



Category	Details
Budget	Rs. 25 Lakh
Plot Area	400 sq.m.
Family size	
Dairy Animal	

The Family of six members is taken into consideration having a typical Maharashtrian background.

The Plot size is taken as 50m x 80m and the attempt is to design a unit that is self-sustaining. The built fits within 400sqmt.

The climate of Shrigonda is hot and dry, with cold winters and scarce rainfall. The design attempts to provide thermal comfort as well as take care of the basic every day needs of the residents like water, electricity, waste management as well as food.



Daily activities of the family...



The farmer- Baba

His every day activities include morning rituals, prayer, working in the field as well as spending time with his parents and children. He is the man of the house and also entertains guests often.



The farmer's father- Azoba

His every day activities include morning rituals, prayer, sometimes helping his son in the field as well as spending time with his grand children and his old friends.



The farmer's children-

Their daily activity includes going to school, studying, playing, helping with house and field work, spending time with grandparents and friends. The boy enjoys reading and the girl enjoys creative arts and handicraft as hobbies.



The farmer's wife- Aie

Her every day activities include morning rituals, prayer, cooking food, cleaning the house, sending children to school, helping her husband in the field as well as taking care of the in-laws and children.

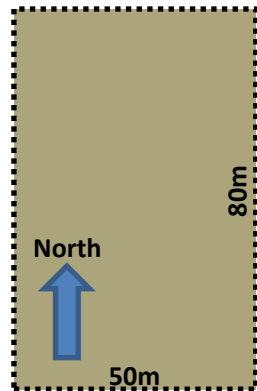


The farmer's mother- Ajji

Her every day activities include morning rituals, prayer, helping in cooking food & cleaning, playing with grand children.

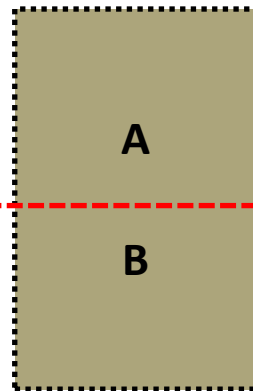


The Site



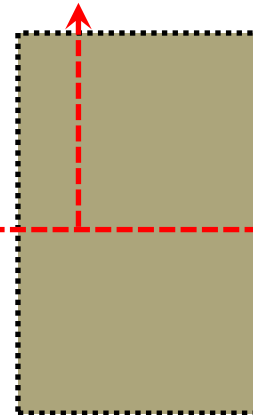
The Site:

Location is considered as Shrigonda. The size of the plot is 50m x 80m.



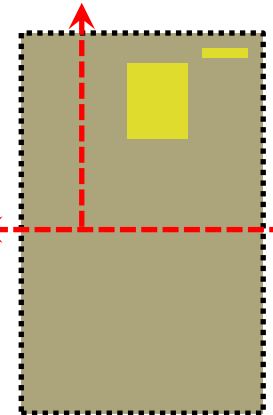
The Division 1:

The site is divided into a building zone and farm zone



The Division 2:

Part A of the site is further divided into a built zone and landscape zone.



The Built:

The yellow indicates the built parts in the site.

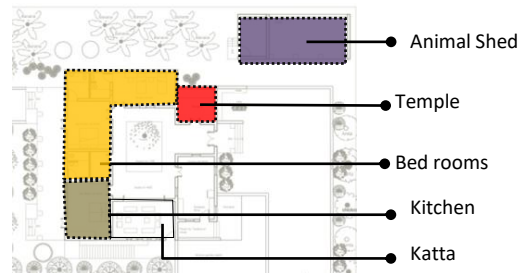
The Built



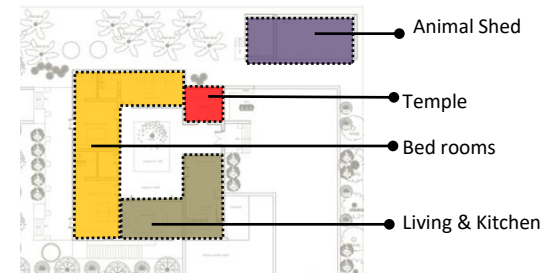
- Private areas
- Religious
- Semi private
- Animals Shed

Explanation:

The home can be constructed in two phases. In the first stage as shown in diagram two bedrooms, toilets, temple and the third room that can be used as kitchen can be constructed. In the second stage living and kitchen can be built. The complete house is built around a courtyard and is surrounded by landscape.

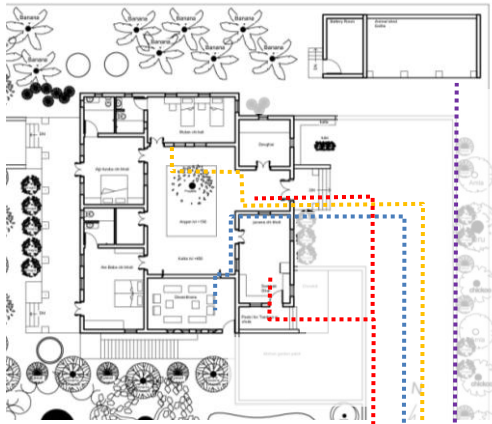


Stage 1:



Stage 2:

Circulation & Orientation



North



Animals
Children
Guests
Elders

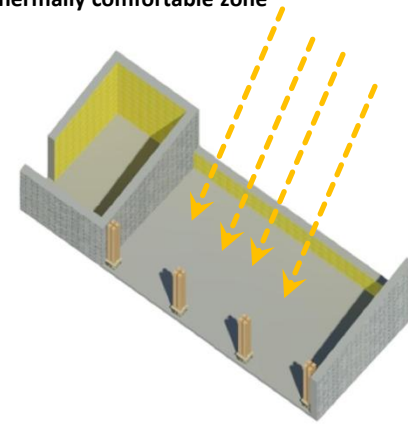
Prominent wind direction & Heat gain: Veranda and parallel windows used for cross ventilation.



Heat gain and glare: Staircase and small openings used to protect the house from the same.

S

Diffused North light used to advantage by placing kids room in this zone.
Animal Shed and temple also placed in this zone.
Thermally comfortable zone



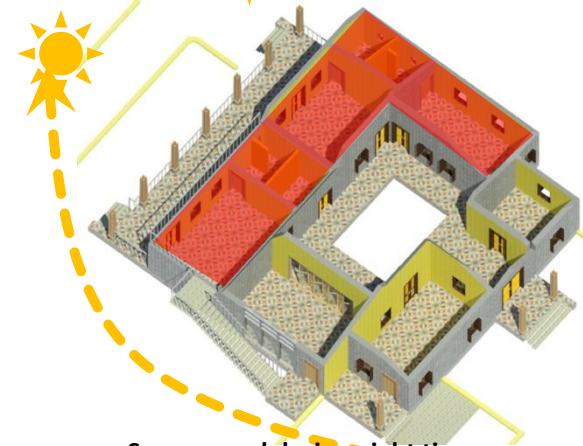
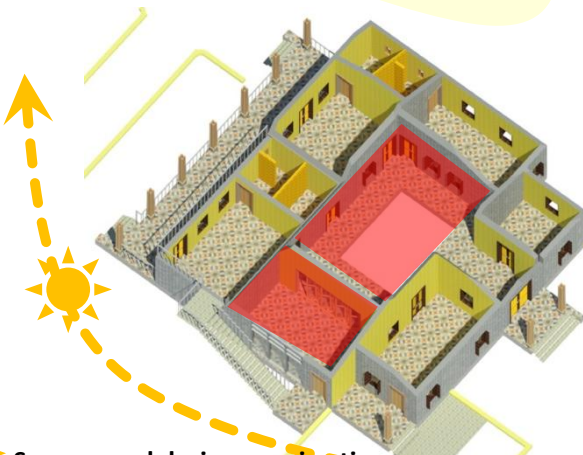
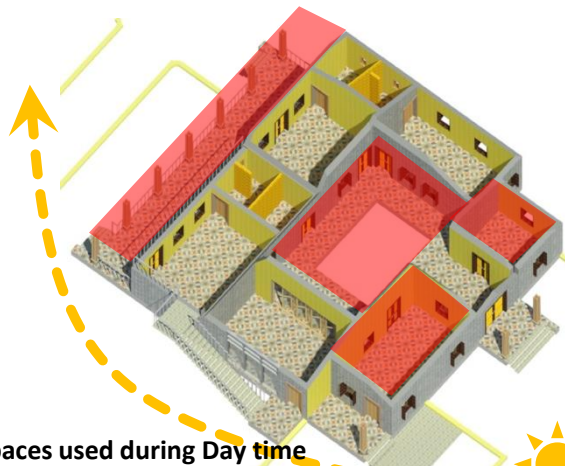
Courtyard helps to eliminate warm air from the house.
The sloping roof helps in increasing the internal volume and creating cooler spaces in summer and warmer spaces in winter.

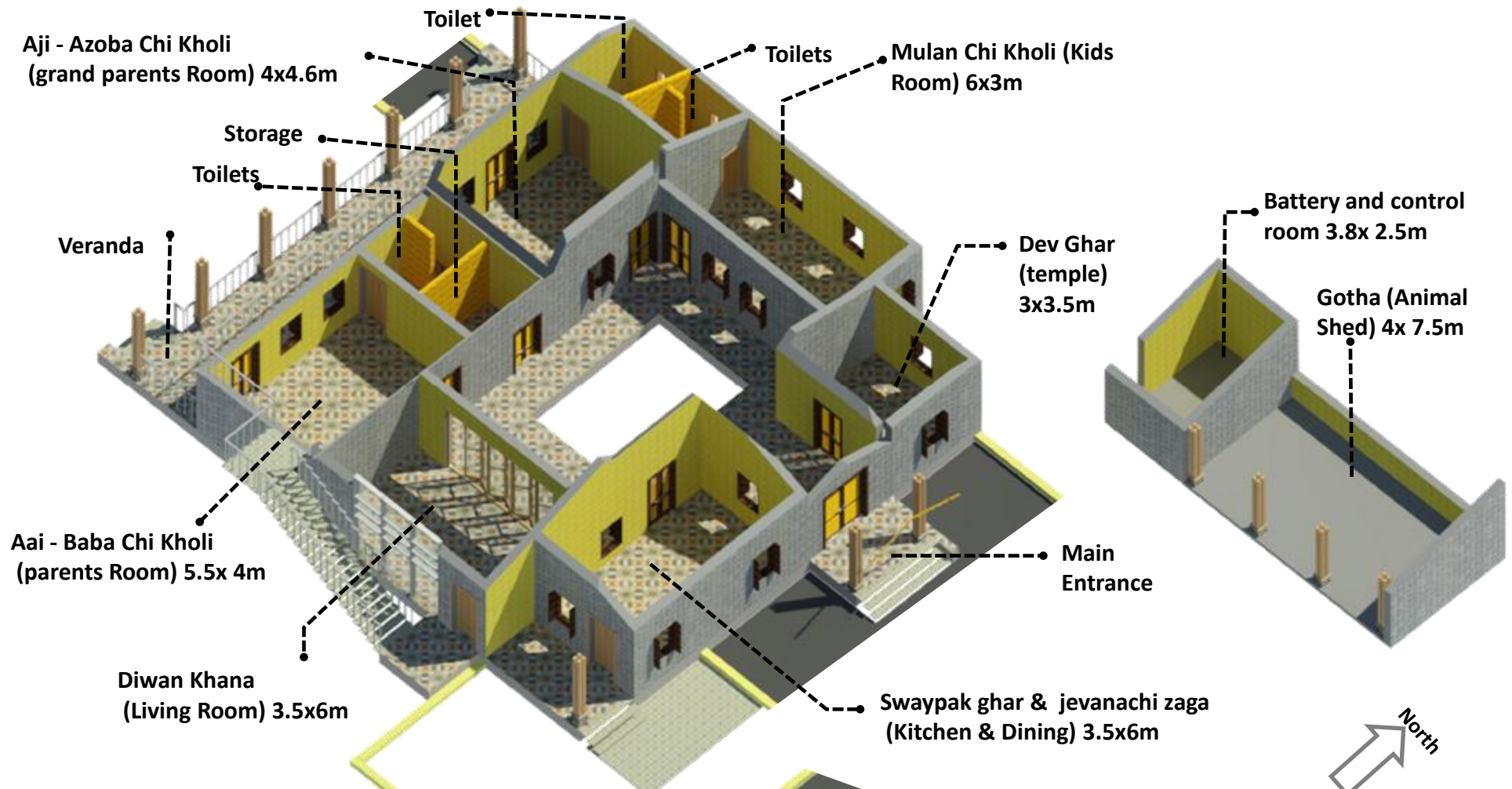


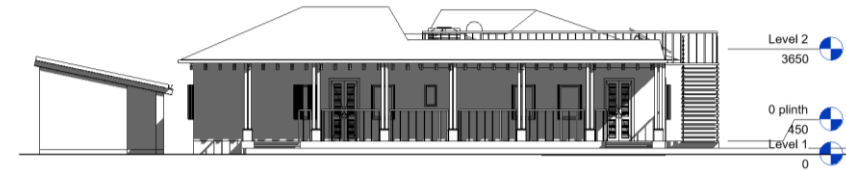
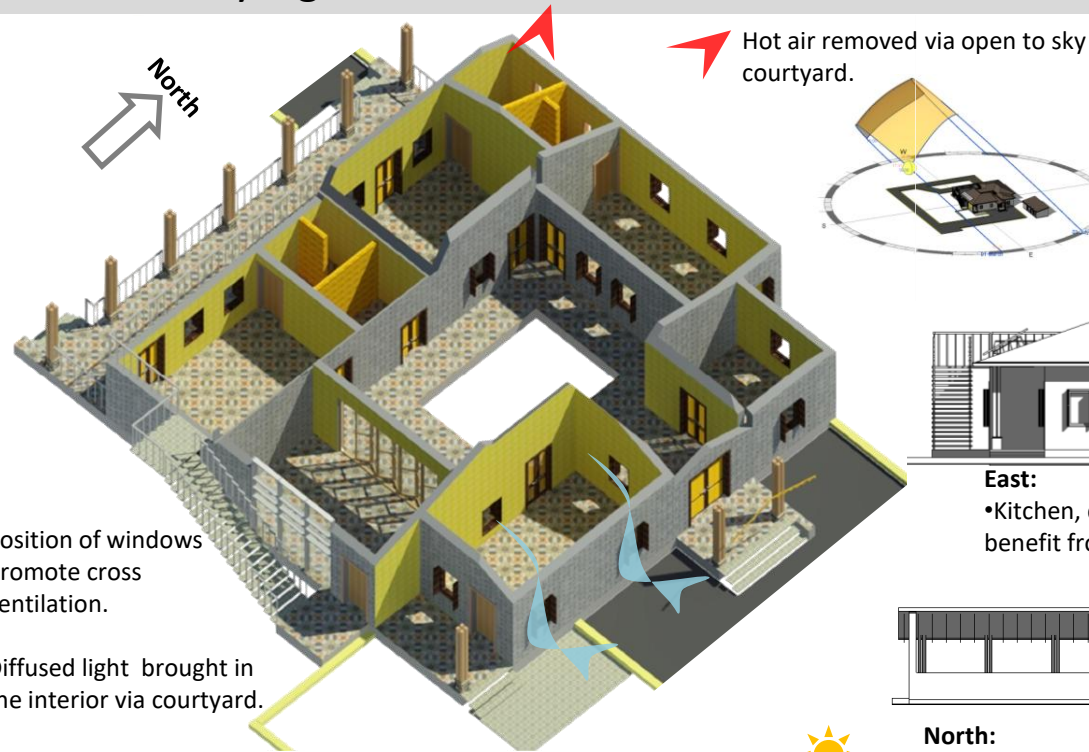
Spaces used during Day time

Spaces used during evening time

Spaces used during night time

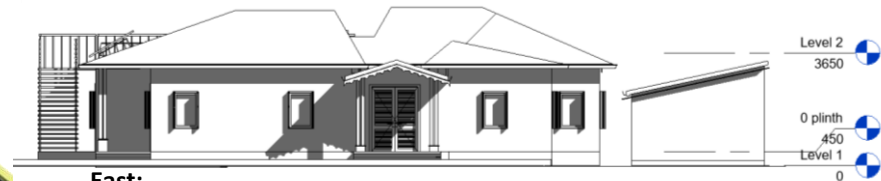






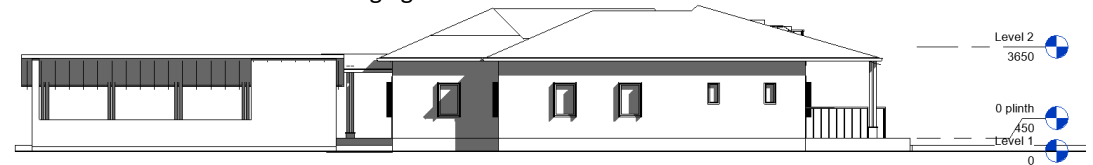
West:

- A long veranda with sloping roof acts as a buffer and provides mutual shading to prevent heat gain.



East:

- Kitchen, dining and temple open up to the east side of the site. All these spaces benefit from the morning light.



North:

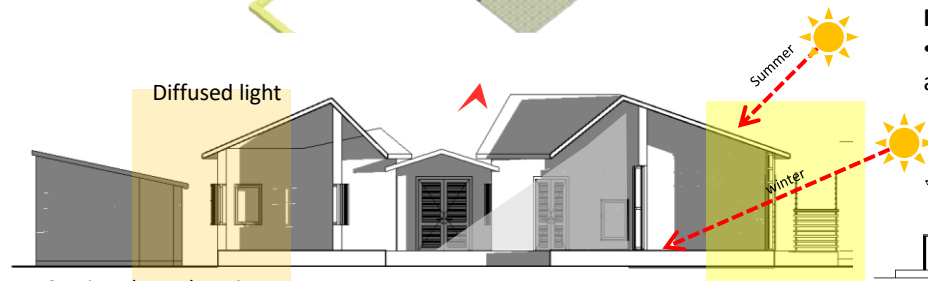
- Children's room is oriented towards the north so that they can benefit from north light and the room remains comparatively cooler making it thermally comfortable.



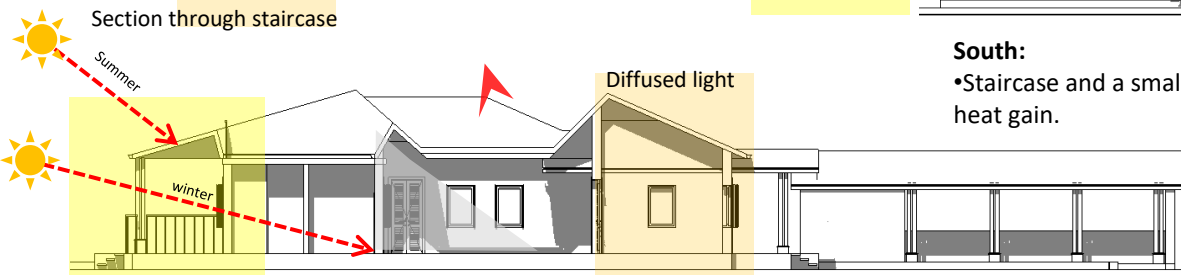
South:

- Staircase and a small veranda are placed in the south as they act like buffer and help cut the heat gain.

- Sloping roofing provides difference in volume and help in keeping the interiors cool in summer and warm in winter.
- Courtyard remains mutually shaded most of time of the day.
- The veranda in the west allows the day light and heat to enter during winter when it is needed.



Section through staircase



Section through courtyard and west veranda



Battery room &
Control room

Solar PV

Hot Water System

Solar pasteurisation for Water:

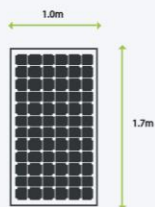
- Contrary to belief, it is not necessary to boil certain water to make it safe to drink. Heating water to 65°C (149°F) for 6 minutes, or to a higher temperature for a shorter time, will kill all germs, viruses, and parasites.
- This process is called pasteurisation. Solar pasteurisation has proven to be a very low-cost disinfection method to produce drinking water out of non-turbid fresh water. This method can be used instead of boiling water.

Solar PV:

- A 5kW solar system may produce enough energy to power the designed home, the roof is designed in such a way that solar panels facing the south can be easily mounted on the roof. The entire roof accommodates roughly 15-17 panels so if the need for power increases in future, the panels can be accommodated.
- As a guide, we will need 3 x 330W for every 1kW of the solar system. If we're considering a 5kW system, that's between 15 and 20 solar panels in combination with battery storage for off grid home. Off Grid Solar PV system will include batteries, which are an expensive part of the system and these would need replacement every few years (4-7 years). A typical Off Grid Solar PV System would cost about Rs 1 lakh. Various concessions and subsidies are available from government easily.

SOLAR PANEL DIMENSIONS

250 - 330 W PANEL



ROOF AREA REQUIRED

- 3KW SYSTEM 15.3 - 20.4 M²
Either: 9 x 330 W panels
or 12 x 250 W panels
- 5KW SYSTEM 25.5 - 34.0 M²
Either: 15 x 330 W panels
or 20 x 250 W panels
- 7KW SYSTEM 35.7 - 47.6 M²
Either: 21 x 330 W panels
or 28 x 250 W panels

Energy Efficient Fittings:

- Energy saving light fittings and power saving gadgets are suggested for the home to minimize the energy consumption.



Solar Water heating:

- For heating water a solar water heating system with 300 litre capacity is designed and placed on the roof above the bedrooms. This is sufficient for bathing and cooking for the family.

Solar Lights:

- For landscaping and lighting the pathways as well as the fence areas – solar lights have been proposed.



Solar powered central control system:

- A smart system to keep a tab on weather condition, crop condition, soil condition and for mapping is put in place. This system is also solar powered.
- For this system the PV are mounted above the cattle shed.

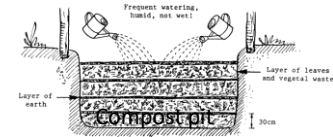
Dual Pit for Toilets:

•This technology consists of two alternating pits connected to a pour flush toilet. The black water (and in some cases grey water) is collected in the pits and allowed to slowly infiltrate into the surrounding soil. Over time, the solids are sufficiently dewatered and can be manually removed with a shovel and reused on-site, much like compost, to improve soil fertility and fertilise crops. Because double pits are used alternately, their life is virtually unlimited. Excavation of humus is easier than faecal sludge. Potential for use of stored faecal material as soil conditioner. Flies and odours are significantly reduced (compared to pits without a water seal). Can be built and repaired with locally available materials. Low (but variable) capital costs depending on materials; no or low operating costs if self-emptied. Small land area required. Maintenance is easy, simple and costs very little. Needs only 1 to 1.5 litres of water for flushing, while conventional flush toilet needs 12 to 14 litres of water. Needs less space than a septic tank toilet system.



Compost Pit for Organic Waste & Animal Dung: Fertilizer & Bio gas

- Compost pit will take care of kitchen or soft yard waste, such as chopped leaves or grass clippings, in a simple pit or trench. After a few weeks, earthworms and microorganisms in the soil convert the organic matter into usable compost.
- An organized trench composting system is designed in which the trench and the planting area are alternated every other year, providing a full year for the material to break down. The organic matter can be used as fertilizer for the farm and also Bio gas can be generated for cooking.



Water Usage:

- Minimizing the usage of water considerably by low flow taps and showers at all places.

Rain Water Harvesting:

- Water from courtyard and sloping roof is collected in an underground water tank which is then treated using Solar pasteurisation as explained in the previous sheet.
- The runoff water from pathways and other hardscape is channelized to a recharge well. This water is sufficient for drinking and cooking for the year.



Rain water harvesting system

Managing grey water:

- Grey water can be treated and used for flushing toilets. Dual washbasin and toilet combination can be used to reuse the water used for washing hands; for flushing.

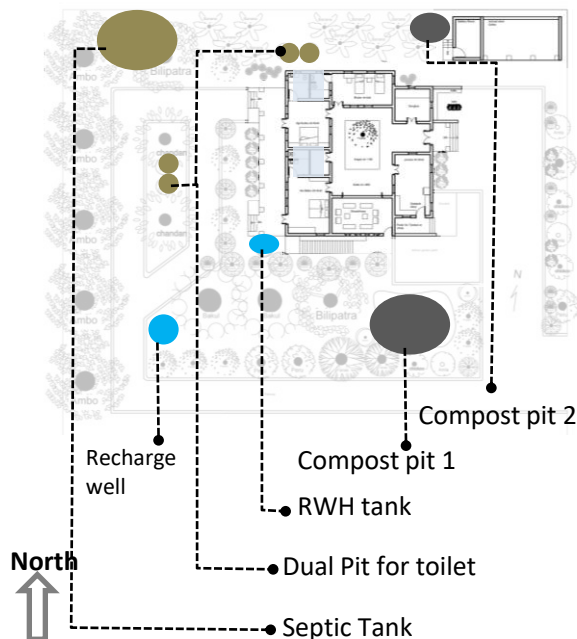
Reducing chemicals in water:

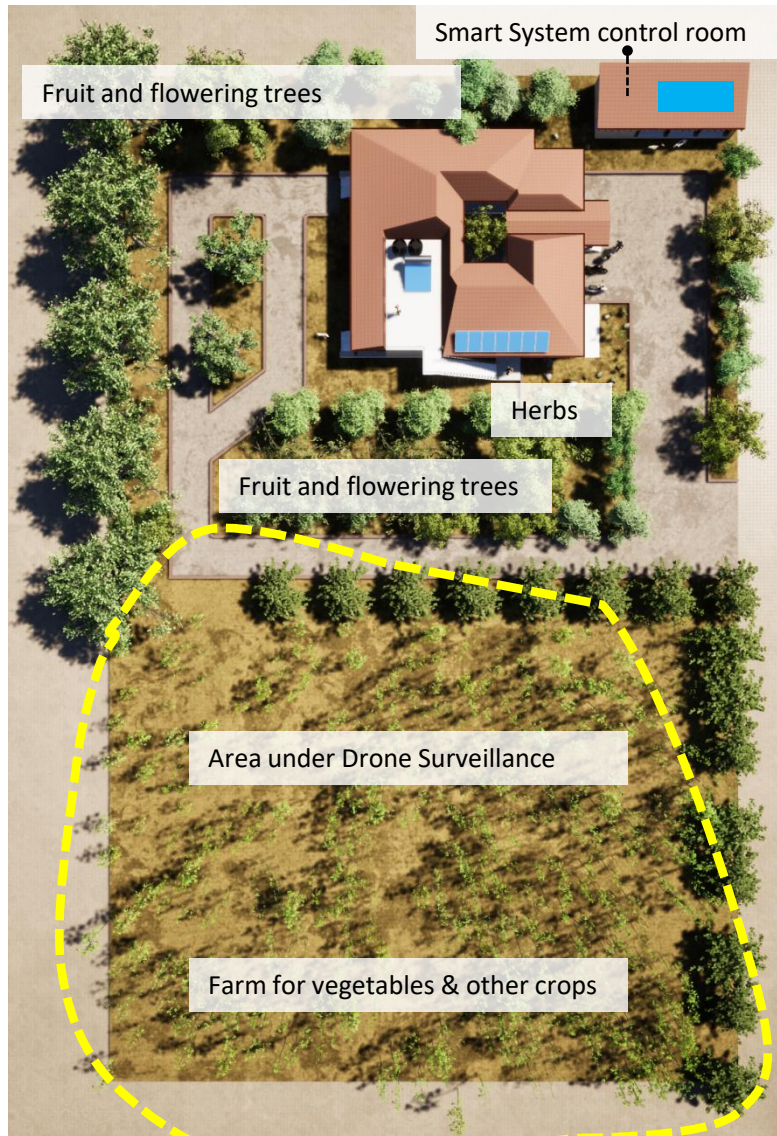
- Using eco friendly cleaning products for home cleaning, bathing etc make it safe to use grey water for landscaping. Since The location has scarce rainfall it is very important to use water more than once.



Eco friendly cleaning products.

Sink and WC combined





Off Grid Food Production:

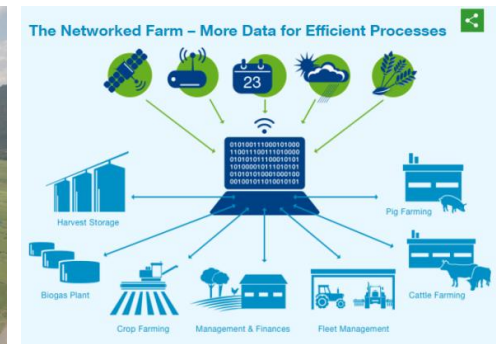
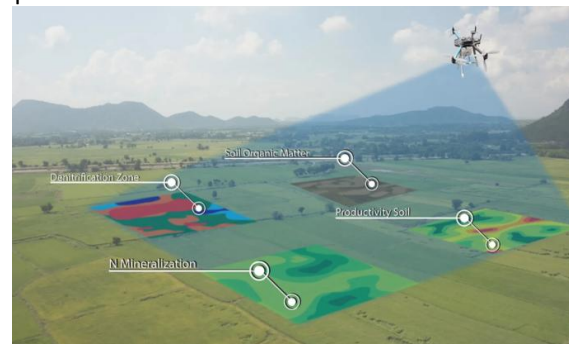
- The plot of 400 sqm is divided in such a way that majority of it can be used for growing food.
- The landscaping is done in such a way that basic needs of herbs, fruits and vegetables are taken care of within the plot. Provision of animal shed is also done while designing. Quality fertilizer and rain water or treated chemical free water is available for farming.



Security and Farm control system...

Smart Systems:

- The provision of control room enables the farmer to check the status of farm as well as animals. Not only that this also give space to keep computerized systems to monitor weather conditions, soil conditions, humidity, temperature and plant performance. Such systems have been used in many countries successfully
- In addition to this large farm areas can be monitored using drones.
- Sensor based security system is proposed for mapping the farm activities as well as for home and animal safety.
- Such a smart system can be powered completely by using solar PV. These Solar PV's can also be mounted on top of Animal shed.



North:

Small shrubs and plants are planned in this part of the site so that ample of north light can enter the children's room.

South:

Larger trees are planted on the southern side on the periphery .

Closer to the house, outside the kitchen, there is a herb garden which provides for basic herbs and spices needed for cooking.

Apart from this large trees like Fanas are planted here.

A larger plot is left for planting crops and other vegetables.

East:

East is a good direction to plant smaller fruit bearing trees like chickoo, guava, pomegranate. There is also an open sitting area outside the temple for grand parents to spend time sitting while the children play.

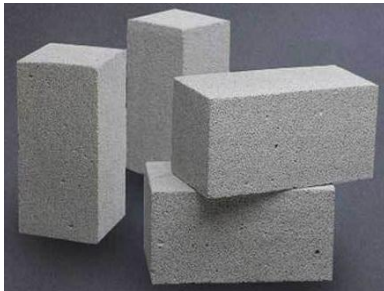
West:

Larger trees are planted on the southern side on the periphery .

Closer to the house, outside the veranda, the flowering plants like mogra and jui are planted. South-west being prominent wind direction, this will promote fragrance into the bed rooms and interiors of the house.



•Both Building Materials as well as systems have been carefully selected to make the home a self sustaining eco friendly unit. The characteristics, carbon footprint and costing for each material or system are based on the study of various literature available. **The area of the house is considered 240 Sqmt including semi open spaces for construction cost.**



AAC Blocks

- Major building material used for all the walls. It is made from mixture of fly ash, cement, lime, gypsum and an aeration agent.
- Carbon emission** is much lower as compared to clay bricks (per sq ft carbon levels: AAC blocks 2.13 kg of CO₂, clay bricks 17.6 kg of CO₂, concrete walls 14 kg of CO₂).
- Better performance in terms of fire resistance, water resistance, termite resistance and good for heat gain resistance .
- Locally available as there are AAC block manufacturers in Ahmednagar reducing its embodied energy further.
- Faster construction, easy to install services, less mortar needed.
- Construction cost is reduced to half as compared to clay bricks.

•**Approx cost: 4,00,000/-**



Recycle content flooring & low Voc Paint

- This flooring is used for all the areas of the house.
- Recycled content flooring is environmentally friendly and is made from recycled glass bottles, plastic, recycled copper and recycled porcelain.
- It is easy to clean and is a very durable material choice for the home.
- Variety of colors can be used to give a change in ambience and aesthetic of each room.
- Low Voc or environment friendly paint is proposed for this house.
- Since the tile is made from **15-20% recycled content its carbon footprint** is less than conventional clay fired tile.
- Estimates are that the use of recycled material in tile manufacturing have prevented more than 200 million pounds of solid waste from ending up in landfills.

•**Approx cost: 3,29,000/-**

Total Carbon emission of the project is much less than a conventional construction simply by using AAC blocks and other sustainable materials. The total Project cost is approximately : 23,59,000/- (1000rs per sqft) Not considering interior and other minor aspects. The cost is considerably lower than conventional buildings.



Water saving systems & fixtures



Bamboo wood/ recycled wood openings



Energy Saving electrical fittings



Solar PV and water heating systems

- As discussed in the previous sheets the house has sustainable systems like solar PV, Water heating, Low flow plumbing fixtures, Dual pit toilets, Rain water harvesting system, led lighting fixtures etc.

•**Approx cost of systems : 10,80,000/-**

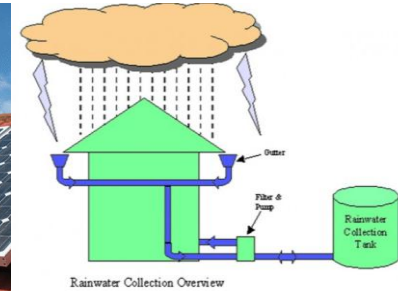
- In addition to this wooden doors and windows are proposed. These could also be made from locally sourced wood or Bamboo wood.

•**Approx cost of systems : 2,50,000/-**

- Landscaping and plantation of trees as well as setting up a drip irrigation system will further cost 3,00,000/-**

- The attempt is to keep low carbon footprint by using materials that have less carbon emission, are locally available and are long lasting .**

- If all the aspects are implemented the building can become a self sustaining ecofriendly unit.**



Rain Water Harvesting system and STP