

MASTER PLAN AND PROJECT GUIDELINES

SANTUARIO TUCTARA

AN ECO-ETHICAL DEVELOPMENT

COTACACHI, ECUADOR



Planning, Permaculture and Design



Joanna Alimanestianu and Associates - New York / Brussels

Hernberto Plaza, Coplaza Arquitectos - Guayaquil, Ecuador

Tropical Andes Ecosiversity Team with Gregory Landua - Quito, Ecuador

INTRODUCTION			
- Mission statement.....	3		
- The Charrette.....	4		
MASTER PLAN			
CONTEXT			
- Location.....	5		
- Vicinity.....	6		
- Cotacachi.....	7		
- Transportation networks.....	8		
VISION AND STRATEGY.....	9		
PRINCIPLES AND DESIGN TOOLS			
- Permaculture zones.....	10		
- Urban transect.....	11		
LOWLANDS			
- Site and owners' vision.....	12		
- Analysis.....	13		
- Permaculture base map.....	14		
- Master plan lot layout.....	15		
- Master plan with building footprints.....	16		
- Master plan with topography.....	17		
- Takeoffs.....	18		
HIGHLANDS			
- Site and owners' vision.....	19		
- Analysis.....	20		
- Permaculture base map.....	21		
- Master plan lot layout.....	22		
- Master plan with building footprints.....	23		
- Master plan with topography.....	24		
- Takeoffs.....	25		
COMMUNITY INFRASTRUCTURE			
- Parquecitos.....	26		
- Land caretaker.....	27		
VIGNETTES			
- Pathway into the Lowlands.....	28		
- Entry court to the Highlands.....	29		
- Western gateway to the Highlands.....	30		
URBAN CODE			
OVERVIEW.....	31		
REGULATING PLAN			
- Lowlands.....	32		
- Highlands.....	33		
REGULATIONS			
- Building placement and restrictions.....	34		
- Access and parking.....	35		
PUBLIC ELEMENTS			
- Landscape walls.....	36		
- Amenities.....	37		
ALLPA DOCUMENTS			
PERMACULTURE			
- Principles.....	38		
- Elements.....	39		
PERMACULTURE MASTER PLAN			
- Lowlands.....	40		
- Highlands.....	41		
- Implementation.....	42		
- Succession plan.....	43		
WATER SYSTEMS			
- Clean water - wastewater.....	44		
- Water harvesting.....	45		
- Aquaculture.....	47		
ENERGY SYSTEMS			
- Energy strategy.....	48		
WASTE SYSTEMS			
- Waste management and recycling.....	49		
LANDSCAPE SYSTEMS			
- Agriculture.....	50		
- Plant types.....	51		
ARCHITECTURAL GUIDELINES			
AN EMERGING ARCHITECTURAL LANGUAGE.....	52		
LOCAL RESPONSE.....	53		
TRADITIONAL BUILDING TYPOLOGIES.....	54		
- Outdoor living spaces.....	55		
EMBRACING PERMACULTURE.....	56		
ECO-SUSTAINABLE STRUCTURES			
- Exterior walls.....	57		
- Interior walls.....	59		
- Columns and beams.....	60		
CELEBRATING THE SUSTAINABLE.....	61		
- Ecological water systems.....	62		
- Natural roofs.....	63		
- Generous eaves.....	64		
- Integrating vertical elements.....	65		
- Exposed ceilings.....	66		
- Natural floors.....	67		
- Deep windows and shutters.....	68		
- Wooden doors.....	69		
- Details and color.....	70		
A VERNACULAR IN EVOLUTION.....	71		
VERNACULAR REFERENCES			
- Historical Cotacachi.....	72		
- Hacienda Ocampo.....	73		
- New Granada, Colombia.....	74		
BIBLIOGRAPHY AND ACKNOWLEDGMENTS.....	75		

INTRODUCTION

“ *We believe that the fabric of the people will determine the character of the community...*

We are fully committed to creating an environment that preserves the integrity of the sanctuary, but also conserves and enhances the natural beauty and ancient cultural heritage that exists among the indigenous villages in the area... We seek to weave a new community that contains the colors of many races, the warp and weft for a cultural fabric...

While [we] will provide the location, the framework and the threads, each homeowner will weave his or her own unique design into our vision for a new progressive community.

- Vision Statement of the Founders of Santuario Tuctara

”



In the mountains of Ecuador, near the town of Cotacachi, a group of founders has come together to plan and build small clusters of homes, studios, work spaces and public spaces. The project's goal is to promote a sustainable rural economy and a beneficial way of life – one that elevates the health and well-being of all those living there and in the surrounding areas, and of those visiting the Cotacachi region. This “eco-village” settlement is conceived to integrate with the landscape

as though it has always belonged there. It will use the best available principles and practices of ecological design, permaculture, and sustainable rural development. It seeks to be in harmony with the people and the natural systems of the area, and, in a small but exemplary way, to strengthen the quality and beauty of this mountainous region.

INTRODUCTION

THE CHARRETTE

From July 18 to 25, 2009, planners, architects and permaculturists came together to begin the creation of an ecological, sustainable and resilient settlement on two properties outside the town of Cotacachi, Ecuador. On a four-hectare parcel, the owners envision live/work homes with productive food gardens grouped together to form an active rural community. On a nearby parcel of six hectares, the owners each reserve land to build family homes, to sell a few lots and to enjoy communal lands for leisure and agricultural production.

To achieve this vision, the specialists, along with the clients, organized a "Charrette," an intensive, on-site, collaborative workshop. Our team of twelve New Urbanists, permaculturists and traditional architects came together from Ecuador, the US and Europe. Along with the six North American and Canadian clients, we assembled at the Rancho Santa Fe Hotel to work for a week exclusively on the project to be named Santuario Tuctara. Days before the actual work session, we all began gathering knowledge of the context and the vision to be implemented. The permaculture experts analyzed the sites and surveyors produced topographical maps. On July 18, the Charrette began with the whole team visiting the sites, adjacent lands and surrounding areas and communities. The following week involved long hours of team work.

Though this was a Charrette for the development of small, private residential groupings, the neighbors, the mayor and public officials were invited to the launching to share their knowledge and to comment on the team's conclusions during the final presentation on July 24, 2009.

The landowners, clients:

Gary Phillips, Emilia Ortiz, Linda McFarlin, César Del Río, James Keegan, Cindy Keegan and Michael Abravanel (son of Emilia Ortiz)

With ambitious objectives, the clients invited the team and managed the logistics.

The professionals:

Humberto (Coro) Plaza from Guayaquil introduced the Charrette concept to the owners. Coro brought his team of architects: Alex Quintong, Gabriela Gonzales, Jacques Carchi and Boliver Argüello.



Joanna Alimaniestianu, a Belgian/USA architect/urbanist, organized and ran the Charrette. She was joined by Kip Katich and Arnie Bocella, both from New York.

Javier Carrera, Fernanda Meneses, Rogelio Simbaña, from Quito and Gregory Landua from the USA formed the permaculture team.

Architects: Fausto Acosta, Rocío Béjar and Ignacio Egas generously spent an afternoon informing the team about local design, building methods and materials.



SANTUARIO TUCTARA

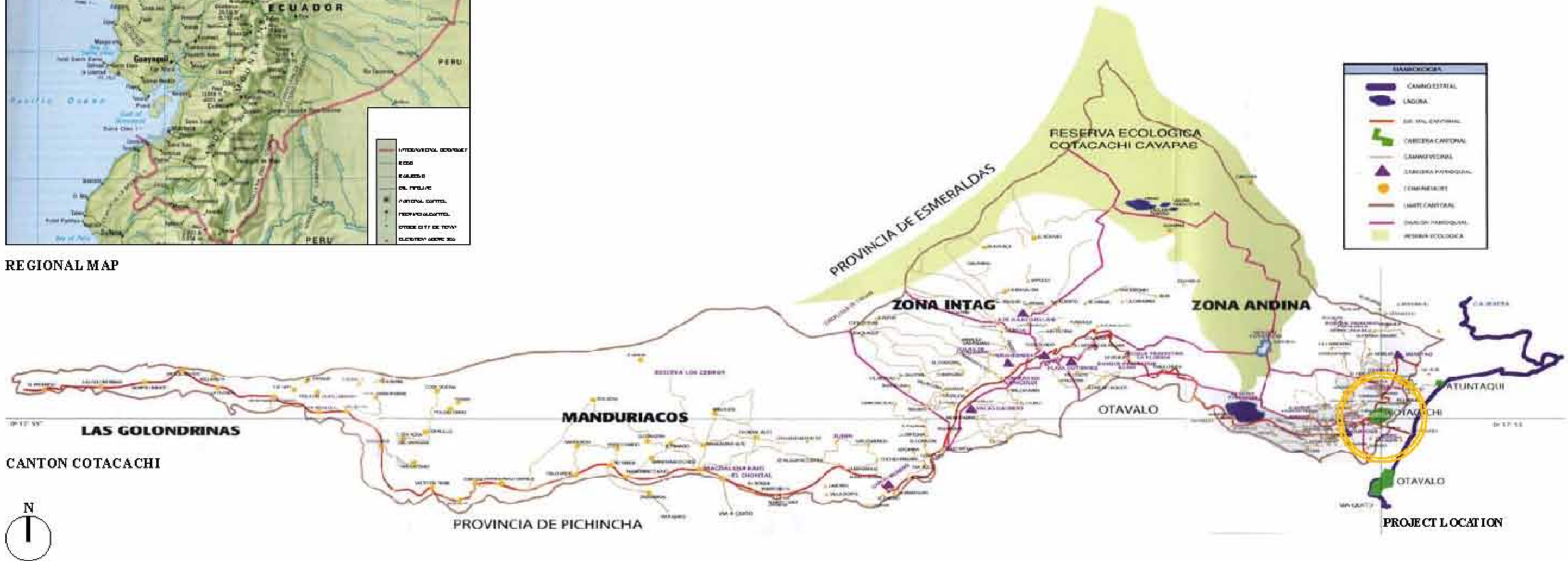
MASTER PLAN - AN ECO-ETHICAL COMMUNITY

LOCATION

The Santuario Tuctara Highlands and Lowlands are located in the northern region of Ecuador, in the province of Imbabura and the canton of Cotacachi. These lands lie at 2,500 meters above sea level. At present unoccupied, they were originally part of a hacienda. The surrounding populations are primarily indigenous people, along with descendants of Europeans, and people of mixed ancestry.



REGIONAL MAP

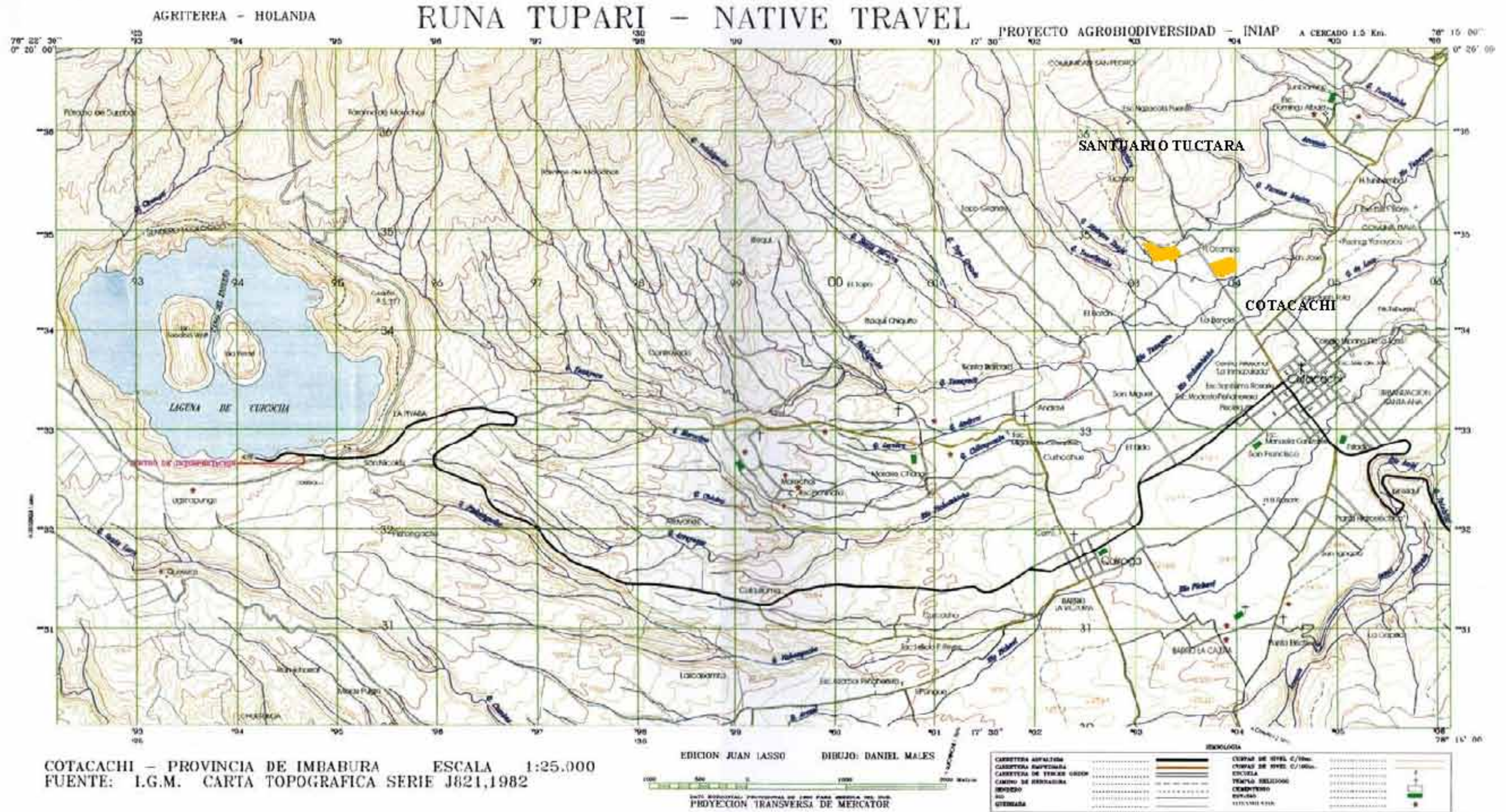


CANTON COTACACHI

PROJECT LOCATION

VICINITY

The Highlands and Lowlands of Santuario Tuctara are settled into the hills to the north of the vibrant town of Cotacachi.



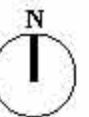
SANTUARIO TUCTARA

MASTER PLAN - AN ECO-ETHICAL COMMUNITY

COTACACHI LANDMARKS

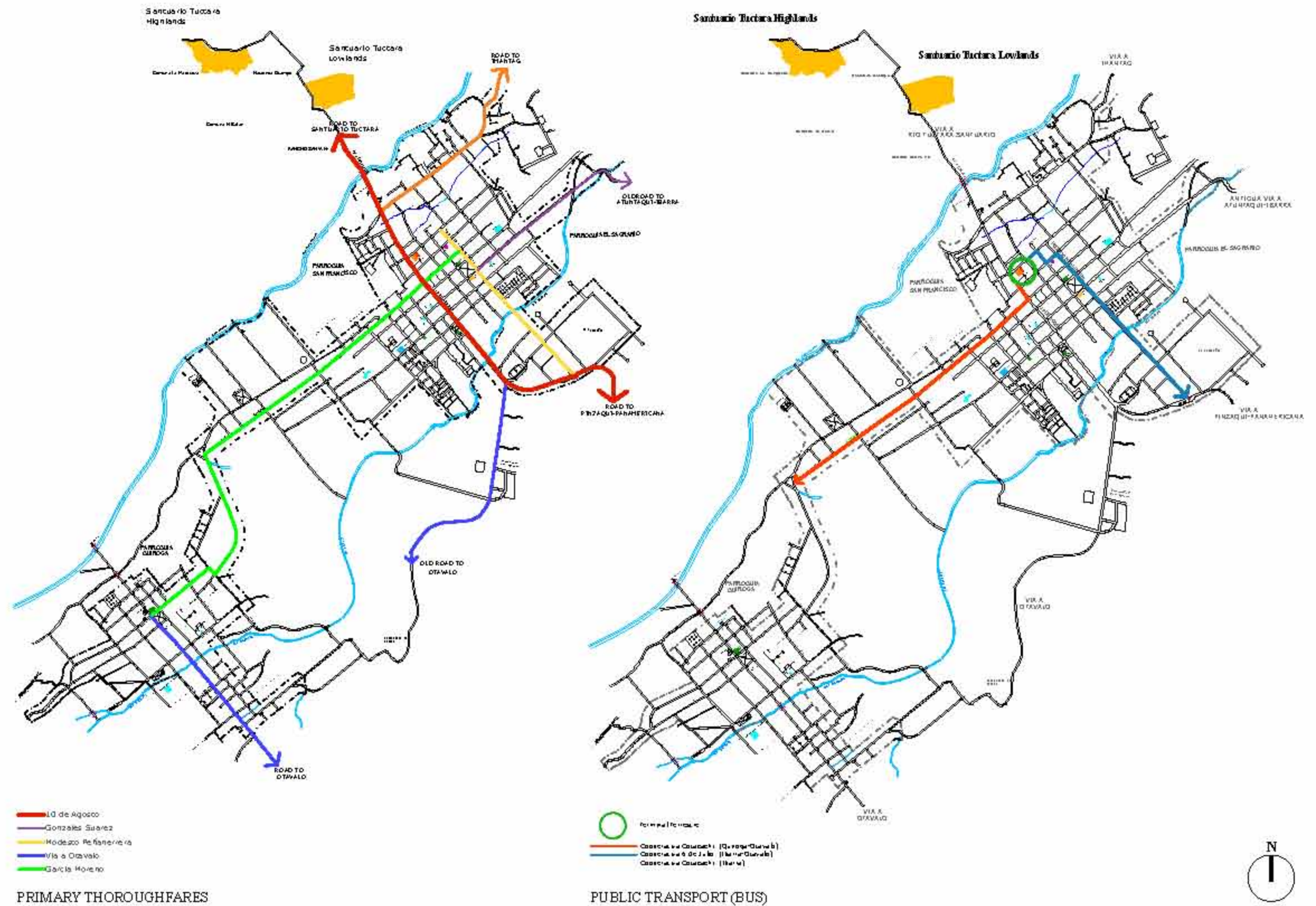
To the south of both the Highlands and Lowlands of Santuario Tuctara lies the town of Cotacachi.

Within walking distance of both future settlements, Cotacachi offers a variety of commercial and cultural destinations as well as a range of daily amenities and social opportunities.



TRANSPORTATION NETWORKS

The network of roads extends to connect to both the Highlands and Lowlands. Public transportation is easily accessible by foot or bicycle, and taxis are easily available for hire.



MASTER PLAN - AN ECO-ETHICAL COMMUNITY

PROJECT SITE AND INTENT

Santuario Tuctara is envisioned as an ecological settlement consisting of two properties, which we are calling the Highlands and Lowlands. These two sites occupy ten hectares of rolling farmland amply provided with streams and springs. They were once part of the 150-year-old Hacienda Ocampo in Cotacachi, Ecuador, two hours north of Quito.

We see Santuario Tuctara as rural, agricultural, and sustainable. It will respect the land and nature, and also offer a healthier way of life. Residents will be able to grow their own food in private or community gardens. Extensive green spaces and wandering pathways will connect the houses, many of which will be attractively screened by trees and landscape.

The Santuario Tuctara community will be designed to encourage walking and biking as healthy, safe, and eco-friendly alternatives to cars. Downtown Cotacachi with its urban attractions is only a few minutes away on foot. For longer trips, transportation by bus, camioneta, and horse can be easily arranged.

It is our hope that the development of these lands will be respectful of and a source of inspiration to surrounding communities, including Hacienda Ocampo. The master plan will provide opportunities for eco-tourism, education, micro-enterprises, and sustainable agriculture.

SOCIAL SUSTAINABILITY

Our approach is to apply Permaculture design ethics and principles to the invisible landscape of human interaction. Santuario Tuctara will create productive links with its neighbors through educational initiatives and active participation in community politics and local commerce.

The parameters of this endeavor will include:

- Integration rather than segregation
- Social connection
- Active political participation
- Local trade
- Education
- Workshops
- Caretakers
- Minga Cooperation on Acequias

We strive for a balance between human settlement and nature, always aiming for the greatest improvement with the least amount of effort and harm. To implement this strategy, we plan to attract young, experienced permaculturalists, probably from North America or Europe, to come tend the land. They will also take on teaching interested local people how to plant nurseries and gardens, regenerate the landscape, and build according to traditional and sustainable methods. With the guidance of two permaculture mentors -- the Seed Saving Network and Living Mandala, one local, the other international -- Santuario Tuctara will be poised to realize its dream.

Once the development is under way and the settlements are beginning to thrive, permanent caretakers for both

Lowlands and Highlands will be recruited from among the newly minted permaculturalists. With caretakers and residents working together, Santuario Tuctara will quickly become a vibrant social community.

This strategy is notably different from the patterns in many parts of the world, where segregated "gated communities" come equipped with armed guards and high walls. Such barriers would alienate the people of the neighborhoods surrounding Santuario Tuctara. Our strategy, on the other hand, seeks to integrate the newcomers and facilitate healthy, long-lasting relations with the broader Cotacachi community.

MICRO-ENTERPRISES

Much of the work of regenerating the landscape and growing food can easily be scaled up to serve as cottage industries and communal enterprises. These initiatives will help balance expenses and can provide extra income. They can also lead to avenues for commerce with the extended community. As productivity increases, new micro-enterprises will spring up and flourish.

Well designed and managed, over time such communal businesses as nurseries and market gardens could easily produce enough money to pay caretaker salaries, cover site-maintenance costs, and eventually provide extra income for the community.

A HOLISTIC APPROACH

To achieve our ecological, sustainable, and beautiful Santuario Tuctara, we are combining the principles of two complementary approaches: Permaculture and New Urbanism. From a Permaculture standpoint, we analyze the site holistically to determine what will be to the mutual benefit of all living creatures: plants, animals, and humans. According to New Urbanist principles, we determine where best to place houses, roads, and public and private spaces to create healthy and magical spaces. From the marriage of these two disciplines, we hope to witness the birth of healthy, inspirational, and magical places.



Site photos

PERMACULTURE

We analyzed the site holistically to determine what would be mutually beneficial for all living creatures: plants, animals, and humans. We first determined what exists on the site and what is lacking. The idea was to determine how to help the land to rejuvenate and flourish so that humans could live in harmony with nature.

ZONES

The positioning of elements in the design is known as zoning. Imagine five concentric rings around the house, called Zones I, II, III, IV and V. Zone I is closest to the house and Zone V is generally furthest away.

Different elements are placed in each zone, depending on how often they are to be visited. For example, the vegetables and herbs are grown close to the house in Zone I, while orchard trees are further away in Zones II or III. The more attention an element requires, the closer to the house it should be.

ZONE 0

Home, Hearth, Living Space - designed to integrate into the landscape.



ZONE I

Area immediately around Zone 0, fully visible from the houses. A place for yards, children's playgrounds, small lawns, culinary herb beds, and cultivated gardens for the household.



ZONE II

Area close to Zone 0, but not fully visible from the houses. Located here are things that may need to be tended daily, such as compost piles, chickens, guinea pigs, and orchards.



ZONE III

Farther away lie agricultural fields and pastures. This is the place for growing maize and wheat, for example, as well as an area where mid-sized animals, like pigs, llamas, and goats, can graze.



ZONE IV

This is a transition zone that provides pasture for cattle and horses, areas for trees of various kinds - firewood, fruit, nut, palm - as well as for large water catchments and storage systems, aquaculture, ethnobotanic gardens, etc.



ZONE V

This last zone is completely under the control of nature. It is an area of wilderness inside the property. Initially - and subsequently from time to time - plants may be introduced to help nature grow there, but Zone V should be left alone and as free as possible from human

influence. Pathways can cross Zone V, clearings can be made and seating added to contemplate and learn from the Pachamama (Mother Earth). Zone V weaves through the property, connecting the landscape with wildlife corridors.



URBAN TRANSECT

Along with the Permaculture Zones (preceding page), Santuario Tuctara designs also use the “urban-to-rural transect” to assure a balanced human environment.

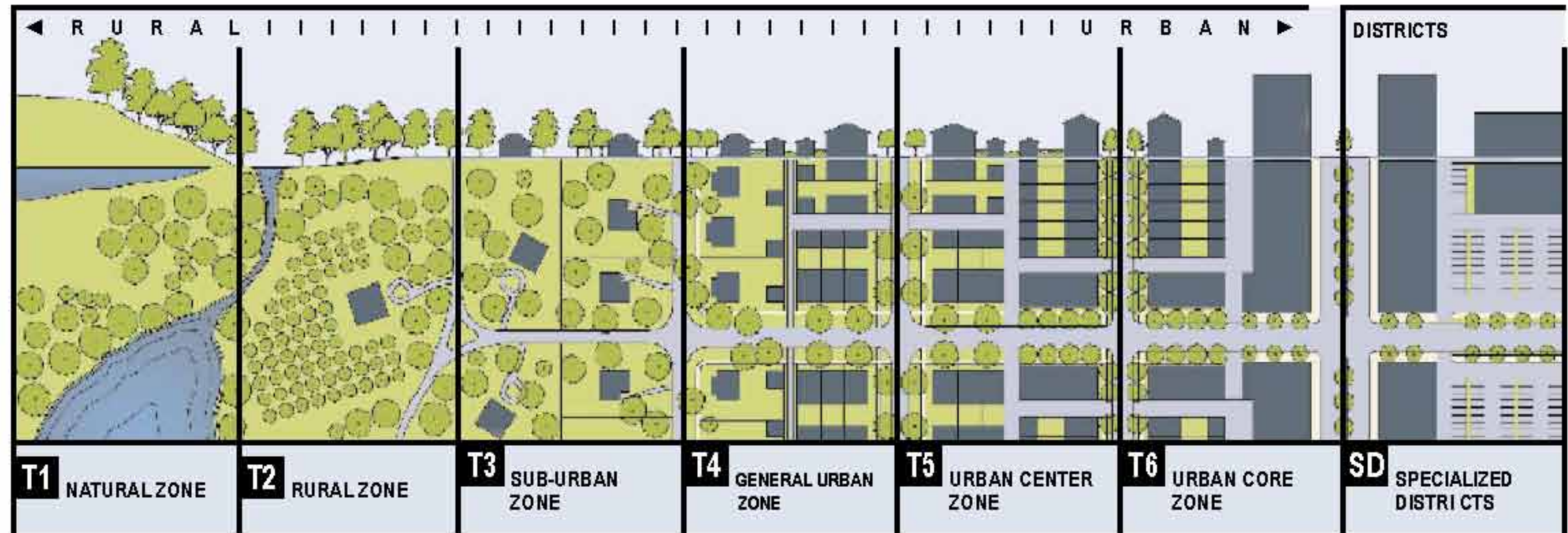
The urban-to-rural transect is an urban planning tool created by New Urbanists. The transect defines a series of zones, or T-zones, that transition from sparse rural dwellings to the dense urban core.

Transect-based planning offers a valuable alternative to the modern Euclidean zoning system that typically produces suburban sprawl, where large areas are separated and dedicated to a single purpose – housing, offices, or shopping – and it is difficult to reach one from the other. By contrast, transect-based planning promotes integrated development within a series of mixed-use zones that respect the natural context, thereby strengthening the character and qualities of place.

The transect identifies and strengthens the character and qualities of place based upon their context.

Because Santuario Tuctara is made up of two relatively small and separate pieces of land, they can not in themselves become autonomous and balanced neighborhoods with a whole range of T-zones. The Highlands and Lowlands must be designed as pieces of a larger whole, complementing and becoming valued assets to the community puzzle.

The Lowlands and the Highlands are designed with respect for the adjacent lands that provide commercial and cultural activities and with the understanding that they will complement them. The Lowlands and the Highlands belong to the more rural spectrum of the transect, providing country homes and rural live/work houses surrounded by nature. The town of Cotacachi and, eventually, the nearby Hacienda and the neighboring communities will provide other needs for sustainable living.



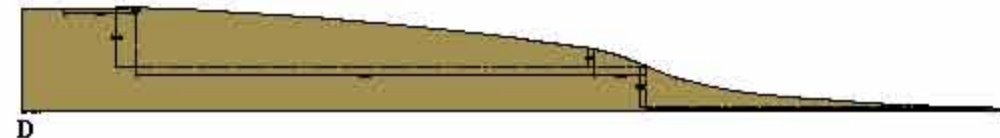
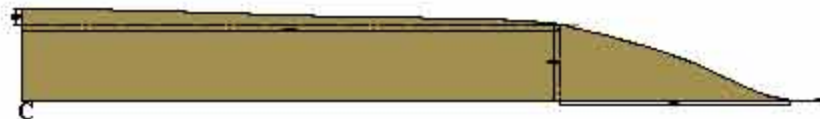
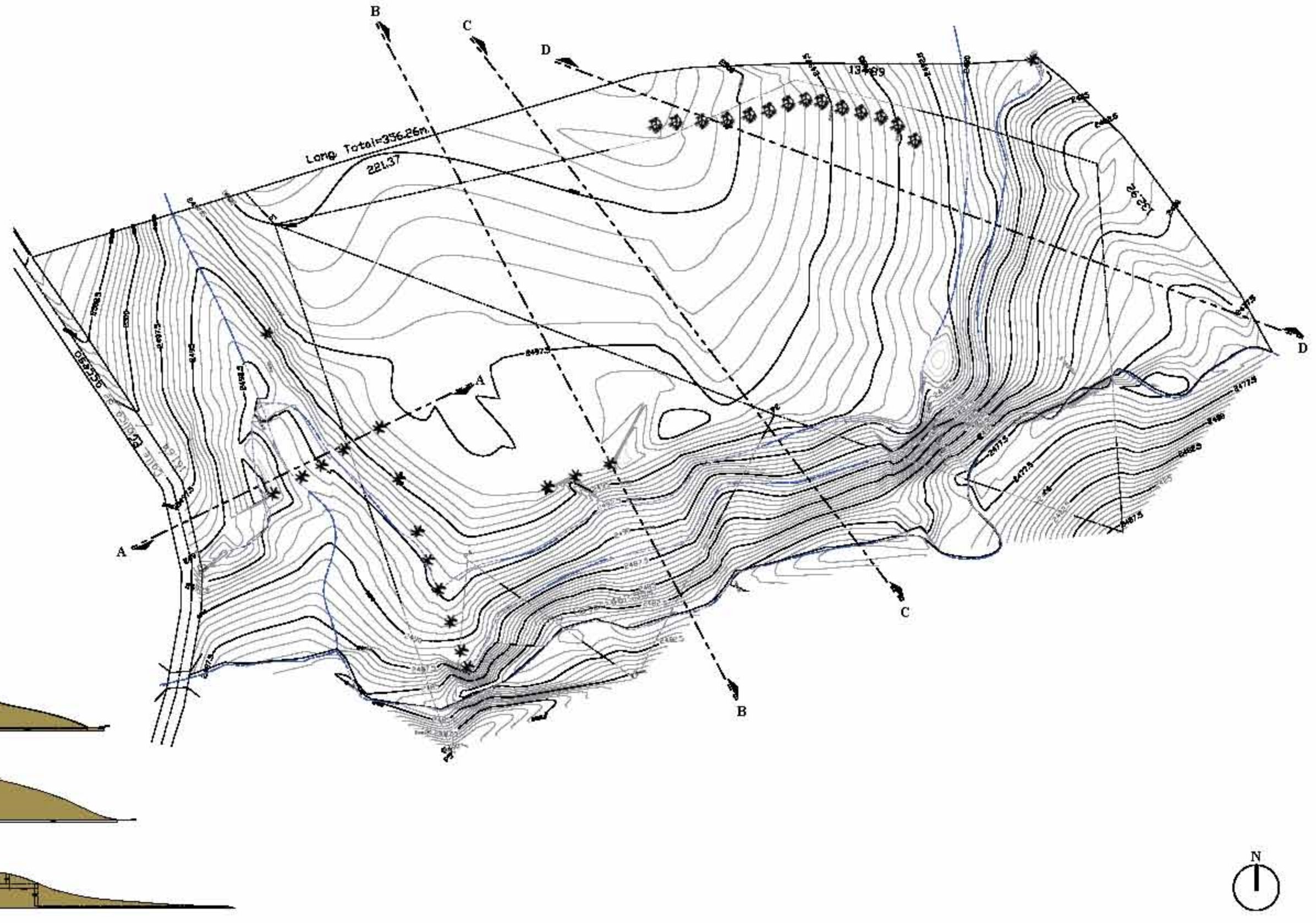
OWNERS' VISION FOR THE LOWLANDS

The Lowlands consists of six hectares and will have approximately seven to eight home sites, three of which will be reserved for the owners. The other sites will be sold to be built upon by future owners. Lot sizes per residence will vary. The site will include agriculture, aquaculture, and animal husbandry designed as a "permaculture" system.

The site will retain its pastoral, agricultural look with plenty of green, trees, vegetables and flowers. Perhaps partially underground or bermed houses with sod roofing would help preserve the natural green landscape.

On this property there is a large flat area that lies fallow but has agricultural potential. It is surrounded on three sides by sloping land that falls to marshy areas, two irrigation canals, and a stream. There are opportunities to design common green spaces on the site, including aquaculture ponds, streams, and a meditation area. The landscape consists of ferns, pampas, and lush native plants. Cows, horses, sheep and goats currently graze here.

The Lowlands will ideally remain free of cars, with pathways for alternative transportation methods to be determined. The entire site will include roads, paths, gardens, public spaces, and other features as specified during the Charrette and in further detailed designs.



LOWLANDS ANALYSIS

WALKING THE LAND

An integral part of creating a permaculture design is walking the land. It is essential to spend as much time as possible on the land to determine patterns and get a feel for the landscape.

As we walked the land during our Charrette, we divided the property into areas corresponding to the naturally occurring patterns.

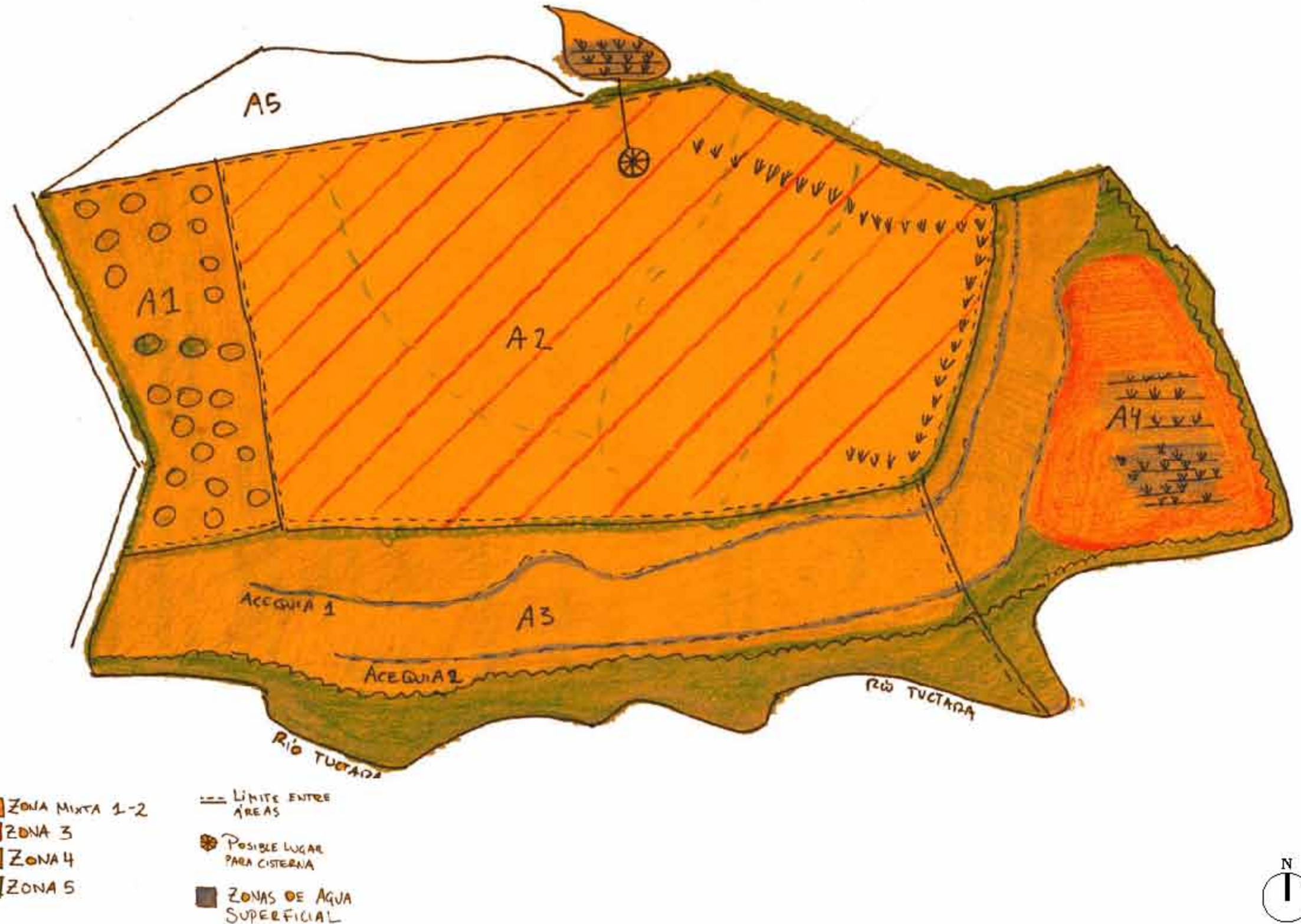
AREA 1: Property entrance. This area, sloping upwards towards Area 2, consists of a gully with very wet soil.

AREA 2: A gentle slope flowing from a point near the northeast border. The soil is compacted, poor in nutrients, and very dry. This is the biggest area of the property, which is hit by strong winds coming mainly from the northeast in the afternoon. No irrigation is present.

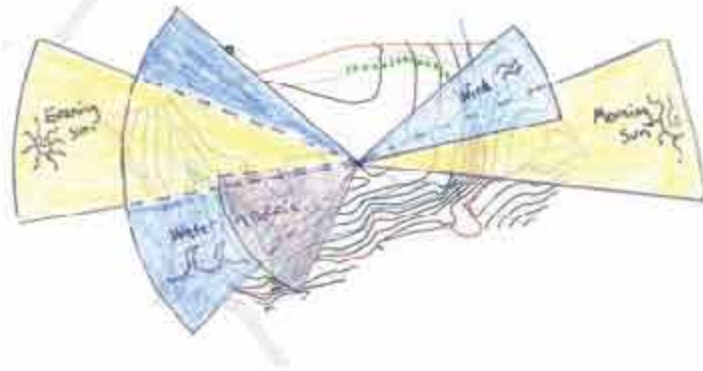
AREA 3: A strong slope flowing towards Río Tuctara, south facing. Two parallel irrigation channels follow the contour of the property.

AREA 4: Wetlands at river level.

AREA 5: This property belongs to the Hacienda but is key to the development of natural water flows in the Lowlands.



SECTOR ANALYSIS DIAGRAM



The sector analysis shows us where and how elements influence the site (in Permaculture parlance, elements are referred to as "sectors"). For instance, in the Equatorial region, the sun rises high overhead all year, from almost due east in the morning setting almost due west in the evening. Plotting this graphically allows us to make informed design decisions about the orientation of houses relative to the sun, wind, and water flows to help integrate them into the landscape.

SECTORS

Wind: East-southeast (from Imbabura)

Sun: Morning sun to the east, evening sun to the west

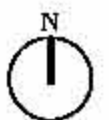
Water: From the west-northwest, following the general contour and acequias flowing down the landscape

Traffic: Human access from the south and southwest



LOWLANDS PERMACULTURE BASE MAP

Following the site analysis (page 13) and the study of the various sectors, this initial permaculture map was developed as the underpinning for the design of the master plan. For zone descriptions, see page 10.



MASTER PLAN LOT LAYOUT

The Master Plan closely follows the initial vision and program. Three large lots are reserved for the three owners - each with a flat building site and garden area as well as wilder areas sloping downward to the east and south. On the western ridge three smaller lots are for sale. A caretaker's lot is located on a high point overlooking the property. It is also placed to oversee the country pathway that leads from the public road to the residences.

We propose to create a large pond by damming one of the irrigation canals. The dam is also designed as a bridge connecting the main public road over deep contours to the residences (see illustration, page 28). A series of ponds is envisioned farther downslope. A cistern, covered with a gazebo, will be placed at the highest point on the property to supply water in all directions. The central focus is a communal meditation point overlooking the valley to the southeast.



MASTER PLAN LAY OUT WITH BUILDING FOOTPRINTS



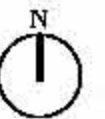
PROGRAM

- 3 individual, developer-owner lots (A, B, C)
- 3 lots to be sold (L-1, L-2, L-3)
- 1 caretaker homestead
- agriculture fields farmed by caretaker (Z III)*
- continuous agro-forestry fields (Z IV)*
- wilderness reserve (Z V)*
- living fence surrounding development
- integral water systems
- communal lookout (southwest corner)
- access and leisure pathways throughout

* For zones, see page 14

NOTE

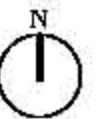
Building footprints are shown for scale only and are not indicative of the appropriate building placement or building typology as outlined in the Urban Code and Architectural Guidelines of this document.



LOWLANDS MASTER PLAN WITH TOPOGRAPHY



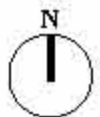
NOTE
For site sections, see page 12.



MASTER PLAN AREA TAKEOFFS



Zones I-II	23,662.03 m ²
Zone III	2,902.79 m ²
Zone IV	22,084.30 m ²
Zone V	8,192.58 m ²
Common Areas	1,071.18 m ²
Roads	1,482.38 m ²
TOTAL	59,395.25 m²

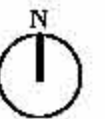
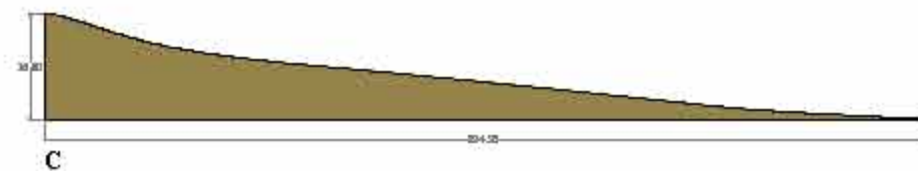
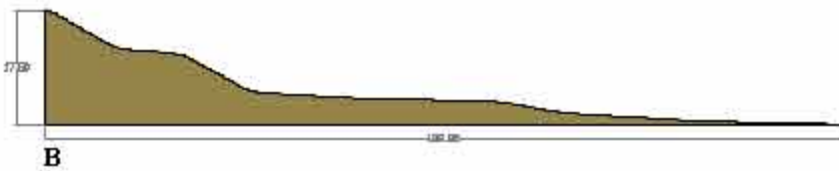
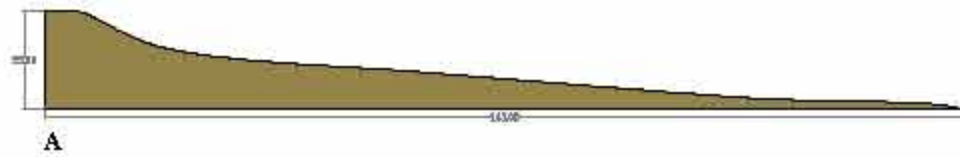
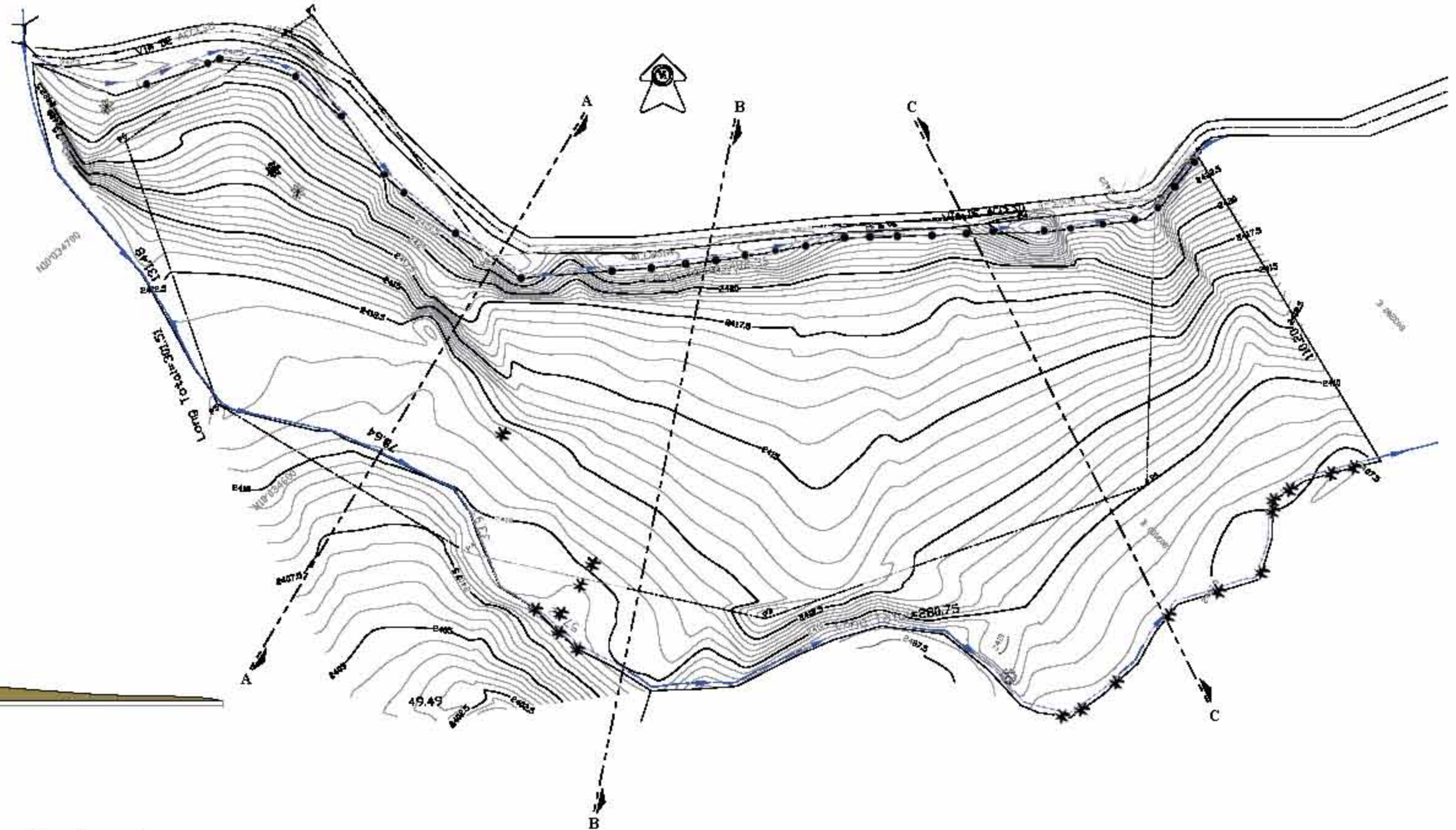


OWNERS' VISION FOR THE HIGHLANDS

The Highlands is imagined as a small village, possibly with more commercial potential than the Lowlands. The property is four hectares in size, bordering a small indigenous village and, on the west side, the land on which the Hacienda residence sits. The property is mostly flat with few trees, and includes an irrigation canal along the front public road that borders the property to the north. Water rights for irrigation, and a large, pure spring flow into its irrigation canals.

The program may include clustered residential houses. Other possibilities include a 'live/work' community for artists and practitioners of natural medicine. This could also be an ideal village for agro-tourism businesses.

Throughout the property land should be reserved for common gardens and community activities. Other features could include a lake and/or small ponds.



HIGHLANDS ANALYSIS

WALKING THE LAND

As noted earlier, walking the land is an integral part of creating a permaculture design. It is essential to spend as much time as possible on the land to get a feel for it and to determine patterns.

As we walked the land, we divided the property into areas corresponding to the natural patterns of the landscape.

AREA 1: Currently one of the entrances to the property. The soil, of sand and loam, is dry, poor, and very compacted. To the north flows a big and deep irrigation channel, west to east. There is an abandoned path following this channel, surrounded by vegetation.

The rest of the area gently slopes towards the south, with no clear division between this area and Area 2. The difference is one of moisture, with the land becoming suddenly greener and thus forming a border between the areas.

Vegetation is very basic, with some big chilcas, thorny bushes, and very little ground cover. There are several eucalyptus and pine trees that provide some shade but drain and poison the soil.

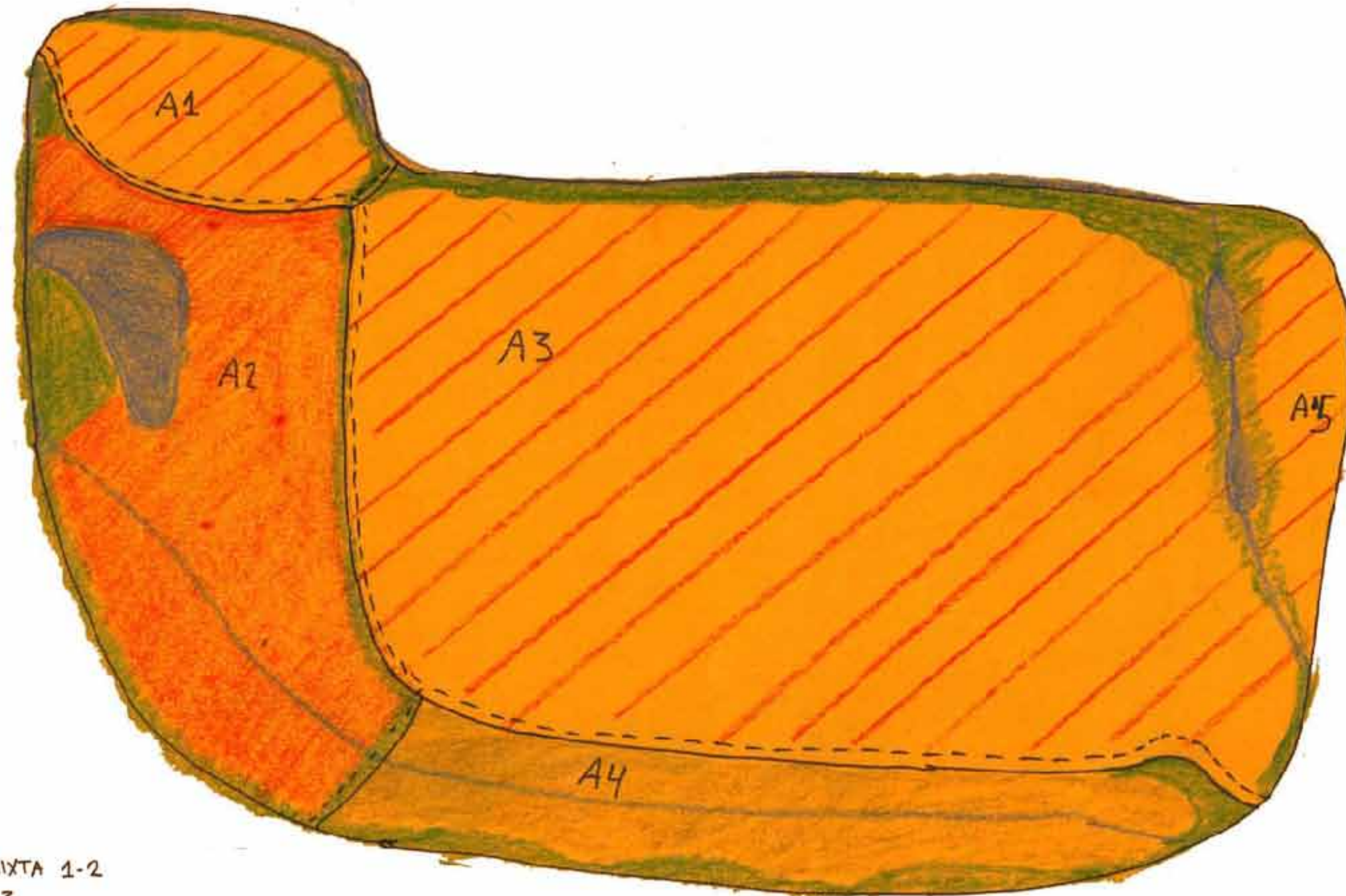
To the southeast, the land drops to Area 2 and climbs to form a narrow pathway leading to Area 3.

AREA 2: A short green, moist slope leads to the south and a large wetland. In the center grows totora, a water-loving cane. To the west is a small ravine that is quickly increasing in size because of a surfacing aquifer. To the south of the totora patch there is moist kykuyu grassland, crossed by the ravine, which has now turned into an irrigation channel.

Current conditions make this land unsuitable for building or cultivating of any kind.

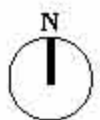
AREA 3: This is a big, sad, dry extension of land. The soil has been overused and compacted by machinery and cattle. It is compressed sandy loam of very poor nutrient content and structure. The area is windy and well exposed to the sun.

AREA 4: A strong slope, south facing. Good moist soil. An irrigation channel follows the contour.



- ZONA MIXTA 1-2
- ZONA 3
- ZONA 4
- ZONA 5
- ZONA AGUA SUPERFICIAL

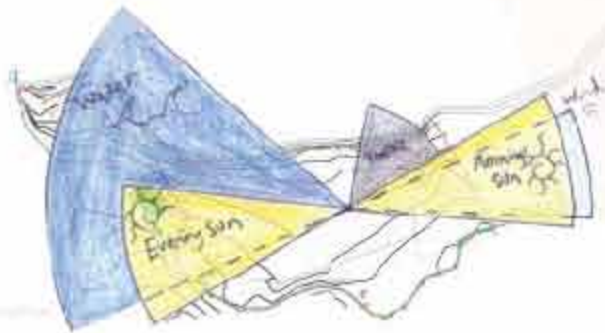
== LIMITE ENTRE AREAS



HIGHLANDS PERMACULTURE BASE MAP

Following the site analysis (page 20) and the study of the various sectors (below), this initial permaculture map was developed as the underpinning for the design of the master plan. For zone descriptions, see page 10.

SECTOR ANALYSIS DIAGRAM



The sector analysis shows us where and how elements influence the site (in Permaculture parlance, elements are referred to as "sectors"). For instance, in the Equatorial region, the sun rises high overhead all year, from almost due east in the morning, setting almost due west in the evening. Plotting this graphically allows us to make informed design decisions about the orientation of houses relative to the sun, wind, and water flows to help integrate them into the landscape.

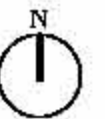
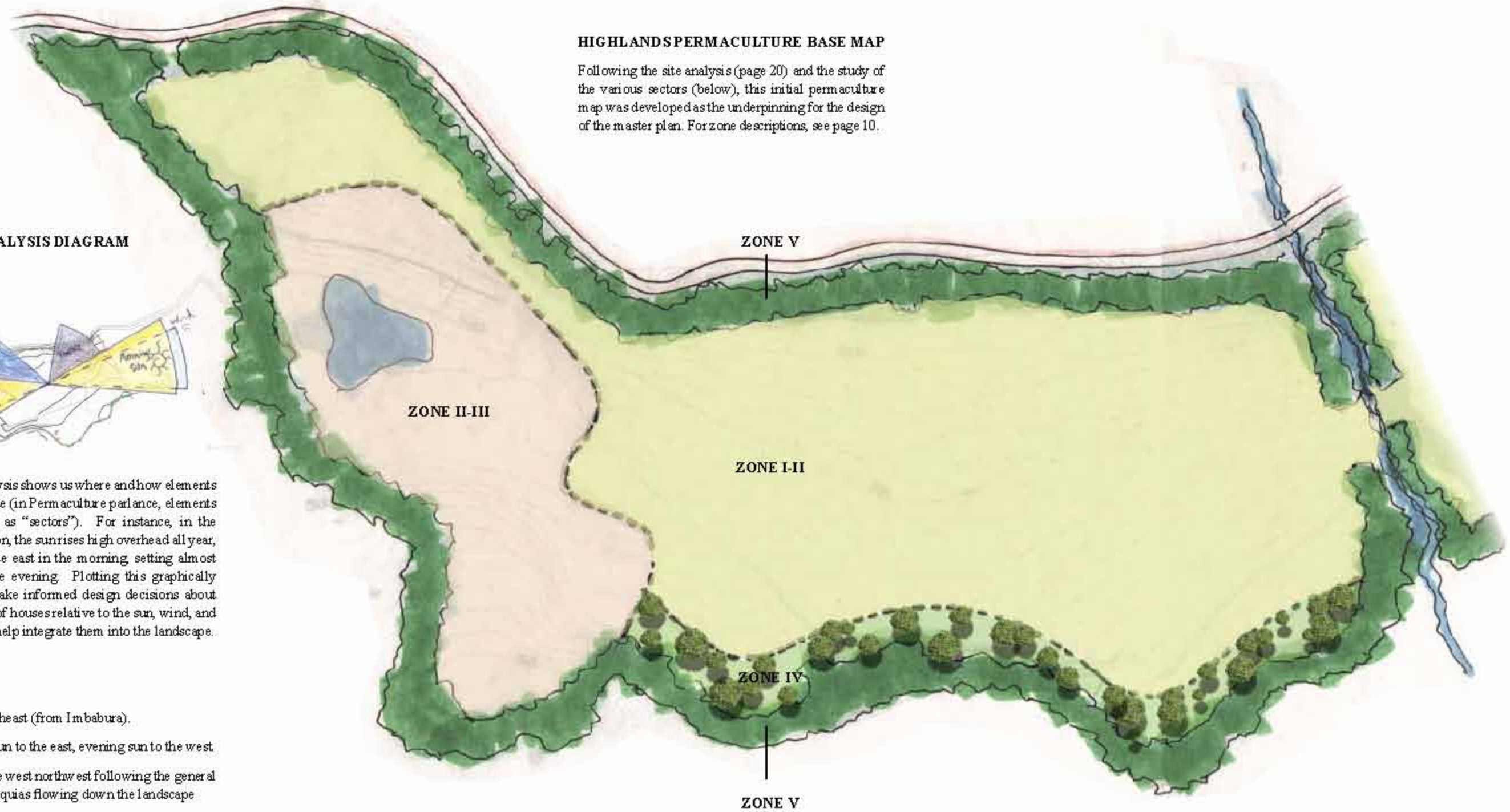
SECTORS

Wind: East southeast (from Imbabura).

Sun: Morning sun to the east, evening sun to the west.

Water: From the west northwest following the general contour and acequias flowing down the landscape.

Traffic: Human access is from the north and northeast.



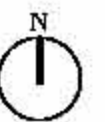
MASTER PLAN LOT LAYOUT

The Master Plan closely follows the initial vision of creating clusters of live/work homes. Though smaller than the Lowlands lots, every property here will have room for gardening and raising animals. These four hectares will be car-free with only limited access by vehicles for emergencies and heavy goods servicing.

There will be a variety of communal places: two parquecitos for small gatherings and a large commons, or green, for sports and larger occasions including fairs and weddings.

Two lots in the northwestern corner have their own entrance off the public (earthen) road and parking spots at the front entry.

The main entrance pathway has a terminated vista – a lookout point for all to enjoy the view of the countryside.



MASTER PLAN LOT LAYOUT WITH BUILDING FOOTPRINTS



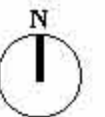
PROGRAM

- 15 lots to be sold (adhering to permaculture master planning and principles)
- 1 caretaker homestead
- agriculture fields farmed by caretaker (Z III)*
- continuous agro-forestry fields (Z IV)*
- wilderness reserve (Z V)*
- living fence surrounding development
- integral water systems
- communal gazebo lookout
- communal agriculture shed
- community village green
- community park
- rural parking and community entrance

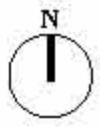
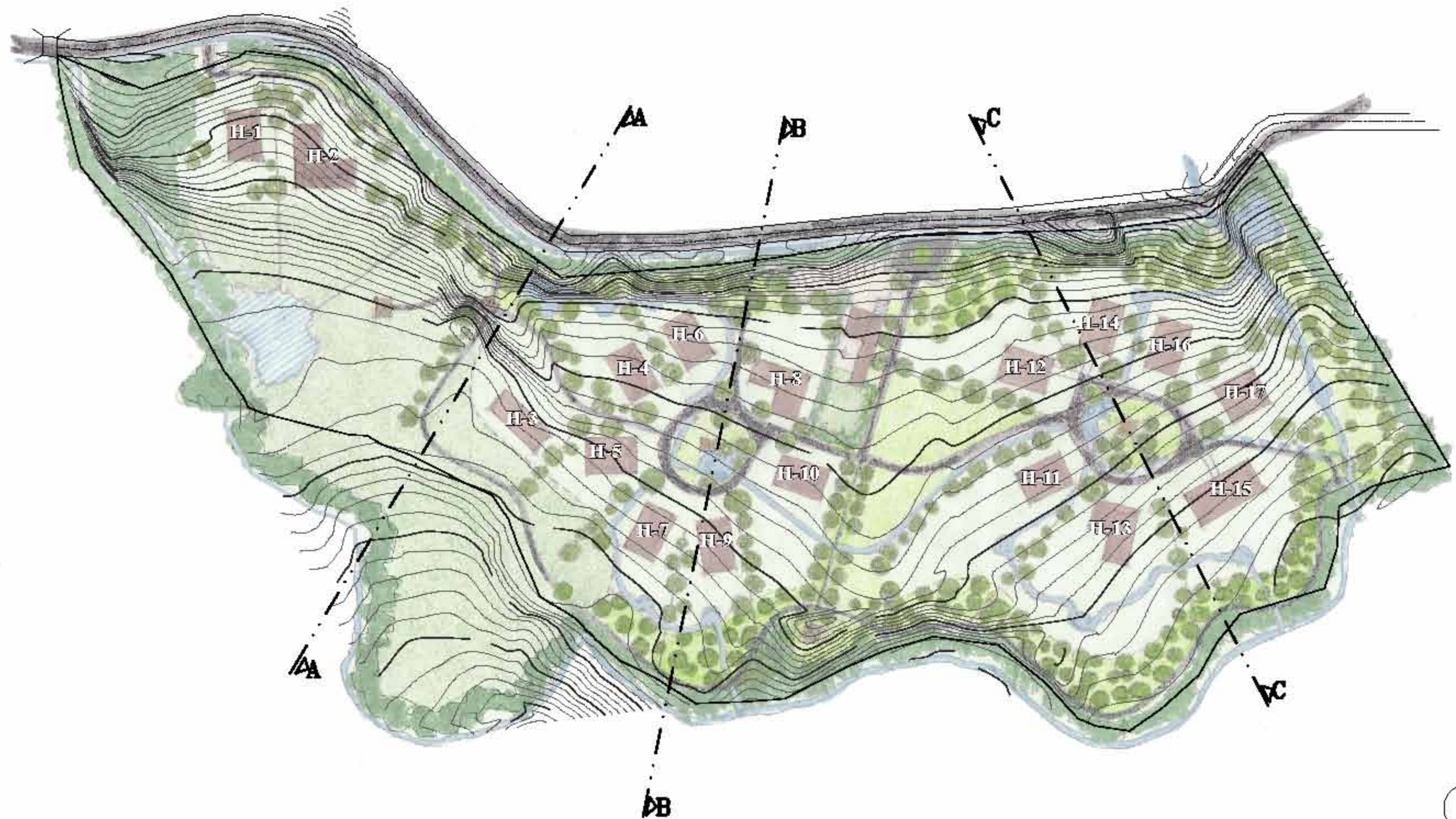
*For zones, see page 21

NOTE

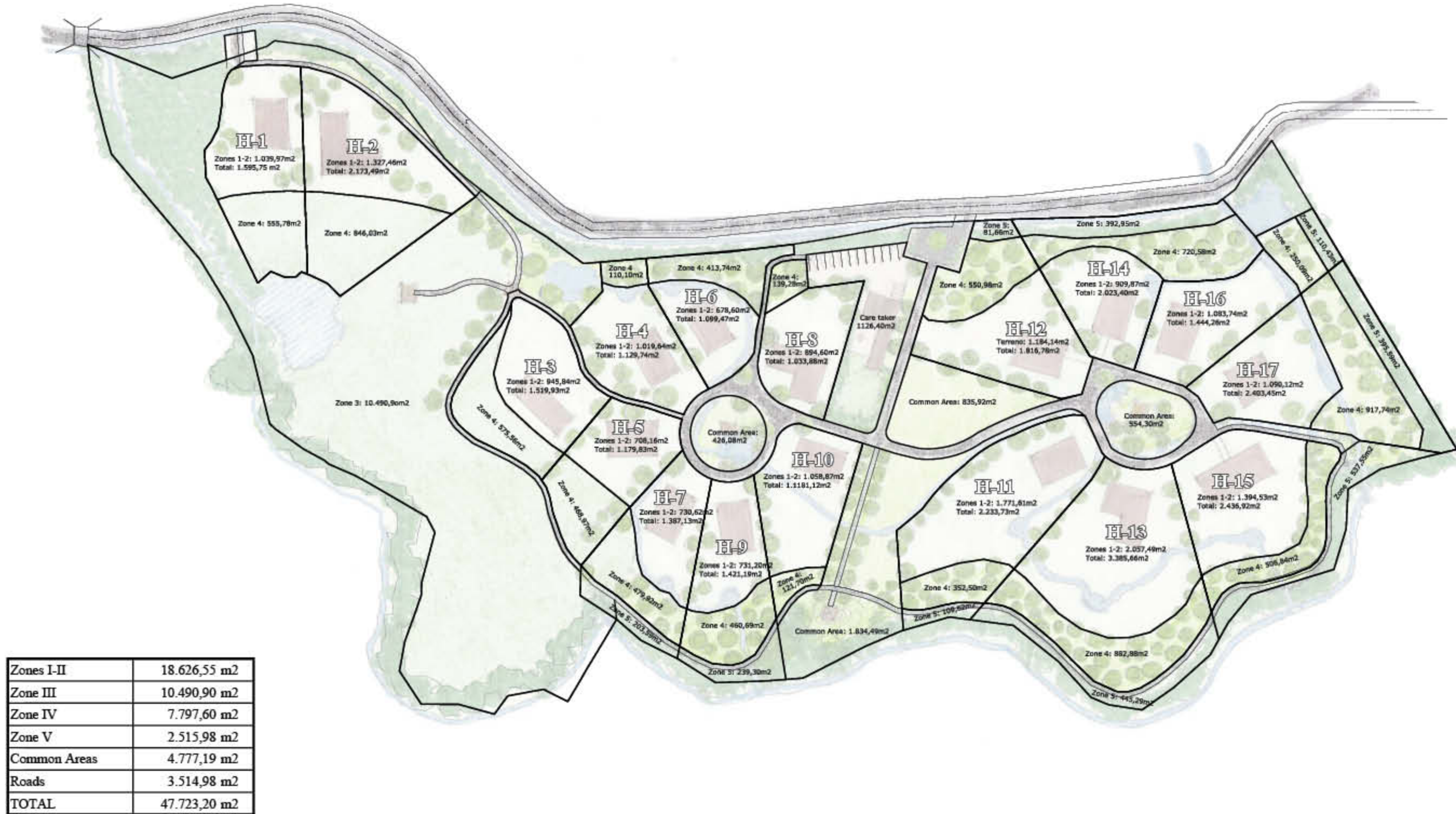
Building footprints are shown for scale only and are not indicative of the appropriate building placement or building typology as outlined in the Urban Code and Architectural Guidelines of this document.



HIGHLANDS MASTER PLAN WITH TOPOGRAPHY



MASTER PLAN AREA TAKEOFFS



HIGHLANDS PARQUECITOS

CONCEPT

These parquecitos, or small parks, provide both a green and beautiful view from the houses and a place for communal activities.

Two communal spaces form the heart of Santuario Tuctara Highlands. These spaces will be suitable for intimate conversations with friends, card games, book club meetings, or nights out under the stars. They will be shielded by lush plantings and trees.

EASTERN PARQUECITO

- Has a pond with a wooden dock. Reeds and canes should be growing in the southwestern corner.
- The whole area is covered by kikuyo grass.
- There is a tunneled entrance.
- Two big trees provide shelter to a covered structure where we find an earthen oven, a barbecue, and a bench.
- Flower beds and small trees complement the parquecito.

WESTERN PARQUECITO

- A swale in the east side directs overflow from the road, providing moisture for a group of trees and bushes.
- A kiosk serves as a community billboard and provides shelter for tables and chairs.
- A water-feature beautifies a little plaza surrounded by benches.
- A playground with wooden structures, surrounded by flower beds, complements the parquecito to the east.



LAND CARETAKER

DESCRIPTION

The caretakers will cultivate a small market garden and keep the overall permaculture design moving towards rapid regeneration of the landscape and sustainable, abundant productivity. A central part of this function will be adding organic material to key parts of the landscape. To do this effectively, two large-scale composting systems will be needed on the property. One will be on the caretaker's property, the other by the camellones. They will provide access to fertile organic material in key parts of the property, and allow for harvesting of surplus biomass from the Zone III and IV systems to be cycled back into Zones I and II.

OPTIONS

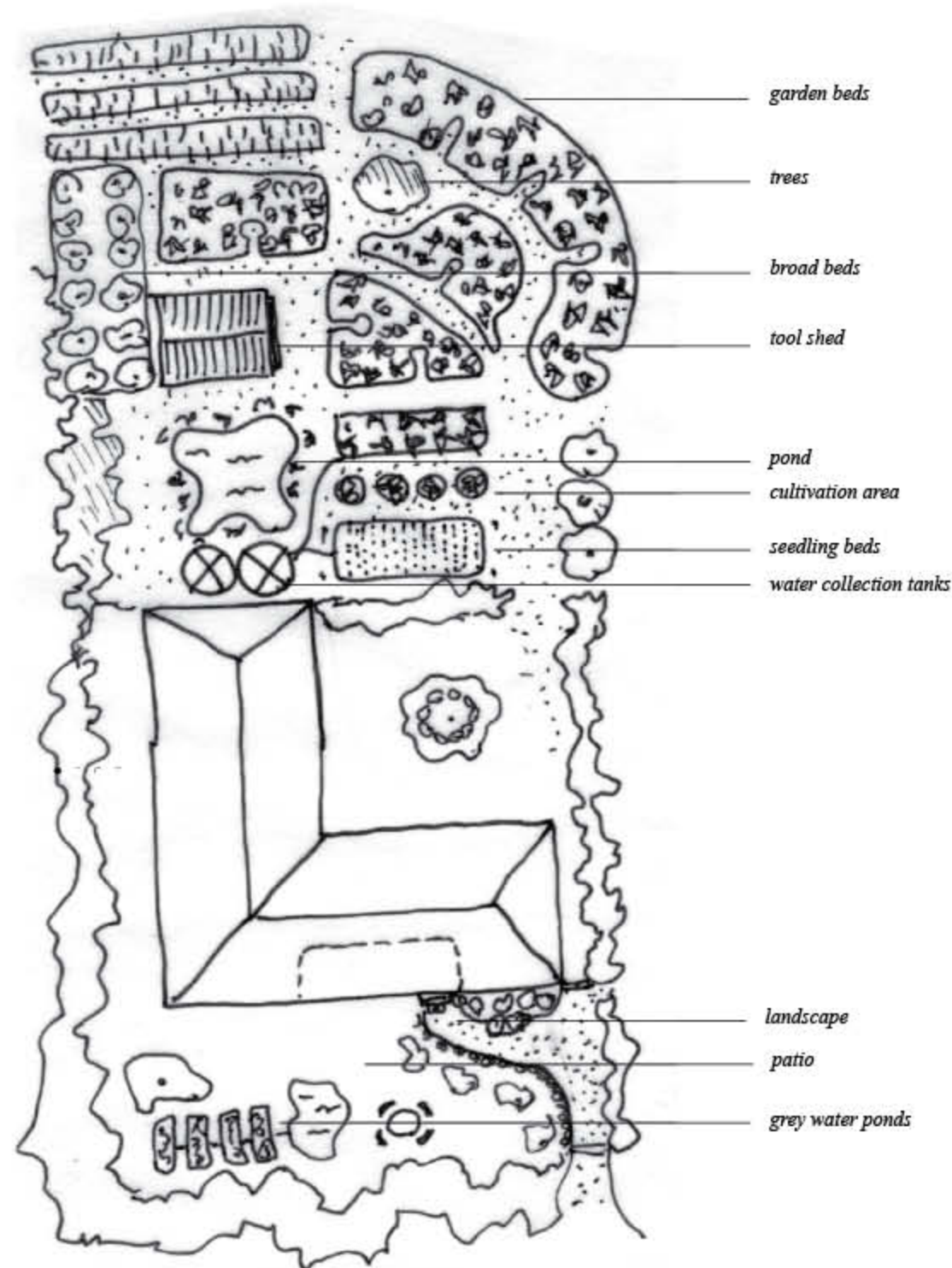
Windrows: Most suitable for the Zone III camellones system, a windrow is a long 1-meter wide and 1-meter tall compost system that can be easily turned and added to.

Compost bins: Bins offer a neat solution for household composting. Using several bins in sequence assures a steady supply of compost.

Worm farms: Using a worm farm opens up the possibility of high-quality compost fertilizer to be produced in concentrated amounts for use around the property and possibly for sale.

INTEGRATION

The composting system will be designed as an integral part of the landscape. Biomass harvesting will cycle nutrients from Zones III and IV and back to Zones II and III.



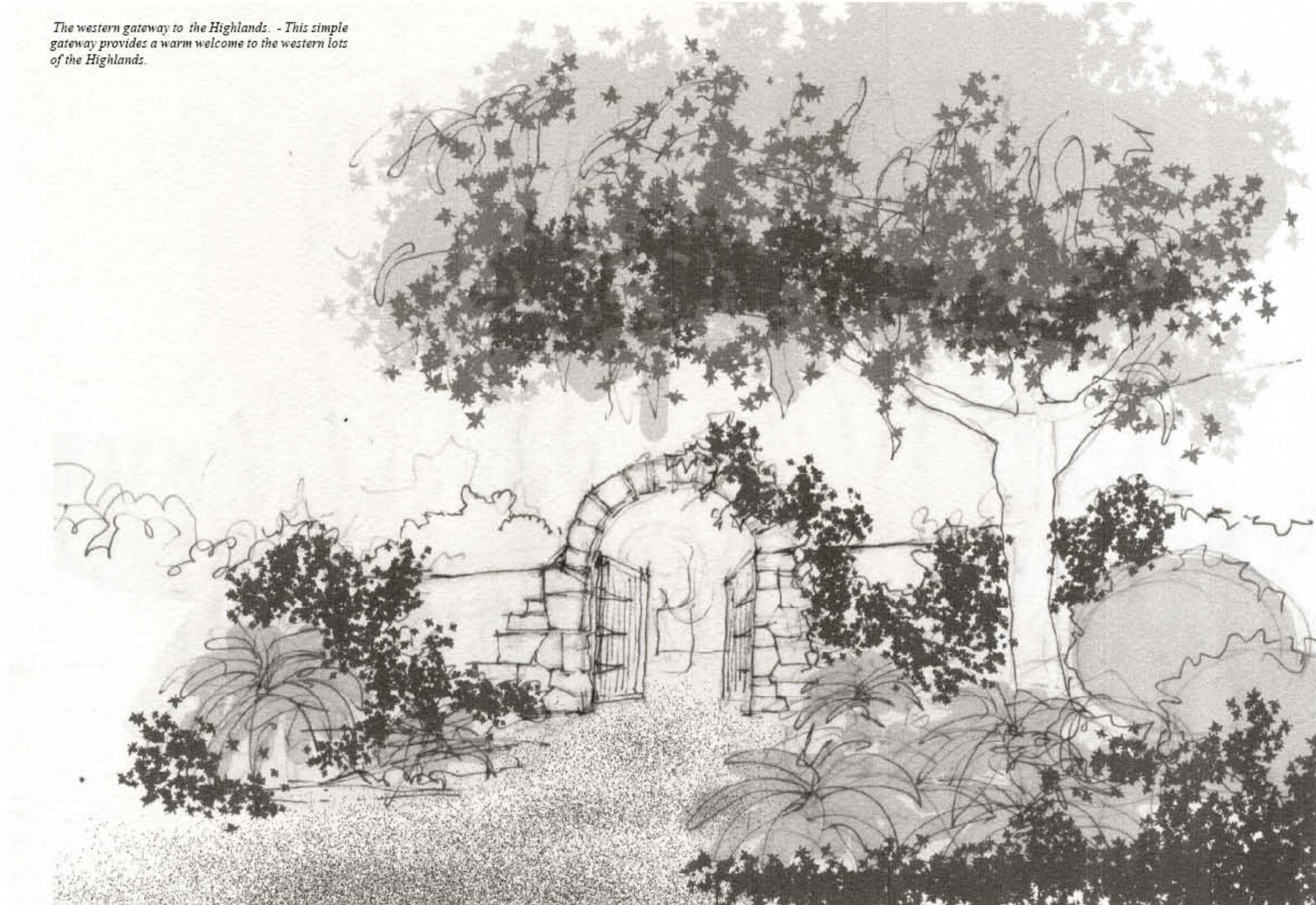


The entrance pathway to the Lowlands. – This pathway winds over a dam that creates a pond above the ravine and climbs up to the residences beyond. The caretaker's house looks out over the Lowlands.



The main entrance to the Highlands – The gateway courtyard celebrates entering the Highlands, welcoming visitors and residents alike as it provides a sense of security and privacy.

The western gateway to the Highlands. - This simple gateway provides a warm welcome to the western lots of the Highlands.



URBAN CODE - SMART DEVELOPMENT

URBAN CODE

Overview

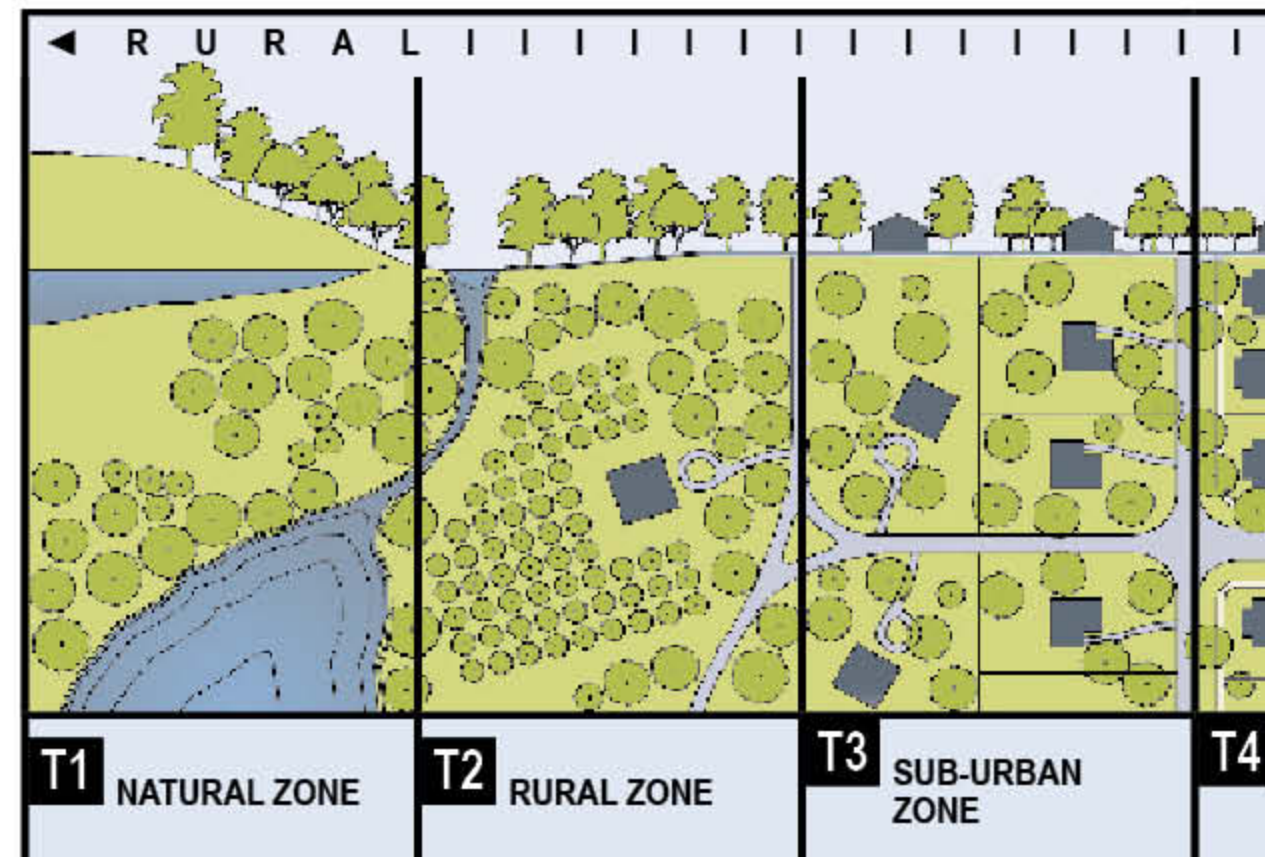
The Highlands and Lowlands of Santuario Tuctara are fairly small lands to urbanize. Regardless of size, the use of the transect and regulating plans clarifies the vision and intentions and facilitates implementation.

1. The Rural to Urban Transect

The Rural to Urban Transect is a tool used to identify the character of different human habitats running from the most rural to the most urban. For Santuario Tuctara, only the lower and more rural zones T1, T2 and T3 apply. As discussed previously the Highlands and the Lowlands must be seen as parts of a much larger urban system where the higher T-zones are found in areas of the nearby town of Cotacachi.

2. The Regulating Plans

Based on master plans, Regulating Plans are developed to designate where transect zones are located and where urban codes apply. Regulating Plans for the Lowlands and Highlands can be found on pages 32 and 33.



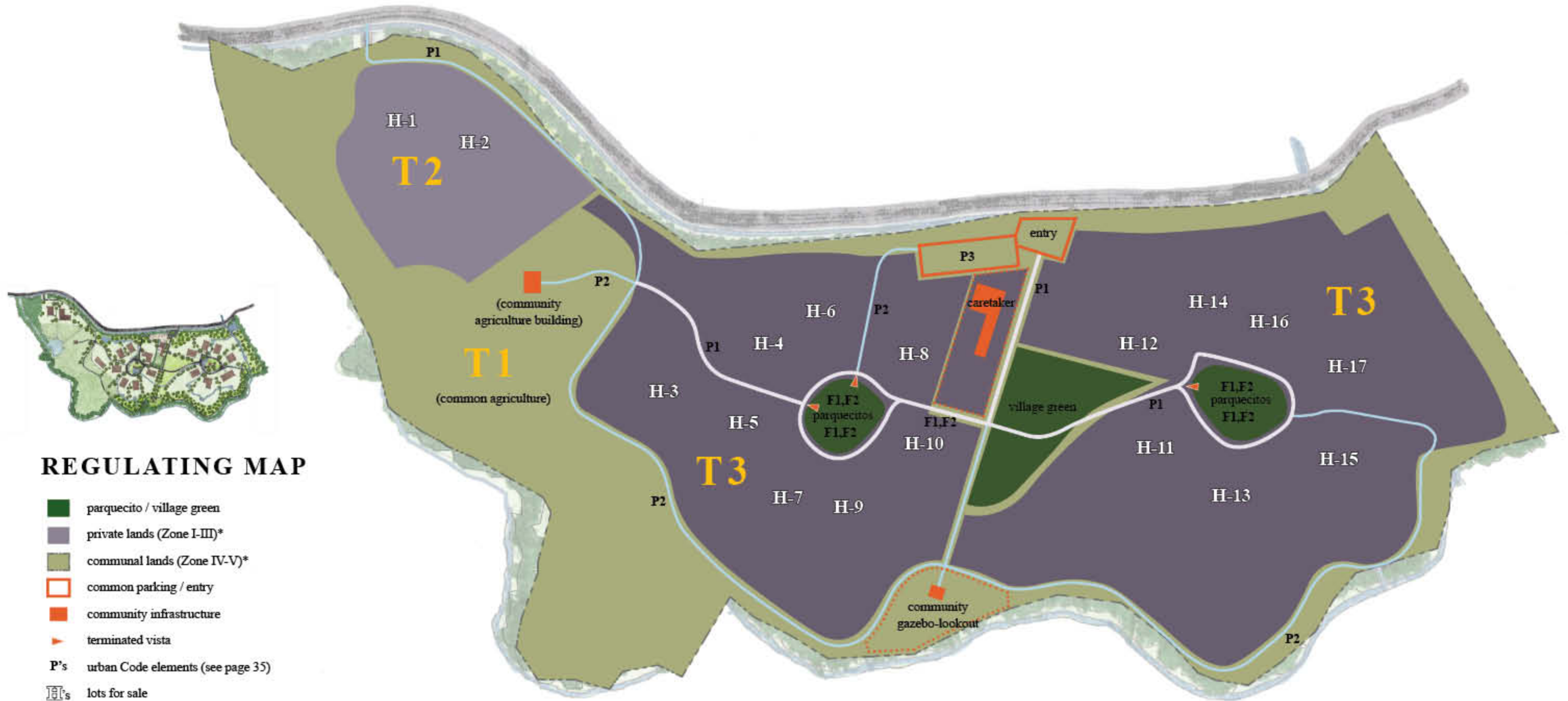


REGULATING MAP

- private lands (Zone I-III)*
- communal lands (Zone IV-V)*
- community infrastructure
- terminated vista
- P's** urban code elements (see page 35)
- L's** lots for sale
- A,B,C** lots for owner/developers
- T's** transect zones (see page 31)
- primary access paths
- leisure paths

*For zones, see page 10





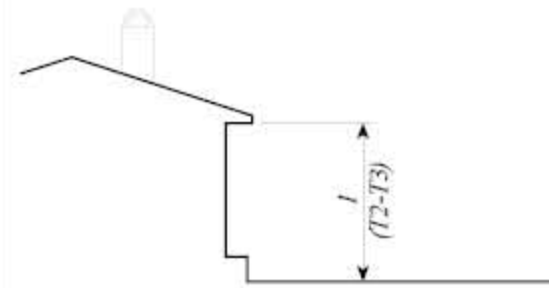
REGULATING MAP

- parquecito / village green
- private lands (Zone I-III)*
- communal lands (Zone IV-V)*
- common parking / entry
- community infrastructure
- terminated vista
- P's** urban Code elements (see page 35)
- lots for sale
- T's** transect zones (see page 31)
- primary access paths
- leisure paths

*For zones, see page 10



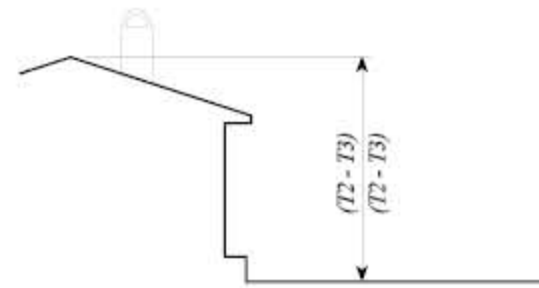
LOT COVERAGE AND CONFIGURATION



STOREY

T2, T3

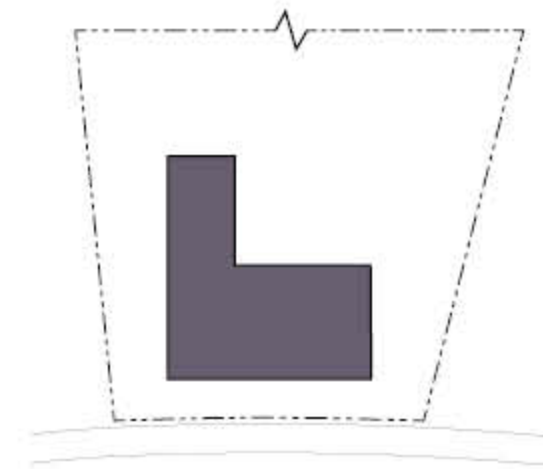
All buildings shall be one storey.



HEIGHT

T2, T3

Buildings shall not be more than 6 meters in height, measured from the adjacent finished grade to the top of the roof (excluding chimneys and water catchment).



LOT COVERAGE

The maximum building square-footage, including attached, covered porches and hardscape patios and courtyards, as listed:

T3

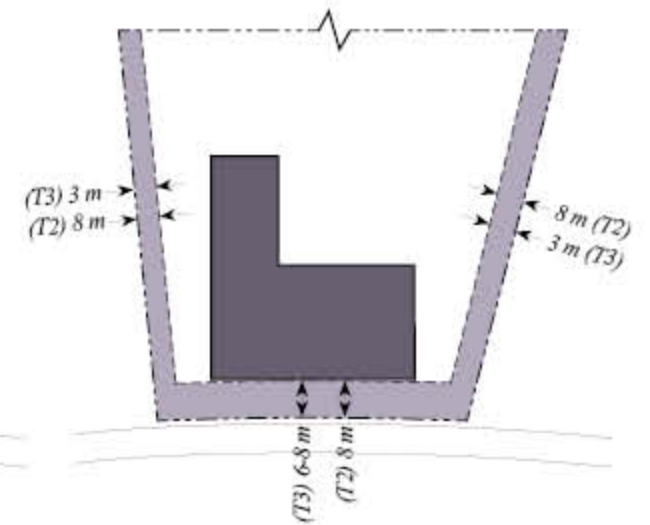
- Lot < 1000 square meters, total building square meters no more than 50% of lot.

- Lot > 1000 square meters < 2000 meters, total building no more than 500 square meters.

- Lot > 2000 meters, total building area no more than 750 square meters.

T2

- Lot > 2000 meters, total building area no more than 750 square meters.



SETBACK

All ancillary and habitable buildings shall be set back from the lot line as follows:

T3

- Front - minimum of 6-meter, maximum 8-meter setback from front lot line.

- Side - minimum of 3-meter setback from side lot line.

T2

- Front - minimum of 8-meter setback from front lot line.

- Side - minimum of 8-meter setback from side lot line.

PARKING

T3 - HIGHLANDS

All resident and guest parking shall be confined to the perimeter of the development in a lot. Number of spaces must not exceed one parking stall per residential lot.

The common parking area(s) shall be visually screened by vegetation – living walls – and have a drive aisle no wider than 4 meters with minimized impervious paving.

The common parking area(s) shall be constructed with either local river-stone cobble or compacted gravel base.

The common parking area(s) shall be designed to sheet-flow storm-water a minimum slope of 10cm rise per 4m run and flow into a ditch or swale (typically 40cm deep). The water must flow through a vegetated swale for filtration before discharging into any other body of water or into the landscape. The discharge must be incorporated into the larger water management and grading design of the site.

T2 - LOWLANDS

Residential, long-term parking shall be maintained within the individual lots and shall be visually screened by vegetation or living walls.

Short-term and guest parking shall be allowed along the P1 access pathways only.

If necessary, garages and carports are allowed but shall be either screened properly and integrated into the landscape, or incorporated as entry features that follow the principles and intent of the architectural guidelines.

PATHWAYS AND ACCESS

All pathways are primarily pedestrian, if not exclusively; all must use natural and local stones, river-rock, gravel and earth – NO concrete, asphalt, macadam, modular or monolithic paving material permitted.

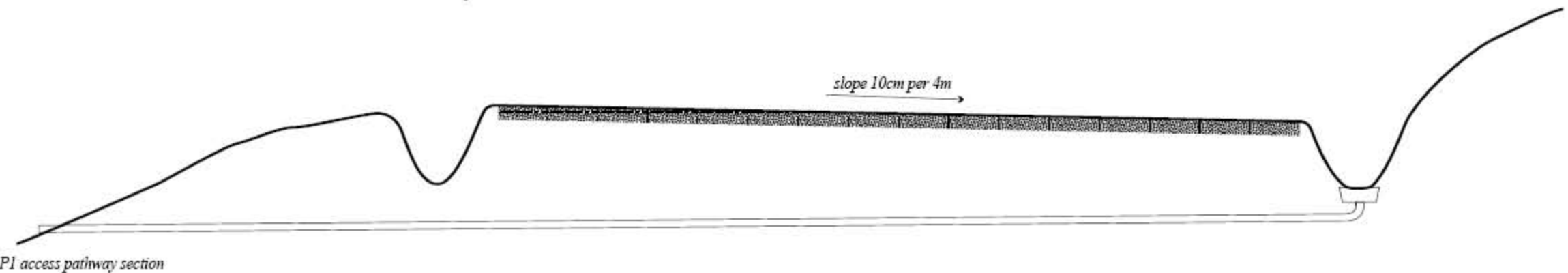
T2, T3 - HIGHLANDS & LOWLANDS

- **P1** - primary access pathway
 - Primarily compacted gravel with local river-rock cobble when necessary
 - 3-4 meters wide with ditch each side
 - road drainage cross-slope 10cm/4m
 - drainage ditch 0.5m wide, 0.4m deep; must provide an invert, or storm drain, every 100 to 200 linear meters; invert and drainage pipe must be incorporated into site water management and grading plan

- **P2** - Community connections and pedestrian leisure paths
 - compacted gravel and pebble base as well as open-paver flagstone and brick
 - 1-2 meters wide

- **P3** - Rural community parking
 - local river-rock cobble

- **P4** - Dam-access pathway
 - river-rock cobble
 - 3-4 meters wide



common parking example



nearby rural pathway



local river-stone cobble



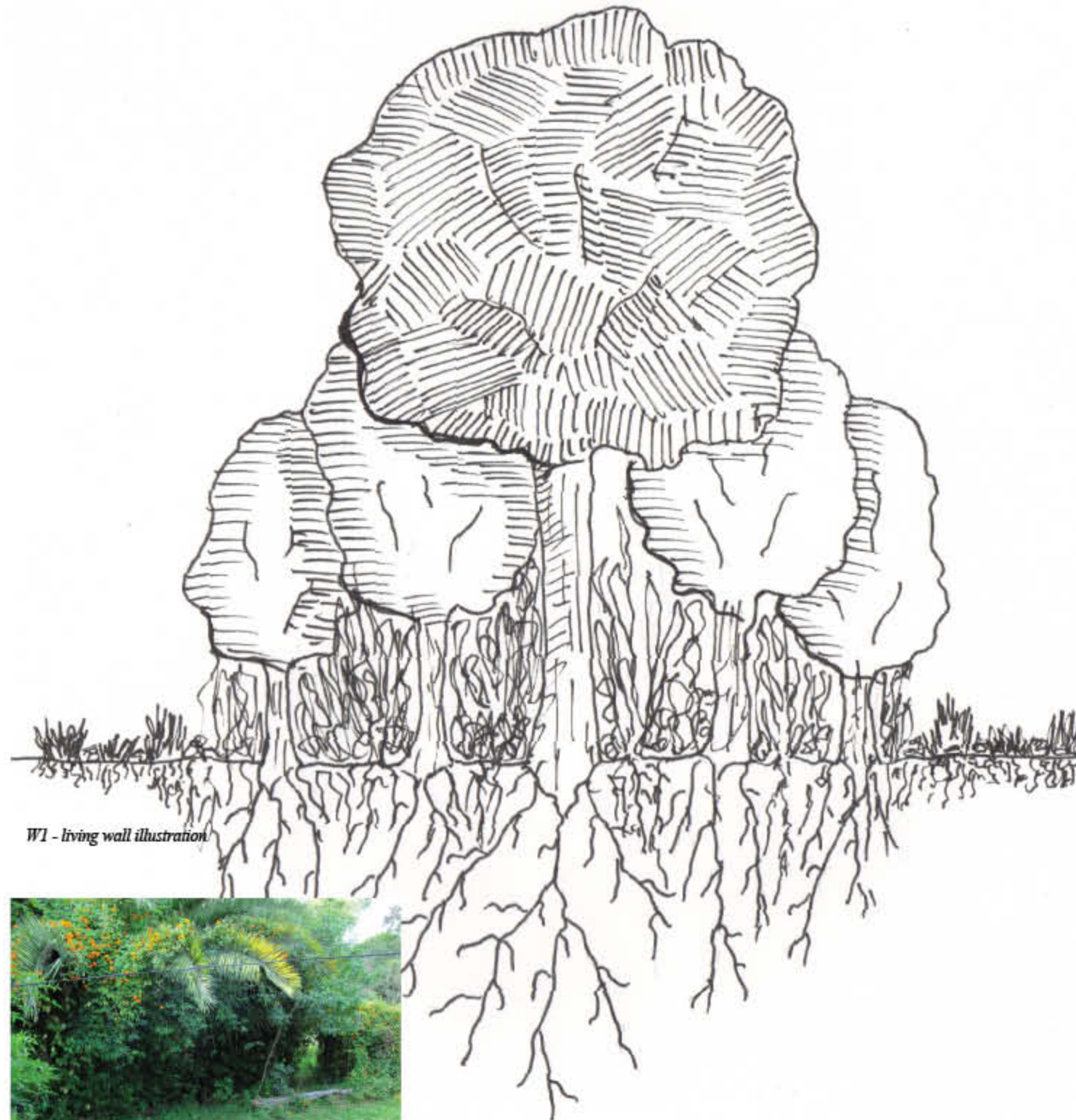
stone bridge example

LANDSCAPE WALLS

Like all elements, walls needed to separate areas or activities should have multiple uses. A living wall, which provides security, should also provide refuge for wild plants and animals.

W1 - Living walls, densely vegetated landscape features for land-use separation, must adhere to Permaculture principles as outlined in this document.

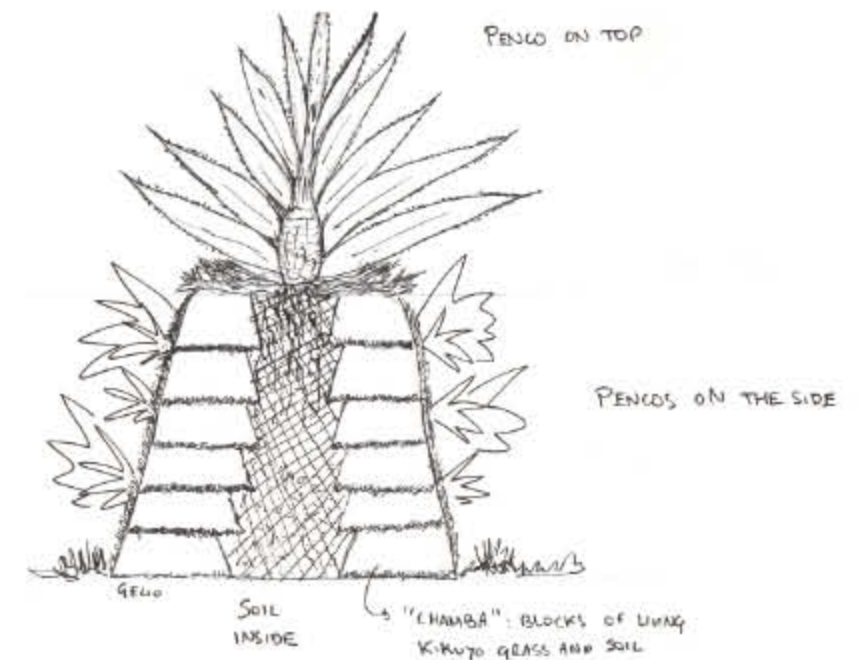
W2 - Living fences, adobe or rammed earth walls with vegetation, such as agave and cactus, planted atop the wall.



W1 - living wall illustration



W1 - living wall example



W2 - living fence section sketch



W2 - living fence section example

ENTRY FEATURES

Entry features shall contribute to the public realm by announcing the individual domains, providing an enhanced entry sequence for visitors and daily life.

- E1 - Entranceway celebrating the transition from the public realm to a private domain (P1)



E1 - example of entranceway to a private lot

URBAN FURNITURE

The public realm shall have a number of public amenities that are in character with the overall palette.

- F1 - Benches shall be distributed along pathways and on the village greens
- F2 - Tables shall be distributed along pathways and on the village greens



F1 - bench example (Juego Espiral)



F2 - table example (Juego Espiral)

PARQUECITO AMENITIES

A communal gathering space, the parquecito shall be provided with elements that will contribute and encourage community gatherings. Whether for informal, daily activities or formal celebrations and events, the parquecito should provide a range of options – the basic amenities indicated below plus others that will answer community needs.

- A1 - Earthen oven fueled by wood
- A2 - Wooden playground feature



A1 - example of a local oven

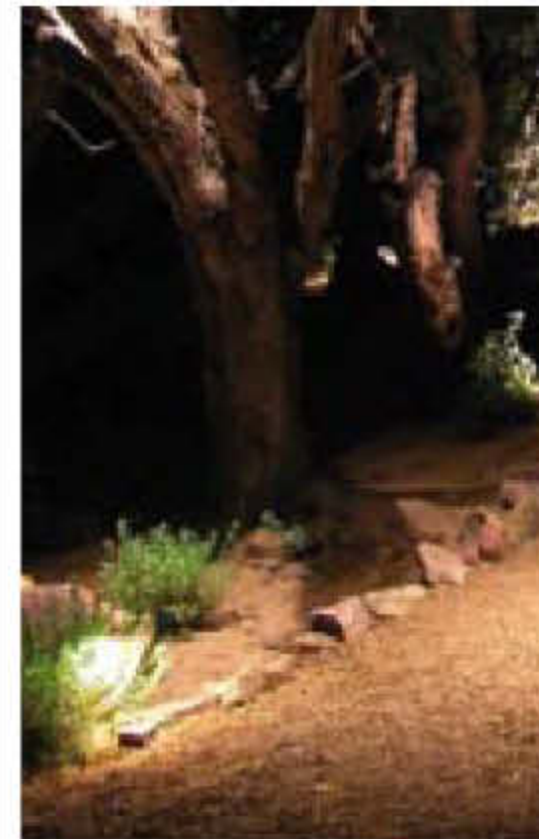


A2 - example of a playground feature

PUBLIC LIGHTING

Public lighting shall be limited to the primary pathways and locations to conserve energy, reduce light pollution, and preserve the rural nocturnal environment. Lighting should be close to the ground to illuminate only the pathway surface. It will be motion-sensor activated and solar powered.

- L1 - Solar security lighting with motion-sensor activation



L1 - example of landscape lighting

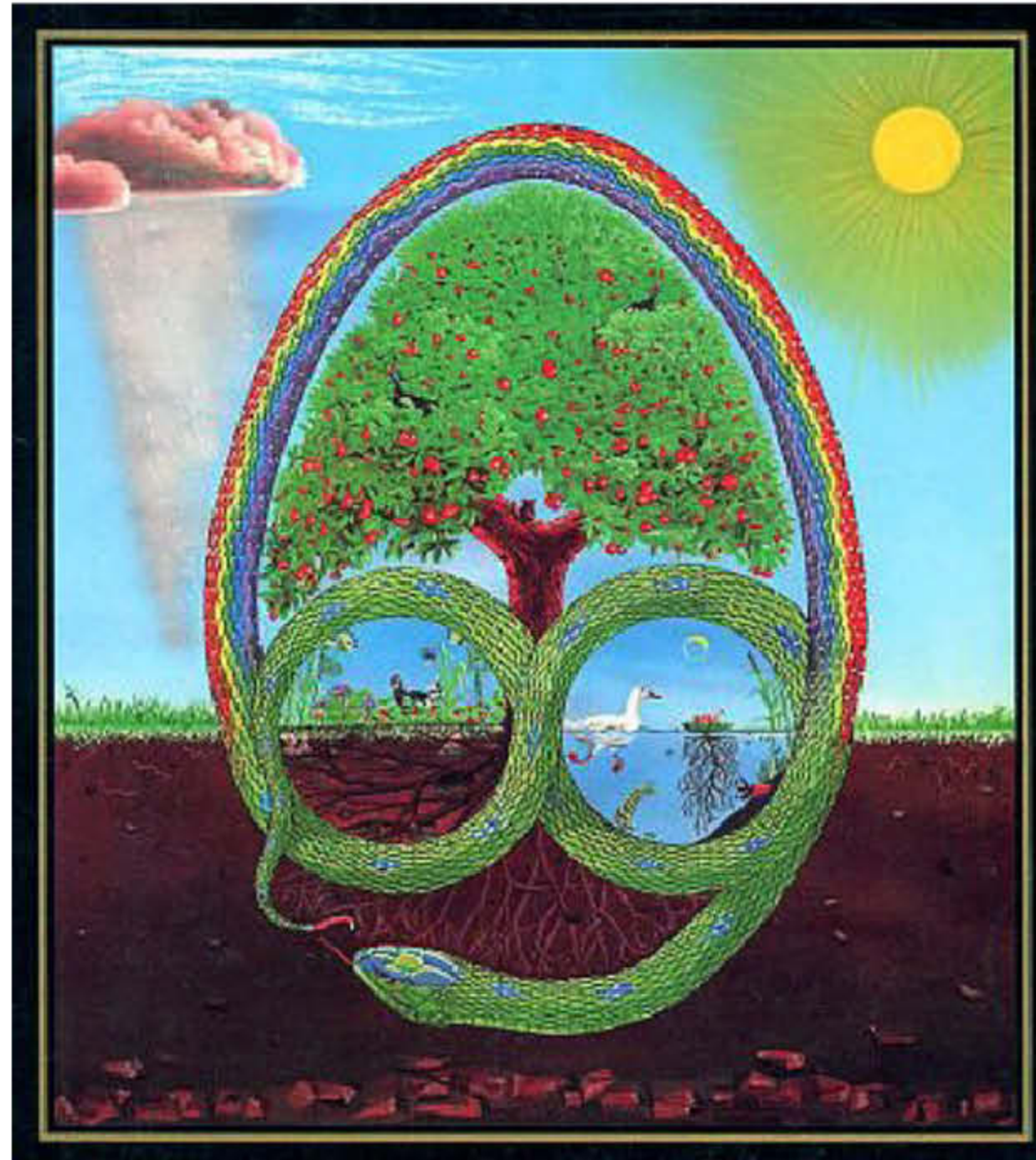
PERMACULTURE PRINCIPLES

Permaculture is a design science focused on using ecological patterns to mimic the productivity, diversity and resilience of natural ecosystems. Permaculture integrates ecological, social, economic, cultural and architectural considerations to design human habitations in harmony with their environment.

Santuario Tuctara will be a model of permaculture design. Land-use and cultural integration strategies will model sustainable development in a way that respects the local culture, works to preserve native plant and animal species, regenerates the landscape, and incorporates this new community into the multi-cultural population of Cotacachi.

Permaculture Design is a system that starts from a strong ethical framework, then uses ecological principles and systems to guide the design process. We have used this ethical framework and principles to create a holistic design for Santuario Tuctara.

Bioregional Context: Inter-Andean Valley at 2,500 meters above sea level. Cool to warm temperatures. Native vegetation largely replaced by agriculture. Strong presence of native cultures. Connections to the subtropical valley of Intag to the east, and to colder regions in Imbabura and the Cotacachi mountains. Cotacachi borders the Cotacachi-Cayapas reserve.



“Allpa in Quechua means the Land, at its most all-embracing – the landscape, the soil, the sky, the clouds, the myriad insects, the plethora of plants, the animals, the relationships between beings, the smells, the noises, the stars at night.”

- Javier Carrera



SANTUARIO TUCTARA

ECO-ETHICAL DEVELOPMENT

In keeping with the ethical principles of permaculture, Santuario Tuctara is striving to create a space that regenerates the ecology and culture of Cotacachi and beyond.

EARTH CARE: Rebuilding natural capital by creating swales, planting native species, and reforesting the landscape, Santuario Tuctara is helping regenerate the biodiversity and natural capital of the Cotacachi region.

PEOPLE CARE: Looking after self, kin and community by making safe, healthy spaces where each individual owner and family can live and grow in harmony with nature. Santuario Tuctara will not only care for its residents but will also create a sustainable model for agriculture and building. This approach can serve as an example for the people of Cotacachi and beyond.

FAIR SHARE: By limiting consumption, avoiding mono-culture, distributing surplus in a fair manner, and including the local people as partners, Santuario Tuctara will develop a sustainable economic model for healthy living.

DESIGN ACCORDING TO PRINCIPLES

Simply declaring our ethics is not enough. The design and implementation of our dream for a sustainable community must embody these ideals.

KEY ELEMENTS OF THE DESIGN

Water: Both properties will harvest water into ponds and cisterns and hydrate the landscape with contour swales, using the water available from the acequias, rain-water catchments, and springs.

Reforestation: Native species will form the core of the lush forest being planted on both properties. Small, intimate gathering places will be nestled into the green landscape. Fruit trees and medicinals will offer abundance to inhabitants who walk through the

landscape.

Food: Indigenous camellones (raised beds) will be cultivated in the low-lying marshy areas of the property, and an ample harvest of fresh, organic vegetables will be available for on-site use and sale. Individual owners will also have fertile garden plots for personal vegetable and herb gardens nestled between fruit trees.

Soil Restoration: The hydrating swale system, erosion control, and active soil building will regenerate the depleted soils of Santuario Tuctara Lowlands and Highlands.

Beauty: The stunning views and lush landscape will provide an intimate and sublime space for people to live, work and play. This landscape will be created following the natural contours of the land, accentuating the existing beauty by integrating thoughtful cultivation with wilderness reserves.



1. Observe & interact
"Beauty is in the eye of the beholder"

- walking the local landscape
- creating opportunities for local feedback
- engaging local leaders and keepers of wisdom



2. Catch & store energy
"Make hay while the sun shines"

- renewable energy like micro-hydro
- catching water on the landscape



3. Obtain a yield
"You can't work on an empty stomach"

- Productive systems like:
- aquaculture
 - raised-bed gardens (camellones)
 - super-productive food forests



4. Apply self regulation & accept feedback
"The sins of the fathers are visited on the children of the seventh generation"

- limiting use of the land to what will be sustainable
- creating opportunities for community feedback



5. Use & value renewable resources & services
"Let nature take its course"

- using llamas for "mowing" the grass
- on-site composting systems



6. Produce no waste
"A stitch in time saves nine"
"Waste not, Want not"

- zero-waste policy
- composting systems
- grey-water systems
- composting toilets



7. Design from patterns to details
"Can't see the forest for the trees"

- regional master plan
- sector analysis
- zones
- regeneration
- integration



8. Integrate rather than segregate
"Many hands make light work"

- education and integration strategy with local community
- zone V living fence
- swales connecting landscape



9. Use small & slow solutions
"The bigger they are, the harder they fall"
"Slow and steady wins the race"

- starting with a nursery, creating a forest
- 10-year land regeneration plan
- 2-year education plan



10. Use & value diversity
"Don't put all your eggs in one basket"

- poly-culture gardens
- diverse native forest
- zone V edge maximized
- orchards
- aquaculture



11. Use edges & value the marginal
"Don't think you are on the right track just because it's a well-beaten path"

- zone V edge
- camellones
- low-lying ponds
- walking paths
- cistern pergola



12. Creatively use & respond to change
"Vision is not seeing things as they are but as they will be"

- harnessing real estate development trends
- helping spread permaculture education and knowledge
- creating a working model for the future

ZONE ELEMENTS

All land should be put to practical use.

Zone I includes elements that can be seen from home and need to be visited daily. Zone II includes elements that also need to be visited daily, or almost daily, but should be a bit farther away or hidden from the house.

Zone I, where people live, must be as aesthetically pleasing as possible - and functional as well. Zone II should be designed for landscape as much as for human needs. The landscapes of Zones III, IV and V become increasing wild and natural.

ZONE I ELEMENTS

- A stone and soil herb spiral planted with aromatic herbs for kitchen use.
- One to three lemon trees, close to kitchen door.
- A path wide enough for a wheelbarrow, winding up in a way that creates a beautiful yet useful circuit around the garden.
- Keyhole and broad garden beds around the path.
- Patio, lawn, and playground.
- Medicinal / aromatic herbs and flowers integrated with vegetables in the same beds.

ZONE II ELEMENTS

- A living fence separating this zone from Zone I.
- Compost and worm-compost piles under the shade of trees.
- A little building for storing tools and produce, and next to it a firewood storage place.
- Options:*
- Fruit trees.
- Free-range poultry in movable pens. If poultry is present, fruit trees are mandatory.
- Garden beds to be rotated with poultry pens.
- Other small to mid-sized animals.
- A pond with aquaculture.

PERMACULTURE MASTER PLAN ZONES



(Zone Elements continued...)

ZONE III ELEMENTS

- Camellones and other raised cultivation beds made out of soil and compost
- Trellis plants, like achogcha, granadilla, taxo
- Edible garden plants, including roots, fruits, legumes, leafy vegetables
- Flowers and herbs
- Soil-improving plants, such as legumes
- An aquaculture system (pond)

ZONE IV ELEMENTS

- Fruit and nut trees, different sizes
- Companion trees and bushes, legume trees
- Beehives
- Companion animals, such as poultry and llamas

ZONE V ELEMENTS

- Let nature grow and develop by itself
- Places to sit and enjoy the natural environment; benches, old boulders

PERMACULTURE MASTER PLAN ZONES



IMPLEMENTATION

LANDSCAPE AND INFRASTRUCTURE

ELEMENT	RECOMMENDED TIME OF YEAR	RECOMMENDED PERSONNEL
Implementing the tree nursery	August, to be ready by the beginning of September	RGS personnel to train nursery manager
Collecting seeds for the nursery	September to November	RGS personnel and nursery manager
Nursery maintenance	September and ongoing	RGS personnel to provide 6 days training to nursery manager
Zone III ponds and irrigation, survey and implementation	July to September	RGS personnel and local crew
Camellones system implementation	October to December	RGS personnel, nursery manager and / or caretaker, and crew
Swales survey and implementation	October to March, depending on trees from the nursery or bought	RGS personnel, nursery manager and / or caretaker, and crew
Property borders survey and implementation	October to March, depending on trees from the nursery or bought	RGS personnel, nursery manager and / or caretaker, and crew
Highlands irrigation and ponds system survey and implementation	July to September	RGS personnel, nursery manager and / or caretaker, and crew
Lot borders survey and planting	October to March, depending on trees from the nursery or bought	RGS personnel, nursery manager and / or caretaker, and crew
Pathway development	July to September	

RGS - Network of Seed Guardians

SUCCESSION PLAN

Succession is a natural ecological process whereby ecological systems evolve from simple systems with low biodiversity to complex and diverse ecosystems.

Permaculture is, in part, the art of speeding succession. Moving a degraded landscape from bare ground into a diverse and productive forest garden requires advancing rapidly through the pioneer and secondary phases of succession to arrive at the tertiary ecosystem level. It is not enough to simply plant fruit trees. First we must plant nitrogen-fixing pioneer species (often confused with weeds) to help break up the soil and add nutrients. Then we must plant "nurse trees" to further break up the soil and provide shade for the tender fruit, nut and flowering trees we want to showcase in our final forest.

This process will take several years and is closely tied to the nursery element of design, which will give us species needed for every phase of succession. At the point when they are needed, the species will have been started and be at a level of maturity that will help achieve rapid growth.

The succession strategy will have two primary phases followed by a third, maintenance phase. These phases overlap with one another.

PHASE ONE: PIONEER

Time frame: 0-18 Months

Description: The Phase One strategy relies on living mulch and hardy pioneer species. This phase is essential for preparing the soil for the next stage of succession. Using seed balls, cover crops, and hardy tree species (nurse trees), this stage will allow more delicate species to thrive in the next phase of planting.

<i>Especie</i>	<i>Descripción</i>	<i>Tiempo de Transplante Desde la Semilla o Estaca</i>	<i>Especie</i>	<i>Descripción</i>	<i>Tiempo de Transplante Desde la Semilla o Estaca</i>
Trinitaria	arbusto	2 meses	Guarangos Silvestre	arbusto denso	3 meses
Laurel de Cera	arbustiva	3 meses	Uña de Gato	arbusto cobertor	2 meses
Sacha Olivo	arbustiva alta denso	2 meses	Pencos	bromelia gigante	3 meses o plantulas
Chilca	arbustiva denso	2 meses	Espino de Mote	arbusto denso	3 meses
Lupinos	arbusto	1 ½ meses	Chanchacos	arbusto	3 meses
Higuerilla	arbusto alto y denso	2 meses	Guanto Panameño	arbusto alto y denso	1 meses
Trueno	arbusto denso	2 meses	Chamanas	arbusto pequeño denso	3 meses
Sacha Quishuar	arbusto	4 meses	Casantillos	arbusto denso	3 meses
Achira	arbusto denso	1 mes	Alpa Anís	arbusto pequeño	2 meses
Bambú Andino	arbusto	3 meses	Canelillo	arbusto	3 meses
Locrohomas	arbusto alto y denso	2 meses	Moras Silvestre	arbusto cobertor	3 meses o estaca
Fucsias	arbusto	3 meses	Cholan	arbusto alto	3 meses
Guanto	arbusto denso	2 meses	Jullag	arbusto denso	2 meses

PHASE TWO: ESTABLISHMENT

Time frame: 12-36 months

Description: In the establishment phase, diverse perennial species are planted after they have had time to mature in the greenhouse. The pattern of planting hardy species to prepare the soil continues, but now we have a more stable micro-climate, more soil moisture and more ability to introduce delicate species. We begin to form poly-cultural guilds and build multi-level forest gardens with climbing vines, trees, bushes and ground cover. Rapid-growing trees start to create a shade canopy. Many plants will still need human care.

<i>Especie</i>	<i>Descripción</i>	<i>Tiempo de Transplante Desde la Semilla o Estaca</i>	<i>Especie</i>	<i>Descripción</i>	<i>Tiempo de Transplante Desde la Semilla o Estaca</i>
Alisos	arbol	4 meses	Chirimoya	arbol frutal	7 meses
Nogal	arbol alto	6 meses	Duraznos	arbol pequeño frutal	9 meses con ingerto
Acacias Silvestres	arbol	4 meses	Manzanas	arbol pequeño frutal	9 meses con ingerto
Capuli	arbol denso	6 meses	Poroton	arbol frutal	5 meses
Tilos	arbol	4 meses	Nispero	arbol frutal	5 meses
Arrayán	arbol	8 meses	Higo	arbol pequeño frutal	5 meses estaca
Puma Maqui	arbol	7 meses	Tomate de Arbol	arbol frutal pequeño	4 meses
Sacha Capuli	arbol denso	5 meses	Chigualcan	arbol frutal	4 meses
Molle	arbol denso	5 meses	Uvilla	arbusto denso frutal	4 meses
Quishuar	arbol	5 meses	Moras	arbusto denso frutal	4 meses
Guabas	arbol frutal	4 meses	Limones	arbol pequeño	9 meses

PHASE THREE: MAINTENANCE

Time frame: 24 months and beyond

Description: Now we see a young forest, vibrant and alive. Volunteer species will start to appear in the new micro-climates we have established. New birds, lizards and butterflies will arrive – this is Mother Earth telling us we are on the right track. We introduce the most delicate species. By creating a variety of micro-climates across the landscape, we are able to plant species that are on the edge of or even outside their normal planting zones. We begin introducing coffee, bananas, and other more tropical species. In this phase only the rarer and more delicate species will need direct human care. Now much of the work becomes harvesting, keeping paths clear, and cycling mulch and compost material into Zones I and II.

<i>Especie</i>	<i>Descripción</i>	<i>Tiempo de Transplante Desde la Semilla o Estaca</i>
Bromelias	colgante	introducir
Muzgos	colgantes	introducir
Orquidias	colgantes	introducir
Taxo	trepadoras densas	4 meses
Granadilla	trepadoras densas	4 meses
Maracuyá Negra	trepadoras densas	4 meses
Platano Lojano	arbusto frutal	6 meses
Café de la Sierra	arbusto	5 meses

WATER AND THE LAND

DESIGN PARAMETERS

- harvest and store as much water as possible
- redundancy in water systems (e.g. grid, well, ponds, cisterns)
- hydrate subsoil and topsoil for plant growth.
- use water as a connecting and governing pattern across the landscape
- model sustainable water use
- clean filter all water flowing on and off the site

OPTIONS

Brief: In the Ecuadorian permaculture movement, there is a differentiation between **harvesting** water and **planting** water. This reflects a deep cultural understanding of the different strategies of sustainable water management. "Planting water" describes strategies to hydrate the landscape. "Harvesting water" describes strategies to save water in catchment systems like cisterns and ponds.

Harvesting Water

- hard-surface catchment
- roof catchment into cisterns
- landscape catchment
- irrigation ditches
- keypoint ponds

Planting Water

- parking lot run-off control and filtration
- path run-off control and filtration
- keyline contour systems
- swales
- terraces

RECOMMENDATIONS

We recommend creating integrated water harvesting and hydration systems for both properties. Both hydration and storage strategies should be connected to the water system by overall design. The water catchment cisterns and ponds must have overflow systems that connect with keylines and swales.

GREY-WATER LIVING FILTER

Concept: The wastewater coming from sinks, showers and laundry is called grey water. It is full of nutrients that can be used by plants. This water passes through a living filter, a set of four boxes (also referred to as ponds) filled with plants that eat the wastes it carries, cleaning it and turning it into fresh water.

MATERIALS

- Pipes coming from the house
- An oil trap, consisting of a small box of bricks with a lid
- 4 small ponds of ferrocement
- An outlet, made of ceramic, stone, and ferrocement connecting to an irrigation channel or gravel sink
- Pipes connecting all elements

IMPLEMENTATION

Grey water coming from a house connects to its own independent drainage system – a series of ponds. The size of each system must be calculated according to each family's use of water.

The first of these ponds is tightly planted with reeds in such a way that the roots form a mat that prevents solids from flowing to the next pond. The second pond has half as many reeds plus floating plants. The third and fourth ponds have no reeds, only floating plants. The fourth is finally clean enough to have fish.

Through an outlet the pond water leads to either a nearby irrigation channel or a sink ditch, consisting of a 50x50x200 cm trench filled with gravel and surrounded by trees - such as willows, alisos, or fruit trees - that drink up and evaporate the water.

POLICIES

- Avoid oils in the system. Oils can be stored in bottles for recycling
- Only biodegradable soaps should be used. The living filter can digest some petroleum detergents, but it is better not to overload it
- Other substances that reach the filter should also be biodegradable. Non-biodegradable substances should be stored for recycling

WASTEWATER

DESIGN PARAMETERS

- grey-water filters
- connecting with gardens
- single system
- separate systems
- sand filter
- living filter
- garden filter

RECOMMENDATIONS

We recommend separate systems, one for the Lowlands and one for the Highlands. This will reduce maintenance and allow for simplicity of scale.

We recommend that dry composting toilet systems be used. They are a simple and cost-effective solution, avoiding complicated black-water treatment systems.

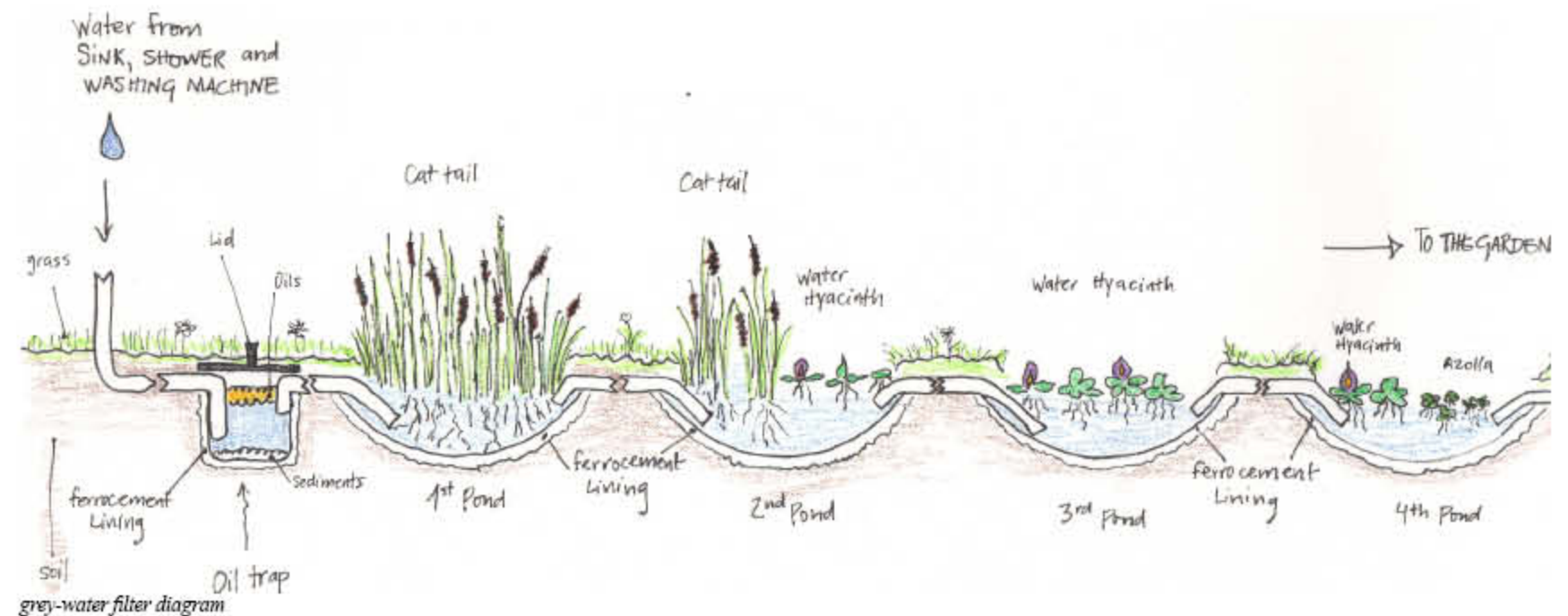
Watson Wick wet toilets could provide a simple and ecological alternative. See page 49.



grey-water filtration tank concealed with lush vegetation



grey-water filtration tank - an aesthetic garden amenity



CENTRAL SWALE ON CONTOUR

PURPOSE AND ADVANTAGE

- Control erosion and hydrate the landscape
- Connect the landscape

DESCRIPTION

Integration: The swale will help tie together the landscape. It will integrate with the living fence system, and provide a natural boundary between the upper and lower parts of the plateau areas. Depending on preference of style and needs, the swale can be planted alternating with very thick and high vegetation or low and more sparse tertiary forest species (e.g. orchard). The swale can be crossed by bridges or simple foot paths, and will allow for a light truck to pass over it without harming the truck or the swale.

Allowing the landscape to inform how we live: The swale reminds us about the flows of water and energy across the landscape. It allows us to capture water, stop erosion, and have a daily reminder of the gentle curves of the landscape.

Curving: The curve of the swale on contour will create different spaces on the property and allow for the feeling of more space to grow out of the landscape.

SPECIFICATIONS

- 80 centimeters deep by 2.5 meters wide
- planting options
- multi-layer
- planted with a living fence or larger trees on bottom edge. Smaller shrubs and bushes on upper edge. Natural growth in the middle

IMPLEMENTATION

- by hand
- on contour
- planted quickly

Maintenance: Integration with Zone IV maintenance plan.



swale diagrammatic section

CISTERN

FUNCTION

Water storage: 75,000 liters of water stored at all times. Fed by a solar pump from the upwelling just off the northeast side of the property in Area 5.

Pressure: This cistern will be used to pressurize the entire property side-drip irrigation system for the orchards and Zone I gardens.

Lookout: The cistern will be covered with a pergola to become the terminated vista of the entrance road and the Highlands lookout towards the distant mountains. This country-garden pergola will be covered with vines, and will mark the gathering of water.

AESTHETIC DESIGN

An octagonal bamboo-frame pergola overhead will create a sunlight-dappled atmosphere underneath. This will be the perfect place for picnics and social gatherings, to complement the meditation overlook on the lower part of the property.

Garden: A garden will surround the cistern in a mandala pattern. Flowers will bloom all year around and create an immensely fragrant and attractive space to which birds are likely to be attracted. Humans will

find it very appealing to spend time in this amazing space and chat with the neighbors.

Vines: Vines will climb the sides and roof of the structure, hiding the cistern and creating a green space.

Pergola: Built of bamboo or timber, this light structure will hide the cistern with a functional neighborhood-gathering space.

CISTERN BUILDING SPECIFICATIONS

Tank: A 2m x 7m ferrocement tank holding 75,000 liters will sit on a poured, reinforced-concrete foundation. This tank will need to be built by ferrocement experts, such as those at the Ecuadorian Permaculture Network.

Timber frame: A weather-resistant structure of eucalyptus or pambil palm will be built around the cistern. It will have lattice work around the outside and a solid wooden floor so that picnics or even dances can be held in the space.

Filter: A simple sand filter will help keep the water clear of any pesticide run-off or bacterial blooming once it is drained out of the cistern and on its way to be used.

MAINTENANCE

Both the ferrocement and pergola will need some amount of maintenance. The ferrocement tank will need to be checked every six months. The caretakers can easily be trained to inspect and perform minor maintenance needs. With regular check-ups and needed maintenance, the tank can last many years.

NEIGHBORING LAND-USE STRATEGY

In order to fill this tank easily and to create a natural pond from the surfacing aquifer, it will be necessary to cooperate with the hacienda to clear out some of the cane that grows just on the other side of the northern property line.

The pond can serve as a water catchment basin to be used by the hacienda for irrigation, watering cattle, or simply as a pleasant place to sit. It will not affect Hacienda land use in a negative way. A run-off catchment system and living filtration system can help filter any run-off from the Hacienda property to keep the pond and cistern water clean.



cistern hidden under gazebo

RESERVOIRS

POND ONE - Northwest corner of the Lowlands

DESCRIPTION

This pond is formed by a dam that also acts as a bridge for the single-lane road entering the property from the west. It will hold a large amount of water and will overflow into an irrigation channel along the middle contour of the property, just below the swale.

The pond should be stocked with fish and allowed to become a beautiful habitat for different species. As one of the first things seen on the property, the pond will provide a striking introduction. It is bordered on the west by forest and overlooked by the caretaker's house. As the road crosses the gully, it will also act as a dam to create a beautiful and productive pond. This integration of road, dam, and pond into the landscape will eloquently express the principles of permaculture design.

DETAILS

Gabions, packed earth, cobblestone, gentle back slope, deep lower edge, gentle edges sloping north and west.

PRINCIPLES OF DEVELOPMENT

Gabions: Using gabions will cut the costs substantially from conventional methods while maintaining structural integrity. In keeping with the owner/developers' wishes, it will also provide a working model for large-scale applications in the region.

Key Point: Building the road/dam across this key point of the landscape will maximize water retention, facilitate implementation, and protect the existing acequia.

Integration: The pond will be integrated into the overall land-use design in several ways. First and most obviously it will serve as a multi-functional road/dam. Second, the pond will provide an additional source of irrigation water; it may also supply water features on private lots. Waterfalls, ponds and wetland systems can be fed from the overflow of this pond with little or no pumping.

Permaculture Implementation: This pond should be maintained, or at least overseen, by permaculture experts to assure its integrity for habitat and functionality. The overflow will need careful attention to integrate properly into the water design.

Maintenance: This pond will require little or no maintenance. Occasional cleaning-out of lilies and algae for use in the caretaker's compost system will keep the pond clean and clear for aqua-cultural usage and aesthetic value.

POND TWO - Eastern side of the Lowlands

Pond Two will be a simple pond near the camellones, created by scraping some earth away to be integrated into the camellones system. The resulting shallow pond will be filled continuously by the aquifer. The run-off will feed into Rio Tuctara. This pond will increase the aesthetic quality of the east-facing view and provide habitat for frogs and birds.



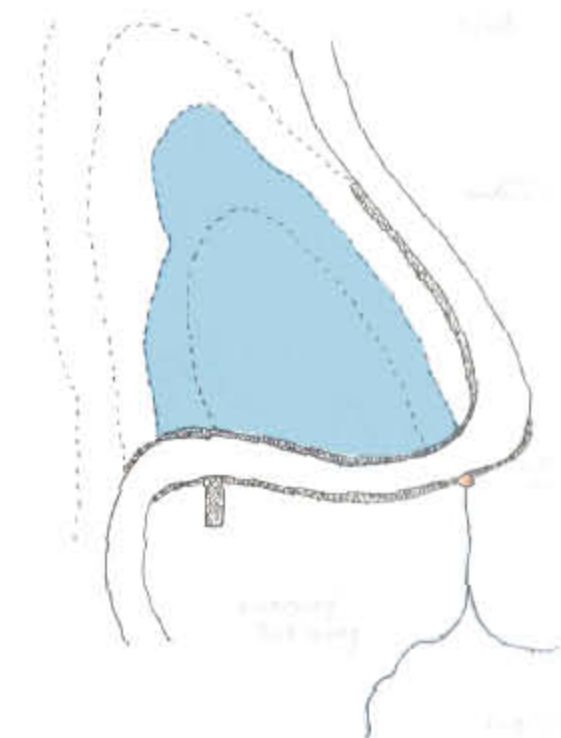
Pond example



Example of pond and outdoor living



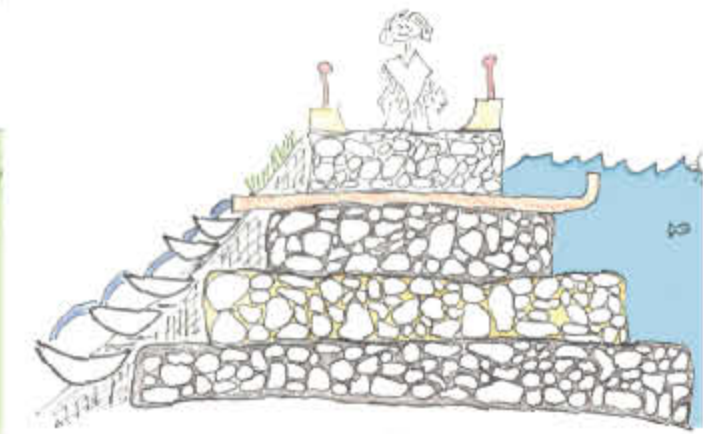
Pond and irrigation amenity



Plan of dam and Pond One



View of dam, gabion construction



Cross-section of dam

Pond 1 illustration, gabion construction

AQUACULTURE

DESCRIPTION

The first pond, half a meter deep, will be ornamental and perfect for bathing. The subsequent ponds will be for aquaculture. Raising tilapia and koi (one species for each pond), will provide on-site fresh fish and additional income for the caretaker.

FUNCTION

The whole aquaculture system will be a multi-functional system.

SOCIAL

The first pond will function to create a neighborhood space for playing and bathing in a beautiful forest setting. This pond will be 50 centimeters deep and 4 meters wide. It will be a great place to hang out and play with kids.

FOOD

The lower two ponds will be deeper and less wide. They will have crenellated edges and provide perfect habitat for koi and tilapia - fresh fish for the residents of Santuario Tuctara.

AESTHETICS

The bubbling spring and clear water, cascading streams and deep pools set amidst a forest will provide an idyllic place to walk where residents can hang out or read a book.

MAINTENANCE

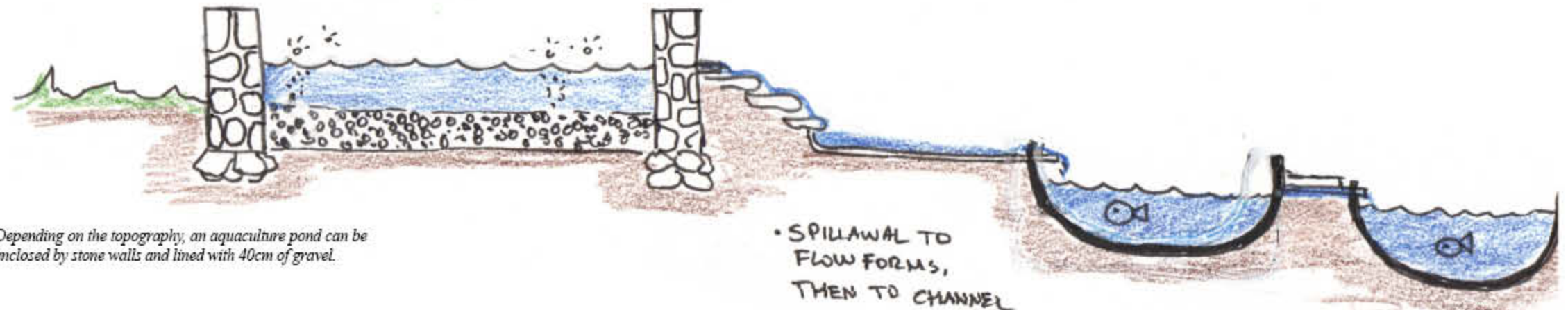
The fish will need to be harvested for food, and algae and lilies harvested for compost.

BUILDING PROCESS

Dig out the spring and line it with gravel and sand. Build a small stone wall. Create flow forms between the ponds. Dig and line the lower ponds. Connect the ponds with the acequia.



Aquaculture pond



Depending on the topography, an aquaculture pond can be enclosed by stone walls and lined with 40cm of gravel.

ENERGY SYSTEMS

DESIGN PARAMETERS

Energy use will follow the guiding principles of Permaculture Design. This means using appropriate and renewable energy sources for both properties.

- low-energy-use design (energy reduction)
- redundancy in energy system
- ease of maintenance
- ease of repair

Highlands: Shared energy system

Lowlands: Individual energy systems

OPTIONS

Sources of energy

- photo-voltaic system
- wind power
- micro-hydro
- gas pumps
- propane
- wood

Reducing consumption

- passive solar house design
- energy-efficient appliances
 - stove/oven
 - washing machine
 - dryer (use outdoor dryer)
- wood-burning stove
- root cellar

- passive solar water
- solar oven and stove
- insulation

RECOMMENDATIONS

Our recommendation is to design every house according to strict passive-solar and integrated-wood heating systems. Any pumps or other systems that are integral to the land-use system should be connected with redundant renewable systems.

A passive solar house in this climate should have east- and west-facing windows to catch and store the morning and evening sun. The architectural design of the house should integrate thermal mass on the inside, which should be painted in dark colors to store heat.

The stove, oven, backup water heater and in-floor heating systems will all be integrated into a single wood-fired system.

Each house will be plugged into the grid, but also will have redundant renewable energy sources for key services (water pumps, lighting, etc). Each house will have its own battery bank and AC electricity system.

We recommend micro-hydro and wind power as the renewable sources used for backup and essential systems.

SOLAR HOT WATER

Concept: The sun is the main source of energy for our planet: it's free, powerful, and sustainable.

Given Cotacachi's available sunlight throughout the year, solar showers are a good option for a main water heating system, helped by a firewood backup for the cloudiest days of the year.

MATERIALS

The proposed solar shower system consists of

- The water heater, made of a shallow metal box painted in black, with a copper tube coil and glass cover
- A thermostatic storage tank to provide water for the house by gravity

The backup system consists of:

- A metal tank above a fireplace, stove, oven or other firewood-powered element, connected to the water grid and using thermal siphon force

IMPLEMENTATION

It is recommended that each house have its own solar system and backup.

Backup system should be placed only in connection with a multi-use wood-burning stove, not something that's only fired to warm the water.

WIND POWER

Windmill: Production of energy (electricity) for specific elements (pumps for example)

Very important as a general backup energy system for the property. Depending on the needs, one or more per property.

AESTHETICS

The model doesn't show major variation from the typical US design. Windmill tower can be used to grow vines (fruits or otherwise). Vines will climb the sides of the structure, hiding it.

STRUCTURE

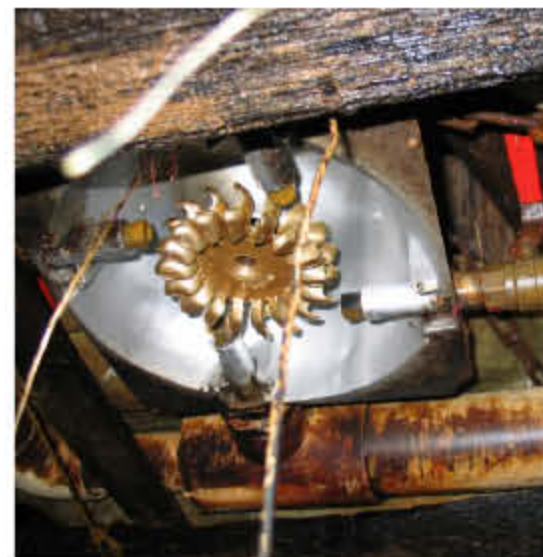
Steel and tin, as available on the market. Can be second-hand. Probably best to buy in the US.

Batteries and wiring can be obtained in Ecuador, and local people can do the installation.

The structure, the wiring and batteries will need regular maintenance, at least once a year.

PLACEMENT

Windmills need to face strong winds, so they should not be placed behind windbreaks. Best results are achieved by forming a funnel with living fences, directing wind towards windmills.



WASTE MANAGEMENT AND RECYCLING

DESIGN PARAMETERS

- low consumption
- zero waste
- waste as a resource
- use of all non-toxic waste on property or in community
- organization and distribution of all excess resources

OPTIONS

- household composting systems
- community composting system
- buried mulch
- animal feed
- use of cellulosic material as fuel
- recycling of glass in building projects

RECOMMENDATIONS

Composting: We recommend household composting systems for both Lowlands and Highlands. We also recommend larger-scale composting infrastructure for each property to complement the caretaker's market garden. All organic material will be composted in the household or development systems.

Waste Separation: We recommend household waste separation systems (plastic, compost, cellulose, glass) and larger community systems that each household can empty into.

Recycling Pickup: Separated waste can be picked up by a local service or taken out on a weekly or bimonthly basis. Individual families should not be relied upon to take the recycling to its appropriate place. Transportation of recyclable material can form a part of the caretaking family's weekly routine.

Toxic Waste Policy: Batteries, computers, etc: Ecuador has limited capacity to deal with toxic waste in a safe and healthy manner. Because of this, each owner/developer, and the development as a whole, needs to be responsible for finding ways of dealing with toxic wastes. The Santuario Tuctara Permaculture Team recommends that batteries and used electronics be collected twice per year, and sent back with individuals traveling to the United States or Europe where toxic waste disposal systems are common.

Plastic Policy: The use of plastic will be kept to a minimum. Plastic that cannot be avoided will be reused or recycled.

COMPOSTING TOILET

40% of all the water we use literally gets flushed down the drain.

In an ecologically sensitive location like Santuario Tuctara, where the water table is very high, flushing human waste into the water table is simply not an option.

Composting toilets, or dry sanitation systems, are a simple and environmentally friendly way of disposing of human waste. Dry composting systems turn human waste into fertile compost to be used to enrich the soil.

Sanitation and aesthetics are key aspects of composting toilet systems. Low maintenance and ease of use are also important.

Essential to a properly functioning composting toilet system is maintaining the correct ratio of carbon to nitrogen. Human waste is mostly nitrogen, so adding carbon (like sawdust from local mills) helps balance the ratio to the correct 3:1 mix that allows odor-free composting.

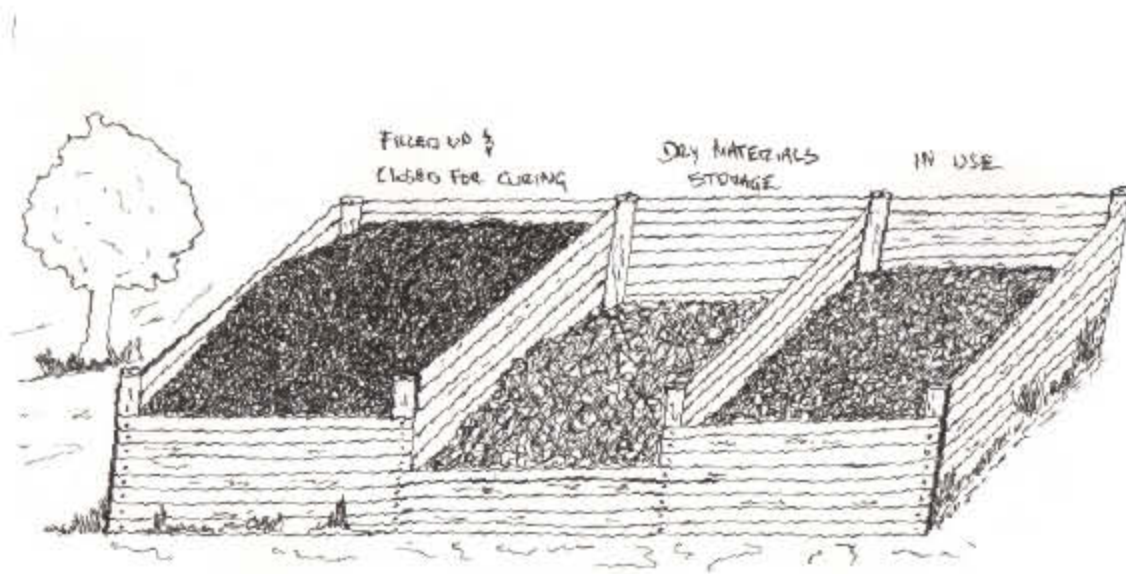
Santuario Tuctara will use well-designed composting toilets to add fertility to the landscape, avoid polluting the water table, and keep residents healthy and safe.

ALTERNATIVE TOILET

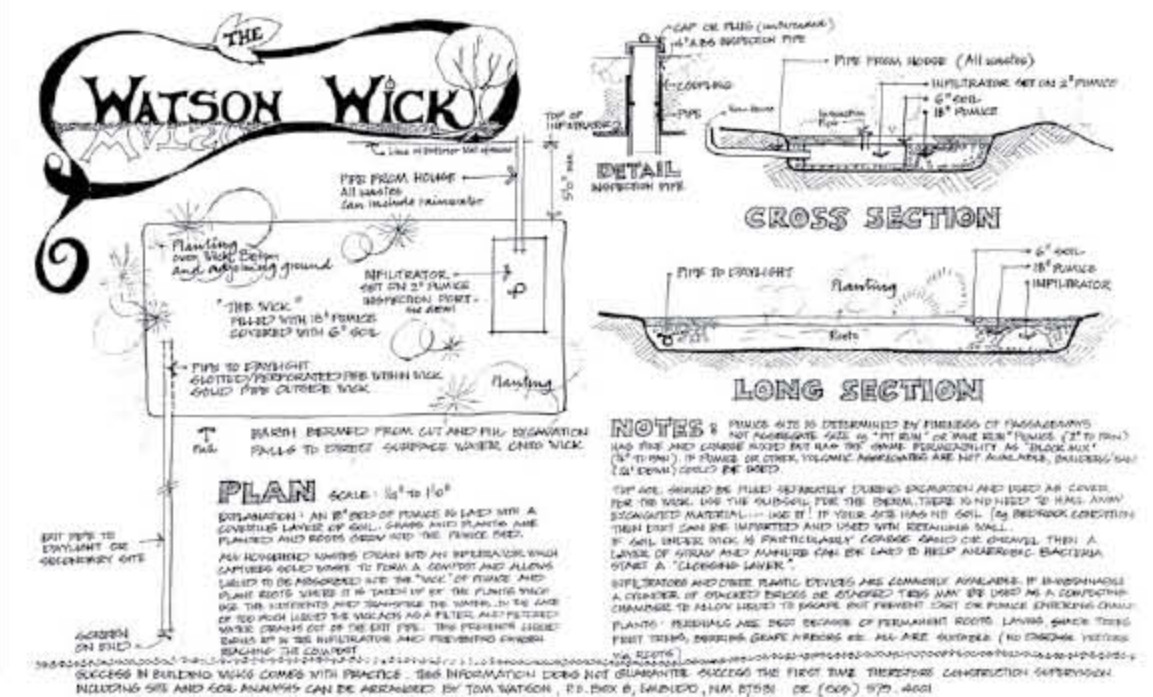
WATSON WICK WET TOILET

Watson Wicks, also known as pumice wicks, are a very simple, inexpensive septic system alternative; shallow, subsurface bio-swaales designed to reuse the nutrients and water in blackwater for irrigating and feeding plants.

- all solids naturally dissolve
- the waste is never handled so there are no disease vectors
- no odors
- supports vegetation growing close to the house, even edible food can be grown (with the exception of roots foods such as carrots)
- can be easily dimensioned and scaled to the need
- no need to collect into one large collector – each toilet can be directly connected to outside.
- cost of construction and skill level is minimal
- no maintenance or emptying is necessary as for septic systems



continuous composting system

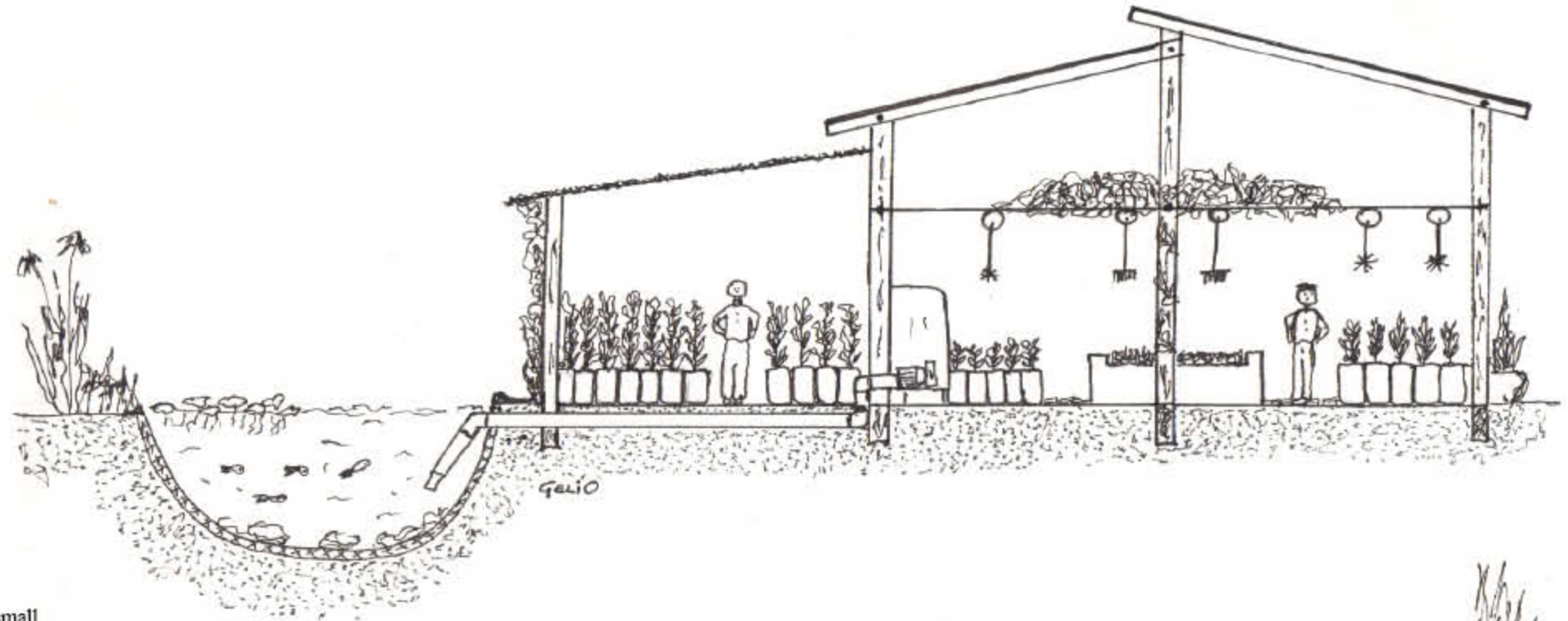


TREE NURSERY

DESCRIPTION

A key part of the Santuario Tuctara permaculture plan is the creation of a nursery. This will allow the trees and other perennials to start maturing and help speed the succession of the landscape from its current damaged state into productivity and health.

The nursery can also become a cornerstone of micro-enterprise for the residents of Santuario Tuctara and the local community. There is currently no comparable nursery in the north of Ecuador, and by establishing one on Santuario Tuctara we will help steward the biological health and wealth of the area and create a sustainable income for the community.



CAMELLONES

Camellones (elevated garden beds) will serve to cultivate swampy areas and will revive an ancestral Andean cultivation method.

They can be used to grow vegetables, grains, and other crops organically, with a high level of crop per area and a minimum of irrigation.

They will provide a beautiful, eye-catching garden bed design with a high degree of diversity.

SPECIFICATION

Elevated garden beds, at least 40 cms high to allow drainage, surrounded by surface water or swampy soil and pathways.

Shapes of beds and patterns of bed organization will follow requirements for erosion control and water management. An expert needs to be hired to do the initial design. Beds should remain as designed for as long as they are needed and should be reinforced every year.

PLANT TYPES

A diversity of plants should be grown on the camellones, including: vegetables, grains, leguminous plants, perennials and annuals, lots of flowers (to attract bees and other beneficial insects) and aromatic

herbs, fruits, climbing vines, ground vines and small plants.

OTHER ELEMENTS

Toolshed; organic fertilizer production area: compost piles, bokashi, and vermicompost; living fences to provide organic materials for fertilizers and mulching; pathways.

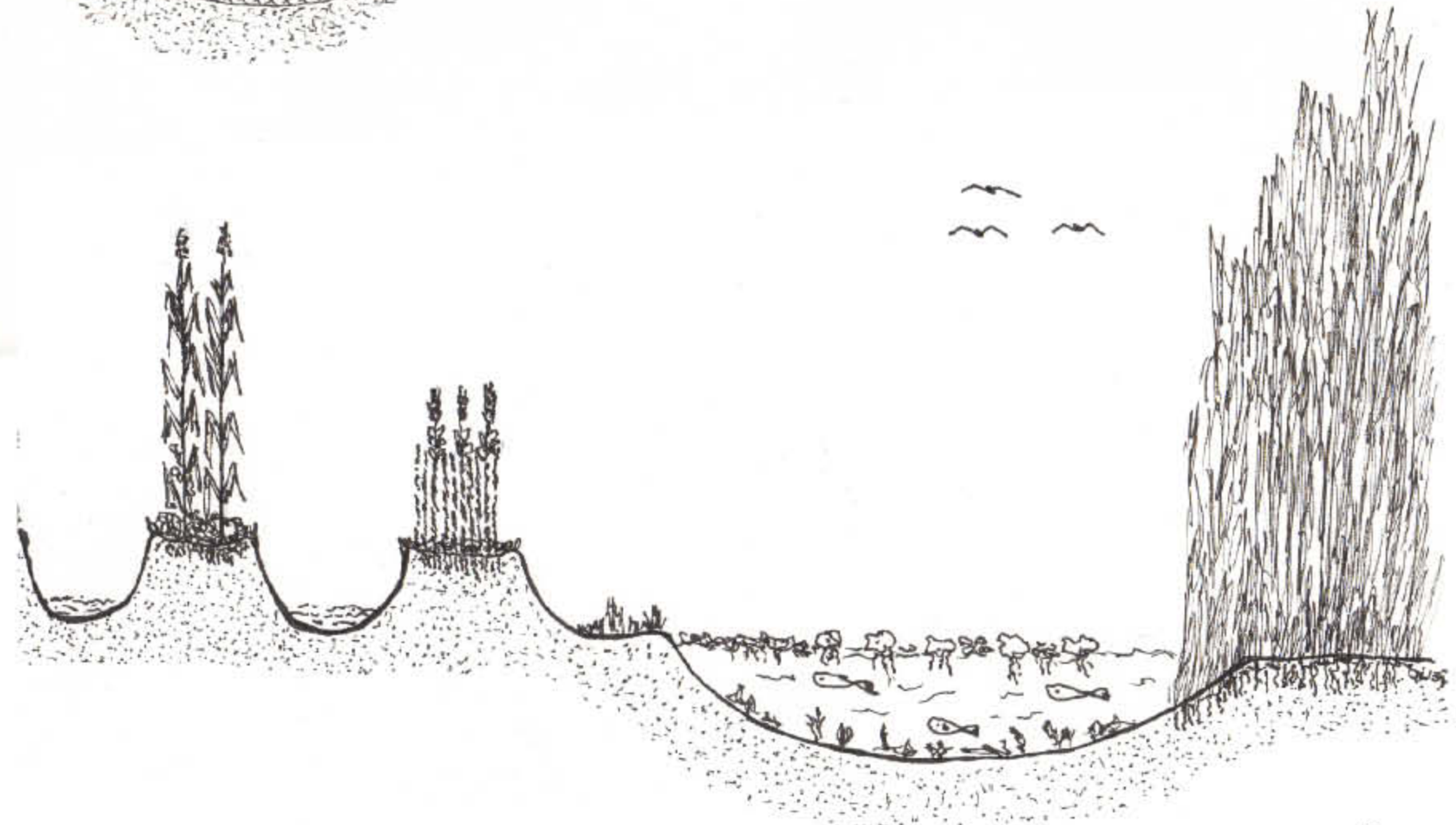
IMPLEMENTATION

- Design phase
- Clearing the land
- Shaping the beds
- Planting and cultivation

Placement : In swampy areas of both properties, the center of the area will be dug out to create a pond (aquaculture system) with spillway. This pond will be the outlet for the camellones system's excess moisture. Soil from the excavated pond will be used to build camellones.

MAINTENANCE

Will need regular maintenance with daily visits and at least three full man-days per week.



VEGETATION

HUERTAS DE LA CASA (KITCHEN GARDEN)

General Lechuga, tomate, rabanito, col, remolacha, berros, zanahoria amarilla, rucula, culantro, perejil, apio, coliflor, zuquini, pepinillo, albahaca, vainita, pimiento, ají, remolacha, cebollas, ajos, heneldo, cebollín, nastuerzo, espinaca, dahicon, acelgas, kaly, mishuna, col de Bruselas, espárrago



CULTIVOS, CAMELLONES (RAISED PLANTING BEDS)

Cereales Maíz, trigo, cebada, centeno, quínoa, amaranto,

Trepadoras Fréjol, achogcha, lenteja, arveja, ají rocotos,

Cobertores Zapallo, zambo, frutilla silvestre

Tubérculos Jicama, camote, arracacha o zanahoria blanca, papa, ocas, mellocos, mashua, mizo

Otros Habas, chochos



TREPADORES (CLIMBERS)

Perennes Taxo, granadillas, maracuyá negra, cidrayote, moras

Anuales Achogcha, fréjol gualea



HUERTOS FRUTALES (ORCHARDS)

Árboles perennes Capuli, guabas, aguacate, chirimoyas, duraznos, manzanas, guato o poroton, nispero, higo

Arbustos perennes Tomate de árbol, chigualcan, uvilla, moras, limones

Ciclo anuales Babacos



HUERTA DE PLANTAS MEDICINALES Y AROMÁTICAS (MEDICINAL AND HERBAL PLANTS)

General Menta, matico, salve rial, manzanilla, ortiga negra y blanca, hierba luisa, cedron, romero, llantén, escansel, tipo, caléndula, manga faqui, sacha zanahoria, clavel de suelo, valeriana, pata de pájaro, hierba del corazón, ruda, santa maría, sango rachee, bledo, hierba de la fuerza, berros, chamico, cruz casha, zábila



BARRERAS VIVAS (LIVING WALLS)

General Guanto, chilca, guarangos silvestre, uña de gato, pencos, espino de mote, chanchacos, guanto panameño, chamanas, truenos, higuierillas, casanto, cesantillos, alpa anís, canelillo, moras silvestre



CORTINAS ROMPEVIENTOS (WINBREAK)

General Alisos, nogal, cholán, acacias silvestres, capuli, tilos, chilcas, moras silvestres, jollag



CORREDORES BIOLÓGICOS (BIOLOGICAL CORRIDORS)

General Alisos, cholán, laurel de cera, sangre de drago andino, colcas, truenos, olivos silvestres, bambú andinos, higuierilla, trinitarias, arrayán, puma maquis, sacha capuli, cedrillos, pendos, quishuar, sacha quishuar, piperáceas, chilcas, porotón, carrizo, locrohomas azul y rojo, fucsias, guatillo, sacha chamana, jugllas, casanto casantillo, colcas



TECHO VIVO (LIVING ROOF)

General alfalfa, trebol, cebada, trigo, avena, pasto milinn, ray grase, capuchina, bledo, amaranto, lenteja, arveja, and kikuyu



ARCHITECTURAL GUIDELINES - AN EMERGING ARCHITECTURAL LANGUAGE

The built environment of Santuario Tuctara is the result of an emerging architectural language, one that combines native knowledge, colonial influences, and ecological advancements. It is based on a sustainable way of life and develops based on evolving needs, research of site conditions, climate, and local building knowledge and materials.

The architecture of Santuario Tuctara respects and complements the natural beauty that surrounds it. It seeks not to compete but to harmonize. Homes are human-scale, one-storey buildings that hug the ground, allowing them to become mostly hidden. Architectural spaces answer different human needs: solitude and privacy, community, and openness to nature. Architecture is designed for daily life and everyday enjoyment, by integrating the built environment with the surrounding landscape.

Permaculture is crucial to the design of the home as well as the site. A mutual exchange exists between the architecture and the landscape. The designer must consider the needs of the land as well as the needs of the building so that they can benefit from each other. The gardens, water-collection tanks, grey-water pools, and other features of permaculture Zone I are designed simultaneously with the house. These features are essential to creating a self-sustaining environment.



I. Local Response

Before the design process begins, one must properly site the building according to the local climate and context, especially considering the sun, wind, and views.



II. Traditional Building Typology

Building typology reflects simple massing influenced by traditional designs and highlights outdoor spaces. Inspired by nature and the climate, living spaces transition easily from interior to exterior, encouraging outdoor living spaces.



III. The Principle of Permaculture

Permaculture is essential to the design of the house, allowing the built environment to work with nature to become self-sustaining. Nature is an essential part of everyday life at Santuario Tuctara.



IV. Natural Structural Materials

Local, natural materials will help create a sustainable environment as well as an architectural language that is appropriate for the climate and for the site. Santuario Tuctara will benefit from native as well as advanced construction techniques.



V. Celebrating Sustainable Techniques

Sustainable systems are integrated with the architecture rather than simply added on. Such techniques are celebrated because they result in an architecture that is beautiful as well as self-sustaining.

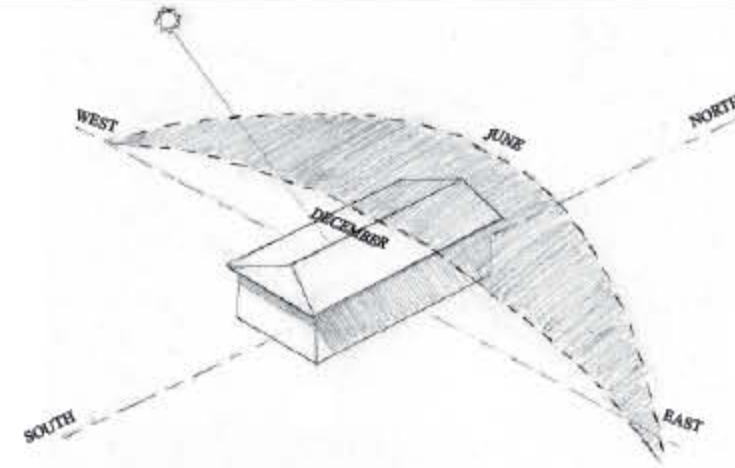
ARCHITECTURAL GUIDELINES - AN EMERGING ARCHITECTURAL LANGUAGE

LOCAL RESPONSE

The first step in achieving sustainability is to properly site the building on the lot according to the climate and context. Three main influences impact all sites at Santuario Tuctara: the sun, the wind, and the views towards the colossal mountains - Father Imbabura and Mother Cotacachi.

SUN : EAST AND WEST

Cotacachi's daily sun primarily affects the east and west facades. However, the surrounding mountains block facades from early morning or late afternoon's horizontal rays, avoiding the need for substantial protection.



RECOMMENDATIONS

Longest facades should be oriented east/west. The rooms with early activities should be facing east to receive the first sunlight. Rooms oriented to the west will be warmer during the night after catching the last sunlight.

Windows can also be placed so that interiors can benefit from direct solar heat.

No large trees should be planted in a way that blocks sunlight that could heat the walls and provide natural light to interior spaces of the east and west facades.

WIND

East or northeast winds are prevalent, providing welcome natural ventilation.

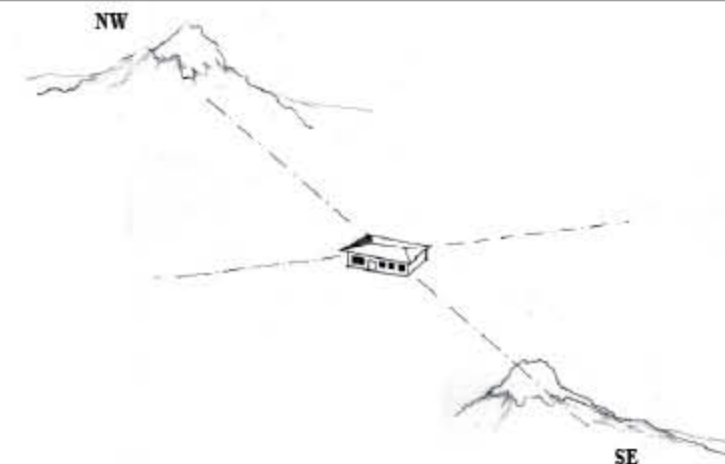


RECOMMENDATIONS

Houses and openings such as windows should be designed to take advantage of east to west cross-ventilation. If protection is necessary, landscape or trees can provide protection from heavy winds. However, this landscape must be placed at a distance from the house so that sunlight can still heat the walls.

THE VIEW

The prominent mountains, Father Imbabura and Mother Cotacachi, are amazing features of natural beauty that influence how buildings are oriented. Imbabura is southeast of the site ; Cotacachi is northwest.



RECOMMENDATIONS

Buildings and outdoor sitting areas should be oriented towards the beautiful mountain views and the general natural beauty surrounding them. Ideally, windows should frame the southeast and northwest mountain views.

ARCHITECTURAL GUIDELINES - AN EMERGING ARCHITECTURAL LANGUAGE

TRADITIONAL BUILDING TYPOLOGY

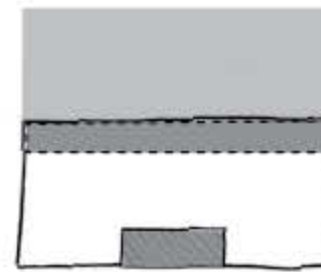
During earlier centuries simple building typologies naturally evolved over time in the region. They were originally imported by settlers and were gradually modified by later generations to correspond to their needs, ways of living, and the local context. The simpler, smaller versions were appropriated by modest families and the larger ones for haciendas.

In all cases the simplicity of these typologies corresponds to rational ways of building, eliminating complicated techniques and additional materials, thereby reducing construction time and costs. These building types are also generally easier to repair and modify, adding to their resilience and sustainability. They are also highly livable.

Because the Cotacachi climate is temperate, living outdoors is a pleasure. To take best advantage of this, all these typologies provide covered entrances or 'zaguan', corridors and living spaces in the form of a 'soportal,' and exterior courtyards.

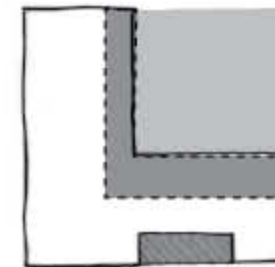
CLUSTERS OF BUILDINGS

While the diagrams to the right display single-home configurations, there can be more than one building on each site. For instance, the main building may be complemented by ancillary buildings such as bedroom cottages, work studios, and sheds. These should be placed so as to create attractive and useful outdoor spaces.



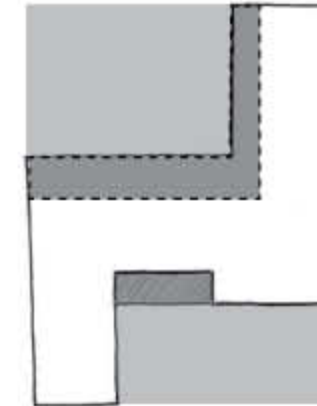
Rectangular Shape

This simple rectangular shape includes a zaguan within the building envelope, facing the public realm. The soportal to the rear acts as an exterior covered passage and/or a private outdoor living space. It overlooks the open-air courtyard in the back.



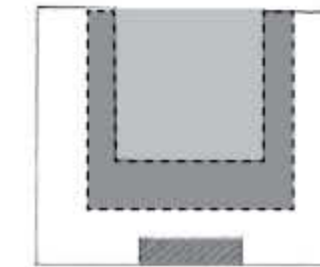
L - Shaped Configuration

This building type is enlarged with a back wing intended for more private usage. The courtyard in the back is now surrounded on two sides of the house. On the right, a wide soportal serves as a living space. On the left, the narrow soportal is a walkway accessing interior spaces.



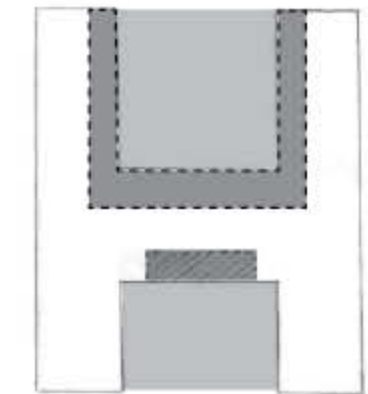
Z - Shaped Configuration

The added wing to the front is intended for more public activities. As in the L-shaped type, the back wing and courtyard are for private activities.



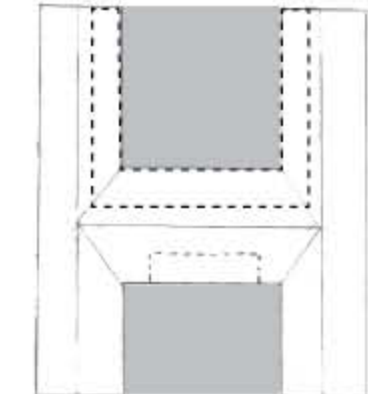
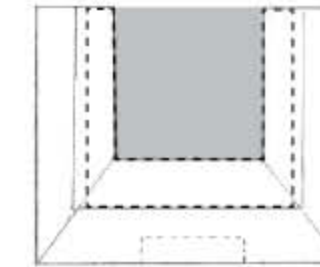
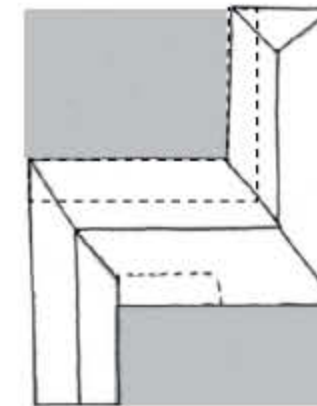
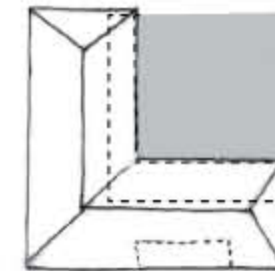
U-Shaped Configuration

The building has been enlarged by two wings surrounding a private courtyard in the rear. A narrow soportal on each wing provides a covered outdoor walkway giving access to interior spaces. A larger soportal in the center provides a living space overlooking the rear courtyard.



H-Shaped Configuration

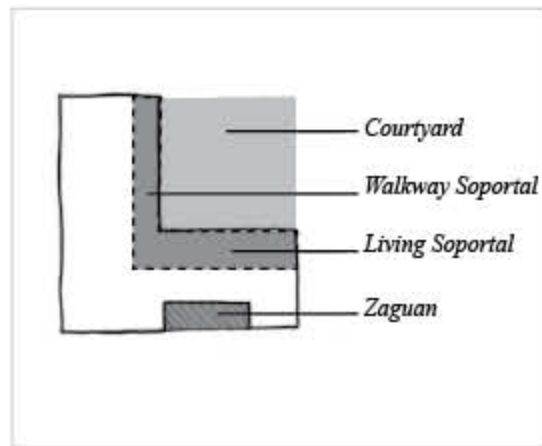
The largest building typology adds two public wings in the front, surrounding a more public courtyard. The courtyard to the rear is the private domain lined with soportales on three sides.



OUTDOOR LIVING SPACES

Three traditional outdoor spaces are recommended:

- The Zaguán or Entrance Porch
- The Soportal : Walkway or Living Room
- The Courtyard



The Zaguán or Entrance Porch

The Zaguán is a generous entrance porch within the building envelope and a very important welcoming space to the interior of the home. It provides covered outdoor space for working and enjoyment while facing the more public realm.



The Soportal : Walkway or Living Room

The Soportal, covered by the extensions of the building roof and supported on columns, lines the long facades. There are two types. A soportal can be a covered exterior walkway giving access to interior spaces, as shown in the photo on the left. It can also be a covered exterior living space, as shown on the right.



The Courtyard

The Courtyard is very important for rural living. It is considered the heart of the home. The photo on the far left shows a large courtyard in a traditional hacienda, open to the sky for herb gardens and other sunlit needs. Portions of the courtyard can also be covered by trellises, pergolas, or trees. Trellises or pergolas should be built with local eucalyptus and treated with linseed oil to protect them from the rain. They can also be combined with local metalwork, as displayed in the right-hand photo.

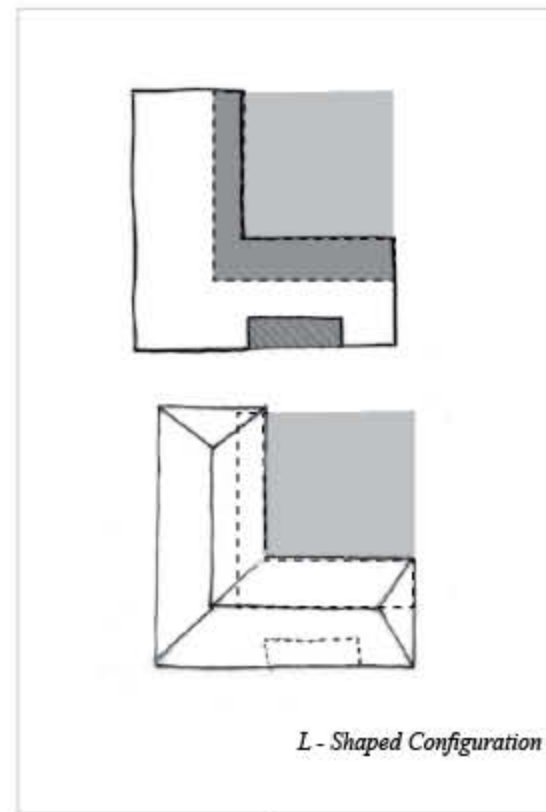
ARCHITECTURAL GUIDELINES - AN EMERGING ARCHITECTURAL LANGUAGE

THE PRINCIPLES OF PERMACULTURE

Once the building is properly sited, the architect and permaculturist will develop a plan so that the natural and built environments can be designed together.

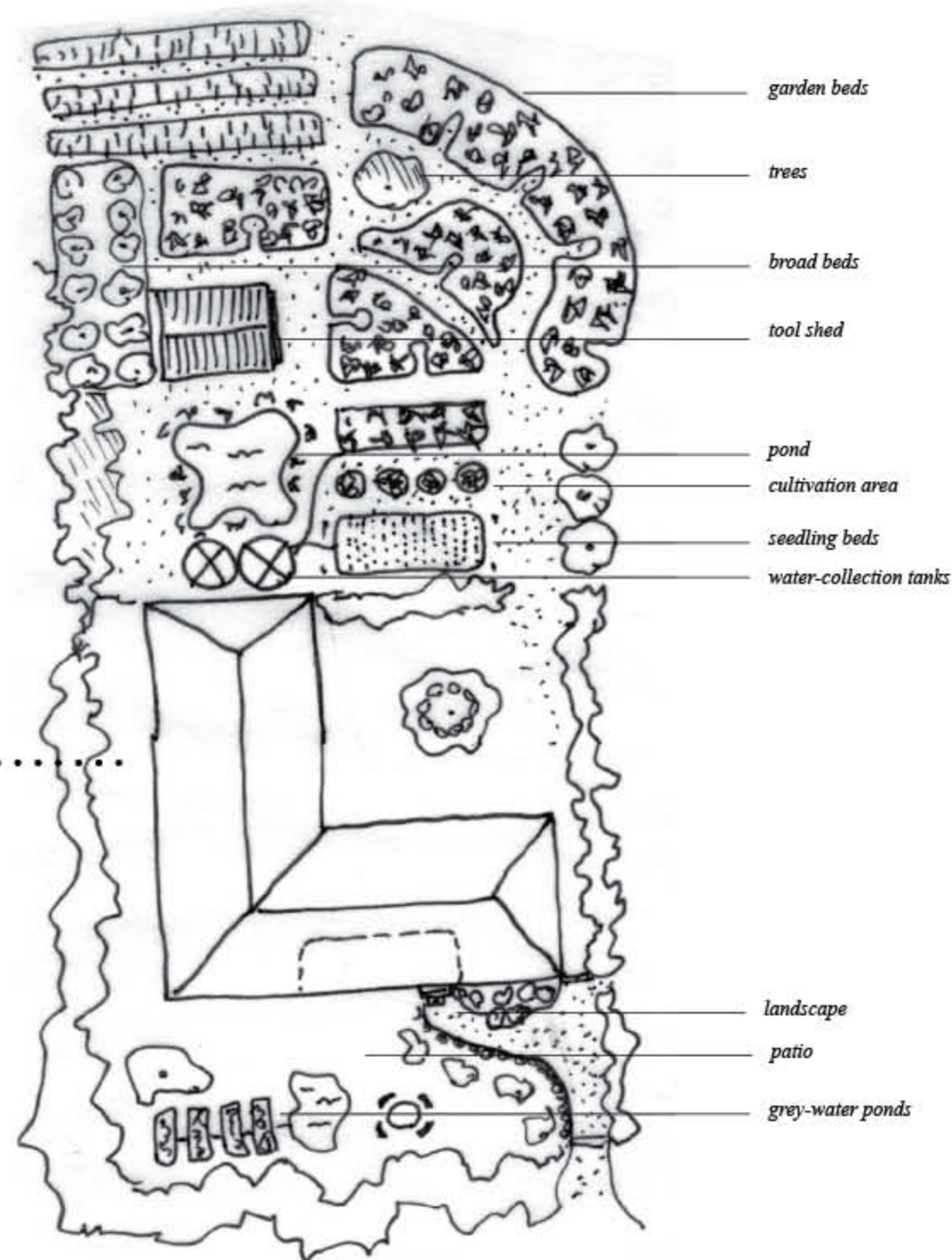
Zone I surrounds the house and continues extensively in the back. In the front, the zaguan faces an outdoor patio, garden, and grey-water ponds. In the back, rain-water collection tanks gather water from the roof. Seeds germinate in a nearby seedling bed. There are other cultivation areas close to the house as well as a pond and a tool shed. Two broad beds grow tree tomatoes and grain. Trees are scattered throughout the property while garden beds offer food and herbs.

Zone II is sited beyond Zone I, to the rear of the property.



L - Shaped Configuration

ZONE 1 GARDEN



STRUCTURAL WALLS

Natural building materials have re-emerged as a response to ecological concerns about our built environment. Because of this new awareness, earthen materials, which are part of a long tradition, are once again responding to the local climate and ecological and social consciousness.

Earthen materials have been used in construction for thousands of years. They offer strong advantages in thermal performance, low toxicity, low embodied energy, and ease of repair. Not only is earth a readily found material in Cotacachi, but it is sustained by local knowledge and experience. While it is versatile and highly workable, it must be protected from water by eave overhangs. It must also be engineered to resist earthquakes.

All buildings constructed with earthen materials require a foundation at least 30 centimeters above grade which must continue below grade until at least 15 cm of undisturbed subsoil is reached.

COMBINATION OF TECHNIQUES

Natural building materials provide us with a large variety of options. By combining different techniques we can maximize passive solar benefits, create unique buildings adapted to the landscape, and maximize the effectiveness of each material.

Of the variety of natural building materials available, the following are most recommended:

- Rammed Earth
- Adobe
- Timber Frame with Bahareque Infill

ADOBE



Adobe requires a minimum wall thickness of 30 cm.

RAMMED EARTH



Rammed Earth varies in thickness between 75cm and 100cm.

TIMBER FRAME WITH BAHAREQUE INFILL



Bahareque, the lightest option, can be as thin as 10 cm.

OTHERS

Cob

Cob is a mixture of sand, clay, straw, and water that is sculpted into a structure by hand. Cob is a very climatically-appropriate building style. Although not a tradition in the area, it resonates with the earth-building vernacular of the Andes. For small, custom sculpted, hand-made homes, cob is an ideal building material. Cob is monolithic and earthquake resistant.

We recommend cob for small unique guest cottages, or as a hybrid material within a building that also incorporates other building methods.

Clay Slip

Clay slip is an insulating infill method in combination with timber frame designs. Clay slip uses straw or chip organic material covered in a light clay slip to create wall panels that are built into slip forms in a timber-frame building. It uses a natural plaster finish.

Transportation and labor costs for importing suitable clay are the only costs associated with this building style. Because it uses organic waste as a fill, and relatively little clay, clay slip is considered very environmentally friendly. Local expertise with this building method is lacking. Outside builders would need to be hired to build the first models and train locals. This should not be difficult to do.

Straw bale

Straw bale is a wall infill system using bales of straw to provide the best insulation available. Straw bale is most appropriate when combined with timber frame styles of building. Straw bale architecture can mimic rammed earth or adobe because of wall thickness and when natural plaster work is applied. It is much lighter, allowing it to be built on a pier foundation.

For homes that may be closer to the soft edge of the southern part of the Lowlands, straw bale is a good option. A timber-frame home with straw bale infill offers excellent thermal-mass insulation and optimal benefits from passive solar orientation.



STRUCTURAL WALLS *(continued)*

ADOBE

RAMMED EARTH

BAHAREQUE AND TIMBER FRAME

DESCRIPTION

Adobe is a building technique used throughout North and South America utilizing local materials. There are two kinds, pressed and dried. To create more strength and resilience, adobe blocks can be pressed in a hand-powered tool.

Rammed earth is a local building technique that can be seen throughout the Cotacachi region and around the world. Thick earthen walls that can last centuries are built by ramming or pressing earth into forms. When fiber-like straw is added, the structure becomes monolithic and extremely strong. Thick walls provide thermal mass, controlling interior temperatures.

Bahareque is a venerable, natural building method native to the Ecuadorian Andes. Beautiful examples can be seen in indigenous villages. Bahareque is a technique much like wattle and daub where an initial structure of bamboo, reed, or small diameter branches is woven together. Then a mudlike mixture is used to fill the spaces. Once this infill is dry, it is plastered over with natural plasters.

ANALYSIS

Adobe belongs to the local vernacular and building knowledge. However, traditional dried adobe techniques could be improved with the addition of pressed adobe. If built properly by artisan 'campesinos' with a good management structure, this technique would be very appropriate and would stand the test of time. By using local, ecological materials and combining pressed adobe with a woven-wall style, we can create unique, resilient buildings in keeping with local building vernacular.

Rammed earth is very well adapted to the Andean region. Climate stabilization, use of local materials, keeping with local building vernacular, and use of local labor all make this option very appropriate. This building technique is rapidly growing in use, and there is extensive expertise in its production and maintenance.

Bahareque is a perfect technique for interior walls of a rammed-earth, adobe, or cob home. It can be built 4 to 12 inches in width. It is also appropriate for exterior walls combined with a timber-frame structure. Since bahareque is a traditional, local building technique, skilled laborers are easy to find in the Cotacachi area.

RECOMMENDATION

If adobe is chosen, we recommend using pressed adobe instead of normal dried adobe. Additionally, we recommend the woven-adobe technique to increase wall strength and resilience. This also offers the possibility of attractive, rounded stylistic elements.

We recommend this style above all others as a standard. Rammed earth will be the most cost-effective and appropriate style. It can also be combined with other styles like bahareque, adobe, or cob if narrower interior walls are desired. However, the thickness of rammed earth offers interesting architectural benefits, such as wall niches, shelves and deep reveals.

We recommend bahareque as an interior wall method and as a possible infill method for any timber frame structures built in Santuario Tuctara. As an infill method, bahareque will be very effective if the house is designed and oriented according to passive solar principles.

SPECIFICATIONS

Openings (for windows or doors) in adobe construction can be no more than 2 meters wide with 1 meter between each opening. Windows can cover no more than 50% of the facade.

Openings (for windows or doors) in rammed-earth construction can be no more than 2 meters wide with 1 meter between each opening. Windows can cover no more than 50% of the facade.

In bahareque, opening limitations depend on the strength and design of the timber frame.

INTERIOR WALLS

Each local, earthen material possesses its own architectural qualities as well as structural limits.

- **Adobe** requires a minimum thickness of 30 cm. Interior adobe spaces can be sculpted into architectural features such as fireplaces or railings. Adobe can integrate other materials such as Cob, which can be more easily manipulated.

- **Rammed Earth** is often used in Cotacachi, possibly because of its extremely thick walls ranging from 75 to 100 cm. These thick walls provide thermal mass as well as opportunities to articulate interior spaces. Rammed earth cannot be sculpted but can be carved into or recessed for niches or other features. Because of the limitation on sculpted forms, is often combined with Cob.

- **Bahareque** is a locally available material that is flexible but does not possess the strength of other earthen materials. Its minimum thickness is 10 cm. When paired with a timber frame, bahareque can be manipulated to create articulated interior features such as fireplaces, benches, and built-ins.



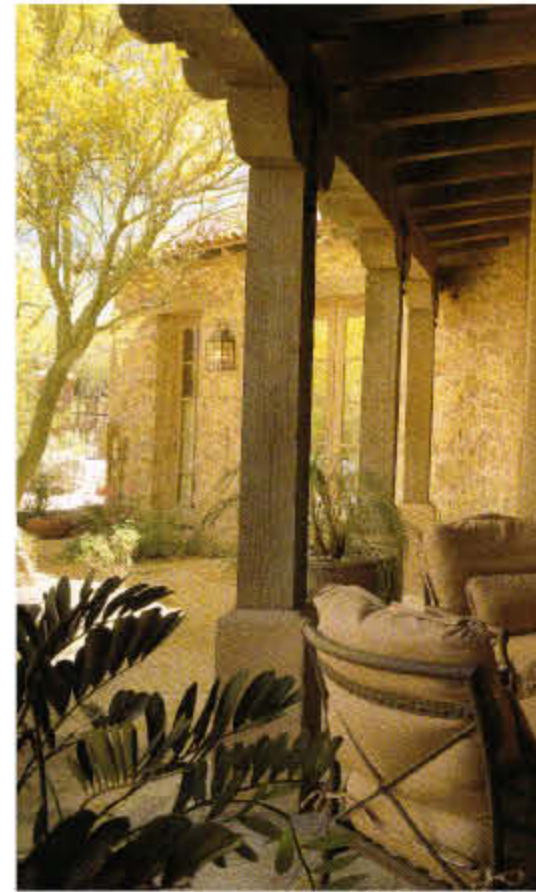
COLUMNS and BEAMS

Traditionally in the Cotacachi region, columns and beams are featured as exposed architectural elements. Eucalyptus, a common local material, is recommended for beams, rafters, and columns.

Their construction should correspond to the local vernacular and site conditions. Therefore, columns should be rustic and informal rather than formal or classical.



This rustic example is appropriate for informal designs.



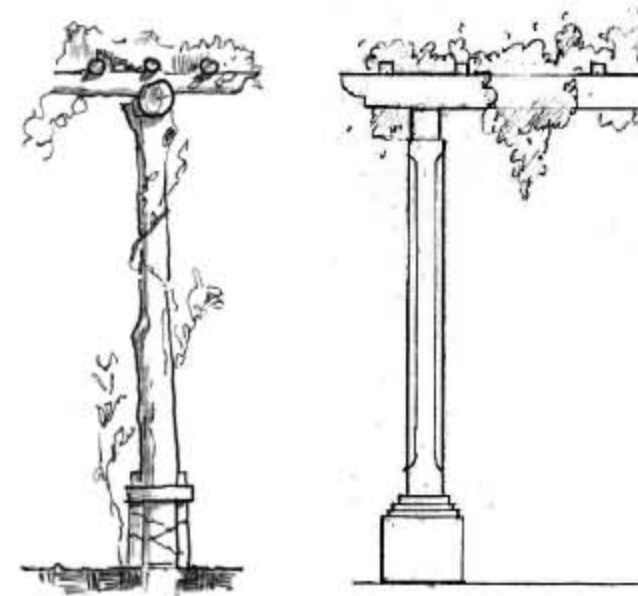
This design is more formal yet still consistent with the rural setting of Santuario Tuctara.



Columns should be designed in coordination with appropriate railings, trellises, and vegetation.



Exposed beams add additional texture to the natural materials of the interior.



COLUMNS / POSTS

Wood posts may be used for interior or exterior columns and for trellises. They should be no less than 16 x 16 cm and should be constructed of a single timber. Their design can range from rustic (left) to more elegant, yet still simple (right).

ARCHITECTURAL GUIDELINES - AN EMERGING ARCHITECTURAL LANGUAGE

Santuario Tuctara's location on the Equator and its altitude of 2500 meters offer remarkable advantages. It benefits from strong solar energy, a temperate climate, and an abundance of spring water and generous rainfall. Because of these exceptional conditions, heating and cooling needs can be met easily through passive design and appropriate material choices, as well as integrated ecological systems.

The sustainable systems that have been developed by permaculture specialists and architects take advantage of natural energy sources and local materials. However, rather than being added elements, which might be unsightly or prone to failure, these sustainable devices are integrated into the architecture so that they become architectural features in and of themselves.

This section will highlight the following sustainable techniques:

- 1 - Sustainable Systems
- 2 - Natural Roofs
- 3 - Generous Eaves
- 4 - Vertical Roof Elements
- 5 - Exposed Ceilings
- 6 - Natural Floors
- 7 - Recessed Windows and Shutters
- 8 - Wooden Doors
- 9 - Details and Color



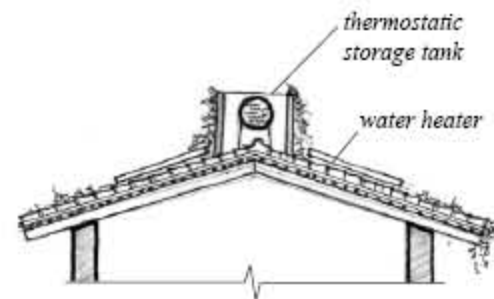
SUSTAINABLE SYSTEMS

While other strategies can be considered or added in the future, the primary systems suggested are:

- Domestic Solar Heating
- Roof-Water Collection
- Wastewater Systems

Refer to the Allpa section for additional systems.

SOLAR HOT WATER



Given Cotacachi's available sunlight throughout the year, solar energy is a good option for domestic water heating, backed up by firewood for the cloudiest days of the year.

The proposed solar-shower system consists of:

- A water heater made of a shallow metal box painted black with a copper tube coil and glass cover
- A thermostatic storage tank to provide water for the house by gravity

The backup system consists of:

- A metal tank above a fireplace, stove, oven or other firewood-powered element connected to the water grid and using thermal siphon force

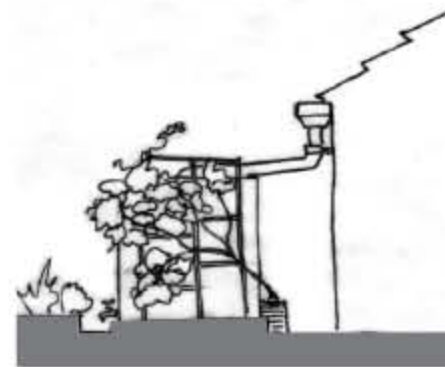
Recommendations:

It is recommended that each house have its own solar system and backup. A backup system should be placed in connection with a multi-use firewood system, not something that's fired only to warm water.

Integration:

The water-storage cistern should be designed in conjunction with the roof or as an architectural feature.

ROOF-WATER COLLECTION



Pure water is a top priority for any permaculture system. Harvesting, retaining, and reusing as much water as possible should be a constant goal.

Recommendations:

We recommend creating an integrated water-harvesting and hydration system for all of Santuario Tuctara. The hydration and storage strategies should be connected to the water system by overall design. The rainwater storage cisterns and ponds must have overflow systems that connect with keylines and swales.

Integration:

The water-collection tank, like the one above, can be concealed by a trellis covered with bougainvillea.

NATURAL ROOFS

At Santuario Tuctara, roofs will be distinctive architectural features. They will be constructed with natural, local materials of tile or earth.

Two suggested roof coverings are possible:

- Natural Clay Tile
- Living Plants

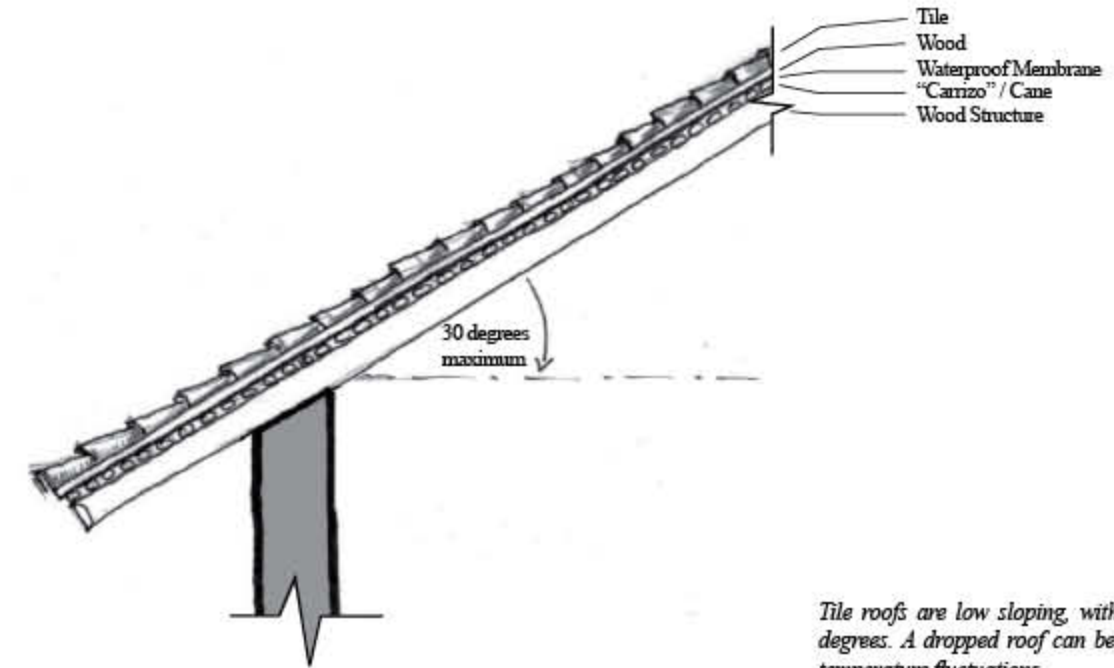
TILE ROOFS

Low sloping, hipped roofs are most typical and traditional. Their material consists of local or reclaimed terracotta tile.

Remarks: Tiles conduct heat but also lose interior heat. Appropriate insulation and/or a dropped ceiling will passively induce a pleasant interior temperature.



TILE ROOFS



Tile roofs are low sloping, with a maximum slope of 30 degrees. A dropped roof can be added to control interior temperature fluctuations.

LIVING ROOFS

Though not as traditional, living roofs are an interesting alternative, blending architecture and landscape. These rooftop gardens provide welcome outdoor sanctuaries or additional garden space.

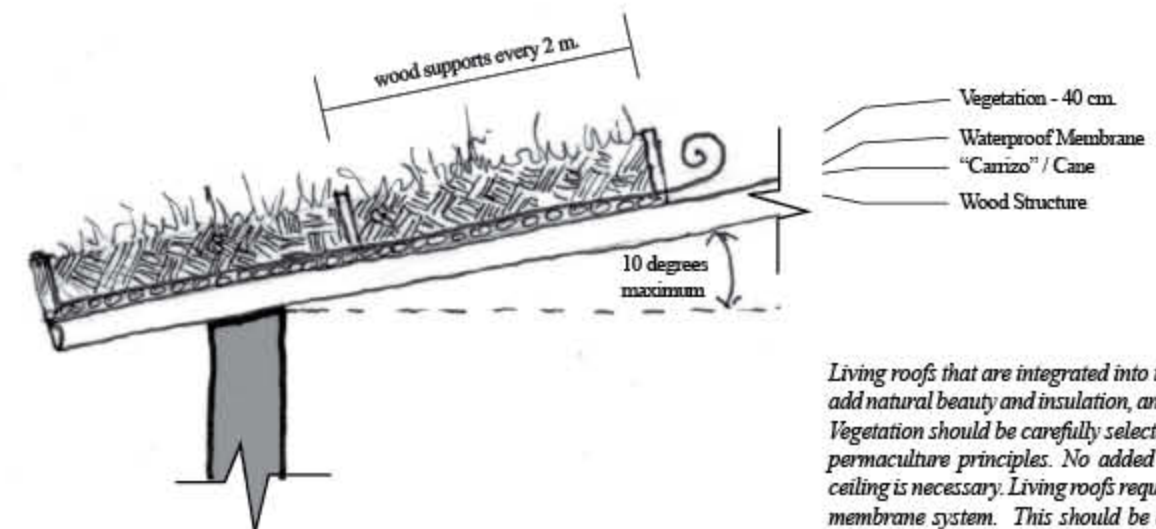
Rooftop plants will mimic a poly-cultural pasture. A living roof that remains green throughout the year can be achieved using a diverse number of plants and allowing the hardy varieties to thrive.

Plant species for living roofs include alfalfa, trebol, cebada, trigo, avena, pasto milinn, ray grase, capuchina, bledo, amarantho, lenteja, arveja, and kicuyo.

Remarks: A living roof will not necessarily warm the house but offers insulation once heat is captured by the sun. Living roofs will also slow rainwater runoff.



LIVING ROOFS

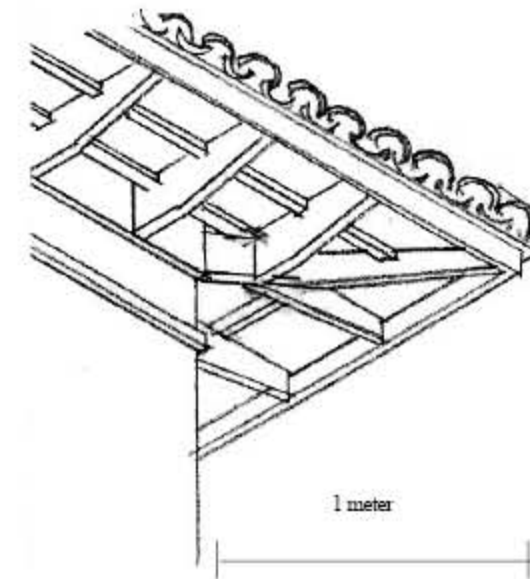
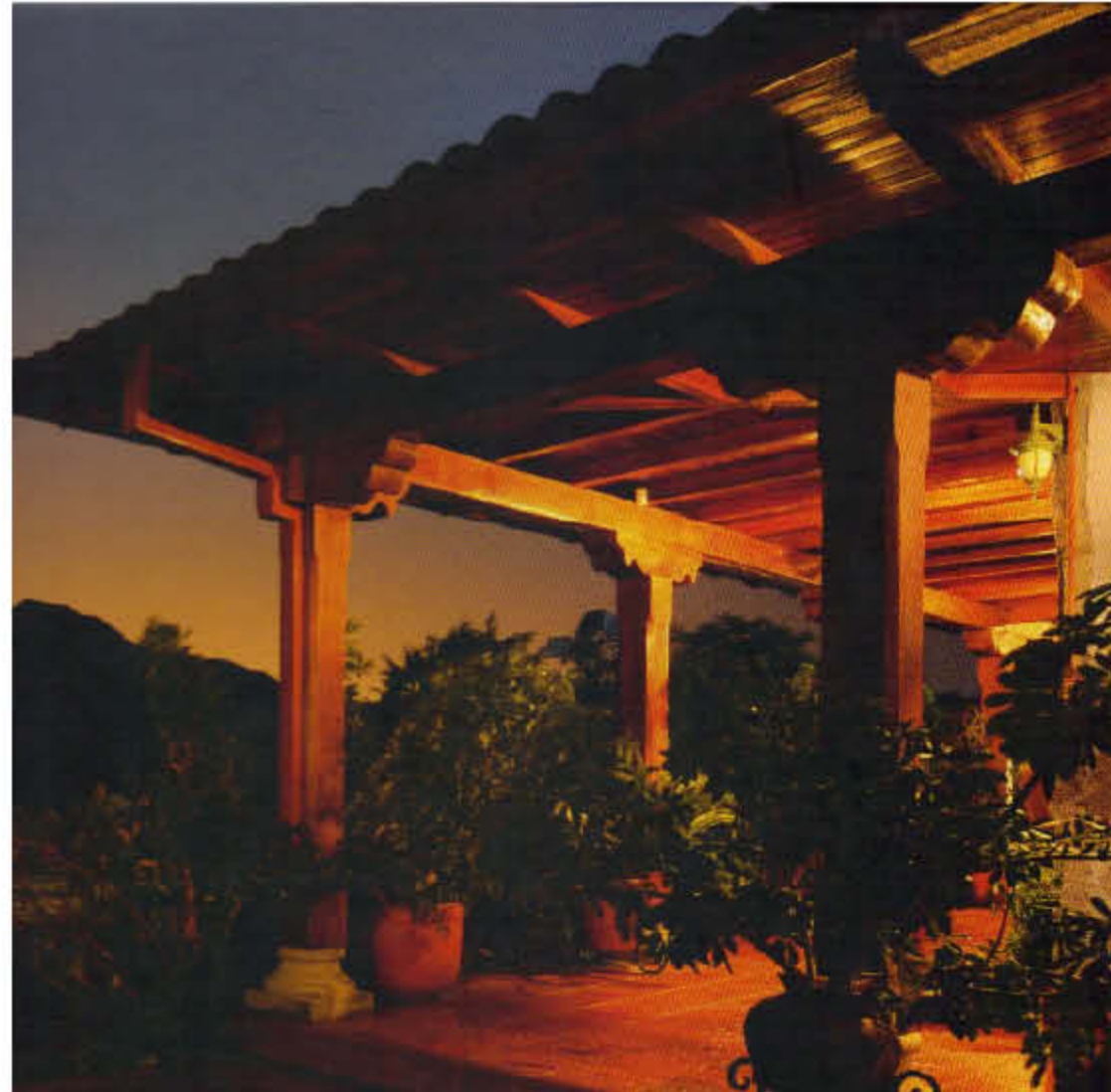


Living roofs that are integrated into the contours of the land add natural beauty and insulation, and help retain rainwater. Vegetation should be carefully selected in coordination with permaculture principles. No added insulation or dropped ceiling is necessary. Living roofs require a carefully designed membrane system. This should be designed by an expert, with easy inspections and repair in mind.

GENEROUS EAVES

Hipped roofs should be designed with 1-meter eave overhangs to shade and protect earthen façades from the rain. While this length may not be the norm in Cotacachi, for Santuario Tuctara it is necessary to shield the earthen structural wall materials.

Substantial eaves are also necessary to protect outdoor earthen fireplaces.



The airy aesthetic of open eaves is appropriate in the culture and context of Santuario Tuctara. Eaves must extend 1 meter from the building to protect earthen façades.

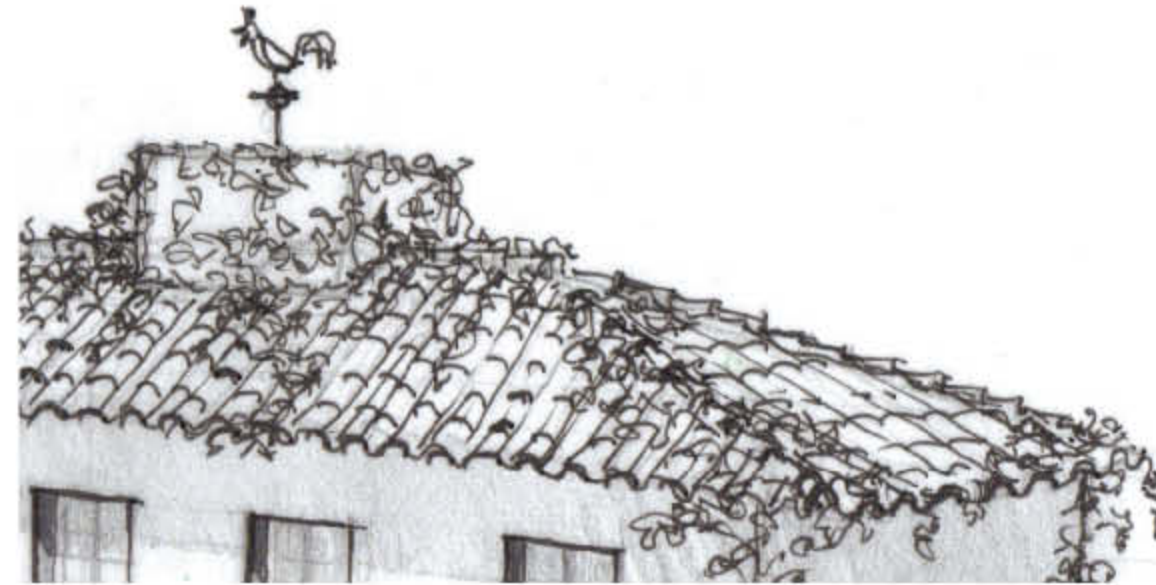


VERTICAL ELEMENTS

All sustainable, ecological techniques and devices such as chimneys and rooftop water tanks must be carefully integrated into the architectural design. This must be done in a way that reflects the holistic vision of Santuario Tuctara, celebrating the human need for comfort through harmony and beauty.

Chimneys should be designed to catch the eye and express the grace of the manmade against the sky.

Because water tanks must be placed at the highest point on the roof, they must be designed as visually appealing architectural features. The tanks themselves should not be visible but should be incorporated into design elements that are elegant additions to the traditional design.



A trellis with bougainvillea has been designed to conceal the water-storage tank, while also bringing color and nature to the tiled roof.



Because the rooftop water tank must be placed at the highest point on the roof, a tower can be integrated to contain this tank, becoming a distinctive architectural feature.



EXPOSED CEILINGS

Ceilings that expose the structure and material of the roof's underside help to express the region's architectural vernacular and local materials.

The logic of the structure is pleasing and natural materials answer a need for materiality and scale. These exposed roof structures should be used in interior spaces and zaguans, soportales, and gazebos.

Recommended materials are :

- Eucalyptus
- Carrizo, or Cane
- Local Timber



Eucalyptus with Carrizo



Eucalyptus with twigs or branches



Exposed Local Timber

NATURAL FLOORS

Like all other building materials, floors should be made of and finished with local and natural materials. This applies to interior and exterior spaces.

Appropriate materials are:

- Earth
- River Stones
- Local Stone
- Local Tile
- Eucalyptus



Earth

Earthen floors are one of the oldest and are found locally. Their surfaces are comfortable, offering warmth and a soft texture. Once they are sealed, they can be cleaned the same as other floors and withstand much traffic. Aesthetically, the appearance of earthen floors can vary according to taste: they can be smooth and matte, combined with wood or stones, or the surface can be scored with distinct patterns. Earth can be used as sub-flooring and covered with tile.



River Stones

River Stone floors give a wonderful rural feeling and can be used for interior and exterior spaces.



Local Stone

Stone floors can be rustic like the example above or more refined.



Local Tile

Tiles must be locally made and with a natural finish. They should be artfully placed and grouted by skilled craftsmen.



Eucalyptus

Eucalyptus is an abundant material in Cotacachi but not native to the area. Because of the damaging affects they have on the soil, eucalyptus trees should be cut and used for floors and construction.

WINDOWS AND SHUTTERS

Windows and operable shutters are important features in this architectural vernacular. They should be made of wood and can be painted or left natural with matte finish. (Refer to page 70 for color scheme.)

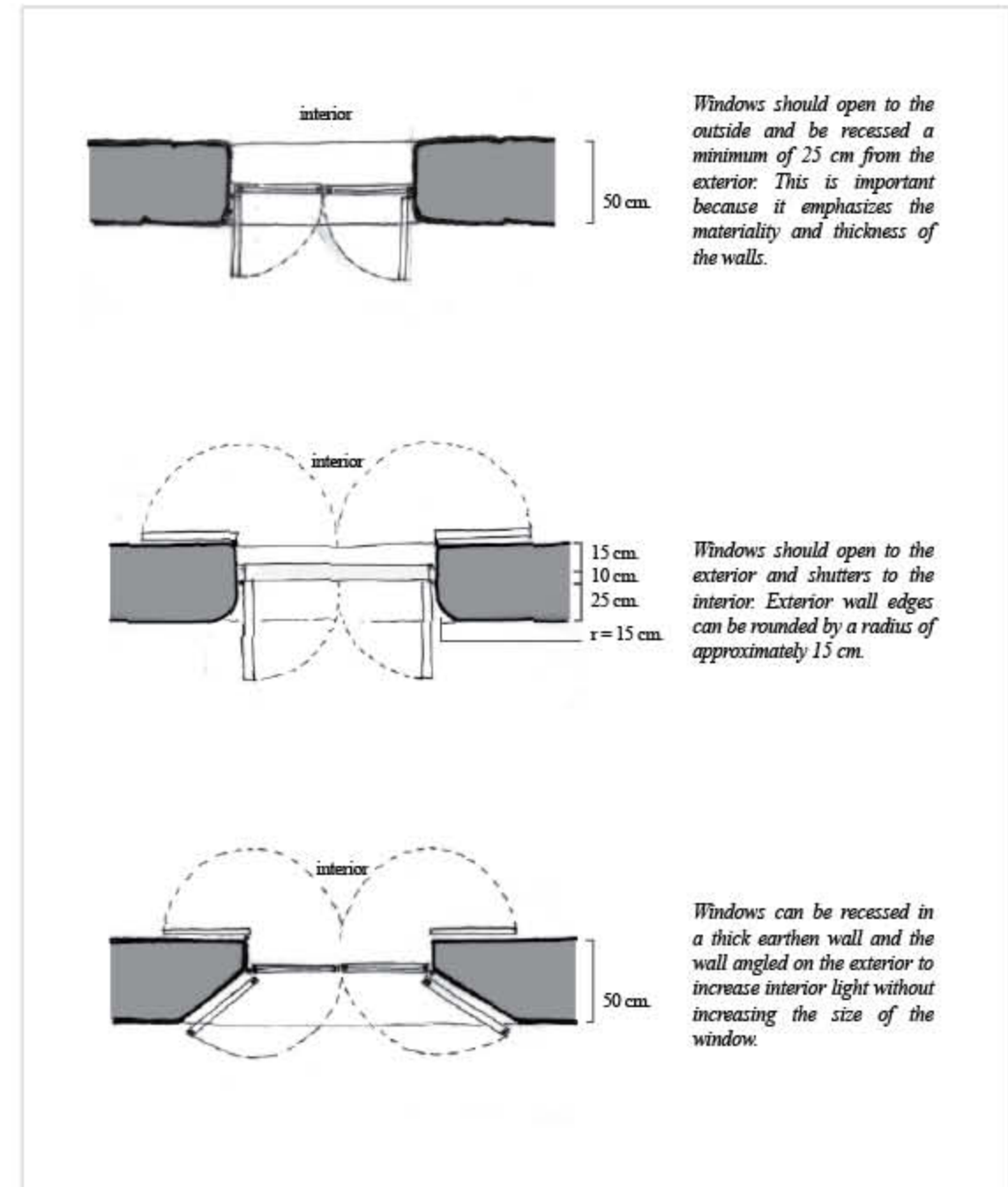
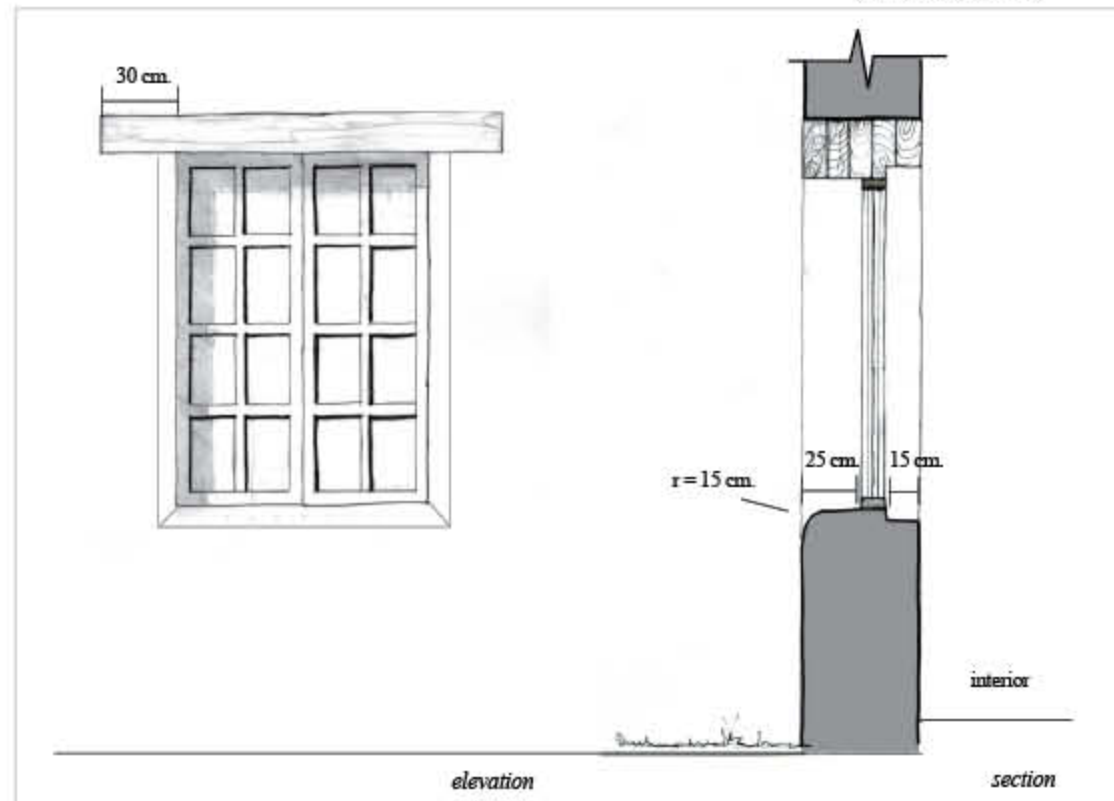
Windows should open to the outside. They should be designed so that they are recessed within the thick, earthen walls approximately 25 cm from the exterior. This emphasizes the substantial, natural quality of the walls and protects the window from rain and sun.

In keeping with the tradition of simple, shutter-free exterior facades, shutters should be placed on the interior. Shutters are useful for added security and can protect interiors from direct morning and afternoon penetrating solar rays. Not only are they functional, but if slatted, they create wonderful light patterns in the interior during the day and from the exterior at night.

Traditionally in Cotacachi, windows are rectangular and designed with or without a wooden lintel. Arched windows are a more recent element of the vernacular style. Their softened quality is a welcome addition to the local architecture. Arched lintels should not be visible, nor should decorative motifs be added above the arches.

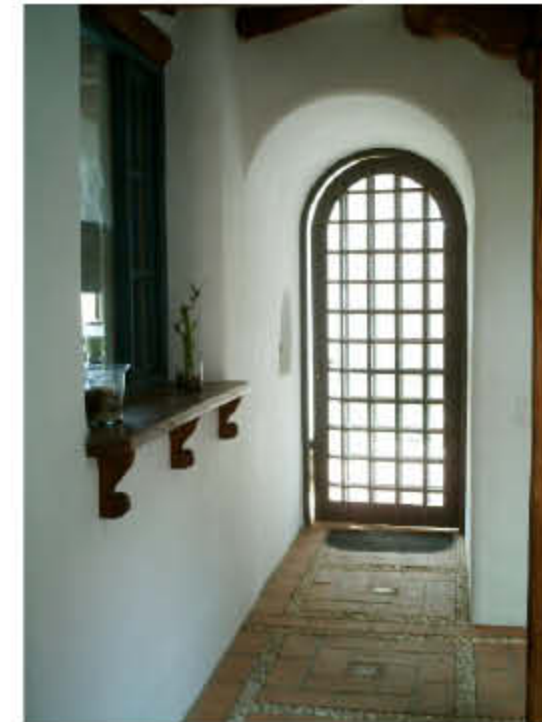


If bars and grills are needed for security, they must also be harmoniously designed decorative elements.



NATURAL DOORS

Entrances to homes must always be visible and easy to access. They must also be human in scale and detailing. They should always be made of wood, and they can be left natural with a matte finish or painted. [See page 70 for color schemes.] Doors should reflect local craftsmanship.



DETAILS

One of the goals for Santuario Tuctara is to highlight the craftsmanship and local knowledge of the area. Local metalwork, tiles, sculpture and other crafts are encouraged.

Traditionally, every home incorporates decorative personal designs on main entry floors. These designs can be made of river stone, tile, or other local materials. Often a sun or moon is included in the pattern.

On interior or exterior walls, nooks are also prevalent.



Weather vanes have traditionally been useful and decorative roof elements indicating direction of the wind and incorporating animal motifs. Each Santuario Tuctara home should have its own personalized weather vane.



Floor designs, often with a sun or moon, are traditional and should be encouraged. The floor above is designed with local river stones and cobblestones.



Earthen walls, especially walls of rammed earth, provide depth for niches on outdoor and indoor facades. They provide space for decorative objects.



Doors are an opportunity to reflect local craftsmanship and natural materials.

COLOR

Exterior facades should use traditional shades of terracotta or earth colors. Colors should be chosen to allow the architecture to merge with the landscape.

If painted, windows, shutters, and doors should be blue or green, as they were often painted in the past. Exterior color should be matte and limited, complementary, and consistent throughout the building.

Windows and doors can be left unpainted. In this case, the same wood should be used consistently throughout the building with a matte, transparent finish. Consistency is crucial. Painted windows can be designed with a natural door, but if they are painted, all windows should be painted the same color.

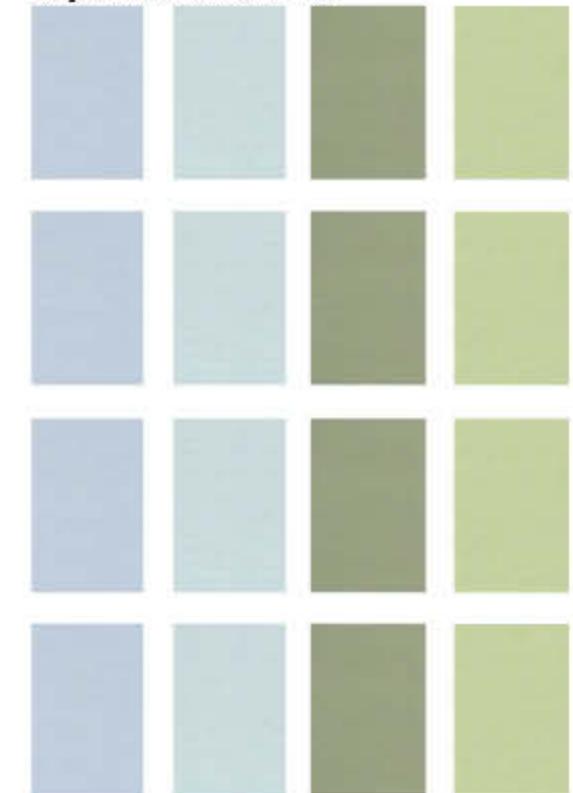
All ironwork should be black.



exterior wall colors



sample window and door colors





These pictures illustrate the historical origins of Cotacachi. While most depict a more urban setting than Santuario Tuctara, they show the vernacular of the region. Tile roofs and earthen walls are prevalent. While typologies are simple and openings rectangular, the more formal buildings are adorned with arched windows.



SANTUARIO TUCTARA

VERNACULAR REFERENCES

ARCHITECTURAL GUIDELINES - AN EMERGING ARCHITECTURAL LANGUAGE

HACIENDA OCAMPO

The neighboring Hacienda exhibits both native and European influences. The building typology is shaped like an H, with two open-air courtyards. Natural rammed-earth walls are protected by generous overhangs and natural tile roofs.



These images can be found in *Casa Colonial: Domestic Architecture of New Granada*, which explores the history behind the colonial architecture in present-day Colombia. The architecture of New Granada is rich in influences with a vernacular that has evolved over time.

Its creative permutations of familiar vernacular elements such as patios and courtyards make this a shining example of diversity through balanced and holistic design. As a most-loved place, this serves as an inspiration for Santuario Tuctara.



SELECTIVE BIBLIOGRAPHY

Casas de Campo Magazine. No 58.

Home Improvement Magazine. Jan 2004

Garden Design Magazine. Aug/Sept 2002

The Small Adobe House. Agnesa Reeve, Robert Reck (photos).

The Basics of Permaculture Design. Ross Mars. Martin Ducker (illustrations).

Permaculture: A Designers' Manual. Bill Mollison.

The Permaculture Book of Ferment and Human Nutrition. Bill Mollison.

Introduction to Permaculture. Bill Mollison.

Casa Colonial: The Domestic Architecture of New Granada. Germán Téllez.

Santa Fe Houses and Gardens. Sue Daley and Steve Gross.

OUR GRATITUDE TO THE FOLLOWING EXPERTS WHO WERE CONSULTED

Fausto Acosta

Rocío Béjar

Ignacio Egas

Julio Guayasamín

Tom Watson

Michael Mehaffy

Marilyn Minden