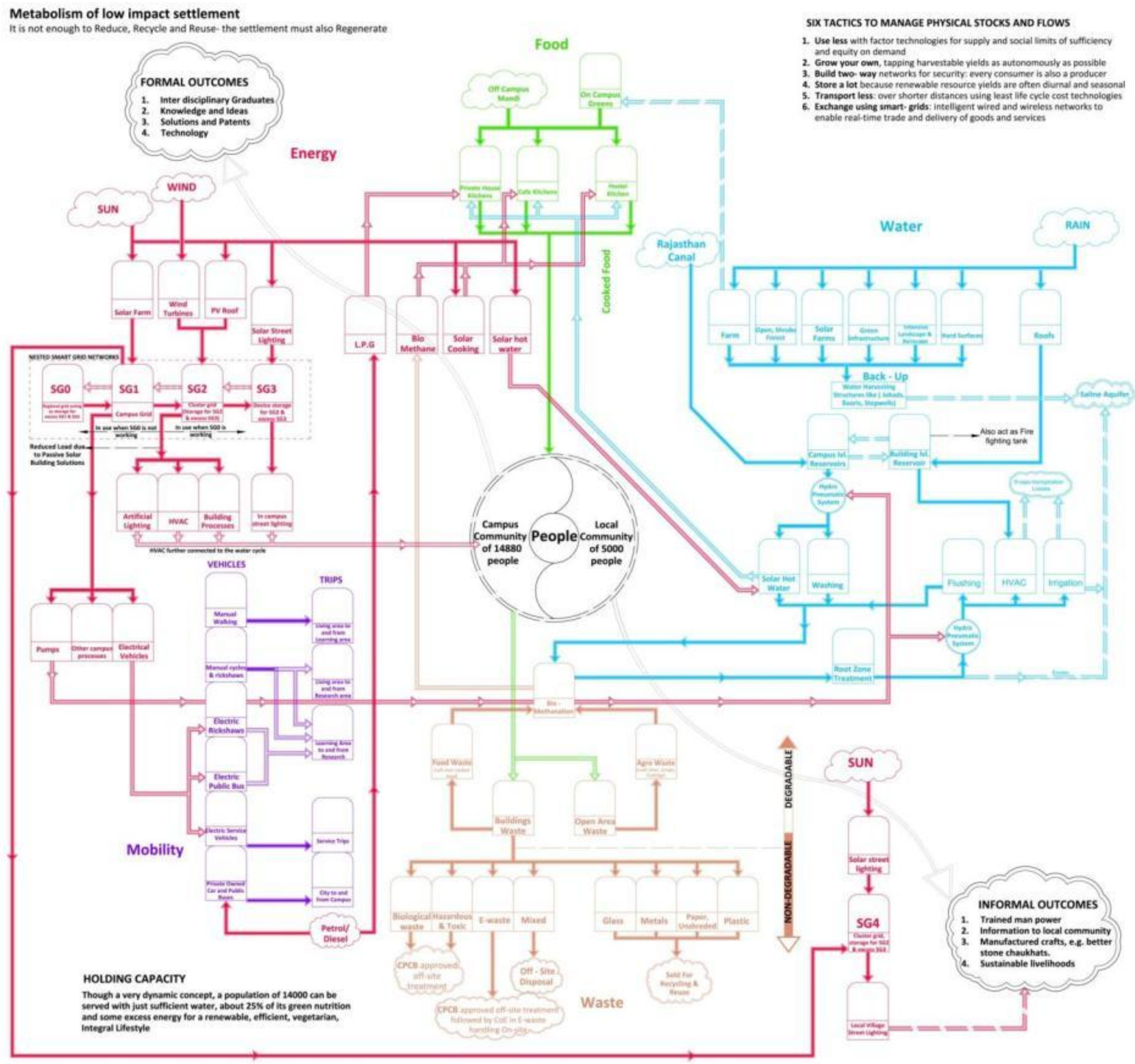

PUNJAB
HIMACHAL
SINDH
VANGA
GUJARAT
VINDHYA
MARATHA
UTKAL
O.A.T.



IIT Jodhpur, Rajasthan - CAMPUS MASTERPLAN

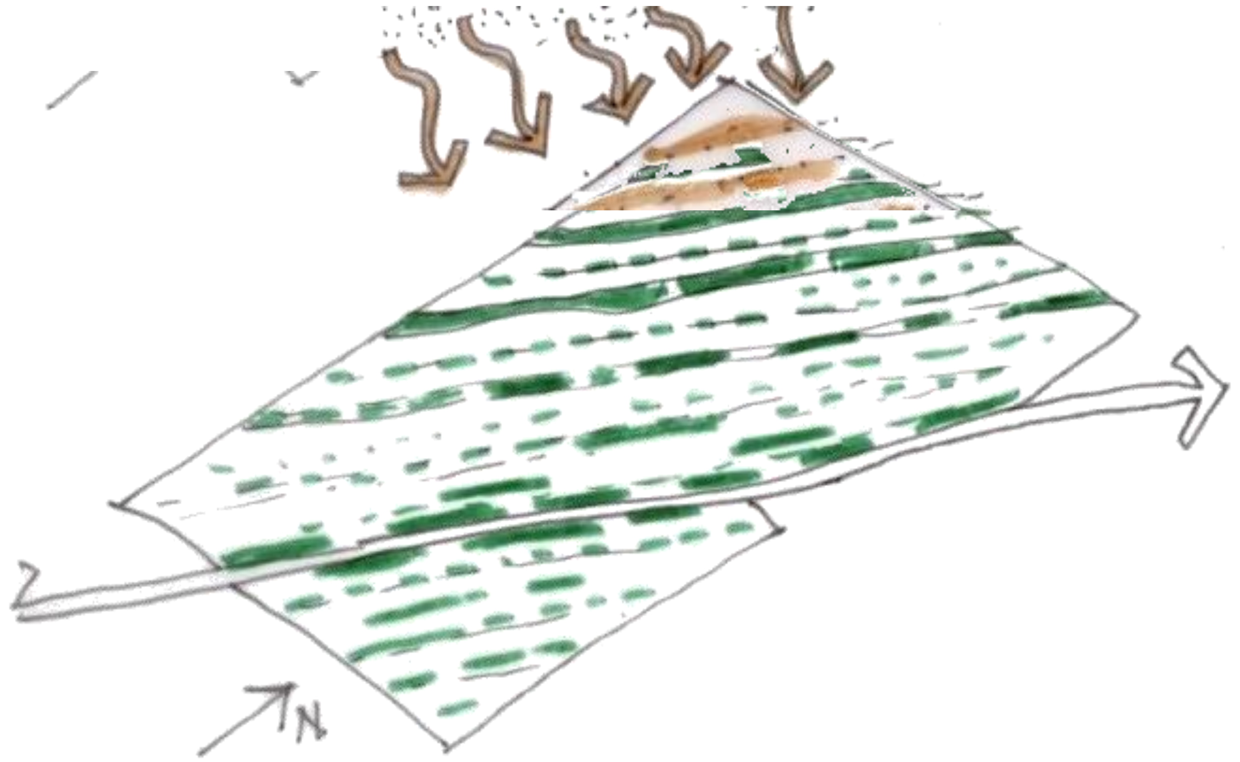
Infrastructure

The Campus Metabolism Diagram

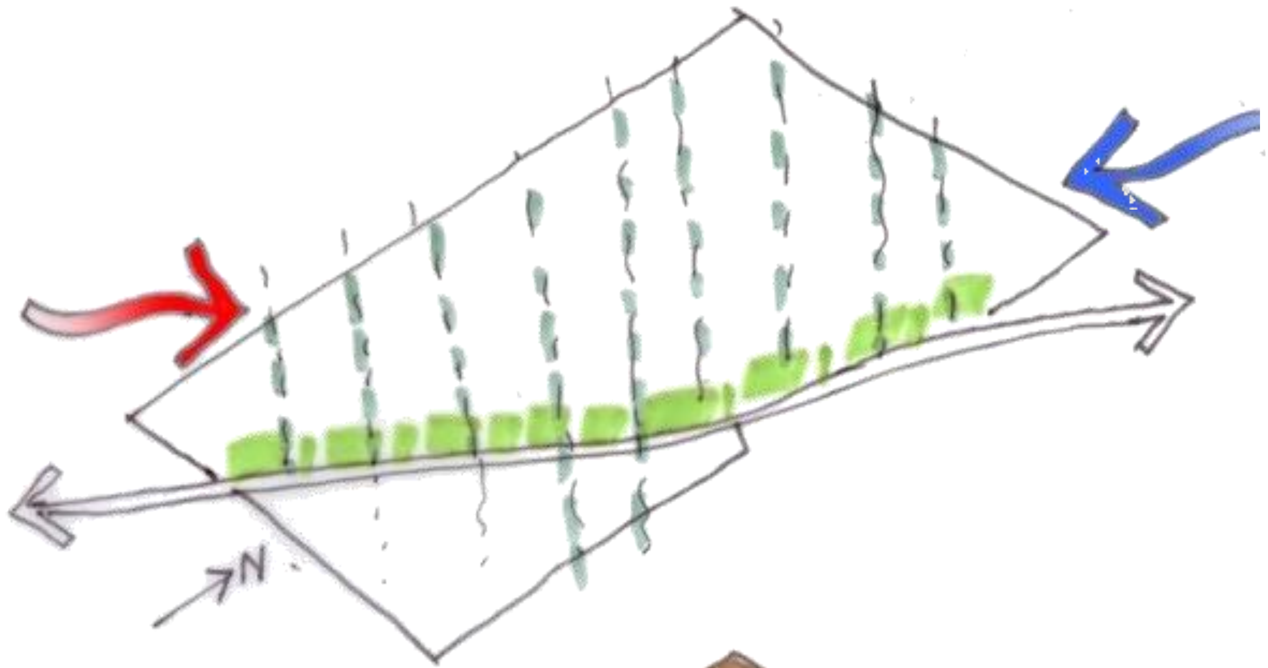


The "Living Laboratory"

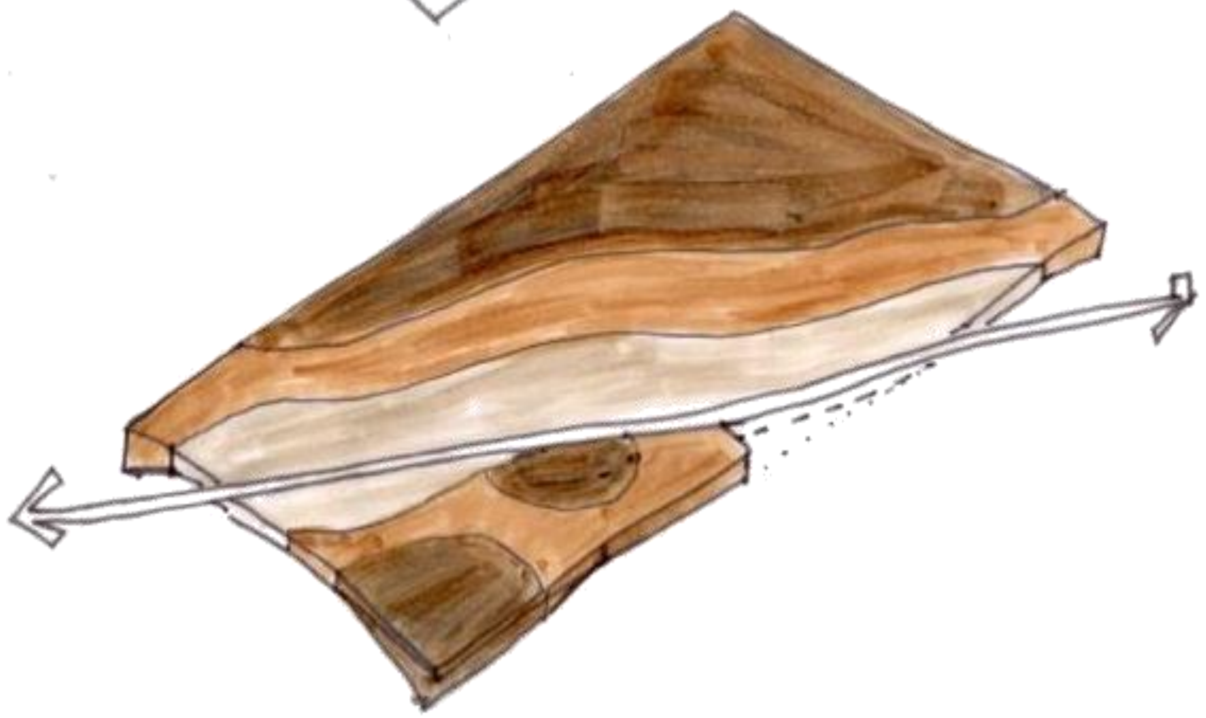
- An interlocking, integral network of complex dynamic systems, like the metabolism of a living organism.
- This meta-system shall be actively studied and monitored to generate intelligent control instructions and partly to mine data.
- A "Smart Intelligent Eco-campus" with the ideals of social, economic and environmental sustainability.



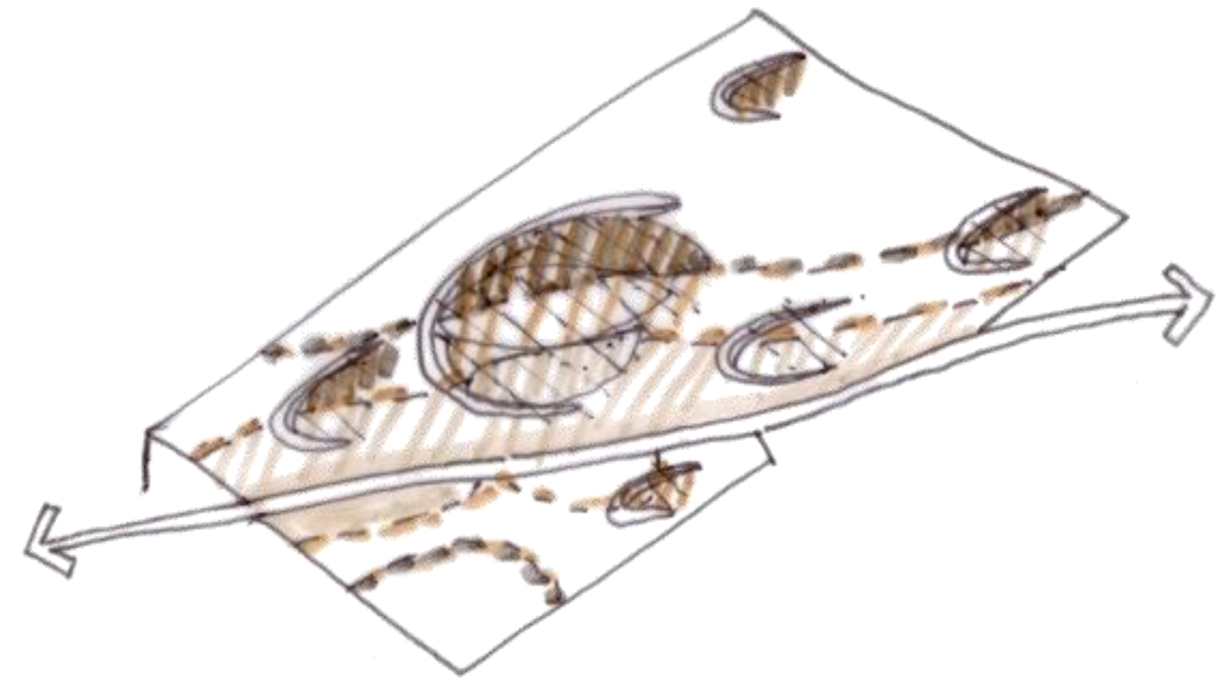
1. Desertification mitigation measures: through a series of ridges and furrows perpendicular to the direction of desert creep



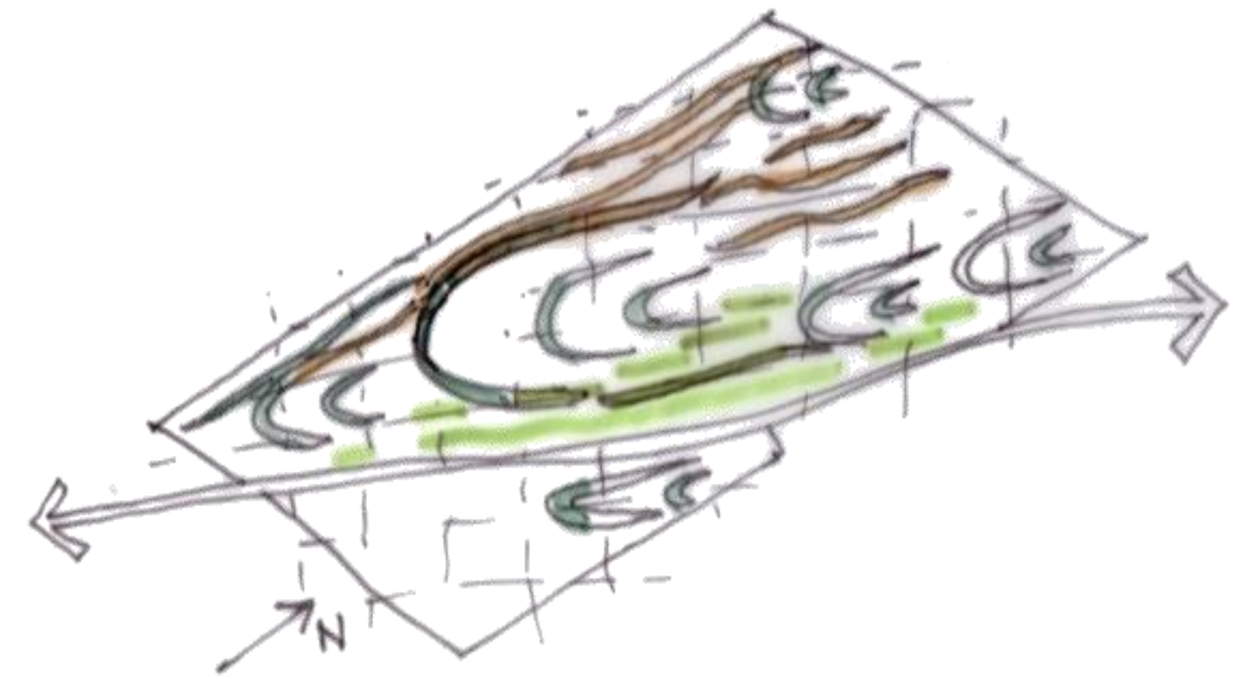
2. Green Buffers:
Along highway & to block-off Hot summer winds (from South-west) & Cold winter winds (from North).



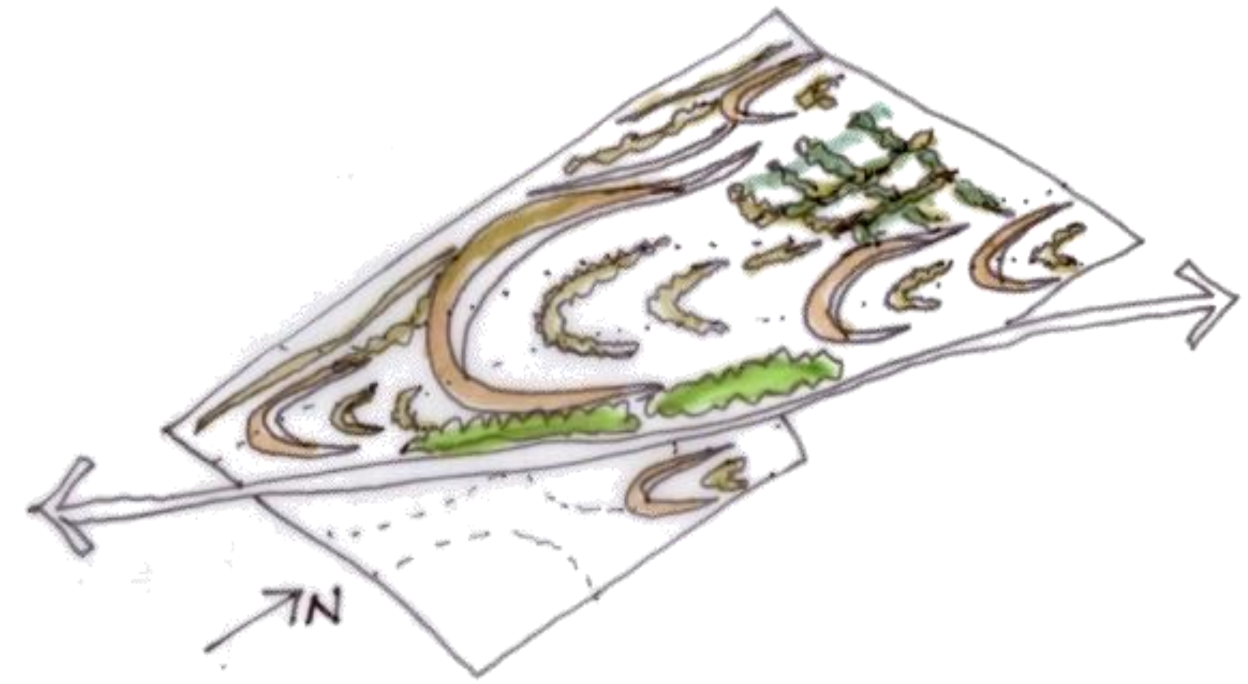
3. Geomorphology:
determined layers of bed rock across the site that varied in depth -- lower towards the west and higher towards the east portions. This in turn which dictates the extent of sub-terrainian structures.



4. Johads:
For subterranean structures and possible 'johad-strategy' (derived from soil-depths) to protect from wind and conserve water.



5. Landscape Pattern:
The juxtaposition of the various landscape infrastructures gives rise to the overall landscape .



6. Overall masterplan:
Building zones are identified that result from the landscape structure placed over the site**.**

A compact protected settlement

De-desertification

- Earthen berms act as signature bounding elements containing compact desert settlements. They mitigate noise, dust, heat, and are part of the de-desertification strategy along with green buffer zones, green infrastructure, compact settlement pattern, and east-west streets.

- This campus provides a protected habitat for flora and fauna (including humans). It rejuvenates the site by providing biodiversity corridors to allow native species to have contiguous habitat and passage across the site and within the region rather than being isolated in island sanctuaries in a human settlement.

-STABILIZE SOIL/ DESERT CREEP: The sand sources need to be stabilized to prevent the movement of desert towards the site. It requires cordoning off the area from biotic influences by appropriate native plant species and allowing the area to develop with groundcover and small shrubs; gradually introducing scrub vegetation and medium trees.

-PREVENT AEOLIAN MOVEMENT/ EROSION: Wind barriers are provided around agricultural fields, reserves for medicinal plants, plantation etc against wind action to prevent deposition of sand over such areas. Wind barriers could have layers of vegetation with varying heights that trap airborne

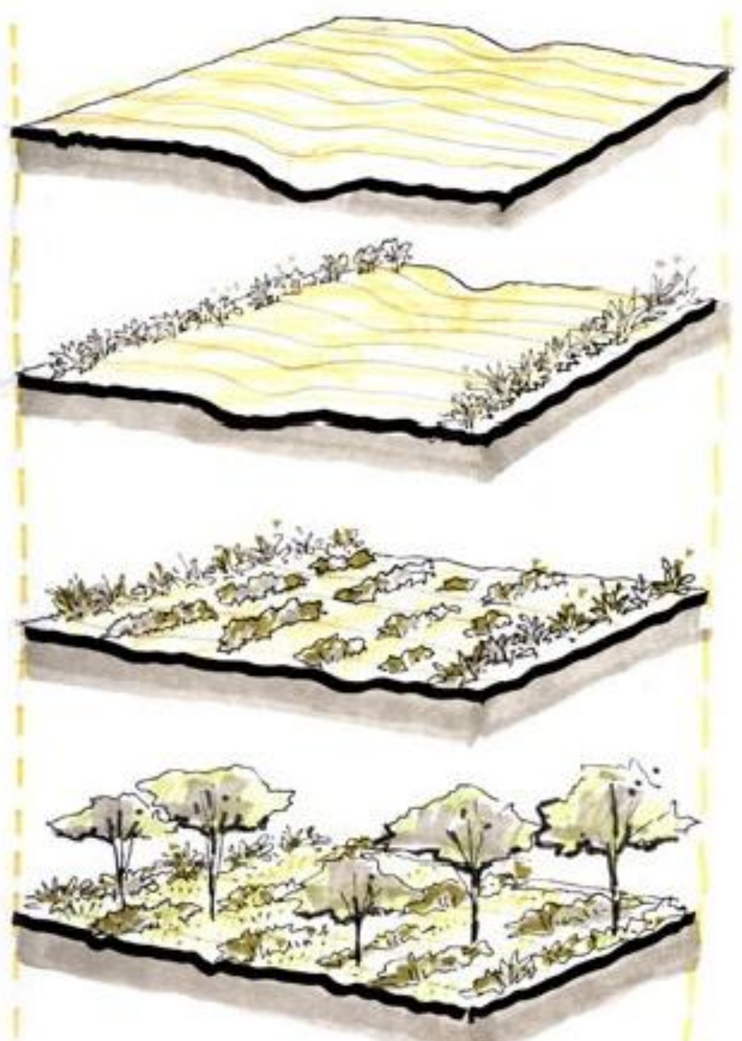


Fig.10.3.1a: Site condition A for Dedesertification control

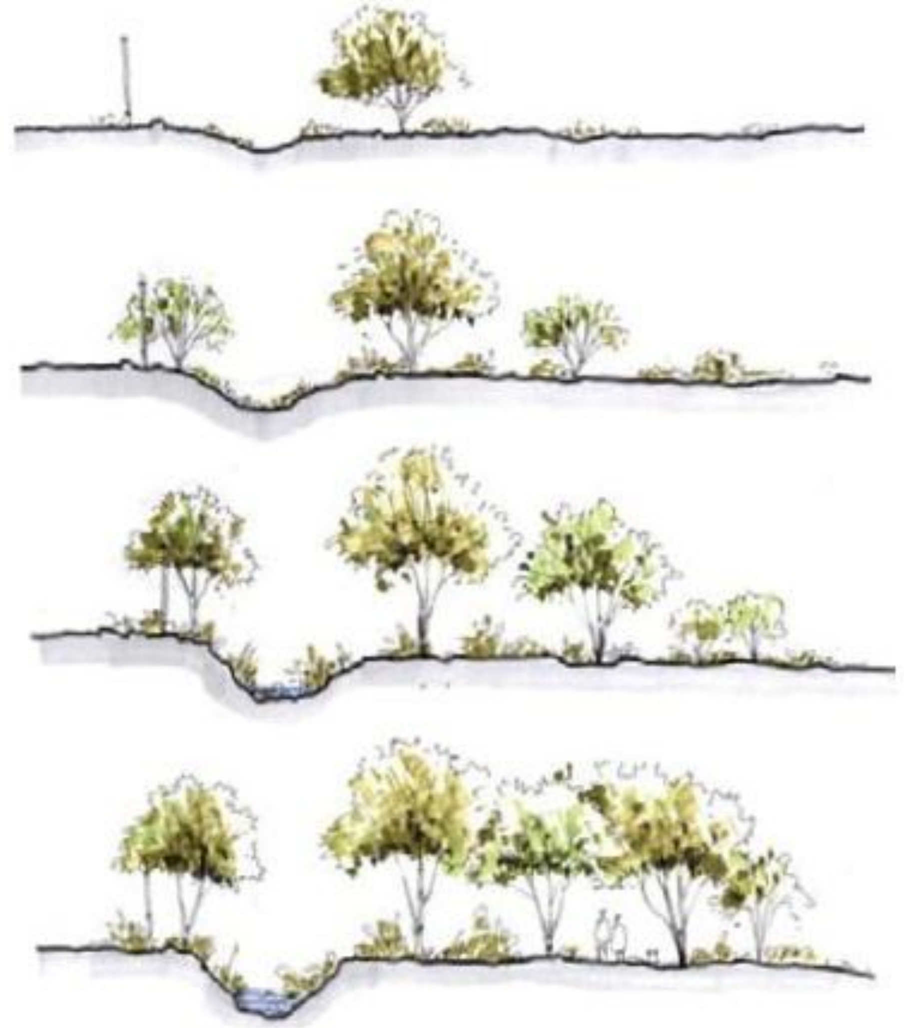


Fig.10.3.1b: Site condition B for Dedesertification control

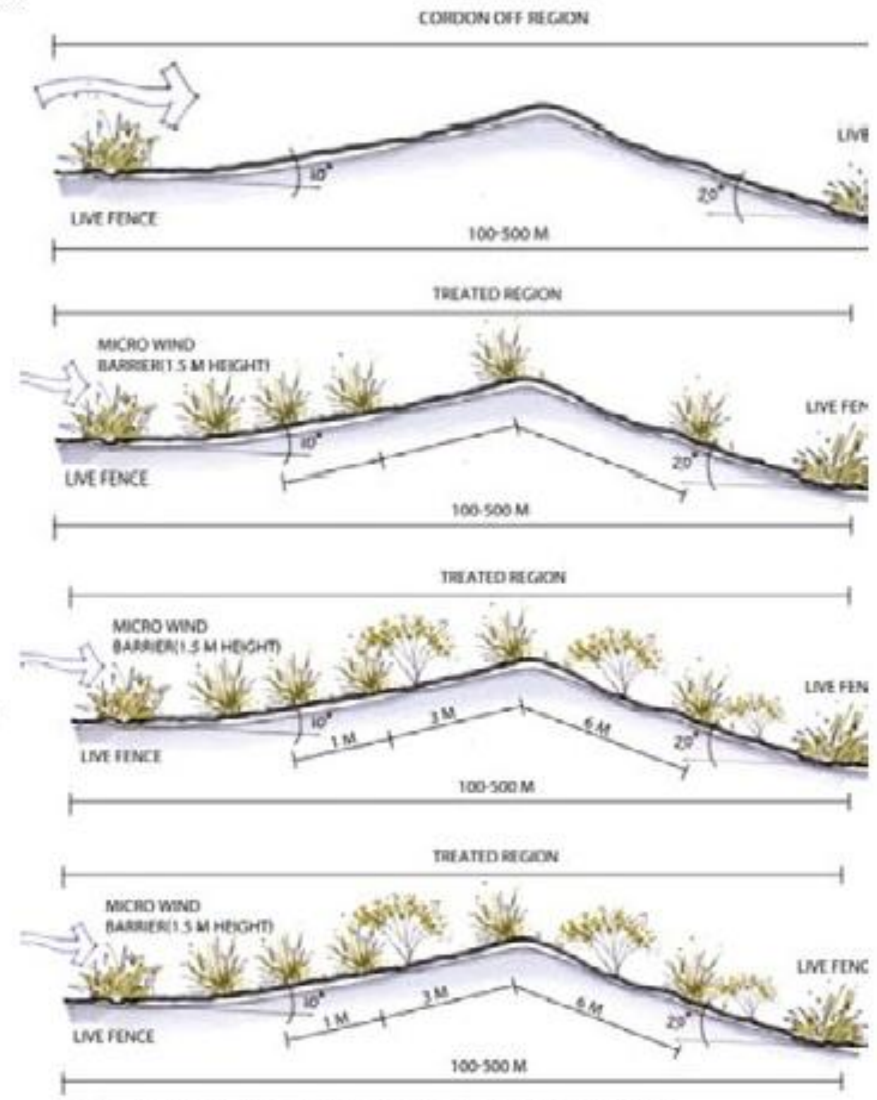


Fig.10.3.1c: Site condition C for Dedesertification control

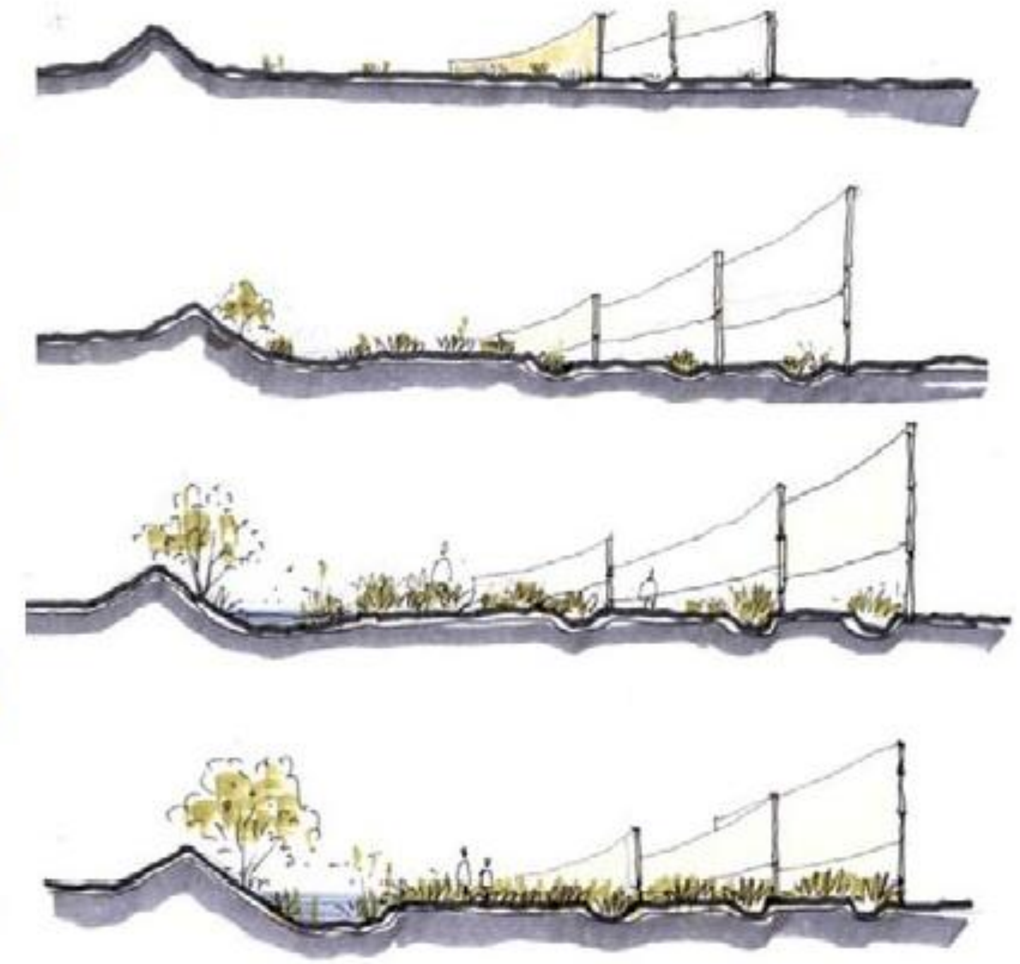
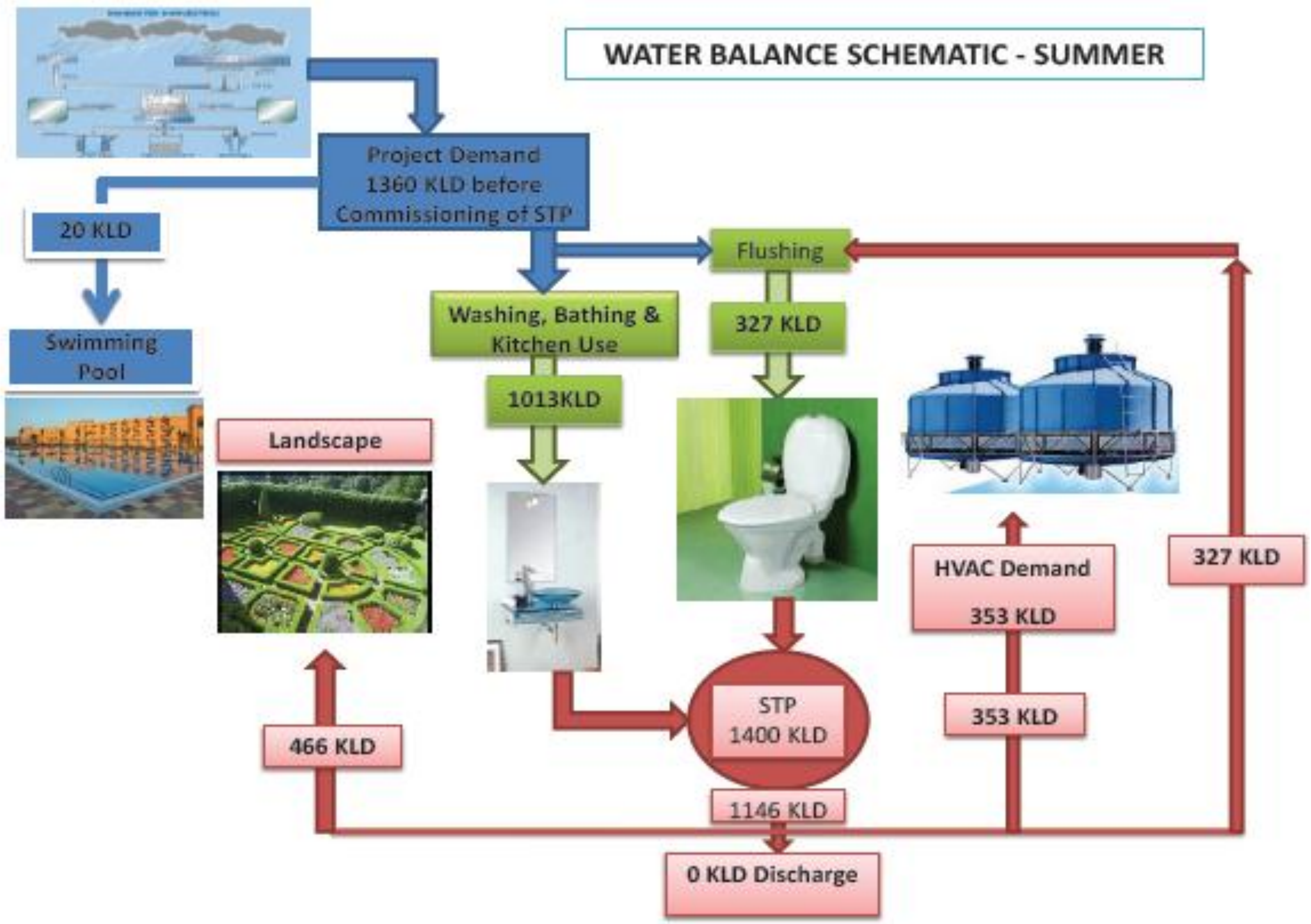


Fig.10.3.1d: Site condition D for Dedesertification Control

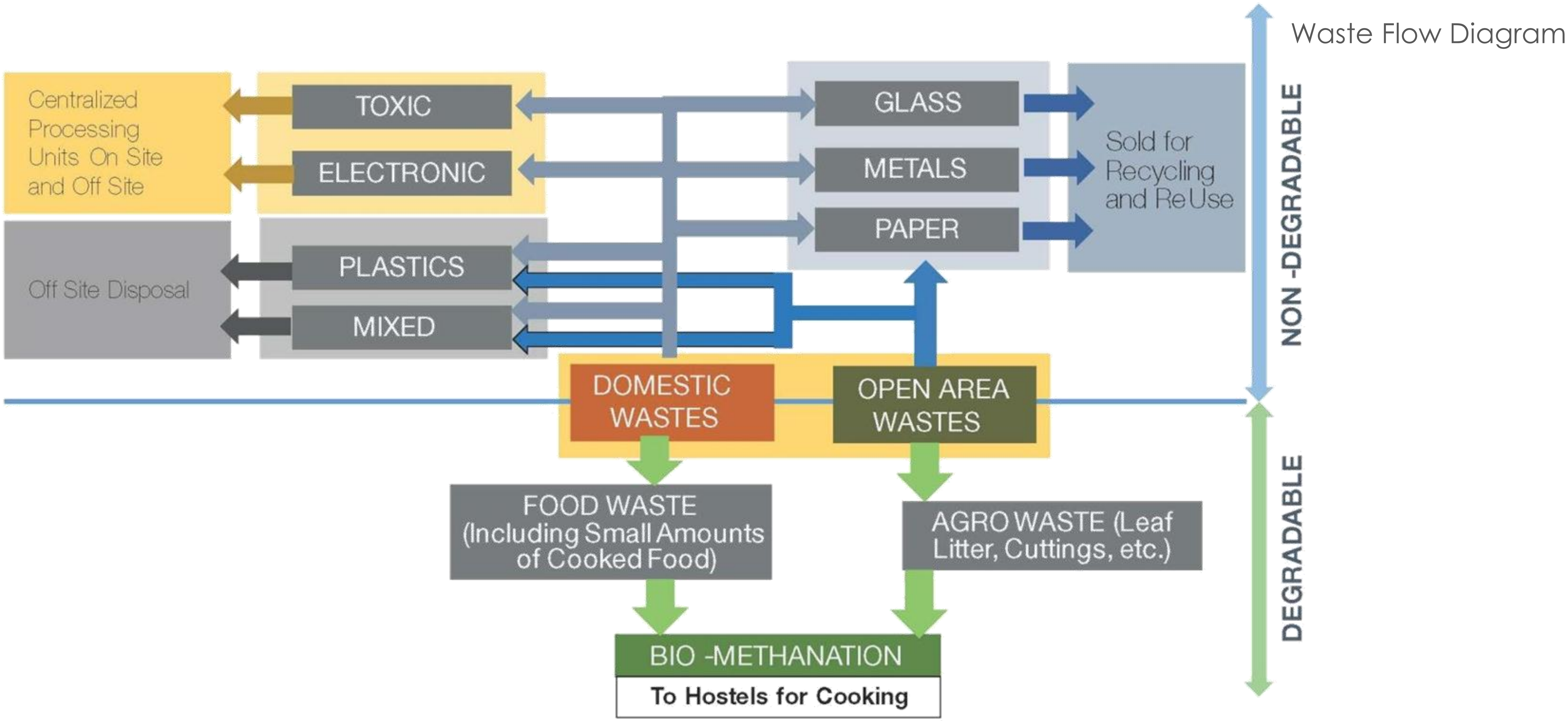
Landscape strategies

- Using hardy native species of plants, conserving water and improving soil moisture, while requiring little upkeep and resistant to diseases.
- Designing to absorb storm water even during extreme rainfall incidents and prevent erosion or flooding.
- The integrated agriculture plan provides appropriate space for organic agriculture suited to arid climates and improves soil moisture and controls desertification while keeping the campus chemical free.



Near Zero Water Campus

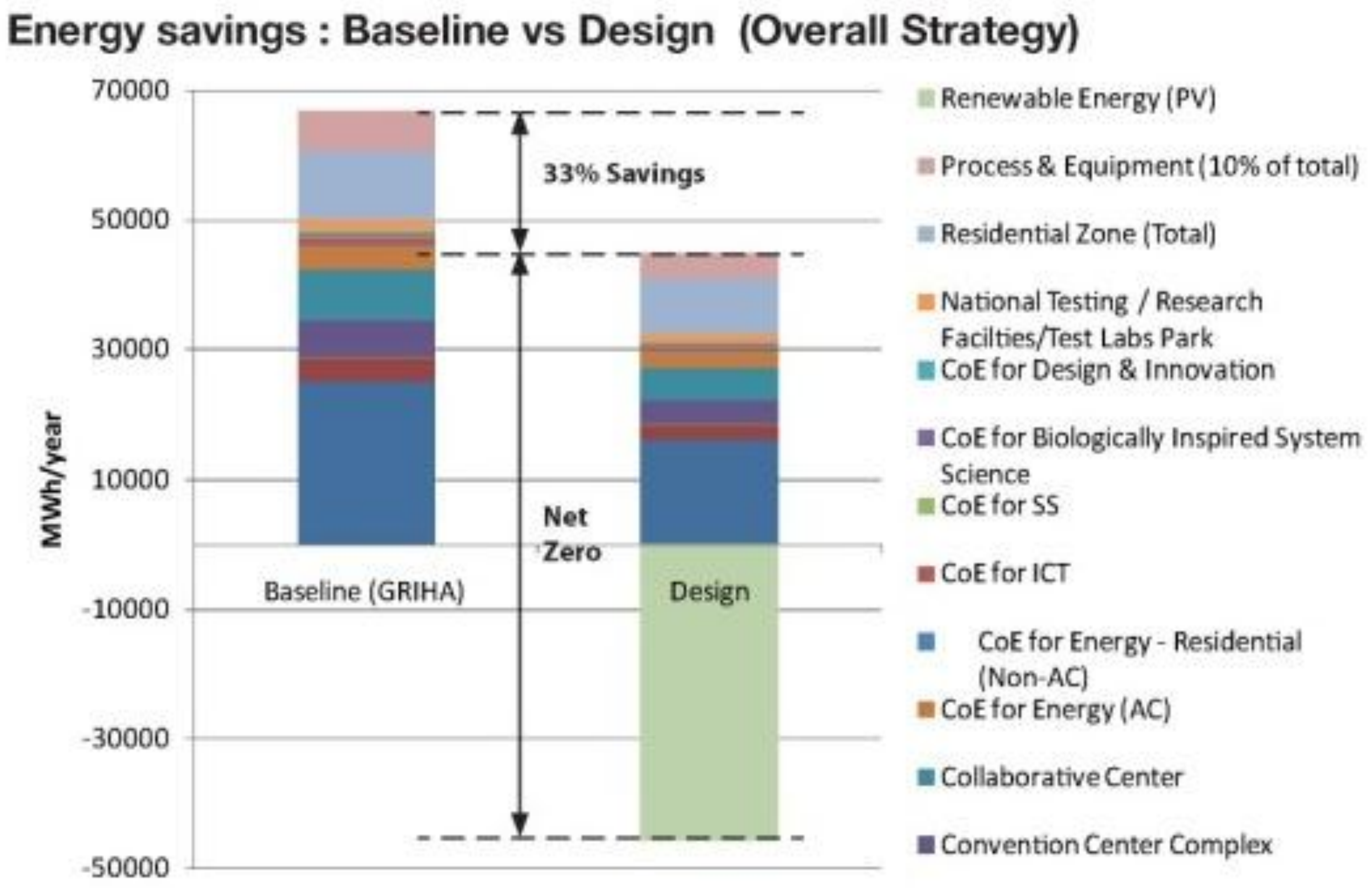
- The Campus aims to be NET-ZERO water at the completion of all its phases.
- The basic concept is to optimize the baseline, reduce demand wherever possible and use water-efficient technologies to minimize wastage.
- Capacity has been provided for rainwater harvesting as well as extensive reuse of treated grey and black water for non-potable uses within the Campus.
- The municipal supply will act as a backup in case of emergency situations. Native as well as drought resistant species of plants have been used to reduce the irrigation demand.

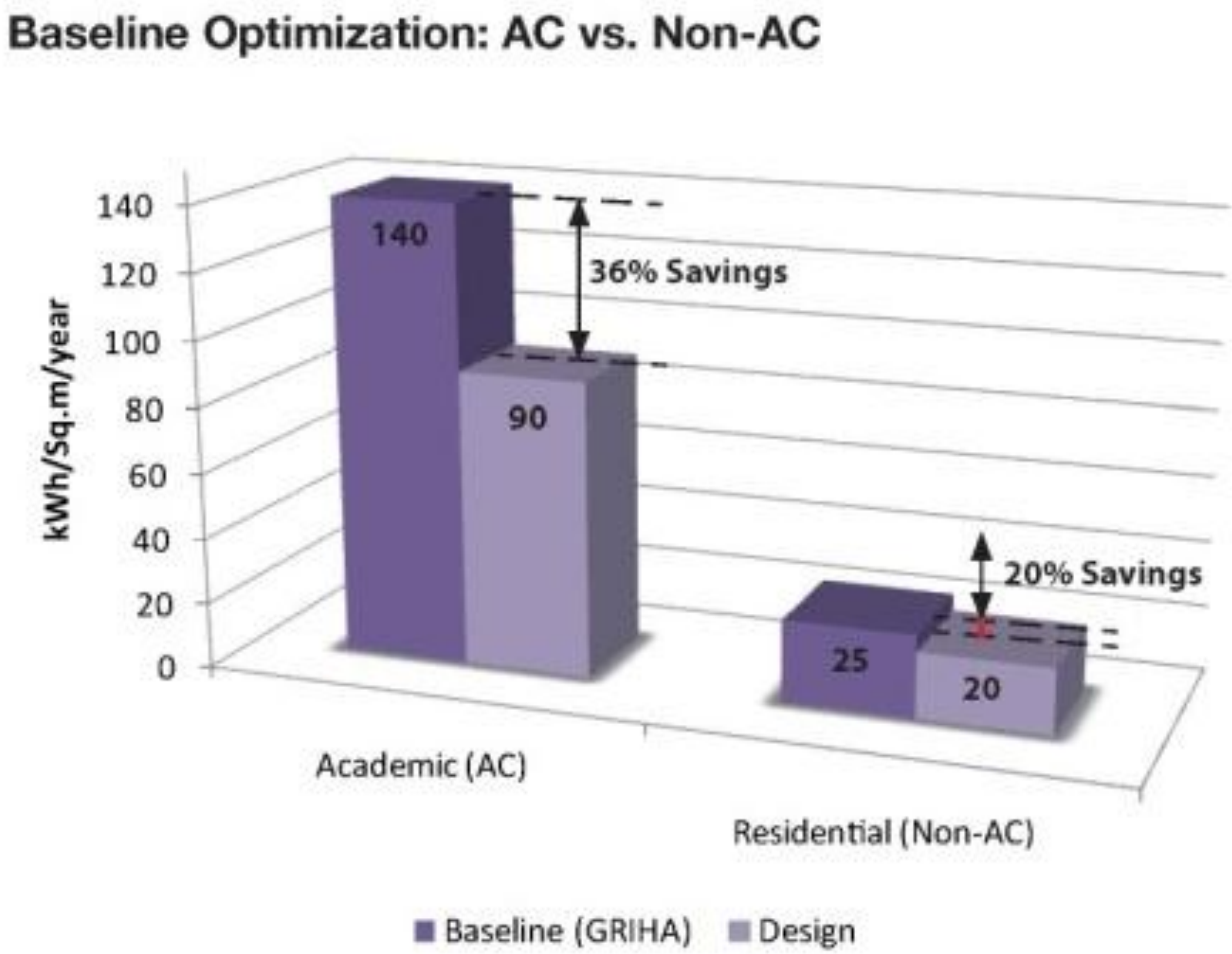


NOTE : VARIOUS COMPONENTS CAN BECOME IITJ MICRO -PROJECTS AND/OR COMMUNITY PROGRAMS

Net-Zero Waste Campus

- The Campus aims to be NET-ZERO waste at the completion of all its phases.
- Segregation-at-source, regular waste collection and a central waste sorting area have been proposed to optimize the waste management process. Strategies to deal with various types of waste have also been suggested.
- Followed efficiently, the Campus may be able to successfully divert 100% of its waste from the landfill site.

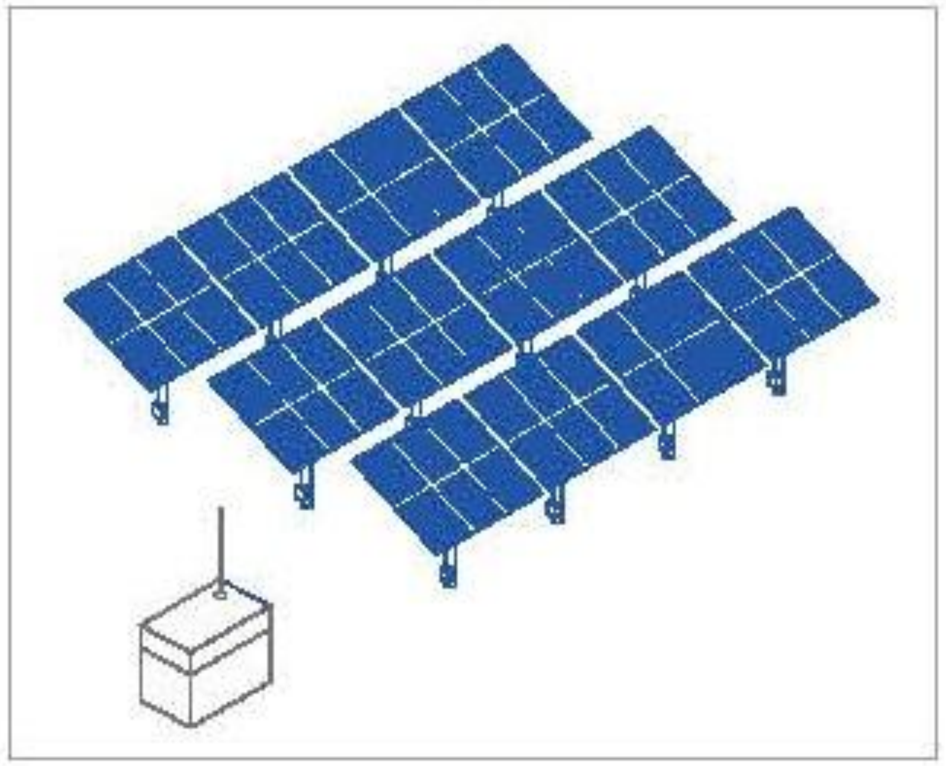




Net Zero Energy Campus

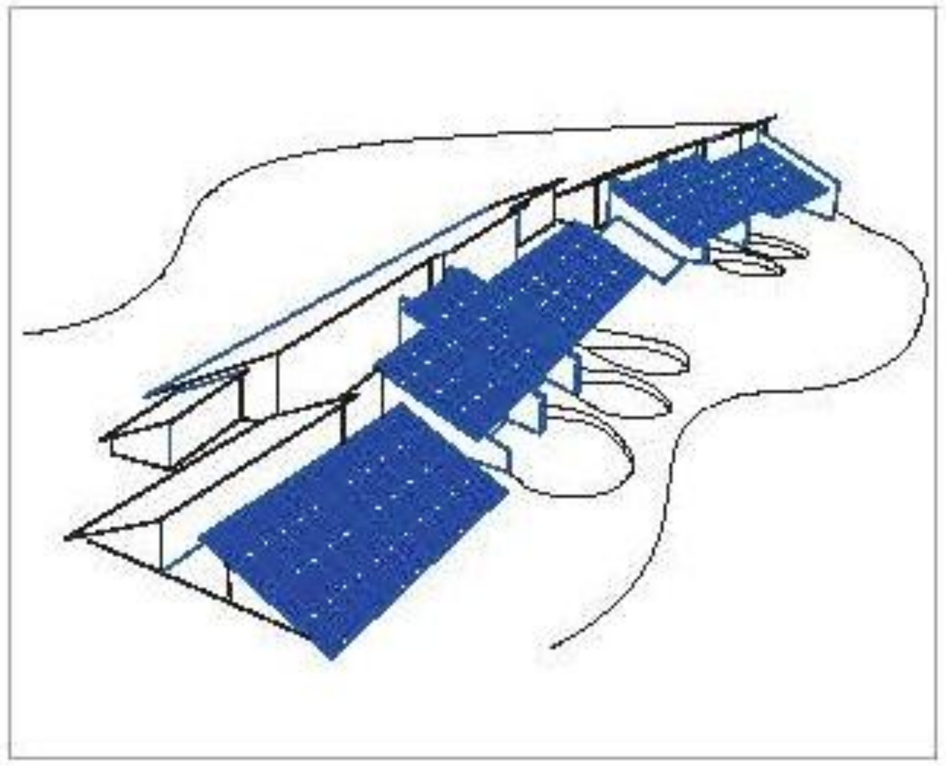
The energy consumption of this campus is reduced to about one-third of business-as-usual with passive and traditional techniques of building (expected energy use = 45 kWh/sqm.yr instead of 130-160 kWh/sqm.yr), integrated with renewable energy technologies, with compact building clustering, and by encouraging a low energy lifestyle (creating a 250 W society). The buildings shall be some of the most energy efficient and low resource consuming buildings globally.

Solar Park



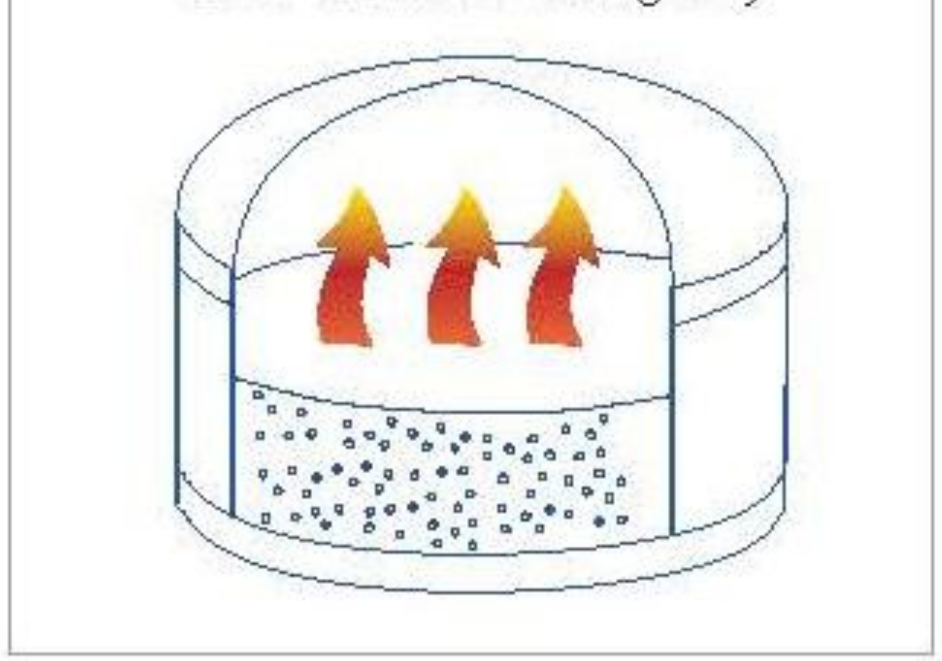
15 MW

Roof-top PV



7.5 MW

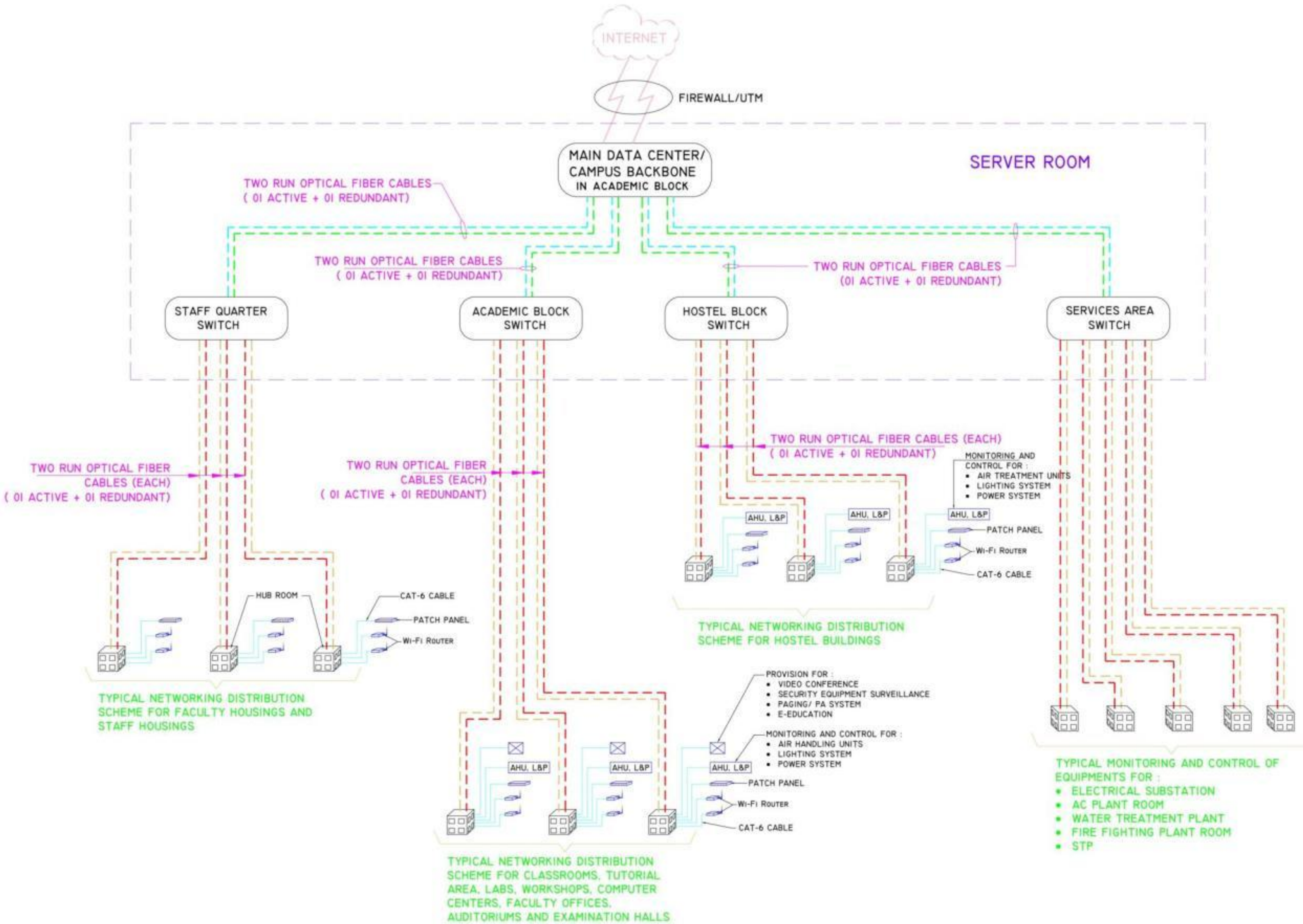
Bio-gas



Net Zero Energy Campus

With 15 MWe consolidated and the 7.5 MWe roof distributed solar generation smart grid systems operational, this becomes a net-zero energy campus for a population of 14,880 people, with almost no captive power or net grid contribution.

Schematic of Network Diagram



ICT *Information Communication Technology*

The plan provides for a high speed ICT backbone with distributed hubs for flexible data exchange within and outside the campus, providing information, communication, security, and access control.

ICT systems make a smart intelligent eco-campus by capturing extensive data about the energy, water, waste, and mobility on campus and integrating them in the campus management systems.

The campus community is itself going to be enabled for learning anywhere, anytime, by the ICT backbone.

Low flow fittings with aerators will provide water conservation

	Griha Base Case (lpf/lpm)	25 % Reduction (lpf/lpm)	50% Reduction (lpf/lpm)
Water closets	**9**	**6.75**	**4.5**
Kitchen faucets	**15**	**11.25**	**7.5**
Lavatory faucets	**15**	**11.25**	**7.5**
Lpf/lpm = liters per flow/liters per minute			

Flushes to be 2/4 litres

For cleanliness, there shall be no floor mounted EWC

Wall-hung EWC

IWC shall be stepped up

The hot water shall be 100% solar in all buildings but 100% backed up with low wattage (1 kW) inline geyers installed at user discretion

Rooftop solar thermal

1kW geyser

Location of Decentralized Wastewater Treatment Plants (DWTS)

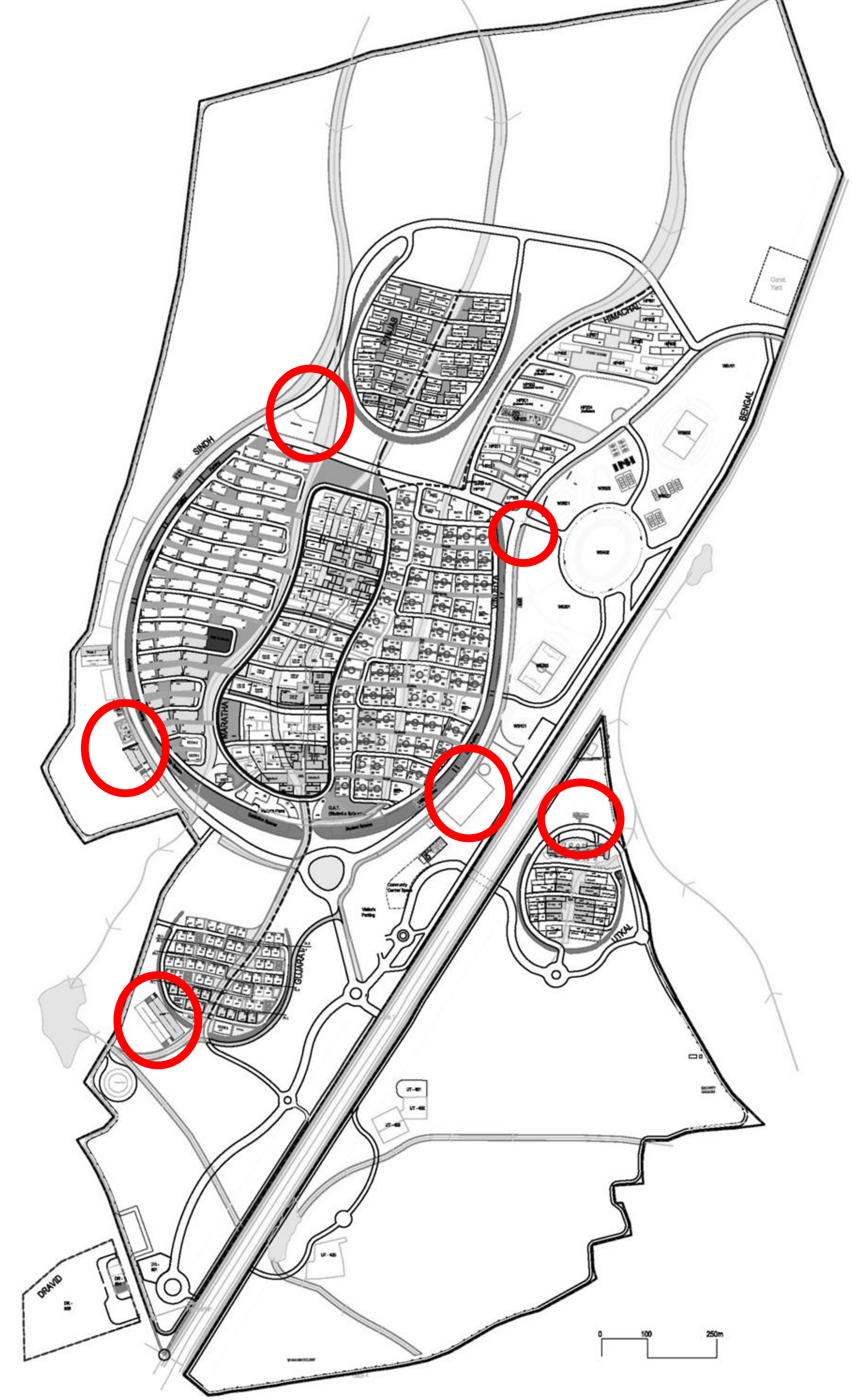
•The grey and black water is collected in the sewage system to go to the DWTS

•One central modular DWTS shall have baffle tanks, planted gravel filter, and some ozonized tertiary treatment and some polishing ponds, all centralized within the campus to five locations.

•Biogas shall be extracted from the residential and hostel sewage to provide partial cooking for hostels

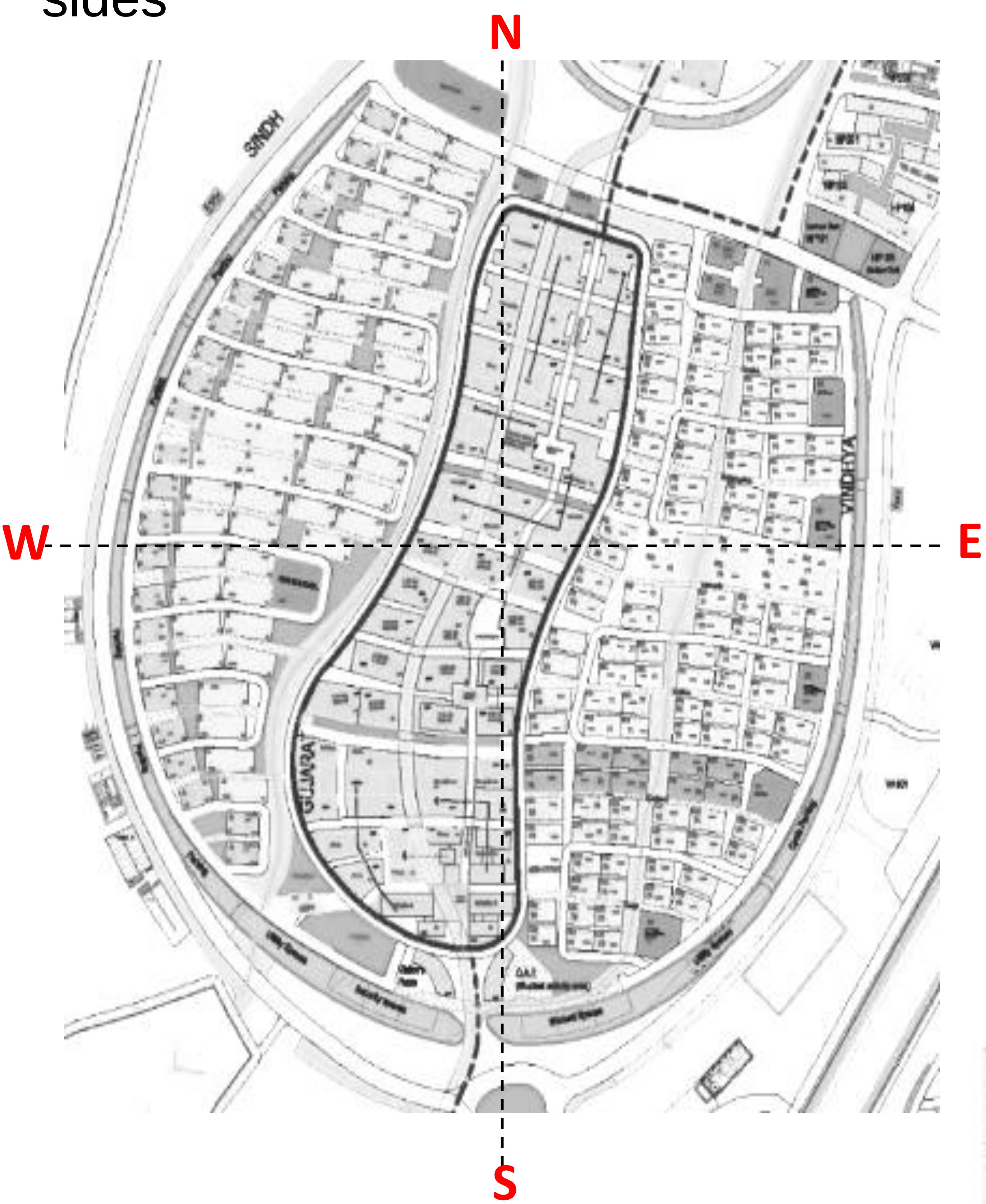
•The "Floating Drum" type of biogas plant will be used.

•DWTS water shall be used for flushing (second hydro-pneumatic system), irrigation (third hydro-pneumatic system, but switched on at fixed times), and HVAC (cooling towers, blended with rain water, see below) in that order of priority



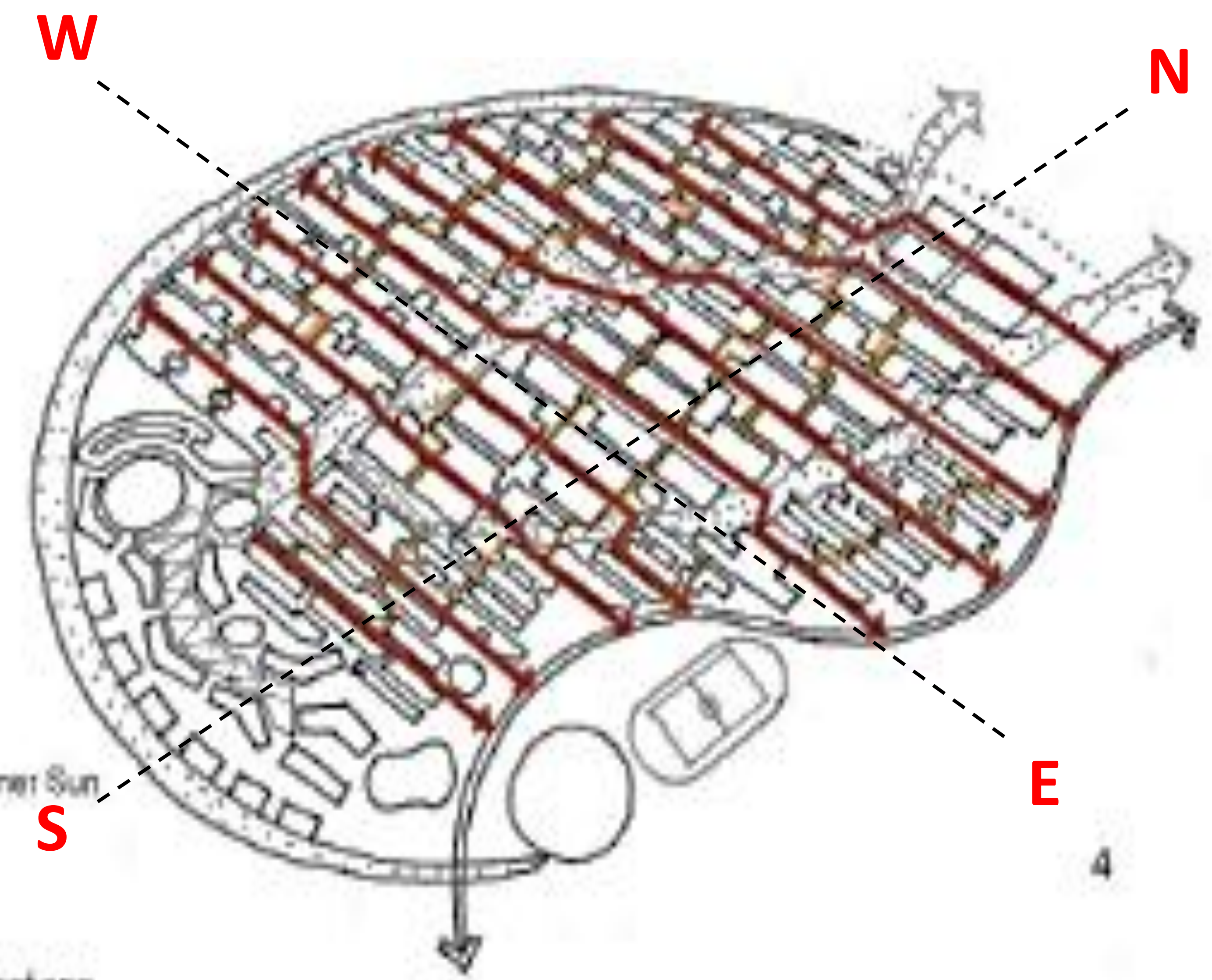
Special Features

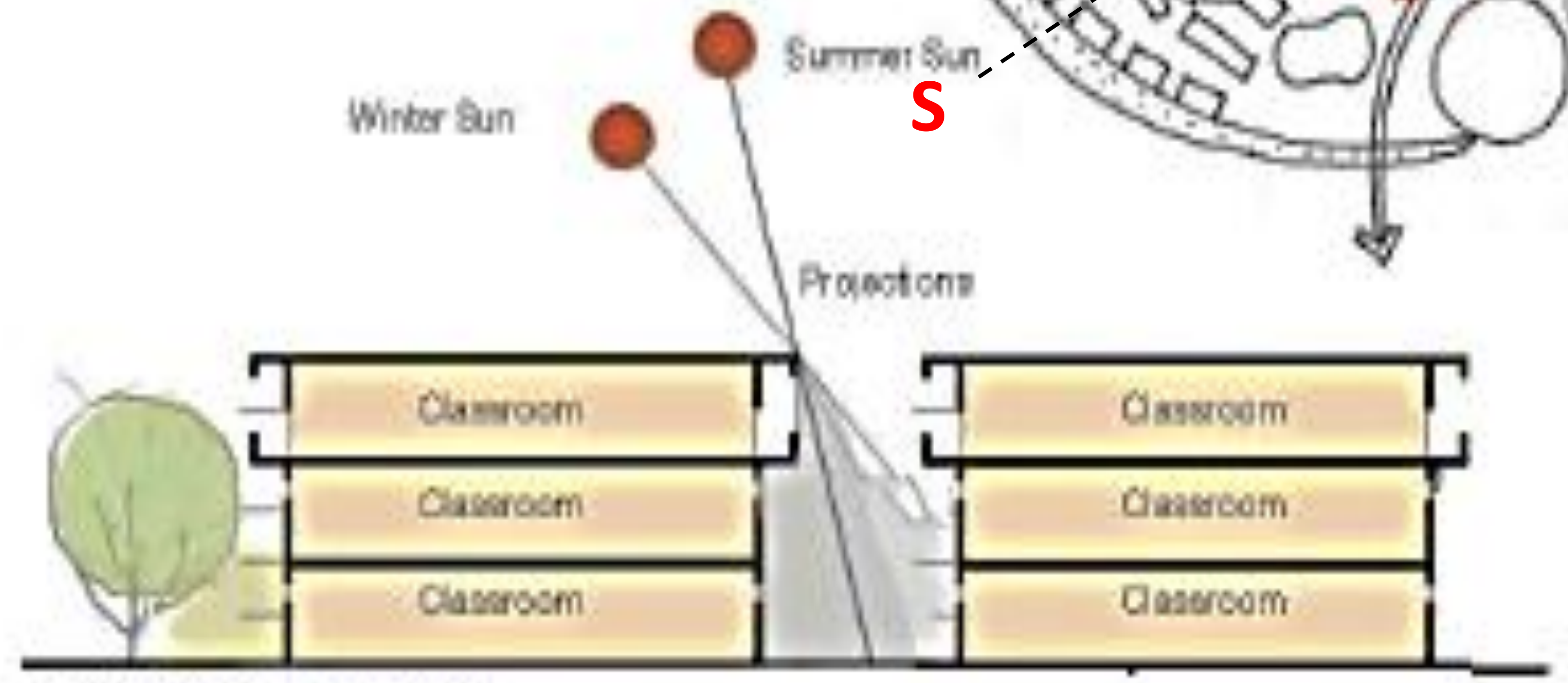
East West Oriented Streets of the campus are shaded by buildings on both sides



4. Narrow & Shaded Streets

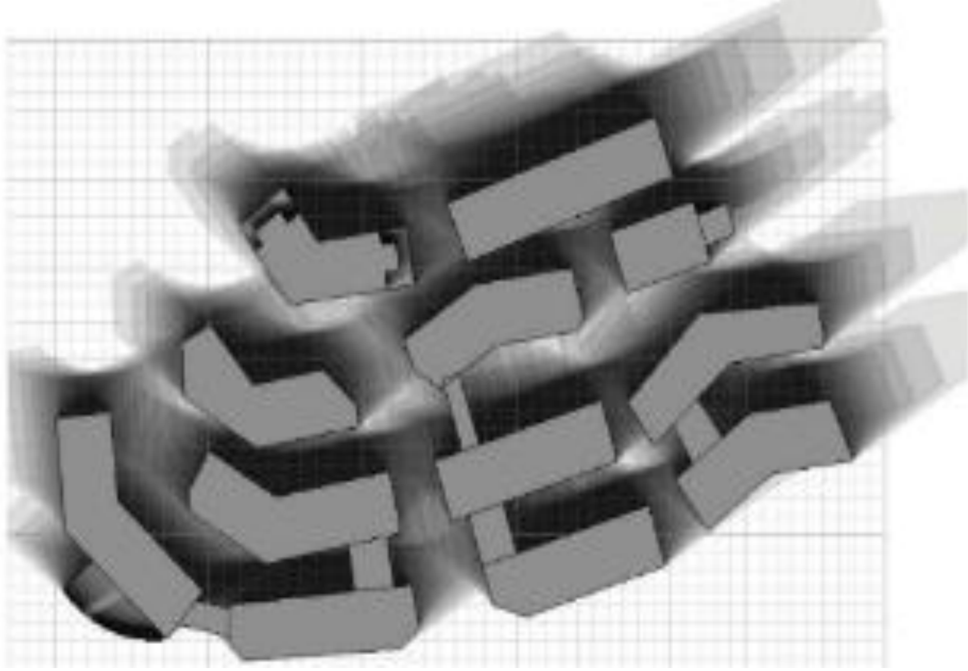
Streets are narrow to create shade and protection. The main streets run in the East-West direction. They are linked through a series of fine-grained pedestrian streets which run in the North South direction The streets will be narrow, suitably shaded in the summers to allow for comfortable pedestrian movement. The dense settlement pattern also aids mutual shading of buildings and shaded streets.



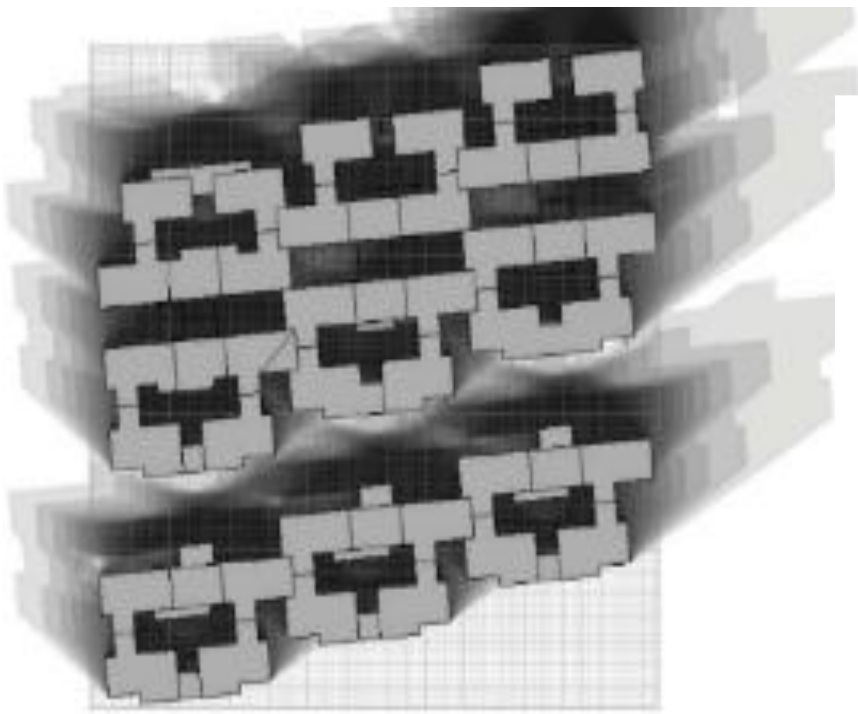


Section through the courtyard

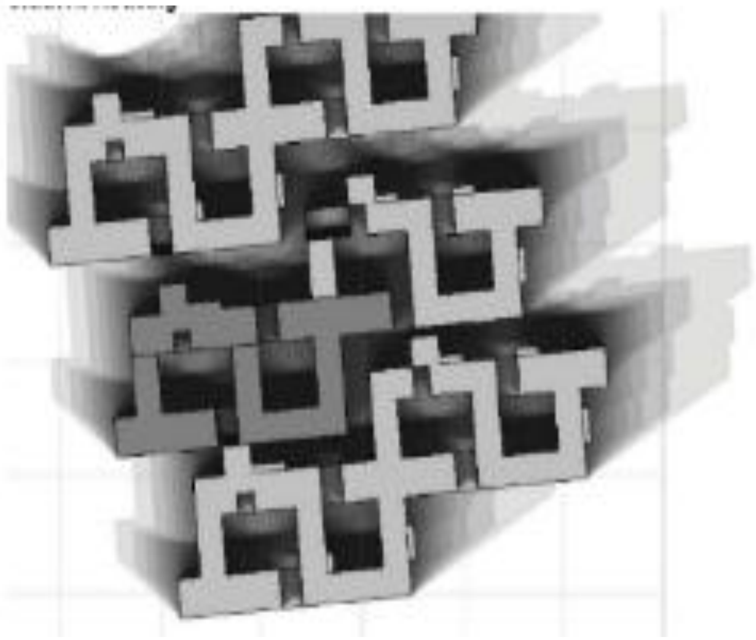
Academic Blocks



Staff- Faculty Housing



Student Housing



Urban Design Guidelines of the Campus are such that buildings provide **mutual shading** to the campus residents during day

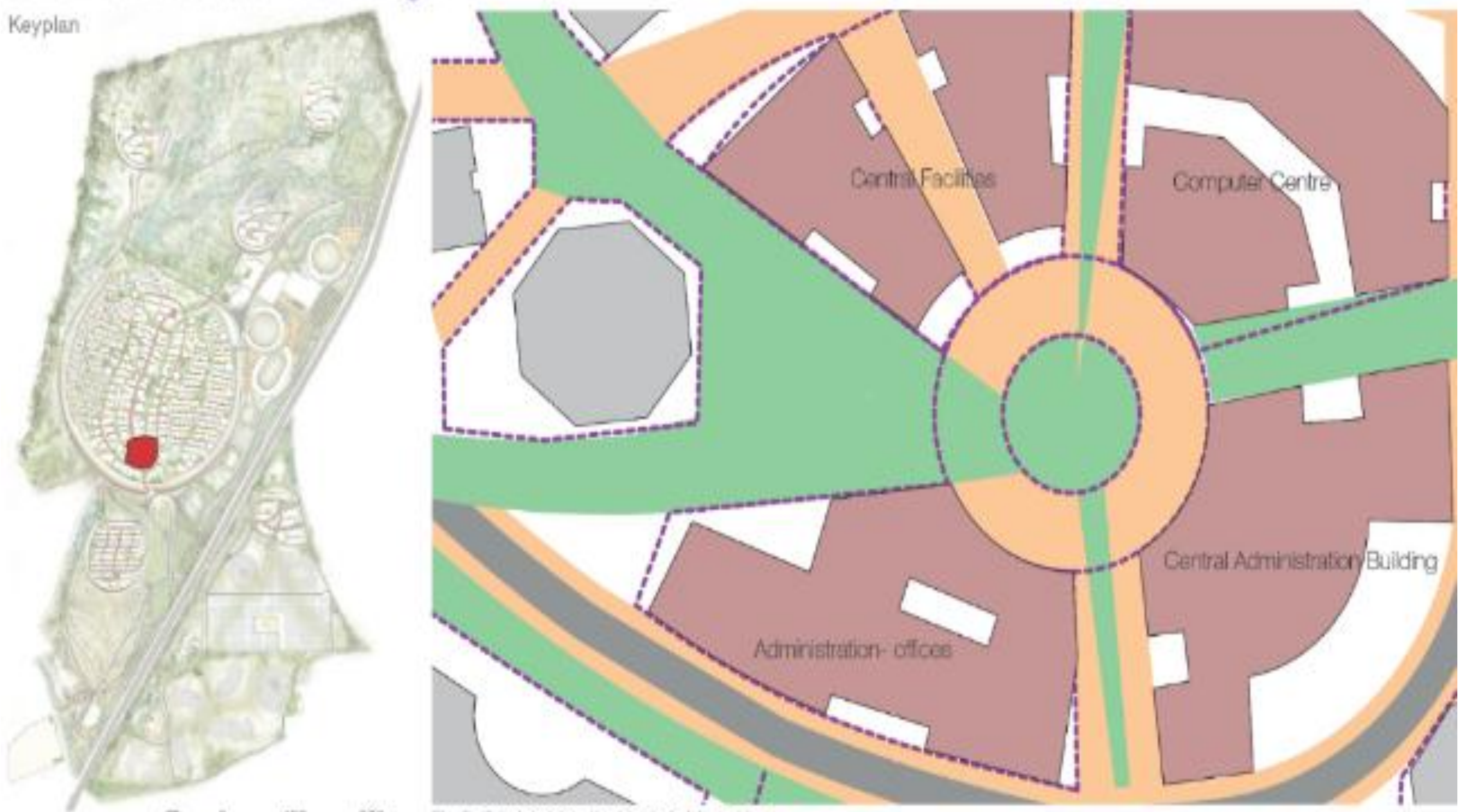
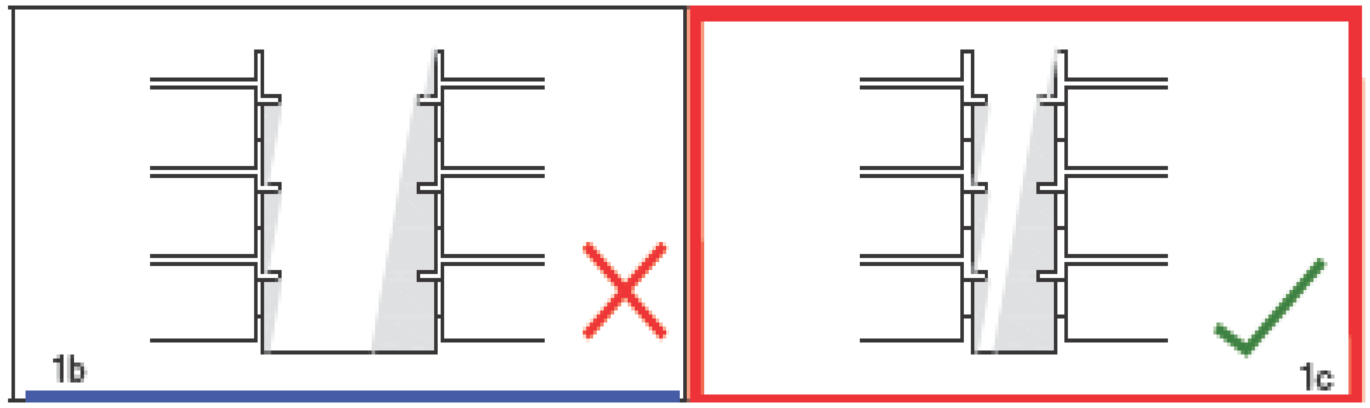


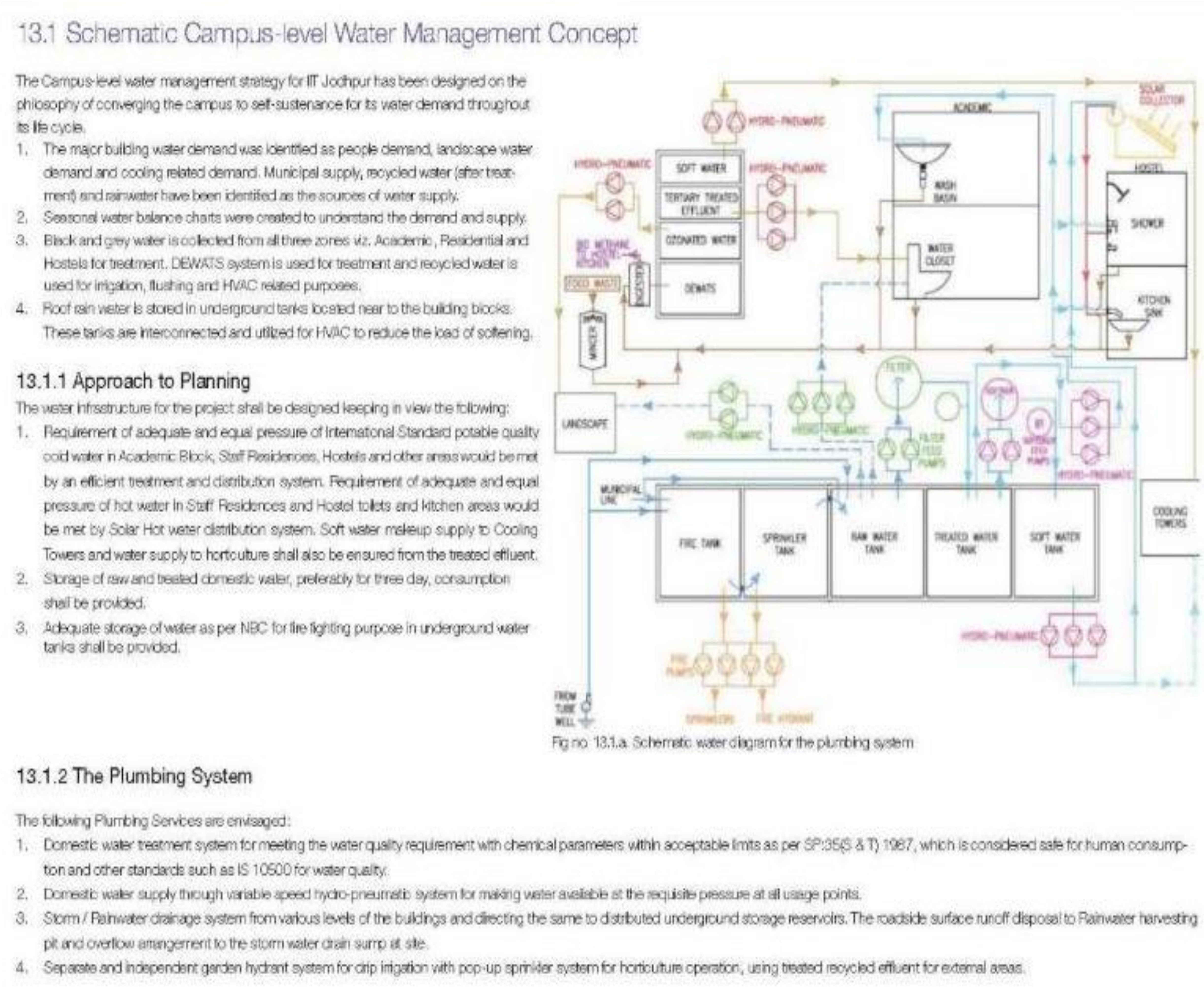
Fig. 5a.8a. Administration blocks in Masterplan




POTENTIAL EXPRESSIONS FOR STAFF HOUSING


VIEW OF TYPICAL STAFF HOUSING COURTYARD

Hydro pneumatic system of water supply in the IITJ Campus



13.1 Schematic Campus-level Water Management Concept

The Campus-level water management strategy for IIT Jodhpur has been designed on the philosophy of converging the campus to self-sustenance for its water demand throughout its life cycle.

1. The major building water demand was identified as people demand, landscape water demand and cooling related demand. Municipal supply, recycled water (after treatment) and rainwater have been identified as the sources of water supply.
2. Seasonal water balance charts were created to understand the demand and supply.
3. Black and grey water is collected from all three zones viz. Academic, Residential and Hostels for treatment. DEWATS system is used for treatment and recycled water is used for irrigation, flushing and HVAC related purposes.
4. Roof rain water is stored in underground tanks located near to the building blocks. These tanks are interconnected and utilized for HVAC to reduce the load of softening.

13.1.1 Approach to Planning

The water infrastructure for the project shall be designed keeping in view the following:

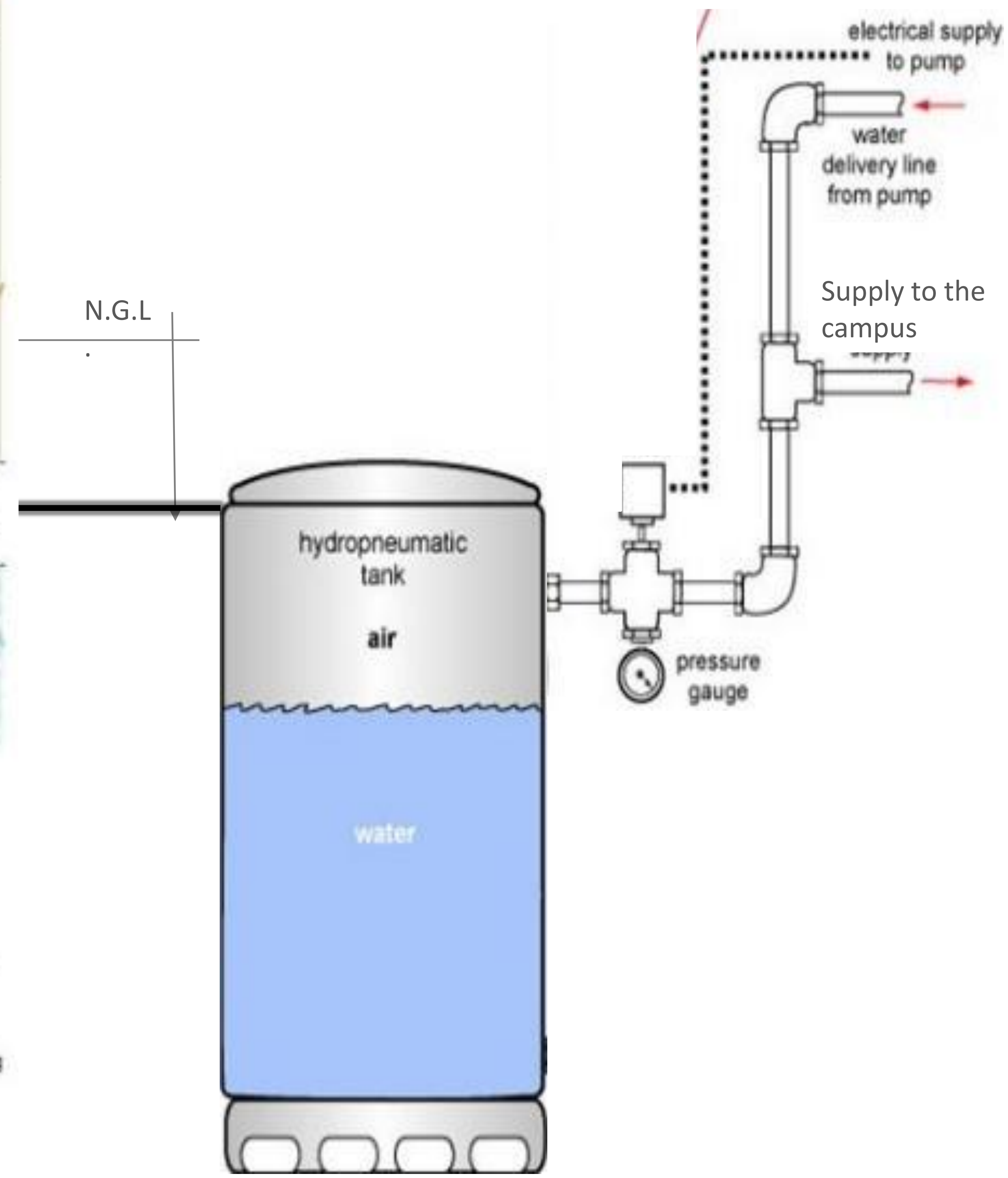
1. Requirement of adequate and equal pressure of International Standard potable quality cold water in Academic Block, Staff Residences, Hostels and other areas would be met by an efficient treatment and distribution system. Requirement of adequate and equal pressure of hot water in Staff Residences and Hostel toilets and kitchen areas would be met by Solar Hot water distribution system. Soft water makeup supply to Cooling Towers and water supply to horticulture shall also be ensured from the treated effluent.
2. Storage of raw and treated domestic water, preferably for three day, consumption shall be provided.
3. Adequate storage of water as per NBC for fire fighting purpose in underground water tanks shall be provided.

Fig no. 13.1.a Schematic water diagram for the plumbing system

13.1.2 The Plumbing System

The following Plumbing Services are envisaged:

1. Domestic water treatment system for meeting the water quality requirement with chemical parameters within acceptable limits as per SP:35(S & T) 1987, which is considered safe for human consumption and other standards such as IS 10500 for water quality.
2. Domestic water supply through variable speed hydro-pneumatic system for making water available at the requisite pressure at all usage points.
3. Storm / Rainwater drainage system from various levels of the buildings and directing the same to distributed underground storage reservoirs. The roadside surface runoff disposal to Rainwater harvesting pit and overflow arrangement to the storm water drain sump at site.
4. Separate and independent garden hydrant system for drip irrigation with pop-up sprinkler system for horticulture operation, using treated recycled effluent for external areas.



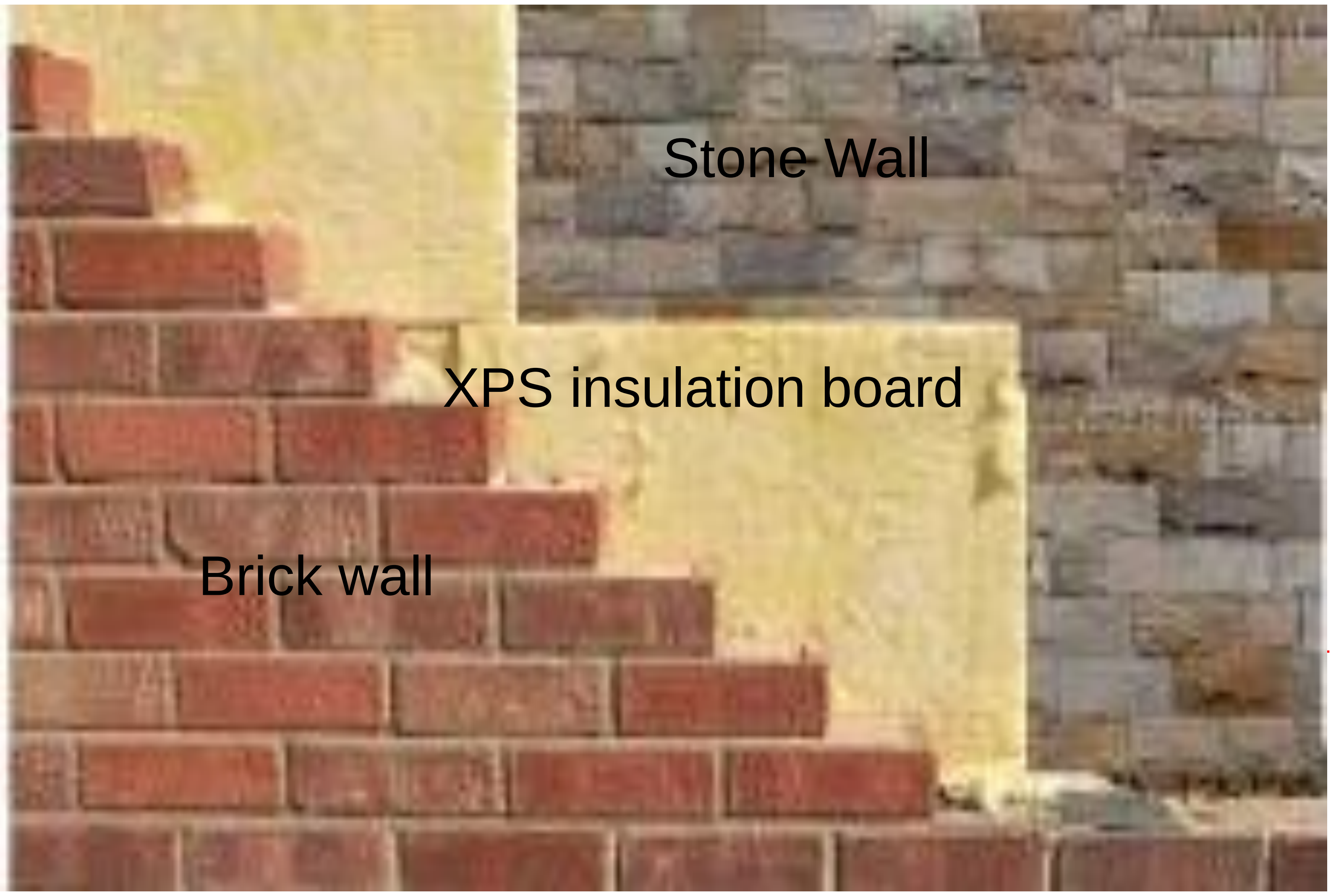
Load Reduction Strategies


Table. 5a.9.ii

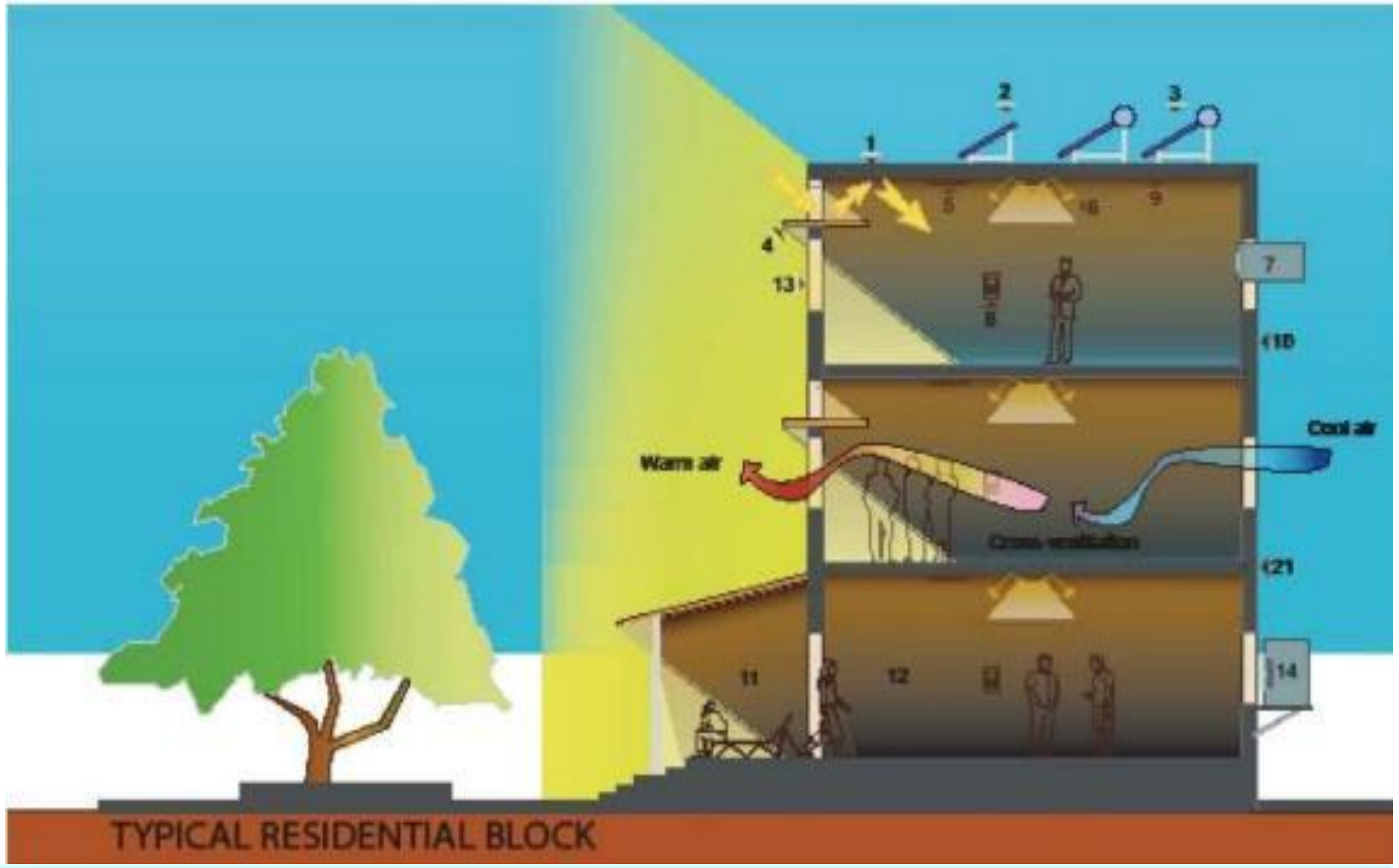
5a.9.7 Material Palette

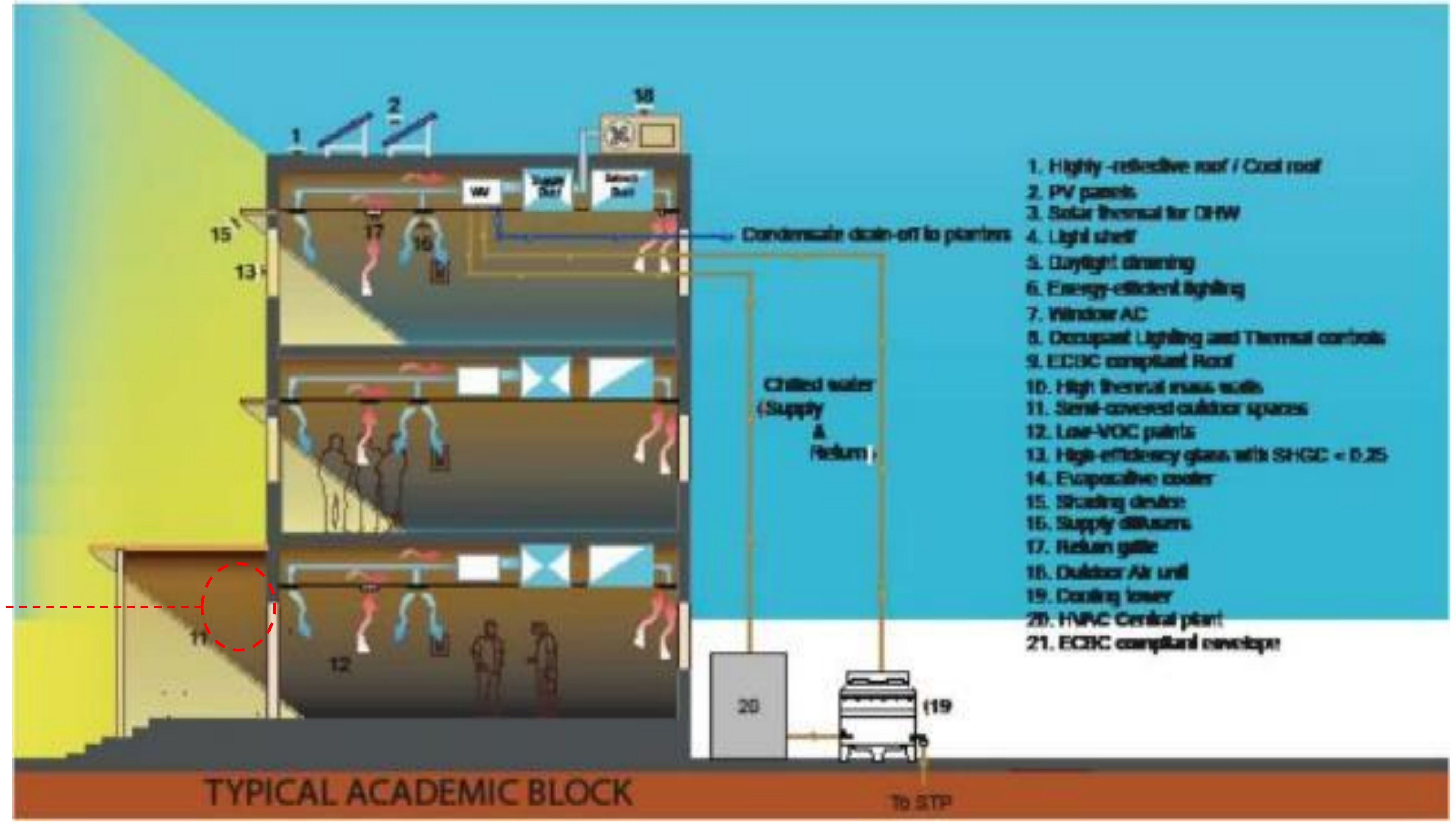
1. The material palette should be chosen based on the following parameters:
   i. Low-embodied energy
   ii. Locally available
   iii. Rapidly renewable
   iv. Containing recycled content
   v. Low/No VOC[#]
2. Materials like sandstone and marble that are locally available and generate local employment should be preferred.
3. No exterior paints shall be done on any surfaces. No external plaster on any surfaces.
4. Natural pigments can be allowed to be mixed with lime plaster for finishes.
5. Roof surfaces (exterior) to be a High albedo surface. And to be made available for roof top solar SPV[#]- Hot water by raising it to a level so that roof does not becomes unusable.
6. Use of insulation and thermal mass to reduce heat gain as prescribed.
7. Colours to be of mainly earthy tones. Colours should have a maximum reflectivity index[#] of 50, and both the primary and accent colours should be complementary and derived from the desert palette. Saturated bright colours should be avoided. No blacks (as they absorb heat), no highly reflective materials (that may cause glare).
8. Steel to be minimized for construction.
9. Window frames to be of material that have low thermal conductivity[#] values.
10. Flooring materials like locally available stone, terrazzo flooring in situ/tiles(using recycled content), cement flooring etc. are preferred.
11. Architects shall be responsible to get the material palette and the colour palette approved by the CMP at two stages: concept design and the tender stage. In case of any discrepancy, the right for selection or rejection and final decision depends on the CMP/Institute.

Double wall system having XPS Insulation



Schematic section showing passive and active energy management strategies





GRIHA LD Rating criteria

GRIHA LD assess the % of overall impact of the development. Lower the % of impact, higher is the GRIHA LD rating. The rating system evaluates on the following basis:-

Overall Impact - I_t	Rating
75% - 66%	★
65% - 56%	★★
55% - 46%	★★★
45% - 36%	★★★★
35% - 25%	★★★★★

The table above suggests that 5 star GRIHA rating requires impact to be between 35% to 25%.

Impact assessment Summary, GRIHA LD – IITJ

Final Design Impact - Quantitative			
Section	Quantative Impact (from 0 to 100%) (Qn)	Normalizing multiplier (M)	Final impact score in each section
Site Planning	50	0.9	45.0
Energy	0	1.0	0.0
Water	45	1.0	45.0
Waste	0	0.8	0.0
Transport	10	0.9	9.0
Total			19.8

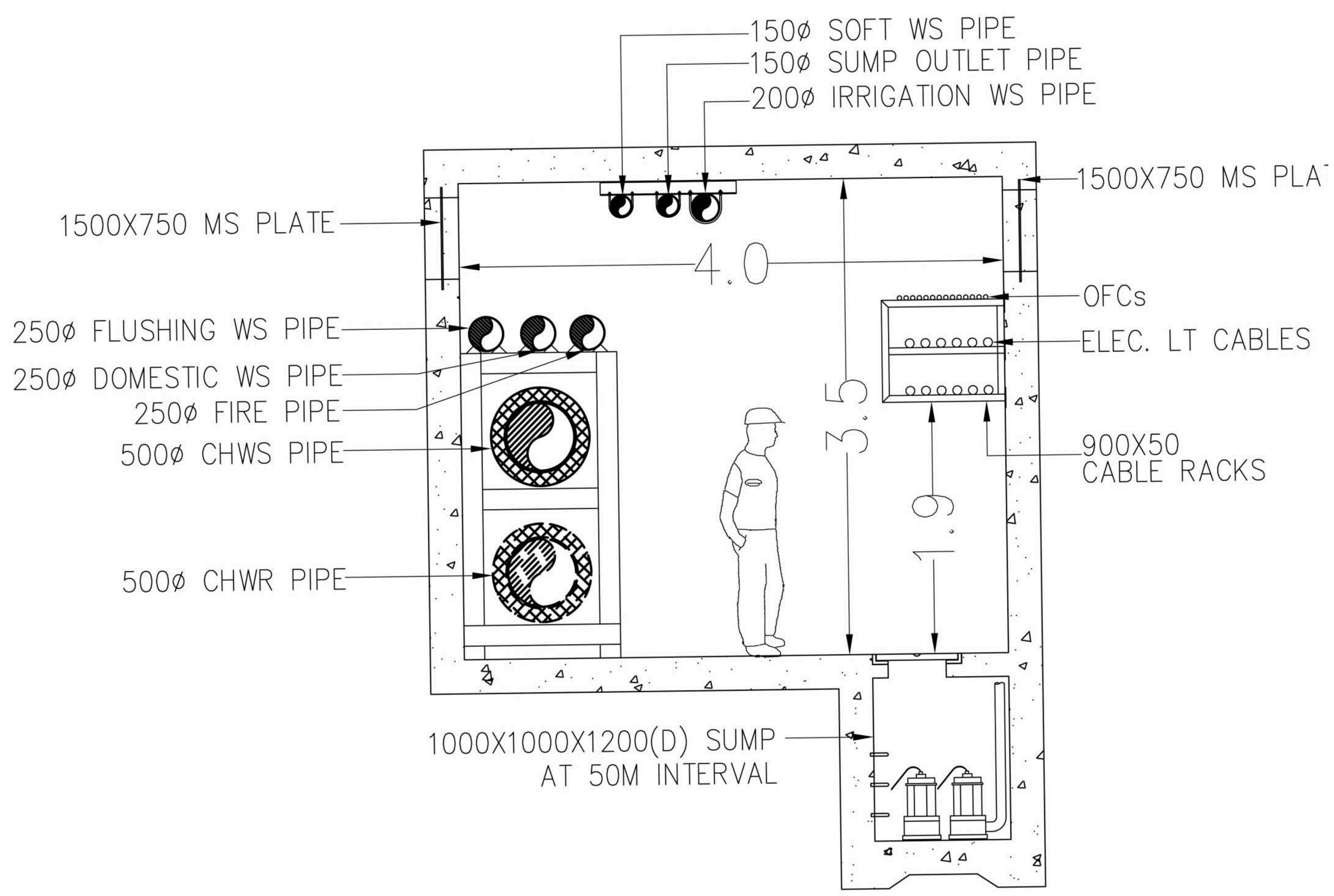
Final Design Impact - Qualitative				
Section	Point score	Qualitative Impact (from 0 to 100%) (Ql)	Normalizing multiplier (M)	Final impact score in each section
Site Planning	100	0	1.0	0.0
Energy	85	15	0.8	12.0
Water	100	0	0.9	0.0
Waste	100	0	0.8	0.0
Transport	100	0	0.9	0.0
Social	85	15	0.9	13.5
Total				4.3

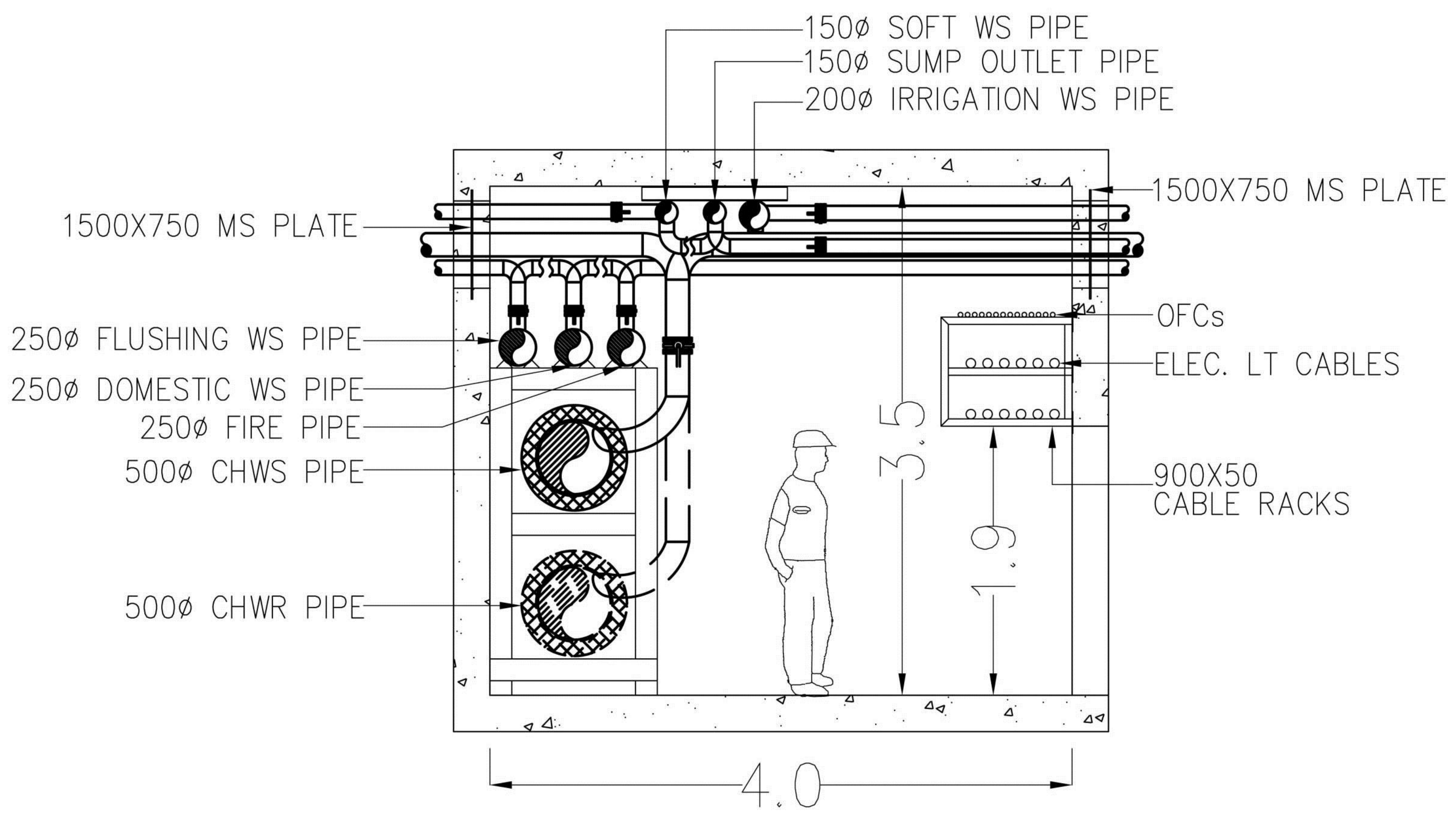
Net Impact	17.7%

Impact of the of the IITJ development is even less than 25%. **This suggests that the campus is even better than a 5 star GRIHA LD rated development**

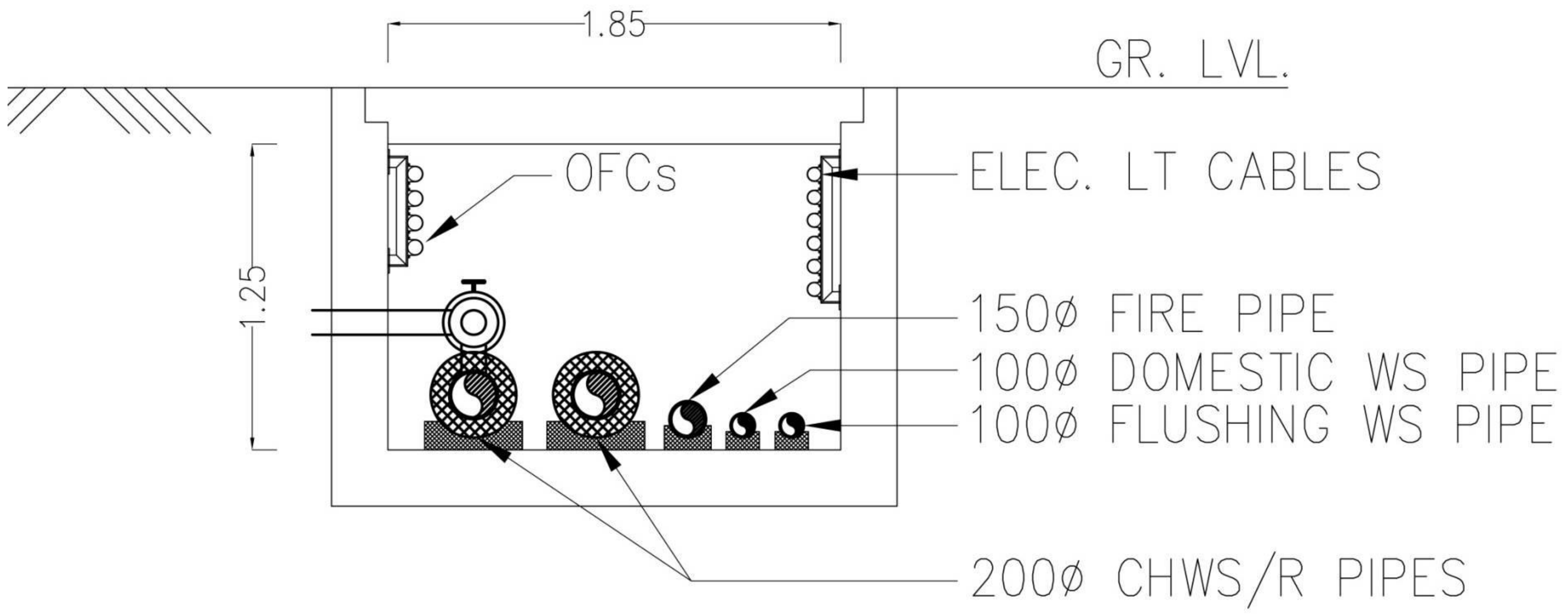
Utility Tunnel

The distribution of pressure and wired services shall be through main service tunnel and trenches for ease of maintenance

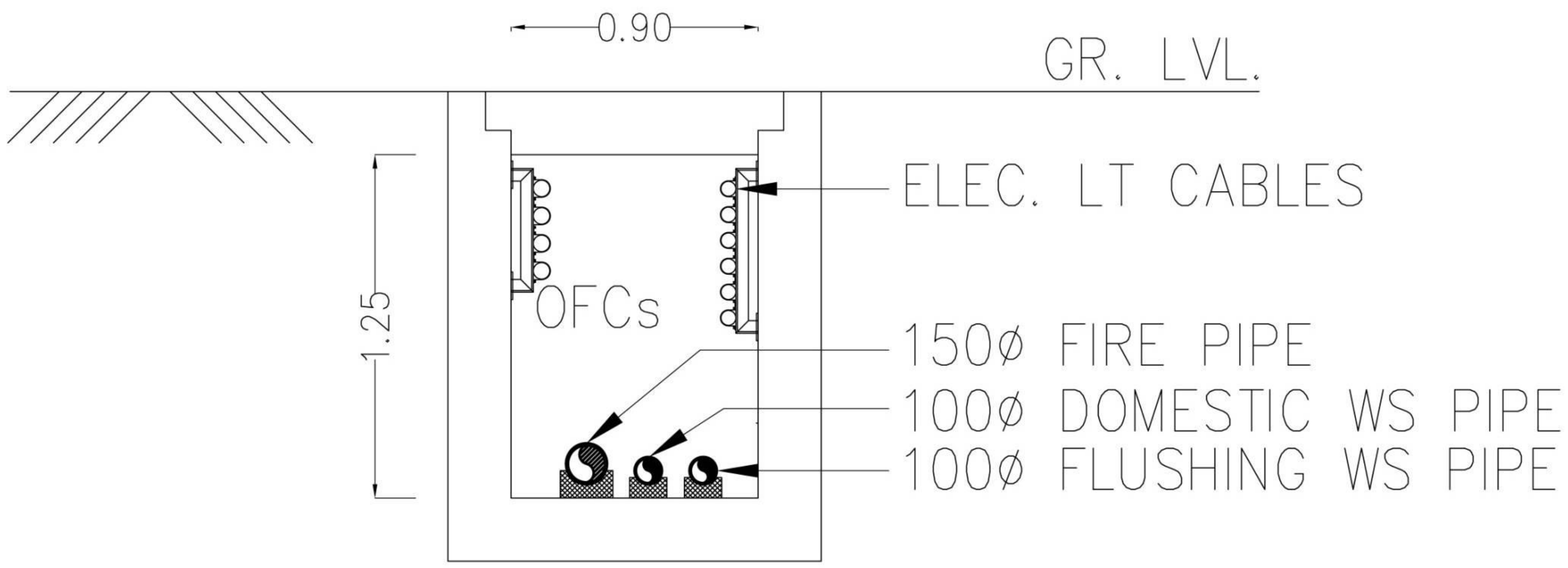




The distribution of pressure and wired services shall be through main service tunnel and trenches for ease of maintenance



TYP. TRENCH SECTION
FOR HOSTEL & ACADEMIC



TYP. TRENCH SECTION
FOR RESIDENTIAL

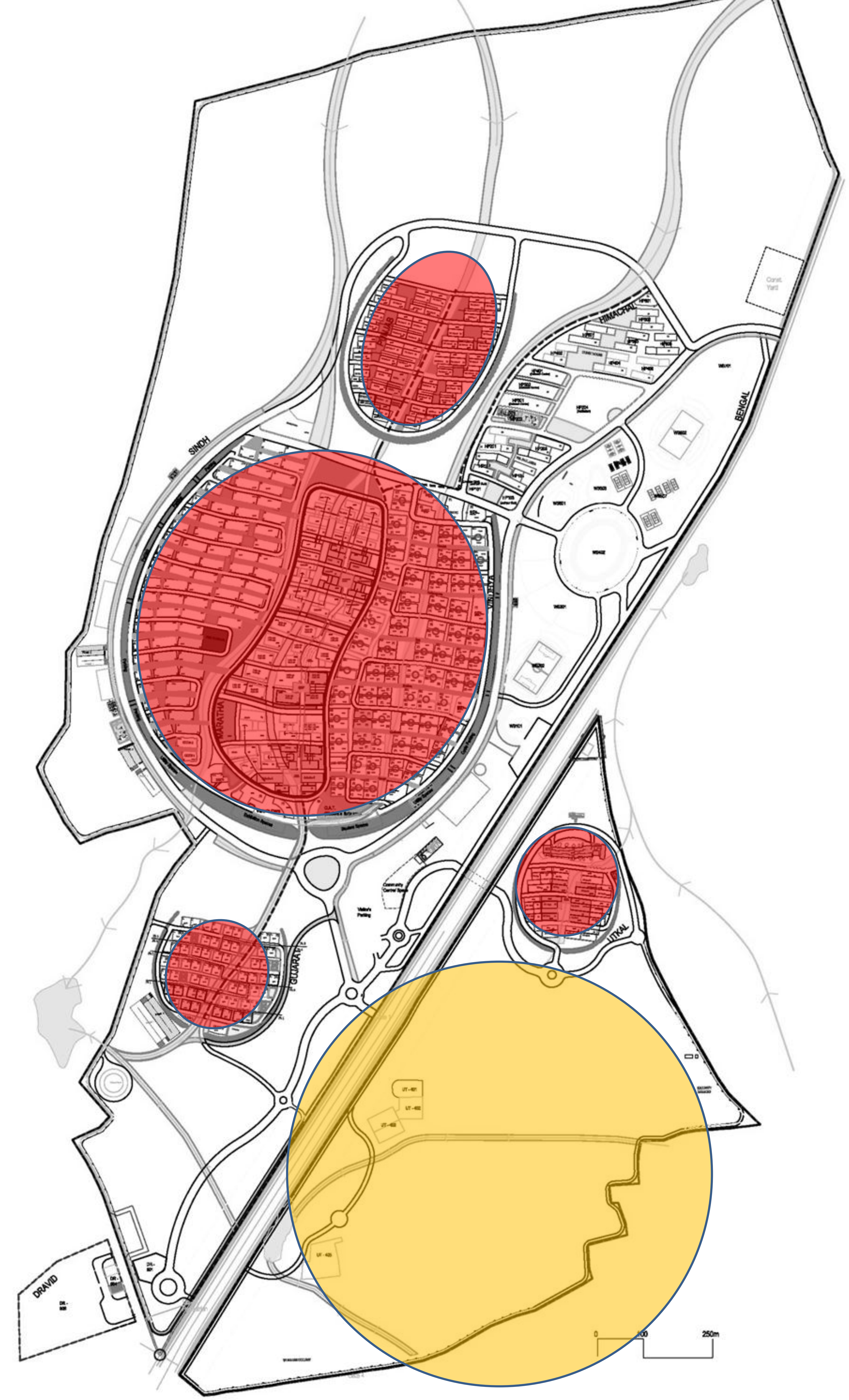
•Roof top solar and field solar is proposed in a1:2 ratio.

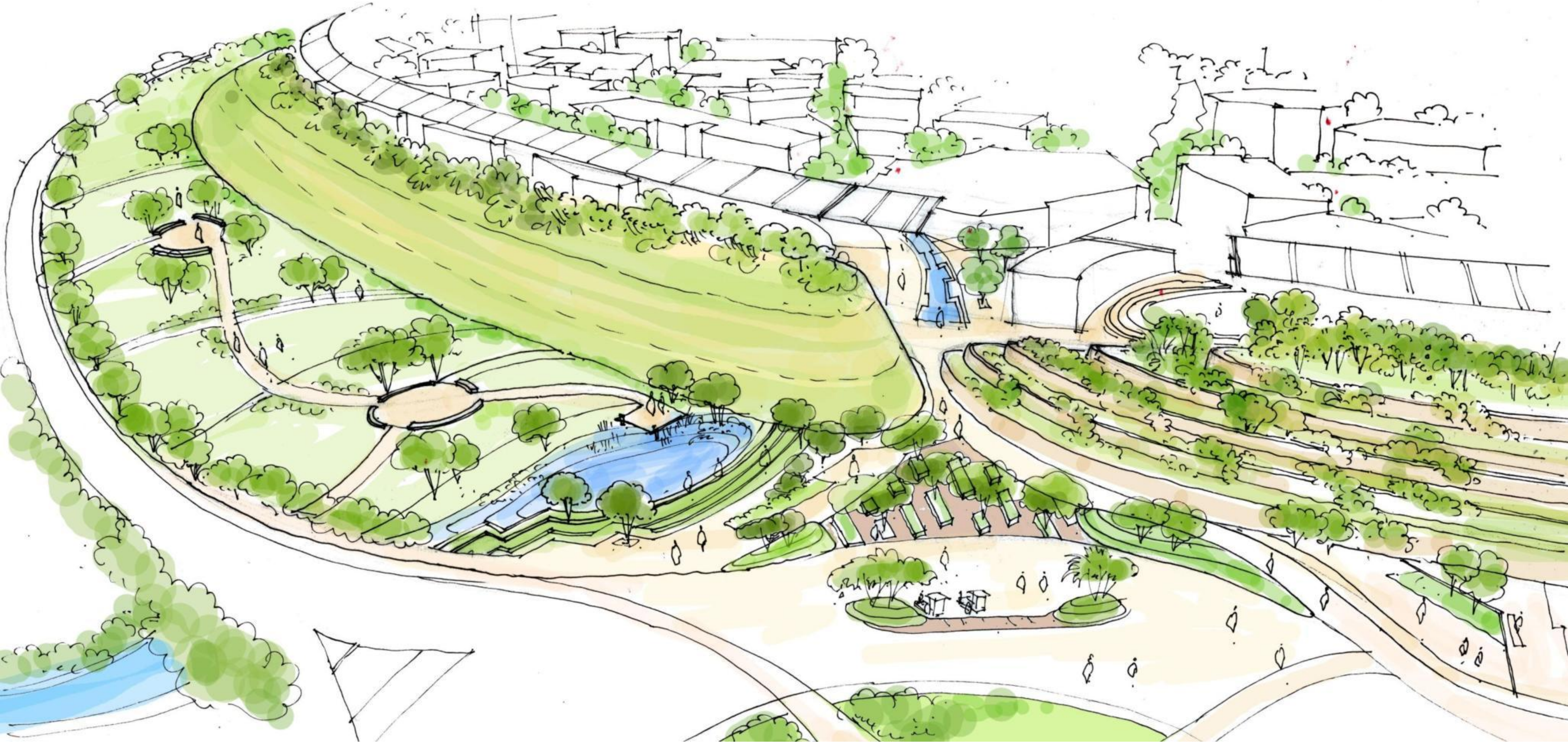
•Probable final phase will require 9 and 18 MW respectively.

•Phase 1 can be about 15% of this, so 1.5 and 3 MW is required.

Roof top solar

Solar farm



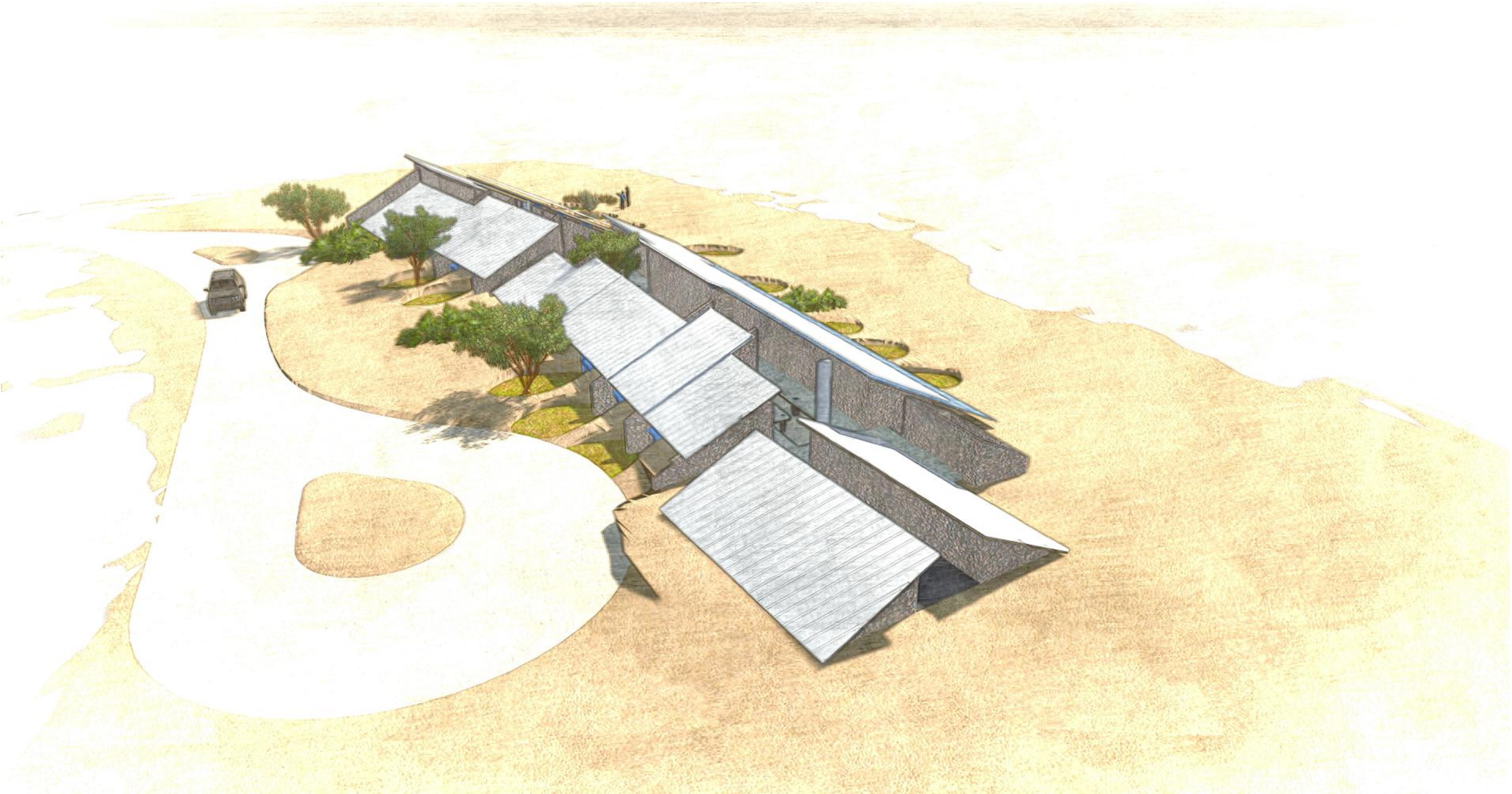


CONCEPTUAL VIEW OF MAIN DROP OFF AREA WITH APPROACH STREET LEADING TO FUSION SQUARE

1. **Boundary**
   a. The berms act as a boundary for defining settlement.
   b. Conceived as an element to create a physical upper bound to the settlement, and is similar to natural boundaries in island communities.
2. **Signature**
   a. The berms also become a visual signature of the campus, rather than a tall building.
   b. Built without need to import any material
   c. Become repositories of excess material created by basement and general slope excavation of the settlement.

FUSION SQUARE/ ‘CHOWK’

SITE OFFICE



LABOUR COLONY

Thank You