



RONTEERAS

town plan - tejido group - spring 09

FRONTERAS REVITALIZATION PLAN

A CONCEPTUAL DESIGN FOR THE COMMUNITY OF FRONTERAS, SONORA

THE TEJIDO GROUP

COLLEGE OF ARCHITECTURE & LANDSCAPE ARCHITECTURE
UNIVERSITY OF ARIZONA
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ACKNOWLEDGEMENTS

Given a project as far reaching and multifaceted as the Fronteras Revitalization Plan, the amount of support, input and encouragement needed was exponentially great. The Tejido Group team received advice, feedback and a great deal of help from many remarkable people who gave their time and energy to try and help this worthy town and contribute to the learning process for the students involved.

This project was made possible through our exceptional clients, Roberto and Alice Valenzuela, who planted the seeds of the project and inspired the team through their tireless dedication, effort and follow through. Always willing to answer questions, seek out information and documents on behalf of the project and help in any way they could, their efforts and inspiration truly enabled the team to move forward in the development of this master plan.

The Tejido Group was fortunate to have had access to a number of experts who gave their time to enlighten and inform the team on a number of issues pertinent to Fronteras. In particular, the group would like to acknowledge Gene Giacomelli of the University of Arizona / School of Agriculture who

came to our class to share his expertise and act as an informed sounding board for our ideas and concepts about agricultural development. His input inspired the addition of greenhouses to the revitalization plan.

Mark Taylor and Robert Archer of Westland Resources also gave their time to visit our class and lecture about water services and wastewater treatment and to answer our questions about water issues in relation to Fronteras. Their input has been most valuable and is greatly appreciated.

The team would also like to thank Dr. Mark Frederickson and his assistant Patricia Rojas for their guidance and advice throughout the semester. Their experience and encouragement has been invaluable in the design process and revitalization plan production.

Most of all, we would like to thank the people of Fronteras for allowing access to their unique, beautiful and valued town. Our hope is that the ideas and designs outlined in this book will help to inspire positive change and serve as a starting point for discussions and planning for the future of Fronteras.



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THE TEJIDO GROUP

Tejido is an extension of the applied research and community outreach activities of Dr. Mark Frederickson / College of Architecture and Landscape Architecture / University of Arizona. Over the past twenty years, the Tejido Group has developed into an interdisciplinary and collaborative applied research program in which faculty and professionals in Landscape Architecture, Planning and Architecture work side by side with University graduate and undergraduate students in an apprenticeship-style professional learning environment. Tejido is also an international experience and has collaborated on projects throughout the United States, the Caribbean, Mexico, and Central America. Projects include: harbor revitalization and waterfront development programs in Panama; the development of coastal planning and

design guidelines for the State of Sonora, Mexico; tourism and resort planning for the Panamanian Canal Zone and Panamanian Government; campus master planning in Arizona and in Panama; small town revitalization master plans for several rural areas in Arizona, Sonora and Sinaloa Mexico including Show Low, Pinetop-Lakeside, Springerville and Clarkdale, Arizona; a resort master plan for the Cuisinart Corporation in Anguilla, British West Indies; and new-town master planning in San Carlos, Mexico, Picacho and Bisbee, Arizona.

Tejido selects projects it wishes to participate in based on several criteria: 1) project uniqueness and pedagogic value in developing our students into exceptional practicing professionals; 2) client need; 3) and, the project's potential impact on society and the environment. Although Tejido

RIGHT: The team traveled to Fronteras, Sonora, Mexico to see the town and meet with the client, Alice Valenzuela.



has, and continues to, develop projects through the construction document phase, we primarily focus on the generation of conceptual alternatives for our clients. We concentrate our efforts on developing innovative concepts through the application of research initiative. Tejido believes that designers gain insight and inspiration from a variety of sources. An essential part of our design and planning processes occurs during pre-design research. During this phase, information garnered from a variety of sources is reviewed and incorporated into the design intentions of our teams of landscape architects, planners, and architects. Unlike associations with traditional design and planning offices, Tejido offers our clients an opportunity to afford in-depth applied research and the subsequent generation of alternative concepts prior to design development and construction documents. In “real-world” situations, the conceptual design process is often foreshortened when financial resources are strictly limited.

As we are essentially a non-profit organization dedicated to the education of our students, and the needs of our clients, we can afford to focus our efforts on pre-design research and schematic exploration with our clients in developing complex, yet tailored master planning solutions. We see our relationship with practicing professionals as one of project creation and not of direct competition. We render conceptual design and planning services that otherwise could not be afforded. Through our work, the communities we serve are able to move towards the future they envision for themselves.

Dr. Mark Paul Frederickson

College of Architecture & Landscape Architecture

University of Arizona

THE TEJIDO DESIGN PROCESS

Although our design process varies according to the nature of the project and our client's needs, we have developed a general approach to idea generation and development based on study of methods employed by exceptional firms throughout the world.

Data Collection and Analysis

In the initial phases, we often begin with shared team data collection and analysis duties. We involve ourselves primarily with three forms of data collection and analysis: (note: we encourage the generation of design and planning ideas during this initial phase in parallel with data collection and analysis tasks).

Case Study Analysis

This portion of our process is absolutely critical to effective communication with our clients. Our case study analysis is exhaustive and dedicated to the generation of design implications resulting from our review of other projects relevant to our own. As our clients witness the successes and failures of other relevant projects around the world they gain confidence in feasibility of their own project and in their designers.

User Group Analysis

In this portion of our process we use structured interviews and Likert scale questionnaires to sample the opinion of our clients. The data collected is often analyzed with basic descriptive statistics, but we have also used ANOVA and multiple regression analysis to examine and develop increasingly complex design implications. We most often survey a range

of user groups: youth and teens, business owners, general citizenry, the elderly, etc... We also will frequently interview individuals with specialized knowledge in an array of fields: education, planning, ecology, development, local politics and history. Our structured interviews ask diverse arrays of individuals the same sets of questions. It is often very useful to then compare responses for points of commonality and divergence.

Contextual and Site Specific Inventory / Analysis

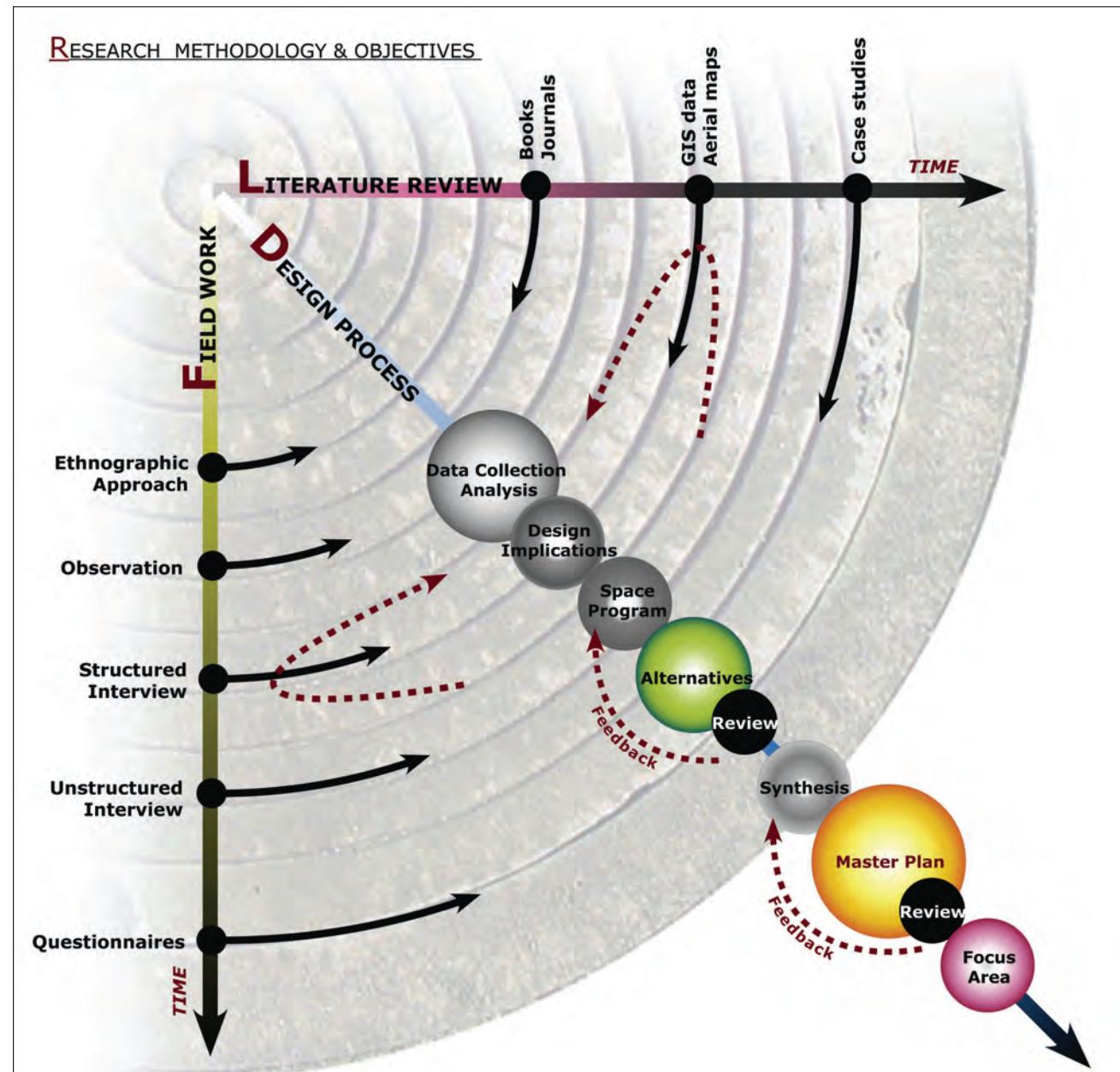
During this phase of inventory and analysis we spend a great deal of time on and around the site as non-participant and participant observers. Some methods we employ approximate those of ethnographers and are qualitative in nature. While others are quite factual and employ low inference descriptor variables. We begin with a large scale contextual analysis – looking for key factors surrounding the site that may influence our design decisions within the site. This may involve detailed analysis of aerial photographs and G.I.S. data. We also photograph the entire site and surrounding urban and natural contexts – looking for existing positive design features unique to the site as well as problem areas in need of attention.

As a summary task of this phase, all participant data collection teams make detailed presentations of their findings to all other participants. In this manner information is disseminated to all participants and collective design synthesis can begin. These presentations include extensive review of all design precepts generated during the collection and analysis



Dr. Mark Frederickson heads the Tejido group - a research, design and planning office dedicated to addressing community needs.

RIGHT: Tejido Process Diagram showing the general process used to arrive at design solutions.



phases. As mentioned, our process encourages design activity throughout data collection and analysis. One general guideline we use is that analysis of fact is incomplete without discussion of the design implications generated by the existence of said fact. These implications are discussed, developed, and faithfully recorded for future synthesis activities.

Concept Generation

This phase asks that each individual attempt to synthesize issues uncovered in our analysis into cohesive planning and design concepts. The individual concepts are reviewed in exhaustive design synthesis sessions. Focus is maintained on idea-building activities where reviewers are charged with the task of making each concept “better.” Clients are fully involved during these “creation” sessions.

The relative merit of various design ideas are then evaluated according to five different design ordering systems that we have developed over the years; functional, environmental, economic, socio-cultural, and aesthetic. These ordering systems form a checklist embedded in our design process, and we believe that an idea’s relevance and usefulness increases according to the number of different ordering systems that it engages. For instance, an idea that concerns itself with only aesthetic issues is not as useful as an idea that fully engages not only aesthetics, but also explores economic and environmental issues as well. A park with flowers is fine, but a park with flowers that increases adjacent land values as it winds its way through adjacent housing as well as mitigates erosion and promotes urban water harvesting is a richer, more layered and therefore more useful concept.

The best ideas are recorded, and in subsequent group and individual charette sessions, they are synthesized into two or three optimum solutions. At this point client review is once again paramount, and alternative concepts are presented in three dimensional detail, including story board sketches, models, and computerized “walkthroughs.”

We are interested in formative not summative feedback. We have found that client feedback is more lucid and fluent when they are presented with a series of easily understandable images and models rather than two-dimensional plans.

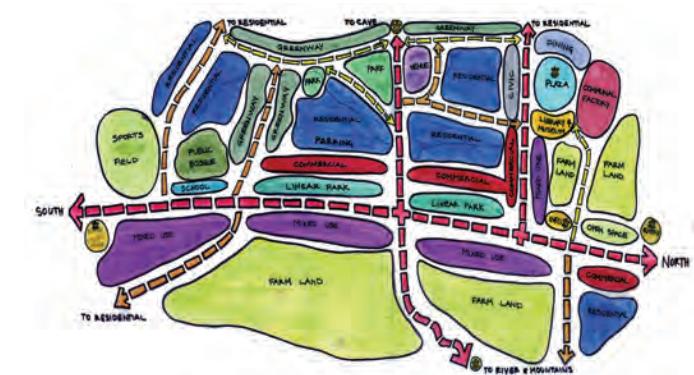
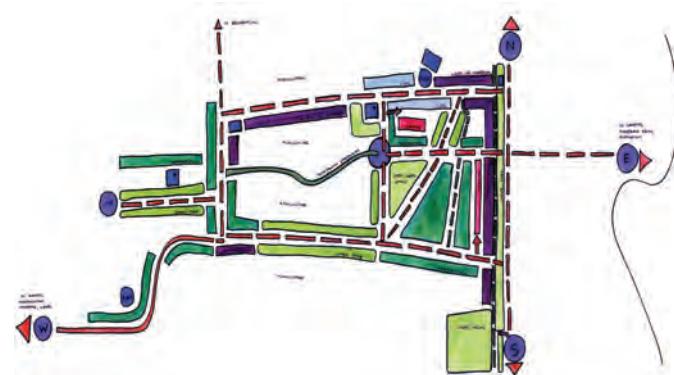
Image Boards

We also use a device we call image boards to elicit response from our clients. These are a series of large scale boards containing images (photographs and drawings) taken from projects in our case study analysis as well as, generated by our designers. These images might discuss design options ranging from building and plant materials to spatial experiences or urban lighting options. We find that our clients feel more comfortable speaking of these actual images from other projects. Their response allows us to gain insight into their predispositions. We use their responses as jumping off points where, hopefully, we will create, combine and develop ideas on to the next level.

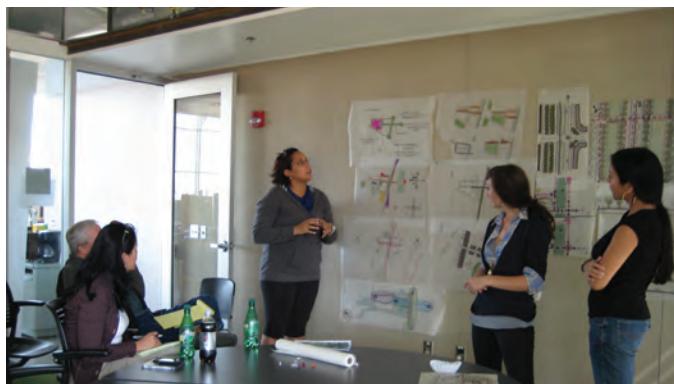
Concept Development

During this phase team members are asked to divide themselves into concept development teams according to their personal philosophical alignments with the alternative concepts at hand. Each of the alternatives will then receive additional attention. Prototypical focus areas located within the planning

RIGHT: Diagrams like these help designers to understand spatial relationships and landuse and to develop concept alternatives.



RIGHT: Reviews and design charettes are conducted regularly throughout the design process to in order to generate ideas and monitor design process.



concept will be identified and developed in greater detail. Ideas from these focus areas may have application to other areas contained within the concept. At any point when idea generation seems to grow stale we might jump into more individual or group charette activities. At other times, we might revisit data collection and analysis phases to better inform our process through the collection of new information or the analysis of old data through new eyes. Internal / external reviews are exhaustive and involved during this period. It is critical that participants have mastered small group dynamics by this stage in the process. Respect and positive

idea building are the tools of choice during these potentially contentious design tasks.

Products

We will usually deliver a series of web-based digital presentations and boards to our clients along with a comprehensive master planning document. Our clients often use the document and boards as marketing tools in their attempts to solicit Federal, State, and private funding. We include a section in each document that covers marketing strategies and sources of funding relevant to our clients and the future of the project. These master planning documents are thorough and go to great length to

establish positive correlation between data collected and data implemented into the design. Origins of design ideas are traced to their source and relevance to the project is explained in some depth. This can be accomplished graphically and verbally. This, in turn, helps establish credibility to ourselves, to our clients, and eventually to potential investors in our design decision process.

Implementation Strategies

Our approach to phasing is usually avoid chronological approaches and focus our energy on developing situational matrices for our clients. This type of phasing is based upon occurrences in the economy, demographics, or environmental contexts of the project, i.e. interest rates, new housing starts, environmental regulations, etc... We develop discreet development packages for our clients, and we call these modules of development. Given the appropriate political and economic environment, any one of these modules can be implemented independently from the others.

Working Environment

We have been fortunate to have had the opportunity to explore and at times, develop new methods of design and presentation. We have found that above all else, the process should remain fun; isn't it strange how easily we forget what initially drew us to the design professions? This usually means full opportunity to participate and share ideas in a respectful and energetic learning environment. Collaborative design can be a miserable experience, or it can be delightful. We believe that enthusiasm

for the material, the process, and the people involved in design enables us to effectively build learning environments where ideas flow freely, unimpeded by excessively harsh criticism, and where the advantages of collaboration are consistently apparent. In this context enthusiasm can become motivational, and could be described as an enabling process where teachers and students listen, question, reflect, empathize, and advise in sincere, non-manipulative manners. They look for strengths and possibilities rather than core-defects and inevitabilities.

On any given day and circumstance, what we have said here will be modified, augmented and diminished. The value of flexible thinking and learning strategies is therefore apparent. Some of the phenomena we have been speaking of are certainly learnable if the motivation to learn them is alive within an individual. Respect, sincerity, enthusiasm, and adaptability are difficult commodities to fake, and in this sense, the personal caliber of the people involved in collaborative efforts is essential. We have found that philosophical, personal, and professional disparity becomes decipherable and even advantageous in most respectful and trusting environments. And, of course, as projects, sites, design teams and clients change, there are limitless fine-tuning moves that design environments can make to enhance learning and ideation.

PROJECT TIMELINE

RIGHT:

The project timeline graphic highlights key dates and major activities of the Fronteras project as undertaken by the Tejido Group.

These include initial contacts with the client, hiring of the Tejido Group, site visits, presentations and completion of the project.

Although dates are listed for each phase of the project, it is important to note that some activities began and ended within the dates mentioned, while others were ongoing such as the analysis, research, and design processes. For these, only the start dates are noted even though they continued up until the final document was completed.



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INTRODUCTION

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- Project Scope, Purpose, Need
- Procedure of Study

Place text here

SCOPE, PURPOSE, NEED

The Tejido group was first approached by Alice and Roberto Valenzuela in the Spring of 2008 to develop a revitalization plan for Fronteras, Sonora, Mexico that would be a source of inspiration for economic stimulus as well as a plan for the anticipated future expansion of the town. The Valenzuelas articulated their vision of an enlivened Fronteras benefiting from the development of “diversified, grass roots enterprises” and an investment in infrastructure to support public health, light industrial and residential development.

For the past nineteen years, the Valenzuelas have owned and operated Rancho Mababi, a cattle ranch 30 miles southwest of Fronteras, where they raise grass-fed beef. Roberto, a Mexican national, was raised in Agua Prieta, one hour north of Fronteras. His family has ranned in Mexico for several generations and, after living in the San Francisco area for many years, the couple decided to move themselves and their two sons to Mexico to continue running the family ranch. The Valenzuelas have since expanded their business to include eco-tourism adventures in the mountains that surround their ranch.

Unfortunately, the culturally and historically vibrant town of Fronteras has not fared as well. Due to the closing of the Levalor Blinds factory in 2002 most jobs in town were lost. The lack of employment opportunities in Fronteras has forced many people to leave their hometown in search of work elsewhere.

Despite the economic circumstances of the town,

it is rich in cultural and natural resources which can serve as opportunities for economic stimulation. The town's proximity to the Douglas, Arizona border to the north, the Sierra Madre mountain range to the east and west and its rich cultural history are all assets that could serve as a draw for tourism and investors.

The Valenzuelas and other community members have a vision for Fronteras, one with a healthier, more diversified economy for the town. A healthy economy will enable the children of Fronteras to remain if they choose and to raise their families in their hometown, secure in knowledge that there will be job opportunities for their children. Our clients envision a future full of growth and opportunity for the community. As Fronteras looks forward toward a brighter future, having a master planning document to guide its development and growth has the potential to be a vital asset, particularly for attracting investment.

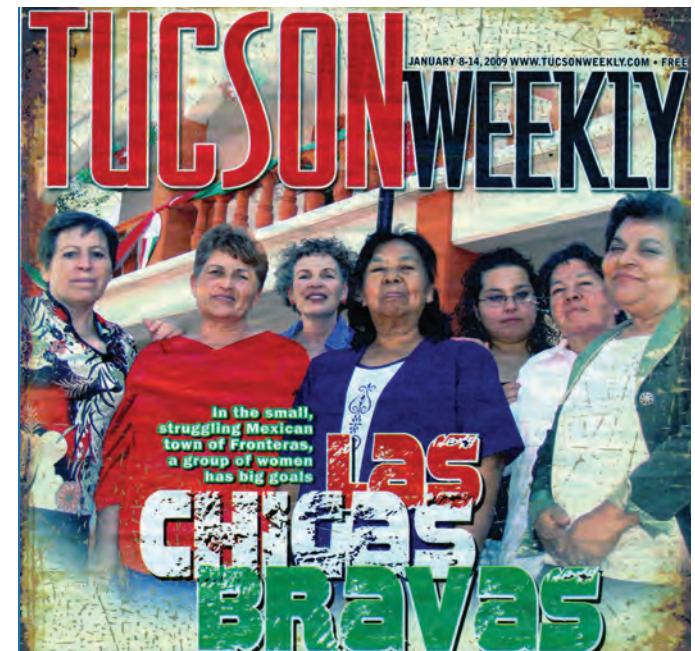
This master planning document is intended to identify ways in which the town could be revitalized and to provide a basic road map for growth. It is important to note that this is a conceptual plan meant to stimulate discussion, begin the idea generation process and serve as a communication tool.



Roberto and Alice Valenzuela recognize the inherent value and unique culture of the town of Fronteras and believe in its potential for growth.

LEFT: Fronteras, indicated by the blue dot is located south of the Agua Prieta and the Arizona border.

RIGHT: Community groups such as this local women's cooperative, *Cooperativa Rural de Fronteras*, are actively seeking investment in the town and working to create employment and development opportunities.



Procedure of Study

- We initiated a detailed site inventory and analysis of the town of Fronteras and its surroundings
- We researched the history of Fronteras and its famous citizens to identify historic town treasures and ideas for future development
- We spoke with specialists in areas such as waste water treatment and agricultural sciences
- We conducted a thorough review of relevant literature such as new urbanist theory and landscape ecology in order to develop principles to guide the design and planning process
- We researched an array of relevant case studies, from which we drew design implications
- We visited the town of Fronteras to better

understand its layout, assets and need, and to walk through conceptual ideas

- We performed a series of internal design charettes to generate diverse solutions and synthesize optimum solutions
- We identified areas of focus and developed multiple design options for each
- We developed a web site presentation to communicate our design process and conceptual ideas
- We developed a detailed master planning document that will not only direct future development and revitalization, but will also act as a communication and marketing tool for future investment



A graphic element consisting of a flock of stylized birds in various colors (blue, white, green, brown, red) flying in a curved path towards the right side of the page. The word "ANALYSIS" is written in a large, bold, outlined font, positioned at the end of the bird's flight path.

ANALYSIS

CONTENTS

Contextual

- Location
- Climate
- History
- Economic

Site

- Circulation
- Landform
- Infrastructure
- Land Use
- Land Ownership
- Open Space
- Vegetation and Wildlife
- Views

Designers gain insight and inspiration from a variety of sources, but an essential part of the design process is pre-design research and analysis. The analysis process starts at the beginning of a project and continues until the final document is published. Throughout the design process, analysis is constantly referred to in order to generate and support design ideas.

Many individual elements are brought together to form a thorough site analysis. Each element plays an integral part in design decisions and information is garnered from a number of fields of study. Critical socio-cultural, functional, aesthetic, economic, and environmental issues are identified and examined in depth. The landscape architect then distills relevant design and planning implications from the analysis of the information collected, and incorporates these design implications into the design intention.

All of the information in the following chapter informed the final conceptual designs for the site. Particularly relevant or interesting design implications are noted in the margins.



LOCATION

Fronteras is a rural Mexican pueblo located near the north-eastern border of the state of Sonora. The town is also the capital of its municipality, with which it shares a name. Fronteras lies 30 miles south of the border city of Agua Prieta, Mexico. The town is located 150 miles southeast of Tucson, Arizona, and 180 miles northeast of Hermosillo, Sonora. Highway 17 runs north and south through the middle of the pueblo.

Nestled among foothills of the northern edge of the Sierra Madre Occidental mountain range, Fronteras

rests in an ecologically diverse environment. The town also sits several miles east of Lake Juribana (a substantial man made reservoir) and historic Cuquiarachi, which features a 17th century catholic church.

The rural character of the landscape is also emphasized through the town's main industries: farming and ranching. Many essential urban amenities and health care services are only accessible in Agua Prieta.

LEFT: Lush farmland and grazing cattle during the spring in Fronteras.

RIGHT: Sonoran Desert monsoon.



Some months in Fronteras can be very windy, creating dust storms throughout town.



CLIMATE

"The weather is very volatile. You can have freezes in May as an example or giant hail storms, floods, droughts etc."

--Roberto Valenzuela

Fronteras sits in a semi-dry temperate climate, at an elevation of 1136 meters.

The median average annual temperature is 17 C° (62 F°). The average temperature from June to August is between 20 and 25 C° (68 and 77 F°), and the average monthly temperature is 6 C°(43 F°) in December and January.

The rainy season is from June to August with an average annual precipitation of 444 mm. June is the rainiest month in Fronteras, "when there is actually some water in the river," says Roberto Valenzuela. The growing season for almost every crop is in the summer, although there is some grazing in the winter.



Floods occur during the monsoon season. Flooding of Rio Nacoziari can be so severe, that, before bridges were built, people had to travel south to find a safe crossing.

According to the NOAA National Climatic Data Center and Servicio Meteorológico Nacional, precipitation during March to August of 2008 was considered at a normal range of -0.4 to 0.4. Precipitation from June to August ranges from 300 to 500 mm, with August ranging from 100 to 150 mm.

Freezing occurs from November to March. According to Mr. Valenzuela, snowstorms are occurring less frequently as the climate changes.

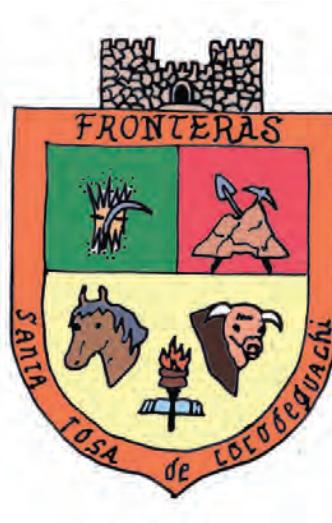
Design Implications

- **Climatic variability suggests that greenhouses may offer an appropriate solution to a short growing season**
- **The town could benefit from the construction of bridges over the Nacoziari River to enable year round access to the eastside**



Regional Map Key

- ★ Fronteras
- Bisbee
- Douglas
- Cuquiarachi
- Esqueda
- Nacozari
- Arizpe



LEFT: This regional map indicates the various cities discussed within this section for orientation and context.

RIGHT: The shield of Fronteras shows an adobe fort representing various battles; wheat and barley with a sickle alluding to the town's agricultural history; a bull and horse that speak to livestock, which historically was the town's main source of income; and a book and torch in the center representing education and concern for the townspeople of Fronteras.

HISTORY

A town's history is an integral part of its identity, knowing how a town came to be allows one to develop design solutions which are appropriate and enhance its existing identity. A town's culture and history also enhances its potential as a profitable tourist destination. Studies show that 35 percent of travelers planned to visit a historic site while on vacation. Tourists' trends also indicate that visitors stay longer and spend more money at historic sites than other locations.

The following is both a general history and historic analysis of the town of Fronteras. At the end of this section, we included a local scale map which highlights areas within town that may have cultural and/or historical significance and therefore may be in need of preservation and possibly restoration.

Early History

The town currently known as Fronteras was originally inhabited by a group of indigenous tribes known as the Opatas. Opatas were the original inhabitants of most of

Sonora, where the Sierra is located. These indigenous tribes occupied the Opateria in the central and northern regions of Mexico and into southern Arizona. Their territory extended from the Huachuca Mountains of southern Arizona into Central Sonora, Mexico. The northern most mission of the Opata Indians, San Ignacio de Cuquiarachi is approximately 7 miles to the west of Fronteras and is currently a small town which sits on a hill with a small church, schoolhouse and plaza.

Fronteras was once referred to as "Corodeguachi" which is the opata word for "crane road." The name was changed to Santa Rosa de Corodeguachi in 1645 when the town was founded by missionaries of the Society of Jesus.

In 1654, to counter native revolts on Spanish settlements, Captain Francisco Ramirez Salazar established the company, "La Caballeria de las Fronteras" or "The Cavalry of the Frontier" and formed a presidio on a bluff near what is currently the northwest section of town. Originally it was meant to be a mobile

Spanish explorer, Juan Bautista de Anza, who opened the overland route from Mexico to California and established the first settlement at San Francisco, was born in the municipality of Fronteras (near Arizpe) in 1735 where his father and grandfather had served as commanders. In fact, in 1752 he also enlisted in the army at the Presidio of Fronteras and advanced rapidly to captain by 1760. In 1775, de Anza headed an expedition of settlers which opened one of the first routes to Alta California, establishing the city of San Francisco. Today, de Anza's remains lie in the main church in Arizpe which is approximately 50 miles southwest of downtown Fronteras.

LEFT: A beautiful view over Fronteras and looking toward the Sierra Espuelas, or Spur Mountains, which is at the northern end of the great Sierra Madre or Continental Divide. Presidio remnants in the lower left of this image appear to be all that is left of the Captain's House on the bluff. Restoration and preservation of the presidio would enhance the town's appeal as a historic landmark.

RIGHT: From the base of the southern end of the bluff, a small cave can be seen. Legend has it that this is one of two prisons which held Geronimo for up to twelve years after his capture in the late 1800s.

Native American leader of the Chiricahua Apache, Geronimo (1829-1909), was imprisoned in the town of Fronteras after he was captured in the Torres Mountains to the southeast in the late 1800s; however, the exact dates of his capture vary. Remnants of the cave in which he was held can still be seen on the northwest side of the town and there is a small museum near the town plaza which documents much of this history and displays the gate that once held him within his cell.



unit but eventually the company made this their home base. This was done mainly because it was the site of a large flowing spring known as Corodeguachi. The presidio became known as the Presidio of Corodeguachi over time; however, since the name of the company was the "Cavalry of the Frontiers," the presidio became known as the Presidio de Fronteras and "Fronteras" eventually became the namesake of the entire town.

In 1726, Don Juan Bautista de Anza (de Anza senior) was left in charge of the troops at Fronteras as the previous captain, Don Gregorio Alvarez Tunon y Quiros, had greatly neglected the settlement and was replaced by Anza after a failed inspection by Brigadier General Pedro de Rivera. De Anza who had been in charge at the settlement of Janos along with his own commanding officer and father-in-law, Antonio Bezerra Nieto, went from being lieutenant to captain and inherited the responsibility of protecting settlements to the south from Apache strongholds to the north. With the presidio being on such a high point, it was not hard for sentries, posted twenty four

hours a day and located in a guardhouse adjoining the captain's house, to see oncoming Apache attacks. All of the buildings at the presidio were made of sun-dried brick adobe which was perfectly suitable for stopping Apache arrows. Remnants of these adobe buildings can still be seen on the bluff; however, very little remains and much of what is left has been marred with graffiti.

Fronteras' past as an agricultural town can be traced back to these days of the presidio. The nearby Corodeguachi spring, water in the area and deep fertile soils made the valley prime agricultural land. As was common at most Spanish colonial military installations, homes of the vecinos who farmed and ran livestock surrounded the walls of the presidio. Not only did this help protect these families but it also created a market to which the vecinos could sell their goods. The Corodeguachi spring used to be a quarter of a mile to the southeast making it the perfect location for a flour mill which became one of Fronteras' first centers of economic activity in both



LEFT: Three old Southern Pacific Line train cars dot the landscape near the town's northern entrance which can be moved and converted for various uses such as a food cart or focal point, embracing part of the town's historic identity.

RIGHT: The old train depot is one of the first landmarks seen upon entering the town. Although it currently does not serve a function it could be repaired and upgraded to serve as a visitors center. November 7th is known as the Day of the Railroader in Mexico after Jesus Garcia, a railroad engineer, saved the town of Nacoziari from a dynamite explosion on November 7, 1906.

pre and post-Revolutionary days. The flour mill itself seems to be long gone, however, the site of the spring still remains which could make this area a good choice for restoration and/or repair.

Fronteras Railroad History

Although Fronteras was settled long before the implementation of the railroad line that currently cuts through the middle of town, it continued to grow because of this line. The Phelps Dodge Corporation was an American mining company founded in 1834 by Anson Greene Phelps and William E. Dodge. The company originally consisted of an import-export trade business that shipped U.S. grown cotton to England in return for precious metals; however, as copper was being discovered in the American West, the company expanded its business and began to focus on its own mining operations. As the company grew, they set their sights on copper-rich Arizona and began investing in railroads to make a connection between their eastern shores and the west.

The small mining town of Nacoziari de Garcia is approximately forty miles south of Fronteras. As copper markets boomed in the 1890s, Arizona mining engineer Louis D. Ricketts was sent by Dr. James Douglas, chief engineer of the Arizona and South Eastern Railroad to investigate the copper resources of Sonora and eventually Nacoziari. Although the mines here were originally discovered in 1660, their tie to Fronteras came about after the mines were acquired by Moctezuma Copper Co., a subsidiary of Phelps Dodge. The mined copper was hauled by mule train from Mexico to the U.S. until the railroad, el Ferrocarril de Nacoziari, was completed in 1904. In this way, Phelps and Dodge were able to connect the mining town of Bisbee, to the new border town of Douglas (an hour north of Fronteras) and on to Nacoziari. With the Sierra Espuelas to the east of Fronteras, the railroad line was built directly between the mountain range and the old Presidio of Fronteras, making Fronteras an ideal stop along the way and effectively expanding the town around the railroad. The old train depot, while in need of restoration, still stands

LEFT: Acequias continue to guide water around the town and irrigate fields; however, some of the historic acequias have been turned off or diverted elsewhere.

RIGHT: Although Fronteras was traditionally an agricultural town, fields are more commonly used now for grazing and ranching.



near the entrance of town along with three old railroad cars.

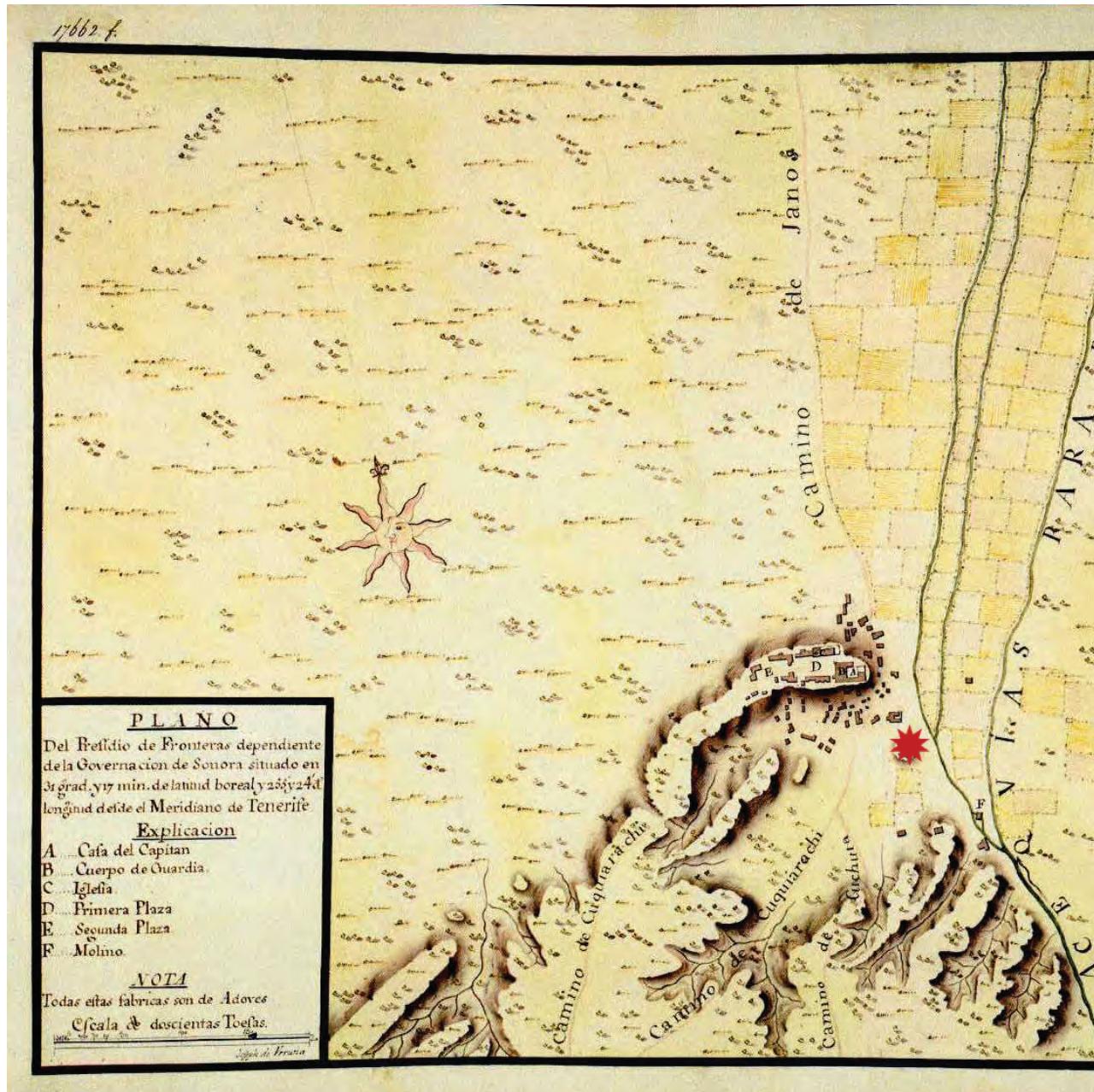
Recent History

In Mexico, many small towns like Fronteras look to maquiladoras as their main source of economic stimulus. A maquiladora is factory that imports materials and equipment for assembly or manufacturing and then re-exports the assembled product. Fronteras is not unlike other towns in this way. In 2002, a Levolor blinds factory closed and moved several miles south near the neighboring town of Esqueda, taking most of the town's jobs with it. Since the factory was the only maquiladora in Fronteras, this meant that many of the townspeople were left without jobs. As a result, many residents have had to seek work elsewhere in Mexico and the United States. Although the Levolor blinds factory has closed, the empty building is currently being used to house an electronics recycling business employing less than twenty people.

Currently, Fronteras' main economic activities consist of agriculture and cattle raising for meat production. The main agricultural crops in the past have been wheat, beans, corn and grasses for grazing. Trucks and trains consistently pass through the town on their way south toward Esqueda and even farther south to the smelter in Nacozari (La Caridad).

Design Implications

- **Restore and repair historic buildings and sites such as Geronimo's cave, Presidio de Fronteras and flour mill/spring site**
- **Promote the rich history of Fronteras on its website to attract tourism**
- **Restore and assign new uses to existing features, such as the old train depot and train cars, as a way to emphasize its unique character**



LOCAL MAP (HISTORIC)

LEFT: This 1767 map of Fronteras (Santa Rosa de Corodegauchi) by Jose de Urrutia details the historic Presidio of Fronteras showing the captains house, guardhouse, church, plazas, and flour mill. Also depicted on this map is el Camino de Cuquiarachi, still in existence, which leads to the town of Cuquiarachi to the west.



Existing plaza location
(for orientation)

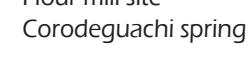
BELOW: Drawing of Juan Bautista de Anza (junior), from an oil portrait by Fray Orsi in 1774.

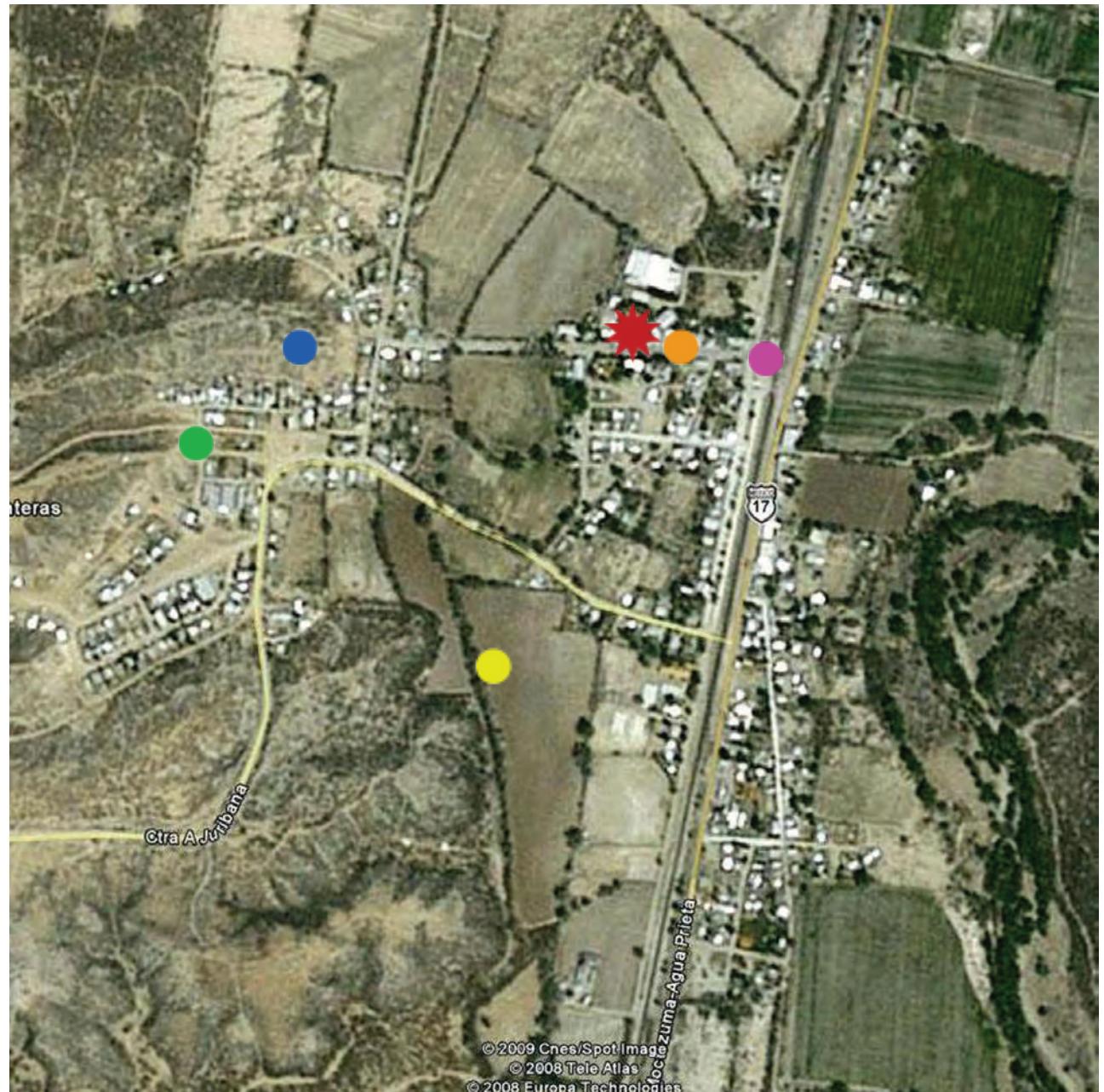


LOCAL MAP (TODAY)

The map to the right indicates the locations of some of the historic and culturally significant sites within Fronteras.

LOCAL MAP KEY

-  Plaza
-  Presidio de Fronteras
-  Geronimo's cave
-  Train Depot
-  Flour mill site
-  Corodeguachi spring
-  Museum





LEFT: Town residents and highway travelers alike commonly shop at the roadside "Super T" market on the north side of town.

CENTER: Neighborhood retail often occurs in a mixed-use setting

RIGHT: Irrigated row crops of Cuquiarachi valley are fed by the upstream lake.

ECONOMIC

Background

The town of Fronteras is one founded on roots of agriculture and frontier defense. In the 20th century, this sleepy hamlet was transformed by the arrivals of rail cars, tractor trailers, and *maquiladoras*. While its heyday may have passed, contemporary Fronteras is in a period of economic redefinition.

Agriculture

The past and current heart of Fronteras economy is agriculture. Traditional Native American crops such as squash and corn within the fertile valleys of the Nacozari were supplemented by Spanish introduction of grazing livestock.. Development of a well- and reservoir-fed and *acequia*-distributed irrigation system, railroad and modern roadway transport, and export through the U.S. border and port of Guaymas tipped the balance of agricultural production towards cattle.

Roadside Economy

In addition to increasing the speed of goods transport, the highway also recentered commercial activity to the roadside, drawing economic vitality away from the older parts of town surrounding the presidio and church. While many businesses are supported by roadway traffic between Hermosillo and Douglas, AZ, many travelers simply drive on past.

Throughout this period, what major urban developments have occurred (boulevard, auditorium) as political pet projects, seemingly disconnected from and non-contributing to a cohesive city plan.

Mining and Maquiladoras

Grupo Mexico employs many residents in the town of Esqueda within an active copper mine and smelter. While, for a short period of time, Fronteras residents were employed by a PVC blinds factory on the central

Agricultural Inventory:

- no storage capacity for fruits or vegetables
- hay is baled and stored
- tin warehouse built for wheat storage has never been used
- all farming done by private farmers; no collectives
- summer growing season, winter grazing season

LEFT: Many miners at the Grupo Mexico Cananea mine are bussed in from neighboring towns for their shifts.

RIGHT: "Las chicas bravas" process late-model computers and TVs within the factory building on the Fronteras plaza.



plaza, this company moved its operations and many of its workers to Esqueda in 1999.

Maquiladoras run by non-residents bring a temporary jobs boom, but these opportunities often go bust.

A New Paradigm

In recent years, local residents have formed *Patronato por el Futuro de Fronteras, A.C. (PFF)* and have collaborated with U.S.-based nonprofit Amanecer to fund, develop, and train residents to run an electronics recycling business housed in the former blinds factory.

Additional current and future vacant space within both towns represent opportunities for industrial or commercial retrofit, including explorations to locate a Phoenix-based battery-cable factory.

Design Implications

- Export of specialty agricultural goods to international markets should be expanded
- Natural amenities such as the river and mountains represent opportunities for growth of an ecotourism sector
- Refracting the flow of highway traffic can increase the time and spent by potential customers who are currently just passersby
- Success within electronics recycling can serve as a foundation for further industrial growth sectors



This map graphically represents the town's general entry points as well as primary and secondary vehicular circulation patterns.

CIRCULATION KEY

	Plaza (orientation)
	North Entrance
	South Entrance
	Railroad Tracks
	Highway 17
	Primary
	Secondary

CIRCULATION

The way cars and people move throughout a community plays a vital role in its success. Analyzing circulation patterns and conditions allows one to see how a community is currently functioning and assists in making decisions regarding safety, reinforcement and facilitation of movement, parking requirements, accessibility and infrastructure improvements.

Circulation conditions in Fronteras pose several challenges. These challenges have been organized

in this section based on issues which relate to the town's approach and entry, pedestrian experience and circulatory infrastructure conditions.

The map above displays the major circulation features in Fronteras. Primary and secondary streets were designated based on a visual assessment of the frequency of use of these streets as well as their physical conditions.

APPROACH AND ENTRY

TOP LEFT: Lack of traffic calming devices such as welcome signage, stop signs and vegetation at the town's north entrance limit recognition of entering an inhabited town.

TOP RIGHT: The high speed limit through town, 60km/h, encourages visitors to pass through without stopping.

BOTTOM: While there are clear signs near both north and south entrances, they do not provide a proper welcome because they are located too far from the actual beginning of the town.



Design Implications

- Utilize traffic calming devices which slow traffic to increase pedestrian safety and draw attention to commercial enterprises
- Create entry sequences which clearly welcome visitors into town
- Incorporate wayfinding devices, such as street signs and focal points to assist in navigation through town





INTERSECTIONS & ACCESS

TOP: The wide boulevard located just west of the railroad tracks creates the need to make U-turns to enter and exit town.

BOTTOM: The awkward entrance and roundabout near the Avenue Dr. Samuel Ocana Garcia does not clearly define this prominent intersection.

Design Implications

- Utilize excess space near boulevard for features, such as a linear park, plaza or market, which will enhance the commercial and residential fronts along this segment of road
- Redesign main street intersection to clearly direct traffic into the cultural and civic area of town

PEDESTRIAN EXPERIENCE

TOP: Lack of sidewalks and pedestrian paths makes navigating through town inconvenient and unsafe for pedestrians.

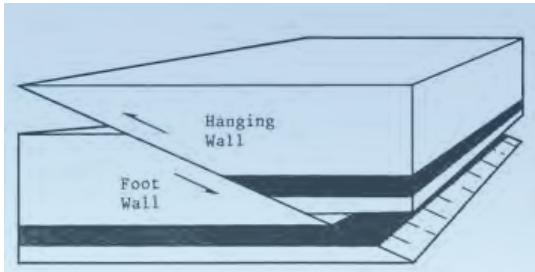
BOTTOM: Highway 17 and the Naco-Zarri Railroad cut through the middle of Fronteras. The highway is utilized regularly by large vehicles; high speeds and insufficient crossings make it a barrier to pedestrians.



Design Implications

- Implement pedestrian-focused infrastructure such as buffered paths, sidewalks and crosswalks in order to identify Fronteras' as a walkable town
- Incorporate pedestrian crossings at key intersections to increase safety and encourage pedestrian exploration of the entire town





INSET: Thrust fault geology results in basin and range topography of the Sierra Madre Occidental cordillera.

LEFT: Mountains to the east of Fronteras are likely eroded sheer sides of "hanging walls."

RIGHT: This picture overlooking Fronteras from the eastern mountains shows the river bottom, floodplain, and the gradually-rising backside of the next "hanging wall" mountain range to the west.

LANDFORM

Orogeny

The Sierra Madre Occidental is a mountain range formed from a thrust fault active in the late Oligocene period, some 23 million years ago. Under stress of colliding continental plates, thrust faults shear previously flat planes along lines, forcing one side of the line up and over the opposite. Mountain ranges resulting from this type of activity generally are composed of sheer heights on one side of the ridge and gradual rises on the other. These two types of geology are clearly seen to the east and west of the town of Fronteras, respectively.

Since the Oligocene, these mountains have slowly eroded through the action of wind and water. It is the action of these two elements that has created the spectacular diversity of landforms surrounding contemporary Fronteras.

Soils

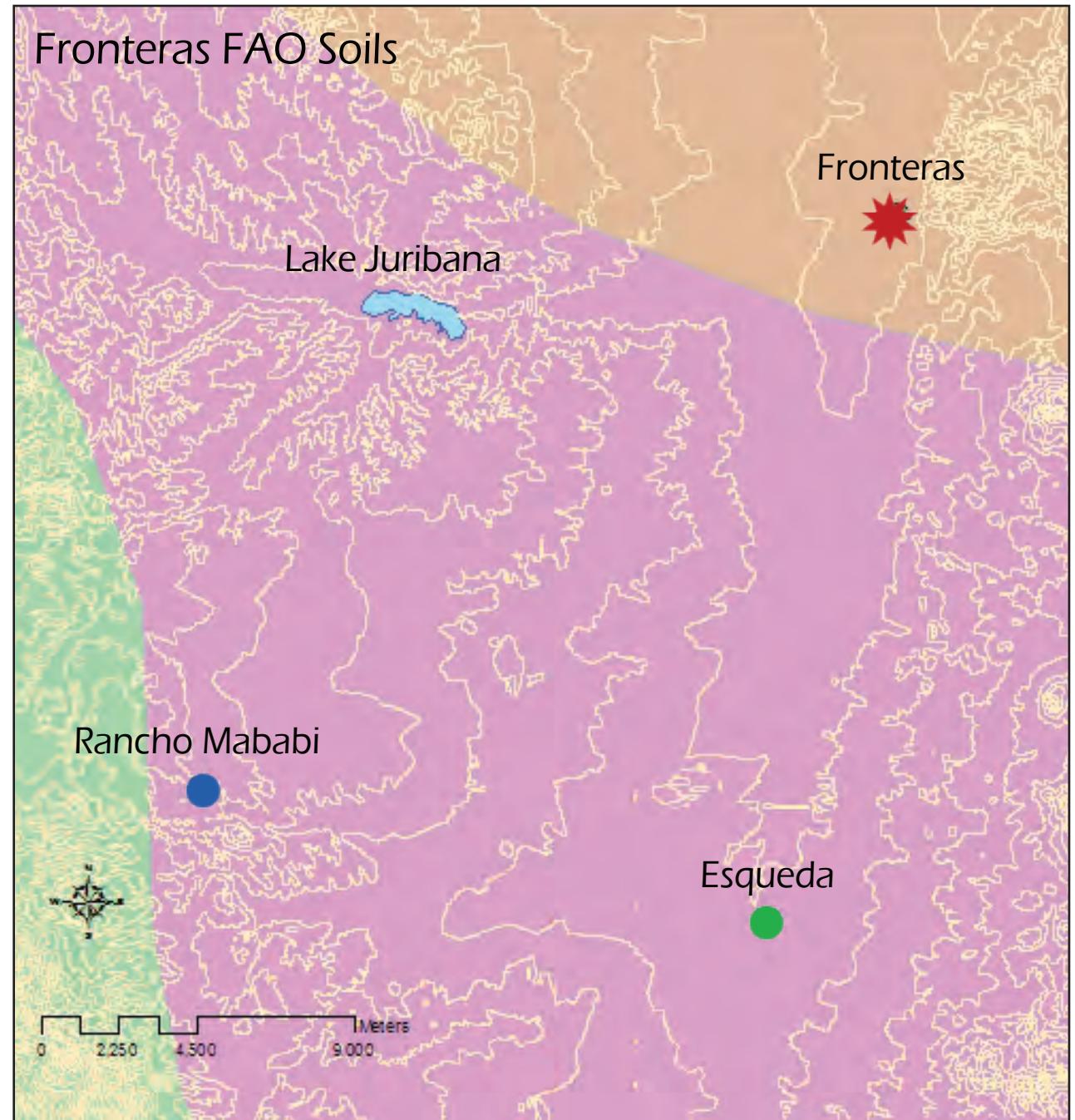
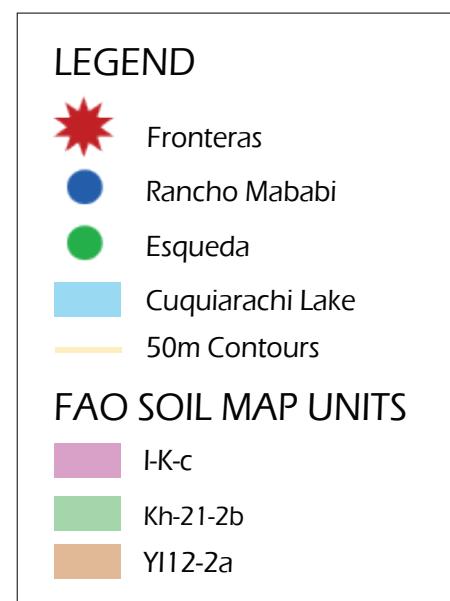
Beginning along the ridgeline to the east, the mountains are composed of uplifted bedrock which lies very close to the surface, thinly covered by lithosol soils. The unique montane features of this range have been preserved by the Mexican federal government as the Los Ajos preserve. In the 25 kilometers between this ridgeline and the valley floor, these hard-rock features give way to deeper, loamy, caliche-free, kastanozem soils of gently rolling foothills and the headwaters of the Juribana drainage. These soils support the productive landscapes of area ranches, such as Rancho Mababi.

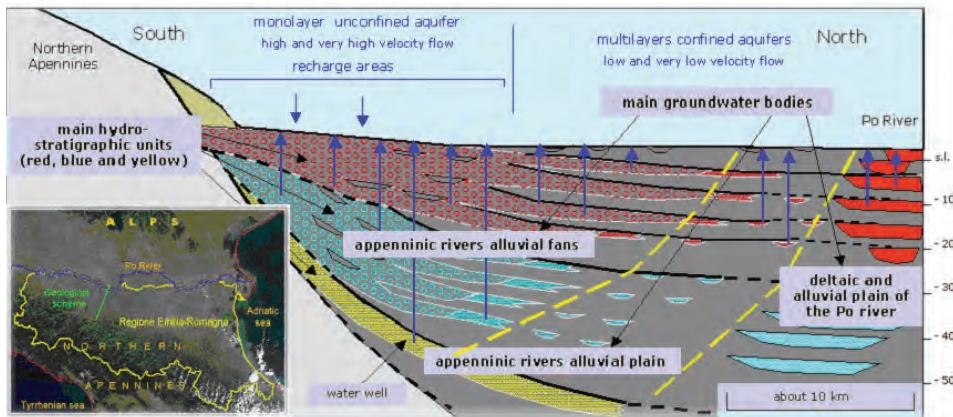
Within the valley bottoms, while the composition of loam increases within the soils, a caliche or hardpan layer is common, approximately a meter below the surface. These kastonozem and chernozem soils are

Instituto Nacional de Estadística y Geografía (INEGI) is the Mexican Federal Government's data management agency for ecophysiological information. INEGI work with the U.S. Geological Survey (USGS) and the Food and Agriculture Organization (FAO,) to provide course-scale

The map on the opposite page depicts the location of three major soil map units, from lower left to upper right:

- Kh-21-2b: Haplic Kastanozems
- I-K-C: Lithosol-Kastanozem-Chernozem
- YI





LEFT: Similar to the Italian alluvial plain depicted, the groundwater of Fronteras lies within the lower levels of an alluvial fan, above impermeable bedrock

RIGHT and OPPOSITE RIGHT: The Rio Nacozari drainage begins south of Esqueda and runs north through Fronteras on its way to the international border.

OPPOSITE LEFT: Cattle grazing on the thin soils of mesas surrounding town has created severe erosion.

made more agriculturally productive by plowing and irrigation.

Surrounding town, mesas are primarily composed of yermosol alluvial deposits. Top soils in these mesas are very thin and hard and are immediately underlain by a clay layer and often a hardpan. These poor-quality soils can only support shrubby, low-stature mesquites and sporadic forage. For this reason, these lands have been of limited use as open range for cattle herds kept in the valleys. Generations of cattle grazing has further depleted the vegetative cover and associated root structure of these mesas. This, in combination with the hoof action of these cattle, has resulted in erosional gulleys which are most evident along the sides of the mesas overlooking town.

Natural Hydrology

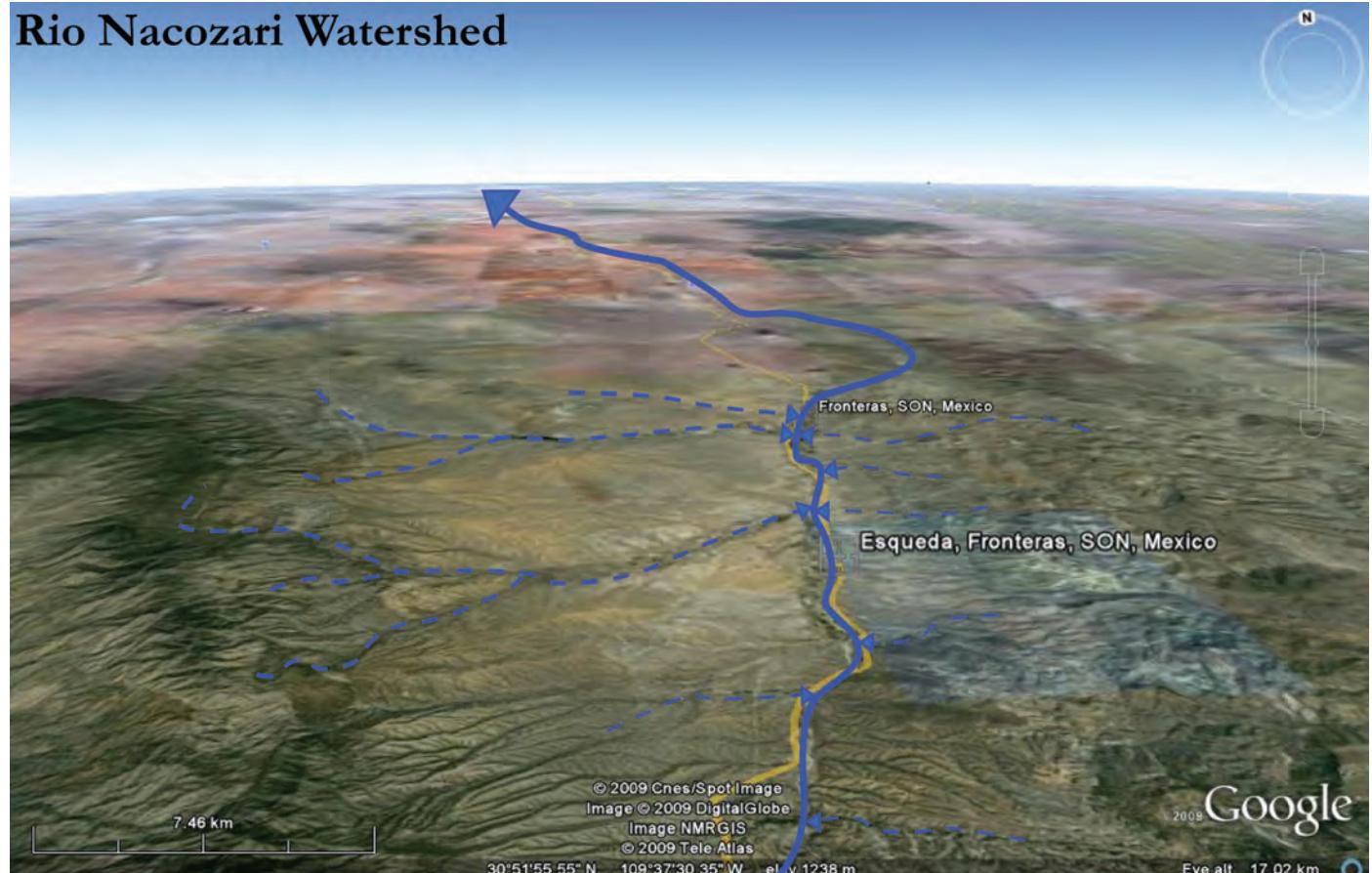
The major Rio Nacorazi drainage is fed by many small washes and biologically-productive valleys. The

watershed is much more vast to the west of the river than to the east due to the afore-mentioned thrust fault geology. Additionally, the comparatively greater depth of permeable soil in the west allows for a longer season of water retention.

The municipio, according to residents, has been under drought conditions for approximately the past ten years. Whether the current drought is a result of a decadal hydrological cycle or is a more permanent result of aquifer use or climate change remains to be seen.



Rio Nacozari Watershed



Design Implications

- Soil degradation on the mesas presents challenges to the development of these areas as verdant destinations
- The fertile soils and abundant waters of many areas of the municipio support high biological productivity, and should be protected for these land uses
- Impermeable soils far removed from groundwater, while considered “poor quality” from the perspective of biological productivity, present ideal opportunities for the siting of high-impact land uses such as dumpsites or building development



LEFT: Upstream, at the confluence of the Cuquiarachi valley with the Nacozari, lies one of two wells that feed the acequia system of Fronteras.

CENTER: An open sewage lagoon adjacent to the Nacozari lies at the terminus of municipal blackwater lines downstream of town.

RIGHT: Water is pumped directly from a well on the SE side of town into an elevated potable water tank that feeds the town buildings by gravity; power lines overhead of sidewalk.

INFRASTRUCTURE

Water Distribution

Three wells in town supply both irrigation and potable waters to the city of Fronteras through the force of gravity. Cuquiarachi valley is irrigated by water stored in a large upstream reservoir, which has drawn down the aquifer along the Nacozari. Rights to agricultural waters are purchased from and granted by the ejido or Carlos Mungia, owners of the wells.

Wastewater management

A gravity fed sewer system transport blackwater from town homes and businesses along the highway to storage in an above-ground lagoon

Above-ground lines

Electric distribution, telephone, and abandoned telegraph lines run along roadsides throughout town. Electric transmission lines span the hills to the east.

Design Implications

- The only surface waters in town, the acequias, are mostly innaccessible. Can these be incorporated into public spaces?
- Retrofitting the rudimentary sewage system can improve water quality and create a wetlands amenity to humans
- Lines overhead of sidewalk along highway should be buried to allow for unobstructed easterly views and the growth of street trees

TOP LEFT: Telephone and electric distribution lines and abandoned telegraph lines flank the highway as one approaches from the North by car.



TOP CENTER: High-voltage electric transmission lines span canyons in foothills east of town.

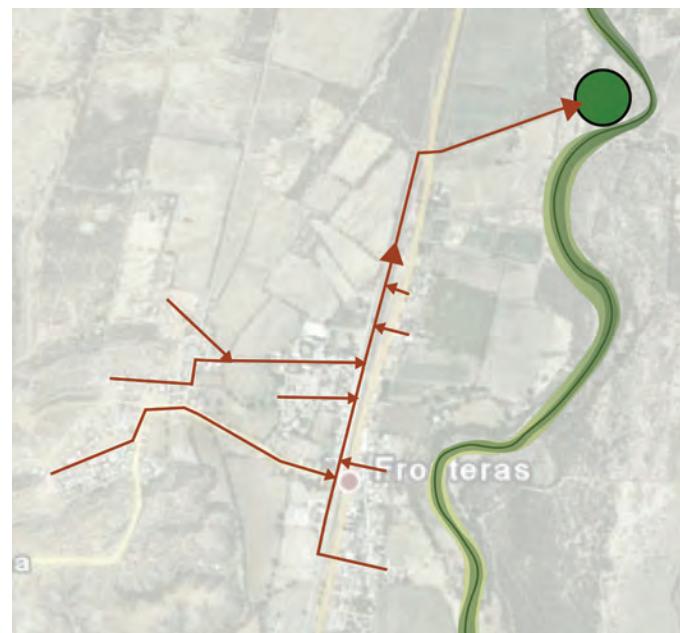


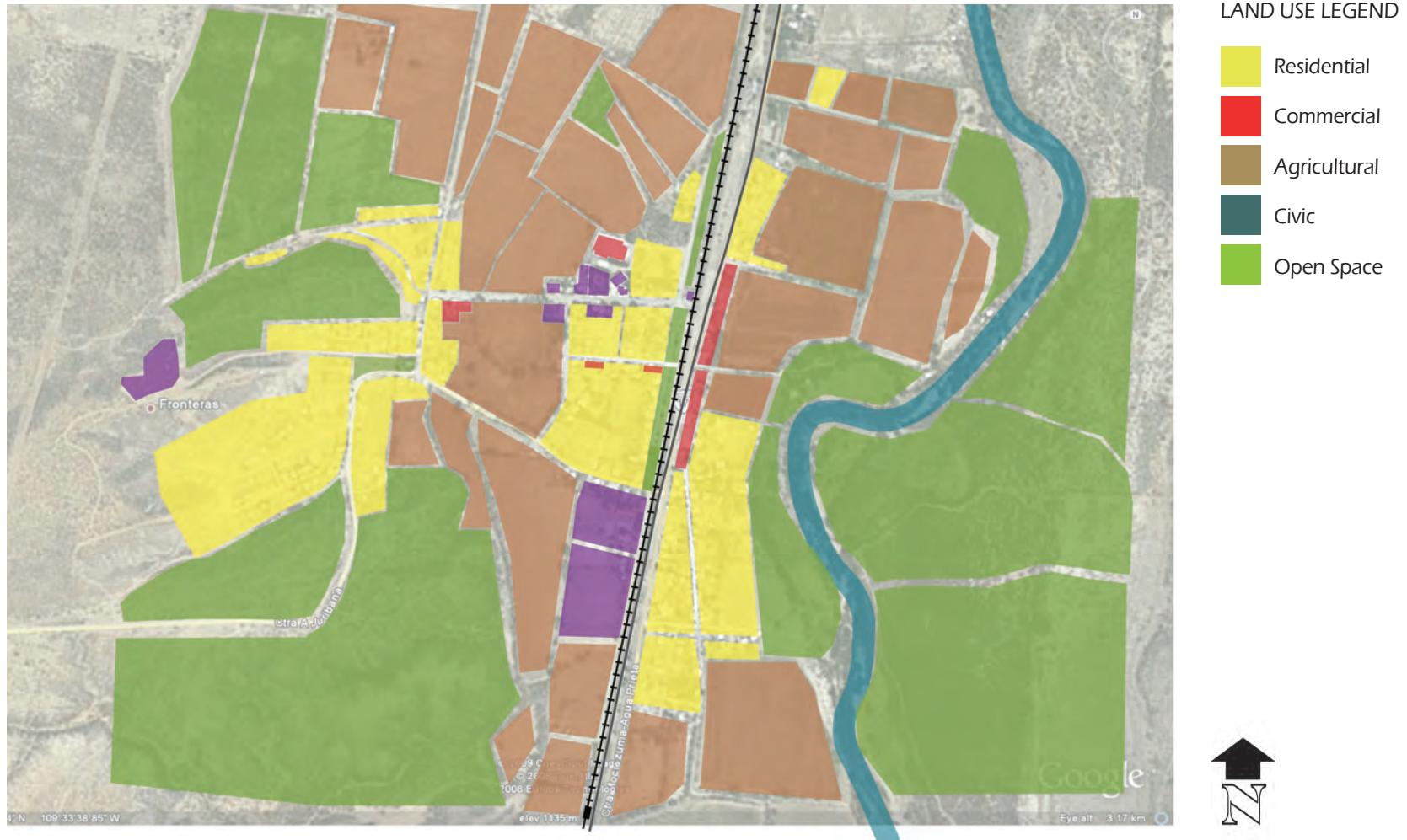
TOP RIGHT: Social trails have developed along some of the more scenic acequias.



BOTTOM RIGHT: Wells (blue circles) draw groundwater into above-ground acequias (blue lines) that irrigate pasture land and row crops.

BOTTOM LEFT: Existing sewer system (brown lines) collects wastewater from feeder lines through town to a main line on the west side of the road, which crosses the highway at a prominent box culvert to on its way to the sewage lagoon (green circle).





LAND USE

Several opportunities for redevelopment and infill development exist within Fronteras. An inventory of land use and ownership helps to determine which parcels may be available for use in the generation of design concepts. Parcels that are vacant, publicly owned, abandoned or for sale offer the most potential. These properties tend to be more easily acquired and readily accessible. However, select

private parcels have also been included in this analysis. The acquisition of key private parcels can help to bring a strong master plan into reality.

Land use in the town of Fronteras is made up of residential, agricultural, open space, commercial and civic areas.

Our clients provided us with information regarding

Two vacant, agricultural parcels located to the west of the plaza on the main street, are designated as communally-owned lands, or 'ejido' lands.

These centrally-located parcels have great potential for future growth and development.

These images show views across one of the parcels, looking to the north and south.



certain parcels in the area around downtown Fronteras. We also used aerial photographs to help determine land use on the periphery of the town. It should be pointed out that this information may not reflect current uses.

This diagram shows that residential areas are concentrated around the highway and railroad, with some newer development toward the southwest. Agricultural fields surround, and weave through, the residential areas, illustrating the current agrarian nature of the town. Areas of open space are found as one travels further east and west, where the topography changes and elevation increases.

The spots of commercial activity are part of the residential fabric of Fronteras, and consist of small shops and home businesses along the main roads. Civic spaces include the plaza, municipal buildings, schools, and ball fields.

Design Implications:

- **Land that is currently vacant, or not being used, may hold the most promise for acquisition**

Land Ownership

Fronteras is surrounded by agricultural fields, some of which are privately held, and others are designated as *ejido* lands.

The *ejido*, or communally farmed plot, emerged as the uniquely Mexican form of redistributing large landholdings. Under this arrangement, a group of villagers could petition the government to seize private properties that exceeded certain specified sizes, and then the government expropriated the property and created an *ejido*. The state retained title to the land but granted the villagers, now known as ejidatarios, the right to farm the land, either in a collective manner or through the designation of individual parcelas. Ejidatarios' rights were limited – they could not sell or mortgage their land but could pass their usufruct rights to their heirs. Ejidatarios had to work their land regularly in order to maintain rights over it.

In 1992 the government radically changed the ejido land tenure system. Under the new law, an ejido can award its members individual titles to the land.



LEFT: A daycare center which is operated out of a resident's home, this home business shows one type of mixed-use activity found within the town.

CENTER, RIGHT & BELOW: A telecommunications center, a dress shop, and an "ad-hoc" gas station are all located along one residential street – an example of how commercial activity fits seamlessly into the framework of the neighborhood.

Ejidatarios can, in turn, choose to rent, sell, or mortgage their properties. Ejidatarios do not need to work their lands to maintain ownership over them. They also may enter into partnerships with private entrepreneurs. The law also effectively ends the redistribution of land through government decree.

Design Implications

- Two parcels central to our master plan design are currently designated as ejido lands. Under the new land reform laws, it may be possible to purchase those parcels from the ejidatarios
- In order to acquire these parcels, negotiations will be necessary. Where purchase of ejido lands is not possible, land swaps are recommended for use in negotiations

Zoning

Zoning laws dictate what types of land uses are allowed in different parts of the city. They are meant to help maintain compatibility within and between zones with different needs and uses, such as

residential, agricultural, commercial and industrial.

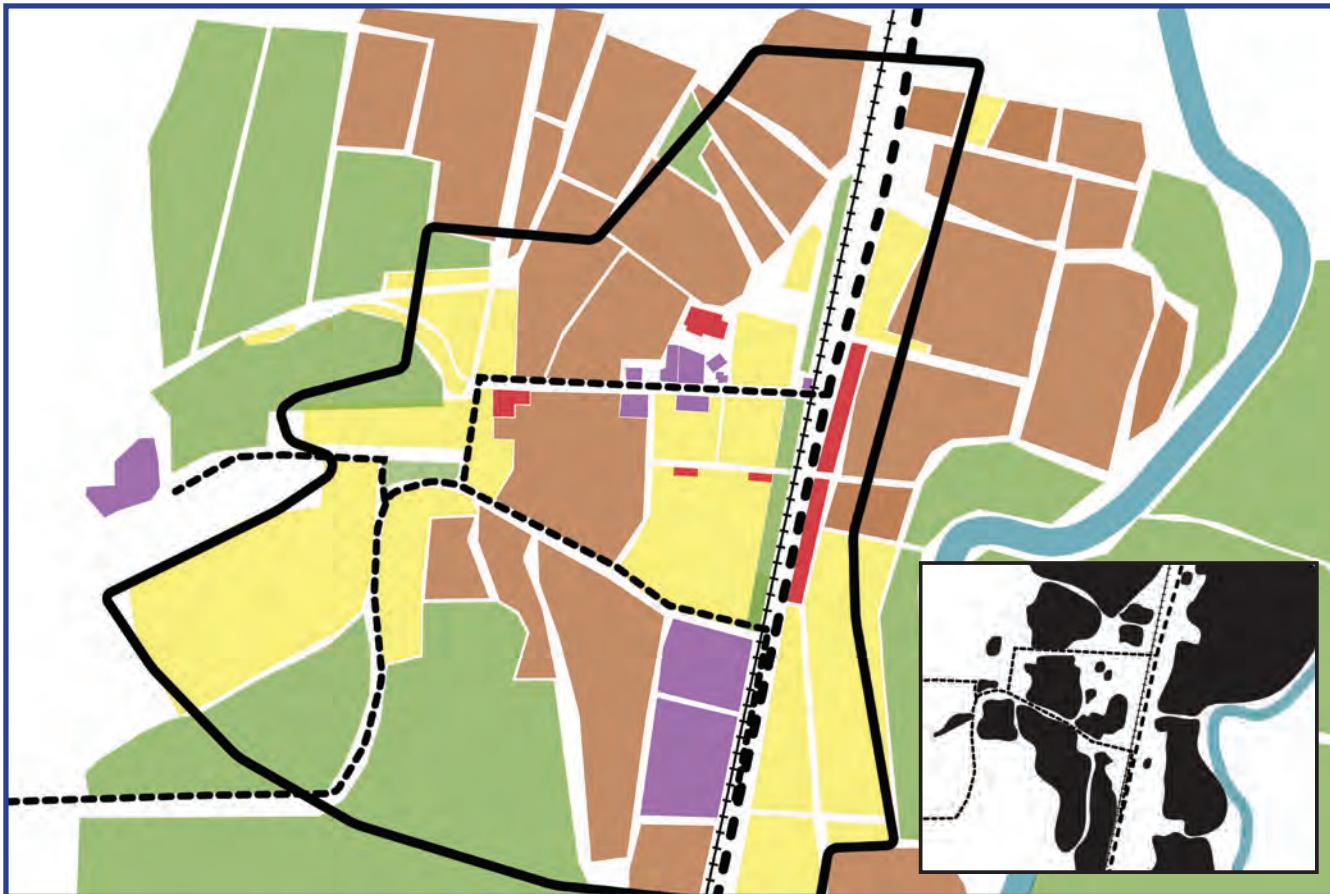
In Fronteras, while there exists concentrations of residential and agricultural use, there aren't any official zoning regulations, to our knowledge.

Our analysis of current land use in Fronteras, combined with the knowledge of general zoning laws, helps us understand how our designs can be placed appropriately and fit into the existing mosaic in this agricultural town.

Design Implications

- Design with the intention of maintaining consistency within the existing city fabric
- Where possible, proposed land uses should be compatible with existing land uses





LEFT: Existing land use with conceptual town envelope outline, indicating urban growth limit. To the west, growth is limited by the topography of the presidio bluff. To the east of the highway, growth has been limited in an effort to protect the aesthetic quality and ecological health of the riparian area. To the south and southwest the growth boundary allows for higher levels of development as road infrastructure is already in place and could easily be connected to the highway. It should be noted that even within the growth limit, every effort should be made to provide small pockets of open space for the use and enjoyment of the community.

INSET: Fronteras open space, shown in black.

LAND USE LEGEND	
	Residential
	Commercial
	Agricultural
	Civic
	Open Space



OPEN SPACE

As towns and cities grow it is vital to assess available open space to meet the needs of the community and limit growth in certain areas. A need has been recognized to preserve certain open space lands because of their importance in producing public goods and services such as food, fiber, recreation and natural hazard mitigation, or because they possess important geological or biological features.

In the diagram above, open space is shown in black to illustrate how much potential there is for growth and development in the heart of the town. By

utilizing this open space and infilling any necessary development, the majority of the townspeople can remain within a one mile radius making all amenities of the town within walking distance. Also, with so much open space further afield there are many opportunities for land swaps where those who own land in the town could trade for more land in a different location. With a uniform goal in mind, the people of Fronteras have the potential to shape their town and start afresh to create a sense of place which is unique to all of Sonora.

An urban growth boundary, or UGB, is a regional boundary, set in an attempt to control urban sprawl by allowing the area inside the boundary for higher density urban development and the area outside for lower density development. In a rural context this boundary is typically referred to as a town envelope or curtilage.



VEGETATION AND WILDLIFE

The town of Fronteras lies within and between distinct and important biotic communities: to the east, Rio Nacozari flowing north toward the border with Arizona and to both the west and the east, is the Sierra Madre Occidental mountain range, the Sierra Espuelas (spurs) form the town boundaries.

Fronteras, the town lies within a semi-desert grassland and Chihuahuan desert scrub community moving toward an oak woodland / chaparral community as elevations rise in the foothills. In contrast to the surrounding biotic communities, the development

within Fronteras and the planting of exotic and ornamental species has changed the vegetative nature of the town.

Riparian Corridor

The sinuous wash corridor is an ecologically sensitive and aesthetically beautiful feature to the east of town. The wash flows primarily during the June monsoon rains and remains relatively dry the remainder of the year. It is characterized by lush vegetation primarily in the form of broad leaf deciduous trees, in

LEFT: Looking east over the main street from the plateau housing the remnants of the old presidio one can see the lush vegetative quality of the town and the leafy cottonwoods of the riparian corridor at the base of the mountains.

RIGHT: The soft texture of the Goodings willow compliments the shores of the watercourse.

LEFT: This image taken along the Arizona portion of the San Pedro River shows the distinct vegetative contrast between riparian corridors and the arid surroundings.

RIGHT: Cottonwood trees are so named for the 'cotton' - like quality of the seeds.

Development along washes is often popular for the beautiful views but such development can have a decidedly detrimental effect on many of the plant and animal species that call riparian zones home, thus ruining the views and amenities that brought development in the first place.

Pollution and over use of water can change water quality and greatly reduced its levels.

LEFT: The black-tailed jackrabbit may be spotted in the lowlands surrounding the wash.

RIGHT: Though rare, the yellow-billed cuckoo might be glimpsed along the shores of the watercourse.



LEFT: The western barking frog is an animal that might be found around the riparian corridor.

RIGHT: The vermillion flycatcher is a showy bird that may be seen around the Fronteras wash in the Spring, Summer and Fall seasons.



Natural amenities with healthy vegetation and abundant animal species, like the east side riparian corridor, can be a major draw for tourists interested in viewing wildlife.

particular the majestic cottonwood (*Populus fremontii*). The presence of the cottonwoods underscores the significance of the watercourse for the area and its

importance as a wildlife habitat. The wash functions as a corridor for the movement and migration of a multitude of animal and insect species.



Sierra Madre Occidental Foothills

The hills to the east and west of Fronteras move from a semi-desert grassland to an oak/chaparral



plant community. Eventually, the elevation rises to reach the Sierra Madre woodlands, which is a hotspot for biodiversity with approximately 5,300 species of

LEFT: Shrubby mesquites cling to the mesa slopes around the town.

RIGHT: Fiery ocotillo grows in patches along the foothills.

LEFT: Shrubby manzanita can be seen dotting the hillsides of Fronteras.

RIGHT: Shrub live oak grows well in the foothills of the town.

LEFT: The sensitive ocelot can be found in relatively healthy numbers in the mountainous areas surrounding Fronteras.

RIGHT: Gambel's quail are a common sight in desert scrub communities.



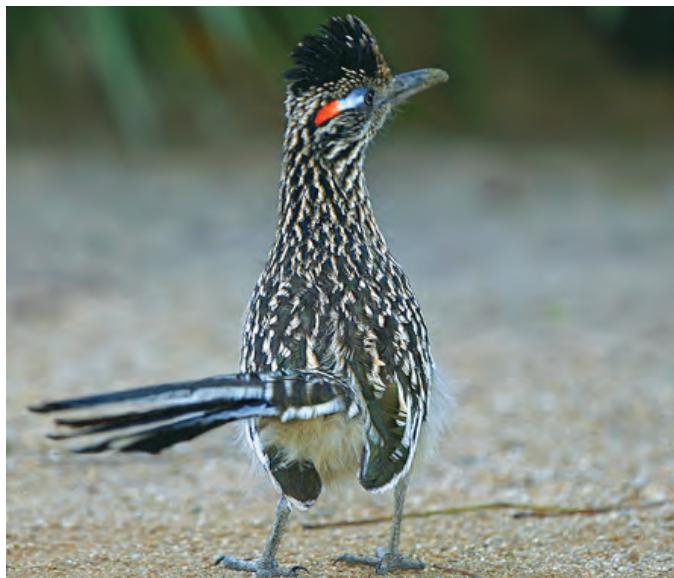
LEFT: The wide-range of the regal golden eagle extends into Fronteras' surroundings.

RIGHT: The violet-crowned hummingbird might be found in the Sierra Madres around Fronteras.



flowering plants. Indeed, a quarter of all Mexican flora, can be found in these mountainous regions of Mexico. The plant diversity of the woodlands

provides habitat for an equally rich and diverse wildlife community.



Grassland / Chihuahuan Desert Scrub

The town of Fronteras lies primarily within the semi-desert grassland and Chihuahuan desert scrub biotic

LEFT: Plant species such as creosote bush (*Larrea tridentata*), and whitethorn acacia (*Acacia constricta*) are common in Chihuahuan desertscrub zones.

RIGHT: The land surrounding Juribana Lake is characteristic of desertscrub with small shrubs and plants such as prickly pear (*Opuntia engelmannii*).

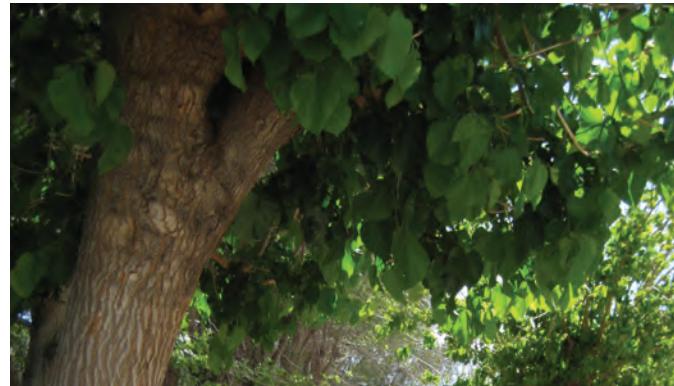
LEFT: Birds such as the infamous road runner find the Chihuahuan desertscrub community very hospitable.

RIGHT: Fronteras lies at the outskirts of the Monarch butterfly fall migration route. These beautiful butterflies may well be seen in the fall months.

communities. These are characterized by long-lived, low shrubs and grasses. Many bird, mammal, insect and reptile species can be found in this area.

LEFT: Mulberry tree, part of an allee along the front of Retroworks factory.

RIGHT: Elderberry trees bloom delicately throughout the town.



LEFT: Roses of all colors are cultivated in many yards and public spaces of Fronteras.

RIGHT: Cherry blossoms are in bloom in early April and are present in many home gardens.



Fronteras Plant Life

Many of the species grown in town have great aesthetic qualities and can produce food, such as, mulberries and pomegranates.

Though the town of Fronteras lies primarily within the Chihuahuan Desert scrub and straddles the Sierra Madrean Woodlands and San Pedro River Basin, the plants cultivated within the community are primarily exotic. Green leafy and flowering plants seem to be favored, most notable are several varieties of eucalyptus and roses. Mulberry, ash and tree privet are also prevalent.

These preferences stand in sharp contrast to the shrubby mesquite and manzanita scrub lands and grasslands on the outskirts of town.

Design Implications

- Combining the lush vegetation of the town with native species such as mesquite in town public spaces could help enhance wildlife connectivity and reduce water usage while not straying too far from the aesthetics of the town
- Incorporating roses and other flowering species that do well in the town into design elements is appropriate
- Preserving natural open space can help wildlife and ecological health and attract tourism



LEFT: A painted tire alongside the Highway as you enter the town, marking the entrance to Fronteras.



RIGHT: An abandoned railroad car on the side of the Highway which can be utilized as an entry marker.



LEFT: On the train tracks looking north as you enter the town. Because these tracks divide the town, visual access from each side of the town should be carefully designed to decrease the sense of this division.

RIGHT: Open agricultural fields back dropped by mountains to the east. Views such as these should be maintained as they add to the agricultural charm of Fronteras.

VISUAL ANALYSIS

The entry sequence to Fronteras consists of railroad tracks along the west side of Highway 17 and open pasture land on the east side. The sense of arrival when you enter Fronteras does not occur at any specific point; there is no signage, vegetation, or activity that draws your attention. The railroad tracks that run north-south parallel to Highway 17 divide the town into two sectors: the east and the west. The west side of the tracks is where the majority of activity occurs. There is an existing town plaza, auditorium, schools, civic buildings, and street vegetation. The majority of the land within the town is allocated to open pasture land for farmers and ranchers. As you veer off of the main Highway, the feeling of being

on a ranch, surrounded by mountains emerges. The streets are small and narrow with open agricultural fields to either side. They are lined by acequia's and back dropped by beautiful mountains.

The entrance to the town is marked by a historic railroad station that is currently vacant and abandoned. The road that leads you into the center of town is not evident until after you have turned and entered into the town. Once off the highway and into the central part of town, you are surrounded by beautiful vernacular architecture and the town plaza which is a focal point within the town. There are no street signs, and businesses are typically run out of

LEFT: View of an acequia running alongside an agricultural field. Pedestrian paths can be designed to run past acequias as they provide pleasant glimpses and sounds of running water.

RIGHT: Geronimo's cave at the east end of town. Increasing the vegetation on this hill would add visual appeal to this historic marker.



LEFT: Small street off of Highway 17 lined with trees leading you back to the river to the east.

RIGHT: A view of the lake outside of town.



Fronteras is a little town full of charm, immersed in the beautiful Sonoran landscape. It has the amenities to thrive agriculturally and because of its historical significance, it has potential to be a great tourist attraction.

residences, making them hard to identify and making navigating through the town difficult.

The town has a great deal of historic charm, being the birth place of de Anza and home to Geronimo's cave on the east end of town. As you exit the town to the east, and continue past the small village of Cuquiarachi, you find yourself arriving at a beautiful lake sunken into mountains. During a site visit, upon arriving at the lake at sunset, there were two people fishing on the small beach at the north end of the lake, leading us to believe that the lake is healthy and abundant with fish and wildlife.

Design Implications:

- Increase/enhance visual access to existing amenities such as the Sierra Espuelas to the east or the old presidio bluff to the west
- Restore historic remnants such as the old train cars and train depot which can be utilized as visual markers which identify the town
- Incorporate landscaping and signage along the main highway to emphasize the entrance and importance of Fronteras





LITERATURE REVIEW

CONTENTS

- New Urbanism
- Critical Regionalism
- Landscape Ecology
- Small Town Revitalization
- Sustainable Development
- Rural Development
- Responsible Tourism

Design success and relevance is incumbent upon the ability of the landscape architect to stay at the forefront of research and innovation in the profession. For this reason, a thorough review of seminal and emerging theories in design, planning and landscape architecture is completed at the start and throughout the design process.

This chapter documents the literature review process and highlights the elements most pertinent to Fronteras and the development of its revitalization plan. The overall theories and their design implications then become the overarching principles guiding the design process.

The literature reviewed includes economic and ecological development principles as well as theories on town planning and architecture.



LEFT: Civic buildings and public gathering places require important sites and deserve distinctive form to reinforce community identity and the culture of democracy. (Principle of New Urbanism) Jackson Taylor Plaza

RIGHT: Architecture and landscape design should grow from local climate, topography, history, and building practice. (Principle of New Urbanism) Aspen, Colorado.

NEW URBANISM

Background

New Urbanism arose in the early 1980s as an urban design movement. It aims to re-invent the old urbanism before the advent of the automobile, but embraces the automobile as a transportation mode. Its goal is to reform aspects of real estate development, urban planning and zoning codes.

The Congress for the New Urbanism, founded in 1993, is the leading international organization promoting new urbanist design principles.

New urbanists believe their strategies can reduce traffic congestion, increase affordable housing, and rein in urban sprawl. They support context-appropriate architecture, balanced live-and-work spaces, historic preservation, safe streets, green building, and the redevelopment of brownfield land.

Defining New Urbanism

“Giving people many choices for living an urban lifestyle in sustainable, convenient and enjoyable places, while providing the solutions to peak oil, global warming, and climate change.”

Principles with Relevance

New Urbanism is applicable to projects of different scales, ranging from a small village to a metropolis. The following is an extracted list of the principles applicable to Fronteras.

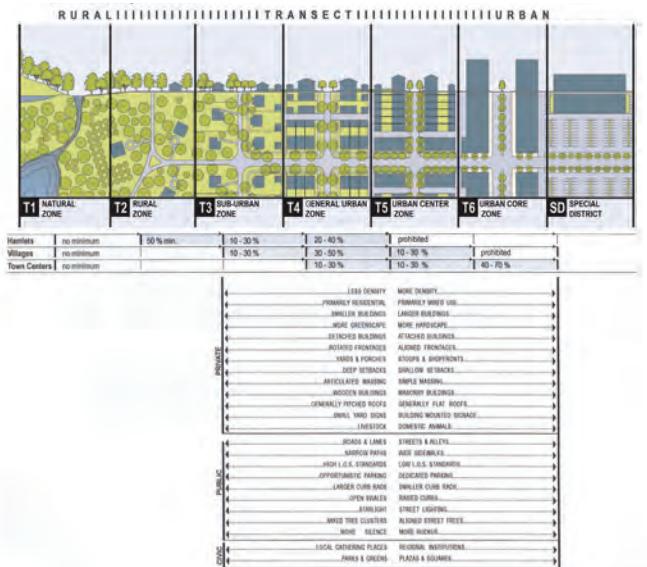
1. Infill development within existing urban areas conserves environmental resources, economic investment, and social fabric, while reclaiming marginal and abandoned areas.
2. Neighborhoods should be compact, pedestrian-friendly, and mixed-use. Corridors are regional

Principles of New Urbanism

1. Walkability
2. Connectivity
3. Mixed-use and Diversity
4. Mixed Housing
5. Quality Architecture and Urban Design
6. Traditional Neighborhood Structure
7. Increase Density
8. Smart Transportation
9. Sustainability
10. Quality of Life

LEFT: The neighborhood, the district, and the corridor are the essential elements of development and redevelopment. They form identifiable areas that encourage citizens to take responsibility for their maintenance and evolution. (Principle of New Urbanism) Transect Planning

RIGHT: Individual architectural projects should be seamlessly linked to their surroundings. This issue transcends style. (Principle of New Urbanism) Village in Dade County



"By focusing development, New Urbanism promotes efficient use of infrastructure and preservation of habitats and farmland. Transportation plays a pivotal role in sustainability and truly efficient transportation (walking, bicycling, and transit use) is only possible where there is compact, urban form."

Congress for the New Urbanism

connectors of neighborhoods and districts; they range from boulevards and rail lines to rivers and parkways.

3. Concentrations of civic, institutional, and commercial activity should be embedded in neighborhoods and districts. Schools should be sized and located to enable children to walk or bicycle.

4. The revitalization of urban places depends on safety and security. The design of streets and buildings should reinforce safe environments, but not at the expense of accessibility and openness.

5. The economic health and harmonious evolution of towns can be improved through graphic urban design codes that serve as predictable guides for change.

6. A range of parks tot-lots and village greens to ball fields and community gardens, should be distributed within neighborhoods. Conservation areas and open

lands should be used to define and connect different neighborhoods and districts.

7. Streets and squares should be safe, comfortable, and interesting to the pedestrian. Properly configured, they encourage walking and enable neighbors to know each other and protect their communities.

8. The development and redevelopment of towns should respect historical patterns, precedents, and boundaries.

9. Many activities of daily living should occur within walking distance, allowing independence to those who do not drive. Interconnected networks of streets should be designed to encourage walking, reduce the number and length of automobile trips, and conserve energy.



LEFT: The use of adobe is an aspect of vernacular architecture that should be preserved and integrated into new design. Adobe architecture with its thermal mass is a true response to the region and the land.

RIGHT: Another vernacular aspect is the planting of roses throughout the town. Although roses are not native to the region, they are taken care of and are a source of community pride. Critical Regionalism theory would agree with preserving this vernacular to help define 'place' for Fronteras.

CRITICAL REGIONALISM

Background

Critical Regionalism is an architectural theory that argues one must look at and understand place, which includes: region, culture, history, natural surroundings and elements of the site and then synthesize this information with technological innovation in order to design effectively and appropriately. This theory was first put forth by Alexander Tzonis and Liane Lefairve and later expanded upon and made more widely recognized by Kenneth Frampton in the essay “Towards Critical Regionalism: Six Points for an Architecture of Resistance.”

In using the term ‘resistance,’ Frampton is arguing against a modernist universalism driven by technological innovation and overvaluation of pure form at the expense of the uniqueness of place. It is an argument for honoring the vernacular of a place without reducing that attempt to honor into mere sentimental representation.

Frampton argues that one should look critically at the forms and technologies of a vernacular architecture or design style and seek to understand the rationality behind them, particularly where those forms respond to the context of the site. He asserts that one should preserve that which is best integrated with its context and environment. At the same time, he contends that one should not be afraid to incorporate emerging technologies where appropriate, as it may improve the design and experience of the architecture.

Relevance

A primary goal of the revitalization plan for Fronteras is the establishment of a ‘Face of Fronteras’ – in essence, finding, defining, and celebrating the community’s sense of place. A ‘Face of Fronteras’ defines how the town meets the world and is an important way to attract visitors to the town to explore, shop and enjoy the many assets Fronteras has to offer. Further, it can be a tool both for

LEFT: Buildings like Tadao Ando's Chi-Chu Museum of Art in Naoshima, Japan follow critical regionalism in terms of their response to site without attempting to merely mimic traditional forms.

RIGHT: The Ramada House by Judith Chafee is a great example of response to site. Its prominent ramada protects the house from the harsh summer sun in the desert and allows winter light to penetrate and warm the house in winter.



attracting investors. And most importantly, it can help to increase community pride and be a catalyst for organization and care for the town.

Another benefit of using Critical Regionalist theory as a lens in looking at the town is that it can help assess key assets and identify improvements that can be made. Critical Regionalism argues against a fear of change – instead it maintains that carefully evaluated change is important and helpful for development and growth. With it we can identify what should be preserved and what might be best to take out and replace with an innovative solution. It is vital to note here that celebrating and honoring the past is important, but not at the expense of improving quality of life issues for its residents. Design solutions that look to the site and culture of Fronteras yet arrive at new forms are just as valid as those which preserve

the vernacular – one evokes the past and celebrates it while the other looks to the future. Both respond to site and place.

DESIGN IMPLICATIONS

- Look to the site, culture, history and region for inspiration in developing design
- Change from traditional forms is appropriate when it incorporates new technology or innovations that are an improvement upon what is already in place and can improve quality of life
- A synthesis of traditional forms and solutions that respond to site with technological innovation can be the best design solution
- Evaluate and design using all five senses – do not rely solely on the visual
- Do not seek universalism – celebrate 'place,' i.e. Fronteras, in every gesture

Six Points for an Architecture of Resistance

Frampton's essay, "Towards Critical Regionalism: Six Points for an Architecture of Resistance," begins with a long quote from Paul Ricoeur, a prominent French philosopher with a focus on phenomenology, which essentially states a problem: that of a loss of traditional culture due to the use of universal technological modernization. He fears that the world is headed toward a single, homogenous civilization. His solution is to look to the past, to the source of cultures and civilizations and use that past to inform decisions about modernization. The six points that Frampton puts forth to argue toward a critical regionalist approach to design follow:

1. 'Culture and Civilization'

Frampton relates Ricoeur's statements to architecture and city design, stating that the building industry restricts development to universal forms. He argues that developments such as mass production or use of new technology such as air conditioning ensures homogenous built forms and the only way to mediate is through the use of facades that simply hide the true forms and serve no real purpose other than dressing. Therefore, even at a city scale, true culture cannot be expressed.

2. 'The Rise and Fall of the Avant-Garde'

He asserts that while the avant-garde has been invaluable in creating change and moving society forward, it can be fleeting and often inappropriate, ignoring the lessons of the past. He argues that lasting, effective design can only be achieved by establishing oneself as an *arrière-garde*. By this, he means that one should follow behind and evaluate the avant-garde before appropriating its ideas and in so doing look to the past and glean from it that which is valuable and has been left behind by the avant-garde.

3. 'Critical Regionalism & World Culture'

Frampton begins to define his use of critical regionalism, and states that the *arrière-garde* position is that of a critical regionalist – falling between a sentimental grasp for the past and a misguided push toward progress for the sake of progress. He writes that an *arrière-garde* designer looks to "resistant, identity-giving culture ... having recourse to universal technique." In essence,



he argues for maintaining identity while making use of technological advancements.

4. 'The Resistance of the Place-Form'

In this point, he argues against the development of the 'Megalopolis' or sprawling city that is not bound by conditions of the site. He says that this 'Megalopolis' is placeless and that one should instead strive to bind urban space to its site, its place-form, and to encourage density for the purposes of political and social development of a city.

5. 'Culture vs. Nature: Topography, Context, Climate, Light and Tectonic Form'

He takes the argument down to a smaller scale saying that designers need to have a thorough understanding of site – that is its forms and topography, its climate and exposure to light as well as the context around it – in order to develop relevant, critically regional design. Here is where the uniqueness of place can stand out against universal modernization.

6. 'The Visual vs. the Tactile'

In Frampton's final argument, he argues that designers must consider more than just the visual when developing design solutions. A designer must think about a user's tactile and other sensory experiences of the space that is being created. This can be from thermal comfort, to the sound of the ground as someone walks through, to the smell of building materials, to the feel of a wall or a banister. All these points help to prop up the argument for consideration of critical regionalism in design.

LEFT: This restaurant along the highway in Fronteras is a good example of how traditional building forms and material are woven in the town fabric. The CMU block structure behind – might be considered a technological advance, yet it isn't in keeping with the vernacular, or surrounding building scale.

If designed and constructed in a way to better reflect existing forms, this combination of buildings might be considered an example of critical regionalism, which argues that there is a way to maintain identity while introducing new technology.



LEFT: Juribana Lake is a wonderful amenity for the town of Fronteras and plays host to considerable wildlife. Increasing vegetative richness and structural diversity around some areas of the lake can enhance its wildlife habitat potential and further increase its natural beauty.

RIGHT: This aerial of the town of Fronteras shows that the town is highly vegetated already. Increasing the diversity of plants and including more native species can further improve the ecological health and wildlife connectivity of the town.

LANDSCAPE ECOLOGY

Landscape ecology is the study of the land, its processes and components. It is studied in order to better understand and predict the structure, function, changes and health of a landscape. Understanding the fundamentals of landscape ecology is very important when planning for the future development of a community.

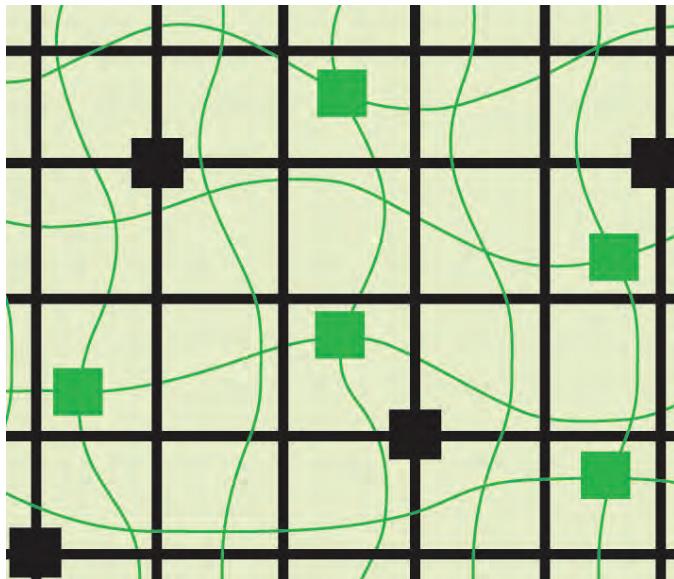
Relevance

The ecology of Fronteras has been greatly effected by the ranching and agricultural practices that have been the basis of the economy and the aesthetic of the town. Within the town and immediate vicinity there is some lack of plant and animal species richness or diversity. Even as far out as Juribana lake near the town of Cuquiarachi the plant communities are generally comprised of only a few plant species and there is little variety noted in the bird population.

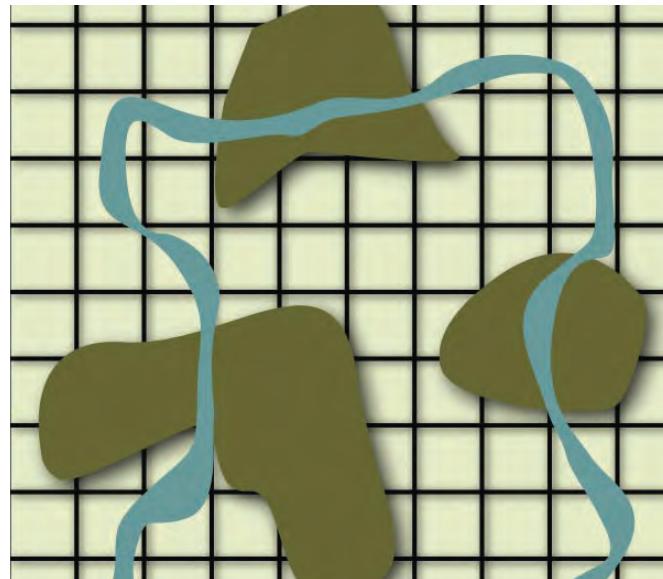
The surrounding region, however, boasts a landscape particularly rich in terms of wildlife and plant communities. The ecological health of the land within the town of Fronteras can be improved by enhancing its connections to the already ecologically healthy mountain and grasslands that surround the town.

Having a healthy mosaic of preserved open space within the town begins to address the close relationship between the town's economy and the environment. Once these landscapes are protected, connecting them becomes a priority through the establishment of open space corridors. The preservation and connection of these spaces creates opportunities to support more plant and animal diversity, which benefits the entire community.

For this reason, the design process begins with



LEFT: Urban and environmental systems should be integrated with care to avoid conflict.



RIGHT: A diagram showing a matrix, some patches and a corridor. A matrix is the most extensive and most connected landscape element type present, which plays the dominant role in landscape function. It is also the landscape element surrounding a patch. A patch is a nonlinear area of land that differs in appearance from its surroundings. A corridor is a narrow strip of land that differs from the matrix on either side.

identifying open space to be preserved. These spaces can be in the form of protected wild areas, parks, plazas and pedestrian ways. In laying out the open space, sensitive areas and important features are taken into account. Then, paying attention to topography, hydrology, vegetation, views and climatic data. A more detailed design is developed incorporating building layouts, streets and other design features.

A few of the most important concepts in the study of Landscape Ecology are explored here including systems, matrices, patches, corridors, and edge effect.

Systems

There are two major systems at work within Fronteras, the urban system and the environmental system. The urban system includes the town infrastructure (roads, buildings, utilities, etc.) and the environmental system includes all of the natural

patches and corridors within and around the town, including open land such as agricultural fields (particularly ones that are not being cultivated), riparian areas such as the river to the east of town, and the mountainous zones. The connectivity between these systems is of importance when devising plans for development.

Matrix, Patch and Corridor

Fronteras is surrounded by a Sonoran Desert Matrix. There are patches of disturbed areas within the matrix, as well as riparian and drainage corridors. The revitalization plan will include the specification of patches to be created in the form of parks and natural open space areas. Connecting the patches that are within Fronteras to each other and the natural open space of the surrounding land helps to reduce species isolation and creates a healthier system for the



LEFT: A gradual edge effect is more desirable than an abrupt edge. An edge effect is defined as the species composition or abundance in the boundary of a patch or corridor relative to the species.

Healthy edges between elements consider the following:

- A gradual edge allows for greater plant and animal diversity.
- Creating a healthy edge benefits many bird species as well as deer, and many other mammals.
- All landscape types should present and attract as many species as it can support.

benefit of animals and people. Currently, narrow and unpaved roads act as corridors for people as well as animals. When the roads are widened and paved, they will remain corridors, but may also act as barriers for certain animals. The main barrier of this type is the highway running north south and bisecting the town. For these elements to work together as a whole, connectivity must be optimized through wildlife pass-throughs and increased vegetative edges.

Edge Effect

Creating and maintaining a healthy interface between two different landscapes, such as a riparian/desert interface (like Juribana lake) benefits the site's ecology as well as residents and visitors who appreciate the diversity of species and eco-tourism activities associated with these landscapes.

DESIGN IMPLICATIONS

- Increased connectivity throughout the town of Fronteras and with the surrounding lands can be obtained through development of open space within the town, creating pedestrian corridors that can serve as wildlife pass-throughs and increasing vegetative edges between elements (such as linear parks and streetscape elements)
- Increased edge plantings around elements of value for tourism opportunities can greatly increase wildlife and plants species richness and diversity



LEFT: Regular public meetings help establish and maintain public support. Meetings should be well-organized and focused while allowing for plenty of community input.

RIGHT: Architecture and landscape designs serve as the face of a small town. There should be cohesion in the building facades and plantings which also emphasize the local character.

SMALL TOWN REVITALIZATION

Small town revitalization is a way to strengthen the social, physical and economic value of a community. The main goal is to improve the livability and quality of life in a community by expanding and attracting employment, shopping and social activities. (Adapted from *A Manual for Small Downtowns*)

Relevance

Many small towns and rural communities like Fronteras are losing people, jobs, and quality of life due to economic instability. Small towns must be able to maintain economic quality to be self-sustaining, having a revitalization strategy can help reach that goal.

Principles with Relevance

The following principles have been identified by several authors and organizations which have developed comprehensive revitalization programs.

1. Organization – May begin with the formation

of just one group which acts as a catalyst for the revitalization (ie: mayor, interested private citizen or business person) who helps identify problems and gather facts and information to convince others to see the problem as well. The group may be in the form of a merchant's association or advisory commission to influence elected officials, business people and citizens.

2. **Grass roots effort** – Since many projects are financed by local people much of the public relations and organization efforts should focus attention on building local support. Well-advertised public meetings describe the group's intentions and solicit support.

3. **Planning** – A successful plan should be realistic but exciting. Developing a vision, identifying strategies and developing a plan of action are key. Recruit active community participants to help volunteer, provide input and provide potential sources

Signs of a Town in Need of Revitalizing (Cook and Bentley, 1986)

- Deteriorating buildings and facilities
- Poor business conditions
- Visual blight
- Apathetic attitudes
- Absence of aggressive business practices

LEFT: Advertising is key in both the initial community involvement phase and the revitalization project as a whole. Local media and signage should be utilized to bring attention and raise excitement regarding various projects and to seek local support.

RIGHT: Part of the economic restructuring of a small town is diversifying the economy but so is creating a niche market, such as the export of local signature tamales to the U.S.



Principles of Small Town Revitalization
(Cook and Bentley, 1986 and Ryan, et al. 1999)

1. Organization
2. Grass roots effort
3. Planning
4. Aesthetics
5. Promotion/Advertisement
6. Economic Restructuring
7. Public Policy
8. Traffic, Parking and Public Transit
9. Leadership
10. Tourism
11. Public Relations
12. Architecture
13. Streetscape

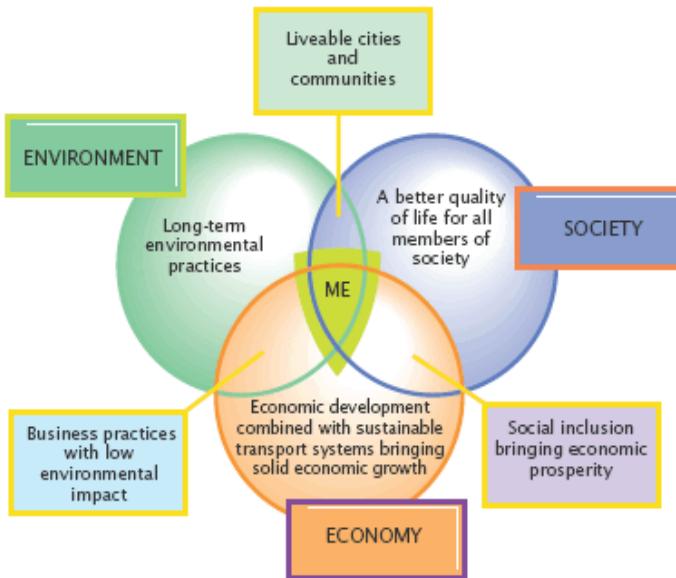
of financial support.

4. **Aesthetics** - The visual quality of buildings, signs, window displays, and public areas are considered crucial elements.
 - *Architecture* – Major environmental component to attract people. Establish overall character. Color guidelines, awnings and signage.
 - *Streetscape* – Paved sidewalks encourages casual walking, window shopping and exploration. Clear, accessible and attractive crosswalks are necessary as are narrowed streets to slow traffic and encourage pedestrian circulation.
 - *Plantings* – street shade enhance outdoor areas. Street furniture and utilities should blend in architecture.

5. **Promotion** – Advertise the revitalization effort via TV, radio, brochures and fliers. Advertising helps to make others aware of a town which offers unique goods and services. Promotion is also vital at the grass roots phase to seek support.

6. **Economic restructure** - Establish a diverse economy which targets external dollars to stimulate the local economy. Also, fill gaps such as recruiting new stores, encouraging mixed use infill and improving management skills through seminars and workshops. Keep money local by having four essential items: *adequate housing, availability of necessary goods and services, recreation and industry that brings in outside capital.*

7. **Traffic, Parking and Public Transit** – Alter and improve circulation by rerouting through traffic and adding parking behind buildings.



LEFT: Due to housing shortage and significant greenhouse gas emissions in Mexico there has been much pressure on the government to provide more sustainable housing options. Mexican developer, Geo, provides eco-options like solar panels and passive solar heaters in their homes.

RIGHT: Diagram of the principles of sustainable development shows the interconnectedness and relationships between the environment, society and the economy

SUSTAINABLE DEVELOPMENT

Background

Sustainability has become one of the most diversified concepts in shaping our future. Sustainability applies to almost all professions, whether it is executed through design, marketing, landscaping, or any other profession that impacts that ecological health of the earth. Economic, ecological, and community development need to be demanded simultaneously for sustainable development to emerge.

For sustainable development to become a reality, it relies not only on organizations that have set guidelines, but also on individual community members. It is a collective decision that requires effort on each individuals part and the willingness to change and sacrifice for a better future.

Relevance

In Fronteras, we hope to aim for a sustainable lifestyle for those that live there, and wish to do so through

the resources they already have at their disposal. Based on the existing population and lifestyles of the people of Fronteras, we believe that sustainable agriculture is a logical and feasible aim to achieving this. Creating facilities that promote sustainability agriculturally and architecturally is an idea that could be successfully implemented in Fronteras. The concept of using resources that allow agriculture to not only to feed families, but to generate income for the town as well, is one of many steps toward sustainability. This concept requires divisions of labor that research not only agriculture and food production, but land and water management, and biodiversity and climate change.

Although achieving true sustainability is hard to measure, several principles can help a community reach toward the goal of sustainability. As described in the book *Toward Sustainable Communities* by Mark Roseland, a sustainable community should:

- **Resemble a living system in which human,**

According to the United Nation's World Commission on Environment and Development report, Our Future "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

LEFT: "La Valenciana," located in the zone of Iztapalapa in Mexico City has 10 solar-powered water systems and 700 square meters of wall area that has been transformed into vertical gardens with specialized rock bases to allow water filtration to the subsoil.

RIGHT: Residents of the Solarizations community in Freiburg, Germany produce more energy than they consume. The excess electricity can be sold off and fed into the regular power grid.

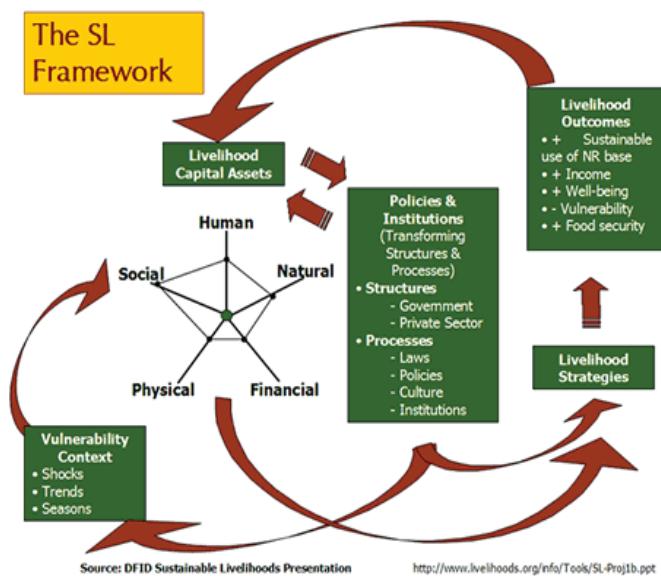


Major Principles of Sustainability

- Elimination of poverty, on a human and environmental level
- Reduction of our consumption of resources and production of waste
- Universal cooperation pertaining to the fundamentals of sustainability
- Refocus and orientation to local community development
- natural, and economic elements are mutually supporting and draw strength from one another
- Increase the community and regional self-reliance to reduce dependency on imports
- Employ a compact urban pattern that promotes carbon neutral forms of transportation (ie: walking and bicycling)
- Move toward bio-regional air, watershed and land management sharing local government responsibilities and boundaries
- Employ alternative energy sources such as solar, wind, geothermal etc. to reduce the use of fossil fuels
- Designs should reduce the amount of natural capital consumed by applying proper solar and wind orientation, using energy saving building materials, living within

ecological limits, creating effective resource management, and minimizing consumption

- Create a driver economic base and encourage local merchants to circulate capital within the community
- Involve a rich civic life and shared information among community members
- Ensure a vibrant democracy with well-informed citizens
- Foster human capital through education, skill training, and experience
- Ensure people have basic needs met such as safety, food, shelter, education, income, and employment
- Preserving cultural capital such as traditions and values, heritage and place, arts, diversity, and social history



LEFT: Christian Extension Service missionary engages in roadside commerce in Kabala, Sierra Leone.

RIGHT: The Sustainable Rural Livelihoods Framework of the Chronic Poverty Research Center.

RURAL DEVELOPMENT

Relevance

In our efforts to revitalize the rural town of Fronteras, we must strive to reduce the biases of our professional process, and create places for research and development of *intermediate technologies* to reduce community risk in a dignified manner.

“Putting the Last First”

In the treatise “Rural Development: Putting the Last First,” Robert Chambers explains that “reversals” are needed to increase opportunities for a “decent and secure livelihood” for those trapped in poverty. The key to this, he explains is analyzing the relationship between the two major actors in this relationship: the rural poor and the outsider. “The initiative, in enabling them [poorer rural people] better to help themselves, lies with outsiders who have more power

and resources and most of whom are neither rural nor poor.”

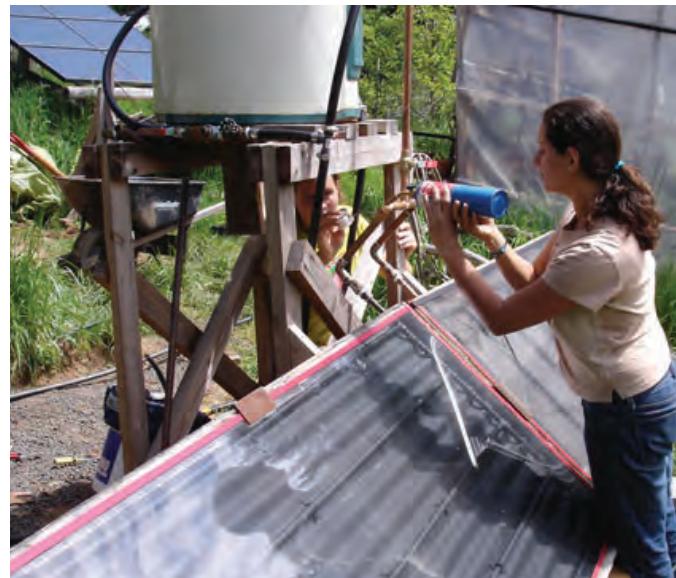
He goes on to recognize that outsiders commonly have six classes of biases as a result of the limited *spatial* realm in which they interact, the constraints of the *project* on which they are working, the concentration on *persons* of influence or wealth, a tendency to visit in dry *seasons* of plenty, *diplomatic* taboos, and the *professional* concerns of a particular specialty.

One solution he suggests to overcoming these biases is to focus research and development moneys on the “researchable physical and social aspects of rural life.”

Rather than “direct attention towards whatever is urban, industrial, ‘high’ technology, capital-intensive, appropriate for temperate climates, and marketed

LEFT: Participants at the Aprovecho non-profit research and education center construct a solar hot-water heater.

RIGHT: Rural agro-processing in Ghana through UNIDO Rural Enterprise Development Support Project.



and exported;” professional training in this realm should instead focus upon “what is rural, agricultural, ‘low’-tech, labour-intensive, appropriate for tropical climates, retained by the household and locally consumed.”

“Small is Beautiful”

In his book, “Small is Beautiful: Economics as if People Mattered”, English economist E.F. Schumacher calls for a decentralized economy of “smallness within bigness” as a more suitable paradigm for developing areas. Fundamental to this paradigm shift is a re-ordering of workplace priorities: placing “dignified and meaningful” character over efficiency, and including respect for the finite supply of natural resources. Put simply “the aim ought to be to obtain the maximum amount of well being with the minimum amount of consumption.”

In later works, Schumacher went on to describe that in order to create these ideal workplaces, developing communities must incorporate *intermediate technologies*, or tools and technology that are more expensive to invest in than current technology of a community, but an order of magnitude less expensive than high-tech solutions, can be built and serviced locally, and will provide long-term efficiency.

John C. Turner, architect, in “Housing By People,” goes on to describe this ideal as *appropriate technology*, or that which benefits the community and does not make it dependent on other systems over which they have no control.



LEFT: Fronteras and its surrounding community have many natural, historic and cultural features that could be potential tourist draws.

RIGHT: Crowds of tourists can overwhelm a community and decrease the quality of life for residents.

RESPONSIBLE TOURISM

Tourism

Tourism is the world's largest industry and is an economic lifeline for many countries. As such, there are many approaches, philosophies and subcategories within the industry. Yet, there are some universal features within the vast and diverse field of tourism. According to Edward Inskeep, tourist destinations generally include:

- Tourist attractions and activities
- Overnight accommodations
- Support facilities and services (guides, restaurants, retail, banks, medical, etc.)
- Transportation
- Infrastructure (water, electric, sewage, communications, etc.)
- Institutional (education, marketing, management, etc.)

These universal development needs help provide a

framework when composing a tourism development scheme.

Relevance

Tourism can be a powerful economic driver for a town like Fronteras. Understanding and evaluating how tourism can and should affect the town of Fronteras and the lives of its residents is critical in developing marketing and planning strategies. The following is a summation and critique of some general categories of tourism.

Mass Tourism

Mass tourism involves large amounts of people traveling to a particular destination within a short period of time. This type of tourism is typically viewed as economically valuable by many countries and investors. However, this type of tourism is ultimately unsustainable. Mass tourism can have the effect of isolating communities, diluting cultures, negatively impacting natural areas, and destroying

LEFT: All-inclusive resorts can cut visitors off from the true culture and nature of a place.

RIGHT: Sustainable tourism seeks better interaction between tourists and residents, as well as environmentally sustainable activities.



the very amenity that draws visitors to an area. Mass tourism can include ‘sun and sand tourism,’ cruises, sightseeing, and some all inclusive resorts.

All-Inclusive Resorts

All-inclusive resorts are typically upscale and offer all amenities and activities within the resort grounds or throughout the resort. Many all-inclusive packages include accommodation, meals, activities, and facilities on site. These resorts have appeal because they allow people to avoid some of the hassles often encountered when traveling. On the other hand, these resorts can create an isolated experience, devoid of local culture and context. These resorts also tend to funnel money generated to corporate headquarters, often located in another country, thereby keeping money out of local hands.

Sustainable Tourism

Sustainable tourism aims to reduce the negative impacts created by standard tourism while improving

economic stability, sociocultural sensitivity, and environmental sustainability. It seeks to respond to the needs of the present while ensuring that future generations will continue to have the same opportunities. Sustainable tourism is practiced in both urban, rural, and wilderness areas and includes the subcategories of eco-tourism and geotourism. The beauty, grace and vibrant culture of Fronteras and its surrounding natural amenities make it a very viable tourist destination. Developing sustainable tourism strategies for Fronteras is imperative in order to bring about a positive economic impact without the negative social and environmental effects that can accompany mass tourism and other less balanced tourism approaches.

Eco-tourism

Eco-tourism is defined by the International Tourism Society (TIES) as “responsible travel to natural areas that conserves the environment and improves



LEFT: Eco-tourism emphasizes interaction with nature or remote areas in responsible ways.

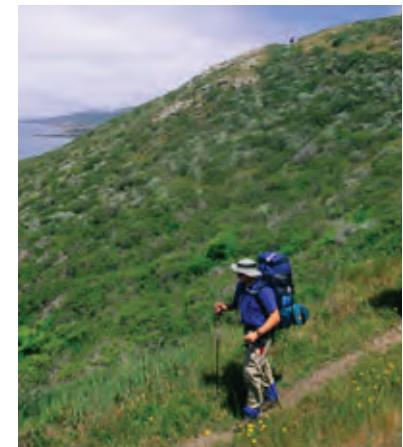
RIGHT: Geotourism follows many of the same principles as eco-tourism but is more all-encompassing in terms of cultural and economic sustainability.

the welfare of local people.” According to TIES, “experiential” tourism, which includes eco-tourism, nature, heritage, cultural, and soft adventure tourism, as well as some sectors of rural and community tourism, are expected to grow quickly over the next two decades. Eco-tourism is similar to sustainable tourism, but focuses primarily on remote or wilderness areas.

Geotourism

Geotourism was developed by National Geographic Travel editor Jonathan Tourtellot in 1997. It resembles eco-tourism but incorporates more economically, culturally and ecologically sustainable principles. The tenants of geotourism are:

- Keeping integrity of place
- Adhering to international codes from the World Tourism Organization and other tourism organizations
- Encouraging growth in market segments most likely to respect local cultures
- Encouraging market diversity
- Ensuring tourist satisfaction
- Basing tourism on community resources and encouraging business partnerships between local businesses and civic groups
- Helping businesses to build upon the area’s nature, history, culture, cuisine, artisanry, performance art, etc.
- Encouraging micro- to medium-sized enterprises and business strategies that benefit the community with poverty alleviation and stewardship policies
- Protecting and enhancing the appeal of the destination by keeping tourists volumes to the carrying capacity of the land
- Anticipating development pressures and when possible, containing resort and home sprawl, especially on coasts and islands to ensure continued resident access to the waterfront or other natural or cultural amenity
- Encouraging businesses to conserve resources
- Continuously planning and adjusting to changes



Hiking and mountain biking might be activities that tourists could enjoy in Fronteras.

LEFT: Talkeetna, Alaska is a small village that has adopted a tourism planning project to better integrate tourists into to the town and keep the local population from feeling overrun.

RIGHT: The proximity of Talkeetna to Denali National Park is a major draw for tourists.



Responsible tourism should celebrate the culture of a place without commodifying it or replacing it.

- Engaging visitors and hosts in learning about the destination
- Consistently re-evaluating the current situation and plan

A Cautionary Tale

Tourism can be very lucrative and often plays a primary role in a community's development. However, local inhabitants and local economies often do not truly benefit from its presence. This happens when money is channeled back to corporate headquarters, a natural, cultural or historic amenity is destroyed or when a way of life is so deeply altered that the quality of life of the residents is diminished.

Talkeetna, Alaska can be a cautionary tale for Fronteras. Talkeetna residents found that their close proximity to Denali National Park as well as the spectacular views of the Alaska Range and the rustic character of their village caused a threefold rise in annual visitation from 30,000 to 120,000 people.

The problems that this influx of tourists caused became overwhelming to the several hundred local inhabitants. People not only felt unhappy about the congestion, parking problems and poor commercial development, but felt that they were losing what they loved best about their town, like a "...sense of contact with history and their neighbors and the natural world." The town ultimately created an ambitious tourism planning project with the goal of addressing the immediate side effects of rapid tourism growth and finding ways to give residents hope that they can both accommodate growth and hold onto the qualities that make Talkeetna a unique community.

The story of Talkeetna can be a lesson and a cautionary tale for Fronteras. Devising a tourism development strategy before problems arise is infinitely more useful than waiting for them to appear. Once problems become apparent they can already have caused damage that can have lasting detrimental effects on the town, its people and environment.





CASE STUDIES

CONTENTS

- Tourism Strategies
- Town Identity
- Community Organization
- Agricultural Opportunities
- Utility Infrastructure Development

While the literature review process allows access to knowledge of current theories and principles in landscape architecture, planning and design, studying particular cases gives real-life examples of guiding principles in action. The case review process helps designers to evaluate the successes and failures of projects and help to guide design by building upon the merits of other projects and avoiding the pitfalls that have occurred previously.

The case studies were chosen as relevant examples for possible development and design ideas for Fronteras. Many of the case studies deal with economic development strategies for Fronteras, including tourism ideas. Others focus on a specific need for Fronteras such as the development of new waste management strategies. Each case study discusses its relevance to Fronteras and highlights important lessons learned in the form of design implications.

TOURISM STRATEGIES

Tourism has the potential to become a major driver of economic growth in the town of Fronteras. The review of literature relevant to tourism development discussed in the preceding Guiding Principles chapter highlighted implementation strategies that may be best for the health and growth of the town; that is, developing a model that preserves resources and capitalizes on the natural and cultural assets of Fronteras without exploiting them, in essence, means generating responsible, sustainable tourism development strategies. The case studies in this section seek ways in which these strategies can be realized, while identifying pitfalls to be avoided in Fronteras.



LEFT: Guest rooms are surrounded by beautiful orchards, colorful flowers and plants.

RIGHT: Visitors also learn about local cultures and traditions. In Ocotepec, town members gather together to decorate the cemetery.

CULINARY SCHOOLS | MEXICO

Background

Culinary vacations have become very popular with everyone from expert chefs to the average cook. What many of these people have in common is a desire to learn and experience something new, typically in a unique environment. Not only do these culinary vacations benefit the chef leading the class but they benefit the town as a whole. Aside from being an enticing attraction to bring people to the town, they help sustain local town economy as well. The classes in combination with field trips, help disperse visitors throughout the town, bringing business to local markets, shops and historic and cultural attractions.

Relevance

In many cases the culinary vacations are sold as packages. Fronteras could benefit from such an enterprise because it would allow local business

owners to work together to create all-inclusive packages, thereby spreading money throughout the entire town. Trips could be packaged to include visits to the local town museum, farmer's market, agricultural fields, ranches, historic landmarks, and more 'natural' attractions such as lake side fishing, guided mountain hikes, horseback riding and hunting. Classes can also be combined with local ranches, hotels and B&B tourism packages, to create a rich and attractive experience for those visiting Fronteras.

La Villa Bonita

La Villa Bonita School of Mexican Cuisine is located in a six bedroom house in the mountain village of Tepoztlán, Mexico, 45 minutes south of Mexico City. Chef Ana García serves as host and instructor during four- or seven-night visits. In addition to learning how to prepare traditional Mexican dishes, students go on excursions to the town market to select ingredients and meet local townspeople. Field trips



ABOVE: During their stay, visitors learn how to select and use fresh vegetables, such as the Chile Poblano, in many dishes.

LEFT: Dona Estella demonstrates a cooking technique to a small group of four, the typical class limit.

RIGHT: The Garden Cottage double room. Classes and bed & breakfast style accommodations occur in the couple's hacienda style home.



also include hikes up the nearby Tepozteco pyramid and visits to local cultural events during Mexican holidays.

Mexican Home Cooking School

The Mexican Home Cooking School is located in the home of Dona Estela and her husband Jon Jarvis in Tlaxcala, Mexico, which is a two hour drive from Mexico City. Hands-on classes are led by Dona Estela in her family's tradition of a combination of Spanish, French and indigenous cuisine. Five day visits also include trips to the public market, or to the home's garden for fresh vegetables and herbs. They also include outings to pre-Hispanic archeological sites, local events and festivals, Mexican folkloric dances and nearby villages.

Design Implications

- Identify an existing site or create a new location for accommodating guests, with adequate facilities for culinary instruction.
- Restore and preserve local cultural, historic and natural elements which can serve as additional attractions or amenities to bring visitors to Fronteras.
- Facilitate dialog between merchants, land owners and residents to help establish potential excursion packages.



LEFT: The Immersion School in Veracruz is located near the Gulf of Mexico and allows for ample tourism opportunities for students.

CENTER: The typical Mexican town thrives with the economic help of tourism like the immersion school.

RIGHT: A businessman rides to work on his horse, which could be a familiar site for tourists in the ranching town of Fronteras.

SPANISH IMMERSION SCHOOL | VERACRUZ, MEXICO

Background

The idea of an immersion school is to throw students with little to no Spanish background into an environment where the only language spoken is Spanish. Through this process students can rapidly excel in their conversational skills.

Veracruz Immersion School offers several specific types of programs which include Business, Subjunctive Intensive and Conversational Spanish. There is also a “Mexican cooking in the Spanish Language” class where students learn the techniques of traditional Mexican cuisine while improving their Spanish skills.

Relevance

An immersion school could provide a significant financial boost to those involved in the school as well as the town in general. Most students spend significant time participating in tourist activities with

the townsfolk such as hiking and horseback riding. This kind of tourism elicits a stronger and more meaningful bond than would be achieved by the stereotypical markets where vendors sell souvenirs.

Fronteras is in a similar position to offer a variety of activities to tourists. By incorporating many types of entertainment an immersion school can play a huge role in providing income for many people in the town. It is also an easy drive for the people of southern Arizona to visit.

A Complete Package

The Veracruz Immersion program uses its wide range of tourist activities to entice people to make the trip. Some of the activities they offer are whitewater rafting, swimming in the ocean, exploring the town and birdwatching.

Some of the interesting activities that Fronteras has to offer are birdwatching, hiking, mountain-biking,

Quick Facts:

Average Length of Stay: 3 weeks

Average Age of Student: 46

Beginner to Intermediate Skill Levels

All Faculty have Bachelor Degrees or Higher

Six Different Spanish Immersion Programs

Pima Community College credits can be acquired upon completion

LEFT: Veracruz Immersion School claims to be the home of many rare birds like the Lafa pictured. The Fronteras region is also home to many illusive migratory birds.

RIGHT: Whitewater rafting is offered by Veracruz School. Fronteras could offer Jeep or horseback rides or guided hikes through the beautiful Sonoran landscape.



Jeeping, hunting, fishing and horseback riding. This means there are numerous chances to solicit goods and services to the students of an immersion school.

Design Implications

- In order to encourage interaction between students and townspeople, the school must be carefully located within Fronteras.
- The success of the school relies on the participation of those townspeople who are offering tourist activities in the town. In this way the parties involved will need to achieve synergy for success.
- The school could house the students or they could also live with local families nearby and have a greater appreciation of the Fronteras culture.



LEFT: Equestrian instructors teach guests how to nurture/handle horses.

CENTER: Carriage rides transport visitors through the beautiful landscape.

RIGHT: Horseback guides interpret the landscape (flora and fauna).

CUADRA SAN FRANCISCO | LOS CABOS, MEXICO

Background

Established in 1994, Cuadra San Francisco is a professional equestrian center with stables based in Los Cabos, Mexico.

Cuadra San Francisco provides an array of equestrian activities for guests of all ages and abilities.

Relevance

Horse culture is richly ingrained in the history of Fronteras and the state of Sonora. The rustic cowboy traditions of previous generations may resonate with romantic adventurers throughout the world.

While various ranches within the municipality offer diverse rural excursions, a well-managed equestrian facility may serve as the hub for ecological tourism throughout the region. This facility may provide an array of on-site services and link guests with activity centers (i.e. ranches, parks, commerce centers, etc.) throughout the territory.

Equestrian Activity

Cuadra San Francisco attracts business through a variety of services. The company promotes daily horseback excursions of various length and intensity. Guests mount horses that are suited to the size and experience of the rider. Young children can learn to ride on one of the stable's many ponies. Lessons are provided in a safe atmosphere before leaving on a rugged trail.

Mexican guides lead visitors through the stimulating Sonoran countryside. These guides accommodate visitors of various abilities and speak English as well as Spanish. Guides interpret the natural, historical, and cultural environments along the trail throughout the experience. Cuadra San Francisco also encourages photography shoots with outgoing visitors. The company has even accommodated fashion photographers and music video directors.

Services include:

DAILY EXCURSIONS

- carriage rides
- private trail rides
- full moon horseback rides
- pony rides for young children
- landscape interpretation
- photo shoots

THE SCHOOL OF EQUITATION

- dressage
- horsemanship

FESTIVITIES

- feria parades
- horse dancing
- weddings

RETAIL

- hand made leather saddles

LEFT: Photo shoots capture memorable moments for enamored guests.

RIGHT: Equestrian center staff dress up for local fairs and parades.

BELOW: Cuadra San Francisco sells hand made leather saddles.



Visitors interested in a more immersing equestrian experience may enroll in The School of Equitation. This school hosts week-long camps that teach dressage and horsemanship.

Cuadra San Francisco also participates in local events and festivals. The company wears traditional charro clothing and performs in parades. Cuadra San Francisco also demonstrates the finesse of horse dancing and often accompanies weddings.

Design Implications

- Fronteras may showcase its unique cultural and historical identity through guided tours of the countryside.
- A central equestrian hub would stimulate spending in the town while also providing a local outlet for interested entrepreneurs throughout the region.
- The equestrian center may benefit from a location on the eastern side of the town of Fronteras. Local trail rides may begin along the wash and lead toward Rancho Los Fresnos. Another trail route could include La Misión de Cuquiarachi and its bordering lake.



Did you know that birding is the number one sport in America?

According to US Fish and Wildlife Service, there are currently 51.3 million birders in the United States alone, and this number continues to grow.

GREAT TEXAS COASTAL BIRDING TRAIL | PORT ARANSAS, TEXAS

Background

Built in 2000, the 700-mile coastal trail brings thousands of visitors and business to the small town of Port Aransas, Texas, population 3,370 [in 2003].

“By all accounts, the trail has been a win-win proposition. It offers outdoor recreation for the growing number of people who enjoy watching wildlife, gives a boost to small towns that have lost jobs and population in the decades since WWII, gives landowners a way to diversify farm and ranch income, and provides an incentive for habitat conservation while building a constituency for conservation. Touted as a model of sustainable tourism, the trail won the prestigious British Airways Tourism for Tomorrow Award in 2001, beating out 115 entries from 47 countries.” (Planning, Dec. 2003)

Relevance

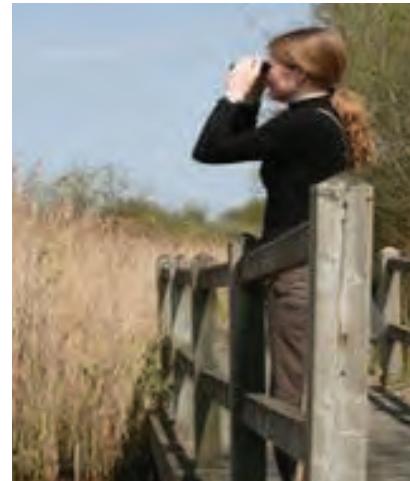
The region around the Sierra Madre Mountains has been described as one of the most biologically diverse areas in the world. There is an opportunity for Fronteras to capitalize on its natural beauty and wildlife by creating infrastructure to support nature and eco-tourism to the region.

Outdoor Recreation

Birdwatching and “birding” is a booming international business that attracts low volume, low impact and high return visitors, boosting economies and supporting jobs in rural areas. Birdwatching is one of the fastest growing recreations in the United States. There are many reasons why this is the case: birders appreciate the enjoyment that comes from being outdoors, the satisfaction of learning about the natural world, and the pleasure of seeing an

LEFT: Platforms and structures provide safe, designated areas for interacting with nature, affording great views and protecting the landscape.

RIGHT: Birdwatching is an appealing pastime for people of all ages.



unexpected flash of color in the trees.

Birdwatchers are generally well-educated and have the time, money and willingness to travel to off-the-beaten-path destinations. Birdwatching also contributes to conservation by focusing on sustainable activities and small groups of people focused on nature and preservation. Birding tourism can also encourage local communities to conserve and protect their natural heritage, and provide alternate employment options to more damaging jobs like logging, mining and the illegal wildlife trade.

Design Implications

- “Bird-viewing” locations could be designated as part of the eco-tourism amenities and nature trail system.
- At key vantage points, elevated structures could be constructed to provide birders and hikers with better viewing opportunities.
- These structures would serve as pull-out spots and way-finding devices along trail.



The terms 'birding' and 'birdwatching' are today used interchangeably, although 'birding' is preferred by many since this includes the auditory component involved in spotting birds.

Birders and 'twitchers', travel long distances to see a rare bird that would be "ticked" off their "life lists".

BIRDING TOUR COMPANIES | ARIZONA & MEXICO

Background

There are many companies that offer birding tours around the world to large and small groups. These tours are led by knowledgeable people in the field, typically natural history and avian experts.

The cost for tours depends on the number of days and location of the trip. On average, tours can cost between \$1,500 and \$3,000 per person. This price usually includes travel, food and lodging.

Relevance

Located just south of the U.S. border in northern Sonora, Fronteras is sited close to many well-known birdwatching "hot spots," such as Patagonia, AZ, the Rio Grande River region in southern Texas and El Cielo Biosphere Reserve in the northeastern state of Tamaulipas.

Fronteras is known to host hundreds of species of migrating birds, and has potential to be included on

the list of places for great birdwatching experiences in North America.

Bird Touring Companies

There are quite a few bird touring companies based in southern Arizona, which organize local, day trips as well as overnight tours to other countries.

WINGS Birding Tours has over thirty years of experience leading bird-focused tours around the world. In 1987, they moved their headquarters from Maine to Tucson. They plan ten trips to different regions in Mexico.

Adventure Birding Company, based in Tucson, offers touring trips around the state, as well as birding tours to Mexico and Texas.

Naturalist Journey, based in Portal, AZ, organizes tours all over the world. In Mexico, they travel to the northeastern region of Tamaulipas.

MexBirds, founded in 2003, offers all-inclusive

CONTACT INFORMATION

WINGS Birding Tours

www.wingsbirds.com
wings@wingsbirds.com
(520) 320-9868

Adventure Birding Company

www.adventurebirding.com
info@adventurebirding.com

Naturalist Journeys

Small Group Birding &
Natural History Tours
Portal, AZ 85632
(520) 558-1146; (866) 900-1146

MexBirds

www.mexbirds.net/
mexbirds@gmail.com
Phone: 011(52)81-8378-5926

Companies like MexBirds hire and train residents to give bird and butterfly tours, introducing jobs into the local economy and increasing conservation awareness.



MexBirds promotes the fact that their tours support the local and regional economy in Mexico.

According to their literature, MexBirds is “a socially and environmentally responsible tour operating company, working to help local inhabitants of Natural Protected Areas in Mexico make a living through bird and butterfly watching tourism.

“Don’t forget that by participating you will contribute to conservation and sustainable development of rural communities or “ejidos” immersed in this wonderful Reserve.”

package trips departing from the Texas Valley to the El Cielo Biosphere Reserve, located in the state of Tamaulipas, Mexico.

Before this area was created as a reserve, logging was the predominant economic activity of the region. In order to develop alternative sources of income for people living in the region, residents were trained as butterfly/bird watching guides, increasing conservation awareness.

They are partnered with many state and local governmental organizations in Mexico and in south Texas, increasing their marketing visibility.

Design Implications

- It would make sense for Fronteras to include birdwatching as part of its outdoor recreation amenities, appealing to global and national tourists
- Fronteras could market itself with companies located near Tucson, attracting people from the United States who are interested in (nearby) foreign travel.
- Fronteras could link up with a Mexican touring company, like MexBirds, perhaps proposing that a satellite staff be based in Fronteras.



Copper Canyon
ADVENTURES

The California Native

People Love Our Copper Canyon Adventures:

“We had a great time on the Copper Canyon trip. It was a wonderful trip. Everything went as scheduled and the plans you made for us were great. We took the van to Banegasito. It was well worth the ride. Very exciting. There is one place I would have wanted to miss. El Fuerte is a particularly nice town. We were invited to a fiesta which was a birthday celebration for some descendants of the Tarahumara Indians there. They were released brought in by bus from all over Mexico. A really fun evening—dancing horses, free beer and food and lots of music. Another highlight was our stay at Divisadero. The food and facilities were wonderful service, outstanding scenery. It was so peaceful that it was hard to leave. Thanks for your good planning efforts.”

Donna and Russ Redick

“I had a wonderful time and I appreciate the thoughtfulness that obviously went into structuring the trip. I have recommended your company to many people and will continue to do so. It was a very good experience; thanks for making my vacation so enjoyable.”

Allison Miner

“One cannot imagine how beautiful and impressive the Copper Canyon is until you see it from the train and listen to the sounds of the Indian people.”

John and Jane Reiter

“The guide was fabulous—the best we have ever had. The close up meeting of people and history is unique. A wealth of information of the entire area shared by the guide was excellent.”

Glenn Storch

“It was a beautiful trip—everything was perfect. Such a country and good new friends. Here is to more of it.”

Carolyne Krebsma

“It was a beautiful trip—everything was perfect. Such a country and good new friends. Here is to more of it.”

Levon Sparks

LEFT: 72 dpi thumbnail images of tourist activity (smaller image = actual size) appeal to the potential visitor while keeping page-loading time at a minimum

RIGHT: Printable pamphlets include testimonials of previous visitors recounting their adventures

ONLINE MARKETING | COPPER CANYON, MEXICO

Background

Barranca del Cobre, otherwise known as Copper Canyon, in Chihuahua state, is an international tourist destination offering access to a spectacular Sierra Madre canyon complex and its associated culture. Train is the most popular method of visitation to this National Park.

Multiple websites connect the potential visitor to tourism opportunities in Copper Canyon. Copper Canyon Tours (<http://www.coppercanyontours.com/index.htm>) is a U.S.-owned tour company that offers multi-day tour packages primarily to U.S. tourists. These tours include arranged lodging, scheduled events, transportation, and interaction with native Tarahumara Indians.

Copper Canyon Insider (coppercanyoninsider.com), provides succinct descriptions of the Canyon's major attractions, and links the website visitor to webpages

or simple contact information of family-owned tour-guide companies, lodges, and restaurants.

A wikipedia entry, as well as personal photos uploaded to Panoramio, are presented as links as one reviews the area using Google Maps.

Relevance

Contents of these websites are printed in English and include package trip itineraries, graphic and verbal emphasis on interaction of cultures, printable online travel brochures, and visitor testimonies.

Transportation by a retrofitted freight-train line, in combination with opportunities for nature-based recreation and cultural exchange, are emphasized in these online marketing tools, selling the visit to Copper Canyon as a multi-faceted rural tourism experience.

Similarly, the municipality of Fronteras offers unspoiled natural amenities, an operational railroad,

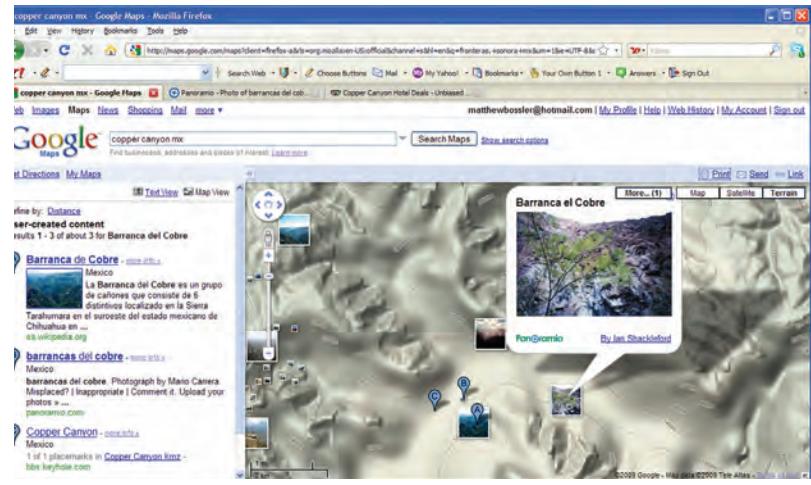
A Guide for Ecotourism Operators, Judy Carwacki: suggestions for effective websites

(<http://www.planeta.com/planeta/97/0597operators.html>)

- Entertain with text and graphics
- Emphasize ecology and conservation over amenities
- Link to and from government tourism offices and informational websites
- Provide easy-to-find, up-to-date contact information for at least one person
- Seal the deal with online reservation forms and questionnaires for customized experiences

LEFT: Copper Canyon Insider serves as a visitor portal to various tourist activities and companies.

RIGHT: Google Maps allows the potential visitor to view the lay of the land, with linked wikipedia descriptions and personal photos on Panoramio.



- Provide photos of unique geographical features, birds, plants, etc.
- Include the term "Ecotourism" in title of web document and insert other associated keywords throughout document

and the potential for culture-based tourism. While it may not boast a world-class canyon system, its proximity to the border and tourism centers Bisbee and Tombstone, Arizona, and Arizpe and Moctezuma, Sonora suggest that a similar ecotourism scenario, marketed via an organized website, is an opportunity to be explored.

Design Implications

- Create dual-purpose website as portal for visitors to Fronteras and for presentation of project/master plan
- Get the word out by keywording, creating open-forum descriptions of regional attractions (wiki,) and linking website to search engines, user-friendly mapping applications, photo-posting sites, and other popular websites

TOWN IDENTITY

Having a cohesive, well-defined identity is essential both in marketing a town for tourism and developing pride and care in a community. The citizens of Fronteras are proud of their town as exemplified by their planting of roses and other ornamental plant species and their citizens groups; it is a strong community. The case studies that follow highlight ways that other towns have sought to define themselves and utilize those identities to generate marketing strategies, economic growth and community investment.



LEFT: Plazas should provide a variety of space, sizes and configurations, to allow for performances, vending, and comfortable pedestrian circulation.

RIGHT: A variety of activities during Saturday afternoons at the Jardín del Centenario attract people from all over Mexico City.

COYOACAN | MEXICO CITY, MEXICO

Background

Coyoacán was founded in 1521 by the Spanish. It was the major trade center during pre-Columbian times, in the southern part of Mexico City. It covers an area of approximately 54 square kilometers and has a population of about 628,100.

A total of 50 structures have been listed as historic monuments, including mansions, monasteries and churches. Artistic monuments have also been designated (146 total), but have not been listed as historic structures.

Coyoacán is composed of various barrios, similar to most Mexican towns and cities. The historic core is mixed-use. Most shops serving residents were established long ago, while those targeting tourists are recent, these include dining of various scales, from taco stands to chain restaurants. Other uses include residential, civic, religious, open space, museums, and

art galleries. Coyoacán has a long history of housing various artists, including Frida Kahlo, Rufino Tamayo and Diego Rivera.

In the original designation of Coyoacán as a district, there were several colonias and barrios that were left out despite having physical clues showing they were part of the district. Hence, many of its residents became resentful toward the local government and neighboring communities.

Coyoacán is highly visited by international and national tourists, but primarily by residents of other districts. Its popularity in recent years has contributed to traffic and pedestrian congestion, illegal parking fees by 'franeleros', extensive alcohol consumption, and informal commerce that congest sidewalks.

Relevance

The municipality of Coyoacán is a model for Fronteras, through its urban spaces, history of



ABOVE: Water is a major attraction and most well visited urban spaces have a theme water feature. In Fronteras, an 'acequia' theme would be as appropriate as a splashing coyote fountain in Coyoacan.

LEFT: Locally owned restaurants and bars help keep money in local hands. La Guadalupana offers a taste of local and regional cuisine since 1932, and is a local hang-out place, as well as a tourist attraction.

RIGHT: Typical street and facade in Coyoacán, with 3-5 inch tall sidewalks made from local stone. Bicycles are a common transportation mode, as well as 'peseros', vans that function as public transportation.



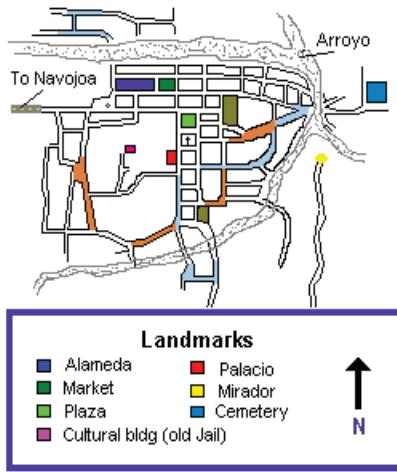
community involvement, and ongoing public events. Fronteras can benefit from the lessons learned in the importance of community involvement, as well as the use of public space. Community involvement and strategic urban planning will help create a healthy social and economic base for Fronteras.

Coyoacán offers a variety of urban tourism services the town of Fronteras can also provide:

- Language schools
- Art, history and science museums
- Historic, art and architecture tours
- Music, dance and performance events
- Culinary experiences and weekly outdoor markets

Design Implications

- Equal and fair local involvement in the preservation and planning of any community is essential to its success.
- Strong guidelines and ordinances can alleviate the negative effects of a districts' popularity, such as permits for street vending and illegal parking fees.
- Creating spaces for local outdoor markets, bars and restaurants can attract a variety of visitors to Fronteras.
- Declaration of historic monuments can help revitalize Fronteras.
- The local artist culture and history in Fronteras could be explored as a way to draw tourism and foster local pride.



ALAMOS | SONORA, MEXICO

Background

Alamos is a quaint colonial mining town founded in 1681 by the Spanish. Located in the foothills of the Sierra Madre Occidental at 1,346 feet, it is nestled in an ecologically rich and diverse environment. The town's winding roads follow the topography of the land and create attractive views from different angles.

Alamos itself is a historic tourism destination and has 188 National Historic Monuments. Currently, it is being considered for nomination as a United Nations World Heritage Site.

Alamos has kept its charm throughout the years, and with the building of the international highway from Navojoa to Nogales in 1951, economic development took rise. Today, Alamos is a vibrant colonial city highly visited by international and national tourists. It has a population of 10,000 people, with around 250 international families. The economy of Alamos

is based on the two active mines, which provide employment for locals. The clever marketing of Alamos as a "Pueblo Magico" has allocated funds to pay for underground utilities.

Relevance

Alamos can serve as an inspiration for Fronteras. It has all the elements of a successful small town with similar historic and ecological history. Comparable with most colonial Mexican towns and cities, Alamos has a central plaza, Plaza de Armas, adjacent to the main church and surrounded by the town's most prominent feature, its arcades. It has an 'alameda' and a market, all within a short walking distance.

The narrow streets provide a pedestrian-friendly environment which Fronteras can use as a model to direct its street development toward a more pedestrian friendly design.

LEFT: Alamos is located in an ecological area similar to Fronteras, and with similar history.

CENTER: The streets in Fronteras are not as colonial as those found in Alamos, but they have a potential to have their own vernacular charm.

RIGHT: Alamos provides its visitors maps showing major destinations. This map also shows that the major destinations easily are easily accessible by pedestrians, and dispersed throughout town.

LEFT: Outdoor dinning is a very popular activity that can create another source of revenue for residents of Fronteras.

RIGHT: Similar to Alamos, Fronteras can create a “mirador” for their town. This creates activity for locals and visitors, as well as creates opportunities for commercial development along the path to the mirador.



Tourism Opportunities Abound

Alamos offers a variety of urban tourism services:

- Language schools
- Museum of Sonoran History Culture
- Tours of Mayo villages
- Historic and architecture tours
- “Muralismo al Fresco” art tours
- Music, dance and performance events

Alamos also provides ecological tourism opportunities:

- Walking and hiking tours
- Estuary and river tours
- Bird watching and horseback riding
- Hunting and fishing

Accommodations offered include lodging with a Mexican family, hotels, hostels, vacation rentals, or ecolodges. Economic revitalization and growth will allow Fronteras to offer all of these lodging options.

Design Implications

- Plazas function as nodes of activity and cultural experience. The uses around a plaza should be traditional, geared toward economic vitality and community activities.
- The natural preserve around Fronteras can help develop ecotourism activities.
- Employment of locals by international investors and residents can benefit the town’s economy.
- The history of towns is an important asset; however, as towns grow it is important to spread tourism throughout the town to avoid degradation of main areas.
- Creating a slogan for a town can attract local and international investors.



LEFT: Fronteras can benefit from using live music as a tourist attraction. Mariachi bands are seen often in Tlaquepaque.

CENTER: Streets can provide a comfortable pedestrian environment, with a variety colors, textures, cuisine, and shopping.

RIGHT: Residential streets can also offer interesting walks for visitors, where the vernacular can be appreciated.

SAN PEDRO TLAQUEPAQUE | JALISCO, MEXICO

Background

San Pedro Tlaquepaque is a colonial municipality in the Mexican state of Jalisco. During the 20th century it was absorbed by the outward spread of the state capital, Guadalajara. The municipality's area is 270.88 sq. km (104.59 sq. mi).

The name Tlaquepaque derives from Nahuatl and means “place above clay land”. Tlaquepaque is famous for its ceramics, bronze sculpture, blown glass and embroidered textiles. It is also known for its mariachi, tequila, and cuisine, as well as for the friendliness and warmth of the locals.

Relevance

The municipality of Tlaquepaque is a model for Fronteras, through its design, economic, and ongoing events. Fronteras can tap into its unique features, such as its social and agricultural history, and its ecological richness, to create a market similar

to Tlaquepaque. Creating a pedestrian friendly environment and expanding on their local strengths will also create new economic drivers for Fronteras. Tlaquepaque offers a variety of tourist services the town of Fronteras can also provide:

- Language centers
- Museums
- Bus tours
- Historic and commercial tours
- Art and architecture tours
- Music, dance and performance events

Accommodations offered include stay with a Mexican family, hotel, or a furnished apartment. While Fronteras may not be prepared to offer the latter, it can offer home stays.

Plaza as Destination

Beautiful XIX century architecture lines many of the

LEFT: A typical layout of a plaza with the ‘fuente’ and ‘kiosco’ in the main square, Jardín Hidalgo, with the church in the background. Fronteras can create its own plaza identity using the same principles.

RIGHT: Unique planting vessels, pavement, and architectural facades make for interesting pedestrian streets, sure to attract tourists.

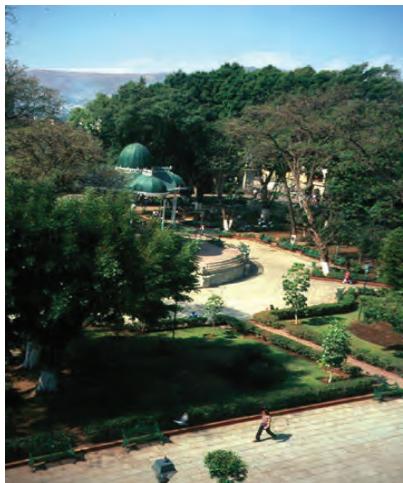


streets in Tlaquepaque. The main street is closed to traffic, allowing people to stroll, dine, and shop at a leisurely pace. Shops specialize in arts and crafts from all over Mexico, with some streets lined with skillful painters selling their art.

Plaza El Parián is a popular destination in Tlaquepaque, flanked by columned arcades and surrounded by restaurants and bars. In the main square, El Jardín Hidalgo, a large statue of Hidalgo dominates. During the annual San Pedro festivities, the square is filled with booths and merchants. Other important features of Tlaquepaque include its two main churches and the Benito Juárez market.

Design Implications

- The Geronimo Museum can be renovated and marketed to attract tourists.
- Local outdoor markets, bars and restaurants can attract a variety of visitors to Fronteras.
- Pedestrian-only streets help create a sense of safety and more leisure shopping and dining.
- Main squares and plaza should be well maintained and designed to be the heart of the town.
- The local culture, history and ecology of Fronteras can help draw in tourism and local pride.



LEFT: One of the zocalo's where people gather.

CENTER: Park within the town that is shaded by tall trees overhead.

RIGHT: Zocalo with circulation space and landscaped gardens surrounding the plaza.

PLAZA DE LA CONSTITUCION | OAXACA, MEXICO

Background

Plaza de la Constitucion is a public, pedestrian space in Oaxaca, Mexico that embodies entertainment and diverse activity that represents primary social place. Macedonio Alcala, the walkway along Plaza de la Constitucion radiates energy and character that is unified by the governing symbolic manifestation of Spanish power that it was built on. The historical and significant symbol that Oaxaca was formulated around its zocalo, meaning daily fiesta. The historical significance of the zocalo has become a critical component in developing the social networks within Oaxaca's urban fabric.

Because of its historical importance and symbolic colonial architecture, Plaza de la Constitucion has become a critical element in unifying Oaxaca's urban fabric and social vitality. Visitors and locals are able

to enjoy the space harmoniously by engaging in the vast array of activities that stimulate the streetscape. Shops, cafe's, and historic attractions are intermingled along the street, while vendors sell local produce and musicians perform in open-air plazas.

Relevance

All activity is centered around the plaza's central square that was designed to be the primary focal point for the city's layout, tying together important colonial institutions, and symbolizing the historical significance of the conquistador. The central square is lined with low shrubbery to maintain clear visual paths in all direction with four fountains surrounded by taller trees in the center to provide shade.

The Plaza's significance as a social space in a historically relevant urban setting is holistically diversified with religious and political gatherings.

LEFT: View down the main street at night when the drag is lit up and abundant with activity.

RIGHT: View of the streetscape from the road and activity outside of an existing historical building.



The sociocultural diversity of this place is what allows it to maintain its vitality and sustain pride and maintenance amongst the locals.

Guiding Principles

The ideas that generated Oaxaca's design were diversifying the functions of a space, creation of a cohesive urban fabric, and most importantly, refocusing on local community development.

Similarly in Fronteras, local community development is a top priority. By rebuilding communities within the town, surrounding spaces and new developments can thrive and be brought to life. One of the ways in which we intend to begin this process, is addressing the issue of circulation and how people move around the town. To encourage social interaction, we hope to implement pedestrian walkways and parks that circulate throughout the town in attempts to create

a cohesive design. This idea is successfully illustrated within the town on Oaxaca. With the similar cultural background and historical relevance, hopefully we can utilize some of the design principles that made Oaxaca such a wonderful place to bring Fronteras to life.

Design Implications:

- **Making local community development a top priority in Fronteras**
- **Rebuilding communities by changing and renovating existing circulation pathways throughout the town**
- **Increase the amount of pedestrian walkways and parks within Fronteras, creating nodes throughout the town that are a part of a cohesive circulation system**



LEFT: Groves of shade trees alternate sides of the mall to promote enjoyable meandering.

CENTER: Clumps of cafe tables, near water features, defined by shade trees and elevated planters, create "dining rooms."

RIGHT: Wayfinding to the mall, which is offset of major vehicular routes, is hampered by limited extension of paving elements into the surrounding neighborhood.

MAIN STREET MALL | CHARLOTTESVILLE, VIRGINIA

Background

Main Street in Charlottesville, Virginia, like most towns in the U.S., was drastically altered by the rapid rise of the automobile. Sucking the life out of a grid of warehouses and industries fed by a bustling rail station and main road through town, Interstate 64 bypassed travelers from the Eastern Seaboard around the outskirts of town while on their way to the west. Adding fuel to the fire, autocentric suburban shopping centers with expansive free parking lots and hidden infrastructure pulled local consumers away from the increasingly congested downtown. In the 1970s, city leaders hired renowned landscape architect Lawrence Halprin to re-envision this historic space in the mold of a pedestrian mall.

Informed by a series of consensus-building public charettes, Halprin's design solution closed five blocks to vehicular traffic, laid brick under foot and grew limbs and leaves overhead. While it took two decades

to take root, this pedestrian mall now serves as one of the most successful examples of its type.

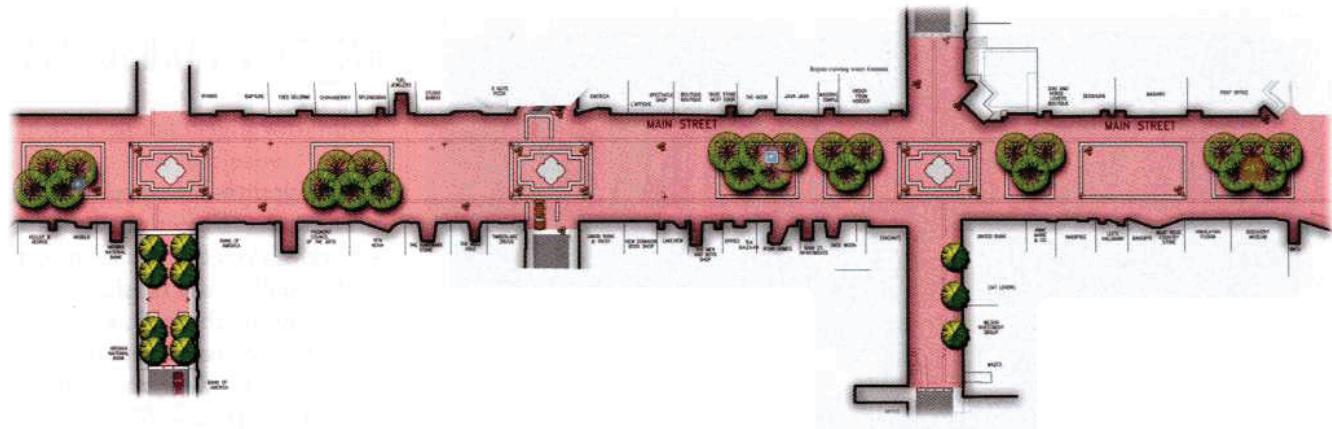
Relevance

Recognizing the differences between an Eastern U.S. college city and Fronteras, these two towns both boast deep histories, and a downtown layout inherited from an era of rail traffic and regional highways. As such, our designs for the central corridor of Fronteras can be informed by Charlottesville's lessons in pedestrian economy and place-making.

Key Components

Halprin's design of the Charlottesville Downtown Mall, like many of his designs, relied upon graceful choreographed movement, iconic pieces of water-bearing cubist sculpture, and ample public seating. Elizabeth Meyer, a Halprin scholar from the University of Virginia, upon completing a tour through the linear space, remarked to a companion,

RIGHT: Ground-plane patterns provide linear unity while street trees direct visitors from one side of storefronts to the other.



While Halprin originally designed the fountains in the Main Street Mall to be publicly accessible to passers-by, restaurant owners have surrounded them with 'al fresco' dining tables. While this privatization of civic features is resented by some, the popularity and bustling activity of these open-air 'rooms' increases the enlivening effect of the fountains on the public mall.

"Did you see the way we moved? We didn't just walk straight down the storefronts."

Subsequent design updates refocused business activity to create an entertainment and dining destination, a move that cemented the mall's success and institutionalization. In the 1990s, the city invested in a public amphitheater with expansive views across downtown as a terminal attraction that draws pedestrians into and through the mall on free "Fridays after Five" concert nights and opening nights of clustered art galleries. Additionally, two-way traffic was opened on a parallel street and two cross streets were opened across the mall to provide limited access to business owners and residents.

Design Implications

- Large linear public spaces can be scaled down to the pedestrian by removing overhead utility clutter and limiting the extent of site lines through alternating obstacles to flow
- Small investments in water features, shade trees, and human-scale borders yield big returns by creating semi-private outdoor rooms
- A moderate amount of vehicular traffic and adjacent parking is essential to the economic vitality and circulatory permeability of a pedestrian mall
- Minimal business startup costs for appropriately sized stores is essential to creating small-scale private enterprise



LEFT: Graphic aerial map of Las Ramblas and the different sectors along the boulevard.

CENTER: Las Ramblas during the day illustrating pedestrian space and interaction.

RIGHT: Aerial view of Las Ramblas situated in the urban fabric of Barcelona.

LAS RAMBLAS | BARCELONA, SPAIN

Background

Las Ramblas is considered one of the world's top places. It is the synthesis of access & linkages, comfort & image, use & activity, and sociability that allow Las Ramblas to create such a defined sense of community. It prioritizes and accommodates to the pedestrian, which allows for a socially stimulating and naturalistic sense of place. The street is lined with cafe's, shops and markets, cultural centers, museums, and monuments. The abundant amount of activity on the street promotes social contact and diverse sociability.

Before Las Ramblas became what it is today, it was a riverbed that acted as a barrier to medieval Barcelona. The dynamics of the city changed when the city was expanded past the riverbed, resulting in development on either side in the late 18th century. The Spanish word "ramblista" means *one who saunters along the Ramblas*, and became the underlying ideology for

designing how Las Ramblas exists today.

Because pedestrians take precedent, the street was designed 1.5km long and 60' wide with sidewalks less than 10' wide on either side to encourage pedestrians to walk in the center of the street. The pedestrian street is separated from traffic by a row of trees buffering the noise and creating a sense of enclosure to the pedestrian street.

Relevance

Every element on Las Ramblas is harmoniously integrated into the holistically balanced design. The building heights and landscaping are proportioned to the street and the pedestrians that inhabit the space. This balanced design embodies a comfortable atmosphere when inhabitants can find solitude and enjoy outdoor activities at all hours of the day in an urban fabric that is constantly transforming. The diverse sociocultural character of Las Ramblas not

LEFT: A view of one of the narrower sidewalks along the main street of Las Ramblas

RIGHT: A sector of Las Ramblas that is more densely packed with commercial activity.



Guiding Principles.

- Focusing the creation of public amenities in depilated neighborhoods
- Provide adequate public facilities to every neighborhood
- Reuse of brownfields sustainable planning
- Restricting urban sprawl by focusing on redevelopment rather than new development
- Reclaiming famous inner courtyards that act as open space within each block

only makes it a central node within the city, but revitalizes and rehabilitates the surrounding urban fabric.

Guiding Principles

The guiding principles that the Las Ramblas design team utilized are very similar to what we strive to implement in Fronteras. The main focus for Fronteras as it relates to Las Ramblas is to provide adequate public spaces for the people of Fronteras. Las Ramblas focused on orienting the design of the streetscape back to the Mediterranean Sea, whereas we strive to orient Fronteras back to the already existing nodes of importance that we hope to redesign and develop. The existing plaza is an important node within the town, surrounded by iconic buildings that have incredible potential to be places of significant social and economic growth. By providing adequate public facilities and spaces within Fronteras, we hope to stimulate the social and economic aspects of the town.

Design Implications:

- Make local community development a top priority in Fronteras
- Rebuild communities by changing and renovating existing circulation pathways throughout the town
- Increase the amount of pedestrian walkways and parks within Fronteras, creating nodes throughout the town that are a part of a cohesive circulation system



LEFT: A typical house at Armory Park del Sol.

CENTER: The lush native vegetation that lines the numerous sidewalks.

RIGHT: Rain chains and cisterns are innovative ways in which Armory Park del Sol collects rainwater to be used for the landscape.

ARMORY PARK DEL SOL COMMUNITY | TUCSON, ARIZONA

Background

Located near the heart of downtown Tucson exists a community where all the houses were developed to be small, efficient LEED certified homes, in close proximity to many offices, restaurants and entertainment venues. This community, known as Armory Park del Sol, was constructed by John Wesley Miller to establish sensible dwellings for Tucsonians who are concerned with how they are contributing to the energy draw of Tucson. Many homes feature solar panels on their roofs to generate clean electricity. Miller has now developed a “Net Zero Energy” home which he hopes will illicit more construction.

Defined

A LEED development is one that is specifically designed to meet the standards of the Leadership in Energy and Environmental Design or LEED certification. LEED entails a variety of qualifiers

to evaluate the impact a built structure has on its environment in the short and long term. Everything from the quality of insulation, efficiency of the construction process and the use of active energy reducing items like solar panels is organized into categories for rating environmental design.

Relevance

Since Fronteras is a clean slate for development with lots of promise for growth, it is worth considering how a sustainable community could draw attention to the town and help create a new, forward-thinking identity for Fronteras. The most basic way to create this identity is by simply constructing quality homes that will not be abandoned in a decade. Also, because Fronteras is spread over such a small area, a community in the heart of the town would make the town “walkable” which is another great attribute for any town looking to excel in sustainable strategies.

The main categories of the evaluation are as follows:

- Sustainable Sites
- Water Efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality
- Innovation and Design Process

These are the elements that a Fronteras community would need to incorporate in order to receive LEED certification. LEED grants four levels of certification based on their evaluation. These are Certified, Silver, Gold and Platinum.

LEFT: A typical house in the Armory Park del Sol Community. Native vegetation in the landscape reduces need for water use.

RIGHT: Rows of Armory Park del Sol houses are divided by walkways rather than streets creating a communal sense of place and promoting neighborly interactions.



Many new communities in the U.S. are adopting this type of development strategy. If Fronteras were to showcase concern for utilization of natural resources and sustainable development, it would set it apart and could bring notoriety to the town.

This interest would equate to tourism, new jobs and a higher quality of living for residents of Fronteras. Even the construction could be completed by residents of the municipality of Fronteras which would result in income and opportunity for families.

While the initial cost of a development plan for a neighborhood like this might be high, it is likely that the money could quickly be recovered by people from the area moving in and forming a closely-knit community.

Design Implications

- A community layout like the one seen above would work very well in a town where car ownership is very low.
- These homes use material and technologies which are already prevalent in the town of Fronteras.
- The town could apply for grants in order to acquire the solar panels for generating electricity.
- During winter months, solar energy could be sold to neighboring towns, thus bringing more money into Fronteras.

COMMUNITY ORGANIZATION

Essential to any development in a small town is input and investment from the community as a whole. Community buy-in is needed to support change from the initial idea and approval processes to volunteering and implementation stages of a development. Fronteras has a history of community organization and investment in the town by its citizens. The case studies that follow identify some ideas for enhancing community involvement and maximizing its benefits.



LEFT: The ARAN logo shows the binational focus of this reforestation initiative.

RIGHT: Behind ARAN is the philosophy of Paulo Freire's liberation pedagogy; an active and democratic process, that breaks down power structures. The dichotomy between educator and learner does not exist – they all learn from one another.

AMBOS NOGALES REVEGETATION PARTNERSHIP (ARAN) | NOGALES, MEXICO

Background

Formed in 2003, the Ambos Nogales Revegetation Partnership (ARAN) includes more than 20 organizations in the educational, governmental, business and industry, and nongovernmental sectors, which partner together to address the environmental needs of two cities: Nogales, AZ and Nogales, Sonora.

Initially it started with a binational research team comprised of students from the Bureau of Applied Research in Anthropology (BARA) at the University of Arizona, and from the CETIS 128 (Technological Education Center), in Nogales, Sonora. The group later expanded to include representatives from the non-profit and governmental sectors, maquilas and neighborhood leaders. The group had the initial goal of developing an assessment of the environmental problems in the region and developing a plan of

action to improve air and environmental quality for Ambos Nogales, which translates as “both Nogales”.

Relevance

While Fronteras is a much smaller city than Nogales, its residents could benefit from partnerships established between the town and organizations, businesses, enterprises.

ARAN began with three pilot projects: a schoolyard habitat in a primary school, a park in a local neighborhood, and a nursery at a local high school. These projects were easy to organize, execute and provided a foundation on which to build, so they were able, later, to address larger environmental issues.

Community-based Research

ARAN focuses its efforts on building long term sustainable partnerships, looking for common

Community-based research provides a framework for learning and reflection in action.

Key tenets:

- To foster collaboration among community members and researchers (including students),
- Engage all in reflective practice and reciprocal learning,
- Build the capacity of community groups to create change,
- Balance research and action,
- Practice inter- and multidisciplinary work, and
- Situate community concerns in a larger context.

LEFT: Public participation actively invites engagement from the community. The projects are the vehicle through which partnerships and networks are built.

RIGHT: High school students partner with the community to complete projects that show by example that these projects can work and benefit all parties.

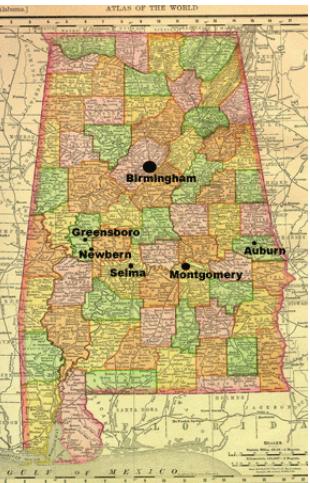


To foster continued learning, ARAN members meet once a month to share ideas and information. ARAN also performs periodical self-assessments, an annual retreat and two conferences per year, where participants can share their work and learning with each other and with the community at large.

goals and ideas that allow them to advance their efforts to improve the environmental quality for the benefit of the whole community. Some of their key strategies to achieve this goal include the creation of educational experiences specifically tailored to meet the community's needs; including partners and participants from non-profit organizations, government, maquilas and business that can provide legitimacy, access and support to the group; maintain the interest and participation of partners by continually meeting their needs; and learning to work effectively within the constraints of a modest budget.

Design Implications

- Community-university partnerships integrate learning and social change and foster civic participation.
- Begin with simple, pilot projects in order to build trust and develop a process for decision making.
- Community members work in collaboration with school students to implement the projects.



The Rural Studio consists of three different programs, where students move to the rural community for a semester or a year. During that time, they design and build community projects or homes, like the Butterfly House (at right), a wheelchair-accessible home designed for clients Anderson and Ora Lee Harris, which included special features for water harvesting and an energy-efficient ventilation system.

RURAL STUDIO PROJECTS | RURAL SOUTHEAST, USA

Background

The Rural Studio is a design-build architecture studio run by Auburn University which aims to teach students about the social responsibilities of the profession of architecture while also providing safe, well-constructed and inspirational homes and buildings for poor communities in rural west Alabama, part of the so-called “Black Belt”.

The studio was founded in 1993 by architects Samuel Mockbee and D. K. Ruth. Each year the program builds about five projects, has resulted in the completion of more than 80 houses and civic projects in Hale, Perry and Marengo counties in Alabama.

Relevance

Local stakeholders in Fronteras have expressed interest in forming a partnership with the University of Arizona to create a Institute for a Sustainable Community. The architecture component could

be based on Rural Studio’s model, where students actively engage with the community, and invite them into the design process, working toward a goal of an inclusive, participatory experience. Also, there is the potential to use local, salvaged materials that might otherwise, be added to the local dump. Architecture students could engage in materials investigation and innovative technologies in order to design residential housing units which are economically and environmentally sustainable. These signature structures could be included in in-fill development projects in Fronteras, unique, yet fitting in with the vernacular architecture of the town.

“Classroom of the Community”

Community participation is a large component of The Rural Studio. By inserting themselves into the culture, students have the opportunity to design from within. Mockbee’s mission combined helping

“The best way to make real architecture is by letting a building evolve out of the culture and place.”

Samuel Mockbee

Many of the projects emphasize the use of local, salvaged, donated materials. The Mason's Bend Community Center (left) includes rammed earth walls and a roof made of aluminum sheets and 1980s GMC sedan car windows salvaged from a Chicago scrap yard, which cost \$120.

In order to form the Yancey Chapel's walls (right), students filled 1,000 donated, old tires with soil, fortified them with reinforcing bars, wrapped them with wire mesh, and coated them with stucco.



The organic farmer's stand in Perry County, AL also serves as a local landmark and gathering place. Local artists and artisans were employed in the design, display features and marketing for the stand, strengthening its place in the community.

students design and build inexpensive, sustainable structures, while teaching them fundamentals of decency and fairness. Students enrolled in the Rural Studio are exposed to the concept of “context based learning” where they actually live in and become a part of the community in which they are working. It is through this process that they learn the critical skills of planning, design, and building in a socially responsible manner.

Design Implications

- The town of Fronteras could be the site for a multi-disciplinary educational program within Sonora.
- The program could feature an intellectual exchange between students and residents, working together to build residential and community projects, at the same time fostering community-building.
- Innovative building materials and techniques could, potentially, place Fronteras at the forefront of design, highlighting its vision towards the future.

AGRICULTURAL OPPORTUNITIES

Fronteras has an agriculturally rich history and present, dedicated land and a community with expertise in the industry. The case studies that follow are examples of opportunities that might be explored in the agricultural industry. Diversifying the industry might help to generate jobs and ensure more year-round employment as well as produce crops that can demand a higher sales price. Included in this section are some ideas for vertical integration, such as canning or processing produce into other products (like salsa or tamales), that might help to keep more money and jobs in Fronteras.



LEFT: Fields that have just been plowed and are ready to be planted.

RIGHT: A controlled indoor agriculture environment provides an excellent opportunity to teach the community about organic farming

NEW LEAF FARM | DURHAM, MAINE

Background

New Leaf Farm is a farm in Durham, Maine that grows organic produce and is passionate about maintaining sustainable agriculture and utilizing sustainable agricultural systems. They primarily grow vegetables, herbs, and fruits, but are also exploring the idea of expanding to livestock, where they organically raise chickens, steer, and pigs. They currently till four acres for vegetable and fruit production, and six for grain crops. Because the farm is located in New England, the weather is seasonal, and alternative growing techniques are required to sustain crop production in colder weather. They use solar heated greenhouses to initialize 50,000 seedlings each year before they are transplanted. The season begins in early May and by late November when the weather is colder, the crops are ready to be stored.

Relevance

Organic agriculture is currently the fastest growing

food sector. It is a process that uses sustainable methods to preserve the environment throughout every stage of crop production. According to the Codex Alimentarius Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods, *the primary goal of organic agriculture is to optimize the health and productivity of interdependent communities of soil life, plants, animals, and people.* It is important to recognize that organic agriculture is not limited to organic products, and that any natural process or system utilized to grow crops is considered organic. Economically speaking, organic agriculture exceeds conventional farming. While costly to implement, organic farming ultimately reduces federal costs, reduces the use of fossil fuels, and improves animal habitats and the productivity of the land. With advanced technology agriculture, greenhouses and hydroponics can make organic farming a possibility in any climate and almost any location due to the small footprint of a

QUICK FACTS

New Leaf Farm

Crops: Diversified vegetables and herbs with emphasis on salad mix

Markets: 6 restaurants, 2 natural food stores, and 40-family CSA

Total Farm Acreage: 105 acres

Cultivated Acres: 2 to 3 acres in vegetables each year, with an additional 6 acres in cover crops as part of vegetable rotation (9.5 acres total for vegetables); 1 in fruit trees, 0.2 acres in high tunnels, 14.5 in hay and pasture

LEFT: Ecological tourism to organic farms is one way for small farms make the sometimes difficult transition from conventional agriculture to ecological agriculture

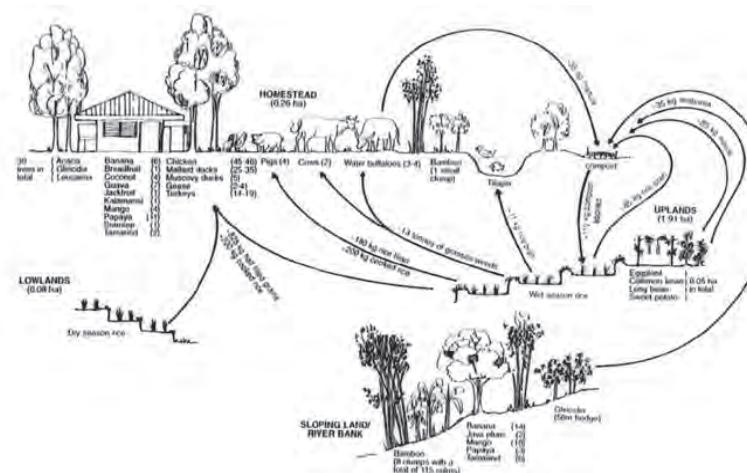
RIGHT: "Organic farming is a form of agriculture that relies on crop rotation, green manure, compost, biological pest control, and mechanical cultivation to maintain soil productivity and control pests, excluding or strictly limiting the use of synthetic fertilizers and synthetic pesticides, plant growth regulators, livestock feed additives, and genetically modified organisms."



Organic farming is a science within itself that conventional farmers can learn while they transfer their capital resources and skills to master a trade that can be even more profitable than conventional farming.

greenhouse compared to an open field.

In Fronteras, organic farming can be an attempt to create more jobs, produce naturally grown food, and create a more sustainable community for the town. It can also be a partial solution to generating eco-tourism in Fronteras, by using it as a tool to help small farmers make the transition from conventional agriculture to ecological agriculture. The soil, land, and already knowledgeable residents of Fronteras, make it an ideal place to implement organic farming.



Design Implications

- Develop training programs which teach farmers organic farming methods
- Market Fronteras as a town with a diverse agricultural market, making them more competitive with surrounding town farms
- Eco-education summer programs can be implemented as a way for farmers to earn extra income and provide additional tourism opportunities in Fronteras



LEFT: Starting small, tomato vines grow very well in a hydroponic environment

CENTER: Tomato vines, particularly when arranged in this way are able to produce a very large amount of fruit each growing cycle

RIGHT: Boutique varieties of tomatoes, such as this Campari, can sell for a premium

EUROFRESH FARMS | WILLCOX, ARIZONA

Background

Eurofresh is the largest producer of tomatoes in the United States. The company operates a vast series of large-scale greenhouse facilities in Willcox and Snowflake, Arizona, hydroponically growing several varieties of tomatoes and cucumbers.

Relevance

One possible development scenario for Fronteras is the construction of greenhouses that will enable the town to produce crops each season as well as provide stable employment year round for Fronteras residents.

The sun-rich environment of Fronteras makes it ideal for greenhouse crop production. Hydroponic produce, while not organic, can be grown pesticide-free and the enclosed environment helps to reduce water lost through evaporation. Water can then be recirculated, thereby reducing the overall drain on the water supply of the town.

The location of Fronteras near the border is ideal for export to the U.S. and for greater profit margins, the produce can be packaged, canned, bottled or further processed into a food product by workers in Fronteras.

Eurofresh Farms

While Eurofresh grows on a scale that Fronteras could never compete with, it is important to understand and study, as it is the primary competition for all greenhouse growers in the west.

Eurofresh began in Pennsylvania but soon moved to Arizona for its year-round sun and moderate climate. These same growing conditions exist in Fronteras.

Using greenhouses for production enables Eurofresh to produce consistent, quality crops throughout the year, including the off-season. Eurofresh is able to charge a premium for the consistency of the product and the year-round availability. The choice of tomato

"Eurofresh Farms launched an internal company-wide packaging initiative, the Life Cycle Approach™, in 2007 in response to the negative effects that packaging can have on water and land usage. The first phase of this initiative involved converting all white paper pre print boxes to Kraft paper boxes. These wax-free unbleached boxes are environmentally more "green," taking less wood to produce, using less energy, more readily including recycled fibers, and producing fewer questionable by-products. In addition, Kraft boxes are 40 percent recyclable.

"Additional efforts in reducing plastic packaging led us to convert our clear plastic clamshell packaging to 50 percent recycled material. We are continually working to improve our packaging

LEFT: Packaging and inspecting produce can provide many jobs for a community

RIGHT: Eurofresh farms is a very large scale operation as this aerial over their greenhouses shows



efforts by evaluating vendors with higher concentrations of recycled and biodegradable materials, and in the coming months will be implementing further packaging improvements."

and cucumber as the company's main crops is due to the high level of productivity of these plants. Tomatoes and cucumbers, being mostly water, are relatively heavy and since they are sold by weight there is further opportunity for increased profit.



Use Less, Use Wisely,
Leave Less Behind

*No chlorine based bleaching chemicals
were used in the manufacturing of this box.*

Design Implications

- Differentiating from large scale producers, such as Eurofresh, can be done by filling niche markets or producing 'boutique', heirloom or other gourmet vegetable varieties
- Packaging on site can eliminate middlemen and increase profit margins
- Locating greenhouses within easy walking distance of most homes in the town is ideal
- Locating a possible packaging facility near greenhouses can reduce transport costs



LEFT: Sonoita Vineyards, located in Elgin, AZ is the oldest commercial winery in the Southwest.

CENTER: The rolling grassland and high elevation are ideal growing conditions for grapes – very similar to Burgundy, France.

RIGHT: The winery currently grows seven varieties of grape and is planning on including more in the near future.

SONOITA VINEYARDS | ELGIN, ARIZONA

Background

Established in 1983, Sonoita Vineyards is composed of 40 acres of vines and produces 10,000 gallons of wines per year. It lies at an altitude of 5,000 feet and is surrounded by rolling grassland dotted with oaks.

Relevance

While the majority of wine grown in Sonora, Mexico is grown in west of Fronteras in Hermosillo and Caborca, the similar terrain between Sonoita, Arizona and Fronteras makes the establishment of a vineyard in the town a realistic possibility. Both regions lie at similar elevations and have similar vegetative communities.

Vineyards in Fronteras could be a successful way to establish a product for export and a draw for tourists.

Dry Climate Vineyards

Sonoita Vineyards first began as an experiment in

1973 when Dr. Gordon Dutt, a now retired soil scientist from the University of Arizona, decided to test how grapes would grow in the harsh Arizona climate. His experiment turned out to be quite successful and he found that the red clay soil (*terra rosa*) of the Sonoita region was quite ideal and produced grapes of brilliant color and high acidity.

The winery is surrounded on three sides by mountain ranges and is located on the southern side of a hill providing protection for the grapes from wind and frost.

The dry climate of the region helps protect the grapes from rot, mold and mildew as well as prevent the phylloxera louse from taking hold. Indeed, the majority of insects and pests that bother grapes do not flourish in the sunny, dry climate of the Southwest. This enables the vineyards to significantly reduce the amount of pesticide used in comparison with conventional growers in other regions.

Varieties of wine produced at the vineyards:

- Chardonnay
- Sauvignon Blanc
- Cabernet Sauvignon
- Syrah
- Merlot
- Pinot Noir
- Mission (grapes brought by the Spanish missionaries in the 16th century)

LEFT: Tours, wine tasting and catered lunch are offered at the vineyard

RIGHT: The location of the vineyard on the southern side of a hill helps to protect the vines from wind and frost damage



The annual 'Blessing of the Vineyards' festival takes place April 25th. Festivities include tours, wine tasting, music, food and horseback riding and are a draw for tourists and locals alike.

The vineyards seek to maintain the ecology of the land to preserve it and the vineyards for future generations. One way in which the farm attempts to be light on the land is through passive water harvesting techniques. The location of the vineyards on a hillside forces water to infiltrate the whole site and the strategic location of berms retains the water on site. The vineyards also compost all by-products of the wine making process such as grape seed and stems, and uses the material to fertilize the vines.

The vineyards cater to tourists and potential buyers by offering tours, wine tastings, catered lunches and even rent out the main hall for private parties and events.

Design Implications

- The soil, altitude and climate of Fronteras closely resembles Sonoita, AZ -- possible locations for vineyards would likely be southern hillsides, like those in Sonoita
- The lack of severe pest problems in the dry climate of Fronteras may make it an ideal condition for the production of organic wines which sell for a premium
- Water harvesting practices can be designed to significantly reduce the amount of water required to support a vineyard



LEFT: Irrigated lowland fields near parched mountains provide an ideal herb-growing environment in San Jose de Cabo.

CENTER: Greenhouses maintained by the cooperative grow basil plants from seed before distributing to members.

RIGHT: Carlos Burgoen, organic farmer with the Cabo Cooperative, harvests mint for market.

NORTHWEST MEXICO ORGANIC MARKETS | VARIOUS LOCATIONS

Background

Organic produce grown in northwestern Mexico is a quickly-growing, but minor agricultural sector. Relying upon agricultural infrastructure that runs traditional growing techniques, organic produce makes its way to mostly international consumers via packaging, distribution, and savvy marketing.

Production

A very successful cooperative of organic farmers operates in San Jose del Cabo, Baja California Sur. By operating as a concentrated cooperative, the organic farmers can save on certification and tool costs through economies of scale. Greenhouse infrastructure serves as a source of both living and educational matter.

In Hermosillo, Rico Farms, run by Francisco Tapia, Sr. and Jr., takes advantage of sea-moderated climate patterns and an ample aquifer to grow melons,

squash, cucumbers, and flame grapes in varying seasons year-round. The Tapias claim that the key to the success of their farm is the low-sodium water supply and isolation caused by the surrounding preserved hills, which serve as a buffer to prevent pests such as whitefly from reaching the crops.

Export and Packaging

Produce packing and distribution to the United States drives the economy of Nogales, Arizona, and is also an integral sector Nogales, Sonora. These agribusinesses, such as New Harvest Organics, have benefited from the opening of cross-border markets from the North American Free Trade Agreement (NAFTA; Rico, 2008.)

Market

From packaging facilities in Ambos Nogales, Tijuana, and elsewhere, Mexican-grown produce is trucked to supermarkets, foodbanks, and regional grocer

TOP LEFT & RIGHT: Multi-generational demos at the Bisbee Farmers Market draw community members and visitors to an educational experience and smorgasbord of specialty products.

BOTTOM LEFT: Port of Guaymas.

BOTTOM RIGHT: Hard-skinned squash such as Koboche stores longer than summer squash, making it an ideal export crop.

FAR RIGHT: Locally-produced organic food can make it straight to the table within the community, increasing the profit to the farmer and generating associated ecotourism opportunities, as in the Hacienda de los Santos in Alamos, Sonora, Mexico.



distribution centers throughout Mexico and the United States. Some major metropolitan cities within Mexico have begun to support organic food markets. (Lotter, 2005.) Additionally, some of the specialty produce such as Koboche squash makes it into the shopping bags of international consumers as far away as Japan via the port of Guaymas.

Strategic entry into specialty food markets such as tourist towns (Alamos, Bisbee) or near universities (Tucson, Albuquerque) can plant the seeds for regional demand and future expansion (Hall, 2005.) Additionally, web-marketing through viral video or participation in organic agriculture blogs such as sustainabletable.org can increase awareness of the production area and connect the interested consumer to the producer (Sundwall, 2008.)

Design Implications

- **Organic fruit and vegetable production is a viable enterprise in the states of Baja California Norte and Sonora, though successful ventures are concentrated in ideal, sea-breeze-moderated climates**
- **Organic certification and specialty tool and facility costs for the individual farmer can lowered by the formation of a farmers' cooperative**
- **Packaging and developing markets independently of major distributors and grocers, while creating greater start-up costs, can realize greater ultimate profits to Fronteras and compliment synergistic industries**

UTILITY INFRASTRUCTURE DEVELOPMENT

Fronteras has many opportunities for growth in its promising future. Essential to that growth is the development of adequate utilities and infrastructure to support the population and resultant industries. The case studies that follow provide examples of wastewater treatment and waste management facilities as well as small town industrial development options. These are included in the hope that they will help to identify what is most pertinent and realistic for Fronteras and can serve as base for further research and ideas.



The pilot-scale treatment system is comprised of an up flow anaerobic sludge blanket, a facultative lagoon, two free surface wetlands, a disk filter, storage, and subsurface irrigation for on-campus landscaping. System construction was complete in March 2008, and system start-up is ongoing.

UABJO DEMONSTRATION WETLAND WASTEWATER TREATMENT, RECLAMATION, AND OUTREACH PROGRAM | OAXACA, MEXICO

Background

Oaxaca City, the temperate capital of Oaxaca is located at about 5000 feet above sea level in the Sierra Madre de Sur Mountains. In 2003, estimated population was 526,000. In the early 2000s the Oaxaca City built and initiated a new activated sludge wastewater treatment plant. In surrounding communities, subsurface wetlands have been implemented to varying levels of success.

In 2006, the University of Benito Juarez in Oaxaca (UABJO), began implementation of a natural wastewater treatment, reuse, demonstration and outreach program, which is made up of two main components:

1. An on-campus demonstration wetland wastewater treatment system that treats a portion of campus wastewater and reuses this treated wastewater for on-

campus landscaping.

2. An outreach program that consists of a conference series; demonstration system workshops; local community outreach; wastewater quality monitoring and analysis; and international exchange opportunities

Relevance

Fronteras needs to find an environmental method of handling its wastewater. Currently, effluent is being discharged into area streams. Given the cost of constructing a wetland system, it may benefit Fronteras to partner with a university, other towns, and potentially create a model site for this type of wastewater treatment, on a smaller scale than Oaxaca.

Collaborative Program

The UABJO project is unusual, as it is a collaborative effort between two international universities, the

Outreach programs include an ongoing series of wastewater treatment/reuse and watershed management conferences and hands-on workshops at the demonstration facility.



University of Benito Juarez in Oaxaca, Oaxaca (UABJO) and Humboldt State University in Arcata, California (HSU), and residents of Oaxaca. HSU is assisting with project expertise and design; UABJO is funding, managing, operating and providing outreach on the project; and the State of Oaxaca constructed the system under the supervision of the UABJO.

The project vision entails implementation of a demonstration facility for conducting outreach programs, including watershed management conferences and workshops. To date, two conferences have been conducted, in 2006 and 2008, and one was scheduled for February 2009.

Design Implications

- This pilot program may serve as a model for a collaborative university-community program
- Fronteras could work with the university in Hermosillo to start a similar program, and provide education and outreach for other communities and small towns in Sonora



LEFT: Milagro is located west of downtown Tucson.

RIGHT: In order to achieve optimal energy efficiency, the housing units were built with adobe brick and metal roofs that are well insulated. The units are also oriented to take advantage of passive solar principles and each house is equipped with a solar hot water heater.

MILAGRO COHOUSING COMMUNITY | TUCSON, ARIZONA

Background

Milagro Cohousing Community is an award-winning co-housing community of 28 energy efficient, passive solar, adobe homes on a 43-acre site in the Tucson mountains. In an effort to create a more sustainable community, a number of green features were incorporated into the design of Milagro. The homes were clustered to preserve more than $\frac{3}{4}$ of the property in its natural state, leaving 35 acres of open space for community residents to enjoy.

The landscape features permaculture design and an emphasis on native plants. Wetlands and an underground irrigation system for wastewater recycling are utilized in the community, as well as rainwater harvesting.

In order to recycle all of Milagro's wastewater, a wetlands wastewater treatment and reclamation process was constructed. Construction costs were

partially offset because: 1) sewage pumps weren't installed to lift sewage to the end of the city sewage line, and 2) they don't pay the monthly sewer connection fee.

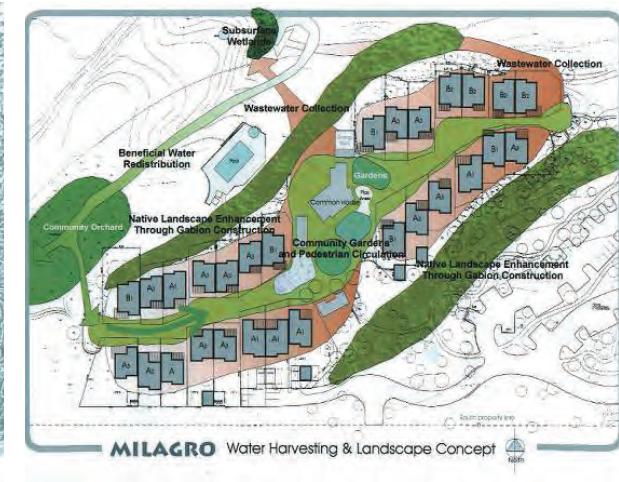
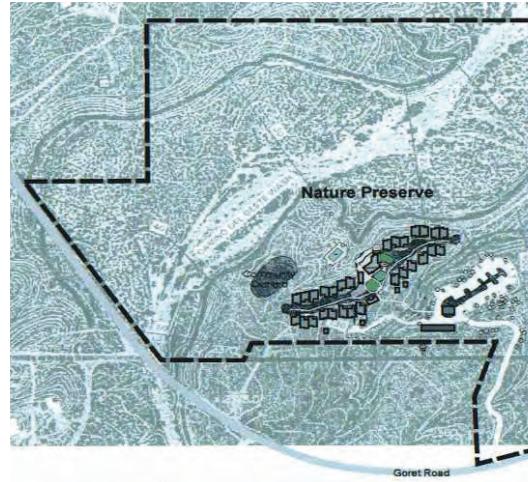
A brief description of the system: waste is first received by septic tanks which settle the solids. Septic outflow is fed to one of two treatment beds, which are planted with bull rushes and sedges. Decomposition takes place in the gravel bed, through bacteria living on the roots of the plants and on the surface of the gravel. The outflow from the treatment beds is gathered in a 1,000-gallon collection tank, and then pumped up through the center of the community, and out through a subsurface irrigation system. Reports claim that there isn't any odor.

Relevance

Fronteras faces the challenge of finding an appropriate, economical system to deal with its

LEFT: Clustered development strategies allow for the preservation of open space.

RIGHT: This sustainable community sited the constructed wetlands around the periphery of the clustered housing, which provides a vegetative, habitat-rich environment.



current wastewater problems. Milagro, while at a smaller scale, found a way to handle all of its wastewater without needing connections to the city's water infrastructure. Additionally, the constructed wetlands provide landscape benefits, aesthetic and environmental, as treated effluent is used for irrigation purposes.

Integrated System

Milagro Cohousing has coordinated its wastewater to work in conjunction with a water harvesting system. This includes extensive passive water-harvesting earthworks and cisterns throughout the site.

Design Implications

- Secondary effluent from sewage treatment plants can be used to create wetland parks.
- This type of system can be an aesthetic asset for a community and provide great wildlife habitat.
- Constructed wetlands are more expensive than traditional lagoon systems; but there may be funding opportunities through grants.
- The treated effluent could be used to irrigate revegetated areas.



LEFT: Aerial view of the Odense Environmental Center, an operation of Odense Waste Management Company, LTD.

RIGHT: Short term storage of recyclable PVC. All recyclables are separated out in order to reduce the total amount of refuse put into the landfill.

ODENSE WASTE MANAGEMENT | ODENSE, DENMARK

Background

Odense Waste Management Company's Environmental Center (EC), located in Odense, Denmark, was built in 1994 with the aim of being one of Europe's most environmentally safe landfills. The opening of the new EC corresponded to the closing of the former landfill in the area. The mission of the EC includes proper monitoring and maintenance of the closing of the facility and beyond.

Relevance

The community of Fronteras is in great need of a sanitary, ecologically sound waste management system. Currently, the town uses an open pit dump that frequently catches on fire and fails to contain much of the plastic and lighter materials deposited into it causing litter to scatter in the vicinity. There is also no protection for the underlying soil and aquifer. The Odense Environmental Center could be a good model in planning a new waste management strategy

for Fronteras and its surrounding communities.

Odense Environmental Center

The Environmental Center has a three part vision:

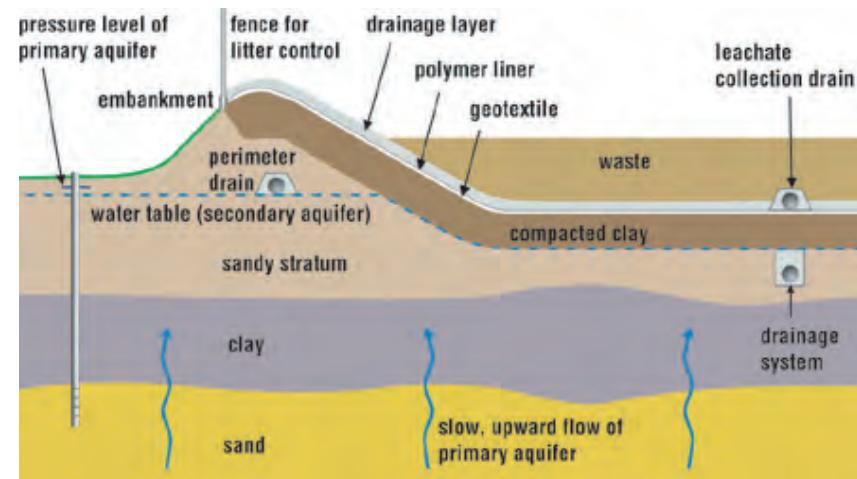
- To remain at the forefront of waste management technology, to continually gain knowledge and remain competitive in the industry
- To attract and keep qualified employees, who play an active role in increasing the company's activities, both nationally and internationally.
- To have a strong environmental profile and to execute changes in order to be known as one of the leading and most efficient waste management companies in Denmark.

In accordance with these goals the company is certified with two international, environmental management standard systems. The facility manages to recycle 50% of the waste it receives, thus greatly reducing the amount of solid waste being landfilled

LEFT: View of the compacting of shredder waste - waste from vehicles and other appliances that are shredded to reduce volume.



RIGHT: Section of the Odense Landfill showing the lining layers that protect the underlying soil and aquifers from contamination.



Activities at the Environmental Center:

- Receiving area, workshop and administration
- Pre-treatment plant for processing leachate
- Composting of yard waste
- Composting of biomass (sludge from sewage Treatment)
- Treatment of soil contaminated with oil
- Screening of slag from waste incineration
- Intermediate landfilling of possibly recyclable waste
- Intermediate landfilling of combustible waste
- Landfilling of asbestos-containing waste
- Landfilling of shredder waste
- Landfilling of waste suitable for landfilling

and extending the lifetime of the landfill. The environmental efforts of the EC managed to extend the estimated lifetime of the landfill from 30 years to 130.

One of the activities of the EC is the Educational Outreach program that opens the doors of the facility to anyone who wishes to learn about the EC or modern environmental management practices. Highlighted is the 2-week biomass composting course.

Also of note is the production of energy for the surrounding community from gases generated by the decomposition of gases from the now closed landfill.

Design Implications

- By incorporating best practices in recycling, composting and other green waste management technologies in the plan for a new landfill, costs and space needed can be greatly reduced.
- An innovative, regional landfill for the municipality of Fronteras can be a major employment source for the area
- Careful management of the former dump site can reduce pollution, generate energy and create open space
- Location of a new landfill must be carefully considered so as not to affect groundwater and fertile soil



LEFT: The site lies along Canada's western 'Sunshine' coast, 90 minutes from Vancouver

RIGHT: While still within easy walking distance the location of the light industrial park is on the periphery of the village

ECO-VILLAGE | SECHELT, BC, CANADA

Background

Eco Village is a development which began in 2007 with the objective of creating a small, sustainability-minded community designed for people to live and work within a small area. The plan for the village included the development of a light industrial park within the 30-acre development site.

Relevance

Though this new 'village' differs greatly from Fronteras in a multitude of ways, the call to develop light industry within the borders of the community to enable walkability to the workplace is a model that Fronteras can look to in developing its own light industrial facilities. Moreover, some of the goals and directives of the Eco-Village light industrial plan may help to entice industrial investors and market products produced within Fronteras' own light industrial 'park.'

Eco-Village, Light Industry

Sechelt, BC lies north along the coast from Vancouver, Canada. The 30-acre development site for the whole of Eco-Village is very small, much smaller than the town of Fronteras itself.

The village is being constructed in accordance with LEED standards (Leadership in Energy and Environmental Design) and is meant to be a walkable community in which people can both live and work. This is an ideal for Fronteras as well -- having adequate jobs for the population within the town so that there is no need for people to leave in order earn a living.

The light industrial portion of the Eco-Village plan is adjacent to other workplace buildings but buffered somewhat by vegetation in order to preserve quality views into the site, to provide wildlife habitat and connectivity and to allow for open, green space for

LEFT: Historically, the Sechelt region has relied on logging and fishing for economic sustenance. The creation of Eco-Village represents a move toward a more sustainable development and economic support model

RIGHT: Industrial development tends to be envisioned as large scale 'big box' buildings surrounded by parking and set outside of town like this one in Ann Arbor, MI. But this is only one model for development and it does not suit Fronteras well

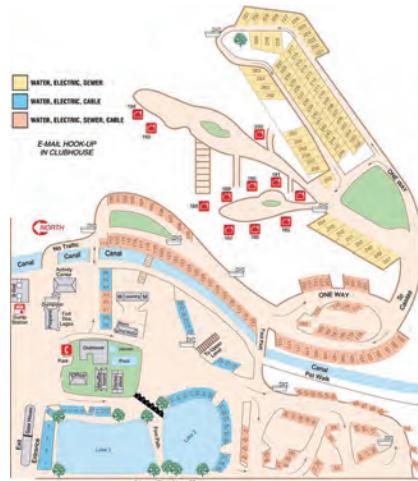


workers and residents to enjoy the outdoors.

While Fronteras cannot afford to be overly selective when attracting potential industrial development, it is important to think about the overall environmental impact of the industry recruited and the subsequent effect on the health of the residents of the town. Eco-Village has created a set of bylaws regulating the types of businesses allowed, thereby maintaining the integrity of the site and concept and attracting environmentally-friendly businesses that want to be associated with that type of development.

Design Implications

- Locating complimentary functions (such as farms and packaging facilities) near one another can save fuel and time
- Clustering buildings together can create a campus-like approach
- Adequate vegetative buffer is needed to preserve rural views of, and from, the town
- Green space surrounding light industrial buildings can function as a park-like setting and provide for wildlife habitat as well as help to mediate pollution



LEFT: The entrance to the St. David RV park is clearly marked for visibility from the road but the park itself is set back to allow quiet and privacy for visitors

CENTER: Many campsites in St. David are located facing the water and have outdoor cooking facilities

RIGHT: This St. David park plan shows the layout of the campsites and the various amenities

WESTERN HORIZON RESORTS | SAINT DAVID, ARIZONA & KINO BAY, SONORA, MEXICO

Background

Western Horizon Resorts RV Camping Network is a private network of RV campgrounds primarily located in the Southwestern United States.

Members pay daily fees, that vary by campground and season, for a camp site, water and electrical hookups, and other amenities. Individual members have the option of making reservations at any of the affiliated RV parks and are often eligible for discounts on daily fees. Many of these campgrounds are set up for long-term (four to six weeks) stays.

Relevance

Fronteras can take advantage of its prime location along a major North/South highway by establishing the first inland RV campground in Sonora, Mexico. Given the adequate open land and the adjacency to many natural and cultural amenities, Fronteras could appeal to winter ‘snowbird’ RV travelers from the

United States and Canada for short- or even-long term stays.

The Western Horizon RV campgrounds at in St. David, Arizona, USA and Kino Bay, Sonora, Mexico are good benchmarks for an RV center in Fronteras due to their relative proximity, attraction to similar user groups and comparable natural aesthetic.

St. David RV Resort and WHR Kino Bay

The St. David RV Resort lies midway between Tucson and Douglas (the border crossing for Fronteras) in rural Arizona. St. David, AZ sits at an altitude similar to Fronteras and thus users of the park enjoy a delightfully comparable landscape. The rural location is similar also in terms of distance to services such as medical facilities, gas stations and banks.

St. David RV Resort is open year round and has 173 full and 42 partial site hook-ups along with a trailer and small casita cabin for non-RV travelers.



Simple, 30 amp electrical and water hook-ups are provided both in St. David and Kino Bay

LEFT: Clubhouses, like this one from Kino Bay, are important as they provide RV travelers with social outlets and often have services such as laundry, kitchen and bathrooms

RIGHT: The Kino Bay RV campground separates camp sites in order to capitalize on good views of the mountains and ocean. The ground is bare earth with sites and roads delineated by stone



WHR Kino Bay Details:

\$5 USD daily usage fee includes:

- 20 gallons of water (non-purified)
- electrical hook-up (30 amp)
- 1 'Honey Bucket' visit per week (sewage disposal)

On-Site Amenities

- clubhouse
 - kitchen
 - gathering rooms
- pool/hot tub
- public bathrooms
- coin showers
- coin laundry
- purified water for purchase

The site offers a variety of amenities including a pool, several outdoor games such as shuffleboard and horseshoes, as well as an artificial lake attracting local and migratory birds.

WHR Kino Bay is located west of the city of Hermosillo on the Sea of Cortez. The campground itself is a 100 acre site located on the beach front. The park has 89 full sites all with ocean views.

The Kino Bay RV park is designed to accommodate long-term camping (up to six weeks) but also allows short term (daily) camping. The park is closed during the summer months.

Design Implications

- Water is a major draw for RV travelers. Locating an RV park near a lake or a water treatment lagoon will bring birds and other wildlife and meet the aesthetic expectations of campers. Those who stay long-term expect pool or other water recreation facilities
- Locating an RV park on the outskirts of town is desirable to minimize visual conflict and to provide a natural setting
- A small park with fewer than 30 utility hook-ups is more than adequate
- Amenities such as laundry and grocery services/facilities and a club house should be planned





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 - Plazas Miradores
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 - Educational District
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 - Wastewater Wetlands

Design success and relevance is incumbent upon the ability of the landscape architect to stay at the forefront of research and innovation in the profession. For this reason, a thorough review of seminal and emerging theories in design, planning and landscape architecture is completed at the start and throughout the design process.

This chapter documents the literature review process and highlights the elements most pertinent to Fronteras and the development of its revitalization plan. The overall theories and their design implications then become the overarching principles guiding the design process.

The literature reviewed includes economic and ecological development principles as well as theories on town planning and architecture.



LEFT: Highway 17 cuts through Fronteras. Few elements slow traffic or direct visitors.

RIGHT: The local landfill is unregulated and pollutes the town. Plastic trash bags blow for miles.

SUMMARY OF FINDINGS

In order to ensure a responsible approach to development within the town of Fronteras, issues identified through intensive site analysis and thorough case reviews must receive further inspection to identify interrelationships within the town's multiple systems (i.e. transportation, business, ecology, urban infrastructure, etc.). Issues are categorized according to Functional, Environmental, Economic, Aesthetic, and Socio-cultural ordering systems.

FUNCTIONAL

Circulation represents the greatest functional challenge to Fronteras.

Major circulation is defined by highway 17, which divides the middle of the town. This highway induces high traffic levels and speeds, while hindering access (pedestrian and vehicular) to both sides of the pueblo. The main highway exit is also obscure and inhibits travelers from entering Fronteras. Wayfinding elements along circulatory routes are limited, while

inadequate road surfaces deter exploration in some of the more appealing areas of the town and region. We intend to respond to these issues with traffic calming strategies, defined pedestrian and vehicular highway crossings, streetscape improvements, complimentary routes, and emphasis on alternative modes of transportation.

ENVIRONMENTAL

Fronteras is located in a region with consummate natural treasures. The ecology within the surrounding Sonoran foothills and Sierra Madre mountain range attracts researchers and vacationers from all over the world. Waste management, however, represents the greatest environmental challenge to face Fronteras.

Existing waste management strategies and facilities are increasingly polluting the rural town and environment. The current waste water management lagoon is old, small, and exhausted. The landfill is unregulated and located within close proximity to

LEFT: This agricultural field has been farmed for over 250 years.

RIGHT: Lake Juribana may generate income as an ecotourism and recreation destination.



the town. We intend to address this challenge by proposing various waste management strategies and recycling options that benefit the environmental and economic values of the community. These strategies will help identify the type and location of waste management facilities.

ECONOMIC

The rural community of Fronteras maintains a strong agricultural base. Vegetable crop production is the largest source of income for town residents. Nearby ranches also generate revenue through cattle sales and beef production. External agricultural competition and limited internal economic diversification epitomize the community's greatest economic challenges.

Fronteras agricultural origins begin in the early 18th century. Many of today's crop fields have been farmed for over 250 years. Agricultural production processes have remained constant and relatively

unchanged throughout that extensive period of time; although, plot sizes have decreased as families divide farm land between succeeding generations. Many family farmed agricultural fields are no longer economically viable, as costs outweigh revenue potential. External companies can out compete local farmers in the regional market by offering economies of scale. Because traditional agricultural practices are not as practical as they once were, many male residents have relocated. Much of the remaining population subsists upon light industrial work provided by external companies. These foreign companies, however, don't always have a vested interest in the community. Money doesn't stay within local hands. Fronteras has already seen the departure of its most recent major income generator, as that external company relocated to a more profitable location. In order to stabilize and diversify the economic foundation within Fronteras, we propose the introduction of niche, specialization,



LEFT: Salon Fronteras, a multipurpose facility, sits along the highway above the northern entrance of the town, but doesn't relate to the historic identity nor cultural aspirations of the community. Its location blocks views of the eastern foothills, and draws activity out of the center of Fronteras.

RIGHT: This culturally significant building anchors the main entrance into the community, but suffers from neglect and degredation.

and alternative agricultural practices (i.e. green house farming, value added food production, organic farming, aquaculture, etc.) This also provides an opportunity to incorporate agricultural education within the economic framework. We also encourage local entrepreneurship, based on regionally identifiable resources and services. These business opportunities should appeal to people throughout the world. Such opportunities may include: Spanish language immersion programs, Sonoran culinary programs, home stay travel experiences, equestrian excursions, ranching adventures, camping opportunities, etc. These opportunities, among many others, would form the basis of a local ecotourism strategy that would complement the town's rustic character.

AESTHETIC

The peaceful town of Fronteras exudes a rural patchwork of modest semi-ubiquitous living spaces, dilapidated historic architecture, exotic street side

vegetation, serene agricultural fields, and well preserved grassland and riparian habitat. Universality and historic degradation pose the greatest aesthetic challenges to Fronteras.

Fronteras has constructed various streetscapes and public buildings over the past several decades. These streetscapes frequently showcase common exotic plant materials (i.e. eucalyptus, Italian cypress, bougainvillea, etc.). While the foreign vegetation embodies the essence of modernization, it lacks the ability to generate a unique and accurate sense of place. Current residential expansion has also been modernized at the expense of architectural identity. Various historic structures have even been abandoned, as generational needs shifted and new construction arose. Although the pueblo's aesthetic foundation is rooted in a historical archetype, very little vernacular architecture is represented in modern construction. Though contemporary residents now look toward the future, innovative architectural design

LEFT: Residential expansion has encroached along the edges of "Geronimo's cave prison."

RIGHT: The largest market in Fronteras rests alongside the highway, in order to appeal commuters.



is noticeably absent. We promote the advancement of both indigenous and novel design types; yet, we propose avoiding thematic, trendy, or melodramatic fabrications. We also promote the incorporation of native and near native plant materials, to compliment exotic vegetation within the existing urban fabric. The renovation of historic structures will celebrate original character of the town, while advancing infill projects and protecting scenic agricultural fields and open space.

SOCIAL-CULTURAL

The small community of Fronteras retains a history and culture of distinctively large proportions. Current land uses, however, represent the greatest socio-cultural challenge to face Fronteras. The town's cultural landscape and architecture have been disturbed by sprawl and neglect.

Many land uses have evolved independently, without holistic planning. Much of the commercial activity

in town has developed alongside the highway, discouraging residents and visitors from activating social spaces within the heart of Fronteras. Public open space is also limited, and many amenities are nonexistent (i.e. public bathrooms, bus stops, drinking fountains, etc.). Present residential development is currently spreading throughout the outer edges of the pueblo. This suburban sprawl is disturbing historically/culturally sensitive landscapes (i.e. Geronimo's prison cave, Presidio Santa Rosa de Corodéguachi, etc.) while drawing attention away from the urban core.

We recognize the sensitive nature of revitalization centered land use planning and intend to illustrate opportunities for responsible growth and development that meet the values of the community. We advocate urban infill, mixed use development, pedestrian oriented design, open space planning, recreation development, and historic conservation and renewal.

CONCEPT DEVELOPMENT | REGIONAL SCALE DIAGRAMS



Fronteras regional aerial photo highlighting Highway 17 and the Nacozari River running parallel to one another, the surrounding Sierra Madres and Lake Juribana



1. TARGET DESTINATION

Whereas Fronteras presently attracts little outside attention, its rich history and unique environment will form the foundation upon which the town evolves into a dynamic tourism terminus.

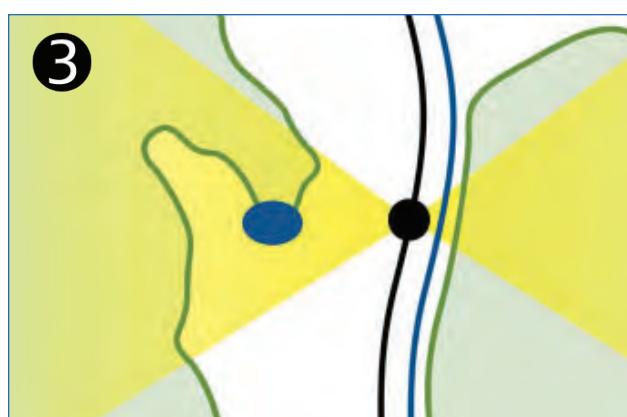
Fronteras will also exemplify novel economic diversification strategies with rural northern Mexico, and serve as a model for the surrounding municipalities.



2. EXPLORATION NODE

Fronteras currently pursues commercial interests along highway 17; yet, East/West points of interest will redirect traffic and provide more valuable cultural interaction between travelers and community members.

The small town will anchor responsible recreational activities and unique educational endeavors along the beautiful landscape East/West of the highway.



3. FRONTERAS FORKLIFT

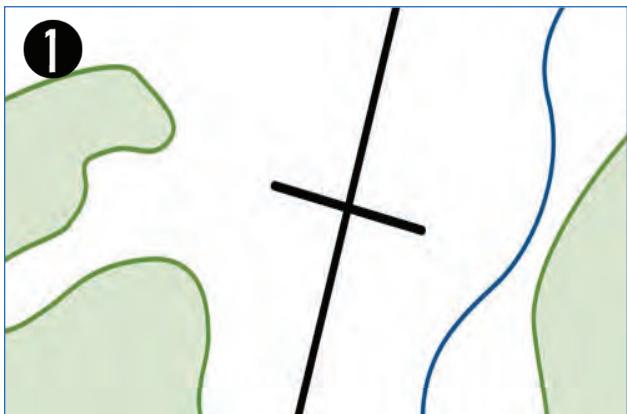
Like a forklift, Fronteras will reach low into its cultural base to raise the economic standing of an entire municipality. Economic diversification strategies include: environmental tourism, cultural tourism, alternative agricultural training, niche agricultural production, and produce marketing.

Fronteras will thrive as it entices business through the outpouring of exceptional educational, recreational, and social opportunities.

CONCEPT DEVELOPMENT | LOCAL SCALE DIAGRAMS

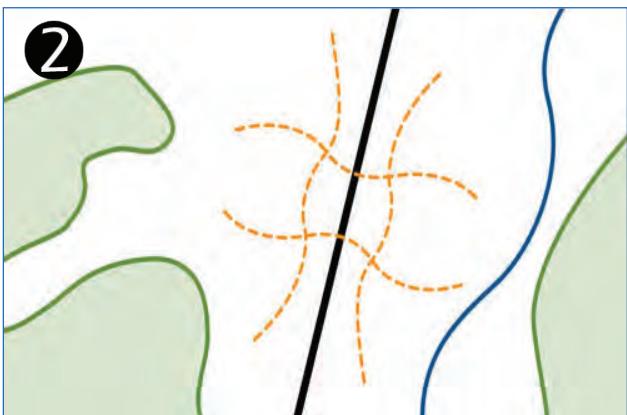


Fronteras local aerial photo highlighting Highway 17, the Nacozari River to the east and the old presidio to the west



1. JUNCTION FUNCTION

Travelers may presently pass by the town of Fronteras without even recognizing its existence. A prominent East/West axis will slow traffic and welcome visitors off of the highway. This junction will lead guests toward several key activity nodes within the community, and form positive first impressions of the urban environment.



2. PEDESTRIAN LACES

Fronteras is currently divided by a major rural highway, and encompasses several disjointed developments.

Like the laces of a shoe, Pedestrian corridors and streetscapes will bind various urban patches and unify seemingly disassociated land uses.

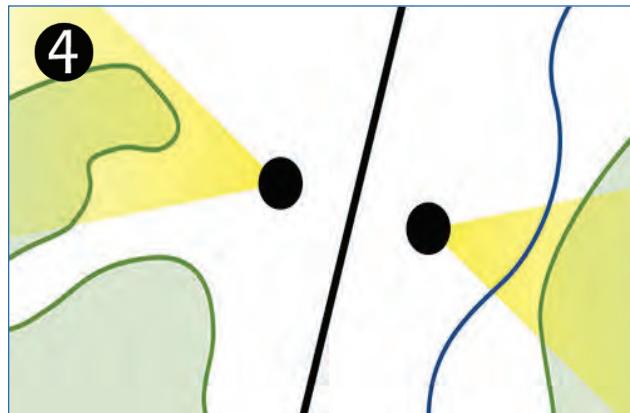
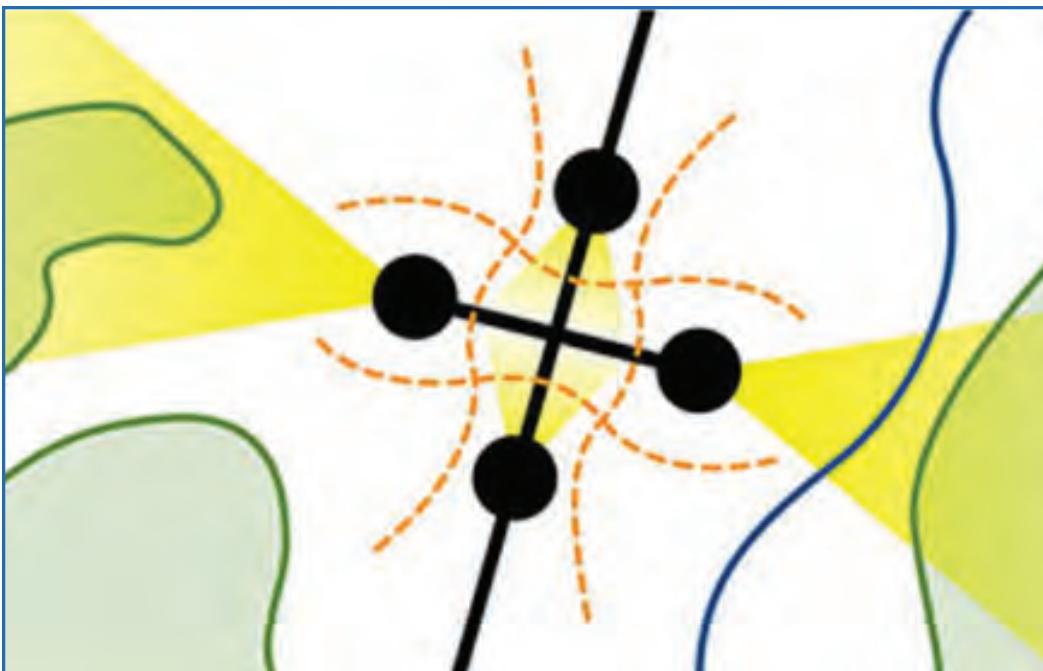


3. INNER RADIANCE

The majority of commercial activity in Fronteras presently occurs alongside highway 17, as businesses pursue northbound and southbound travelers.

Activity nodes on the northern and southern edges of the town will describe spatial functions along the highway and reveal town identity. These nodes will draw guests inward and unveil positive town sentiments about education, commerce, tourism, and community.

CONCEPT DEVELOPMENT | FINAL SYNTHESIS DIAGRAM



4. OUTER RADIANCE

While tremendous historical, environmental, and recreational interests lay east and west of the town of Fronteras, little has been done to organize, interpret, maintain, or unify these assets.

Outer activity nodes will serve as sources of education and recreation, and encourage exploration in the surrounding environment. These nodes will orient visitors as well as provide meaningful interactions with community members.

FRONTERAS FUSION

Fronteras will enhance the lives of local residents through the integration of natural and cultural resources within its urban fabric and beyond.

Redefined pedestrian and vehicular circulation routes will unite various community developments, and the gentle slowing of highway traffic will entice

drivers to turn off and spend some time in Fronteras.

Thoughtful activity nodes will reveal the true “face of Fronteras,” and anchor various commercial, community, tourism, and education spaces.

Fronteras will fuse town values with physical planning concepts.

CONCEPT DEVELOPMENT | ON-SITE DIAGRAMS



ABOVE: Existing land use diagram

Generating multiple concepts is vital during the design development phase. This allows designers to explore the possibilities of multiple solutions to the same problem. Exploration allows one the opportunity to identify both the strongest and weakest portions of an idea and blend the very best into a final conceptual design.

The overall design concept on the preceding pages discusses the need to capture energy in Fronteras and spread it outward, throughout the entire town. Here, two concepts are discussed which use that very theory as a basis; however, they are manifested differently, each with unique expressions of the same final goal.

LAND USE LEGEND

Yellow	Residential
Red	Commercial
Brown	Agricultural
Purple	Public
Green	Open Space
Orange	Mixed Use



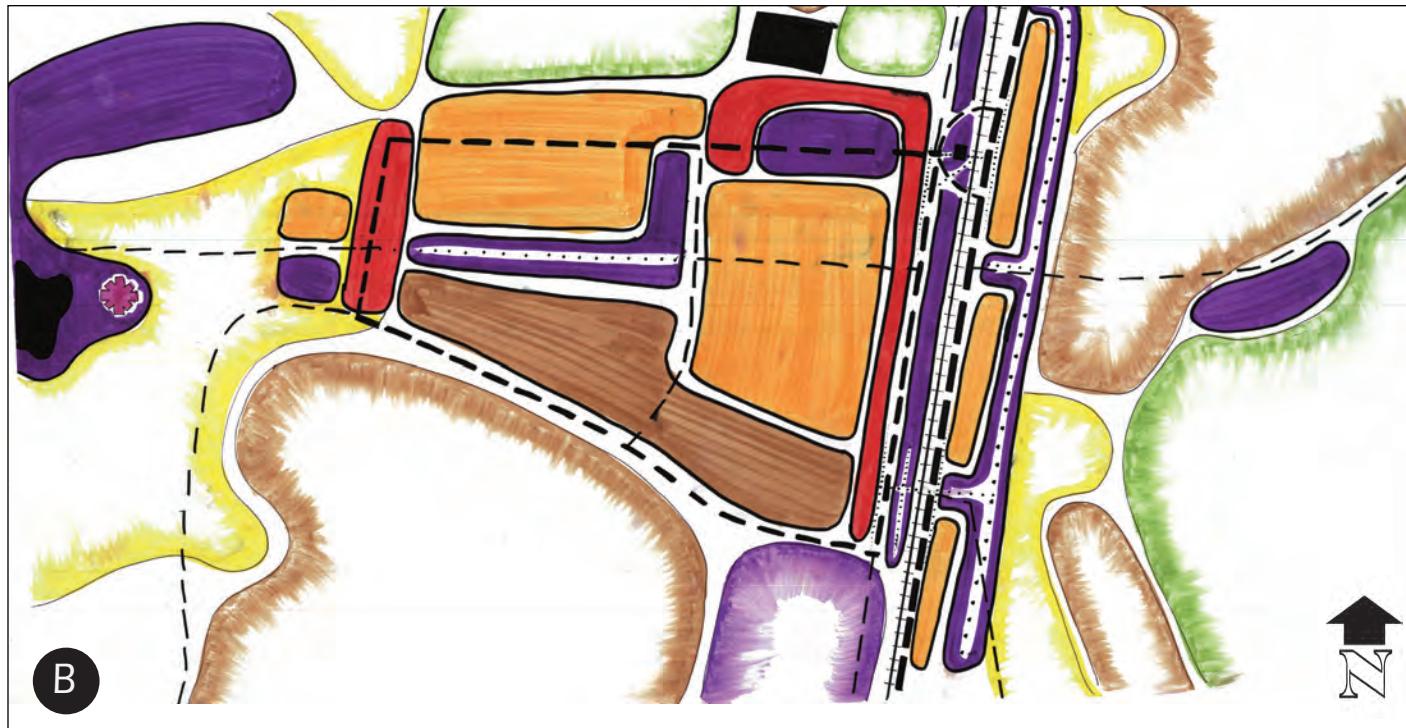
A. CENTRAL CROSS

To further the idea of extending Fronteras' energy outward, the Central Cross concept quite literally creates a very strong vertical east-west access, thereby making Abelardo L. Rodriguez the town's main street. Rather than entering town off of Highway 17 near the train depot, the town's main entrance is now positioned at a central location and users are encouraged by commercial activity to venture east and west.

In addition to vehicular circulation, there is a strong emphasis on pedestrian movement in this concept. Several pedestrian only paths are introduced and the General Ignacio Zaragoza Boulevard is closed off to vehicles creating pedestrian only linear park.

Significant features:

- Strong east-west access and commercial concentration along Abelardo L. Rodriguez Blvd
- Increased pedestrian paths
- Increase of commercial activity along highway
- Pedestrian path through central agricultural fields
- Rear vehicle access to commercial activity on General Ignacio Zaragoza Blvd
- Pedestrian only General Ignacio Zaragoza Blvd



B. TWO FACES OF FRONTERAS

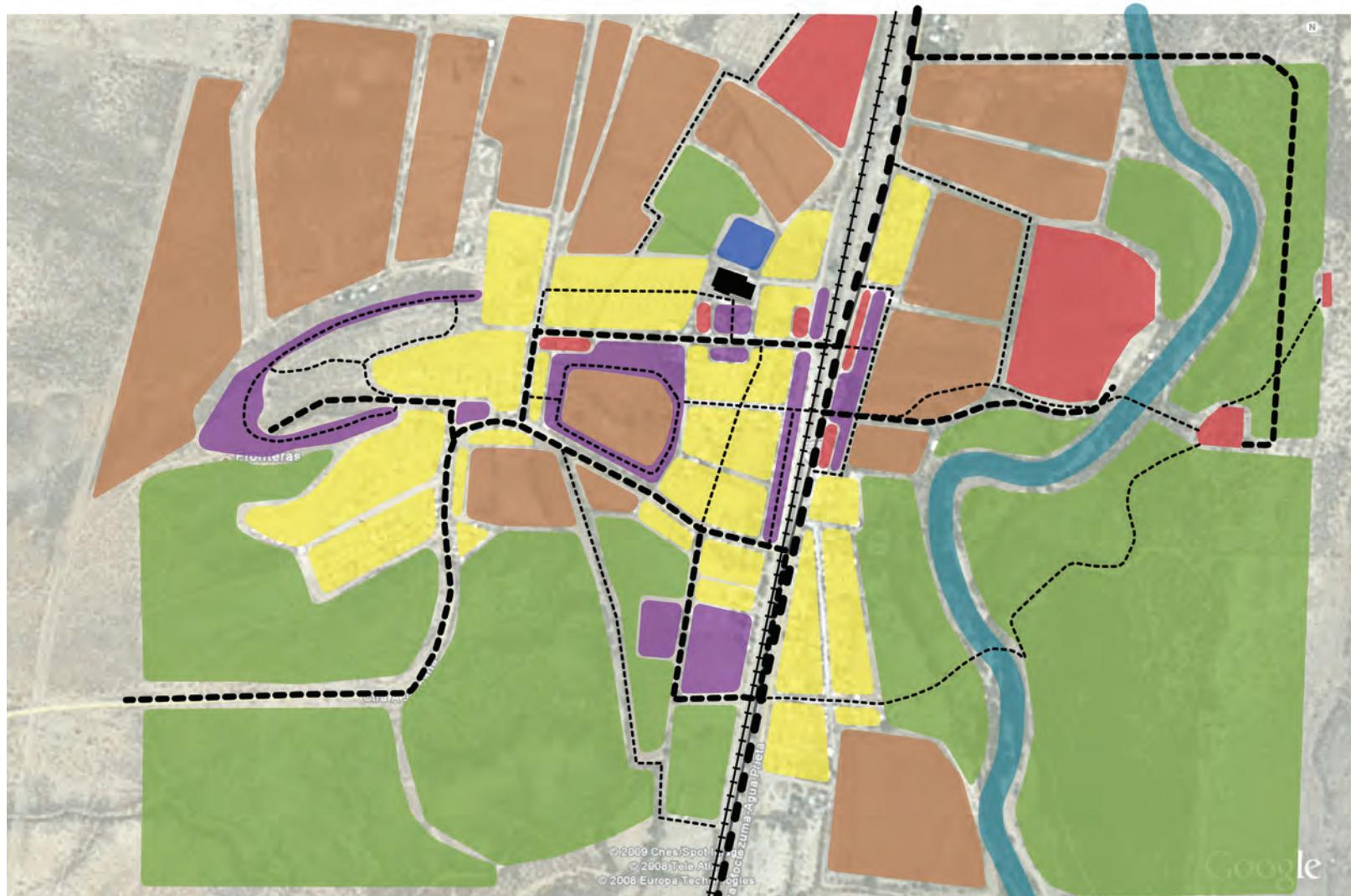
The primary focus of this concept is to maintain Avenida Dr. Samuel Ocana Garcia as the town's main street by focusing attention at the entrance near the train depot and locating commercial activity at the end of the street. To bring attention to the town's east side, widened streets bring attention to plazas miradores and the Sierra Espuelas beyond. Behind the mixed use activity on this side, a walkway connects the placitas for a unique pedestrian experience.

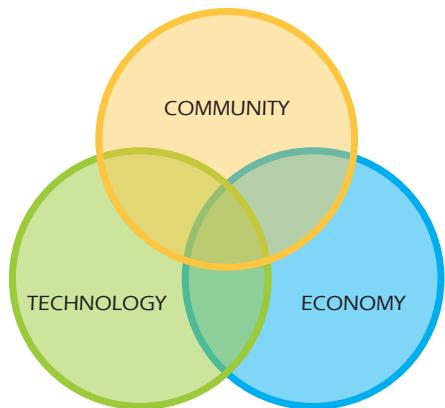
On the west side of town, the southern agricultural parcel has been mirrored along Avenida Pultarco Elias Calles, increasing the rural nature of this street. While the south side has a very historic rural quality to it, the north side of town boasts opportunities for development and new enterprises.

Significant features:

- Avenida Dr. Samuel Ocana Garcia maintained as main street
- Increased pedestrian paths and Hwy 17 crossings
- Introduction of commercial activity along Avenida Juan Aldama
- Visual and pedestrian access along Hwy 17 to plazas miradores and agricultural land east of the highway
- Introduction of a mesa park near the old Presidio
- Northern agricultural parcel transformed to mixed use
- Highly developed north side, traditional south side
- Increased mixed use development

CONCEPT DEVELOPMENT | SYNTHESIS DIAGRAM





DESIGN PHILOSOPHY

Throughout the analysis, literature review and concept development phases of this project an overall design philosophy emerged, specific to the town of Fronteras. With its small-town rural qualities and our own responsibility to develop design solutions which keep its final user in mind, the idea of Community and all that it encompasses became vitally important. Additionally, in order to allow Fronteras room to grow into a self-sustaining town with thriving markets and financial stability, Economy became central to the ultimate success of the Fronteras master plan. In order to help Fronteras become more economically viable, the use of Technology was implemented to give Fronteras a certain edge that would make it a competitive force in the state of Sonora and possibly across borders. These three ideals: Community, Technology and Economy became the primary focus of our research and design solutions and can be seen throughout each of the modules that were designed. On the opposite page appears the Fronteras Final Synthesis Diagram, where pieces of both the Central

Cross and Two Faces of Fronteras concepts can be seen. Exploring and combining the best of both concepts allowed a final design concept to develop and emerge. What manifested in the form of this synthesis concept is a compilation of the best solutions which could allow Fronteras to meet its ultimate goal. These solutions include: increased economic opportunities in key areas of town, a reinvigoration of the existing main street, as well as, the development of a strong vertical access through the center of town. Additionally, Fronteras has been given room to grow through the implementation of in-fill residential development and increased attention on its existing infrastructure. Fronteras' new Green Heart in the center of town has become fertile ground for new ideas and technology in sustainable development to flourish. Interwoven through all of these ideas are the people of Fronteras. Not only do these design solution focus on their livelihood within the town, but there is a focus on the overall pedestrian experience throughout it as well.



A detailed master plan map for Fronteras. The map features several large, irregularly shaped green land parcels of varying shades, representing different ownership or usage types. A winding brown line, likely a road or river, cuts through the land. Two distinct clusters of buildings are shown: one cluster on the left side containing several buildings with green roofs and surrounding trees, and another larger cluster on the right side. Small white squares and circles are scattered across the map, possibly indicating specific landmarks or survey points.

FRONTERAS MASTER PLAN



FRONTERAS MASTER PLAN MODULES

Deciding what projects should occur during what phase of the development process is often difficult to predict due to funding, public interest, political climate and the negotiation process. To better orchestrate that process, we have divided the master plan into likely phasing packages, or modules of development. Each of these modules consists of smaller focus areas which have been grouped according to how they relate to one another or how they should function in the long term. In addition to guiding the direction of development, these modules and their corresponding focus areas [right] have also been used to organize and present this chapter.

The following pages zoom into each of these focus areas, exploring them more closely. At the end of this chapter each module of development is revisited and the relationship between focus areas is explained in further detail. With an understanding that full execution of these modules could take decades, the conceptual master plan is being presented as a synthesis of all of the modules upon completion.

A. Approach & Entry

- Entrances
- Highway 17

B. Pedestrian Interaction

- General Ignacio Zaragoza Promenade
- Plazas Miradores

C. Civic & Public

- Plaza
- Educational District

D. Technology & Growth

- “Green Heart”
- Fronteras Community Center
- Residential Infill

E. History & Culture

- Geronimo’s Cave
- Mirador/park
- Historic sites

F. Environmental Recreation

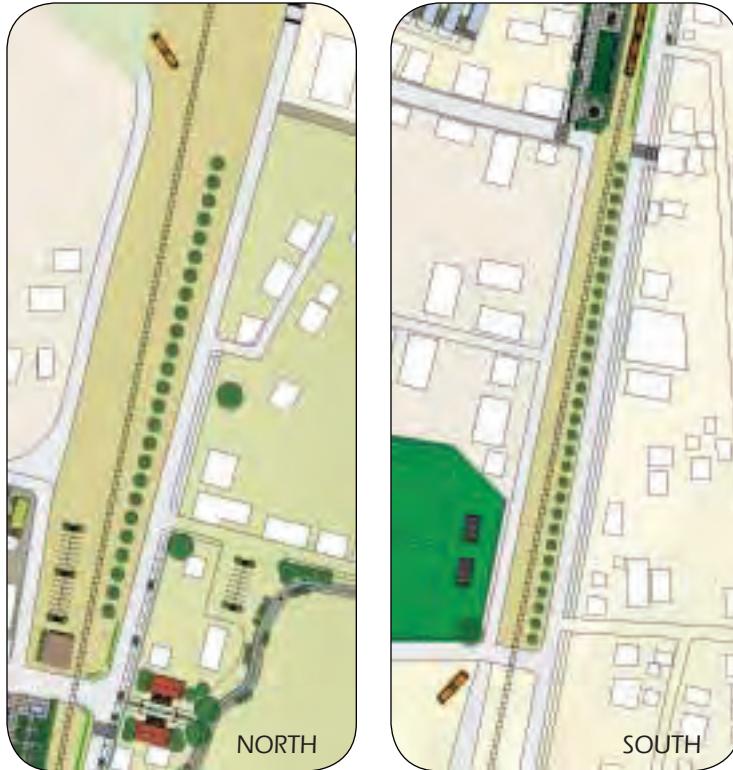
- Ecolodge & Trails
- Lake Development

G. Industry & Enterprise

- Factory
- Light industrial park
- Gas station

H. Fundamental Facilities

- Wastewater treatment wetlands
- Dump
- RV Park

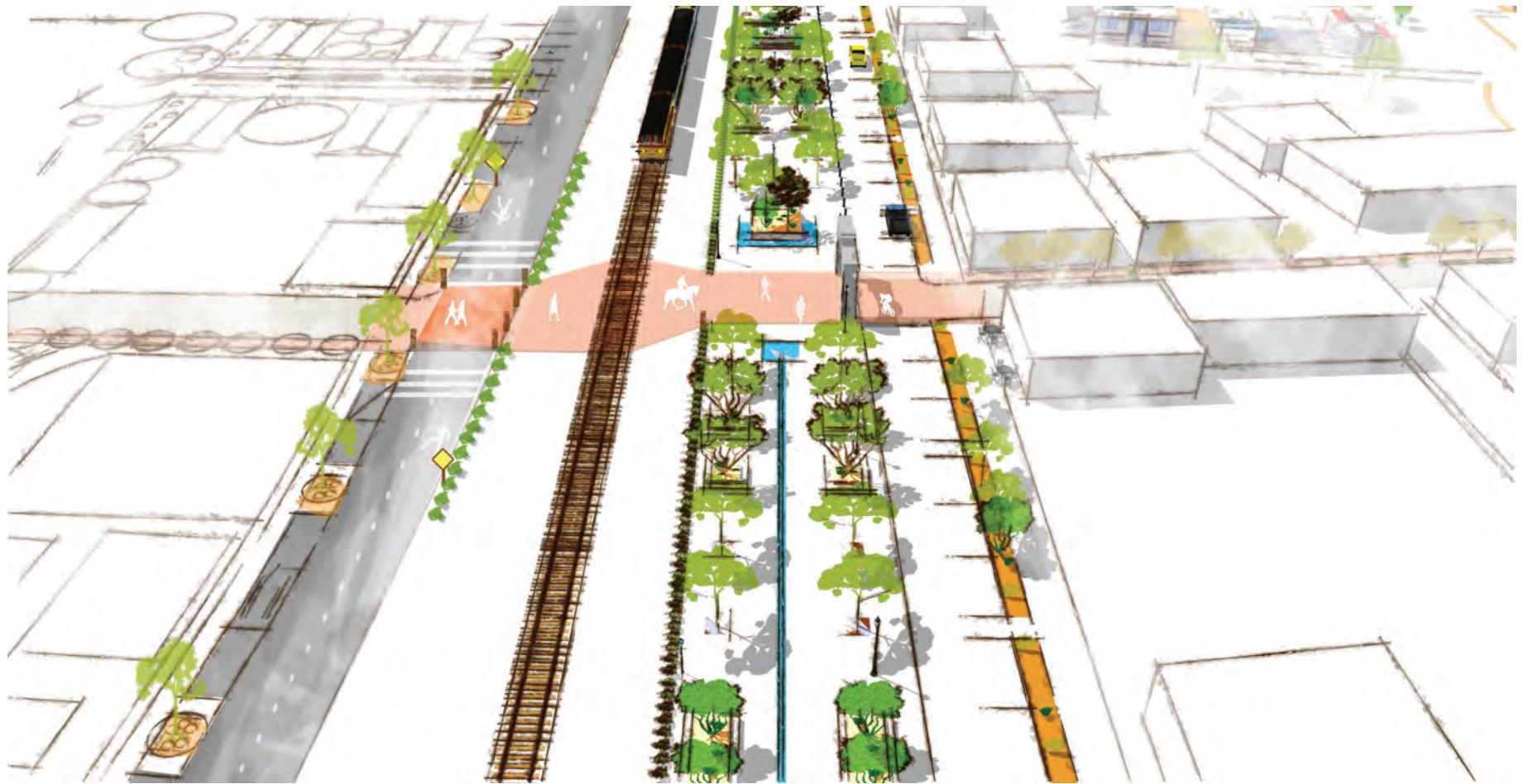


HIGHWAY CORRIDOR

The entry sequence into Fronteras is important as it creates the first impression of the town. Vegetation layout techniques and traffic calming measures were used to slow and invite travelers into Fronteras.

The cottonwood trees at the south entry of town were replicated at the north entry. This line of large, single species trees grounds the town and provides a sense of entry into Fronteras for residents, tourists and travelers.

Traffic calming measures create a safe pedestrian environment and slow traffic. A speed table with contrasting paving pattern was included at the crossing of street Abelardo L. Rodriguez and highway Jose Lopez Portillo. The speed table not only slows traffic, but it also raises pedestrians off the street level to help them see oncoming vehicles. Other traffic calming measures include pedestrian signs, crosswalk markings, stop signs, rumble strips at the north and south entry, and vegetation.



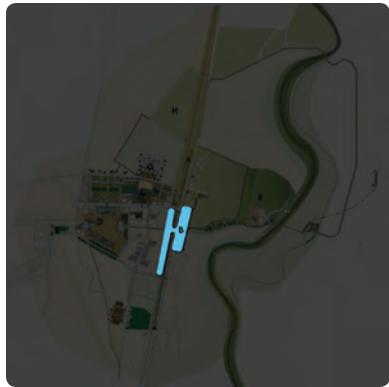
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A driver approaching Fronteras is first welcomed by a sign in the form of a train car, which speaks to its identity associated with the railroad, and she slows down as she approaches a set of rumble strips. An alley of cottonwood trees continues to direct her journey, until the view opens up to the west to reveal the historic train depot, which sits at the major intersection and entrance into the town.

She stops at a crosswalk and as she waits, notices a variety of dining and leisure opportunities along Jose Lopez Portillo. As she moves towards Abelardo L. Rodriguez, she slows down to cross the speed table and park along the promenade, where she enjoys lunch at a local restaurant.





GENERAL IGNACIO ZARAGOZA PROMENADE

The main portal into town is the road and railroad running through town, and the adjacent spaces are the face of Fronteras. The redesigning of the boulevard will help create an inviting and comfortable environment that attracts locals and visitors. In turn, this will bring much needed revenue for the town.

The boulevard was redesigned as a pedestrian plaza, primarily as an area for a farmers market, performances, religious festivities and other events. The redesign focuses on accommodating existing north-south pedestrian movement and across the railroad tracks at three designated pedestrian crossings. Local vehicular use was also considered in the redesign of the boulevard. Residents along the west side park their vehicles along the sidewalk, and the boulevard is used as a vehicular corridor. Keeping this use in mind, a one-way, 24km/h thoroughfare was designed, with continued use of parking.

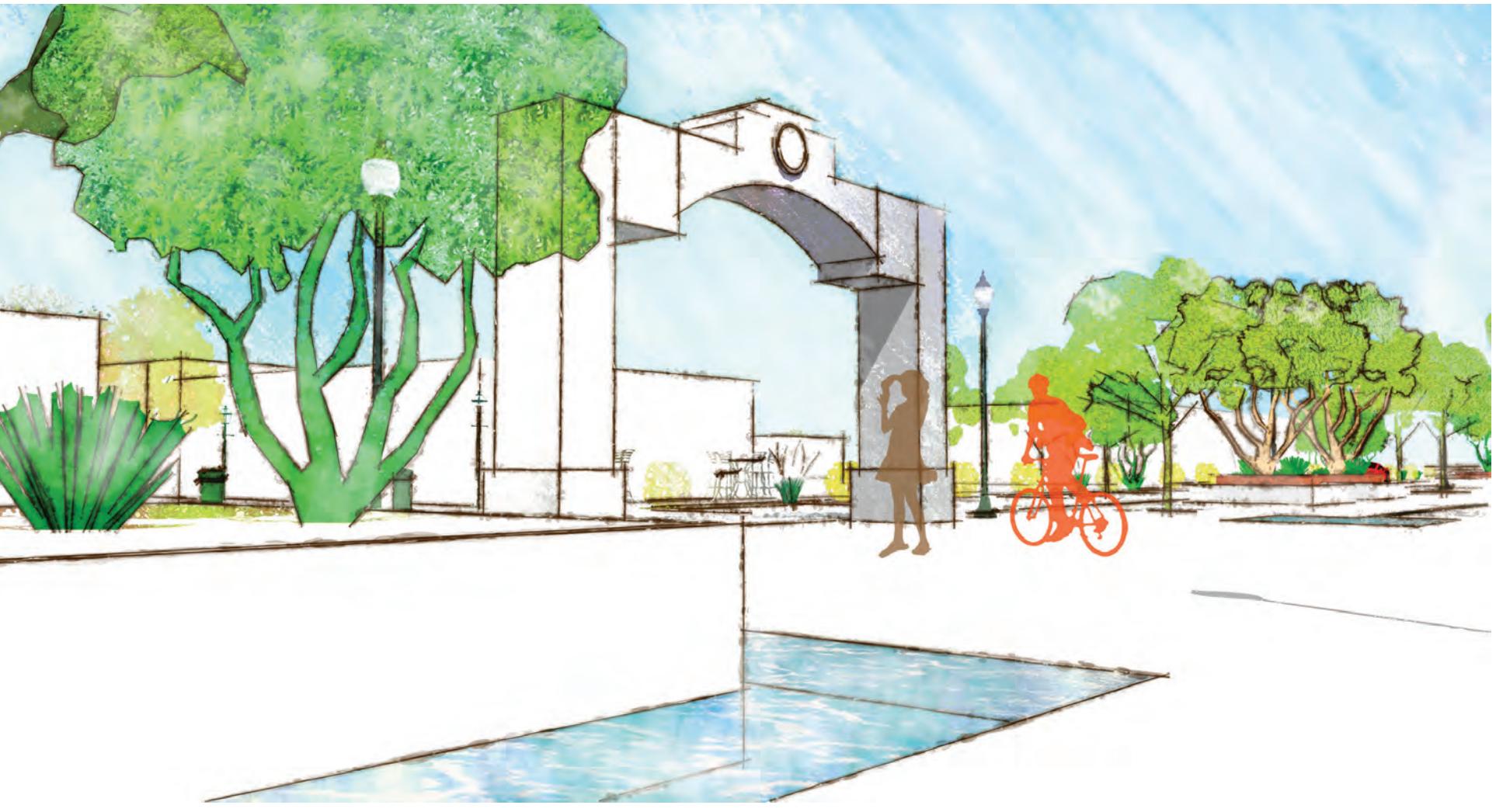


In an effort to accommodate future land use, including the renovation of residential to mixed-use or light commercial, the sidewalk along the existing residential strip was widened to allow space for outdoor dining, passerby, seating, and vegetation. The landscape area in front of the residences is reserved for adjacent residents as communal landscaping space. Currently, neighboring residents use the median as a planting space for small fruit trees, annuals, and roses. The use of the new median will continue this tradition, and promote individual ownership of the new boulevard space.

The largest trees throughout the boulevard are meant to unify the space and create a continuous visual line that extends along the north-south axis,

but also extends east west through the plazas, main town plaza, and the agricultural and architectural center. Smaller trees, shrubs, and accent plantings are used to create pedestrian scale and an aesthetically pleasing environment. The use of an array of tree sizes and dormancy periods also creates a variety of shade opportunities throughout the year. Trees between the railroad buffer zone and the boulevard are of a single species and serve as a physical and psychological buffer, while still allowing visibility across the railroad tracks.

The entry to Fronteras is its first impression and should be a major focus of redevelopment, beautification, and marketing for the town.



The gateway emphasizes the east-west axis. The design and materials are simple concrete and stucco, yet aligned with the local vernacular style. More than an architectural feature, it connects the east agriculture area with the west agriculture area through the urban corridor.

The water features are metamorphic of the existing and historic acequias throughout the region. Where possible, the water used will be from a non-potable source, or from an adjacent acequia. The reflecting pools and linear water feature have an interior black finish, designed to hold slow flowing water. The overall design aesthetic of the boulevard is contemporary, with crisp, clean construction lines and edges.



Seating areas are designed to accommodate a variety of users and activities, from people watching and outdoor performance, to private conversation and outdoor lecture. They are made from integral color concrete with a smooth finish.

The hardscape is composed of local stone in a square pattern and is consistent throughout the entire length and width of the boulevard, including the vehicular surface. The sidewalk surface is composed of the same, but the squares are half the size or less. Trees not in raised planters are set in a bed of local cobblestone, similar to the ones seen in Esqueda.

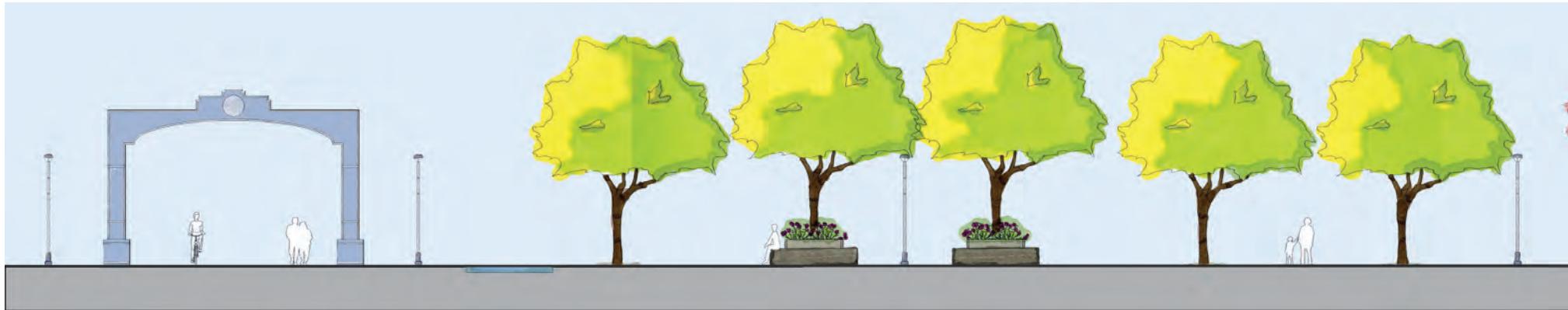


Looking north from inside the kiosco, there is a lawn area for outdoor play, created with children in mind since they use this part of the boulevard as an after-schools play area. The lawn can also have a variety of uses, including audience space for kiosk performances. The kiosk adds emphasis to the south side of the boulevard, and functions as an area for gathering and activity.



Lighting throughout the boulevard will help create a safe environment and active night use of the boulevard. Night travelers who may otherwise not stop in Fronteras will be more likely to stop if the space is lit or active. Day travelers might stop when they see light post banners advertising festivities or events.





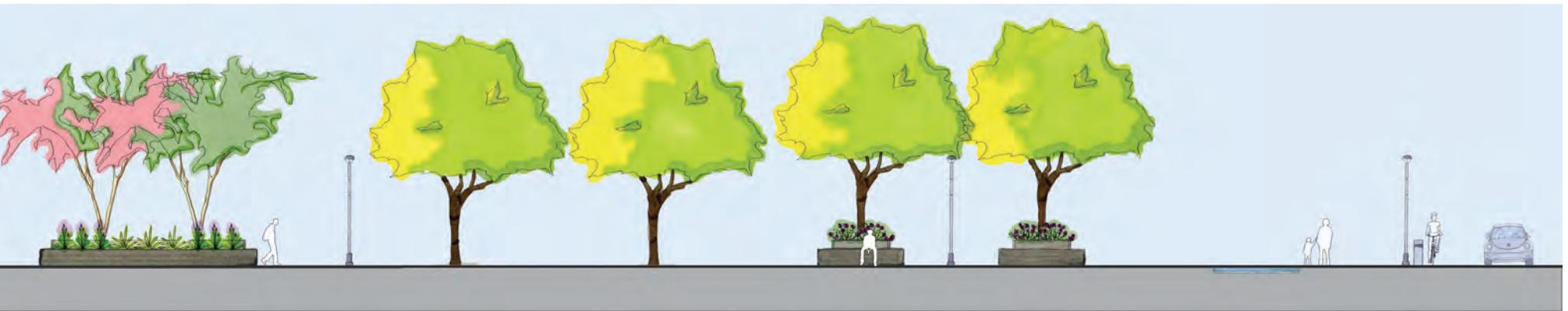
This elevation looks west. It shows the proportions of open space to seating and vegetation, as well as other physical elements. These spaces were designed to provide adequate

room for outdoor markets and events, while maintaining a comfortable pedestrian environment for everyday use.



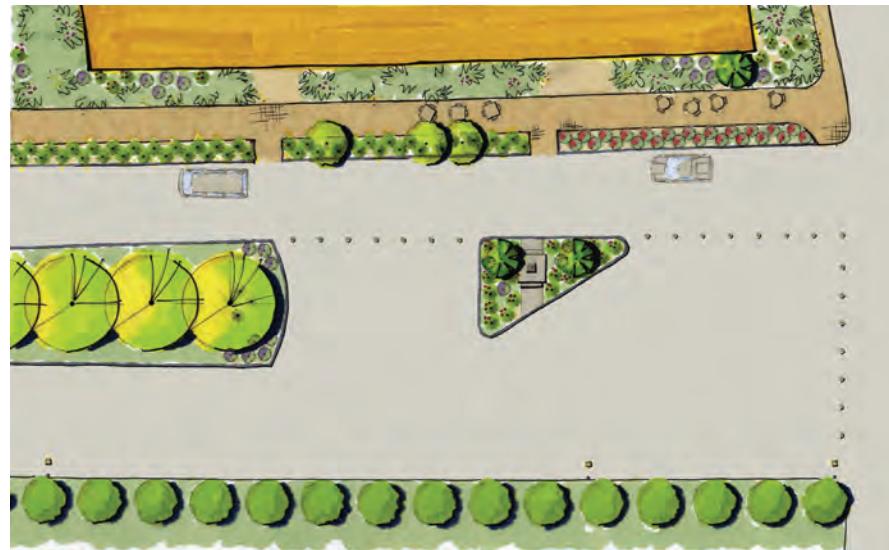
This elevation looks north, showing the elements in relation to each other and to the pedestrian scale. The elevation cut starts at the residential area to the west of the promenade, and shows the relationship with the outdoor pedestrian environment

to the railroad and highway. On the east side, it shows an outdoor amphitheater with seating and trails that lead to the equestrian center.





The addition of simple, inexpensive streetscape elements like bollards and shrubs lining a maintained sidewalk can immensely benefit the pedestrian experience.



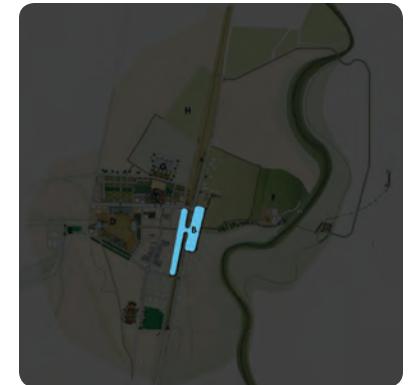
BOULEVARD CHANGE-OUT / OPTION 2

As an alternative, simple steps in the direction of the boulevard design can take place if funding is not available. These recommended steps include maintaining the center medians as they exist, but adding the following:

- Bollards to create a pedestrian only area and a one-way street
- Trash and recycling bins
- 7–10 feet wide sidewalk
- 3–5 feet wide landscape medians next to sidewalk with access points
- Trees in a species ratio of 60:30:10

- Large shrubs between the boulevard and the railroad right-of-way
- Shrubs, accents, and annuals to the existing and new medians
- Marked parallel parking lines

Existing vegetation in poor health should be demolished, and trees not conforming to the tree species ratio should be removed or replanted elsewhere.



PLACITAS

The primary design goal inherent in the placitas and pedestrian walkways on the east side is to open up the existing barrier of buildings along Highway 17 in order to create circulatory and visual permeability. The placitas are intended to be places activated by commerce and deep, verdant vistas from the highway towards the east in a manner that creates secondary east-west axes.

By creating space that is pedestrian-only, the design increases social interaction and allows for integration of community. It encourages outdoor activity next to the comforting flow of historic acequias, and creates an opportunity for pedestrians, bikers, runners, and horseback riders to enjoy the beauty of Fronteras in an inviting public space. The walkways are programmed to be partially paved so that the space can be enjoyed by cyclists, parents with strollers, and disabled individuals.



The placitas were designed to be “punch-outs,” connecting the activity along Highway 17 to the newly-developed pedestrian corridors on the backside. They have been sized and located around public aesthetic amenities to create small-scale commercial activity that could produce jobs and generate income for the local residents. Shop owners will be incentivized to take ownership of landscaped irrigated areas and walkways along their store-fronts in order to maintain an inviting customer environment

The south placita creates an interior courtyard anchored by symbols of both potable and irrigation waters.



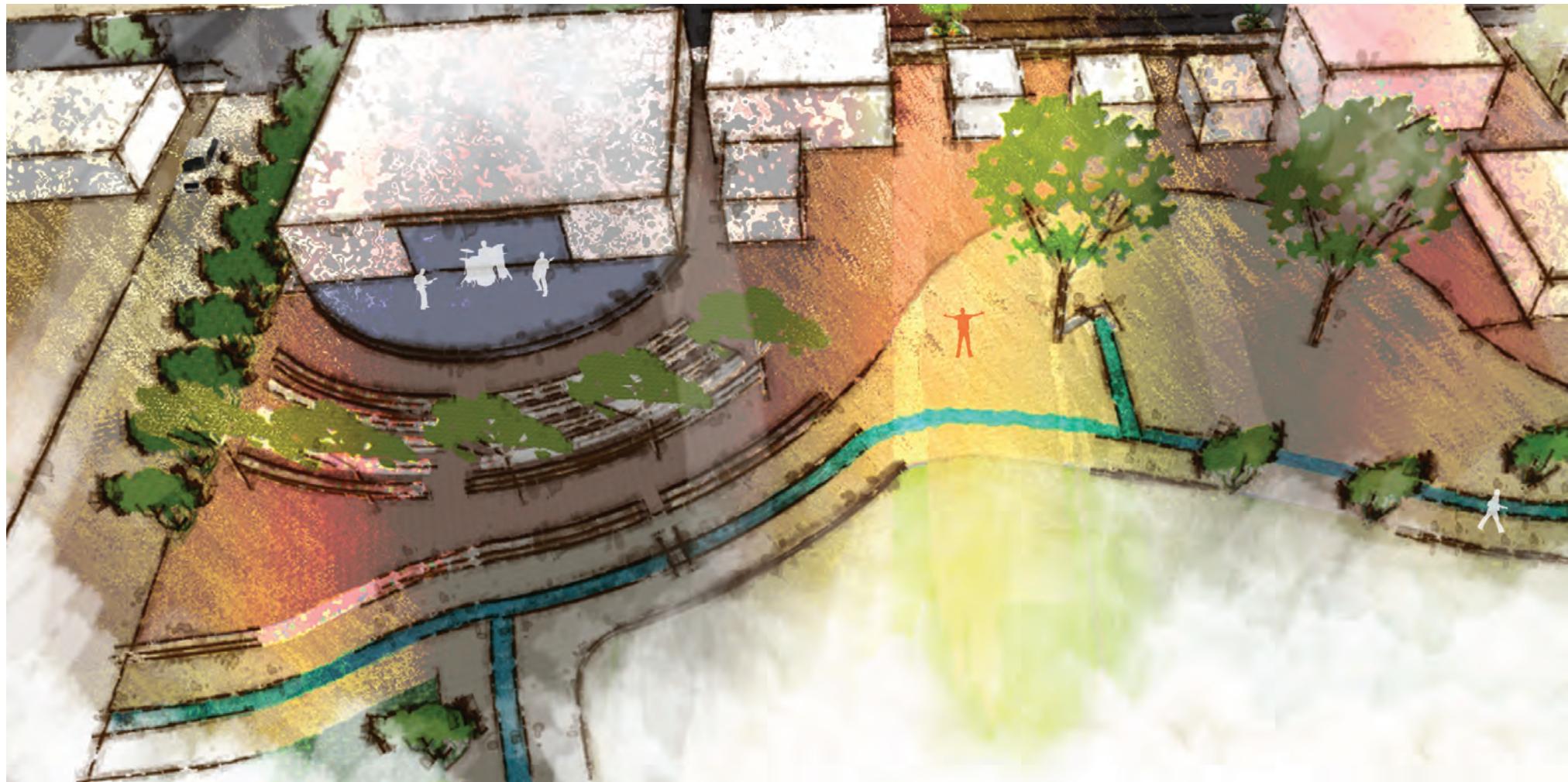


The aesthetic goal of designing a pedestrian, public space to the east was to expose the beautiful back porch of Fronteras. Framed by the views to the east, this circulatory experience on the east side of town is one in which visitors and residents alike can interact and enjoy the landscape.

Cafes along the north placita offer a place for both inward and outward reflection.

"Punched-out" placitas introduce passersby to the rich natural heritage of productive pastures, a beautiful river, and impressive background mountain views

By opening up the east side for pedestrian recreation and access, this design will create a comfortable environment that will encourage local residents and visitors to explore and spend time within the beautiful urban matrix of Fronteras.



existing town gathering space becomes a wellspring of civic pride

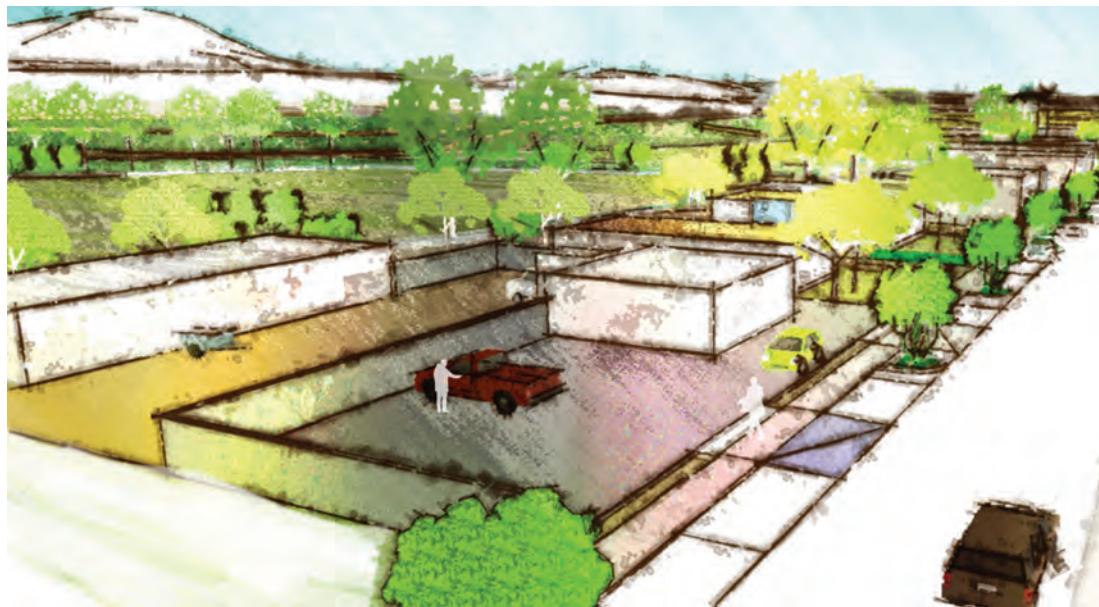


The “back porch” of Fronteras connects landscapes of agricultural and economic productivity.



Another design goal is to optimize pedestrian space while minimally impacting the landscape. Most proposed vegetation along the walkways and placitas will be irrigated by opening acequia waters into gate-controlled basins, reducing the use of potable water. Minimal recontouring will be necessary to these basins, proposed designs avoid major earthworking and demolition and create a tourism-based economy that will hopefully take ownership over the function of the ecological system upon which it depends.

Floodgates invigorate the “front porch” of future enterprise with life-giving, vernacular waters.



Street trees are planted to soften the hard edge of the highway and provide a more comfortable experience for pedestrians.

While the emphasis of circulation is pedestrian through these spaces, vehicular travel will also be improved by the siting of one major parking lot on the north terminus of the paved pedestrian walkway, and designated parallel parking spots complemented by landscaped curb extensions.



PLAZA

In Mexico, plazas serve a variety of purposes: park, party hall, gathering place, and landmark. Plazas are places for festivities and yet they are also places for reflection and solace. From elaborate quinceaneras and weddings to a simple coffee and conversation with a friend, Mexican plazas are spaces that are meant to be enjoyed. Plazas in Mexico also play a vital role in a town's identity, acting as a landmark and meeting place. Often when first visiting a town in Mexico, the plaza will be the place in town that you see and realize that you have arrived.

Fronteras' redesigned plaza has become more of a focal point within the town by connecting it to its surroundings. The planter wall between the plaza and auditorium has been removed and the plaza's main axis rotated, creating a welcoming forecourt to the town's cultural centers of activity. Within the plaza itself much of the geometry remains as this clearly directs movement in all directions. Removal of the fence surrounding the plaza and the addition of smaller trees transforms the plaza into an inviting and comfortable place.



The addition of retail enterprises such as cafes and restaurants can enliven the plaza and boost the economy of the area.



A water feature or other focal point on axis with the auditorium and gazebo can create a wonderful gathering space and entryway for the plaza and the auditorium. Rotating the plazas main access creates a welcoming forecourt to the plaza and auditorium, which can be accented by a water feature or other focal point.



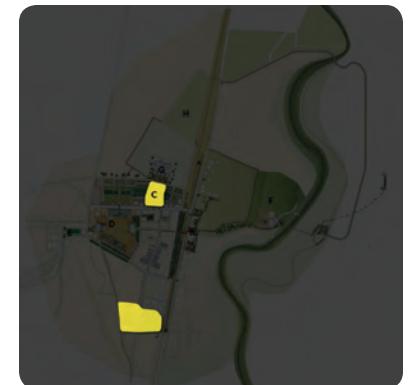
With its ideal location in the cultural center of town, the existing auditorium can be renovated for many purposes such as a movie theater.



Located between the plaza and proposed neighborhood greenbelts, the current factory would be a lovely spot for a future indoor/outdoor marketplace. Here local artisans, farmers and cooks can sell their goods to visitors and community members in a shady park-like setting.



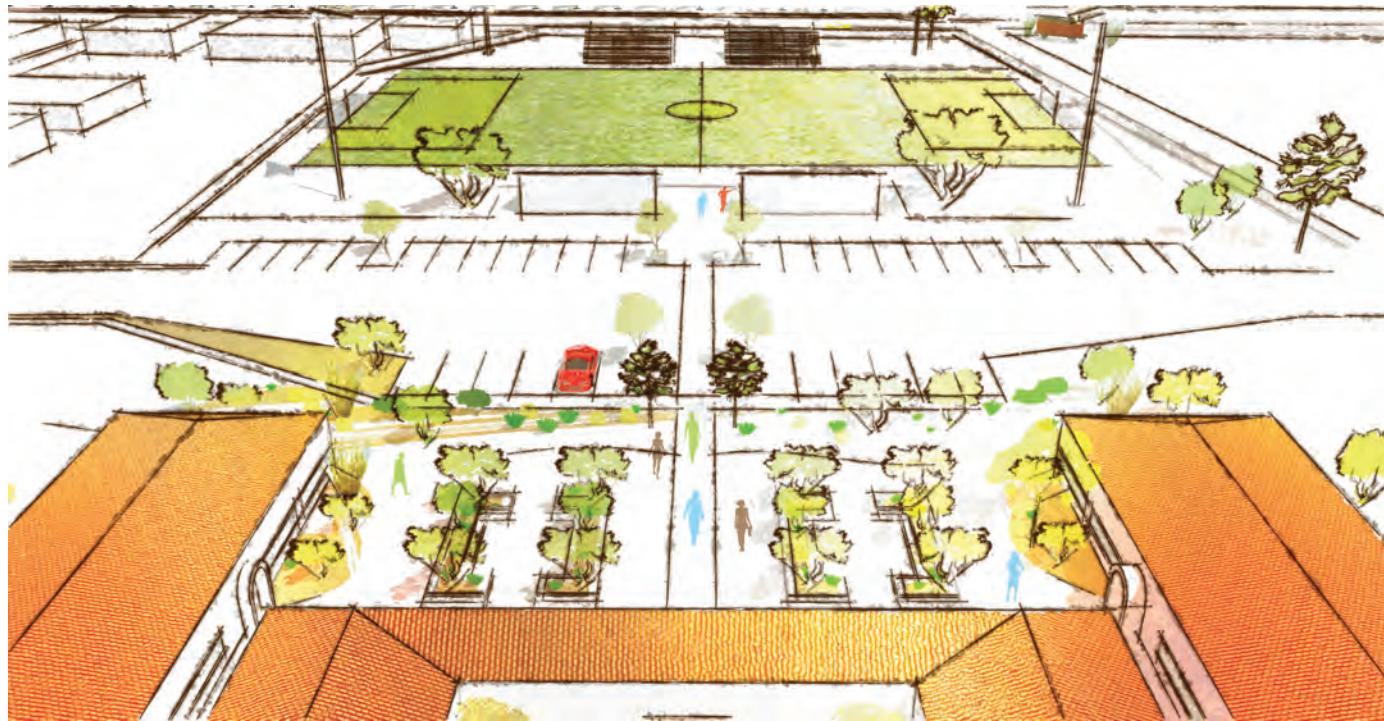
Playgrounds and picnic spaces may be included in new residential development along the neighborhood greenbelt.



EDUCATIONAL DISTRICT

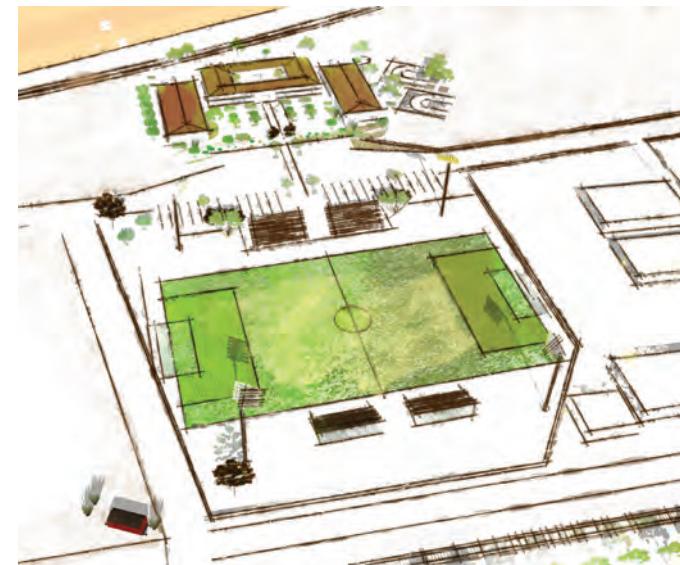
The educational district anchors the southern end of Fronteras and connects with the Gral. Ignacio Zaragoza Promenade. This zone lies between the Yaqui, Balcon, and Girasoles residential neighborhoods. Access to the educational district is pedestrian-oriented, although vehicles may enter from Plutarco Elias Calles road or the newly proposed highway exit, which crosses Blvd. Jose Lopez Portillo south of the present sports facility. Traffic calming strategies must receive the highest priority, in order to slow vehicular circulation throughout the entire district.

This educational zone would include daycare as well as primary, middle, and secondary school facilities. This region preserves the town's pastoral aesthetic and encourages continued agricultural involvement throughout the landscape. Within the educational district the secondary school assumes stewardship of the current sports ground, and provides the maintenance required for a model playing field. This sports field would accommodate students throughout the day, while catering to large outdoor sporting events on weekday evenings, weekends, and holidays.



School/Field Connection: The high school opens onto the western edge of the sports ground. They are connected through view sheds and circulatory paths. Because the school and field are separated by a minor rural road, traffic calming strategies must accompany any development.

High School: The newly proposed high school functions soundly with the renovated sports playing field.



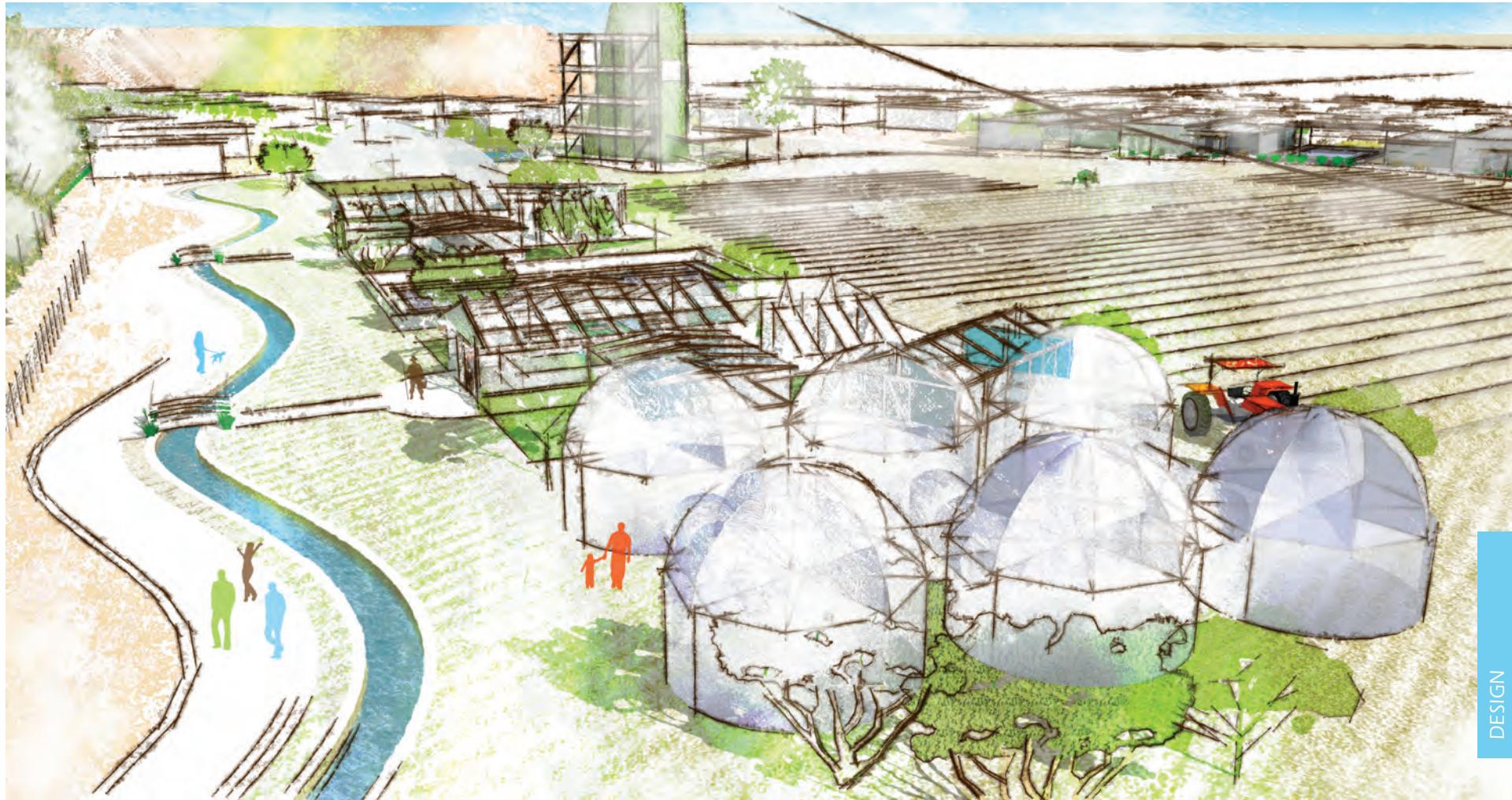


Southern Entrance: The proposed highway exit is anchored by a rustic train car. This exit provides direct access to the playing fields for an evening soccer match.



GREEN HEART

Central to the revitalization of Fronteras is the development of the Green Heart. The Green Heart occupies the vacant ex-agricultural fields between the streets Plutarco Elias Calles and Av. Dr. Samuel Garcia. While the site is accessible by vehicle along these roads, the main entrance is located at the western edge of the residential street Santa Rosa de Corodehuachi. This street would unite with Abelardo L. Rodriguez, to form a major pedestrian-oriented east-west town axis. This facility supports the proposed Institute for Sustainable Community Development (see appendix #) as well as a community center, Alternative Agricultural Learning Center, and iconic vegetative tower.

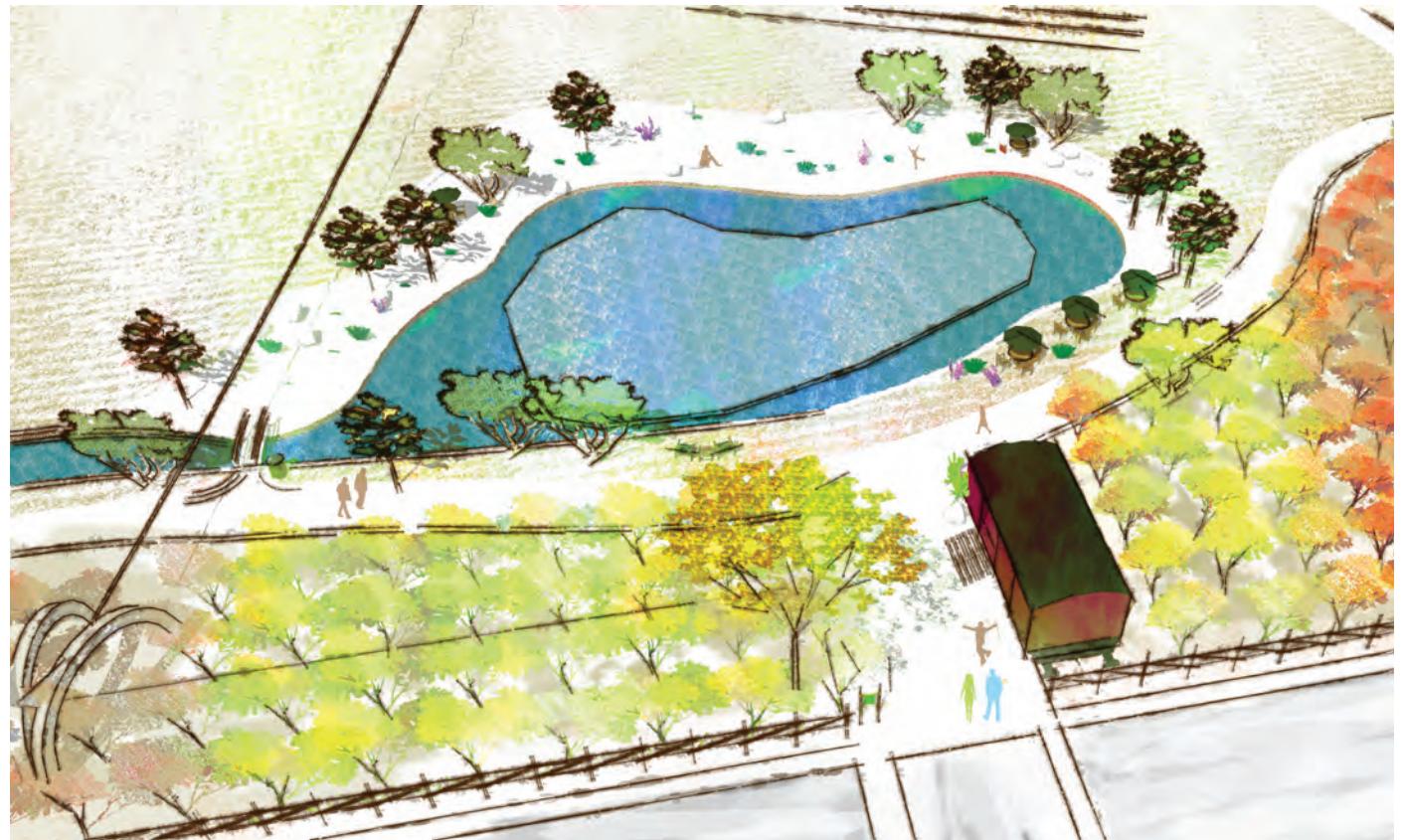


The Green Heart supports a range of alternative agricultural practices.



The main pedestrian entrance to the Green Heart is flanked by a Taco Shop, derived from an old rail car.

The Alternative Agricultural Learning Center may grow catfish in an aquaculture facility. Additionally, catfish byproducts may be used to nourish crops. Surplus fish may inhabit a pond along the eastern entrance to the Green Heart. This pond could provide an opportunity for locals to buy fresh fish, while offering a refreshing retreat during warm summer afternoons.



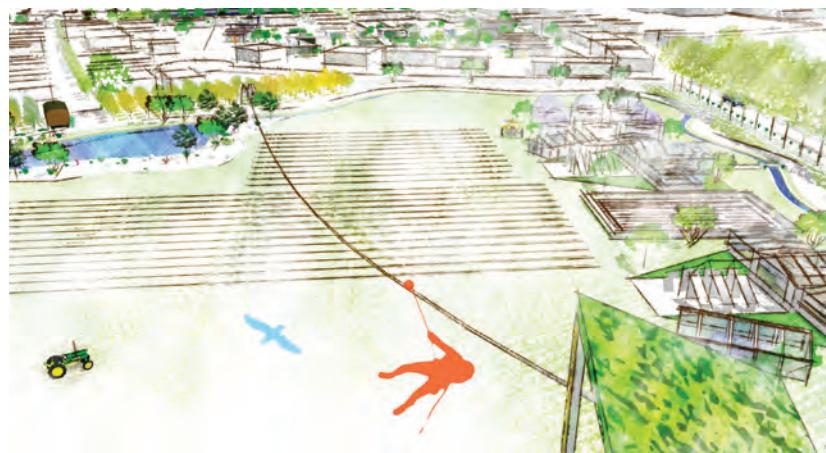
A public trail stretches along the acequia that nourishes much of the Green Heart.





The iconic vegetative tower rises resolutely above experimental agricultural fields. This tower may be seen from the main highway.

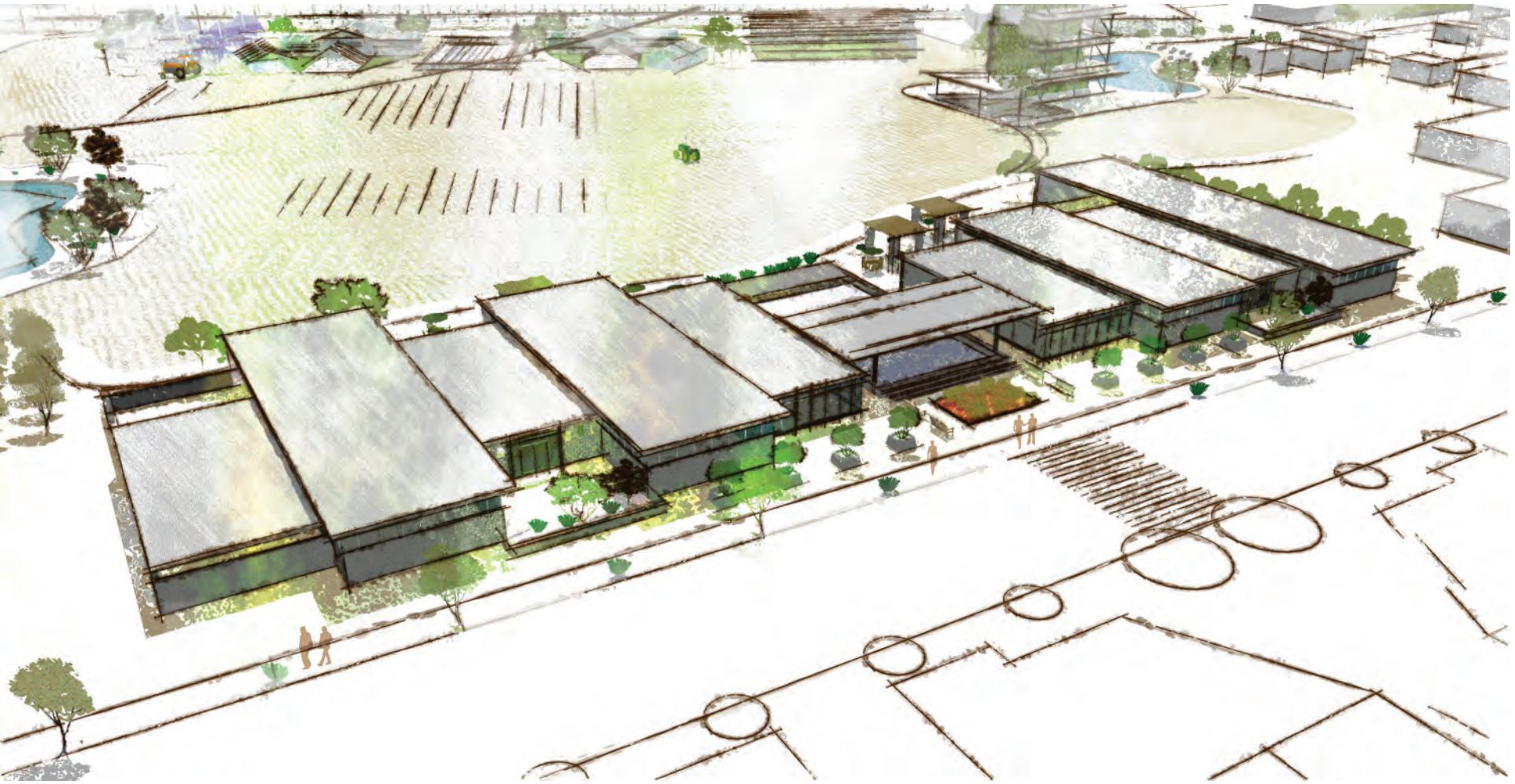
The vegetative tower features a zip line. This recreational component refreshes the agriculture facility and adds an exciting tourism component. Alternative recreational options could include rock climbing up the tower, or bungee jumping from the tower.





Plutarco Elias Calles is the largest residential street in Fronteras. This rural lane links the Yaqui, Centro Sur, and Girasoles neighborhoods with the redeveloped educational district. This country road is lined with large street trees and low shrubs. It is buffered agricultural fields and rustic fences. This street also features signed bike lanes.

Community members from the Ladrillera, Balcon, and Yaqui neighborhood have direct access to the Green Heart.



FRONTERAS COMMUNITY CENTER

The Institute for Sustainable Community Development will combine research and design in the areas of architecture, landscape architecture, and urban design. This facility would ultimately sponsor design/build residential and commercial projects within the town of Fronteras and greater community. This institute has the potential to redefine development within all of rural Sonora.

The Alternative Agricultural Learning Center will provide research opportunities in the areas of greenhouse farming, hydroponics, and aquaculture. This facility could incorporate

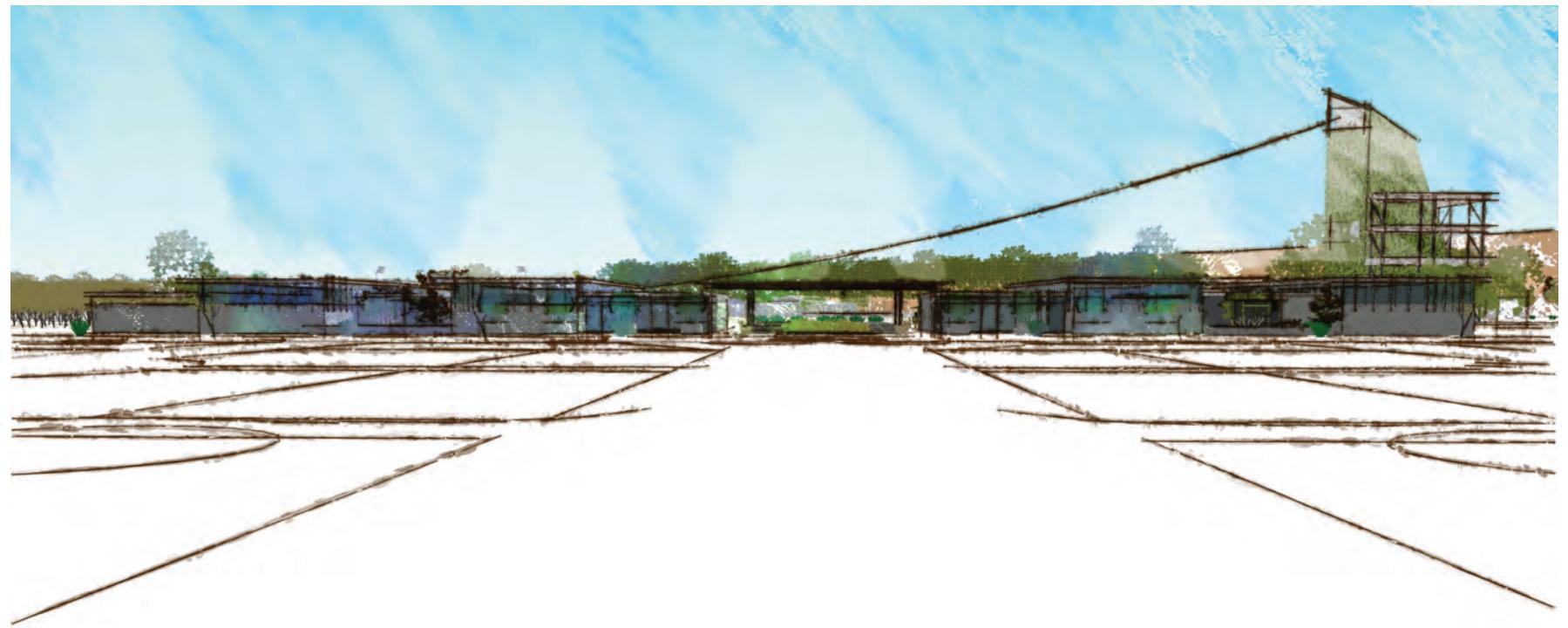
A birds-eye view of the two buildings with agriculture fields behind.

business management, production, and marketing services for niche money crops and value added food products produced within the Green Heart. As a major academic establishment, the center could provide community outreach services for the entire state of Sonora. Services could include learning seminars, apprenticeships, training programs, and marketing assistance. This type of facility may also serve as a satellite campus, partnering with agricultural programs from universities throughout Mexico and the United States.



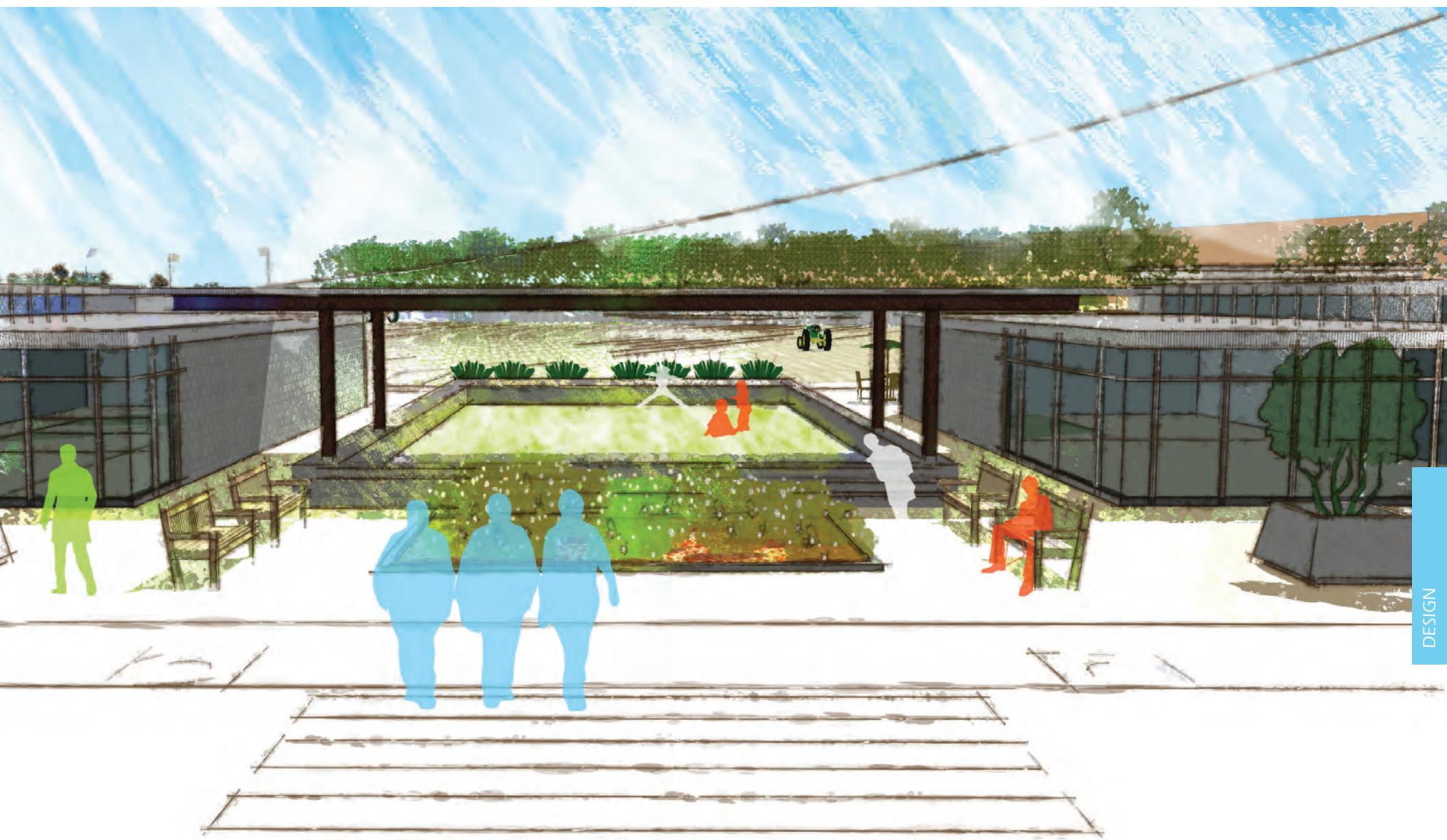
The exterior of the building is designed to fit in with vernacular construction while pushing typical aesthetics establish the building as an icon for the town.

The Community and Research Center opens up to the agriculture fields where new farming practices and pedagogies are developed to help farmers be more successful and knowledgeable.





The alternating roof planes of the community center and research center provide natural lighting into the interior space during the day.



In between the community center and research center is a grassy area which can accommodate a variety of uses including a place for musicians to perform.



RESIDENTIAL INFILL

The Institute for Sustainable Community Development focuses on emerging technologies in architecture, landscape architecture, and urban design, including solar and wind technologies, and materials. The town of Fronteras will be the primary beneficiary of this research, through the design and construction of innovative and experimental homes that showcase LEED principles.

Infill refers to the reuse of land or space within a built environment as a form of redevelopment and containment of growth within a town or city core. The goal is to preserve agricultural lands and natural areas and reduce energy consumption, ultimately creating a healthier town less dependant on automobiles.

The recommended sites for residential infill include the areas along the street Plutarco Ellas Calles, and directly to the east and west of the main plaza. These areas will slowly be redeveloped into active spaces, filling in the gaps between existing structures.



New neighborhoods can display LEED principles and make use of reclaimed and local materials.



New housing may showcase emerging intermediate technologies and sustainable design principles such as water harvesting, solar energy collection and energy-saving planting design.

HOMESTAYS

"Homestay" is a form of tourism that encourages visitors to rent a room in the home of a local family, rather than a commercial motel. Homestays enable residents to earn money from within their own habitation. This form of tourism also creates cross cultural ties between the local populace and foreign travelers. While residents are encouraged to create homestays throughout the town of Fronteras, a central homestay hub and plaza would enable visitors to interact with one another and energize the heart of the pueblo. Incentive for the creation of homestays behind the Palacio Municipal would encourage enduring tourism in a central town location. This area connects directly to the plaza, the green heart, and the principle promenade. The creation of a communal homestay plaza may also serve as a center for dining, socializing, and recreation.

Example Mexican Homestay Websites:

http://www.intercultural-mexico.com/homestay_in_mexico.htm

<http://www.experienciatepoztlan.com/familyhomestay.html>

<http://www.bajacal.com/accommodations/homestay.html>

<http://www.spanishmexico.com/homestay.html>





Vacationers relax under the shade of native trees and play Bocce ball with residents in an open court.



DESIGN

Visitors relax by an outdoor bar and café. This outdoor facility takes advantage of the temperate weather conditions enjoyed by the town's residents.



GERONIMO'S CAVE



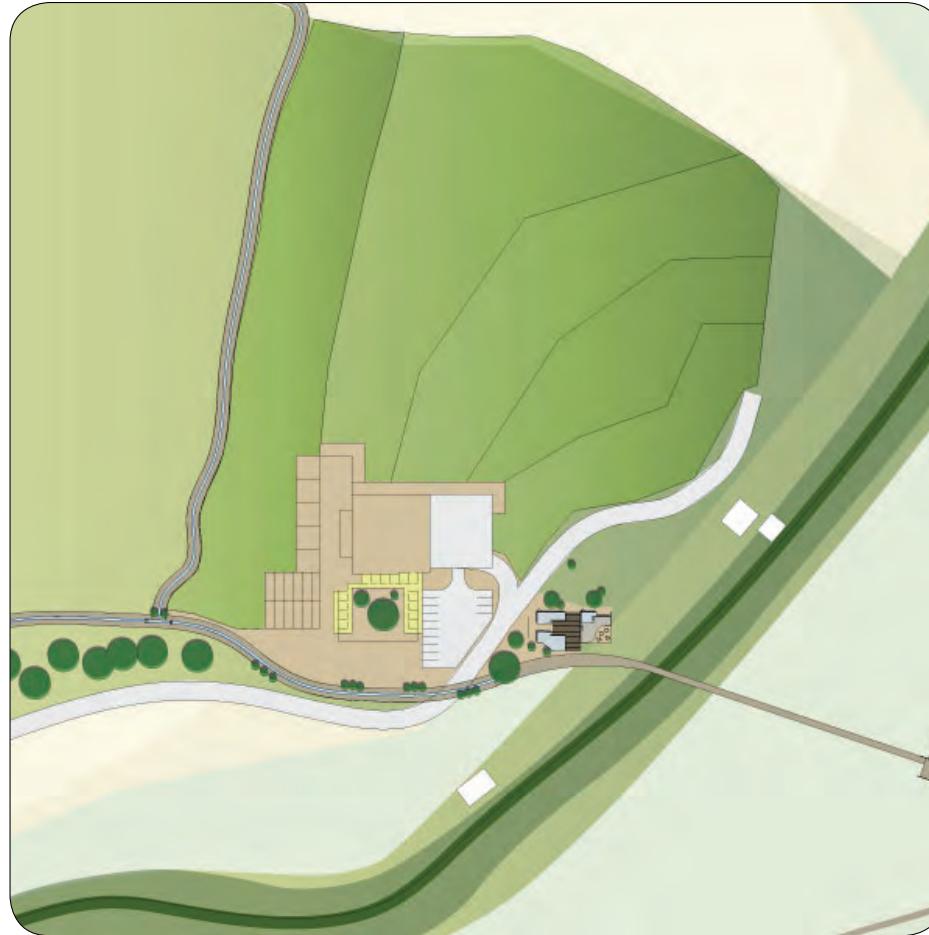
A local park in the El Balcon neighborhood can act as a gathering space and recreation area for residents on the west side of town.

The El Balcon park may also serve as a gateway to a trail system along the mesas to the west, as well as, the historic Geronimo's cave.





A park or viewing point atop the western mesas will provide unparalleled views of Fronteras, in particular its Green Heart.

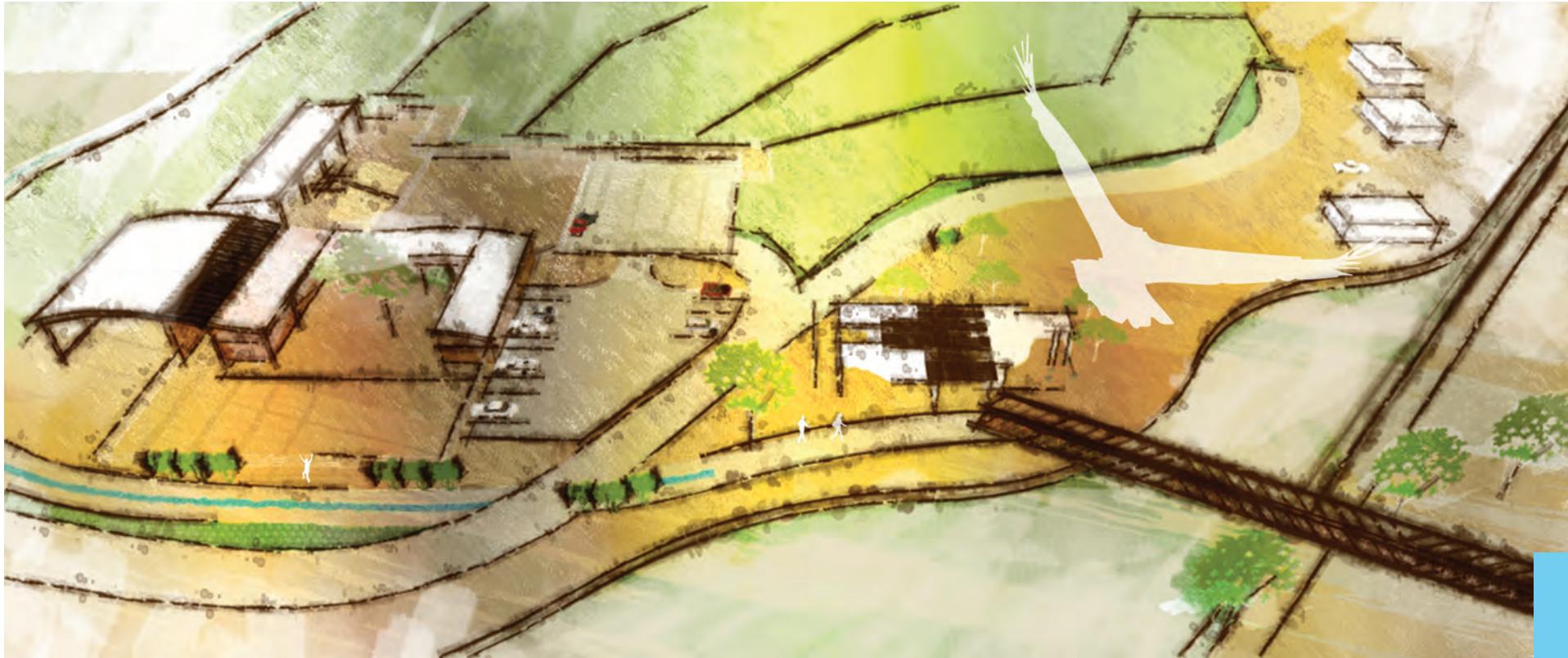


EQUESTRIAN CENTER

Multiple attractions adorn a naturalistic Abelardo L. Rodriguez, emphasizing a central spine of equestrian travel connecting the ecolodge along the river to the Green Heart and beyond. An equestrian center, including stables, pastures, paddocks, and a show ring can be utilized by visiting horse-owners and will also provide resident horses for leaded town and hillside group rides.

Along the east side of the river, a gently rolling river trail runs along the banks from the RV and camping wetlands on the north, past the edge of a wilderness trailhead at the mouth of a rocky canyon, and leading to canopy-level and river-bottom crossings as one heads south. This public river trail will offer a more quiet and adventurous alternative.

Additionally, this trail system will be accessible by mountain bikes available for rent at the ecolodge. In order to reduce conflict between horses and bikes, singletrack trails will be programmed by a single set of users each day of the week (eg., equestrians on Saturdays, mountain-bikers on Sundays.)



As the visitor progresses along Abelardo L. Rodriguez, they are encompassed by a destination that celebrates the outdoor beauty of Fronteras.



Elegant curves of the equestrian center introduce visitors to a slower pace.

Equestrian shows enliven the town with the energy of livestock.

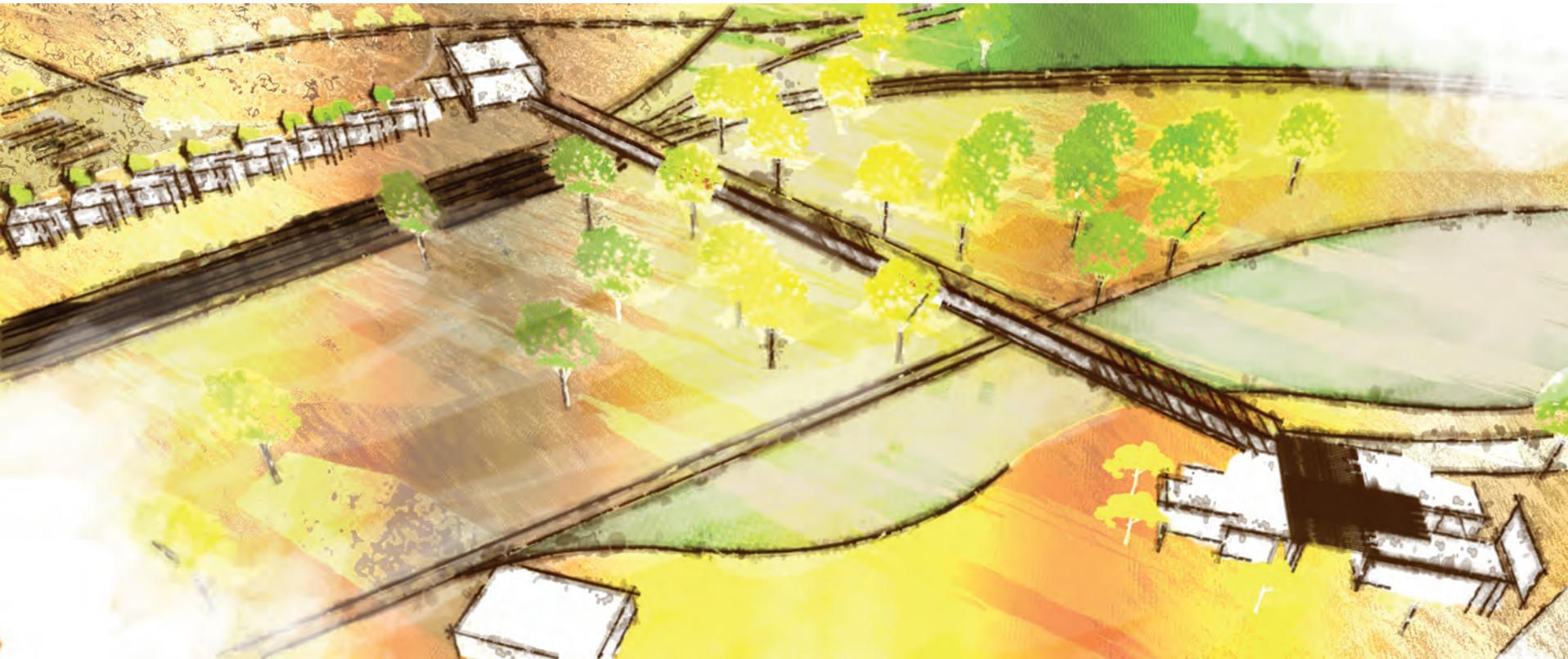




ECOLODGE

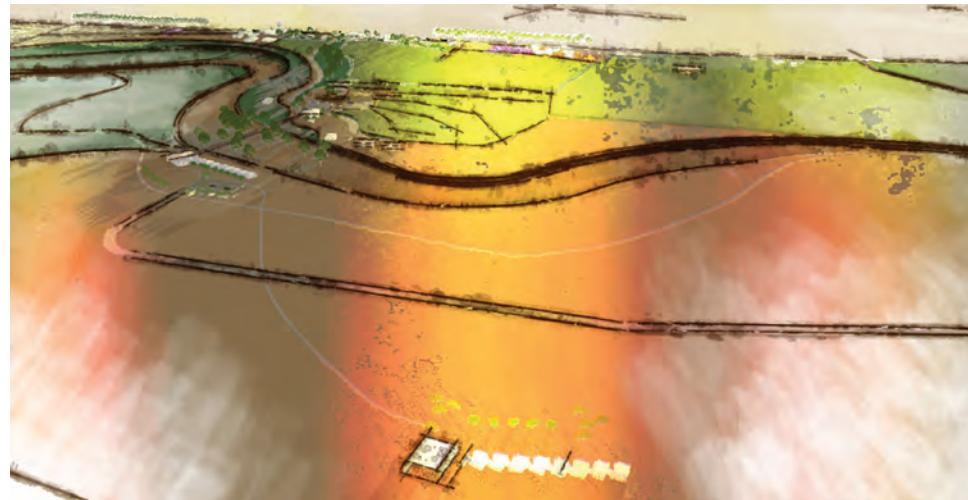
The aesthetic goal when designing the Ecolodge was to extrude the architectural space to frame the view sheds looking out over Fronteras. The Ecolodge is intended to be an extension of the landscape along the east-west axis rather than a barrier to the landscape.

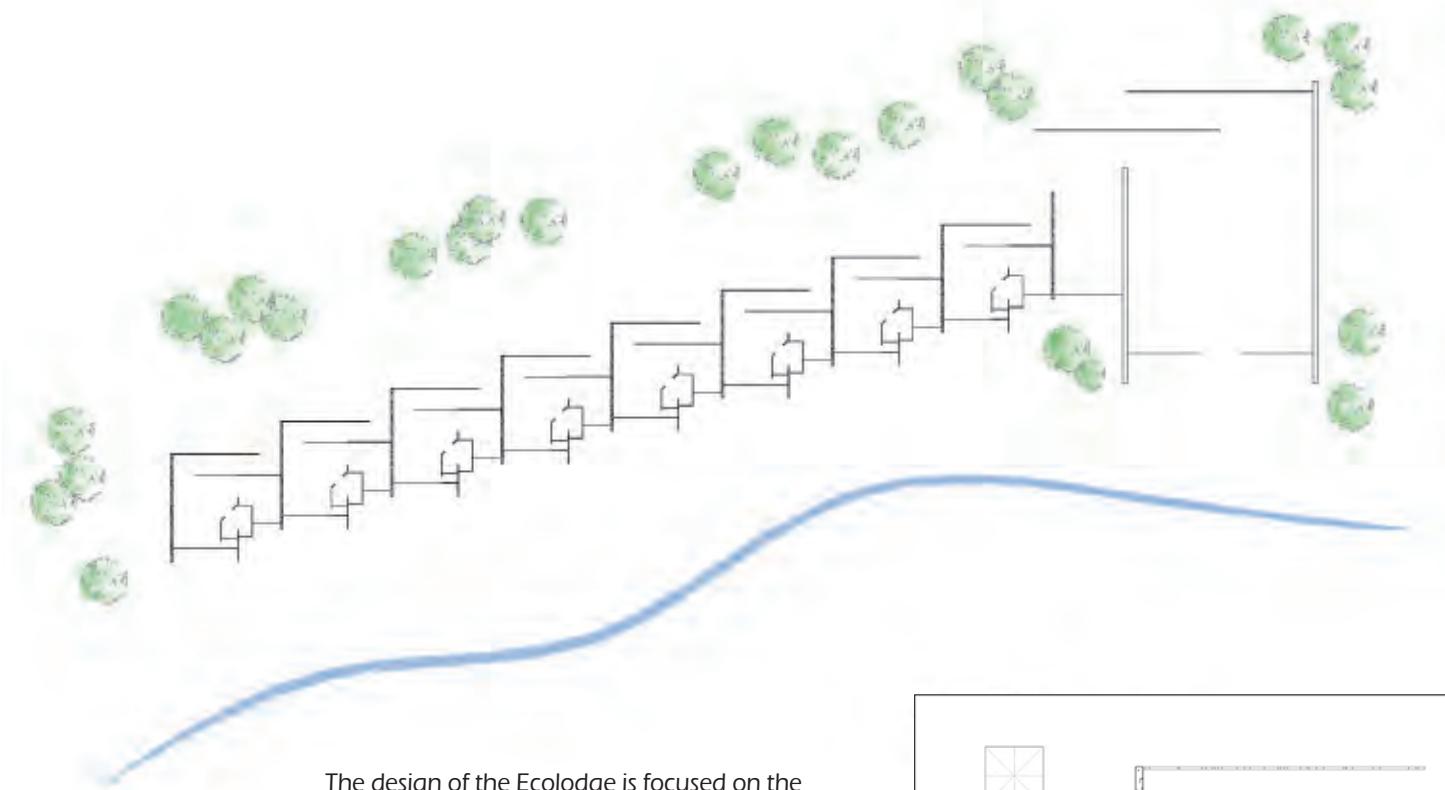
A variety of lodging experiences are available to visitors of the Fronteras Ecolodge. Whether it's beautiful sunsets or shrouded oases, the Ecolodge delivers.



The entrance to the EcoLodge is intended to be one that embraces visitors and acts as a threshold to the canyon and river on the east.

A canopy-level bridge introduces hikers and lodge residents to the wild side of Fronteras.





The design of the Ecolodge is focused on the extension of space and processional movement. The footprint of the lodge traces the contour of the river, connecting the architectural experience of the lodge to the naturally existing landscape. The placement of the Ecolodge was integral – it is sited in close proximity to the river, yet located far enough back on the shelf so that it won't interfere with the typology of the riverbed.

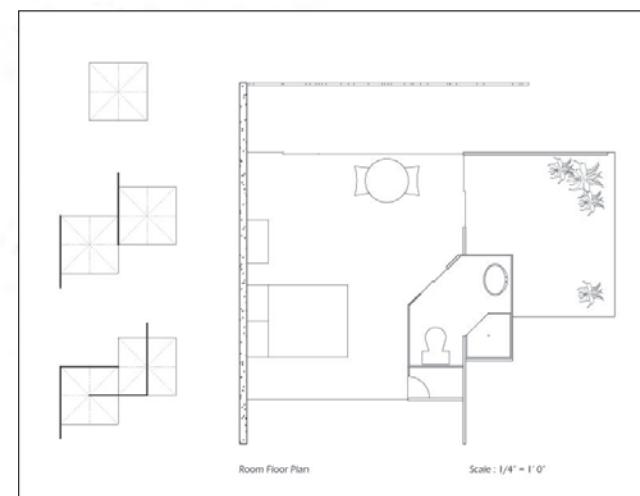
The design intends to optimize view sheds from each room while impacting the land as minimally as possible.

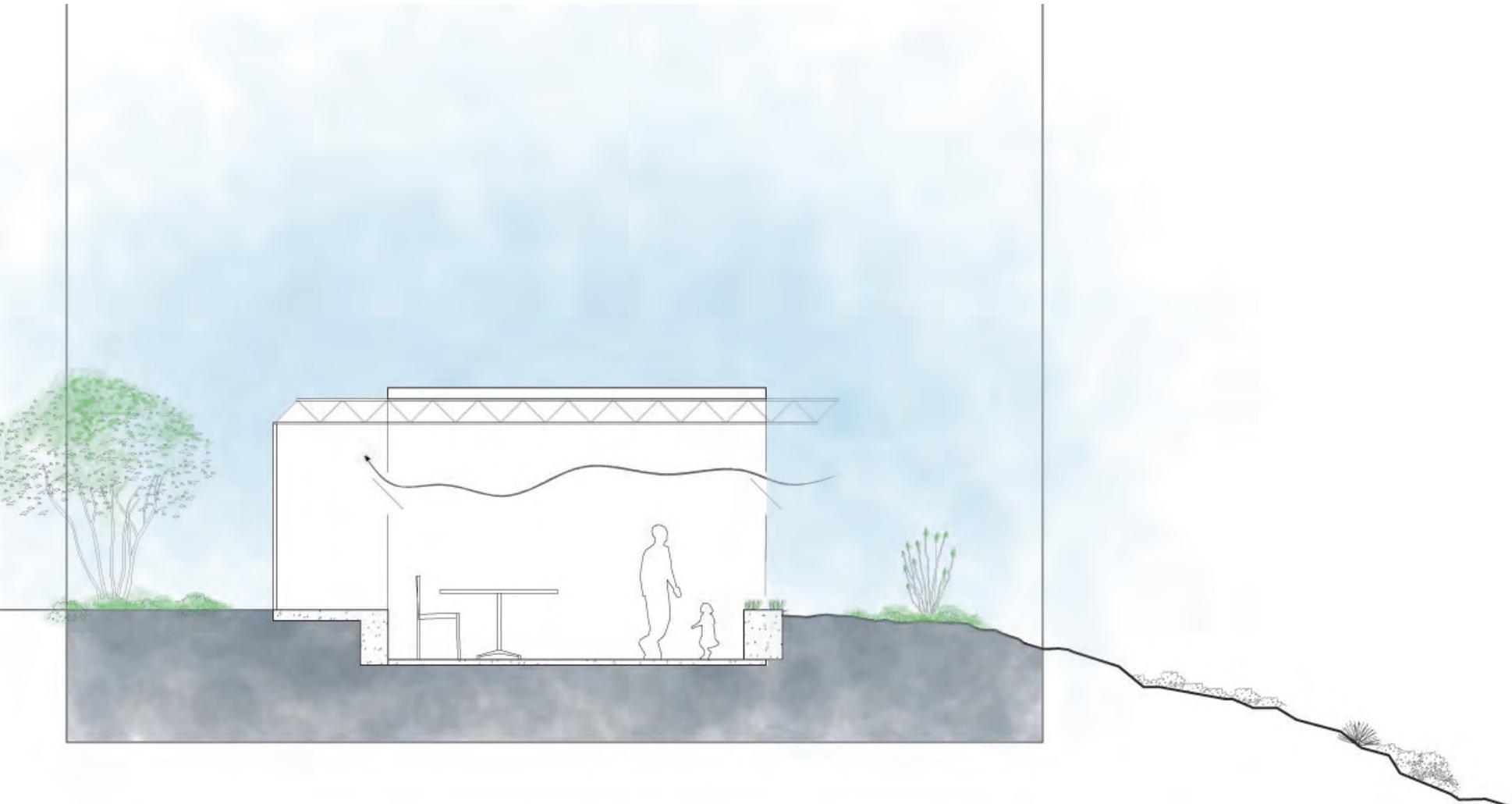
Guest Rooms

Indoor space: 255 sq. feet
 Open living space: 227 sq. feet
 Bathroom: 28 sq. feet
 Closet: 8 sq. feet
 Outdoor patio: 120 sq. feet
 Roof patio: 200 sq. feet
 Entrance walkway: 100 sq. feet

Community Space

Indoor space: 2552 sq. feet
 Public patio: 528 sq. feet
 Community garden: 100 sq. feet



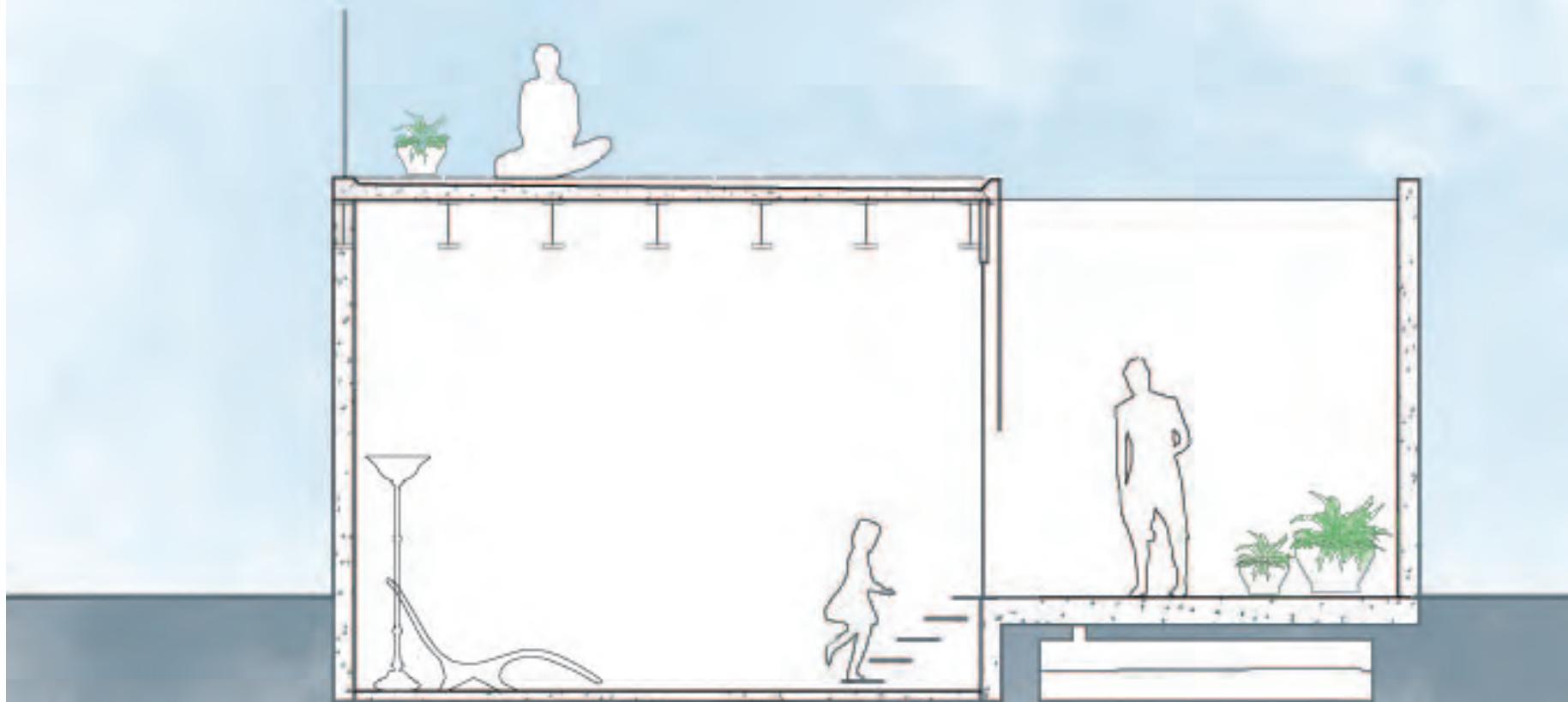


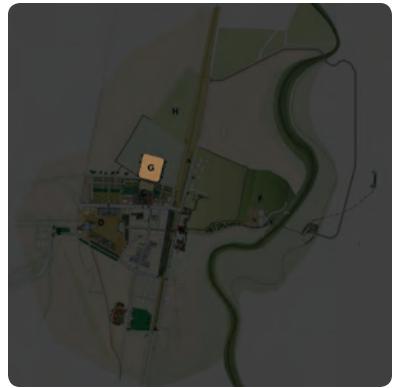
Each individual room is sunken three feet into the earth to reduce the amount of light exposure when laying down, and to create a more intimate connection to the surrounding landscape from within the room. The east and west facades have operable, glazed windows that allow for cross ventilation through the space. The shade screen to the east, designed to relate to the materiality and pattern of the railroad tracks, blocks direct sunlight from entering into the room.

Each unit is equipped with a personal garden, accessible through the west-facing window, which allows visitors to grow their own produce and have a unique connection and understanding of the land.

Each room is designed to collect and harvest the rainwater from the roof. The water is stored in an underground tank, ready for future use.

To optimize outdoor space, each room has its own private outdoor patio, as well as a habitable roof that is accessible by a ladder.

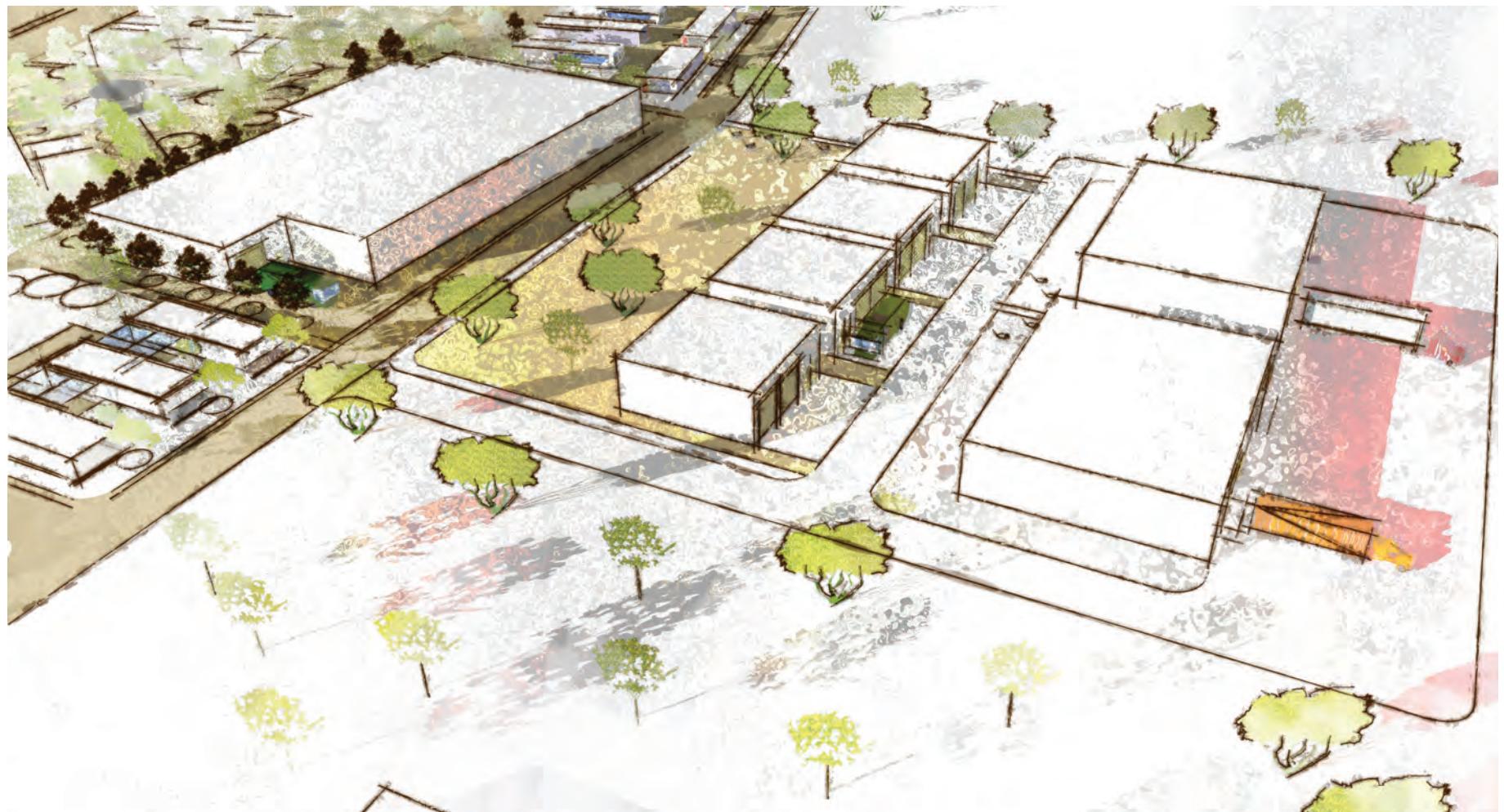




LIGHT INDUSTRIAL PARK

Light industrial development is designated for the area north of the RetroWorks Inc. factory. Industry will include plastics recycling, assembling of battery cables, and other manufacturing of materials for export.

The entry to this industrial park will include a gas station, convenience store and rest area.





WASTEWATER TREATMENT WETLANDS

Please see Design Recommendations section.

MODULES OF DEVELOPMENT





DESIGN RECOMMENDATIONS

CONTENTS

Waste Management Facility
Recommendations

Remediation of Existing Landfill
Streetscape Recommendations



LEFT: This map shows the approximate location of the current waste disposal site for Fronteras.

RIGHT: The existing landfill lies open to the elements. As a result, light weight trash, such as plastic bags, are often blown into town causing both unsightly and unsanitary litter.

WASTE MANAGEMENT FACILITY RELOCATION RECOMMENDATIONS

The first critical task in the relocation of the waste management facility in Fronteras is the identification of a suitable site. Many factors go into the selection process. At the most fundamental level, one must be sure potential sites comply with six major factors:

- land availability
- good drainage characteristics
- suitable soil conditions
- visually isolated location
- above known flood levels
- access to transportation

Many of these factors will require input and assessment by experts in various fields before final

determinations can be made. The revitalization plan is recommending a few sites that merit further investigation into their appropriateness for a waste management facility location.

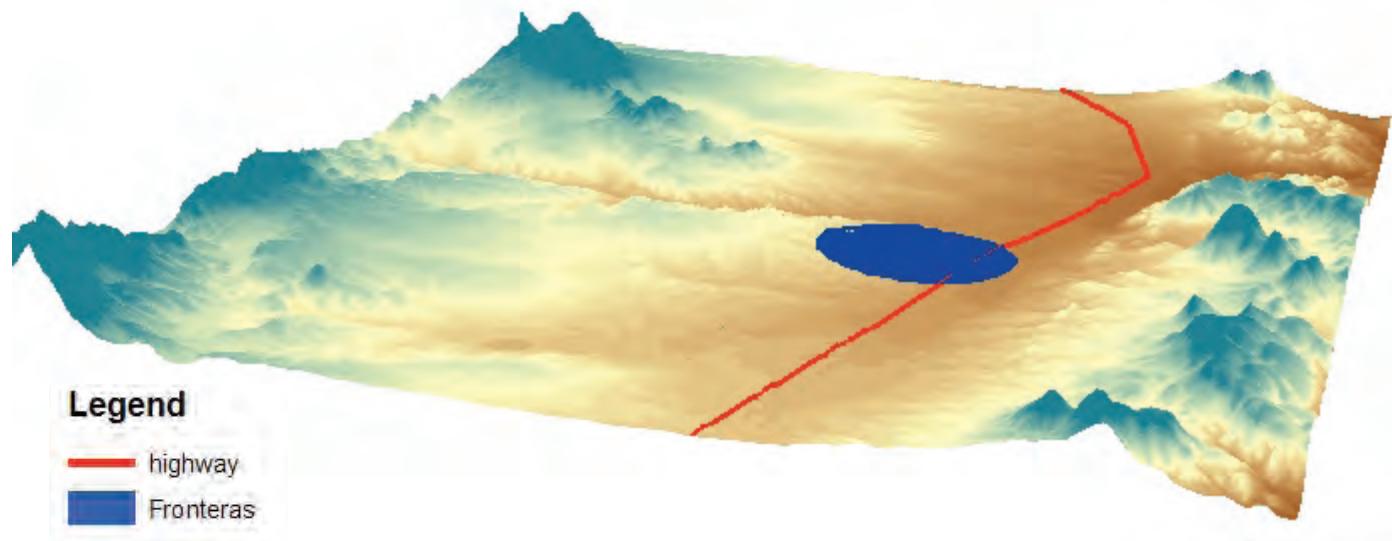
Land Availability

Clearly, the first consideration for any facility is whether the land is owned or can be acquired for development. Land swapping and other arrangements may be necessary to acquire the most appropriate parcel. Due to a lack of knowledge about specific landownership in the municipality all land is assumed to be available for purchase or land swap. This is one of the reasons several sites are identified.

Good Drainage Characteristics

Rainwater runoff is another major consideration. In

RIGHT: The map on the right (in which Fronteras is indicated by a blue circle and the highway is a red line) is a view looking to the northwest. This map shows the general topography of the region and can be useful in determining viewsheds and sighting drainage patterns and low points.



the design of a waste facility it is standard to divert existing runoff patterns from higher ground around the site but there are three major runoff qualities to avoid:

- areas of perched runoff collection
- groundwater recharge areas
- direct surface flows to major streams

Essentially, perched runoff collection happens when water builds up in depressions in the land formation and therefore percolates down into the ground rather than flowing over the area.

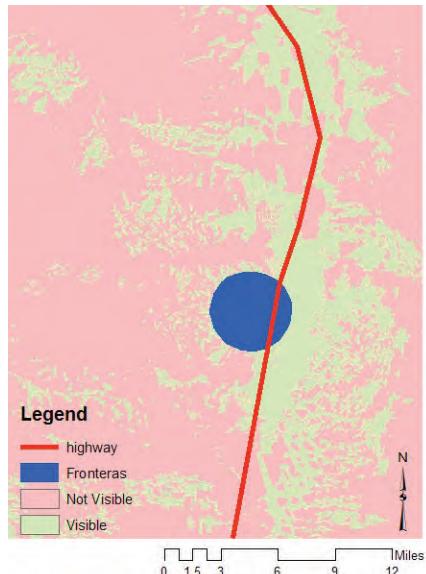
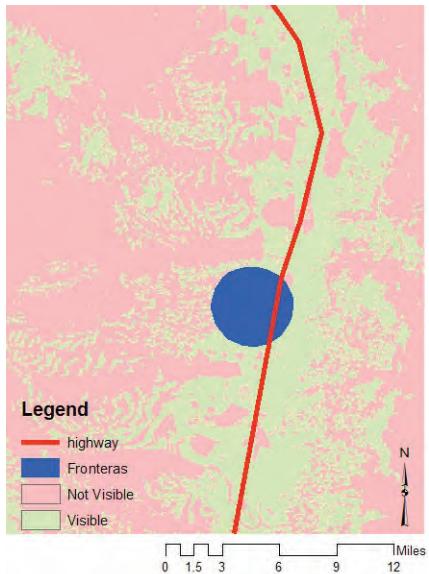
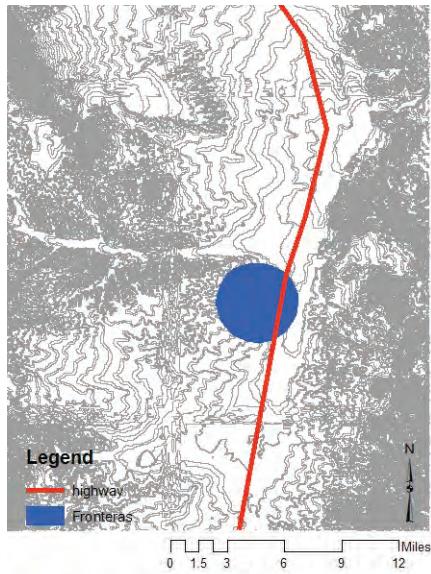
The character of the land around Fronteras is such that a large portion of the east side of the highway is subject to one or more of the drainage qualities that are best avoided. A course drainage evaluation would recommend higher ground on the west side of the

highway. Further research and examination should be done for an exact location.

Suitable Soil Conditions

The soil characteristics of a site are extremely important in determining its suitability for a landfill facility. It is important for the quality and facility of the cover it provides and more importantly for the manner of the interface between the landfill and the groundwater system.

The best soils are ones that enable slow percolation of the water to slow and filter water before it reaches the groundwater. A soil survey should be conducted before final location decisions are made.



LEFT: This map shows the topography of the region and the location of Fronteras and the highway.

CENTER: This map shows areas that are visible from the highway and Fronteras.

RIGHT: This map shows areas that are visible from the town of Fronteras and the nearby sections of highway only.

Visually Isolated Location

Because landfills and other waste management facilities are considered visually unappealing, it is important to consider viewsheds when choosing a location for construction. This is particularly pertinent for Fronteras as the town hopes to develop tourism, especially tourism centering on its valuable natural resources and aesthetics.

The maps above show the approximate locations of Fronteras and the highway. The areas in green are visible from one or more points in the town or along the highway while the areas in pink are areas that are not visible from those locations. The center map would indicate that a location further from the highway would be more ideal as it would be better hidden from view. However, it may not be possible

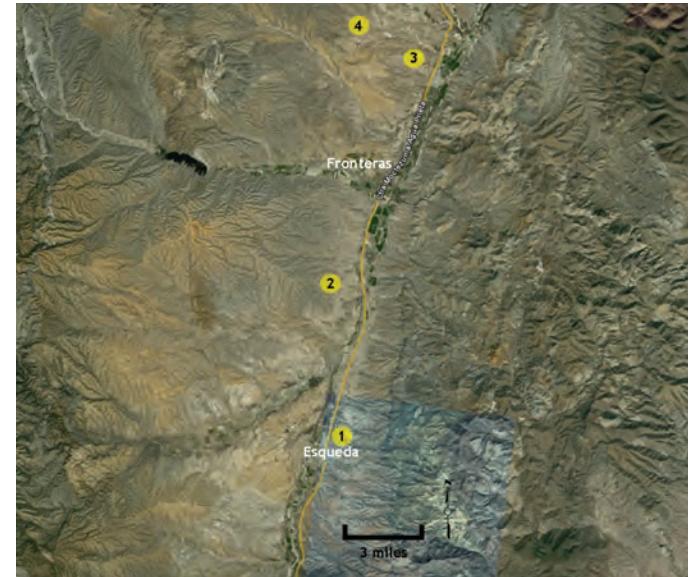
to locate a facility so far from the main highway. For this reason map on the right was created. The map looks at views only from the town and highway entrances. Many more areas become available when sights views of town are not considered.

Above Known Flood Levels

For obvious reasons landfills and waste management facilities should not be placed in areas prone to flooding or where flooding has occurred in the past. The danger of water percolating through the cover and into the groundwater system or waste simply being washed away is too great. Most of the most flood prone areas of Fronteras lie to the east of the highway and would be best avoided. A study of the aquifer and drainage and flood patterns should be conducted prior to any final decisions being made.

POTENTIAL LOCATIONS FOR WASTE MANAGEMENT FACILITY

1. Existing mine near Esqueda
2. Midpoint between Fronteras and Esqueda to the west of the main highway
3. North of Fronteras to the west of the highway
4. North of Fronteras set off to the west of the highway



Access to Transportation

Finally, access to transportation is critical for the functionality of the facility. It should be located near known roads or where roads can be easily constructed. These roads must be able to bear the weight of heavy truck traffic. Locating the facility close to the highway would be best in order to adequately and efficiently serve both the towns of Fronteras and Esqueda.

Location Recommendations

Four general zones have been identified as potential sites for the location of a municipal waste management facility. The first location recommends the reuse of an old mine site near Esqueda once it can no longer be used for mining purposes. This is likely the most cost effective option as no new land

need be acquired or manipulated. It also has the advantage of slow water percolation. The second site is advantageous because it is midway between Fronteras and Esqueda and in a location that is not very visible. The third and fourth sites are located north of both towns. Locating them north of town keeps the landfill well away from the water supply for both communities. The fourth site is farther from the highway which limits visibility but also inhibits access. All potential locations require further investigation and research to determine their viability.



LEFT: The current site used for refuse disposal lies at the south western edge of town

RIGHT: Garbage from the landfill is spread by wind over a large expanse of land

REMEDIATION OF EXISTING LANDFILL

One recommendation of this revitalization plan is the closing of the existing town waste disposal site and the establishment of a larger, modern waste management facility that could serve Fronteras and neighboring Esqueda. The closure of the existing site will be a welcome change for the town as it is currently both visually unappealing and an environmental hazard. Light weight materials such as plastic bags are carried away by the wind and litter the ground for several hundred yards around the site. The open pit is regularly set on fire, sending noxious gases into the air which is then carried by the wind over the town.

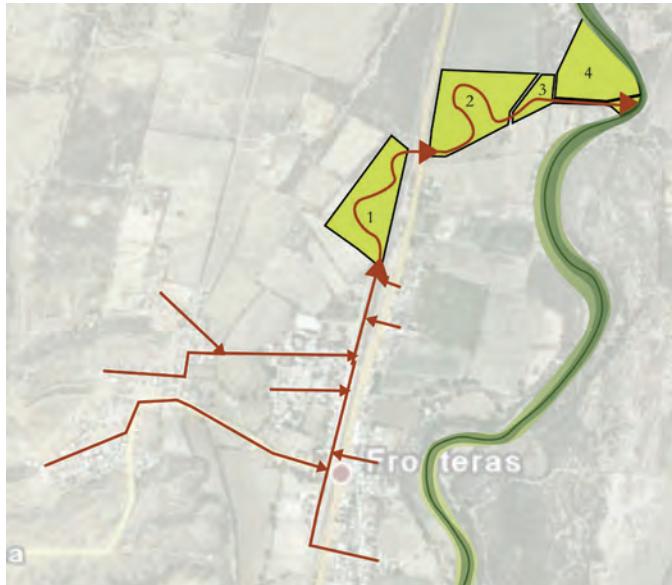
Once a new facility is open, what to do with the existing site must be determined. Many options are available but few are low cost solutions. The most economic option is simply to cover the site with soil

and allow it to remain an unused brownfield. It is unclear how contaminated this site is - soil testing would need to be done but it is likely there is at least some contamination of the ground. Therefore, merely covering up the site is not the best option for the health of the town. One reasonably economic choice, short of excavating the soil (which would be extremely costly), is phytoremediation.

Phytoremediation is the use of plants to extract contaminates from the soil through the root systems of said plants. The contamination is then taken into the stems and leaves of the plants and which can then be harvested, compacted and disposed. Phytoremediation is a slow process and by no means a perfect solution but may help to reduce toxicity in the soil surround Fronteras and help to improve the overall health of the community.



The Alpine Pennyress or *Thlaspi caerulescens* is an example of a hyperaccumulator. These plants are especially able to extract and retain large amounts of contaminates the soil. Cultivating plants such as these might help to improve the quality of the soil on the site



WASTEWATER TREATMENT

Tejido group met with Mark F. Taylor and Robert Archer from WestLand Resources to discuss wastewater treatment options for Fronteras.

INFLUENT WATER - from housing and industry
Things you want to know when designing a wastewater treatment system:

- What is the water quality?
- Peaking factor (times: “Nitrogen rush comes in the morning”)

REGULATORY - what jurisdiction and regulations are you dealing with?

- The regulatory environment you’re dealing with affects the treatment plant.
- In a system reduced in space or size, air is forced into system without water to feed the microorganisms.
- These processes happen naturally in an “open” and

spread-out wetland system.

INTENSIVE TREATMENT SCENARIO:

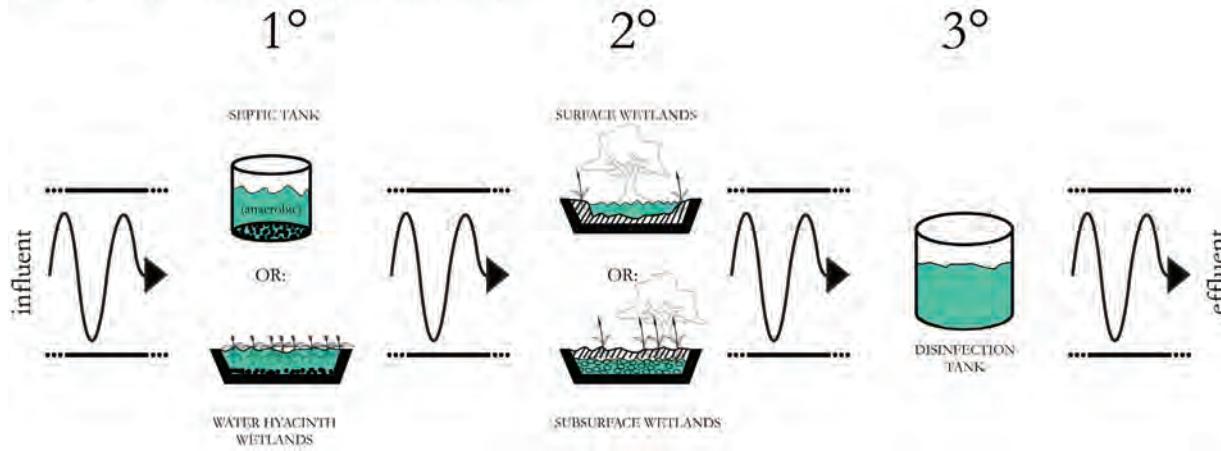
Three Standard Systems:

- SBR - sequencing batch reactor (2 tanks, one has aeration and one has non-aeration cycles)
- MBR - membrane bioreactor
- EA - extended aeration (best system for smaller plants)

Tanks still have to accommodate for the amount of waste produced, no matter how much water is used. On average, every US home uses/produces about 210-220 gallons per day. Biowaste can be sold as fertilizers for non-food crops, but it needs testing to be used for food crops (legal in the US).

Tanks are about 10'x12' and there has to be a class 2 operator to care for the system every two weeks (fill out forms, etc.). Maintenance is minimal except when

From source to sink: wastewater treatment process alternatives



the system does not meet the building size, problems can arise. Someone has to check the sewer lines, etc. daily.

Constructed Cost:

- 1 million-gallon plant costs 14 USD per gallon
- 45 USD per gallon with a system that includes odor control, nitrogen, etc.

Maintenance:

- 2 USD per 1-thousand gallons

Polymers and industrial waste all have to be removed before they get into the system. Everyone taping into the system has to take care of his or her own water through pre-treatment.

WETLANDS TREATMENT SCENARIO

Primary (1°) treatment Types:

1. Septic tank - anaerobic

System process: Waste goes into a septic tank, wetland, filtration stage, and then it goes into a disinfection

tank.

2. Hyacinth wetland – anaerobic with floating plants on the surface (usually water is not visible); this area holds solids and needs to be cleaned out yearly.

System process: Waste goes into wetland, filtration stage, and then it goes into a disinfection tank.

Secondary (2°) treatment types (wetlands):

1. Open water wetland (Surface wetland). Water and plants are visible if you stand at its edge; cheaper, but may smell.
2. Sub-surface wetland. Filled with gravel, then mesh, then plants, water level is lower than gravel, you can't see the water and there is no odor. Better for areas close to human activity, but entrances might need to be cleaned (Example: Arizona-Sonora Desert Museum).

EFFLUENT WATER - what do you do with the water after you treat it?

Option 1: recharge basin

Option 2: subsurface disposal

Option 3. dispose into stream

- Reuse it - golf courses, baseball or soccer fields
- Put it into a disposal basin to percolate back into the ground, such as a leach-field (similar to septic tank)

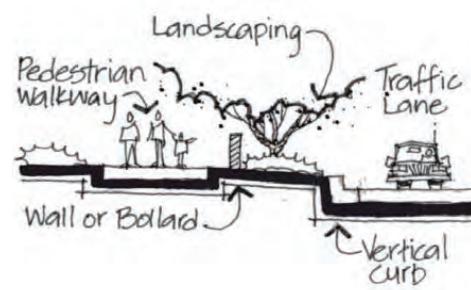
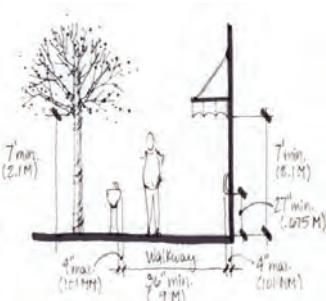
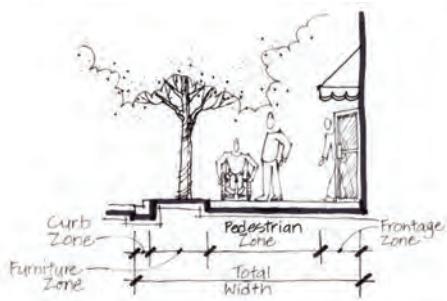
MAINTENANCE AND COSTS:

- Odor comes from the old, stale sewage that is not getting oxygen. A well maintained plant does not smell (normal smells are earthy, but not foul)
- Wetland construction costs is 1/2 to 2/3 less to build and far less maintenance is required. Ocassional removal of dead plant material is required.
- Wetlands need liners (pvc or other local source)
- Information Sources include: <http://www.nesc.wvu.edu/smallflows.cfm>,

Small Flows: <http://inside.mines.edu/research/smallq/index.html>

Design Implications:

- In order to use wastewater as a riparian amenity in areas of high traffic, odor should be reduced to a minimum
- In order to prevent incidental exposure to wastewater in areas of high traffic, open-water systems should be avoided
- Existing wastewater infrastructure analysis, case studies, and expressed resident interest suggests that available land on the north side of town be converted to an RV park with septic tank and subsurface wetland (parcel 1,) campground with subsurface wetland (parcel 2,) and disinfection tank (parcel 3) system connected to Rio Nacozari riparian area, while the existing lagoon (parcel 4) is remediated (see above)



LEFT: Pedestrian zones require certain widths in order to meet safety and comfort levels.

CENTER: There are minimum vertical and horizontal clearances for pedestrian safety. Wider sidewalks are needed to create a comfortable environment.

RIGHT: In larger or more active streets, physical separators are recommended.

STREETSCAPE RECOMMENDATIONS | DESIGN GUIDE-

Fronteras is a pedestrian friendly town with most destinations accessible by foot. Most residents do not own a vehicle, and reach most destinations in town by bicycle or on foot. However, Fronteras is lacking safe and comfortable outdoor amenities, including consistent and even sidewalks where sidewalks exist, lighting, and paved streets.

Providing this infrastructure will help in creating a more inviting and walkable environment, and overall enhancement of the town. Implemented, these improvements will ensure pedestrian oriented growth and businesses, an economic benefit for Fronteras.

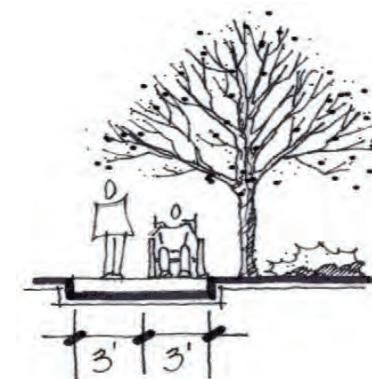
RECOMMENDATIONS FOR ALL STREETS

The following safety design recommendations are applicable to all streets in Fronteras:

- 6 foot wide sidewalks, visually separate from the path of vehicles
- Sidewalk surfaces are slip resistant, without cracks, or grades over 5%
- Sidewalks are physically separated from vehicular traffic by at least one vertical or horizontal element,

such as a curb or landscaped area.

- Sidewalks safely cross driveways with their paving pattern extending through the driveway, with few driveways to cross
- All intersection corners and changes in elevation have ramps
- There is at least 1 foot-candle of lighting at intersections and crosswalks
- Pedestrian crossings across major roads have a defined crosswalk
- Minimum 60% shade coverage along sidewalks and at gathering nodes
- The street and sidewalk width to building height should be at a 1:1 ration where possible
- Streets are paved with a permeable surface such as pavers, cobble stone, stabilized decomposed granite, or compacted native soil. The use of asphalt is dissuaded.



Sidewalks should be a minimum of 6' wide to provide space for passing.

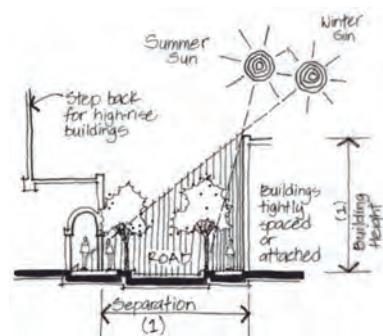
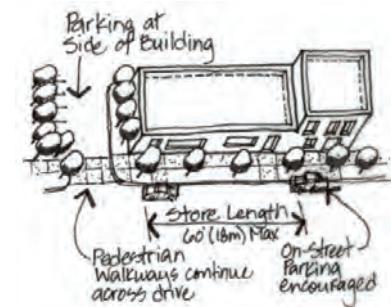
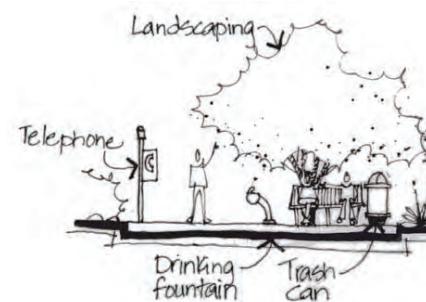
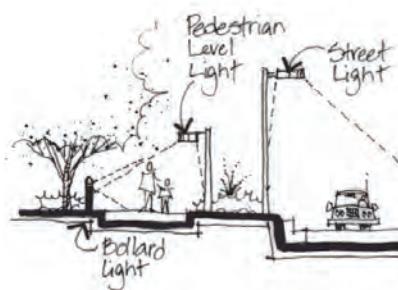


A vertical change of 1/4 inch or more can cause a wheelchair or stroller wheel to get caught.

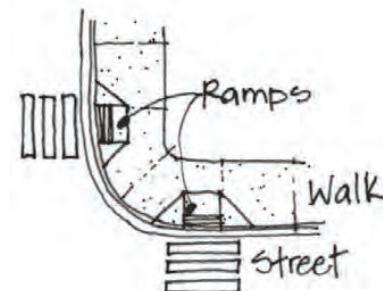
LEFT: A variety of lighting is important for safety and comfort, but also important to keep spaces active in the evenings and nighttime.

CENTER: Typical amenities include trash bins, telephones, and seating.

RIGHT: Parking on-street and behind buildings is encouraged. Building lengths should be limited to 60ft. to provide variety and pedestrian scale.



One to one vertical to horizontal ratios provide a human sense of scale, as well as shade.



Directional ramps with a color and texture change of surface should be provided. This encourages cars to slow down, and pedestrians to feel safe and comfortable.

PROMENADE – General Ignacio Zaragoza

The promenade is an area designed as a destination and requires additional design attention to become not only safe, but comfortable. In addition to the safety design recommendations, the following also apply to the promenade:

- 7 to 12 foot wide sidewalks to provide space for outdoor dining, seating, and outdoor displays
- Lighting is spaced so there is a continuous 1 foot-candle of lighting
- Traffic calming improvements to slow vehicular speeds in appropriate areas, such as on the crossings with Avenida Jose Lopez Portillo
- Minimal amount or no driveways cross the sidewalk
- Sidewalks, vehicular and pedestrian surfaces have a decorative theme
- A variety of seating opportunities
- Trash and recycling receptacles, telephones, drinking fountains, and restrooms
- Wayfinding and informational signage
- Public art spaces

EAST WEST STREET –

Santa Rosa de Corodehuachi

The east west street between the architecture and agriculture research center and the promenade is a major corridor. In addition to the safety design recommendations, the following also apply to the east-west street:

- Walking surface composed of stabilized decomposed granite or compacted native soil to allow for equestrian and vehicular use
- If space does not allow, sidewalks can be provided only on one side of the street
- Pedestrian scale street trees should be provided on both sides of the street for balance and continuity
- Lighting is spaced so there is a continuous 1 foot-candle of lighting
- Wayfinding and informational signage
- Trash and recycling receptacles, and telephones
- Where space is limited for planting strips, large decorative planting pots should be used



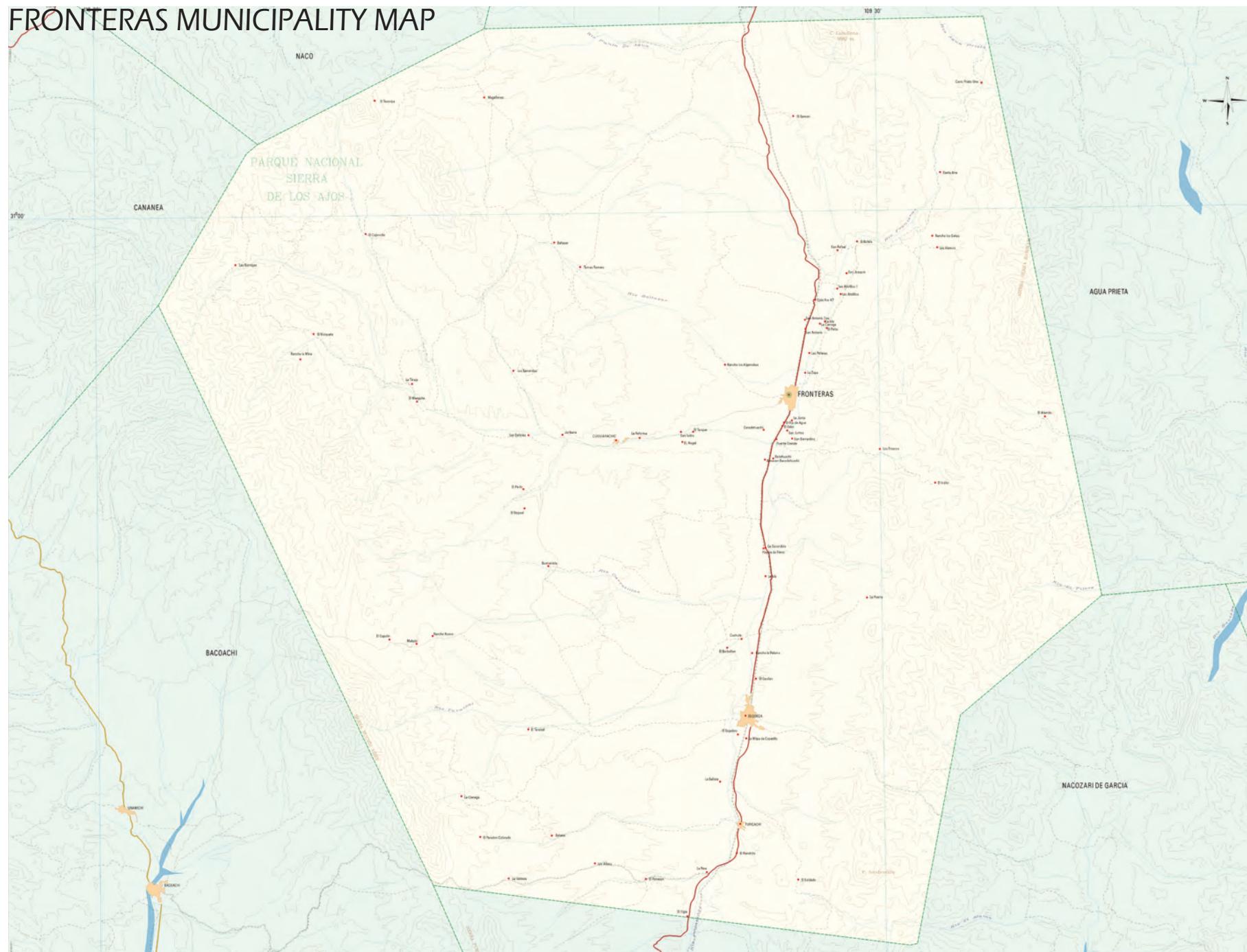
A decorative graphic of various colored birds (green, blue, brown, red) flying in a cluster above the title.

INTRODUCTION

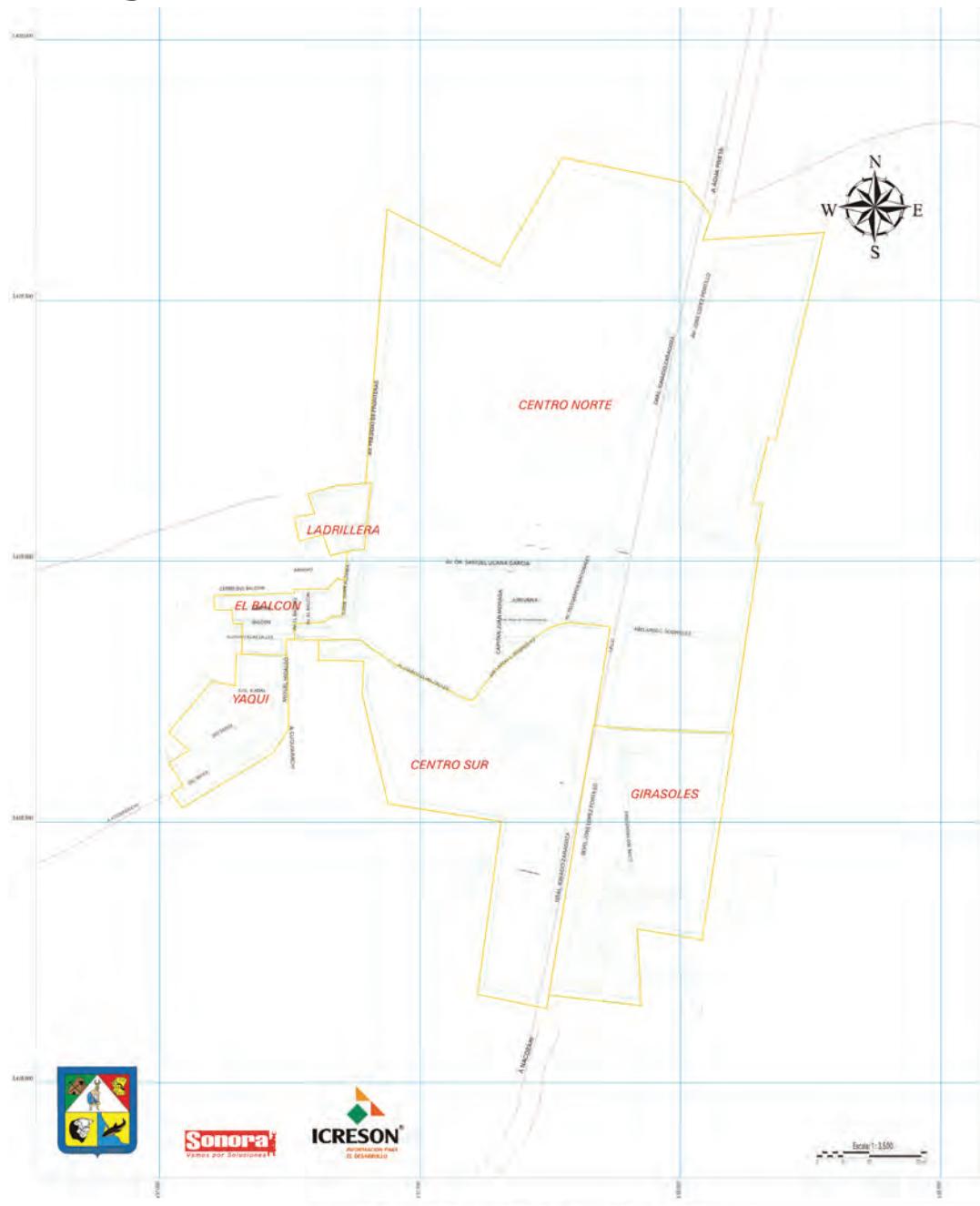
CONTENTS

- Regional and Municipal Maps
- Architectural Inventory
- Rainwater Harvesting
- Traffic Calming
- Plant Palette
- Hardscape Materials Palette
- Meeting Minutes: Westland Resources
- Meeting Minutes: Gene Giacomelli
- Institute of Sustainable Development
- Sources of Funding

FRONTERAS MUNICIPALITY MAP



DOWNTOWN FRONTERAS MAP

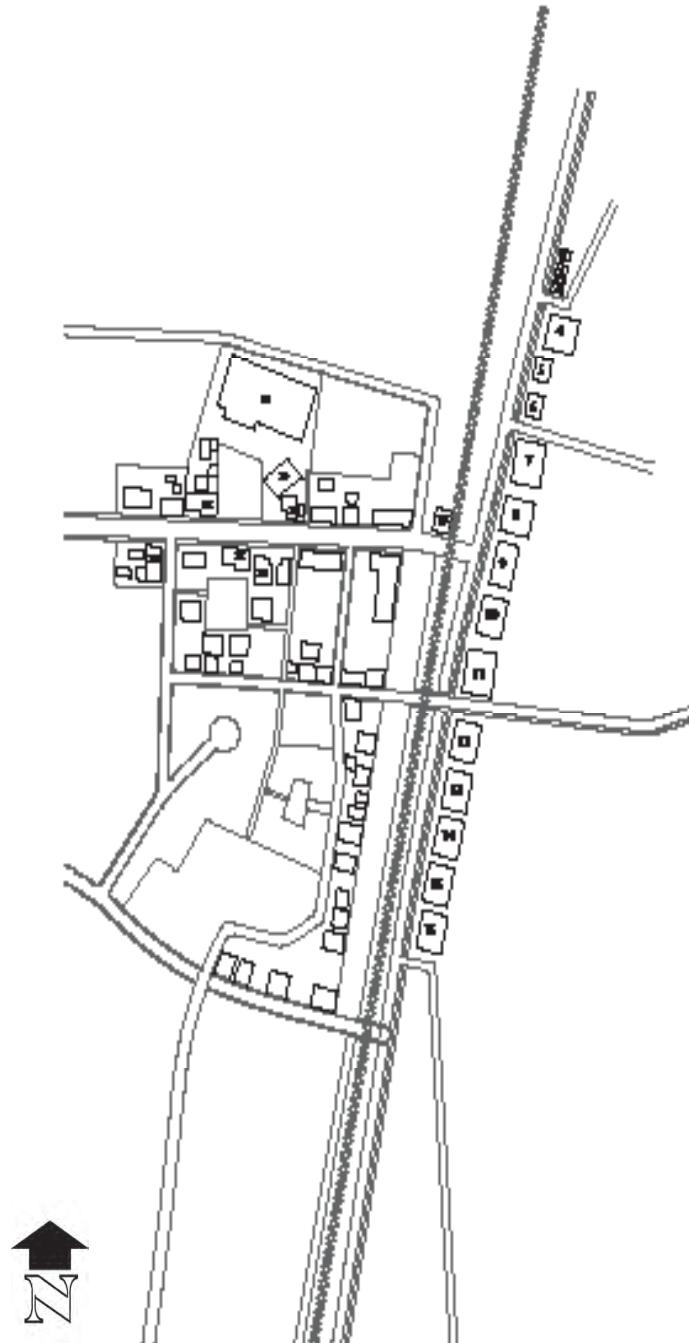


MAPA DE FRONTERAS, SON.



ARCHITECTURE INVENTORY

The vernacular architecture of Fronteras can be classified as affordable, concrete block, single-story buildings with the exception of Colonial architecture that is sparsely dispersed throughout the town. When designing, it is important to evaluate the existing architecture of a place. Because the majority of the architecture in Fronteras is constructed of concrete block, the buildings are extremely modular. By constructing with locally manufactured materials, the cost of construction can be minimized and the time it takes to construct a building can be shortened. With these ideas as the underlying principles for Fronteras architecture, we hope to design new architecture that explores a new palette of materials and geometries, while maintaining simple construction and affordability.



LEFT: Mission San Xavier del bac located near Tucson, Arizona is a good example of Spanish Colonial architecture that is seen in the southwest regions of the United States and in Sonora, Mexico.

RIGHT: This map indicates the locations of the buildings looked at in this inventory.



1) Description : Fronteras Salon

Use : commercial/ industrial

Evaluation : This building has potential to be renovated and used as agricultural storage for the farmers within the town

2) Description : Abandoned brick structure

Use : abandoned

Evaluation : The materials from this abandoned building could be recycled and used to construct new architecture

3) Description : Local Mechanic

Use : commercial

Evaluation : Existing structure could be renovated to create a more adequate working environment

4) Description : El Camino Del Lago

Use : abandoned

Evaluation : Relocate to allow for open views to the east

5) Description : Yellow brick housing

Use : residential

Evaluation : Preserve and allow to function as it currently exists

6) Description : Local Barber Shop

Use : residential/ commercial

Evaluation : Preserve and allow to function as it currently exists

7) Description : Brick construction home

Use : residential

Evaluation : Potential relocation to allow for entrance to the placita's to the east

8) Description : Local Market

Use : commercial

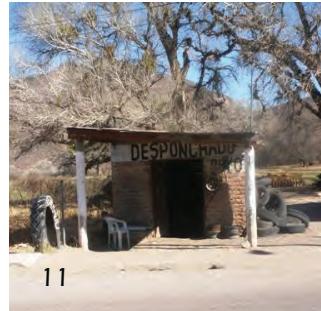
Evaluation : Renovate and restore facade



9



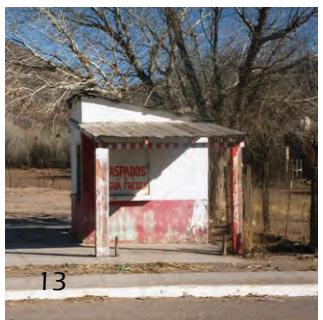
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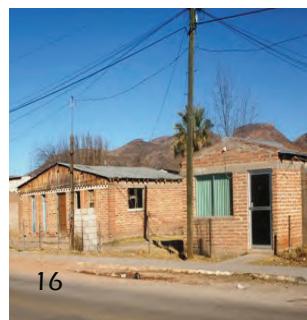
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14



15



16

9) Description : Housing

Use : residential

Evaluation : Preserve and allow to function as it currently exists

10) Description : Dance Hall

Use : civic, public building

Evaluation : Complete restoration of building that preserves its significance and allows for more adequate function

11) Description : Desponchadu

Use : commercial

Evaluation : Relocate to allow for open views to the east.

12) Description : Housing

Use : residential

Evaluation : Preserve and allow to function as it currently exists

13) Description : Water Shack

Use : abandoned

Evaluation : Relocate to allow for open views to the east and potential new commercial architecture

14) Description : Clothing Store

Use : commercial

Evaluation : Renovate and restore facade

15) Description : Local grocery store

Use : commercial

Evaluation : Renovate interior and facade to improve function of store and increase business

16) Description : Brick housing

Use : residential

Evaluation : Renovate and restore facades



17)



18)



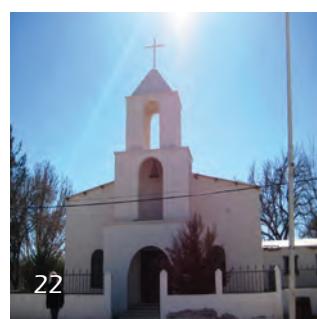
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20)



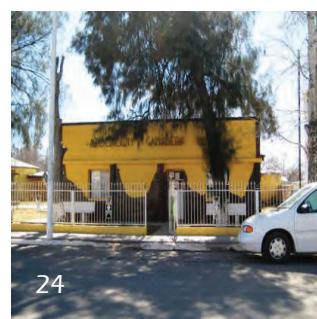
21)



22)



23)



24)

17) Description : Railroad Station

Use : civic

Evaluation : Complete restoration of building that preserves its significance and allows for more adequate function

18) Description : Elementary School

Use : educational

Evaluation : Possible relocation to allow for expansion of plaza and commercial functions

19) Description : Factory

Use : industrial

Evaluation : Renovate and restore interior and facades to improve working environment

20) Description : Auditorium

Use : civic, public

Evaluation : Preserve and restore

21) Description : Art Museum

Use : civic, public

Evaluation : Renovate facade to allow for a more inviting entrance

22) Description : Local Church

Use : public

Evaluation : Preserve and allow to function as it currently exists

23) Description : Municipal building

Use : civic

Evaluation : Preserve and allow to function as it currently exists

24) Description : Civic building

Use : civic

Evaluation : Preserve and restore



LEFT: Picturesque stone berms anchor planting basins. These berms channel rainwater to areas where it is most beneficial for arid vegetation.

HARVESTING RAINWATER FOR LANDSCAPE USE

by Patricia Waterfall, Extension Agent, University of Arizona

Historically, harvested rain water provided water for drinking, landscape watering, and for agricultural uses. Once urban areas started to develop, centralized water supply systems replaced the need to harvest water. More recently, people have become reacquainted with water harvesting, using it to provide water for residential and commercial landscapes.

Harvesting rainwater can reduce the use of drinking water for landscape irrigation. It is also an effective water conservation tool and proves more beneficial when coupled with the use of native, low-water-use and desert-adapted plants. Additionally, rainwater is available free of charge and puts no added strain on the municipal supply or private wells.

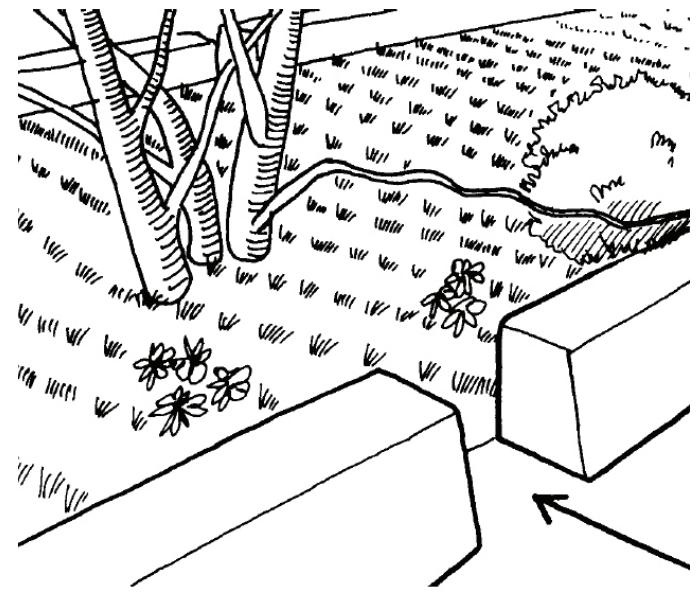
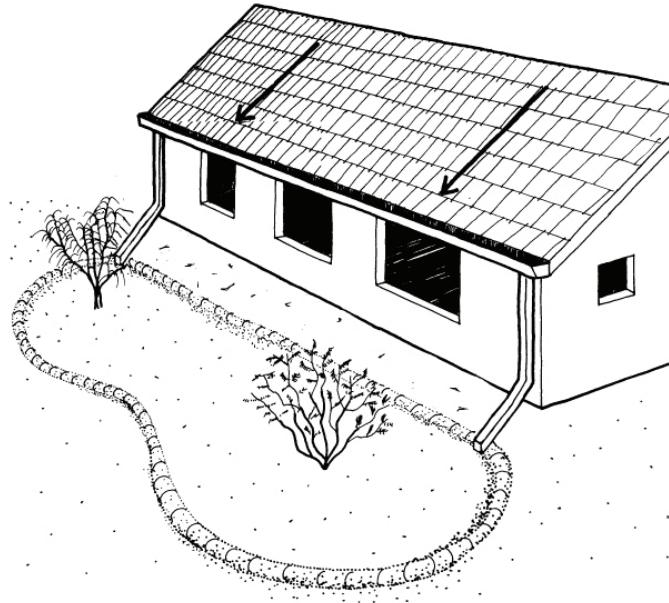
Throughout [much of the Sonoran desert], annual and seasonal precipitation varies widely and is often scarce when plant water requirements are high during the summer months. In the desert regions of [Sonora], approximately half of the annual rain falls in winter, the remainder during the summer monsoons. At higher elevations, in addition to the

monsoons, winter precipitation may come in the form of snow providing opportunities for water harvesting when it melts. Only native and some plants that can nourish in our soils and climate can live on the annual rainfall received. Plants from non-arid climates require a great deal of supplemental irrigation.

There are many water harvesting opportunities on developed sites and it can easily be planned into a new landscape during the design phase. Homes, schools, parks, parking lots, apartment complexes, and commercial facilities all provide sites where rainfall can be harvested. Even very small yards can benefit from water harvesting.

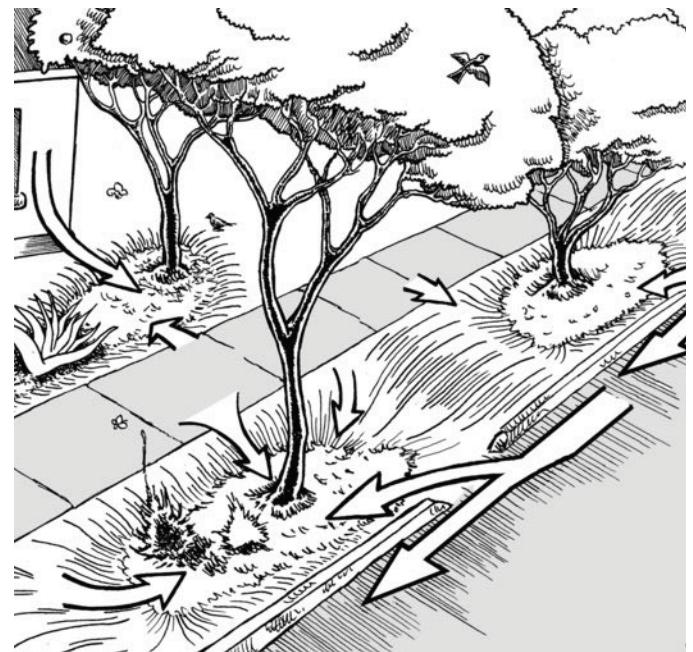
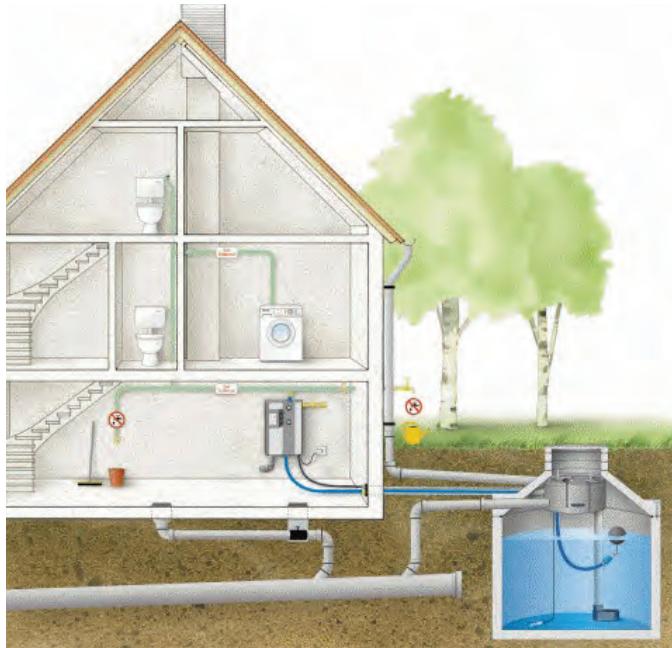
TOP LEFT: Roof water feeds a garden below.

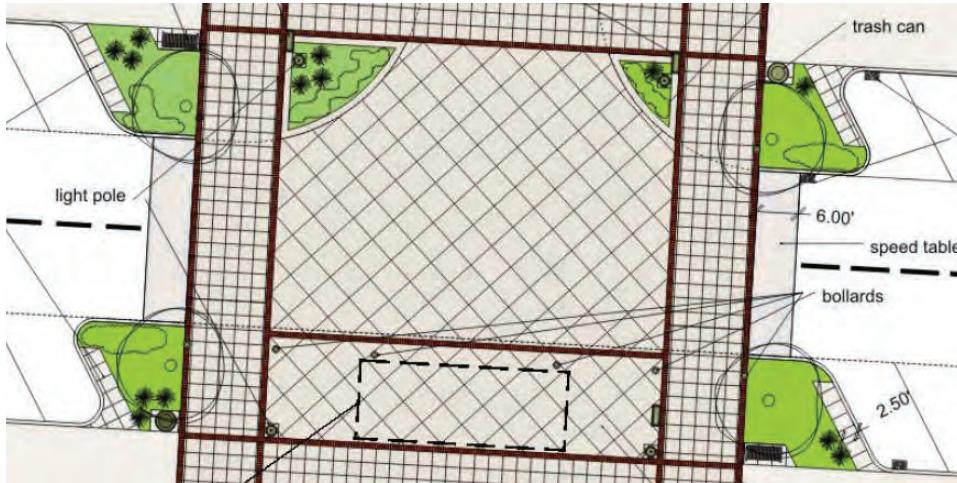
TOP RIGHT: Curb cuts allow water to reach planting basins on the side of a road.



BOTTOM LEFT: A cistern may collect rain water and grey water. This water is stored until pumped through an irrigation system.

BOTTOM RIGHT: Swales slow, spread, and sink rain water.





LEFT: Snohomish Washington has created a plan to improve the walkability of its historic district. This plan portrays a speed table, surrounded by diagonal parking and vegetative buffers.

RIGHT: Community members gather to paint intersections in Brooklyn, New York.

TRAFFIC CALMING 101

by Project for Public Spaces

Developed in Europe, traffic calming (a direct translation of the German “vekehrsberuhigung”) is a system of design and management strategies that aim to balance traffic on streets with other uses. It is founded on the idea that streets should help create and preserve a sense of place, that their purpose is for people to walk, stroll, look, gaze, meet, play, shop and even work alongside cars - but not dominated by them. The tools of traffic calming take a different approach from treating the street only as a conduit for vehicles passing through at the greatest possible speed. They include techniques designed to lessen the impact of motor vehicle traffic by slowing it down, or literally “calming” it. This helps build human-scale places and an environment friendly to people on foot.

Besides its power to improve the livability of a place, the beauty of traffic calming is that it can be applied inexpensively and flexibly. The strategies

outlined below in The Traffic Calming Toolbox can be employed by painting lines, colors and patterns; using planters, bollards and other removable barriers; eliminating or adding parking; or installing sidewalk extensions or similar structures with temporary materials. All provide an opportunity to test devices, combinations and locations, fine-tuning the approach according to results. Traffic calming, along with other small-scale improvements, can enhance a place immediately, while being tested and refined to meet long-term needs. When funds are available, the right combination of devices can be transformed into permanent improvements and extended over a broader area. Regardless of what traffic-calming action is undertaken, the benefit to a community is greater when the technical improvements are strengthened by visual enhancements like trees, flowers and other amenities.

The Traffic Calming Toolbox :

- Diagonal Parking
- Changing One-Way Streets to Two-Way
- Widening Sidewalks/Narrowing Streets and Traffic Lanes
- Bulbs - Chokers - Neckdowns
- Chicane
- Roundabouts
- Traffic Circles
- Raised Medians
- Tight Corner Curbs
- Diverters
- Road Humps, Speed Tables, and Cushions
- Rumble Strips and Other Surface Treatments

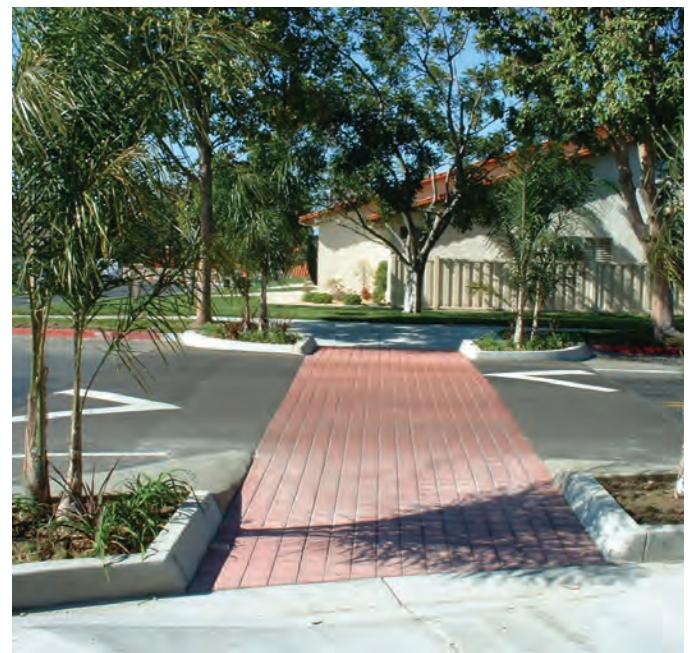
TOP LEFT: Although accessible by automobiles, this streetscape caters to pedestrians, while creating a unique sense of place.

TOP RIGHT: Pedestrian crosswalks can beautify the streetscape.

BOTTOM LEFT: Narrow medians with signage fit the smallest roads.

BOTTOM MIDDLE: Speed bumps and chokers slow travelers on residential routes.

BOTTOM RIGHT: Speed tables slow traffic at intersections.





LEFT: Cottonwood

CENTER LEFT: Palo Verde Flower

CENTER RIGHT: Ash

RIGHT: Black Dalea

PLANT PALETTE

Trees

Acacia constricta
Acacia farnesiana
Acacia greggii
Celtis pallida
Celtis reticulata
Fraxinus spp.
Lysiloma watsonii
Morus spp.
Parkinsonia aculeata
Parkinsonia floridum
Parkinsonia microphylla
Parkinsonia praecox
Populus fremontii
Prosopis glandulosa
Prosopis velutina
Sambucus nigra

Shrubs

Ambrosia deltoidea
Atriplex spp.
Calliandra californica
Cordia parvifolia

Whitethorn Acacia
Sweet Acacia
Catclaw Acacia
Desert Hackberry
Netleaf Hackberry
Ash
Featherbush
Mulberry
Mexican Palo Verde
Blue Palo Verde
Little Leaf Palo Verde
Palo Brea
Cottonwood
Honey Mesquite
Velvet Mesquite
Elderberry

Triangle Leaf Bursage
Saltbush
Baja Fairy Duster
Little Leaf Cordia

Cordia sonorae
Dalea frutescens
Dalea pulchra
Dodonaea viscosa
Encelia farinosa farinosa
Hyptis emoryi
Jatropha cardophylla
Justicia californica
Justicia candicans
Lantana camera
Larrea tridentata
Lippia palmeri
Lycium berlandieri
Lycium brevipes brevipes
Oenothera kunthiana
Physalis crassifolia integrifolia
Physalis crassifolia versicolor
Plumbago scandens
Ruellia californica
Ruellia peninsularis
Salvia similis
Senna covesii
Simmondsia chinensis

Sonoran Cordia
Black Dalea
Indigo Bush
Hopbush
Brittlebrush
Desert Lavender
Limberbush
Chuparosa
Red Justicia
Lantana
Creosote
Desert Oregano
Wolfberry
Desert Thorn
Globe Mallow
Tomatillo
Desert Tomatillo
Desert Plumbago
Dwarf Ruellia
Baja Ruellia
Salvia
Desert Senna
Jojoba

Street trees provide important functions such as shading pedestrians, providing a sense of human scale to a street, reducing heat gain on roadways and giving a unique character to different parts of a community. Although desert trees do not grow as tall as more common street trees found throughout the US, there are still some native trees that can be trained to function very well as street trees.

LEFT: Aloe Vera

CENTER LEFT: Regal Mist

CENTER RIGHT: Parry's Agave

RIGHT: Texas Bear Grass



Cacti/Succulents

Agave parryi
Agave vilmoriana
Agave vivipera vivipera
Aloe Barbadensis
Dasyliion wheeleri
Echinocereus engelmannii
Ferocactus emoryi
Fouquieria macdougalii
Fouquieria splendens
Hechtia montana
Mammillaria spp.
Opuntia arborescens
Opuntia bravoana
Opuntia fulgida fulgida
Opuntia gosseliniana
Opuntia versicolor
Stenocereus alamosensis

Organic agriculture and locally grown food can be an important component in pursuing an environmentally and economically sustainable community. While greenhouses allow the growth of any number of fresh vegetables and fruit, native plants can also be a great local food source that requires little extraordinary effort.

Grasses

Aristida purpurea
Bouteloua curtipendula
Muhlenbergia capillaris

Parry's Agave
 Octopus Agave
 Giant Megan's Bay
 Aloe Vera
 Desert Spoon
 Hedgehog Cactus
 Barrel cactus
 Mexican Tree Ocotillo
 Ocotillo
 False Agave
 Pincushion cactus
 Pencil cholla
 Prickly Pear
 Chain fruit cholla
 Violet Prickly Pear
 Staghorn cholla
 Octopus Cactus

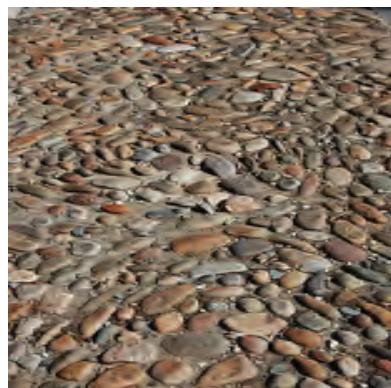
Muhlenbergia rigida
Muhlenbergia rigens
Nassella tenuissima
Nolina spp.
Nolina Texana
Schizachyrium scoparium

Nashville Muhly
 Deer Grass
 Mexican Feather Grass
 Bear Grass
 Texas Bear Grass
 Little Bluestem

Edible Native Vegetation

Scientific Name	Edible Part	Culinary Use
<i>Agave spp.</i>	fruits	tequila, bacanora
<i>Capsicum spp.</i>	fruits	spicy peppers
<i>Celtis reticulata</i>	berries	eaten raw
<i>Fouquieria splendens</i>	flowers	punch, in salads
<i>Justicia californica</i>	flowers	in salads
<i>Opuntia spp. bravoana</i>	fruits, pads	jellies, jams,
<i>Opuntia fulgida</i>	fruits	candy, eaten raw
<i>Opuntia versicolor</i>	flower buds	vegetable
<i>Physalis spp.</i>	fruits	salsa, verde sauce
<i>Prosopis velutina</i>	pods	flour, molasses
<i>Simmondsia chinensis</i>	fruits	nuts, oil
<i>Stenocereus spp.</i>	fruits	eaten raw

MATERIALS | HARDSCAPE



MEETING MINUTES | Westland Resources

Tejido group met with Mark F. Taylor and Robert Archer from WestLand Resources to discuss wastewater treatment options for Fronteras.

INFLUENT WATER - from housing and industry

Things you want to know when designing a wastewater treatment system:

- a. What is the water quality?
- b. Peaking factor (times: “Nitrogen rush comes in the morning”)

REGULATORY - what jurisdiction and regulations are you dealing with?

- The regulatory environment you’re dealing with affects the treatment plant.
- In a system reduced in space or size, air is forced into system without water to feed the microorganisms.
- These processes happen naturally in an “open” and spread-out wetland system.

INTENSIVE TREATMENT SCENARIO:

Three Standard Systems:

1. SBR - sequencing batch reactor (2 tanks, one has aeration and one has non-aeration cycles)
2. MBR - membrane bioreactor
3. EA - extended aeration (best system for smaller plants)

Tanks still have to accommodate for the amount of waste produced, no matter how much water is used. On average, every US home uses/produces about 210-220 gallons per day. Biowaste can be sold as fertilizers for non-food crops, but it needs testing to be used for food crops (legal in the US).

Tanks are about 10’x12’ and there has to be a class 2 operator to care for the system every two weeks (fill out forms, etc.). Maintenance is minimal except when the system does not meet the building size, problems can arise.



Someone has to check the sewer lines, etc. daily.

Constructed Cost:

- 1 million-gallon plant costs 14 USD per gallon
- 45 USD per gallon with a system that includes odor control, nitrogen, etc.

Maintenance:

- 2 USD per 1-thousand gallons

Polymers and industrial waste all have to be removed before they get into the system. Everyone taping into the system has to take care of his or her own water through pre-treatment.

WETLANDS TREATMENT SCENARIO

Primary (1°) treatment Types:

1. Septic tank - anaerobic

System process: Waste goes into a septic tank, wetland, filtration stage, and then it goes into a disinfection tank.

2. Hyacinth wetland – anaerobic with floating plants on the surface (usually water is not visible); this area holds solids and needs to be cleaned out yearly.

System process: Waste goes into wetland, filtration stage, and then it goes into a disinfection tank.

Secondary (2°) treatment types (wetlands):

1. Open water wetland (Surface wetland). Water and plants are visible if you stand at its edge; cheaper, but may smell.
2. Sub-surface wetland. Filled with gravel, then mesh, then plants, water level is lower than gravel, you can’t see the water and there is no odor. Better for areas close to human activity, but entrances might need to be cleaned (Example: Arizona-Sonora Desert Museum).

EFFLUENT WATER - what do you do with the water after you treat it?

Option 1: recharge basin

Option 2: subsurface disposal

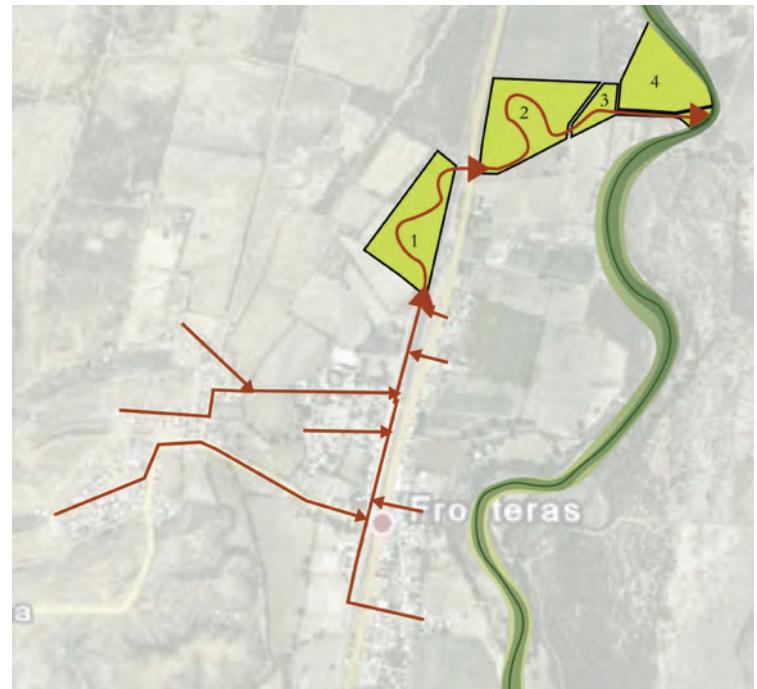
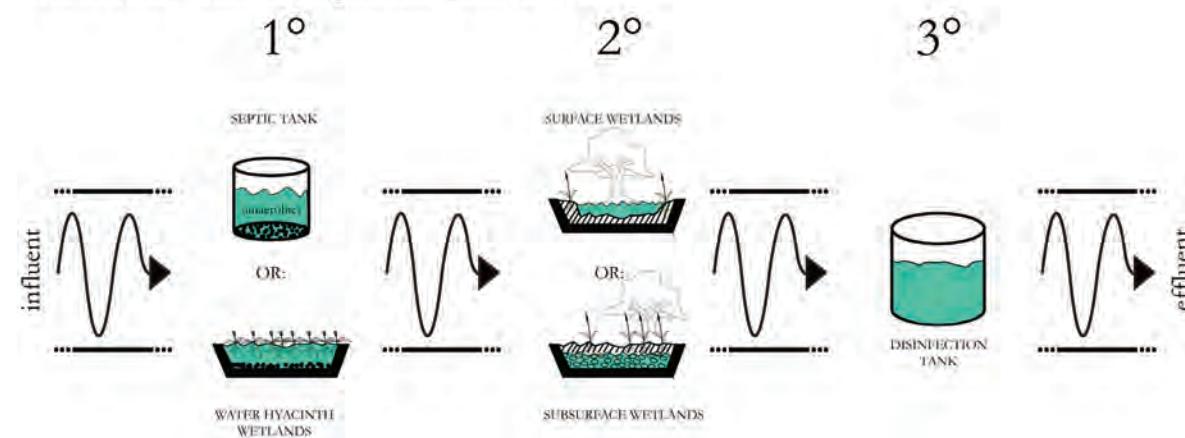
Option 3. dispose into stream

- Reuse it - golf courses, baseball or soccer fields
- Put it into a disposal basin to percolate back into the ground, such as a leach-field (similar to septic tank)

MAINTENANCE AND COSTS:

- Odor comes from the old, stale sewage that is not getting oxygen. A well maintained plant does not smell (normal smells are earthy, but not foul)
- Wetland construction costs is 1/2 to 2/3 less to build and far less maintenance is required. Occasional removal of dead plant material is required.
- Wetlands need liners (pvc or other local source)
- Information Sources include: <http://www.nesc.wvu.edu/smallflows.cfm>, Small Flows: <http://inside.mines.edu/research/smallq/index.html>

From source to sink: wastewater treatment process alternatives



Design Implications:

- In order to use wastewater as a riparian amenity in areas of high traffic, odor should be reduced to a minimum
- In order to prevent incidental exposure to wastewater in areas of high traffic, open-water systems should be avoided
- Existing wastewater infrastructure analysis, case studies, and expressed resident interest suggests that available land on the north side of town be converted to an RV park with septic tank and subsurface wetland (parcel 1,) campground with subsurface wetland (parcel 2,) and disinfection tank (parcel 3) system connected to Rio Nacozari riparian area, while the existing lagoon (parcel 4) is remediated (see above)

MEETING MINUTES | Gene Giacomelli

The purpose of this meeting was to discuss alternative agricultural options for Fronteras. Gene Giacomelli volunteered his time to present and discuss his experience in the field, alternative agricultural options, and ways of utilizing agriculture to stimulate the economy.

AGRICULTURAL OPTIONS:

OPEN LAND FARMING

- Open land farming is a relatively simple option for agricultural use. It typically works best on flat, open land that is shielded from the wind and receives sufficient sun exposure throughout the year.
- It is a simple solution to environmentally clean up barren land that is not functional or being utilized.
- It allows for natural processes such as biological activity and rainfall to occur, and allows for the opportunity to collect rainwater to irrigate the land.

HYDROPONIC GREENHOUSES

- Hydroponic greenhouses are an alternative form of agriculture, where plants are raised and grown under carefully controlled conditions that require specialty skill sets.
- The biggest advantage to growing hydroponically is that the crop yields are higher than with conventional agriculture. The amount of produce grown in a greenhouse requires a much smaller footprint of space than conventional agriculture.
- Greenhouses allow for agriculture to exist in any location and any climate. They also allow for a different kind of social development.
- Tomatoes are the most valuable greenhouse crop in terms of the quantity they yield over such a short period of time.
- The lack of education and knowledge about how greenhouses function is the reason why they aren't more prevalent.
- A small built greenhouse typically costs 2-3 dollars per square foot. A high

tech greenhouse increases to 20 dollars per square foot. The increase in cost is partly due to the increased price of steel and concrete. From a low cost greenhouse to a high cost greenhouse the yield of produce ranges from 20 kilos- 70 kilos.

- “High Tunnel” is a movement that is trying to make greenhouse agriculture affordable.

CASE STUDIES:

GroLive!

- “A pilot greenhouse grower training program (GroLive!) is under development by a collaborative effort of International Trade Development Center (ITDC) and CEAC to address the increasing need for training and technical support across the greenhouse industry.”
- The program entails a 6-8 week course at the University of Arizona, where training in hydroponics and greenhouse management will be taught. The incentive of GroLive! is to eventually purchase greenhouse facilities outside of the University that can be monitored and with assisted management through satellite and computer programs.
- GroLive! enables communities and individuals with minimal greenhouse knowledge to utilize greenhouse agriculture.

CRITERIA FOR IMPLEMENTING NEW AGRICULTURE IN FRONTERAS:

- Being able to find a product niche, creating something that others cannot compete with
- Making sure that the product is consistent and high quality
- Have the means and facilities to produce enough yield to generate enough income to have a marketable product
- Allowing residents of Fronteras to take a greenhouse management course at the University of Arizona to gain the knowledge of how to produce hydroponically.
- Survey south of the border to see what the Hispanic market is demanding

ALTERNATIVE POSSIBILITIES FOR FRONTERAS:

PACKAGING FACILITY :

- Possibly creating a packaging facility in Fronteras that packages tomatoes and cucumbers for Eurofresh
- Nogales could be the exporting location because they are accustomed to purchasing Mexican produce. However, the quality of the product and packaging must remain consistent and safe.
- Being able to establish a strong relationship with a shipping company is critical in being successful

AQUACULTURE :

- Synthesizing aquaculture with hydroponics
- Utilizing the feces from the fish to initiate the growth of lettuce. The lettuce then becomes nutrients and food for the fish.
- Lettuce is a fast growing crop, which is why this cycle works so efficiently. It takes approximately 30-40 days to produce a head of lettuce.

VINEYARDS :

- The success of growing grapes and having a vineyard depends entirely on the microclimate. It takes a very unique microclimate and soil properties to grow grapes.
- Synthesizing vineyards and greenhouse agriculture, to allow for vineyards to exist in any climatic condition.
- Being able to control the microclimate and soil within a greenhouse, could produce a suitable environment to grow grapes.

WHAT ABOUT FRONTERAS:

- Fronteras has a multitude of options to explore in terms of agriculture.
- In terms of controlled agricultural environments, the local market is what makes them profitable.
- Trying to utilize agricultural development as the underlying principle that the community can develop upon.
- Creating an identity by redefining the land-use based on function.

Institute for Sustainable Community Development - Project Proposal

SYNOPSIS:

The residents of Fronteras, Sonora, propose a partnership with the University of Arizona to create the Institute for Sustainable Community Development (ISCD), whose purpose is to explore integrated solutions to social, economic, and environmental problems. These challenges include affordable housing, employment, water and energy infrastructure, and environmental protection.

Fronteras will serve as the site for ISCD to develop and implement relevant ideas with interdisciplinary teams and local residents. ISCD will forge and refine cutting-edge paradigms that will enhance its international reputation for pioneering sustainable solutions in challenging environments. It will also establish a powerful and reproducible model for other communities in Mexico seeking to survive and prosper.

BACKGROUND:

Fronteras, Sonora, lies just 35 miles from the U.S. border at Douglas, Arizona. The area has a population of 10,000 where mining, ranching, and farming are the primary economic activities. Like most rural communities in Mexico, it suffers from government inattention because:

- 1) Its small population and distance from the state capital give it little political influence.
- 2) Its unimportance to legislators means Fronteras receives a disproportionately small share of tax revenues for public projects and infrastructure development.
- 3) By law, politicians cannot be re-elected in Mexico. Each election means starting over, with progress from the previous term of office often erased. This lack of continuity is particularly problematic at the local level. Mayors, elected every three years, completely replace the town bureaucracy with their own new staff, and their own pet agendas.

These conditions have impelled local residents to seek a new paradigm for development that does not depend on politics or government programs--one that is privately funded and administered at the grass roots level. Residents envision a vibrant and self-sufficient economy that capitalizes on the town's existing physical and cultural assets to develop projects that are sustainable and locally controlled. The Institute for Sustainable Community Development is proposed to realize this vision.

COLLABORATION:

Fronteras requests that the College of Architecture/Landscape Architecture (CALA) serve as the lead organization for ISCD and act as liaison between the community and the University. CALA is currently collaborating with Fronteras to develop an integrated urban plan on which to base anticipated growth and development.

CALA affirms that ideas are truly sustainable only if they operate on several levels of sustainability:

Functional – is it safe, easily maintained and does it circulate well?

Environmental – does it rehabilitate and preserve existing habitat?

Social – does it encourage learning and meaningful social interaction?

Economic – are the planning solutions economically sustainable?

Aesthetic – are the design outcomes aesthetically appropriate and sensitive to the cultural and natural heritage of the region?

These issues mean that Fronteras' future as a well-conceived community requires critical input from an array of specialists at the University of Arizona including engineers, landscape architects, ecologists, economists, and artists, as well as architects. Fronteras values CALA's experience in developing planning solutions that are multidisciplinary, densely layered and consider issues across a wide spectrum of professions. The community anticipates a dynamic relationship between all parties, one that changes and adapts as outcomes are evaluated, lessons are learned, and resources such as funding or materials are received.

CALA CONTRIBUTIONS:

CALA's proposed role in ISCD will be predominantly organizational and managerial. CALA possesses the foundational expertise that Fronteras needs to achieve ISCD's mission of community development that is ongoing, sustainable, and transformational.

Among its proposed duties, Fronteras needs CALA to:

- Provide a suggested plan for the organizational structure of ISCD
- Establish a code of conduct for participating parties (e.g., staff, students, local residents)
- Develop a comprehensive architectural and land use plan which capitalizes on the area's existing physical and cultural assets and drives further community development
- Propose a timetable and tentative goals for proposed projects
- Collaborate with other U of A schools/departments for services including researching, writing, and obtaining grants to cover ISCD expenses, such as:

Vehicle rental and mileage costs for students and professors

Vehicle permits and insurance for travel to Mexico

Tools, equipment, and supplies (e.g., cement mixers, balers, material shredders)

Purchase of doors and windows, electrical and plumbing supplies, light fixtures, toilets, sinks, stoves and refrigerators for a housing development

Utility bills associated with living in mobile homes provided for professors and students

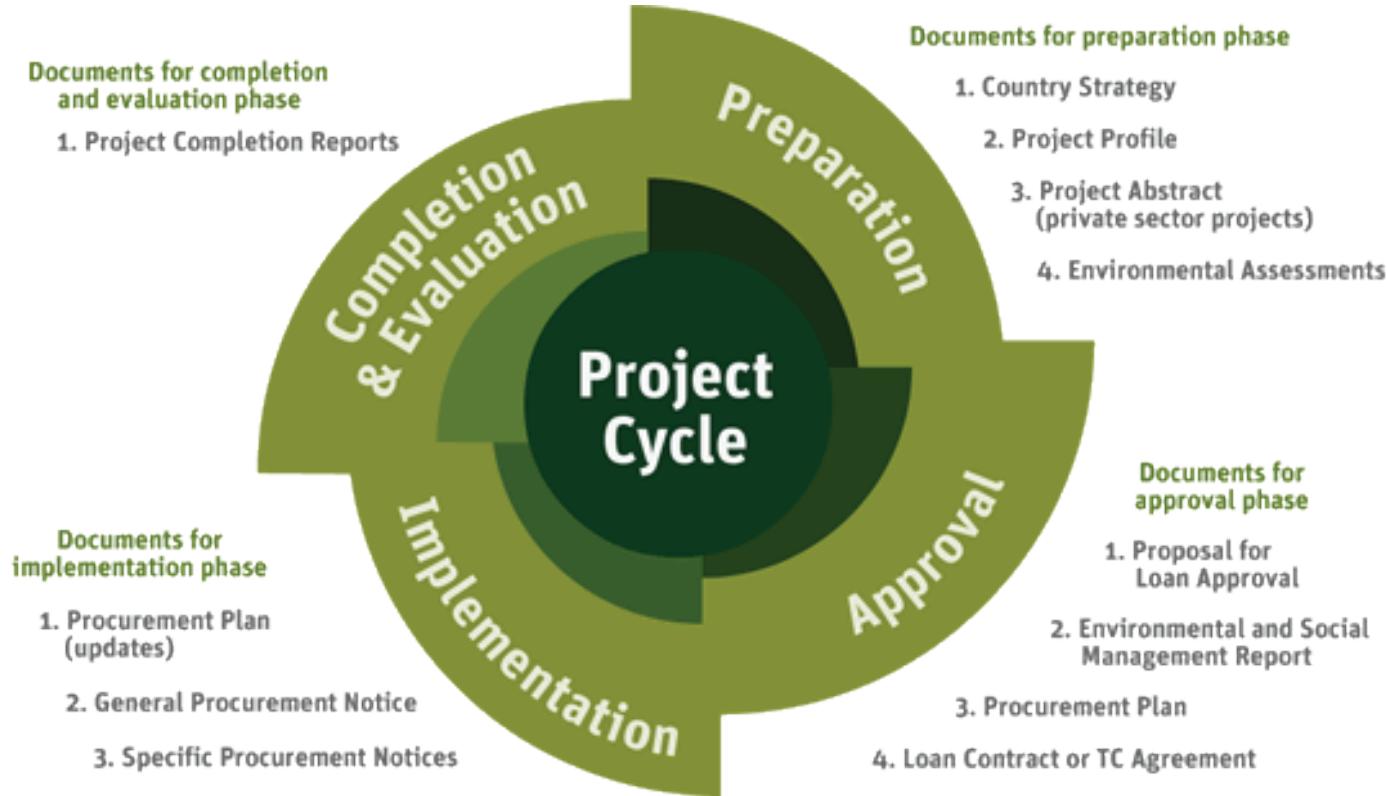
Salary for an onsite Mexican project architect/administrator who supervises local labor, interfaces with the town government, manages accounting, fields press inquiries and organizes receptions, etc.

IMPACT & OUTCOME:

The Institute for Sustainable Community Development will heighten international exposure for the University of Arizona while it:

- positions Fronteras as a model for other communities in Mexico seeking long-term solutions to social, cultural, and economic challenges.
- pioneers prototypes that stimulate increased creativity in the approaches to sustainability issues
- generates for the University of Arizona other opportunities for trans-border collaboration

The Institute for Sustainable Community Development has the potential to dramatically change how people live, to energize entire communities, and to inspire breakthroughs in sustainable community development that are both thoughtful and visionary.



LEFT: The project cycle diagram emphasizes the cyclical nature of the application and approval process for IDB funding

SOURCES OF FUNDING

There are many places to look to secure funding for development of Fronteras. Here is a detailed description of one source with other suggested sources listed afterward.

The Inter-American Development Bank (IDB) (<http://www.iadb.org/>) operates in Latin America and the Caribbean and is particularly interested in investing in socially and environmentally sustainable projects that benefit local communities. Indeed, its mission is to provide both public and private sector funding “to combat poverty and promote social

equity through programs tailored to local conditions.”

The Bank’s operating strategy in Mexico focuses on four points: social sector modernization, poverty reduction, integration of Mexico with the rest of North America, modernization of the state, and lowering barriers that limit the competitiveness and efficient development of the private sector.

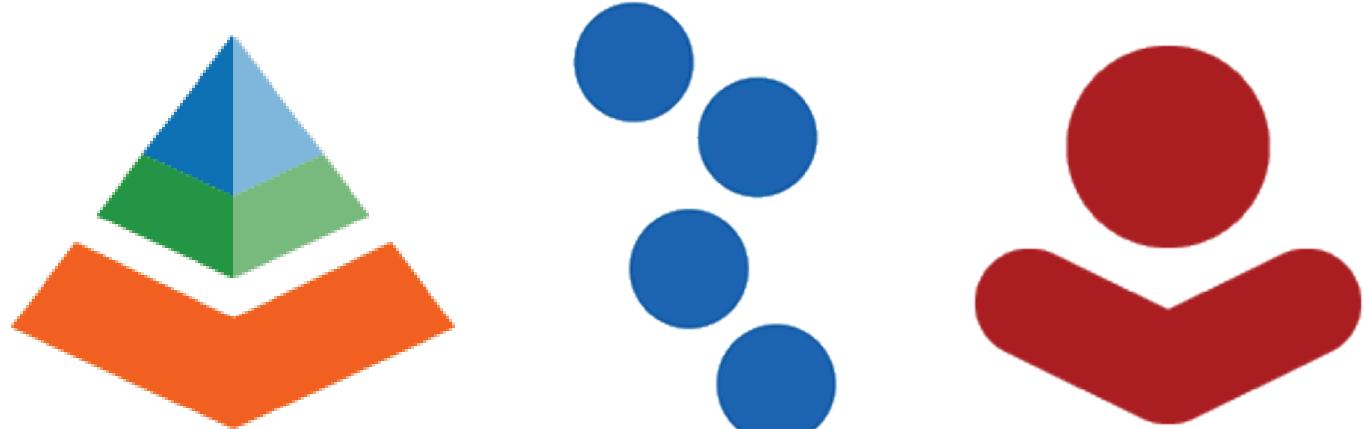
The Fronteras revitalization plan fits well into all four categories and is therefore an excellent candidate to solicit funds from the IDB. The application process differs depending on whether it is a government

The IDB has several priority initiatives for which it seeks to provide funding

LEFT: "Opportunities for the Majority Initiative" promotes business models that benefit low income populations

CENTER: "Water and Sanitation Initiative" supports funding of projects that work toward water and sanitation solutions for communities within member countries

RIGHT: The "Education Initiative" works to improve educational quality through projects that work to improve early childhood development, the transition from school to work, and teacher quality



(public) entity or a private entity such as an individual or business. The application process for the public sector can be seen in the diagram above. Private sector funding can be secured only if the project proves to benefit the country, demonstrate both financial and technical viability, and meet environmental and social requirements outlined by the IDB.

Clearly funding agencies are selective and demanding in their distribution of funds and the application processes are difficult and time consuming but the clear and direct benefit of project ideas outlined in this document should fit even the most stringent of criteria.

The following are other sources of funding to consider:

MEXICO

- Centro de Investigación en Alimentación y Desarrollo A.C. CIAD
<http://www.ciad.mx/content/view/193/1/>

- Comisión del Fomento al Turismo
<http://institucional.sonoraturismo.gob.mx/vision-mision.htm>

INTERNATIONAL

- US Trade and Development Agency, United States
<http://www.ustda.gov/>
- International Development Association
<http://www.worldbank.org/>
- United States Agency for International Development
<http://www.usaid.gov/>
- Just World International
<http://www.justworldinternational.org/>